

## 1. Foreword

### A: FOREWORD

These manuals are used when performing maintenance, repair or diagnosis of Subaru LEGACY.

Applicable model:  
2008MY BL\*\*\*\*, BP\*\*\*\*

The manuals contain the latest information at the time of publication. Changes in the specifications, methods, etc. may be made without notice.

# How to Use This Manuals

## HOW TO USE THIS MANUALS

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### **1. How to Use This Manuals**

#### **A: HOW TO USE THIS MANUALS**

##### **1. STRUCTURE**

Each section consists of SCT that are broken down into SC that are divided into sections for each component. The specification, maintenance and other information for the components are included, and the diagnostic information has also been added where necessary.

##### **2. CONTENTS**

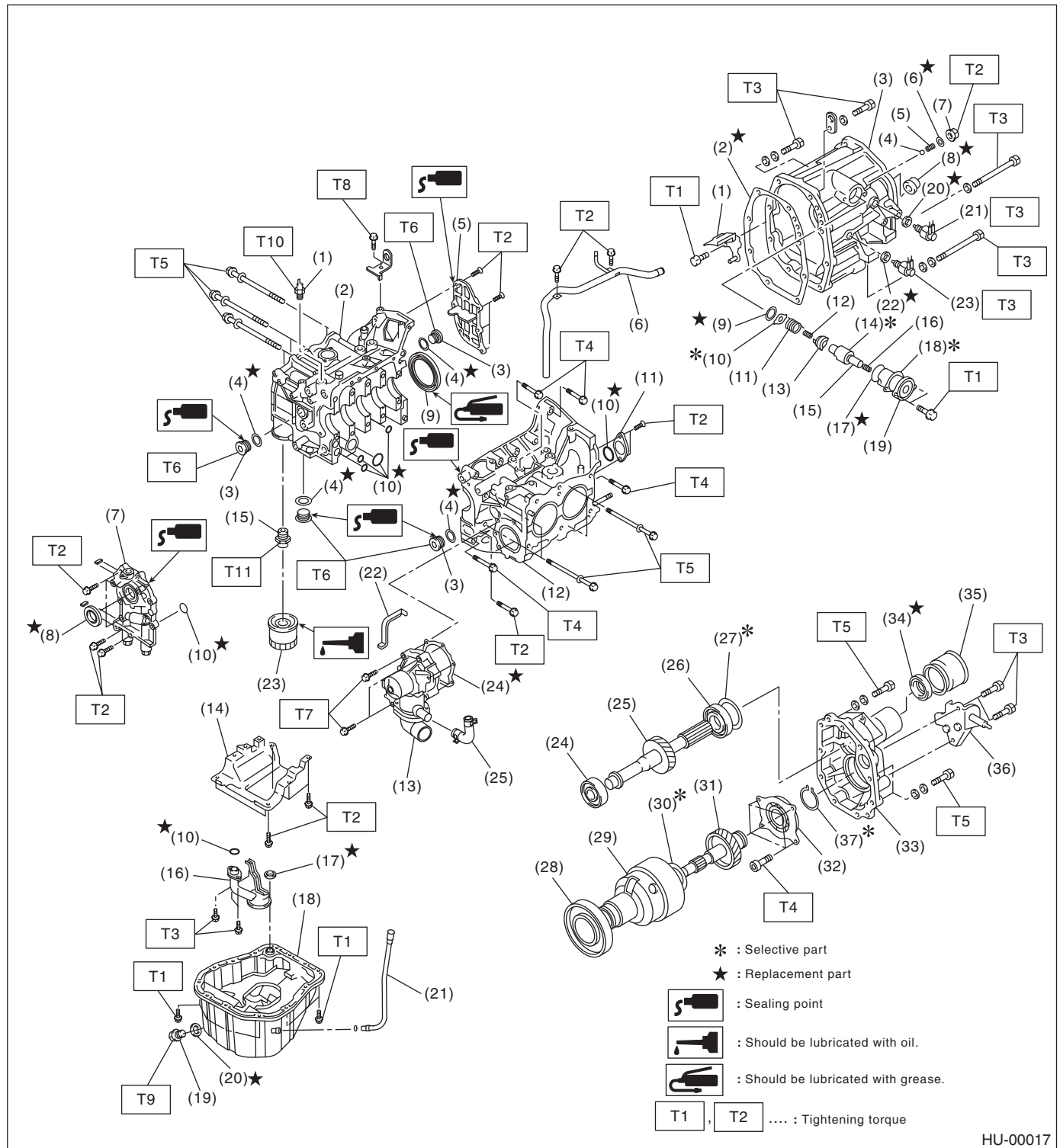
The first page has an index with tabs.

## 3. COMPONENT

Illustrations are provided for each component. The information necessary for repair work (tightening torque, grease up points, etc.) is described on these illustrations. Information is described using symbol.

To order parts, refer to parts catalogue.

### Example:



HU-00017

# How to Use This Manuals

## HOW TO USE THIS MANUALS

### 4. SPECIFICATION

If necessary, specifications are also included.

### 5. INSPECTION

Inspections to be carried out before and after maintenance are included.

### 6. MAINTENANCE

- Maintenance instructions for serviceable parts describe work area and detailed step with illustration. It also describes the use of special tool, tightening torque, caution for each procedure.
- If many serviceable parts are included in one service procedure, appropriate reference is provided for each parts.

#### Example:

## 15. Main Shaft Assembly for Single-Range ← (A)

### A: REMOVAL ← (B)

1) Remove the manual transmission assembly from vehicle. <Ref. to MT-33, REMOVAL, Manual Transmission Assembly.> ← (C)

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11) Tighten the lock nuts to the specified torque using ST1 and ST2.

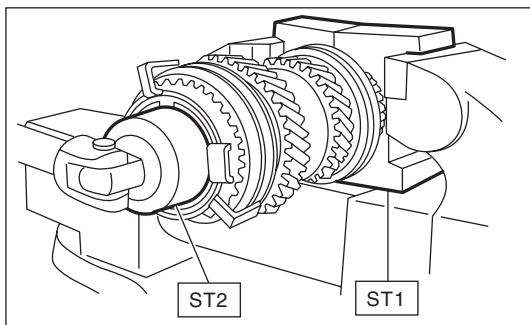
NOTE: ← (D)  
Secure the lock nuts in two places after tightening.

ST1 498937000 TRANSMISSION HOLDER

ST2 499987003 SOCKET WRENCH (35) ← (E) (F)

#### Tightening torque:

**118 N·m (12.0 kgf-m, 86.8 ft-lb)** ← (G)



HU-00020

(A) Component

(B) Process

(C) Reference

(D) Cautions

(E) Tool number of special tool

(F) Name of special tool

(G) Tightening torque

(H) Illustration

## 7. DIAGNOSIS

Tables showing a step-by-step process make it easy to conduct diagnosis.

## 8. SI UNITS

Measurements in these manuals are according to the SI units. Metric and yard/pound measurements are also included.

### Example:

#### ***Tightening torque:***

***44 N·m (4.5 kgf·m, 33 ft·lb)***

Item	SI units	Conventional unit	Remarks
Force	N (Newton)	kgf	1 kgf = 9.80655 N
Mass (Weight)	kg, g	kg, g	
Capacity	ℓ, mℓ or cm <sup>3</sup>	ℓ or cc	1 cc = 1 cm <sup>3</sup> = 1 mℓ
Torque	N·m	kgf·m, kgf·cm	1 kgf·m = 9.80655 N·m
Rotating speed	rpm	rpm	
Pressure	kPa (kilopascal)	kgf/cm <sup>2</sup>	1 kgf/cm <sup>2</sup> = 98.0655 kPa
		mmHg	1 mmHg = 0.133322 kPa
Power	W	PS	1 PS = 0.735499 kW
Calorie	W·h	cal	1 kcal = 1.16279 W·h
Fuel consumption rate	g/kw·h	g/PS·h	1 g/PS·h = 1.3596 g/kW·h

The figure used in these manuals are described in the SI units and conventional units are described in ( ).

# How to Use This Manuals

## HOW TO USE THIS MANUALS

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### 9. EXPLANATION OF TERMINOLOGY

#### List

AAI	: Air Assist Injection	MD	: Mini Disc
A/B	: Airbag	MID	: Multi-information Display
ABS	: Anti-lock Brake System	MFI	: Multi Point Injection
A/C	: Air Conditioner	MP-T	: Multi-Plate Transfer
A/F	: Air Fuel Ratio	MT	: Manual Transmission
ALT	: Generator	NA	: Natural Aspiration
ASSY	: Assembly	NC	: Normal Close (Relay)
AT	: Automatic Transmission	NO	: Normal Open (Relay)
ATF	: Automatic Transmission Fluid	OP	: Option Parts
AWD	: All Wheel Drive	P/S	: Power Steering
BATT	: Battery	P/W	: Power Window
CD-R/RW	: CD Recordable/Rewritable	PCD	: Pitch Circle Diameter
CPU	: Central Processing Unit	PCV	: Positive Crankcase Ventilation
DOHC	: Double Overhead Camshaft	RH	: RH (Right Hand)
DVD	: Digital Versatile Disc	Rr	: Rear
ECM	: Engine Control Module	SI-DRIVE	: SUBARU Intelligent Drive
EGR	: Exhaust Gas Recirculation	SOHC	: Single Overhead Camshaft
ELR	: Emergency Locking Retractor	SRS	: Supplemental Restraint System
EX	: Exhaust	SSM	: Subaru Select Monitor
F/B	: Fuse & Joint Box	ST	: Special Tool
FL	: Fusible Link	SW	: Switch
Ft	: Full-time (AWD)	TCS	: Traction Control System
FWD	: Front Wheel Drive	TGV	: Tumble Generator Valve
GPS	: Global Positioning System	T/M	: Transmission
H/U	: Hydraulic Unit	TPMS	: Tire Pressure Monitoring System
IG	: Ignition	ViS-C	: Viscous Coupling
INT	: Intermittent	VSV	: Vacuum Switching Valve
ISC	: Idle Speed Control	VTD	: Variable Torque Distribution
LH	: LH (Left Hand)	W/H	: Wiring Harness
LSD	: Limited Slip Differential	Pr	: Primary
M/B	: Main Fuse & Relay Box	2ndr	: Secondary

# LEGACY

## SPECIFICATIONS

### 1. LEGACY

#### A: DIMENSION

##### 1. SEDAN MODEL

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Overall length	mm (in)	4,700 (185.0)		
Overall width	mm (in)	1,730 (68.1)		
Overall height (at C.W.)	mm (in)	1,425 (56.1)	1,425 (56.1), 1,435 (56.5) <sup>*2</sup>	1,435 (56.5)
Compartment	Length	1,900 (74.8)		
	Width	1,445 (56.9)		
	Height	1,165 (45.9), 1,100 (43.3) <sup>*1</sup>		
Wheelbase	mm (in)	2,670 (105.1)		
Tread	Front	1,495 (58.9)		
	Rear	1,485 (58.5)		
Minimum road clearance	mm (in)	150 (5.9)	150 (5.9), 160 (6.3) <sup>*2</sup>	160 (6.3)

\*1: With sunroof

\*2: 2.5 GT spec. B model

##### 2. WAGON MODEL

Model		2.5 L SOHC	2.5 L DOHC turbo
Overall length	mm (in)	4,785 (188.4)	
Overall width	mm (in)	1,730 (68.1)	
Overall height (at C.W.)	mm (in)	1,475 (58.1)	
Compartment	Length	1,840 (72.4)	
	Width	1,445 (56.9)	
	Height	1,190 (46.9), 1,145 (45.1) <sup>*1</sup>	
Wheelbase	mm (in)	2,670 (105.1)	
Tread	Front	1,495 (58.9)	
	Rear	1,485 (58.5)	
Minimum road clearance	mm (in)	150 (5.9)	155 (6.1)

\*1: With sunroof

#### B: ENGINE

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Engine type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine		Horizontally opposed, liquid cooled, 6-cylinder, 4-stroke gasoline engine
Valve arrangement		Overhead camshaft		
Bore × stroke	mm (in)	99.5 × 79.0 (3.917 × 3.110)		89.2 × 80.0 (3.512 × 3.150)
Displacement	cm <sup>3</sup> (cu in)	2,457 (149.9)		3,000 (183.06)
Compression ratio		10.0	8.4	10.7
Ignition order		1 — 3 — 2 — 4		1 — 6 — 3 — 2 — 5 — 4
Idle speed at Park or Neutral position	rpm	650 (MT) 700 (AT)	750	650
Maximum output	kW (HP)/rpm	125 (170)/6,000	184 (243)/6,000	185 (245)/6,600
Maximum torque	N·m (kgf-m, ft-lb)/rpm	230 (23.5, 170)/4,400	327 (33.3, 241)/3,600	291 (29.7, 215)/4,200

**C: ELECTRICAL**

Model			2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Ignition timing (at idling)		BTDC	13°	MT: 12° AT: 17°	15°
Spark plug	Type and manufacturer		NGK: FR5AP-11	NGK: SILFR6A	NGK: ILFR6B
Generator			12V — 110A		
Battery	Type and capacity (5HR)	MT	12V — 48AH (55D23L)		
		AT	12V — 52AH (75D23L)		

**D: TRANSMISSION**

Model			2.5 L SOHC		2.5 L DOHC turbo			3.0 L DOHC
Transmission type			5MT	4AT	5MT	5AT	6MT	5AT
Clutch type			DSPD	TCC	DSPD	TCC	DSPD	TCC
Gear ratio	1st		3.454	2.785	3.166	3.540	3.636	3.540
	2nd		2.062	1.545	1.882	2.264	2.235	2.264
	3rd		1.448	1.000	1.296	1.471	1.521	1.471
	4th		1.088	0.694	0.972	1.000	1.137	1.000
	5th		0.780	—	0.738	0.834	0.891	0.834
	6th		—	—	—	—	0.707	—
	Rev.		3.333	2.272	3.333	2.370	3.545	2.370
Reduction gear (Front)	1st reduction	Type of gear	—	Helical	—	Helical	—	Helical
		Gear ratio	—	1.000	—	1.000	—	1.000
	Final reduction	Type of gear	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid
		Gear ratio	3.900	4.111	3.900	3.083	3.900	3.272
Reduction gear (Rear)	Transfer reduction	Type of gear	Helical	—	Helical	—	Helical	—
		Gear ratio	1.000	—	1.000	—	1.100	—
	Final reduction	Type of gear	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid
		Gear ratio	3.900	4.111	3.900	3.083	3.545	3.272

5MT: 5-forward speeds with synchromesh and 1-reverse

4AT: Electronically controlled fully-automatic, 4-forward speeds and 1-reverse

5AT: Electronically controlled fully-automatic, 5-forward speeds and 1-reverse

DSPD: Dry Single Plate Diaphragm

TCC: Torque Converter Clutch

**E: STEERING**

Model			2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Type			Rack & pinion		
Turns, lock to lock			3.2	2.8, 2.6 <sup>*1</sup>	2.6
Minimum turning diameter	m (ft)	Curb to curb	10.8 (35.4), 11.6 (38.0) <sup>*1</sup>		11.6 (38.0)
		Wall to wall	11.6 (38.1), 12.4 (40.7) <sup>*1</sup>		12.4 (40.7)

\*1: 2.5 GT spec. B model

**F: SUSPENSION**

Front	Macpherson strut type suspension
Rear	Multi-link type suspension



# LEGACY

## SPECIFICATIONS

### G: BRAKE

Model	2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Service brake system	Dual circuit hydraulic with vacuum suspended power unit		
Front	Ventilated disc brake		
Rear	Disc brake	Ventilated disc brake	
Parking brake	Mechanical on rear brakes		

### H: TIRE

Model	2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Wheel size	16 × 6 <sup>1</sup> / <sub>2</sub> JJ <sup>*2</sup> , 17 × 7JJ	17 × 7JJ, 18 × 7JJ <sup>*1</sup>	18 × 7JJ
Tire size	P205/55 R16 89H <sup>*2</sup> , P205/50 R17 88V	215/45 R17 91W, 215/45 R18 89Y <sup>*1</sup>	P215/45 R18 89W
Type	Tubeless, Steel belted radial		

\*1: 2.5 GT spec. B model

\*2: Model for Canada

### I: CAPACITY

Model		2.5 L SOHC		2.5 L DOHC turbo			3.0 L DOHC	
		5MT	4AT	5MT	5AT	6MT	5AT	
Fuel tank		ℓ (US gal, Imp gal)		64 (16.9, 14.1)				
Engine oil	Total capacity (Overhaul)	ℓ (US qt, Imp qt)					5.0 (5.3, 4.4)	7.0 (7.4, 6.2)
	Filling amount of engine oil ℓ (US qt, Imp qt)	When replacing engine oil and oil filter		4.2 (4.4, 3.7)			4.3 (4.5, 3.8)	5.7 (6.0, 5.0)
		When replacing engine oil only		4.0 (4.2, 3.5)			5.5 (5.8, 4.8)	
Transmission gear oil		ℓ (US qt, Imp qt)	3.5 (3.7, 3.1)	—	3.5 (3.7, 3.1)	—	4.1 (4.3, 3.6)	—
ATF		ℓ (US qt, Imp qt)	—	9.3 (9.8, 8.2)	—	9.8 (10.4, 8.6)	—	9.8 (10.4, 8.6)
Front differential gear oil		ℓ (US qt, Imp qt)	—	1.2 (1.3, 1.1)	—	1.4 (1.5, 1.2)	—	1.4 (1.5, 1.2)
Rear differential gear oil		ℓ (US qt, Imp qt)	0.8 (0.8, 0.7)			1.0 (1.1, 0.9)	0.8 (0.8, 0.7)	
Power steering fluid		ℓ (US qt, Imp qt)	0.7 (0.7, 0.6)					
Engine coolant		ℓ (US qt, Imp qt)	6.4 (6.8, 5.6)	6.3 (6.7, 5.5)	7.3 (7.7, 6.4)	7.2 (7.6, 6.3)	7.3 (7.7, 6.4)	7.2 (7.6, 6.3)

**J: WEIGHT**

**1. US MODEL**

Model		Sedan							
		2.5 L SOHC							
		2.5 i					2.5 i Limited		
		5MT		4AT			4AT		
Curb weight (C.W.)	Front	kg (lb)	819 (1,805)	826 (1,820)	839 (1,850)	846 (1,865)	841 (1,855)	850 (1,875)	853 (1,880)
	Rear	kg (lb)	665 (1,465)	674 (1,485)	669 (1,475)	678 (1,495)	669 (1,475)	676 (1,490)	676 (1,490)
	Total	kg (lb)	1,483 (3,270)	1,499 (3,305)	1,508 (3,325)	1,524 (3,360)	1,510 (3,330)	1,526 (3,365)	1529 (3,370)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)
Option	Vehicle dynamics control		—	—	—	—	○	—	○
	Power package		—	—	—	—	—	○	○
	Side airbag		○	○	○	○	○	○	○
	Curtain airbag		○	○	○	○	○	○	○
	Sunroof		—	○	—	○	—	○	○
	Navigation (DVD)		—	—	—	—	—	—	—

# LEGACY

## SPECIFICATIONS

Model		Sedan						
		2.5 L DOHC turbo					3.0 L DOHC	
		2.5 GT Limited				2.5 GT spec. B	3.0 R Limited	
		5MT	5AT		6MT	5AT		
Curb weight (C.W.)	Front	kg (lb)	871 (1,920)	898 (1,980)	900 (1,985)	903 (1,990)	912 (2,010)	928 (2,045)
	Rear	kg (lb)	678 (1,495)	683 (1,505)	683 (1,505)	683 (1,505)	689 (1,520)	680 (1,500)
	Total	kg (lb)	1,549 (3,415)	1,581 (3,485)	1,583 (3,490)	1,585 (3,495)	1,601 (3,530)	1,608 (3,545)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,010 (4,435)	2,010 (4,435)	2,010 (4,535)	2,010 (4,435)	2,010 (4,435)	2,010 (4,535)
Option	Vehicle dynamics control		—	—	○	○	○	○
	Power package		○	○	○	○	○	○
	Side airbag		○	○	○	○	○	○
	Curtain airbag		○	○	○	○	○	○
	Sunroof		○	○	○	○	○	○
	Navigation (DVD)		—	—	—	○	○	○

2. CANADA MODEL

Model			Sedan						
			2.5 L SOHC						
			2.5 i			2.5 i Limited			
			5MT		4AT		4AT		
Curb weight (C.W.)	Front	kg (lb)	819 (1,805)	826 (1,820)	839 (1,850)	846 (1,865)	850 (1,875)	853 (1,880)	
	Rear	kg (lb)	665 (1,465)	674 (1,485)	669 (1,475)	678 (1,495)	676 (1,490)	676 (1,490)	
	Total	kg (lb)	1,483 (3,270)	1,499 (3,305)	1,508 (3,325)	1,524 (3,360)	1,526 (3,365)	1,529 (3,370)	
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	
Gross vehicle weight (G.V.W.)		kg (lb)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	
Option	Vehicle dynamics control		—	—	—	—	—	○	
	Power package		—	—	—	—	○	○	
	Side airbag		○	○	○	○	○	○	
	Curtain airbag		○	○	○	○	○	○	
	Sunroof		—	○	—	○	○	○	
	Navigation (DVD)		—	—	—	—	—	—	

# LEGACY

## SPECIFICATIONS

Model		Sedan				Wagon				
		2.5 L DOHC turbo				2.5 L SOHC				
		2.5 GT Limited			2.5 GT spec. B	2.5 i				
		5MT	5AT		6MT	5MT		4AT		
Curb weight (C.W.)	Front	kg (lb)	871 (1,920)	898 (1,980)	900 (1,985)	912 (2,010)	814 (1,795)	821 (1,810)	835 (1,840)	841 (1,855)
	Rear	kg (lb)	678 (1,495)	683 (1,505)	683 (1,505)	689 (1,520)	685 (1,510)	694 (1,530)	685 (1,510)	694 (1,530)
	Total	kg (lb)	1,549 (3,415)	1,581 (3,485)	1,583 (3,490)	1,601 (3,530)	1,499 (3,305)	1,515 (3,340)	1,520 (3,350)	1,535 (3,385)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)	1,960 (4,325)
Option	Vehicle dynamics control		—	—	○	○	—	—	—	—
	Power package		○	○	○	○	—	—	—	—
	Side airbag		○	○	○	○	○	○	○	○
	Curtain airbag		○	○	○	○	○	○	○	○
	Sunroof		○	○	○	○	—	○	—	○
	Navigation (DVD)		—	—	—	○	—	—	—	—

Model		Wagon		
		2.5 L DOHC turbo		
		2.5 GT Limited		
		5MT	5AT	
Curb weight (C.W.)	Front	kg (lb)	869 (1,915)	898 (1,980)
	Rear	kg (lb)	703 (1,550)	703 (1,550)
	Total	kg (lb)	1,572 (3,465)	1,601 (3,530)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,060 (4,545)	2,060 (4,545)
Option	Vehicle dynamics control		—	—
	Power package		○	○
	Side airbag		○	○
	Curtain airbag		○	○
	Sunroof		○	○
	Navigation (DVD)		—	—

**3. OPTION**

Option	Front kg (lb)	Rear kg (lb)	Total kg (lb)
Vehicle Dynamics Control	5.6 (12.4)	0.2 (0.4)	5.8 (12.7)
Audio	1.8 (4.0)	0.7 (1.5)	2.5 (5.5)
Power package	1.8 (4.0)	3.1 (6.8)	4.9 (10.8)
Side airbag	1.9 (4.2)	1.9 (4.2)	3.8 (8.4)
Curtain airbag (Sedan model)	0.4 (0.9)	5.3 (11.7)	5.7 (12.6)
Curtain airbag (Wagon model)	0.5 (1.1)	5.0 (11.0)	5.5 (12.1)
Sunroof (Sedan model)	8.1 (17.9)	8.9 (19.6)	17.0 (37.5)
Sunroof (Wagon model)	8.3 (18.3)	18.7 (41.3)	27.0 (59.6)
Navigation (DVD)	2.2 (4.9)	0.8 (1.8)	3.0 (6.6)

# OUTBACK

## SPECIFICATIONS

## 2. OUTBACK

### A: DIMENSION

#### 1. WAGON MODEL

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Overall length	mm (in)	4,800 (189.0)		
Overall width	mm (in)	1,770 (69.7)		
Overall height (at C.W.)	mm (in)	1,605 (63.2)		
Compartment	Length	mm (in)	1,840 (72.4)	
	Width	mm (in)	1,445 (56.9)	
	Height	mm (in)	1,190 (46.9), 1,145 (45.1) <sup>*1</sup>	
Wheelbase	mm (in)	2,670 (105.1)		
Tread	Front	mm (in)	1,495 (58.9)	
	Rear	mm (in)	1,490 (58.7)	
Minimum road clearance	mm (in)	215 (8.5)	220 (8.7)	215 (8.5)

\*1: With sunroof

### B: ENGINE

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Engine type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine		Horizontally opposed, liquid cooled, 6-cylinder, 4-stroke gasoline engine
Valve arrangement		Overhead camshaft		
Bore × stroke	mm (in)	99.5 × 79.0 (3.917 × 3.110)		89.2 × 80.0 (3.512 × 3.150)
Displacement	cm <sup>3</sup> (cu in)	2,457 (149.9)		3,000 (183.06)
Compression ratio		10.0	8.4	10.7
Ignition order		1 — 3 — 2 — 4		1 — 6 — 3 — 2 — 5 — 4
Idle speed at Park or Neutral position	rpm	650 (MT) 700 (AT)	750	650
Maximum output	kW (HP)/rpm	125 (170)/6,000	184 (243)/6,000	185 (245)/6,600
Maximum torque	N·m (kgf·m, ft·lb)/rpm	230 (23.5, 170)/4,400	327 (33.3, 241)/3,600	291 (29.7, 215)/4,200

### C: ELECTRICAL

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Ignition timing (at idling)	BTDC	MT: 10° AT: 15°	MT: 12° AT: 17°	15°
Spark plug	Type and manufacturer	NGK: FR5AP-11	NGK: SILFR6A	NGK: ILFR6B
Generator		12V — 110A		
Battery	Type and capacity (5HR)	MT	12V — 48AH (55D23L)	
		AT	12V — 52AH (75D23L)	

## D: TRANSMISSION

Model		2.5 L SOHC		2.5 L DOHC turbo		3.0 L DOHC	
Transmission type		5MT	4AT	5MT	5AT	5AT	
Clutch type		DSPD	TCC	DSPD	TCC	TCC	
Gear ratio	1st	3.454	2.785	3.166	3.540	3.540	
	2nd	2.062	1.545	1.882	2.264	2.264	
	3rd	1.448	1.000	1.296	1.471	1.471	
	4th	1.088	0.694	0.972	1.000	1.000	
	5th	0.825	—	0.738	0.834	0.834	
	Rev.	3.333	2.272	3.333	2.370	2.370	
Reduction gear (Front)	1st reduction	Type of gear	—	Helical	—	Helical	Helical
		Gear ratio	—	1.000	—	1.000	1.000
	Final reduction	Type of gear	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid
		Gear ratio	4.111	4.444	4.444	3.272	3.272
Reduction gear (Rear)	Transfer reduction	Type of gear	Helical	—	Helical	—	—
		Gear ratio	1.000	—	1.000	—	—
	Final reduction	Type of gear	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid
		Gear ratio	4.111	4.444	4.444	3.272	3.272

5MT: 5-forward speeds with synchromesh and 1-reverse

4AT: Electronically controlled fully-automatic, 4-forward speeds and 1-reverse

5AT: Electronically controlled fully-automatic, 5-forward speeds and 1-reverse

DSPD: Dry Single Plate Diaphragm

TCC: Torque Converter Clutch

## E: STEERING

Model		2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Type		Rack & pinion		
Turns, lock to lock		3.2		
Minimum turning diameter	m (ft)	Curb to curb	10.8 (35.4)	
		Wall to wall	11.6 (38.1)	

## F: SUSPENSION

Front	Macpherson strut type suspension
Rear	Multi-link type suspension



# OUTBACK

## SPECIFICATIONS

### G: BRAKE

Model	2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Service brake system	Dual circuit hydraulic with vacuum suspended power unit		
Front	Ventilated disc brake		
Rear	Disc brake		
Parking brake	Mechanical on rear brakes		

### H: TIRE

Model	2.5L SOHC BASE	2.5 L SOHC	2.5 L DOHC turbo	3.0 L DOHC
Wheel size	16 × 6 <sup>1</sup> / <sub>2</sub> JJ	16 × 6 <sup>1</sup> / <sub>2</sub> JJ <sup>*1</sup> , 17 × 7JJ	17 × 7JJ	17 × 7JJ
Tire size	P225/60 R16 97H	P225/60 R16 97H <sup>*1</sup> , P225/55 R17 95V		
Type	Tubeless, Steel belted radial			

\*1: 2.5 L SOHC model for Canada

### I: CAPACITY

Model		2.5 L SOHC		2.5 L DOHC turbo		3.0 L DOHC		
		5MT	4AT	5MT	5AT	5AT		
Fuel tank		ℓ (US gal, Imp gal)		64 (16.9, 14.1)				
Engine oil	Total capacity (Overhaul)	ℓ (US qt, Imp qt)		5.0 (5.3, 4.4)		7.0 (7.4, 6.2)		
	Filling amount of engine oil ℓ (US qt, Imp qt)	When replacing engine oil and oil filter		4.2 (4.4, 3.7)		4.3 (4.5, 3.8)	5.7 (6.0, 5.0)	
		When replacing engine oil only		4.0 (4.2, 3.5)		5.5 (5.8, 4.8)		
Transmission gear oil		ℓ (US qt, Imp qt)		3.5 (3.7, 3.1)	—	3.5 (3.7, 3.1)	—	—
ATF		ℓ (US qt, Imp qt)		—	9.3 (9.8, 8.2)	—	9.8 (10.4, 8.6)	9.8 (10.4, 8.6)
Front differential gear oil		ℓ (US qt, Imp qt)		—	1.2 (1.3, 1.1)	—	1.4 (1.5, 1.2)	1.4 (1.5, 1.2)
Rear differential gear oil		ℓ (US qt, Imp qt)		0.8 (0.8, 0.7)				
Power steering fluid		ℓ (US qt, Imp qt)		0.7 (0.7, 0.6)				
Engine coolant		ℓ (US qt, Imp qt)		6.4 (6.8, 5.6)	6.3 (6.7, 5.5)	7.3 (7.7, 6.4)	7.2 (7.6, 6.3)	7.2 (7.6, 6.3)

## J: WEIGHT

### 1. US MODEL

Model			Wagon				
			2.5 L SOHC				
			2.5 i				
			5MT		4AT		
Curb weight (C.W.)	Front	kg (lb)	823 (1,815)	830 (1,830)	844 (1,860)	846 (1,865)	846 (1,865)
	Rear	kg (lb)	696 (1,535)	705 (1,555)	696 (1,535)	696 (1,535)	696 (1,535)
	Total	kg (lb)	1,520 (3,350)	1,535 (3,385)	1,540 (3,395)	1,542 (3,400)	1,542 (3,400)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)
Option	Vehicle dynamics control		—	—	—	○	—
	Power package		—	—	—	—	—
	Side airbag		○	○	○	○	○
	Curtain airbag		○	○	○	○	○
	Sunroof		—	○	—	—	—
	Navigation (DVD)		—	—	—	—	○

Model			Wagon				
			2.5 L SOHC				
			2.5 i Limited				
			5MT		4AT		
Curb weight (C.W.)	Front	kg (lb)	837 (1,845)	857 (1,890)	860 (1,895)	860 (1,895)	862 (1,900)
	Rear	kg (lb)	712 (1,570)	712 (1,570)	712 (1,570)	712 (1,570)	712 (1,570)
	Total	kg (lb)	1,549 (3,415)	1,569 (3,460)	1,572 (3,465)	1,572 (3,465)	1,574 (3,470)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)
Option	Vehicle dynamics control		—	—	○	—	○
	Power package		○	○	○	○	○
	Side airbag		○	○	○	○	○
	Curtain airbag		○	○	○	○	○
	Sunroof		○	○	○	○	○
	Navigation (DVD)		—	—	—	○	○

# OUTBACK

## SPECIFICATIONS

Model			Wagon			
			2.5 L DOHC turbo			
			2.5 XT Limited			
			5MT		5AT	
Curb weight (C.W.)	Front	kg (lb)	880 (1,940)	882 (1,945)	912 (2,010)	914 (2,015)
	Rear	kg (lb)	723 (1,595)	723 (1,595)	723 (1,595)	723 (1,595)
	Total	kg (lb)	1,603 (3,535)	1,606 (3,540)	1,635 (3,605)	1,637 (3,610)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,060 (4,545)	2,060 (4,545)	2,060 (4,545)	2,060 (4,545)
Option	Vehicle dynamics control		○	○	○	○
	Power package		○	○	○	○
	Side airbag		○	○	○	○
	Curtain airbag		○	○	○	○
	Sunroof		○	○	○	○
	Navigation (DVD)		—	○	—	○

Model			Wagon	
			3.0 L DOHC	
			3.0 R LL Bean	
			5AT	
Curb weight (C.W.)	Front	kg (lb)	923 (2,035)	925 (2,040)
	Rear	kg (lb)	719 (1,585)	719 (1,585)
	Total	kg (lb)	1,642 (3,620)	1,644 (3,625)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,100 (4,635)	2,100 (4,635)
Option	Vehicle dynamics control		○	○
	Power package		○	○
	Side airbag		○	○
	Curtain airbag		○	○
	Sunroof		○	○
	Navigation (DVD)		—	○

## 2. CANADA MODEL

Model			Wagon					
			2.5 L SOHC					
			2.5 i			2.5 i Limited		
			5MT		4AT		4AT	
Curb weight (C.W.)	Front	kg (lb)	823 (1,815)	830 (1,830)	844 (1,860)	850 (1,875)	857 (1,890)	860 (1,895)
	Rear	kg (lb)	696 (1,535)	705 (1,555)	696 (1,535)	705 (1,555)	712 (1,570)	712 (1,570)
	Total	kg (lb)	1,520 (3,350)	1,535 (3,385)	1,540 (3,395)	1,556 (3,430)	1,569 (3,460)	1,572 (3,465)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)	2,010 (4,435)
Option	Vehicle dynamics control		—	—	—	—	—	○
	Power package		—	—	—	—	○	○
	Side airbag		○	○	○	○	○	○
	Curtain airbag		○	○	○	○	○	○
	Sunroof		—	○	—	○	○	○
	Navigation (DVD)		—	—	—	—	—	—

# OUTBACK

## SPECIFICATIONS

Model			Wagon			
			2.5 L DOHC turbo			
			2.5 XT Limited			
			5MT		5AT	
Curb weight (C.W.)	Front	kg (lb)	880 (1,940)	882 (1,945)	912 (2,010)	914 (2,015)
	Rear	kg (lb)	723 (1,595)	723 (1,595)	723 (1,595)	723 (1,595)
	Total	kg (lb)	1,603 (3,535)	1,606 (3,540)	1,635 (3,605)	1,637 (3,610)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,060 (4,545)	2,060 (4,545)	2,060 (4,545)	2,060 (4,545)
Option	Vehicle dynamics control		—	○	—	○
	Power package		○	○	○	○
	Side airbag		○	○	○	○
	Curtain airbag		○	○	○	○
	Sunroof		○	○	○	○
	Navigation (DVD)		—	—	—	—

Model			Wagon			
			3.0 L DOHC			
			3.0 R		3.0 R Limited	
			5AT			
Curb weight (C.W.)	Front	kg (lb)	914 (2,015)	916 (2,020)	923 (2,035)	925 (2,040)
	Rear	kg (lb)	703 (1,550)	703 (1,550)	719 (1,585)	719 (1,585)
	Total	kg (lb)	1,617 (3,565)	1,619 (3,570)	1,642 (3,620)	1,644 (3,625)
Gross axle weight ratio (G.A.W.R.)	Front	kg (lb)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)	1,040 (2,295)
	Rear	kg (lb)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)	1,060 (2,340)
Gross vehicle weight (G.V.W.)		kg (lb)	2,100 (4,635)	2,100 (4,635)	2,100 (4,635)	2,100 (4,635)
Option	Vehicle dynamics control		—	○	○	○
	Power package		—	—	○	○
	Side airbag		○	○	○	○
	Curtain airbag		○	○	○	○
	Sunroof		—	—	○	○
	Navigation (DVD)		—	—	—	○

## 3. OPTION

Option	Front kg (lb)	Rear kg (lb)	Total kg (lb)
Vehicle Dynamics Control	5.6 (12.4)	0.2 (0.4)	5.8 (12.7)
Audio	1.8 (4.0)	0.7 (1.5)	2.5 (5.5)
Power package	1.8 (4.0)	3.1 (6.8)	4.9 (10.8)
Side airbag	1.9 (4.2)	1.9 (4.2)	3.8 (8.4)
Curtain airbag (Sedan model)	0.4 (0.9)	5.3 (11.7)	5.7 (12.6)
Curtain airbag (Wagon model)	0.5 (1.1)	5.0 (11.0)	5.5 (12.1)
Sunroof (Sedan model)	8.1 (17.9)	8.9 (19.6)	17.0 (37.5)
Sunroof (Wagon model)	8.3 (18.3)	18.7 (41.3)	27.0 (59.6)
Navigation (DVD)	2.2 (4.9)	0.8 (1.8)	3.0 (6.6)



### 1. Precaution

#### A: CAUTION

Please clearly understand and adhere to the following general precautions. They must be strictly followed to avoid minor or serious injury to the person doing the work or people in the area.

#### 1. ABS

Handle the ABS as a total system. Do not disassemble or attempt to repair parts which are not instructed in this manual. Follow the directions in this manual when performing maintenance on the ABS/SCM&H/U. When parts other than those specified are disassembled, it is possible that the ABS system will not operate when needed or cause it to operate incorrectly and result in injury.

#### 2. VEHICLE DYNAMICS CONTROL (VDC)

Handle the VDC as a total system. Do not disassemble or attempt to repair individual parts. Follow the directions in this manual when performing maintenance on the VDCCM&H/U. When parts other than those specified are disassembled, it is possible that the VDC system will not operate when needed or cause it to operate incorrectly and result in injury.

#### 3. BRAKE FLUID

If brake fluid gets in your eyes or on your skin, do the following:

- Wash eyes and seek immediate medical attention.
- Wash your skin with soap and then rinse thoroughly with water.

#### 4. RADIATOR FAN

The radiator fan may rotate without warning, even when the engine is not ON. Do not place your hand, cloth, tools or other items near the fan at any time.

#### 5. ROAD TEST

Always conduct road tests in accordance with traffic rules and regulations to avoid bodily injury and interrupting traffic.

#### 6. AIRBAG

To prevent bodily injury from unexpected deployment of airbags and unnecessary maintenance, follow the instructions in this manual when performing maintenance on or near the airbag components, around front of the vehicle (radiator panel, front wheel apron, front side frame, front bumper, front hood, front fender), around side of the vehicle (front door, rear door, center pillar, rear fender, side sill, rear wheel apron), around rear of the vehicle (rear seat cushion, rear floor, rear crossmember), and on or near the airbag wiring harnesses.

To prevent unexpected deployment, turn the ignition switch to OFF and disconnect the ground cable from battery, then wait at least 20 seconds before starting work.

#### 7. AIRBAG AND SEAT BELT PRETENSIONER DISPOSAL

To prevent bodily injury from unexpected airbag deployment, do not dispose the airbag modules and seat belt pretensioner in the same way as other waste. Follow all government regulations concerning disposal of refuse.

#### 8. AIRBAG MODULE

Adhere to the following when handling and storing the airbag module to prevent bodily injury from unexpected deployment:

- Do not hold the harnesses or connectors to carry the module.
- Do not face the bag in the direction that it opens towards yourself or other people.
- Do not face the bag in the direction that it opens towards the floor or walls.

#### 9. AIRBAG SPECIAL TOOL

To prevent unexpected deployment, only use special tools.

#### 10. WINDOW

Always wear safety glasses when working around any glass to prevent glass fragments from damaging your eyes.

#### 11. WINDOW ADHESIVE

Always use the recommended or equivalent adhesive when attaching glass to prevent it from coming falling, resulting in accidents and injury.



## **12.OIL**

When handling oil, carefully observe the following to prevent unexpected accidents.

- Prepare container and waste cloths when performing work which oil could possibly spill. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing outside, for environmental protection.
- Follow all government regulations concerning disposal of refuse when disposing.

## **13.FUEL**

When handling and storing fuel, carefully observe the following to prevent unexpected accidents.

- Be careful of fires.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent it from penetrating the floor or flowing out, to protect the environment.
- Follow all government and local regulations concerning disposal of refuse when disposing.

## **14.ENGINE COOLANT**

When handling engine coolant, adhere to the following to prevent from unexpected accident.

- Never remove the radiator cap because of the danger of engine coolant blowing out when the engine coolant is hot.
- Prepare a container and cloth to prevent spraying of engine coolant when performing work in which engine coolant can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing.

## **15.AIR CONDITIONER REFRIGERANT**

In order to prevent from global warming, avoid releasing air conditioner refrigerant into the atmosphere. Using a refrigerant recovery system, discharge and reuse it.

# Precaution

PRECAUTION

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## 1. Note

### A: NOTE

This is the information that can improve the efficiency of maintenance and assure the sound work.

### 1. FASTENERS NOTICE

Fasteners are used to prevent the parts from damage, dislocation and play due to looseness. Fasteners must be tightened to the specified torque.

Do not apply paint, lubricant, rust retardant or other substance to the surface around bolts, nuts, etc. Doing so will make it difficult to obtain the correct torque and result in looseness and other problem.

### 2. STATIC ELECTRICITY DAMAGE

Do not touch the control modules, connectors, logic boards and other such parts when there is a possibility of static electricity. Always use a static electricity prevention cord or touch grounded metal for the elimination of static electricity before conducting work.

### 3. BATTERY

When removing the battery terminal, always be sure to turn the ignition switch to OFF to prevent electrical damage of the control module from overcurrent. Be sure to remove the battery ground cable first.

### 4. SERVICE PARTS

Use genuine parts for maximum performance and maintenance when conducting repairs. Subaru/FHI will not be responsible for poor performance resulting from the use of parts except for genuine parts.

### 5. PROTECTING VEHICLE UNDER MAINTENANCE

Make sure to attach the fender cover, seat covers, etc. before work.

### 6. ENSURING SECURITY DURING WORK

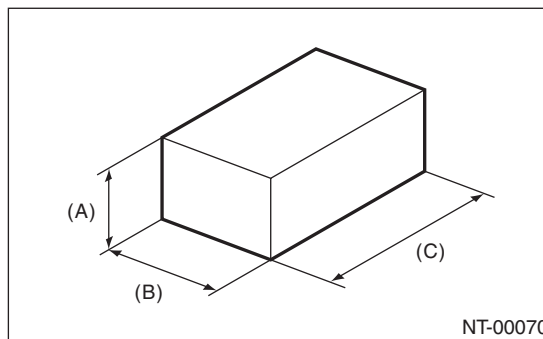
When working in a group of two or more, perform the work with calling each other to ensure mutual safety.

## 7. LIFT AND JACK

When using a lift or shop jack raise a vehicle or using rigid rack to support a vehicle, always follow instructions concerning jack-up points and weight limits to prevent the vehicle from falling, which could result in injury. Be especially careful that the vehicle is balanced before raising it. Be sure to set the wheel stoppers when jacking-up only the front or rear side of the vehicle.

### NOTE:

- When using a lift, follow its operation manual before work.
- Do not work or leave unattended while the vehicle is supported with jack, support it with rigid racks.
- Be sure to use the rigid racks with rubber attached to cradle to support the vehicle.
- When using a plate lift, use a rubber attachment.

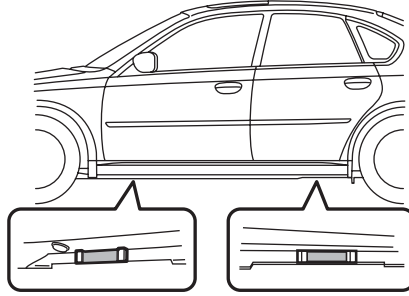


- (A) 80 mm (3.1 in) or more
- (B) 100 — 150 mm (3.94 — 5.91 in)
- (C) 120 — 190 mm (4.72 — 7.48 in)

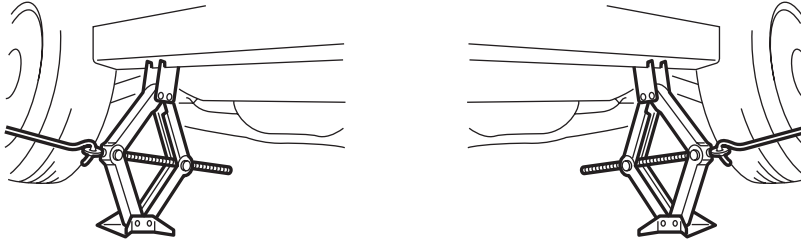
- Align the cushion rubber end of plate lift with the end of rubber attachment. (Portion b) Also, align the protrusion portion of the supporting locations with the end of attachment. (Portion a)

- Do not use the plate lift whose attachment does not reach the supporting locations.

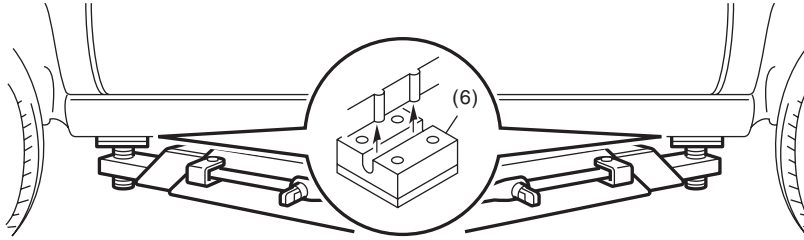
(1)



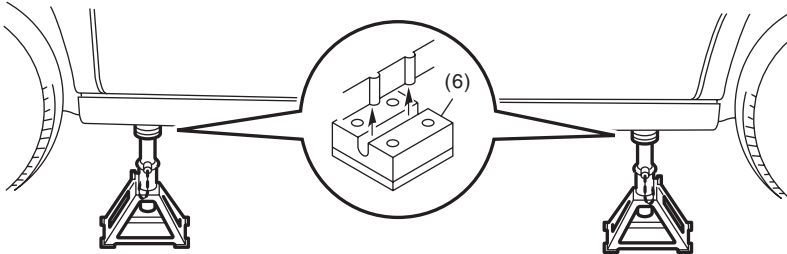
(2)



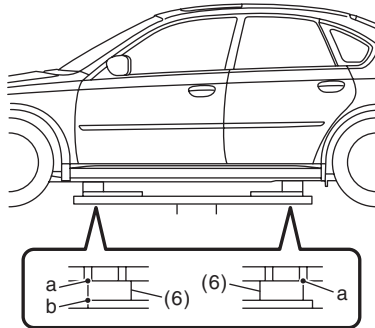
(3)



(4)



(5)



(1) Supporting locations  
(2) Pantograph jack

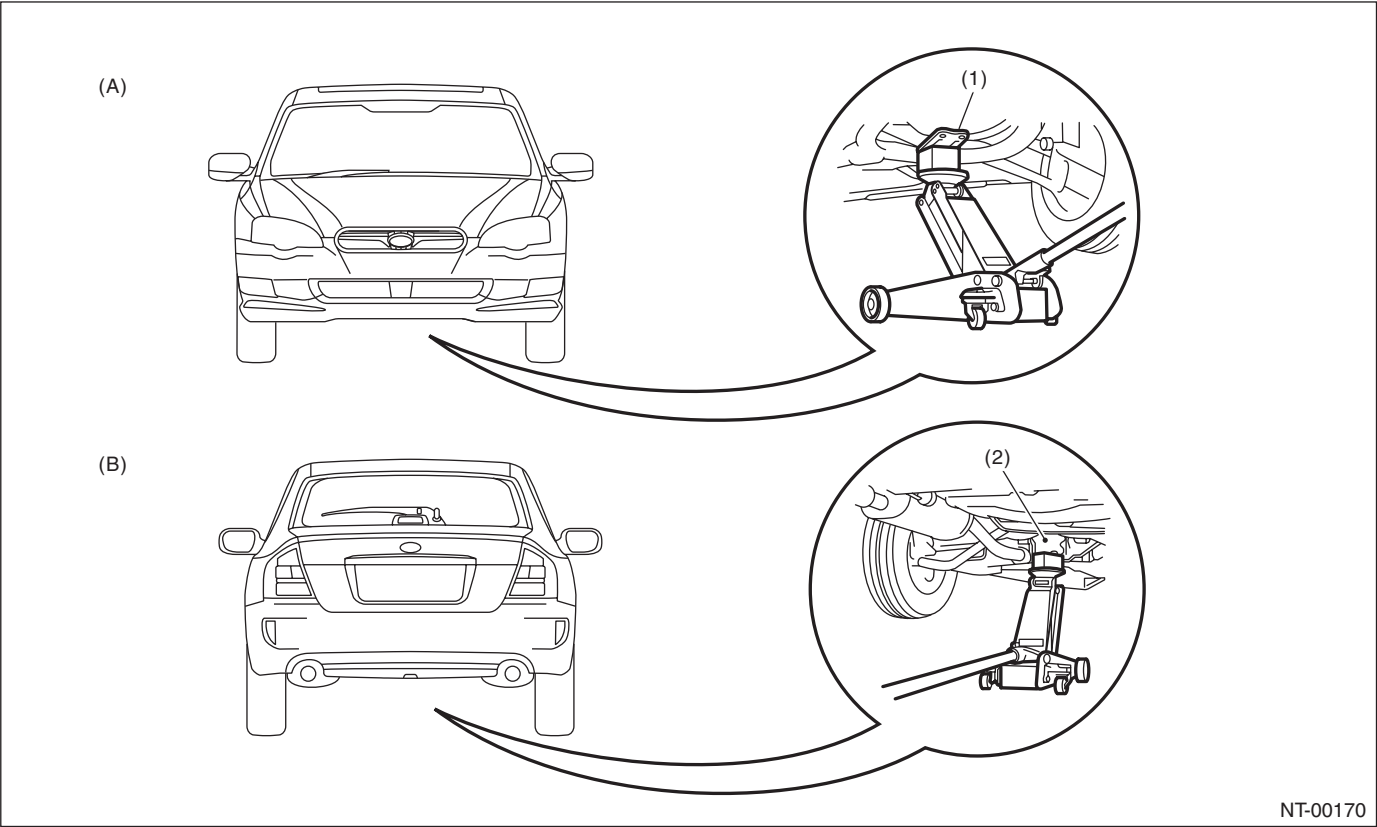
(3) Swing arm lift  
(4) Rigid rack

(5) Plate lift  
(6) Attachment

NT-00086

# Note

NOTE



NT-00170

(A) Front

(B) Rear

(1) Front crossmember

(2) Rear differential

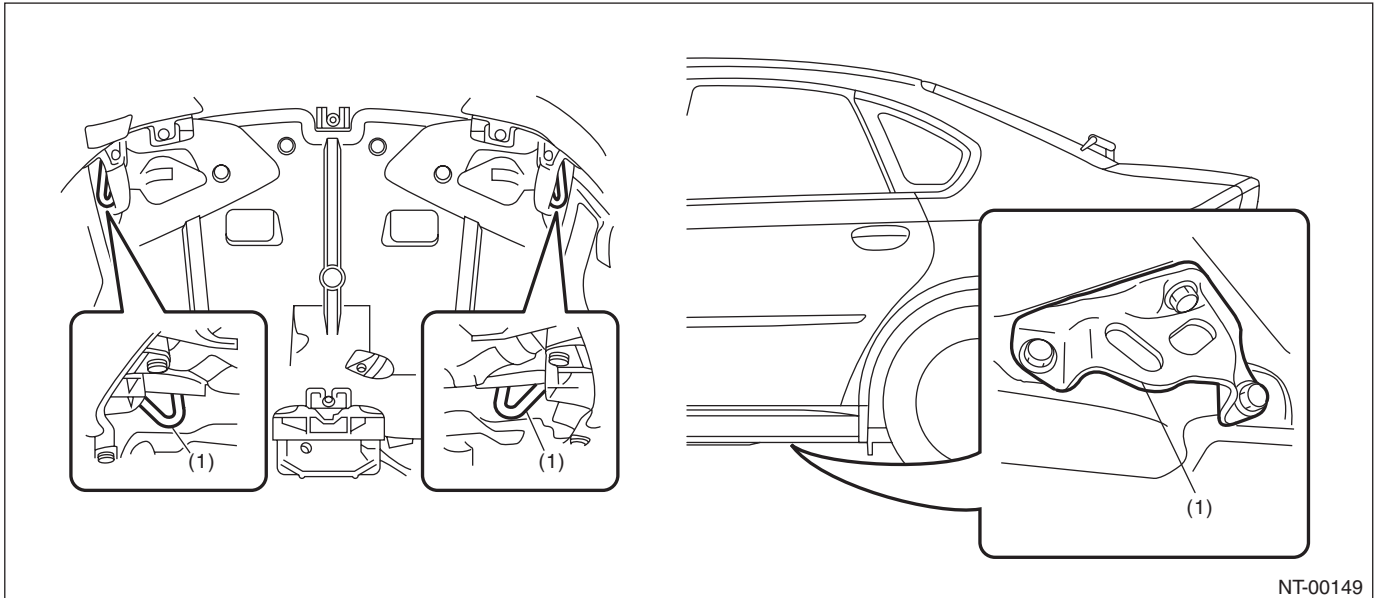
## 8. TIE-DOWNS

Tie-downs are used when transporting vehicles and when using the chassis dynamo. Attach tie-down only to the specified locations on the vehicle.

- TIE-DOWN LOCATION

### CAUTION:

Use the T-hook for rear tie-down. Do not use the hook other than T-hook, otherwise it can be removed when transporting vehicles.



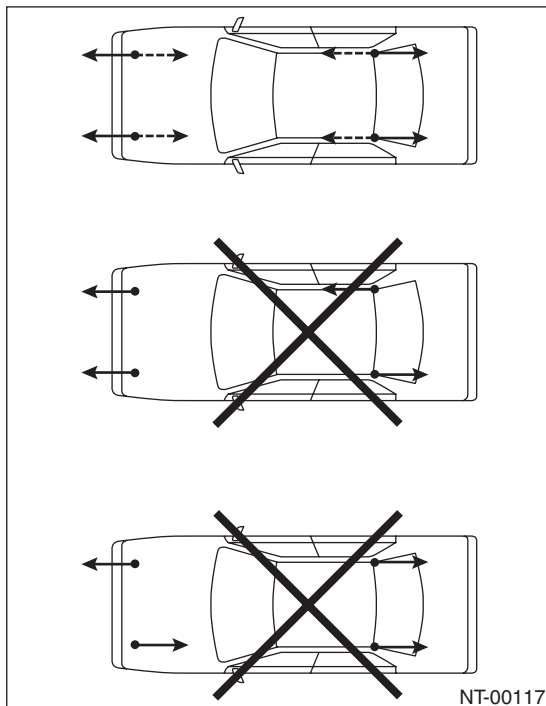
NT-00149

- (1) Hook for tie-down

- CHAIN DIRECTION AT TIE-DOWN CONDITION

### NOTE:

Pull the chains LH and RH in the same direction, but front and rear side in the counter direction. Pull all the chains in a same moment.

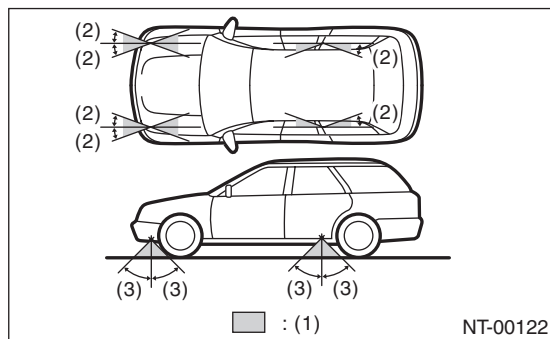


NT-00117

## Note

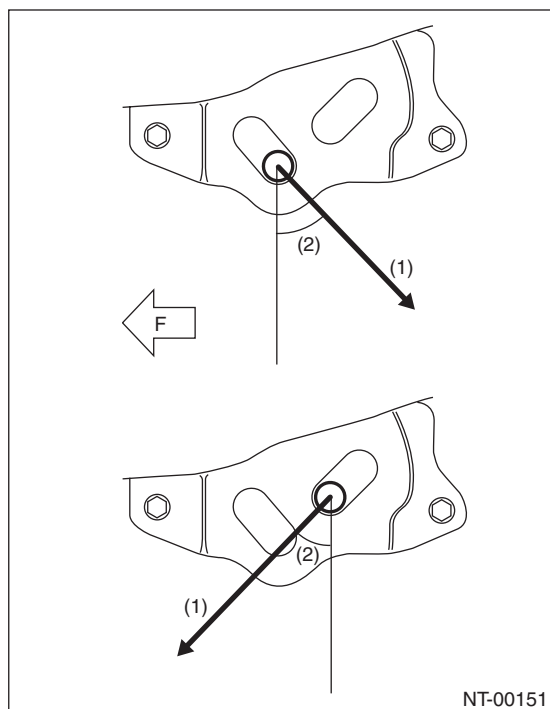
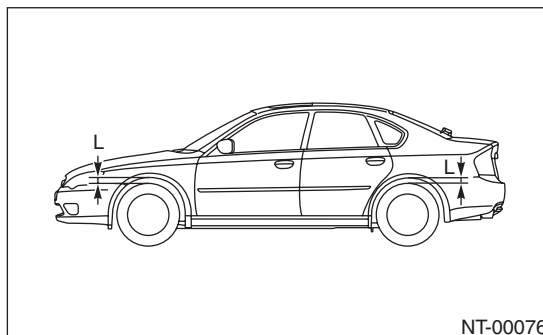
### NOTE

#### • CHAIN PULLING RANGE AT TIE-DOWN CONDITION



- (1) Chain pulling range at tie-down condition
- (2) 20°
- (3) 45°

- Vehicle sinking volume at tie-down condition  
Measure the distance between the highest tire point and highest arch point before and after tie-down. Difference of measured values (sinking volume) should be within 50 mm (1.97 in) and make sure to fix the vehicle securely.



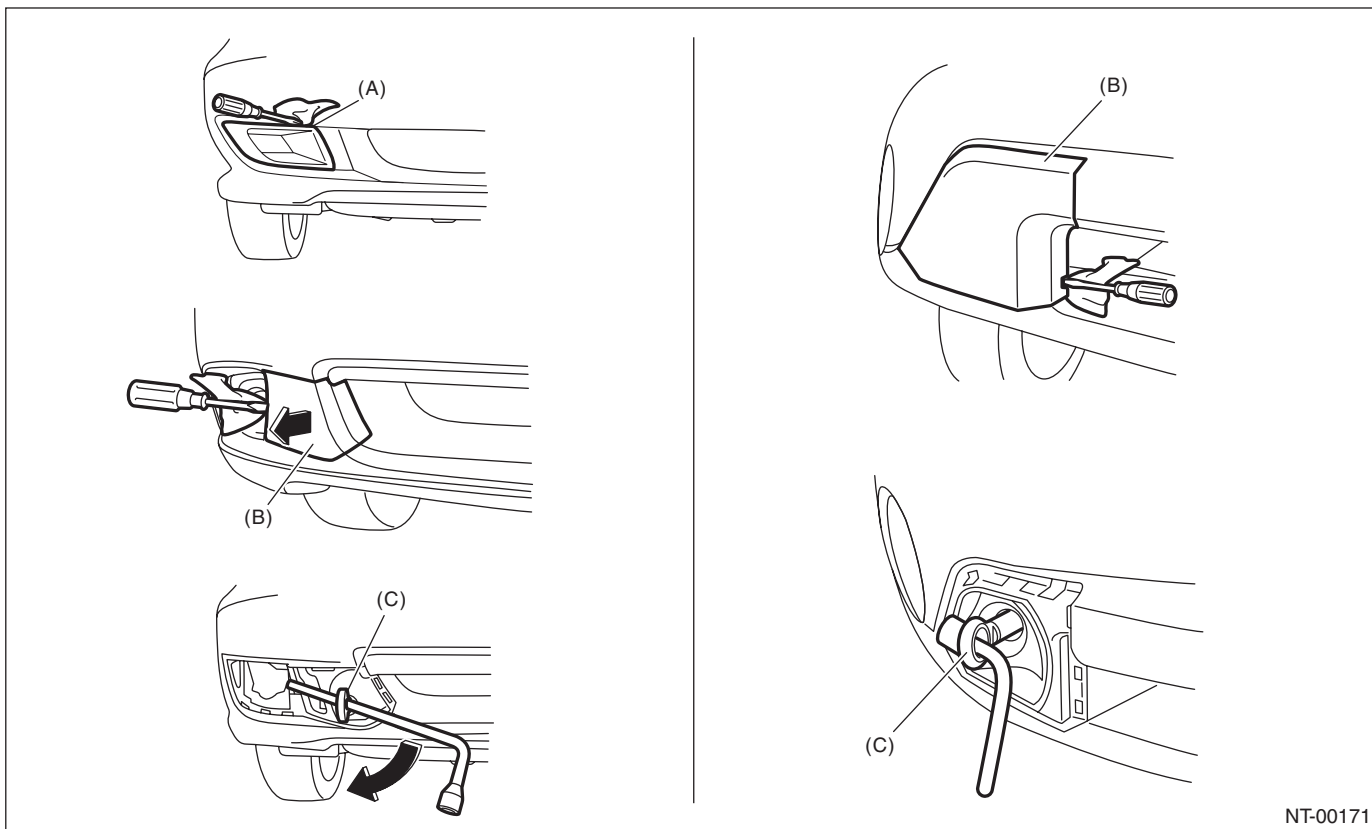
- (F) Front side
- (1) Tightening direction of chain
- (2) 45°

## 9. TOWING

Avoid towing vehicles except when the vehicle cannot be driven. For models with AWD, AT or VTD, use a loader instead of towing. When towing other vehicles, pay attention to the following to prevent hook or vehicle damage resulting from excessive weight.

- Do not tow other vehicles with a front tie-down hook.
- Make sure the vehicle towing is heavier than the vehicle being towed.
- Front

Remove the fog light cover (except for OUTBACK model) and hook cover, and then install the hook.



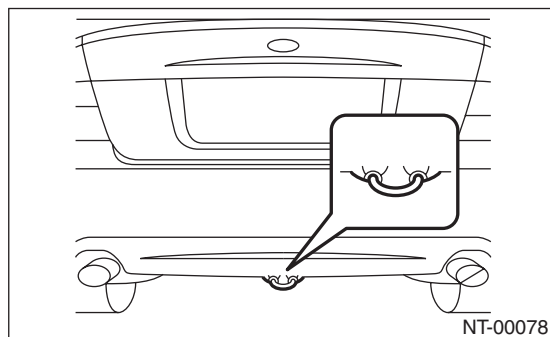
NT-00171

(A) Fog light cover (except for OUT-  
BACK model)

(B) Hook cover

(C) Hook

- Rear



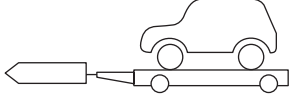

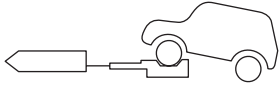
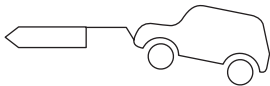
NT-00078



# Note

## NOTE

### • Notes

Towing	Precautions	MT	AT
Lifting up four wheels (On a trailer)    NT-00023	Towing the vehicle after lifting up all four wheels is a basic rule for AWD model.	○	○
Rope    NT-00024	<ul style="list-style-type: none"> <li>• Check if both front and rear wheels are rotated normally.</li> <li>• AT model driving conditions: Driving speed 50 km/h (31 MPH) or less</li> <li>Allow driving distance 30 km (19 miles) or less</li> </ul>	○	▲
Raising the front wheels    NT-00025	Prohibited for full-time AWD model.	×	×
Lifting up the front wheels    NT-00026	<ul style="list-style-type: none"> <li>• Prohibited, due to damage on bumper, front grille, etc.</li> <li>• Do not raise the vehicle with bumper.</li> </ul>	×	×

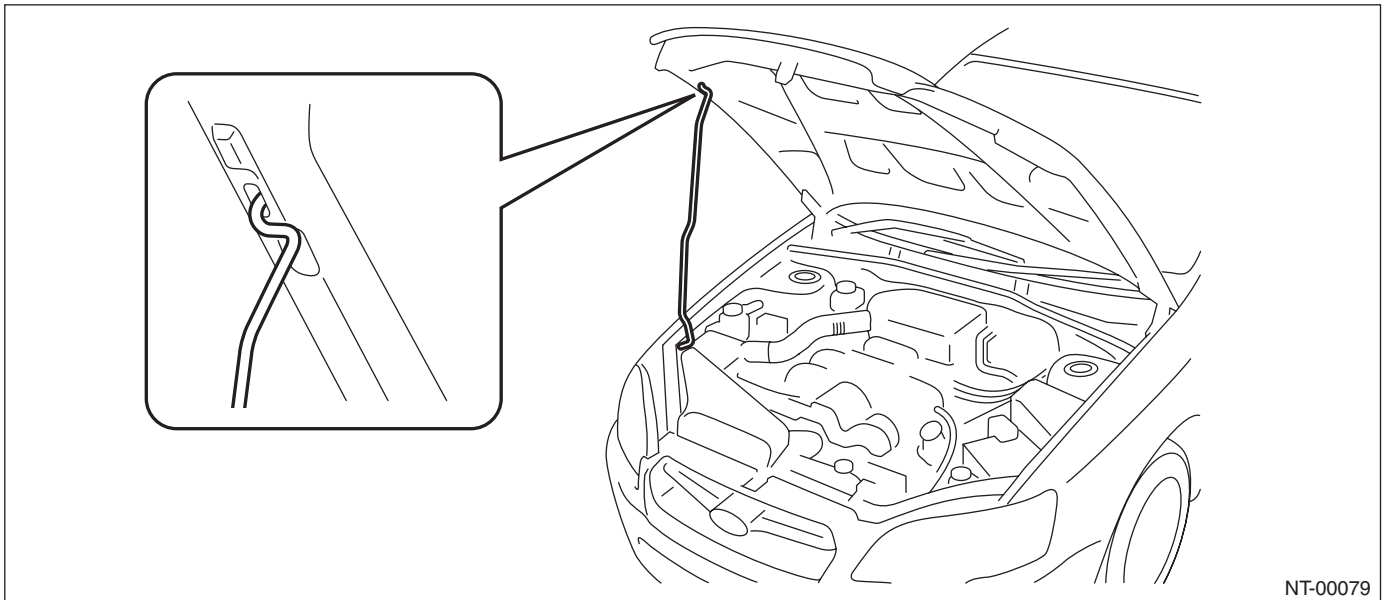
Marked ○ : OK, Marked × : Prohibited, Marked ▲ : Conditionally OK.

**CAUTION:**

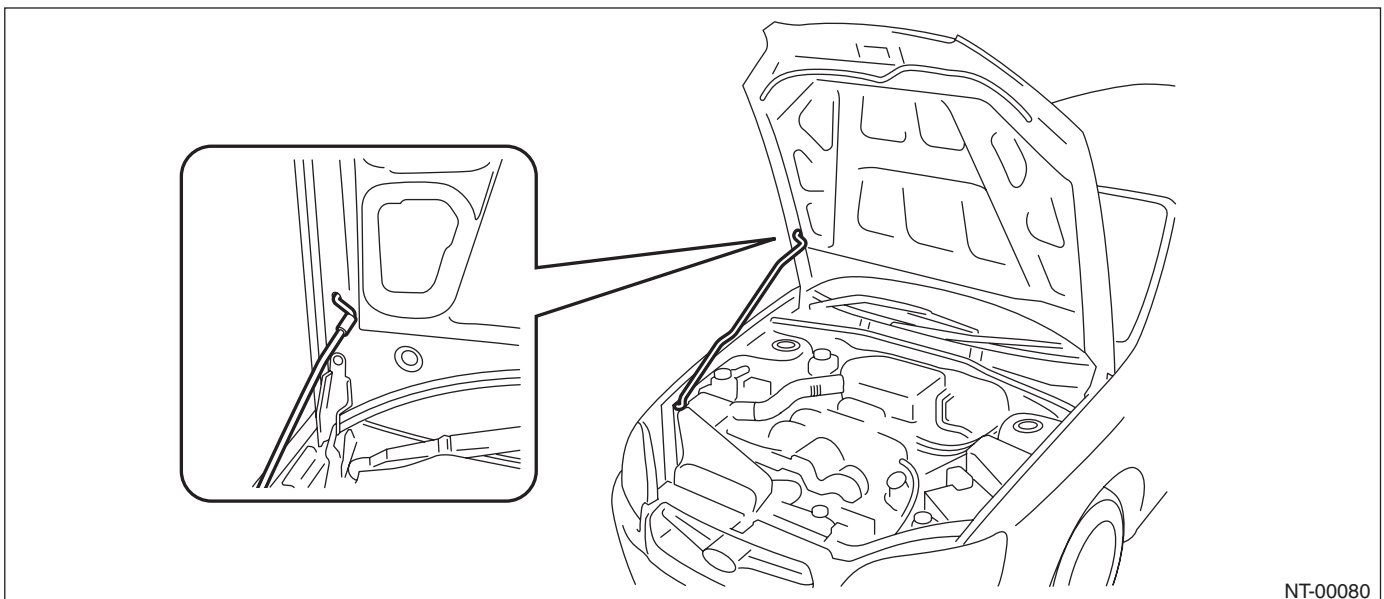
- Check ATF, gear oil and rear differential oil before driving.
- Place the shift lever in “N” position during towing.
- Do not lift up the rear wheels to avoid unsteady rotation.
- Turn the ignition key to “ACC”, then check the steering wheel moves freely.
- Release the parking brake to avoid tire dragging.
- Since the power steering does not work, be careful for the heavy steering effort. (When engine is stopped)
- Since the servo brake does not work, be careful that the brake is not applied effectively. (When engine is stopped)
- In case of the malfunction of internal transmission or drive system, lift up four wheels (on a trailer) for towing.

**10.FRONT HOOD STAY INSTALLATION**

- At the check and general maintenance



- When wider hood opening is necessary  
Set the stay into the hole of lower hood as shown in the figure below.



## NOTE

### 11. GENERAL SCAN TOOL

Using general scan tools will greatly improve the efficiency of repairing engine electronic throttle controls. Subaru Select Monitor can be used to diagnose the engine, ABS, air conditioner and other parts.

### 12. AWD CIRCUIT MEASURES

#### 1) Full-time AWD MT model

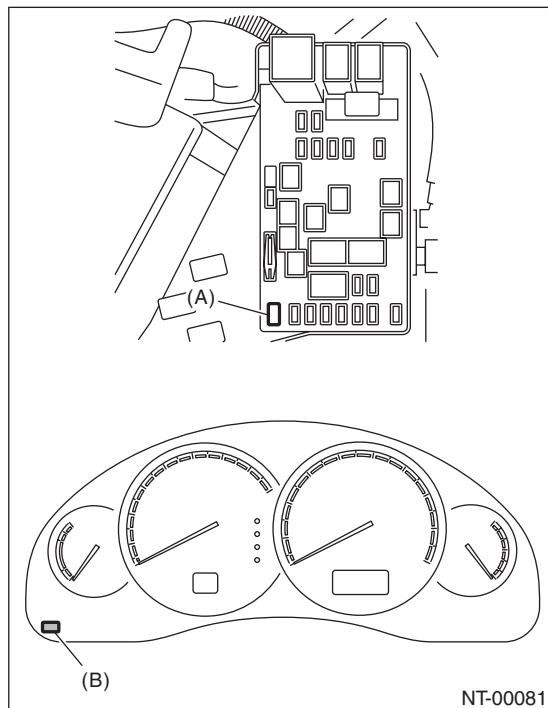
Since viscous coupling (limited slip differential) is used in the center differential, cut-off of AWD circuit cannot be carried out.

#### 2) Full-time AWD 5AT model

Since VTD type is used in the center differential, cut-off of AWD circuit cannot be carried out.

#### 3) Full-time AWD 4AT model

Insert a spare fuse into FWD fuse holder in the fuse box located in the left side of engine room to select the FWD. Since electronically controlled MT-P hydraulic multi-plate clutch is adapted for center differential, select FWD. When maintenance is performed with jack-up or on the free roller, check the illumination of AWD warning light in the combination meter.



- (A) FWD fuse holder
- (B) AWD warning light

### 13. SPEEDOMETER TEST

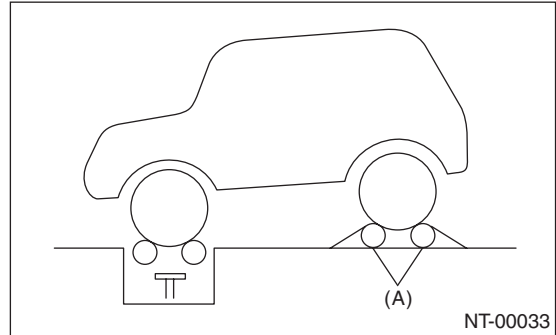
#### 1) Rear wheel free roller system

(1) Set the free roller on the floor of rear wheel side securely according to the wheel base and rear tread of the vehicle.

(2) Let the vehicle ride on the tester and free roller gently.

#### CAUTION:

**Fix the vehicle using a pulling metal (chain or wire) to the front and rear towing hooks or tie-down hook to prevent the lateral runout of front wheels and springing out of vehicle.**



- (A) Free roller

(3) Set the speedometer tester.

(4) Conduct the speedometer test work.

#### CAUTION:

**Do not operate the clutch quickly and do not accelerate or decelerate suddenly during work.**

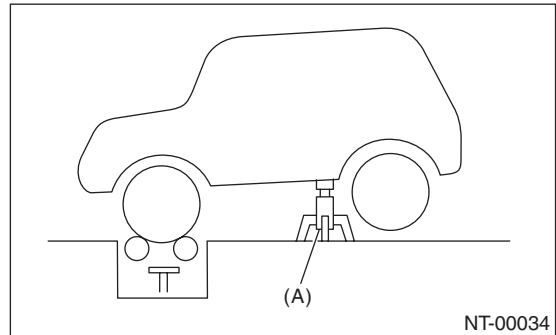
#### 2) Rear wheel jack-up system

(1) Set the vehicle on speedometer tester.

#### CAUTION:

**Fix the vehicle using a pulling metal (chain or wire) to the front and rear towing hooks or tie-down hook to prevent the lateral runout of front wheels and springing out of vehicle.**

(2) Jack up the rear wheels and set the rigid racks to the specified locations of side sill.



- (A) Rigid rack

(3) Conduct the speedometer test work.

#### CAUTION:

**Do not operate the clutch quickly and do not accelerate or decelerate suddenly during work.**

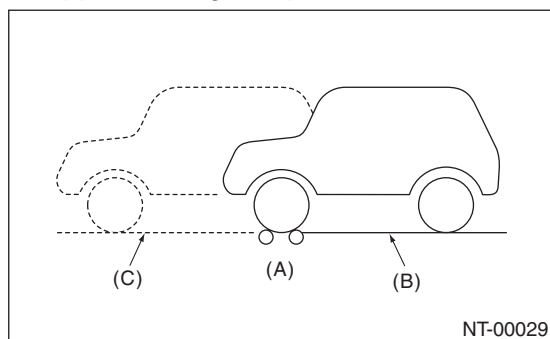
### 14. BRAKE TEST

#### 1) Full-time AWD MT model

- (1) Perform this test after driving the vehicle 2 to 3 km (1.24 to 1.86 miles) on road in order to stabilize the viscous torque of viscous coupling.
- (2) Keep the front or rear wheels on the ground for this test.

**NOTE:**

Effect of the viscous torque on braking force will be added approx. 25 kg compared with FWD model.



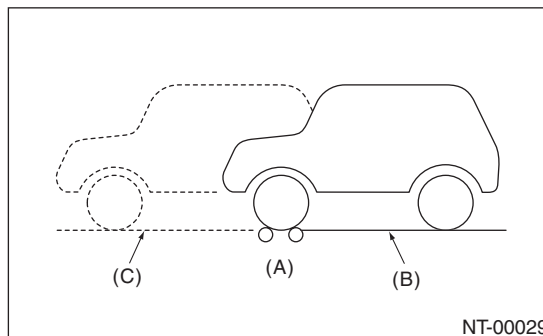
- (A) Brake tester
- (B) Position for measuring front wheel
- (C) Position for measuring rear wheel

#### (3) When the brake dragging force is large.

- Check the dragging of brake pad or brake shoe.
- Since it may be affected by the viscosity of viscous coupling, jack up either of the front or rear two wheels to check the each wheel rotation condition with the viscous coupling affection removed.

#### 2) Full-time AWD AT model

- (1) Keep the front or rear wheels on the ground during measurement.



- (A) Brake tester
- (B) Position for measuring front wheel
- (C) Position for measuring rear wheel

#### (2) When the brake dragging force is large.

- Check the dragging of brake pad or brake shoe.

**Specifications:**

	Braking force
Rear wheel total	More than 10% of load on front or rear wheels
Difference between right and left wheels	Less than 8% of load on front or rear wheels
Grand total	More than 50% of vehicle weight at the time of test

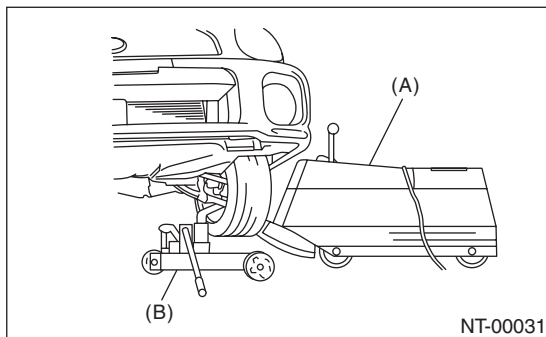
- When measurement is difficult to carry out because both of front wheels are locked, brake force measurement in this condition conforms to standard grand total.

## 15.ON THE CAR WHEEL BALANCING

### CAUTION:

- Carry out this procedures after measuring the balance of each single tire.
- Set the vehicle so that the front and rear wheels are the same height.
- Release the parking brake during measurement.
- Rotate each wheel by hands, and make sure it rotates without dragging.
- Do not operate the clutch quickly and do not accelerate or decelerate suddenly during work.
- When an error is indicated during engine drive, do not use the motor drive together.

1) Set the rigid rack to the specified locations of side sill, jack up the front or rear two wheels of non-measuring side and set the pickup stands to two wheels of measuring side.



- (A) Balancer body  
(B) Pickup stand

2) For drive wheel, drive the tires with engine for measurement.

3) For non-drive wheel, drive the tires from the on the car wheel balancer for measurement.

# Identification

## IDENTIFICATION

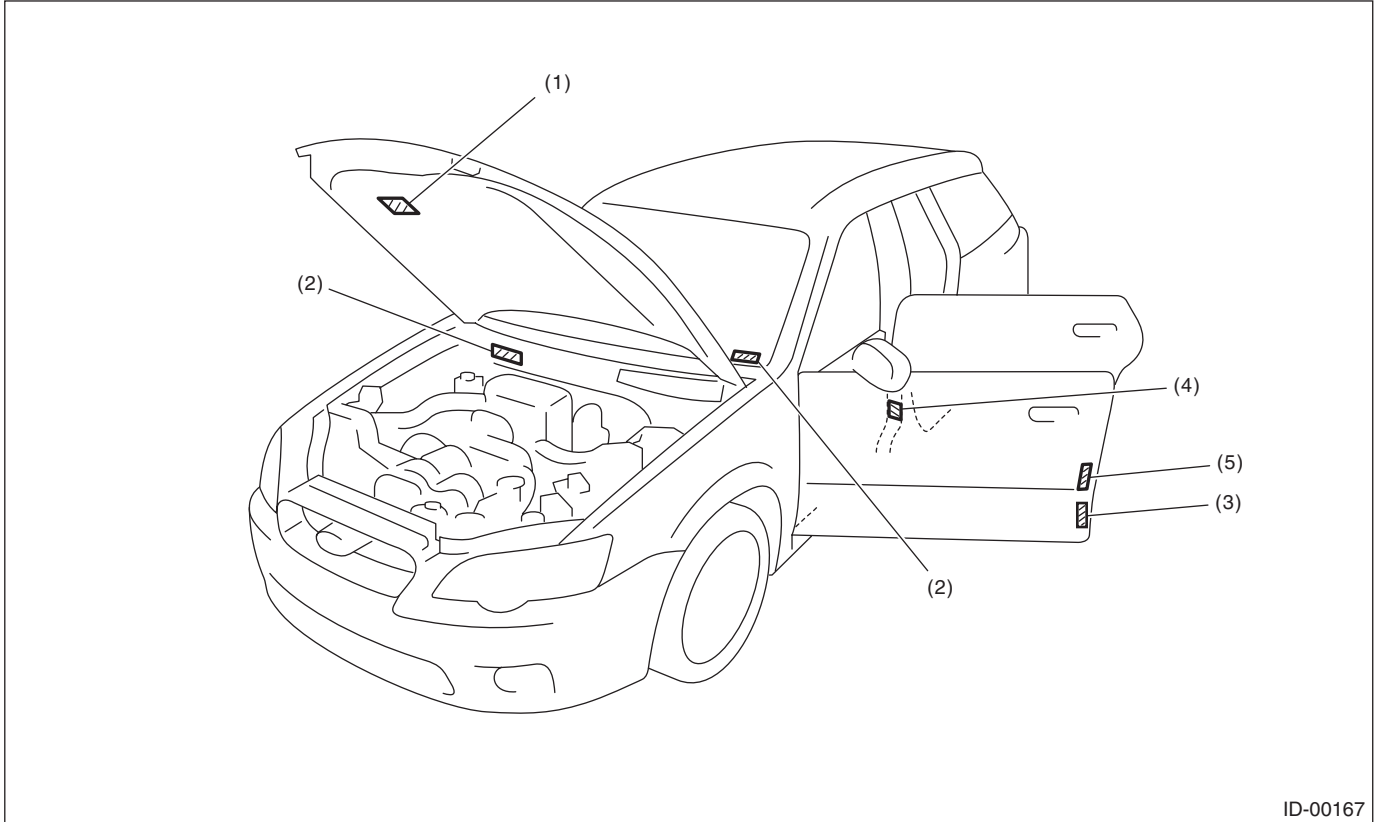
### 1. Identification

#### A: IDENTIFICATION

##### 1. IDENTIFICATION NUMBER & LABEL LOCATIONS

The V.I.N. (Vehicle Identification Numbers) is used to classify the vehicle.

##### • POSITIONING OF THE PLATE LABEL FOR IDENTIFICATION



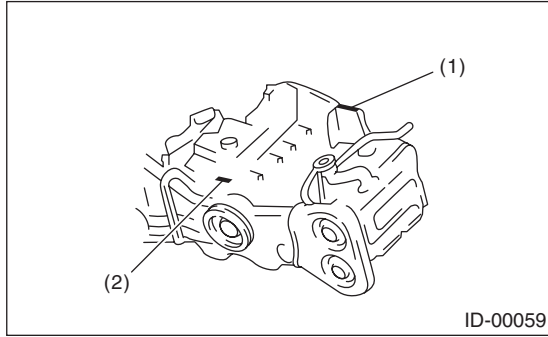
ID-00167

- (1) Emission control label  
(2) Vehicle identification number (V.I.N.)

- (3) Model number label  
(4) Tire inflation pressure label (Driver's side)

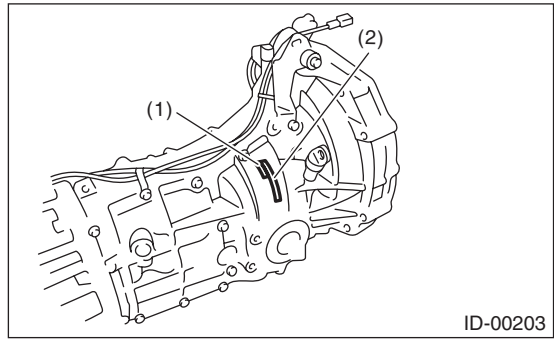
- (5) Emission control label FMVSS label (U.S. model)  
CMVSS label (Canada model)

• **ENGINE**



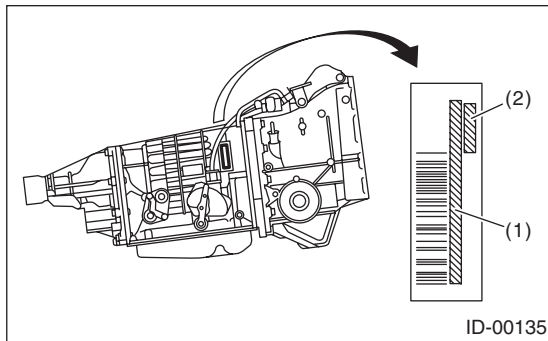
- (1) Engine serial number (Punch mark)
- (2) Engine type (Crankcase upper side)

• **MANUAL TRANSMISSION  
5MT (non-turbo model)**



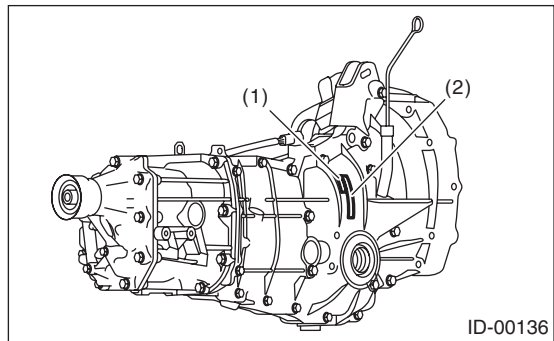
- (1) Transmission serial No.
- (2) MT type label

• **AUTOMATIC TRANSMISSION  
4AT**



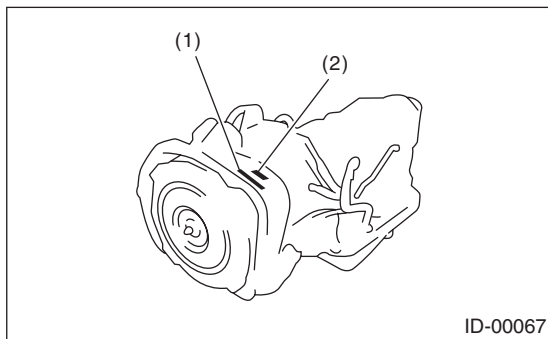
- (1) AT type label
- (2) Transmission serial number label

**5MT (turbo model)**



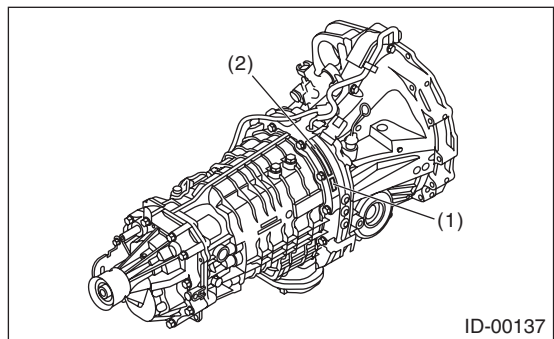
- (1) Transmission serial No.
- (2) MT type label

**5AT**



- (1) AT type label
- (2) Transmission serial number label

**6MT**

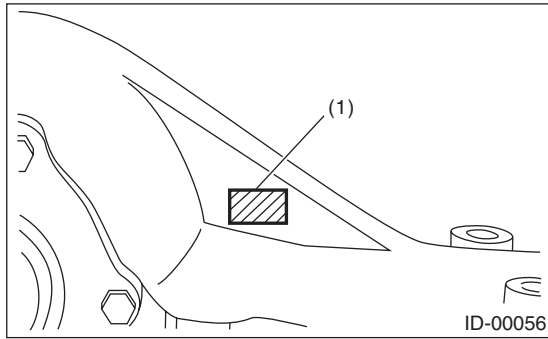


- (1) Transmission serial No.
- (2) MT type label

# Identification

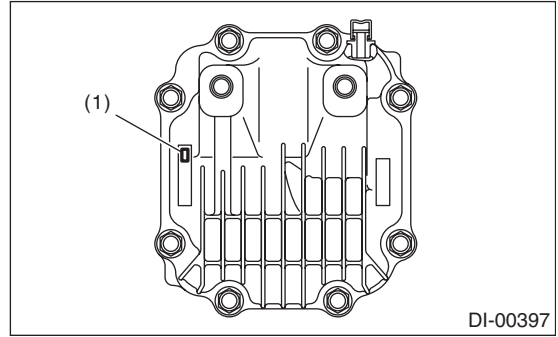
## IDENTIFICATION

### • REAR DIFFERENTIAL T-TYPE



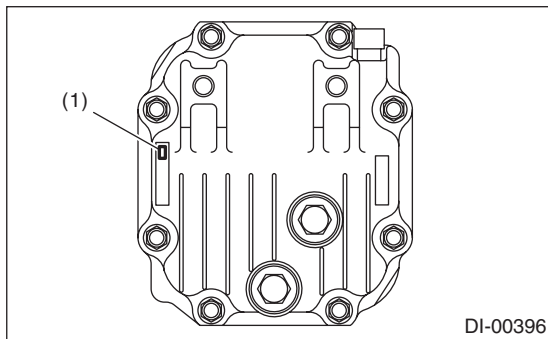
(1) Type (white paint)

### VA2-TYPE



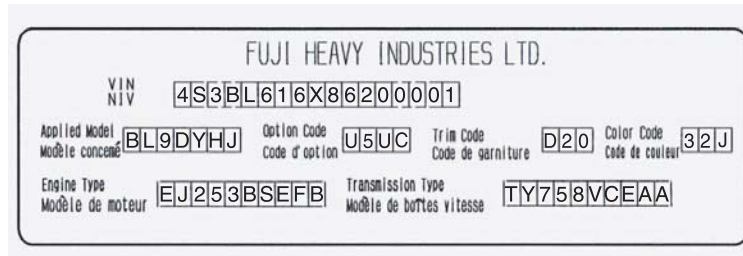
(1) Type (label)

### VA1-TYPE



(1) Type (label)

### • MODEL NUMBER LABEL



ID-00200



## 2. MEANING OF V.I.N.

The meaning of the V.I.N. is as follows:

**[4S3BL616X86200001]**

The starting and ending brackets ( [ ] ) are stop marks.

Digits	Code	Meaning	Details
1 — 3	4S3	Manufacturer body area	4S3: Except for OUTBACK model 4S4: OUTBACK model
4	B	Car line	LEGACY
5	L	Body type	L: Sedan P: Wagon
6	6	Displacement	6: 2.5 L AWD 8: 3.0 L AWD
7	1	Grade	0: OBK 2.5 BASE 1: 2.5 i, OBK 2.5 i 2: 2.5-LTD, OBK 2.5 i-LTD 3: OBK 2.5 XT-LTD 4: OBK 3.0 R 5: OBK 3.0 R-LTD, 3.0 R-LTD 6: OBK 3.0 R-LB (L.L.Bean) 7: 2.5 GT-LTD 9: 2.5 GT-B
8	6	Restraint or GVWR Class	6: Manual belts, Dual airbag, Side airbag (Except for OUTBACK model) C: Class C (GVWR 4001 — 5000 lb) (OUTBACK model)
9	X	Check digit	0 — 9 & X
10	8	Model year	8: 2008MY
11	6	Transmission type	3: Full-time AWD 6MT 4: Full-time AWD 5AT 6: Full-time AWD 5MT 7: Full-time AWD 4AT
12 — 17	200001	Serial number	From 200001: Sedan From 300001: Wagon

# Identification

## IDENTIFICATION

### 3. MODEL NUMBER PLATE

The model number plate indicates the type, V.I.N. <Ref. to ID-5, MEANING OF V.I.N., IDENTIFICATION, Identification.>, applied model, option code, trim code, engine type, transmission type and the exterior color code. This information is helpful when placing orders for parts.

• **BL9DYHJ**

Digits	Code	Meaning	Details
1	B	Series	LEGACY
2	L	Body type	L: Sedan P: Wagon
3	9	Engine displacement Drive system Suspension system	9: 2.5 L AWD E: 3.0 L AWD
4	D	Model year	D: 2008MY
5	Y	Destination	Y: U.S., Canada
6	H	Grade	C: 2.5 GT Limited D: OUTBACK 2.5 XT Limited F: 2.5 GT spec. B H: 2.5 i K: 2.5 i Limited P: OUTBACK 2.5 BASE S: OUTBACK 2.5 i T: OUTBACK 2.5 i Limited U: OUTBACK 3.0 R V: OUTBACK 3.0 R Limited X: OUTBACK 3.0 R L.L.Bean
7	J	Transmission, fuel feed system	D: DOHC MFI Turbo 5MT J: SOHC MFI 5MT H: DOHC MFI Turbo 6MT L: SOHC MFI 4AT TIP U: DOHC MFI 5AT TIP V: DOHC MFI Turbo 5AT TIP

The engine and transmission type are as follows.

• **ENGINE**

**EJ253BSEFB**

Digits	Code	Meaning	Details
1 and 2	EJ	Engine type	EJ: 4 cylinder EZ: 6 cylinders
3 and 4	25	Displacement	25: 2.5 L 30: 3.0 L
5	3	Fuel feed system	3: MFI non-turbo (SOHC) 5: MFI turbo D: MFI non-turbo (DOHC, H6)
6	B	Emission control	B: For USA
7	S	Mounted transmission	C: D-5AT E: 5MT (Flexible type flywheel, Wide angle damper type disc wheel) G: 6MT P: 4AT S: 5MT (Flexible type flywheel)
8 — 10	EFB	Detailed specifications	Used when ordering parts. See the parts catalog for details.

# Identification

IDENTIFICATION

## • TRANSMISSION

### TY758VCEAA

Digits	Code	Meaning	Details
1	T	Transmission	T: Transmission
2	Y	Transmission type	G: Full-time AWD 5AT center differential V: Full-time AWD AT center differential Y: Full-time AWD MT center differential Z: Full-time AWD AT MPT
3 and 4	75	Identification	1B: 4AT 5D: 5AT 75: 5MT 85: 6MT
5	8	Series	6: 6MT 7: 5AT 8: 5MT or 4AT
6	V	Transmission specifications	C: Full-time AWD VTD 5AT L: Full-time AWD MPT 4AT M: Full-time AWD center differential 4AT V: Full-time AWD 5MT single range with viscous coupling center differential W: Full-time AWD 6MT single range with viscous coupling center differential
7	C	Mounted vehicle	C: 2.5 L SOHC F: 2.5 L SOHC V: 3.0 L DOHC W: 2.5 L DOHC Turbo
8 — 10	EAA	Detailed specifications	Used when ordering parts. See the parts catalog for details.

## • REAR DIFFERENTIAL

### XJ

Code	Reduction gear ratio	LSD
CD	4.444	Viscous
CF	4.444	Viscous
EW	3.900	Viscous
HY	3.545	Torsen
JE	4.111	Viscous
T1	3.900	None
T2	4.111	None
TP	4.444	None
XJ	4.111	None
XU	3.272	Viscous
XZ	3.083	Viscous

# Identification

## IDENTIFICATION

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### • OPTION

#### U5UC

Digits	Code	Meaning	Details
1 — 2	U5	Destination	C0: Canada U4: U.S. For USA U5: U.S. For states using California emission standards U6: U.S. For states not using California emission standards
3	U	Option equipment	3: Cruise control, Power pack D: Vehicle dynamics control (VDC), Cruise control E: Vehicle dynamics control (VDC), Cruise control, Power pack U: Cruise control
4	C	Option equipment	C: A/C, Side airbag, Curtain airbag K: A/C, Side airbag, Curtain airbag, Sunroof, Navigation system W: A/C, Side airbag, Curtain airbag, Sunroof

# Recommended Materials

## RECOMMENDED MATERIALS

### 1. Recommended Materials

#### A: RECOMMENDED MATERIALS

##### 1. GENERAL

To insure the best performance, always use the specified oil, gasoline, adhesive, sealant, etc. or a substitute of equivalent quality.

##### 2. FUEL

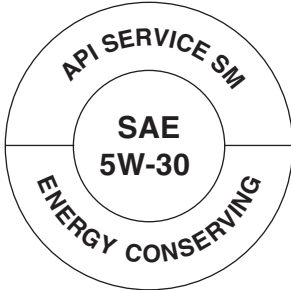

Always use gasoline of the same or higher octane value than specified in the owner's manual. Ignoring the specifications below will result in damage or poor performance of engine and fuel injection system. Use the specified gasoline to correct performance.

##### Unleaded gasoline

In order to reduce air pollution, use unleaded gasoline for the vehicle equipped with catalytic converter. Using leaded gasoline may damage the catalytic converter.



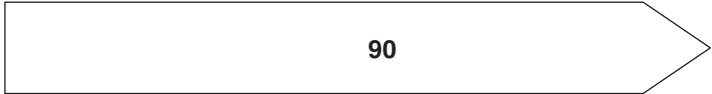


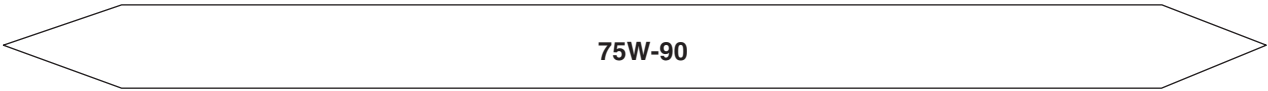
##### 3. LUBRICANTS

Use either lubricants in the table below or equivalent. See the table below to choose the correct SAE viscosity.

Lubricants	Recommended materials	
	API standard	ILSAC standard
Engine oil Choose oil suitable for the standard from the right.	SM "Energy conserving"  RM-00049	GF-4  RM-00002
Manual Transmission Oil	GL-5	—
AT front differential gear oil	GL-5	—
Rear differential gear oil	GL-5	—

# Recommended Materials

RECOMMENDED MATERIALS

SAE viscosity No. and applicable temperature								
Engine oil								
(°C)	-30	-20	-10	0	10	20	30	40
(°F)	-22	-4	14	32	50	68	86	104
								
								
RM-00060								
Manual transmission oil, rear differential gear oil and AT front differential gear oil								
(°C)	-30	-20	-10	0	10	20	30	40
(°F)	-22	-4	14	32	50	68	86	104
								
								
								
								
RM-00058								

# Recommended Materials

## RECOMMENDED MATERIALS

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### 4. FLUID

Use the fluids specified in the table below. Do not mix two different kinds or makes of fluid.

#### CAUTION:

**Always use the recommended or equivalent ATF. Using material except recommended one or substitute would cause trouble.**

Fluid	Recommended materials	Alternative	Remarks
Automatic transmission fluid	SUBARU ATF HP	IDEMITSU: ATF HP Castrol: Transmax J	—
Power steering fluid	DEXRON III	—	—
Brake fluid	FMVSS No. 116, DOT3, or DOT4	—	—
Clutch fluid	FMVSS No. 116, DOT3, or DOT4	—	—

### 5. COOLANT

Use genuine coolant to protect the engine.

Coolant	Recommended materials	Item number	Alternative
Coolant	SUBARU coolant	000016218	Phosphoric acid (non-amine) type
Water for dilution	Distilled water	—	Tap water (Soft water)
Cooling system protective agent	Cooling system conditioner	SOA345001	None

### 6. REFRIGERANT

Standard air conditioners on Subaru vehicles use HFC134a refrigerant. Do not mix it with other refrigerants. Also, do not use any compressor oil other than DENSO OIL 8.

Air conditioner	Recommended materials	Item number	Alternative
Refrigerant	HFC134a	—	None
Compressor oil	DENSO OIL 8	—	None

# Recommended Materials

RECOMMENDED MATERIALS

## 7. GREASE

Use grease and supplementary lubricants shown in the table below.

Grease	Application point	Recommended materials	Item number	Alternative
Supplementary lubricants	<ul style="list-style-type: none"> <li>• Oxygen sensor</li> <li>• Bolts etc.</li> </ul>	Spray type lubricant	—	—
Grease	MT main shaft	NICHIMOLY N-130	—	—
	Clutch master cylinder push rod	SILICONE GREASE G-40M	004404003	—
	<ul style="list-style-type: none"> <li>• Gear shift lever</li> <li>• Clutch activating cylinder</li> <li>• Clutch pedal</li> <li>• Brake pedal</li> <li>• Clutch bearing</li> <li>• Clutch release lever</li> </ul>	SUNLIGHT 2	003602010	—
	Select lever	Multemp AC-D Multemp SH-W (Shift lock part)	—	—
	<ul style="list-style-type: none"> <li>• Door latch</li> <li>• Door striker</li> </ul>	SILICONE GREASE G-30M	004404002	—
	Steering gearbox	VALIANT GREASE M2	003608001	ONE LUBER SG or MO
	Disc brake (lock pin, guide pin, piston boot)	NIGLUBE RX-2	000041000	—
	Between brake pad and shim	Molykote AS-880N	K0777YA010	—
	Brake pad clip	Molykote M7439	K0777YA000	—
	Front axle PTJ	NKG302	28395AG02A	—
	Front axle EBJ	NTG2218-M	28395AG01A	—
	<ul style="list-style-type: none"> <li>• Rear axle EBJ</li> <li>• Rear axle BJ</li> </ul>	NKG106	28395AG040A	—
	Rear axle DOJ	NKG205	28495AG00A	—

## 8. ADHESIVE

Use the adhesives shown in the table below, or equivalent.

Adhesive	Application point	Recommended materials	Item number	Alternative
Adhesive	Windshield, rear window glass, rear quarter glass, rear gate and body	Dow Automotive's adhesive: ESSEX U-400HV or the equivalent Glass primer: U-401 and U-402 Painted surface primer: U-413	—	—
	Rearview mirror base	REPAIR KIT IN MR	65029FC000	—
	Soft vinyl	CEMEDINE 540	—	3M's EC-776, EC-847 or EC-1022 (Spray type)
	Momentary sealant	CEMEDINE 3000	—	ARMSTRONG's Eastman 910



## Recommended Materials

### RECOMMENDED MATERIALS

#### 9. SEAL MATERIAL

Use the seal material shown in the table below, or equivalent.

Seal material	Application point	Recommended materials	Item number	Alternative
Seal material	<ul style="list-style-type: none"> <li>• MT transmission case</li> <li>• Converter case</li> </ul>	THREE BOND 1215	004403007	DOW CORNING No. 7038
	<ul style="list-style-type: none"> <li>• Cylinder block</li> <li>• DOHC camshaft cap (Turbo model)</li> <li>• Cylinder head plug (Turbo model)</li> <li>• Oil pump (Except for 3.0 L model)</li> <li>• SOHC camshaft cap</li> <li>• Cam cap (3.0 L model)</li> <li>• Cylinder head plug (Turbo model)</li> <li>• Rocker cover (3.0 L model and turbo model)</li> <li>• Oil pan (Pan upper) (3.0 L model)</li> <li>• Block (Pan upper) (3.0 L model)</li> <li>• Back cover (Front cover, block head, pan upper) (3.0 L model)</li> <li>• Engine oil pan (Except for 3.0 L model)</li> <li>• Separator cover (Except for 3.0 L model)</li> </ul>	THREE BOND 1217G	K0877Y0100	—
	Transmission oil pan (AT model)	THREE BOND 1217B	K0877YA020	—
	<ul style="list-style-type: none"> <li>• Rear differential</li> <li>• Engine oil pressure switch</li> <li>• Connector (Oil hose) (Turbo model)</li> <li>• Connector (Heater hose) (3.0 L model)</li> <li>• Cylinder head (Nipple) (3.0 L model)</li> <li>• Camshaft bowl-shape plug (3.0 L model)</li> </ul>	THREE BOND 1324	004403042	—
Seal material	<ul style="list-style-type: none"> <li>• Rear differential</li> <li>• Service hole plug (Except for 3.0 L model)</li> <li>• PCV valve</li> </ul>	THREE BOND 1105	004403010	DOW CORNING No. 7038
	Steering adjusting screw	THREE BOND 1141	004403006	—
	<ul style="list-style-type: none"> <li>• Front sealing cover</li> <li>• Rear sealing cover</li> </ul>	3M Butyl Rubber 8626	—	—

# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

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### 1. Pre-delivery Inspection

#### A: GENERAL DESCRIPTION

The purposes of the pre-delivery inspection (PDI) are as follows.

- Remove the additional parts used for ensuring the vehicle quality during transportation and restore the vehicle to its normal condition.
- Check the vehicle before delivery is in normal condition.
- Check the vehicle or parts for any damage occurred during transportation or storage.
- Check the vehicle after repair is in normal condition.
- Make sure to provide a complete vehicle to customer.

For above reasons, all SUBARU dealers (dealerships) must carry out the PDIs before delivery of vehicle. Refer to this manual unless otherwise specified.

## B: PRE-DELIVERY INSPECTION (PDI) PROCEDURE

### STATIC CHECKS JUST AFTER VEHICLE RECEIPT

Procedure	Check point
1. Appearance check	<ol style="list-style-type: none"> <li>1. If the vehicle is covered with protective coating, visually check the vehicle body for damage and dents. If the protective coating has been removed, visually check the body painted area for damage or stains in detail.</li> <li>2. Visually check the glass and light lenses for any damage, cracks or excessive gaps between body sheet metal.</li> <li>3. Visually check the plated parts for any damage.</li> </ol>
2. Tire check	<ol style="list-style-type: none"> <li>1. Check the tires for damage, defective, and dents on wheels.</li> <li>2. Check the tire air pressure.</li> </ol>
3. Fuse installation	If the vehicle is about to be delivered to customer, attach a back-up fuse.
4. Lock/unlock and open/close operation checks of doors.	<ol style="list-style-type: none"> <li>1. Using the key, check the trunk lid can be locked or unlocked normally.</li> <li>2. Open and close all doors to check that there are no defective.</li> <li>3. Operate the power door lock switch to check that the door (rear gate) is locked and unlocked normally.</li> </ol>
5. Operation check of child safety lock system	Check the child safety lock system operates normally.
6. Open/close operation checks of trunk lid	<ol style="list-style-type: none"> <li>1. Operate the trunk lock release lever to check that the trunk lid opens normally.</li> <li>2. Check that main and sub keys can lock/unlock the release lever, and that valet key can not lock/unlock the release lever.</li> <li>3. Open and close the trunk lid to see that there are no abnormal conditions.</li> </ol>
7. Operation check of trunk lid release lever	Operate the trunk lid release lever to check that the trunk lock is unlocked normally.
8. Check the rear gate for lock/unlock and open/close operations.	<ol style="list-style-type: none"> <li>1. Check if the rear gate can be unlocked normally through the emergency hole.</li> <li>2. Open and close the rear gate to see that there are no abnormal conditions.</li> </ol>
9. Operation check of fuel lid opener lock release lever	Operate the fuel lid opener to check that the fuel lid is unlocked normally.
10. Accessory check	<p>Check that the following accessories are provided.</p> <ul style="list-style-type: none"> <li>• Owner's manual</li> <li>• Warranty booklet</li> <li>• Maintenance note</li> <li>• Spare key</li> <li>• Jack</li> <li>• Tool set</li> <li>• Spare tire</li> </ul>
11. Operation check of front hood lock release system	Operate the front hood lock release lever to check that the front hood is unlocked normally.
12. Battery	Check the battery terminals for any abnormal conditions such as rust and trace of battery fluid leaks.
13. Brake fluid	Check that the fluid level is normal.
14. Engine oil	Check that the oil level is normal.
15. Transmission gear oil	Check that the transmission gear oil level is normal.
16. AT front differential gear oil	Check that the AT front differential oil level is normal.
17. Engine coolant	Check that the engine coolant level is normal.
18. Clutch fluid	Check that the clutch fluid level is normal.
19. Window washer fluid	Check that the window washer fluid level is normal.
20. Front hood latch check	Check that the hood is closed and latched securely.
21. Keyless entry system	Check that the keyless entry system operates normally.
22. Alarm system	Check that the alarm system operates normally.
23. Seat	<ol style="list-style-type: none"> <li>1. Check the seat surfaces for stains or dirt.</li> <li>2. Check the seat installation conditions and functionality.</li> <li>3. Check that the occupant detection system for passenger's seat operates normally.</li> </ol>
24. Seat belt	<ol style="list-style-type: none"> <li>1. Check the seat belt installation conditions and functionality.</li> <li>2. Check that the seat belt warning system operates normally.</li> </ol>

# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

### CHECKS WITH THE ENGINE RUNNING

Procedure	Check point
25. Test mode connector	Test mode connector
26. Immobilizer system	1. Check that the engine starts with all keys that are equipped on vehicle. 2. 60 seconds after turning ignition switch from ON to ACC or OFF, or immediately after removing the key, check that the security indicator light blinking.
27. Starting condition	Start the engine and check that the engine starts smoothly.
28. Exhaust system	Check that the exhaust noise is normal and no leaks are found.
29. Indicator and warning lights	Check that all the indicator and warning lights are gone out.
30. Heater & ventilation	Check that the heater & ventilation system operates normally.
31. Air conditioner	Check that the air conditioner operates normally.
32. Clock	Check that the clock operates normally.
33. Audio	Check the radio, CD player for normal operation.
34. Navigation system	1. Check all display functions for normal operation. 2. Check the map disc (DVD) are provided on vehicle. 3. Check that the navigation system operates normally.
35. Front accessory power supply socket	Check that the front accessory power socket operates normally.
36. Lighting system	Check that the lighting system operates normally.
37. Wiper deicer	Check that the wiper deicer operates normally.
38. Illumination control	Check that the illumination control operates normally.
39. Window washer	Check that the window washer system operates normally.
40. Wiper	Check that the wiper system operates normally.
41. Power window operation check	Check that the power window operations normally.
42. Sunroof	Check that the sunroof operates normally.
43. Door mirror	Check that the remote control mirror operates normally.

### DYNAMIC TEST WITH THE VEHICLE RUNNING

Procedure	Check point
44. Brake test	Check the foot brake for normal operations.
45. Parking brake	Check the parking brake for normal operations.
46. AT shift control	Check that the AT shift patterns are correct.
47. Cruise control	Check that the cruise control system operates normally.

### CHECKS AFTER DYNAMIC TEST

Procedure	Check point
48. ATF level	Check that the ATF level is correct.
49. Power steering fluid level	Check that the power steering fluid level is normal.
50. Fluid leak check	Check for fluid/oil leaks.
51. Water leak test	Spray the vehicle with water and check for water leaks.
52. Appearance check 2	1. Remove the protective coating (if equipped). 2. Check the body paints for damage and stain. 3. Check the plated parts for damage and rust.

## 1. APPEARANCE CHECK

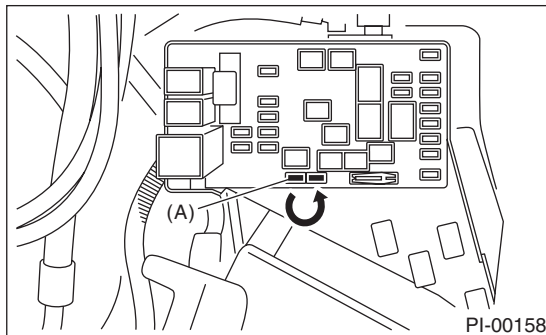
- If the vehicle is covered with protective coating, visually check the vehicle body for damage and dents.
- When the protective coating is removed, visually check the body paints for damage or stains in detail and repair as necessary.
- Visually check the windshield glass, door glasses and light lenses for any damage, cracks or excessive gaps to the body sheet metal and repair as necessary.
- Visually check the plated parts, such as the grilles and door knobs, for damage or loss of gloss and replace the parts as necessary.

## 2. TIRE CHECK

- Check the tires for damage, defective, and dents on wheels.
- Check and adjust the tire size, spare tire and tire air pressure described on the tire air pressure label (driver's side).

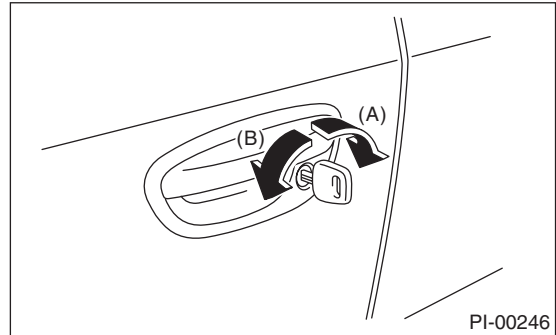
## 3. FUSE INSTALLATION

Fuses for the back-up circuit have been removed to prevent battery discharge. If the vehicle is about to be delivered to the customer, attach a 20 A fuse (A) as shown in the figure.



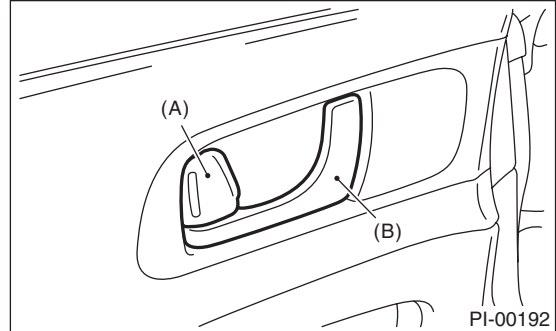
## 4. LOCK/UNLOCK AND OPEN/CLOSE OPERATION CHECKS OF DOORS.

1) Using the key, lock and unlock the door several times to check for normal operation. Open and close the door several times for smooth movement.



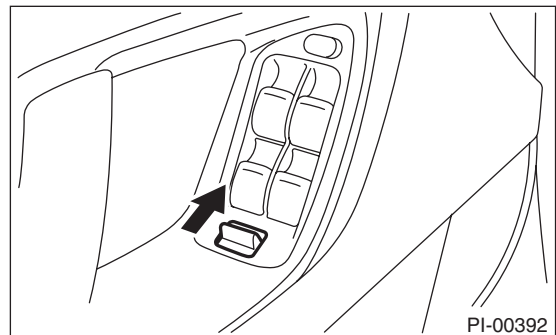
- (A) Unlock
- (B) Lock

2) Completely close the driver's door, and then check the smooth movement with operating door lock knob from lock to unlock several times. Set the door lock knob (A) to lock position. Then pull the inner remote (B) to ensure that doors will not open. For other doors, place the door lock knob (A) to lock position and then pull the inner remote (B) to ensure that doors will not open.



- (A) Door lock knob
- (B) Inner remote

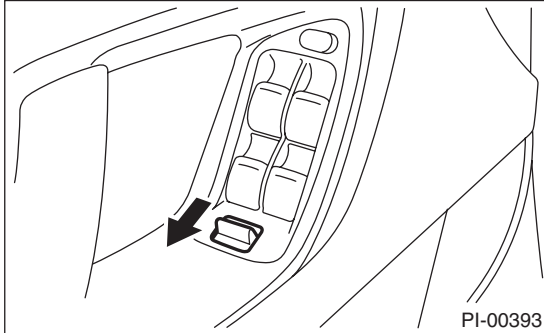
3) Close all the doors, and then press the lock on power door lock switch at driver's side. Check that all doors including rear gate are locked.



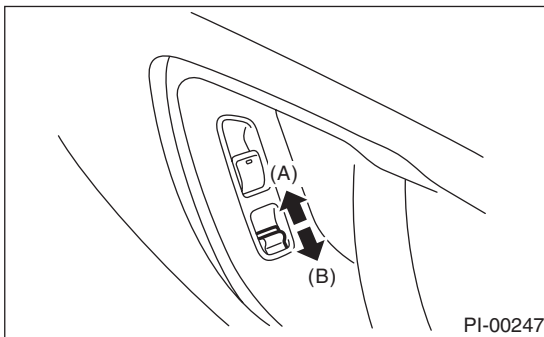
# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

4) Press the driver's side power door lock switch to unlock side. Check that all doors including rear gate are unlocked.



5) Check that the power door lock switch on the passenger's side also locks and unlocks.

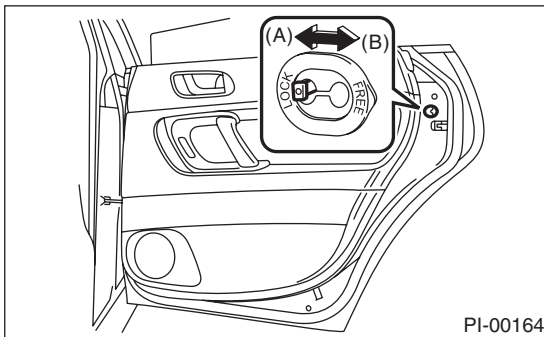


- (A) Lock
- (B) Unlock

6) Insert the key to ignition switch, and open the driver's side door. Press lock on power door lock. Check that the door is not locked.

## 5. CHECK THE OPERATION OF CHILD SAFETY LOCK SYSTEM

- 1) Set the child safety lock on both rear doors to the lock position.
- 2) Close the rear doors completely.
- 3) Check that the lock levers of the rear doors are in the unlock position. Then, pull inner remote of rear doors to ensure that the doors will not open.

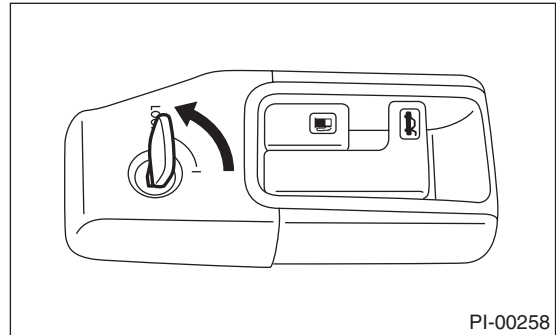


- (A) Lock
- (B) Unlock

4) Pull the outer handles to ensure that doors will open.

## 6. OPEN/CLOSE OPERATION CHECKS OF TRUNK LID

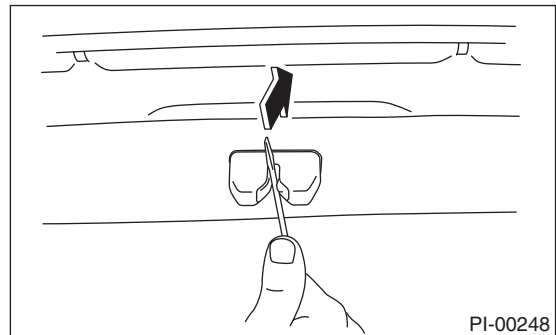
- 1) Operate the trunk lock release lever to check that the trunk lid opens normally.
- 2) Open and close the trunk lid several times for smooth movement.
- 3) Lock the trunk lock release lever using main key or sub key.



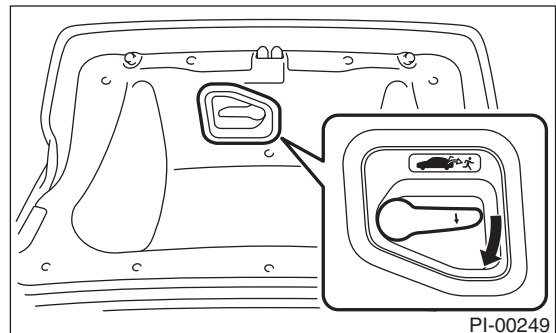
- 4) Check that the trunk lock release lever does not operate.
- 5) Check if the trunk lock release lever is not locked and unlocked using valet key.

## 7. OPERATION CHECK OF TRUNK LID RELEASE HANDLE

1) Use a flat tip screwdriver. Slide the screwdriver blade from the slit aperture of the lock assembly fully to the end until you hear a click. This places the latch in the locked position.



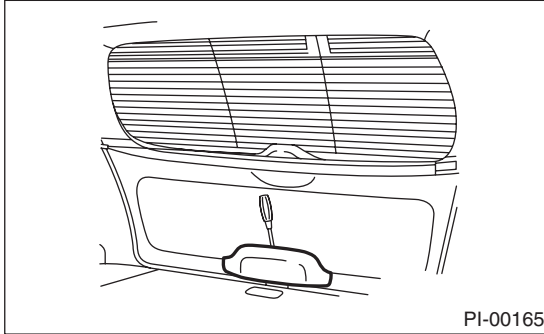
2) Move the release handle from outside the vehicle in the direction of the arrow to check if the latch is released.



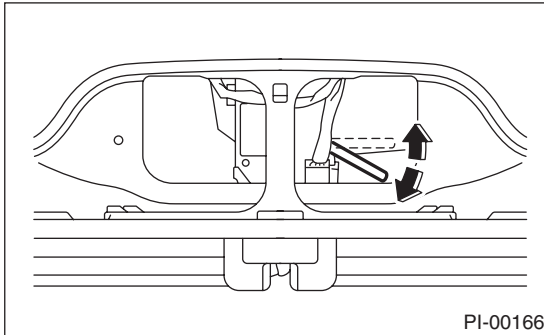
## 8. LOCK/UNLOCK AND OPEN/CLOSE OPERATION CHECKS OF REAR GATE

- 1) Open and close the rear gate several times for smooth movement.
- 2) Operate the rear gate lever to check that the rear gate is locked and unlocked normally.

(1) Remove the cover inside the rear gate.



(2) Operate the lever to check that the rear gate is locked and unlocked normally.



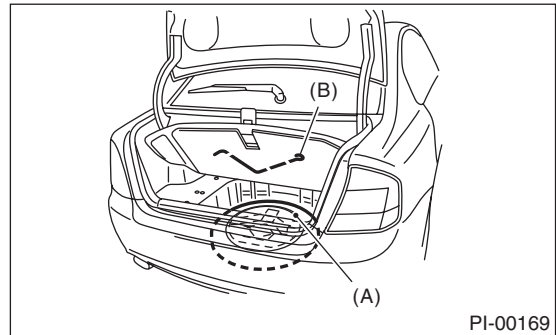
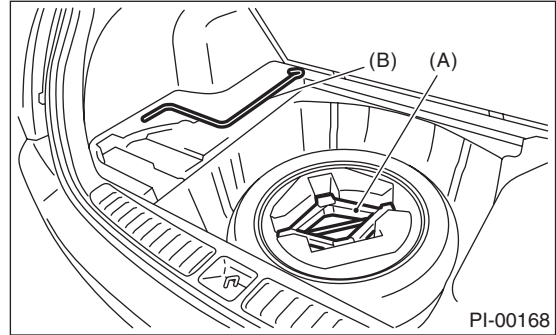
## 9. OPERATION CHECK OF FUEL LID OPENER LOCK RELEASE LEVER

Operate the fuel lid opener to check that the fuel lid is unlocked normally. Check that the filler cap is securely closed.

## 10. ACCESSORY CHECK

Check that the following accessories are provided.

- Owner's manual
- Warranty booklet
- Maintenance note
- Spare key
- Jack
- Tool set
- Spare tire



(A) Jack

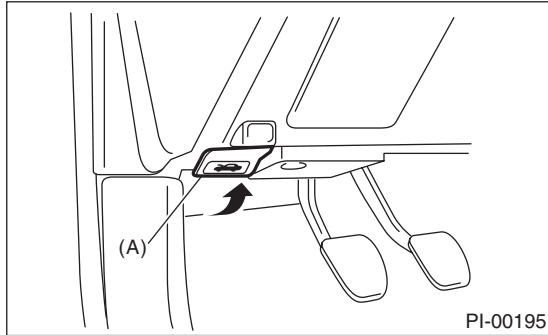
(B) Jack handle

# Pre-delivery Inspection

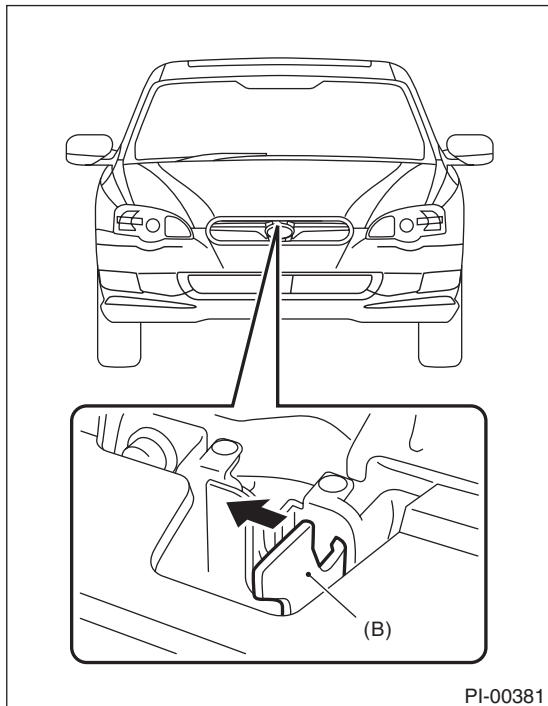
## PRE-DELIVERY INSPECTION

### 11. OPERATION CHECK OF FRONT HOOD LOCK RELEASE SYSTEM

Operate the front hood lock release lever (A) to check that the front hood is unlocked normally.

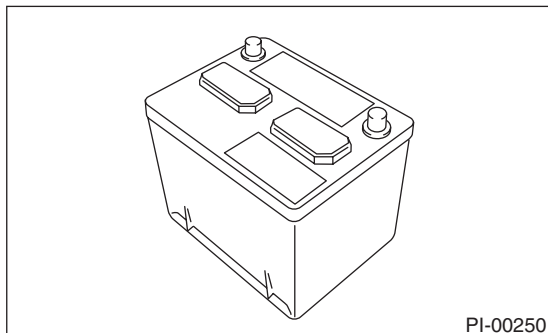


Operate the lever (B) and check that the front hood is opened normally. Support the front hood with hood stay.



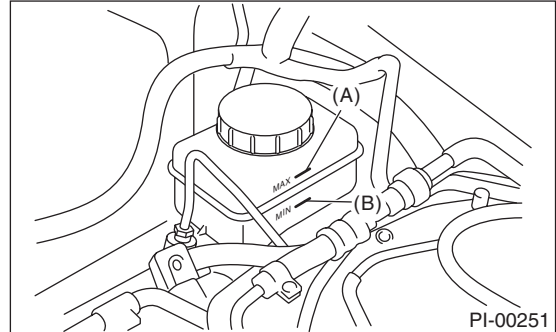
### 12. BATTERY

Check the battery terminals to make sure that there are no rust or corrosions due to fluid leaks.



### 13. BRAKE FLUID

Check that the brake fluid level is normal. If the amount is insufficient, carry out a brake line test to identify brake fluid leaks and check the brake operation. After that, refill the brake fluid tank with the specified type of fluid.



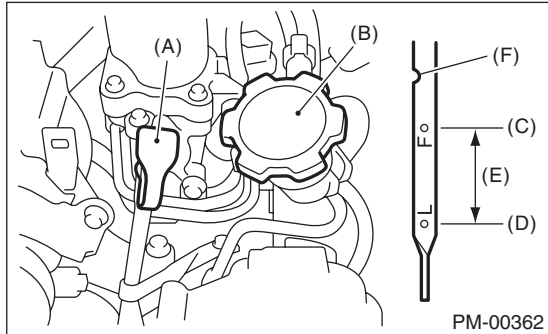
- (A) MAX. level
- (B) MIN. level



## 14. ENGINE OIL

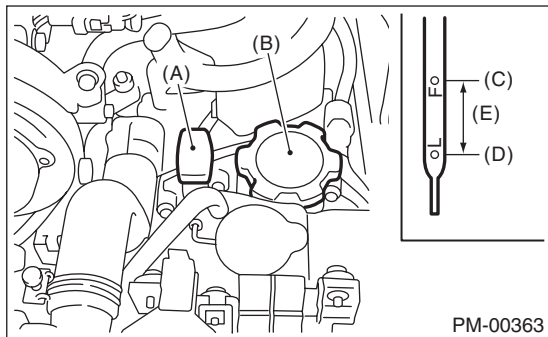
Check the engine oil amount. If the amount of oil is insufficient, check that no leaks are found. Then, add the necessary amount of the specified engine oil.

- Except for 3.0 L model



- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
- (F) Notch mark

- 3.0 L model

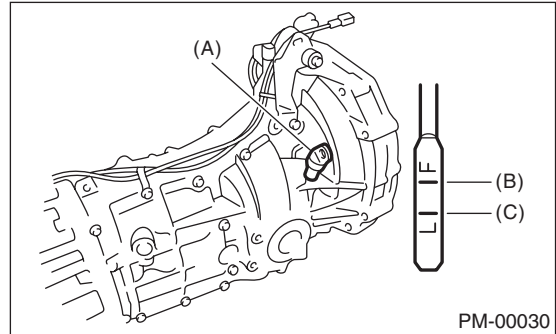


- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

## 15. TRANSMISSION GEAR OIL

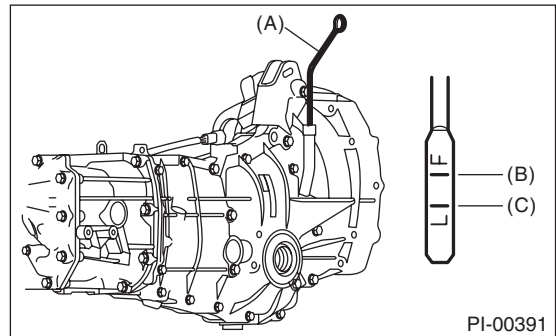
Check that the transmission gear oil level is normal. If the amount of fluid is insufficient, check that no leaks are found. Then add the necessary amount of the specified transmission gear oil.

- 5MT model (Non-turbo model)



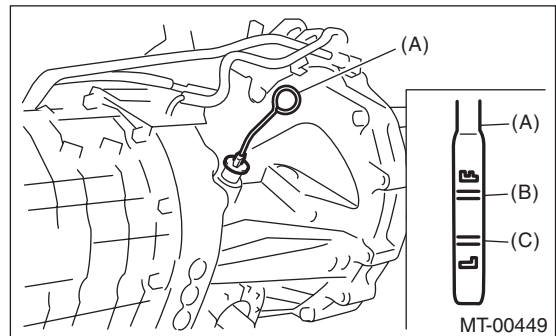
- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

- 5MT model (Turbo model)



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

- 6MT model



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

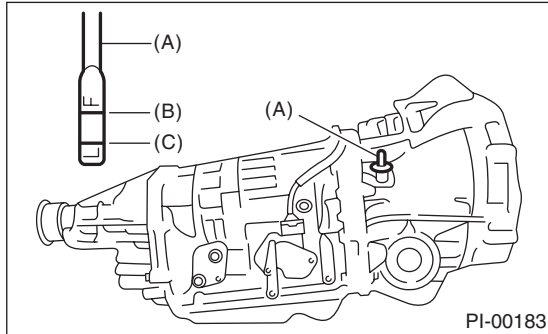
# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

### 16. AT FRONT DIFFERENTIAL GEAR OIL

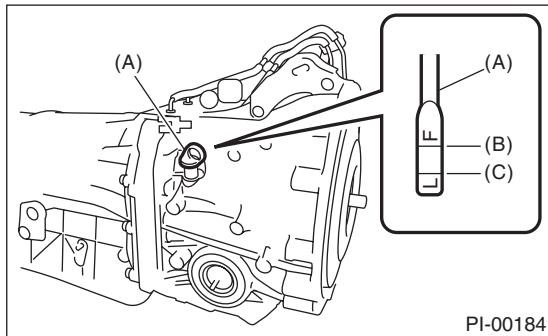
Check that the AT front differential oil level is normal. If the amount of oil is insufficient, check that no leaks are found. Then, add the necessary amount of the specified AT front differential oil.

- 4AT model



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

- 5AT model



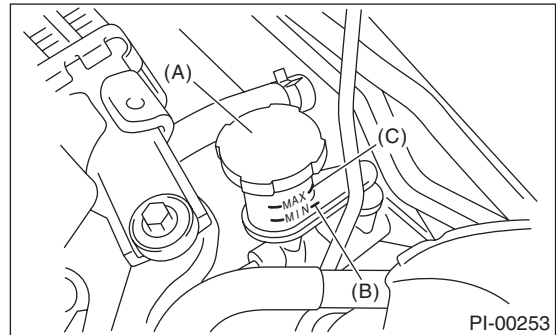
- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

### 17. ENGINE COOLANT

Check that the engine coolant level on the reservoir tank is normal. If the amount of engine coolant is insufficient, check that no leaks are found. Then, add the necessary amount of coolant with the specified concentration.

### 18. CLUTCH FLUID

Check that the clutch fluid level is normal. If the amount of fluid is insufficient, check that no leaks are found. Then, add the necessary amount of specified fluid.



- (A) Reservoir tank
- (B) MIN. level
- (C) MAX. level

### 19. WINDOW WASHER FLUID

Check that the window washer fluid level is normal. If the amount is insufficient, check that no leaks are found. Then, add the necessary amount of washer fluid.

### 20. FRONT HOOD LATCH CHECK

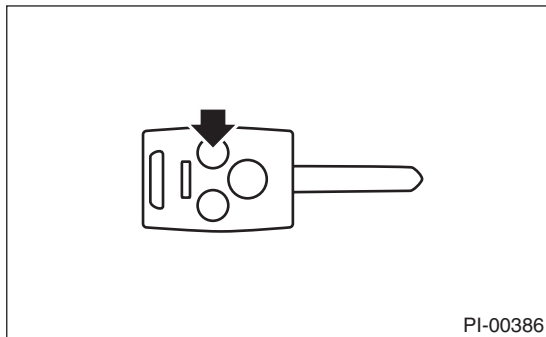
Retract the front hood stay and close the front hood. Check that the front hood is securely latched.

## 21. KEYLESS ENTRY SYSTEM

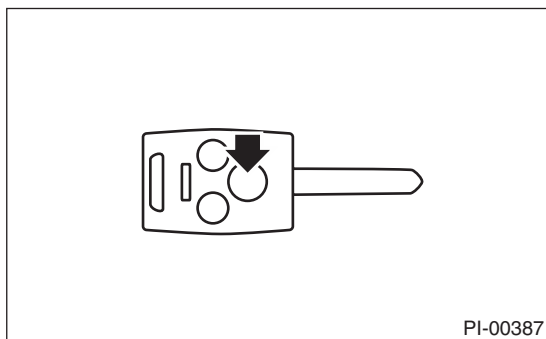
**NOTE:**

The following inspections show the initial settings. When the settings are different from the initial settings, use Subaru Select Monitor to check the details of each setting for inspections. <Ref. to LAN(diag)-26, OPERATION, Read Current Data.>

- 1) Fully open all the door windows.
- 2) Remove the key from the ignition switch and close all the doors including rear gate.
- 3) Press the rear gate and trunk open button for at least one second.
  - Check if the trunk is opened and the hazard light blinks twice and the buzzer sounds twice. (Sedan model)
  - Check if the rear gate is unlocked and the hazard light blinks twice and the buzzer sounds twice. (Wagon model)

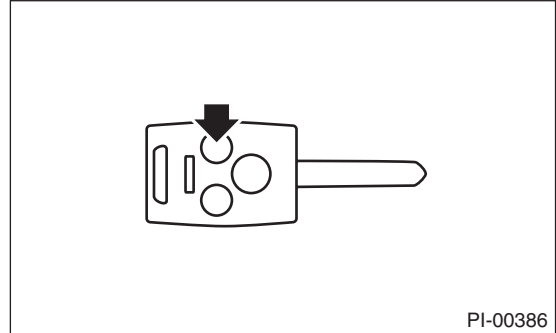


- 4) Press the “LOCK” button on the keyless transmitter with one of the doors (including the rear gate and trunk) opened. Check if all the doors are locked, hazard light blinks five times and the buzzer sounds five times and warning shows one of the doors (including the rear gate and trunk) open.
- 5) Close all the doors including rear gate and trunk. Press the “LOCK” button momentarily on the keyless transmitter. Check that all the doors (including rear gate and trunk) are locked, hazard light blinks once and buzzer sounds once.



- 6) Press the “UNLOCK” button momentarily on the keyless transmitter. Check that the driver’s door is unlocked and hazard light blinks twice and the buzzer sounds twice.

And press the “UNLOCK” button momentarily again in 5 seconds. Check that all the doors including rear gate are unlocked.



- 7) Within a distance of 10 m from a vehicle, press keyless transmitter’s “LOCK” button three times within 5 seconds. Check that the horn honks once and that the hazard light blinks three times.

- 8) Move the power door lock switch to the lock position with one of doors (including the rear gate) opened. Next, close all the doors including rear gate. Check if all the doors are locked and buzzer sounds once and the hazard light flashes once.

- 9) Check buzzer operation.

The buzzer sounds when the doors are locked or unlocked. The buzzer can be turned off if desired. Turn the buzzer off or on with following procedure.

- (1) Close all the doors including rear gate, then remove the key from ignition key lock.
- (2) Press the power door lock switch to unlock and hold it until the operation is finished.
- (3) Insert the key into ignition key lock, and insert and remove the key in ignition key lock 5 times in 10 seconds.
- (4) When finished step (3), open and close the driver’s door once within 10 seconds.

**NOTE:**

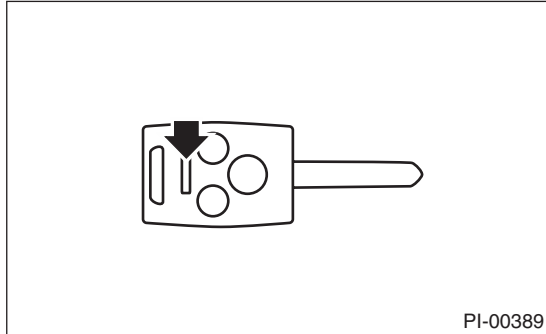
When opening and closing of the door is not available within 10 seconds, hazard light blinks once and the change over operation is cancelled. Retry from the step (1).

- (5) Hazard light blinks 3 times and the buzzer sound turns ON or OFF.

# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

10) Press the Panic button on the keyless transmitter. Check if the alarm condition happens (horn sounds continuously, hazard light blinks, security indicator comes on). Check whether this condition lasts until any button on the keyless transmitter is pressed or lasts for 30 seconds.

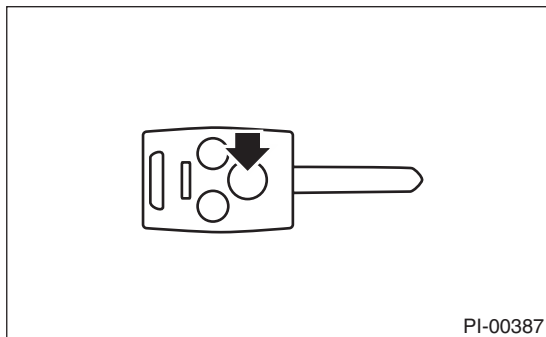


## 22.ALARM SYSTEM

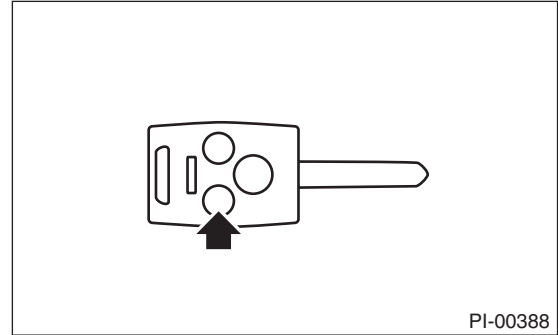
### NOTE:

The following inspections show the initial settings. When the settings are different from the initial settings, use Subaru Select Monitor to check the details of each setting for inspections. <Ref. to LAN(diag)-27, OPERATION, Function Setting (Customize).>

- 1) Fully open all the door windows.
- 2) Remove the key from the ignition switch and close all the doors including rear gate.
- 3) Press the "LOCK" button momentarily on the keyless transmitter. All doors are locked, and buzzer sounds once, hazard blinks once, security indicator light blinks faster (five times per two seconds) for 30 seconds and goes slower (twice per two seconds), then the alarm system is in set condition.



4) Press the "UNLOCK" button momentarily on the keyless transmitter. When the door of the driver's seat is unlocked, the buzzer sounds twice, the hazard light flashes twice, the room light turns on and the security indicator light flashes once in three seconds, and the alarm system enters the release mode.



5) Close all the doors including rear gate. Press the "LOCK" button momentarily on the keyless transmitter. When all the doors are locked, buzzer sounds once, hazard blinks once and the alarm system is in set condition in 30 seconds.

6) Unlock a door using the inner lock knob and open the door while the security system is in the set mode. Check if the alarm condition happens (horn sounds continuously, hazard light blinks, security indicator illuminates). Check if this condition lasts for a maximum of three minutes or until the "UNLOCK" button of the keyless transmitter is pressed.

### NOTE:

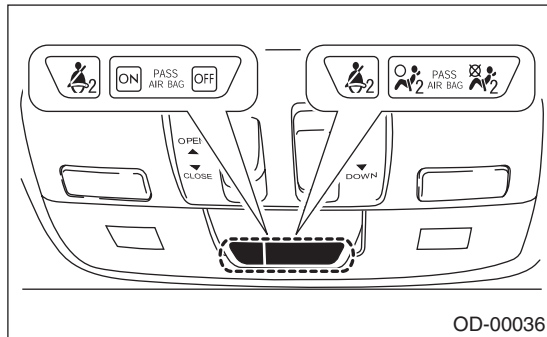
The alarm condition will cease in 30 seconds once the door is closed.

7) When none of above is applicable, check the troubleshooting of security system.

## 23. SEAT

- 1) Check the seat surfaces for stains or dirt.
- 2) Check that each seat provides full functionality in sliding and reclining. Check that the seat position memory for driver's power seat function properly. Check all available functions of the rear seat such as a trunk-through center armrest.
- 3) Check the passenger's seat occupant detection system.

- (1) Turn the ignition switch to ON.
- (2) Check that the ON and OFF of passenger's airbag indicator light come on simultaneously for about 6 seconds and go off for 2 seconds, and then only OFF illuminates again.



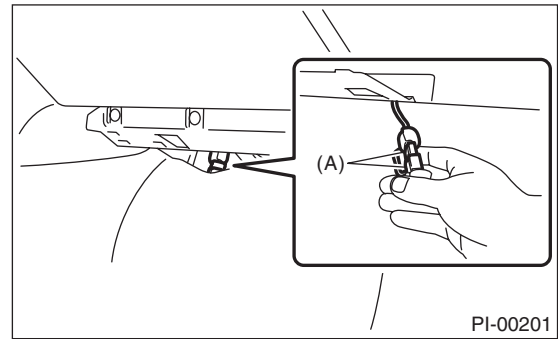
- (3) With a person weighing approximately 70 kg (155 lb) or more sitting in the passenger's seat, check whether the passenger's airbag indicator light illuminates or not.
- (4) Empty the passenger seat, then check whether the passenger's side airbag indicator light illuminate off.

## 24. SEAT BELT

- 1) Check installation condition of seat belt.
- 2) Pull out the seat belt and then release it. Check that the belt retracts smoothly.
- 3) Check that the ALR seat belt operates normally.
- 4) Check seat belt warning system
  - (1) Turn the ignition switch to ON without fastening driver's and passenger's seat belts.
  - (2) Check if the seat belt warning lights of driver's and passenger's side blink for about six seconds and the buzzer beeps intermittently.
  - (3) Then, check that the seat belt warning light comes on → blink in about 15 second cycles. (If the passenger seat is empty, the seat belt warning light for passenger's side does not operate.)

## 25. TEST MODE CONNECTOR

Turn the ignition switch to ON and check that the malfunction indicator light starts blinking. If the light blinks, return the ignition key to LOCK. Pull out the test mode connector from the back of glove box lower cover, and disconnect the test mode connector. Then, turn the ignition key to ON again. If the malfunction indicator light blinks at that time in spite of the disconnected test mode connector, carry out an engine diagnosis.



(A) Test mode connector (green)

## 26. IMMOBILIZER SYSTEM

- 1) Check that the engine starts with all keys that are equipped on vehicle.
- 2) 60 seconds after turning ignition switch from ON to ACC or OFF, or immediately after removing the key, check that the security indicator light blinking.

### NOTE:

If malfunctions occur, refer to "IMMOBILIZER (DIAGNOSIS)".

## 27. STARTING CONDITION

Start the engine and check that the engine starts smoothly. If the battery voltage is low, recharge or replace the battery. If any noises are observed, immediately stop the engine and check and repair the abnormal components.

## 28. EXHAUST SYSTEM

Listen to the exhaust noise to see if no noises are observed. Check for exhaust leaks.

## 29. INDICATOR AND WARNING LIGHTS

Check that all the indicator and warning lights are off.

## 30. HEATER & VENTILATION

Operate the heater & ventilation system to check for normal airflow outlet control, air inlet control, airflow capacity and heating performance.

# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

### 31. AIR CONDITIONER

Operate the air conditioner. Check that the A/C compressor operates normally and enough cooling is provided.

#### NOTE:

To prevent the insufficient lubrication of air conditioner, operate the air conditioner for 5 minutes at idling.

### 32. CLOCK

Check the clock for normal operations and enough accuracy.

### 33. AUDIO

Check the radio for full functionality and normal noise level. Check the CD unit operations.

### 34. NAVIGATION SYSTEM

- 1) Check all display functions for normal operation.
- 2) Check the map disc (DVD) are provided on vehicle.
- 3) Check that the navigation system operates normally.

### 35. FRONT ACCESSORY POWER SUPPLY SOCKET

- 1) Check the operation of the front accessory power supply socket.
- 2) Check operation of the accessory power supply socket in console box.

### 36. LIGHTING SYSTEM

- 1) Check the headlight operations.
- 2) Check the stop light operation.
- 3) Check other lights for normal operations.

### 37. WIPER DEICER

Check that the wiper deicer operates normally.

### 38. ILLUMINATION CONTROL

Check that the illumination control operates normally.

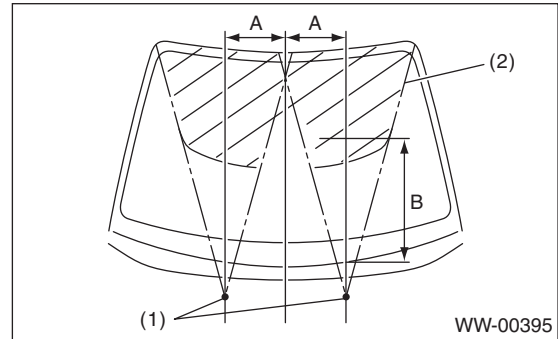
### 39. WINDOW WASHER

Check that the window washer system injects washer fluid to the specified area of the windshield shown in the figure.

#### Front injection position:

**A: 250 mm (9.84 in)**

**B: 535 mm (21.1 in)**



(1) Nozzle

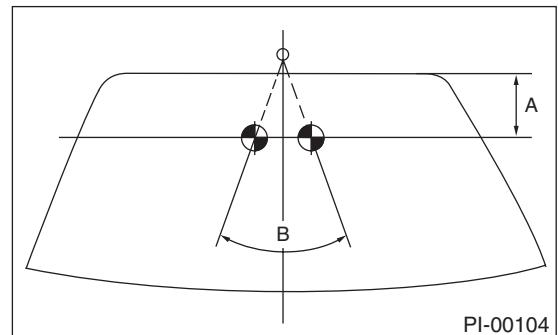
(2) Spray area (shaded area)

#### Rear injection position:

**Wagon model**

**A: 70 mm (2.8 in)**

**B: 70°**



### 40. WIPER

Check the front and rear wipers for normal operations.

### 41. POWER WINDOW OPERATION CHECK

Operate the power window switches one by one to check that each of the power windows goes up and down without noises.

### 42. SUNROOF

Check that the sunroof operates normally.

### 43. DOOR MIRROR

Check that the remote control mirror operates normally.

### 44. BRAKE TEST

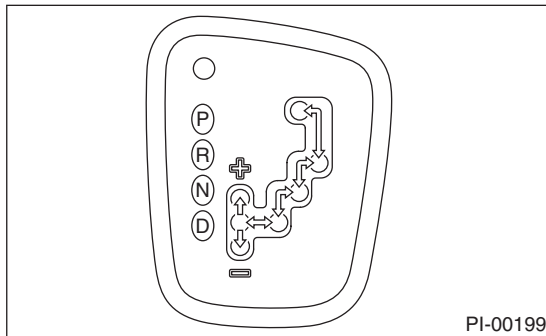
Check the foot brake for normal operations.

## 45. PARKING BRAKE

Check the parking brake for normal operations. When pulling the parking brake lever with force of 200 N (20.4 kgf, 45.0 lb), check that the lever stroke of parking brake lever is 5 to 6 notches.

## 46. AT SHIFT CONTROL

- 1) Turn the ignition switch to ON.
- 2) While brake pedal is not depressed, check if the select lever does not move from "P" range.
- 3) While brake pedal is depressed, check if the select lever moves from "P" range.
- 4) Set the select lever to other than "P" range.
- 5) When the ignition switch is turned to OFF, check if the ignition key switch cannot be removed.
- 6) Set the AT selector lever to each gear position and check the shifting while driving the vehicle.



### • 4AT

Selector position	Gear position			
	1st	2nd	3rd	4th
D	OK	OK	OK	OK
Manual mode	OK	OK	OK	OK

### • 5AT

Selector position	Gear position				
	1st	2nd	3rd	4th	5th
D	OK	OK	OK	OK	OK
Manual mode	OK	OK	OK	OK	OK

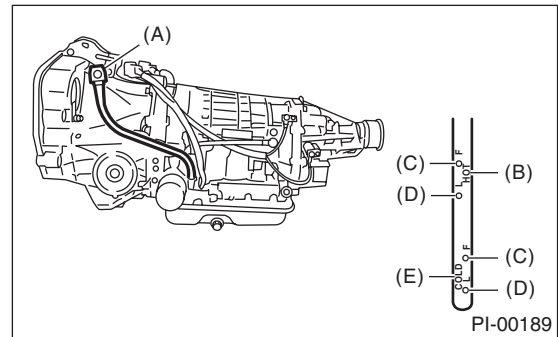
## 47. CRUISE CONTROL

Operate the cruise control system. Check that the system is activated and deactivated correctly.

## 48. ATF LEVEL

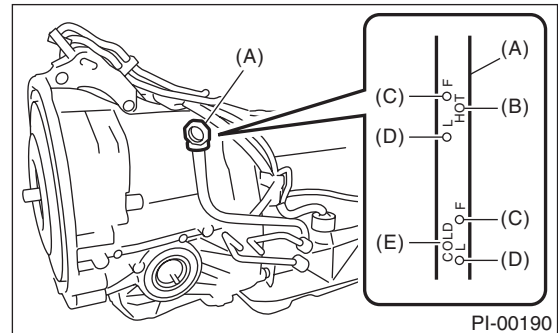
After selecting all positions (P, R, N, D), set the select lever in "P" range. Idle the engine for 1 — 2 minutes, and measure the ATF level. If the amount is insufficient, check that no leaks are found. Then, add the necessary amount of the specified ATF.

### • 4AT



- (A) Level gauge
- (B) ATF level range at "HOT" [70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at "COLD" [20 — 30°C (68 — 86°F)]

### • 5AT



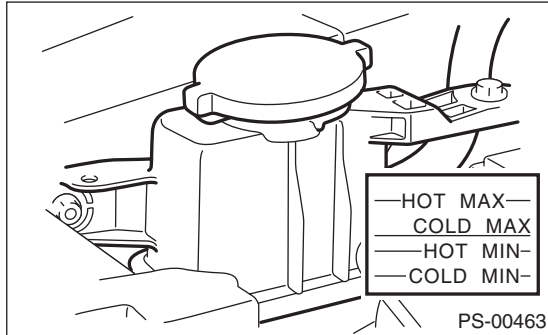
- (A) Level gauge
- (B) ATF level range at "HOT" [70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at "COLD" [20 — 30°C (68 — 86°F)]

# Pre-delivery Inspection

## PRE-DELIVERY INSPECTION

### 49. POWER STEERING FLUID LEVEL

Check that the power steering fluid level is normal. If the amount is insufficient, check that no leaks are found. Then add the necessary amount of the specified power steering fluid.



### 50. FLUID LEAK CHECK

Check entire areas of the vehicle for any trace of coolant/oil/fluid leaks.

### 51. WATER LEAK TEST

Spray the vehicle with water using a hose and check that no water enters the passenger compartment.

- Before performing the water leakage test, remove anything that may obstruct the operation or which must be kept dry.
- Close all the windows and doors securely. Close the hood and trunk lid before starting the test.
- Spray the vehicle with water using a hose. The rate of water spray must be approx. 20 — 25 ℓ (5.3 — 6.6 US gal, 4.4 — 5.5 Imp gal) per minute.

When spraying water on areas adjacent to the floor and wheel house, increase the pressure. When spraying water on areas other than the floor and wheel house, decrease the pressure. But the force of water must be made strong occasionally by pressing the end of the hose.

#### NOTE:

Be sure to keep the hose at least 10 cm (3.9 in) away from vehicle.

Check the following areas.

- Front window and body framework mating portion
- Door mating portions
- Glass mating portions
- Rear quarter window mating portions
- Rear window and body framework mating portion
- Around roof drips

If any dampness in the compartments is discovered after the water has been applied, carefully check all the areas that may have possibly contributed to the leak.

### 52. APPEARANCE CHECK 2

1) When vehicle body is covered with protective film, peel it off.

#### NOTE:

- Use of steam facilitates peeling off the wrap guard.
- For a vehicle left for a long time or at low temperature, sprinkle some water heated to 50 — 60°C (122 — 140°F) over the vehicle to raise its surface temperature before peeling off the wrap guard. Do not use the water heated to over 60°C (140°F).
- If the adhesive remains exist on the coated surface, soak a flannel rag, etc. with a small amount of coating wax or solvent such as oil benzene and IPA, put the soaked cloth on the remains lightly, and then wipe them off with a flannel rag etc.
- Keep solvent from touching the resin or rubber parts. Do not use coating wax or solvent while the component surface temperature is high due to hot weather etc.
- If the coated surface is swollen out due to seams or moisture, expose the vehicle to the sunlight for a few hours or heat the seam and swollen portions using a dryer etc.
- Dispose of the peeled wrap guard as burnable industrial garbage.

2) Check the whole vehicle body for flaking paint, damage by transportation, corrosion, dirt, cracks or blisters.

#### NOTE:

- It is better to determine an inspection pattern in order to avoid missing an area, since the total inspection area is wide.
- Do not repair the body paint unless absolutely necessary. Also, if the vehicle is in need of repair to remove scratches or corroded paint, the repair area must be limited to the minimum. Re-painting and spray painting must be avoided as possible.

3) Check each window glass for scratches carefully. Slight damage may be removed by polishing with cerium oxide. (Fill a cup half with cerium oxide, and add warm water to it. Then agitate the content until it turns to wax. Apply this wax to a soft cloth, and polish the glass with it.)

4) Check each portion of the vehicle body and underside components for the formation of rust. If rust is discovered, remove it with sandpaper of #80 to #180 and treat the surface with rust preventive. After this treatment is completed, flush the portion thoroughly, and prepare the surface for repair painting.

5) Check each portion of body and all of the plated parts for deformation or distortion. Also, check each light lens for cracks.



6) Peel the protective tape, vinyl wrapping and identification seal attached to the following places.

- Seats
- Door trim
- Floor carpet
- Side sill
- Front hood lock release lever
- Edge rear
- Rear wiper
- Sedan rear combination light (Trunk lid opening portion)
- Roof rail
- Door mirror

# Pre-delivery Inspection

PRE-DELIVERY INSPECTION

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## General Description

PERIODIC MAINTENANCE SERVICES

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### 1. General Description

#### A: GENERAL DESCRIPTION

Be sure to perform periodic maintenance in order to maintain vehicle performance and find problems before they occur.

# Schedule

## PERIODIC MAINTENANCE SERVICES

### 2. Schedule

#### A: MAINTENANCE SCHEDULE 1

##### 1. U.S.

- Other than U5 model

		Maintenance interval [Number of months or km (miles), whichever occurs first]																	Remarks
Months		3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
× 1,000 km		4.8	12	24	36	48	60	72	81.4	96	108	120	132	144	156	168	180	192	
× 1,000 miles		3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
1	Engine oil	3.0 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
		2.5 L		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2	Engine oil filter	3.0 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
		2.5 L		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
3	Spark plug					R				R				R				R	
										R									R
4	Drive belt(s)					I				I				I			R		
5	Camshaft drive belt					I				I				I			R		
6	Fuel line					(I)				(I)				(I)				I	
7	Air cleaner element					R				R				R				R	
8	Cooling system					I				I				I				I	
9	Engine coolant					R				R				R				R	
10	Clutch system			I		I		I		I		I		I		I		I	
11	Transmission oil					I				I				I				I	
12	ATF					I				I				I				I	
13	Front & rear differential oil					I				I				I				I	
14	Brake line			I		I		I		I		I		I		I		I	
15	Brake fluid					R				R				R				R	
16	Disc brake pad and disc			I		I		I		I		I		I		I		I	
17	Parking brake			I		I		I		I		I		I		I		I	
18	Suspension			I		I		I		I		I		I		I		I	
19	Wheel bearing									(I)								(I)	
20	Axle boots and joints			I		I		I		I		I		I		I		I	
21	Tire rotation		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	
22	Steering system (Power steering)			I		I		I		I		I		I		I		I	
23	A/C filter	Replace every 12 months or 15,000 km (9,300 miles).																	Note 5.

Symbols used:

R: Replace

I: Inspection

(R) or (I): Recommended service for safe vehicle operation.

# Schedule

## PERIODIC MAINTENANCE SERVICES

### NOTE:

1. This inspection is not required to maintain emission warranty eligibility and it does not affect the manufacturer's obligations under EPA's in-use compliance program.
2. When the vehicle is used in extremely dusty conditions, the air cleaner element should be replaced more often.
3. ATF filter is maintenance free part. ATF filter needs replacement, when it has physically rust, damaged or ATF leaked.
4. A tire should be replaced when the tread wear indicator appears as a solid band across the tread. The indicators appear when the remaining tread has been worn to 1.6 mm (0.063 in) or less.
5. When the A/C filter is installed.
6. For 2.5 L turbo model, replace every 3.75 months or 6,000 km (3,750 miles).

### • U5 model

		Maintenance interval [Number of months or km (miles), whichever occurs first]											Remarks	
Months		3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75		To be continued to the next table
× 1,000 km		4.8	12	24	36	48	60	72	81.4	96	108	120		
× 1,000 miles		3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75		
1	Engine oil		R	R	R	R	R	R	R	R	R	R		
2	Engine oil filter		R	R	R	R	R	R	R	R	R	R		
3	Spark plug					R				R				
4	Drive belt(s)					I				I				
5	Camshaft drive belt					I				I				
6	Fuel line					(I)				(I)				Note 1.
7	Air cleaner element					R				R				Note 2.
8	Cooling system					I				I				
9	Engine coolant					R				R				
10	Clutch system			I		I		I		I		I		
11	Transmission oil					I				I				
12	ATF					I				I				Note 3.
13	Front and rear differential oil					I				I				
14	Brake line			I		I		I		I		I		
15	Brake fluid					R				R				
16	Disc brake pad and disc			I		I		I		I		I		
17	Parking brake			I		I		I		I		I		
18	Suspension			I		I		I		I		I		
19	Wheel bearing									(I)				
20	Axle boots and joints			I		I		I		I		I		
21	Tire rotation		I	I	I	I	I	I	I	I	I	I		Note 4.
22	Steering system (Power steering)			I		I		I		I		I		
23	A/C filter	Replace every 12 months or 15,000 km (9,300 miles).											Note 5.	

### Symbols used:

R: Replace

I: Inspection

(R) or (I): Recommended service for safe vehicle operation.

### NOTE:

1. This inspection is not required to maintain emission warranty eligibility and it does not affect the manufacturer's obligations under EPA's in-use compliance program.
2. When the vehicle is used in extremely dusty conditions, the air cleaner element should be replaced more often.
3. ATF filter is maintenance free part. ATF filter needs replacement, when it has physically rust, damaged or ATF leaked.
4. A tire should be replaced when the tread wear indicator appears as a solid band across the tread. The indicators appear when the remaining tread has been worn to 1.6 mm (0.063 in) or less.
5. When the A/C filter is installed.

# Schedule

## PERIODIC MAINTENANCE SERVICES

		Maintenance interval [Number of months or km (miles), whichever occurs first]											Remarks
Months	Continued from the previous table	82.5	90	97.5	105	112.5	120	127.5	135	142.5	150		
× 1,000 km		132	144	156	168	180	192	204	216	228	240		
× 1,000 miles		82.5	90	97.5	105	112.5	120	127.5	135	142.5	150		
1	Engine oil	R	R	R	R	R	R	R	R	R	R		
2	Engine oil filter	R	R	R	R	R	R	R	R	R	R		
3	Spark plug		R				R				R		
4	Drive belt(s)		I		R				I				
5	Camshaft drive belt		I		R				I				
6	Fuel line		(I)				I				(I)	Note 1.	
7	Air cleaner element		R				R				R	Note 2.	
8	Cooling system		I				I				I		
9	Engine coolant		R				R				R		
10	Clutch system		I		I		I				I		
11	Transmission oil		I				I				I		
12	ATF		I				I				I	Note 3.	
13	Front and rear differential oil		I				I				I		
14	Brake line		I		I		I		I		I		
15	Brake fluid		R				R				R		
16	Disc brake pad and disc		I		I		I		I		I		
17	Parking brake		I		I		I		I		I		
18	Suspension		I		I		I		I		I		
19	Wheel bearing						(I)				(I)		
20	Axle boots and joints		I		I		I		I		I		
21	Tire rotation		I	I	I	I	I	I	I	I	I	Note 4.	
22	Steering system (Power steering)		I		I		I		I		I		
23	A/C filter	Replace every 12 months or 15,000 km (9,300 miles).										Note 5.	

Symbols used:

R: Replace

I: Inspection

(R) or (I): Recommended service for safe vehicle operation.

**NOTE:**

1. This inspection is not required to maintain emission warranty eligibility and it does not affect the manufacturer's obligations under EPA's in-use compliance program.
2. When the vehicle is used in extremely dusty conditions, the air cleaner element should be replaced more often.
3. ATF filter is maintenance free part. ATF filter needs replacement, when it has physically rust, damaged or ATF leaked.
4. A tire should be replaced when the tread wear indicator appears as a solid band across the tread. The indicators appear when the remaining tread has been worn to 1.6 mm (0.063 in) or less.
5. When the A/C filter is installed.

# Schedule

## PERIODIC MAINTENANCE SERVICES

### 2. CANADA

		Maintenance interval																	Remarks		
		[Number of months or km (miles), whichever occurs first]																			
		Months	3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5		120	
× 1,000 km		4.8	12	24	36	48	60	72	81.4	96	108	120	132	144	156	168	180	192			
× 1,000 miles		3	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120			
1	Engine oil	3.0 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		
		2.5 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
2	Engine oil filter	3.0 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
		2.5 L	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
3	Spark plug					R				R					R				R	2.5 L non-turbo model	
										R									R	For 2.5 L turbo, 3.0 L model	
4	Drive belt(s)					I				I					I			R			
5	Camshaft drive belt					I				I					I			R			
6	Fuel line					(I)				(I)					(I)				I	Note 1.	
7	Air cleaner element					R				R					R				R	Note 2.	
8	Cooling system					I				I					I				I		
9	Engine coolant					R				R					R				R		
10	Clutch system			I		I		I		I		I		I		I			I		
11	Transmission oil					I				I					I				I		
12	ATF					I				I					I				I	Note 3.	
13	Front & rear differential oil					I				I					I				I		
14	Brake line			I		I		I		I		I		I		I			I		
15	Brake fluid					R				R					R				R		
16	Disc brake pad & disc			I		I		I		I		I		I		I			I		
17	Parking brake			I		I		I		I		I		I		I			I		
18	Suspension			I		I		I		I		I		I		I			I		
19	Wheel bearing									(I)									(I)		
20	Axle boots & joints			I		I		I		I		I		I		I			I		
21	Tire rotation		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	Note 4.	
22	Steering system (Power steering)			I		I		I		I		I		I		I			I		
23	A/C filter	Replace every 12 months or 15,000 km (9,300 miles).																	Note 5.		

Symbols used:

R: Replace

I: Inspection

(R) or (I): Recommended service for safe vehicle operation.

**NOTE:**

1. This inspection is not required to maintain emission warranty eligibility and it does not affect the manufacturer's obligations under EPA's in-use compliance program.

2. When the vehicle is used in extremely dusty conditions, the air cleaner element should be replaced more often.

3. ATF filter is maintenance free part. ATF filter needs replacement, when it has physically rust, damaged or ATF leaked.

4. A tire should be replaced when the tread wear indicator appears as a solid band across the tread. The indicators appear when the remaining tread has been worn to 1.6 mm (0.063 in) or less.

5. When the A/C filter is installed.

# Schedule

## PERIODIC MAINTENANCE SERVICES

### B: MAINTENANCE SCHEDULE 2

Item	Maintenance interval	Repeat short distance drive	Repeat rough/muddy road drive	Extremely cold weather area	Salt or other corrosive used or coastal area	High humidity or mountain area	Repeat towing trailer
Engine oil	3.75 months	R		R			R
	6,000 km						
	3,750 miles						
Engine oil filter	3.75 months	R		R			R
	6,000 km						
	3,750 miles						
Fuel line	7.5 months				I		
	12,000 km						
	7,500 miles						
Transmission oil	15 months						R
	24,000 km						
	15,000 miles						
ATF	15 months						R
	24,000 km						
	15,000 miles						
Front and rear differential oil	15 months						R
	24,000 km						
	15,000 miles						
Brake line	7.5 months				I		
	12,000 km						
	7,500 miles						
Brake fluid	15 months					R	
	24,000 km						
	15,000 miles						
Disc brake pad & disc	7.5 months	I	I		I		I
	12,000 km						
	7,500 miles						
Parking brake	7.5 months	I	I		I		I
	12,000 km						
	7,500 miles						
Suspension	7.5 months		I	I	I		
	12,000 km						
	7,500 miles						
Axle boots & joints	7.5 months	I	I	I	I		I
	12,000 km						
	7,500 miles						
Steering system (Power steering)	7.5 months		I	I	I		
	12,000 km						
	7,500 miles						



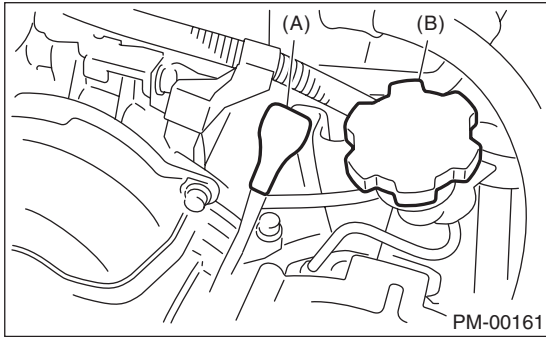
# Engine Oil

## PERIODIC MAINTENANCE SERVICES

### 3. Engine Oil

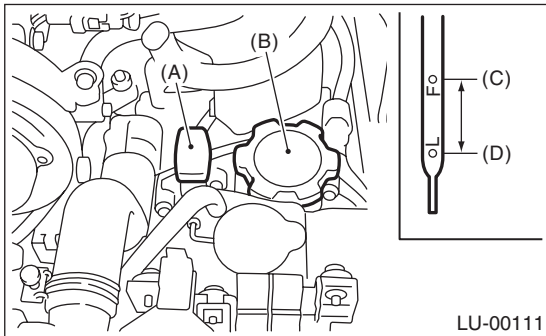
#### A: REPLACEMENT

- 1) Set the vehicle on a lift.
  - 2) Open the engine oil filter cap for quick draining of the engine oil.
- 2.5 L model



- (A) Oil level gauge
- (B) Oil filler cap

- 3.0 L model



- (A) Oil level gauge
- (B) Oil filler cap
- (C) Upper level
- (D) Lower level

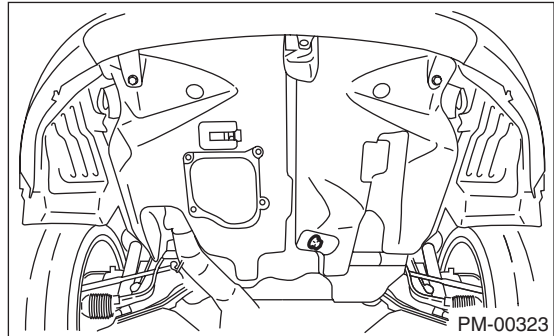
- 3) Lift up the vehicle.

- 4) Drain the engine oil by removing the engine oil drain plug.

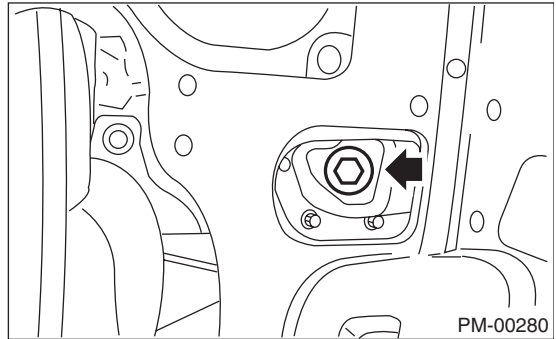
#### NOTE:

Prepare the container for draining of engine oil.

- 2.5 L model



- 3.0 L model



5) Tighten the engine oil drain plug after draining the engine oil.

**CAUTION:**

If the engine oil is split over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

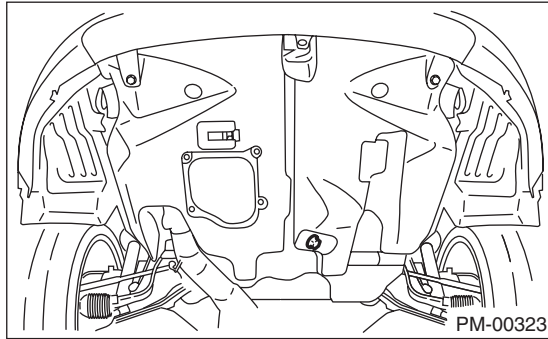
**NOTE:**

Use a new drain plug gasket.

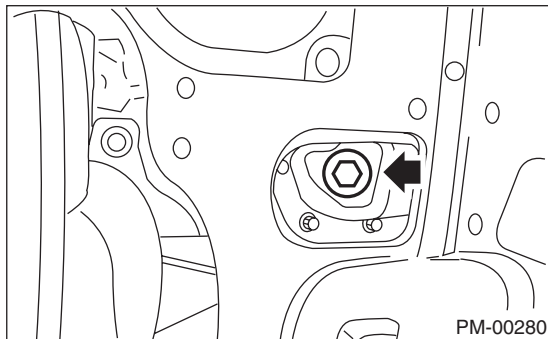
**Tightening torque:**

**44 N·m (4.5 kgf-m, 33 ft-lb)**

- 2.5 L model



- 3.0 L model



6) Fill engine oil through the level gauge up to the upper level. Place the vehicle on a level surface when checking oil level. Use engine oil of the proper quality and viscosity, selected in accordance with the following.

**Recommended oil:**

Refer to "RM" section. <Ref. to RM-2, LUBRICANTS, RECOMMENDED MATERIALS, Recommended Materials.>

**NOTE:**

The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

**Engine oil capacity**

**2.5 L model**

**Upper level:**

**Approx. 4.0 ℓ (4.2 US qt, 3.5 Imp qt)**

**Lower level:**

**Approx. 3.0 ℓ (3.2 US qt, 2.6 Imp qt)**

**3.0 L model**

**Upper level:**

**Approx. 5.5 ℓ (5.8 US qt, 4.8 Imp qt)**

**Lower level:**

**Approx. 4.5 ℓ (4.8 US qt, 4.0 Imp qt)**

**CAUTION:**

It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.

**NOTE:**

If the vehicle is used in regions of high temperature or in other severe environments, use oil with the viscosities shown below. API Standard: SM SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

7) Close the engine oil filler cap.

8) Start the engine and warm it up for a time.

9) Stop the engine to inspect the oil level again. If necessary, add engine oil up to the upper level on level gauge. <Ref. to PM-10, INSPECTION, Engine Oil.>

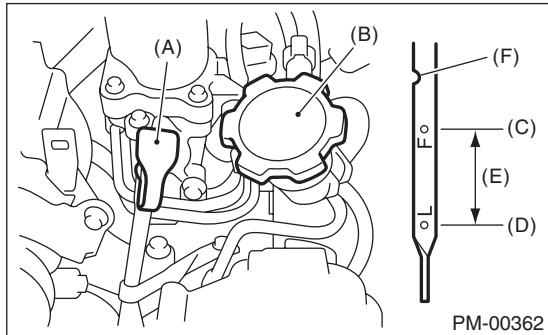
# Engine Oil

## PERIODIC MAINTENANCE SERVICES

### B: INSPECTION

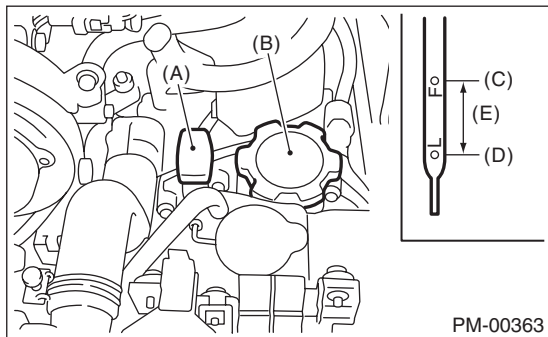
- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
- 4) Remove the level gauge again and record the oil level. If the engine oil level is below the "L" line, add oil to bring the level up to the "F" line.

- 2.5 L model



- (A) Oil level gauge
- (B) Oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1 ℓ (1.1 US qt, 0.9 Imp qt)
- (F) Notch mark

- 3.0 L model



- (A) Oil level gauge
- (B) Oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1 ℓ (1.1 US qt, 0.9 Imp qt)

5) Start and warm-up the engine.

6) After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.

**NOTE:**

Just after driving or while the engine is warm, engine oil level may show in the range between the "F" line and the notch mark. This is caused by thermal expansion of engine oil. (2.5L model)

7) To prevent overfilling the engine oil, do not add oil above the "F" line when the engine is cold.

**CAUTION:**

If the engine oil is spilled over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

**NOTE:**

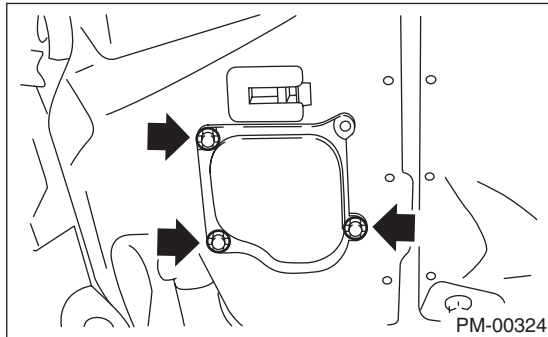
Upper level and lower level are set when the engine is cold because the oil level gauge is used for daily maintenance.

## 4. Engine Oil Filter

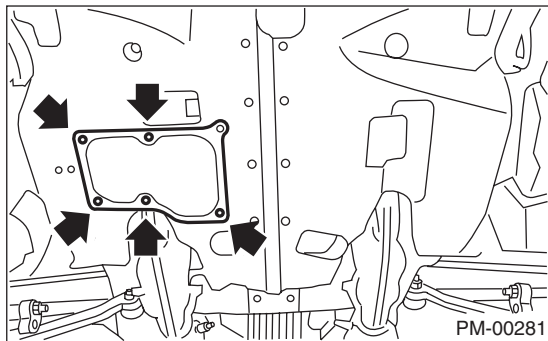
### A: REPLACEMENT

1) Remove the service hole cover clip.

- 2.5 L model

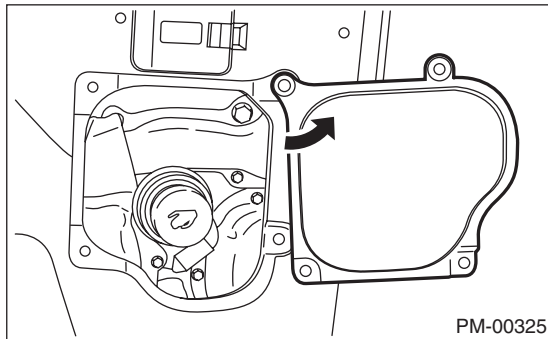


- 3.0 L model

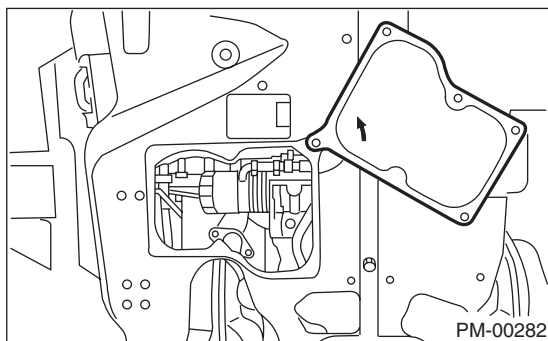


2) Rotate the service hole cover in the direction of the arrow.

- 2.5 L model



- 3.0 L model



3) Remove the oil filter using the ST.

- 3.0 L model

ST 49857000

OIL FILTER WRENCH (Outer diameter: 80 mm (3.15 in))

- 2.5 L model

ST 18332AA000

OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))

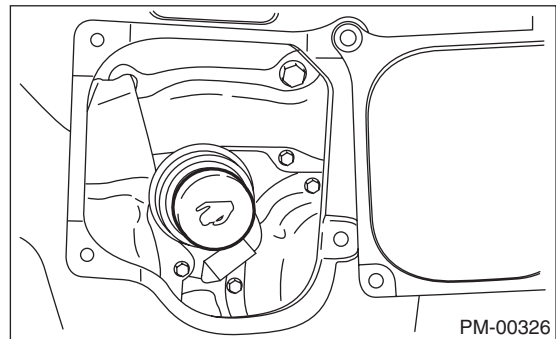
ST 18332AA010

OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))

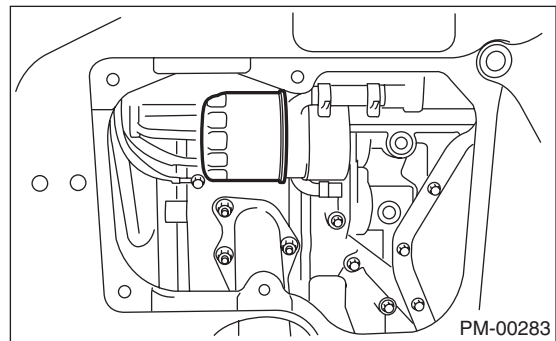
#### NOTE:

However, in 2.5 model, SUBARU genuine oil filter having outer diameter of 68 mm (2.68 in) or 65 mm (2.6 in) can also be used.

- 2.5 L model



- 3.0 L model



# Engine Oil Filter

## PERIODIC MAINTENANCE SERVICES

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4) Clean the oil filter installation surface on cylinder block and oil cooler.

5) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.

6) To install the oil filter, turn the filter by hand while being careful not to damage the seal rubber. When the seal rubber just touches the oil cooler, tighten by using a torque wrench or turn the filter by the specified amount.

### **CAUTION:**

**Do not tighten excessively, or oil may leak.**

- 3.0 L model

Oil filter 80 mm (3.15 in) in outer diameter

14 N·m (1.4 kgf-m, 10.3 ft-lb) or tighten 3/4 rotation.

- 2.5 L model

Oil filter 68 mm (2.68 in) in outer diameter

14 N·m (1.4 kgf-m, 10.3 ft-lb) or tighten 1 rotation.

Oil filter 65 mm (2.56 in) in outer diameter

12 N·m (1.2 kgf-m, 8.7 ft-lb) or tighten 2/3 — 3/4 rotation.

### **CAUTION:**

**If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

7) Replace the service hole cover in the original position.

8) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

### **NOTE:**

The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

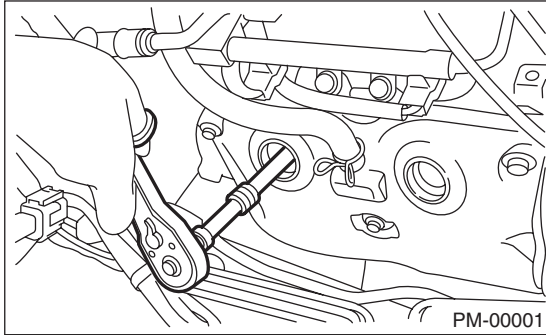
9) Check the engine oil level. <Ref. to PM-10, INSPECTION, Engine Oil.>

## 5. Spark Plug

### A: REPLACEMENT

#### 1. 2.5 L NON-TURBO MODEL

- 1) Remove the intake duct and intake chamber.
- 2) Remove the battery.
- 3) Disconnect the spark plug cord.
- 4) Remove the spark plug with a spark plug socket.



- 5) Tighten the new spark plug lightly with hand, and then secure with a spark plug socket to the specified torque.

**Recommended spark plug:**

**NGK: FR5AP-11**

**Tightening torque:**

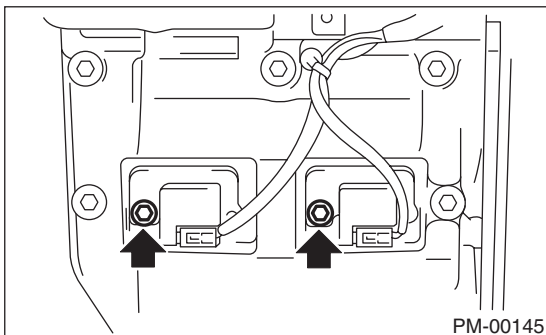
**21 N·m (2.1 kgf·m, 15.2 ft·lb)**

**NOTE:**

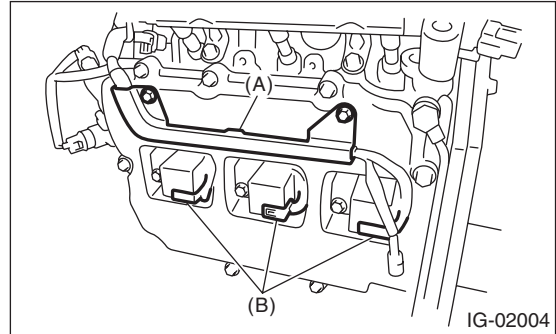
- Be sure to place the gasket between the cylinder head and spark plug.
- If the torque wrench is not available, tighten the spark plug until gasket contacts cylinder head; then tighten further 1/4 to 1/2 turns.

#### 2. 2.5 L TURBO AND 3.0 L MODEL

- 1) Remove the battery and battery carrier.
- 2) Remove the air cleaner case.
- 3) Detach the connector from ignition coil.
- 4) Remove the ignition coil.
  - 2.5 L turbo model



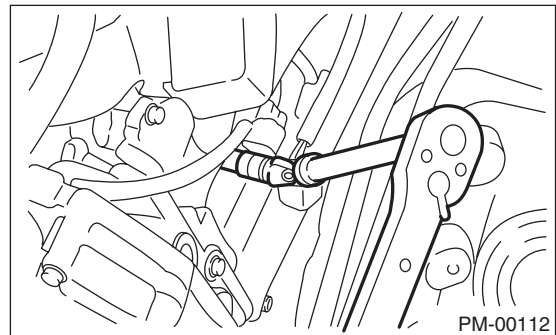
- 3.0 L model



(A) Bracket

(B) Connector

- 5) Remove the spark plug with a spark plug socket.



- 6) Tighten the new spark plug lightly with hand, and then secure with a spark plug socket to the specified torque.

**Recommended spark plug:**

**2.5 L Turbo model**

**NGK: SILFR6A**

**3.0 L model**

**NGK: ILFR6B**

**Tightening torque:**

**21 N·m (2.1 kgf·m, 15.2 ft·lb)**

- 7) Tighten the ignition coil.

**Tightening torque:**

**16 N·m (1.6 kgf·m, 11.7 ft·lb)**

**NOTE:**

- Be sure to place the gasket between the cylinder head and spark plug.
- If the torque wrench is not available, tighten the spark plug until gasket contacts cylinder head; then tighten further 1/4 to 1/2 turns.

## 6. V-belt

### A: INSPECTION

#### 1. 2.5 L NON-TURBO AND 2.5 L TURBO MODEL

- 1) Replace the belts if cracks, fraying or wear are found.
- 2) Check the V-belt tension and adjust it if necessary by changing the generator installing position or idler pulley installing position. <Ref. to PM-15, REPLACEMENT, V-belt.>

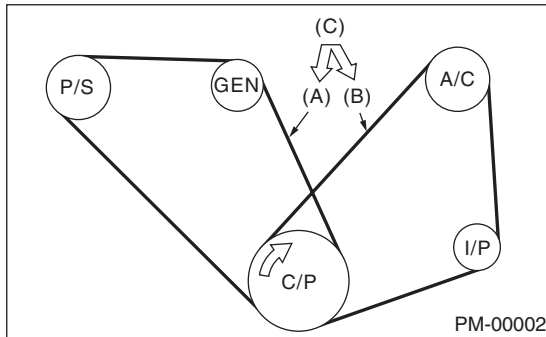
#### Belt tension (without belt tension gauge):

(A)

**When installing new part: 7 — 9 mm**  
**(0.276 — 0.354 in)**  
**At inspection: 9 — 11 mm**  
**(0.354 — 0.433 in)**

(B)

**When installing new part: 7.5 — 8.5 mm**  
**(0.295 — 0.335 in)**  
**At inspection: 9.0 — 10.0 mm**  
**(0.354 — 0.394 in)**



- (A) Front side belt
- (B) Rear side belt
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C A/C compressor pulley
- I/P Idler pulley

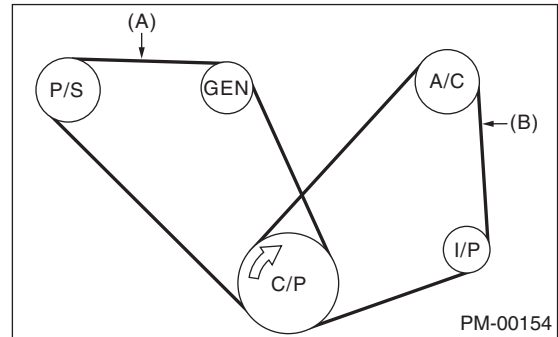
#### Belt tension (with belt tension gauge):

(A)

**When installing new part: 640 — 785 N**  
**(65.3 — 80.0 kgf, 144 — 176 lbf)**  
**At inspection: 490 — 640 N**  
**(50 — 65 kgf, 110 — 144 lbf)**

(B)

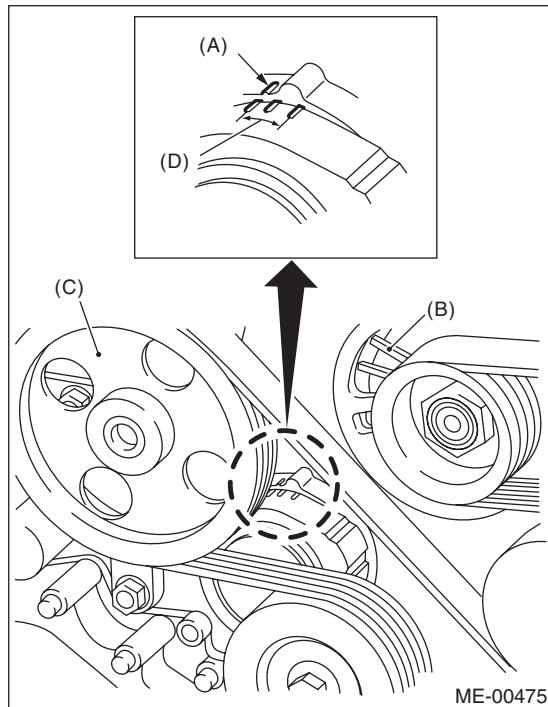
**When installing new part: 620 — 760 N**  
**(63 — 77 kgf, 140 — 170 lbf)**  
**At inspection: 350 — 450 N**  
**(36 — 46 kgf, 79 — 101 lbf)**



- (A) Front side belt
- (B) Rear side belt
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C A/C compressor pulley
- I/P Idler pulley

## 2. 3.0 L MODEL

- 1) Replace the belts if cracks, fraying or wear are found.
- 2) Check that the V-belt automatic belt tensioner indicator (A) is within the range (D).



- (A) Indicator
- (B) Generator
- (C) Power steering oil pump
- (D) Service limit

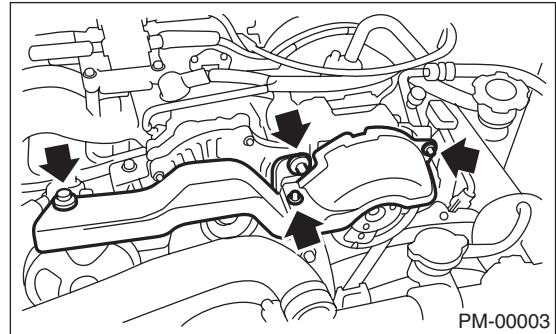
## B: REPLACEMENT

### 1. FRONT SIDE BELT (FOR POWER STEERING OIL PUMP AND GENERATOR)

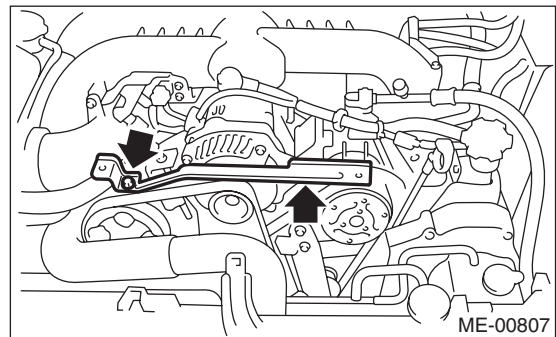
**NOTE:**

Wipe off any oil and water on the belt and pulley.

- 1) Remove the collector cover. (If equipped)
- 2) Remove the V-belt covers.
  - 2.5 L non-turbo model



- 2.5 L turbo model



- 3) Loosen the lock bolt (A).
- 4) Loosen the slider bolt (B).
- 5) Remove the front side belt (C).
- 6) Install a new V-belt, and tighten the slider bolt so as to obtain the specified belt tension.
- 7) Tighten the lock bolt (A).
- 8) Tighten the slider bolt (B).

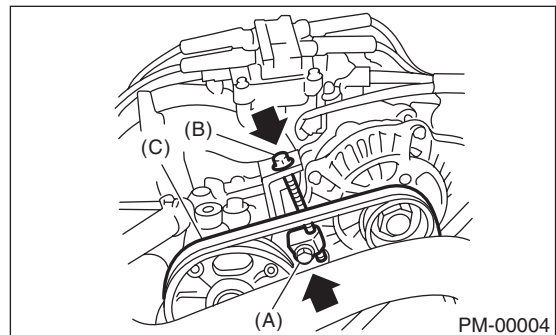
**Tightening torque:**

**Lock bolt**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

**Slider bolt**

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**





# V-belt

## PERIODIC MAINTENANCE SERVICES

### 2. REAR SIDE BELT (FOR A/C)

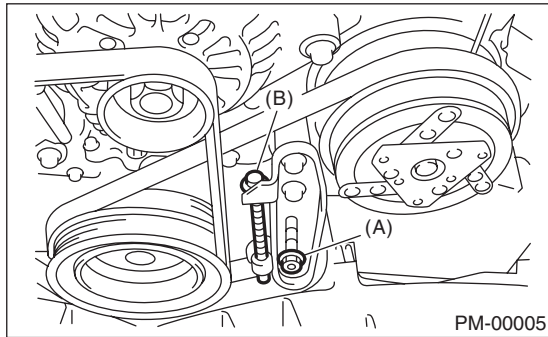
#### NOTE:

Wipe off any oil and water on the belt and pulley.

- 1) Remove the front side belts.
- 2) Loosen the lock nut (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the rear side belt.
- 5) Install a new V-belt, and tighten the slider bolt so as to obtain the specified belt tension.
- 6) Tighten the lock nut (A).

#### Tightening torque:

**23 N·m (2.3 kgf-m, 17.0 ft-lb)**

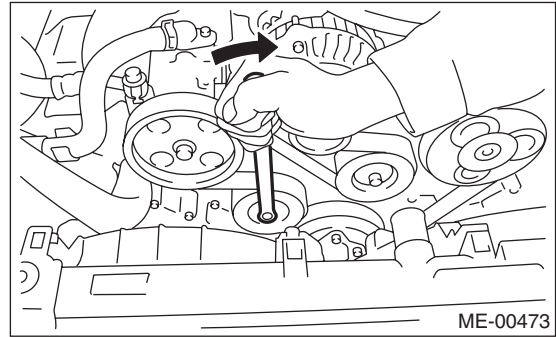


- 7) Install the front side belt.

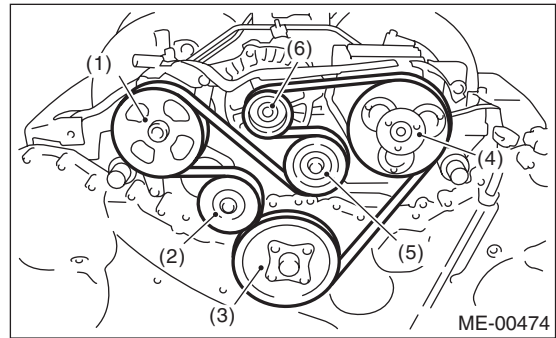
- 2.5 L non-turbo model <Ref. to ME(H4SO)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>
- 2.5 L turbo model <Ref. to ME(H4DOTC)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

### 3. 3.0 L MODEL

- 1) Fit the tool to the belt tensioner mounting bolt.
- 2) Turn the tool clockwise, and loosen the V-belt to remove.



- 3) Remove the V-belt cover.
- 4) Install in the reverse order of removal.



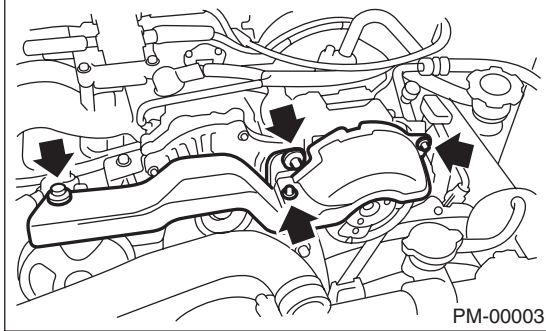
- (1) Power steering oil pump
- (2) Belt tension adjuster
- (3) Crank pulley
- (4) A/C compressor
- (5) Belt idler
- (6) Generator

## 7. Timing Belt

### A: REPLACEMENT

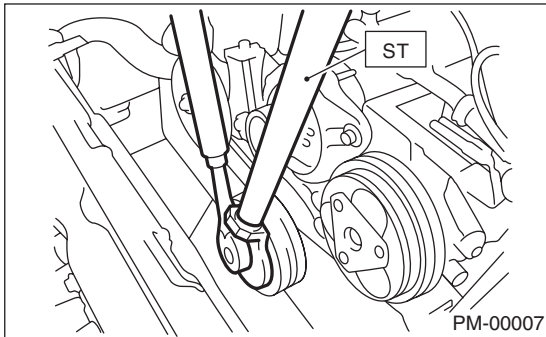
#### 1. 2.5 L NON-TURBO MODEL

- 1) Protect the radiator with cardboard and blanket.
- 2) Remove the V-belt covers.



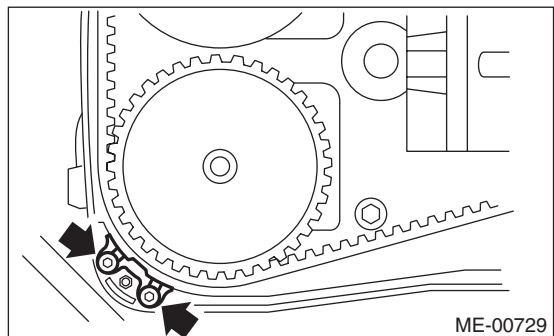
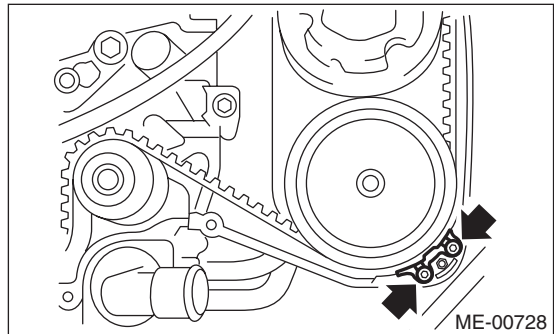
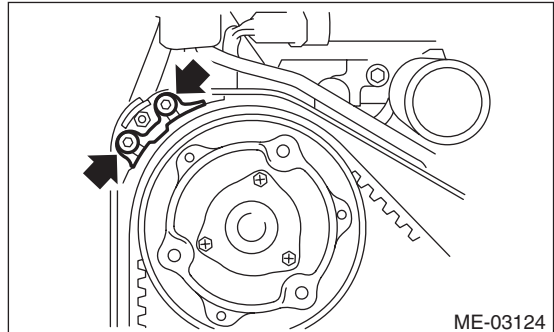
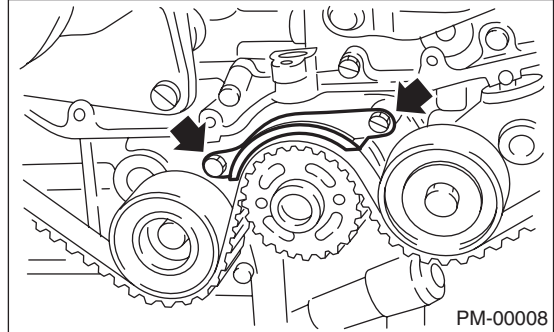
- 3) Remove the V-belts. <Ref. to ME(H4SO)-37, V-belt.>
- 4) Remove the A/C compressor V-belt tensioner.
- 5) Use the ST to lock the crankshaft, and remove the pulley bolt.

ST 499977100 CRANK PULLEY WRENCH



- 6) Remove the crank pulley.
- 7) Remove the belt cover (LH).
- 8) Remove the front timing belt cover.

- 9) Remove the timing belt guide. (MT model)



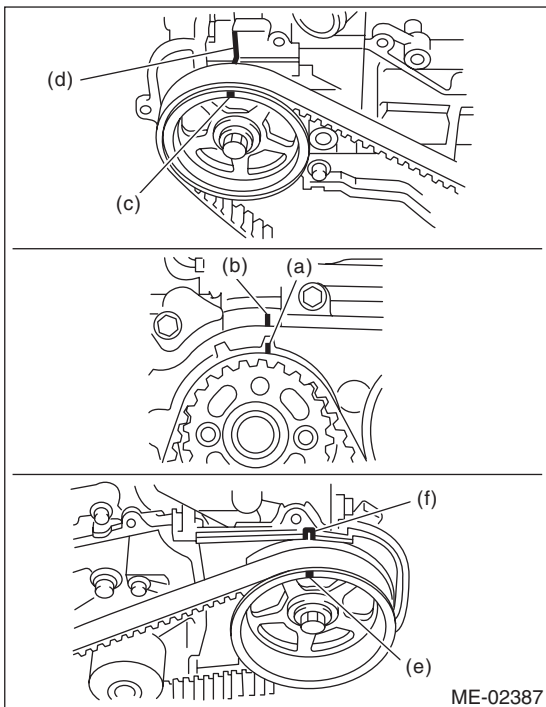
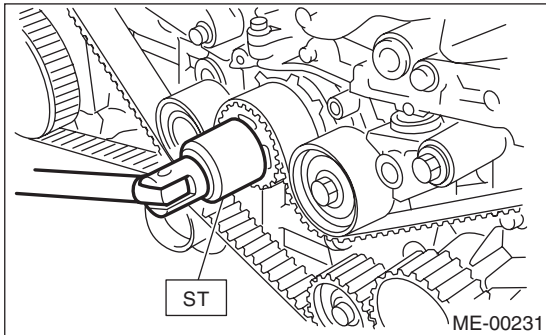
# Timing Belt

## PERIODIC MAINTENANCE SERVICES

10) If the alignment mark (a) or arrow mark (which indicates rotation direction) on the timing belt has faded away, put new marks on the belt before removing as shown in procedures below.

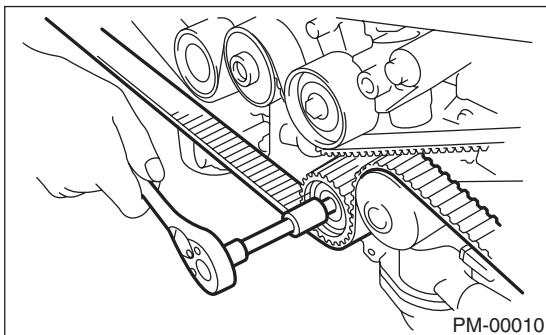
(1) Use the ST to turn crankshaft. Align the mark (a) of sprocket to the cylinder block notch (b), and then ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) or left side cam sprocket mark (e), timing belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET



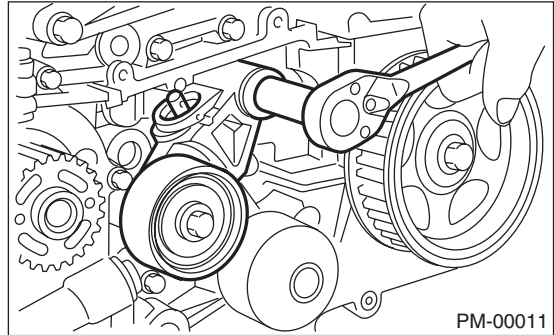
11) Remove the belt idler.

12) Remove the belt idler (No. 2).



13) Remove the timing belt.

14) Remove the automatic belt tension adjuster assembly.

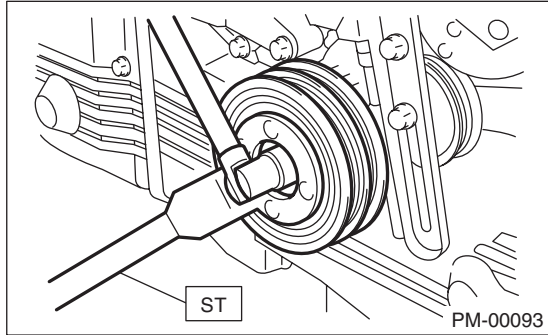


15) Install in the reverse order of removal. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>

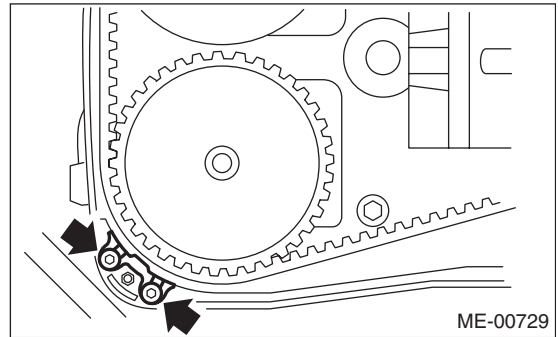
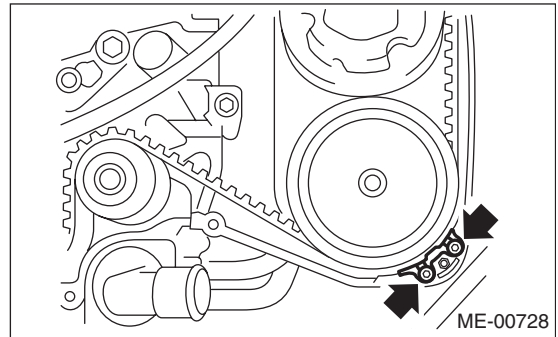
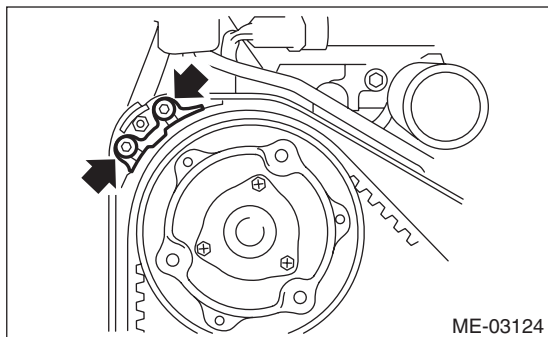
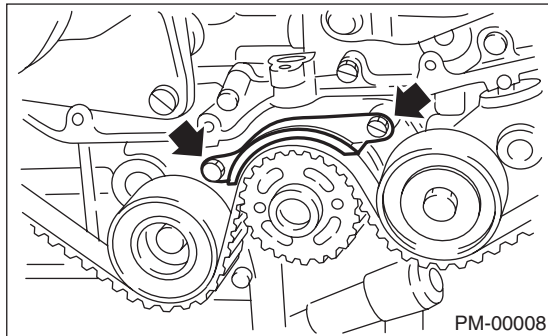
## 2. 2.5 L TURBO MODEL

- 1) Protect the radiator with cardboard and blanket.
- 2) Remove the V-belts. <Ref. to ME(H4DOTC)-37, V-belt.>
- 3) Remove the A/C compressor V-belt tensioner.
- 4) Remove the pulley bolt. Using the ST, lock the crankshaft.

ST 499977100 CRANK PULLEY WRENCH

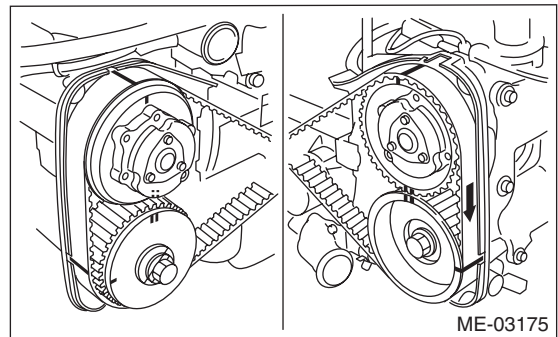
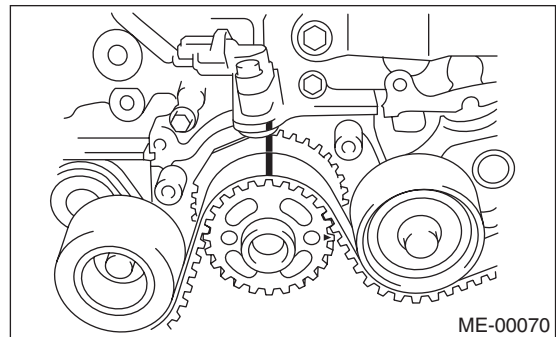


- 5) Remove the crank pulley.
- 6) Remove the belt cover (LH).
- 7) Remove the belt cover (RH).
- 8) Remove the front belt cover.
- 9) Remove the timing belt guide. (MT model)



- 10) Turn the crankshaft and align the alignment marks on crankshaft, and left and right cam sprockets with notches of belt cover and cylinder block. Use the ST to turn crankshaft.

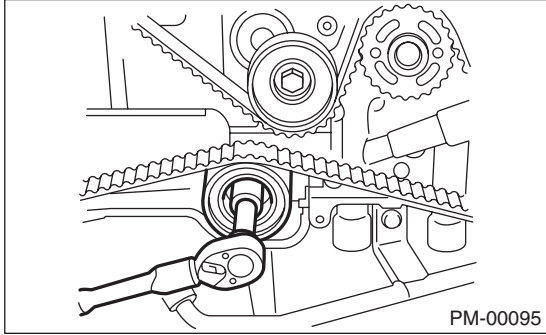
ST 499987500 CRANKSHAFT SOCKET



# Timing Belt

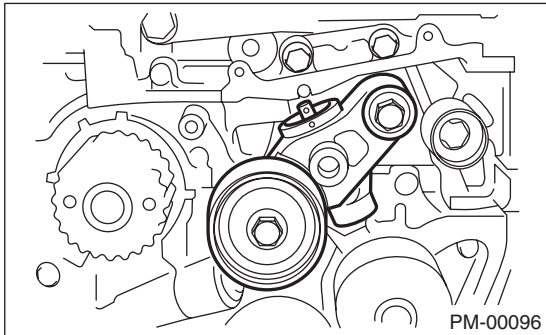
## PERIODIC MAINTENANCE SERVICES

11) Remove the belt idler.



12) Remove the timing belt.

13) Remove the automatic belt tension adjuster assembly.



14) Install in the reverse order of removal. <Ref. to ME(H4DOTC)-42, Timing Belt.>

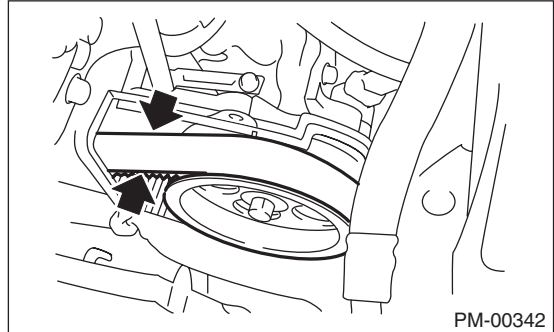
### CAUTION:

**When installing the timing belt, be sure to align all alignment marks on the belt with corresponding marks on the sprockets. If incorrectly installed, interference between pistons and valves may occur.**

## B: INSPECTION

### 1. 2.5 L NON-TURBO MODEL

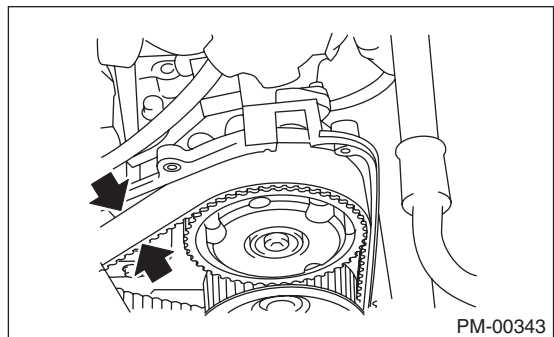
- 1) Remove the timing belt cover (LH).
- 2) While cranking engine at least four rotations, check the timing belt back surface for cracks or damage. Replace the faulty timing belt as needed.
- 3) When the side part of timing belt is abnormally worn (fluff or jumping out of core) or damaged, check the idlers, tensioner, water pump pulley and cam sprocket to determine idler alignment (square-ness). Replace the worn timing belt.



4) Install the timing belt cover (LH).

### 2. 2.5 L TURBO MODEL

- 1) Remove the timing belt cover (LH).
- 2) While cranking engine at least four rotations, check the timing belt back surface for cracks or damage. Replace the faulty timing belt as needed.
- 3) When the side part of timing belt is abnormally worn (fluff or jumping out of core) or damaged, check the idlers, tensioner, water pump pulley and cam sprocket to determine idler alignment (square-ness). Replace the worn timing belt.



4) Install the timing belt cover (LH).

## 8. Fuel Line

### A: INSPECTION

The fuel line is located mostly internally, so check pipes, areas near pipes, and engine compartment piping for rust, hose damage, loose band, etc. If faulty parts are found, repair or replace them.

- 2.5 L non-turbo model

<Ref. to FU(H4SO)-59, Fuel Delivery and Evaporation Lines.>

- 2.5 L turbo model

<Ref. to FU(H4DOTC)-69, Fuel Delivery, Return and Evaporation Lines.>

- 3.0 L model

<Ref. to FU(H6DO)-60, Fuel Delivery and Evaporation Lines.>

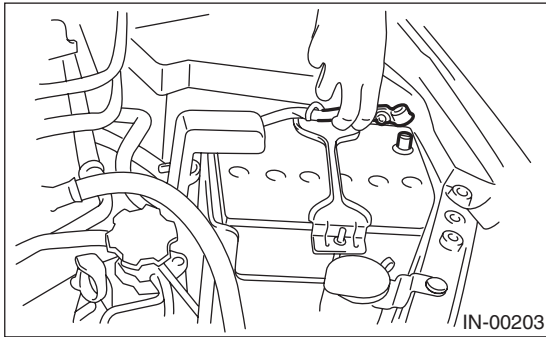
# Air Cleaner Element

## PERIODIC MAINTENANCE SERVICES

### 9. Air Cleaner Element

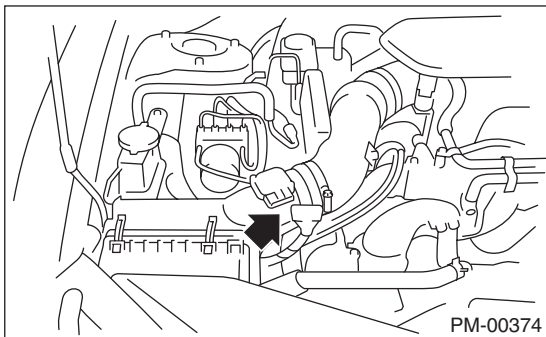
#### A: REPLACEMENT

1) Disconnect the ground cable from battery.

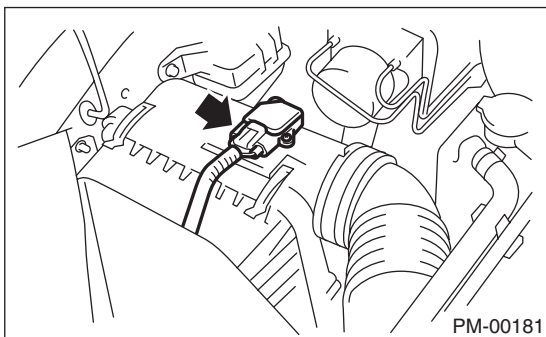


2) Disconnect the connector from mass air flow sensor.

- Non-turbo model



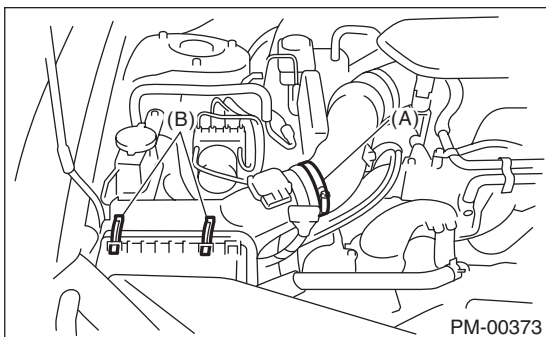
- Turbo model



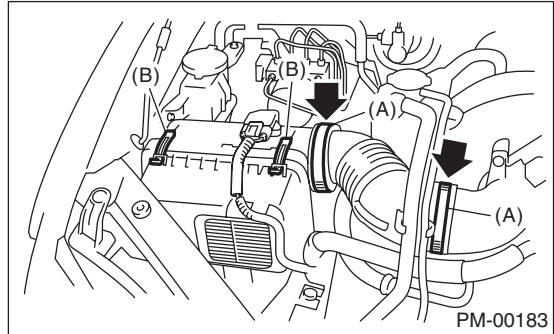
3) Loosen the clamps (A) which connect the air cleaner case to intake duct.

4) Remove the clips (B) on air cleaner case.

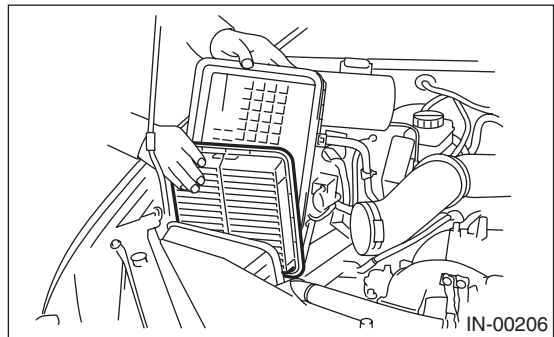
- Non-turbo model



- Turbo model



5) Remove the air cleaner element.



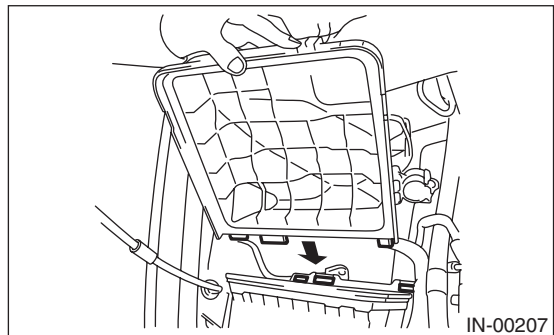
6) Install in the reverse order of removal.

#### CAUTION:

When replacing the air cleaner element, use **SUBARU Genuine** air cleaner element according to the engine type. Using other air cleaner element may affect engine performance.

#### NOTE:

- Fasten with a clip after inserting the lower tab of case.



- Refer to "COMPONENT" for tightening torque.
  - 2.5 L non-turbo model  
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>
  - 2.5 L turbo model  
<Ref. to IN(H4DOTC)-2, COMPONENT, General Description.>
  - 3.0 L model  
<Ref. to IN(H6DO)-2, COMPONENT, General Description.>

## 10. Cooling System

### A: INSPECTION

1) To check the radiator for leakage, fill it with engine coolant, and attach the radiator cap tester (A) to the filler neck, and apply pressure. Check the following points:

**Non-turbo model:**

**157 kPa (1.6 kg/cm<sup>2</sup>, 23 psi)**

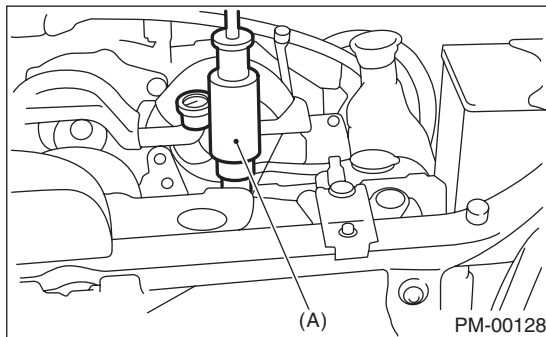
**Turbo model:**

**122 kPa (1.2 kg/cm<sup>2</sup>, 18 psi)**

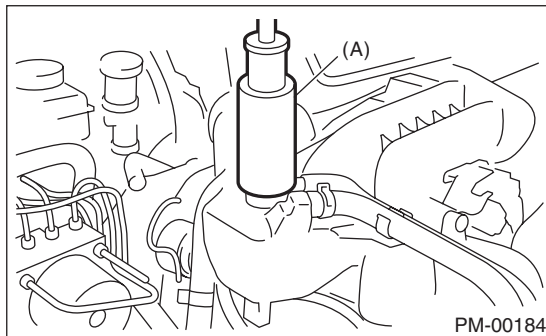
- Each portion of radiator for leakage
- Hose joints and other connections for leakage

**NOTE:**

- For turbo model, be sure to install the tester to filler tank side.
- Be particularly careful not to deform the filler neck of radiator when installing and removing the tester and after testing.
  - Non-turbo model



- Turbo model



- When performing this check, be sure to keep the engine stationary and fill radiator with coolant.
- Wipe off check points before applying pressure.
- Use care not to spill coolant when detaching tester from radiator.
- Do not remove the radiator side cap. (Turbo model)

2) Check the radiator cap valve open pressure using radiator cap tester.

**NOTE:**

Rust or dirt on the cap may prevent valve from functioning normally: be sure to clean the cap before testing.

Raise the pressure until the needle of gauge stops and see if the pressure can be retained for five to six seconds. Replace the radiator cap if it is opened under a pressure less than the service limit value for this period.

**Radiator cap valve open pressure**

**Non-turbo model**

**Standard:**

**93 — 123 kPa (0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)**

**Service limit:**

**83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)**

**Turbo model**

**Filler tank side**

**Standard:**

**93 — 123 kPa (0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)**

**Service limit:**

**83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)**

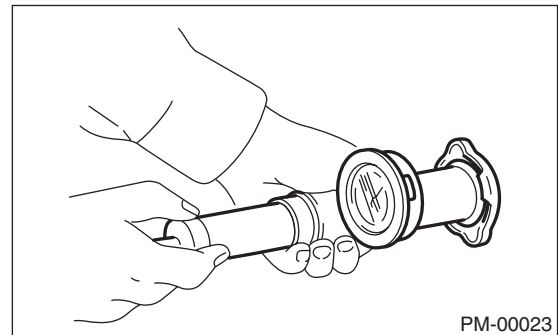
**Radiator side**

**Standard:**

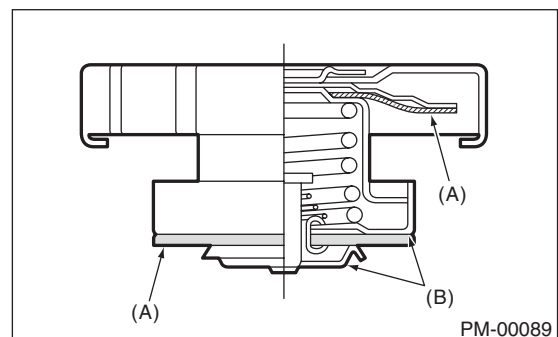
**122 — 152 kPa (1.24 — 1.55 kg/cm<sup>2</sup>, 18 — 22 psi)**

**Service limit:**

**112 kPa (1.14 kg/cm<sup>2</sup>, 16 psi)**



- **2.5 L model**



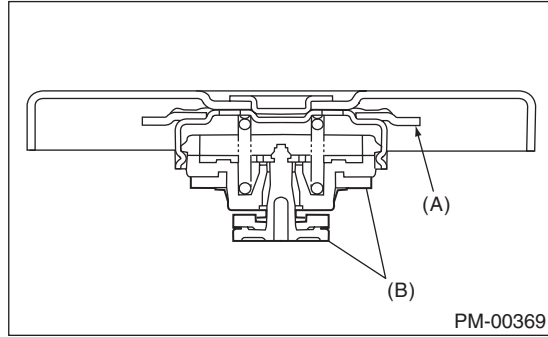


# Cooling System

## PERIODIC MAINTENANCE SERVICES

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- **3.0 L model**



- (A) Check points for deformation
- (B) Check points for deformation, damage, rust

3) Start the engine, and then check it does not over-heat or it is cooled excessively. If it overheats or it is cooled excessively, check the cooling system.

**CAUTION:**

**If the engine coolant is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.**

- 2.5 L non-turbo model

<Ref. to CO(H4SO)-14, Water Pump.> <Ref. to CO(H4SO)-16, Thermostat.> <Ref. to CO(H4SO)-18, Radiator.> <Ref. to CO(H4SO)-22, Radiator Cap.>

- 2.5 L turbo model

<Ref. to CO(H4DOTC)-15, Water Pump.> <Ref. to CO(H4DOTC)-17, Thermostat.> <Ref. to CO(H4DOTC)-19, Radiator.> <Ref. to CO(H4DOTC)-23, Radiator Cap.>

- 3.0 L model

<Ref. to CO(H6DO)-13, Water Pump.> <Ref. to CO(H6DO)-14, Thermostat.> <Ref. to CO(H6DO)-16, Radiator.> <Ref. to CO(H6DO)-19, Radiator Cap.>

4) Check the radiator fan operates using Subaru Select Monitor, when the coolant temperature exceeds 96°C (205°F). If it does not operate, check the radiator fan system.

- 2.5 L non-turbo model

<Ref. to CO(H4SO)-8, INSPECTION, Radiator Fan System.>

- 2.5 L turbo model

<Ref. to CO(H4DOTC)-9, INSPECTION, Radiator Fan System.>

- 3.0 L model

<Ref. to CO(H6DO)-9, INSPECTION, Radiator Fan System.>

## 11. Engine Coolant

### A: REPLACEMENT

#### 1. REPLACEMENT OF ENGINE COOLANT

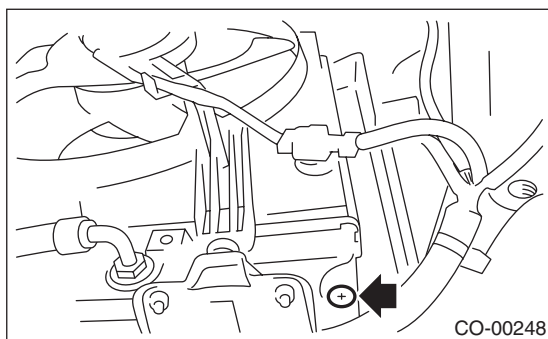
##### WARNING:

The radiator is of the pressurized type. Do not attempt to open the radiator cap immediately after the engine has been stopped.

##### CAUTION:

If the engine coolant is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

- 1) Lift up the vehicle.
- 2) Remove the under cover.
- 3) Place a container under drain pipe.
- 4) Remove the drain plug to drain engine coolant into container.



- 5) For quick draining, open the radiator cap.

##### NOTE:

- For turbo model, be sure to open the radiator cap on the filler tank side.
  - Be careful not to spill coolant on the floor.
- 6) Drain the coolant from reservoir tank.
  - 7) Tighten the radiator drain plug securely after draining coolant.
  - 8) Pour cooling system conditioner through the filler neck.

##### **Cooling system protective agent:**

**Cooling system conditioner (part No. SOA635071)**

- 9) Pour the engine coolant into the radiator (or the coolant filler tank on turbo models) up to the filler neck position.

- 10) Fill engine coolant into the reservoir tank up to "FULL" level.

##### **Recommended engine coolant:**

Refer to "RM" section. <Ref. to RM-4, COOLANT, RECOMMENDED MATERIALS, Recommended Materials.>

##### **Coolant capacity (fill up to "FULL" level):**

##### **2.5 L non-turbo model**

###### **MT model**

Approx. 6.4 ℓ (6.8 US qt, 5.61 Imp qt)

###### **AT model**

Approx. 6.3 ℓ (6.7 US qt, 5.5 Imp qt)

##### **2.5 L turbo model**

###### **MT model**

Approx. 7.3 ℓ (7.7 US qt, 6.4 Imp qt)

###### **AT model**

Approx. 7.2 ℓ (7.6 US qt, 6.3 Imp qt)

##### **3.0 L model**

Approx. 7.2 ℓ (7.6 US qt, 6.3 Imp qt)

- 11) Close the radiator cap (or the coolant filler tank cap on turbo models), and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)

- 12) Wait for one minute after the engine stops, then open the radiator cap (or the coolant filler tank cap on turbo models). If the engine coolant level drops, add engine coolant into the radiator (or the coolant filler tank on turbo models) up to the filler neck position.

- 13) Perform the procedures 11) and 12) again.

- 14) Install the radiator cap (or the coolant filler tank cap on turbo models) and reservoir tank cap properly.

- 15) Start the engine and operate the heater at maximum hot position and the blower speed setting to "LO".

- 16) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

##### NOTE:

- Be careful with the engine coolant temperature gauge to prevent overheating.
- If the radiator hose becomes harden with the pressure of engine coolant, air bleeding operation seems to be almost completed.

- 17) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.

- 18) Open the radiator cap (or the coolant filler tank cap on turbo models). If the engine coolant level drops, add engine coolant into the coolant filler tank up to the filler neck position and the reservoir tank to "FULL" level.

- 19) Install the radiator cap (or the coolant filler tank cap on turbo models) and reservoir tank cap properly.

# Engine Coolant

## PERIODIC MAINTENANCE SERVICES

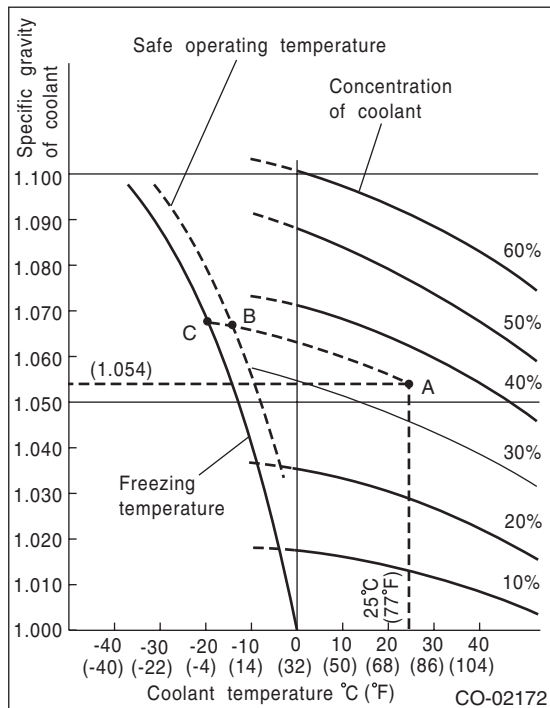
20) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard from heater core, repeat the procedures from step 16).

### 2. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of SUBARU coolant is shown in the diagram. Measuring the temperature and specific gravity of the coolant will provide this information.

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).



### 3. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

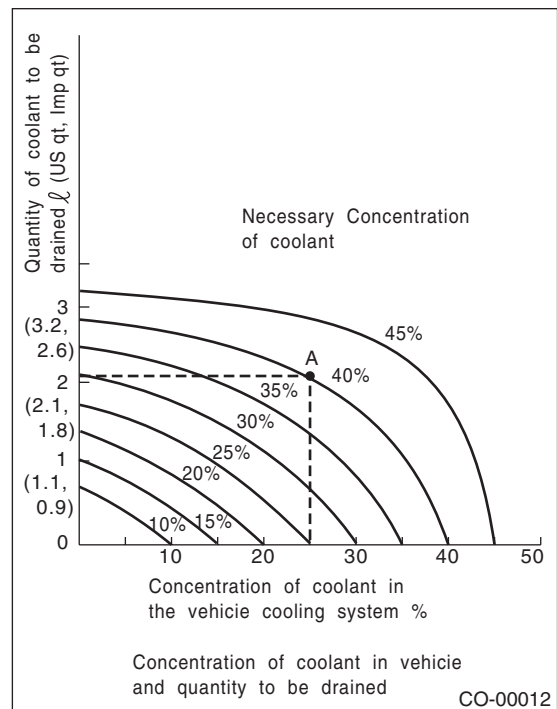
To adjust the concentration of coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU Genuine Coolant (concentration 50%).

The amount of engine coolant that should be replaced can be determined using the diagram.

[Example]

Assume that the engine coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of engine coolant concentration intersects with the 40% curve of the necessary engine coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 ℓ (2.2 US qt, 1.8 Imp qt). Drain 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of the undiluted solution of SUBARU coolant.

If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.

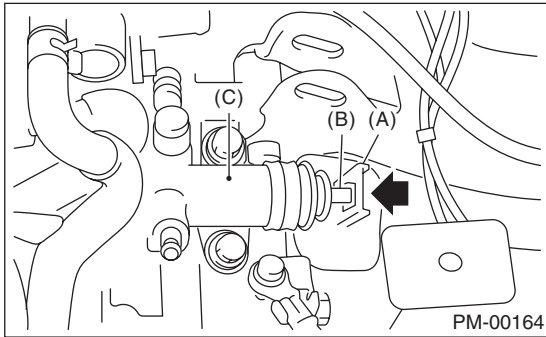


## 12. Clutch System

### A: INSPECTION AND ADJUSTMENT

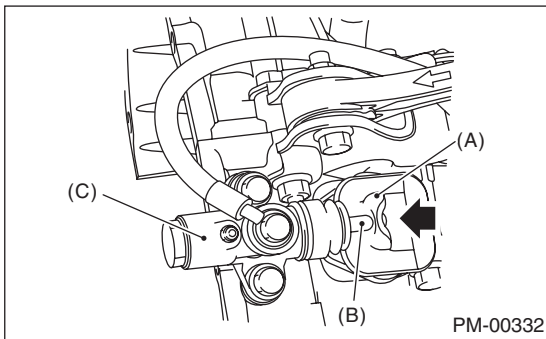
1) Push the release lever to retract the push rod of the operating cylinder and check if the fluid level in the clutch reservoir tank rises or not.

- 5MT model (Non-turbo model)



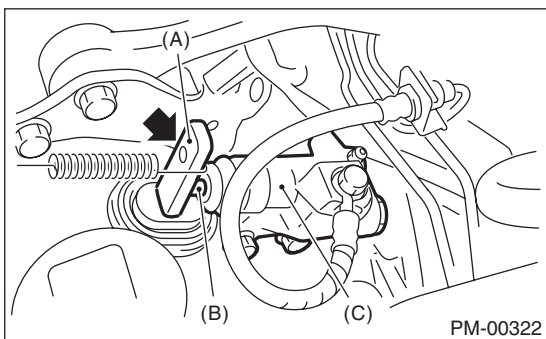
- (A) Release lever
- (B) Push rod
- (C) Operating cylinder

- 5MT model (Turbo model)



- (A) Release lever
- (B) Push rod
- (C) Operating cylinder

- 6MT model



- (A) Release lever
- (B) Push rod
- (C) Operating cylinder

2) If the fluid level rises, pedal free play is correct.  
 3) If the fluid level does not rise, or the push rod cannot be retracted, adjust the clutch pedal. <Ref. to CL-31, Clutch Pedal.>

4) Check the fluid level using the scale on the outside of the clutch reservoir tank (A). If the level is below "MIN" (B), inspect the clutch master cylinder, operating cylinder and hydraulic line for fluid leaks. If fluid leaks are found, repair or replace. If fluid leaks are not found, add clutch fluid to bring it up to "MAX" (C) of clutch reservoir tank.

#### Recommended clutch fluid:

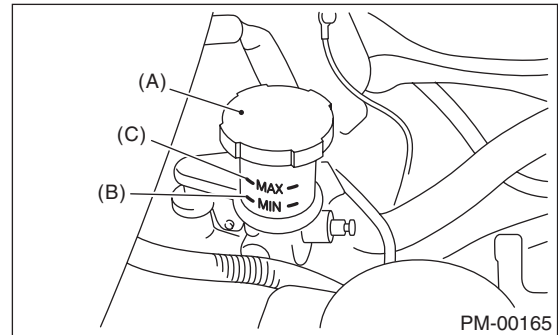
**Refer to "RM" section. <Ref. to RM-4, FLUID, RECOMMENDED MATERIALS, Recommended Materials.>**

#### CAUTION:

**Prevent the clutch fluid from being splashed over vehicle body. If the clutch fluid is splashed over vehicle body, flush it, and then wipe it up.**

#### NOTE:

- Avoid mixing different brands of brake fluid to prevent degradation of the fluid.
- Be careful not to allow dirt or dust to get into the reservoir tank.



- (A) Reservoir tank
- (B) MIN. level
- (C) MAX. level

# Transmission Gear Oil

## PERIODIC MAINTENANCE SERVICES

### 13. Transmission Gear Oil

#### A: REPLACEMENT

##### 1. MANUAL TRANSMISSION

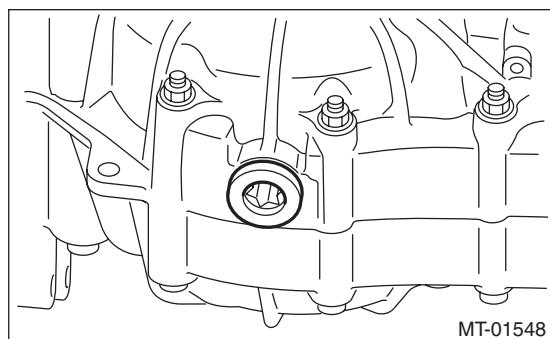
1) Drain the gear oil by removing drain plug.

#### CAUTION:

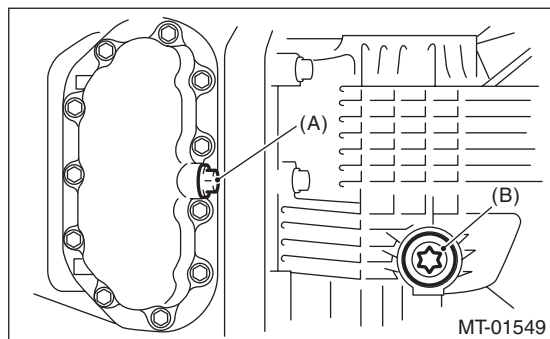
If the transmission gear oil is spilled over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

#### NOTE:

- Before starting work, cool off the transmission gear oil well.
- Drain the gear oil by removing drain plug using TORX® BIT T70.
- 5MT



- 6MT



- (A) Drain plug (Oil pan side)
- (B) Drain plug (Clutch housing side)

2) Replace the gasket with new part, and then tighten the drain plug to specified torque.

#### Tightening torque:

##### 5MT (Aluminum gasket)

44 N·m (4.5 kgf·m, 32.5 ft·lb)

##### 5MT (Copper gasket)

70 N·m (7.1 kgf·m, 51.6 ft·lb)

##### 6MT (Oil pan side):

44 N·m (4.5 kgf·m, 32.5 ft·lb)

##### 6MT (Clutch housing side):

70 N·m (7.1 kgf·m, 51.6 ft·lb)

3) Fill the transmission gear oil through the oil level gauge up to the upper point of level gauge.

#### Recommended gear oil:

Refer to "RM" section. <Ref. to RM-2, LUBRICANTS, RECOMMENDED MATERIALS, Recommended Materials.>

#### NOTE:

Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.

#### Gear oil capacity:

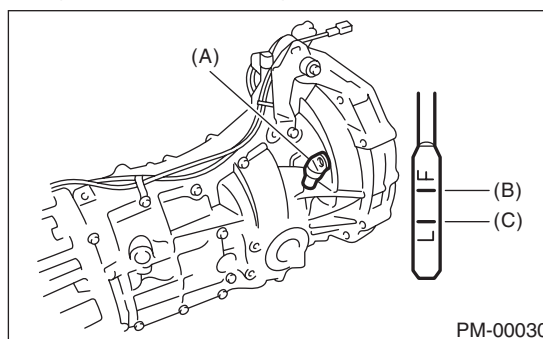
##### 5MT model:

3.5 ℓ (3.7 US qt, 3.1 Imp qt)

##### 6MT model:

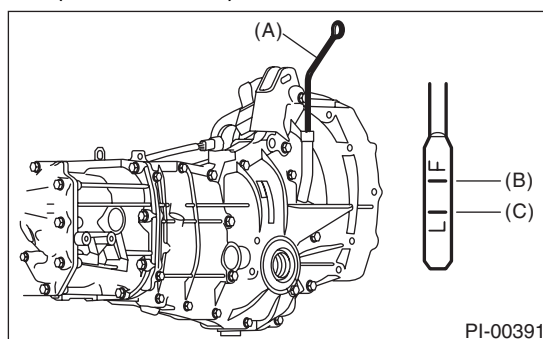
4.1 ℓ (4.3 US qt, 3.6 Imp qt)

- 5MT (Non-turbo model)



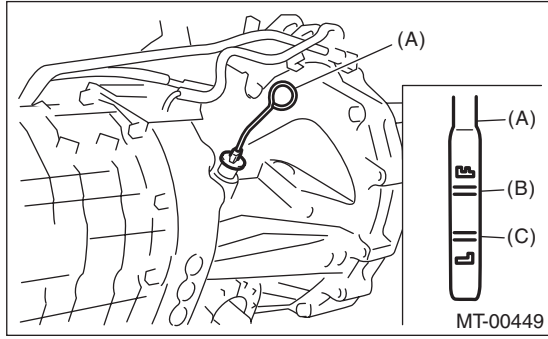
- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

- 5MT (Turbo model)



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

- 6MT



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

# Automatic Transmission Fluid

## PERIODIC MAINTENANCE SERVICES

### 14. Automatic Transmission Fluid

#### A: INSPECTION

##### CAUTION:

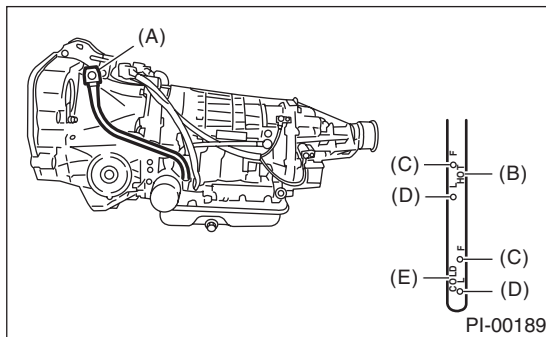
The level of ATF varies with fluid temperature. Pay attention to the fluid temperature when checking ATF level.

1) Raise the ATF temperature by driving a distance of 5 to 10 km (3 to 6 miles). Otherwise, idle the engine to raise ATF temperature to 70 — 80°C (158 — 176°F) on Subaru Select Monitor. <Ref. to 4AT(diag)-16, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

2) Make sure the vehicle is level.

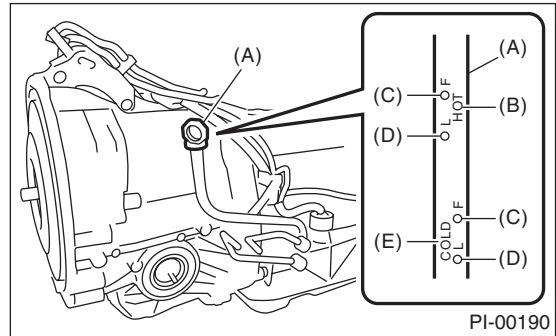
3) After selecting all positions (P, R, N, D), shift the select lever in “P” range. Idle the engine for 1 — 2 minutes, and measure the ATF level.

##### • 4AT model



- (A) Level gauge
- (B) ATF level range at “HOT”  
[70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at “COLD”  
[20 — 30°C (68 — 86°F)]

##### • 5AT model



- (A) Level gauge
- (B) ATF level range at “HOT”  
[70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at “COLD”  
[20 — 30°C (68 — 86°F)]

4) Make sure that ATF level is above the center of upper and lower marks at “HOT” side.

5) If the ATF level is below the center between upper and lower marks, add the recommended ATF until the fluid level is found above the center between upper and lower marks.

##### CAUTION:

- Use care not to exceed the upper limit level.
- Adding ATF to the upper limit mark on “HOT” side when the ATF temperature is less than 70°C (158°F) will overfilling of ATF, causing a transmission failure.

6) Check ATF level after raising ATF temperature to 70 — 80°C (158 — 176°F) by running the vehicle or by idling the engine again.

7) Check the ATF for leaks.

Check for leaks in the transmission. If there are leaks, it is necessary to repair or replace gasket, oil seals, plugs or other parts.

## B: REPLACEMENT

### 1. AUTOMATIC TRANSMISSION FLUID

**CAUTION:**

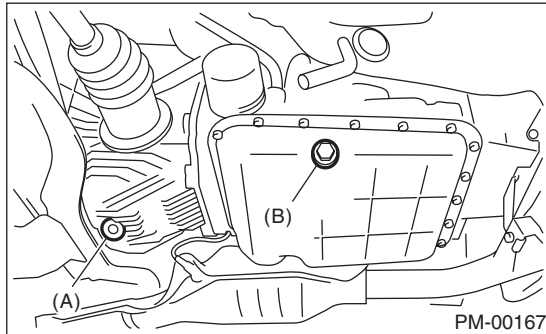
If the ATF is spilled over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Drain the ATF by removing drain plug.

**NOTE:**

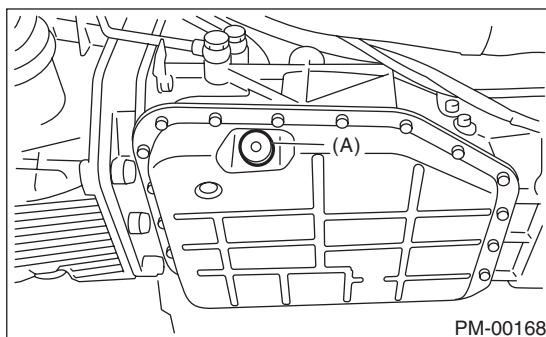
Before starting work, cool off the ATF well.

- 4AT model



- (A) Front differential gear oil drain plug
- (B) ATF drain plug

- 5AT model



- (A) ATF drain plug

2) Replace the gasket with new part, and then tighten the drain plug to specified torque.

**Tightening torque:**

**4AT model**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

**5AT model**

**20 N·m (2.0 kgf·m, 14.8 ft·lb)**

3) Pour in the ATF using the oil charge pipe.

**Recommended ATF:**

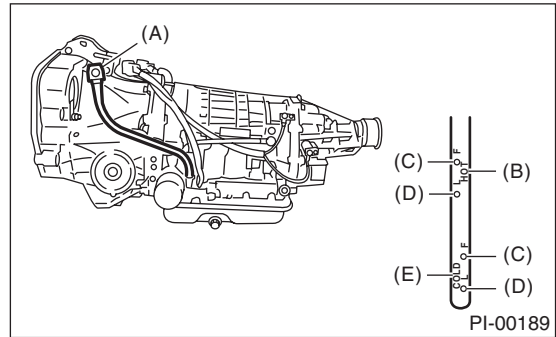
Refer to "RM" section. <Ref. to RM-4, FLUID, RECOMMENDED MATERIALS, Recommended Materials.>

**Capacity:**

Fill with the same amount of ATF as drained.

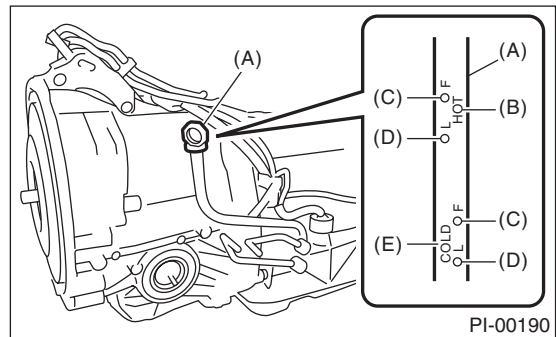
4) Check the ATF level. <Ref. to PM-30, INSPECTION, Automatic Transmission Fluid.>

- 4AT model



- (A) Level gauge
- (B) ATF level range at "HOT" [70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at "COLD" [20 — 30°C (68 — 86°F)]

- 5AT model



- (A) Level gauge
- (B) ATF level range at "HOT" [70 — 80°C (158 — 176°F)]
- (C) Upper level
- (D) Lower level
- (E) ATF level range at "COLD" [20 — 30°C (68 — 86°F)]



# Automatic Transmission Fluid

## PERIODIC MAINTENANCE SERVICES

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### 2. ATF FILTER

#### CAUTION:

If the ATF is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

#### NOTE:

Basically, the ATF filter is maintenance free, but when it is rusted or physically damaged or leaking, the ATF filter needs to be replaced.

For the replacement procedure of ATF filter, refer to "ATF FILTER".

- 4AT model

<Ref. to 4AT-63, ATF Filter.>

- 5AT model

<Ref. to 5AT-58, ATF Filter.>

## 15. Front & Rear Differential Gear Oil

### A: REPLACEMENT

#### 1. FRONT DIFFERENTIAL (MT MODEL)

Front differential gear oil for MT model lubricates the transmission and differential together. Refer to "Transmission Oil" for replacement procedure. <Ref. to PM-28, Transmission Gear Oil.>

#### 2. FRONT DIFFERENTIAL (AT MODEL)

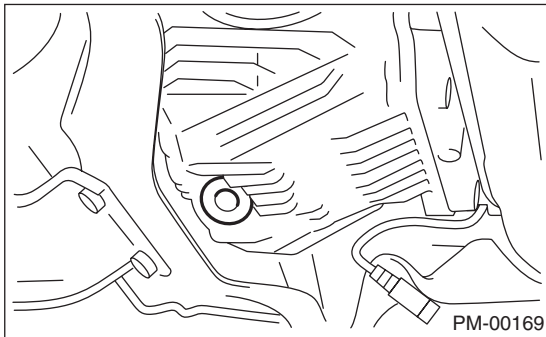
1) Drain the differential gear oil by removing drain plug using TORX® BIT T70.

#### CAUTION:

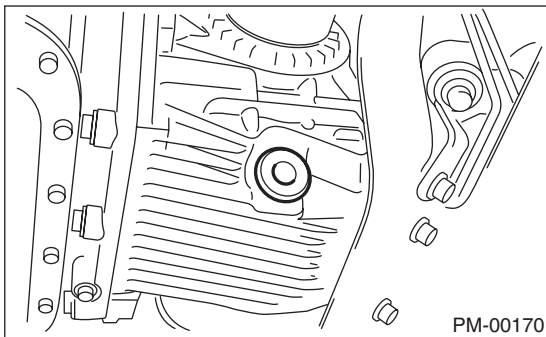
**If the front differential gear oil is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.**

#### NOTE:

- Before starting work, cool off the differential gear oil well.
- 4AT model



- 5AT model



2) Replace the gasket with new part, and then tighten the drain plug to specified torque.

#### Tightening torque:

- **4AT model**  
**Copper gasket**  
**70 N·m (7.1 kgf-m, 51.6 ft-lb)**  
**Aluminum gasket**  
**44 N·m (4.5 kgf-m, 32.5 ft-lb)**
- **5AT model**  
**Copper gasket**  
**70 N·m (7.1 kgf-m, 51.6 ft-lb)**

# Front & Rear Differential Gear Oil

## PERIODIC MAINTENANCE SERVICES

3) Fill differential gear oil through the oil level gauge hole up to the upper point of level gauge.

### **Recommended gear oil:**

**Refer to "RM" section. <Ref. to RM-2, LUBRICANTS, RECOMMENDED MATERIALS, Recommended Materials.>**

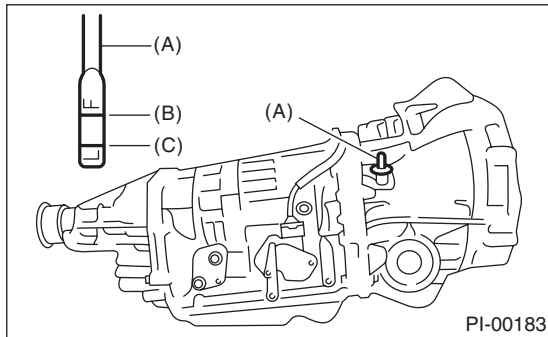
### **NOTE:**

Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.

### **Gear oil capacity:**

#### **4AT model**

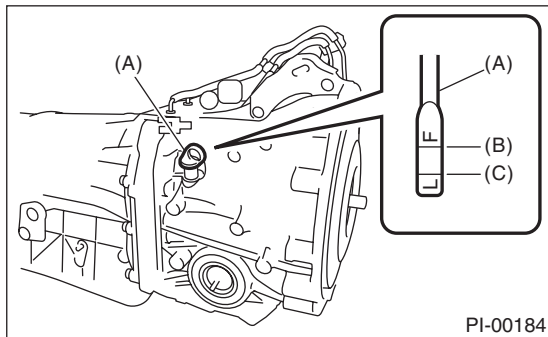
**1.1 — 1.3 ℓ (1.2 — 1.4 US qt, 1.0 — 1.1 Imp qt)**



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

#### **5AT model**

**1.3 — 1.5 ℓ (1.4 — 1.6 US qt, 1.1 — 1.3 Imp qt)**



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

### **3. REAR DIFFERENTIAL**

- 1) Drain the oil by removing drain plug.
- 2) Remove the filler plug for quick draining oil.
- 3) Install the drain plug after draining oil.

### **NOTE:**

- Apply liquid gasket to the drain plug threads for T-type (except for turbo 6MT model).
- Use a new gasket for VA-type and T-type (turbo 6MT model).

### **Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010)**

### **Tightening torque:**

**T-type (except for turbo 6MT model)**

**49.0 N·m (5.0 kgf-m, 36.2 ft-lb)**

**T-type (turbo 6MT model)**

**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

**VA1-type**

**34 N·m (3.5 kgf-m, 25.3 ft-lb)**

**VA2-type**

**29 N·m (3.0 kgf-m, 21.4 ft-lb)**

# Front & Rear Differential Gear Oil

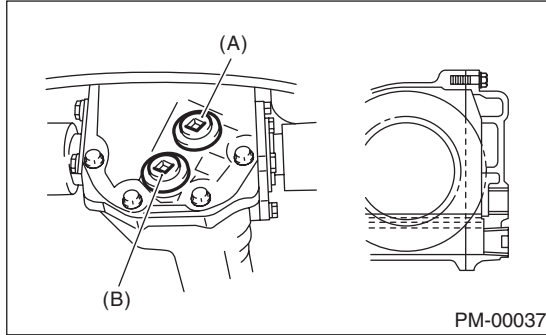
PERIODIC MAINTENANCE SERVICES

4) Pour oil to the bottom end of filler plug hole.

### Recommended gear oil:

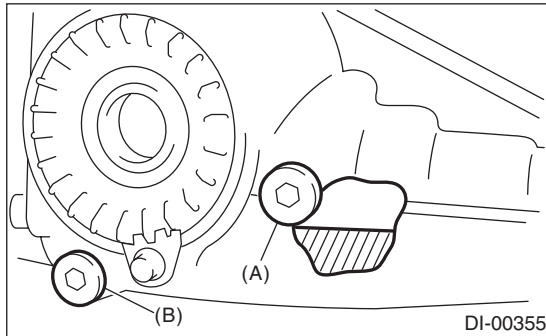
**Refer to "RM" section. <Ref. to RM-2, LUBRICANTS, RECOMMENDED MATERIALS, Recommended Materials.>**

- Except for VA2-type



- (A) Filler plug
- (B) Drain plug

- VA2-type



- (A) Filler plug
- (B) Drain plug

### Oil capacity:

**Except for turbo 6MT model**

**0.8 ℓ (0.8 US qt, 0.7 Imp qt)**

**Turbo 6MT model**

**1.0 ℓ (1.1 US qt, 0.9 Imp qt)**

### NOTE:

Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.

5) Install the filler plug.

### NOTE:

- Apply liquid gasket to the drain plug threads for T-type (except for turbo 6MT model).
- Use a new gasket for VA-type and T-type (turbo 6MT model).

### Liquid gasket:

**THREE BOND 1105 (Part No. 004403010)**

### Tightening torque:

**T-type (except for turbo 6MT model)**

**49.0 N·m (5.0 kgf-m, 36.2 ft-lb)**

**T-type (turbo 6MT model)**

**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

**VA1-type**

**34 N·m (3.5 kgf-m, 25.3 ft-lb)**

**VA2-type**

**29 N·m (3.0 kgf-m, 21.4 ft-lb)**

## 16. Brake Line

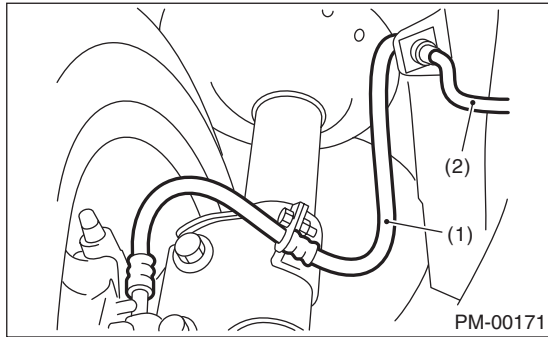
### A: INSPECTION

#### 1. BRAKE LINE

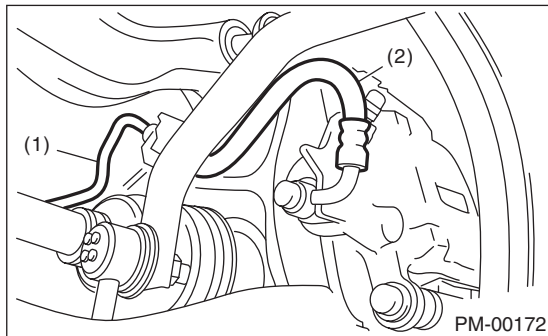
- 1) Check for scratches, swelling, corrosion, traces of fluid leakage on the brake hoses or pipe joints.
- 2) Check the possibility of adjacent parts interfering with brake pipes/hoses during driving, and loose connections/clamps.
- 3) Check any trace of fluid leakage, scratches, etc. on master cylinder, wheel cylinder and pressure control valve.

**NOTE:**

- When the brake fluid level in the reservoir tank is lower than specified limit, the brake warning light on the combination meter will illuminate.
- Visually check the brake hose for damage. (Use a mirror where it is difficult to see)



- (1) Front brake hose
- (2) Front brake pipe



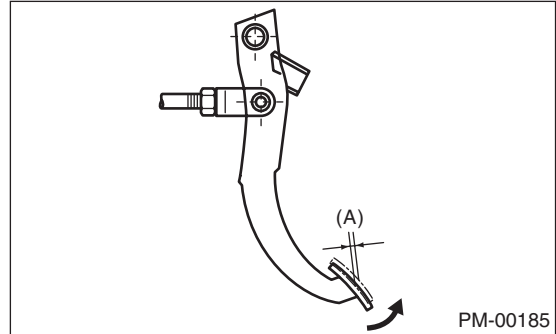
- (1) Rear brake pipe
- (2) Rear brake hose

#### 2. SERVICE BRAKE

- 1) Check the free play of brake pedal by pulling up the pedal with a force of 10 N (1 kgf, 2 lb) or less.

**Brake pedal free play (Pulling up direction of pedal)**

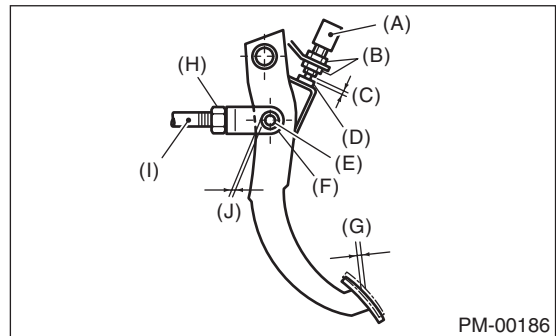
**0.5 — 2.0 mm (0.02 — 0.08 in)**



(A) Pedal free play

- 2) If the free play is out of specifications above, adjust the brake pedal as follows.

- (1) Make sure the engine is off. (No vacuum is applied to brake booster.)
- (2) There should be play between brake booster clevis and pin at brake pedal installing portion. [Pulling up the brake pedal pad with a force of 10 N (1 kgf, 2 lb) or less to a stroke of 0.5 to 2.0 mm (0.02 to 0.08 in).]
- (3) If there is no free play between clevis pin and clevis, turn brake switch adjusting nut until the clearance between stopper and screw of brake switch becomes 0.3 mm (0.012 in).



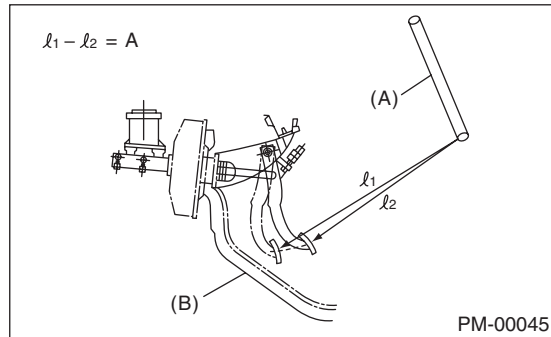
- (A) Brake switch
- (B) Adjusting nut
- (C) 0.3 mm (0.012 in)
- (D) Stopper
- (E) Clevis pin
- (F) Clevis
- (G) Pedal free play
- (H) Lock nut
- (I) Brake booster operating rod
- (J) Play at pin

### 3) Check the pedal stroke.

While the engine is idling, depress the brake pedal with a 490 N (50 kgf, 110 lb) load and measure the distance between the brake pedal and steering wheel. With the brake pedal released, measure the distance between pedal and steering wheel again. The pedal stroke is normal if the difference between two measured values is the specified value or less. If the measured value is the specification or more, there is possibility of entering air in hydraulic unit.

#### **Brake pedal stroke A:**

**95 mm (3.7 in)/ 490 N (50 kgf, 110 lb) or less**



- (A) Steering wheel
- (B) Toe board

4) Check to see if air is in the hydraulic brake line by the feel of pedal operation. If air appears to exist in the line, bleed it from the system.

5) Check for even operation of all brakes, using a brake tester or by driving the vehicle for a short distance on a straight road.

### 3. BRAKE SERVO SYSTEM

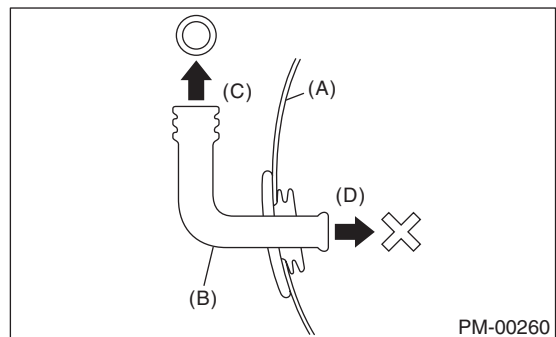
1) With the engine off, depress the brake pedal several times applying the same pedal force. Make sure the travel distance should not change.

2) With the brake pedal depressed, start the engine. Make sure the pedal should move slightly toward the floor.

3) With the brake pedal depressed, stop the engine and keep the pedal depressed for 30 seconds. Make sure the pedal height should not change.

4) A check valve is incorporated into the brake booster nipple part. Disconnect the vacuum hose to inspect function of check valve.

Make sure air flows from the booster end to engine end but does not flow in the opposite direction in the check valve.



- (A) Brake booster
- (B) Check valve
- (C) Engine side
- (D) Brake booster side

5) Check the vacuum hose for cracks or other damage.

#### NOTE:

When installing the vacuum hose on the engine and brake booster, do not use soapy water or lubricating oil on their connections.

6) Check the vacuum hose to make sure it is tightly secured.

# Brake Fluid

## PERIODIC MAINTENANCE SERVICES

### 17.Brake Fluid

#### A: REPLACEMENT

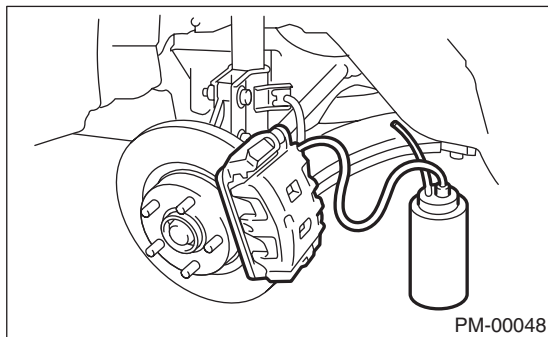
- 1) Either jack-up the vehicle and place a rigid rack under it, or lift up the vehicle.
- 2) Remove all the wheels.
- 3) Drain the brake fluid from master cylinder.
- 4) Refill the reservoir tank with recommended brake fluid.

#### **Recommended brake fluid:**

**Refer to “RM” section. <Ref. to RM-4, FLUID, RECOMMENDED MATERIALS, Recommended Materials.>**

#### NOTE:

- Avoid mixing different brands of brake fluid to prevent degrading the quality of fluid.
  - Be careful not to allow dirt or dust to get into the reservoir tank.
  - Perform the operation in the order from farthest wheel cylinder to the master cylinder.
- 5) Install one end of a vinyl tube onto the air bleeder and insert the other end of the tube into a container to collect the brake fluid.



#### NOTE:

- Cover the bleeder with cloth, when loosening it, to prevent brake fluid from being splashed over surrounding parts.
- While bleeding air, keep the reservoir tank filled with brake fluid to prevent entry of air.
- Operate the brake pedal slowly.
- For convenience and safety, two people should do the work.
- The amount of brake fluid required is approx. 500 mℓ (16.9 US fl oz, 17.6 Imp fl oz) for total brake system.

- 6) Instruct your co-worker to depress the brake pedal slowly two or three times and then hold it depressed.

- 7) Loosen the bleeder screw approximately 1/4 turn until a small amount of brake fluid drains into the container, and then quickly tighten the screw.

- 8) Repeat steps 6) and 7) until there are no air bubbles in drained brake fluid and new fluid flows through vinyl tube.

#### NOTE:

Add brake fluid as necessary while performing the air bleed operation, in order to prevent the tank from running short of brake fluid.

- 9) After completing the bleeding operation, hold the brake pedal depressed and tighten the screw and install bleeder cap.

#### **Tightening torque:**

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**

- 10) Bleed air from each wheel cylinder by following steps from 5) to 9).

- 11) Depress the brake pedal with a force of approx. 294 N (30 kgf, 66 lb) and hold it there for approx. 20 seconds. At this time check the pedal to see if it makes any unusual movement. Visually inspect the bleeder screws and brake pipe joints to confirm there is no fluid leakage.

- 12) Install the wheels, and drive the vehicle for a distance of 2 to 3 km (1 to 2 miles) to confirm that brakes are operating properly.

## 18. Disc Brake Pad and Disc

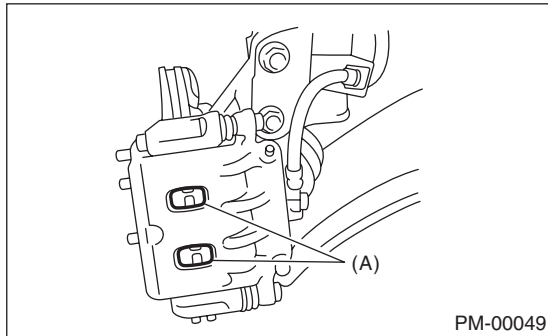
### A: INSPECTION

1) Jack-up the vehicle and support with rigid racks. Then remove the wheels.

2) Visually check the pad thickness through inspection hole of disc brake assembly. Replace the pad if necessary.

**NOTE:**

When replacing a pad, always replace the pads for both the left and right wheels at the same time. Also replace the pad clips if they are twisted or worn.



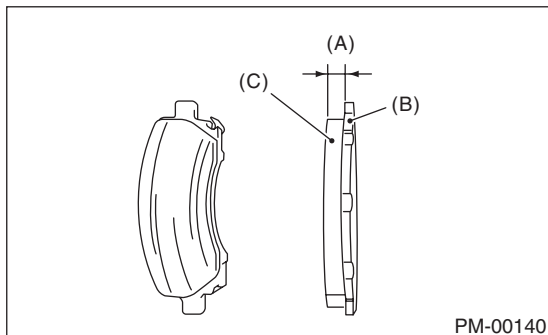
(A) Inspection hole

• Front

Pad thickness		mm (in)
Standard	16-inch	11 (0.43)
	17-inch	11 (0.43)
Wear limit	16-inch	1.5 (0.059)
	17-inch	1.5 (0.059)

• Rear

Pad thickness		mm (in)
Standard	Solid disc type	9 (0.35)
	Ventilated disc type	9 (0.35)
Wear limit	Solid disc type	1.5 (0.059)
	Ventilated disc type	1.5 (0.059)



(A) Pad thickness  
(B) Back metal  
(C) Lining

3) Check the disc rotor, and correct or replace if it is damaged or worn.

• Front

Disc rotor thickness		mm (in)
Standard	16-inch	24 (0.94)
	17-inch	30 (1.18)
Wear limit	16-inch	22 (0.87)
	17-inch	28 (1.10)

• Rear

Disc rotor thickness		mm (in)
Standard	Solid disc type	10 (0.39)
	Ventilated disc type	18 (0.71)
Wear limit	Solid disc type	8.5 (0.34)
	Ventilated disc type	16 (0.63)

4) Remove the caliper body. <Ref. to BR-17, Front Disc Brake Assembly.> <Ref. to BR-25, Rear Disc Brake Assembly.>

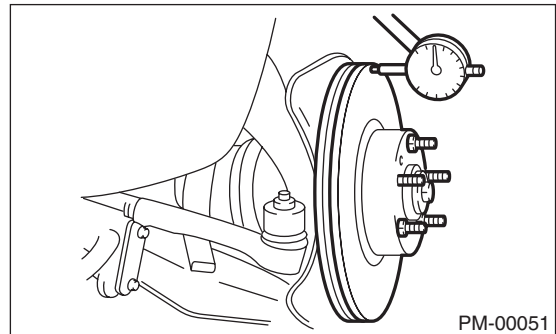
5) Tighten the wheel nuts to secure disc rotor.

6) Set a dial gauge at a point less than 10 mm (0.39 in) from outer periphery of the rotor, and then measure the disc rotor runout.

**Disc rotor runout limit:**

**Front: 0.05 mm (0.002 in)**

**Rear: 0.05 mm (0.002 in)**





# Parking Brake

## PERIODIC MAINTENANCE SERVICES

### 19. Parking Brake

#### A: INSPECTION

Inspect the brake linings and disc rotor of both sides of the rear brake at the same time by removing disc rotor.

1) Inspect the brake shoes for damage or deformation and check the brake linings for wear.

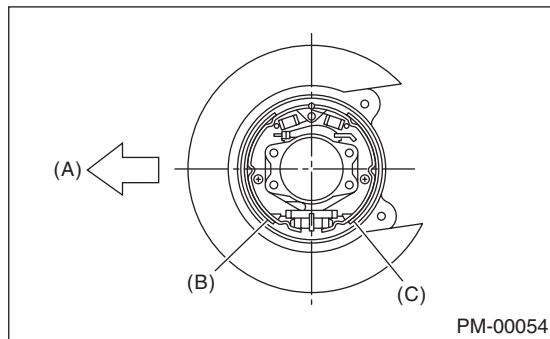
#### NOTE:

Always replace both primary and secondary brake shoes for the left and right wheels at the same time.

**Thickness of brake lining (except for back metal):**

**Standard: 3.2 mm (0.126 in)**

**Wear limit: 1.5 mm (0.059 in)**



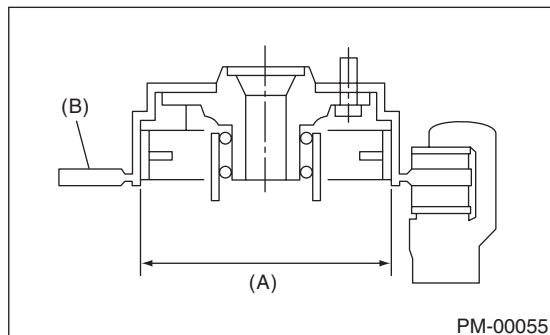
- (A) Forward
- (B) Brake shoe (Primary side)
- (C) Brake shoe (Secondary side)

2) Check the inside of disc rotor for wear, dents or other damage. If the inside surface of disc rotor is streaked, correct the surface with emery cloth (#200 or more). If it is unevenly worn or tapered, correct or replace it.

**Brake drum inside diameter:**

**Standard: 170 mm (6.69 in)**

**Wear limit: 171 mm (6.73 in)**



- (A) Inside diameter
- (B) Disc

3) If the deformation or wear of back plate, shoe, etc. is noticeable, replace them.

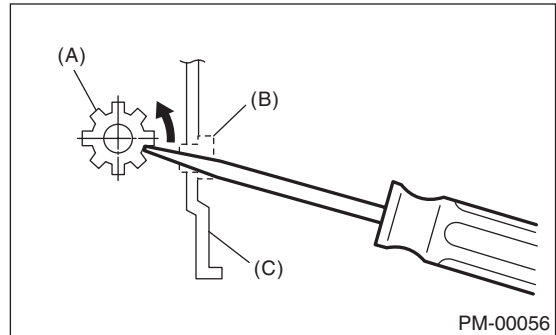
4) When the shoe return spring tension is excessively weakened, replace it.

#### B: ADJUSTMENT

For rear disc brake, adjust the parking brake after bleeding air.

1) Remove the rear cover (rubber) installed at back plate.

2) Turn the adjuster toward arrow mark (upward) until it is locked slightly, by using flat-tip screwdriver as shown in the figure.



- (A) Adjuster
- (B) Cover (rubber)
- (C) Back plate

3) Turn back (downward) the adjuster 3 to 4 notches.

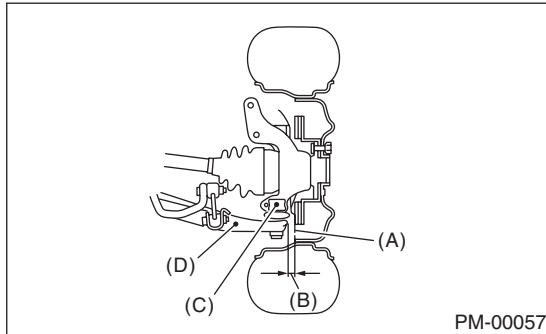
4) Install the cover (rubber) in original position correctly.

## 20. Suspension

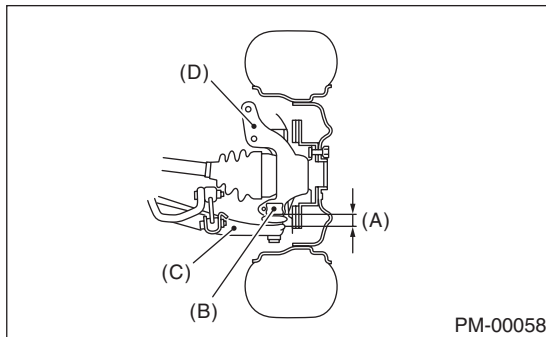
### A: INSPECTION

#### 1. SUSPENSION BALL JOINT

- 1) Jack-up the vehicle until front wheels are off ground.
- 2) Grasp the bottom of tire and move it in and out along the shaft. If relative movement (B) is observed between the brake disc cover (A) and the end of front arm (D), ball joint (C) may be excessively worn.



- 3) Grasp the end of front arm and move it up and down. Relative movement (A) between the housing (D) and front arm (C) boss indicates ball joint (B) may be excessively worn.



- 4) If relative movement is observed in the step 2), 3), remove and inspect the ball joint. If the free play exceeds standard value, replace the ball joint. <Ref. to FS-18, Front Ball Joint.>

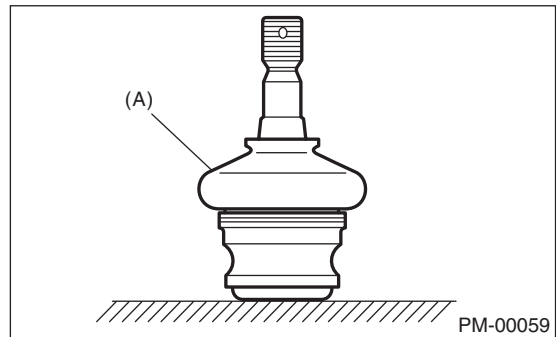
#### 5) Damage of dust seal

Visually inspect the ball joint dust seal. If it is damaged, remove the front arm. <Ref. to FS-20, Front Arm.> Also, measure the free play of the ball joint. <Ref. to FS-18, Front Ball Joint.>

- (1) If the free play exceeds standard value, replace the ball joint.
- (2) If the dust seal is damaged, replace with a new ball joint.

#### NOTE:

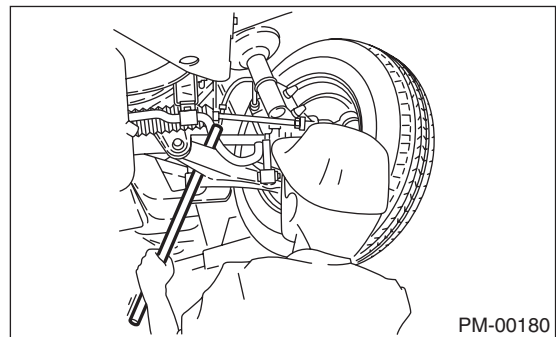
When the front arm ball joint has been removed or replaced, check the toe-in of front wheel. If the front wheel toe-in is not at specified value, adjust the toe-in. <Ref. to FS-8, Wheel Alignment.>



(A) Dust seal

#### 2. FRONT, REAR SUSPENSION BUSHING

Apply pressure with tire lever etc. to inspect the bushing for abnormal fatigue or damage. Replace the bushings if there is abnormal fatigue or damage.



# Suspension

## PERIODIC MAINTENANCE SERVICES

---

### 3. WHEEL ARCH HEIGHT

1) Unload the cargoes and set the vehicle in curb weight (empty) condition.

2) Check the wheel arch height of front and rear suspensions to ensure that they are within specified values. <Ref. to FS-8, Wheel Alignment.>

3) When the wheel arch height is out of standard, visually inspect following components and replace deformed parts.

- Suspension components [Front strut assembly and rear damper assembly]

- Parts connecting suspension and body

4) When no components are deformed, adjust wheel arch height by replacing coil spring in the suspension whose wheel arch height is out of standard. <Ref. to FS-8, Wheel Alignment.> <Ref. to RS-7, Wheel Alignment.>

### 4. WHEEL ALIGNMENT OF FRONT SUSPENSION

1) Check the alignment of front suspension to ensure that following items conform to standard values.

- Toe-in
- Camber
- Caster
- Steering angle

<Ref. to FS-8, Wheel Alignment.>

2) When the caster angle does not conform to reference obviously, visually inspect the following components and replace deformed parts.

- Suspension components [Strut assembly, crossmember, front arm, etc.]

- Parts connecting suspension and body

3) When the toe-in and camber are out of standard value, adjust them so that they conform to standard value.

4) When the right-and-left turning angles of tire are out of standard, adjust to standard value.

### 5. WHEEL ALIGNMENT OF REAR SUSPENSION

1) Check the alignment of rear suspension to ensure that following items are within standard values.

- Toe-in
- Camber
- Thrust angle

<Ref. to RS-7, Wheel Alignment.>

2) When the camber angle does not conform to standard value, visually inspect the following components. If the deformation is observed, replace the damaged parts.

- Suspension components [Shock absorber, front link, rear link, upper link, rear arm, sub frame, etc]

- Parts connecting suspension and body

3) When the toe-in and thrust angle are out of standard value, adjust them so that they conform to standard value.

### 6. OIL LEAKAGE OF STRUT AND SHOCK ABSORBER

Visually inspect the front strut and rear shock absorber for oil leakage. Replace the front strut and rear shock absorber if oil leaks excessively.

### 7. TIGHTNESS OF BOLTS AND NUTS

Check the bolts and nuts for looseness. Retighten the bolts and nuts to specified torque. If the self-locking nuts and bolts are removed, replace them with new parts.

- Front suspension

<Ref. to FS-4, COMPONENT, General Description.>

- Rear suspension

<Ref. to RS-3, COMPONENT, General Description.>

### 8. DAMAGE TO SUSPENSION PARTS

Check the following parts and the fastening portion of the vehicle body for deformation or excessive rusting which impairs the suspension. If necessary, replace the damaged parts with new parts. If minor rust formation, pitting, etc. are noted, remove the rust and take rust prevention measure.

- Front suspension

- Front arm
- Crossmember
- Strut

- Rear suspension

- Sub frame
- Front link
- Rear link
- Upper link
- Rear arm
- Shock absorber

- In the area where salt is sprayed to melt snow on a road in winter, check suspension parts for damage caused by rust every 12 months after lapse of 60 months. Take rust prevention measures as required.

## 21. Wheel Bearing

### A: INSPECTION

#### 1. FRONT WHEEL BEARING

**NOTE:**

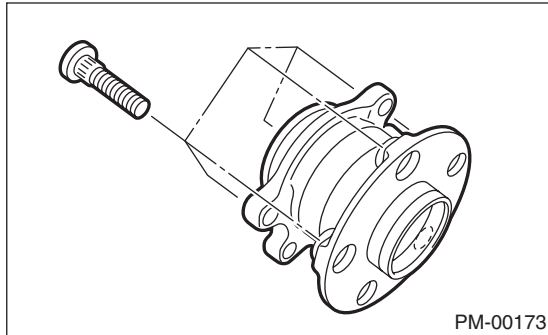
Inspect the condition of front wheel bearing grease.

- 1) Jack-up the front side of vehicle.
- 2) While holding the front wheel by hand, swing it in and out to check bearing free play.
- 3) Loosen the wheel nuts, and remove the front wheel.
- 4) If the bearing free play exists in step 2) above, attach a dial gauge to the hub and measure axial play in axial direction.

**Service limit:**

***Straight-ahead position within 0.05 mm (0.0020 in)***

- 5) Remove the bolts and self-locking nuts, and extract the front arm from front crossmember.
  - 6) Remove the PTJ of front drive shaft from transmission. <Ref. to DS-13, Front Axle.>
  - 7) While supporting the front drive shaft horizontally with one hand, turn the hub with the other hand to check for noise or binding.
- If the hub is noisy or binds, replace the front axle.



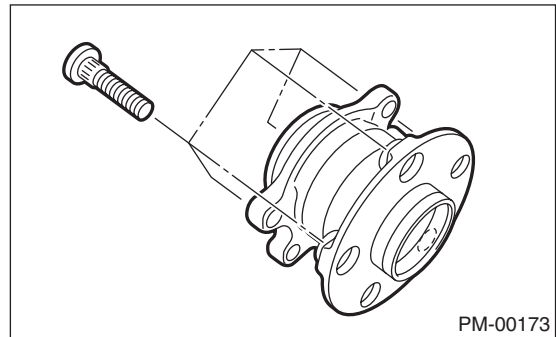
#### 2. REAR WHEEL BEARING

- 1) Jack-up the rear side of vehicle.
- 2) While holding the rear wheel by hand, swing it in and out to check bearing free play.
- 3) Loosen the wheel nuts, and remove the rear wheel.
- 4) If the bearing free play exists in step 2) above, attach a dial gauge to the hub and measure axial play in axial direction.

**Service limit:**

***Straight-ahead position within 0.05 mm (0.0020 in)***

- 5) Remove the DOJ of rear drive shaft from rear differential. <Ref. to DS-27, Rear Drive Shaft.>
  - 6) While supporting rear drive shaft horizontally with one hand, turn the hub with the other hand to check for noise or binding.
- If the hub is noisy or binds, replace the rear axle.



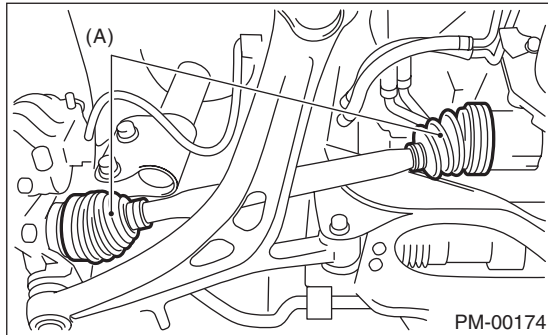
### 22. Axle Boots & Joints

#### A: INSPECTION

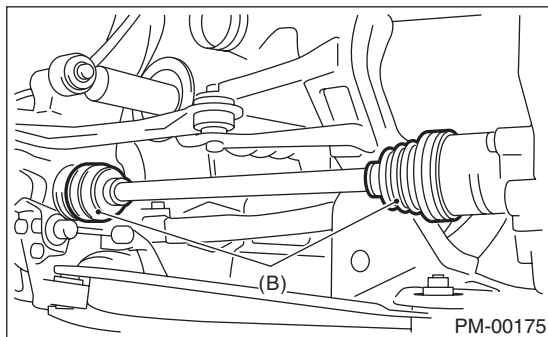
##### 1. FRONT AND REAR AXLE BOOTS

Inspect the front axle boots (A) and rear axle boots (B) for deformation, damage or failure. If faulty, replace with a new part. <Ref. to DS-23, Front Drive Shaft.> <Ref. to DS-27, Rear Drive Shaft.>

- Front



- Rear



##### 2. PROPELLER SHAFT

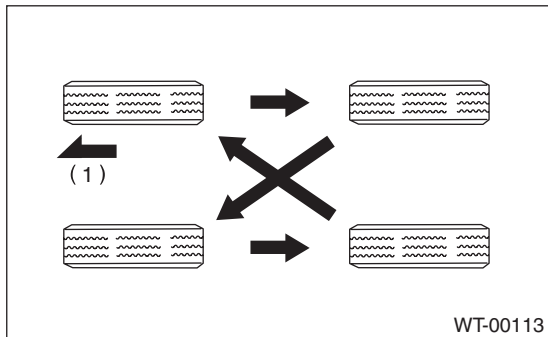
Inspect the propeller shaft for damage or failure. If faulty, replace with a new part. <Ref. to DS-10, Propeller Shaft.>

## 23. Tire Rotation

### A: INSPECTION

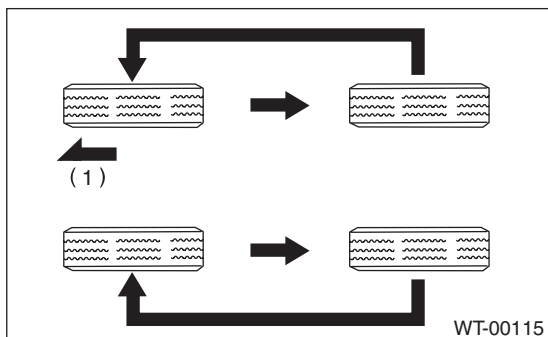
- 1) When the tread has worn down to less than 1.6 mm (0.063 in) or the wear indicator appears across the tread, replace the tire. (Replace the right and left tire as a set.)
- 2) If the tire appears to be worn unevenly, adjust the wheel alignment.
- 3) Next, make a tire rotation between front and rear as shown in the figure, make sure tires are worn evenly.

- When the direction of tire rotation is not specified

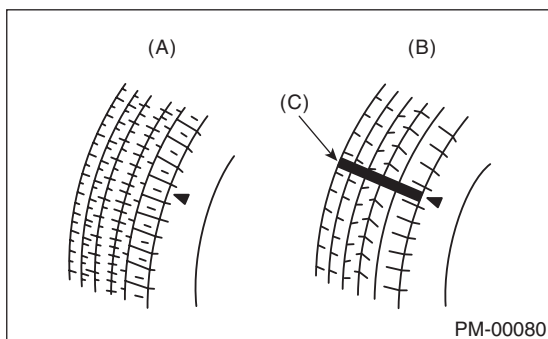


(1) Front

- With instruction for the direction of tire rotation



(1) Front



- (A) New tread
- (B) Damaged tread
- (C) Tread wear indicator

- 4) Re-register the transmitter ID when rotation was performed. (3.0 L U4 model) <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

# Steering System (Power Steering)

## PERIODIC MAINTENANCE SERVICES

### 24. Steering System (Power Steering)

#### A: INSPECTION

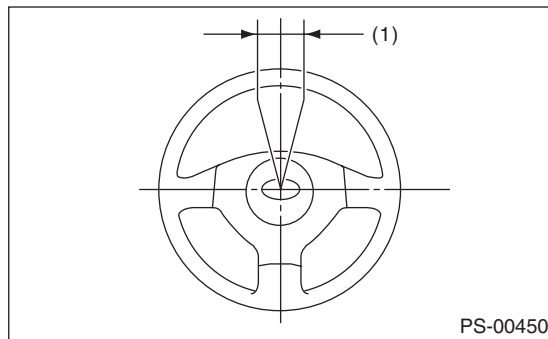
##### 1. STEERING WHEEL

- 1) Set the steering wheel in a straight-ahead position, and check the wheel spokes to make sure they are correctly set in their specified positions.
- 2) Lightly turn the steering wheel to the left and right to determine the point where front wheels start to move.

Measure the distance of the movement of steering wheel at the outer periphery of wheel.

##### **Steering wheel free play:**

**0 — 17 mm (0 — 0.67 in)**



(1) Steering wheel free play

Move the steering wheel vertically toward the shaft to ascertain if there is play in the direction.

##### **Maximum permissible play:**

**0.5 mm (0.020 in)**

- 3) Drive the vehicle and check the following items during operation.

##### (1) Steering force:

The effort required for steering should be smooth and even at all points, and should not vary.

##### (2) Pulled to one side:

Steering wheel should not be pulled to either side while driving on a level surface.

##### (3) Wheel runout:

Steering wheel should not show any sign of runout.

##### (4) Return factor:

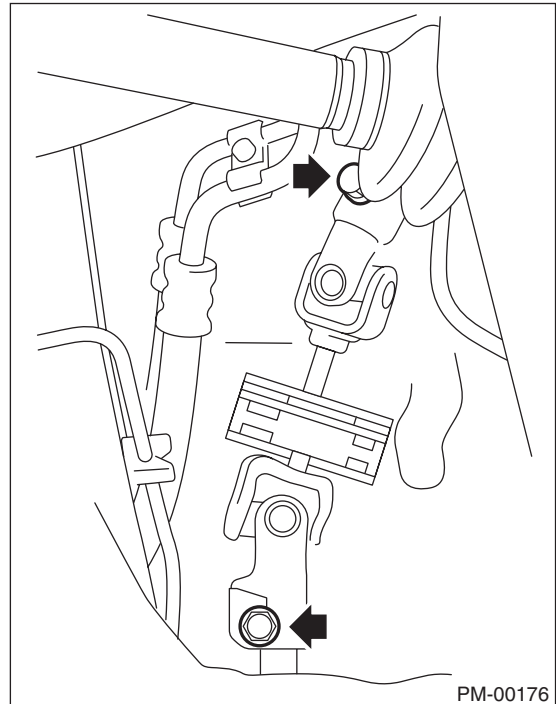
Steering wheel should return to its original position after it has been turned and then released.

##### 2. STEERING SHAFT JOINT

When the steering wheel free play is excessive, disconnect the universal joint of steering shaft and check it for any play and yawing torque (at the point of the crossing direction). Also inspect for any damage to sealing or worn serrations. If the joint is loose, retighten the mounting bolts to the specified torque.

##### **Tightening torque:**

**24 N·m (2.4 kgf-m, 17.7 ft-lb)**

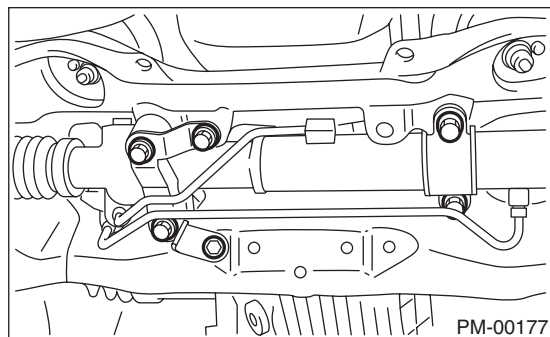


## 3. GEARBOX

1) With the vehicle placed on a level surface, turn the steering wheel 90° in both the left and right directions. While the wheel is being rotated, reach under the vehicle and check for looseness in gearbox.

### **Tightening torque:**

**60 N·m (6.1 kgf·m, 44.1 ft·lb)**

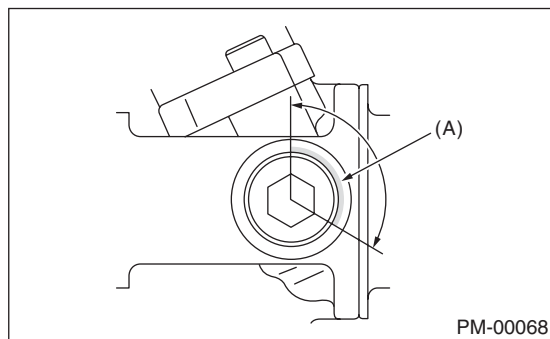


2) Check the boot for damage, cracks or deterioration.  
 3) With the vehicle placed on a level surface, quickly turn the steering wheel to the left and right. While steering wheel is being rotated, check the gear backlash. If any noise is noticed, adjust the gear backlash.

4) Apply liquid gasket to at least 1/3 of entire perimeter of adjusting screw thread.

5) Tighten the adjusting screw to 25 N·m (2.5 kgf·m, 18.1 ft·lb) and then loosen.

6) Tighten the adjusting screw to 3.9 N·m (0.40 kgf·m, 2.9 ft·lb) and then loosen 20°.



(A) Apply liquid gasket to at least 1/3 of entire perimeter.

7) Install the lock nut. While holding the adjusting screw with wrench, tighten the lock nut using ST. ST 926230000 SPANNER

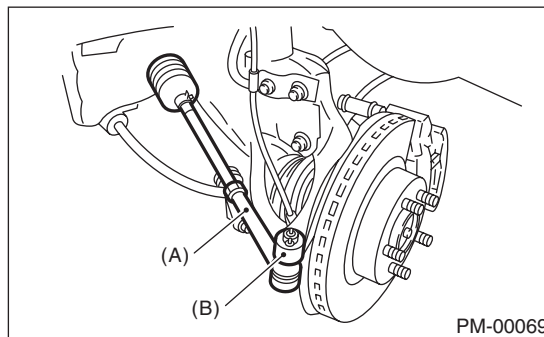
### **Tightening torque (lock nut):**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

Hold the adjusting screw with wrench to prevent it from turning while tightening the lock nut.

## 4. TIE-ROD

1) Check the tie-rod and tie-rod ends for bends, scratches or other damage.



(A) Tie-rod end  
 (B) Knuckle arm

2) Check the connections of knuckle ball joints for play, inspect for damage on dust seals, and check free play of ball studs. If castle nut is loose, retighten it to the specified torque, then tighten further up to a maximum of 60° until the cotter pin hole is aligned.

### **Tightening torque:**

**27 N·m (2.75 kgf·m, 19.9 ft·lb)**

3) Check the lock nut on the tie-rod for tightness. If it is loose, retighten it to the specified torque.

### **Tightening torque:**

**85 N·m (8.7 kgf·m, 63 ft·lb)**



# Steering System (Power Steering)

## PERIODIC MAINTENANCE SERVICES

### 5. POWER STEERING FLUID LEVEL

#### CAUTION:

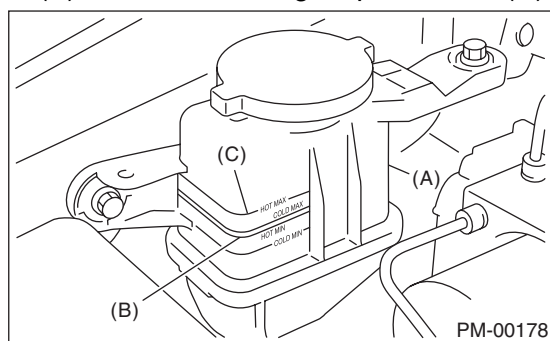
If the power steering fluid is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

#### NOTE:

- Check at power steering fluid temperature 20°C (68°F); read the fluid level on the “COLD” side.
- Check at power steering fluid temperature 80°C (176°F); read the fluid level on the “HOT” side.

1) Place the vehicle with engine “OFF” on a level surface.

2) Check the fluid level using the scale on the outside of the reservoir tank (A). If the level is below “MIN” (B), add fluid to bring it up to “MAX” (C).



#### NOTE:

If fluid level is at MAX level or above, drain fluid to keep the level in the specified range of indicator by using a syringe or the like.

#### Recommended fluid:

Refer to “RM” section. <Ref. to RM-4, FLUID, RECOMMENDED MATERIALS, Recommended Materials.>

#### Fluid capacity:

0.8 ℓ (0.8 US qt, 0.7 Imp qt)

### 6. POWER STEERING FLUID FOR LEAKS

#### CAUTION:

If the power steering fluid is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

Inspect the underside of oil pump and gearbox of power steering system, hoses, pipes and their couplings for fluid leaks.

If the fluid leaks are found, retighten their fitting bolts (or nuts) and/or replace their parts.

#### NOTE:

- Wipe the leaked fluid off after correcting fluid leaks.
- Also pay attention to clearances between hoses (or pipes) and other parts when inspecting fluid leaks.

### 7. HOSES OF OIL PUMP FOR DAMAGES

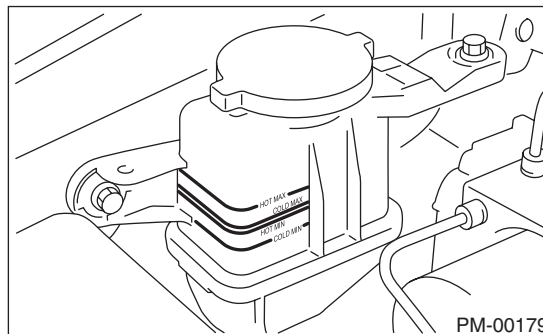
#### CAUTION:

If the power steering fluid is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

Check the pressure hose and return hose of oil pump for crack, swell or damage. Replace the hose with a new part if necessary.

#### NOTE:

Prevent hoses from turning and/or bending when installing hoses.



### 8. POWER STEERING PIPES FOR DAMAGES

#### CAUTION:

If the power steering fluid is spilt over exhaust pipe, wipe it off with cloth to avoid emitting smoke or causing a fire.

Check the power steering pipes for corrosion and damage.

Replace the pipes with new parts if necessary.

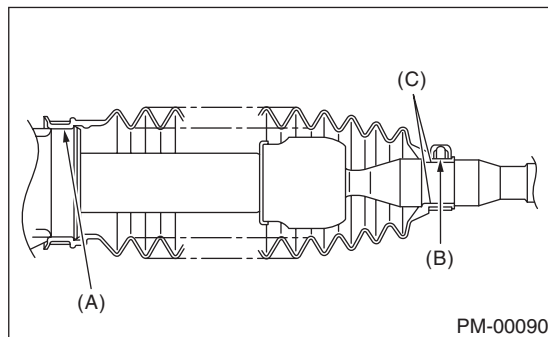
## 9. GEARBOX BOOTS

Inspect both sides of the gearbox boot as follows, and correct the defects if necessary.

- 1) Positions (A) and (B) of the gearbox boot are fitted correspondingly in grooves (A) and (B) of the gearbox and rod (C).
- 2) Clips are fitted outside of positions (A) and (B) of boot.
- 3) Boot does not have crack or hole.

### NOTE:

Rotate (B) position of gearbox boot against the torsion produced by the adjustment of toe-in etc. Apply grease to the groove (C).



## 10. FITTING BOLTS AND NUTS

Inspect the fitting bolts and nuts of oil pump and bracket for looseness, and retighten them if necessary.

Inspect and/or retighten them when engine is cold.

# Steering System (Power Steering)

PERIODIC MAINTENANCE SERVICES

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# General Description

FUEL INJECTION (FUEL SYSTEMS)

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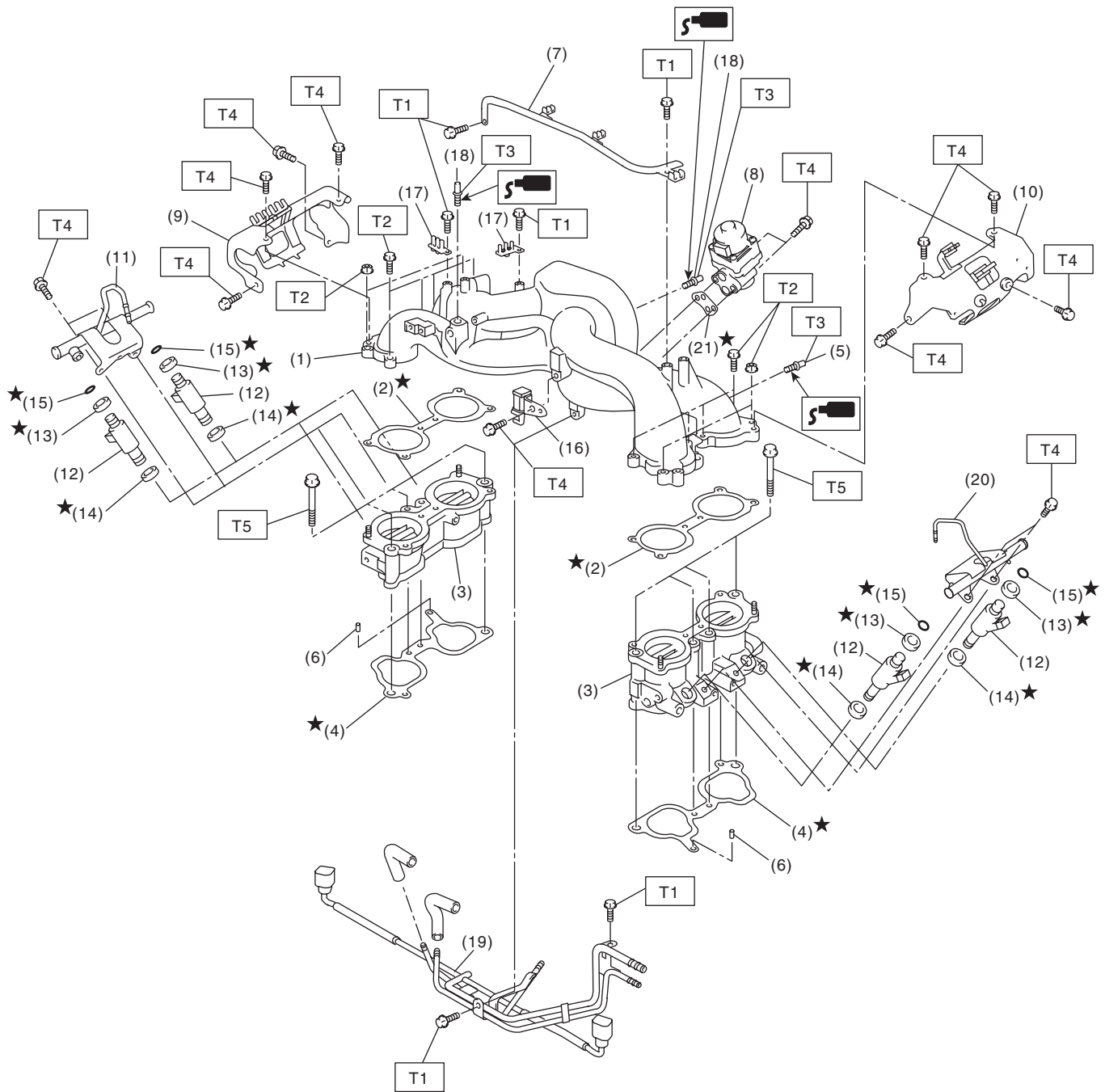
## 1. General Description

### A: SPECIFICATION

Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 Imp gal)
	Install locations	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	550 — 850 kPa (5.6 — 8.7 kg/cm <sup>2</sup> , 79.7 — 123.2 psi)
	Discharge rate	125 ℓ (33 US gal, 27.5 Imp gal)/h or more. [12 V at 300 kPa (3.06 kg/cm <sup>2</sup> , 43.5 psi)]
Fuel filter		Intank type

### B: COMPONENT

#### 1. INTAKE MANIFOLD



FU-03232

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

- |                             |                                   |                            |
|-----------------------------|-----------------------------------|----------------------------|
| (1) Intake manifold         | (11) Fuel injector pipe RH        | (20) Fuel injector pipe LH |
| (2) Gasket                  | (12) Fuel injector                | (21) Gasket                |
| (3) Intake manifold (lower) | (13) O-ring                       |                            |
| (4) Gasket                  | (14) O-ring                       |                            |
| (5) Nipple                  | (15) O-ring                       |                            |
| (6) Guide pin               | (16) Purge control solenoid valve |                            |
| (7) Plug cord stay          | (17) Plug cord holder             |                            |
| (8) EGR valve               | (18) Nipple                       |                            |
| (9) Fuel pipe protector RH  | (19) Fuel pipe ASSY               |                            |
| (10) Fuel pipe protector LH |                                   |                            |

---

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 8.75 (0.89, 6.5)**

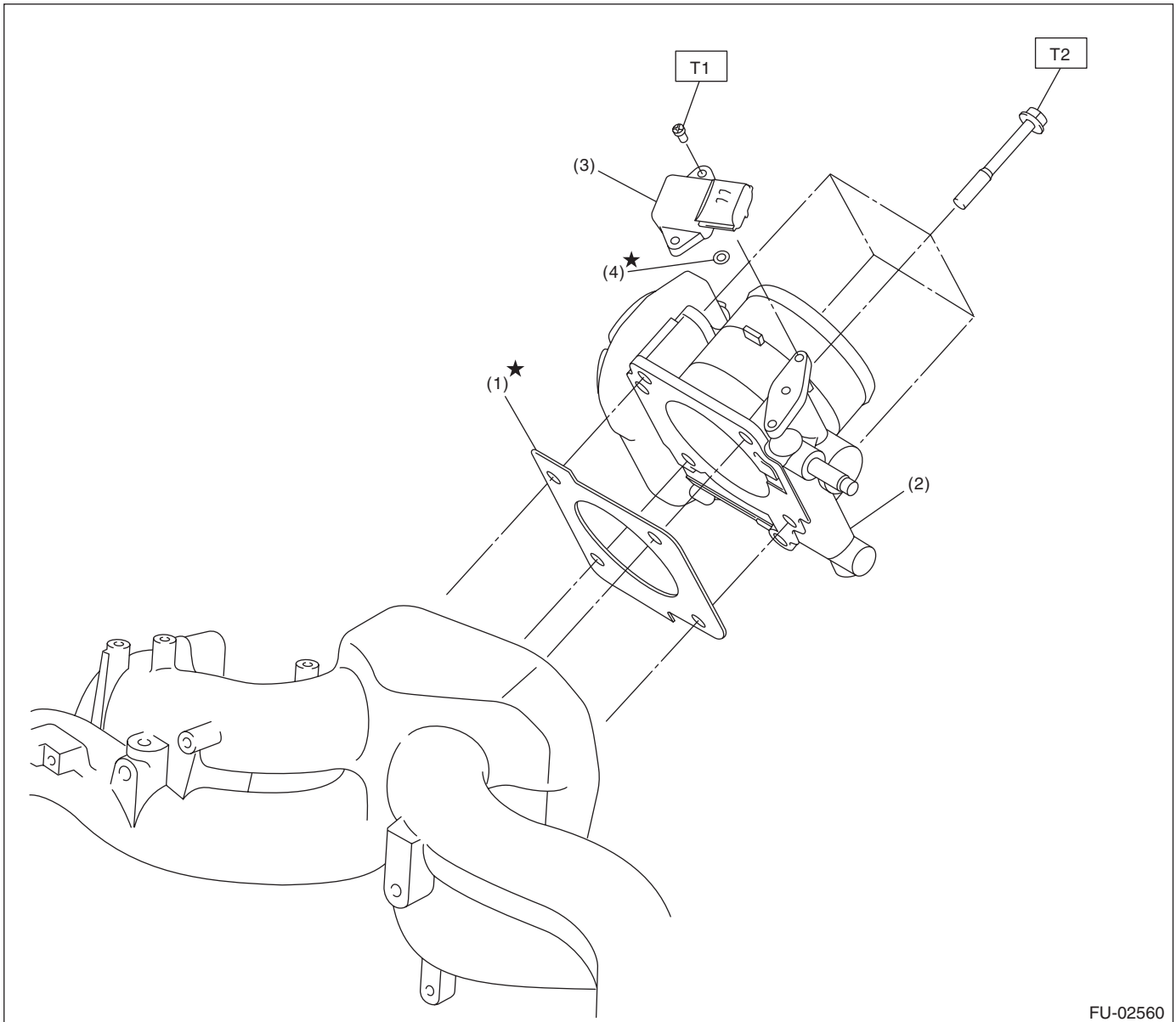
**T3: 17 (1.7, 12.5)**

**T4: 19 (1.9, 14.0)**

**T5: 25 (2.5, 18.4)**

---

## 2. AIR INTAKE SYSTEM



FU-02560

- |                                       |            |
|---------------------------------------|------------|
| (1) Gasket                            | (4) O-ring |
| (2) Throttle body                     |            |
| (3) Manifold absolute pressure sensor |            |

---

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 2 (0.2, 1.5)**

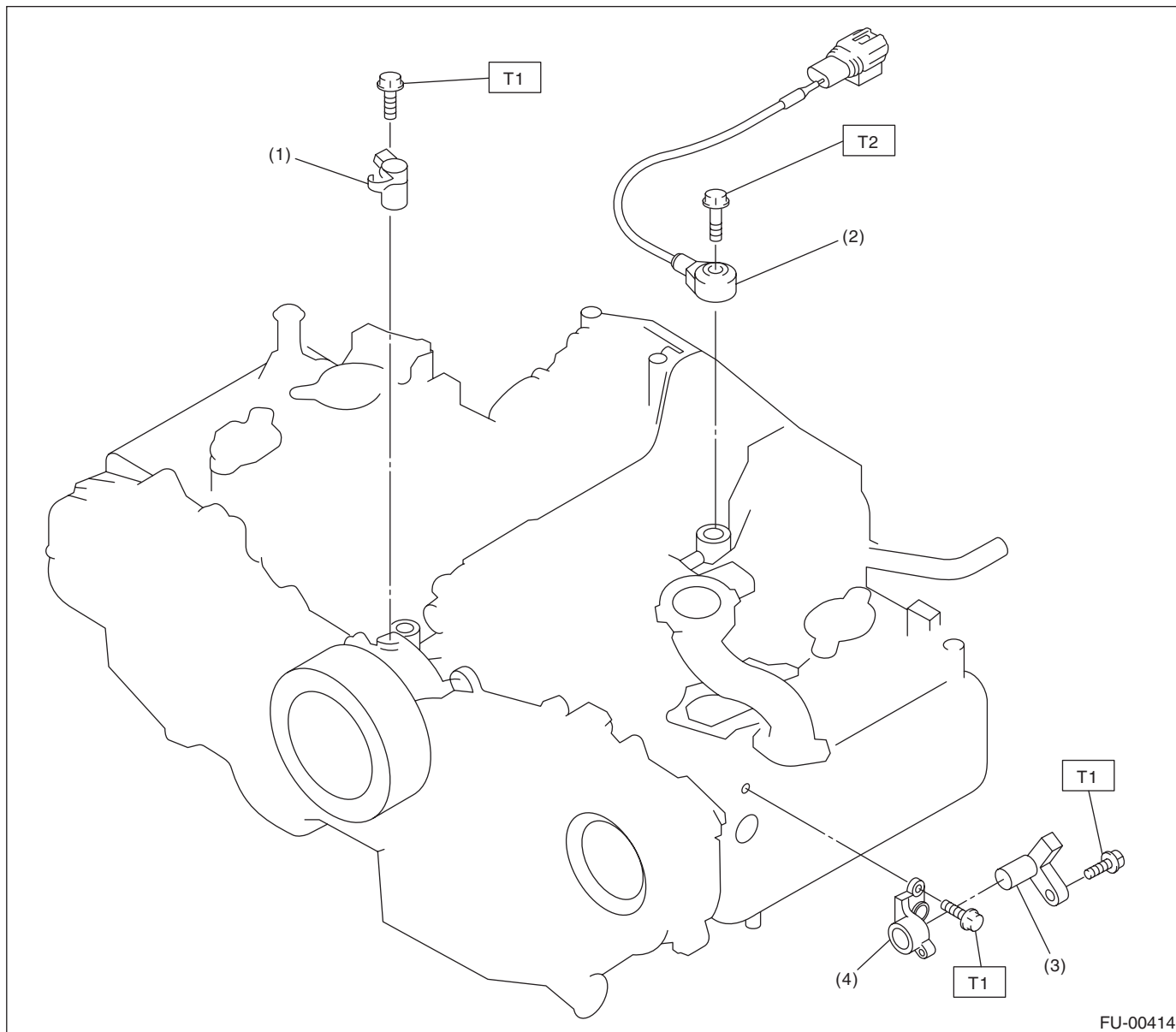
**T2: 8 (0.8, 5.9)**

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# General Description

FUEL INJECTION (FUEL SYSTEMS)

## 3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



- (1) Crankshaft position sensor
- (2) Knock sensor
- (3) Camshaft position sensor

- (4) Camshaft position sensor support

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 24 (2.4, 17.7)**





# General Description

## FUEL INJECTION (FUEL SYSTEMS)

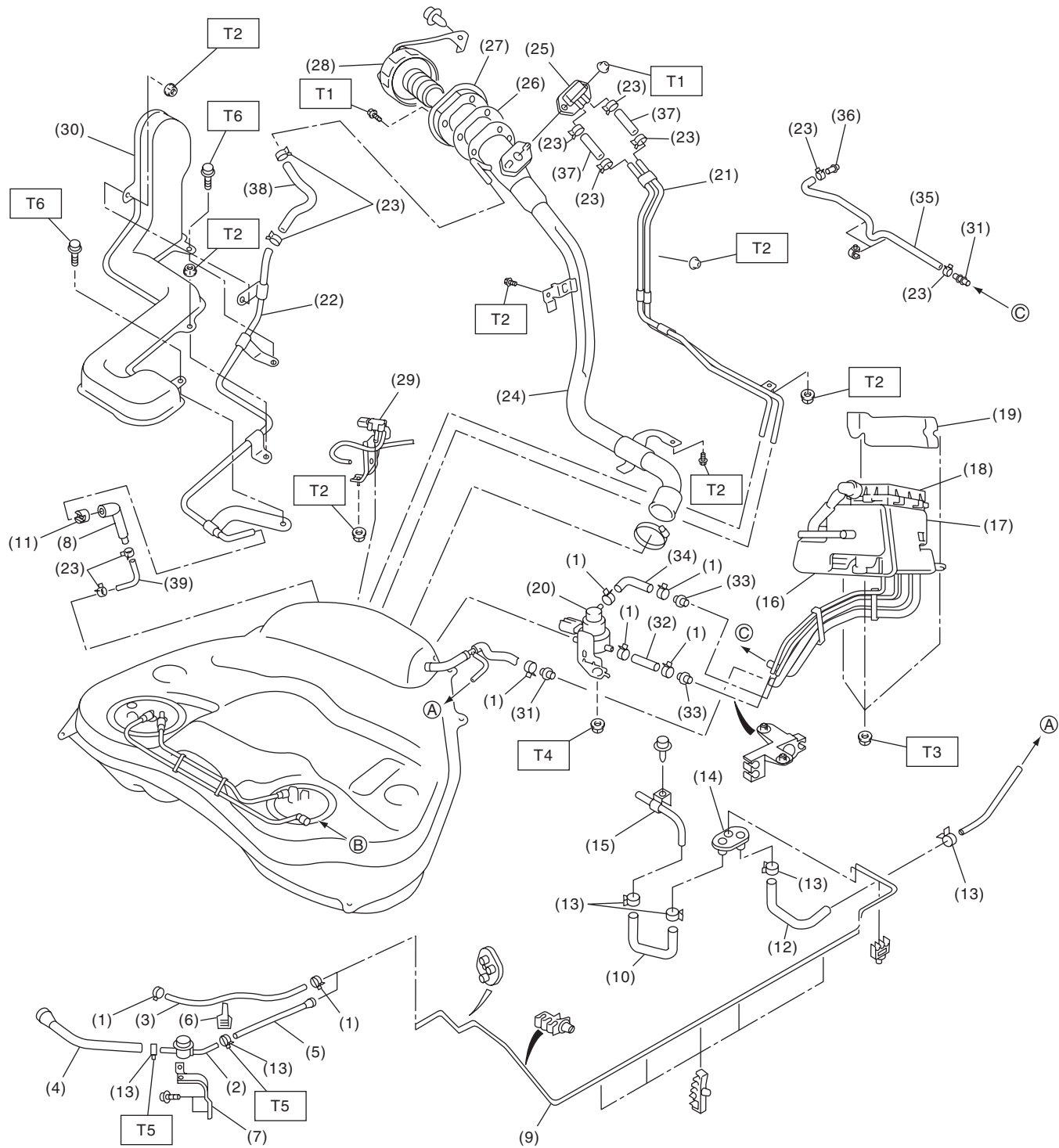
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(1) Fuel tank	(14) Fuel filler hose	(27) Evaporation hose C
(2) Fuel tank band RH	(15) Clamp	(28) Evaporation hose D
(3) Fuel tank band LH	(16) Evaporation hose A	(29) Evaporation pipe
(4) Delivery tube	(17) Clip	(30) Evaporation hose E
(5) Jet pump tube	(18) Evaporation hose F	(31) Fuel sub level sensor filter
(6) Retainer	(19) Fuel tank protector LH (rear)	(32) Fuel sub level sensor protector
(7) Fuel pump ASSY	(20) Stopper RH	
(8) Fuel pump upper plate	(21) Stopper LH	<hr/> <b>Tightening torque:N·m (kgf-m, ft-lb)</b>
(9) Fuel pump gasket	(22) Heat shield cover	<b>T1: 4.4 (0.45, 3.2)</b>
(10) Fuel level sensor	(23) Fuel tank protector RH (front)	<b>T2: 9 (0.9, 6.6)</b>
(11) Fuel sub level sensor	(24) Fuel tank protector LH (front)	<b>T3: 17.5 (1.78, 12.9)</b>
(12) Fuel sub level sensor upper plate	(25) Evaporation hose B	<b>T4: 33 (3.4, 25)</b>
(13) Fuel sub level sensor gasket	(26) Connector	<hr/>

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

### 5. FUEL LINE



FU-03120

## General Description

### FUEL INJECTION (FUEL SYSTEMS)

(1) Clip	(17) Drain valve	(33) Connector B
(2) Fuel damper valve	(18) Drain filter	(34) Canister hose B
(3) Evaporation hose A	(19) Canister protector	(35) Drain hose
(4) Fuel delivery hose A	(20) Pressure control solenoid valve	(36) Drain hose connector
(5) Fuel delivery hose B	(21) Evaporation pipe A	(37) Evaporation hose C
(6) Clip	(22) Evaporation pipe B	(38) Evaporation hose D
(7) Bracket	(23) Clip	(39) Evaporation hose E
(8) Evaporation tube	(24) Fuel filler pipe	
(9) Fuel pipe ASSY A	(25) Shut valve	
(10) Fuel delivery hose C	(26) Gasket	
(11) Retainer	(27) Filler ring	
(12) Evaporation hose B	(28) Fuel filler cap	
(13) Clamp	(29) Fuel tank pressure sensor	
(14) Grommet	(30) Evaporation pipe protector	
(15) Fuel pipe ASSY B	(31) Connector A	
(16) Canister	(32) Canister hose A	

---

**Tightening torque:N·m (kgf-m, ft-lb)****T1: 4.4 (0.45, 3.2)****T2: 7.5 (0.76, 5.5)****T3: 8 (0.8, 5.9)****T4: 17.6 (1.8, 13)****T5: 1.25 (0.13, 0.94)****T6: 1.0 (0.1, 0.7)**

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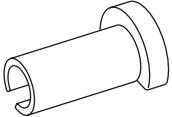
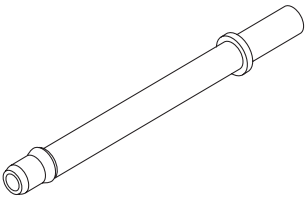
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

## General Description

FUEL INJECTION (FUEL SYSTEMS)

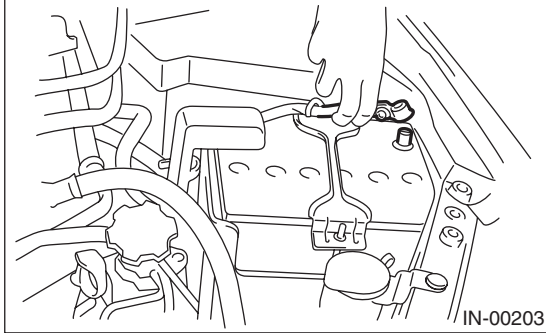
### D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for removing the quick connector.
 ST18471AA000	18471AA000 (Newly adopted tool)	FUEL PIPE ADAPTER	Used for extracting fuel.

## 2. Throttle Body

### A: REMOVAL

1) Disconnect the ground cable from the battery.

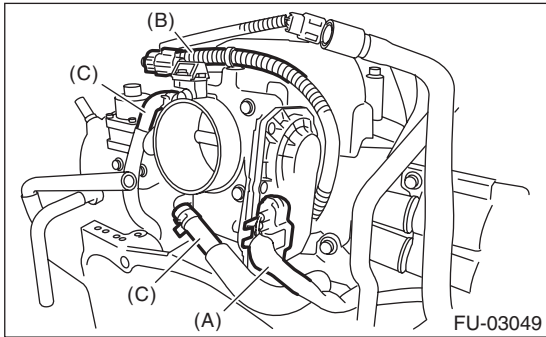


2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>

3) Disconnect the connectors from throttle position sensor and manifold absolute pressure sensor.

4) Disconnect the engine coolant hoses from the throttle body.

5) Remove the bolts which secure the throttle body to the intake manifold and remove the throttle body.



- (A) Throttle position sensor
- (B) Manifold absolute pressure sensor
- (C) Engine coolant hose

### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**

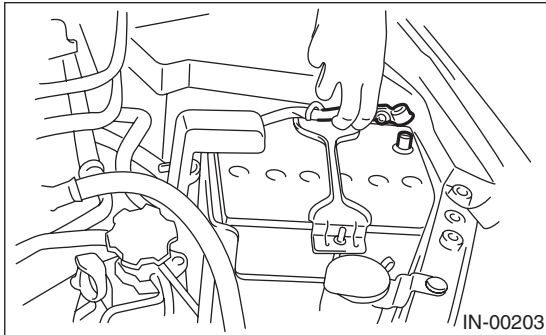
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

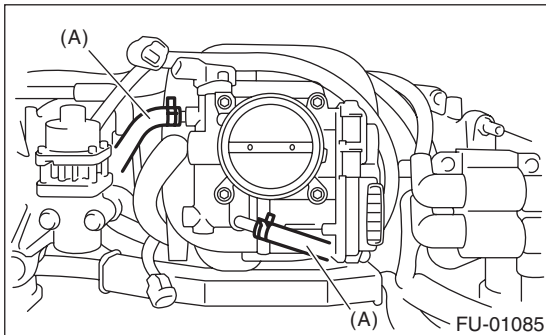
### 3. Intake Manifold

#### A: REMOVAL

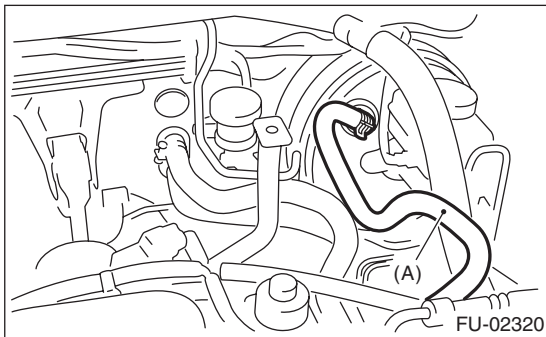
- 1) Release the fuel pressure.  
<Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.> <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 4) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 5) Remove the spark plug cords from the spark plugs by pulling the plug caps. (Do not pull the cord.)
- 6) Disconnect the engine coolant hoses (A) from throttle body.

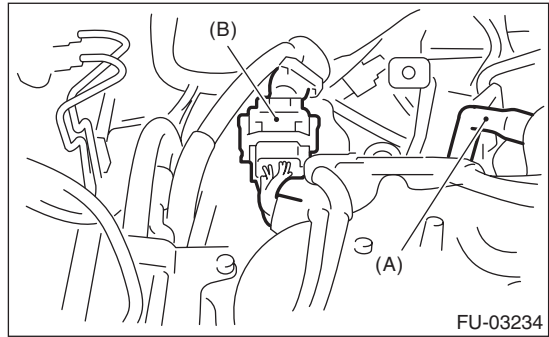


- 7) Disconnect the brake booster hose (A).

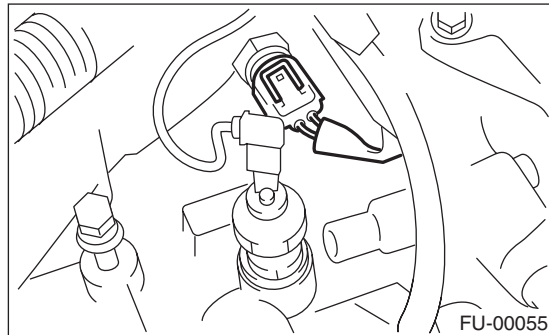


- 8) Disconnect the PCV hose (A) from intake manifold.

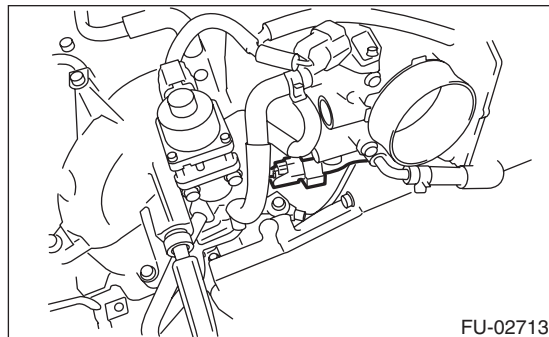
- 9) Disconnect the engine harness connectors (B) from bulkhead harness connectors.



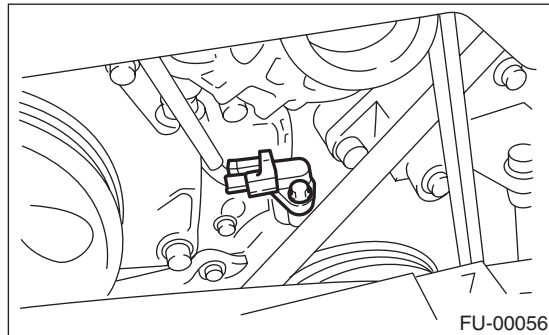
- 10) Disconnect the connectors from the engine coolant temperature sensor.



- 11) Disconnect the knock sensor connector.



- 12) Disconnect the connector from crankshaft position sensor.

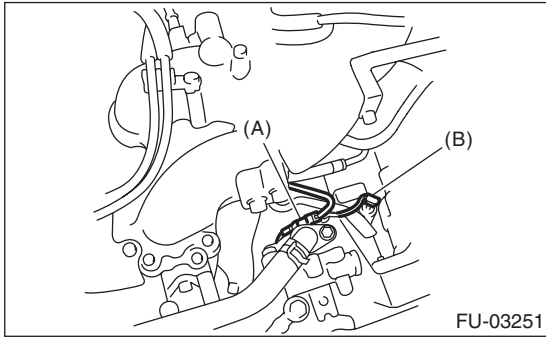


- 13) Disconnect the connector from power steering pump switch (A).

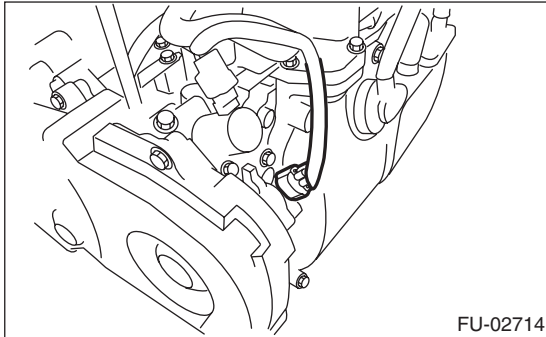
# Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

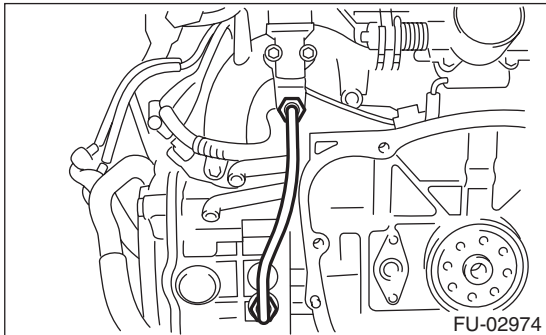
- 14) Disconnect the connector from the oil pressure switch (B).



- 15) Disconnect the connector from the camshaft position sensor.



- 16) Remove the EGR pipe from intake manifold.



- 17) Disconnect the following connector.  
(1) Front oxygen (A/F) sensor connector  
(2) Rear oxygen sensor connector  
(3) Engine harness connectors

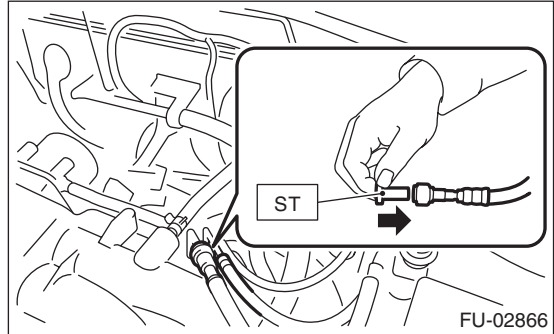
- 18) Disconnect the fuel hoses from fuel pipe.  
(1) Disconnect the quick connector on the fuel delivery line by pushing the ST in the direction of the arrow.

ST 42099AE000 CONNECTOR REMOVER

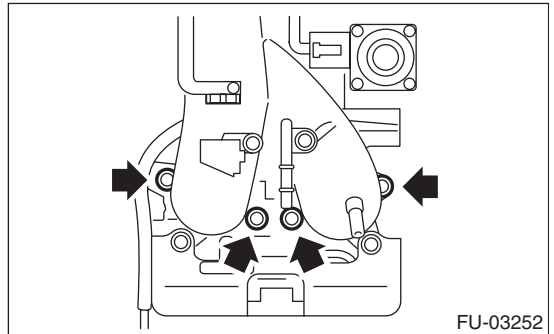
- (2) Remove the clip and disconnect the evaporation hose from the pipe.

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



- 19) Remove the bolts which secure intake manifold to cylinder head.



- 20) Remove the intake manifold.

## B: INSTALLATION

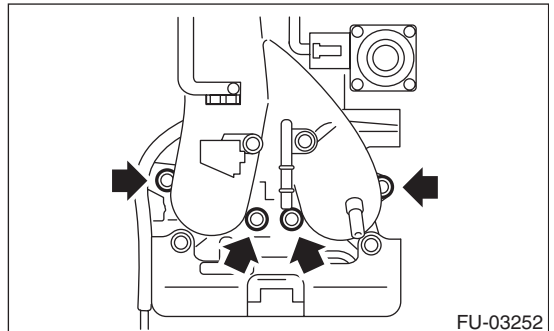
- 1) Install the intake manifold onto cylinder heads.

### NOTE:

Use a new gasket.

### Tightening torque:

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

2) Connect the fuel hose and evaporation hose to the fuel pipe.

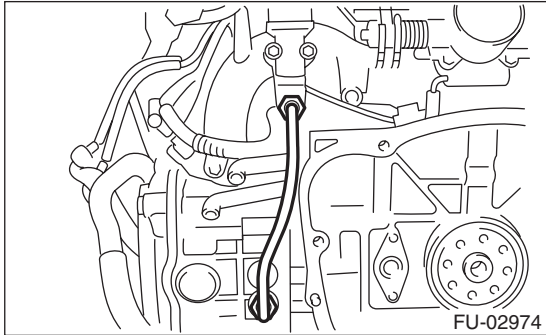
### NOTE:

If fuel hoses or clamps are damaged, replace them with new parts.

3) Install the EGR pipe to intake manifold.

### Tightening torque:

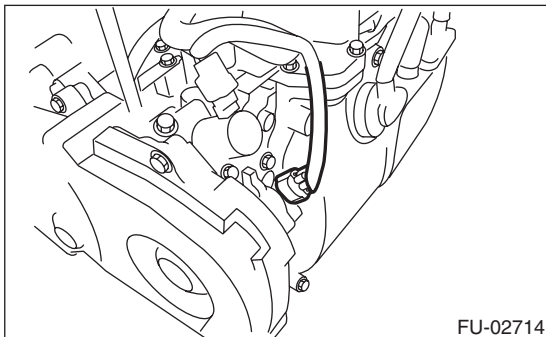
**34 N·m (3.4 kgf·m, 24.6 ft·lb)**



4) Connect the following connectors.

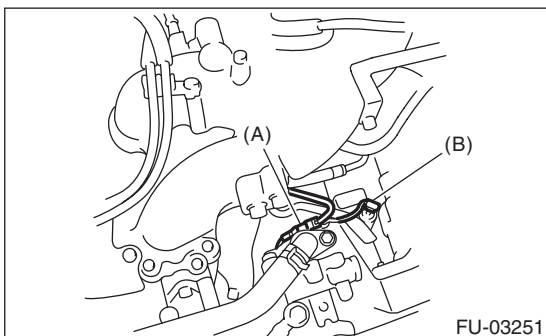
- (1) Front oxygen (A/F) sensor connector
- (2) Rear oxygen sensor connector
- (3) Engine harness connectors

5) Connect the connectors to camshaft position sensor.

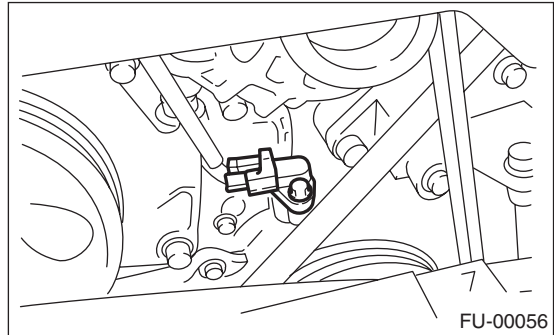


6) Connect the connector to the power steering pump switch (A).

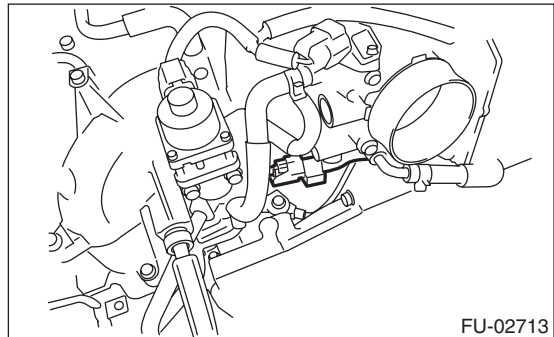
7) Connect the connector to the oil pressure switch (B).



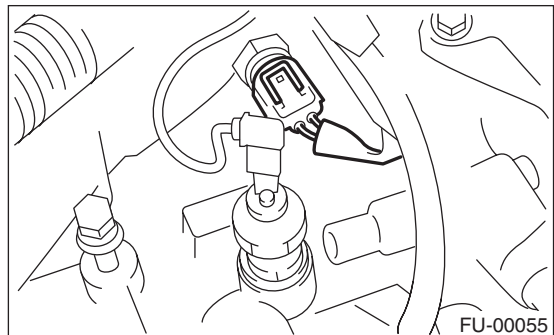
8) Connect the connector to crankshaft position sensor.



9) Connect the knock sensor connector.

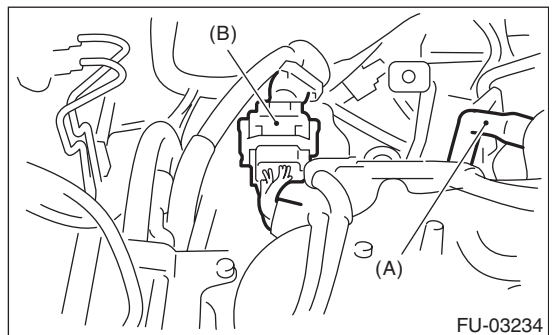


10) Connect the connector to engine coolant temperature sensor.



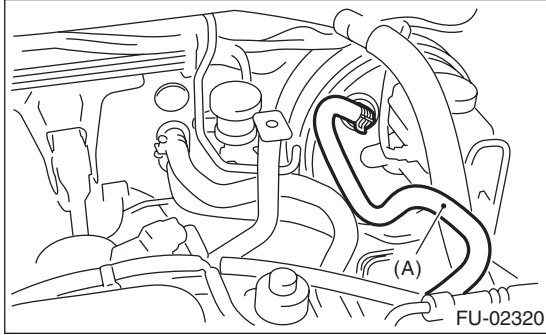
11) Connect the PCV hose (A) to intake manifold.

12) Connect the engine harness connectors (B) to bulkhead harness connectors.

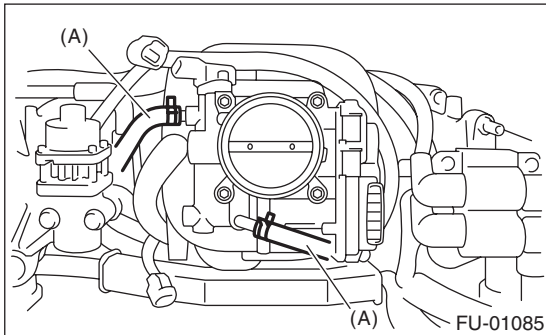




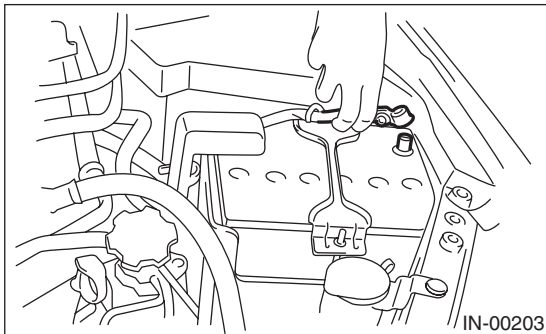
- 13) Connect the brake booster hose (A).



- 14) Connect the engine coolant hoses (A) to throttle body.

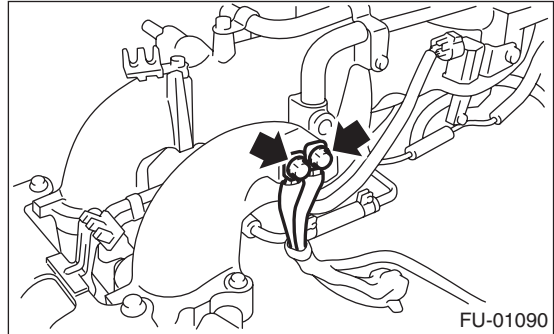


- 15) Connect the spark plug cords to spark plugs.  
 16) Install the generator. <Ref. to SC(H4SO)-15, INSTALLATION, Generator.>  
 17) Install the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>  
 18) Install the fuse of fuel pump relay to the main fuse box.  
 19) Connect the battery ground cable to battery.

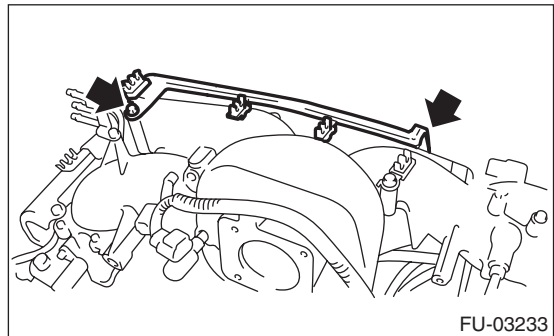


## C: DISASSEMBLY

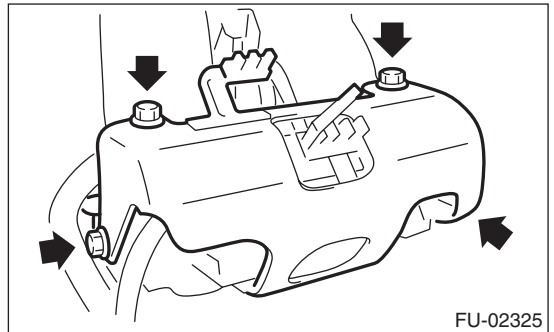
- 1) Disconnect the engine ground terminal from intake manifold.



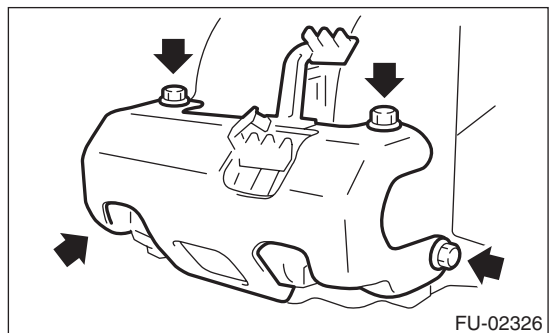
- 2) Remove the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, REMOVAL, Ignition Coil and Ignitor Assembly.>  
 3) Remove the throttle body. <Ref. to FU(H4SO)-11, REMOVAL, Throttle Body.>  
 4) Remove the EGR valve. <Ref. to FU(H4SO)-27, REMOVAL, EGR Valve.>  
 5) Remove the plug cord stay.



- 6) Remove the fuel pipe protector LH.



- 7) Remove the fuel pipe protector RH.

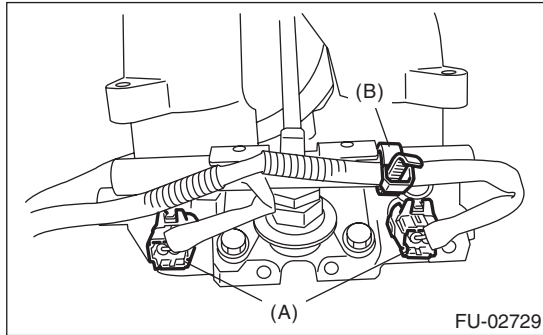


# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

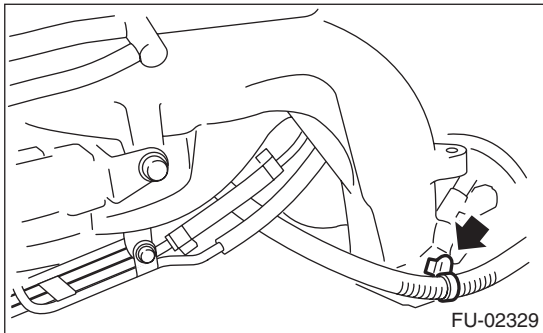
8) Disconnect the connectors (A) from fuel injector.

9) Remove the harness band (B) which holds the engine harness to injector pipe.

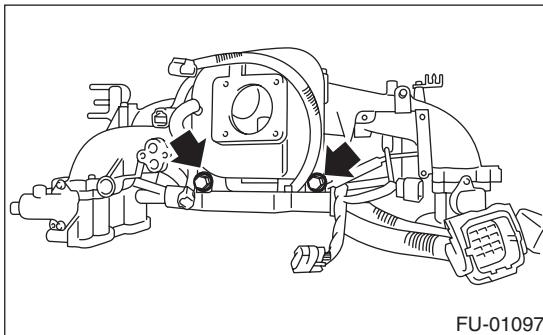


10) Remove the purge control solenoid valve.  
<Ref. to EC(H4SO)-6, REMOVAL, Purge Control Solenoid Valve.>

11) Remove the harness band clips which install the engine harness.



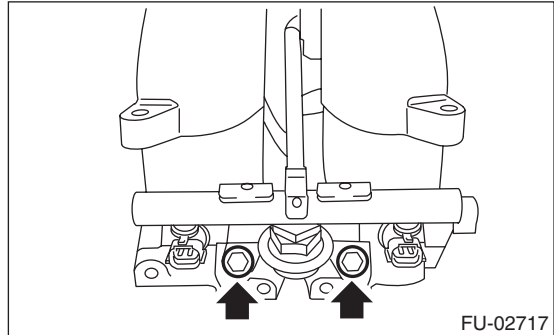
12) Remove the bolts which hold engine harness to intake manifold.



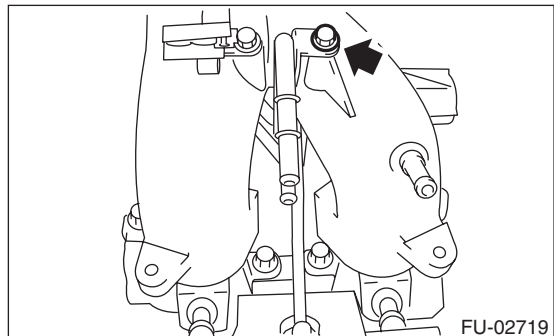
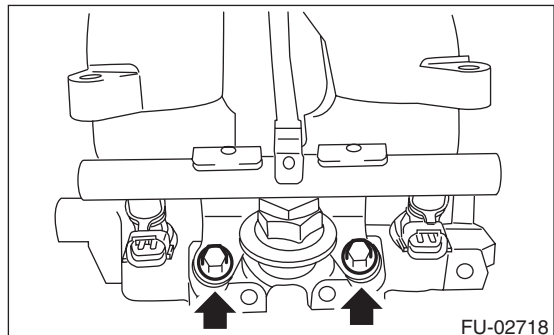
13) Remove the engine harness from intake manifold.

14) Remove the bolts which install fuel injector pipe on the intake manifold as shown in the figure.

• RH side

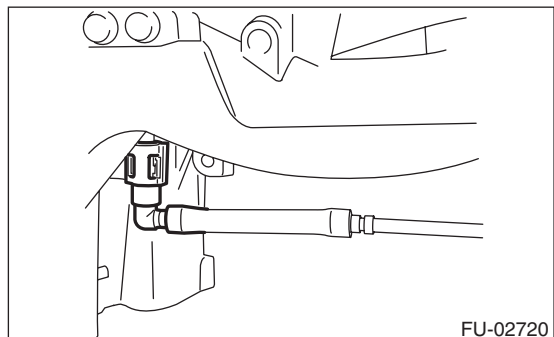


• LH side



15) Remove the fuel injectors from the fuel injector pipe.

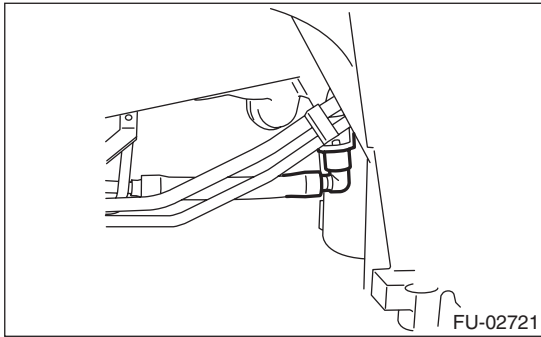
16) Disconnect the quick connector that fastens the fuel injector pipe RH to the fuel pipe.



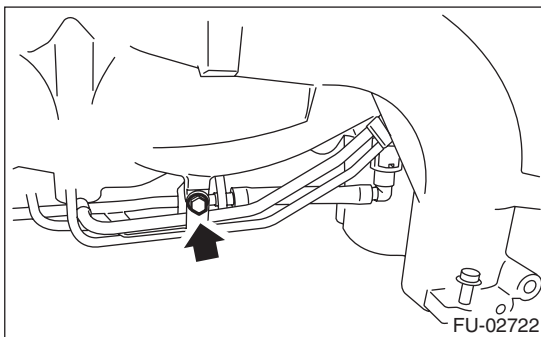
# Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

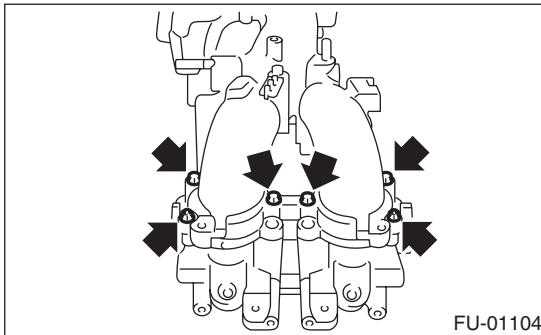
- 17) Disconnect the quick connector that fastens the fuel injector pipe LH to the fuel pipe.



- 18) Remove the fuel injector pipe RH and LH.  
19) Remove the bolts which install fuel pipes on intake manifold.



- 20) Remove the fuel pipe from intake manifold.  
21) Remove the intake manifold.



## D: ASSEMBLY

NOTE:

When assembling the nipple, apply liquid gasket.

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010)**

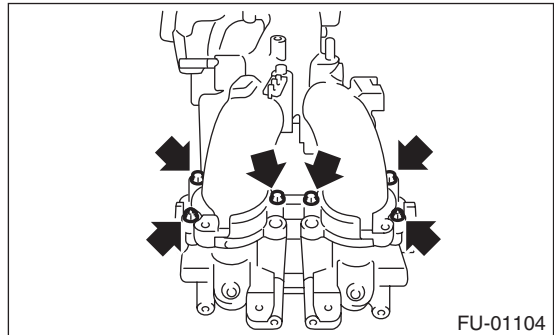
- 1) Install the intake manifold.

NOTE:

Use a new gasket.

**Tightening torque:**

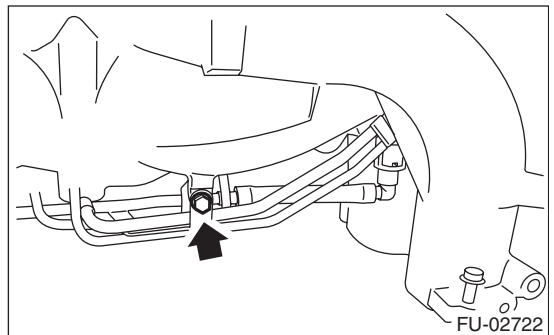
**8.75 N·m (0.89 kgf·m, 6.5 ft·lb)**



- 2) Tighten the bolts which install fuel pipes on intake manifold.

**Tightening torque:**

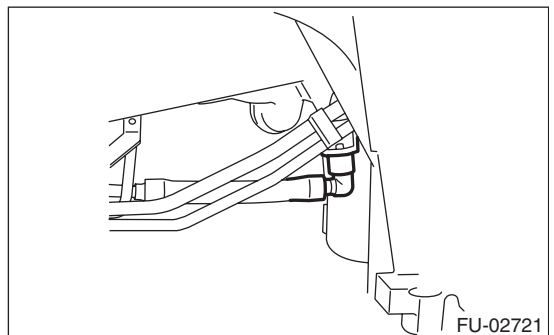
**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- 3) Connect the fuel injector pipe LH to the fuel pipe.

NOTE:

Connect the quick connector securely.



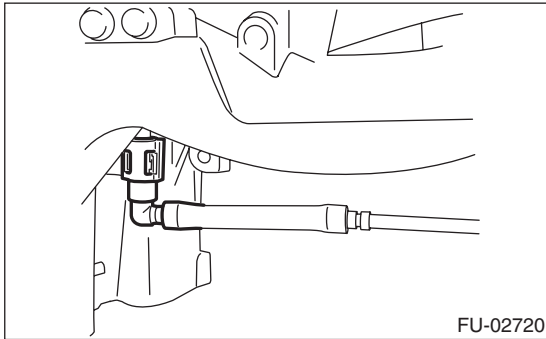
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

4) Connect the fuel injector pipe RH to the fuel pipe.

NOTE:

Connect the quick connector securely.



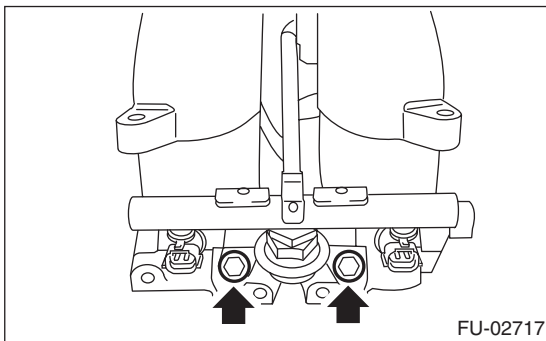
5) Install the fuel injector.

6) Tighten the bolts which install fuel injector pipes on intake manifold.

- RH side

**Tightening torque:**

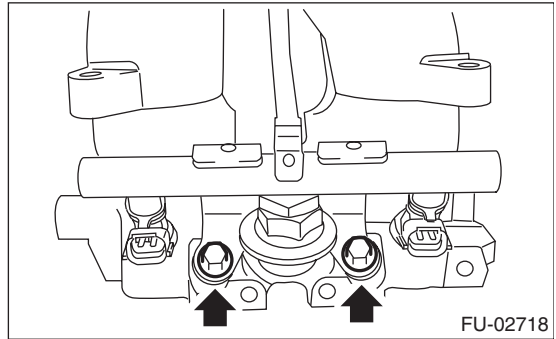
**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



- LH side

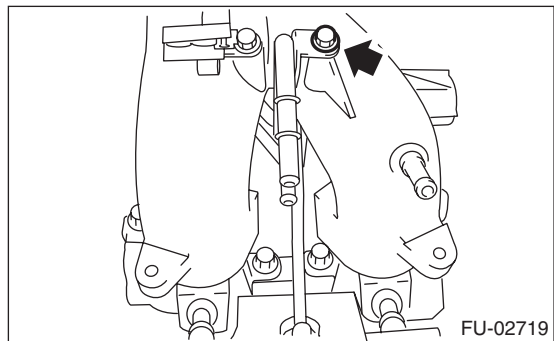
**Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

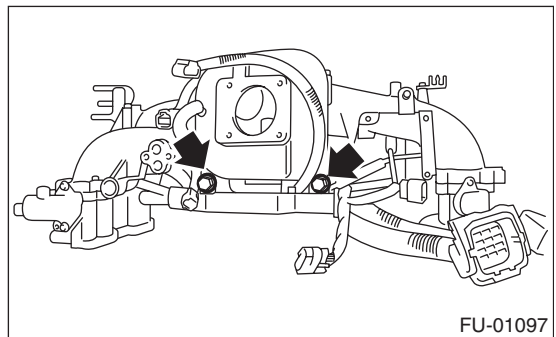


7) Install the engine harness to the intake manifold.

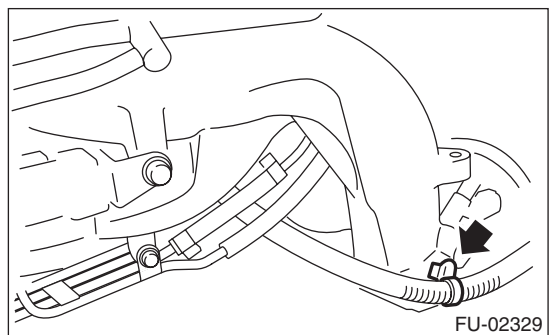
8) Tighten the bolts which install engine harness on intake manifold.

**Tightening torque:**

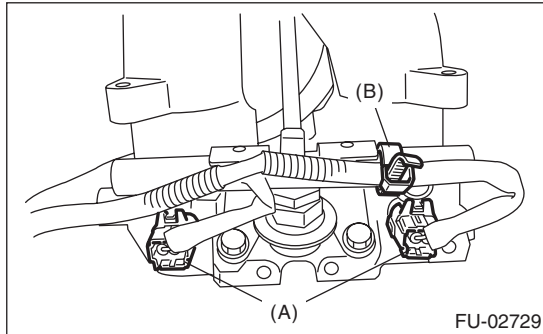
**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



9) Hold the engine harness using the harness band clips.



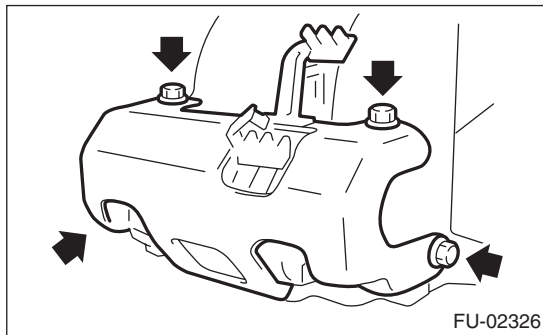
- 10) Install the purge control solenoid valve. <Ref. to EC(H4SO)-6, INSTALLATION, Purge Control Solenoid Valve.>
- 11) Connect the connectors (A) to fuel injector.
- 12) Hold the engine harness to injector pipe by harness band (B).



- 13) Install the fuel pipe protector RH.

**Tightening torque:**

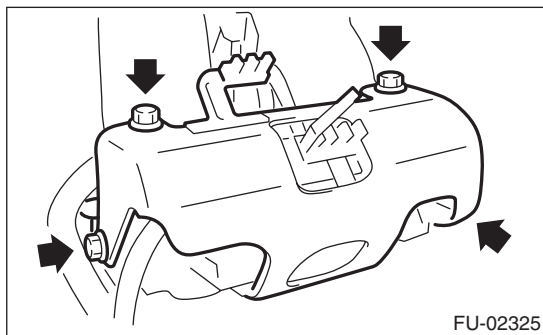
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



- 14) Install the fuel pipe protector LH.

**Tightening torque:**

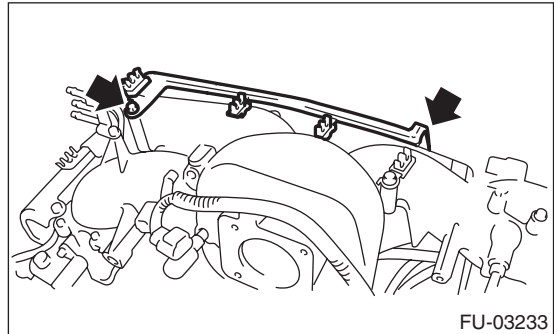
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



- 15) Install the plug cord stay.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- 16) Install the EGR valve. <Ref. to FU(H4SO)-27, INSTALLATION, EGR Valve.>

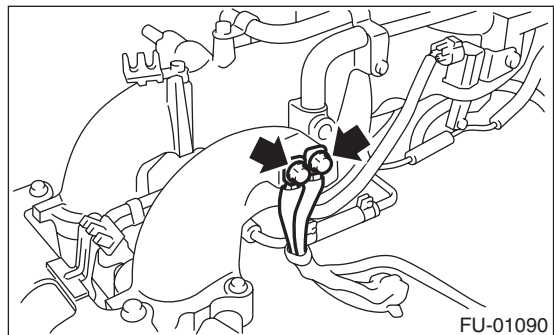
- 17) Install the throttle body to the intake manifold. <Ref. to FU(H4SO)-11, INSTALLATION, Throttle Body.>

- 18) Install the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, INSTALLATION, Ignition Coil and Ignitor Assembly.>

- 19) Install the engine ground terminal to intake manifold.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



## E: INSPECTION

Make sure the fuel pipe and fuel hoses are not damaged and the connections are tightened firmly.

# Engine Coolant Temperature Sensor

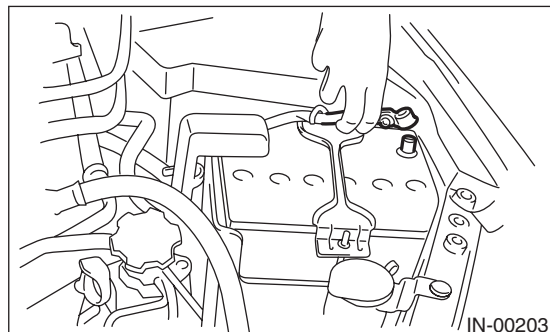
FUEL INJECTION (FUEL SYSTEMS)

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## 4. Engine Coolant Temperature Sensor

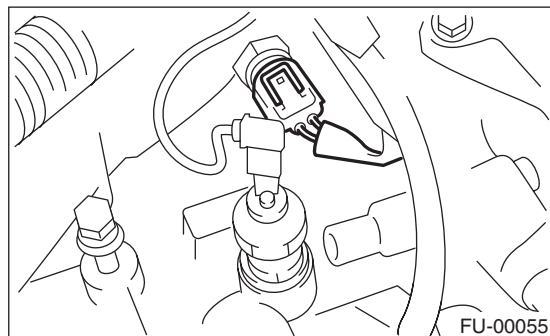
### A: REMOVAL

1) Disconnect the ground cable from the battery.



2) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>

3) Disconnect the connectors from the engine coolant temperature sensor.



4) Remove the engine coolant temperature sensor.

### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

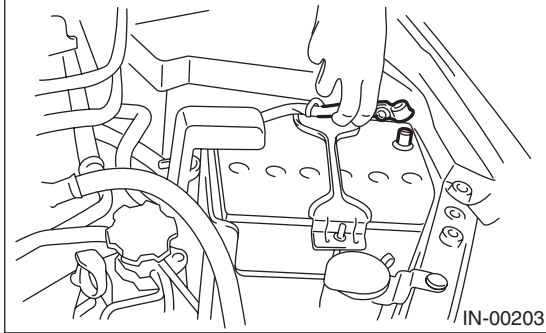
# Crankshaft Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

## 5. Crankshaft Position Sensor

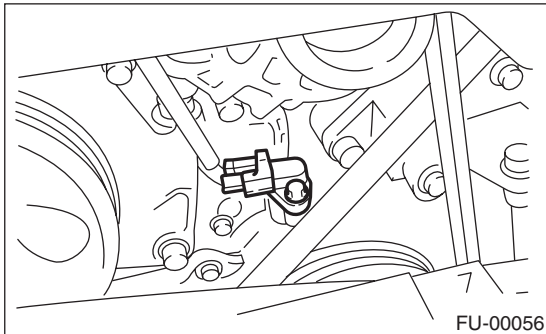
### A: REMOVAL

1) Disconnect the ground cable from the battery.

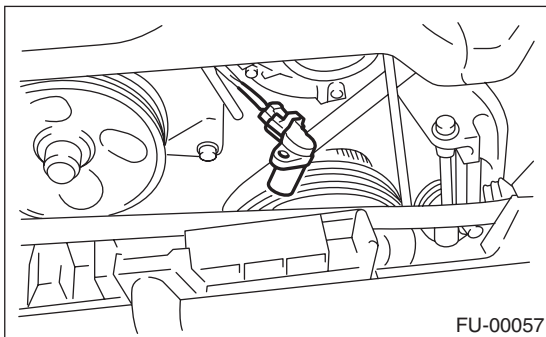


2) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>

3) Remove the bolt which installs crankshaft position sensor to cylinder block.



4) Remove the crankshaft position sensor, and then disconnect the connector from it.

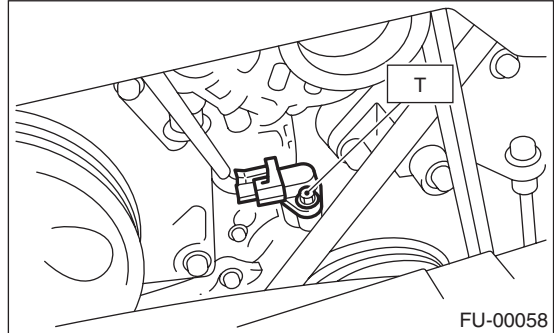


### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**T: 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



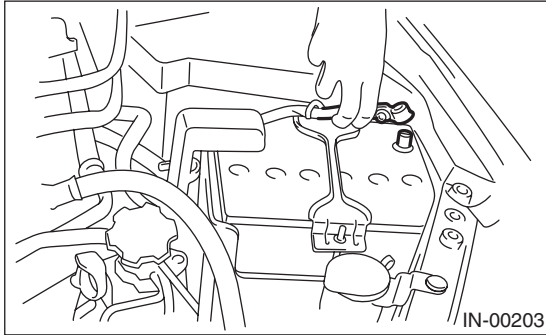
# Camshaft Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

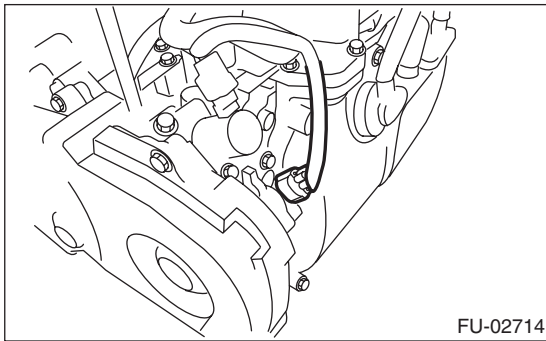
## 6. Camshaft Position Sensor

### A: REMOVAL

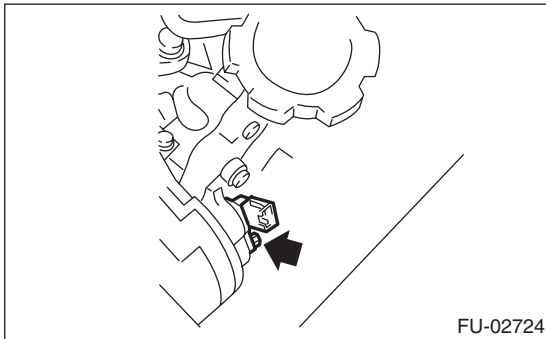
1) Disconnect the ground cable from the battery.



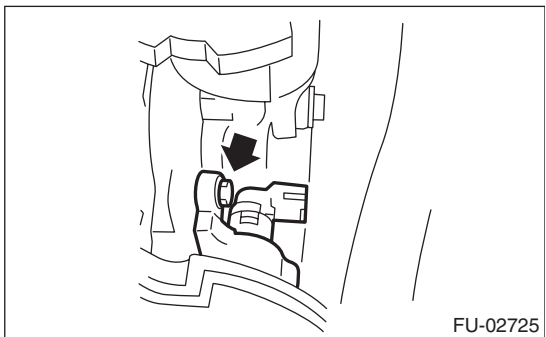
2) Disconnect the connector from the camshaft position sensor.



3) Remove the bolt which installs camshaft position sensor to the support.

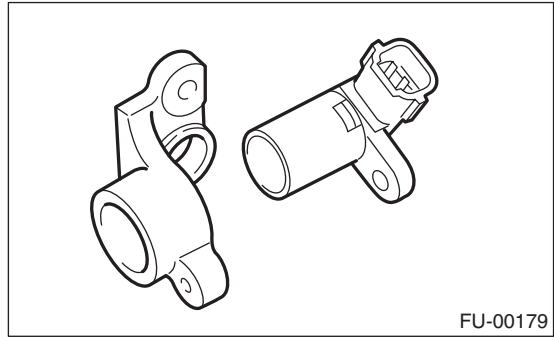


4) Remove the bolt which installs camshaft position sensor support to camshaft cap LH.



5) Remove the camshaft position sensor and the support as a unit.

6) Remove the camshaft position sensor from the camshaft position sensor support.



### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Camshaft position sensor support**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

**Camshaft position sensor**

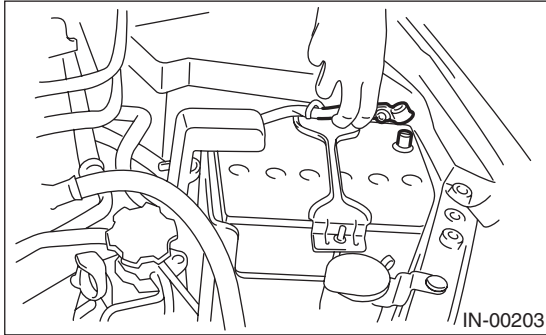
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



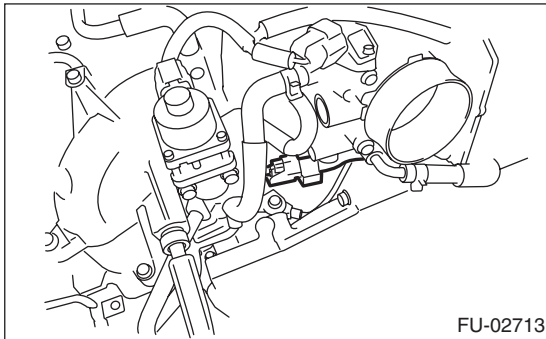
## 7. Knock Sensor

### A: REMOVAL

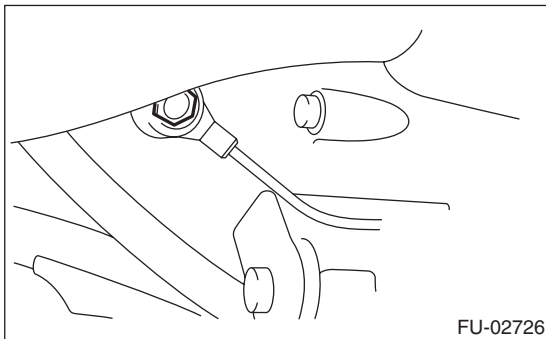
- 1) Disconnect the ground cable from the battery.



- 2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 3) Disconnect the knock sensor connector.



- 4) Remove the knock sensor from the cylinder block.



### B: INSTALLATION

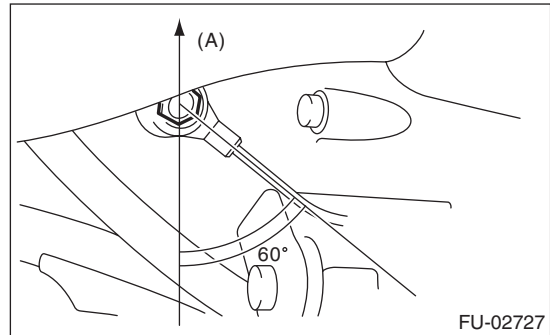
- 1) Install the knock sensor to the cylinder block.

#### NOTE:

Extraction area of knock sensor cord must be positioned at a 60° angle relative to the engine rear.

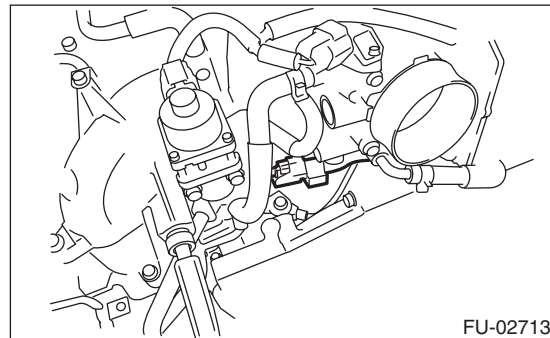
#### Tightening torque:

**24 N·m (2.4 kgf·m, 17.7 ft·lb)**

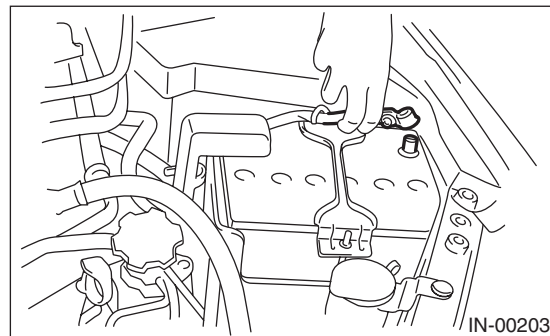


(A) Front side

- 2) Connect the knock sensor connector.



- 3) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
- 4) Connect the battery ground cable to battery.



# Throttle Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

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## 8. Throttle Position Sensor

### A: SPECIFICATION

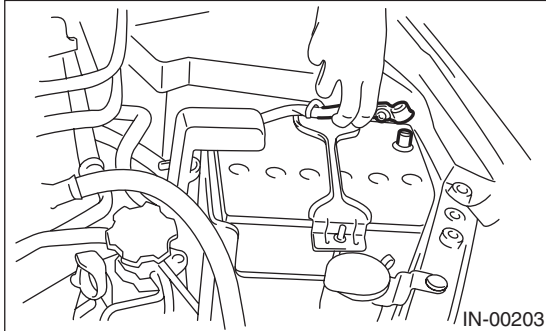
Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.

Refer to "Throttle Body" for removal and installation procedure. <Ref. to FU(H4SO)-11, REMOVAL, Throttle Body.> <Ref. to FU(H4SO)-11, INSTALLATION, Throttle Body.>

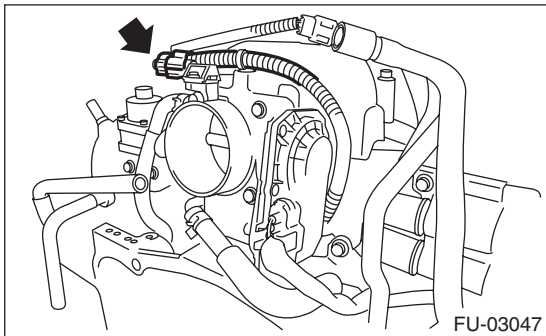
## 9. Manifold Absolute Pressure Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.



- 2) Disconnect the connector from manifold absolute pressure sensor.



- 3) Remove the manifold absolute pressure sensor from throttle body.

### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use new O-rings.

**Tightening torque:**

**2 N·m (0.2 kgf·m, 1.5 ft·lb)**

# Mass Air Flow and Intake Air Temperature Sensor

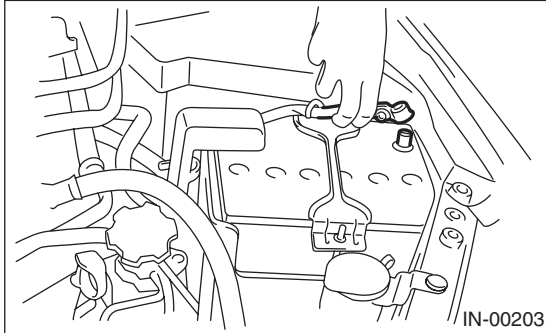
FUEL INJECTION (FUEL SYSTEMS)

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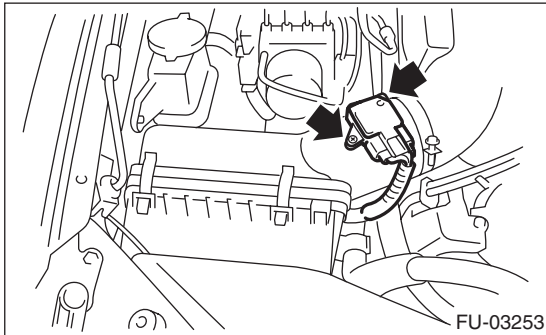
## 10. Mass Air Flow and Intake Air Temperature Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.



- 2) Disconnect the connectors from the mass air flow and intake air temperature sensor.
- 3) Remove the mass air flow and intake air temperature sensor.



### B: INSTALLATION

Install in the reverse order of removal.

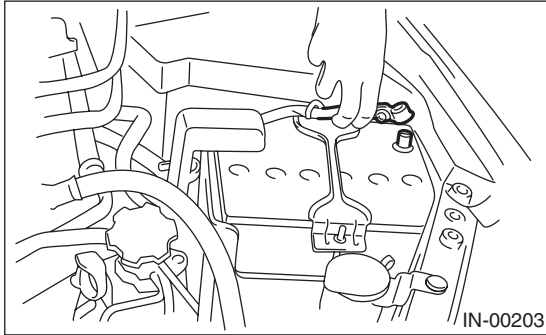
**Tightening torque:**

**1 N·m (0.1 kgf·m, 0.7 ft·lb)**

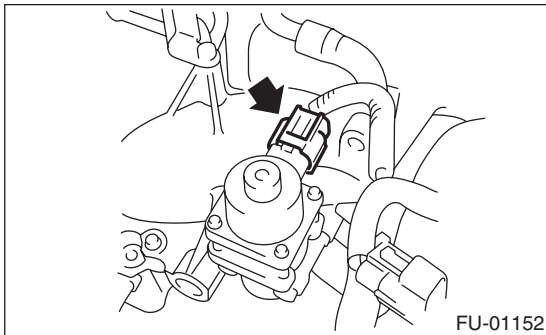
## 11.EGR Valve

### A: REMOVAL

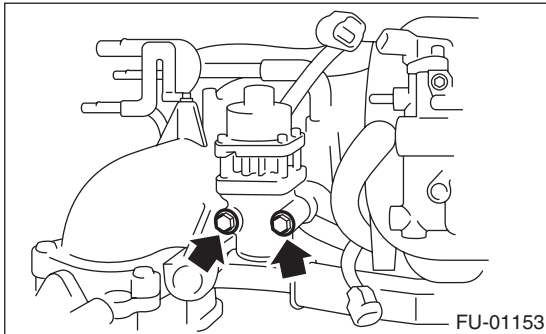
- 1) Disconnect the ground cable from the battery.



- 2) Disconnect the connector from the EGR valve.



- 3) Remove the EGR valve from intake manifold.



### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**

# Fuel Injector

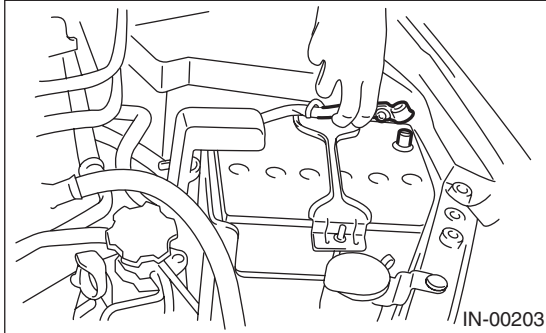
## FUEL INJECTION (FUEL SYSTEMS)

### 12. Fuel Injector

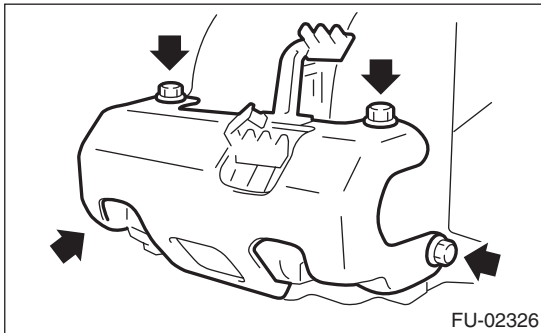
#### A: REMOVAL

##### 1. RH SIDE

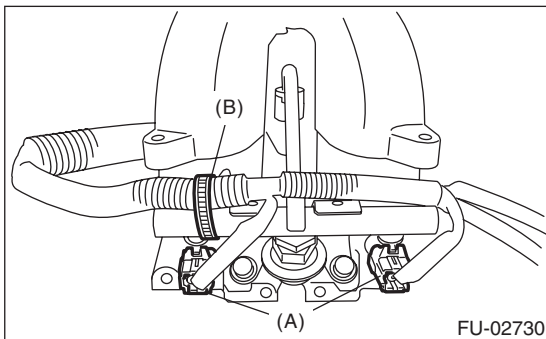
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Disconnect the ground cable from the battery.



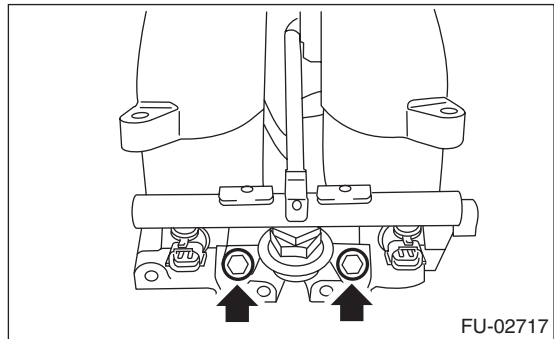
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 5) Remove the spark plug cords from spark plugs (#1 and #3 cylinders).
- 6) Remove the fuel pipe protector RH.



- 7) Disconnect the connectors (A) from fuel injector.
- 8) Remove the harness band (B) which holds the engine harness to injector pipe.



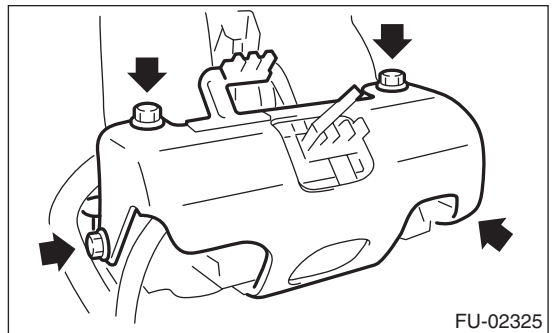
- 9) Remove the bolt which holds fuel injector pipe onto intake manifold.



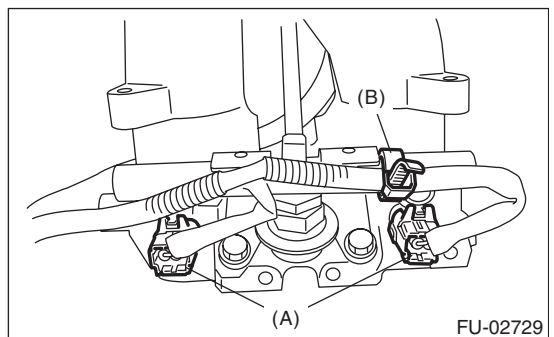
- 10) Remove the fuel injector while lifting up the fuel injector pipe.

##### 2. LH SIDE

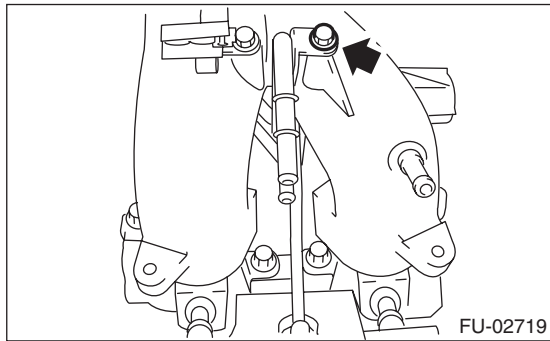
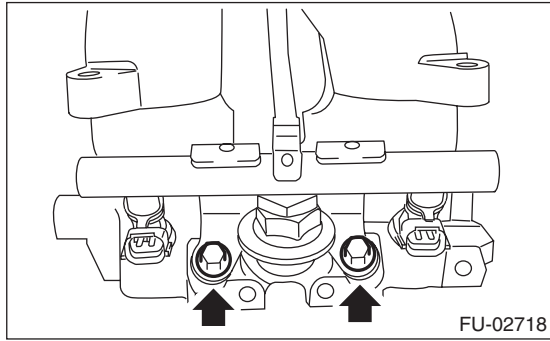
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the spark plug cords from spark plugs (#2 and #4 cylinders).
- 5) Remove the fuel pipe protector LH.



- 6) Disconnect the connectors (A) from fuel injector.
- 7) Remove the harness band (B) which holds the engine harness to injector pipe.



8) Remove the bolt which holds fuel injector pipe onto intake manifold.



9) Remove the fuel injector while lifting up the fuel injector pipe.

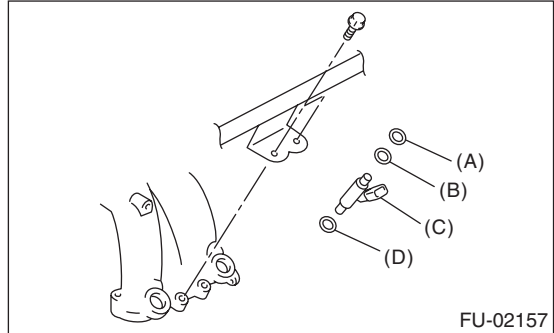
## B: INSTALLATION

### 1. RH SIDE

Install in the reverse order of removal.

NOTE:

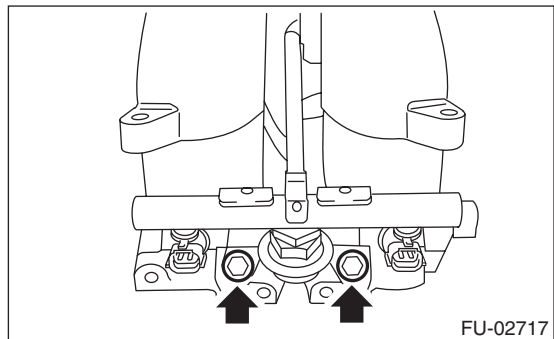
Use new O-rings.



- (A) O-ring
- (B) O-ring
- (C) Fuel injector
- (D) O-ring

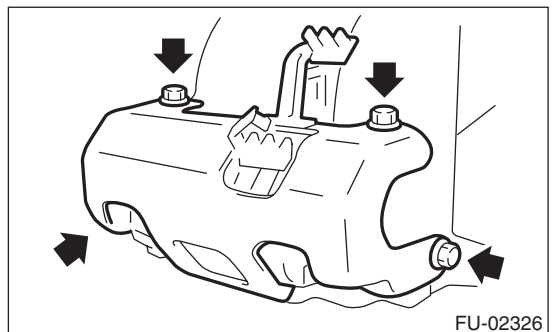
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



# Fuel Injector

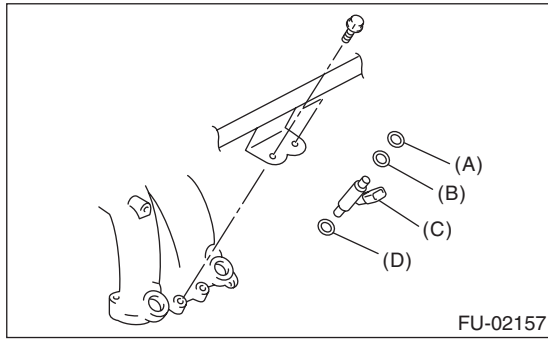
## FUEL INJECTION (FUEL SYSTEMS)

### 2. LH SIDE

Install in the reverse order of removal.

NOTE:

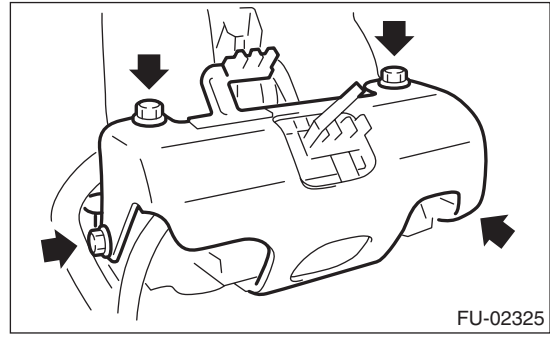
Use new O-rings.



- (A) O-ring
- (B) O-ring
- (C) Fuel injector
- (D) O-ring

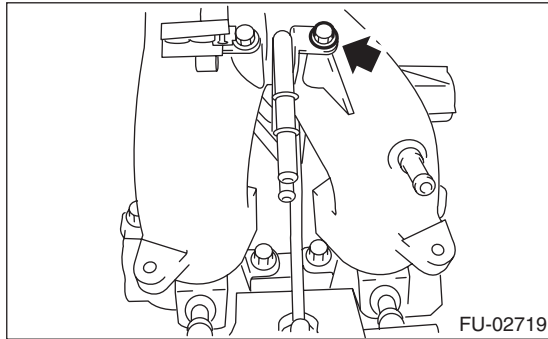
**Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



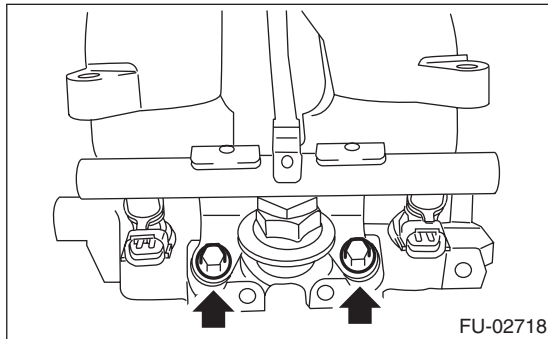
**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



**Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**

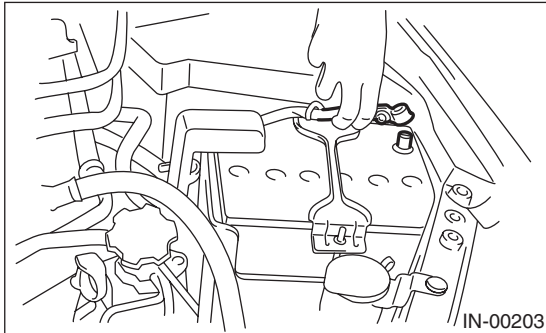




## 13. Variable Valve Lift Diagnosis Oil Pressure Switch

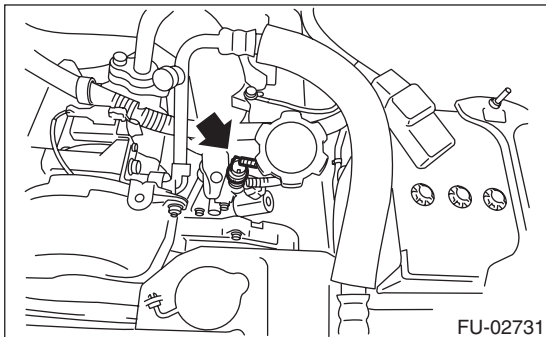
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.

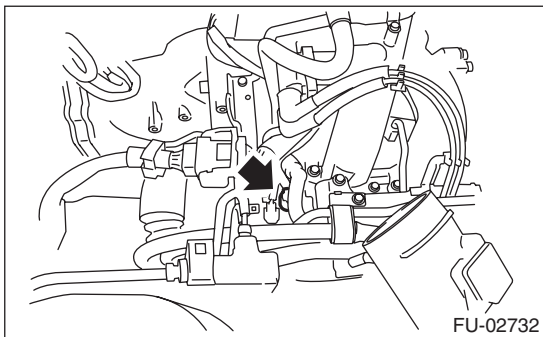


- 2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 3) Remove the engine harness connector from the bracket.
- 4) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.
- 5) Remove the variable valve lift diagnosis oil pressure switch.

- LH side



- RH side



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Apply liquid gasket to the variable valve lift diagnosis oil pressure switch threads.

#### Liquid gasket:

**THREE BOND 1324 (Part No. 004403042) or equivalent**

#### Tightening torque:

**17 N·m (1.7 kgf·m, 12.5 ft·lb)**

# Oil Temperature Sensor

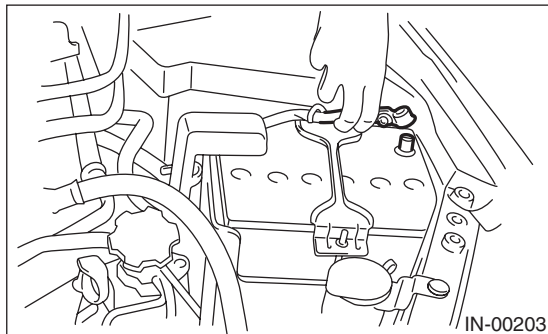
FUEL INJECTION (FUEL SYSTEMS)

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## 14.Oil Temperature Sensor

### A: REMOVAL

1) Disconnect the ground cable from the battery.

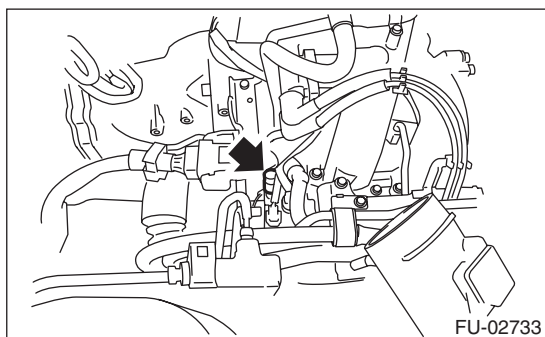


2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>

3) Remove the engine harness connector from the bracket.

4) Disconnect the connector from the oil temperature sensor.

5) Remove the oil temperature sensor.



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

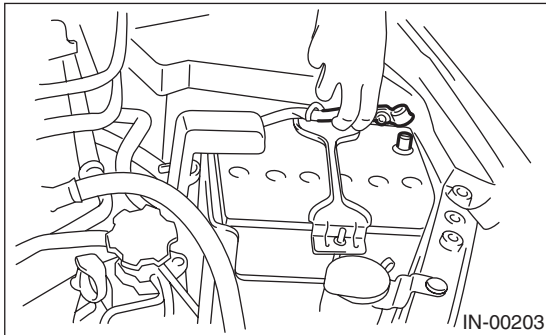
# Front Oxygen (A/F) Sensor

FUEL INJECTION (FUEL SYSTEMS)

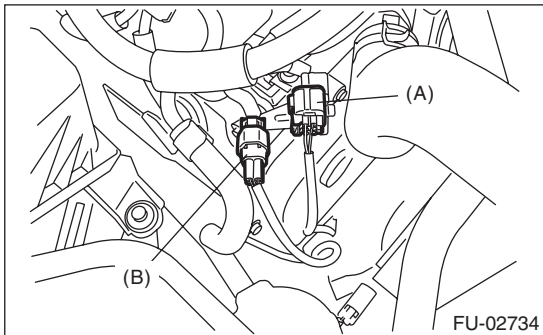
## 15. Front Oxygen (A/F) Sensor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
- 4) Remove the clip fastening the harness and disconnect the front oxygen (A/F) sensor connector.



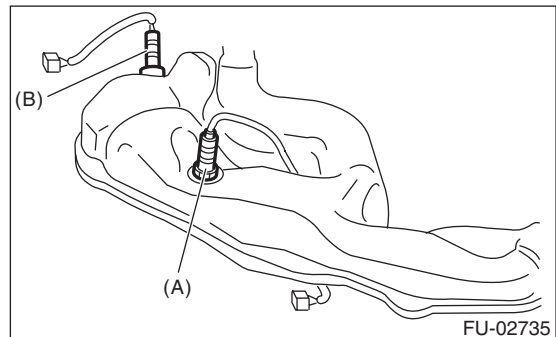
- (A) Front oxygen (A/F) sensor connector  
(B) Rear oxygen sensor connector

- 5) Lift up the vehicle.
- 6) Remove the under cover.
- 7) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

- 8) Remove the front oxygen (A/F) sensor.

### CAUTION:

When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, because it can damage the exhaust pipe.



- (A) Front oxygen (A/F) sensor  
(B) Rear oxygen sensor

### B: INSTALLATION

- 1) Before installing front oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of front oxygen (A/F) sensor. This facilitates the next removal.

### CAUTION:

Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

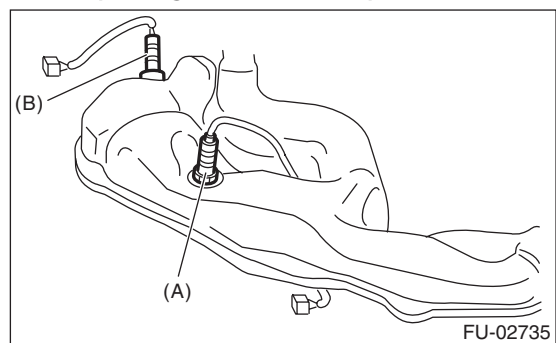
### Anti-seize compound:

**NEVER-SEEZ NSN, JET LUBE or equivalent**

- 2) Install the front oxygen (A/F) sensor.

### Tightening torque:

**21 N·m (2.1 kgf·m, 15.5 ft·lb)**



- (A) Front oxygen (A/F) sensor  
(B) Rear oxygen sensor

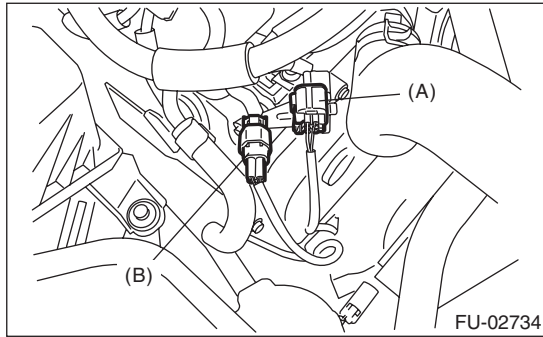
- 3) Install the under cover.
- 4) Lower the vehicle.

## Front Oxygen (A/F) Sensor

### FUEL INJECTION (FUEL SYSTEMS)

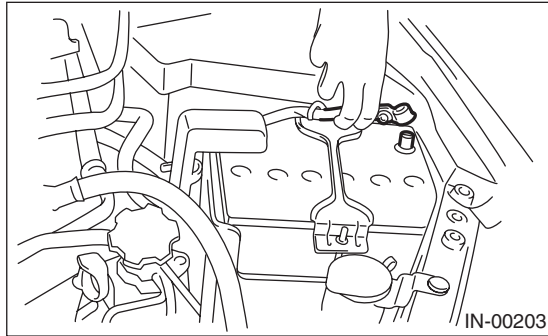
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5) Connect the connector of front oxygen (A/F) sensor connector and fasten the harness with clips.



- (A) Front oxygen (A/F) sensor connector
- (B) Rear oxygen sensor connector

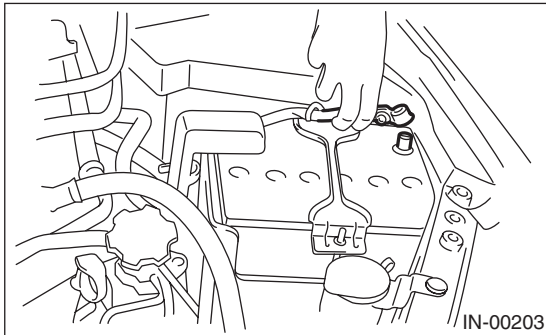
6) Connect the battery ground cable to battery.



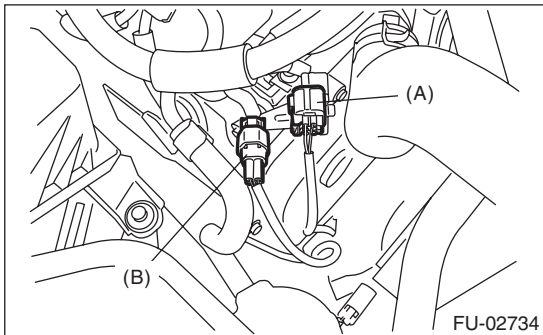
## 16.Rear Oxygen Sensor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
- 4) Remove the clip fastening the harness and disconnect the rear oxygen (A/F) sensor connector.



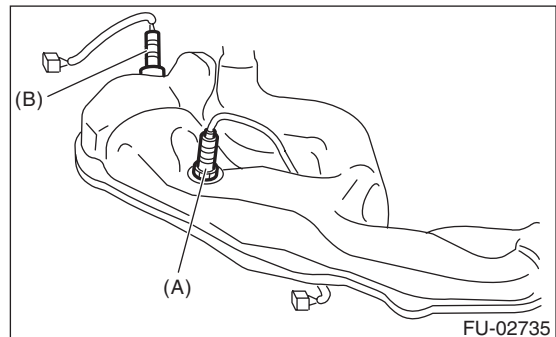
- (A) Front oxygen (A/F) sensor connector  
(B) Rear oxygen sensor connector

- 5) Lift up the vehicle.
- 6) Remove the under cover.
- 7) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

- 8) Remove the rear oxygen sensor.

### CAUTION:

**When removing the rear oxygen (A/F) sensor, wait until exhaust pipe cools, because it can damage the exhaust pipe.**



- (A) Front oxygen (A/F) sensor  
(B) Rear oxygen sensor

### B: INSTALLATION

- 1) Before installing rear oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of rear oxygen (A/F) sensor. This facilitates the next removal.

### CAUTION:

**Never apply anti-seize compound to the protector of rear oxygen sensor.**

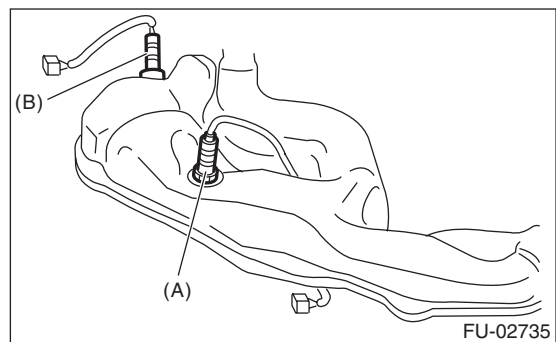
### Anti-seize compound:

**NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent**

- 2) Install the rear oxygen sensor.

### Tightening torque:

**21 N·m (2.1 kgf·m, 15.5 ft·lb)**



- (A) Front oxygen (A/F) sensor  
(B) Rear oxygen sensor

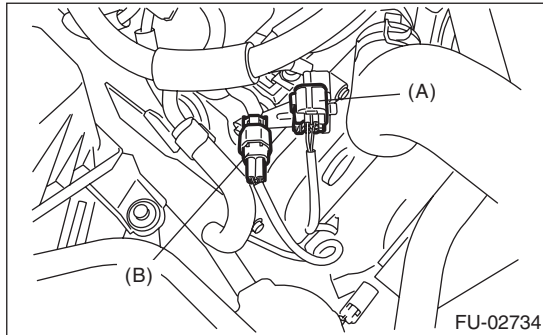
- 3) Install the under cover.
- 4) Lower the vehicle.

## Rear Oxygen Sensor

### FUEL INJECTION (FUEL SYSTEMS)

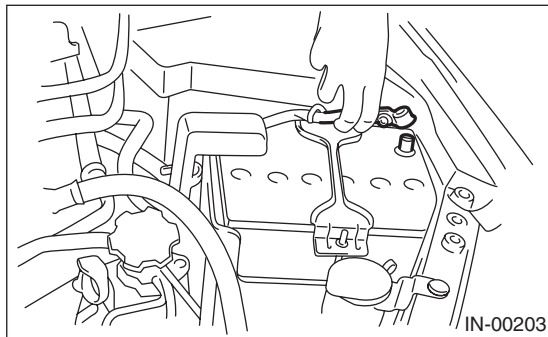
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5) Connect the connector to rear oxygen sensor and mount the harness clips to the bracket for fastening.



- (A) Front oxygen (A/F) sensor connector
- (B) Rear oxygen sensor connector

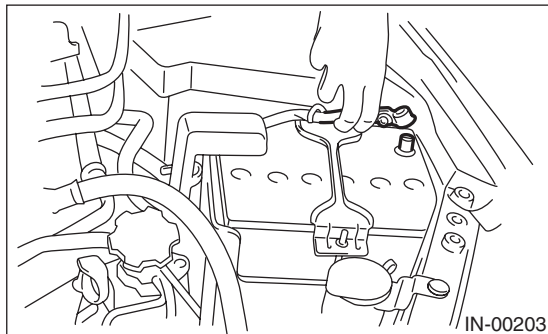
6) Connect the battery ground cable to battery.



## 17.Engine Control Module (ECM)

### A: REMOVAL

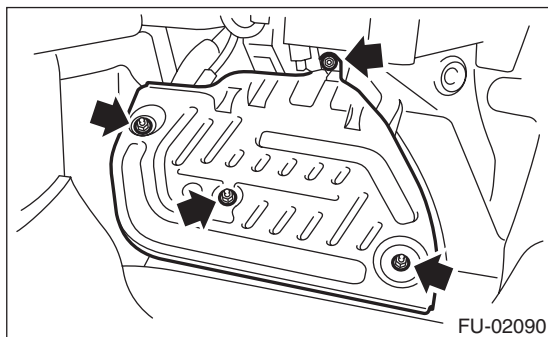
- 1) Disconnect the ground cable from the battery.



- 2) Remove the lower inner trim of passenger's side.

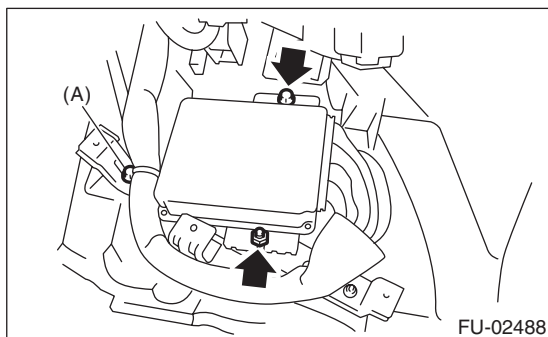
<Ref. to EI-61, REMOVAL, Lower Inner Trim.>

- 3) Detach the floor mat of passenger's seat.
- 4) Remove the protect cover.



- 5) Remove the bolts and nuts which hold the ECM to the bracket.

- 6) Remove the clip (A) from bracket.



- 7) Disconnect the ECM connectors, and take out the ECM.

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

- When replacing the ECM, be careful not to use the ECM for wrong specifications to avoid any damage to fuel injection system.
- When replacing the ECM, be careful not to damage the harnesses and connectors.

#### Tightening torque:

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

# Main Relay

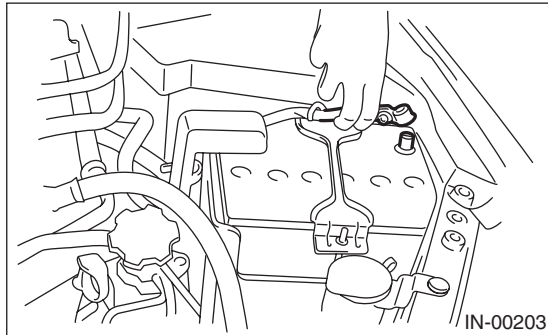
FUEL INJECTION (FUEL SYSTEMS)

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## 18.Main Relay

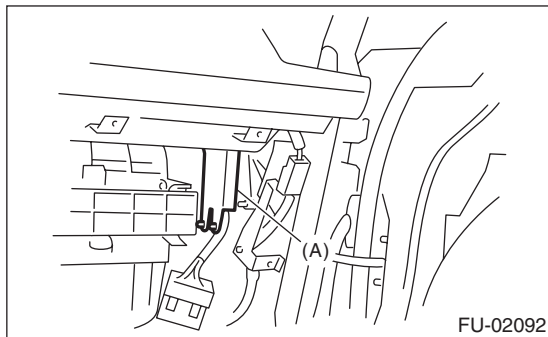
### A: REMOVAL

1) Disconnect the ground cable from the battery.

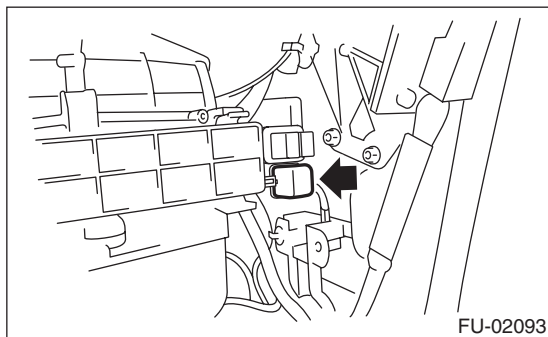


2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>

3) Remove the harness cover (A).



4) Disconnect the connectors from main relay.



### B: INSTALLATION

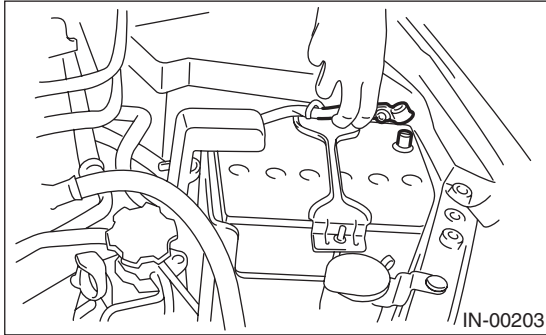
Install in the reverse order of removal.



## 19. Fuel Pump Relay

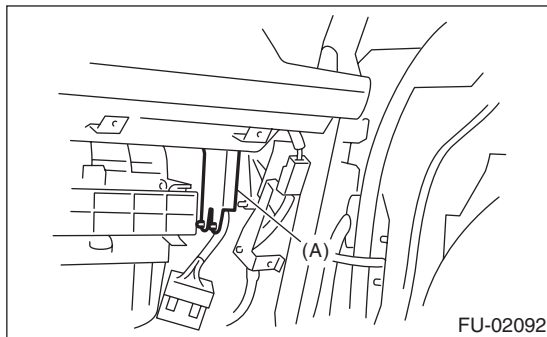
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.

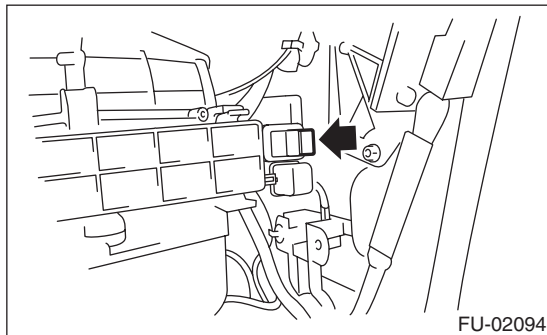


- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>

- 3) Remove the harness cover (A).



- 4) Disconnect the connector from fuel pump relay.



### B: INSTALLATION

Install in the reverse order of removal.

# Electronic Throttle Control Relay

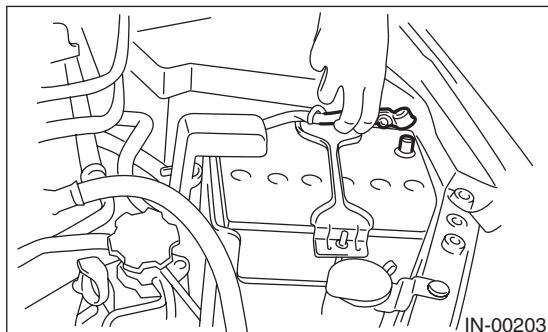
FUEL INJECTION (FUEL SYSTEMS)

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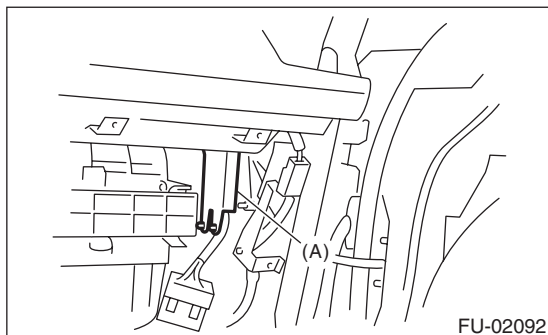
## 20. Electronic Throttle Control Relay

### A: REMOVAL

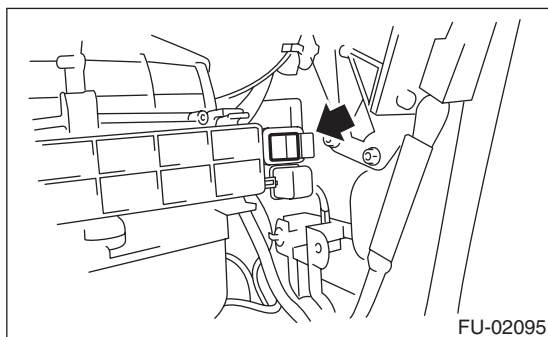
- 1) Disconnect the ground cable from the battery.



- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from electric throttle control relay.



### B: INSTALLATION

Install in the reverse order of removal.

## 21. Fuel

### A: PROCEDURE

#### 1. RELEASING OF FUEL PRESSURE

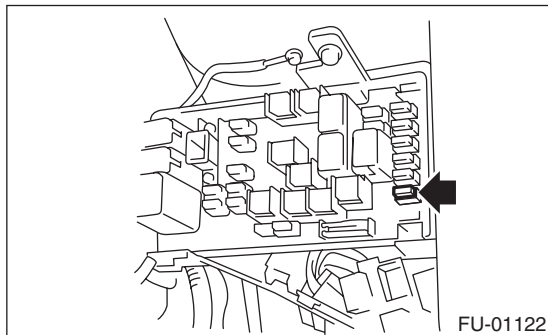
**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

**CAUTION:**

Be careful not to spill fuel.

1) Remove the fuse of fuel pump from main fuse box.



- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn the ignition switch to OFF.

#### 2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

**CAUTION:**

Be careful not to spill fuel.

**NOTE:**

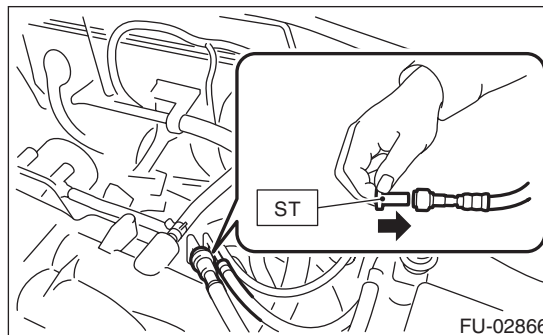
- If the fuel pump is not driven, refer to DRAINING FUEL (THROUGH THE FUEL FILLER HOSE). <Ref. to FU(H4SO)-41, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
  - Be careful not to let the battery run out.
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

**CAUTION:**

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



- 3) Connect ST to the fuel delivery hose.  
ST 18471AA000 FUEL PIPE ADAPTER
- 4) Connect the gasoline proof hose to ST and put the end of the hose in the container.
- 5) Drive the fuel pump and drain the fuel using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-57, FUEL PUMP CONTROL (ON/OFF DRIVE), OPERATION, System Operation Check Mode.>

**CAUTION:**

Be careful not to spill fuel.

#### 3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

**CAUTION:**

- Be careful not to spill fuel.
  - The fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.
- 1) Set the vehicle on a lift.
  - 2) Lift up the vehicle.
  - 3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - 4) Open the fuel filler flap lid, and remove the fuel filler cap.
  - 5) Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).

# Fuel

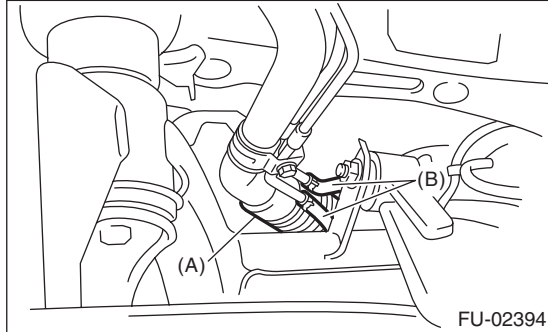
## FUEL INJECTION (FUEL SYSTEMS)

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6) Disconnect the fuel filler hose (A) from the fuel filler pipe.

**CAUTION:**

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



- (A) Fuel filler hose  
(B) Evaporation hose

7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

**CAUTION:**

**Be careful not to spill fuel.**

## 22. Fuel Tank

### A: REMOVAL

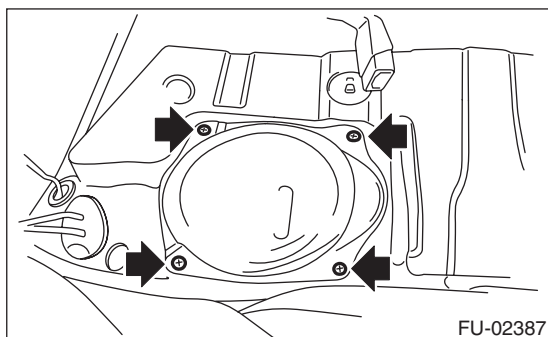
**WARNING:**

Place "NO OPEN FLAMES" signs near the working area.

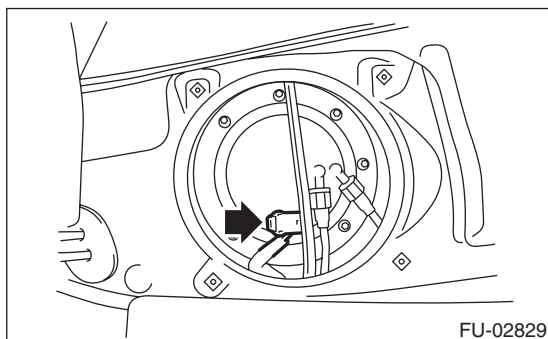
**CAUTION:**

Be careful not to spill fuel.

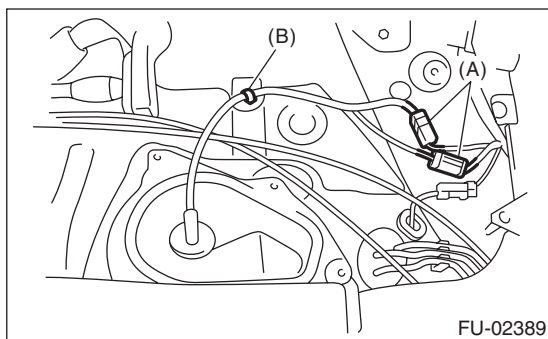
- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Drain fuel from fuel tank.  
<Ref. to FU(H4SO)-41, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 4) Remove the rear seat.
- 5) Remove the service hole cover of fuel pump.



- 6) Disconnect the connector from fuel pump.

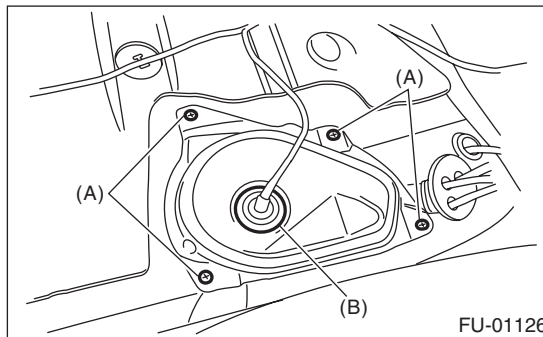


- 7) Remove the connector (A) and clip (B).



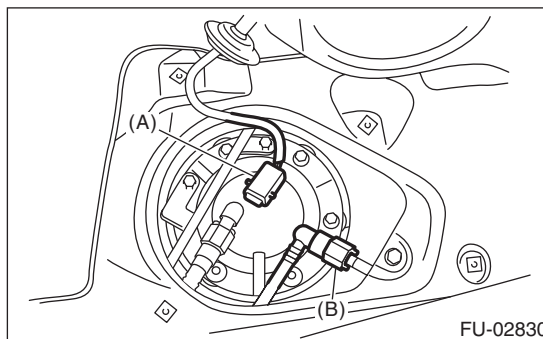
- 8) Remove the service hole cover of fuel sub level sensor.

- (1) Remove the bolt (A).
- (2) Push the grommet (B) down and remove the service hole cover.



- 9) Disconnect connector (A) from fuel sub level sensor.

- 10) Disconnect the quick connector on the fuel delivery hose (B). <Ref. to FU(H4SO)-59, REMOVAL, Fuel Delivery and Evaporation Lines.>



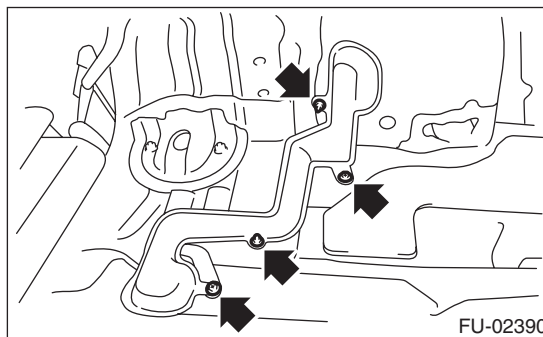
- 11) Remove the trunk room trim. (Sedan model)

<Ref. to EI-70, REMOVAL, Trunk Room Trim.>

- 12) Remove the rear quarter trim. (Wagon model)

<Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>

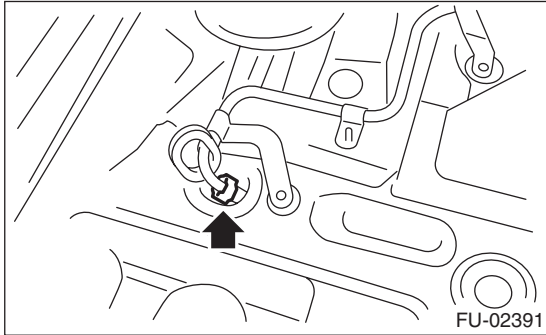
- 13) Remove the pipe protector.



# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

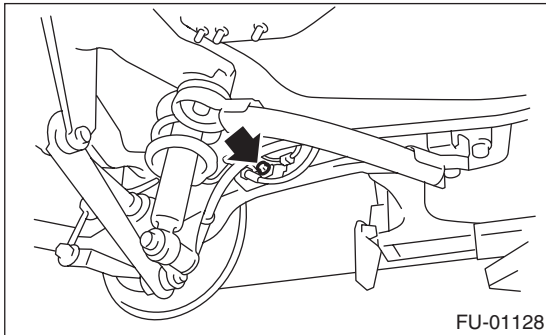
14) Remove the grommet and disconnect the quick connector of the evaporation pipe. <Ref. to FU(H4SO)-59, REMOVAL, Fuel Delivery and Evaporation Lines.>



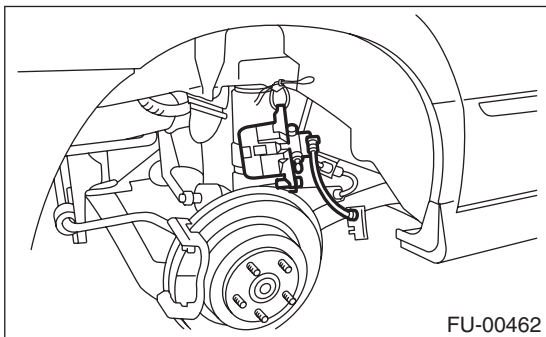
15) Remove the rear wheels.

16) Lift up the vehicle.

17) Remove the bolts which secure the rear brake hose mounting bracket.



18) Remove the rear brake caliper and tie it to the body side of the vehicle.



19) Remove the parking brake cable from the parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

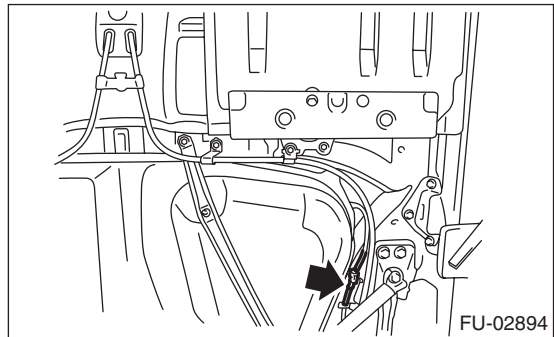
20) Lift up the vehicle.

21) Remove the rear exhaust pipe. <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.>

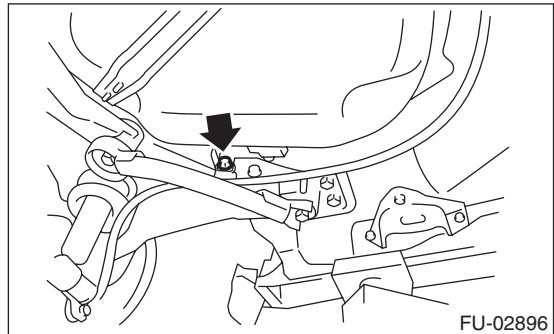
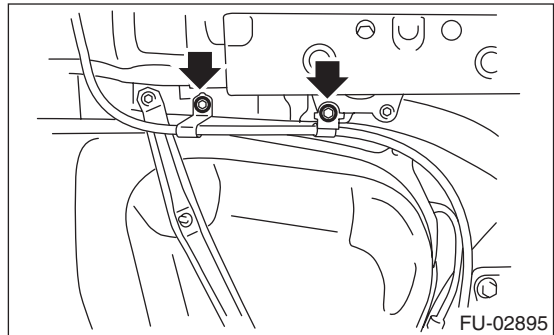
22) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

23) Remove the heat shield cover.

24) Disconnect the connector from the rear ABS wheel speed sensor.



25) Remove the bolts securing the parking brake cable clamp.



# Fuel Tank

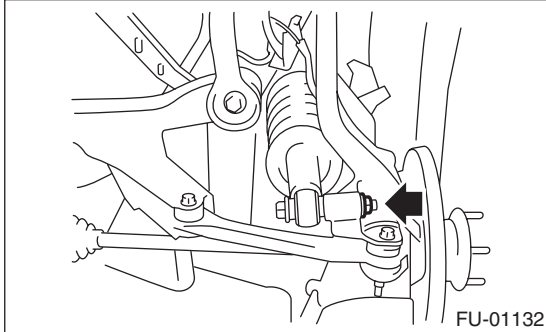
## FUEL INJECTION (FUEL SYSTEMS)

26) Remove the rear suspension assembly.

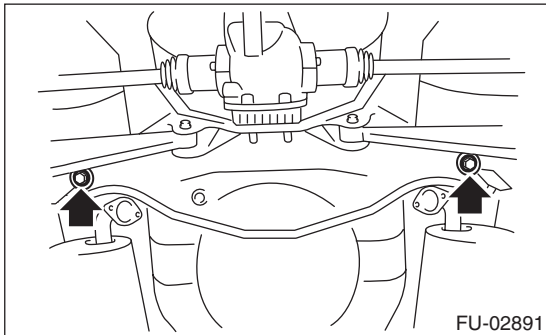
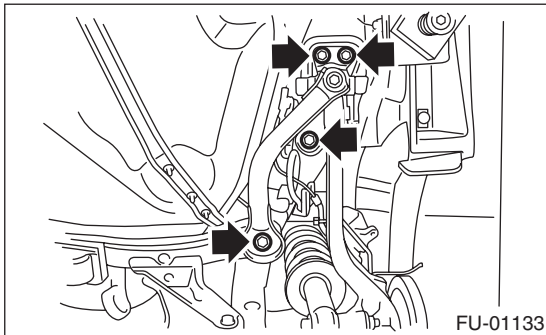
### WARNING:

**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Remove the bolts which hold the rear shock absorber to the rear suspension arm.

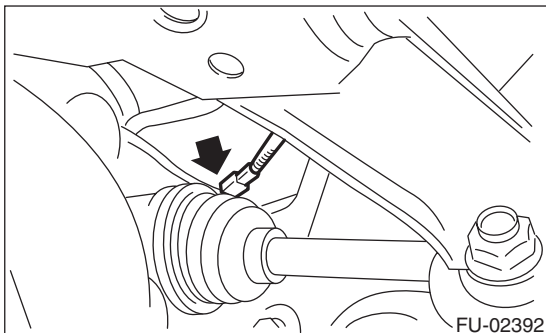


- (3) Remove the bolts which secure the rear suspension assembly to the body.

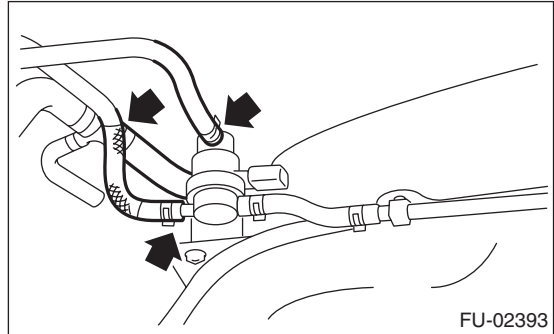


- (4) Remove the rear suspension assembly.

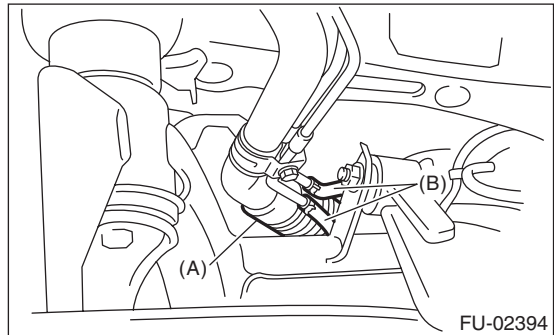
27) Disconnect the connector.



28) Disconnect the evaporation hose.



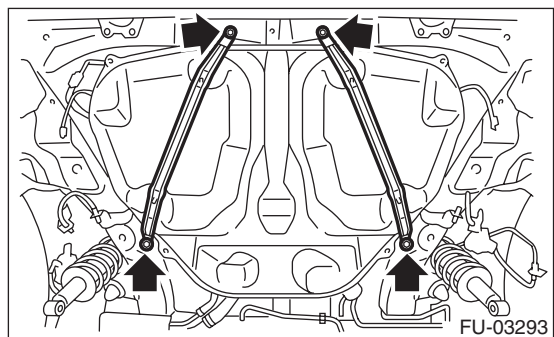
29) Disconnect the fuel filler hose (A) and evaporation hose (B).



30) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

### WARNING:

- A helper is required to perform this work.
- The fuel may remain in the fuel tank. Be careful not to let the fuel tank fall off when removing as it is bad balance on either side.



# Fuel Tank

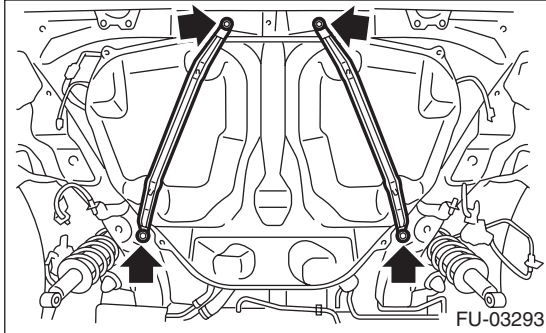
## FUEL INJECTION (FUEL SYSTEMS)

### B: INSTALLATION

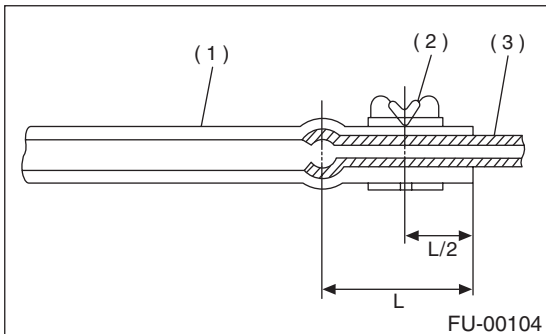
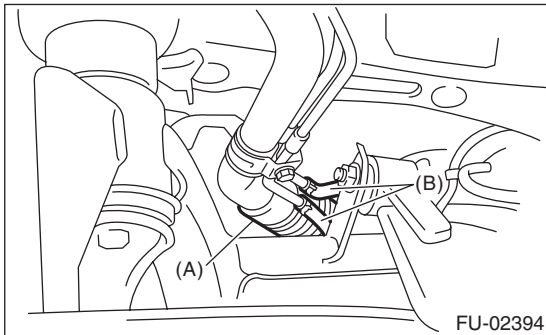
1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

#### WARNING:

**A helper is required to perform this work.**

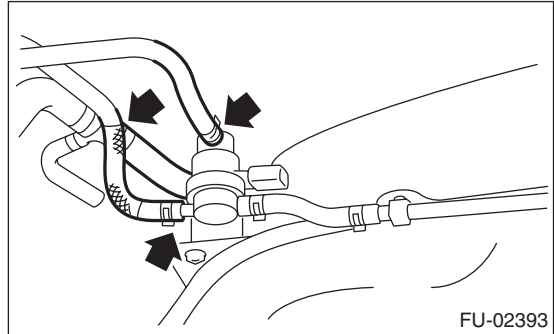


2) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.



- (1) Hose
- (2) Clip or clamp
- (3) Pipe

3) Connect the evaporation hose.

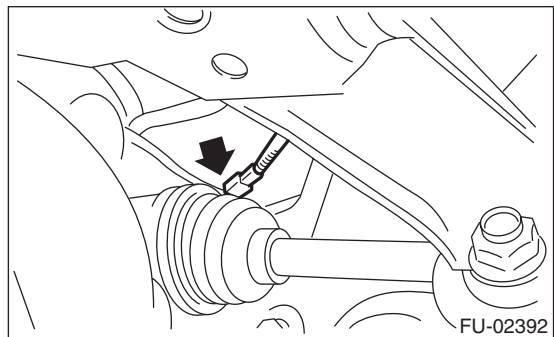


4) Tighten the fuel tank band bolts.

#### Tightening torque:

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**

5) Connect the connector.





6) Install the rear suspension assembly.

**WARNING:**

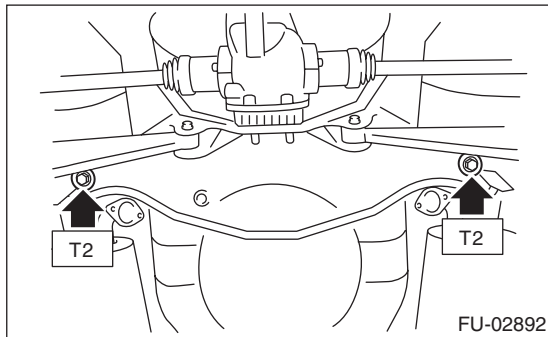
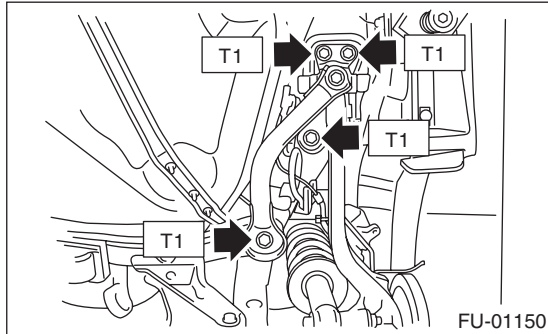
**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Support the rear suspension assembly, and tighten the bolts which secure the rear suspension assembly to the body.

**Tightening torque:**

**T1: 125 N·m (12.7 kgf-m, 92.2 ft-lb)**

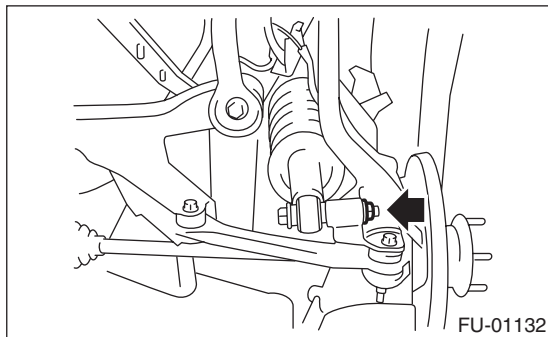
**T2: 175 N·m (17.8 kgf-m, 129 ft-lb)**



- (3) Tighten the bolts which hold the rear shock absorber to the rear suspension arm. <Ref. to RS-10, INSTALLATION, Rear Arm.>

**Tightening torque:**

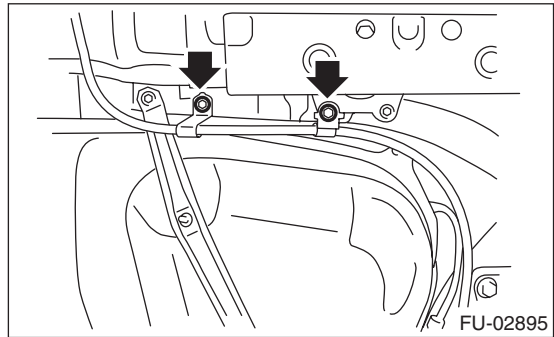
**62 N·m (6.3 kgf-m, 46 ft-lb)**



7) Tighten the bolts holding the parking brake cable clamp.

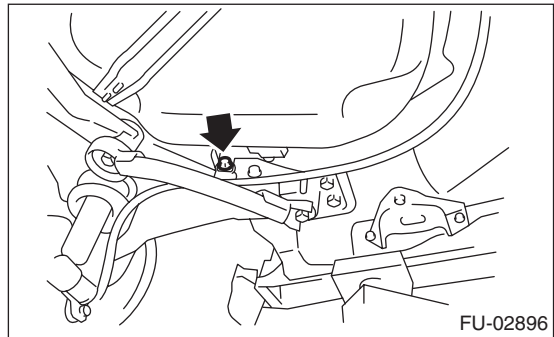
**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

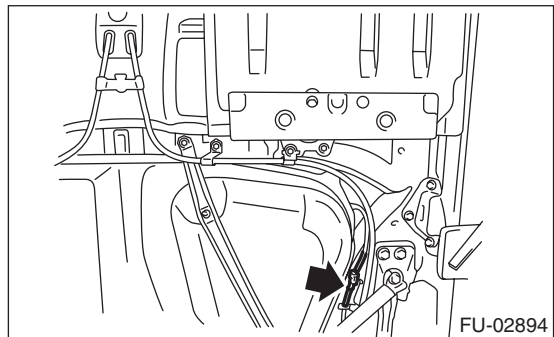


**Tightening torque:**

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**



8) Connect the connector to the rear ABS wheel speed sensor.



- 9) Install the heat shield cover.
- 10) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 11) Install the rear exhaust pipe. <Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.>
- 12) Lower the vehicle.
- 13) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>
- 14) Install the rear brake caliper.

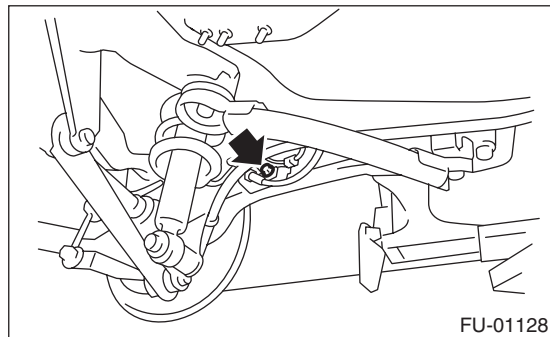
# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

15) Tighten the bolts which secure the rear brake hose mounting bracket.

### **Tightening torque:**

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**



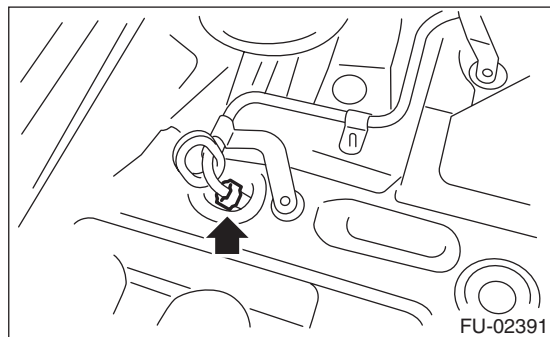
16) Lower the vehicle.

17) Install the rear wheels.

### **Tightening torque:**

**100 N·m (10.2 kgf·m, 73.8 ft·lb)**

18) Connect the quick connector of the evaporation pipe. <Ref. to FU(H4SO)-60, INSTALLATION, Fuel Delivery and Evaporation Lines.>

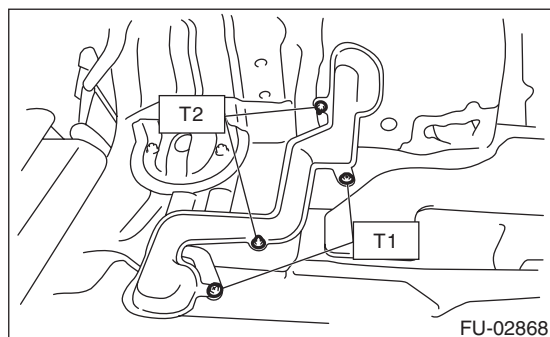


19) Install the pipe protector.

### **Tightening torque:**

**T1: 1 N·m (0.1 kgf·m, 0.7 ft·lb)**

**T2: 7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**

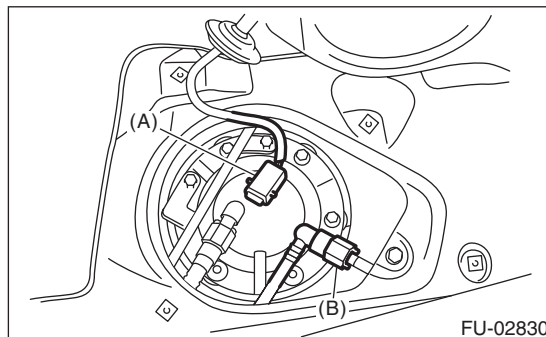


20) Install the trunk room trim. (Sedan model) <Ref. to EI-71, INSTALLATION, Trunk Room Trim.>

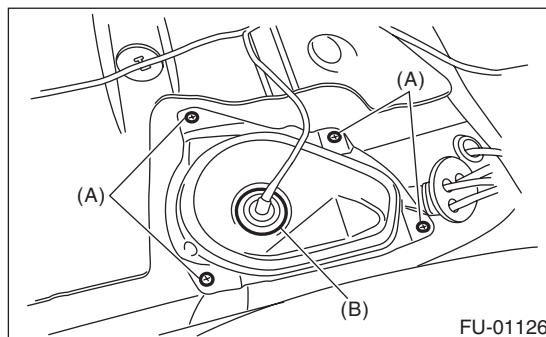
21) Install the rear quarter trim. (Wagon model) <Ref. to EI-64, INSTALLATION, Rear Quarter Trim.>

22) Connect connector (A) to the fuel sub level sensor.

23) Connect the quick connector (B) of the fuel delivery hose. <Ref. to FU(H4SO)-60, INSTALLATION, Fuel Delivery and Evaporation Lines.>

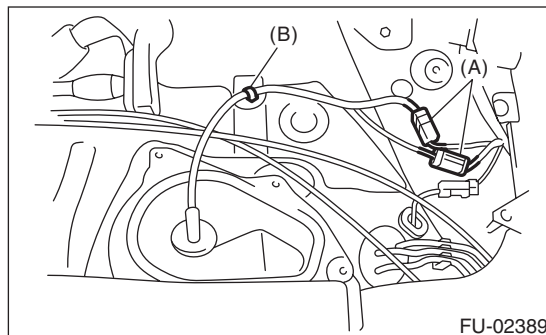


24) Install the service hole cover of fuel sub level sensor.

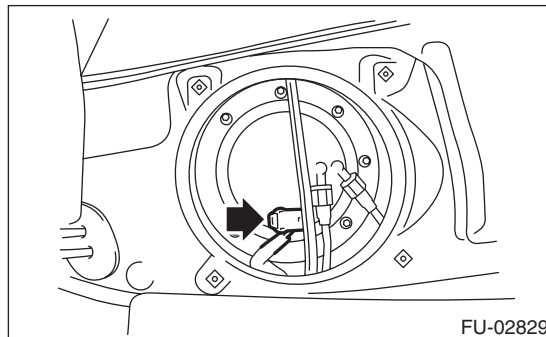


(A) Bolt  
(B) Grommet

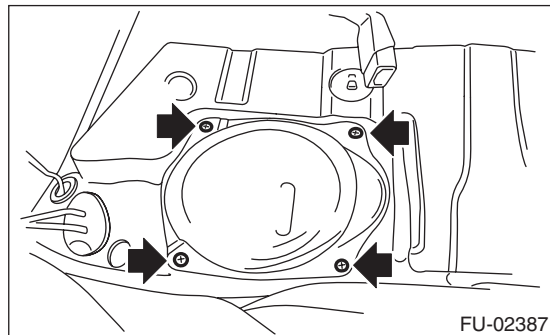
25) Connect connector (A), and install clip (B).



26) Connect the connector to the fuel pump.



27) Install the service hole cover of fuel pump.



28) Install the rear seat.

29) Install the fuse of fuel pump to main fuse box.

### **C: INSPECTION**

1) Check that the fuel tank does not have holes, cracks or is damaged in any way.

2) Make sure that the fuel pipe and fuel hose are not cracked and that the connections are tight.

# Fuel Filler Pipe

FUEL INJECTION (FUEL SYSTEMS)

## 23. Fuel Filler Pipe

### A: REMOVAL

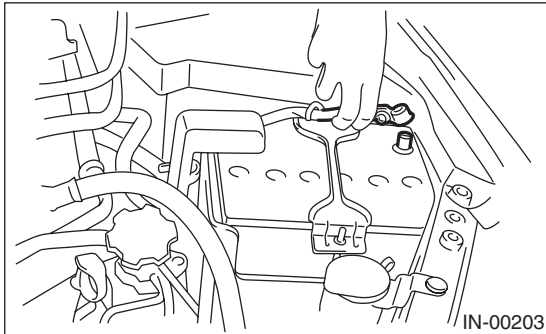
#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

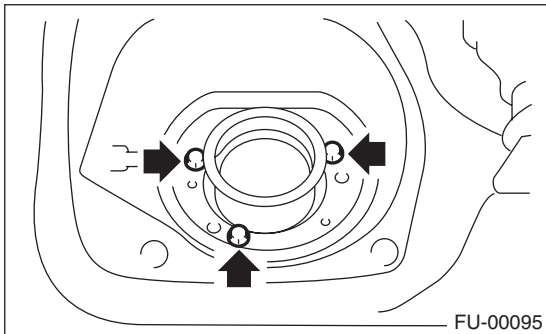
#### CAUTION:

Be careful not to spill fuel.

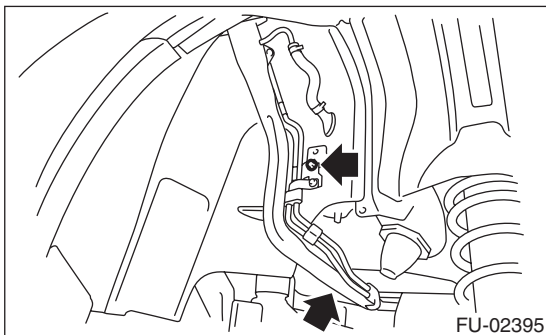
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



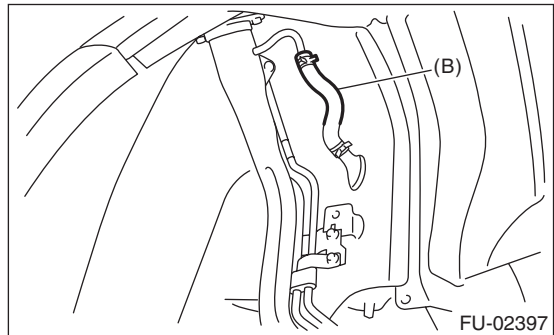
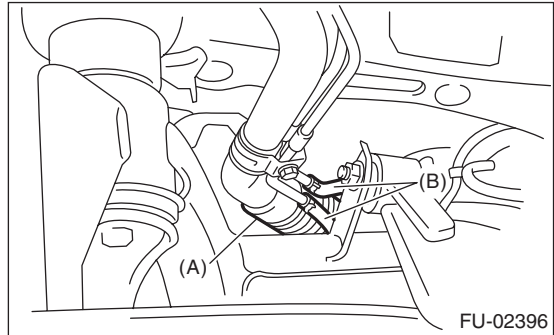
- 3) Open the fuel filler flap lid, and remove the filler cap.
- 4) Remove the screws which secure gasket.



- 5) Remove the rear wheel RH.
- 6) Lift up the vehicle.
- 7) Drain fuel from the fuel tank. <Ref. to FU(H4SO)-41, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 8) Remove the mud guard. <Ref. to EI-29, REMOVAL, Mud Guard.>
- 9) Remove the rear sub frame. <Ref. to RS-21, REMOVAL, Rear Sub Frame.>
- 10) Remove the bolts which hold fuel filler pipe bracket on the body.



- 11) Loosen the clamp, and disconnect the fuel filler hose (A) and evaporation hose (B).



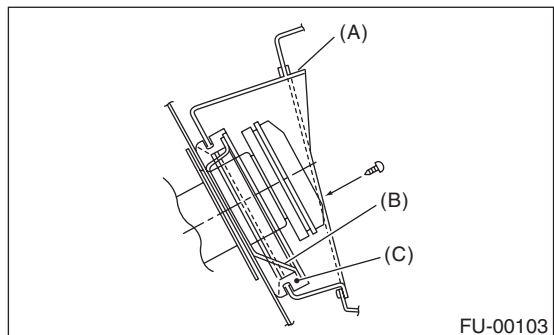
- 12) Remove the fuel filler pipe to the underside of the vehicle.

### B: INSTALLATION

- 1) Open the fuel filler flap lid.
- 2) Set the fuel saucer (A) with rubber seal (C), and insert the fuel filler pipe into hole from the inner side of apron.
- 3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

#### NOTE:

If the edges of rubber seal are folded toward inside, straighten it with a flat tip screwdriver.



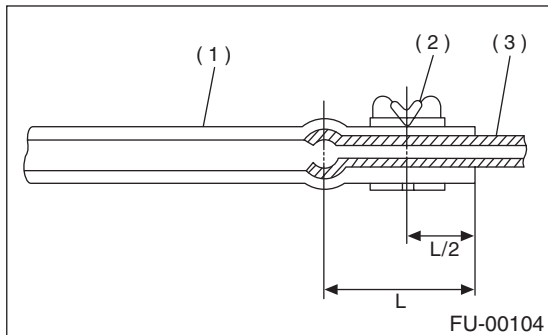
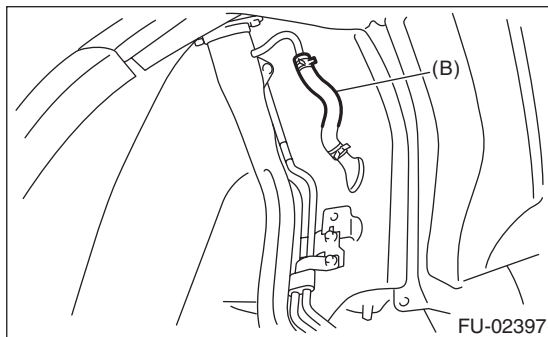
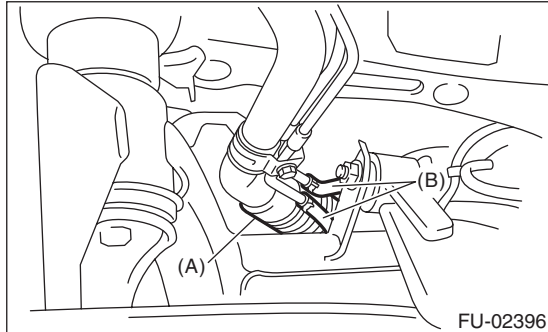
# Fuel Filler Pipe

FUEL INJECTION (FUEL SYSTEMS)

4) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.

**Tightening torque:**

**2.5 N·m (0.3 kgf-m, 1.8 ft-lb)**

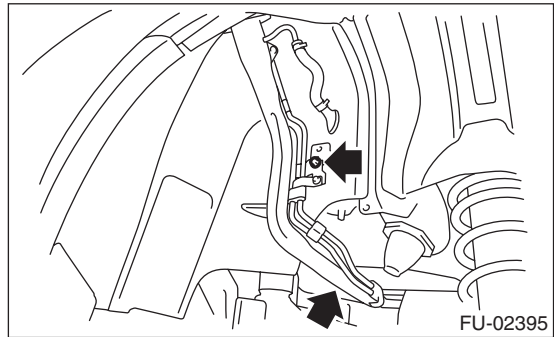


- (1) Hose
- (2) Clip or clamp
- (3) Pipe

5) Tighten the bolts which hold fuel filler pipe bracket on the body.

**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



6) Install the rear sub frame. <Ref. to RS-21, INSTALLATION, Rear Sub Frame.>

7) Install the mud guard. <Ref. to EI-29, INSTALLATION, Mud Guard.>

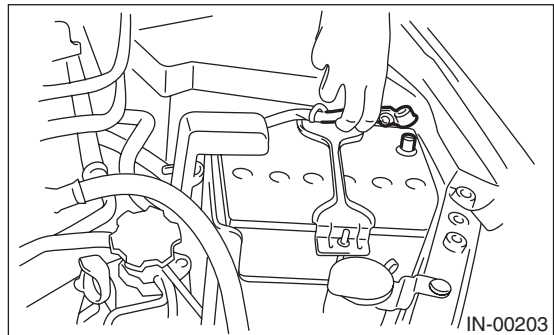
8) Lower the vehicle.

9) Install the rear wheel RH.

**Tightening torque:**

**100 N·m (10.2 kgf-m, 73.8 ft-lb)**

10) Connect the battery ground cable to battery.



## C: INSPECTION

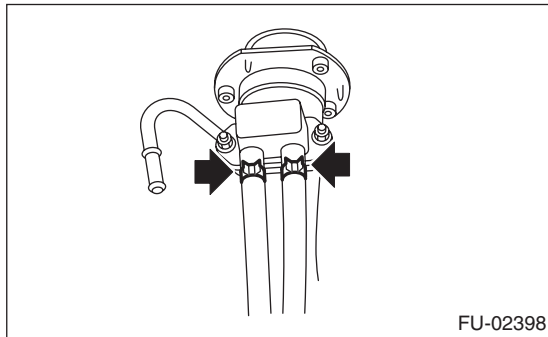
- 1) Check that the fuel tank does not have holes, cracks or is damaged in any way.
- 2) Make sure that the fuel hose is not cracked and that the connections are tight.

# Fuel Filler Pipe

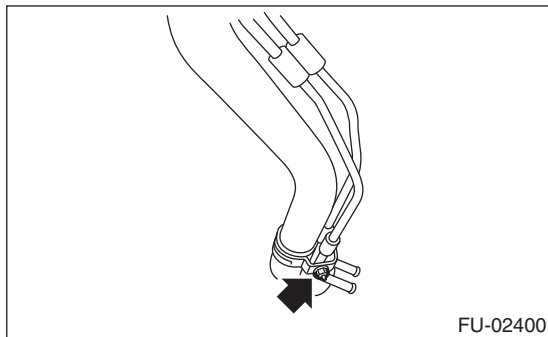
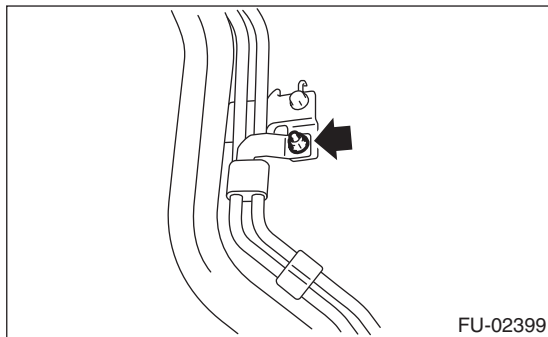
## FUEL INJECTION (FUEL SYSTEMS)

### D: DISASSEMBLY

1) Move the clamp and disconnect the evaporation hose from the shut valve.



2) Remove the nut which holds the evaporation pipe assembly to the fuel filler pipe.



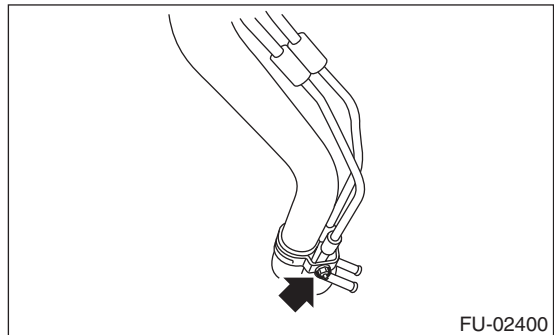
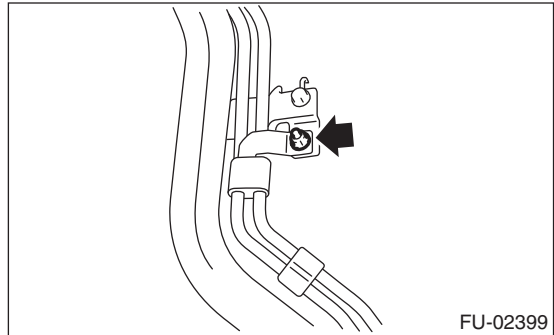
3) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-14, REMOVAL, Shut Valve.>

### E: ASSEMBLY

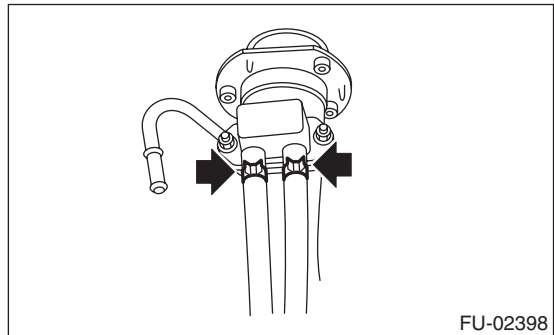
1) Install the shut pipe to the fuel filler pipe. <Ref. to EC(H4SO)-14, INSTALLATION, Shut Valve.>  
2) Tighten the nuts which secure the evaporation pipe assembly to the fuel filler pipe.

**Tightening torque:**

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



3) Connect the evaporation hose to the shut valve.



## 24. Fuel Pump

### A: REMOVAL

**WARNING:**

Place "NO OPEN FLAMES" signs near the working area.

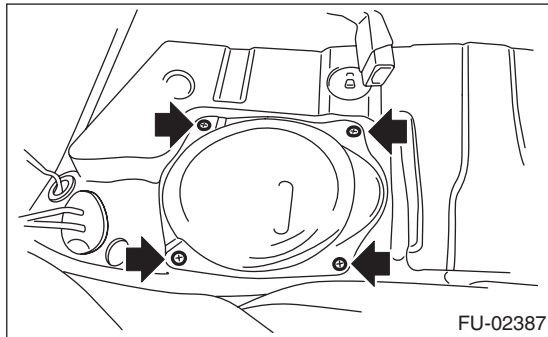
**CAUTION:**

- Be careful not to spill fuel.
- When the fuel gauge pointer is at two third or more, the fuel may spill out. Be sure to drain the fuel before the operation.

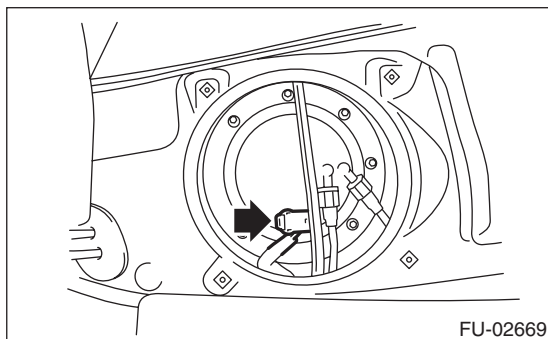
**NOTE:**

Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Drain fuel. <Ref. to FU(H4SO)-41, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 3) Remove the rear seat.
- 4) Remove the service hole cover.

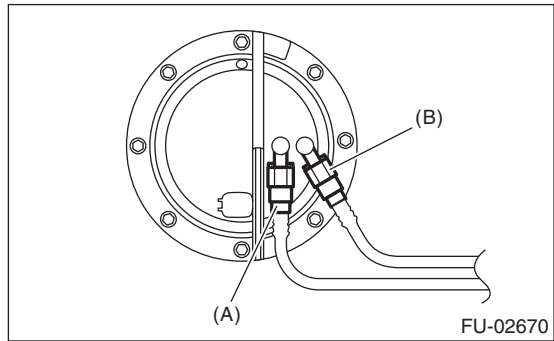


- 5) Disconnect the connector from fuel pump.



- 6) Disconnect the quick connector, and then disconnect the fuel delivery hose and jet pump hose. <Ref. to FU(H4SO)-59, REMOVAL, Fuel Delivery and Evaporation Lines.>

- 7) Remove the nuts which install fuel pump assembly onto fuel tank.



- (A) Delivery hose  
(B) Jet pump hose

- 8) Remove the fuel pump assembly from the fuel tank.

### B: INSTALLATION

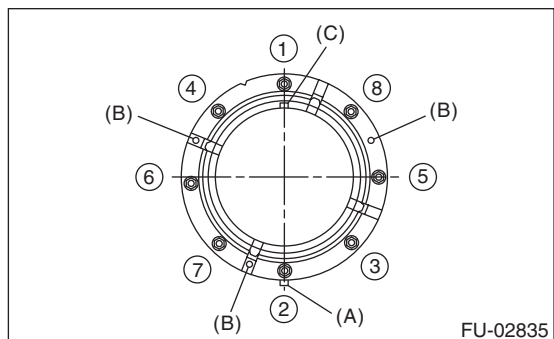
Install in the reverse order of removal.

**NOTE:**

- Use a new gasket.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- When assembling, point the protrusion of the gasket (A) towards the front of the vehicle.
- Insert the protrusion (B) of the gasket into the upper plate. (3 locations)
- Align the protrusion (C) of the fuel pump assembly to the cut out in the upper plate.
- Tighten the nuts to the specified torque in the order as shown in the figure.

**Tightening torque:**

**4.4 N·m (0.45 kgf-m, 3.2 ft-lb)**



# Fuel Pump

FUEL INJECTION (FUEL SYSTEMS)

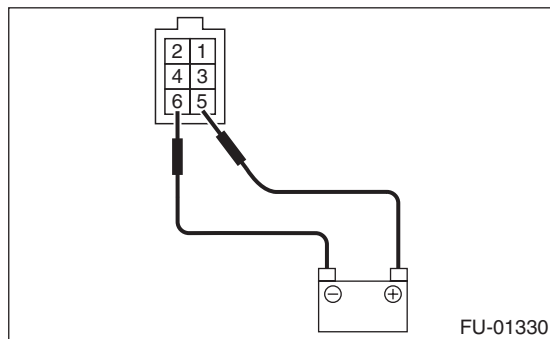
---

## C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump, and apply the battery power supply to check whether the pump operates.

### WARNING:

- Wipe off fuel completely.
- Keep the battery as far apart from fuel pump as possible.
- Be sure to turn the battery supply to ON and OFF on the battery side.
- Do not run the fuel pump for a long time under non-load condition.





## 25. Fuel Level Sensor

### A: REMOVAL

**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

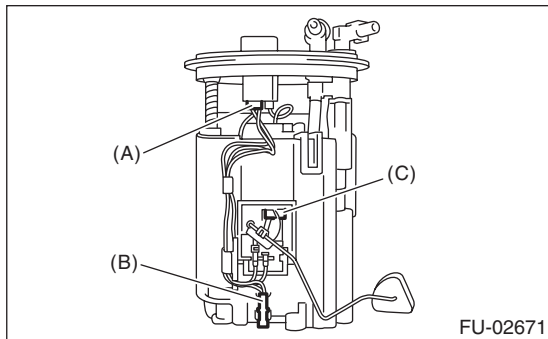
**CAUTION:**

Be careful not to spill fuel.

**NOTE:**

The fuel level sensor is built in fuel pump assembly.

- 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-53, REMOVAL, Fuel Pump.>
- 2) Disconnect the connector from fuel pump bracket.
- 3) Remove the fuel level sensor and fuel temperature sensor.



- (A) Connector
- (B) Fuel temperature sensor
- (C) Fuel level sensor

### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**4.4 N·m (0.45 kgf·m, 3.2 ft·lb)**

# Fuel Sub Level Sensor

FUEL INJECTION (FUEL SYSTEMS)

## 26. Fuel Sub Level Sensor

### A: REMOVAL

#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

#### CAUTION:

- Be careful not to spill fuel.
- Prior to start work, be sure to set the fuel volume to three-fourth full of the fuel tank. If the fuel is more than three-fourth full of the fuel tank, be careful because the fuel may spill out.

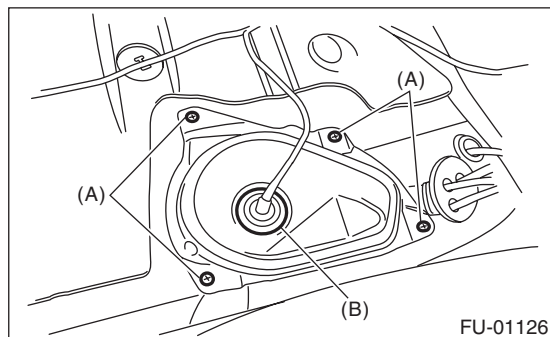
1) Drain fuel. <Ref. to FU(H4SO)-41, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>

2) Remove the rear seat.

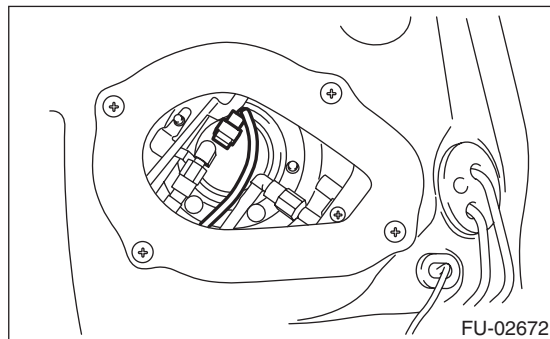
3) Remove the service hole cover.

(1) Remove bolt (A).

(2) Push the grommet (B) down and remove the service hole cover.

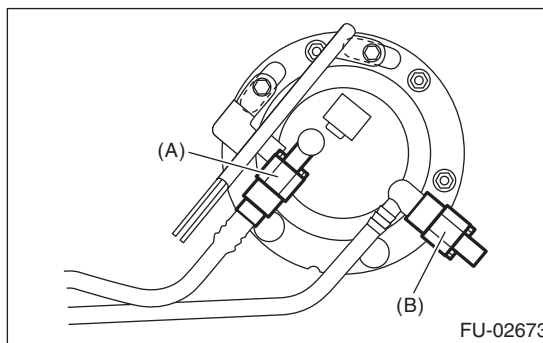


4) Disconnect the connector from the fuel sub level sensor.



5) Disconnect the quick connector, then disconnect the fuel delivery hose and jet pump hose. <Ref. to FU(H4SO)-59, REMOVAL, Fuel Delivery and Evaporation Lines.>

6) Remove the nuts and bolts which install fuel sub level sensor on fuel tank.



(A) Jet pump hose

(B) Delivery hose

7) Remove the fuel sub level sensor.

### B: INSTALLATION

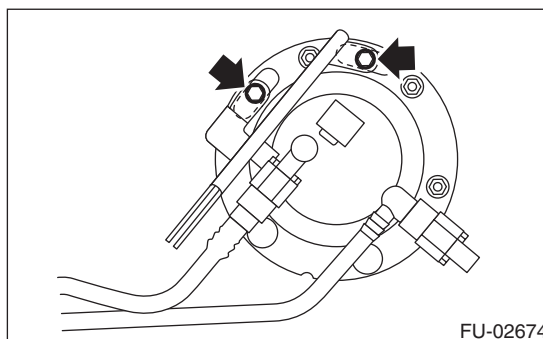
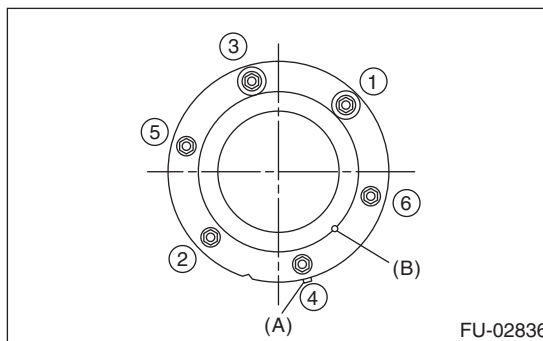
Install in the reverse order of removal.

#### NOTE:

- Use a new gasket.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the following figure.
- Align protrusion (B) of the fuel sub level sensor to the cut out in the fuel sublevel sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.

#### Tightening torque:

**4.4 N·m (0.45 kgf·m, 3.2 ft·lb)**



## 27. Fuel Filter

### A: SPECIFICATION

Fuel filter forms a single unit with fuel pump.

Refer to "Fuel Pump" for removal and installation.

<Ref. to FU(H4SO)-53, REMOVAL, Fuel Pump.>

<Ref. to FU(H4SO)-53, INSTALLATION, Fuel Pump.>

# Fuel Damper Valve

FUEL INJECTION (FUEL SYSTEMS)

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## 28. Fuel Damper Valve

### A: REMOVAL

#### WARNING:

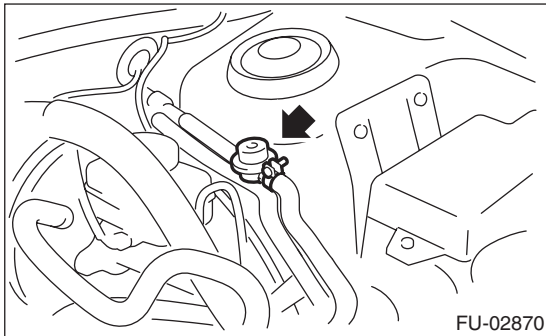
Place "NO OPEN FLAMES" signs near the working area.

#### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Remove the fuel damper valve from the fuel delivery line.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

***1.25 N·m (0.13 kgf-m, 0.94 ft-lb)***

## 29. Fuel Delivery and Evaporation Lines

### A: REMOVAL

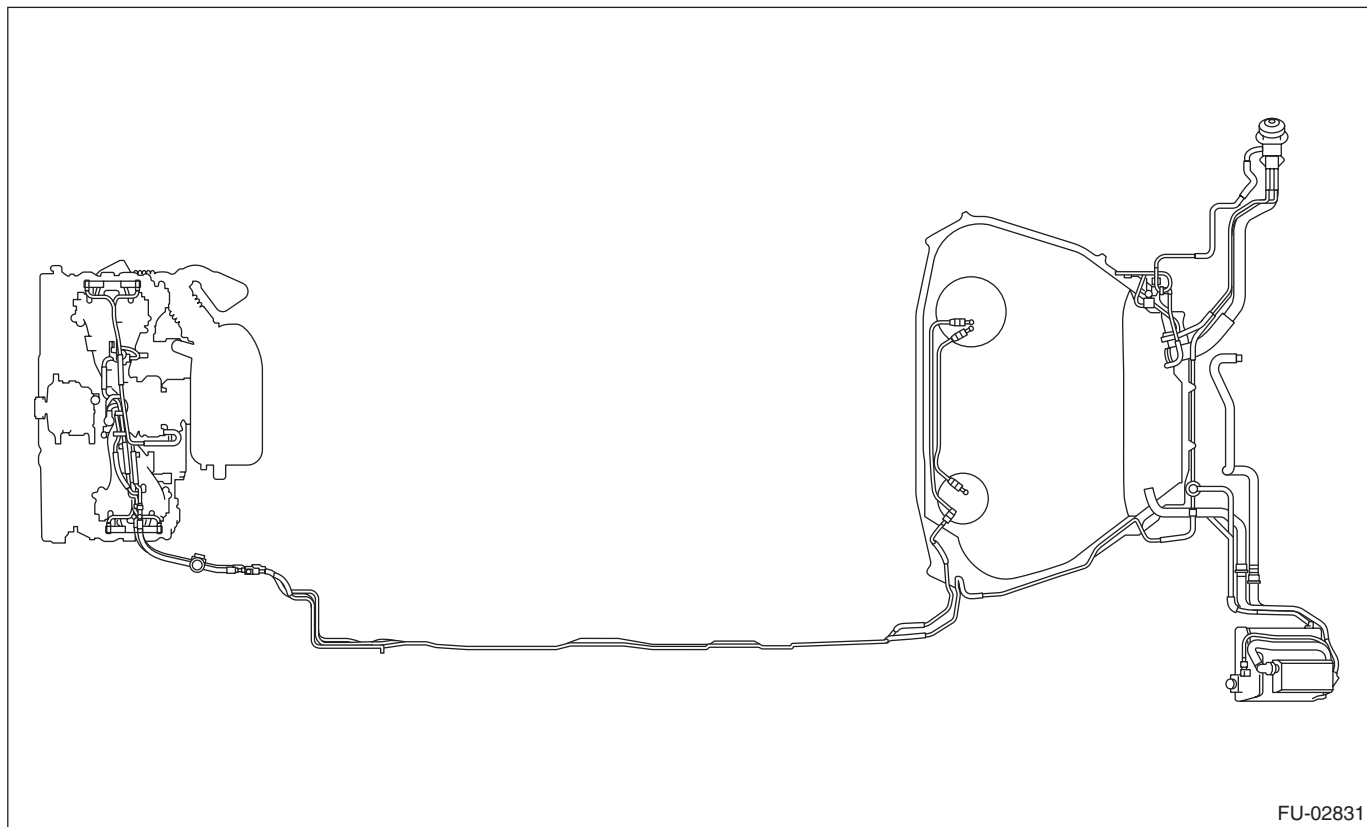
#### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

#### CAUTION:

**Be careful not to spill fuel.**

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the floor mat. <Ref. to EI-72, REMOVAL, Floor Mat.>
- 5) Disconnect the fuel delivery pipes and hoses, and then disconnect the evaporation pipes and hoses.



# Fuel Delivery and Evaporation Lines

## FUEL INJECTION (FUEL SYSTEMS)

6) In the engine compartment, disconnect the fuel delivery hoses and evaporation hose.

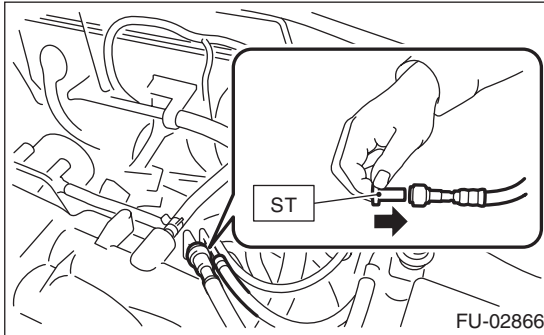
(1) Disconnect the quick connector of the fuel delivery line by pushing the ST in the direction of the arrow.

ST 42099AE000 CONNECTOR REMOVER

(2) Remove the clip and disconnect the evaporation hose from the pipe.

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



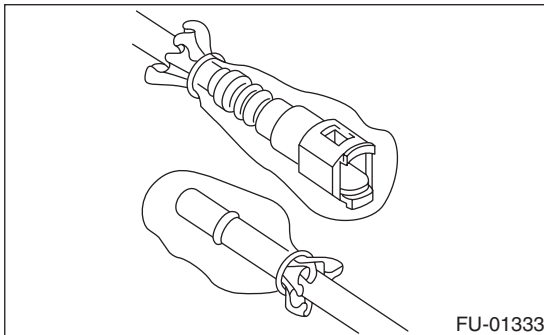
7) Lift up the vehicle.

8) Remove the fuel tank. <Ref. to FU(H4SO)-43, REMOVAL, Fuel Tank.>

9) Separate the quick connector of fuel line.

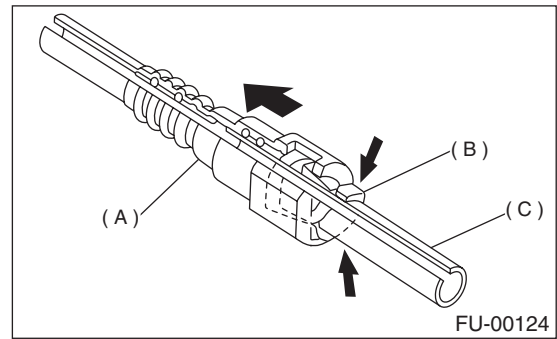
(1) Clean the pipe and connector, if they are covered with dust.

(2) To prevent from damaging or entering foreign matter, wrap the pipes and connectors with plastic bag etc.



(3) Hold the connector (A) and push the retainer (B) down.

(4) Pull out the connector (A) from the retainer (B).



(A) Connector

(B) Retainer

(C) Pipe

## B: INSTALLATION

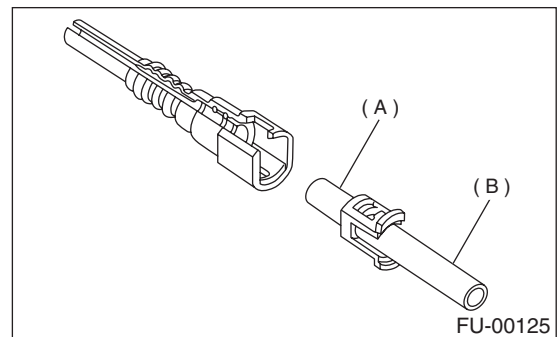
1) Connect the quick connector on fuel line.

### CAUTION:

Make sure there is no damage or dust on the connections. If necessary, clean seal surface of pipe.

### NOTE:

Use a new retainer.



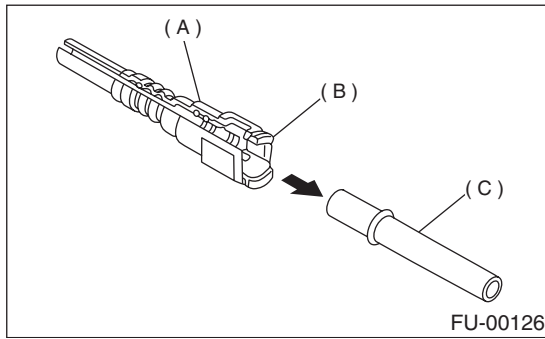
(A) Seal surface

(B) Pipe

# Fuel Delivery and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

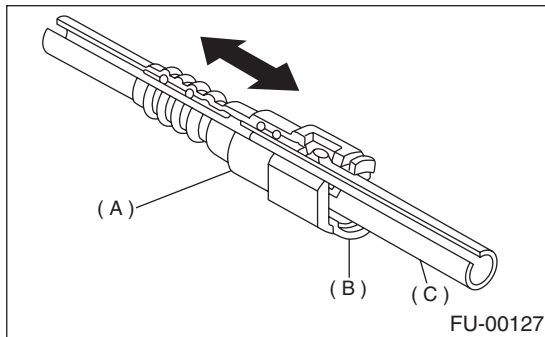
- (1) Set the new retainer (B) to connector (A).
- (2) Push the pipe into the connector completely.



- (A) Connector
- (B) Retainer
- (C) Pipe

### CAUTION:

- Pull the connector to ensure it is connected securely.
- Make sure the two retainer claws are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
- (B) Retainer
- (C) Pipe

- 2) Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the amount to be inserted is specified.

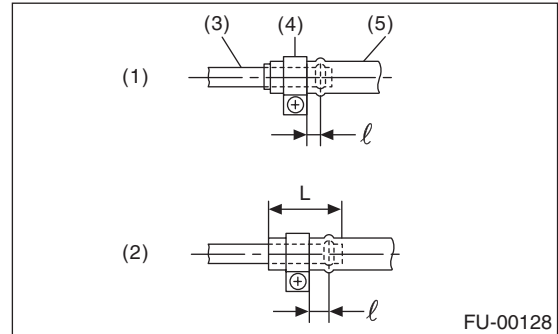
Type B: When the amount to be inserted is not specified.

$$\ell : 2.5 \pm 1.5 \text{ mm } (0.098 \pm 0.059 \text{ in})$$

$$L : 22.5 \pm 2.5 \text{ mm } (0.886 \pm 0.098 \text{ in})$$

### CAUTION:

Be sure to inspect hoses and their connections for any leakage of fuel.

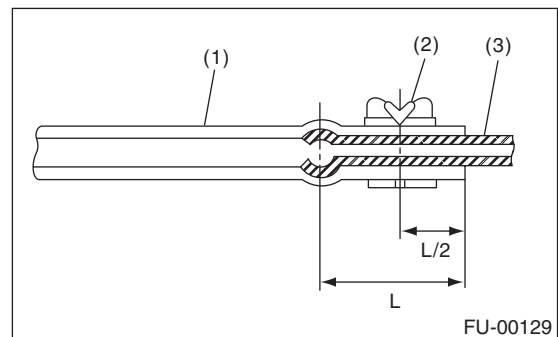


- (1) Type A
- (2) Type B
- (3) Pipe
- (4) Clamp
- (5) Hose

- 3) Connect the evaporation hose to the pipe with an overlap of approx. 15 to 20 mm (0.59 to 0.79 in).

### Fuel evaporation hose:

$$L = 17.5 \pm 2.5 \text{ mm } (0.689 \pm 0.098 \text{ in})$$



- (1) Hose
- (2) Clip
- (3) Pipe

## C: INSPECTION

- 1) Make sure that there are no cracks on the fuel pipes and fuel hoses.
- 2) Make sure the fuel pipe and fuel hose connections are tightened firmly.

# Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

## 30. Fuel System Trouble in General

### A: INSPECTION

Trouble and possible cause		Corrective action
<b>1. Insufficient fuel supply to injector</b>		
1)	Fuel pump does not operate.	
	○ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	○ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
2)	Decline of fuel pump function	Replace the fuel pump.
3)	Clogged fuel filter	Replace the fuel filter.
4)	Clogged or bent fuel pipe or hose	Clean, correct or replace the fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent air breather tube or pipe	Clean, correct or replace the air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator	Replace.
<b>2. Leakage or blow out of fuel</b>		
1)	Loose joints of the fuel pipe	Retighten.
2)	Cracked fuel pipe, hose and fuel tank	Replace.
3)	Defective welding part on the fuel tank	Replace.
4)	Clogged air breather tube or air vent tube	Clean, correct or replace the air breather tube or air vent tube.
<b>3. Gasoline smell inside of compartment</b>		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe	Retighten.
2)	Fuel saucer gasket air tightness fault	Correct or replace the gasket.
3)	Inoperative fuel pump modulator or circuit	Replace.
<b>4. Defective fuel meter indicator</b>		
1)	Defective operation of fuel level sensor	Replace.
2)	Defective operation of fuel meter	Replace.
<b>5. Noise</b>		
1)	Large operation noise or vibration of fuel pump	Replace.

#### NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill the fuel tank fully to prevent this.
- In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
- When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
- Before using water removing agent, follow the cautions noted on the bottle.



# General Description

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

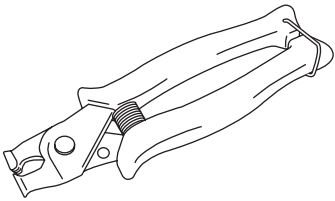
## 1. General Description

### A: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.

### B: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	TOOL NAME	REMARKS
 ST18353AA000	18353AA000	CLAMP PLIERS	<ul style="list-style-type: none"><li>• Used for removing and installing the PCV hose.</li><li>• This is a general tool made by the French company CAILLAU. (code) 54.0.000.205 To make this easier to obtain in the same way as genuine Subaru parts, it has been provided with a tool number as an ST.</li></ul>

# Front Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 2. Front Catalytic Converter

### A: REMOVAL

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

### B: INSTALLATION

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check for hole or rust.

# Rear Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 3. Rear Catalytic Converter

### A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-7, REMOVAL, Center Exhaust Pipe.>

### B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-7, INSTALLATION, Center Exhaust Pipe.>

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check for hole or rust.

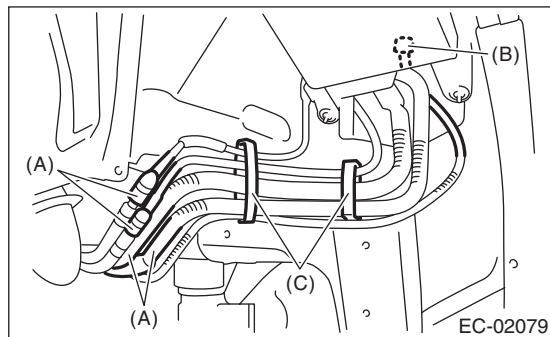
# Canister

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

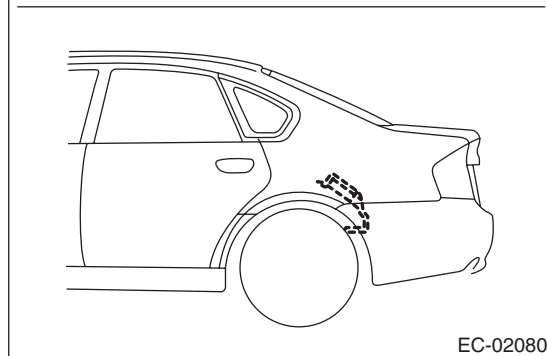
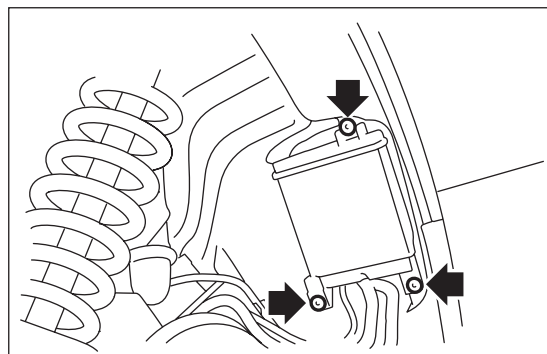
## 4. Canister

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the rear wheel LH.
- 4) Remove the rear mud guard LH.
- 5) Disconnect quick connector (A).
- 6) Disconnect the drain valve connector (B).
- 7) Remove clip (C).



- 8) Remove the canister from body.



### B: INSTALLATION

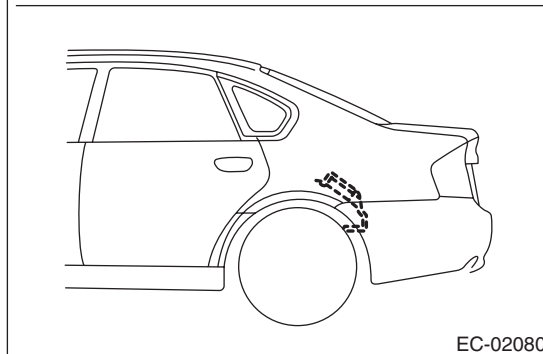
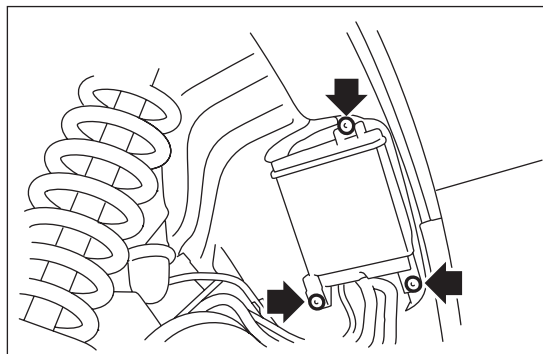
Install in the reverse order of removal.

#### NOTE:

Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.

#### Tightening torque:

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**



### C: INSPECTION

Make sure the canister and canister hoses are not cracked or loose.

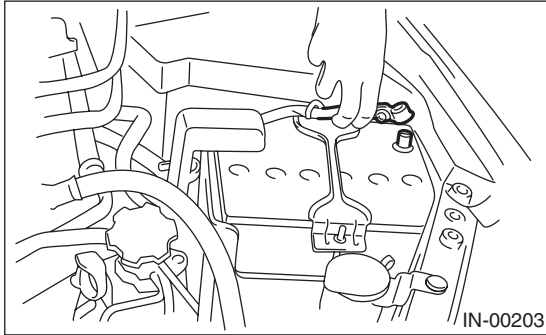
# Purge Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

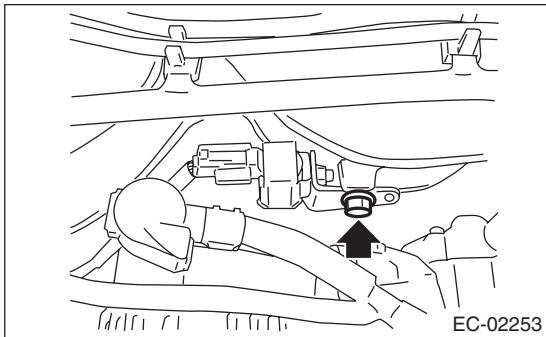
## 5. Purge Control Solenoid Valve

### A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector and evaporation hoses of purge control solenoid valve, and then remove the purge control solenoid valve.

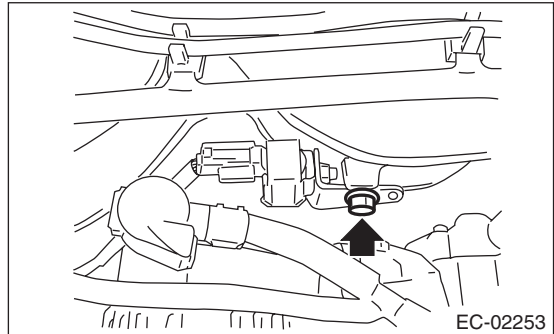


### B: INSTALLATION

Install in the reverse order of removal.

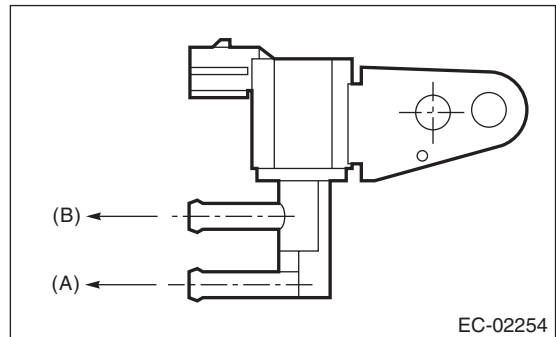
**Tightening torque (Purge control solenoid valve attachment bolt):**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



#### NOTE:

Connect the evaporation hose as shown in the figure.



- (A) To fuel pipe (intake manifold)
- (B) To fuel pipe (evaporation line)

### C: INSPECTION

Make sure the hoses are not cracked or loose.

## **EGR Valve**

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### **6. EGR Valve**

#### **A: REMOVAL**

For removal procedure, refer to "FU" section. <Ref. to FU(H4SO)-27, REMOVAL, EGR Valve.>

#### **B: INSTALLATION**

For installation procedure, refer to "FU" section. <Ref. to FU(H4SO)-27, INSTALLATION, EGR Valve.>

## Fuel Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### 7. Fuel Level Sensor

#### A: REMOVAL

For removal procedure, refer to "FU" section. <Ref. to FU(H4SO)-55, REMOVAL, Fuel Level Sensor.>

#### B: INSTALLATION

For installation procedure, refer to "FU" section. <Ref. to FU(H4SO)-55, INSTALLATION, Fuel Level Sensor.>

# Fuel Temperature Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 8. Fuel Temperature Sensor

### A: REMOVAL

The fuel temperature sensor is integrated into fuel level sensor as one unit; therefore, refer to "Fuel Level Sensor" for removal procedure. <Ref. to FU(H4SO)-55, REMOVAL, Fuel Level Sensor.>

### B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to "Fuel Level Sensor" for installation procedure. <Ref. to FU(H4SO)-55, INSTALLATION, Fuel Level Sensor.>



## Fuel Sub Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

### 9. Fuel Sub Level Sensor

#### A: REMOVAL

For removal procedure, refer to "FU" section. <Ref. to FU(H4SO)-56, REMOVAL, Fuel Sub Level Sensor.>

#### B: INSTALLATION

For installation procedure, refer to "FU" section. <Ref. to FU(H4SO)-56, INSTALLATION, Fuel Sub Level Sensor.>

# Fuel Tank Pressure Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

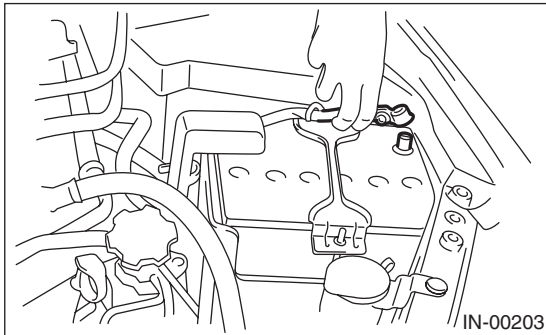
## 10. Fuel Tank Pressure Sensor

### A: REMOVAL

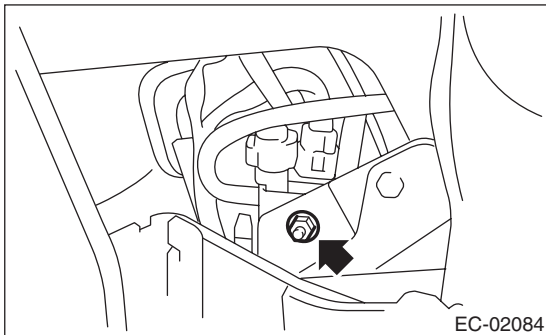
#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

- 1) Set the vehicle on a lift.
- 2) Open the fuel filler flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



- 4) Lift up the vehicle.
- 5) Disconnect the connector from the fuel tank pressure sensor.
- 6) Disconnect the pressure hose from the fuel tank pressure sensor.
- 7) Remove the fuel tank pressure sensor along with the bracket.

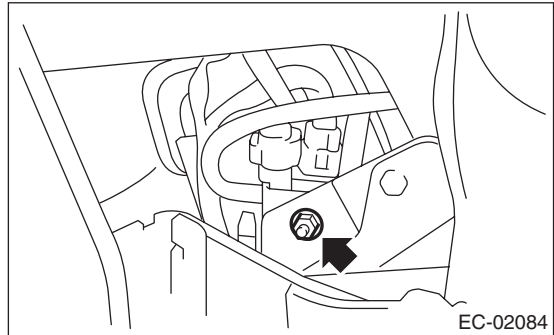


### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

**7.4 N·m (0.75 kgf-m, 5.4 ft-lb)**



### C: INSPECTION

Make sure the hoses are not cracked or loose.

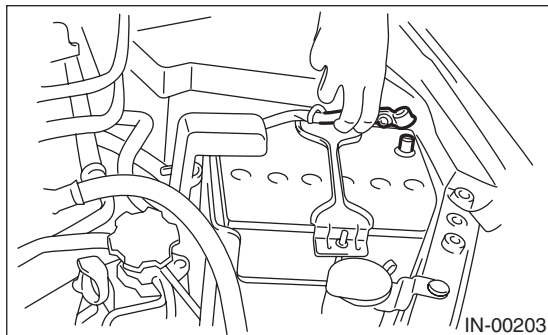
# Pressure Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

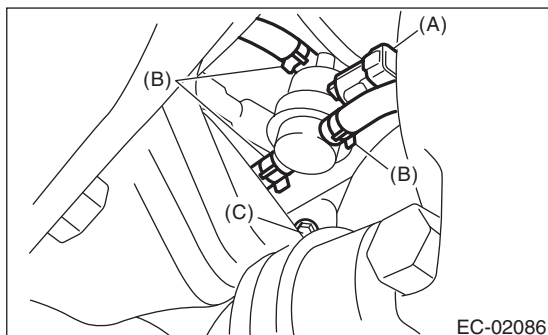
## 11. Pressure Control Solenoid Valve

### A: REMOVAL

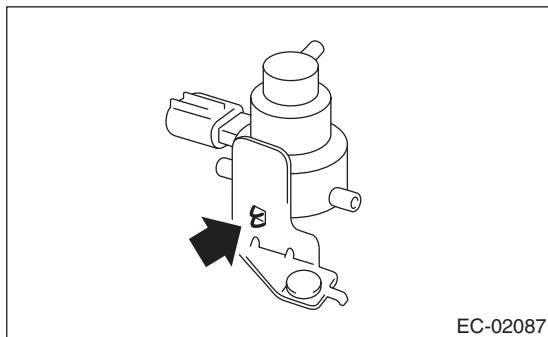
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift up the vehicle.
- 4) Disconnect connector (A) from the pressure control solenoid valve.
- 5) Disconnect the evaporation hose (B) from the pressure control solenoid valve.
- 6) Remove the bolts (C) which secure the bracket to the fuel tank.



- 7) Remove the pressure control solenoid valve and bracket as a unit.
- 8) Remove the pressure control solenoid valve from the bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

*7.35 N·m (0.7 kgf-m, 5.4 ft-lb)*

### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 12.Drain Filter

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain filter from canister.

Refer to "Canister" for removal and installation procedure. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>

<Ref. to EC(H4SO)-5, INSTALLATION, Canister.>

# Shut Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 13. Shut Valve

### A: REMOVAL

#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

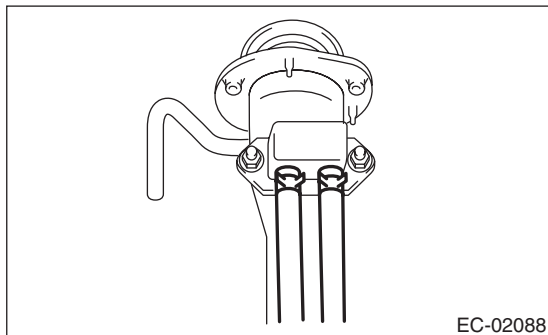
#### CAUTION:

Be careful not to spill fuel.

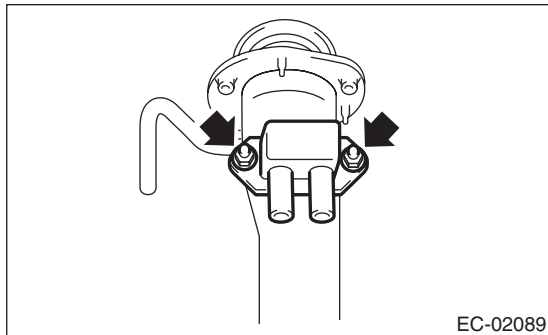
1) Remove the fuel filler pipe.

<Ref. to FU(H4SO)-50, REMOVAL, Fuel Filler Pipe.>

2) Disconnect the evaporation hose from the shut valve.



3) Remove the shut valve from the fuel filler pipe.

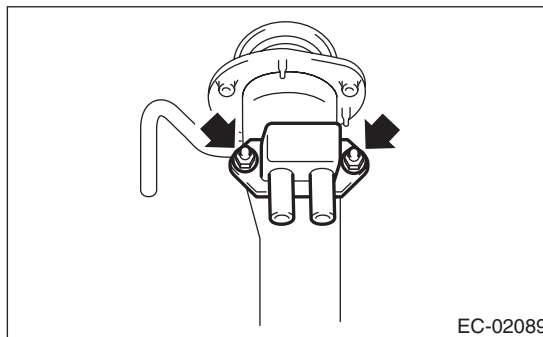


### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

4.5 N·m (0.46 kgf·m, 3.3 ft·lb)



### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 14.Drain Valve

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain valve from canister.

Refer to "Canister" for removal and installation procedure. <Ref. to EC(H4SO)-5, INSTALLATION, Canister.>

# PCV Hose Assembly

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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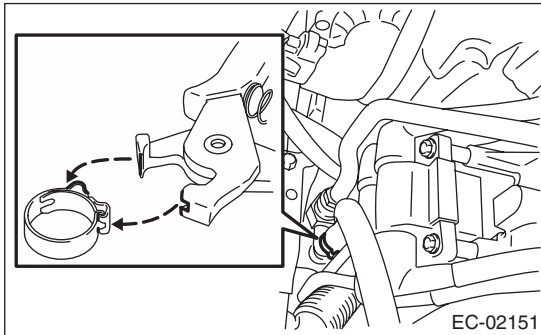
## 15.PCV Hose Assembly

### A: REMOVAL

#### CAUTION:

**Do not remove unless the PCV hose, diagnostics connector and PCV valve are damaged.**

- 1) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
  - 2) Fit the depression in the ST with the protrusion on the clamp to unlock.
  - 3) Remove the PCV hose assembly.
- ST 18353AA000 CLAMP PLIERS



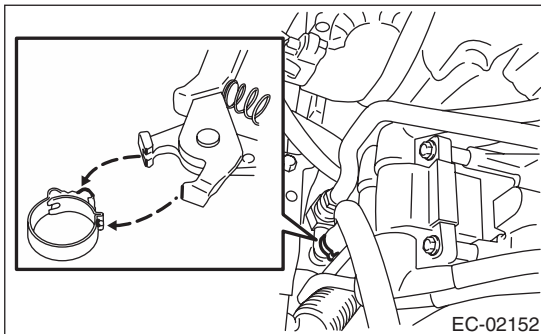
### B: INSTALLATION

#### NOTE:

Replace the clamp with a new part.

- 1) Install the PCV hose assembly, then lock by fitting the ST on the clamp protrusion.

ST 18353AA000 CLAMP PLIERS



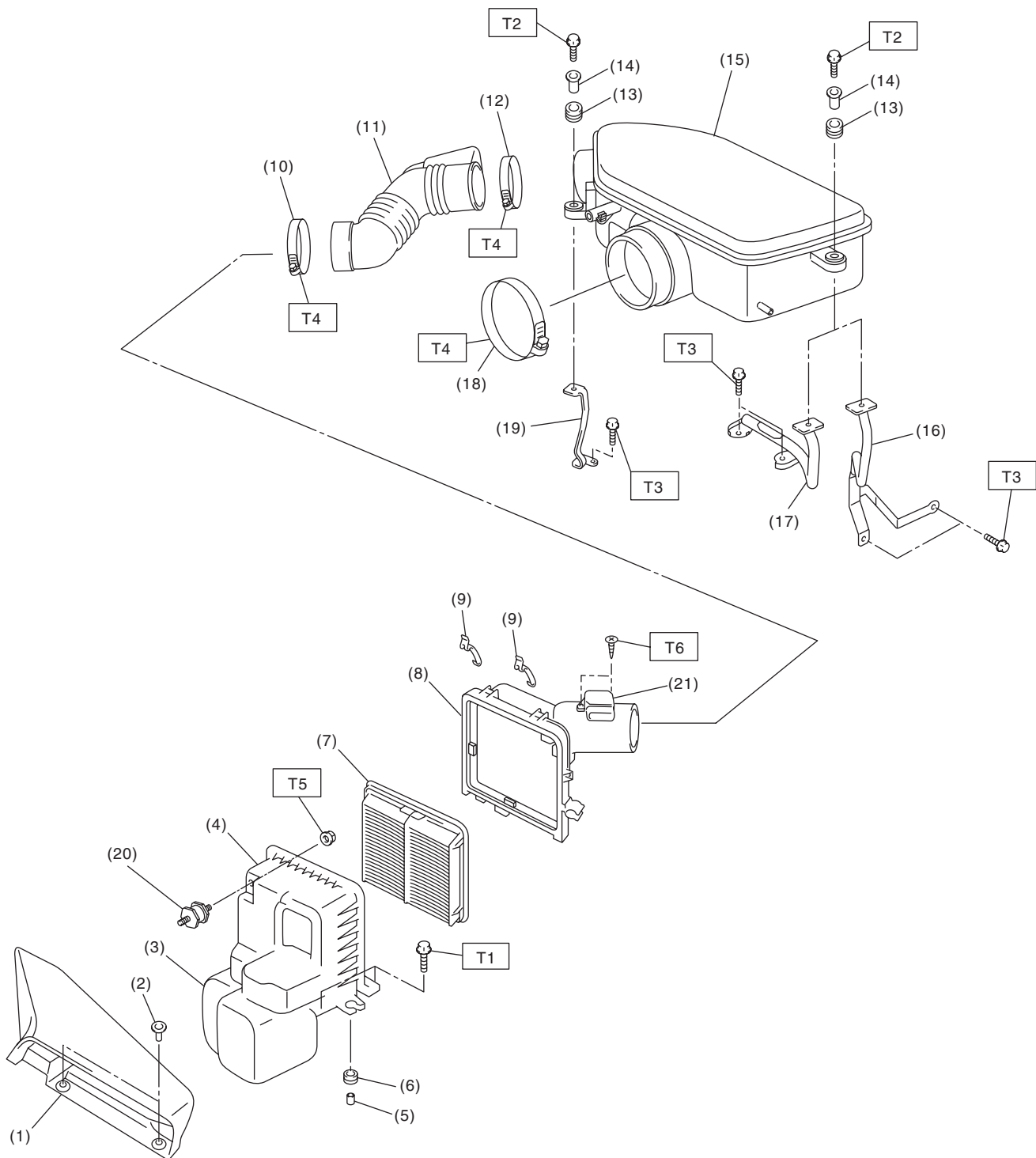
- 2) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

# General Description

INTAKE (INDUCTION)

## 1. General Description

A: COMPONENT



IN-02263

IN(H4SO)-2



# General Description

INTAKE (INDUCTION)

(1) Air intake duct	(11) Intake boot	(21) Mass air flow and intake air temperature sensor
(2) Clip	(12) Clamp	
(3) Resonator chamber	(13) Cushion	
(4) Air cleaner case (front)	(14) Spacer	
(5) Spacer	(15) Air intake chamber	
(6) Cushion	(16) Stay LH (MT model)	
(7) Air cleaner element	(17) Stay LH (AT model)	
(8) Air cleaner case (rear) (with HC absorption filter : U5 model)	(18) Clamp	
(9) Clip	(19) Stay RH	
(10) Clamp	(20) Cushion	

---

**Tightening torque:N·m (kgf-m, ft-lb)**

**T1: 6 (0.6, 4.4)**

**T2: 6.5 (0.66, 4.8)**

**T3: 16 (1.6, 11.8)**

**T4: 3 (0.3, 2.2)**

**T5: 7.5 (0.76, 5.5)**

**T6: 1 (0.1, 0.7)**

---

## B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

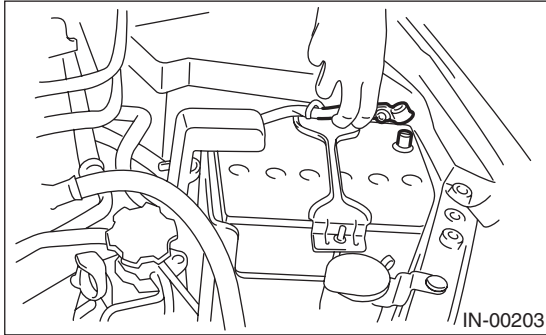
# Air Cleaner Element

INTAKE (INDUCTION)

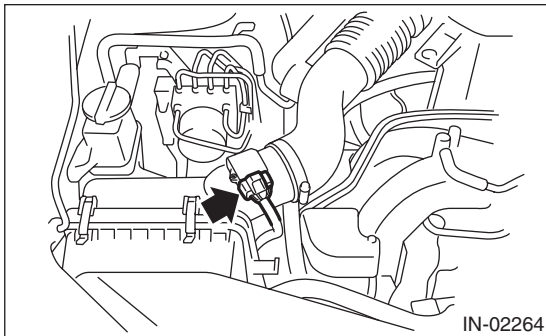
## 2. Air Cleaner Element

### A: REMOVAL

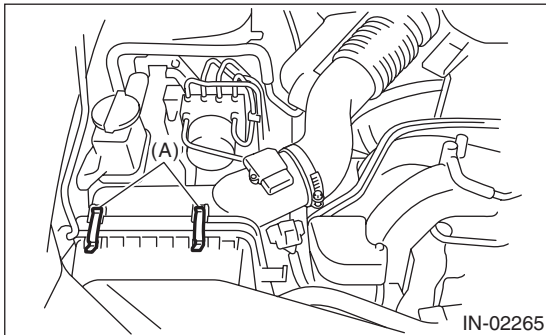
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from mass air flow and intake air temperature sensor.



- 3) Remove the clip (A) securing upper side of air cleaner case.



- 4) Pull the air cleaner case (rear) backward of the vehicle, and remove the air cleaner element.

### NOTE:

Be careful of the power steering hose fixed to the bottom of the air cleaner case (rear).

### B: INSTALLATION

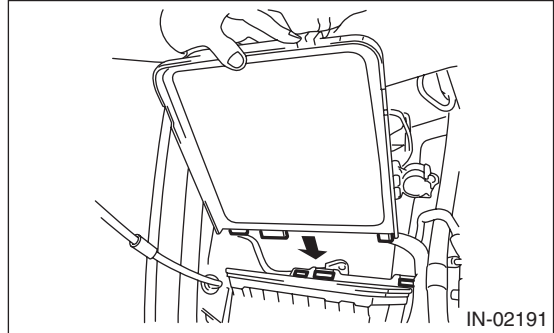
Install in the reverse order of removal.

### CAUTION:

Be sure to use **SUBARU** genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Otherwise engine performance may be damaged.

### NOTE:

Fasten with a clip after inserting the lower tab of case.



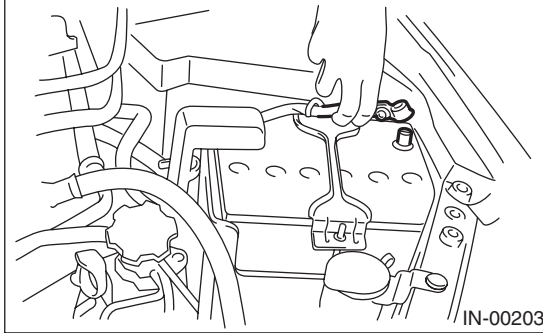
### C: INSPECTION

- 1) Replace if excessively damaged or dirty.
- 2) Replace the air cleaner case (rear) if the HC absorption filter is damaged. (U5 model)

## 3. Air Cleaner Case

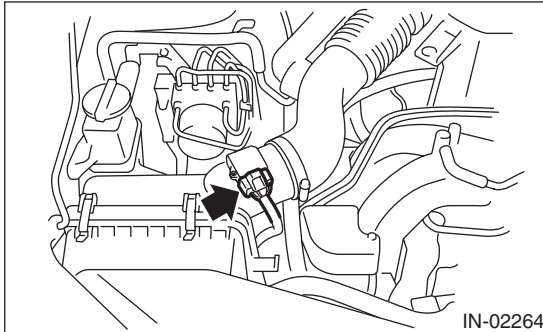
### A: REMOVAL

1) Disconnect the ground cable from the battery.



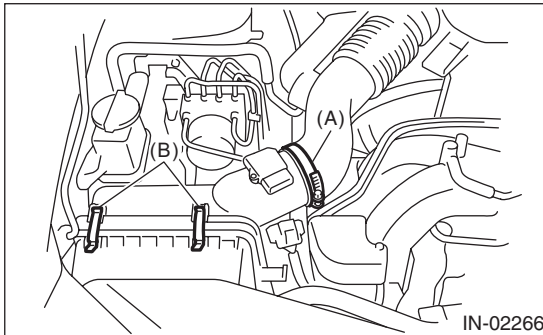
2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

3) Disconnect the connector from mass air flow and intake air temperature sensor.

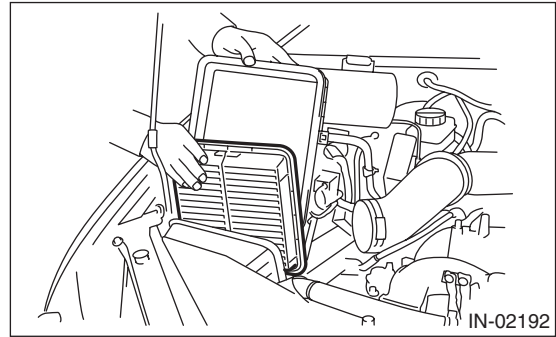


4) Loosen the clamps (A) which connect the air cleaner case and the intake boot.

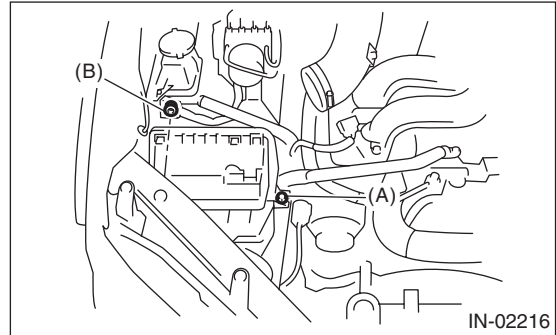
5) Remove the clip (B) securing the upper side of air cleaner case.



6) Remove the air cleaner case (rear) and air cleaner element.



7) Remove the bolts (A) and nut (B) which secure the air cleaner case to body.



8) Remove the air cleaner case (front).

# Air Cleaner Case

INTAKE (INDUCTION)

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## B: INSTALLATION

Install in the reverse order of removal.

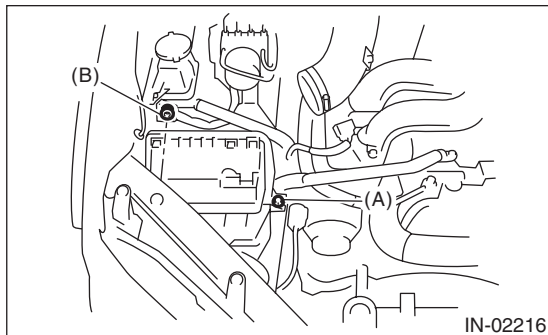
**Tightening torque:**

**Bolt (A)**

**6 N·m (0.6 kgf-m, 4.4 ft-lb)**

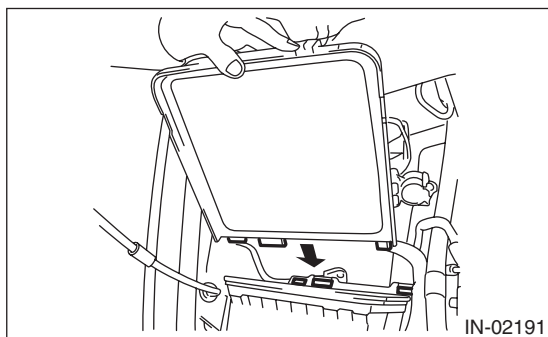
**NUT (B)**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



**NOTE:**

Fasten with a clip after inserting the lower tab of case.



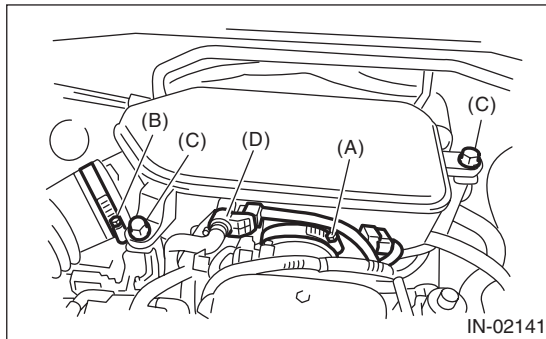
## C: INSPECTION

Check for cracks or loose connections.

## 4. Air Intake Chamber

### A: REMOVAL

- 1) Loosen the clamp (A) which connects air intake chamber to throttle body.
- 2) Loosen the clamp (B) which connects intake boot to air intake chamber.
- 3) Remove the bolt (C) which secures air intake chamber to the stay.
- 4) Disconnect the connector (D).



- 5) Disconnect the blow-by hoses, and then remove air intake chamber.

### B: INSTALLATION

Install in the reverse order of removal.

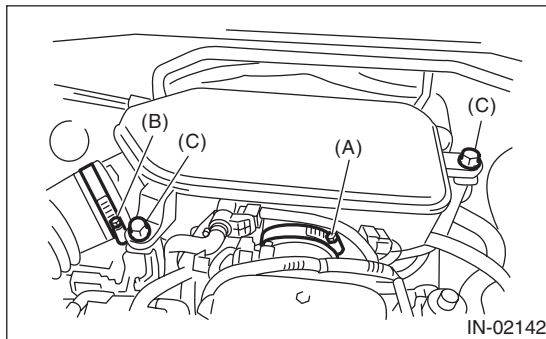
#### *Tightening torque:*

**Clamp (A), (B)**

**3 N·m (0.3 kgf·m, 2.2 ft·lb)**

**Bolt (C)**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



### C: INSPECTION

- 1) Check for cracks or loose connections.
- 2) Inspect that no foreign objects are mixed in the air intake chamber.

# Air Intake Duct

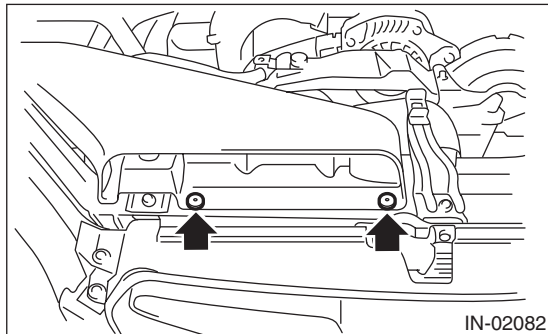
INTAKE (INDUCTION)

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## 5. Air Intake Duct

### A: REMOVAL

- 1) Remove the clip which installs the air intake duct on the front side of body.
- 2) Remove the air intake duct.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Check for cracks or loose connections.
- 2) Check that no foreign matter is mixed in air intake duct.

## 6. Resonator Chamber

### A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for the removal procedure. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

### B: INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for the installation procedure. <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>

### C: INSPECTION

Check for cracks or loose connections.

# Resonator Chamber

INTAKE (INDUCTION)

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IN(H4SO)-10



# General Description

MECHANICAL

## 1. General Description

### A: SPECIFICATION

Engine	Model		2.5 L		
	Cylinder arrangement		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine		
	Valve system mechanism		Belt driven Single overhead camshaft 4 valve/cylinder		
	Bore × Stroke		mm (in) 99.5 × 79.0 (3.917 × 3.110)		
	Piston displacement		cm <sup>3</sup> (cu in) 2,457 (150)		
	Compression ratio		10.0		
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm <sup>2</sup> , psi) 1,020 — 1,275 (10.4 — 13.0, 148 — 185)		
	Number of piston rings		Pressure ring: 2, Oil ring: 1		
	Intake valve timing		Constant	Open	BTDC 0°
				Close	ABDC 58°
			Low speed	Open	BTDC 0°
				Close	ABDC -10°
			High speed	Open	BTDC 14°
				Close	ABDC 62°
	Exhaust valve timing		Open	BBDC 30°	
			Close	ATDC 14°	
	Valve clearance		mm (in)	Intake	0.20±0.04 (0.0079±0.0016)
				Exhaust	0.25±0.04 (0.0098±0.0016)
Idling speed [at neutral position on MT, or “P” or “N” position on AT]		rpm	MT	650±100 (No load) 850±100 (A/C ON)	
			AT	700±100 (No load) 850±100 (A/C ON)	
Ignition order			1 → 3 → 2 → 4		
Ignition timing		BTDC/ rpm	MT	10°±8°/650	
			AT	15°±8°/700	

NOTE:

US: Undersize OS: Oversize

# General Description

MECHANICAL

Belt tension adjuster	Protrusion of adjuster rod			mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Belt tensioner	Spacer O.D.			mm (in)	17.955 — 17.975 (0.7069 — 0.7077)	
	Tensioner bushing I.D.			mm (in)	18.00 — 18.08 (0.7087 — 0.7118)	
	Clearance between spacer and bushing		mm (in)	Standard	0.025 — 0.125 (0.0010 — 0.0049)	
	Side clearance of spacer		mm (in)	Standard	0.20 — 0.55 (0.0079 — 0.0217)	
Valve rocker arm	Clearance between shaft and arm		mm (in)	Standard	0.020 — 0.054 (0.0008 — 0.0021)	
Camshaft	Bending limit			mm (in)	0.025 (0.0010)	
	Thrust clearance			mm (in)	Standard	0.030 — 0.090 (0.0012 — 0.0035)
	Cam lobe height	mm (in)	Intake	Constant	Standard	40.075 — 40.175 (1.5778 — 1.5817)
				Low speed	Standard	35.496 — 35.596 (1.3975 — 1.4014)
				High speed	Standard	40.315 — 40.415 (1.5872 — 1.5911)
			Exhaust		Standard	39.289 — 39.389 (1.5468 — 1.5507)
	Camshaft journal O.D.			mm (in)	31.928 — 31.945 (1.2570 — 1.2577)	
	Camshaft journal hole I.D.			mm (in)	32.000 — 32.018 (1.2598 — 1.2605)	
Oil clearance		mm (in)	Standard	0.055 — 0.090 (0.0022 — 0.0035)		
Cylinder head	Surface warpage limit (Mating surface with cylinder block)			mm (in)	0.035 (0.0014)	
	Grinding limit			mm (in)	0.1 (0.004)	
	Standard height			mm (in)	97.5 (3.84)	
Valve seat	Seating angle				90°	
	Contacting width	mm (in)	Intake	Standard	0.8 — 1.4 (0.03 — 0.055)	
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)	
Valve guide	Inside diameter			mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
	Protrusion above head	mm (in)	Intake	Standard	20.0 — 21.0 (0.787 — 0.827)	
			Exhaust	Standard	16.5 — 17.5 (0.650 — 0.689)	
Valve	Head edge thickness	mm (in)	Intake	Standard	0.8 — 1.2 (0.03 — 0.047)	
			Exhaust	Standard	1.0 — 1.4 (0.039 — 0.055)	
	Stem outer diameter	mm (in)	Intake	Standard	5.950 — 5.965 (0.2343 — 0.2348)	
			Exhaust	Standard	5.945 — 5.960 (0.2341 — 0.2346)	
	Valve stem gap	mm (in)	Standard	Intake	Standard	0.035 — 0.062 (0.0014 — 0.0024)
				Exhaust	Standard	0.040 — 0.067 (0.0016 — 0.0026)
	Overall length	mm (in)	Intake	Standard	120.6 (4.75)	
Exhaust			Standard	121.7 (4.79)		
Valve spring	Free length			mm (in)	55.2 (2.173)	
	Squareness				2.5°, 2.4 (0.094) or less	
	Tension/spring height	N (kgf, lb)/mm (in)	Set		235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/45.0 (1.772)	
			Lift		578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/34.7 (1.366)	
Cylinder block	Surface warpage limit (mating with cylinder head)			mm (in)	0.025 (0.00098)	
	Grinding limit			mm (in)	0.1 (0.004)	
	Standard height			mm (in)	201.0 (7.91)	
	Cylinder inner diameter	mm (in)	Standard	A	Standard	99.505 — 99.515 (3.9175 — 3.9179)
				B	Standard	99.495 — 99.505 (3.9171 — 3.9175)
	Taper		mm (in)	Standard	0.015 (0.0006)	
	Out-of-roundness		mm (in)	Standard	0.010 (0.0004)	
	Piston clearance		mm (in)	Standard	-0.010 — 0.010 (-0.00039 — 0.00039)	
Cylinder inner diameter boring limit (diameter)			mm (in)	To 100.005 (3.9372)		

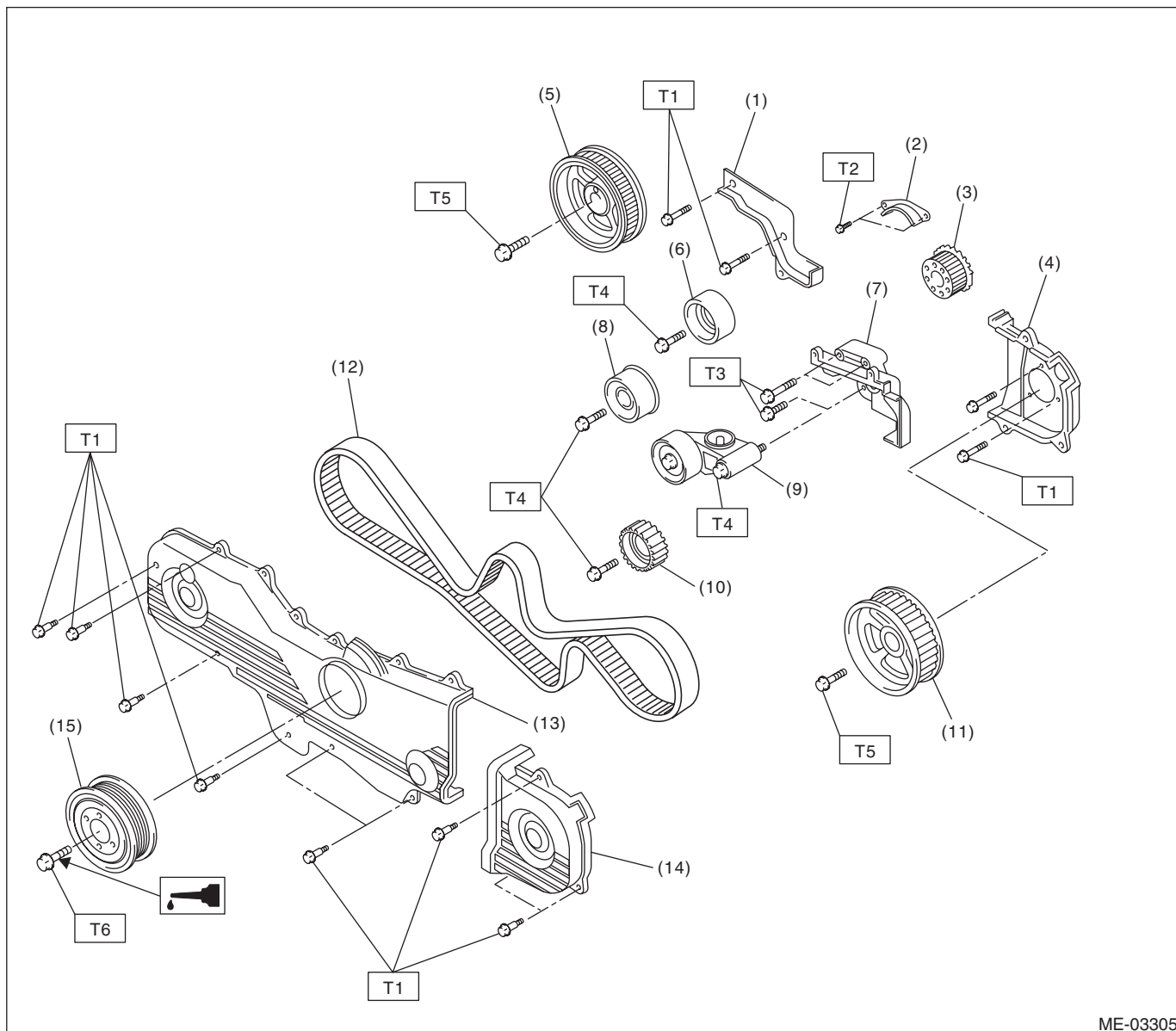
# General Description

## MECHANICAL

Piston	Outer diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)	
				B	99.495 — 99.505 (3.9171 — 3.9175)	
			0.25 (0.0098) OS		99.745 — 99.765 (3.9270 — 3.9278)	
			0.50 (0.0197) OS		99.995 — 100.015 (3.9368 — 3.9376)	
Piston pin	Clearance between piston and piston pin:		mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)	
	Degree of fit		Piston pin must be fitted into position with thumb at 20°C (68°F).			
Piston ring	Ring closed gap	mm (in)	Top ring	Standard	0.20 — 0.35 (0.0079 — 0.0138)	
			Second ring	Standard	0.37 — 0.52 (0.0144 — 0.0203)	
			Oil ring	Standard	0.20 — 0.50 (0.0079 — 0.0197)	
	Ring groove gap	mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)	
			Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)	
Connecting rod	Bend or twist per 100 mm (3.94 in) in length		mm (in)	Limit	0.10 (0.0039)	
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance		mm (in)	Standard	0.016 — 0.044 (0.00063 — 0.0017)	
	Bearing size (Thickness at center)	mm (in)	Standard		1.492 — 1.501 (0.0587 — 0.0591)	
			0.03 (0.0012) US		1.510 — 1.513 (0.0594 — 0.0596)	
			0.05 (0.0020) US		1.520 — 1.523 (0.0598 — 0.0600)	
			0.25 (0.0098) US		1.620 — 1.623 (0.0638 — 0.0639)	
Bushing of small end	Clearance between piston pin and bushing		mm (in)	Standard	0 — 0.022 (0 — 0.0009)	
Crankshaft	Bend limit		mm (in)		0.035 (0.0014)	
	Crank pin	Out-of-roundness		mm (in)	0.003 (0.0001)	
		Cylindricality		mm (in)	0.004 (0.0002)	
		Grinding limit (dia.)		mm (in)	To 51.750 (2.0374)	
	Crank journal	Out-of-roundness		mm (in)	0.005 (0.0002)	
		Cylindricality		mm (in)	0.006 (0.0002)	
		Grinding limit (dia.)		mm (in)	To 59.758 (2.3527)	
	Crank pin outer diameter	mm (in)	Standard		51.984 — 52.000 (2.0466 — 2.0472)	
			0.03 (0.0012) US		51.954 — 51.970 (2.0454 — 2.0461)	
			0.05 (0.0020) US		51.934 — 51.950 (2.0446 — 2.0453)	
			0.25 (0.0098) US		51.734 — 51.750 (2.0368 — 2.0374)	
	Crank journal outer diameter	mm (in)	Standard		59.992 — 60.008 (2.3619 — 2.3625)	
			0.03 (0.0012) US		59.962 — 59.978 (2.3607 — 2.3613)	
0.05 (0.0020) US			59.942 — 59.958 (2.3599 — 2.3605)			
0.25 (0.0098) US			59.742 — 59.758 (2.3520 — 2.3527)			
Thrust clearance		mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Oil clearance		mm (in)	Standard	0.010 — 0.030 (0.0001 — 0.0012)		
Main bearing	Main bearing	#1, #3	mm (in)		Standard	1.998 — 2.011 (0.0787 — 0.0792)
			0.03 (0.0012) US		2.017 — 2.020 (0.0794 — 0.0795)	
			0.05 (0.0020) US		2.027 — 2.030 (0.0798 — 0.0799)	
			0.25 (0.0098) US		2.127 — 2.130 (0.0837 — 0.0839)	
		#2, #4, #5	mm (in)		Standard	2.000 — 2.013 (0.0787 — 0.0793)
			0.03 (0.0012) US		2.019 — 2.022 (0.0795 — 0.0796)	
			0.05 (0.0020) US		2.029 — 2.032 (0.0799 — 0.0800)	
			0.25 (0.0098) US		2.129 — 2.132 (0.0838 — 0.0839)	

## B: COMPONENT

### 1. TIMING BELT



ME-03305

- |                                  |  |
|----------------------------------|--|
| (1) Timing belt cover No. 2 (RH) | (9) Automatic belt tension adjuster ASSY |
| (2) Timing belt guide (MT model) | (10) Belt idler No. 2                    |
| (3) Crank sprocket               | (11) Cam sprocket No. 2                  |
| (4) Timing belt cover No. 2 (LH) | (12) Timing belt                         |
| (5) Cam sprocket No. 1           | (13) Front timing belt cover             |
| (6) Belt idler (No. 1)           | (14) Timing belt cover (LH)              |
| (7) Tensioner bracket            | (15) Crank pulley                        |
| (8) Belt idler (No. 2)           |  |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 5 (0.5, 3.7)**

**T2: 9.75 (1.0, 7.2)**

**T3: 24.5 (2.5, 18.1)**

**T4: 39 (4.0, 28.8)**

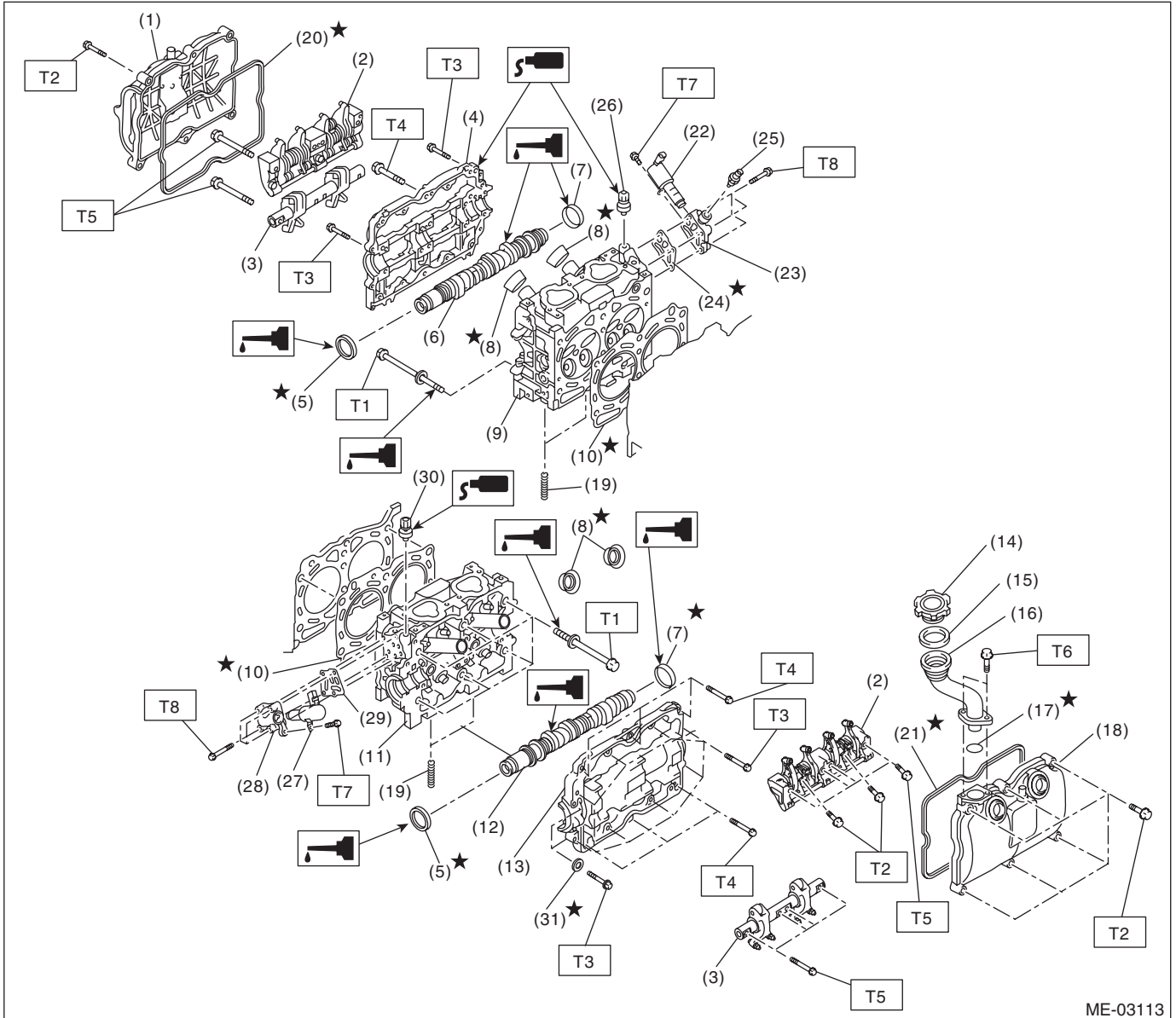
**T5: 78 (8.0, 57.5)**

**T6: <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>**

# General Description

MECHANICAL

## 2. CYLINDER HEAD AND CAMSHAFT



# General Description

MECHANICAL

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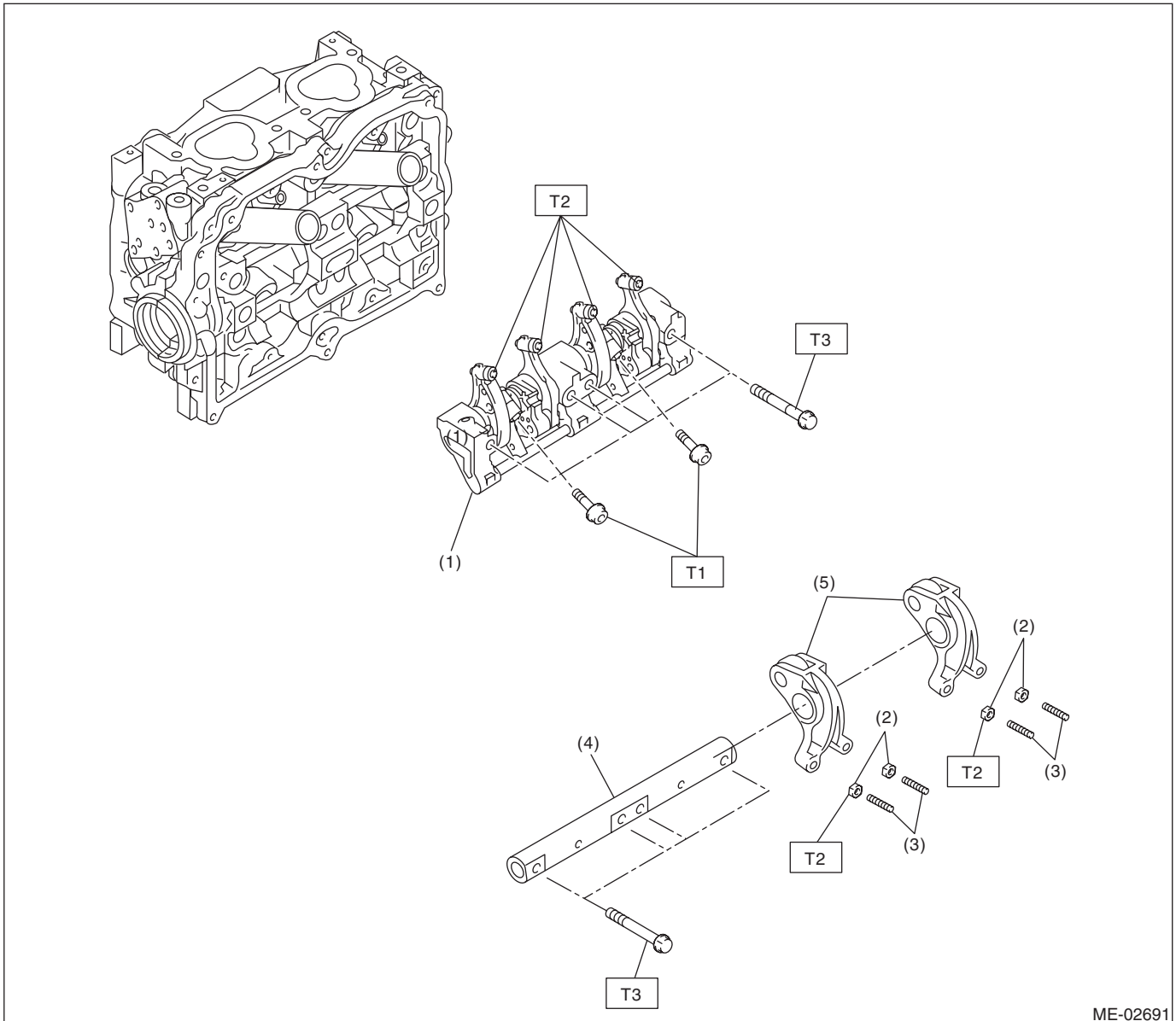
(1) Rocker cover (RH)	(17) O-ring	(30) Variable valve lift diagnosis oil pressure switch (LH)
(2) Intake valve rocker assembly	(18) Rocker cover (LH)	(31) Seal washer
(3) Exhaust valve rocker assembly	(19) Stud bolt	
(4) Camshaft cap (RH)	(20) Rocker cover gasket (RH)	
(5) Oil seal	(21) Rocker cover gasket (LH)	<b>Tightening torque:N·m (kgf-m, ft-lb)</b>
(6) Camshaft (RH)	(22) Oil switching solenoid valve (RH)	<b>T1: &lt;Ref. to ME(H4SO)-58, INSTALLATION, Cylinder Head.&gt;</b>
(7) Plug	(23) Oil switching solenoid valve holder (RH)	<b>T2: &lt;Ref. to ME(H4SO)-50, INSTALLATION, Valve Rocker Assembly.&gt;</b>
(8) Spark plug pipe gasket	(24) Gasket	
(9) Cylinder head (RH)	(25) Oil temperature sensor	
(10) Cylinder head gasket	(26) Variable valve lift diagnosis oil pressure switch (RH)	<b>T3: 9.75 (1.0, 7.2)</b>
(11) Cylinder head (LH)	(27) Oil switching solenoid valve (LH)	<b>T4: 18 (1.8, 13.3)</b>
(12) Camshaft (LH)	(28) Oil switching solenoid valve holder (LH)	<b>T5: 25 (2.5, 18.4)</b>
(13) Camshaft cap (LH)	(29) Gasket	<b>T6: 6.4 (0.65, 4.7)</b>
(14) Oil filler cap		<b>T7: 8 (0.8, 5.9)</b>
(15) Gasket		<b>T8: 10 (1.0, 7.4)</b>
(16) Oil filler duct		

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# General Description

MECHANICAL

## 3. VALVE ROCKER ASSEMBLY



ME-02691

- (1) Intake valve rocker arm ASSY
- (2) Valve rocker nut
- (3) Valve rocker adjusting screw

- (4) Exhaust rocker shaft
- (5) Exhaust valve rocker arm

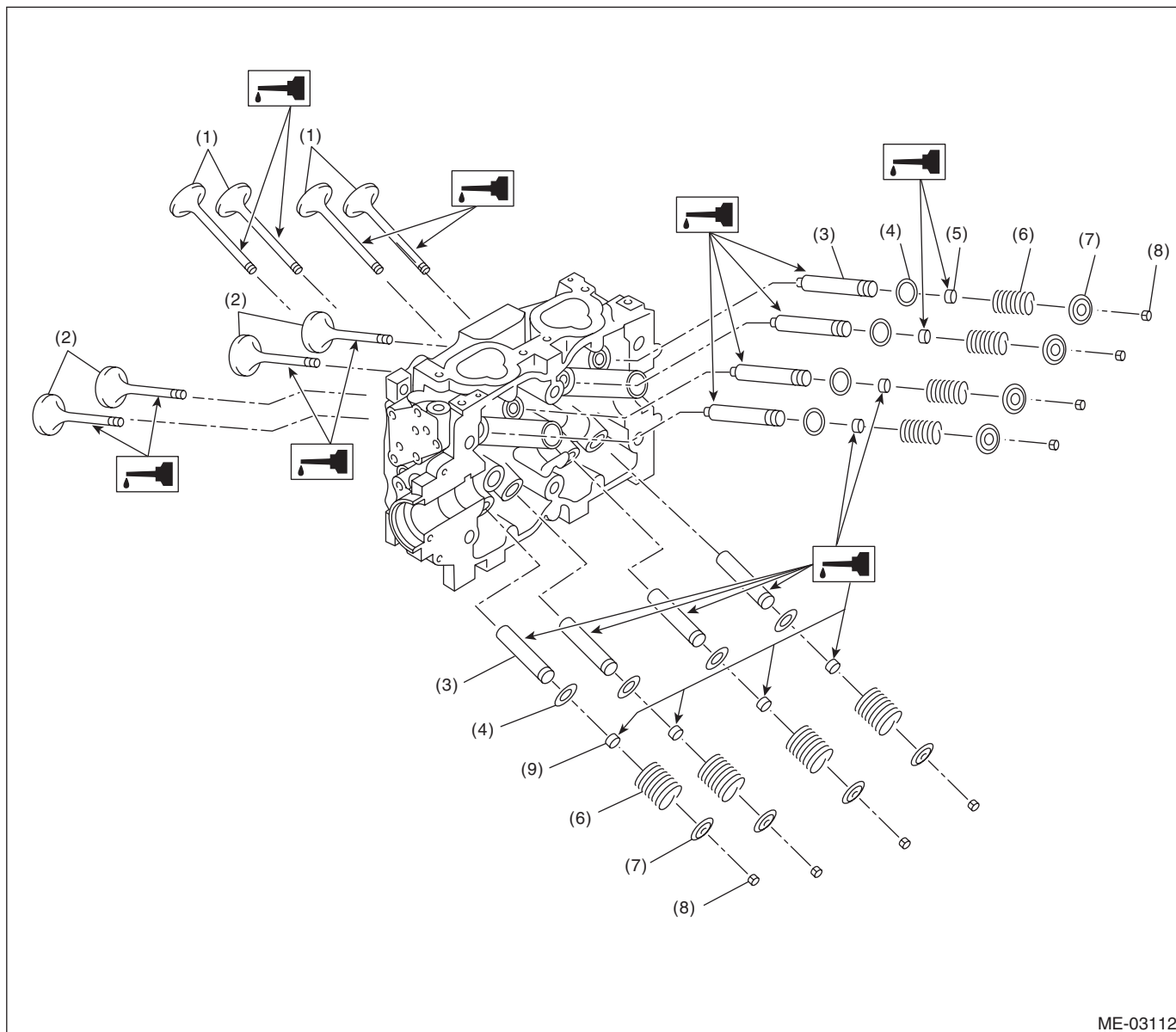
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6 (0.6, 4.3)**

**T2: 9.75 (1.0, 7.2)**

**T3: 25 (2.5, 18.4)**

## 4. CYLINDER HEAD AND VALVE ASSEMBLY



ME-03112

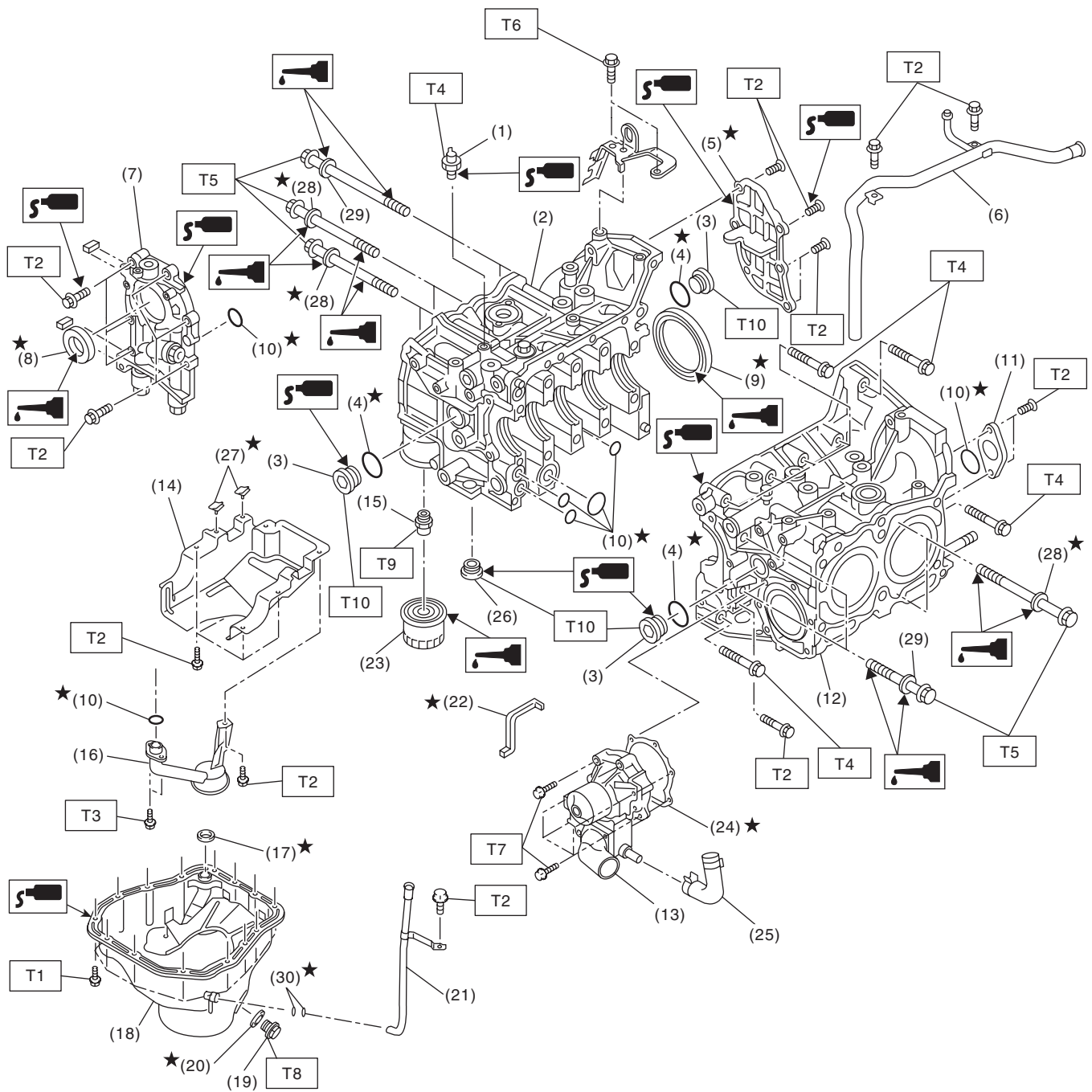
- |                   |                           |                            |
|-------------------|---------------------------|----------------------------|
| (1) Exhaust valve | (4) Valve spring seat     | (7) Retainer               |
| (2) Intake valve  | (5) Intake valve oil seal | (8) Retainer key           |
| (3) Valve guide   | (6) Valve spring          | (9) Exhaust valve oil seal |



# General Description

MECHANICAL

## 5. CYLINDER BLOCK



ME-03307

ME(H4SO)-10

# General Description

MECHANICAL

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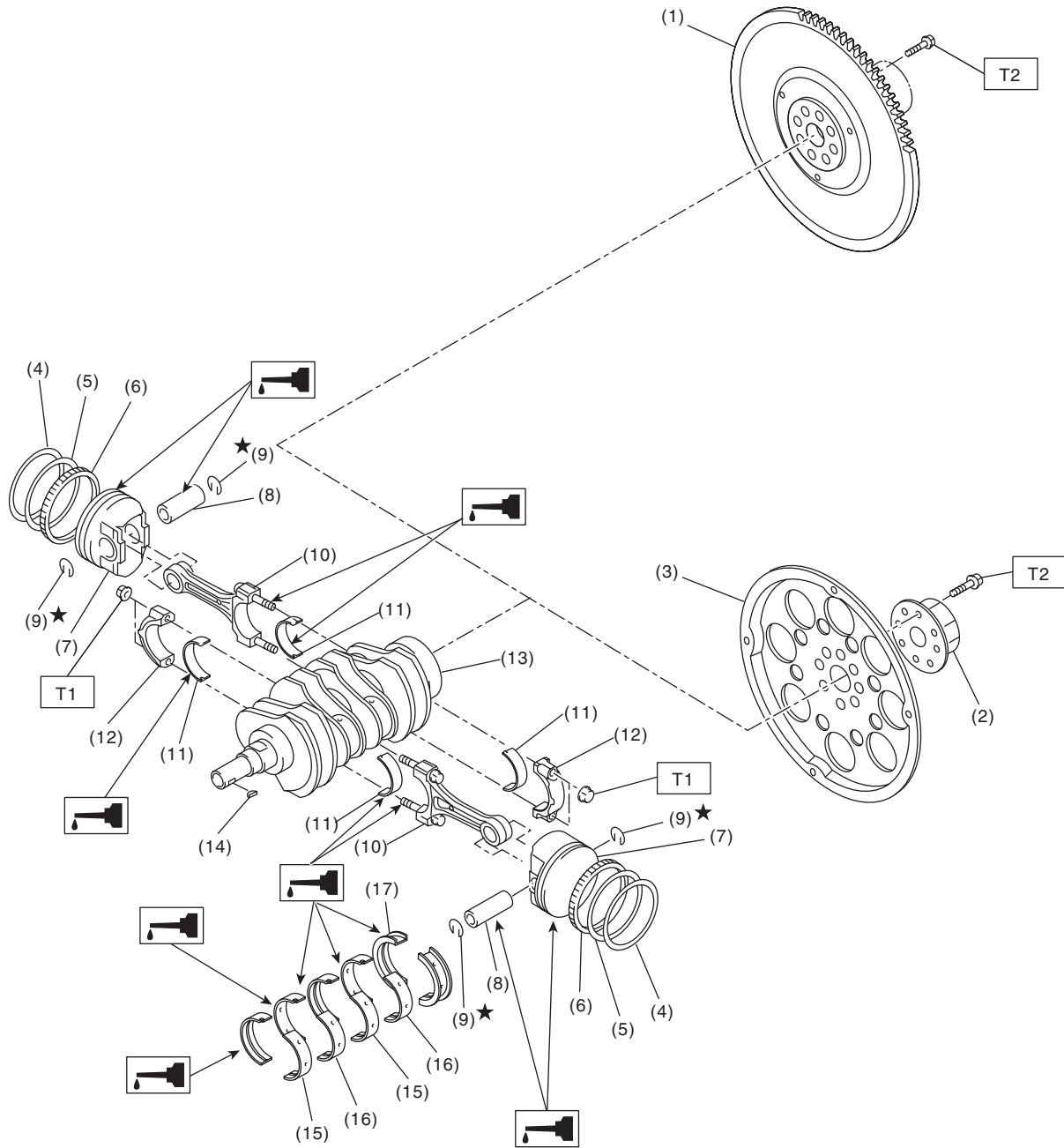
(1) Oil pressure switch	(16) Oil strainer	<b>Tightening torque:N·m (kgf-m, ft-lb)</b>
(2) Cylinder block (RH)	(17) Gasket	<b>T1: 5 (0.5, 3.7)</b>
(3) Service hole plug	(18) Oil pan	<b>T2: 6.4 (0.65, 4.7)</b>
(4) Gasket	(19) Drain plug	<b>T3: 10 (1.0, 7.4)</b>
(5) Oil separator cover	(20) Drain plug gasket	<b>T4: 25 (2.5, 18.4)</b>
(6) Water by-pass pipe	(21) Oil level gauge guide	<b>T5: &lt;Ref. to ME(H4SO)-69, INSTAL-</b>
(7) Oil pump	(22) Water pump sealing	<b>LATION, Cylinder Block.&gt;</b>
(8) Front oil seal	(23) Oil filter	<b>T6: 16 (1.6, 11.8)</b>
(9) Rear oil seal	(24) Gasket	<b>T7: First 12 (1.2, 8.7)</b>
(10) O-ring	(25) Water pump hose	<b>Second 12 (1.2, 8.7)</b>
(11) Service hole cover	(26) Plug	<b>T8: 44 (4.5, 32.5)</b>
(12) Cylinder block (LH)	(27) Seal	<b>T9: 45 (4.6, 33.2)</b>
(13) Water pump	(28) Seal washer	<b>T10: 70 (7.1, 51.6)</b>
(14) Baffle plate	(29) Washer	
(15) Oil filter connector	(30) O-ring	

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# General Description

MECHANICAL

## 6. CRANKSHAFT AND PISTON



ME-03292

- |                              |                             |                                |
|------------------------------|-----------------------------|--------------------------------|
| (1) Flywheel (MT model)      | (8) Piston pin              | (15) Crankshaft bearing #1, #3 |
| (2) Reinforcement (AT model) | (9) Snap ring               | (16) Crankshaft bearing #2, #4 |
| (3) Drive plate (AT model)   | (10) Connecting rod         | (17) Crankshaft bearing #5     |
| (4) Top ring                 | (11) Connecting rod bearing |                                |
| (5) Second ring              | (12) Connecting rod cap     |                                |
| (6) Oil ring                 | (13) Crankshaft             |                                |
| (7) Piston                   | (14) Woodruff key           |                                |

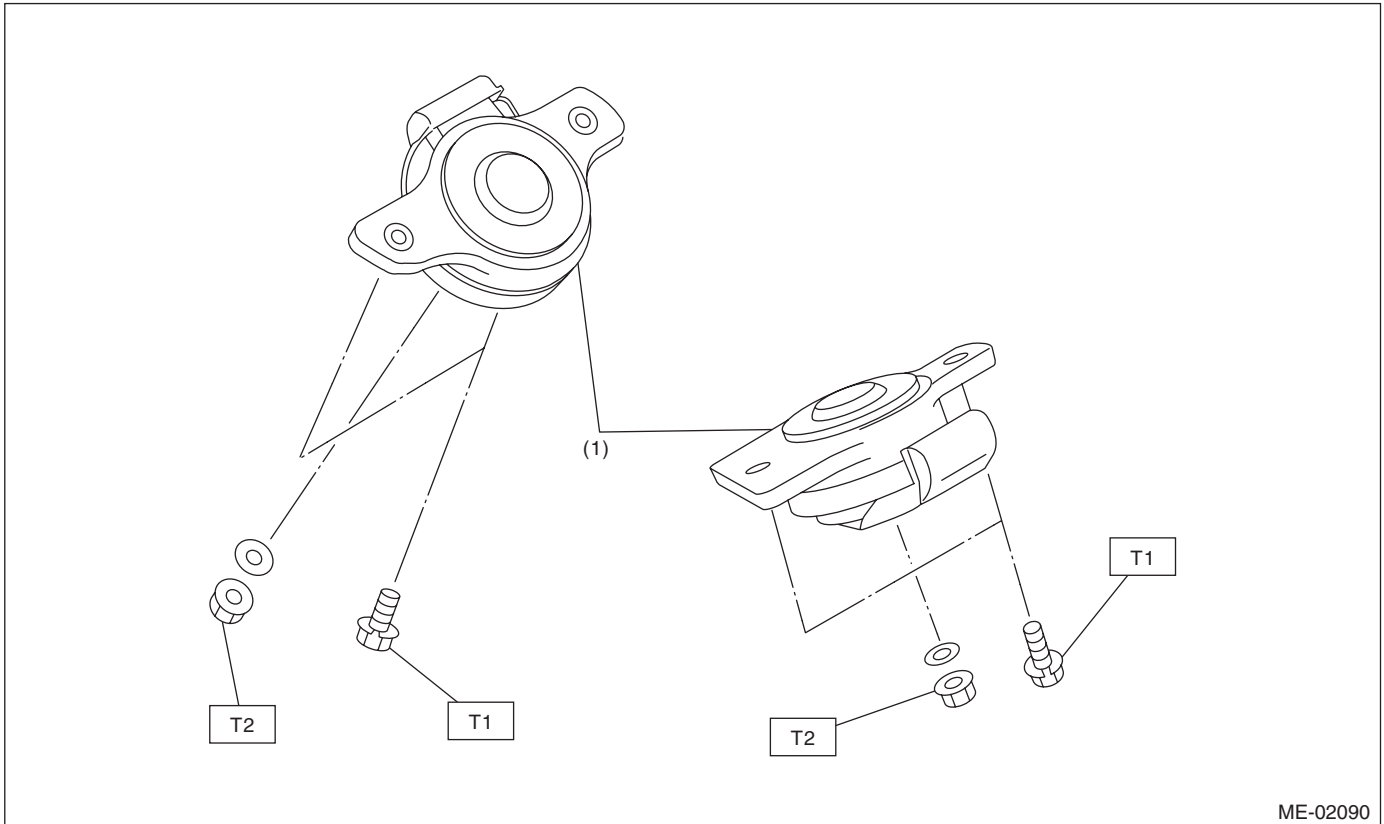
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 45 (4.6, 33.2)**

**T2: 72 (7.3, 53.1)**

**ME(H4SO)-12**

## 7. ENGINE MOUNTING



ME-02090

(1) Front cushion rubber

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 35 (3.6, 25.8)**

**T2: 75 (7.6, 55.3)**

### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.

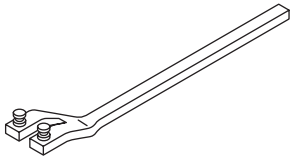
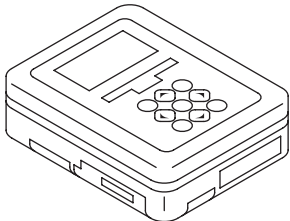
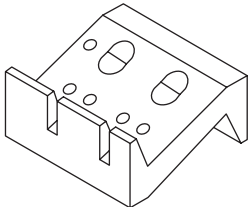
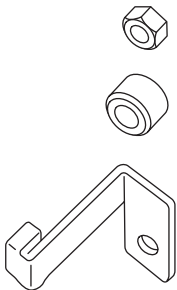
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new parts as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
- Prior to starting work, prepare the following:  
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift up or lower the vehicle when necessary. Make sure to support the correct positions.

# General Description

MECHANICAL

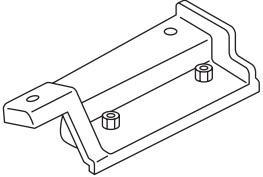
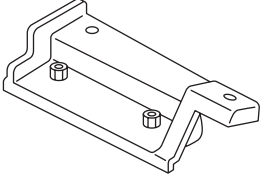
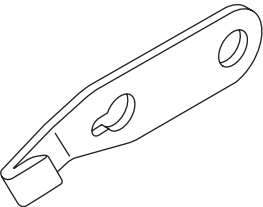
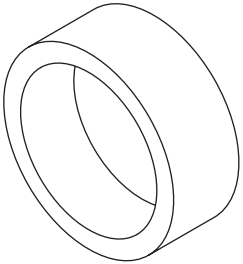
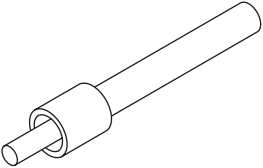
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18231AA010</p>	18231AA010	CAM SPROCKET WRENCH	<ul style="list-style-type: none"> <li>Used for removing and installing cam sprocket.</li> <li>CAMSHAFT SPROCKET WRENCH (499207100) can also be used.</li> </ul>
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.
 <p>ST-498267800</p>	498267800	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> <li>Used for replacing valve guides.</li> <li>Used for removing and installing valve spring.</li> </ul>
 <p>ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

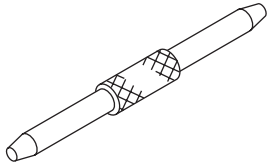
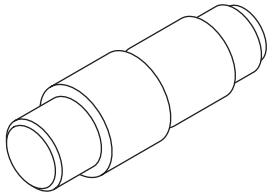
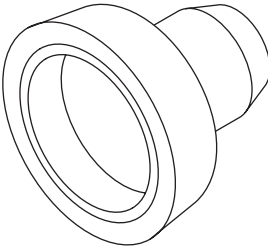
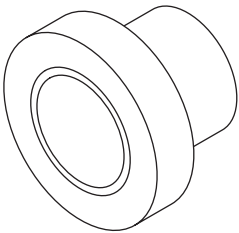
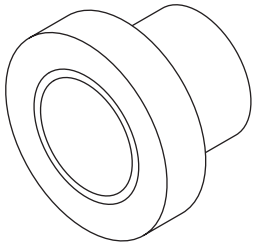
# General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used together with the ENGINE STAND (499817100).
 <p>ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used together with the ENGINE STAND (499817100).
 <p>ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for removing and installing the flywheel and the drive plate.
 <p>ST-498747300</p>	498747300	PISTON GUIDE	Used for installing piston in cylinder.
 <p>ST-498857100</p>	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

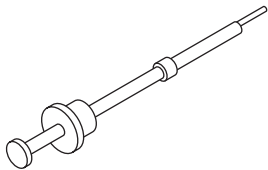
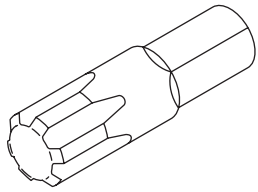
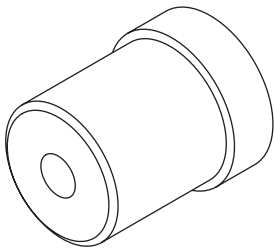
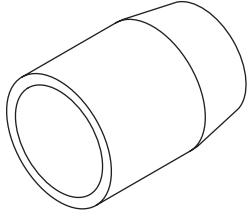
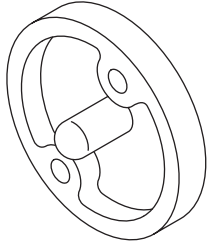
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p style="text-align: center;">ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 <p style="text-align: center;">ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL GUIDE (499597100).</li> </ul>
 <p style="text-align: center;">ST-499587500</p>	499587500	OIL SEAL INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the camshaft oil seal.</li> <li>• Used together with the OIL SEAL GUIDE (499597000).</li> </ul>
 <p style="text-align: center;">ST-499587700</p>	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.

# General Description

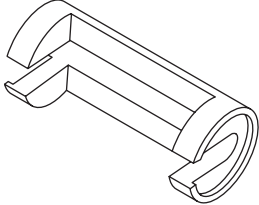
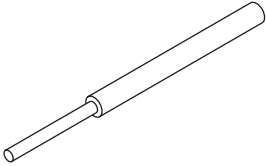
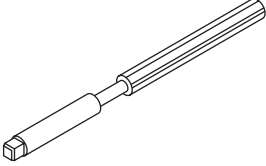
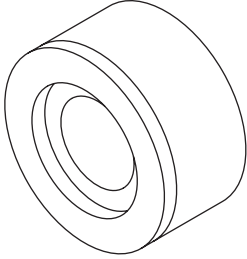
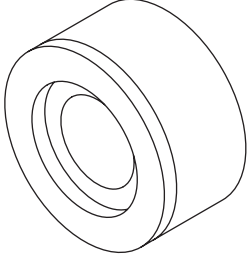
MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 <p style="text-align: center;">ST-499497000</p>	499497000	TORX® PLUS	Used for removing and installing camshaft cap.
 <p style="text-align: center;">ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 <p style="text-align: center;">ST-499597000</p>	499597000	OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing the camshaft oil seal.</li> <li>• Used together with the CAMSHAFT OIL SEAL INSTALLER (499587500).</li> </ul>
 <p style="text-align: center;">ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL INSTALLER (499587200).</li> </ul>



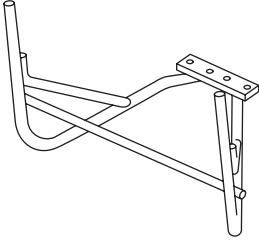
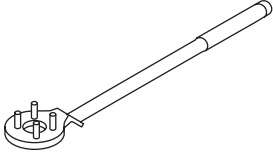
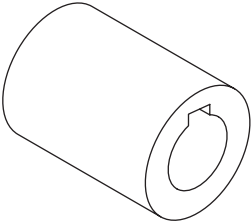
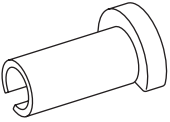
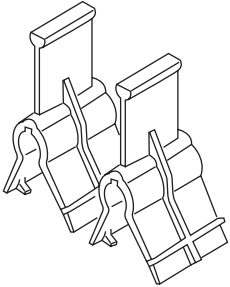
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 <p style="text-align: center;">ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p style="text-align: center;">ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p style="text-align: center;">ST-499767700</p>	499767700	VALVE GUIDE ADJUSTER	Used for installing valve guides. (Intake side)
 <p style="text-align: center;">ST-499767800</p>	499767800	VALVE GUIDE ADJUSTER	Used for installing valve guides. (Exhaust side)

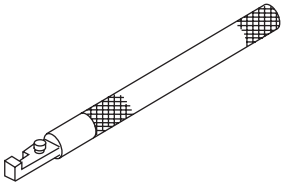
# General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499817100</p>	499817100	ENGINE STAND	<ul style="list-style-type: none"> <li>• Stand used for engine disassembly and assembly.</li> <li>• Used together with the ENGINE STAND ADAPTER RH (498457000) &amp; LH (498457100).</li> </ul>
 <p>ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 <p>ST-499987500</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p>ST42099AE000</p>	42099AE000	CONNECTOR REMOVER	Used for removing the quick connector.
 <p>ST18354AA000</p>	18354AA000	VALVE ROCKER HOLDER	Used for installing the valve rocker assembly (intake). (2-piece set)

# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18258AA000	18258AA000	SPRING INSTALLER	Used for installing the valve rocker assembly (intake).

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Vacuum gauge	Used for measuring vacuum pressure.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.
Timing light	Used for measuring ignition timing.

## E: PROCEDURE

It is possible to conduct the following service procedures with engine on vehicle, however, the procedures described in this section are based on the condition that the engine is removed from vehicle.

- V-belt
- Timing belt
- Valve rocker ASSY
- Camshaft
- Cylinder head

## 2. Compression

### A: INSPECTION

**CAUTION:**

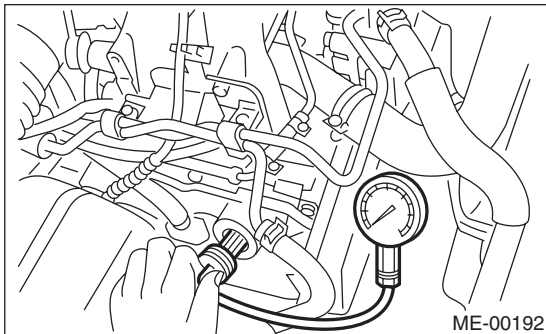
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) After warming-up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Release the fuel pressure.  
<Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 4) Remove all spark plugs. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
- 5) Fully open the throttle valve.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tightly against the spark plug hole.

**NOTE:**

When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.

- 8) Crank the engine by the starter motor, and read the maximum value on the gauge when the needle of gauge is steady.



- 9) Perform at least two measurements per cylinder, and check that the values are correct.

**Compression (throttle full open):**

**Standard**

**1,020 — 1,275 kPa (10.4 — 13.0 kgf/cm<sup>2</sup>,  
148 — 185 psi)**

**Difference between cylinders**

**49 kPa (0.5 kgf/cm<sup>2</sup>, 7 psi), or less**

- 10) After inspection, install the related parts in the reverse order of removal.

## 3. Idle Speed

### A: INSPECTION

1) Before checking the idle speed, check the following item:

(1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

4) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

**Idle speed [No load and gears in neutral, "P" or "N" range]:**

**650±100 rpm (MT model)**

**700±100 rpm (AT model)**

5) Check the idle speed when loaded. (Turn the A/C switch to "ON" and operate the compressor for at least one minute before measurement.)

**Idle speed [A/C ON and gears in neutral, "P" or "N" range]:**

**850±100 rpm**

NOTE:

Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the prescribed idle speed cannot be maintained, refer to the General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

## 4. Ignition Timing

### A: INSPECTION

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

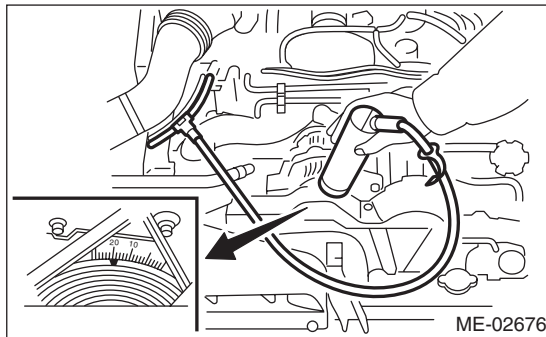
4) Connect the timing light to #1 cylinder spark plug cord, and then light the timing mark with the timing light.

5) Start the engine and check the ignition timing at idle speed as shown below.

**Ignition timing [BTDC/rpm]:**

**$10^{\circ} \pm 8^{\circ} / 650$  (MT Model)**

**$15^{\circ} \pm 8^{\circ} / 700$  (AT model)**



If the timing is not correct, check the ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

# Intake Manifold Vacuum

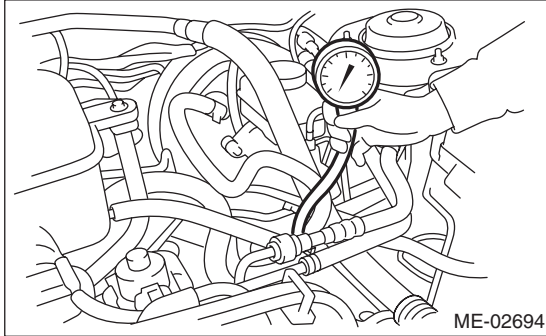
MECHANICAL

## 5. Intake Manifold Vacuum

### A: INSPECTION

- 1) Warm-up the engine.
- 2) Disconnect the brake vacuum hose from intake manifold, and then install the vacuum gauge.
- 3) Keep the engine at idle speed and read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.



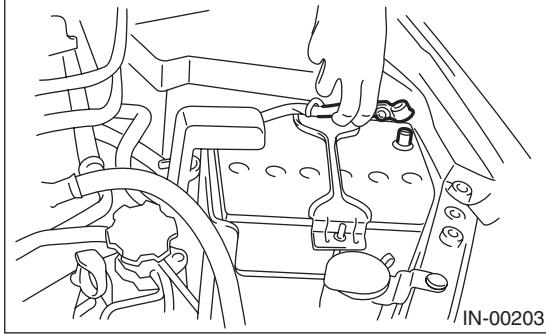
**Vacuum pressure (at idling, A/C "OFF"):**  
**Less than  $-60.0$  kPa ( $-450$  mmHg,  $-17.72$  inHg)**

Diagnosis of engine condition by measurement of intake manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Air leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
3. Needle drops suddenly and intermittently from normal position.	Sticky valve
4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
5. Needle vibrates above and below normal position in narrow range.	Defective ignition system

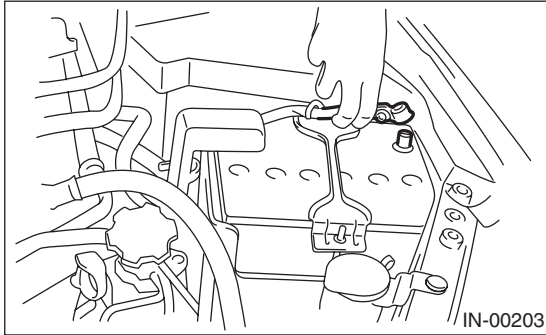
## 6. Engine Oil Pressure

### A: INSPECTION

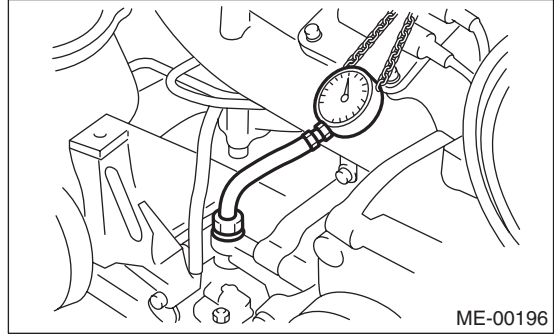
- 1) Disconnect the ground cable from the battery.



- 2) Remove the oil pressure switch. <Ref. to LU(H4SO)-20, REMOVAL, Oil Pressure Switch.>
- 3) Connect the oil pressure gauge to cylinder block.
- 4) Connect the ground cable to battery.



- 5) Start the engine, and measure the oil pressure.



#### Oil pressure:

##### Standard

**98 kPa (1.0 kg/cm<sup>2</sup>, 14 psi) or more at 600 rpm**  
**294 kPa (3.0 kg/cm<sup>2</sup>, 43 psi) or more at 5,000 rpm**

- If the oil pressure is out of specification, check the oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-22, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H4SO)-22, INSPECTION, Engine Lubrication System Trouble in General.>

#### NOTE:

Standard value is based on an engine oil temperature of 80°C (176°F).

- 6) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4SO)-20, INSTALLATION, Oil Pressure Switch.>

#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



## 7. Fuel Pressure

### A: INSPECTION

#### CAUTION:

- Before removing the fuel pressure gauge, release the fuel pressure.
- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

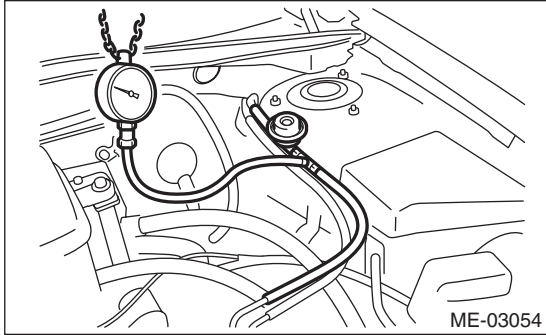
#### NOTE:

Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

1) Release the fuel pressure.

<Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Disconnect the fuel delivery hose from the fuel damper, and connect the fuel pressure gauge.



3) Install the fuse of fuel pump to main fuse box.

4) Start the engine.

5) Measure the fuel pressure after warming up the engine.

#### **Fuel pressure:**

##### **Standard:**

**338 — 348 kPa (3.4 — 3.5 kg/cm<sup>2</sup>, 49 — 50 psi)**

#### NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm<sup>2</sup>, 1 to 3 psi) higher than standard values during high-altitude operations.

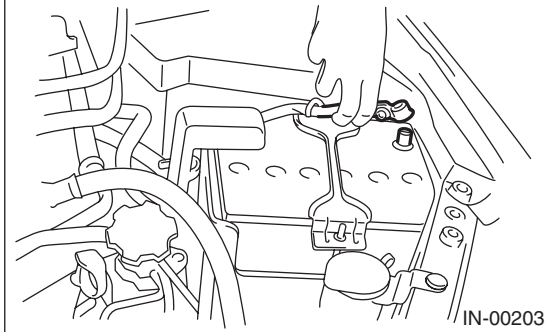
## 8. Valve Clearance

### A: INSPECTION

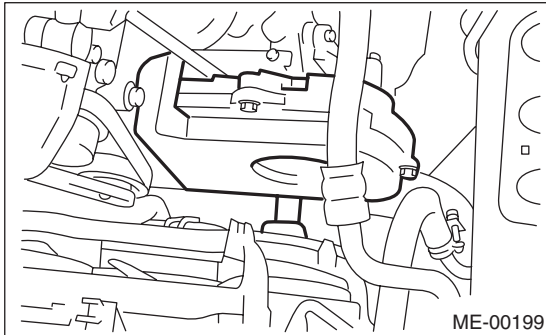
**NOTE:**

Inspection and adjustment of valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Lower the vehicle.
- 5) Disconnect the ground cable from the battery.



- 6) Remove the timing belt cover (LH).



- 7) Remove the fuel injector. <Ref. to FU(H4SO)-28, REMOVAL, Fuel Injector.>

- 8) When inspecting #1 and #3 cylinders

- (1) Disconnect the spark plug cords from spark plugs RH side. <Ref. to IG(H4SO)-4, RH SIDE, REMOVAL, Spark Plug.>
- (2) Disconnect the PCV hose from the rocker cover (RH).
- (3) Remove the bolts, then remove the rocker cover (RH).

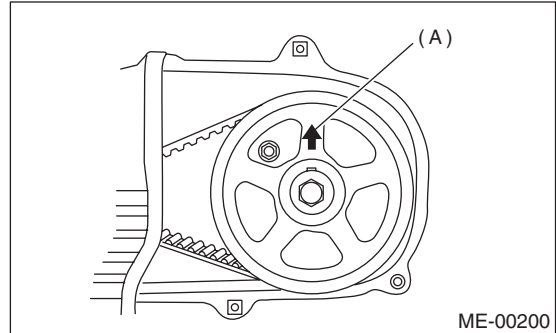
- 9) When inspecting #2 and #4 cylinders

- (1) Disconnect the spark plug cords from spark plugs (LH side). <Ref. to IG(H4SO)-4, LH SIDE, REMOVAL, Spark Plug.>
- (2) Disconnect the PCV hose from the rocker cover (LH).
- (3) Remove the bolts, then remove the rocker cover (LH).

- 10) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

**NOTE:**

When the arrow mark (A) on cam sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



- 11) Measure #1 cylinder valve clearance by using thickness gauge (A).

**NOTE:**

- Insert the thickness gauge (A) in as horizontally as possible with respect to the valve stem end face.
- Lift up the vehicle and measure the exhaust valve clearances.

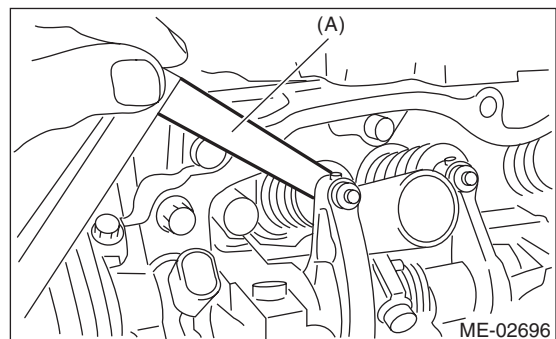
**Valve clearance:**

**Intake**

**$0.20 \pm 0.04$  mm ( $0.0079 \pm 0.0016$  in)**

**Exhaust**

**$0.25 \pm 0.04$  mm ( $0.0098 \pm 0.0016$  in)**



- 12) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-28, ADJUSTMENT, Valve Clearance.>

# Valve Clearance

## MECHANICAL

13) Measure the valve clearance in #3, #2 and #4 cylinder in the same measurement procedure as #1 cylinder in this order.

### NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
- By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.

14) After inspection, install the related parts in the reverse order of removal.

## B: ADJUSTMENT

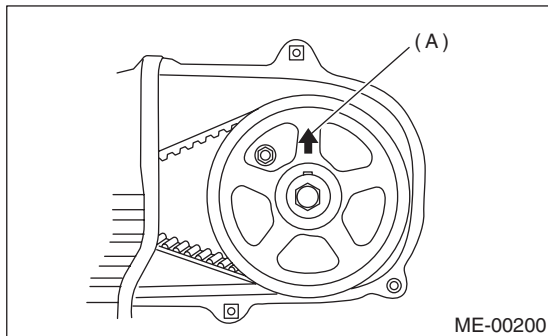
### NOTE:

Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

### NOTE:

When the arrow mark (A) on cam sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



2) Adjust the #1 cylinder valve clearance.

- (1) Loosen the valve rocker nut and screw.
- (2) Set a suitable thickness gauge.
- (3) While noting the valve clearance, tighten the valve rocker adjusting screw.
- (4) When the specified valve clearance is obtained, tighten the valve rocker nut.

### NOTE:

- Insert a thickness gauge in a direction as horizontal as possible with respect to the valve stem end face.
- Lift up the vehicle and adjust the exhaust valve clearances.

### Valve clearance:

#### Intake

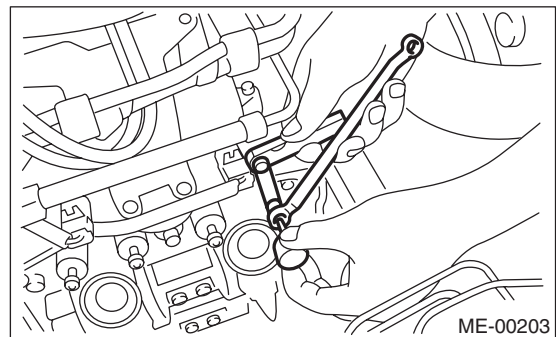
$0.20 \pm 0.04$  mm ( $0.0079 \pm 0.0016$  in)

#### Exhaust

$0.25 \pm 0.04$  mm ( $0.0098 \pm 0.0016$  in)

### Tightening torque:

$9.75$  N·m ( $1.0$  kgf·m,  $7.2$  ft·lb)



3) Adjust the valve clearance in #3, #2 and #4 cylinder in the same adjustment procedure as #1 cylinder in this order.

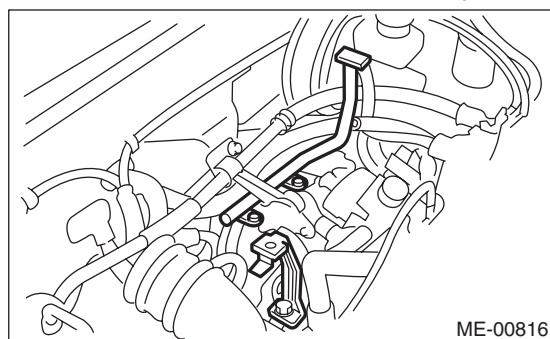
### NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
  - By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.
- 4) Ensure the valve clearances of each cylinder are within specifications. If necessary, readjust the valve clearances.

## 9. Engine Assembly

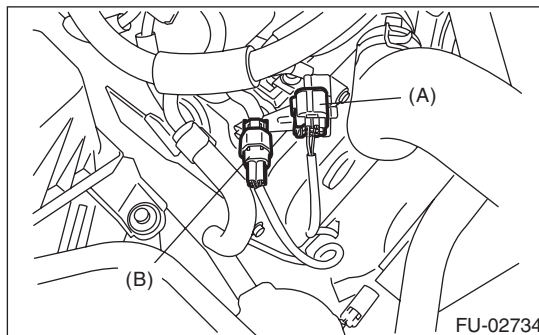
### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully and support with the front hood stay.
- 3) Collect the refrigerant from the A/C system. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 4) Release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 5) Disconnect the battery cable, and then remove the battery from the vehicle body.
- 6) Remove the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.> <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 7) Remove the under cover.
- 8) Remove the radiator from the vehicle. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>
- 9) Disconnect the A/C pressure hoses from A/C compressor.
- 10) Remove the air intake chamber stay.



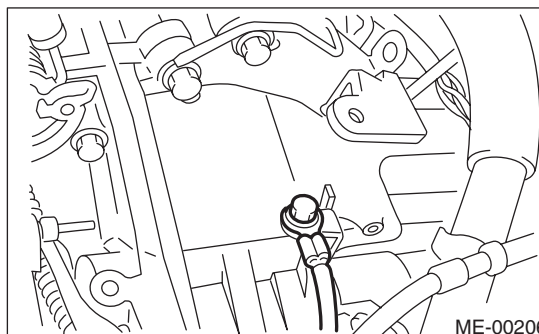
- 11) Disconnect the following connectors and cables.

- (1) Front oxygen (A/F) sensor connector
- (2) Rear oxygen sensor connector

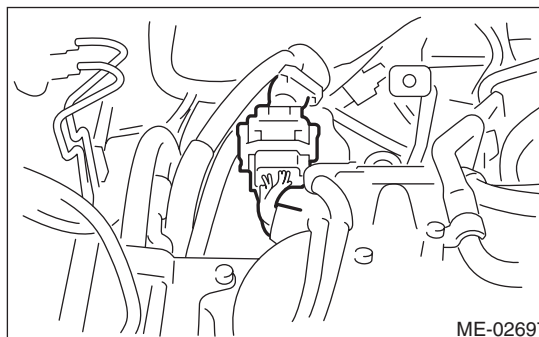


- (A) Front oxygen (A/F) sensor connector
- (B) Rear oxygen sensor connector

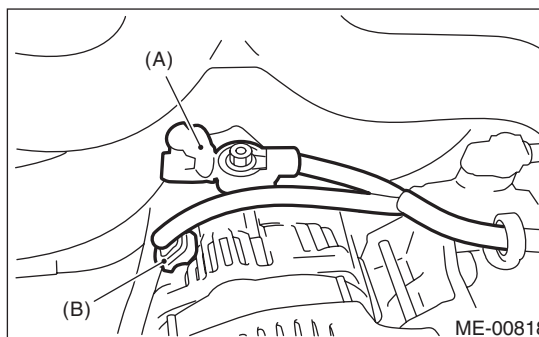
- (3) Engine ground terminal



- (4) Engine harness connectors



- (5) Generator connector and terminal

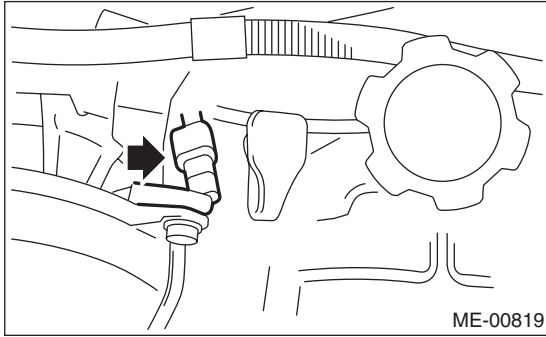


- (A) Terminal
- (B) Generator connector

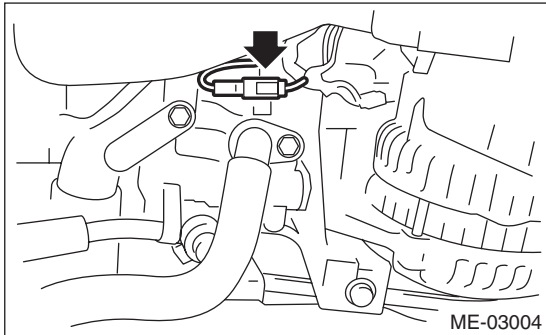
# Engine Assembly

## MECHANICAL

### (6) A/C compressor connector

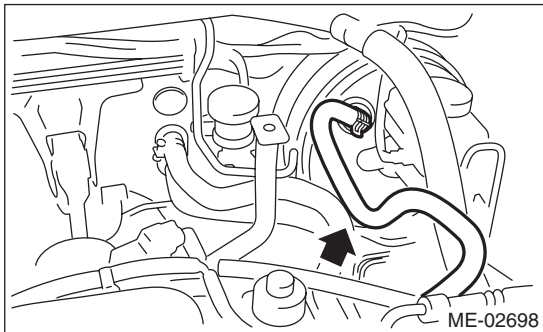


### (7) Power steering switch connector



### 12) Disconnect the following hoses.

#### (1) Brake booster vacuum hose

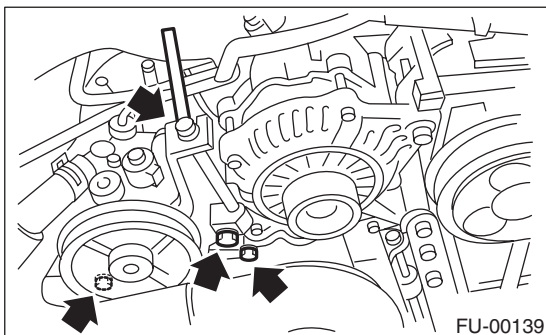


#### (2) Heater inlet and outlet hoses

### 13) Remove the power steering pump.

(1) Remove the front side belts. <Ref. to ME(H4SO)-37, FRONT SIDE BELT, REMOVAL, V-belt.>

(2) Remove the bolts which secure the power steering pump to the bracket.



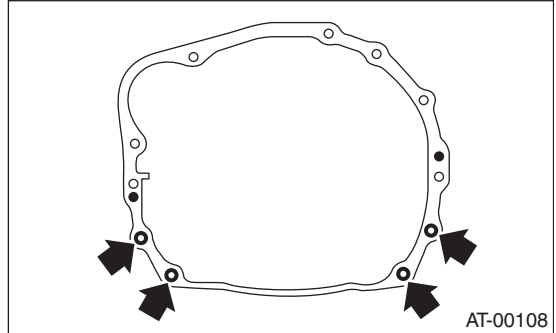
(3) Place the power steering pump on the right side wheel apron.

14) Lift up the vehicle.

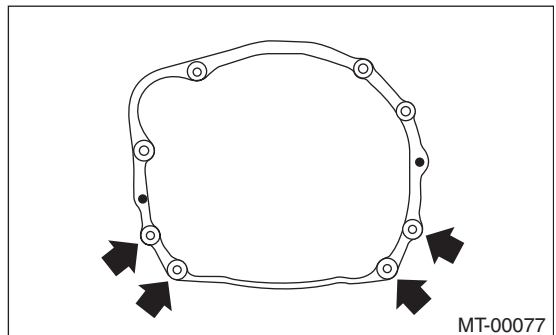
15) Remove the front and center exhaust pipes. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

16) Remove the bolts and nuts which hold lower side of transmission to engine.

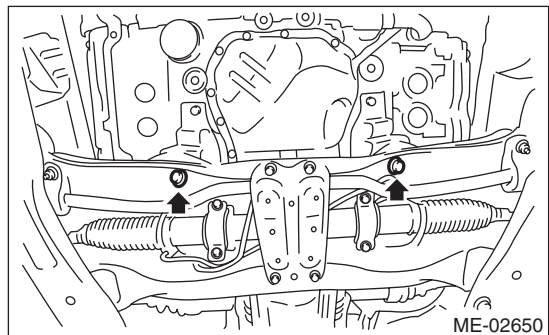
• AT model



• MT model

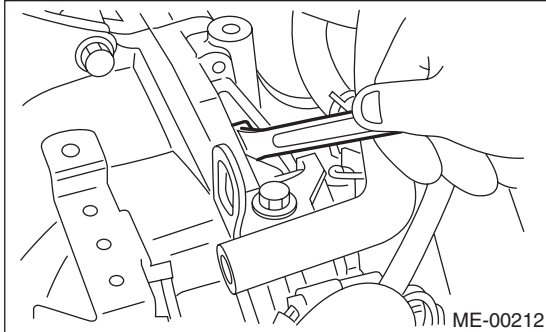


17) Remove the nuts which install front cushion rubber onto front crossmember.

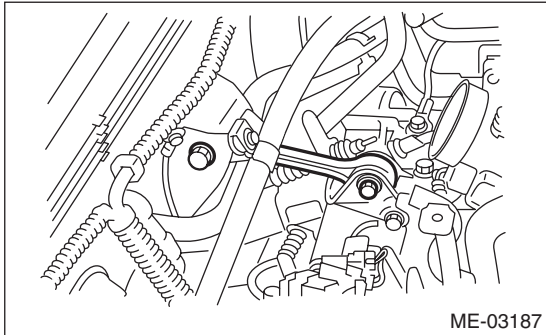


18) Separate the torque converter clutch from drive plate. (AT model)

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold torque converter clutch to drive plate.
- (4) Remove all bolts while turning the crankshaft with a socket wrench.



19) Remove the pitching stopper.



20) Disconnect the fuel hoses from fuel pipe.

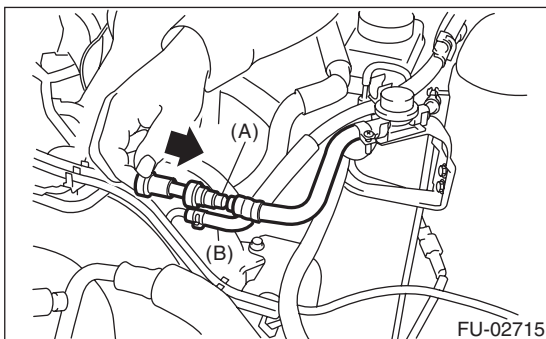
- (1) Disconnect the quick connector on the fuel delivery line by pushing the ST in the direction of the arrow.

ST 42099AE000 CONNECTOR REMOVER

- (2) Remove the clip and disconnect the evaporation hose from the pipe.

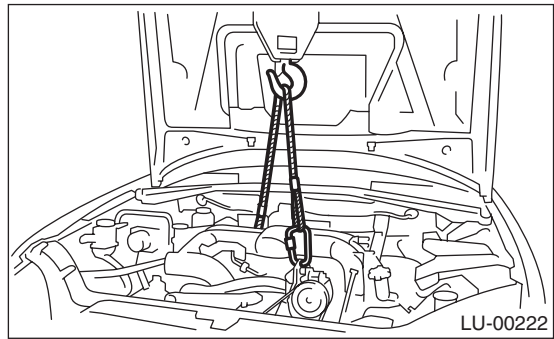
**CAUTION:**

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



- (A) Fuel delivery hose
- (B) Evaporation hose

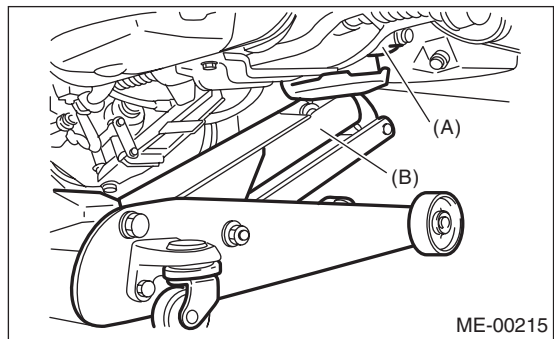
21) Support the engine with a lifting device and wire ropes.



22) Support the transmission with a garage jack.

**CAUTION:**

Doing this is very important to prevent the transmission from lowering due to its own weight.



- (A) Transmission
- (B) Garage jack

# Engine Assembly

## MECHANICAL

23) Separation of engine and transmission.

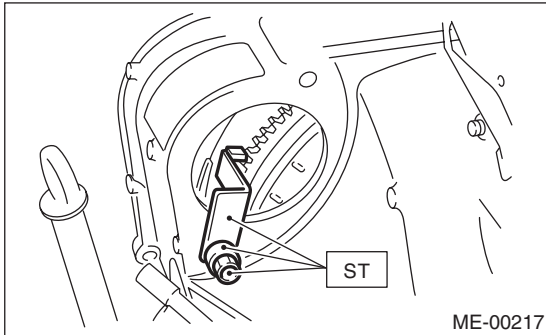
### CAUTION:

**Before removing the engine away from transmission, check to be sure no work has been overlooked.**

(1) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>

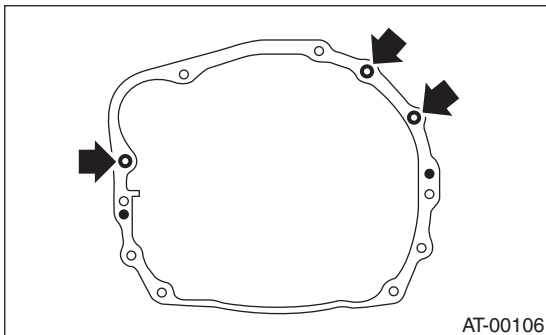
(2) Set the ST to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

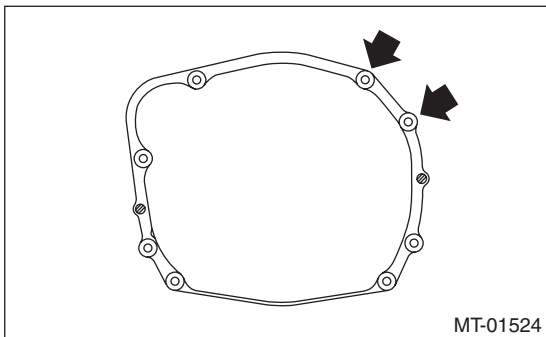


(3) Remove the bolts which hold upper side of transmission to engine.

- AT model



- MT model



24) Remove the engine from vehicle.

(1) Slightly raise the engine.

(2) Raise the transmission with garage jack.

(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.

(4) Slowly move the engine away from engine compartment.

### NOTE:

Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

25) Remove the front cushion rubbers.

## B: INSTALLATION

1) Install the front cushion rubbers to engine.

### Tightening torque:

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

2) Apply a small amount of grease to splines of main shaft. (MT model)

3) Position the engine in engine compartment and align it with transmission.

### NOTE:

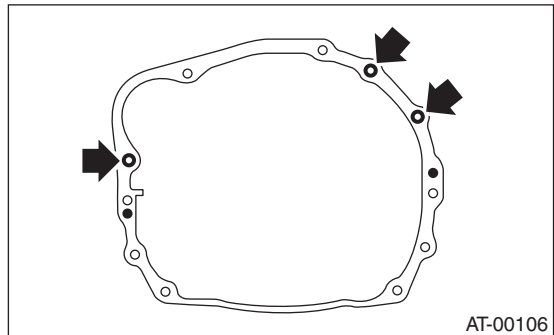
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

4) Tighten the bolts which hold upper side of transmission to engine.

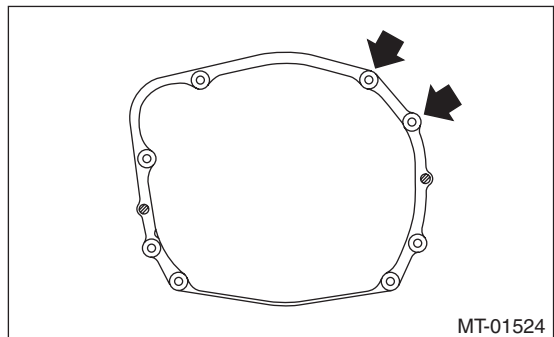
### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

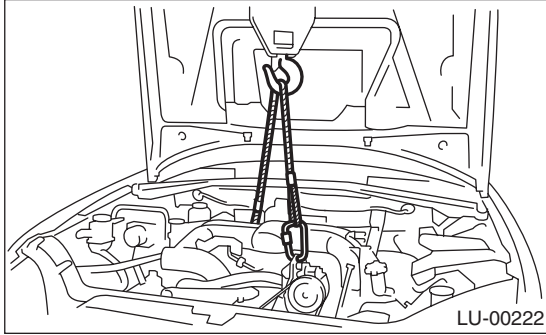
- AT model



- MT model



- 5) Remove the lifting device and wire ropes.

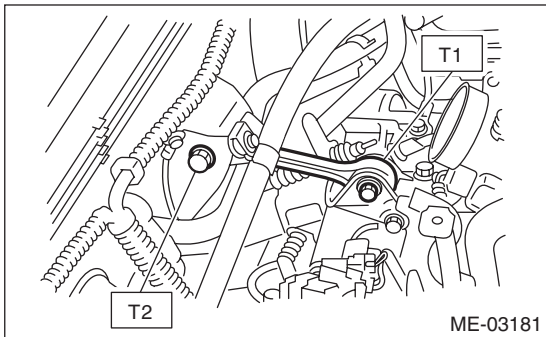


- 6) Remove the garage jack.  
7) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 8) Remove the ST from the torque converter clutch case. (AT model)

**NOTE:**

Be careful not to drop the ST into the torque converter clutch case when removing the ST.

ST 498277200 STOPPER SET

- 9) Install the starter. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>

- 10) Install the torque converter clutch to drive plate. (AT model)

(1) Tighten the bolts which hold torque converter clutch to drive plate.

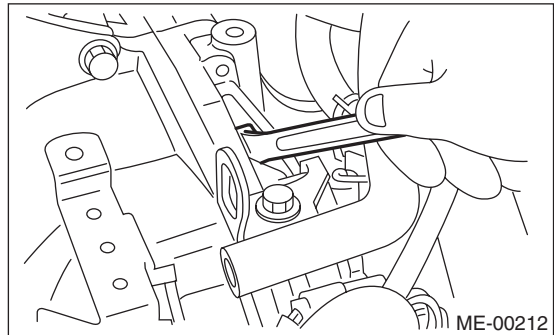
(2) Tighten other bolts while rotating the crankshaft using socket wrench.

**NOTE:**

Be careful not to drop bolts into the torque converter clutch housing.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



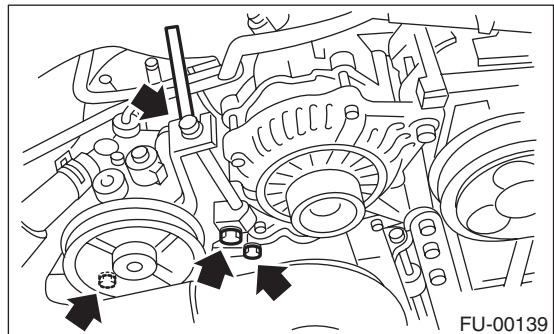
(3) Install the service hole plug.

- 11) Install the power steering pump.

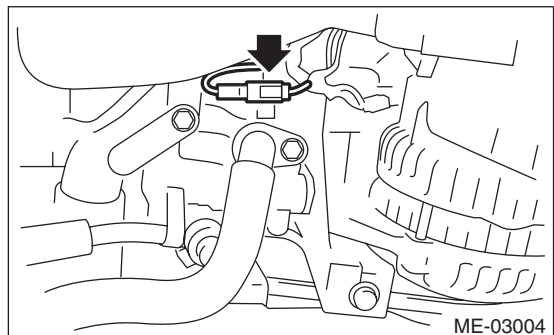
(1) Install the power steering pump to the bracket.

**Tightening torque:**

**Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-4, COMPONENT, General Description.>**



- (2) Connect the power steering switch connector.



- (3) Install and adjust the front side belt. <Ref. to ME(H4SO)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>



# Engine Assembly

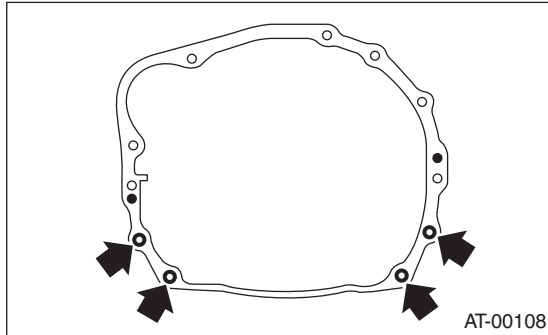
## MECHANICAL

- 12) Lift up the vehicle.
- 13) Tighten the bolts and nuts which hold lower side of the transmission to engine.

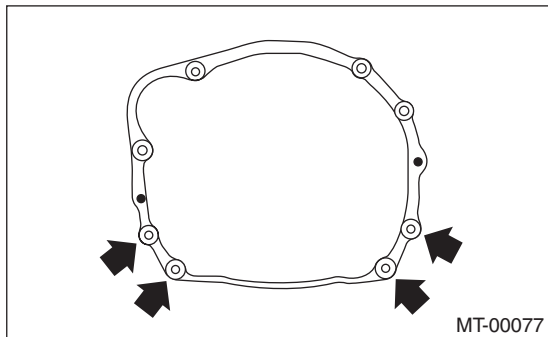
### **Tightening torque:**

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

- AT model



- MT model



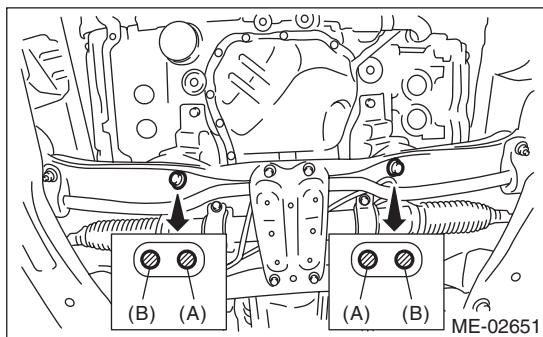
- 14) Tighten the nuts which install the front cushion rubber onto crossmember.

### **NOTE:**

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.

### **Tightening torque:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**



- 15) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 16) Lower the vehicle.
- 17) Connect the following hoses.
  - (1) Fuel delivery hose and evaporation hose
  - (2) Heater inlet and outlet hoses
  - (3) Brake booster vacuum hose

- 18) Connect the following connectors and terminals.

- (1) Front oxygen (A/F) sensor connector
- (2) Rear oxygen sensor connector
- (3) Engine harness connectors
- (4) Generator connector and terminal
- (5) A/C compressor connector

- 19) Install the air intake chamber stay.

### **Tightening torque:**

**16 N·m (1.6 kgf-m, 11.8 ft-lb)**

- 20) Tighten the engine ground cable.

### **Tightening torque:**

**14 N·m (1.4 kgf-m, 10.1 ft-lb)**

- 21) Install the A/C pressure hoses. <Ref. to AC-39, INSTALLATION, Hose and Tube.>
- 22) Install the radiator to vehicle. <Ref. to CO(H4SO)-19, INSTALLATION, Radiator.>
- 23) Install the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
- 24) Install the under cover.
- 25) Install the battery in the vehicle, and connect cables.
- 26) Fill engine coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 27) Check the ATF level and replenish it if necessary. <Ref. to 4AT-28, INSPECTION, Automatic Transmission Fluid.>
- 28) Charge the A/C system with refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>
- 29) Remove the front hood stay, and close the front hood.
- 30) Lower the vehicle from the lift.

## **C: INSPECTION**

- 1) Check that pipes, hoses, connectors and clamps are installed firmly.
- 2) Check the engine coolant is at specified level.
- 3) Check the ATF is at specified level. (AT model)
- 4) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

## 10.Engine Mounting

### A: REMOVAL

- 1) Remove the engine unit. <Ref. to ME(H4SO)-29, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

##### *Engine mounting*

*35 N·m (3.6 kgf·m, 25.8 ft-lb)*

### C: INSPECTION

Make sure that no crack or other damages do not exist.

## 11. Preparation for Overhaul

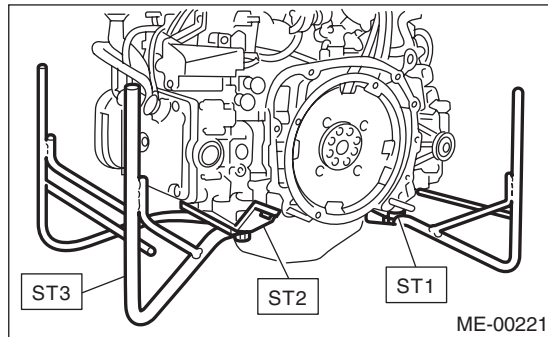
### A: PROCEDURE

1) After removing the engine from body, secure it to ST in the following procedure.

ST1 498457000 ENGINE STAND ADAPTER  
RH

ST2 498457100 ENGINE STAND ADAPTER  
LH

ST3 499817100 ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process.

Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

## 12.V-belt

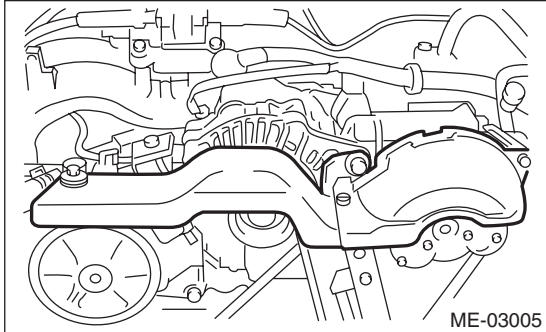
### A: REMOVAL

#### NOTE:

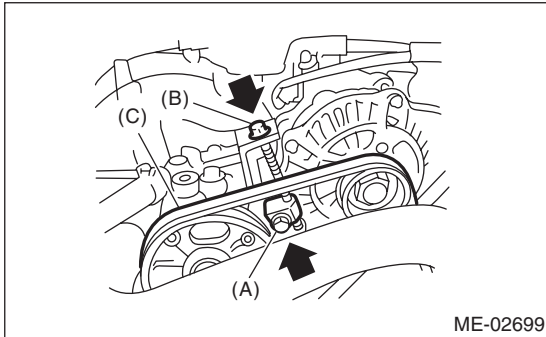
Perform the work with the engine installed to body when replacing a single part.

#### 1. FRONT SIDE BELT

- 1) Remove the V-belt covers.

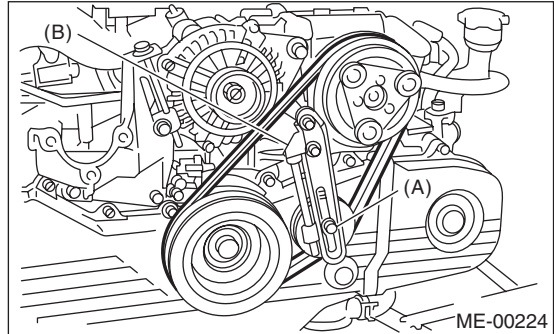


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).

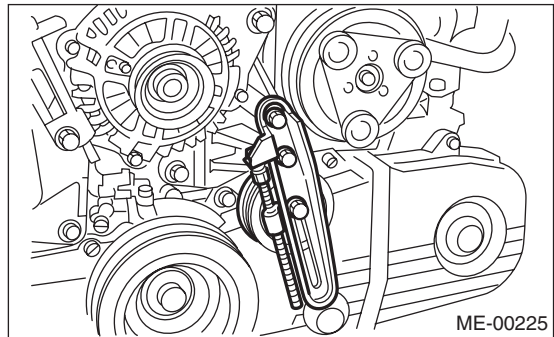


#### 2. REAR SIDE BELT

- 1) Remove the front side belts. <Ref. to ME(H4SO)-37, FRONT SIDE BELT, REMOVAL, V-belt.>
- 2) Loosen the lock nut (A).
- 3) Loosen the slider bolt (B).



- 4) Remove the rear side belt.
- 5) Remove the belt tensioner.



## B: INSTALLATION

### NOTE:

Wipe off any oil and water on the belt and pulley.

### 1. FRONT SIDE BELT

- 1) Install the front side belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4SO)-39, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

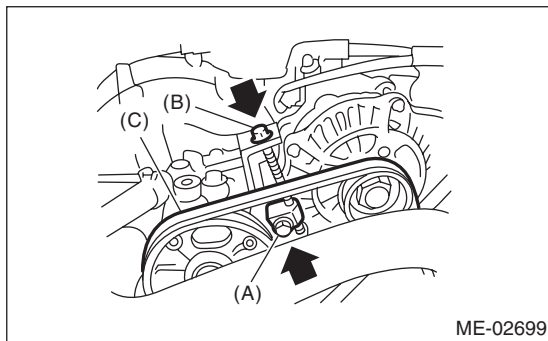
#### **Tightening torque:**

##### **Lock bolt (A)**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

##### **Slider bolt (B)**

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**



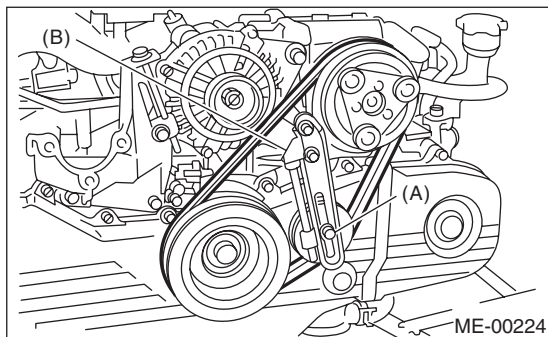
### 2. REAR SIDE BELT

- 1) Install the belt tensioner.
- 2) Install the rear side belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-39, INSPECTION, V-belt.>
- 3) Tighten the lock nut (A).

#### **Tightening torque:**

##### **Lock nut (A)**

**23 N·m (2.3 kgf-m, 17.0 ft-lb)**



- 4) Install the front side belt. <Ref. to ME(H4SO)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

## C: INSPECTION

- 1) Replace the belts, if crack, fraying or wear is found.
- 2) Remove the V-belt cover and reservoir tank. (with belt tension gauge)
- 3) Check the V-belt tension and adjust it if necessary by changing the generator installing position or idler pulley installing position.

### Belt tension (with belt tension gauge):

#### (A)

**When installing new parts:**

**640 — 780 N (65 — 80 kgf, 144 — 175 lb)**

**At inspection**

**490 — 640 N (50 — 65 kgf, 110 — 144 lb)**

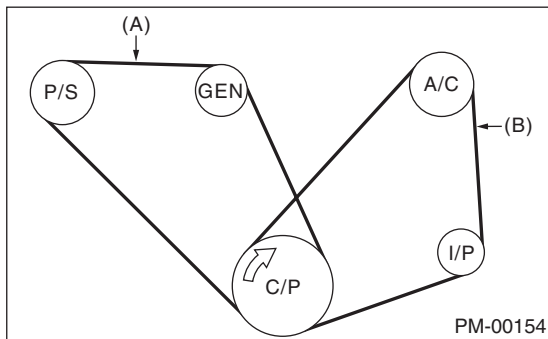
#### (B)

**When installing new parts:**

**650 — 750 N (66 — 76 kgf, 146 — 169 lb)**

**At inspection**

**350 — 450 N (36 — 46 kgf, 78 — 101 lb)**



- (A) Front side belt
- (B) Rear side belt
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley

### Belt tension (without belt tension gauge):

#### (A)

**When installing new parts:**

**7 — 9 mm (0.276 — 0.354 in)**

**At inspection**

**9 — 11 mm (0.354 — 0.433 in)**

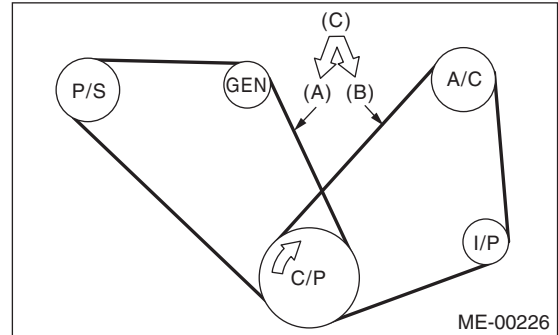
#### (B)

**When installing new parts:**

**7.5 — 8.5 mm (0.295 — 0.335 in)**

**At inspection**

**9.0 — 10.0 mm (0.354 — 0.394 in)**



- (A) Front side belt
- (B) Rear side belt
- (C) 98 N (10 kg, 22 lbf)
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley

## 13.Crank Pulley

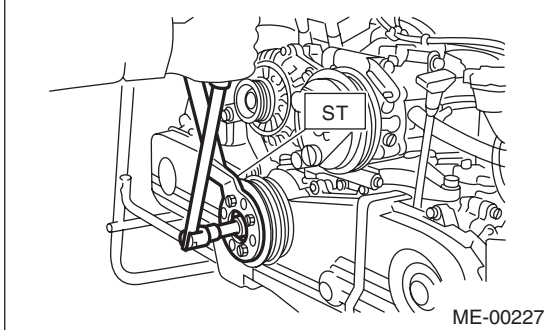
### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH



- 3) Remove the crank pulley.

### B: INSTALLATION

- 1) Install the crank pulley.
- 2) Install the pulley bolt.

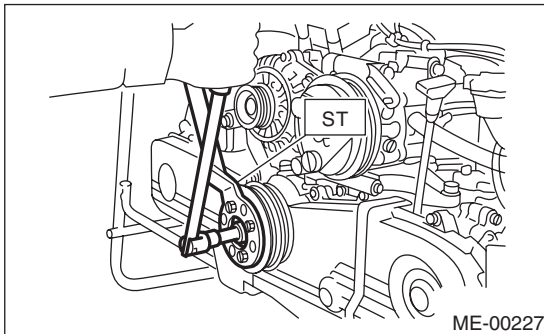
To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH

- (1) Clean the crankshaft thread using compressed air.
- (2) Apply engine oil to the crank pulley bolt seat and thread.
- (3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 32.5 ft-lb).
- (4) Tighten the crank pulley bolts.

**Tightening torque:**

**180 N·m (18.4 kgf-m, 132.8 ft-lb)**



- 3) Check that the tightening angle of the crank pulley bolt is 65° or more. Perform the following procedures when less than 65°.

**CAUTION:**

**If the tightening angle of crank pulley bolt is less than 65°, the bolt is damaged. In this case, the bolt must be replaced.**

- (1) Replace the crank pulley bolts and clean them.

**Crank pulley bolt:**

**Part No. 12369AA011**

- (2) Clean the crankshaft thread using compressed air.
- (3) Apply engine oil to the crank pulley bolt seat and thread.
- (4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 32.5 ft-lb).
- (5) Tighten the crank pulley bolts 65° to 75°.

**NOTE:**

Conduct the tightening procedures by confirming the turning angle of crank pulley bolt referring to the gauge indicated on timing belt cover.

- 4) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Make sure the V-belt is not worn or otherwise damaged.
- 2) Check the tension of the belt. <Ref. to ME(H4SO)-39, INSPECTION, V-belt.>

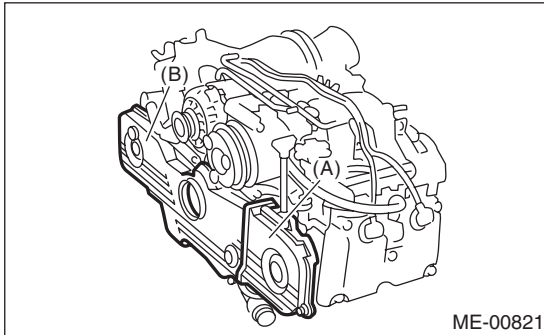
## 14. Timing Belt Cover

### A: REMOVAL

#### NOTE:

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover (LH).
- 4) Remove the front timing belt cover.



- (A) Timing belt cover (LH)  
(B) Front timing belt cover

### B: INSTALLATION

- 1) Install the front timing belt cover.

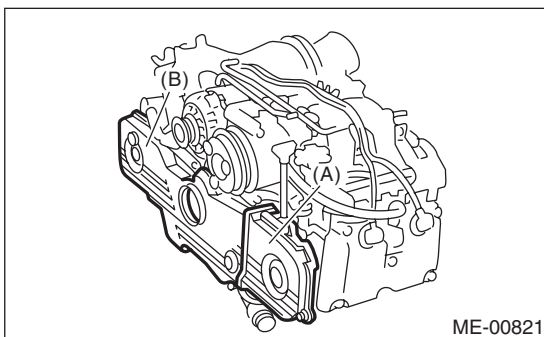
#### **Tightening torque:**

**5 N·m (0.5 kgf·m, 3.7 ft·lb)**

- 2) Install the timing belt cover (LH).

#### **Tightening torque:**

**5 N·m (0.5 kgf·m, 3.7 ft·lb)**



- (A) Timing belt cover (LH)  
(B) Front timing belt cover

- 3) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>
- 4) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

### C: INSPECTION

Check the cover for damage.



# Timing Belt

MECHANICAL

## 15. Timing Belt

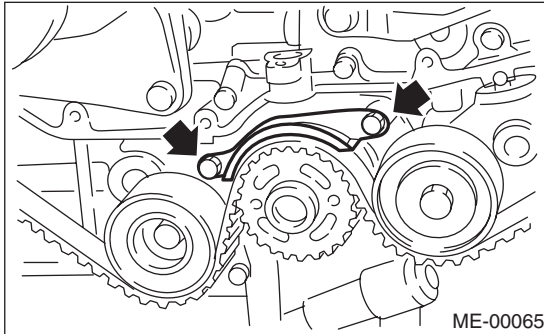
### A: REMOVAL

#### NOTE:

Perform the work with the engine installed to body when replacing a single part. For operation procedures, refer to "Timing Belt" in the PM section. <Ref. to PM-17, Timing Belt.>

#### 1. TIMING BELT

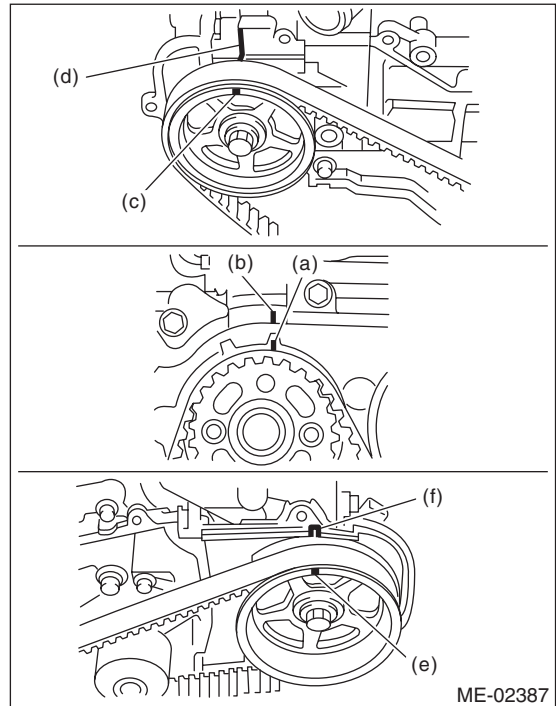
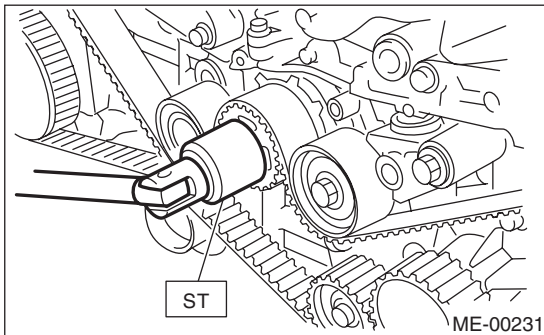
- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt guide. (MT model)



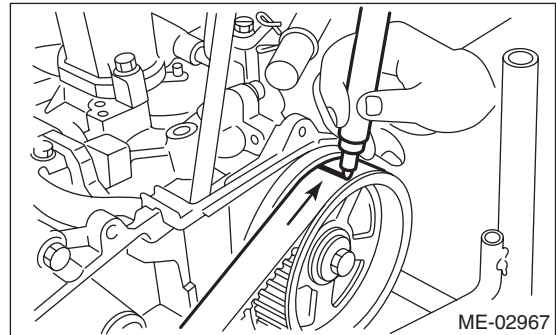
5) If the alignment mark (a) or arrow mark (which indicates rotation direction) on the timing belt has faded away, put new marks on the belt before removing as shown in procedures below.

- (1) Use the ST to turn crankshaft. Align the mark (a) of sprocket to the cylinder block notch (b), and then ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) or left side cam sprocket mark (e), timing belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET

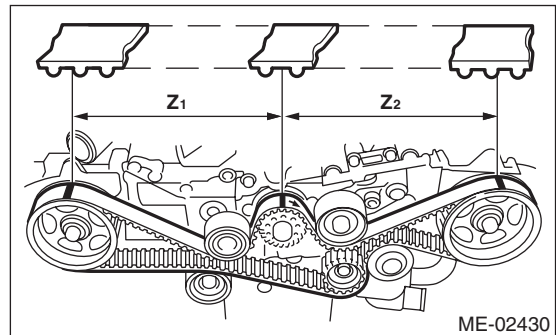


(2) Using white paint, put an alignment mark or an arrow mark on timing belts in relation to the crank sprocket and cam sprockets.

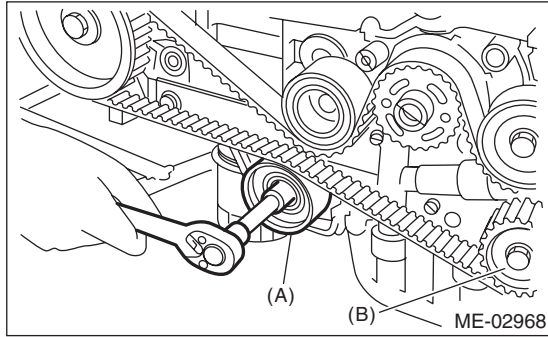


**$Z_1$ : 46.8 teeth**

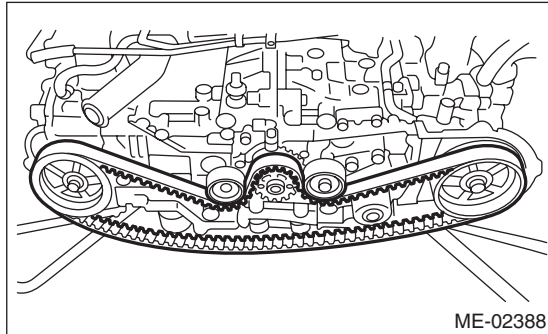
**$Z_2$ : 43.7 teeth**



- 6) Remove the belt idler (A).
- 7) Remove the belt idler (B).

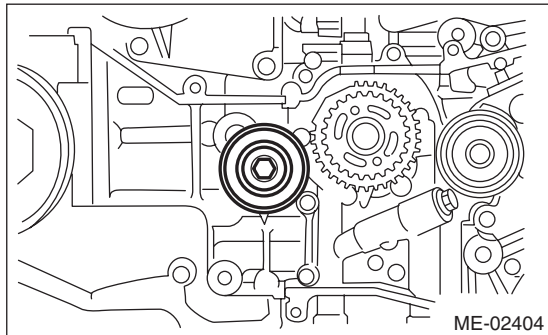


- 8) Remove the timing belt.

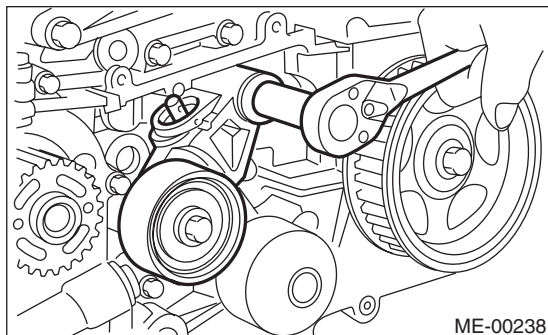


## 2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

- 1) Remove the belt idler (No. 1).



- 2) Remove the automatic belt tension adjuster assembly.



## B: INSTALLATION

### 1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

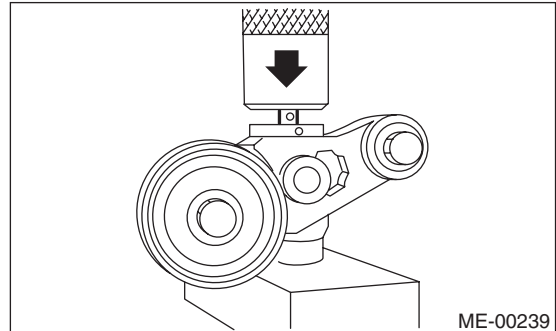
- 1) Prepare for installation of automatic belt tension adjuster assembly.

#### CAUTION:

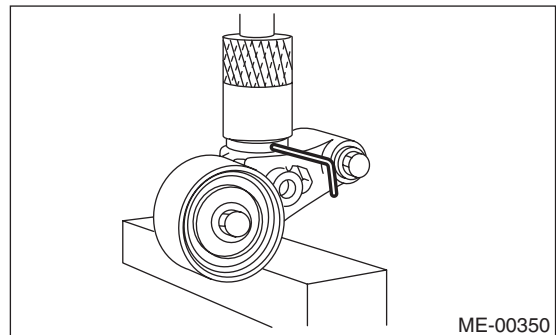
- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking three minutes or more.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Push in the adjuster rod to the end face of the cylinder. However, do not push in the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
- Do not release the press pressure until stopper pin is completely inserted.

- (1) Attach the automatic belt tension adjuster assembly to vertical pressing tool.

- (2) Slowly move the adjuster rod down with a pressure of 165 N (16.8 kgf, 37.1 lb) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.



- (3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.



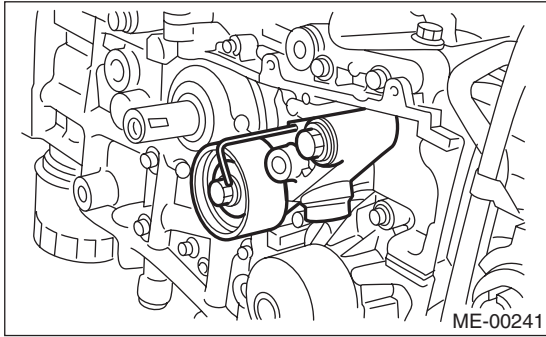
# Timing Belt

## MECHANICAL

2) Install the automatic belt tension adjuster assembly.

**Tightening torque:**

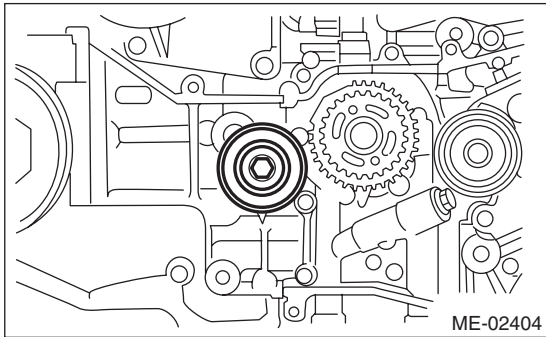
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**



3) Install the belt idler (No. 1).

**Tightening torque:**

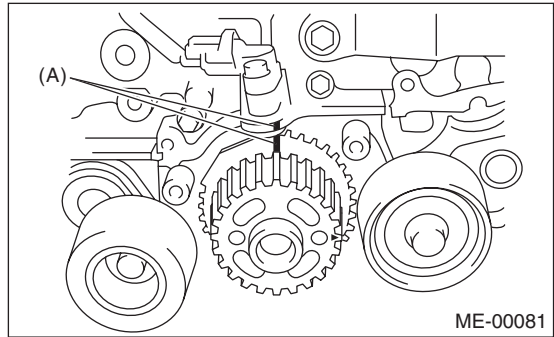
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**



## 2. TIMING BELT

1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-43, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

2) Align the mark (A) on crank sprocket with the mark on oil pump cover at cylinder block.

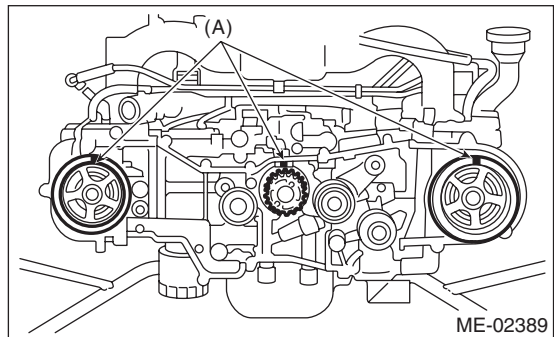


3) Turn the cam sprocket No. 1 and No. 2 using the ST1, and position the alignment marks (A) on each at the highest positions.

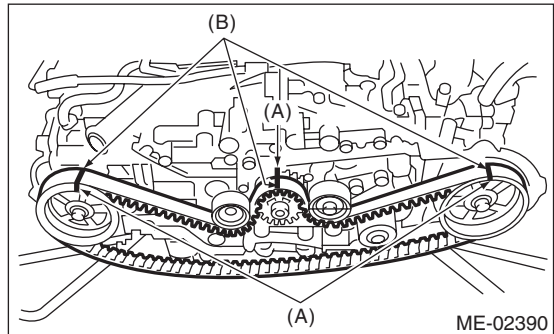
ST1 18231AA010 CAM SPROCKET WRENCH

NOTE:

CAMSHAFT SPROCKET WRENCH (499207100) can also be used.



4) While aligning the alignment mark (B) on timing belt with the mark (A) on sprockets, position the timing belt properly.



5) Install the belt idler (B).

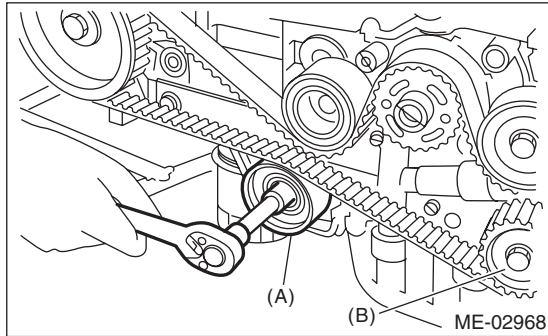
**Tightening torque:**

**39 N·m (4.0 kgf·m, 28.8 ft·lb)**

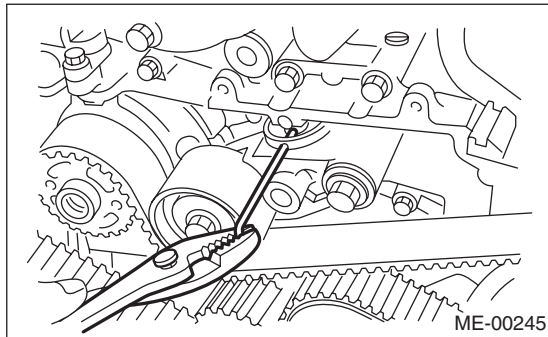
6) Install the belt idler (A).

**Tightening torque:**

**39 N·m (4.0 kgf·m, 28.8 ft·lb)**

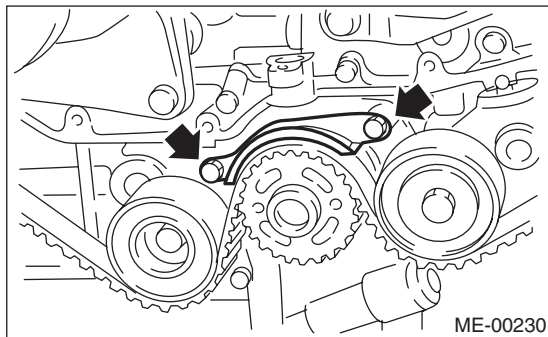


7) After ensuring the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tension adjuster.



8) Install the timing belt guide. (MT model)

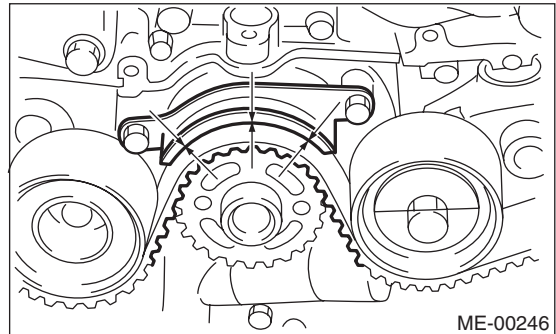
(1) Temporarily tighten the bolts mounting the timing belt guide.



(2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

**Clearance:**

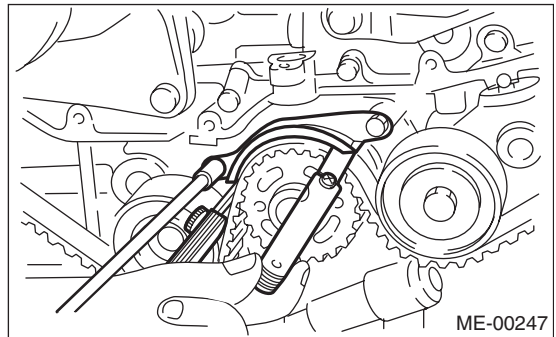
**1.0±0.5 mm (0.039±0.020 in)**



(3) Tighten the bolts mounting the timing belt guide.

**Tightening torque:**

**9.75 N·m (1.0 kgf·m, 7.2 ft·lb)**



9) Install the timing belt cover.

<Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>

10) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>

11) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

# Timing Belt

MECHANICAL

## C: INSPECTION

### 1. TIMING BELT

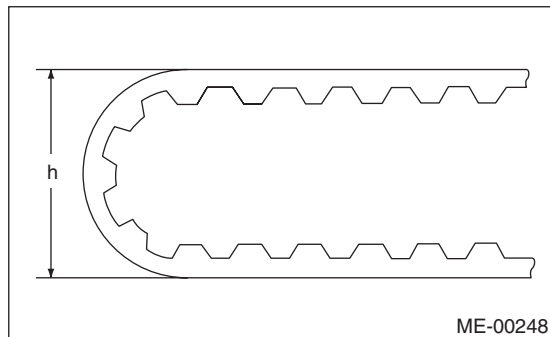
- 1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.
- 2) Check the condition on the back surface of the timing belt. If cracks are found, replace the belt.

#### CAUTION:

- Be careful not to let oil, grease or coolant contact the timing belt. Remove quickly and thoroughly if this happens.
- Do not bend the timing belt sharply.

*In radial diameter h:*

**60 mm (2.36 in) or more**



### 2. AUTOMATIC BELT TENSION ADJUSTER

- 1) Visually check the oil seals for leaks, and rod ends for abnormal wear and scratches. If necessary, replace the automatic belt tension adjuster assembly.

#### NOTE:

Slight traces of oil at rod's oil seal does not indicate a problem.

- 2) Check that the adjuster rod does not move when a pressure of 165 N (16.8 kgf, 37.1 lb) is applied to it. This is to check adjuster rod stiffness.

- 3) If the adjuster rod is not stiff and moves freely when applying 165 N (16.8 kgf, 37.1 lb), check it using the following procedures:

- (1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.

- (2) With the adjuster rod moved all the way up, apply a pressure of 165 N (16.8 kgf, 37.1 lb) to it. Check the adjuster rod stiffness.

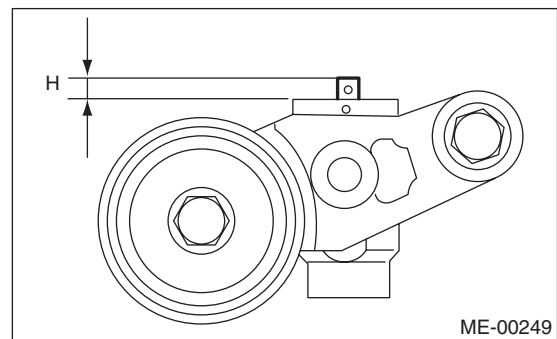
- (3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new part.

#### CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
  - Do not use a lateral type vise.
  - Push the adjuster rod vertically.
  - Press the adjuster rod gradually taking three minutes or more.
  - Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
  - Push in the adjuster rod to the end face of the cylinder. However, do not push in the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
- 4) Measure the amount of rod protrusion "H" from the end surface of the body. If it is not within specified range, replace with new part.

**Amount of rod protrusion H:**

**5.2 — 6.2 mm (0.204 — 0.244 in)**



### 3. BELT TENSION PULLEY

- 1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly if faulty.
- 2) Check the belt tension pulley for smooth rotation. Replace if noise or excessive play occurs.
- 3) Check the belt tension pulley for grease leakage.

### 4. BELT IDLER

- 1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.
- 2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.
- 3) Check the belt idler for grease leakage.

## 16. Cam Sprocket

### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part.

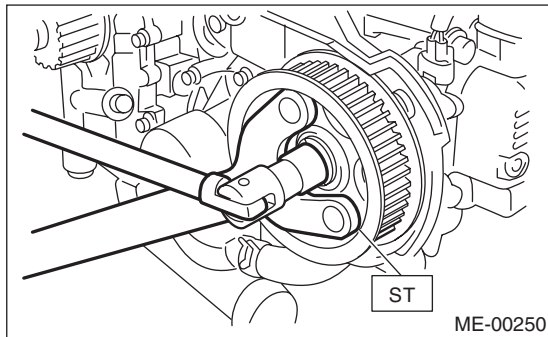
- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 5) Remove the camshaft position sensor. <Ref. to FU(H4SO)-22, REMOVAL, Camshaft Position Sensor.>

6) Fasten the cam sprocket and remove from the cam shaft using ST.

ST 18231AA010 CAM SPROCKET WRENCH

**NOTE:**

CAMSHAFT SPROCKET WRENCH (499207100) can also be used.



### B: INSTALLATION

1) Fasten the cam sprocket and install to the cam shaft using ST.

ST 18231AA010 CAM SPROCKET WRENCH

**NOTE:**

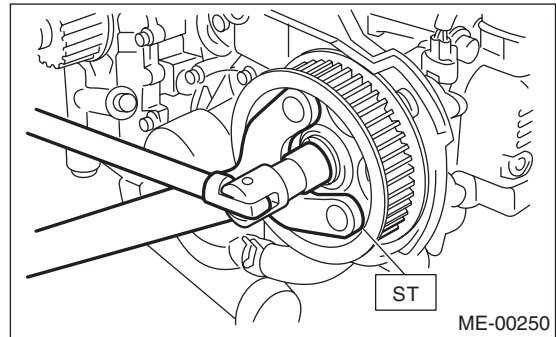
CAMSHAFT SPROCKET WRENCH (499207100) can also be used.

**Tightening torque:**

**78 N·m (8.0 kgf·m, 57.5 ft·lb)**

**NOTE:**

Do not confuse left and right side cam sprockets during installation. They should be distinguished by the L or R indication.



2) Install the camshaft position sensor. <Ref. to FU(H4SO)-22, INSTALLATION, Camshaft Position Sensor.>

3) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>

4) Install the timing belt cover.

<Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>

5) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>

6) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

### C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.

2) Make sure there is no free play between cam sprocket and key.

3) Check the cam sprocket protrusion used for sensor for damage and contamination of foreign matter.

# Crank Sprocket

MECHANICAL

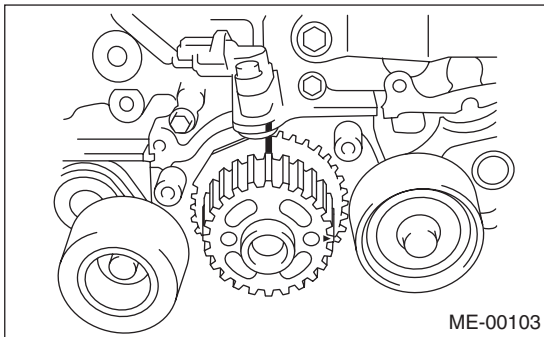
## 17. Crank Sprocket

### A: REMOVAL

NOTE:

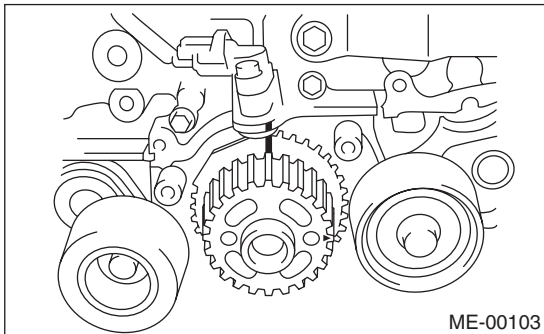
Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 5) Remove the crank sprocket.



### B: INSTALLATION

- 1) Install the crank sprocket.



- 2) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>
- 3) Install the timing belt cover. <Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>
- 4) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Check the crank sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between crank sprocket and key.
- 3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

## 18. Valve Rocker Assembly

### A: REMOVAL

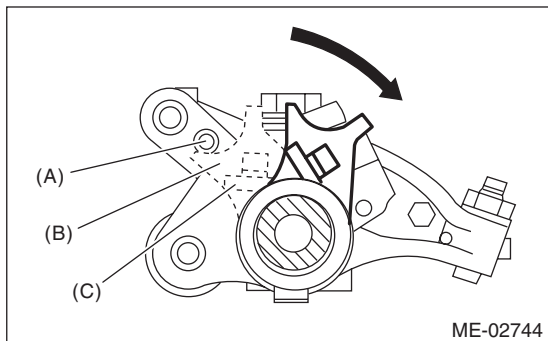
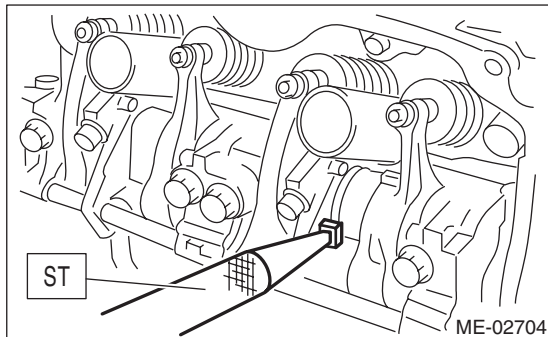
**NOTE:**

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4SO)-27, Valve Clearance.>

- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>
- 6) Disconnect the PCV hose and remove the rocker cover.
- 7) Remove the valve rocker assembly.

(1) Use the ST to rotate the spring stopper in the direction of the arrow to remove it from adjuster pin.

ST 18258AA000 SPRING INSTALLER

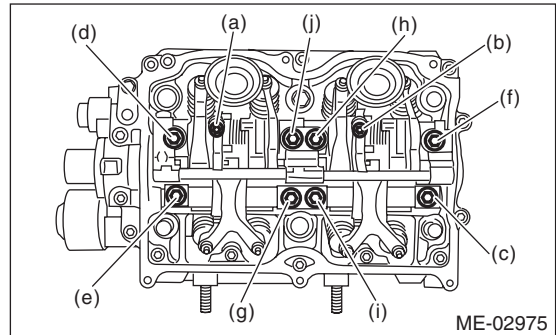


- (A) Adjuster pin
- (B) Spring stopper
- (C) Spring

(2) Remove the bolts (a) through (j) in alphabetical sequence.

**NOTE:**

Leave two or three threads of bolts (i) and (j) engaged in order to retain the valve rocker assembly.

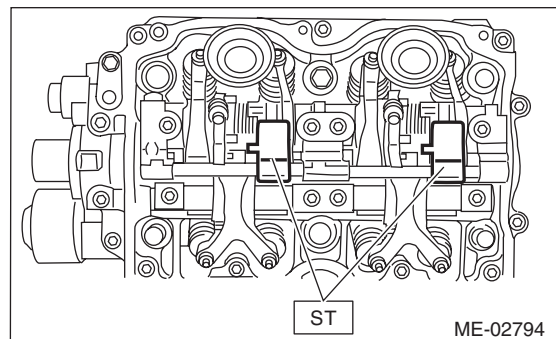


(3) Remove the valve rocker assembly.

**NOTE:**

Set the ST in the position shown in the drawing to remove the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER





# Valve Rocker Assembly

MECHANICAL

## B: INSTALLATION

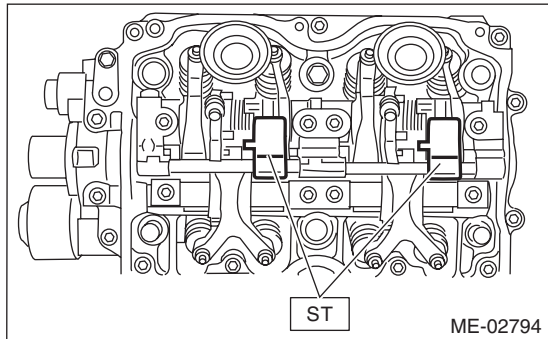
1) Install the valve rocker assembly.

(1) Temporarily tighten the bolts equally in alphabetical order as shown in the figure.

NOTE:

- Do not temporarily tighten the bolts (i) and (j).
- Set the ST in the position shown in the drawing to mount the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER



(2) Tighten the bolts (a) through (h) to specified torque.

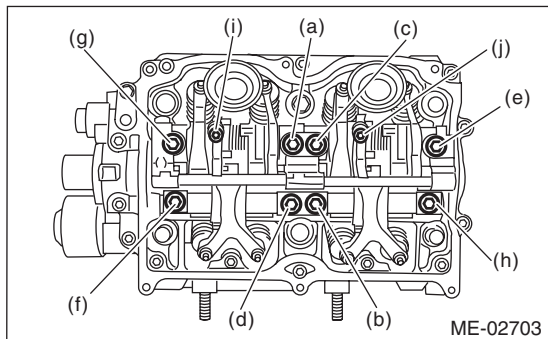
**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

(3) Tighten the bolts (i) through (j) to specified torque.

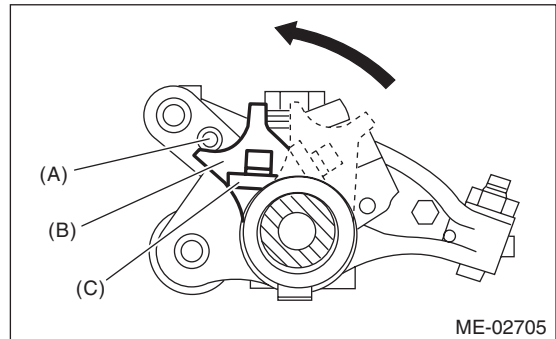
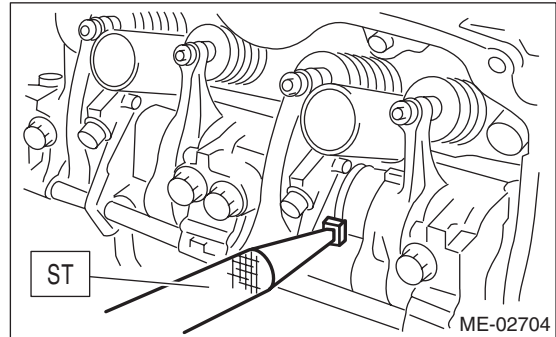
**Tightening torque:**

**6 N·m (0.6 kgf-m, 4.3 ft-lb)**



(4) Use the ST to rotate the spring stopper in the direction of the arrow to fasten the adjuster pin.

ST 18258AA000 SPRING INSTALLER



- (A) Adjuster pin
- (B) Spring stopper
- (C) Spring

2) Install the cam sprocket. <Ref. to ME(H4SO)-47, INSTALLATION, Cam Sprocket.>

3) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>

4) Adjust the valve clearance. <Ref. to ME(H4SO)-28, ADJUSTMENT, Valve Clearance.>

- 5) Install the rocker cover.  
 (1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

Use a new rocker cover gasket.

- (2) Tighten the bolts in two stages in alphabetical sequence as shown in figure.

**Tightening torque:**

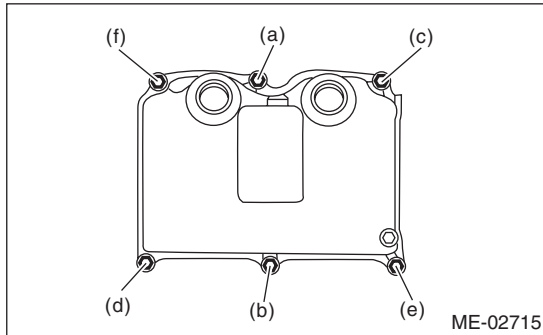
**1st**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

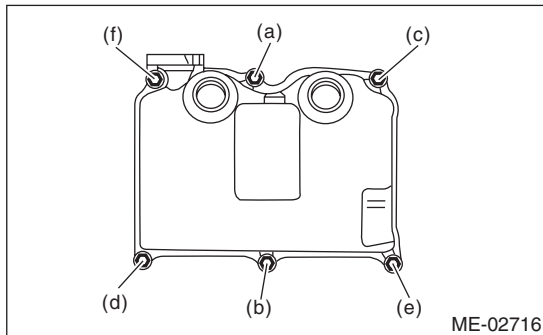
**2nd (only (a) and (b) are tightened)**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

RH side



LH side



- 6) Connect the PCV hose.  
 7) Install the timing belt cover.  
 <Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>  
 8) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>  
 9) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

## C: DISASSEMBLY

**NOTE:**

Intake valve rocker assembly cannot be disassembled.

- 1) Remove the exhaust valve rocker arm from the rocker shaft.

**NOTE:**

Keep all the removed parts in order for re-installing in their original positions.

- 2) Remove the nut and adjusting screw from exhaust valve rocker.

## D: ASSEMBLY

**NOTE:**

Intake valve rocker assembly cannot be disassembled.

- 1) Install the adjusting screw and nut to the exhaust valve rocker.

- 2) Insert the exhaust valve rocker arm to rocker shaft.

**NOTE:**

Valve rocker arms, and rocker shaft have identification marks. Make sure the parts with same markings are properly assembled.

# Valve Rocker Assembly

MECHANICAL

## E: INSPECTION

### 1. INTAKE VALVE ROCKER ASSEMBLY

- 1) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker assembly.
- 2) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker assembly.

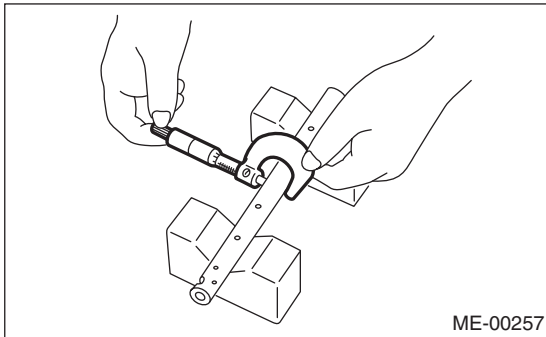
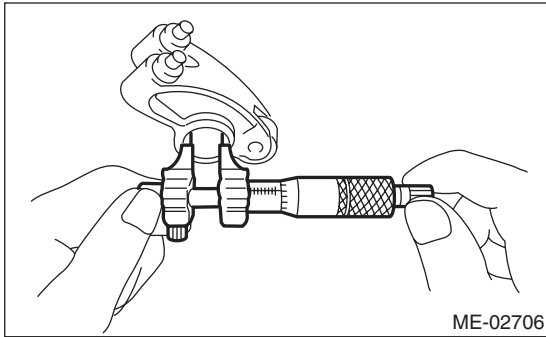
### 2. EXHAUST VALVE ROCKER ASSEMBLY

- 1) Measure the inner diameter of valve rocker arm and outer diameter of valve rocker shaft, and confirm the difference (oil clearance) between the two values.

**Clearance between arm and shaft:**

**Standard**

**0.020 — 0.054 mm (0.0008 — 0.0021 in)**



- 2) If the oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows the greater amount of wear.

**Rocker arm inside diameter:**

**22.020 — 22.041 mm (0.8669 — 0.8678 in)**

**Rocker shaft diameter:**

**21.987 — 22.000 mm (0.8656 — 0.8661 in)**

- 3) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm.
- 4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

## 19. Camshaft

### A: REMOVAL

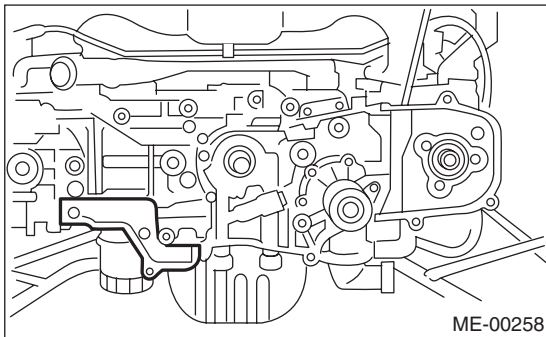
**NOTE:**

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4SO)-27, Valve Clearance.>

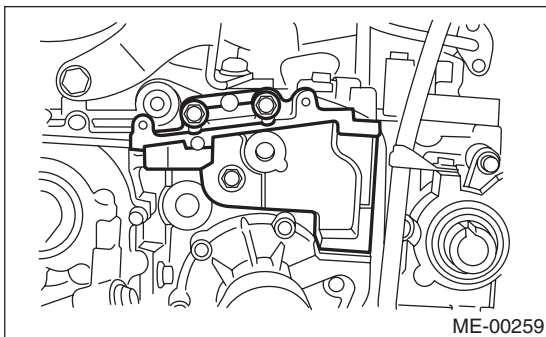
- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>
- 6) Remove the timing belt cover No. 2 (LH).
- 7) Remove the timing belt cover No. 2 (RH).

**NOTE:**

Do not damage or lose the seal rubber when removing the timing belt covers.



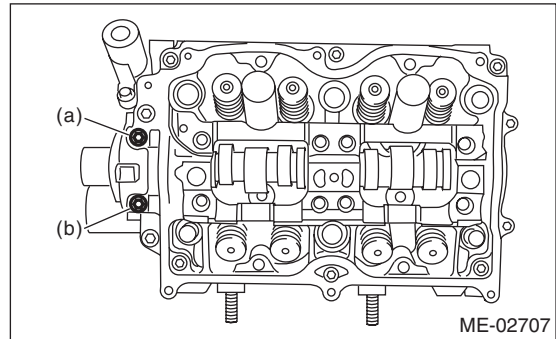
- 8) Remove the tensioner bracket.



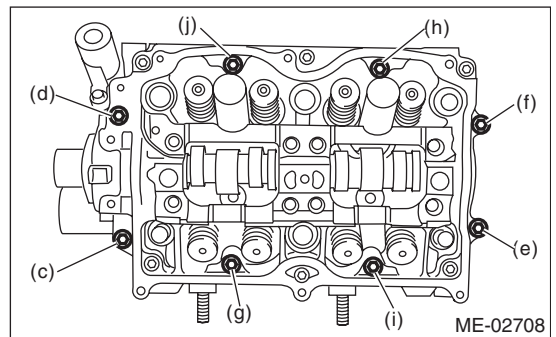
- 9) Remove the camshaft position sensor support. (LH side only)
- 10) Remove the valve rocker assembly. <Ref. to ME(H4SO)-49, REMOVAL, Valve Rocker Assembly.>

- 11) Remove the camshaft cap.

(1) Remove the bolts (a) and (b) in alphabetical sequence.

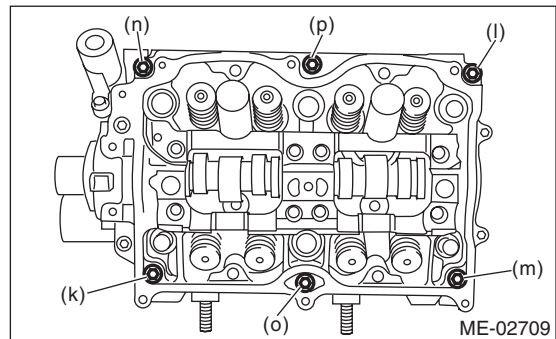


(2) Equally loosen the bolts (c) through (j) all the way in alphabetical sequence.



(3) Remove the bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX® PLUS



(4) Remove the camshaft cap.

12) Remove the camshaft.

13) Remove the oil seal.

14) Remove the plug from rear side of camshaft.

**CAUTION:**

**Do not scratch the journal surface when removing the oil seal.**

15) Similarly, remove the camshafts (RH) and related parts.

# Camshaft

MECHANICAL

## B: INSTALLATION

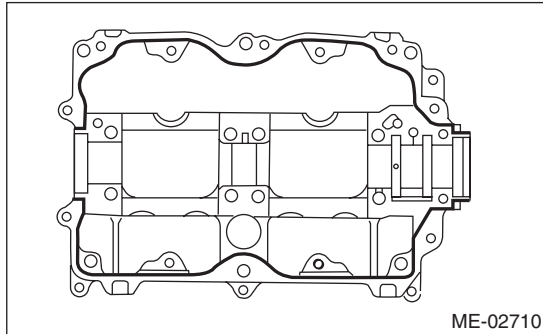
- 1) Apply a thin coat of engine oil to camshaft journals, and install the camshaft.
- 2) Install the camshaft cap.
  - (1) Apply liquid gasket to the mating surfaces of camshaft cap.

NOTE:

Install within 5 min. after applying liquid gasket.

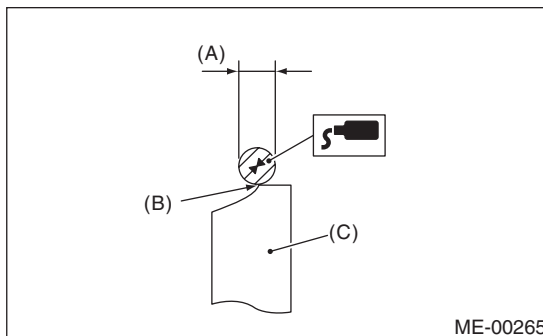
**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100)**

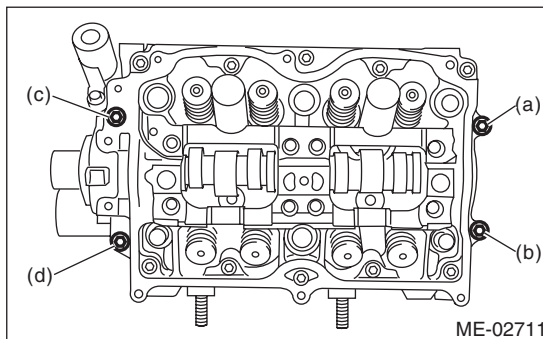


NOTE:

Apply a coat of liquid gasket of 3 mm (0.12 in) in diameter (A) along the edge (B) of camshaft cap (C) mating surface.



- (2) Temporarily tighten the bolts (a) through (d) in alphabetical sequence.

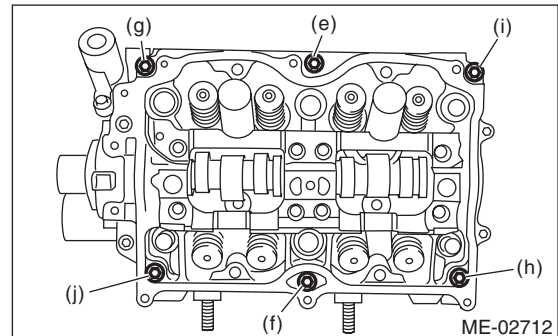


- (3) Install the valve rocker assembly.  
<Ref. to ME(H4SO)-50, INSTALLATION, Valve Rocker Assembly.>

- (4) Tighten the TORX® bolts (e) through (j) in alphabetical sequence using the ST.  
ST 499497000 TORX® PLUS

**Tightening torque:**

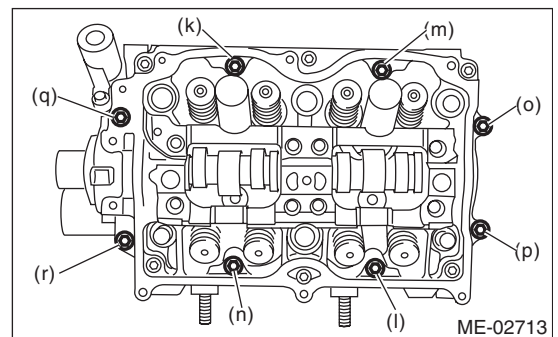
**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



- (5) Tighten the bolts (k) through (r) in alphabetical sequence.

**Tightening torque:**

**9.75 N·m (1.0 kgf·m, 7.2 ft·lb)**



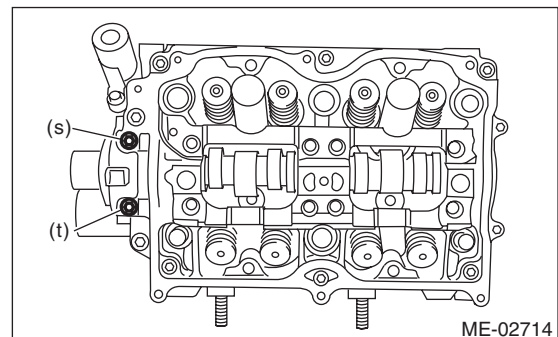
- (6) Tighten the bolts (s) and (t) in alphabetical sequence.

NOTE:

- Use a new seal washer.
- Install and tighten the seal washer to the bolt.

**Tightening torque:**

**9.75 N·m (1.0 kgf·m, 7.2 ft·lb)**

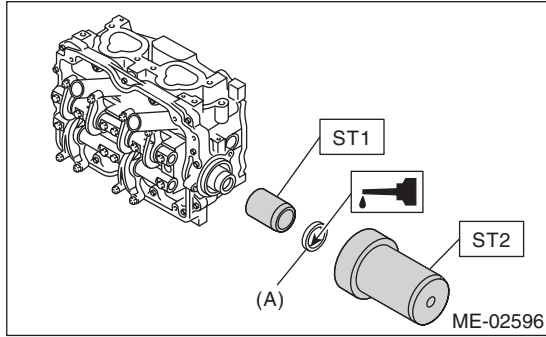


3) Apply a coat of engine oil to camshaft oil seal periphery and oil seal lips and install the oil seal (A) on camshaft using ST1 and ST2.

**NOTE:**

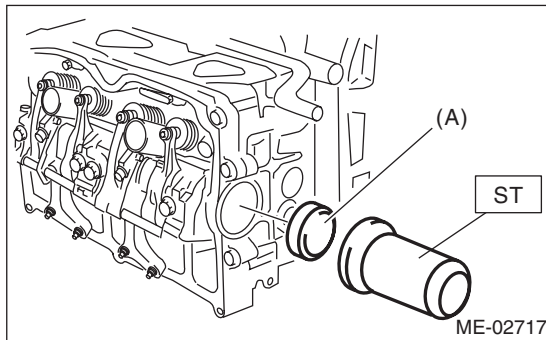
Use a new oil seal.

- ST1 499597000 OIL SEAL GUIDE
- ST2 499587500 OIL SEAL INSTALLER



4) Apply a coat of engine oil to plug periphery and install the plug (A) using ST.

- ST 499587700 CAMSHAFT OIL SEAL INSTALLER



5) Install the camshaft position sensor support. (LH side only)

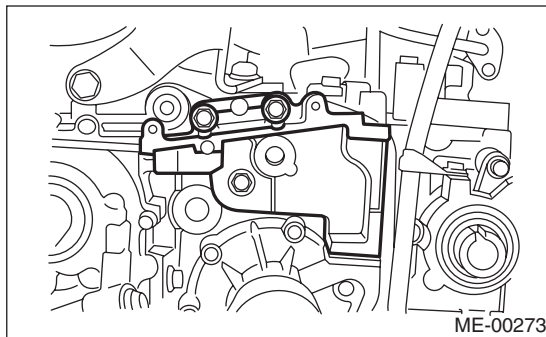
**Tightening torque:**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

6) Similarly, install the parts on right-hand side.  
7) Install the tensioner bracket.

**Tightening torque:**

**24.5 N-m (2.5 kgf-m, 18.1 ft-lb)**



8) Install the timing belt cover No. 2 (RH).

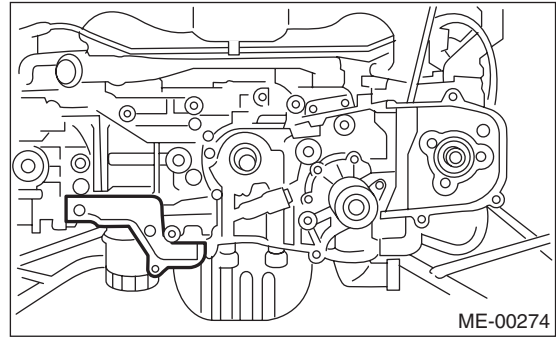
**Tightening torque:**

**5 N-m (0.5 kgf-m, 3.7 ft-lb)**

9) Install the timing belt cover No. 2 (LH).

**Tightening torque:**

**5 N-m (0.5 kgf-m, 3.7 ft-lb)**



10) Install the cam sprocket. <Ref. to ME(H4SO)-47, INSTALLATION, Cam Sprocket.>

11) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>

12) Adjust the valve clearance. <Ref. to ME(H4SO)-28, ADJUSTMENT, Valve Clearance.>

13) Install the rocker cover.

- (1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

Use a new rocker cover gasket.

- (2) Tighten the bolts in two stages in alphabetical sequence as shown in figure.

**Tightening torque:**

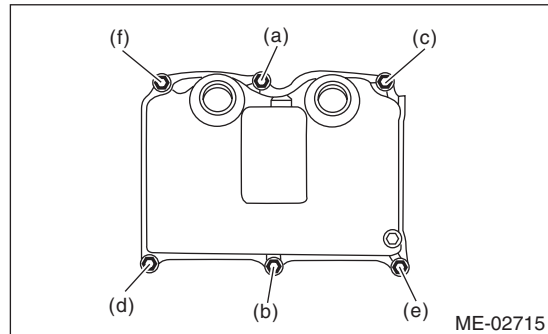
**1st**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

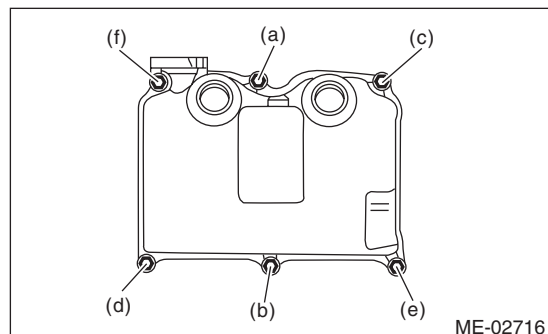
**2nd (only (a) and (b) are tightened)**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

RH side



LH side



# Camshaft

## MECHANICAL

- 14) Connect the PCV hose.
- 15) Install the timing belt cover.  
<Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>
- 16) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>
- 17) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

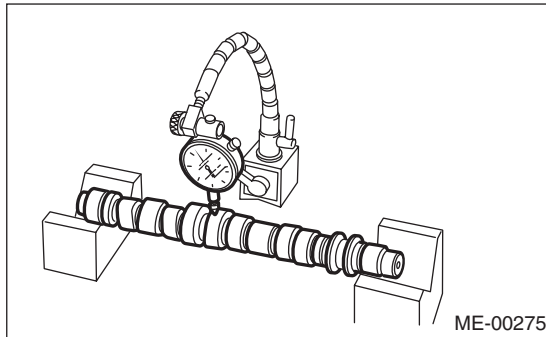
## C: INSPECTION

### 1. CAMSHAFT

- 1) Measure the bend, and repair or replace if necessary.

#### Service limit:

**0.025 mm (0.00098 in)**



- 2) Check the journal for damage and wear. Replace if faulty.
- 3) Measure the outer diameter of camshaft journal and inner diameter of cylinder head journal, and check the difference (oil clearance) between the two values. If the oil clearance is not within the standard, replace the camshaft or cylinder head as necessary.

Unit: mm (in)		
Oil clearance	Standard	0.055 — 0.090 (0.0022 — 0.0035)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

- 4) Check the cam face condition, and remove the minor faults by grinding with oil stone. Measure the cam height H. If it is not within the standard or offset wear occurs, replace it.

#### Cam height H:

Part		Unit: mm (in)
Intake	Constant	Standard 40.075 — 40.175 (1.5778 — 1.5817)
	Low speed	Standard 35.496 — 35.596 (1.3975 — 1.4014)
	High speed	Standard 40.315 — 40.415 (1.5872 — 1.5911)
Exhaust		Standard 39.289 — 39.389 (1.5468 — 1.5507)

#### Cam base circle diameter A:

##### Intake

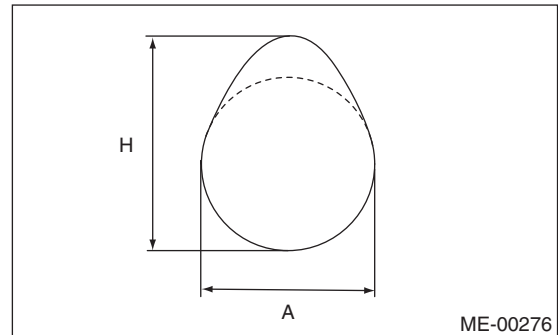
**34.00 mm (1.3386 in)**

##### Exhaust

**34.00 mm (1.3386 in)**

#### Base circle step of adjacent intake cams (low speed and high speed):

**0.03 mm (0.001 in) or less**



- 5) Measure the thrust clearance of camshaft with setting the dial gauge at end of camshaft. If the thrust clearance is not within the standard or there is offset wear, replace the camshaft caps and cylinder head as a set. If necessary, replace the camshaft.

#### Standard:

**0.030 — 0.090 mm (0.0012 — 0.0035 in)**

## 20. Cylinder Head

### A: REMOVAL

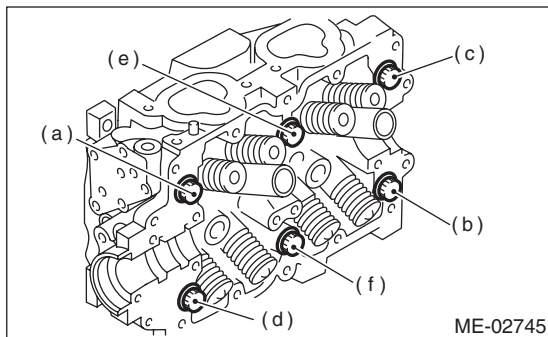
**NOTE:**

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4SO)-27, Valve Clearance.>

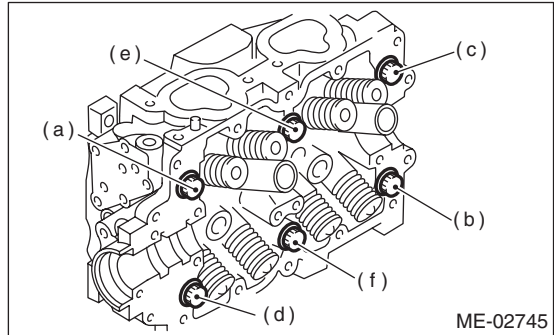
- 1) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>
- 6) Remove the intake manifold. <Ref. to FU(H4SO)-12, REMOVAL, Intake Manifold.>
- 7) Remove the bolt which installs the A/C compressor bracket on cylinder head.
- 8) Remove the valve rocker assembly. <Ref. to ME(H4SO)-49, REMOVAL, Valve Rocker Assembly.>
- 9) Remove the camshaft. <Ref. to ME(H4SO)-53, REMOVAL, Camshaft.>
- 10) Remove the oil level gauge guide. (LH side only)
- 11) Remove the cylinder head bolts in alphabetical sequence as shown in the figure.

**NOTE:**

Leave bolts (a) and (c) engaged by three or four threads to prevent the cylinder head from falling.



- 12) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (a) and (c) to remove cylinder head.



- 13) Remove the cylinder head gasket.

**CAUTION:**

**Be careful not to scratch the mating surface of cylinder head and cylinder block.**

- 14) Similarly, remove the cylinder head (RH).



# Cylinder Head

## MECHANICAL

### B: INSTALLATION

1) Install the cylinder head and gaskets on cylinder block.

#### CAUTION:

**Be careful not to scratch the mating surface of cylinder block and cylinder head.**

#### NOTE:

Use a new cylinder head gasket.

2) Tighten the cylinder head bolts.

- (1) Apply a thin coat of engine oil to washer and bolt thread.
- (2) Tighten all bolts to 29 N·m (3.0 kgf·m, 21.4 ft·lb) in alphabetical order.
- (3) Tighten all bolts to 69 N·m (7.0 kgf·m, 50.9 ft·lb) in alphabetical order.
- (4) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.
- (5) Tighten all bolts to 42 N·m (4.3 kgf·m, 31.0 ft·lb) in alphabetical order.
- (6) Tighten all bolts by 80 to 90° in alphabetical order.
- (7) Tighten all bolts by 40 to 45° in alphabetical order.

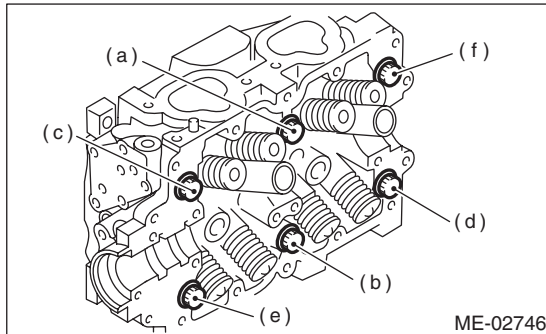
#### CAUTION:

**The tightening angle of the bolt should not exceed 45°.**

- (8) Further tighten the bolts (a) and (b) by 40 — 45°.

#### CAUTION:

**Make sure the total “re-tightening angle” of the step (7) and (8) does not exceed 90°.**



3) Install the oil level gauge guide. (LH side only)

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

4) Install the camshaft. <Ref. to ME(H4SO)-54, INSTALLATION, Camshaft.>

5) Install the valve rocker assembly. <Ref. to ME(H4SO)-50, INSTALLATION, Valve Rocker Assembly.>

6) Install the A/C compressor bracket on cylinder head.

7) Install the intake manifold.

<Ref. to FU(H4SO)-13, INSTALLATION, Intake Manifold.>

8) Install the cam sprocket. <Ref. to ME(H4SO)-47, INSTALLATION, Cam Sprocket.>

9) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>

10) Adjust the valve clearance. <Ref. to ME(H4SO)-28, ADJUSTMENT, Valve Clearance.>

11) Install the rocker cover.

- (1) Install the rocker cover gasket to the rocker cover.

#### NOTE:

Use a new rocker cover gasket.

- (2) Tighten the bolts in two stages in alphabetical sequence as shown in figure.

#### Tightening torque:

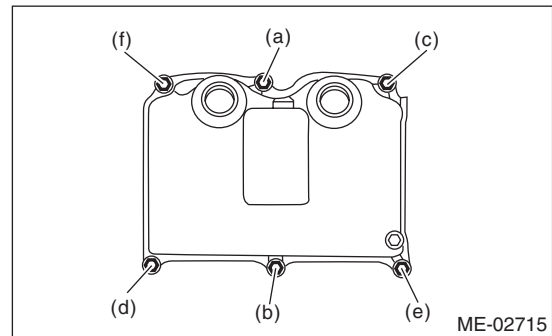
##### 1st

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

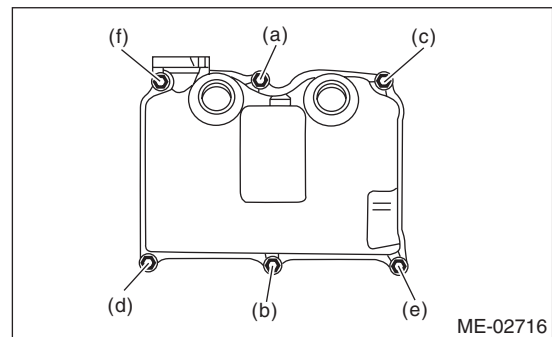
**2nd (only (a) and (b) are tightened)**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

RH side



LH side



12) Connect the PCV hose.

13) Install the timing belt cover.

<Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>

14) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>

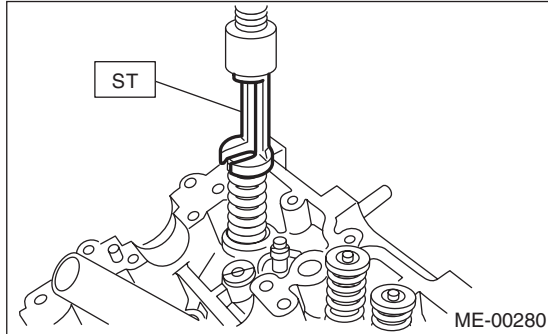
15) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

## C: DISASSEMBLY

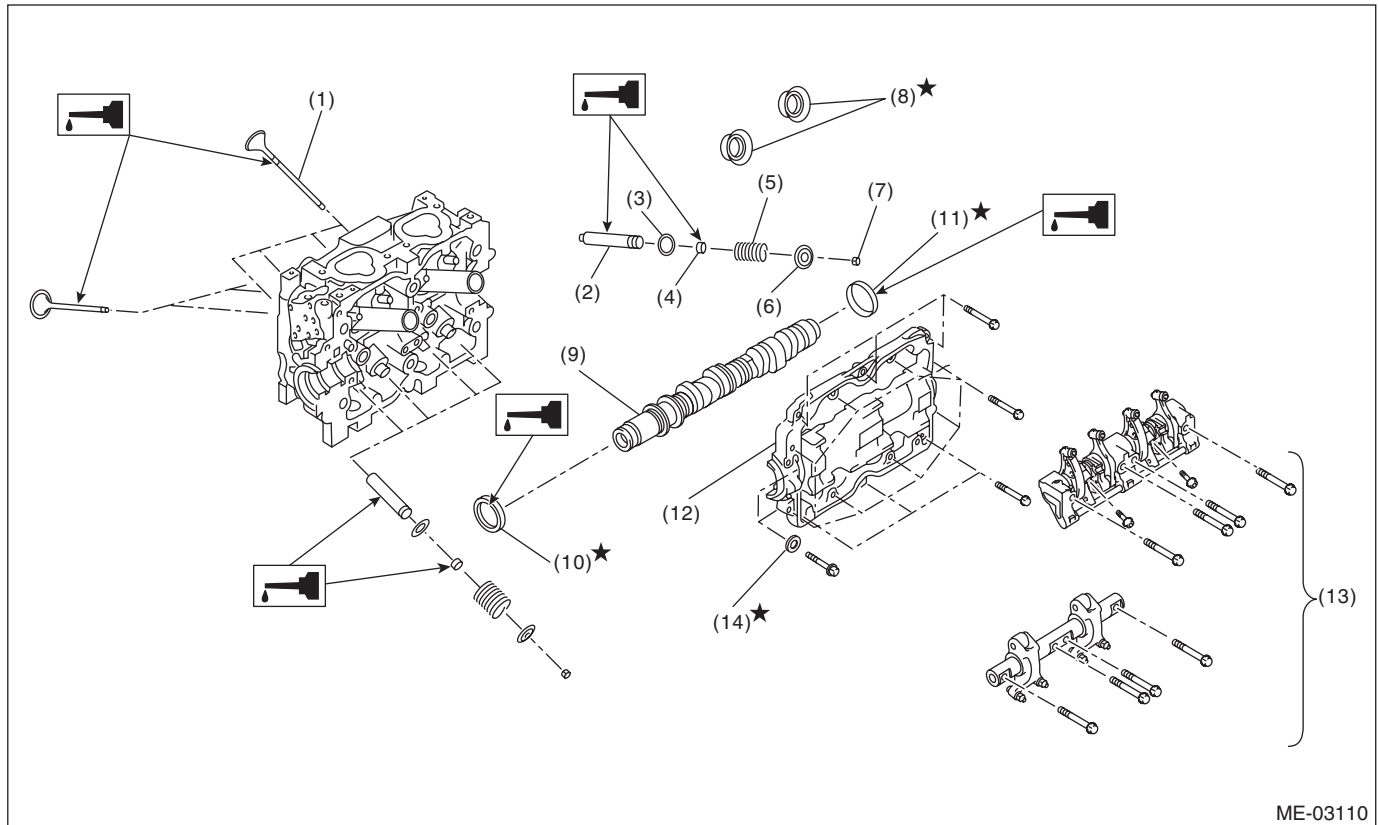
- 1) Place the cylinder head on the ST.  
ST 498267800 CYLINDER HEAD TABLE
- 2) Compress the valve spring and remove the valve spring retainer key using ST. Remove each valve and valve spring.  
ST 499718000 VALVE SPRING REMOVER

### NOTE:

- Keep all the removed parts in order for re-installing in their original positions.
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.



## D: ASSEMBLY



- |                       |                       |                        |
|-----------------------|-----------------------|------------------------|
| (1) Valve             | (6) Retainer          | (11) Plug              |
| (2) Valve guide       | (7) Retainer key      | (12) Camshaft cap      |
| (3) Valve spring seat | (8) Spark plug gasket | (13) Valve rocker ASSY |
| (4) Oil seal          | (9) Camshaft          | (14) Seal washer       |
| (5) Valve spring      | (10) Oil seal         |                        |

# Cylinder Head

## MECHANICAL

- 1) Install the valve spring and valve.
  - (1) Coat the stem of each valve with engine oil and insert the valve into the valve guide.

### NOTE:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (2) Set the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

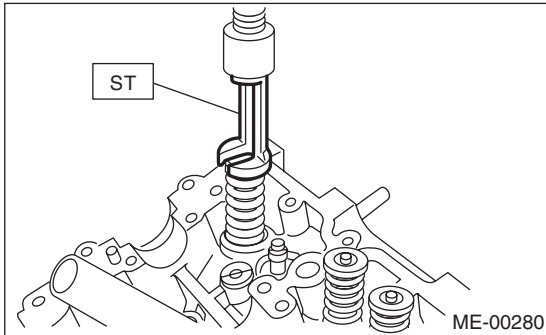
- (3) Install the valve spring and retainer.

### NOTE:

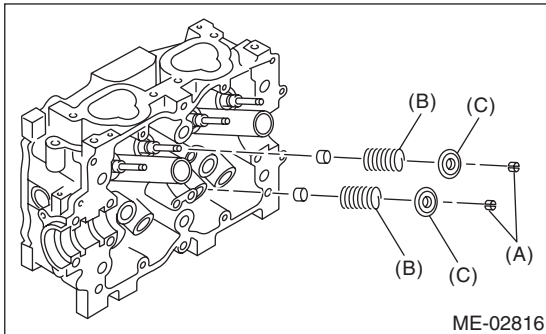
Be sure to install the valve spring with its close-coiled end facing the seat on cylinder head.

- (4) Set the ST on valve spring.

ST 499718000 VALVE SPRING REMOVER



- (5) Compress the valve spring and fit the valve spring retainer key.



- (A) Retainer key
- (B) Valve spring
- (C) Retainer

- (6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

## E: INSPECTION

### 1. CYLINDER HEAD

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

2) Place the cylinder head on the ST.

ST 498267800 CYLINDER HEAD TABLE

3) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B).

If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

**Warping limit:**

**0.035 mm (0.0014 in)**

**Grinding limit:**

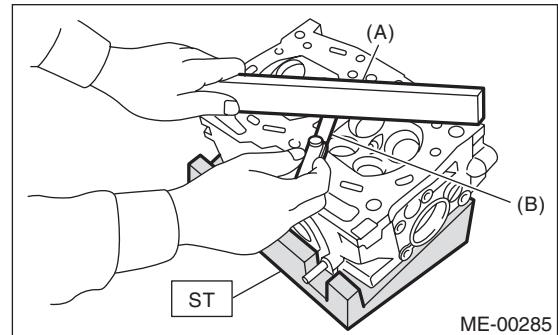
**0.1 mm (0.004 in)**

**Standard height of cylinder head:**

**97.5 mm (3.839 in)**

### NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.



## 2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

**Valve seat width *W*:**

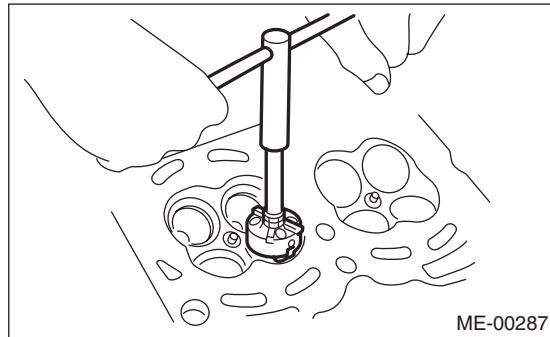
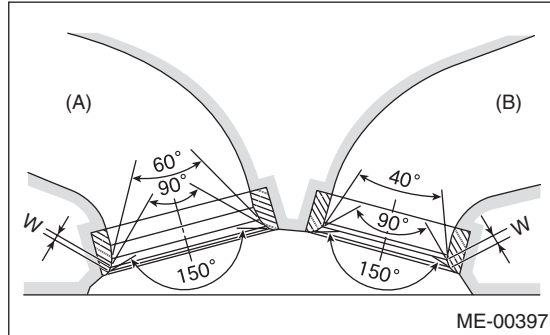
**Standard:**

**Intake (A)**

**0.8 — 1.4 mm (0.03 — 0.055 in)**

**Exhaust (B)**

**1.2 — 1.8 mm (0.047 — 0.071 in)**



## 3. VALVE GUIDE

1) Check the clearance between valve guide and valve stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

**Clearance between the valve guide and valve stem:**

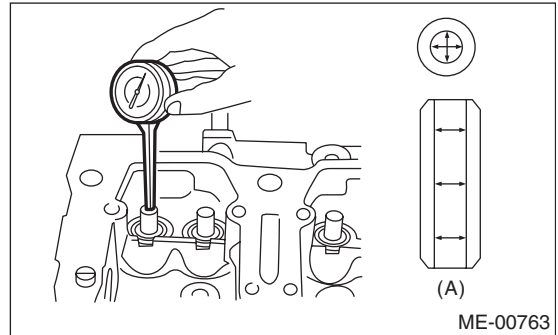
**Standard:**

**Intake**

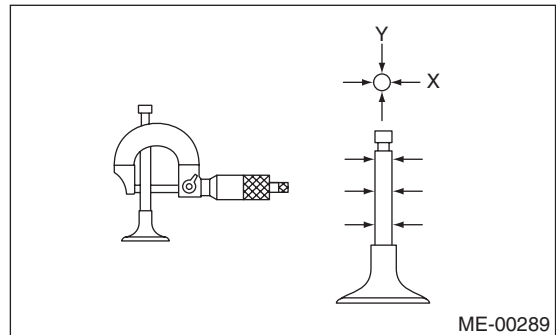
**0.035 — 0.062 mm (0.0014 — 0.0024 in)**

**Exhaust**

**0.040 — 0.067 mm (0.0016 — 0.0026 in)**



(A) Valve guide



# Cylinder Head

## MECHANICAL

2) If the clearance between valve guide and stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. See the following procedure for valve guide replacement.

### Valve guide inner diameter:

**6.000 — 6.012 mm (0.2362 — 0.2367 in)**

### Valve stem outer diameters:

#### Intake

**5.950 — 5.965 mm (0.2343 — 0.2348 in)**

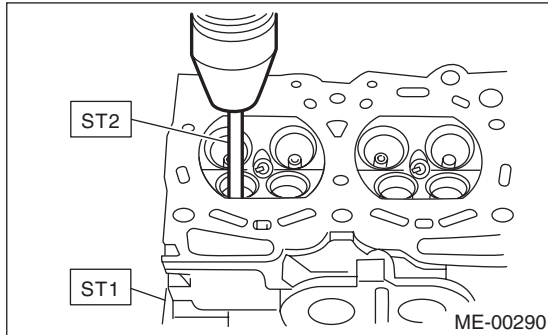
#### Exhaust

**5.945 — 5.960 mm (0.2341 — 0.2346 in)**

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267800 CYLINDER HEAD TABLE  
ST2 499767200 VALVE GUIDE REMOVER



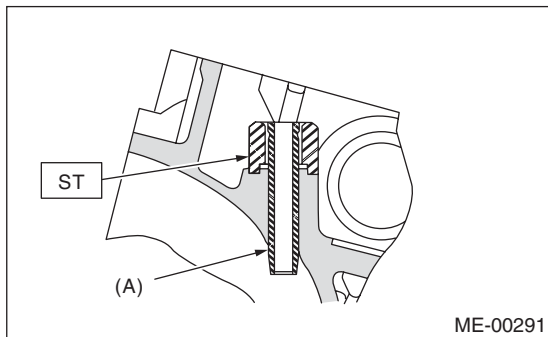
(3) Turn the cylinder head upside down and place the ST as shown in the figure.

#### Intake side

ST 499767700 VALVE GUIDE ADJUSTER

#### Exhaust side

ST 499767800 VALVE GUIDE ADJUSTER



(A) Valve guide

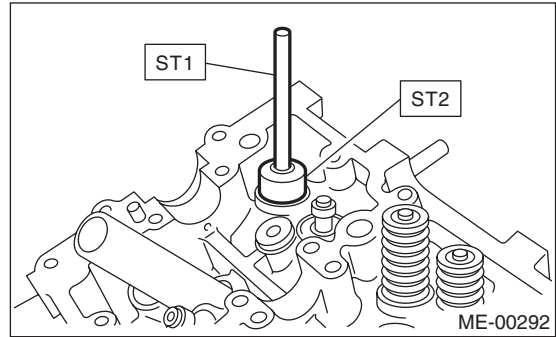
(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in cylinder, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER  
Intake side

ST2 499767700 VALVE GUIDE ADJUSTER  
Exhaust side

ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

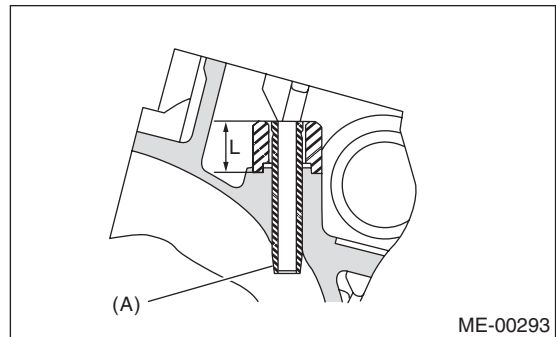
### Valve guide protrusion L:

#### Intake

**20.0 — 21.0 mm (0.787 — 0.827 in)**

#### Exhaust

**16.5 — 17.5 mm (0.650 — 0.689 in)**



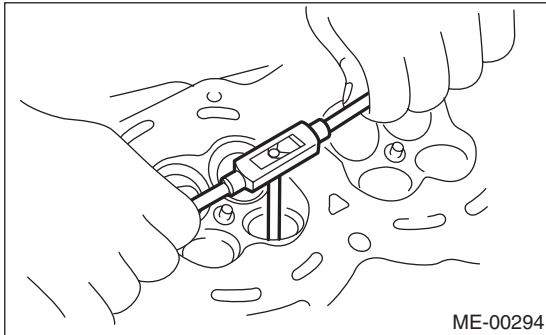
(A) Valve guide

(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

**NOTE:**

- Apply engine oil to the ST when reaming.
- If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.
- If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.

ST 499767400 VALVE GUIDE REAMER



(8) After reaming, clean the valve guide to remove chips.

(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

## 4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace the valve with a new part if damaged, worn, deformed, or if “H” is less than the specified limit.

**Head edge thickness H:**

**Intake (A)**

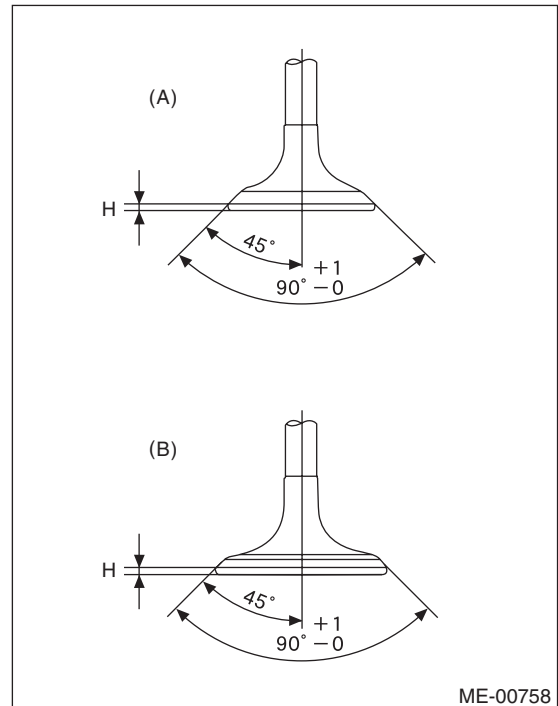
**Standard:**

**0.8 — 1.2 mm (0.03 — 0.047 in)**

**Exhaust (B)**

**Standard:**

**1.0 — 1.4 mm (0.039 — 0.055 in)**



2) Put a small amount of grinding compound on the seat surface, and lap the valve and seat surface. Replace with a new valve oil seal after lapping.

**NOTE:**

It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

**Valve overall length:**

**Intake**

**120.6 mm (4.75 in)**

**Exhaust**

**121.7 mm (4.79 in)**

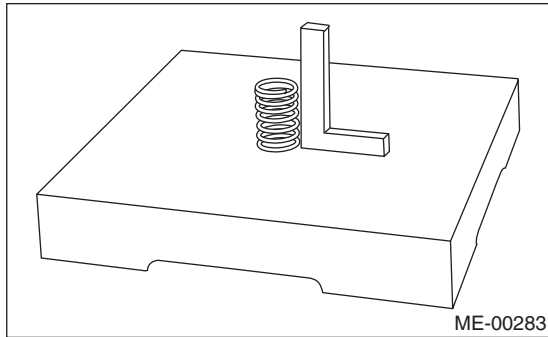
# Cylinder Head

## MECHANICAL

### 5. VALVE SPRING

- 1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.
- 2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top of spring using a try square.

Free length	mm (in)	55.2 (2.173)
Tension/spring height N (kgf, lbf)/mm (in)	Set	235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/ 45.0 (1.772)
	Lift	578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/ 34.7 (1.366)
Squareness		2.5°, 2.4 mm (0.094 in) or less



### 6. INTAKE AND EXHAUST VALVE OIL SEAL

- 1) For the following, replace the oil seal with a new part.

See the procedure 2) and subsequent for replacement procedures.

- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

- 2) Place the cylinder head on ST1.

- 3) Using the ST2, press in the oil seal.

ST1 498267800 CYLINDER HEAD TABLE

ST2 498857100 VALVE OIL SEAL GUIDE

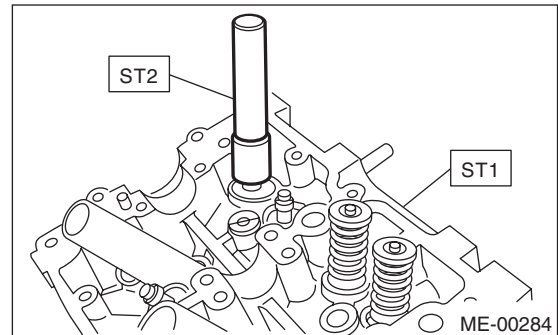
#### NOTE:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer or strike in.
- The intake valve oil seal and exhaust valve oil seal can be distinguished by colors.

#### Color of rubber part:

**Intake [Gray]**

**Exhaust [Green]**



## 21. Cylinder Block

### A: REMOVAL

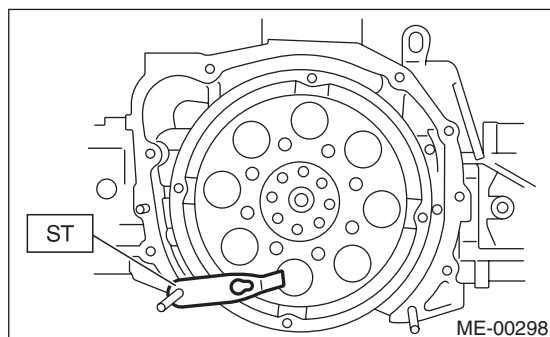
**NOTE:**

Before conducting this procedure, drain the engine oil completely.

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-12, REMOVAL, Intake Manifold.>
- 2) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt. <Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>
- 6) Remove the cam sprocket. <Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket. <Ref. to ME(H4SO)-48, REMOVAL, Crank Sprocket.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the cylinder head. <Ref. to ME(H4SO)-57, REMOVAL, Cylinder Head.>
- 10) Remove the clutch disc and cover. (MT model) <Ref. to CL-13, REMOVAL, Clutch Disc and Cover.>
- 11) Remove the flywheel. (MT model) <Ref. to CL-16, REMOVAL, Flywheel.>
- 12) Remove the drive plate. (AT model)

Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER

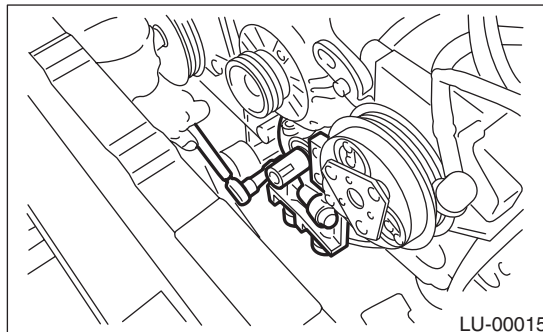


- 13) Remove the oil separator cover.
- 14) Remove the water by-pass pipe for heater.
- 15) Remove the water pump. <Ref. to CO(H4SO)-14, REMOVAL, Water Pump.>

- 16) Remove the bolts which install oil pump onto cylinder block.

**NOTE:**

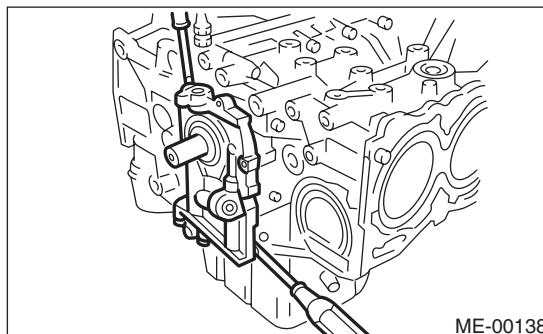
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



- 17) Remove the oil pump from cylinder block using a flat tip screwdriver.

**CAUTION:**

**Be careful not to scratch the mating surface of cylinder block and oil pump.**



- 18) Remove the front oil seal from the oil pump.
- 19) Remove the oil pan.
  - (1) Set the part so that the cylinder block (LH) is on the upper side.
  - (2) Remove the bolts which secure oil pan to cylinder block.
  - (3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

**CAUTION:**

**Do not use a screwdriver or similar tools in place of oil pan cutter.**

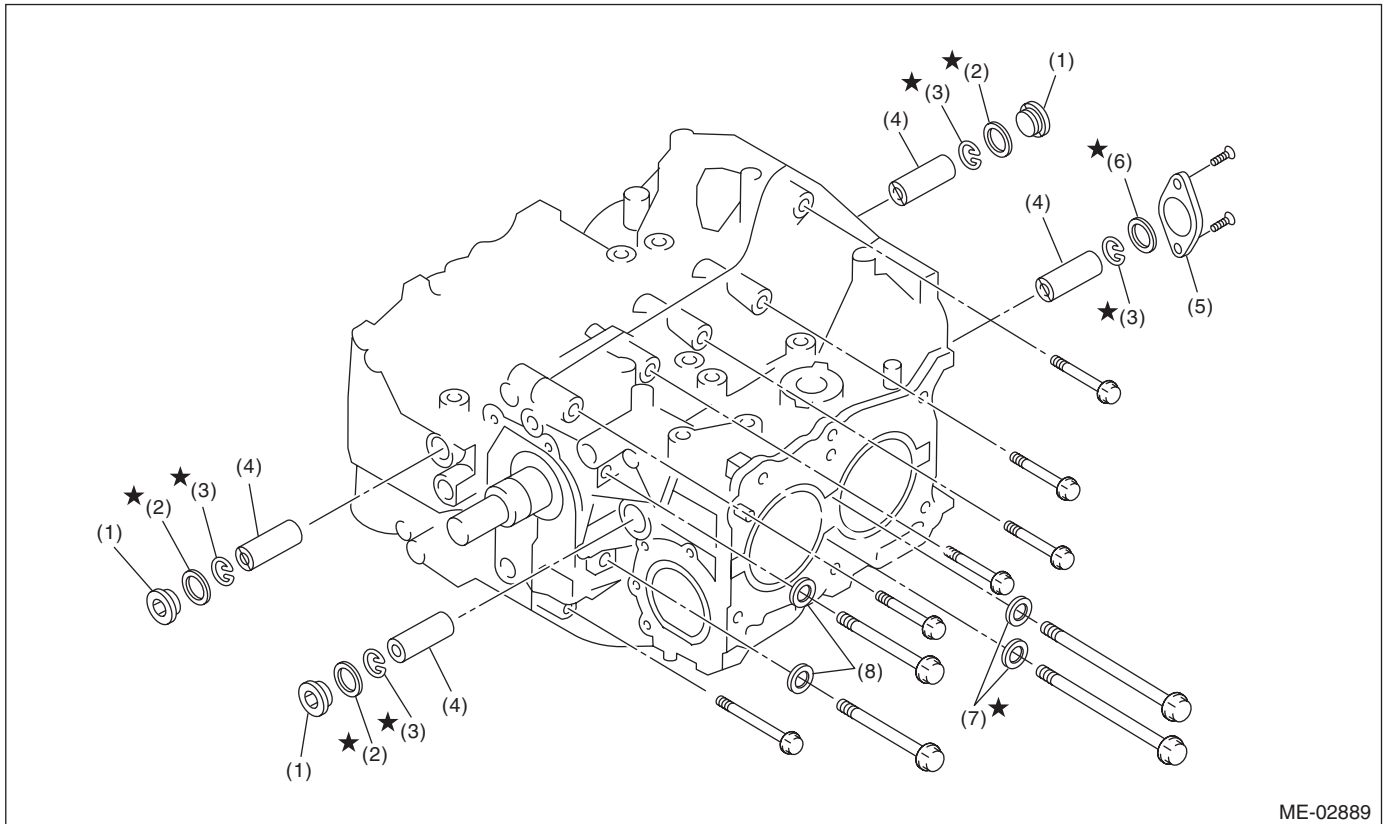
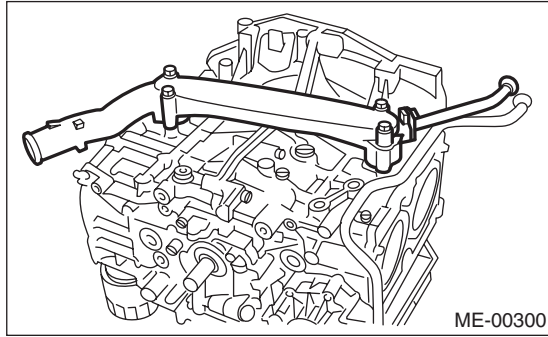
- 20) Remove the oil strainer stay.
- 21) Remove the oil strainer.
- 22) Remove the baffle plate.
- 23) Remove the oil filter. <Ref. to LU(H4SO)-21, REMOVAL, Engine Oil Filter.>



# Cylinder Block

## MECHANICAL

24) Remove the water pipe.

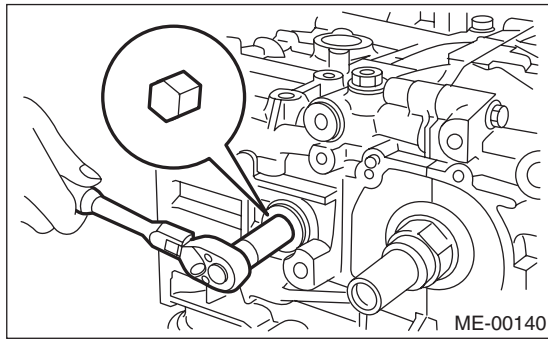


- (1) Service hole plug
- (2) Gasket
- (3) Snap ring

- (4) Piston pin
- (5) Service hole cover
- (6) O-ring

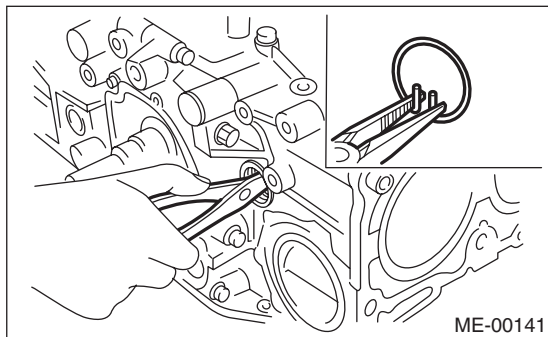
- (7) Seal washer
- (8) Washer

25) Remove the service hole plug using a hexagon wrench (14 mm).



26) Remove the service hole cover.

27) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.

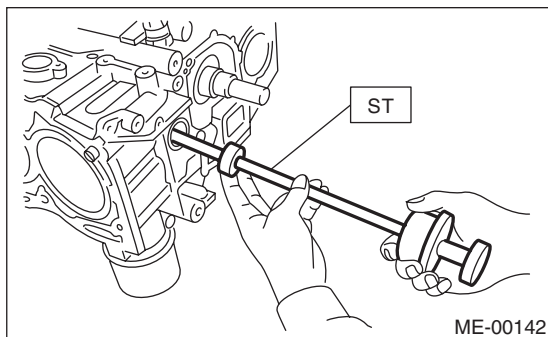


28) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



29) Similarly draw out the piston pins from #3 and #4 pistons.

30) Remove the cylinder block connecting bolt on the RH side.

31) Loosen the cylinder block connecting bolt on the LH side by 2-3 turns.

32) Set the part so that the cylinder block (LH) is on the upper side, and remove the cylinder block connecting bolt.

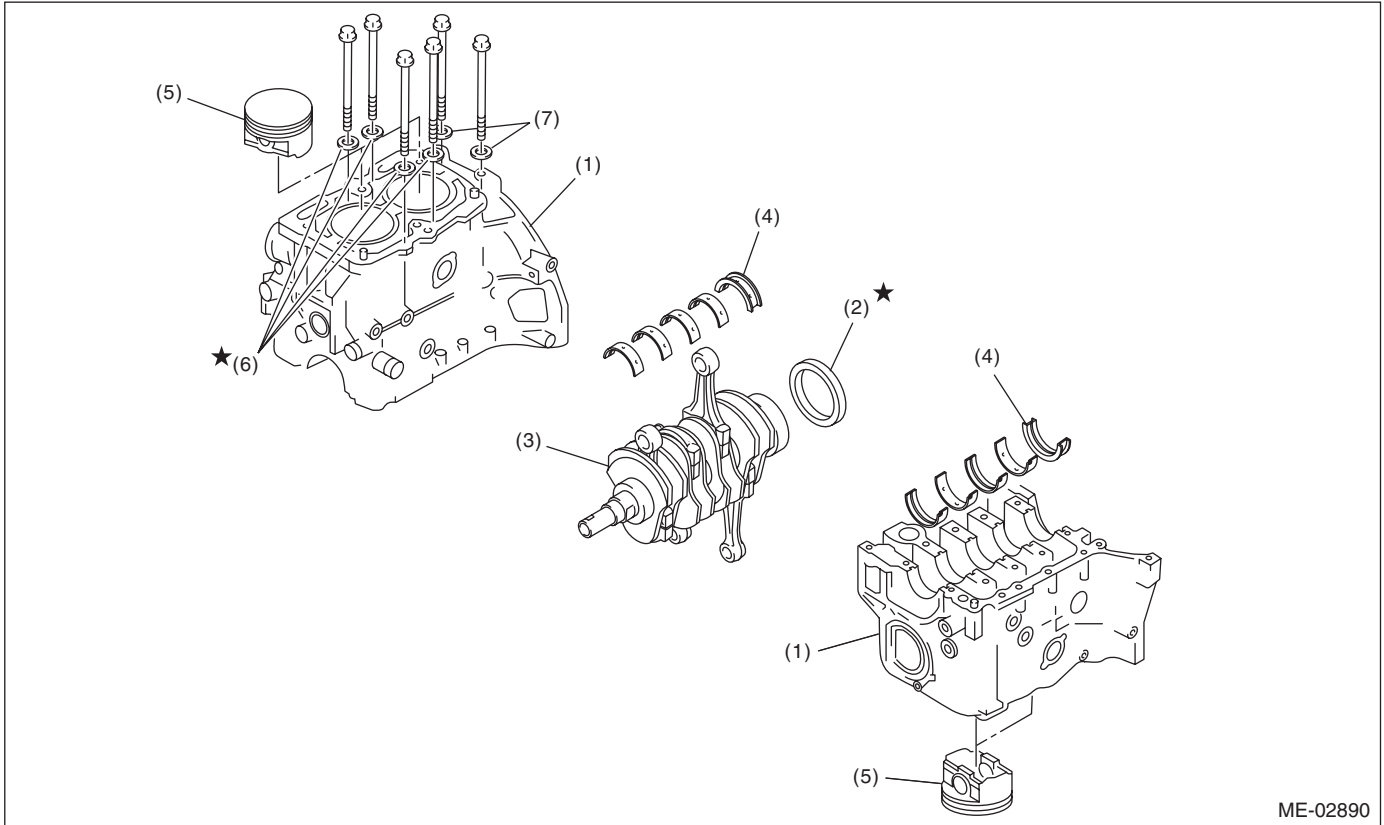
# Cylinder Block

## MECHANICAL

33) Separate the cylinder block (RH) and (LH).

### NOTE:

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



ME-02890

- |                    |                        |                 |
|--------------------|------------------------|-----------------|
| (1) Cylinder block | (4) Crankshaft bearing | (6) Seal washer |
| (2) Rear oil seal  | (5) Piston             | (7) Washer      |
| (3) Crankshaft     |                        |                 |

34) Remove the rear oil seal.

35) Remove the crankshaft together with connecting rod.

36) Remove the crankshaft bearings from cylinder block using a hammer handle.

### NOTE:

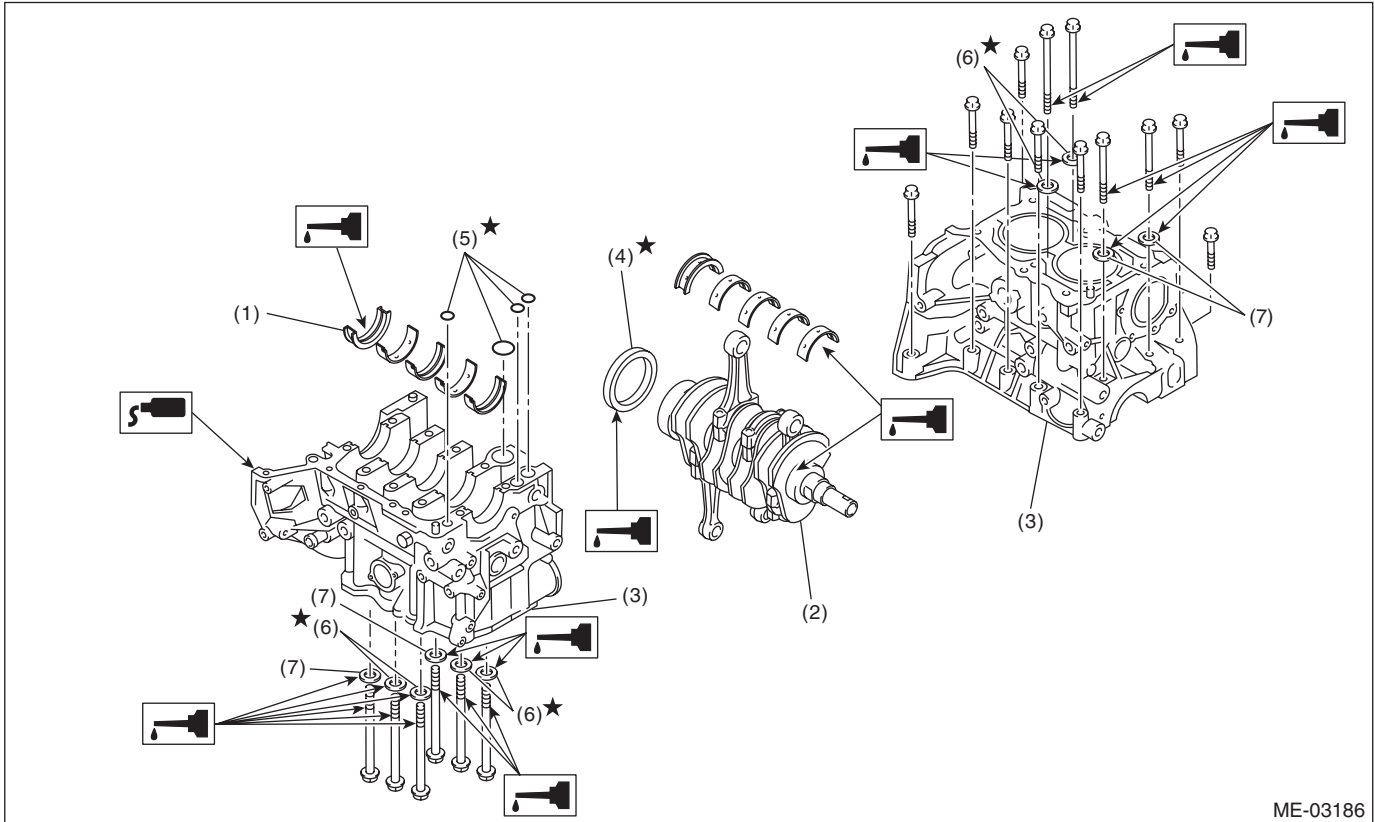
Be careful not to confuse the crankshaft bearing combination. Press the bearing at the end opposite to locking lip.

37) Remove each piston from cylinder block using wooden bar or hammer handle.

### NOTE:

Be careful not to confuse the original combination of piston and cylinder.

## B: INSTALLATION



- |                        |                   |                 |
|------------------------|-------------------|-----------------|
| (1) Crankshaft bearing | (4) Rear oil seal | (6) Seal washer |
| (2) Crankshaft         | (5) O-ring        | (7) Washer      |
| (3) Cylinder block     |                   |                 |

1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.

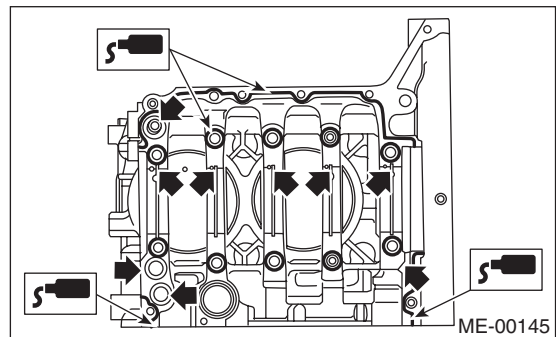
2) Position the crankshaft and O-ring on the cylinder block (RH).

3) Apply liquid gasket to the mating surfaces of cylinder block (RH), and position the cylinder block (LH).

**NOTE:**

- Install within 5 min. after applying liquid gasket.
- Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.

**Liquid gasket:**  
**THREE BOND 1217G (Part No. K0877Y0100)**  
**or equivalent**



# Cylinder Block

## MECHANICAL

4) Apply a coat of engine oil to the washer and bolt thread.

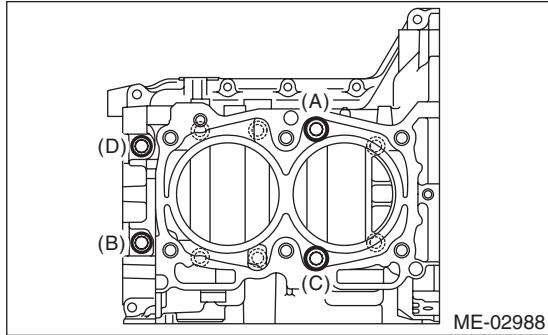
### NOTE:

Use a new seal washer.

5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

### Tightening torque:

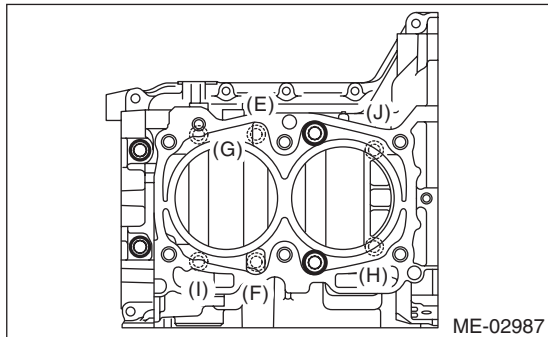
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

### Tightening torque:

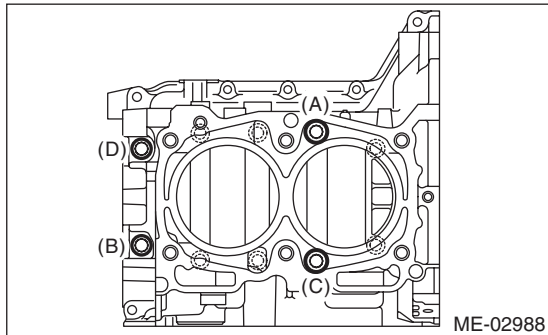
**10 N·m (1.0 kgf·m, 7.2 ft·lb)**



7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

### Tightening torque:

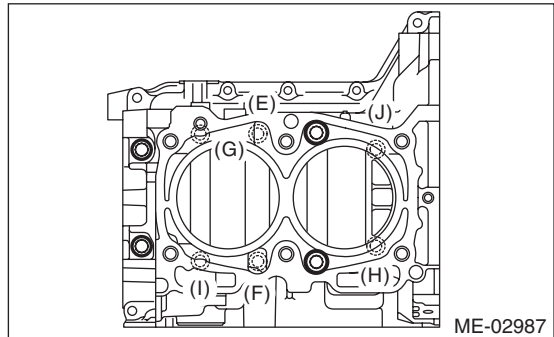
**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



8) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

### Tightening torque:

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

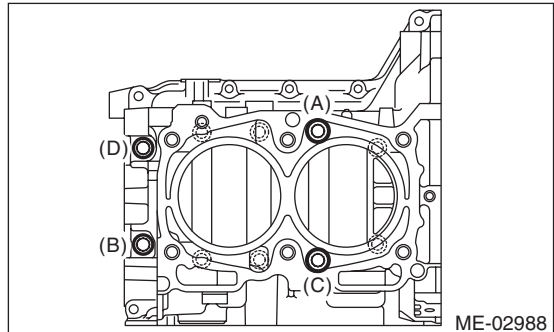
### Tightening angle:

**90°**

- (B), (D): Torque tightening

### Tightening torque:

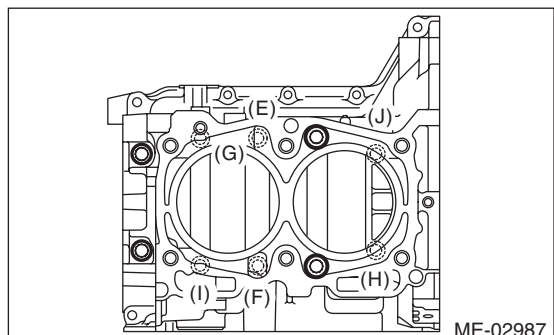
**40 N·m (4.1 kgf·m, 29.6 ft·lb)**



10) Tighten the RH side cylinder block connecting bolts (E — J) in alphabetical order.

### Tightening angle:

**90°**

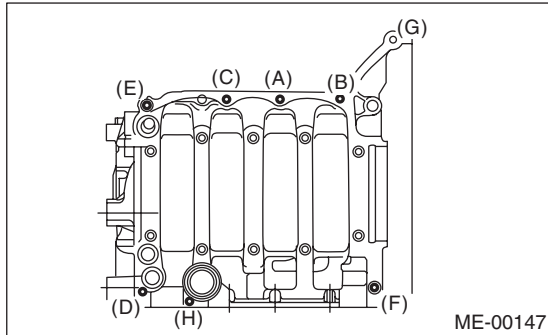


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on LH side (A — H) in alphabetical sequence.

**Tightening torque:**

(A) — (G): 25 N·m (2.5 kgf·m, 18.4 ft·lb)

(H): 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)



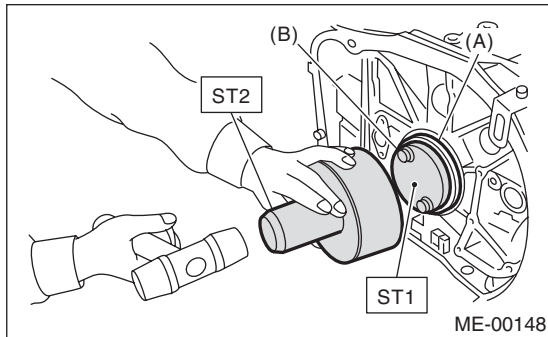
12) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

**NOTE:**

Use new rear oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER

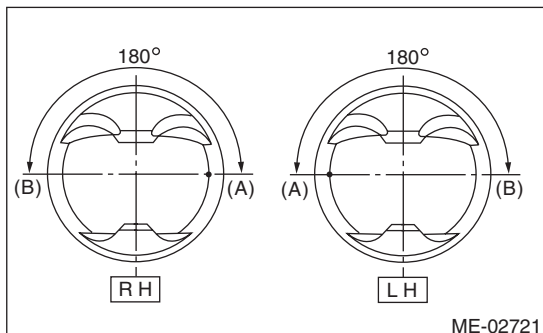


(A) Rear oil seal

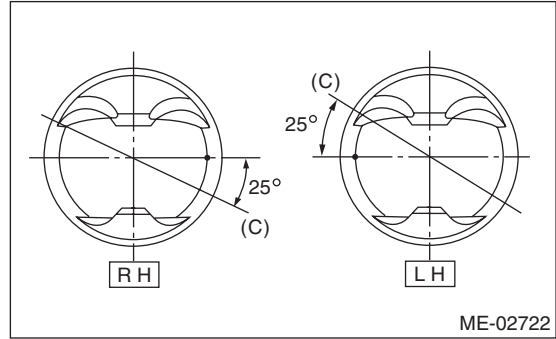
(B) Flywheel attaching bolt

13) Position the top ring gap at (A) or (B) in the figure.

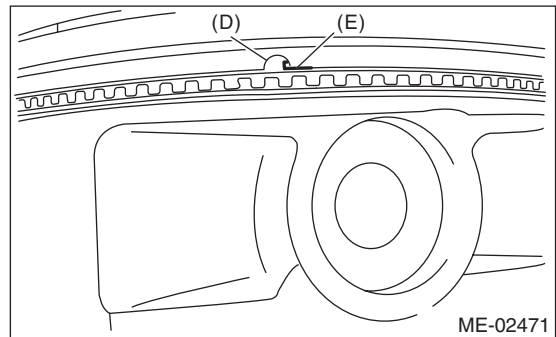
14) Position the second ring gap at 180° on the reverse side the top ring gap.



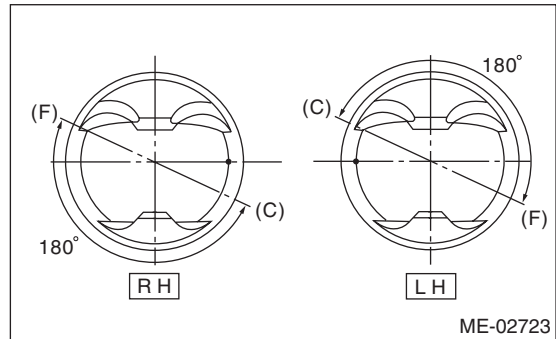
15) Position the upper rail gap at (C) in the figure.



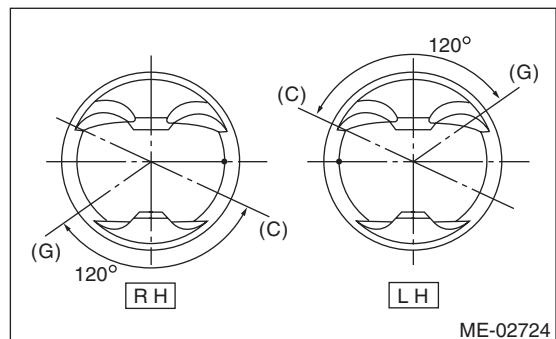
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure.



18) Position the lower rail gap at (G) in the figure.



**NOTE:**

- Make sure ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.

# Cylinder Block

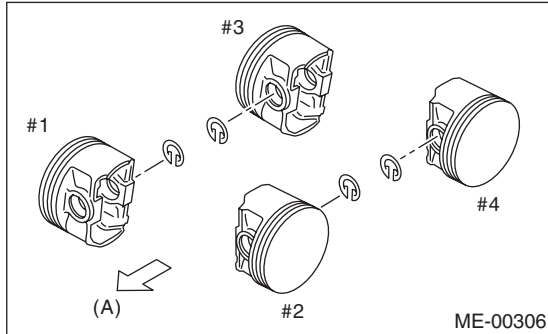
## MECHANICAL

19) Install the snap ring.

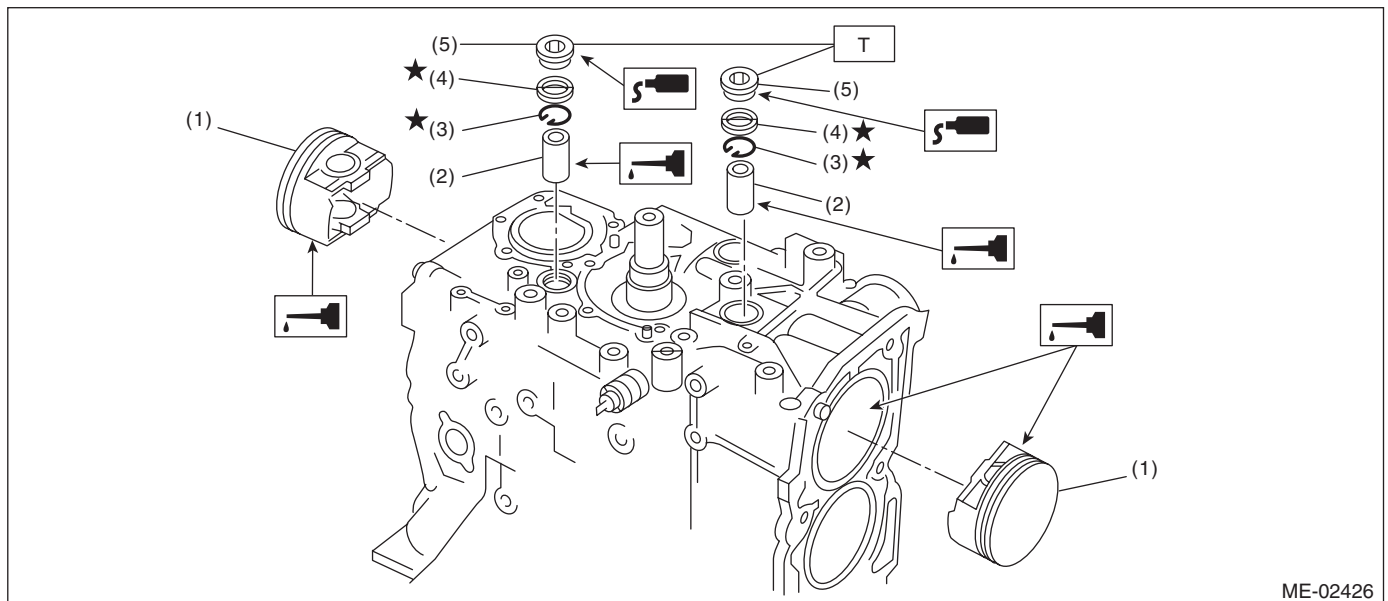
Before installing the piston to the cylinder block, install the snap rings to the piston holes on the opposite side of the service holes on the cylinder block.

### NOTE:

Use new snap rings.



(A) Front side



- |                |                       |
|----------------|-----------------------|
| (1) Piston     | (4) Gasket            |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring  |                       |

**Tightening torque: N-m (kgf-m, ft-lb)**  
**T: 70 (7.1, 51.6)**

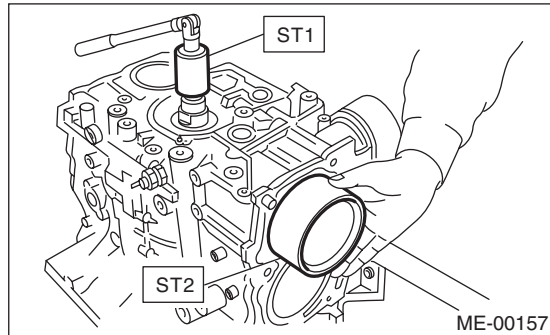
20) Install the piston.

- (1) Set the parts so that the #1 and #2 cylinders are on the upper side.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

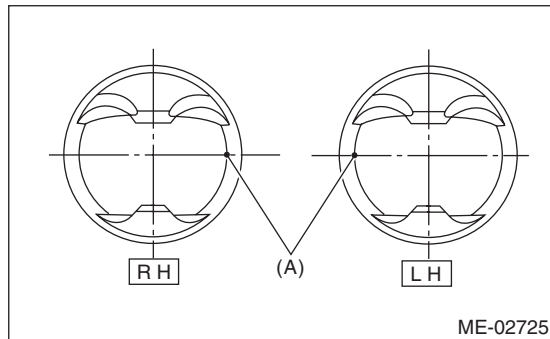
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



NOTE:

Face the piston front mark towards the front of the engine.

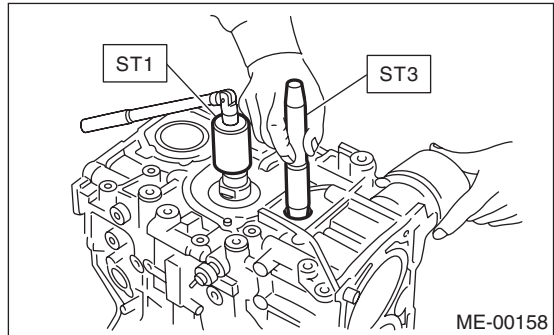


(A) Front mark

21) Install piston pin.

- (1) Apply a coat of engine oil to ST3.
- (2) Insert ST3 into the service hole to align piston pin hole with connecting rod small end.

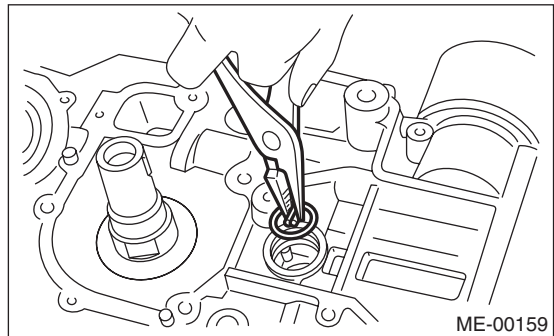
ST3 499017100 PISTON PIN GUIDE



- (3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
- (4) Install the snap ring.

NOTE:

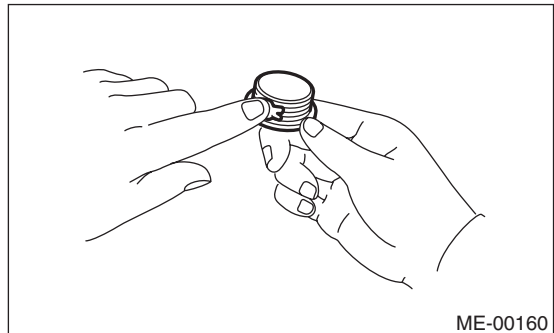
Use new snap rings.



- (5) Apply liquid gasket to the threaded portion of the service hole plug.

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**





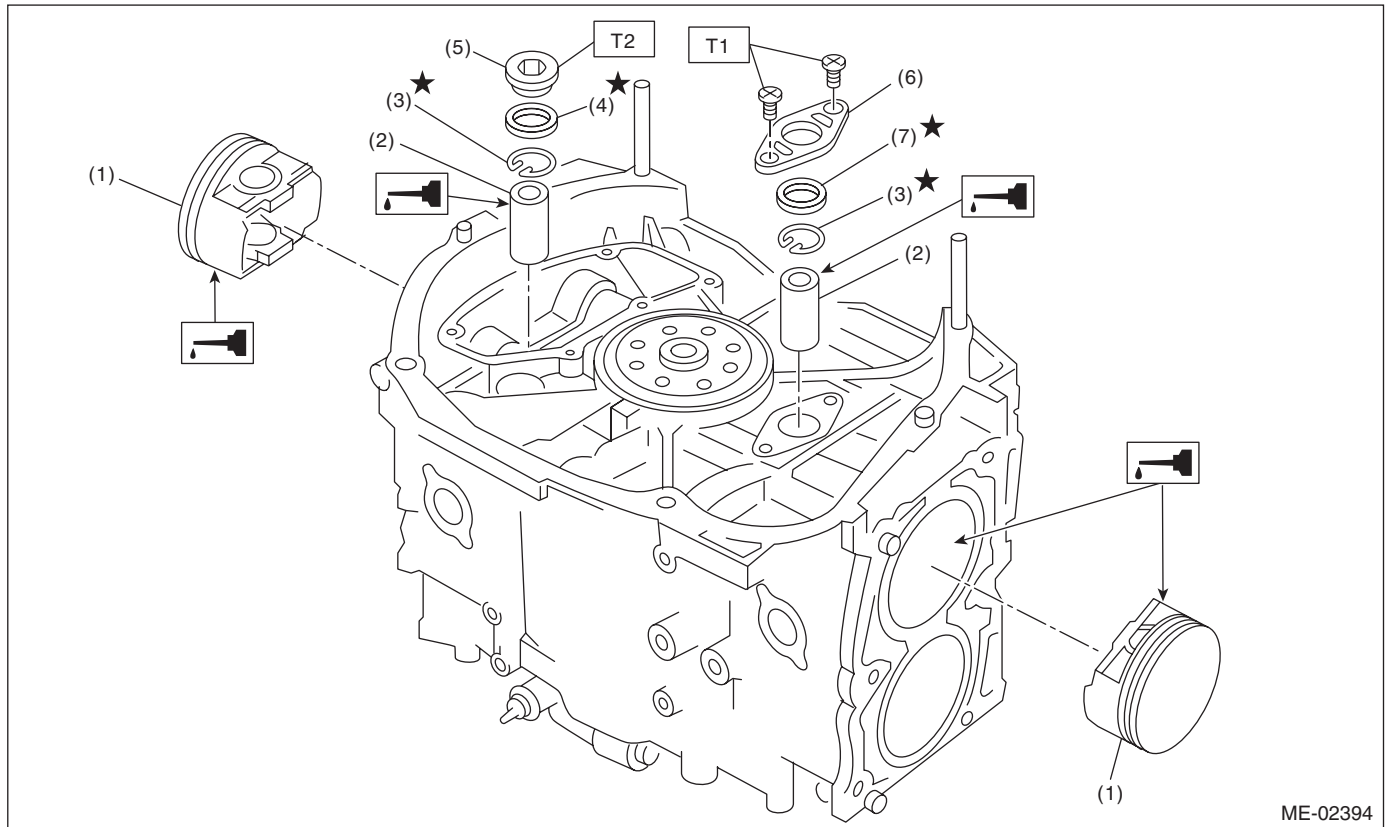
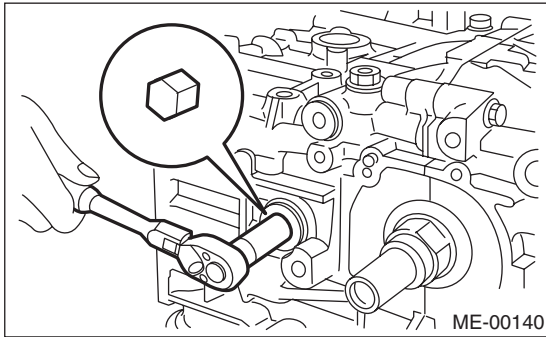
# Cylinder Block

## MECHANICAL

(6) Install the water pump and gasket.

### NOTE:

Use a new gasket.



- |                |                        |
|----------------|------------------------|
| (1) Piston     | (5) Service hole plug  |
| (2) Piston pin | (6) Service hole cover |
| (3) Snap ring  | (7) O-ring             |
| (4) Gasket     |                        |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 70 (7.1, 51.6)**

(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

(8) Install the service hole cover.

### NOTE:

Use new O-rings.

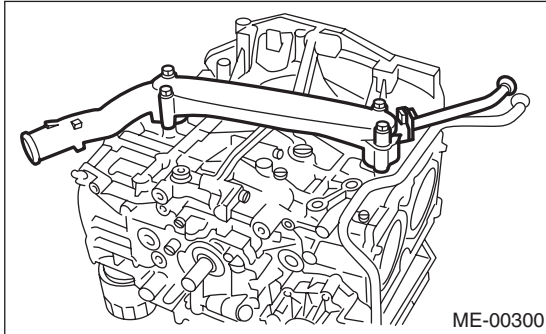
22) Install the water pipe.

NOTE:

Use new O-rings.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



23) Install the baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

24) Install the oil strainer.

NOTE:

Use new O-rings.

**Tightening torque:**

**10 N·m (1.0 kgf-m, 7.4 ft-lb)**

25) Install the oil strainer stay.

NOTE:

Tighten the oil strainer stay together with baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

26) Apply liquid gasket to the mating surfaces of the oil pan, and install the oil pan.

NOTE:

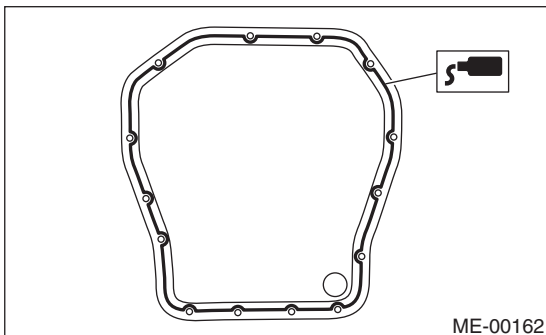
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



27) Apply liquid gasket to the mating surfaces of the oil separator cover and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:

- Install within 5 min. after applying liquid gasket.
- Use a new separator cover.

**Liquid gasket:**

- **Mating surface**

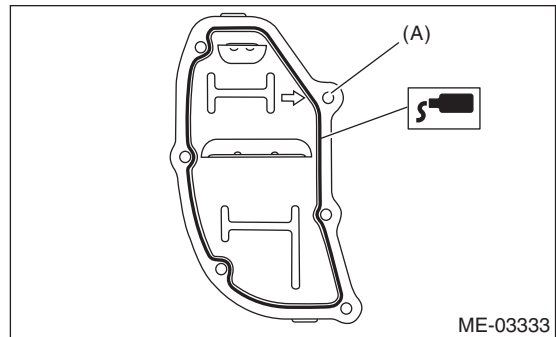
**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

- **(A) bolt threads (when reusing bolts)**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



28) Install the flywheel. (MT model)

<Ref. to CL-16, INSTALLATION, Flywheel.>

29) Install the clutch disc and cover. (MT model)

<Ref. to CL-13, INSTALLATION, Clutch Disc and Cover.>

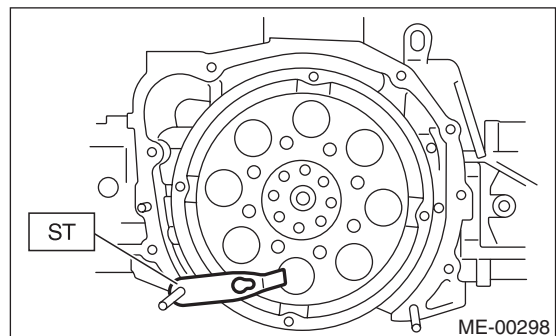
30) Install the drive plate. (AT model)

To lock the crankshaft, use the ST.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**72 N·m (7.3 kgf-m, 53.1 ft-lb)**



# Cylinder Block

## MECHANICAL

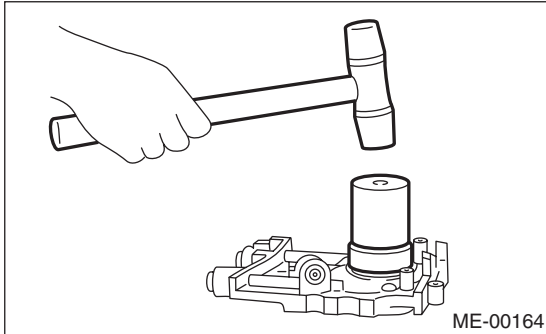
31) Install the oil pump.

(1) Using the ST, install the front oil seal.

ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new front oil seal.



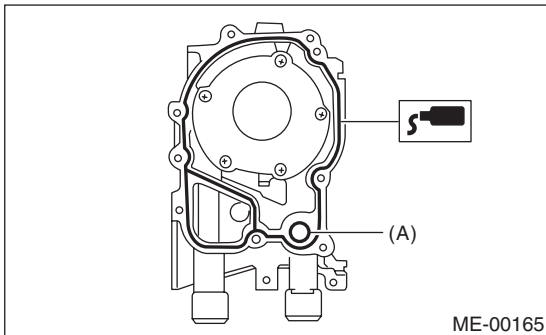
(2) Apply liquid gasket to the matching surface of oil pump.

NOTE:

Install within 5 min. after applying liquid gasket.

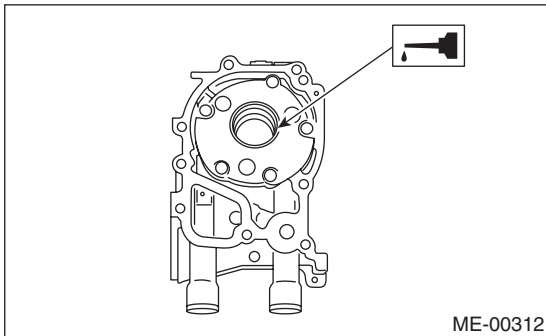
**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



(4) Install the oil pump to cylinder block. Be careful not to damage the oil seal during installation.

NOTE:

- Make sure the oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings and oil seals.
- Do not forget to assemble O-rings.

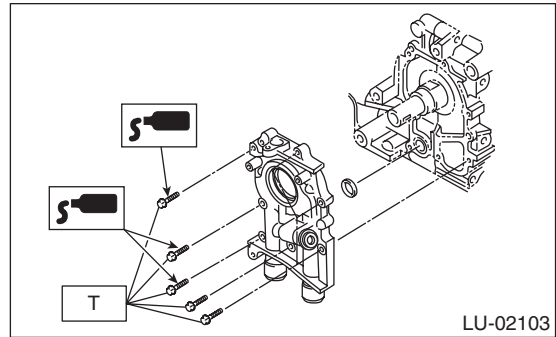
(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

**Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



32) Install the water pump and gasket.

NOTE:

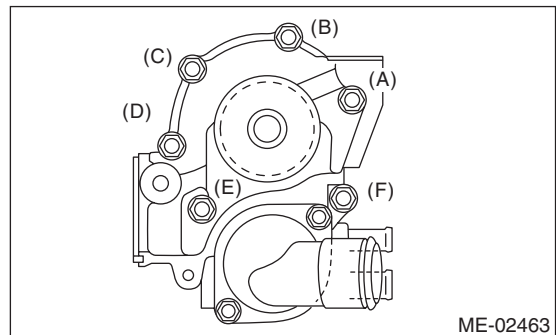
When installing the water pump, tighten bolts in two stages in alphabetical order as shown in the figure.

- Use a new gasket.

**Tightening torque:**

**First: 12 N·m (1.2 kgf-m, 8.7 ft-lb)**

**Second: 12 N·m (1.2 kgf-m, 8.7 ft-lb)**



33) Install the water by-pass pipe for heater.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

34) Install the oil filter.

<Ref. to LU(H4SO)-21, INSTALLATION, Engine Oil Filter.>

- 35) Install the cylinder head. <Ref. to ME(H4SO)-58, INSTALLATION, Cylinder Head.>
- 36) Install the camshaft. <Ref. to ME(H4SO)-54, INSTALLATION, Camshaft.>
- 37) Install the valve rocker assembly. <Ref. to ME(H4SO)-50, INSTALLATION, Valve Rocker Assembly.>
- 38) Install the crank sprocket. <Ref. to ME(H4SO)-48, INSTALLATION, Crank Sprocket.>
- 39) Install the cam sprocket. <Ref. to ME(H4SO)-47, INSTALLATION, Cam Sprocket.>
- 40) Install the timing belt. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt.>
- 41) Adjust the valve clearance. <Ref. to ME(H4SO)-28, ADJUSTMENT, Valve Clearance.>
- 42) Install the rocker cover.
  - (1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

- Use a new rocker cover gasket.
- (2) Tighten the bolts in two stages in alphabetical sequence as shown in figure.

**Tightening torque:**

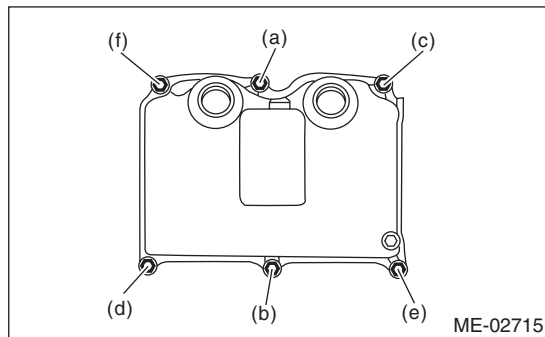
**1st**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

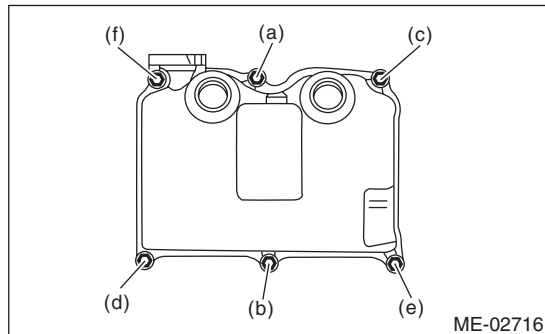
**2nd (only (a) and (b) are tightened)**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

RH side



LH side



- 43) Connect the PCV hose.

- 44) Install the timing belt cover. <Ref. to ME(H4SO)-41, INSTALLATION, Timing Belt Cover.>
- 45) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>
- 46) Install the intake manifold. <Ref. to FU(H4SO)-13, INSTALLATION, Intake Manifold.>
- 47) Install the generator and A/C compressor with their brackets.

**Tightening torque:**

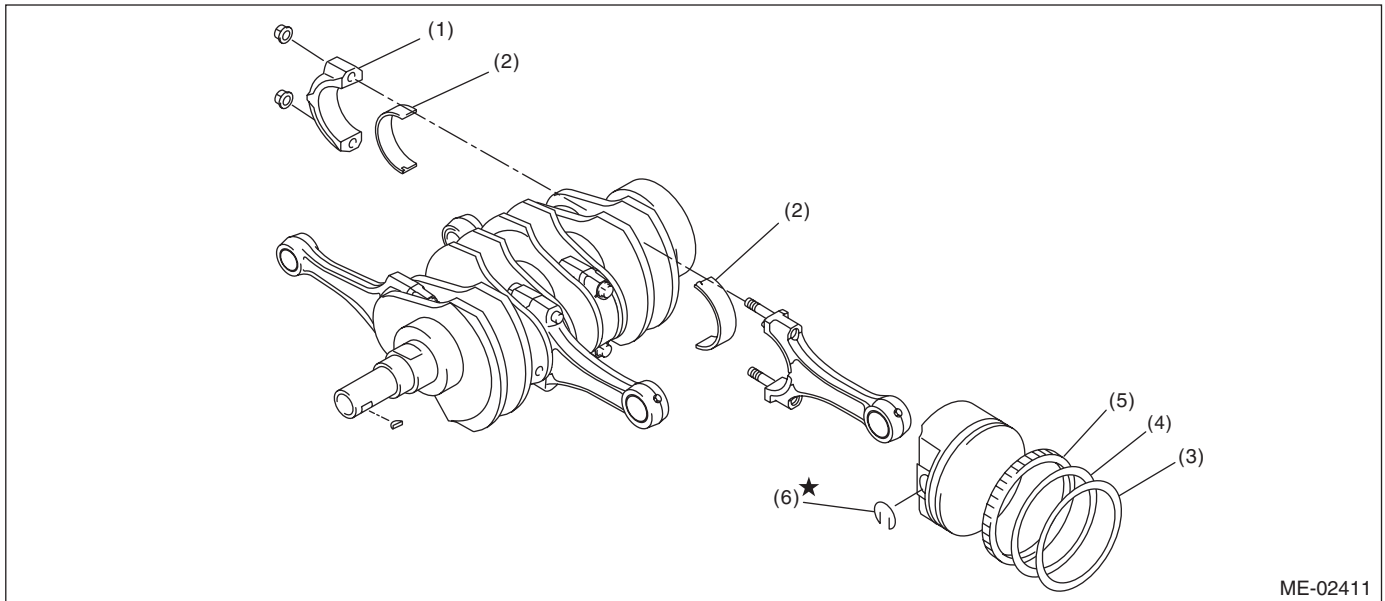
**36 N·m (3.7 kgf-m, 26.6 ft-lb)**

- 48) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

# Cylinder Block

MECHANICAL

## C: DISASSEMBLY



(1) Connecting rod cap

(3) Top ring

(5) Oil ring

(2) Connecting rod bearing

(4) Second ring

(6) Snap ring

1) Remove the connecting rod cap.

2) Remove the connecting rod bearing.

### NOTE:

Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

3) Remove the piston rings using piston ring expander.

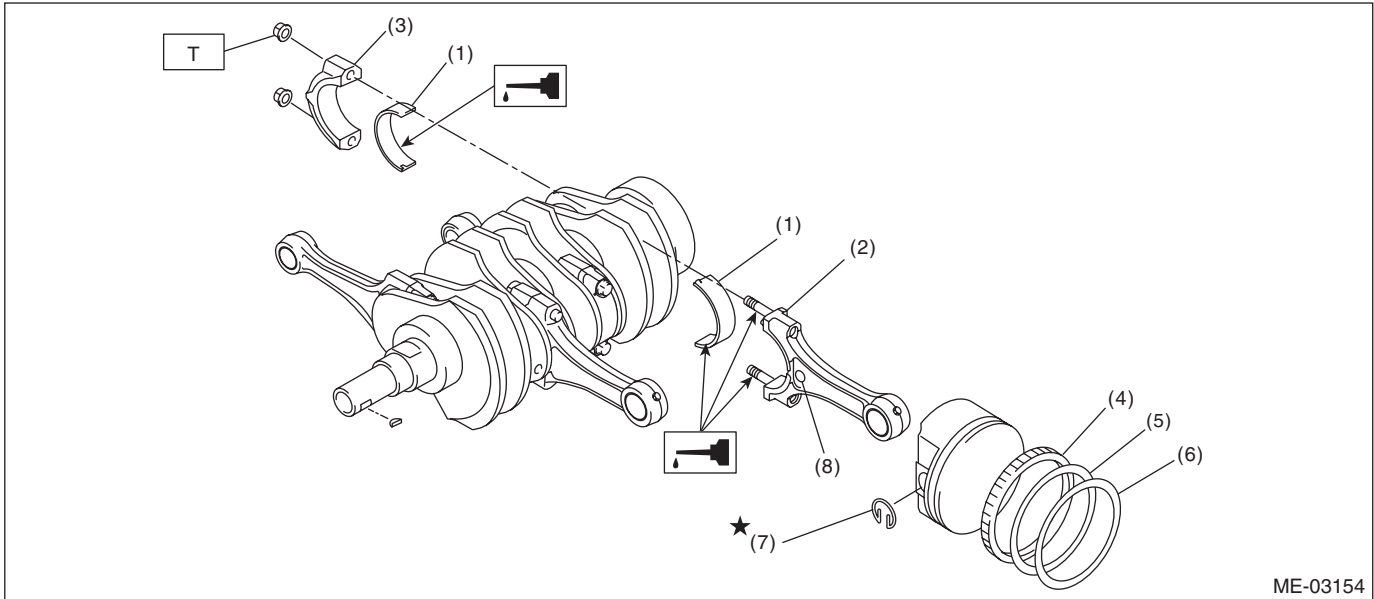
4) Remove the oil ring by hand.

### NOTE:

Arrange the removed piston rings in proper order, to prevent confusion.

5) Remove the snap ring.

## D: ASSEMBLY



ME-03154

- |                            |                 |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod         | (6) Top ring    |
| (3) Connecting rod cap     | (7) Snap ring   |
| (4) Oil ring               | (8) Side mark   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 45 (4.6, 33.2)**

1) Apply oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.

2) Position each connecting rod with the side with a side mark facing forward, and install it.

3) Tighten the connecting rod cap with connecting rod nut. Make sure the arrow mark on connecting rod cap facing front during installation.

**NOTE:**

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod nuts, apply oil on the threads.

**Tightening torque:**

**45 N·m (4.6 kgf·m, 33.2 ft·lb)**

4) Install the oil ring upper rail, expander and lower rail by hand.

5) Install the second ring and top ring using piston ring expander.

**NOTE:**

Assemble so that the piston ring mark "R" faces the top side of the piston.

# Cylinder Block

MECHANICAL

## E: INSPECTION

### 1. CYLINDER BLOCK

- 1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
- 2) Check the oil passages for clogging.
- 3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

**Warping limit:**  
**0.025 mm (0.00098 in)**

**Grinding limit:**  
**0.1 mm (0.004 in)**

**Standard height of cylinder block:**  
**201.0 mm (7.91 in)**

### 2. CYLINDER AND PISTON

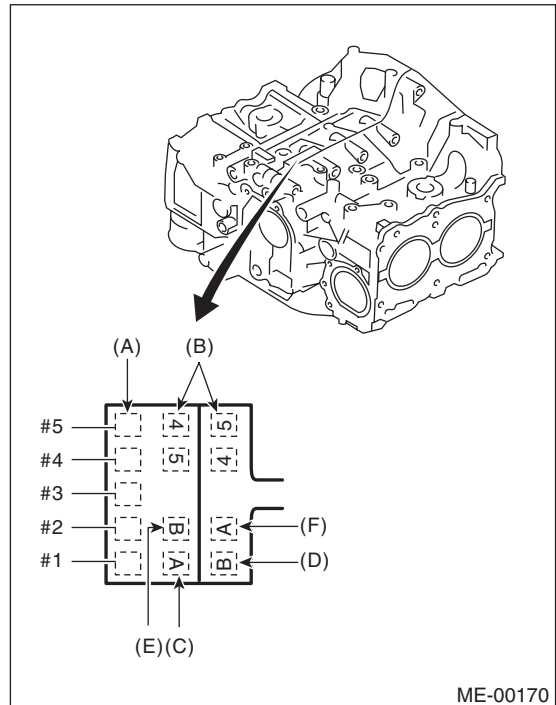
- 1) The cylinder bore size is stamped on the front upper face of the cylinder block.

NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.

**Standard diameter:**

**A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)**  
**B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)**



- (A) Main journal size mark
- (B) Cylinder block (RH) — (LH) combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

## 2) Cylinder inner diameter measurement

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Taper:

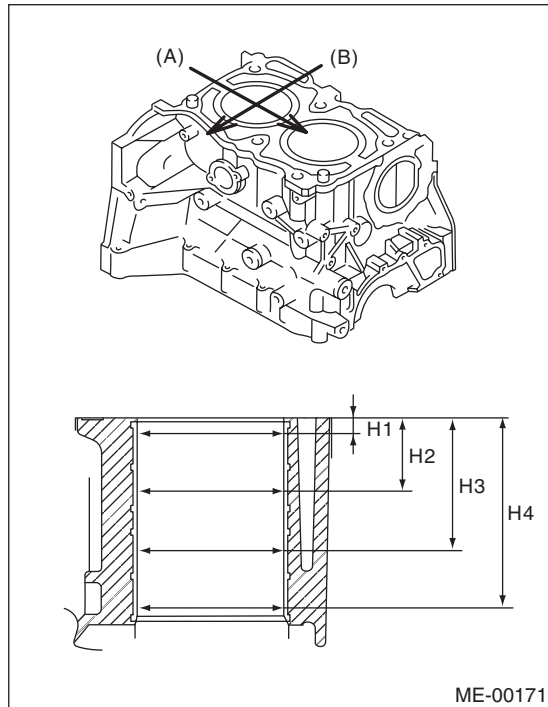
#### Standard:

0.015 mm (0.0006 in)

### Out-of-roundness:

#### Standard:

0.010 mm (0.0004 in)



(A) Piston pin direction

(B) Thrust direction

H1 10 mm (0.39 in)

H2 45 mm (1.77 in)

H3 80 mm (3.15 in)

H4 115 mm (4.53 in)

3) When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

## 4) Cylinder outer diameter measurement

Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Piston grade point H:

38.2 mm (1.504 in)

### Standard:

A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)

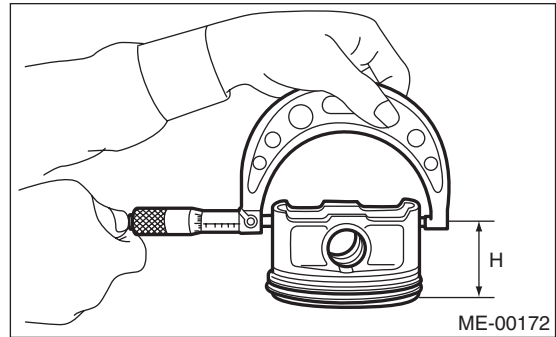
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)

### 0.25 mm (0.0098 in) oversize:

99.745 — 99.765 mm (3.9270 — 3.9278 in)

### 0.50 mm (0.0197 in) oversize:

99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Cylinder to piston clearance at 20°C (68°F):

#### Standard:

-0.010 — 0.010 mm (-0.00039 — 0.00039 in)



# Cylinder Block

## MECHANICAL

### 6) Boring and honing

(1) If any of the measured value of taper, out-of-roundness or cylinder-to-piston clearance is out of standard or if there is any damage on the cylinder wall, rebores it to replace with an oversize piston.

#### CAUTION:

**When any of the cylinders needs reboring, other cylinders must be bored at the same time, and replaced with oversize pistons.**

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

#### NOTE:

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

**Cylinder inner diameter boring limit (diameter):**  
**100.005 mm (3.9372 in)**

### 3. PISTON AND PISTON PIN

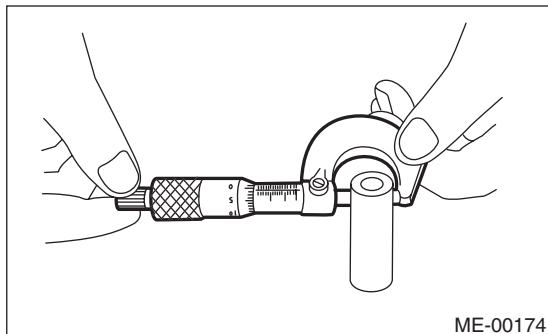
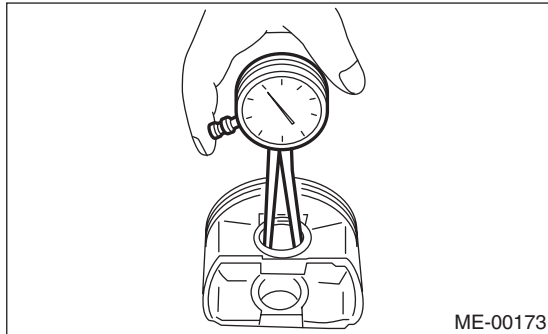
1) Check the piston and piston pin for breaks, cracks or wear. Replace if faulty.

2) Check the piston ring groove for wear and damage. Replace if faulty.

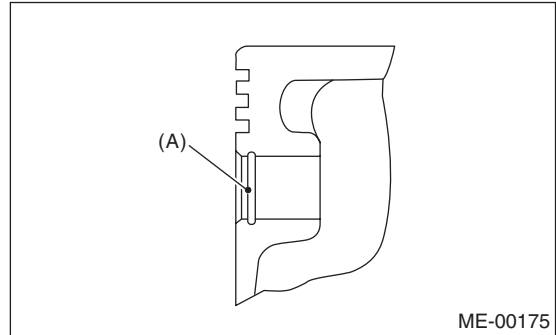
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

**Clearance between piston hole and piston pin:**  
**Standard**

**0.004 — 0.008 mm (0.0002 — 0.0003 in)**



4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.



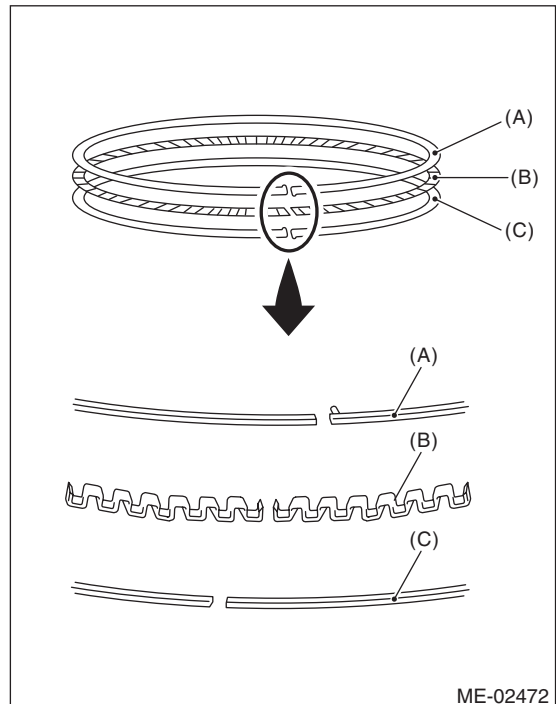
5) Check the piston pin snap ring for distortion, cracks and wear.

### 4. PISTON RING

1) If the piston ring is broken, damaged and worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new part of the same size as the piston.

#### NOTE:

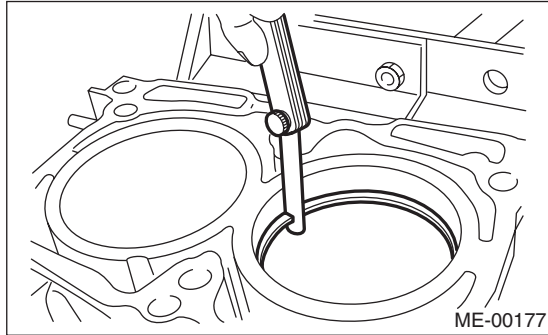
- The top ring and second ring have the mark to determine the direction to install on them. When installing them to piston, face this mark to the top side.
- Oil ring consists of the upper rail, expander and lower rail. Be careful about the direction of rail when installing the oil ring to piston.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

2) Squarely place the piston ring and oil ring in cylinder using the piston, and measure the piston ring gap with a thickness gauge.

		Standard mm (in)
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)
	Second ring	0.37 — 0.52 (0.0144 — 0.0203)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)

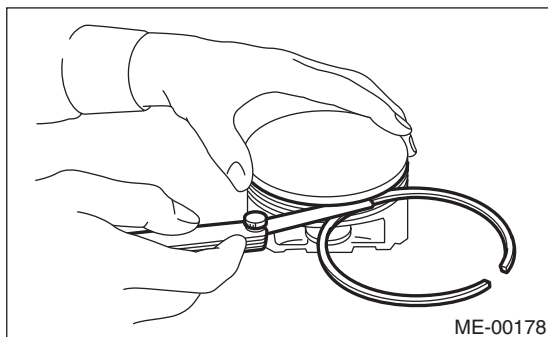


3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

**NOTE:**

Before measuring the clearance, clean the piston ring groove and piston ring.

		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



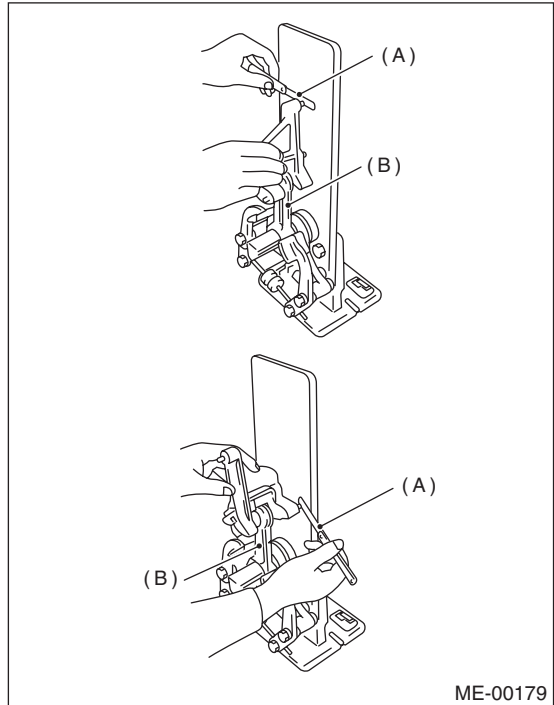
## 5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.

2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

**Limit of bend or twist per 100 mm (3.94 in) in length:**

**0.10 mm (0.0039 in)**



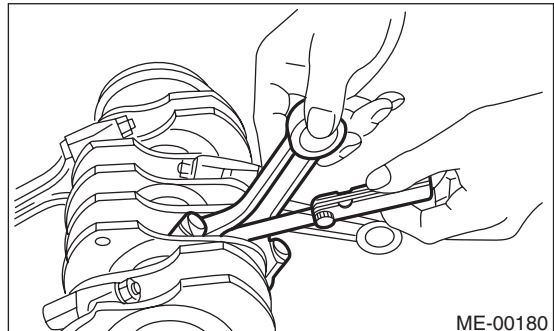
(A) Thickness gauge  
(B) Connecting rod

3) Install the connecting rod fitted with bearing to the crankshaft, and measure the thrust clearance using a thickness gauge. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

**Connecting rod thrust clearance:**

**Standard**

**0.070 — 0.330 mm (0.0028 — 0.0130 in)**



4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

# Cylinder Block

## MECHANICAL

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or under-size as necessary.

### Connecting rod oil clearance:

#### Standard

**0.016 — 0.044 mm (0.00063 — 0.0017 in)**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492 — 1.501 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) Undersize	1.510 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) Undersize	1.520 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) Undersize	1.620 — 1.623 (0.0638 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

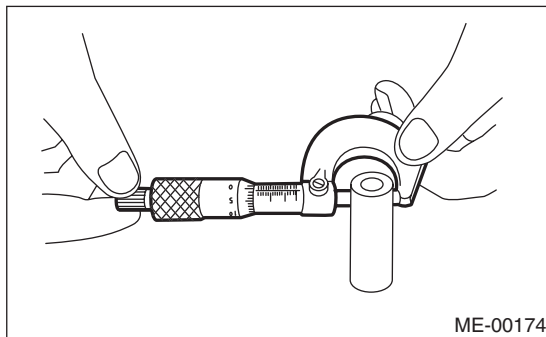
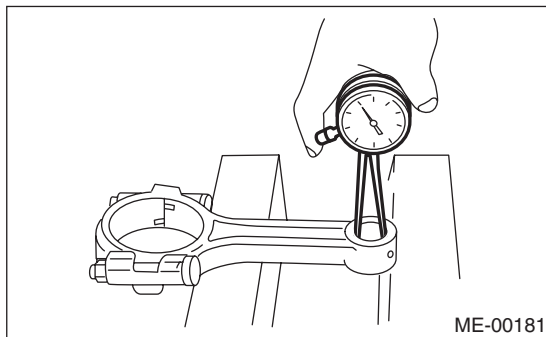
6) Inspect the bushing at connecting rod small end, and replace with a new part if worn or damaged.

7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace it with a new part.

### Clearance between piston pin and bushing:

#### Standard

**0 — 0.022 mm (0 — 0.0009 in)**

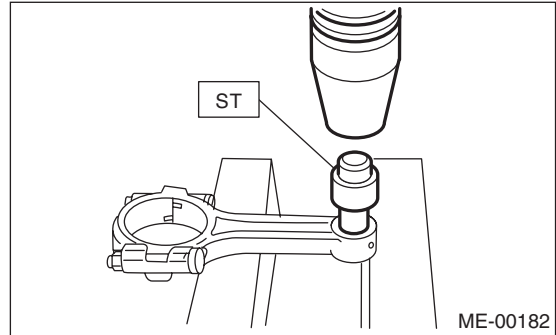


8) The replacement procedure for the connecting rod small end bushing is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with the ST after applying oil on the periphery of new bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod, and ream the inside of the bushing.

(4) After completion of reaming, clean the bushing to remove chips.

## 6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. If defective, replace the crankshaft.

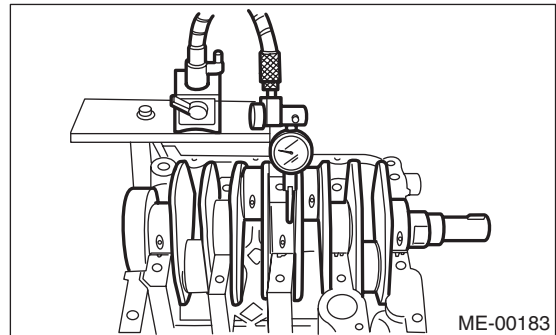
2) Measure the bend of crankshaft. If it exceeds the limit, correct or replace it.

### NOTE:

If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

### Crankshaft bend limit:

**0.035 mm (0.0014 in)**



3) Inspect the crank journal and crank pin for wear. If they are not within the specification, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

**Crank pin:**

**Out-of-roundness**

**0.003 mm (0.0001 in)**

**Cylindricity**

**0.004 mm (0.0002 in)**

**Grinding limit (dia.)**

**To 51.750 mm (2.0374 in)**

**Crank journal:**

**Out-of-roundness**

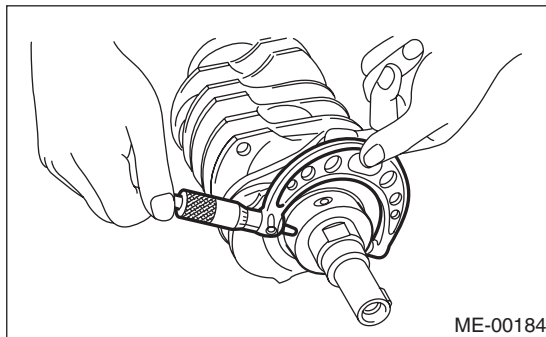
**0.005 mm (0.0002 in)**

**Cylindricity**

**0.006 mm (0.0002 in)**

**Grinding limit (dia.)**

**To 59.758 mm (2.3527 in)**



		Unit: mm (in)		
		Crank journal outer diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.492 — 1.501 (0.0587 — 0.0591)
0.03 (0.0012) Undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) Undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.620 — 1.623 (0.0638 — 0.0639)

# Cylinder Block

## MECHANICAL

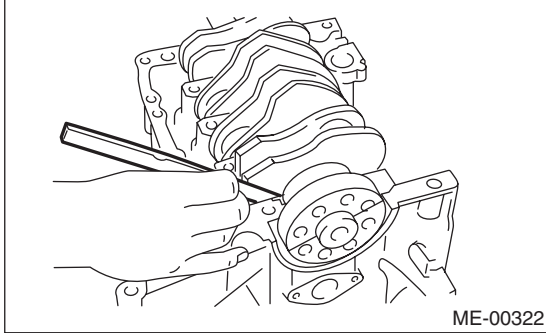
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4) Measure the thrust clearance of crankshaft at center bearing by using thickness gauge. If the thrust clearance is not within the standard, replace the bearing.

### **Crankshaft thrust clearance:**

#### **Standard**

**0.030 — 0.115 mm (0.0012 — 0.0045 in)**



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or grind to correct the crankshaft as necessary.

### **Crankshaft oil clearance:**

#### **Standard**

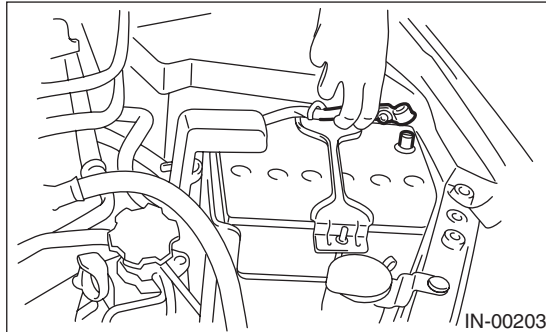
**0.010 — 0.030 mm (0.0004 — 0.0012 in)**

## 22.Oil Switching Solenoid Valve

### A: REMOVAL

#### 1. RH SIDE

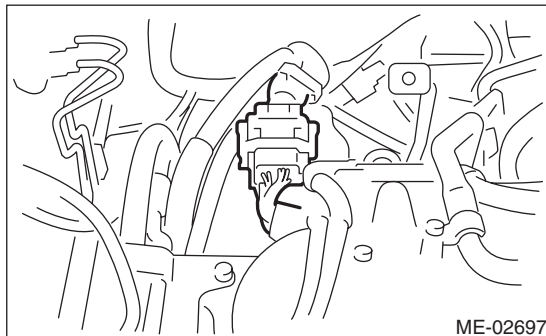
1) Disconnect the ground cable from the battery.



2) Remove the air intake chamber.

<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>

3) Remove the engine harness connector from the bracket.



4) Disconnect the connector from the oil switching solenoid valve.

5) Remove the oil switching solenoid valve.

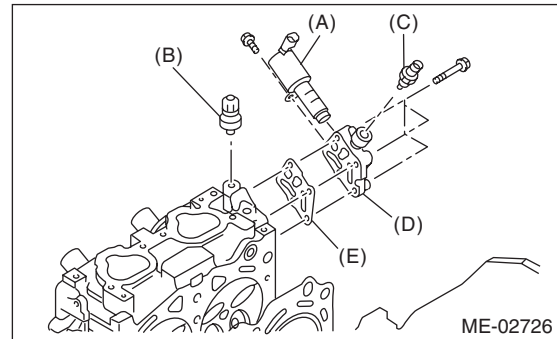
6) Remove the variable valve lift diagnosis oil pressure switch.

<Ref. to FU(H4SO)-31, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>

7) Remove the oil temperature sensor.

<Ref. to FU(H4SO)-32, REMOVAL, Oil Temperature Sensor.>

8) Remove the oil switching solenoid valve holder from the cylinder head.



(A) Oil switching solenoid valve

(B) Variable valve lift diagnosis oil pressure switch

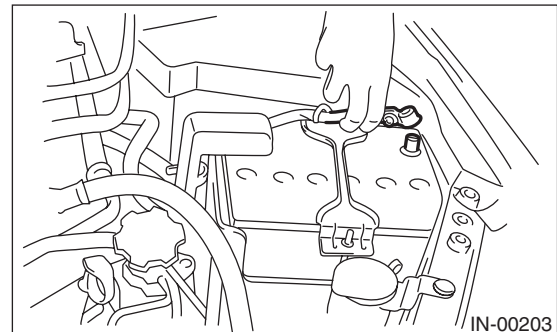
(C) Oil temperature sensor

(D) Oil switching solenoid valve holder

(E) Gasket

#### 2. LH SIDE

1) Disconnect the ground cable from the battery.



2) Remove the V-belts.

<Ref. to ME(H4SO)-37, REMOVAL, V-belt.>

3) Remove the crank pulley.

<Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>

4) Remove the timing belt cover.

<Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>

5) Remove the timing belt.

<Ref. to ME(H4SO)-42, REMOVAL, Timing Belt.>

6) Remove the cam sprocket.

<Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>

7) Remove the timing belt cover No. 2 (LH).

8) Disconnect the connector from the oil switching solenoid valve.

9) Remove the oil switching solenoid valve.

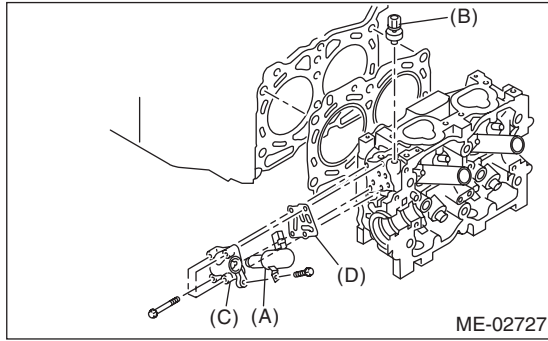
10) Remove the variable valve lift diagnosis oil pressure switch.

<Ref. to FU(H4SO)-31, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>

# Oil Switching Solenoid Valve

## MECHANICAL

11) Remove the oil switching solenoid valve holder from the cylinder head.



- (A) Oil switching solenoid valve
- (B) Variable valve lift diagnosis oil pressure switch
- (C) Oil switching solenoid valve holder
- (D) Gasket

## B: INSTALLATION

### 1. RH SIDE

Install in the reverse order of removal.

NOTE:

- Use a new gasket.
- Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
- Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

**Tightening torque:**

**T1**

**8 N-m (0.8 kgf-m, 5.9 ft-lb)**

**T2**

**10 N-m (1.0 kgf-m, 7.4 ft-lb)**

**T3**

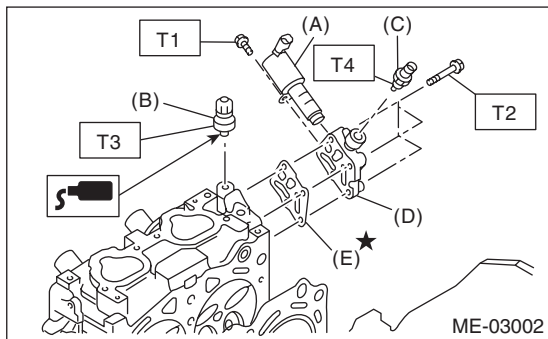
**17 N-m (1.7 kgf-m, 12.5 ft-lb)**

**T4**

**18 N-m (1.8 kgf-m, 13.3 ft-lb)**

**Liquid gasket**

**THREE BOND 1324 (Part No. 004403042)**



- (A) Oil switching solenoid valve
- (B) Variable valve lift diagnosis oil pressure switch
- (C) Oil temperature sensor
- (D) Oil switching solenoid valve holder
- (E) Gasket

### 2. LH SIDE

Install in the reverse order of removal.

NOTE:

- Use a new gasket.
- Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
- Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

**Tightening torque:**

**T1**

**8 N-m (0.8 kgf-m, 5.9 ft-lb)**

**T2**

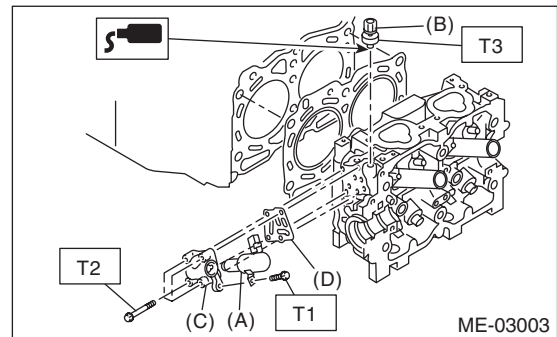
**10 N-m (1.0 kgf-m, 7.4 ft-lb)**

**T3**

**17 N-m (1.7 kgf-m, 12.5 ft-lb)**

**Liquid gasket**

**THREE BOND 1324 (Part No. 004403042)**



- (A) Oil switching solenoid valve
- (B) Variable valve lift diagnosis oil pressure switch
- (C) Oil switching solenoid valve holder
- (D) Gasket

## 23. Intake and Exhaust Valve

### A: SPECIFICATION

Refer to "Cylinder Head" for removal and installation procedures of intake and exhaust valves. <Ref. to ME(H4SO)-57, REMOVAL, Cylinder Head.> <Ref. to ME(H4SO)-58, INSTALLATION, Cylinder Head.>



## 24.Piston

### A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(H4SO)-65, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-69, INSTALLATION, Cylinder Block.>

## 25.Connecting Rod

### A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod.

<Ref. to ME(H4SO)-65, REMOVAL, Cylinder Block.>

<Ref. to ME(H4SO)-69, INSTALLATION, Cylinder Block.>

## 26.Crankshaft

### A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(H4SO)-65, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-69, INSTALLATION, Cylinder Block.>

## 27.Engine Trouble in General

### A: INSPECTION

NOTE:

The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Very often" to "Rarely".

A — Very often

B — Sometimes

C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch	C
		Defective starter	B
	Battery	Improper connection of the terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	B
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
Incorrect valve timing		B	
Improper engine oil (low viscosity)		B	

# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
Worn or stuck piston rings, cylinder and piston		C	
Incorrect valve timing		B	
Improper engine oil (low viscosity)	B		
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
Incorrect valve timing		B	
Improper engine oil (low viscosity)	B		

# Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
	Lubrication system	Improper engine oil (low viscosity)	B
		Incorrect oil pressure	B
Cooling system	Defective rocker cover gasket	C	
	Overheating	C	
Others	Evaporative emission control system malfunction	A	
	Stuck or damaged throttle valve	B	

# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Lubrication system	Incorrect oil pressure	B
Cooling system	Overheating	C	
	Over-cooling	C	
Others	Evaporative emission control system malfunction	A	
4. Surging	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Cooling system	Overheating	B
Others	Evaporative emission control system malfunction	C	

# Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Overheating	B
	Others	Evaporative emission control system malfunction	B
7. After burning in exhaust system	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
Lubrication system	Incorrect oil pressure	C	
Cooling system	Over-cooling	C	
Others	Evaporative emission control system malfunction	C	
8. Knocking	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
	Cooling system	Overheating	A
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
	Lubrication system	Loosened oil pump attaching bolts and defective gasket	B
		Defective oil filter gasket	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
	Loosened oil pan fitting bolts or defective oil pan	B	



# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK	
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A	
	Intake system	Dirty air cleaner element	A	
	Timing belt	Defective timing	B	
	Compression	Incorrect valve clearance		B
		Loosened spark plug or defective gasket		C
		Loosened cylinder head bolt or defective gasket		C
		Improper valve sealing		B
		Defective valve stem		C
		Worn or broken valve spring		C
		Worn or stuck piston rings, cylinder and piston		B
		Incorrect valve timing		B
	Lubrication system	Incorrect oil pressure		C
	Cooling system	Over-cooling		C

## 28.Engine Noise

### A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> <li>• Valve mechanism is defective.</li> <li>• Incorrect valve clearance</li> <li>• Worn valve rocker</li> <li>• Worn camshaft</li> <li>• Broken valve spring</li> </ul>
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
	Oil pressure is normal.	Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload condition.	<ul style="list-style-type: none"> <li>• Ignition timing advanced</li> <li>• Accumulation of carbon inside combustion chamber</li> <li>• Wrong spark plug</li> <li>• Improper gasoline</li> </ul>
Clank when engine speed is 1,000 to 2,000 rpm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn cylinder liner and piston ring</li> <li>• Broken or stuck piston ring</li> <li>• Worn piston pin and hole at piston end of connecting rod</li> </ul>
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn cam sprocket</li> <li>• Worn camshaft journal bore in cylinder head</li> </ul>
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Poor contact of generator brush and rotor
Gear scream when starting engine	—	<ul style="list-style-type: none"> <li>• Defective ignition starter switch</li> <li>• Worn gear and starter pinion</li> </ul>
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> <li>• Loose V belt</li> <li>• Defective water pump shaft</li> </ul>
Hissing sound	—	<ul style="list-style-type: none"> <li>• Insufficient compression</li> <li>• Air leakage in air intake system, hose, connection or manifold</li> </ul>
Timing belt noise	—	<ul style="list-style-type: none"> <li>• Loose timing belt</li> <li>• Belt contacting with case/adjacent part</li> </ul>
Valve noise	—	Incorrect valve clearance

**NOTE\*)**

When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

# Engine Noise

MECHANICAL

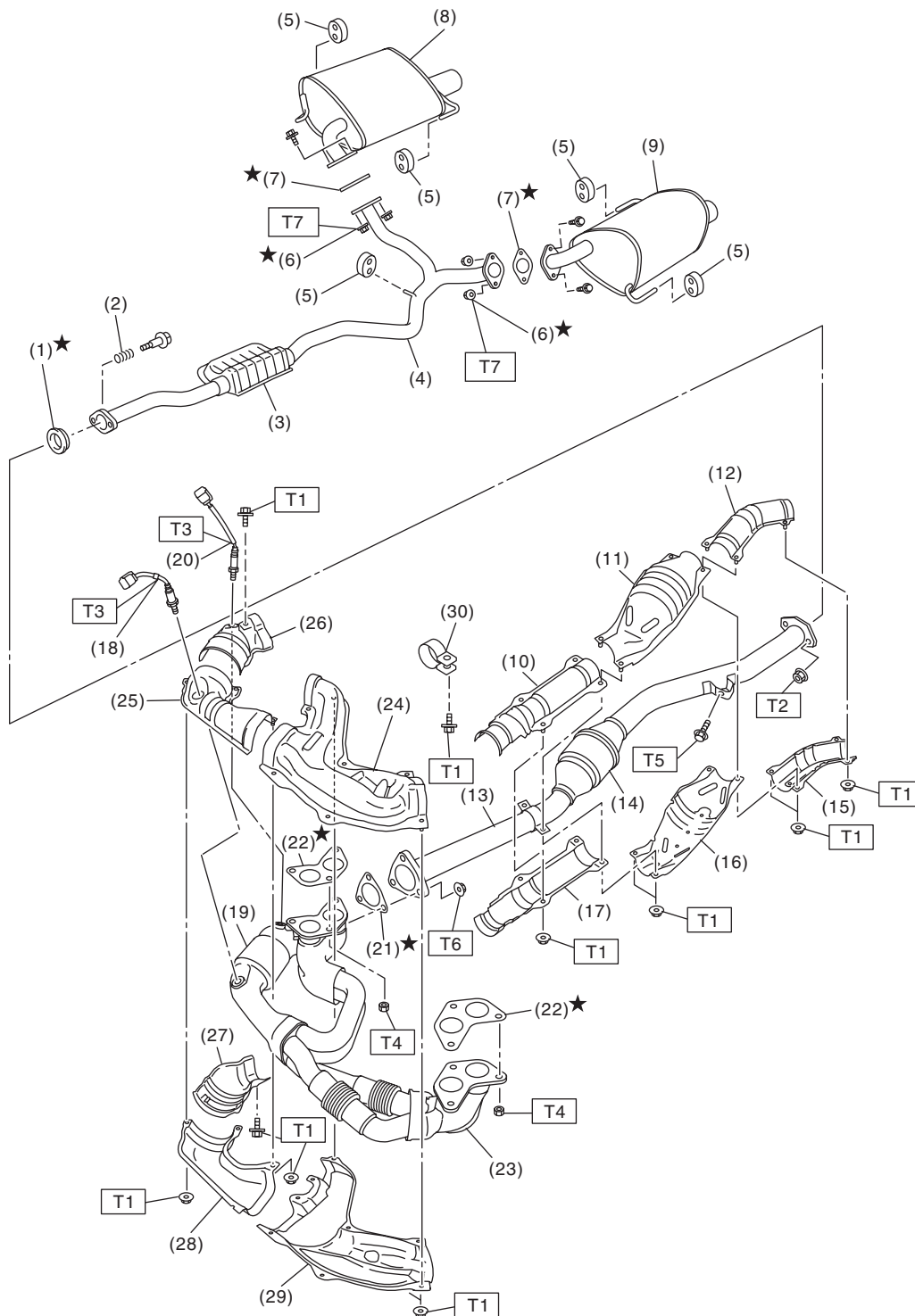
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# General Description

EXHAUST

## 1. General Description

### A: COMPONENT



EX-02221

# General Description

EXHAUST

(1) Gasket	(15) Center exhaust pipe rear lower cover	(27) Front catalytic converter lower cover
(2) Spring	(16) Rear catalytic converter lower cover	(28) Front exhaust pipe lower cover RH
(3) Chamber	(17) Center exhaust pipe front lower cover	(29) Front exhaust pipe lower cover LH
(4) Rear exhaust pipe	(18) Front oxygen (A/F) sensor	(30) Band
(5) Cushion rubber	(19) Front catalytic converter	
(6) Self-locking nut	(20) Rear oxygen sensor	
(7) Gasket	(21) Gasket	
(8) Muffler (RH)	(22) Gasket	
(9) Muffler (LH)	(23) Front exhaust pipe	
(10) Center exhaust pipe front upper cover	(24) Front exhaust pipe upper cover LH	
(11) Rear catalytic converter upper cover	(25) Front exhaust pipe upper cover RH	
(12) Center exhaust pipe rear upper cover	(26) Front catalytic converter upper cover	
(13) Center exhaust pipe		
(14) Rear catalytic converter		

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**Tightening torque:N·m (kgf-m, ft-lb)**

**T1: 13 (1.3, 9.4)**

**T2: 18 (1.8, 13.3)**

**T3: 21 (2.1, 15.5)**

**T4: 30 (3.1, 22.1)**

**T5: 35 (3.6, 25.8)**

**T6: 40 (4.1, 29.5)**

**T7: 48 (4.9, 35.4)**

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## B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

# Front Exhaust Pipe

## EXHAUST

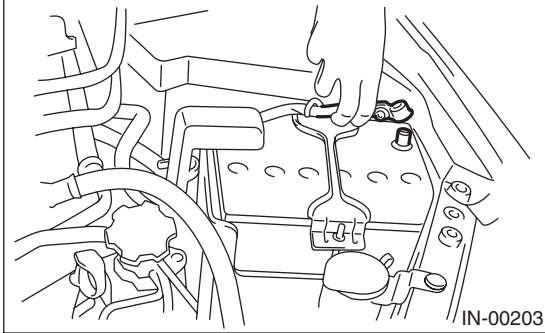
### 2. Front Exhaust Pipe

#### A: REMOVAL

##### CAUTION:

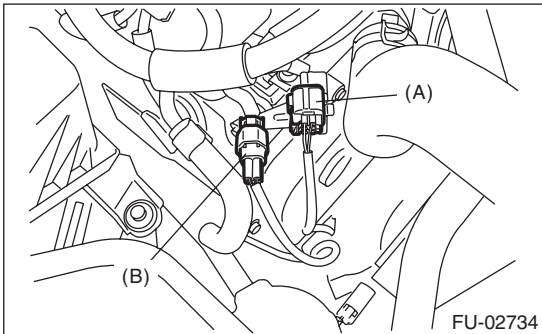
Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



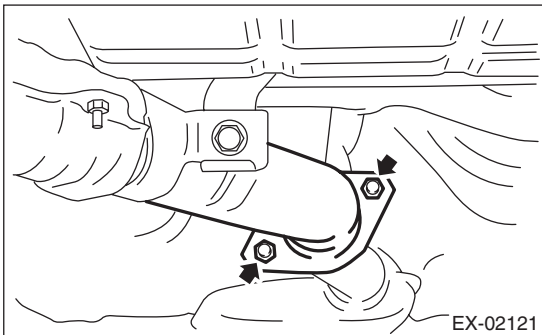
- 3) Unclip the clip fastening the harness and disconnect the following connectors.

- (1) Front oxygen (A/F) sensor connector
- (2) Rear oxygen sensor connector



- (A) Front oxygen (A/F) sensor connector  
(B) Rear oxygen sensor connector

- 4) Lift up the vehicle.
- 5) Separate the center exhaust pipe from rear exhaust pipe.

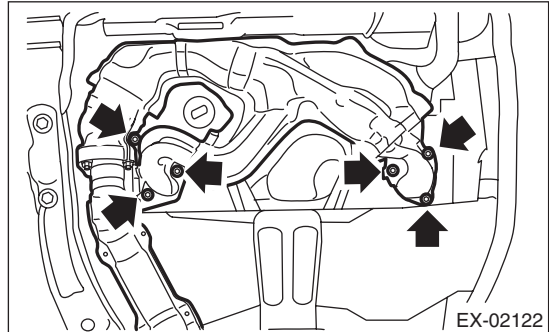


- 6) Remove the under cover.

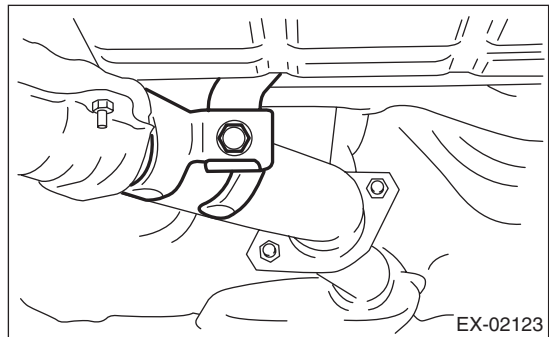
- 7) Remove the nuts which hold front exhaust pipe onto cylinder heads.

##### CAUTION:

Be careful not to pull down the front and center exhaust pipe assembly.



- 8) Remove the bolt which holds center exhaust pipe to hanger bracket.

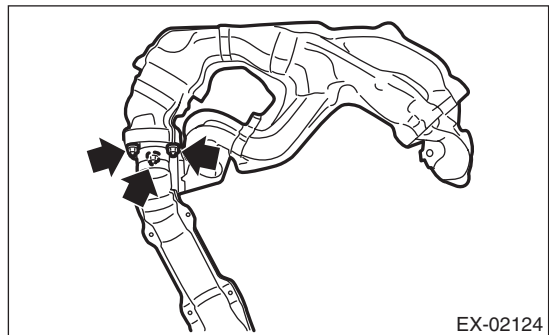


- 9) Remove the front and center exhaust pipe assembly from the vehicle.

##### CAUTION:

- The front and center exhaust pipe assemblies are very heavy. Be careful not to drop the exhaust pipes when removing.
- After removing the front and center exhaust pipe assemblies, do not pull on the rear exhaust pipe with excessive force.

- 10) Separate the front exhaust pipe from center exhaust pipe.



- 11) Remove the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H4SO)-33, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-35, REMOVAL, Rear Oxygen Sensor.>

## B: INSTALLATION

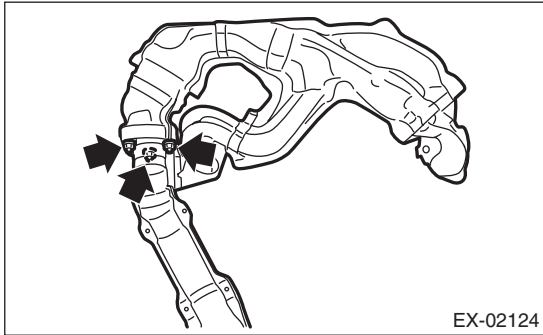
- 1) Install the front oxygen (A/F) sensor and rear oxygen sensor to the front exhaust pipe. <Ref. to FU(H4SO)-33, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-35, INSTALLATION, Rear Oxygen Sensor.>
- 2) Install the front exhaust pipe to center exhaust pipe.

NOTE:

Use a new gasket.

**Tightening torque:**

**40 N·m (4.1 kgf-m, 29.5 ft-lb)**

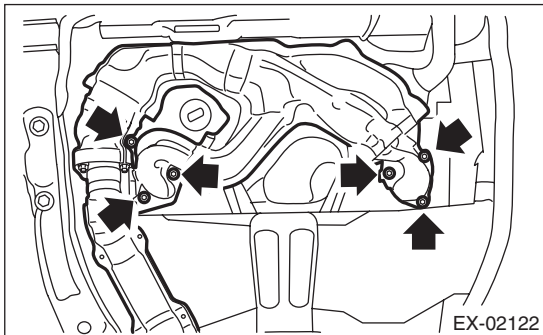


- 3) Install the front and center exhaust pipe assembly to the vehicle.

NOTE:

Use a new gasket.

- 4) Temporarily tighten the nuts which hold front exhaust pipe to cylinder heads.



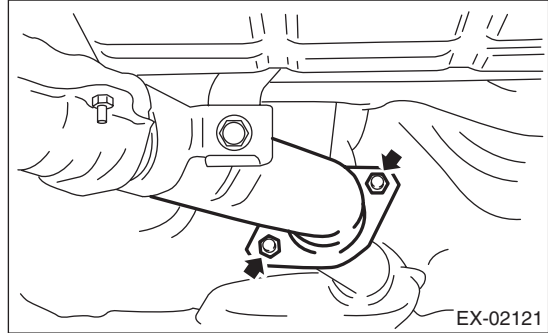
- 5) Tighten the bolt which holds the center exhaust pipe to exhaust pipe.

NOTE:

Use a new gasket.

**Tightening torque:**

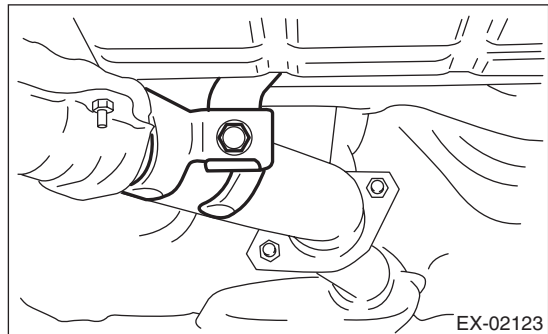
**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



- 6) Tighten the bolt which holds center exhaust pipe to hanger bracket.

**Tightening torque:**

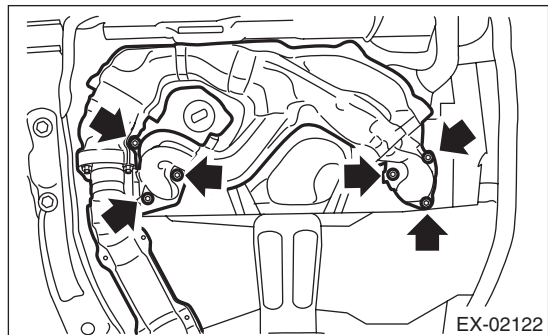
**35 N·m (3.6 kgf-m, 25.8 ft-lb)**



- 7) Tighten the nuts which hold front exhaust pipe to cylinder heads.

**Tightening torque:**

**30 N·m (3.1 kgf-m, 22.1 ft-lb)**



- 8) Install the under cover.

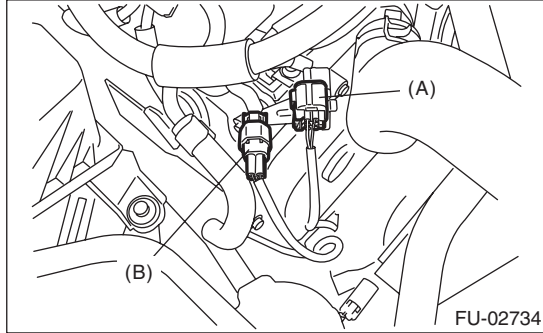
- 9) Lower the vehicle.

## Front Exhaust Pipe

### EXHAUST

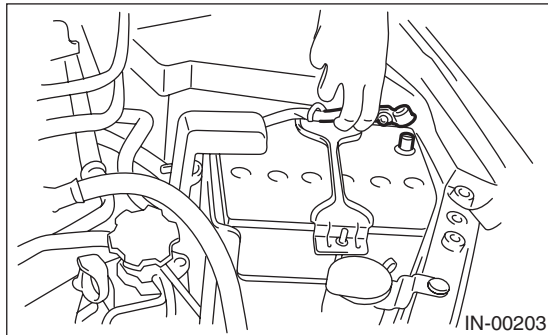
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- 10) Connect the following connectors.
  - (1) Front oxygen (A/F) sensor connector
  - (2) Rear oxygen sensor connector



- (A) Front oxygen (A/F) sensor connector
- (B) Rear oxygen sensor connector

- 11) Connect the battery ground cable to battery.



### **C: INSPECTION**

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.



## 3. Center Exhaust Pipe

### A: REMOVAL

- 1) After removing the center and front exhaust pipes as one unit, separate them. Refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 2) Remove the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H4SO)-33, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-35, REMOVAL, Rear Oxygen Sensor.>

### B: INSTALLATION

- 1) Install the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H4SO)-33, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-35, INSTALLATION, Rear Oxygen Sensor.>
- 2) Install the center exhaust pipe and front exhaust pipe as one unit. Refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

# Rear Exhaust Pipe

EXHAUST

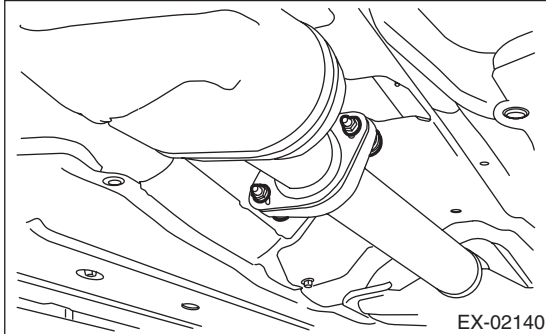
## 4. Rear Exhaust Pipe

### A: REMOVAL

#### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the rear exhaust pipe from center exhaust pipe.

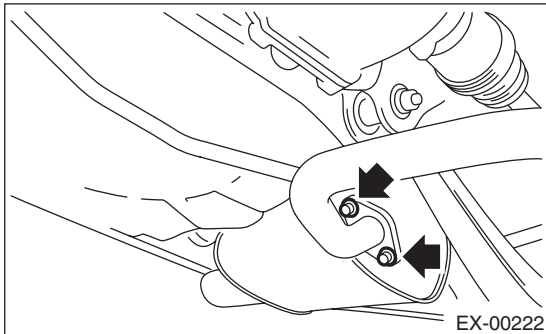


- 4) Separate the rear exhaust pipe from muffler.

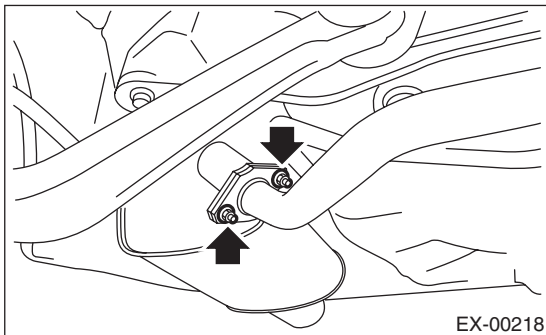
#### CAUTION:

Be careful not to pull down the rear exhaust pipe.

- LH side

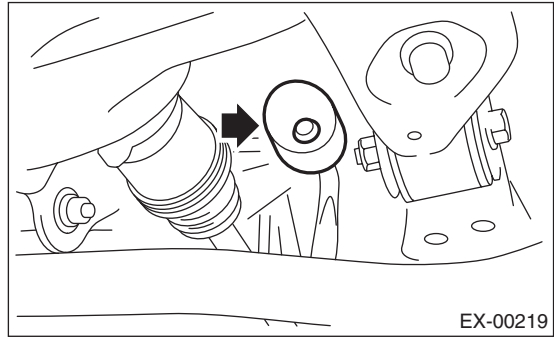


- RH side



- 5) Apply a coat of spray type lubricant to the mating area of cushion rubber.

- 6) Remove the rear exhaust pipe bracket from cushion rubber.



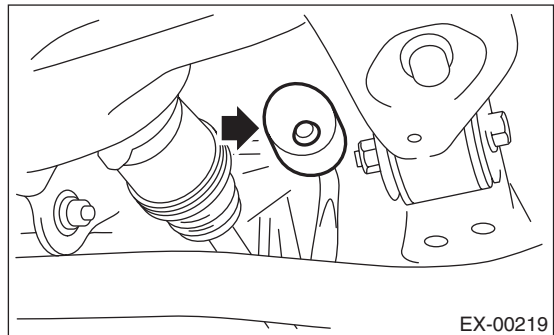
- 7) Remove the rear exhaust pipe.

### B: INSTALLATION

- 1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 2) Install the rear exhaust pipe bracket to cushion rubber.

#### NOTE:

After assembling, decrease the lubricant which was applied to the cushion rubber while removing/installing.



3) Install the rear exhaust pipe to muffler.

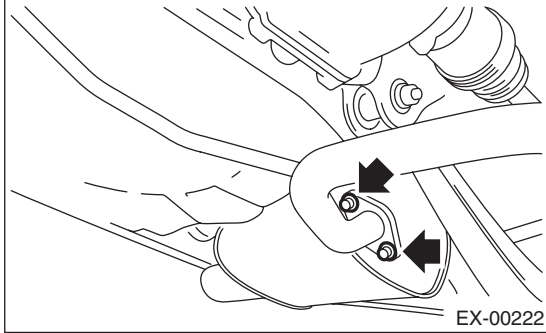
NOTE:

Use a new gasket and self-locking nut.

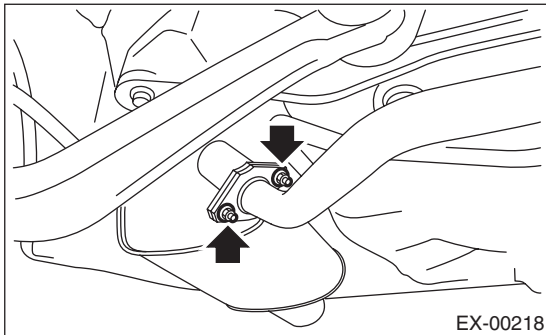
**Tightening torque:**

**48 N·m (4.9 kgf-m, 35.4 ft-lb)**

- LH side



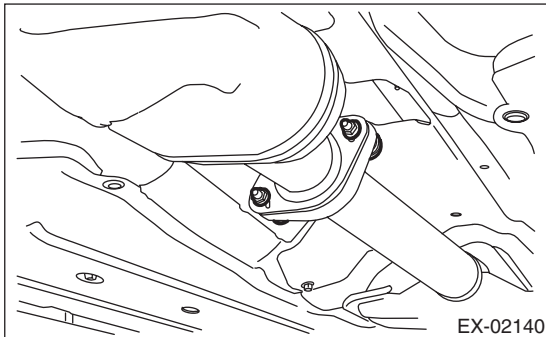
- RH side



4) Install the rear exhaust pipe to center exhaust pipe.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



## C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

# Muffler

## EXHAUST

### 5. Muffler

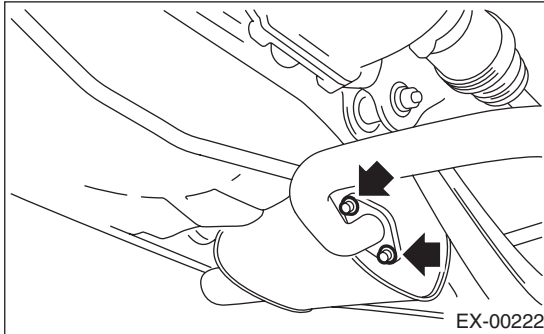
#### A: REMOVAL

##### CAUTION:

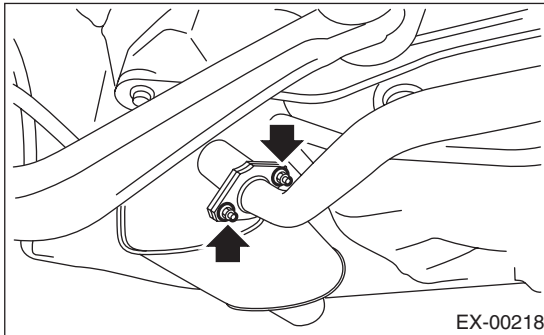
Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the muffler from rear exhaust pipe.

- LH side



- RH side

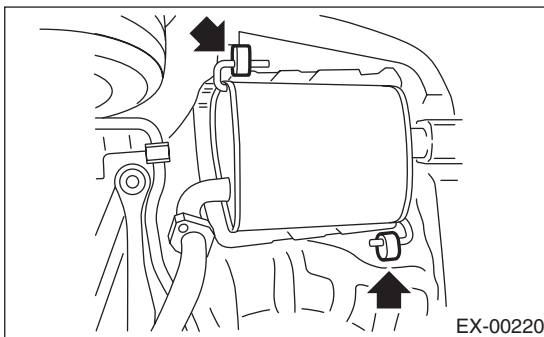


- 4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 5) Remove the front and rear cushion rubber, and then remove the muffler.

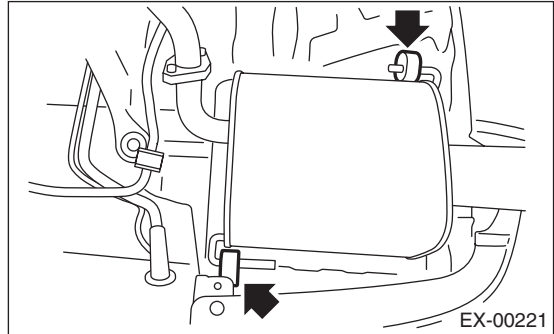
##### CAUTION:

Be careful not to drop the muffler during removal.

- LH side



- RH side



#### B: INSTALLATION

Install in the reverse order of removal.

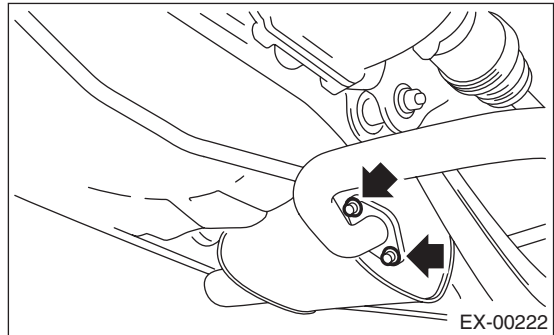
##### NOTE:

- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

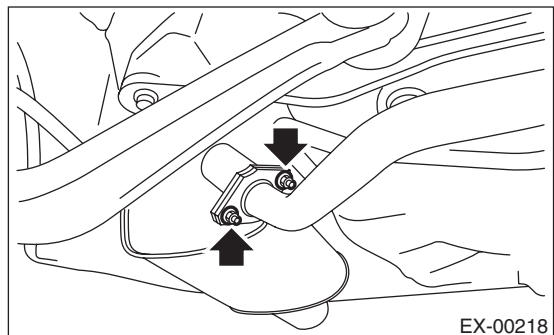
##### Tightening torque:

**48 N·m (4.9 kgf-m, 35.4 ft-lb)**

- LH side



- RH side



#### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

# General Description

## COOLING

### 1. General Description

#### A: SPECIFICATION

Cooling system		Electric fan + Forced engine coolant circulation system		
Total engine coolant capacity		ℓ (US qt, Imp qt)	MT: approx. 6.4 (6.8, 5.6) AT: approx. 6.3 (6.7, 5.5)	
Water pump	Type		Centrifugal impeller type	
	Discharge performance I	Discharge rate	ℓ (US gal, Imp gal) /min. 20 (5.3, 4.4)	
		Pump speed — Discharge pressure		760 rpm — 2.9 kPa (0.3 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance II	Discharge rate	ℓ (US gal, Imp gal) /min. 100 (26.4, 22.0)	
		Pump speed — Discharge pressure		3,000 rpm — 49 kPa (5.0 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance III	Discharge rate	ℓ (US gal, Imp gal) /min. 200 (52.8, 44.0)	
		Pump speed — Discharge pressure		6,000 rpm — 225.4 kPa (23 mAq)
		Engine coolant temperature		80°C (176°F)
	Impeller diameter		mm (in)	76 (2.99)
Number of impeller vanes			8	
Pump pulley diameter		mm (in)	60 (2.36)	
Clearance between impeller and case		Standard mm (in)	0.5 — 1.5 (0.020 — 0.060)	
Thermostat	Type		Wax pellet type	
	Starting temperature to open		80 — 84°C (176 — 183°F)	
	Fully opens		95°C (203°F)	
	Valve lift	mm (in)	9.0 (0.354) or more	
	Valve bore	mm (in)	35 (1.38)	
Radiator fan	Motor input	Main fan	90 W	
		Sub fan	90 W	
	Fan diameter / Blade	Main fan	300 mm (11.81 in)/4	
		Sub fan	300 mm (11.81 in)/5	
Radiator	Type		Down flow, pressure type	
	Core dimensions	Width × Height × Thickness mm (in)	687.4 × 340 × 16 (27.06 × 13.39 × 0.63)	
	Pressure range in which cap valve is open	kPa (kg/cm <sup>2</sup> , psi)	Above: 108±15 or more (1.1±0.15, 16±2) Below: -1.0 to -4.9 or less (-0.01 — -0.05, -0.1 — -0.7)	
	Fins		Corrugated fin type	
Reservoir tank	Capacity	ℓ (US qt, Imp qt)	0.45 (0.48, 0.40)	

# General Description

COOLING

Coolant	Recommended materials	Item number	Alternative
Coolant	SUBARU coolant	000016218	Phosphoric acid (non-amine) type
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	None

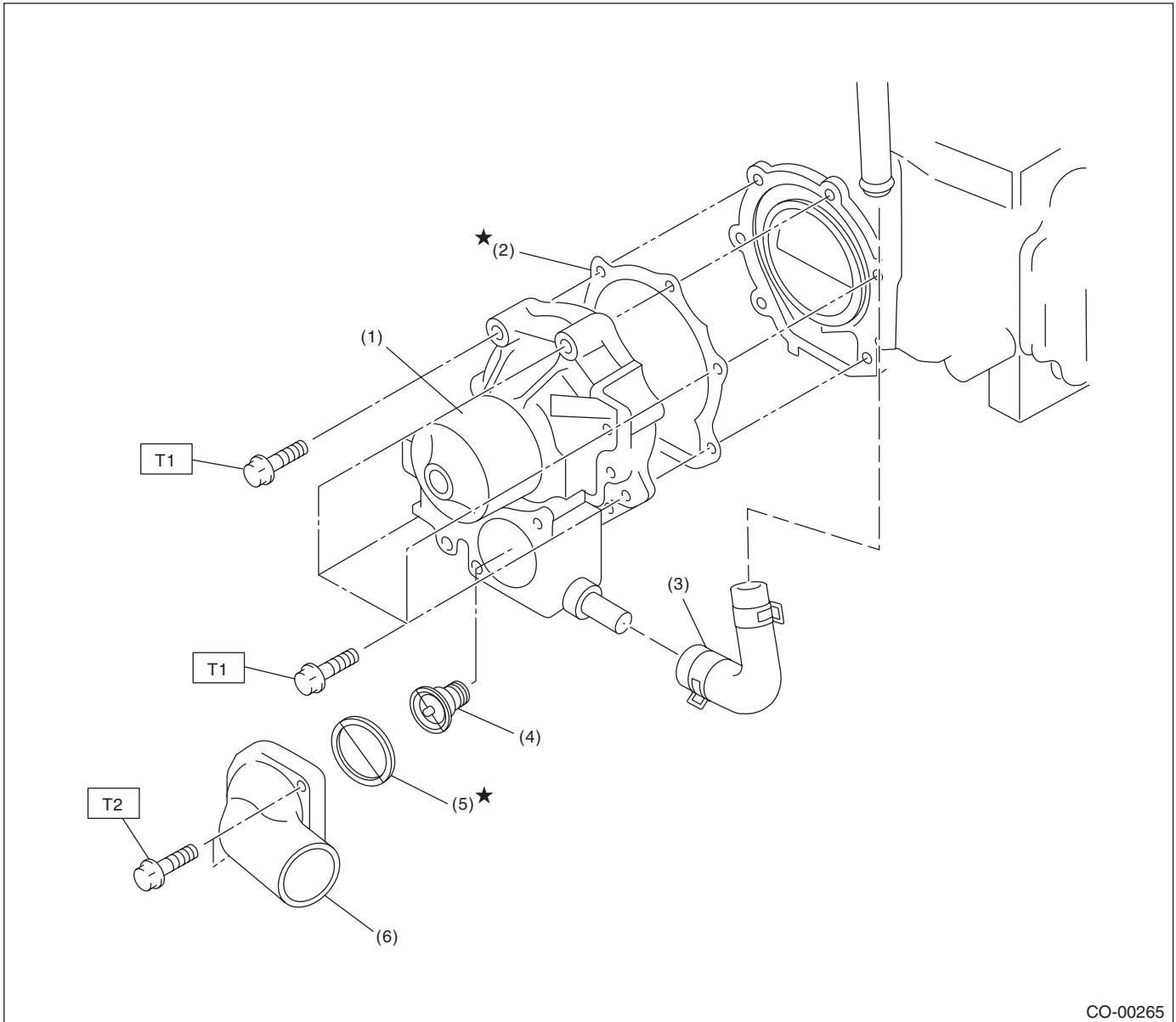
Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 95°C (203°F) or less Decrease: 92°C (198°F) or less	Increase: 96 — 99°C (205 — 210°F) Decrease: 93 — 94°C (199 — 201°F)	Increase: 100°C (212°F) or more Decrease: 95°C (203°F) or more
		Radiator fan operation	Radiator fan operation	Radiator fan operation
During acceleration: 19 km/h (12 MPH) or less During deceleration: 10 km/h (6 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 20 — 69 km/h (12 — 43 MPH) During deceleration: 11 — 64 km/h (7 — 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 70 — 105 km/h (43 — 65 MPH) During deceleration: 65 — 103 km/h (40 — 64 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
During acceleration: 106 km/h (66 MPH) or more During deceleration: 104 km/h (65 MPH) or more	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

# General Description

COOLING

## B: COMPONENT

### 1. WATER PUMP



- |                         |                      |
|-------------------------|----------------------|
| (1) Water pump ASSY     | (5) Gasket           |
| (2) Gasket              | (6) Thermostat cover |
| (3) Heater by-pass hose |                      |
| (4) Thermostat          |                      |

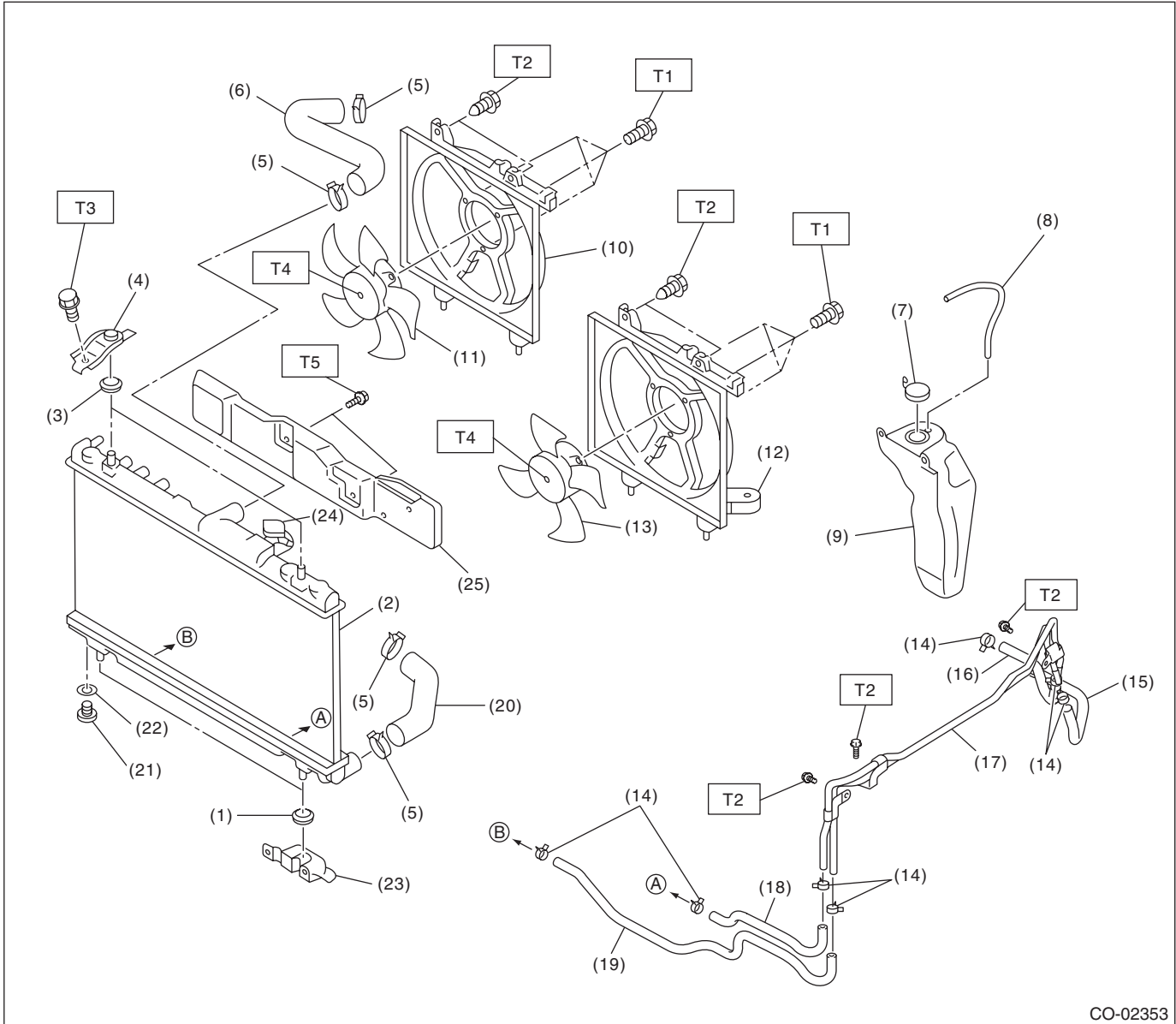
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: First 12 (1.2, 8.9)**

**Second 12 (1.2, 8.9)**

**T2: 12 (1.2, 8.9)**

## 2. RADIATOR & RADIATOR FAN



CO-02353

- |  |  |                             |
|--|--|-----------------------------|
| (1) Radiator lower cushion                         | (12) Radiator main fan shroud                        | (22) O-ring                 |
| (2) Radiator                                       | (13) Radiator main fan, radiator main fan motor ASSY | (23) Radiator lower bracket |
| (3) Radiator upper cushion                         | (14) ATF hose clamp (AT model)                       | (24) Radiator cap           |
| (4) Radiator upper bracket                         | (15) ATF hose A (AT model)                           | (25) Heat shield cover      |
| (5) Clamp  | (16) ATF hose B (AT model)                           |                             |
| (6) Radiator hose A                                | (17) ATF pipe (AT model)                             |                             |
| (7) Engine coolant reservoir tank cap              | (18) ATF hose C (AT model)                           |                             |
| (8) Over flow hose                                 | (19) ATF hose D (AT model)                           |                             |
| (9) Engine coolant reservoir tank                  | (20) Radiator hose B                                 |                             |
| (10) Radiator sub fan shroud                       | (21) Radiator drain plug                             |                             |
| (11) Radiator sub fan, radiator sub fan motor ASSY |  |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 5 (0.5, 3.7)**

**T2: 7.5 (0.76, 5.5)**

**T3: 12 (1.2, 8.9)**

**T4: 3.4 (0.35, 2.5)**

**T5: 3 (0.3, 2.2)**



# General Description

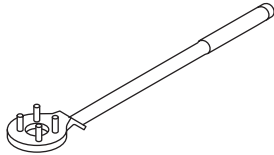
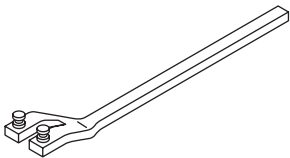
## COOLING

### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

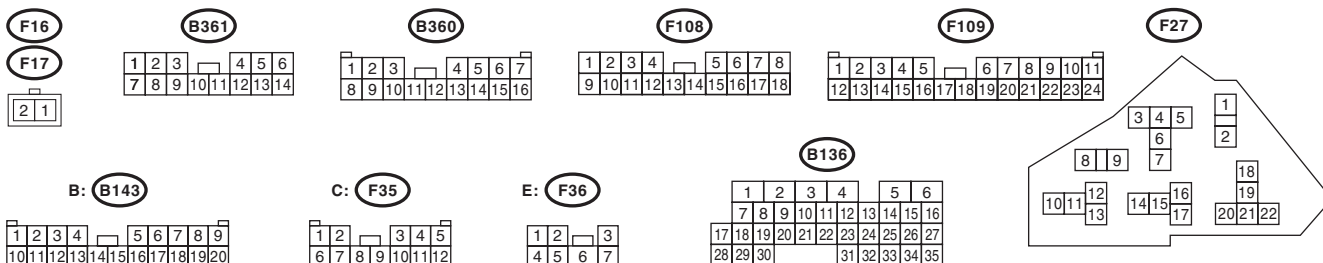
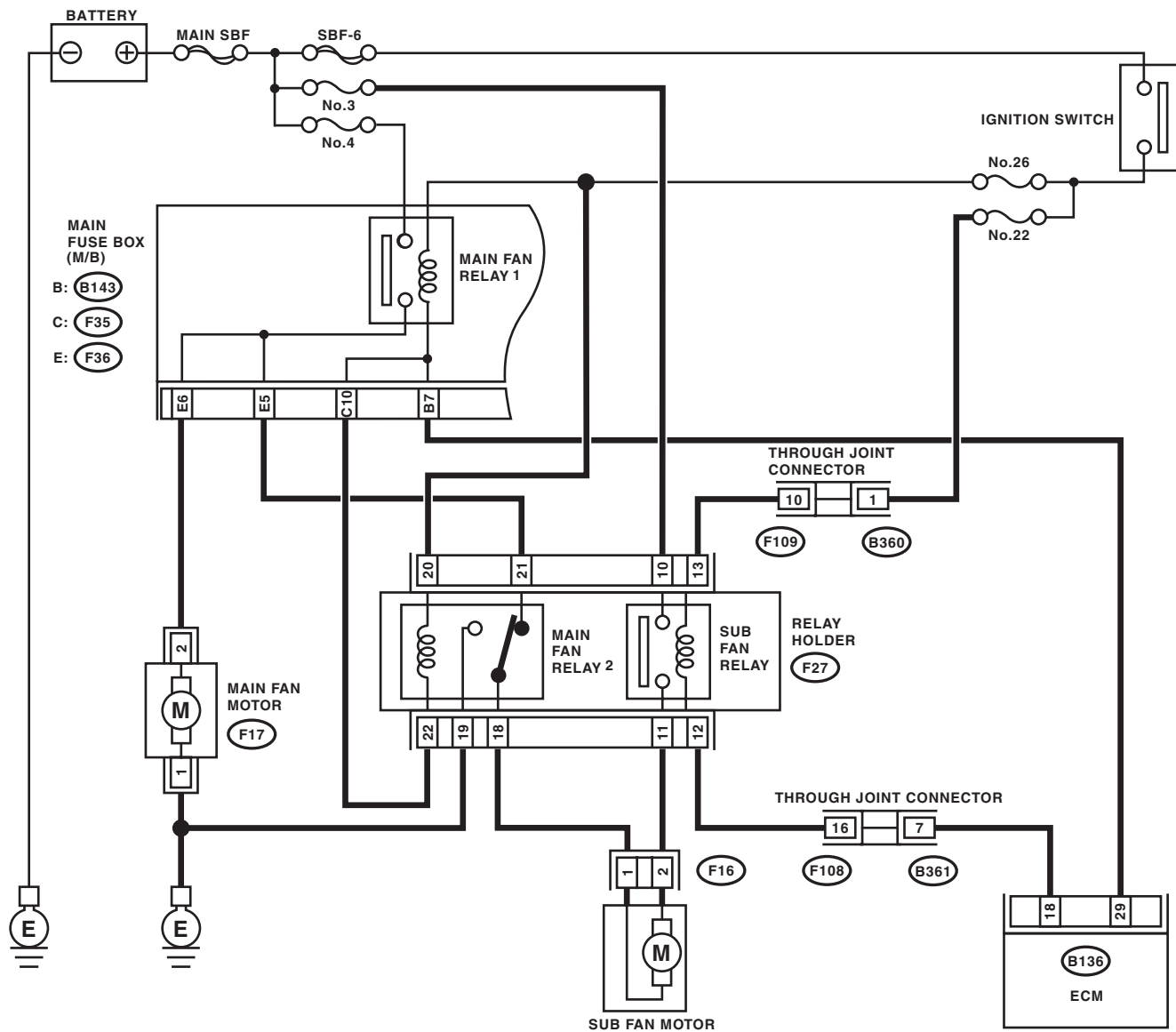
### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 ST18231AA010	18231AA010	CAM SPROCKET WRENCH	<ul style="list-style-type: none"><li>• Used for removing and installing cam sprocket.</li><li>• CAM SPROCKET WRENCH (499207100) can also be used.</li></ul>

## 2. Radiator Fan System

### A: WIRING DIAGRAM



CO-02319

# Radiator Fan System

## COOLING

### B: INSPECTION

#### DETECTING CONDITION:

- Engine coolant temperature is 96°C (205°F) or more.
- Vehicle speed is 19 km/h (12 MPH) or below.

#### TROUBLE SYMPTOMS:

Radiator main and sub fans do not rotate under the above conditions.

Step	Check	Yes	No
<b>1 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. <b>NOTE:</b> • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detailed procedures. <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at low speed?	Go to step 2.	Go to step 3.
<b>2 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. <b>NOTE:</b> • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detailed procedures. <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step 27.
<b>3 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from the relay holder. 3) Measure the voltage between the sub fan relay terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 4.	Go to step 5.
<b>4 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the sub fan relay terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 13 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 7.	Go to step 6.
<b>5 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.

# Radiator Fan System

COOLING

Step	Check	Yes	No
<b>6 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
<b>7 CHECK SUB FAN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. <i>Terminal</i> <i>No. 10 — No. 11:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Replace the sub fan relay.
<b>8 CHECK SUB FAN RELAY.</b> 1) Connect the sub fan relay terminals No. 13 and No. 12 to the battery. 2) Measure the resistance between sub fan relay terminals. <i>Terminal</i> <i>No. 10 — No. 11:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Replace the sub fan relay.
<b>9 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector. <i>Connector &amp; terminal</i> <i>(F16) No. 2 — (F27) No. 11:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 10.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
<b>10 CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.</b> 1) Remove the main fan relay 2 from the relay holder. 2) Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector. <i>Connector &amp; terminal</i> <i>(F16) No. 1 — (F27) No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 11.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
<b>11 CHECK POOR CONTACT.</b> Check poor contact of sub fan motor connector.	Is there poor contact in the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step 12.
<b>12 CHECK SUB FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 2 of the sub fan motor, and the ground (-) terminal to terminal No. 1.	Does the sub fan rotate?	Go to step 13.	Replace the sub fan motor.
<b>13 CHECK MAIN FAN RELAY 2.</b> Measure the resistance of main fan relay 2. <i>Terminal</i> <i>No. 21 — No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 14.	Replace the main fan relay 2.
<b>14 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 terminal and main fan motor connector. <i>Connector &amp; terminal</i> <i>(F17) No. 2 — (F27) No. 21:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 15.	Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.

# Radiator Fan System

## COOLING

Step	Check	Yes	No
<b>15 CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.</b> Measure the resistance between main fan motor connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(F17) No. 1 — Chassis ground:</b></i>	Is resistance less than 5 Ω?	Go to step 16.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
<b>16 CHECK POOR CONTACT.</b> Check poor contact of main fan motor connector.	Is there poor contact in the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step 17.
<b>17 CHECK MAIN FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 2 of the main fan motor, and the ground (-) terminal to terminal No. 1.	Does the main fan rotate?	Go to step 18.	Replace the main fan motor.
<b>18 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 18 — (F27) No. 12:</b></i>	Is resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between sub fan relay terminal and ECM.
<b>19 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).>
<b>20 CHECK MAIN FAN RELAY 1.</b> 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance of terminal in main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step 21.	Replace the main fan relay 1.
<b>21 CHECK MAIN FAN RELAY 1.</b> 1) Connect the main fan relay 1 coil side terminal to the battery. 2) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step 22.	Replace the main fan relay 1.
<b>22 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 terminal and main fan motor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(F17) No. 2 — (F36) No. 6:</b></i>	Is resistance less than 1 Ω?	Go to step 23.	Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.
<b>23 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 29 — (B143) No. 7:</b></i>	Is the resistance less than 1 Ω?	Go to step 24.	Repair the open circuit of the harness between main fan relay 1 terminal and ECM.

# Radiator Fan System

COOLING

Step	Check	Yes	No
<b>24 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.</b> Measure the resistance between main fan relay 2 terminal and ECM connector. <b>Connector &amp; terminal</b> <b>(B136) No. 29 — (F27) No. 22:</b>	Is resistance less than 1 Ω?	Go to step 25.	Repair the open circuit of the harness between main fan relay 2 terminal and ECM.
<b>25 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 4 and 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 26.
<b>26 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact of the ECM connector.	Repair the power supply circuit to the main fuse box.
<b>27 CHECK OPERATION OF RADIATOR FAN.</b> If the both fans do not rotate at high speed in the condition of step 2, check whether the sub fan is rotating.	Does the sub fan rotate?	Go to step 20.	Go to step 28.
<b>28 CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.</b> 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 19 — Chassis ground:</b>	Is resistance less than 1 Ω?	Go to step 29.	Repair the open circuit of harness between main fan relay 2 and chassis ground.
<b>29 CHECK POWER SUPPLY TO MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 20 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 30.	Repair the power supply line.
<b>30 CHECK MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. <b>Terminal</b> <b>(F27) No. 18 — (F27) No. 19:</b>	Is the resistance 1 MΩ or more?	Go to step 31.	Replace the main fan relay 2.
<b>31 CHECK MAIN FAN RELAY 2.</b> 1) Connect the battery to main fan relay 2 terminals No. 20 and No. 22. 2) Measure the resistance of main fan relay 2. <b>Terminal</b> <b>(F27) No. 18 — (F27) No. 19:</b>	Is the resistance less than 1 Ω?	Go to step 23.	Replace the main fan relay 2.

## 3. Engine Coolant

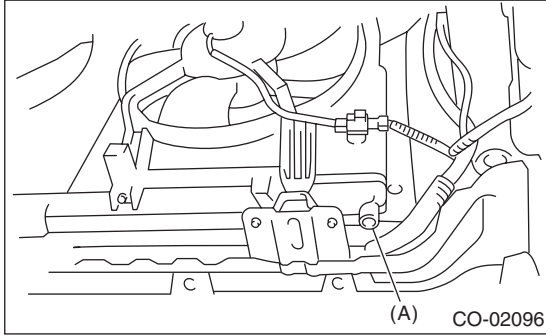
### A: REPLACEMENT

#### 1. DRAINING OF ENGINE COOLANT

- 1) Lift up the vehicle.
- 2) Remove the under cover.
- 3) Remove the drain plug to drain engine coolant into container.

**NOTE:**

Remove the radiator cap so that engine coolant will drain faster.



(A) Drain plug

- 4) Install the drain plug.

#### 2. FILLING OF ENGINE COOLANT

- 1) Pour cooling system conditioner through the filler neck.

**Cooling system protective agent:**

**Refer to "SPECIFICATION" for the cooling system protective agent. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>**

- 2) Pour engine coolant into the radiator up to the filler neck position.

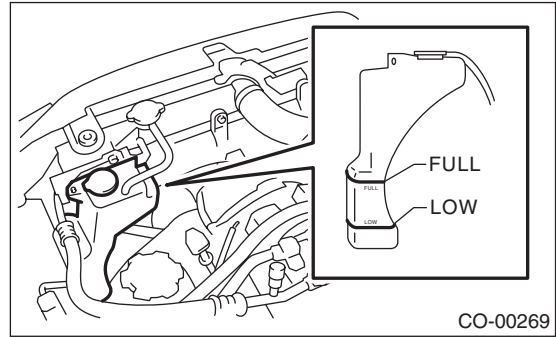
**Recommended engine coolant:**

**Refer to "SPECIFICATION" for the recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>**

**Coolant level:**

**Refer to "SPECIFICATION" for the recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>**

- 3) Fill engine coolant into the reservoir tank up to "FULL" level.



- 4) Close the radiator cap and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)

- 5) Wait for one minute after the engine stops, open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.

- 6) Perform the procedures 4) and 5) again.

- 7) Attach the radiator cap and reservoir tank cap properly.

- 8) Start the engine and operate the heater at maximum hot position and the blower speed setting at "LO"

- 9) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

**NOTE:**

Be careful with the engine coolant temperature gauge to prevent overheating.

- 10) Stop the engine and wait until the engine coolant temperature drops to 30°C (86°F) or less.

- 11) Open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position and reservoir tank to the "FULL" level.

- 12) Attach the radiator cap and reservoir tank cap properly.

- 13) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard at this time, perform the procedures from 9) again.

## B: INSPECTION

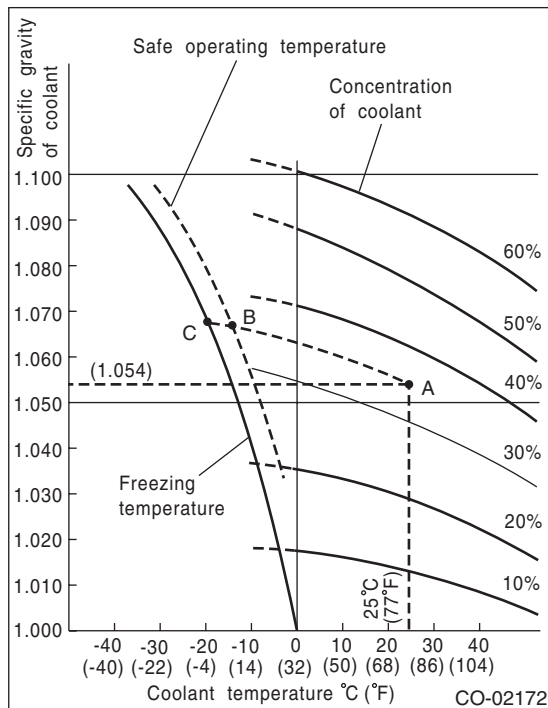
### 1. RELATIONSHIP OF ENGINE COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of engine coolant is shown in the diagram 1. Measuring the temperature and specific gravity of the coolant will provide this information.

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).

- Diagram 1



### 2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of coolant according to temperature, find the proper engine coolant concentration in the diagram 1 and replace the necessary amount of coolant with an undiluted solution of engine coolant (concentration 50%).

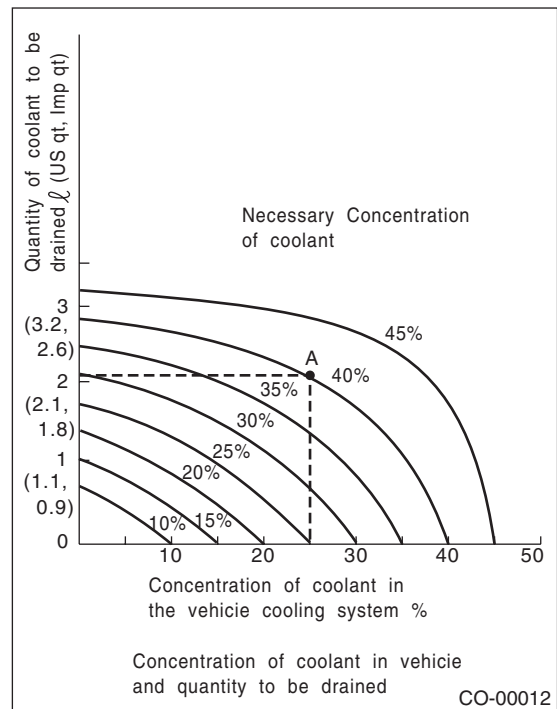
The amount of engine coolant that should be replaced can be determined using the diagram 2.

[Example]

Assume that the engine coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of engine coolant concentration intersects with the 40% curve of the necessary engine coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 ℓ (2.2 US qt, 1.8 Imp qt). Drain 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 ℓ (2.2 US qt, 1.8 Imp qt) undiluted engine coolant solution.

If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.

- Diagram 2





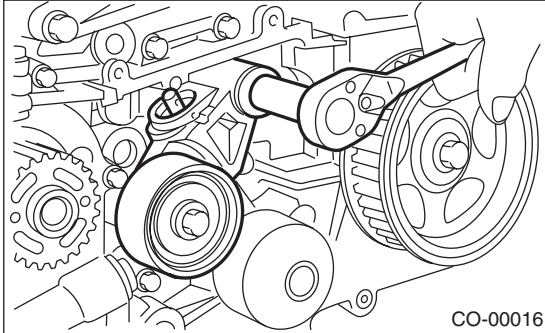
# Water Pump

## COOLING

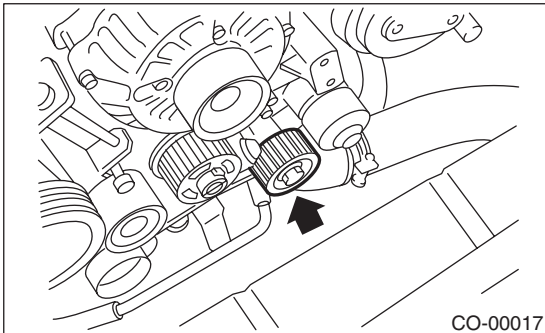
### 4. Water Pump

#### A: REMOVAL

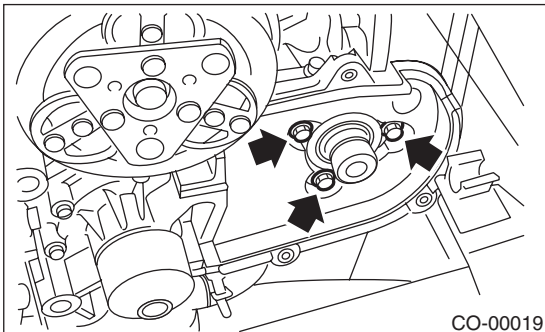
- 1) Remove the radiator. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>
- 2) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt. <Ref. to ME(H4SO)-42, TIMING BELT, REMOVAL, Timing Belt.>
- 5) Remove the automatic belt tension adjuster.



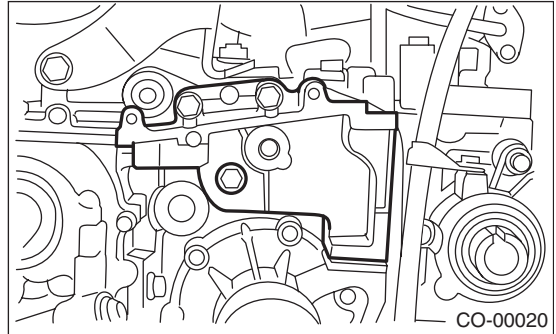
- 6) Remove the belt idler No. 2.



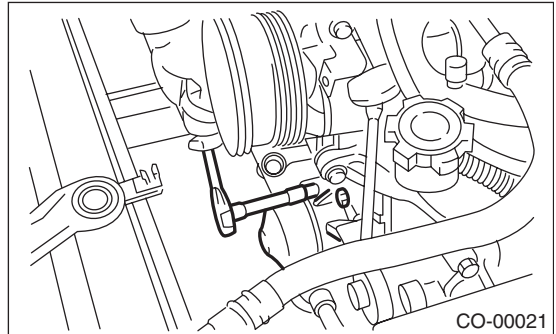
- 7) Remove the cam sprocket (LH) using ST. <Ref. to ME(H4SO)-47, REMOVAL, Cam Sprocket.>
- 8) Remove the belt cover (LH) No. 2.



- 9) Remove the tensioner bracket.



- 10) Disconnect the hose from water pump.
- 11) Remove the water pump.



## B: INSTALLATION

1) Install the water pump onto cylinder block (LH).

NOTE:

- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

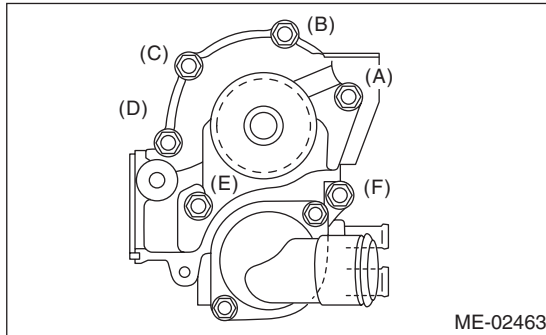
**Tightening torque:**

**First:**

**12 N·m (1.2 kgf-m, 8.9 ft-lb)**

**Second:**

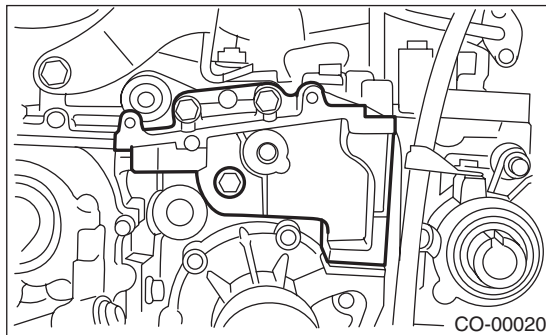
**12 N·m (1.2 kgf-m, 8.9 ft-lb)**



- 2) Install the hose to water pump.  
3) Install the tensioner bracket.

**Tightening torque:**

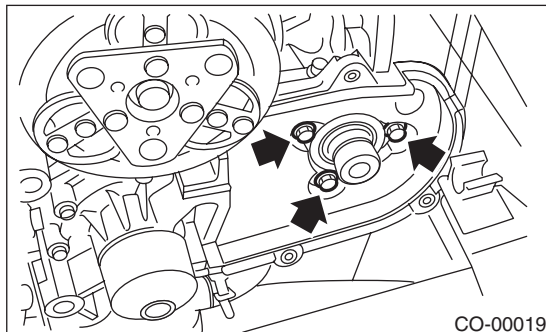
**24.5 N·m (2.5 kgf-m, 18.1 ft-lb)**



- 4) Install the belt cover No. 2 (LH).

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

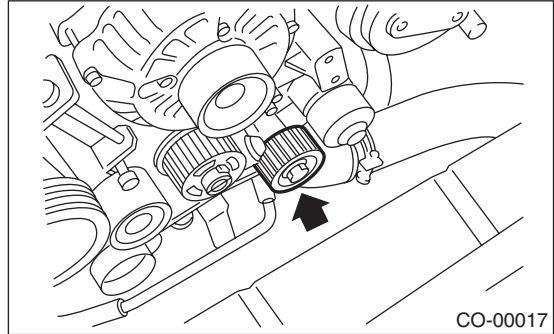


- 5) Install the cam sprocket (LH) using ST. <Ref. to ME(H4SO)-47, INSTALLATION, Cam Sprocket.>

- 6) Install the belt idler No. 2.

**Tightening torque:**

**39 N·m (4.0 kgf-m, 28.8 ft-lb)**



- 7) Install an automatic belt tensioner with the tension rod held by a pin. <Ref. to ME(H4SO)-43, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

- 8) Install the timing belt. <Ref. to ME(H4SO)-44, TIMING BELT, INSTALLATION, Timing Belt.>

- 9) Install the crank pulley. <Ref. to ME(H4SO)-40, INSTALLATION, Crank Pulley.>

- 10) Install the V-belts. <Ref. to ME(H4SO)-38, INSTALLATION, V-belt.>

- 11) Install the radiator. <Ref. to CO(H4SO)-19, INSTALLATION, Radiator.>

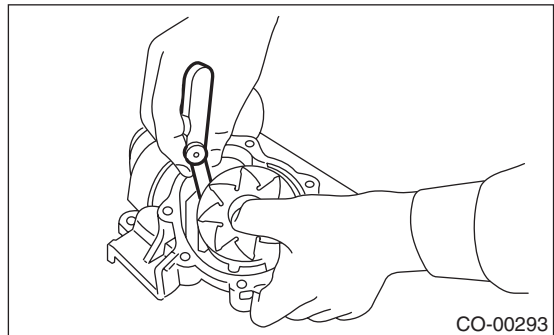
## C: INSPECTION

- 1) Check the water pump bearing for smooth rotation.
- 2) Check the water pump pulley for abnormalities.
- 3) Make sure the impeller is not deformed or damaged.
- 4) Inspect the clearance between impeller and pump case.

**Clearance between impeller and pump case:**

**Standard**

**0.5 — 1.5 mm (0.020 — 0.060 in)**



- 5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace the water pump assembly.

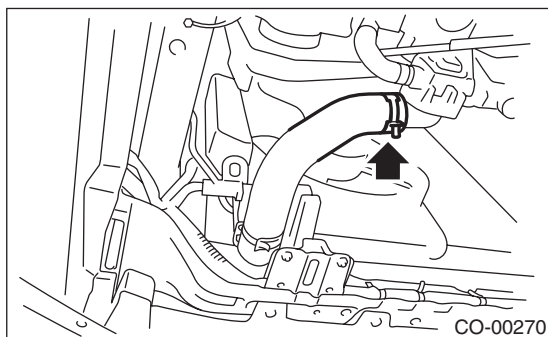
# Thermostat

## COOLING

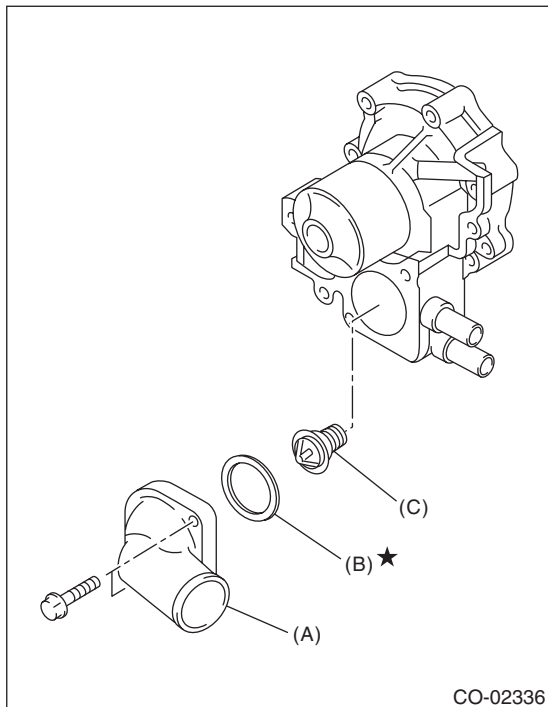
### 5. Thermostat

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely. <Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Remove the front exhaust pipe. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 6) Disconnect the radiator outlet hose from thermostat cover.



- 7) Remove the thermostat cover, and then remove the gasket and thermostat.



- (A) Thermostat cover
- (B) Gasket
- (C) Thermostat

#### B: INSTALLATION

- 1) Install a gasket to thermostat.

#### NOTE:

Use a new gasket.

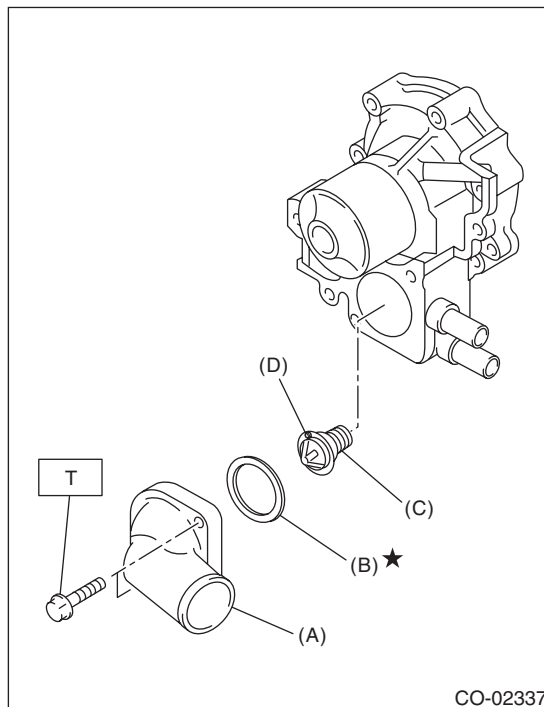
- 2) Install the thermostat and thermostat cover.

#### NOTE:

The thermostat must be installed with the jiggle pin facing upward.

#### Tightening torque:

**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- (A) Thermostat cover
- (B) Gasket
- (C) Thermostat
- (D) Jiggle pin

- 3) Connect the radiator outlet hose to thermostat cover.
- 4) Install the front exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 5) Install the under cover.
- 6) Lower the vehicle.
- 7) Fill engine coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

**C: INSPECTION**

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.

- Inspection method

Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measured value should meet the specification.

**NOTE:**

- Leave the thermostat in the boiling water for five minutes or more before measuring valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

**Opening start temperature:**

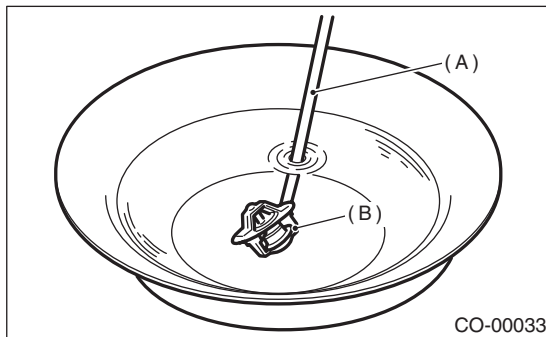
**80 — 84°C (176 — 183°F)**

**Full open temperature:**

**95°C (203°F)**

**Valve lift:**

**9.0 mm (0.354 in) or more**



(A) Thermometer

(B) Thermostat

# Radiator

## COOLING

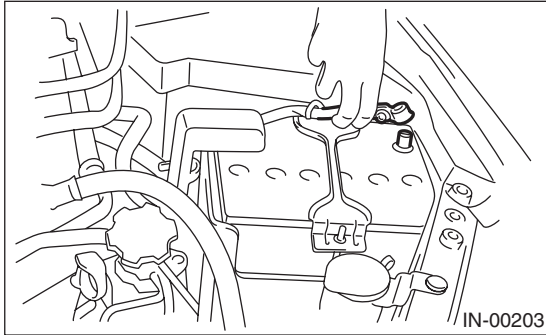
### 6. Radiator

#### A: REMOVAL

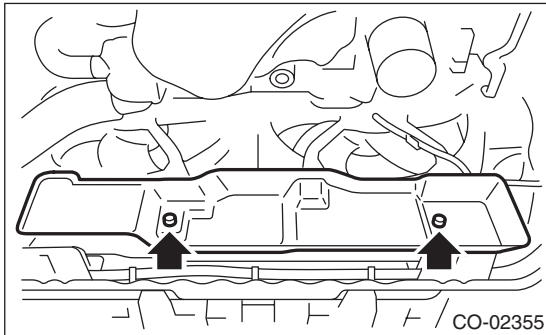
##### CAUTION:

The radiator is pressurized. Wait until engine cools down before working on the radiator.

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.

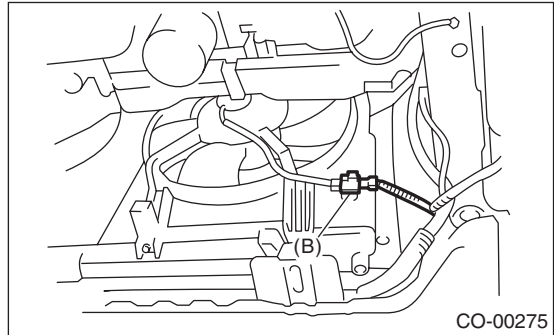
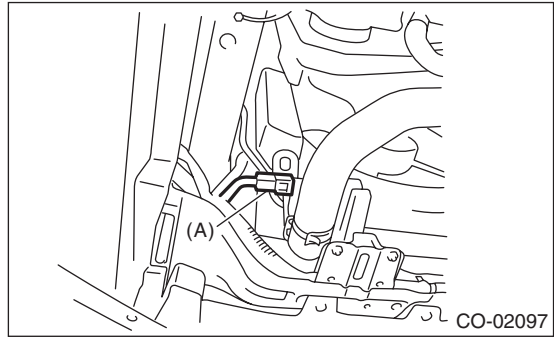


- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the heat shield cover from radiator. (AT model)

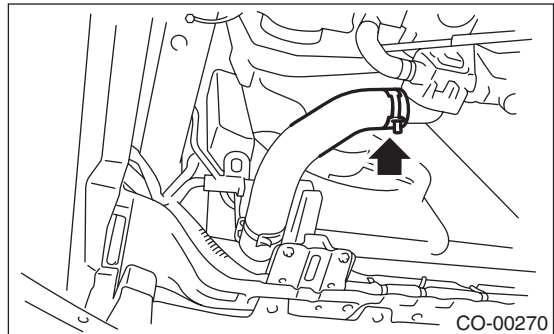


- 6) Drain engine coolant completely.  
<Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

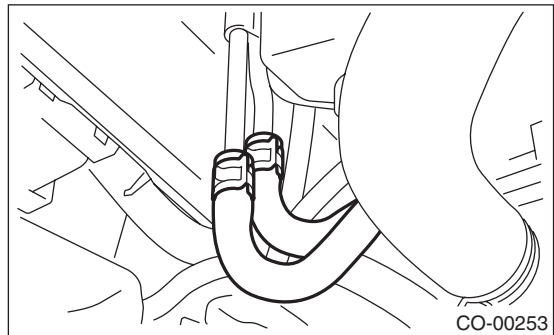
- 7) Disconnect the radiator main fan motor connector (A) and sub fan motor connector (B).



- 8) Disconnect the radiator outlet hose from thermostat cover.

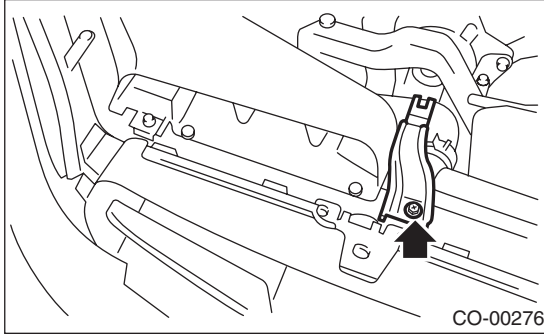


- 9) Disconnect the ATF cooler hoses from ATF pipes. (AT model)  
Plug the ATF pipe to prevent ATF from leaking.



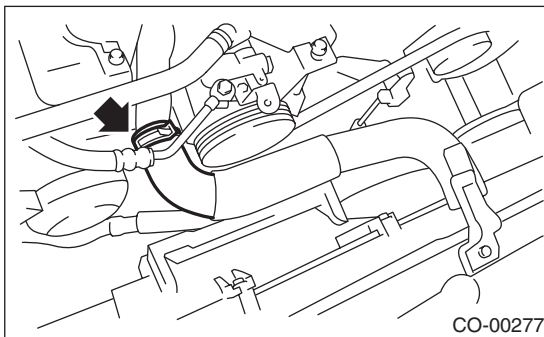
- 10) Lower the vehicle.
- 11) Disconnect the over flow hose.
- 12) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>

13) Remove the hood stay holder.

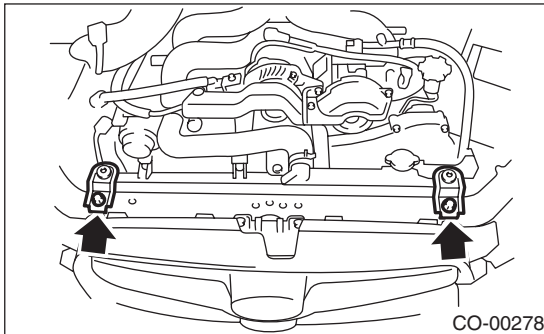


14) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

15) Disconnect the radiator inlet hoses from the engine.



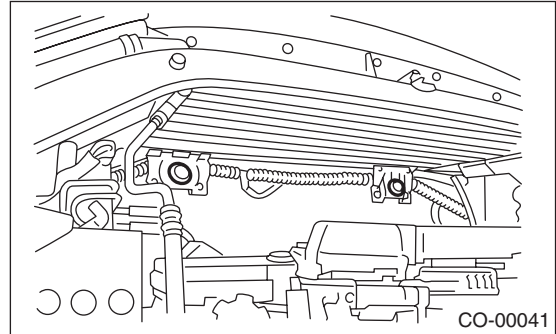
16) Remove the radiator upper brackets.



17) Lift the radiator up and away from vehicle.

## B: INSTALLATION

1) Attach the radiator lower cushion to the hole on the radiator lower bracket.



2) Install the radiator to vehicle.

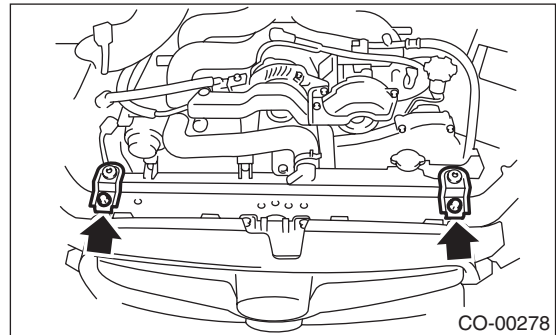
### NOTE:

Make pins on the lower side of radiator be fitted into the radiator lower cushions on body side.

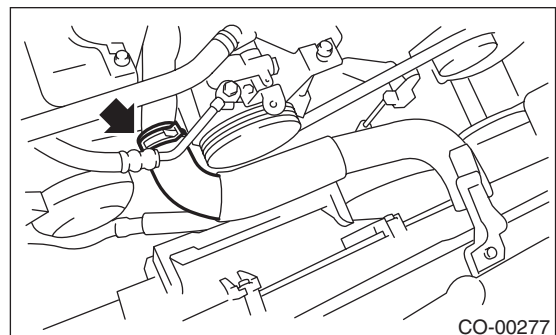
3) Install the radiator upper brackets and tighten the bolts.

### Tightening torque:

**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



4) Connect the radiator inlet hose.



5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

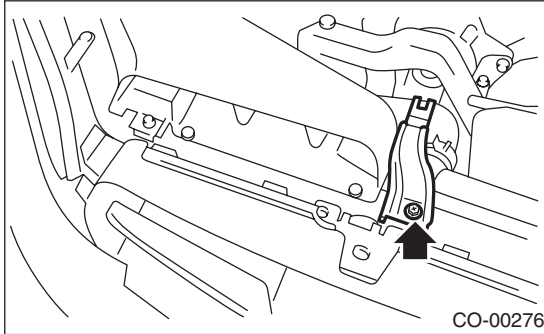
# Radiator

## COOLING

6) Install the hood stay holder.

**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

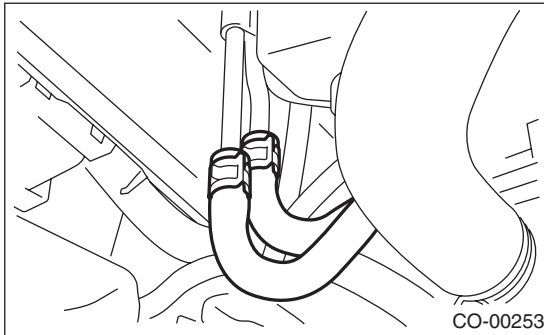


7) Install the reservoir tank. <Ref. to CO(H4SO)-27, INSTALLATION, Reservoir Tank.>

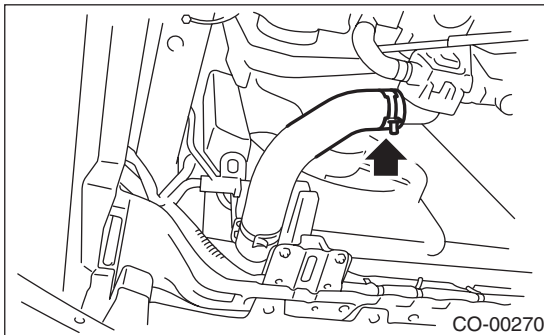
8) Connect the over flow hose.

9) Lift up the vehicle.

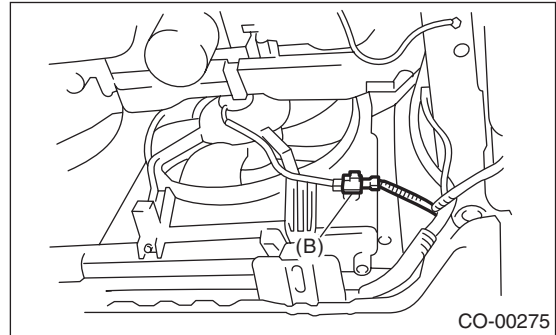
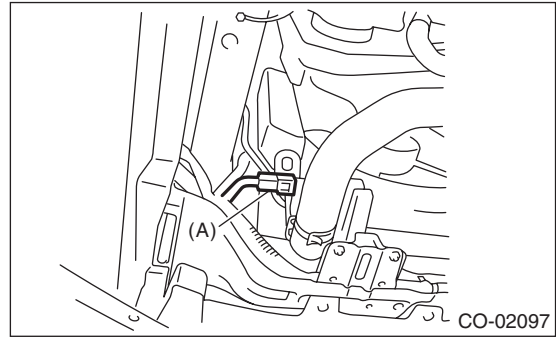
10) Connect the ATF cooler hoses. (AT model)



11) Connect the radiator outlet hose.



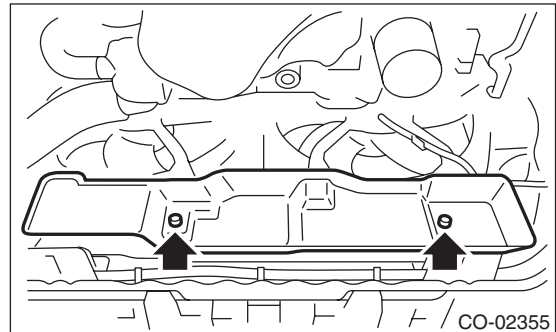
12) Connect the radiator main fan motor connector (A) and sub fan motor connector (B).



13) Install the heat shield cover. (AT model)

**Tightening torque:**

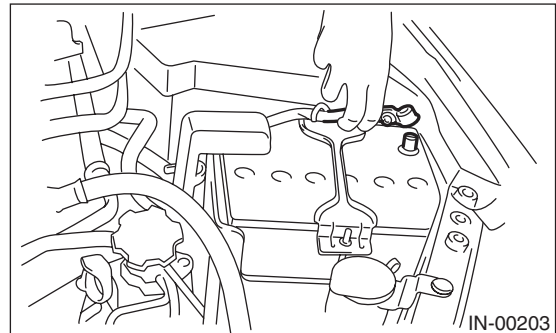
**3 N·m (0.3 kgf-m, 2.2 ft-lb)**



14) Install the under cover.

15) Lower the vehicle.

16) Connect the battery ground cable to battery.

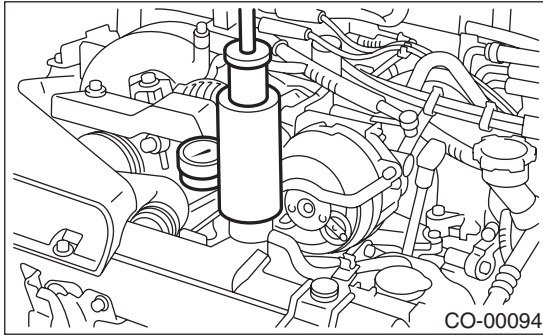


17) Fill engine coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

18) Check the ATF level. <Ref. to 4AT-28, INSPECTION, Automatic Transmission Fluid.>

**C: INSPECTION**

1) Remove the radiator cap, fill the radiator with engine coolant, and then install the tester to the installation position of cap.



2) Apply a pressure of 157 kPa (1.6 kg/cm<sup>2</sup>, 23 psi) to the radiator and check the following points:

- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

**CAUTION:**

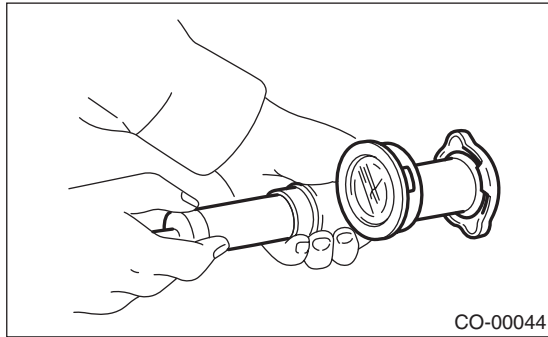
- **Engine should be turned off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful of engine coolant from spurting out when removing the tester.**
- **Be careful not to deform the filler neck of radiator when installing and removing the tester.**



## 7. Radiator Cap

### A: INSPECTION

1) Attach the radiator cap to tester.



2) Increase pressure until the tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds. Replace the cap if it is opened under a pressure less than the service limit value.

**Standard:**

***93 — 123 kPa (0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)***

**Service limit:**

***83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)***

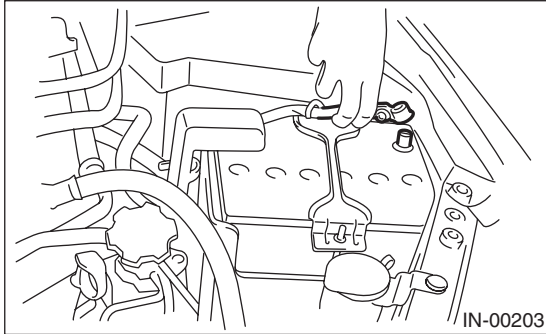
**CAUTION:**

**Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.**

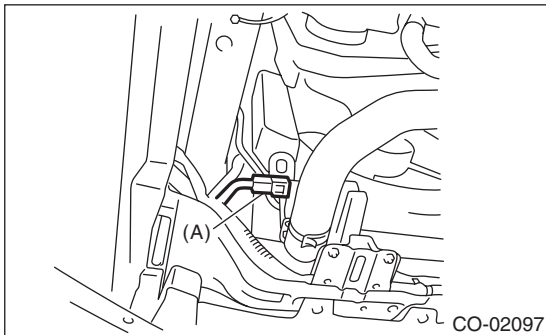
## 8. Radiator Main Fan and Fan Motor

### A: REMOVAL

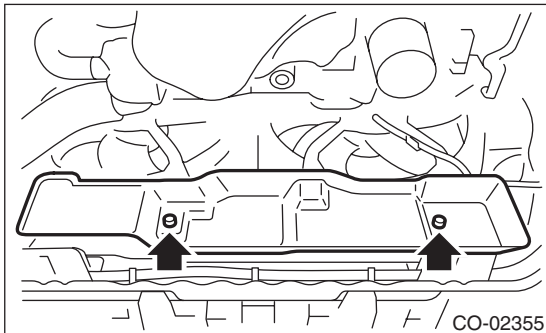
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the connector (A) of the main fan motor.

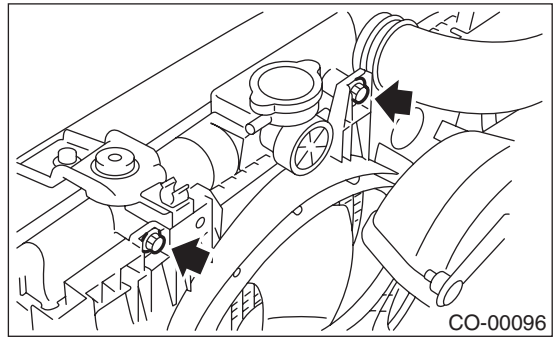


- 6) Remove the heat shield cover. (AT model)



- 7) Remove the ATF hose from the clip of the radiator main fan motor assembly. (AT model)
- 8) Lower the vehicle.
- 9) Disconnect the over flow hose.
- 10) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>

- 11) Remove the bolts which hold the radiator main fan shroud to the radiator.



- 12) Remove the radiator main fan motor assembly.

### B: INSTALLATION

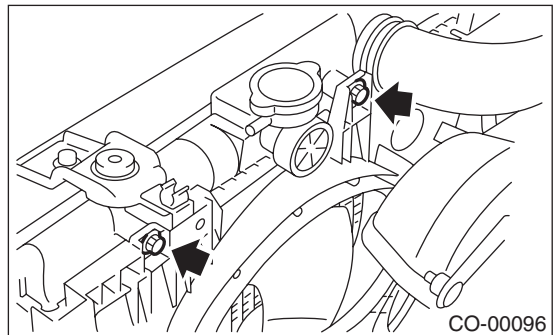
Install in the reverse order of removal.

#### NOTE:

If the installation of the radiator main fan motor assembly is difficult, attempt installation after loosening the bolts which hold the radiator sub fan motor assembly.

#### Tightening torque:

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**

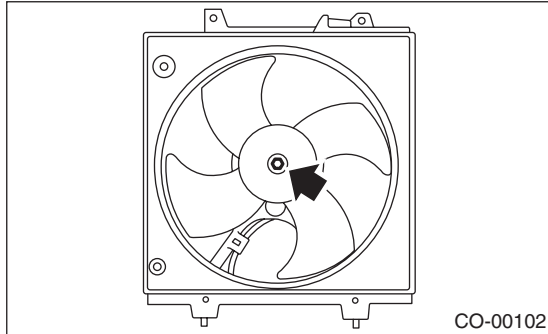


# Radiator Main Fan and Fan Motor

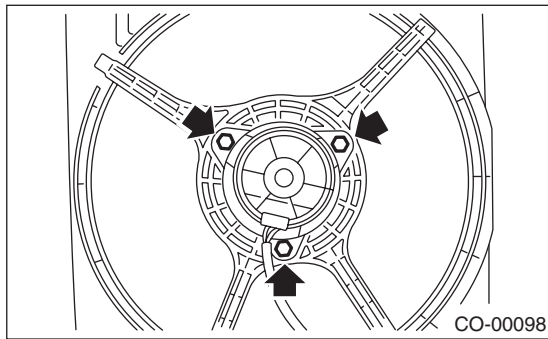
## COOLING

### C: DISASSEMBLY

- 1) Remove the clip which holds motor connector onto the shroud.
- 2) Remove the nuts which hold the fan to the fan motor.



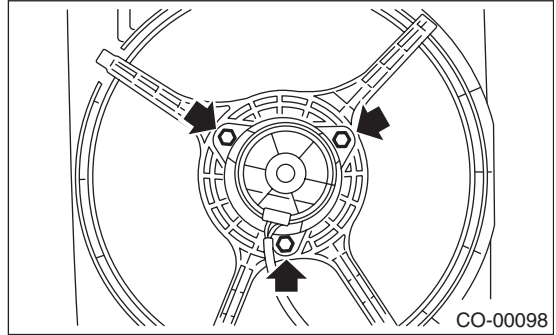
- 3) Remove the bolts which hold fan motor onto shroud.



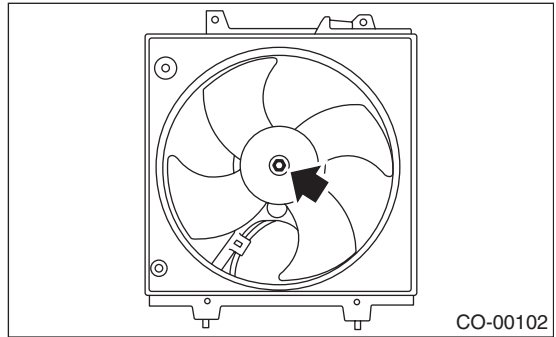
### D: ASSEMBLY

Assemble in the reverse order of disassembly.

**Tightening torque:**  
**5 N·m (0.5 kgf·m, 3.7 ft·lb)**



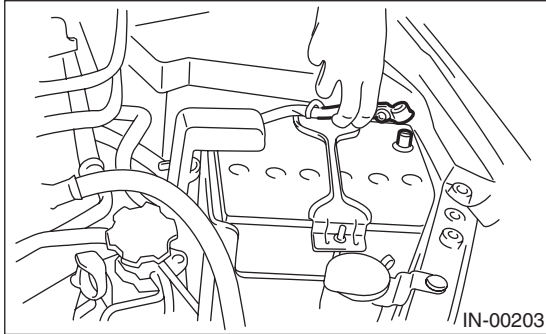
**Tightening torque:**  
**3.4 N·m (0.35 kgf·m, 2.5 ft·lb)**



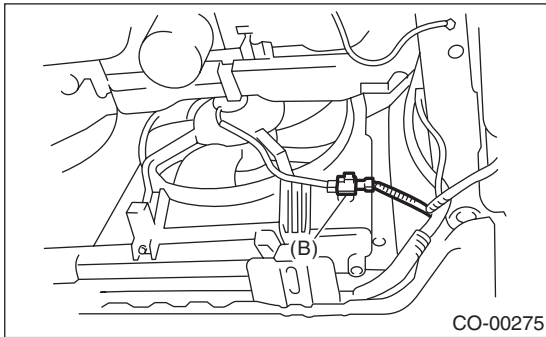
## 9. Radiator Sub Fan and Fan Motor

### A: REMOVAL

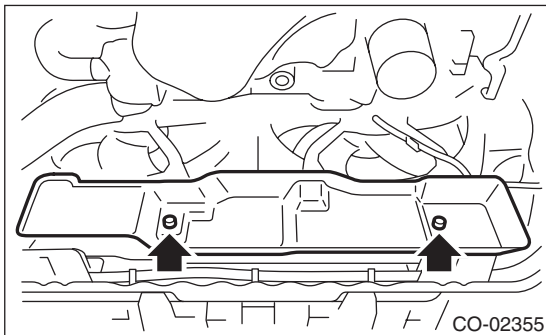
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the connector (B) of sub fan motor.

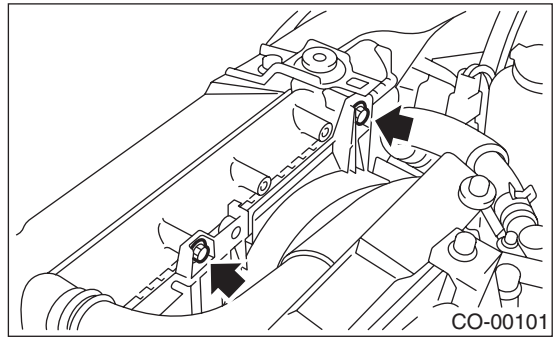


- 6) Remove the heat shield cover. (AT model)



- 7) Remove the ATF hose from the clip of the radiator sub fan motor assembly. (AT model)
- 8) Lower the vehicle.
- 9) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

- 10) Remove the bolts which hold the radiator sub fan shroud to the radiator.



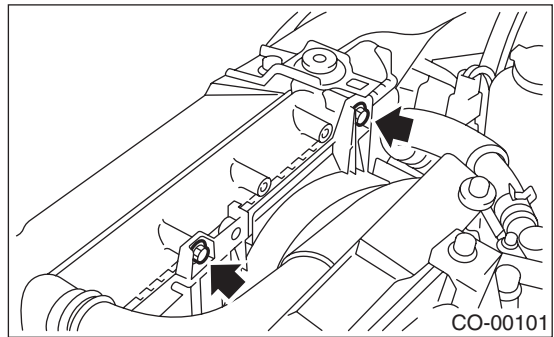
- 11) Remove the radiator sub fan motor assembly from underneath the vehicle.

### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

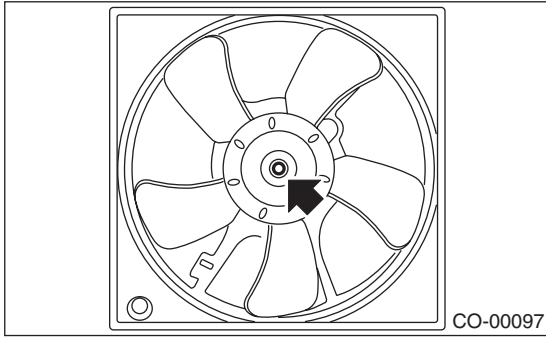


# Radiator Sub Fan and Fan Motor

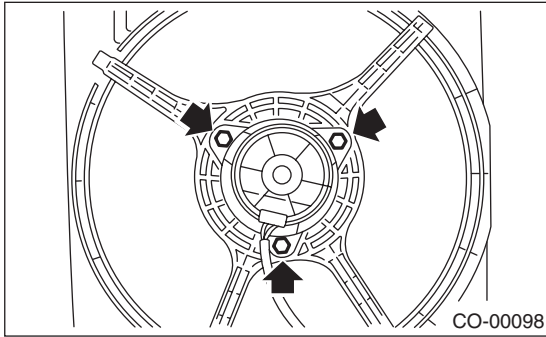
## COOLING

### C: DISASSEMBLY

- 1) Remove the clip which holds the fan motor connector to the shroud.
- 2) Remove the nuts which hold the fan motor.



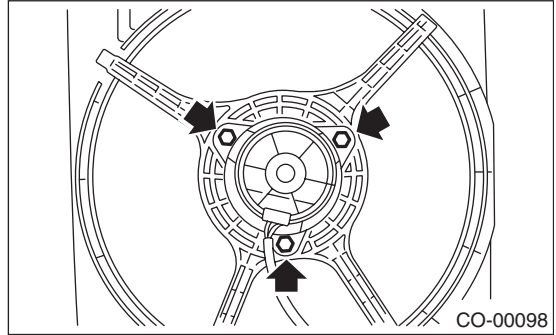
- 3) Remove the bolts which hold fan motor onto shroud.



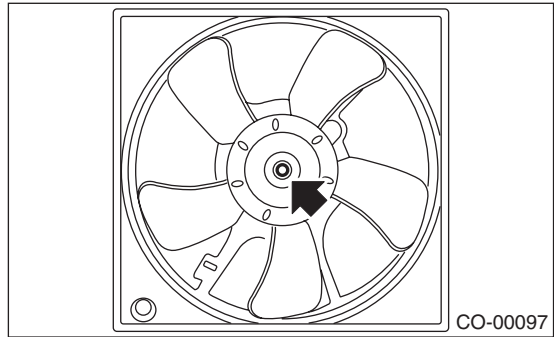
### D: ASSEMBLY

Assemble in the reverse order of disassembly.

**Tightening torque:**  
**5 N·m (0.5 kgf·m, 3.7 ft·lb)**



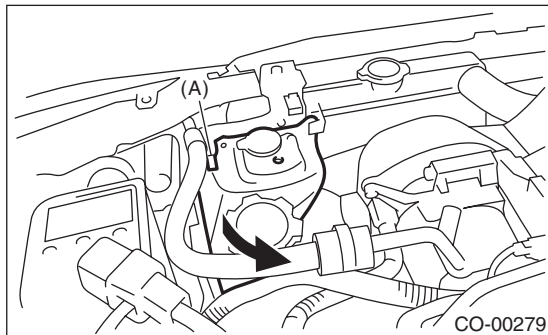
**Tightening torque:**  
**3.4 N·m (0.35 kgf·m, 2.5 ft·lb)**



## 10. Reservoir Tank

### A: REMOVAL

- 1) Disconnect the over flow hose connected to the radiator filler neck.
- 2) Push in the hook (A), and pull the reserve tank in the direction of the arrow to remove.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Make sure the engine coolant level is between "FULL" and "LOW".

# Engine Cooling System Trouble in General

COOLING

## 11.Engine Cooling System Trouble in General

### A: INSPECTION

Trouble	Possible cause	Corrective action
Overheat	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on timing belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Engine oil mixed in engine coolant	Replace the engine coolant. If it is ineffective, inspect and repair the engine side.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Correct or replace.
	n. Dragging brake	Adjust.
	o. Defective radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them.
Over-cooling	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Correct or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Correct or replace.
	d. Leakage around cylinder head gasket	Retighten the cylinder head bolts or replace the gasket.
	e. Cylinder head and block damaged or cracked	Correct or replace.
	f. Damaged or cracked thermostat case	Correct or replace.
	g. Leakage from radiator	Correct or replace.
Abnormal noise	a. Timing belt problem	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

# General Description

LUBRICATION

## 1. General Description

### A: SPECIFICATION

Lubrication method			Forced lubrication	
Oil pump	Pump type		Trochoid type	
	Number of teeth	Inner rotor	9	
		Outer rotor	10	
	Outer rotor diameter × thickness		mm (in) 76 × 10 (2.99 × 0.47)	
	Tip clearance between inner and outer rotors		mm (in) 0.04 — 0.14 (0.0016 — 0.0055)	
	Side clearance between inner rotor and pump case		mm (in) 0.02 — 0.07 (0.0008 — 0.0028)	
	Case clearance between outer rotor and pump case		Standard mm (in) 0.10 — 0.175 (0.0039 — 0.0069)	
	Performance (Oil temperature 80°C (176°F))	600 rpm	Discharge pressure	kPa (kg/cm <sup>2</sup> , psi) 98 (1.0, 14)
			Discharge rate	ℓ (US qt, Imp qt)/min. 4.6 (4.9, 4.0) or more
		5,000 rpm	Discharge pressure	kPa (kg/cm <sup>2</sup> , psi) 294 (3.0, 43)
Discharge rate			ℓ (US qt, Imp qt)/min. 47.0 (49.7, 41.4) or more	
Relief valve working pressure		kPa (kg/cm <sup>2</sup> , psi) 588 (6.0, 85)		
Oil filter	Filter type		Full-flow filter type	
	Filtration area	cm <sup>2</sup> (sq in)	Outer diameter: 68 mm (2.68 in)	800 (124)
			Outer diameter: 65 mm (2.56 in)	470 (72.9)
	By-pass valve opening pressure		kPa (kg/cm <sup>2</sup> , psi) 160 (1.63, 23.2)	
	Outer diameter × width	mm (in)	Outer diameter: 68 mm (2.68 in)	68 × 65 (2.68 × 2.56)
			Outer diameter: 65 mm (2.56 in)	65 × 74.4 (2.56 × 2.93)
Installation screw specifications		M 20 × 1.5		
Oil pres- sure switch	Type		Immersed contact point type	
	Operating voltage — power consumption		12 V — 3.4 W or less	
	Warning light operating pressure		kPa (kg/cm <sup>2</sup> , psi) 14.7 (0.15, 2.1)	
	Proof pressure		kPa (kg/cm <sup>2</sup> , psi) 981 (10, 142) or more	
Engine oil	Total capacity (Overhaul)		ℓ (US qt, Imp qt) 5.0 (5.3, 4.4)	
	When replacing engine oil and oil filter		ℓ (US qt, Imp qt) 4.2 (4.4, 3.7)	
	When replacing engine oil only		ℓ (US qt, Imp qt) 4.0 (4.2, 3.5)	



**Recommended oil:**

**Items having the API standard SM “Energy Conserving” logo or ILSAC standard GF-4 Starburst mark label on the container**

SAE (1)							
(°C)	-30	-20	-15	0	15	30	40
(°F)	-22	-4	5	32	59	86	104

LU-02329

- (1) SAE viscosity No. and applicable temperature
- (2) Recommended

**CAUTION:**

**It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.**

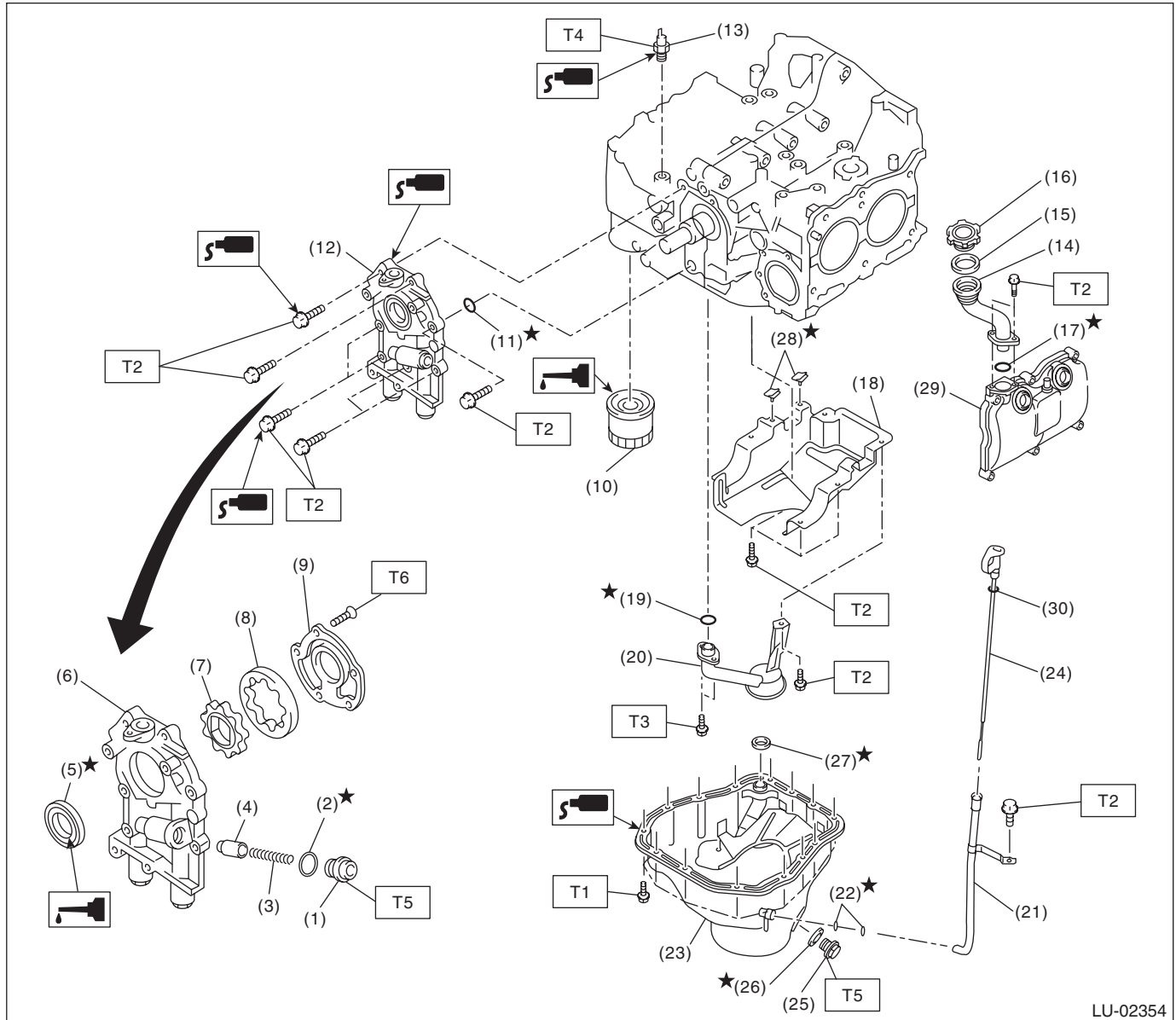
**NOTE:**

If the vehicle is used in regions with high temperatures or in other severe environments, use oil with the viscosities shown below. API standard: SM or SL  
 SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

# General Description

LUBRICATION

## B: COMPONENT



LU-02354

- |                          |                            |
|--------------------------|----------------------------|
| (1) Plug                 | (14) Oil filler duct       |
| (2) Gasket               | (15) Gasket                |
| (3) Relief valve spring  | (16) Oil filler cap        |
| (4) Relief valve         | (17) O-ring                |
| (5) Front oil seal       | (18) Baffle plate          |
| (6) Oil pump case        | (19) O-ring                |
| (7) Inner rotor          | (20) Oil strainer          |
| (8) Outer rotor          | (21) Oil level gauge guide |
| (9) Oil pump cover       | (22) O-ring                |
| (10) Oil filter          | (23) Oil pan               |
| (11) O-ring              | (24) Oil level gauge       |
| (12) Oil pump ASSY       | (25) Drain plug            |
| (13) Oil pressure switch | (26) Drain plug gasket     |

(27) Gasket

(28) Seal

(29) Rocker cover

(30) O-ring

### **Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 5 (0.5, 3.7)**

**T2: 6.4 (0.65, 4.7)**

**T3: 10 (1.0, 7.2)**

**T4: 25 (2.5, 18.4)**

**T5: 44 (4.5, 32.5)**

**T6: 5.4 (0.55, 4.0)**

**LU(H4SO)-4**

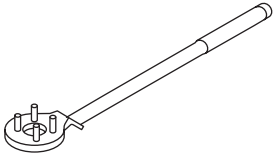
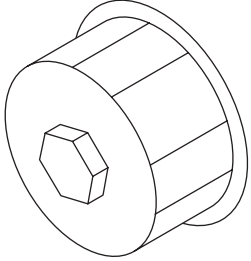
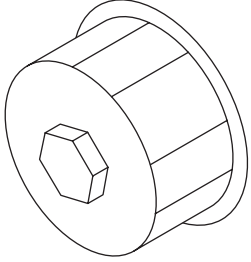
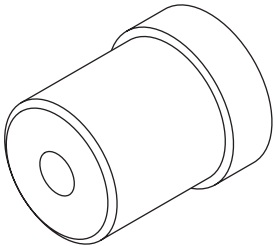
### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

# General Description

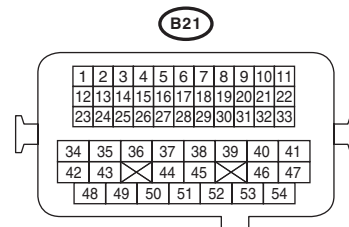
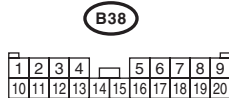
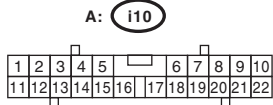
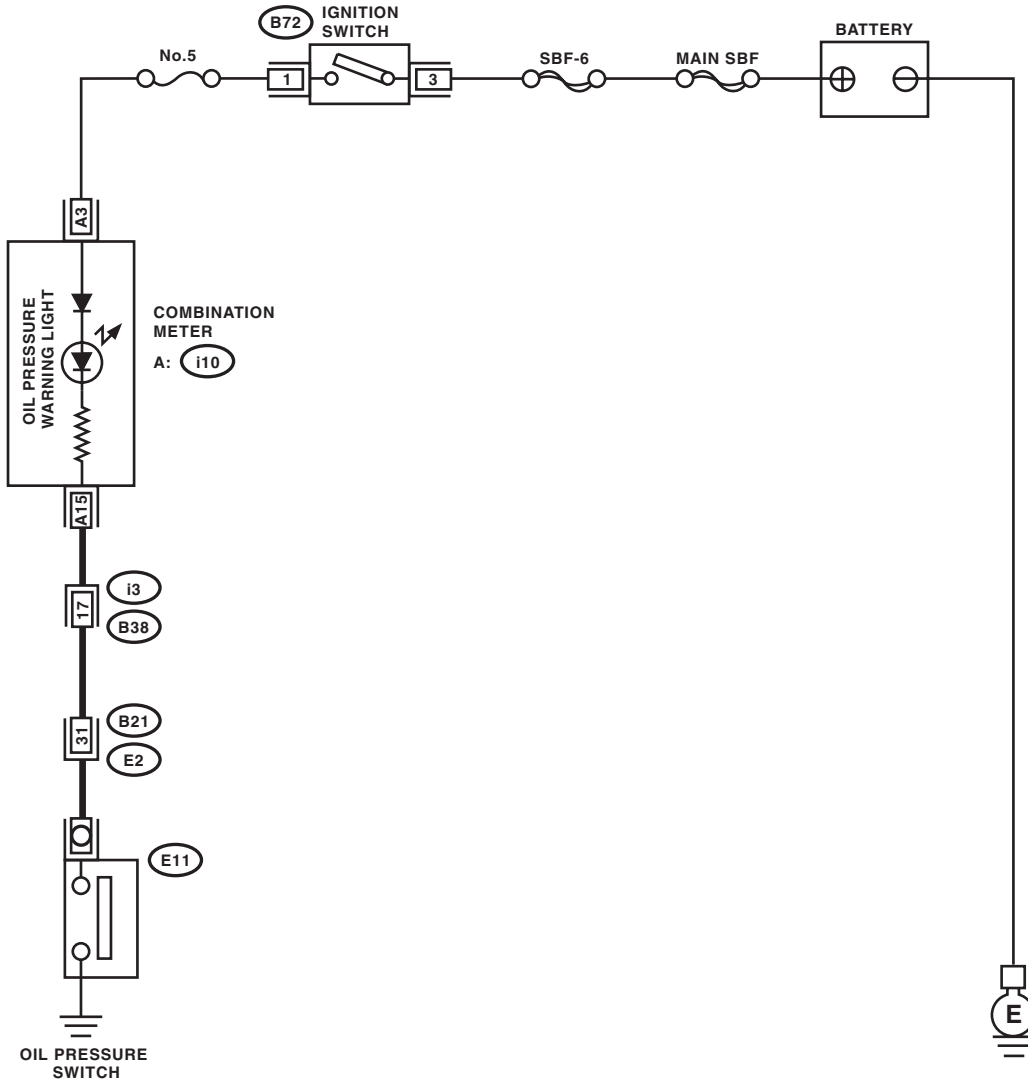
## LUBRICATION

### D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 <p style="text-align: center;">ST18332AA000</p>	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))
 <p style="text-align: center;">ST18332AA010</p>	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))
 <p style="text-align: center;">ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil seal into oil pump.

## 2. Oil Pressure System

### A: WIRING DIAGRAM



LU-02355

# Oil Pressure System

LUBRICATION

## B: INSPECTION

	Step	Check	Yes	No
1	<b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Check other warning lights.	Does the warning light illuminate?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
2	<b>CHECK THE HARNESS CONNECTOR BETWEEN THE COMBINATION METER AND THE OIL PRESSURE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between oil pressure switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E11) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Replace the oil pressure switch.	Go to step 3.
3	<b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. <b>Terminal</b> <b>(i10) No. 3 — No. 15:</b>	Is the resistance less than 10 $\Omega$ ?	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between combination meter and oil pressure switch</li> <li>• Poor contact in combination meter connector</li> <li>• Poor contact in oil pressure switch connector</li> <li>• Poor contact in coupling connector</li> </ul>	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>

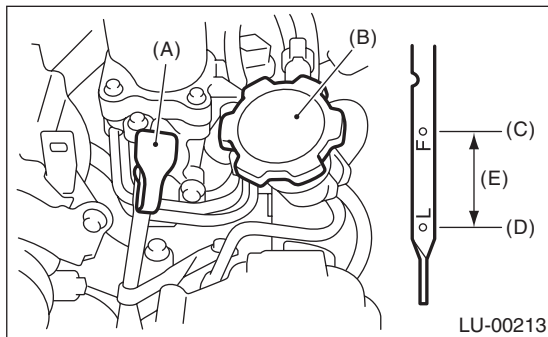
## 3. Engine Oil

### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe away the oil.
- 3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
- 4) Remove the oil level gauge again and check the reading. If the engine oil level is below "L" line, add oil to bring the level up to "F" line.
- 5) Start the engine and warm it up for a time.
- 6) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.
- 7) Just after driving or while the engine is warm, engine oil level shows in the range between F line and cutout portion. This is caused by thermal expansion of engine oil.

#### NOTE:

- To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
- As the oil level gauge is used for daily maintenance, the upper level and the lower level is set assuming that the engine is cold.



- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

### B: REPLACEMENT

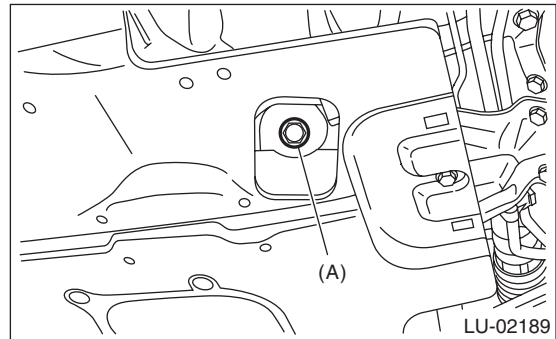
- 1) Set the vehicle on a lift.
- 2) Open the engine oil filler cap for quick draining of engine oil.
- 3) Lift up the vehicle.
- 4) Drain engine oil by loosening the engine oil drain plug.

#### CAUTION:

**If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

#### NOTE:

Prepare the container for draining of engine oil.



(A) Drain plug

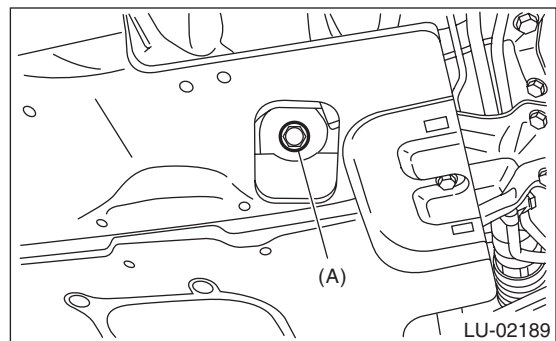
- 5) Tighten the engine oil drain plug after draining engine oil.

#### NOTE:

Use a new drain plug gasket.

#### Tightening torque:

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**



(A) Drain plug

# Engine Oil

## LUBRICATION

---

6) Using engine oil of proper quality and viscosity, fill engine oil through the filler duct to the “F” line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

**Recommended oil:**

**Refer to “SPECIFICATION” for the recommended oil. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>**

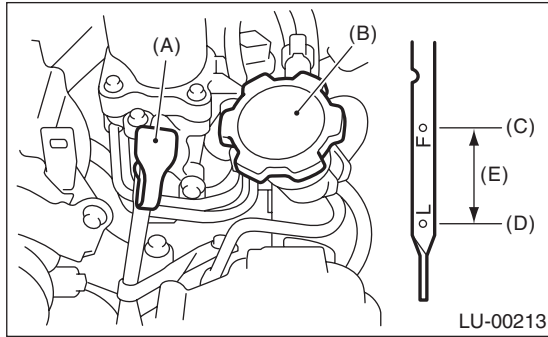
**Engine oil capacity:**

**Refer to “SPECIFICATION” for the engine oil capacity. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>**

7) Close the engine oil filler cap.

8) Start the engine and warm it up for a time.

9) After the engine stops, recheck the oil level. If necessary, add engine oil up to the “F” line on the oil level gauge.



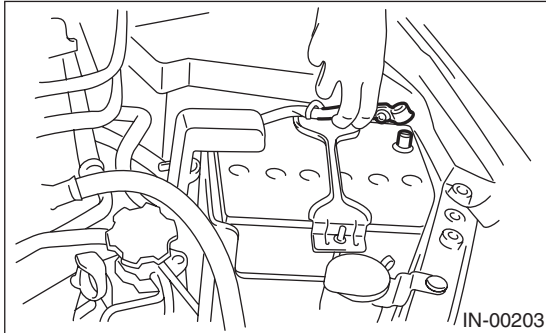
- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)



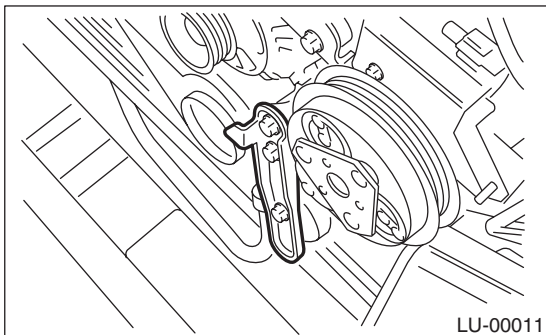
## 4. Oil Pump

### A: REMOVAL

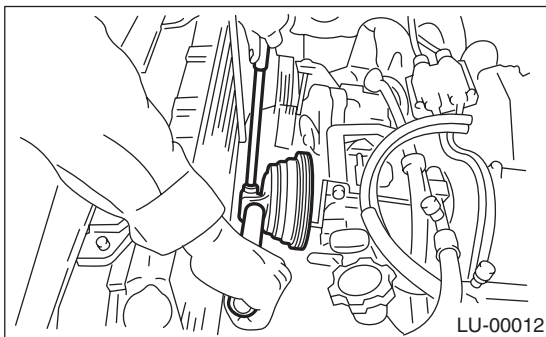
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Lower the vehicle.
- 6) Remove the radiator. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>
- 7) Remove the crankshaft position sensor. <Ref. to FU(H4SO)-21, REMOVAL, Crankshaft Position Sensor.>
- 8) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.>
- 9) Remove the belt tensioner.

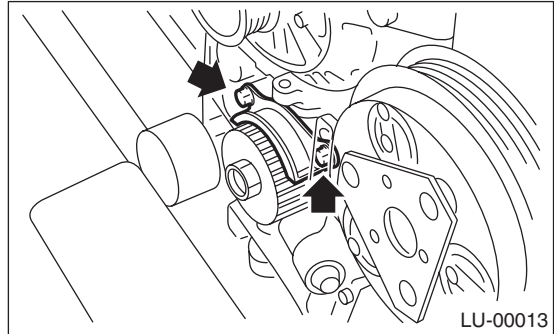


- 10) Remove the crank pulley using ST. <Ref. to ME(H4SO)-40, REMOVAL, Crank Pulley.>

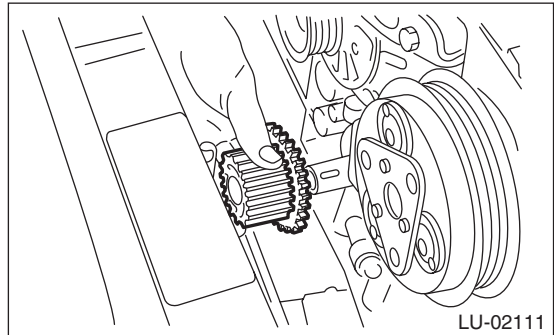


- 11) Remove the water pump. <Ref. to CO(H4SO)-14, REMOVAL, Water Pump.>

- 12) Remove the timing belt guide. (MT model)



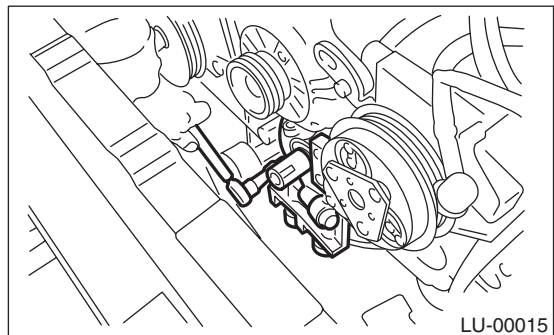
- 13) Remove the crank sprocket.



- 14) Remove the bolts which install oil pump onto cylinder block.

**NOTE:**

When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



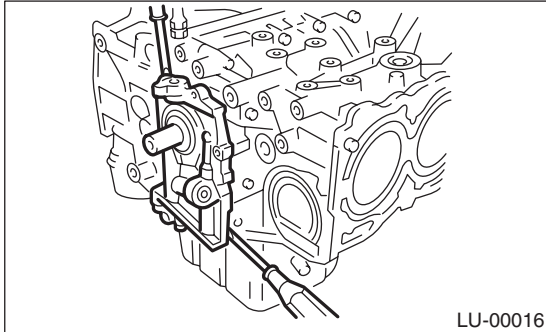
# Oil Pump

## LUBRICATION

15) Remove the oil pump by using flat tip screwdriver.

### CAUTION:

Be careful not to scratch mating surfaces of cylinder block and oil pump.



16) Remove the front oil seal from the oil pump.

## B: INSTALLATION

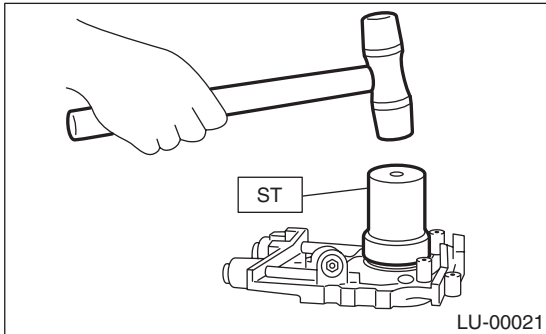
Install in the reverse order of removal.

Perform the following.

1) Using the ST, install the front oil seal.  
ST 499587100 OIL SEAL INSTALLER

### NOTE:

Use a new front oil seal.



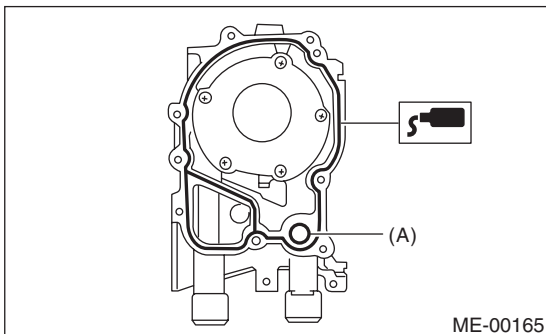
2) Apply liquid gasket to the mating surfaces of oil pump.

### NOTE:

Install within 5 min. after applying liquid gasket.

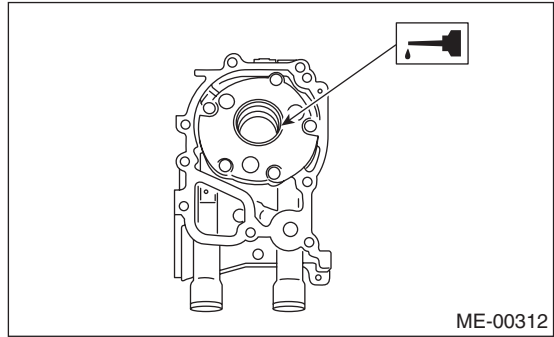
### Liquid gasket:

**THREE BOND 1217G (Part No. K0877Y0100)**  
or equivalent



(A) O-ring

3) Apply a coat of engine oil to the inside of the front oil seal.



4) Install the oil pump to cylinder block. Be careful not to damage the front oil seal during installation.

### NOTE:

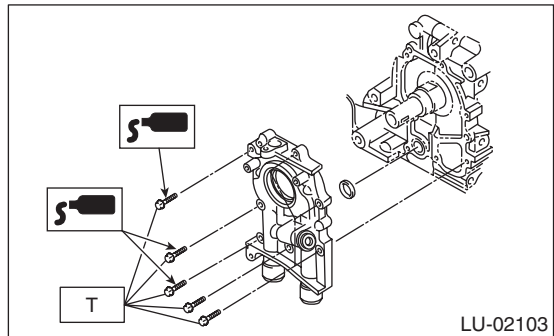
- Make sure the front oil seal lip is not folded.
  - Align the flat surface of oil pump's inner rotor with crankshaft before installation.
  - Use a new O-ring when installing the oil pump.
- 5) Apply liquid gasket to the three bolts thread shown in figure. (when reuse the bolts)

### Liquid gasket:

**THREE BOND 1324 (Part No. 004403042)** or equivalent

### Tightening torque:

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

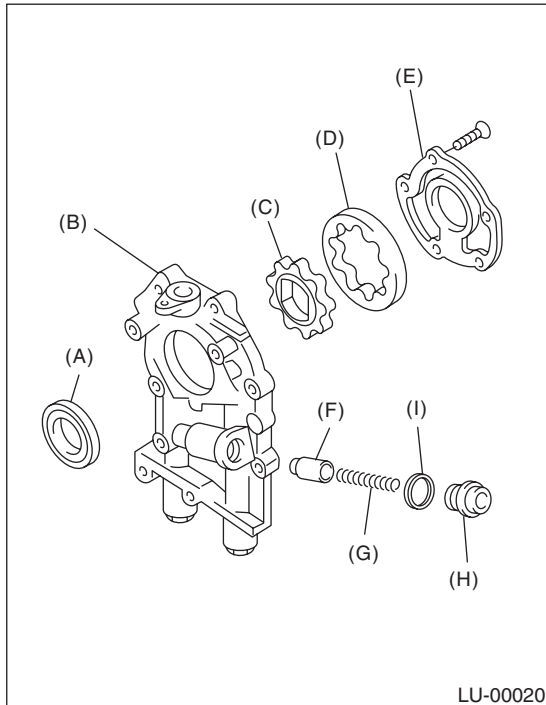


## C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

### NOTE:

Before disassembling the oil pump, remove the relief valve.



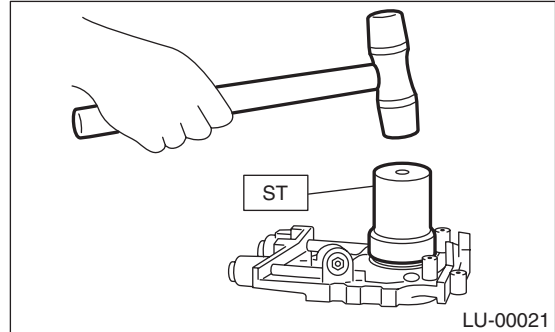
- (A) Front oil seal
- (B) Oil pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Oil pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

## D: ASSEMBLY

- 1) Assemble the front oil seal by using ST. ST 499587100 OIL SEAL INSTALLER

### NOTE:

Use a new front oil seal.



- 2) Apply a coat of engine oil to inner and outer rotors.
- 3) Assemble the inner and outer rotors in their original positions.
- 4) Assemble the oil relief valve and install relief valve spring and plug.

### NOTE:

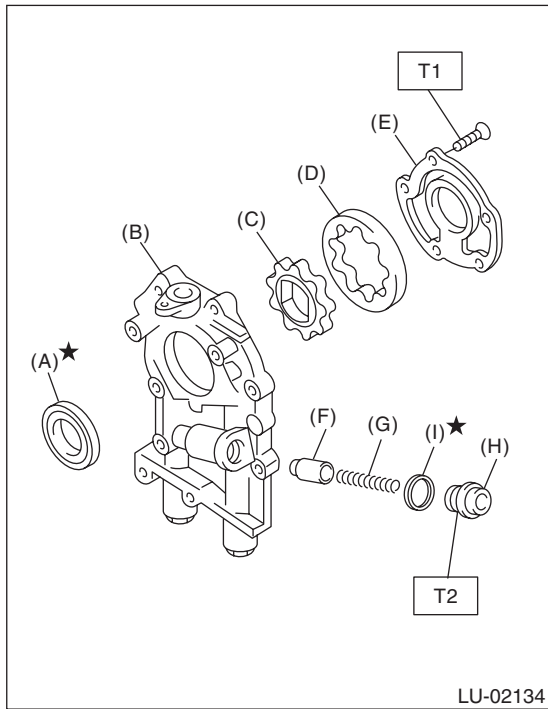
Use a new gasket.

5) Assemble the oil pump cover.

**Tightening torque:**

**T1: 5.4 N·m (0.55 kgf-m, 4.0 ft-lb)**

**T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)**



- (A) Front oil seal
- (B) Oil pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Oil pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

## E: INSPECTION

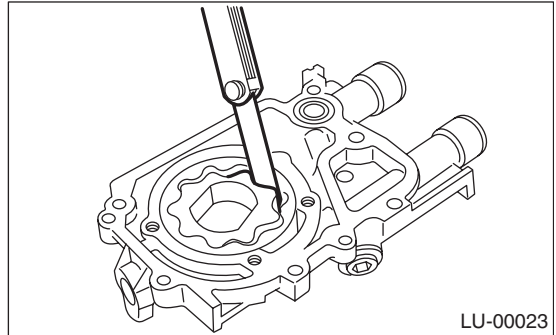
### 1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a matched set.

**Tip clearance:**

**Standard:**

**0.04 — 0.14 mm (0.0016 — 0.0055 in)**



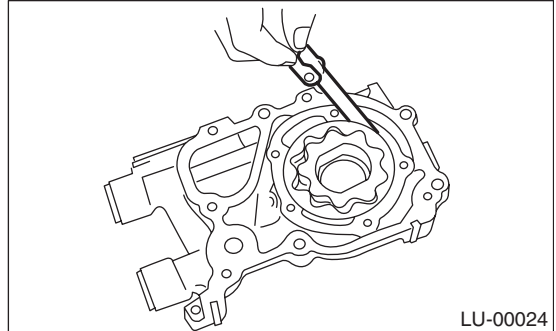
### 2. CASE CLEARANCE

Measure the clearance between the outer rotor and the oil pump case. If the clearance is not within the limit, replace the rotor.

**Case clearance:**

**Standard:**

**0.10 — 0.175 mm (0.0039 — 0.0069 in)**



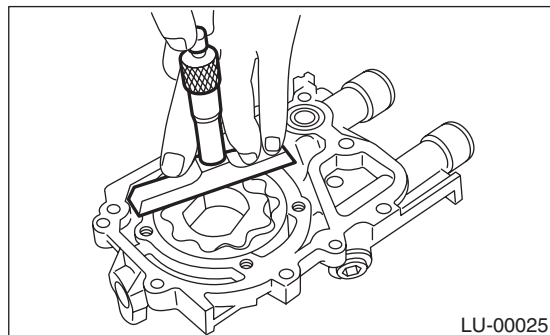
### 3. SIDE CLEARANCE

Measure the gap between the inner rotor and the oil pump to measure the clearance between the inner rotor and the oil pump cover as shown in the figure. If the clearance is not within the limit, replace the rotor or the oil pump case.

**Side clearance:**

**Standard:**

**0.02 — 0.07 mm (0.0008 — 0.0028 in)**



### 4. OIL RELIEF VALVE

Check the valve for assembly condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

**Relief valve spring:**

**Free length**

**73.7 mm (2.902 in)**

**Installed length**

**54.7 mm (2.154 in)**

**Load when installed**

**93.1 N (9.49 kgf, 20.88 lbf)**

### 5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

### 6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

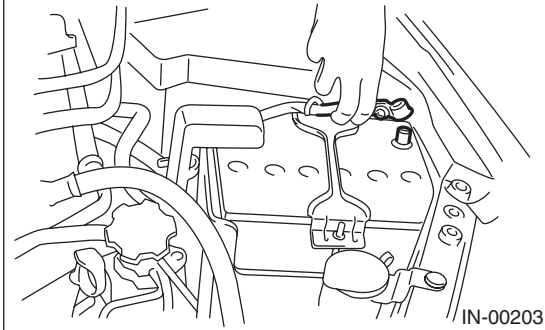
# Oil Pan and Strainer

## LUBRICATION

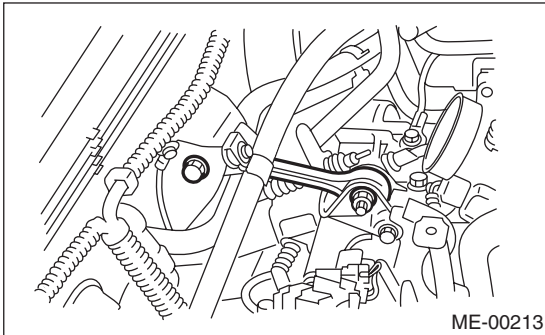
### 5. Oil Pan and Strainer

#### A: REMOVAL

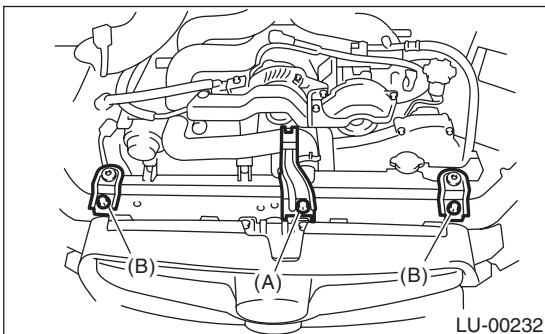
- 1) Set the vehicle on a lift.
- 2) Remove the front wheels.
- 3) Disconnect the ground cable from the battery.



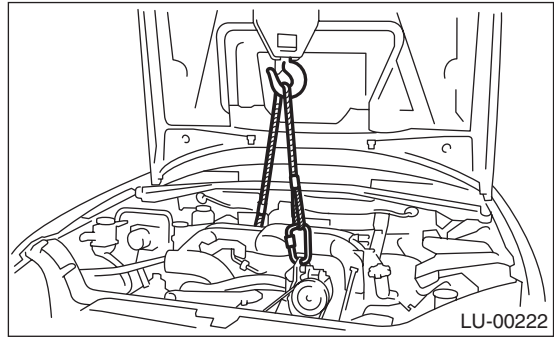
- 4) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 5) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 6) Remove the pitching stopper.



- 7) Remove the hood stay holder (A) and radiator upper brackets (B).



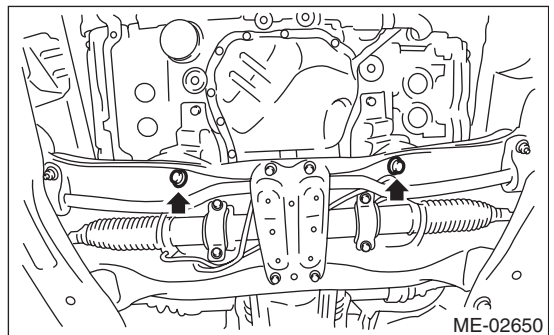
- 8) Support the engine with a lifting device and wire ropes.



- 9) Lift up the vehicle.

**CAUTION:**  
When lifting up the vehicle, raise up wire ropes at the same time.

- 10) Remove the under cover.
- 11) Drain the engine oil. <Ref. to LU(H4SO)-9, REPLACEMENT, Engine Oil.>
- 12) Remove the front and center exhaust pipes. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 13) Remove the nuts which install front cushion rubber onto front crossmember.

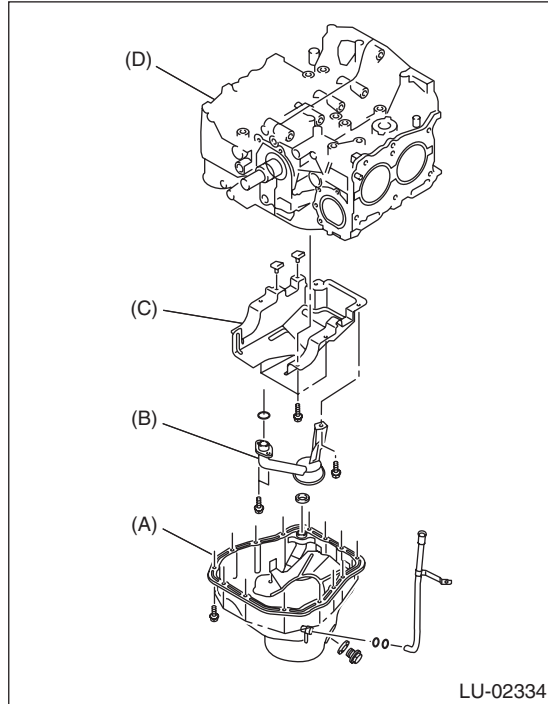


- 14) Remove the bolts which install oil pan on cylinder block with the engine raised up.
- 15) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

**CAUTION:**  
Do not use a screwdriver or similar tool in place of oil pan cutter.

- 16) Remove the oil strainer.

17) Remove the baffle plate.



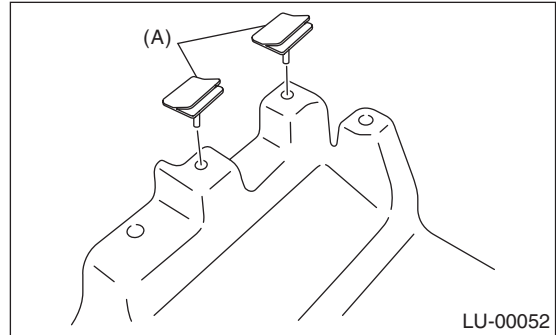
- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

## B: INSTALLATION

### NOTE:

Before installing the oil pan, clean the mating surface of oil pan and engine block.

1) Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.



2) Install the baffle plate.

### **Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

3) Install the oil strainer to the cylinder block.

### NOTE:

Use new O-rings.

### **Tightening torque:**

**10 N·m (1.0 kgf·m, 7.2 ft·lb)**

4) Tighten the oil strainer stay together with the baffle plate.

### **Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

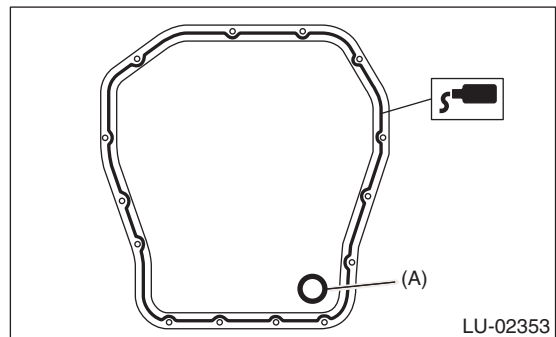
5) Apply liquid gasket to the mating surfaces, and install the oil pan.

### NOTE:

- Use a new gasket.
- Install within 5 min. after applying liquid gasket.

### **Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



- (A) Gasket

# Oil Pan and Strainer

## LUBRICATION

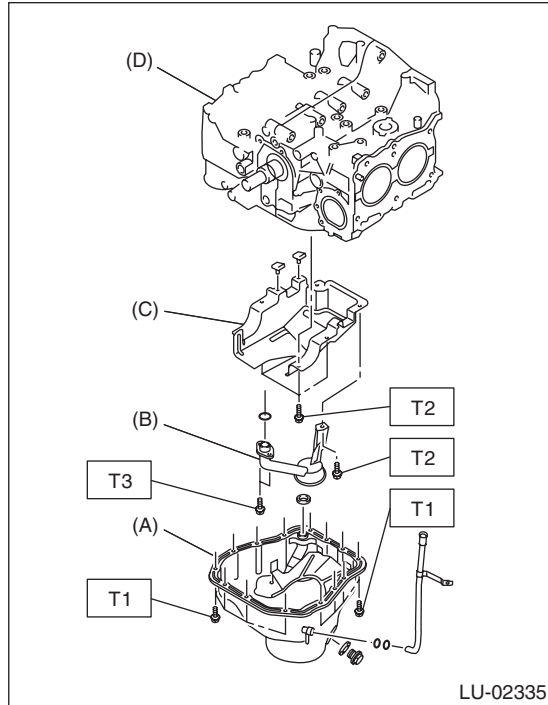
6) Tighten the bolts which install the oil pan to the cylinder block.

### Tightening torque:

**T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)**

**T2: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

**T3: 10 N·m (1.0 kgf-m, 7.2 ft-lb)**



- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

7) Lower the engine onto front crossmember.

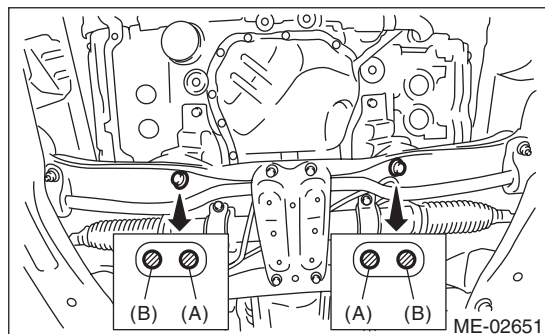
8) Tighten the nuts which install front cushion rubber onto front crossmember.

### NOTE:

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.

### Tightening torque:

**85 N·m (8.7 kgf-m, 62.7 ft-lb)**



9) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

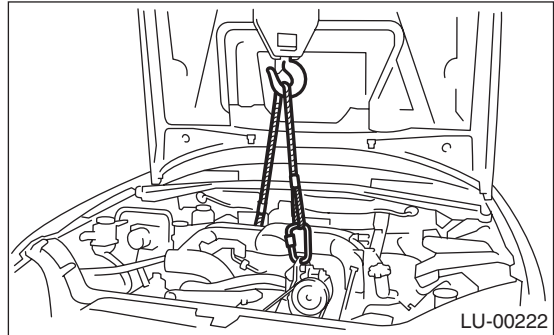
10) Install the under cover.

11) Lower the vehicle.

### CAUTION:

**When lowering the vehicle, lower the lift up device and wire ropes at the same time.**

12) Remove the lifting device and wire ropes.

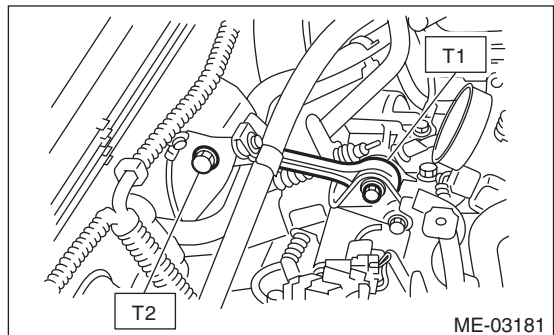


13) Install the pitching stopper.

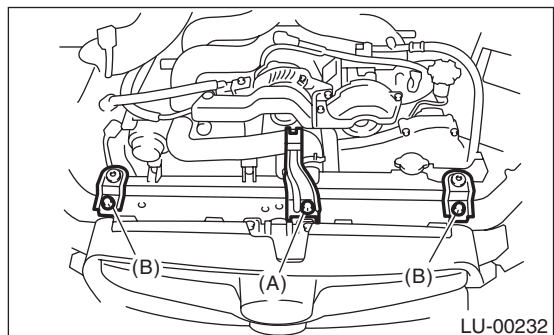
### Tightening torque:

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



14) Install the hood stay holder (A) and radiator upper brackets (B).



15) Install the air intake chamber.

<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

16) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>

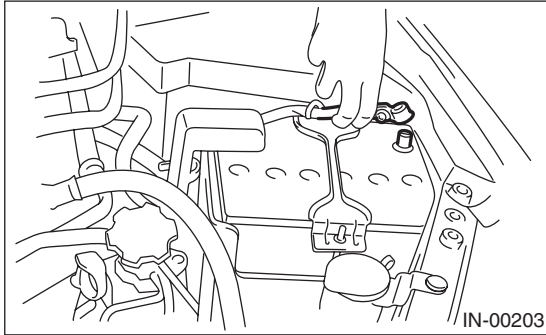


17) Install the front wheels.

**Tightening torque:**

**100 N·m (10.2 kgf·m, 73.8 ft·lb)**

18) Connect the battery ground cable to battery.



19) Refill the engine oil. <Ref. to LU(H4SO)-9, INSPECTION, Engine Oil.>

## **C: INSPECTION**

Visually check that the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

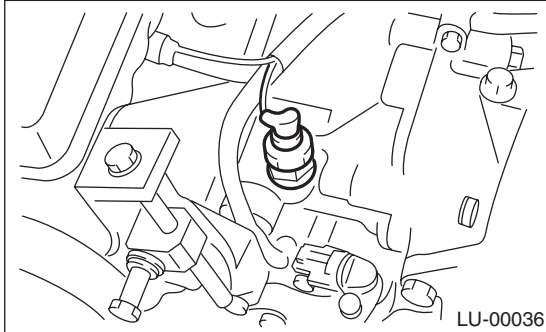
# Oil Pressure Switch

LUBRICATION

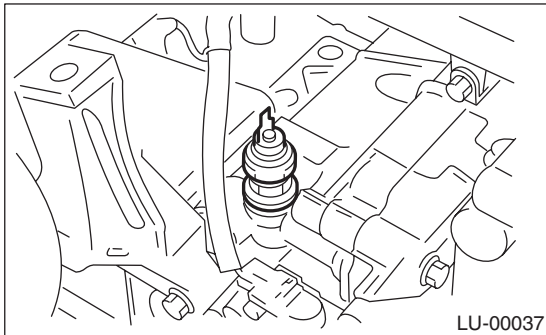
## 6. Oil Pressure Switch

### A: REMOVAL

- 1) Remove the generator from the bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 2) Disconnect the terminal from oil pressure switch.



- 3) Remove the oil pressure switch.

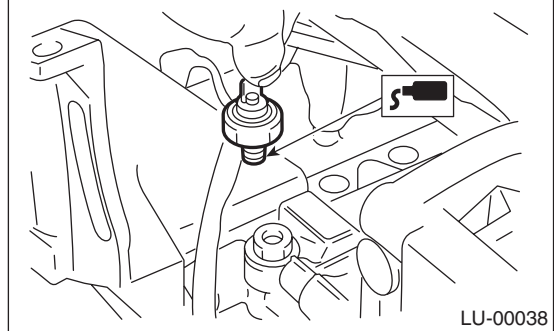


### B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

**Liquid gasket:**

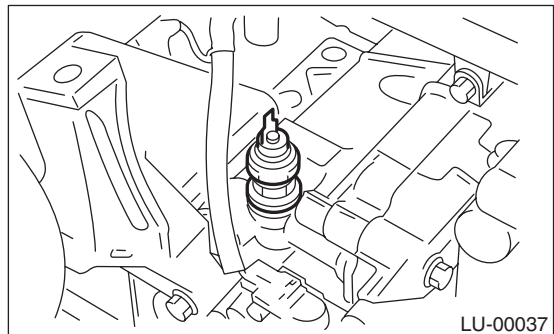
**THREE BOND 1324 (Part No. 004403042) or equivalent**



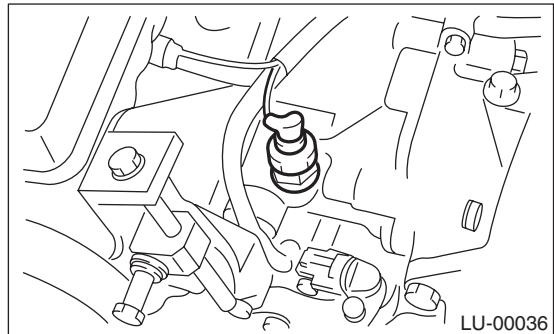
- 2) Install the oil pressure switch to the cylinder block.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- 3) Connect the terminal to the oil pressure switch.



- 4) Install the generator to the bracket. <Ref. to SC(H4SO)-15, INSTALLATION, Generator.>

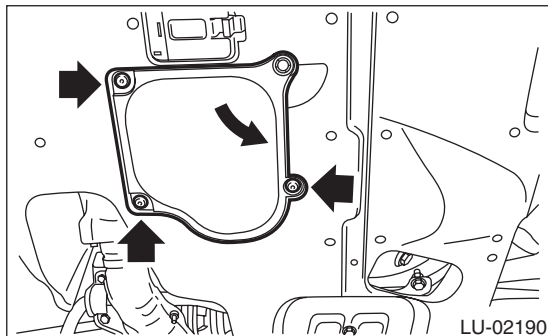
### C: INSPECTION

Check the oil pressure switch installation portion for oil leakage and oil seepage.

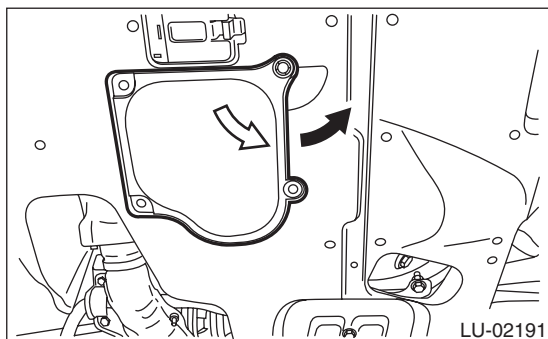
## 7. Engine Oil Filter

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the clip.



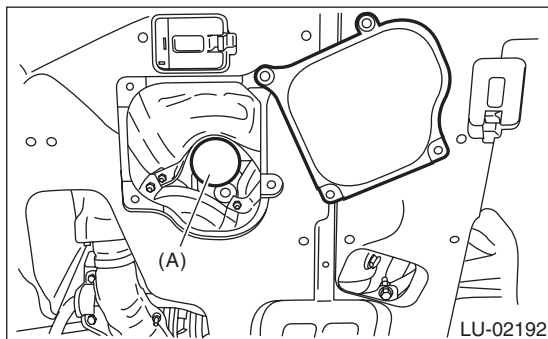
- 4) Rotate the service hole cover in the direction of the arrow.



- 5) Remove the oil filter using the ST.

ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in) for oil filter)

ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in) for oil filter)



(A) Oil filter

### B: INSTALLATION

#### CAUTION:

**Do not tighten excessively, or oil may leak.**

- 1) Clean the oil filter installation surface on cylinder block or oil cooler.
- 2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 3) Install the oil filter turning it by hand, being careful not to damage the seal rubber.
  - Tighten the oil filter 65 mm (2.56 in) in diameter (approx. 2/3 — 3/4 rotation) after the seal rubber of the oil filter comes in contact with cylinder block or oil cooler. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.7 ft-lb).
  - Tighten the oil filter 68 mm (2.68 in) in diameter (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with cylinder block or oil cooler. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
- 4) Put the service hole cover back.
- 5) Lower the vehicle.

### C: INSPECTION

- 1) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

#### NOTE:

The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level. <Ref. to LU(H4SO)-9, INSPECTION, Engine Oil.>

#### CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

# Engine Lubrication System Trouble in General

## LUBRICATION

### 8. Engine Lubrication System Trouble in General

#### A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains ON.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Clean or replace.
		Malfunction of oil relief valve in oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil (including deterioration)	Replace.
		Broken pipe of oil strainer	Replace.
Stuck oil pump rotor		Replace.	
2. Warning light does not illuminate.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact of terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed 1. — 2.

# General Description

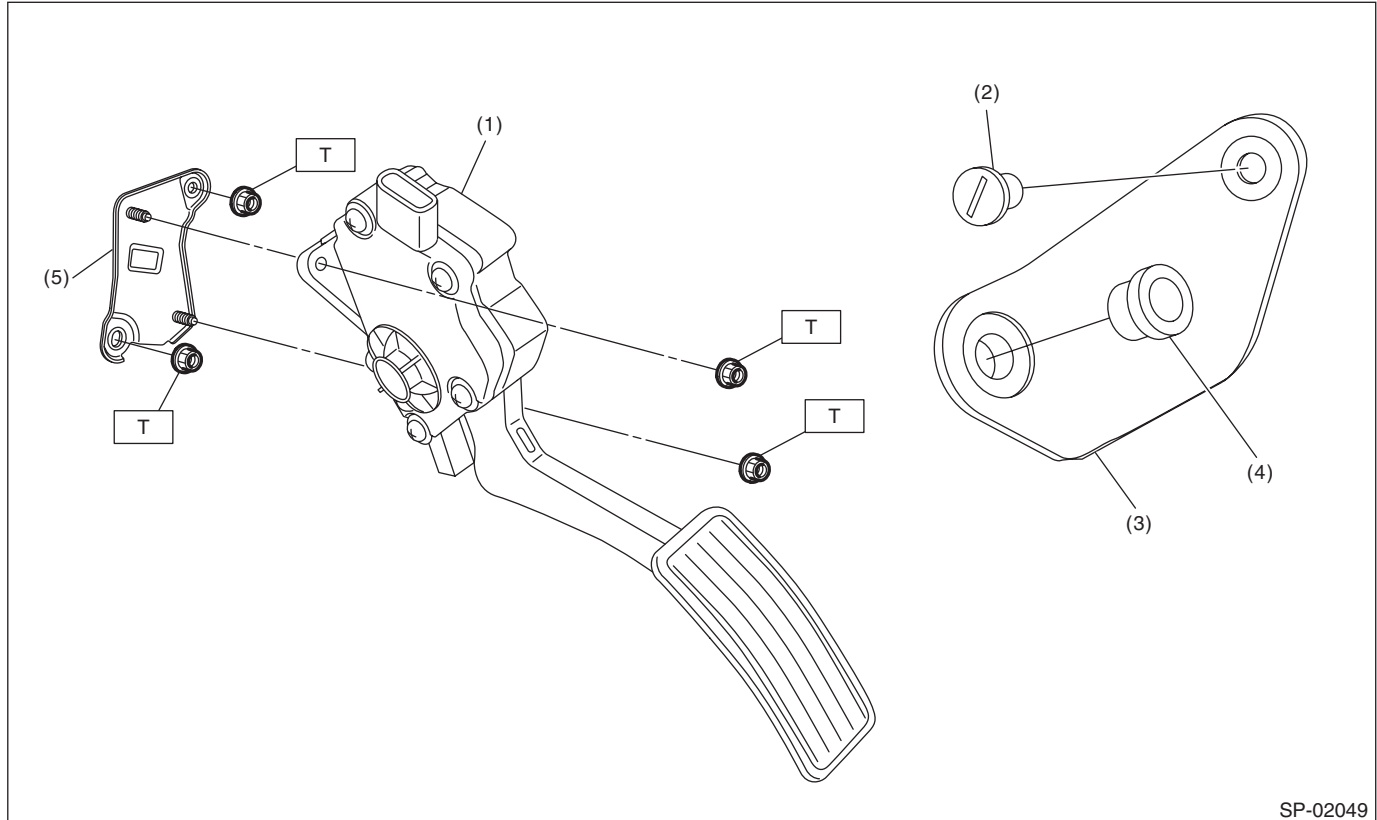
## SPEED CONTROL SYSTEMS

### 1. General Description

#### A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	50 — 63 mm (1.97 — 2.48 in)
-------------------	--------	--------------	-----------------------------

#### B: COMPONENT



- |                            |                               |
|----------------------------|-------------------------------|
| (1) Accelerator pedal ASSY | (4) Accelerator stopper       |
| (2) Clip                   | (5) Accelerator pedal bracket |
| (3) Accelerator plate      |                               |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 18 (1.8, 13.3)**

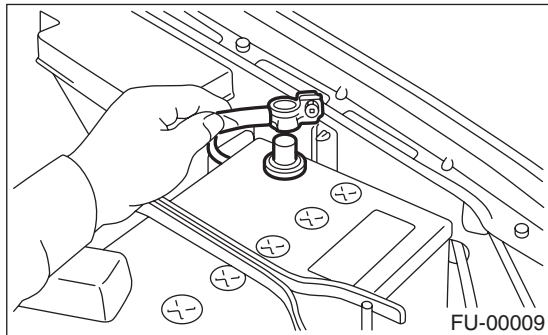
#### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal or installation.
- Keep the parts in order and protect them from dust and dirt.
- Before removal or installation, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

## 2. Accelerator Pedal

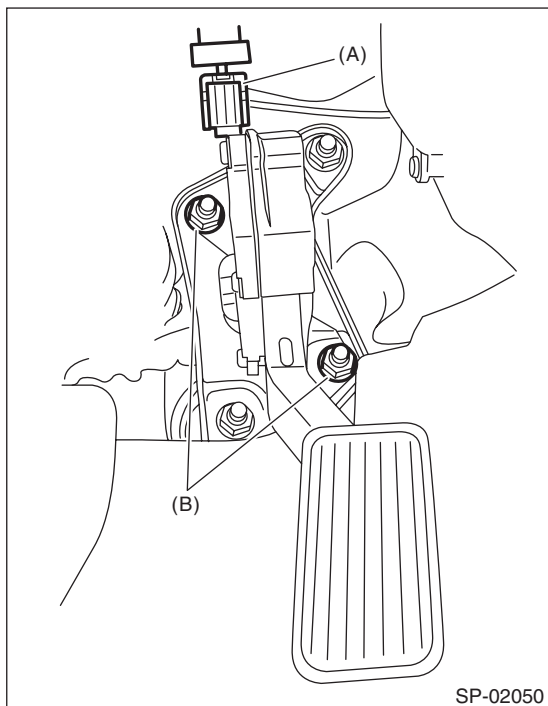
### A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A).

3) Remove the nut (B) securing accelerator pedal assembly.



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

### C: DISASSEMBLY

NOTE:

The accelerator pedal cannot be disassembled.

# Accelerator Pedal

SPEED CONTROL SYSTEMS

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# General Description

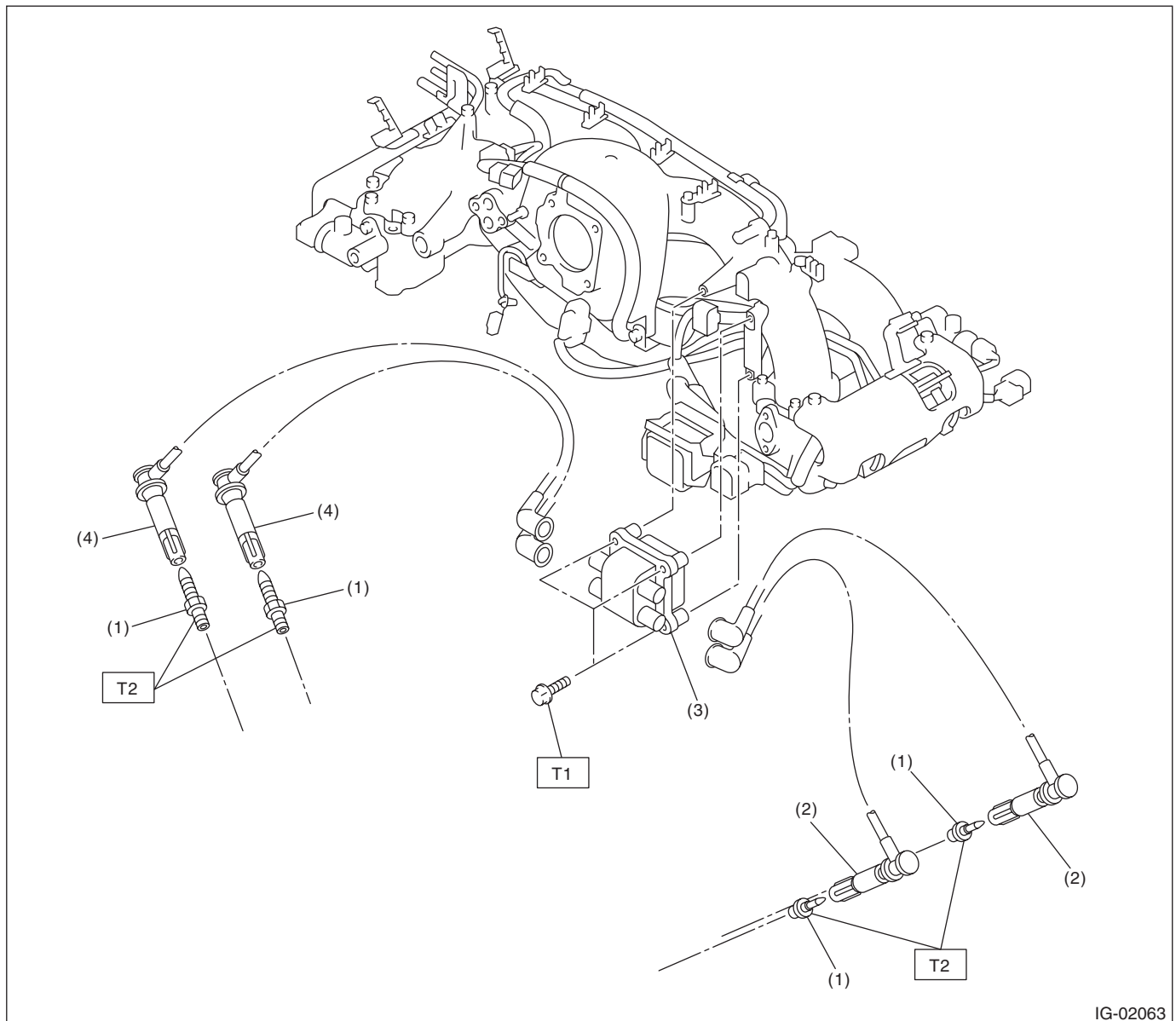
## IGNITION

### 1. General Description

#### A: SPECIFICATION

Item		Specification	
Engine	Model	2.5 L SOHC Non-turbo	
Ignition coil & ignitor assembly	Type	FH 0286/FH 0363	
	Manufacturer	Diamond Electric	
	Secondary coil resistance	11.2 kΩ±15%	
Spark plug	Manufacturer and type	NGK: FR5AP-11	
	Thread size (diameter, pitch, length)	mm	14, 1.25, 19
	Spark plug gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)
	Electrode		Platinum

#### B: COMPONENT



- (1) Spark plug
- (2) Spark plug cord (#1, #3)
- (3) Ignition coil and ignitor ASSY
- (4) Spark plug cord (#2, #4)

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.9)**

**T2: 21 (2.1, 15.5)**



### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

# Spark Plug

## IGNITION

### 2. Spark Plug

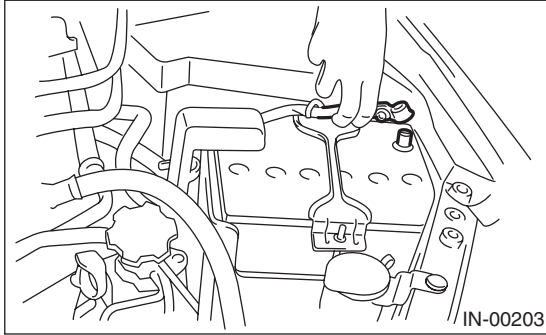
#### A: REMOVAL

##### Spark plug:

Refer to "SPECIFICATION" for the recommended spark plug. <Ref. to IG(H4SO)-2, SPECIFICATION, General Description.>

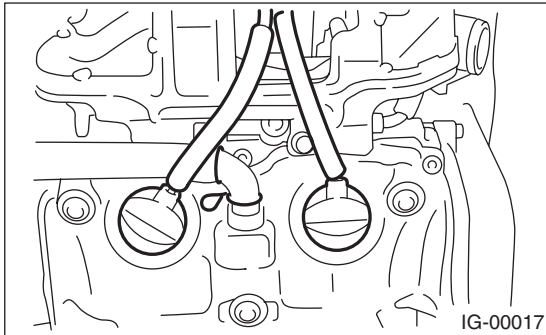
##### 1. RH SIDE

- 1) Disconnect the ground cable from the battery.

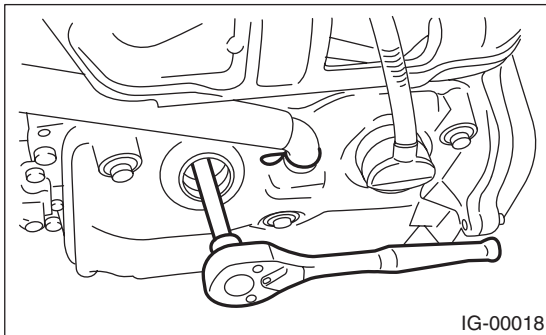


- 2) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

- 3) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)



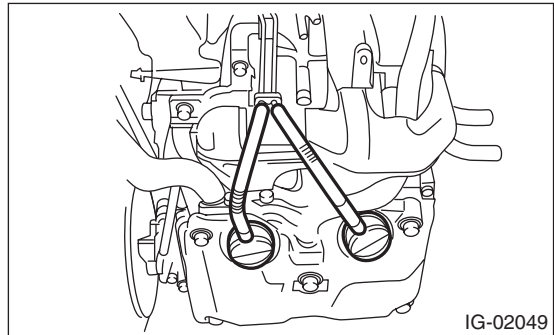
- 4) Remove the spark plug with a spark plug socket.



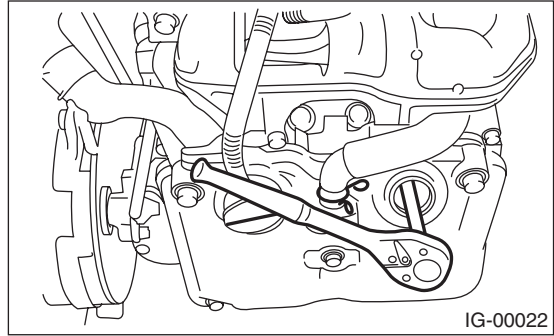
##### 2. LH SIDE

- 1) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>

- 2) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)



- 3) Remove the spark plug with a spark plug socket.



#### B: INSTALLATION

##### 1. RH SIDE

Install in the reverse order of removal.

##### Tightening torque:

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

##### 2. LH SIDE

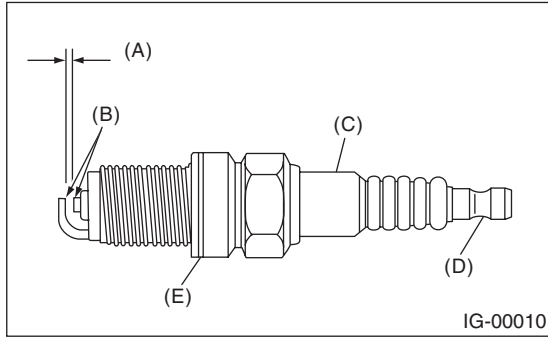
Install in the reverse order of removal.

##### Tightening torque:

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

## C: INSPECTION

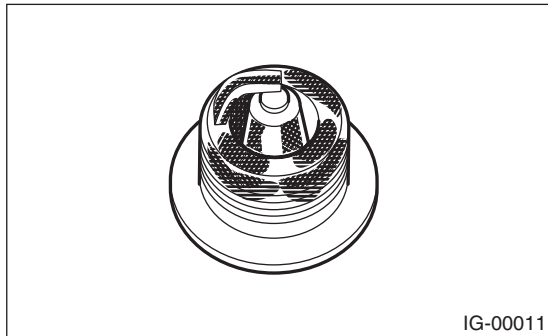
Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Spark plug gap
- (B) Carbon accumulation or wear
- (C) Cracks
- (D) Damage
- (E) Damaged gasket

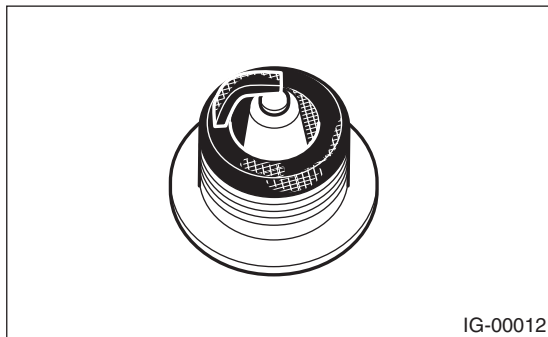
### 1) Normal:

Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



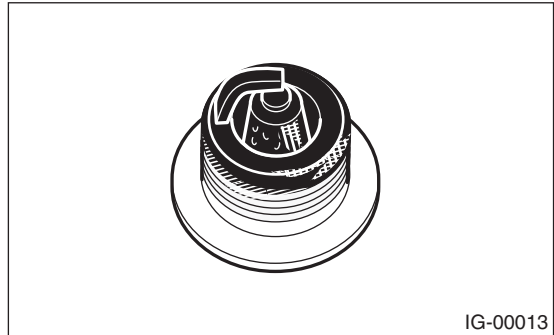
### 2) Carbon fouled:

Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture and dirty air cleaner.



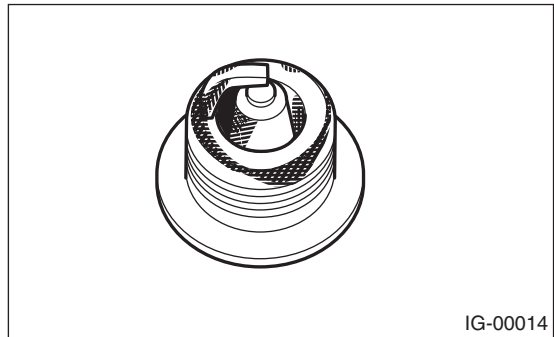
### 3) Oil fouled:

Wet black deposits show oil entrance into the combustion chamber through worn rings or pistons, or excessive clearance between valve guides and stems.



### 4) Overheating:

White or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, incorrect ignition timing, wrong selection of fuel, and loose spark plugs.



## D: ADJUSTMENT

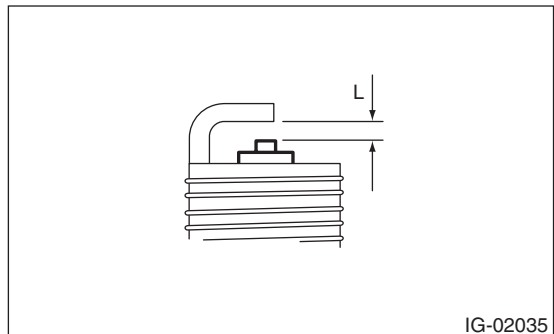
Clean spark plugs with a nylon brush, etc. Clean and remove the carbon or oxide deposits. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, measure the spark plug gap using a gap gauge.

### NOTE:

- Never use plug cleaner.
- Do not use metal brush or it will wear insulator.

### Spark plug gap L:

**1.0 — 1.1 mm (0.039 — 0.043 in)**



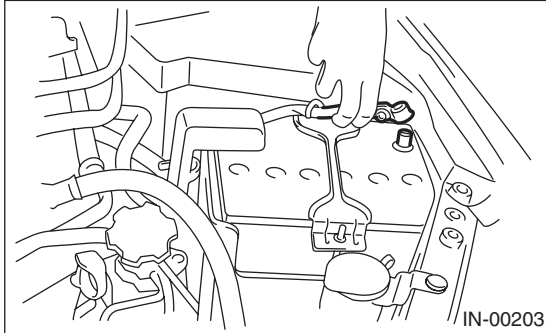
# Ignition Coil and Ignitor Assembly

## IGNITION

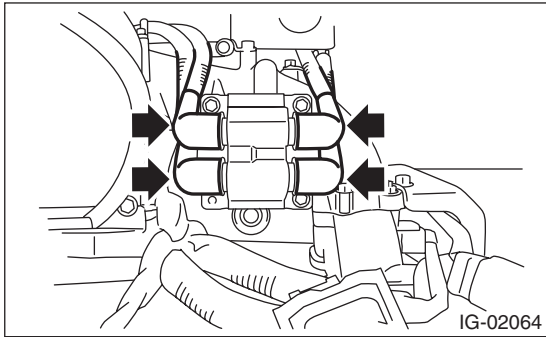
### 3. Ignition Coil and Ignitor Assembly

#### A: REMOVAL

1) Disconnect the ground cable from the battery.

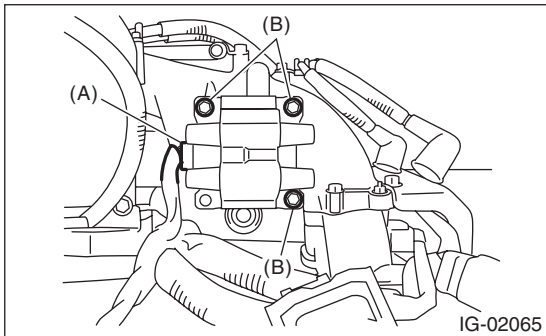


2) Disconnect the spark plug cords from ignition coil and ignitor assembly.



3) Disconnect the connector from the ignition coil & ignitor assembly.

4) Remove the bolt which secures the ignition coil and ignitor assembly to the intake manifold.



#### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**

**CAUTION:**

Connect the spark plug cords to correct positions. Failure to do so will damage the unit.

#### C: INSPECTION

Check the secondary coil resistance using a tester. Replace if defective.

**CAUTION:**

- If the resistance is extremely low, it indicates the presence of a short-circuit.
- Ignitor is integrated with the coil. Therefore the resistance of primary side coil cannot be measured.

**Specified resistance:**

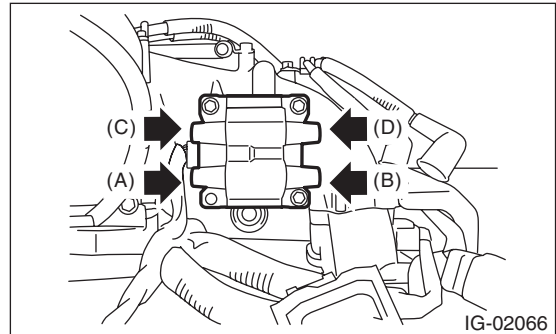
**[Secondary side]**

**Between (A) and (B)**

**11.2 kΩ±15%**

**Between (C) and (D)**

**11.2 kΩ±15%**



## 4. Spark Plug Cord

### A: INSPECTION

Check the following items.

- Damage to cords, deformation, burning or rust formation of terminals
- Resistance value of cords

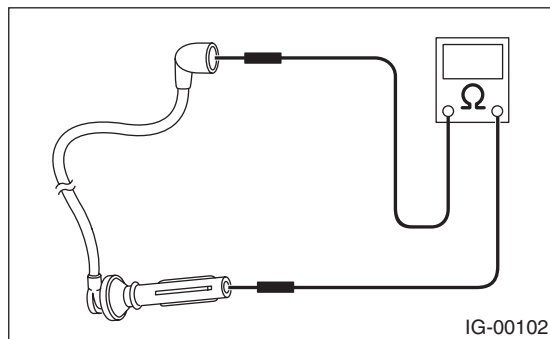
#### **Specified resistance:**

**#1 cord: 7.1 — 12.1 k $\Omega$**

**#2 cord: 12.1 — 19.9 k $\Omega$**

**#3 cord: 7.7 — 13.0 k $\Omega$**

**#4 cord: 12.3 — 20.2 k $\Omega$**



# Spark Plug Cord

IGNITION

---

**IG(H4SO)-8**

# General Description

## STARTING/CHARGING SYSTEMS

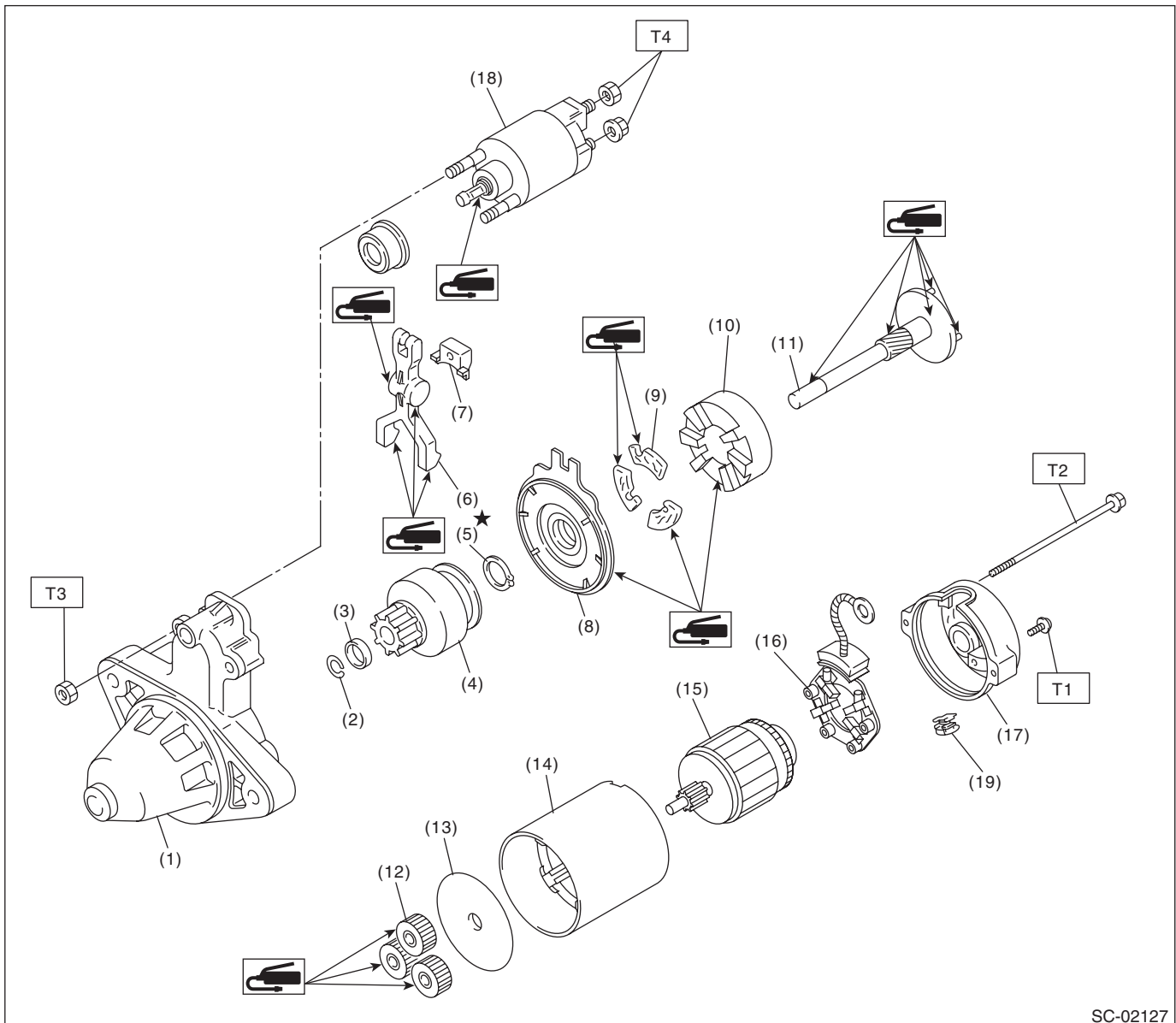
### 1. General Description

#### A: SPECIFICATION

Item		Specification		
Vehicle model		MT	AT	
Starter	Type	Reduction type		
	Model	428000-4780	428000-4790	
	Manufacturer	DENSO		
	Voltage and output	12 V — 1.6 kW	12 V — 1.6 kW	
	Direction of rotation	Counterclockwise (when observed from pinion)		
	Number of pinion teeth	9	9	
	No-load characteristics	Voltage	11 V	11 V
		Current	90 A or less	90 A or less
		Rotating speed	1,900 rpm or more	1,900 rpm or more
	Load characteristics	Voltage	8 V	8 V
		Current	370 A	370 A
		Torque	11.1 N·m (1.1 kgf-m, 8.2 ft-lb) or more	11.1 N·m (1.1 kgf-m, 8.2 ft-lb) or more
		Rotating speed	910 rpm or more	910 rpm or more
	Lock characteristics	Voltage	3 V	3 V
Current		750 A or less	750 A or less	
Torque		15.5 N·m (1.6 kgf-m, 11.4 ft-lb) or more	15.5 N·m (1.6 kgf-m, 11.4 ft-lb) or more	
Generator	Type	Rotating-field three-phase type, voltage regulator built-in type, with load response control system		
	Model	2.5 L Non-turbo	A003TG2391ZC	
		3.0 L Non-turbo	A003TG0591	
		2.5 L Turbo	A003TG0491	
	Manufacturer	Mitsubishi Electric		
	Voltage and output	12V — 110A		
	Polarity on ground side	Negative		
	Direction of rotation	Clockwise (when observed from pulley side)		
	Armature connection	3-phase Y-type		
	Output current	1,500 rpm — 50 A or more 2,500 rpm — 91 A or more 5,000 rpm — 105 A or more		
Regulated voltage	14.1 — 14.8 V [20°C (68°F)]			
Battery	Type and capacity	12 V — 48 AH (55D23L)	12 V — 52 AH (75D23L)	

### B: COMPONENT

#### 1. STARTER



SC-02127

- |                            |                        |                         |
|----------------------------|------------------------|-------------------------|
| (1) Starter housing        | (10) Internal gear     | (18) Magnet switch ASSY |
| (2) Snap ring              | (11) Shaft             | (19) Drain duct         |
| (3) Stopper                | (12) Planetary gear    |                         |
| (4) Overrunning clutch     | (13) Starter plate     |                         |
| (5) Snap ring              | (14) Yoke              |                         |
| (6) Shift lever            | (15) Armature          |                         |
| (7) Starter seal           | (16) Brush holder ASSY |                         |
| (8) Shock absorber bearing | (17) Starter cover     |                         |
| (9) Shock absorber         |                        |                         |

---

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 1.4 (0.14, 1.03)**

**T2: 6 (0.6, 4.4)**

**T3: 7.5 (0.8, 5.5)**

**T4: 10 (1.0, 7.4)**

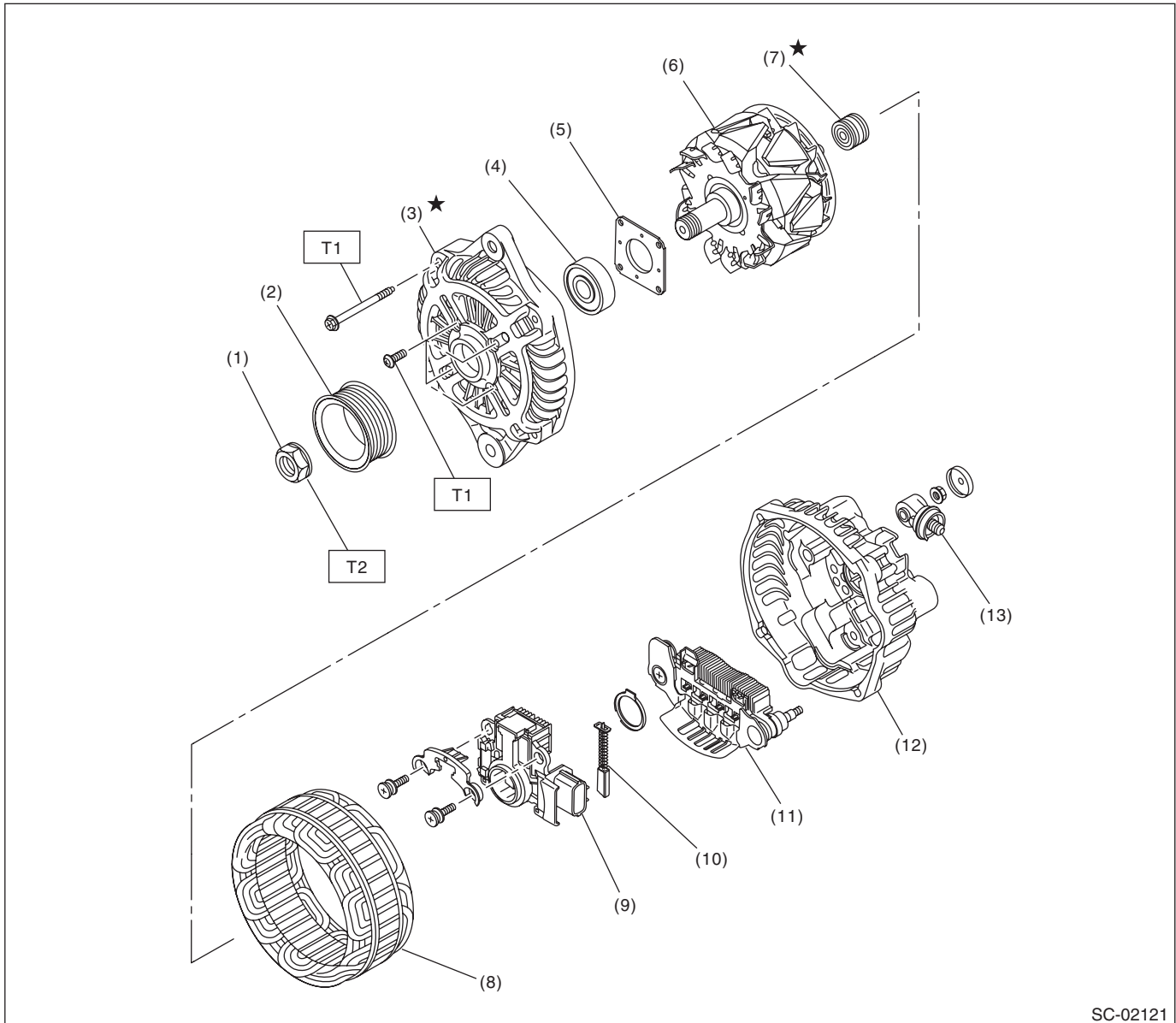
---



# General Description

## STARTING/CHARGING SYSTEMS

### 2. GENERATOR



SC-02121

- |                      |                             |               |
|----------------------|-----------------------------|---------------|
| (1) Pulley nut       | (7) Bearing                 | (13) Terminal |
| (2) Pulley           | (8) Stator coil             |               |
| (3) Front cover      | (9) IC regulator with brush |               |
| (4) Ball bearing     | (10) Brush                  |               |
| (5) Bearing retainer | (11) Rectifier              |               |
| (6) Rotor            | (12) Rear cover             |               |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 4.7 (0.48, 3.5)**

**T2: 108 (11.0, 79.8)**

### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

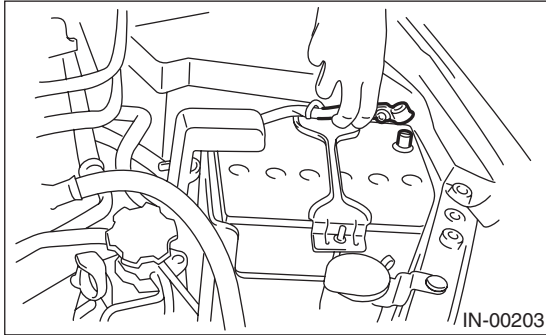
# Starter

## STARTING/CHARGING SYSTEMS

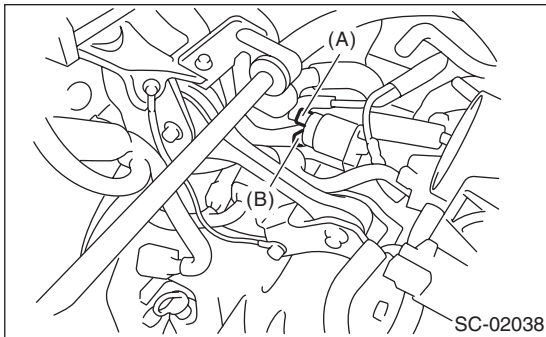
### 2. Starter

#### A: REMOVAL

- 1) Disconnect the ground cable from the battery.



- 2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.> <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 3) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Remove the air intake chamber stay LH. (2.5 L non-turbo model)
- 5) Disconnect the connector and terminal from starter.



- (A) Terminal
- (B) Connector

- 6) Remove the starter from transmission.

#### B: INSTALLATION

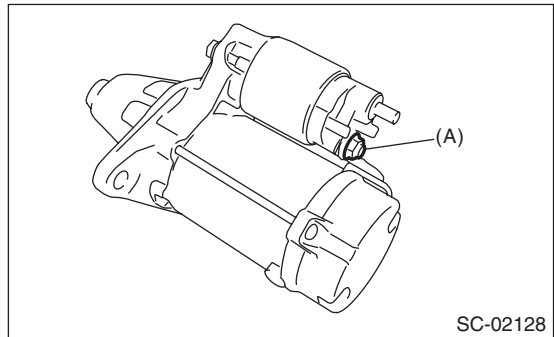
Install in the reverse order of removal.

#### **Tightening torque:**

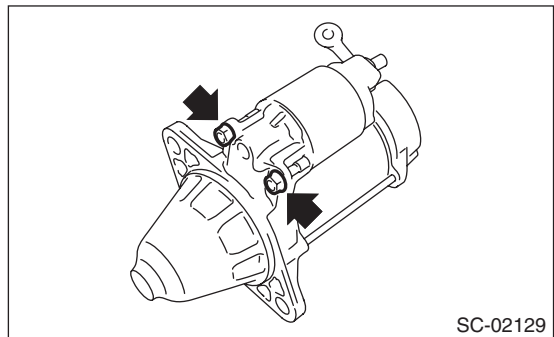
**50 N·m (5.1 kgf·m, 36.9 ft·lb)**

#### C: DISASSEMBLY

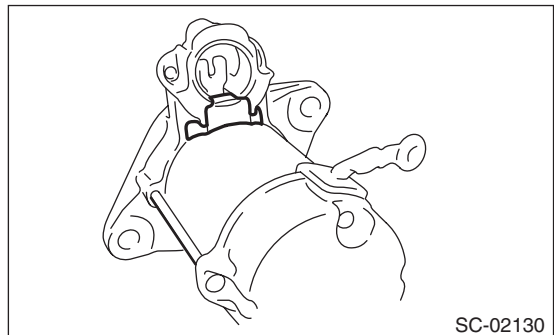
- 1) Loosen the nut which holds terminal M (A) of magnet switch assembly, and then disconnect the harness from terminal.



- 2) Remove the nuts which secure the magnet switch assembly and remove the magnet switch assembly.



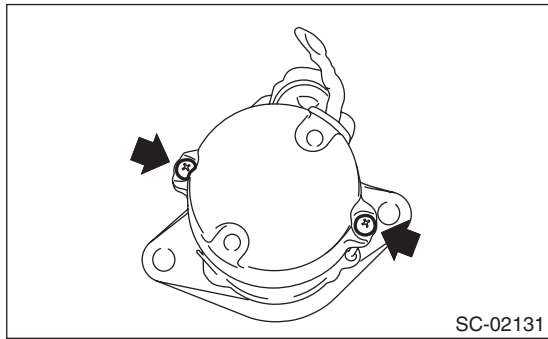
- 3) Remove the starter seal.



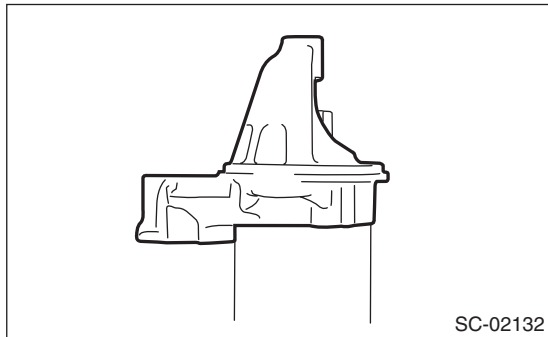
# Starter

## STARTING/CHARGING SYSTEMS

4) Remove the through bolts on both sides, and then remove the starter housing.

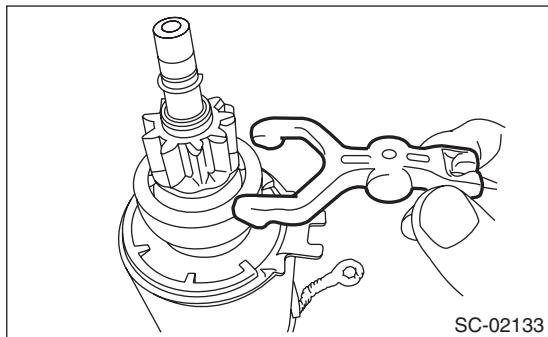


SC-02131



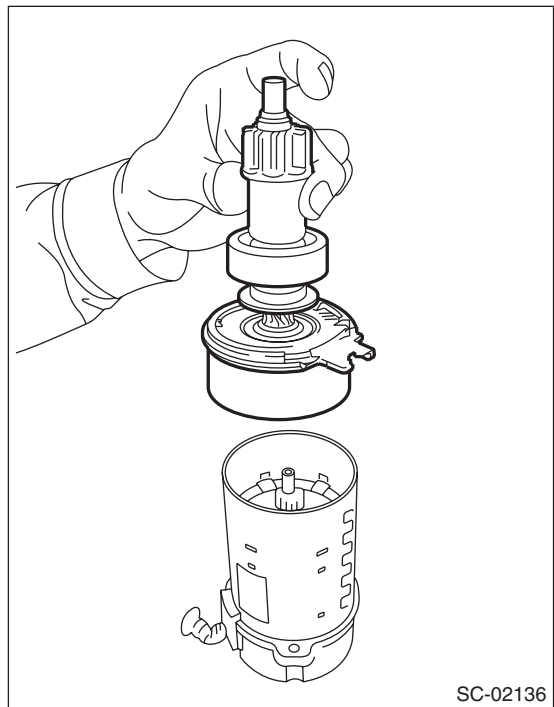
SC-02132

5) Remove the shift lever.



SC-02133

6) Remove the overrunning clutch, shock absorber bearing and shaft from the yoke as an assembly.



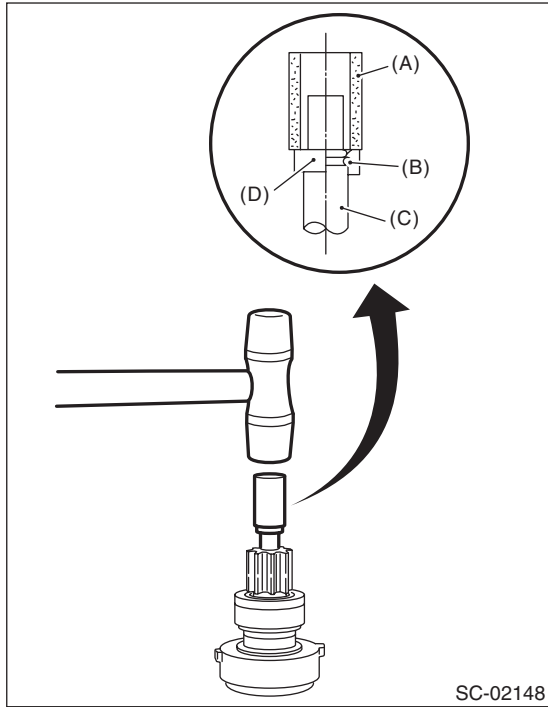
SC-02136

# Starter

## STARTING/CHARGING SYSTEMS

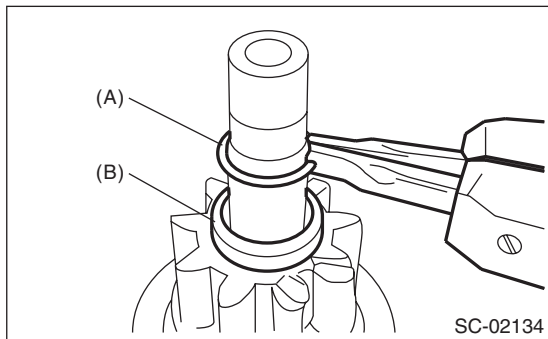
7) Remove the overrunning clutch from shaft assembly as follows:

(1) Using a plastic hammer, remove the stopper from snap ring by lightly tapping the stopper with an appropriate tool (such as a fit socket wrench).

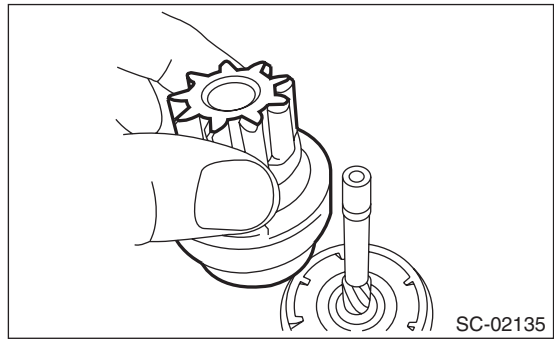


- (A) Appropriate tool
- (B) Snap ring
- (C) Shaft
- (D) Stopper

(2) Remove the snap ring (A) from the shaft, and then remove the stopper (B).

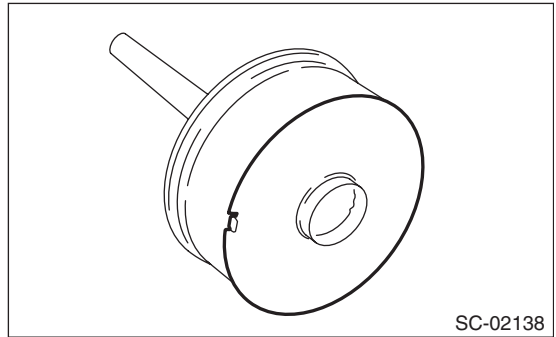


(3) Remove the overrunning clutch from the shaft.

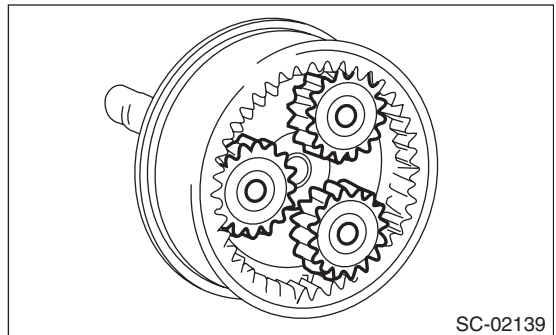


8) Remove the shock absorber as follows:

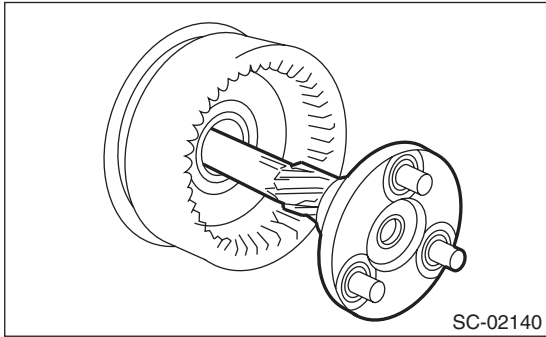
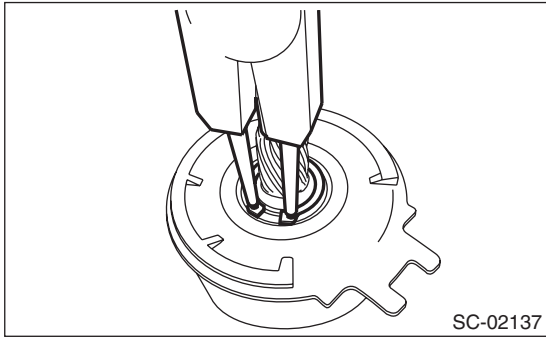
(1) Remove the starter plate.



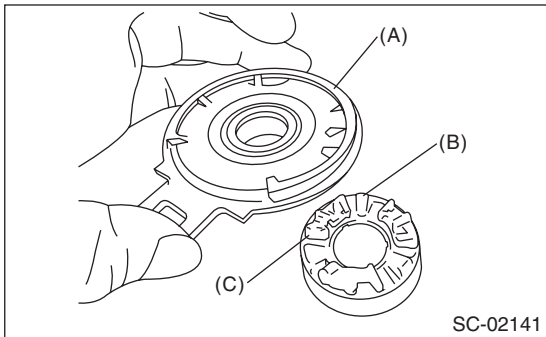
(2) Remove the planetary gear.



(3) Remove the snap ring, and then remove the shaft.



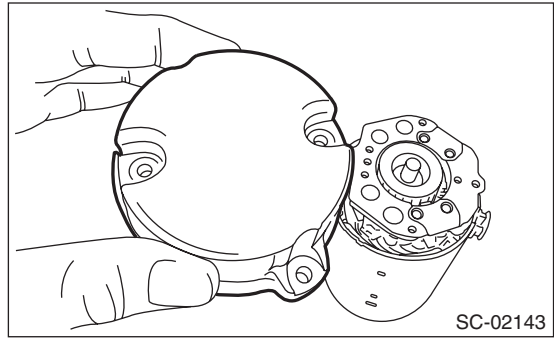
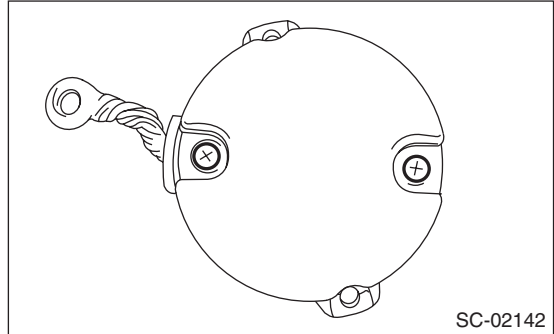
(4) Separate the shock absorber bearing (A) from the internal gear (B), and then remove the shock absorber (C).



9) Remove the screws to remove the starter cover from the brush holder assembly.

**NOTE:**

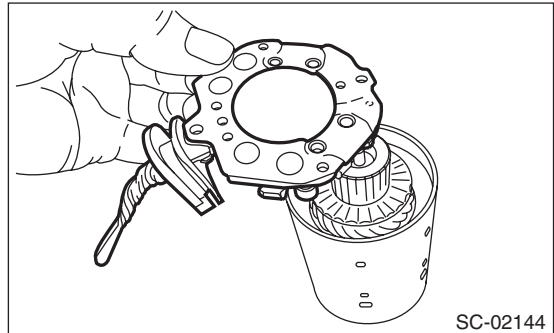
Hold the screws down and separate the starter cover so that the brush holder assembly remains on the armature side.



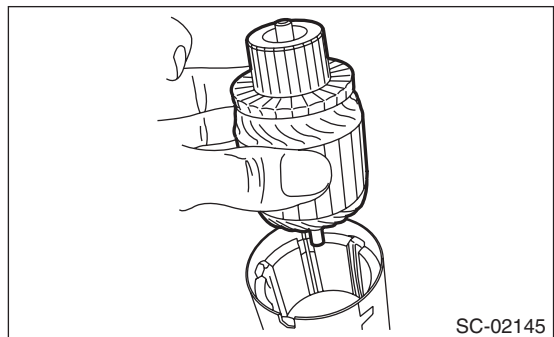
10) Remove the brush holder assembly from the armature.

**NOTE:**

Push the brushes against the springs by hand to avoid the damage to the brushes.



11) Remove the armature from yoke.

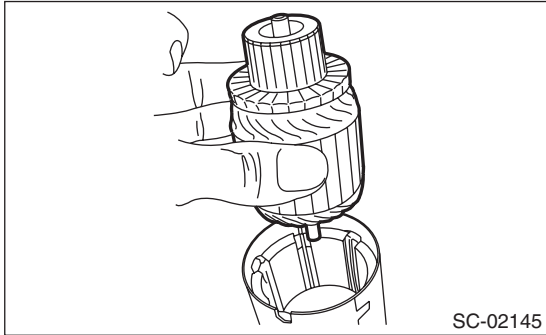


# Starter

## STARTING/CHARGING SYSTEMS

### D: ASSEMBLY

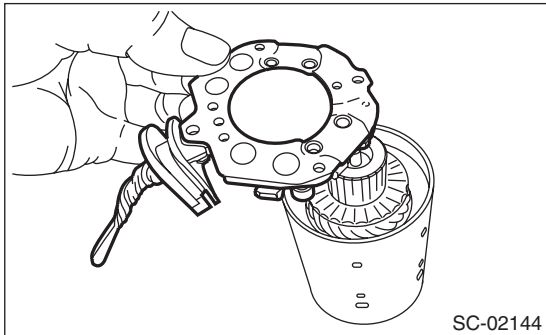
1) Install the armature to yoke.



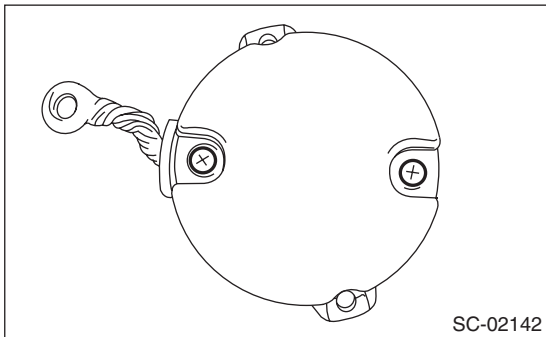
2) Install the brush holder assembly to the armature.

**NOTE:**

Push the brushes against the springs by hand to avoid the damage to the brushes.



3) Install the starter cover, and then secure it to the brush holder assembly with the screws.



4) Assemble the shock absorber as follows:

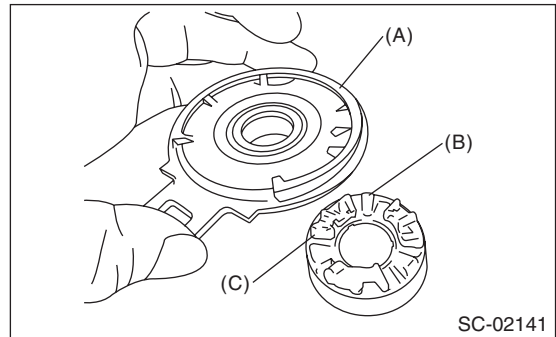
(1) Apply grease to the shock absorber (C), and install the internal gear (B) to the shock absorber bearing (A).

**NOTE:**

Align with the claw position of internal gear to install shock absorber bearing.

**Grease:**

**DENSO HL50**



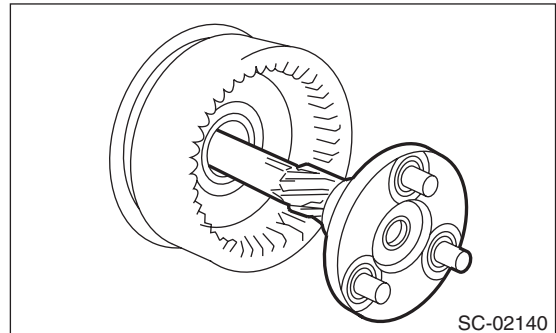
(2) Install the shaft to the internal gear.

**NOTE:**

Apply grease to the sliding part for the shaft inside the internal gear.

**Grease:**

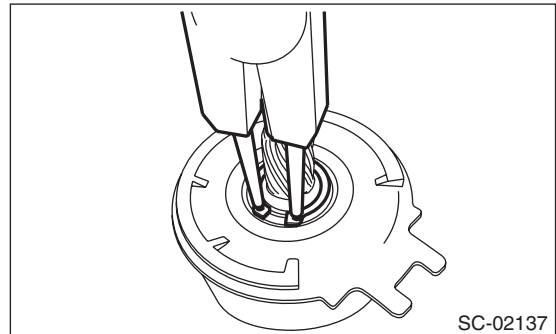
**DENSO HL50**



(3) Install the snap ring to shaft.

**NOTE:**

Use new snap rings.



- 5) Install the planetary gear to the internal gear.  
 (1) Apply grease to the installation part of the planetary gear.

**Grease:**

**DENSO HL50**

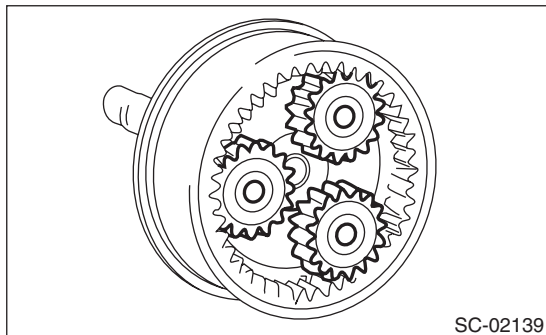
- (2) Install the planetary gear to pin.  
 (3) Apply grease to the planetary gear, internal gear and upper part of the pin.

**NOTE:**

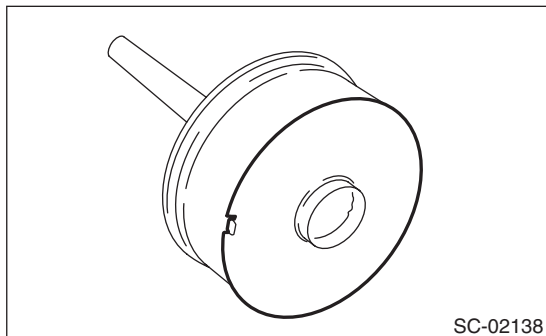
- Apply grease so that it contacts each gear.
- Be careful not to allow dirt to get in.

**Grease:**

**DENSO HL50**



- (4) Install the starter plate.

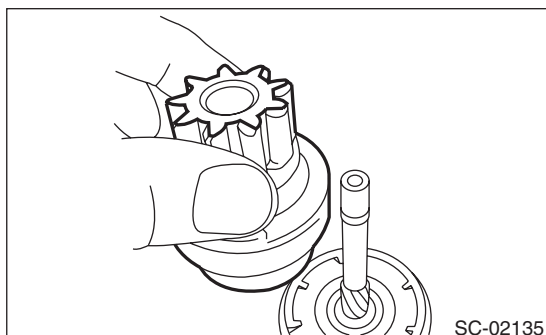


- 6) Assemble the overrunning clutch as follows:  
 (1) Apply grease to the spline portion of the shaft.

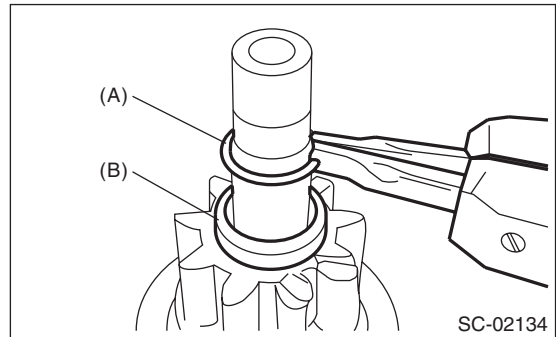
**Grease:**

**DENSO HL50**

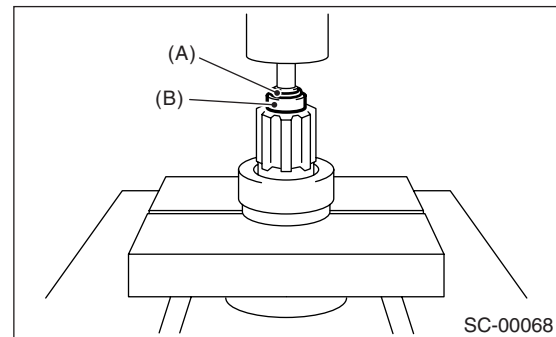
- (2) Install the overrunning clutch to shaft.



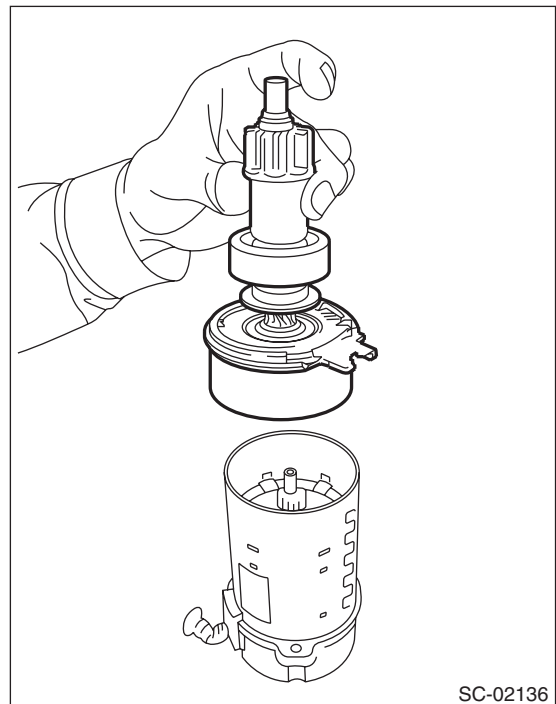
- (3) Install the stopper (B) to the shaft, and install the snap ring (A).



- (4) Press-fit the stopper (B) to snap ring (A) using a press.



- 7) Assemble the overrunning clutch, shock absorber and shaft to the yoke as one unit.





# Starter

## STARTING/CHARGING SYSTEMS

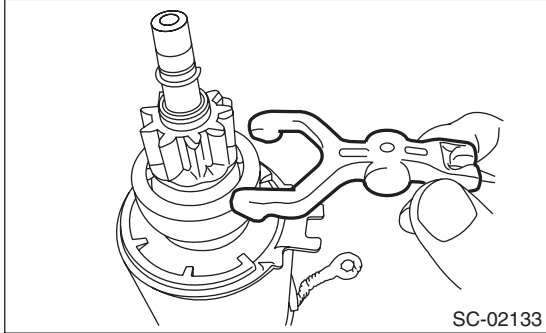
8) Install the shift lever.

**NOTE:**

Apply grease to the contact portion of the shift lever.

**Grease:**

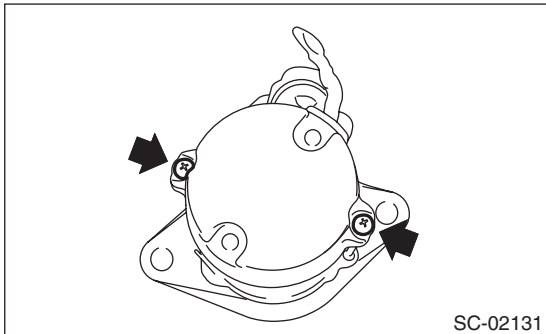
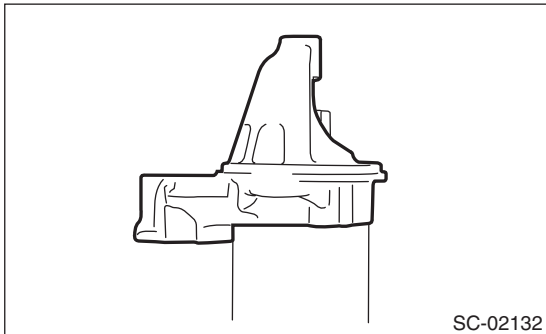
**DENSO HL50**



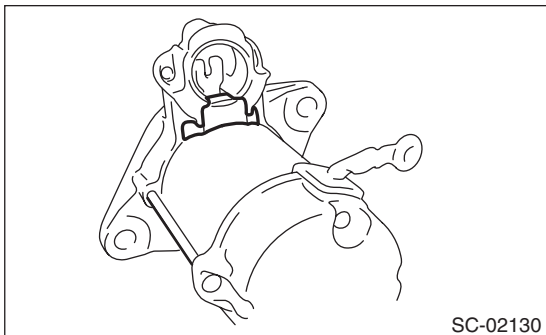
9) Install the starter housing, and tighten the through bolts on both sides.

**Tightening torque:**

**6 N-m (0.6 kgf-m, 4.4 ft-lb)**



10) Install the starter seal.



11) Install the magnet switch assembly to the starter housing, and tighten the nuts.

**NOTE:**

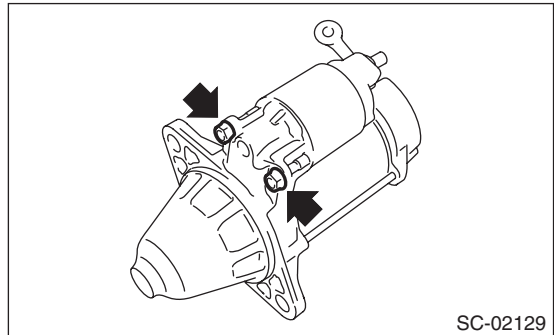
Apply grease to the installation part of the shift lever.

**Grease:**

**DENSO HL50**

**Tightening torque:**

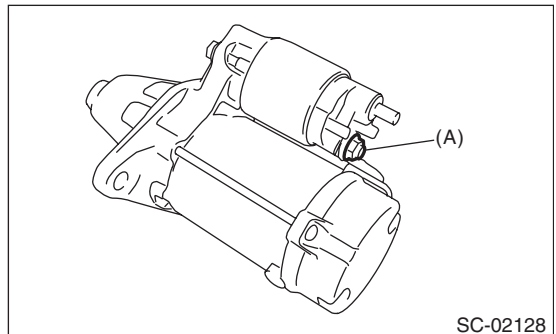
**7.5 N-m (0.8 kgf-m, 5.5 ft-lb)**



12) Install the harness to the terminal M (A) of the magnet switch assembly, and tighten the nut.

**Tightening torque:**

**10 N-m (1.0 kgf-m, 7.4 ft-lb)**



### E: INSPECTION

#### 1. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground.

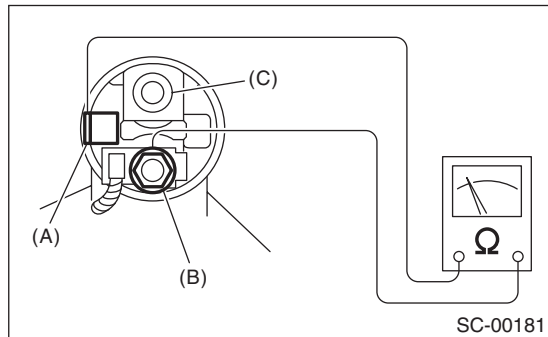
Also check to be sure there is no continuity between terminal M and B.

##### Terminal/Resistance:

**S — M/1  $\Omega$  or less**

**S — Ground/1  $\Omega$  or less**

**M — B/1 M $\Omega$  or more**



- (A) Terminal S
- (B) Terminal M
- (C) Terminal B

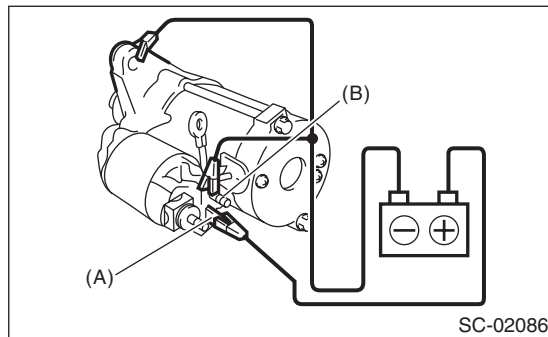
#### 2. SWITCH ASSEMBLY OPERATION

##### NOTE:

Test period of each test must be within short time (3 — 5 seconds).

##### 1) Vacuum test

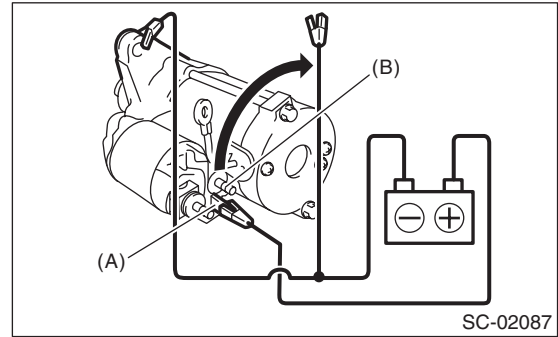
Disconnect the harness from terminal M and connect it as shown in the figure. Make sure the pinion gear sticks out.



- (A) Terminal S
- (B) Terminal M

##### 2) Hold test

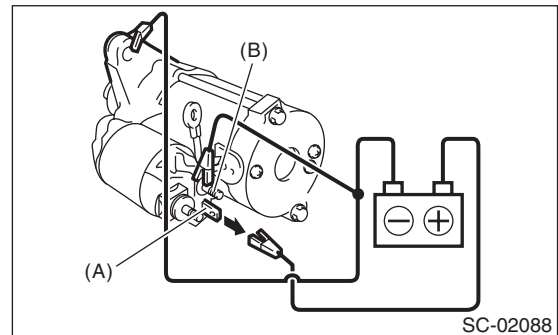
Make sure the pinion gear remains stick out even after disconnecting terminal M in the above condition.



- (A) Terminal S
- (B) Terminal M

##### 3) Return test

Connect the positive terminal to terminal S and the negative terminal to terminal M and starter body to pull the pinion gear at the main contact point. Make sure the pinion gear returns to its original position when the terminal S is disconnected.



- (A) Terminal S
- (B) Terminal M

# Starter

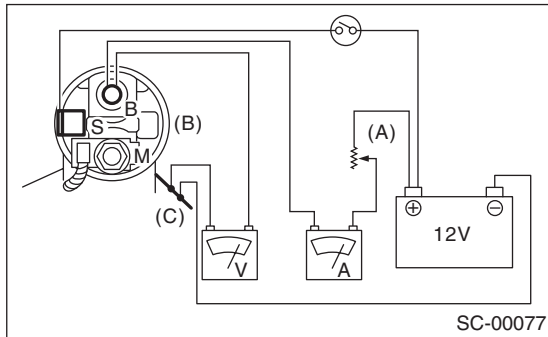
## STARTING/CHARGING SYSTEMS

### 3. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.

Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.

For these performance tests, use the circuit shown in figure.



- (A) Variable resistance
- (B) Starter body
- (C) Magnetic switch

#### 1) No-load test

With switch on, adjust the variable resistance until the voltage is 11 V, read the value of ammeter to measure rotating speed. Compare these values with the standard.

#### **No-load test (standard):**

##### **Voltage/Current**

**MT model**

**Max. 11 V/90 A or less**

**AT model**

**Max. 11 V/90 A or less**

##### **Rotating speed**

**MT model**

**1,900 rpm or more**

**AT model**

**1,900 rpm or more**

#### 2) Load test

Apply the specified braking torque to starter. The condition is satisfactory if the current draw and rotating speed are within specifications.

#### **Load test (standard):**

##### **Voltage/Load**

**MT model**

**8 V/11.1 N·m (1.1 kgf-m, 8.2 ft-lb)**

**AT model**

**8 V/11.1 N·m (1.1 kgf-m, 8.2 ft-lb)**

##### **Current/Speed**

**MT model**

**370 A/910 rpm or more**

**AT model**

**370 A/910 rpm or more**

#### 3) Lock test

With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

#### **Lock test (standard):**

##### **Voltage/Current**

**MT model**

**3 V/750 A or less**

**AT model**

**3 V/750 A or less**

##### **Torque**

**MT model**

**15.5 N·m (1.6 kgf-m, 11.4 ft-lb)**

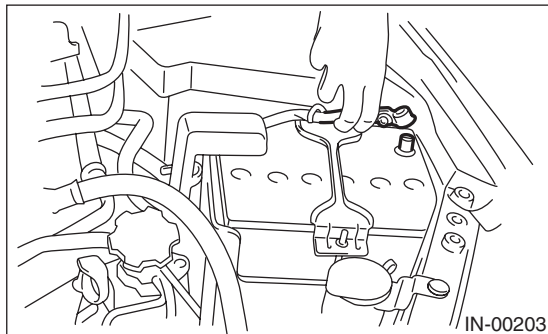
**AT model**

**15.5 N·m (1.6 kgf-m, 11.4 ft-lb)**

## 3. Generator

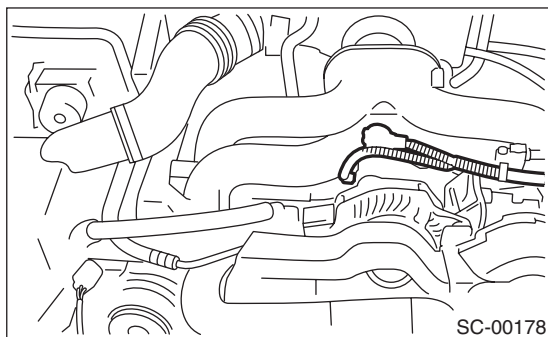
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.

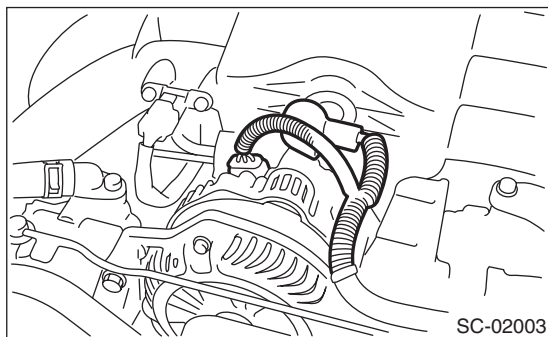


- 2) Disconnect the connector and terminal from generator.

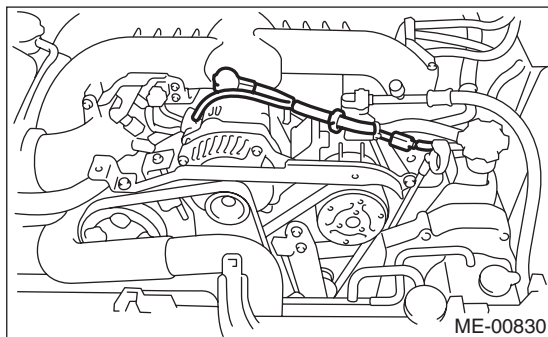
- 2.5 L Non-turbo model



- 3.0 L Non-turbo model



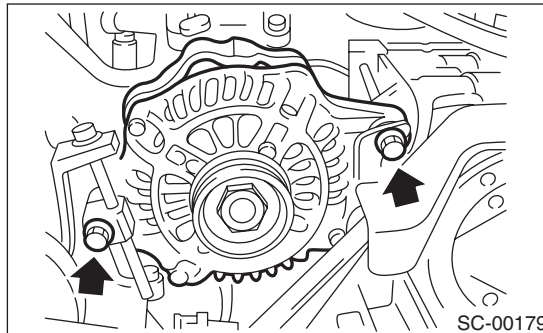
- Turbo model



- 3) Remove the V-belt covers.

- 4) Remove the front side belts.  
<Ref. to ME(H4SO)-37, FRONT SIDE BELT, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-37, FRONT SIDE BELT, REMOVAL, V-belt.> <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>

- 5) Remove the bolts which install the generator onto bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

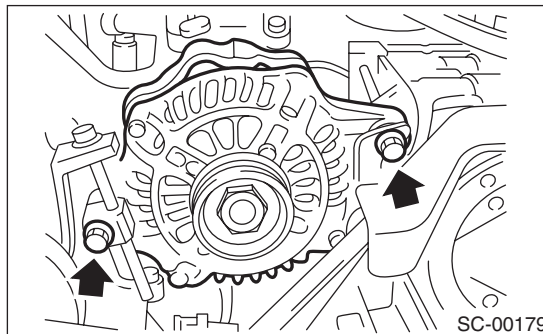
#### CAUTION:

Check and adjust the V-belt tension.

<Ref. to ME(H4SO)-39, INSPECTION, V-belt.>

<Ref. to ME(H4DOTC)-39, INSPECTION, V-belt.>

<Ref. to ME(H6DO)-40, INSPECTION, V-belt.>

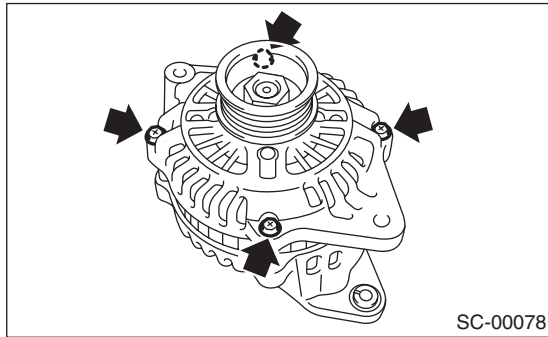


# Generator

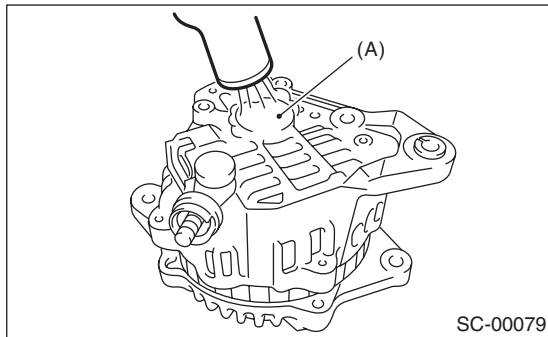
## STARTING/CHARGING SYSTEMS

### C: DISASSEMBLY

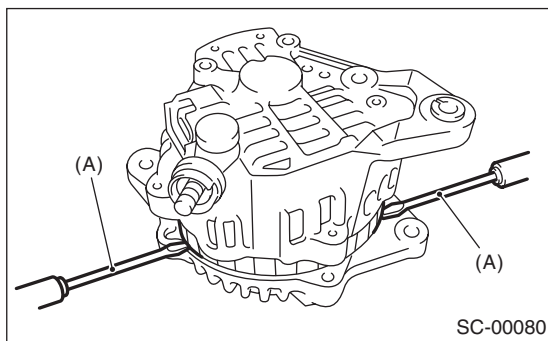
1) Remove the four through-bolts.



2) Use a drier to heat the rear cover (A) portion to 50°C (122°F).

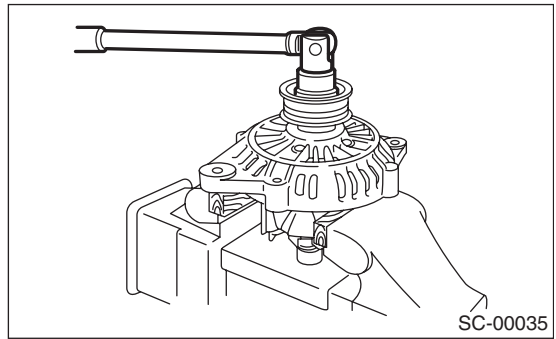


3) Insert the end of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

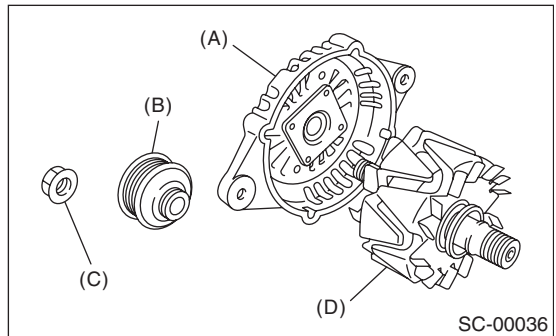


(A) Screwdriver

4) Using a vise, support the rotor and remove the pulley bolt.



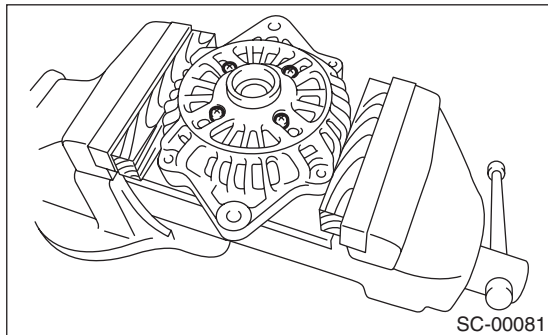
**CAUTION:**  
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



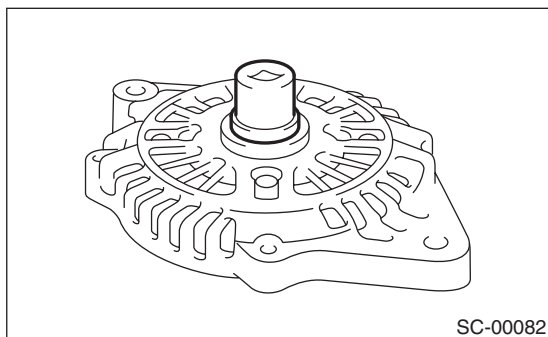
- (A) Front cover
- (B) Pulley
- (C) Nut
- (D) Rotor

5) Use the following procedures to remove the ball bearings.

(1) Remove the bolt, and then detach the bearing retainer.

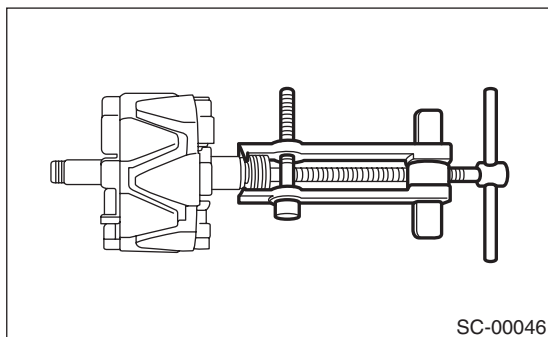


(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.



(3) Use the press to push the ball bearings out from the front cover.

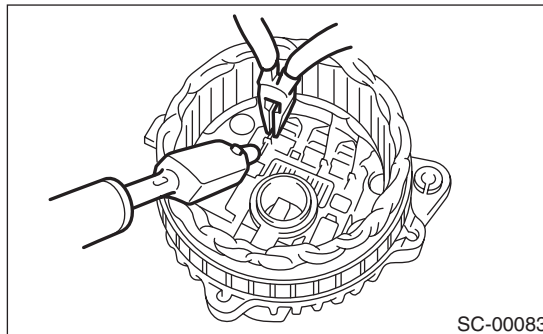
6) Using the bearing puller, remove the bearings from the rotor.



7) Disconnect the connection between the rectifier and stator coil, then remove the stator coil.

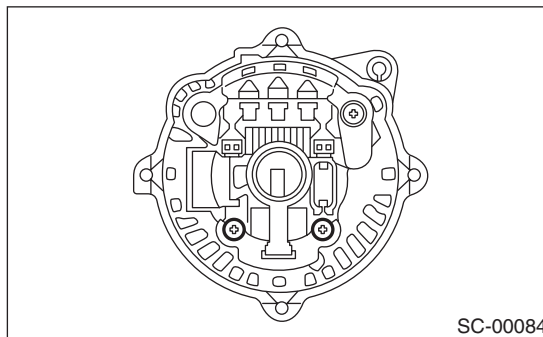
### CAUTION:

The rectifier is easily damaged by heat. Do not allow a 180 — 270 W soldering iron to contact the terminals for 5 seconds or more at a time.

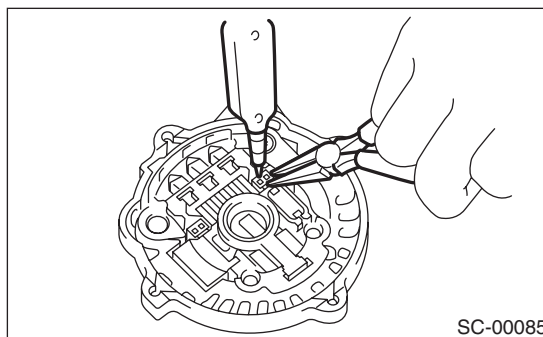


8) Use the following procedures to remove the IC regulator.

(1) Remove the screws which secure the IC regulator to the rear cover.



(2) Disconnect the connection between the IC regulator and rectifier, then remove the IC regulator.

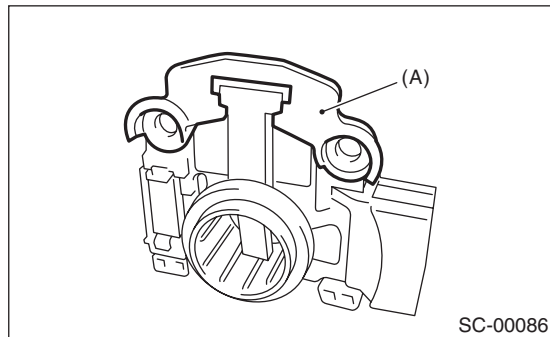


# Generator

## STARTING/CHARGING SYSTEMS

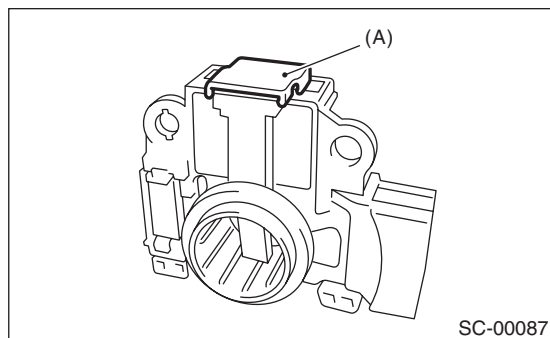
9) Use the following procedures to remove the brush.

(1) Remove the cover A.



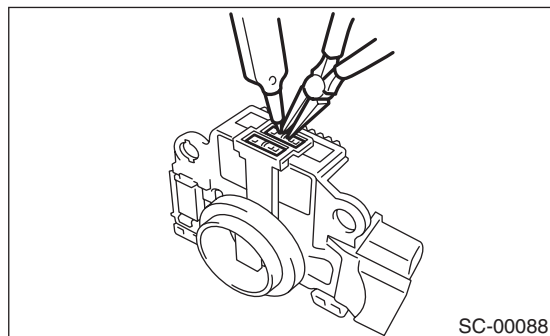
(A) Cover A

(2) Remove the cover B.



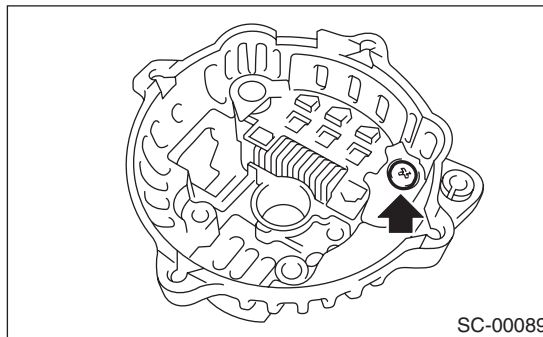
(A) Cover B

(3) Disconnect the connection and remove the brush.

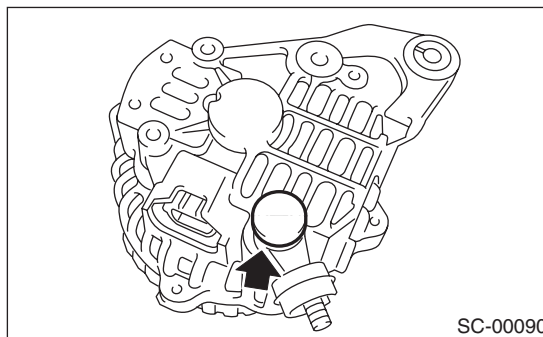


10) Remove the rectifier as follows.

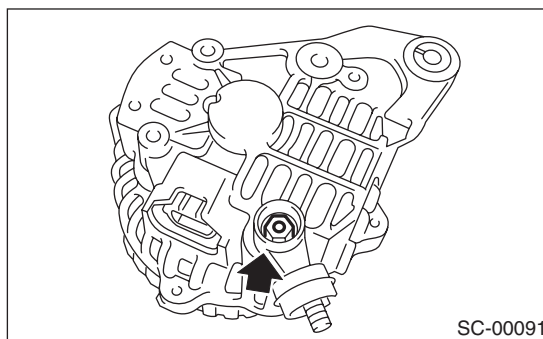
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover on terminal B.



(3) Remove the nuts of terminal B, then remove the rectifier.



**D: ASSEMBLY**

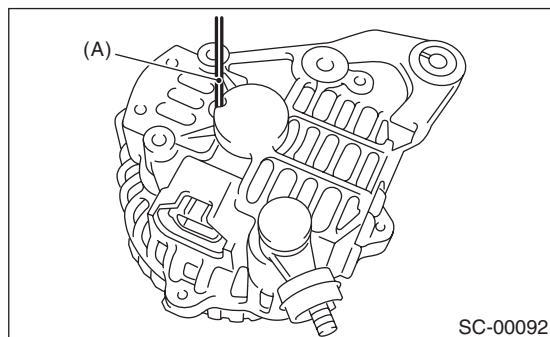
Assemble in the reverse order of disassembly.

## 1) Pull-out of the brush

Before assembling, press the brush down into the brush holder, then fix the brush in that position by inserting a [1 mm (0.08 in) dia., 40 to 50 mm (1.6 to 2.0 in) long] wire through the hole as shown in the figure.

**CAUTION:**

**After re-assembling, remove the wire.**



(A) Wire

## 2) Install the ball bearings.

(1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.

(2) Using a press to press the ball bearings into the specified location.

(3) Install the bearing retainer.

3) Use a press to install the bearings (rear side) to the rotor shaft.

4) Heat the bearing box in rear cover [50 to 60°C (122 to 140°F)], and then press the rear bearing into rear cover.

**CAUTION:**

**Do not apply grease to the rear bearings. If there is any oil on the bearing box, remove it completely.**

5) After re-assembling, manually turn the pulley to check that the rotor rotates smoothly.

**E: INSPECTION**

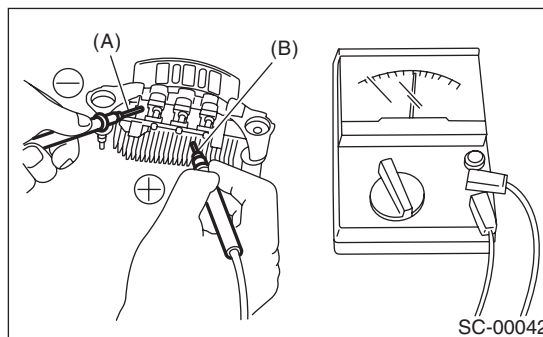
## 1. DIODE

**CAUTION:**

**There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.**

## 1) Check the positive diode

Check for continuity between the diode lead and positive side heat sink. If resistance is 1  $\Omega$  or less only in the direction from the diode lead to the heat sink, the positive diode is OK.

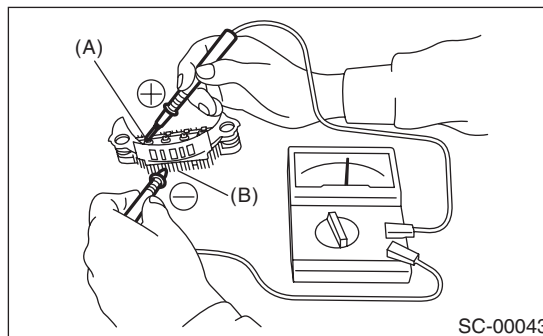


(A) Diode lead

(B) Heat sink (positive side)

## 2) Check negative diode

Check for continuity between the negative side heat sink and diode lead. If resistance is 1  $\Omega$  or less only in the direction from the heat sink to the diode lead, the negative diode is OK.



(A) Diode lead

(B) Heat sink (negative side)



# Generator

## STARTING/CHARGING SYSTEMS

### 2. ROTOR

#### 1) Slip ring surface

Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.

#### 2) Slip ring outer diameter

Measure the slip ring outer diameter. Replace the rotor assembly if the slip ring is worn.

#### **Slip ring outer diameter:**

##### **Standard**

**22.7 mm (0.894 in)**

##### **Limit**

**22.1 mm (0.870 in)**

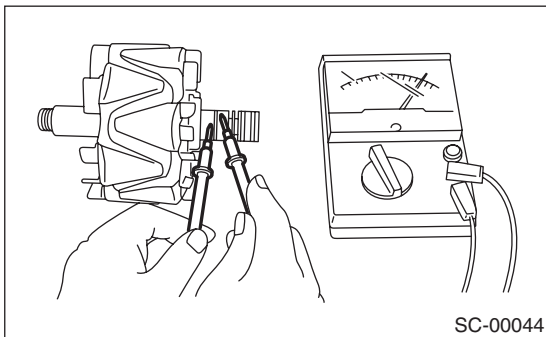
#### 3) Continuity test

Using a circuit tester, check the resistance between slip rings.

If the resistance is not within the standard, replace the rotor assembly.

#### **Specified resistance:**

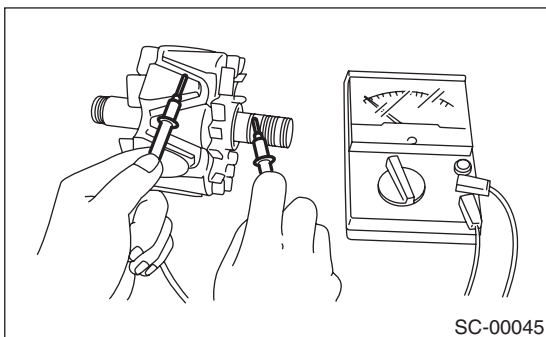
**Approximately 1.6 — 1.9  $\Omega$**



SC-00044

#### 4) Insulation test

Check the continuity between slip ring and rotor core or shaft. If the resistance is 1  $\Omega$  or less, replace the rotor assembly because the rotor coil is grounded.



SC-00045

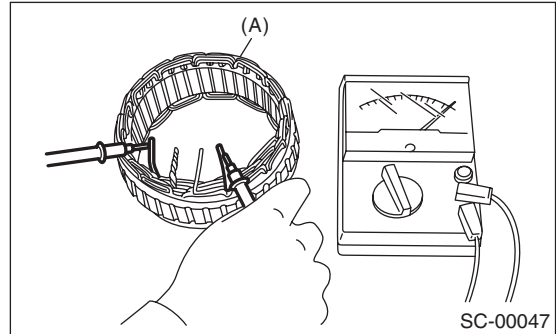
#### 5) Ball bearings (rear side)

Check the rear ball bearing. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

### 3. STATOR

#### 1) Continuity test

Inspect continuity between the stator coil lead wire terminals. If the resistance is 1 M $\Omega$  or more, the lead wire is damaged. Replace the stator assembly.

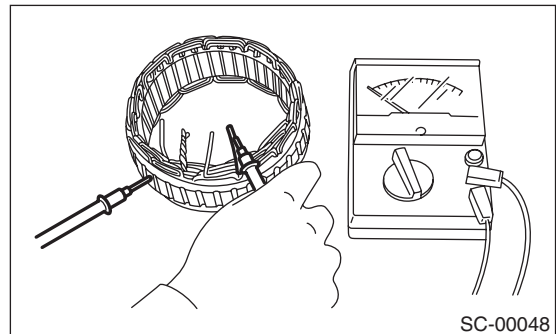


SC-00047

(A) Stator

#### 2) Insulation test

Inspect the continuity between the stator coil stator core and lead wire terminals. If the resistance is 1  $\Omega$  or less, the stator coil is grounded. Replace the stator assembly.



SC-00048

#### 4. BRUSH

1) Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

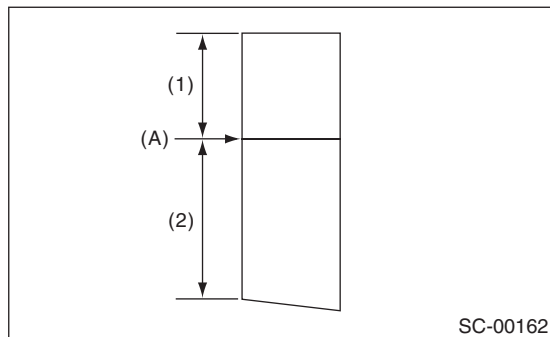
**Brush length:**

**Service limit (1)**

**5.0 mm (0.197 in)**

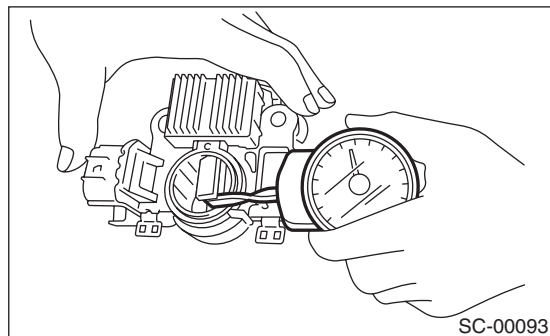
**Standard (2)**

**18.5 mm (0.728 in)**



2) Check that there is appropriate pressure on the brush spring.

Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is 2.2 N (0.224 kgf, 7.91 oz) or less, replace the brush spring with a new one. 4.8 — 6.0 N (0.489 — 0.612 kgf, 17.26 — 21.58 oz) pressure is required on the new spring.



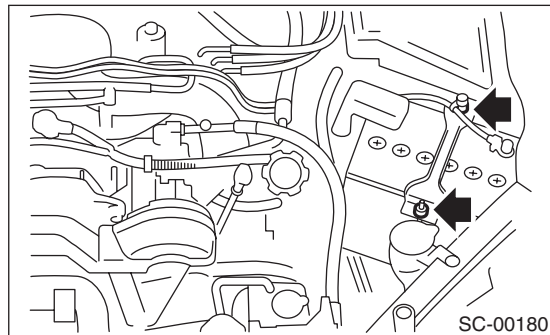
#### 5. BEARING (FRONT SIDE)

Check the front ball bearing. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

### 4. Battery

#### A: REMOVAL

- 1) Disconnect the positive (+) terminal after disconnecting the negative (-) terminal of battery.
- 2) Remove the flange nut from battery rod and remove battery holder.



- 3) Remove the battery.

#### B: INSTALLATION

Install in the reverse order of removal.

##### **Tightening torque:**

**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**

##### **NOTE:**

- Clean the battery cable terminals and apply grease to retard the formation of corrosion.
- Connect the battery positive (+) terminal, and then connect the negative (-) terminal.
- After the battery is installed, initial diagnosis of the electronic throttle control is performed. For this reason, start the engine 10 seconds or more after the ignition switch was turned to ON.

#### C: INSPECTION

##### **WARNING:**

- Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.
- Make sure the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.
- In addition, be careful not to let the electrode contact with the coated parts.
- Be careful when handling the batteries because they produce explosive gases.
- Be sure to keep battery away from any fire.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.
- Ventilate sufficiently when using or charging battery in enclosed space.
- Before starting work, remove rings, metal watch-bands, and other metal jewelry.
- Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle.

##### **1. EXTERNAL PARTS**

Check the battery case, top cover, vent plugs, and terminal posts for dirt or cracks. If necessary, clean with water and wipe with a dry cloth.

Apply a thin coat of grease on the terminal posts to prevent corrosion.

##### **2. ELECTROLYTE LEVEL**

Check the electrolyte level in each cell. If the level is below MIN level, bring the level to MAX level by pouring distilled water into the battery cell. Do not fill beyond MAX level.

### 3. SPECIFIC GRAVITY OF ELECTROLYTE

1) Measure specific gravity of electrolyte using a hydrometer and a thermometer.

Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following equation:

$$S_{20} = St + 0.0007 \times (t - 20)$$

*S<sub>20</sub>*: Specific gravity corrected at electrolyte temperature of 20°C (68°F)

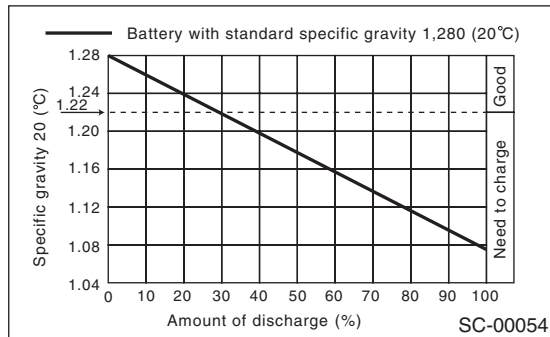
*St*: Measured specific gravity

*t*: Measured temperature (°C)

**Determine whether or not battery must be charged, according to corrected specific gravity.**

**Standard specific gravity: 1.220 — 1.290 [20°C (68°F)]**

2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



### D: MEASUREMENT

#### WARNING:

**Do not bring an open flame close to the battery when working.**

#### CAUTION:

- Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.
- Be careful since battery electrolyte overflows while charging the battery.
- Observe instructions when handling the battery charger.
- Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.

### 1. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte should be held within the specific range from 1.250 to 1.290 for one hour or more.

2) Voltage per battery cell should be held at a specific value in a range from 2.5 to 2.8 V for one hour or more.

### 2. CHECK CONDITION OF CHARGE WITH HYDROMETER

Hydrometer indicator	State of charge	Corrective action
Green dot	65% or more	Load test
Dark dot	65% or less	Charge battery
Clear dot	Low electrolyte	Replace the battery.* (If cranking is difficult)

\* Check electrical system before replacement.

### 3. NORMAL CHARGING

Charge the battery at the current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

### 4. QUICK CHARGING

Quick charging is a method that the battery is charged in a short period of time with a relatively large current by using a quick charger.

Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not increase the electrolyte temperature above 40°C (104°F).

Also the quick charging is a temporary mean to bring battery voltage up to some level, and battery should be charged slowly with low current as a rule.

#### CAUTION:

- Observe the items in 3. NORMAL CHARGING.
- Never use 10 A or more when charging the battery because it will shorten the battery life.

# Battery

STARTING/CHARGING SYSTEMS

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SC(H4SO)-24

# Basic Diagnostic Procedure

ENGINE (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### 1. ENGINE

	Step	Check	Yes	No
1	<p><b>CHECK ENGINE START FAILURE.</b></p> <p>1) Ask the customer when and how the trouble occurred using the interview checklist. &lt;Ref. to EN(H4SO)(diag)-3, CHECK, Check List for Interview.&gt;</p> <p>2) Start the engine.</p>	Does the engine start?	Go to step 2.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4SO)(diag)-68, Diagnostics for Engine Starting Failure.>
2	<p><b>CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.</b></p>	Does the malfunction indicator light illuminate?	Go to step 3.	Inspection using "General Diagnostic Table". <Ref. to EN(H4SO)(diag)-307, INSPECTION, General Diagnostic Table.>
3	<p><b>CHECK INDICATION OF DTC ON DISPLAY.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Connect the Subaru Select Monitor or general scan tool to data link connector.</p> <p>3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool.</p> <p>4) Read DTC using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>Refer to "Read Diagnostic Trouble Code" for detailed operation procedure. &lt;Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Record the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H4SO)(diag)-59, Malfunction Indicator Light.>
4	<p><b>PERFORM DIAGNOSIS.</b></p> <p>1) Perform the Clear Memory Mode. &lt;Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.&gt;</p> <p>2) Perform the Inspection Mode. &lt;Ref. to EN(H4SO)(diag)-44, Inspection Mode.&gt;</p>	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-90, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Check List for Interview

ENGINE (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

#### 1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of purchase		Fuel brand	
Date of repair		Odometer reading	km
V.I.N.			miles
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Various/Others:		
Ambient air temperature	°C ( °F)		
	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold		
Place	<input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner city <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Rough road <input type="checkbox"/> Others:		
	<input type="checkbox"/> Cold <input type="checkbox"/> Warming-up <input type="checkbox"/> After warming-up <input type="checkbox"/> Any temperature <input type="checkbox"/> Others:		
Engine speed	rpm		
Vehicle speed	km/h (MPH)		
Driving conditions	<input type="checkbox"/> Not affected <input type="checkbox"/> At starting <input type="checkbox"/> While idling <input type="checkbox"/> At racing <input type="checkbox"/> While accelerating <input type="checkbox"/> While cruising <input type="checkbox"/> While decelerating <input type="checkbox"/> While turning (RH/LH)		
Headlight	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Rear defogger	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Blower	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Audio	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
A/C compressor	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	CD/Cassette	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Radiator fan	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Car phone	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Front wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Wireless device	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Rear wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF		

# Check List for Interview

## ENGINE (DIAGNOSTICS)

### 2. CHECK LIST NO. 2

Check the following item about the vehicle's state when malfunction indicator light illuminates.

#### NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators illuminate. <input type="checkbox"/> Yes / <input type="checkbox"/> No
<input type="checkbox"/> Low fuel warning light <input type="checkbox"/> Charge indicator light <input type="checkbox"/> AT diagnostic indicator light <input type="checkbox"/> ABS warning light <input type="checkbox"/> Oil pressure indicator light
b) Fuel level
• Lack of gasoline: <input type="checkbox"/> Yes / <input type="checkbox"/> No • Indicator position of fuel gauge: • Experienced running out of fuel: <input type="checkbox"/> Yes / <input type="checkbox"/> No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
d) Intentional connecting or disconnecting of hoses: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
e) Installing of parts other than genuine parts: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What: • Where:
f) Occurrence of noise: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
g) Occurrence of smell: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: <input type="checkbox"/> Yes / <input type="checkbox"/> No
i) Troubles occurred
<input type="checkbox"/> Engine does not start. <input type="checkbox"/> Engine stalls during idling. <input type="checkbox"/> Engine stalls while driving. <input type="checkbox"/> Engine speed decreases. <input type="checkbox"/> Engine speed does not decrease. <input type="checkbox"/> Rough idling <input type="checkbox"/> Poor acceleration <input type="checkbox"/> Back fire <input type="checkbox"/> After fire <input type="checkbox"/> Does not shift. <input type="checkbox"/> Excessive shift shock



## 3. General Description

### A: CAUTION

1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

#### CAUTION:

- All airbag system wiring harnesses and connectors are yellow. Do not use the electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.

2) Never connect the battery in reverse polarity. Failure to do so will damage the ECM instantly, and the fuel injector and other parts will also be damaged.

3) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.

4) Before disconnecting the connectors of each sensor and ECM, be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>

5) Measure the voltage or resistance of individual sensor or all electrical control modules using a tapered pin with a diameter of less than 0.6 mm (0.024 in). Do not insert the pin 4 mm (0.16 in) or more into the part.

#### CAUTION:

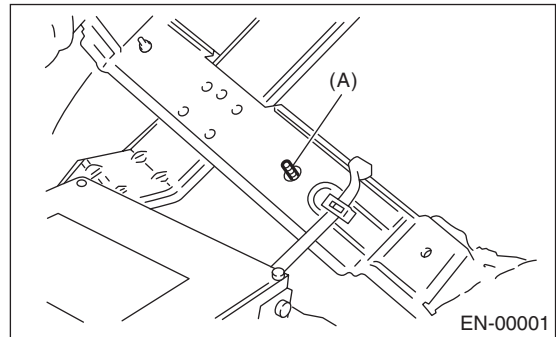
**When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.**

#### NOTE:

When replacing the ECM of the models with immobilizer, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the "IMMOBILIZER TEACHING OPERATION MANUAL".

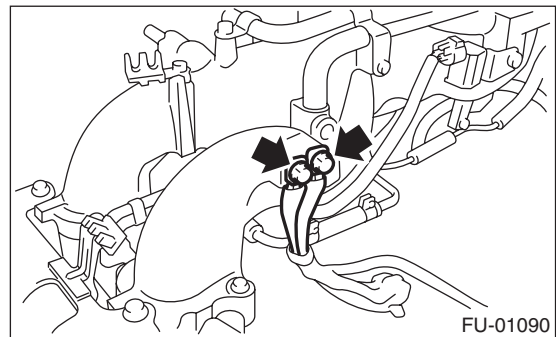
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.

7) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

8) Use the engine ground terminal or engine assembly for the grounding point to chassis when measuring the voltage and resistance in engine compartment.



9) Every MFI-related part is a precision part. Do not drop them.

10) Observe the following cautions when installing a radio in MFI equipped models.

#### CAUTION:

- The antenna must be kept as far apart as possible from control unit. (The ECM is located under the passenger's seat floor mat.)
- The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.
- Carefully adjust the antenna for correct matching.
- When mounting a large power type radio, pay special attention to the three items mentioned above.
- Incorrect installation of the radio may affect the operation of ECM.

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H4SO)-41, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

# General Description

## ENGINE (DIAGNOSTICS)

12) For the model with ABS, the ABS warning light may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clear procedure of self-diagnosis function.

### B: INSPECTION

Before performing diagnostics, check the following item which might affect engine problems.

#### 1. BATTERY

1) Measure the battery voltage and specific gravity of the electrolyte.

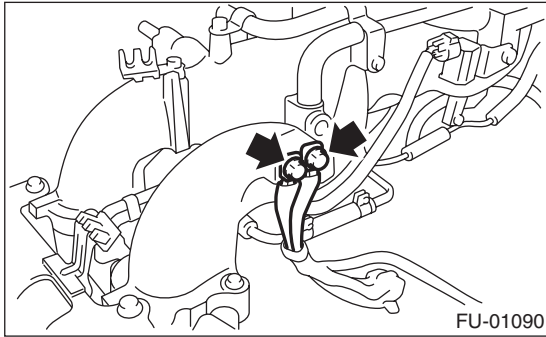
**Standard voltage: 12 V**

**Specific gravity: 1.260 or more**

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

#### 2. ENGINE GROUND

Check if the engine ground terminal is properly connected to engine.



### C: NOTE

#### 1. GENERAL DESCRIPTION

- The on-board diagnostic (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic throttle control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
- Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
- The OBD system incorporated with the vehicles within this type of engine complies with OBD-II regulations. The OBD system monitors the components and the system malfunction listed in "Engine Section" which affects on emissions.
- When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
- The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer first when it detects a malfunction.
- If the OBD system detects malfunctions such as the fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
- When the malfunction does not occur again for three consecutive driving cycles, malfunction indicator light is turned off, but DTC remains at on-board computer.
- When troubleshooting the vehicle which complies with OBD-II regulations, connect the Subaru Select Monitor or general scan tool to the vehicle.

## 2. ENGINE AND EMISSION CONTROL SYSTEM

- The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.

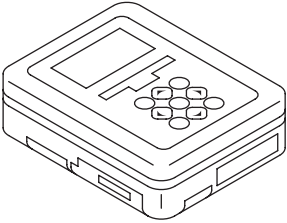
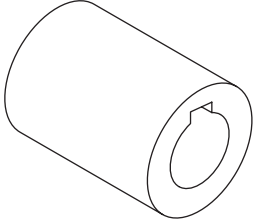
With this system, the fuel which is pressurized at a constant pressure is injected into the intake air passage of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system, where the electro-magnetic injection valve (fuel injector) opens for a short period of time depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.

- Furthermore, all operating conditions of the engine are converted into electronic signals, and this enables additional system features with greatly improved adaptability, making it easier to add compensation features.

The MFI system also has the following features:

- Reduced emission of harmful exhaust gases.
- Reduction in fuel consumption
- Increased engine output.
- Superior acceleration and deceleration
- Superior startability and warm-up performance in cold weather since compensation is made for engine coolant and intake air temperature

## D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

# Electrical Component Location

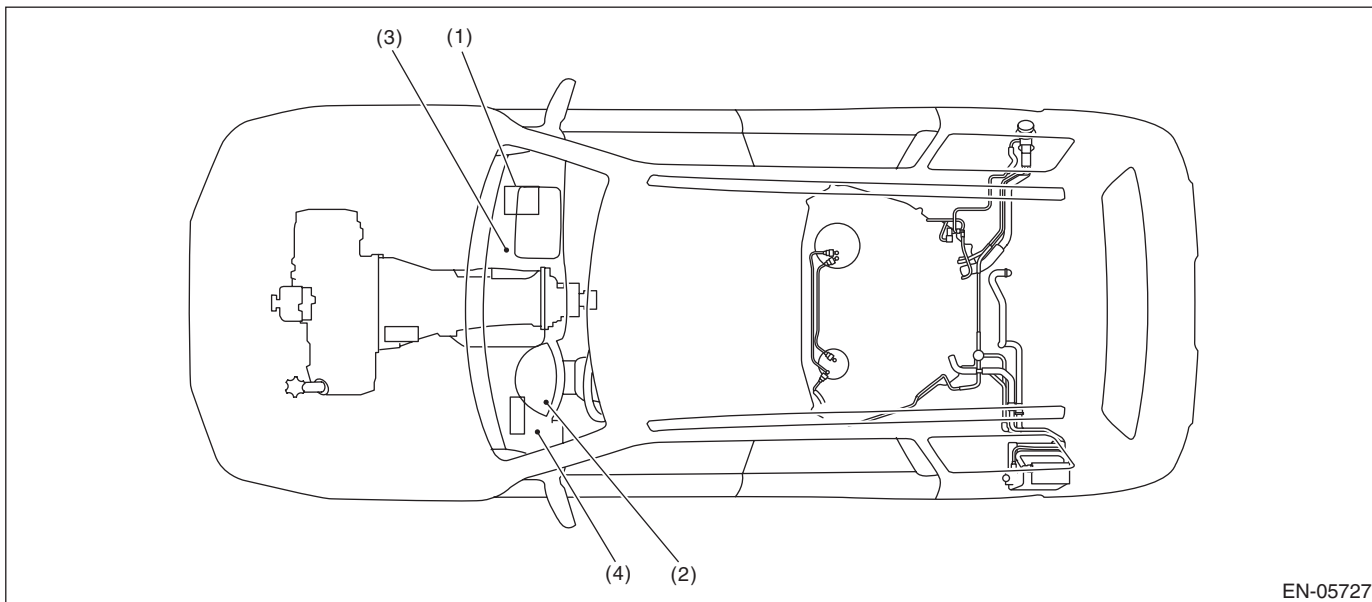
ENGINE (DIAGNOSTICS)

## 4. Electrical Component Location

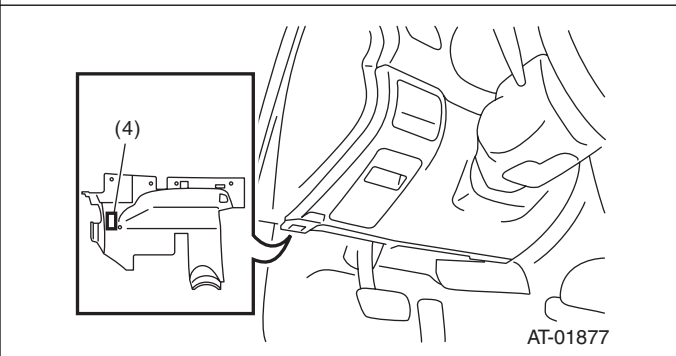
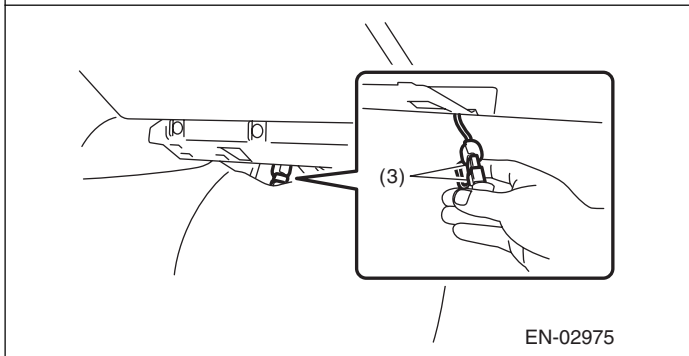
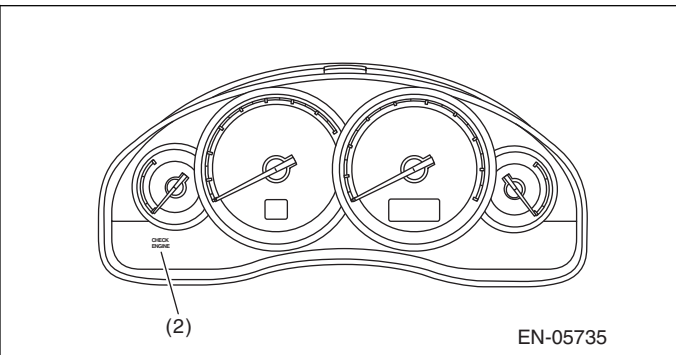
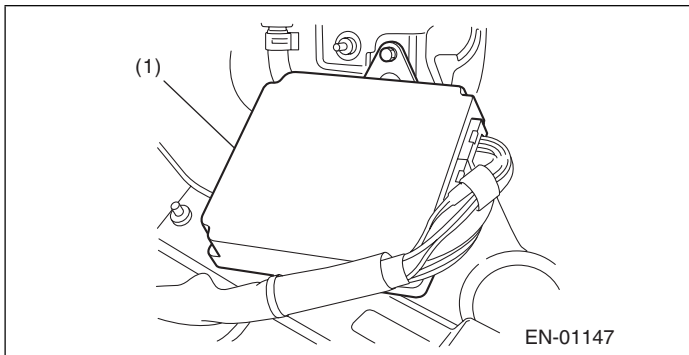
### A: LOCATION

#### 1. ENGINE

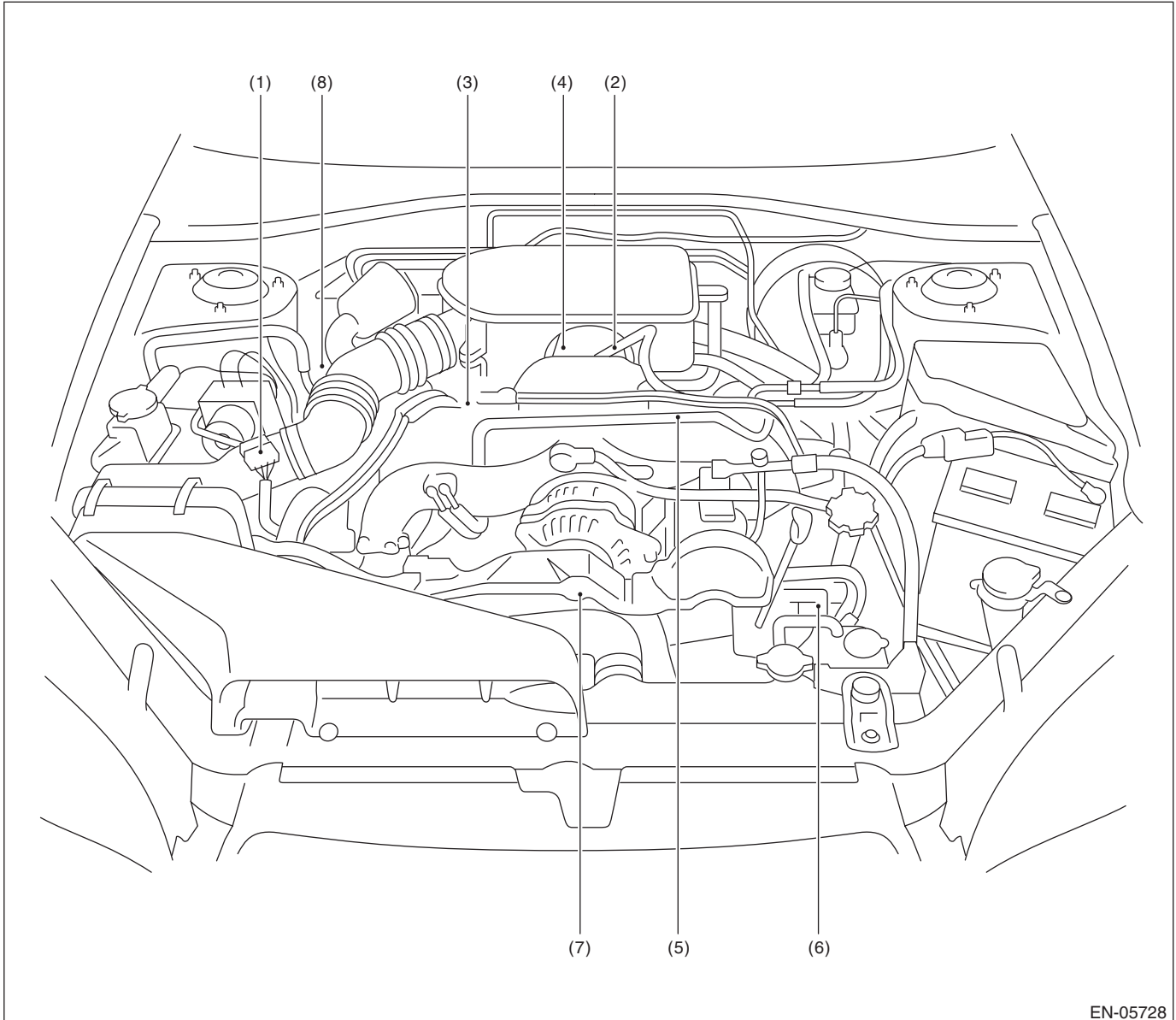
- Control module



- (1) Engine control module (ECM)      (3) Delivery (test) mode connector      (4) Data link connector  
(2) Malfunction indicator light



- Sensor



(1) Mass air flow and intake air temperature sensor

(2) Manifold absolute pressure sensor

(3) Engine coolant temperature sensor

(4) Electronic throttle control

(5) Knock sensor

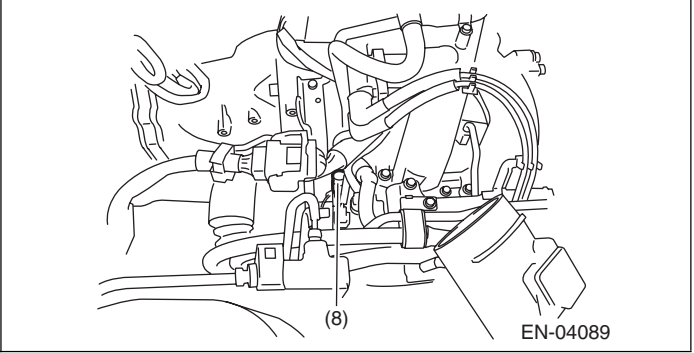
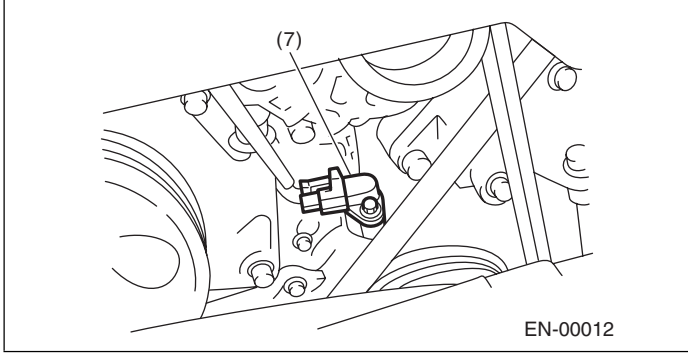
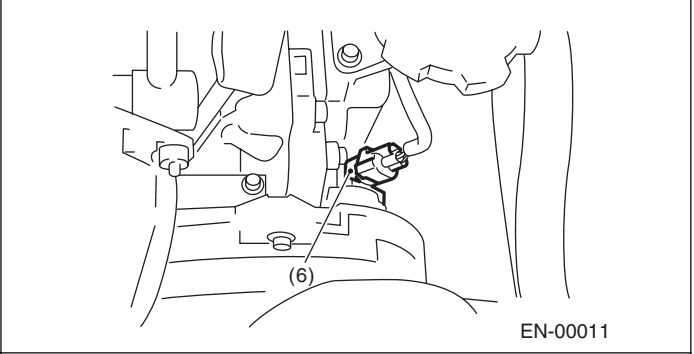
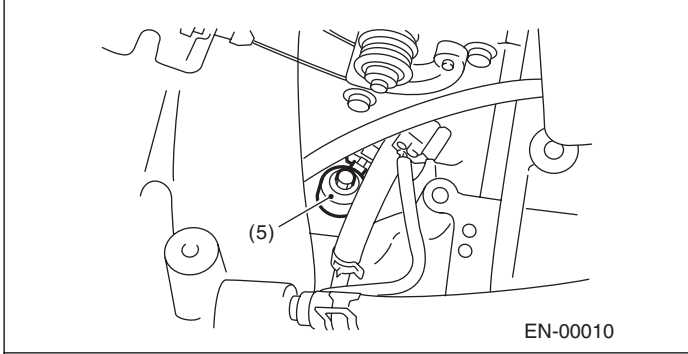
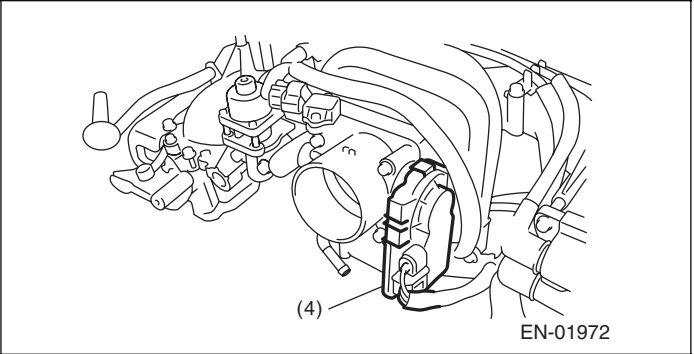
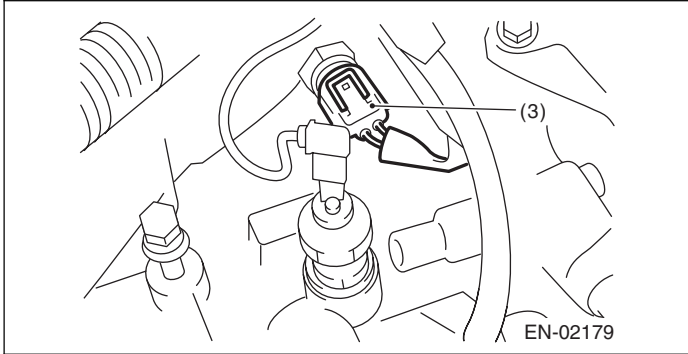
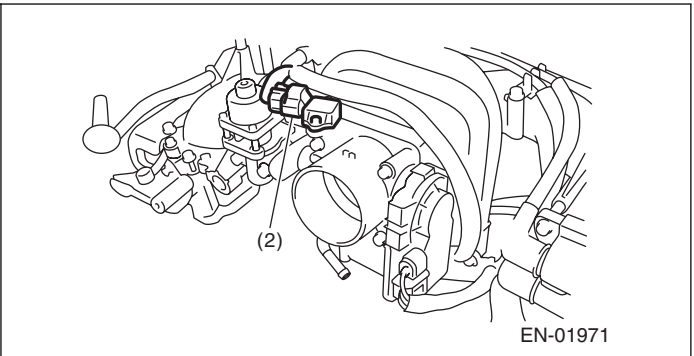
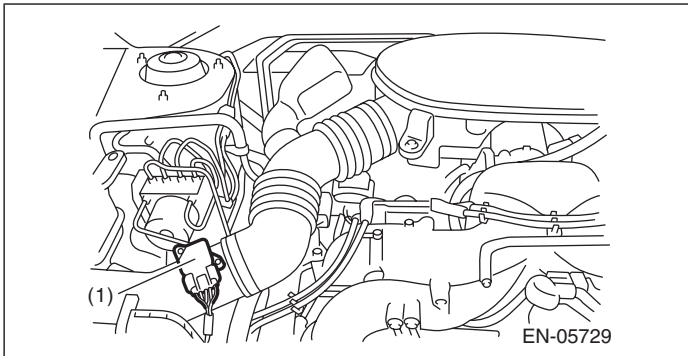
(6) Camshaft position sensor

(7) Crankshaft position sensor

(8) Oil temperature sensor

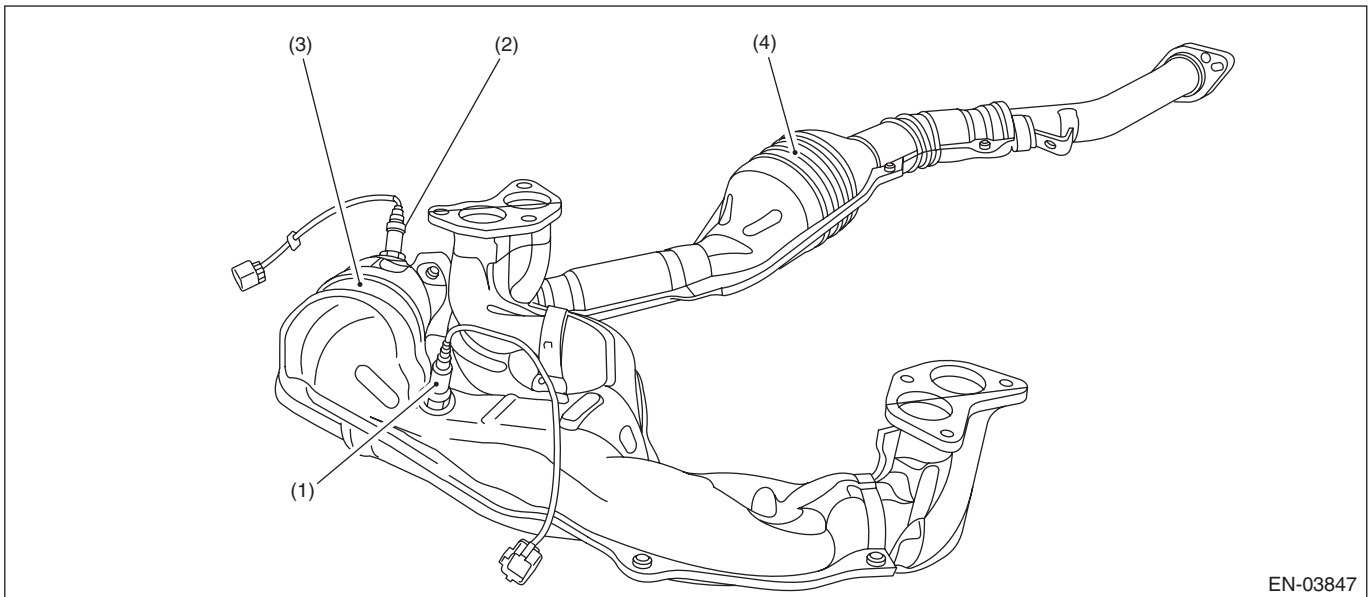
# Electrical Component Location

## ENGINE (DIAGNOSTICS)

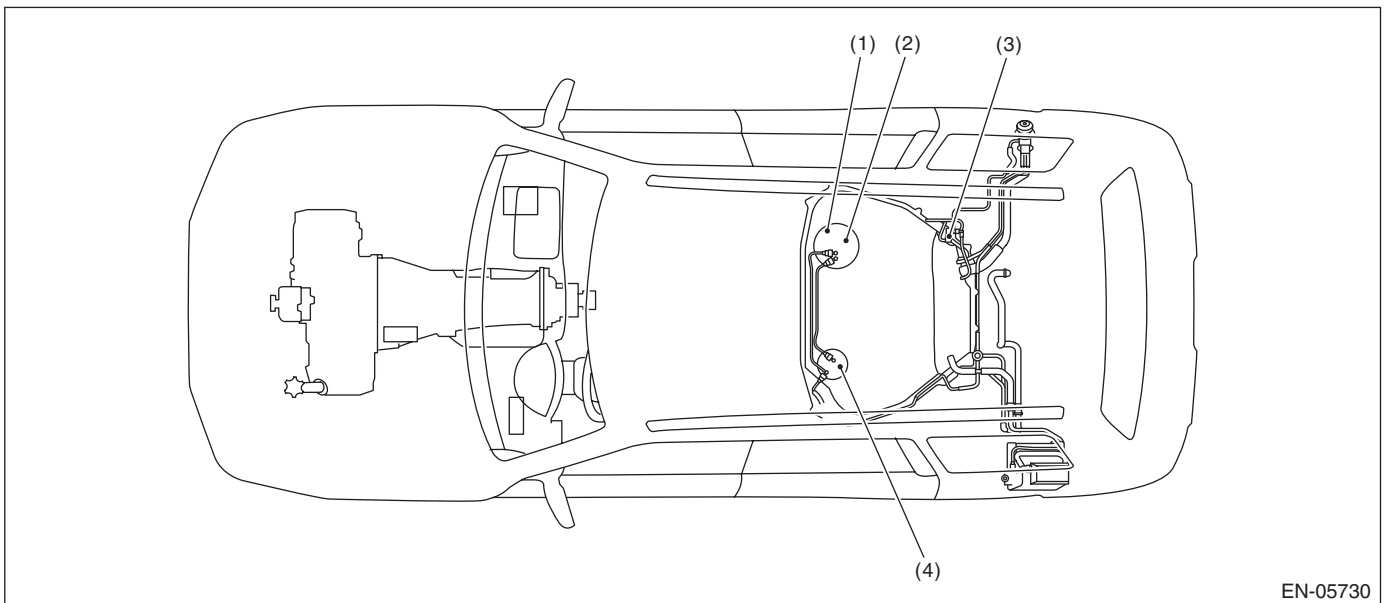


# Electrical Component Location

ENGINE (DIAGNOSTICS)



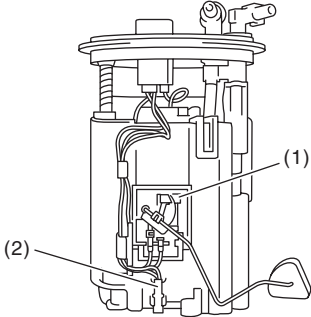
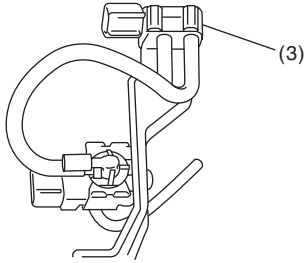
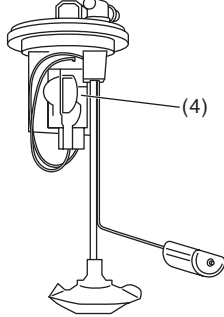
- (1) Front oxygen (A/F) sensor
- (2) Rear oxygen sensor
- (3) Front catalytic converter
- (4) Rear catalytic converter



- (1) Fuel level sensor
- (2) Fuel temperature sensor
- (3) Fuel tank pressure sensor
- (4) Fuel sub level sensor

# Electrical Component Location

## ENGINE (DIAGNOSTICS)

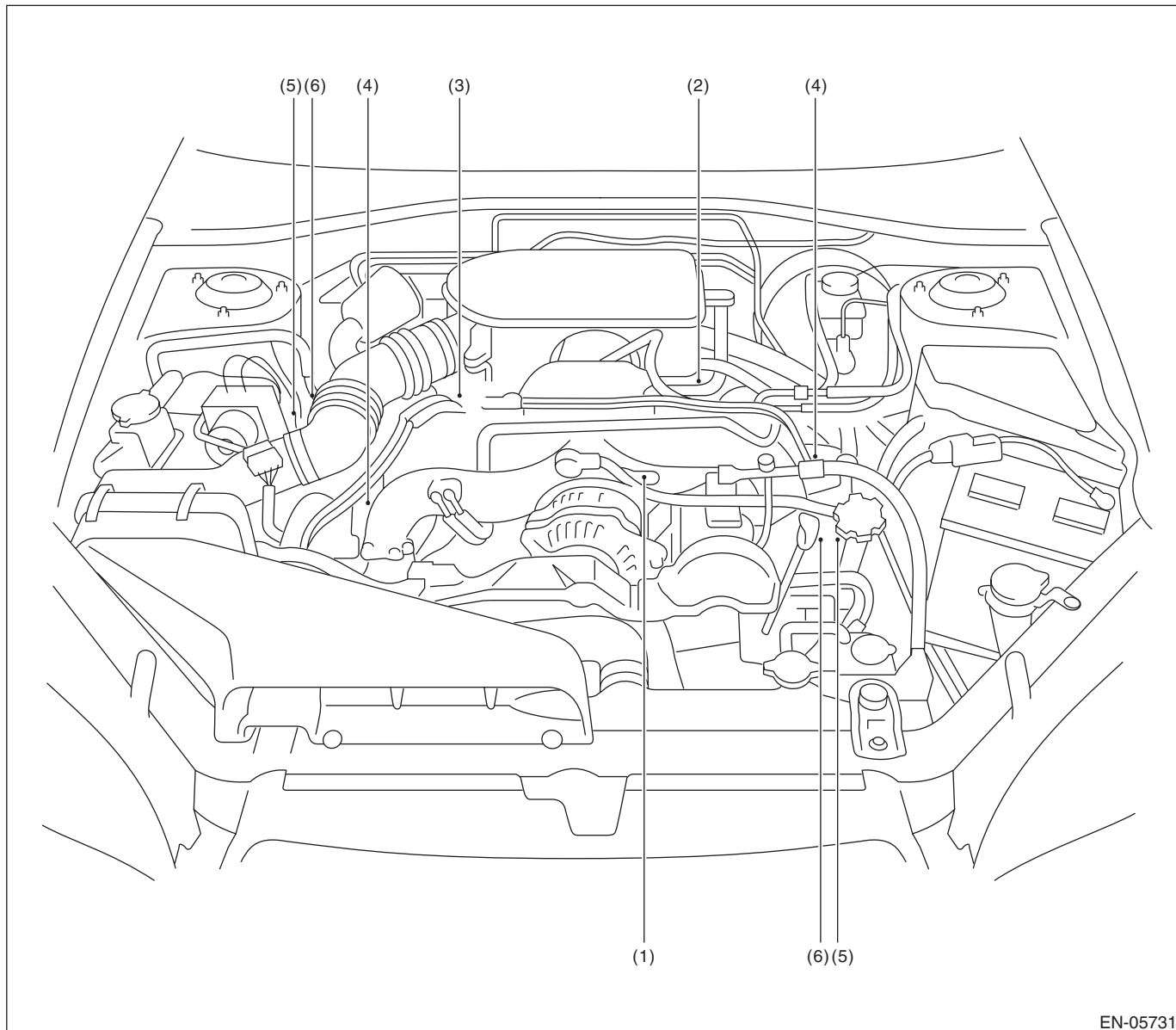
 <p>EN-05725</p>	 <p>EN-03003</p>
 <p>EN-03132</p>	<p>SUBARU.</p>



# Electrical Component Location

ENGINE (DIAGNOSTICS)

- Solenoid valve, actuator, emission control system parts and ignition system parts



EN-05731

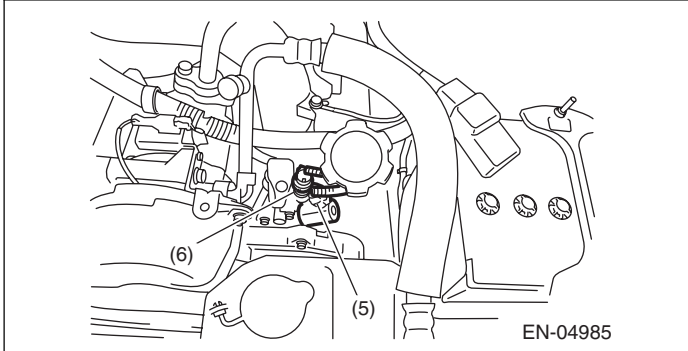
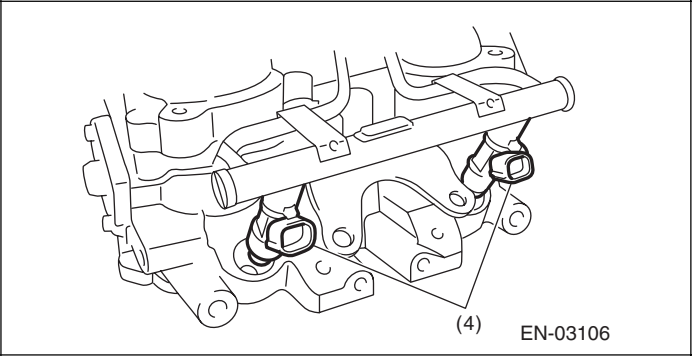
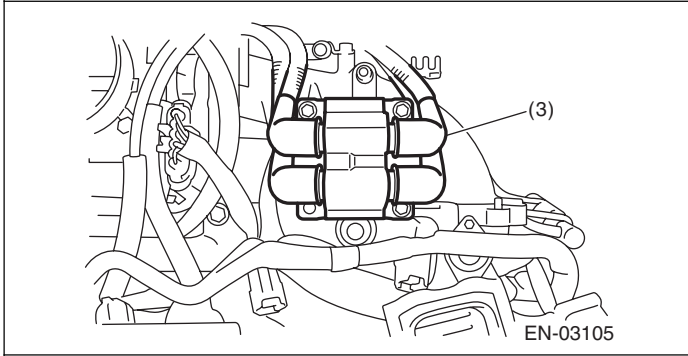
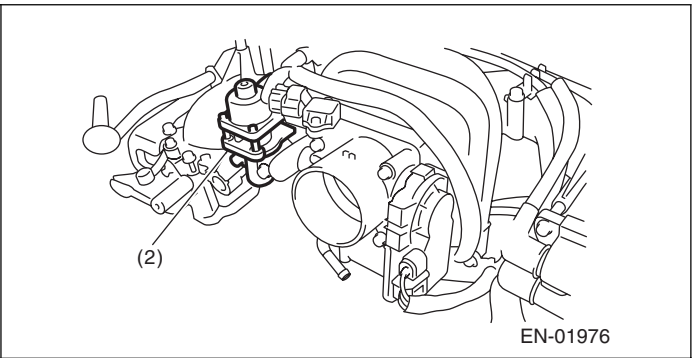
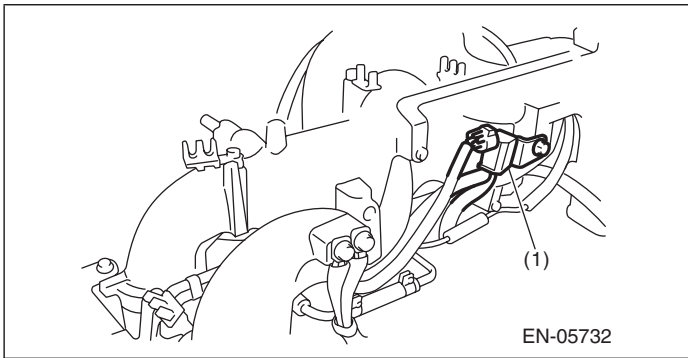
- (1) Purge control solenoid valve
- (2) EGR valve
- (3) Ignition coil and ignitor ASSY

- (4) Fuel injector
- (5) Oil switching solenoid valve

- (6) Variable valve lift diagnosis oil pressure switch

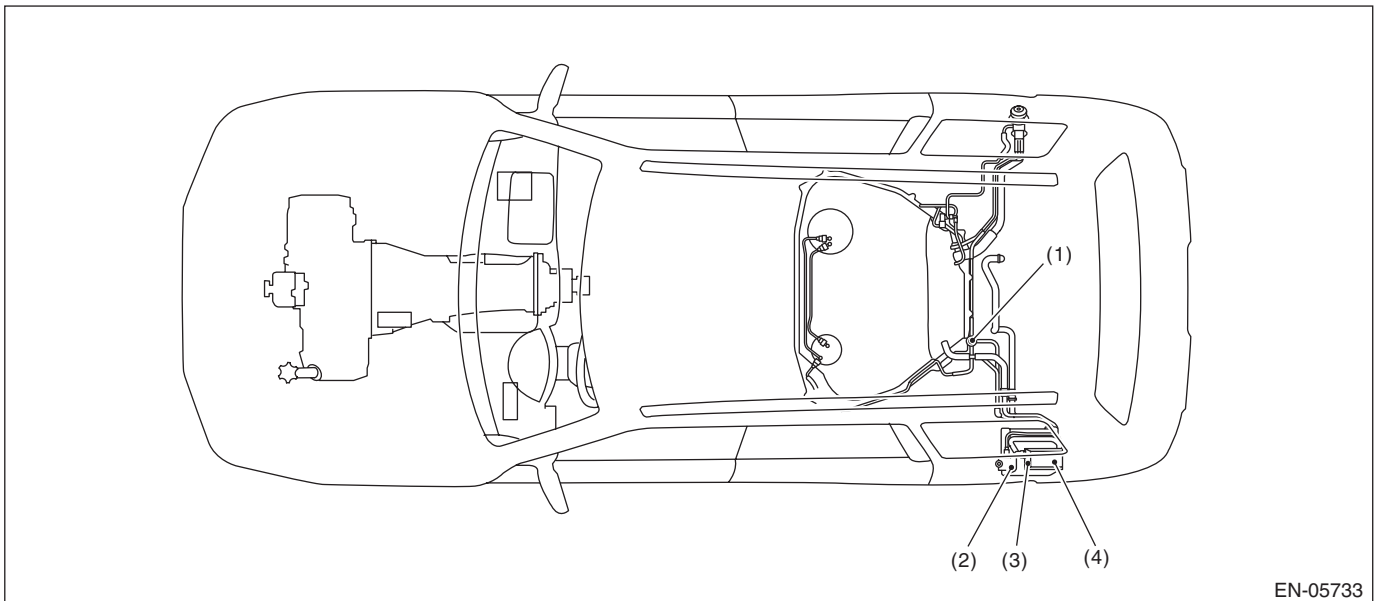
# Electrical Component Location

## ENGINE (DIAGNOSTICS)

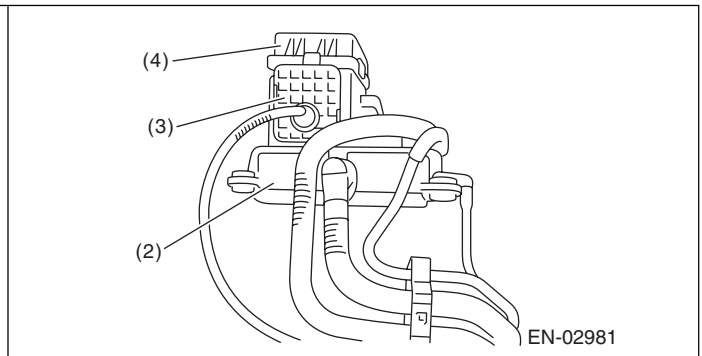
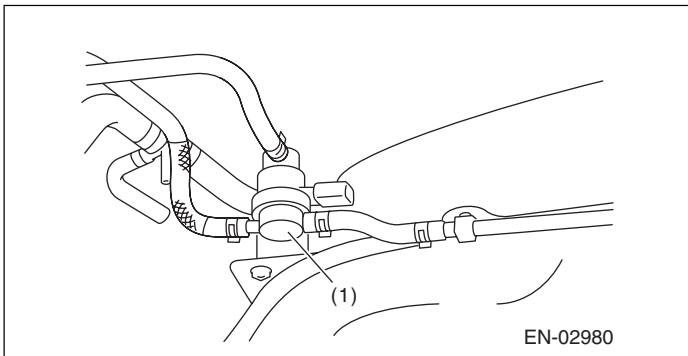


# Electrical Component Location

ENGINE (DIAGNOSTICS)

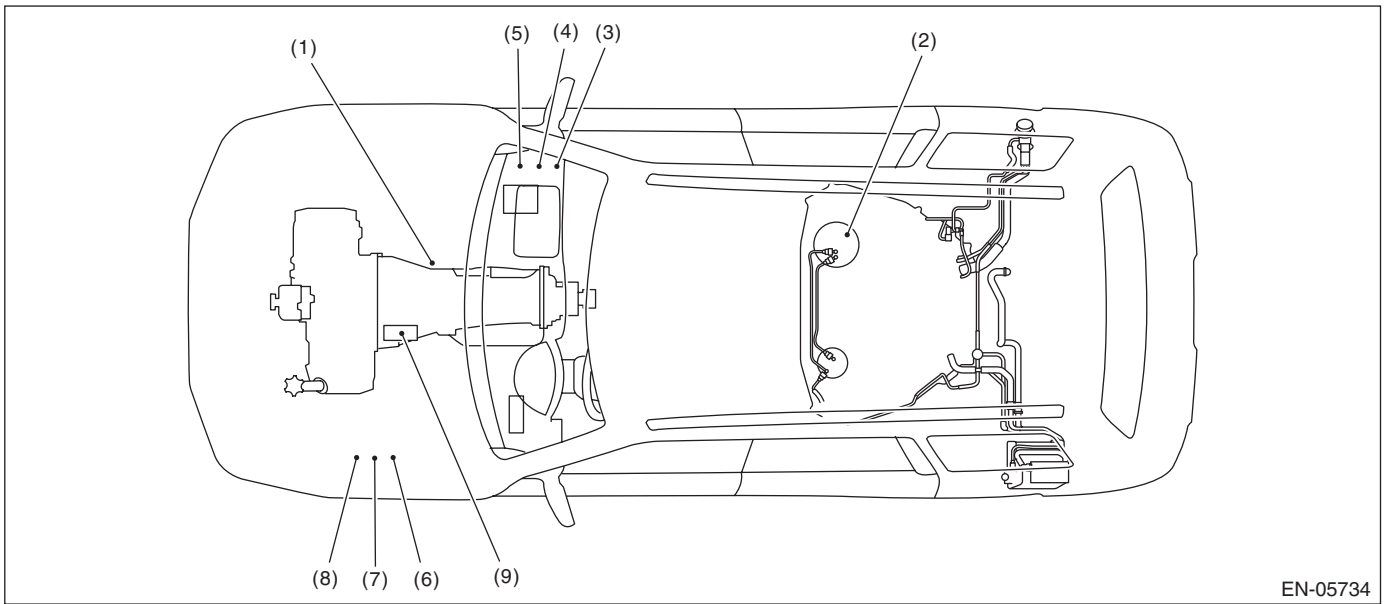


- (1) Pressure control solenoid valve
- (2) Canister
- (3) Drain valve
- (4) Drain filter



# Electrical Component Location

## ENGINE (DIAGNOSTICS)

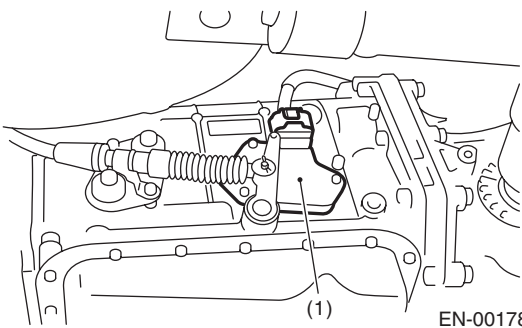
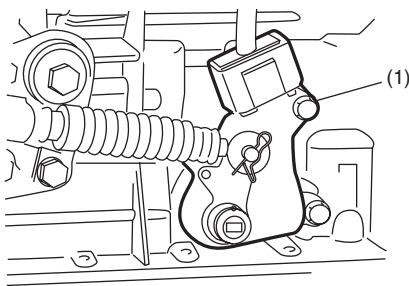
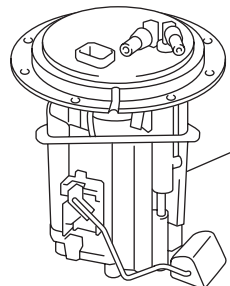
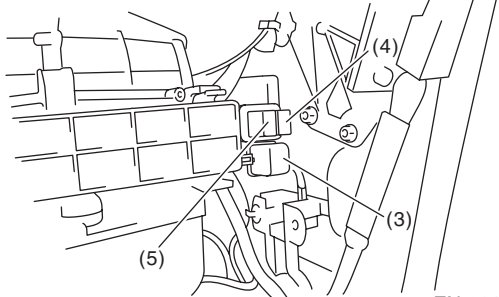
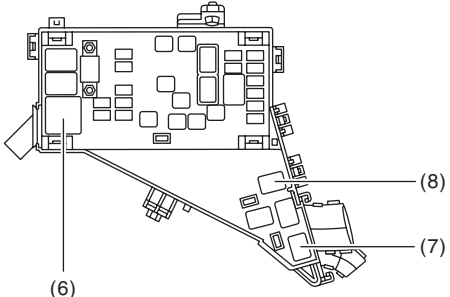
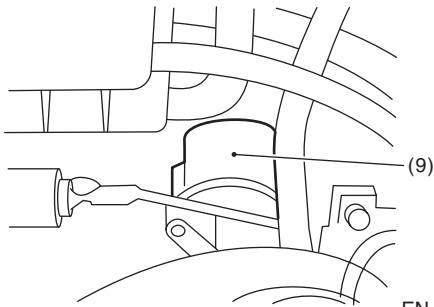


EN-05734

- |                      |                                       |                               |
|----------------------|---------------------------------------|-------------------------------|
| (1) Inhibitor switch | (4) Fuel pump relay                   | (7) Radiator sub fan relay    |
| (2) Fuel pump        | (5) Electronic throttle control relay | (8) Radiator main fan relay 2 |
| (3) Main relay       | (6) Radiator main fan relay 1         | (9) Starter                   |

# Electrical Component Location

ENGINE (DIAGNOSTICS)

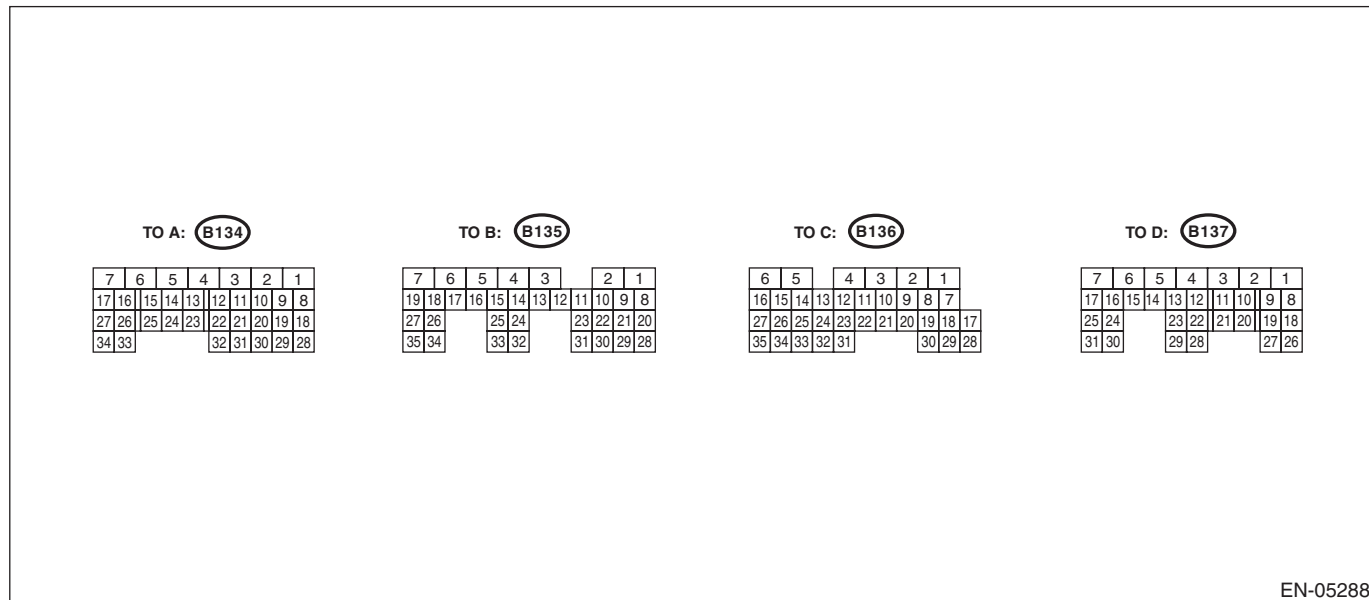
<p>Transmission serial No. 4078112 or earlier</p>  <p>(1)</p> <p>EN-00178</p>	<p>Transmission serial No. 4078113 or later</p>  <p>(1)</p> <p>EN-06888</p>
 <p>(2)</p> <p>EN-05726</p>	 <p>(3)</p> <p>(4)</p> <p>(5)</p> <p>EN-03150</p>
 <p>(6)</p> <p>(7)</p> <p>(8)</p> <p>EN-06796</p>	 <p>(9)</p> <p>EN-02096</p>

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

## 5. Engine Control Module (ECM) I/O Signal

### A: ELECTRICAL SPECIFICATION



EN-05288

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
Crankshaft position sensor	Signal (+)	B134	13	0	-7 — +7	Waveform
	Signal (-)	B134	14	0	0	—
	Shield	B134	24	0	0	—
Camshaft position sensor	Signal (+)	B134	12	0	-7 — +7	Waveform
	Signal (-)	B134	22	0	0	—
	Shield	B134	24	0	0	—
Electronic throttle control	Main	B134	18	0.64 — 0.72 Fully opened: 3.96	0.64 — 0.72 (After engine is warmed-up.)	Fully closed: 0.6 Fully opened: 3.96
	Sub	B134	28	1.51 — 1.58 Fully opened: 4.17	1.51 — 1.58 (After engine is warmed-up.)	Fully closed: 1.48 Fully opened: 4.17
	Power supply	B134	19	5	5	—
	GND (sensor)	B134	29	0	0	—
Electronic throttle control motor (+)	B137	5		Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (-)	B137	4		Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply	B136	1		10 — 13	12 — 14	—
Electronic throttle control motor relay	B136	21		ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	When ignition switch is turned to ON: ON

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 1.0 Fully opened: 3.5	Fully closed: 1.0 Fully opened: 3.5	—
	Main power supply	B135	21	5	5	—
	GND (Main sensor)	B135	29	0	0	—
	Sub sensor signal	B135	31	Fully closed: 1.0 Fully opened: 3.5	Fully closed: 1.0 Fully opened: 3.5	—
	Sub power supply	B135	22	5	5	—
	GND (Sub sensor)	B135	30	0	0	—
Rear oxygen sensor	Signal	B135	4	0	0 — 0.9	—
	Shield	B135	1	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B136	3	10 — 13	1 — 14	Duty waveform
	Signal 2	B136	2	10 — 13	1 — 14	Duty waveform
Rear oxygen sensor heater signal		B136	4	10 — 13	1 — 14	Duty waveform
Engine coolant temperature sensor		B134	34	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.
Starter switch		B136	32	0	0	AT model Cranking: 8 — 14 MT model Cranking with the clutch pedal pressed: 8 — 14
Starter relay control		B136	20	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
A/C switch		B136	24	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
Ignition switch		B135	19	10 — 13	12 — 14	—
Neutral position switch	AT	B136	31	ON: 0 OFF: 12±0.5		For AT model, switch is ON when select lever is shifted into "P" or "N" range.
	MT			ON: 0 OFF: 12±0.5		For MT model, switch is ON when select lever is shifted into "N" range.
Delivery (test) mode connector		B135	27	10 — 13	13 — 14	When connected: 0
Knock sensor	Signal	B134	15	2.5	2.5	—
	Shield	B134	25	0	0	—
Back-up power supply		B135	5	10 — 13	12 — 14	Ignition switch "OFF" : 10 — 13
Control module power supply		B134	7	10 — 13	12 — 14	—
		B135	2	10 — 13	12 — 14	—
Ignition control	#1, #2	B137	18	0	1 — 3.4	Waveform
	#3, #4	B137	19	0	1 — 3.4	Waveform
Fuel injector	#1	B137	8	10 — 13	1 — 14	Waveform
	#2	B137	9	10 — 13	1 — 14	Waveform
	#3	B137	10	10 — 13	1 — 14	Waveform
	#4	B137	11	10 — 13	1 — 14	Waveform
Fuel pump relay control		B136	12	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—

## Engine Control Module (ECM) I/O Signal

### ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
A/C relay control	B136	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Radiator fan relay 1 control	B136	18	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Radiator fan relay 2 control	B136	29	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Self-shutoff control	B136	23	0.5 or less	0.5 or less	—	
Malfunction indicator light	B136	11	—	—	Light "ON": 1 or less Light "OFF": 10 — 14	
Engine speed output	B136	22	—	0 — 13 or more	Waveform	
Oil temperature sensor signal	B134	23	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.	
PCV diagnosis connector	B134	30	0	0	—	
Purge control solenoid valve	B137	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Duty waveform	
EGR valve	Signal 1	B134	8	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 2	B134	9	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 3	B134	10	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 4	B134	20	0 or 10 — 13	0 or 12 — 14	Waveform
Power steering oil pressure switch	B134	33	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Blower fan switch	B135	11	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—	
A/C middle pressure switch	B136	33	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—	
Oil switching solenoid valve RH	Signal (+)	B137	25	0	Duty waveform	Drive frequency: 300 Hz
	Signal (-)	B137	24	0	0	—
Oil switching solenoid valve LH	Signal (+)	B137	31	0	Duty waveform	Drive frequency: 300 Hz
	Signal (-)	B137	30	0	0	—
Variable valve lift diagnosis oil pressure switch RH	B134	31	0	0	—	
Variable valve lift diagnosis oil pressure switch LH	B134	32	0	0	—	
Front oxygen (A/F) sensor	Signal (+)	B135	9	—	2.7 — 2.9	—
	Signal (-)	B135	8	—	2.35 — 2.25	—
	Shield	B135	1	0	0	—
Manifold absolute pressure sensor	B134	6	3.4 — 3.8	1.4 — 1.8	—	
Air flow sensor	Signal	B135	26	—	0.3 — 4.5	—
	Shield	B135	35	0	0	—
	GND	B135	34	0	0	—
Intake air temperature sensor signal	B135	18	0.3 — 4.6	0.3 — 4.6	—	
Immobilizer communication 1	B136	26	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—	
Immobilizer communication 2	B136	34	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—	
SSM communication line	B136	16	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—	



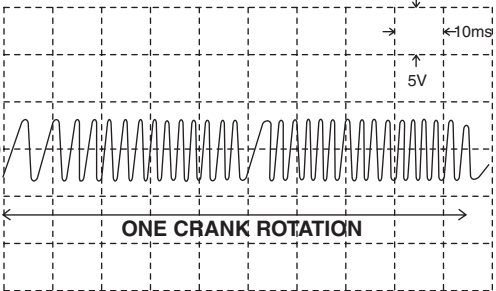
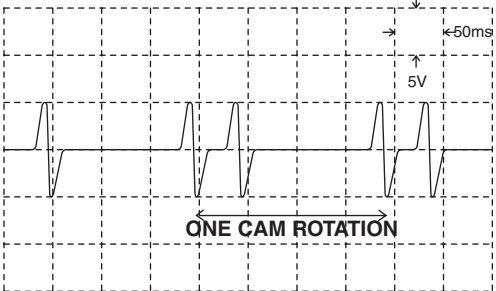
# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
Sensor power supply	B134	19	5	5	—	
	B135	22	5	5	—	
GND (sensor)	B134	29	0	0	—	
	B135	30	0	0	—	
GND	(Engine 1)	B134	5	0	0	—
	(Engine 2)	B137	7	0	0	—
	(Engine 3)	B137	2	0	0	—
	(Engine 4)	B137	1	0	0	—
	(Engine 5)	B137	3	0	0	—
	(Ignition 1)	B137	26	0	0	—
	(Ignition 2)	B137	6	0	0	—
	(Body)	B136	6	0	0	—
Clutch switch	B136	25	When clutch pedal is depressed: 0 When brake pedal is released: 10 — 13	When clutch pedal is depressed: 0 When brake pedal is released : 12 — 14	—	
Brake switch 1	B135	20	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released : 12 — 14	—	
Brake switch 2	B135	28	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed : 12 — 14 When brake pedal is released: 0	—	
Cruise control main switch	B135	12	ON: 0 OFF: 5	ON: 0 OFF: 5	—	
Cruise control command switch	B135	24	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating cancel: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST : 0.5 — 1.5 When operating cancel: 0 — 0.5	—	
Fuel temperature sensor	B135	17	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (77°F)	
Fuel tank pressure sensor	B135	32	2.3 — 2.7	2.3 — 2.7	Value after removing fuel filler cap and installing again	
Pressure control solenoid valve	B136	28	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Drain valve	B136	17	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
CAN communication line (+)	B136	27	2.5 — 3.5	2.5 — 3.5	Waveform	
CAN communication line (-)	B136	35	1.5 — 2.5	1.5 — 2.5	Waveform	
AT/MT identification line	B136	15	—	—	MT model: 1 or less	

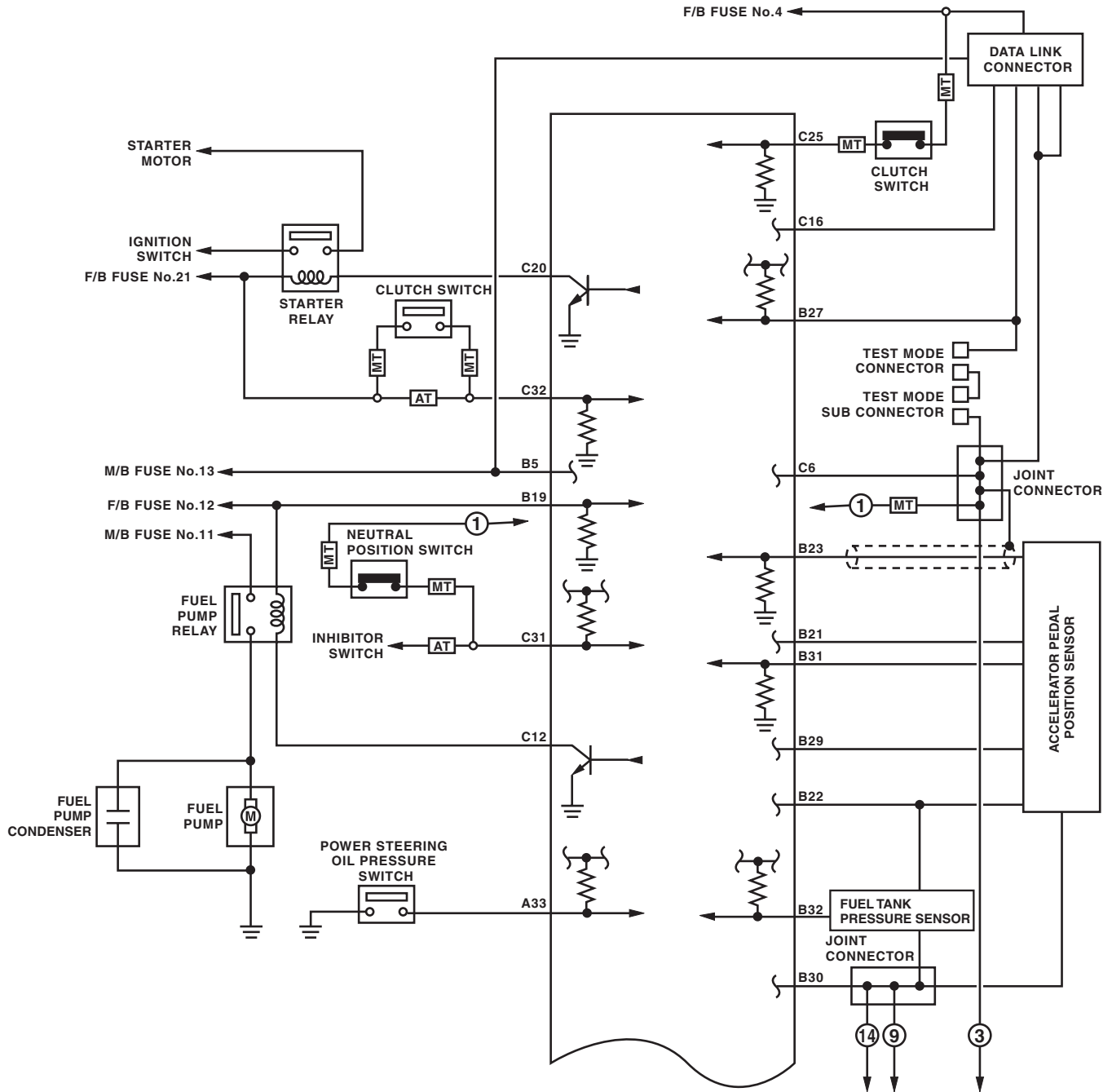
# Engine Control Module (ECM) I/O Signal

## ENGINE (DIAGNOSTICS)

Input/output name	Measuring condition	Waveform
1. Crankshaft position sensor	During idling	 <p style="text-align: right;">EN-05322</p>
2. Camshaft position sensor	During idling	 <p style="text-align: right;">EN-05323</p>

# Engine Control Module (ECM) I/O Signal

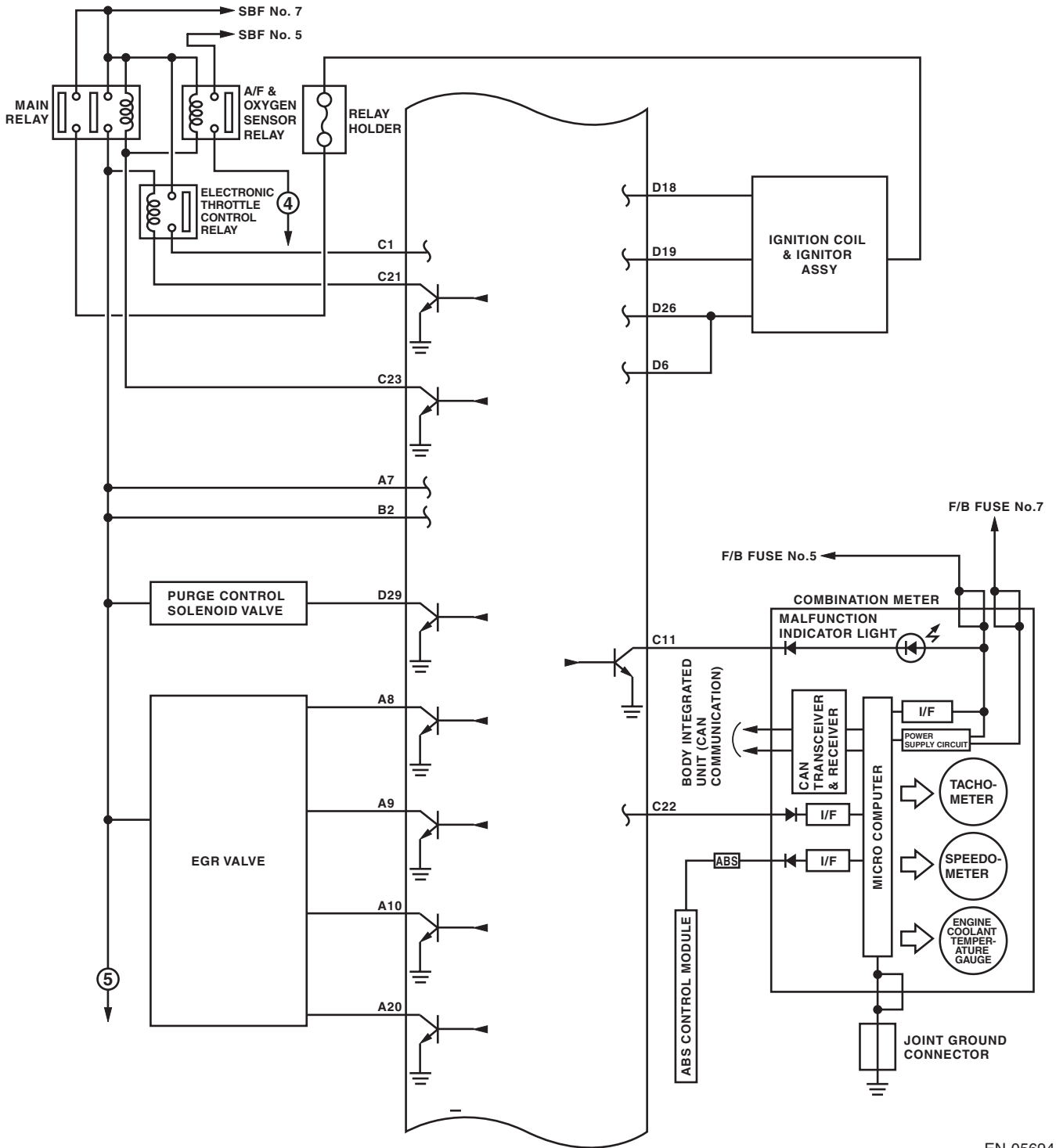
ENGINE (DIAGNOSTICS)



EN-05693

# Engine Control Module (ECM) I/O Signal

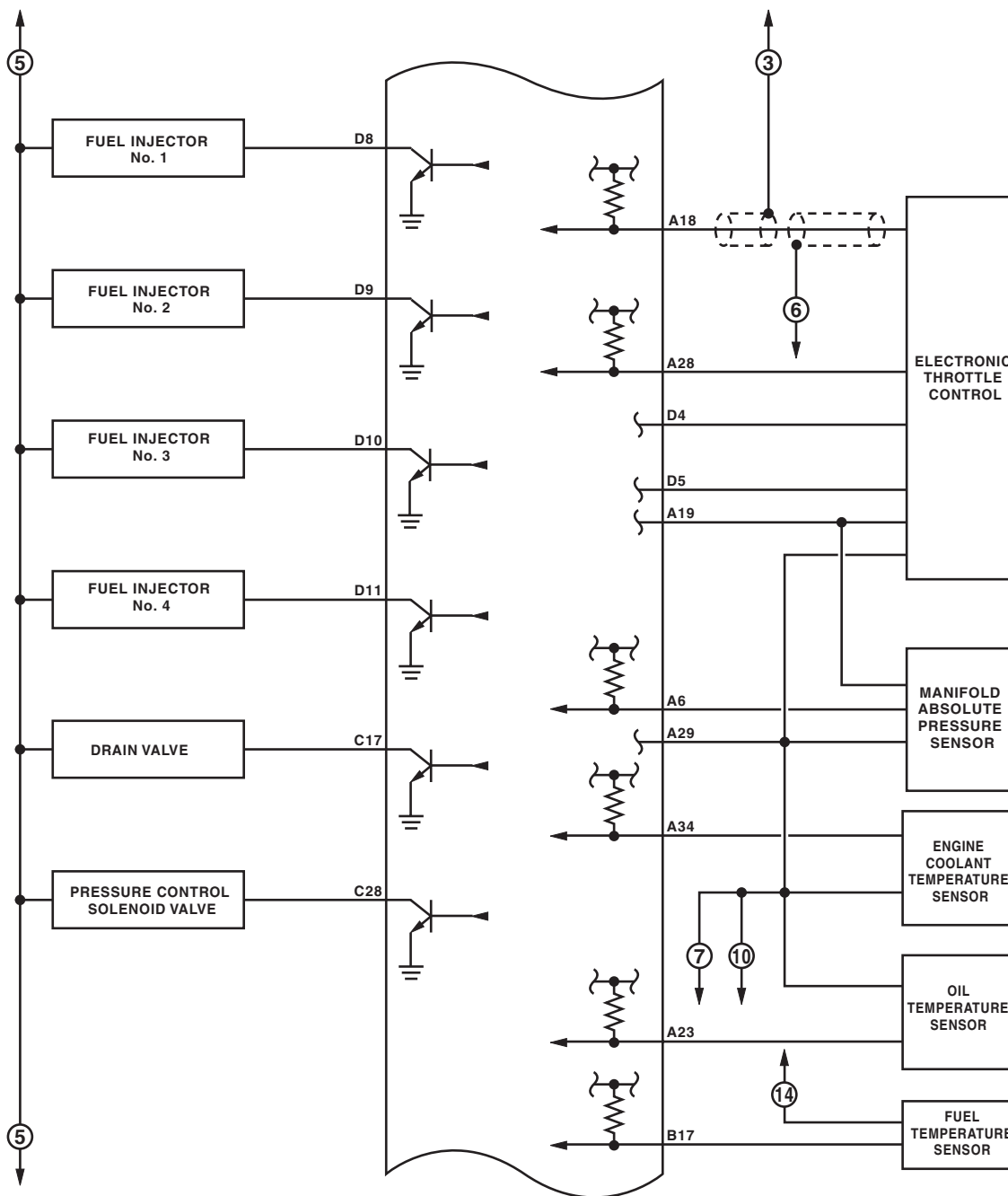
ENGINE (DIAGNOSTICS)



EN-05694

# Engine Control Module (ECM) I/O Signal

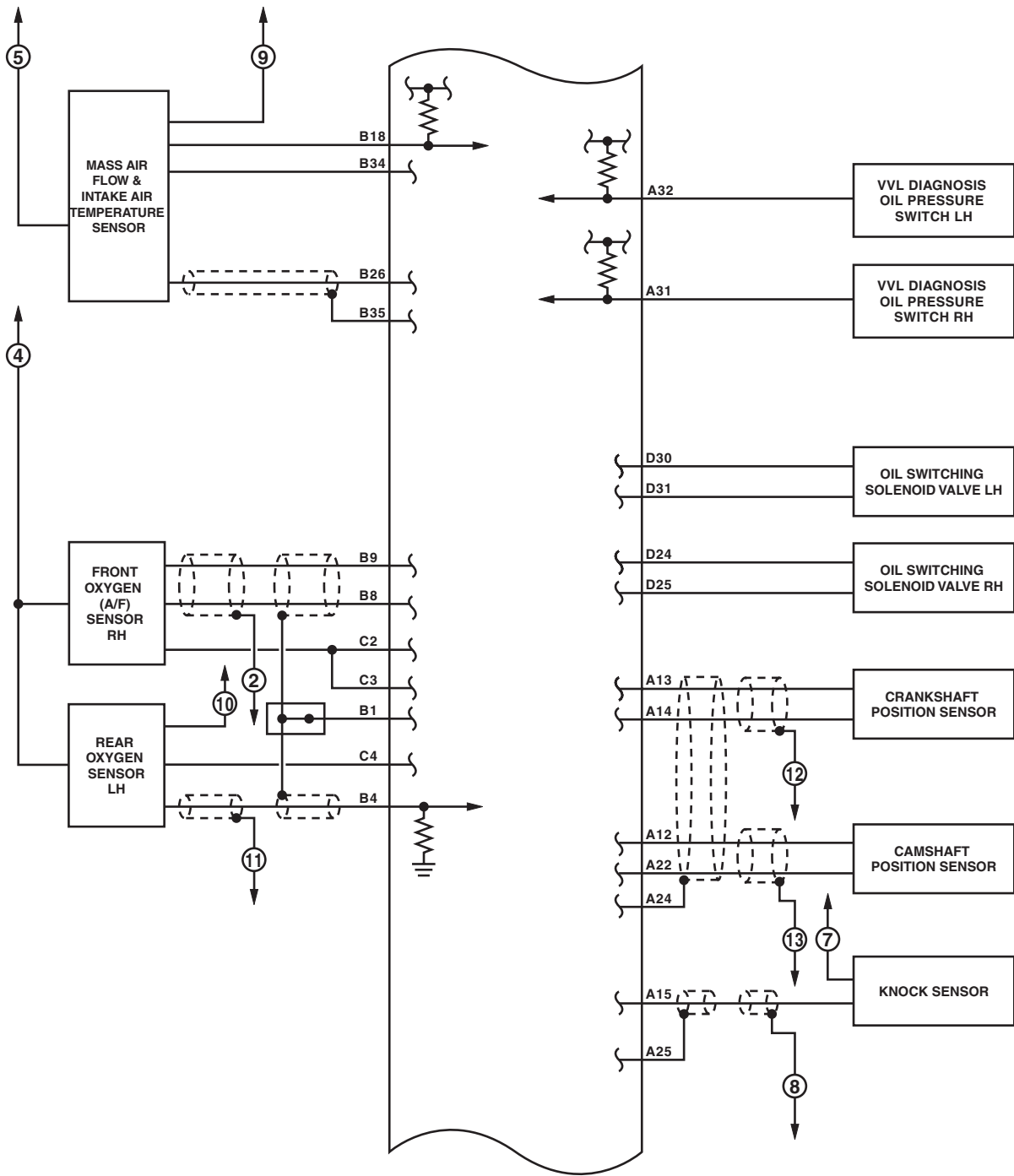
ENGINE (DIAGNOSTICS)



EN-05036

# Engine Control Module (ECM) I/O Signal

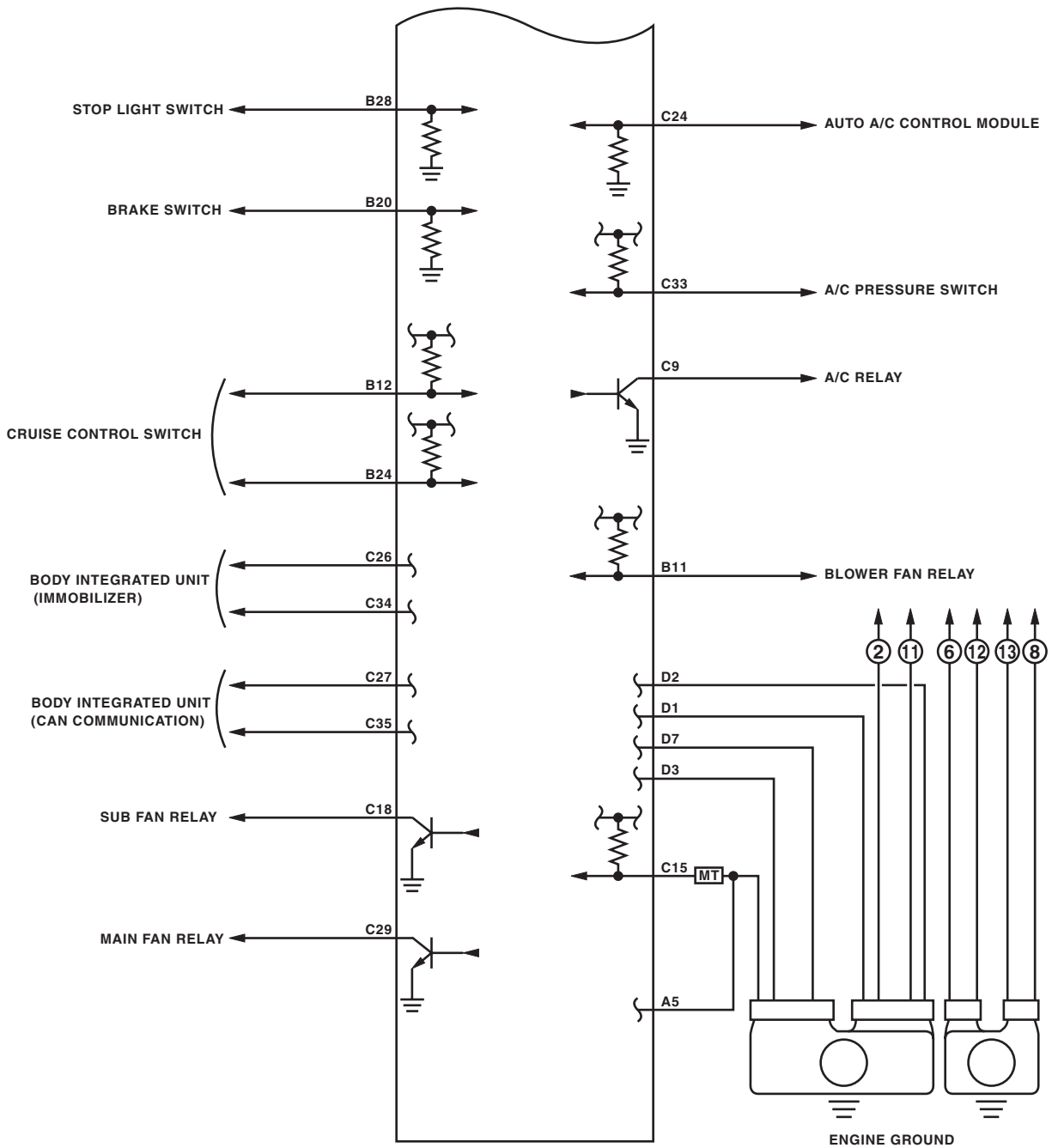
ENGINE (DIAGNOSTICS)



EN-05695

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)



EN-05696

# Engine Condition Data

ENGINE (DIAGNOSTICS)

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## 6. Engine Condition Data

### A: ELECTRICAL SPECIFICATION

Contents	Specification
Engine load	17.6 — 40.5 (%): Idling
	14.7 — 29.8 (%): 2,500 rpm racing

Measuring condition:

- After engine is warmed-up.
- Gear position is in “N” or “P” range.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.



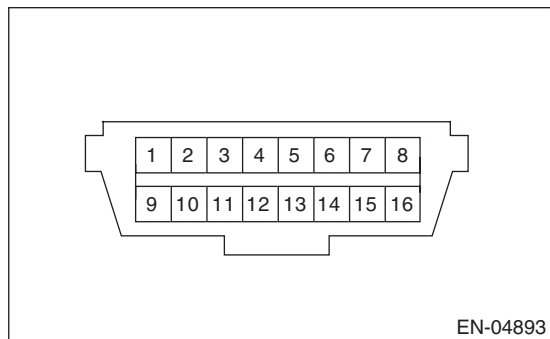
## 7. Data Link Connector

### A: NOTE

This connector is used for Subaru Select Monitor.

### CAUTION:

**Do not connect any scan tools except Subaru Select Monitor or general scan tool because the circuit for Subaru Select Monitor may be damaged.**



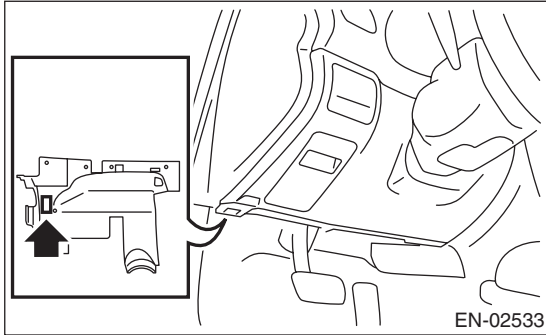
Terminal No.	Contents	Terminal No.	Contents
1	Blank	9	Blank
2	Blank	10	Blank
3	Blank	11	Blank
4	Ground	12	Blank
5	Ground	13	Blank
6	CAN (+)	14	CAN (-)
7	Subaru Select Monitor signal	15	Blank
8	Blank	16	Power supply

### 8. General Scan Tool

#### A: OPERATION

##### 1. HOW TO USE GENERAL SCAN TOOL

- 1) Prepare a scan tool (general scan tool) required by SAE J1978.
- 2) Open the cover and connect the general scan tool to the data link connector located in the lower portion of instrument panel (on the driver's side).



- 3) Using the general scan tool, call up DTC and freeze frame data.

General scan tool functions consist of:

- (1) MODE \$01: Current powertrain diagnostic data
- (2) MODE \$02: Powertrain freeze frame data
- (3) MODE \$03: Emission-related powertrain DTC
- (4) MODE \$04: Clear/Reset emission-related diagnostic information
- (5) MODE \$06: Request on-board monitoring test results for intermittently monitored systems
- (6) MODE \$07: Request on-board monitoring test results for continuously monitored systems
- (7) MODE \$09: Request vehicle information

Read out the data according to repair procedures.  
(For detailed operation procedure, refer to the general scan tool instruction manual.)

#### NOTE:

For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

# General Scan Tool

ENGINE (DIAGNOSTICS)

## 2. MODE \$01: (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.

A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$01	Number of emission-related powertrain DTC, and malfunction indicator light status and diagnosis support information	—
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C
\$06	Short term fuel trim	%
\$07	Long term fuel trim	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	km/h, MPH
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C or °F
\$10	Air flow rate from mass air flow sensor	g/sec
\$11	Throttle valve absolute opening angle	%
\$13	Check whether oxygen sensor is installed.	—
\$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
\$1C	Supporting OBD system	—
\$1F	Elapsed time after starting the engine	sec
\$21	Travel distance after the malfunction indicator light illuminates	km
\$24	A/F value and A/F sensor output voltage (Bank 1 Sensor 1)	— and V
\$2C	Target EGR	%
\$2D	EGR deviation	%
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$30	Number of warm ups after DTC clear	—
\$31	Travel distance after DTC clear	km
\$32	Fuel tank pressure	Pa
\$33	Barometric pressure	kPa
\$34	A/F value and A/F sensor current (Bank 1 Sensor 1)	— and mA
\$3C	Catalyst temperature #1	°C
\$41	Diagnostic monitor of each drive cycle	—
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%
\$4D	Engine operating time while malfunction indicator lit	min
\$4E	Elapsed time after DTC clear	min
\$51	Fuel used	—
\$5A	Relative accelerator opening angle	%

### NOTE:

Refer to general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE \$01).

# General Scan Tool

## ENGINE (DIAGNOSTICS)

### 3. MODE \$02 (POWERTRAIN FREEZE FRAME DATA)

Refer to data denoting the operating condition when trouble is detected by on-board diagnosis system. A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$02	DTC that caused the freeze frame data storage required by CARB	—
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C
\$06	Short term fuel trim (Bank 1 Sensor 1)	%
\$07	Long term fuel trim (Bank 1 Sensor 1)	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	km/h, MPH
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C or °F
\$10	Air flow rate from mass air flow sensor	g/sec
\$11	Throttle valve absolute opening angle	%
\$13	Check whether oxygen sensor is installed.	—
\$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
\$1C	Supporting OBD system	—
\$1F	Elapsed time after starting the engine	sec
\$2C	Target EGR	%
\$2D	EGR deviation	%
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$32	Fuel tank pressure	Pa
\$33	Barometric pressure	kPa
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%

#### NOTE:

Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE \$02).

### 4. MODE \$03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

### 5. MODE \$04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refer to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

#### NOTE:

Refer to general scan tool manufacturer's instruction manual to clear the emission-related diagnostic information (MODE \$04).

# General Scan Tool

ENGINE (DIAGNOSTICS)

## 6. MODE \$06

Refer to test value of troubleshooting and data of test limit indicated on the support data bit sequence table. A list of the support data is shown in the following table.

OBDMID	TID	SID	Diagnostic item
\$01	\$81	\$0A	A/F sensor continuity abnormal (Bank 1 Sensor 1)
	\$82	\$8D	
	\$83	\$14	
	\$84	\$1E	A/F sensor range abnormal (Bank 1 Sensor 1)
	\$85	\$1E	
	\$86	\$20	A/F sensor response abnormal (Bank 1 Sensor 1)
\$02	\$87	\$0B	Oxygen sensor circuit abnormal (Bank 1 Sensor 2)
	\$88	\$0B	
	\$07	\$0B	Oxygen sensor drop abnormal (Bank 1 Sensor 2)
	\$08	\$0B	
	\$A5	\$0B	
	\$05	\$10	Oxygen sensor response abnormal (Bank 1 Sensor 2)
\$06	\$10		
\$21	\$89	\$20	Catalyst deterioration diagnosis (Bank 1)
\$31	\$8A	\$FD	EGR system diagnosis
\$39	\$93	\$FE	Evaporative emission control system (Cap off)
\$3B	\$94	\$FE	Evaporative emission control system (0.04 inch leak)
	\$95	\$FE	
\$3C	\$96	\$FE	Evaporative emission control system (0.02 inch leak)
	\$97	\$FE	
\$3D	\$98	\$FE	Evaporative emission control system (Purge flow)
\$41	\$99	\$24	A/F sensor heater abnormal (Bank 1 Sensor 1)
	\$9A	\$24	
	\$9B	\$14	A/F sensor heater characteristics abnormal (Bank 1 Sensor 1)
\$42	\$9C	\$24	Oxygen sensor heater abnormal (Bank 1 Sensor 1)
	\$9D	\$24	
\$A1	\$0B	\$24	Misfire monitoring (All cylinders)
	\$0C	\$24	
\$A2	\$0B	\$24	Misfire monitoring (#1 cylinder)
	\$0C	\$24	
\$A3	\$0B	\$24	Misfire monitoring (#2 cylinder)
	\$0C	\$24	
\$A4	\$0B	\$24	Misfire monitoring (#3 cylinder)
	\$0C	\$24	
\$A5	\$0B	\$24	Misfire monitoring (#4 cylinder)
	\$0C	\$24	

## 7. MODE \$07

Refer to the data of DTC (pending code) for troubleshooting result about emission in the first time.

## 8. MODE \$09

Refer to data of vehicle specification (V.I.N., calibration ID, diagnosis frequency etc.).

# Subaru Select Monitor

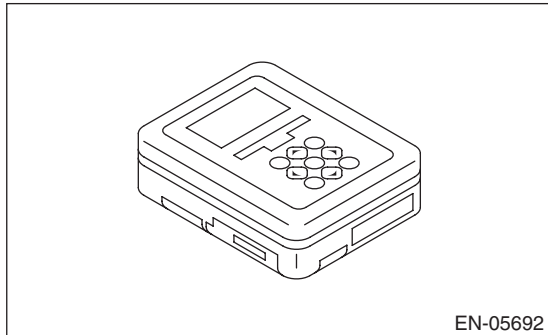
ENGINE (DIAGNOSTICS)

## 9. Subaru Select Monitor

### A: OPERATION

#### 1. HOW TO USE THE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

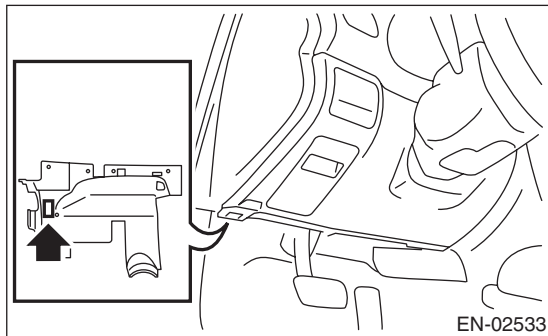
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

8) Call up DTC and data, then record them.

#### NOTE:

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

#### 2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to indicate DTC. <Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).>

#### 3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (OBD MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to indicate DTC. <Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).>

**4. READ CURRENT DATA FOR ENGINE (NORMAL MODE)**

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {Current Data Display & Save}.
  - 5) On the «Current Data Display & Save» display screen, select the {Normal sampling}.
  - 6) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure	Note (at idling)
Engine load	Engine Load	%	21.0%
Engine coolant temperature signal	Coolant Temp.	°C or °F	85°C or 185°F or more (after warm-up)
A/F correction 1	A/F Correction #1	%	-0.8%
A/F learning 1	A/F Learning #1	%	0.0%
Intake manifold absolute pressure	Mani. Absolute Pressure	mmHg, kPa, inHg or psig	200 — 300 mmHg, 26.7 — 40 kPa, 7.8 — 11.8 inHg or 3.8 — 5.8 psig
Engine speed signal	Engine speed	rpm	700 rpm (Agree with the tachometer indication)
Meter vehicle speed signal	Vehicle Speed	km/h or MPH	0 km/h or 0 MPH (at parking)
Ignition timing signal	Ignition Timing	deg	14 — 16 deg
Intake air temperature signal	Intake Air Temp.	°C or °F	(Ambient air temperature)
Amount of intake air	Mass Air Flow	g/s or lb/m	2.5 g/s or 0.33 lb/m
Throttle opening angle signal	Throttle Opening Angle	%	2.0%
Rear oxygen sensor voltage	Rear O2 Sensor	V	0.1 — 0.7 V
Battery voltage	Battery Voltage	V	12 — 14 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1.26 V
Injection 1 pulse width	Fuel Injection #1 Pulse	ms	2.82 ms
Knock sensor compensation	Knocking Correction	deg	0.0 deg
Atmospheric pressure signal	Atmosphere Pressure	mmHg, kPa, inHg or psig	(Atmosphere pressure)
Intake manifold relative pressure	Mani. Relative Pressure	mmHg, kPa, inHg or psig	(Air intake absolute pressure – atmosphere pressure)
Ignition learning value	Learned Ignition Timing	deg	0 deg
Acceleration opening angle signal	Accel. Opening Angle	%	0.0%
Fuel temperature signal	Fuel Temp.	°C or °F	+20°C or +68°F
Purge control solenoid duty ratio	CPC Valve Duty Ratio	%	0 — 3%
No. of EGR steps	No. of EGR Steps	STEP	0 STEP
A/F sensor current value 1	A/F Sensor #1 Current	mA	-0.2 — 0.2 mA
A/F sensor resistance value 1	A/F Sensor #1 Resistance	Ω	32 Ω
A/F sensor output lambda 1	A/F sensor output lambda 1	—	1.0
A/F correction 3	A/F Correction #3	%	0.3%
A/F learning 3	A/F Learning #3	%	0.00%
Throttle motor duty	Throttle Motor Duty	%	-15%
Throttle power supply voltage	Throttle Motor Voltage	V	(Battery voltage)
Sub throttle sensor voltage	Sub-throttle Sensor	V	1.52 V
Main throttle sensor voltage	Main-throttle Sensor	V	0.66 V

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
Sub accelerator sensor voltage	Sub-accelerator Sensor	V	0.68 V
Main accelerator sensor voltage	Main-accelerator Sensor	V	0.68 V
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	0 km/h or 0 MPH
Fuel level sensor signal	Fuel Level Resistance	$\Omega$	2 — 96 $\Omega$
Engine oil temperature	Engine Oil Temperature	$^{\circ}\text{C}$	$\geq 85^{\circ}\text{C}$ (After engine is warmed-up.)
Oil switching solenoid valve duty R	OSV Duty R	%	16.9%
Oil switching solenoid valve duty L	OSV Duty L	%	16.9%
Oil switching solenoid valve current R	OSV Current R	mA	192 mA
Oil switching solenoid valve current L	OSV Current L	mA	192 mA
Variable valve lift mode	VVL Lift Mode	—	1
#1 cylinder roughness monitor	Roughness Monitor #1	—	0
#2 cylinder roughness monitor	Roughness Monitor #2	—	0
#3 cylinder roughness monitor	Roughness Monitor #3	—	0
#4 cylinder roughness monitor	Roughness Monitor #4	—	0
Knock sensor compensation	Knocking Correction	deg	0.0 deg
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig	+7.7 mmHg, +1.1 kPa, +0.31 inHg or +0.15 psig
AT/MT identification terminal	AT Vehicle ID Signal	—	AT vehicle/MT vehicle
Delivery (test) mode terminal	Test Mode Terminal	—	U check
D check request flag	D Check Request	—	OFF
Delivery (test) mode terminal	Delivery Mode	—	OFF
Neutral position switch signal	Neutral Position Switch	—	Neutral
Soft idle switch signal	Idle Switch Signal	—	At idle
Ignition switch signal	Ignition Switch	—	ON input
Power steering switch signal	P/S Switch	—	OFF input (when OFF)
Air conditioning switch signal	A/C Switch	—	OFF input (when OFF)
Starter switch signal	Starter Switch	—	OFF input
Rear oxygen monitor	Rear O2 Rich Signal	—	Rich/Lean
Knocking signal	Knocking Signal	—	None
Crankshaft position sensor signal	Crankshaft Position Signal	—	Provided
Camshaft position sensor signal	Camshaft Position Signal	—	Provided
Rear defogger switch signal	Rear Defogger Switch	—	OFF input (when OFF)
Blower fan switch signal	Blower Fan Switch	—	OFF input (when OFF)
Light switch signal	Light Switch	—	OFF input (when OFF)
A/C middle pressure switch signal	A/C Mid Pressure Switch	—	OFF input (when OFF)
Air conditioner compressor relay output signal	A/C Compressor Signal	—	OFF output (when OFF)
Radiator fan relay 1 signal	Radiator Fan Relay #1	—	OFF output (when OFF)
Radiator fan relay 2 signal	Radiator Fan Relay #2	—	OFF output (when OFF)
Fuel pump relay signal	Fuel Pump Relay	—	ON output
PCV hose assembly diagnosis signal	Blow-by Leak Diagnosis Connector	—	Connected
Pressure control solenoid valve signal	PCV Solenoid Valve	—	OFF output
Drain valve signal	Vent. Solenoid Valve	—	OFF output
Variable valve lift diagnosis oil pressure switch signal 1	Eng. Oil Press. SW 1	—	ON
Variable valve lift diagnosis oil pressure switch signal 2	Eng. Oil Press. SW 2	—	ON
AT coordinate retard angle demand signal	Retard Signal from AT	—	None
AT coordinate fuel cut demand signal	Fuel Cut Signal from AT	—	None



# Subaru Select Monitor

ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
AT coordinate permission signal	Torque Control Permission Signal	—	Allowed (prohibited on MT vehicles)
Electronic throttle control motor relay signal	ETC Motor Relay	—	ON
Clutch switch signal	Clutch Switch	—	OFF (when OFF)
Stop light switch signal	Stop Light Switch	—	OFF (when OFF)
SET/COAST switch signal	SET/COAST Switch	—	OFF (when OFF)
RES/ACC switch signal	RESUME/ACCEL Switch	—	OFF (when OFF)
Brake switch signal	Brake Switch	—	OFF input (when OFF)
Main switch signal	Main Switch	—	OFF input (when OFF)
Body integrated unit data reception	Body Int. Unit Data	—	ON
Body integrated unit counter update	Body Int. Unit Count	—	ON
Cruise control cancel switch signal	Cruise Control Cancel Switch	—	OFF input (when OFF)
Malfunction indicator light signal	MIL Lit Flag	—	Off (when unlit)

**NOTE:**

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

### 5. READ CURRENT DATA FOR ENGINE (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Current Data Display & Save}.
  - 6) On the «Current Data Display & Save» display screen, select the {All Data Display}.
  - 7) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Referential value (at idling)	Unit of measure
Number of diagnosis code	Number of DTC	0	—
Condition of malfunction indicator light	MI (MIL)	OFF	—
Monitoring test of misfire	Misfire monitoring (Supp)	YES	—
Monitoring test of misfire	Misfire monitoring (Rdy)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Supp)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Rdy)	YES	—
Monitoring test of comprehensive component	Component monitoring (Supp)	YES	—
Monitoring test of comprehensive component	Component monitoring (Rdy)	YES	—
Test of catalyst	Catalyst Diagnosis (Supp)	YES	—
Test of catalyst	Catalyst Diagnosis (Rdy)	NO	—
Test of heating-type catalyst	Heated catalyst (Supp)	NO	—
Test of heating-type catalyst	Heated catalyst (Rdy)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Supp)	YES	—
Test of evaporative emission purge control system	Evaporative purge system (Rdy)	NO	—
Secondary air system test	Secondary air system (Supp)	NO	—
Secondary air system test	Secondary air system (Rdy)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Supp)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Rdy)	N/A	—
Test of oxygen sensor	Oxygen sensor (Supp)	YES	—
Test of oxygen sensor	Oxygen sensor (Rdy)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Supp)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Rdy)	NO	—
Test of EGR system	EGR system (Supp)	YES	—
Test of EGR system	EGR system (Rdy)	NO	—
Air fuel ratio control system for bank 1	Fuel system for Bank1	Normal CLOSE	—
Engine load data	Engine Load	23.0	%
Engine coolant temperature signal	Coolant Temp.	92	°C
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	A/F Correction Value #1	-0.8	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	A/F Learning Value #1	0.0	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	211	mmHg

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Engine speed signal	Engine Speed	700	rpm
Vehicle speed signal	Vehicle Speed	0	km/h
#1 Cylinder ignition timing	Ignition timing adv.#1	16.0	°
Intake air temperature signal	Intake Air Temp.	36	°C
Amount of intake air	Mass Air Flow	2.7	g/s
Throttle position signal	Throttle Opening Angle	13	%
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	0.7	V
A/F correction (Bank 1 Sensor 2)	A/F Correction #12	0.0	%
On-board diagnostic system	OBD system	OBD/OBD2	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	Support	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	Support	—
Time elapsed after engine start	Time Since Engine Start	—	sec
Driving distance after the malfunction indicator light illuminates	Lighted MI lamp history	—	km
A/F lambda signal (Bank 1 Sensor 1)	A/F sensor #11	1.001	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F sensor #11	2.79	V
Target EGR	Target EGR	—	%
EGR error	EGR deviation	—	%
Evaporative purge	Commanded Evap Purge	0	%
Fuel level signal	Fuel Level	—	%
Number of warm ups after DTC clear	Number of warm-ups	—	—
Driving distance after DTC clear	Meter since DTC cleared	—	km
Fuel tank pressure signal	Fuel Tank Pressure	8.8	mmHg
Atmospheric pressure signal	Atmosphere Pressure	Atmospheric pressure	mmHg
A/F lambda signal (Bank 1 Sensor 1)	A/F sensor #11	1.001	—
A/F sensor current (Bank 1 Sensor 1)	A/F sensor #11	0.00	mA
Catalyst temperature #1	Catalyst Temperature #11	—	°C
Monitoring test of misfire	Misfire monitoring (Enable)	YES	—
Monitoring test of misfire	Misfire monitoring (Comp)	NO	—
Monitoring test of fuel system	Fuel system monitoring (Enable)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Comp)	NO	—
Monitoring test of comprehensive component	Component monitoring (Enable)	YES	—
Monitoring test of comprehensive component	Component monitoring (Comp)	NO	—
Test of catalyst	Catalyst Diagnosis (Enable)	YES	—
Test of catalyst	Catalyst Diagnosis (Comp)	NO	—
Test of heating-type catalyst	Heated catalyst (Enable)	N/A	—
Test of heating-type catalyst	Heated catalyst (Comp)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Enable)	NO	—
Test of evaporative emission purge control system	Evaporative purge system (Comp)	NO	—
Secondary air system test	Secondary air system (Enable)	N/A	—

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Secondary air system test	Secondary air system (Comp)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Enable)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Comp)	N/A	—
Test of oxygen sensor	Oxygen sensor (Enable)	YES	—
Test of oxygen sensor	Oxygen sensor (Comp)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Enable)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Comp)	NO	—
Test of EGR system	EGR system (Enable)	YES	—
Test of EGR system	EGR system (Comp)	NO	—
ECM power voltage	Control module voltage	13.789	V
Absolute load	Absolute Load Value	22	%
A/F ratio target lambda	Target Equivalence Ratio	0.976	—
Relative throttle opening angle	Relative Throttle Pos.	2	%
Ambient temperature	Ambient Temperature	Ambient air temperature	°C
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	32	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	13	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	13	%
Target throttle opening angle	Target Throt. Act. Cont.	0	%
Engine operating time while malfunction indicator lit	Time while MIL lighted	—	min
Time elapsed after DTC clear	Time since DTC cleared	—	min
Fuel used	Type of fuel	GAS	—
Relative accelerator opening angle	Relative Accelera. Pos.	0	%

**NOTE:**

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

**6. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)**

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Freeze Frame Data Display}.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Freeze frame data DTC code	Freeze frame data	DTC
Air fuel ratio control system for bank 1	Fuel system for Bank1	Normal CLOSE or OPEN early period
Engine load data	Engine Load	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psig
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing advance for #1 cylinder	Ignition Timing	°
Intake air temperature signal	Intake Air Temp.	°C or °F
Amount of intake air	Mass Air Flow	g/s or lb/m
Throttle position signal	Throttle Opening Angle	%
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	Support
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	Support
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	V
A/F correction (Bank 1 Sensor 2)	A/F Correction #12	%
On-board diagnostic system	OBD system	—
Time elapsed after engine start	Time Since Engine Start	sec
Target EGR	Target EGR	%
EGR deviation	EGR Error	%
Evaporative purge	Commanded Evap Purge	%
Fuel level signal	Fuel Level	%
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig
Atmospheric pressure	Atmosphere Pressure	mmHg, kPa, inHg or psig
ECM power voltage	Control module voltage	V
Absolute load	Absolute Load Value	%
A/F ratio target lambda	Target Equivalence Ratio	—
Relative throttle opening angle	Relative Throttle Pos.	%
Ambient temperature	Ambient Temperature	°C or °F
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	%
Target throttle opening angle	Target Throt. Act. Cont.	%

**NOTE:**

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Subaru Select Monitor

ENGINE (DIAGNOSTICS)

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## 7. V.I.N REGISTRATION

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {V.I.N. Registration}.
- 5) Perform the procedures shown on the display screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 10. Read Diagnostic Trouble Code (DTC)

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Diagnostic Code(s) Display}.
- 5) On the «Diagnostic Code(s) Display» screen, select the {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Diagnostic Code(s) Display}.
- 6) Make sure DTC is shown on the screen.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### 3. GENERAL SCAN TOOL

Refer to data denoting emission-related powertrain DTC.

For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### NOTE:

Refer to general scan tool manufacturer’s instruction manual to access powertrain DTC (MODE \$03).

# Inspection Mode

ENGINE (DIAGNOSTICS)

## 11. Inspection Mode

### A: PROCEDURE

Perform the diagnosis shown in the following DTC table.

When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer the item on the drive cycle. <Ref. to EN(H4SO)(diag)-49, Drive Cycle.>

DTC	Item	Condition
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	—
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	—
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	—
P0112	Intake Air Temperature Sensor 1 Circuit Low	—
P0113	Intake Air Temperature Sensor 1 Circuit High	—
P0117	Engine Coolant Temperature Circuit Low	—
P0118	Engine Coolant Temperature Circuit High	—
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	—
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	—
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	—
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	—
P0182	Fuel Temperature Sensor “A” Circuit Low Input	—
P0183	Fuel Temperature Sensor “A” Circuit High Input	—
P0197	Engine Oil Temperature Sensor Low	—
P0198	Engine Oil Temperature Sensor High	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	—
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	—
P0335	Crankshaft Position Sensor “A” Circuit	—
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	—
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	—
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	—
P0447	Evaporative Emission Control System Vent Control Circuit Open	—
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	—
P0452	Evaporative Emission Control System Pressure Sensor Low Input	—
P0453	Evaporative Emission Control System Pressure Sensor High Input	—
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor “A” Circuit Low	—
P0463	Fuel Level Sensor “A” Circuit High	—
P0500	Vehicle Speed Sensor “A”	—
P0512	Starter Request Circuit	—
P0513	Incorrect Immobilizer Key	—



# Inspection Mode

ENGINE (DIAGNOSTICS)

DTC	Item	Condition
P0600	Serial Communication Link	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0607	Control Module Performance	—
P0638	Throttle Actuator Control Range/Performance (Bank 1)	—
P0700	Transmission Control System (MIL Request)	—
P0851	Park/Neutral Switch Input Circuit Low	—
P0852	Park/Neutral Switch Input Circuit High	—
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	—
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	—
P1160	Return Spring Failure	—
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	—
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	—
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	—
P1560	Backup power supply	—
P1570	Antenna	—
P1571	Reference Code Incompatibility	—
P1572	IMM Circuit Failure	—
P1574	Key Communication Failure	—
P1576	EGI Control Module EEPROM	—
P1577	IMM Control Module EEPROM	—
P1578	Meter Failure	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	—
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	—
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	—
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	—
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	—
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	—
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	—
P2227	Barometric Pressure Circuit Range/Performance	—
P2228	Barometric Pressure Circuit Low	—
P2229	Barometric Pressure Circuit High	—

# Inspection Mode

## ENGINE (DIAGNOSTICS)

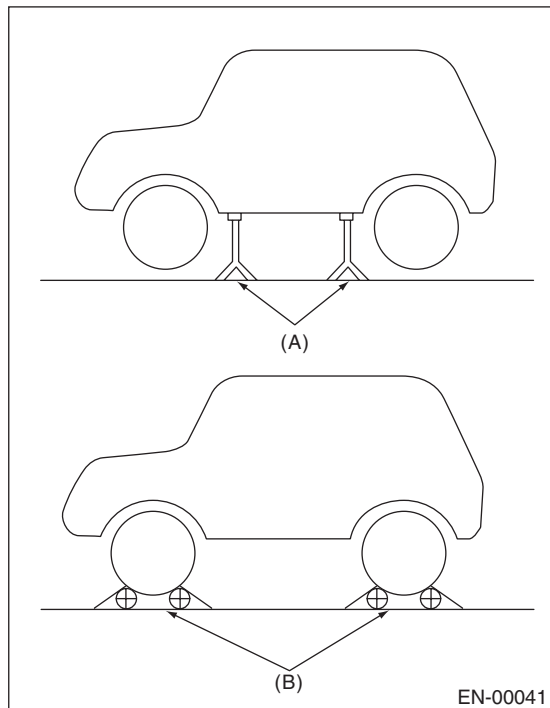
### 1. PREPARATION FOR THE INSPECTION MODE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].

2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

#### WARNING:

- Before raising the vehicle, ensure parking brakes are applied.
- Do not use a pantograph jack in place of a rigid rack.
- Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.
- Do not abruptly depress/release clutch pedal or accelerator pedal during works even when the engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the rigid racks and vehicle.
- Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



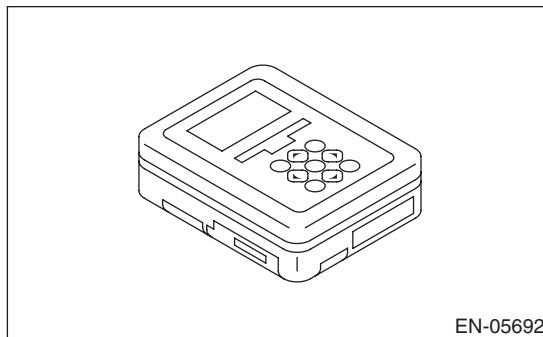
- (A) Rigid racks  
(B) Free rollers

### 2. SUBARU SELECT MONITOR

1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>

2) Warm-up the engine.

3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-7, PREPARATION TOOL, General Description.>



4) Prepare the personal computer which has been installed the Subaru Select Monitor.

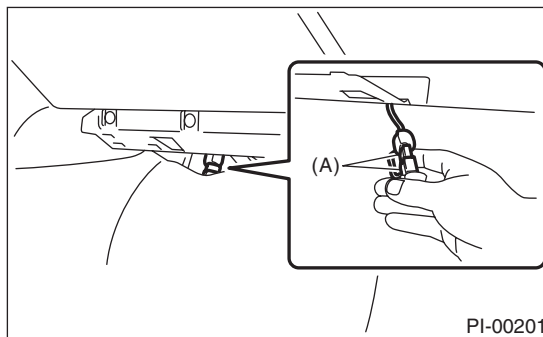
5) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

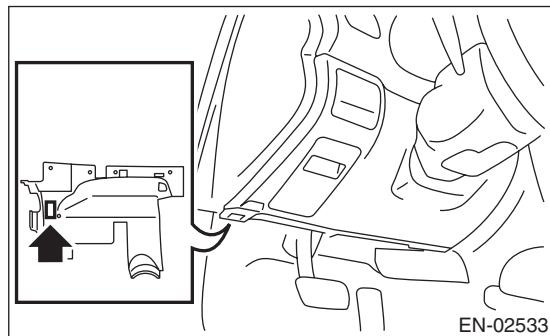
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to the SDI.

7) Connect the delivery (test) mode connector (A) located under the glove box.



8) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

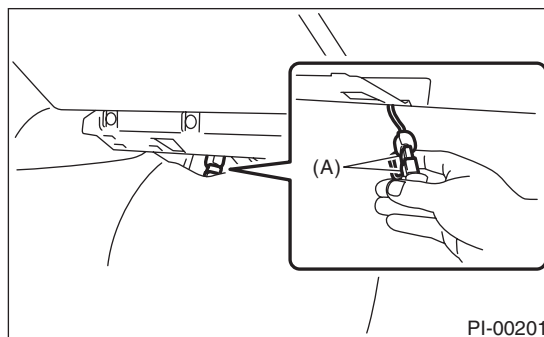
- 9) Start up the personal computer.
- 10) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".
- 11) On the «Main Menu» display screen, select the {Each System Check}.
- 12) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 13) Click the [OK] button after the information of engine type has been displayed.
- 14) On the «Engine Diagnosis» display screen, select the {D Check}.
- 15) When the «Perform Inspection (Dealer Check) Mode» is shown on the screen, click the [Next] button.
- 16) Perform subsequent procedures as instructed on the display screen.
  - If trouble still remains in the memory, the corresponding DTC appears on the display screen.

**NOTE:**

- For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".
- For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".  
<Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>
- Release the parking brake.
- The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis function. <Ref. to ABS(diag)-24, Clear Memory Mode.>

### 3. GENERAL SCAN TOOL

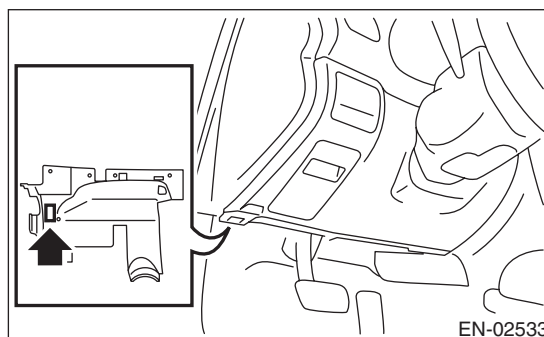
- 1) After performing the diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>
- 2) Warm-up the engine.
- 3) Connect the delivery (test) mode connector (A) located under the glove box.



4) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).

**CAUTION:**

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**



5) Start the engine.

**NOTE:**

- Ensure the selector lever is placed in "P" range before starting. (AT model)
  - Depress the clutch pedal when starting engine. (MT model)
- 6) Using the selector lever or shift lever, turn the P position switch and N position switch to ON.
  - 7) Depress the brake pedal to turn the brake switch ON. (AT model)
  - 8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.

## Inspection Mode

### ENGINE (DIAGNOSTICS)

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9) Place the select lever or shift lever in D position (AT model) or 1st gear (MT model) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

**NOTE:**

- For AWD model, release the parking brake.
- The speed difference between front and rear wheels may illuminate the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system. <Ref. to ABS(diag)-24, Clear Memory Mode.>

10) Using the general scan tool, check DTC and record the result(s).

**NOTE:**

- For detailed operation procedures, refer to the general scan tool operation manual.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.

<Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>

## 12. Drive Cycle

### A: PROCEDURE

For the troubleshooting, there are driving patterns described below. Driving in the specified pattern allows to diagnose malfunctioning items listed below. After the repair of the following trouble items, be sure to drive the vehicle with the specified drive patterns to check whether the function is resumed correctly.

#### 1. PREPARATION FOR DRIVE CYCLE

- 1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
- 2) After performing the diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>
- 3) Disconnect the delivery (test) mode connector.

#### NOTE:

- Perform the diagnosis after warming up the engine except when the engine coolant temperature at starting is specified.
- Perform the diagnosis twice if the DTC marked with \*. After completing the first diagnosis, stop the engine and perform second diagnosis in same condition.

#### 2. DRIVE CYCLE A (AFTER RUNNING 20 MINUTES AT 80 KM/H (50 MPH), IDLE THE ENGINE FOR 1 MINUTE.)

DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Coolant temperature at start is less than 20°C (68°F).
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	—
*P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle B or C as well.
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0442	Evaporative Emission Control System Leak Detected (Small Leak)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0451	Evaporative Emission Control System Pressure Sensor	—
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0459	Evaporative Emission System Purge Control Valve Circuit High	—
P1443	Vent Control Solenoid Valve Function Problem	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle B or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle B or C as well.

# Drive Cycle

## ENGINE (DIAGNOSTICS)

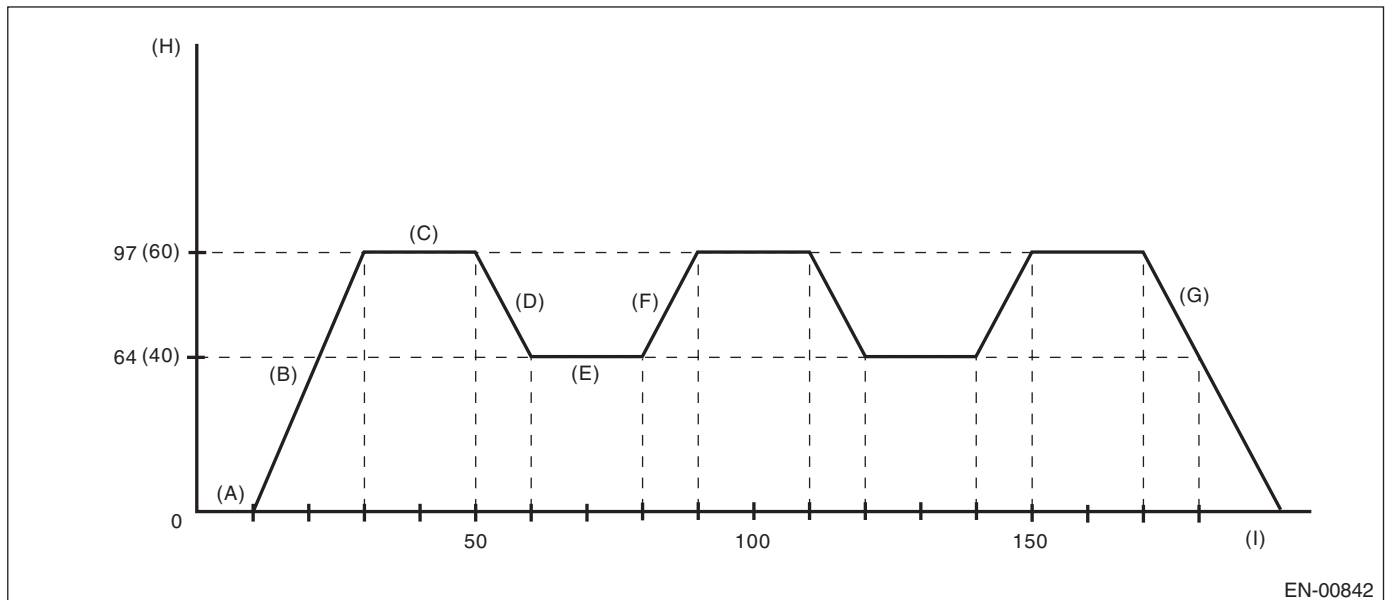
### 3. DRIVE CYCLE B — 10 MINUTES IDLING

**NOTE:**

Drive the vehicle at 10 km/h (6 MPH) or more before diagnosis.

DTC	Item	Condition
*P0126	Insufficient Engine Coolant Temperature for Stable Operation	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0464	Fuel Level Sensor Circuit Intermittent	—
*P0506	Idle Air Control System RPM Lower Than Expected	—
*P0507	Idle Air Control System RPM Higher Than Expected	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or C as well.

### 4. DRIVE CYCLE C — DRIVE THE VEHICLE WITH FOLLOWING DRIVE PATTERNS



EN-00842

- |   |  |  |
|---|--|--|
| (A) Idle the engine for 10 seconds or more.               | (D) Decelerate with fully closed throttle to 64 km/h (40 MPH). | (G) Stop vehicle with the throttle fully closed. |
| (B) Accelerate to 97 km/h (60 MPH) within 20 seconds.     | (E) Drive the vehicle at 64 km/h (40 MPH) for 20 seconds.      | (H) Vehicle speed km/h (MPH)                     |
| (C) Drive the vehicle at 97 km/h (60 MPH) for 20 seconds. | (F) Accelerate to 97 km/h (60 MPH) within 10 seconds.          | (I) Sec.   |

# Drive Cycle

## ENGINE (DIAGNOSTICS)

DTC	Item	Condition
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	—
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	—
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
*P0068	MAP/MAF - Throttle Position Correlation	—
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	—
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	—
*P0101	Mass Or Volume Air Flow Circuit Range/Performance	—
*P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0400	Exhaust Gas Recirculation Flow	—
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	—
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	—
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	—
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	—
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	—
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	—
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	—
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or B as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or B as well.

# Drive Cycle

## ENGINE (DIAGNOSTICS)

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### 5. DRIVE CYCLE D

#### • DRIFT DIAGNOSIS

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Make sure that fuel remains 10 ℓ (2.6 US gal, 2.2 Imp gal) or more and the battery voltage is 10.9 V or more.
- 3) Start the engine, and check that the engine coolant temperature increases by 10°C (50°F) or more, and reaches 75°C (167°F) or more, when the engine is warmed up.
- 4) Idle the engine for 120 seconds or more in the condition of step 3.

#### • STUCK DIAGNOSIS

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>
- 3) Drive the vehicle for the distance equal to the fuel of 50 ℓ (13.2 US gal, 11 Imp gal).

#### NOTE:

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	—

### 6. DRIVE CYCLE E

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>
- 3) Drive the vehicle for the distance equal to the fuel of 30 ℓ (7.9 US gal, 6.6 Imp gal).

#### NOTE:

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0461	Fuel Level Sensor "A" Circuit Range/Performance	—

### 7. DRIVE CYCLE F

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Start the engine, and warm it up until engine coolant temperature increases over 95°C (203°F).
- 3) After the engine has reached the state of procedure 2), idle the engine for 10 minutes or more.

#### NOTE:

Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	—



## 8. DRIVE CYCLE H

- 1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.>
- 2) With the ignition switch ON, read the engine coolant temperature, intake air temperature and fuel temperature. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
- 3) If the values from step 2) satisfy the following two conditions, start the engine.

**Condition:**

***|Engine coolant temperature — intake air temperature | ≤ 5°C (41°F)***

***|Engine coolant temperature — fuel temperature | ≤ 2°C (36°F)***

**NOTE:**

- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
  - Start AT vehicles in the P range, and MT vehicles in the N position.
- 4) Idle the engine for 1 minute under the conditions in step 3).

DTC	Item	Condition
*P1602	Control Module Programming Error	—

# Clear Memory Mode

ENGINE (DIAGNOSTICS)

---

## 13. Clear Memory Mode

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Clear Memory}.
- 5) When the «Clear Memory?» is shown on the screen, click the [Yes] button.
- 6) When «Done» and «Turn ignition switch to OFF» is shown on the display screen, turn the ignition switch to OFF.

#### NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. Therefore, start the engine 10 seconds or more after have turning the ignition switch to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Clear Diagnostic Code?}.
- 6) When the «Clear Diagnostic Code?» is shown on the screen, click the [Yes] button.
- 7) When «Done» and «Turn ignition switch to OFF» is shown on the display screen, turn the ignition switch to OFF.

#### NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. Therefore, start the engine 10 seconds or more after have turning the ignition switch to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

#### 3. GENERAL SCAN TOOL

For clear memory procedures using the general scan tool, refer to “General Scan Tool Instruction Manual”.

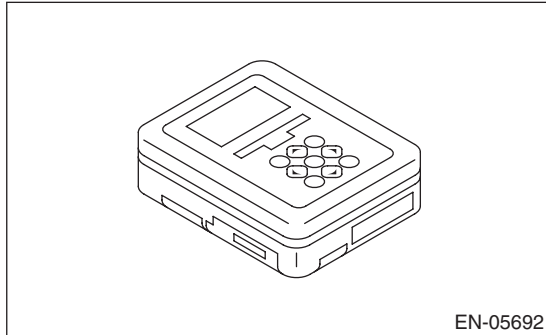
#### NOTE:

Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.

## 14. Compulsory Valve Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

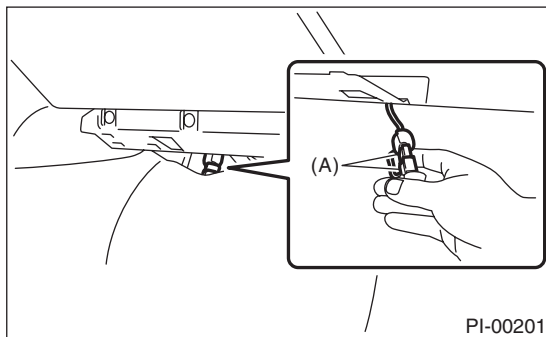
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

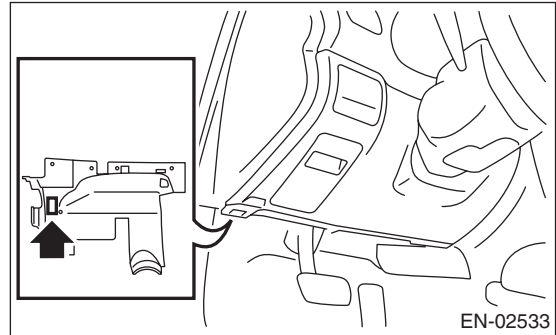
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the delivery (test) mode connector (A) located under the glove box.



6) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

7) Start up the personal computer.

8) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

9) On the «Main Menu» display screen, select the {Each System Check}.

10) On the «System Selection Menu» display screen, select the {Engine Control System}.

11) Click the [OK] button after the information of engine type has been displayed.

12) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

13) On the «System operation check mode» display screen, select the {Actuator ON/OFF Operation}.

14) Select the desired compulsory actuator on the «Actuator ON/OFF Operation» display screen and click the [Next] button.

# Compulsory Valve Operation Check Mode

## ENGINE (DIAGNOSTICS)

---

15) Clicking the [Finished] button completes the compulsory valve operation check mode. The display will then return to the «Actuator ON/OFF Operation» screen.

- A list of the support data is shown in the following table.

Description	Display
Compulsory fuel pump relay operation check	Fuel Pump
Compulsory purge control solenoid valve operation check	CPC Solenoid
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay
Compulsory pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory drain valve operation check	Vent Control Solenoid Valve

### NOTE:

- The following parts will be displayed but not functional.

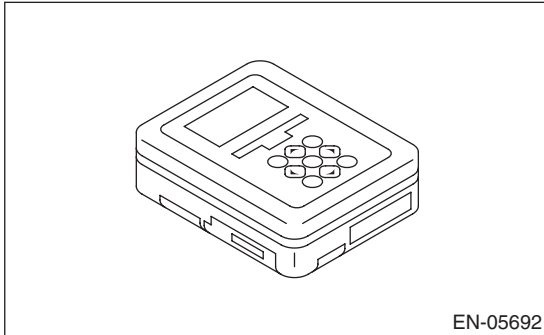
Display
EGR Solenoid Valve
ASV Solenoid Valve
FICD Solenoid
Pressure Switching Sol. 1
Pressure Switching Sol. 2
AAI Solenoid
Fuel Tank Sensor Control Valve
Turbocharger Wastegate Solenoid
Exhaust Bypass Valve Control Permit Flag
Secondary Air Combination Valve 1

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 15. System Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

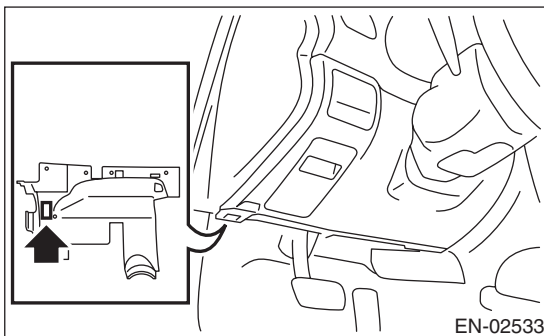
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

**NOTE:**

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

8) On the «Main Menu» display screen, select the {Each System Check}.

9) On the «System Selection Menu» display screen, select the {Engine Control System}.

10) Click the [OK] button after the information of engine type has been displayed.

11) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

12) The following items will be displayed on screen.

Display
Actuator ON/OFF Operation
Security System
Fuel Pump Control
Idling Ignition Timing Fixed
Idle Speed Control
Injector Control
EGR Valve Control

### 1. FUEL PUMP CONTROL (OFF DRIVE)

**CAUTION:**

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>**

1) On the «System operation check mode» display, select the {Fuel Pump Control}.

2) On the «Fuel Pump Control» display screen, select the {OFF Operation}.

3) On the «Start the Engine» display screen, start the engine and click the [OK] button.

4) Click the [Cancel] button to end the OFF drive. The screen will return to the «Fuel Pump Control» screen.

**NOTE:**

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

### 2. FUEL PUMP CONTROL (ON/OFF DRIVE)

**CAUTION:**

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>**

1) On the «System operation check mode» display, select the {Fuel Pump Control}.

2) On the «Fuel Pump Control» display screen, select the {ON/OFF Operation}.

3) On the «Turn Ignition Switch ON with Engine Stalled» display screen, turn the ignition switch to ON and click the [OK] button.

4) Click the [Cancel] button to end the ON/OFF drive. The screen will return to the «Fuel Pump Control» screen.

**NOTE:**

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

# System Operation Check Mode

## ENGINE (DIAGNOSTICS)

### 3. IDLING IGNITION TIMING FIXED

#### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>.**

- 1) On the «System operation check mode» display screen, select the {Idling Ignition Timing Fixed}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) Click the [Cancel] button to end the idle ignition timing fixed. The screen will return to the «System Operation Check Mode» screen.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 4. IDLE SPEED CONTROL

#### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>.**

- 1) On the «System operation check mode» display screen, select the {Idle Speed Control}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) In the «Idle Engine Speed Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.

Setting is possible in a range between 500 rpm — 2,000 rpm, in increments of 50 rpm. However, the engine speed that can actually be controlled will vary depending on the vehicle.

- 4) Click the [Cancel] button to end the idle speed control. The screen will return to the «System Operation Check Mode» screen.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 5. INJECTOR CONTROL. (INJECTION STOP MODE)

#### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>.**

- 1) On the «System operation check mode» display, select the {Injector Control}.
- 2) On the «Injector Control» display screen, select the {Injection Stop Mode}.
- 3) Select the desired injector number on the «Injection Stop Mode» screen, and click the [OK] button.
- 4) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 5) Click the [Cancel] button to return the «Injection Stop Mode» display screen.

- 6) On the «Injection Stop Mode» display screen, click the [Return] button to end the «Injection Stop Mode». The screen will return to the «Injector Control» screen.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 6. INJECTOR CONTROL. (INJECTION QUANTITY CONTROL)

#### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>.**

- 1) On the «System operation check mode» display, select the {Injector Control}.
- 2) On the «Injector Control» display screen, select the {Injection Quantity Control}.
- 3) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 4) In the «Injection Quantity Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button. Setting is possible in a range between 0 — 20%, in increments of 1%.
- 5) Click the [Cancel] button to end the injection quantity control. The screen will return to the «Injector Control» screen.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 7. EGR VALVE CONTROL

#### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>.**

- 1) On the «System operation check mode» display, select the {EGR Valve Control}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) In the «EGR Valve Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button. Setting is possible in 1 STEP increments. However, the number of STEPs that can actually be controlled will vary depending on the vehicle.
- 4) Click the [Cancel] button to end the EGR valve control. The screen will return to the «System Operation Check Mode» screen.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 16. Malfunction Indicator Light

### A: PROCEDURE

1. Activation of malfunction indicator light. <Ref. to EN(H4SO)(diag)-60, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on. <Ref. to EN(H4SO)(diag)-61, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off. <Ref. to EN(H4SO)(diag)-63, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink. <Ref. to EN(H4SO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking. <Ref. to EN(H4SO)(diag)-66, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

# Malfunction Indicator Light

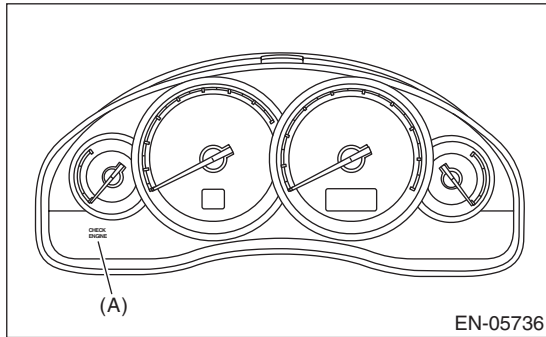
ENGINE (DIAGNOSTICS)

## B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

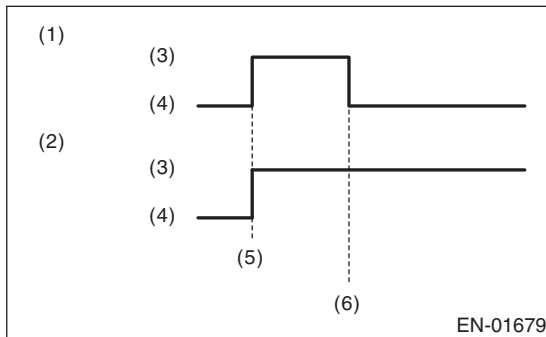
1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

### NOTE:

If the engine malfunction indicator light does not illuminate, perform diagnostics of malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4SO)(diag)-61, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

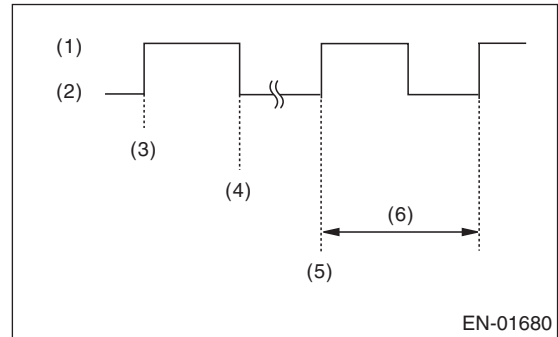


2) After starting the engine, the malfunction indicator light goes out. If it does not go off, either the engine or emission control system has malfunction.



- (1) No faulty
- (2) Trouble occurs
- (3) ON
- (4) OFF
- (5) Ignition switch ON
- (6) Engine start

3) If the diagnostic system detects a misfire which could damage the catalyst, the malfunction indicator light will blink at a cycle of 1 Hz.



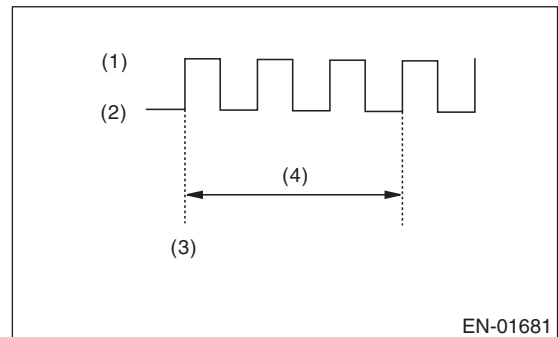
- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) Engine start
- (5) Misfire start
- (6) 1 second

4) Turn the ignition switch to OFF and connect the delivery (test) mode connector.

(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.

(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.



- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) 1 second



# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

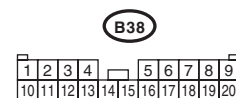
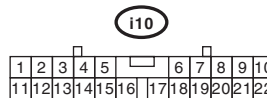
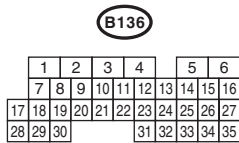
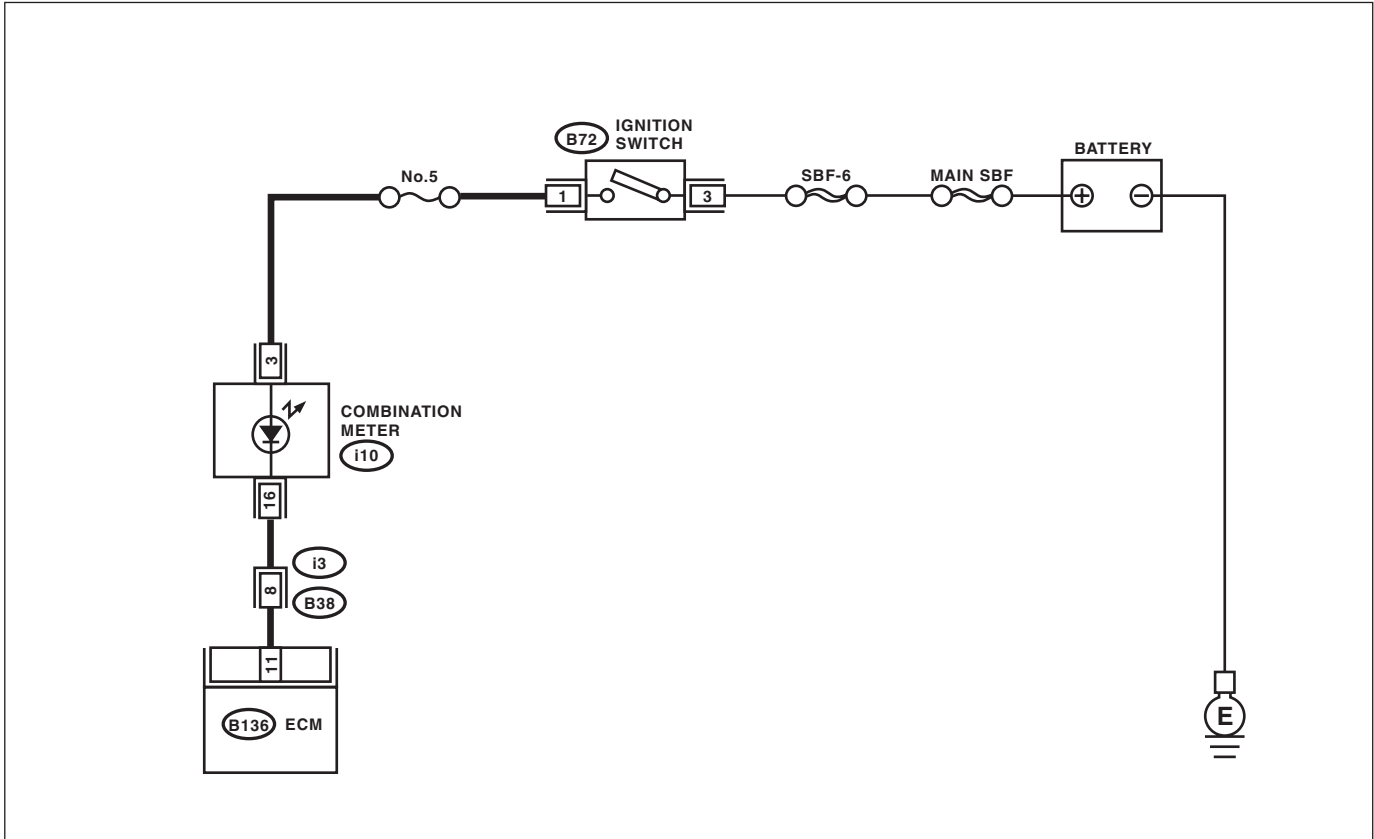
### DIAGNOSIS:

The malfunction indicator light circuit is open or shorted.

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not come on.

### WIRING DIAGRAM:



EN-05697

# Malfunction Indicator Light

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 11 (+) — Chassis ground (-):</b></i>	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.
<b>2 CHECK POOR CONTACT.</b> Check for poor connection by shaking or pulling ECM connector and harness.	Does the malfunction indicator light illuminate?	Repair poor contact of the ECM connector.	Go to step 3.
<b>3 CHECK ECM CONNECTOR.</b> Check the connection of ECM connector.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>	Repair the connection of ECM connector.
<b>4 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-19, Combination Meter.> 3) Disconnect the connector from ECM and combination meter. 4) Measure the resistance of harness between ECM and combination meter connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 11 — (i10) No. 16:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and combination meter connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>5 CHECK POOR CONTACT.</b> Check poor contact of combination meter connector.	Is there poor contact in combination meter connector?	Repair the poor contact of combination meter connector.	Go to step 6.
<b>6 CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between combination meter connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(i10) No. 3 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Replace the combination meter circuit board. <Ref. to IDI-19, Combination Meter.>	Check the following item and repair if necessary. NOTE: <ul style="list-style-type: none"> <li>• Blown out of fuse (No. 5)</li> <li>• Open or short circuit in harness between fuse (No. 5) and battery terminal</li> <li>• Poor contact of ignition switch connector</li> </ul>

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

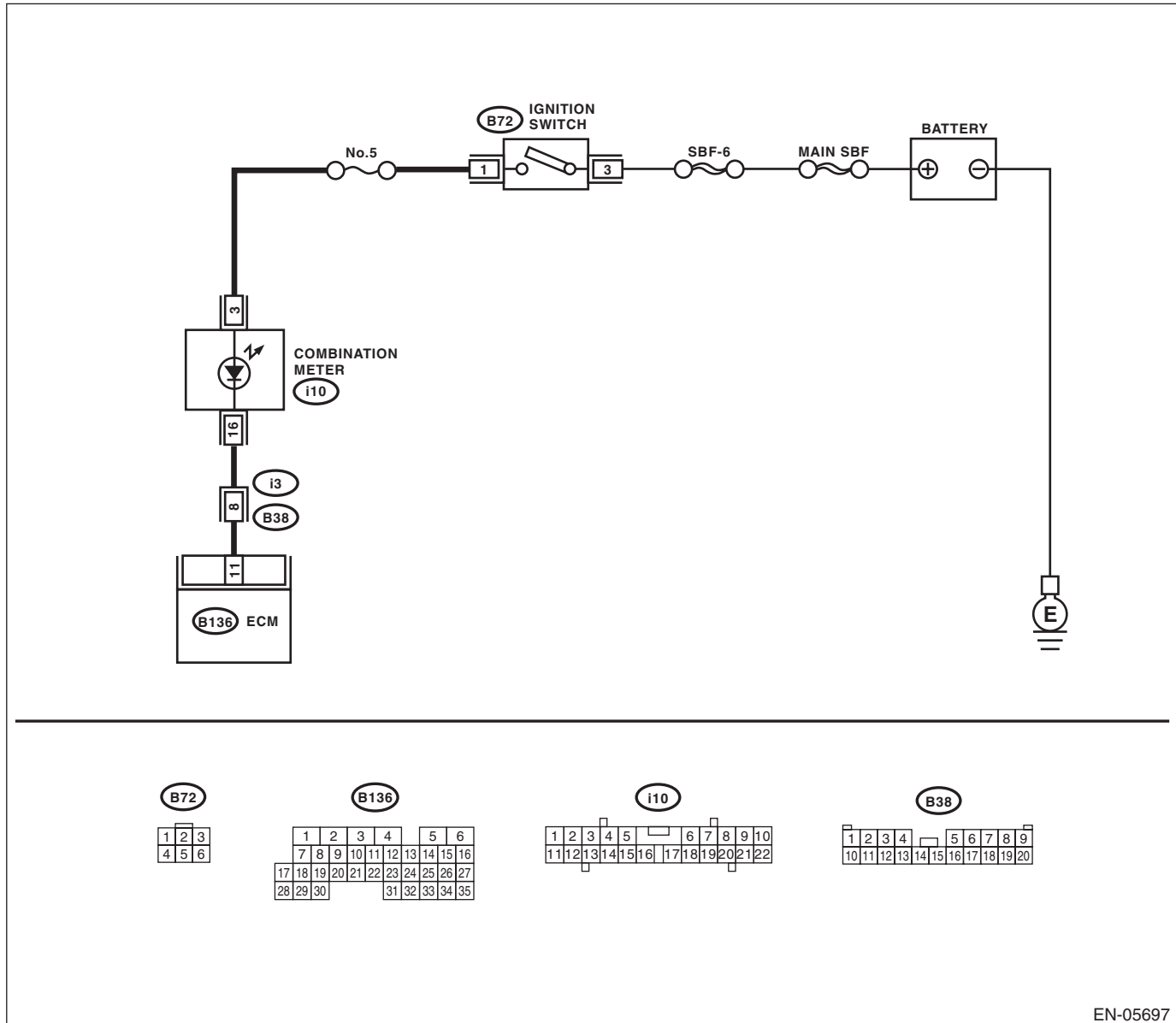
### DIAGNOSIS:

The malfunction indicator light circuit is shorted.

### TROUBLE SYMPTOM:

Although malfunction indicator light illuminates when the engine runs, DTC is not shown on the Subaru Select Monitor display.

### WIRING DIAGRAM:



EN-05697

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

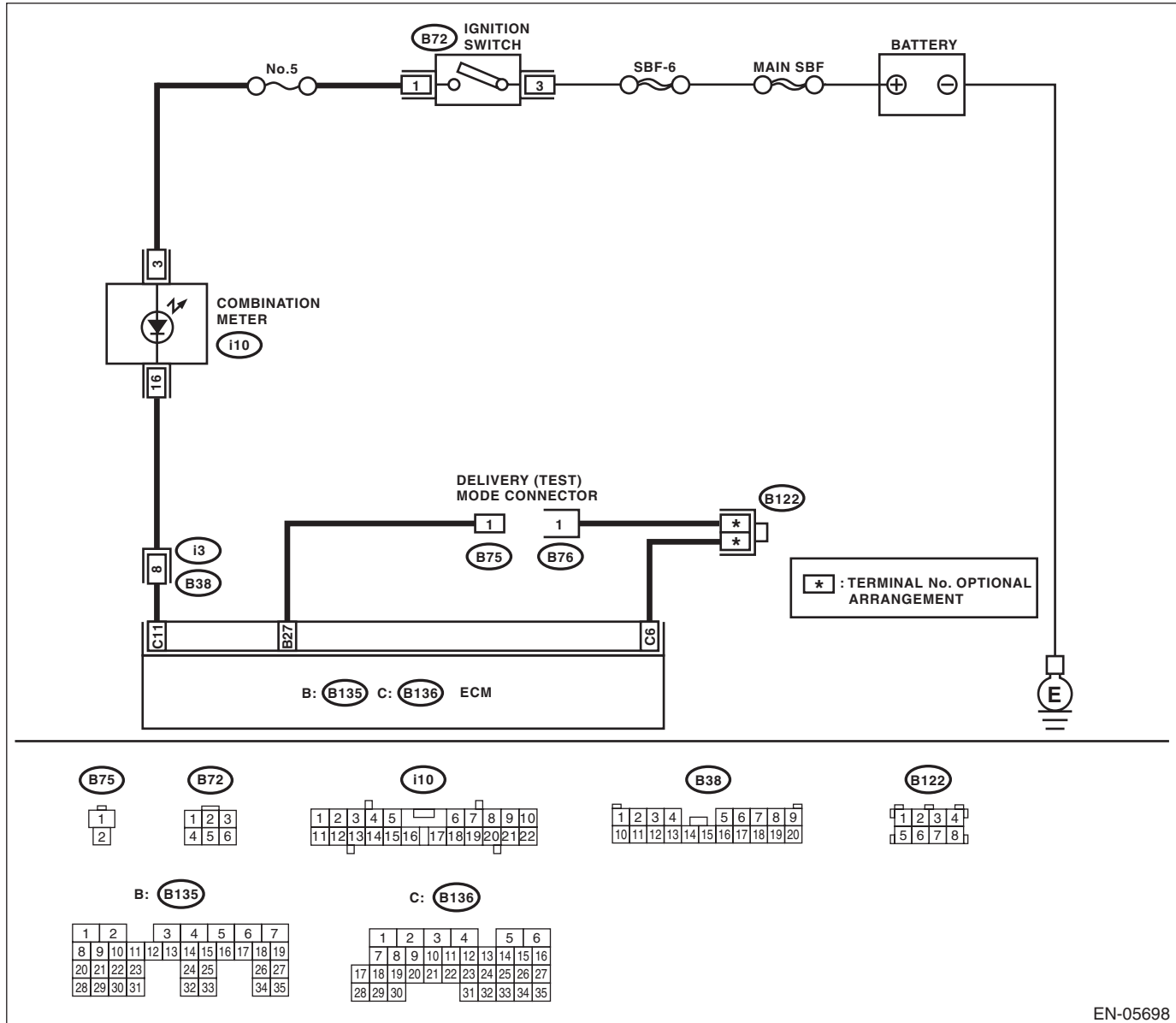
### DIAGNOSIS:

- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

### TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

### WIRING DIAGRAM:



EN-05698

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector. 3) Turn the ignition switch to ON. (engine OFF)	Does the malfunction indicator light illuminate?	Go to step 2.	Repair the malfunction indicator light circuit. <Ref. to EN(H4SO)(diag)-61, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
<b>2 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between combination meter and ECM connector.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN DELIVERY (TEST) MODE CONNECTOR AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between delivery (test) mode connector and ECM. <b>Connector &amp; terminal</b> <b>(B76) No. 1 — (B136) No. 6:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between delivery (test) mode connector and chassis ground
<b>4 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Go to step 5.
<b>5 CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.</b> 1) Connect the delivery (test) mode connector. 2) Measure the resistance of harness between ECM and delivery (test) mode connector. <b>Connector &amp; terminal</b> <b>(B135) No. 27 — (B136) No. 6:</b>	Is the resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between ECM and delivery (test) mode connector.
<b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

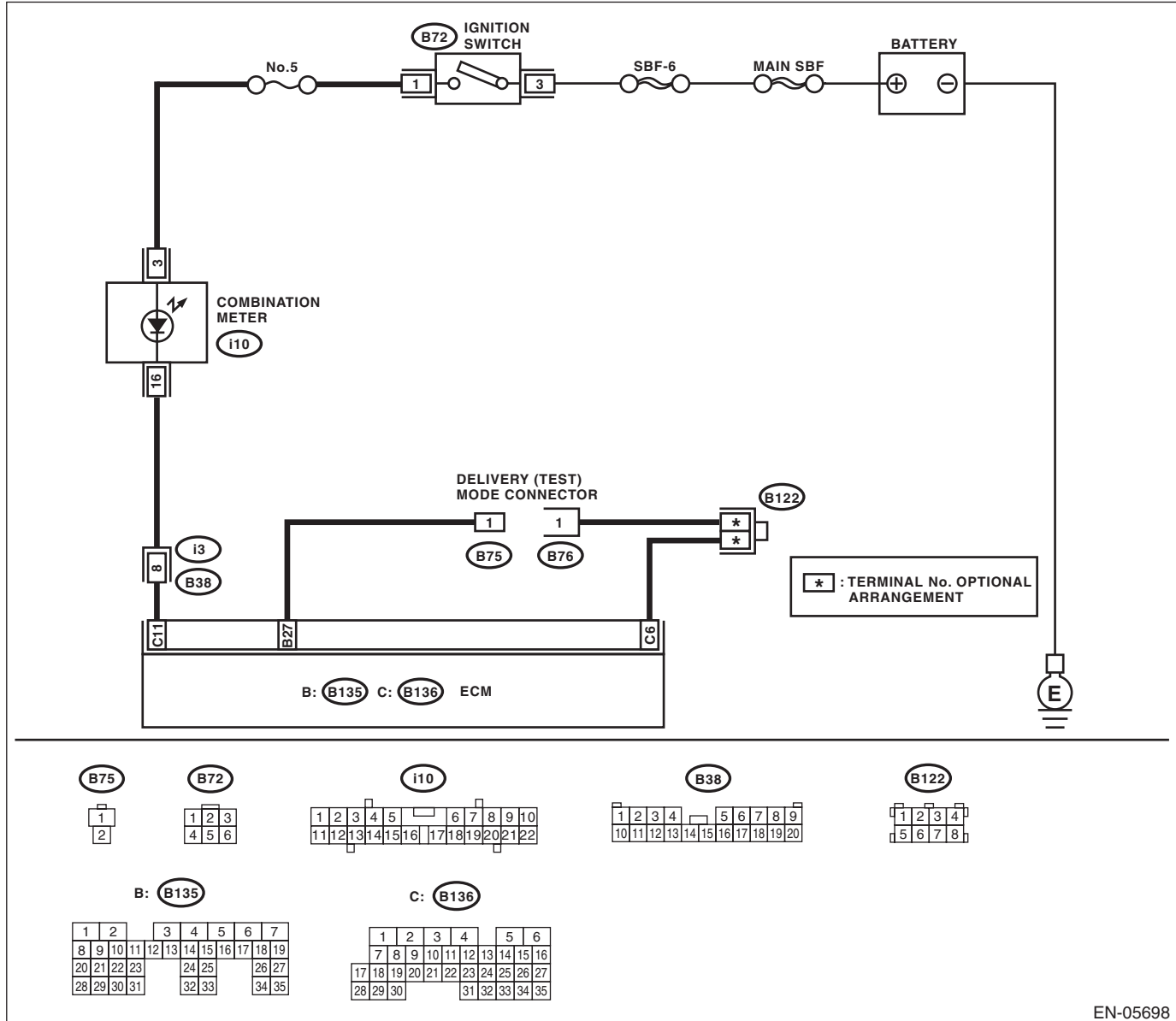
### DIAGNOSIS:

The delivery (test) mode connector circuit is shorted.

### TROUBLE SYMPTOM:

Malfunction indicator light blinks when delivery (test) mode connector is not connected.

### WIRING DIAGRAM:



EN-05698

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK DELIVERY (TEST) MODE CONNECTOR.</b> 1) Disconnect the delivery (test) mode connector. 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step 2.	System is normal. NOTE: Malfunction indicator light blinks when delivery (test) mode connector is connected.
<b>2 CHECK HARNESS BETWEEN ECM CONNECTOR AND DELIVERY (TEST) MODE CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. <i>Connector &amp; terminal                      (B135) No. 27 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Repair the short circuit of harness between ECM and delivery (test) mode connector.	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

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## 17. Diagnostics for Engine Starting Failure

### A: PROCEDURE

1. Check of the fuel amount
↓
2. Inspection of starter motor circuit <Ref. to EN(H4SO)(diag)-69, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line <Ref. to EN(H4SO)(diag)-73, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system <Ref. to EN(H4SO)(diag)-75, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit <Ref. to EN(H4SO)(diag)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit <Ref. to EN(H4SO)(diag)-81, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>



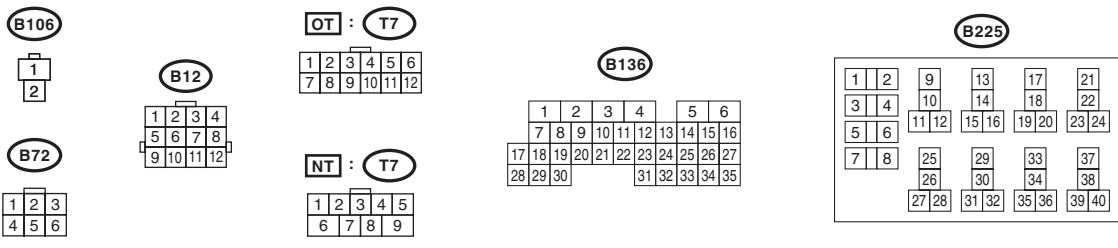
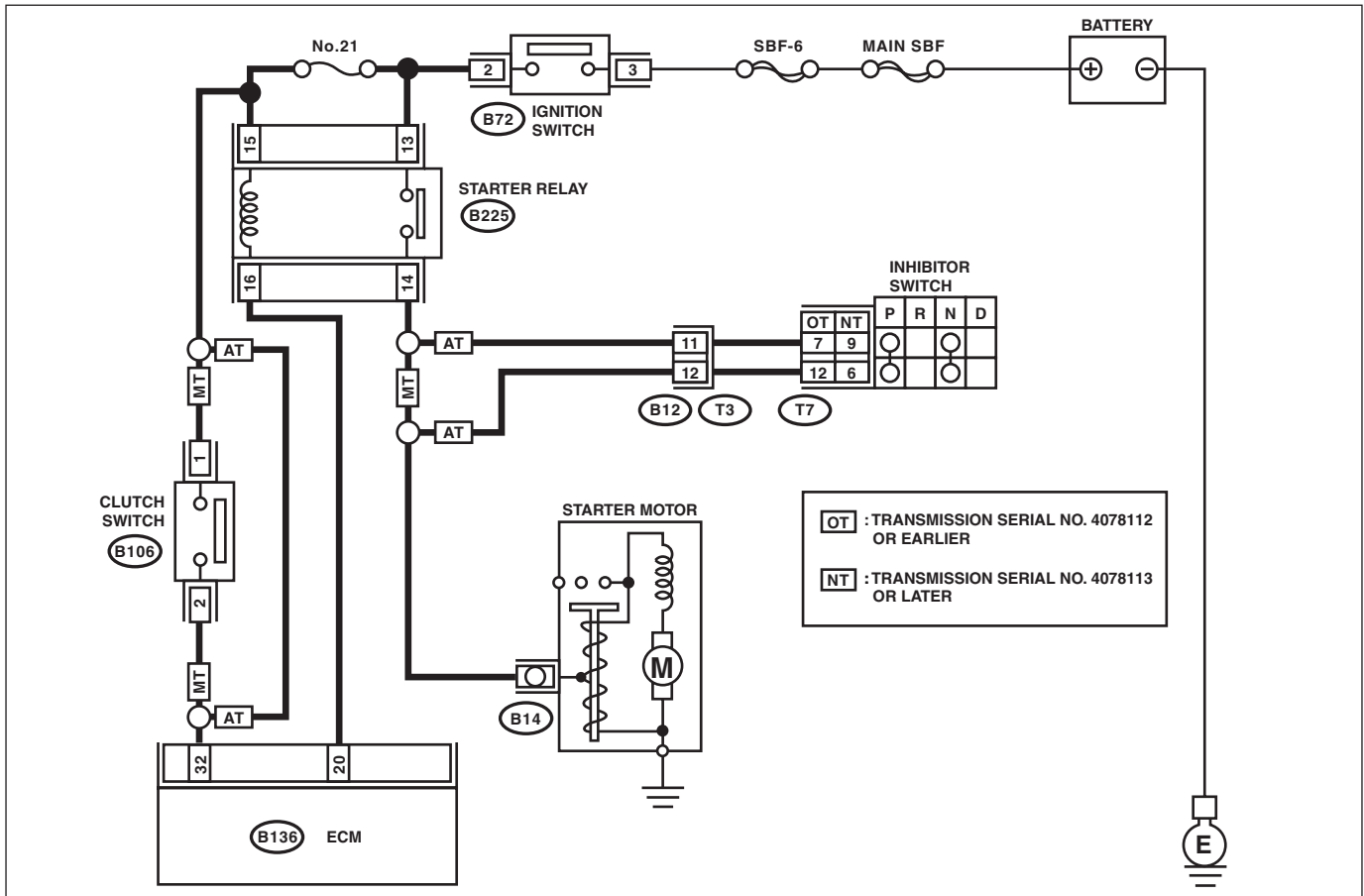
# Diagnostics for Engine Starting Failure

## B: STARTER MOTOR CIRCUIT

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, Inspection Mode.>.

### WIRING DIAGRAM:



EN-06894

Step	Check	Yes	No
1	<b>CHECK BATTERY.</b> Check the battery voltage.	Go to step 2.	Charge or replace the battery.
2	<b>CHECK OPERATION OF STARTER MOTOR.</b> NOTE: Check the security alarm is not sounding.	Go to step 3.	Go to step 4.

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>3</b> <b>CHECK DTC.</b>	Is DTC displayed? <Ref. to EN(H4SO)(diag)-43, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Repair poor contact of the ECM connector.
<b>4</b> <b>CHECK INPUT SIGNAL FOR STARTER MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn the ignition switch to START. 4) Measure the power supply voltage between starter motor connector terminal and engine ground. <b>Connector &amp; terminal</b> <b>(B14) No. 1 (+) — Engine ground (-):</b> NOTE: For AT model, place the select lever in "P" range or "N" range. For MT model, depress the clutch pedal.	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4SO)-6, Starter.>	Go to step 5.
<b>5</b> <b>CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.</b> 1) Disconnect the connector from ignition switch. 2) Measure the power supply voltage between ignition switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B72) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 6.	Repair the open circuit or ground short of harness between ignition switch and battery, and check fuse SBF No. 6 and MAIN SBF.
<b>6</b> <b>CHECK IGNITION SWITCH.</b> 1) Disconnect the connector from ignition switch. 2) Measure the resistance between ignition switch terminals after turning the ignition switch to START position. <b>Terminals</b> <b>No. 2 — No. 3:</b>	Is the resistance less than 5 Ω?	Go to step 7.	Replace the ignition switch.
<b>7</b> <b>CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter relay. 3) Connect the connector to ignition switch. 4) Measure the input voltage between starter relay connector and chassis ground after turning the ignition switch to START position. <b>Connector &amp; terminal</b> <b>(B225) No. 13 (+) — Chassis ground (-):</b> <b>(B225) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 8.	Repair open or ground short circuit of harness between starter relay and ignition switch.
<b>8</b> <b>CHECK STARTER RELAY.</b> 1) Connect the battery to starter relay terminals No. 15 and No. 16. 2) Measure the resistance between starter relay terminals. <b>Terminals</b> <b>No. 13 — No. 14:</b>	Is the resistance less than 1 Ω?	Go to step 9.	Replace the starter relay.

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>9 CHECK HARNESS BETWEEN STARTER RELAY AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between starter relay and ECM. <i>Connector &amp; terminal (B225) No. 16 — (B136) No. 20:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 10.	Repair the open or ground short circuit of harness between starter relay and ECM.
<b>10 CHECK TRANSMISSION TYPE.</b>	Is the transmission type AT?	Go to step 11.	Go to step 15.
<b>11 CHECK ECM INPUT VOLTAGE.</b> 1) Turn the ignition switch to START. 2) Measure the input voltage between ECM connector and chassis ground. <i>Connector &amp; terminal (B136) No. 32 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 12.	Repair the open or ground short circuit of harness between ECM and ignition switch.
<b>12 CHECK HARNESS BETWEEN STARTER RELAY AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Measure the resistance of harness between the starter relay and inhibitor switch. <i>Connector &amp; terminal Transmission serial No. 4078112 or earlier (B225) No. 14 — (T7) No. 7: Transmission serial No. 4078113 or later (B225) No. 14 — (T7) No. 9:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 13.	Repair open circuit of harness between starter relay and inhibitor switch.
<b>13 CHECK HARNESS BETWEEN INHIBITOR SWITCH AND STARTER MOTOR.</b> Measure the resistance of harness between the inhibitor switch and starter motor. <i>Connector &amp; terminal Transmission serial No. 4078112 or earlier (T7) No. 12 — (B14) No. 1: Transmission serial No. 4078113 or later (T7) No. 6 — (B14) No. 1:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 14.	Repair open circuit of harness between inhibitor switch and starter motor.
<b>14 CHECK INHIBITOR SWITCH.</b> 1) Place the select lever other than "P" range and "N" range. 2) Measure the resistance between inhibitor switch connector terminals. <i>Terminals Transmission serial No. 4078112 or earlier No. 7 — No. 12: Transmission serial No. 4078113 or later No. 6 — No. 9:</i>	Is the resistance 1 M $\Omega$ or more?	Check the ECM power supply and ground line. <Ref. to EN(H4SO)(diag)-73, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Replace the inhibitor switch. <Ref. to 4AT-47, Inhibitor Switch.>
<b>15 CHECK HARNESS BETWEEN IGNITION SWITCH AND CLUTCH SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from clutch switch. 3) Turn the ignition switch to START. 4) Measure the voltage between the clutch switch and chassis ground. <i>Connector &amp; terminal (B106) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 16.	Repair the open or ground short circuit of harness between clutch switch and ignition switch.

## Diagnostics for Engine Starting Failure

### ENGINE (DIAGNOSTICS)

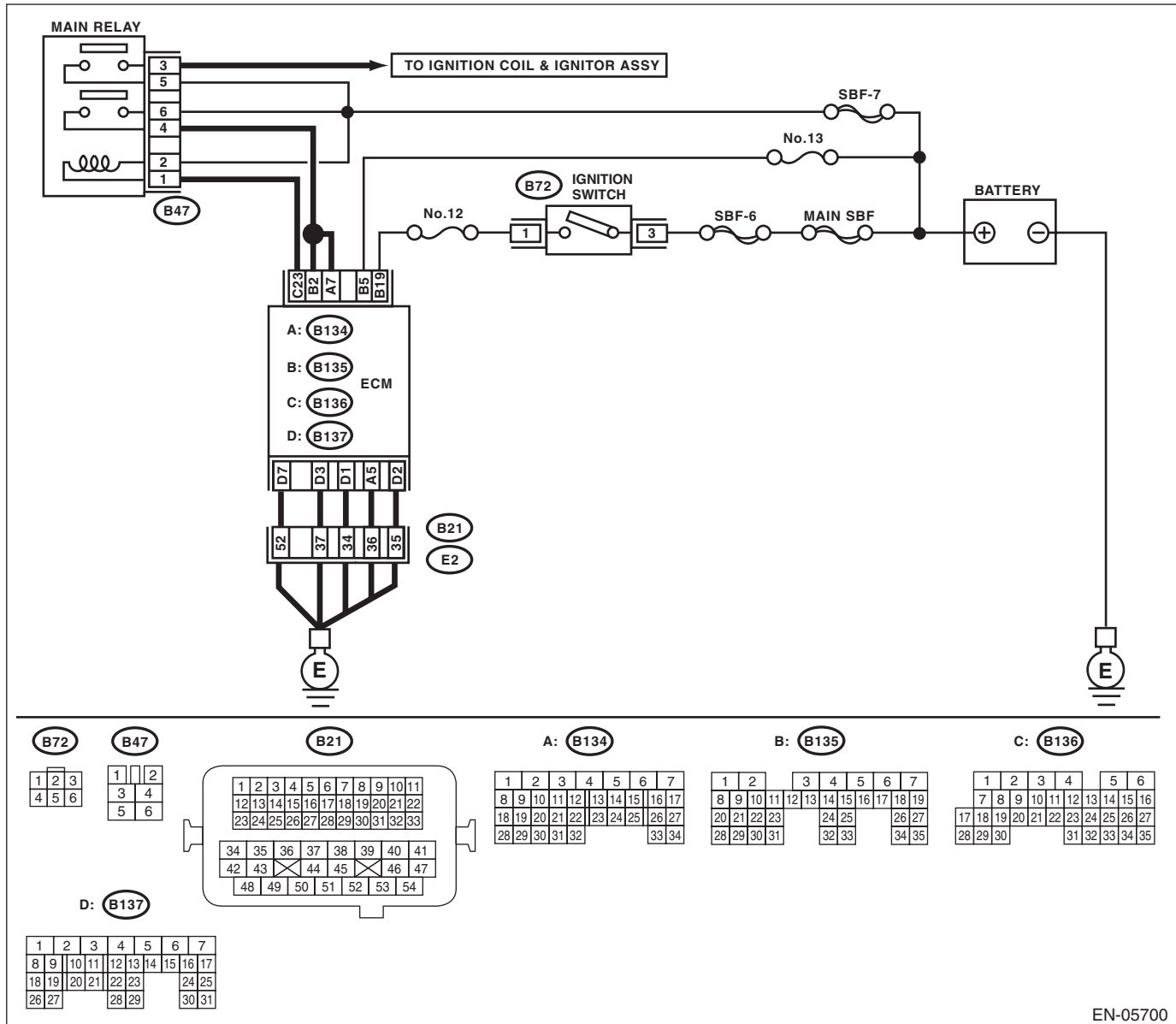
Step	Check	Yes	No
<b>16</b> <b>CHECK CLUTCH SWITCH.</b> Measure the resistance between clutch switch terminals while depressing the clutch. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 17.	Replace the clutch switch.
<b>17</b> <b>CHECK HARNESS BETWEEN ECM AND CLUTCH SWITCH.</b> Measure the resistance of harness between ECM and clutch switch. <i>Connector &amp; terminal</i> <i>(B136) No. 32 — (B106) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Contact your SOA service center.	Repair the open circuit of harness between the ECM and clutch switch.

## C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK MAIN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. <b>Terminals</b> <b>No. 3 — No. 5:</b> <b>No. 4 — No. 6:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 2.	Replace the main relay.
<b>2</b> <b>CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM connector and engine grounding terminal.
<b>3</b> <b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 5 (+) — Chassis ground (-):</b> <b>(B135) No. 19 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 4.	Repair the open or ground short circuit of power supply circuit.
<b>4</b> <b>CHECK INPUT VOLTAGE OF MAIN RELAY.</b> Measure the voltage between main relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B47) No. 1 (+) — Chassis ground (-):</b> <b>(B47) No. 5 (+) — Chassis ground (-):</b> <b>(B47) No. 6 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 5.	Repair the open or ground short circuit of harness of power supply circuit.
<b>5</b> <b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 7 (+) — Chassis ground (-):</b> <b>(B135) No. 2 (+) — Chassis ground (-):</b> <b>(B136) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H4SO)(diag)-75, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the open or ground short circuit of harness between ECM connector and main relay connector.

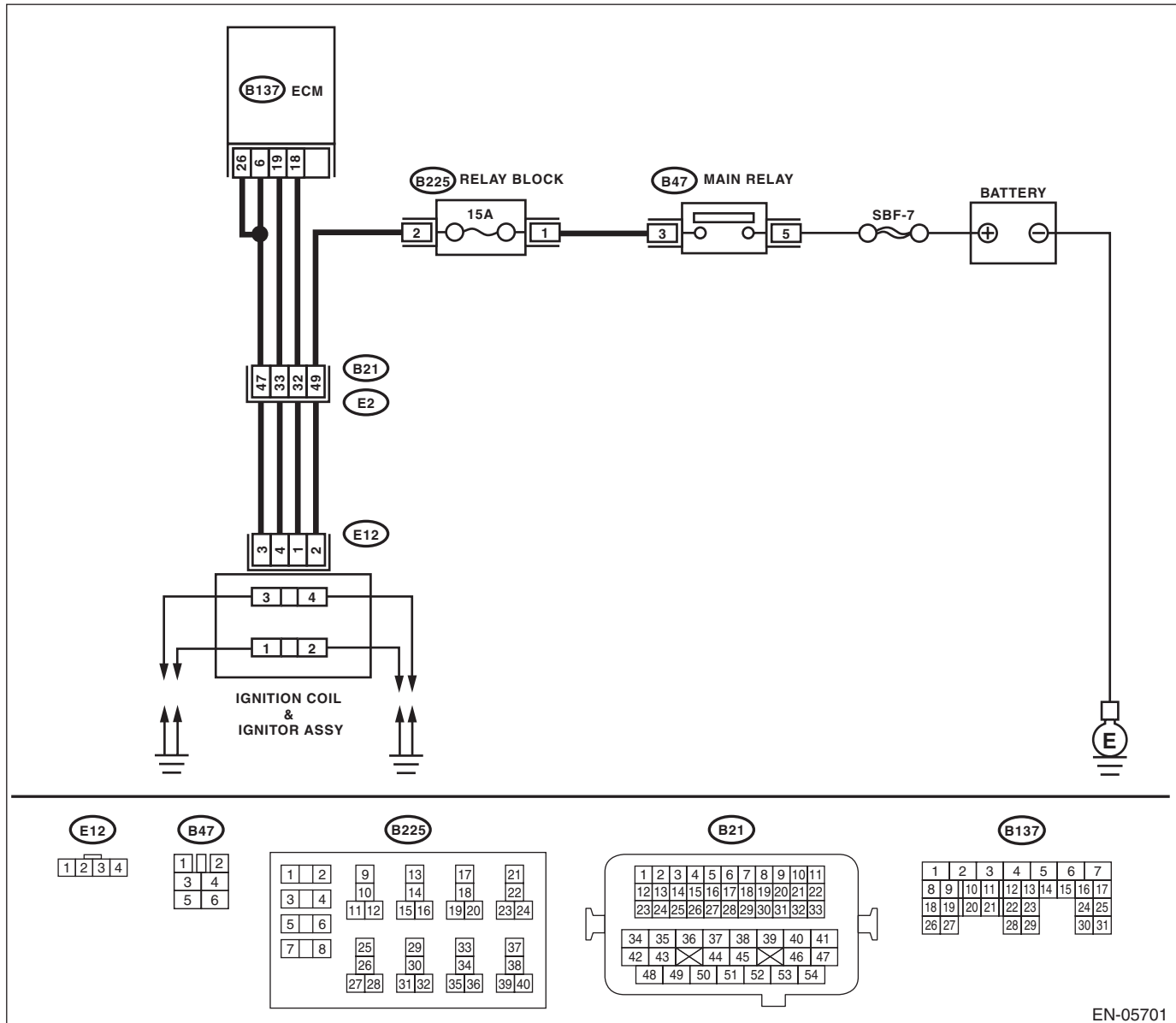
# Diagnostics for Engine Starting Failure

## D: IGNITION CONTROL SYSTEM

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05701

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK IGNITION SYSTEM FOR SPARKS.</b></p> <p>1) Remove the plug cord cap from each spark plug.</p> <p>2) Install a new spark plug on plug cord cap.</p> <p><b>CAUTION:</b> <b>Do not remove the spark plug from engine.</b></p> <p>3) Contact the spark plug thread portion to engine.</p> <p>4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder.</p>	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4SO)(diag)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.
<p><b>2</b></p> <p><b>CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL AND IGNITOR ASSEMBLY.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ignition coil and ignitor assembly.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the power supply voltage between ignition coil and ignitor assembly connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E12) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit of harness between the ignition coil and ignitor assembly, and main relay connector • Poor contact of coupling connector • Blown out of fuse
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN IGNITION COIL AND IGNITOR ASSEMBLY, AND ECM.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance between the ignition coil and ignitor assembly connector, and ECM.</p> <p><b>Connector &amp; terminal</b> <b>(E12) No. 3 — (B137) No. 6:</b> <b>(E12) No. 3 — (B137) No. 26:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: Open circuit in harness between ignition coil and ignitor assembly connector, and ECM
<p><b>4</b></p> <p><b>CHECK IGNITION COIL AND IGNITOR ASSEMBLY.</b></p> <p>1) Remove the spark plug cords.</p> <p>2) Measure the resistance between spark plug cord contact portions to check secondary coil.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b> <b>No. 3 — No. 4:</b></p>	Is the resistance between 10 and 15 kΩ?	Go to step 5.	Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.>
<p><b>5</b></p> <p><b>CHECK INPUT SIGNAL FOR IGNITION COIL AND IGNITOR ASSEMBLY.</b></p> <p>1) Connect the connector to the Ignition coil and ignitor assembly.</p> <p>2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil and ignitor assembly connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E12) No. 1 (+) — Engine ground (-):</b> <b>(E12) No. 4 (+) — Engine ground (-):</b></p>	Does the voltage vary 10 V or more?	Go to step 6.	Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.>



# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Disconnect the connector from the ignition coil and ignitor assembly.                      4) Measure the resistance of harness between ECM and ignition coil and ignitor assembly connector.</p> <p><b>Connector &amp; terminal</b>  <i>(B137) No. 18 — (E12) No. 1:</i>  <i>(B137) No. 19 — (E12) No. 4:</i></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 7.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and ignition coil and ignitor assembly connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>7</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.</b></p> <p>Measure the resistance of harness between ECM and engine ground.</p> <p><b>Connector &amp; terminal:</b>  <i>(B137) No. 18 — Engine ground:</i>  <i>(B137) No. 19 — Engine ground:</i></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 8.</p>	<p>Repair the ground short circuit of harness between ECM and ignition coil and ignitor assembly connector.</p>
<p><b>8</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the ECM connector.</p>	<p>Is there poor contact in ECM connector?</p>	<p>Repair poor contact of the ECM connector.</p>	<p>Check fuel pump circuit. &lt;Ref. to EN(H4SO)(diag)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.&gt;</p>

# Diagnostics for Engine Starting Failure

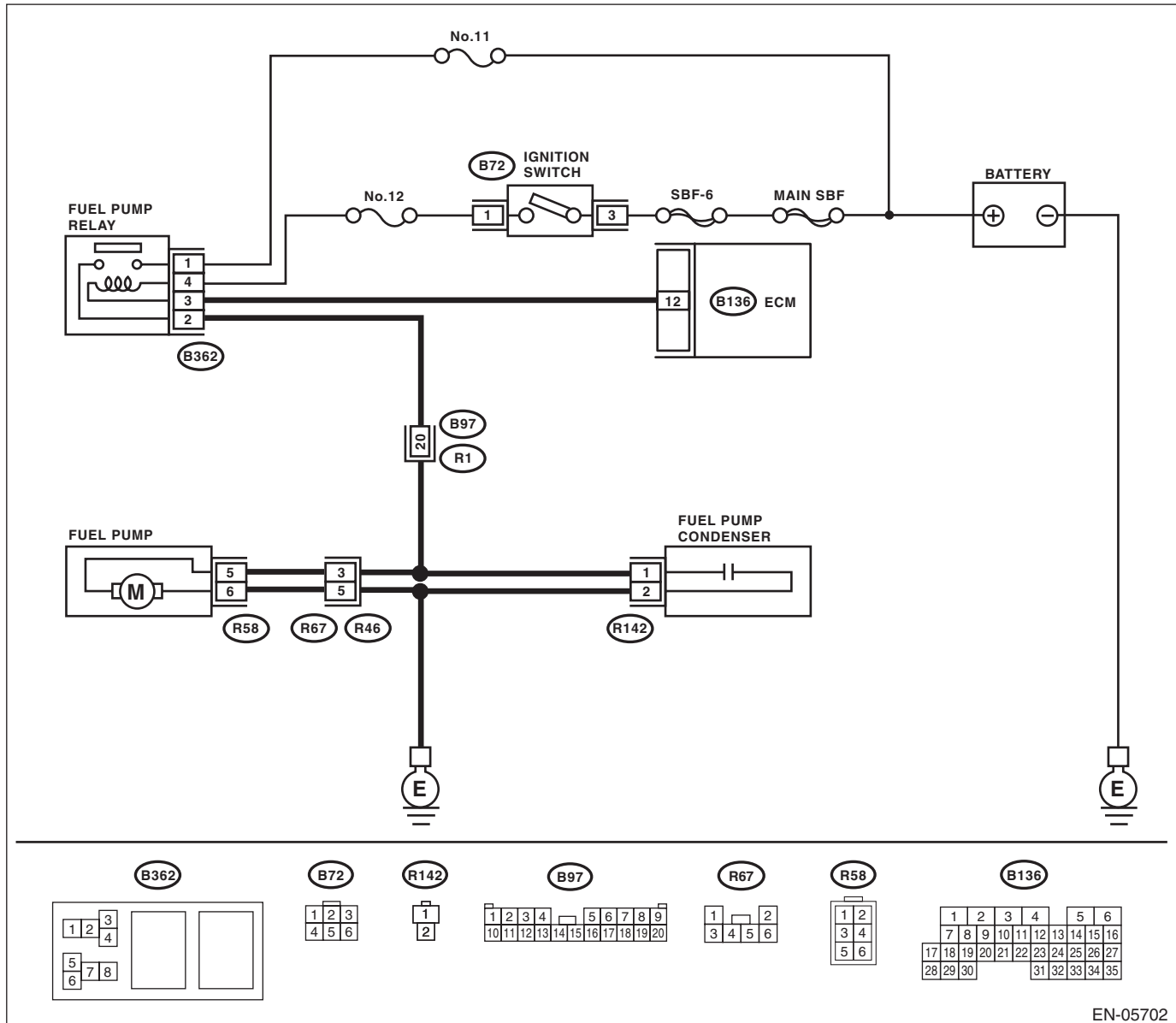
ENGINE (DIAGNOSTICS)

## E: FUEL PUMP CIRCUIT

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05702

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK OPERATING SOUND OF FUEL PUMP.</b> Make sure that the fuel pump operates for two seconds when turning the ignition switch to ON. NOTE: Fuel pump operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to “Compulsory Valve Operation Check Mode”. &lt;Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.&gt;</p>	Does the fuel pump emit operating sound?	Check the fuel injector circuit. <Ref. to EN(H4SO)(diag)-81, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.
<p><b>2 CHECK GROUND CIRCUIT OF FUEL PUMP.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuel pump access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the resistance of harness connector between fuel pump and chassis ground. <b>Connector &amp; terminal</b> <b>(R58) No. 6 — Chassis ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: Open circuit in harness between fuel pump connector and chassis grounding terminal
<p><b>3 CHECK POWER SUPPLY TO FUEL PUMP.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground. <b>Connector &amp; terminal</b> <b>(R58) No. 5 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Replace the fuel pump. <Ref. to FU(H4SO)-53, Fuel Pump.>	Go to step 4.
<p><b>4 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness connector between fuel pump and fuel pump relay. <b>Connector &amp; terminal</b> <b>(R58) No. 5 — (B362) No. 2:</b></p>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact of coupling connector
<p><b>5 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.</b> Measure the resistance of harness between fuel pump and fuel pump relay connector. <b>Connector &amp; terminal</b> <b>(R58) No. 5 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 6.	Repair the short circuit of harness between fuel pump and fuel pump relay connector.
<p><b>6 CHECK FUEL PUMP RELAY.</b> 1) Disconnect the connectors from fuel pump relay and main relay. 2) Remove the fuel pump relay and main relay with bracket. 3) Connect the battery to fuel pump relay connector terminals No. 3 and No. 4. 4) Measure the resistance between connector terminals of fuel pump relay. <b>Terminals</b> <b>No. 1 — No. 2:</b></p>	Is the resistance less than 10 Ω?	Go to step 7.	Replace the fuel pump relay. <Ref. to FU(H4SO)-39, Fuel Pump Relay.>

## Diagnostics for Engine Starting Failure

### ENGINE (DIAGNOSTICS)

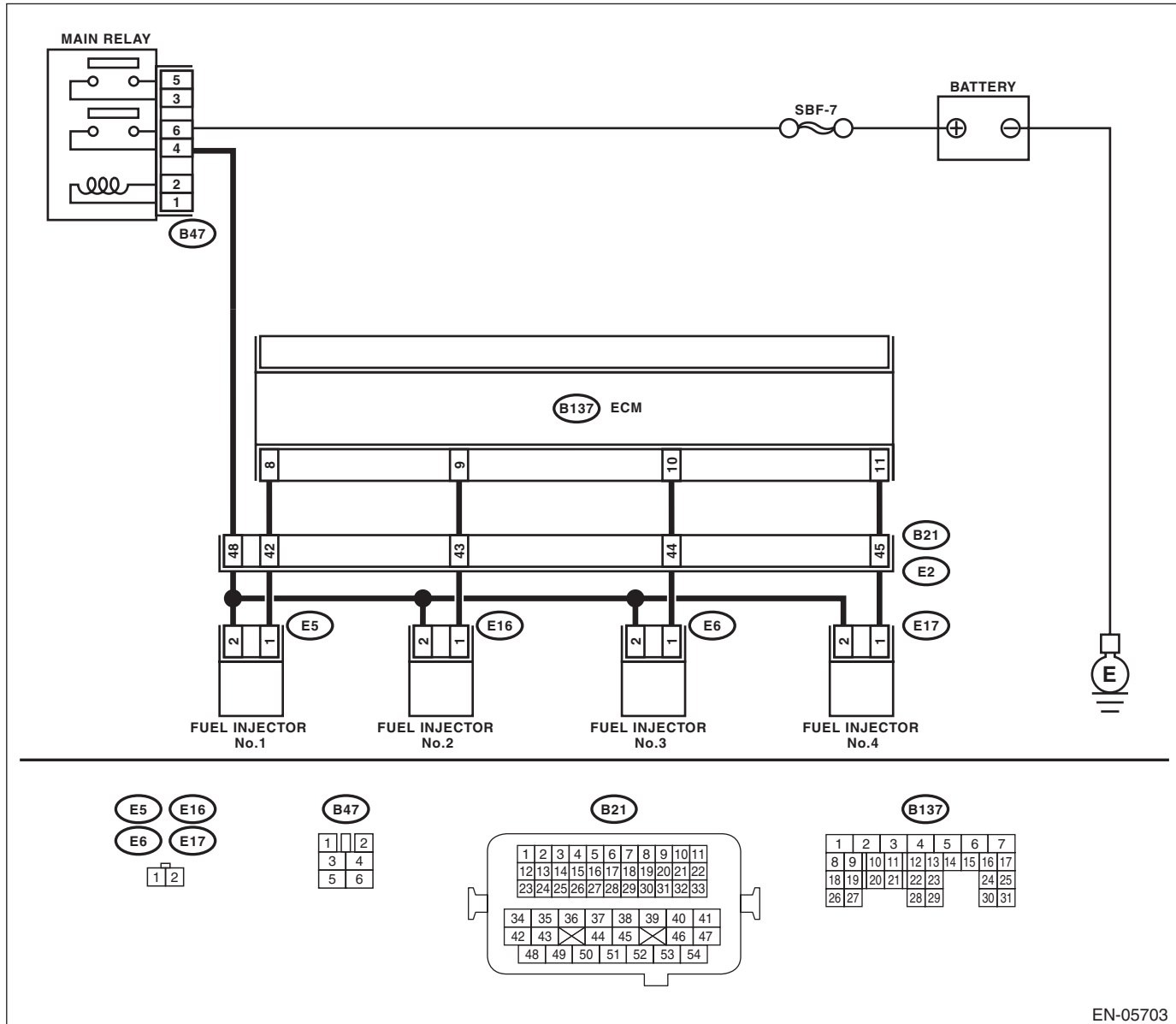
Step	Check	Yes	No
<b>7</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and fuel pump relay connector. <b>Connector &amp; terminal</b> <b>(B136) No. 12 — (B362) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 8.	Repair the open circuit of harness between ECM and fuel pump relay connector.
<b>8</b> <b>CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Check the fuel injector circuit. <Ref. to EN(H4SO)(diag)-81, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

## F: FUEL INJECTOR CIRCUIT

### CAUTION:

- Check or repair only faulty parts.
- After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05703

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OPERATION OF EACH FUEL INJECTOR.</b> While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector for this check.	Does the fuel pump emit operating sound?	Check the fuel pressure. <Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.>	Go to step 2.
<b>2 CHECK POWER SUPPLY TO EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between fuel injector terminal and engine ground. <b>Connector &amp; terminal</b> <b>#1 (E5) No. 2 (+) — Engine ground (-):</b> <b>#2 (E16) No. 2 (+) — Engine ground (-):</b> <b>#3 (E6) No. 2 (+) — Engine ground (-):</b> <b>#4 (E17) No. 2 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and fuel injector connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of fuel injector connector</li> </ul>
<b>3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 — (E5) No. 1:</b> <b>#2 (B137) No. 9 — (E16) No. 1:</b> <b>#3 (B137) No. 10 — (E6) No. 1:</b> <b>#4 (B137) No. 11 — (E17) No. 1:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> Measure the resistance of harness between ECM and fuel injector connector. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 — Chassis ground:</b> <b>#2 (B137) No. 9 — Chassis ground:</b> <b>#3 (B137) No. 10 — Chassis ground:</b> <b>#4 (B137) No. 11 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and fuel injector connector.
<b>5 CHECK EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 5 — 20 Ω?	Go to step 6.	Replace the faulty fuel injector.
<b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Inspection using “General Diagnostic Table” <Ref. to EN(H4SO)(diag)-307, INSPECTION, General Diagnostic Table.>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 18. List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Item	Reference
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to EN(H4SO)(diag)-90, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to EN(H4SO)(diag)-92, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-94, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-96, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-98, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-100, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-102, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to EN(H4SO)(diag)-104, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to EN(H4SO)(diag)-106, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to EN(H4SO)(diag)-108, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to EN(H4SO)(diag)-110, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to EN(H4SO)(diag)-112, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-114, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4SO)(diag)-116, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H4SO)(diag)-118, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4SO)(diag)-120, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H4SO)(diag)-122, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-124, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H4SO)(diag)-126, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to EN(H4SO)(diag)-128, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H4SO)(diag)-130, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H4SO)(diag)-132, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	<Ref. to EN(H4SO)(diag)-134, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	<Ref. to EN(H4SO)(diag)-136, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H4SO)(diag)-138, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to EN(H4SO)(diag)-139, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4SO)(diag)-140, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-141, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-143, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-145, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-147, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-149, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-151, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-153, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to EN(H4SO)(diag)-155, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0172	System Too Rich (Bank 1)	<Ref. to EN(H4SO)(diag)-158, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-160, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to EN(H4SO)(diag)-162, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to EN(H4SO)(diag)-164, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-166, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0197	Engine Oil Temperature Sensor Low	<Ref. to EN(H4SO)(diag)-168, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0198	Engine Oil Temperature Sensor High	<Ref. to EN(H4SO)(diag)-170, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	<Ref. to EN(H4SO)(diag)-172, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	<Ref. to EN(H4SO)(diag)-174, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4SO)(diag)-175, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4SO)(diag)-175, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4SO)(diag)-175, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4SO)(diag)-176, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-182, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-184, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to EN(H4SO)(diag)-186, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-188, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-190, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-192, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0400	Exhaust Gas Recirculation Flow	<Ref. to EN(H4SO)(diag)-194, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4SO)(diag)-196, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to EN(H4SO)(diag)-200, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to EN(H4SO)(diag)-203, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to EN(H4SO)(diag)-205, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to EN(H4SO)(diag)-207, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to EN(H4SO)(diag)-209, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H4SO)(diag)-211, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H4SO)(diag)-213, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to EN(H4SO)(diag)-216, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H4SO)(diag)-219, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to EN(H4SO)(diag)-221, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor "A" Circuit Range /Performance	<Ref. to EN(H4SO)(diag)-222, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to EN(H4SO)(diag)-222, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to EN(H4SO)(diag)-223, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H4SO)(diag)-223, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor "A"	<Ref. to EN(H4SO)(diag)-224, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to EN(H4SO)(diag)-225, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to EN(H4SO)(diag)-227, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4SO)(diag)-229, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0600	Serial Communication Link	<Ref. to EN(H4SO)(diag)-230, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4SO)(diag)-231, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4SO)(diag)-232, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Control Module Performance	<Ref. to EN(H4SO)(diag)-233, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range /Performance (Bank 1)	<Ref. to EN(H4SO)(diag)-234, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H4SO)(diag)-234, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to EN(H4SO)(diag)-235, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Park/Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4SO)(diag)-237, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to EN(H4SO)(diag)-239, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4SO)(diag)-241, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1152	O2 Sensor Circuit Range /Performance (Low) (Bank1 Sensor1)	<Ref. to EN(H4SO)(diag)-243, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1153	O2 Sensor Circuit Range /Performance (High) (Bank1 Sensor1)	<Ref. to EN(H4SO)(diag)-245, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4SO)(diag)-246, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4SO)(diag)-247, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to EN(H4SO)(diag)-249, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to EN(H4SO)(diag)-251, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to EN(H4SO)(diag)-253, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-255, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-256, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-259, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up Voltage Circuit Malfunction	<Ref. to EN(H4SO)(diag)-261, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-19, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1574	KEY Communication Failure	<Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	<Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1602	Control Module Programming Error	<Ref. to EN(H4SO)(diag)-263, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to EN(H4SO)(diag)-273, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to EN(H4SO)(diag)-278, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H4SO)(diag)-288, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H4SO)(diag)-290, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to EN(H4SO)(diag)-291, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to EN(H4SO)(diag)-292, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to EN(H4SO)(diag)-294, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to EN(H4SO)(diag)-296, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	<Ref. to EN(H4SO)(diag)-298, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	<Ref. to EN(H4SO)(diag)-300, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	<Ref. to EN(H4SO)(diag)-303, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2227	Barometric Pressure Circuit Range /Performance	<Ref. to EN(H4SO)(diag)-305, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2228	Barometric Pressure Circuit Low	<Ref. to EN(H4SO)(diag)-305, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2229	Barometric Pressure Circuit High	<Ref. to EN(H4SO)(diag)-306, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 19. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE /PERFORMANCE (BANK 1)

#### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

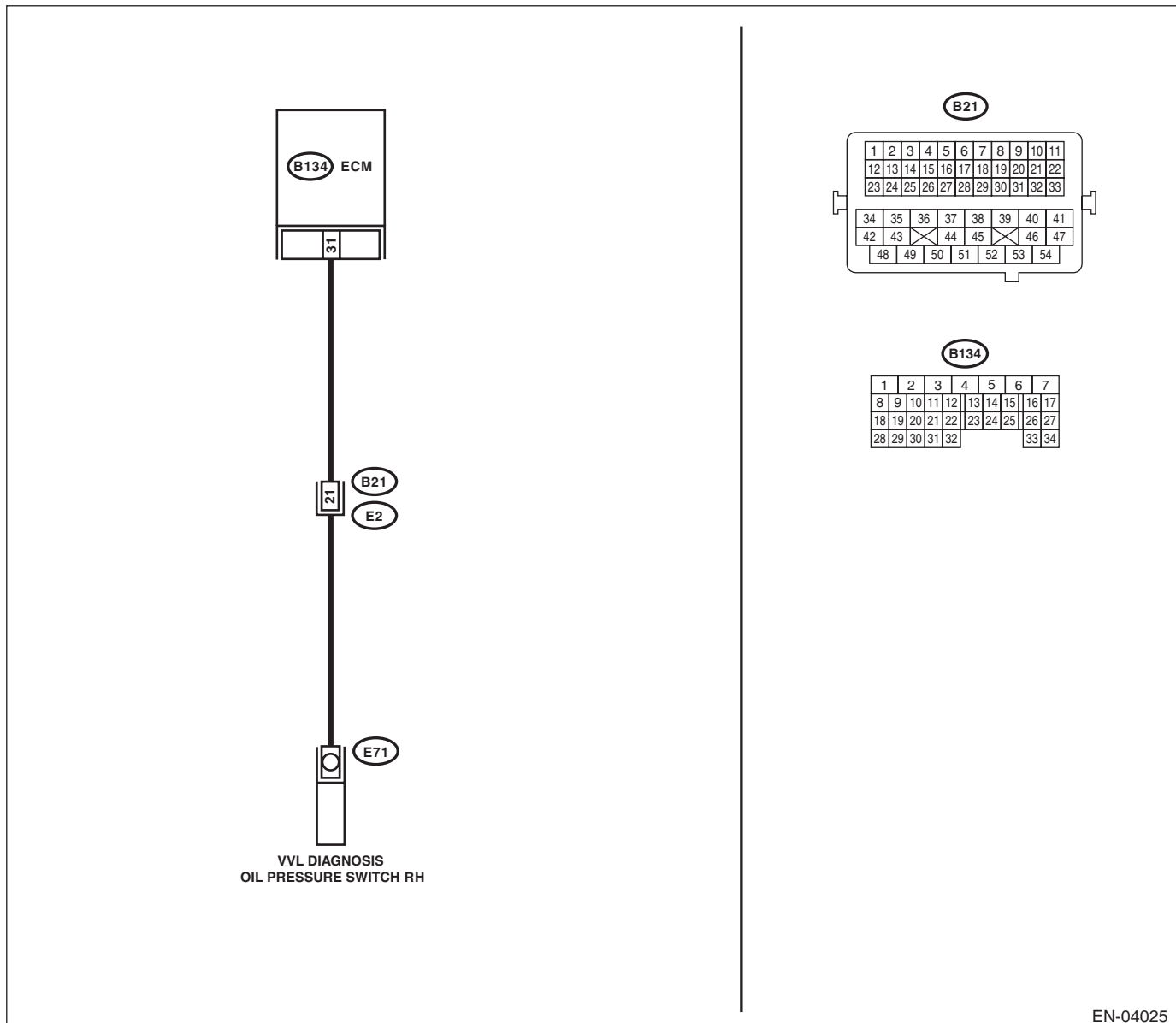
#### TROUBLE SYMPTOM:

Erroneous idling

#### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

#### WIRING DIAGRAM:



EN-04025

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 31 — (E71) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>Measure the resistance between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E71) No. 1 — Engine ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E71) No. 1 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power of the harness between the ECM and variable valve lift diagnosis oil pressure switch connector.	Go to step 4.
<p><b>4</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Replace the oil switching solenoid valve. <Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.> Go to step 5.	END.
<p><b>5</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Check for oil routing.	END.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE /PERFORMANCE (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-11, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

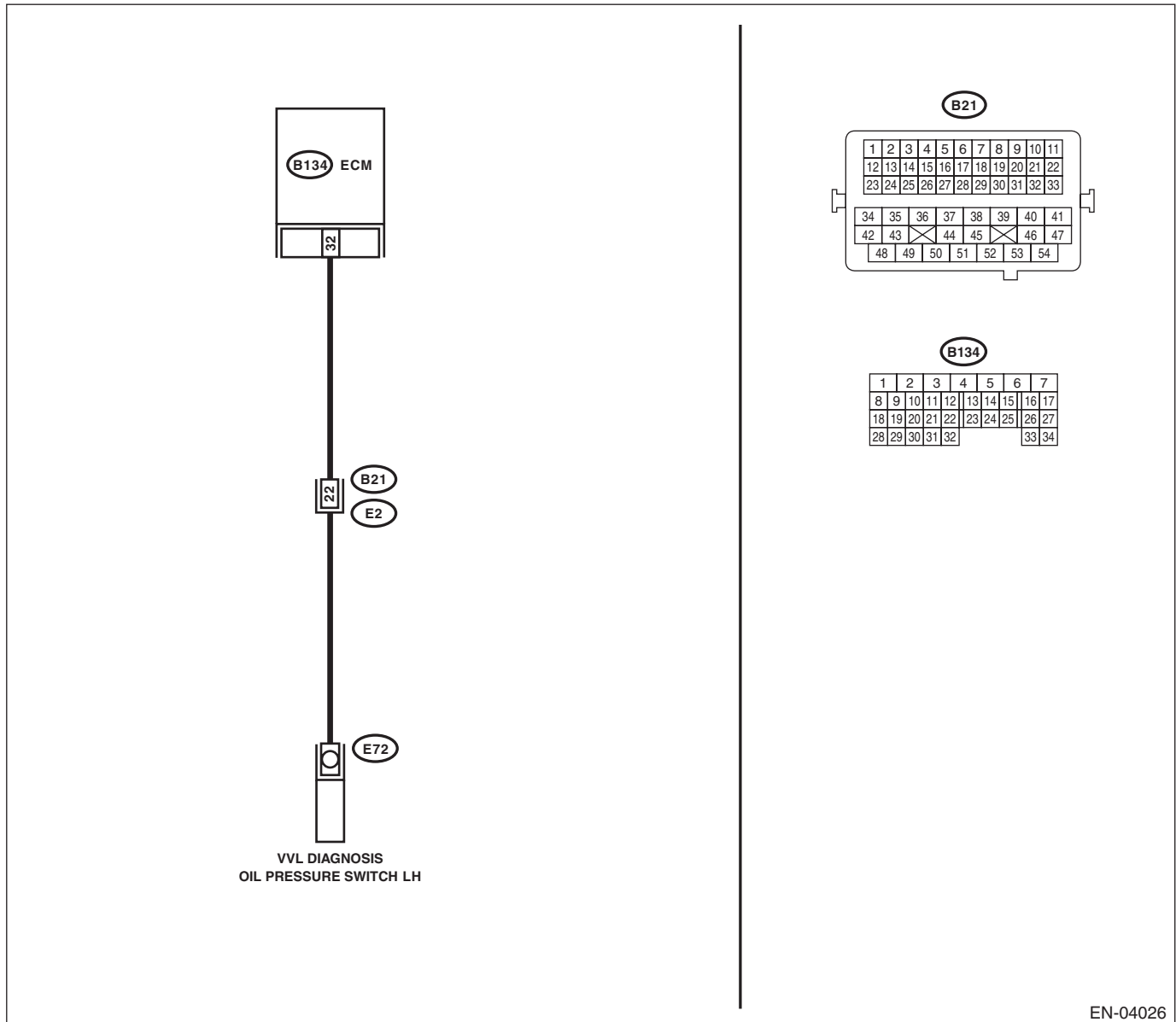
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 32 — (E72) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>Measure the resistance between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E72) No. 1 — Engine ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E72) No. 1 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power of the harness between the ECM and variable valve lift diagnosis oil pressure switch connector.	Go to step 4.
<p><b>4</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Replace the oil switching solenoid valve. <Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.> Go to step 5.	END.
<p><b>5</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Check for oil routing.	END.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## C: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

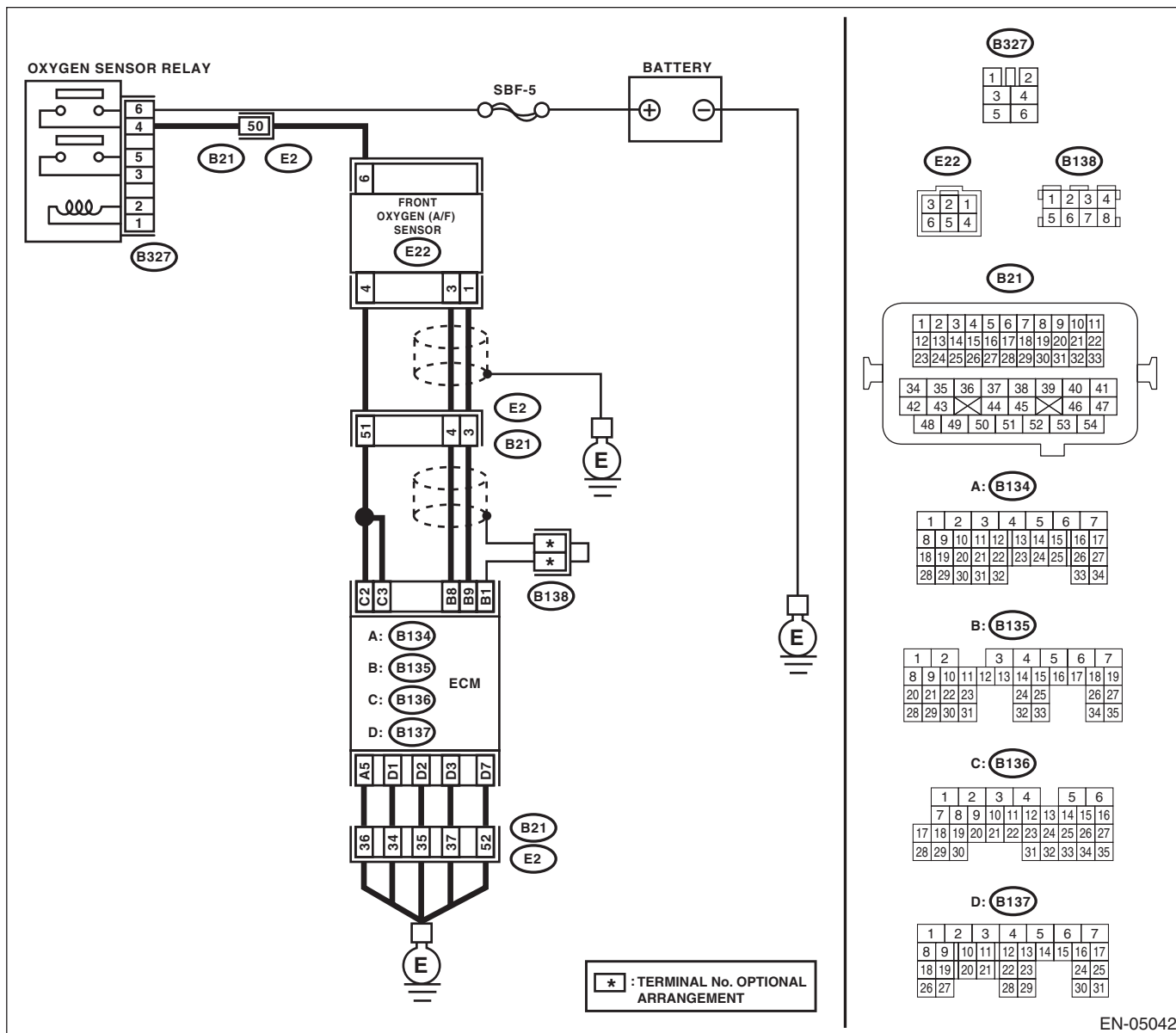
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-12, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Start and warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B136) No. 2 — (E22) No. 4:</b> <b>(B136) No. 3 — (E22) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E22) No. 1:</b> <b>(B135) No. 8 — (E22) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR.</b> Measure the resistance between front oxygen (A/F) sensor connector terminals. <b>Terminals</b> <b>No. 6 — No. 4:</b>	Is the resistance less than 5 Ω?	Go to step 4.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>
<b>4</b> <b>CHECK POOR CONTACT.</b> Check poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## D: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

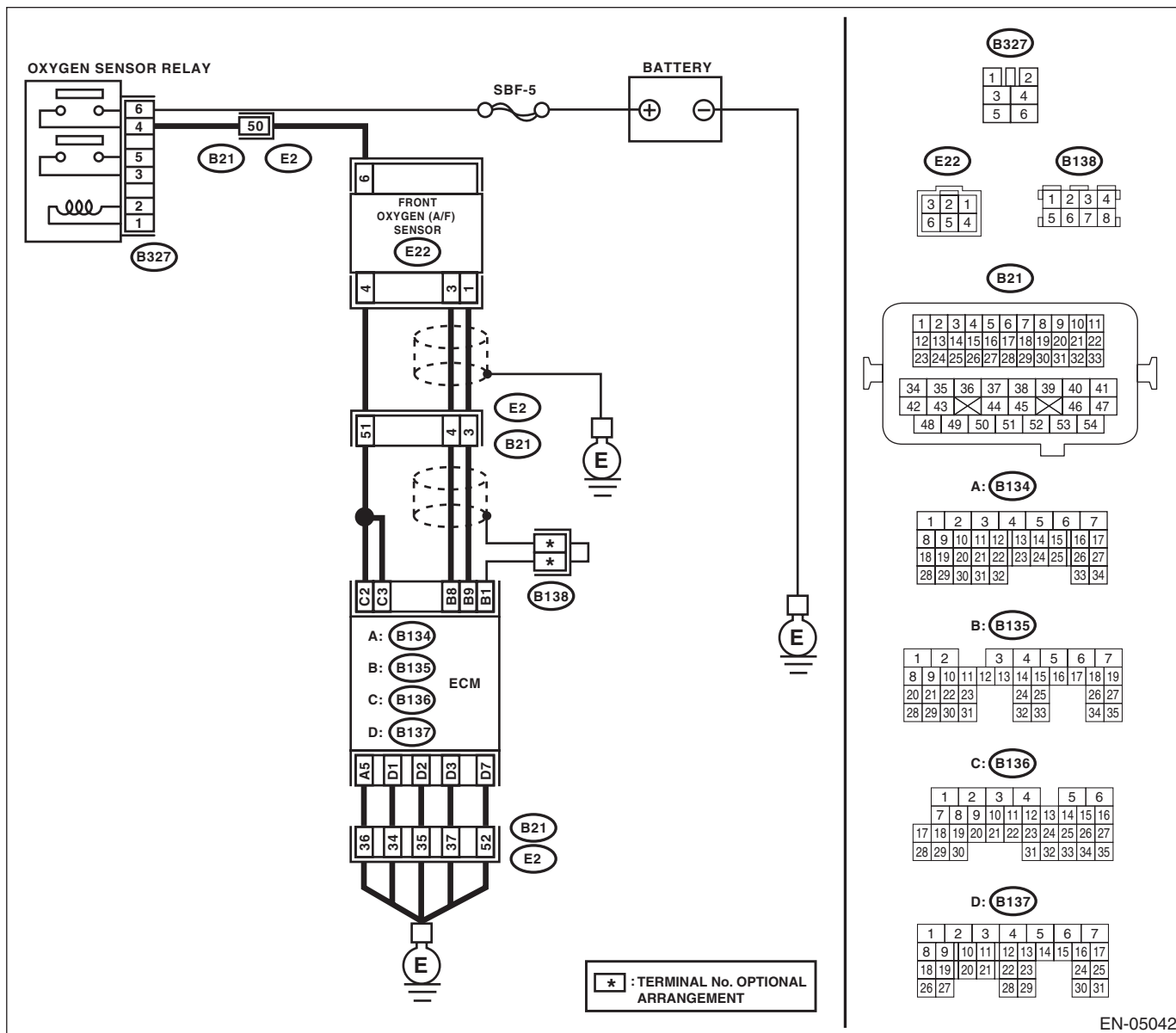
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-14, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E22) No. 6 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the power supply line or replace the main relay.  NOTE: In this case, repair the following item: • Open circuit in harness between A/F, oxygen sensor relay and front oxygen (A/F) sensor connector • Poor contact in A/F, oxygen sensor relay connector • Poor contact in coupling connector
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B136) No. 2 — (E22) No. 4:</b> <b>(B136) No. 3 — (E22) No. 4:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor.
<b>3</b> <b>CHECK GROUND CIRCUIT FOR ECM.</b> Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<b>4</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR.</b> Measure the resistance between front oxygen (A/F) sensor connector terminals. <b>Terminals</b> <b>No. 6 — No. 4:</b>	Is the resistance between 2 — 3 $\Omega$ ?	Repair poor contact of the ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## E: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

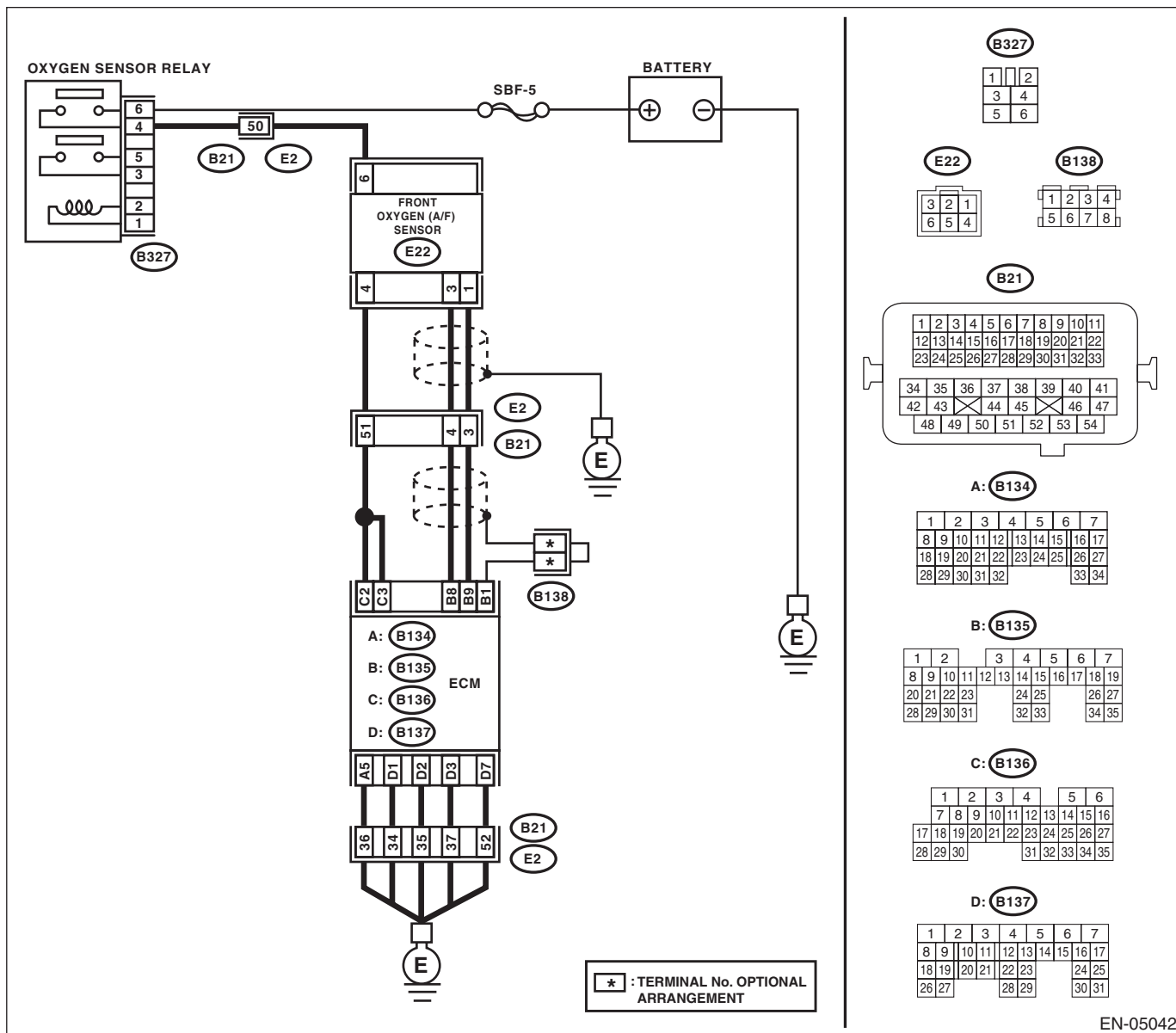
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-16, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B136) No. 2 (+) — Chassis ground (-):</b></p> <p><b>(B136) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>1) Disconnect the connectors from the ECM.</p> <p>2) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B134) No. 5 — Chassis ground:</b></p> <p><b>(B137) No. 1 — Chassis ground:</b></p> <p><b>(B137) No. 2 — Chassis ground:</b></p> <p><b>(B137) No. 3 — Chassis ground:</b></p> <p><b>(B137) No. 7 — Chassis ground:</b></p>	<p>Is the resistance less than 5 <math>\Omega</math>?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b></p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## F: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

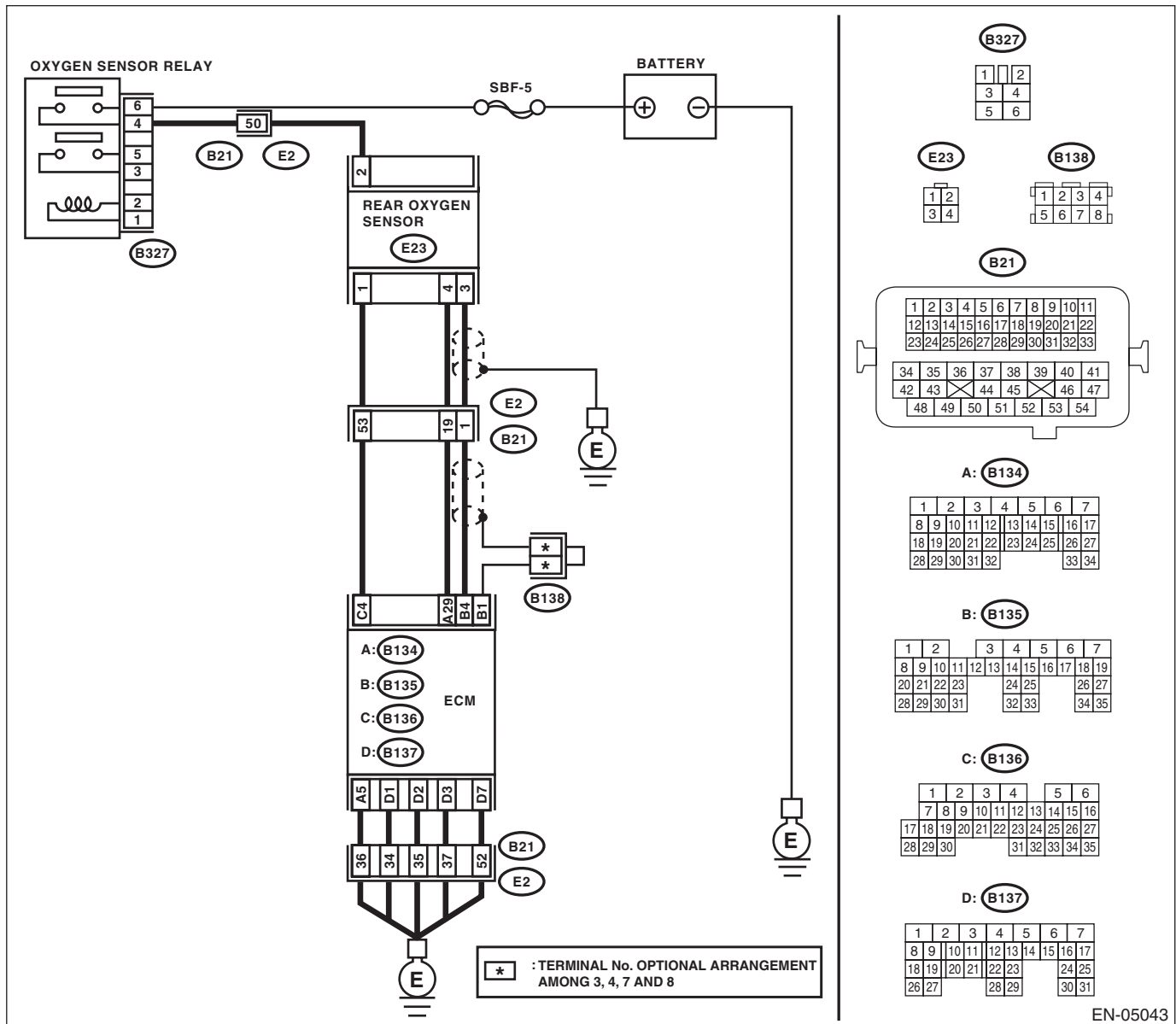
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-18, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



**B327**

1	2
3	4
5	6

**E23**

1	2
3	4

**B138**

1	2	3	4
5	6	7	8

**B21**

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	*	44	45	*	46	47			
48	49	50	51	52	53	54				

**A: B134**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	
28	29	30	31	32		33
						34

**B: B135**

1	2		3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25		26	27			
28	29	30	31		32	33	
							34
							35

**C: B136**

1	2	3	4		5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30		31	32	33
						34
						35

**D: B137**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17		18	19	20
21	22	23		24	25	
26	27		28	29		30
						31

EN-05043



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and engine ground.  <b>Connector &amp; terminal</b>  <b>(E23) No. 2 (+) — Engine ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 2.</p>	<p>Repair the power supply line or replace the main relay.                      NOTE:                      In this case, repair the following item:                      • Open circuit in harness between A/F, oxygen sensor relay and rear oxygen sensor                      • Poor contact in A/F, oxygen sensor relay connector                      • Poor contact in coupling connector</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance between ECM and oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B136) No. 4 — (E23) No. 1:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 3.</p>	<p>Repair the open circuit of the harness between ECM and rear oxygen sensor.</p>
<p><b>3</b></p> <p><b>CHECK GROUND CIRCUIT FOR ECM.</b>                      Measure the resistance of harness between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	<p>Is the resistance less than 5 <math>\Omega</math>?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.                      NOTE:                      In this case, repair the following item:                      • Open circuit of harness between ECM and engine ground                      • Poor contact in ECM connector                      • Poor contact of coupling connector</p>
<p><b>4</b></p> <p><b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor connector terminals.  <b>Terminals</b>  <b>No. 2 — No. 1:</b></p>	<p>Is the resistance between 5 — 7 <math>\Omega</math>?</p>	<p>Repair poor contact of the ECM connector.</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H4SO)-35, Rear Oxygen Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## G: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

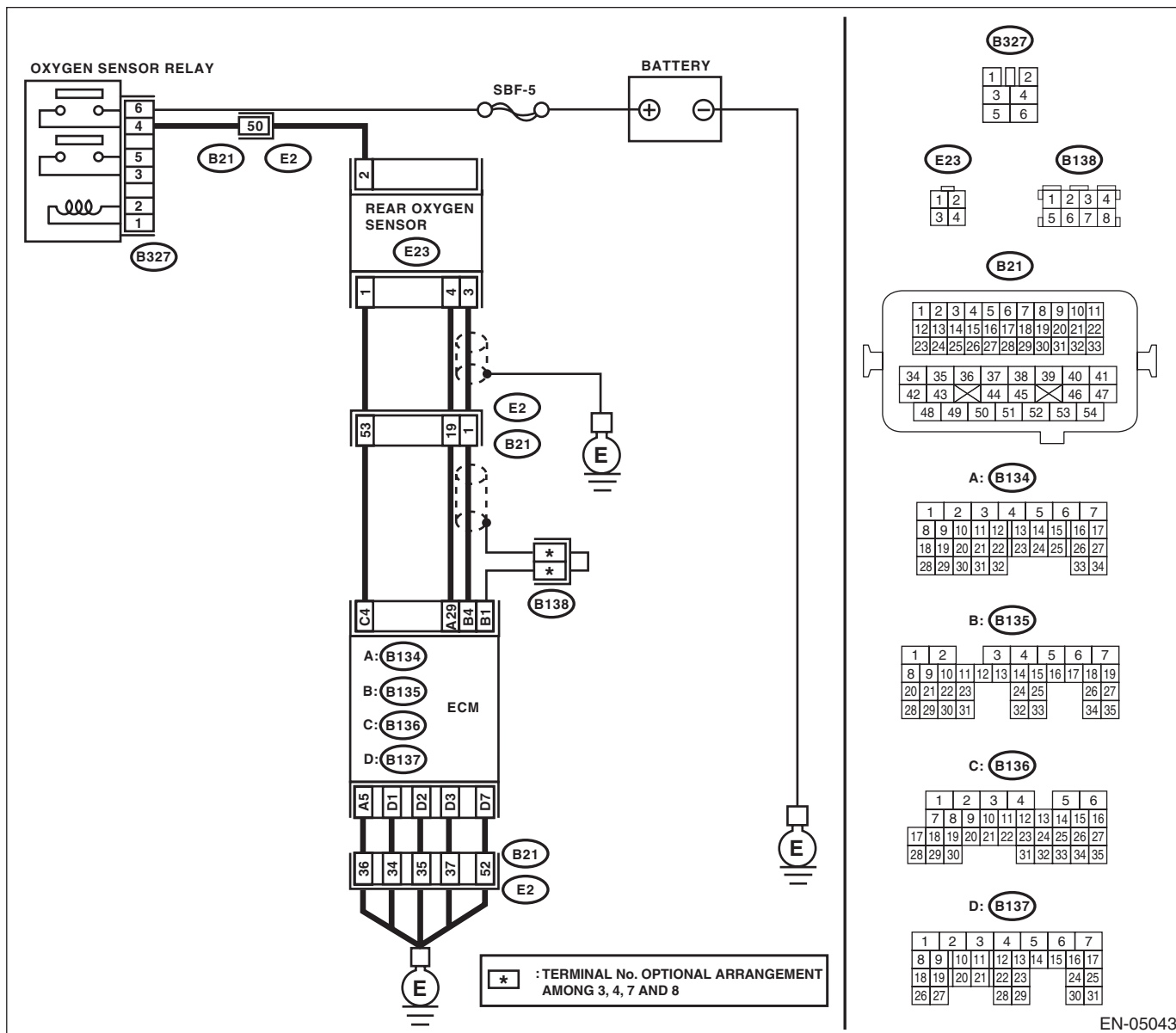
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-20, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05043

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 4 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector.	Go to step 2.
2	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>1) Disconnect the connectors from the ECM.</p> <p>2) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 Ω?	Repair the poor contact of the ECM connector.	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>            In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

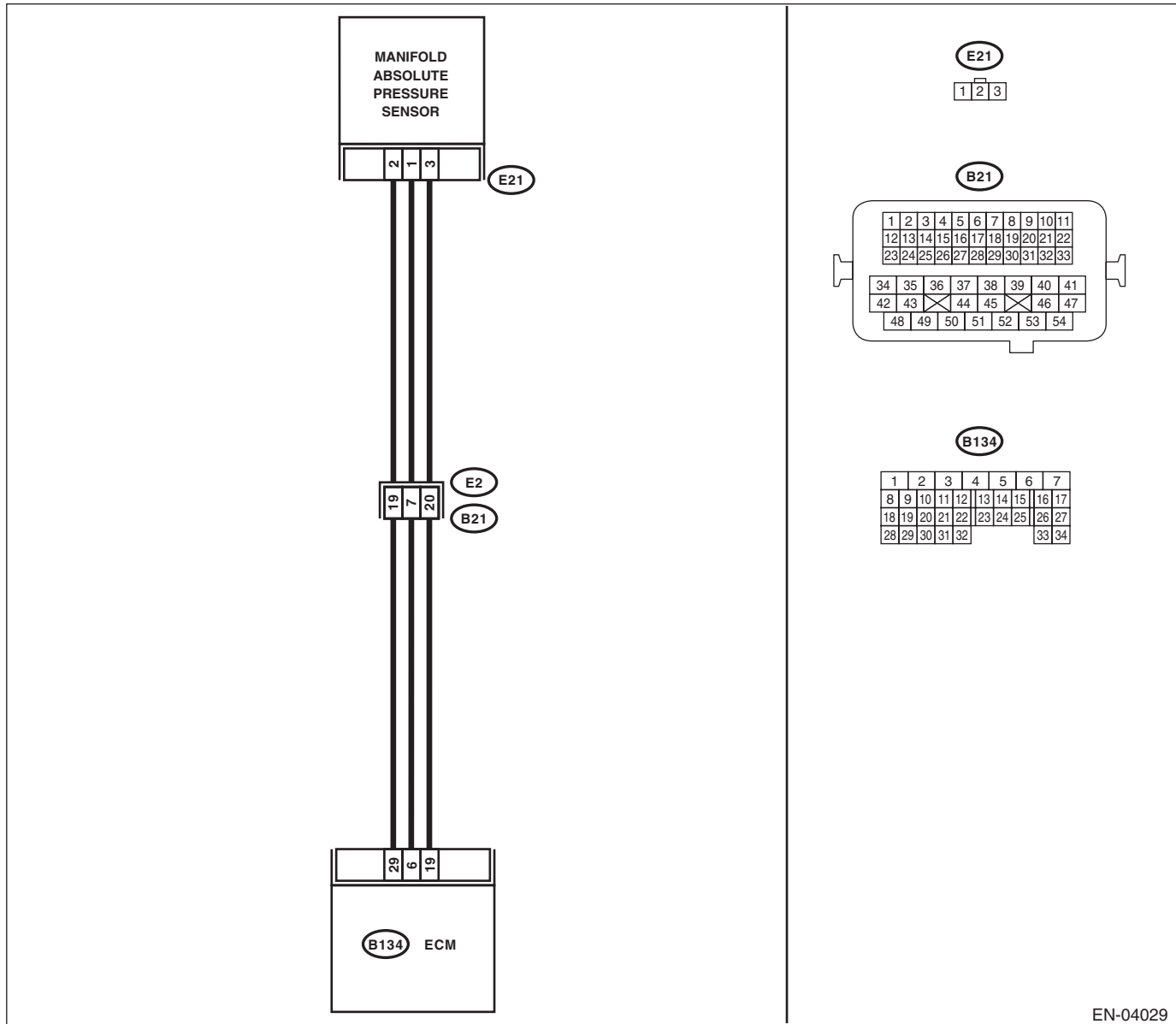
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-22, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04029

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 2.
2	<b>CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) during idling?	Go to step 3.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-25, Manifold Absolute Pressure Sensor.>
3	<b>CHECK THROTTLE OPENING ANGLE.</b> Read the data of throttle position signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value less than 5% when throttle is fully closed?	Go to step 4.	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>
4	<b>CHECK THROTTLE OPENING ANGLE.</b>	Is the measured value 85% or more when throttle is fully open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-25, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-25, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

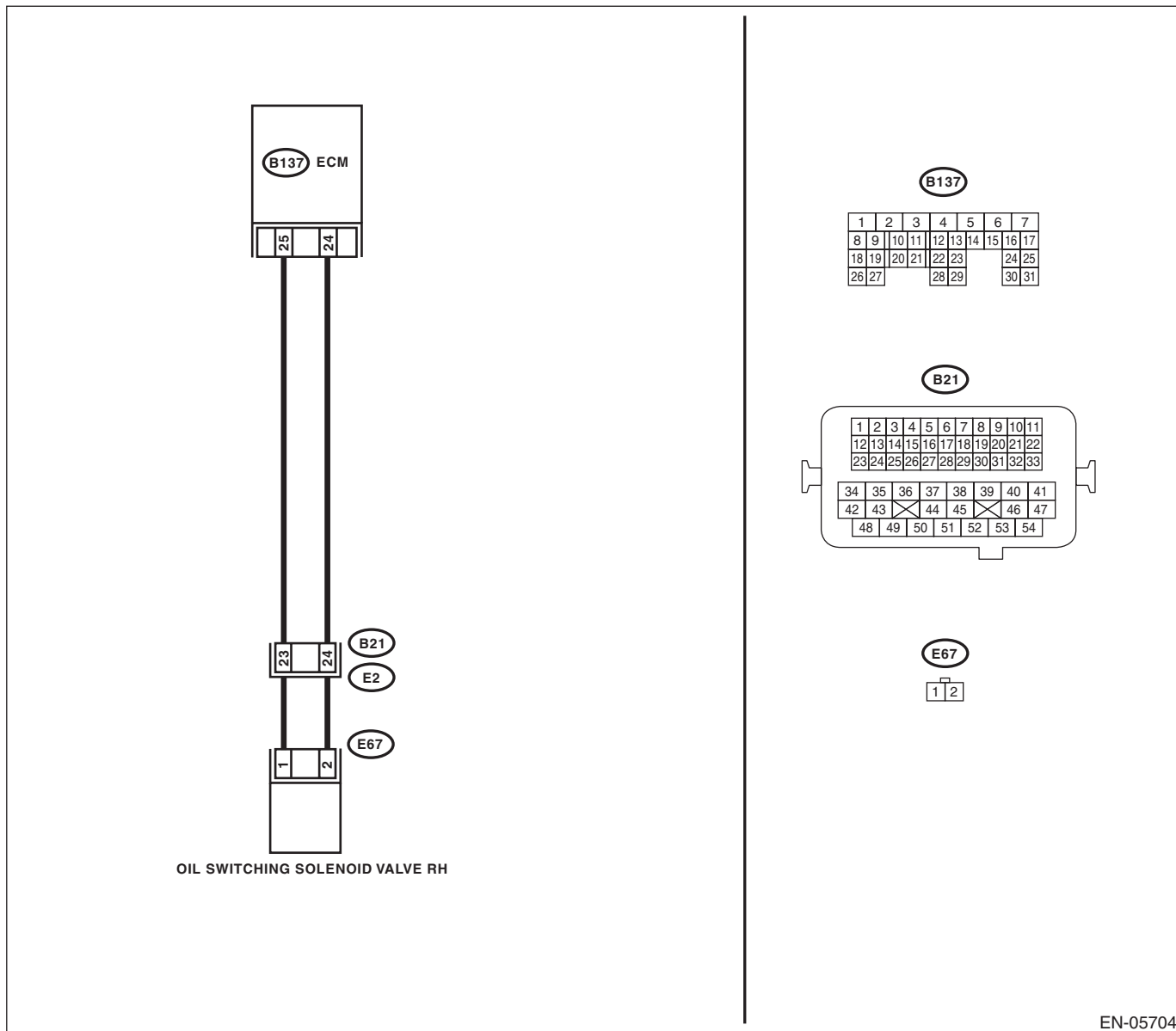
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05704

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the resistance of harness between ECM and oil switching solenoid valve.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — (E67) No. 1:</b>  <b>(B137) No. 24 — (E67) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — Chassis ground:</b>  <b>(B137) No. 24 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and oil switching solenoid valve connector.</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-26, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

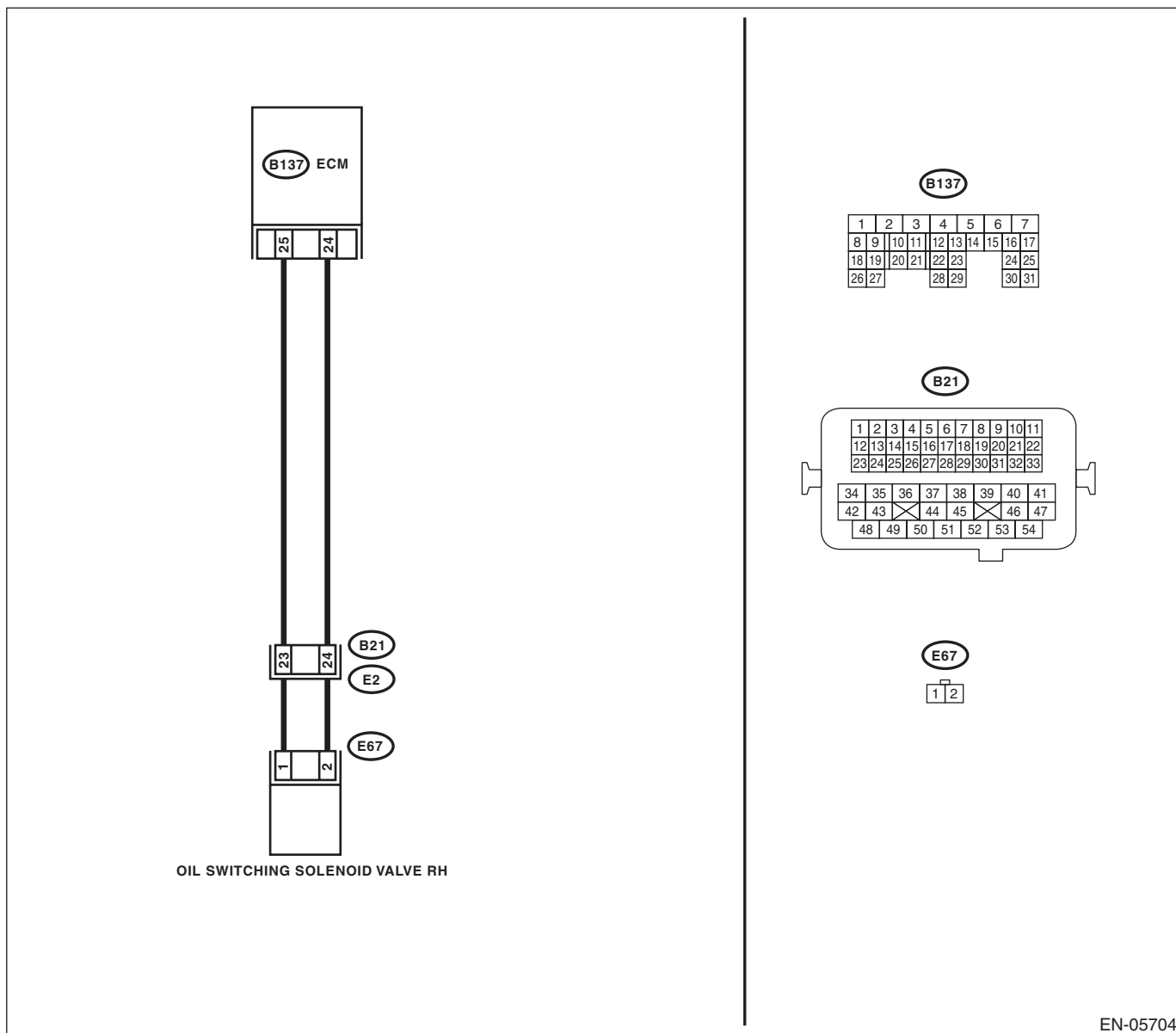
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05704



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 (+) — Chassis ground (-):</b>  <b>(B137) No. 24 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V?</p>	<p>Go to step 2.</p>	<p>Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector.</p>
<p><b>2</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance of harness between ECM and oil switching solenoid valve connector.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — (E67) No. 1:</b>  <b>(B137) No. 24 — (E67) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>3</b>     <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-27, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

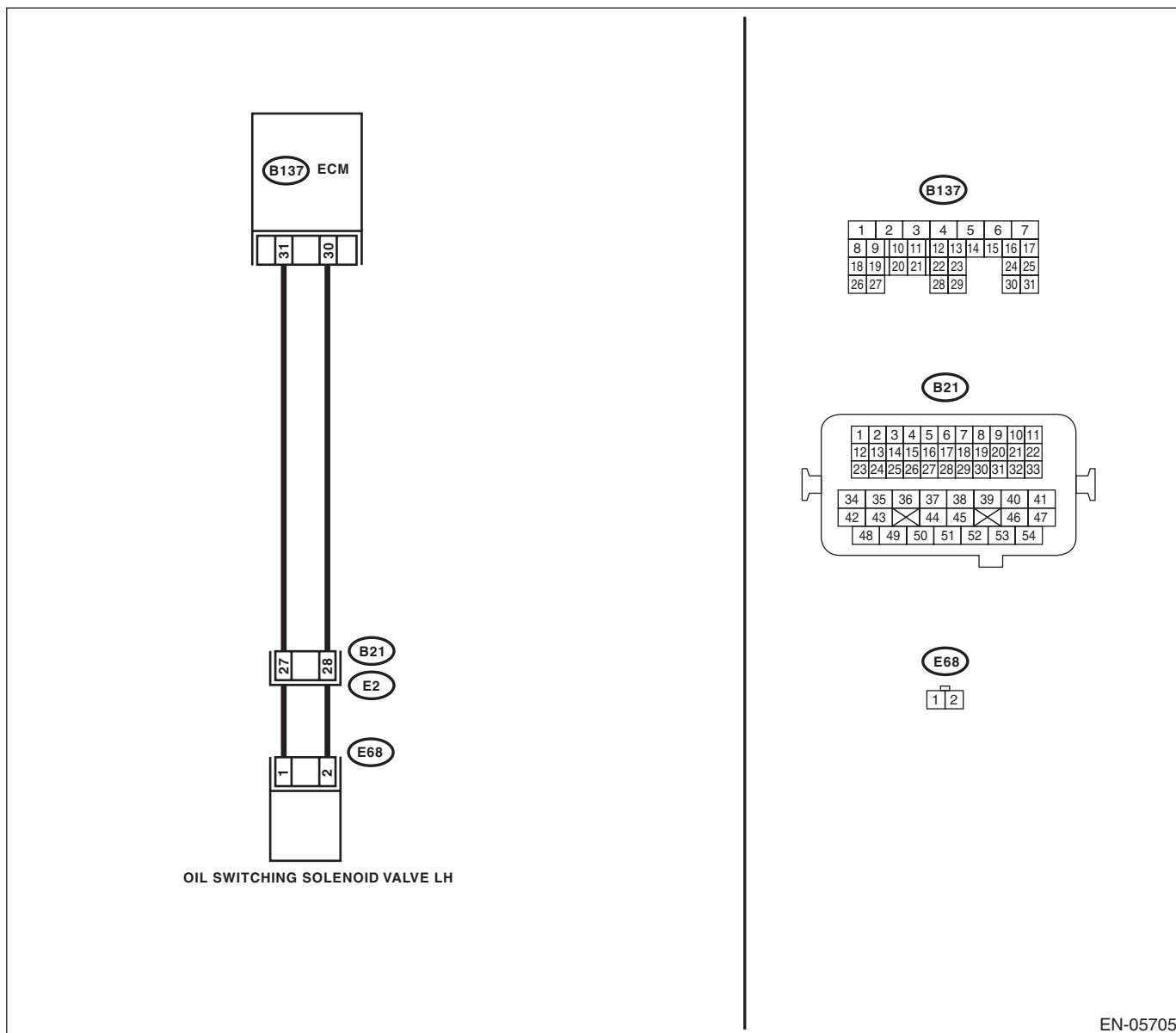
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05705

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the resistance between ECM and oil switching solenoid valve.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — (E68) No. 1:</b>  <b>(B137) No. 30 — (E68) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — Chassis ground:</b>  <b>(B137) No. 30 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and oil switching solenoid valve connector.</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION<Ref. to GD(H4SO)-27, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

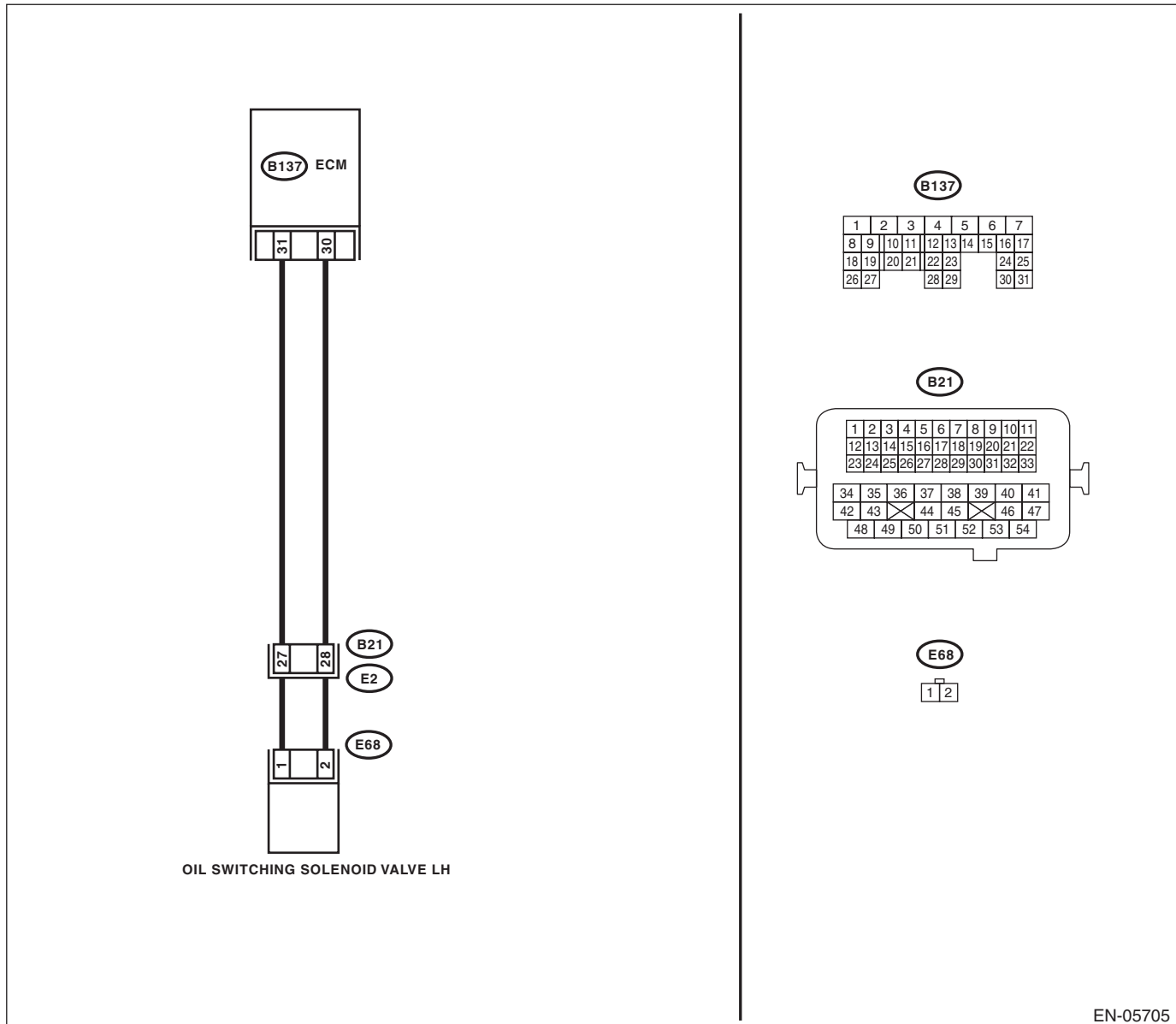
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05705

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 (+) — Chassis ground (-):</b>  <b>(B137) No. 30 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V?</p>	<p>Go to step 2.</p>	<p>Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector.</p>
<p><b>2</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between the ECM and oil switching solenoid valve connector.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — (E68) No. 1:</b>  <b>(B137) No. 30 — (E68) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.            NOTE:            In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and oil switching solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3</b>     <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H4SO)-87, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## M: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-28, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

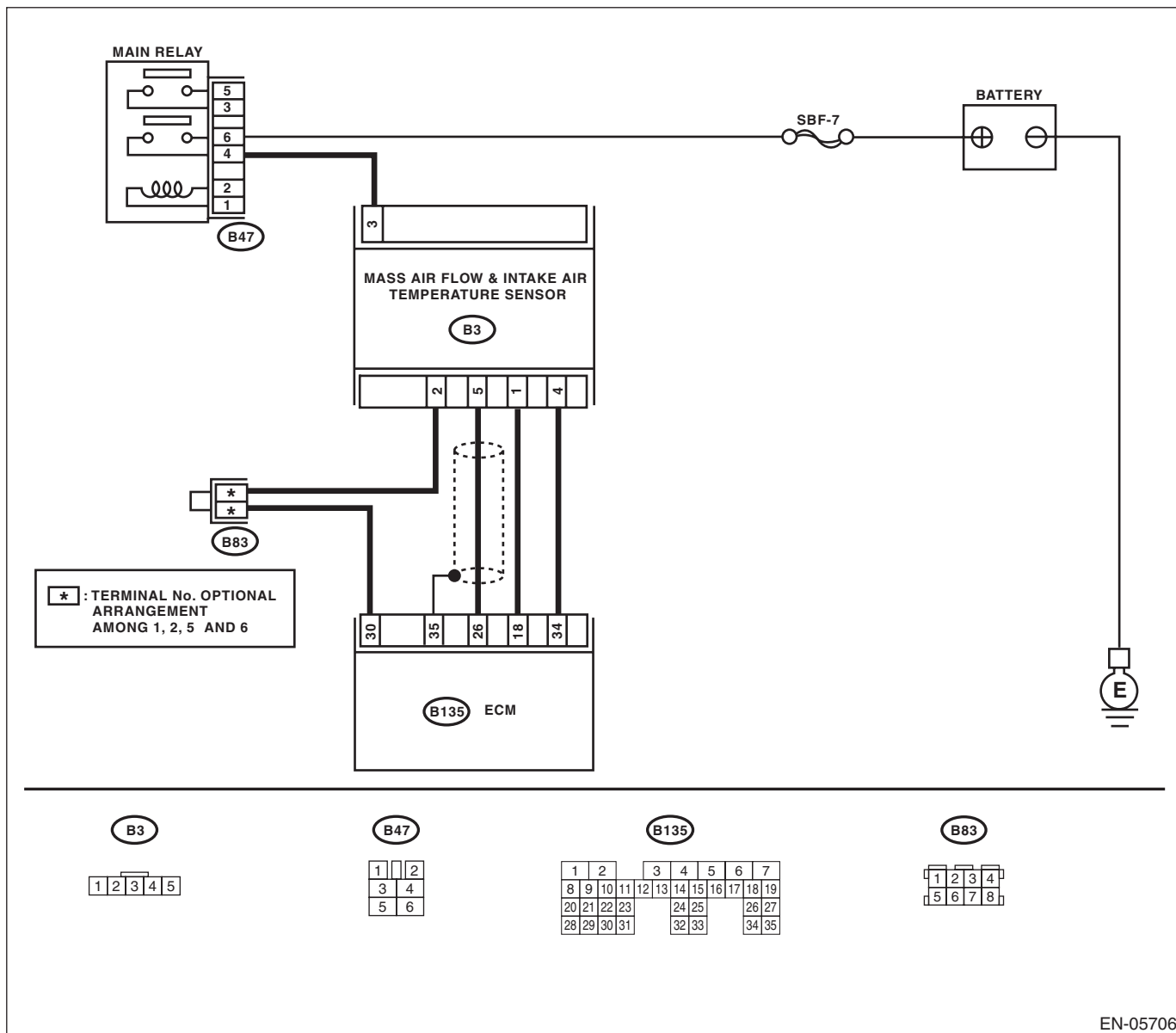
### TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05706

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-31, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

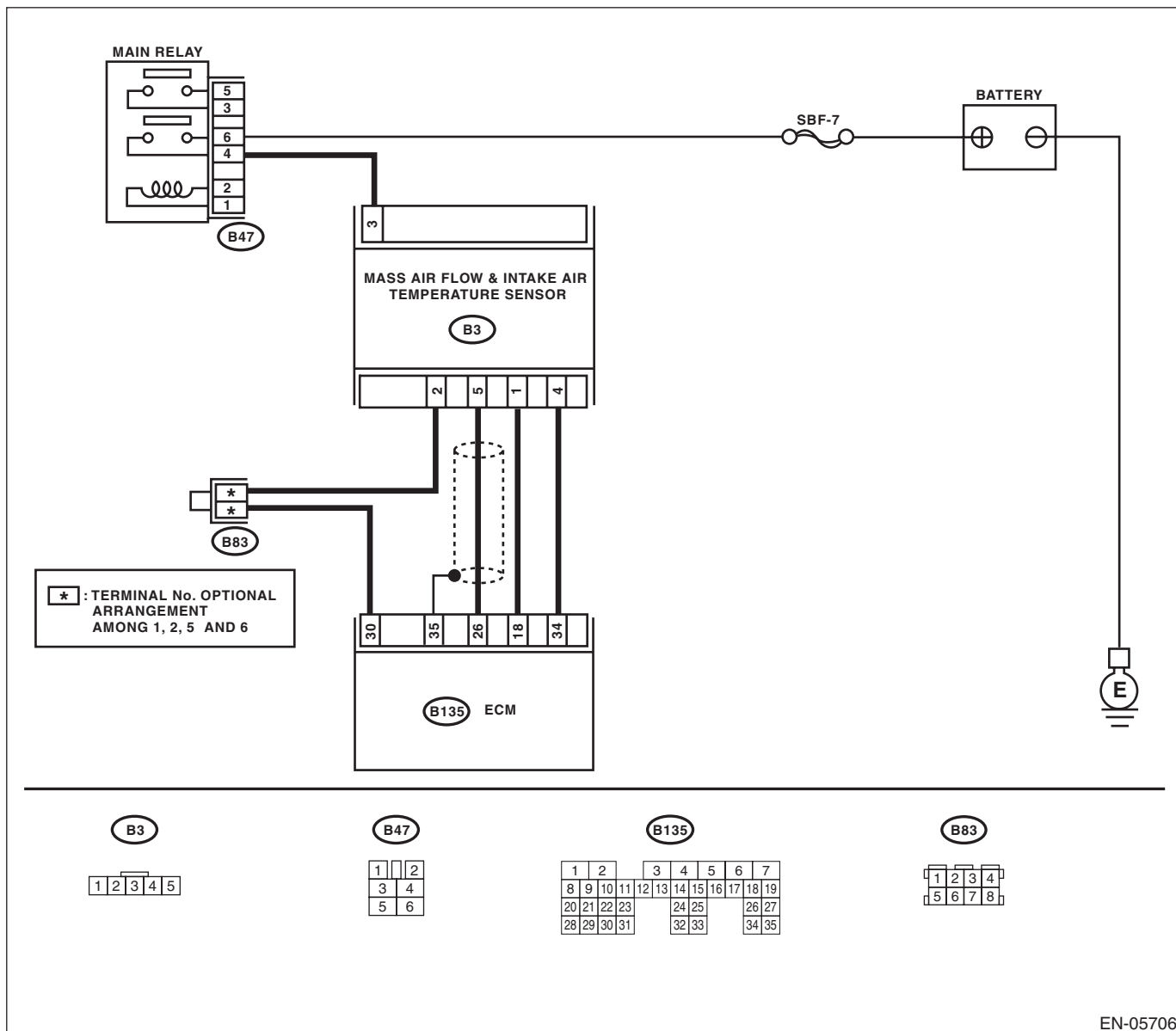
### TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool. NOTE: <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage less than 0.2 V?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then reperform the diagnosis again. NOTE: In this case, temporary poor contact of connector may be the cause.
<b>2 CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the mass air flow and intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(B3) No. 3 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and the mass air flow and intake air temperature sensor connector.</li> <li>• Poor contact of main relay connector</li> </ul>
<b>3 CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 26 — (B3) No. 5:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 26 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
<b>5 CHECK POOR CONTACT.</b> Check for any poor contact in the ECM or the mass air flow or intake air temperature sensor connector.	Is there poor contact in the ECM or the mass air flow and intake air temperature sensor connector?	Repair any poor contact in the ECM or the mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-33, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

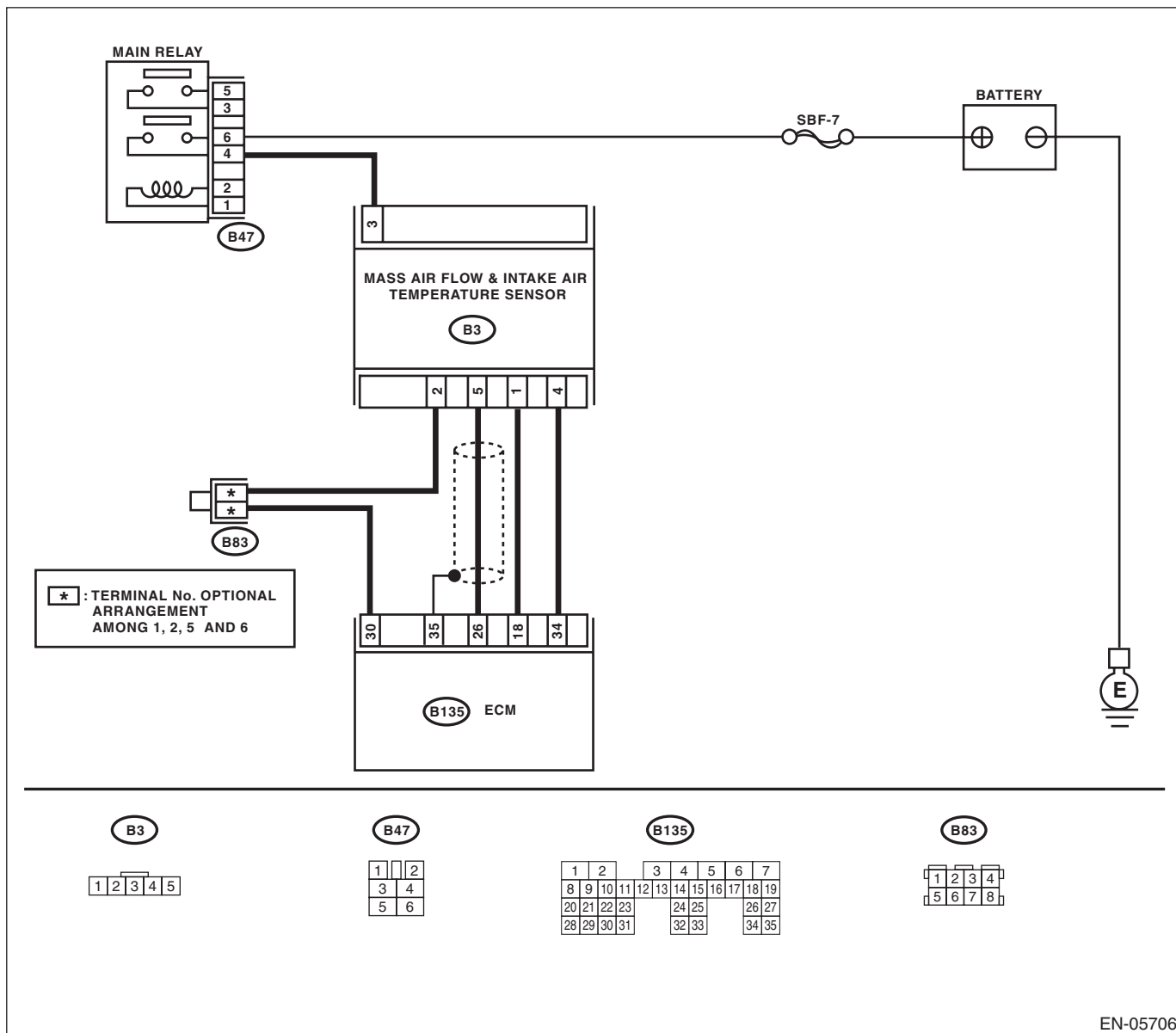
### TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05706

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the mass air flow and intake air temperature sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow & intake air temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between mass air flow and intake air temperature sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(B3) No. 4 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM, mass air flow and intake air temperature sensor connectors.</li> <li>Poor contact in ECM connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for any poor contact between the mass air flow and intake air temperature sensor connectors.</p>	Is there poor contact in the mass air flow and intake air temperature sensor connectors?	Repair any poor contact of the mass air flow and intake air temperature sensor connectors.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## P: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

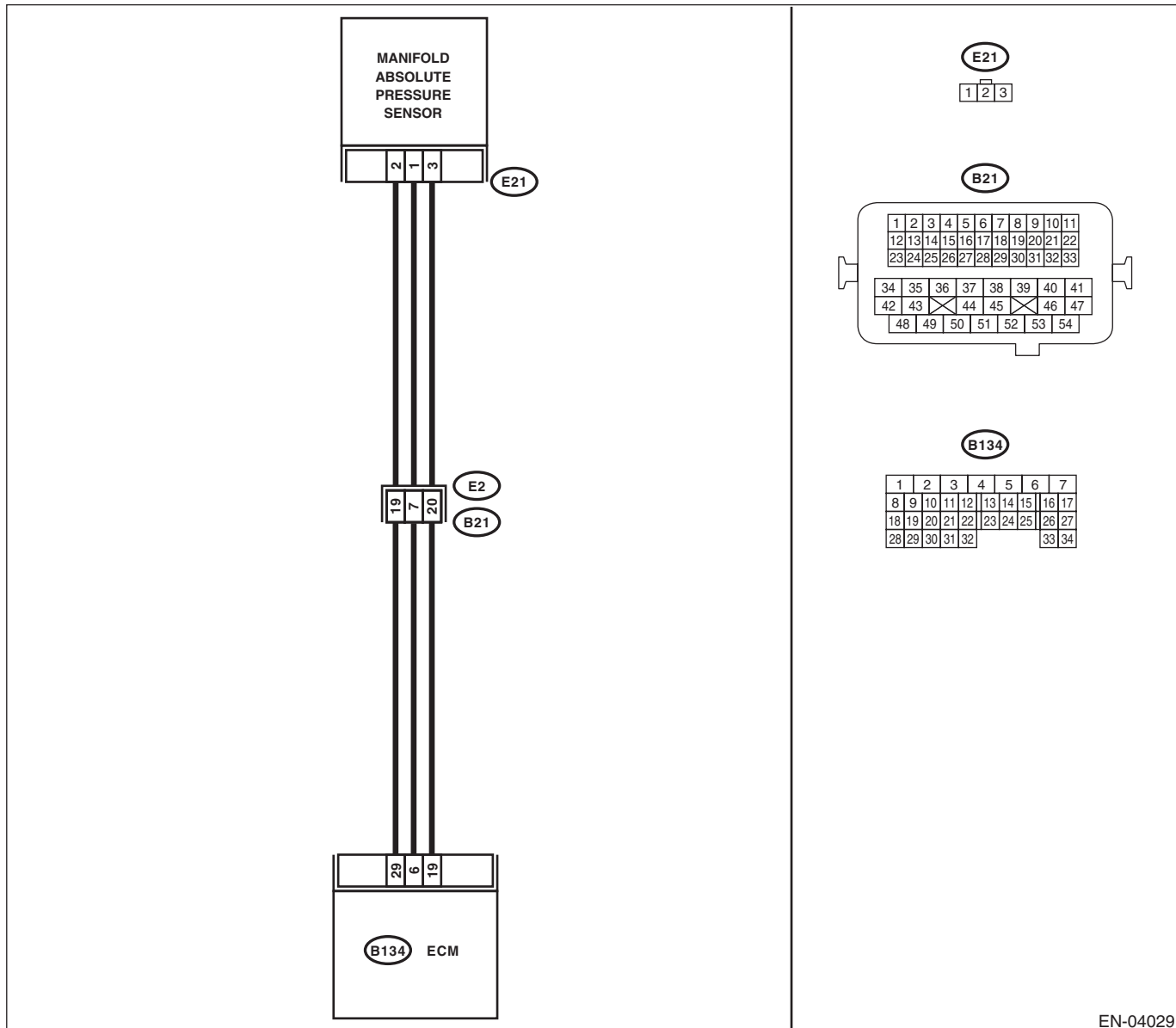
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-35, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04029

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg) ?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK POWER SUPPLY OF THE MANIFOLD ABSOLUTE PRESSURE SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from manifold absolute pressure sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between manifold absolute pressure sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(E21) No. 3 (+) — Engine ground (-):</b></p>	<p>Is the voltage 4.5 V or more?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and manifold absolute pressure sensor connector.</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B134) No. 6 — (E21) No. 1:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and manifold absolute pressure sensor connector.</li> <li>Poor contact of coupling connector</li> </ul>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B134) No. 6 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 5.</p>	<p>Repair ground short circuit of harness between ECM and manifold absolute pressure sensor connector.</p>
<p><b>5</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact between the ECM and manifold pressure sensor connector.</p>	<p>Is there poor contact in the ECM or manifold absolute pressure sensor connector?</p>	<p>Repair the poor contact in the ECM or manifold absolute pressure sensor connector.</p>	<p>Replace the manifold absolute pressure sensor. &lt;Ref. to FU(H4SO)-25, Manifold Absolute Pressure Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Q: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

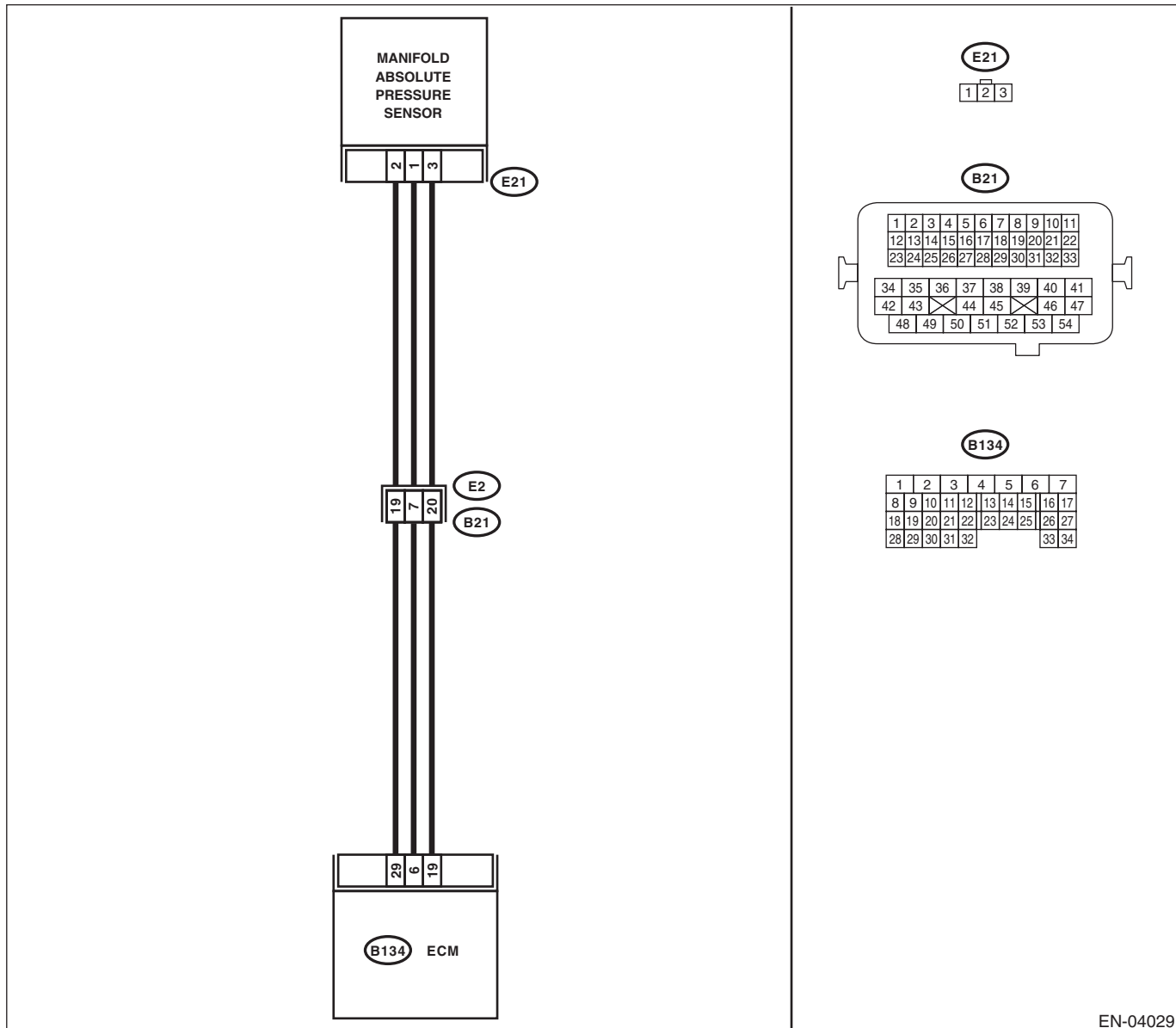
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-37, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04029

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from manifold absolute pressure sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?</p>	<p>Repair the short circuit to power in the harness between ECM and manifold absolute pressure sensor connector.</p>	<p>Go to step 3.</p>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E21) No. 2 — Engine ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and manifold absolute pressure sensor connector.</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
<p><b>4</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the manifold absolute pressure sensor connector.</p>	<p>Is there poor contact in manifold absolute pressure sensor connector?</p>	<p>Repair the poor contact of manifold absolute pressure sensor connector.</p>	<p>Replace the manifold absolute pressure sensor. &lt;Ref. to FU(H4SO)-25, Manifold Absolute Pressure Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-39, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

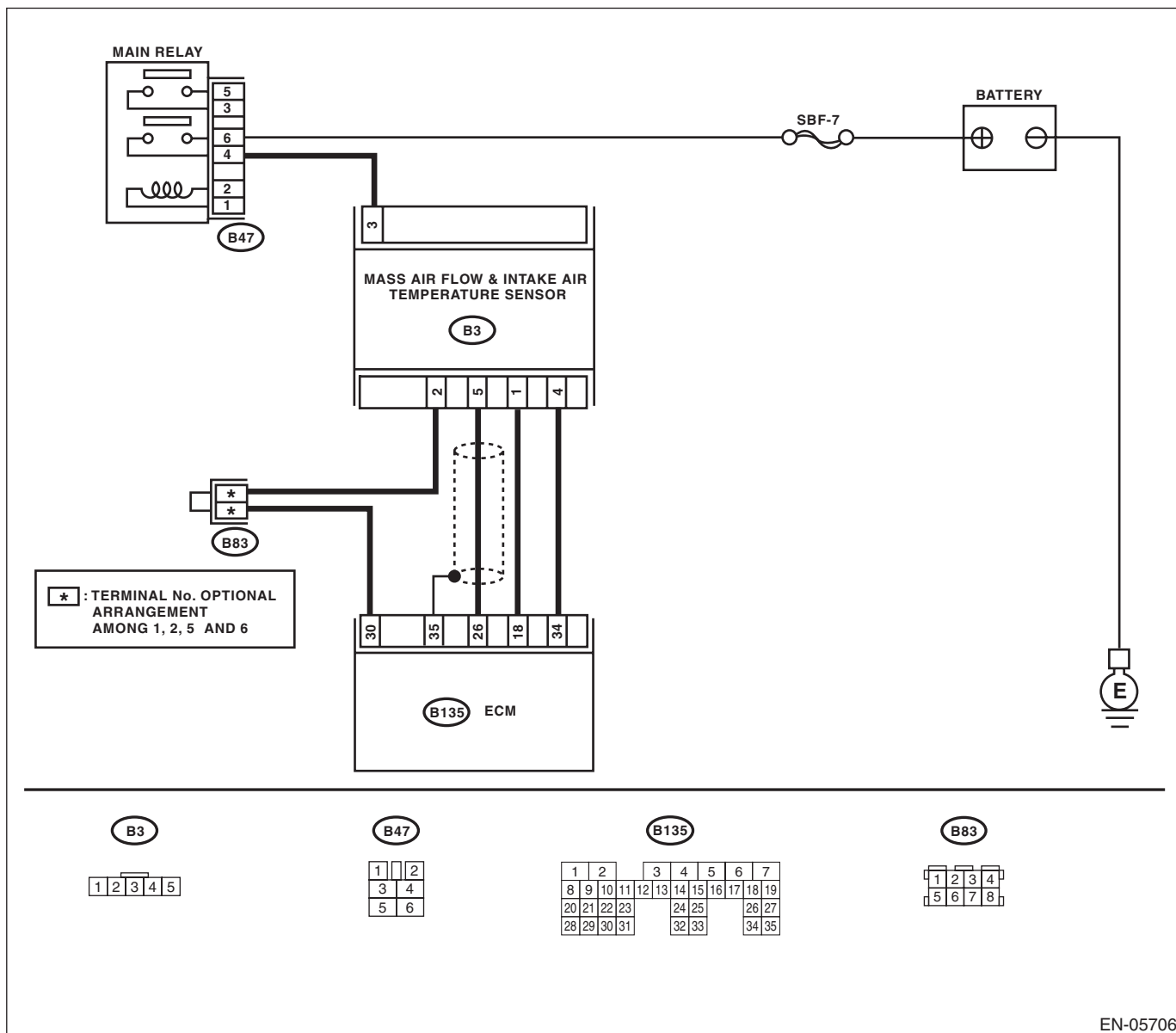
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05706



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK ENGINE COOLANT TEMPERATURE.</b></p> <p>1) Start the engine and warm-up completely. 2) Measure the engine coolant temperature using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>	<p>Check DTC P0125 using "List of Diagnostic Trouble Code (DTC)". &lt;Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-41, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

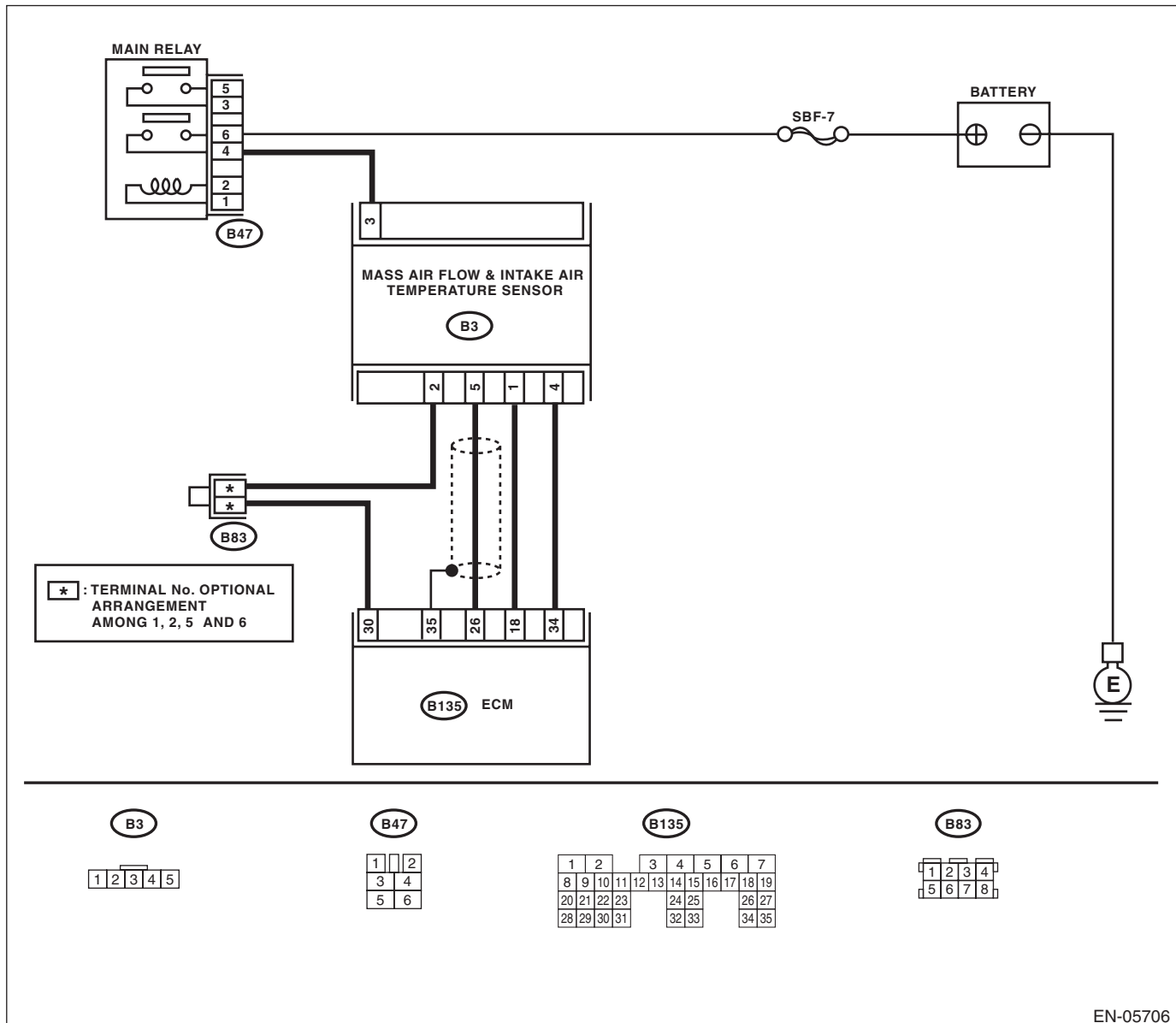
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05706

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the intake air temperature 120°C (248°F) or higher?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and the mass air flow &amp; intake air temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 18 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between the ECM and the mass air flow &amp; intake air temperature sensor connectors.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-43, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

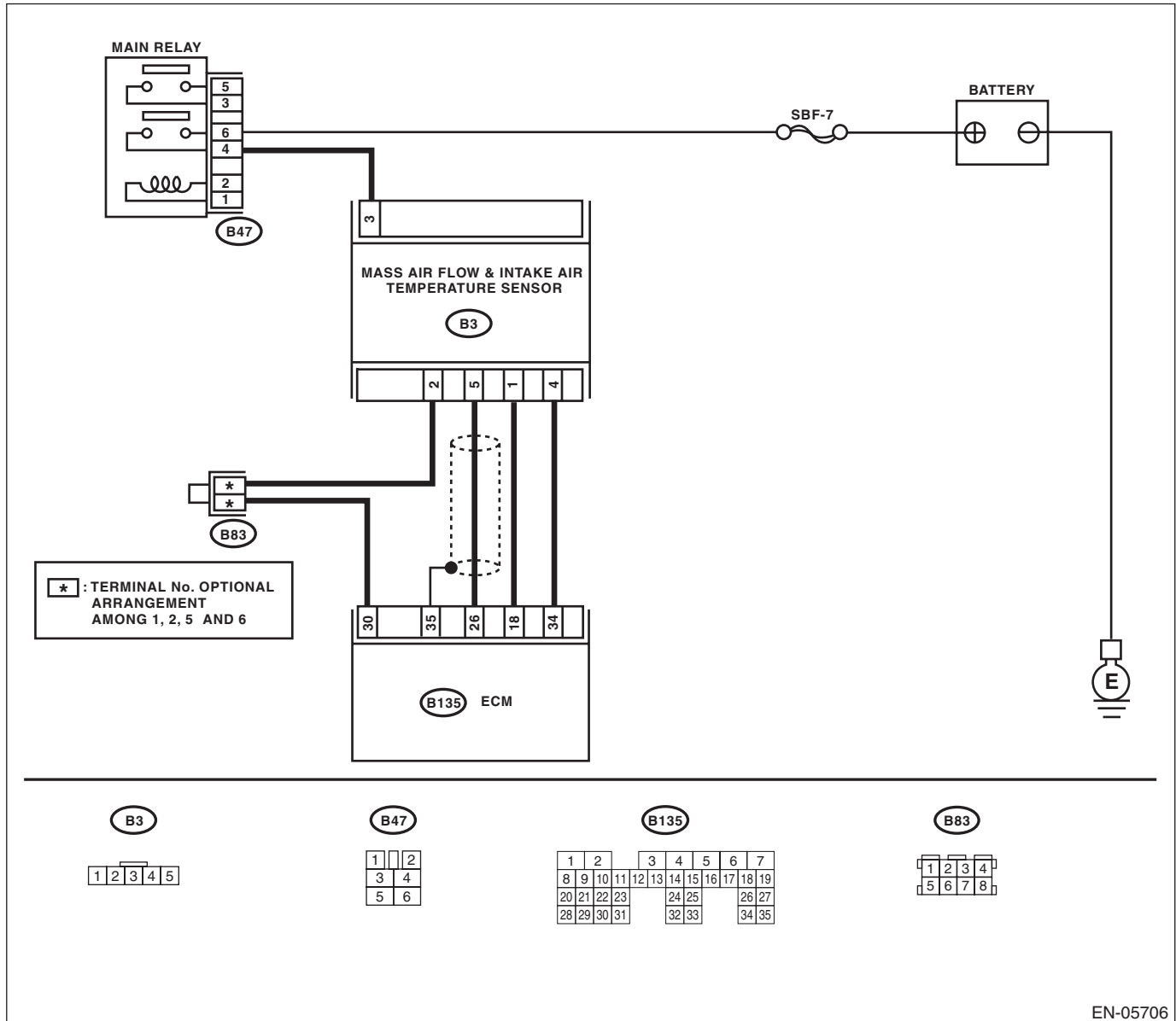
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05706

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the intake air temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK POOR CONTACT.</b> Repair any poor contact between the ECM and the mass air flow & intake air temperature sensor connectors.	Is there poor contact in the ECM or the mass air flow & intake air temperature sensor connectors?	Repair any poor contact between the ECM and the mass air flow & intake air temperature sensor connectors.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and the mass air flow & intake air temperature sensor. 3) Measure the resistance of harness between ECM and mass air flow & intake air temperature sensor connectors.  <i>Connector &amp; terminal</i> <i>(B135) No. 18 — (B3) No. 1:</i> <i>(B135) No. 30 — (B3) No. 2:</i>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of harness between the ECM and mass air flow & intake air temperature sensor connectors.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground.  <i>Connector &amp; terminal</i> <i>(B135) No. 18 (+) — Chassis ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow & intake air temperature sensor connectors.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-45, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

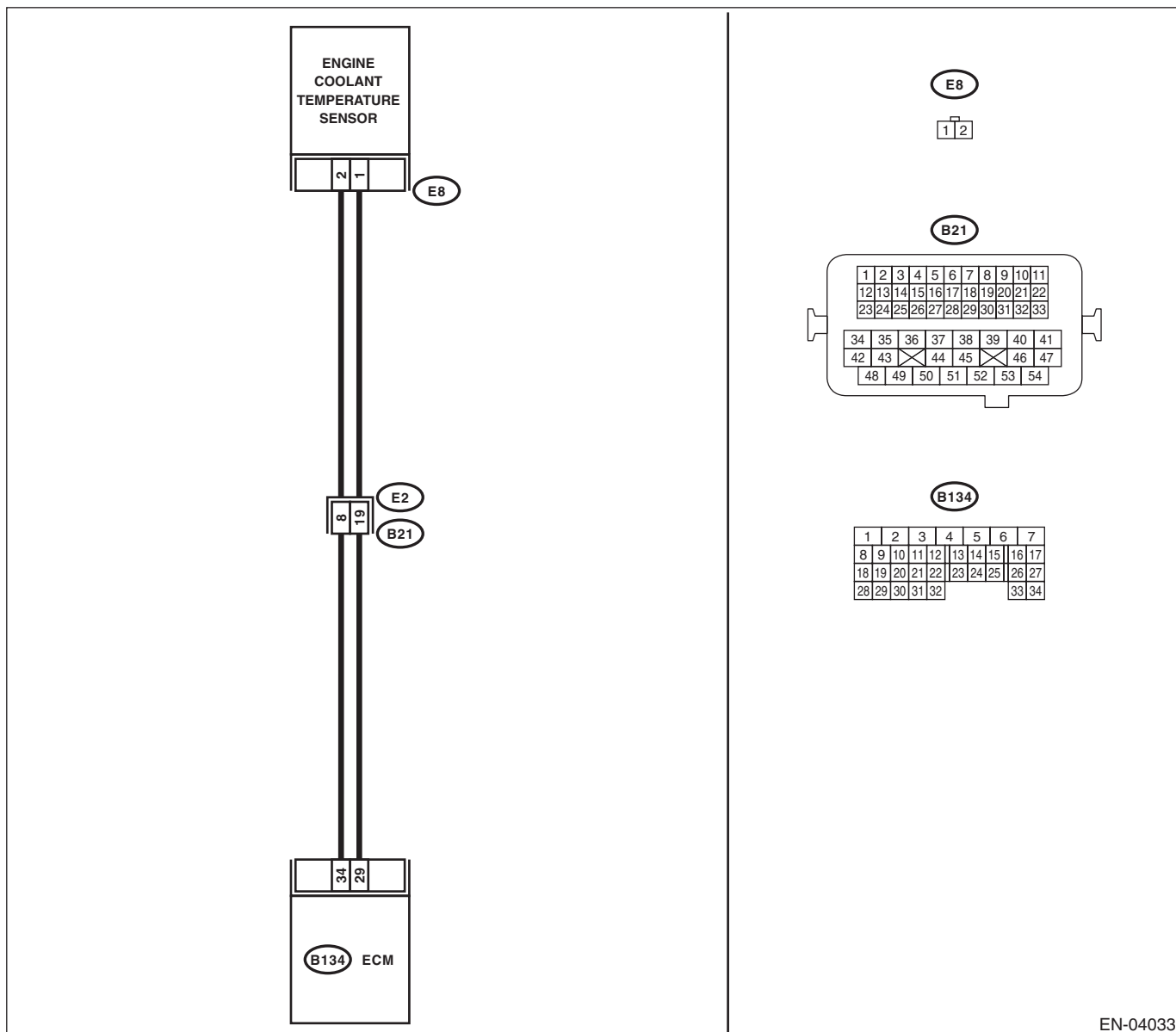
### TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04033

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature 150°C (302°F) or higher ?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and engine coolant temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 34 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>	Repair the ground short circuit of the harness between the ECM and engine coolant temperature sensor.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-47, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

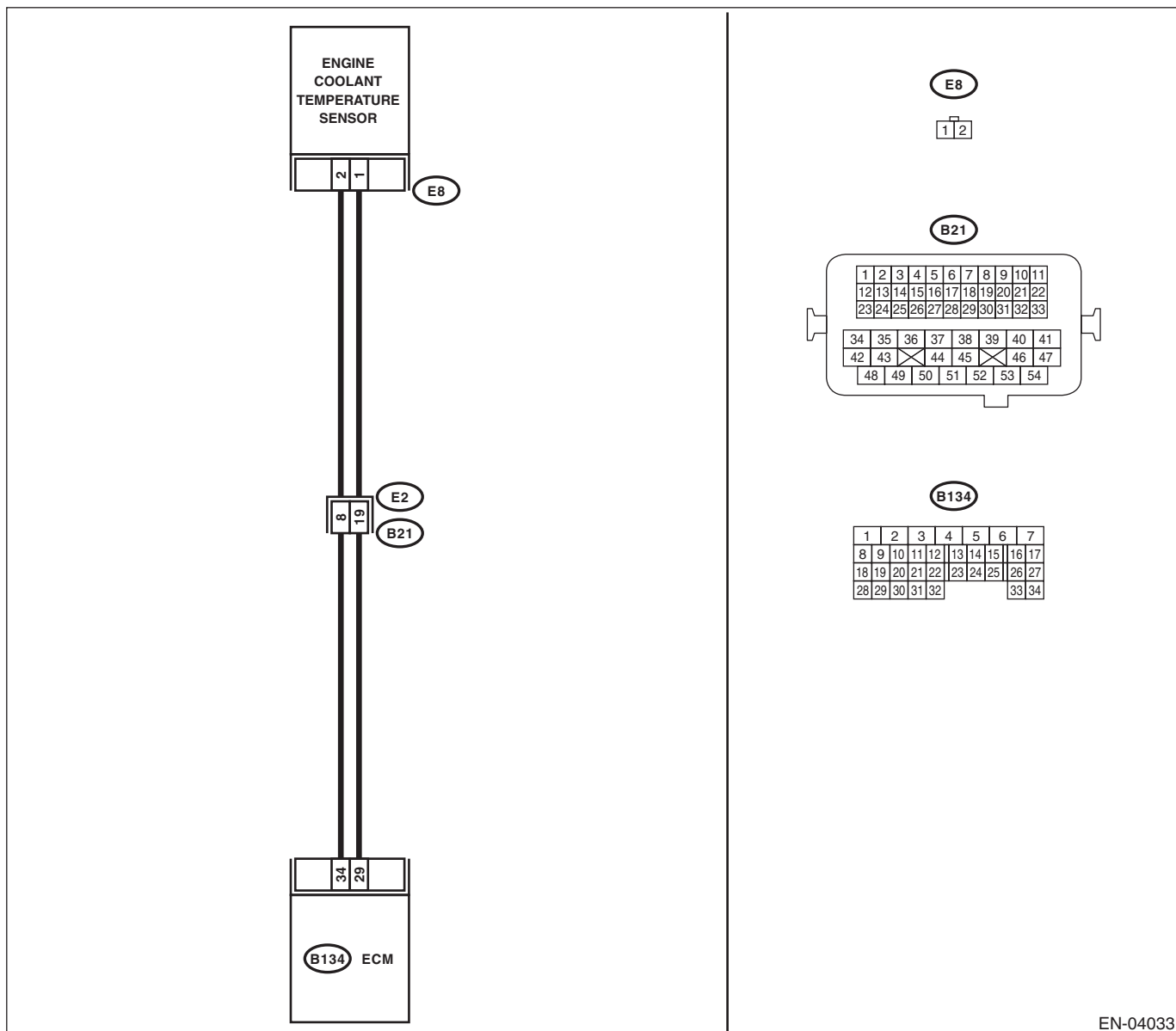
### TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04033



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Repair any poor contact between the ECM and engine coolant temperature sensor connectors.</p>	Is there poor contact in the ECM or engine coolant temperature sensor connectors?	Repair any poor contact between the ECM and engine coolant temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and engine coolant temperature sensor.</p> <p>3) Measure the resistance of the harness between the ECM and engine coolant temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> (B134) No. 34 — (E8) No. 2: (B134) No. 29 — (E8) No. 1:</p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and engine coolant temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON.</p> <p>3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> (B134) No. 34 (+) — Chassis ground (-):</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and engine coolant temperature sensor connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## W: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-49, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

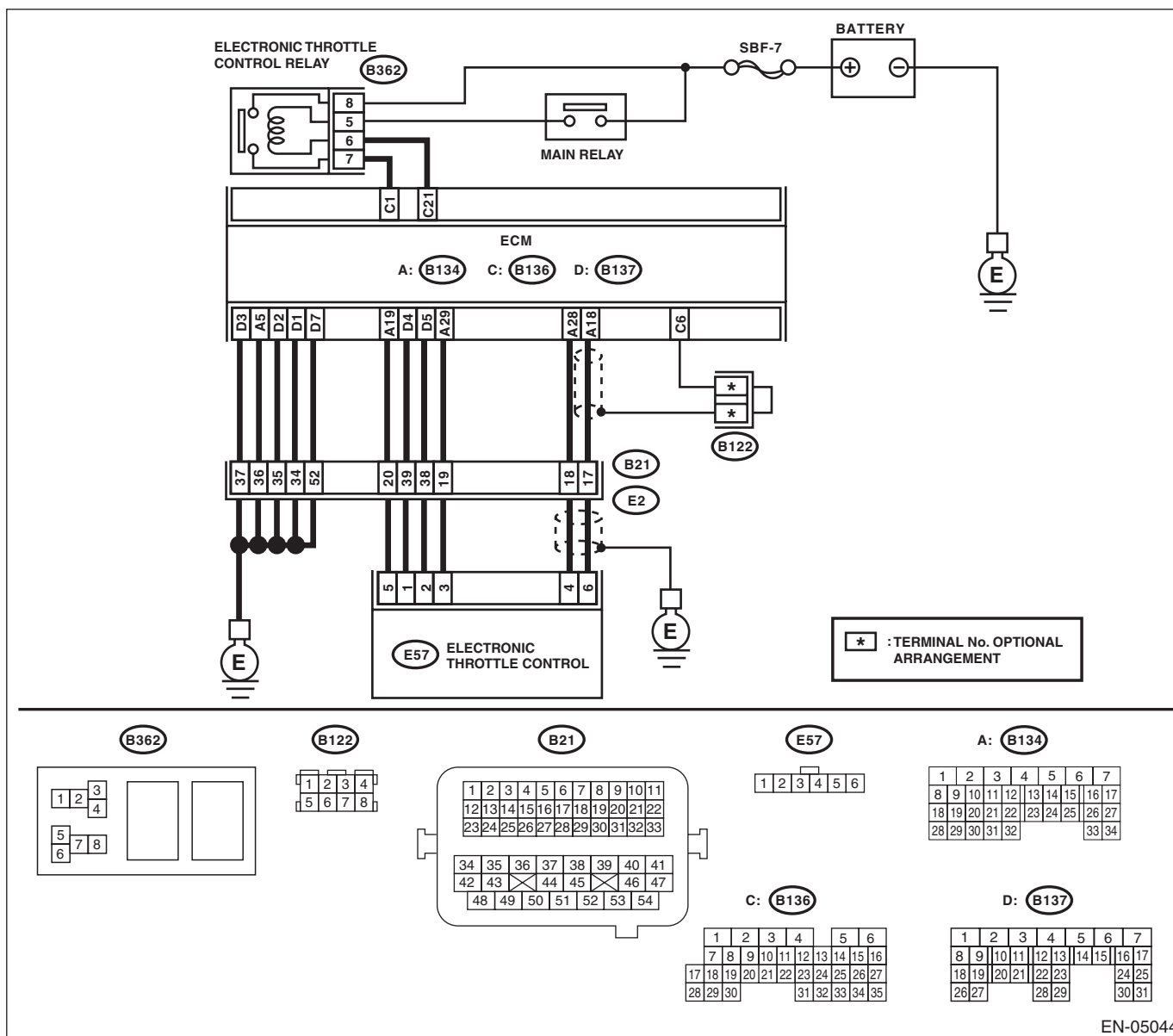
### TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from ECM and electronic throttle control.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 18 — Chassis ground:</b>  <b>(B134) No. 18 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 18 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H4SO)-11, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. &lt;Ref. to FU(H4SO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-51, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

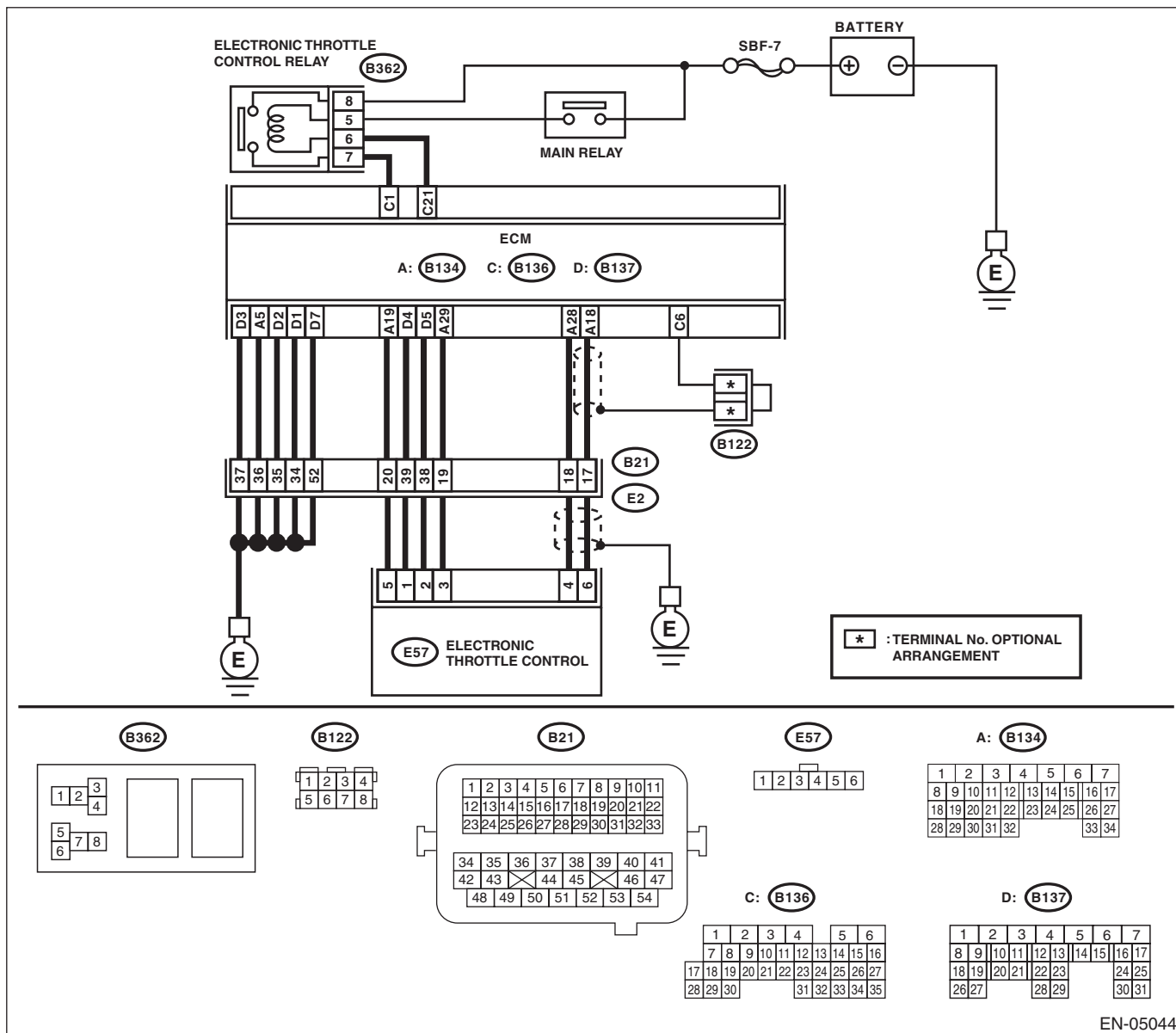
### TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Y: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-53, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

Engine does not return to idle.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK TIRE SIZE.</b>	Is the tire size as specified? and the same size as other three wheels?	Go to step 2.	Replace the tire.
2	<b>CHECK ENGINE COOLANT.</b> Check the following items: <ul style="list-style-type: none"><li>• Amount of engine coolant</li><li>• Engine coolant freeze</li><li>• Contamination of engine coolant</li></ul>	Is the engine coolant normal?	Go to step 3.	Fill or replace the engine coolant. <Ref. to CO(H4SO)-12, REPLACEMENT, Engine Coolant.>
3	<b>CHECK THERMOSTAT.</b>	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H4SO)-16, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>

## Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-56, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

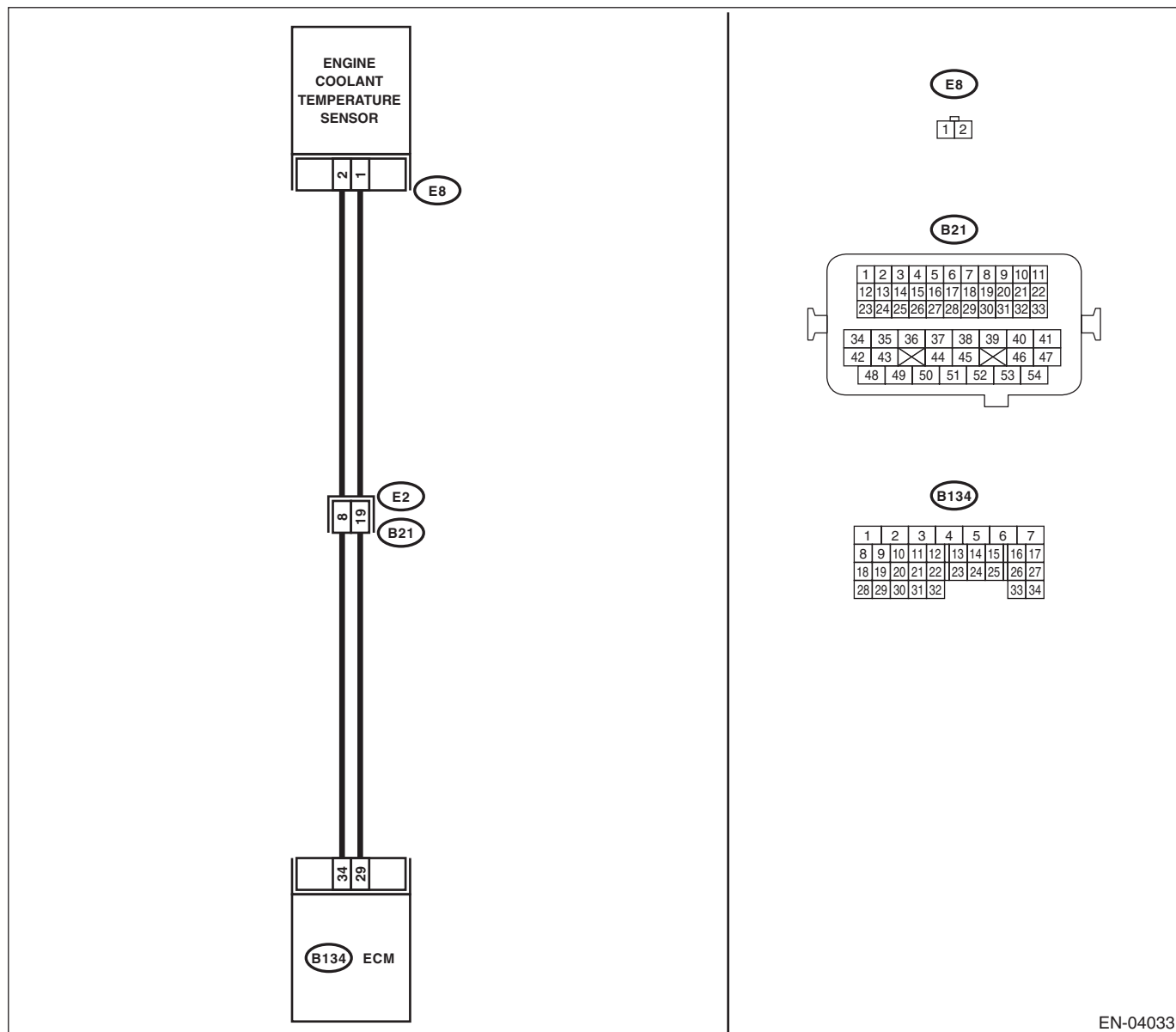
### TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04033

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed-up. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed-up?	Repair the poor contact of the ECM connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>

### AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-58, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### TROUBLE SYMPTOM:

Thermostat remains open.

#### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK ENGINE COOLANT.</b>	Are the coolant level and mixture ratio of engine coolant to anti-freeze solution correct?	Go to step 2.	Replace the engine coolant. <Ref. to CO(H4SO)-12, REPLACEMENT, Engine Coolant.>
2	<b>CHECK RADIATOR FAN.</b> 1) Start the engine. 2) Check the radiator fan operation.	Does the radiator fan continuously rotate for 3 minutes or more during idling?	Repair radiator fan circuit. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.>and <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H4SO)-16, Thermostat.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

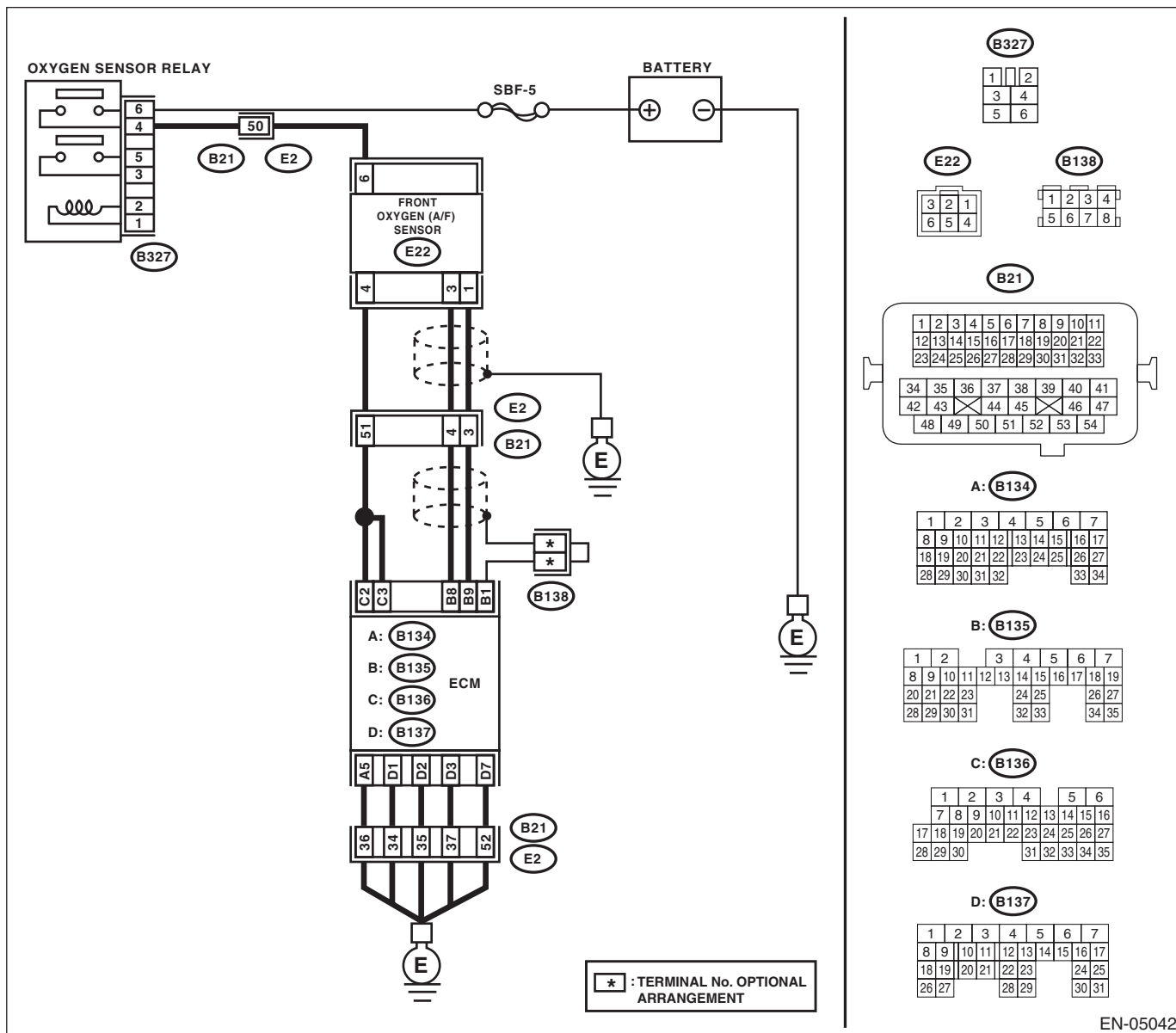
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-60, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

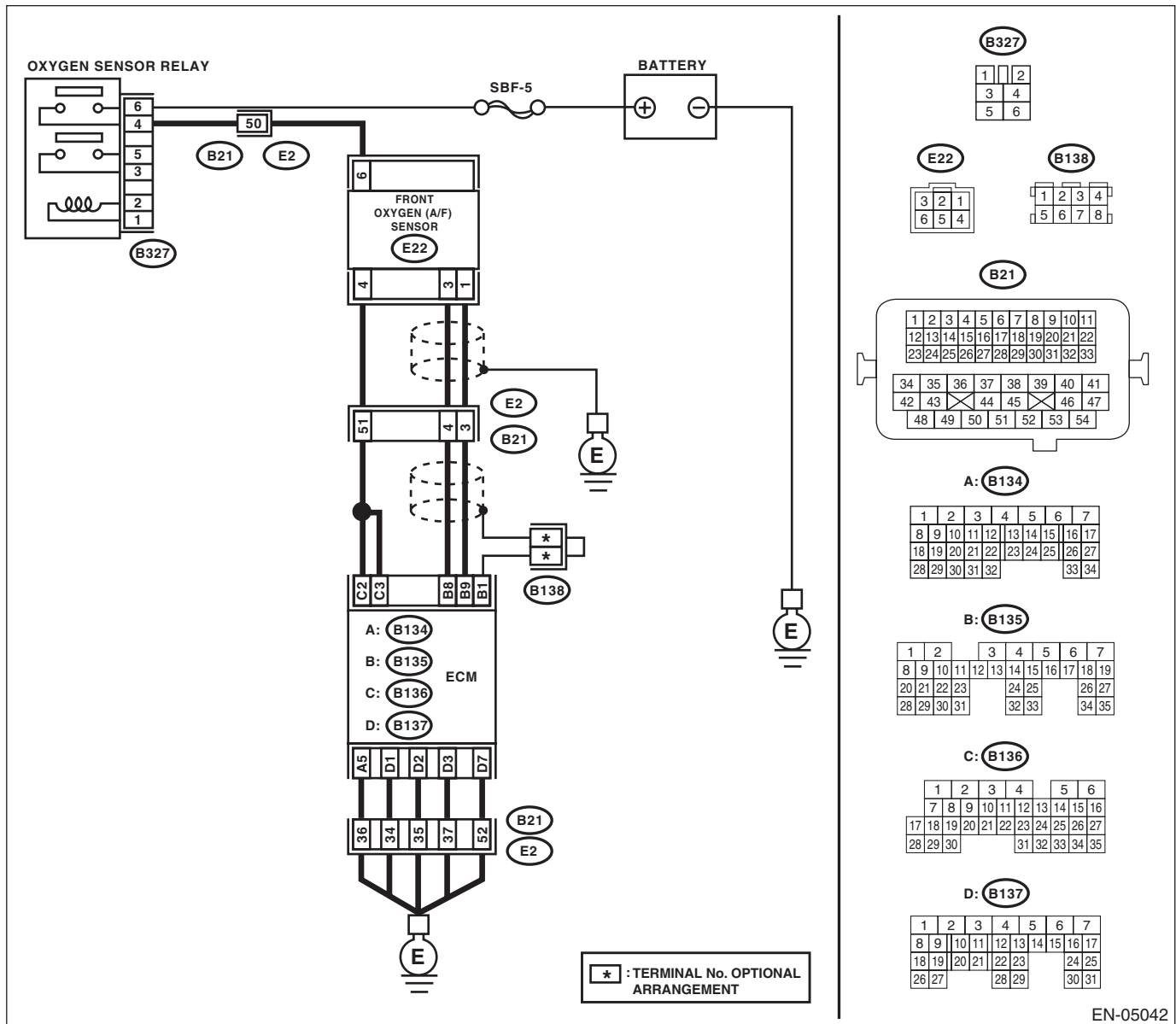
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-62, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05042

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AD:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

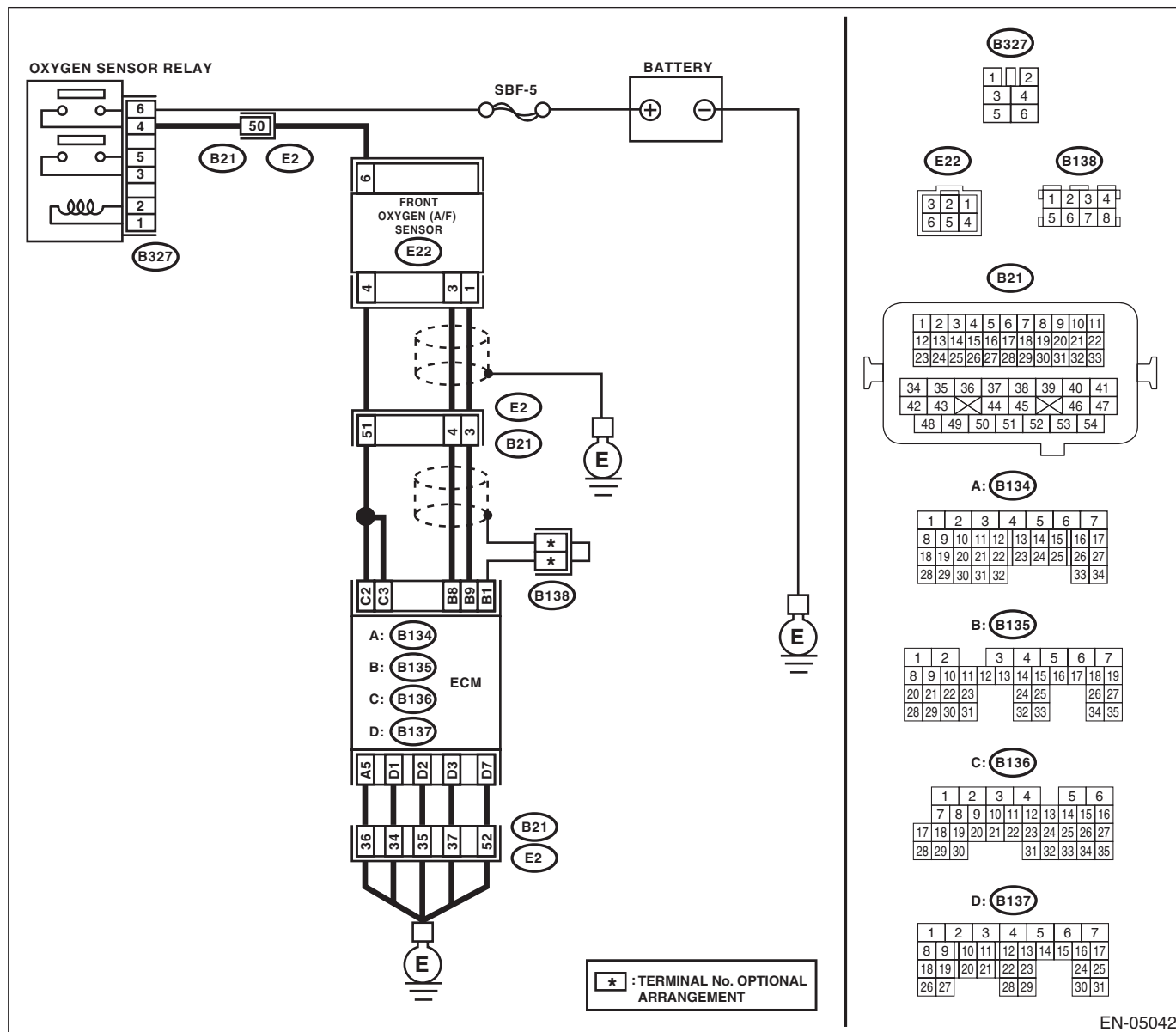
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-64, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK EXHAUST SYSTEM.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Loose installation of front portion of exhaust pipe onto cylinder heads</li><li>• Loose connection between front exhaust pipe and front catalytic converter</li><li>• Damage of exhaust pipe resulting in a hole</li></ul>	Is there any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AE:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

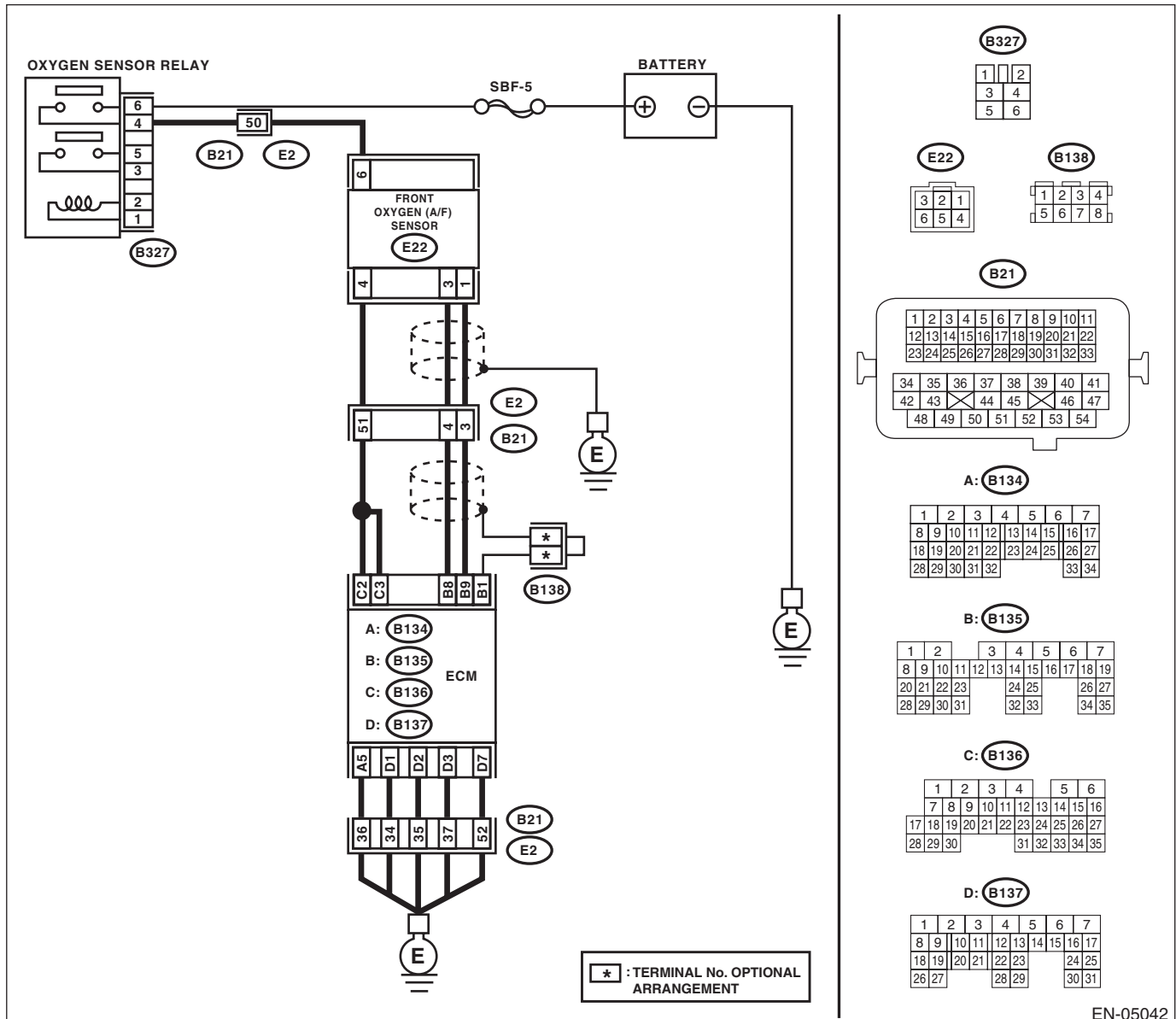
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-67, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 9 — (E22) No. 1:</b>  <b>(B135) No. 8 — (E22) No. 3:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Check poor contact of ECM and front oxygen (A/F) sensor connector.</p>	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AF:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

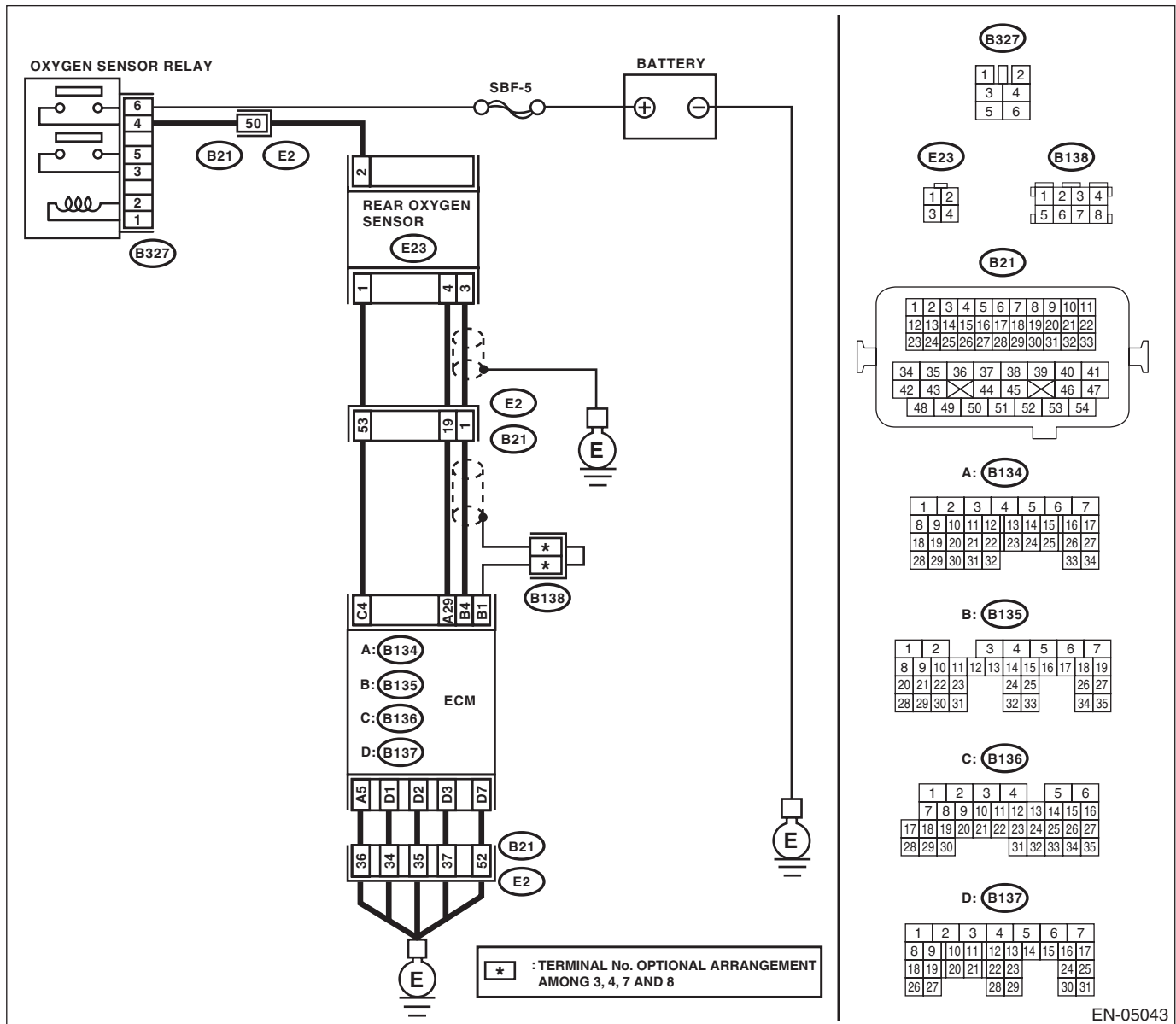
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-69, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05043

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (E23) No. 3:</b> <b>(B134) No. 29 — (E23) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E23) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the rear oxygen sensor connector</li> <li>• Poor contact in ECM connector</li> </ul>
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Loose part and incomplete installation of exhaust system</li> <li>• Damage (crack, hole etc.) of parts</li> <li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li> </ul>	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AG:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

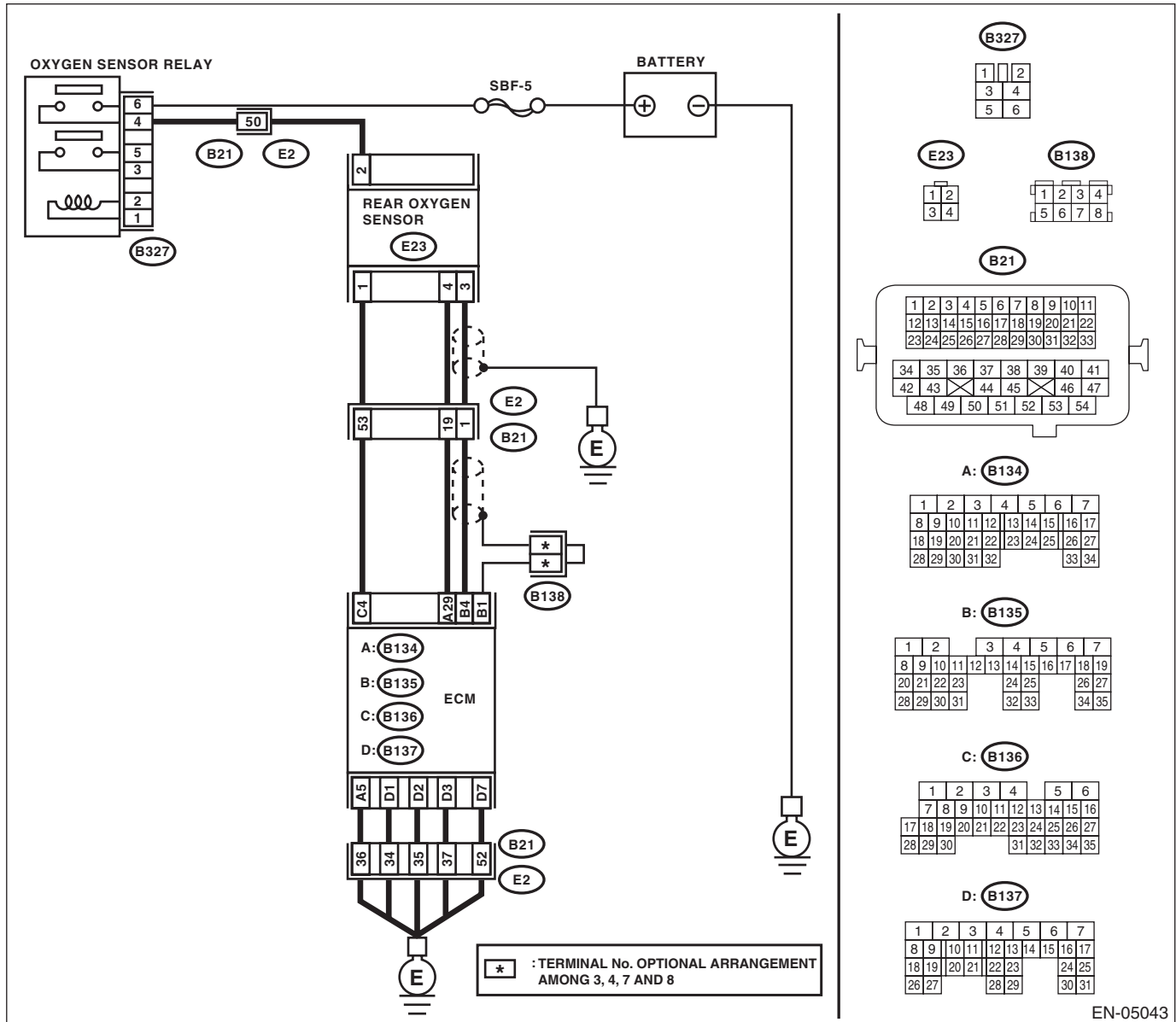
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-72, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05043

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 4 — (E23) No. 3:</b></i> <i><b>(B134) No. 29 — (E23) No. 4:</b></i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(E23) No. 3 (+) — Chassis ground (-):</b></i>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AH:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

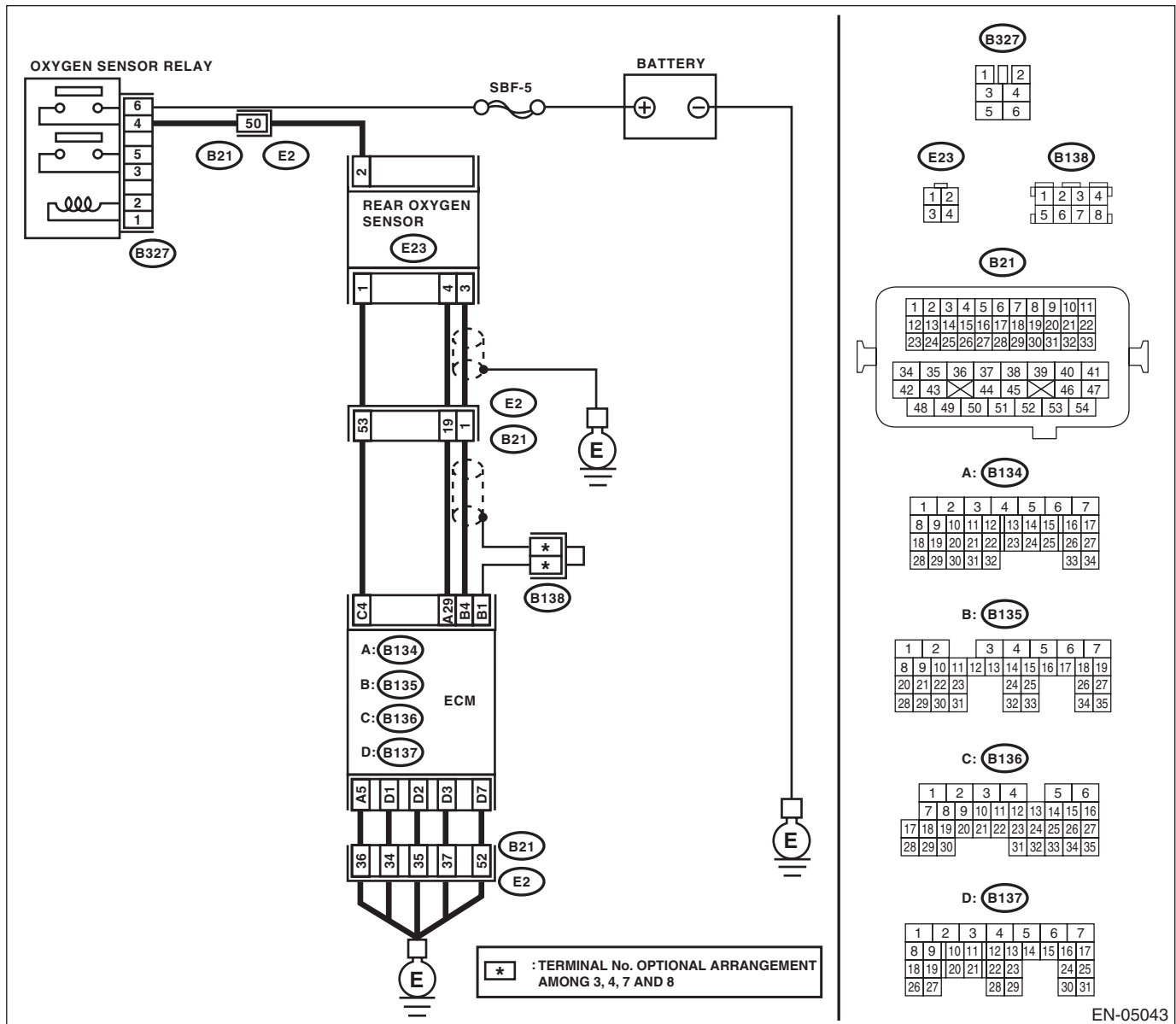
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-73, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05043

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and rear oxygen sensor.                      3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 4 — (E23) No. 3:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      Measure the resistance between rear oxygen sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(E23) No. 3 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>3</b></p> <p><b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor terminals.  <b>Terminals</b>  <b>No. 3 — No. 4</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H4SO)-35, Rear Oxygen Sensor.&gt;</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.                       NOTE:                      In this case, there may be a temporary connector contact failure.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

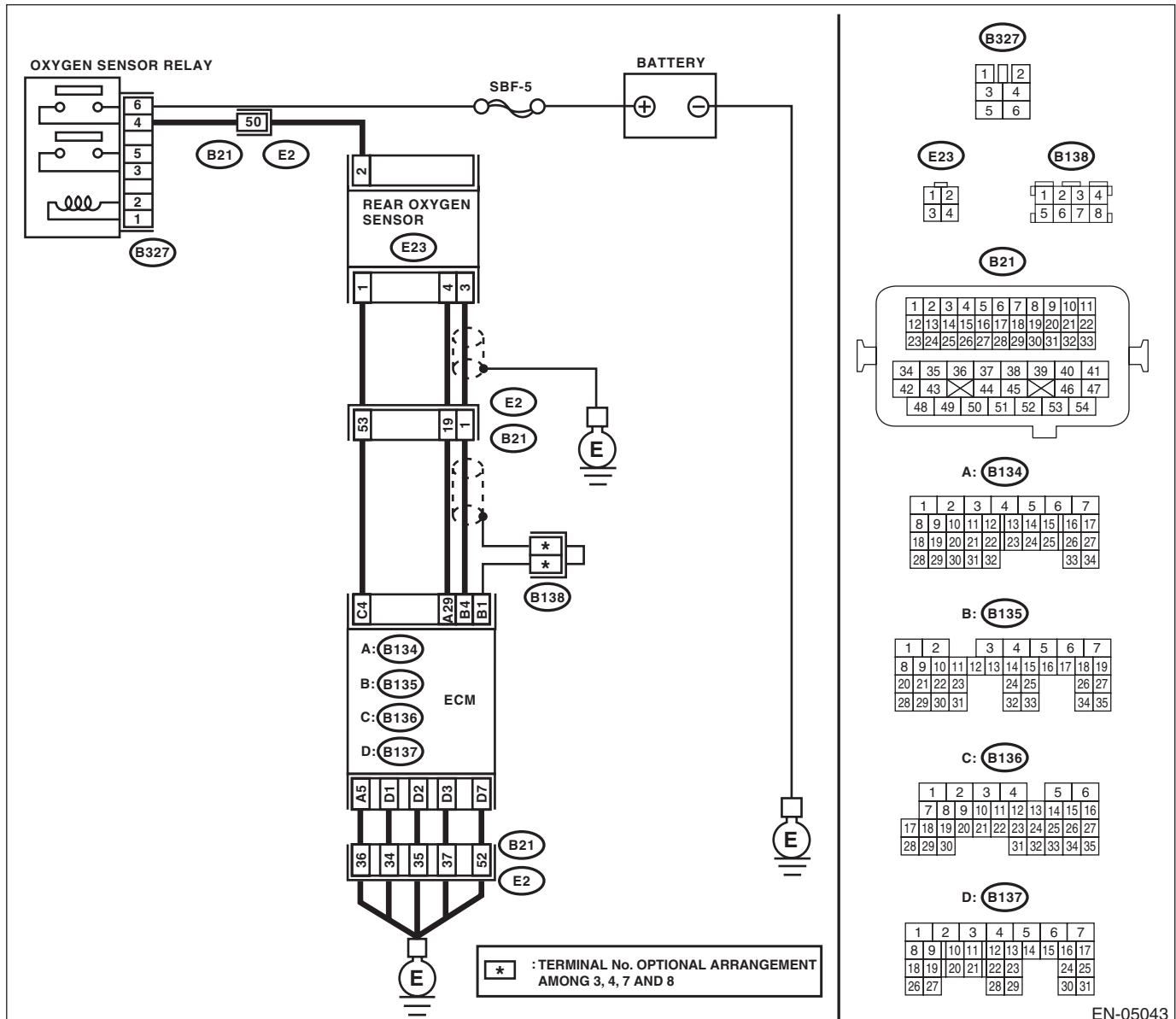
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-80, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05043

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 6.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 6.	Go to step 3.
<b>3 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 4.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (E23) No. 3:</b> <b>(B134) No. 29 — (E23) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E23) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 0.2 — 0.5 V?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H4SO)-35, Rear Oxygen Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the rear oxygen sensor connector</li> <li>• Poor contact in ECM connector</li> </ul>
<p><b>6</b></p> <p><b>CHECK EXHAUST SYSTEM.</b>                      Check exhaust system parts.</p> <p><b>NOTE:</b>                      Check the following items.</p> <ul style="list-style-type: none"> <li>• Loose part and incomplete installation of exhaust system</li> <li>• Damage (crack, hole etc.) of parts</li> <li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li> </ul>	<p>Is there any fault in exhaust system?</p>	<p>Repair or replace faulty parts.</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H4SO)-35, Rear Oxygen Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AJ:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4SO)(diag)-158, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AK:DTC P0172 SYSTEM TOO RICH (BANK 1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-83, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system. Go to step 2.
2	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system. Go to step 3.
3	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place "NO OPEN FLAMES" signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. Measure the fuel pressure. <Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 339.5 — 360.5 kPa (3.5 — 3.7 kg/cm <sup>2</sup> , 49 — 52 psi)?	Go to step 4.  Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
4	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step 5.  Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 6.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>6</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 70°C (158°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AL:DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE /PERFORMANCE

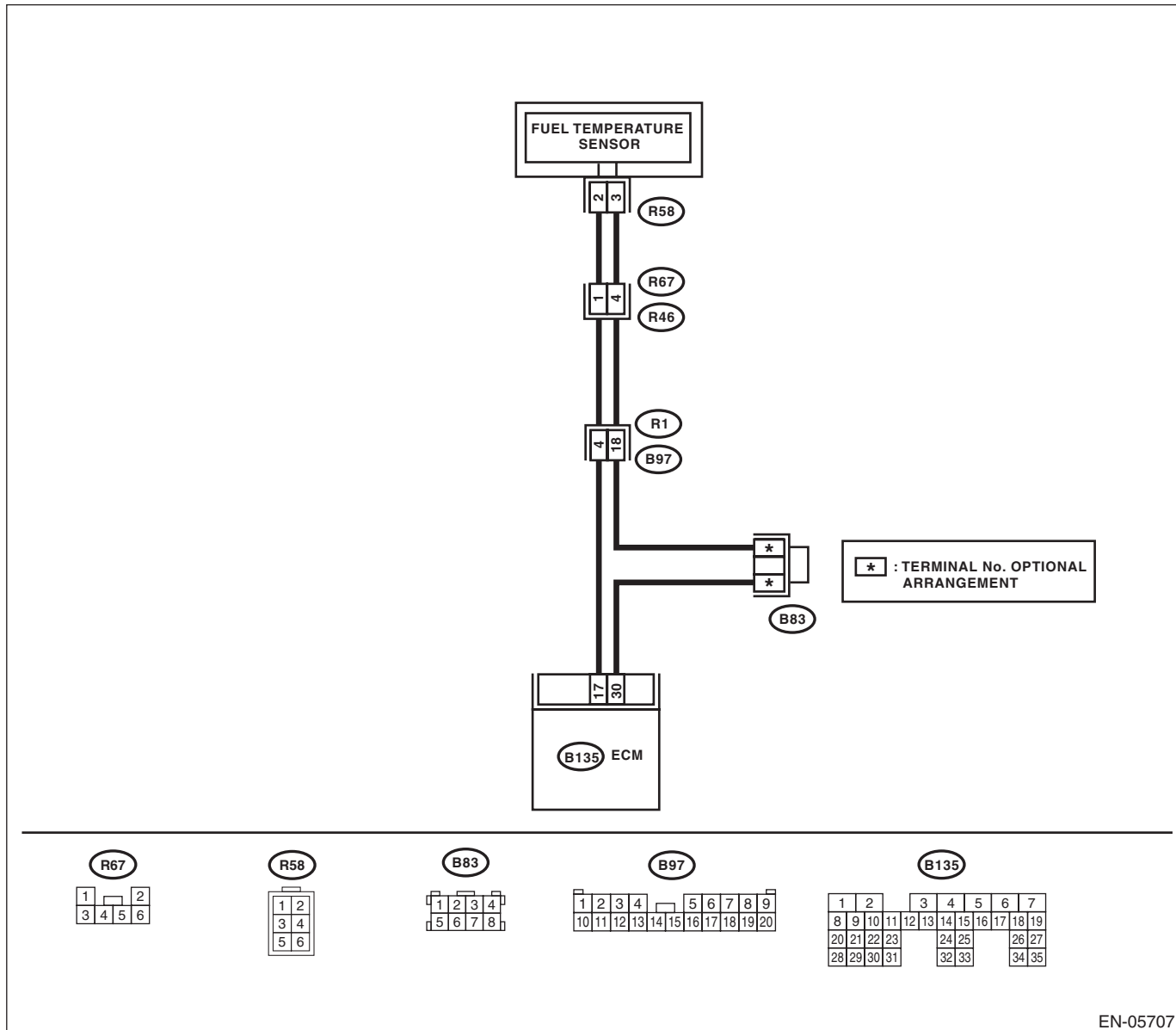
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-85, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05707

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-9, Fuel Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AM:DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT

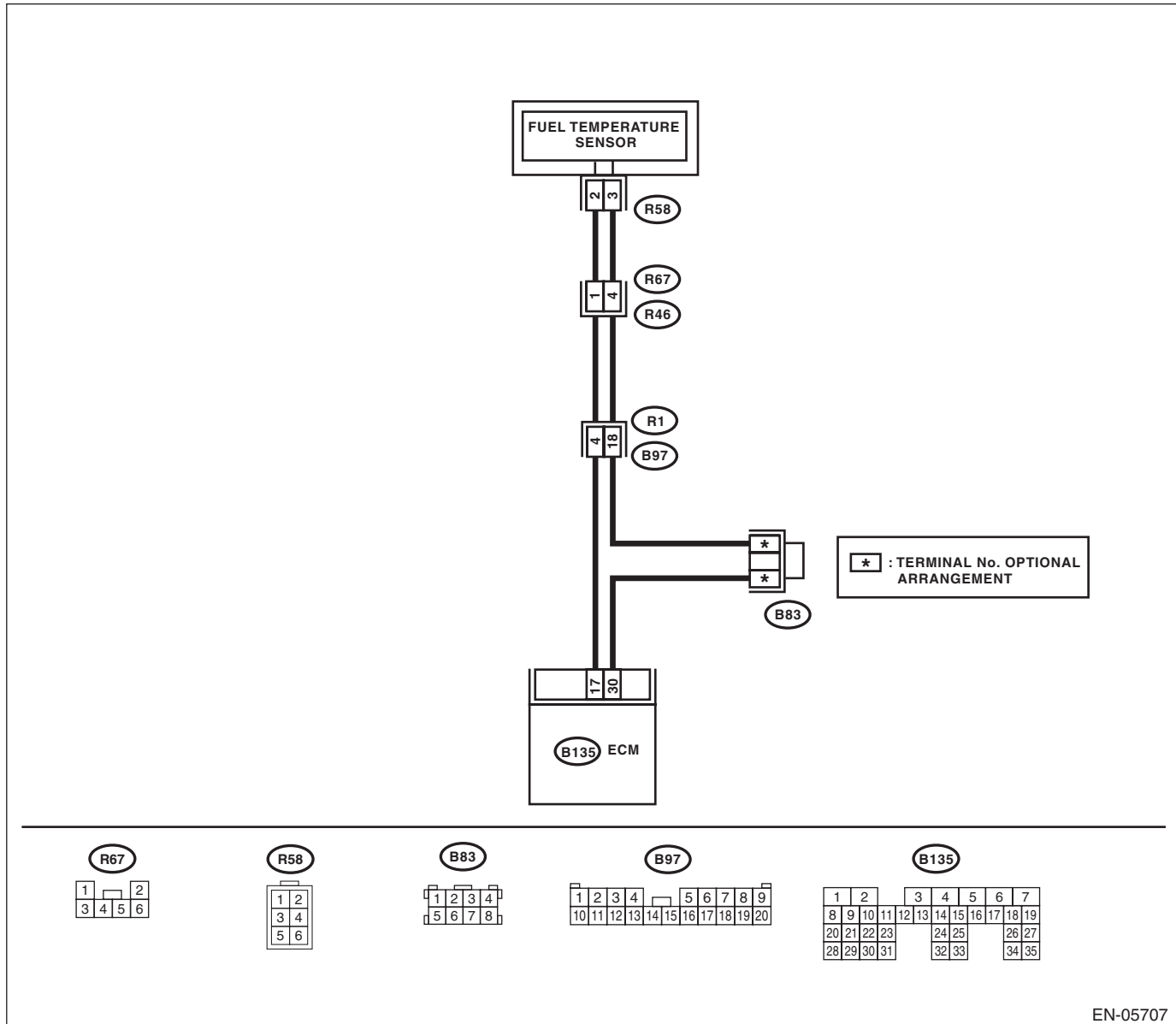
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-88, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05707

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.</p> <p>NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p>	Is the temperature 120°C (248°F) or higher?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE: In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and fuel temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 17 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-9, Fuel Temperature Sensor.>	Repair the ground short circuit of harness between ECM and fuel pump.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AN:DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT

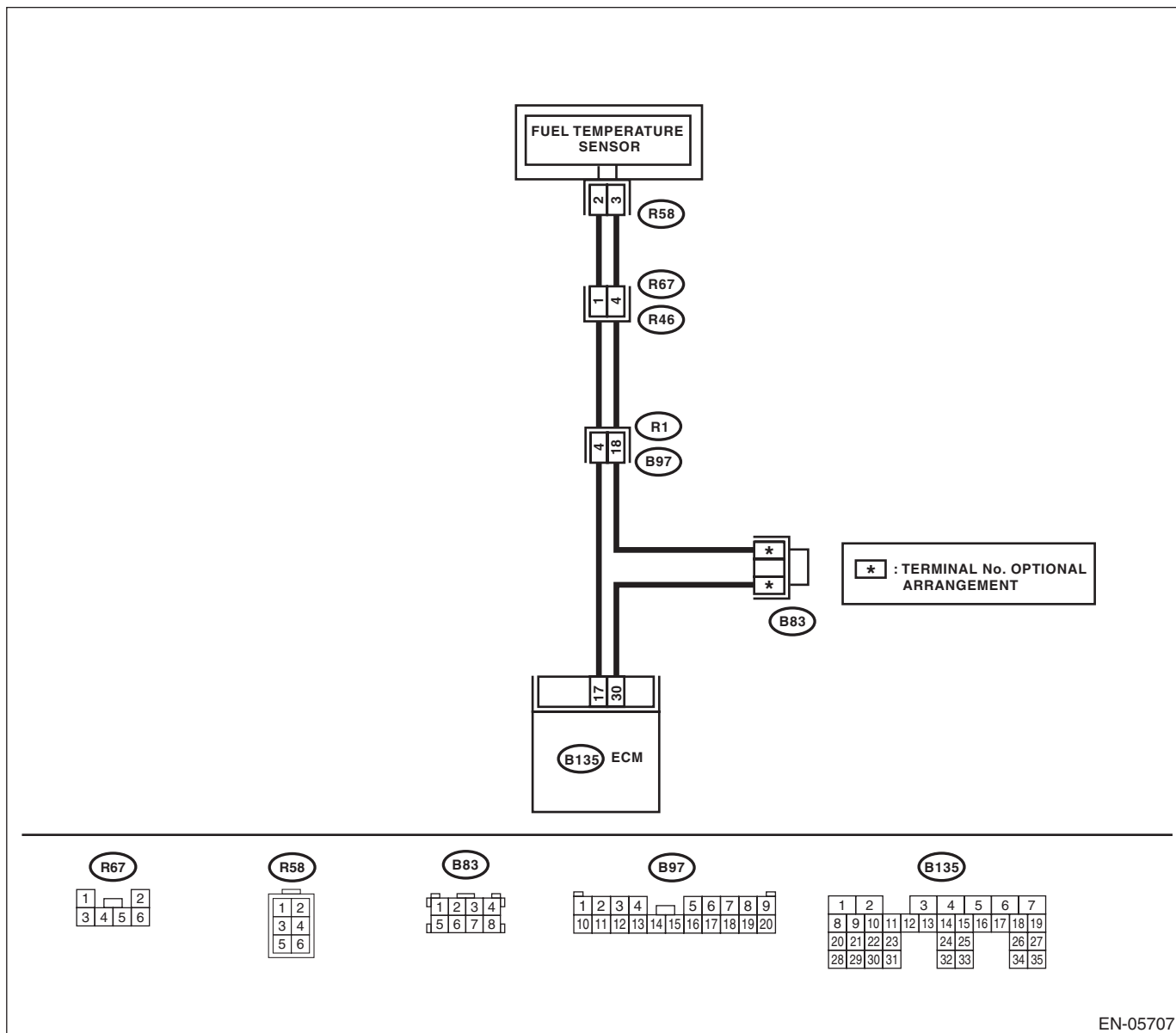
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-90, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05707



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.</p> <p>NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p>	Is the temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ )?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Repair any poor contact between the ECM and fuel temperature sensor connectors.</p>	Is there poor contact in the ECM or fuel temperature sensor connectors?	Repair any poor contact between the ECM and fuel temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and fuel temperature sensor.</p> <p>3) Measure the resistance of the harness between the ECM and fuel temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 17 — (R58) No. 2:</b> <b>(B135) No. 30 — (R58) No. 3:</b></p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and fuel temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON.</p> <p>3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 17 (+) — Chassis ground (-):</b></p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and fuel temperature sensor connector.	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-9, Fuel Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AO:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE /PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-92, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

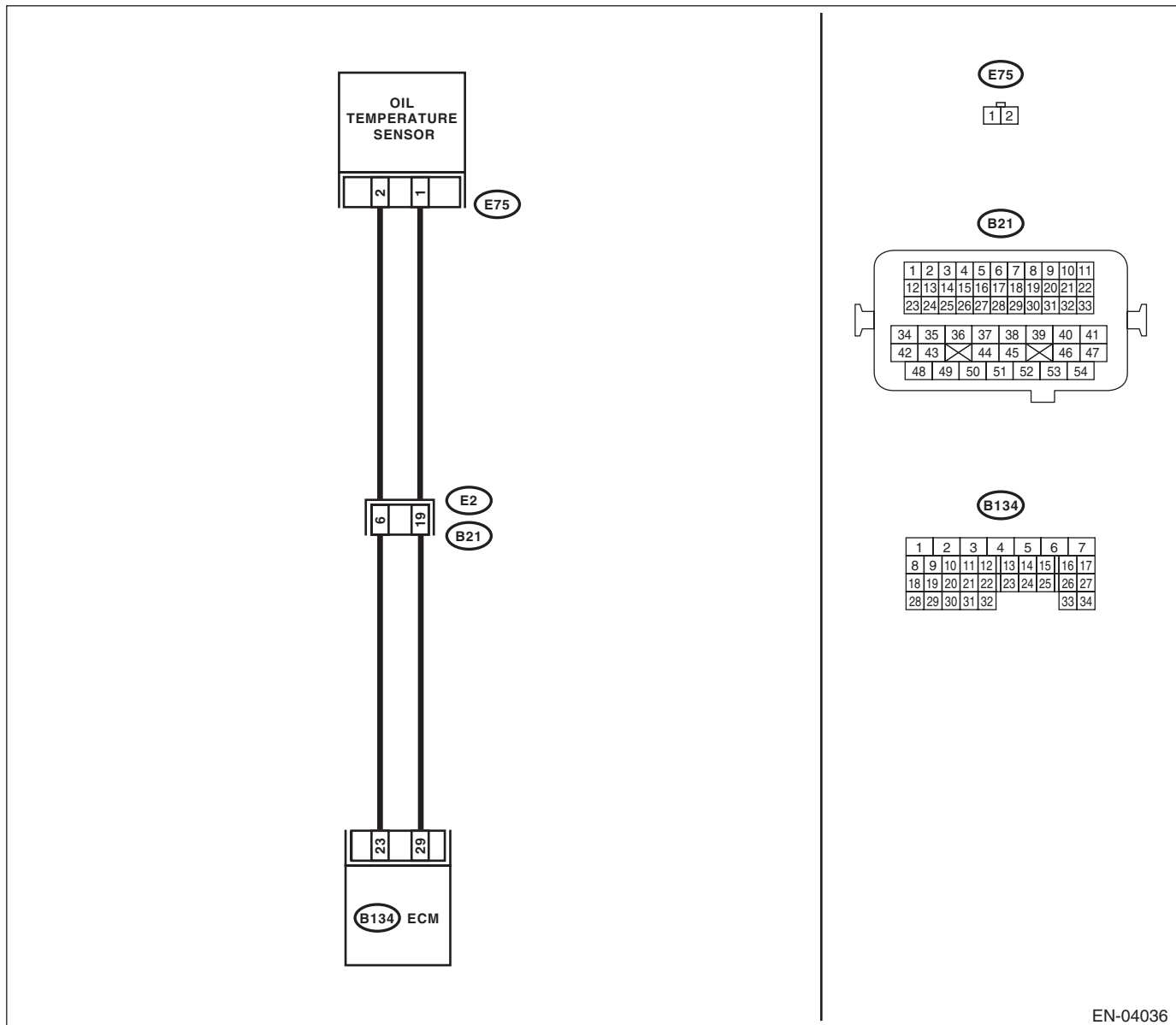
**TROUBLE SYMPTOM:**

- Hard to start
- Erroneous idling
- Poor driving performance

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



EN-04036

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the oil temperature sensor. <Ref. to FU(H4SO)-32, Oil Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AP:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-94, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

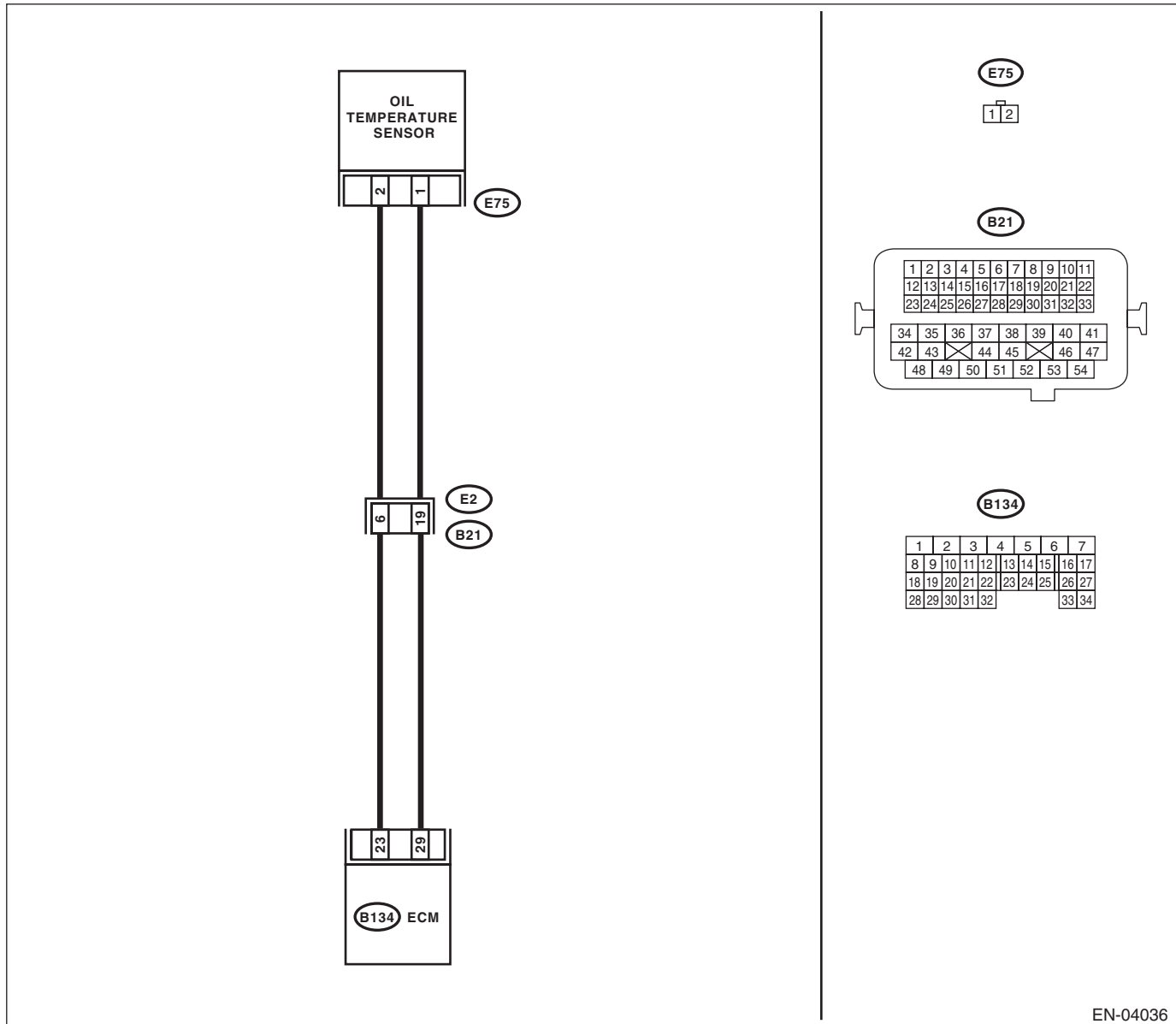
TRUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-04036

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the oil temperature 215°C (419°F) or more?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and oil temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 23 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the oil temperature sensor. &lt;Ref. to FU(H4SO)-32, Oil Temperature Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and oil temperature sensor.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AQ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-95, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

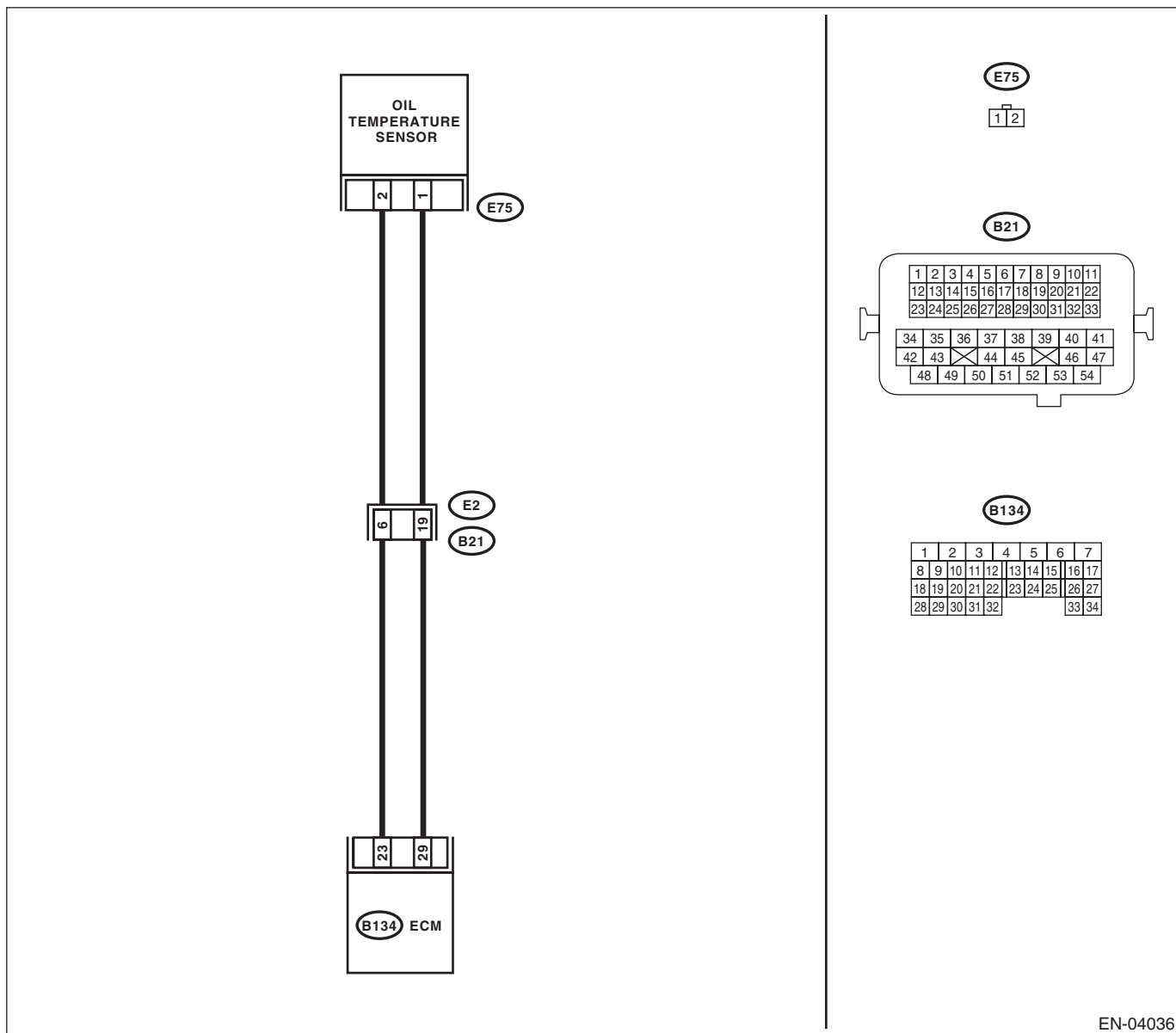
### TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04036

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the oil temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ )?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the ECM and oil temperature sensor connector.</p>	Is there poor contact in the ECM or oil temperature sensor connector?	Repair the poor contact in the ECM or the oil temperature sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and oil temperature sensor.</p> <p>3) Measure the resistance of the harness between the ECM and oil temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> (B134) No. 23 — (E75) No. 2: (B134) No. 29 — (E75) No. 1:</p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and oil temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON.</p> <p>3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> (B134) No. 23 (+) — Chassis ground (-):</p>	Is the voltage 5 V or more?	Repair the short circuit to power supply in the harness between the ECM and oil temperature sensor connector.	Replace the oil temperature sensor. <Ref. to FU(H4SO)-32, Oil Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AR:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-96, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

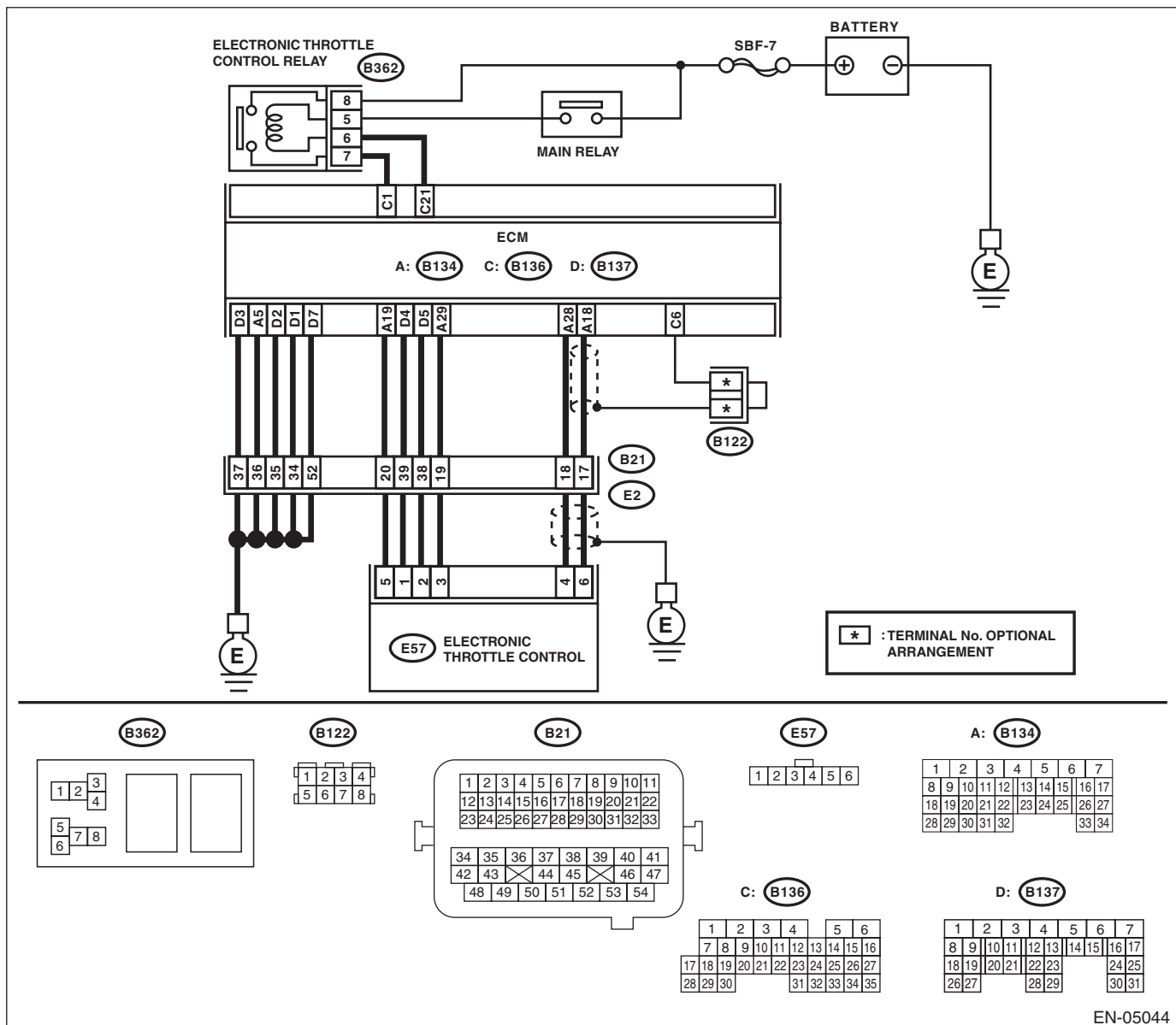
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from ECM and electronic throttle control.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 28 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E57) No. 4 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H4SO)-11, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. &lt;Ref. to FU(H4SO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AS:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-98, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

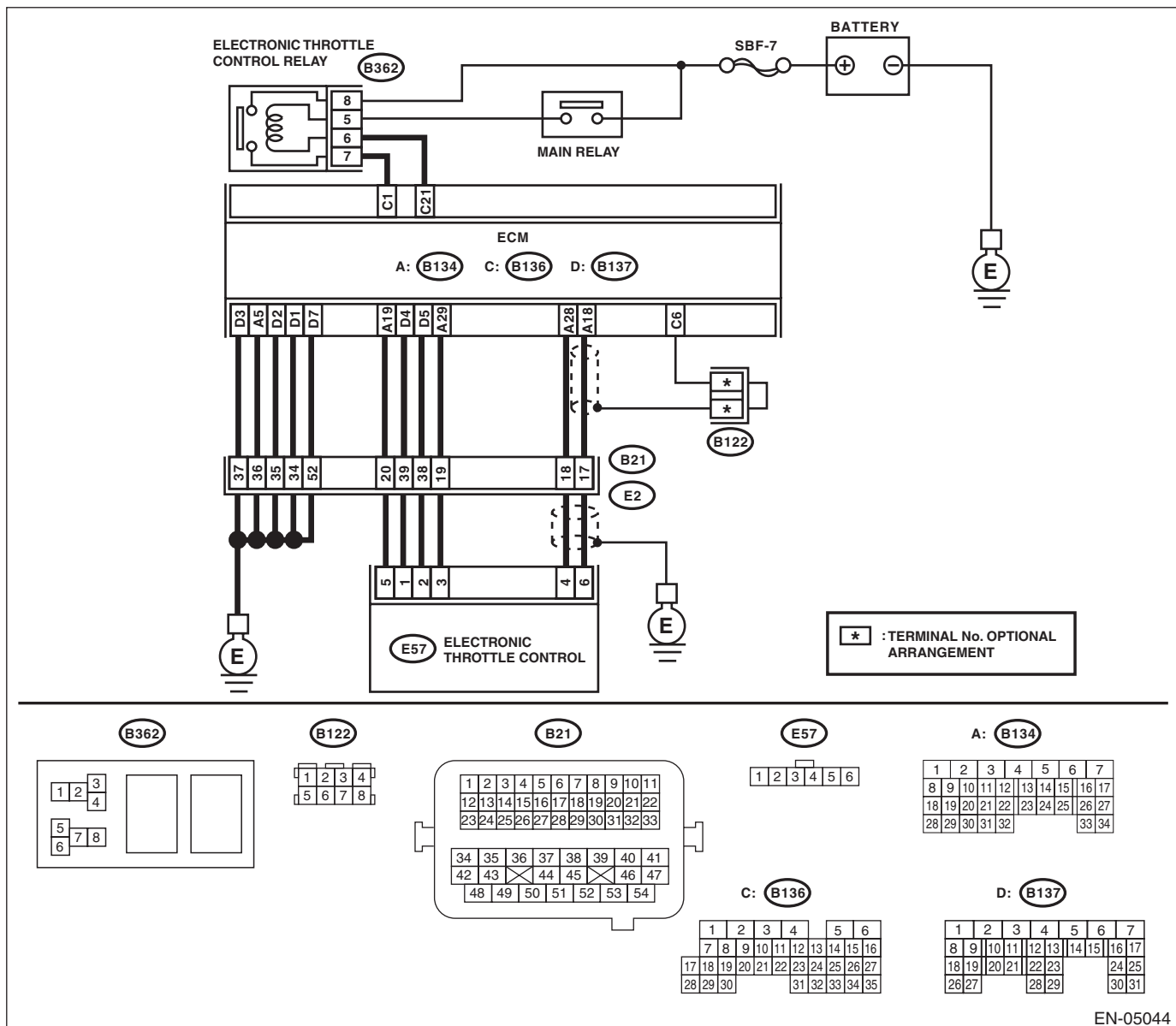
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<b>3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 MΩ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

## AT:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-176, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AU:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-176, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AV:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-176, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AW:DTC P0304 CYLINDER 4 MISFIRE DETECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-107, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

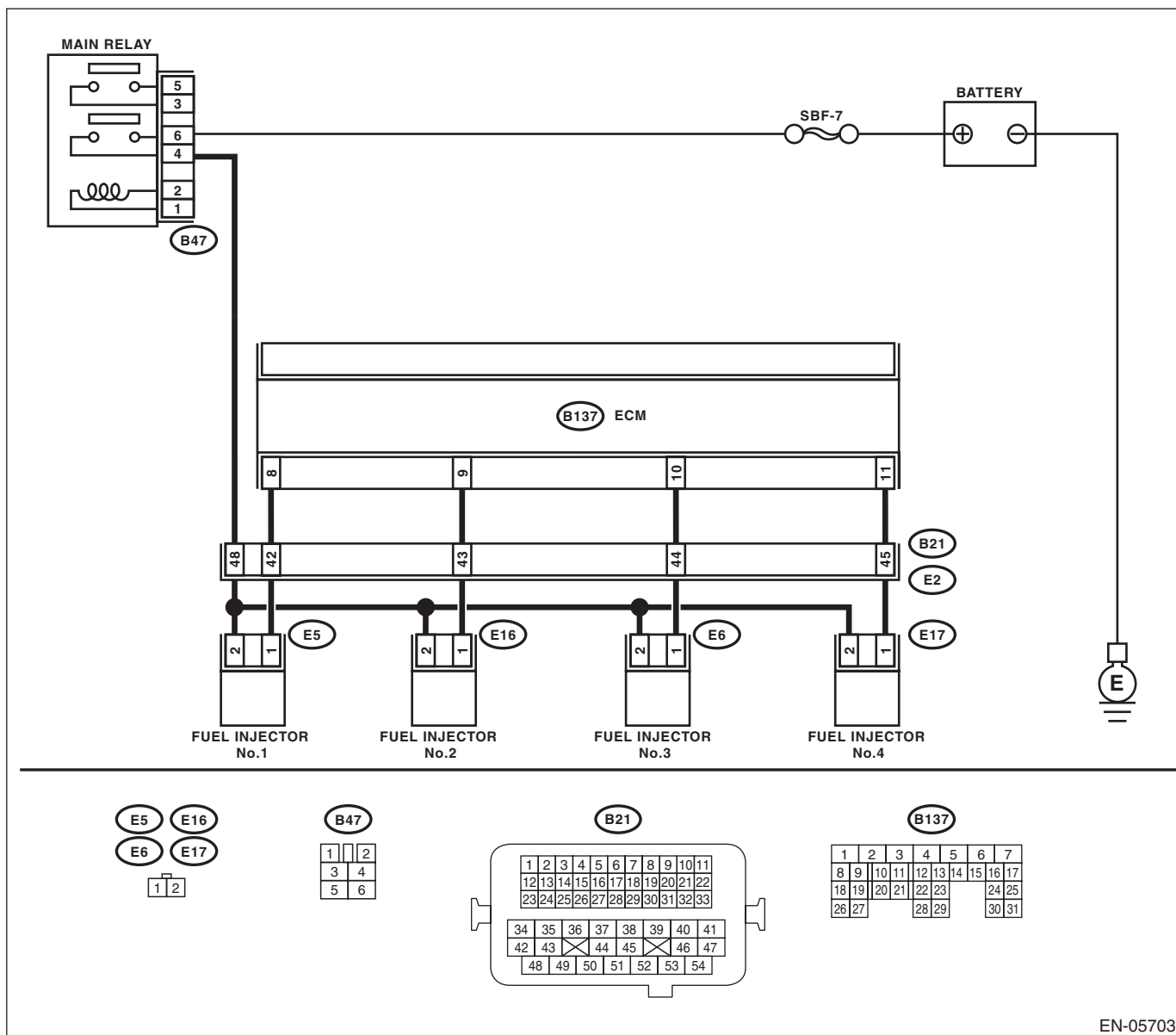
### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling
- Rough driving

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05703

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	<p><b>CHECK OUTPUT SIGNAL OF ECM.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between the ECM and chassis ground for faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (B137) No. 8 (+) — Chassis ground (-):</b>  <b>#2 (B137) No. 9 (+) — Chassis ground (-):</b>  <b>#3 (B137) No. 10 (+) — Chassis ground (-):</b>  <b>#4 (B137) No. 11 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 6.	Go to step 2.
2	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (E5) No. 1 — Engine ground:</b>  <b>#2 (E16) No. 1 — Engine ground:</b>  <b>#3 (E6) No. 1 — Engine ground:</b>  <b>#4 (E17) No. 1 — Engine ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and fuel injector.
3	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>Measure the resistance of harness between the ECM and fuel injector on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (B137) No. 8 — (E5) No. 1:</b>  <b>#2 (B137) No. 9 — (E16) No. 1:</b>  <b>#3 (B137) No. 10 — (E6) No. 1:</b>  <b>#4 (B137) No. 11 — (E17) No. 1:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK FUEL INJECTOR.</b></p> <p>Measure the resistance between fuel injector terminals on faulty cylinder.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 5.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-28, Fuel Injector.>
5	<p><b>CHECK POWER SUPPLY LINE.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (E5) No. 2 (+) — Engine ground (-):</b>  <b>#2 (E16) No. 2 (+) — Engine ground (-):</b>  <b>#3 (E6) No. 2 (+) — Engine ground (-):</b>  <b>#4 (E17) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and fuel injector connector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 (+) — Chassis ground (-):</b> <b>#2 (B137) No. 9 (+) — Chassis ground (-):</b> <b>#3 (B137) No. 10 (+) — Chassis ground (-):</b> <b>#4 (B137) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 7.
<b>7 CHECK FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H4SO)-28, Fuel Injector.>	Go to step 8.
<b>8 CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 9.
<b>9 CHECK CRANK SPROCKET.</b> Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have damaged teeth?	Replace the crank sprocket. <Ref. to ME(H4SO)-48, Crank Sprocket.>	Go to step 10.
<b>10 CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft using ST, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 499987500                      CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-42, Timing Belt.>	Go to step 11.
<b>11 CHECK FUEL LEVEL.</b>	Is the fuel meter indication higher than the "Lower" level?	Go to step 12.	Replenish fuel so that fuel meter indication is higher than the "Lower" level. After replenishing fuel, Go to step 12.
<b>12 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4SO)(diag)-54, Clear Memory Mode.> NOTE: • Subaru Select Monitor <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool Refer to operating manuals for the general scan tool. 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step 14.	Go to step 13.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
13	<b>CHECK CAUSE OF MISFIRE.</b>	Has the cause of misfire been detected while running the engine?	Finish diagnostics operation, if the engine has no abnormality.  Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact in ECM connector • Poor contact of coupling connector
14	<b>CHECK AIR INTAKE SYSTEM.</b>	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?
15	<b>CHECK MISFIRE SYMPTOM.</b> 1) Turn the ignition switch to ON. 2) Read DTC. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step 20.  Go to step 16.
16	<b>CHECK DTC.</b>	Are DTCs P0301 and P0302 displayed on the Subaru Select Monitor or general scan tool?	Go to step 21.  Go to step 17.
17	<b>CHECK DTC.</b>	Are DTCs P0303 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step 22.  Go to step 18.
18	<b>CHECK DTC.</b>	Are DTCs P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step 23.  Go to step 19.
19	<b>CHECK DTC.</b>	Are DTCs P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step 24.  Go to step 25.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
<b>20</b>	<b>ONLY ONE CYLINDER.</b>	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Spark plug cord</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
<b>21</b>	<b>GROUP OF #1 AND #2 CYLINDERS.</b>	Are there any faults in #1 and #2 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)(diag)-75, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
<b>22</b>	<b>GROUP OF #3 AND #4 CYLINDERS.</b>	Are there any faults in #3 and #4 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)(diag)-75, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
23	<b>GROUP OF #1 AND #3 CYLINDERS.</b>	Are there any faults in #1 and #3 cylinders?  Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing belt teeth</li> </ul>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	<b>GROUP OF #2 AND #4 CYLINDERS.</b>	Are there any faults in #2 and #4 cylinders?  Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing belt teeth</li> </ul>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	<b>CYLINDER AT RANDOM.</b>	Is the engine idle rough?  Go to DTC P0171. <Ref. to EN(H4SO)(diag)-158, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AX:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-108, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

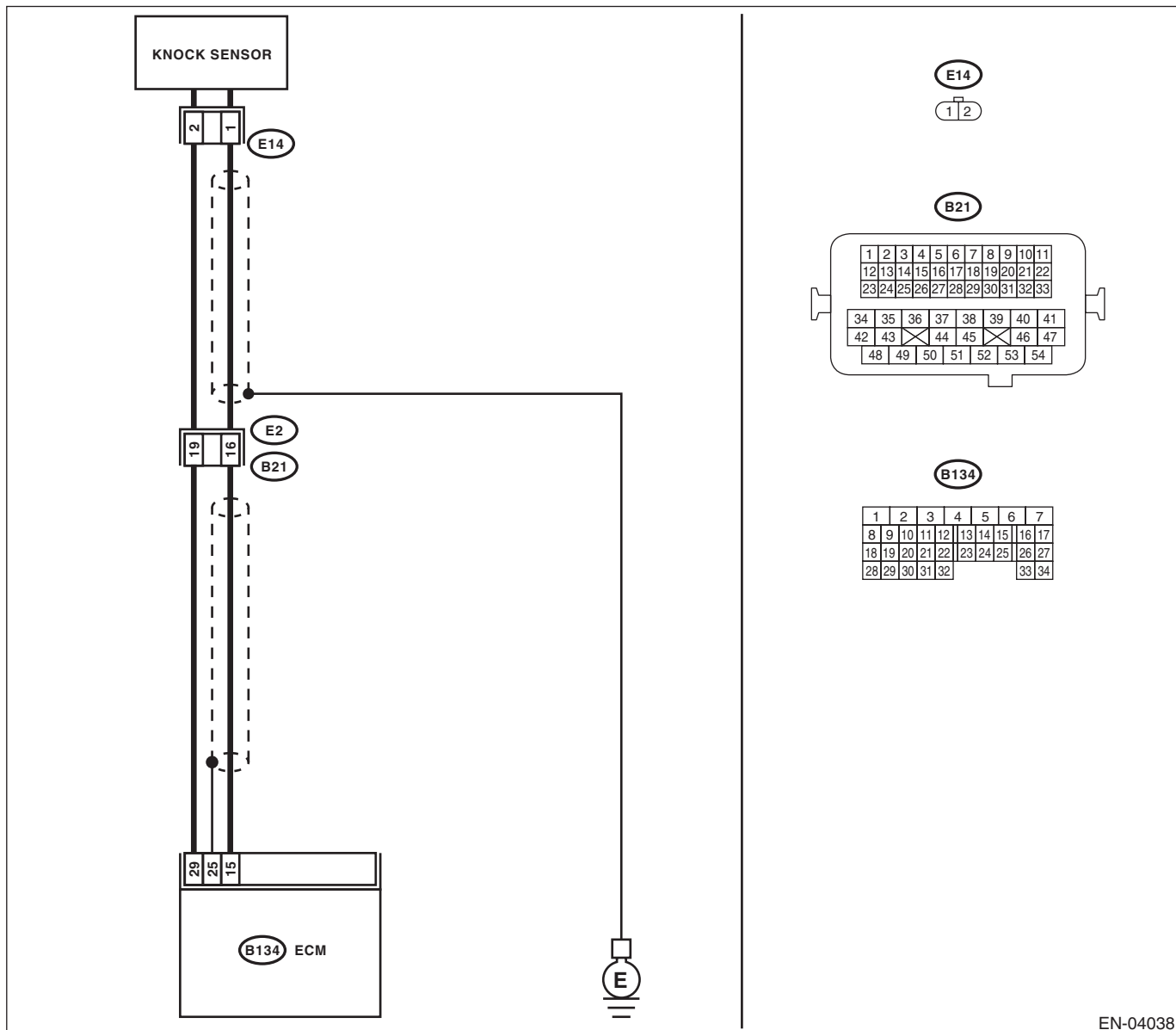
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04038

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 15 — (B134) No. 29:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair poor contact of the ECM connector.</p>
2	<p><b>CHECK KNOCK SENSOR.</b></p> <p>1) Disconnect the connector from knock sensor.</p> <p>2) Measure the resistance between knock sensor terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H4SO)-23, Knock Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and knock sensor</li> <li>• Poor contact of the knock sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AY:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-110, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

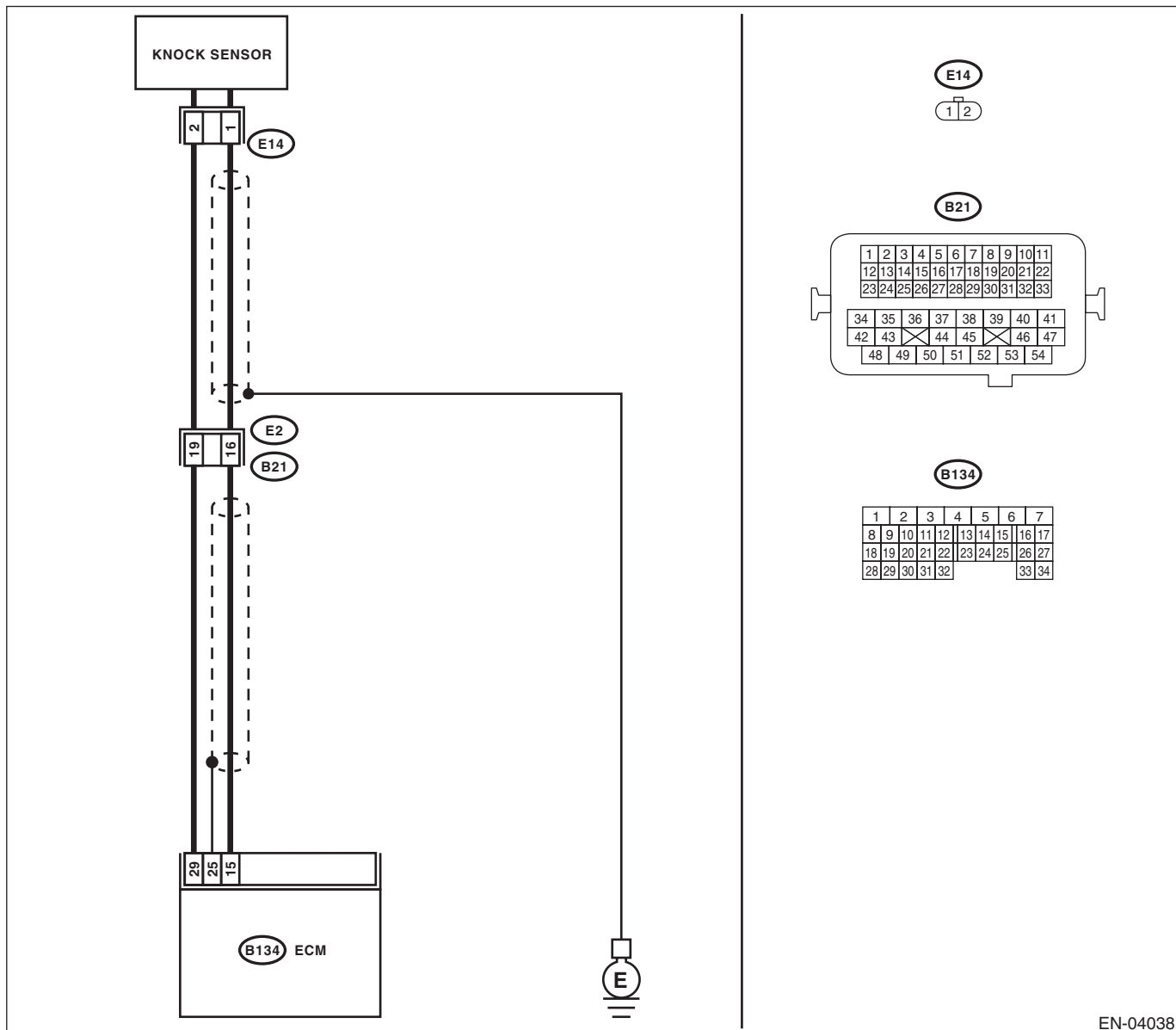
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04038

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>     <b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 15 — (B134) No. 29:</b></p>	<p>Is the resistance less than 500 kΩ?</p>	<p>Go to step 2.</p>	<p>Go to step 3.</p>
<p><b>2</b>     <b>CHECK KNOCK SENSOR.</b>            1) Disconnect the connector from knock sensor.            2) Measure the resistance between knock sensor terminals.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance less than 500 kΩ?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H4SO)-23, Knock Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between the ECM and knock sensor connector.</p> <p><b>NOTE:</b>            The harness between both connectors are shielded. Remove the shield and repair the short circuit of the harness circuit.</p>
<p><b>3</b>     <b>CHECK INPUT SIGNAL OF ECM.</b>            1) Connect the ECM.            2) Turn the ignition switch to ON.            3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 15 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 2 V or more?</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p><b>NOTE:</b>            In this case, there may be a temporary connector contact failure.</p>	<p>Repair poor contact of the ECM connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AZ:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-112, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

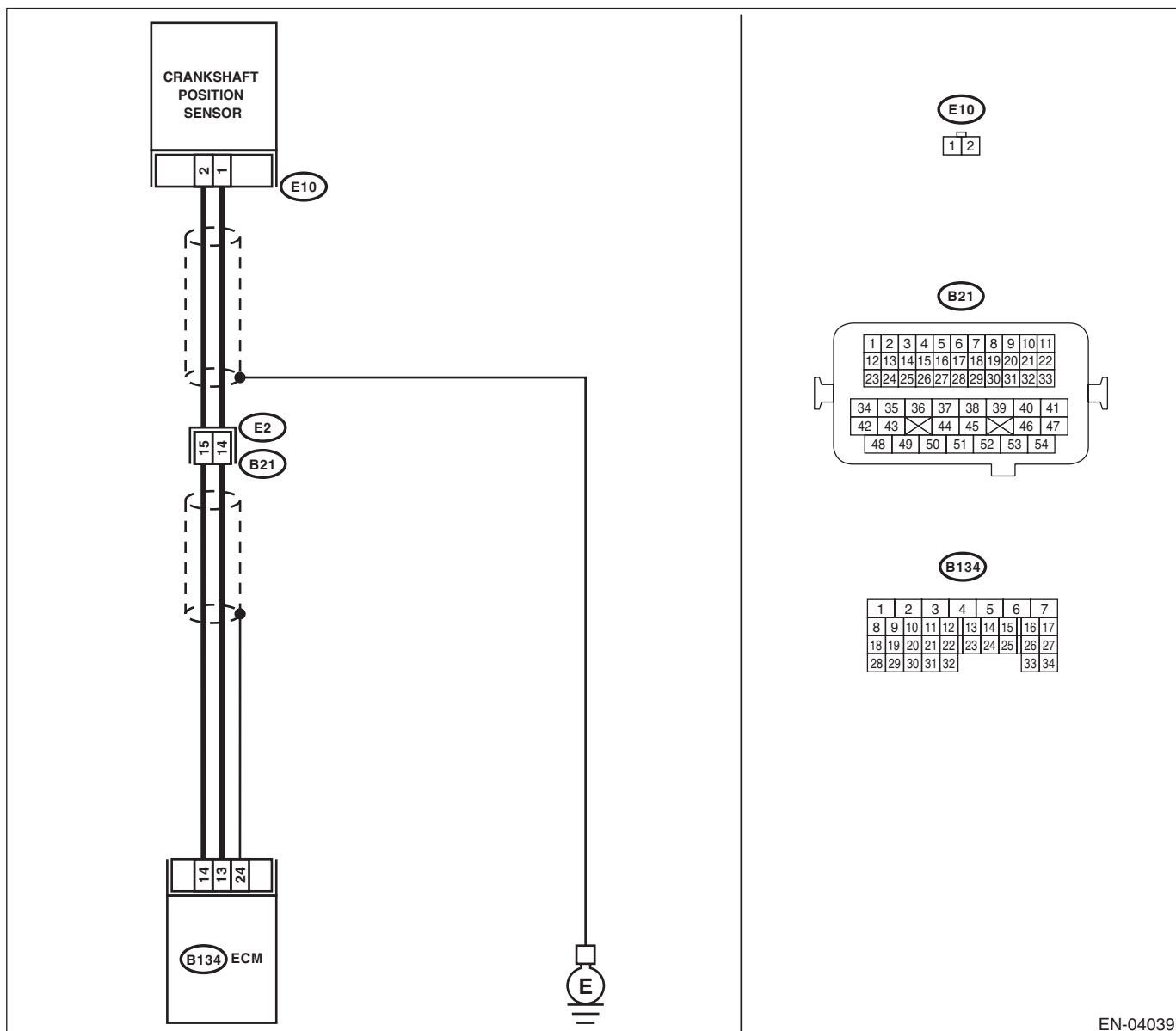
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04039

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1	<b>CHECK INSTALLATION CONDITION OF CRANKSHAFT POSITION SENSOR.</b>	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.  Tighten the crankshaft position sensor installation bolt securely.
2	<b>CHECK CRANKSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the crankshaft position sensor. 3) Measure the resistance between connector terminals of crankshaft position sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 1 and 4 k $\Omega$ ?	Go to step 3.  Replace the crankshaft position sensor. <Ref. to FU(H4SO)-21, Crankshaft Position Sensor.>
3	<b>CHECK HARNESS BETWEEN ECM AND CRANK SHAFT POSITION SENSOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between the ECM and crankshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 13 — (E10) No. 1:</b> <b>(B134) No. 14 — (E10) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM and crankshaft position sensor connector.  Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and crankshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BA:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-114, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

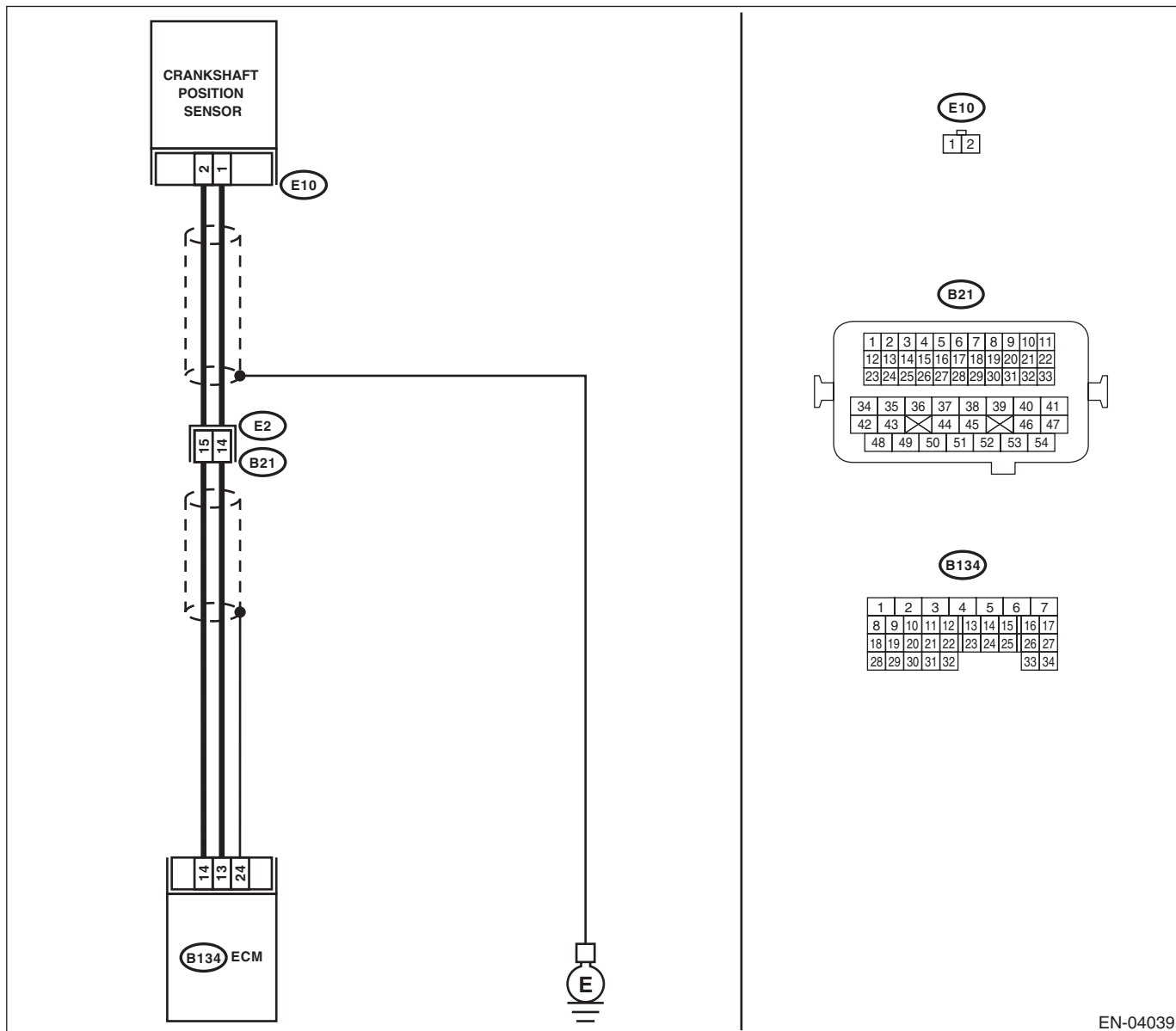
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04039



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.</b> Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.	Tighten the crankshaft position sensor installation bolt securely.
<b>2</b>	<b>CHECK CRANK SPROCKET.</b> Remove the timing belt cover.	Are crank sprocket teeth cracked or damaged?	Replace the crank sprocket. <Ref. to ME(H4SO)-48, Crank Sprocket.>	Go to step 3.
<b>3</b>	<b>CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block.	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-42, Timing Belt.>	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-21, Crankshaft Position Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BB:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-116, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

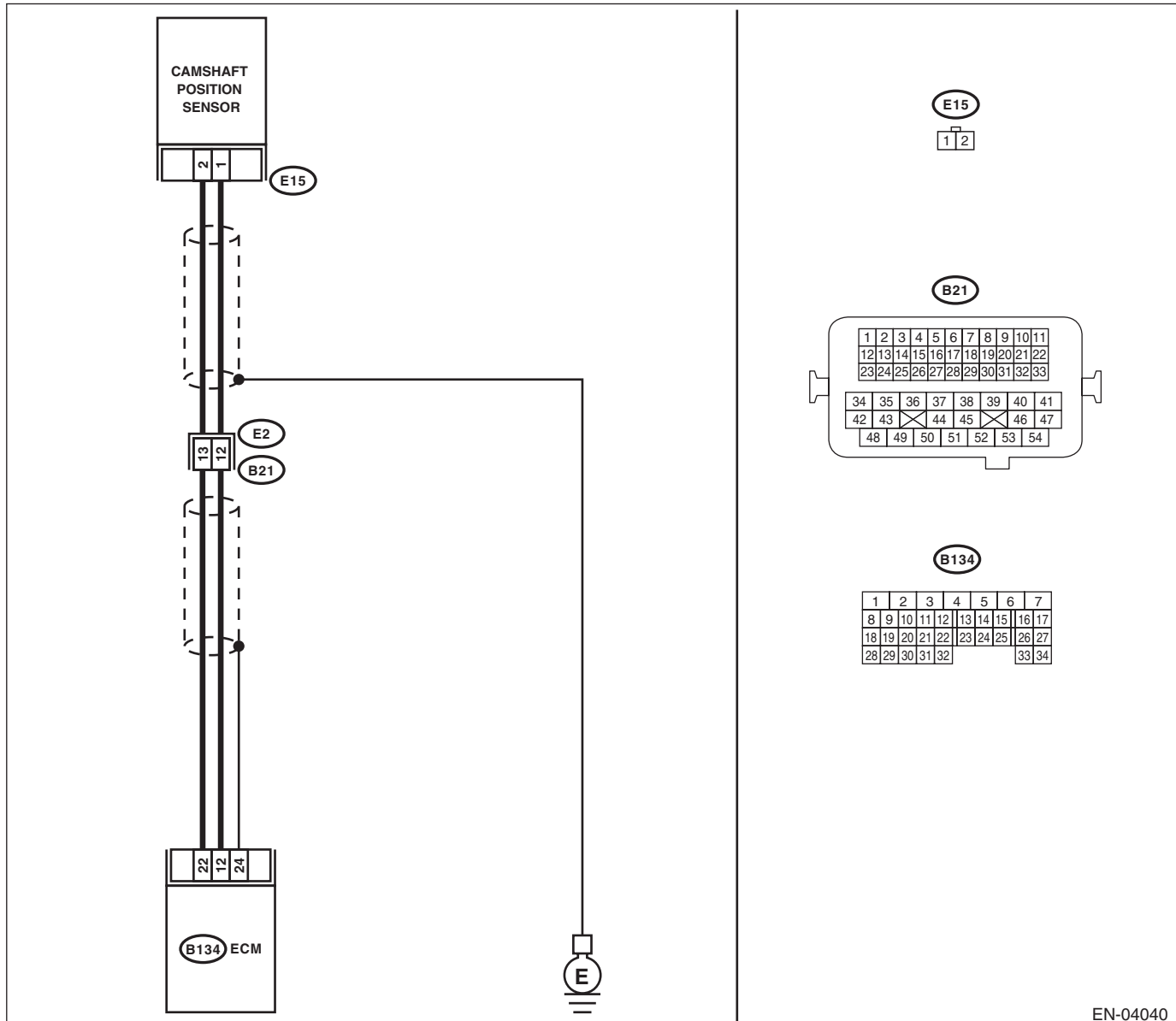
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04040

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and camshaft position sensor.</p> <p>3) Measure the resistance of harness between the ECM and camshaft position sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 12 — (E15) No. 1:</b>  <b>(B134) No. 22 — (E15) No. 2:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	<p>Repair the harness and connector.</p> <p>NOTE:            In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and camshaft position sensor</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
2	<p><b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR.</b></p> <p>Measure the resistance between camshaft position sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E15) No. 1 — Engine ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	<p>Repair the short circuit to ground of harness between the ECM and camshaft position sensor.</p> <p>NOTE:            The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit.</p>
3	<p><b>CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.</b></p>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 4.	Tighten the camshaft position sensor installation bolt securely.
4	<p><b>CHECK CAMSHAFT POSITION SENSOR.</b></p> <p>1) Remove the camshaft position sensor.</p> <p>2) Measure the resistance between connector terminals of camshaft position sensor.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	Is the resistance between 1 and 4 kΩ?	Repair the poor contact of the ECM or camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-22, Camshaft Position Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BC:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE /PERFORMANCE (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-118, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

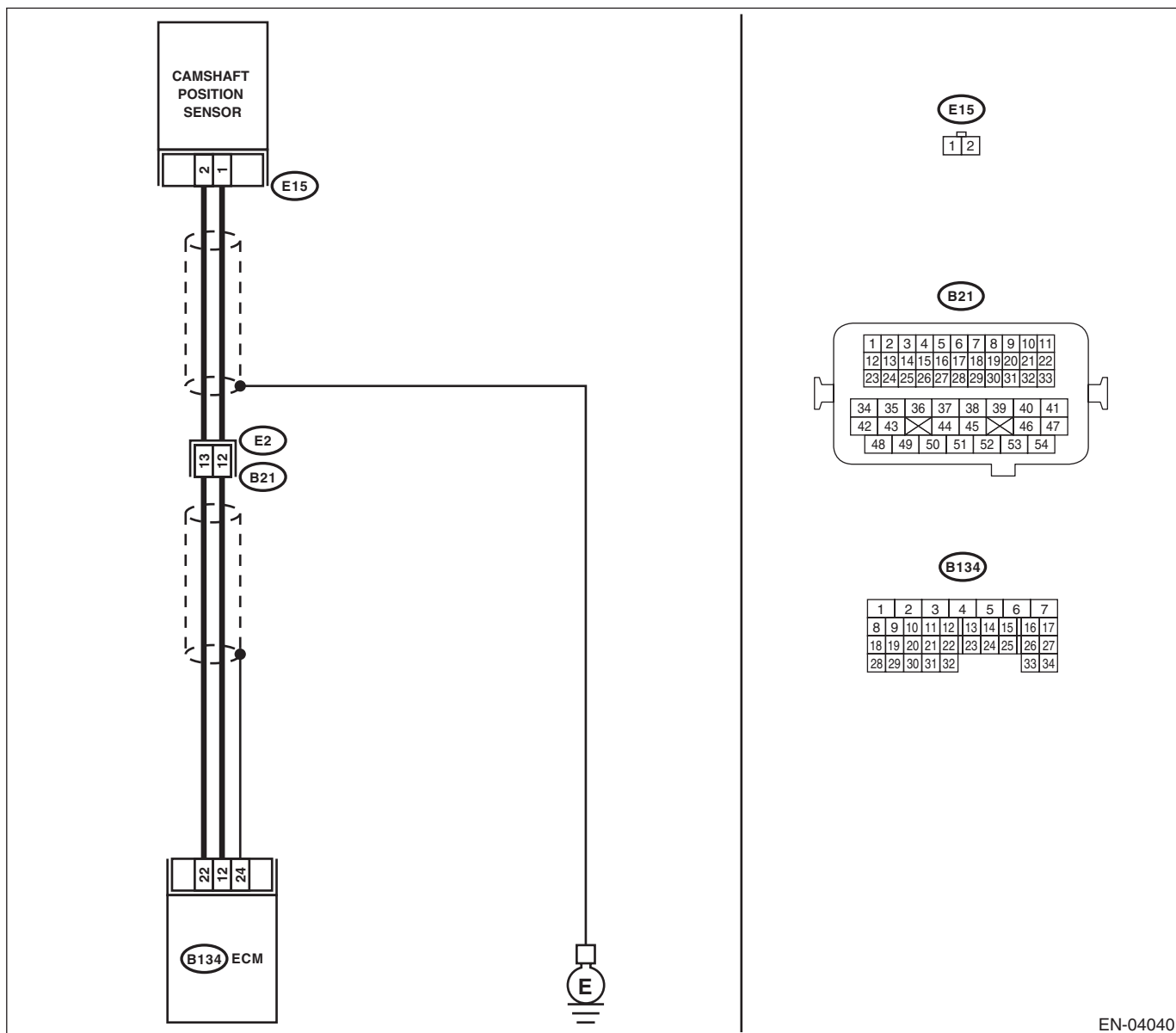
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04040

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and camshaft position sensor. 3) Measure the resistance of harness between the ECM and camshaft position sensor connector. <i>Connector &amp; terminal</i> <i>(B134) No. 12 — (E15) No. 1:</i> <i>(B134) No. 22 — (E15) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of the harness between the ECM and camshaft position sensor • Poor contact in ECM connector • Poor contact of coupling connector
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR.</b> Measure the resistance between camshaft position sensor connector and engine ground. <i>Connector &amp; terminal</i> <i>(E15) No. 1 — Engine ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit to ground of harness between the ECM and camshaft position sensor. NOTE: The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit.
<b>3</b> <b>CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 4.	Tighten the camshaft position sensor installation bolt securely.
<b>4</b> <b>CHECK CAMSHAFT POSITION SENSOR.</b> 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 1 and 4 kΩ?	Go to step 5.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-22, Camshaft Position Sensor.>
<b>5</b> <b>CHECK CAM SPROCKET.</b> Remove the timing belt cover. <Ref. to ME(H4SO)-41, Timing Belt Cover.>	Are cam sprocket teeth cracked or damaged?	Replace the cam sprocket. <Ref. to ME(H4SO)-47, Cam Sprocket.>	Go to step 6.
<b>6</b> <b>CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft using the ST, and align the alignment mark on the cam sprocket with the alignment mark on the timing belt cover LH. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-42, Timing Belt.>	Replace the camshaft position sensor. <Ref. to FU(H4SO)-22, Camshaft Position Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-120, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

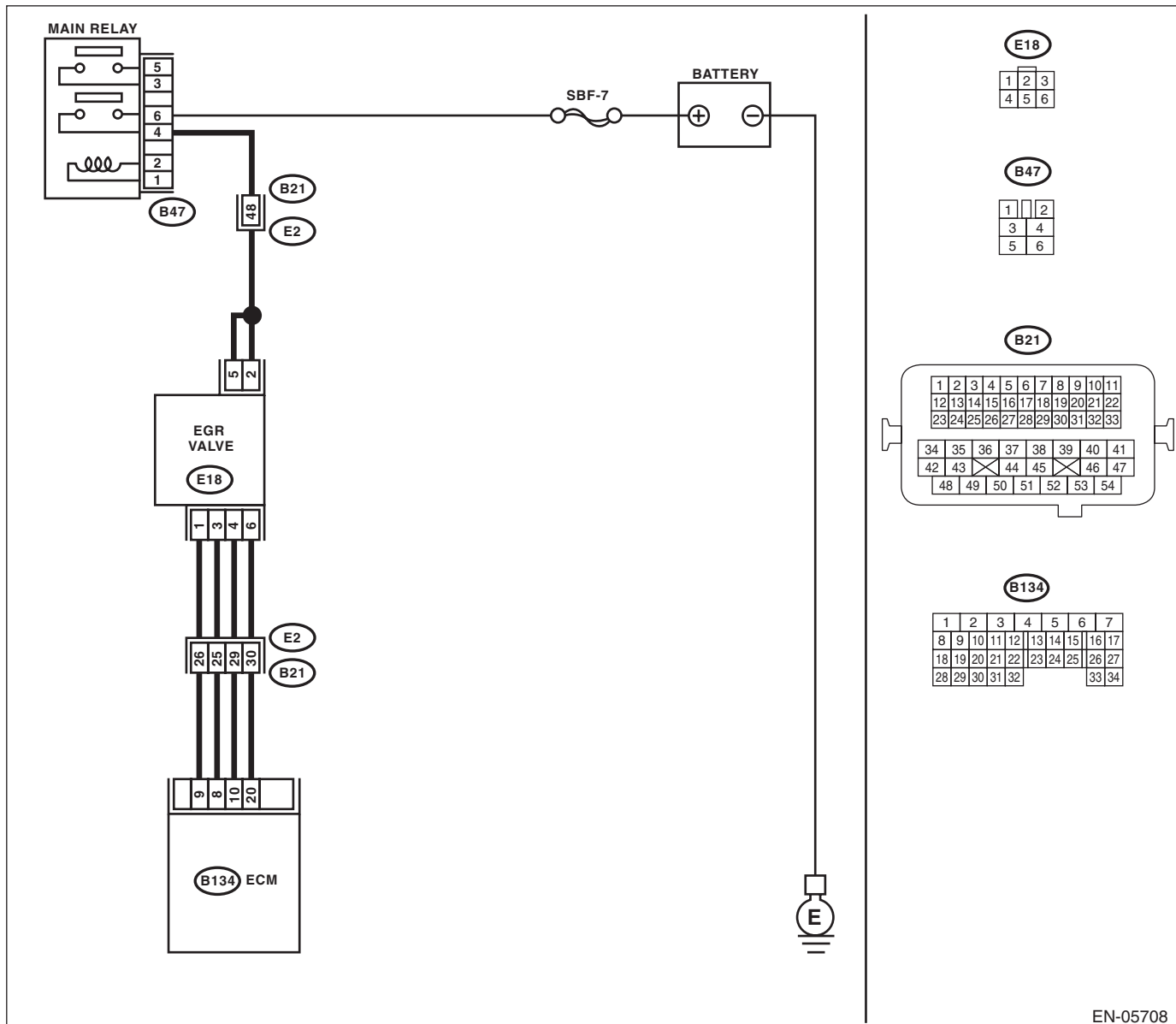
### TROUBLE SYMPTOM:

- Movement performance problem when engine is low speed.
- Improper idling
- Movement performance problem

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05708

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 53.3 kPa (400 mmHg, 15.75 inHg) or more?</p>	<p>Make sure that the EGR valve, manifold absolute pressure sensor and throttle body are installed securely.</p>	<p>Go to step 2.</p>
2	<p><b>CHECK EGR SOLENOID VALVE.</b></p> <p>Remove the EGR valve.</p>	<p>Are there holes, plugged piping or foreign objects caught in the EGR system?</p>	<p>Repair the EGR system.</p>	<p>Replace the EGR valve. &lt;Ref. to FU(H4SO)-27, EGR Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BE:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-124, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

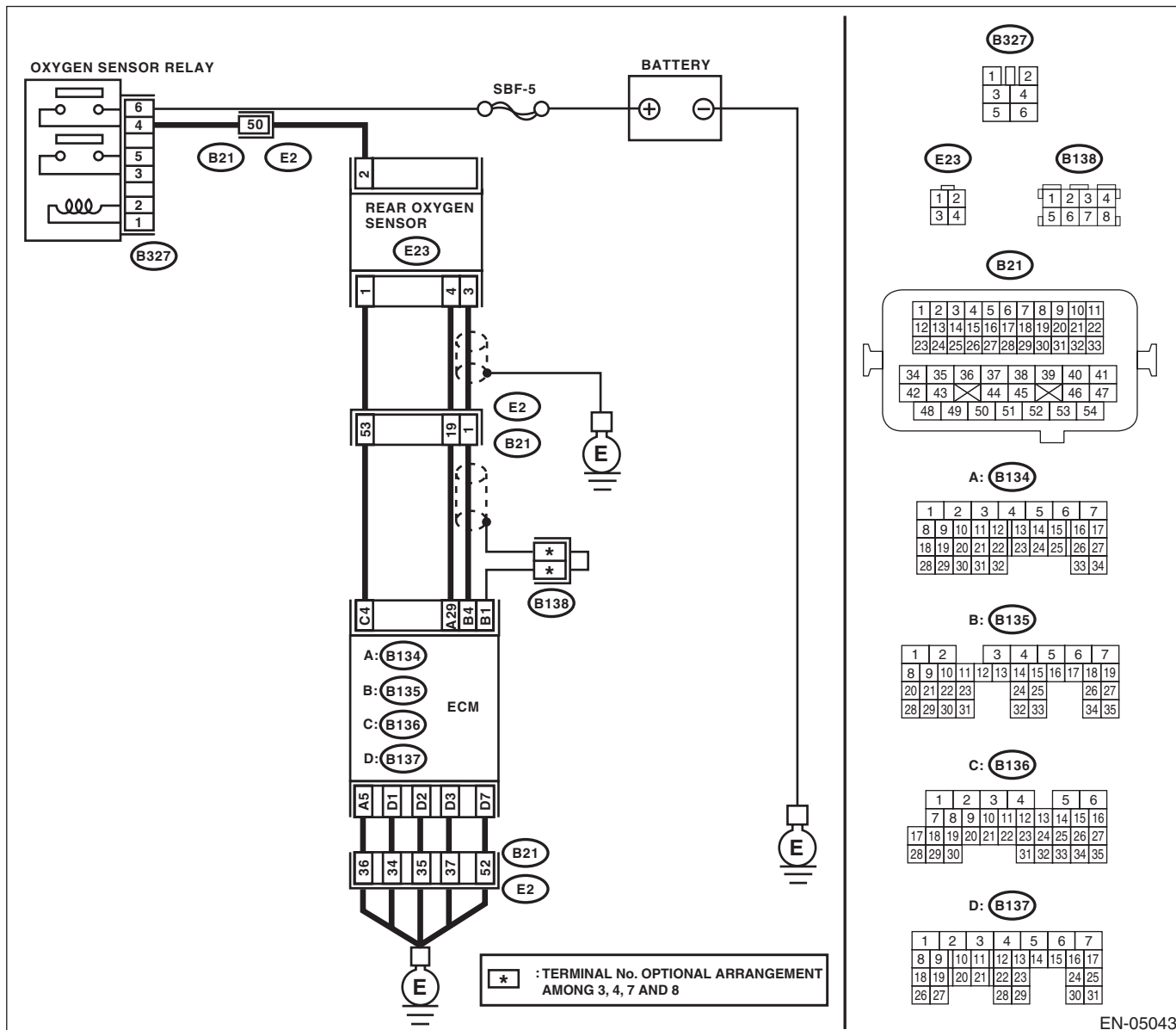
### TROUBLE SYMPTOM:

- Engine stalls.
- Idle mixture is out of specifications.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:

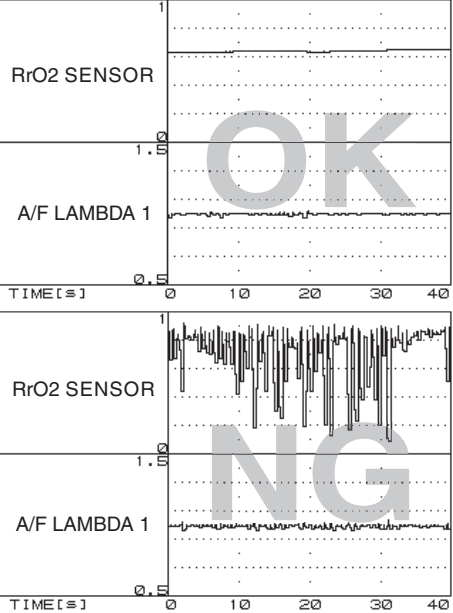


EN-05043



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK EXHAUST SYSTEM.</b> Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes.</p> <p>NOTE: Check the following positions.</p> <ul style="list-style-type: none"> <li>• Between cylinder head and front exhaust pipe</li> <li>• Between front exhaust pipe and front catalytic converter</li> <li>• Between front catalytic converter and rear catalytic converter</li> <li>• Loose or improperly attached front oxygen (A/F) sensor or rear oxygen sensor</li> </ul>	<p>Is there any fault in exhaust system?</p>	<p>Repair or replace the exhaust system. &lt;Ref. to EX(H4SO)-2, General Description.&gt;</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).</b> 1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH). 2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data.</p> <div style="display: flex; flex-direction: column; align-items: center;">  <p style="margin-top: 10px;">EN-04895</p> </div>	<p>Is a normal waveform displayed?</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.</p> <p>NOTE: In this case, temporary poor contact of connector may be the cause.</p>	<p>Go to step 3.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>3</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).</b></p> <p>1) Run the engine at idle.</p> <p>2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data.</p> <div> <p>RrO2 SENSOR</p> <p>TIME[=] 0 10 20 30 40</p> </div> <div> <p>RrO2 SENSOR</p> <p>TIME[=] 0 10 20 30 40</p> </div> <p style="text-align: right;">EN-04896</p>	<p>Is a normal waveform displayed?</p>	<p>Go to step 4.</p>	<p>Go to step 5.</p>
<p><b>4</b></p> <p><b>CHECK CATALYTIC CONVERTER.</b></p>	<p>Is the catalytic converter damaged?</p>	<p>Replace the catalytic converter. &lt;Ref. to EC(H4SO)-3, Front Catalytic Converter.&gt;</p>	<p>Go to step 5.</p>
<p><b>5</b></p> <p><b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	<p>Has water entered the connector?</p>	<p>Completely remove any water inside.</p>	<p>Go to step 6.</p>
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from ECM and rear oxygen sensor.</p> <p>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b> (B135) No. 4 — (E23) No. 3: (B134) No. 29 — (E23) No. 4:</p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 7.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E23) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 0.2 — 0.5 V?</p>	<p>Go to step <b>8</b>.</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>            Repair the following locations.</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the ECM and rear oxygen sensor</li> <li>• Poor contact in ECM connector</li> </ul>
<p><b>8</b></p> <p><b>CHECK REAR OXYGEN SENSOR SHIELD.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Expose the rear oxygen sensor connector body side harness sensor shield.</p> <p>3) Measure the resistance between the sensor shield and chassis ground.</p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Replace the rear oxygen sensor.            &lt;Ref. to FU(H4SO)-35, Rear Oxygen Sensor.&gt;</p>	<p>Repair the open circuit in the rear oxygen sensor harness.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BF:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-127, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

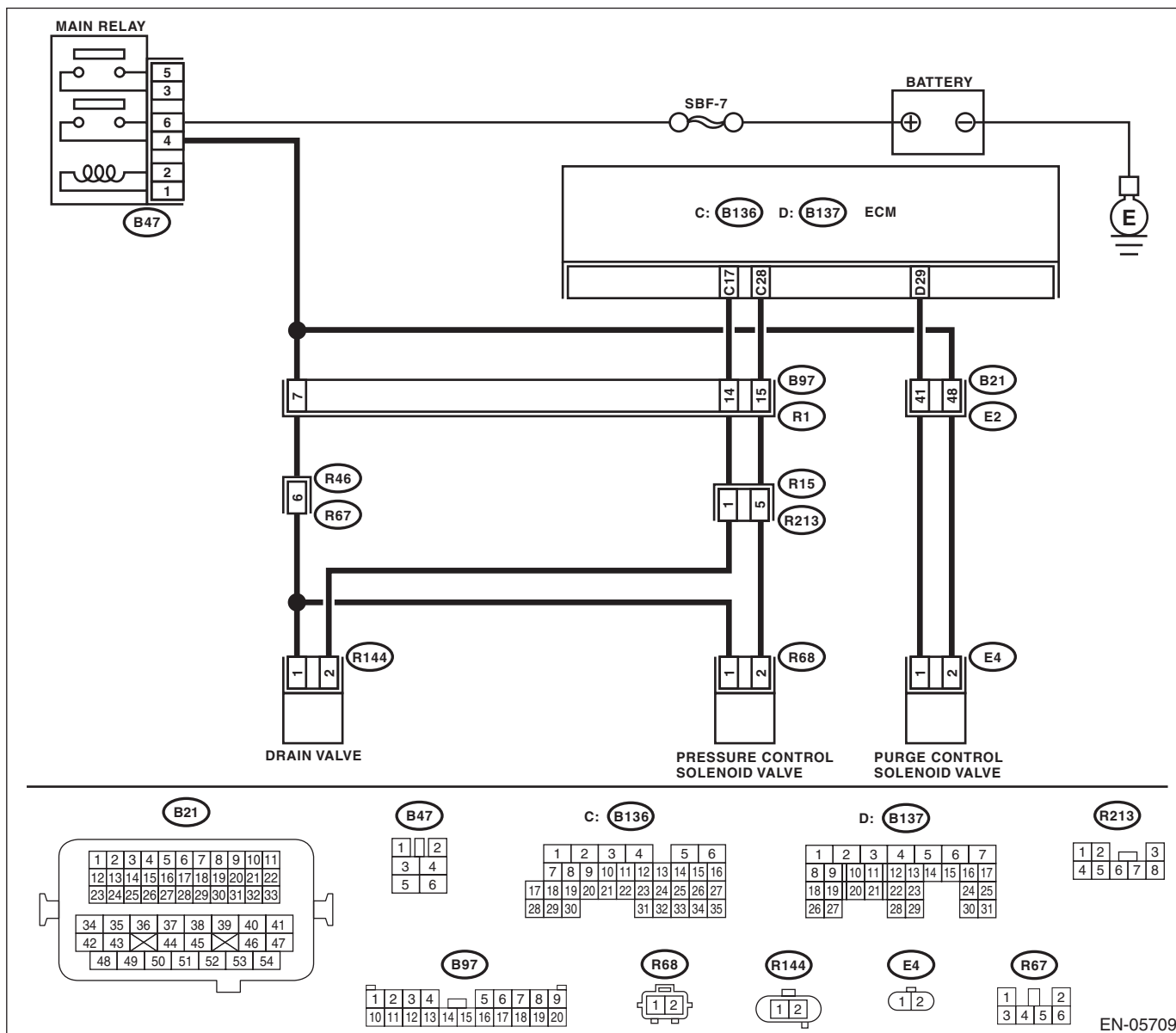
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2 CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
<b>3 CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-50, Fuel Filler Pipe.>	Go to step 4.
<b>4 CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>
<b>5 CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
<b>6 CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>
<b>7 CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-59, Fuel Delivery and Evaporation Lines.>	Go to step 8.
<b>8 CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 9.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 1.0 mm (0.04 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

## BG:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

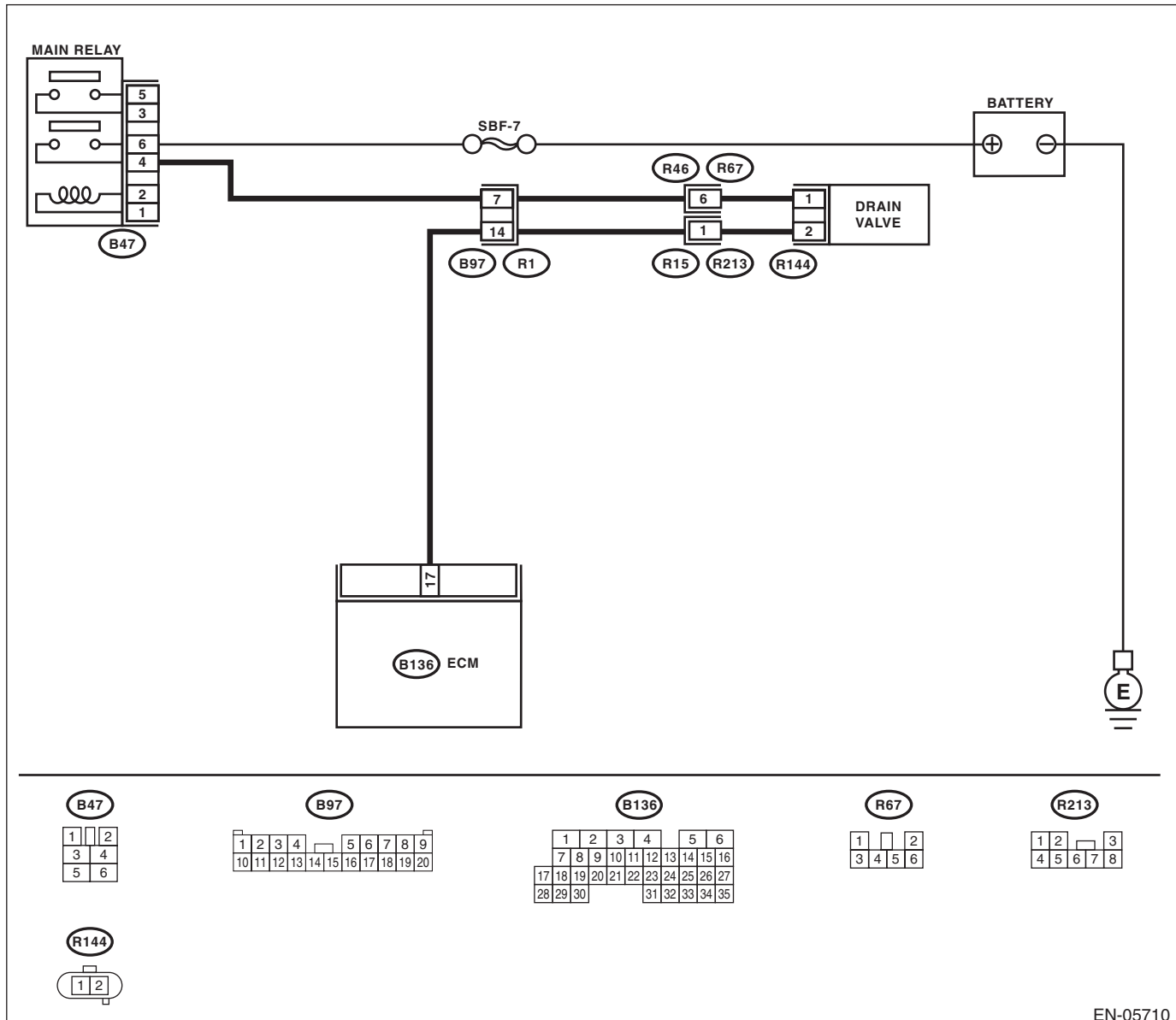
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-144, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05710

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Measure the resistance between the drain valve connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 2 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and drain valve connector.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> Measure the resistance of harness between ECM and drain valve connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 — (R144) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and drain valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4</b> <b>CHECK DRAIN VALVE.</b> Measure the resistance between drain valve terminals. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>
<b>5</b> <b>CHECK POWER SUPPLY TO DRAIN VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between drain valve and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 1 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair poor contact of the drain valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and drain valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>



## BH:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

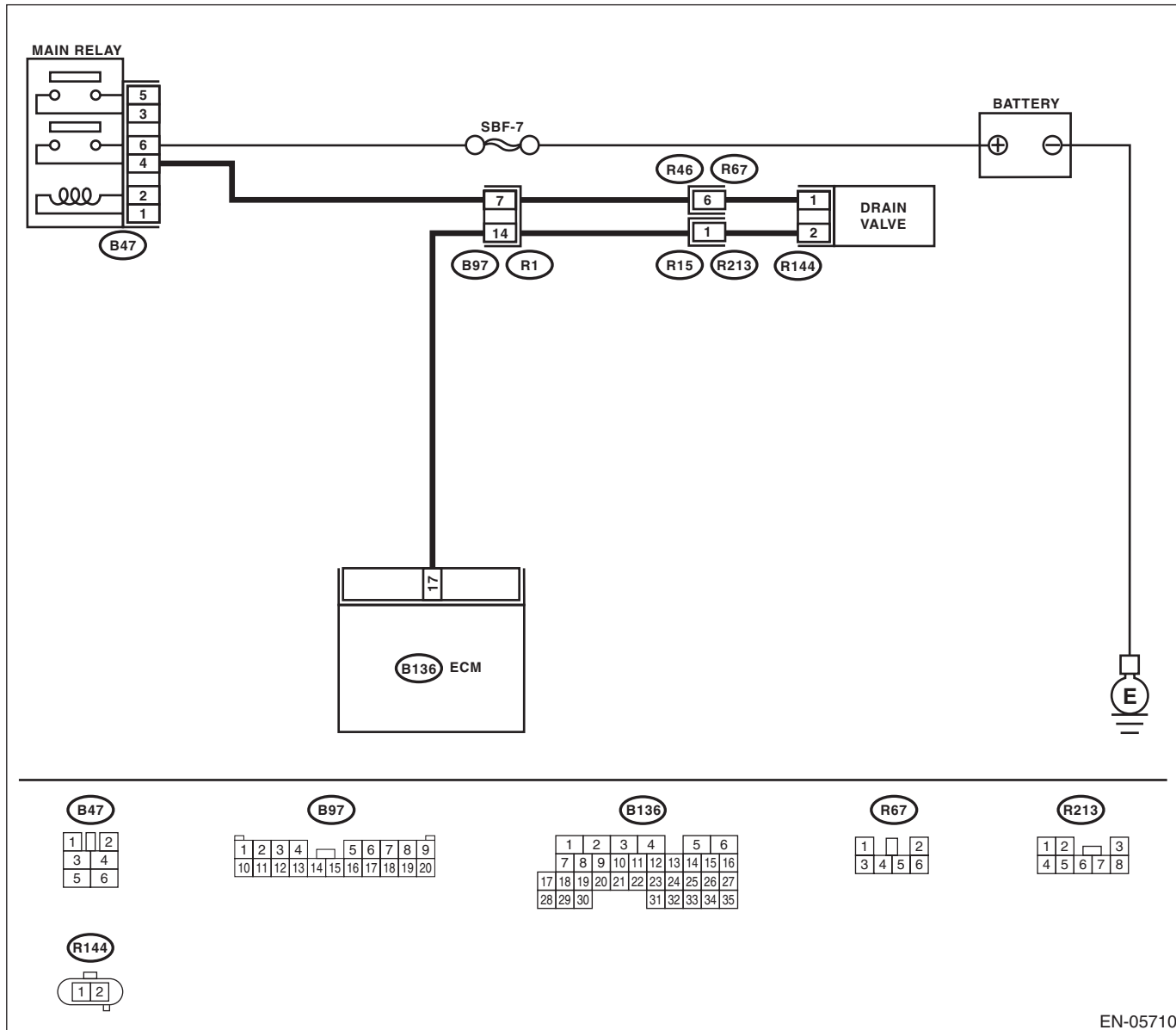
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-146, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05710

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 17 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and drain valve connector.	Go to step 2.
2	<b>CHECK DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between drain valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>	Repair the poor contact of the ECM connector.

## BI: DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

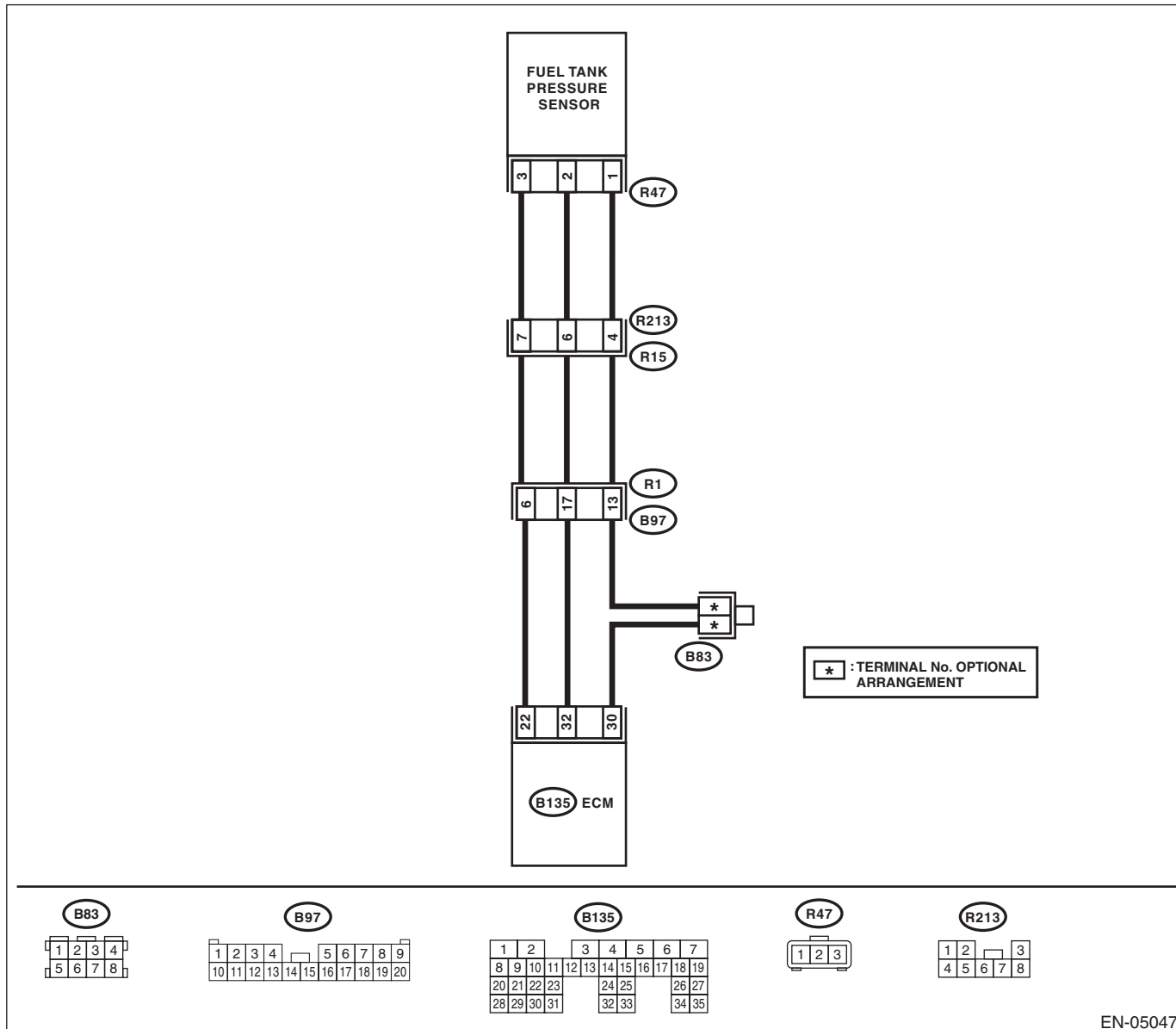
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-148, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05047

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2</b>	<b>CHECK PRESSURE VACUUM LINE.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank</li><li>• Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank</li></ul>	Is there any fault in pressure/vacuum line?	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

## BJ:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

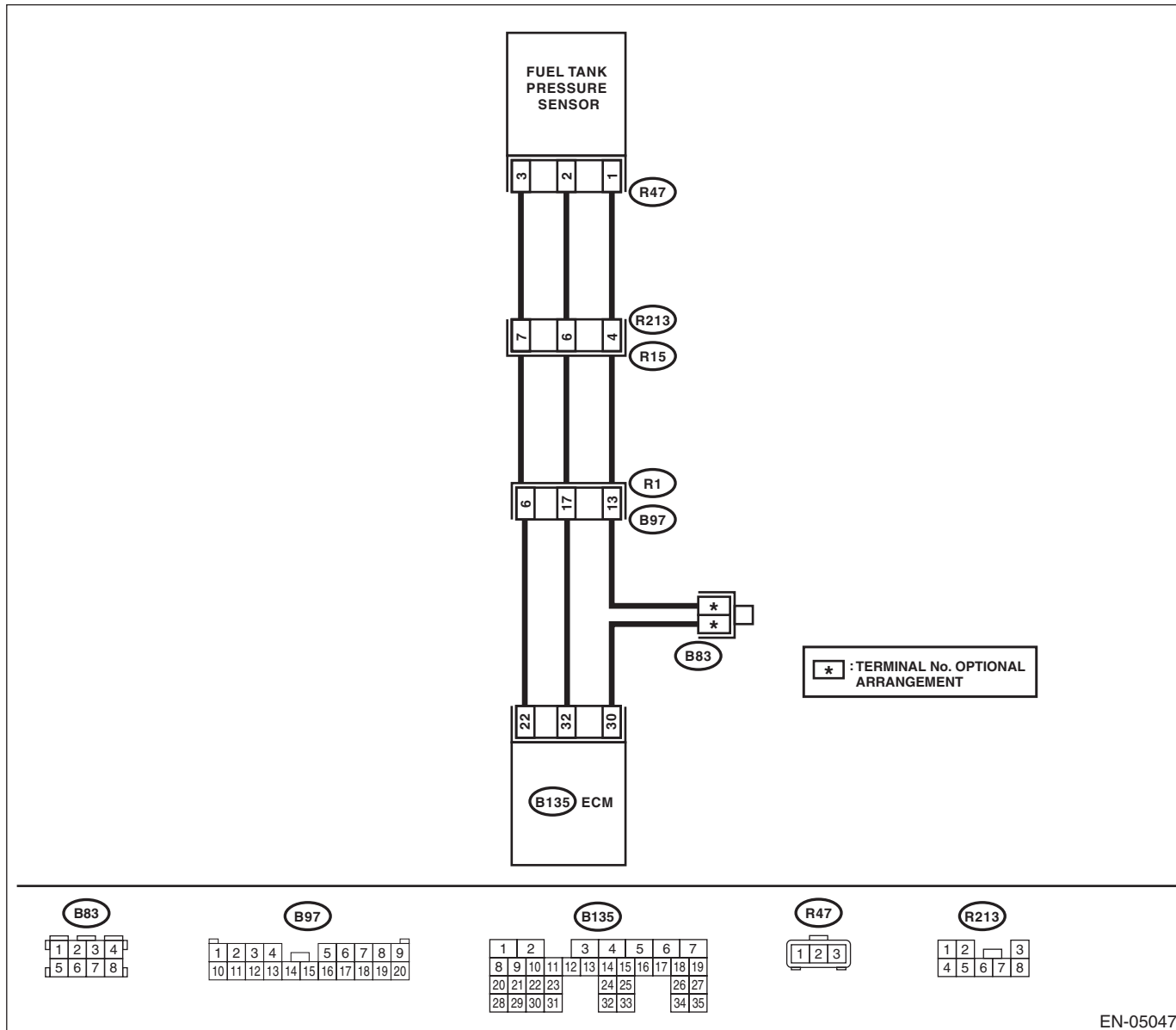
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-150, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05047

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK CURRENT DATA.</b> 1) Turn the ignition switch to ON. 2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.  <b>NOTE:</b> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value less than -7.41 kPa (-55.6 mmHg, -2.19 inHg)?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  <b>NOTE:</b> In this case, there may be a temporary connector contact failure.
<b>2 CHECK FUEL TANK PRESSURE SENSOR POWER SOURCE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the fuel tank pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between the fuel tank pressure sensor connector and chassis ground.  <b>Connector &amp; terminal</b> <b>(R47) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 3.	Repair the harness and connector.  <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel tank pressure sensor connector</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between the ECM and fuel tank pressure sensor connector.  <b>Connector &amp; terminal</b> <b>(B135) No. 32 — (R47) No. 2:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector.  <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel tank pressure sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b> <b>(B135) No. 32 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and fuel tank pressure sensor connector.
<b>5 CHECK POOR CONTACT.</b> Check for poor contact between the ECM and fuel tank pressure sensor connector.	Is there poor contact in the ECM or fuel tank pressure sensor connector?	Repair the poor contact in the ECM or fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

## BK:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

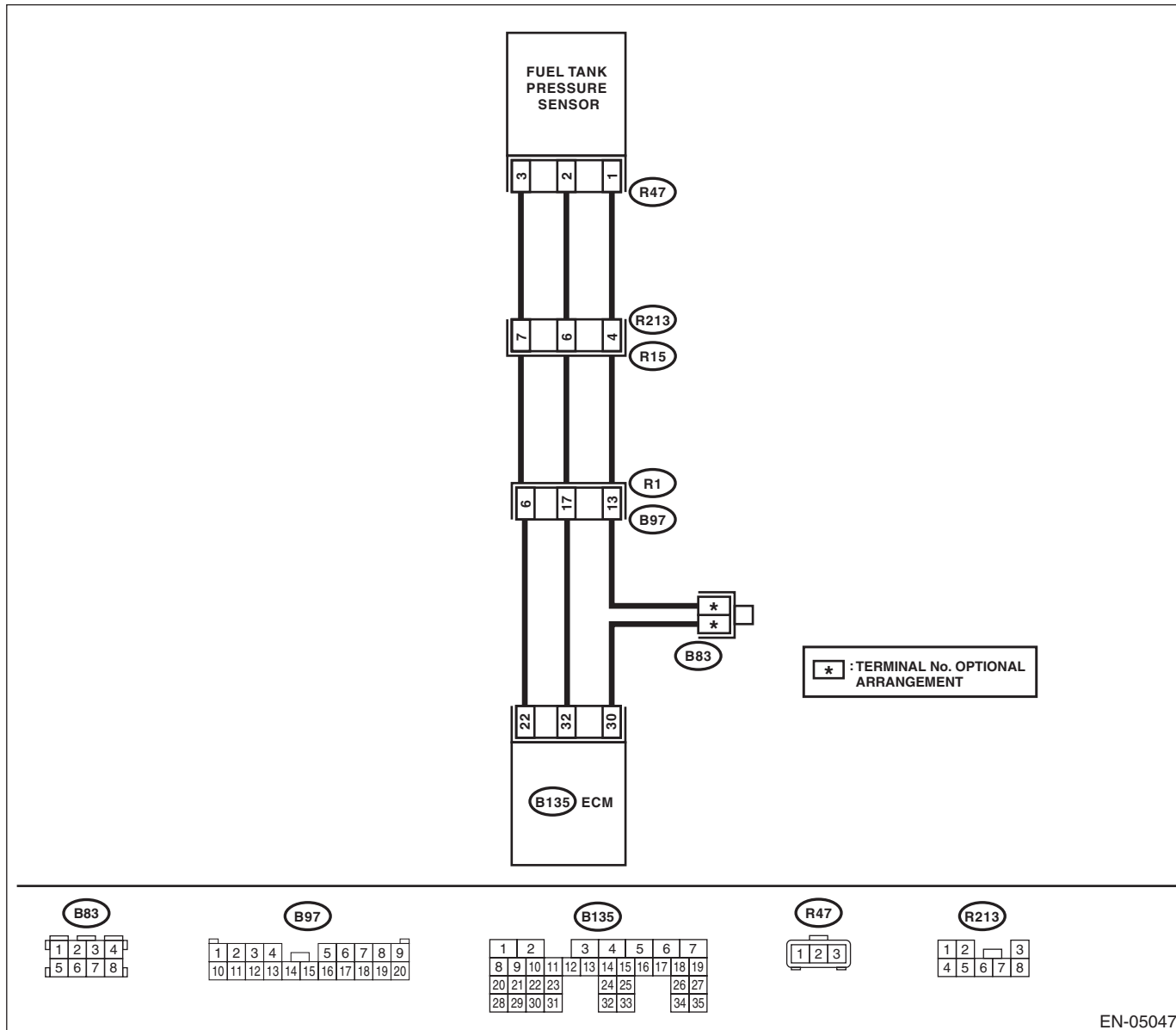
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-152, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05047

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the fuel tank pressure sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more?	Repair the short circuit to power in the harness between ECM and fuel tank pressure sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between fuel tank pressure sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(R47) No. 1 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and fuel tank pressure sensor connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the fuel tank pressure sensor connector.</p>	Is there poor contact in fuel tank pressure sensor connector?	Repair the poor contact in the fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BL:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-153, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

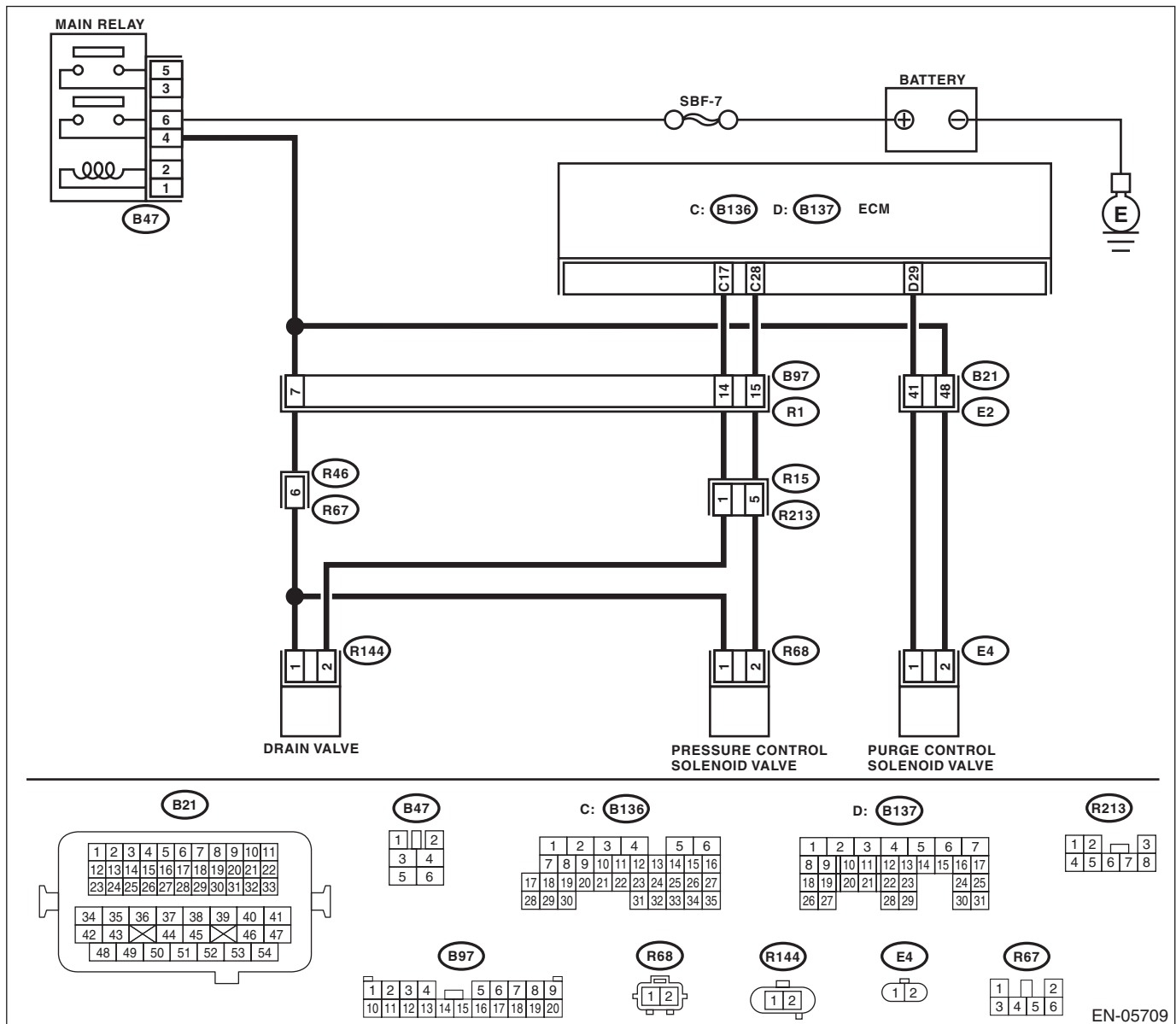
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-50, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-59, Fuel Delivery and Evaporation Lines.>	Go to step 8.
8	<b>CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 9.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 0.5 mm (0.020 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BM:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-153, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

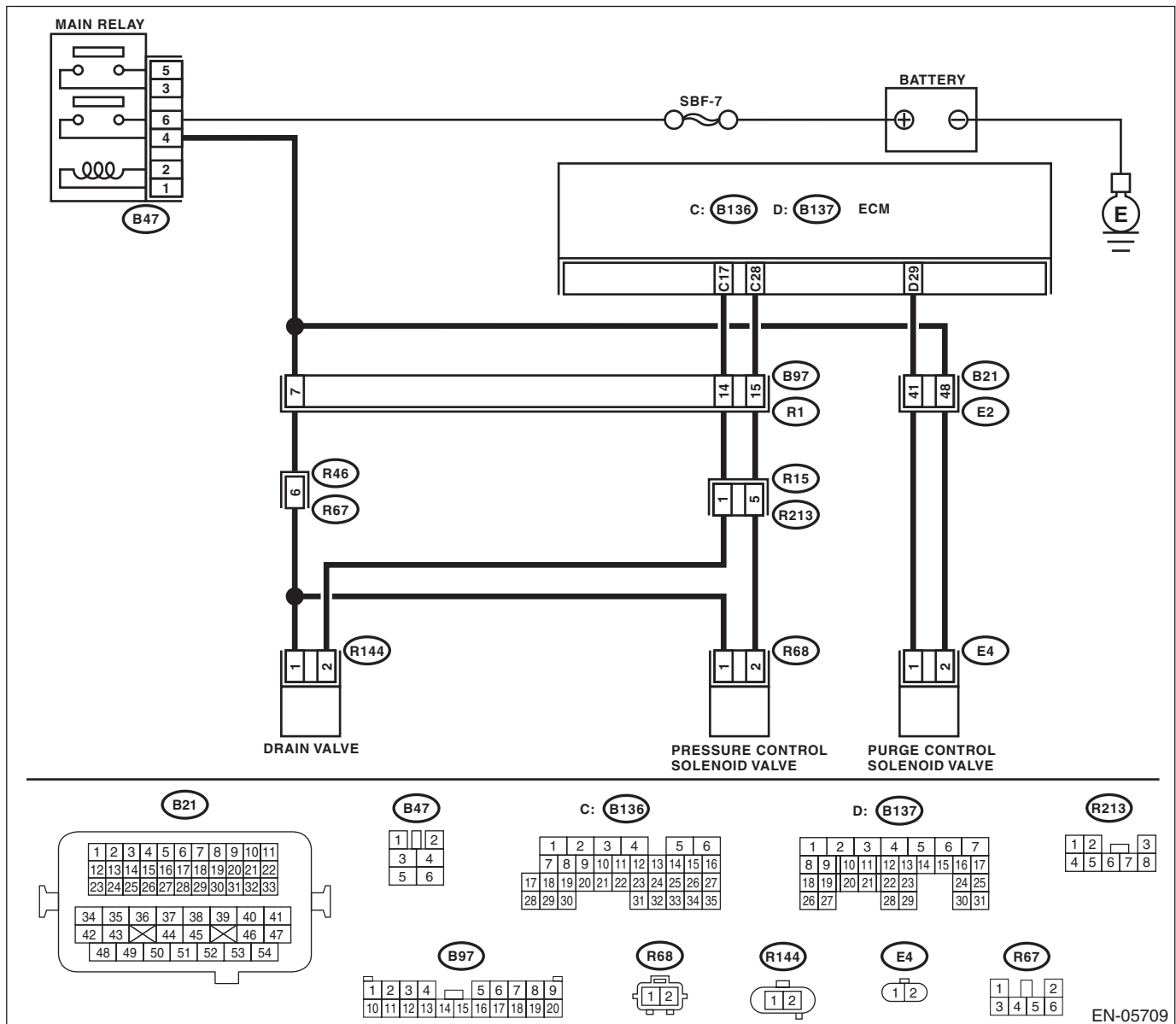
### TROUBLE SYMPTOM:

- Fuel odor
- Fuel filler cap loose or lost

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05709

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-50, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Are there any disconnected, broken or clogged evaporation lines?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-59, Fuel Delivery and Evaporation Lines.>	Go to step 8.
8	<b>CHECK CANISTER.</b>	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 9.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>9</b>	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-43, Fuel Tank.>	Go to step 10.
<b>10</b>	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Are there holes, cracks, clogging, or disconnections, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BN:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-154, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

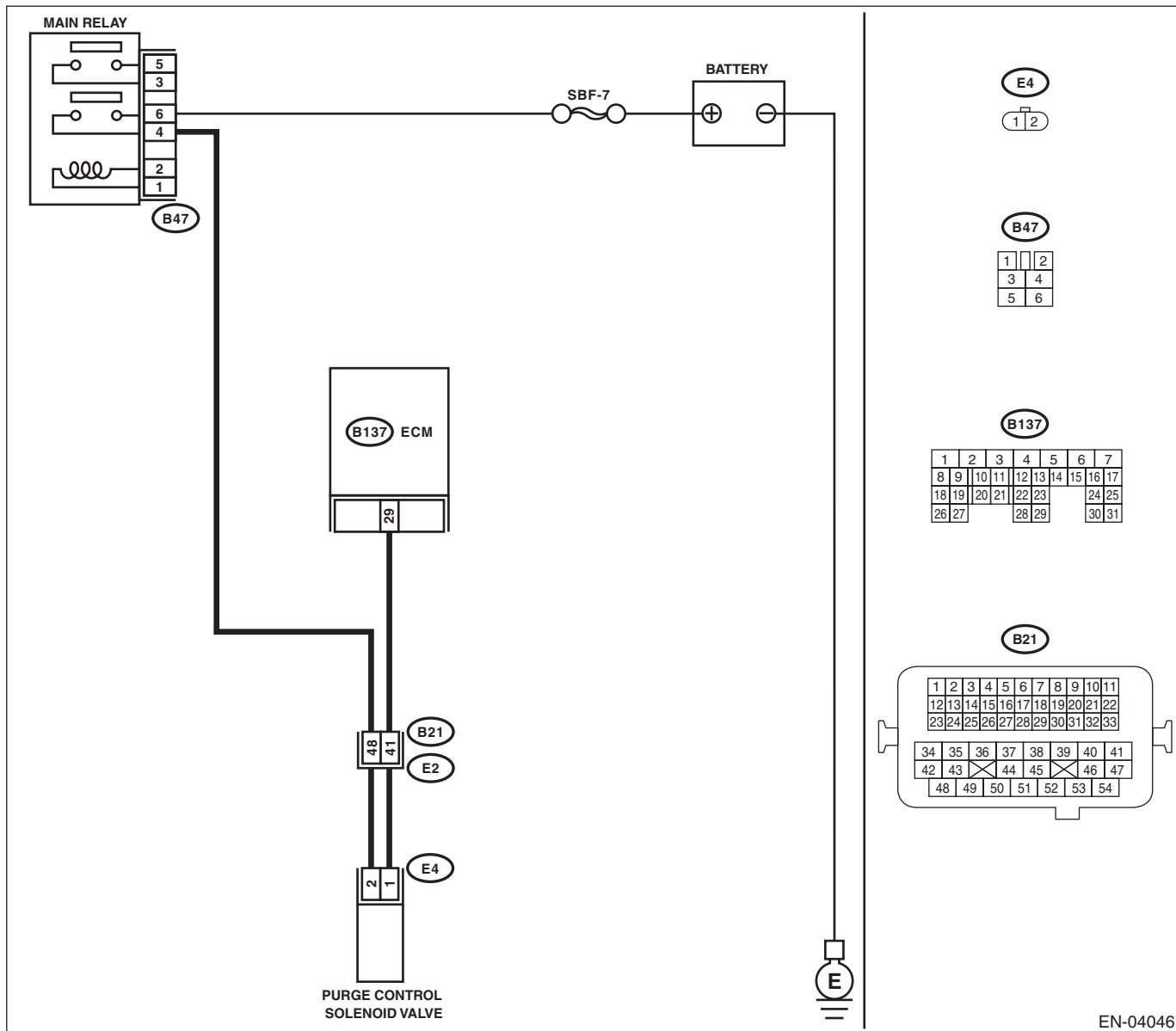
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04046

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B137) No. 29 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Measure the resistance between the purge control solenoid valve connector and engine ground. <i>Connector &amp; terminal</i> <i>(E4) No. 1 — Engine ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and purge control solenoid valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and purge control solenoid valve. <i>Connector &amp; terminal</i> <i>(B137) No. 29 — (E4) No. 1:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and purge control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 10 — 100 Ω?	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
<b>5 CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. <i>Connector &amp; terminal</i> <i>(E4) No. 2 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of purge control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and purge control solenoid valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BO:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-156, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

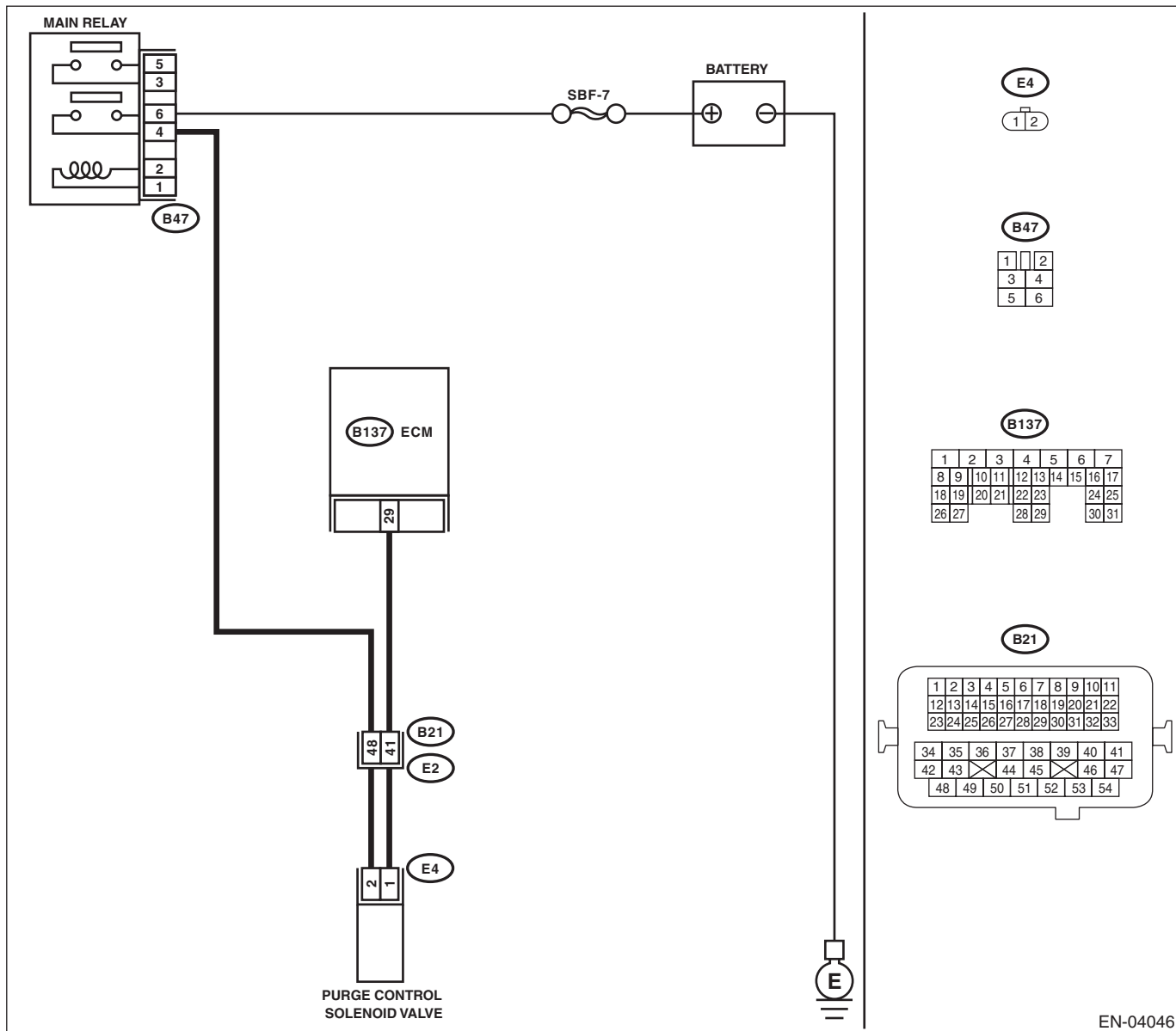
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04046

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B137) No. 29 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and purge control solenoid valve connector.	Go to step 2.
<b>2 CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>	Repair the poor contact of the ECM connector.

## BP:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-158, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
<b>1 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H4SO)-55, Fuel Level Sensor.> <Ref. to FU(H4SO)-56, Fuel Sub Level Sensor.>

## BQ:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

### NOTE:

For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4SO)(diag)-223, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BR:DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-162, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is DTC P0462 or P0463 displayed on the Subaru Select Monitor?	Check the combination meter. <Ref. to IDI-13, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

## BS:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-164, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is DTC P0464 displayed on the display?	Check the combination meter. <Ref. to IDI-13, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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## BT:DTC P0500 VEHICLE SPEED SENSOR “A”

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-168, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK DTC OF ABS.</b> Check DTC of ABS.	Is DTC of ABS displayed?	Perform the diagnosis according to DTC. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BU:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-170, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

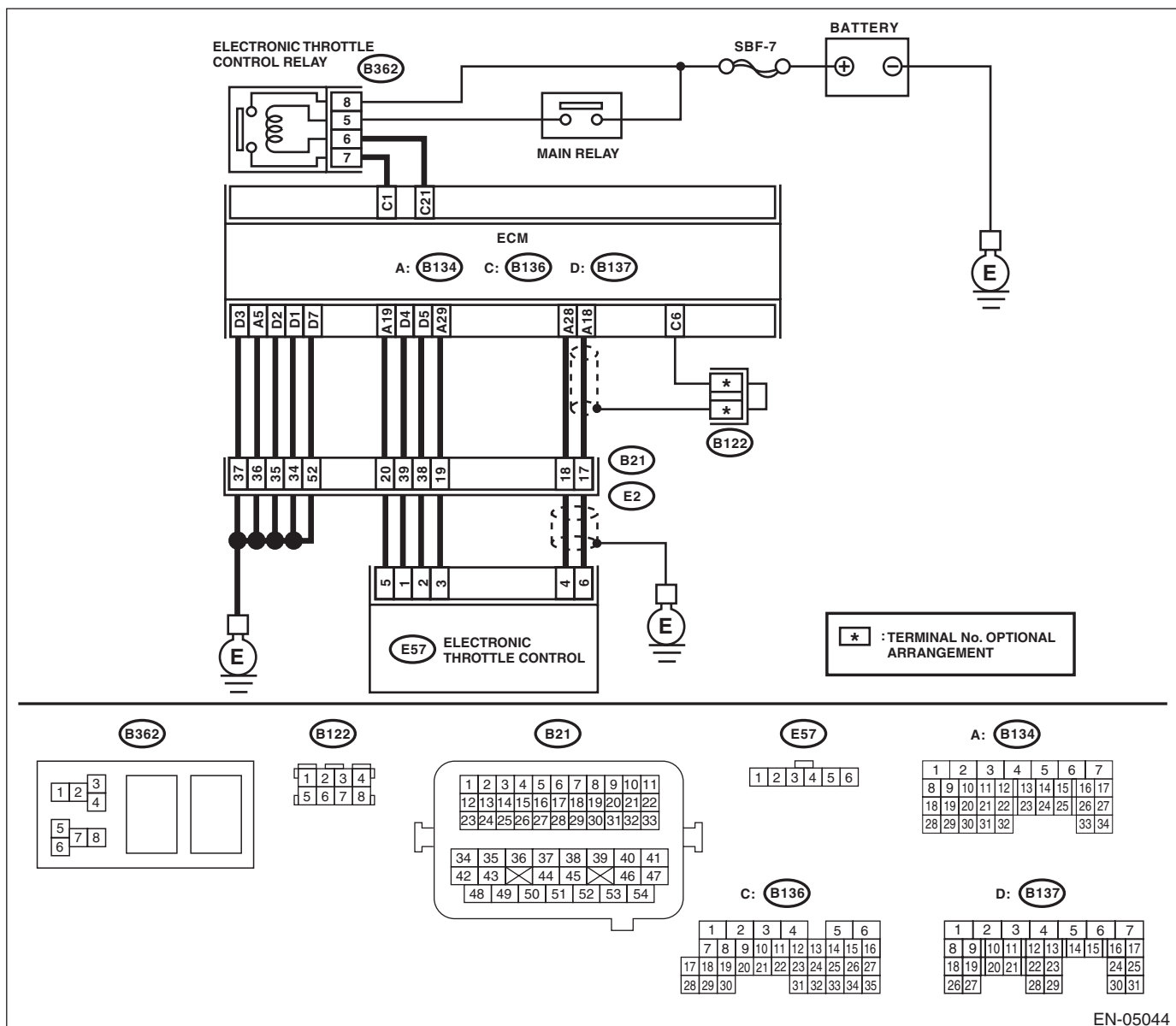
### TROUBLE SYMPTOM:

- Hard to start the engine.
- Engine does not start.
- Improper idling
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2</b> <b>CHECK AIR CLEANER ELEMENT.</b> 1) Turn the ignition switch to OFF. 2) Check the air cleaner element.	Is there excessive clogging on air cleaner element?	Replace the air cleaner element. <Ref. to IN(H4SO)-4, Air Cleaner Element.>	Go to step 3.
<b>3</b> <b>CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Remove the electronic throttle control. 2) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BV:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-172, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

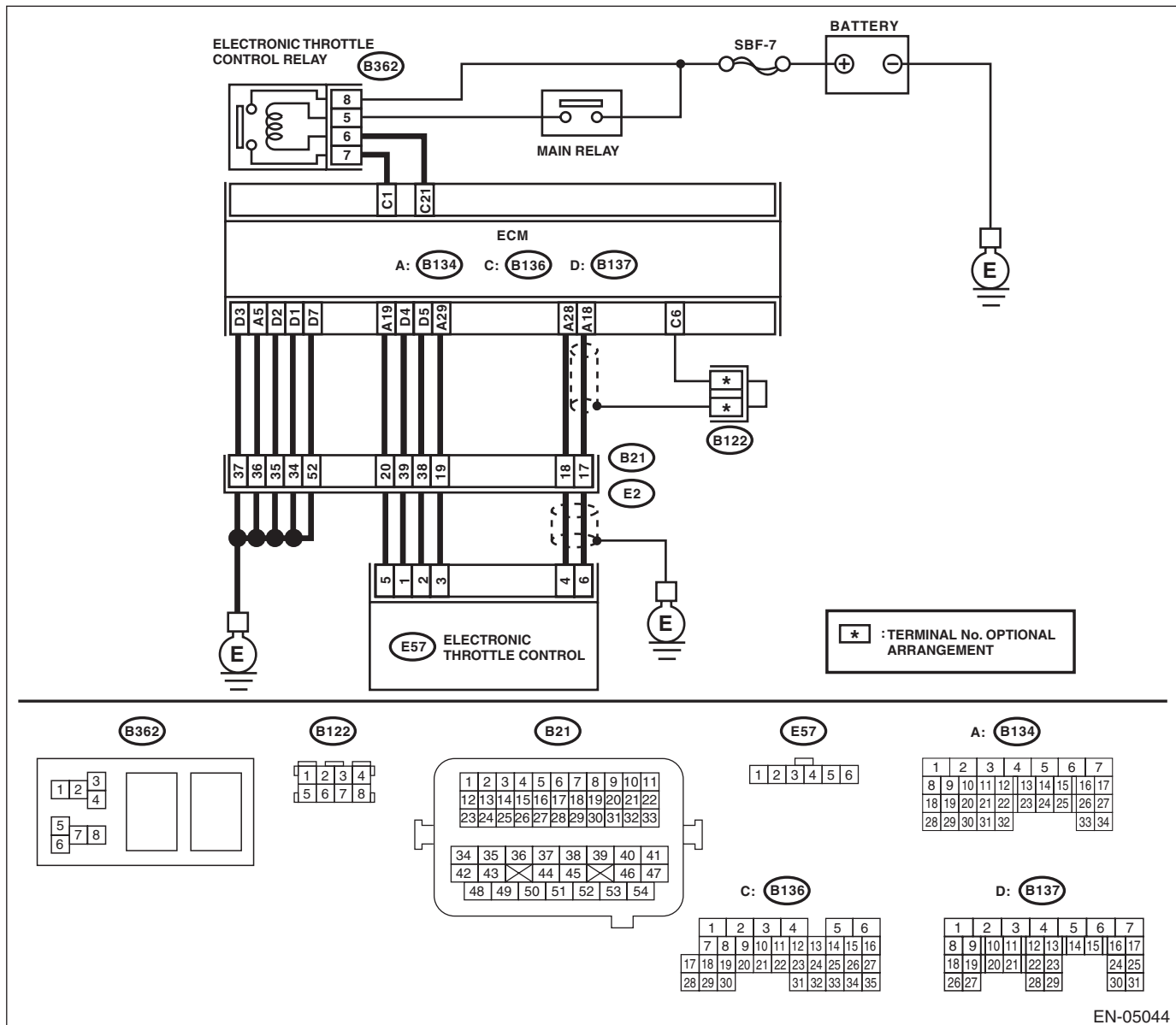
### TROUBLE SYMPTOM:

Engine keeps running at higher speed than specified idle speed.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2</b> <b>CHECK AIR INTAKE SYSTEM.</b> 1) Start and idle the engine. 2) Check the following items. <ul style="list-style-type: none"> <li>• Loose installation of intake manifold and throttle body</li> <li>• Cracks of intake manifold gasket and throttle body gasket</li> <li>• Disconnection of vacuum hoses</li> </ul>	Is there any fault in air intake system?	Repair air suction and leaks.	Go to step 3.
<b>3</b> <b>CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control. 3) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



## BW:DTC P0512 STARTER REQUEST CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-174, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

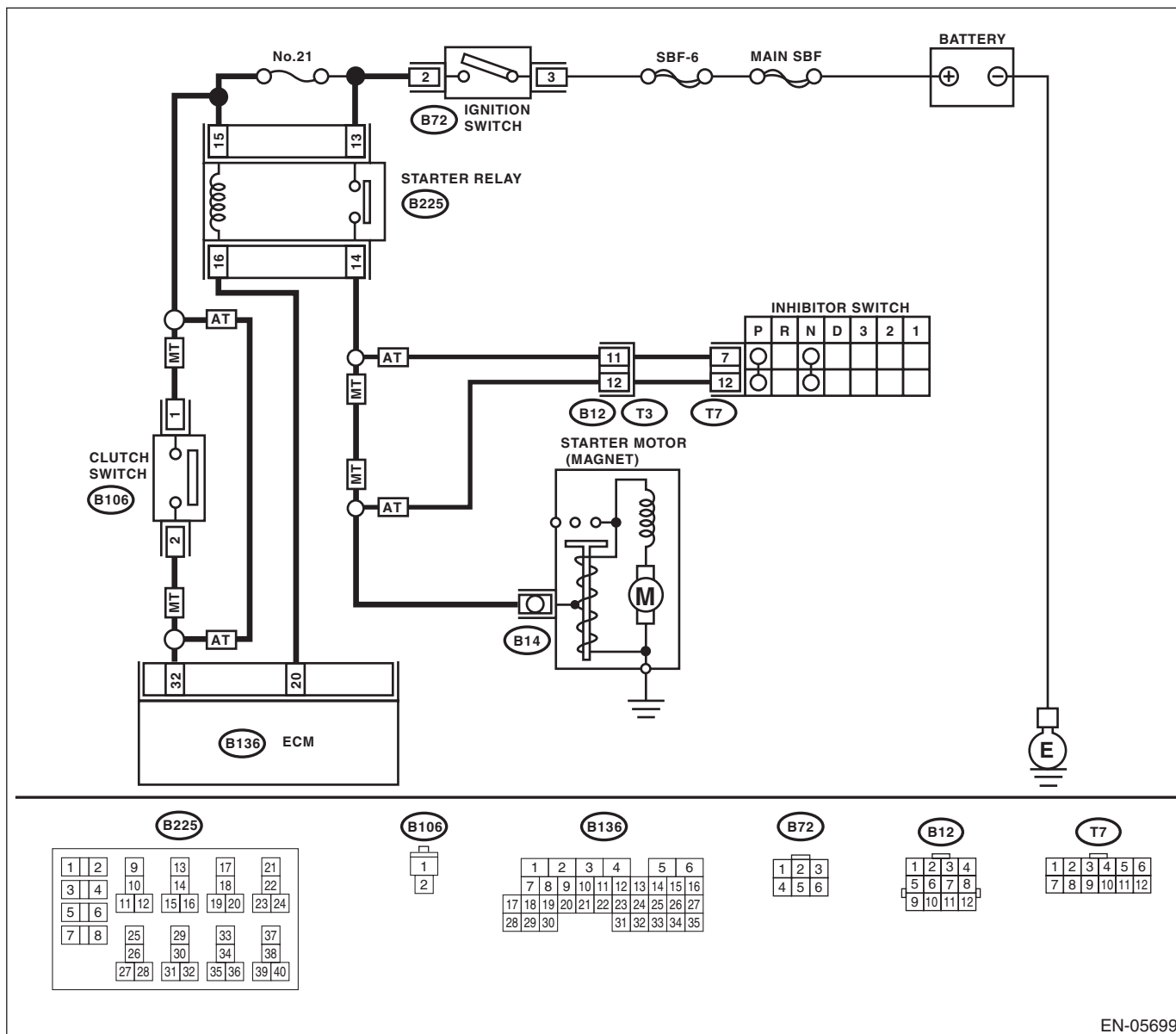
### TROUBLE SYMPTOM:

Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND IGNITION SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 32 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and ignition switch.	Repair the poor contact of the ECM connector.

## BX:DTC P0600 SERIAL COMMUNICATION LINK

NOTE:

For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BY:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-178, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

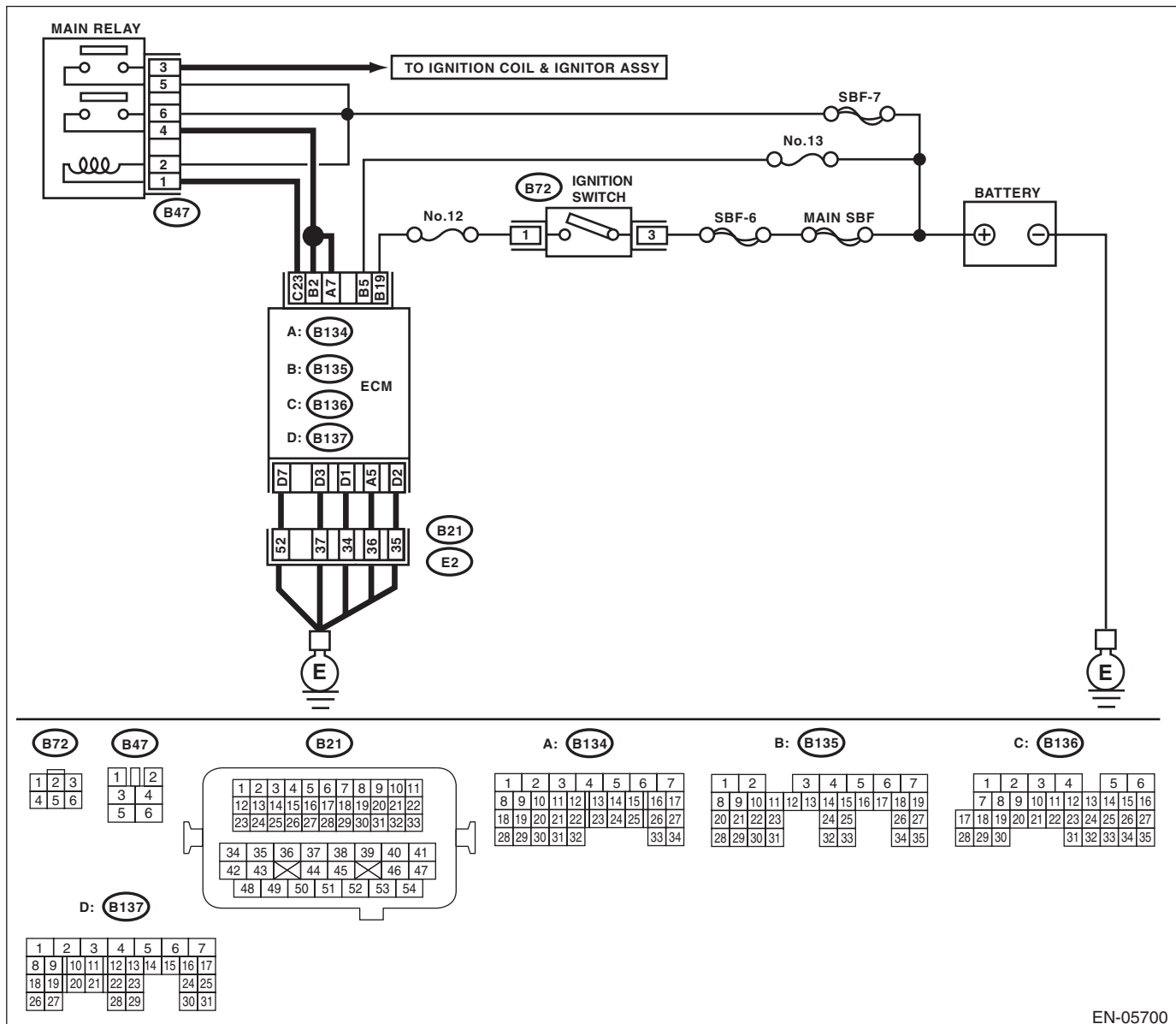
### TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05700

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

## **BZ:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR**

NOTE:

For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4SO)(diag)-233, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CA:DTC P0607 CONTROL MODULE PERFORMANCE

### DTC DETECTING CONDITION:

- Depending on the content of malfunction, adapt either of the followings.
  - Immediately at fault recognition
  - Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-181, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

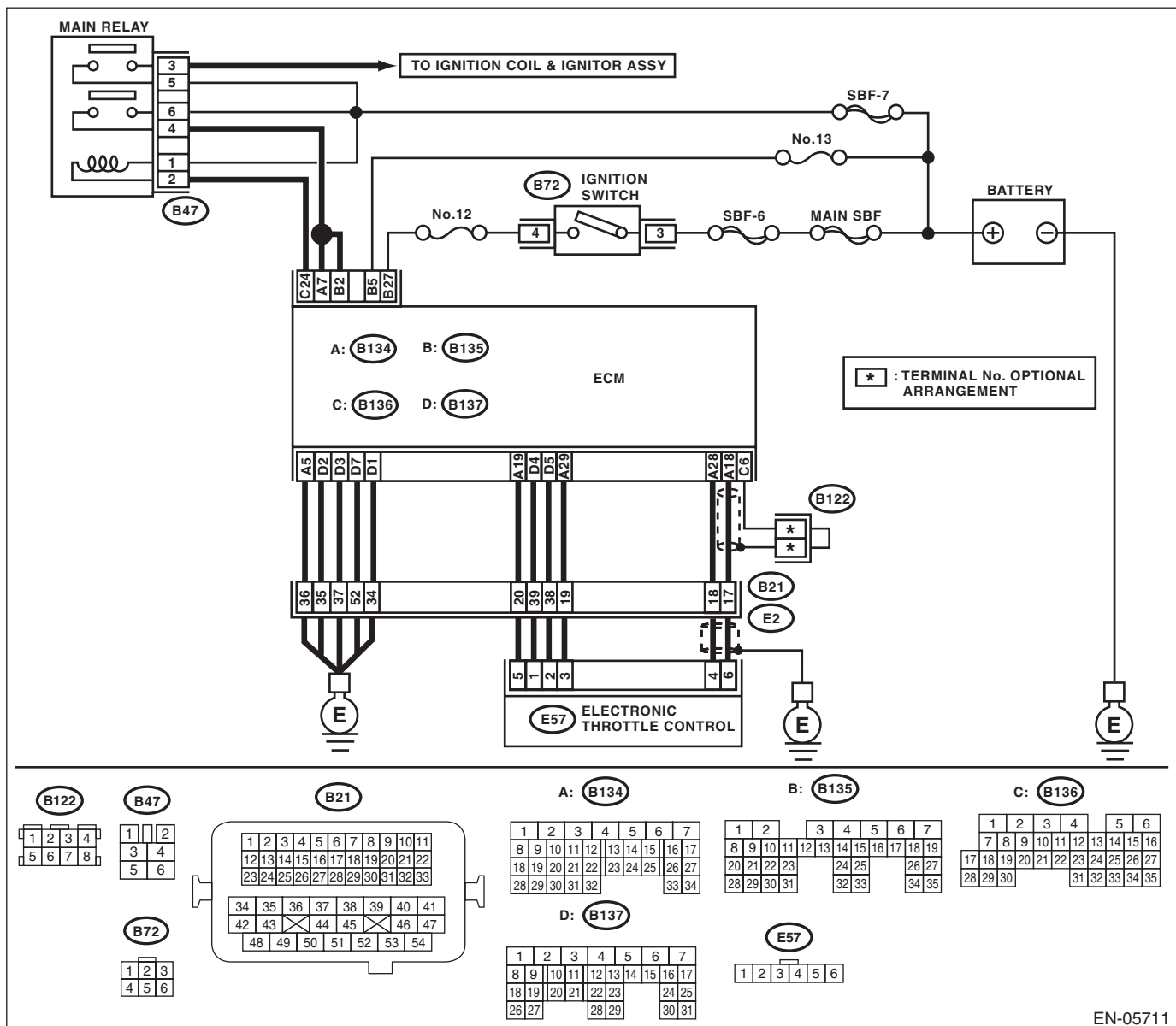
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 7 (+) — Chassis ground (-):</b> <b>(B135) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 2.	Repair the open or ground short circuit of power supply circuit.
2	<b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Start the engine. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 7 (+) — Chassis ground (-):</b> <b>(B135) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 13 — 15 V?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
3	<b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (E57) No. 5:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
4	<b>CHECK ECM GROUND HARNESS.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 (+) — Chassis ground (-):</b> <b>(B137) No. 1 (+) — Chassis ground (-):</b> <b>(B137) No. 2 (+) — Chassis ground (-):</b> <b>(B137) No. 3 (+) — Chassis ground (-):</b> <b>(B137) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Repair the following item. <ul style="list-style-type: none"> <li>• Open circuit of ground circuit</li> <li>• Retightening of engine ground terminals</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>

### CB:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

**NOTE:**

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### CC:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

**NOTE:**

For the diagnostic procedure, refer to AT section. <Ref. to 4AT(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CD:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-188, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

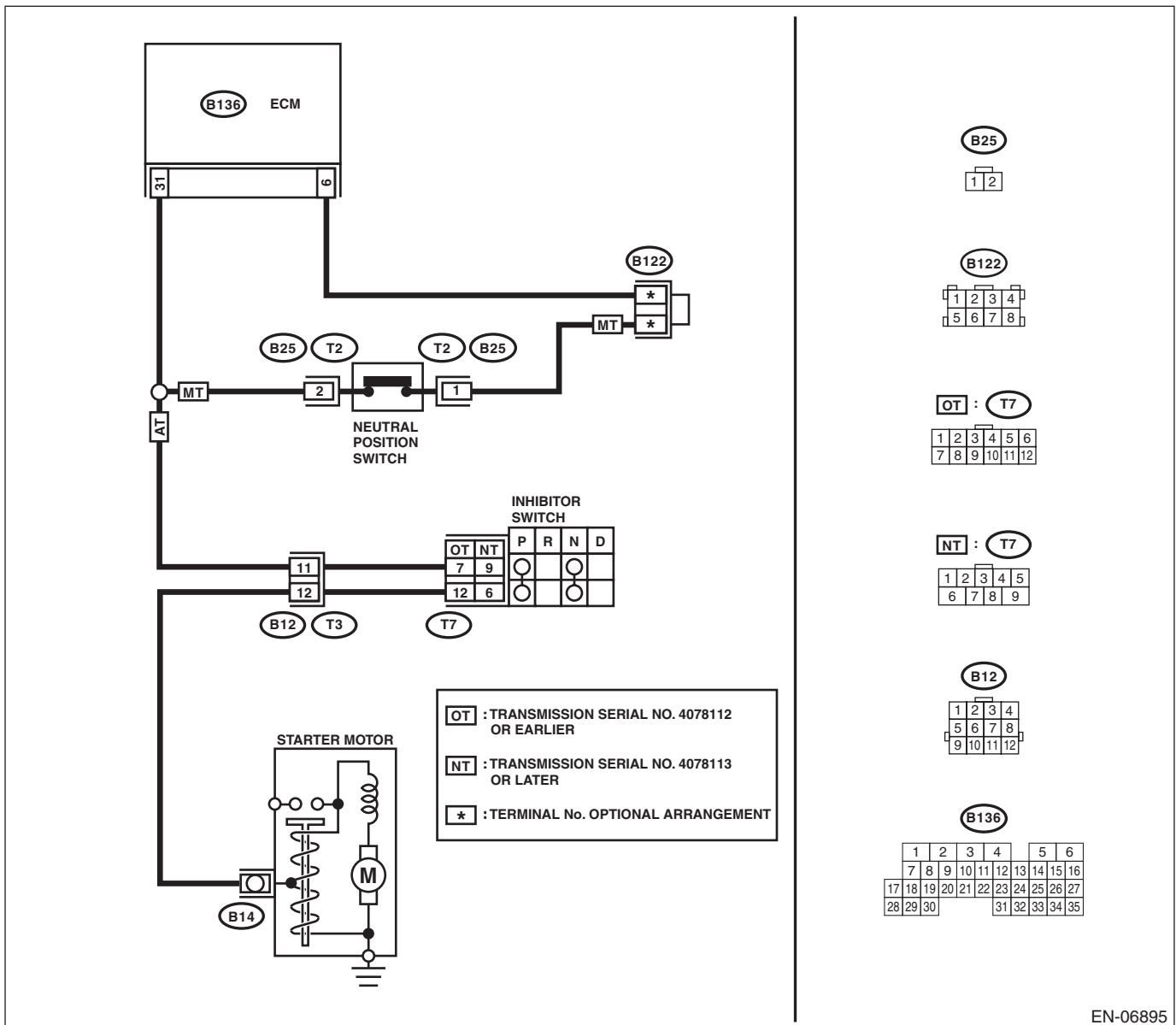
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-06895

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK SELECT CABLE.</b>	Are there any faults in the select cable?	Repair or adjust the select cable. <Ref. to CS-27, Select Cable.>	Go to step 2.
<b>2</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Place the select lever other than "P" range and "N" range. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and transmission harness connector (T3). 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the ground short circuit of harness between ECM and transmission harness connector.
<b>4</b> <b>CHECK TRANSMISSION HARNESS CONNECTOR.</b> 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance between the transmission harness connector and engine ground. <b>Connector &amp; terminal</b> <b>(T3) No. 11 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Replace the inhibitor switch. <Ref. to 4AT-47, Inhibitor Switch.>	Repair the ground short circuit of harness between transmission harness connector and inhibitor switch connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CE:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-189, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

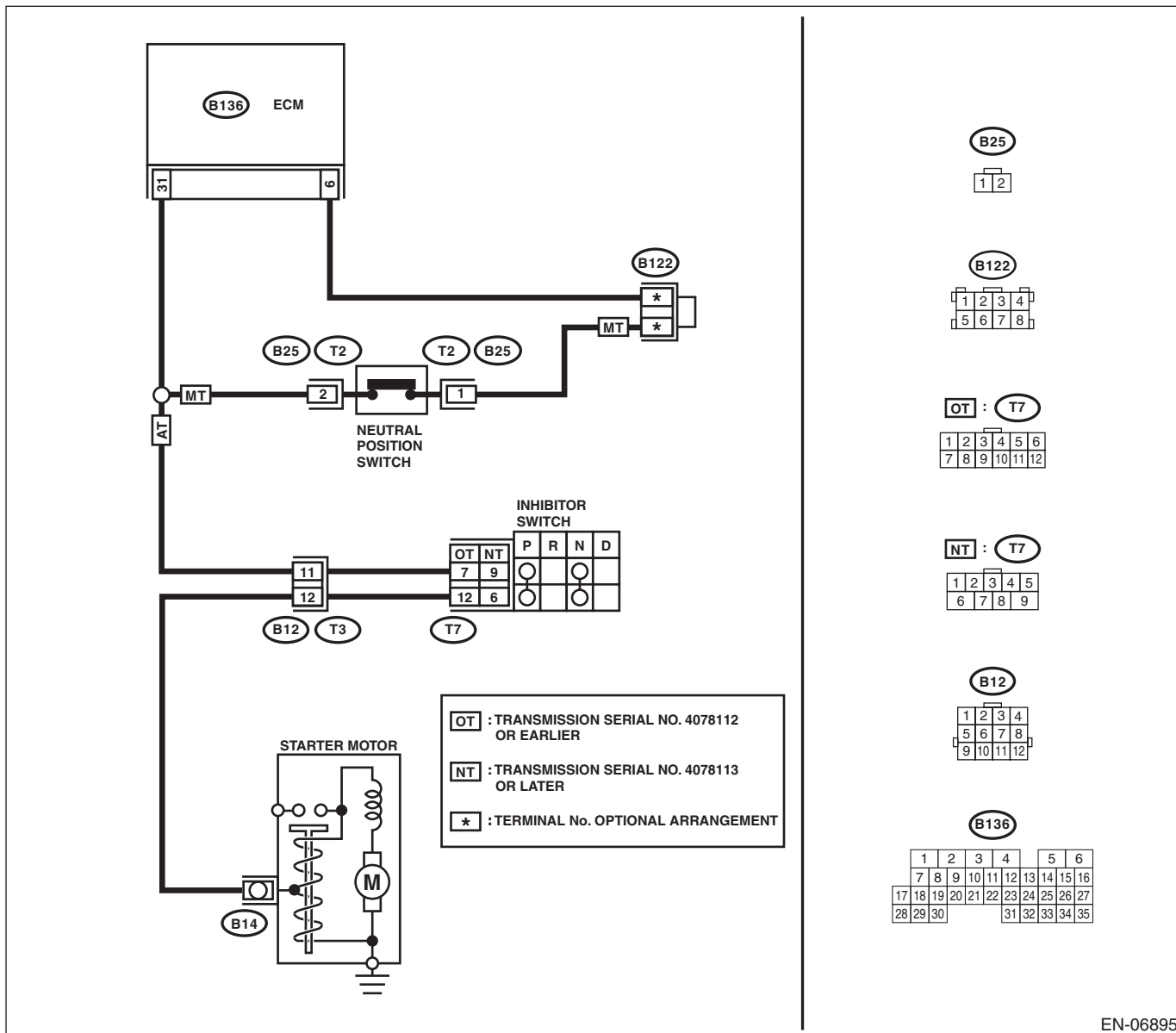
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-06895

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Place the shift lever in a position except for neutral. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and transmission harness connector (T2). 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Repair the short circuit of transmission harness, or replace the neutral position switch.	Repair the ground short circuit of harness between ECM and transmission harness connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CF:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-191, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

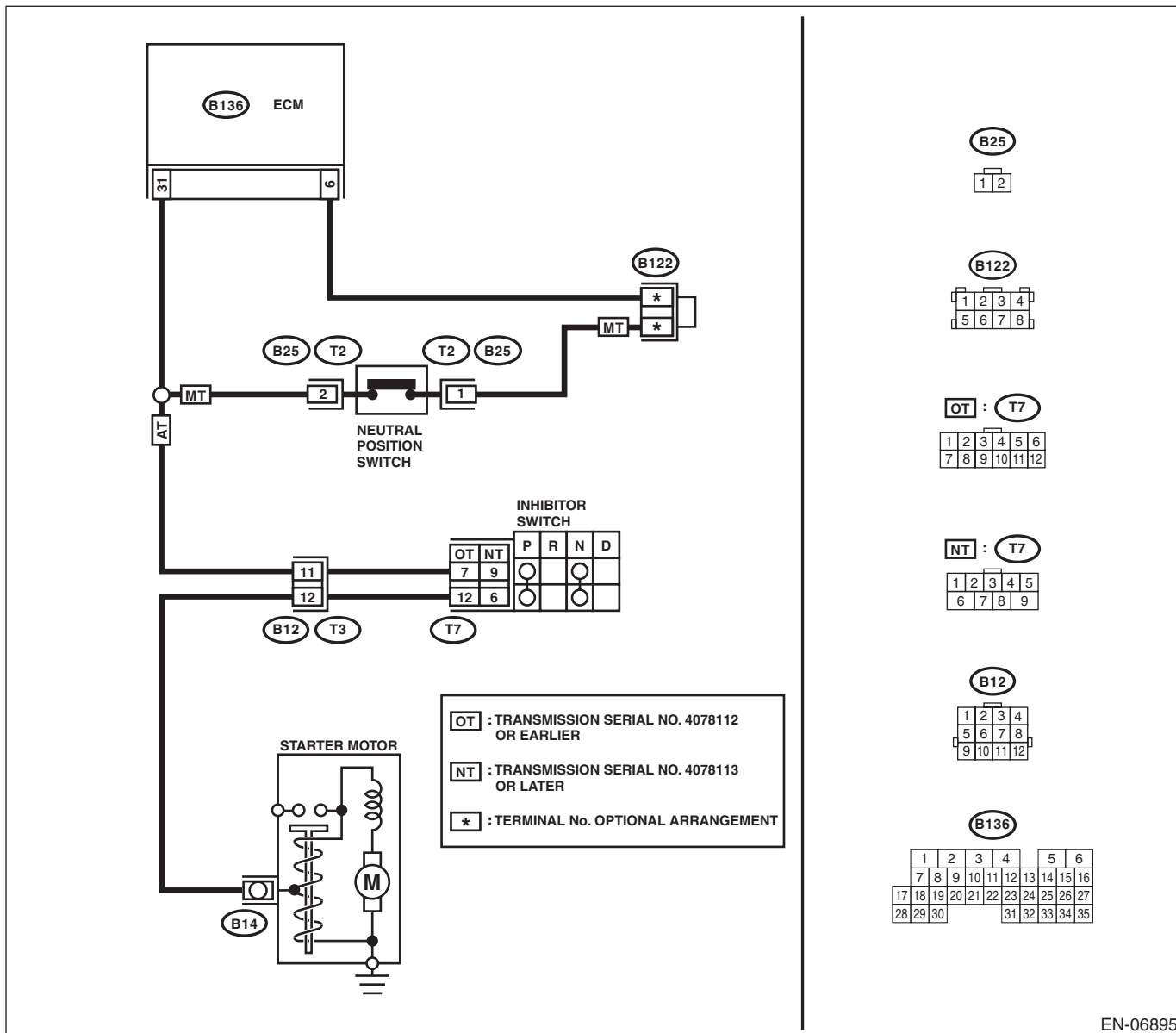
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-06895

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK SELECT CABLE.</b>	Are there any faults in the select cable?	Repair or adjust the select cable. <Ref. to CS-27, Select Cable.>	Go to step 2.
<b>2</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground with select lever at "P" range and "N" range. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and inhibitor switch. 3) Measure the resistance of harness between ECM and inhibitor switch connector. <b>Connector &amp; terminal</b> <b>Transmission serial No. 4078112 or earlier</b> <b>(B136) No. 31 — (T7) No. 7:</b> <b>Transmission serial No. 4078113 or later</b> <b>(B136) No. 31 — (T7) No. 9:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and inhibitor switch connector • Poor contact of coupling connector
<b>4</b> <b>CHECK INHIBITOR SWITCH GROUND LINE.</b> Measure the resistance of harness between inhibitor switch connector and engine ground. <b>Connector &amp; terminal</b> <b>Transmission serial No. 4078112 or earlier</b> <b>(T7) No. 12 — Engine ground:</b> <b>Transmission serial No. 4078113 or later</b> <b>(T7) No. 6 — Engine ground:</b>	Is the resistance less than 5 Ω?	Replace the inhibitor switch. <Ref. to 4AT-47, Inhibitor Switch.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between inhibitor switch connector and starter motor ground line • Poor contact of coupling connector • Poor contact in starter motor connector • Poor contact in starter motor ground • Starter motor

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CG:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-192, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

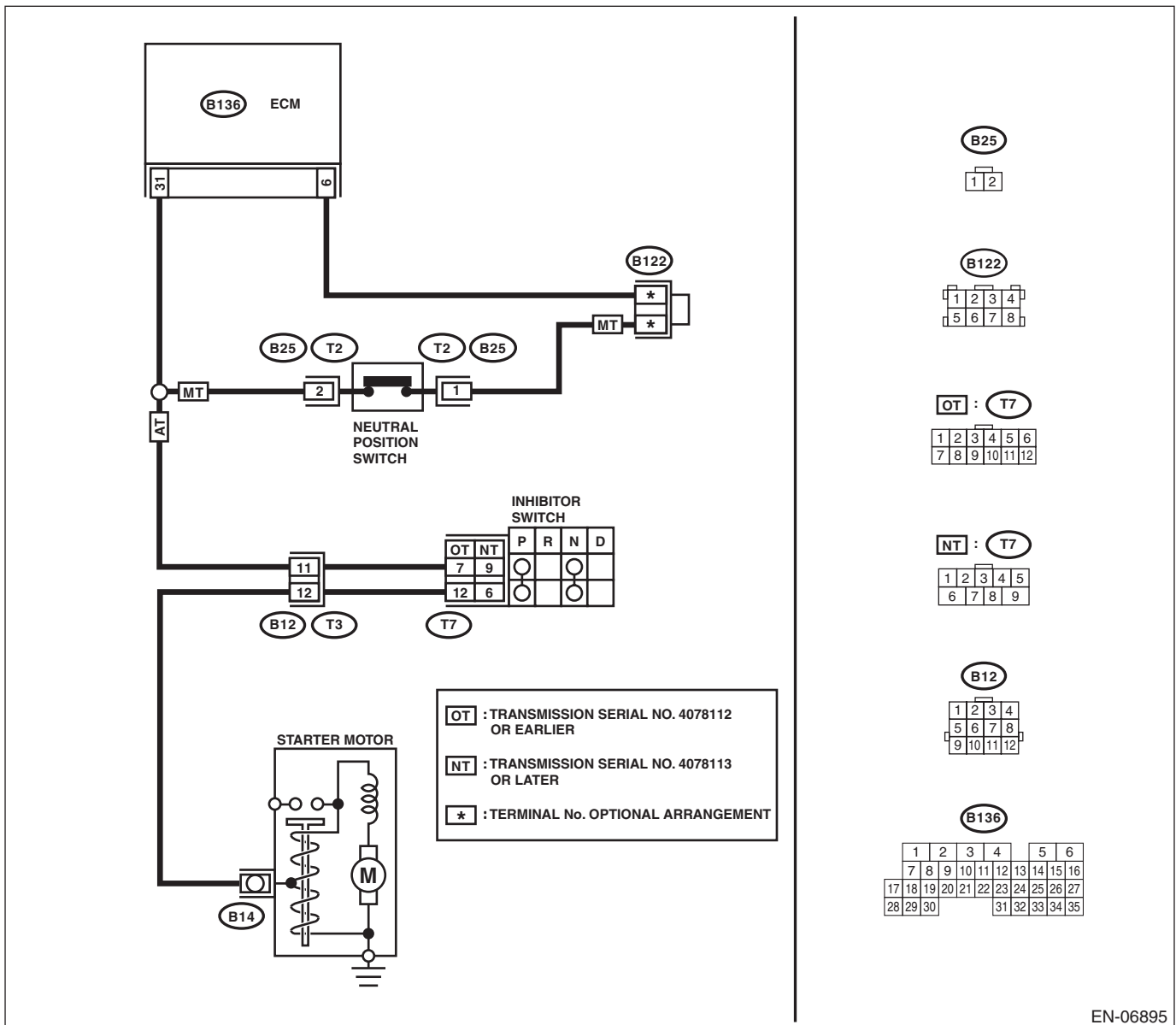
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-06895

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect connectors from the ECM and transmission harness. 3) Measure the resistance of harness between ECM and transmission harness connector. <b>Connector &amp; terminal</b> <b>(B136) No. 31 — (T2) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and transmission harness connector.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR.</b> Measure the resistance of harness between ECM and transmission harness connector. <b>Connector &amp; terminal</b> <b>(B136) No. 6 — (T2) No. 1:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between transmission harness connector and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4</b> <b>CHECK NEUTRAL SWITCH.</b> 1) Place the shift lever in neutral. 2) Measure the resistance between transmission harness connector terminals. <b>Connector &amp; terminal</b> <b>(T2) No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of transmission harness connector.	Repair the open circuit of transmission harness, or replace the neutral switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CH:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

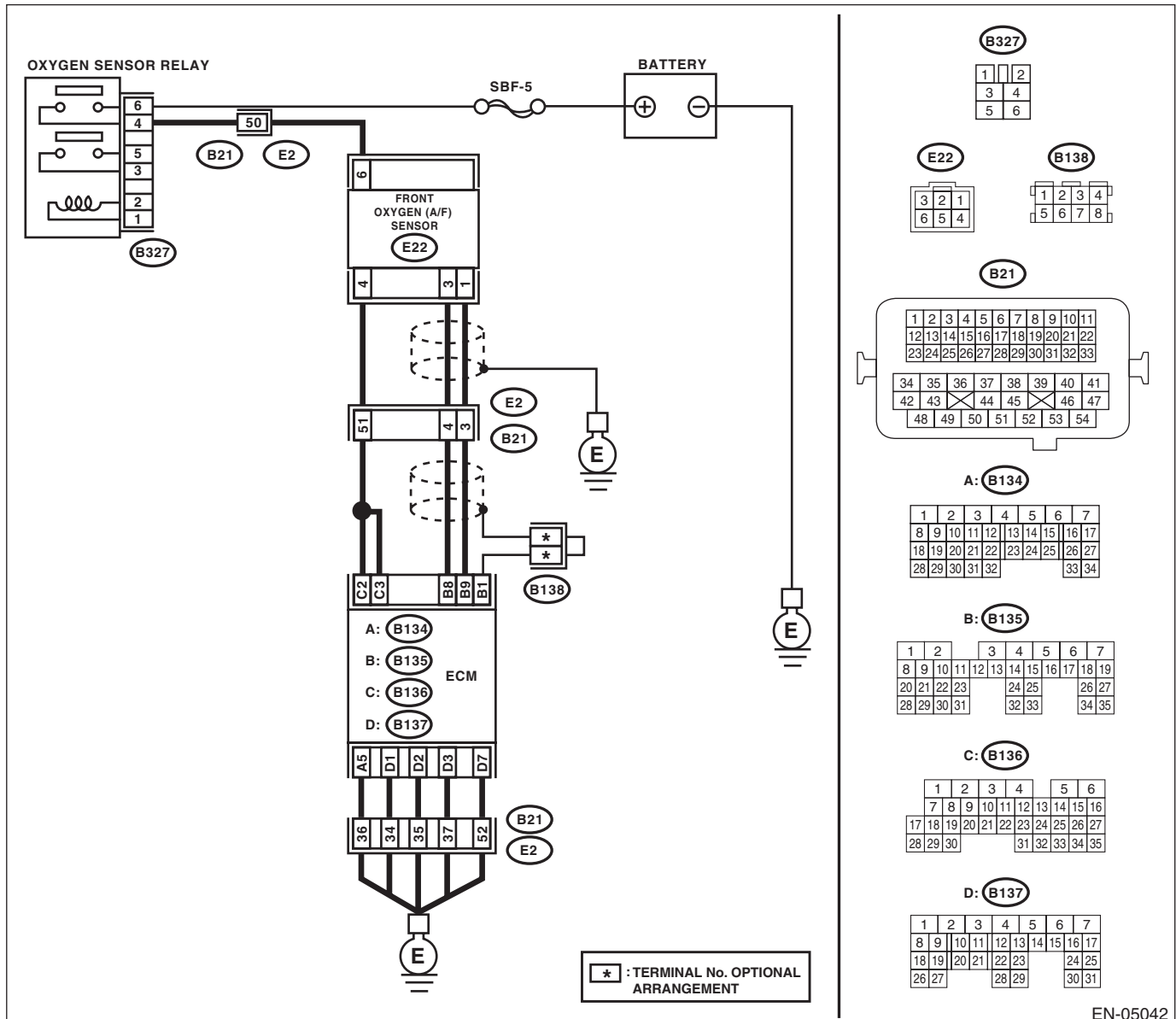
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-194, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E22) No. 1:</b> <b>(B135) No. 8 — (E22) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector</li> <li>• Poor contact in front oxygen (A/F) sensor connector</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CI: DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

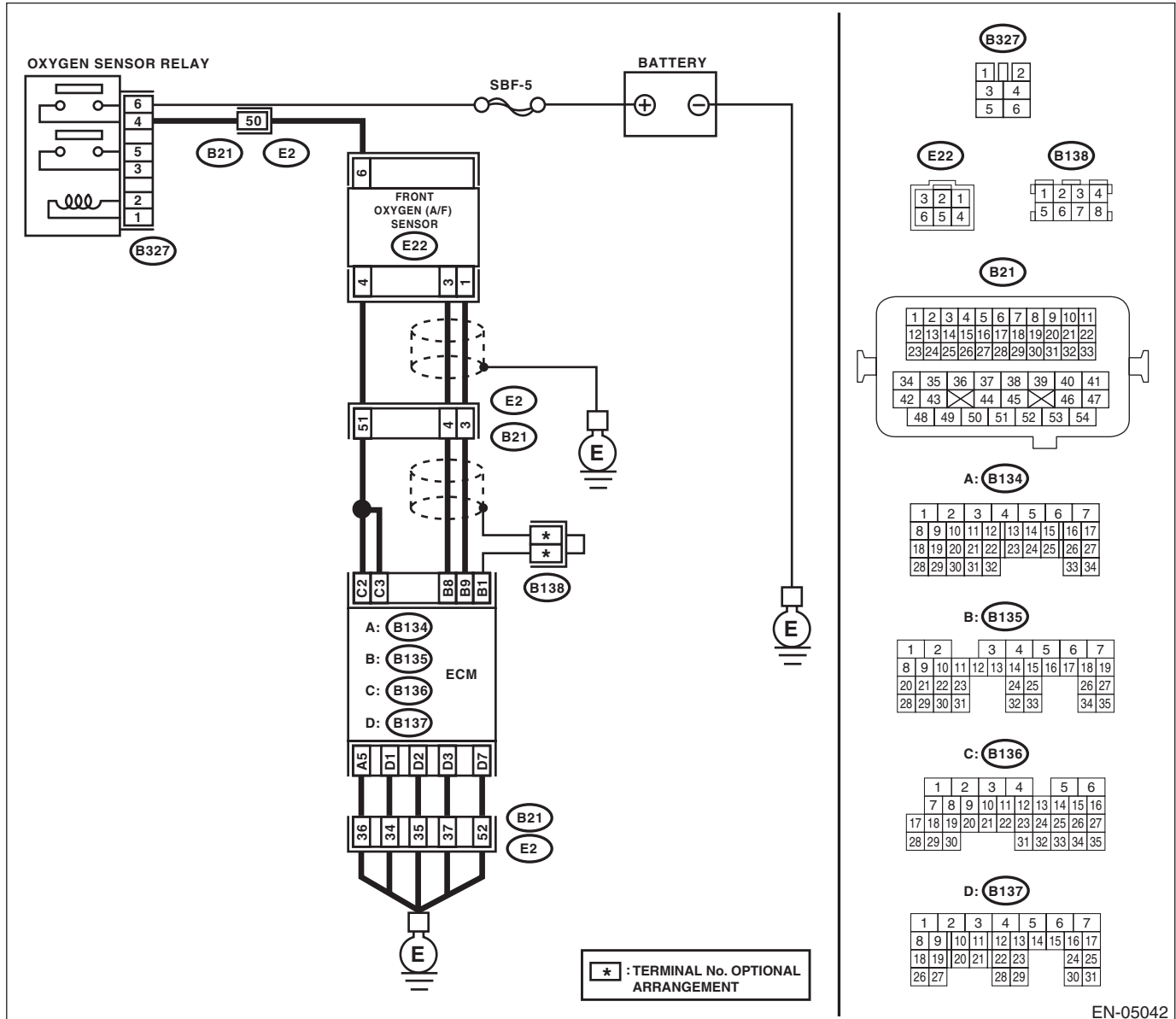
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-197, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05042

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3</b> <b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 5.	Go to step 4.
<b>4</b> <b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>
<b>5</b> <b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>	Repair the poor contact of the ECM connector.

### CJ:DTC P1160 RETURN SPRING FAILURE

NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CK:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

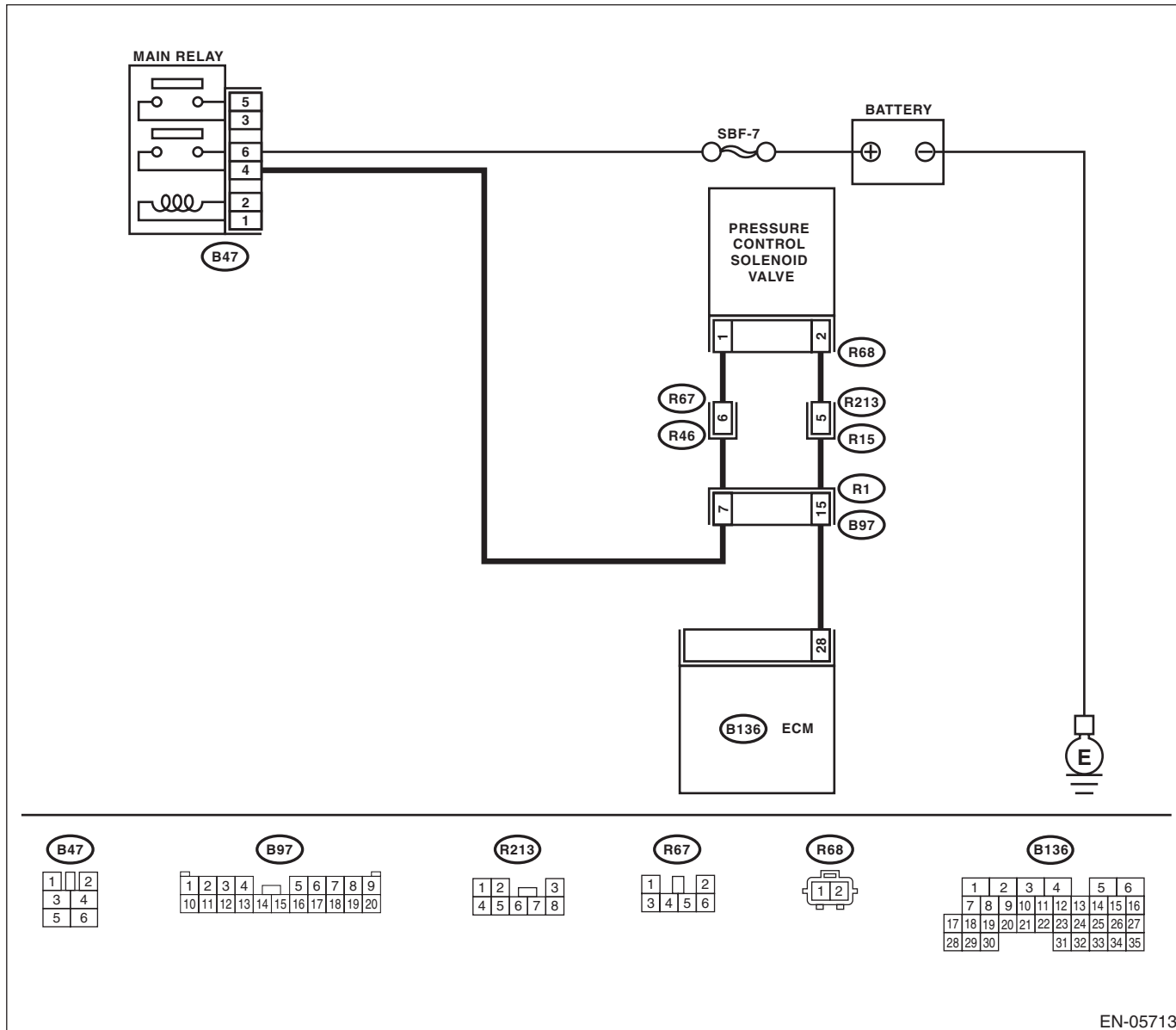
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-202, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05713

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 28 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Measure the resistance between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 2 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and pressure control solenoid valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and pressure control solenoid valve connector. <i>Connector &amp; terminal</i> <i>(B136) No. 28 — (R68) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance between pressure control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>
<b>5 CHECK POWER SUPPLY TO THE PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of pressure control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between main relay and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CL:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

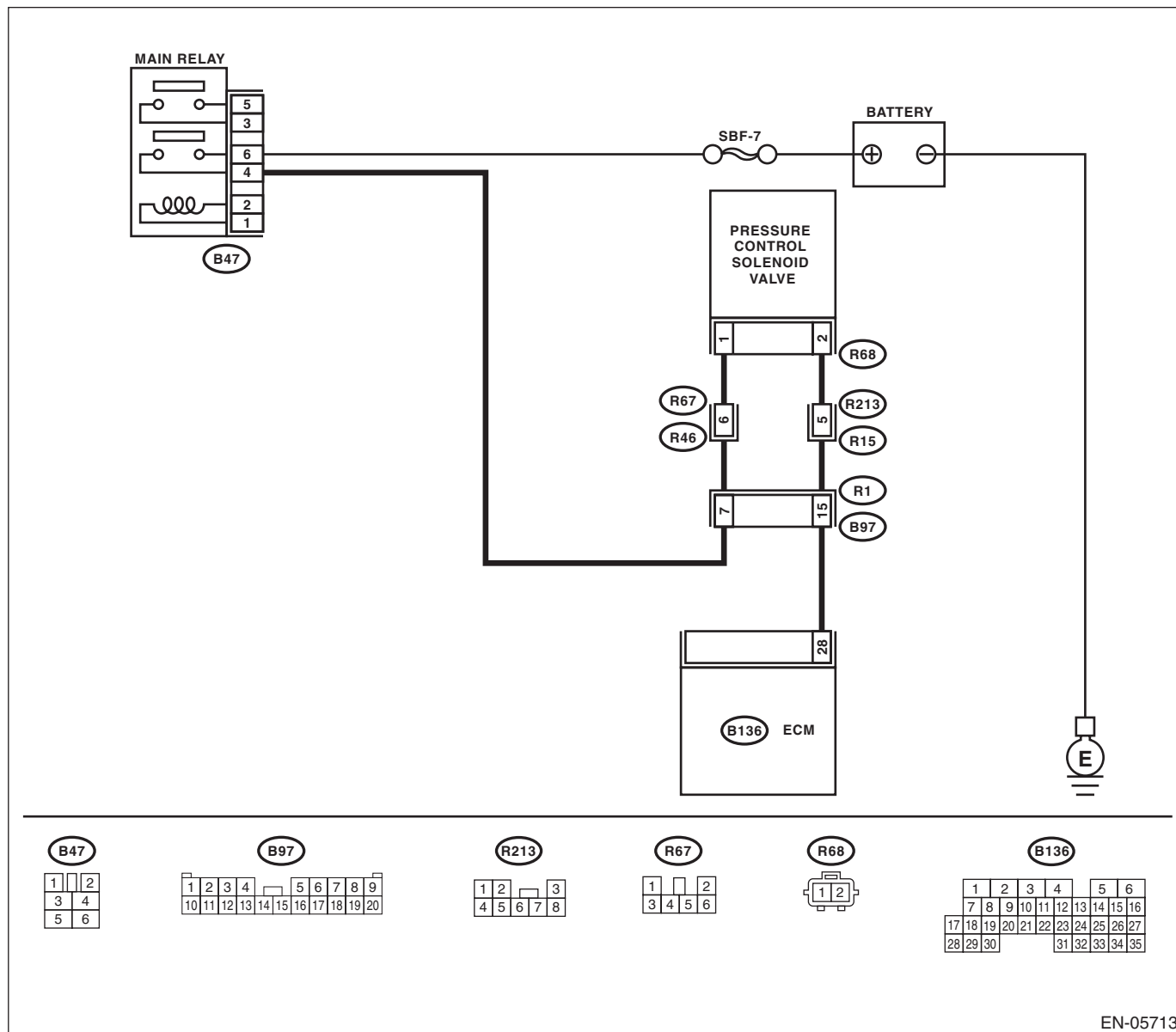
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-204, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05713

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 28 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Replace the pressure control solenoid valve. &lt;Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.&gt;</p>	<p>Repair the poor contact of the ECM connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CM:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-206, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

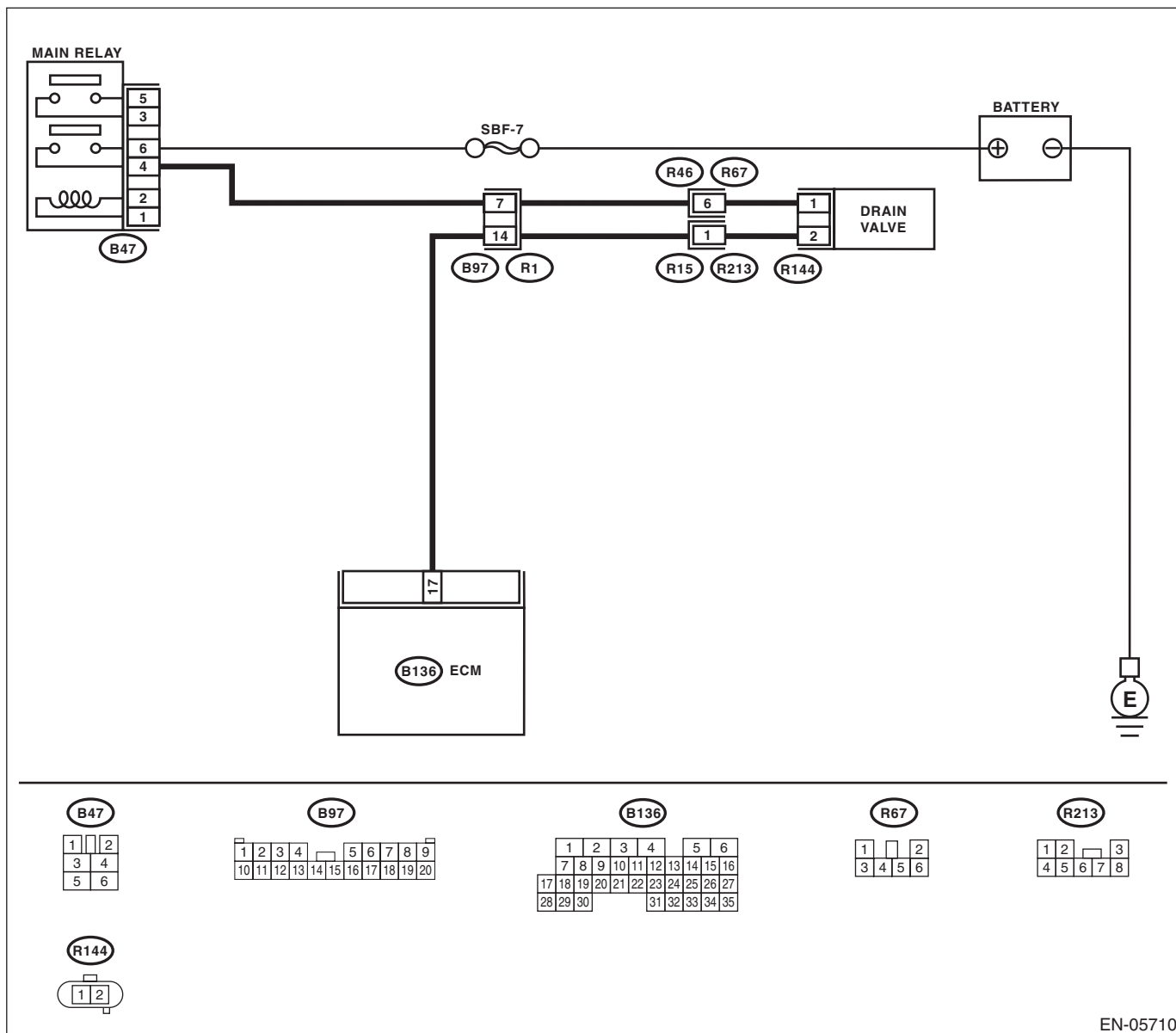
### TROUBLE SYMPTOM:

Improper fuel supply

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05710

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2 CHECK DRAIN HOSE.</b> Check the drain hose for clogging.	Is there clogging in the drain hose?	Replace the drain hose.	Go to step 3.
<b>3 CHECK DRAIN VALVE OPERATION.</b> 1) Turn the ignition switch to OFF. 2) Connect the delivery (test) mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) Operate the drain valve.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-55, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Repair the poor contact of the ECM connector.	Replace the drain valve. <Ref. to EC(H4SO)-15, Drain Valve.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CN:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-208, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

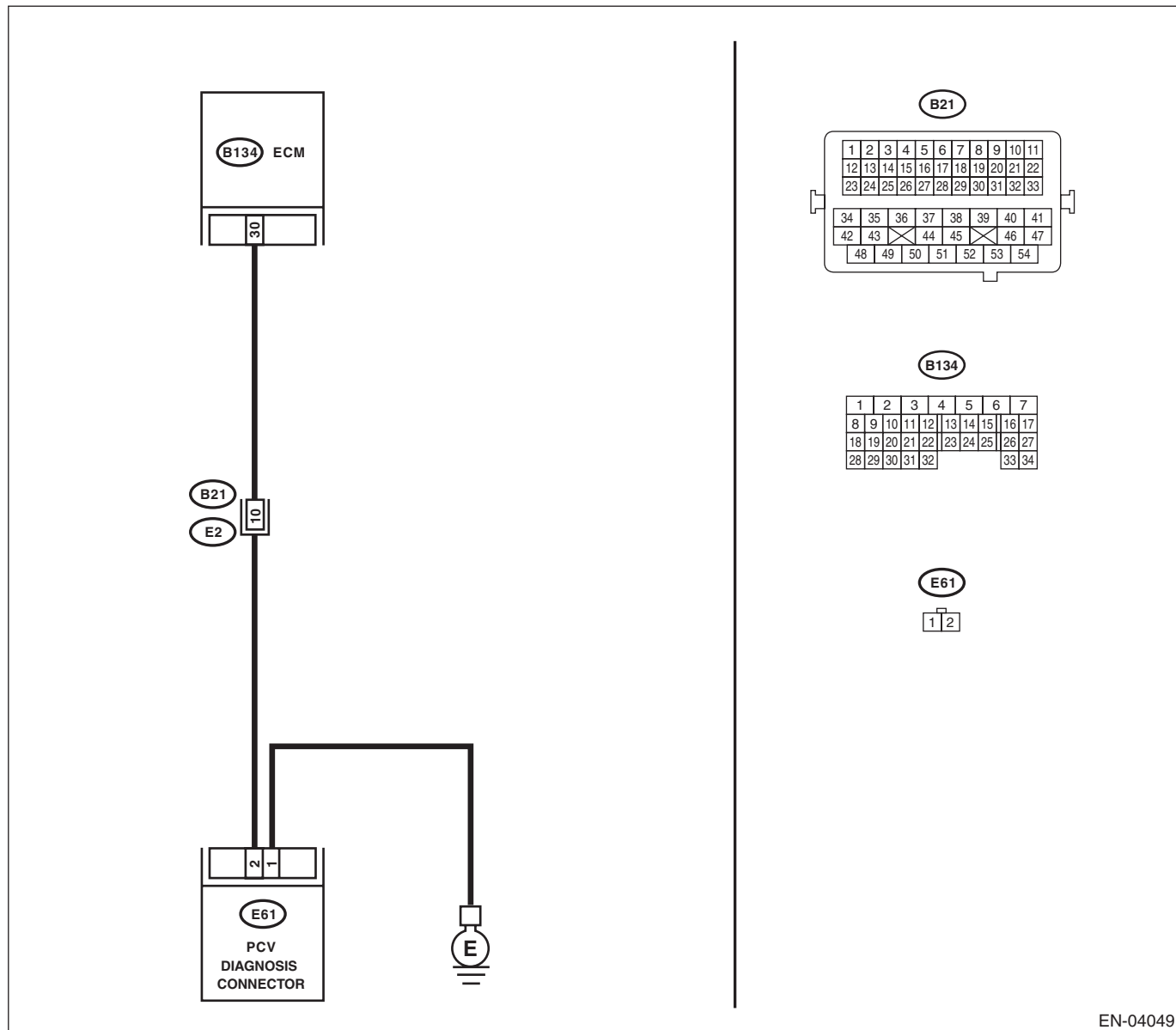
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04049

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK BLOW-BY HOSE.</b> Check the blow-by hose condition.	Is there any disconnection or crack in blow-by hose?	Repair or replace the blow-by hose.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and PCV hose assembly. 3) Measure the resistance of harness between ECM and PCV hose assembly. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 30 — (E61) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and PCV hose assembly.
<b>3 CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.</b> Measure the resistance between PCV hose assembly and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 30 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 4.	Repair the ground short circuit of harness between ECM and PCV hose assembly.
<b>4 CHECK GROUND CIRCUIT OF PCV HOSE ASSEMBLY.</b> Measure the resistance of harness between PCV hose assembly and engine ground. <i><b>Connector &amp; terminal</b></i> <i><b>(E61) No. 1 — Engine ground:</b></i>	Is the resistance less than 5 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between PCV hose assembly and engine ground.
<b>5 CHECK THE PCV HOSE ASSEMBLY.</b> Measure the resistance between the PCV hose assembly terminals. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact in ECM and PCV hose assembly connector.	Replace the PCV hose assembly.

## **CO:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-256, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **CP:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-259, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **CQ:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-256, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **CR:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-259, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **CS:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-256, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **CT:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-259, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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## **CU:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-210, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance
- Engine breathing

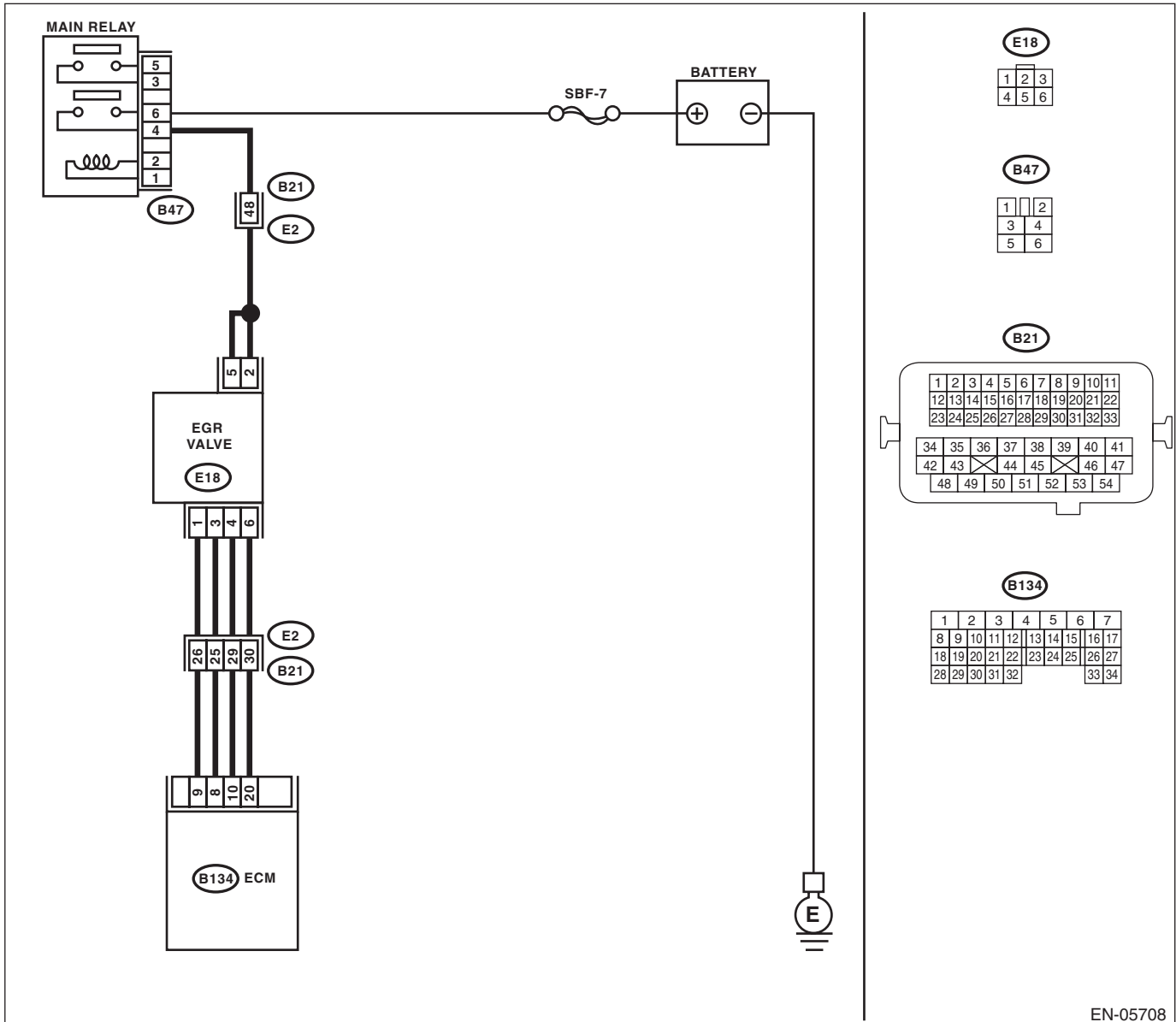
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05708

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY TO EGR VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the EGR valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between EGR valve connector and engine ground. <b>Connector &amp; terminal</b> <b>(E18) No. 2 (+) — Engine ground (-):</b> <b>(E18) No. 5 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between EGR valve and main relay connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>2 CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and EGR valve connector. <b>Connector &amp; terminal</b> <b>DTC P1492; (B134) No. 8 — (E18) No. 3:</b> <b>DTC P1494; (B134) No. 9 — (E18) No. 1:</b> <b>DTC P1496; (B134) No. 10 — (E18) No. 4:</b> <b>DTC P1498; (B134) No. 20 — (E18) No. 6:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and EGR valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3 CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>DTC P1492; (B134) No. 8 — Chassis ground:</b> <b>DTC P1494; (B134) No. 9 — Chassis ground:</b> <b>DTC P1496; (B134) No. 10 — Chassis ground:</b> <b>DTC P1498; (B134) No. 20 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 4.	Repair the ground short in harness between ECM and EGR valve connector.
<b>4 CHECK POOR CONTACT.</b> Check poor contact in ECM and EGR valve connector.	Is there poor contact in ECM or EGR valve connector?	Repair the poor contact in ECM or EGR valve connector.	Replace the EGR valve. <Ref. to FU (H4SO)-27, EGR Valve.>

## **CV:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-212, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-214, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance
- Engine breathing

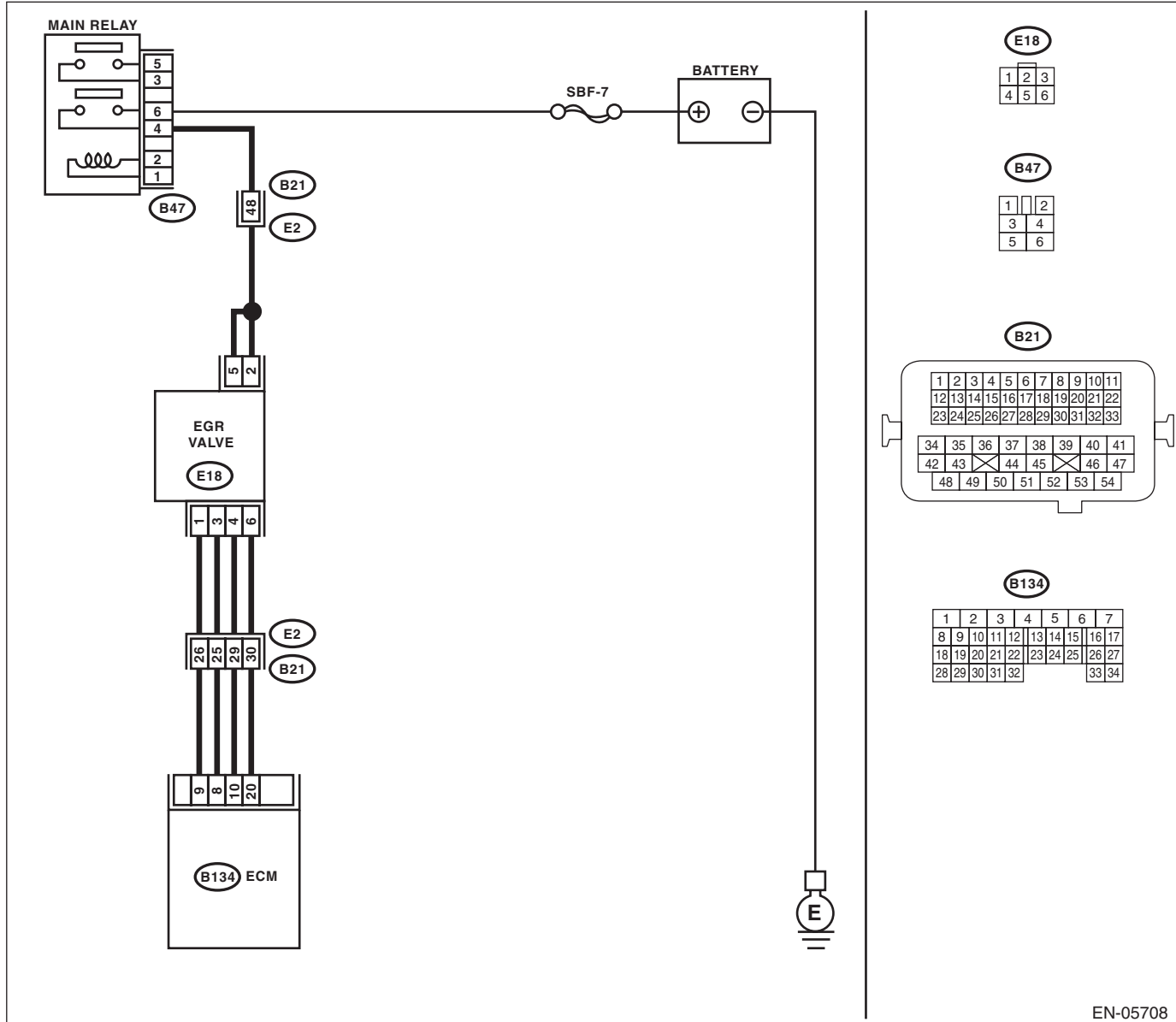
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05708

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                  2) Disconnect the connector from the EGR valve.                  3) Turn the ignition switch to ON.                  4) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>DTC P1493; (B134) No. 8 (+) — Chassis ground (-):</b>  <b>DTC P1495; (B134) No. 9 (+) — Chassis ground (-):</b>  <b>DTC P1497; (B134) No. 10 (+) — Chassis ground (-):</b>  <b>DTC P1499; (B134) No. 20 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between the ECM and EGR valve connectors.</p>	<p>Repair the poor contact of the ECM connector.</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CW:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

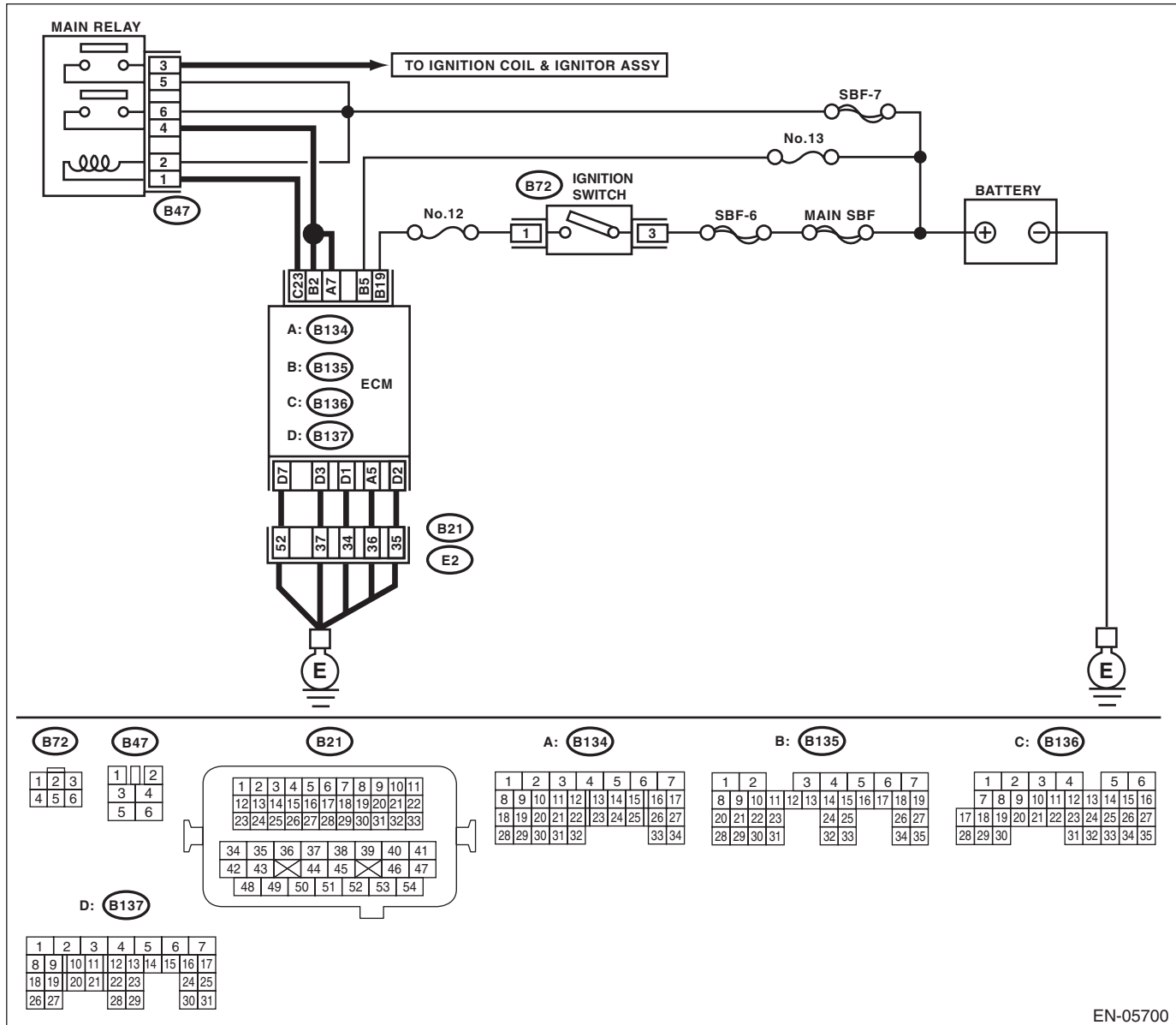
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-215, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05700

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 5 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 5 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and battery terminal.
<b>3 CHECK FUSE NO. 13 (IN MAIN FUSE BOX).</b>	Is the fuse blown out?	Replace the fuse.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and battery</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of battery terminal</li> </ul>

## **CX:DTC P1602 CONTROL MODULE PROGRAMMING ERROR**

### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-217, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **TROUBLE SYMPTOM:**

- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

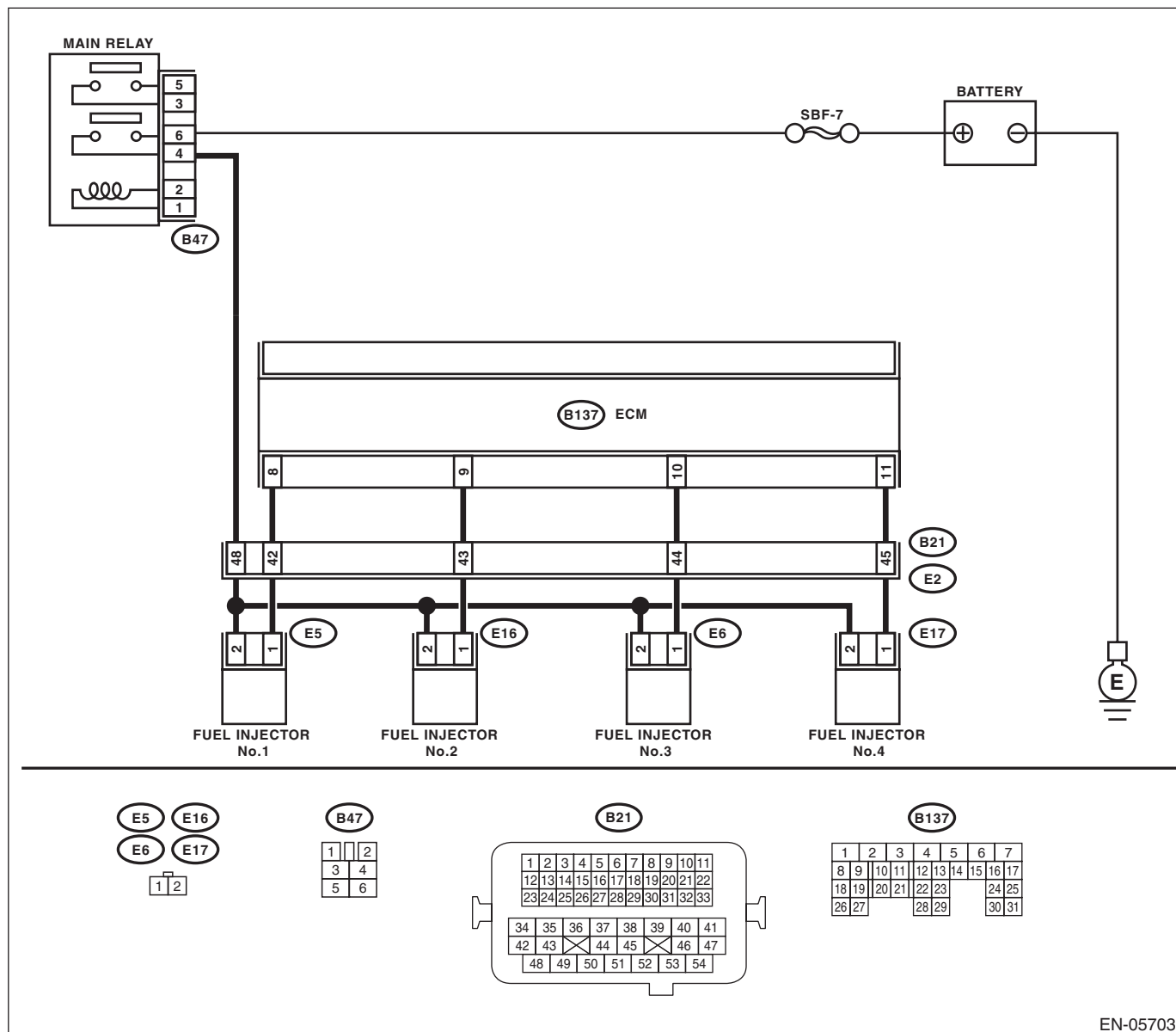
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

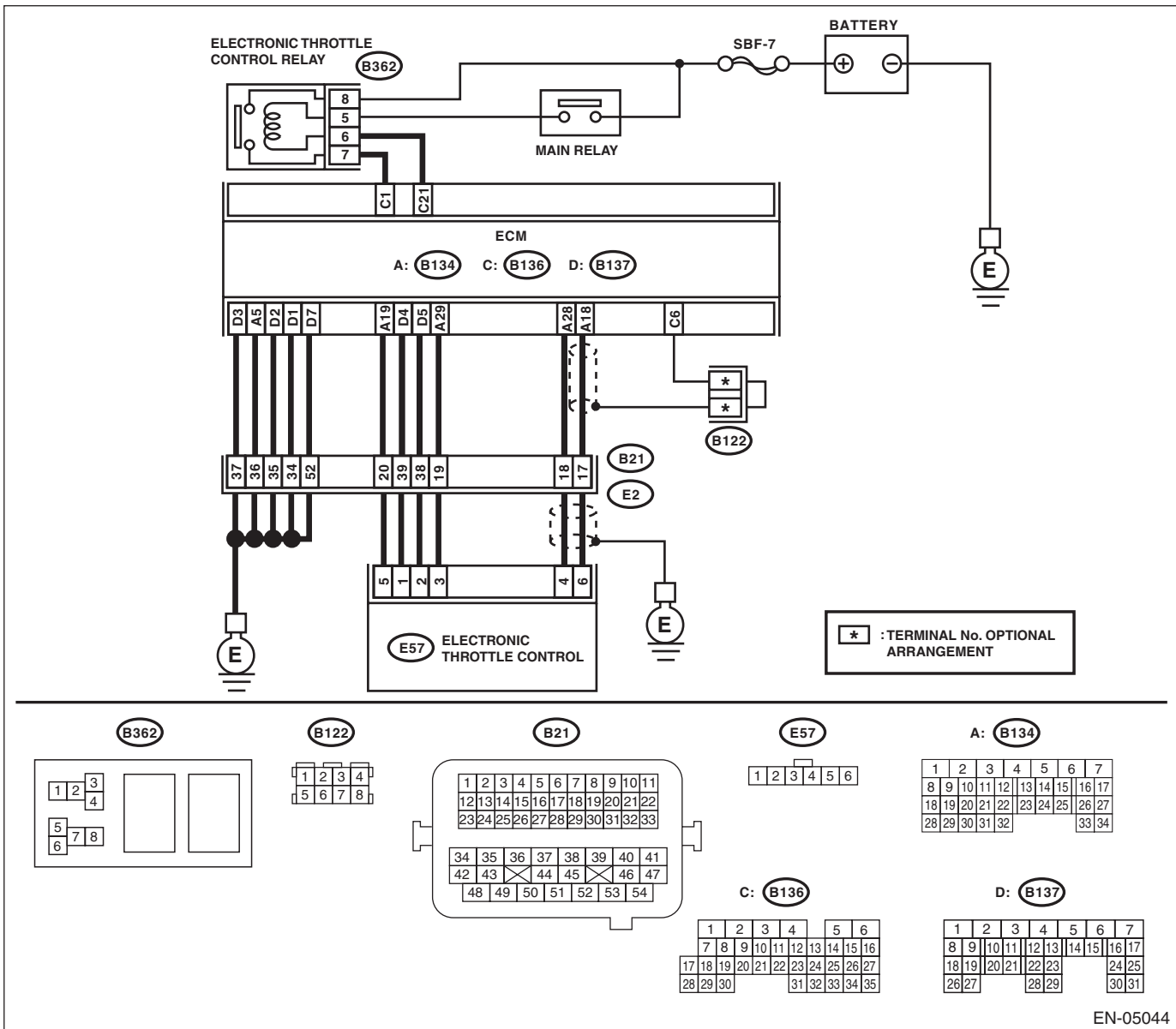
## WIRING DIAGRAM:



EN-05703

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)



Step	Check	Yes	No	
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK ENGINE OIL.</b>	Is there a proper amount of engine oil?	Go to step 3.	Replace engine oil. <Ref. to LU(H4SO)-9, REPLACEMENT, Engine Oil.>
3	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 4.
4	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 5.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK FUEL PRESSURE.</b></p> <p><b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area.</p> <p><b>CAUTION:</b> Be careful not to spill fuel.</p> <p>Measure the fuel pressure. &lt;Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.&gt;</p> <p><b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.</p>	<p>Is the measured value 339.5 — 360.5 kPa (3.5 — 3.7 kg/cm<sup>2</sup>, 49 — 52 psi)?</p>	<p>Go to step 6.</p>	<p>Repair the following item.</p> <p>Fuel pressure is too high:</p> <ul style="list-style-type: none"> <li>• Clogged fuel line or bent hose</li> </ul> <p>Fuel pressure is too low:</p> <ul style="list-style-type: none"> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel line</li> </ul>
<p><b>6</b></p> <p><b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up completely.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Go to step 7.</p>	<p>Replace the engine coolant temperature sensor. &lt;Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.&gt;</p>
<p><b>7</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 8.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>8</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Go to step 9.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>9</b></p> <p><b>CHECK OUTPUT SIGNAL OF ECM.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Measure the voltage between the ECM and chassis ground for faulty cylinders.</p> <p><b>Connector &amp; terminal</b></p> <p><b>#1 (B137) No. 8 (+) — Chassis ground (-):</b></p> <p><b>#2 (B137) No. 9 (+) — Chassis ground (-):</b></p> <p><b>#3 (B137) No. 10 (+) — Chassis ground (-):</b></p> <p><b>#4 (B137) No. 11 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 14.</p>	<p>Go to step 10.</p>
<p><b>10</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from fuel injector on faulty cylinders.</p> <p>3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders.</p> <p><b>Connector &amp; terminal</b></p> <p><b>#1 (E5) No. 1 — Engine ground:</b></p> <p><b>#2 (E16) No. 1 — Engine ground:</b></p> <p><b>#3 (E6) No. 1 — Engine ground:</b></p> <p><b>#4 (E17) No. 1 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 11.</p>	<p>Repair the ground short circuit of harness between ECM and fuel injector.</p>
<p><b>11</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>Measure the resistance of harness between the ECM and fuel injector on faulty cylinders.</p> <p><b>Connector &amp; terminal</b></p> <p><b>#1 (B137) No. 8 — (E5) No. 1:</b></p> <p><b>#2 (B137) No. 9 — (E16) No. 1:</b></p> <p><b>#3 (B137) No. 10 — (E6) No. 1:</b></p> <p><b>#4 (B137) No. 11 — (E17) No. 1:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 12.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>12 CHECK FUEL INJECTOR.</b> Measure the resistance between fuel injector terminals on faulty cylinder. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 13.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-28, Fuel Injector.>
<b>13 CHECK POWER SUPPLY LINE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. <i>Connector &amp; terminal</i> <i>#1 (E5) No. 2 (+) — Engine ground (-):</i> <i>#2 (E16) No. 2 (+) — Engine ground (-):</i> <i>#3 (E6) No. 2 (+) — Engine ground (-):</i> <i>#4 (E17) No. 2 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and fuel injector connector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>
<b>14 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders. <i>Connector &amp; terminal</i> <i>#1 (B137) No. 8 (+) — Chassis ground (-):</i> <i>#2 (B137) No. 9 (+) — Chassis ground (-):</i> <i>#3 (B137) No. 10 (+) — Chassis ground (-):</i> <i>#4 (B137) No. 11 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 15.
<b>15 CHECK FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H4SO)-28, Fuel Injector.>	Go to step 16.
<b>16 CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 17.
<b>17 CHECK CRANK SPROCKET.</b> Remove the timing belt cover. <Ref. to ME(H4SO)-41, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have damaged teeth?	Replace the crank sprocket. <Ref. to ME(H4SO)-48, Crank Sprocket.>	Go to step 18.
<b>18 CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft using ST, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 499987500                      CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-42, Timing Belt.>	Go to step 19.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>19 CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Remove the electronic throttle control relay.                      3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay.                      4) Measure the resistance between electronic throttle control relay terminals.</p> <p><b>Terminals</b>  <b>No. 8 — No. 7:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 20.	Replace the electronic throttle control relay.
<p><b>20 CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 8 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 21.	Repair the open or ground short circuit of power supply circuit.
<p><b>21 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Disconnect the connectors from the ECM.                      2) Turn the ignition switch to ON.                      3) Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 6 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 22.
<p><b>22 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Measure the resistance between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 6 — Chassis ground:</b>  <b>(B362) No. 7 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 23.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<p><b>23 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the resistance between the ECM and electronic throttle control relay connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 21 — (B362) No. 6:</b>  <b>(B136) No. 1 — (B362) No. 7:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 24.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<p><b>24 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from ECM and electronic throttle control.                      3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 18 — Chassis ground:</b>  <b>(B134) No. 18 — (B136) No. 6:</b>  <b>(B134) No. 28 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 25.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>25 CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 — Engine ground:</i> <i>(E57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 26.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>
<b>26 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 27.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>27 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 3 — Engine ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 28.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>28 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 (+) — Engine ground (-):</i> <i>(E57) No. 4 (+) — Engine ground (-):</i>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 29.
<b>29 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <i>(B134) No. 19 — (B134) No. 18:</i> <i>(B134) No. 19 — (B134) No. 28:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 30.	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.
<b>30 CHECK SENSOR OUTPUT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step 31.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>31 CHECK SENSOR OUTPUT.</b> Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step <b>32</b> .	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>
<b>32 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B137) No. 5 — (E57) No. 2:</b> <b>(B137) No. 4 — (E57) No. 1:</b>	Is the resistance less than 1 Ω?	Go to step <b>33</b> .	Repair the open circuit of harness between ECM and electronic throttle control.
<b>33 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 2 (+) — Engine ground (-):</b> <b>(E57) No. 1 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step <b>34</b> .
<b>34 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 2 — Engine ground:</b> <b>(E57) No. 1 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step <b>35</b> .	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>35 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <b>Connector &amp; terminal</b> <b>(E57) No. 2 — (E57) No. 1:</b>	Is the resistance 1 MΩ or more?	Go to step <b>36</b> .	Repair the short circuit of harness between ECM and electronic throttle control.
<b>36 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 Ω?	Go to step <b>37</b> .	Repair the open circuit of the harness between the ECM and engine ground.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>37</b> <b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <i>Terminals</i> <i>No. 2 — No. 1:</i>	Is the resistance 50 $\Omega$ or less?	Go to step <b>38</b> .	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>
<b>38</b> <b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CY:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

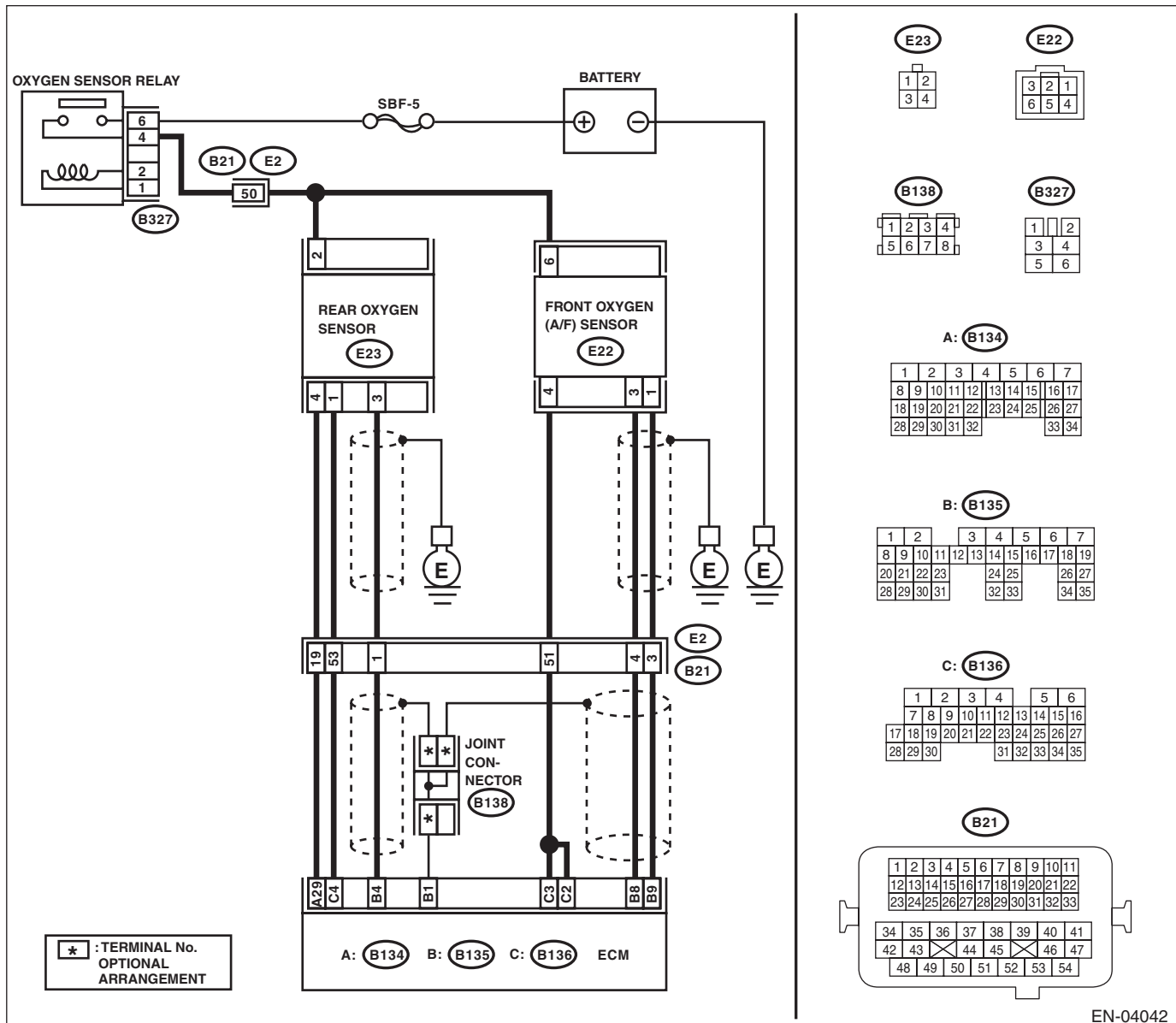
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-219, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
3	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E22) No. 1:</b> <b>(B135) No. 8 — (E22) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
4	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 7.	Go to step 6.
6	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 7.	Go to step 8.
7	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 1 (+) — Chassis ground (-):</b> <b>(E22) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>8</b>	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system. Go to step <b>9</b> .
<b>9</b>	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system. Go to step <b>10</b> .
<b>10</b>	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 339.5 — 360.5 kPa (3.5 — 3.7 kg/cm <sup>2</sup> , 49 — 52 psi)?	Go to step <b>11</b> . Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
<b>11</b>	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step <b>12</b> . Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>
<b>12</b>	<b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step <b>13</b> . Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>13 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	Go to step 14.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>
<p><b>14 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 490 mV or more?	Go to step 15.	Go to step 16.
<p><b>15 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 17.	Go to step 16.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>16</b> <b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 18.
<b>17</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR AND REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>	Go to step 18.
<b>18</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <i>Connector &amp; terminal</i> <i>(B135) No. 4 — (E23) No. 3:</i> <i>(B134) No. 29 — (E23) No. 4:</i>	Is the resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>19</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground.  <i>Connector &amp; terminal</i> <i>(E23) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact in ECM connector • Poor contact of coupling connector

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CZ:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

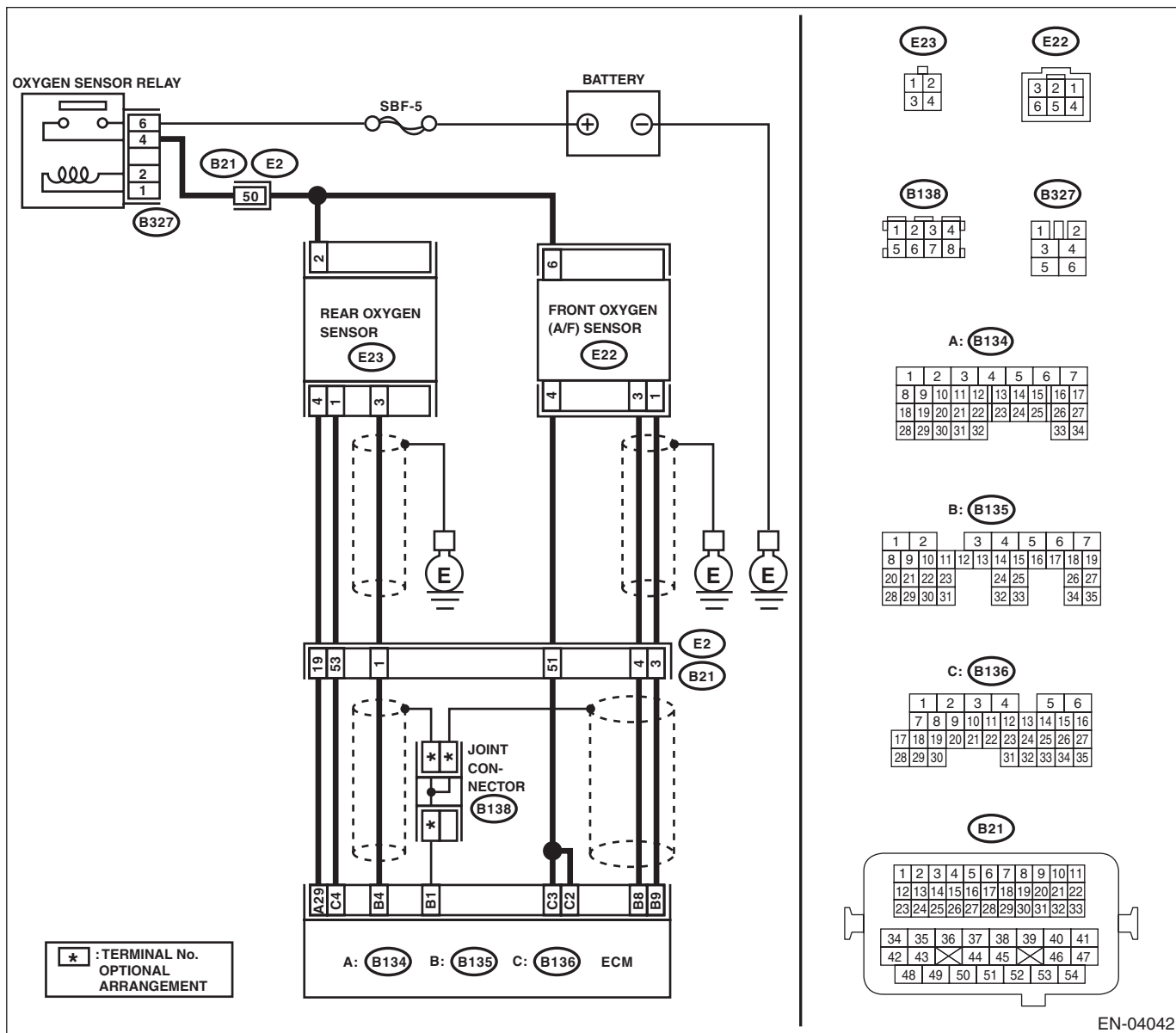
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-221, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-04042

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
3	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E22) No. 1:</b> <b>(B135) No. 8 — (E22) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
4	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 7.	Go to step 6.
6	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 7.	Go to step 8.
7	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E22) No. 1 (+) — Chassis ground (-):</b> <b>(E22) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>8</b>	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system. Go to step <b>9</b> .
<b>9</b>	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system. Go to step <b>10</b> .
<b>10</b>	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 339.5 — 360.5 kPa (3.5 — 3.7 kg/cm <sup>2</sup> , 49 — 52 psi)?	Go to step <b>11</b> .  Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
<b>11</b>	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step <b>12</b> .  Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-20, Engine Coolant Temperature Sensor.>
<b>12</b>	<b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step <b>13</b> .  Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>13 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	Go to step 14.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-26, Mass Air Flow and Intake Air Temperature Sensor.>
<p><b>14 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 490 mV or more?	Go to step 15.	Go to step 16.
<p><b>15 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 17.	Go to step 16.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>16 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 18.
<b>17 CHECK FRONT OXYGEN (A/F) SENSOR AND REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.  <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-33, Front Oxygen (A/F) Sensor.>	Go to step 18.
<b>18 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (E23) No. 3:</b> <b>(B134) No. 29 — (E23) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>19 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground.  <b>Connector &amp; terminal</b> <b>(E23) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-35, Rear Oxygen Sensor.>	Repair the harness and connector.  <b>NOTE:</b> In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact in ECM connector • Poor contact of coupling connector

## DA:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-223, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

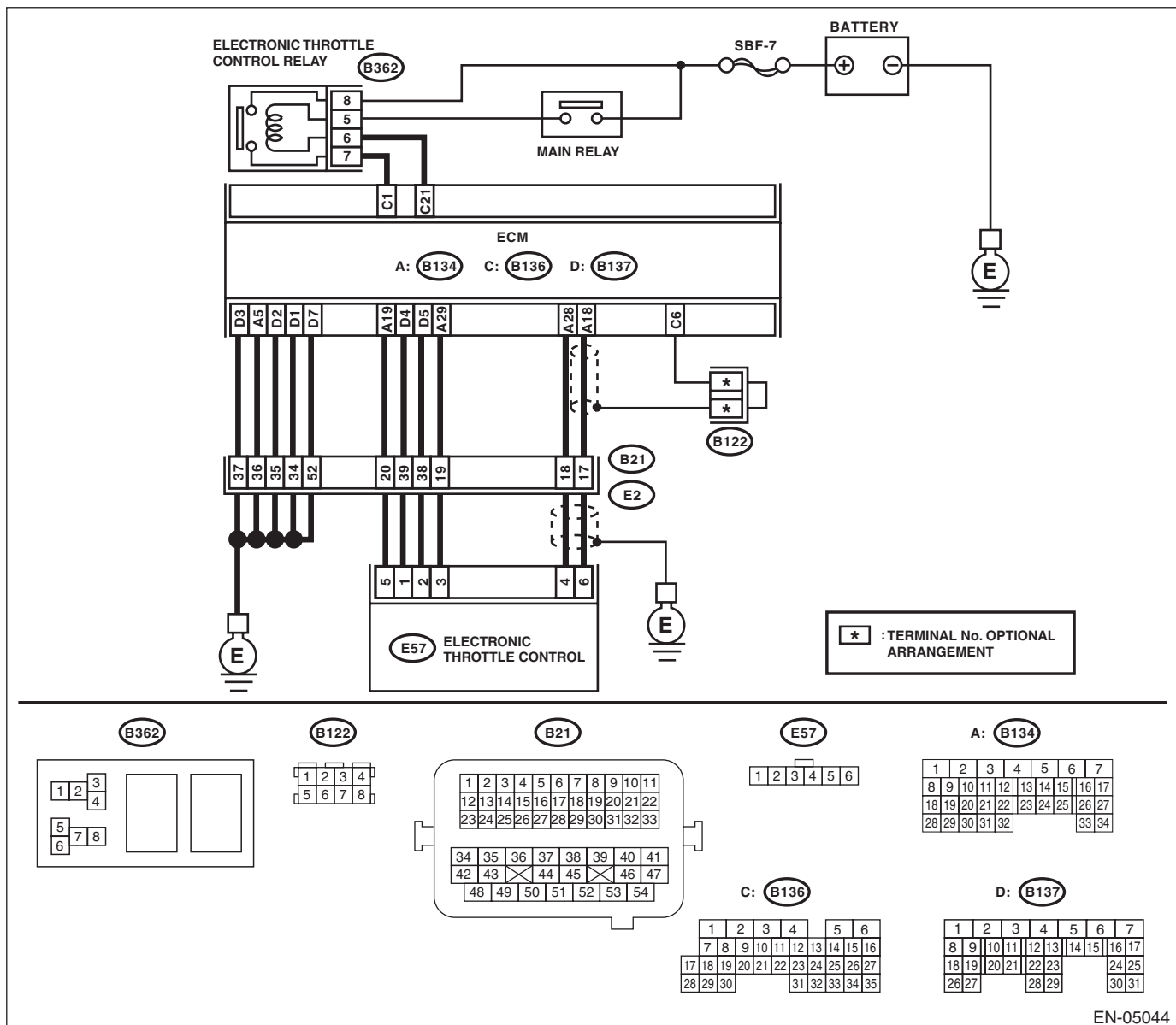
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals.</p> <p><b>Terminals</b> <b>No. 8 — No. 7:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Replace the electronic throttle control relay.
<p><b>2</b></p> <p><b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 8 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 6 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 4.
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 6 — Chassis ground:</b> <b>(B362) No. 7 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the resistance between the ECM and electronic throttle control relay connector.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 21 — (B362) No. 6:</b> <b>(B136) No. 1 — (B362) No. 7:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from electronic throttle control. 3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 19 — Chassis ground:</b> <b>(B134) No. 18 — Chassis ground:</b> <b>(B134) No. 18 — (B136) No. 6:</b> <b>(B134) No. 28 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7 CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 — Engine ground:</i> <i>(E57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>
<b>8 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>9 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 3 — Engine ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 10.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>10 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 (+) — Engine ground (-):</i> <i>(E57) No. 4 (+) — Engine ground (-):</i>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 11.
<b>11 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <i>(B134) No. 19 — (B134) No. 18:</i> <i>(B134) No. 19 — (B134) No. 28:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 12.	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.
<b>12 CHECK SENSOR OUTPUT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step 13.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>13 CHECK SENSOR OUTPUT.</b> Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step 14.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>
<b>14 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <i>(B137) No. 5 — (E57) No. 2:</i> <i>(B137) No. 4 — (E57) No. 1:</i>	Is the resistance less than 1 Ω?	Go to step 15.	Repair the open circuit of harness between ECM and electronic throttle control.
<b>15 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 2 (+) — Engine ground (-):</i> <i>(E57) No. 1 (+) — Engine ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step 16.
<b>16 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 2 — Engine ground:</i> <i>(E57) No. 1 — Engine ground:</i>	Is the resistance 1 MΩ or more?	Go to step 17.	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>17 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <b>Connector &amp; terminal</b> <i>(E57) No. 2 — (E57) No. 1:</i>	Is the resistance 1 MΩ or more?	Go to step 18.	Repair the short circuit of harness between ECM and electronic throttle control.
<b>18 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <i>(B134) No. 5 — Chassis ground:</i> <i>(B137) No. 1 — Chassis ground:</i> <i>(B137) No. 2 — Chassis ground:</i> <i>(B137) No. 3 — Chassis ground:</i> <i>(B137) No. 7 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Go to step 19.	Repair the open circuit of the harness between the ECM and engine ground.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
19	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance 50 $\Omega$ or less?	Go to step 20.	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>
20	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4SO)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DB:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-225, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

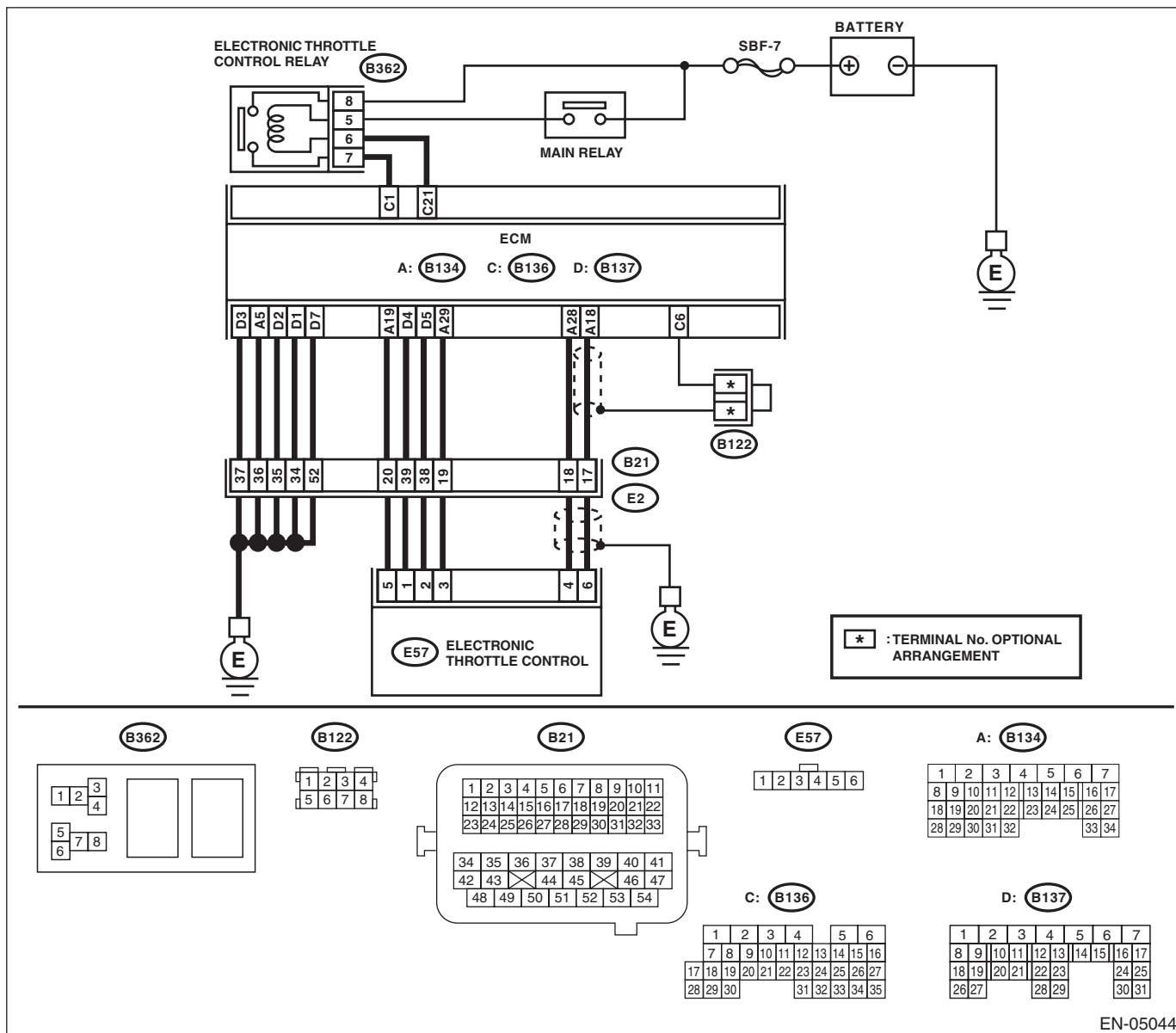
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals.</p> <p><b>Terminals</b> <b>No. 8 — No. 7:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 2.</p>	<p>Replace the electronic throttle control relay.</p>
<p><b>2</b></p> <p><b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 8 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 3.</p>	<p>Repair the open or ground short circuit of power supply circuit.</p>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 6 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between ECM and electronic throttle control relay.</p>	<p>Go to step 4.</p>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B362) No. 6 — Chassis ground:</b> <b>(B362) No. 7 — Chassis ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Go to step 5.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control relay.</p>
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the resistance between the ECM and electronic throttle control relay connector.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 21 — (B362) No. 6:</b> <b>(B136) No. 1 — (B362) No. 7:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Repair the open circuit of harness between ECM and electronic throttle control relay.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DC:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

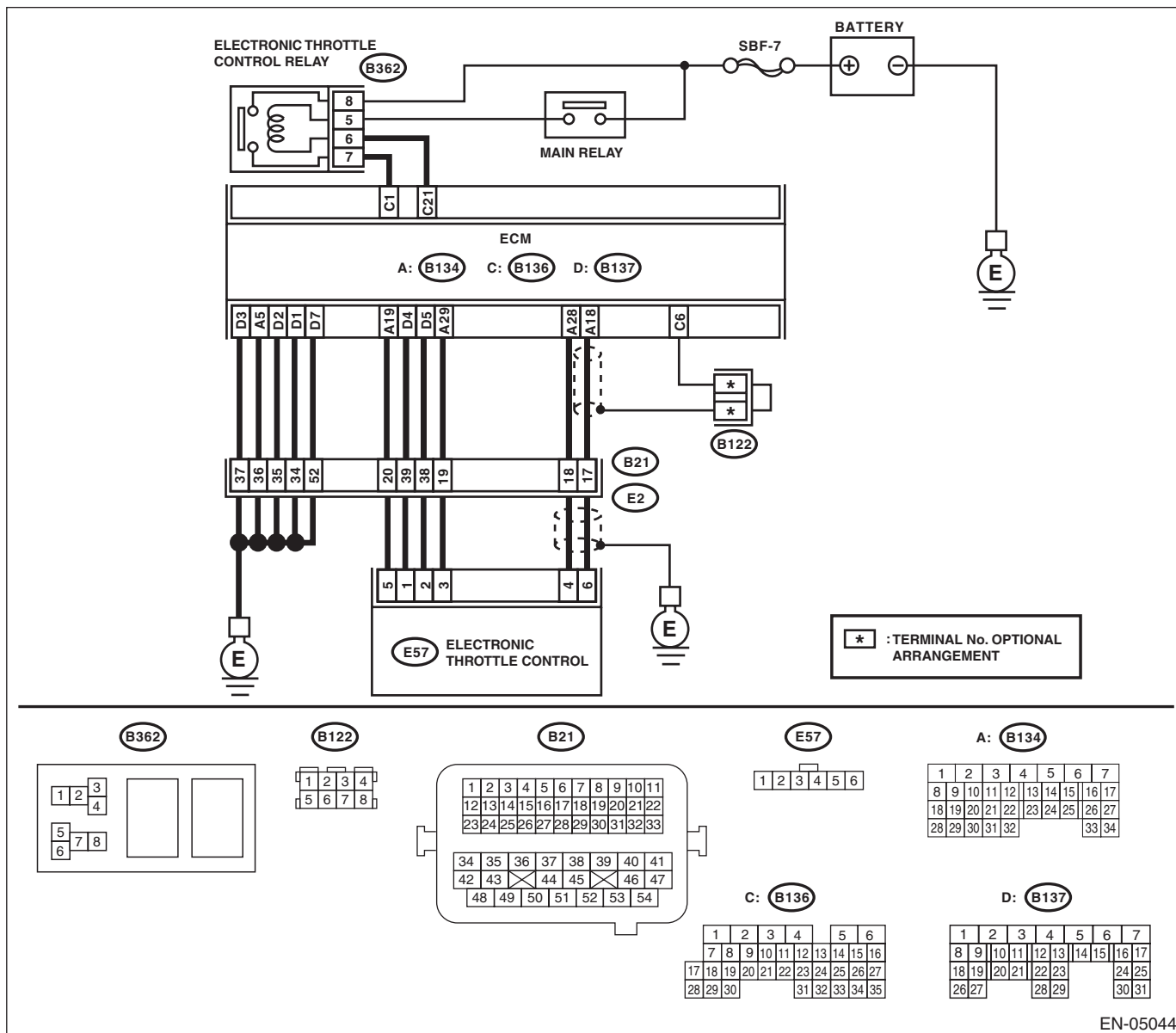
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-227, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05044

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Measure the resistance between electronic throttle control relay terminals. <b>Terminals</b> <b>No. 8 — No. 7:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Replace the electronic throttle control relay.
<b>2</b> <b>CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 21 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Repair the poor contact of the ECM connector.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.

## DD:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

### NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-283, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DE:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-231, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

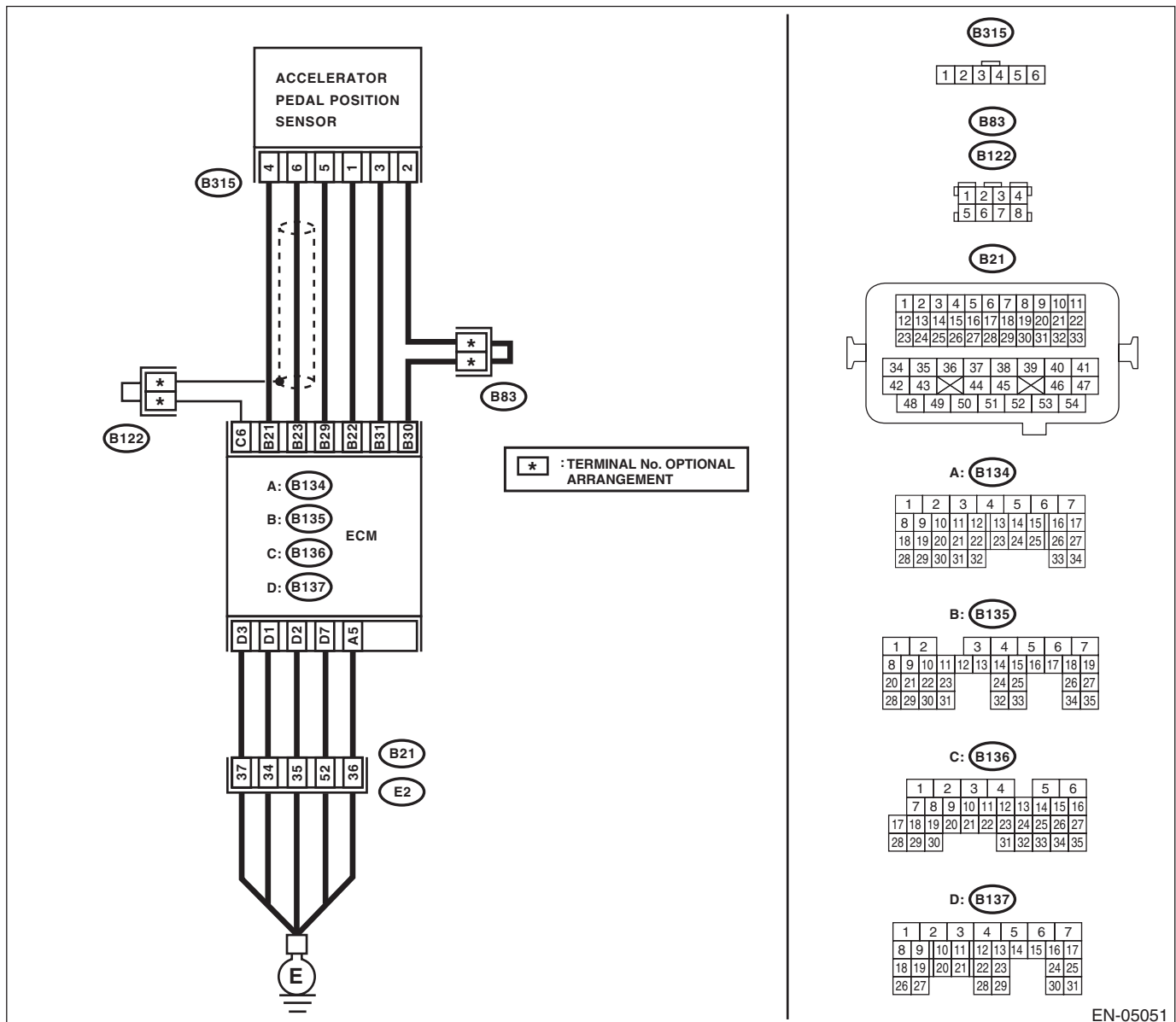
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05051



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B135) No. 21 — Chassis ground:</b></p> <p><b>(B135) No. 23 — Chassis ground:</b></p> <p><b>(B135) No. 23 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B315) No. 6 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H4SO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DF:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-233, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

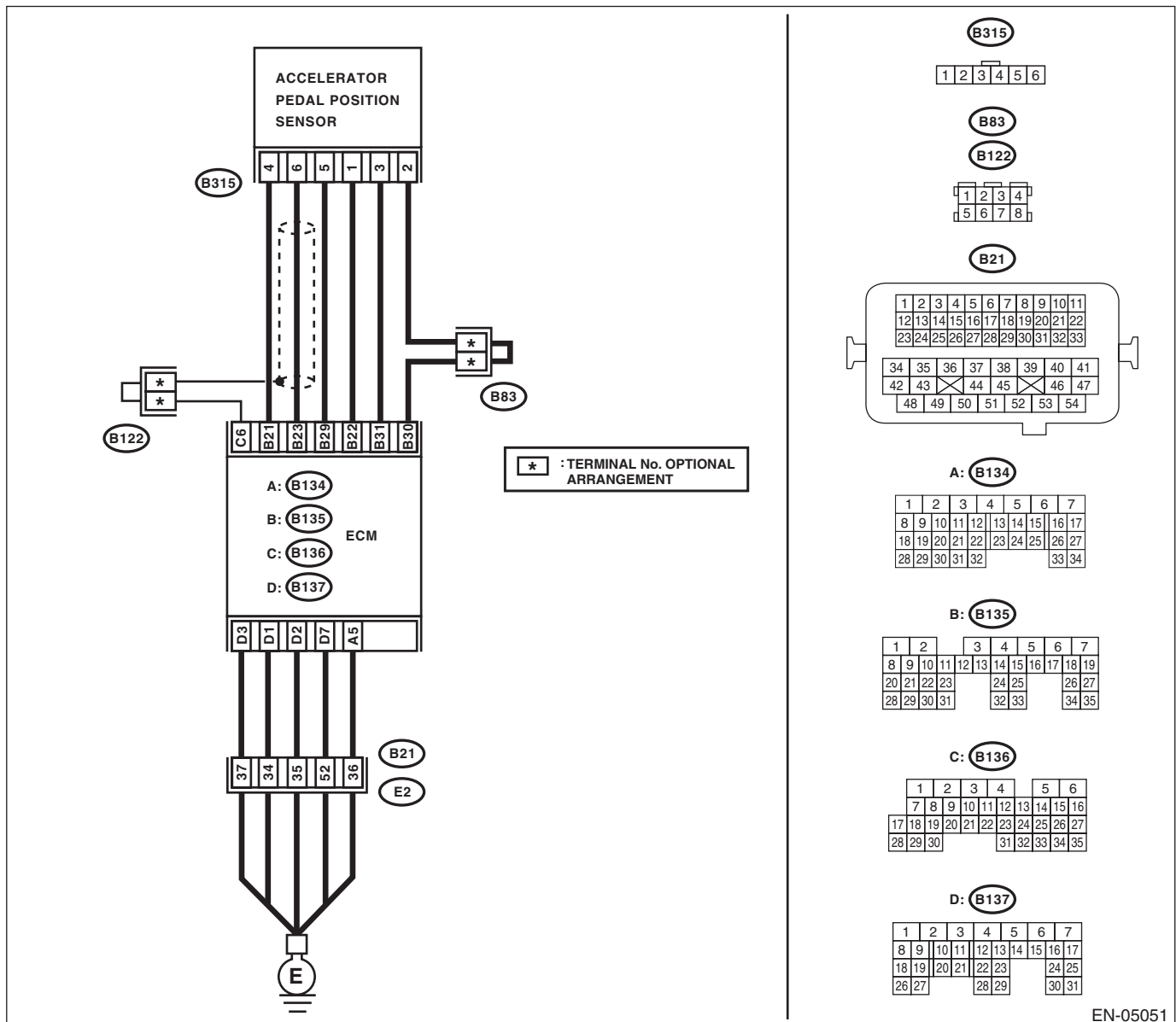
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05051

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from the ECM and accelerator pedal position sensor.            3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 23 — (B315) No. 6:</b>  <b>(B135) No. 29 — (B315) No. 5:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Connect the ECM.            2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 5 — Chassis ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and engine ground            • Poor contact in ECM connector            • Poor contact of coupling connector</p>
<p><b>3</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to ON.            2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 6 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.85 V or more?</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>	<p>Go to step 4.</p>
<p><b>4</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B135) No. 21 — (B135) No. 23:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DG:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-235, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

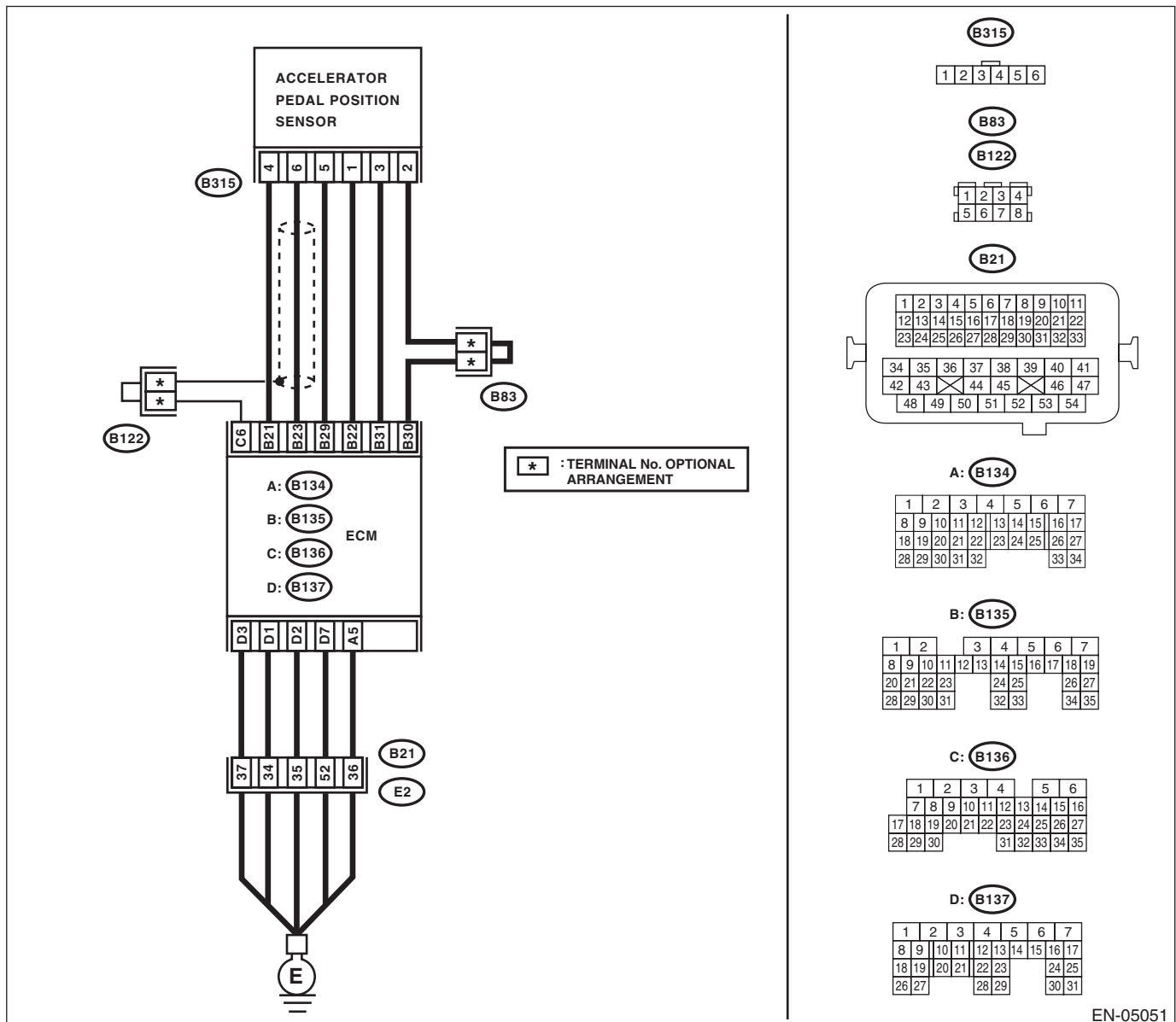
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05051

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 22 — Chassis ground:</b>  <b>(B135) No. 31 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 3 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H4SO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DH:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-237, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

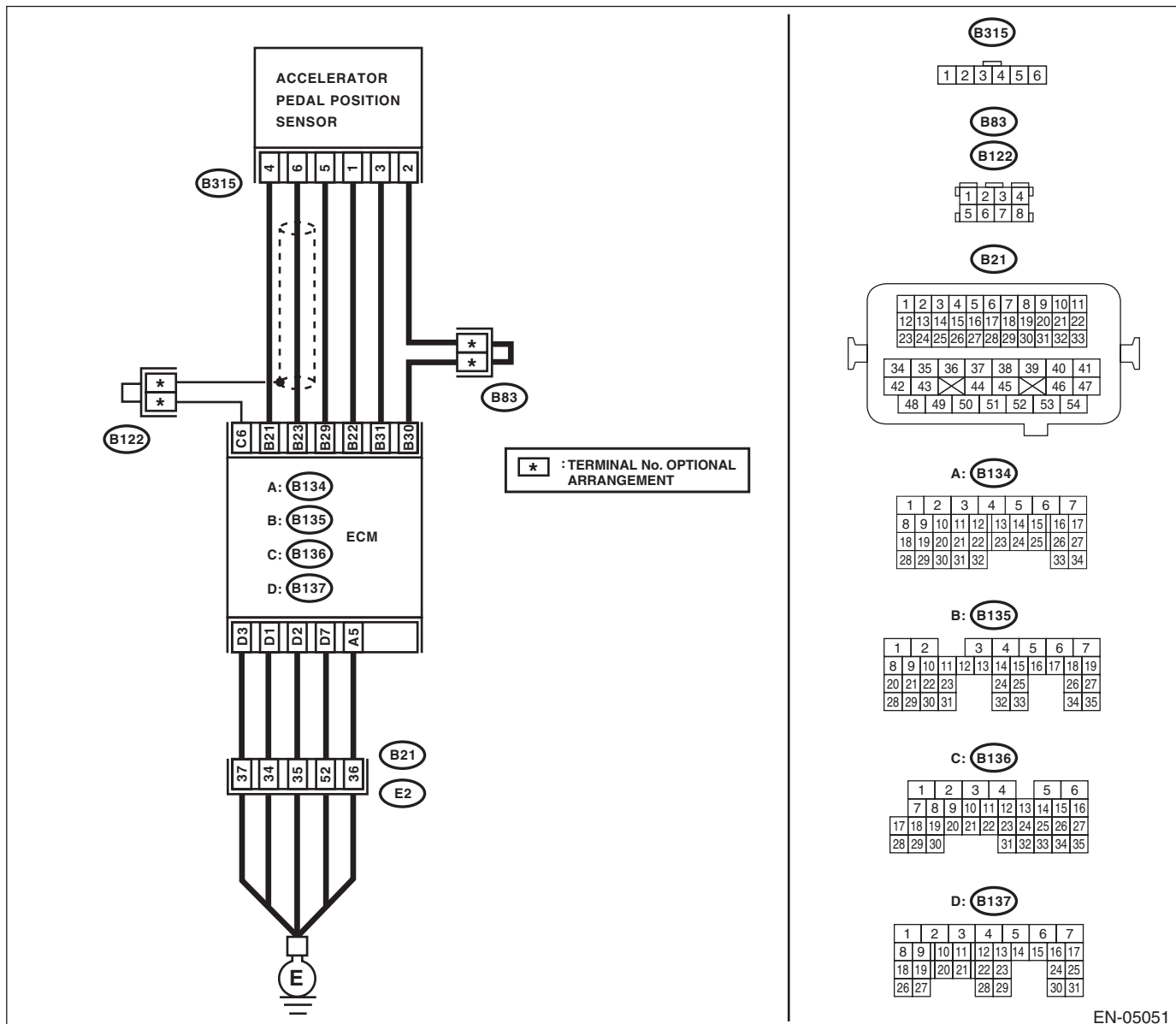
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05051

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from the ECM and accelerator pedal position sensor.            3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 31 — (B315) No. 3:</b>  <b>(B135) No. 30 — (B315) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Connect the ECM.            2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 2 — Chassis ground:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and engine ground            • Poor contact in ECM connector            • Poor contact of coupling connector</p>
<p><b>3</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to ON.            2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.85 V or more?</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>	<p>Go to step 4.</p>
<p><b>4</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B135) No. 22 — (B135) No. 31:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DI: DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-239, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

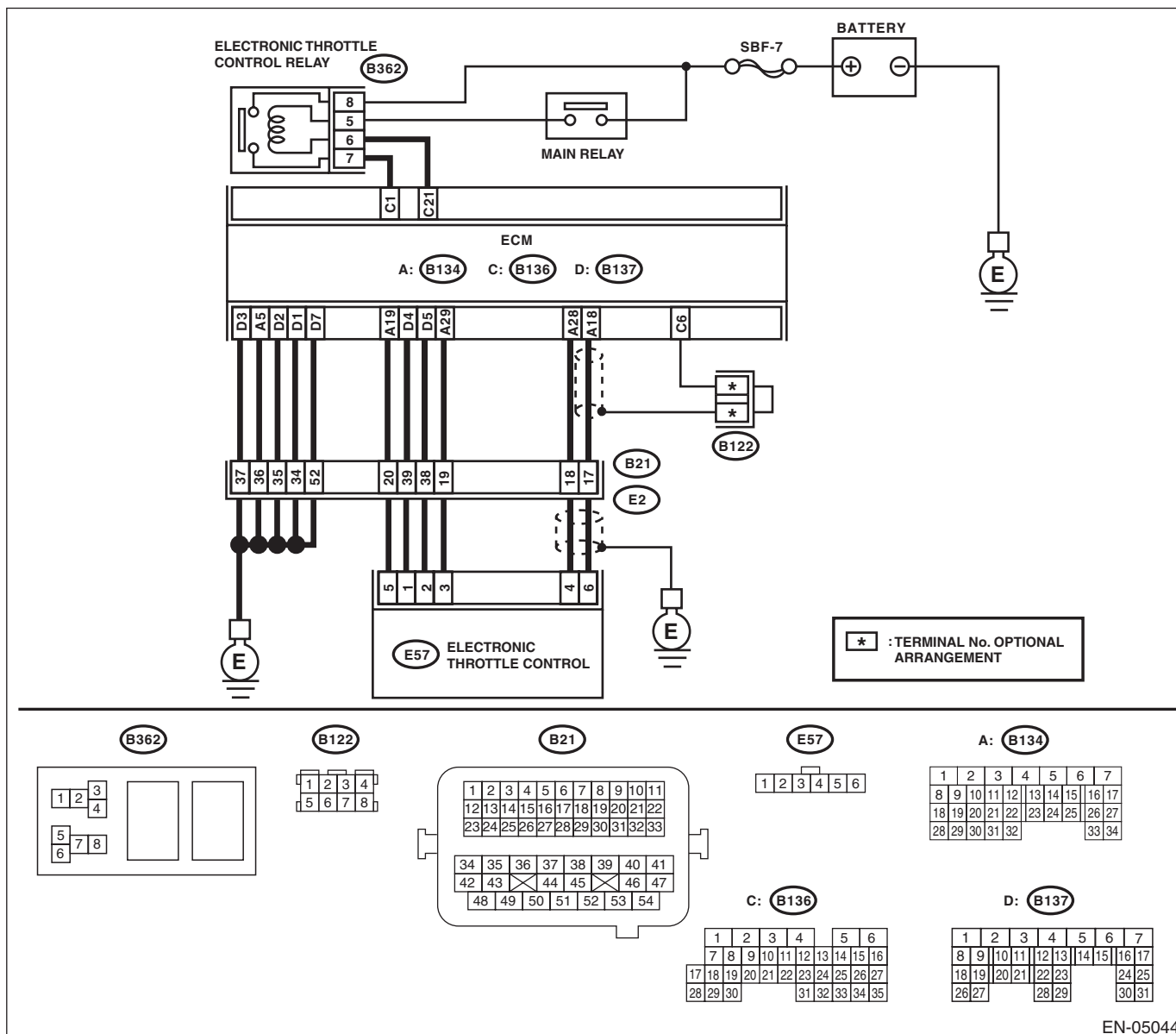
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05044



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 19 — Chassis ground:</b> <b>(B134) No. 18 — Chassis ground:</b> <b>(B134) No. 18 — (B136) No. 6:</b> <b>(B134) No. 28 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E57) No. 6 — Engine ground:</b> <b>(E57) No. 4 — Engine ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b> <b>(E57) No. 4 (+) — Engine ground (-):</b></p>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
6	<b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DJ:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-241, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

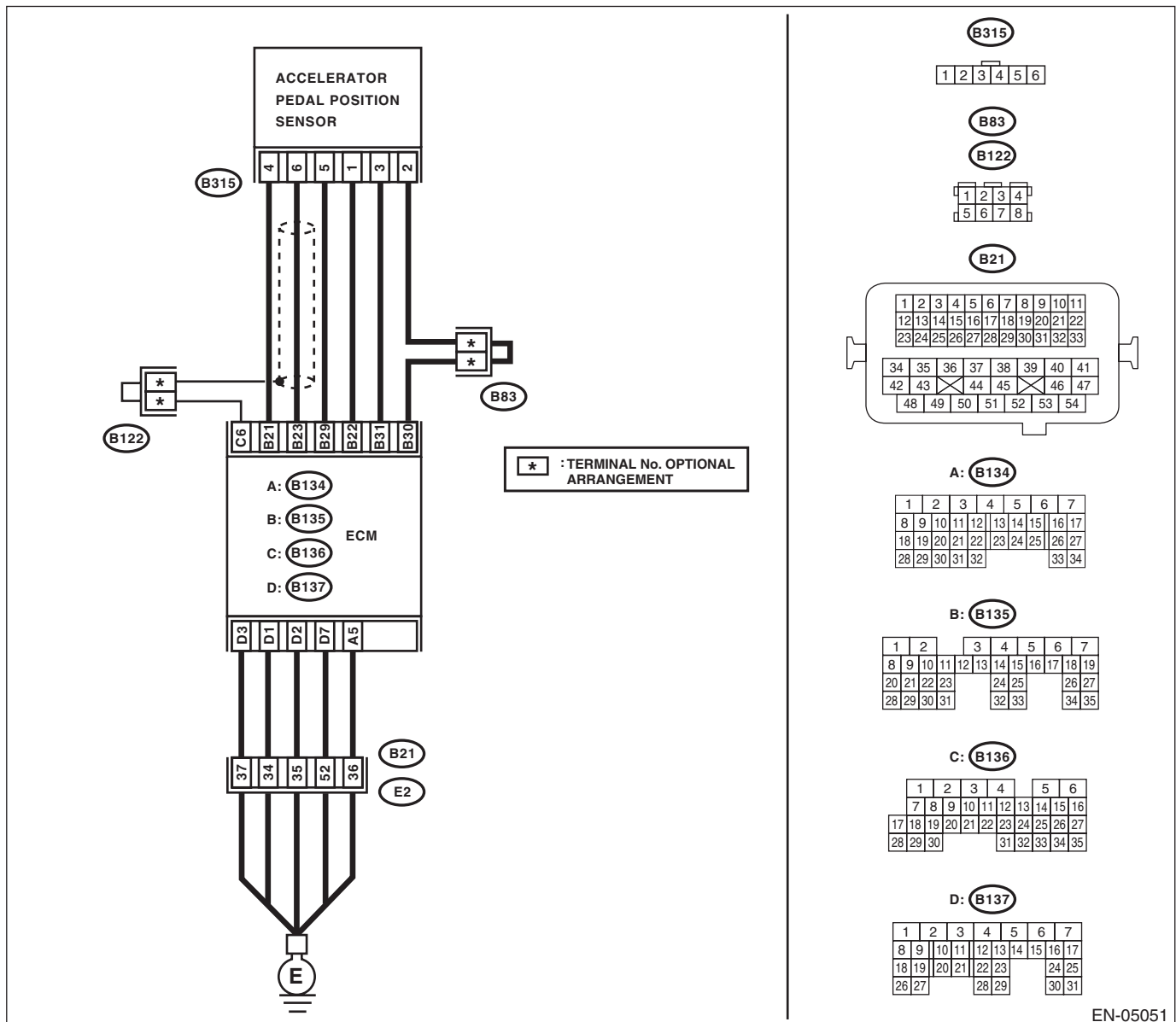
### TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05051

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>Main accelerator pedal position sensor signal</b> <b>(B135) No. 23 (+) — Chassis ground (-):</b> <b>Sub accelerator pedal position sensor signal</b> <b>(B135) No. 31 (+) — Chassis ground (-):</b></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Go to step 3.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b></p> <p>1) Measure the voltage between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 6 (+) — Chassis ground (-):</b> <b>(B315) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Ground short circuit of harness between the ECM and accelerator pedal position sensor connectors.</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.</b></p> <p>Check the resistance of harness between the accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 5 — Chassis ground:</b> <b>(B315) No. 2 — Chassis ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DK:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-243, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

## DL:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-244, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DM:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-245, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

## 20. General Diagnostic Table

### A: INSPECTION

#### 1. ENGINE

**NOTE:**

Malfunction of parts other than those listed is also possible. <Ref. to ME(H4SO)-93, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Ignition parts (*1) 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4)
2. Rough idling	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Ignition parts (*1) 5) Air intake system (*5) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay 12) EGR valve
3. Engine does not return to idle.	1) Engine coolant temperature sensor 2) Electronic throttle control 3) Manifold absolute pressure sensor 4) Mass air flow and intake air temperature sensor 5) EGR valve
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Electronic throttle control 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) A/C switch and A/C cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1) 12) EGR valve
5. Engine stalls, hesitates, or sputters at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Electronic throttle control 9) Fuel pump and fuel pump relay 10) EGR valve

## General Diagnostic Table

### ENGINE (DIAGNOSTICS)

Symptom	Problem parts
6. Surging	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Fuel pump and fuel pump relay 9) EGR valve
7. Spark knock	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay 7) EGR valve
8. After burning in exhaust system	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

\*1: Check ignition coil and ignitor assembly and spark plug.

\*2: Indicate the symptom occurring only in cold temperatures.

\*3: Ensure the secure installation.

\*4: Check fuel injector, fuel pressure regulator and fuel filter.

\*5: Inspect air leak in air intake system.



# List of Diagnostic Trouble Code (DTC)

## GENERAL DESCRIPTION

### 1. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Index
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to GD(H4SO)-11, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-12, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-14, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-16, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-18, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-20, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to GD(H4SO)-22, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to GD(H4SO)-25, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to GD(H4SO)-26, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to GD(H4SO)-27, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to GD(H4SO)-27, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4SO)-28, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H4SO)-31, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H4SO)-33, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4SO)-35, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4SO)-37, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H4SO)-39, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H4SO)-41, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to GD(H4SO)-43, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H4SO)-45, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H4SO)-47, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	<Ref. to GD(H4SO)-49, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	<Ref. to GD(H4SO)-51, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to GD(H4SO)-53, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to GD(H4SO)-56, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4SO)-58, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-60, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-62, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-64, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-67, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-69, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-72, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-73, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to GD(H4SO)-80, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4SO)-82, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4SO)-83, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to GD(H4SO)-85, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to GD(H4SO)-88, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to GD(H4SO)-90, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-92, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0197	Engine Oil Temperature Sensor Low	<Ref. to GD(H4SO)-94, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0198	Engine Oil Temperature Sensor High	<Ref. to GD(H4SO)-95, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P0222	Throttle/Pedal Position Sensor/ Switch "B" Circuit Low	<Ref. to GD(H4SO)-96, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/ Switch "B" Circuit High	<Ref. to GD(H4SO)-98, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4SO)-100, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4SO)-107, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4SO)-107, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4SO)-107, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-108, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-110, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to GD(H4SO)-112, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to GD(H4SO)-114, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-116, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-118, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0400	Exhaust Gas Recirculation Flow	<Ref. to GD(H4SO)-120, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4SO)-124, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H4SO)-127, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H4SO)-144, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H4SO)-146, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to GD(H4SO)-148, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H4SO)-150, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H4SO)-152, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4SO)-153, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to GD(H4SO)-153, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H4SO)-154, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to GD(H4SO)-156, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor "A" Circuit Range/Performance	<Ref. to GD(H4SO)-158, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to GD(H4SO)-160, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to GD(H4SO)-162, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4SO)-164, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor "A"	<Ref. to GD(H4SO)-168, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H4SO)-170, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to GD(H4SO)-172, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4SO)-174, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0513	Incorrect Immobilizer Key	<Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0600	Serial Communication Link	<Ref. to GD(H4SO)-176, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4SO)-178, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H4SO)-180, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0607	Control Module Performance	<Ref. to GD(H4SO)-181, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to GD(H4SO)-184, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0700	Transmission Control System (MIL Request)	<Ref. to GD(H4SO)-187, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to GD(H4SO)-188, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to GD(H4SO)-189, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to GD(H4SO)-191, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to GD(H4SO)-192, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-194, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-197, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4SO)-200, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4SO)-202, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4SO)-204, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H4SO)-206, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to GD(H4SO)-208, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-210, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-212, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-214, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-214, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-214, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-214, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-214, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-214, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-up Voltage Circuit Malfunction	<Ref. to GD(H4SO)-215, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1570	Antenna	<Ref. to GD(H4SO)-216, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1571	Reference Code Incompatibility	<Ref. to GD(H4SO)-216, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to GD(H4SO)-216, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1574	Key Communication Failure	<Ref. to GD(H4SO)-216, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1576	EGI Control Module EEPROM	<Ref. to GD(H4SO)-216, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P1577	IMM Control Module EEPROM	<Ref. to GD(H4SO)-216, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1578	Meter Failure	<Ref. to GD(H4SO)-216, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1602	Control Module Programming Error	<Ref. to GD(H4SO)-217, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H4SO)-219, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H4SO)-221, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H4SO)-223, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H4SO)-225, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4SO)-227, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to GD(H4SO)-229, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to GD(H4SO)-231, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to GD(H4SO)-233, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to GD(H4SO)-235, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	<Ref. to GD(H4SO)-237, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	<Ref. to GD(H4SO)-239, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	<Ref. to GD(H4SO)-241, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2227	Barometric Pressure Circuit Range/Performance	<Ref. to GD(H4SO)-243, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2228	Barometric Pressure Circuit Low	<Ref. to GD(H4SO)-244, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2229	Barometric Pressure Circuit High	<Ref. to GD(H4SO)-245, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

## 2. Diagnostic Trouble Code (DTC) Detecting Criteria

### A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG with either Low NG or High NG.

A variable valve lift diagnosis oil pressure switch is installed for diagnosis. It is possible to determine whether the intake valve is in high mode (increase the amount of lift) or in low mode (suppressing the amount of lift) when the variable valve lift diagnosis oil pressure switch is turned ON or OFF.

#### • Normal

Oil switching solenoid valve duty	Intake valve	Variable valve lift diagnosis oil pressure switch
Large	High mode	ON
Minimum	Low mode	OFF

#### • Low NG

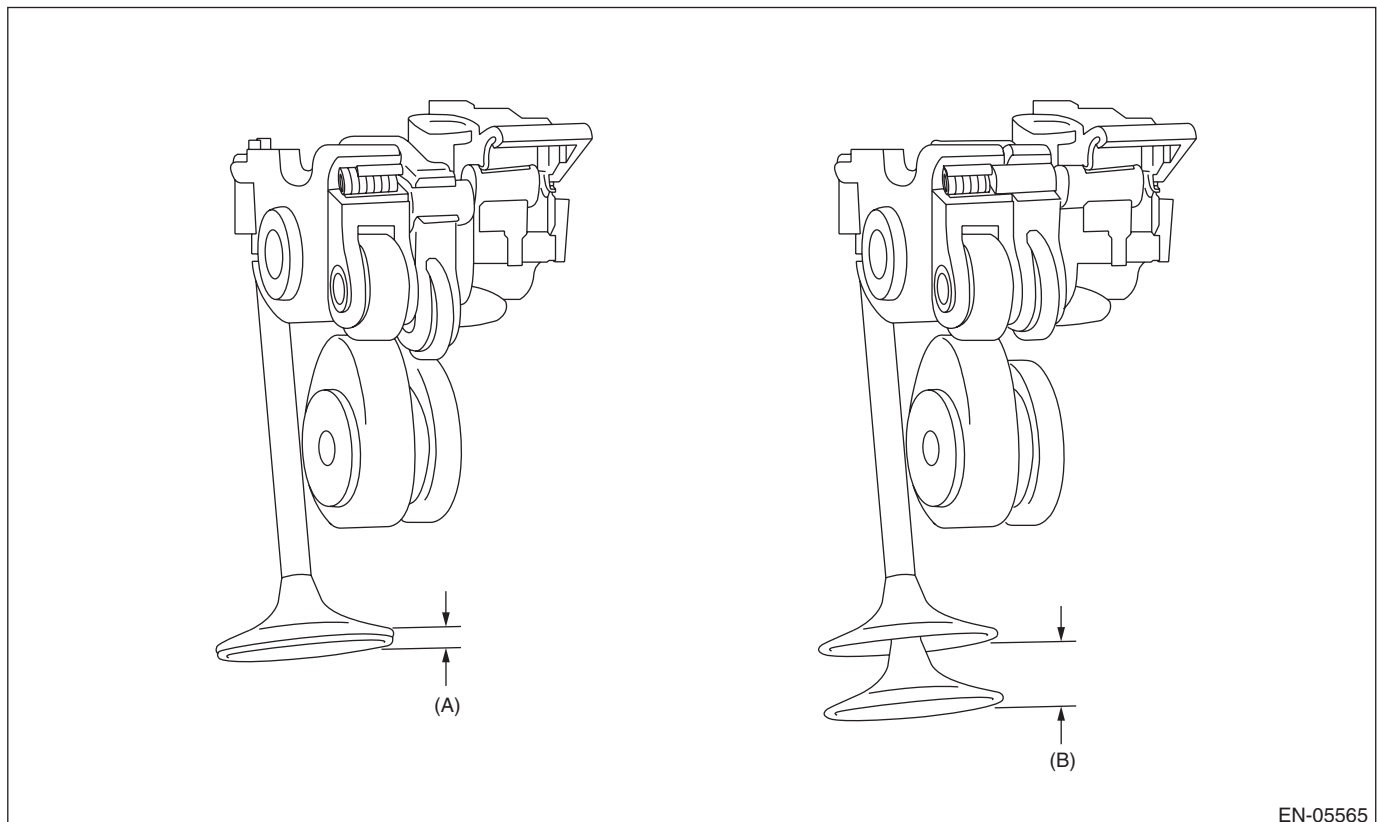
When the variable valve lift diagnosis oil pressure switch remains OFF even though the intake valve tried to enter high mode (oil switching solenoid valve duty is large), this is judged as a Low NG.

#### • High NG

When the variable valve lift diagnosis oil pressure switch remains ON even though the intake valve tried to enter low mode (oil switching solenoid valve duty is small), this is judged as a High NG.

#### 2. COMPONENT DESCRIPTION

The variable valve lift system optimizes the intake valve lift by switching between the low lift cam and the high lift cam according to the engine speed. The amount of intake valve lift is varied by controlling the oil switching solenoid valve duty according to signals from the ECM.



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(A) Low lift

(B) High lift

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
After engine starting	$\geq 6000$ ms
Engine oil temperature	$\geq 15$ °C (59 °F)
Variable valve lift control	Operation

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 6 seconds after engine start while variable valve lift is being controlled



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	OFF
<b>High</b>	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	ON

#### Time Needed for Diagnosis:

Low side: 784 ms

High side: 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	ON
<b>High</b>	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	OFF

#### Time Needed for Diagnosis:

Low side: 208 ms

High side: 3000 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### **B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)**

#### **1. OUTLINE OF DIAGNOSIS**

##### **NOTE:**

For the detection standard, refer to DTC P0026. <Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

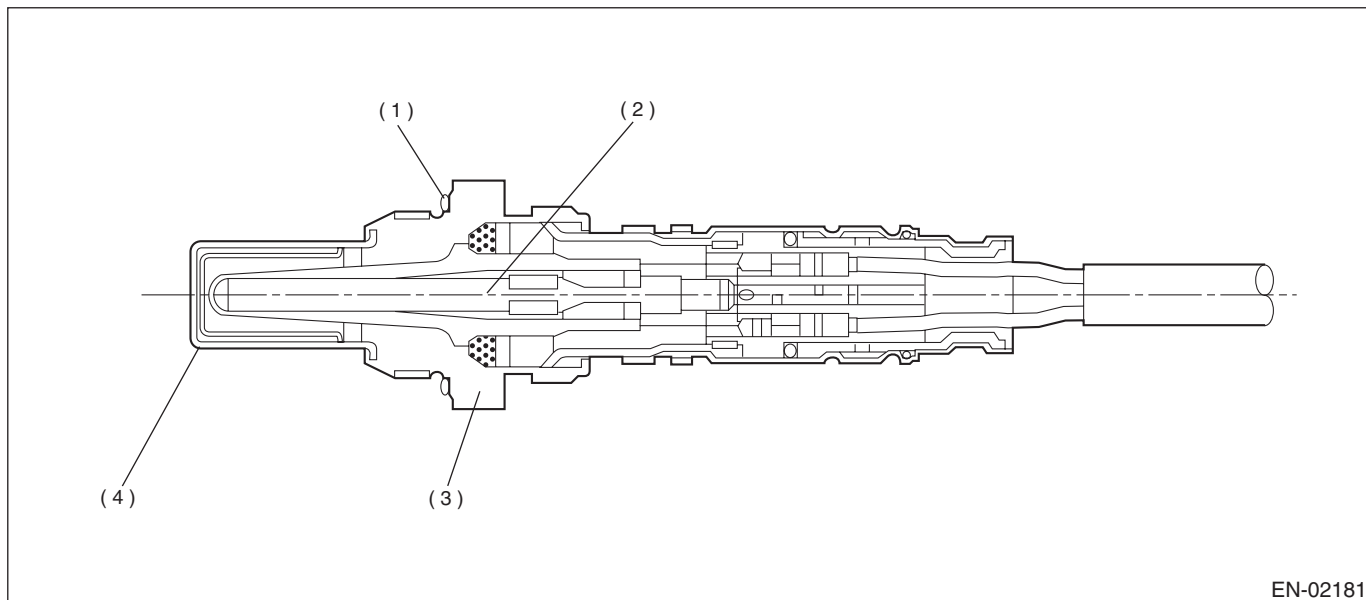
### C: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.

Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

#### 2. COMPONENT DESCRIPTION



(1) Gasket

(3) Sensor housing

(4) Protection tube

(2) Ceramic heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Condition established time	≥ 42000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
Control duty ≥ 35 %	Experienced
After fuel cut	≥ 20000 ms

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms or more have passed since the engine started.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	$\leq$ 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Front oxygen (A/F) sensor sub learning compensation: Not allowed to calculate.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### D: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

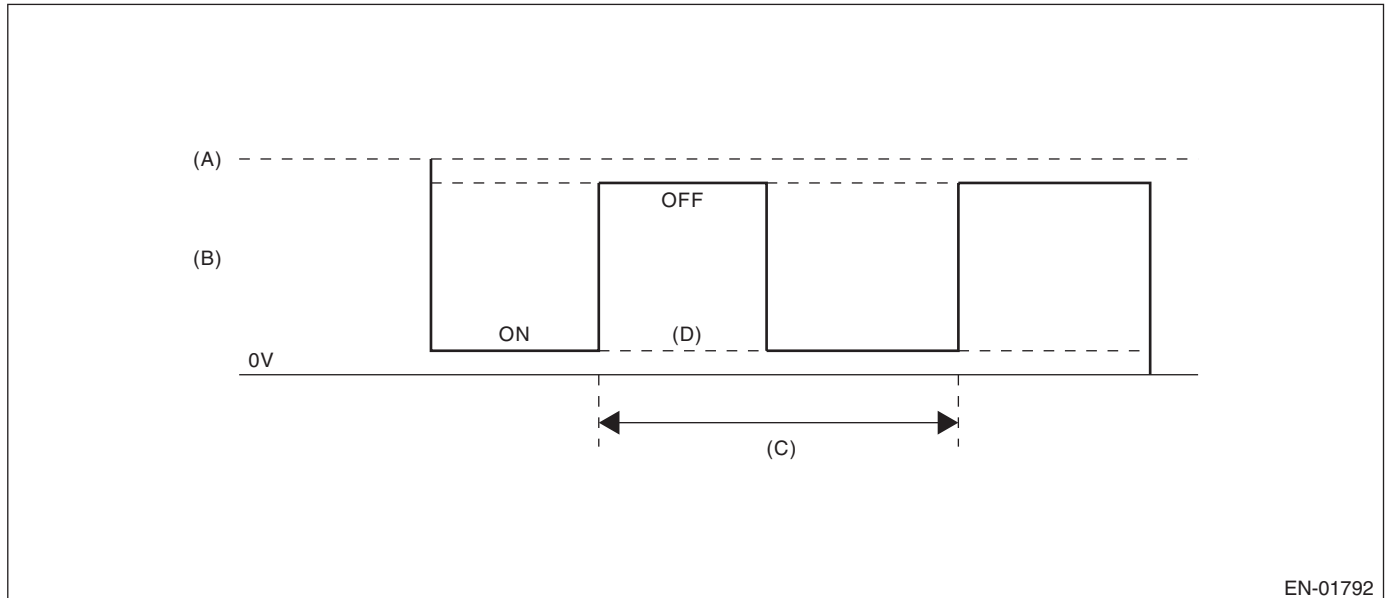
#### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 128 milliseconds

(D) Low error

(B) Front oxygen (A/F) sensor heater  
output voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Front oxygen (A/F) sensor heater control duty	< 87.5 %

**Time Needed for Diagnosis:** 4 ms × 250 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on the heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### E: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

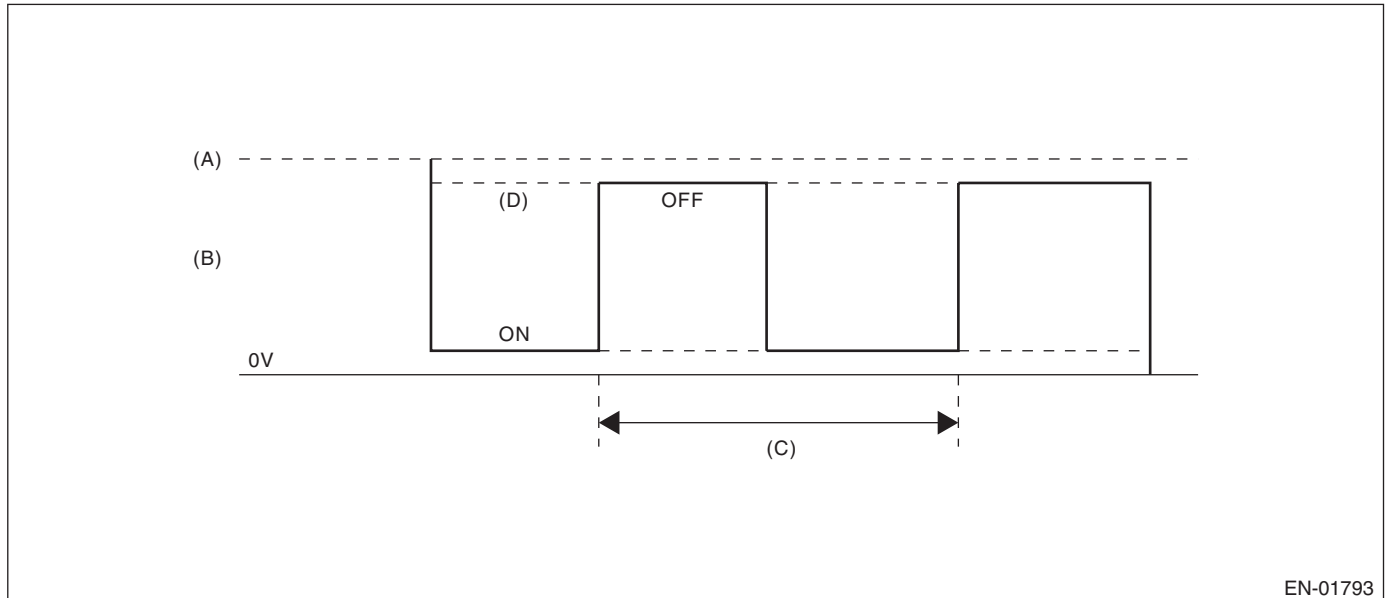
#### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 128 milliseconds

(D) High error

(B) Front oxygen (A/F) sensor heater  
output voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Front oxygen (A/F) sensor heater control duty	$\geq 12.5 \%$

**Time Needed for Diagnosis:** 4 ms  $\times$  500 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on the heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### F: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

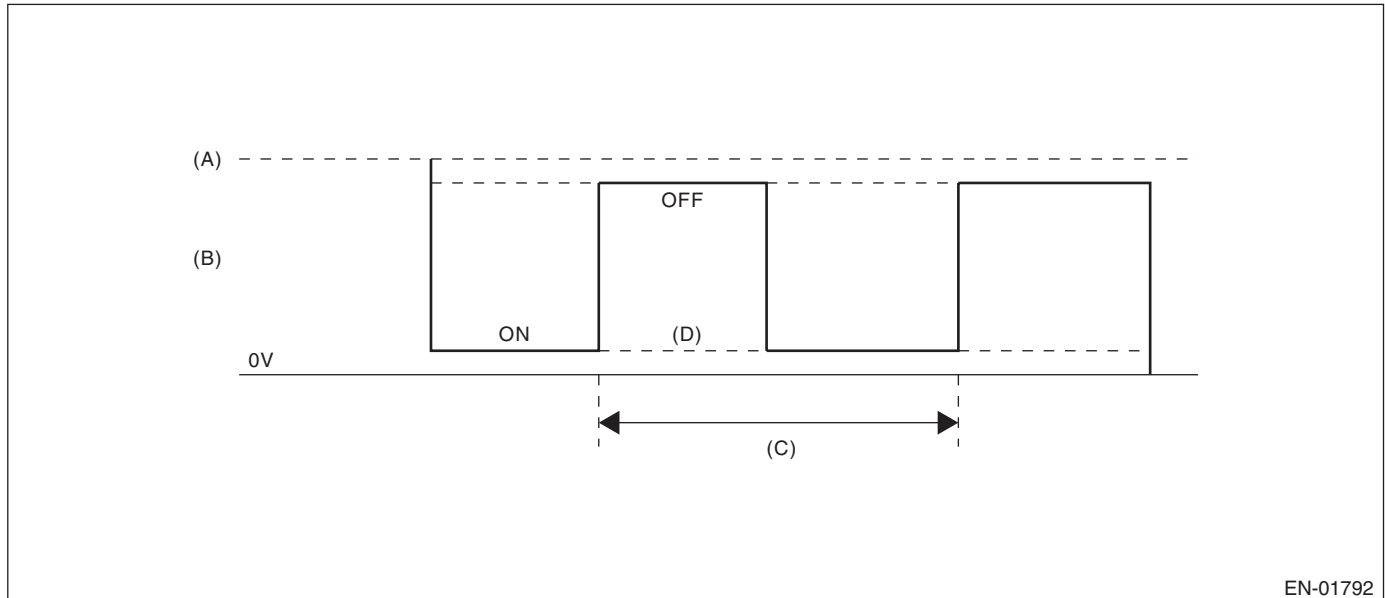
#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) Low error

(B) Output voltage of the rear oxygen sensor heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 8000$ rpm

#### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Rear oxygen sensor heater control duty	< 75 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### G: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

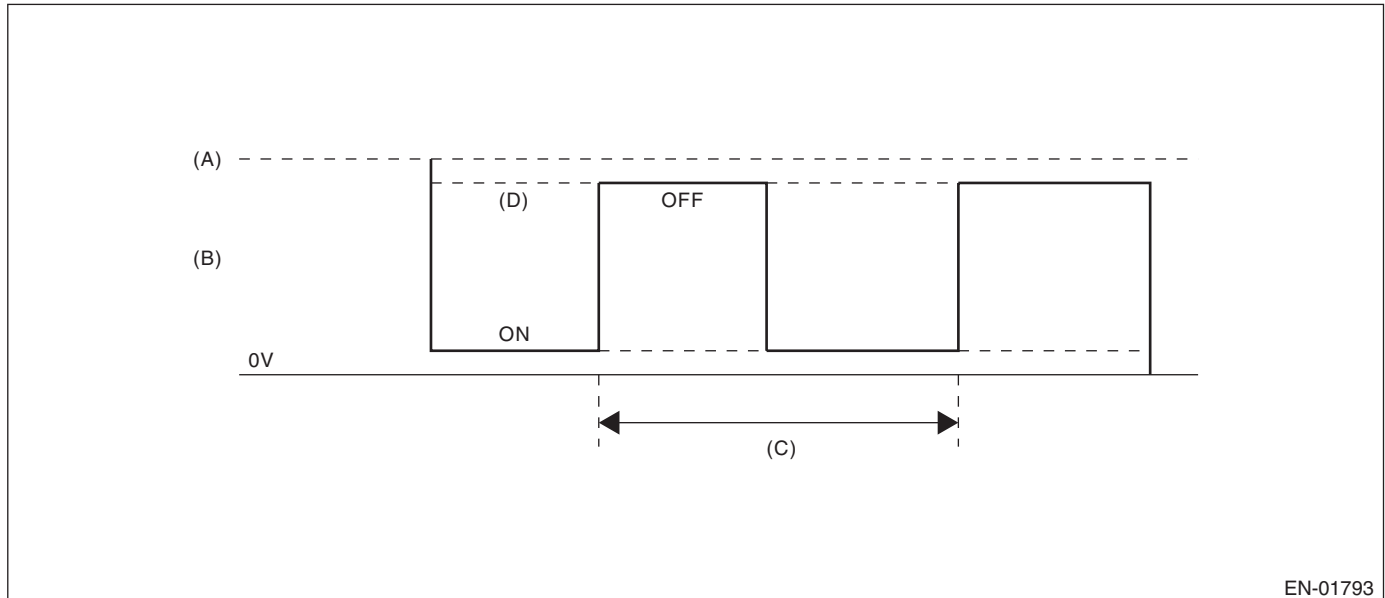
#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) High error

(B) Output voltage of the rear oxygen sensor heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 8000$ rpm

#### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	≥ 20 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

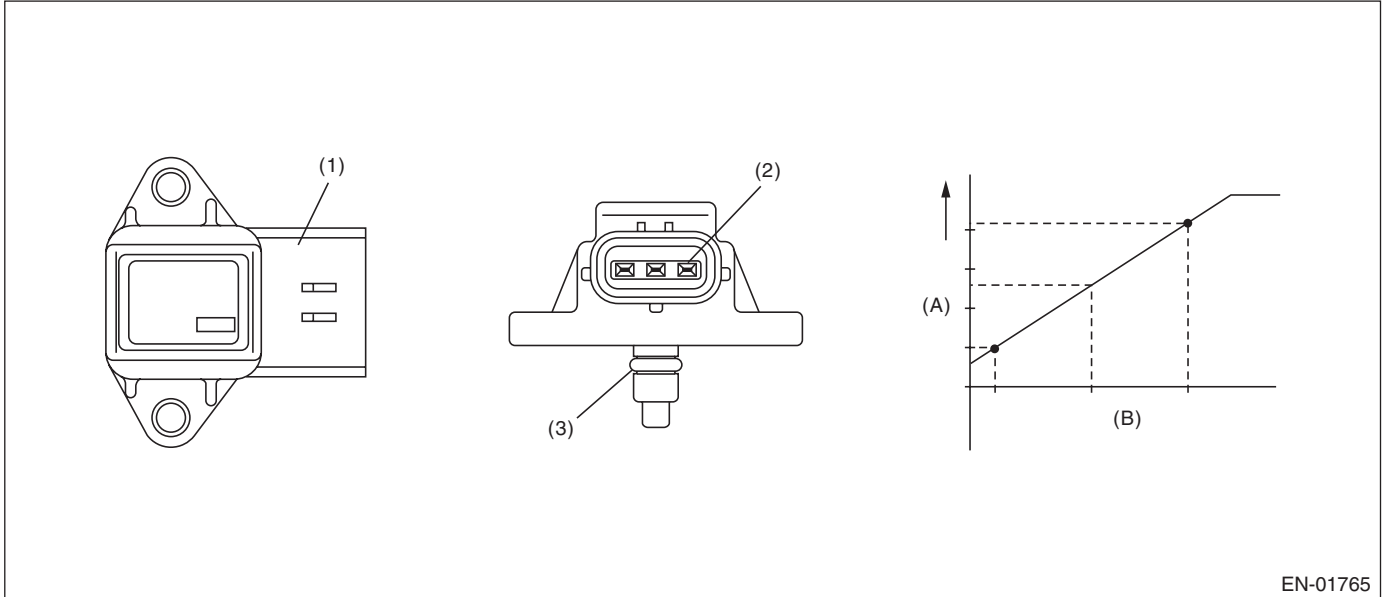
### H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

#### 1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.

Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

#### 2. COMPONENT DESCRIPTION



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- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 12 deg
Output voltage	< 1.4 V
Engine load	> 0.55 g/rev (0.019 oz/rev)
<b>High</b>	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44 deg
Output voltage	≥ 3.4 V
Engine load	< 0.4 g/rev (0.014 oz/rev)

### Time Needed for Diagnosis:

Low side: 3000 ms

High side: 7000 msec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

If the duration of time while the following conditions are met is longer than the time indicated, judge as OK.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 12 deg
Output voltage	≥ 1.4 V
Engine load	> 0.55 g/rev (0.019 oz/rev)
<b>High</b>	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44 deg
Output voltage	< 3.4 V
Engine load	< 0.4 g/rev (0.014 oz/rev)

### Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open circuit of the oil switching solenoid valve.

Judge as NG when the current is small even though the output duty is large.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio	$\geq 30$ %
Control current	$< 0.026$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Oil switching solenoid valve target current value – Oil switching solenoid valve current value	$< 0.08$ A
Target current	$\geq 0.11$ A

**Time Needed for Diagnosis:** 2000 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect short circuits of the oil switching solenoid valve.

Judge as a short NG when the current is large even though the output duty is small.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio	$< 7$ %
Control current	$\geq 0.465$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
$ \text{Oil switching solenoid valve target current value} - \text{Oil switching solenoid valve current value} $	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## **K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0076. <Ref. to GD(H4SO)-25, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0077. <Ref. to GD(H4SO)-26, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

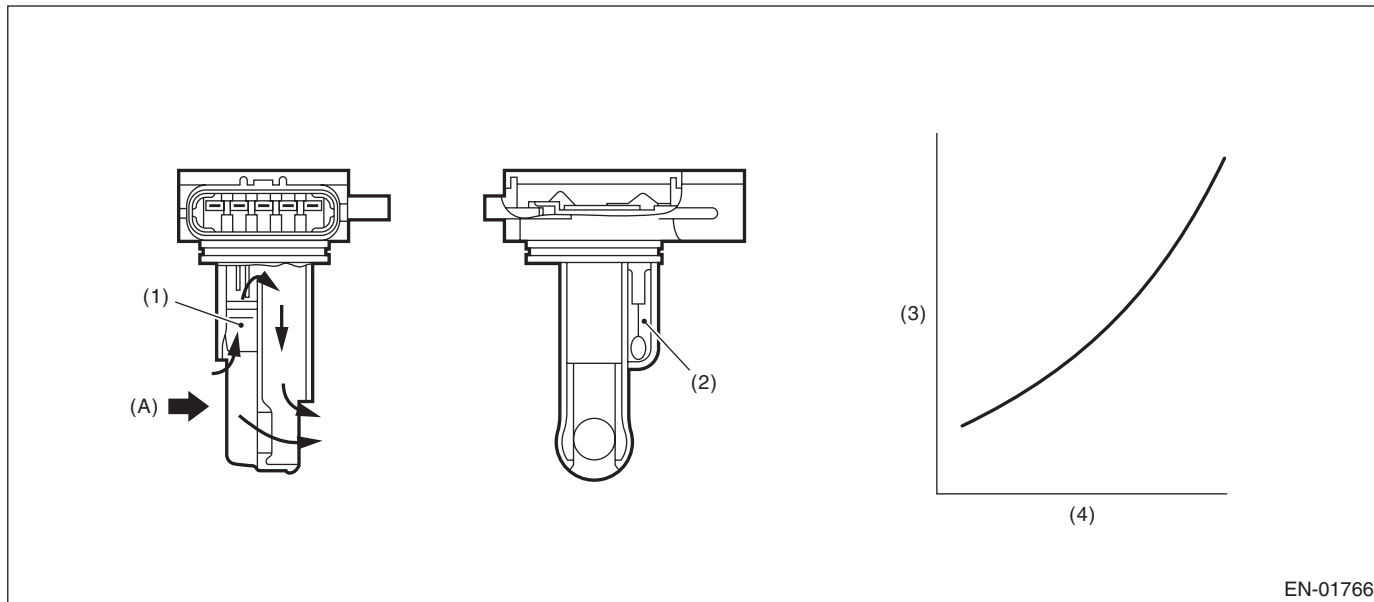
### M: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

#### 2. COMPONENT DESCRIPTION



(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Output voltage	< 1.2 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 13 deg
Intake manifold pressure	≥ 53.32 kPa (400 mmHg, 15.748 inHg)
<b>High (1)</b>	
Output voltage	≥ 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 deg
Intake manifold pressure	≥ 39.99 kPa (300 mmHg, 11.811 inHg)
<b>High (2)</b>	
Output voltage	≥ 1.45 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 deg
Intake manifold pressure	≥ 39.99 kPa (300 mmHg, 11.811 inHg)
Fuel system diagnosis	Rich side malfunction

### Time Needed for Diagnosis:

Low: 3000 ms

High: 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Output voltage	≥ 1.2 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 13 deg
Intake manifold pressure	≥ 53.32 kPa (400 mmHg, 15.748 inHg)
<b>High</b>	
Output voltage	< 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 deg
Intake manifold pressure	< 39.99 kPa (300 mmHg, 11.811 inHg)
Fuel system diagnosis	Rich side normal

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### **Time Needed for Diagnosis:**

Low: Less than 1 second

High: Less than 1 second

### **6. DTC CLEAR CONDITION**

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### **7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS**

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### **8. FAIL SAFE**

None

### **9. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

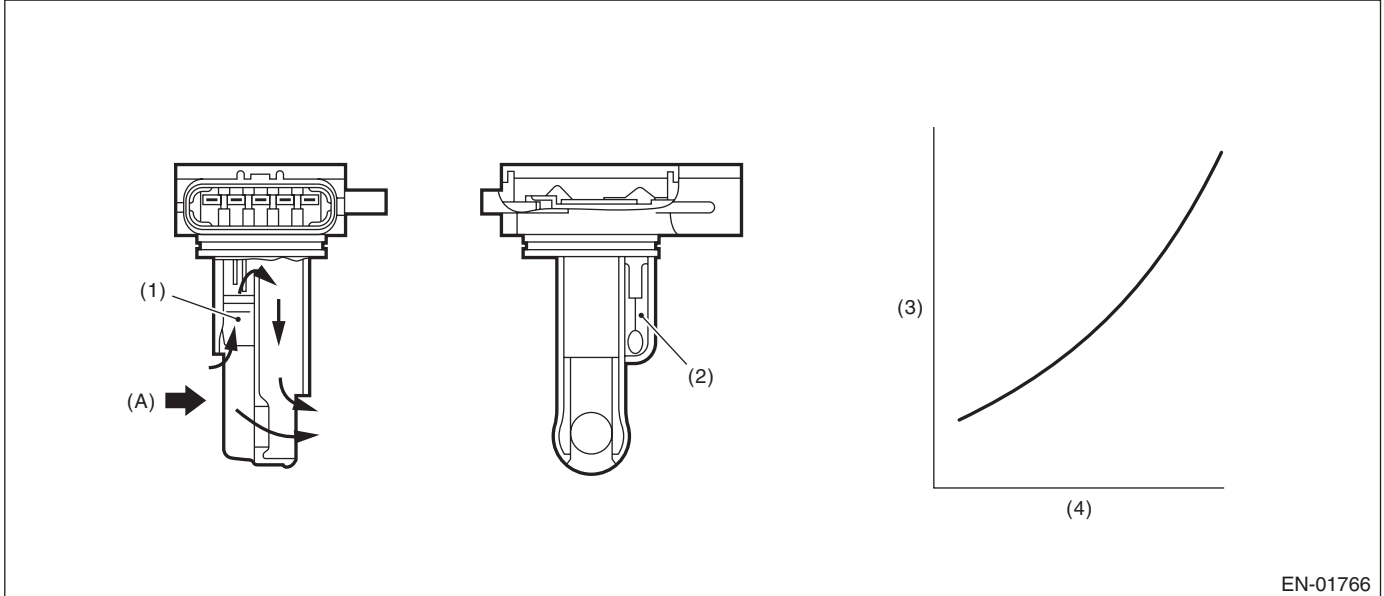
GENERAL DESCRIPTION

## N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01766

(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.22$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> 0.22$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

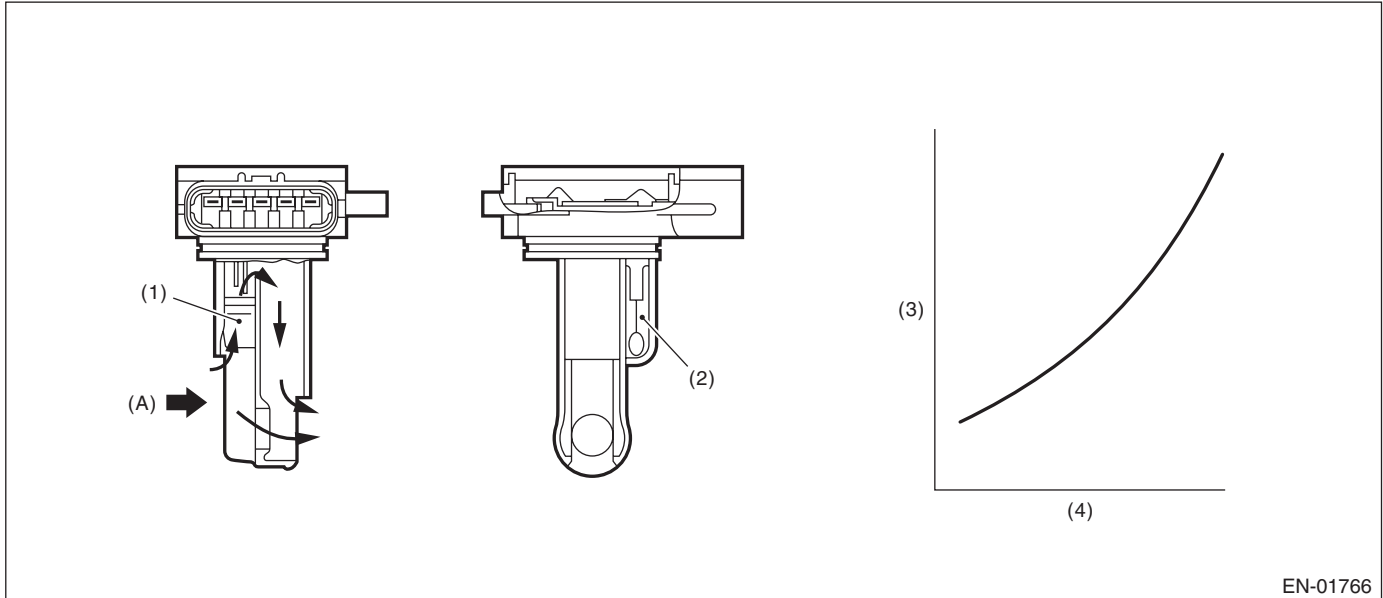
GENERAL DESCRIPTION

## O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01766

- (1) Air flow sensor  
(2) Intake air temperature sensor  
(3) Voltage (V)  
(4) Amount of intake air (kg (lb)/s)  
(A) Air

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.179943192$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.179943192$ V

**Time Needed for Diagnosis:** Less than 1 second



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

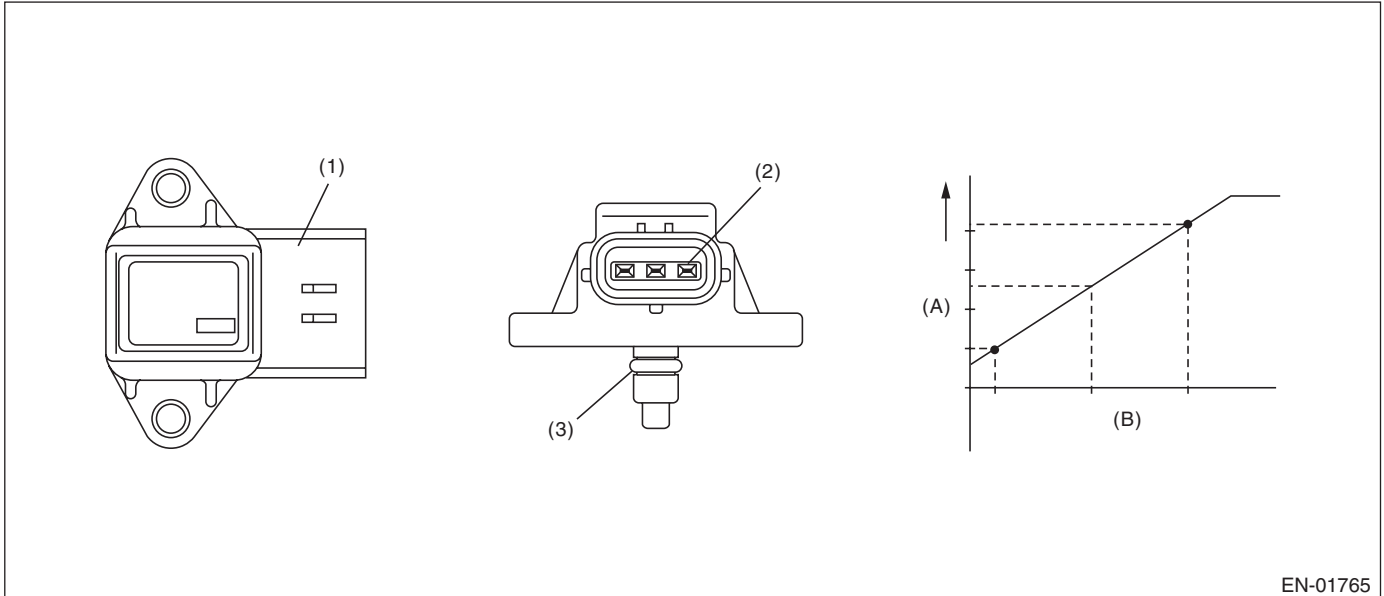
GENERAL DESCRIPTION

## P: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01765

(1) Connector  
(2) Terminals

(3) O-ring

(A) Output voltage  
(B) Absolute pressure

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.573$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> 0.573$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

ISC feedback: Not allowed to calculate the amount of feedback.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

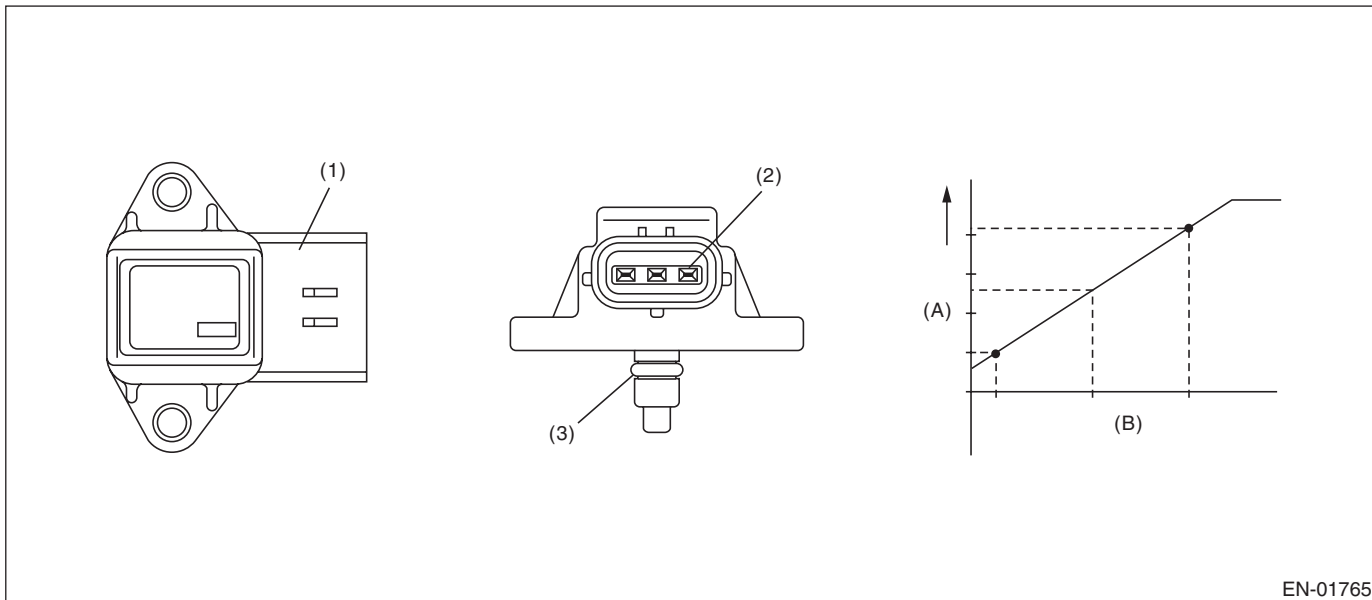
## Q: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.

Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.38757221$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.38757221$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

ISC feedback: Not allowed to calculate the amount of feedback.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

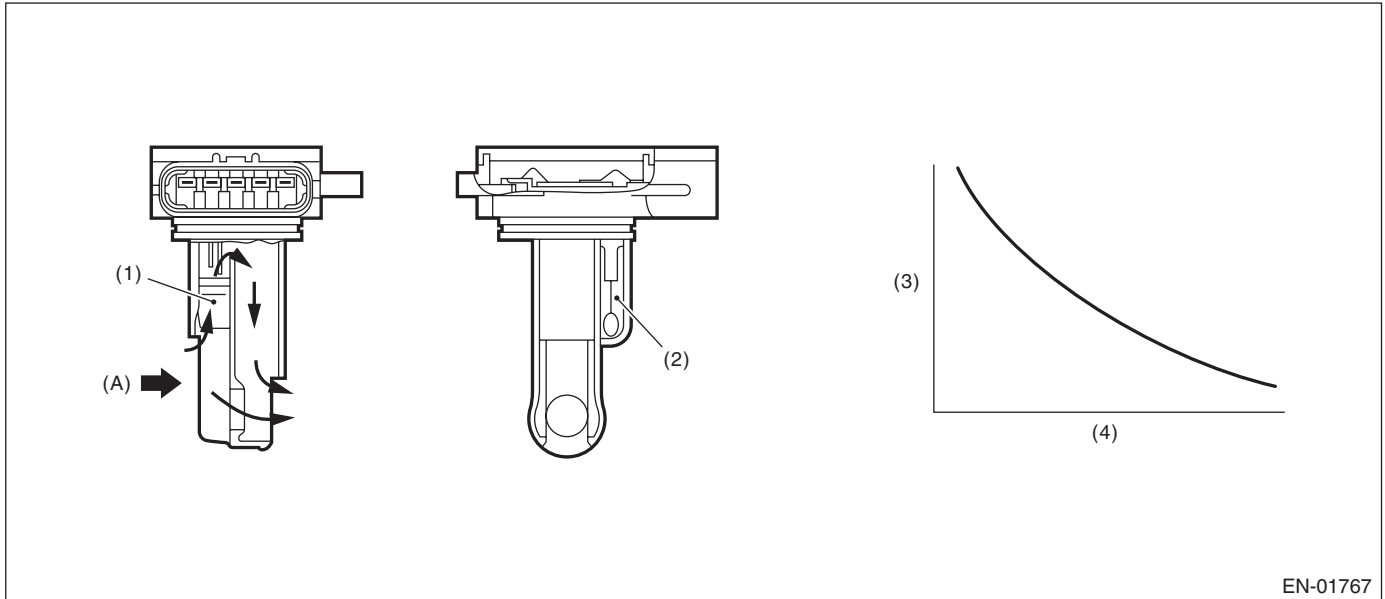
## R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

### 2. COMPONENT DESCRIPTION



EN-01767

(1) Air flow sensor

(3) Resistance value ( $\Omega$ )

(A) Air

(2) Intake air temperature sensor

(4) Intake air temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	$< 30^{\circ}\text{C}$ ( $86^{\circ}\text{F}$ )
Engine coolant temperature	$\geq 100^{\circ}\text{C}$ ( $212^{\circ}\text{F}$ )
Battery voltage	$\geq 10.9\text{ V}$
Continuous time when the vehicle speed is less than 60 km/h (37.3 MPH)	$\geq 600\text{ sec}$

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 0.02 V (Equivalent to approximately 0.5°C (0.9°F) near 25°C)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	≥ 0.02 V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

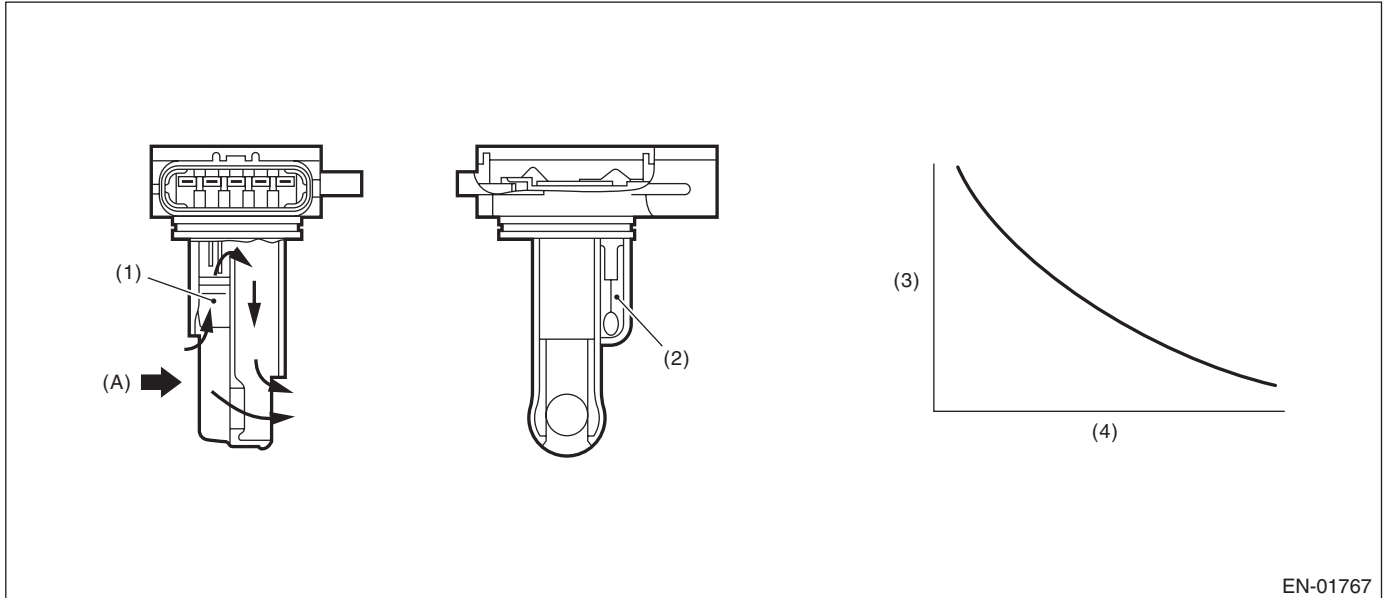
Memorize the freeze frame data. (For test mode \$02)

## S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01767

- |                                   |                                    |         |
|-----------------------------------|------------------------------------|---------|
| (1) Air flow sensor               | (3) Resistance value (Ω)           | (A) Air |
| (2) Intake air temperature sensor | (4) Intake air temperature °C (°F) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.230975449 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.230975449 V

**Time Needed for Diagnosis:** Less than 1 second



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

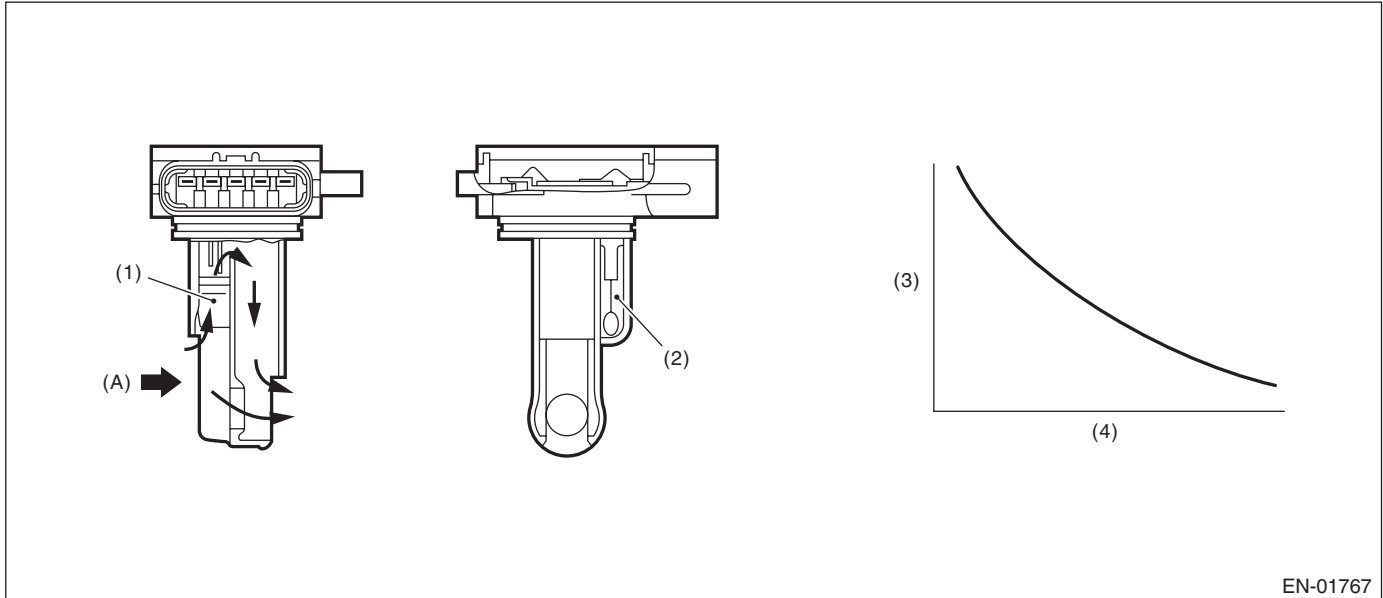
Memorize the freeze frame data. (For test mode \$02)

## T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01767

- |                                   |                                    |         |
|-----------------------------------|------------------------------------|---------|
| (1) Air flow sensor               | (3) Resistance value (Ω)           | (A) Air |
| (2) Intake air temperature sensor | (4) Intake air temperature °C (°F) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

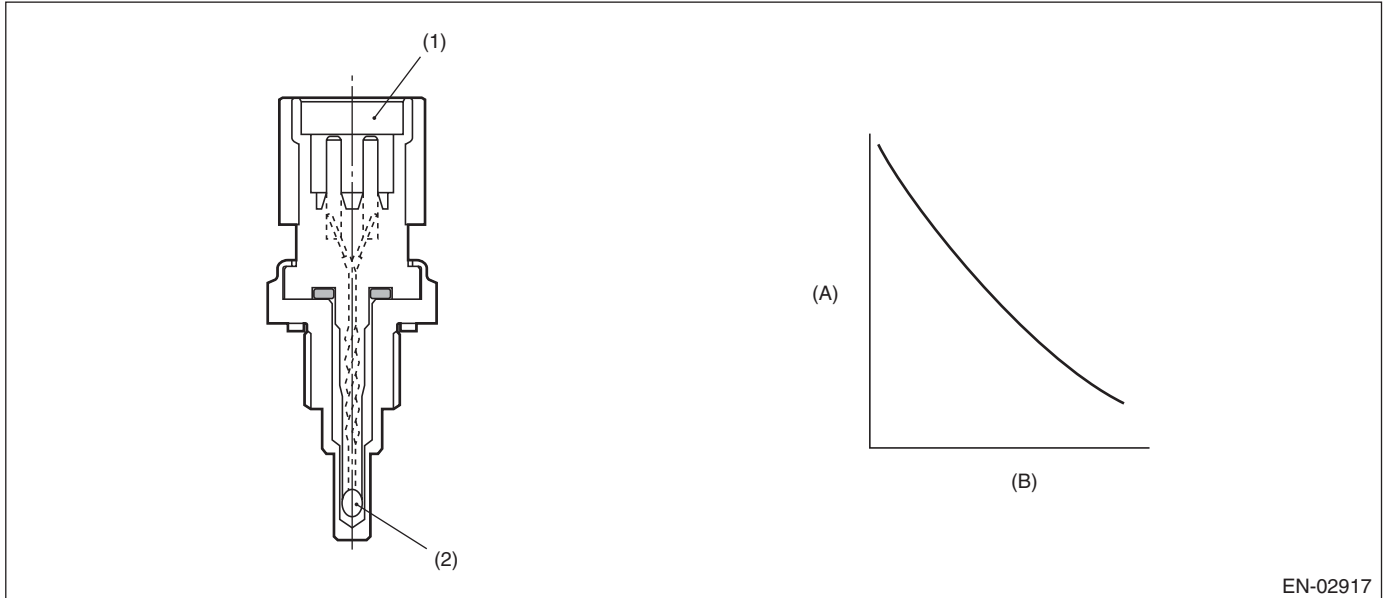
GENERAL DESCRIPTION

## U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-02917

- (1) Connector
- (2) Thermistor element

- (A) Resistance value (k $\Omega$ )
- (B) Temperature °C (°F)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.264738528 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq$ 0.264738528 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan turn to ON.

### 9. ECM OPERATION AT DTC SETTING

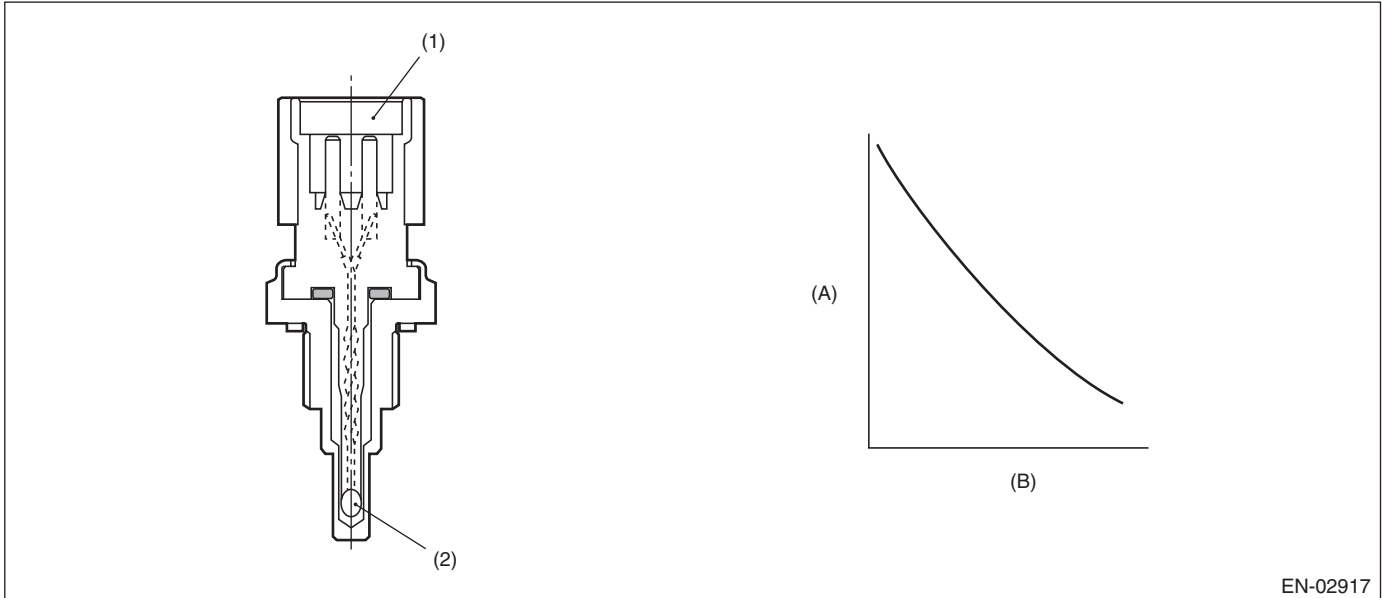
Memorize the freeze frame data. (For test mode \$02)

## V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-02917

- |                        |                           |
|------------------------|---------------------------|
| (1) Connector          | (A) Resistance value (kΩ) |
| (2) Thermistor element | (B) Temperature °C (°F)   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan turn to ON.

### 9. ECM OPERATION AT DTC SETTING

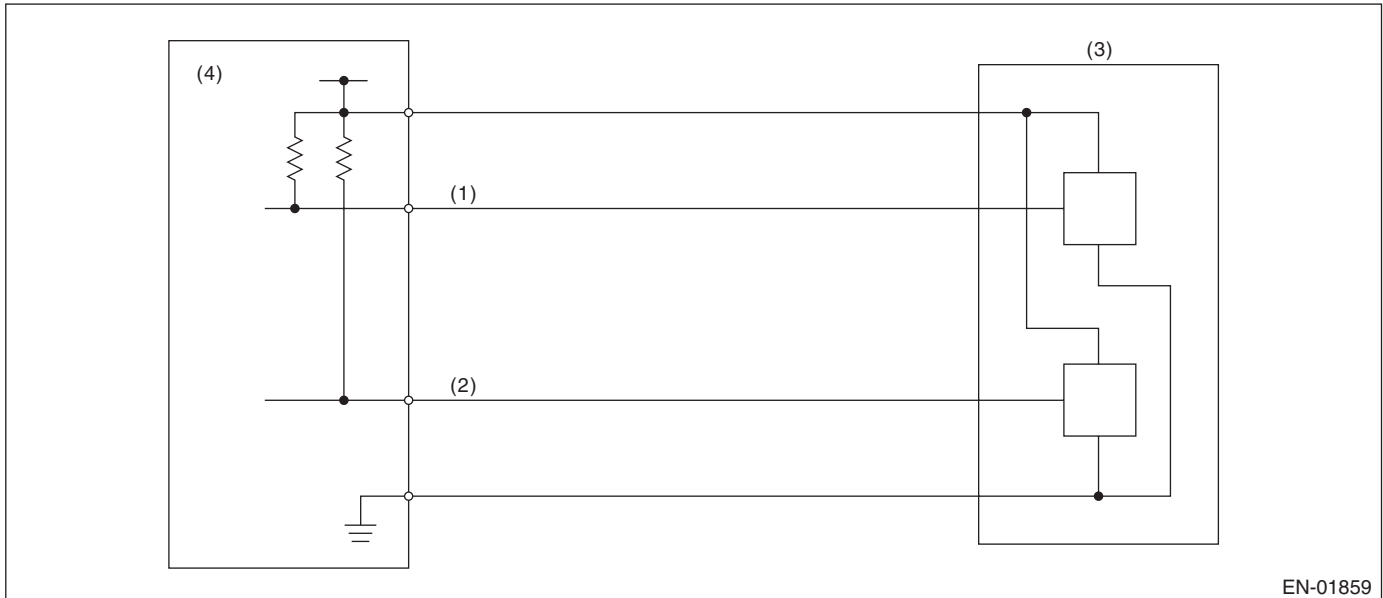
Memorize the freeze frame data. (For test mode \$02)

## W: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal      (3) Throttle position sensor      (4) Engine control module (ECM)  
 (2) Throttle position sensor 2 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\leq 0.217$ V

**Time Needed for Diagnosis:** 24 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$> 0.217$ V

**Time Needed for Diagnosis:** 24 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

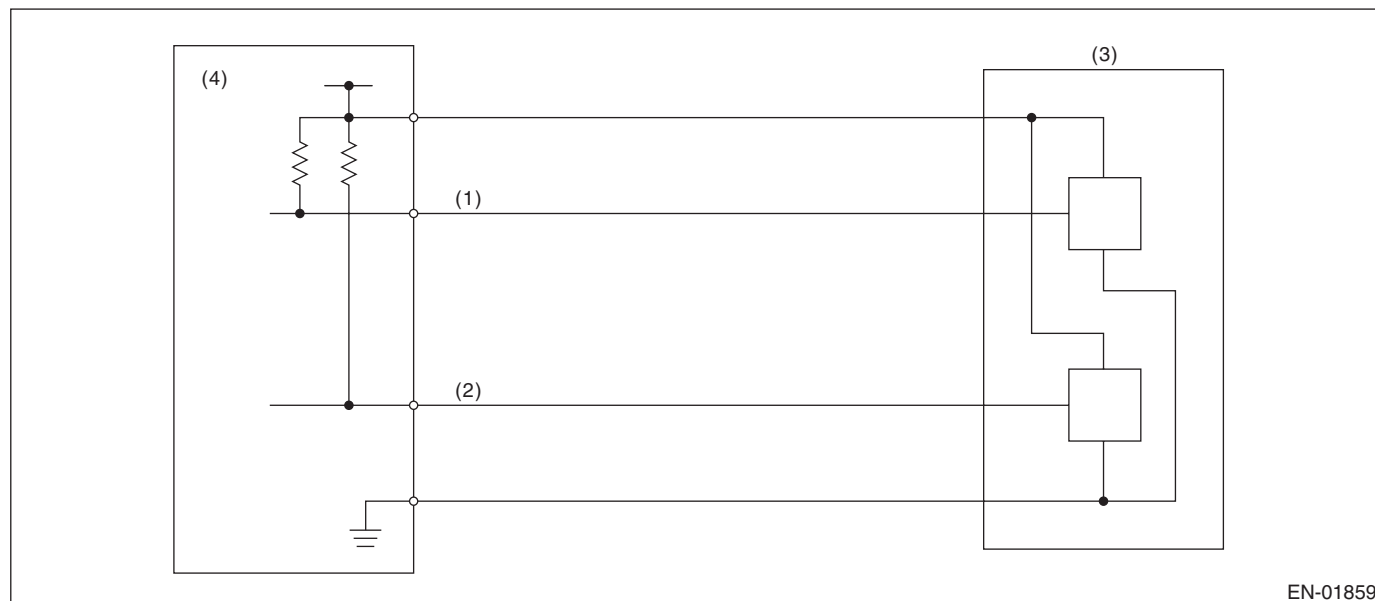
## X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.

Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal
- (2) Throttle position sensor 2 signal

- (3) Throttle position sensor

- (4) Engine control module (ECM)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\geq 4.858$ V

**Time Needed for Diagnosis:** 24 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.858$ V

**Time Needed for Diagnosis:** 24 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

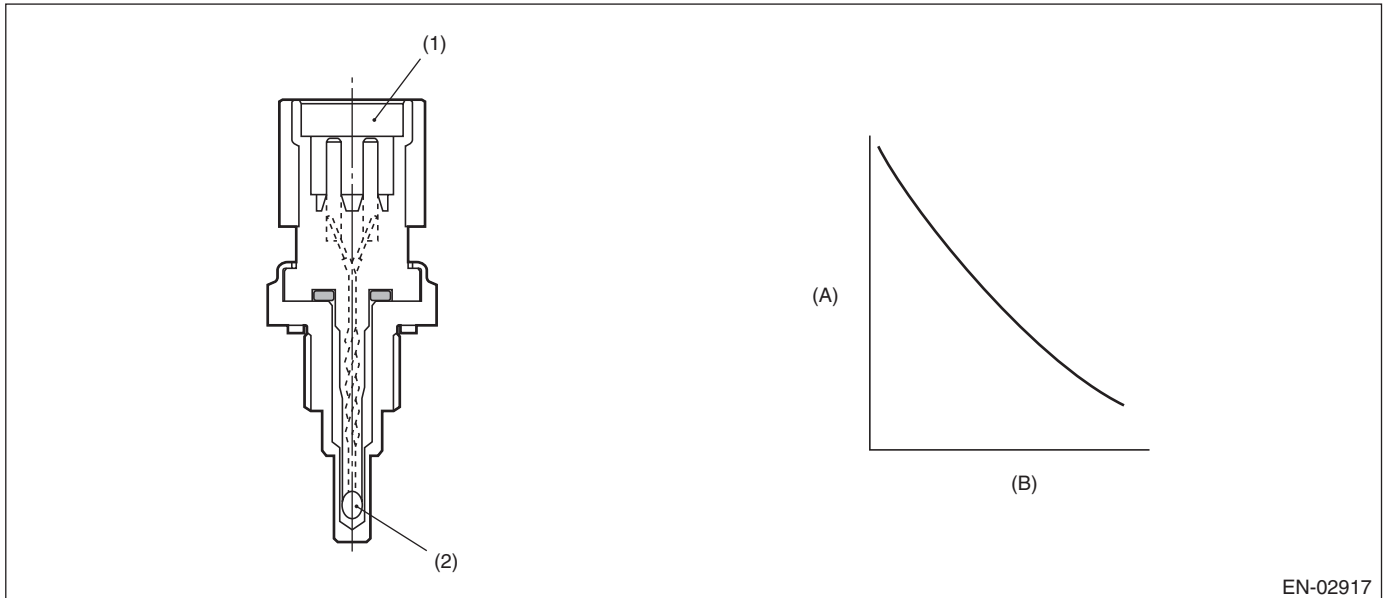
## Y: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.

Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

### 2. COMPONENT DESCRIPTION



EN-02917

- |                        |                           |
|------------------------|---------------------------|
| (1) Connector          | (A) Resistance value (kΩ) |
| (2) Thermistor element | (B) Temperature °C (°F)   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ Value from Map
Battery voltage	≥ 10.9 V

#### Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG if the criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgment value of timer after engine start

Timer for diagnosis after engine start

a. Timer stop at fuel cut

b. During the driving conditions except a) above, timer counts up as follows.

64 milliseconds + TWCNT milliseconds (the time of at 64 milliseconds)

TWCNT is defined as follows,

TWCNT = 0 at idle switch ON,

TWCNT show on the following table at idle switch OFF.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-20 (-4)	0 ms	32.076 ms	39.977 ms	47.879 ms	82.544 ms	117.209 ms	154.214 ms	185.26 ms
	-10 (14)	0 ms	25.704 ms	33.606 ms	41.508 ms	68.52 ms	95.532 ms	125.667 ms	155.802 ms
	0 (32)	0 ms	17.646 ms	25.548 ms	33.45 ms	53.652 ms	73.855 ms	97.12 ms	120.386 ms
	10 (50)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms
	20 (68)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms

Judgment value of timer after engine starting

$$t = 573669 \text{ ms} - 33924 \text{ ms}/^{\circ}\text{C} \times T_i$$

$T_i$  : The lowest coolant temperature after engine start

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 20 °C (68 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan turn to ON.

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

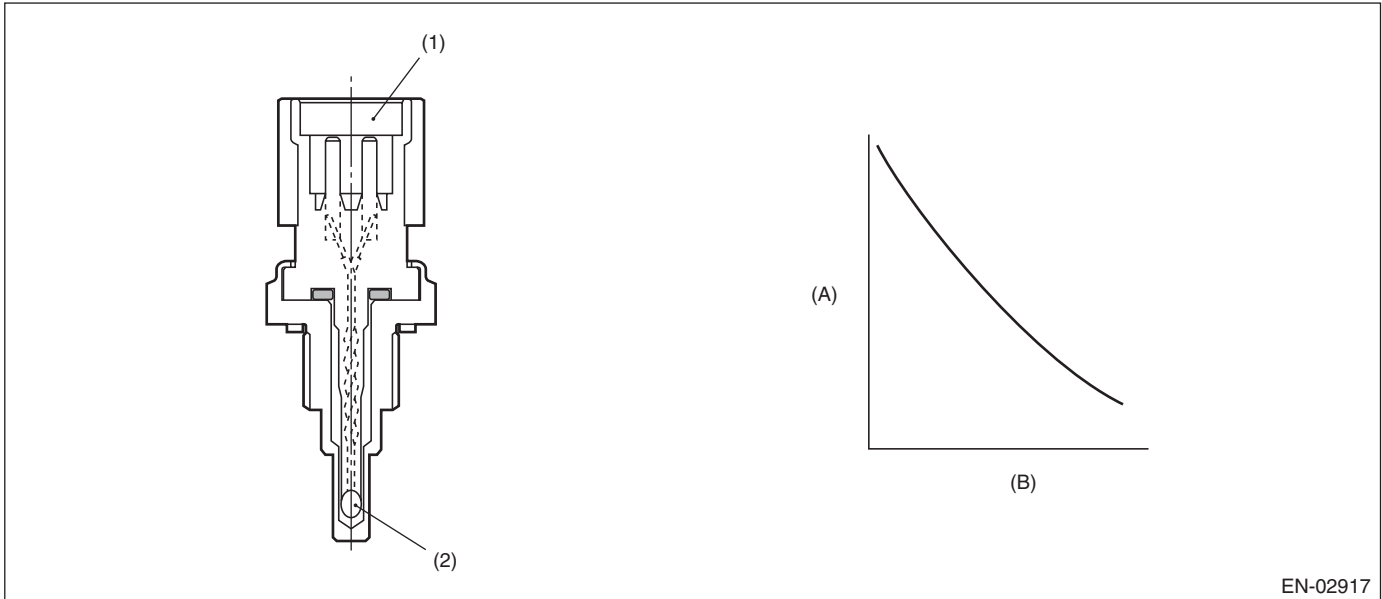
### Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

#### 2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (k $\Omega$ )

(B) Temperature °C (°F)

(1) Connector

(2) Thermistor element

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Refueling from the last engine stop till the current engine start	None
Fuel level	$\geq 15$ L (3.963 US gal, 3.3 Imp gal)
Engine coolant temperature at the last engine stop	$\geq 75$ °C (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	< 2.5 °C (36.5 °F)
Fuel temperature at the last engine stop — fuel temperature	≥ 5 °C (41 °F)
Intake air temperature — fuel temperature	< 2.5 °C (36.5 °F)
Fuel temperature	< 35 °C (95 °F)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	≥ 2.5 °C (36.5 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

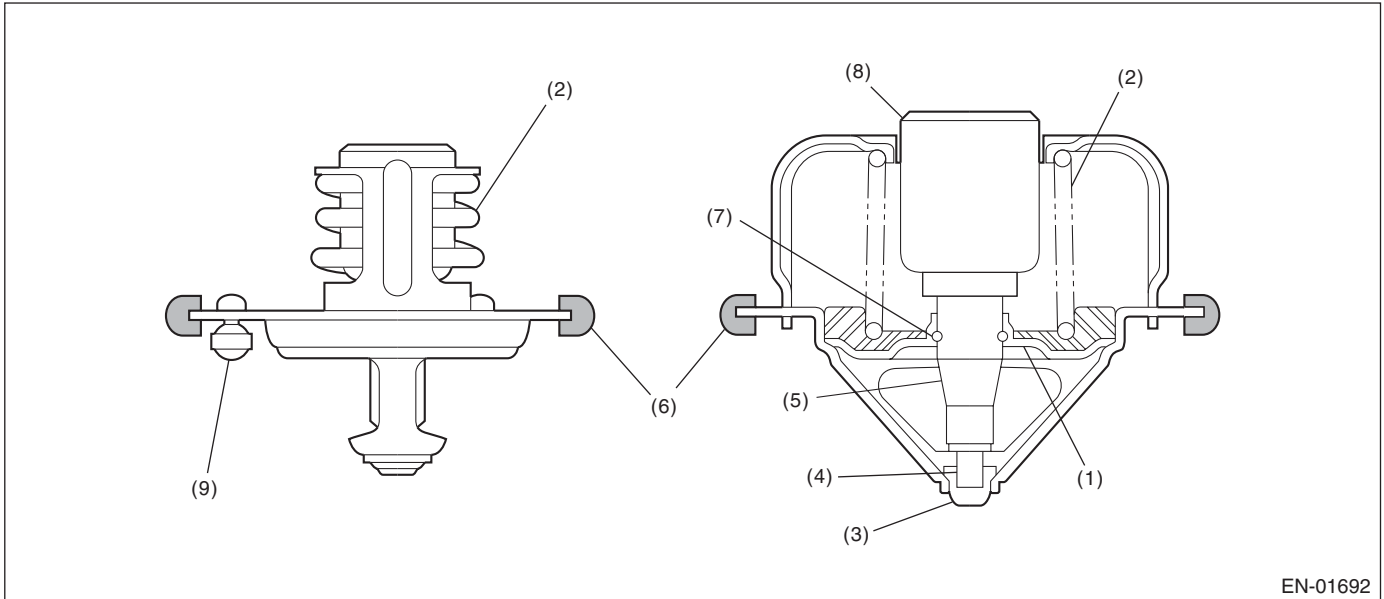
### AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.

Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 75°C (167°F), and the difference is small, before judging NG.

#### 2. COMPONENT DESCRIPTION



EN-01692

- |             |                 |                  |
|-------------|-----------------|------------------|
| (1) Valve   | (4) Piston      | (7) Stop ring    |
| (2) Spring  | (5) Guide       | (8) Wax element  |
| (3) Stopper | (6) Rubber seal | (9) Jiggle valve |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^\circ\text{C}$ (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^\circ\text{C}$ (131 °F)
Estimated coolant temperature	$\geq 75 \text{ }^\circ\text{C}$ (167 °F)
Engine coolant temperature	$\leq 75 \text{ }^\circ\text{C}$ (167 °F)
(Estimated – Measured) Engine coolant temperature	$> 30 \text{ }^\circ\text{C}$ (86 °F)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)

**Time Needed for Diagnosis:** 64 ms  $\times$  3 time  $\times$  152 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^\circ\text{C}$ (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^\circ\text{C}$ (131 °F)
Engine coolant temperature	$\geq 75 \text{ }^\circ\text{C}$ (167 °F)
(Estimated – Measured) Engine coolant temperature	$\leq 30 \text{ }^\circ\text{C}$ (86 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

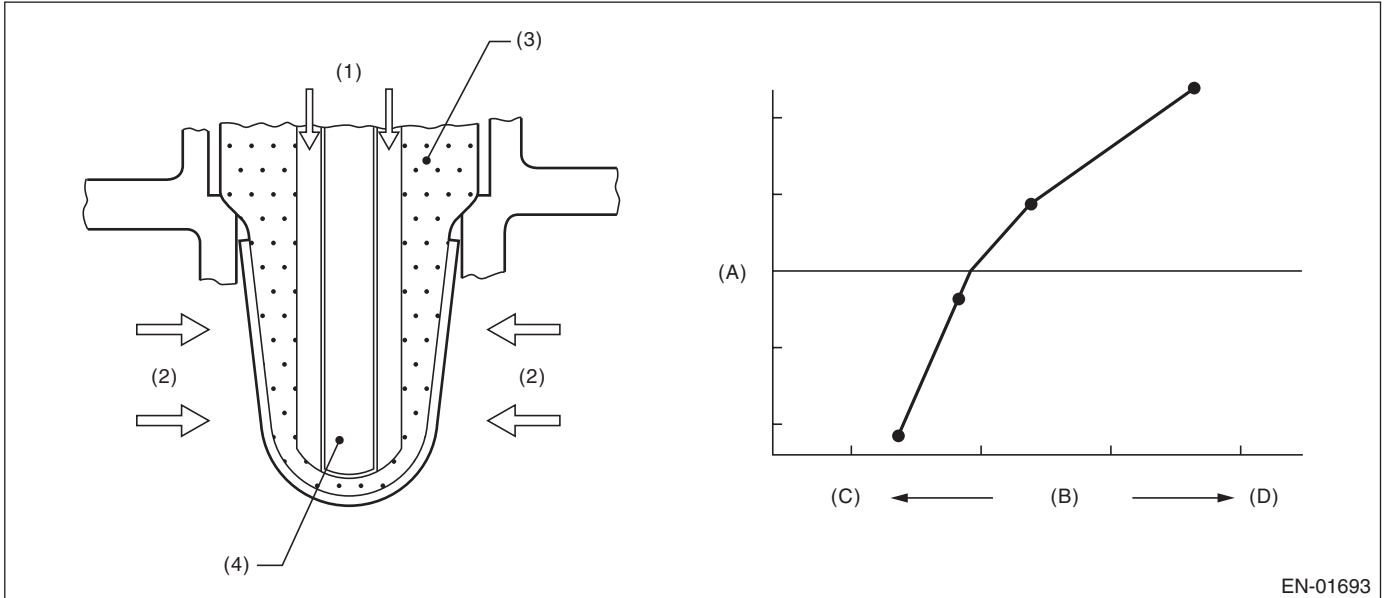
### AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG, when the element voltage is out of the specified range.

#### 2. COMPONENT DESCRIPTION



EN-01693

- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+) or Input voltage (-)	< 1.128 V
or  Input voltage (+) – Input voltage (-)	< 0.23 V
	< 0.644 V

#### Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

|Input voltage (+) – Input voltage (-)|: 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	≥ 1.128 V
Input voltage (-)	≥ 0.23 V
Input voltage (+) – Input voltage (-)	≥ 0.644 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

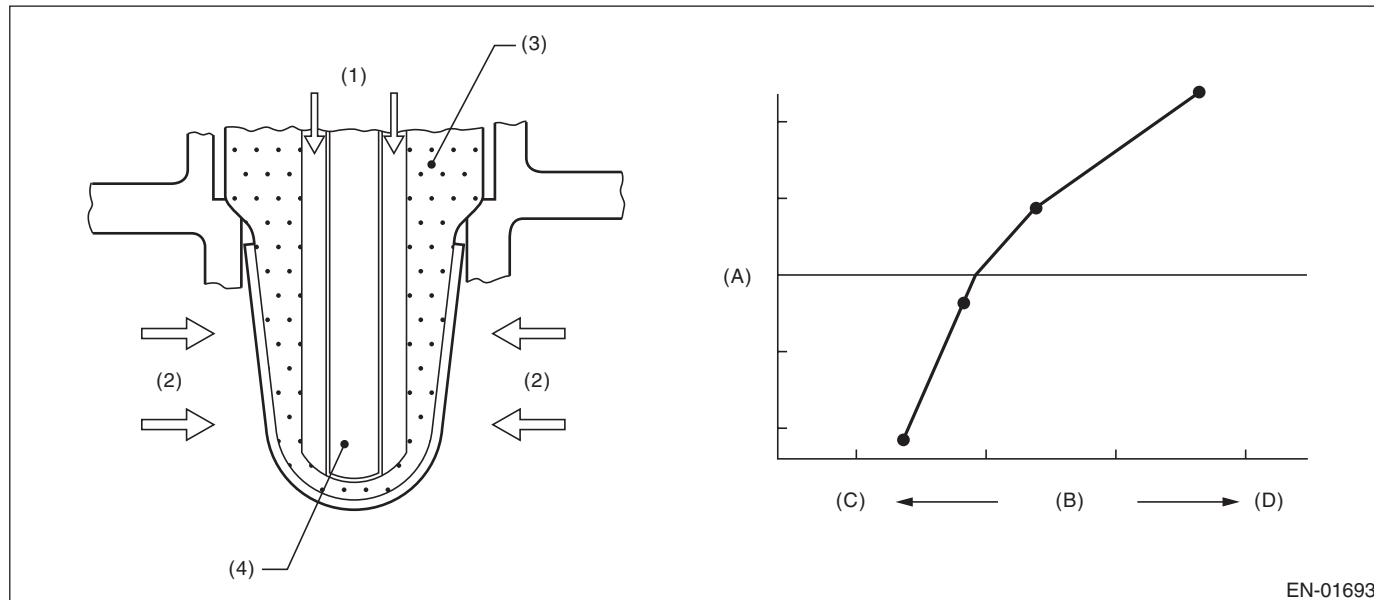
### AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG, when the element voltage is out of the specified range.

#### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

EN-01693

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+) or Input voltage (-)	> 3.589 V  > 3.541 V

#### Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+) Input voltage (-)	$\leq 3.589$ V $\leq 3.541$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

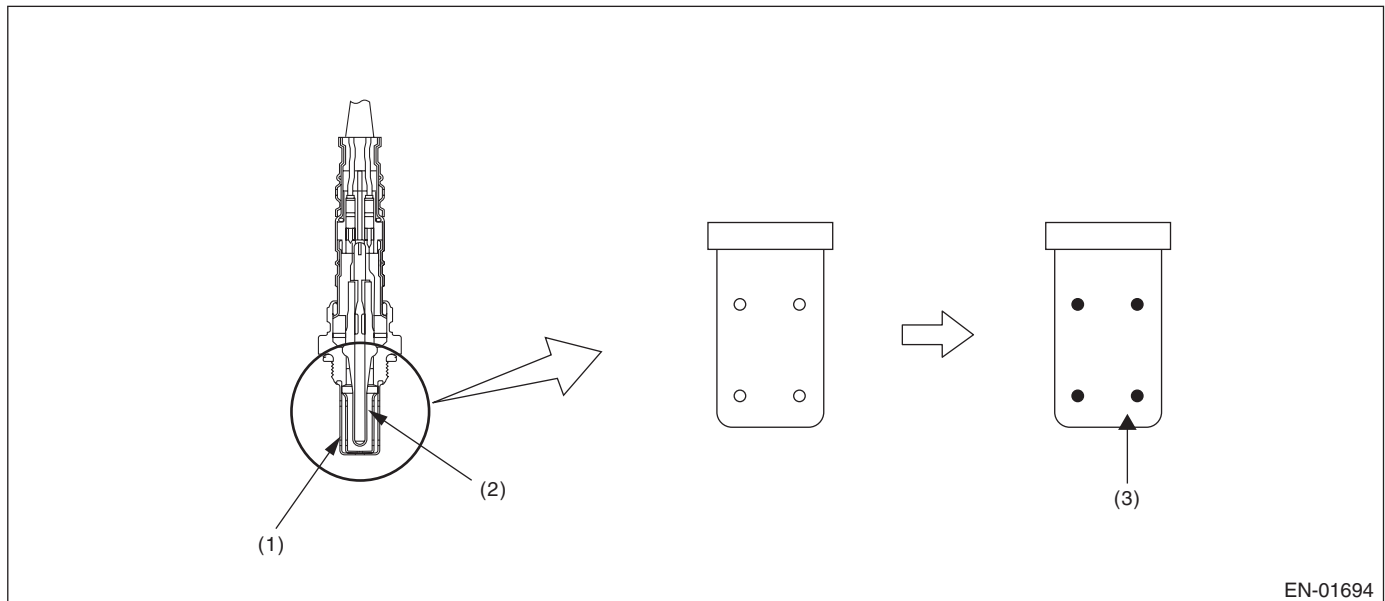
### AD:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.

When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs. Judge as NG when the actual movement in comparison to the ECM control amount is slow.



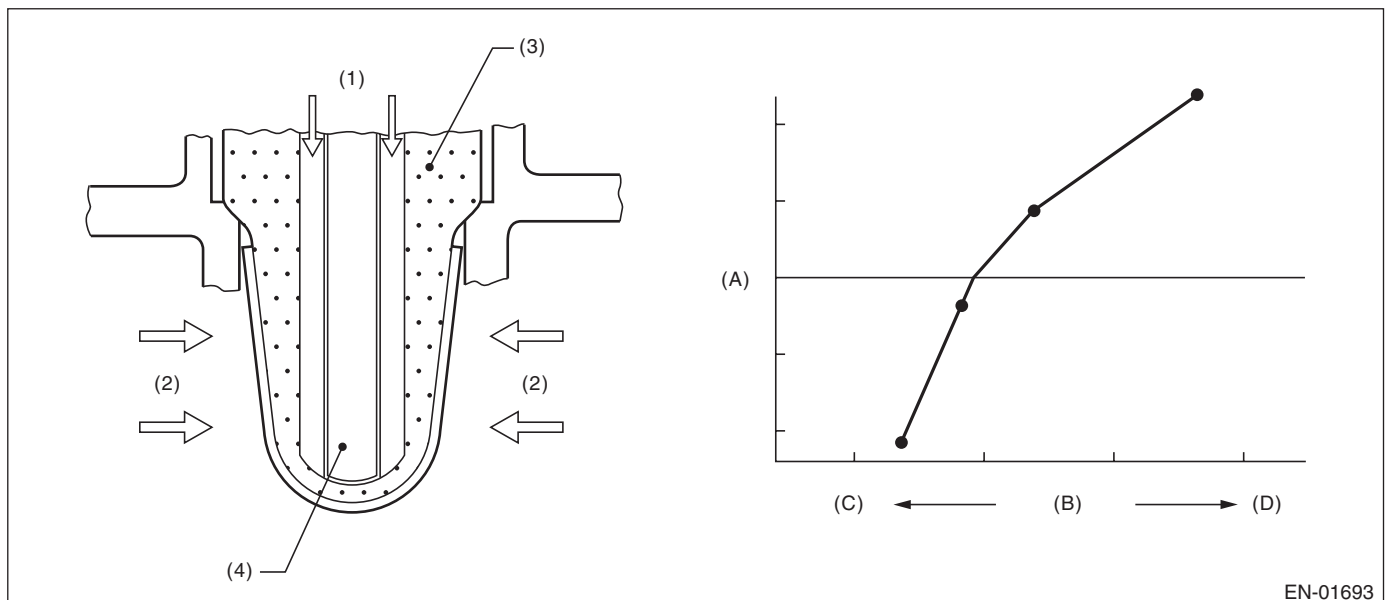
EN-01694

(1) Cover

(2) Zirconia

(3) Clogging

#### 2. COMPONENT DESCRIPTION



EN-01693

(1) Atmosphere

(2) Exhaust gas

(3)  $ZrO_2$

(4) Ceramic heater

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 1024$ ms
Battery voltage	$\geq 10.9$ V
Barometric pressure	$> 75.05$ kPa (563 mmHg, 22.165 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	$0 \Omega - 50 \Omega$
Elapsed time after starting the engine	$\geq 120000$ ms
Engine coolant temperature	$\geq 75$ °C (167 °F)
Engine speed	1000 rpm — 3200 rpm
Vehicle speed	10 km/h — 120 km/h (6.2 MPH — 74.6 MPH)
Amount of intake air	10 g/s — 40 g/s (0.353 oz/s — 1.411 oz/s)
Engine load	$< 0.02$ g/rev (0.001 oz/rev)
Learning value of EVAP conc. during purge	$< 0.2$
Total time of operating canister purge	$\geq 19.9$ sec

## 4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

## 5. DIAGNOSTIC METHOD

Calculate  $faf$  difference, and the  $\lambda$  value difference every  $32\text{ms} \times 4$ . Calculate the diagnosis value after calculating 1640 time.

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
$para_{fca} = td2_{faf}/td2_{lmd}$	$> 0.4$ (U5 model) $> 0.45$ (Except for U5 model)
where, $td2_{faf}(N) = td2_{faf}(n-1) +  d2_{faf}(n) $ $td2_{lmd}(N) = td2_{lmd}(n-1) +  d2_{lmd}(n) $ add up to $32 \text{ ms} \times 4 \times 1640$ time. $d2_{faf}(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $d2_{lmd}(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ $faf$ = main feedback compensation coefficient every 128 milliseconds $lmd$ = output lambda every 128 milliseconds	

**Time Needed for Diagnosis:**  $32 \text{ ms} \times 4 \times 1640$  time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$para_{fca} = td2_{faf}/td2_{lmd}$  where, $td2_{faf}(N) = td2_{faf}(n-1) +  d2_{faf}(n) $ $td2_{lmd}(N) = td2_{lmd}(n-1) +  d2_{lmd}(n) $ add up to $32\text{ ms} \times 4 \times 1640$ time. $d2_{faf}(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $d2_{lmd}(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ $faf$ = main feedback compensation coefficient every 128 milliseconds $lmd$ = output lambda every 128 milliseconds	$\leq 0.4$ (U5 model) $\leq 0.45$ (Except for U5 model)

**Time Needed for Diagnosis:**  $32\text{ ms} \times 4 \times 1640$  time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- A/F sensor sub learning compensation: Not allowed to calculate.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

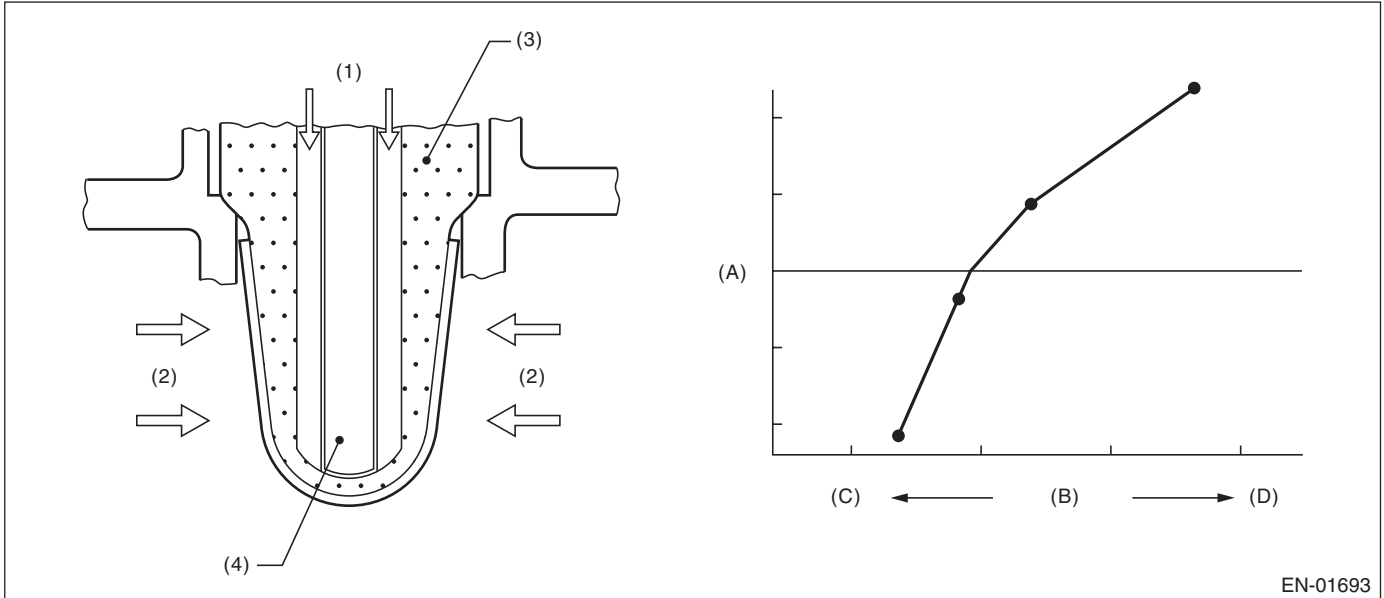
- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## AE:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.  
Judge as NG when the impedance of the element is large.

### 2. COMPONENT DESCRIPTION



- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Time of heater control duty at 70 % or more	$\geq 36000 \text{ ms}$
Front oxygen (A/F) sensor impedance.	$> 500 \Omega$

**Time Needed for Diagnosis:** 5000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Front oxygen (A/F) sensor impedance.	$\leq 500 \Omega$

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

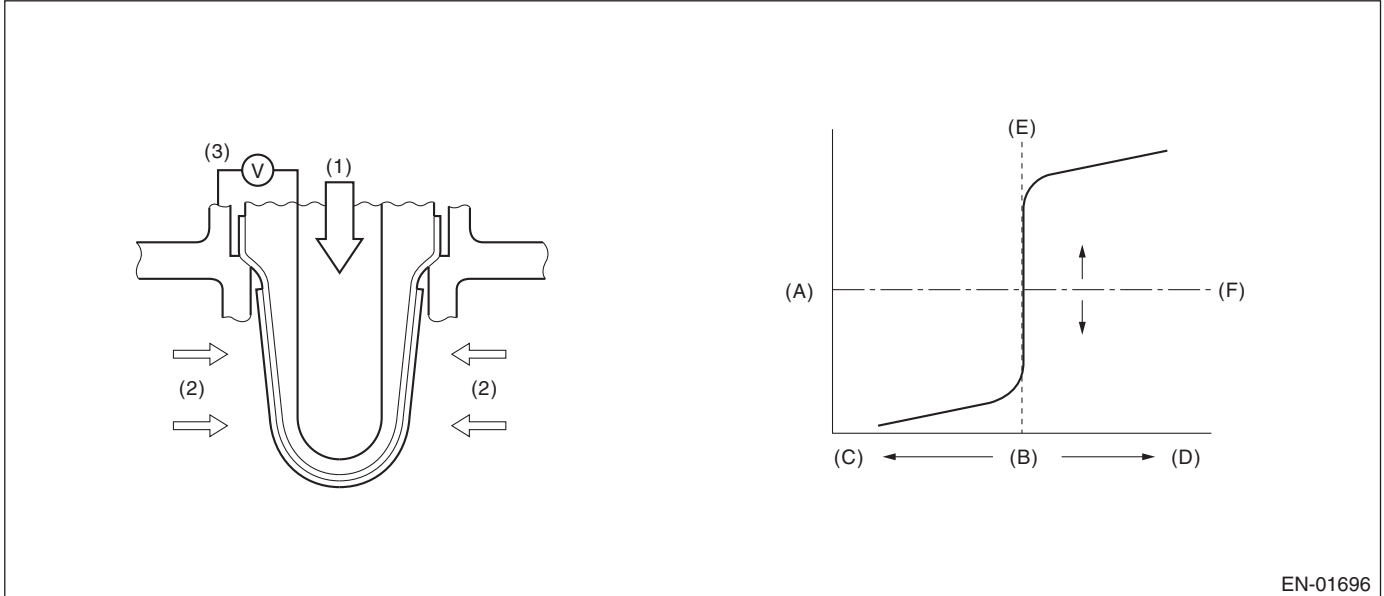
GENERAL DESCRIPTION

## AF:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

### 2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force

(B) Air fuel ratio

(1) Atmosphere

(C) Rich

(D) Lean

(2) Exhaust gas

(E) Theoretical air fuel ratio

(F) Comparative voltage

(3) Electromotive force

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

#### Used for abnormality judgment

Secondary Parameters	Enable Conditions
<b>High</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 5 time Not in limit value $\geq 10.9 \text{ V}$ $\geq 75 \text{ }^\circ\text{C}$ (167 °F)
<b>Low (1)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air	Not in operation In operation < 5 time Not in limit value $\geq 10.9 \text{ V}$ $\geq 75 \text{ }^\circ\text{C}$ (167 °F) $\geq 10 \text{ g/s}$ (0.353 oz/s)
<b>Low (2)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater	Not in operation In operation < 5 time Not in limit value $\geq 10.9 \text{ V}$ $\geq 75 \text{ }^\circ\text{C}$ (167 °F) < 10 g/s (0.353 oz/s) $\geq 30000 \text{ ms}$
<b>Low (3)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater Fuel cut	Not in operation In operation < 5 time Not in limit value $\geq 10.9 \text{ V}$ $\geq 75 \text{ }^\circ\text{C}$ (167 °F) < 10 g/s (0.353 oz/s) $\geq 30000 \text{ ms}$ Experienced

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Used for normality judgment

Secondary Parameters	Enable Conditions
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9$ V
Engine coolant temperature	$\geq 75$ °C (167 °F)

## 4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
<b>High</b>		P0138
Sensor output voltage	$> 1.2$ V	P0158
<b>Low</b>		P0137
Sensor output voltage	$< 0.03$ V	P0157

### Time Needed for Diagnosis

High: 2500 ms

Low (1): 20000 ms

Low (2): 40000 ms

Low (3): Value from Map

### Map

Fuel Cut Time (millisecond)	0	2000	10000
Time needed for diagnosis (millisecond)	40000	40000	60000

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
<b>High</b>		P0138
Sensor output voltage	$\leq 1.2$ V	P0158
<b>Low</b>		P0137
Sensor output voltage	$\geq 0.03$ V	P0157

### Time Needed for Diagnosis

High: Less than 1 second

Low (1): Less than 1 second

Low (2): Less than 1 second

Low (3): Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Sub feedback control: Not allowed

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## **AG:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H4SO)-69, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## AH:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.

Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and Judge as OK if both are OK.

[Rich → lean diagnosis response]

1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK.

2. Judge as NG when the oxygen sensor voltage is large (rich) when recovering from a deceleration fuel cut.

[Lean → rich diagnosis response]

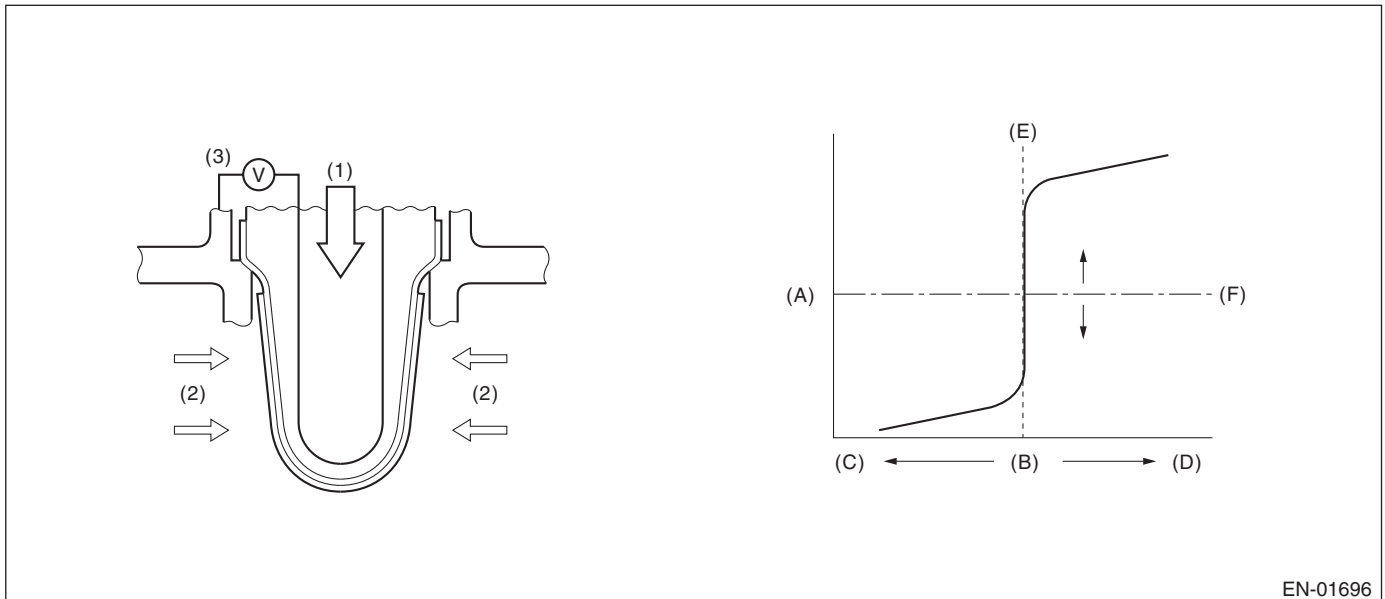
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

### Diagnostic method

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured response time is larger than the threshold value.

### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 3. ENABLE CONDITION

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 60000 ms
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Estimated catalyst temperature	≥ 300 °C (572 °F)
Number of deceleration fuel cut	≥ 1 time

### 4. GENERAL DRIVING CYCLE

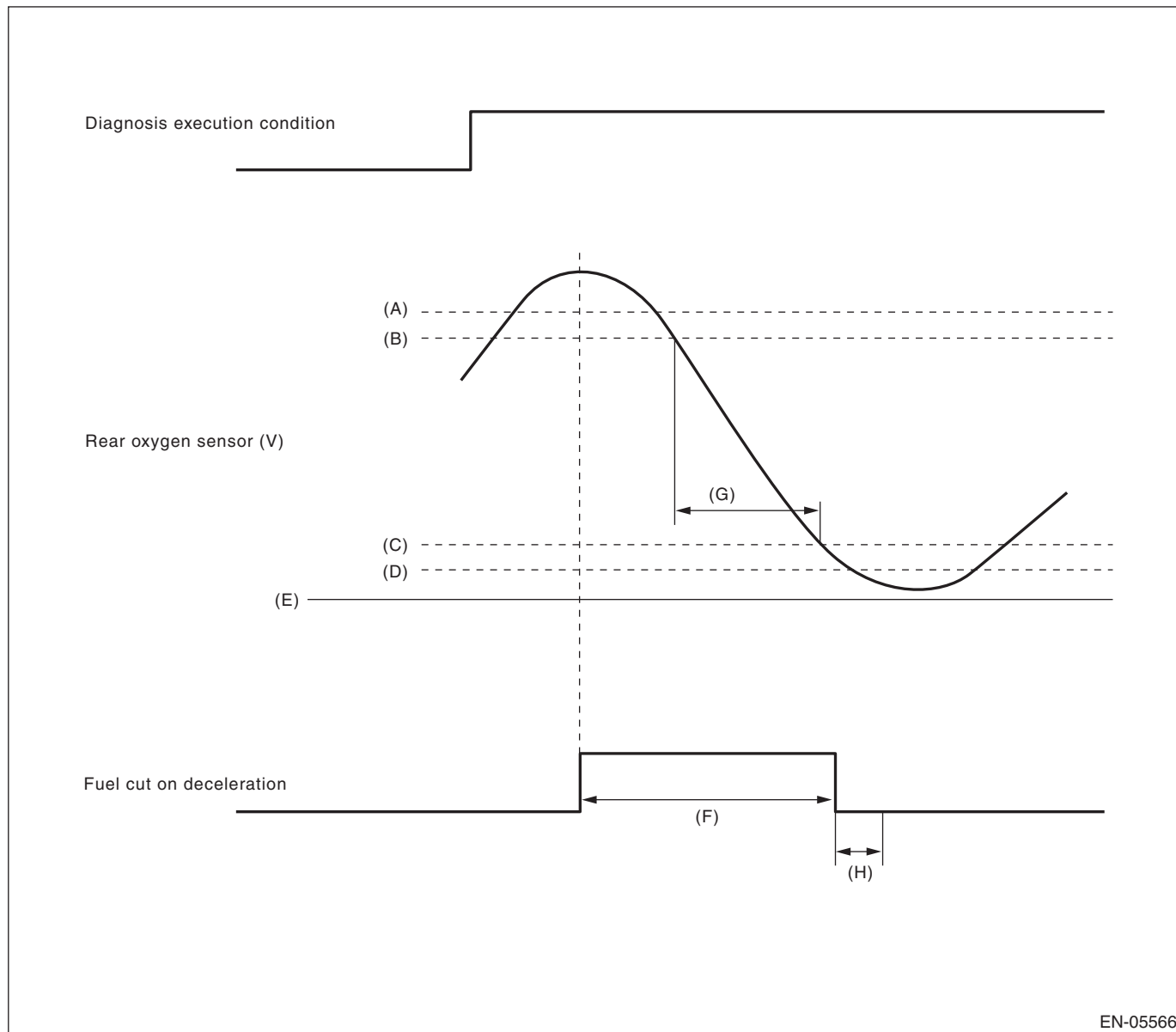
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.



EN-05566

- (A) 0.55 V
- (B) 0.5 V
- (C) 0.2 V
- (D) 0.15 V

- (E) 0 V
- (F) More than 6000 ms
- (G) Measure the response time.

- (H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.  
Response time (diagnosis value) > threshold value → abnormal

#### NOTE:

Variation time of rear oxygen sensor output voltage is short during fuel cut in deceleration. NG judgment should be performed after deceleration fuel cut. Even without deceleration fuel cut, judge as OK if the value is below the threshold.

When the deceleration fuel cut time is 6000 ms or more, judge as NG if the following criteria are met 2000 ms after recovering from the deceleration fuel cut.

2) Judge as NG when the oxygen sensor voltage at recovery from a deceleration fuel cut, is large.

If the fuel cut time in a deceleration fuel cut is long (6000 ms or more), and even after recovering from a deceleration fuel cut, the oxygen sensor voltage is high (0.55 V or more), judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V or Longest time over 0.55 V	> 491 ms  ≥ 2000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	≤ 491 ms

**Time Needed for Diagnosis:** 1 time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 10.ENABLE CONDITION

Lean → rich response diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 60000 ms (U5 model) ≥ 0 ms (Except for U5 model)
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms (U5 model) ≥ 0 ms (Except for U5 model)
Estimated catalyst temperature	≥ 300 °C (572 °F)
Number of deceleration fuel cut	≥ 1 time

## 11.GENERAL DRIVING CYCLE

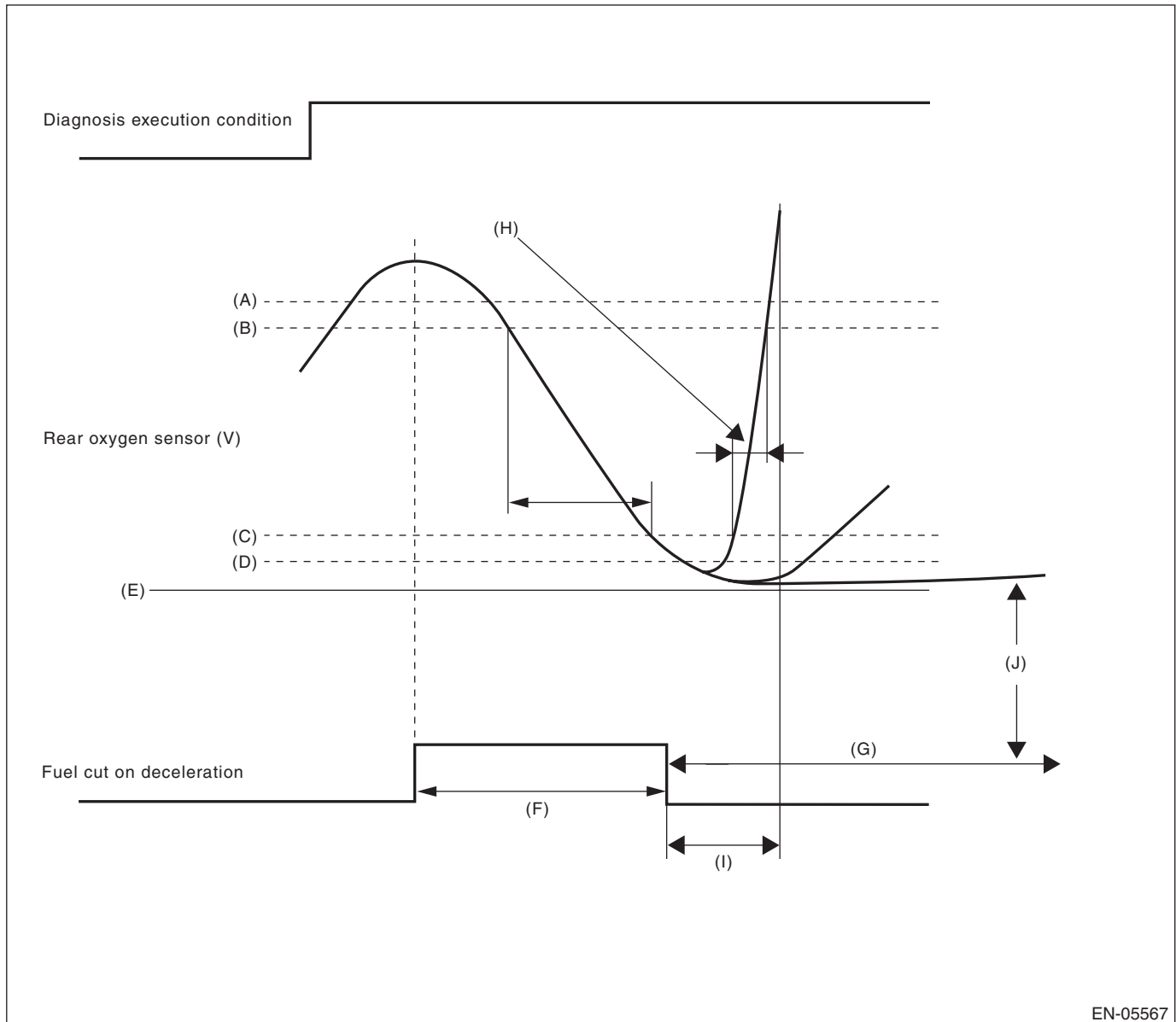
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 12. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.



EN-05567

- (A) 0.55 V
- (B) 0.5 V
- (C) 0.3 V
- (D) 0.25 V
- (E) 0 V
- (F) More than 5 seconds
- (G) More than 120000 ms

- (H) Measure the response time (diagnostic value).
- (I) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- (J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.

Response time (diagnosis value) > threshold value → abnormal

2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V or Longest time under 0.25 V	> 2000 ms  ≥ 120000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

## • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	≤ 2000 ms

**Time Needed for Diagnosis:** 1 time

## 13.DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 15.FAIL SAFE

Sub feedback control: Not allowed

## 16.ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

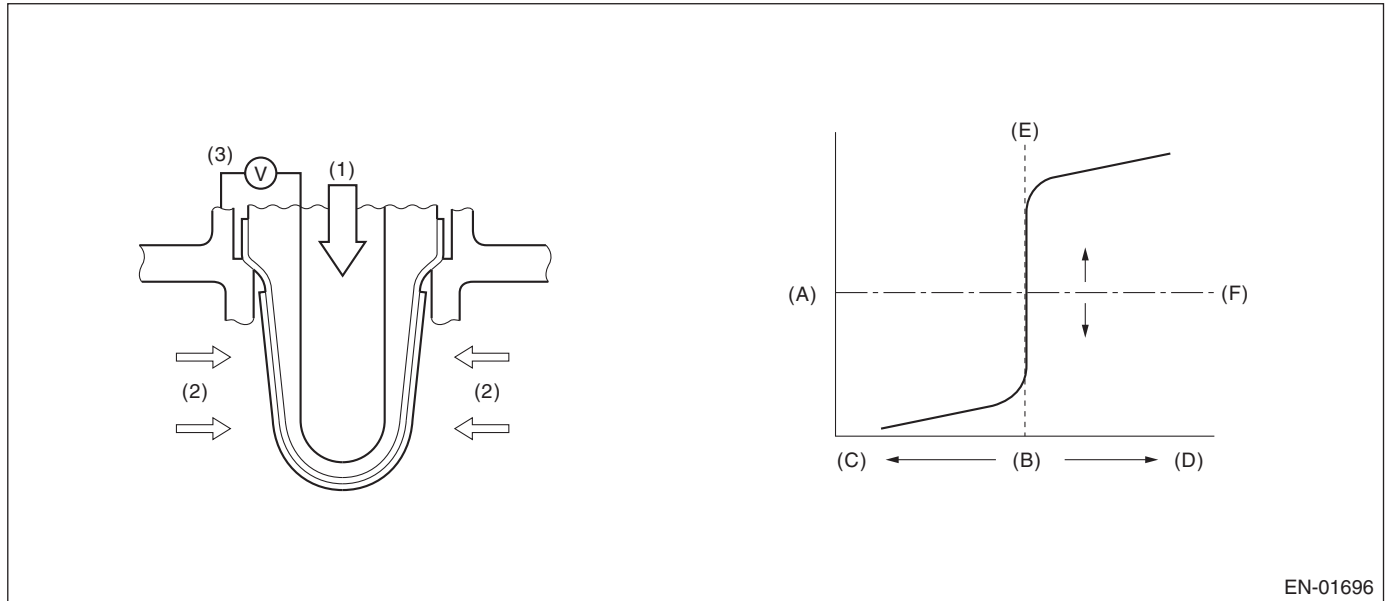
## GENERAL DESCRIPTION

### AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

#### 2. COMPONENT DESCRIPTION



EN-01696

- |                         |                 |                                |
|-------------------------|-----------------|--------------------------------|
| (A) Electromotive force | (C) Rich        | (E) Theoretical air fuel ratio |
| (B) Air fuel ratio      | (D) Lean        | (F) Comparative voltage        |
| (1) Atmosphere          | (2) Exhaust gas | (3) Electromotive force        |

#### 3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control at the rear oxygen sensor	In operation
Target output voltage of rear oxygen sensor	$\geq 0.55 \text{ V} + 0.05 \text{ V}$
Amount of intake air	$\geq 10 \text{ g/s}$ (0.353 oz/s)
Engine coolant temperature	$\geq 75 \text{ }^\circ\text{C}$ (167 $^\circ\text{F}$ )
Misfire detection every 200 rotations	$< 5$ time
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9 \text{ V}$
Deceleration fuel cut of 6000 ms or more.	Experienced

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage or Maximum output voltage	> 0.15 V  < 0.55 V

**Time Needed for Diagnosis:** 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	$\leq 0.15$ V
Maximum output voltage	$\geq 0.55$ V

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### AJ:DTC P0171 SYSTEM TOO LEAN (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

#### Diagnostic method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ 75 °C (167 °F)
Engine load change	< 0.02 g/rev (0.001 oz/rev)
Engine load	≥ Value of Map 1

#### Map1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	Non-turbo	0.208 (0.007)	0.201 (0.007)	0.185 (0.007)	0.183 (0.006)	0.193 (0.007)	0.206 (0.007)	0.206 (0.007)	0.225 (0.008)	0.245 (0.009)

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec × 5 time or more, judge that there is a fault in the fuel system.

##### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	≥ Value of Map 2

#### Map2

##### U5 MODEL

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	1.4	1.4	1.332	1.25	1.25	1.25	1.25

##### EXCEPT FOR U5 MODEL

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	1.4	1.4	1.332	1.265	1.265	1.265	1.265

**Time Needed for Diagnosis:** 10 sec × 5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	< 1.2

**Time Needed for Diagnosis:** 10 sec

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## AK:DTC P0172 SYSTEM TOO RICH (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

#### Diagnostic method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)
Engine load change	$\leq 0.02\text{ g/rev}$ (0.001 oz/rev)
Learning value of EVAP conc.	< 0.15
Cumulative time of canister purge after engine start	$\geq 20\text{ sec}$
Continuous period after canister purge starting	$\geq 29884\text{ ms}$
Engine load	$\geq$ Value of Map 1

#### Map1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	Non-turbo	0.208 (0.007)	0.201 (0.007)	0.185 (0.007)	0.183 (0.006)	0.193 (0.007)	0.206 (0.007)	0.206 (0.007)	0.225 (0.008)	0.245 (0.009)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec × 5 time or more, judge that there is a fault in the fuel system.

#### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	< Value of Map 2

#### Map2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	0.6	0.6	0.668	0.735	0.735	0.735	0.735

**Time Needed for Diagnosis:** 10 sec × 5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK when the malfunction criteria below continues for 10 seconds.

#### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	$\geq 0.8$

**Time Needed for Diagnosis:** 10 sec

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

### 7. FAIL SAFE

Purge control solenoid valve control: Not allowed to purge.

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## AL:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect faults in the fuel temperature sensor output properties.

Diagnosis is performed in two methods (drift diagnosis and stuck diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

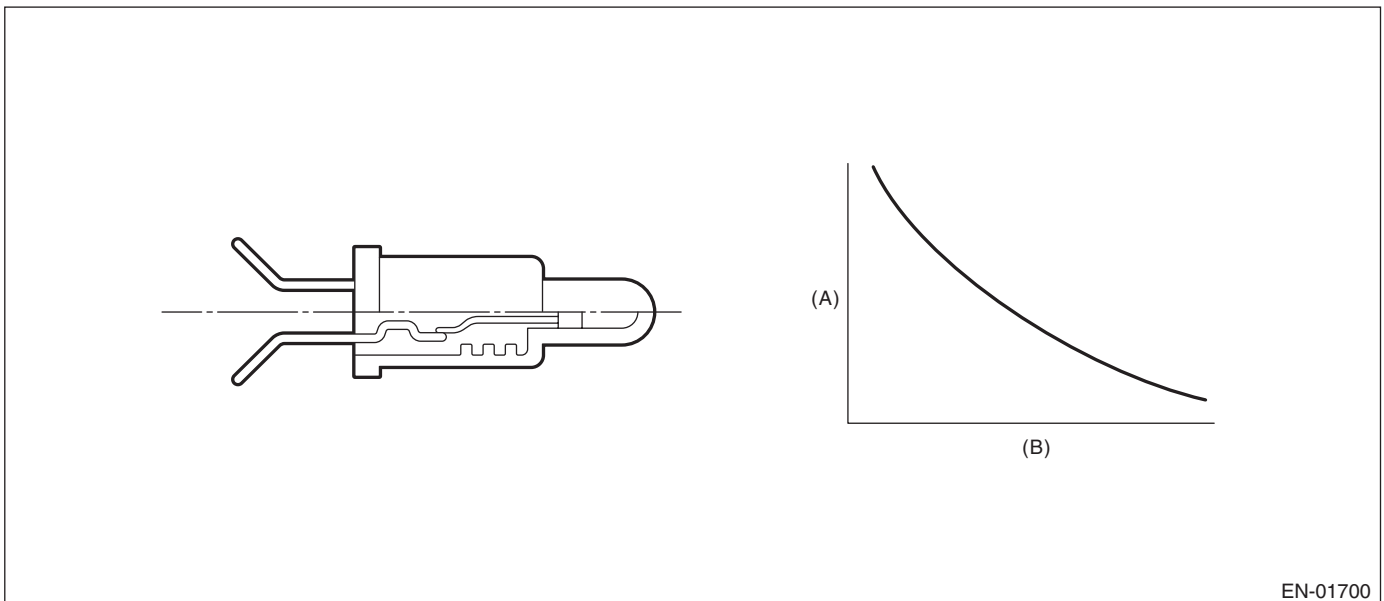
#### Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and judged as NG.

#### Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

### 2. COMPONENT DESCRIPTION



EN-01700

(A) Resistance value ( $\Omega$ )

(B) Fuel temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )

### 3. ENABLE CONDITION

#### DRIFT DIAGNOSIS

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	≥ 10 °C (50 °F)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 120 sec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	< 10 °C (50 °F)
Battery voltage	≥ 10.9 V
Engine coolant temperature	< 75 °C (167 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

### 10. ENABLE CONDITION

#### Stuck Diagnosis

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 20000 ms
Battery voltage	≥ 10.9 V

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 11.GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

## 12.DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	$\geq 551043$ g (19435.287 oz)
Fuel temperature difference between Max. and Min.	$< 2$ °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Fuel temperature difference between Max. and Min.	$\geq 2$ °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 13.DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 15.FAIL SAFE

None

## 16.ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

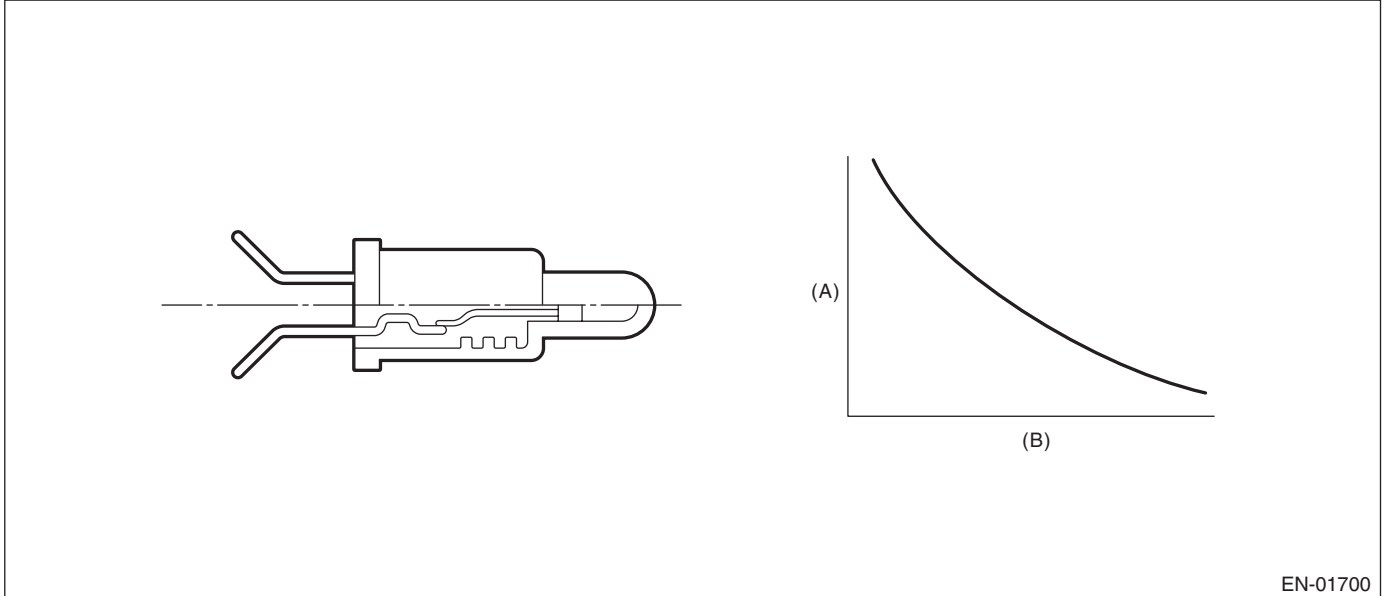
## GENERAL DESCRIPTION

### AM:DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.343951474 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.343951474 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

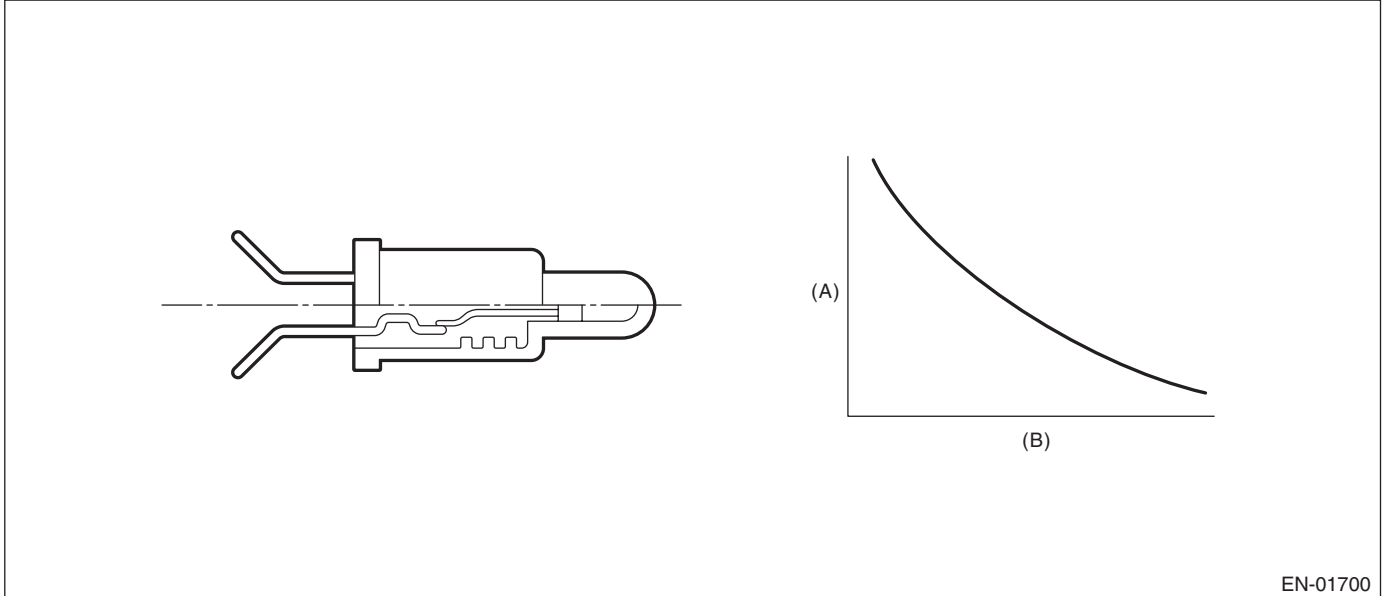
## GENERAL DESCRIPTION

### AN:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** Within 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### AO:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect for abnormal values in the oil temperature sensor output properties.

Judge as NG when the oil temperature does not rise even though the engine is running under a condition where it should rise.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ Value from Map

#### Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 15 °C (59 °F)
After engine start oil temperature sensor characteristic diagnosis timer.	≥ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer

After engine start oil temperature sensor characteristic diagnosis timer (timer for diagnosis).

a. Timer stop at fuel cut

b. During the driving conditions except a) above, timer counts up as follows.

64 milliseconds + TOILCNT milliseconds (at the time of 64 milliseconds).

Where, TOILCNT is determined as follows,

TOILCNT = 0 at idle switch ON

For TOILCNT at Idle switch off, refer to the following table.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-30 (-22)	64 ms	73.2 ms	83.9 ms	96.3 ms	113.2 ms	133.9 ms	160.2 ms	194.6 ms
	-20 (-4)	64 ms	73.3 ms	84 ms	96.6 ms	113.7 ms	135 ms	162 ms	197.4 ms
	-10 (14)	64 ms	73.4 ms	84.2 ms	96.9 ms	114.5 ms	136.4 ms	164.4 ms	201.5 ms
	0 (32)	64 ms	73.5 ms	84.5 ms	97.4 ms	115.6 ms	138.5 ms	168 ms	207.6 ms
	10 (50)	102.2 ms	114.8 ms	129.4 ms	146.7 ms	171.7 ms	203.4 ms	245.1 ms	302.1 ms

After engine start oil temperature characteristic diagnosis timer judgment value (t).

$t = 1882940 \text{ ms} - 43302 \text{ ms}/^{\circ}\text{C} \times T_i$  ( $t \geq 2400000$ )

$T_i$  = The lowest coolant temperature after starting the engine.

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	≥ 15 °C (59 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### AP:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.  
Judge as NG when outside of the judgment value.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.166 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.166$ V

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## AQ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.  
Judge as NG when outside of the judgment value.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.716$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.716$ V

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

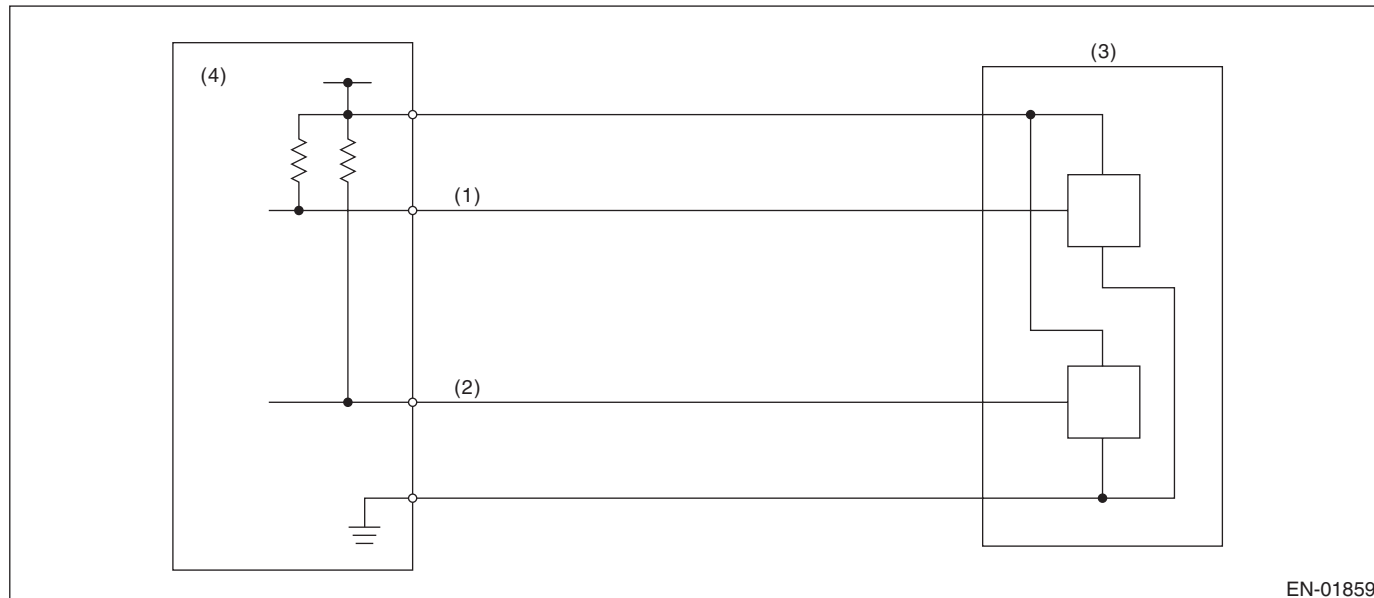
### AR:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\leq 0.926256$ V

**Time Needed for Diagnosis:** 24 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$> 0.926256$ V

**Time Needed for Diagnosis:** 24 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

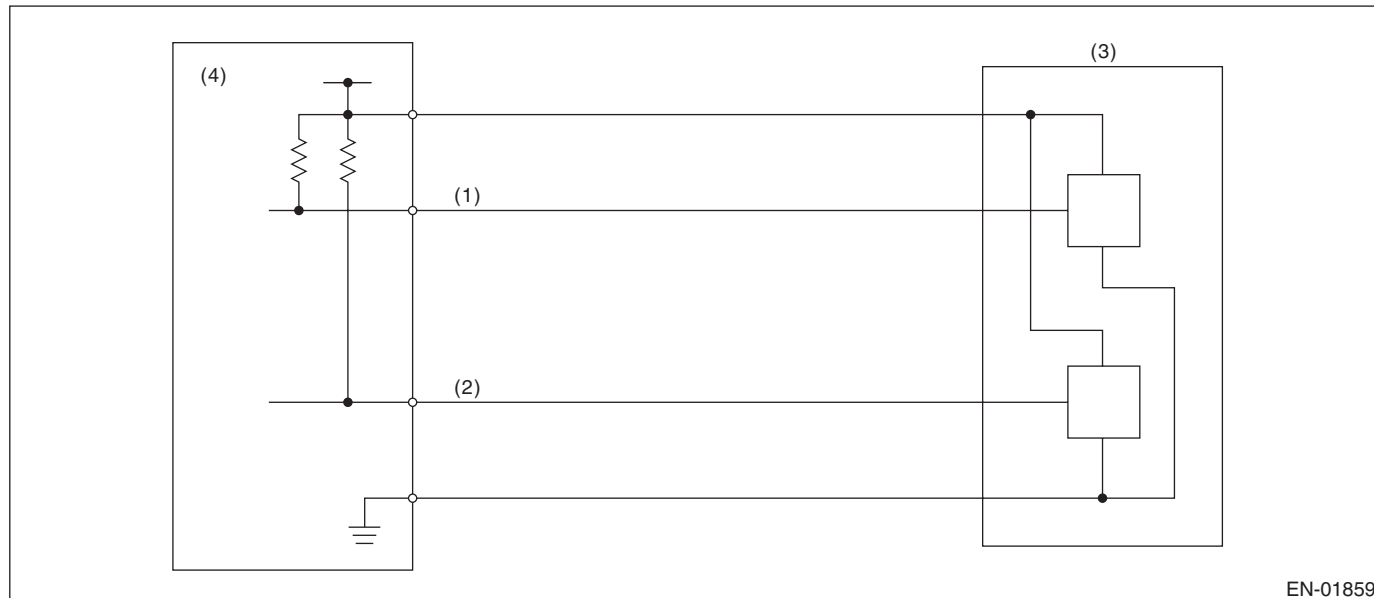
### AS:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 4.858$ V

**Time Needed for Diagnosis:** 24 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$< 4.858$ V

**Time Needed for Diagnosis:** 24 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### AT:DTC P0301 CYLINDER 1 MISFIRE DETECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)

Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below. :

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire

- 180° Interval Difference Method (MT: 1,800 rpm or less; AT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 1024 ms
Intake manifold pressure change at 180° CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 21 deg
Fuel shut-off function	Not in operation
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	460 rpm — 6300 rpm
Intake manifold pressure	≥ Value of Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine load change during 32 milliseconds	< 1000 rpm

#### Map1

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33
(mmHg, inHg)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)

- MT model

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33
(mmHg, inHg)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Map2

- AT model (U5 model)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	25.99 (195.0, 7.677)	23.93 (179.5, 7.067)	23.29 (174.7, 6.878)	23.09 (173.2, 6.819)	23.57 (176.8, 6.961)	25.06 (188.0, 7.402)	26.25 (196.9, 7.752)	26.61 (199.6, 7.858)	26.86 (201.5, 7.933)	29.99 (225.0, 8.858)	33.38 (250.4, 9.858)	37.79 (283.5, 11.161)	39.46 (296.0, 11.654)

- AT model (Except for U5 model)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	25.99 (195.0, 7.677)	23.93 (179.5, 7.067)	23.29 (174.7, 6.878)	23.09 (173.2, 6.819)	23.57 (176.8, 6.961)	25.06 (188.0, 7.402)	26.25 (196.9, 7.752)	26.61 (199.6, 7.858)	26.86 (201.5, 7.933)	29.99 (225.0, 8.858)	33.38 (250.4, 9.858)	37.79 (283.5, 11.161)	39.46 (296.0, 11.654)

- MT model (U5 model)

### Vehicle speed < 64 km/h (39.8 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	24.53 (184, 7.244)	22.7 (170.3, 6.705)	21.35 (160.2, 6.307)	21.54 (161.6, 6.362)	21.51 (161.4, 6.354)	23.25 (174.4, 6.866)	24.73 (185.5, 7.303)	25.77 (193.3, 7.61)	27.09 (203.2, 8)	28.83 (216.3, 8.516)	32.29 (242.2, 9.535)	36.26 (272, 10.709)	37.92 (284.5, 11.201)

### Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	31.59 (237, 9.331)	31.59 (237, 9.331)	31.59 (237, 9.331)	31.06 (233, 9.173)	31.33 (235, 9.252)	33.06 (248, 9.764)	33.86 (254, 10)	28.79 (216, 8.504)	30.13 (226, 8.898)	33.33 (250, 9.843)	36.92 (277, 10.905)	40.12 (301, 11.85)	43.19 (324, 12.756)

- MT model (Except for U5 model)

### Vehicle speed < 64 km/h (39.8 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	24.53 (184, 7.244)	22.7 (170.3, 6.705)	21.35 (160.2, 6.307)	21.54 (161.6, 6.362)	21.51 (161.4, 6.354)	23.25 (174.4, 6.866)	24.73 (185.5, 7.303)	25.77 (193.3, 7.61)	27.09 (203.2, 8)	28.83 (216.3, 8.516)	32.29 (242.2, 9.535)	36.26 (272, 10.709)	37.92 (284.5, 11.201)

### Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	31.59 (237, 9.331)	31.59 (237, 9.331)	31.59 (237, 9.331)	31.06 (233, 9.173)	31.33 (235, 9.252)	33.06 (248, 9.764)	33.86 (254, 10)	28.79 (216, 8.504)	30.13 (226, 8.898)	33.33 (250, 9.843)	36.92 (277, 10.905)	40.12 (301, 11.85)	43.19 (324, 12.756)

## 3. GENERAL DRIVING CYCLE

- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
- Perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

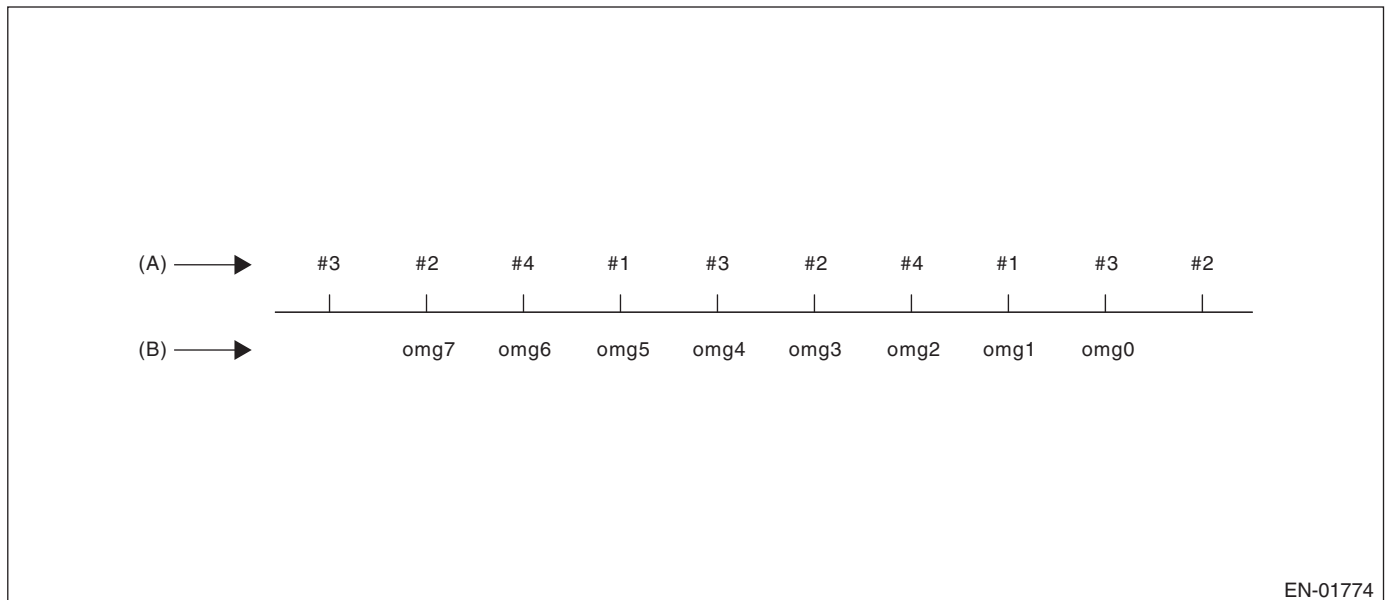
## GENERAL DESCRIPTION

### 4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decreased and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Counting the number of misfires. If the misfire ratio is higher during 1000 revs. or 200 revs., Judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment)
	<ul style="list-style-type: none"> <li>• 180° Interval Difference Method</li> <li>• 360° Interval Difference Method</li> <li>• 720° Interval Difference Method</li> </ul>	<ul style="list-style-type: none"> <li>• FTP 1.5 times misfire NG judgment</li> <li>• Catalyst damage misfire NG judgment</li> </ul>

As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



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(A) Ignition order

(B) Crankshaft position speed

# Diagnostic Trouble Code (DTC) Detecting Criteria

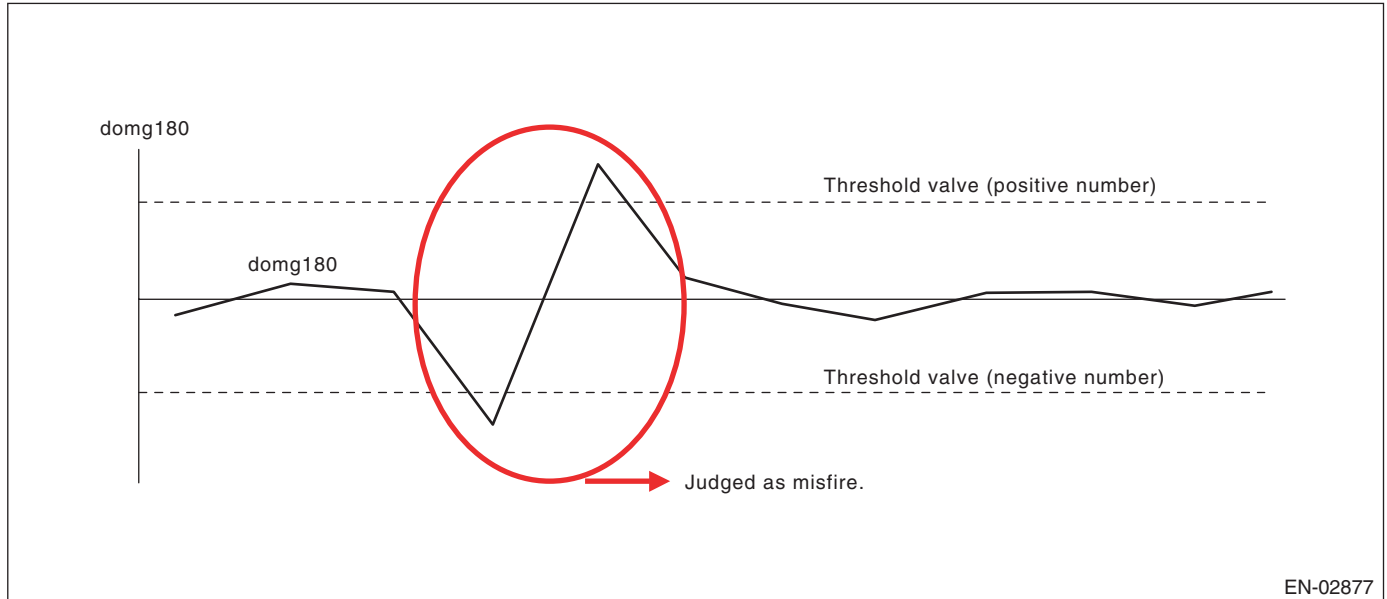
GENERAL DESCRIPTION

## 180° Interval Difference Method

Diagnostic value	$\text{domg } 180 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 5 - \text{omg } 1)/4$
------------------	--

Judge as a misfire in the following cases.

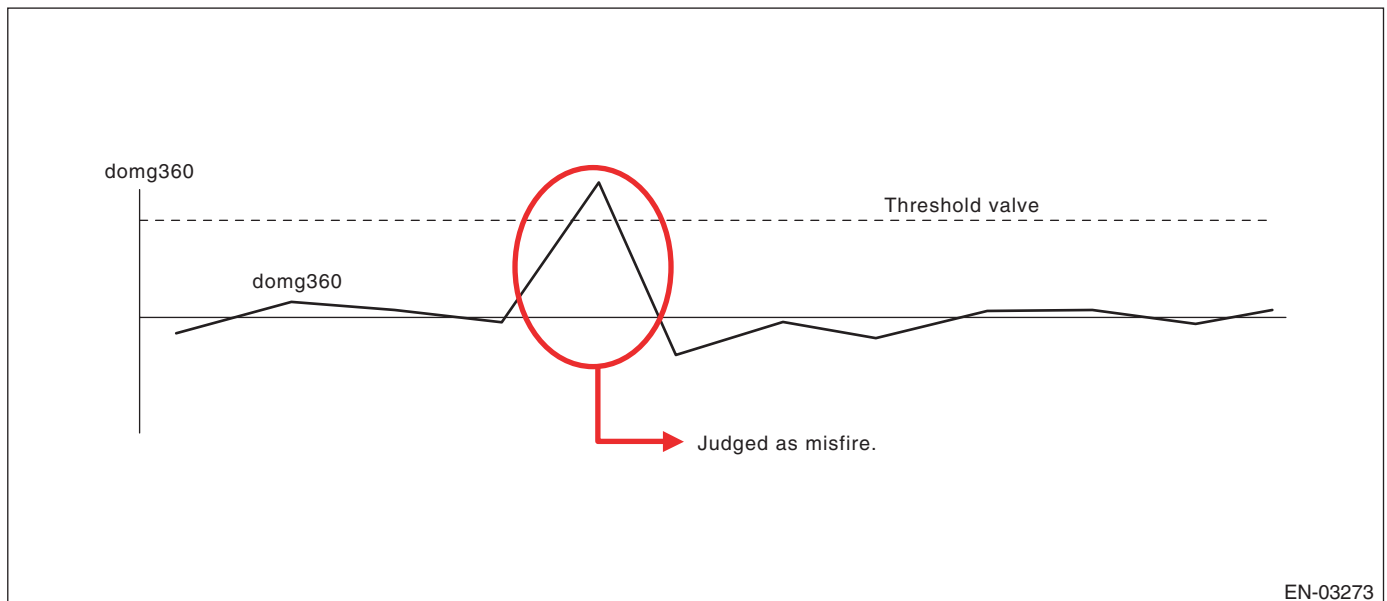
- $\text{domg } 180 > \text{judgment value of positive side}$
- $\text{domg } 180 \leq \text{judgment value of negative side}$   
(Judgment value before 180° CA)



## 360° Interval Difference Method

Diagnostic value	$\text{domg } 360 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 3 - \text{omg } 2)$
------------------	--

Misfire judgment	$\text{domg } 360 > \text{Judgment value} \rightarrow \text{Judge as misfire}$
------------------	--

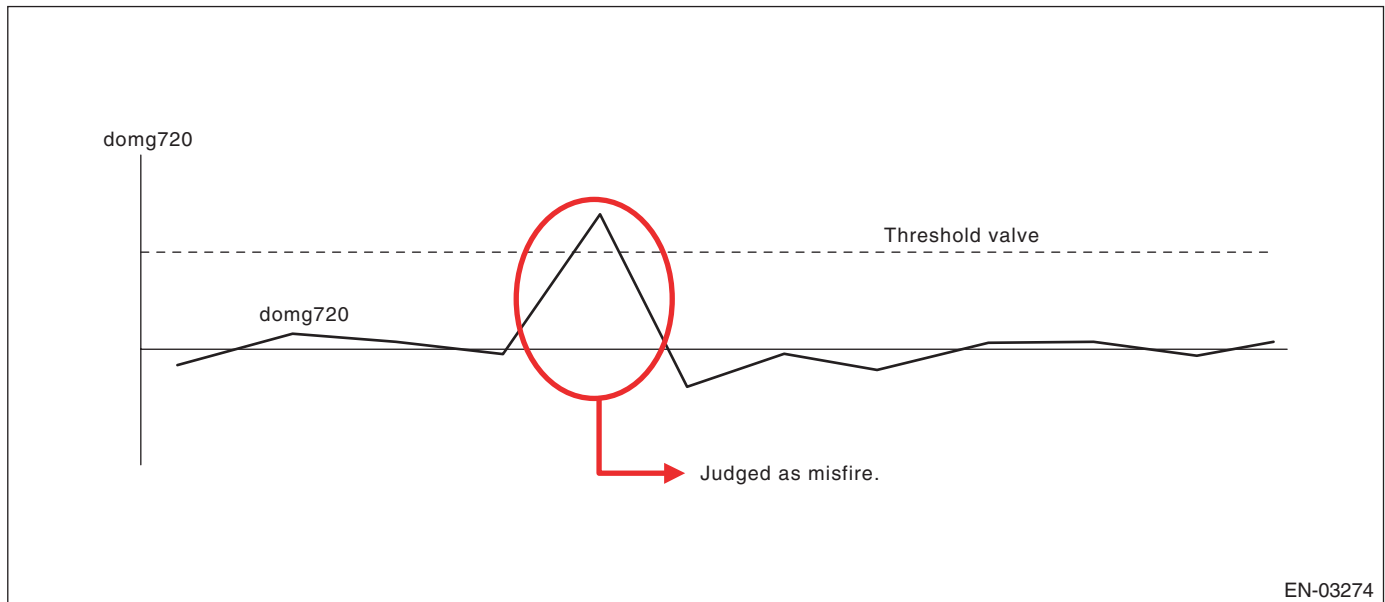


# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 720° Interval Difference Method

Diagnostic value	$\text{domg 720} = (\text{omg 1} - \text{omg 0}) - (\text{omg 5} - \text{omg 4})$
Misfire judgment	$\text{domg 720} > \text{Judgment value} \rightarrow \text{Judge as misfire}$



EN-03274

- FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)
- Abnormality Judgment

**Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)**

Malfunction Criteria	Threshold Value
FTP emission judgment value	$\geq 18 \times 100/2000\%$ in 1000 revs. (U5 model) $\geq 20 \times 100/2000\%$ in 1000 revs. (Except for U5 model)

**Time Needed for Diagnosis:** 1000 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- Normality Judgment

**Judgment Value**

Malfunction Criteria	Threshold Value
FTP emission judgment value	$< 18 \times 100/2000\%$ in 1000 revs. (U5 model) $< 20 \times 100/2000\%$ in 1000 revs. (Except for U5 model)

**Time Needed for Diagnosis:** 1000 engine revs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Catalyst damage misfire (Misfire occurrence level damaging catalyst)
- Abnormality Judgment

## Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	≥ Value of Map 3

## Map 3

### U5 MODEL

		Intake air (g(oz)/rev)							
		0.16 (0.006)	0.28 (0.01)	0.4 (0.014)	0.52 (0.018)	0.64 (0.023)	0.76 (0.027)	0.92 (0.032)	1.1 (0.039)
Engine speed (rpm)	700	100	100	100	100	90	80	64	48
	1000	100	100	100	100	90	80	52	24
	1500	100	100	90	80	69	57	39	22
	2000	80	80	80	80	62	44	33	21
	2500	67	67	58	50	40	31	25	20
	3000	57	57	49	40	30	20	20	20
	3500	44	44	34	24	20	20	20	20
	4000	36	36	28	20	20	20	20	20
	4500	27	27	20	20	20	20	20	20
	5000	20	20	20	20	20	20	20	20
	5500	20	20	20	20	20	20	20	20
	6000	20	20	20	20	20	20	20	20
6300	20	20	20	20	20	20	20	20	

### EXCEPT FOR U5 MODEL

		Intake air (g(oz)/rev)							
		0.16 (0.006)	0.28 (0.01)	0.4 (0.014)	0.52 (0.018)	0.64 (0.023)	0.76 (0.027)	0.92 (0.032)	1.1 (0.039)
Engine speed (rpm)	700	100	100	100	100	90	80	64	48
	1000	100	100	100	100	90	80	63	44
	1500	100	100	90	80	73	67	54	40
	2000	80	80	80	80	68	57	51	44
	2500	80	80	73	67	62	57	51	44
	3000	67	67	62	57	51	44	44	44
	3500	67	67	56	44	40	36	34	31
	4000	57	57	44	31	24	20	20	20
	4500	44	44	33	31	20	20	20	20
	5000	44	44	38	31	20	20	20	20
	5500	36	36	31	27	20	20	20	20
	6000	20	20	20	20	20	20	20	20
6300	20	20	20	20	20	20	20	20	

**Time Needed for Diagnosis:** 200 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- Normality Judgment

## Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	< Value of Map 3

**Time Needed for Diagnosis:** 200 engine revs.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## **AU:DTC P0302 CYLINDER 2 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-100, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **AV:DTC P0303 CYLINDER 3 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-100, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **AW:DTC P0304 CYLINDER 4 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-100, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

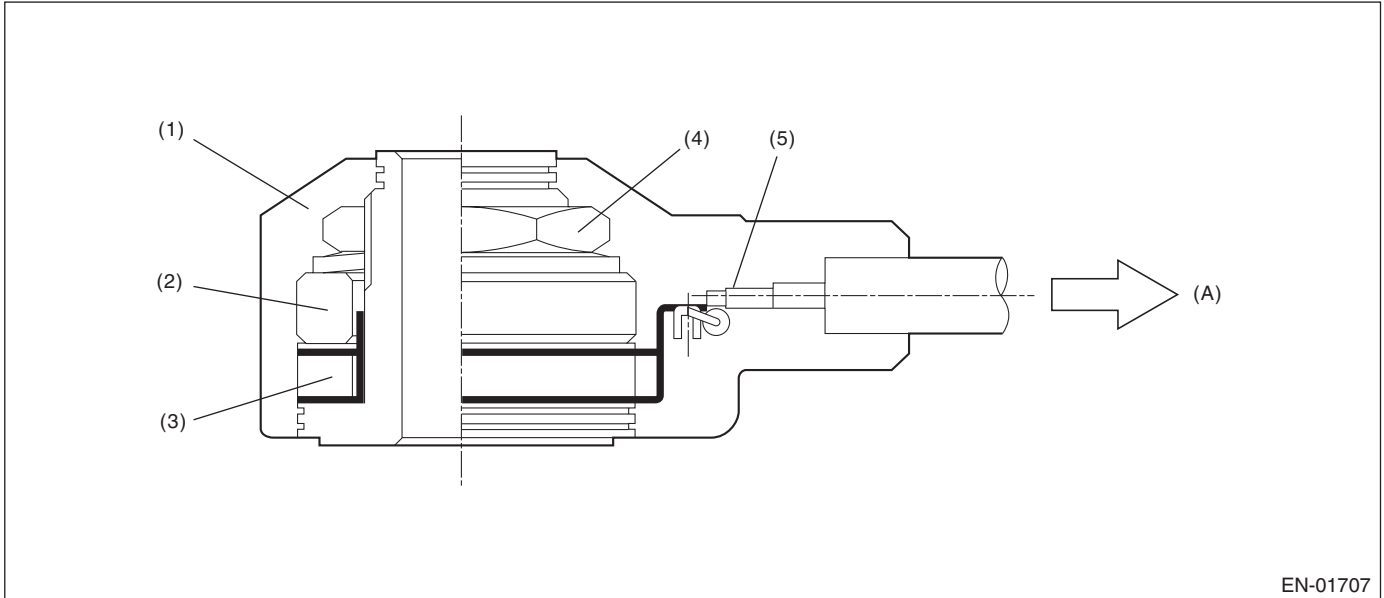
## GENERAL DESCRIPTION

### AX:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.243 V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.243 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

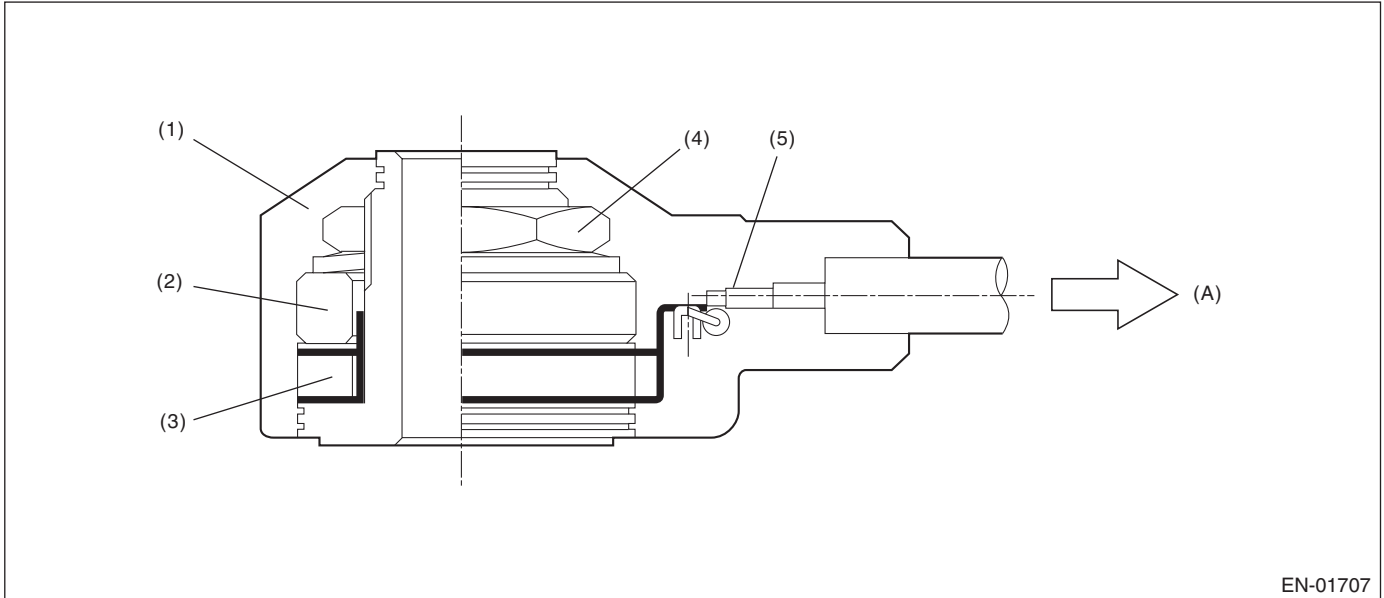
## GENERAL DESCRIPTION

### AY:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.709$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.709$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

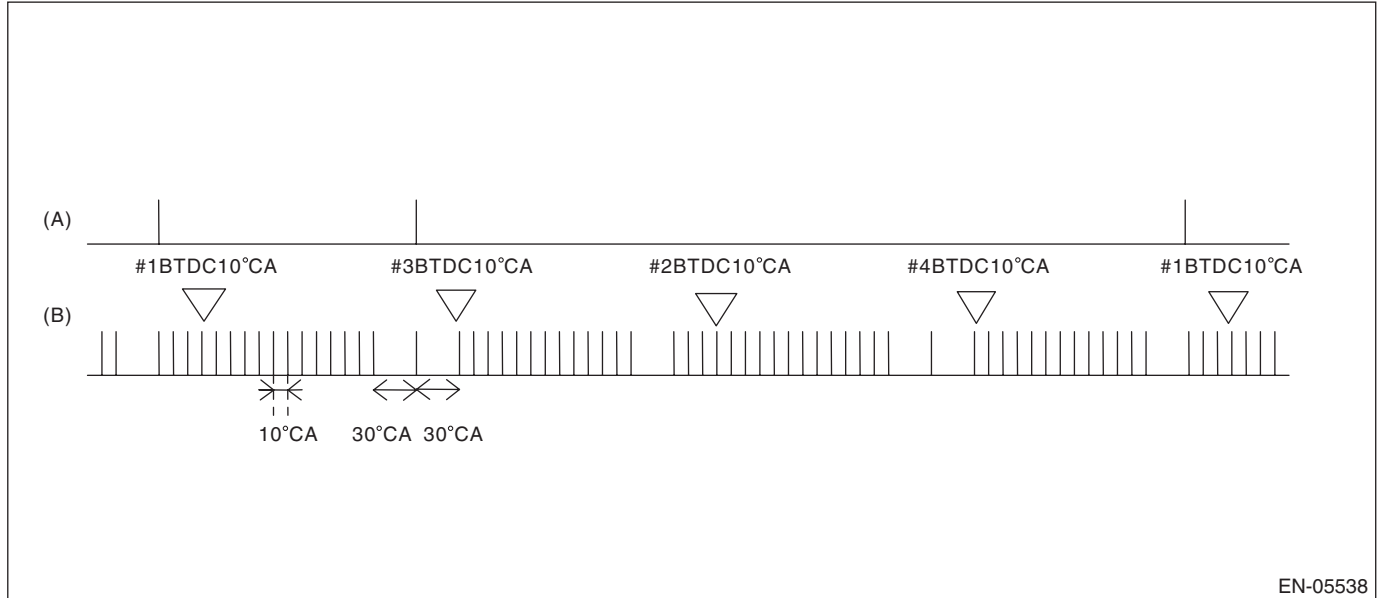
### AZ:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.

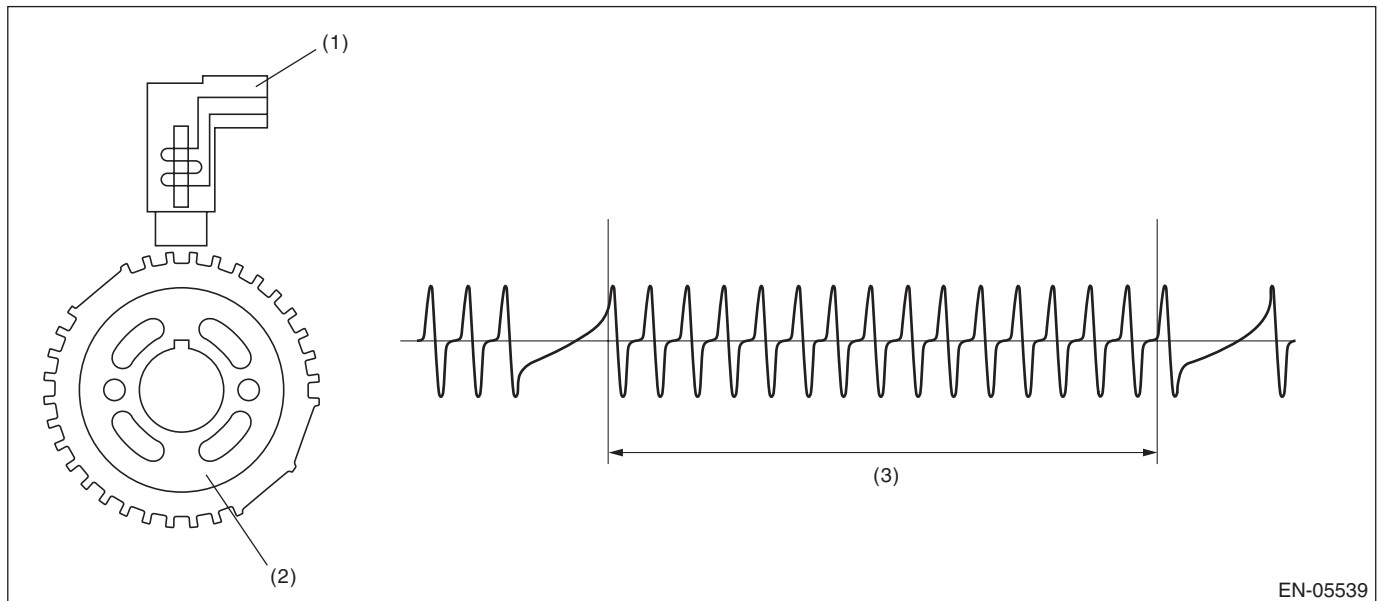
Judge as NG when the crank signal is not input even though the starter was rotated.

#### 2. COMPONENT DESCRIPTION



(A) Cam signal

(B) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Starter switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

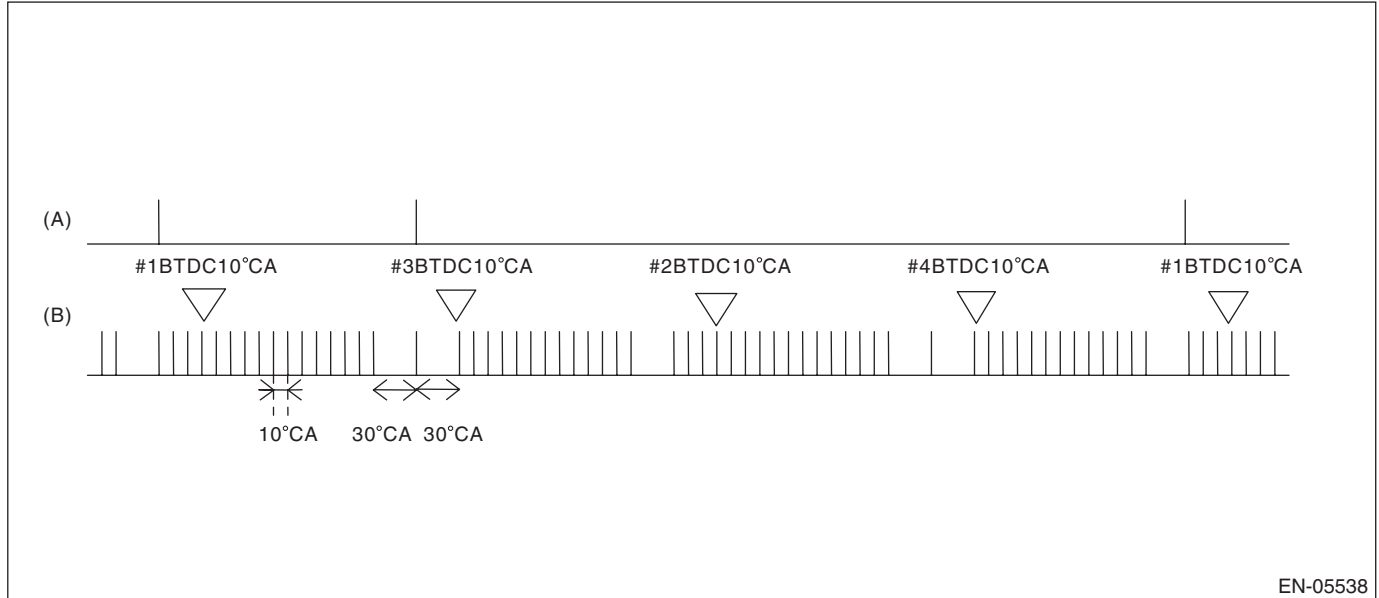
### BA:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

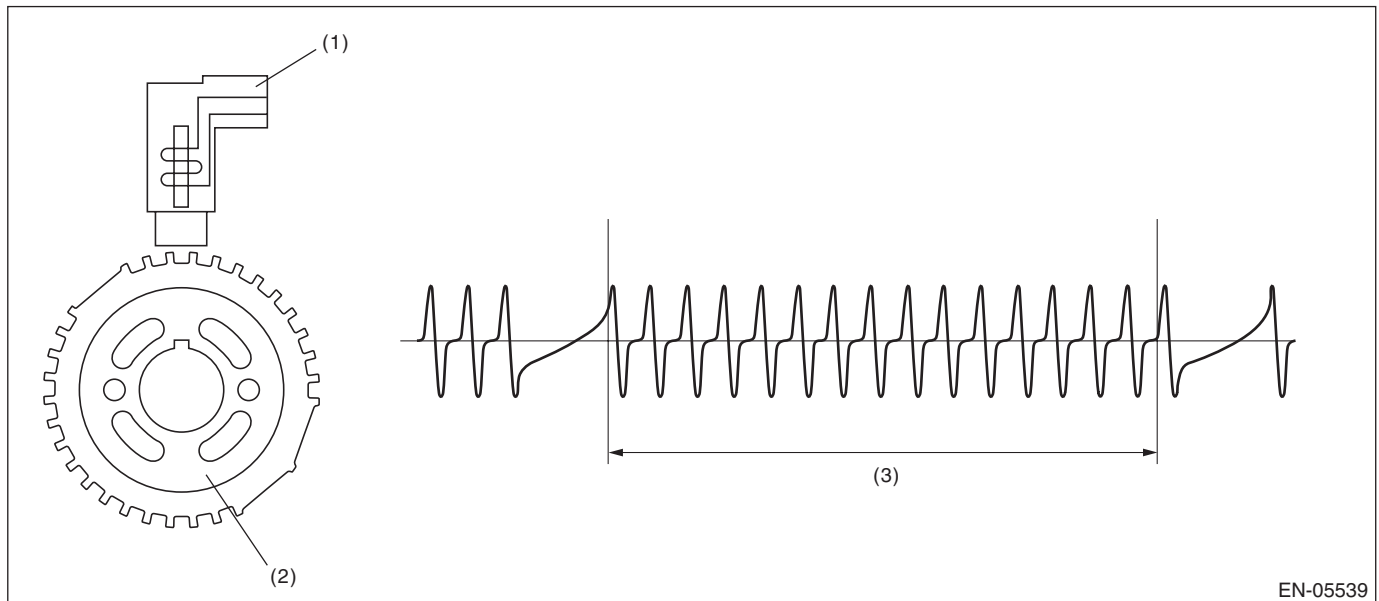
Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

#### 2. COMPONENT DESCRIPTION



(A) Cam signal

(B) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$
Engine speed	$< 4000 \text{ rpm}$

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	Not = 30

**Time Needed for Diagnosis:** 10 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	= 30

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

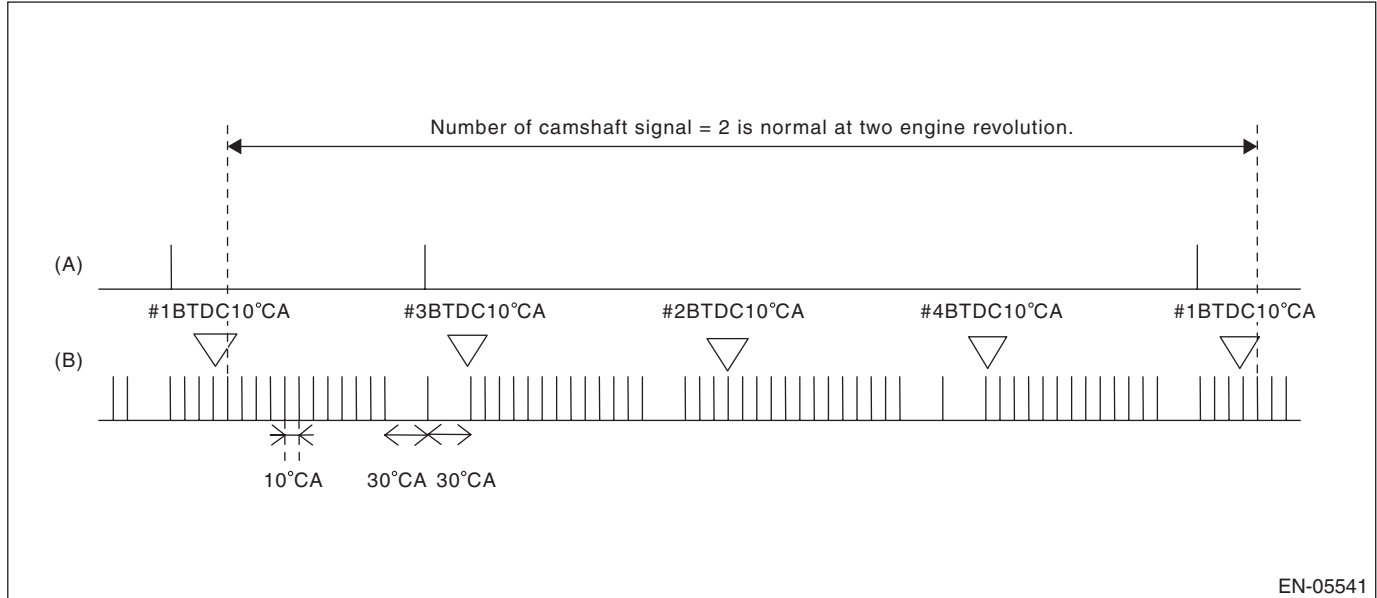
## GENERAL DESCRIPTION

### BB:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.  
Judge as NG when the number of camshaft signals remains abnormal.

#### 2. COMPONENT DESCRIPTION



(A) Camshaft signal

(B) Crankshaft signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 8 \text{ V}$
Amount of camshaft sensor signal during 2 revs.	Not = 2

**Time Needed for Diagnosis:** Two engine revolutions  $\times$  4 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Voltage	$\geq 8 \text{ V}$
Amount of camshaft sensor signal during 2 revs.	= 2

**Time Needed for Diagnosis:** Two engine revolutions

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

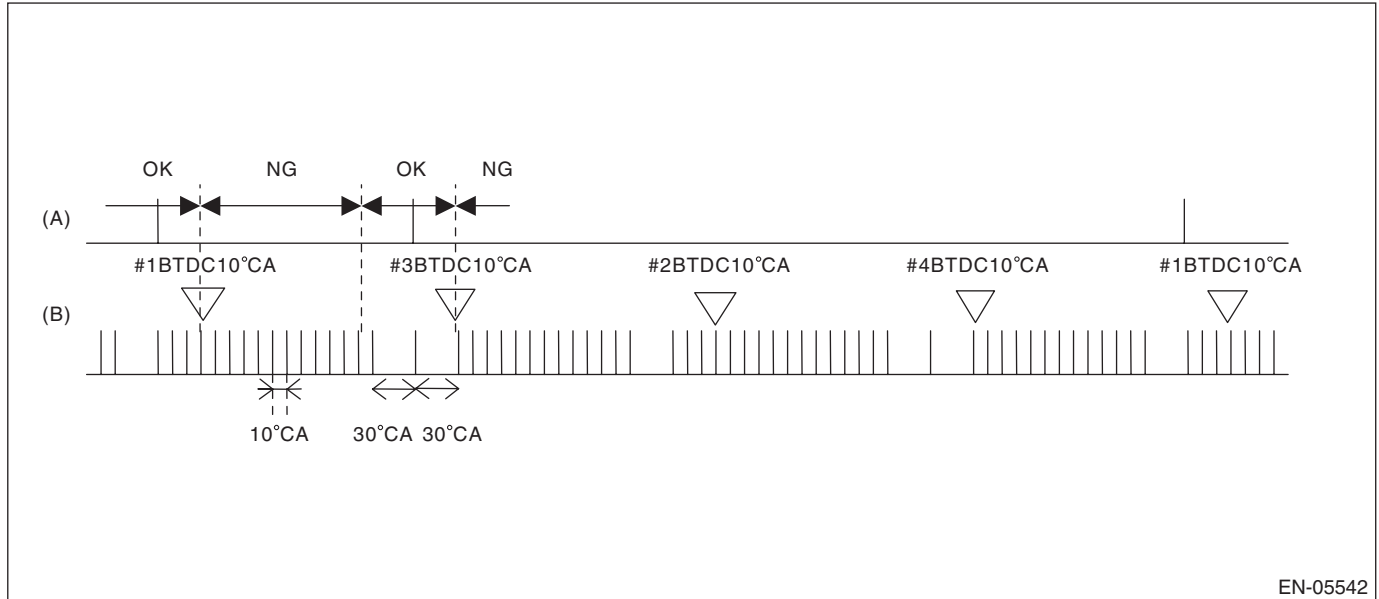
### BC:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/ PERFORMANCE (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor output property.

Judge as NG when the camshaft line signal input timing is shifted from the crankshaft signal because of timing belt tooth chip etc.

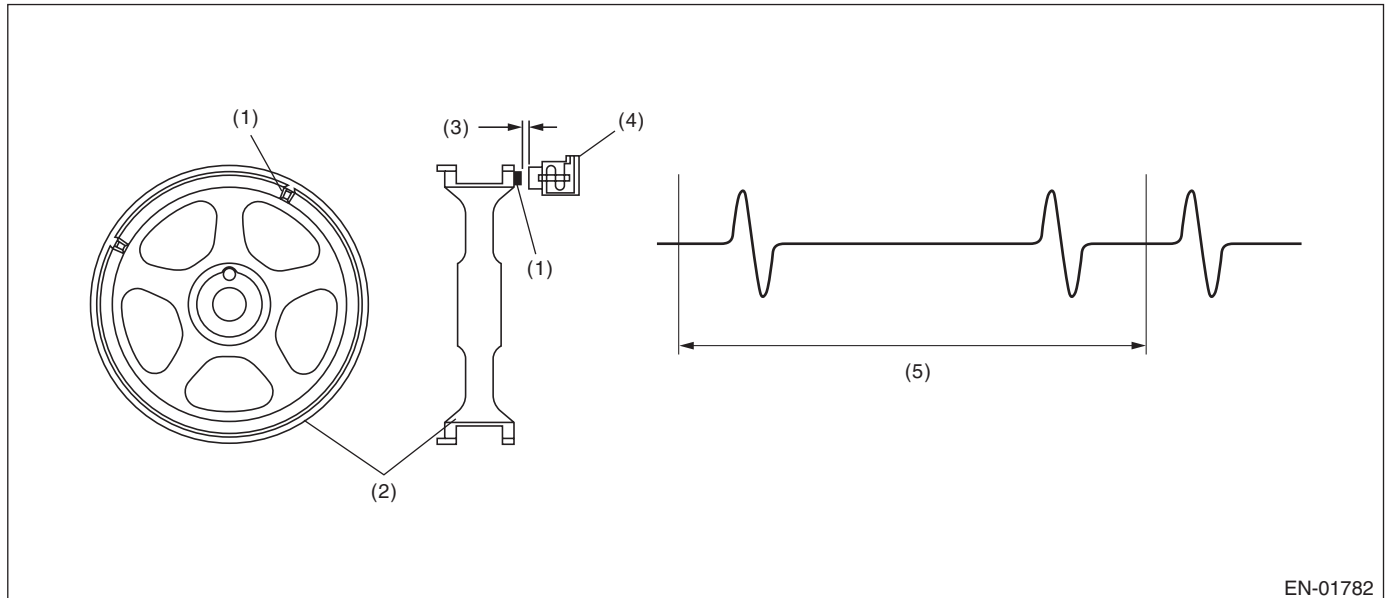
#### 2. COMPONENT DESCRIPTION



EN-05542

(A) Camshaft signal

(B) Crankshaft signal



EN-01782

- (1) Boss
- (2) Cam sprocket

- (3) Air gap
- (4) Camshaft position sensor

- (5) Camshaft one revolution (engine two revolutions)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Cylinder number identification	Completed
Battery voltage	$\geq 8 \text{ V}$
Engine speed	550 rpm — 1000 rpm
Engine operation	Idling
Misfire	Not detected
Engine load change during 4 milliseconds	$\leq 12799.8 \text{ rpm}$

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously at idle speed.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Not between BTDC $10^{\circ}\text{CA}$ and BTDC $80^{\circ}\text{CA}$

**Time Needed for Diagnosis:** 10 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Between BTDC $10^{\circ}\text{CA}$ and BTDC $80^{\circ}\text{CA}$

**Time Needed for Diagnosis:** Two engine revolutions

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

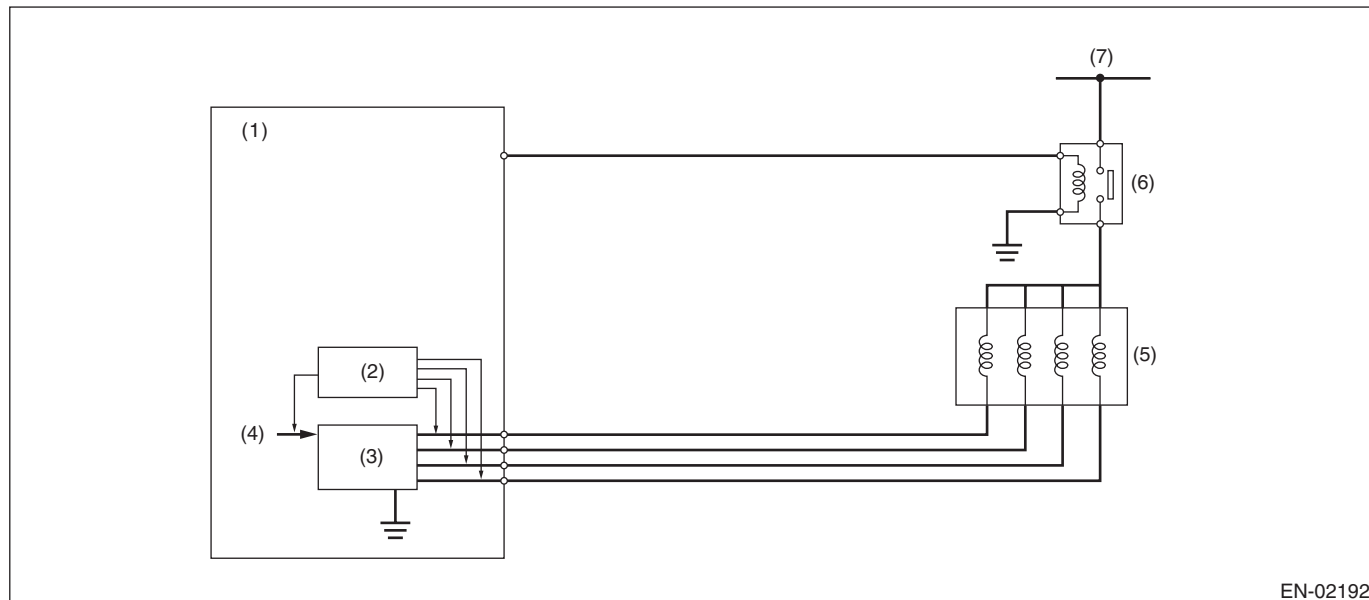
### BD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

#### 1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.

Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

#### 2. COMPONENT DESCRIPTION



EN-02192

- |                       |               |                          |
|-----------------------|---------------|--------------------------|
| (1) ECM               | (4) CPU       | (6) Main relay           |
| (2) Detecting circuit | (5) EGR valve | (7) Battery power supply |
| (3) Switching circuit |               |                          |

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 40 sec
Engine coolant temperature	≥ 75 °C(167 °F)
Engine speed	1200 rpm — 2950 rpm
Intake manifold pressure (absolute pressure)	< 43.99 kPa (330 mmHg, 12.992 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 deg
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Vehicle speed	≥53 km/h (32.9 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF
After neutral switch ON/OFF change	≥ Value from Map
No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan)	≥ 5000 ms

### Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
After neutral switch change msec	0	0	0	0	0	0	0	0

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
After neutral switch change msec	0	0	0	0	0	0	0	0

## 4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once. Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

## 5. DIAGNOSTIC METHOD

Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.

1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 50 steps (nearly full open).
2. Label the intake manifold pressure value as PMON, which is observed after one second has passed since EGR target step was set to 50 steps (when the enable conditions were established), and set the EGR target step to 0.
3. Label the intake manifold pressure as PMOF2, which is observed after one second has passed since EGR target step was set to 0 (after two seconds have passed since the enable conditions were established).

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	< 2.48 kPa (18.63 mmHg, 0.733 inHg)

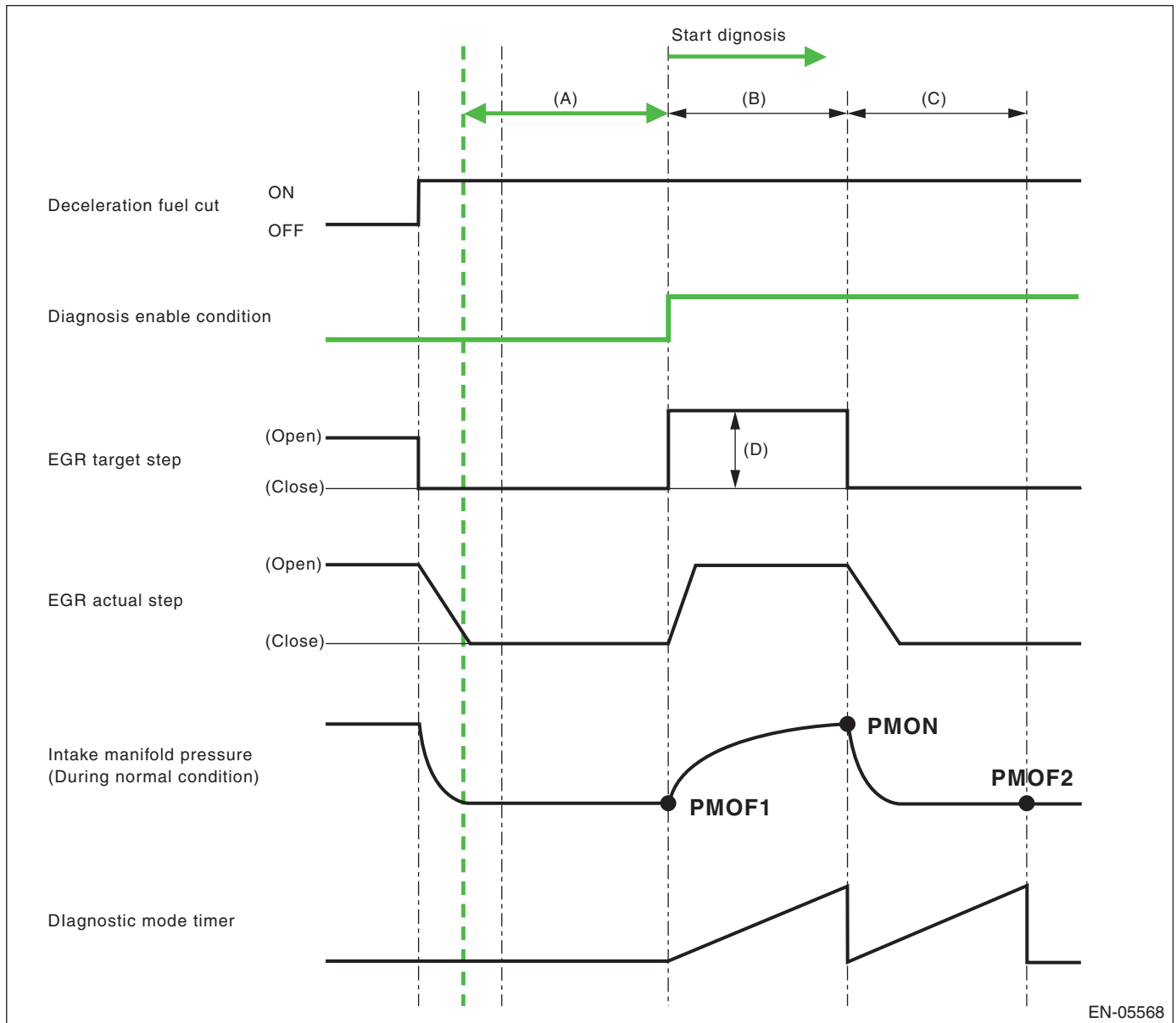
**Time Needed for Diagnosis:** 1 time



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



(A) 3000 ms

(C) 1000 ms

(D) 45 STEP

(B) 1000 ms

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
$PMON - (PMOF1 + PMOF2)/2$	$\geq 2.48 \text{ kPa (18.63 mmHg, 0.733 inHg)}$

**Time Needed for Diagnosis:** 1 time

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

A/F main learning = Not allowed.

Knock learning = Not allowed.

EGR control: Operation prohibited.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BE:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

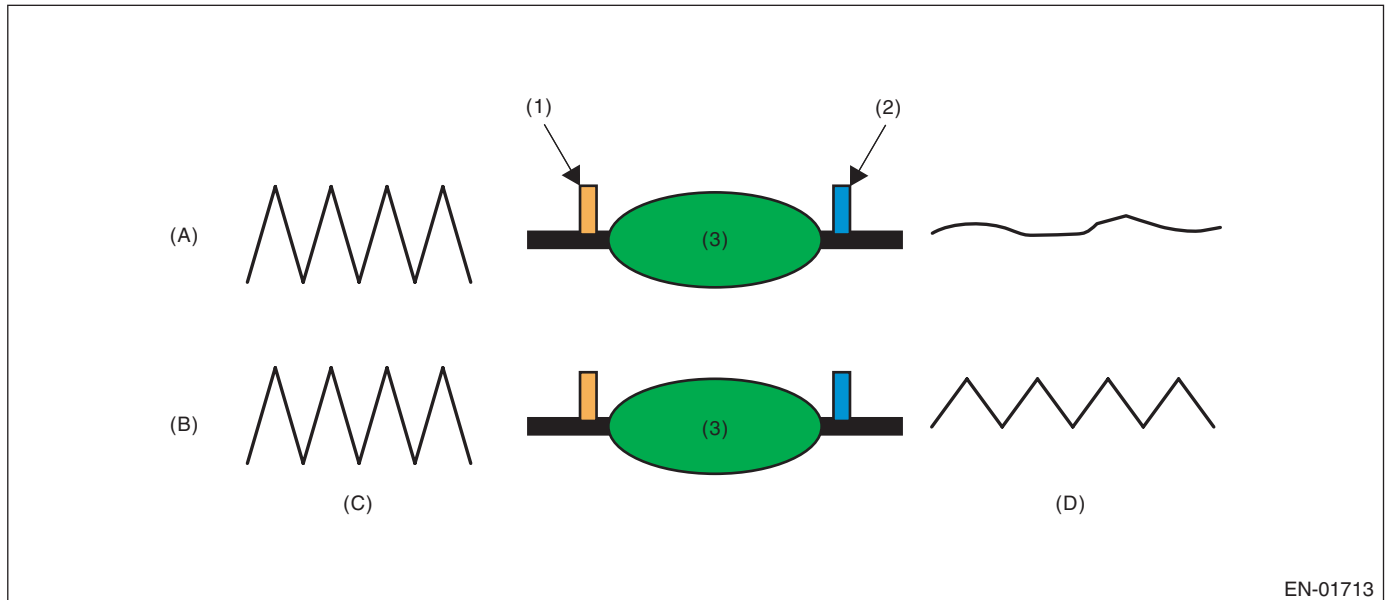
#### 1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.

For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

#### 2. COMPONENT DESCRIPTION



EN-01713

- (1) Front oxygen (A/F) sensor
- (2) Front oxygen sensor
- (3) Catalytic converter

- (A) Normal
- (B) Deterioration
- (C) Output waveform from the front oxygen (A/F) sensor

- (D) Output waveform from the rear oxygen Sensor

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Engine coolant temperature	≥ 70 °C (158 °F)
Estimated catalyst temperature	≥ 300 °C (572 °F)
Misfire detection every 200 rotations	< 5 time
Learning value of evaporation gas density	< 0.2
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 1000 ms
Vehicle speed	> 70 km/h (43.5 MPH)
Amount of intake air	≥ 10 g/s (0.353 oz/s) and < 40 g/s (1.411 oz/s)
Engine load change every 0.5 engine revs.	< 0.02 g/rev (0.001 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 205 sec
Purge execution calculated time	≥ 0 sec

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 70 km/h (43.5 MPH) or higher.

## 5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) and rear oxygen sensor output voltage deviation cumulative value ( $\sum |(ro2sad_n - ro2sad_{n-1})|$ ) per 32 milliseconds  $\times 4$ , and when the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) becomes the predetermined value or more, calculate the diagnostic value.

### • Abnormality Judgment

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
$\sum  (ro2sad_n - ro2sad_{n-1})  / \sum  (sglmd_n - sglmd_{n-1}) $	> 10 (U5 model) > 15.5 (Except for U5 model)

**Time Needed for Diagnosis:** 30 — 55 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$\Sigma  (ro2sad_n - ro2sad_{n-1})  / \Sigma  (sglmd_n - sglmd_{n-1}) $	$\leq 10$ (U5 model) $\leq 15.5$ (Except for U5 model)

**Time Needed for Diagnosis:** 30 — 55 seconds

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

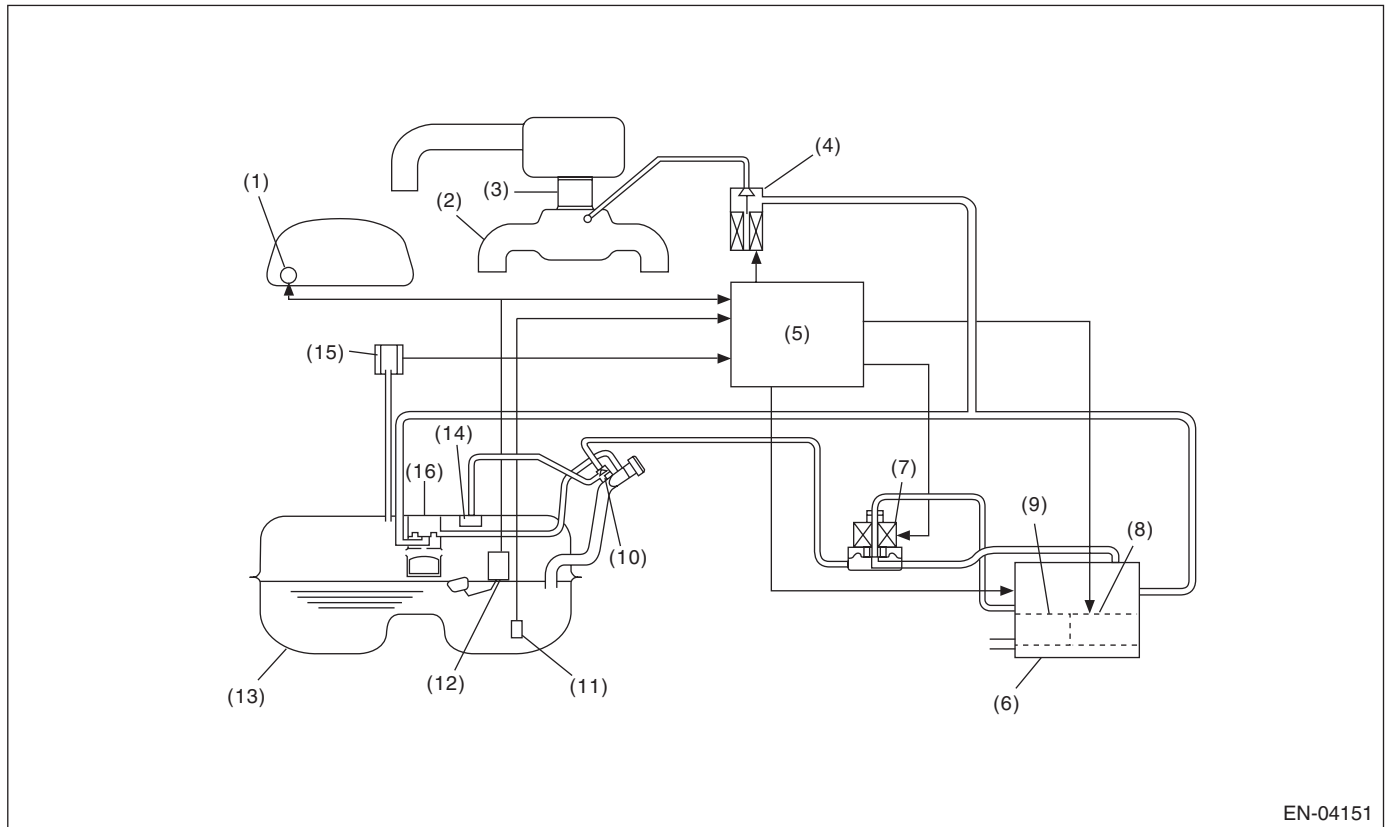
### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## BF:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

### 1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.



EN-04151

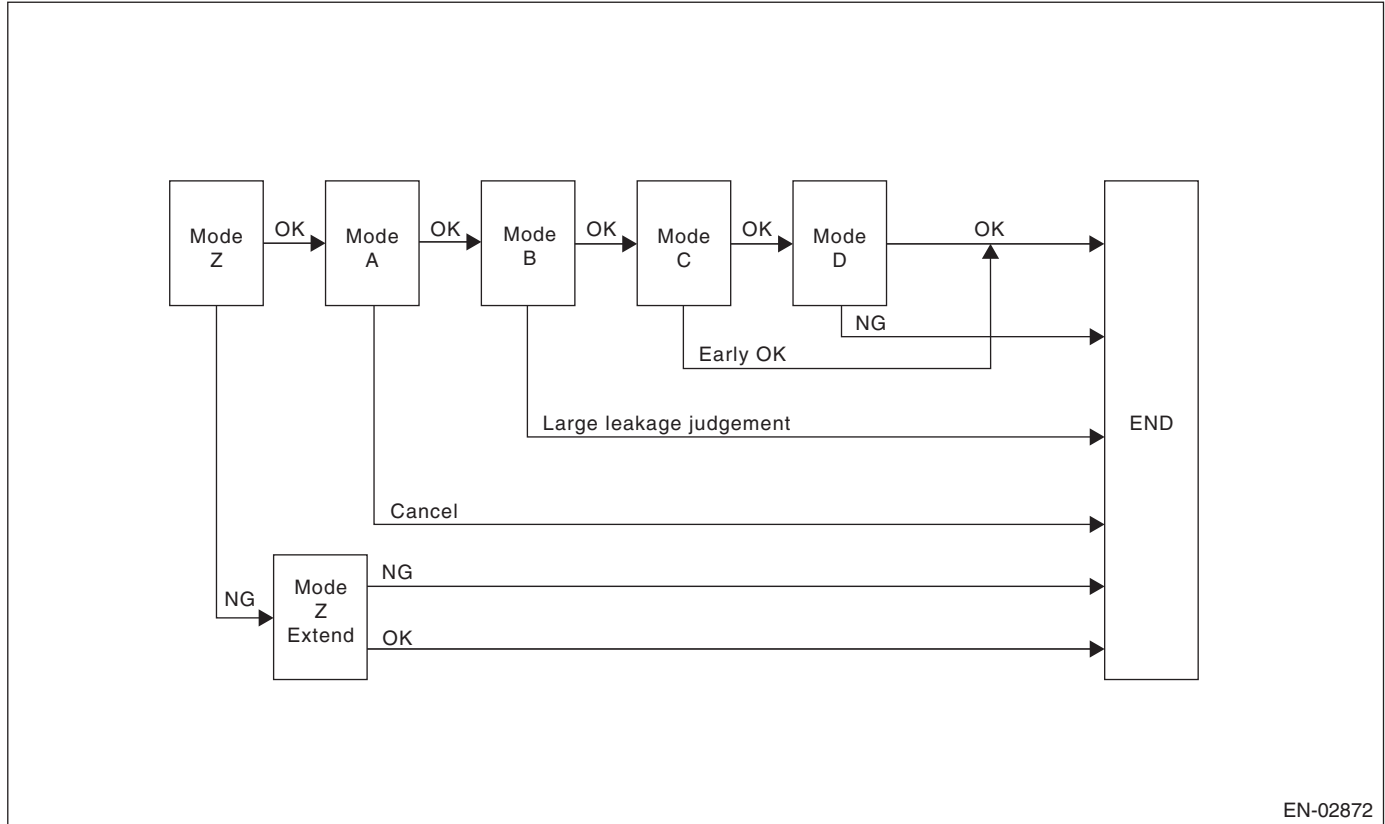
- |                                  |                              |                                |
|----------------------------------|------------------------------|--------------------------------|
| (1) Fuel gauge                   | (7) Pressure control valve   | (12) Fuel level sensor         |
| (2) Intake manifold              | (8) Drain valve              | (13) Fuel tank                 |
| (3) Throttle body                | (9) Drain filter             | (14) Fuel cut valve            |
| (4) Purge control solenoid valve | (10) Shut-off valve          | (15) Fuel tank pressure sensor |
| (5) Engine control module (ECM)  | (11) Fuel temperature sensor | (16) Vent valve                |
| (6) Canister                     |                              |                                |

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 0.04-inch Diagnosis



EN-02872

Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve opening failure diagnosis)	Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start.	0 ms + 3000 ms — 0 ms + 3000 ms + 13000 ms
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	10000 ms
Mode B (Sealed negative pressure, large leakage judgment)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak.	0 — 10000 ms + 25000 ms
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment.	0 — 18500 ms
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value.	0 ms + 10000 ms

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Mode Table for Evaporative Emission Control System Diagnosis

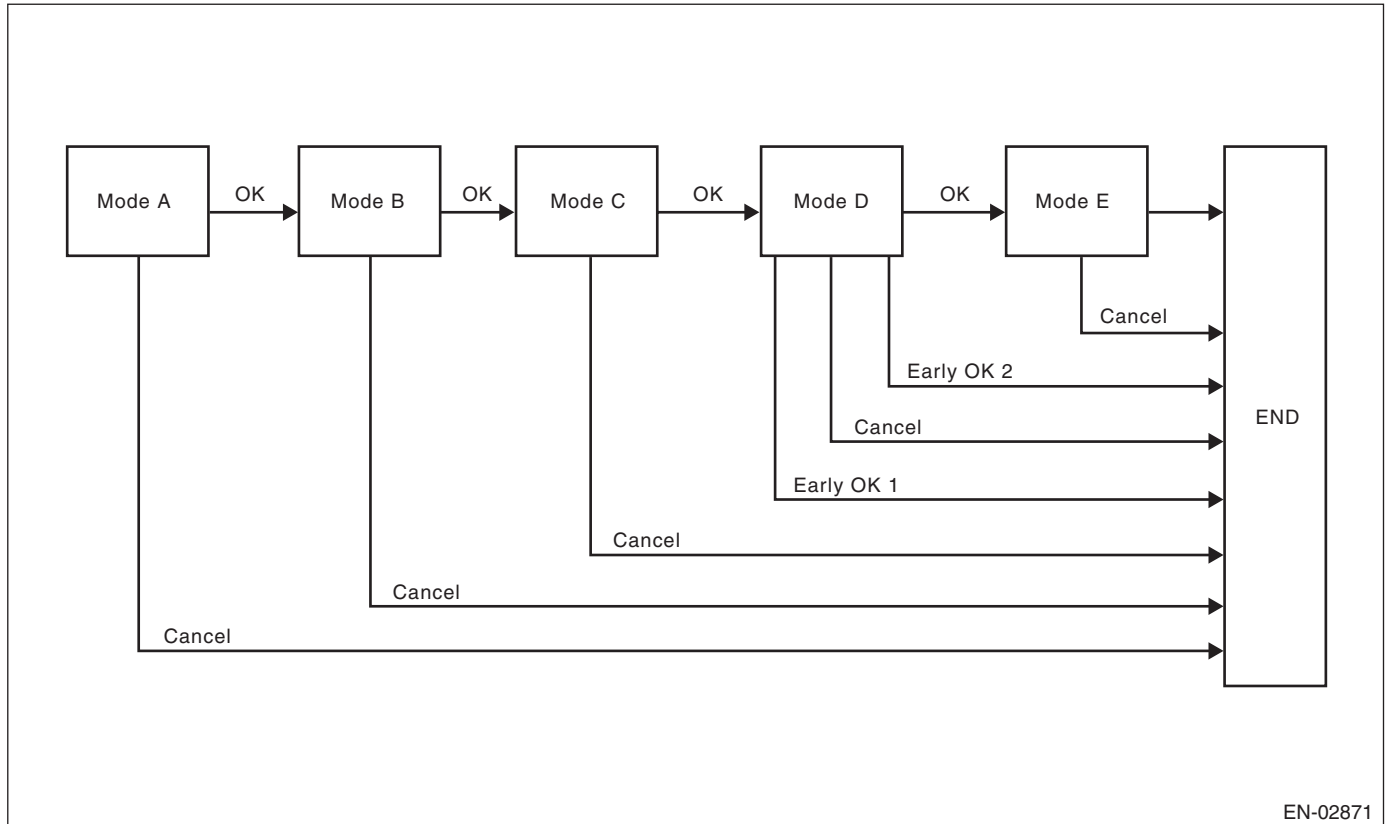
Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg))	Purge control solenoid valve is judged to be open.	P0457
Mode A	Pressure is in proportion to amount of evaporative emission.	—	None
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leak	P0457
Mode C	Reaches target pressure	—	None
Mode D	Pressure change is small.	EVAP system large leak determination. [1.0 mm (0.04 in)]	P0442



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 0.02-inch Diagnosis



Mode	Mode Description	Diagnosis Period
Mode A (0 point compensation)	When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg).	0 — Value of Map 1
Mode B (Negative pressure introduced)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank.	0 — Value of Map 2
Mode C (Negative pressure maintained)	Wait until the tank pressure returns to the target (start level of P2 calculation).	0 — 20000 ms + 0 + Value of Map 2
Mode D (Negative pressure change calculated)	Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment.	0 — 0 ms + 200000 ms
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + 200000 ms + Value of Map 3

#### Map1

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	12000	12000	11000	10000	7500	5000	5000

#### Map2

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	21000	21000	21500	22000	22000	22000	22000

#### Map 3

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	60000	60000	60000	60000	60000	60000	60000

# Diagnostic Trouble Code (DTC) Detecting Criteria

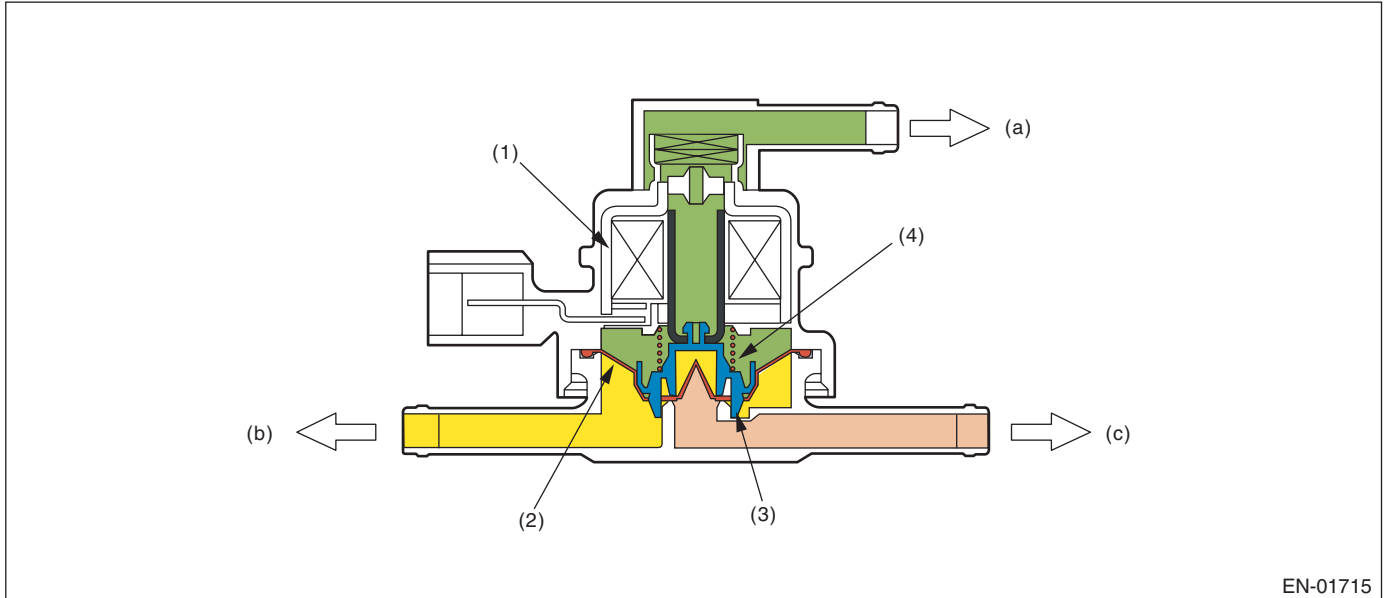
GENERAL DESCRIPTION

## 2. COMPONENT DESCRIPTION

### Pressure control solenoid valve

PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.

The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.



- (1) Solenoid
- (2) Diaphragm

- (3) Valve
- (4) Spring

- (a) Barometric pressure
- (b) Fuel tank
- (c) Canister

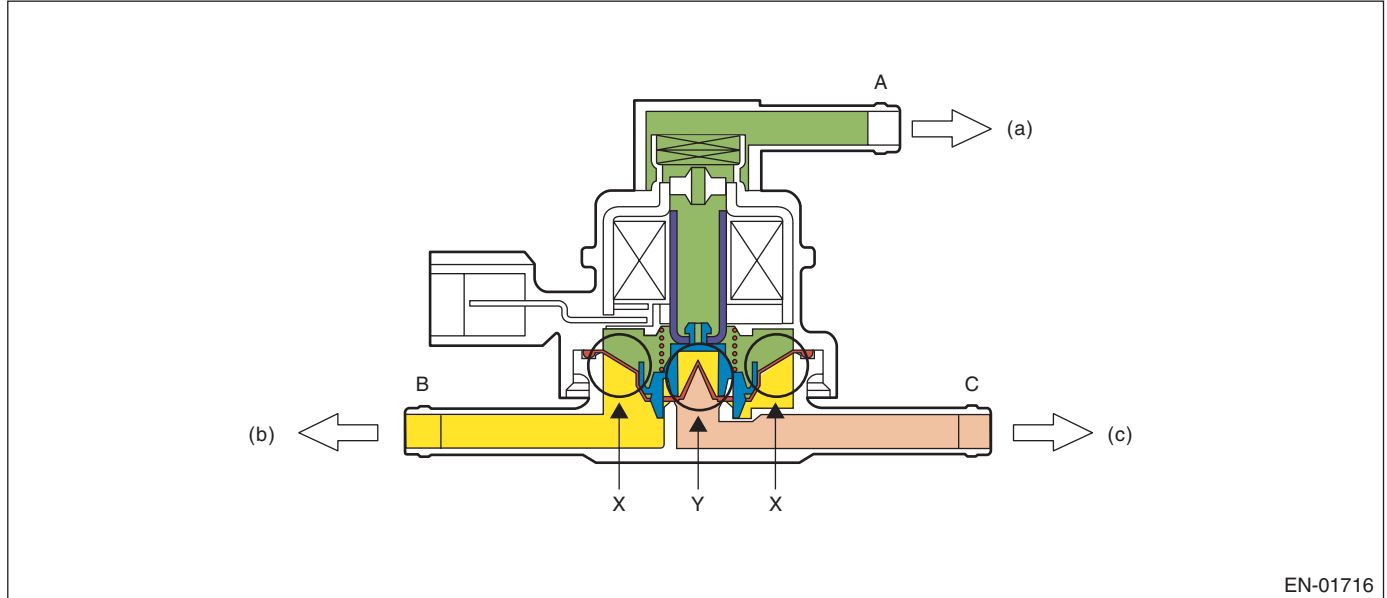
# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Valve Operation and Air Flow

In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.

If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



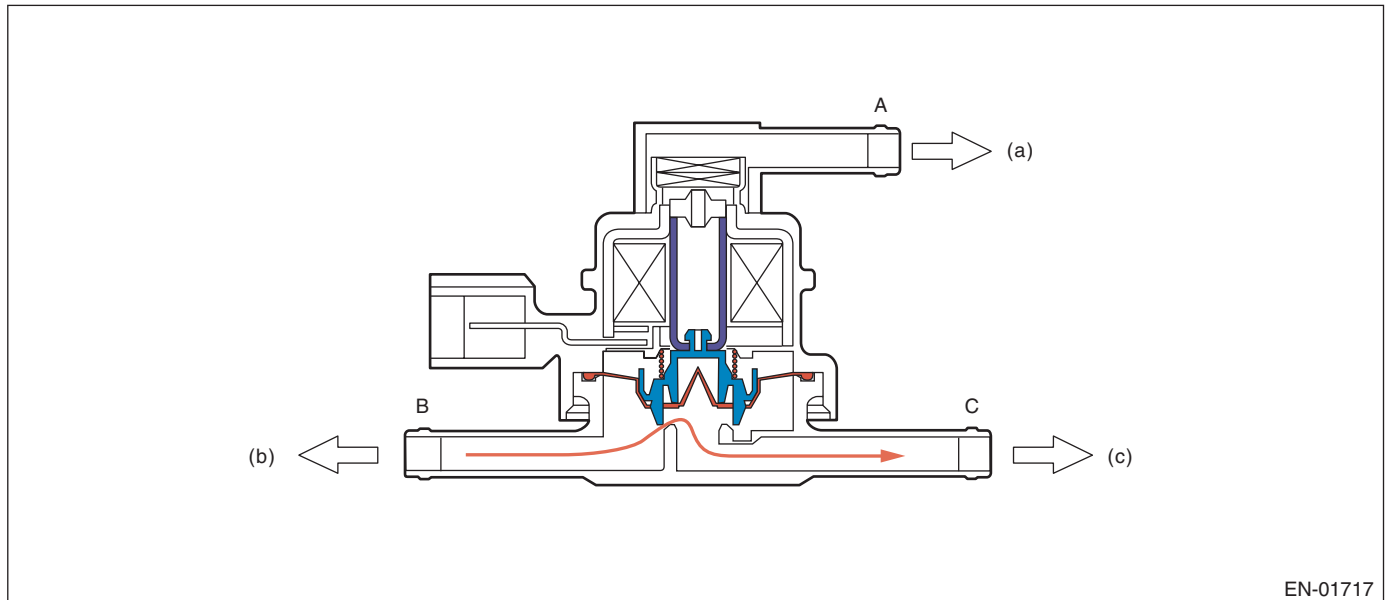
(a) Barometric pressure

(b) Fuel tank

(c) Canister

Condition of pressure	Flow
$A < B$ (solenoid OFF)	$B \rightarrow C$
$B < C$ (solenoid OFF)	$C \rightarrow B$
Solenoid ON	$B \leftrightarrow C$

### When $A < B$ (solenoid OFF)



(a) Barometric pressure

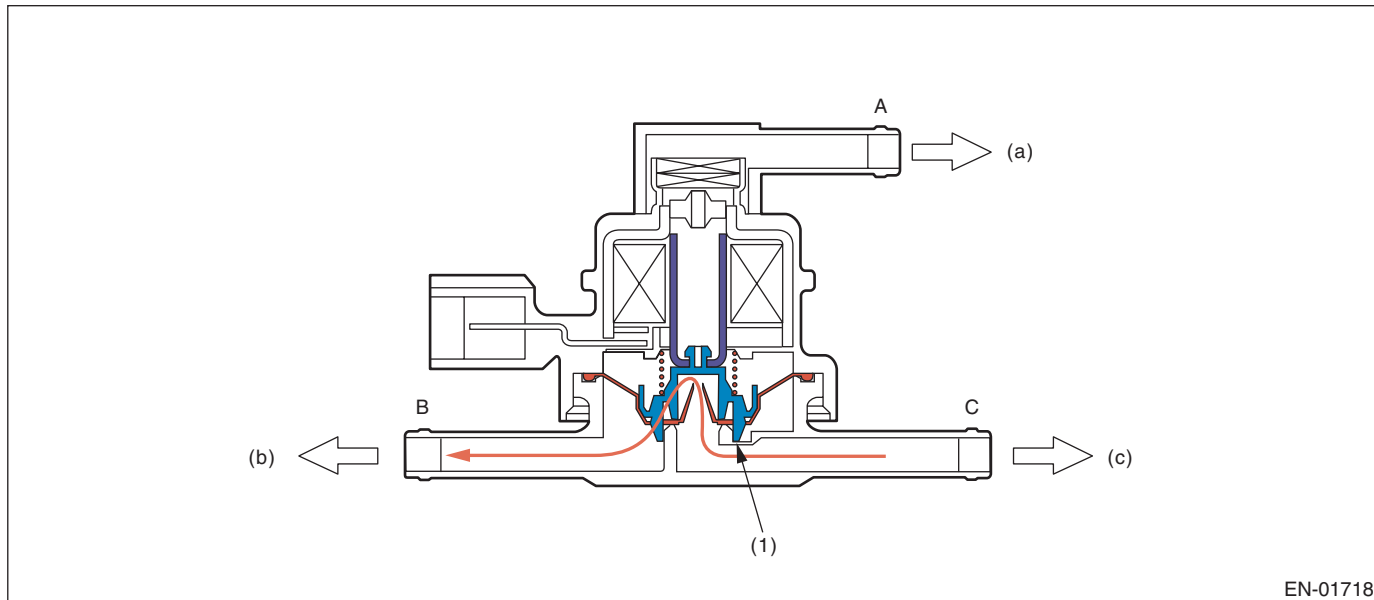
(b) Fuel tank

(c) Canister

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## When $B < C$ (solenoid OFF)



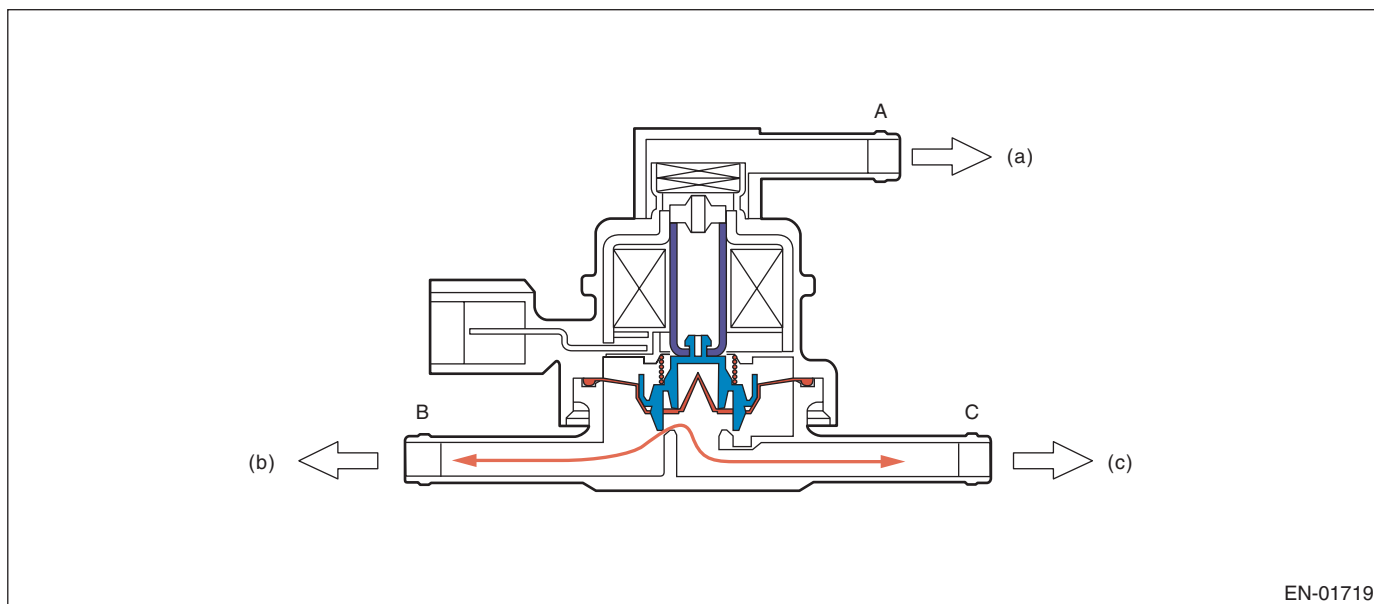
(1) Valve

(a) Barometric pressure

(b) Fuel tank

(c) Canister

## When Solenoid is ON



(a) Barometric pressure

(b) Fuel tank

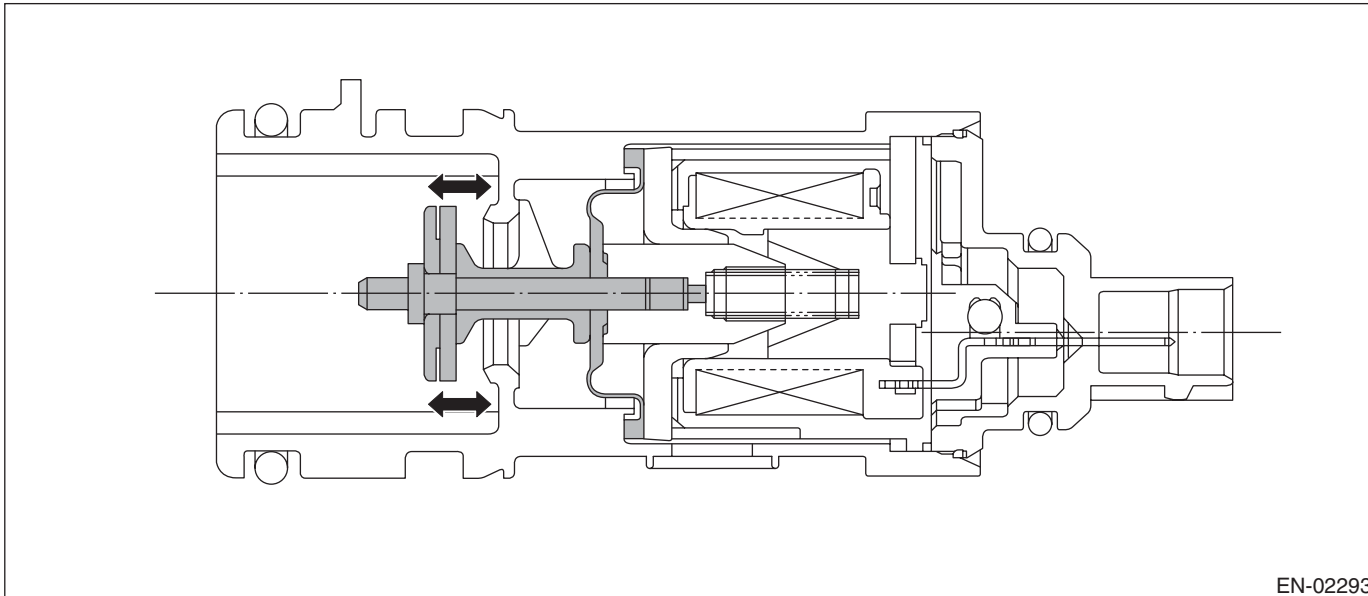
(c) Canister

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Drain valve

Drain valve controls the ambient air to be introduced to the canister.



EN-02293

## 3. ENABLE CONDITION

### 0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75.05 \text{ kPa}$ (563 mmHg, 22.165 inHg)
Total time of canister purge operation	$\geq 120000 \text{ ms}$
Elapsed time after starting the engine	$\geq 856 \text{ sec}$
Learning value of evaporation gas density	$< 0.08$
Engine speed	1050 rpm — 6000 rpm
Fuel tank pressure	$\geq -4 \text{ kPa}$ (-30 mmHg, -1.181 inHg)
Intake manifold relative vacuum (relative pressure)	$\geq -26.66 \text{ kPa}$ (-200 mmHg, -7.874 inHg)
Vehicle speed	$\geq 32 \text{ km/h}$ (19.9 MPH)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Closed air/fuel ratio control	In operation
Fuel temperature	$-10 \text{ }^\circ\text{C}$ (14 $^\circ\text{F}$ ) — $45 \text{ }^\circ\text{C}$ (113 $^\circ\text{F}$ )
Intake air temperature	$\geq -10 \text{ }^\circ\text{C}$ (14 $^\circ\text{F}$ )
Pressure change every one second	$< 1.7 \text{ mmHg}$ (Mode A) $< 1.7 \text{ mmHg}$ (Mode D)
Minimum pressure change value every one second – Maximum pressure change value every one second	$< 1.7 \text{ mmHg}$ (Mode A) $< 1.7 \text{ mmHg}$ (Mode D)
Change of fuel level per 128 milliseconds	$< 2 \text{ L}$ (0.528 US gal, 0.44 Imp gal)
Air fuel ratio	0.76 — 1.25

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
<b>At starting a diagnosis</b>	
Evap. diagnosis	Incomplete
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	> 120000 ms
When cancelling in other than mode A	> 600000 ms
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 120 sec
Fuel temperature	-10 °C (14 °F) — 55 °C (131 °F)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Intake manifold relative vacuum (relative pressure)	≥ -8 kPa (-60 mmHg, -2.362 inHg)
Fuel tank pressure	-0.67 kPa (-5 mmHg, -0.197 inHg) — 1.43 kPa (10.7 mmHg, 0.421 inHg)
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 6000 rpm
<b>During diagnosis</b>	
Change of fuel level	≤ Value of Map 4
Pressure change every one second	< 0.06 kPa (0.44 mmhg, 0.017 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 0.07 kPa (0.51 mmhg, 0.02 inHg) (Mode D)
Pressure change in tank every second	≤ 0.1 kPa (0.75 mmhg, 0.03 inHg)
Barometric pressure change	-0.48 kPa (-3.6 mmhg, -0.142 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode D) -0.32 kPa (-2.4 mmhg, -0.094 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode E)

## Map4

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Change (ℓ, US gal, Imp gal)	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1

## 4. GENERAL DRIVING CYCLE

### 0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

### 0.02-inch Diagnosis

- Perform the diagnosis 125 seconds or more at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 5. DIAGNOSTIC METHOD

#### Purge control solenoid valve stuck open fault diagnosis

DTC

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

#### Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

#### Diagnostic method

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

#### • Abnormality Judgment

If OK judgment cannot be made, extend Mode Z 16, and Judge as NG when the following conditions are established after predetermined amount of time.

#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	> 0.87 kPa (6.5 mmHg, 0.256 inHg)	P0457
evptezini	≤ 1.43 kPa (10.7 mmHg, 0.421 inHg)	
Time of 2 L (0.528 US gal, 0.44 Imp gal) or more fuel no sloshing	≥ 40000 ms	

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 13000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

#### • Normality Judgment

Judge as OK and change to Mode A when the following conditions are established after predetermined time has passed since Mode Z started.

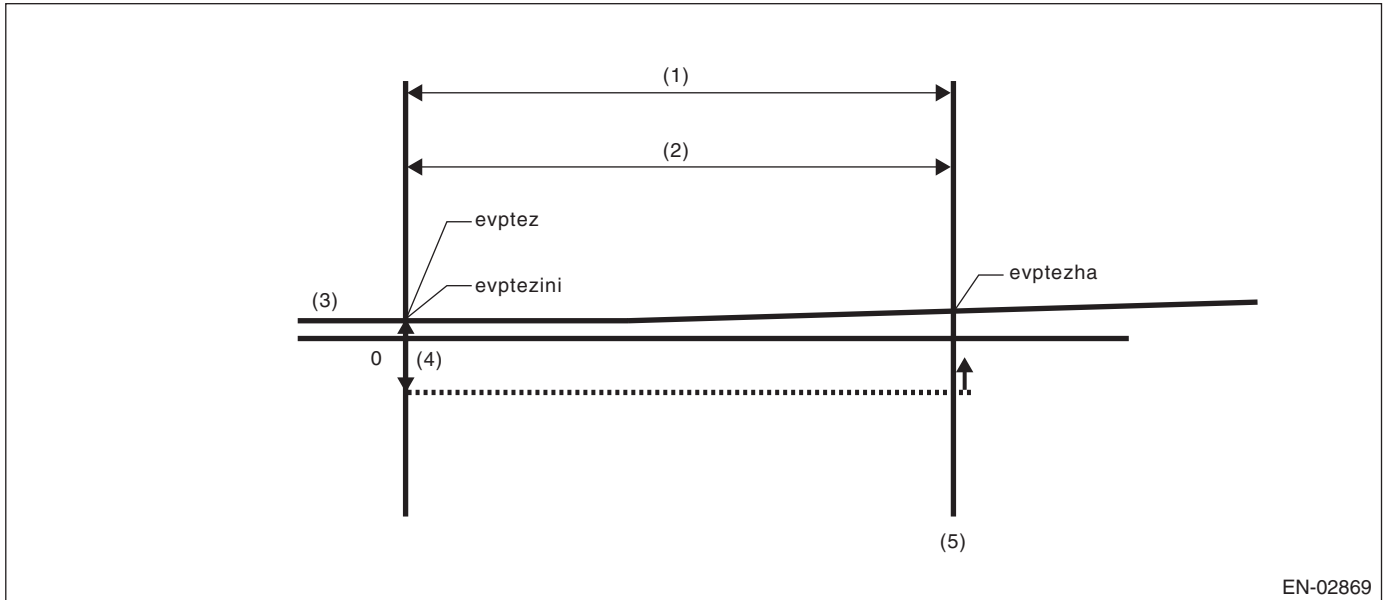
#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	≤ 0.4 kPa (3 mmHg, 0.118 inHg)	P0457

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Normal



(1) Mode Z

(3) Fuel tank pressure

(5) OK judgment

(2) 3000 ms

(4) 0.4 kPa (3 mmHg, 0.118 inHg)

$evptez - evptezha \leq 0.4 \text{ kPa (3 mmHg, 0.118 inHg)}$  Normal when above is established

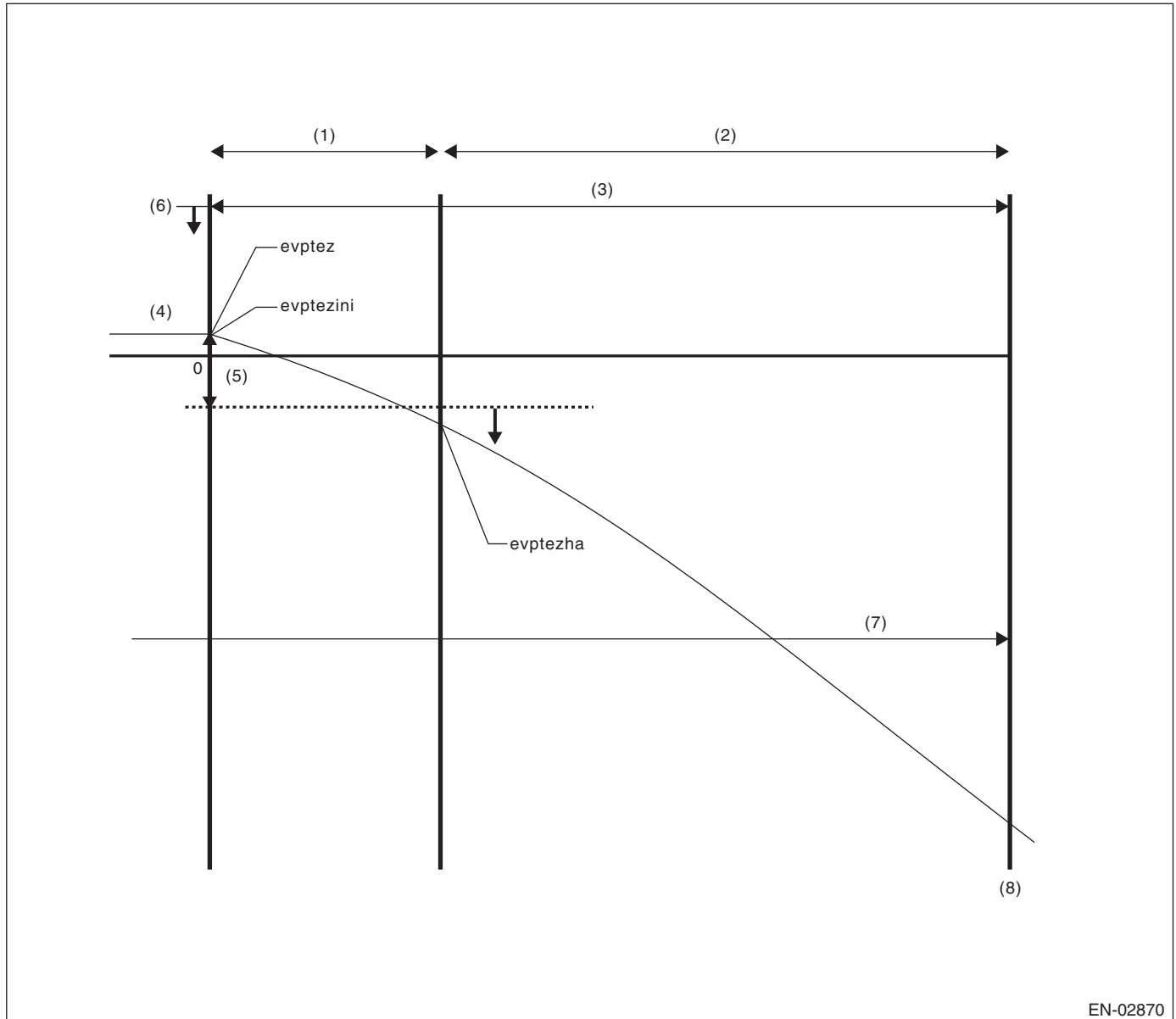
**Time Needed for Diagnosis:** 0 ms + 3000 ms



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Purge control solenoid valve Open Fixation



EN-02870

- |                        |                                      |                               |
|------------------------|--------------------------------------|-------------------------------|
| (1) Mode Z             | (5) 0.87 kPa (6.5 mmHg, 0.256 inHg)  | (7) 40000 ms no fuel sloshing |
| (2) Extended mode Z    | (6) 1.43 kPa (10.7 mmHg, 0.421 inHg) | (8) NG judgment               |
| (3) 3000 ms + 13000 ms |                                      |                               |
| (4) Fuel tank pressure |                                      |                               |

- $evptezini \leq 1.43 \text{ kPa (10.7 mmHg, 0.421 inHg)}$
  - $evptez - evptezha > 0.87 \text{ kPa (6.5 mmHg, 0.256 inHg)}$
  - No fuel sloshing of over 2 L (0.528 US gal, 0.44 Imp gal) lasts for more than 40000 ms.
- Judge as abnormal when all are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Leak Diagnosis

DTC

P0442 Evaporative Emission Control System Leak Detected (Small Leak)

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

### Mode A: (Estimated evaporation gas amount)

Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.

### Mode B: (Negative pressure sealed)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -1.4 kPa (0 → -10.5 mmHg, 0 → -0.413 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.

### Abnormality Judgment

Judge as NG (large leakage) when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time to reach target negative pressure or Mode B time (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started)	≥ 10000 ms + 25000 ms  ≥ 10000 ms  > -0.33 kPa (-2.5 mmHg, -0.098 inHg)	P0457

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms

### Mode C: (Check pressure rise)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D when the tank pressure returns to the start level of P2 calculation.

Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

Tank pressure when starting calculation of P2	Time for advanced OK judgment
-1.3 kPa (-9.75 mmHg, -0.384 inHg)	18500 ms

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18500 ms

### Mode D: (Measure amount of negative pressure change)

Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.

After calculating P2, perform a small leak diagnosis according to the items below.

### When Mode D is ended

Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 - × P1 P2: Tank pressure that changes every 10000 ms in mode D P1: Tank pressure that changes every 10000 ms in mode A	> Value of Map 5	P0442

\*1.5 -: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

### Map 5 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	40 °C (104 °F)	45 °C (113 °F)
0 L (0 US gal, 0 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.35 kPa (2.6 mmHg, 0.102 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.41 kPa (3.05 mmHg, 0.12 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.45 kPa (3.35 mmHg, 0.132 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18500 ms + 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Leak Diagnosis

#### DTC

P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

#### Mode A: (0 point compensation)

When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.

#### Mode B: (Negative pressure introduced)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -2 kPa (0 → -15 mmHg, 0 → -0.591 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Mode C: (Negative pressure maintained)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the predetermined amount of time has passed.

## Mode D: (Calculate the amount of negative pressure change)

Monitor the tank pressure in mode D, calculate (P2) the pressure change in the tank, and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis.

## Normality Judgment

Judge as OK when the following conditions are established.

## Judgment Value

Malfunction Criteria	Threshold Value
<b>Advanced OK judgment 1</b>	
Mode D time	$\geq 0 \text{ ms} + 20000 \text{ ms}$
Tank internal pressure	$\leq \text{Value of Map 6}$
<b>Advanced OK judgment 2</b>	
Mode D time	$\geq 0 \text{ ms} + 200000 \text{ ms}$
P2	$\leq \text{Value of Map 7}$

## Map6

Fuel level ( ℓ , US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	-1.85, -13.9, -0.547	-1.85, -13.9, -0.547	-1.84, -13.8, -0.543	-1.83, -13.7, -0.539	-1.81, -13.6, -0.535	-1.8, -13.5, -0.531	-1.8, -13.5, -0.531

## Map7

Fuel level ( ℓ , US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	0.93, 7, 0.276	0.93, 7, 0.276	0.94, 7.05, 0.278	0.95, 7.1, 0.28	1.09, 8.2, 0.323	1.28, 9.6, 0.378	1.28, 9.6, 0.378

## Mode E: (Evaporation occurrence amount calculation)

Calculate the change of tank pressure with the time evpdset to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
P1	< Value of Map 8

### Map 8 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.25 kPa (1.85 mmHg, 0.073 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)
50 L (13.21 US gal, 11 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
P1	> Value of Map 9

### Map 9 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.4 kPa (3 mmHg, 0.118 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.3 kPa (2.25 mmHg, 0.089 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

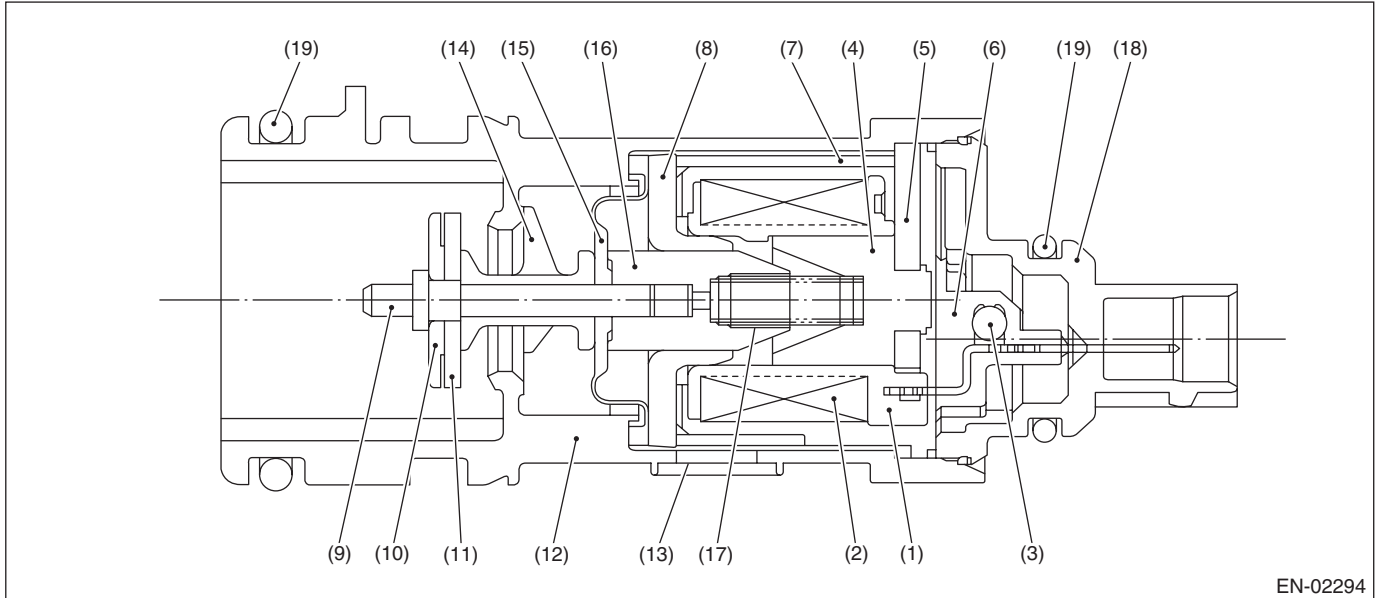
### BG:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (15) Diaphragm    |
| (2) Coil        | (9) Shaft          | (16) Movable core |
| (3) Diode       | (10) Plate         | (17) Spring       |
| (4) Stator core | (11) Valve         | (18) Cover        |
| (5) End plate   | (12) Housing       | (19) O-ring       |
| (6) Body        | (13) Filter        |                   |
| (7) Yoke        | (14) Retainer      |                   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

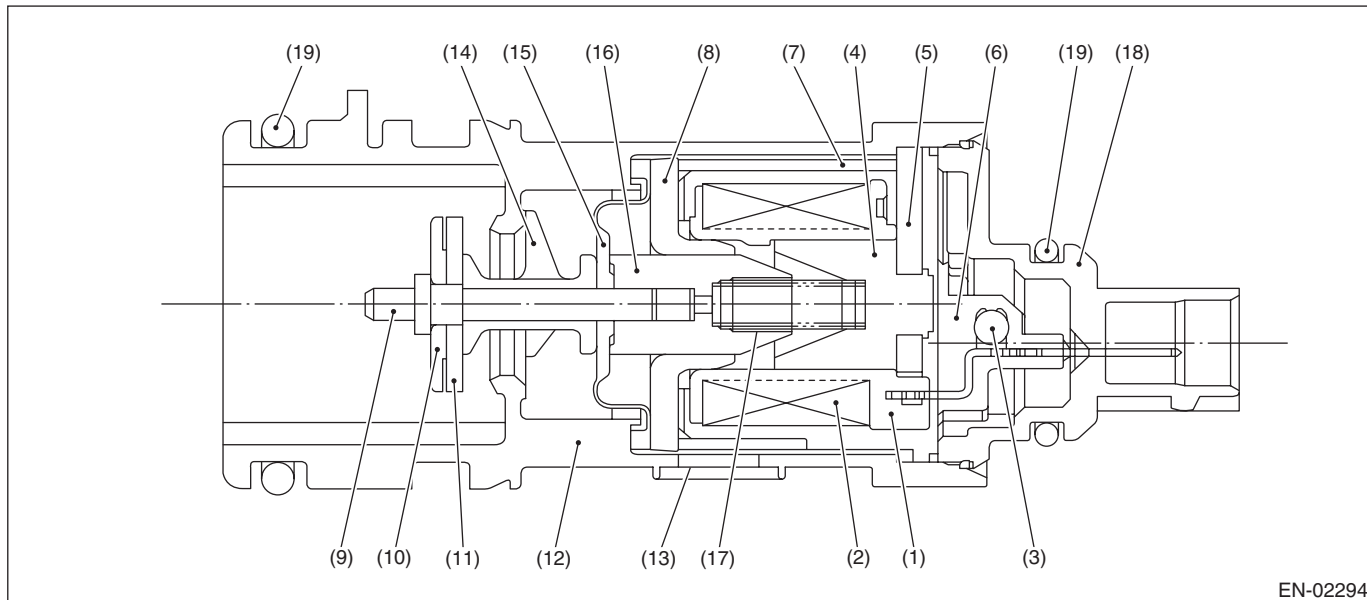
### BH:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (15) Diaphragm    |
| (2) Coil        | (9) Shaft          | (16) Movable core |
| (3) Diode       | (10) Plate         | (17) Spring       |
| (4) Stator core | (11) Valve         | (18) Cover        |
| (5) End plate   | (12) Housing       | (19) O-ring       |
| (6) Body        | (13) Filter        |                   |
| (7) Yoke        | (14) Retainer      |                   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

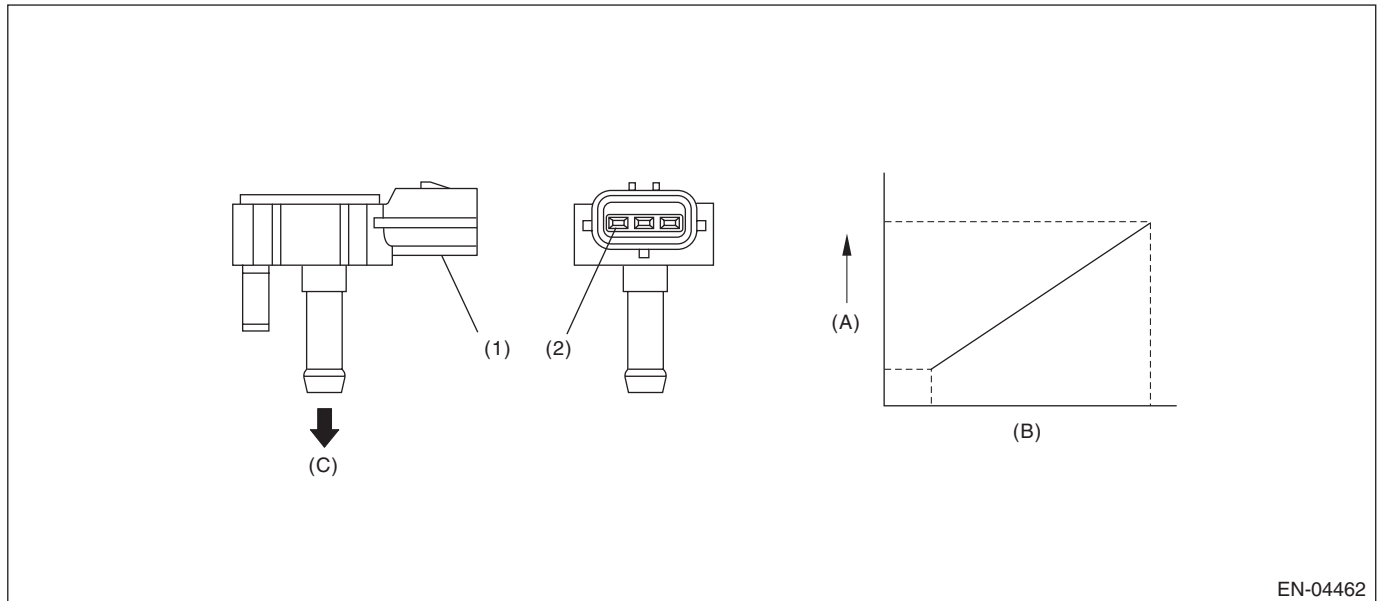
### BI: DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

#### 1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.

Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

#### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	$\geq 60$ sec
Fuel level	$\geq 9.6$ L (2.536 US gal, 2.112 Imp gal)
Fuel temperature	$< 35$ °C (95 °F)
Battery voltage	$\geq 10.9$ V
Barometric pressure	$\geq 75.05$ kPa (563 mmHg, 22.165 inHg)

#### 4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 sec have passed since the engine started.
- Pay attention to the fuel level and temperature.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Number of times that the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more (with enable condition established)	≥ 16 time
Maximum – Minimum tank pressure (with enable condition completed)	< 0.05 kPa (0.375 mmHg, 0.015 inHg)
Maximum – Minimum fuel temperature (with enable condition completed)	≥ 7 °C (44.6 °F)

If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is less than 2 L (0.528 US gal, 0.44 Imp gal), extend 60 sec and make judgment with the Max. and Min. values for the fuel level in 60 sec × 2. If a difference does not appear, extend the time (60 sec × 3, 60 sec × 4, 60 sec × 5) and continue the judgment. If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

**Time Needed for Diagnosis:** 60 sec × 16 time or more

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Maximum – Minimum tank pressure	≥ 0.05 kPa (0.375 mmHg, 0.015 inHg)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

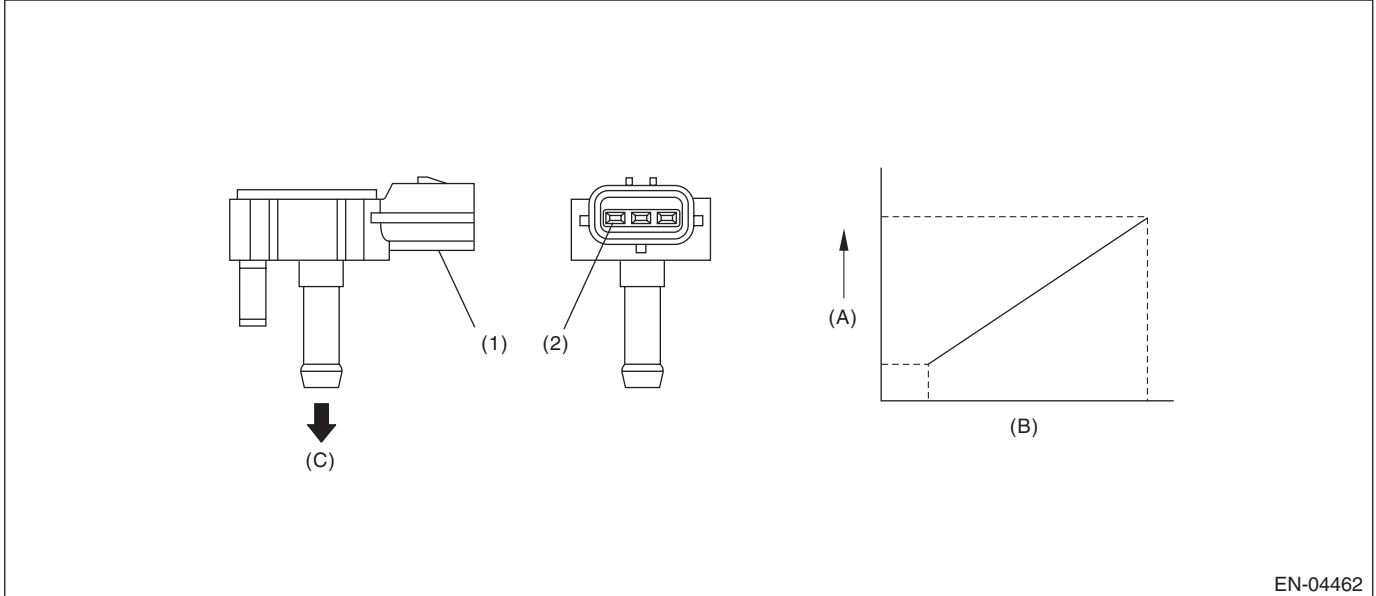
## GENERAL DESCRIPTION

### BJ:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< -7.41 kPa (-55.6 mmHg, -2.189 inHg)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ -7.41 kPa (-55.6 mmHg, -2.189 inHg)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

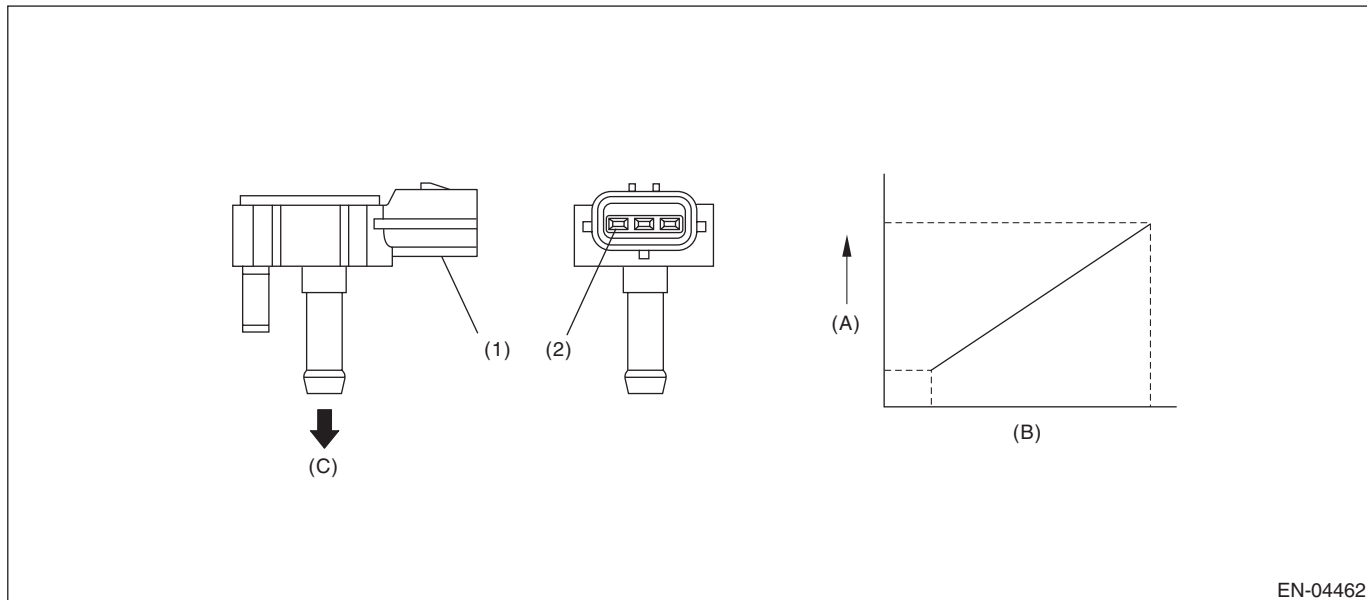
### BK:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-04462

(1) Connector

(2) Terminals

(A) Output voltage

(B) Input voltage

(C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 5000$ ms
Vehicle speed	$\geq 2$ km/h (1.2 MPH)
All conditions of EVAP canister purge	Completed
Learning value of evaporation gas concentration (left and right)	$< 0.08$
Main feedback compensation coefficient (left and right)	$\geq 0.9$
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ 7.94 kPa (59.6 mmHg, 2.346 inHg)
Fuel temperature	< 35 °C (95 °F)
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< 7.94 kPa (59.6 mmHg, 2.346 inHg)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **BL:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)**

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-127, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BM:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)**

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-127, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

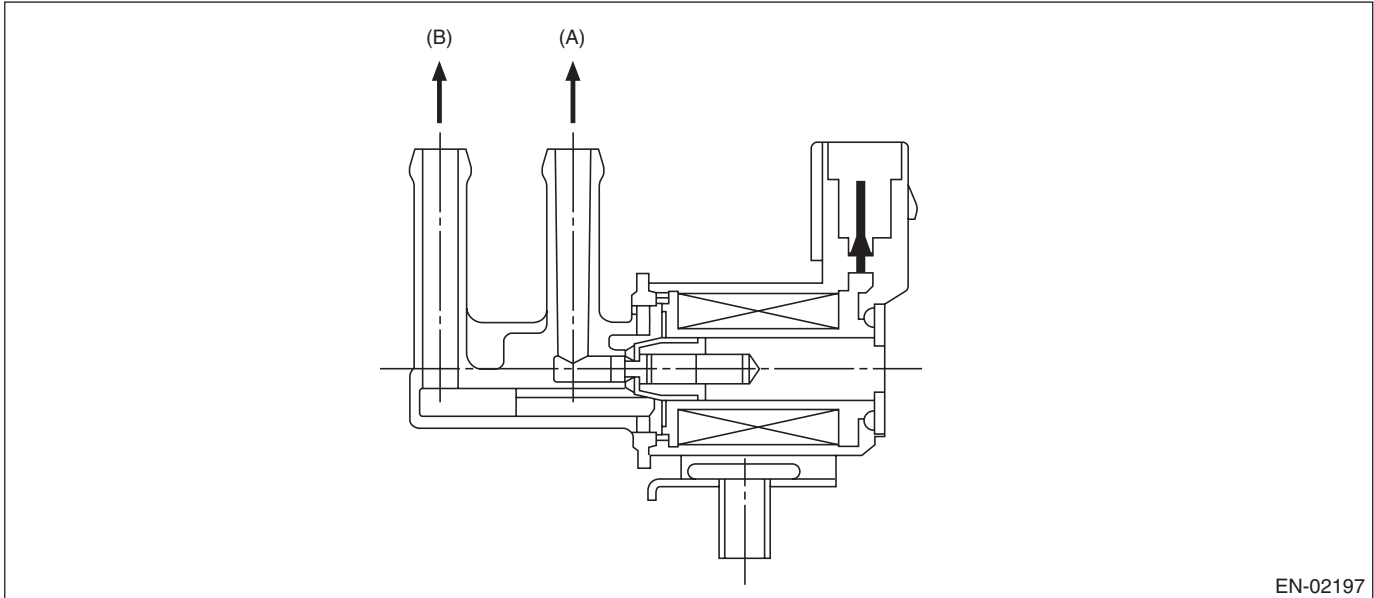
### BN:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	< 0.75
Terminal output voltage	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

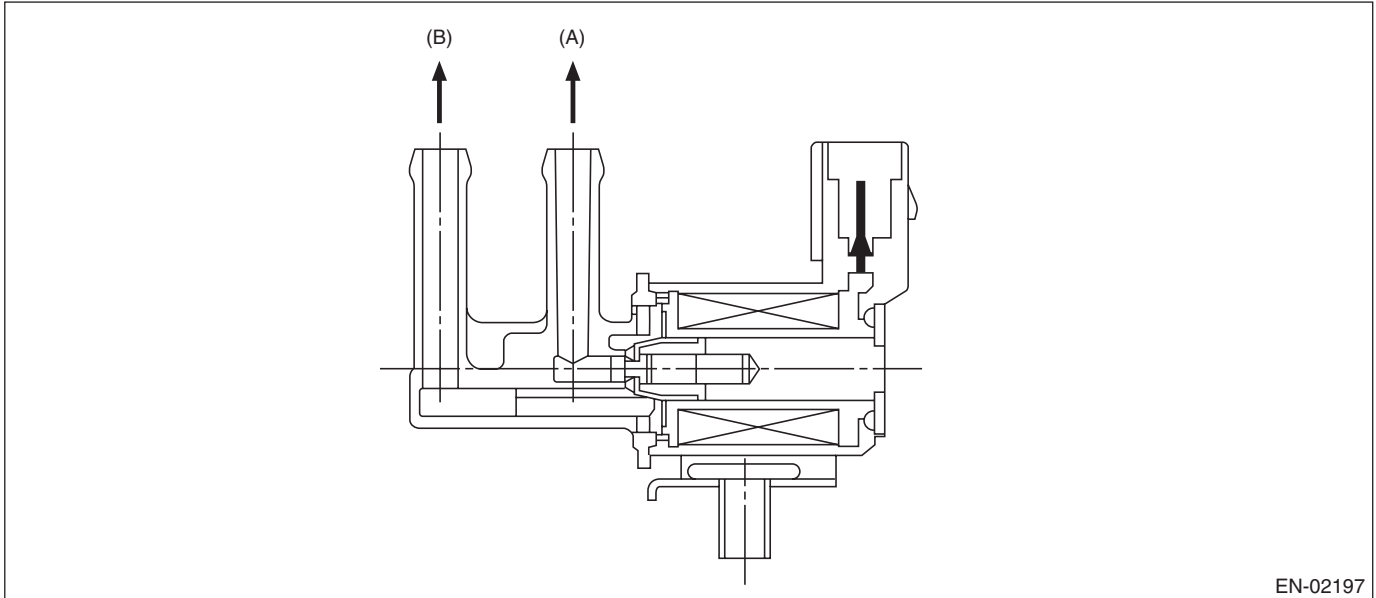
### BO:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	$\geq 0.25$
Terminal output voltage	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

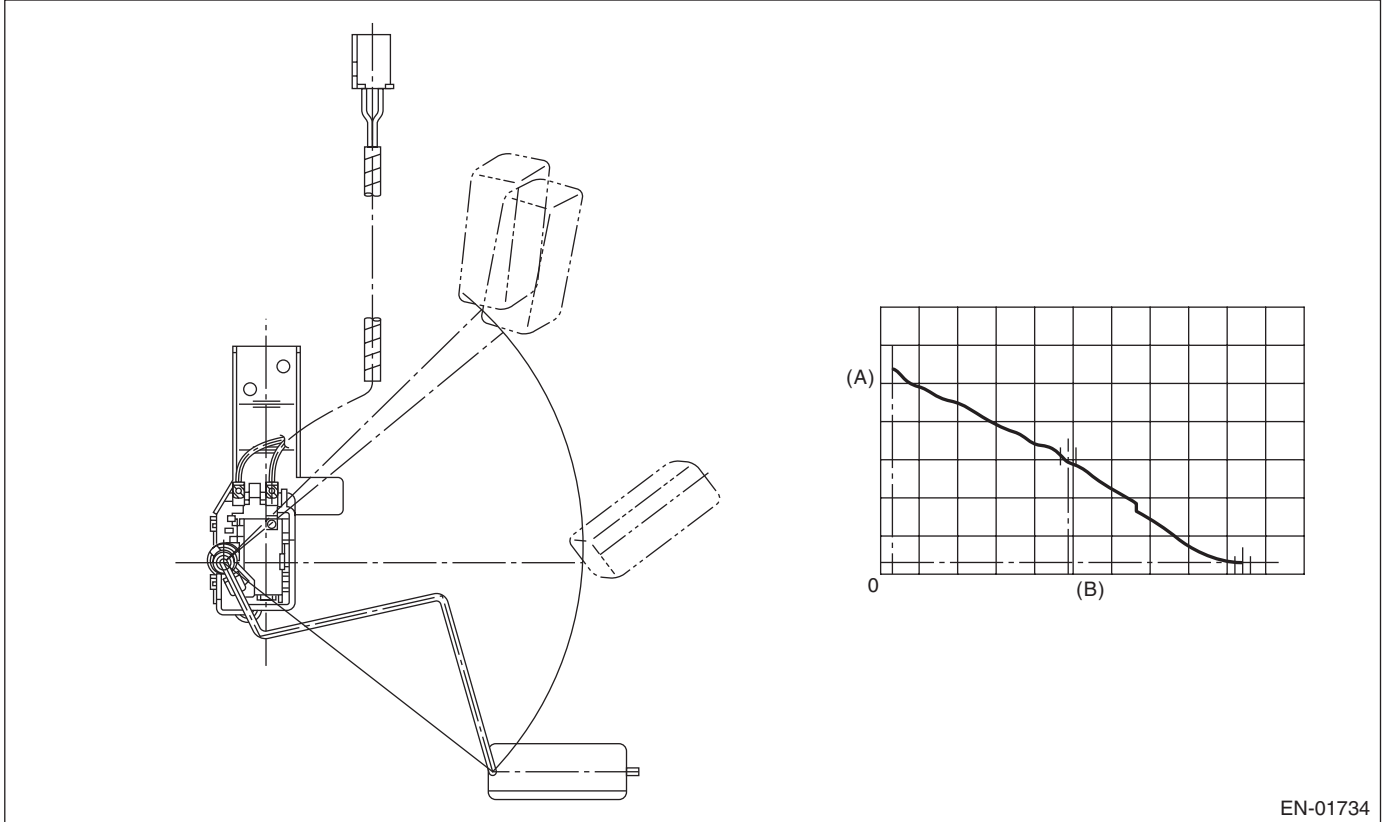
### BP:DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

#### 2. COMPONENT DESCRIPTION



EN-01734

(A) Fuel level

(B) Resistance

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	< 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6000 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	≥ 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6000 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

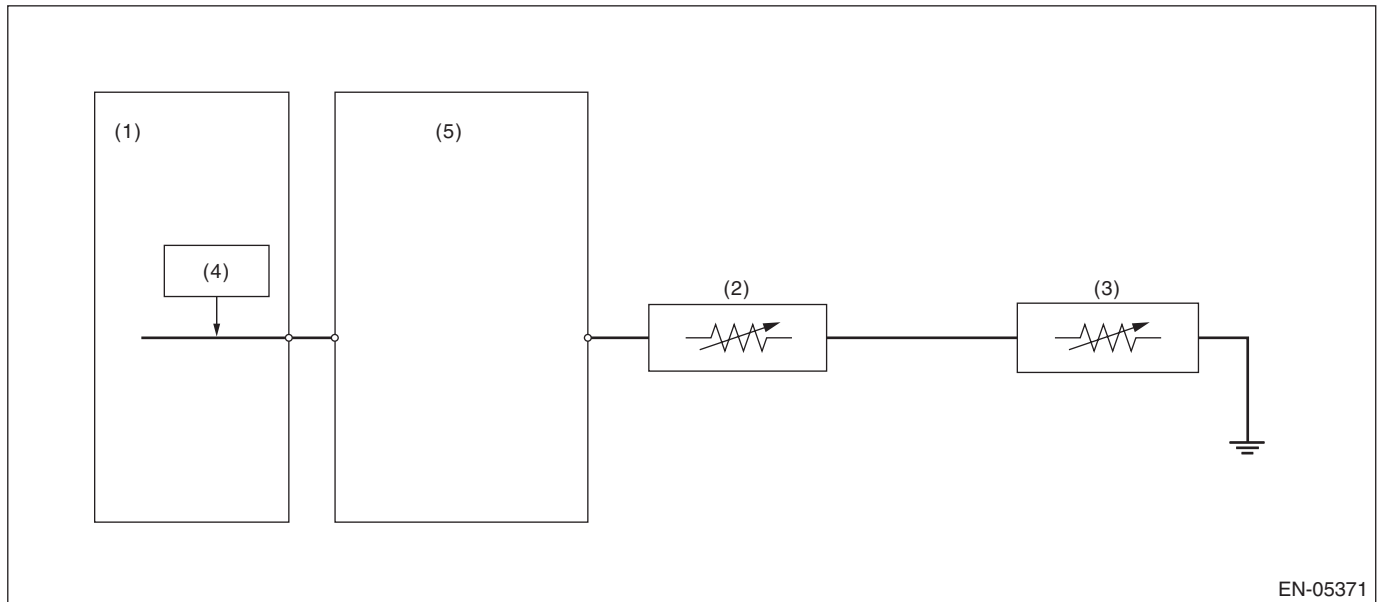
## GENERAL DESCRIPTION

### BQ:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-05371

(1) Engine control module (ECM)

(2) Fuel level sensor

(3) Fuel sub level sensor

(5) Body integrated unit

(4) Detecting circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 0.173$ V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 0.173$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

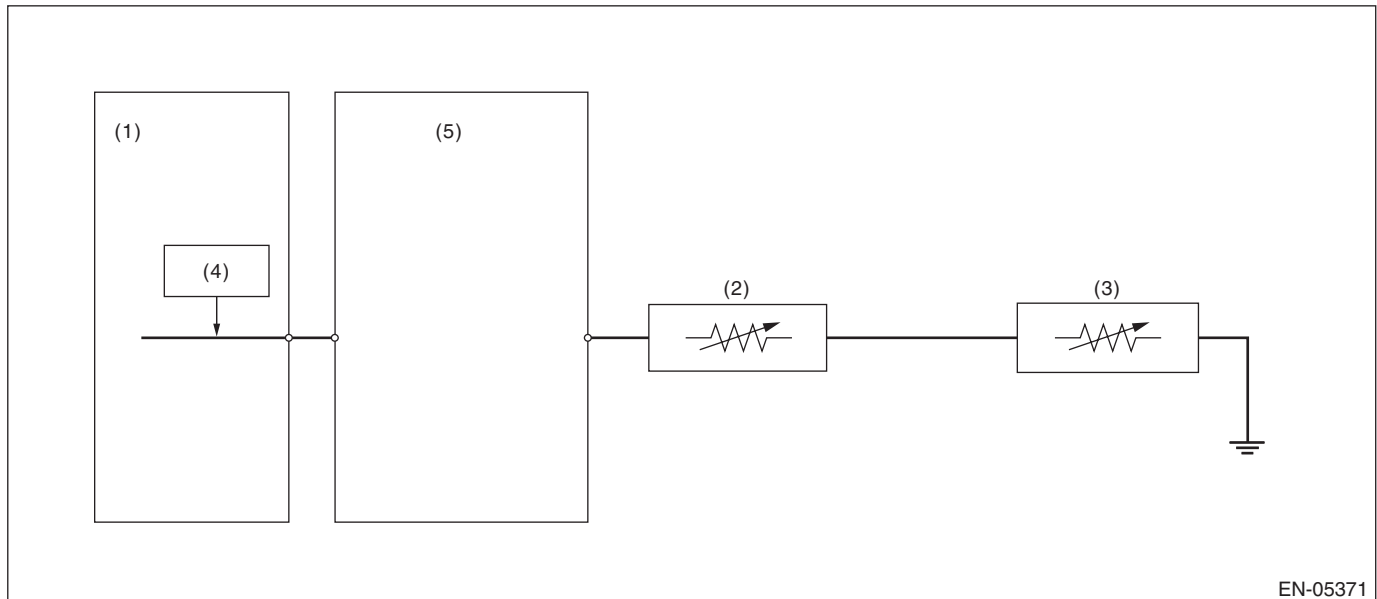
## GENERAL DESCRIPTION

### BR:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-05371

(1) Engine control module (ECM)

(3) Fuel sub level sensor

(4) Detecting circuit

(2) Fuel level sensor

(5) Body integrated unit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 7.212$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 7.212$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### BS:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

#### 1. OUTLINE OF DIAGNOSIS

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

#### 2. ENABLE CONDITION

Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal) and < 54.4 L (14.372 US gal, 11.968 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

#### 3. GENERAL DRIVING CYCLE

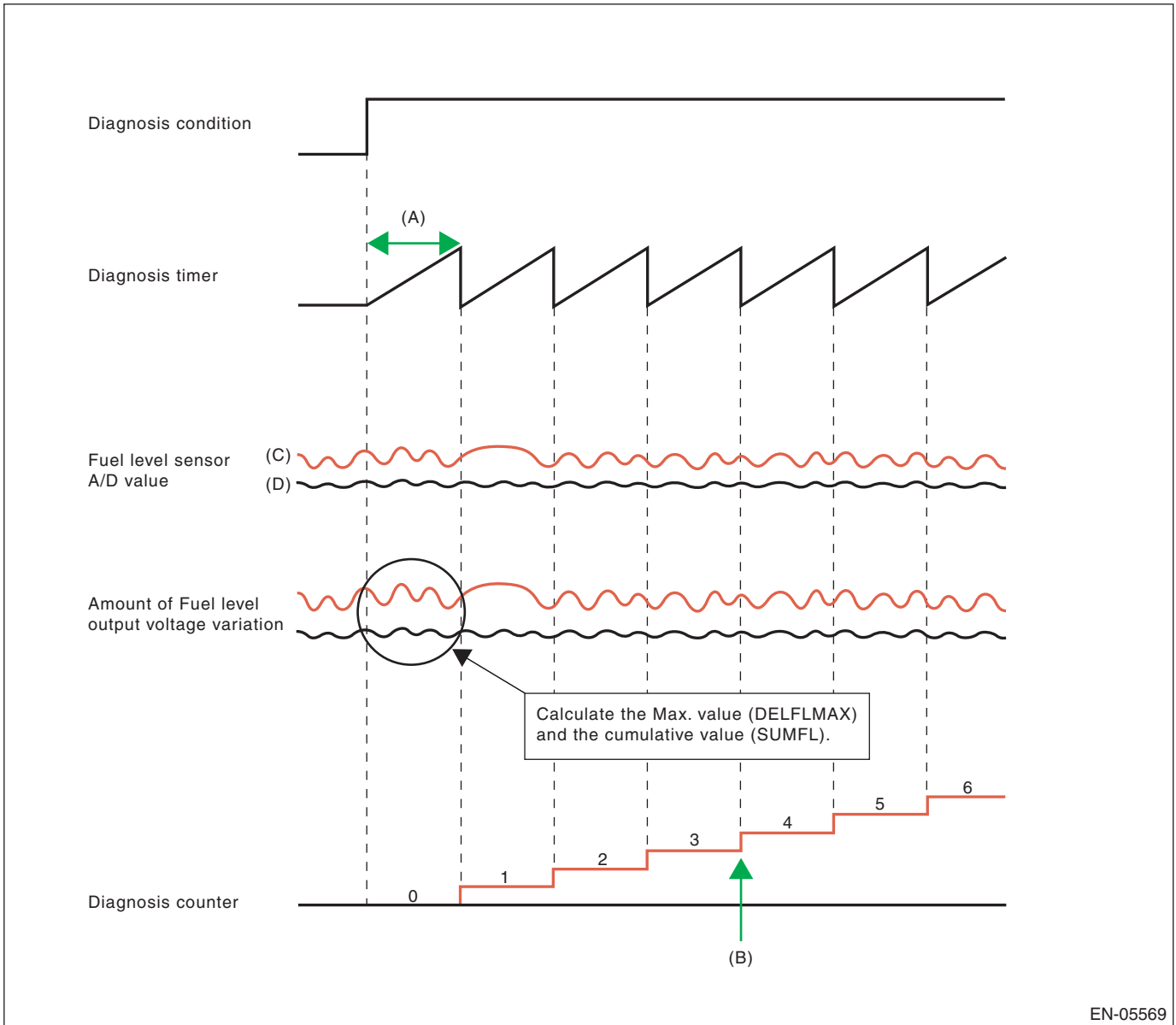
- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

Calculate the Max. value (DELFLMAX) and cumulative value (SUMFL) of output voltage variation of fuel level sensor during 12.2 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time.



EN-05569

- (A) 12288 ms
- (B) NG at 4 time

(C) Malfunction

(D) Normal

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, DELFLMAX or SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	≥ 4 time  ≥ Value from Map  ≥ 25.92 V

#### Map

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Measured voltage (V)	0.27	0.27	0.426	0.582	0.738	0.894	0.894

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

Maximum value – Minimum value of change of tank pressure for 12288 ms	≥ 0.05 kPa (0.375 mmHg, 0.015 inHg)
Maximum value – Minimum value of battery voltage for 12288 ms	≥ 0.609 V

**Time Needed for Diagnosis:** 12288 ms × 4 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
DELFLMAX SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	< Value from Map  < 25.92 V

**Time Needed for Diagnosis:** 12288 ms

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BT:DTC P0500 VEHICLE SPEED SENSOR “A”

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.

Judge NG when the received data from ABSCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

#### 2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the ABS control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the ABS control module and hydraulic control unit.

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 2000 ms

#### 4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Front ABS wheel speed sensor status	Malfunction
Either of the following is established	
Front left wheel speed	≥ 300 km/h (186.4 MPH)
Front right wheel speed	≥ 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Front left wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)
Front right wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 2500 ms

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When Clear Memory is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When Clear Memory is performed

## 8. FAIL SAFE

- Accelerator sensor signal process: Not allowed fully closed point learning. (Hold previous value)
- Vehicle speed sensor signal process: Vehicle speed = 10 km/h (6 MPH)
- Fuel cut control: Not allowed vehicle speed 0 km/h (0 MPH) fuel cut. Normally the high vehicle speed fuel cut performs on vehicle speed condition and engine speed, but perform the fuel cut only on engine speed condition (4,400 rpm or more).
- ISC control: Open loop compensation is set to specified value (1 g (0.04 oz)/s). Not allowed ISC feedback volume calculation.
- Air conditioner control: Not allowed air conditioner cut at accelerating.
- Radiator fan control: Both main and sub fan ON
- Gear ratio judgment: Control as fixed in sixth gear

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BU:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed — Targeted engine speed	< -100 rpm
Feedback value for ISC	Max.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed — Targeted engine speed	≥ -100 rpm

**Time Needed for Diagnosis:** 10 sec

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BV:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	≥ 200 rpm
Feedback value for ISC	Min.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	< 200 rpm

**Time Needed for Diagnosis:** 10 sec

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### BW:DTC P0512 STARTER REQUEST CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.  
Judge as ON NG when the starter SW signal remains ON.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Engine condition	After engine starting
Starter OFF signal	Not detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** 180000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Starter OFF signal	Detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## **BX:DTC P0513 INCORRECT IMMOBILIZER KEY**

### **1. OUTLINE OF DIAGNOSIS**

DTC	Item	Outline of Diagnosis
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
P1570	Antenna	Faulty antenna
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
P1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
P1574	Key Communication Failure	Failure of body integrated unit to verify key (transponder) ID code or transponder failure
P1576	EGI Control Module EEPROM	ECM malfunctioning
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
P1578	Meter Failure	Reference code incompatibility between body integrated unit and combination meter

### **2. ENABLE CONDITION**

When starting the engine.

### **3. GENERAL DRIVING CYCLE**

Perform the diagnosis only after starting the engine.

### **4. DIAGNOSTIC METHOD**

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### BY:DTC P0600 SERIAL COMMUNICATION LINK

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

When CAN communications is not possible, and CAN communications with AT is not possible, judge as NG if data from the AT is not normal.

#### 2. COMPONENT DESCRIPTION

ECM and TCM are connected by high speed CAN.

##### *(Common Specifications)*

*CAN Protocol 2.0 B (Active)*

*Frame Format: 11 Bit ID Frame (Standard Frame)*

##### *(High speed CAN)*

*Conforms to ISO11898*

*Communication Speed: 500 kbps*

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge as NG when the following conditions are established.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	set (error)
or	
ID received from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milli-seconds
or	
Data updated from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milli-seconds

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	clear (No error)
ID received from body integrated unit, TCM, ABSCM and VDCCM	Yes
Data updated from body integrated unit, TCM, ABSCM and VDCCM	Yes

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BZ:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

When there is a problem in the main CPU normal RAM, or the sub CPU normal RAM, judge as NG. Judge as OK when both are operating properly.

If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

#### 4. DIAGNOSTIC METHOD

##### Abnormality Judgment

Judge as NG if the criteria below are met.

##### Judgment Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A cannot be read.
Write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 cannot be read.
Sub CPU normal RAM abnormal Write 5AA5 and then read. (Whole area of RAM)	5AA5 cannot be read.
Write A55A and then read. (Whole area of RAM)	A55A cannot be read.

**Time Needed for Diagnosis:** Undetermined

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

##### Judgment Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A can be read.
And write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 can be read.
Sub CPU normal RAM abnormal Write 5AA5 and then read. (Whole area of RAM)	5AA5 can be read.
And write A55A and then read. (Whole area of RAM)	A55A can be read.

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### CA:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### Abnormality Judgment

Judge as NG if the criteria below are met.

##### Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

**Time Needed for Diagnosis:** Undetermined

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

#### 7. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

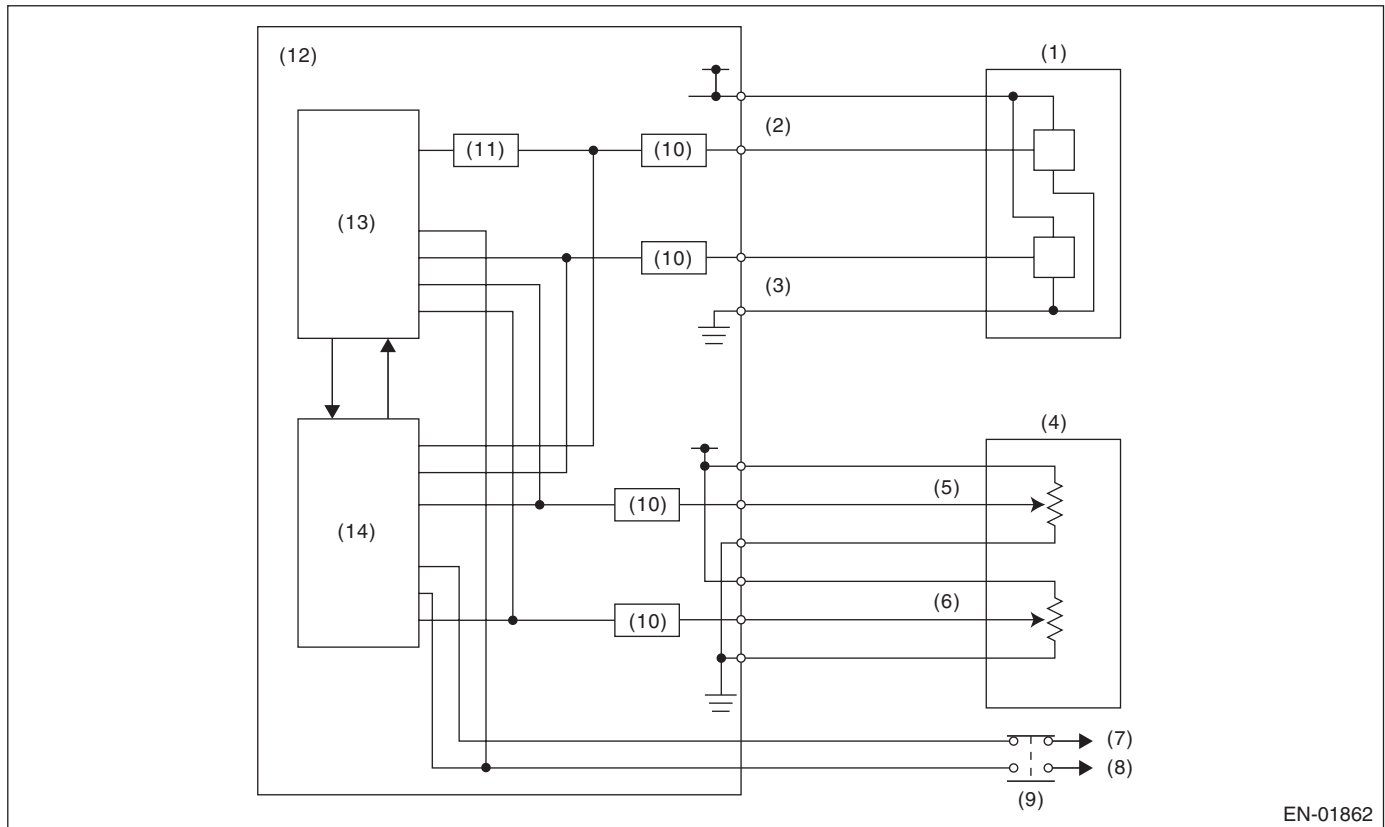
## CB:DTC P0607 CONTROL MODULE PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.

- 1) When the read value of throttle position sensor 1 signal is mismatched between main CPU and sub CPU.
- 2) When the read value of accelerator pedal position sensor 1 signal is mismatched between main CPU and sub CPU.
- 3) When the sub CPU operates abnormally.
- 4) When the communication between main CPU  $\longleftrightarrow$  sub CPU is abnormal.
- 5) When the input amplifier circuit of throttle position sensor 1 is abnormal.
- 6) When the cruise control cannot be canceled correctly.
- 7) When the signal of brake SW1 and 2 is mismatched.

### 2. COMPONENT DESCRIPTION



EN-01862

- |   |   |                                  |
|---|---|----------------------------------|
| (1) Throttle position sensor            | (6) Accelerator pedal position sensor 2 | (11) Amplifier circuit           |
| (2) Throttle position sensor 1          | (7) Battery                             | (12) Engine control module (ECM) |
| (3) Throttle position sensor 2          | (8) Stop light                          | (13) Sub CPU                     |
| (4) Accelerator pedal position sensor   | (9) Brake switch                        | (14) Main CPU                    |
| (5) Accelerator pedal position sensor 1 | (10) I/F circuit                        |                                  |

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(2) Ignition switch	ON
(3) None	—
(4) None	—
(5) Throttle opening angle	
(6) Brake switch (only with cruise control)	ON
(7) None	—

### 4. GENERAL DRIVING CYCLE

- (1) — (4): Always perform the diagnosis continuously.  
(5): Always perform the diagnosis continuously when idling.  
(6): Perform the diagnosis when the brake pedal is depressed.  
(7): Always perform the diagnosis continuously.  
(8): Always perform the diagnosis continuously when the cruise control pedal is not operating.

### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
(1) Difference of CPU reading value of the throttle position sensor signal	$\leq 0.0858 \text{ V}$
(2) Difference of CPU read value of the accelerator pedal position sensor signal	$\leq 0.35 \text{ V}$
(3) WD pulse from sub CPU	WD pulse occur
(4) Communication between CPU	Possible to communicate
(5)  Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	$< 3^\circ$
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal ON
(7) Brake switch 1, 2 signal	SW 1 and 2 are matched

#### Time Needed for Diagnosis:

- 600 milliseconds
- 830 milliseconds
- 200 milliseconds
- 200 milliseconds
- 24 milliseconds
- 250 milliseconds
- 200 milliseconds

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### **8. FAIL SAFE**

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### **9. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

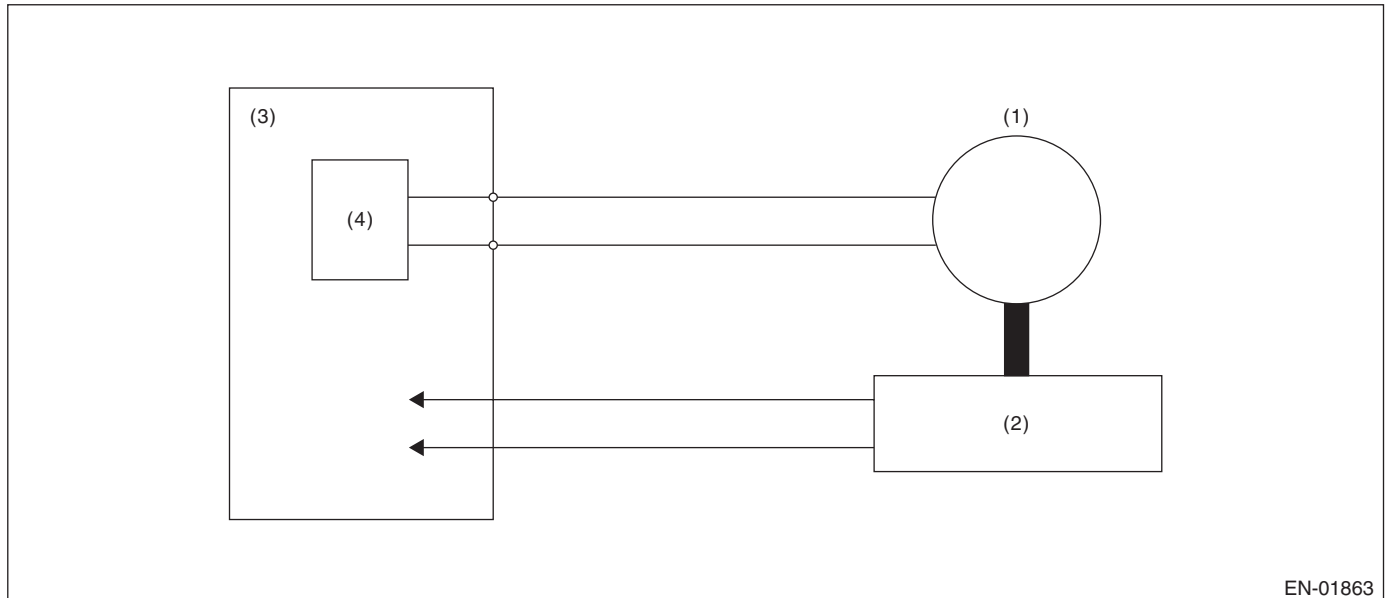
## GENERAL DESCRIPTION

### CC:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

#### 2. COMPONENT DESCRIPTION



EN-01863

- (1) Motor  
(2) Throttle position sensor  
(3) Engine control module (ECM)  
(4) Drive circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Normal operation of electric throttle control	ON

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

#### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

##### Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	3.5° or less
Output duty to drive circuit	95% or less

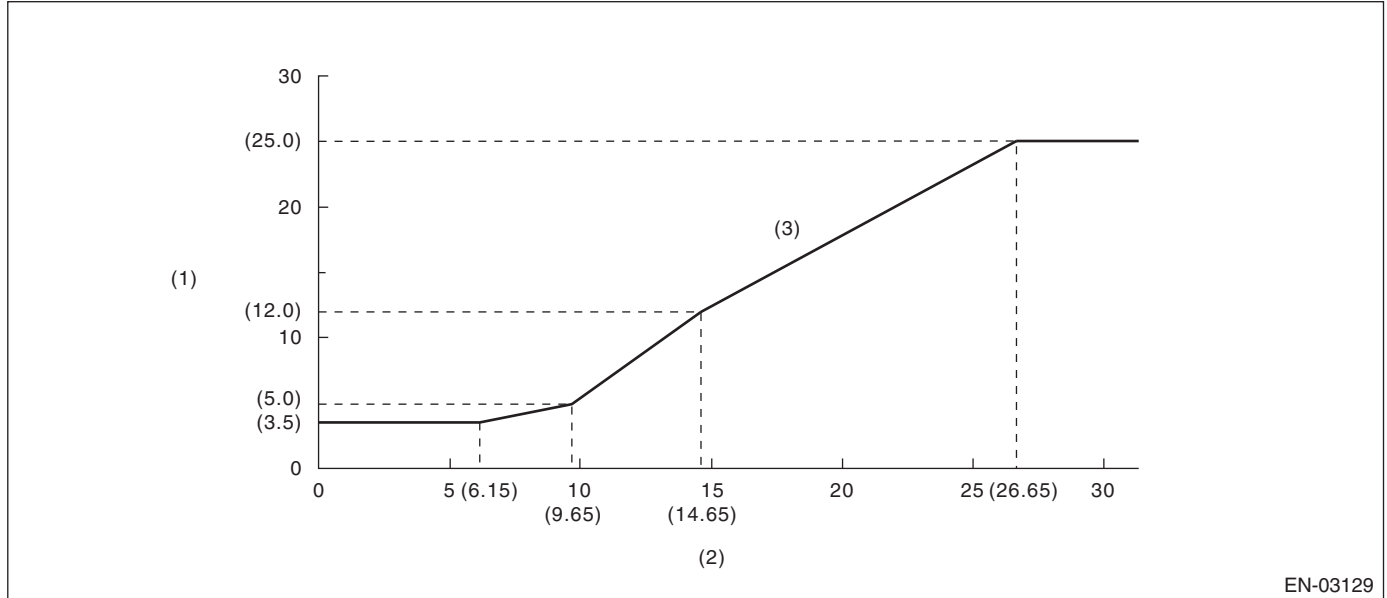
##### Time Needed for Diagnosis:

- Target opening angle and actual opening angle: 250 milliseconds (For NG) 2000 milliseconds (For OK)
- Output duty to drive circuit: 2000 milliseconds

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

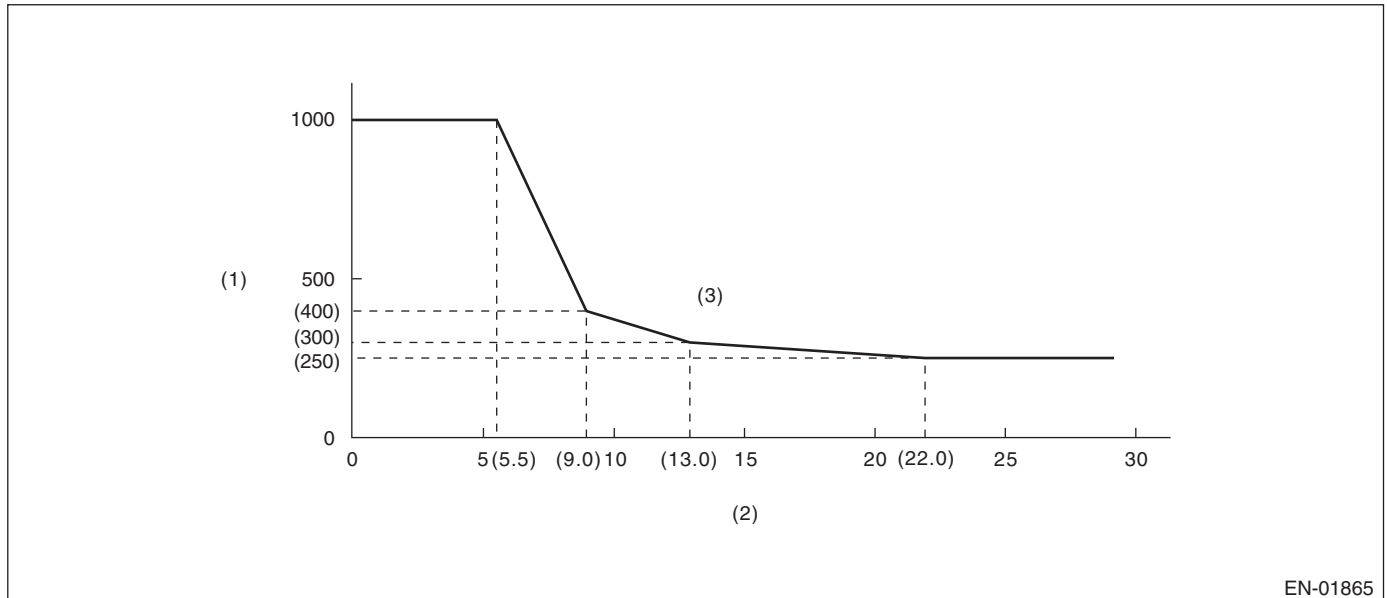
## Details of Judgment Value



EN-03129

- (1) Difference between target opening angle and actual opening angle (°)      (2) Target throttle opening angle (°)      (3) NG area

## Details of Judgment time (The actual opening angle ≤ target opening angle is always 1000 milliseconds)



EN-01865

- (1) Judgment time (milliseconds)      (2) Throttle position sensor 1 opening angle      (3) NG area

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)



## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

---

#### **8. FAIL SAFE**

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

#### **9. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CD:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the AT and there is a MIL lighting request.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	Yes

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	None

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CE:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

#### 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Starter relay	OFF

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "OFF" and when the other switches are "ON"	LOW (ON)

**Time Needed for Diagnosis:** 100 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "OFF" and when the other switches are "ON"	HIGH (OFF)

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

Control of cruise control: Control prohibited

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CF:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Starter relay	OFF

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	LOW (ON) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to HIGH (OFF).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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#### **7. FAIL SAFE**

Control of cruise control: Control prohibited

#### **8. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CG:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

### 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/ "N" range in TCM are "ON" and when the other switches are "OFF"	HIGH (OFF)

**Time Needed for Diagnosis:** 100 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/ "N" range in TCM are "ON" and when the other switches are "OFF"	LOW (ON)

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Control of cruise control: Control prohibited

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CH:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Starter relay	OFF

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	HIGH (OFF) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to LOW (ON).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### 7. FAIL SAFE

Control of cruise control: Control prohibited

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CI: DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

#### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains low.

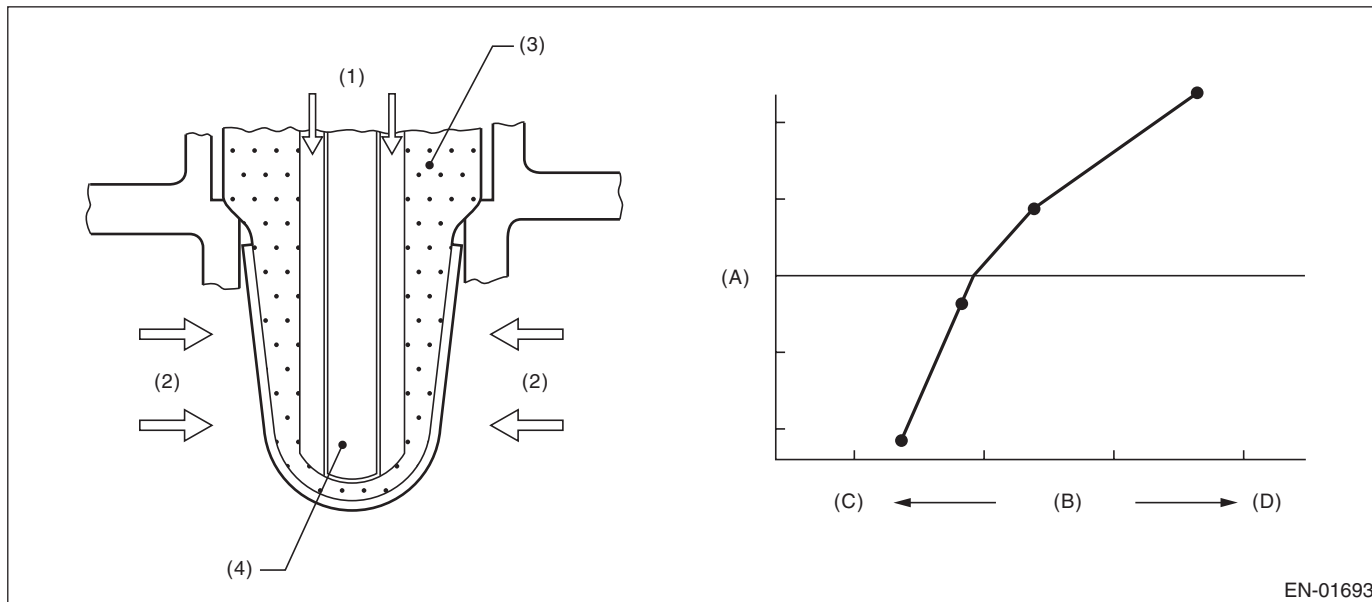
Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio

$\lambda > 1$ : Lean

$\lambda < 1$ : Rich

#### 2. COMPONENT DESCRIPTION



EN-01693

- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 4096$ ms
Battery voltage	$\geq 10.9$ V
Barometric pressure	$\geq 75.05$ kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	$-0.2$ V — $0.1$ V On Min. On Max.
Elapsed time after starting the engine	$\geq 60000$ ms
Engine coolant temperature	$\geq 75$ °C (167 °F)
Vehicle speed	$\geq 20$ km/h (12.4 MPH)
Amount of intake air	$\geq 6$ g/s (0.212 oz/s)
180°Load change at CA	$< 0.02$ g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	$0 \Omega$ — $50 \Omega$
Learning value of evaporation gas density	$< 0.2$
Total time of operating canister purge	$\geq 19.9$ sec
Targeted lambda value load compensation coefficient	$-0.030$ — $0.000$

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
$\lambda$ value	$< 0.85$

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$\lambda$ value	$\geq 0.85$

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Front oxygen (A/F) sensor sub learning compensation: Not allowed to calculate.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## CJ:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

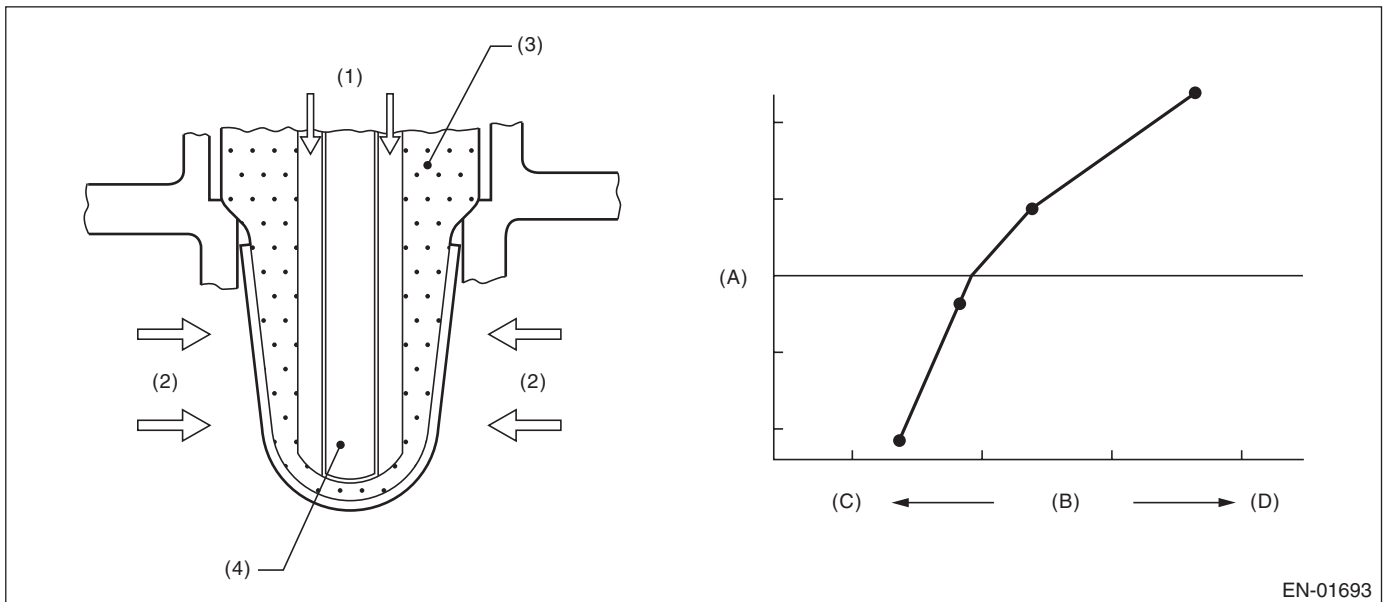
### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains high.

Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio  
 $\lambda > 1$ : Lean  
 $\lambda < 1$ : Rich

### 2. COMPONENT DESCRIPTION



EN-01693

- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	–0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.212 oz/s)
180°Load change at CA	< 0.02 g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 sec
Targeted lambda value load compensation coefficient	–0.030 — 0.000

### 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
λ value	> 1.15

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
λ value	≤ 1.15

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Front oxygen (A/F) sensor sub learning compensation: Not allowed to calculate.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

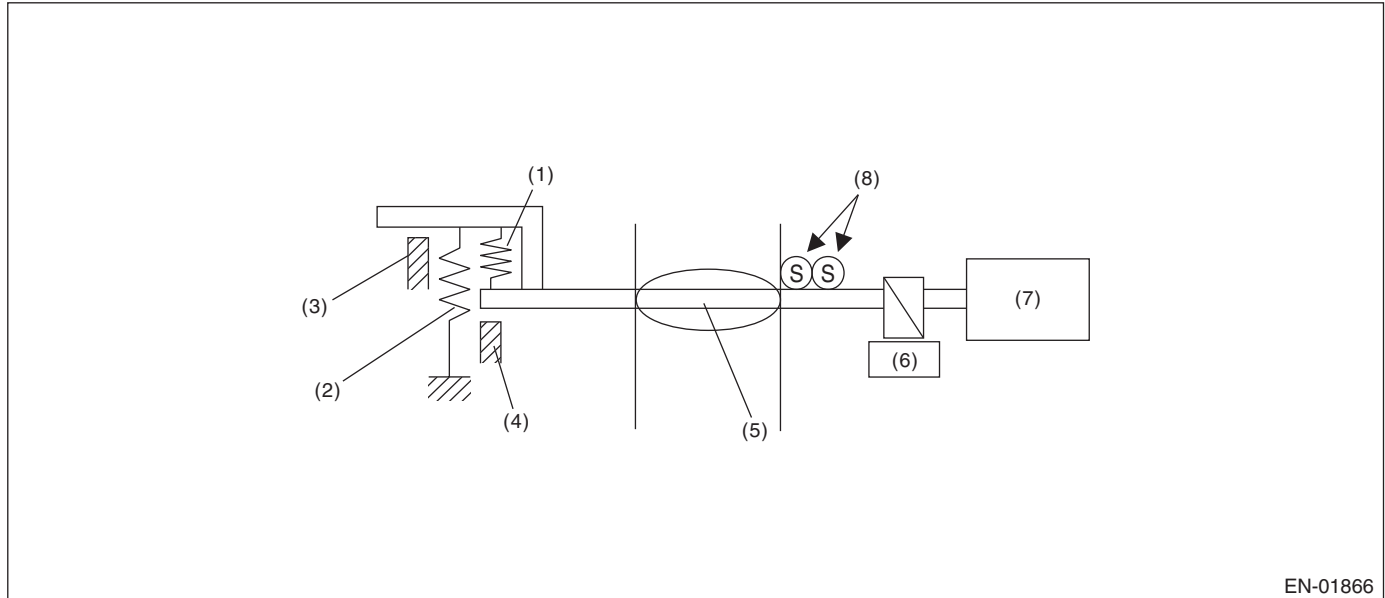
## GENERAL DESCRIPTION

### CK:DTC P1160 RETURN SPRING FAILURE

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

#### 2. COMPONENT DESCRIPTION



- |                          |                         |                                  |
|--------------------------|-------------------------|----------------------------------|
| (1) Opener spring        | (4) Full closed stopper | (7) DC motor                     |
| (2) Return spring        | (5) Throttle valve      | (8) Main and sub throttle sensor |
| (3) Intermediate stopper | (6) Gear                |                                  |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Motor continuity	OFF

#### 4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

#### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

##### Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	$\geq 2^\circ$

**Time Needed for Diagnosis:** 1880 milliseconds

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

#### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

### **8. FAIL SAFE**

Throttle opening is fixed to 6°.

### **9. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

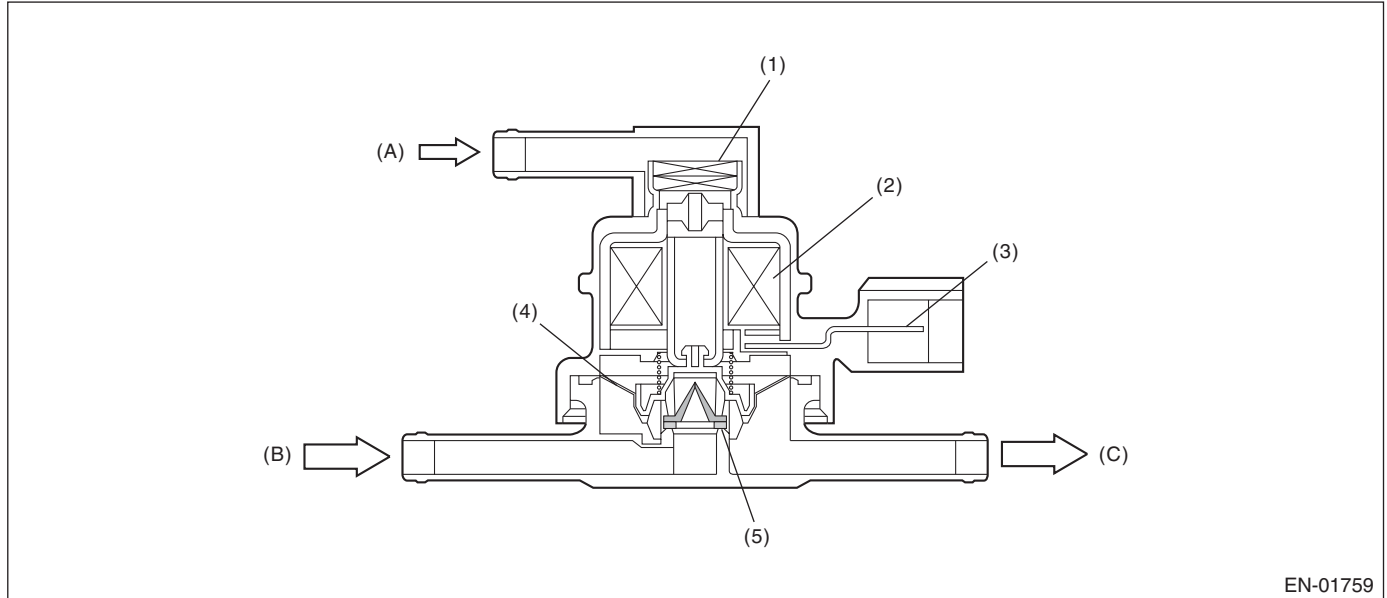
### CL:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

#### 2. COMPONENT DESCRIPTION



- |                        |               |                         |
|------------------------|---------------|-------------------------|
| (1) Filter             | (4) Diaphragm | (A) Barometric pressure |
| (2) Coil               | (5) Valve     | (B) Shut-off valve      |
| (3) Connector terminal |               | (C) To fuel tank        |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

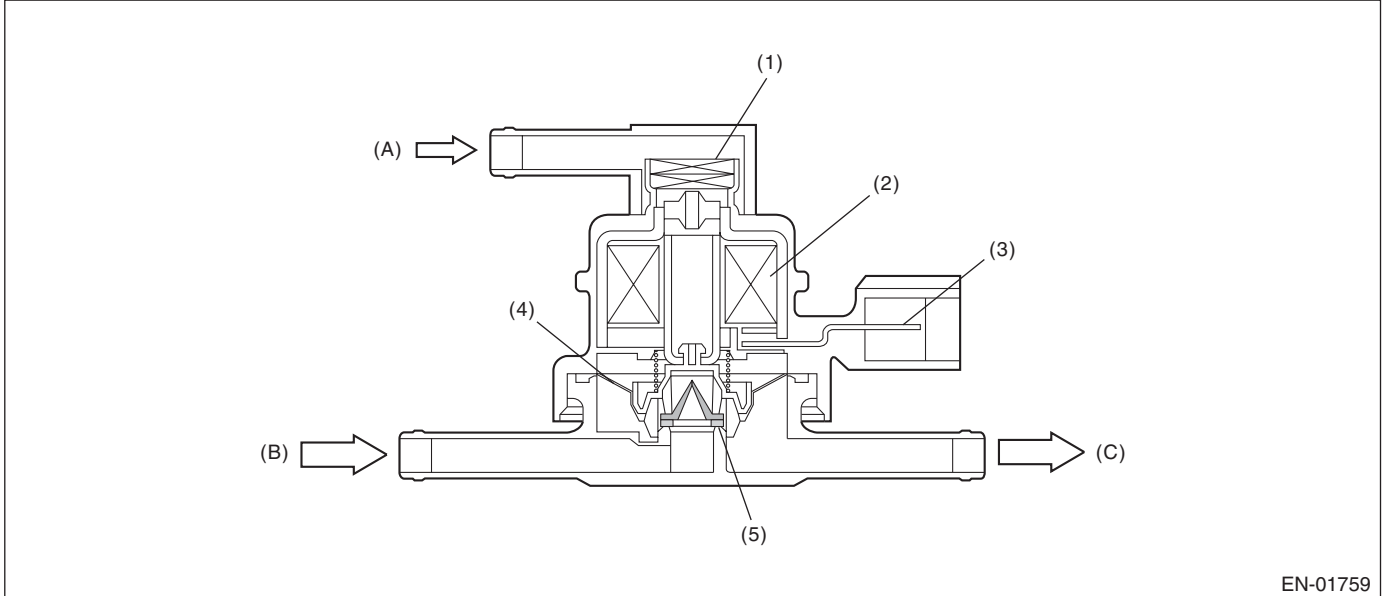
### CM:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

#### 2. COMPONENT DESCRIPTION



(1) Filter

(2) Coil

(3) Connector terminal

(4) Diaphragm

(5) Valve

(A) Barometric pressure

(B) Shut-off valve

(C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

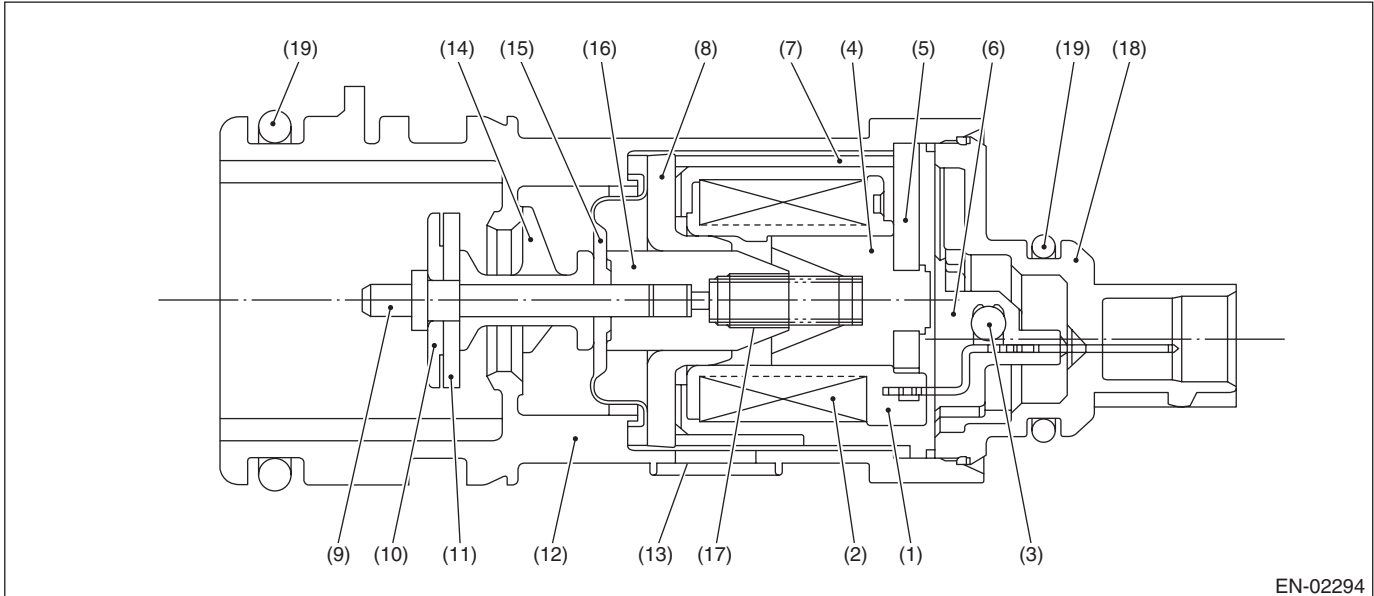
## GENERAL DESCRIPTION

### CN:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

#### 1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.  
Judge as NG when fuel tank pressure is low.

#### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Drain valve	Open
Battery voltage	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75.05 \text{ kPa}$ (563 mmHg, 22.165 inHg)
Tank pressure when starter is OFF → ON	$-0.43 \text{ kPa}$ ( $-3.2 \text{ mmHg}$ , $-0.126 \text{ inHg}$ ) and $1.43 \text{ kPa}$ (10.7 mmHg, 0.421 inHg)

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$\leq -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)

**Time Needed for Diagnosis:** 3000 sec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$> -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)
Cumulative time when all the malfunction criteria below are met.	$\geq 30000$ sec
Purge control solenoid valve duty	Not = 0
Fuel temperature	$-10$ °C ( $14$ °F) — $70$ °C ( $158$ °F)
Intake manifold relative pressure	$\geq -26.66$ kPa ( $-200$ mmHg, $-7.874$ inHg)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

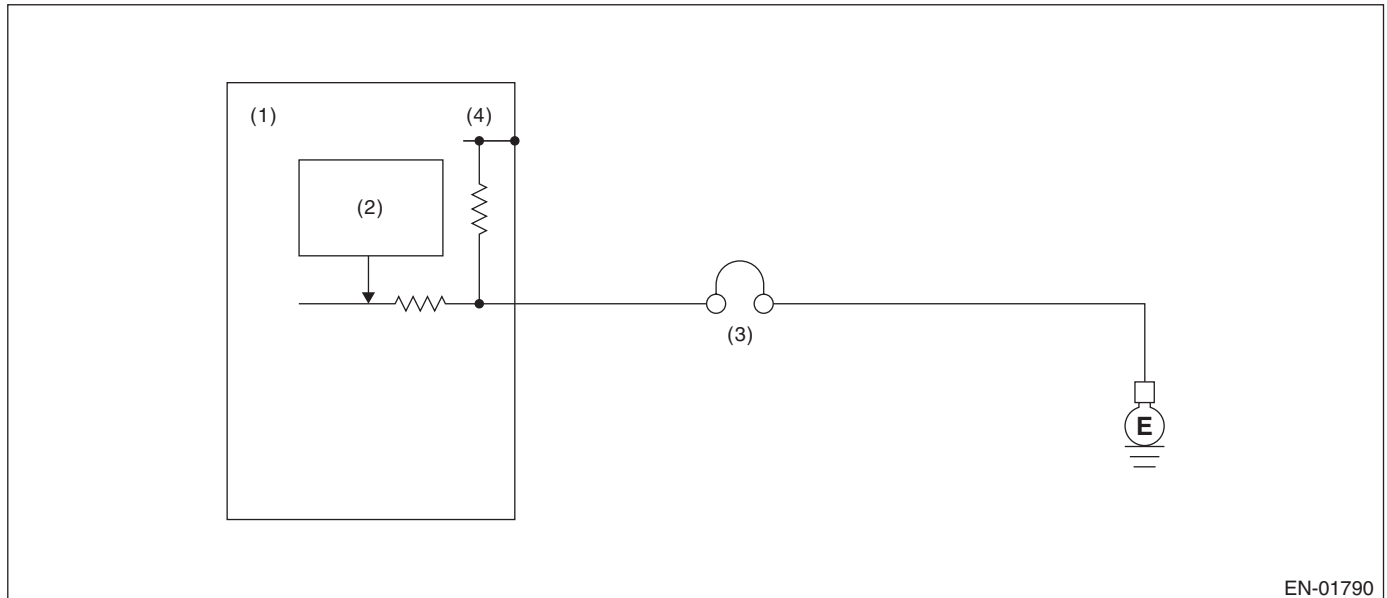
## GENERAL DESCRIPTION

### CO:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

#### 1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose release abnormality.  
Judge as NG when the diagnosis terminal voltage is high.

#### 2. COMPONENT DESCRIPTION



EN-01790

- (1) Engine control module (ECM)      (3) PCV diagnosis connector      (4) 5 V  
(2) Detecting circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

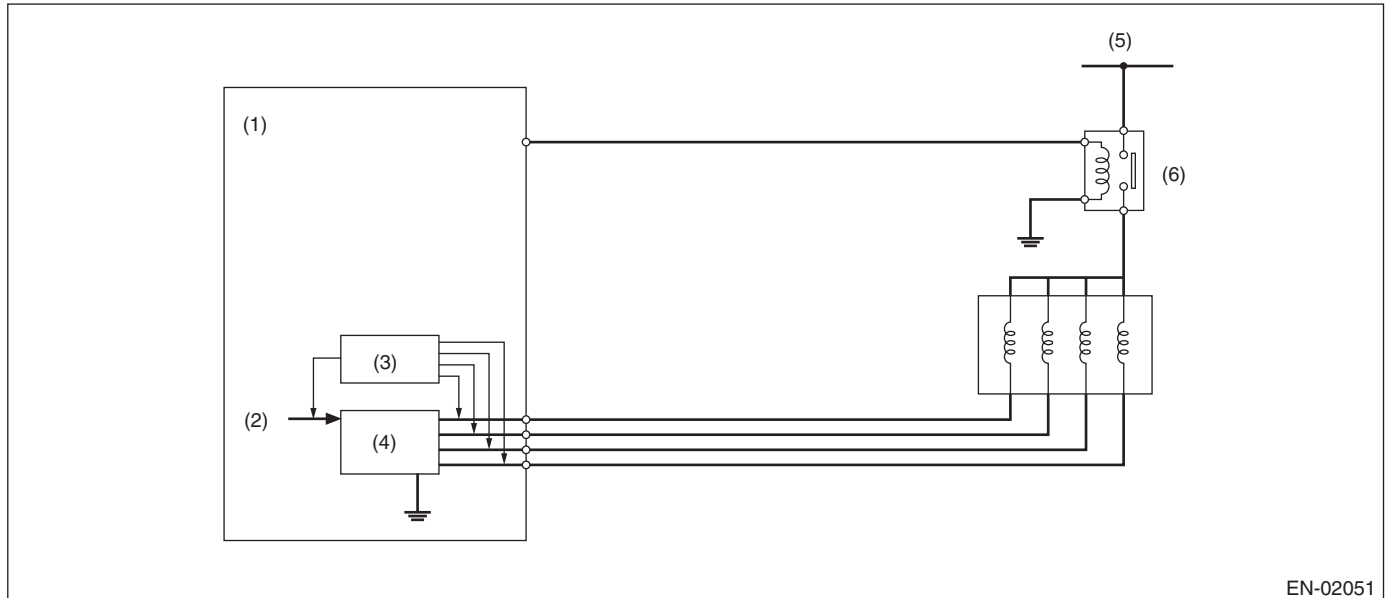
## GENERAL DESCRIPTION

### CP:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

#### 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02051

- |                                 |                       |                     |
|---------------------------------|-----------------------|---------------------|
| (1) Engine control module (ECM) | (3) Detecting circuit | (5) Battery voltage |
| (2) Computer unit (CPU)         | (4) Switch circuit    | (6) Main relay      |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

#### 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal or Terminal voltage level when EGR operates	Low level

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level
Terminal voltage level when EGR operates	High level

**Time Needed for Diagnosis:** 128 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Knock sensor learning compensation: Calculation prohibited.
- EGR control: Operation prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

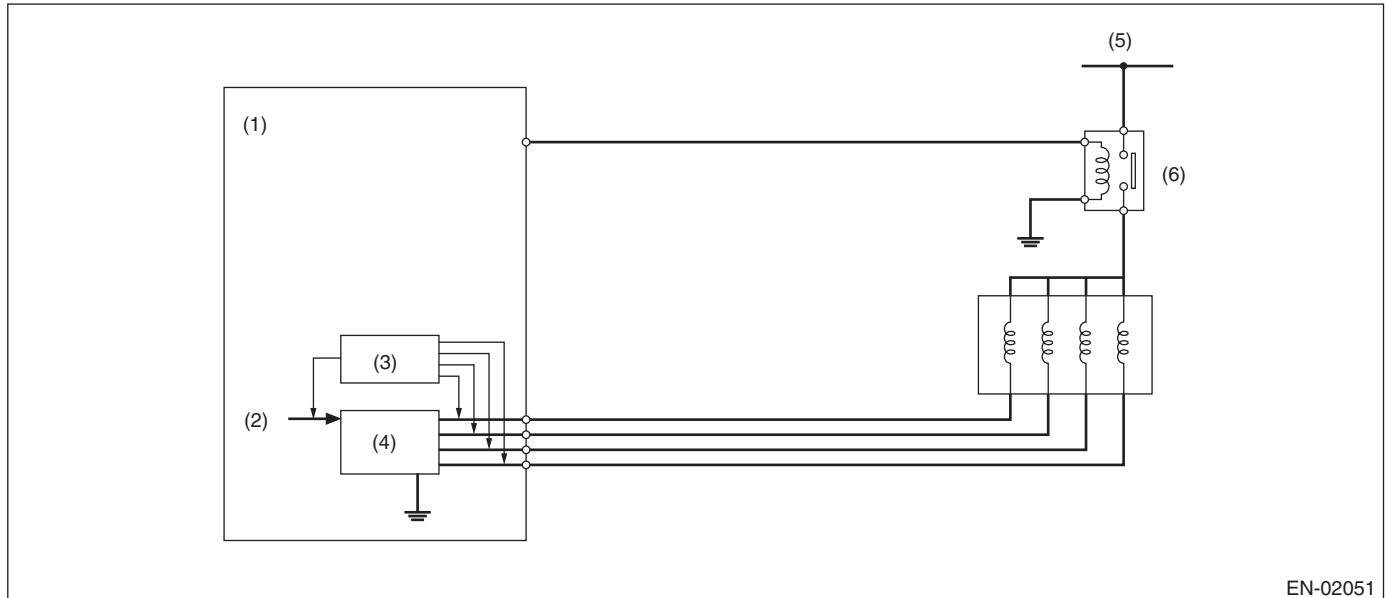
## GENERAL DESCRIPTION

### CQ:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

#### 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02051

- |                                 |                       |                     |
|---------------------------------|-----------------------|---------------------|
| (1) Engine control module (ECM) | (3) Detecting circuit | (5) Battery voltage |
| (2) Computer unit (CPU)         | (4) Switch circuit    | (6) Main relay      |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal or Terminal voltage level when EGR operates	High level

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level
Terminal voltage level when EGR operates	Low level

**Time Needed for Diagnosis:** 128 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Knock sensor learning compensation: Calculation prohibited.
- EGR control: Operation prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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#### **CR:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-210, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CS:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-212, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CT:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-210, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CU:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-212, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CV:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-210, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CW:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-212, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CX:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.  
Judge as NG when the backup power voltage is low.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	Low
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	High
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **CY:DTC P1570 ANTENNA**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **CZ:DTC P1571 REFERENCE CODE INCOMPATIBILITY**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DA:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DB:DTC P1574 KEY COMMUNICATION FAILURE**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DC:DTC P1576 EGI CONTROL MODULE EEPROM**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DD:DTC P1577 IMM CONTROL MODULE EEPROM**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DE:DTC P1578 METER FAILURE**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-175, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DF:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.

Judge as NG if there is exhaust gas temperature diagnosis and idle speed diagnosis and if either of them is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Battery voltage	≥ 10.9 V
Cold start diagnosis	Incomplete
Vehicle speed	< 2 km/h (1.2 MPH)
Misfire within 200 engine revs.	< 5
Time after starting	= 14 seconds

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

### 4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

#### Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value from Map

#### Map

- U5 model

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold value (AT model)	152 °C (305.6 °F)	152 °C (305.6 °F)	152 °C (305.6 °F)	152 °C (305.6 °F)	152 °C (305.6 °F)	143 °C (289.4 °F)	135 °C (275 °F)	127 °C (260.6 °F)	121 °C (249.8 °F)	118 °C (244.4 °F)
Threshold value (MT model)	135 °C (275 °F)	135 °C (275 °F)	135 °C (275 °F)	135 °C (275 °F)	135 °C (275 °F)	135 °C (275 °F)	134 °C (273.2 °F)	129 °C (264.2 °F)	126 °C (258.8 °F)	119 °C (246.2 °F)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

- Except for U5

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold value (AT model)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	127 °C (260.6 °F)	130 °C (266 °F)	127 °C (260.6 °F)	114 °C (237.2 °F)	111 °C (231.8 °F)	117 °C (242.6 °F)
Threshold value (MT model)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	155 °C (311 °F)	156 °C (312.8 °F)	152 °C (305.6 °F)	142 °C (287.6 °F)	140 °C (284 °F)	140 °C (284 °F)

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	≥ Value from Map

**Time Needed for Diagnosis:** Less than 1 second

- Idle speed diagnosis

### Abnormality Judgment

Judge as NG when the following conditions are established after the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –100 rpm)	≥ 6000 ms
Continuous time of (actual retard amount > 30 °CA)	≥ 0 ms

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –100 rpm)	< 6000 ms
Continuous time of (actual retard amount > 30 °CA)	< 0 ms

**Time Needed for Diagnosis:** Less than 1 second

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

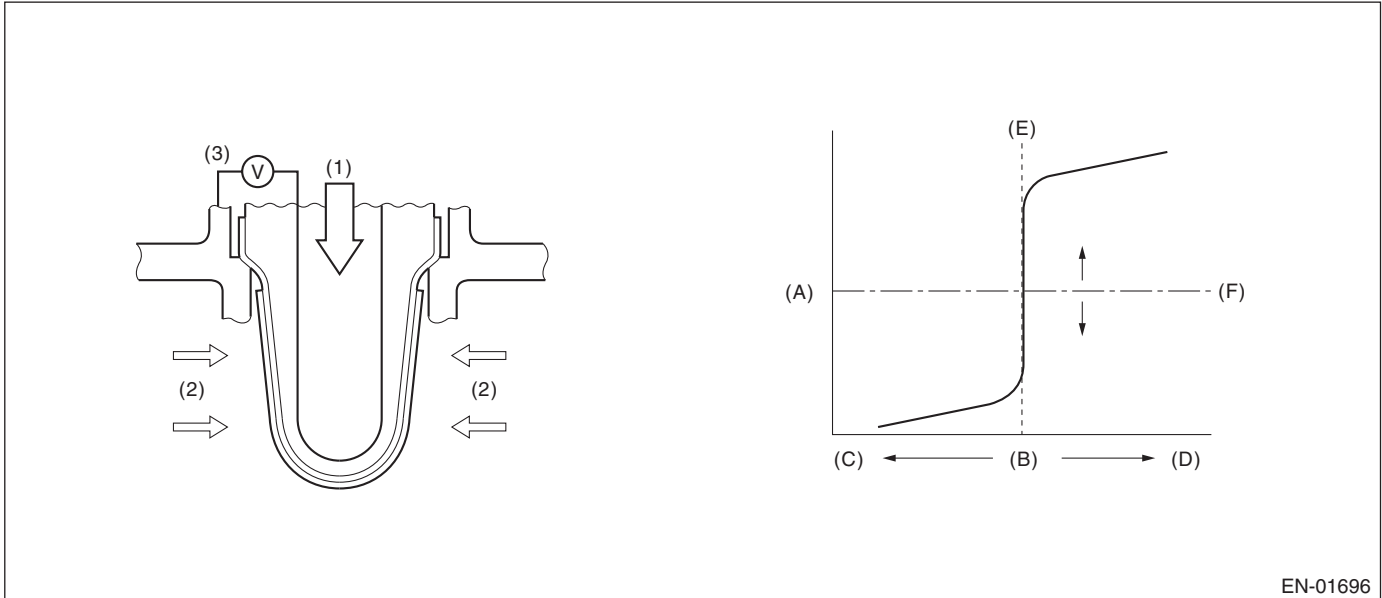
GENERAL DESCRIPTION

## DG:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.  
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

### 2. COMPONENT DESCRIPTION



EN-01696

- |                         |                         |                                |
|-------------------------|-------------------------|--------------------------------|
| (1) Atmosphere          | (A) Electromotive force | (D) Lean                       |
| (2) Exhaust gas         | (B) Air fuel ratio      | (E) Theoretical air fuel ratio |
| (3) Electromotive force | (C) Rich                | (F) Comparative voltage        |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.04

**Time Needed for Diagnosis:** 5 sec × 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ -0.04 + 0

**Time Needed for Diagnosis:** 5 sec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

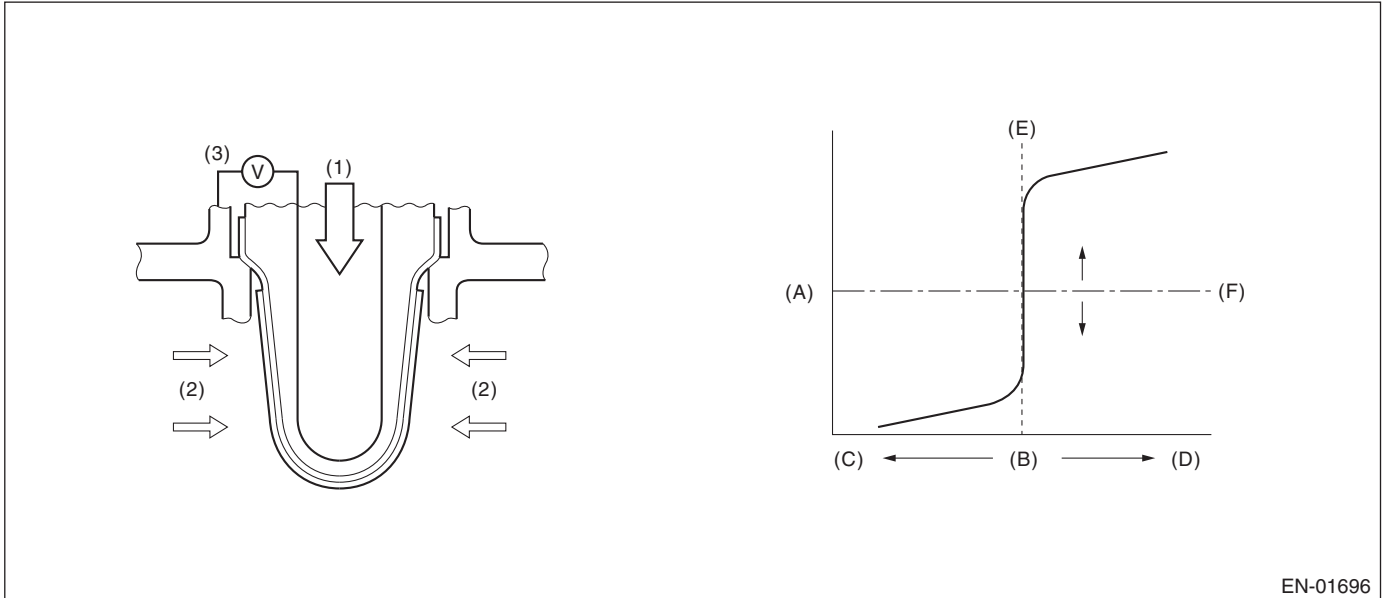
## DH:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.

Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	$\geq 1$ sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	$\geq 0.028$ (U5 model) $\geq 0.038$ (Except for U5 model)

**Time Needed for Diagnosis:** 5 sec  $\times$  1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.028 + -0.002$ (U5 model) $< 0.038 + -0.002$ (Except for U5 model)

**Time Needed for Diagnosis:** 5 sec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

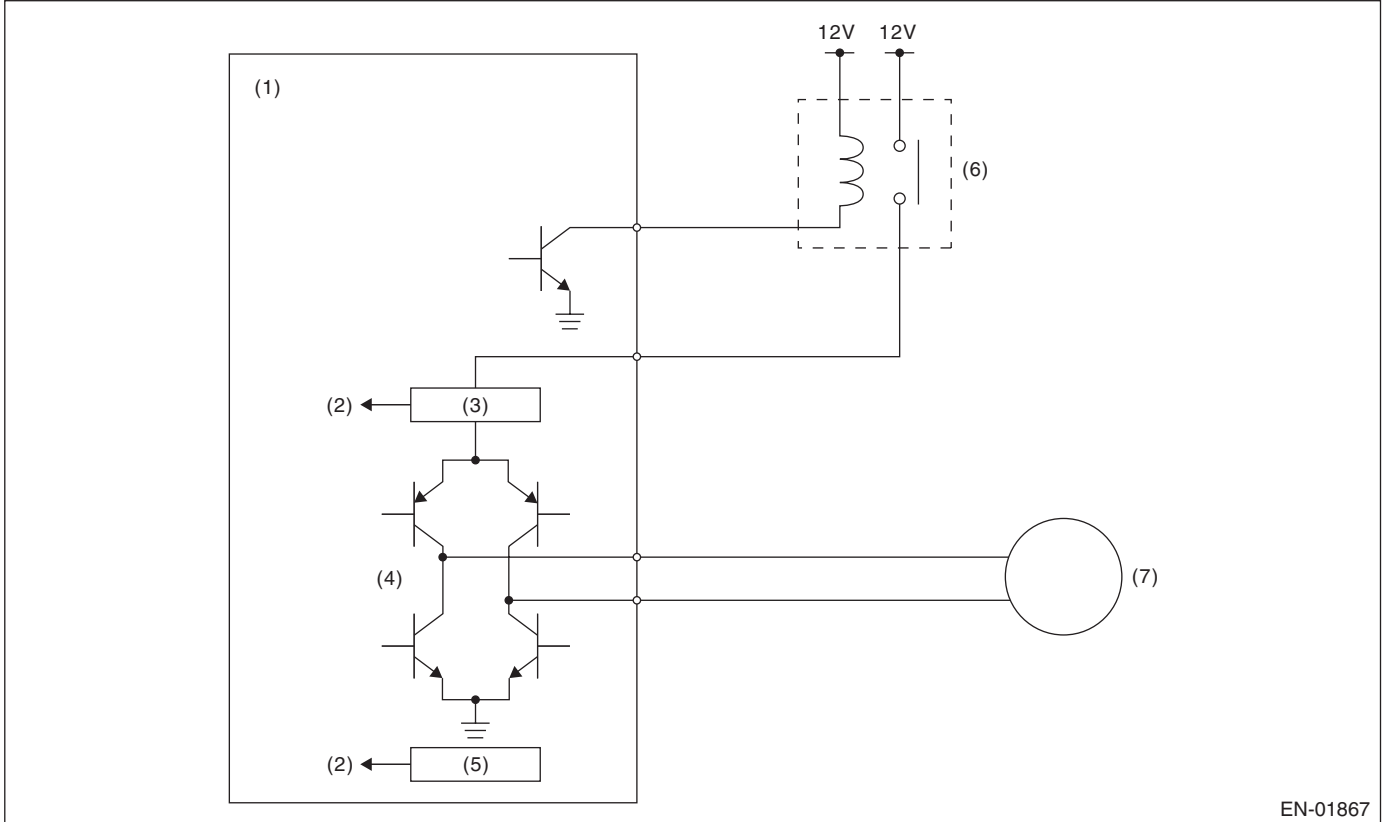
Memorize the freeze frame data. (For test mode \$02)

## DI: DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

### 2. COMPONENT DESCRIPTION



- |                                   |                                   |                                       |
|-----------------------------------|-----------------------------------|---------------------------------------|
| (1) Engine control module (ECM)   | (4) Drive circuit                 | (6) Electronic throttle control relay |
| (2) Detecting circuit             | (5) Temperature detection circuit | (7) Motor                             |
| (3) Overcurrent detection circuit |                                   |                                       |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor current	$\leq 8 \text{ A}$
Drive circuit inner temperature	$\leq 175^{\circ}\text{C}$ (347°F)

#### Time Needed for Diagnosis:

- 500 milliseconds (For NG)
- 2000 milliseconds (For OK)

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

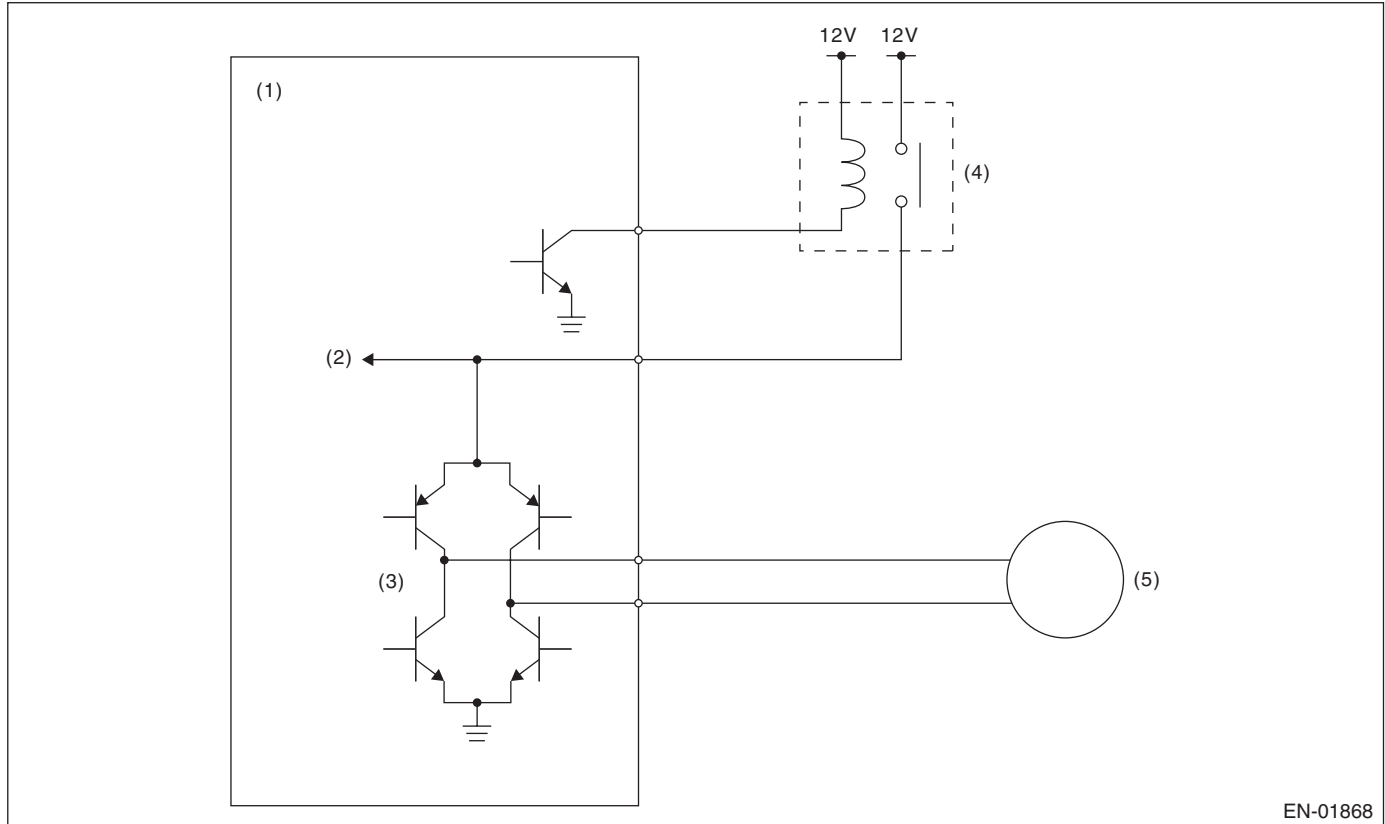
Memorize the freeze frame data. (For test mode \$02)

## DJ:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

### 2. COMPONENT DESCRIPTION



- |                                 |                                       |           |
|---------------------------------|---------------------------------------|-----------|
| (1) Engine control module (ECM) | (3) Drive circuit                     | (5) Motor |
| (2) Voltage detection circuit   | (4) Electronic throttle control relay |           |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Electronic throttle control relay output	ON

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≥ 5 V

#### Time Needed for Diagnosis:

- 400 milliseconds (For NG)
- 2000 milliseconds (For OK)

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

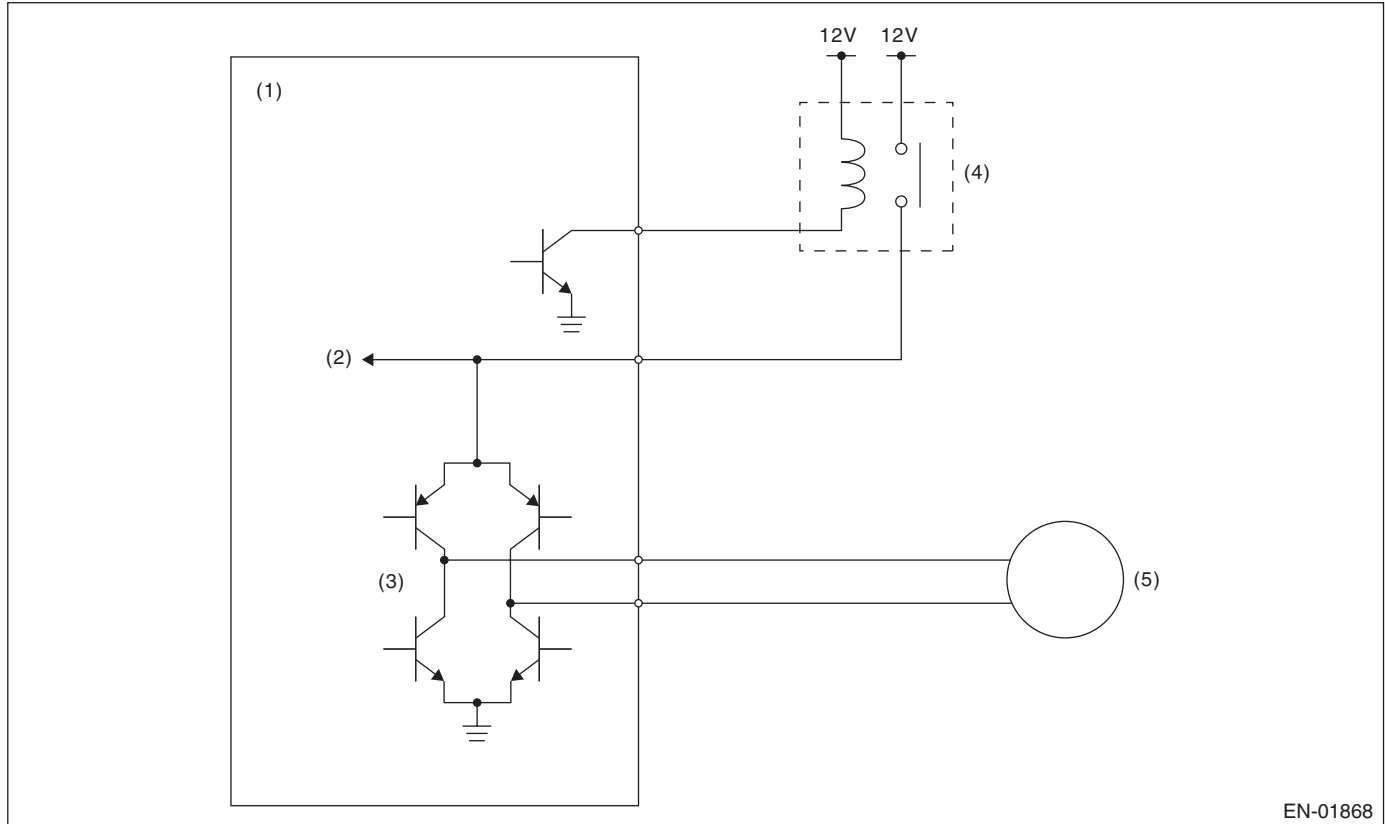
Memorize the freeze frame data. (For test mode \$02)

## DK:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

### 2. COMPONENT DESCRIPTION



EN-01868

- |                                 |                                       |           |
|---------------------------------|---------------------------------------|-----------|
| (1) Engine control module (ECM) | (3) Drive circuit                     | (5) Motor |
| (2) Voltage detection circuit   | (4) Electronic throttle control relay |           |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Electronic throttle control relay output	OFF

### 4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$\leq 5\text{ V}$

#### Time Needed for Diagnosis:

- 600 milliseconds (For NG)
- 400 milliseconds (For OK)

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

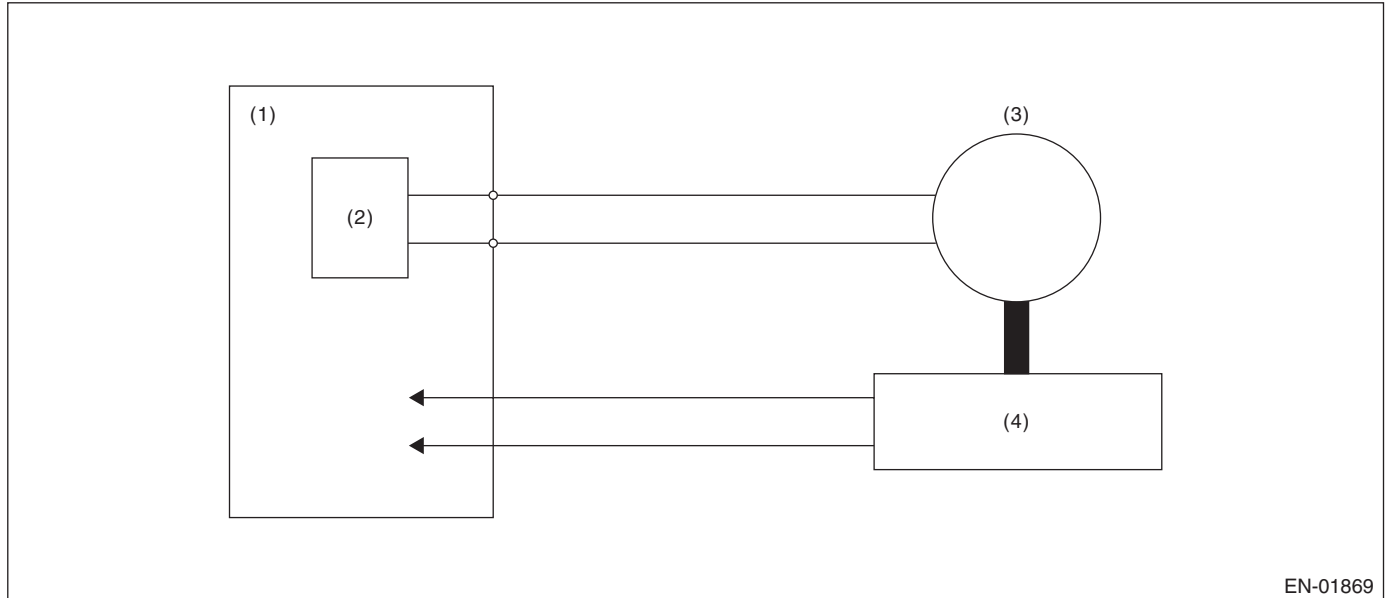
Memorize the freeze frame data. (For test mode \$02)

## DL:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot conducted or abnormal value is detected.

### 2. COMPONENT DESCRIPTION



- |                                 |           |                              |
|---------------------------------|-----------|------------------------------|
| (1) Engine control module (ECM) | (3) Motor | (4) Throttle position sensor |
| (2) Drive circuit               |           |                              |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON → OFF
Ignition switch (only after clear memory)	OFF → ON

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

### 5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	10.12710.127° or more, 19.872° or less
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 1.683°

**Time Needed for Diagnosis:** 8 — 80 milliseconds

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

---

#### **7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS**

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

#### **8. FAIL SAFE**

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

#### **9. ECM OPERATION AT DTC SETTING**

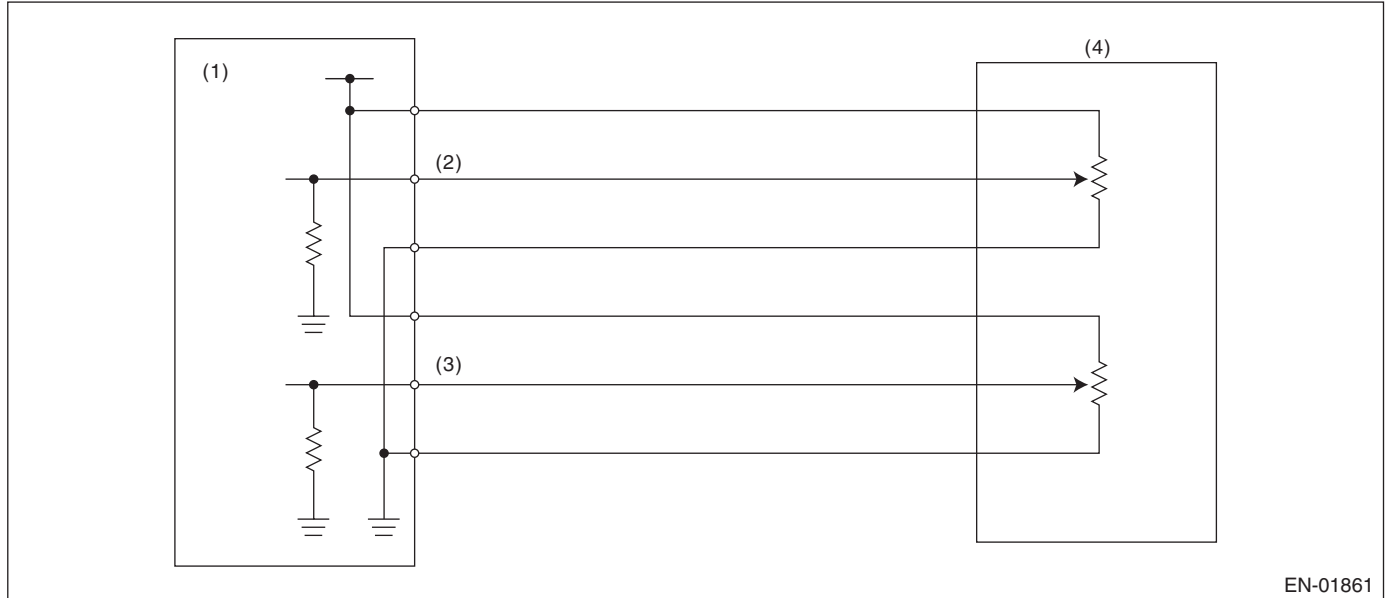
Memorize the freeze frame data. (For test mode \$02)

## DM:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01861

- |  |  |                                       |
|--|--|---------------------------------------|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor |
| (2) Accelerator pedal position sensor 1 signal |  |                                       |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 0.217 V

**Time Needed for Diagnosis:** 100 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.217 V

**Time Needed for Diagnosis:** 100 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

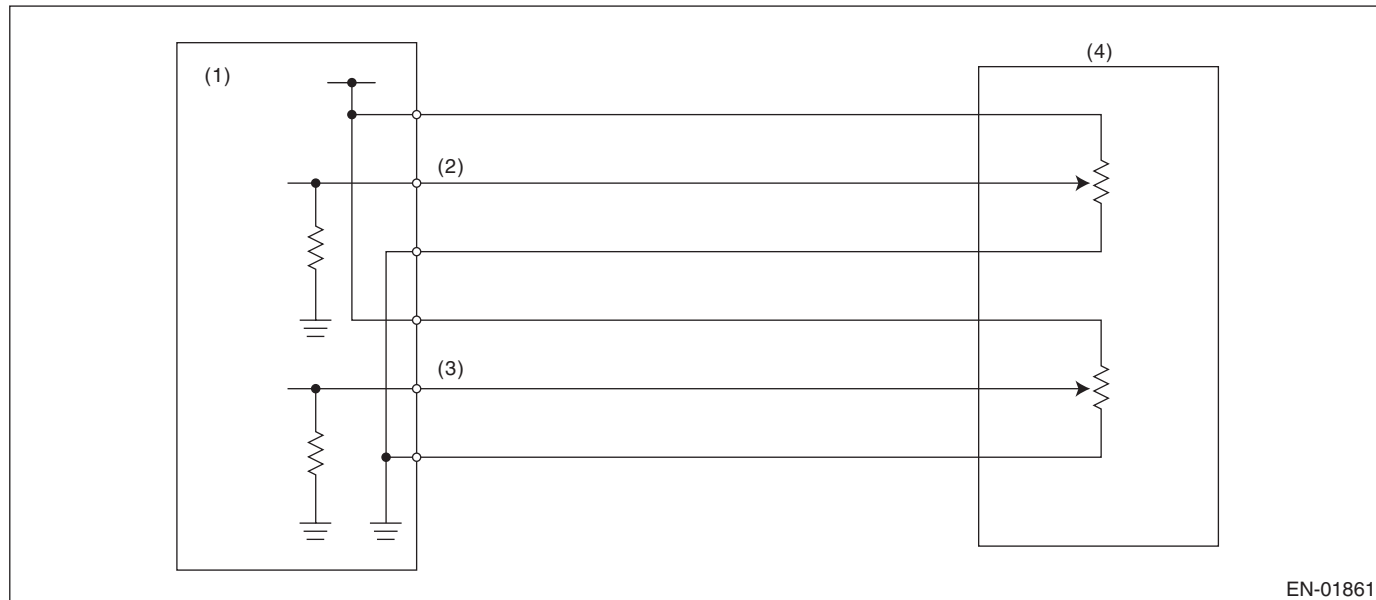
## DN:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.

Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01861

- |  |  |  |
|--|--|--|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 signal |
| (2) Accelerator pedal position sensor 1 signal |  |  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\geq 4.783$ V

**Time Needed for Diagnosis:** 32 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.783$ V

**Time Needed for Diagnosis:** 32 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

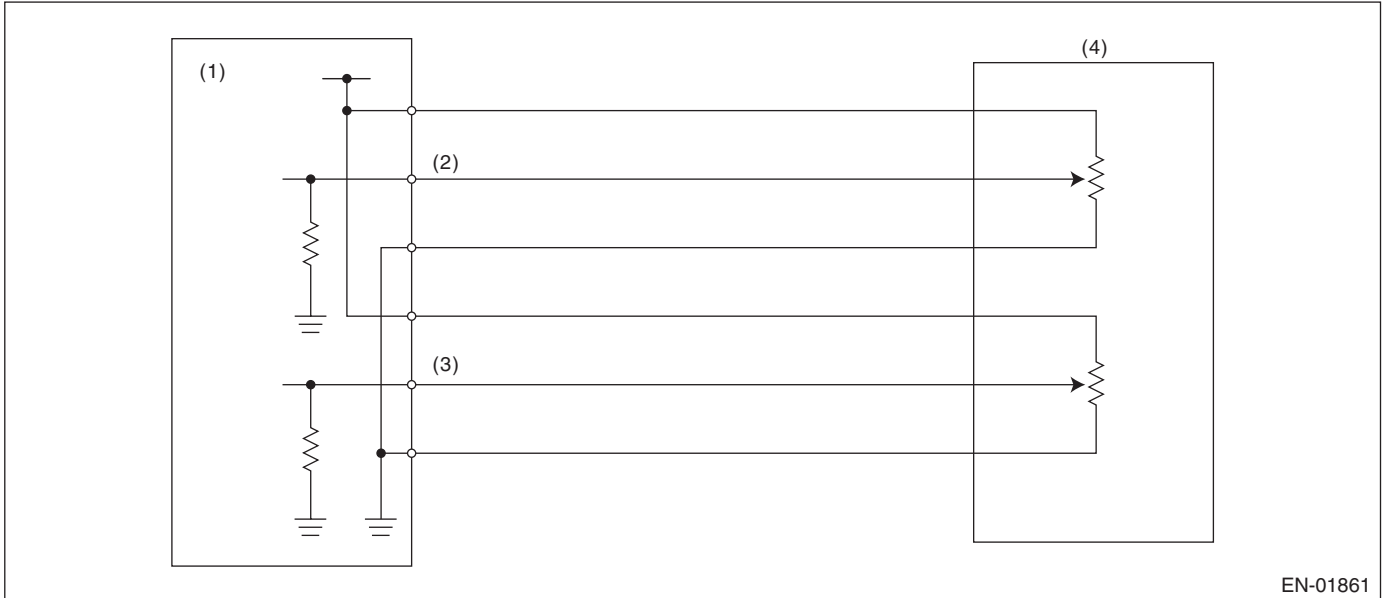
Memorize the freeze frame data. (For test mode \$02)

## DO:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01861

- |  |  |   |
|--|--|---|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 |
| (2) Accelerator pedal position sensor 1 signal |  |   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 0.217 V

**Time Needed for Diagnosis:** 100 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 0.217$ V

**Time Needed for Diagnosis:** 100 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

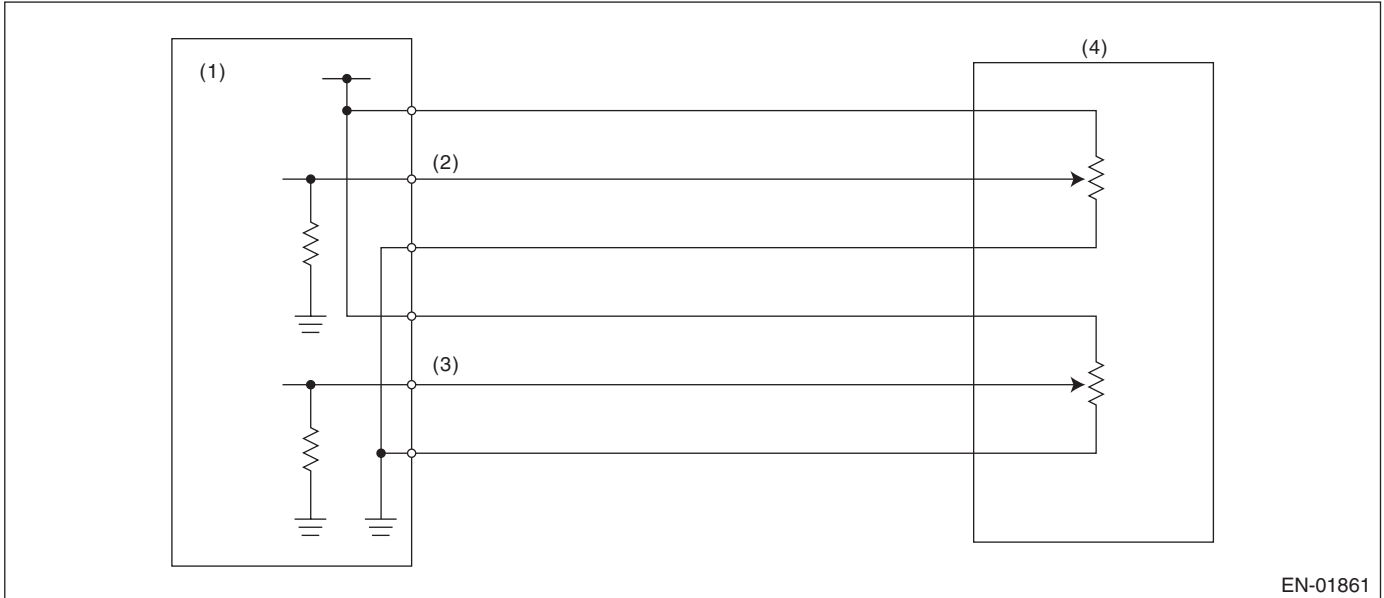
Memorize the freeze frame data. (For test mode \$02)

## DP:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01861

- |  |  |  |
|--|--|--|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 signal |
| (2) Accelerator pedal position sensor 1 signal |  |  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 4.783$ V

**Time Needed for Diagnosis:** 100 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$< 4.783$ V

**Time Needed for Diagnosis:** 100 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

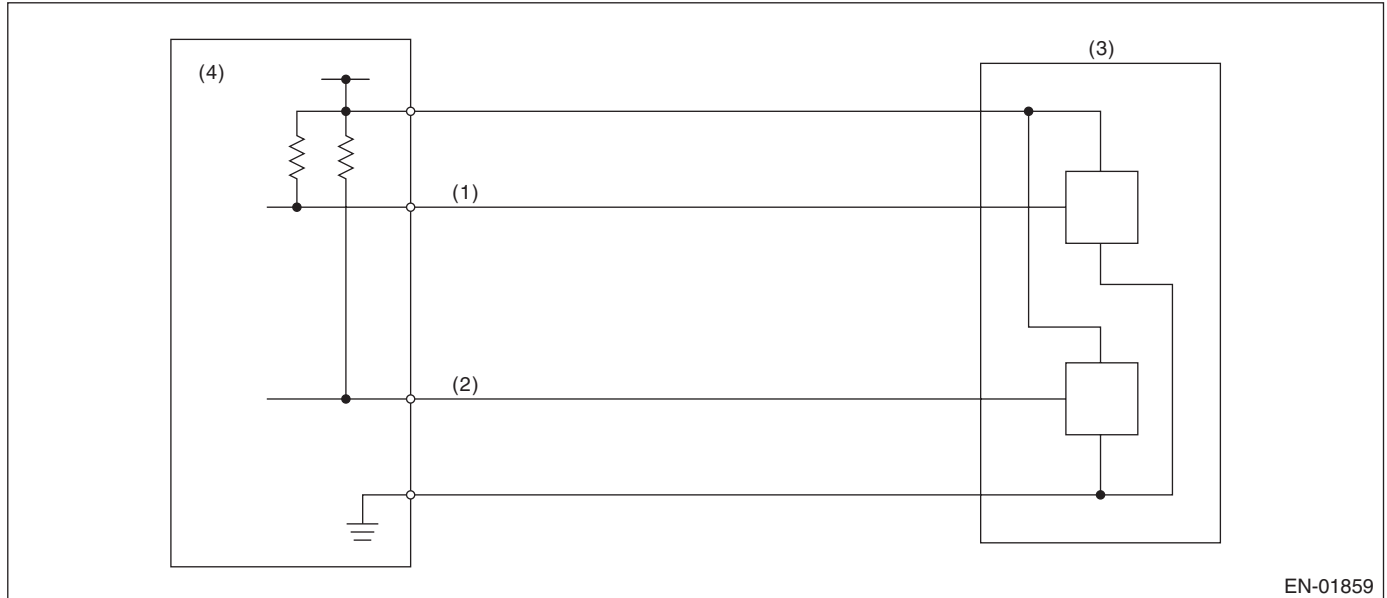
GENERAL DESCRIPTION

## DQ:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

### 2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal  
(2) Throttle position sensor 2 signal

- (3) Throttle position sensor

- (4) Engine control module (ECM)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Value from Map

#### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 2.125 \text{ deg}$	$2.125 \text{ deg} \leq d < 4.25 \text{ deg}$	$4.25 \text{ deg} \leq d < 9 \text{ deg}$	$9 \text{ deg} \leq d < 31.625 \text{ deg}$	$31.625 \text{ deg} \leq d$
Sensor output difference (°)	5.15 deg	6.15 deg	8.28 deg	10.4 deg	12.4 deg

**Time Needed for Diagnosis:** 212 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq$ Value from Map

**Time Needed for Diagnosis:** 24 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

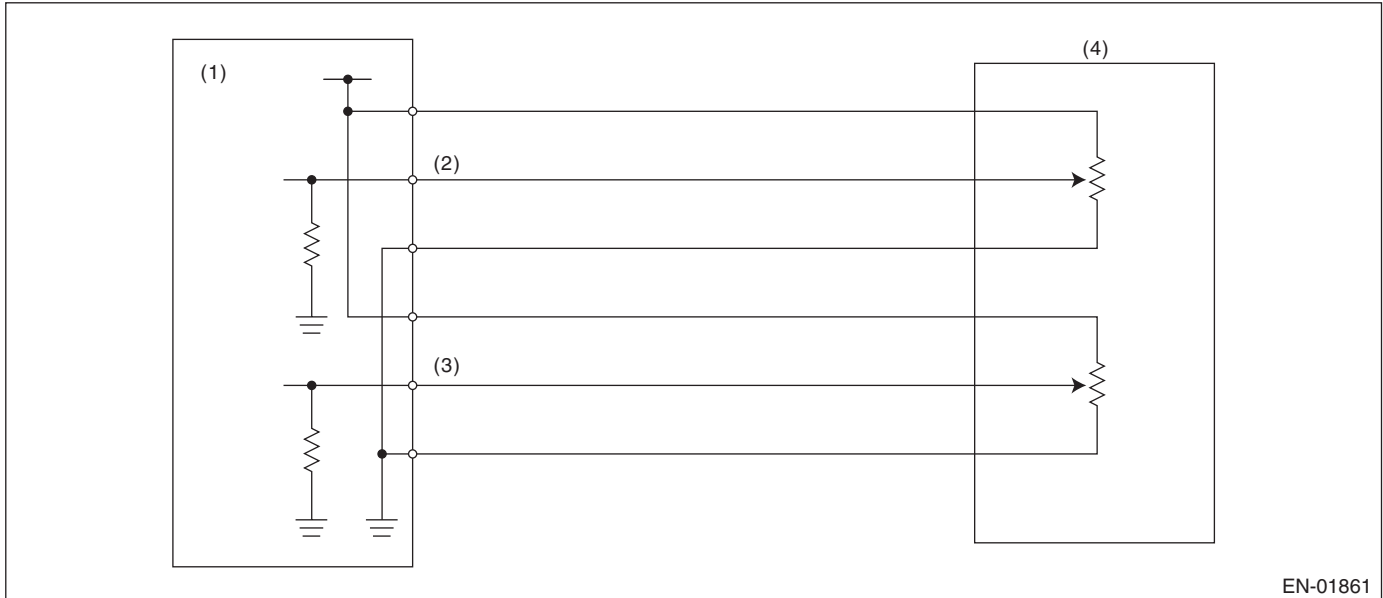
GENERAL DESCRIPTION

## DR:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

### 2. COMPONENT DESCRIPTION



- (1) Engine control module (ECM)      (3) Accelerator pedal position sensor 2 signal      (4) Accelerator pedal position sensor  
(2) Accelerator pedal position sensor 1 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 V$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Map

#### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 0.6 \text{ deg}$	$0.6 \text{ deg} \leq d < 1.2 \text{ deg}$	$1.2 \text{ deg} \leq d < 2 \text{ deg}$	$2 \text{ deg} \leq d < 4 \text{ deg}$	$4 \text{ deg} \leq d$
Sensor output difference (°)	1.465 deg	1.597 deg	1.663 deg	2.455 deg	3.116 deg

**Time Needed for Diagnosis:** 116 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq$ Map

**Time Needed for Diagnosis:** 116 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DS:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of barometric pressure sensor output property.

Judge as NG when the barometric pressure sensor output is largely different from the intake manifold pressure at engine start.

### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Barometric pressure – Intake manifold pressure	≥ 26.66 kPa (200 mmHg, 7.874 inHg)
Intake manifold pressure at engine start – Intake manifold pressure	< 1.33 kPa (9.99 mmHg, 0.393 inHg)

**Time Needed for Diagnosis:** 328 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Barometric pressure – Intake manifold pressure	< 26.66 kPa (200 mmHg, 7.874 inHg)

**Time Needed for Diagnosis:** 262 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101 kPa (760 mmHg, 29.8 inHg).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### DT:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 1.706646812 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 1.706646812$ V

**Time Needed for Diagnosis:** Less than 1 second

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101 kPa (760 mmHg, 29.8 inHg).

#### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DU:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.233789985$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.233789985$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101 kPa (760 mmHg, 29.8 inHg).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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# General Description

FUEL INJECTION (FUEL SYSTEMS)

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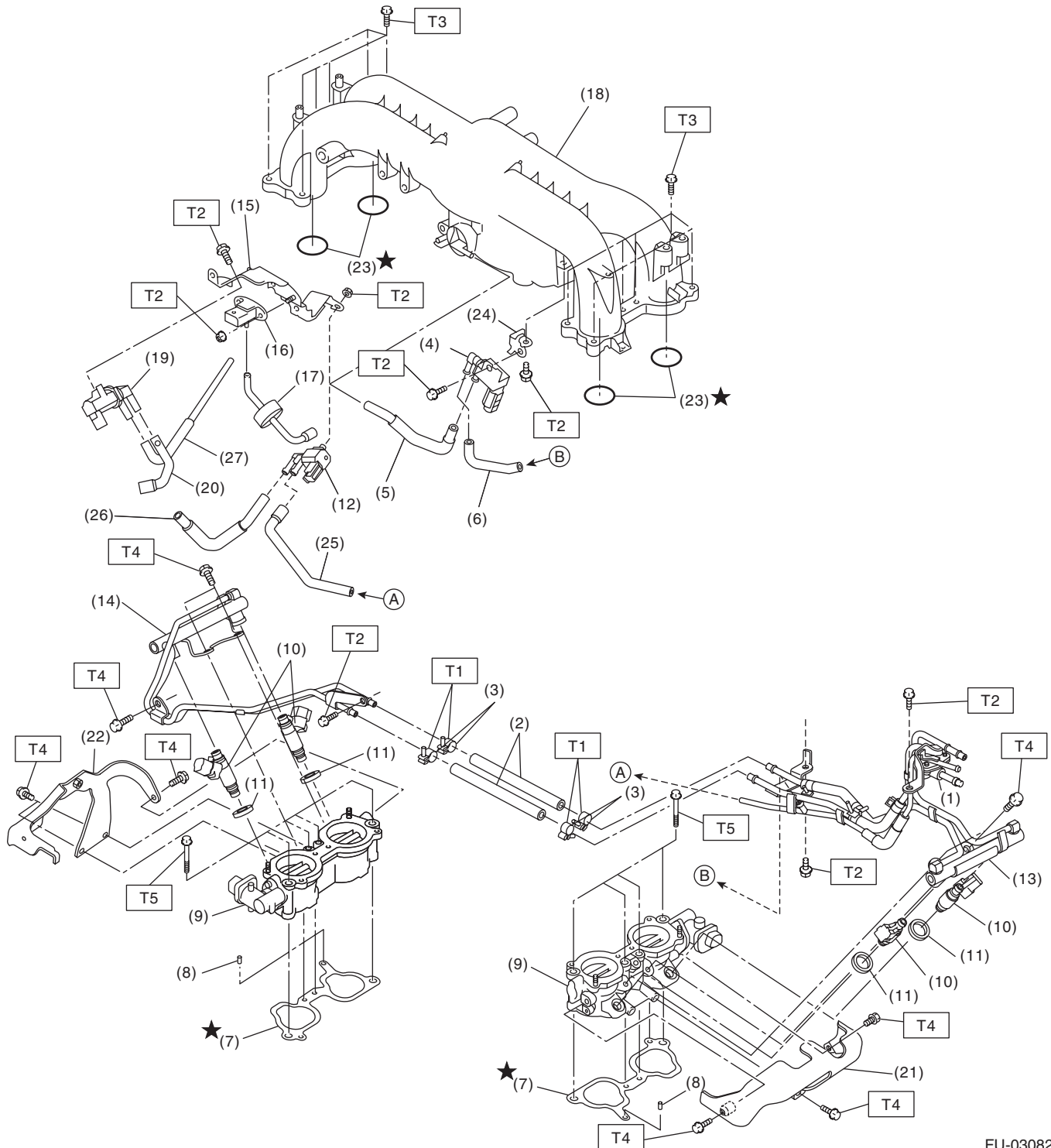
## 1. General Description

### A: SPECIFICATION

Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	550 — 850 kPa (5.61 — 8.67 kg/cm <sup>2</sup> , 79.8 — 123.3 psi)
	Discharge rate	155 ℓ (40.9 US gal, 34.1 Imp gal)/h or more. [12 V at 300 kPa (3.06 kg/cm <sup>2</sup> , 43.5 psi)]
Fuel filter		In-tank type

### B: COMPONENT

#### 1. INTAKE MANIFOLD



FU-03082

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

- |                                     |  |                             |
|-------------------------------------|--|-----------------------------|
| (1) Pressure regulator              | (13) Fuel injector pipe LH                 | (24) Solenoid valve bracket |
| (2) Fuel hose                       | (14) Fuel injector pipe RH                 | (25) Vacuum hose B          |
| (3) Clamp                           | (15) Solenoid valve bracket                | (26) Vacuum hose A          |
| (4) Purge control solenoid valve 1  | (16) Manifold absolute pressure sensor     | (27) Air control hose       |
| (5) Vacuum hose D                   | (17) Filter                                |                             |
| (6) Vacuum hose C                   | (18) Intake manifold                       |                             |
| (7) Intake manifold gasket          | (19) Wastegate control solenoid valve ASSY |                             |
| (8) Guide pin                       | (20) Vacuum hose                           |                             |
| (9) Intake manifold (lower)         | (21) Fuel pipe protector LH                |                             |
| (10) Fuel injector                  | (22) Fuel pipe protector RH                |                             |
| (11) Seal ring                      | (23) O-ring                                |                             |
| (12) Purge control solenoid valve 2 |  |                             |

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**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 1.25 (0.13, 0.94)**

**T2: 6.4 (0.65, 4.7)**

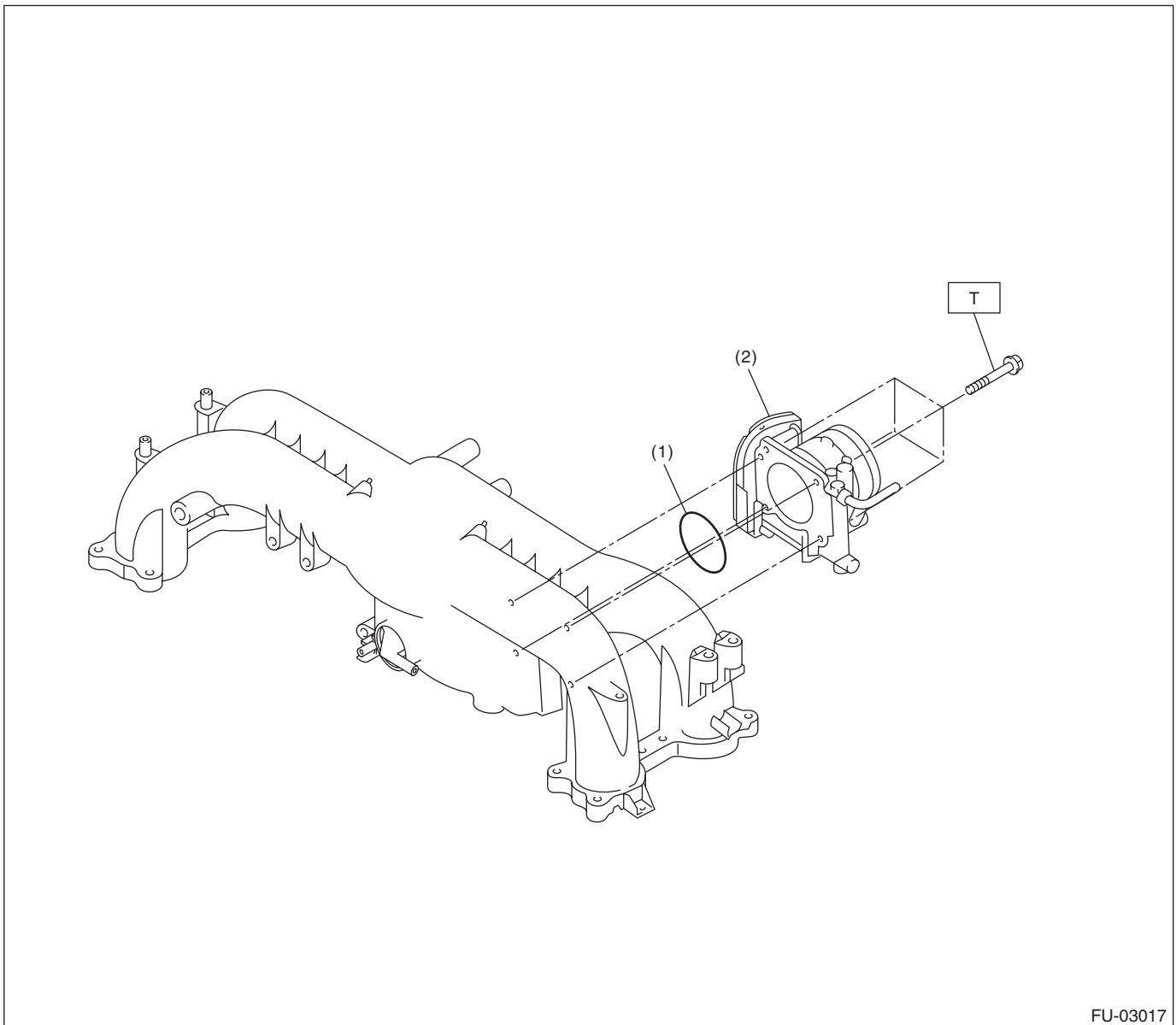
**T3: 8.3 (0.85, 6.1)**

**T4: 19 (1.9, 14.0)**

**T5: 25 (2.5, 18.4)**

---

## 2. AIR INTAKE SYSTEM



FU-03017

(1) O-ring

(2) Throttle body

---

**Tightening torque:N-m (kgf-m, ft-lb)**

**T: 8 (0.8, 5.9)**

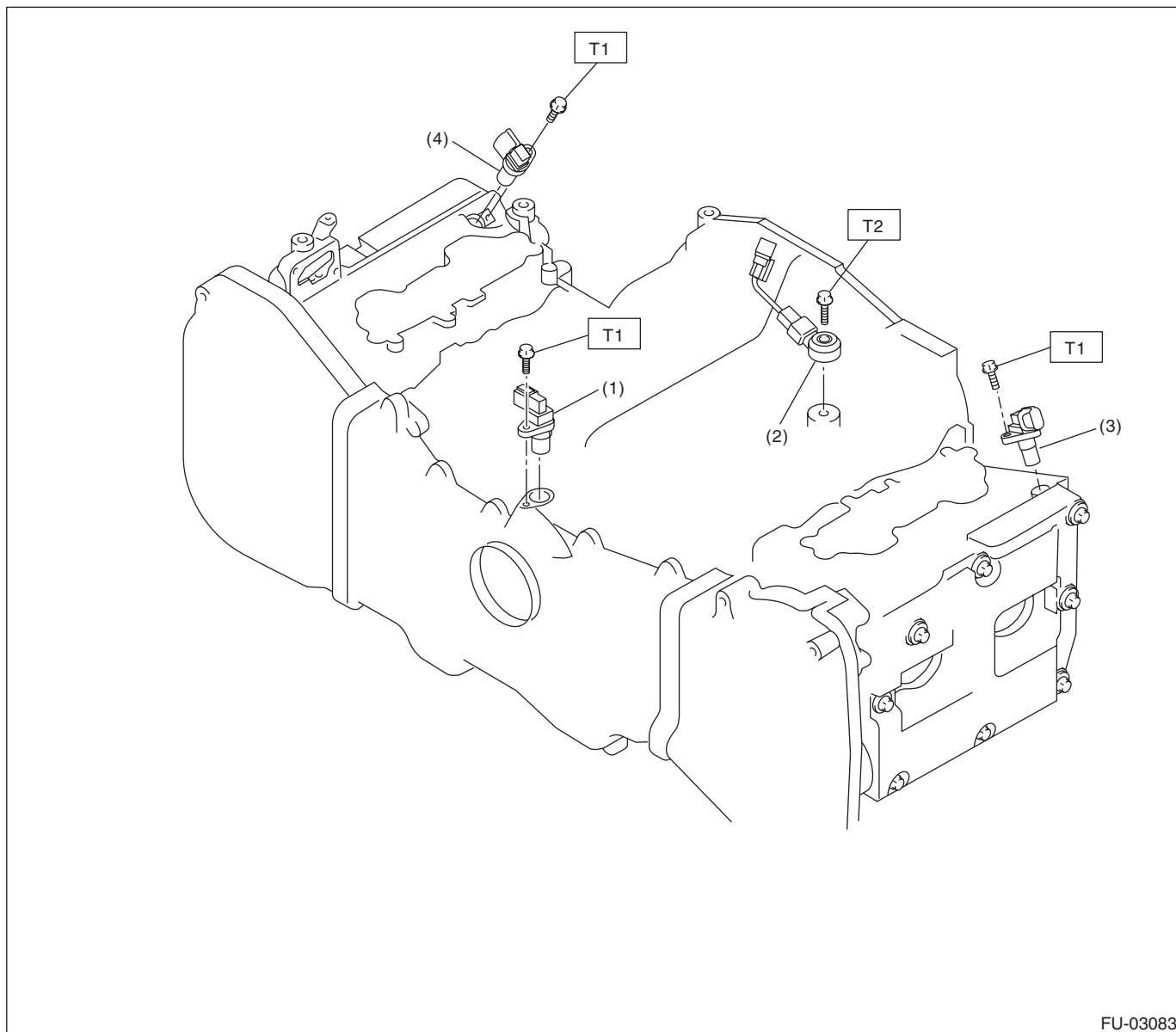
---



# General Description

FUEL INJECTION (FUEL SYSTEMS)

## 3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



FU-03083

(1) Crankshaft position sensor

(4) Camshaft position sensor RH

(2) Knock sensor

(3) Camshaft position sensor LH

**Tightening torque: N·m (kgf·m, ft·lb)**

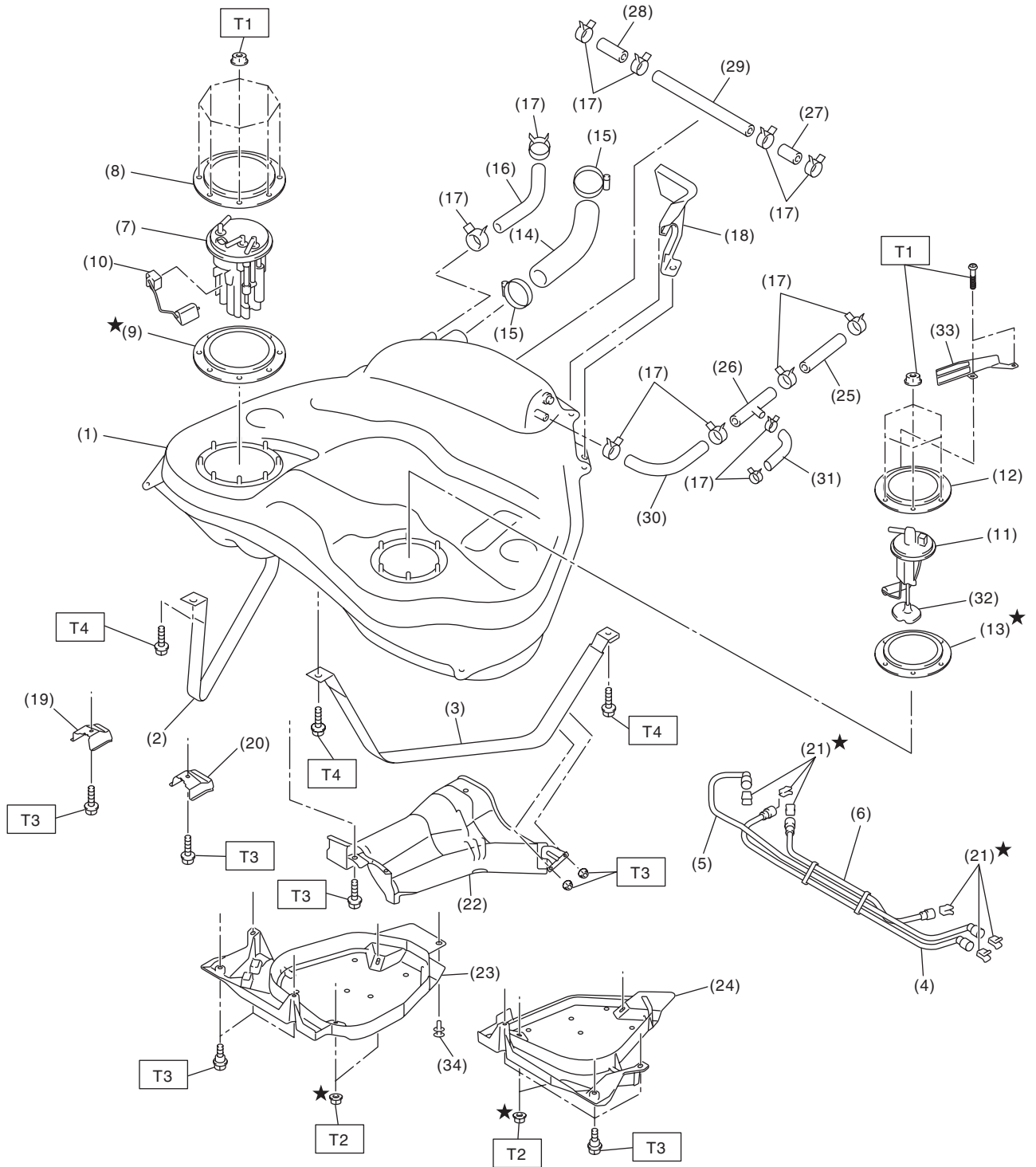
**T1: 6.4 (0.65, 4.7)**

**T2: 24 (2.4, 17.7)**

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

### 4. FUEL TANK



FU-03237

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

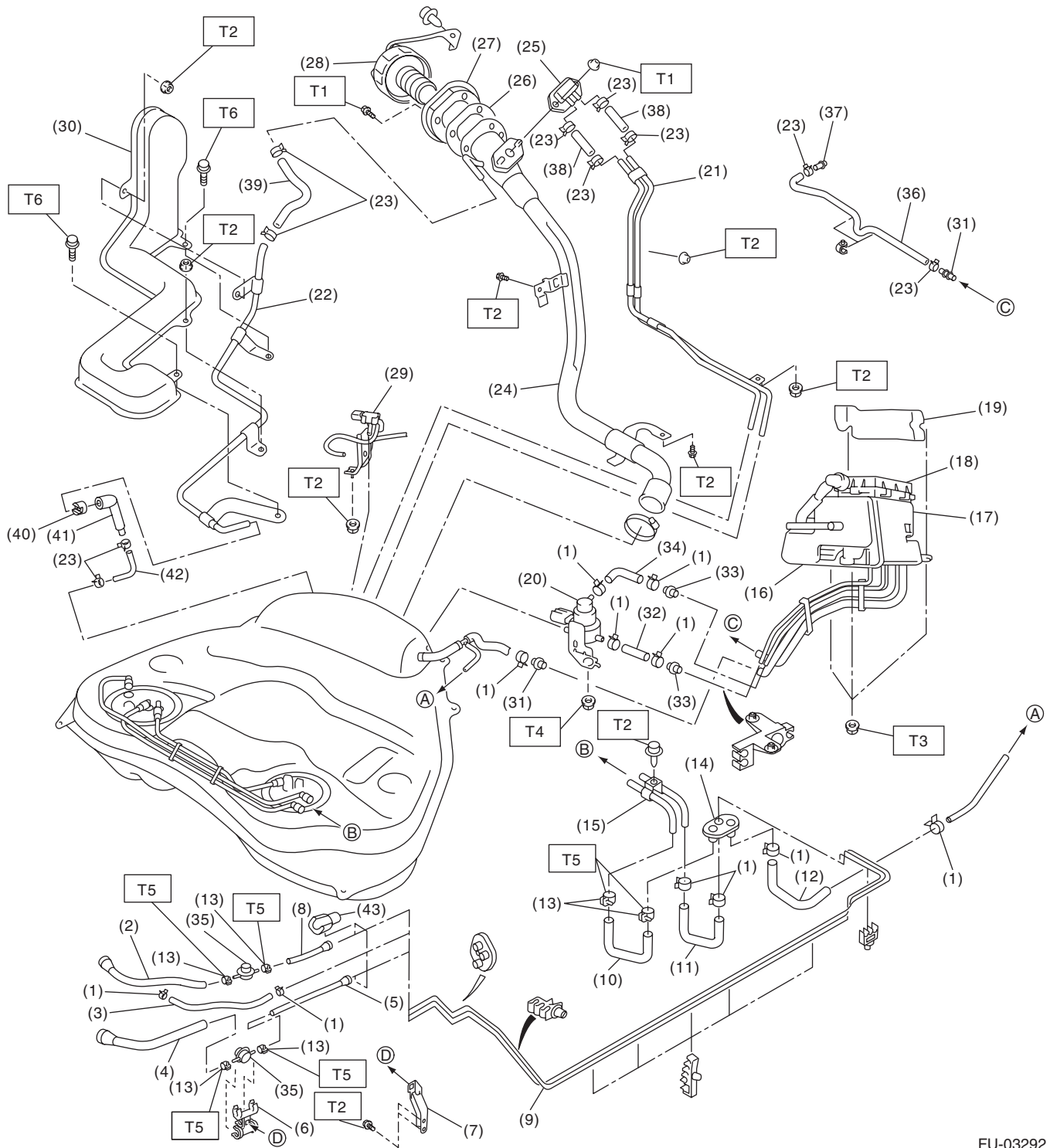
---

(1) Fuel tank	(15) Clamp	(28) Evaporation hose D
(2) Fuel tank band RH	(16) Evaporation hose A	(29) Evaporation pipe
(3) Fuel tank band LH	(17) Clip	(30) Evaporation hose E
(4) Delivery tube	(18) Fuel tank protector LH (Rear)	(31) Evaporation hose F
(5) Return tube	(19) Stopper RH	(32) Fuel sub level sensor filter
(6) Jet pump tube	(20) Stopper LH	(33) Fuel sub level sensor protector
(7) Fuel pump ASSY	(21) Retainer	(34) Clip
(8) Fuel pump upper plate	(22) Heat shield cover	
(9) Fuel pump gasket	(23) Fuel tank protector RH (Front)	<hr/> <b>Tightening torque:N·m (kgf-m, ft-lb)</b>
(10) Fuel level sensor	(24) Fuel tank protector LH (Front)	<b>T1: 4.4 (0.45, 3.2)</b>
(11) Fuel sub level sensor	(25) Evaporation hose B	<b>T2: 9 (0.9, 6.6)</b>
(12) Fuel sub level sensor upper plate	(26) Connector	<b>T3: 17.5 (1.78, 12.9)</b>
(13) Fuel sub level sensor gasket	(27) Evaporation hose C	<b>T4: 33 (3.4, 25)</b>
(14) Fuel filler hose		<hr/>

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

### 5. FUEL LINE



FU-03292

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

(1) Clip	(18) Drain filter	(35) Fuel damper valve
(2) Fuel delivery hose A	(19) Canister protector	(36) Drain hose
(3) Evaporation hose A	(20) Pressure control solenoid valve	(37) Drain hose connector
(4) Fuel return hose A	(21) Evaporation pipe A	(38) Evaporation hose C
(5) Fuel return hose B	(22) Evaporation pipe B	(39) Evaporation hose D
(6) Fuel damper valve holder	(23) Clip	(40) Retainer
(7) Fuel damper valve bracket	(24) Fuel filler pipe	(41) Evaporation tube
(8) Fuel delivery hose B	(25) Shut valve	(42) Evaporation hose E
(9) Fuel pipe ASSY A	(26) Gasket	(43) Quick connector check cover
(10) Fuel delivery hose C	(27) Filler ring	
(11) Fuel return hose C	(28) Fuel filler cap	
(12) Evaporation hose B	(29) Fuel tank pressure sensor	
(13) Clamp	(30) Evaporation pipe protector	
(14) Grommet	(31) Connector A	
(15) Fuel pipe ASSY B	(32) Canister hose A	
(16) Canister	(33) Connector B	
(17) Drain valve	(34) Canister hose B	

---

**Tightening torque:N·m (kgf-m, ft-lb)****T1: 4.4 (0.45, 3.2)****T2: 7.5 (0.76, 5.5)****T3: 8 (0.8, 5.9)****T4: 17.6 (1.8, 13)****T5: 1.25 (0.13, 0.94)****T6: 1.0 (0.1, 0.7)**

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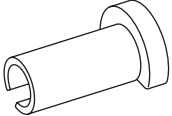
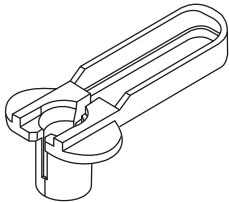
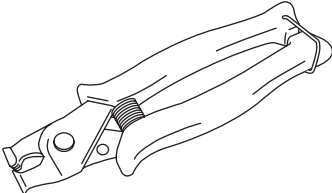
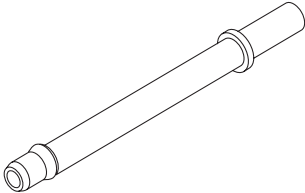
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

## General Description

### FUEL INJECTION (FUEL SYSTEMS)

#### D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for disconnecting quick connector on the fuel delivery hose side of the engine compartment.
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose of the engine compartment.
 ST18353AA000	18353AA000	CLAMP PLIERS	<ul style="list-style-type: none"> <li>• Used for removing and installing the PCV hose.</li> <li>• This is a general tool made by the French company CAILLAU. (code) 54.0.000.205</li> </ul> To make this easier to obtain in the same way as genuine Subaru parts, it has been provided with a tool number as an ST.
 ST18471AA000	18471AA000 (Newly adopted tool)	FUEL PIPE ADAPTER	Used for draining fuel.

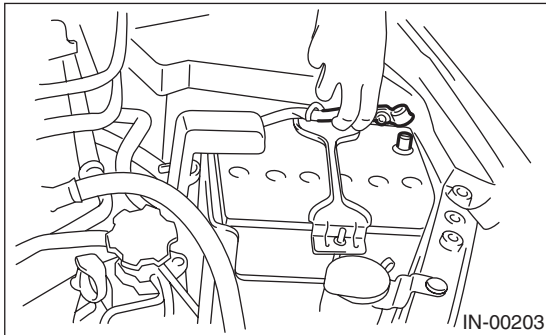
# Throttle Body

FUEL INJECTION (FUEL SYSTEMS)

## 2. Throttle Body

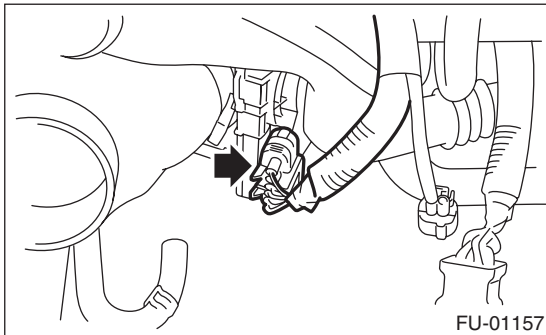
### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.

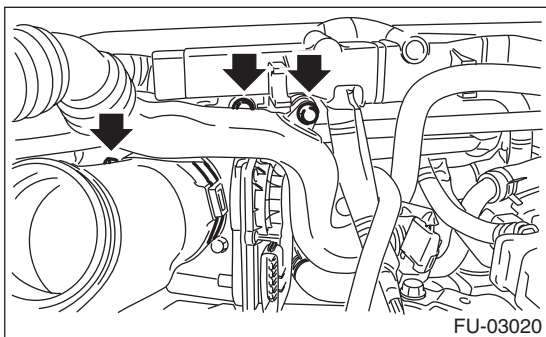


- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>

- 4) Disconnect the connectors from the throttle position sensor.

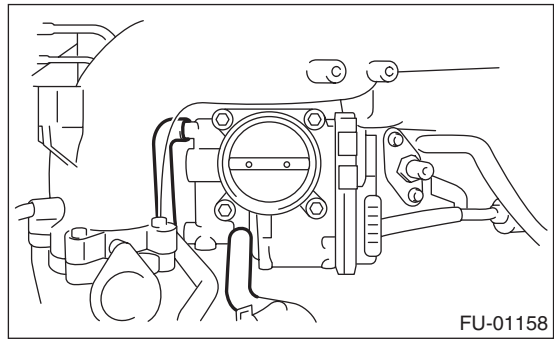


- 5) Remove the bolts which secure the air by-pass pipe and PCV pipe to the intake manifold, and loosen the clamp which connects the throttle body and duct.



- 6) Remove the duct from the throttle body.

- 7) Disconnect the engine coolant hoses from the throttle body.



- 8) Remove the bolts which secure the throttle body to the intake manifold, and remove the throttle body.

### B: INSTALLATION

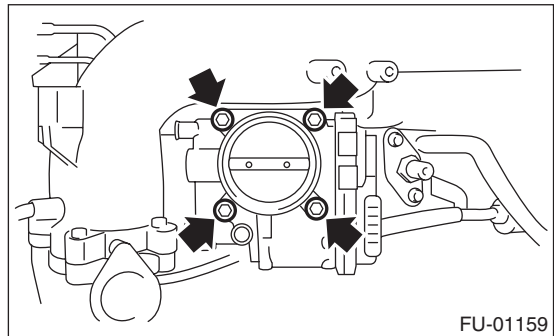
Install in the reverse order of removal.

NOTE:

Use new O-rings.

**Tightening torque:**

**8 N·m (0.8 kgf·m, 5.9 ft·lb)**



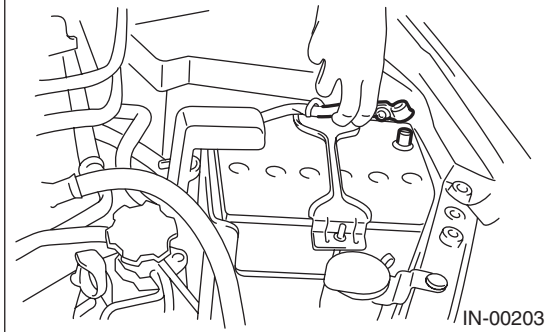
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

### 3. Intake Manifold

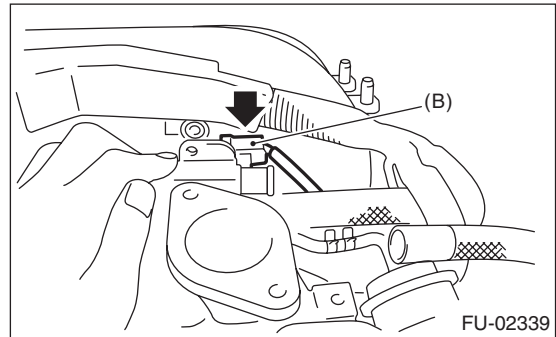
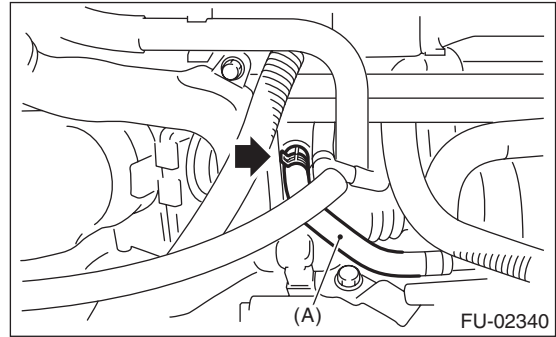
#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure.  
<Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Remove the collector cover.
- 4) Disconnect the ground cable from battery.

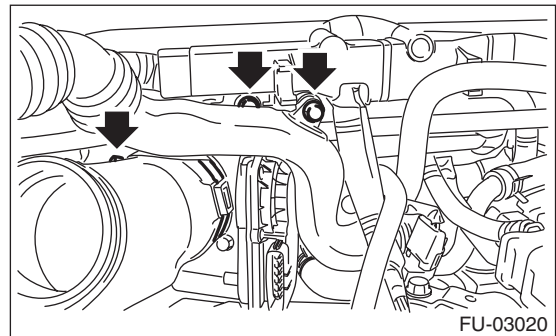


- 5) Open the fuel filler flap lid, and remove the fuel filler cap.
- 6) Lift up the vehicle.
- 7) Remove the under cover.
- 8) Drain approximately 3.0 ℓ (3.2 US qt, 2.6 Imp qt) of coolant.
- 9) Remove the intake duct from the air cleaner case.
- 10) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 11) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 12) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-29, REMOVAL, Coolant Filler Tank.>

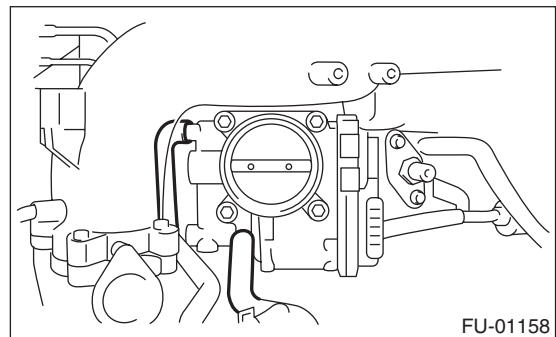
- 13) Disconnect the emission hose (A) and the connector (B) from the PCV hose assembly.



- 14) Remove the bolts which secure the air by-pass pipe and PCV pipe to the intake manifold, and loosen the clamp which connects the throttle body and duct.



- 15) Remove the duct from the throttle body.
- 16) Disconnect the engine coolant hoses from the throttle body.

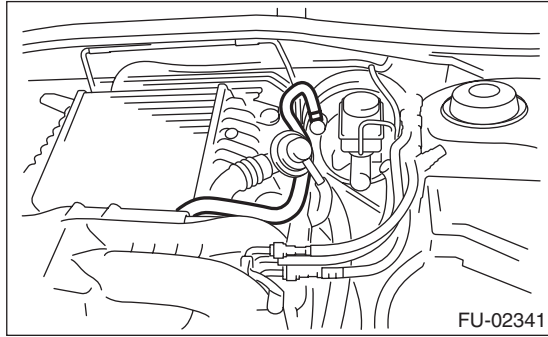




# Intake Manifold

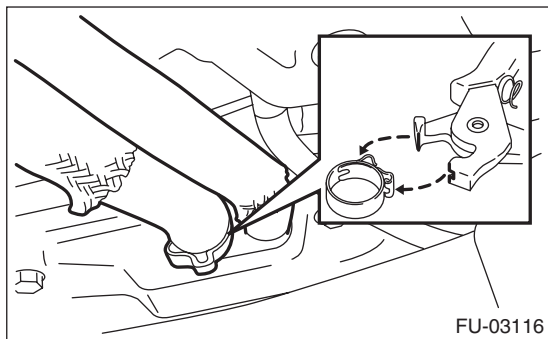
## FUEL INJECTION (FUEL SYSTEMS)

17) Disconnect the brake booster hose.

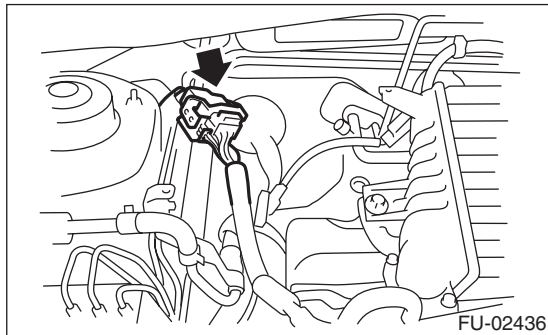


18) Fit the cut out in the ST with the protrusion on the clamp to unlock, and disconnect the PCV hose from the rocker cover.

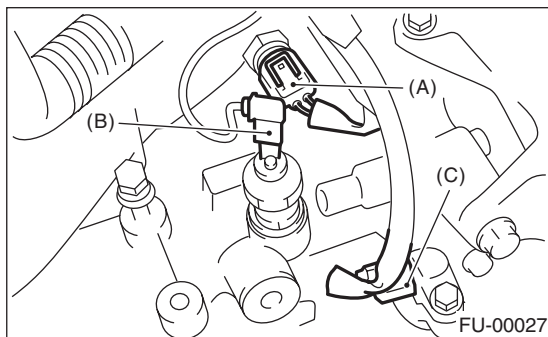
ST 18353AA000 CLAMP PLIERS



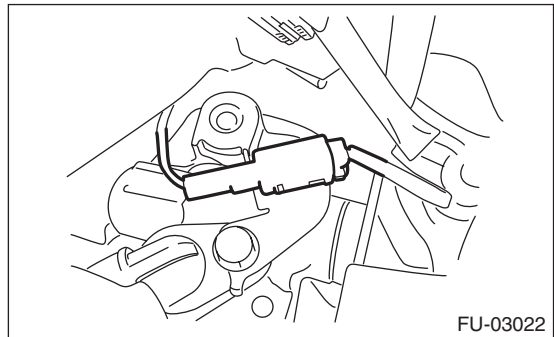
19) Disconnect the engine harness connectors from the bulk head harness connector.



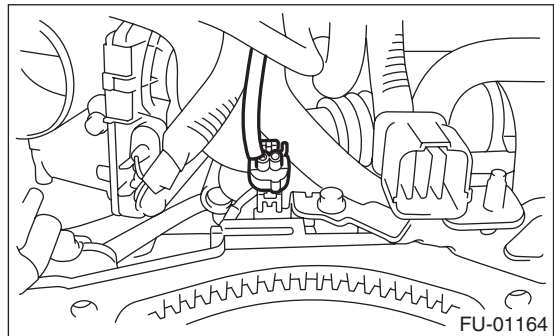
20) Disconnect the connectors from the engine coolant temperature sensor (A), oil pressure switch (B) and crankshaft position sensor (C).



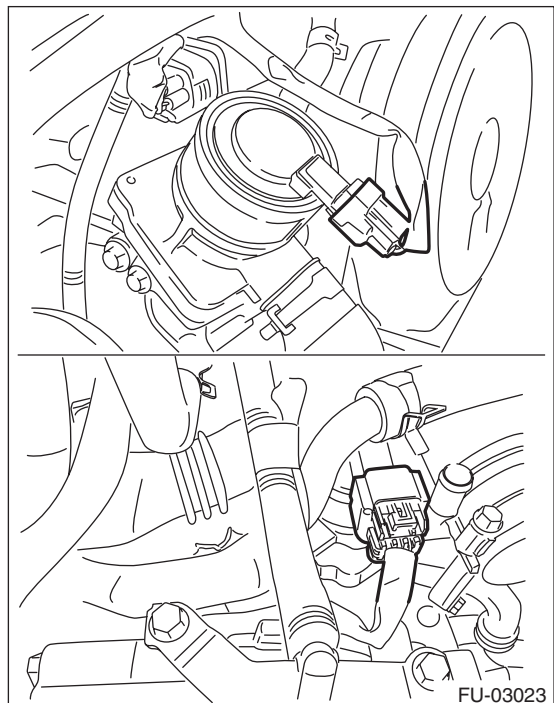
21) Disconnect the connector from power steering pump switch.



22) Disconnect the knock sensor connector.



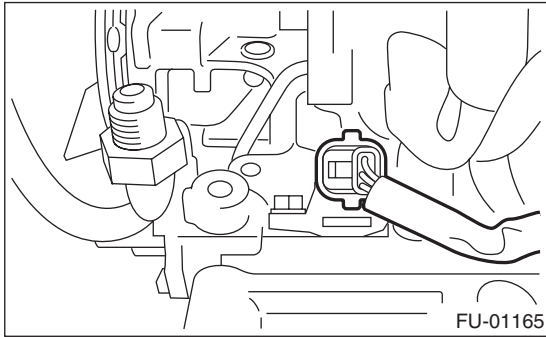
23) Disconnect the connector from the secondary air combination valve.



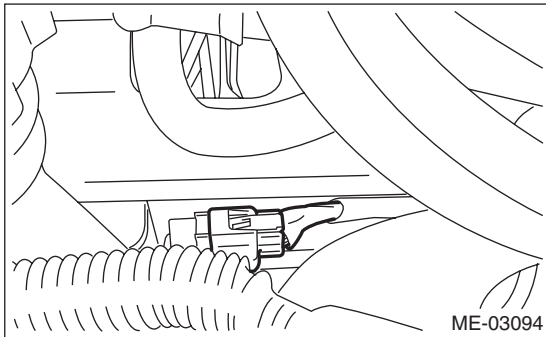
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

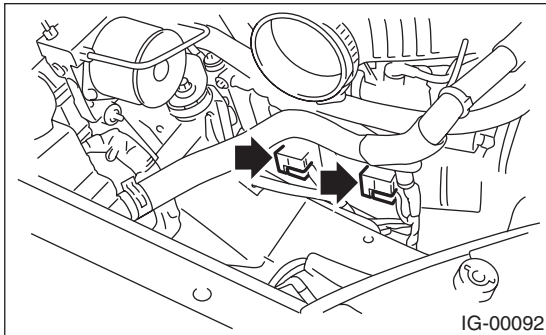
24) Disconnect the connector from the camshaft position sensor.



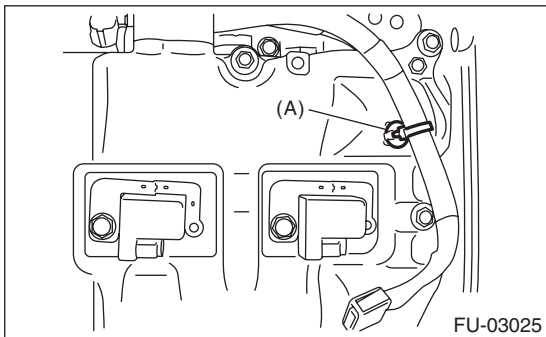
25) Disconnect the connector from the oil flow control solenoid valve.



26) Disconnect the connector from ignition coil.



27) Remove the engine harness fixed by clip (A) from the rocker cover.

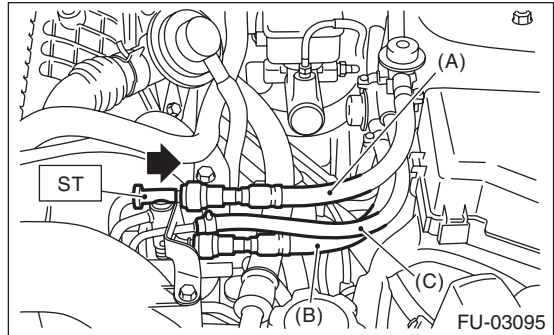


28) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



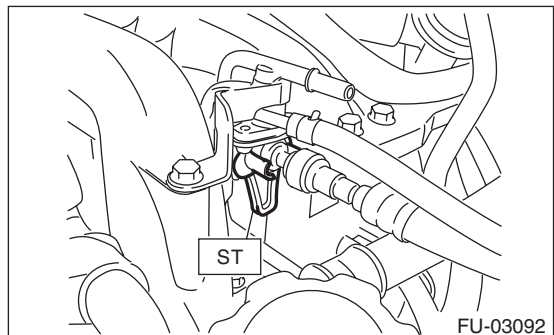
- (A) Fuel delivery hose
- (B) Fuel return hose
- (C) Evaporation hose

29) Disconnect the fuel return hose using the ST.  
ST 18371AA000 CONNECTOR REMOVER

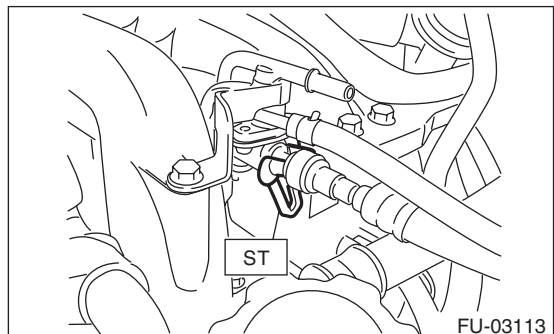
### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

(1) Attach ST to the fuel return pipe as shown in the figure.



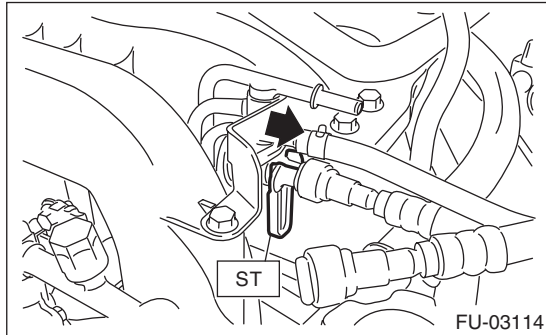
(2) Insert the front side of ST into the quick connector.



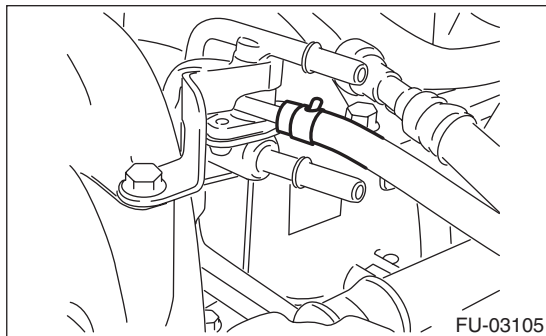
# Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

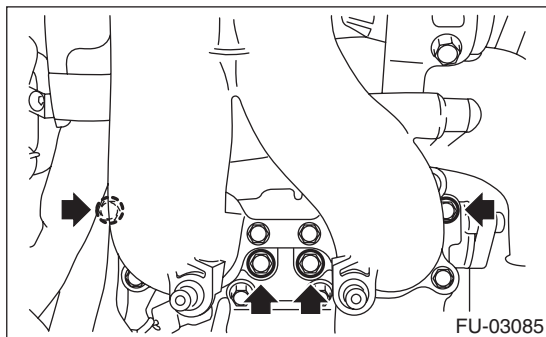
(3) Insert the back side of ST into the quick connector and push ST in the direction of arrow mark to disconnect the fuel return hose.



30) Remove the clip and disconnect the evaporation hose from the fuel pipe.



31) Remove the bolts which hold the tumble generator valve assembly onto the cylinder head.



32) Remove the intake manifold.

## B: INSTALLATION

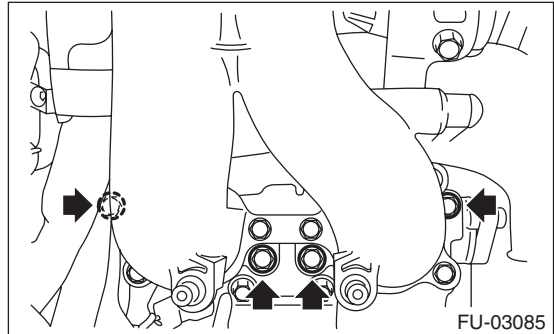
1) Install the intake manifold onto cylinder heads.

NOTE:

Use a new gasket.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

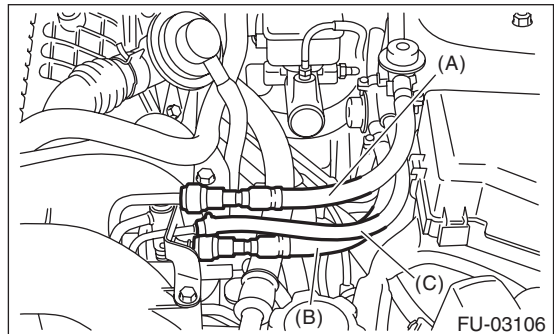


2) Connect the fuel delivery hose, return hose, and evaporation hose.

<Ref. to FU(H4DOTC)-71, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

NOTE:

If fuel hoses or clamps are damaged, replace them with new parts.

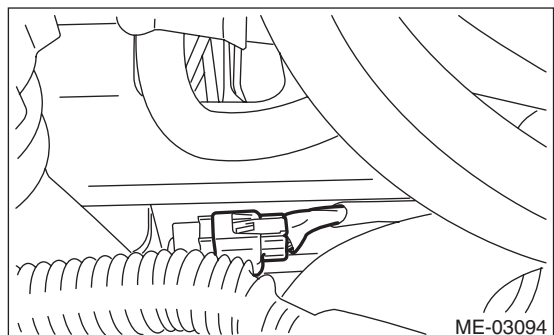


(A) Fuel delivery hose

(B) Fuel return hose

(C) Evaporation hose

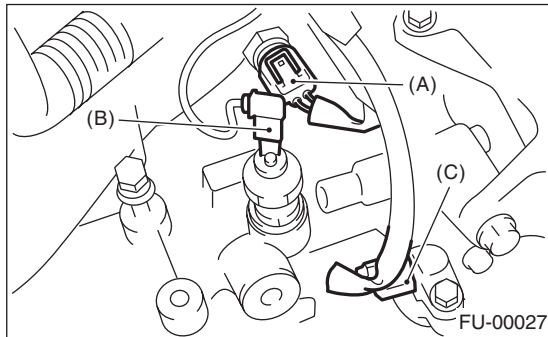
3) Connect the connector to the oil flow control solenoid valve.



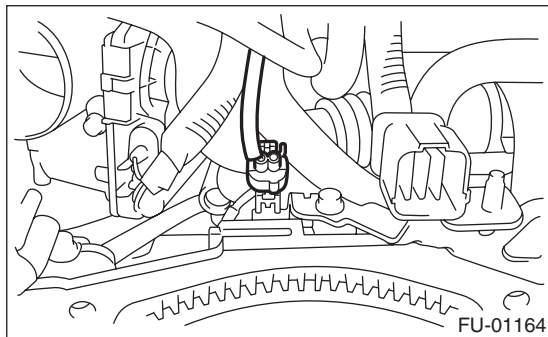
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

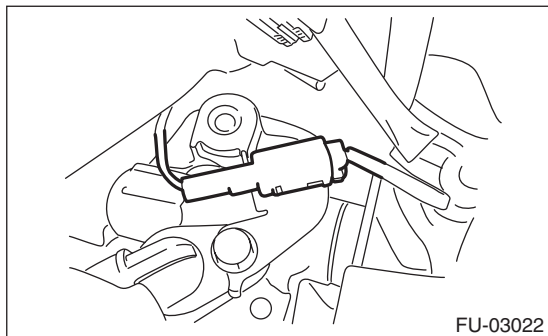
4) Connect the connector to the engine coolant temperature sensor (A), oil pressure switch (B) and crankshaft position sensor (C).



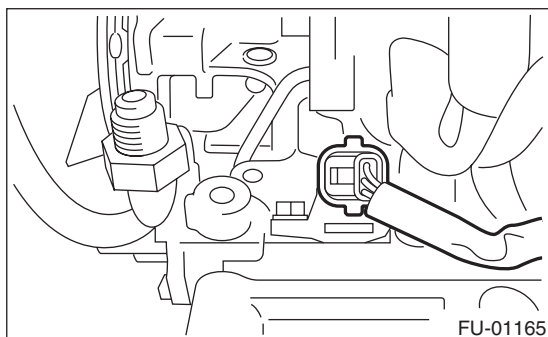
5) Connect the connector to the knock sensor.



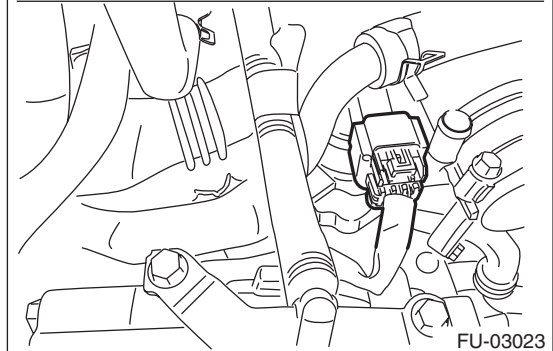
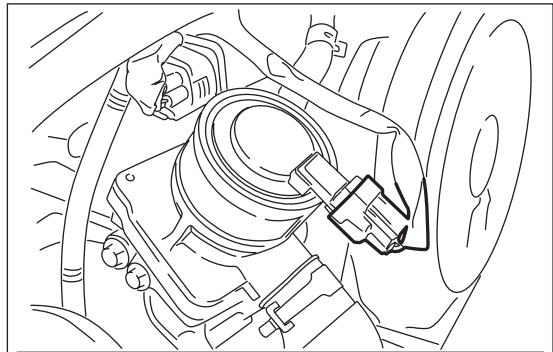
6) Connect the connector to the power steering pump switch.



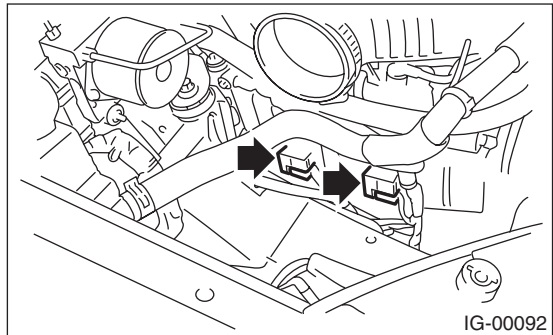
7) Connect the connectors to camshaft position sensor.



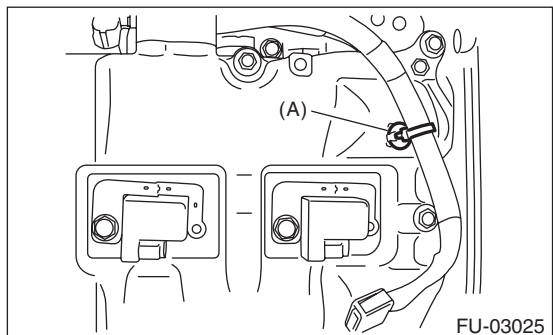
8) Connect the connector to the secondary air combination valve.



9) Connect the connector to the ignition coil.



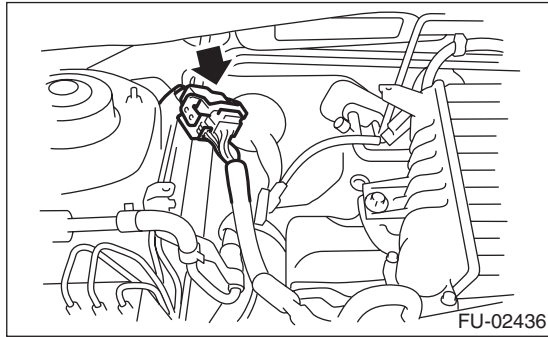
10) Install the engine harness with clip (A) to the rocker cover.



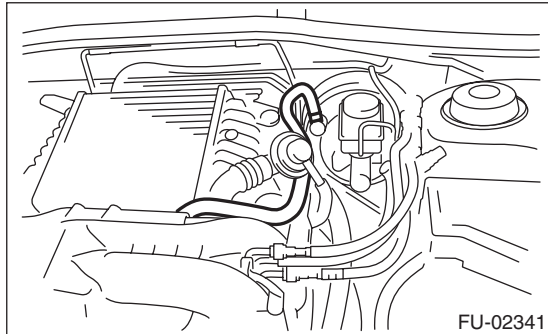
# Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

- 11) Connect the engine harness connectors to the bulkhead harness connectors.



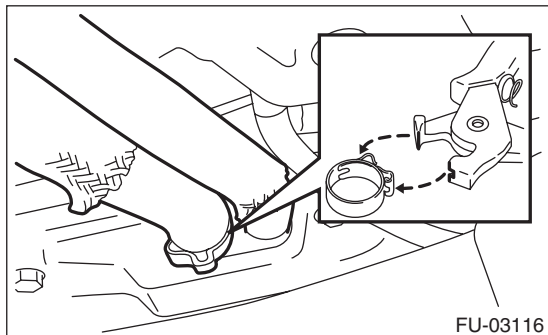
- 12) Connect the brake booster hose.



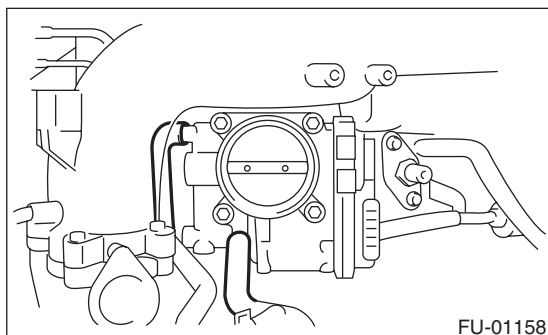
- 13) Connect the PCV hose to the rocker cover and lock it by fitting the clamp protrusion using ST. ST 18353AA000 CLAMP PLIERS

**NOTE:**

Use a new clamp.



- 14) Connect the engine coolant hoses to throttle body.

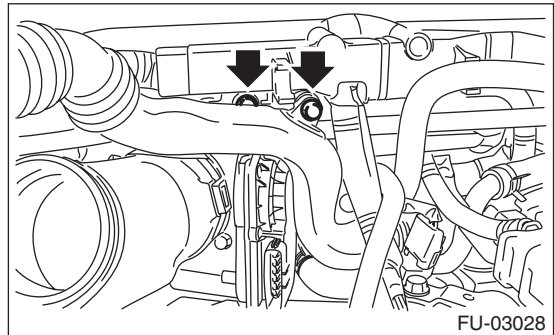


- 15) Install the duct to the throttle body.

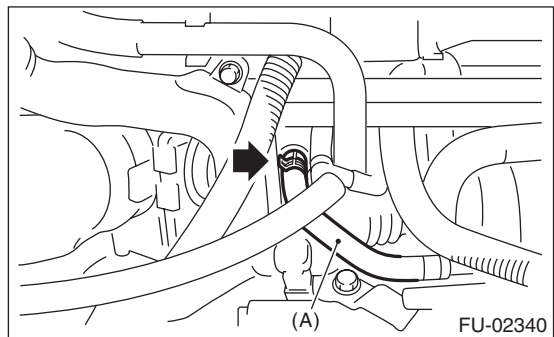
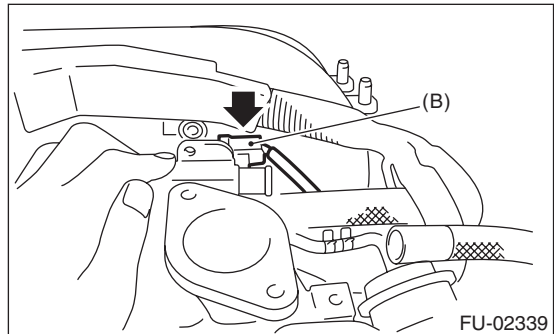
- 16) Attach the bolts which secure the air by-pass pipe and PCV pipe to the intake manifold.

**Tightening torque:**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



- 17) Connect the emission hose (A) and the connector (B) to the PCV hose assembly.



- 18) Install the coolant filler tank.

<Ref. to CO(H4DOTC)-29, INSTALLATION, Coolant Filler Tank.>

- 19) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

- 20) Install the intake duct to the air cleaner case.

- 21) Install the fuse of fuel pump to the main fuse box.

- 22) Connect the battery ground cable to the battery.

- 23) Lift up the vehicle.

- 24) Install the under cover.

- 25) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

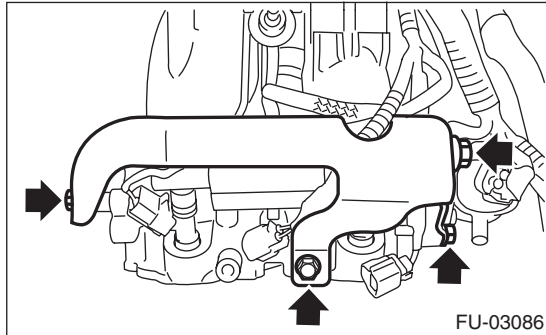
- 26) Install the collector cover.

# Intake Manifold

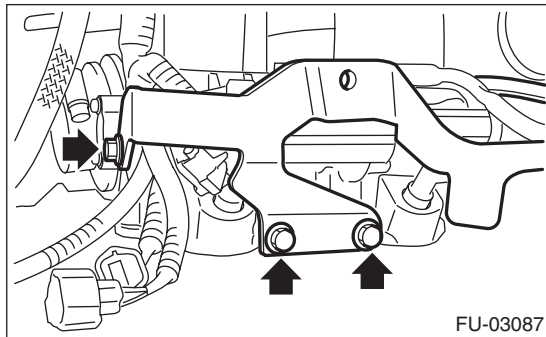
## FUEL INJECTION (FUEL SYSTEMS)

### C: DISASSEMBLY

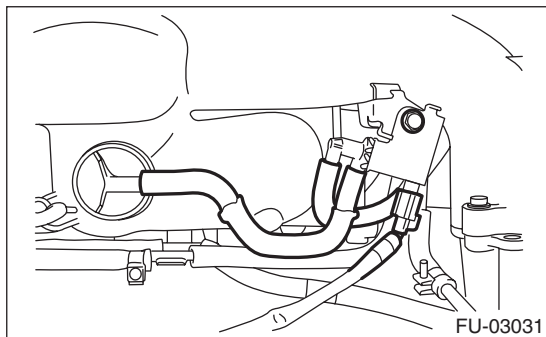
1) Remove the engine ground terminal from the fuel pipe protector LH and remove the fuel pipe protector LH from the intake manifold.



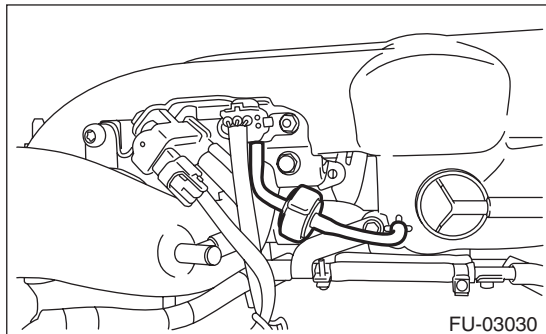
2) Remove the fuel pipe protector RH from the intake manifold.



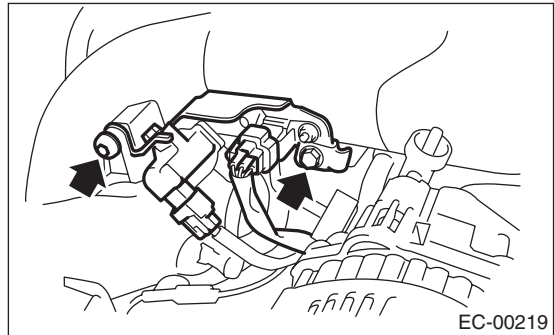
3) Disconnect the evaporation hose and the connector from the purge control solenoid valve 1, and remove the purge control solenoid valve 1 from the intake manifold.



4) Disconnect the filter assembly.

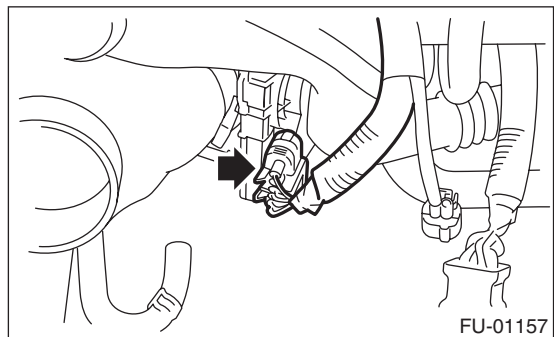


5) Remove the solenoid valve bracket assembly from the intake manifold, and disconnect the connector from the wastegate control solenoid valve, manifold absolute pressure sensor and purge control solenoid valve 2.

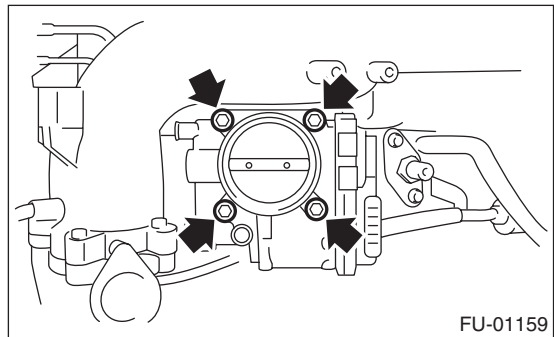


6) Disconnect the evaporation hose of the purge control solenoid valve 2 from the intake duct and fuel pipe assembly.

7) Disconnect the connectors from the throttle position sensor.



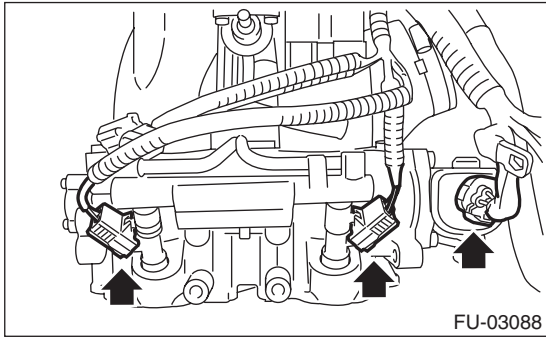
8) Remove the throttle body from the intake manifold.



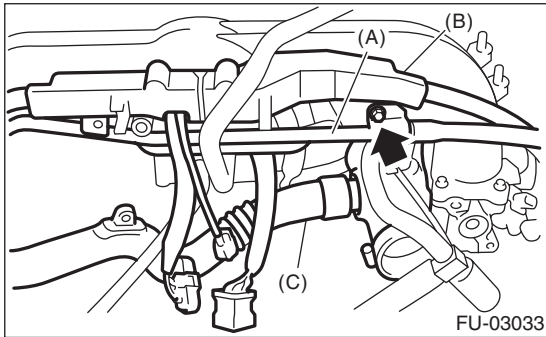
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

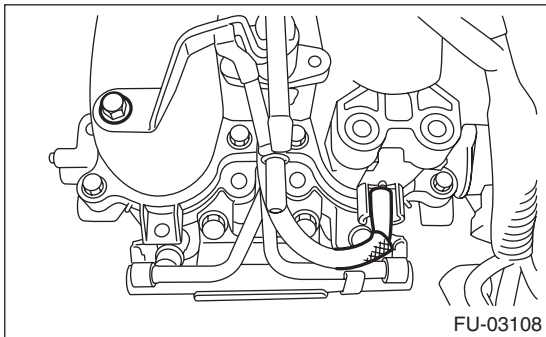
9) Disconnect the connector from the fuel injector and the tumble generator valve assembly.



10) Remove the PCV pipe (A), harness assembly (B) and intake duct (C) from the intake manifold.

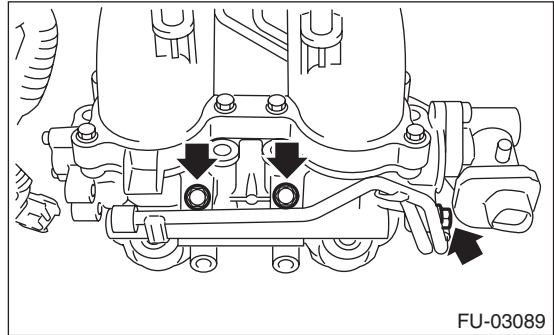


11) Remove the bolt which secures the fuel injector pipe LH onto the front side of intake manifold, and disconnect the pressure regulator vacuum hose from the intake manifold.

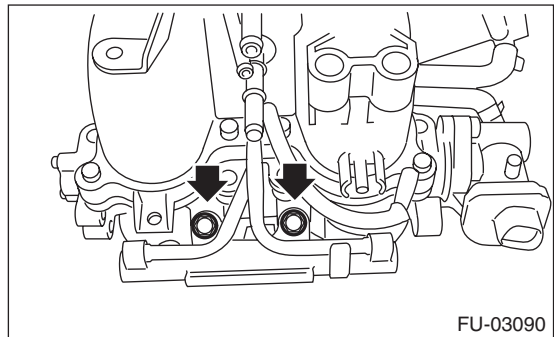


12) Remove the bolt which holds fuel injector pipe onto intake manifold.

- RH side

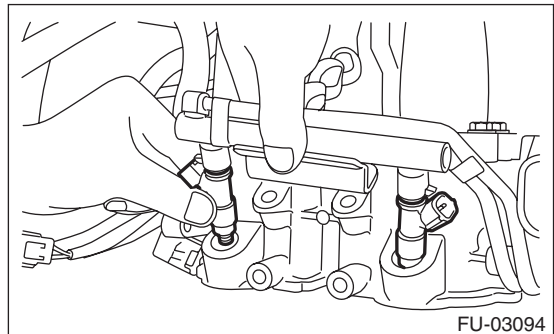


- LH side

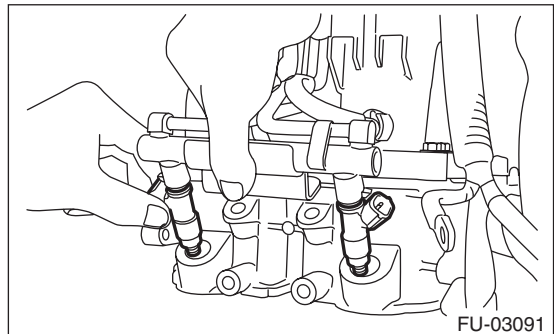


13) Remove the fuel injector.

- RH side



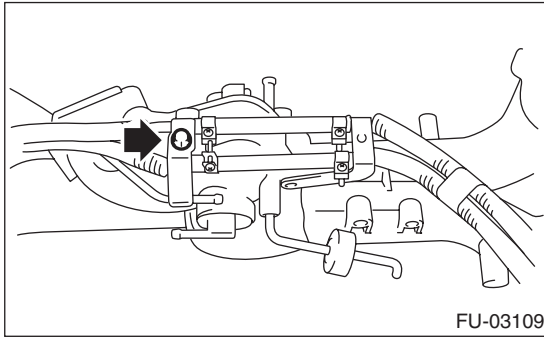
- LH side



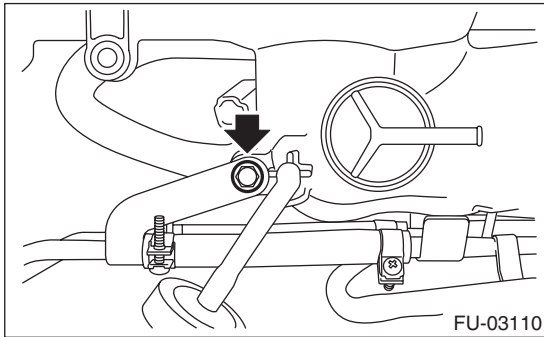
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

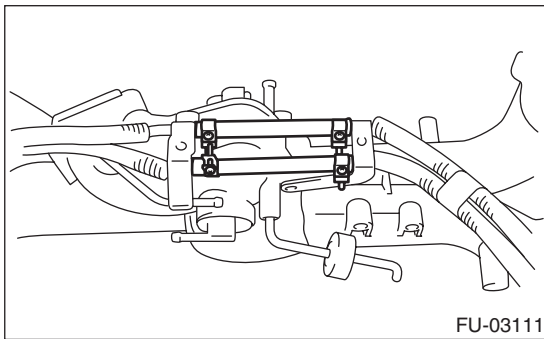
- 14) Remove the bolt which holds fuel injector pipe onto intake manifold.



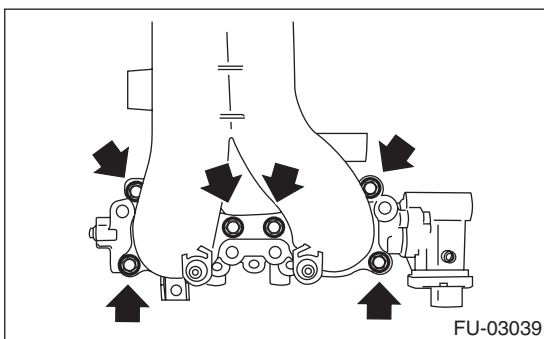
- 15) Remove the bolt which secures fuel injector pipe RH onto the lower side of the intake manifold.



- 16) Loosen the clamp which holds the fuel hose to the fuel injector pipe, and then disconnect the fuel hose from pipe.



- 17) Remove the fuel injector pipe.  
18) Remove the tumble generator valve assembly from the intake manifold.

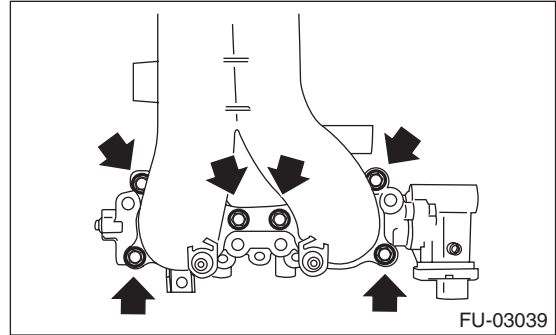


## D: ASSEMBLY

- 1) Install the tumble generator valve assembly onto intake manifold.

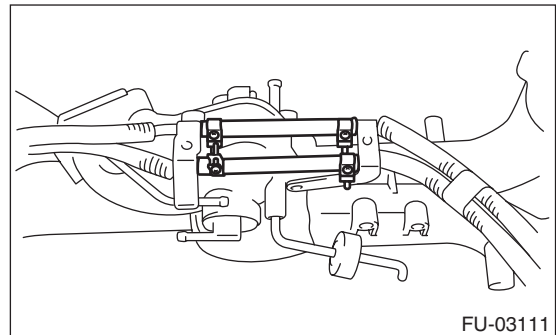
NOTE:  
Use new O-rings.

**Tightening torque:**  
**8.3 N-m (0.85 kgf-m, 6.1 ft-lb)**



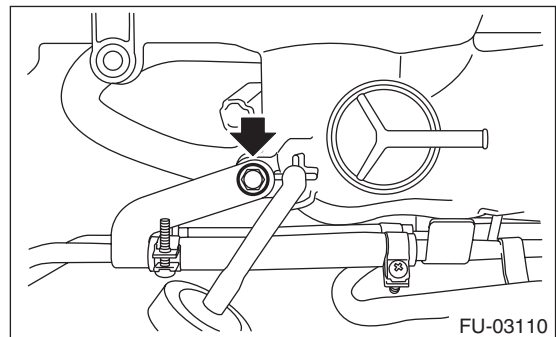
- 2) Install the fuel injector pipe.  
3) Connect fuel hoses to fuel injector pipes on both sides, and secure them with the clamps.

**Tightening torque:**  
**1.25 N-m (0.13 kgf-m, 0.94 ft-lb)**



- 4) Tighten the bolts which secure the fuel injector pipe RH to the lower side of the intake manifold.

**Tightening torque:**  
**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**





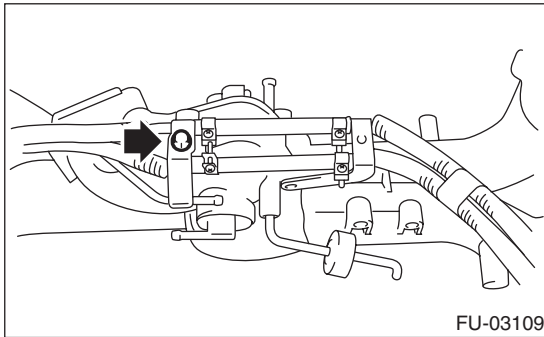
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

5) Tighten the bolts which secure fuel injector pipe onto intake manifold.

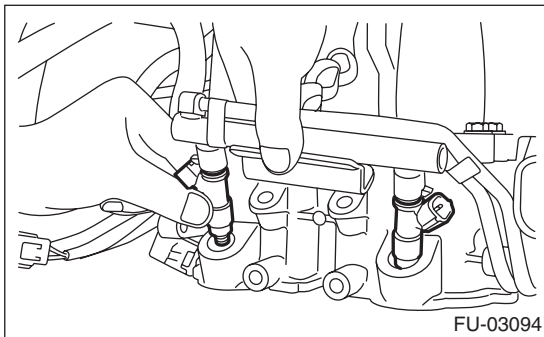
**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

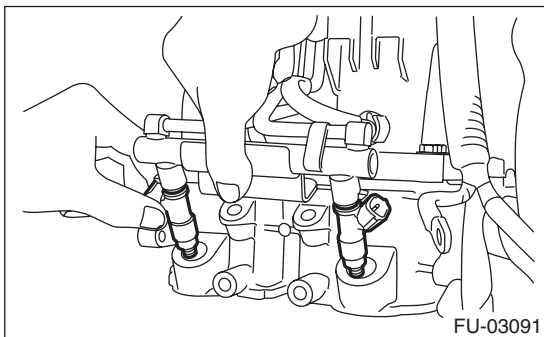


6) Install the fuel injector.

- RH side



- LH side

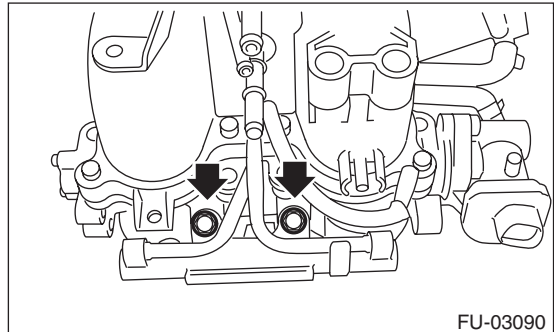


7) Tighten the bolts which secure fuel injector pipe onto intake manifold.

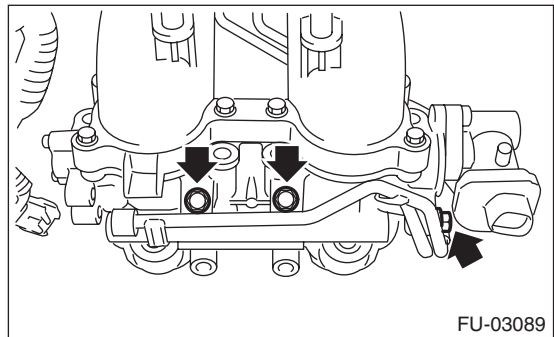
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

- LH side



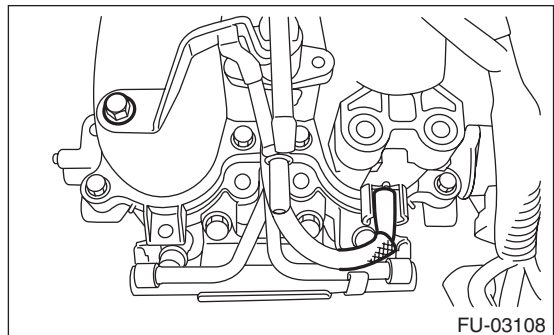
- RH side



8) Tighten the bolt which holds the fuel injector pipe LH to the front side of the intake manifold, and connect the pressure regulator vacuum hose to the intake manifold.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



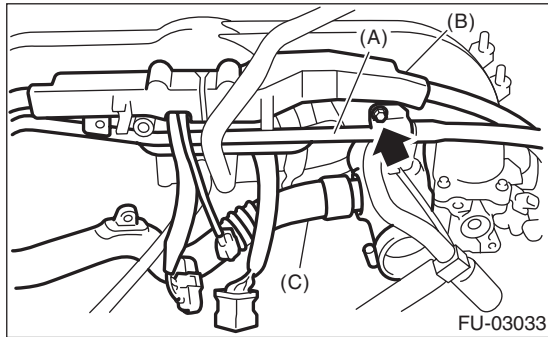
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

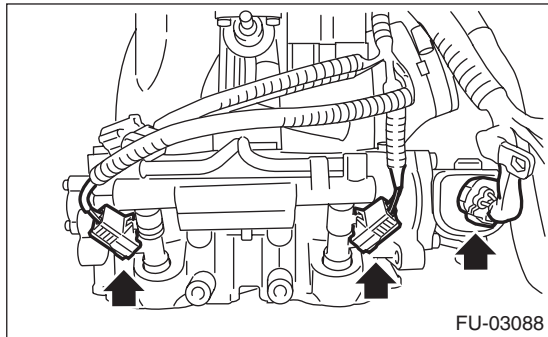
9) Install PCV pipe (A), harness assembly (B) and intake duct (C) to the intake manifold.

**Tightening torque:**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



10) Connect the connector to the fuel injector and the tumble generator valve assembly.



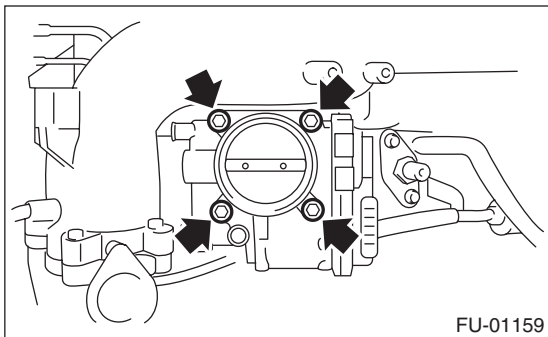
11) Install the throttle body to the intake manifold.

**NOTE:**

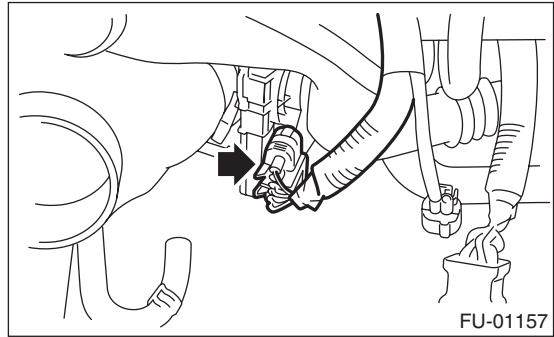
Use new O-rings.

**Tightening torque:**

**8 N·m (0.8 kgf·m, 5.9 ft·lb)**



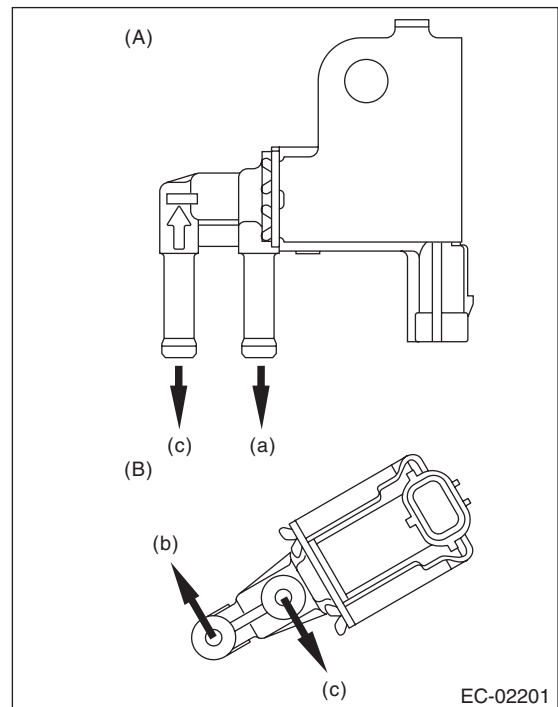
12) Connect the connector to the throttle position sensor.



13) Connect the evaporation hose to the purge control solenoid valve 2.

**NOTE:**

Connect the evaporation hose as shown in the figure.



- (A) Purge control solenoid valve 1
- (B) Purge control solenoid valve 2
- (a) To intake manifold
- (b) To intake duct
- (c) To fuel pipe

# Intake Manifold

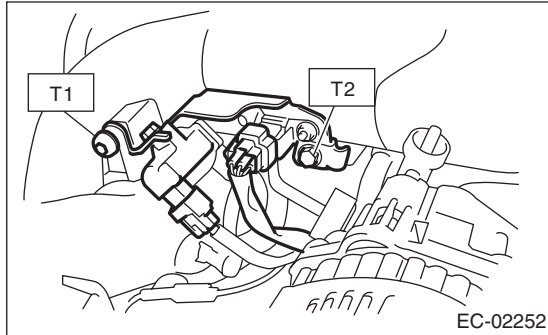
## FUEL INJECTION (FUEL SYSTEMS)

14) Connect the connectors to the wastegate control solenoid valve, manifold absolute pressure sensor and purge control solenoid valve 2, and install the solenoid valve bracket assembly to the intake manifold.

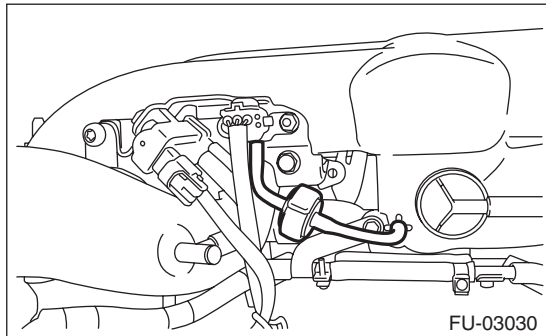
### Tightening torque:

**T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)**

**T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)**



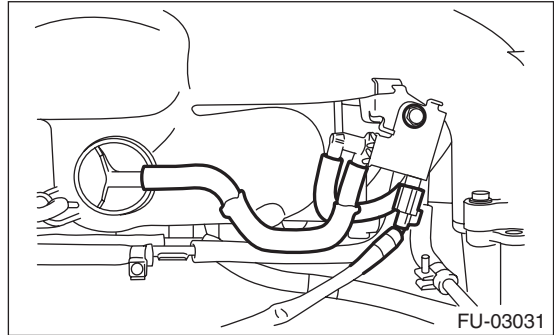
15) Connect the filter assembly.



16) Connect the evaporation hose and the connector to the purge control solenoid valve 1, and install the purge control solenoid valve 1 to the intake manifold.

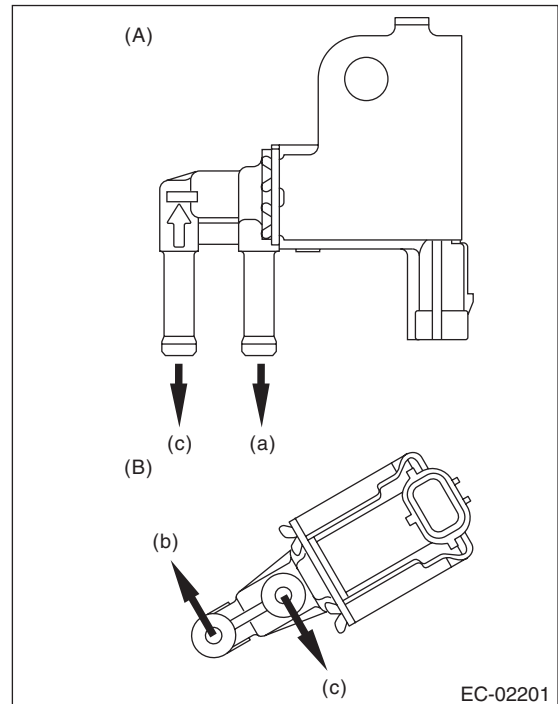
### Tightening torque:

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



### NOTE:

Connect the evaporation hose as shown in the figure.



- (A) Purge control solenoid valve 1
- (B) Purge control solenoid valve 2
- (a) To intake manifold
- (b) To intake duct
- (c) To fuel pipe

# Intake Manifold

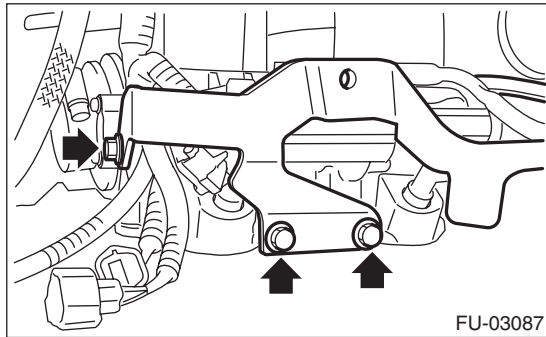
## FUEL INJECTION (FUEL SYSTEMS)

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17) Install the fuel pipe protector RH to the intake manifold.

**Tightening torque:**

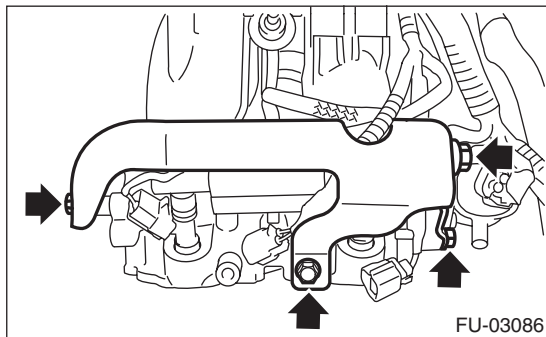
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



18) Install the fuel pipe protector LH to the intake manifold, and install the engine ground terminal to the fuel pipe protector LH.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



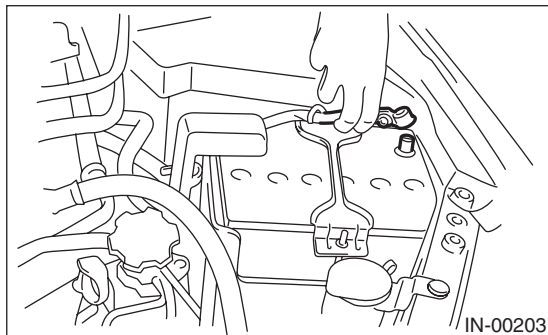
## E: INSPECTION

Make sure that the fuel pipe and fuel hose are not cracked and that the connections are tight.

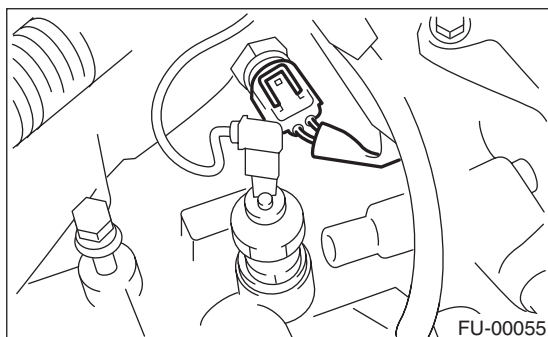
## 4. Engine Coolant Temperature Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 4) Drain engine coolant. <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Disconnect the connectors from the engine coolant temperature sensor.



- 6) Remove the engine coolant temperature sensor.

### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

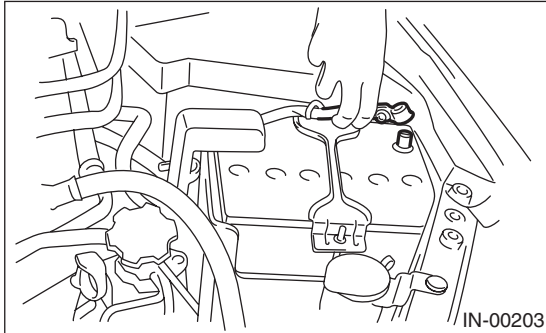
# Crankshaft Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

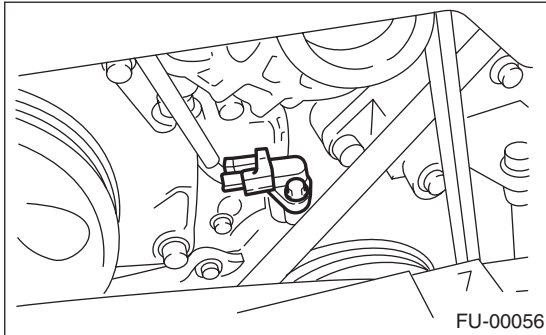
## 5. Crankshaft Position Sensor

### A: REMOVAL

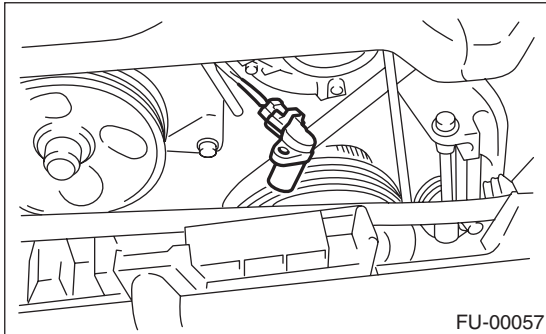
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 4) Remove the bolt which installs crankshaft position sensor to cylinder block.



- 5) Remove the crankshaft position sensor, and then disconnect the connector from it.

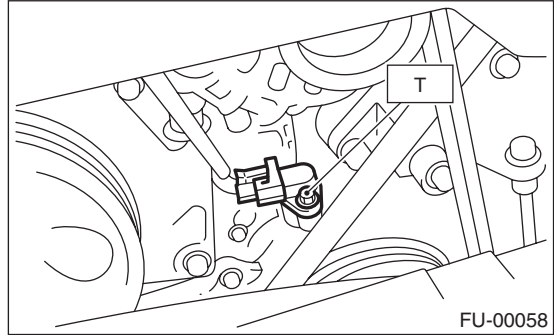


### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

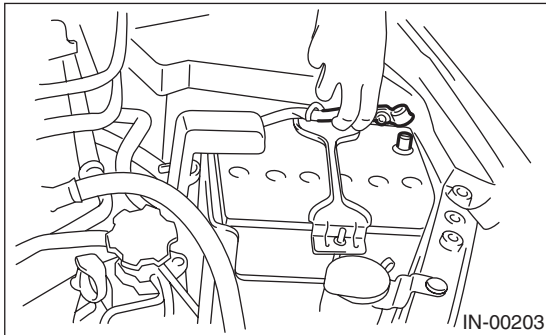
**T: 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



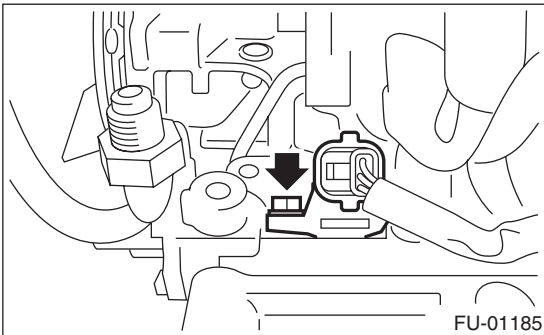
## 6. Camshaft Position Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from camshaft position sensor RH.
- 4) Remove the camshaft position sensor RH from the rear side of the cylinder head.



- 5) Remove the cam shaft position sensor LH in the same way as RH.

### B: INSTALLATION

Install in the reverse order of removal.

#### ***Tightening torque:***

***6.4 N·m (0.65 kgf·m, 4.7 ft·lb)***

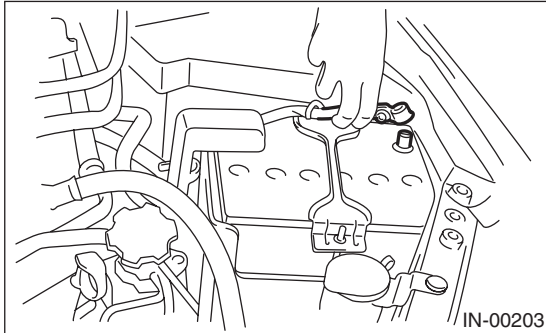
# Knock Sensor

## FUEL INJECTION (FUEL SYSTEMS)

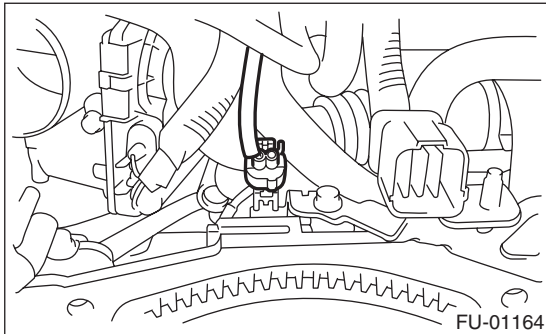
### 7. Knock Sensor

#### A: REMOVAL

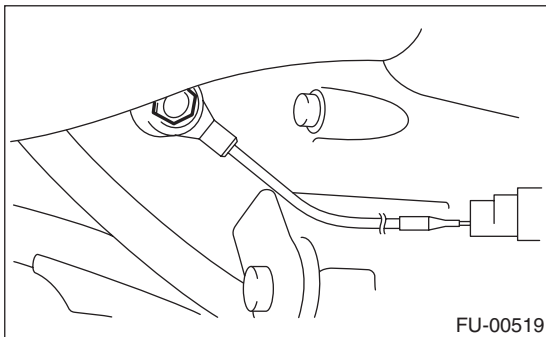
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Disconnect the knock sensor connector.



- 5) Remove the knock sensor from the cylinder block.



#### B: INSTALLATION

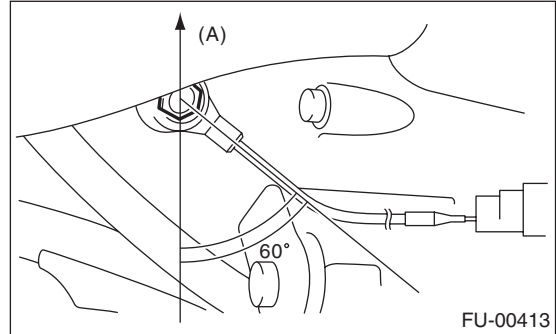
- 1) Install the knock sensor to the cylinder block.

#### NOTE:

The portion of the knock sensor cord that is pulled out must be positioned at a 60° angle relative to the engine rear.

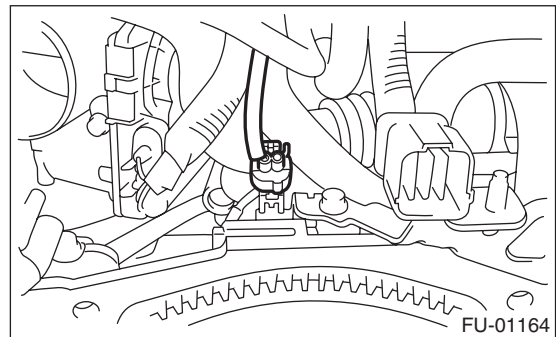
#### Tightening torque:

**24 N·m (2.4 kgf·m, 17.7 ft·lb)**

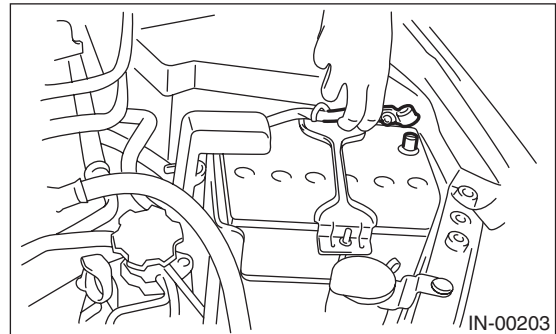


(A) Front side

- 2) Connect the knock sensor connector.



- 3) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 4) Connect the battery ground cable to the battery.



- 5) Install the collector cover.



## 8. Throttle Position Sensor

### A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.

Refer to “Throttle Body” for removal and installation procedure. <Ref. to FU(H4DOTC)-11, REMOVAL, Throttle Body.> <Ref. to FU(H4DOTC)-11, INSTALLATION, Throttle Body.>

# Mass Air Flow and Intake Air Temperature Sensor

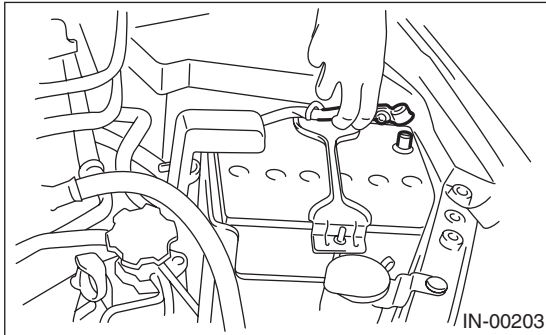
FUEL INJECTION (FUEL SYSTEMS)

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## 9. Mass Air Flow and Intake Air Temperature Sensor

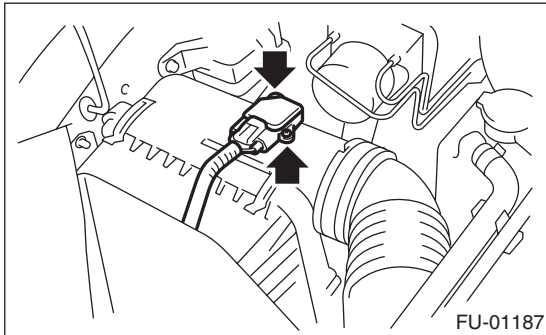
### A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector from the mass air flow and intake air temperature sensor.

3) Remove the mass air flow and intake air temperature sensor.



### B: INSTALLATION

Install in the reverse order of removal.

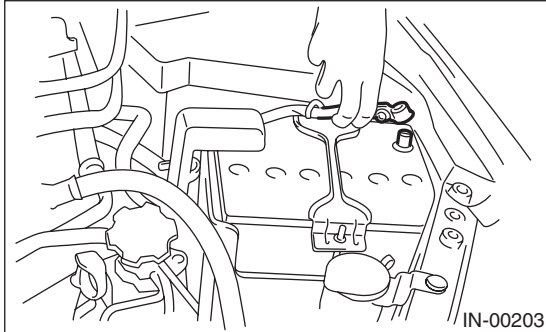
**Tightening torque:**

**1 N·m (0.1 kgf·m, 0.7 ft·lb)**

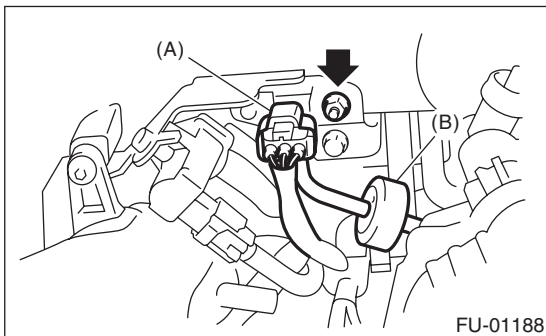
## 10. Manifold Absolute Pressure Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from manifold absolute pressure sensor (A), and remove the filter assembly (B) from intake manifold.
- 4) Remove the manifold absolute pressure sensor from the solenoid valve bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

# Fuel Injector

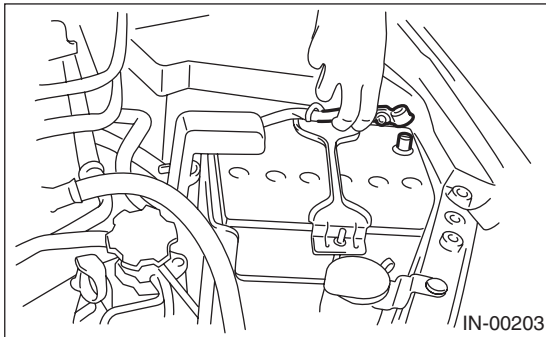
## FUEL INJECTION (FUEL SYSTEMS)

### 11. Fuel Injector

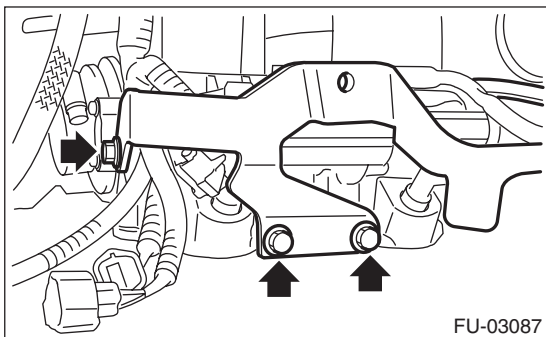
#### A: REMOVAL

##### 1. RH SIDE

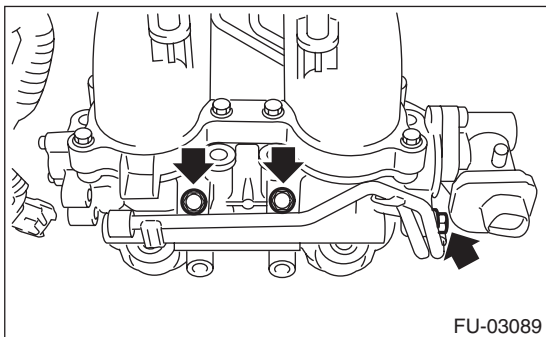
- 1) Release the fuel pressure.  
<Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from battery.



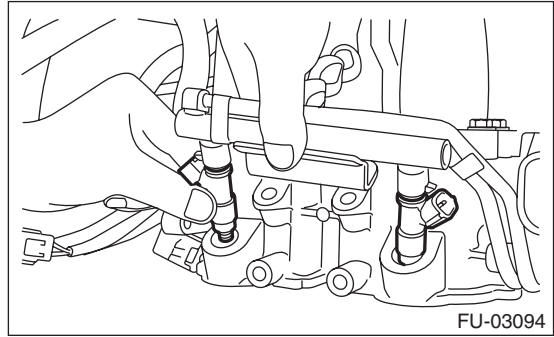
- 4) Open the fuel filler flap lid, and remove the fuel filler cap.
- 5) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 6) Remove the fuel pipe protector RH from the intake manifold.



- 7) Disconnect the connector from fuel injector.
- 8) Remove the bolt which holds fuel injector pipe onto intake manifold.

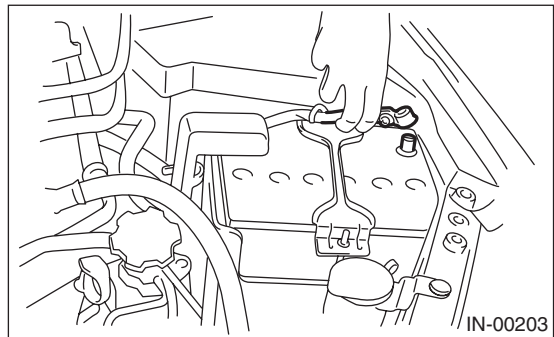


- 9) Remove the fuel injector.

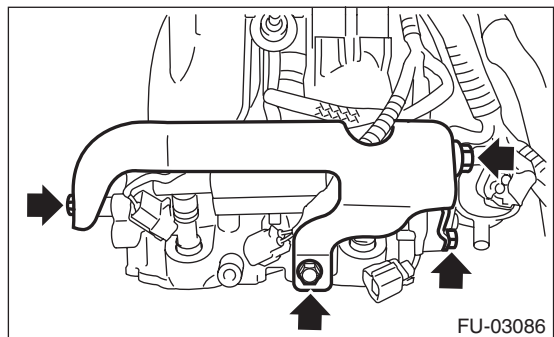


##### 2. LH SIDE

- 1) Release the fuel pressure.  
<Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from battery.

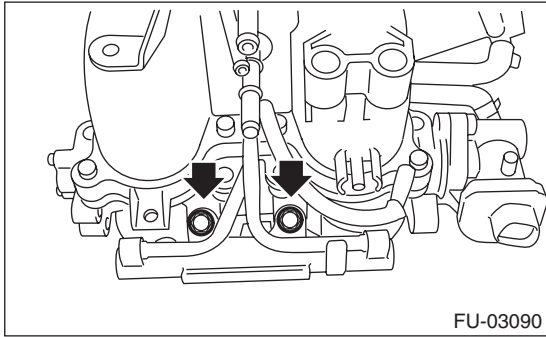
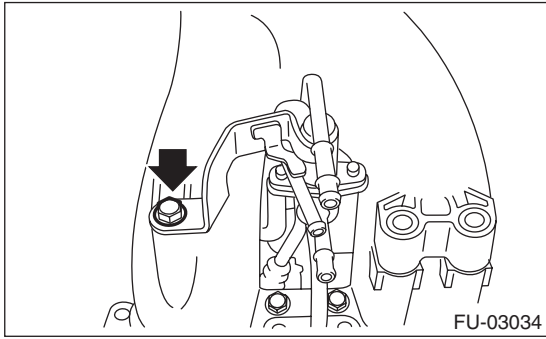


- 4) Open the fuel filler flap lid, and remove the fuel filler cap.
- 5) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 6) Remove the engine ground terminal from the fuel pipe protector LH and remove the fuel pipe protector LH from the intake manifold.

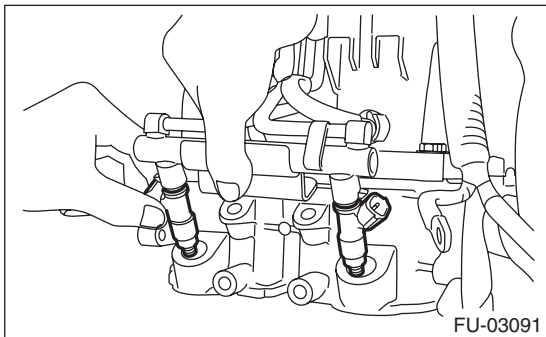


- 7) Disconnect the connector from fuel injector.

8) Remove the bolt which holds fuel injector pipe onto intake manifold.



9) Remove the fuel injector.



# Fuel Injector

## FUEL INJECTION (FUEL SYSTEMS)

### B: INSTALLATION

#### 1. RH SIDE

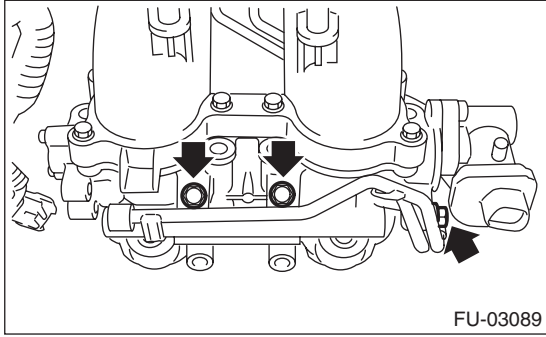
Install in the reverse order of removal.

NOTE:

Use new O-rings.

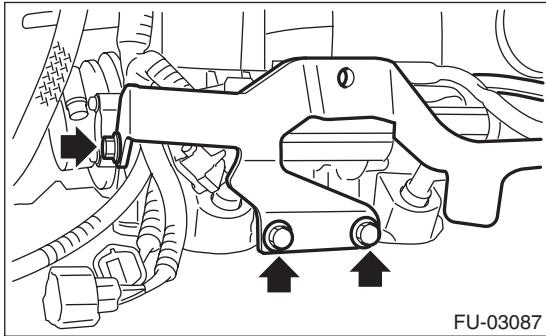
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



#### 2. LH SIDE

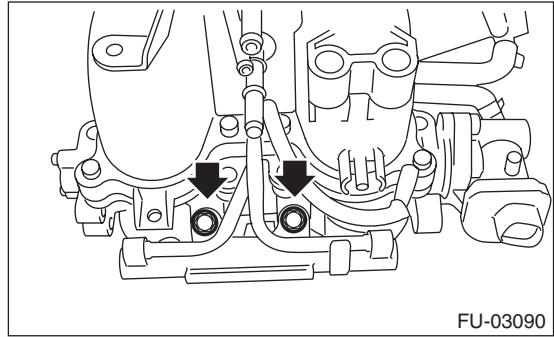
Install in the reverse order of removal.

NOTE:

Use new O-rings.

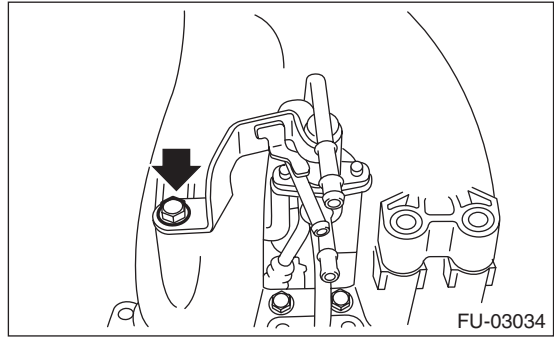
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



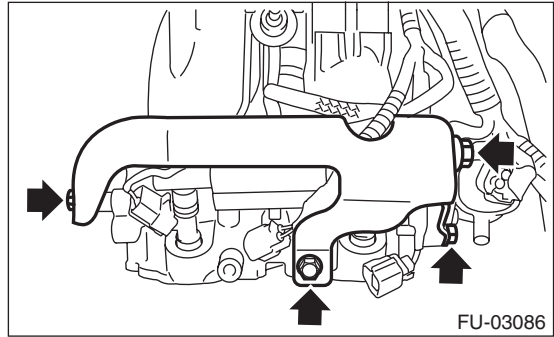
**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



**Tightening torque:**

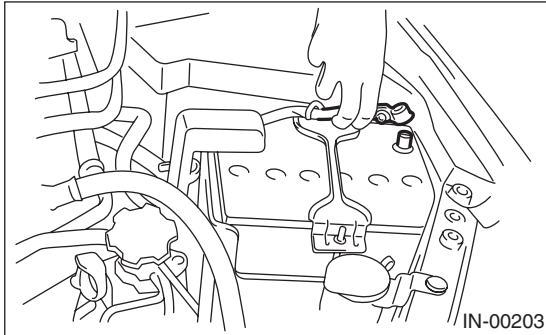
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



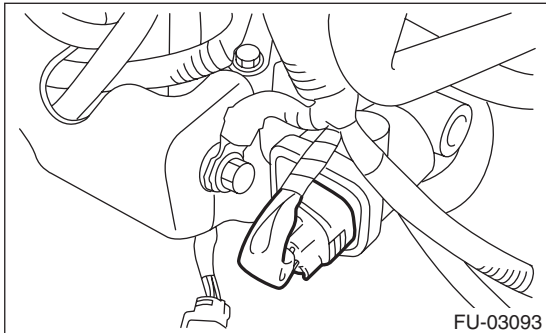
## 12. Tumble Generator Valve Assembly

### A: REMOVAL

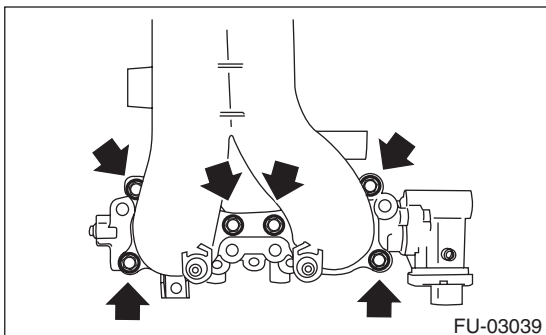
- 1) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from battery.



- 4) Open the fuel filler flap lid, and remove the fuel filler cap.
- 5) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 6) Disconnect the connector from the tumble generator valve assembly.



- 7) Remove the fuel injector. <Ref. to FU(H4DOTC)-32, REMOVAL, Fuel Injector.>
- 8) Remove the tumble generator valve body from intake manifold.



### B: INSTALLATION

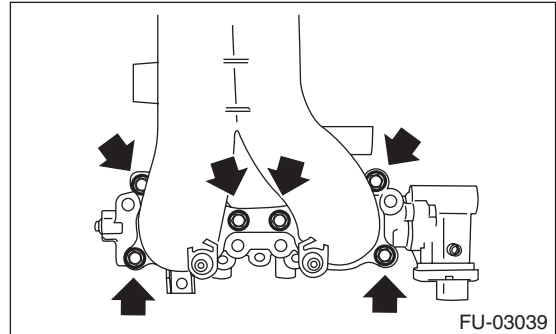
Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**8.3 N·m (0.85 kgf·m, 6.1 ft·lb)**



### **13. Tumble Generator Valve Actuator**

#### **A: SPECIFICATION**

The tumble generator valve assembly cannot be disassembled.

Refer to “Tumble Generator Valve Assembly” for removal and installation procedure. <Ref. to FU(H4DOTC)-35, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(H4DOTC)-35, INSTALLATION, Tumble Generator Valve Assembly.>



## 14. Tumble Generator Valve Position Sensor

### A: SPECIFICATION

The tumble generator valve assembly cannot be disassembled.

Refer to “Tumble Generator Valve Assembly” for removal and installation procedure. <Ref. to FU(H4DOTC)-35, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(H4DOTC)-35, INSTALLATION, Tumble Generator Valve Assembly.>

# Oil Flow Control Solenoid Valve

FUEL INJECTION (FUEL SYSTEMS)

## 15.Oil Flow Control Solenoid Valve

### A: REMOVAL

Oil flow control solenoid valve is a unit with camshaft cap.

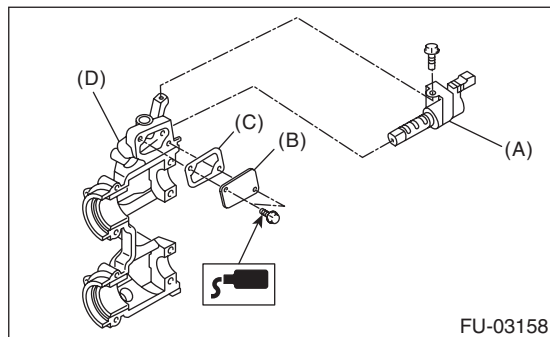
Refer to “Camshaft” for removal procedure. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>

### B: INSTALLATION

Refer to “Camshaft” for installation procedure. <Ref. to ME(H4DOTC)-54, INSTALLATION, Camshaft.>

### C: DISASSEMBLY

- 1) Remove the 2 mounting bolts and remove the oil return cover and gasket.
- 2) Remove the mounting bolt and remove the oil flow control solenoid valve.



- (A) Oil flow control solenoid valve
- (B) Oil return cover
- (C) Gasket
- (D) Camshaft cap

### D: ASSEMBLY

- 1) Install the oil flow control solenoid valve.

**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**

- 2) Apply liquid gasket to the two bolts which secure the oil return cover.

**Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

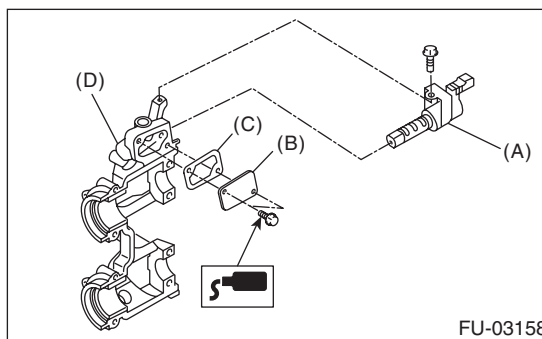
- 3) Attach the oil return cover and gasket.

**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**

NOTE:

Use a new gasket.

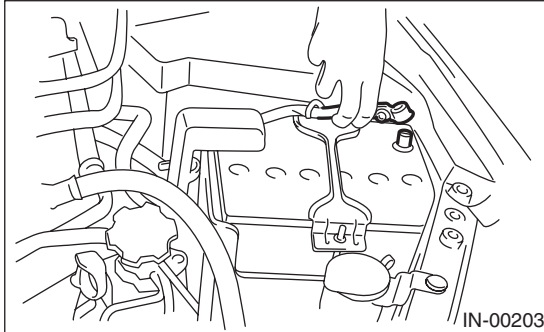


- (A) Oil flow control solenoid valve
- (B) Oil return cover
- (C) Gasket
- (D) Camshaft cap

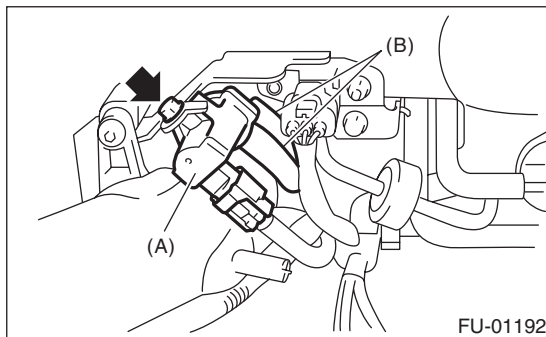
## 16. Wastegate Control Solenoid Valve

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from the wastegate control solenoid valve (A).
- 4) Disconnect pressure hose (B) from the wastegate control solenoid valve.
- 5) Remove the wastegate control solenoid valve from the bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

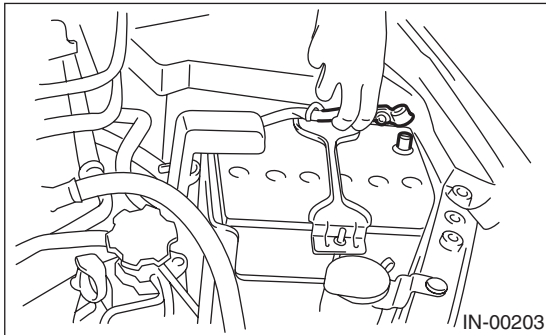
# Front Oxygen (A/F) Sensor

FUEL INJECTION (FUEL SYSTEMS)

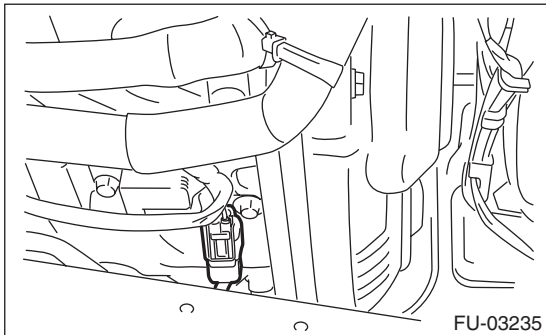
## 17. Front Oxygen (A/F) Sensor

### A: REMOVAL

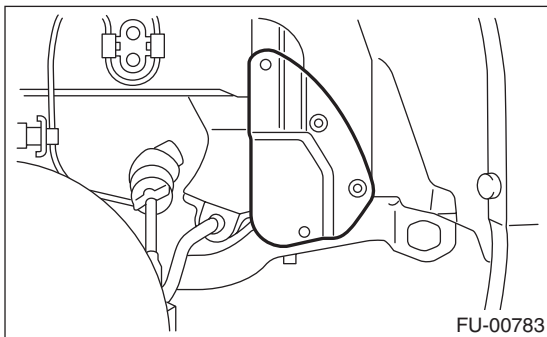
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Remove the air cleaner case. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 4) Disconnect the connector from front oxygen (A/F) sensor.



- 5) Remove the front right side wheel.
- 6) Lift up the vehicle.
- 7) Remove the service hole cover.

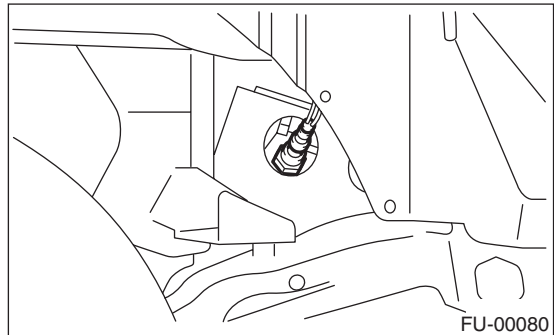


- 8) Apply spray-type lubricant or equivalent to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

- 9) Remove the front oxygen (A/F) sensor.

### CAUTION:

When removing the oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



# Front Oxygen (A/F) Sensor

FUEL INJECTION (FUEL SYSTEMS)

## B: INSTALLATION

1) Before installing front oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of front oxygen (A/F) sensor. This facilitates the next removal.

### CAUTION:

Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

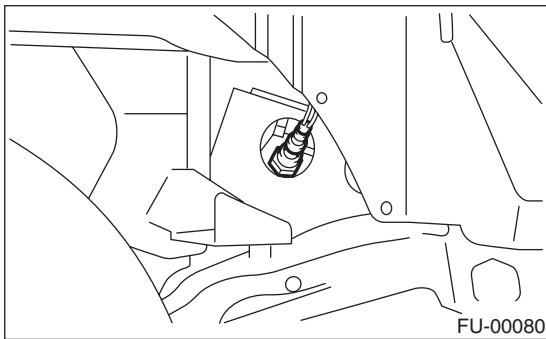
### Anti-seize compound:

**NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent**

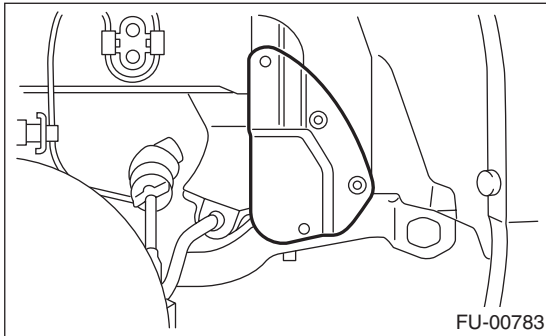
2) Install the front oxygen (A/F) sensor.

### Tightening torque:

**30 N·m (3.1 kgf·m, 22.1 ft·lb)**



3) Install the service hole cover.



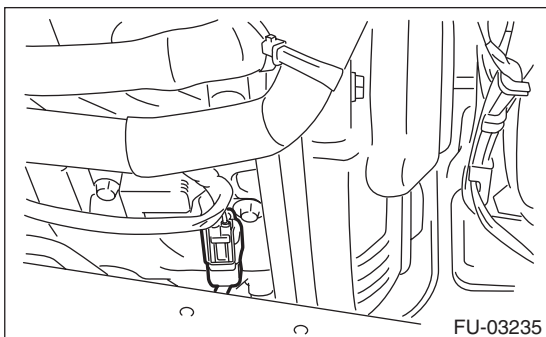
4) Lower the vehicle.

5) Install the front right side wheel.

### Tightening torque:

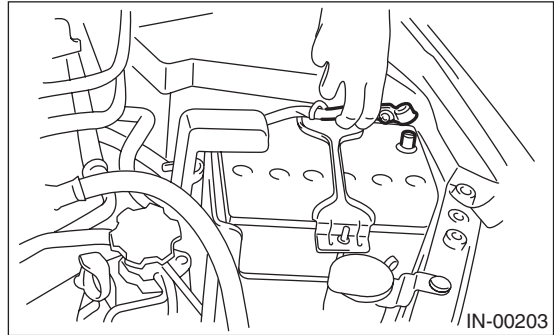
**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

6) Connect the connector of front oxygen (A/F) sensor.



7) Install the air cleaner case. <Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.>

8) Connect the battery ground cable to the battery.



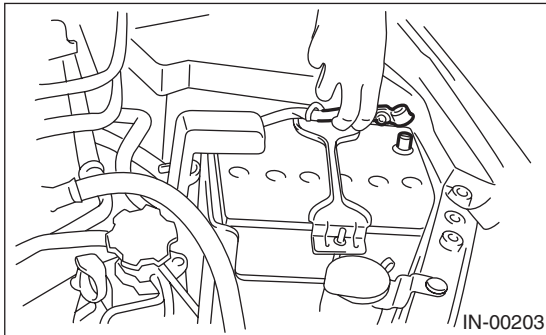
# Rear Oxygen Sensor

FUEL INJECTION (FUEL SYSTEMS)

## 18.Rear Oxygen Sensor

### A: REMOVAL

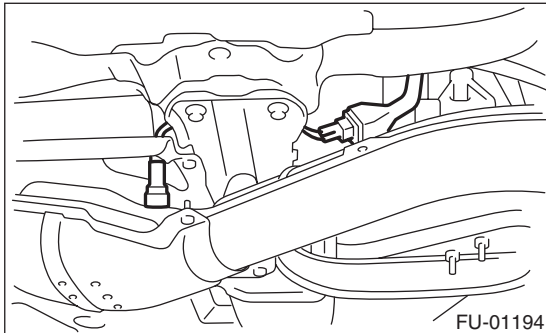
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift up the vehicle.
- 4) Disconnect the connector from the rear oxygen sensor.
- 5) Apply spray-type lubricant or equivalent to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
- 6) Remove the rear oxygen sensor.

### CAUTION:

**When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.**



### B: INSTALLATION

- 1) Before installing rear oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of rear oxygen (A/F) sensor. This facilitates the next removal.

### CAUTION:

**Never apply anti-seize compound to the protector of rear oxygen sensor.**

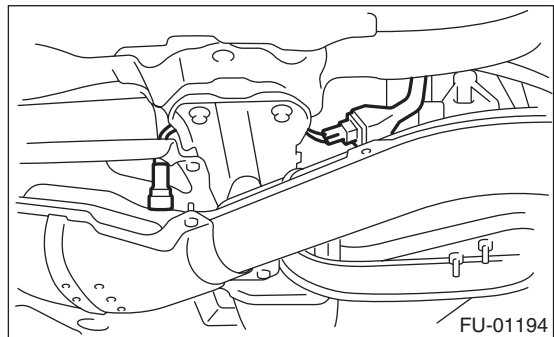
### Anti-seize compound:

**NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent**

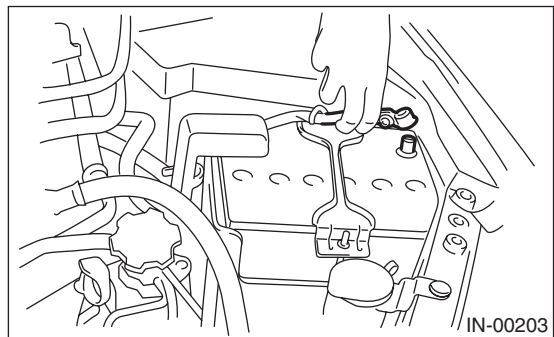
- 2) Install the rear oxygen sensor.

### Tightening torque:

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**



- 3) Connect the connector to rear oxygen sensor.
- 4) Lower the vehicle.
- 5) Connect the battery ground cable to the battery.



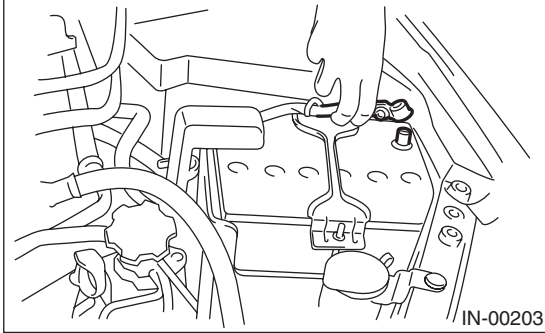
# SI-DRIVE (SUBARU Intelligent Drive) Selector

FUEL INJECTION (FUEL SYSTEMS)

## 19.SI-DRIVE (SUBARU Intelligent Drive) Selector

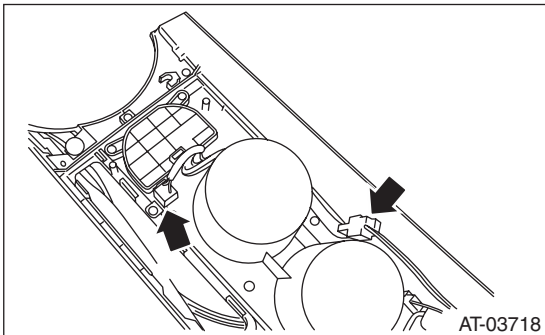
### A: REMOVAL

1) Disconnect the ground cable from battery.

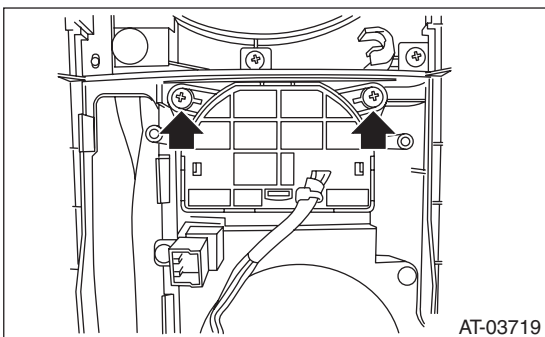


2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>

3) Disconnect the connectors from the SI-DRIVE selector.



4) Remove the screws securing the upper side of the SI-DRIVE selector to the console box.



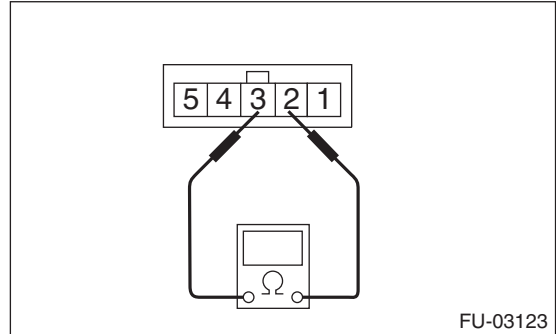
5) Remove the screws which secure the cup holder to the console box, then remove the SI-DRIVE selector.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between SI-DRIVE selector terminals.



Switch position	Terminal No.	Standard
Sport (when turning the SI-DRIVE selector to the left)	2 and 3	Less than 10 $\Omega$
Intelligent (when pushing the SI-DRIVE selector)		0.8 — 1.2 k $\Omega$
Sport Sharp (when turning the SI-DRIVE selector to the right)		2.14 — 3.2 k $\Omega$

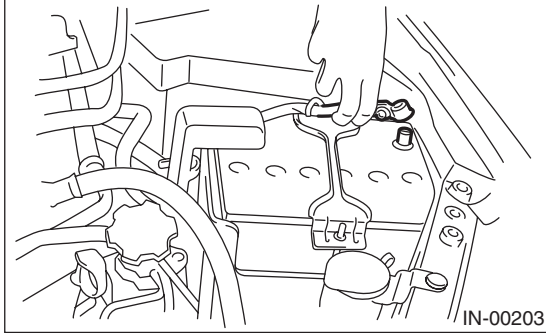
# SI-DRIVE (SUBARU Intelligent Drive) S# Switch

FUEL INJECTION (FUEL SYSTEMS)

## 20.SI-DRIVE (SUBARU Intelligent Drive) S# Switch

### A: REMOVAL

1) Disconnect the ground cable from battery.

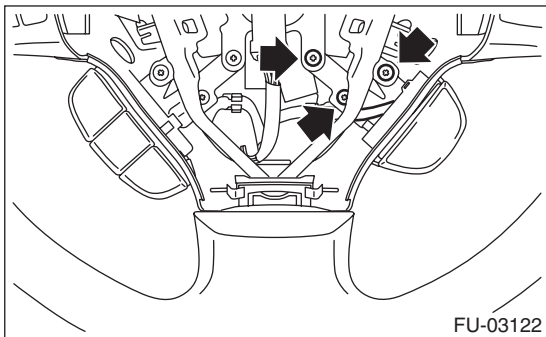


2) Remove the airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

#### WARNING:

**Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>**

3) Remove the screw which holds SI-DRIVE S# switch to the steering wheel, and disconnect the connector from the SI-DRIVE S# switch.

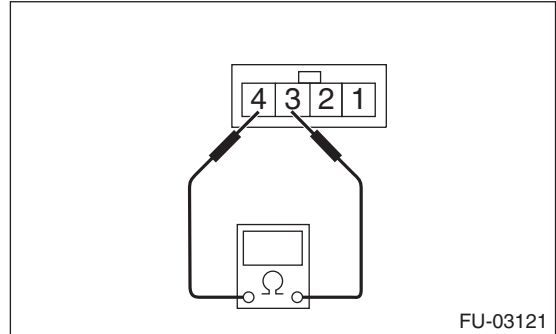


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between SI-DRIVE S# switch terminals.



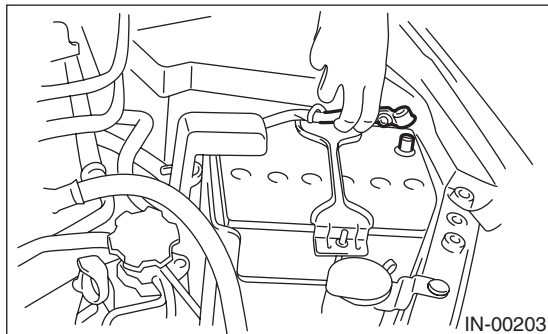
Switch position	Terminal No.	Standard value
ON (When the SI-DRIVE S# switch is pressed)	3 and 4	Less than 10 $\Omega$
OFF		1 M $\Omega$ or more



## 21.Engine Control Module (ECM)

### A: REMOVAL

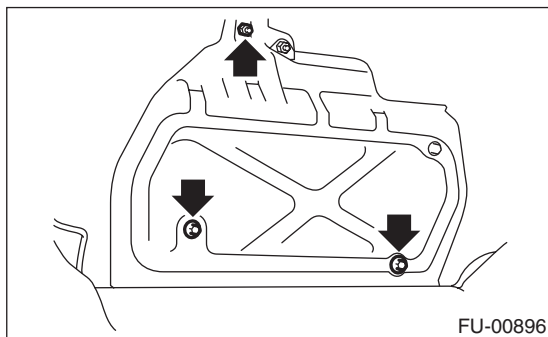
- 1) Disconnect the ground cable from battery.



- 2) Remove the lower inner trim of passenger's side.

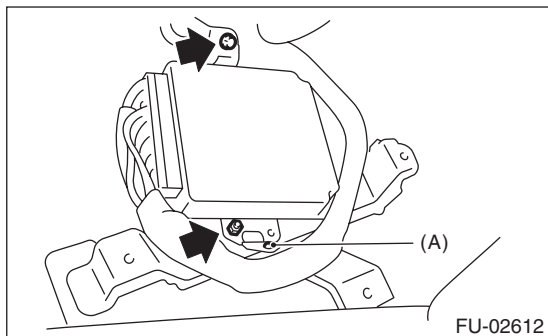
<Ref. to EI-61, REMOVAL, Lower Inner Trim.>

- 3) Detach the floor mat of passenger's seat.
- 4) Remove the protect cover.



- 5) Remove the bolts and nuts which hold the ECM to the bracket.

- 6) Remove the clip (A) from bracket.



- 7) Disconnect the ECM connectors, and take out the ECM.

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

#### **Tightening torque:**

**7.5 N·m (0.8 kgf-m, 5.5 ft-lb)**

# Main Relay

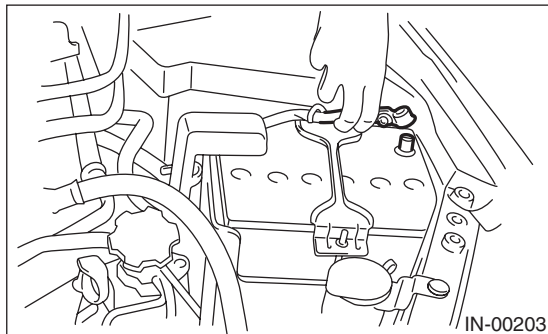
FUEL INJECTION (FUEL SYSTEMS)

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## 22.Main Relay

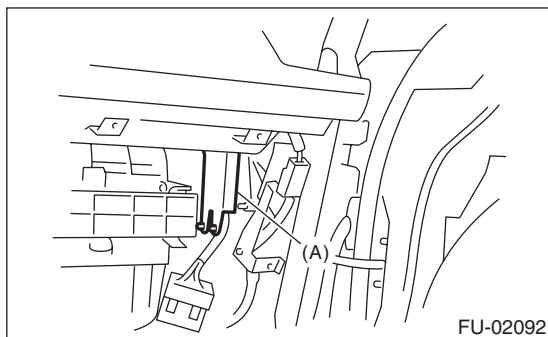
### A: REMOVAL

1) Disconnect the ground cable from battery.

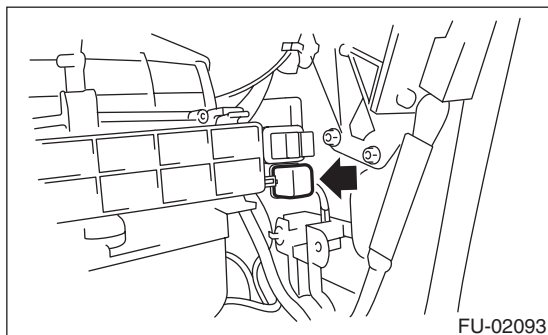


2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>

3) Remove the harness cover (A).



4) Disconnect the connectors from main relay.



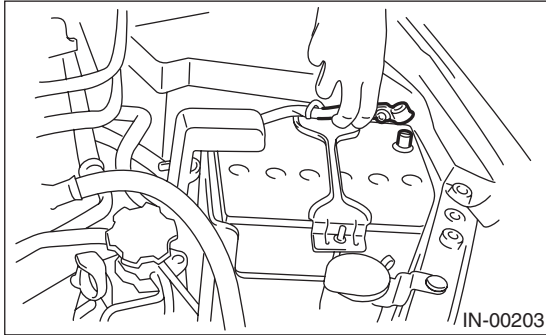
### B: INSTALLATION

Install in the reverse order of removal.

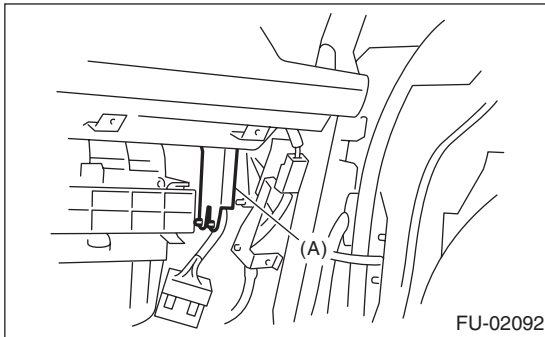
## 23. Fuel Pump Relay

### A: REMOVAL

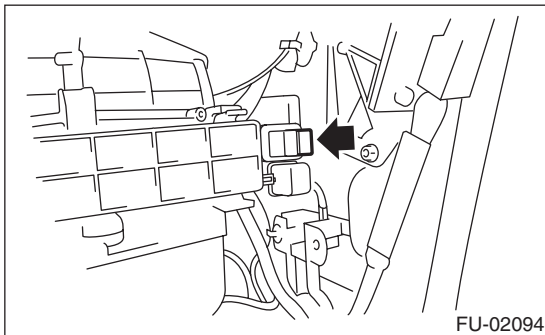
- 1) Disconnect the ground cable from battery.



- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from fuel pump relay.



### B: INSTALLATION

Install in the reverse order of removal.

# Electronic Throttle Control Relay

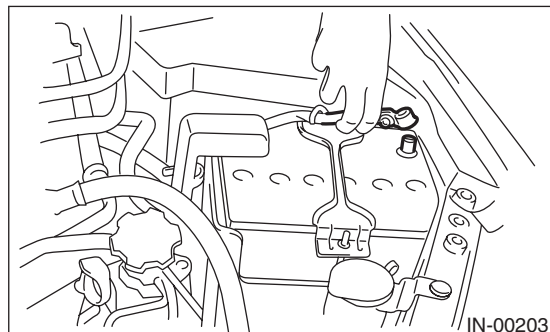
FUEL INJECTION (FUEL SYSTEMS)

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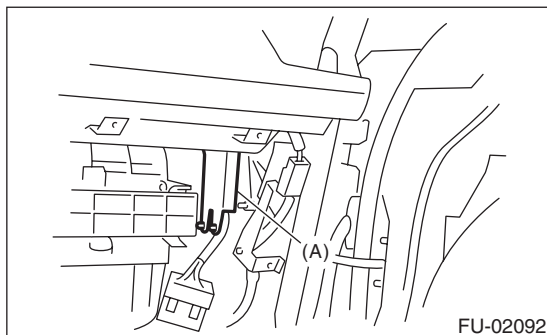
## 24. Electronic Throttle Control Relay

### A: REMOVAL

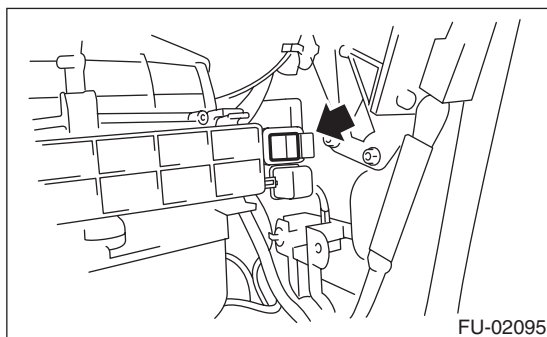
- 1) Disconnect the ground cable from battery.



- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from electric throttle control relay.



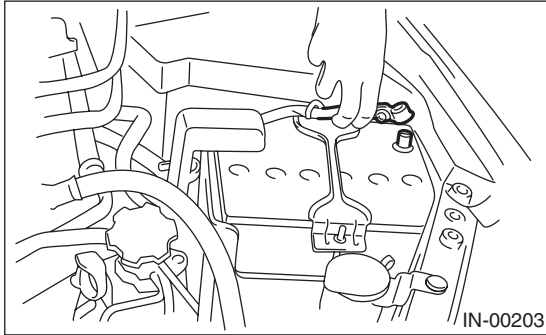
### B: INSTALLATION

Install in the reverse order of removal.

## 25. Fuel Pump Control Unit

### A: REMOVAL

- 1) Disconnect the ground cable from battery.

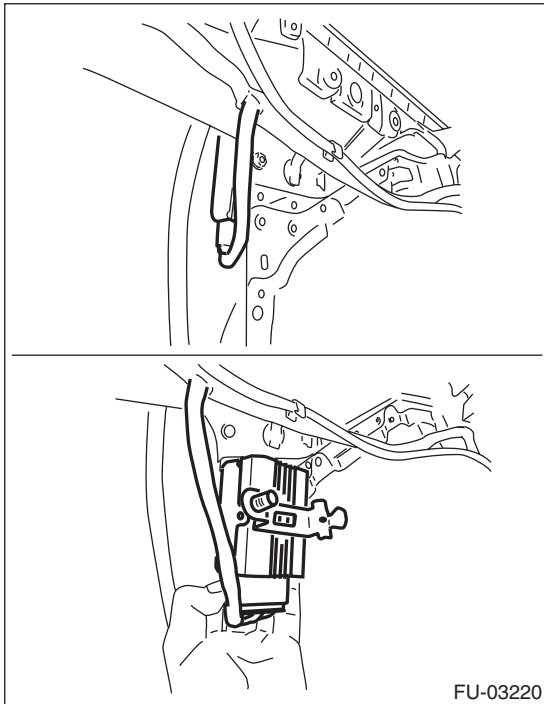


- 2) Remove the rear quarter trim of the left side. (Wagon model) <Ref. to EI-63, REMOVAL, Rear Quarter Trim.>

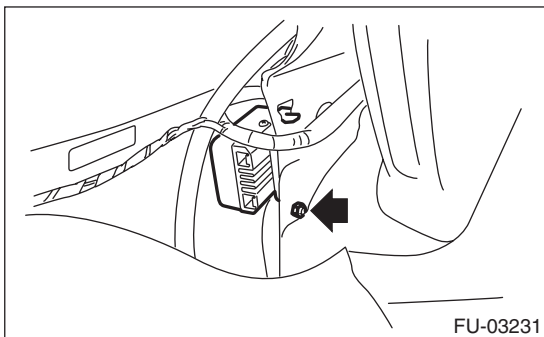
- 3) Peel the trunk side trim of the left side. (Sedan model)

- 4) Remove the fuel pump control unit.

- WAGON MODEL



- SEDAN MODEL



- 5) Disconnect the connector from fuel pump control unit.

### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

### 26. Fuel

#### A: PROCEDURE

##### 1. RELEASING OF FUEL PRESSURE

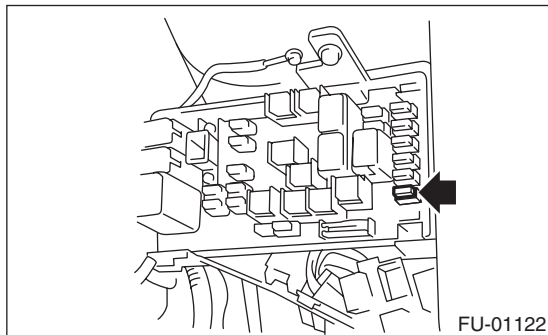
###### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

###### CAUTION:

**Be careful not to spill fuel.**

1) Remove the fuse of fuel pump from main fuse box.



- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn the ignition switch to OFF.

##### 2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

###### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

###### CAUTION:

**Be careful not to spill fuel.**

###### NOTE:

- If the fuel pump cannot be actuated, refer to DRAINING FUEL (THROUGH THE FUEL FILLER HOSE) <Ref. to FU(H4DOTC)-51, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>.
- Be careful not to allow the battery to go flat.

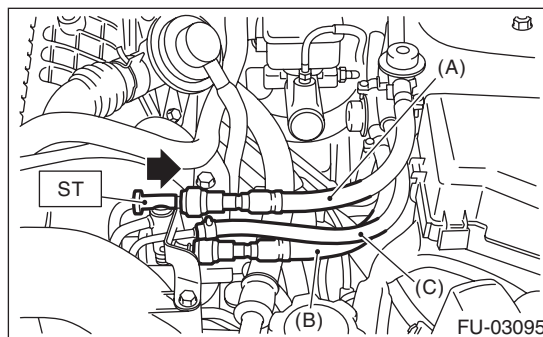
- 1) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

- 2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

###### CAUTION:

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



- 3) Connect ST to the fuel delivery hose.

ST 18471AA000 FUEL PIPE ADAPTER

- 4) Connect the gasoline proof hose to ST, and put the hose end into the container.

- 5) Actuate the fuel pump and drain the fuel using Subaru Select Monitor <Ref. to EN(H4DOTC)(diag)-60, FUEL PUMP CONTROL (ON/OFF DRIVE), OPERATION, System Operation Check Mode.>.

###### CAUTION:

**Be careful not to spill fuel.**

### 3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

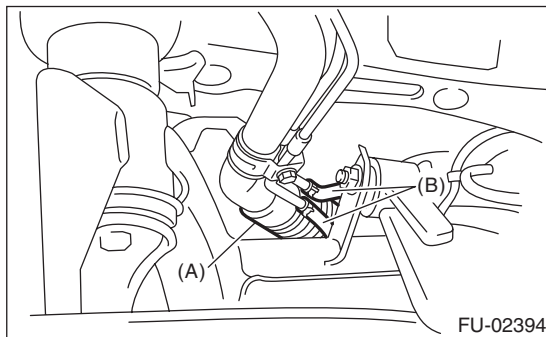
**CAUTION:**

- Be careful not to spill fuel.
- Fuel may remain in the fuel filler pipe. Perform the work after draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 4) Open the fuel filler flap lid, and remove the fuel filler cap.
- 5) Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
- 6) Disconnect the fuel filler hose (A) from the fuel filler pipe.

**CAUTION:**

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



- (A) Fuel filler hose  
(B) Evaporation hose

- 7) Set a container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

**CAUTION:**

Be careful not to spill fuel.

# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

### 27. Fuel Tank

#### A: REMOVAL

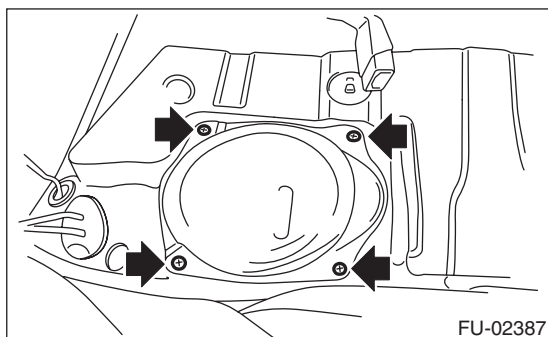
##### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

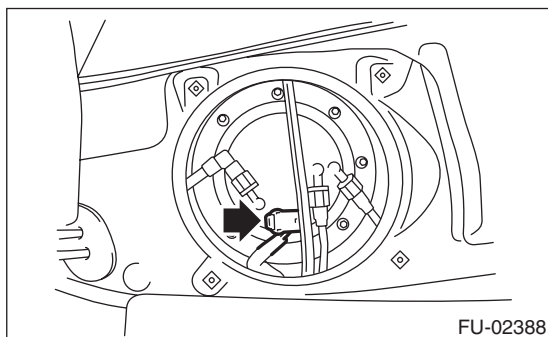
##### CAUTION:

Be careful not to spill fuel.

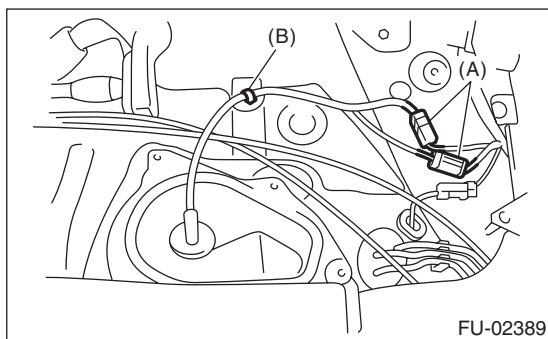
- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Drain fuel from fuel tank. <Ref. to FU(H4DOTC)-50, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 4) Remove the rear seat.
- 5) Remove the service hole cover of fuel pump.



- 6) Disconnect the connector from fuel pump.

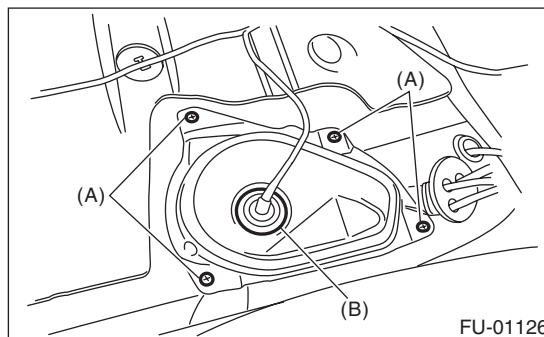


- 7) Remove the connector (A) and clip (B).



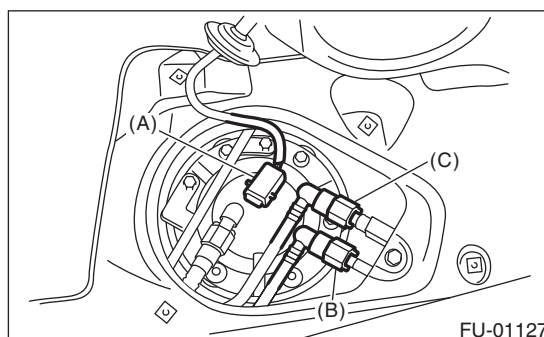
- 8) Remove the service hole cover of fuel sub level sensor.

- (1) Remove the bolt (A).
- (2) Push the grommet (B) down and remove the service hole cover.



- 9) Disconnect connector (A) from fuel sub level sensor.

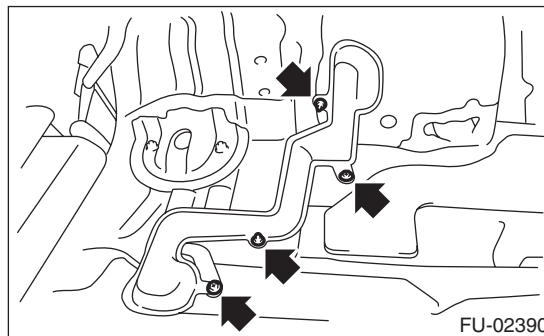
- 10) Disconnect the quick connector of fuel delivery (B) and return hose (C). <Ref. to FU(H4DOTC)-69, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



- 11) Remove the trunk room trim. (Sedan model) <Ref. to EI-70, REMOVAL, Trunk Room Trim.>

- 12) Remove the rear quarter trim. (Wagon model) <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>

- 13) Remove the pipe protector.

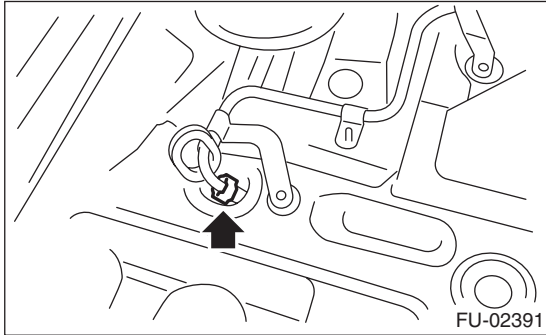




# Fuel Tank

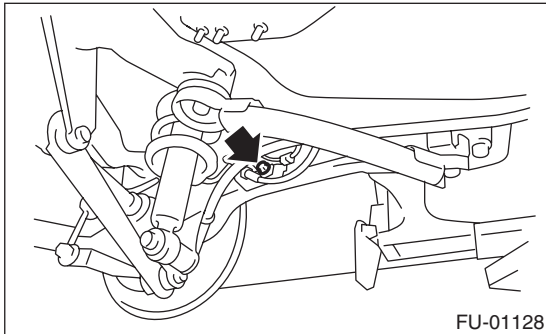
## FUEL INJECTION (FUEL SYSTEMS)

14) Remove the grommet and disconnect the quick connector of the evaporation pipe. <Ref. to FU(H4DOTC)-69, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

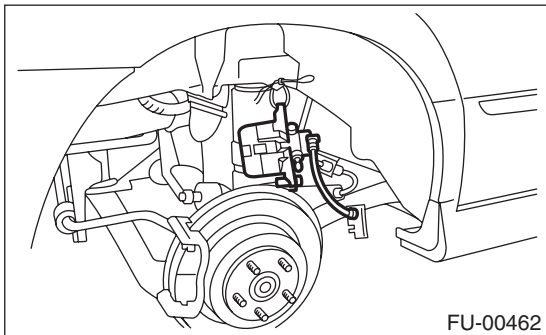


15) Remove the rear wheels.

16) Remove the bolts which secure the rear brake hose mounting bracket.



17) Remove the rear brake caliper and tie it to the body side of the vehicle.



18) Remove the parking brake cable from the parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

19) Lift up the vehicle.

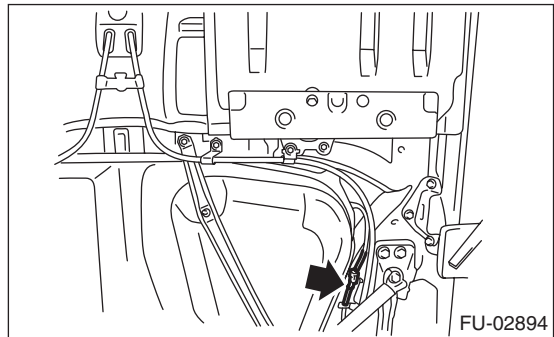
20) Remove the rear exhaust pipe.

<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.>

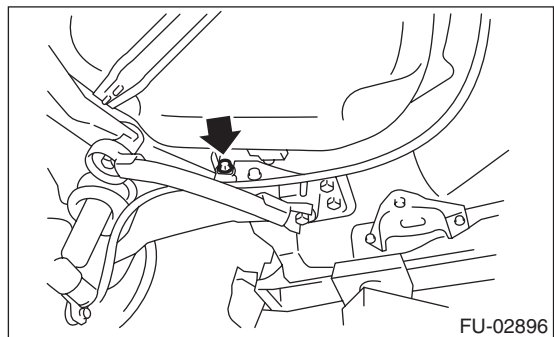
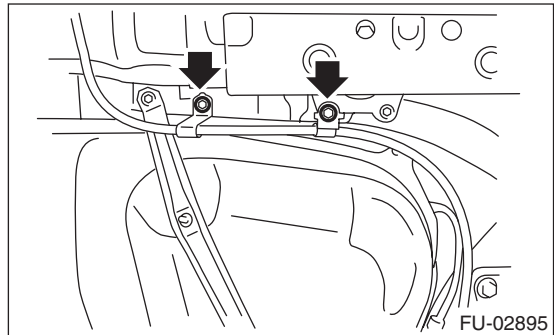
21) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

22) Remove the heat shield cover.

23) Disconnect the connector from the rear ABS wheel speed sensor.



24) Remove the bolts securing the parking brake cable clamp.



# Fuel Tank

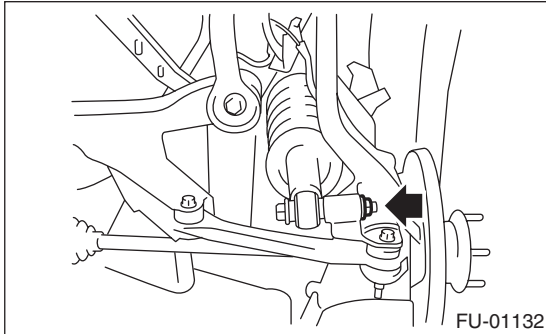
## FUEL INJECTION (FUEL SYSTEMS)

25) Remove the rear suspension assembly.

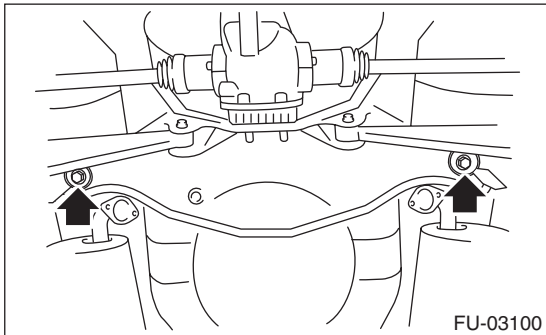
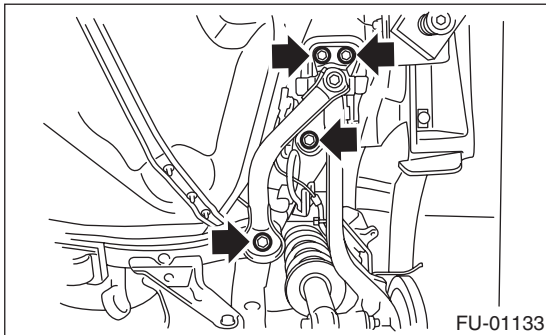
### WARNING:

**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Remove the bolts which hold the rear shock absorber to the rear suspension arm.

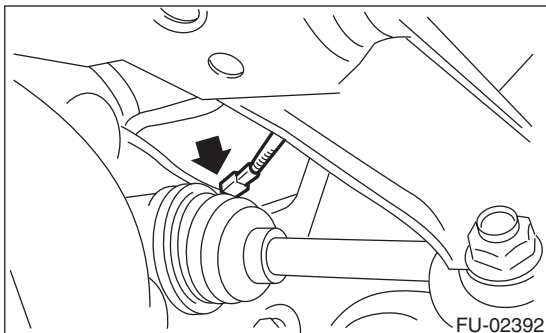


(3) Remove the bolts which secure the rear suspension assembly to the body.

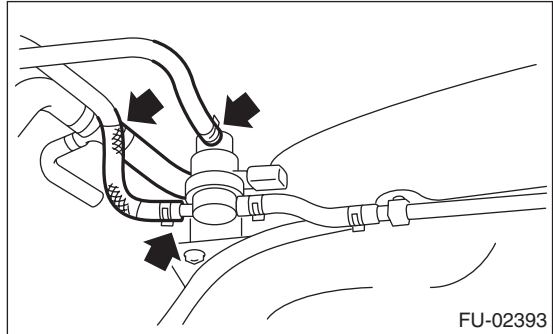


(4) Remove the rear suspension assembly.

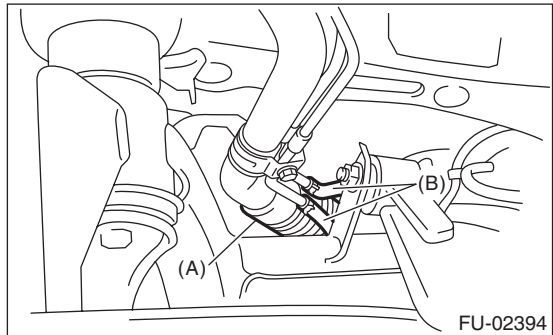
26) Disconnect the connector.



27) Disconnect the evaporation hose.



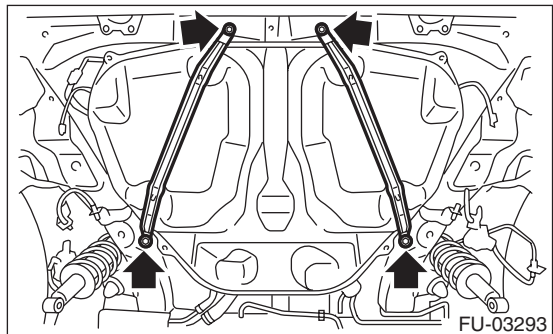
28) Disconnect the fuel filler hose (A) and evaporation hose (B).



29) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

### WARNING:

- A helper is required to perform this work.
- Fuel may remain in the fuel tank. Be careful not to let the fuel tank fall off when removing as it is bad balance on either side.

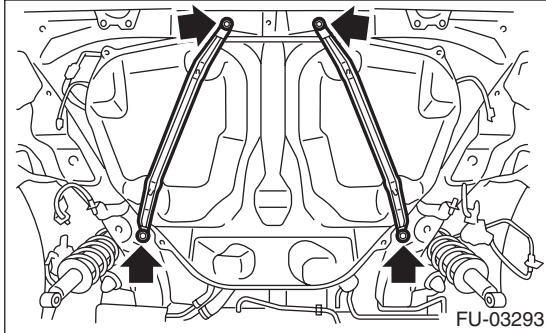


## B: INSTALLATION

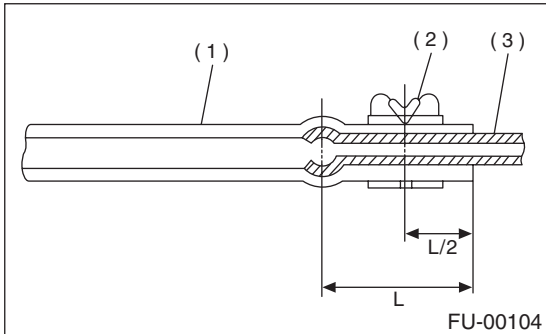
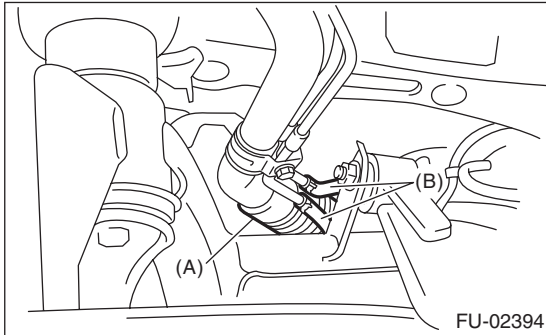
1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

### WARNING:

**A helper is required to perform this work.**

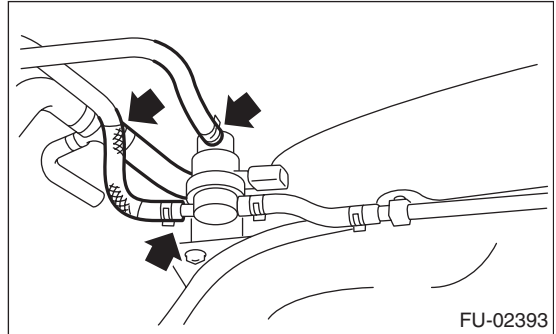


2) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.



- (1) Hose
- (2) Clip or clamp
- (3) Pipe

3) Connect the evaporation hose.

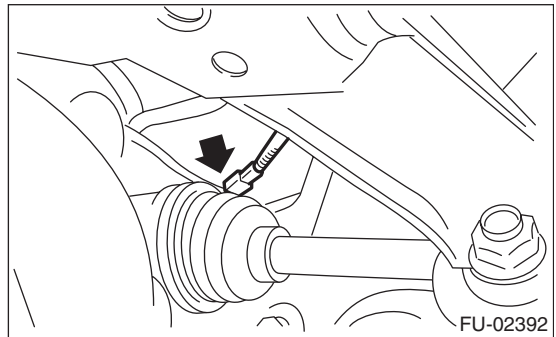


4) Tighten the fuel tank band bolts.

### Tightening torque:

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**

5) Connect the connector.



# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

6) Install the rear suspension assembly.

### CAUTION:

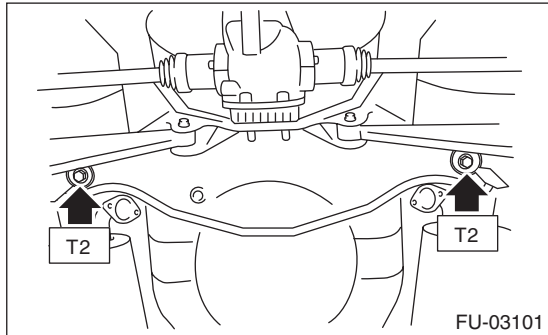
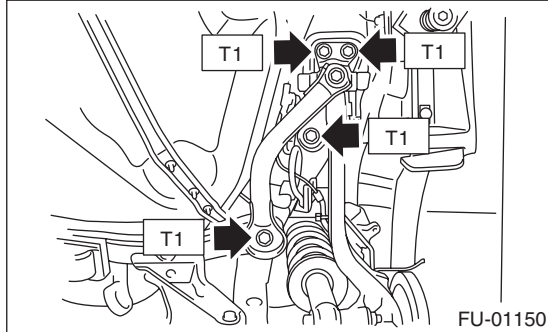
**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Support the rear suspension assembly, and tighten the bolts which secure the rear suspension assembly to the body.

### Tightening torque:

**T1: 125 N·m (12.7 kgf-m, 92.2 ft-lb)**

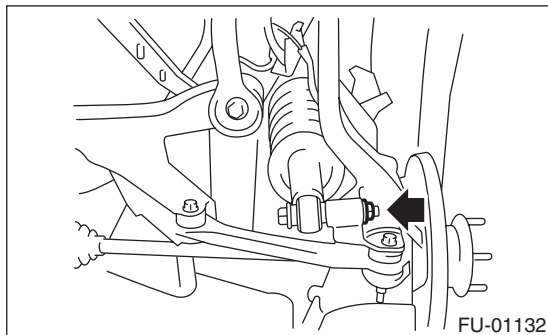
**T2: 175 N·m (17.8 kgf-m, 129 ft-lb)**



- (3) Tighten the bolts which hold the rear shock absorber to the rear suspension arm. <Ref. to RS-10, INSTALLATION, Rear Arm.>

### Tightening torque:

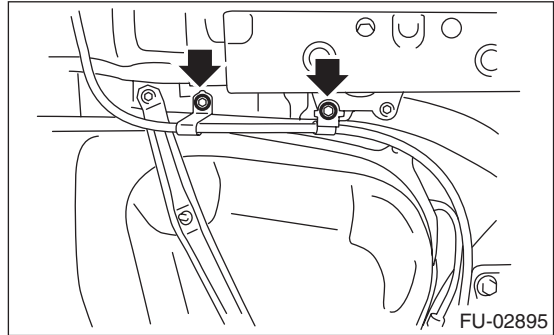
**62 N·m (6.3 kgf-m, 46 ft-lb)**



7) Tighten the bolts holding the parking brake cable clamp.

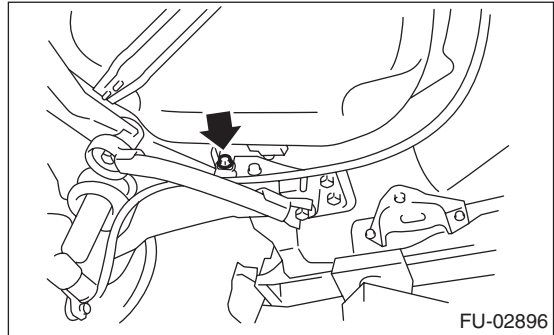
### Tightening torque:

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

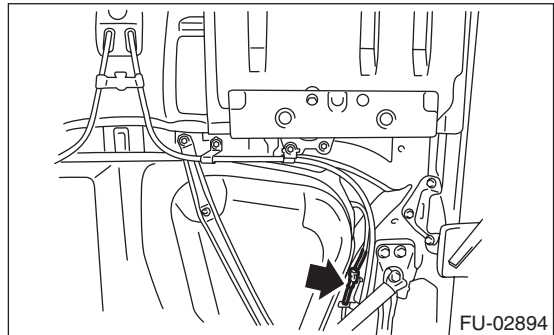


### Tightening torque:

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**



8) Connect the connector to the rear ABS wheel speed sensor.



9) Install the heat shield cover.

10) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

11) Install the rear exhaust pipe. <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.>

12) Lower the vehicle.

13) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>

14) Install the rear brake caliper.

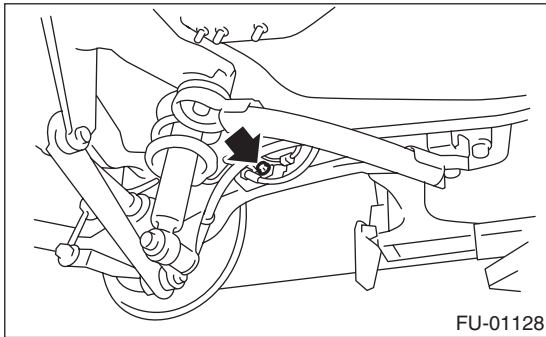
# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

15) Tighten the bolts which secure the rear brake hose mounting bracket.

**Tightening torque:**

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**

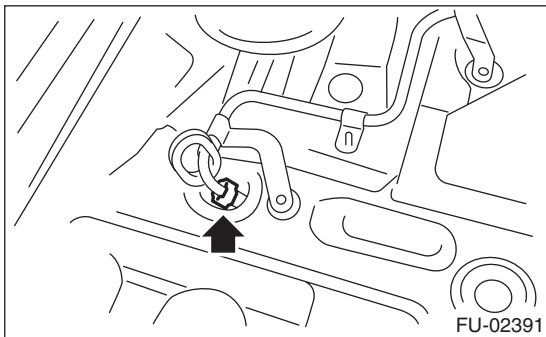


16) Install the rear wheels.

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

17) Connect the quick connector of the evaporation pipe. <Ref. to FU(H4DOTC)-71, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

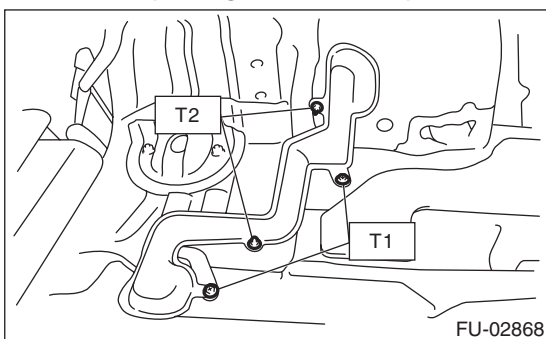


18) Install the pipe protector.

**Tightening torque:**

**T1: 1 N·m (0.1 kgf·m, 0.7 ft·lb)**

**T2: 7.5 N·m (0.7 kgf·m, 5.5 ft·lb)**



19) Install the trunk room trim. (Sedan model) <Ref. to EI-71, INSTALLATION, Trunk Room Trim.>

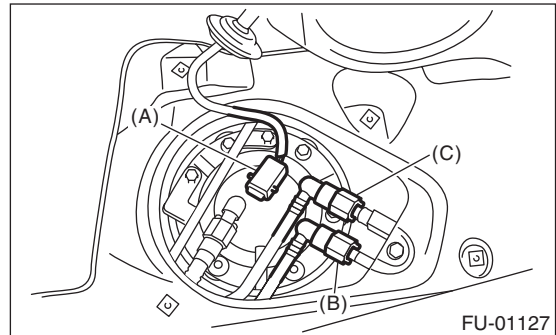
20) Install the rear quarter trim. (Wagon model) <Ref. to EI-64, INSTALLATION, Rear Quarter Trim.>

21) Connect connector (A) to the fuel sub level sensor.

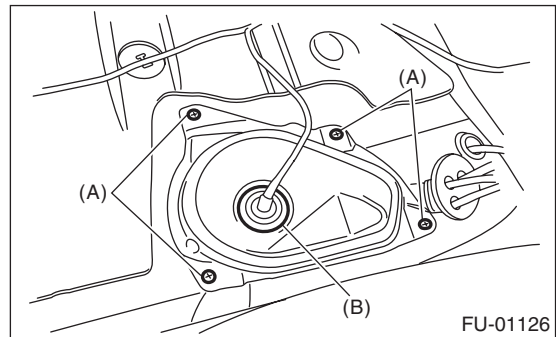
22) Connect the quick connector of fuel delivery (B) and return hose (C). <Ref. to FU(H4DOTC)-71, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

**NOTE:**

When connecting, be careful not to reverse the delivery side and return side.



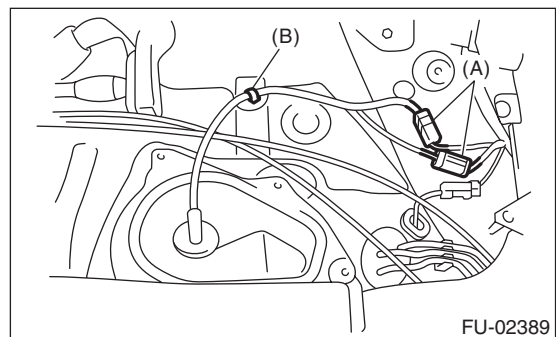
23) Install the service hole cover of fuel sub level sensor.



(A) Bolt

(B) Grommet

24) Connect connector (A), and install clip (B).

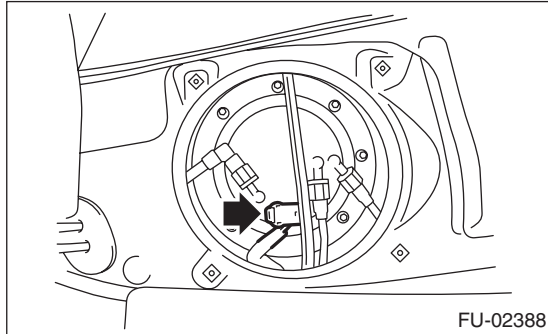


# Fuel Tank

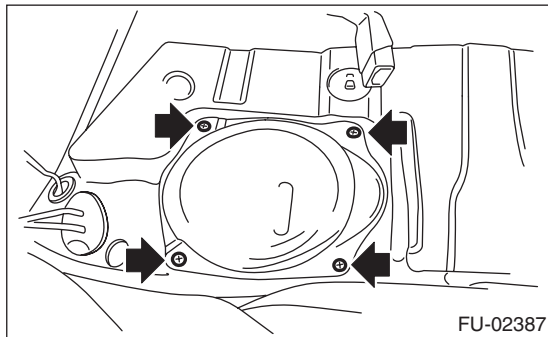
## FUEL INJECTION (FUEL SYSTEMS)

---

25) Connect the connector to the fuel pump.



26) Install the service hole cover of fuel pump.



27) Install the rear seat.

28) Install the fuse of fuel pump to main fuse box.

### **C: INSPECTION**

- 1) Check that the fuel tank does not have holes, cracks or is damaged in any other way.
- 2) Make sure that the fuel pipe and fuel hose are not cracked and that the connections are tight.

## 28. Fuel Filler Pipe

### A: REMOVAL

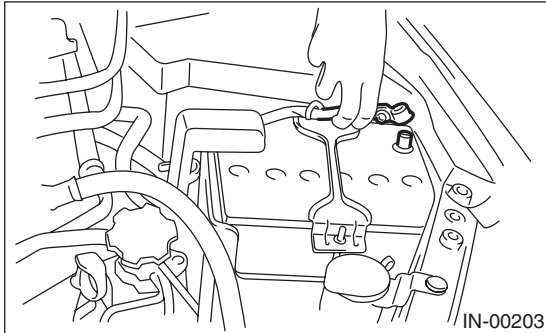
**WARNING:**

Place "NO OPEN FLAMES" signs near the working area.

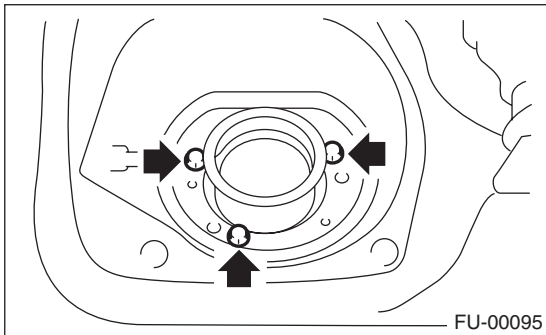
**CAUTION:**

Be careful not to spill fuel.

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.

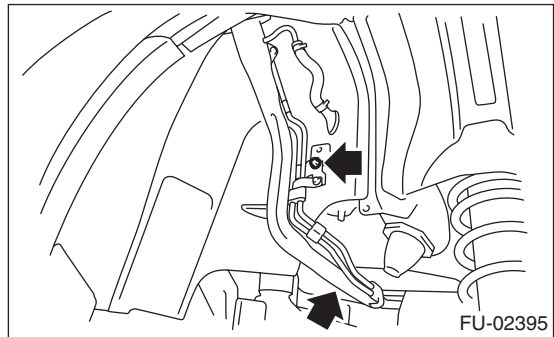


- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the screws which secure gasket.

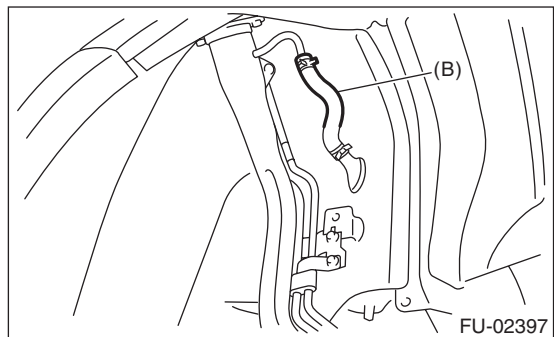
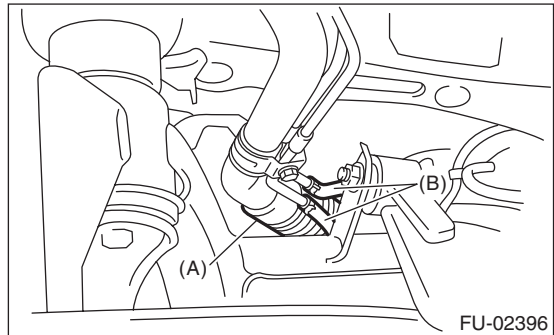


- 5) Remove the rear wheel RH.
- 6) Lift up the vehicle.
- 7) Drain fuel from fuel tank. <Ref. to FU(H4DOTC)-50, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 8) Remove the mud guard. <Ref. to EI-29, REMOVAL, Mud Guard.>
- 9) Remove the rear sub frame. <Ref. to RS-21, REMOVAL, Rear Sub Frame.>

- 10) Remove the bolts which hold fuel filler pipe bracket on the body.



- 11) Loosen the clamp, and disconnect the fuel filler hose (A) and evaporation hose (B).



- 12) Remove the fuel filler pipe to the underside of the vehicle.

# Fuel Filler Pipe

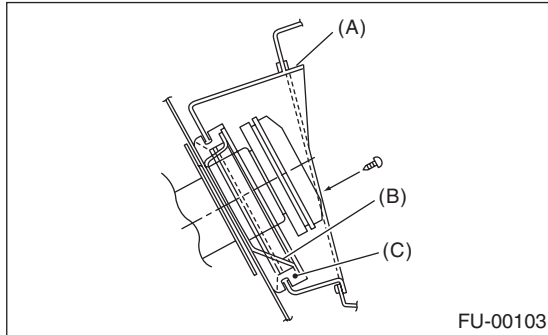
## FUEL INJECTION (FUEL SYSTEMS)

### B: INSTALLATION

- 1) Open the fuel filler flap lid.
- 2) Set the fuel saucer (A) with rubber seal (C), and insert the fuel filler pipe into hole from the inner side of apron.
- 3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

#### NOTE:

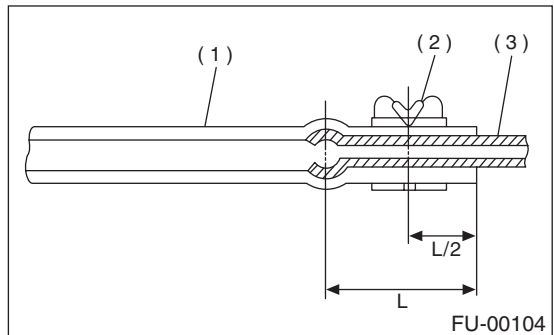
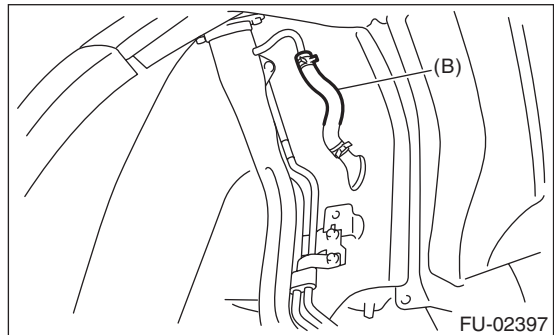
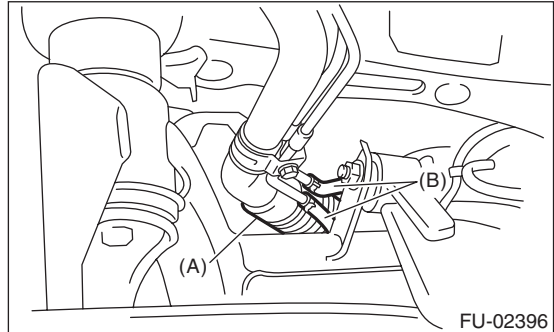
If the edges of rubber seal are folded toward inside, straighten it with a flat tip screwdriver.



- 4) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.

#### Tightening torque:

**2.5 N·m (0.3 kgf·m, 1.8 ft·lb)**



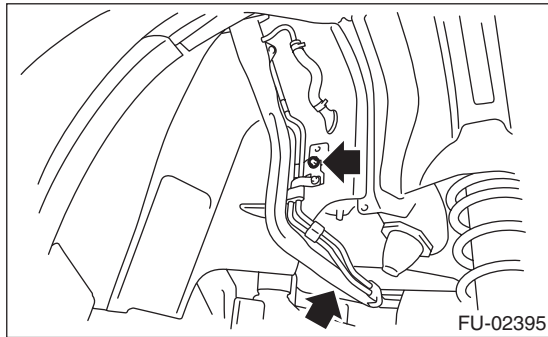
- (1) Hose
- (2) Clip or clamp
- (3) Pipe



5) Tighten the bolts which hold fuel filler pipe bracket on the body.

**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



6) Install the rear sub frame. <Ref. to RS-21, INSTALLATION, Rear Sub Frame.>

7) Install the mud guard. <Ref. to EI-29, INSTALLATION, Mud Guard.>

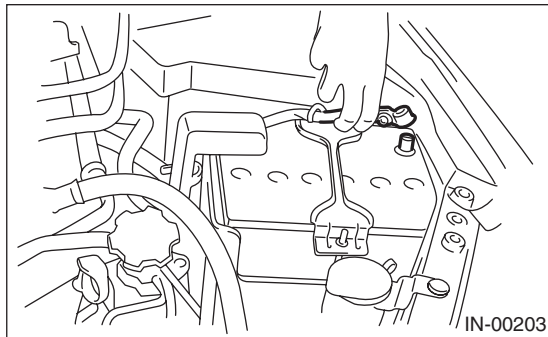
8) Lower the vehicle.

9) Install the rear wheel RH.

**Tightening torque:**

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

10) Connect the battery ground cable to the battery.



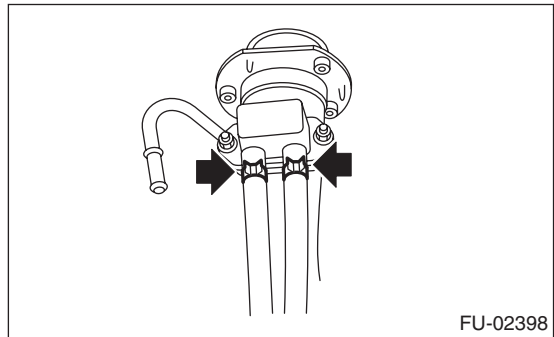
## C: INSPECTION

1) Check that the fuel filler pipe does not have holes, cracks or is damaged in any other way.

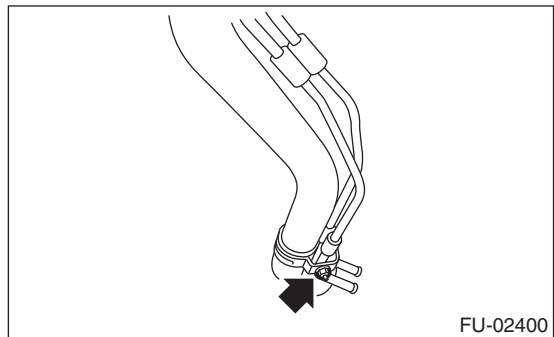
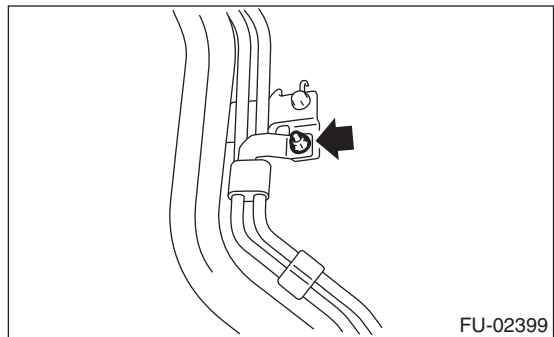
2) Make sure that the fuel hose is not cracked and that the connections are tight.

## D: DISASSEMBLY

1) Move the clamp and disconnect the evaporation hose from the shut valve.



2) Remove the nut which holds the evaporation pipe assembly to the fuel filler pipe.



3) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4DOTC)-17, REMOVAL, Shut Valve.>

# Fuel Filler Pipe

## FUEL INJECTION (FUEL SYSTEMS)

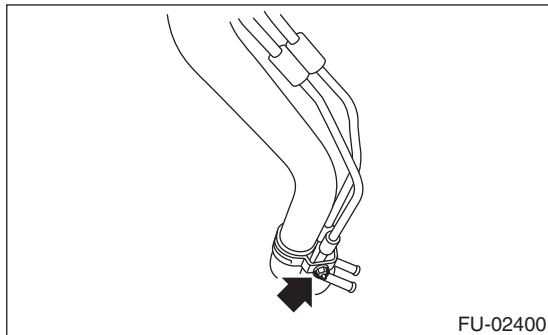
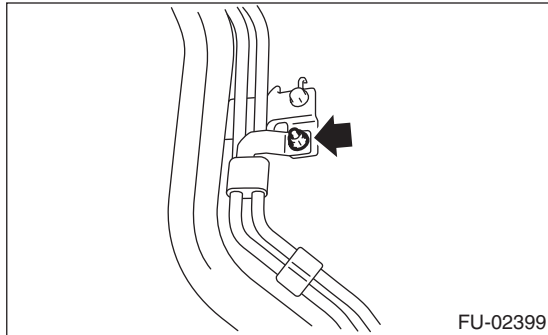
---

### E: ASSEMBLY

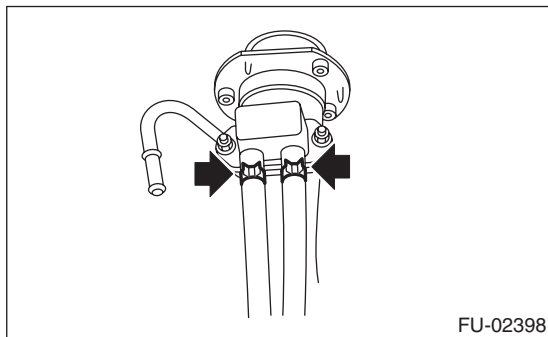
- 1) Install the shut pipe to the fuel filler pipe. <Ref. to EC(H4DOTC)-17, INSTALLATION, Shut Valve.>
- 2) Tighten the nuts which secure the evaporation pipe assembly to the fuel filler pipe.

#### **Tightening torque:**

**7.5 N·m (0.8 kgf·m, 5.5 ft·lb)**



- 3) Connect the evaporation hose to the shut valve.



## 29. Fuel Pump

### A: REMOVAL

**WARNING:**

Place "NO OPEN FLAMES" signs near the working area.

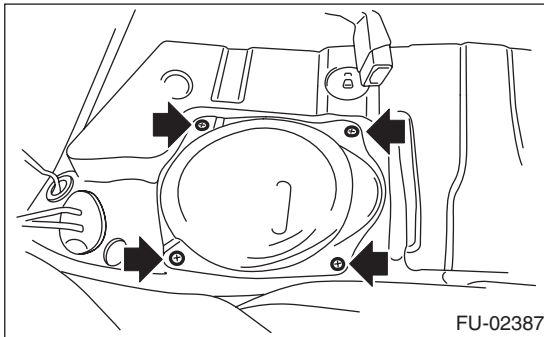
**CAUTION:**

- Be careful not to spill fuel.
- When the fuel meter indication is higher than two third of the total, perform the work after draining the fuel not to spill the fuel.

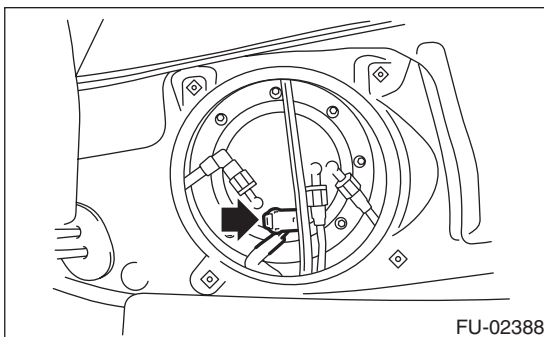
**NOTE:**

Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

- 1) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Drain fuel. <Ref. to FU(H4DOTC)-50, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 3) Remove the rear seat.
- 4) Remove the service hole cover.

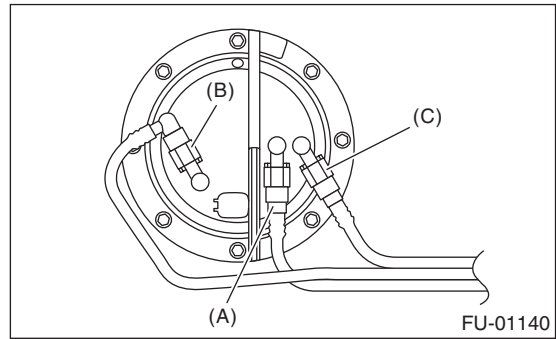


- 5) Disconnect the connector from fuel pump.



- 6) Disconnect the quick connector, then disconnect the fuel delivery hose, return hose and jet pump hose. <Ref. to FU(H4DOTC)-69, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

- 7) Remove the nuts which install fuel pump assembly onto fuel tank.



- (A) Delivery hose
- (B) Return hose
- (C) Jet pump hose

- 8) Remove the fuel pump assembly from the fuel tank.

### B: INSTALLATION

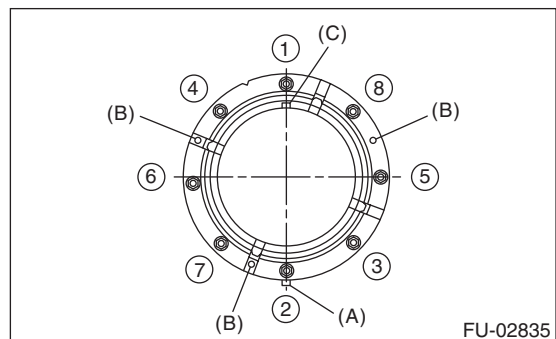
Install in the reverse order of removal.

**NOTE:**

- Use a new gasket.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Install with the protrusion (A) of gasket aimed at the front side of the vehicle.
- Insert the protrusion (B) of gasket to the upper plate. (3 places)
- Align the protrusion (C) of fuel pump assembly with the cutout on the upper plate.
- Tighten the nuts to the specified torque in the order as shown in the figure.

**Tightening torque:**

**4.4 N·m (0.45 kgf·m, 3.2 ft·lb)**



# Fuel Pump

## FUEL INJECTION (FUEL SYSTEMS)

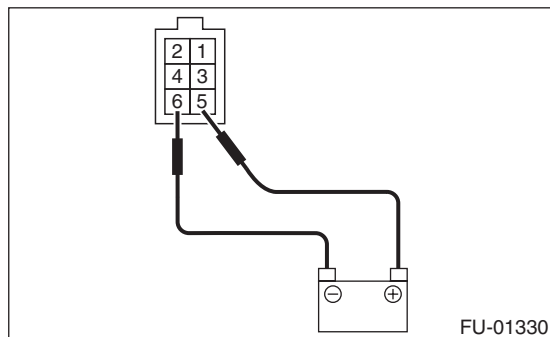
---

### C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump, and apply the battery power supply to check whether the pump operates.

#### WARNING:

- Wipe off fuel completely.
- Keep the battery as far apart from fuel pump as possible.
- Be sure to perform the ON/OFF operation on the battery side.
- Do not run the fuel pump for a long time under non-load condition.



## 30. Fuel Level Sensor

### A: REMOVAL

#### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

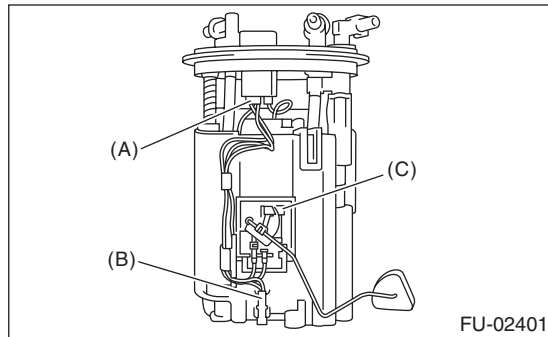
#### CAUTION:

Be careful not to spill fuel.

#### NOTE:

The fuel level sensor is built in fuel pump assembly.

- 1) Remove the fuel pump assembly. <Ref. to FU(H4DOTC)-63, REMOVAL, Fuel Pump.>
- 2) Disconnect the connector from fuel pump bracket.
- 3) Remove the fuel temperature sensor.
- 4) Remove the fuel level sensor.



- (A) Connector
- (B) Fuel temperature sensor
- (C) Fuel level sensor

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Use a new gasket.

#### *Tightening torque:*

**4.4 N·m (0.45 kgf-m, 3.2 ft-lb)**

# Fuel Sub Level Sensor

FUEL INJECTION (FUEL SYSTEMS)

## 31. Fuel Sub Level Sensor

### A: REMOVAL

#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

#### CAUTION:

- Be careful not to spill fuel.
- When the fuel meter indication is higher than two third of the total, perform the work after draining the fuel not to spill the fuel.

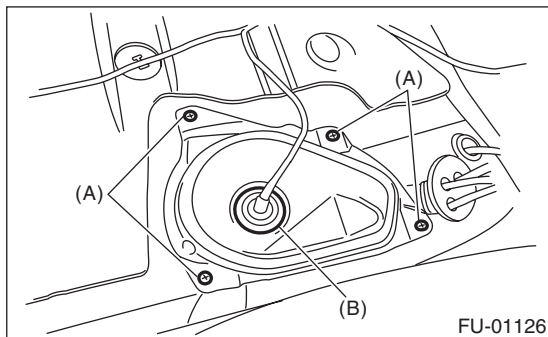
1) Drain fuel. <Ref. to FU(H4DOTC)-50, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>

2) Remove the rear seat.

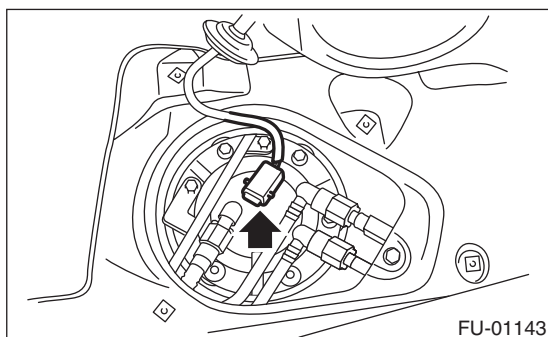
3) Remove the service hole cover.

(1) Remove bolt (A).

(2) Push the grommet (B) down and remove the service hole cover.

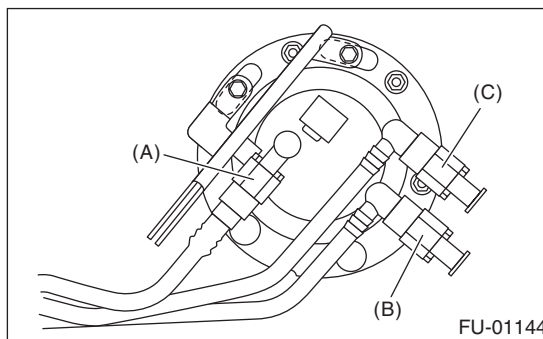


4) Disconnect the connector from the fuel sub level sensor.



5) Disconnect the quick connector, then disconnect the fuel delivery hose, return hose and jet pump hose. <Ref. to FU(H4DOTC)-69, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

6) Remove the nuts and bolts which install fuel sub level sensor on fuel tank.



(A) Jet pump hose

(B) Delivery hose

(C) Return hose

7) Remove the fuel sub level sensor.

### B: INSTALLATION

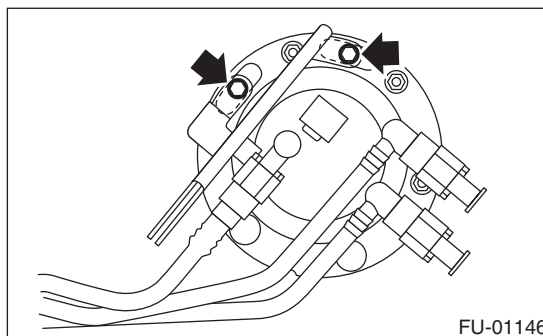
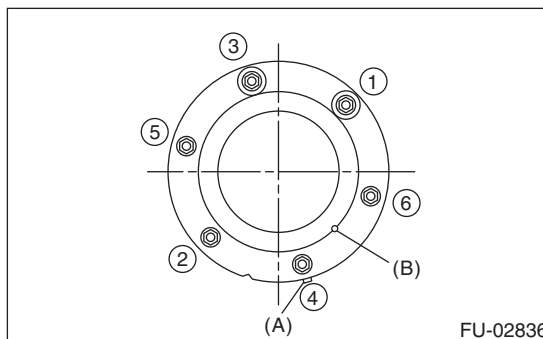
Install in the reverse order of removal.

#### NOTE:

- Use a new gasket.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align the protrusion (A) of gasket to the position shown in the following figure.
- Align the protrusion (B) of fuel sub level sensor with the cutout portion of fuel sub level sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.

#### Tightening torque:

**4.4 N·m (0.45 kgf·m, 3.2 ft·lb)**



## 32. Fuel Filter

### A: SPECIFICATION

Fuel filter forms a single unit with fuel pump.

Refer to "Fuel Pump" for removal and installation.

<Ref. to FU(H4DOTC)-63, REMOVAL, Fuel Pump.>

<Ref. to FU(H4DOTC)-63, INSTALLATION, Fuel Pump.>

# Fuel Damper Valve

FUEL INJECTION (FUEL SYSTEMS)

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## 33. Fuel Damper Valve

### A: REMOVAL

#### WARNING:

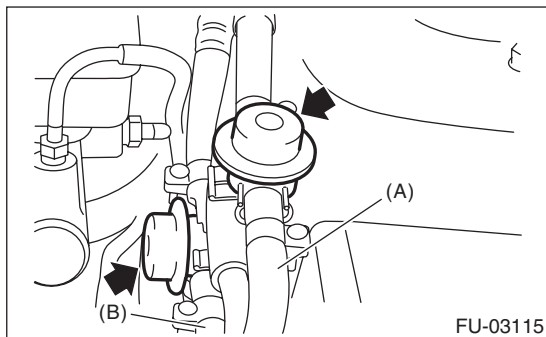
Place “NO OPEN FLAMES” signs near the working area.

#### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Remove the fuel damper valve from the fuel delivery line (A) and the fuel return line (B).



### B: INSTALLATION

#### CAUTION:

If fuel hoses or clamps are damaged, replace them with new parts.

Install in the reverse order of removal.

#### *Tightening torque:*

***1.25 N·m (0.13 kgf·m, 0.94 ft·lb)***



## 34. Fuel Delivery, Return and Evaporation Lines

### A: REMOVAL

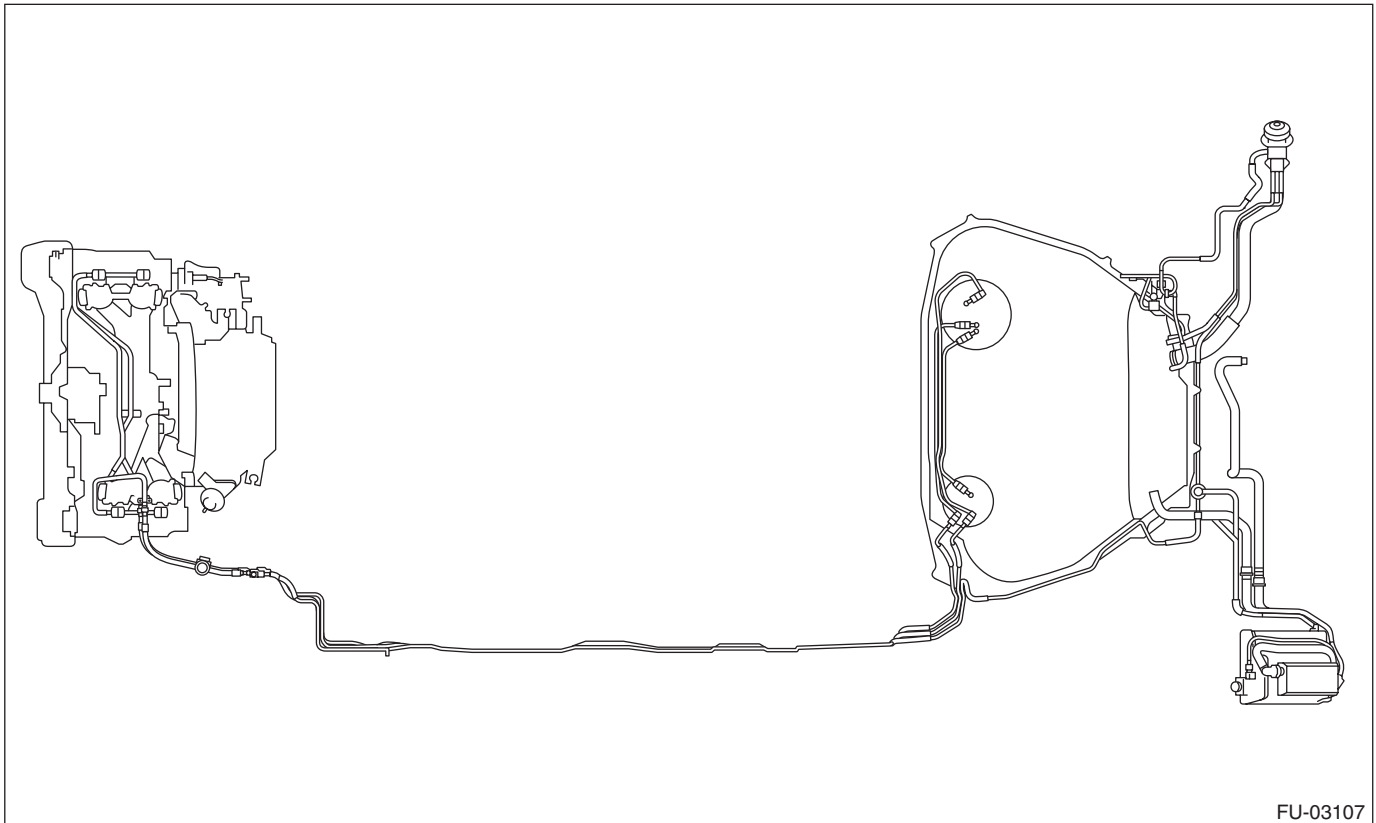
#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

#### CAUTION:

**Be careful not to spill fuel.**

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the floor mat. <Ref. to EI-72, REMOVAL, Floor Mat.>
- 5) Disconnect the fuel delivery pipes and hoses, and then disconnect the fuel return pipes and hoses, evaporation pipes and hoses.



# Fuel Delivery, Return and Evaporation Lines

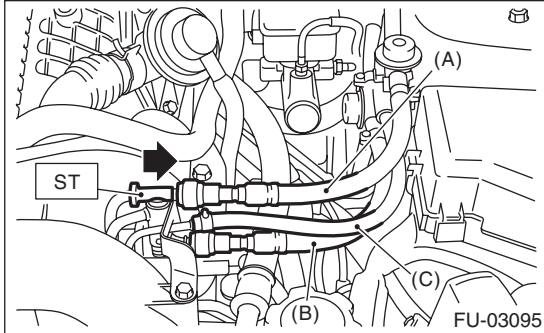
## FUEL INJECTION (FUEL SYSTEMS)

6) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



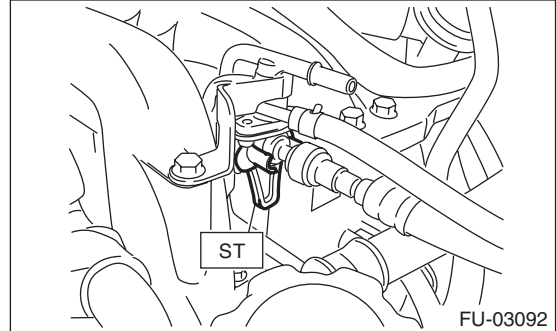
- (A) Fuel delivery hose
- (B) Fuel return hose
- (C) Evaporation hose

7) Disconnect the fuel return hose using the ST.  
ST 18371AA000 CONNECTOR REMOVER

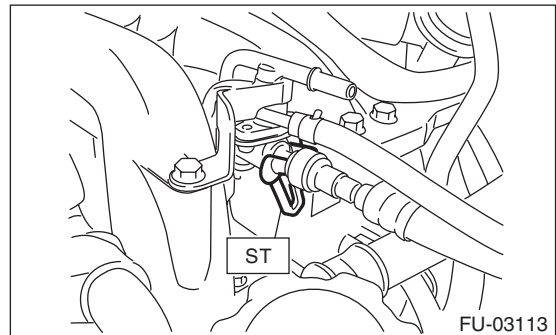
### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

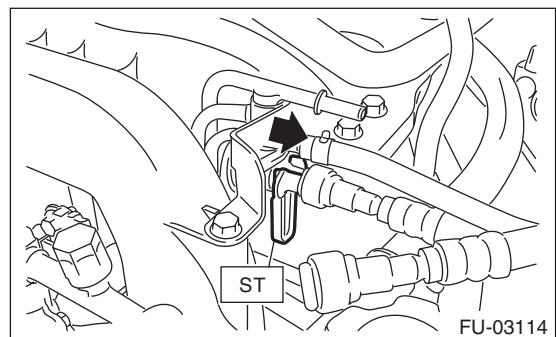
(1) Attach ST to the fuel return pipe as shown in the figure.



(2) Insert the front side of ST into the quick connector.



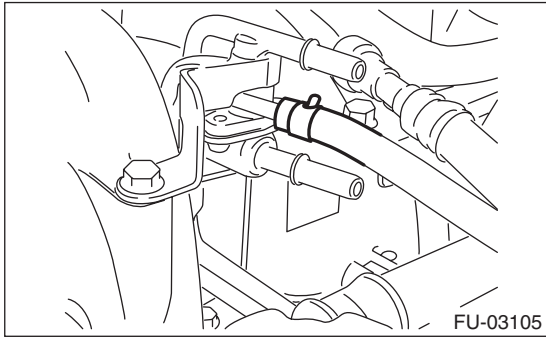
(3) Insert the back side of ST into the quick connector and push ST in the direction of arrow mark to disconnect the fuel return hose.



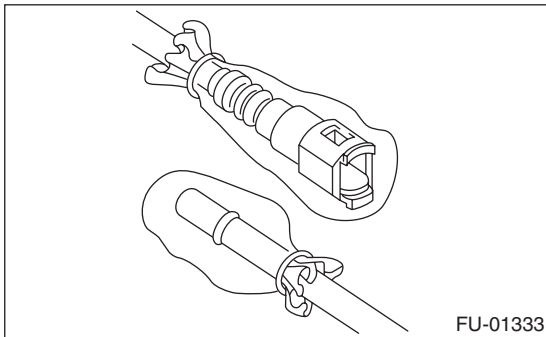
# Fuel Delivery, Return and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

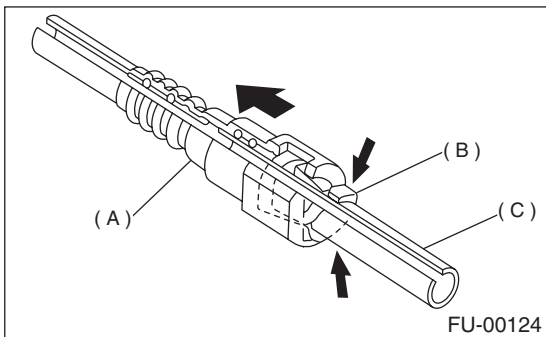
- 8) Remove the clip and disconnect the evaporation hose from the fuel pipe.



- 9) Lift up the vehicle.  
10) Remove the fuel tank. <Ref. to FU(H4DOTC)-52, REMOVAL, Fuel Tank.>  
11) Separate the quick connector of fuel line.  
(1) Clean the pipe and connector, if they are covered with dust.  
(2) To prevent from damaging or entering foreign matter, wrap the pipes and connectors with plastic bag etc.



- (3) Hold the connector (A) and push the retainer (B) down.  
(4) Pull out the connector (A) from the retainer (B).



- (A) Connector  
(B) Retainer  
(C) Pipe

## B: INSTALLATION

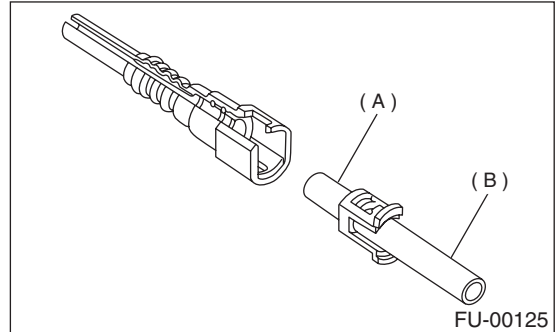
- 1) Connect the quick connector on fuel line.

### CAUTION:

Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.

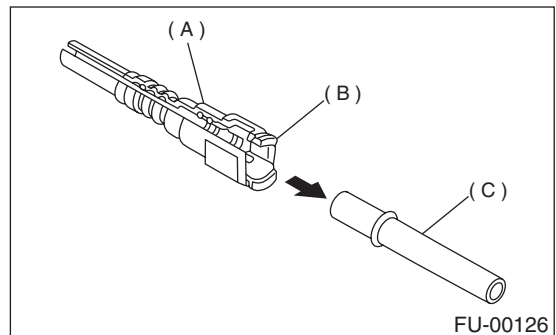
### NOTE:

Use a new retainer.



- (A) Seal surface  
(B) Pipe

- (1) Set the new retainer (B) to connector (A).  
(2) Push the pipe into the connector completely.



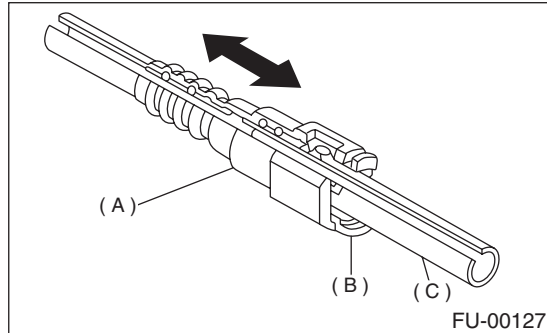
- (A) Connector  
(B) Retainer  
(C) Pipe

# Fuel Delivery, Return and Evaporation Lines

## FUEL INJECTION (FUEL SYSTEMS)

### CAUTION:

- Pull the connector to ensure it is connected securely.
- Make sure the two retainer poles are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
- (B) Retainer
- (C) Pipe

2) Connect the fuel delivery hose and return hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the amount to be inserted is specified.

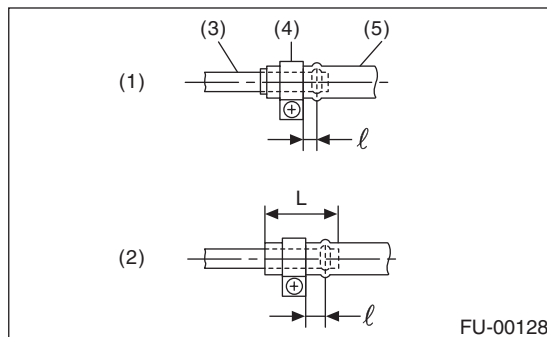
Type B: When the amount to be inserted is not specified.

$\varnothing$ :  $2.5 \pm 1.5$  mm ( $0.098 \pm 0.059$  in)

L:  $22.5 \pm 2.5$  mm ( $0.886 \pm 0.098$  in)

### CAUTION:

Be sure to inspect hoses and their connections for any leakage of fuel.

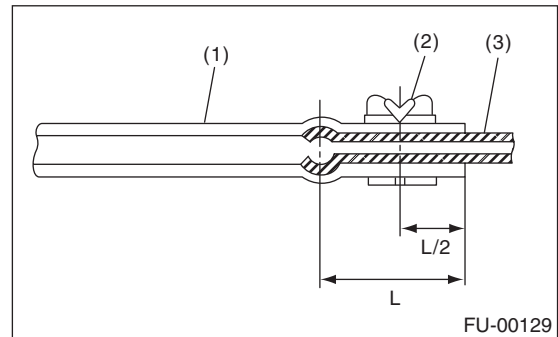


- (1) Type A
- (2) Type B
- (3) Pipe
- (4) Clamp
- (5) Hose

3) Connect the evaporation hose to the pipe with an overlap of 15 to 20 mm (0.59 to 0.79 in).

### Fuel evaporation hose:

L =  $17.5 \pm 2.5$  mm ( $0.689 \pm 0.098$  in)



- (1) Hose
- (2) Clip
- (3) Pipe

## C: INSPECTION

1) Make sure that there are no cracks on the fuel pipes and fuel hoses.

2) Make sure the fuel pipe and fuel hose connections are tightened firmly.

# Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

## 35. Fuel System Trouble in General

### A: INSPECTION

Trouble and possible cause		Corrective action
<b>1. Insufficient fuel supply to injector</b>		
1)	Fuel pump does not operate.	
	○ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	○ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
2)	Decline of fuel pump function	Replace the fuel pump.
3)	Clogged fuel filter	Replace the fuel pump.
4)	Clogged or bent fuel pipe or hose	Clean, correct or replace the fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent air breather tube or pipe.	Clean, correct or replace the air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator	Replace.
<b>2. Leakage or blow out of fuel</b>		
1)	Loose joints of the fuel pipe	Retighten.
2)	Cracked fuel pipe, hose and fuel tank	Replace.
3)	Defective welding part on the fuel tank	Replace.
4)	Clogged air breather tube or air vent tube	Clean, correct or replace the air breather tube or air vent tube.
<b>3. Gasoline smell inside of compartment</b>		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe	Retighten.
2)	Problem in tightness of the fuel saucer gasket air	Correct or replace the gasket.
3)	Inoperative fuel pump modulator or circuit	Replace.
<b>4. Defective fuel meter indicator</b>		
1)	Defective operation of fuel level sensor	Replace.
2)	Defective operation of fuel meter	Replace.
<b>5. Noise</b>		
1)	Large operation noise or vibration of fuel pump	Replace.

#### NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
- In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
- When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
- Before using water removing agent, follow the cautions noted on the bottle.

# Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

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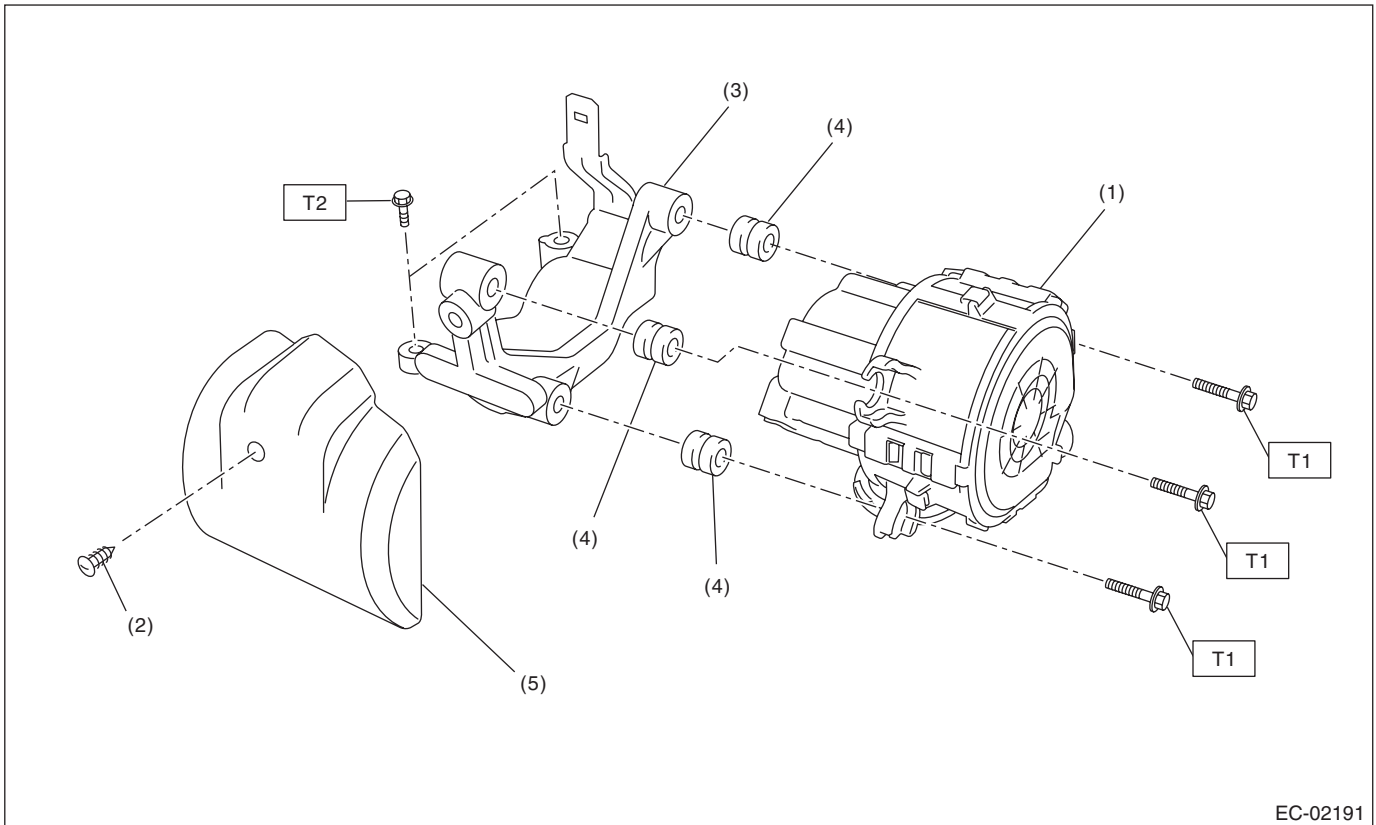
# General Description

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 1. General Description

### A: COMPONENT

#### 1. SECONDARY AIR PUMP



- |                                |                              |
|--------------------------------|------------------------------|
| (1) Secondary air pump         | (4) Bushing                  |
| (2) Clip                       | (5) Secondary air pump cover |
| (3) Secondary air pump bracket |                              |

**Tightening torque: N·m (kgf·m, ft·lb)**

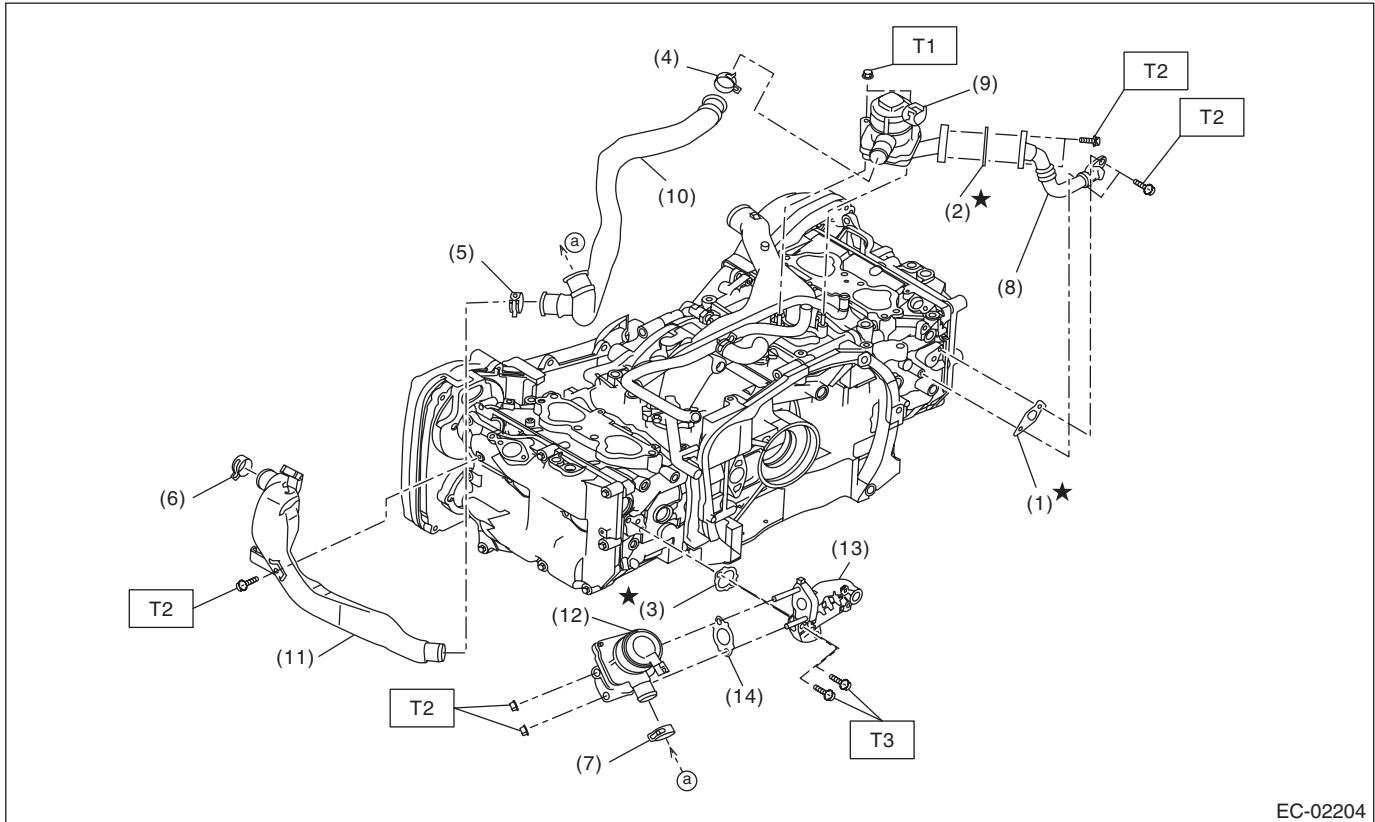
**T1: 6.4 (0.65, 4.7)**

**T2: 19 (1.9, 14.0)**

# General Description

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. SECONDARY AIR COMBINATION VALVE



EC-02204

- |            |   |                            |
|------------|---|----------------------------|
| (1) Gasket | (8) Secondary air pipe RH               | (13) Secondary air pipe LH |
| (2) Gasket | (9) Secondary air combination valve RH  | (14) Gasket                |
| (3) Gasket |   |                            |
| (4) Clamp  | (10) Air duct A                         |                            |
| (5) Clamp  | (11) Air duct B                         |                            |
| (6) Clamp  | (12) Secondary air combination valve LH |                            |
| (7) Clamp  |   |                            |

---

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 9 (0.9, 6.6)**

**T3: 19 (1.9, 14.0)**

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### B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.



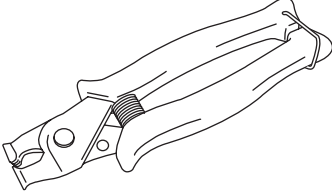
# General Description

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## C: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
  ST18353AA000	18353AA000	CLAMP PLIERS	<ul style="list-style-type: none"><li>• Used for removing and installing the PCV hose.</li><li>• This is a general tool made by the French company CAILLAU. (code) 54.0.000.205</li></ul> To make this easier to obtain in the same way as genuine Subaru parts, it has been provided with a tool number as an ST.

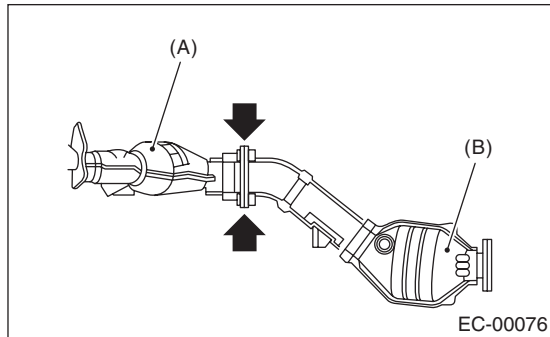
# Front Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. Front Catalytic Converter

### A: REMOVAL

- 1) Remove the center exhaust pipe.  
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 2) Disconnect the front catalytic converter (A) from the rear catalytic converter (B).



### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

# Rear Catalytic Converter

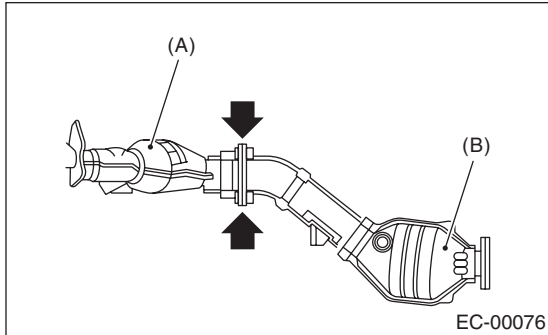
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 3. Rear Catalytic Converter

### A: REMOVAL

- 1) Remove the center exhaust pipe.  
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 2) Disconnect the rear catalytic converter (B) from the front catalytic converter (A).



### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Use a new gasket.

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

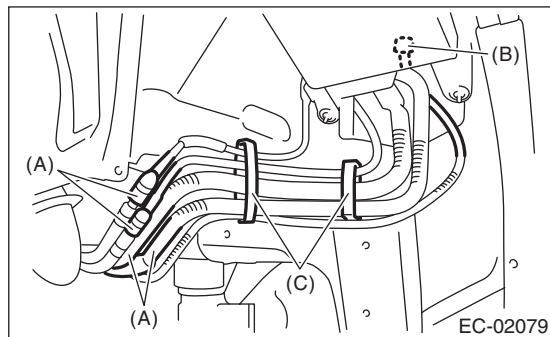
# Canister

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

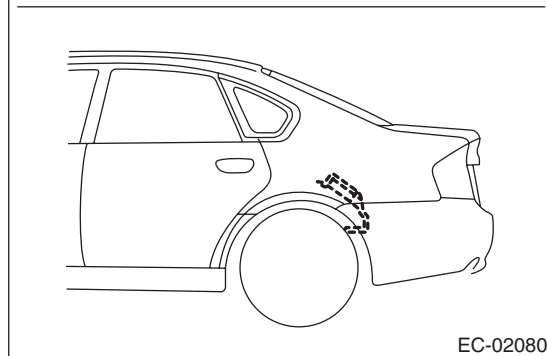
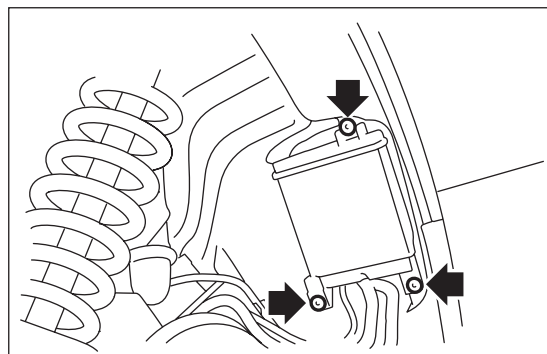
## 4. Canister

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the rear wheel LH.
- 4) Remove the rear mud guard LH.
- 5) Disconnect quick connector (A).
- 6) Disconnect the drain valve connector (B).
- 7) Remove clip (C).



- 8) Remove the canister from body.



### B: INSTALLATION

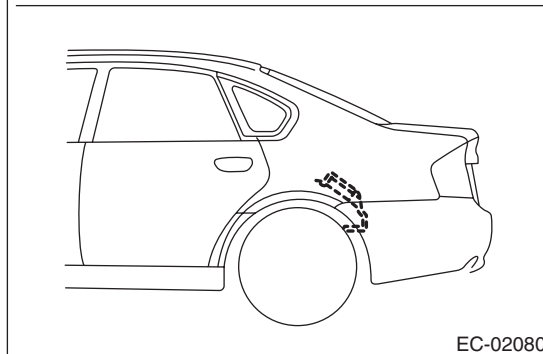
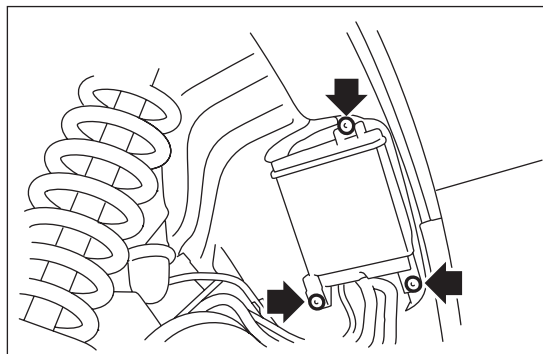
Install in the reverse order of removal.

#### NOTE:

Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.

#### Tightening torque:

**8 N·m (0.8 kgf-m, 5.9 ft-lb)**



### C: INSPECTION

Make sure the canister and canister hoses are not cracked or loose.

# Purge Control Solenoid Valve

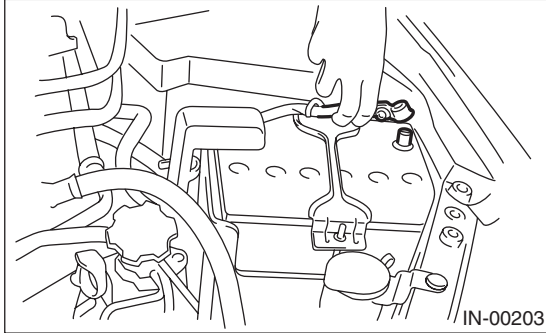
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 5. Purge Control Solenoid Valve

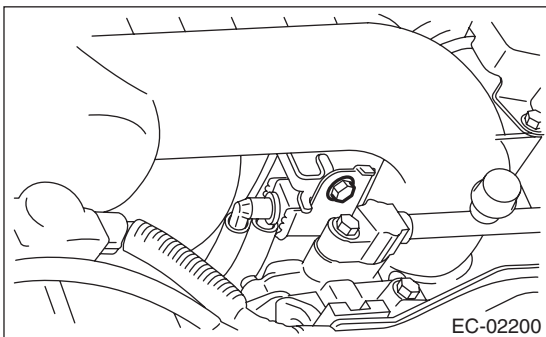
### A: REMOVAL

#### 1. PURGE CONTROL SOLENOID VALVE 1

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



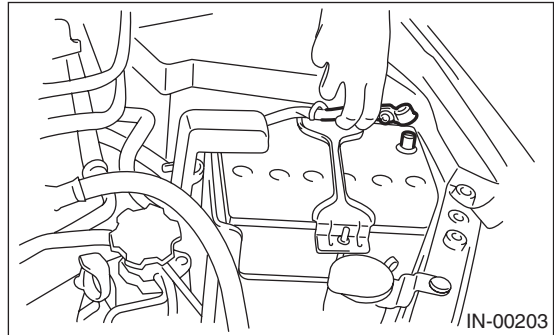
- 3) Remove the bolts that attach the purge control solenoid valve 1 to the intake manifold. Then disconnect the connector from the purge control solenoid valve 1.



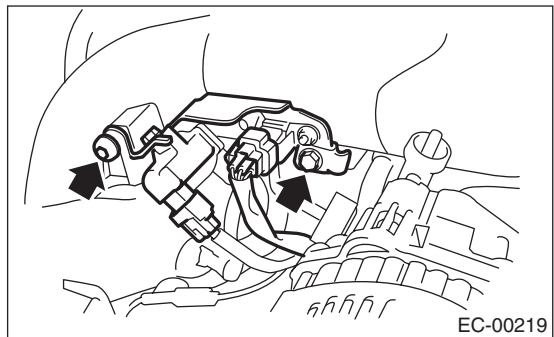
- 4) Disconnect the evaporation hose from the intake manifold and fuel pipe assembly.

#### 2. PURGE CONTROL SOLENOID VALVE 2

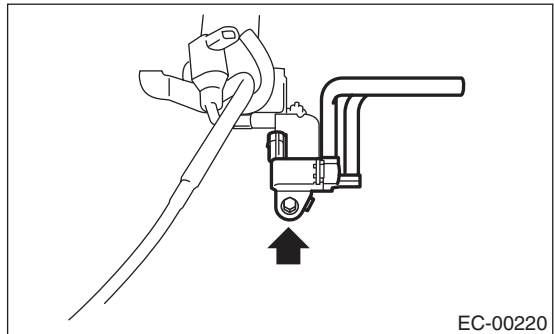
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the solenoid valve bracket assembly from intake manifold.



- 4) Disconnect the connector from purge control solenoid valve 2.
- 5) Disconnect the evaporation hose from the intake duct and fuel pipe assembly.
- 6) Remove the purge control solenoid valve 2 from the solenoid valve bracket assembly.



# Purge Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

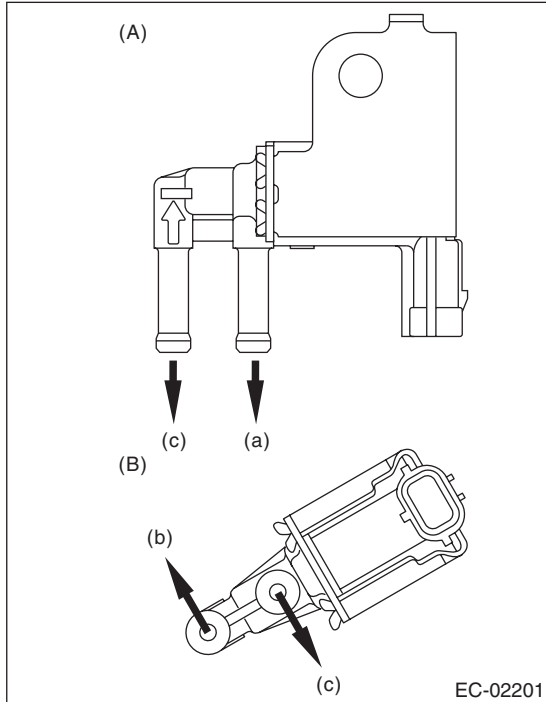
## B: INSTALLATION

### 1. PURGE CONTROL SOLENOID VALVE 1

Install in the reverse order of removal.

#### NOTE:

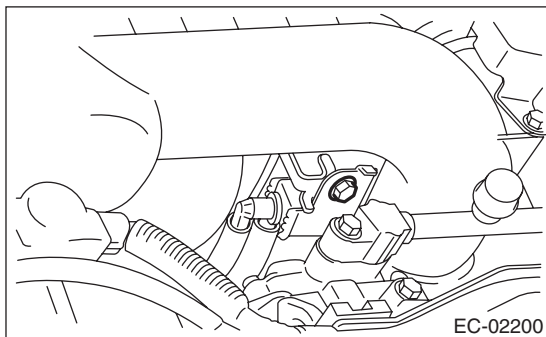
Connect the evaporation hose as shown in the figure.



- (A) Purge Control Solenoid Valve 1
- (B) Purge Control Solenoid Valve 2
- (a) To intake manifold
- (b) To intake duct
- (c) To fuel pipe

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



# Purge Control Solenoid Valve

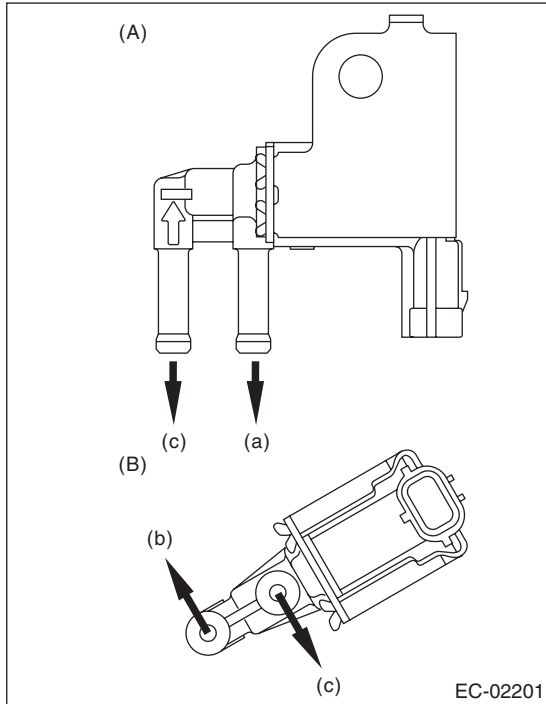
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. PURGE CONTROL SOLENOID VALVE 2

Install in the reverse order of removal.

### NOTE:

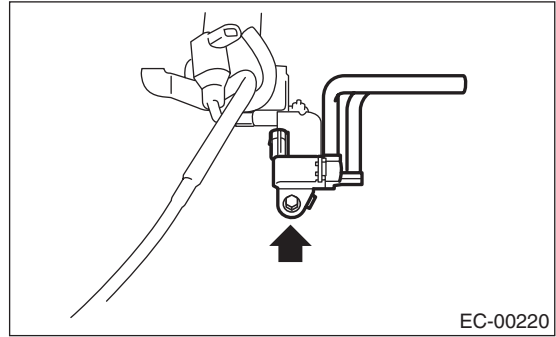
Connect the evaporation hose as shown in the figure.



- (A) Purge Control Solenoid Valve 1
- (B) Purge Control Solenoid Valve 2
- (a) To intake manifold
- (b) To intake duct
- (c) To fuel pipe

### Tightening torque:

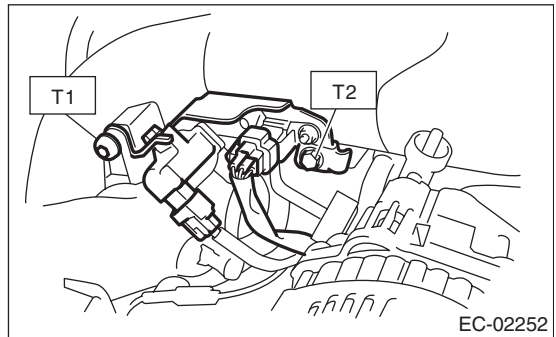
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



### Tightening torque:

**T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)**

**T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)**



## C: INSPECTION

Make sure the hoses are not cracked or loose.

# Fuel Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 6. Fuel Level Sensor

### A: REMOVAL

For removal procedure, refer to "FU(H4DOTC)" section. <Ref. to FU(H4DOTC)-65, REMOVAL, Fuel Level Sensor.>

### B: INSTALLATION

For installation procedure, refer to "FU(H4DOTC)" section. <Ref. to FU(H4DOTC)-65, INSTALLATION, Fuel Level Sensor.>



# Fuel Temperature Sensor

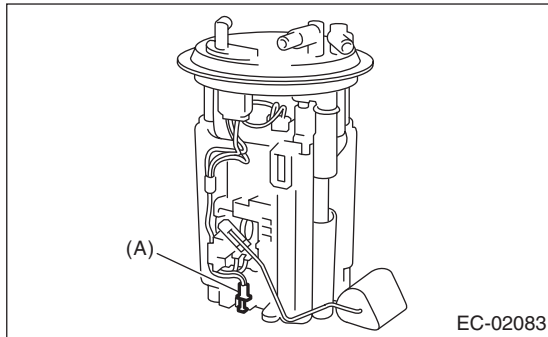
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 7. Fuel Temperature Sensor

### A: REMOVAL

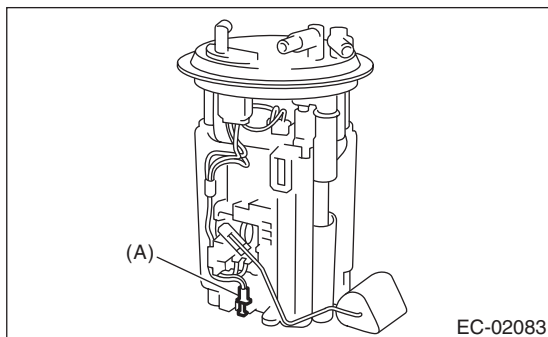
The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for removal procedure. <Ref. to FU(H4DOTC)-65, REMOVAL, Fuel Level Sensor.>



(A) Fuel temperature sensor

### B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for installation procedure. <Ref. to FU(H4DOTC)-65, INSTALLATION, Fuel Level Sensor.>



(A) Fuel temperature sensor

## Fuel Sub Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### 8. Fuel Sub Level Sensor

#### A: REMOVAL

For removal procedure, refer to “FU(H4DOTC)” section. <Ref. to FU(H4DOTC)-66, REMOVAL, Fuel Sub Level Sensor.>

#### B: INSTALLATION

For installation procedure, refer to “FU(F4DOTC)” section. <Ref. to FU(H4DOTC)-66, INSTALLATION, Fuel Sub Level Sensor.>

# Fuel Tank Pressure Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

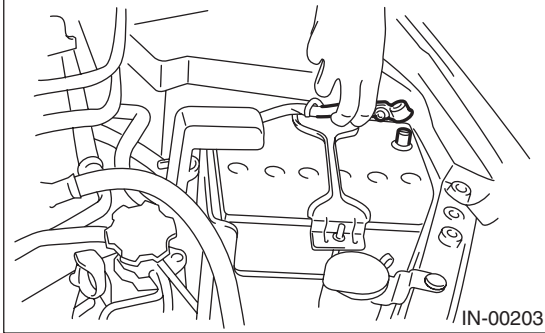
## 9. Fuel Tank Pressure Sensor

### A: REMOVAL

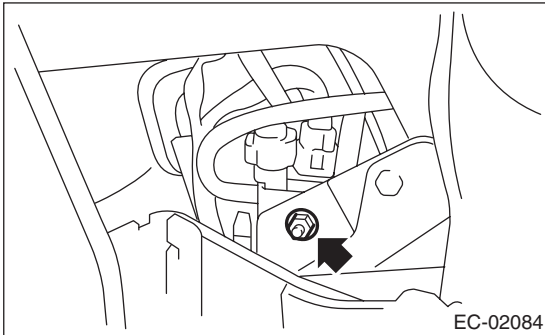
#### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Open the fuel flap lid, and remove the fuel filler cap.
- 4) Lift up the vehicle.
- 5) Disconnect the connector from the fuel tank pressure sensor.
- 6) Disconnect the pressure hose from the fuel tank pressure sensor.
- 7) Remove the fuel tank pressure sensor along with the bracket.

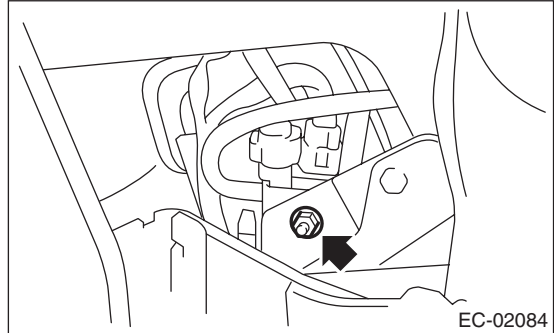


### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

**7.4 N·m (0.75 kgf-m, 5.4 ft-lb)**



### C: INSPECTION

Make sure the hoses are not cracked or loose.

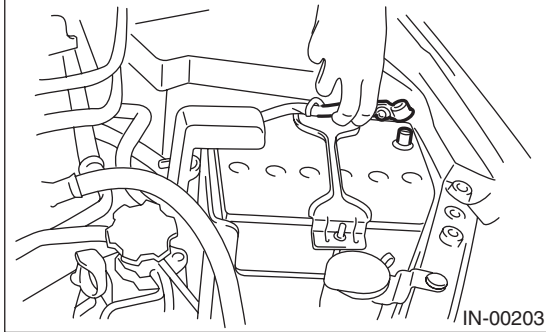
# Pressure Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

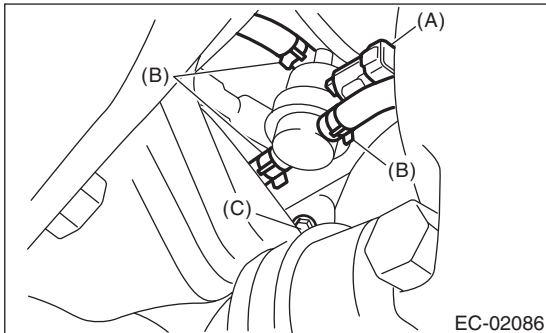
## 10. Pressure Control Solenoid Valve

### A: REMOVAL

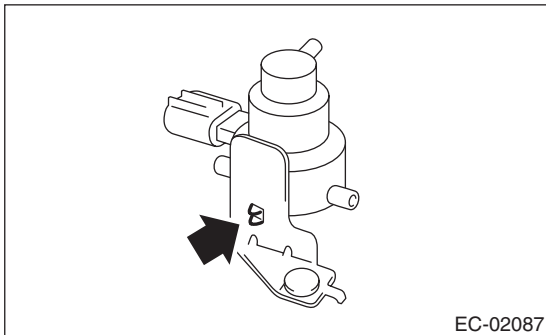
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Disconnect connector (A) from the pressure control solenoid valve.
- 5) Disconnect the evaporation hose (B) from the pressure control solenoid valve.
- 6) Remove the bolts (C) which secure the bracket to the fuel tank.



- 7) Remove the pressure control solenoid valve and bracket as a unit.
- 8) Remove the pressure control solenoid valve from the bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

*7.35 N·m (0.7 kgf-m, 5.4 ft-lb)*

### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 11.Drain Filter

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain filter from canister. Refer to “Canister” for removal and installation procedure. <Ref. to EC(H4DOTC)-7, REMOVAL, Canister.> <Ref. to EC(H4DOTC)-7, INSTALLATION, Canister.>

# Shut Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 12.Shut Valve

### A: REMOVAL

#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

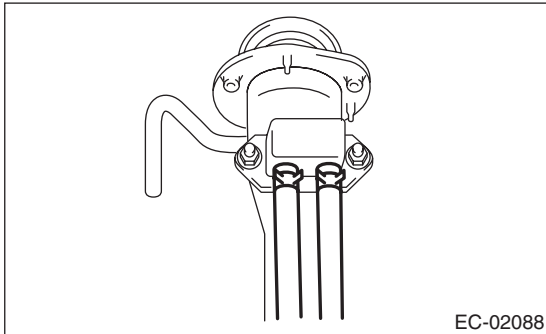
#### CAUTION:

**Be careful not to spill fuel.**

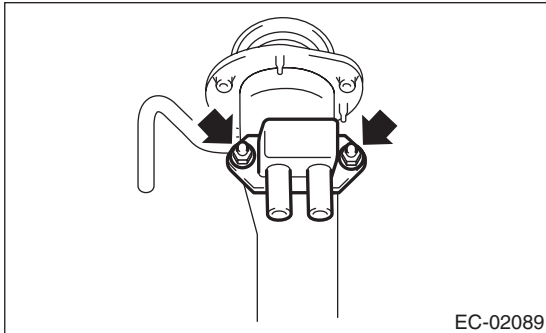
1) Remove the fuel filler pipe.

<Ref. to FU(H4DOTC)-59, REMOVAL, Fuel Filler Pipe.>

2) Disconnect the evaporation hose from the shut valve.



3) Remove the shut valve from the fuel filler pipe.

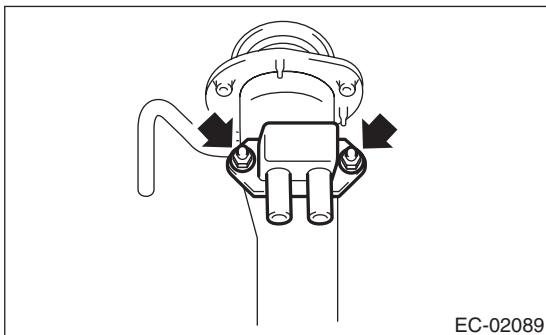


### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

**4.5 N·m (0.46 kgf-m, 3.3 ft-lb)**



### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 13.Drain Valve

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain valve from canister.

Refer to "Canister" for removal and installation procedure. <Ref. to EC(H4DOTC)-7, REMOVAL, Canister.> <Ref. to EC(H4DOTC)-7, INSTALLATION, Canister.>

## 14.PCV Hose Assembly

### A: REMOVAL

#### CAUTION:

**Do not remove unless the PCV hose, diagnostics connector and PCV valve are damaged.**

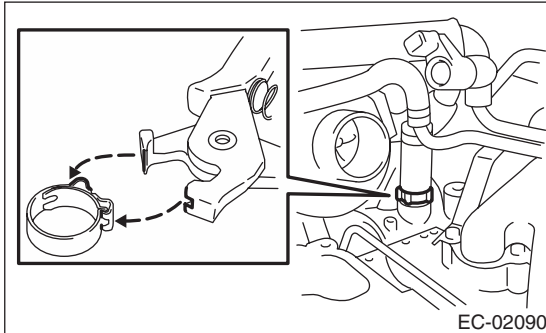
1) Remove the intake manifold.

<Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>

2) Fit the depression in the ST with the protrusion on the clamp to unlock.

3) Remove the PCV hose assembly.

ST 18353AA000 CLAMP PLIERS



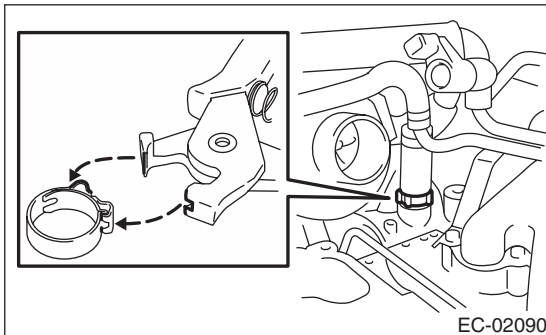
### B: INSTALLATION

#### NOTE:

Use a new clamp.

1) Install the PCV hose assembly, then lock by fitting the ST on the clamp protrusion.

ST 18353AA000 CLAMP PLIERS



2) Install the intake manifold.

<Ref. to FU(H4DOTC)-15, INSTALLATION, Intake Manifold.>



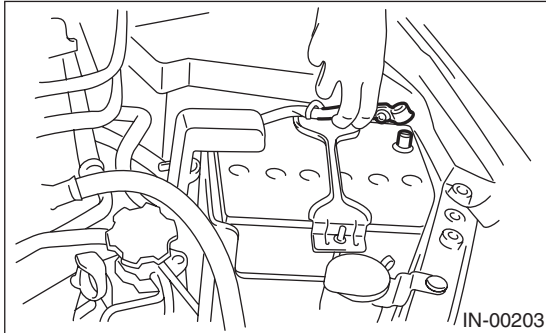
# Secondary Air Pump

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

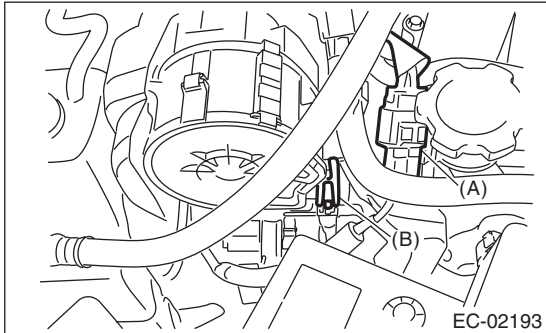
## 15. Secondary Air Pump

### A: REMOVAL

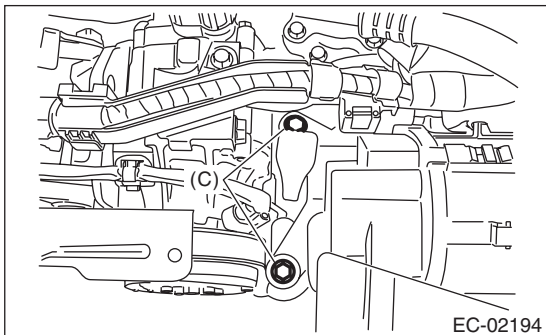
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Disconnect the connector (A) from secondary air pump, and remove the harness.
- 4) Disconnect the hose (B) from secondary air pump.



- 5) Remove the bolt (C) which secures the secondary air pump to the body.

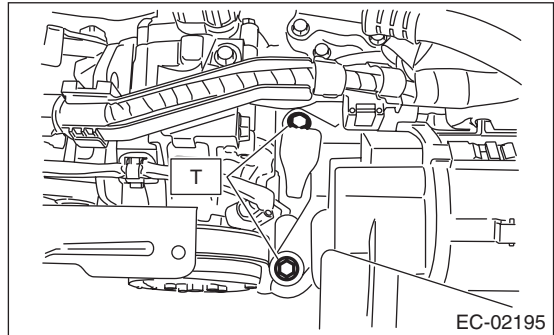


### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



### C: INSPECTION

Make sure the hoses are not cracked or loose.

# Secondary Air Combination Valve

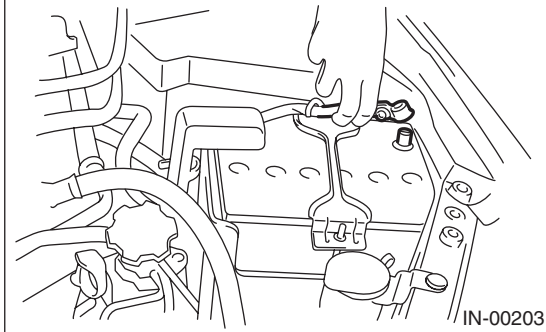
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 16. Secondary Air Combination Valve

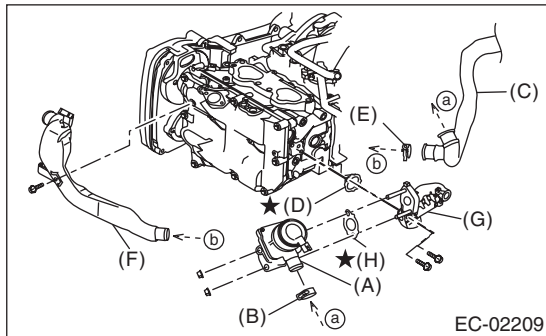
### A: REMOVAL

#### 1. SECONDARY AIR COMBINATION VALVE LH

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



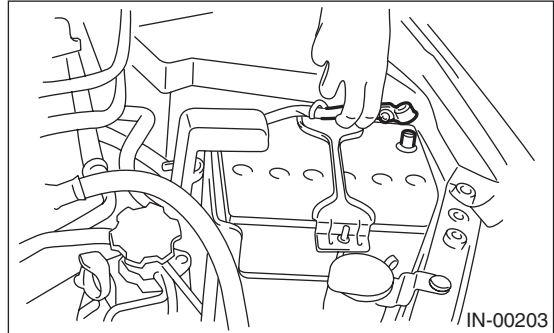
- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Disconnect the connector from the secondary air combination valve LH.
- 5) Disconnect the air duct A.
- 6) Remove the secondary air pipe LH.
- 7) Remove the secondary air combination valve LH.



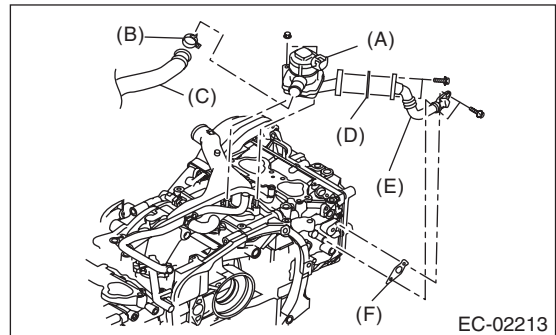
- (A) Secondary air combination valve LH
- (B) Clamp
- (C) Air duct A
- (D) Gasket
- (E) Clamp
- (F) Air duct B
- (G) Secondary air pipe LH
- (H) Gasket

#### 2. SECONDARY AIR COMBINATION VALVE RH

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 5) Disconnect the connector from the secondary air combination valve RH.
- 6) Disconnect the air duct A.
- 7) Remove the secondary air pipe RH.
- 8) Remove the secondary air combination valve RH.



- (A) Secondary air combination valve RH
- (B) Clamp
- (C) Air duct A
- (D) Gasket
- (E) Secondary air pipe RH
- (F) Gasket

# Secondary Air Combination Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## B: INSTALLATION

### 1. SECONDARY AIR COMBINATION VALVE LH

Install in the reverse order of removal.

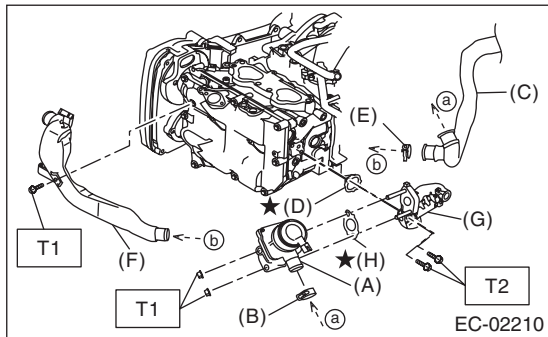
NOTE:

Use a new gasket.

**Tightening torque:**

**T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)**

**T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)**



- (A) Secondary air combination valve LH
- (B) Clamp
- (C) Air duct A
- (D) Gasket
- (E) Clamp
- (F) Air duct B
- (G) Secondary air pipe LH
- (H) Gasket

### 2. SECONDARY AIR COMBINATION VALVE RH

Install in the reverse order of removal.

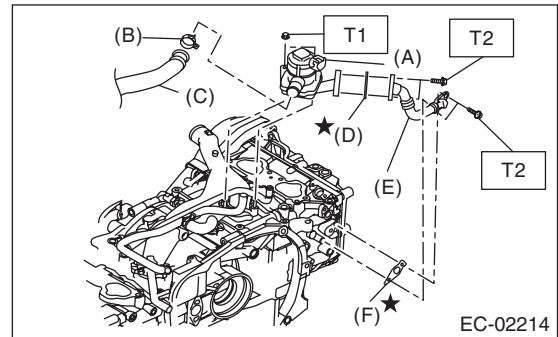
NOTE:

Use a new gasket.

**Tightening torque:**

**T1: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

**T2: 9 N·m (0.9 kgf-m, 6.6 ft-lb)**



- (A) Secondary air combination valve RH
- (B) Clamp
- (C) Air duct A
- (D) Gasket
- (E) Secondary air pipe RH
- (F) Gasket

## C: INSPECTION

Check the air duct and pipe for looseness.

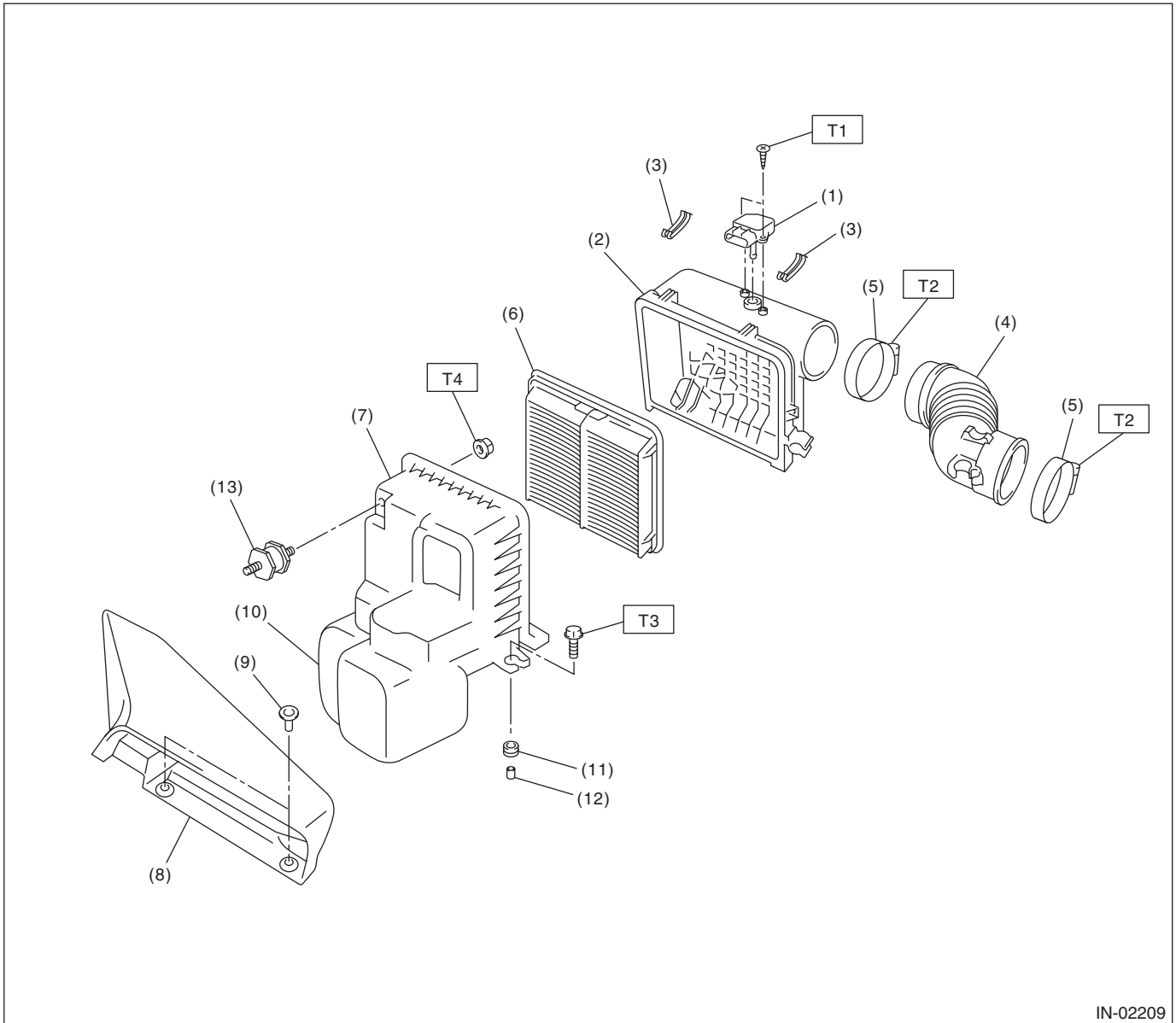
# General Description

INTAKE (INDUCTION)

## 1. General Description

### A: COMPONENT

#### 1. AIR CLEANER



IN-02209

- |   |                              |
|---|------------------------------|
| (1) Mass air flow and intake air temperature sensor | (7) Air cleaner case (front) |
| (2) Air cleaner case (rear)                         | (8) Air intake duct          |
| (3) Clip  | (9) Clip                     |
| (4) Air intake boot                                 | (10) Resonator chamber       |
| (5) Clamp   | (11) Cushion                 |
| (6) Air cleaner element                             | (12) Spacer                  |
|   | (13) Cushion                 |

#### **Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 1 (0.1, 0.7)**

**T2: 2.5 (0.25, 1.8)**

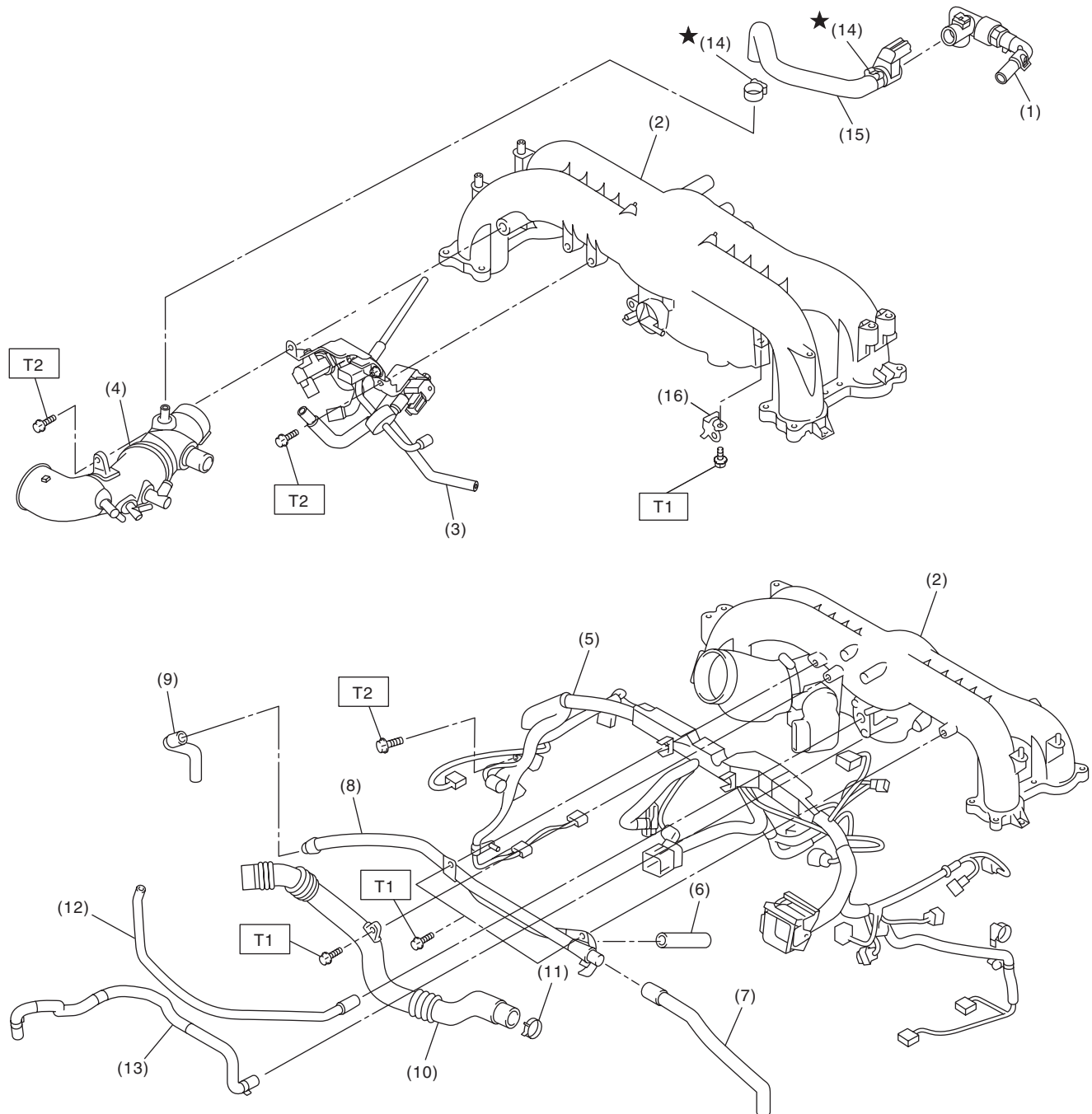
**T3: 6 (0.6, 4.4)**

**T4: 7.5 (0.76, 5.5)**

# General Description

INTAKE (INDUCTION)

## 2. INTAKE DUCT



IN-02224

- |                                 |                         |                             |
|---------------------------------|-------------------------|-----------------------------|
| (1) PCV hose ASSY A             | (8) PCV pipe            | (15) PCV hose ASSY B        |
| (2) Intake manifold             | (9) Vacuum hose         | (16) Solenoid valve bracket |
| (3) Solenoid valve bracket ASSY | (10) Air by-pass pipe   |                             |
| (4) Intake duct                 | (11) Clamp              |                             |
| (5) Engine harness ASSY         | (12) Vacuum hose        |                             |
| (6) Vacuum hose                 | (13) Brake booster hose |                             |
| (7) Vacuum hose                 | (14) Clamp              |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

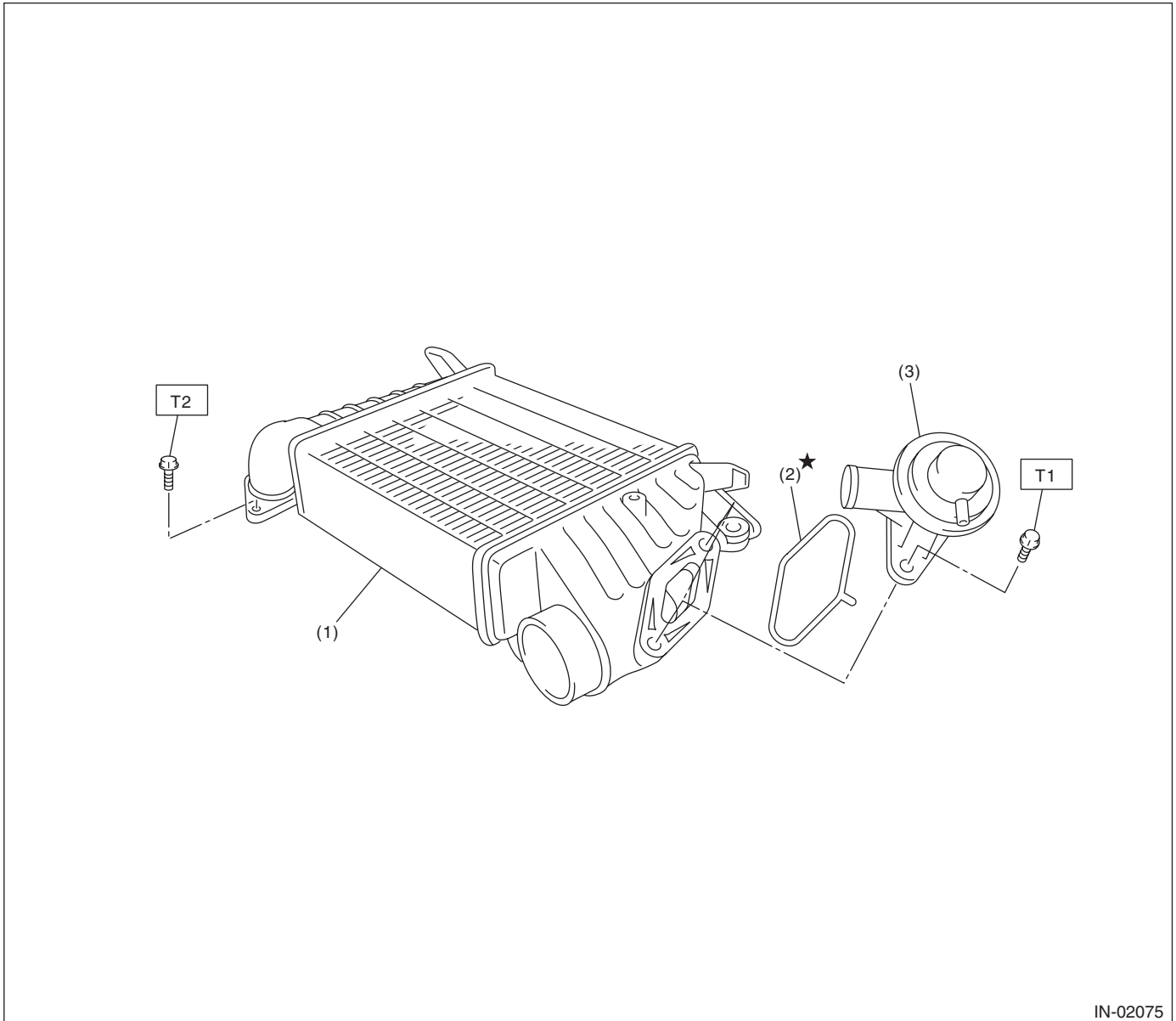
**T2: 19 (1.9, 14.0)**

**IN(H4DOTC)-3**

# General Description

INTAKE (INDUCTION)

## 3. INTERCOOLER



IN-02075

- (1) Intercooler
- (2) O-ring

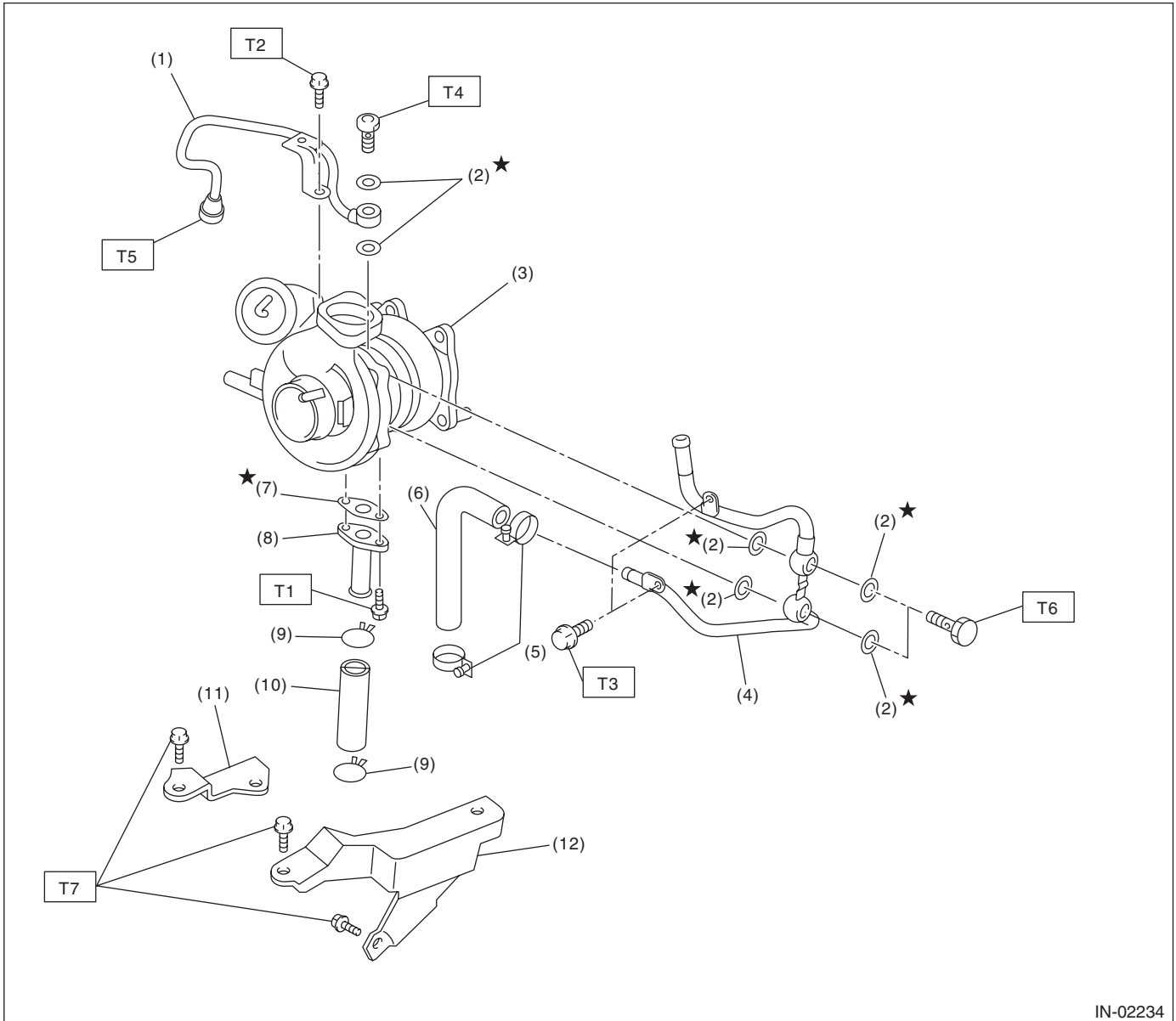
- (3) Air by-pass valve

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.5 (0.66, 4.8)**

**T2: 16 (1.6, 11.8)**

## 4. TURBOCHARGER



- |                         |                              |
|-------------------------|------------------------------|
| (1) Oil inlet pipe      | (9) Clip                     |
| (2) Metal gasket        | (10) Oil outlet hose         |
| (3) Turbocharger        | (11) Turbocharger bracket RH |
| (4) Water pipe          | (12) Turbocharger bracket LH |
| (5) Clamp               |                              |
| (6) Engine coolant hose |                              |
| (7) Gasket              |                              |
| (8) Oil outlet pipe     |                              |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 4.9 (0.5, 3.6)**

**T2: 5 (0.5, 3.7)**

**T3: 7.8 (0.8, 5.8)**

**T4: 16 (1.6, 11.8)**

**T5: 20 (2.0, 14.8)**

**T6: 23 (2.3, 17.0)**

**T7: 33 (3.4, 24.6)**

## General Description

INTAKE (INDUCTION)

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### **B: CAUTION**

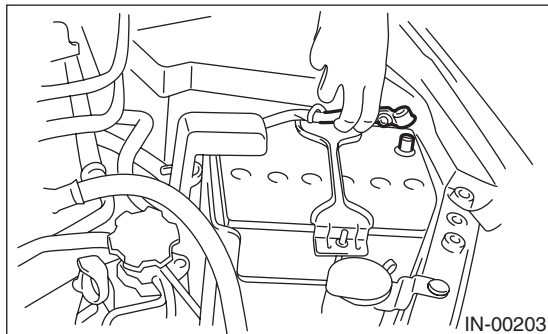
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.



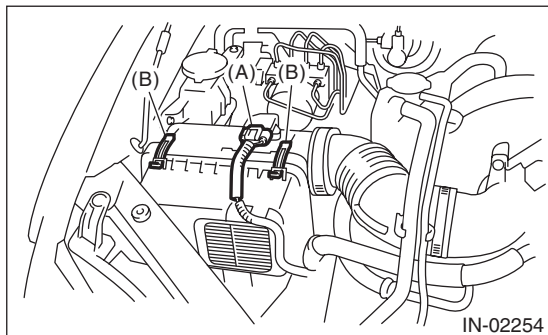
## 2. Air Cleaner Element

### A: REMOVAL

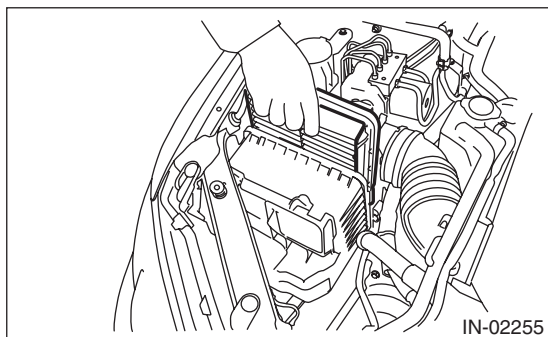
- 1) Disconnect the ground cable from battery.



- 2) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 3) Disconnect the connector (A) from mass air flow and intake air temperature sensor.
- 4) Remove the clip (B) from the air cleaner case.



- 5) Remove the air cleaner element.



### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

Be sure to use **SUBARU** genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Otherwise engine performance may be damaged.

### C: INSPECTION

Replace if excessively damaged or dirty.

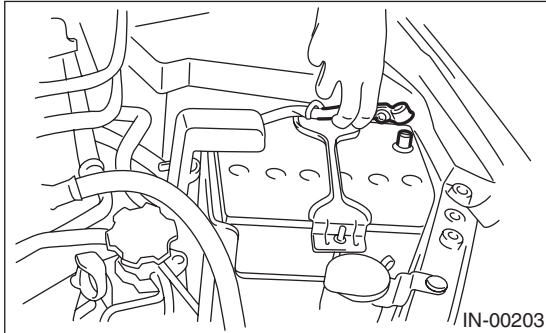
# Air Cleaner Case

INTAKE (INDUCTION)

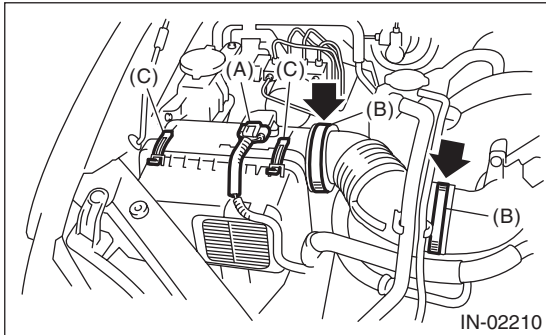
## 3. Air Cleaner Case

### A: REMOVAL

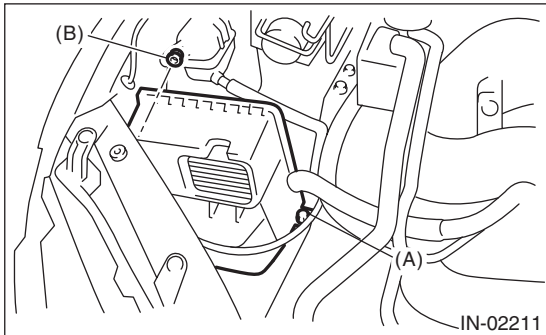
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 4) Disconnect the connector (A) from mass air flow and intake air temperature sensor.
- 5) Loosen the clamp (B) which connects the air intake boot and intake duct.
- 6) Remove the clip (C) from the air cleaner case.



- 7) Remove the air cleaner case (rear) and air intake boot.
- 8) Remove the air cleaner element.
- 9) Remove the bolts (A) and nuts (B) which secure the air cleaner case (front) to the body.



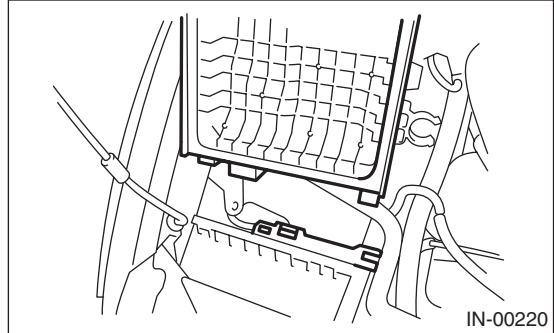
- 10) Remove the air cleaner case (front).

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



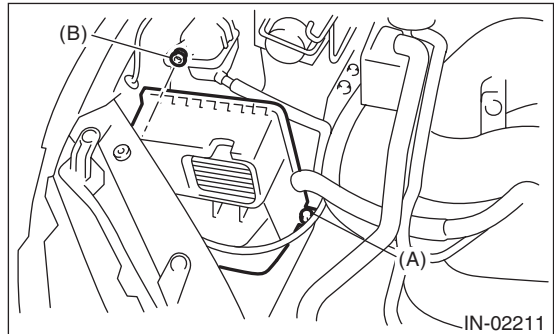
#### Tightening torque:

**Bolt (A)**

**6 N·m (0.6 kgf-m, 4.4 ft-lb)**

**NUT (B)**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



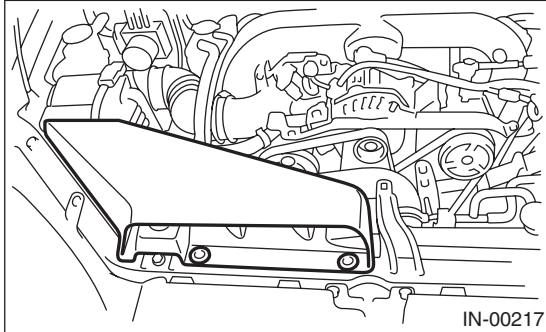
### C: INSPECTION

Check for cracks or loose connections.

## 4. Air Intake Duct

### A: REMOVAL

- 1) Remove the clip which installs the air intake duct on the front side of body.
- 2) Remove the air intake duct.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Check for cracks or loose connections.
- 2) Inspect that no foreign objects in the air intake duct.

### **5. Resonator Chamber**

#### **A: REMOVAL**

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for removal procedure. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>

#### **B: INSTALLATION**

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for installation procedure. <Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.>

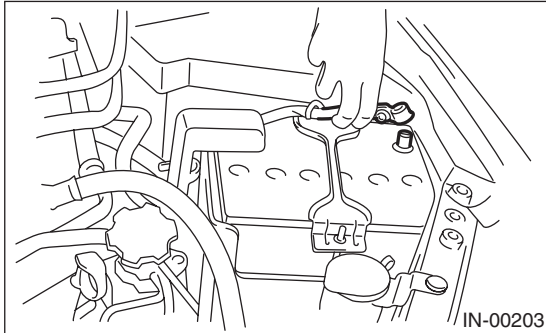
#### **C: INSPECTION**

Check for cracks or loose connections.

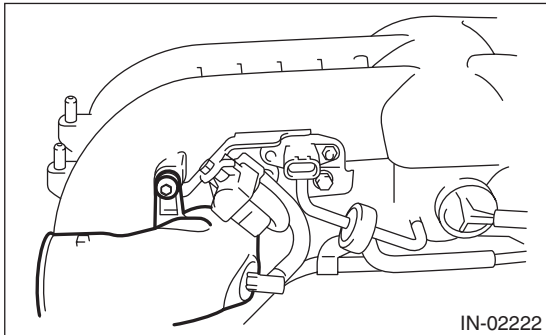
## 6. Intake Duct

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 4) Remove the sensor, engine harness and fuel pipe attached to the intake manifold. <Ref. to FU(H4DOTC)-18, DISASSEMBLY, Intake Manifold.>
- 5) Remove the intake duct from intake manifold.

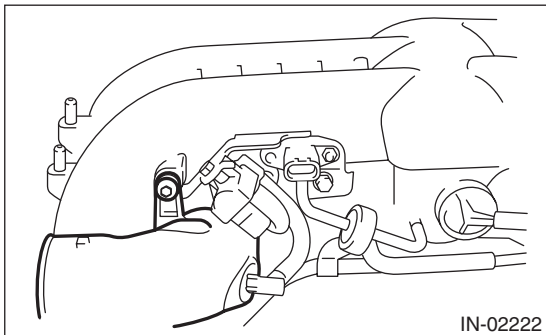


### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



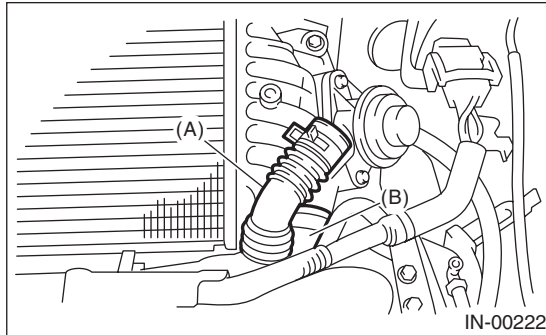
# Intercooler

## INTAKE (INDUCTION)

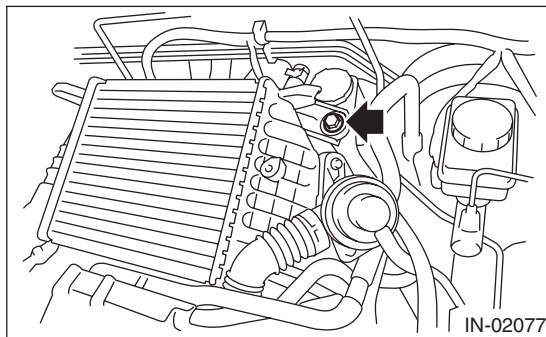
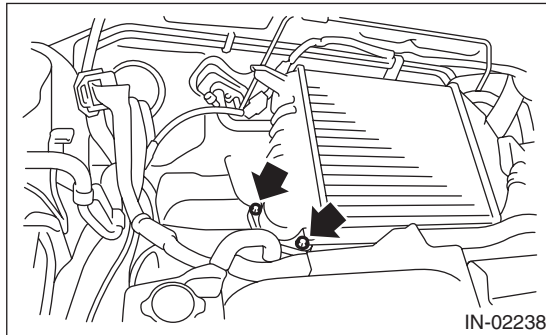
### 7. Intercooler

#### A: REMOVAL

- 1) Remove the collector cover.
- 2) Loosen the clamp and remove the air by-pass pipe (A) from the air by-pass valve.
- 3) Loosen the clamp, and then remove the intake duct (B) from the intercooler.



- 4) Remove the bolts which secure the intake duct to the turbocharger.
- 5) Remove the bolts which secure the intercooler to the bracket, and remove the intercooler.

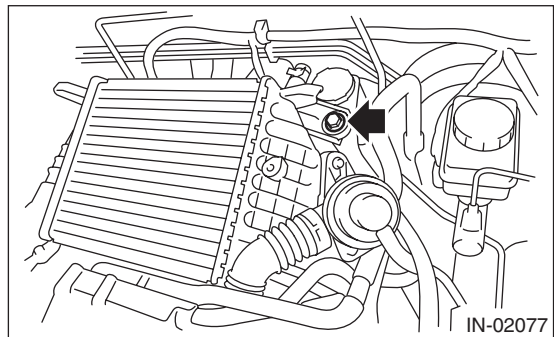
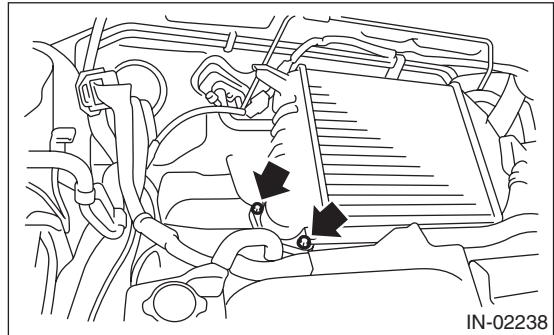


#### B: INSTALLATION

Install in the reverse order of removal.

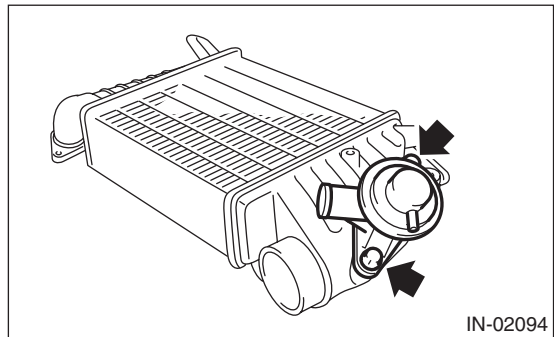
#### *Tightening torque:*

**16 N·m (1.6 kgf-m, 11.8 ft-lb)**



#### C: DISASSEMBLY

- 1) Remove the air by-pass valve from intercooler.



## D: ASSEMBLY

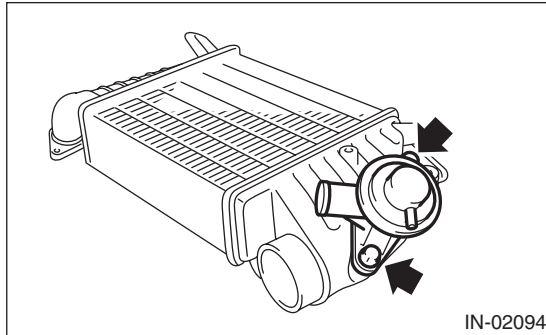
Assemble in the reverse order of disassembly.

NOTE:

- Use new O-rings.
- Be careful not to pinch the O-ring.

**Tightening torque:**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



IN-02094

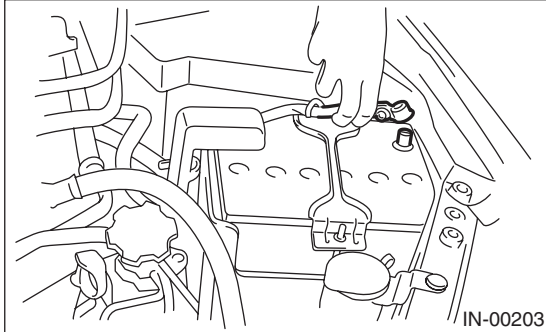
# Turbocharger

## INTAKE (INDUCTION)

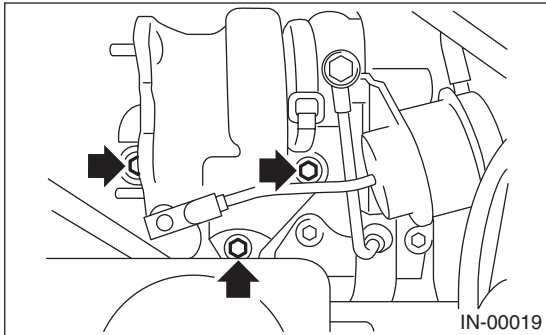
### 8. Turbocharger

#### A: REMOVAL

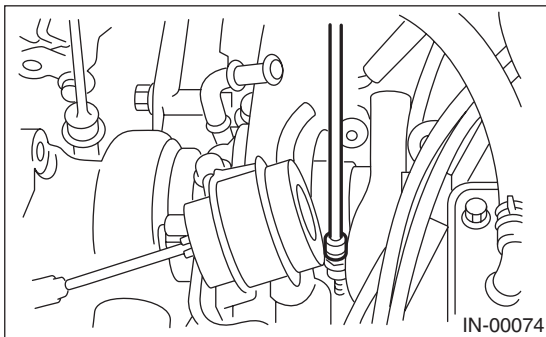
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 5) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 6) Lower the vehicle.
- 7) Separate the turbocharger joint pipe from turbocharger.

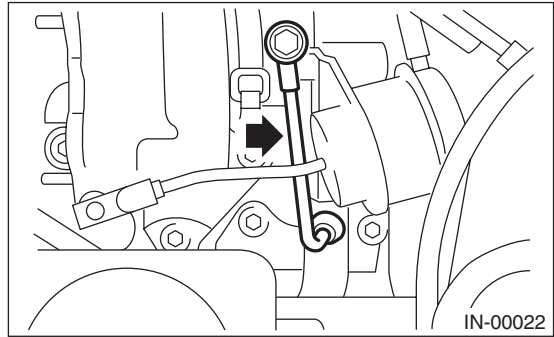


- 8) Disconnect the engine coolant hose which is connected to coolant filler tank.
- 9) Loosen the clamp which secures turbocharger to intake duct.

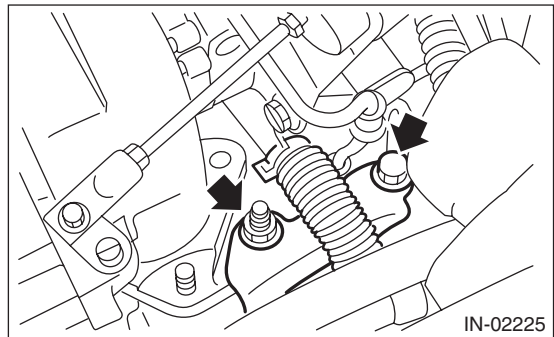


- 10) Remove the bolts which secure oil inlet pipe bracket to turbocharger.

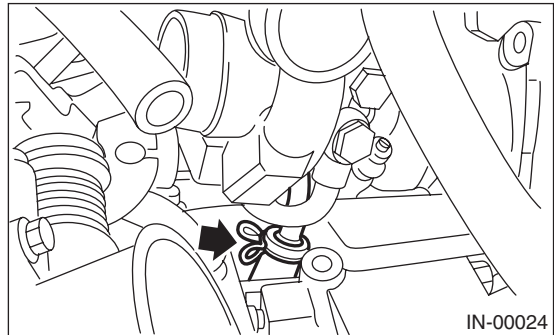
- 11) Remove the oil inlet pipe from the turbocharger.



- 12) Disconnect the engine coolant hose from the water pipe, and remove the turbocharger bracket RH.



- 13) Disconnect the oil outlet hose from the oil outlet pipe.

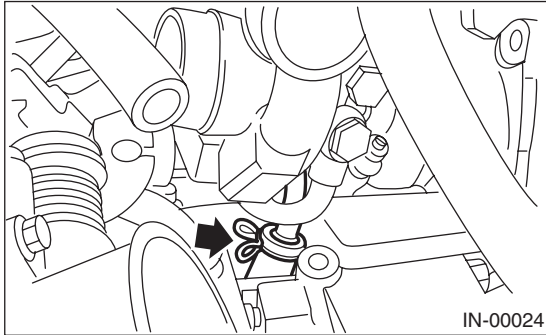


- 14) Take out the turbocharger from engine compartment.



## B: INSTALLATION

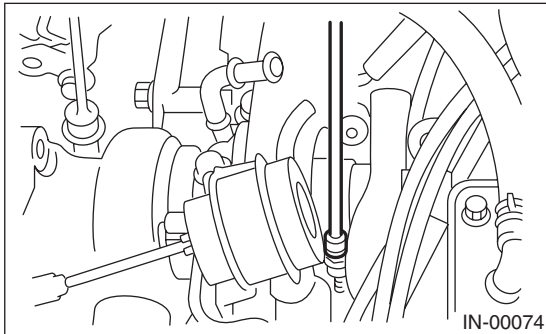
1) Connect the oil outlet hose to the oil outlet pipe.



2) Install the turbocharger to intake duct.

**Tightening torque:**

**3 N·m (0.3 kgf-m, 2.2 ft-lb)**

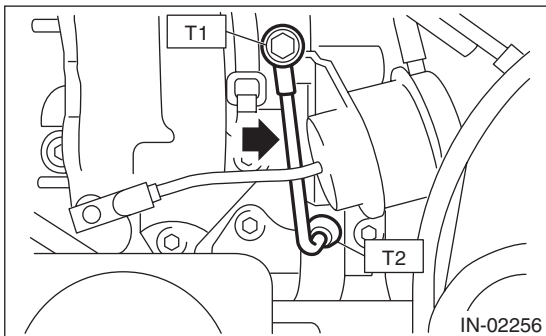


3) Install the oil inlet pipe to the turbocharger.

**Tightening torque:**

**T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)**

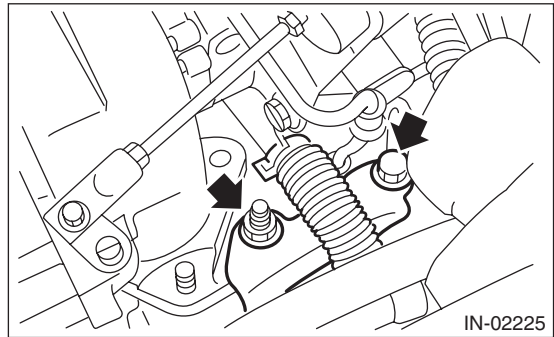
**T2: 20 N·m (2.0 kgf-m, 14.5 ft-lb)**



4) Install the turbocharger bracket RH, and connect the engine coolant hose to the water pipe.

**Tightening torque:**

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**



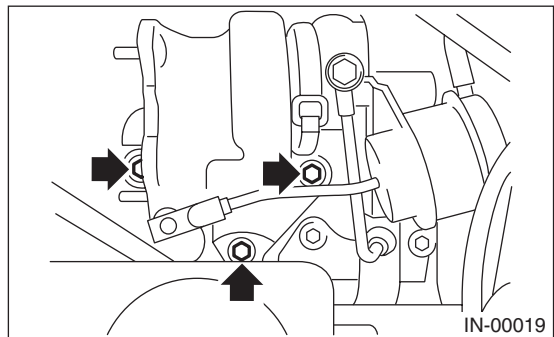
5) Install the joint pipe to turbocharger.

**NOTE:**

Replace the gasket with a new part.

**Tightening torque:**

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**



6) Connect the engine coolant hose which is connected to the coolant filler tank.

7) Lift up the vehicle.

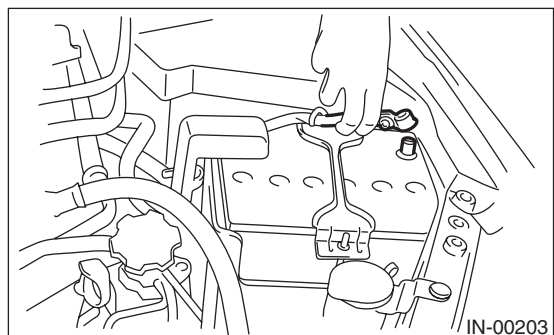
8) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

9) Lower the vehicle.

10) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

11) Install the collector cover.

12) Connect the ground cable to battery.



# Air By-pass Valve

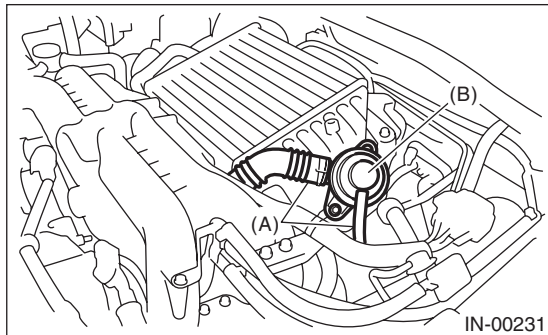
INTAKE (INDUCTION)

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## 9. Air By-pass Valve

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the air by-pass hose (A) from the air by-pass valve.
- 3) Remove the air by-pass valve (B) from the inter-cooler.

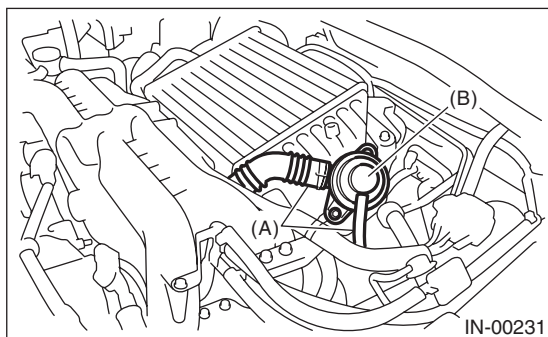


### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



- (A) Air by-pass hose
- (B) Air by-pass valve

# General Description

MECHANICAL

## 1. General Description

### A: SPECIFICATION

Engine	Model		2.5 L		
	Cylinder arrangement		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine		
	Valve system mechanism		Belt driven, double overhead camshaft, 4-valve/cylinder		
	Bore × Stroke		mm (in) 99.5 × 79.0 (3.92 × 3.11)		
	Piston displacement		cm <sup>3</sup> (cu in) 2,457 (149.94)		
	Compression ratio		8.4		
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm <sup>2</sup> , psi) 981 — 1,177 (10 — 12, 142 — 171)		
	Number of piston rings		Pressure ring: 2, Oil ring: 1		
	Intake valve timing		Open	Max. retard	ATDC 5°
				Min. advance	BTDC 35°
			Close	Max. retard	ABDC 65°
				Min. advance	ABDC 25°
	Exhaust valve timing		Open	BBDC 55°	
			Close	ATDC 5°	
	Valve clearance		mm (in)	Intake	0.20±0.02 (0.0079±0.0008)
				Exhaust	0.35±0.02 (0.0138±0.0008)
	Idling speed [at neutral position on MT, or “P” or “N” position on AT]		rpm	No load	750±100
A/C ON				800±100 (MT model) 825±100 (AT model)	
Ignition order			1 → 3 → 2 → 4		
Ignition timing		BTDC/rpm	MT model	12°±10°/750	
			AT model	17°±10°/750	

NOTE:

OS: Oversize US: Undersize

# General Description

MECHANICAL

Belt tension adjuster	Protrusion of adjuster rod		mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Belt tensioner	Spacer O.D.		mm (in)	17.955 — 17.975 (0.7069 — 0.7077)	
	Tensioner bushing I.D.		mm (in)	18.0 — 18.08 (0.7087 — 0.7118)	
	Clearance between spacer and bushing	mm (in)	Standard	0.025 — 0.125 (0.0010 — 0.0049)	
	Side clearance of spacer	mm (in)	Standard	0.20 — 0.55 (0.0079 — 0.0217)	
Camshaft	Bending limit		mm (in)	0.020 (0.0079) or less	
	Thrust clearance		mm (in)	Standard	0.068 — 0.116 (0.0027 — 0.0047)
	Cam lobe height	mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
			Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
	Journal O.D.	mm (in)	Standard	Front	37.946 — 37.963 (1.4939 — 1.4946)
				Center rear	29.946 — 29.963 (1.1790 — 1.1796)
Journal clearance		mm (in)	Standard	0.037 — 0.072 (0.0015 — 0.0028)	
Cylinder head	Surface warpage limit		mm (in)	0.035 (0.0014)	
	Grinding limit		mm (in)	0.3 (0.012)	
	Standard height		mm (in)	127.5 (5.02)	
Valve seat	Seating angle			90°	
	Contacting width	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Inner diameter		mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
	Protrusion above head		mm (in)	15.8 — 16.2 (0.622 — 0.638)	
Valve	Head edge thickness	mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
			Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
	Stem outer diameter	mm (in)	Intake		5.955 — 5.970 (0.2344 — 0.2350)
			Exhaust		5.945 — 5.960 (0.2341 — 0.2346)
	Valve stem gap	mm (in)	Standard	Intake	0.030 — 0.057 (0.0012 — 0.0022)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
Overall length	mm (in)	Intake		104.4 (4.110)	
		Exhaust		104.65 (4.1201)	
Valve spring	Free length		mm (in)	47.32 (1.863)	
	Squareness			2.5°, 2.1 mm (0.083 in) or less	
	Tension/spring height	N (kgf, lb)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)	
			Lift	426 — 490 (43.4 — 50.0, 95.8 — 110)/26.5 (1.043)	
Valve lifter	Outer diameter		mm (in)	Standard	34.959 — 34.975 (1.3763 — 1.3770)
	Inner diameter (cylinder head)		mm (in)	Standard	34.994 — 35.016 (1.3777 — 1.3786)
	Valve lifter clearance		mm (in)	Standard	0.019 — 0.057 (0.0007 — 0.0022)
Cylinder block	Surface warpage limit (Mating surface with cylinder head)		mm (in)	0.025 (0.0098)	
	Grinding limit		mm (in)	0.1 (0.004)	
	Standard height		mm (in)	201.0 (7.91)	
	Cylinder inner diameter	mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)
				B	99.495 — 99.505 (3.9171 — 3.9175)
	Taper		mm (in)	Standard	0.015 (0.0006)
	Out-of-roundness		mm (in)	Standard	0.010 (0.0004)
	Piston clearance		mm (in)	Standard	-0.010 — 0.010 (-0.00039 — 0.00039)
Cylinder inner diameter boring limit (diameter)		mm (in)		To 100.005 (3.9372)	

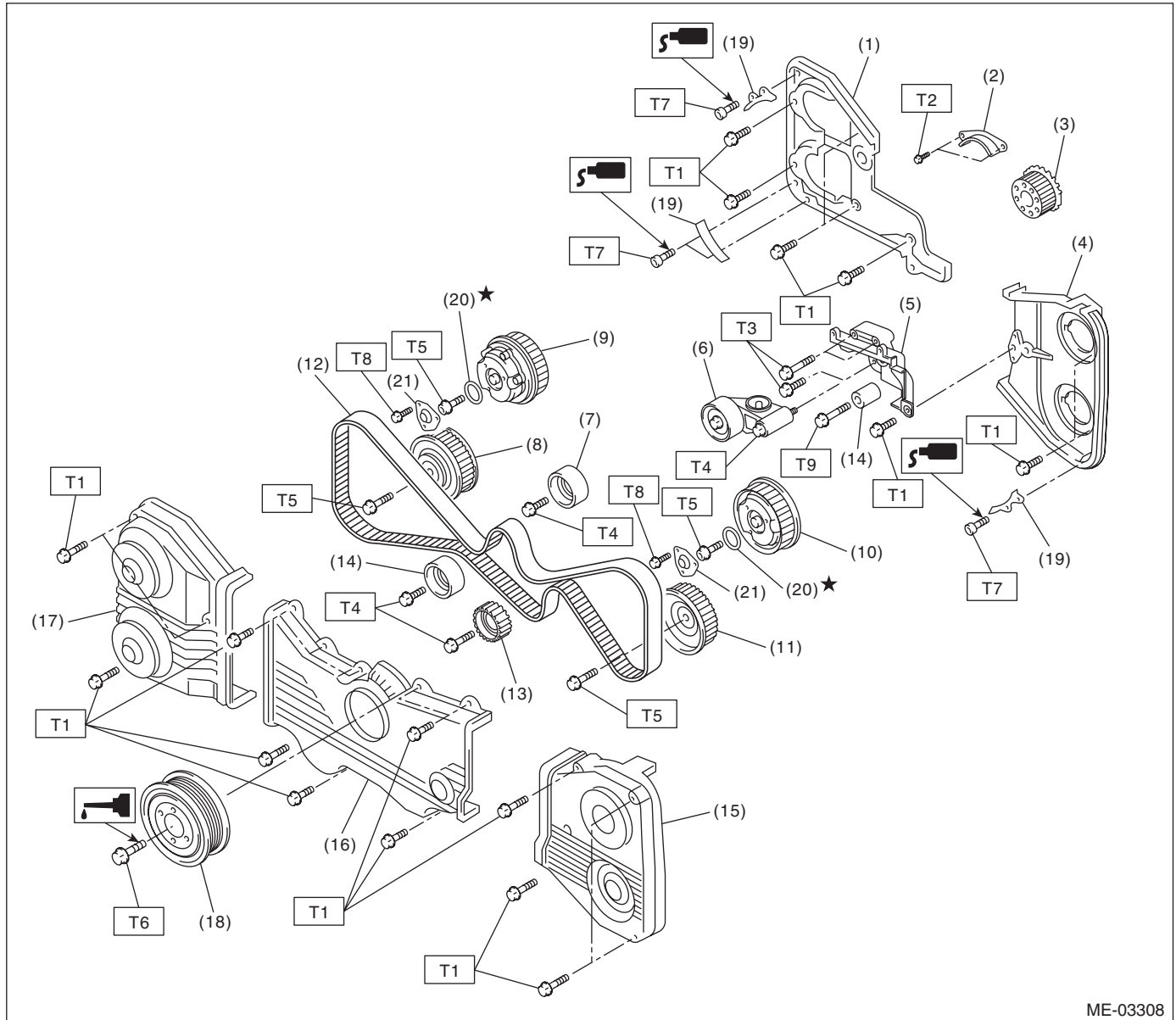
# General Description

## MECHANICAL

Piston	Outer diameter		mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)	
				B	99.495 — 99.505 (3.9171 — 3.9175)		
				0.25 (0.0098) OS		99.745 — 99.765 (3.9270 — 3.9278)	
				0.50 (0.0197) OS		99.995 — 100.015 (3.9368 — 3.9376)	
Piston pin	Standard clearance between piston and piston pin			mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)	
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).			
Piston ring	Ring closed gap		mm (in)	Top ring	Standard	0.20 — 0.25 (0.0079 — 0.0098)	
				Second ring	Standard	0.37 — 0.52 (0.015 — 0.0203)	
				Oil ring	Standard	0.20 — 0.50 (0.0079 — 0.0197)	
	Ring groove gap		mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)	
				Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)	
Connecting rod	Bend or twist per 100 mm (3.94 in) in length			mm (in)	Limit	0.1 (0.0039)	
	Thrust clearance			mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance			mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)	
	Bearing size (Thickness at center)		mm (in)	Standard		1.490 — 1.502 (0.0587 — 0.0591)	
				0.03 (0.0012) US		1.504 — 1.512 (0.0592 — 0.0595)	
				0.05 (0.0020) US		1.514 — 1.522 (0.0596 — 0.0599)	
0.25 (0.0098) US				1.614 — 1.622 (0.0635 — 0.0639)			
Bushing of small end	Clearance between piston pin and bushing			mm (in)	Standard	0 — 0.022 (0 — 0.0009)	
Crankshaft	Bending limit			mm (in)		0.035 (0.0014)	
	Crank pin			Out-of-roundness		mm (in)	0.003 (0.0001)
				Cylindricality		mm (in)	0.004 (0.0002)
				Grinding limit (dia.)		mm (in)	To 51.750 (2.0374)
	Crank journal			Out-of-roundness		mm (in)	0.005 (0.0002)
				Cylindricality		mm (in)	0.006 (0.0002)
				Grinding limit (dia.)		mm (in)	To 59.758 (2.3527)
	Crank pin outer diameter		mm (in)	Standard		51.984 — 52.000 (2.0466 — 2.0472)	
				0.03 (0.0012) US		51.954 — 51.970 (2.0454 — 2.0461)	
				0.05 (0.0020) US		51.934 — 51.950 (2.0447 — 2.0453)	
				0.25 (0.0098) US		51.734 — 51.750 (2.0368 — 2.0374)	
	Crank journal outer diameter		mm (in)	Standard		59.992 — 60.008 (2.3619 — 2.3625)	
				0.03 (0.0012) US		59.962 — 59.978 (2.3607 — 2.3613)	
0.05 (0.0020) US				59.942 — 59.958 (2.3599 — 2.3605)			
0.25 (0.0098) US				59.742 — 59.758 (2.3520 — 2.3527)			
Thrust clearance			mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Oil clearance			mm (in)		0.010 — 0.030 (0.0004 — 0.0012)		
Main bearing	Bearing size (Thickness at center)		#1, #3	Standard		1.998 — 2.011 (0.0787 — 0.0792)	
				0.03 (0.0012) US		2.017 — 2.020 (0.0794 — 0.0795)	
				0.05 (0.0020) US		2.027 — 2.030 (0.0798 — 0.0799)	
				0.25 (0.0098) US		2.127 — 2.130 (0.0837 — 0.0839)	
	#2, #4, #5			Standard		2.000 — 2.013 (0.0787 — 0.0793)	
				0.03 (0.0012) US		2.019 — 2.022 (0.0795 — 0.0796)	
				0.05 (0.0020) US		2.029 — 2.032 (0.0799 — 0.0800)	
				0.25 (0.0098) US		2.129 — 2.132 (0.0838 — 0.0839)	

## B: COMPONENT

### 1. TIMING BELT



ME-03308

- |  |                                   |
|--|-----------------------------------|
| (1) Timing belt cover No. 2 (RH)         | (13) Belt idler No. 2             |
| (2) Timing belt guide (MT model)         | (14) Belt idler                   |
| (3) Crank sprocket                       | (15) Timing belt cover (LH)       |
| (4) Timing belt cover No. 2 (LH)         | (16) Front belt cover             |
| (5) Tensioner bracket                    | (17) Timing belt cover (RH)       |
| (6) Automatic belt tension adjuster ASSY | (18) Crank pulley                 |
| (7) Belt idler                           | (19) Timing belt guide (MT model) |
| (8) Exhaust cam sprocket (RH)            | (20) O-ring                       |
| (9) Intake cam sprocket (RH)             | (21) Actuator cover               |
| (10) Intake cam sprocket (LH)            |                                   |
| (11) Exhaust cam sprocket (LH)           |                                   |
| (12) Timing belt                         |                                   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 5 (0.5, 3.7)**

**T2: 9.75 (1.0, 7.2)**

**T3: 24.5 (2.5, 18.1)**

**T4: 39 (4.0, 28.8)**

**T5: <Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>**

**T6: <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>**

**T7: 6.4 (0.65, 4.7)**

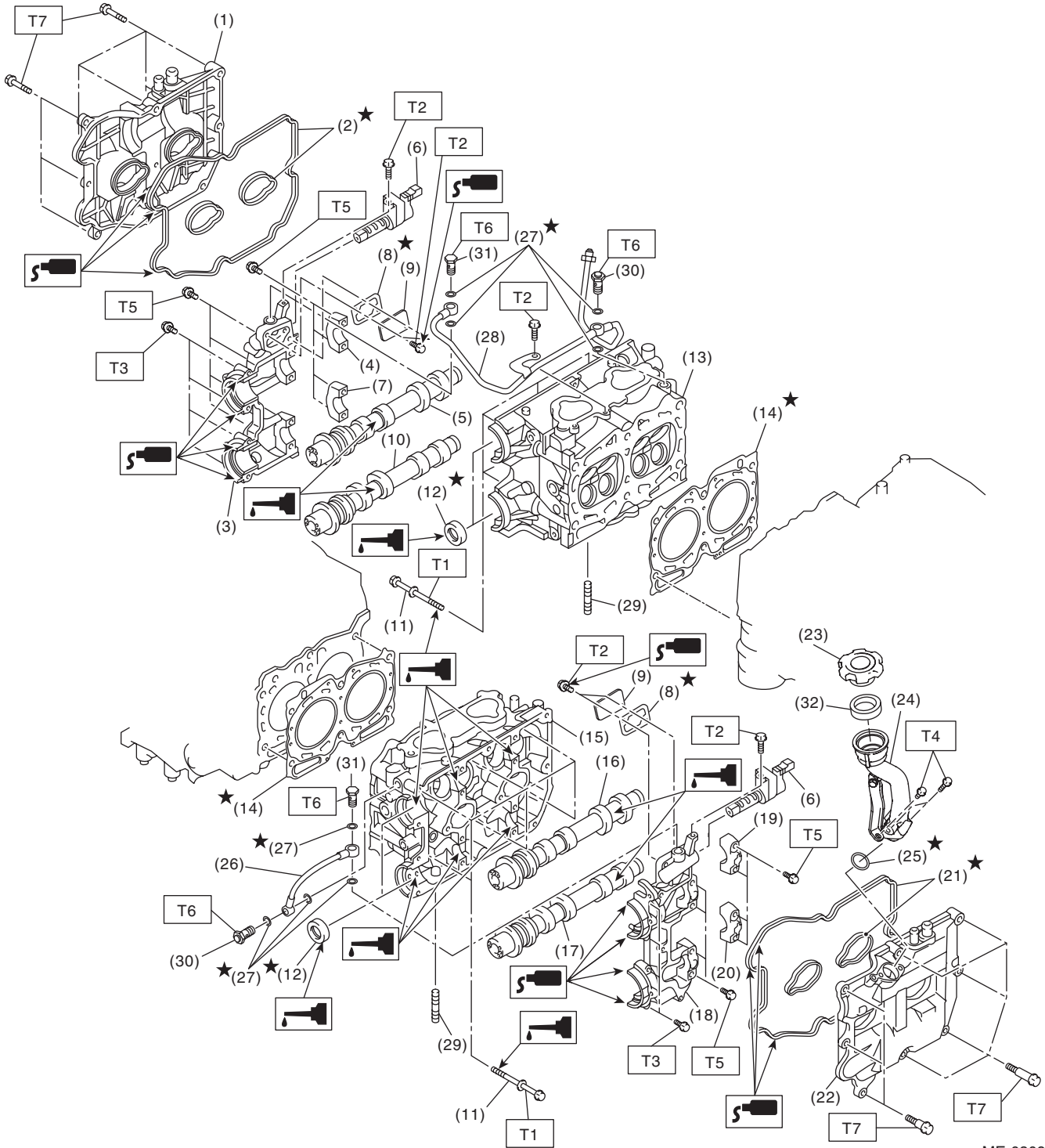
**T8: 3.4 (0.3, 2.5)**

**T9: 25 (2.5, 18.4)**

# General Description

MECHANICAL

## 2. CYLINDER HEAD AND CAMSHAFT



ME-03090

# General Description

MECHANICAL

- |                                     |   |
|-------------------------------------|---|
| (1) Rocker cover (RH)               | (18) Camshaft cap (Front LH)                            |
| (2) Rocker cover gasket (RH)        | (19) Intake camshaft cap (Rear LH)                      |
| (3) Camshaft cap (Front RH)         | (20) Exhaust camshaft cap (Rear LH)                     |
| (4) Intake camshaft cap (Rear RH)   | (21) Rocker cover gasket (LH)                           |
| (5) Intake camshaft (RH)            | (22) Rocker cover (LH)                                  |
| (6) Oil flow control solenoid valve | (23) Oil filler cap                                     |
| (7) Exhaust camshaft cap (Rear RH)  | (24) Oil filler duct                                    |
| (8) Gasket                          | (25) O-ring   |
| (9) Oil return cover                | (26) Oil pipe (LH)                                      |
| (10) Exhaust camshaft (RH)          | (27) Gasket   |
| (11) Cylinder head bolt             | (28) Oil pipe (RH)                                      |
| (12) Oil seal                       | (29) Stud bolt  |
| (13) Cylinder head (RH)             | (30) Union screw with filter<br>(with protrusion)       |
| (14) Cylinder head gasket           | (31) Union screw without filter<br>(without protrusion) |
| (15) Cylinder head (LH)             | (32) Gasket   |
| (16) Intake camshaft (LH)           |   |
| (17) Exhaust camshaft (LH)          |   |

---

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: <Ref. to ME(H4DOTC)-60,  
INSTALLATION, Cylinder  
Head.>**

**T2: 8 (0.8, 5.9)**

**T3: <Ref. to ME(H4DOTC)-54,  
INSTALLATION, Camshaft.>**

**T4: 6.4 (0.65, 4.7)**

**T5: <Ref. to ME(H4DOTC)-54,  
INSTALLATION, Camshaft.>**

**T6: 29 (3.0, 21.4)**

**T7: <Ref. to ME(H4DOTC)-54,  
INSTALLATION, Camshaft.>**

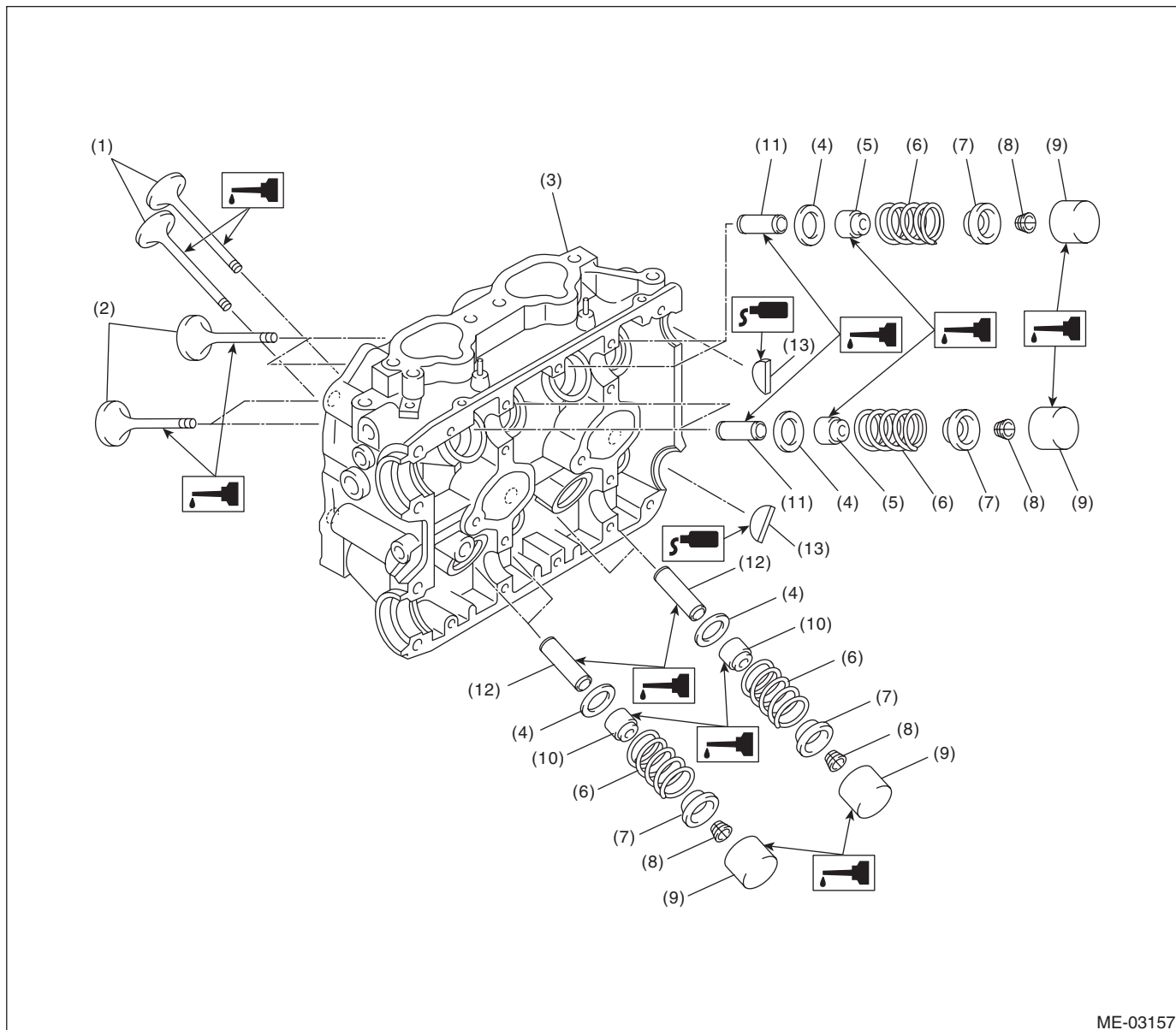
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# General Description

MECHANICAL

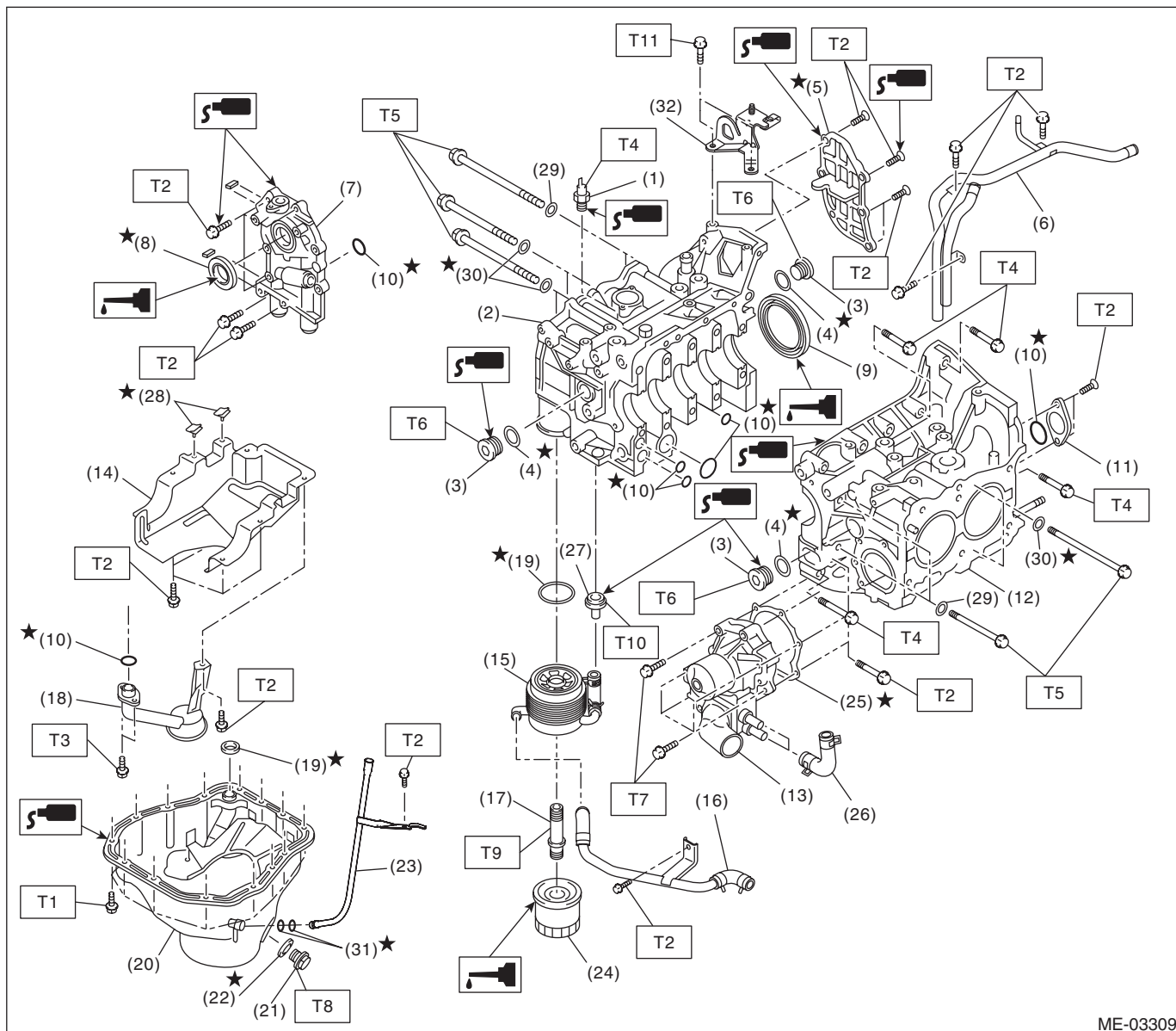
## 3. CYLINDER HEAD AND VALVE ASSEMBLY



ME-03157

- |                           |                  |                             |
|---------------------------|------------------|-----------------------------|
| (1) Exhaust valve         | (6) Valve spring | (10) Exhaust valve oil seal |
| (2) Intake valve          | (7) Retainer     | (11) Intake valve guide     |
| (3) Cylinder head         | (8) Retainer key | (12) Exhaust valve guide    |
| (4) Valve spring seat     | (9) Valve lifter | (13) Plug                   |
| (5) Intake valve oil seal |                  |                             |

## 4. CYLINDER BLOCK



ME-03309

# General Description

## MECHANICAL

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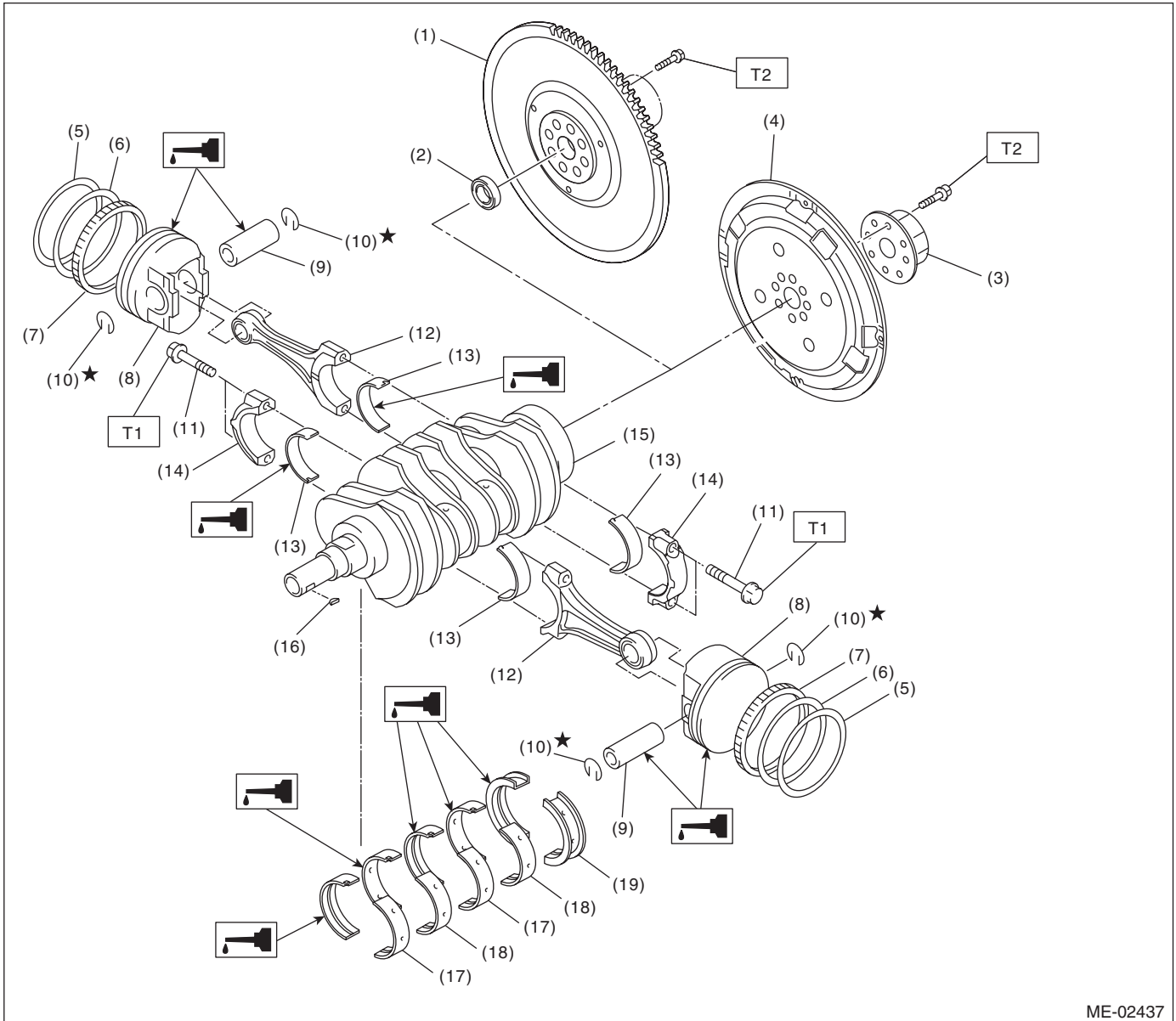
- |                          |                            |
|--------------------------|----------------------------|
| (1) Oil pressure switch  | (17) Connector             |
| (2) Cylinder block (RH)  | (18) Oil strainer          |
| (3) Service hole plug    | (19) Gasket                |
| (4) Gasket               | (20) Oil pan               |
| (5) Oil separator cover  | (21) Drain plug            |
| (6) Water by-pass pipe   | (22) Drain plug gasket     |
| (7) Oil pump             | (23) Oil level gauge guide |
| (8) Front oil seal       | (24) Oil filter            |
| (9) Rear oil seal        | (25) Gasket                |
| (10) O-ring              | (26) Water pump hose       |
| (11) Service hole cover  | (27) Nipple                |
| (12) Cylinder block (LH) | (28) Seal                  |
| (13) Water pump          | (29) Washer                |
| (14) Baffle plate        | (30) Seal washer           |
| (15) Oil cooler          | (31) O-ring                |
| (16) Water by-pass pipe  | (32) Engine rear hanger    |

---

**Tightening torque:N-m (kgf-m, ft-lb)****T1: 5 (0.5, 3.7)****T2: 6.4 (0.65, 4.7)****T3: 10 (1.0, 7.2)****T4: 25 (2.5, 18.4)****T5: <Ref. to ME(H4DOTC)-72,  
INSTALLATION, Cylinder  
Block.>****T6: 70 (7.1, 51.6)****T7: First 12 (1.2, 8.9)  
Second 12 (1.2, 8.9)****T8: 44 (4.5, 32.5)****T9: 54 (5.5, 40)****T10: 69 (7.0, 50.9)****T11: 16 (1.6, 11.6)**

---

## 5. CRANKSHAFT AND PISTON



ME-02437

- |                              |                             |                                |
|------------------------------|-----------------------------|--------------------------------|
| (1) Flywheel (MT model)      | (9) Piston pin              | (17) Crankshaft bearing #1, #3 |
| (2) Ball bearing (MT model)  | (10) Snap ring              | (18) Crankshaft bearing #2, #4 |
| (3) Reinforcement (AT model) | (11) Connecting rod bolt    | (19) Crankshaft bearing #5     |
| (4) Drive plate (AT model)   | (12) Connecting rod         |                                |
| (5) Top ring                 | (13) Connecting rod bearing |                                |
| (6) Second ring              | (14) Connecting rod cap     |                                |
| (7) Oil ring                 | (15) Crankshaft             |                                |
| (8) Piston                   | (16) Woodruff key           |                                |

**Tightening torque: N·m (kgf·m, ft·lb)**

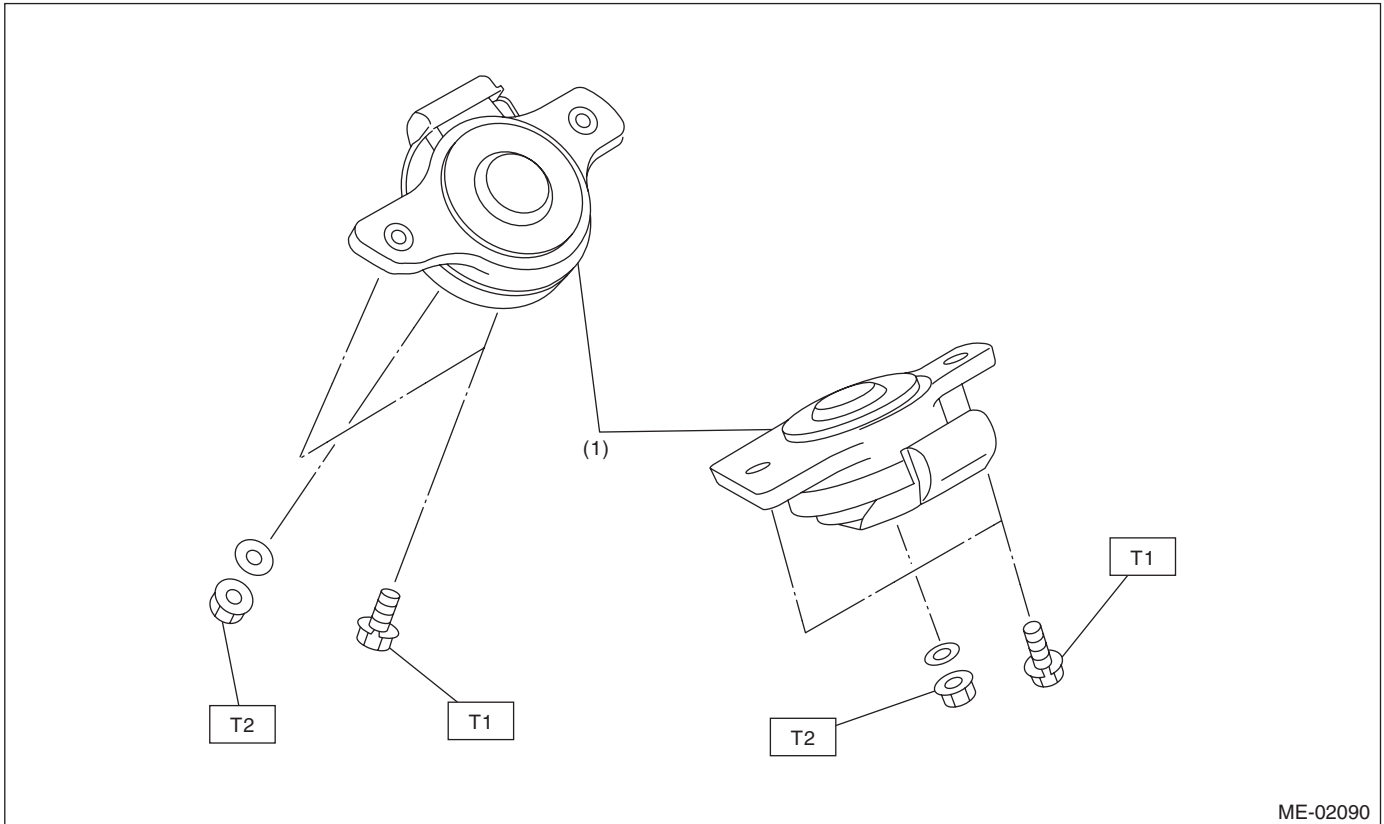
**T1: 52 (5.3, 38.4)**

**T2: 72 (7.3, 53.1)**

# General Description

MECHANICAL

## 6. ENGINE MOUNTING



ME-02090

(1) Front cushion rubber

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 35 (3.6, 25.8)**

**T2: 75 (7.6, 55.3)**

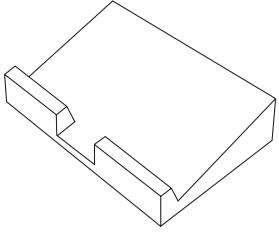
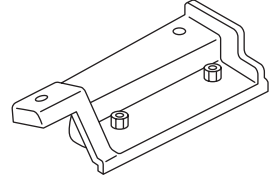
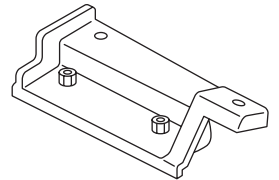
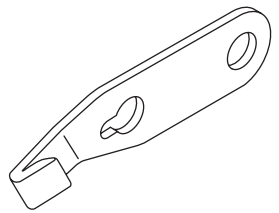
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.

- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or engine coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new parts as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
- Prior to starting work, prepare the following:  
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift up or lower the vehicle when necessary. Make sure to support the correct positions.

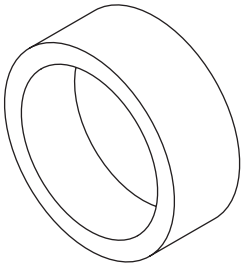
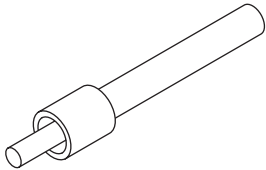
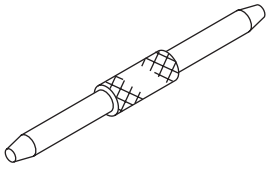
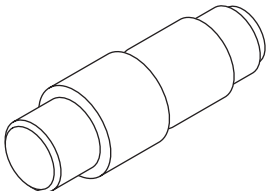
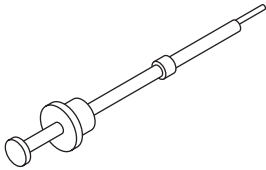
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498267600</p>	498267600	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> <li>• Used for replacing valve guides.</li> <li>• Used for removing and installing valve spring.</li> </ul>
 <p style="text-align: center;">ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used together with the ENGINE STAND (499817100).
 <p style="text-align: center;">ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used together with the ENGINE STAND (499817100).
 <p style="text-align: center;">ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for removing and installing flywheel and drive plate.

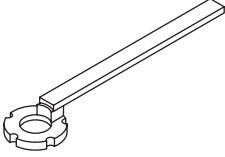
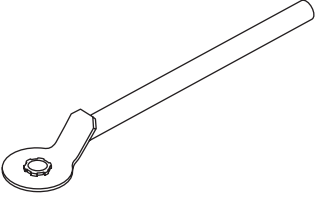
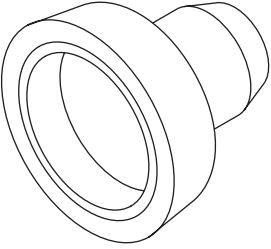
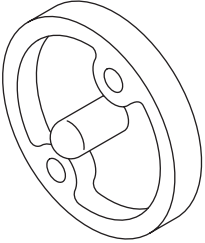
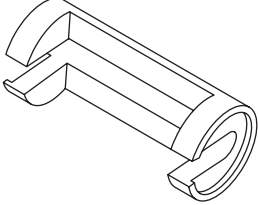
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498747300</p>	498747300	PISTON GUIDE	Used for installing the cup to the wheel cylinder piston. (2.5 L model)
 <p style="text-align: center;">ST-498857100</p>	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 <p style="text-align: center;">ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p style="text-align: center;">ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
 <p style="text-align: center;">ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.

# General Description

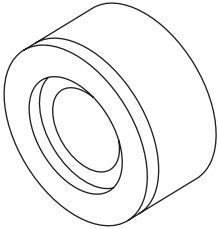
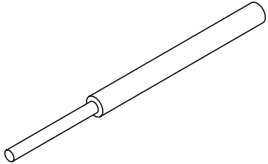
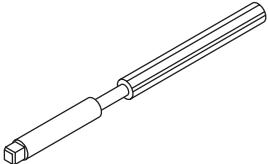
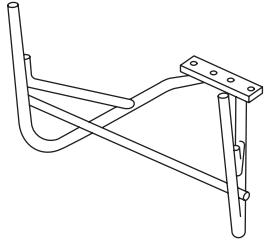
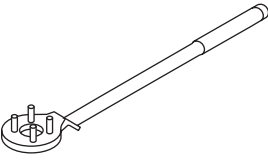
MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499207400</p>	499207400	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.
 <p style="text-align: center;">ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 <p style="text-align: center;">ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL GUIDE (499597100).</li> </ul>
 <p style="text-align: center;">ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL INSTALLER (499587200).</li> </ul>
 <p style="text-align: center;">ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.



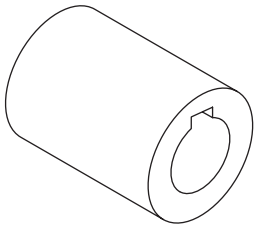
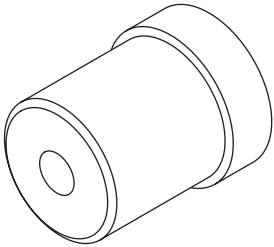
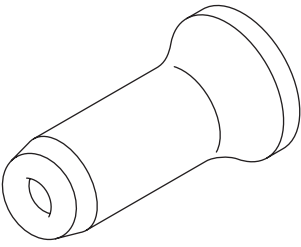
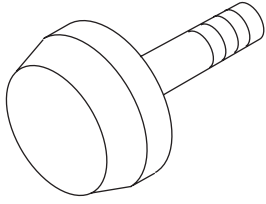
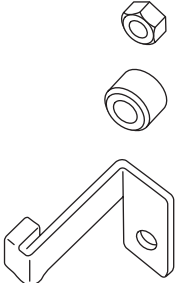
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18251AA020</p>	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 <p style="text-align: center;">ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p style="text-align: center;">ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p style="text-align: center;">ST-499817100</p>	499817100	ENGINE STAND	<ul style="list-style-type: none"> <li>• Stand used for engine disassembly and assembly.</li> <li>• Used together with the ENGINE STAND ADAPTER RH (498457000) &amp; LH (498457100).</li> </ul>
 <p style="text-align: center;">ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.

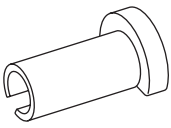
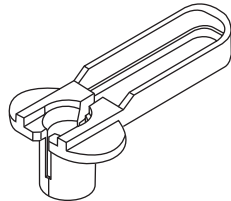
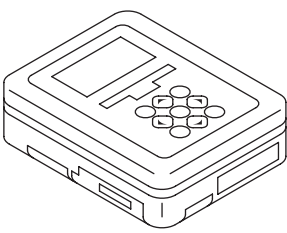
# General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499987500</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p>ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 <p>ST-499587600</p>	499587600	OIL SEAL INSTALLER	Used for installing camshaft oil seal for DOHC engine.
 <p>ST-499597200</p>	499597200	OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing camshaft oil seal for DOHC engine.</li> <li>• Used together with the OIL SEAL INSTALLER (499587600).</li> </ul>
 <p>ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for disconnecting quick connector of the engine compartment.
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose of the engine compartment.
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.

## E: PROCEDURE

It is possible to conduct the following service procedures with engine on vehicle, however, the procedures described in this section are based on the condition that the engine is removed from vehicle.

- V-belt
- Timing belt
- Camshaft
- Cylinder head

## 2. Compression

### A: INSPECTION

**CAUTION:**

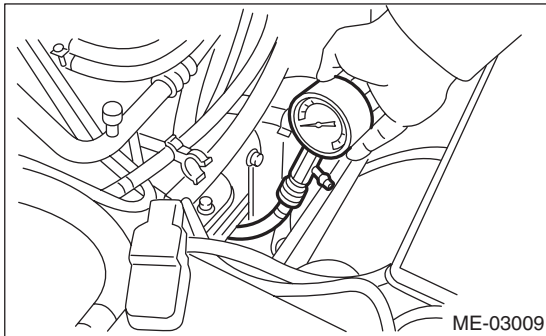
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) Remove the collector cover.
- 2) After warming-up the engine, turn the ignition switch to OFF.
- 3) Make sure that the battery is fully charged.
- 4) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 5) Remove all the spark plugs.  
<Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.>
- 6) Fully open the throttle valve.
- 7) Check the starter motor for satisfactory performance and operation.
- 8) Hold the compression gauge tightly against the spark plug hole.

**NOTE:**

When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.

- 9) Crank the engine by the starter motor, and read the maximum value on the gauge when the needle of gauge is steady.



- 10) Perform at least two measurements per cylinder, and make sure that the values are correct.

**Compression (Fully open throttle):**

**Standard:**

**981 — 1,177 kPa (10 — 12 kgf/cm<sup>2</sup>, 142 — 171 psi)**

**Difference between cylinders:**

**49 kPa (0.5 kgf/cm<sup>2</sup>, 7 psi), or less**

- 11) After inspection, install the related parts in the reverse order of removal.

## 3. Idle Speed

### A: INSPECTION

1) Before checking the idle speed, check the following item:

(1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

4) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

***Idle speed [No load and gears in neutral, "P" or "N" range]:***

***750±100 rpm***

5) Check the idle speed when loaded. (Turn the A/C switch to "ON" and operate the compressor for at least one minute before measurement.)

***Idle speed [A/C ON and gears in neutral, "P" or "N" range]:***

***800±100 rpm (MT model)***

***825±100 rpm (AT model)***

NOTE:

Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the prescribed idle speed cannot be maintained, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

## 4. Ignition Timing

### A: INSPECTION

#### CAUTION:

After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.

#### 1. METHOD WITH SUBARU SELECT MONITOR

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

#### **Ignition timing [BTDC/rpm]:**

**$12^{\circ} \pm 10^{\circ} / 750$  (MT Model)**

**$17^{\circ} \pm 10^{\circ} / 750$  (AT Model)**

If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

#### 2. METHOD WITH TIMING LIGHT

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Remove the air intake duct.

5) Disconnect the connectors of the mass air flow and intake air temperature sensor.

6) Remove the air cleaner cover and element.

7) Connect the timing light to the power wire of #1 ignition coil.

8) Connect the connectors of the air cleaner cover, element, and mass air flow and intake air temperature sensor.

9) Start the engine, turn the timing light to the crank pulley, and check the ignition timing by means of crank pulley indicator.

#### **Ignition timing [BTDC/rpm]:**

**$12^{\circ} \pm 10^{\circ} / 750$  (MT Model)**

**$17^{\circ} \pm 10^{\circ} / 750$  (AT Model)**

If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

# Intake Manifold Vacuum

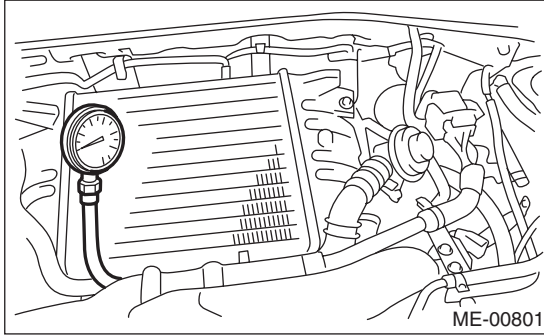
MECHANICAL

## 5. Intake Manifold Vacuum

### A: INSPECTION

- 1) Remove the collector cover.
- 2) Warm-up the engine.
- 3) Disconnect the brake vacuum hose from intake manifold, and then install the vacuum gauge.
- 4) Keep the engine at idle speed and read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.



**Vacuum pressure (at idling, A/C OFF):**

**Less than  $-70.6$  kPa ( $-530$  mmHg,  $-20.85$  inHg)**

**(MT model)**

**Less than  $-68.0$  kPa ( $-510$  mmHg,  $-20.08$  inHg)**

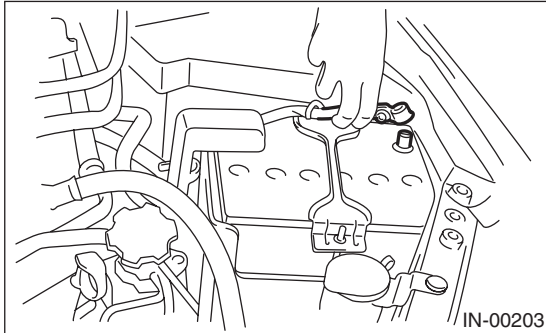
**(AT model)**

Diagnosis of engine condition by measurement of intake manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, or disconnected or damaged vacuum hose
2. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
3. Needle drops suddenly and intermittently from normal position.	Sticky valve
4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
5. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

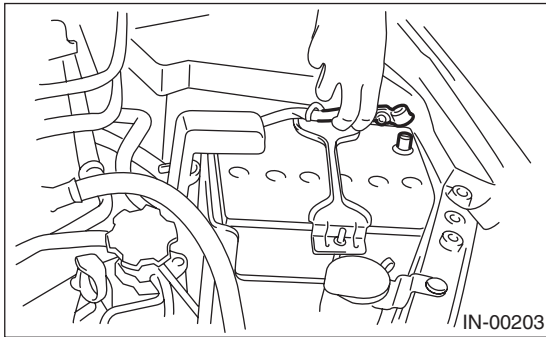
## 6. Engine Oil Pressure

### A: INSPECTION

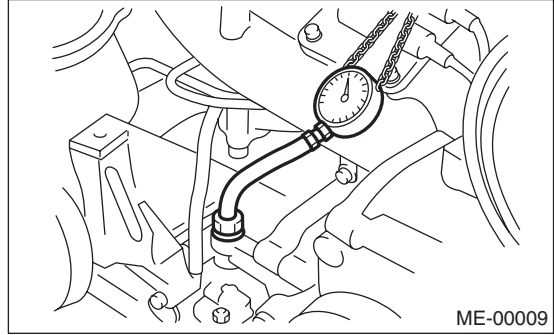
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the oil pressure switch. <Ref. to LU(H4DOTC)-20, REMOVAL, Oil Pressure Switch.>
- 4) Connect the oil pressure gauge hose to cylinder block.
- 5) Connect the battery ground cable to the battery.



- 6) Start the engine, and measure the oil pressure.



#### Oil pressure:

##### Standard

**98 kPa (1.0 kgf/cm<sup>2</sup>, 14 psi) or more  
(at 600 rpm)**

**294 kPa (3.0 kgf/cm<sup>2</sup>, 43 psi) or more  
(at 5,000 rpm)**

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4DOTC)-24, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H4DOTC)-24, INSPECTION, Engine Lubrication System Trouble in General.>

#### NOTE:

Standard value is based on an engine oil temperature of 80°C (176°F).

- 7) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4DOTC)-20, INSTALLATION, Oil Pressure Switch.>

#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



## 7. Fuel Pressure

### A: INSPECTION

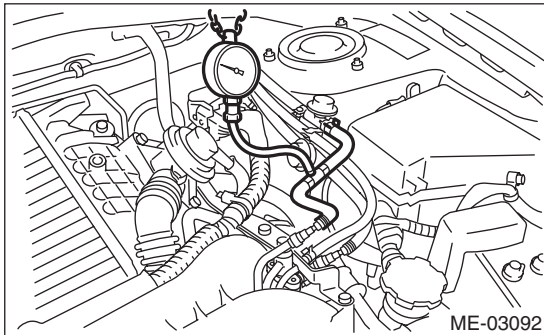
#### CAUTION:

- Before removing the fuel pressure gauge, release the fuel pressure.
- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

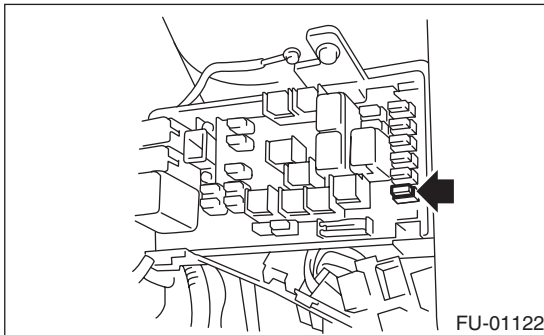
#### NOTE:

If the fuel pressure is out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

- 1) Remove the collector cover.
- 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Disconnect the fuel delivery hose from fuel damper valve, and connect fuel pressure gauge.



- 5) Install the fuse of fuel pump to the main fuse box.



- 6) Start the engine.

- 7) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

#### NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm<sup>2</sup>, 1 to 3 psi) higher than standard values during high-altitude operations.

#### Fuel pressure:

##### Standard

**284 — 314 kPa (2.9 — 3.2 kgf/cm<sup>2</sup>, 41 — 46 psi)**

- 8) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

#### NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm<sup>2</sup>, 1 to 3 psi) higher than standard values during high-altitude operations.

#### Fuel pressure:

##### Standard

**230 — 260 kPa  
(2.35 — 2.65 kgf/cm<sup>2</sup>, 33 — 38 psi)**

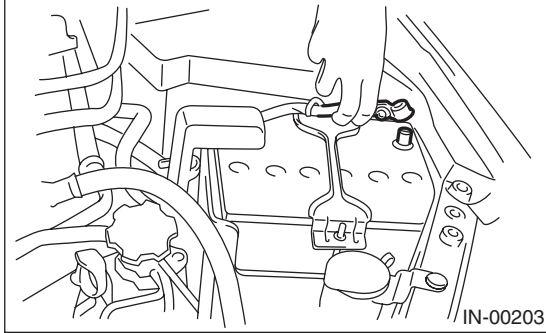
## 8. Valve Clearance

### A: INSPECTION

**NOTE:**

Inspection and adjustment of valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 5) Remove a bolt which secures timing belt cover (RH).
- 6) Lift up the vehicle.
- 7) Remove the under cover.
- 8) Loosen the remaining bolts which secure timing belt cover (RH), then remove the timing belt cover.
- 9) Lower the vehicle.

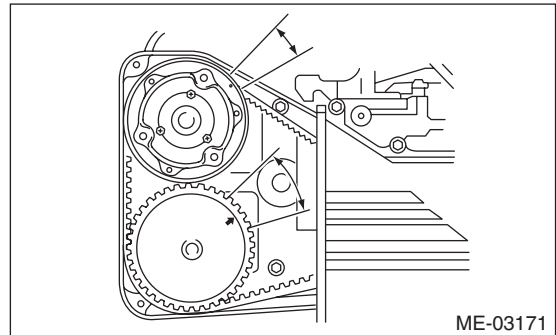
- 10) When inspecting #1 and #3 cylinders
  - (1) Remove the air cleaner case. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
  - (2) Disconnect the connector of ignition coil.
  - (3) Remove the ignition coil.
  - (4) Place a suitable container under the vehicle.
  - (5) Disconnect the PCV hose from the rocker cover (RH).
  - (6) Remove the bolts, then remove the rocker cover (RH).

- 11) When inspecting #2 and #4 cylinders
  - (1) Disconnect the battery cable, and then remove the battery and battery carrier.
  - (2) Remove the secondary air pump. <Ref. to EC(H4DOTC)-20, REMOVAL, Secondary Air Pump.>
  - (3) Disconnect the connector of ignition coil.
  - (4) Remove the ignition coil.
  - (5) Place a suitable container under the vehicle.
  - (6) Disconnect the PCV hose from the rocker cover (LH).
  - (7) Remove the bolts, then remove the rocker cover (LH).

- 12) Turn the crank pulley clockwise until the round mark and arrow mark on the camshaft sprocket are set to position shown in the figure.

**NOTE:**

Turn the crankshaft using socket wrench.



- 13) Measure the #1 cylinder intake valve and #3 cylinder exhaust valve clearance by using thickness gauge (A).

**NOTE:**

- Insert a thickness gauge in a direction as horizontal as possible with respect to the valve lifter.
- Measure the exhaust valve clearances while lifting-up the vehicle.
- If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.

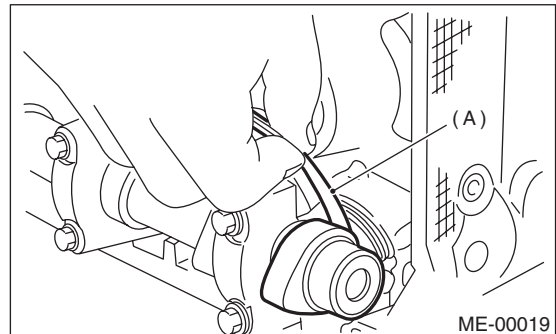
**Valve clearance:**

**Intake**

**$0.20 \pm 0.02$  mm ( $0.0079 \pm 0.0008$  in)**

**Exhaust**

**$0.35 \pm 0.02$  mm ( $0.0138 \pm 0.0008$  in)**



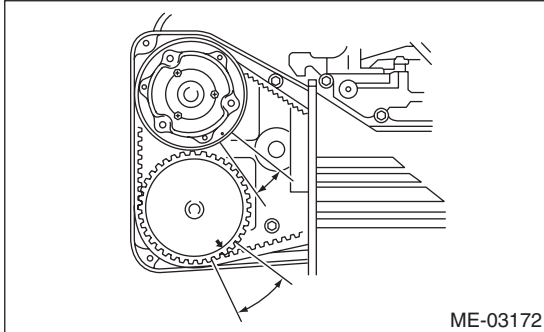
- 14) If necessary, adjust the valve clearance. <Ref. to ME(H4DOTC)-26, ADJUSTMENT, Valve Clearance.>

# Valve Clearance

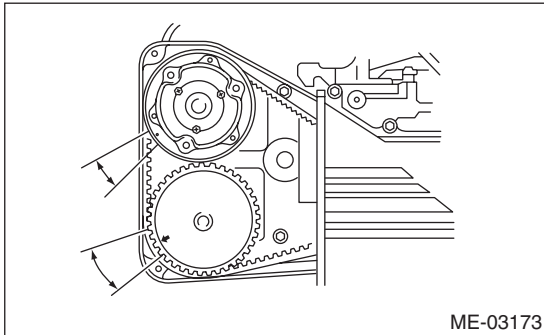
## MECHANICAL

15) Further turn the crank pulley clockwise and then measure the valve clearances again.

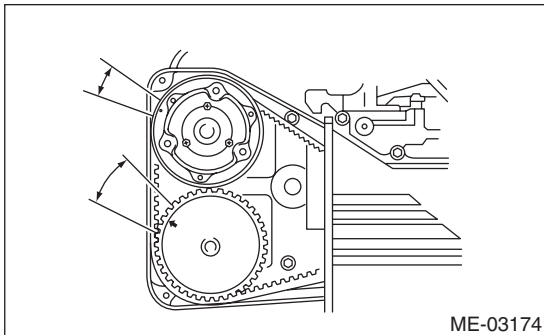
(1) Set the round mark and arrow mark on cam sprocket to the position shown in the figure, and measure the #2 cylinder exhaust valve and #3 cylinder intake valve clearances.



(2) Set the round mark and arrow mark on cam sprocket to the position shown in the figure, and measure the #2 cylinder intake valve and #4 cylinder exhaust valve clearances.



(3) Set the round mark and arrow mark on cam sprocket to the position shown in the figure, and measure the #1 cylinder exhaust valve and #4 cylinder intake valve clearances.



16) After inspection, install the related parts in the reverse order of removal.

## B: ADJUSTMENT

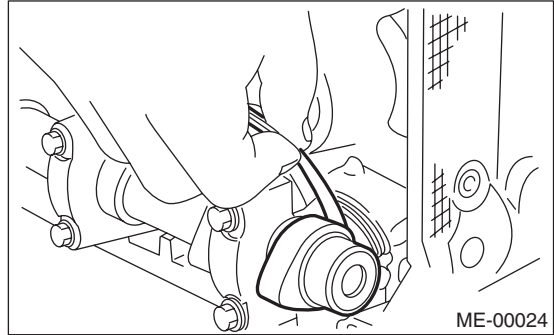
### NOTE:

Adjustment of valve clearance should be performed while engine is cold.

1) Measure all the valve clearances. <Ref. to ME(H4DOTC)-25, INSPECTION, Valve Clearance.>

### NOTE:

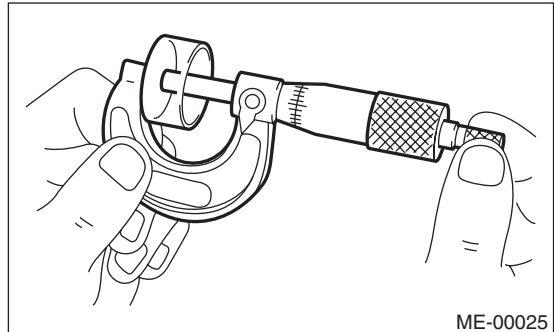
Record each valve clearance after measurement.



2) Remove the camshaft. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>

3) Remove the valve lifter.

4) Measure the thickness of valve lifter using micrometer.



5) Select a valve lifter of suitable thickness from the following table using the measured valve clearance and valve lifter thickness.

Unit: (mm)
Intake valve: $S = (V + T) - 0.20$
Exhaust valve: $S = (V + T) - 0.35$
S: Valve lifter thickness required
V: Measured valve clearance
T: Valve lifter thickness to be used

# Valve Clearance

MECHANICAL

Part No.	Thickness mm (in)
13228 AB102	4.68 (0.1843)
13228 AB112	4.69 (0.1846)
13228 AB122	4.70 (0.1850)
13228 AB132	4.71 (0.1854)
13228 AB142	4.72 (0.1858)
13228 AB152	4.73 (0.1862)
13228 AB162	4.74 (0.1866)
13228 AB172	4.75 (0.1870)
13228 AB182	4.76 (0.1874)
13228 AB192	4.77 (0.1878)
13228 AB202	4.78 (0.1882)
13228 AB212	4.79 (0.1886)
13228 AB222	4.80 (0.1890)
13228 AB232	4.81 (0.1894)
13228 AB242	4.82 (0.1898)
13228 AB252	4.83 (0.1902)
13228 AB262	4.84 (0.1906)
13228 AB272	4.85 (0.1909)
13228 AB282	4.86 (0.1913)
13228 AB292	4.87 (0.1917)
13228 AB302	4.88 (0.1921)
13228 AB312	4.89 (0.1925)
13228 AB322	4.90 (0.1929)
13228 AB332	4.91 (0.1933)
13228 AB342	4.92 (0.1937)
13228 AB352	4.93 (0.1941)
13228 AB362	4.94 (0.1945)
13228 AB372	4.95 (0.1949)
13228 AB382	4.96 (0.1953)
13228 AB392	4.97 (0.1957)
13228 AB402	4.98 (0.1961)
13228 AB412	4.99 (0.1965)
13228 AB422	5.00 (0.1969)
13228 AB432	5.01 (0.1972)
13228 AB442	5.02 (0.1976)
13228 AB452	5.03 (0.1980)
13228 AB462	5.04 (0.1984)
13228 AB472	5.05 (0.1988)
13228 AB482	5.06 (0.1992)
13228 AB492	5.07 (0.1996)
13228 AB502	5.08 (0.2000)
13228 AB512	5.09 (0.2004)
13228 AB522	5.10 (0.2008)
13228 AB532	5.11 (0.2012)
13228 AB542	5.12 (0.2016)
13228 AB552	5.13 (0.2020)
13228 AB562	5.14 (0.2024)
13228 AB572	5.15 (0.2028)
13228 AB582	5.16 (0.2031)
13228 AB592	5.17 (0.2035)

Part No.	Thickness mm (in)
13228 AB602	5.18 (0.2039)
13228 AB612	5.19 (0.2043)
13228 AB622	5.20 (0.2047)
13228 AB632	5.21 (0.2051)
13228 AB642	5.22 (0.2055)
13228 AB652	5.23 (0.2059)
13228 AB662	5.24 (0.2063)
13228 AB672	5.25 (0.2067)
13228 AB682	5.26 (0.2071)
13228 AB692	5.27 (0.2075)
13228 AB702	4.38 (0.1724)
13228 AB712	4.40 (0.1732)
13228 AB722	4.42 (0.1740)
13228 AB732	4.44 (0.1748)
13228 AB742	4.46 (0.1756)
13228 AB752	4.48 (0.1764)
13228 AB762	4.50 (0.1771)
13228 AB772	4.52 (0.1780)
13228 AB782	4.54 (0.1787)
13228 AB792	4.56 (0.1795)
13228 AB802	4.58 (0.1803)
13228 AB812	4.60 (0.1811)
13228 AB822	4.62 (0.1819)
13228 AB832	4.64 (0.1827)
13228 AB842	4.66 (0.1835)
13228 AB852	5.29 (0.2083)
13228 AB862	5.31 (0.2091)
13228 AB872	5.33 (0.2098)
13228 AB882	5.35 (0.2106)
13228 AB892	5.37 (0.2114)
13228 AB902	5.39 (0.2122)
13228 AB912	5.41 (0.2123)
13228 AB922	5.43 (0.2138)
13228 AB932	5.45 (0.2146)
13228 AB942	5.47 (0.2154)
13228 AB952	5.49 (0.2161)
13228 AB962	5.51 (0.2169)
13228 AB972	5.53 (0.2177)
13228 AB982	5.55 (0.2185)
13228 AB992	5.57 (0.2193)
13228 AC002	5.59 (0.2201)
13228 AC012	5.61 (0.2209)
13228 AC022	5.63 (0.2217)
13228 AC032	5.65 (0.2224)

6) Inspect all valves for valve clearance again at this time. If the valve clearance is not correct, repeat the procedure over again from the first step.

7) After inspection, install the related parts in the reverse order of removal.

# Engine Assembly

MECHANICAL

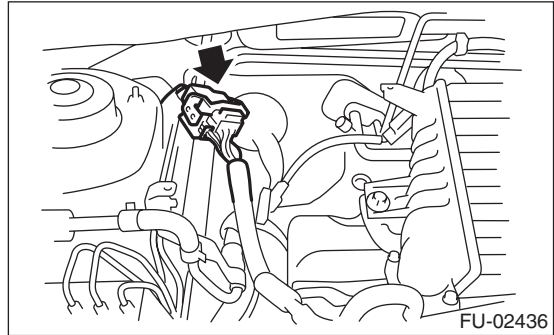
## 9. Engine Assembly

### A: REMOVAL

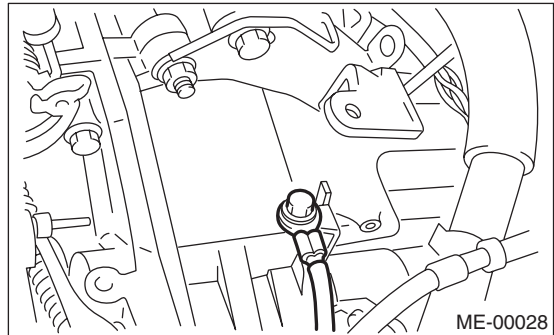
- 1) Set the vehicle on a lift.
- 2) Open the front hood fully and support with the front hood stay.
- 3) Remove the collector cover.
- 4) Collect the refrigerant from A/C system. <Ref. to AC-21, Refrigerant Recovery Procedure.>
- 5) Release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 6) Disconnect the battery cable, and remove the battery from the vehicle.
- 7) Open the fuel filler flap lid, and remove the fuel filler cap.
- 8) Remove the air intake duct and air cleaner case. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.> <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 9) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 10) Remove the radiator from vehicle. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 11) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-29, REMOVAL, Coolant Filler Tank.>
- 12) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-39, REMOVAL, Hose and Tube.>

- 13) Disconnect the following connectors and cables.

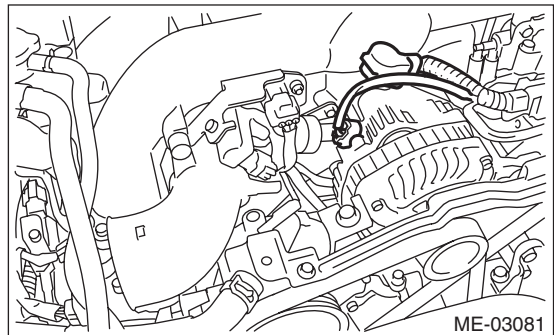
#### (1) Engine harness connectors



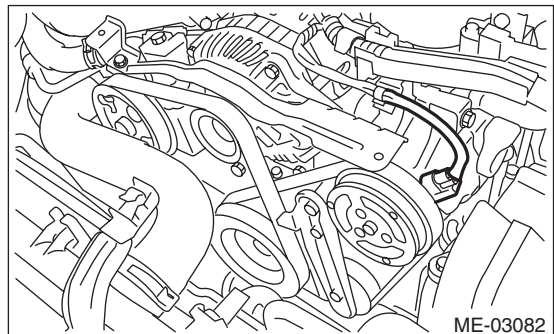
#### (2) Engine ground terminal



#### (3) Generator connector and terminal

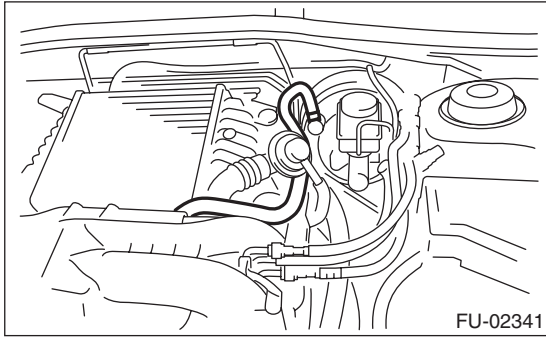


#### (4) A/C compressor connector



14) Disconnect the following hoses.

(1) Brake booster vacuum hose

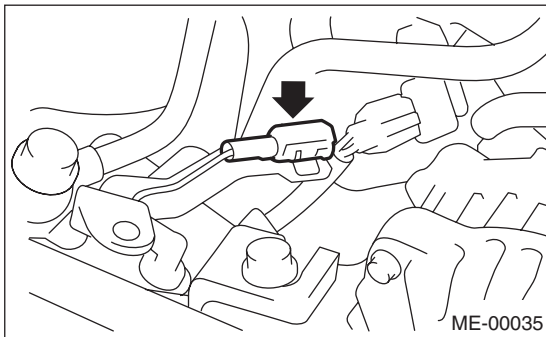


(2) Heater inlet and outlet hoses

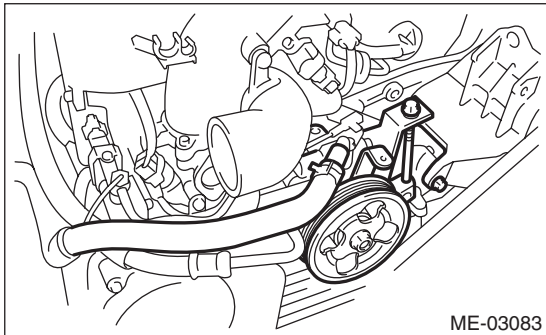
15) Remove the power steering pump from the bracket.

(1) Loosen the lock bolt and slider bolt, and remove the front side belt. <Ref. to ME(H4DOTC)-37, FRONT SIDE BELT, REMOVAL, V-belt.>

(2) Disconnect the power steering pump switch connector.



(3) Remove the power steering pump from the engine. <Ref. to PS-46, REMOVAL, Oil Pump.>



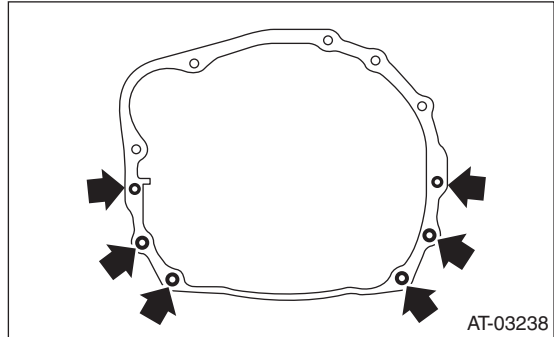
(4) Place the power steering pump on the right side wheel apron.

16) Lift up the vehicle.

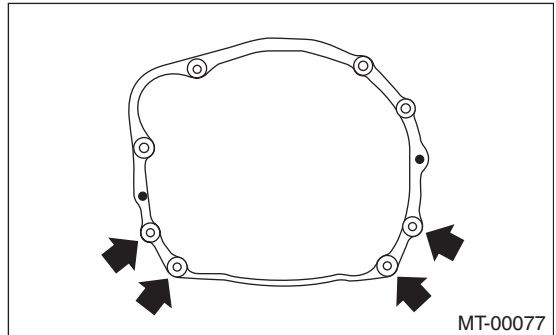
17) Remove the front and center exhaust pipes. <Ref. to EX(H4DOTC)-6, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>

18) Remove the bolts and nuts which hold the lower side of transmission to the engine.

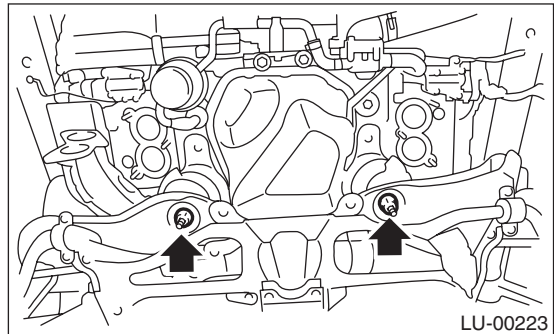
• AT model



• MT model



19) Remove the nuts which install front cushion rubber onto front crossmember.

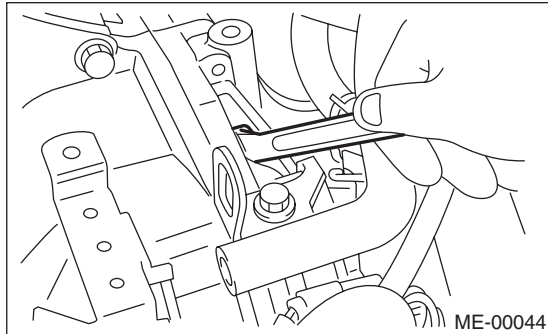


# Engine Assembly

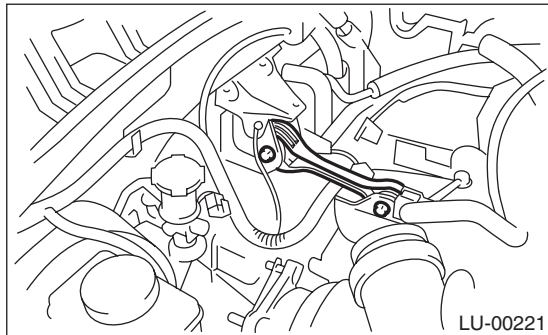
## MECHANICAL

20) Separate the torque converter clutch from drive plate. (AT model)

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold torque converter clutch to drive plate.
- (4) Remove other bolts while rotating the crankshaft using socket wrench.



21) Remove the pitching stopper.

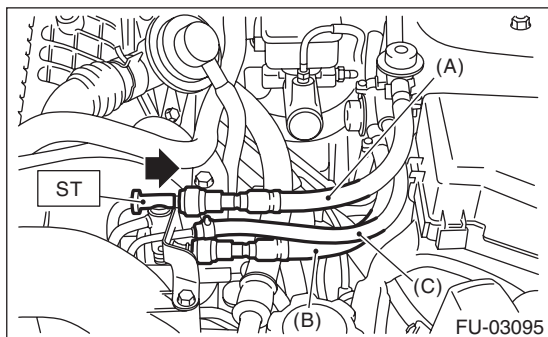


22) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



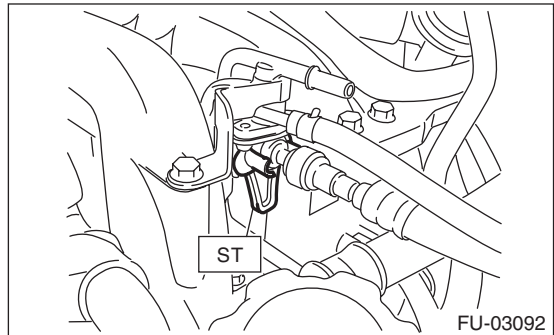
- (A) Fuel delivery hose
- (B) Fuel return hose
- (C) Evaporation hose

23) Disconnect the fuel return hose using the ST.  
ST 18371AA000 CONNECTOR REMOVER

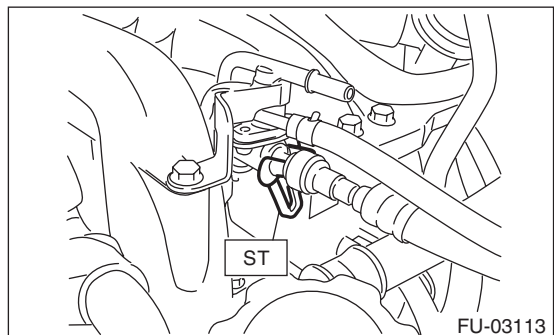
### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

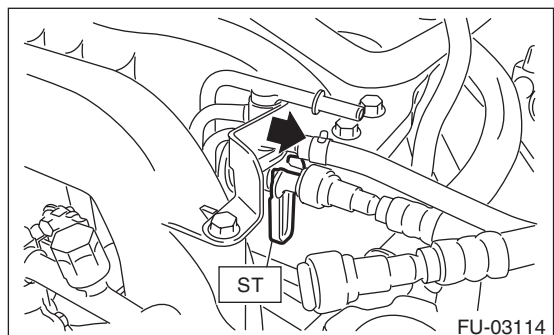
(1) Attach the ST to the fuel return pipe as shown in the figure.



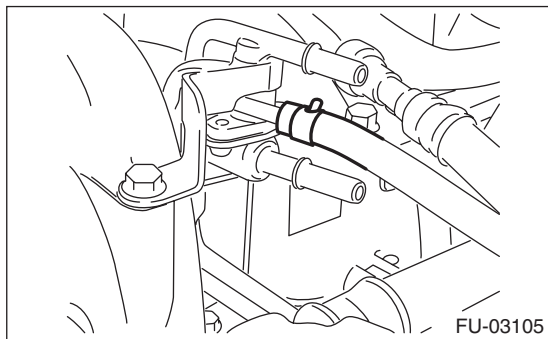
(2) Insert the front side of ST into the quick connector.



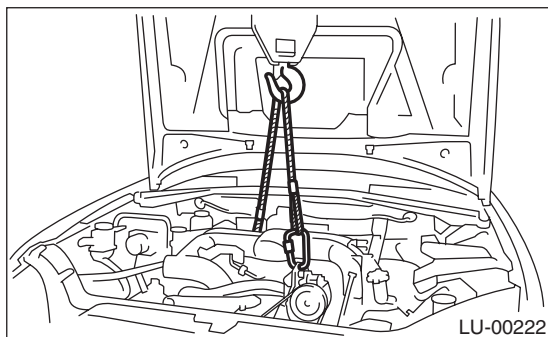
(3) Insert the back side of ST into the quick connector and push ST in the direction of arrow mark to disconnect the fuel return hose.



24) Remove the clip and disconnect the evaporation hose from the fuel pipe.

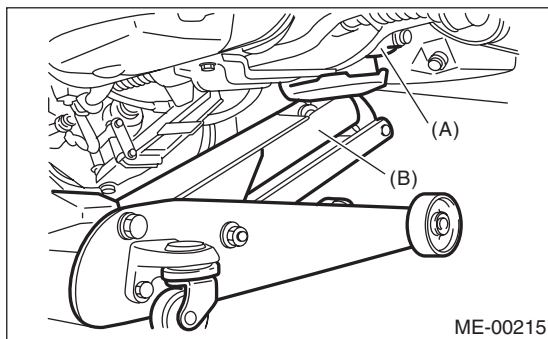


25) Support the engine with a lifting device and wire ropes.



26) Support the transmission with a garage jack.

**CAUTION:**  
Doing this is very important to prevent the transmission from lowering due to its own weight.



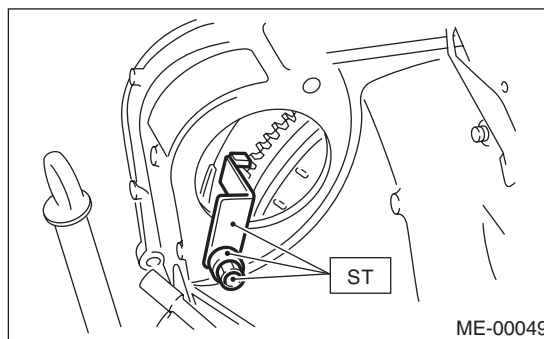
- (A) Transmission
- (B) Garage jack

27) Separation of engine and transmission.

**CAUTION:**  
Before removing the engine away from transmission, check to be sure no work has been overlooked.

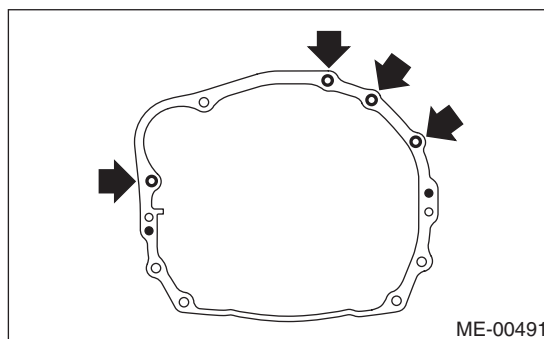
- (1) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
- (2) Set the ST to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

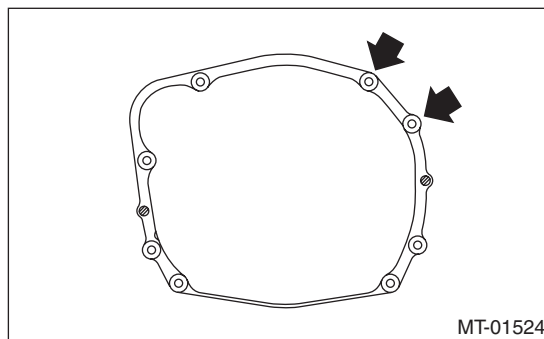


(3) Remove the bolts which hold the upper side of the transmission to the engine.

- AT model



- MT model





# Engine Assembly

## MECHANICAL

- 28) Remove the engine from vehicle.
  - (1) Slightly raise the engine.
  - (2) Raise the transmission with garage jack.
  - (3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
  - (4) Slowly move the engine away from engine compartment.

### NOTE:

Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

- 29) Remove the front cushion rubbers.

## B: INSTALLATION

- 1) Install the front cushion rubbers to engine.

### Tightening torque:

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

- 2) Apply a small amount of grease to splines of main shaft. (MT model)
- 3) Position the engine in engine compartment and align it with transmission.

### NOTE:

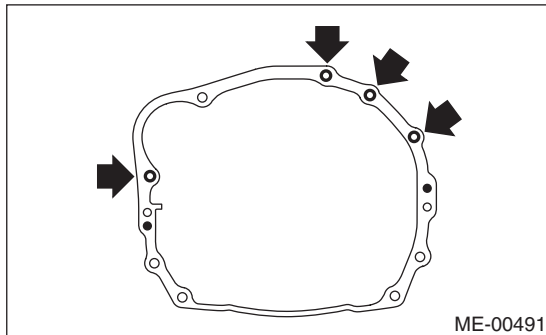
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

- 4) Tighten the bolts which hold upper side of transmission to engine.

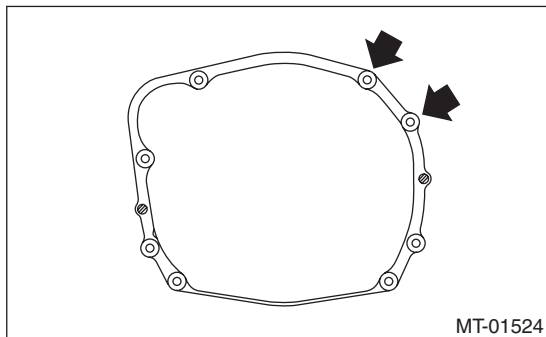
### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

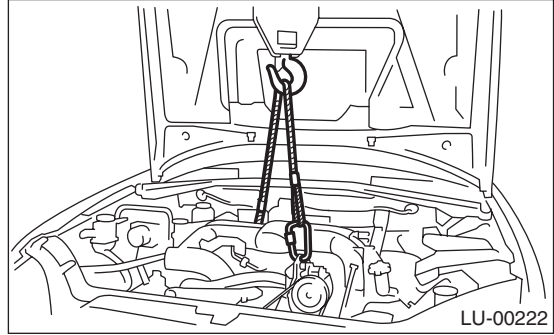
- AT model



- MT model



- 5) Remove the lifting device and wire ropes.

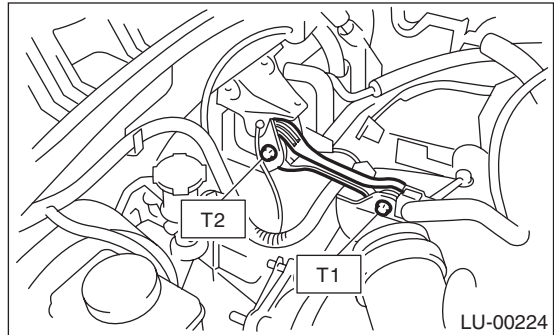


- 6) Remove the garage jack.
- 7) Install the pitching stopper.

### Tightening torque:

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 8) Remove the ST from the torque converter clutch case. (AT model)

### NOTE:

Be careful not to drop the ST into the torque converter clutch case when removing the ST.

ST 498277200 STOPPER SET

- 9) Install the starter. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>

10) Install the torque converter clutch to drive plate.  
(AT model)

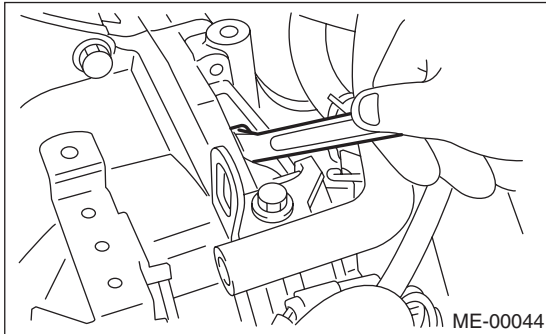
- (1) Tighten the bolts which hold torque converter clutch to drive plate.
- (2) Tighten other bolts while rotating the crankshaft using socket wrench.

**NOTE:**

Be careful not to drop bolts into the torque converter clutch housing.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



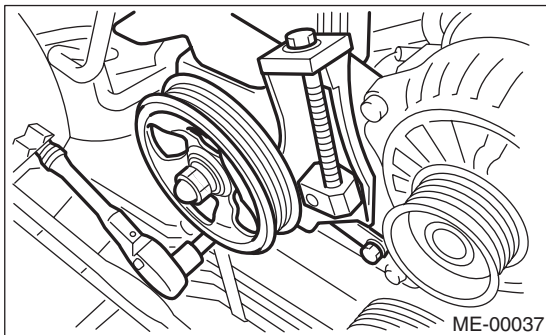
(3) Fit the plug to service hole.

11) Install the power steering pump.

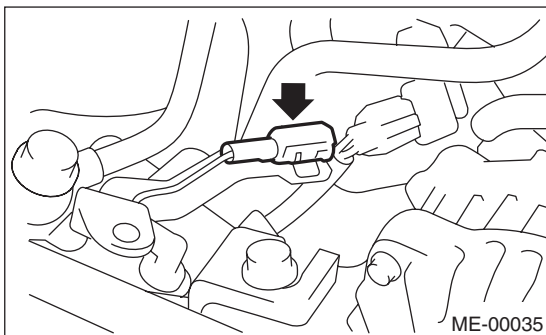
- (1) Install the power steering pump.

**Tightening torque:**

**Refer to "COMPONENT" of "Power Steering" section for the tightening torque. <Ref. to PS-4, COMPONENT, General Description.>**



(2) Connect the power steering pump switch connector.



(3) Install and adjust the front side belt. <Ref. to ME(H4DOTC)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

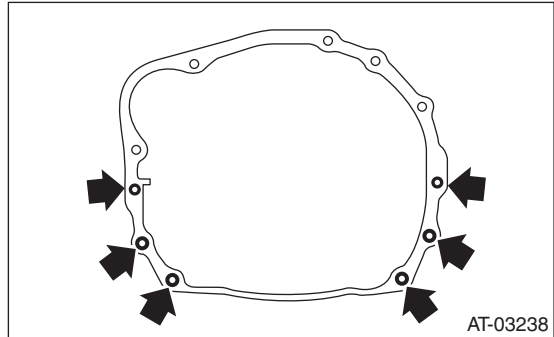
12) Lift up the vehicle.

13) Tighten the bolts and nuts which hold lower side of the transmission to engine.

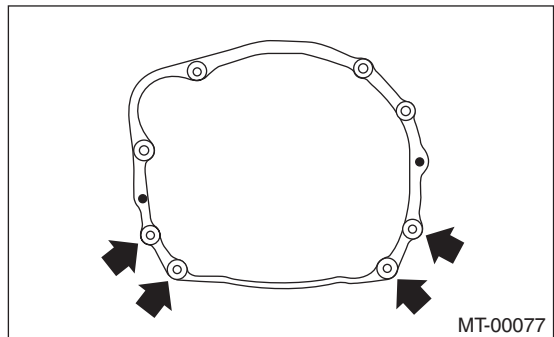
**Tightening torque:**

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

- AT model



- MT model



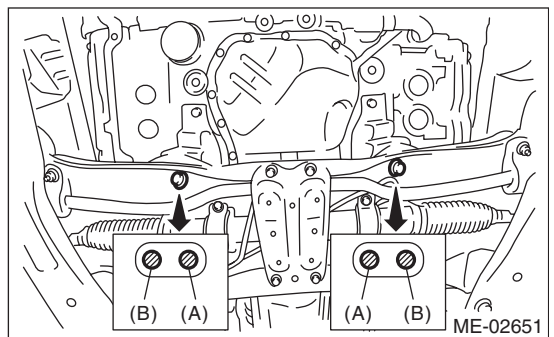
14) Tighten the nuts which install the front cushion rubber onto crossmember.

**NOTE:**

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.

**Tightening torque:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**



15) Install the front and center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-7, INSTALLATION, Front Exhaust Pipe.>

16) Lower the vehicle.

# Engine Assembly

## MECHANICAL

---

- 17) Connect the following hoses.
  - (1) Fuel delivery hose, return hose and evaporation hose
  - (2) Heater inlet and outlet hoses
  - (3) Brake booster vacuum hose
  - (4) Pressure regulator hose
- 18) Connect the following connectors and terminals.
  - (1) Engine ground terminal
  - (2) Engine harness connectors
  - (3) Generator connector and terminal
  - (4) A/C compressor connector
- 19) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 20) Install the air cleaner case and air intake duct. <Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>
- 21) Install the A/C pressure hoses. <Ref. to AC-39, INSTALLATION, Hose and Tube.>
- 22) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>
- 23) Install the coolant filler tank. <Ref. to CO(H4DOTC)-29, INSTALLATION, Coolant Filler Tank.>
- 24) Install the battery in the vehicle, and connect cables.
- 25) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 26) Charge the A/C system with refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>
- 27) Check the ATF level and replenish it if necessary. (AT model) <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>
- 28) Install the collector cover.
- 29) Remove the front hood stay, and close the front hood.
- 30) Lower the vehicle from the lift.

## **C: INSPECTION**

- 1) Check that pipes, hoses, connectors and clamps are installed firmly.
- 2) Check that the engine coolant is at specified level.
- 3) Check that the ATF is at specified level. (AT model)
- 4) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

## 10.Engine Mounting

### A: REMOVAL

- 1) Remove the engine unit. <Ref. to ME(H4DOTC)-28, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

*35 N·m (3.6 kgf·m, 25.8 ft-lb)*

### C: INSPECTION

Make sure that no crack or other damages do not exist.

## 11. Preparation for Overhaul

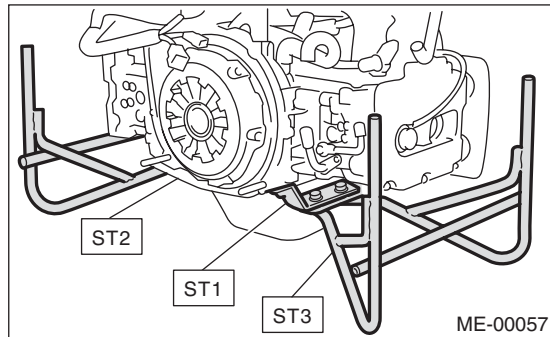
### A: PROCEDURE

1) After removing the engine from body, secure it to ST in the following procedure.

ST1 498457000 ENGINE STAND ADAPTER  
RH

ST2 498457100 ENGINE STAND ADAPTER  
LH

ST3 499817100 ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process.

Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

## 12.V-belt

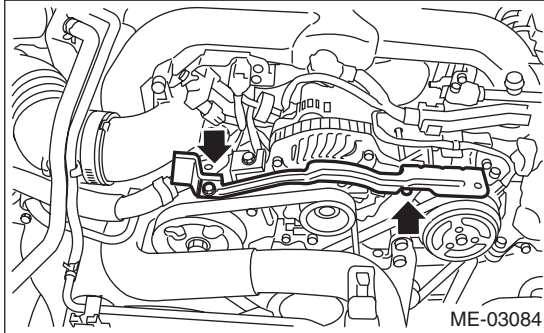
### A: REMOVAL

#### NOTE:

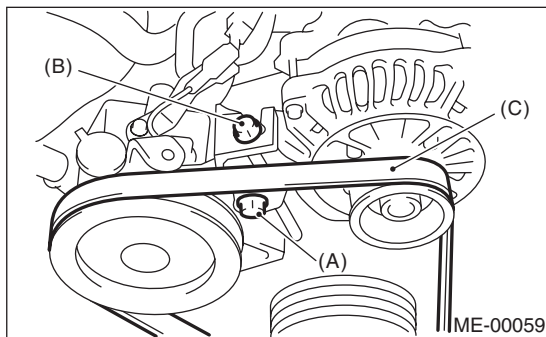
Perform the work with the engine installed to body when replacing a single part.

#### 1. FRONT SIDE BELT

- 1) Remove the collector cover.
- 2) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 3) Remove the collector cover bracket.

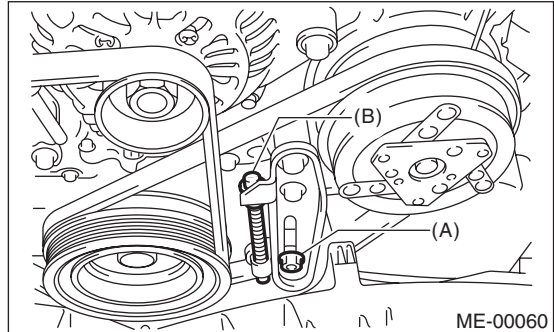


- 4) Loosen the lock bolt (A).
- 5) Loosen the slider bolt (B).
- 6) Remove the front side belt (C).

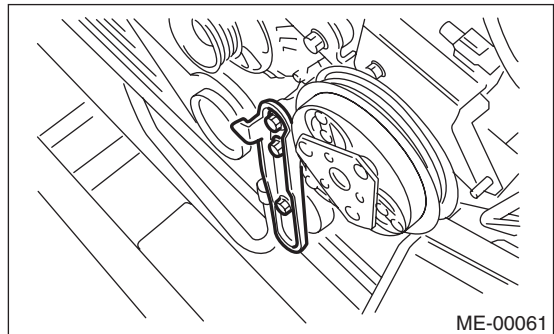


#### 2. REAR SIDE BELT

- 1) Remove the front side belts. <Ref. to ME(H4DOTC)-37, FRONT SIDE BELT, REMOVAL, V-belt.>
- 2) Loosen the lock nut (A).
- 3) Loosen the slider bolt (B).



- 4) Remove the rear side belt.
- 5) Remove the belt tensioner.



## B: INSTALLATION

### NOTE:

Wipe off any oil or water on the belt and pulley.

### 1. FRONT SIDE BELT

- 1) Install the front side belt (C), and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-39, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

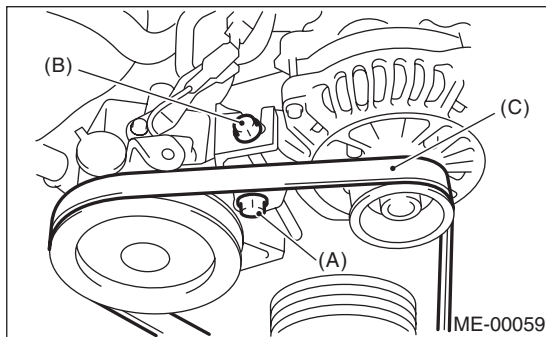
#### Tightening torque:

##### Lock bolt (A):

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

##### Slider bolt (B):

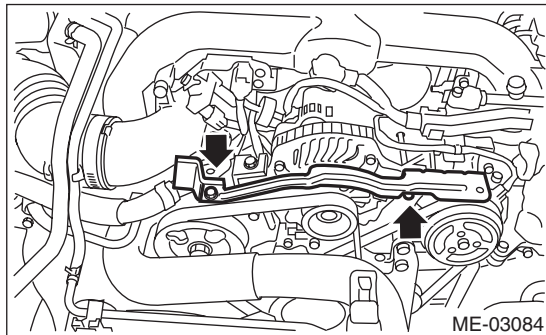
**8 N·m (0.8 kgf-m, 5.9 ft-lb)**



- 4) Install the collector cover bracket.

#### Tightening torque:

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- 5) Install the air intake duct. <Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>
- 6) Install the collector cover.

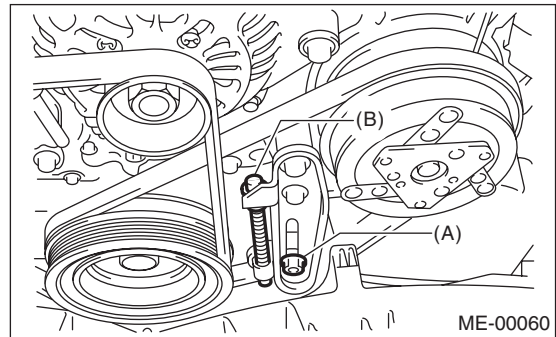
### 2. REAR SIDE BELT

- 1) Install the belt tensioner.
- 2) Install the rear side belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-39, INSPECTION, V-belt.>
- 3) Tighten the lock nut (A).

#### Tightening torque:

##### Lock nut (A):

**23.0 N·m (2.35 kgf-m, 17.0 ft-lb)**



- 4) Install the front side belt. <Ref. to ME(H4DOTC)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

## C: INSPECTION

- 1) Replace the belts, if crack, fraying or wear is found.
- 2) Check the V-belt tension and adjust it if necessary by changing the generator installing position or idler pulley installing position.

### Belt tension (with belt tension gauge):

#### (A)

**When installing new parts:**

**640 — 780 N (65 — 80 kgf, 144 — 175 lbf)**

**At inspection:**

**490 — 640 N (50 — 65 kgf, 110 — 144 lbf)**

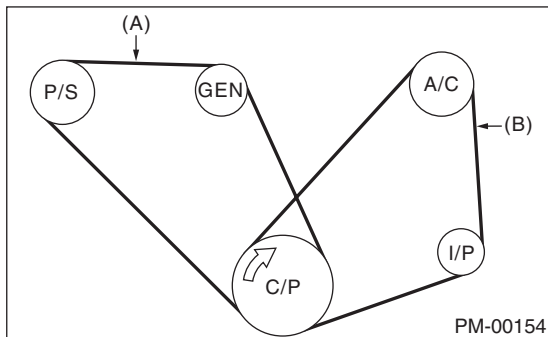
#### (B)

**When installing new parts:**

**650 — 750 N (66 — 76 kgf, 146 — 169 lbf)**

**At inspection:**

**350 — 450 N (36 — 46 kgf, 78 — 101 lbf)**



- (A) Front side belt
- (B) Rear side belt
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C A/C compressor pulley
- I/P Idler pulley

### Belt tension (when not using a belt tension gauge)

#### (A)

**When installing new parts:**

**7 — 9 mm (0.276 — 0.354 in)**

**At inspection:**

**9 — 11 mm (0.354 — 0.433 in)**

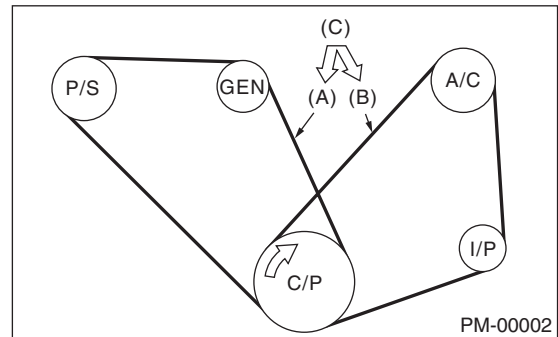
#### (B)

**When installing new parts:**

**7.5 — 8.5 mm (0.295 — 0.335 in)**

**At inspection:**

**9.0 — 10.0 mm (0.354 — 0.394 in)**



- (A) Front side belt
- (B) Rear side belt
- (C) 98 N (10 kgf, 22 lbf)
- C/P Crank pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley



## 13.Crank Pulley

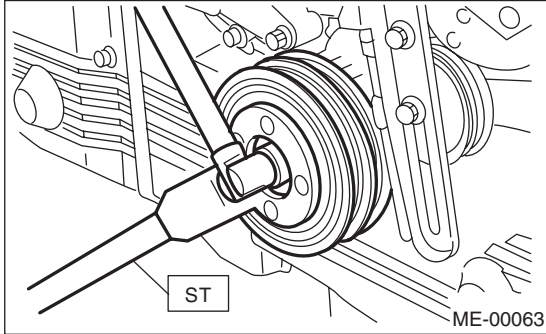
### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH



- 3) Remove the crank pulley.

### B: INSTALLATION

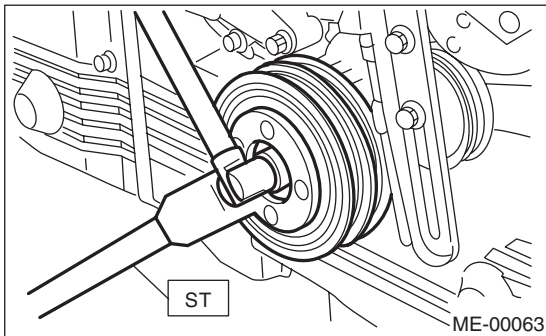
- 1) Install the crank pulley.
- 2) Install the pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH

- (1) Clean the crankshaft thread using compressed air.
- (2) Apply engine oil to the crank pulley bolt seat and thread.
- (3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 32.5 ft-lb).
- (4) Tighten the crank pulley bolts.

**Tightening torque:**

**180 N·m (18.3 kgf-m, 132.7 ft-lb)**



- 3) Check that the tightening angle of the crank pulley bolt is 65° or more. Perform the following procedure when less than 65°.

**CAUTION:**

**If the tightening angle of crank pulley bolt is less than 65°, the bolt is damaged. In this case, the bolt must be replaced.**

- (1) Replace the crank pulley bolts and clean them.

**Crank pulley bolt:**

**Part No. 12369AA011**

- (2) Clean the crankshaft thread using compressed air.
- (3) Apply engine oil to the crank pulley bolt seat and thread.
- (4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 32.5 ft-lb).
- (5) Tighten the crank pulley bolts 65° to 75°.

**NOTE:**

Conduct the tightening procedures by confirming the turning angle of crank pulley bolt referring to the gauge indicated on timing belt cover.

- 4) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Check the V-belt is not worn or otherwise damaged.
- 2) Check the tension of the belt. <Ref. to ME(H4DOTC)-39, INSPECTION, V-belt.>

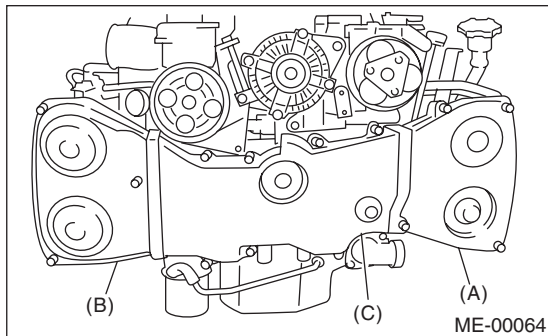
## 14. Timing Belt Cover

### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the secondary air pump. <Ref. to EC(H4DOTC)-20, REMOVAL, Secondary Air Pump.>
- 2) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover (LH) (A).
- 5) Remove the timing belt cover (RH) (B).
- 6) Remove the front timing belt cover (C).



### B: INSTALLATION

- 1) Install the front timing belt cover (C).

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

- 2) Install the timing belt cover (RH) (B).

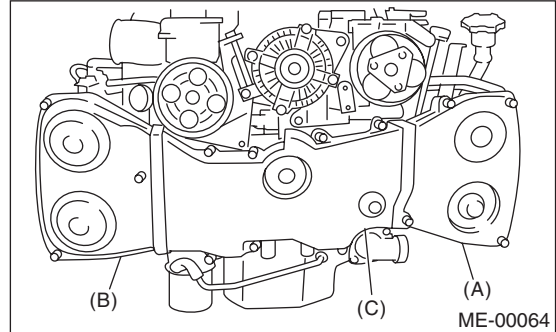
**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

- 3) Install the timing belt cover (LH) (A).

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



- 4) Install the crank pulley. <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

- 5) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

- 6) Install the secondary air pump. <Ref. to EC(H4DOTC)-20, INSTALLATION, Secondary Air Pump.>

### C: INSPECTION

Check the cover for damage.

# Timing Belt

MECHANICAL

## 15. Timing Belt

### A: REMOVAL

#### NOTE:

Perform the work with the engine installed to body when replacing a single part. For operation procedures, refer to "Timing Belt" in the PM section. <Ref. to PM-17, Timing Belt.>

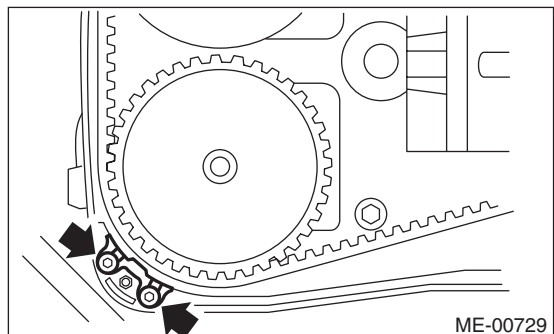
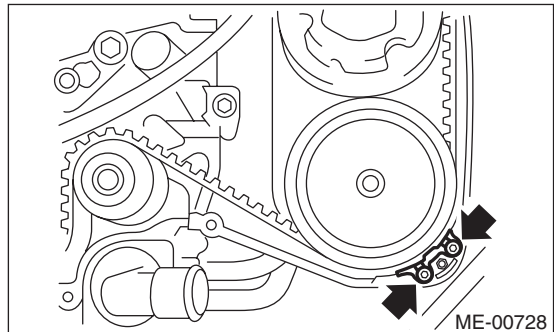
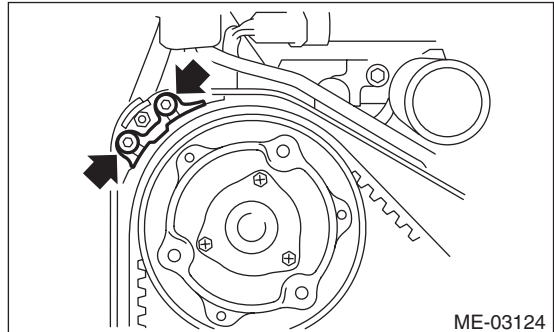
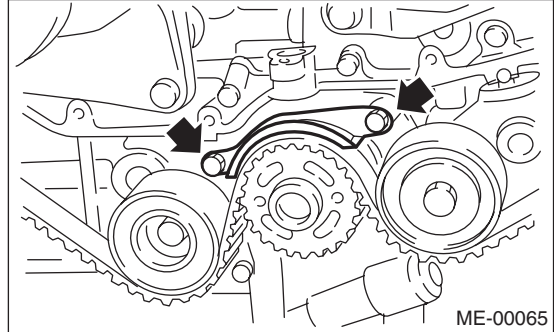
#### 1. TIMING BELT

1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>

2) Remove the crank pulley. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>

3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>

4) Remove the timing belt guide. (MT model)



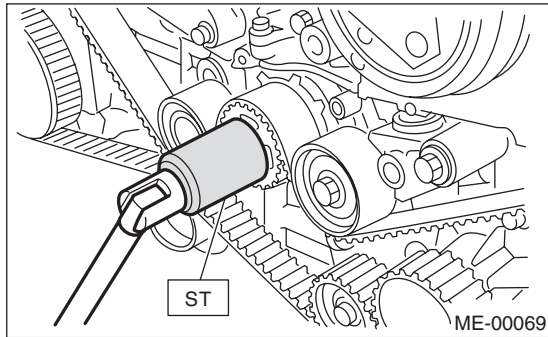
# Timing Belt

MECHANICAL

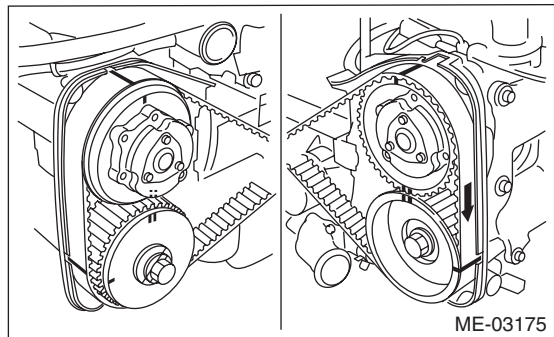
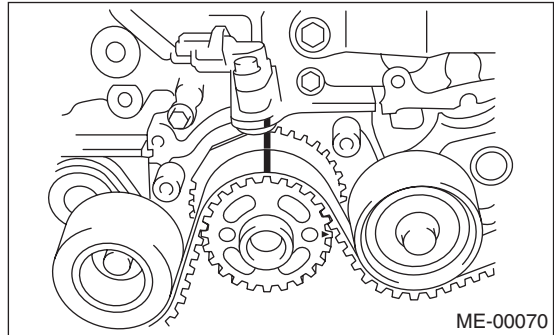
5) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.

(1) Turn the crankshaft using ST, and align the alignment marks on crank sprocket, intake cam sprocket (LH), exhaust cam sprocket (LH), intake cam sprocket (RH) and exhaust cam sprocket (RH) with notches of timing belt cover and cylinder block.

ST 499987500 CRANKSHAFT SOCKET



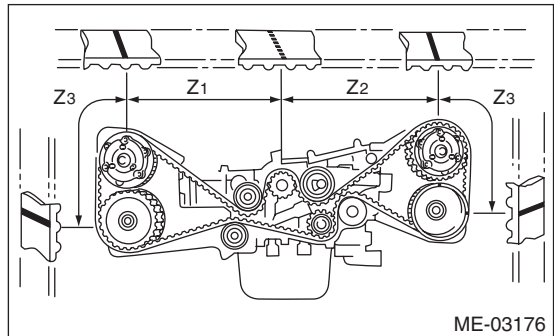
(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the cam sprockets.



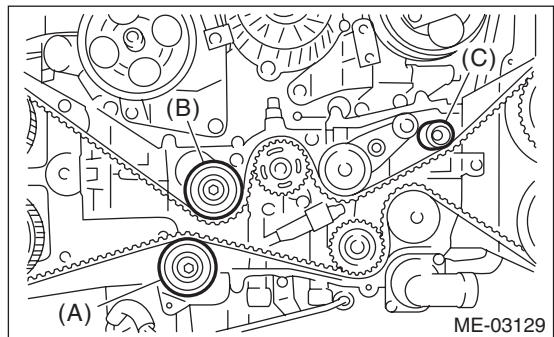
**$Z_1$ : 54.5 teeth**

**$Z_2$ : 51 teeth**

**$Z_3$ : 28 teeth**



6) Remove the belt idler (A).



# Timing Belt

## MECHANICAL

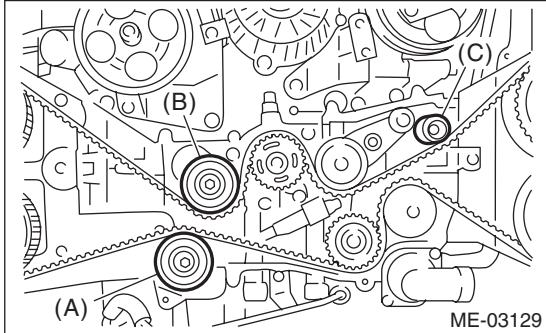
7) Remove the timing belt.

### CAUTION:

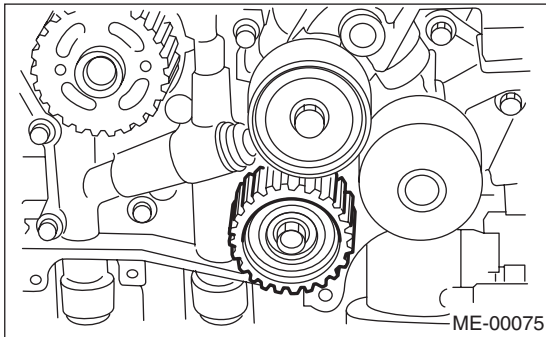
After the timing belt has been removed, never rotate the intake and exhaust sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

## 2. AUTOMATIC BELT TENSION ADJUST-ER ASSEMBLY AND BELT IDLER

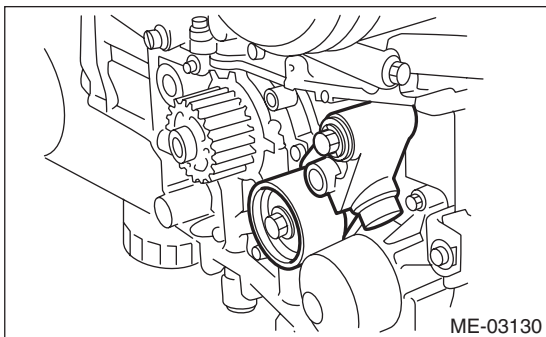
1) Remove the belt idler (B) and (C).



2) Remove the belt idler No. 2.



3) Remove the automatic belt tension adjuster assembly.



## B: INSTALLATION

### 1. AUTOMATIC BELT TENSION ADJUST-ER ASSEMBLY AND BELT IDLER

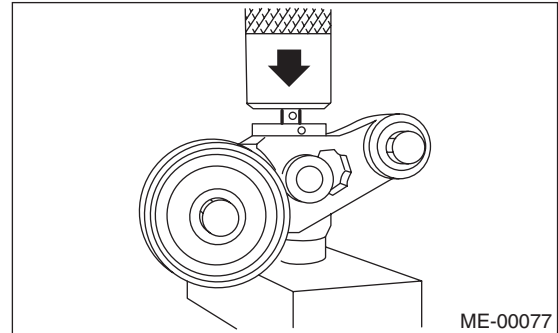
1) Prepare for installation of automatic belt tension adjuster assembly.

### CAUTION:

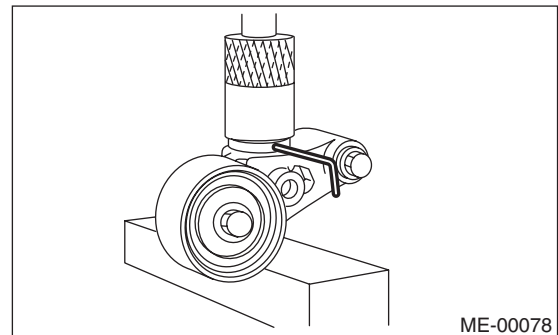
- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking three minutes or more.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
- Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
- Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to vertical pressing tool.

(2) Slowly move the adjuster rod down with a pressure of 165 N (16.8 kgf, 37.1 lbf) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.



(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.



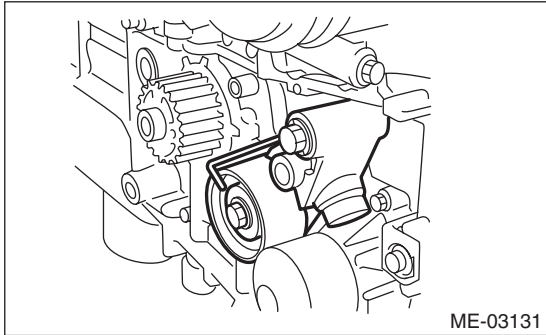
# Timing Belt

MECHANICAL

2) Install the automatic belt tension adjuster assembly.

**Tightening torque:**

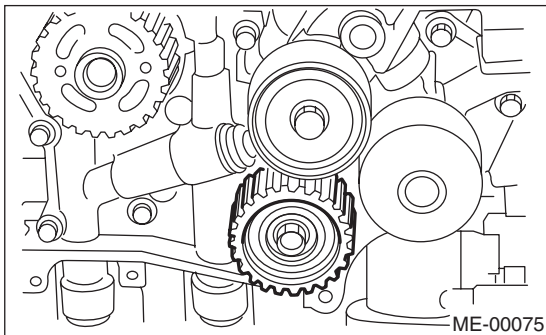
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**



3) Install the belt idler No. 2.

**Tightening torque:**

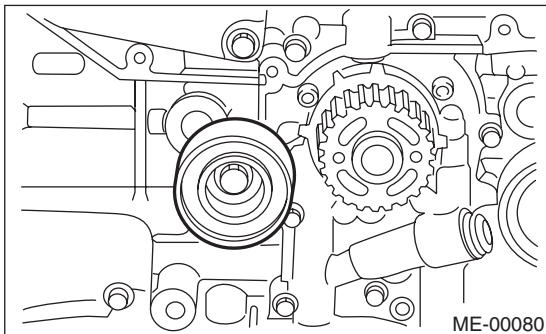
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**



4) Install the belt idlers.

**Tightening torque:**

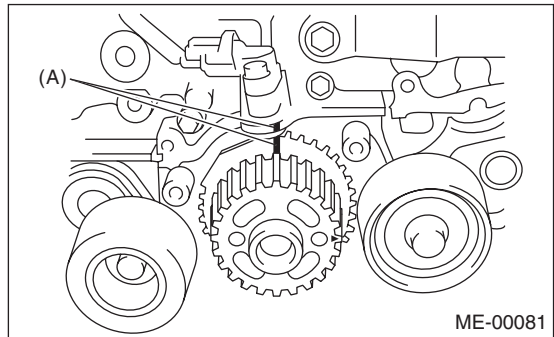
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**



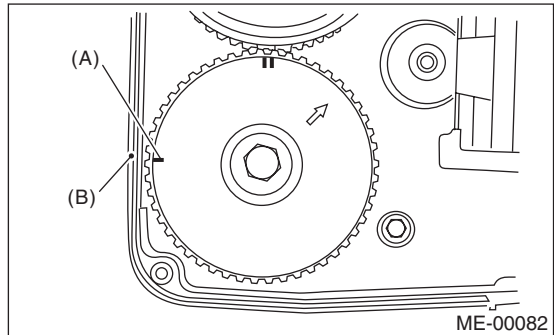
## 2. TIMING BELT

1) Prepare for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4DOTC)-44, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

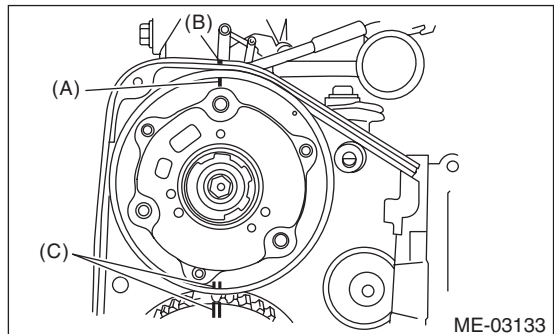
2) Align the mark (A) on crank sprocket with the mark on oil pump cover at cylinder block.



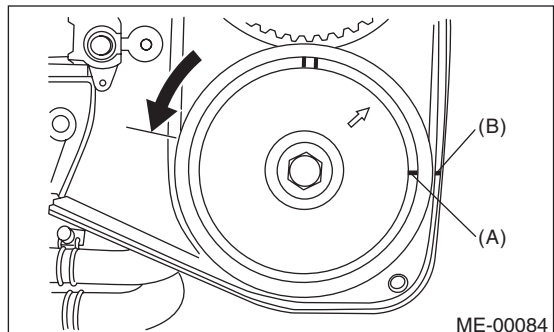
3) Align single line mark (A) on the exhaust cam sprocket (RH) with notch (B) on timing belt cover.



4) Align single line mark (A) on the intake cam sprocket (RH) with notch (B) on timing belt cover. (Make sure that the double lines (C) on intake and exhaust camshaft sprockets are aligned.)



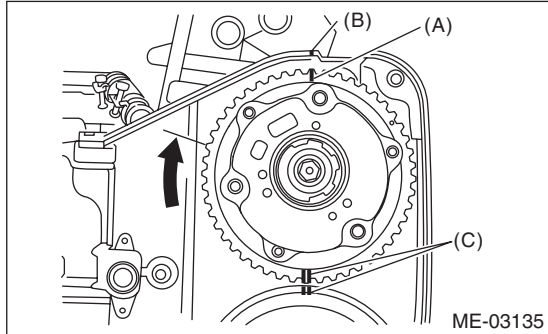
5) Align the single line mark (A) on exhaust cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).



# Timing Belt

## MECHANICAL

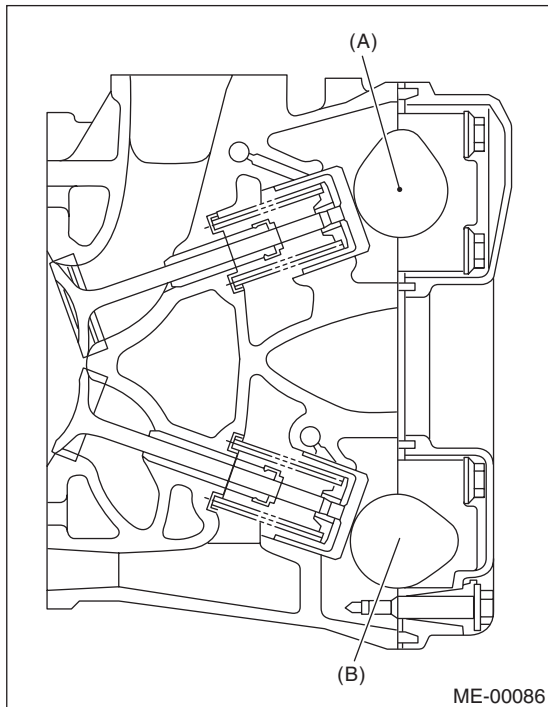
6) Align the single line mark (A) on intake cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket clockwise (as viewed from front of engine). Make sure the double line marks (C) on the intake and exhaust cam sprockets are aligned.



7) Make sure that the cam and crank sprockets are positioned properly.

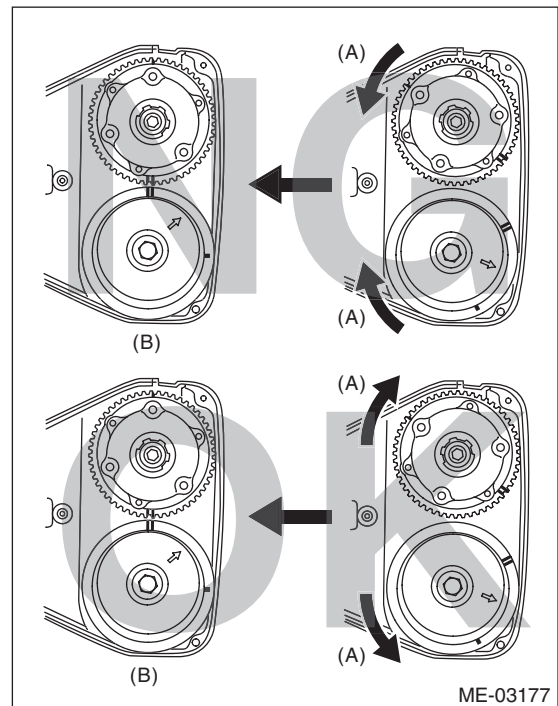
### CAUTION:

• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, the valve heads will interfere with each other, resulting in bent valves.



- (A) Intake camshaft
- (B) Exhaust camshaft

- When the timing belts are not installed, four camshafts are held at the “zero-lift” position, where all cams on camshafts do not push the intake and exhaust valves down. (Under this condition, all valves remain unlifted.)
- When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshafts (LH) are held to push their corresponding valves down. (Under this condition, these valves are held lifted.) Right-side camshafts are held so that their cams do not push valves down.
- Camshafts (LH) must be rotated from the zero-lift position to the position where the timing belt is to be installed with the smallest possible angle, in order to prevent mutual interference of intake and exhaust valve heads.
- Do not allow the camshafts to rotate in the direction shown in the upper figure. Doing this may cause both the intake and exhaust valves to lift simultaneously, resulting in mutual interference of heads.



- (A) Direction of rotation
- (B) Timing belt installation position

# Timing Belt

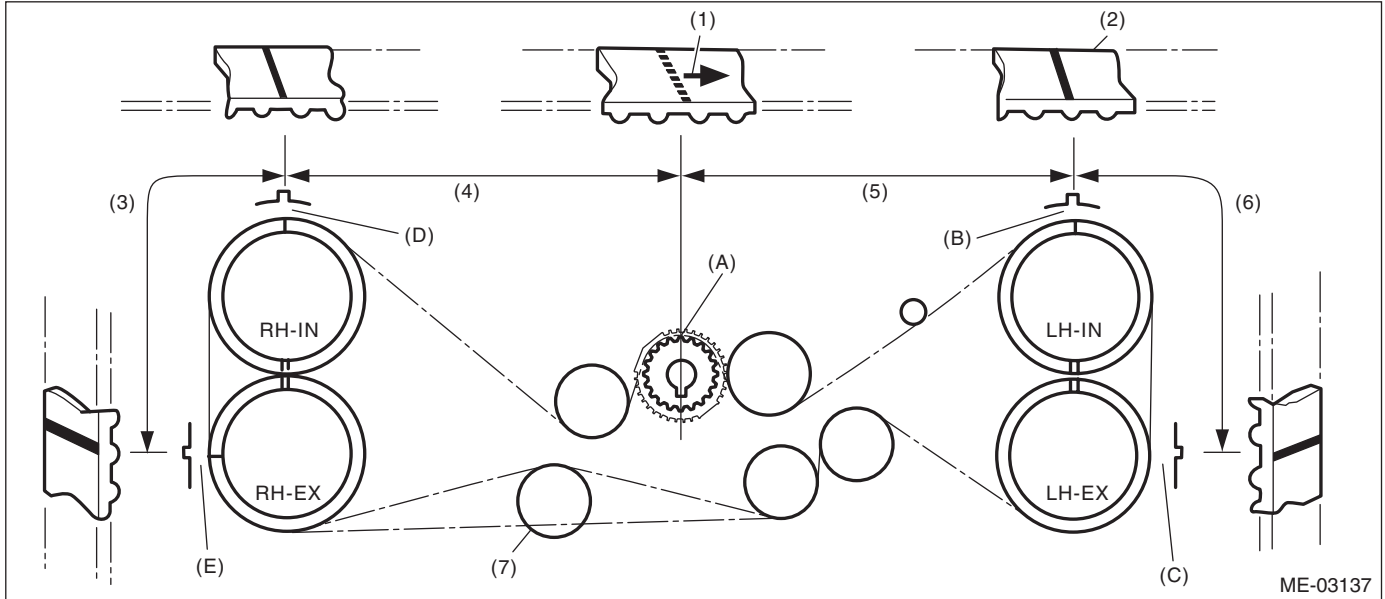
MECHANICAL

8) Install the timing belt.

Align the alignment mark on the timing belt with marks on the sprockets in the alphabetical order shown in the figure. While aligning marks, position the timing belt properly.

### CAUTION:

- If the timing belt slips by 3 or more teeth, the valve and piston may hit each other.
- Make sure that the direction of belt rotation is correct.



- (1) Arrow mark
- (2) Timing belt
- (3) 28 tooth length

- (4) 54.5 tooth length
- (5) 51 tooth length

- (6) 28 tooth length
- (7) Install it in the end



# Timing Belt

## MECHANICAL

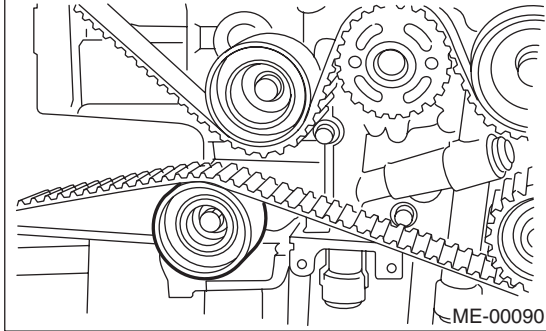
9) Install the belt idlers.

### **Tightening torque:**

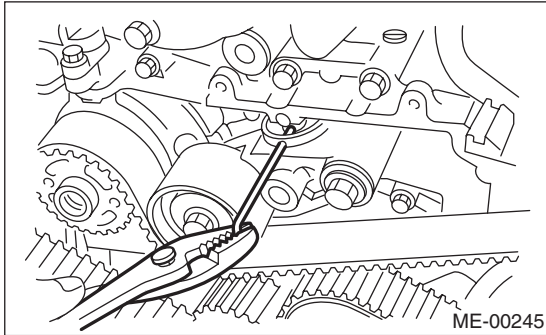
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**

### **NOTE:**

Make sure that the marks on the timing belt and sprockets are aligned.



10) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.



11) Install the timing belt guide. (MT model)

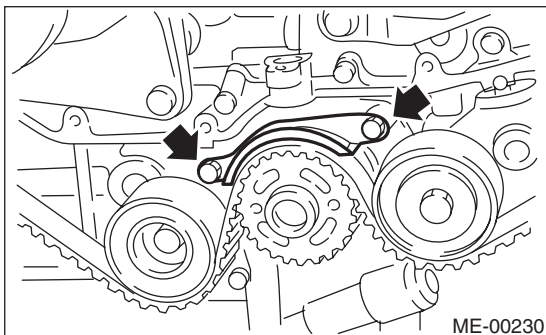
### **NOTE:**

- Clean the threaded portion of timing belt cover before attaching bolts.
- Apply liquid gasket to the threaded portion of cam sprocket. (when reusing bolts)

### **Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

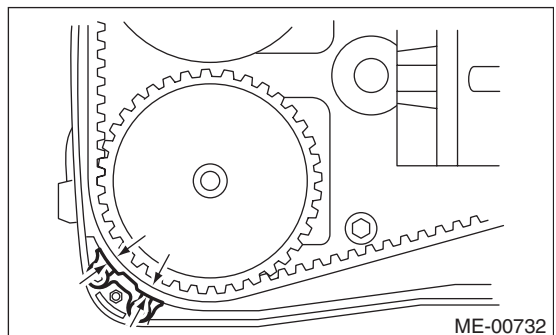
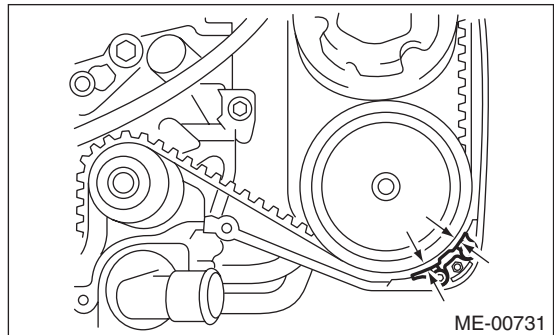
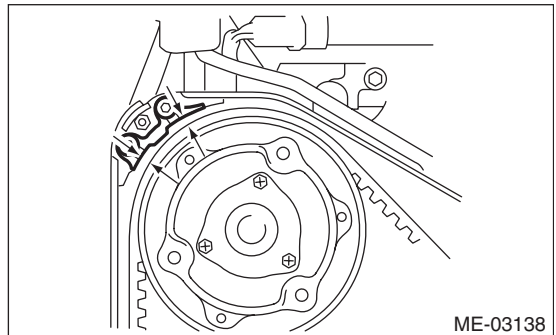
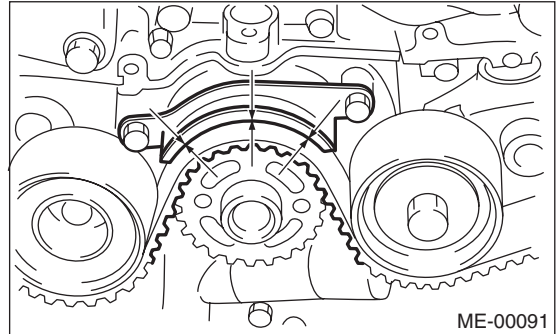
(1) Temporarily tighten the bolts mounting the timing belt guide.



(2) Check and adjust the clearance between timing belt and timing belt guide using a thickness gauge.

### **Clearance:**

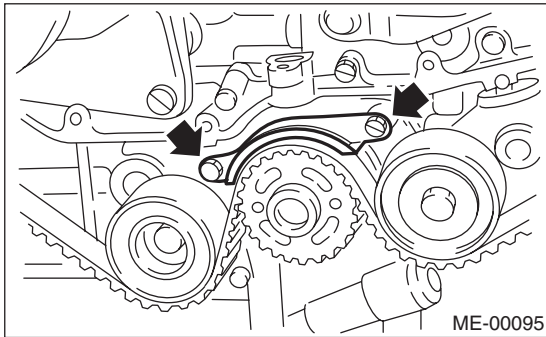
**1.0±0.5 mm (0.039±0.020 in)**



(3) Tighten the bolts mounting the timing belt guide.

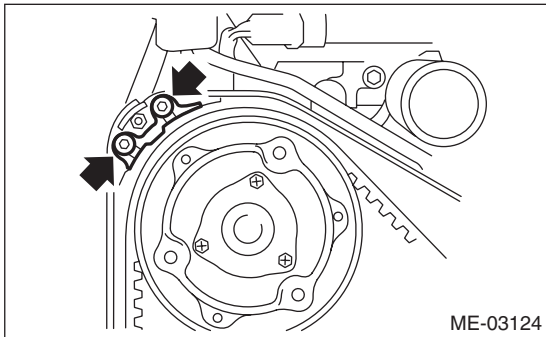
**Tightening torque:**

**9.75 N·m (1.0 kgf·m, 7.2 ft·lb)**



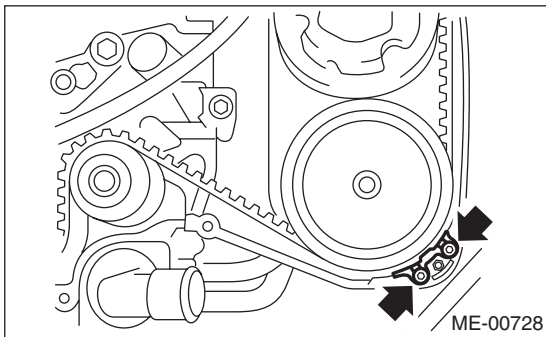
**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



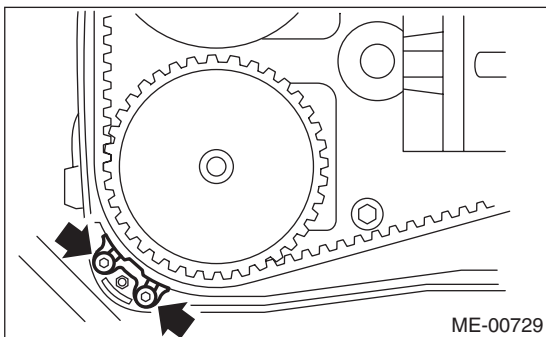
**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



12) Install the timing belt cover.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

13) Install the crank pulley.

<Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

14) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

## C: INSPECTION

### 1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.

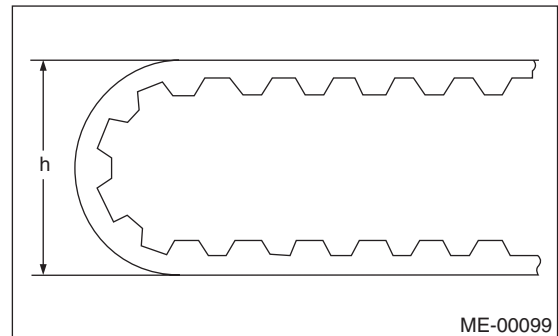
2) Check the condition on the back surface of the timing belt. If cracks are found, replace the timing belt.

#### CAUTION:

- Be careful not to let oil, grease or coolant contact the timing belt. Remove quickly and thoroughly if this happens.
- Do not bend the timing belt sharply.

*In radial diameter h:*

**60 mm (2.36 in) or more**



# Timing Belt

## MECHANICAL

### 2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check the oil seals for leaks, and rod ends for abnormal wear and scratches. If necessary, replace the automatic belt tension adjuster assembly.

#### NOTE:

Slight traces of oil on the oil seal of the rod does not indicate a problem.

2) Check that the adjuster rod does not move when a pressure of 165 N (16.8 kgf, 37.1 lbf) is applied to it. This is to check adjuster rod stiffness.

3) If the adjuster rod is not stiff and moves freely when applying 165 N (16.8 kgf, 37.1 lbf), check it using the following procedures:

(1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.

(2) With the adjuster rod moved all the way up, apply a pressure of 165 N (16.8 kgf, 37.1 lbf) to it. Check the adjuster rod stiffness.

(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new part.

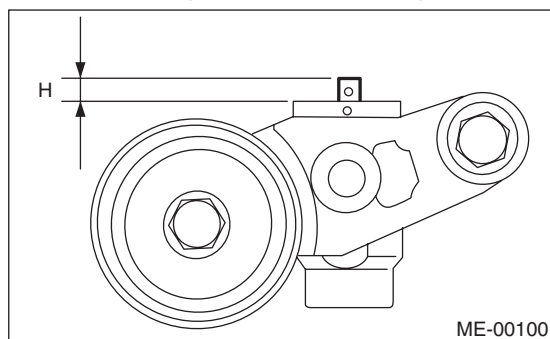
#### CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking three minutes or more.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
- Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.

4) Measure the amount of rod protrusion "H" from the end surface of body. If it is not within specified range, replace with new part.

#### Amount of rod protrusion H:

5.2 — 6.2 mm (0.205 — 0.244 in)



### 3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly with a new part if faulty.

2) Check the belt tension pulley for smooth rotation. Replace if noise or excessive play occurs.

3) Check the belt tension pulley for grease leakage.

### 4. BELT IDLER

1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.

2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.

3) Check the belt idler for grease leakage.

## 16. Cam Sprocket

### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part.

1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>

2) Remove the crank pulley.

<Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>

3) Remove the timing belt cover.

<Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>

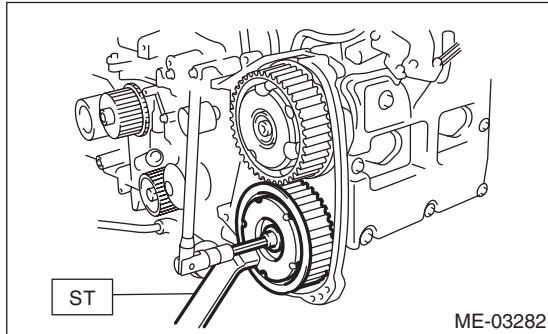
4) Remove the timing belt.

<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>

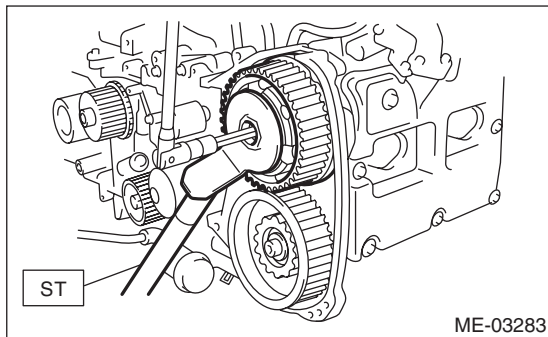
5) Remove the actuator cover of the intake cam sprocket.

6) Fasten the cam sprocket and remove from the cam shaft using ST.

ST 499207400 CAM SPROCKET WRENCH



ST 499977500 CAM SPROCKET WRENCH



### B: INSTALLATION

1) Fasten the cam sprocket and install to the cam shaft using ST.

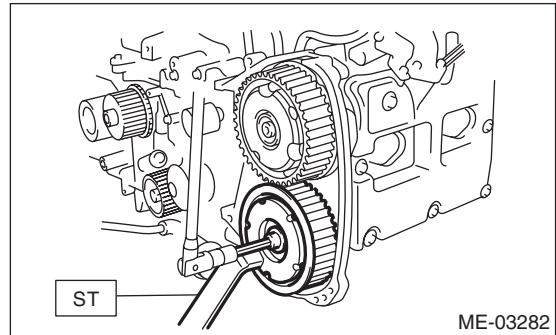
**NOTE:**

Do not confuse the cam sprockets (LH) and (RH) during installation.

ST 499207400 CAM SPROCKET WRENCH

**Tightening torque:**

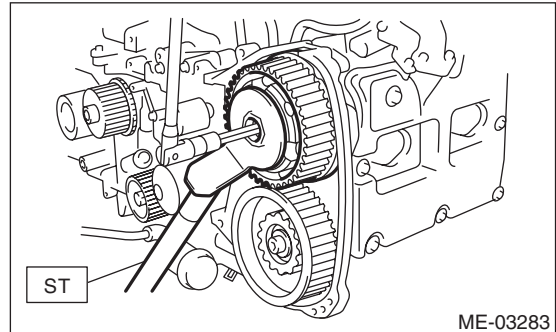
**Tighten to 30 N-m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.**



ST 499977500 CAM SPROCKET WRENCH

**Tightening torque:**

**Tighten to 30 N-m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.**



2) Attach the actuator cover of the intake cam sprocket.

**NOTE:**

Use new O-rings.

**Tightening torque:**

**3.4 N-m (0.3 kgf-m, 2.5 ft-lb)**

3) Install the timing belt. <Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

4) Install the timing belt cover. <Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

5) Install the crank pulley. <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

6) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

### C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.

2) Make sure there is no free play between cam sprocket and key.

# Crank Sprocket

MECHANICAL

## 17. Crank Sprocket

### A: REMOVAL

NOTE:

Perform the work with the engine installed to body when replacing a single part.

1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>

2) Remove the crank pulley.

<Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>

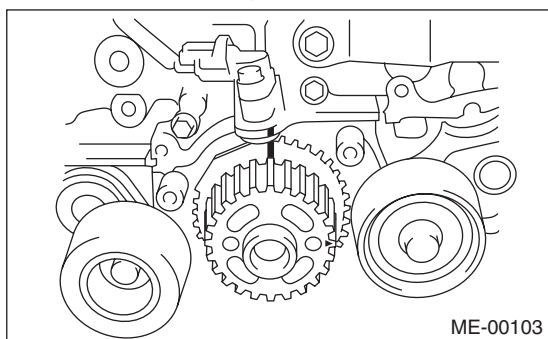
3) Remove the timing belt cover.

<Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>

4) Remove the timing belt.

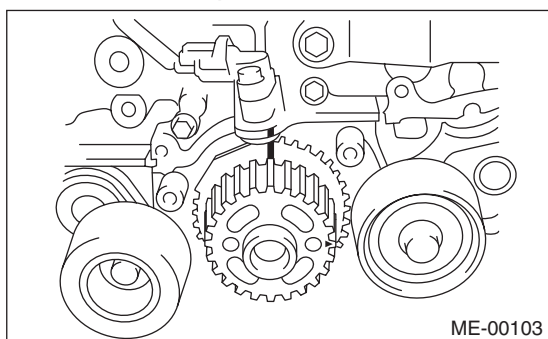
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>

5) Remove the crank sprocket.



### B: INSTALLATION

1) Install the crank sprocket.



2) Install the timing belt.

<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

3) Install the timing belt cover. <Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

4) Install the crank pulley. <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

5) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

### C: INSPECTION

1) Check the crank sprocket teeth for abnormal wear and scratches.

2) Make sure there is no free play between crank sprocket and key.

3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

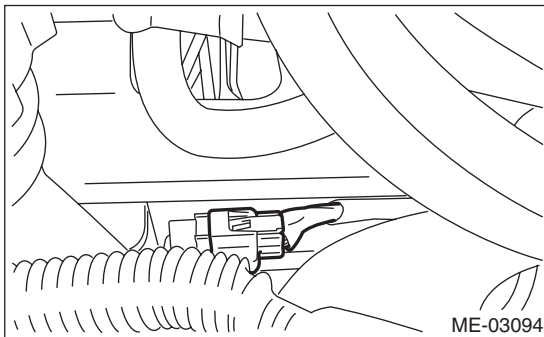
## 18. Camshaft

### A: REMOVAL

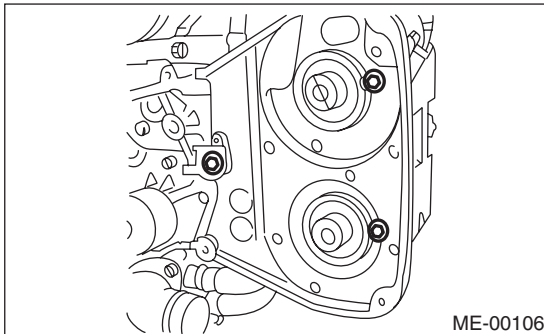
**NOTE:**

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4DOTC)-25, INSPECTION, Valve Clearance.>

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 6) Disconnect the oil flow control solenoid valve assembly connector.



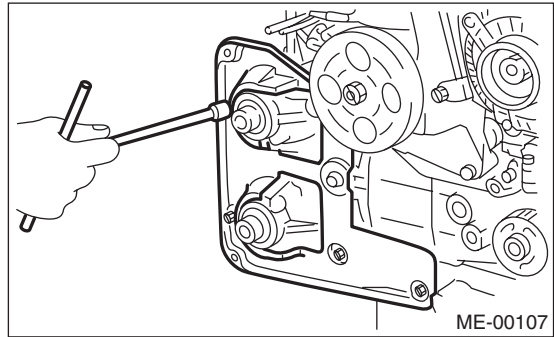
- 7) Remove the timing belt cover No. 2 (LH).



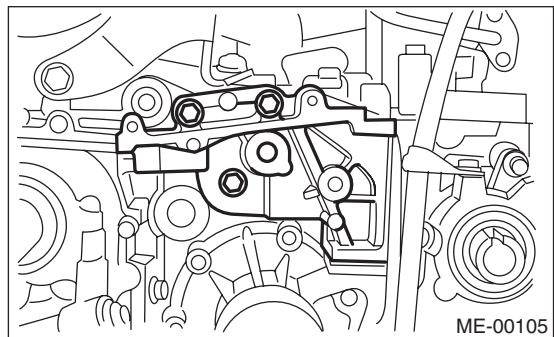
- 8) Remove the timing belt cover No. 2 (RH).

**NOTE:**

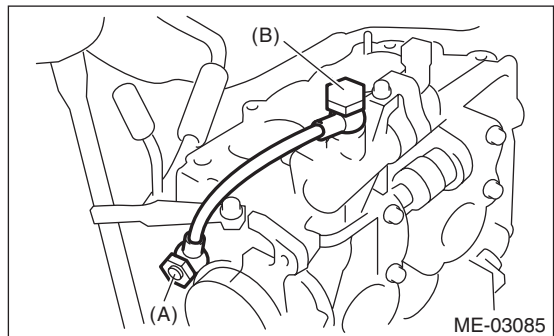
Do not damage or lose the seal rubber when removing the timing belt covers.



- 9) Remove the tensioner bracket.



- 10) Remove the ignition coil.
- 11) Disconnect the PCV hose from the rocker cover.
- 12) Remove the rocker cover and gasket.
- 13) Remove the oil pipe.

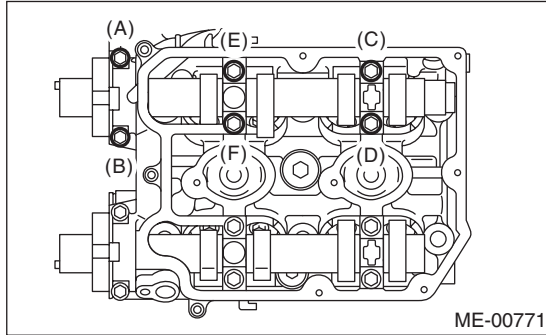


- (A) Union screw with filter (with protrusion)  
 (B) Union screw without filter (without protrusion)

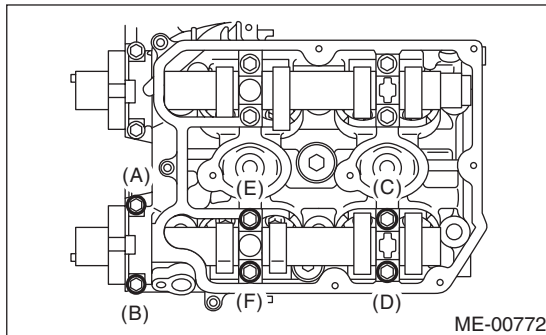
# Camshaft

## MECHANICAL

14) Loosen the oil flow control solenoid valve assembly and intake camshaft cap bolts equally, a little at a time in alphabetical order shown in the figure.



15) Loosen the exhaust camshaft cap bolts equally, a little at a time in alphabetical order shown in the figure.



16) Remove the oil flow control solenoid valve assembly, intake camshaft cap and camshaft.

17) Remove the exhaust camshaft caps and camshaft.

### NOTE:

Arrange camshaft caps in order so that they can be installed in their original positions.

18) Remove the oil seal.

### CAUTION:

**Do not scratch the journal surface when removing the oil seal.**

19) Similarly, remove the camshafts (RH) and related parts.

## B: INSTALLATION

1) Install the camshaft.

Apply engine oil to the cylinder head at camshaft journal installation location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with base circle of the cam lobe.

### NOTE:

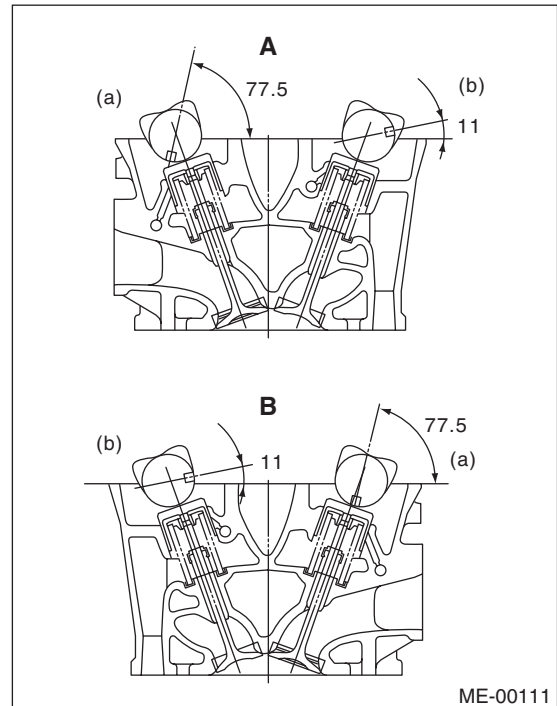
- Set the camshaft to the position shown in the figure.
- When set at the position shown in the figure, it is not necessary to rotate the camshaft (RH) when installing the timing belt, but it is necessary to rotate the camshaft (LH) slightly.

**Intake camshaft (LH):**

**Rotate 80° clockwise.**

**Exhaust camshaft (LH):**

**Rotate 45° counterclockwise.**



A Cylinder head (LH)

B Cylinder head (RH)

(a) Intake camshaft

(b) Exhaust camshaft

2) Install the camshaft cap and oil flow control solenoid valve assembly.

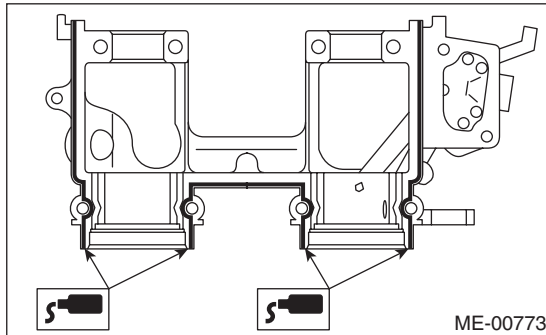
(1) Apply small amount of liquid gasket to the mating surface of cap.

**NOTE:**

- Install within 5 min. after applying liquid gasket.
- Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to come out and flow toward oil seal, resulting in oil leak.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



ME-00773

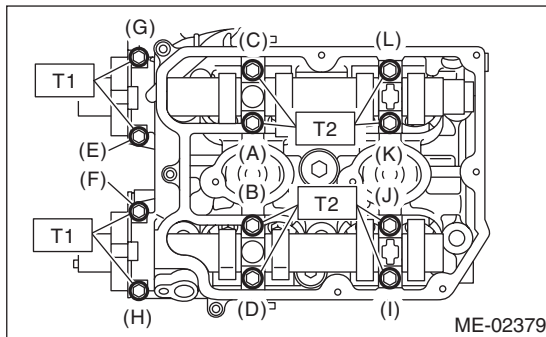
(2) Apply a thin coat of engine oil to the cap bearing surface, and install the cap to the camshaft according to the identification mark.

(3) Gradually tighten the camshaft cap and oil control valve assembly in at least two stages in alphabetical order shown in the figure, and then tighten to specified torque.

**Tightening torque:**

**T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)**

**T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)**



ME-02379

(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at base circle.

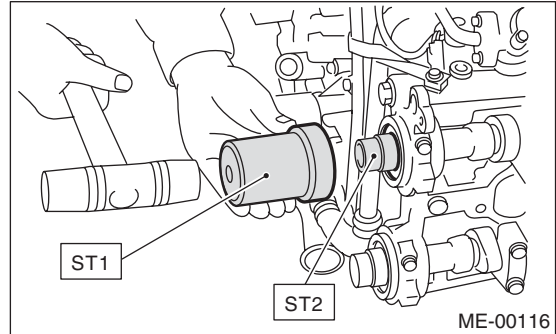
3) Apply a coat of engine oil to the camshaft oil seal periphery and oil seal lips, then install the oil seal on the camshaft using ST1 and ST2.

**NOTE:**

Use a new oil seal.

ST1 499587600 OIL SEAL INSTALLER

ST2 499597200 OIL SEAL GUIDE



ME-00116

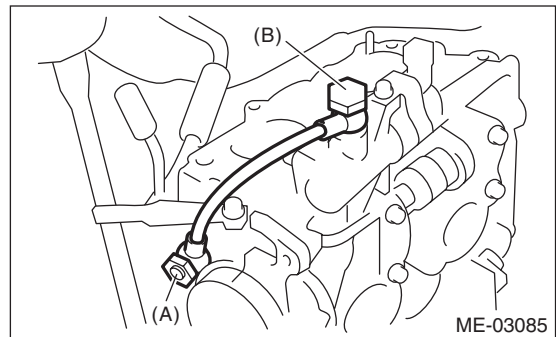
4) Install the oil pipe.

**NOTE:**

Make sure not to mix up the union screws with filter and without filter as their installation positions are different.

**Tightening torque:**

**29 N·m (3.0 kgf-m, 21.4 ft-lb)**

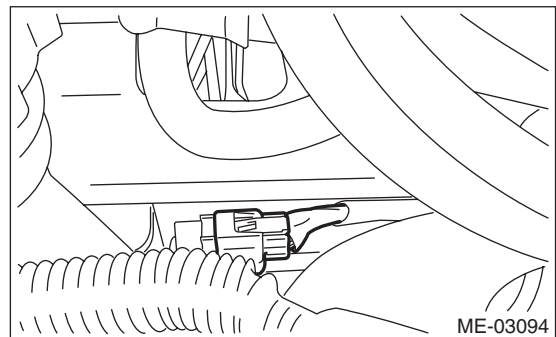


ME-03085

(A) Union screw with filter (with protrusion)

(B) Union screw without filter (without protrusion)

5) Connect the oil flow control solenoid valve connector.



ME-03094

6) Tighten the ignition coil.

7) Similarly, install the parts on right-hand side.



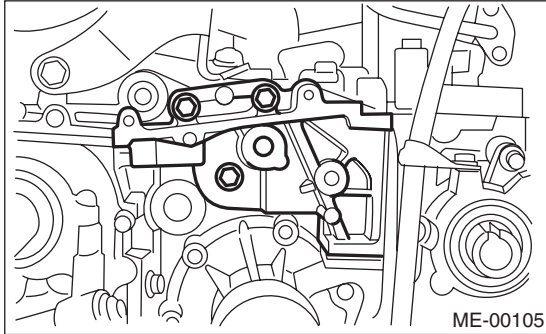
# Camshaft

## MECHANICAL

8) Install the tensioner bracket.

**Tightening torque:**

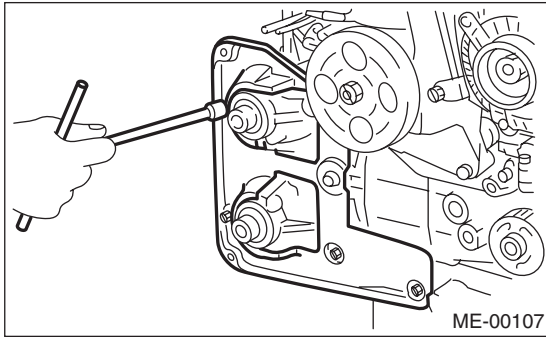
**24.5 N·m (2.5 kgf-m, 18.1 ft-lb)**



9) Install the timing belt cover No. 2 (RH).

**Tightening torque:**

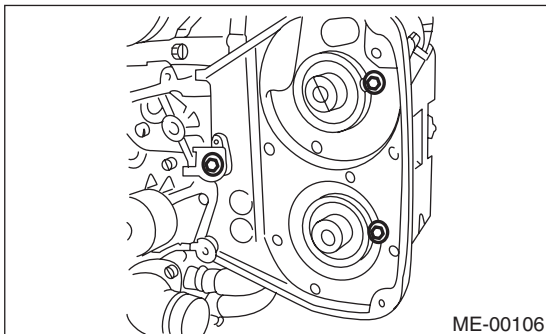
**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



10) Install the timing belt cover No. 2 (LH).

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



11) Install the cam sprocket.

<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

12) Install the timing belt. <Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

13) Adjust the valve clearance. <Ref. to ME(H4DOTC)-26, ADJUSTMENT, Valve Clearance.>

14) Install the rocker cover.

(1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

Use a new gasket.

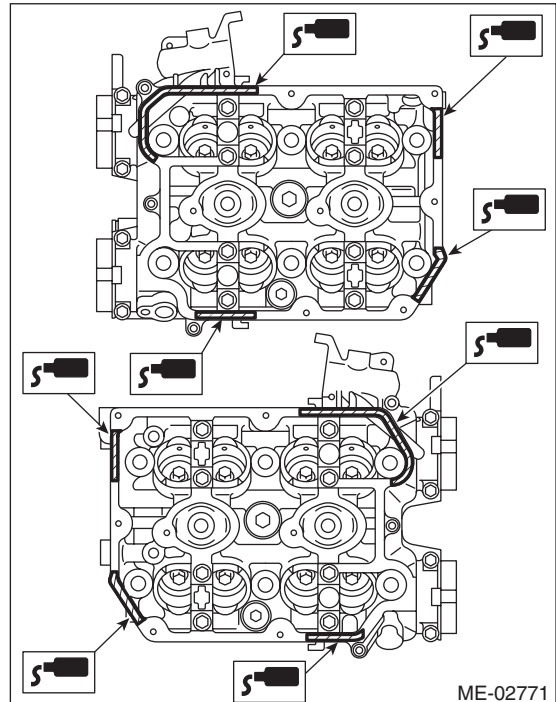
(2) Apply liquid gasket to the specified point of the cylinder head. Apply extra amount of liquid gasket around semicircular plugs 5 mm or more.

**NOTE:**

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

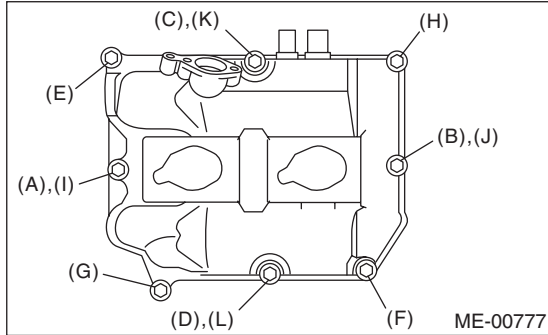
**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



(3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.

(4) Temporarily tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to specified torque in alphabetical order.

**Tightening torque:**  
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



(5) Connect the PCV hose.

15) Install the timing belt cover.  
 <Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

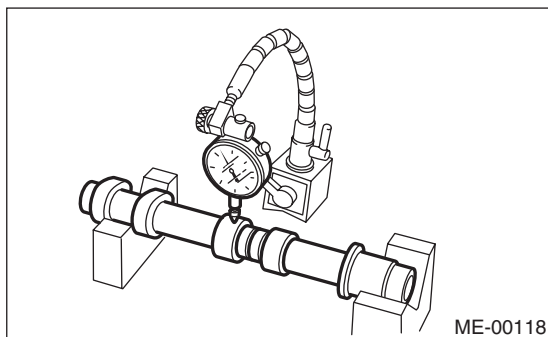
16) Install the crank pulley.  
 <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

17) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

## C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

**Service limit:**  
**0.020 mm (0.0079 in) or less**



2) Check the journal for damage and wear. Replace if faulty.

3) Measure the outside diameter of camshaft journal. If the journal diameter is not within the standard value, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard	37.946 — 37.963	29.946 — 29.963
mm (in)	(1.4939 — 1.4946)	(1.1790 — 1.1796)

4) Measurement of the camshaft journal oil clearance

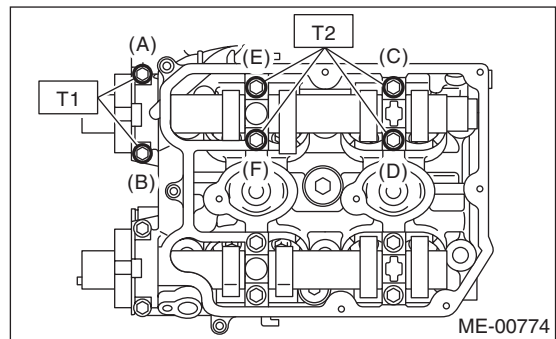
(1) Clean the bearing caps and camshaft journals.

(2) Place the camshafts on cylinder head. (Without installing the valve lifter)

(3) Place a plastigauge across each camshaft journals.

(4) Gradually tighten the cap in at least two stages in alphabetical order shown in the figure, and then tighten to specified torque. Do not turn the camshaft.

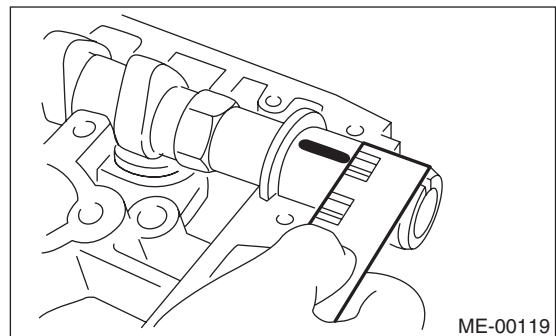
**Tightening torque:**  
**T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)**  
**T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)**



(5) Remove the bearing caps.

(6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the standard, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

**Standard:**  
**0.037 — 0.072 mm (0.0015 — 0.0028 in)**



(7) Completely remove the plastigauge.

# Camshaft

## MECHANICAL

5) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H. If it exceeds the standard or offset wear occurs, replace it.

### **Cam height H:**

#### **Standard**

##### **Intake**

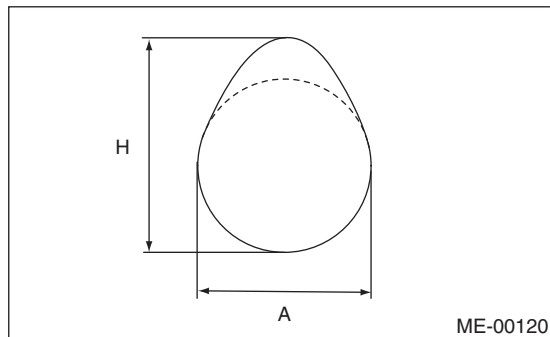
**46.55 — 46.65 mm (1.833 — 1.837 in)**

##### **Exhaust**

**46.75 — 46.85 mm (1.841 — 1.844 in)**

### **Cam base circle diameter A:**

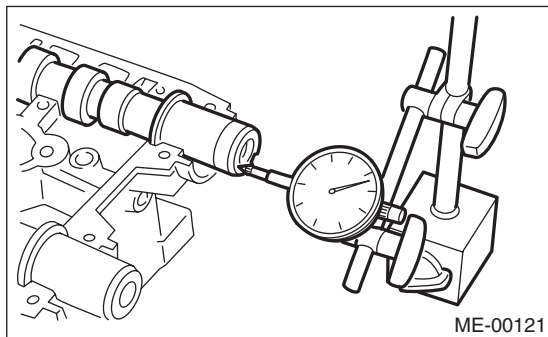
**37.0 mm (1.457 in)**



6) Measure the thrust clearance of camshaft with setting the dial gauge at end of camshaft. If the thrust clearance exceeds the standard or there is offset wear, replace the caps and cylinder head as a set. If necessary replace the camshaft.

### **Standard:**

**0.068 — 0.116 mm (0.0027 — 0.0047 in)**



## 19. Cylinder Head

### A: REMOVAL

**NOTE:**

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H4DOTC)-25, INSPECTION, Valve Clearance.>

1) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>

2) Remove the crank pulley. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>

3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>

4) Remove the timing belt. <Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>

5) Remove the cam sprocket. <Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>

6) Remove the intake manifold. <Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>

7) Remove the secondary air combination valve. <Ref. to EC(H4DOTC)-21, REMOVAL, Secondary Air Combination Valve.>

8) Remove the bolt which installs the A/C compressor bracket on cylinder head.

9) Remove the camshaft. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>

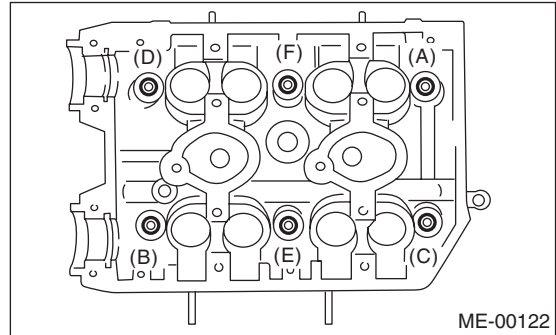
10) Remove the oil level gauge guide. (LH side)

11) Remove the cylinder head bolts in alphabetical order shown in the figure.

**NOTE:**

Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.

12) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.

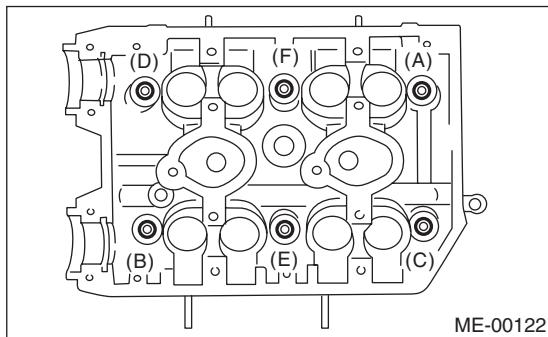


13) Remove the cylinder head gasket.

**CAUTION:**

**Be careful not to scratch the mating surface of cylinder head and cylinder block.**

14) Similarly, remove the cylinder head (RH).



# Cylinder Head

MECHANICAL

## B: INSTALLATION

1) Install the cylinder head and gaskets on cylinder block.

### CAUTION:

**Be careful not to scratch the mating surface of cylinder head and cylinder block.**

### NOTE:

Use a new cylinder head gasket.

2) Tighten the cylinder head bolts.

(1) Apply a thin coat of engine oil to washer and bolt thread.

(2) Tighten all bolts to 29 N·m (3.0 kgf·m, 21.4 ft·lb) in alphabetical order.

(3) Further tighten all bolts to 69 N·m (7.0 kgf·m, 50.9 ft·lb) in alphabetical order.

(4) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.

(5) Tighten all bolts to 49 N·m (5.0 kgf·m, 36.1 ft·lb) in alphabetical order.

(6) Tighten all bolts by 80 to 90° in alphabetical order.

(7) Tighten all bolts by 40 to 45° in alphabetical order.

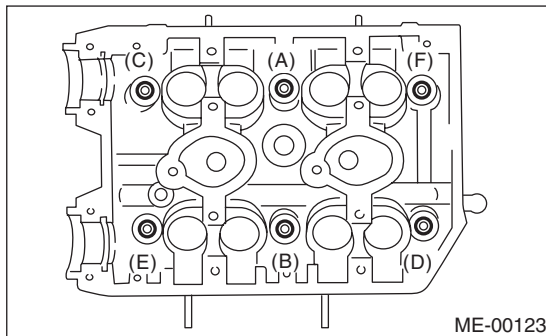
### CAUTION:

**Do not tighten the bolts 45°.**

(8) Further tighten the bolts (A) and (B) by 40 to 45°.

### CAUTION:

**Make sure the total “re-tightening angle” of the step (7) and (8) does not exceed 90°.**



3) Install the oil level gauge guide. (LH side)

### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

4) Install the camshaft. <Ref. to ME(H4DOTC)-54, INSTALLATION, Camshaft.>

5) Install the bolt of A/C compressor bracket to the cylinder head.

### Tightening torque:

**36 N·m (3.7 kgf·m, 26.6 ft·lb)**

6) Install the secondary air combination valve. <Ref. to EC(H4DOTC)-22, INSTALLATION, Secondary Air Combination Valve.>

7) Install the intake manifold.

<Ref. to FU(H4DOTC)-15, INSTALLATION, Intake Manifold.>

8) Install the cam sprocket.

<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

9) Install the timing belt.

<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

10) Adjust the valve clearance. <Ref. to ME(H4DOTC)-26, ADJUSTMENT, Valve Clearance.>

11) Install the rocker cover.

(1) Install the rocker cover gasket to the rocker cover.

### NOTE:

Use a new gasket.

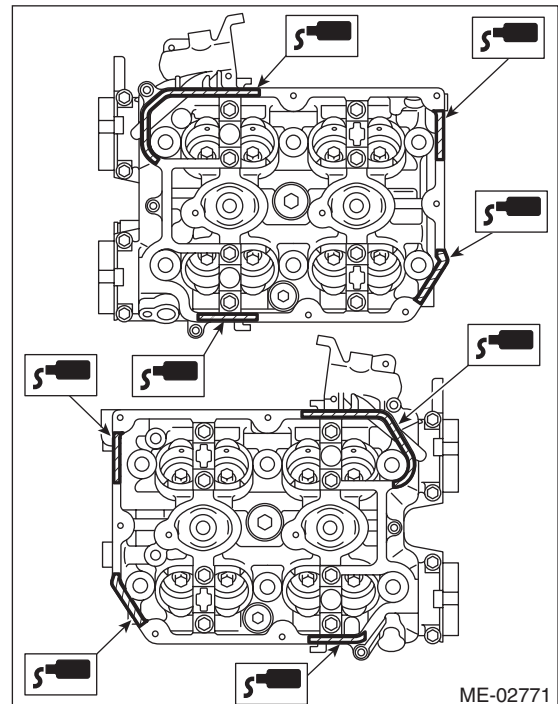
(2) Apply liquid gasket to the specified point of the cylinder head. Apply extra amount of liquid gasket around semicircular plugs 5 mm or more.

### NOTE:

Install within 5 min. after applying liquid gasket.

### Liquid gasket:

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

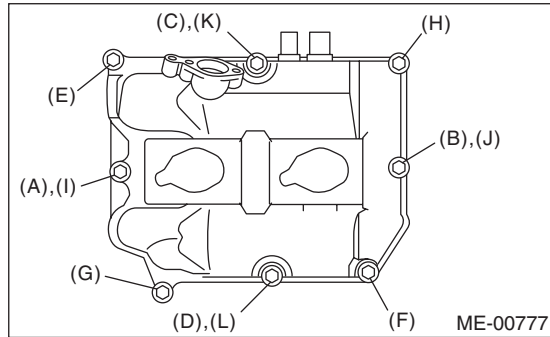


(3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.

(4) Temporarily tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to specified torque in alphabetical order.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



(5) Connect the PCV hose.

12) Install the timing belt cover.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

13) Install the crank pulley.

<Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

14) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

## C: DISASSEMBLY

1) Remove the valve lifter.

2) Place the cylinder head on ST1.

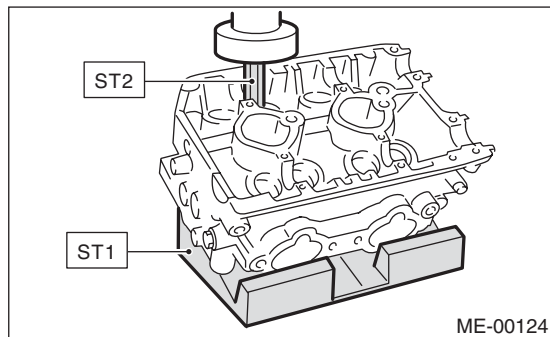
ST1 498267600 CYLINDER HEAD TABLE

3) Using ST2, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST2 499718000 VALVE SPRING REMOVER

**NOTE:**

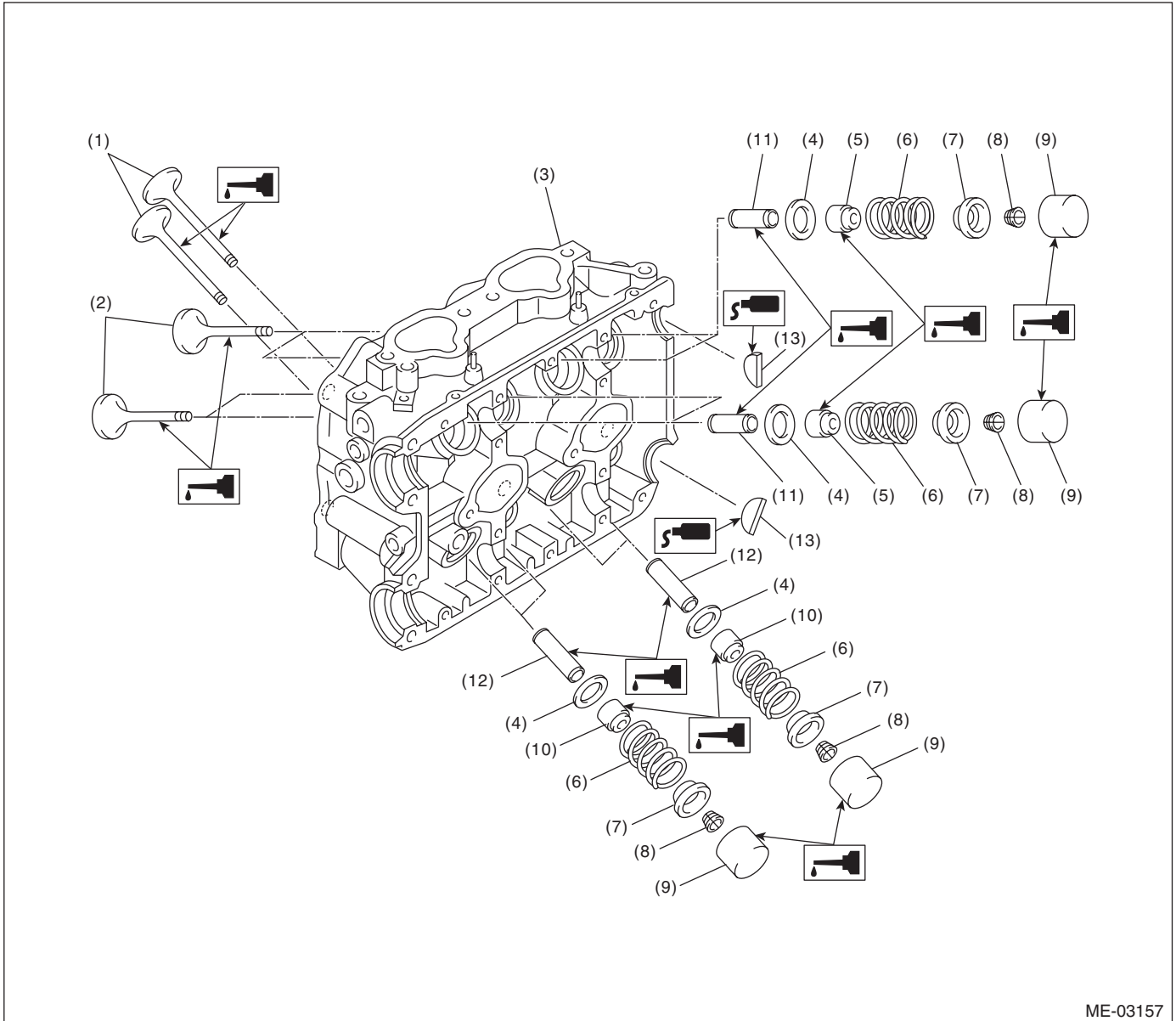
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.



# Cylinder Head

MECHANICAL

## D: ASSEMBLY



ME-03157

- |                           |                  |                             |
|---------------------------|------------------|-----------------------------|
| (1) Exhaust valve         | (6) Valve spring | (10) Exhaust valve oil seal |
| (2) Intake valve          | (7) Retainer     | (11) Intake valve guide     |
| (3) Cylinder head         | (8) Retainer key | (12) Exhaust valve guide    |
| (4) Valve spring seat     | (9) Valve lifter | (13) Plug                   |
| (5) Intake valve oil seal |                  |                             |

- 1) Install the valve spring and valve.
  - (1) Coat the stem of each valve with engine oil and insert the valve into the valve guide.

**NOTE:**

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (2) Set the cylinder head on ST1.

ST1 498267600 CYLINDER HEAD TABLE

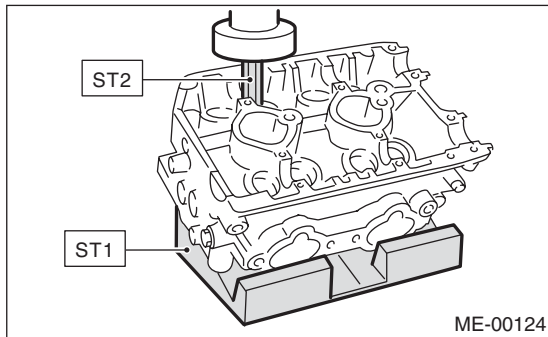
- (3) Install the valve spring and retainer.

**NOTE:**

Be sure to install the valve spring with its close-coiled end facing the seat on cylinder head.

- (4) Set the ST2 on valve spring.

ST2 499718000 VALVE SPRING REMOVER



- (5) Compress the valve spring and fit the valve spring retainer key.

- (6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

- 2) Apply oil to the surfaces of the valve lifter.
- 3) Install the valve lifter.

## E: INSPECTION

### 1. CYLINDER HEAD

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

2) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge (A) and thickness gauge (B).

If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

**Warping limit:**

**0.035 mm (0.0014 in)**

**Grinding limit:**

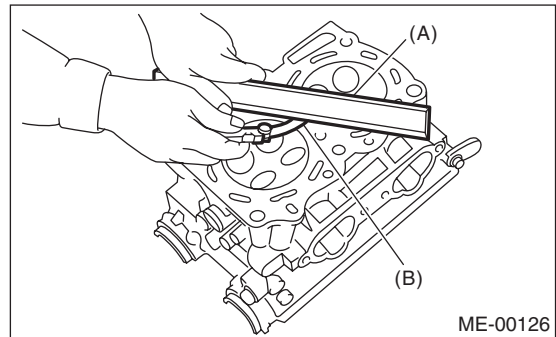
**0.3 mm (0.012 in)**

**Standard height of cylinder head:**

**127.5 mm (5.02 in)**

**NOTE:**

Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.





# Cylinder Head

## MECHANICAL

### 2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

**Valve seat width *W*:**

**Intake**

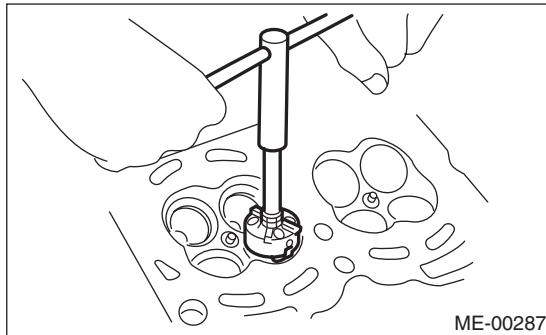
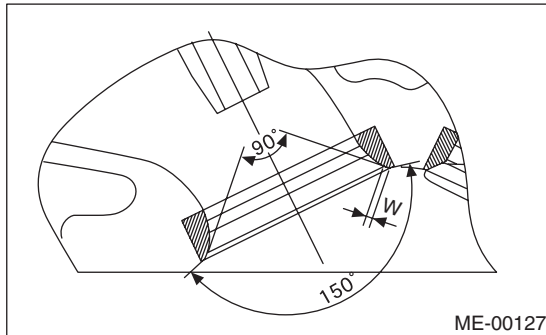
**Standard**

**0.6 — 1.4 mm (0.024 — 0.055 in)**

**Exhaust**

**Standard**

**1.2 — 1.8 mm (0.047 — 0.071 in)**



### 3. VALVE GUIDE

1) Check the clearance between valve guide and valve stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

**Clearance between the valve guide and valve stem:**

**Standard**

**Intake**

**0.030 — 0.057 mm (0.0012 — 0.0022 in)**

**Exhaust**

**0.040 — 0.067 mm (0.0016 — 0.0026 in)**

2) If the clearance between valve guide and valve stem exceeds the standard, replace the valve guide or valve itself whichever shows greater amount of wear or damaged and etc. See the following procedure for valve guide replacement.

**Valve guide inner diameter:**

**6.000 — 6.012 mm (0.2362 — 0.2367 in)**

**Valve stem outer diameters:**

**Intake**

**5.955 — 5.970 mm (0.2344 — 0.2350 in)**

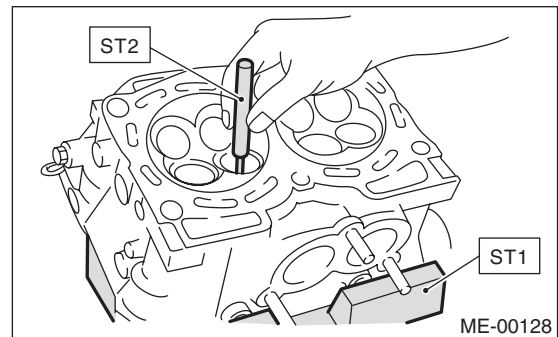
**Exhaust**

**5.945 — 5.960 mm (0.2341 — 0.2346 in)**

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

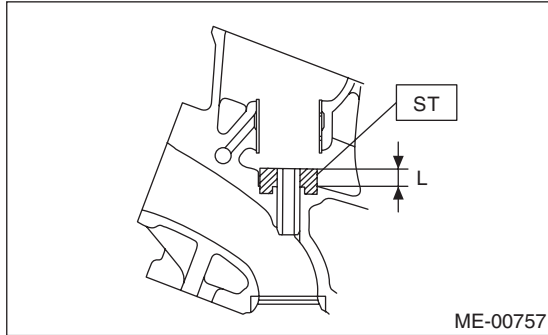
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE  
ST2 499767200 VALVE GUIDE REMOVER



(3) Turn the cylinder head upside down and place the ST as shown in the figure.

ST 18251AA020 VALVE GUIDE ADJUSTER

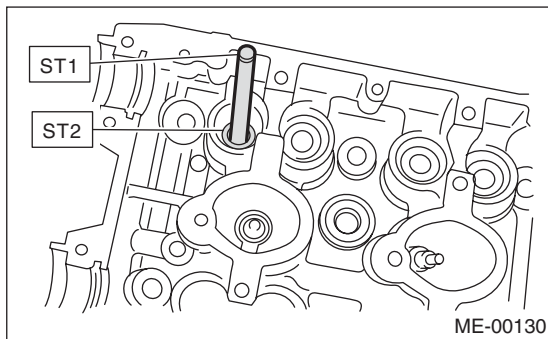


(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in cylinder, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER

ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

**Valve guide protrusion L:**

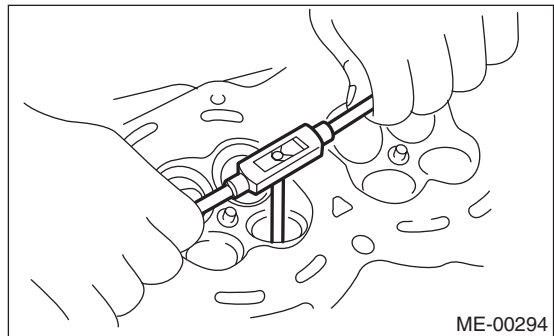
**15.8 — 16.2 mm (0.622 — 0.638 in)**

(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

**NOTE:**

- Apply engine oil to the ST when reaming.
- If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.
- If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.

ST 499767400 VALVE GUIDE REAMER



(8) After reaming, clean the valve guide to remove chips.

(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

# Cylinder Head

MECHANICAL

## 4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace the valve with a new part if damaged, worn, deformed, or if "H" is outside of the specified limit.

**Head edge thickness H:**

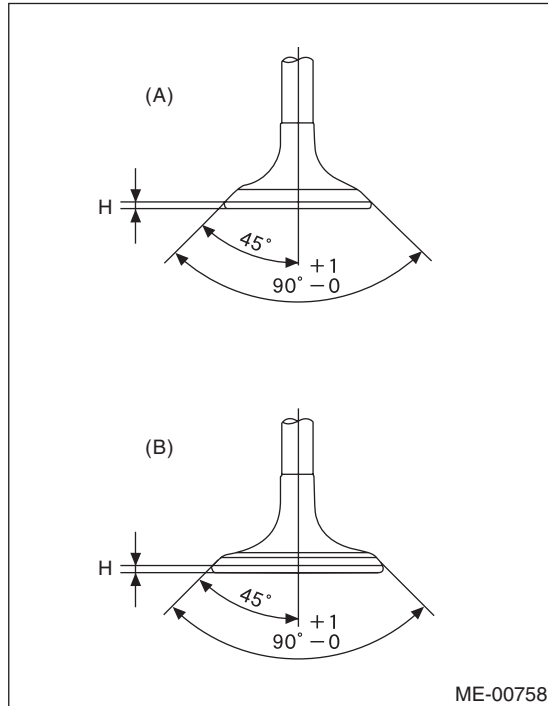
**Standard**

**Intake (A)**

**1.0 — 1.4 mm (0.039 — 0.055 in)**

**Exhaust (B)**

**1.3 — 1.7 mm (0.051 — 0.067 in)**



2) Put a small amount of grinding compound on the seat surface, and lap the valve and seat surface. Install a new valve oil seal after lapping.

**NOTE:**

It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

**Valve overall length:**

**Intake**

**104.4 mm (4.110 in)**

**Exhaust**

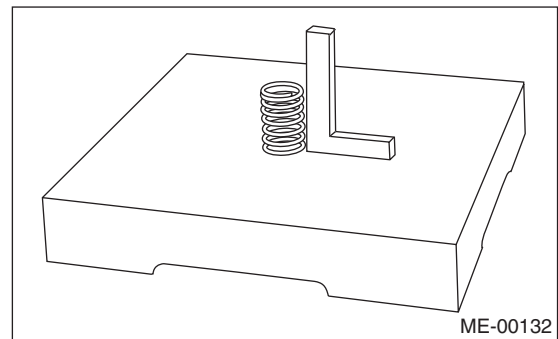
**104.65 mm (4.1201 in)**

## 5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.

2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top of spring using a try square.

Free length	mm (in)	47.32 (1.863)
Tension/spring height N (kgf, lbf)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)
	Lift	426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.041)
Squareness		2.5°, 2.1 mm (0.083 in) or less



## 6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part. See the procedure 2) and subsequent for replacement procedures.

- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1.

3) Using the ST2, press in the oil seal.

ST1 498267600 CYLINDER HEAD TABLE

ST2 498857100 VALVE OIL SEAL GUIDE

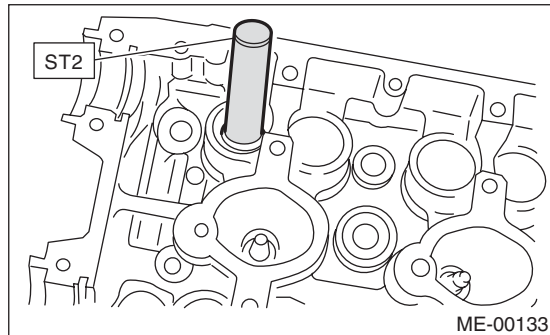
NOTE:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer, etc. or strike in.
- The intake valve oil seal and exhaust valve oil seal can be distinguished by colors.

**Color of rubber part:**

**Intake [Gray]**

**Exhaust [Green]**



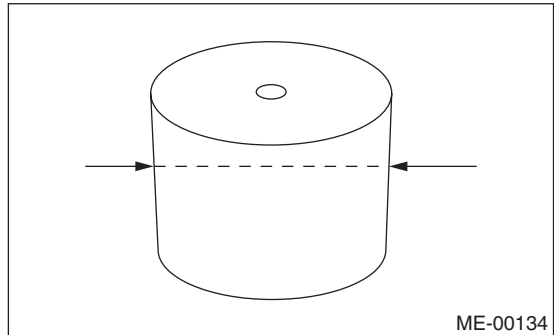
## 7. VALVE LIFTER

1) Check the valve lifter visually.

2) Measure the outer diameter of valve lifter.

**Outer diameter:**

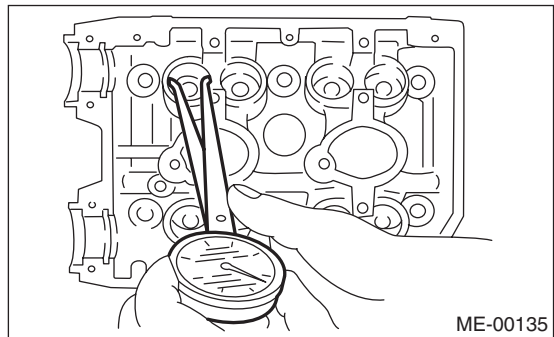
**34.959 — 34.975 mm (1.3763 — 1.3770 in)**



3) Measure the inner diameter of valve lifter mating surface on cylinder head.

**Inner diameter:**

**34.994 — 35.016 mm (1.3777 — 1.3786 in)**



NOTE:

If difference between outer diameter of valve lifter and inner diameter of its mating surface is not within the standard or there is uneven wear, replace the cylinder head.

**Standard:**

**0.019 — 0.057 mm (0.0007 — 0.0022 in)**

# Cylinder Block

MECHANICAL

## 20. Cylinder Block

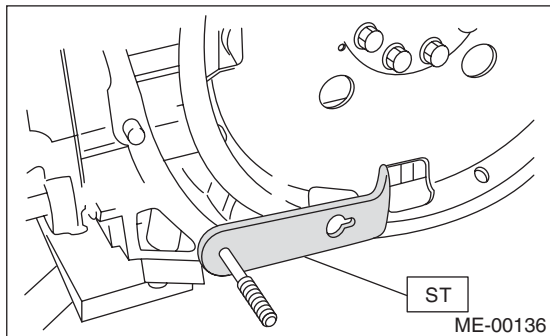
### A: REMOVAL

#### NOTE:

Before conducting this procedure, drain the engine oil completely.

- 1) Remove the intake manifold.  
<Ref. to FU(H4DOTC)-12, REMOVAL, Intake Manifold.>
- 2) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>
- 3) Remove the crank pulley.  
<Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover.  
<Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt.  
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>
- 6) Remove the cam sprocket.  
<Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket.  
<Ref. to ME(H4DOTC)-52, REMOVAL, Crank Sprocket.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the cylinder head.  
<Ref. to ME(H4DOTC)-59, REMOVAL, Cylinder Head.>
- 10) Remove the clutch disc and cover. (MT model)  
<Ref. to CL-13, REMOVAL, Clutch Disc and Cover.>
- 11) Remove the flywheel. (MT model)  
<Ref. to CL-16, REMOVAL, Flywheel.>
- 12) Remove the drive plate. (AT model)  
Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER



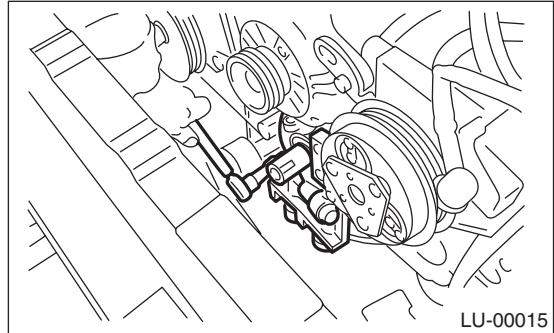
- 13) Remove the oil separator cover.
- 14) Remove the water by-pass pipe for heater.
- 15) Remove the oil filter. <Ref. to LU(H4DOTC)-23, REMOVAL, Engine Oil Filter.>
- 16) Remove the oil cooler. <Ref. to LU(H4DOTC)-23, REMOVAL, Engine Oil Filter.>

- 17) Remove the water pump. <Ref. to CO(H4DOTC)-15, REMOVAL, Water Pump.>

- 18) Remove the bolts which install oil pump onto cylinder block.

#### NOTE:

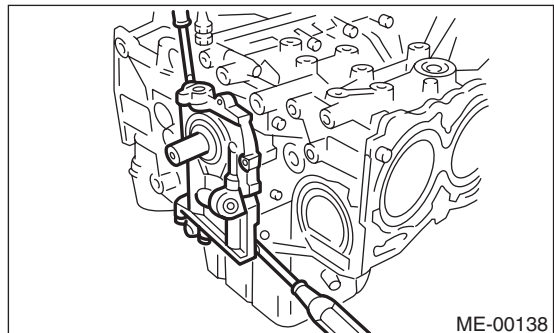
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



- 19) Remove the oil pump from cylinder block using a flat tip screwdriver.

#### CAUTION:

**Be careful not to scratch the mating surface of cylinder block and oil pump.**



- 20) Remove the front oil seal from the oil pump.

- 21) Remove the oil pan.

- (1) Set the part so that the cylinder block (LH) is on the upper side.
- (2) Remove the bolts which secure oil pan to cylinder block.
- (3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

#### CAUTION:

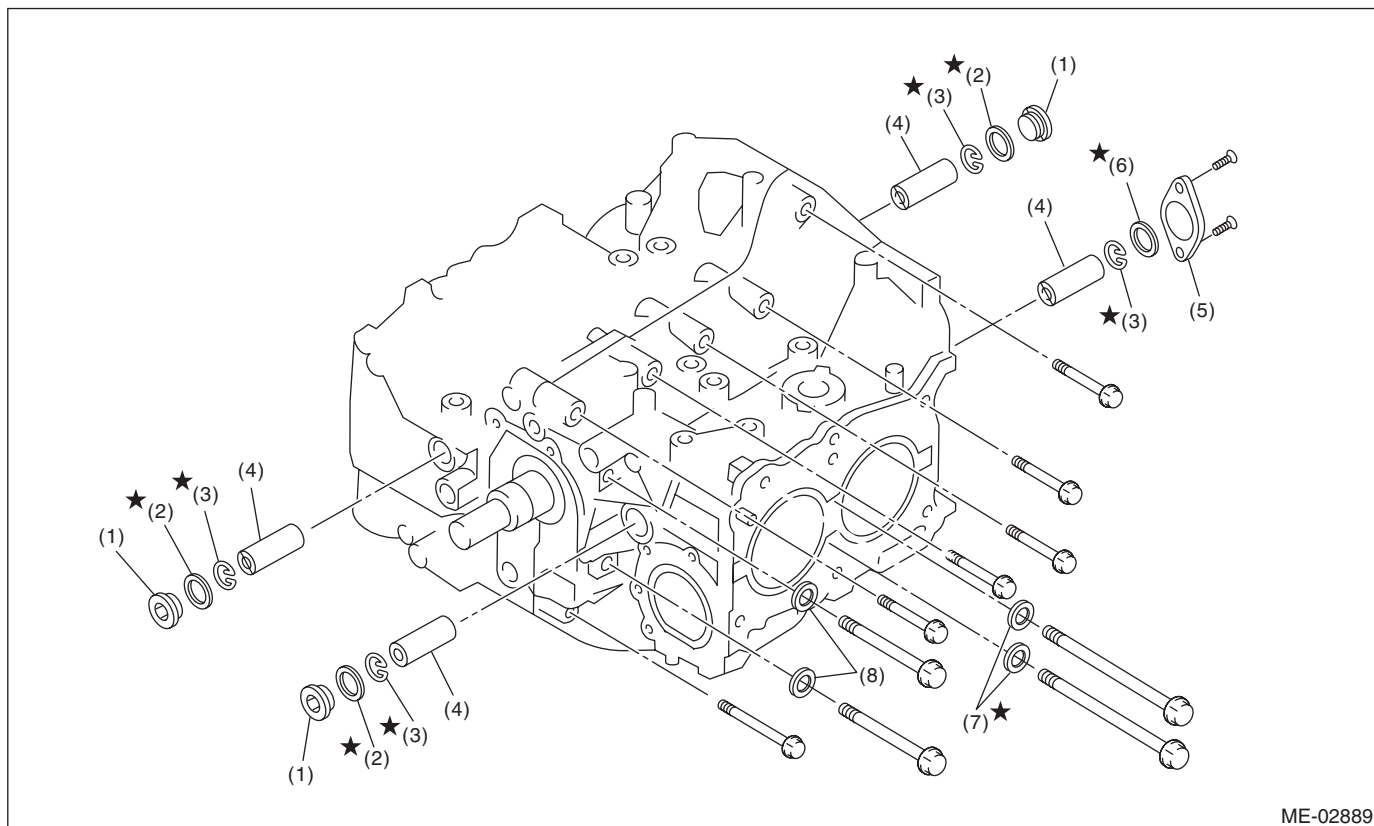
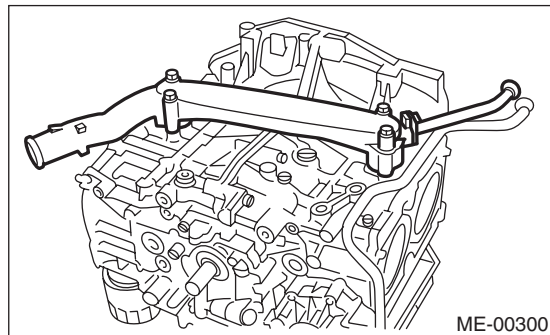
**Do not use a screwdriver or similar tools in place of oil pan cutter.**

- 22) Remove the oil strainer stay.
- 23) Remove the oil strainer.
- 24) Remove the baffle plate.

# Cylinder Block

MECHANICAL

25) Remove the water pipe.



- (1) Service hole plug
- (2) Gasket
- (3) Snap ring

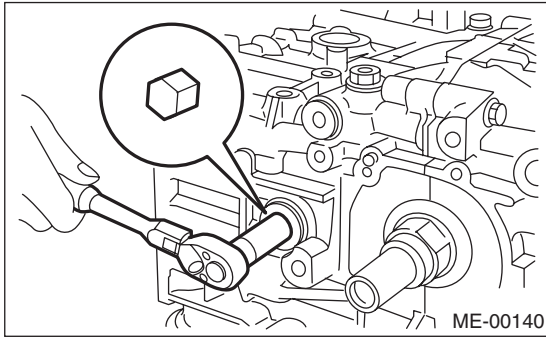
- (4) Piston pin
- (5) Service hole cover
- (6) O-ring

- (7) Seal washer
- (8) Washer

# Cylinder Block

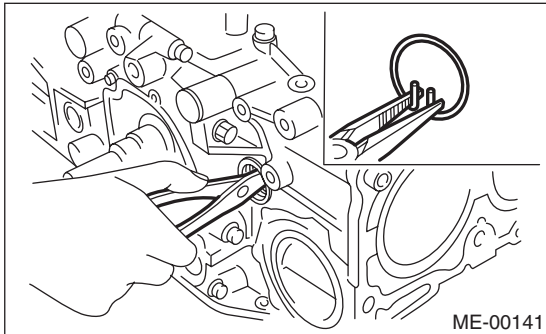
## MECHANICAL

26) Remove the service hole plugs using a hexagon wrench [14 mm].



27) Remove the service hole cover.

28) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.

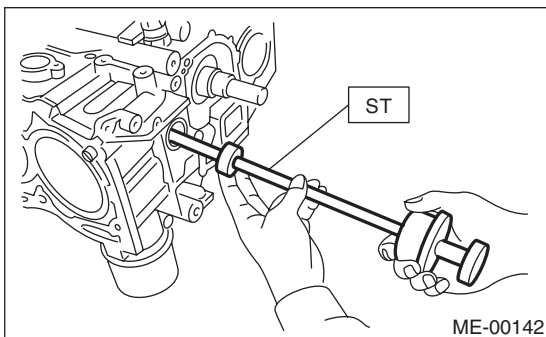


29) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

### NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



30) Similarly remove the piston pins from #3 and #4 pistons.

31) Remove the cylinder block connecting bolt on the RH side.

32) Loosen the cylinder block connecting bolt on the LH side by 2-3 turns.

33) Set the part so that the cylinder block (LH) is on the upper side, and remove the cylinder block connecting bolt.

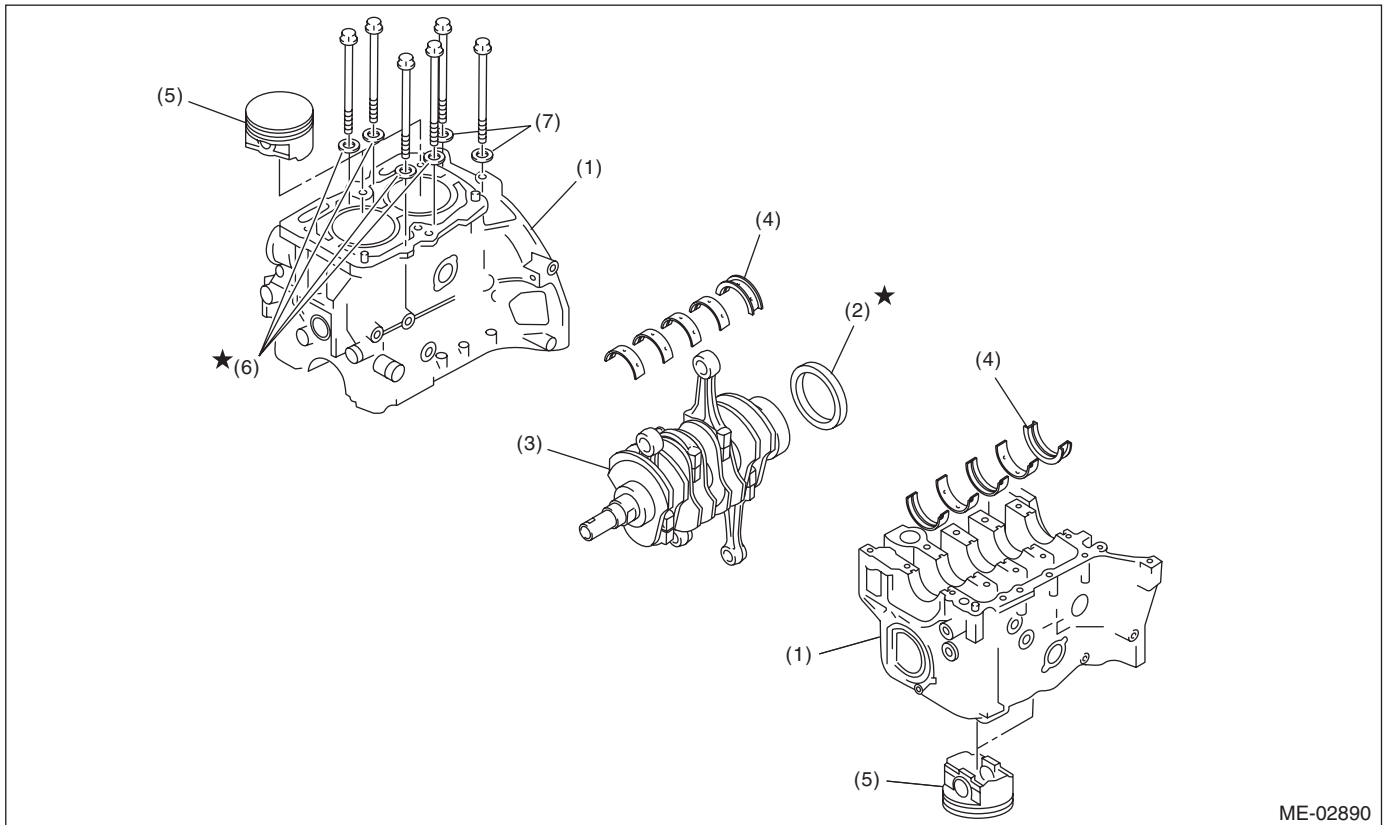
# Cylinder Block

MECHANICAL

34) Separate the cylinder block (LH) and (RH).

**NOTE:**

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



ME-02890

- |                    |                        |                 |
|--------------------|------------------------|-----------------|
| (1) Cylinder block | (4) Crankshaft bearing | (6) Seal washer |
| (2) Rear oil seal  | (5) Piston             | (7) Washer      |
| (3) Crankshaft     |                        |                 |

35) Remove the rear oil seal.

36) Remove the crankshaft together with connecting rod.

37) Remove the crankshaft bearings from cylinder block using a hammer handle.

**NOTE:**

Be careful not to confuse the crankshaft bearing combination. Press the bearing at the end opposite to locking lip.

38) Draw out each piston from cylinder block using wooden bar or hammer handle.

**NOTE:**

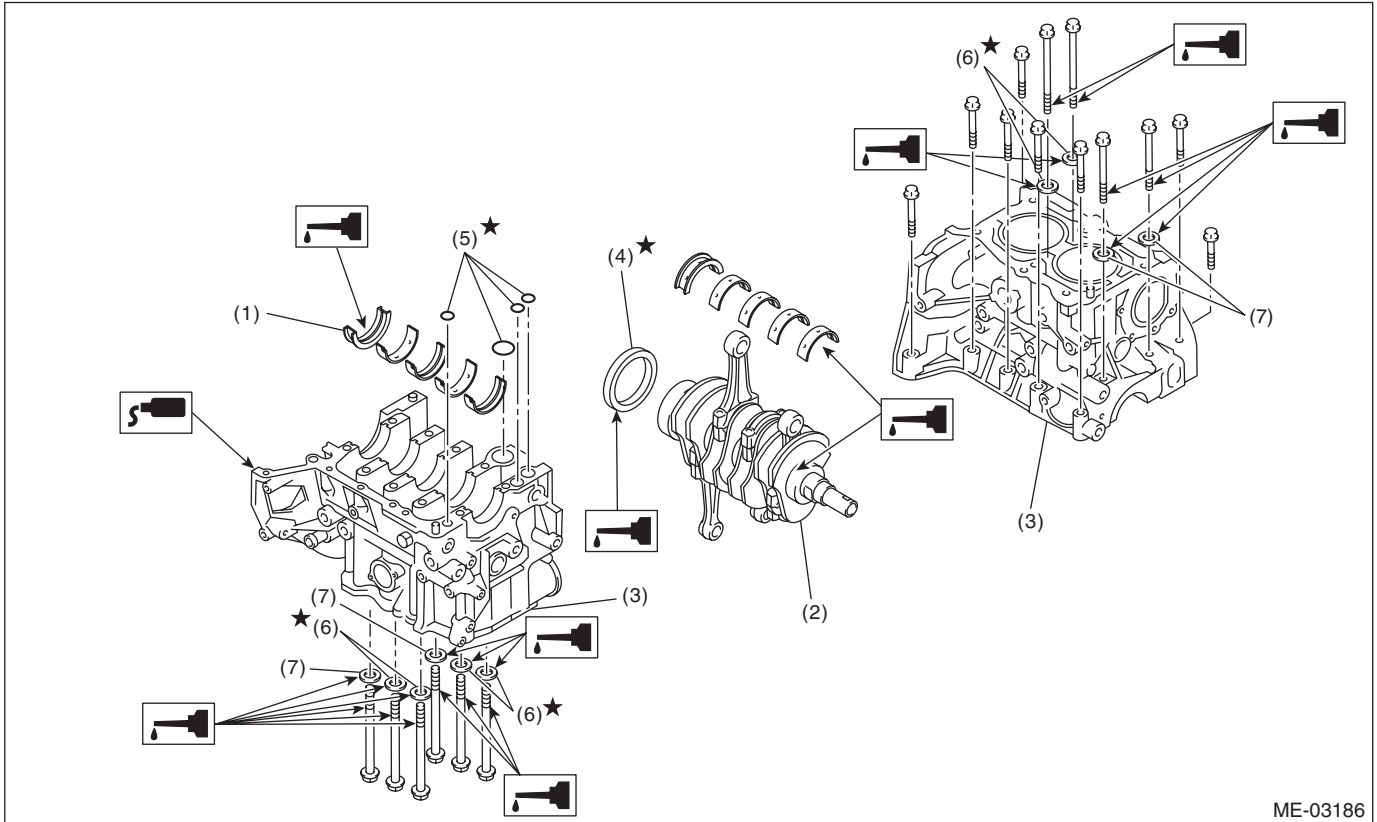
Be careful not to confuse the original combination of piston and cylinder.



# Cylinder Block

MECHANICAL

## B: INSTALLATION



ME-03186

- (1) Crankshaft bearing
- (2) Crankshaft
- (3) Cylinder block

- (4) Rear oil seal
- (5) O-ring
- (6) Seal washer

- (7) Washer

# Cylinder Block

MECHANICAL

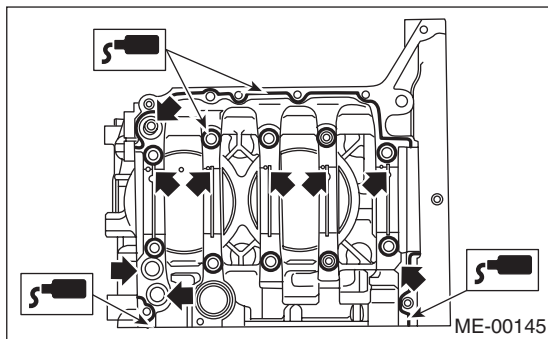
- 1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
- 2) Position the crankshaft and O-ring on the cylinder block (RH).
- 3) Apply liquid gasket to the mating surfaces of cylinder block (RH), and position the cylinder block (LH).

**NOTE:**

- Install within 5 min. after applying liquid gasket.
- Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100)  
or equivalent**



- 4) Apply a coat of engine oil to the washer and bolt thread.

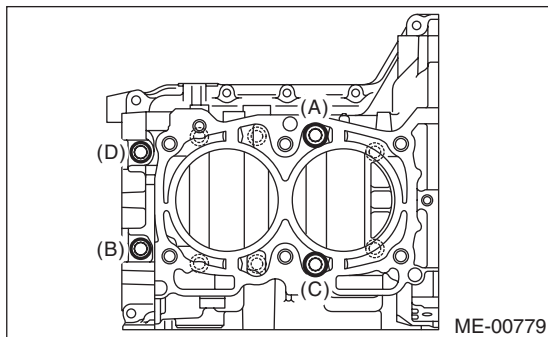
**NOTE:**

Use a new seal washer.

- 5) Tighten the 10 mm cylinder block connecting bolts on LH side (A — D) in alphabetical sequence.

**Tightening torque:**

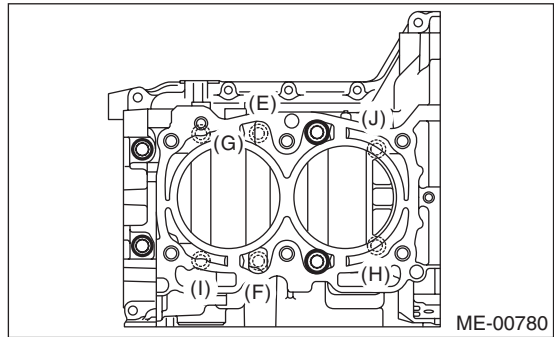
**10 N·m (1.0 kgf-m, 7.2 ft-lb)**



- 6) Tighten the 10 mm cylinder block connecting bolts on RH side (E — J) in alphabetical sequence.

**Tightening torque:**

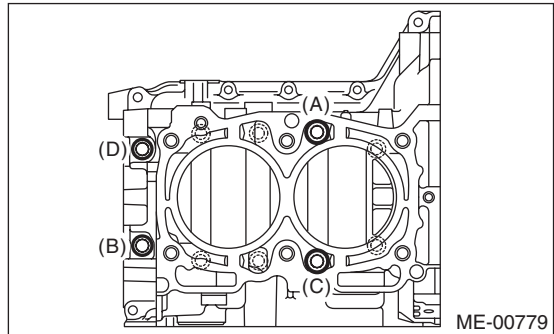
**10 N·m (1.0 kgf-m, 7.2 ft-lb)**



- 7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

**Tightening torque:**

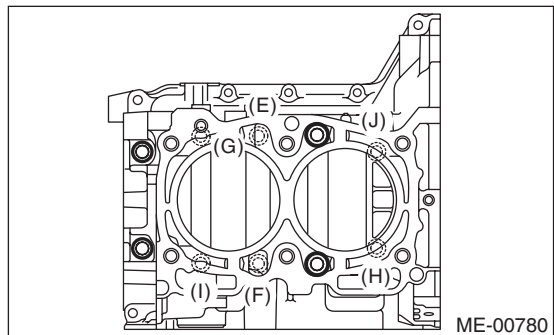
**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



- 8) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



# Cylinder Block

## MECHANICAL

9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

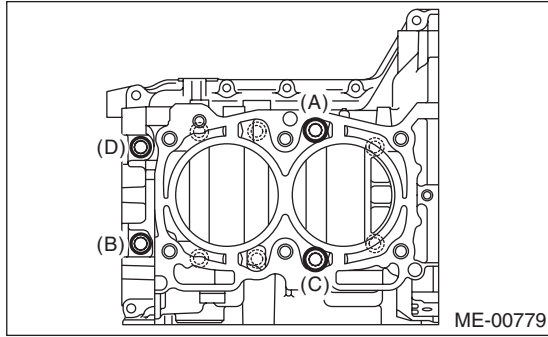
**Tightening angle:**

**90°**

- (B), (D): Torque tightening

**Tightening torque:**

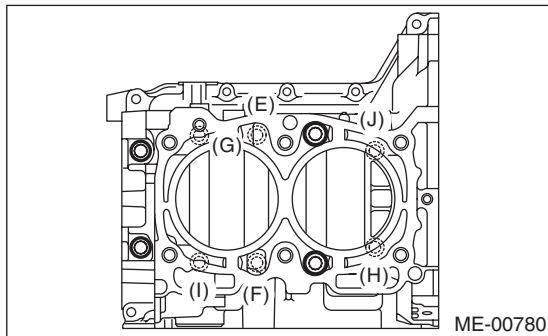
**40 N·m (4.1 kgf·m, 29.5 ft·lb)**



10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

**Tightening angle:**

**90°**

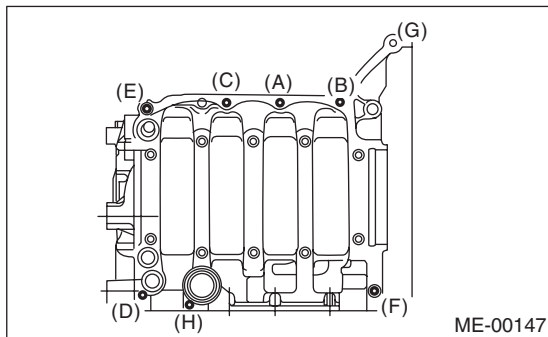


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

**Tightening torque:**

**(A) — (G): 25 N·m (2.5 kgf·m, 18.4 ft·lb)**

**(H): 6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



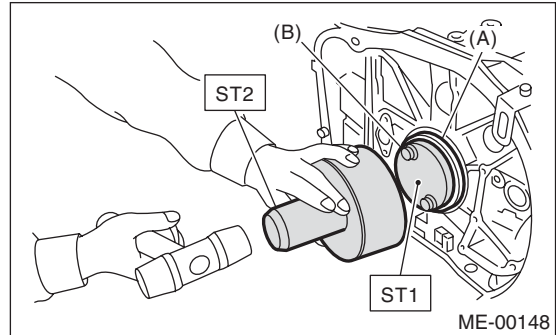
12) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

**NOTE:**

Use a new oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER

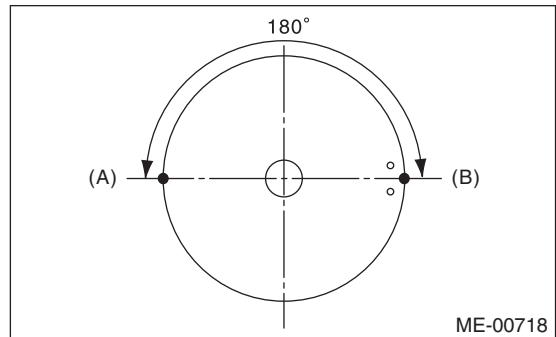


(A) Rear oil seal

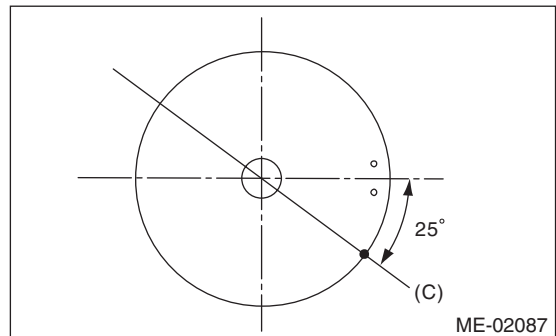
(B) Flywheel attaching bolt

13) Position the top ring gap at (A) or (B) in the figure.

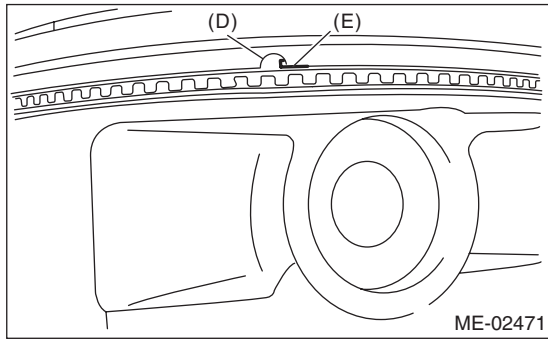
14) Position the second ring gap at 180° on the reverse side the top ring gap.



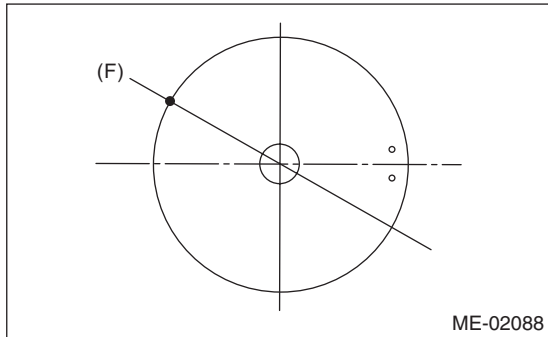
15) Position the upper rail gap at (C) in the figure.



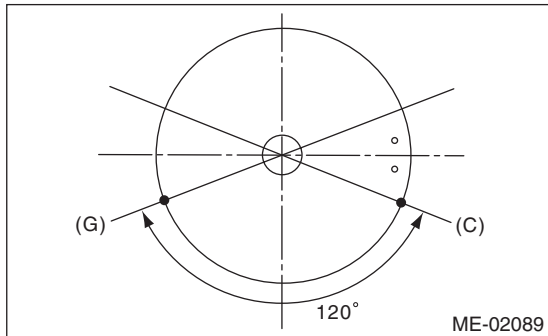
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure on the 180° opposite direction of (C).



18) Set the lower rail gap at position (G), located 120° clockwise from (C).



**NOTE:**

- Make sure ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.

# Cylinder Block

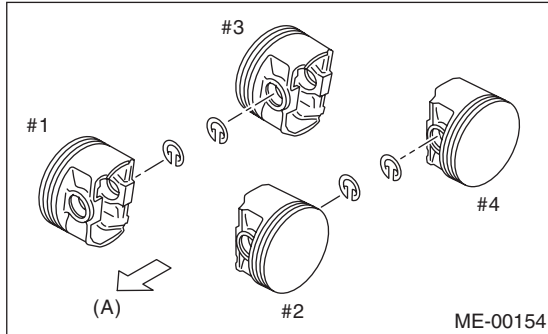
## MECHANICAL

19) Install the snap ring.

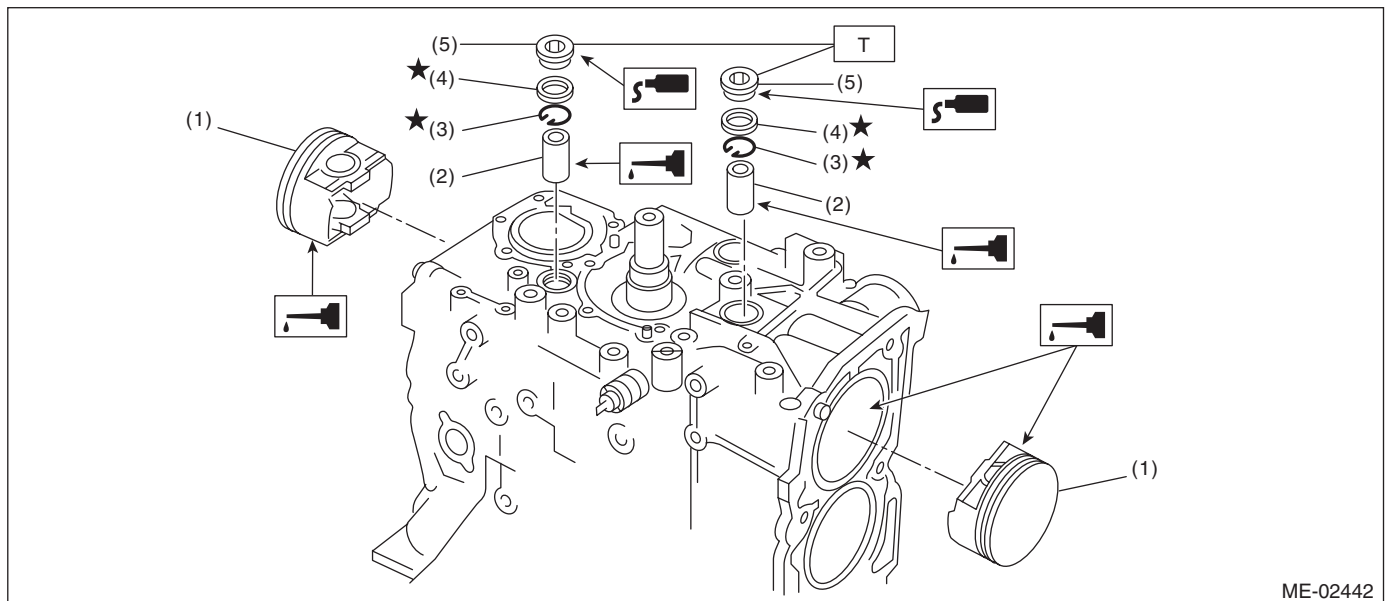
Install the snap rings in the piston holes located opposite to the service holes in cylinder block before positioning pistons in cylinders.

### NOTE:

Use new snap rings.



(A) Front side



- |                |                       |
|----------------|-----------------------|
| (1) Piston     | (4) Gasket            |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring  |                       |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T: 70 (7.1, 51.6)**

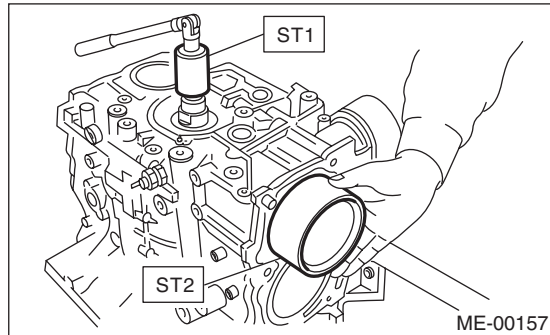
20) Install the piston.

- (1) Set the parts so that the #1 and #2 cylinders are on the upper side.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

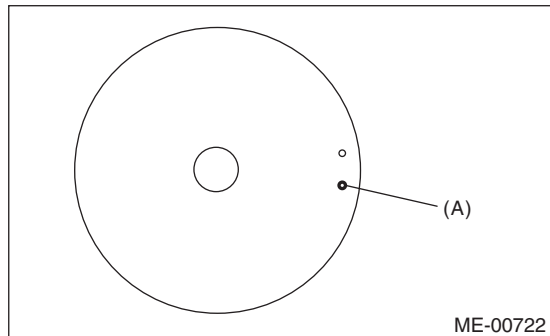
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



NOTE:

Face the piston front mark towards the front of the engine.

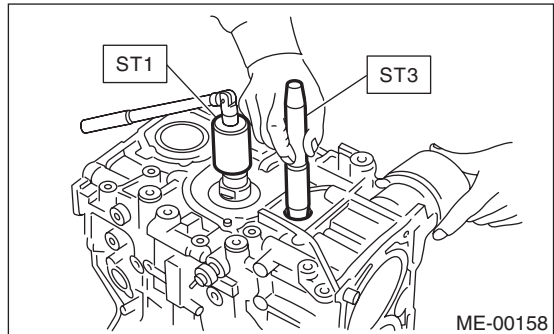


(A) Front mark

21) Install the piston pin.

- (1) Apply a coat of engine oil to ST3 before insertion, and then insert it into the service hole to align piston pin hole with connecting rod small end.

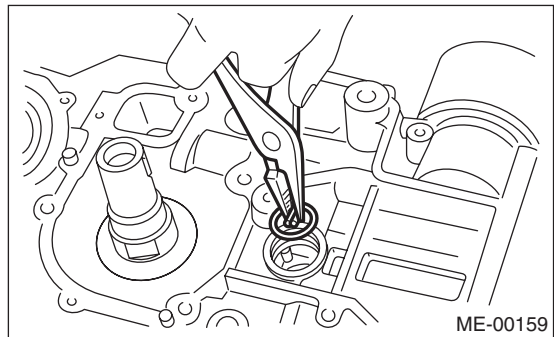
ST3 499017100 PISTON PIN GUIDE



- (2) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
- (3) Install the snap ring.

NOTE:

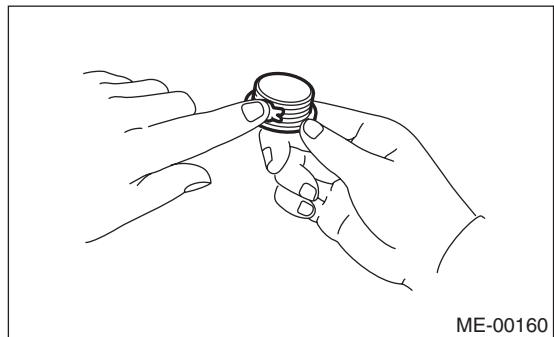
Use new snap rings.



- (4) Apply liquid gasket to the threaded portion of the service hole plug.

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**



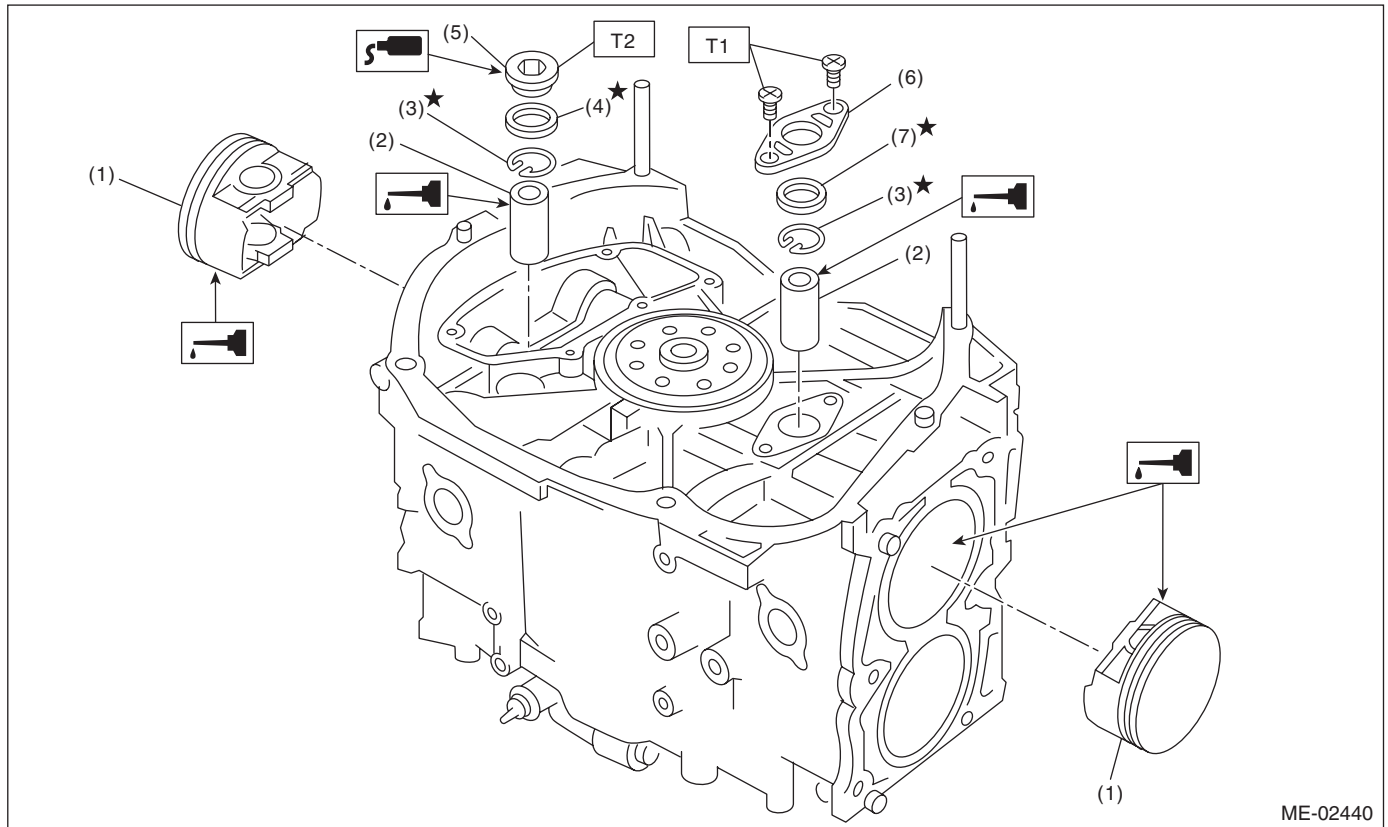
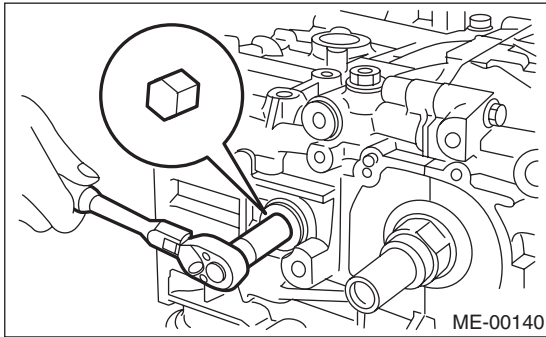
# Cylinder Block

## MECHANICAL

(5) Install the service hole plug and gasket.

### NOTE:

Use a new gasket.



- |                |                        |
|----------------|------------------------|
| (1) Piston     | (5) Service hole plug  |
| (2) Piston pin | (6) Service hole cover |
| (3) Snap ring  | (7) O-ring             |
| (4) Gasket     |                        |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 70 (7.1, 51.6)**

(6) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

(7) Install the service hole cover.

### NOTE:

Use new O-rings.

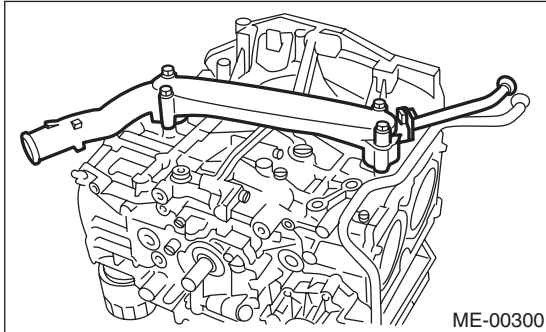
22) Install the water pipe.

NOTE:

Use new O-rings.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



23) Install the baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

24) Install the oil strainer.

NOTE:

Use new O-rings.

**Tightening torque:**

**10 N·m (1.0 kgf·m, 7.2 ft·lb)**

25) Install the oil strainer stay.

NOTE:

Tighten the oil strainer stay together with baffle plate.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

26) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:

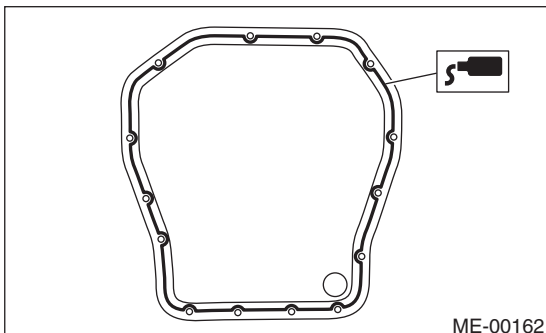
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100)  
or equivalent**

**Tightening torque:**

**5 N·m (0.5 kgf·m, 3.7 ft·lb)**



27) Apply liquid gasket to the mating surface of oil separator cover and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:

- Install within 5 min. after applying liquid gasket.
- Use new oil separator cover.

**Liquid gasket:**

**Mating surface**

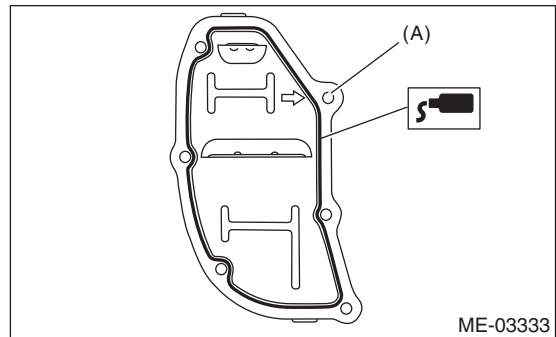
**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

**Bolt thread (A) (when reusing the bolt)**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



28) Install the flywheel. (MT model) <Ref. to CL-16, INSTALLATION, Flywheel.>

29) Install the clutch disc and cover. (MT model) <Ref. to CL-13, INSTALLATION, Clutch Disc and Cover.>

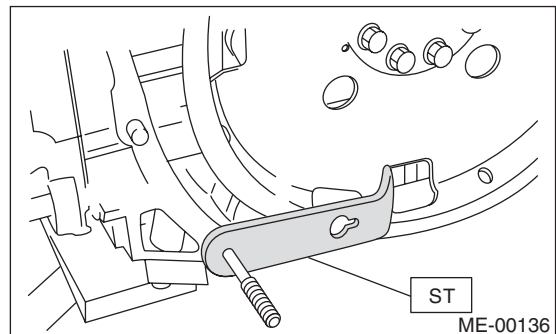
30) Install the drive plate. (AT model)

To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**72 N·m (7.3 kgf·m, 53.1 ft·lb)**





# Cylinder Block

## MECHANICAL

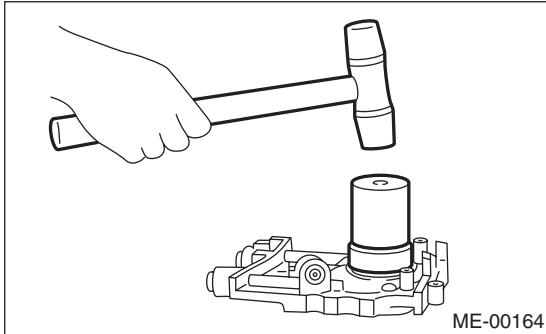
31) Install the oil pump.

(1) Using the ST, install the front oil seal.

ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new front oil seal.



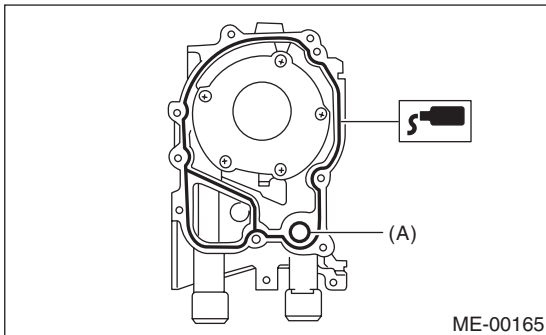
(2) Apply liquid gasket to the matching surface of oil pump.

NOTE:

Install within 5 min. after applying liquid gasket.

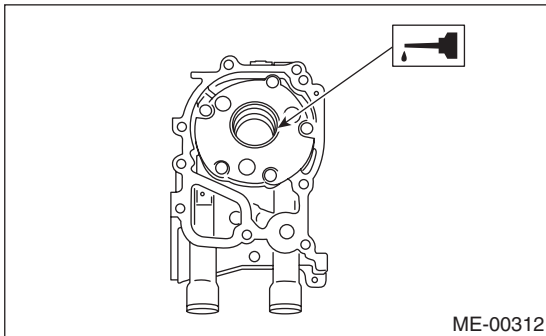
**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



(4) Install the oil pump to cylinder block. Be careful not to damage the oil seal during installation.

NOTE:

- Make sure the oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings and oil seals.
- Do not forget to install the O-ring.

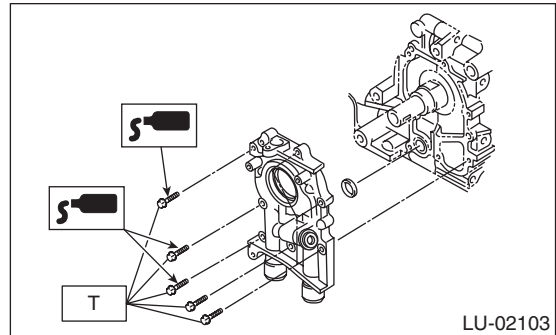
(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

**Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



32) Install the water pump and gasket.

NOTE:

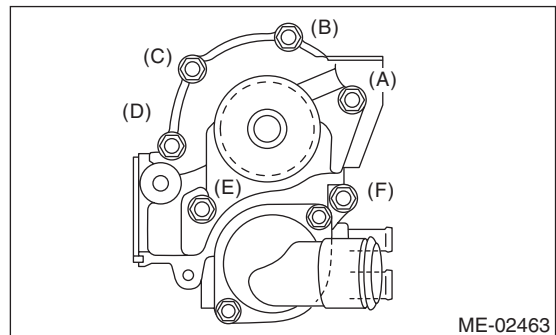
• When installing the water pump, tighten bolts in two stages in alphabetical sequence as shown in the figure.

- Use a new gasket.

**Tightening torque:**

**First: 12 N·m (1.2 kgf·m, 8.9 ft·lb)**

**Second: 12 N·m (1.2 kgf·m, 8.9 ft·lb)**



33) Install the water by-pass pipe for heater.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

34) Install the oil cooler. <Ref. to LU(H4DOTC)-22, INSTALLATION, Engine Oil Cooler.>

35) Install the oil filter. <Ref. to LU(H4DOTC)-23, INSTALLATION, Engine Oil Filter.>

- 36) Install the cylinder head.  
<Ref. to ME(H4DOTC)-60, INSTALLATION, Cylinder Head.>
- 37) Install the camshaft. <Ref. to ME(H4DOTC)-54, INSTALLATION, Camshaft.>
- 38) Install the crank sprocket. <Ref. to ME(H4DOTC)-52, INSTALLATION, Crank Sprocket.>
- 39) Install the cam sprocket.  
<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>
- 40) Install the timing belt.  
<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>
- 41) Adjust the valve clearance. <Ref. to ME(H4DOTC)-26, ADJUSTMENT, Valve Clearance.>
- 42) Install the rocker cover.  
(1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

Use a new gasket.

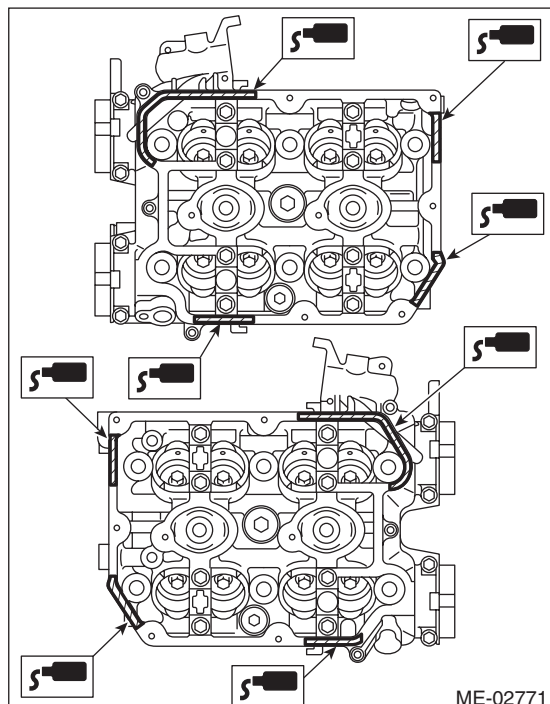
- (2) Apply liquid gasket to the specified point of the cylinder head. Apply extra amount of liquid gasket around semicircular plugs 5 mm or more.

**NOTE:**

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

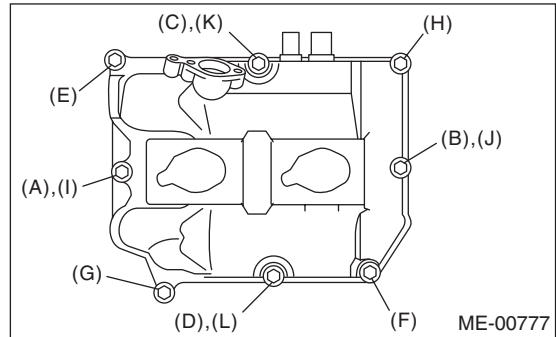
**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



- (3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.
- (4) Temporarily tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to specified torque in alphabetical order.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- (5) Connect the PCV hose.

- 43) Install the timing belt cover.  
<Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>
- 44) Install the crank pulley.  
<Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>
- 45) Install the intake manifold.  
<Ref. to FU(H4DOTC)-15, INSTALLATION, Intake Manifold.>
- 46) Install the generator and A/C compressor with their brackets.

**Tightening torque:**

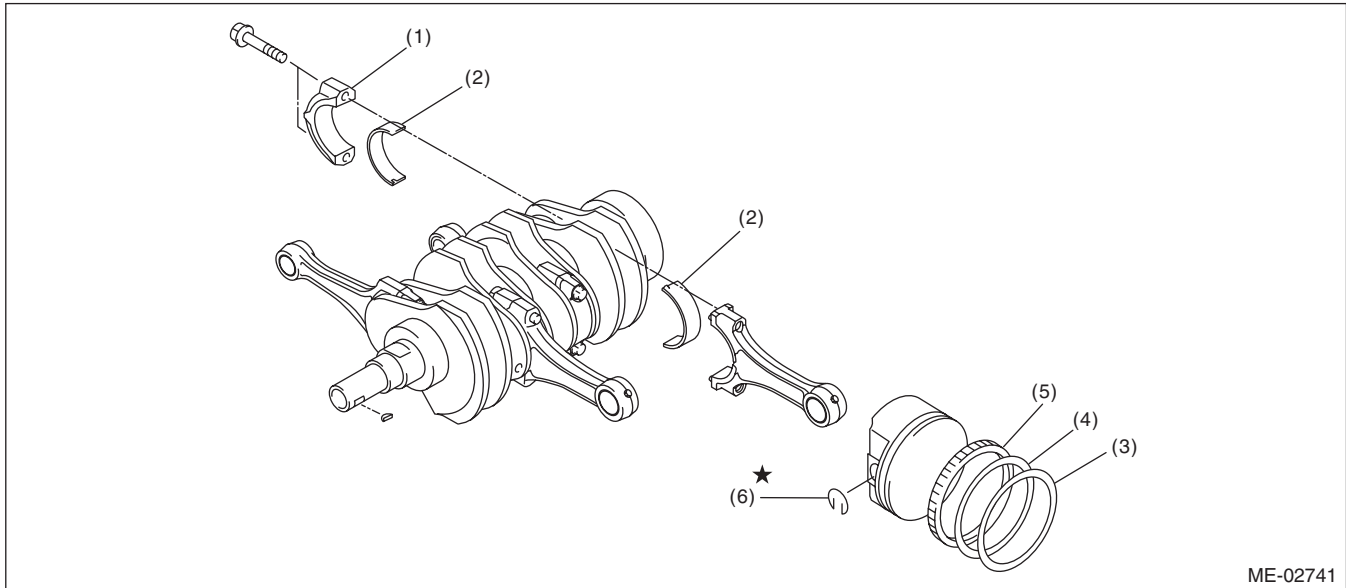
**36 N·m (3.7 kgf-m, 26.6 ft-lb)**

- 47) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

# Cylinder Block

MECHANICAL

## C: DISASSEMBLY



- |                            |                 |               |
|----------------------------|-----------------|---------------|
| (1) Connecting rod cap     | (3) Top ring    | (5) Oil ring  |
| (2) Connecting rod bearing | (4) Second ring | (6) Snap ring |

- 1) Remove the connecting rod cap.
- 2) Remove the connecting rod bearing.

### NOTE:

Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

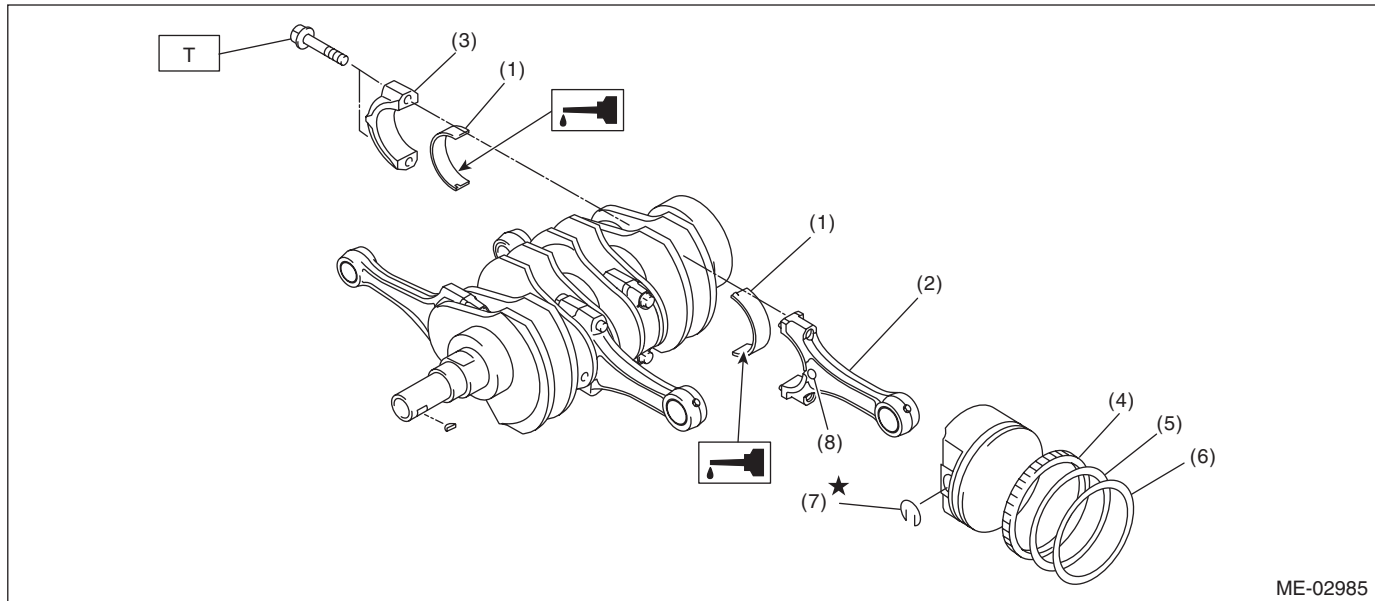
- 3) Remove the piston rings using piston ring expander.
- 4) Remove the oil ring by hand.

### NOTE:

Arrange the removed piston rings in proper order, to prevent confusion.

- 5) Remove the snap ring.

## D: ASSEMBLY



- |                            |                 |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod         | (6) Top ring    |
| (3) Connecting rod cap     | (7) Snap ring   |
| (4) Oil ring               | (8) Side mark   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 52 (5.3, 38.4)**

- 1) Apply oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
- 2) Position each connecting rod with the side mark facing forward.
- 3) Tighten the connecting rod cap with connecting rod bolt. Make sure the arrow mark on connecting rod cap facing front during installation.

**NOTE:**

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod nuts, apply oil on the threads.

**Tightening torque:**

**52 N·m (5.3 kgf·m, 38.4 ft·lb)**

- 4) Install the oil ring upper rail, expander and lower rail by hand.
- 5) Install the second ring and top ring using piston ring expander.

**NOTE:**

Assemble so that the piston ring mark "R" faces the top side of the piston.

# Cylinder Block

MECHANICAL

## E: INSPECTION

### 1. CYLINDER BLOCK

- 1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
- 2) Check the oil passages for clogging.
- 3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

**Warping limit:**  
**0.025 mm (0.00098 in)**

**Grinding limit:**  
**0.1 mm (0.004 in)**

**Standard height of cylinder block:**  
**201.0 mm (7.91 in)**

### 2. CYLINDER AND PISTON

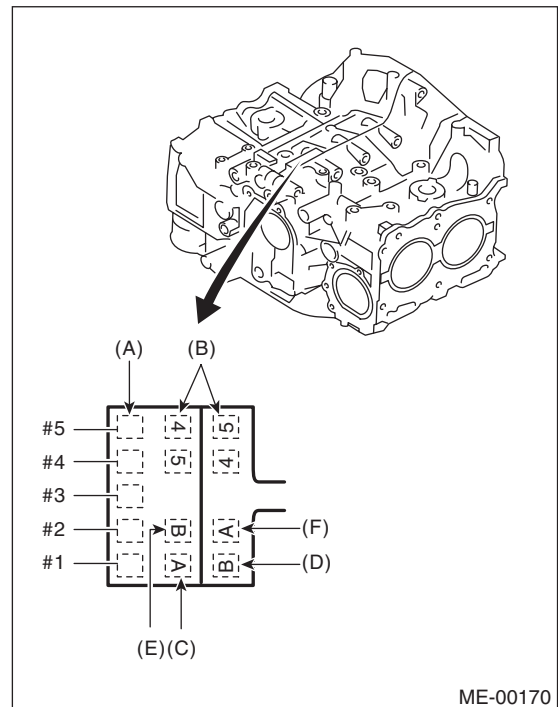
- 1) The cylinder bore size is stamped on the front upper face of the cylinder block.

NOTE:

- Measurement should be performed at a temperature of 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.

**Standard diameter:**

**A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)**  
**B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)**



- (A) Main journal size mark
- (B) Cylinder block (RH) – (LH) combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

## 2) Cylinder inner diameter measurement

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Taper:

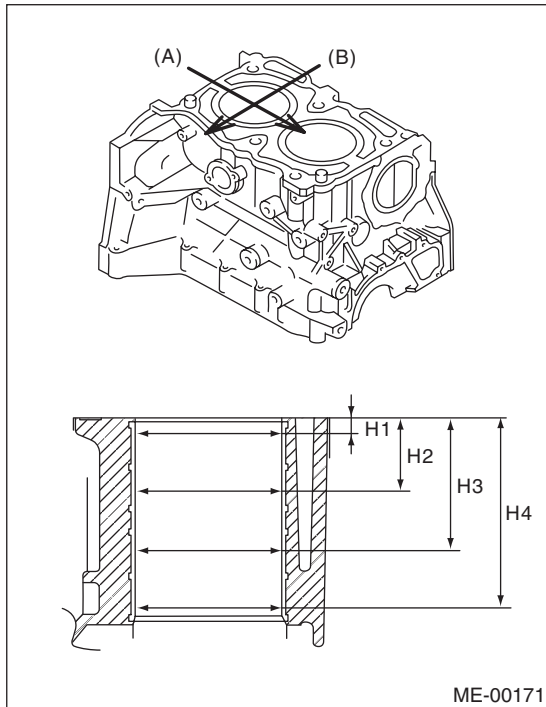
#### Standard

0.015 mm (0.0006 in)

### Out-of-roundness:

#### Standard

0.010 mm (0.0004 in)



(A) Piston pin direction

(B) Thrust direction

H1: 10 mm (0.39 in)

H2: 45 mm (1.77 in)

H3: 80 mm (3.15 in)

H4: 115 mm (4.53 in)

3) When the piston is to be replaced due to general or cylinder wear, select a suitable sized piston by measuring the piston clearance.

## 4) Cylinder outer diameter measurement

Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Piston grade point H:

38.2 mm (1.50 in)

### Piston outer diameter:

#### Standard

A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)

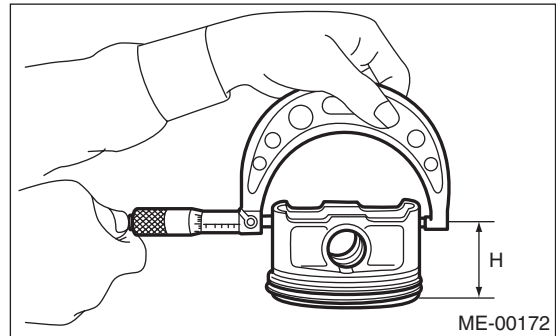
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)

0.25 mm (0.0098 in) *oversize*

99.745 — 99.765 mm (3.9270 — 3.9278 in)

0.50 mm (0.0197 in) *oversize*

99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

### NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

### Cylinder to piston clearance at 20°C (68°F):

#### Standard

-0.010 — 0.010 mm (-0.00039 — 0.00039 in)

## 6) Boring and honing

(1) If any of the measured value of taper, out-of-roundness or cylinder-to-piston clearance is out of standard or if there is any damage on the cylinder wall, rebore it to replace with an oversize piston.

### CAUTION:

**When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and replaced with oversize pistons.**

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

### NOTE:

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

### Cylinder inner diameter boring limit (diameter):

100.005 mm (3.9372 in)

# Cylinder Block

## MECHANICAL

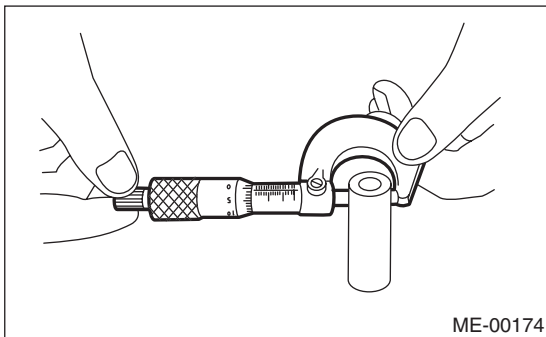
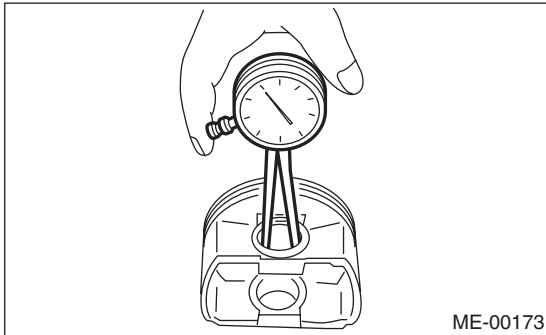
### 3. PISTON AND PISTON PIN

- 1) Check the piston and piston pin for breaks, cracks or wear. Replace if faulty.
- 2) Check the piston ring groove for wear and damage. Replace if faulty.
- 3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

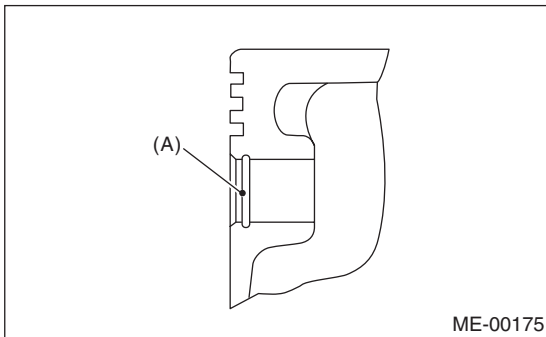
**Standard clearance between piston pin and hole in piston:**

**Standard**

**0.004 — 0.008 mm (0.0002 — 0.0003 in)**



- 4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.



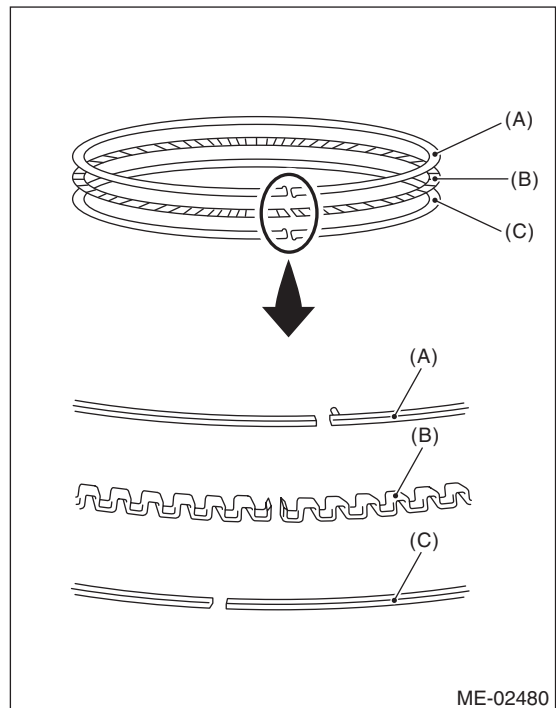
- 5) Check the piston pin snap ring for distortion, cracks and wear.

### 4. PISTON RING

- 1) If the piston ring is broken, damaged or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new part of the same size as piston.

**NOTE:**

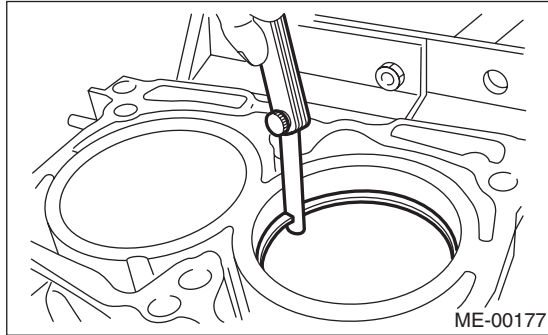
- The top ring and second ring have the mark to determine the direction to install on them. When installing the ring to piston, face this mark to the top side.
- Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

2) Squarely place the piston ring and oil ring in cylinder using the piston, and measure the piston ring gap with a thickness gauge.

		Standard mm (in)
Piston ring gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)
	Second ring	0.37 — 0.52 (0.015 — 0.020)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)

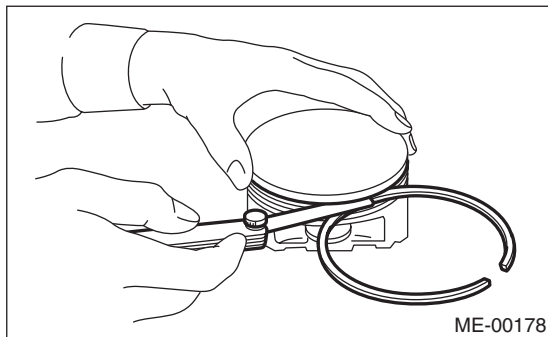


3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

**NOTE:**

Before measuring the clearance, clean the piston ring groove and piston ring.

		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



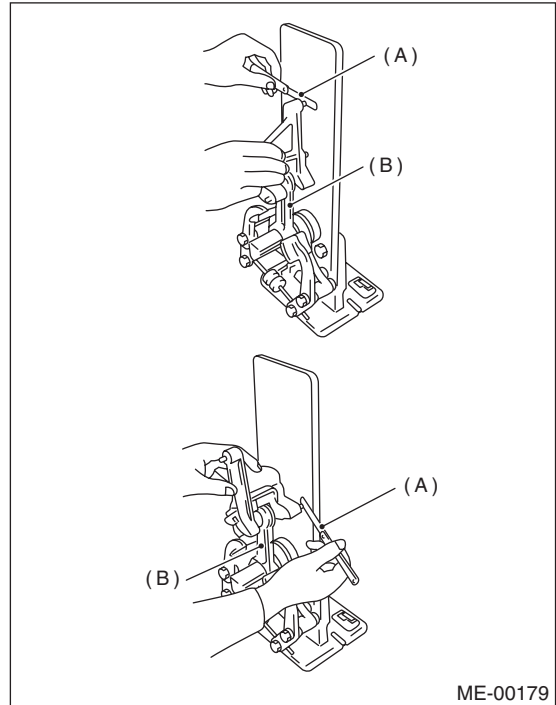
## 5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.

2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

**Limit of bend or twist per 100 mm (3.94 in) in length:**

**0.10 mm (0.0039 in)**



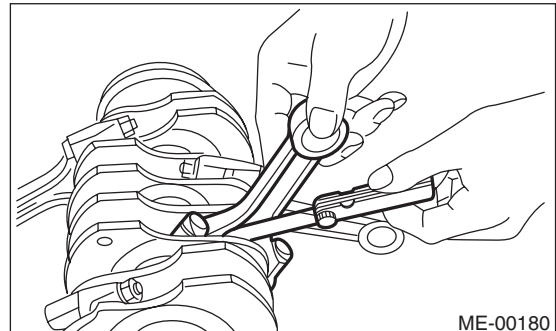
(A) Thickness gauge  
(B) Connecting rod

3) Install the connecting rod fitted with bearing to the crankshaft, and measure the thrust clearance using a thickness gauge. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

**Connecting rod thrust clearance:**

**Standard**

**0.070 — 0.330 mm (0.0028 — 0.0130 in)**



4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.



# Cylinder Block

## MECHANICAL

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or under-size as necessary.

### Connecting rod oil clearance:

#### Standard

**0.017 — 0.045 mm (0.0007 — 0.0018 in)**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

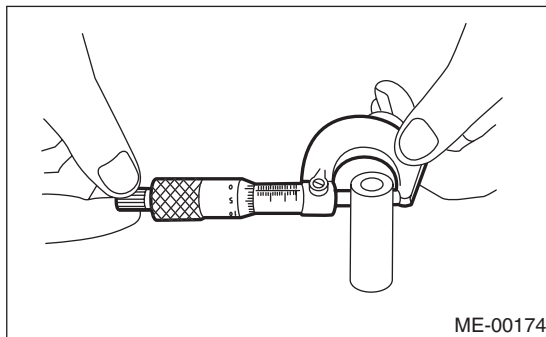
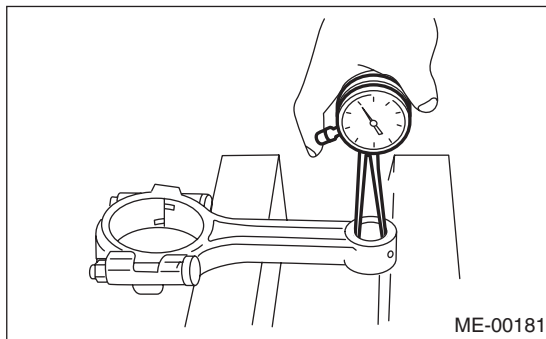
6) Inspect the bushing at connecting rod small end, and replace with a new part if worn or damaged.

7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace it with a new part.

### Clearance between piston pin and bushing:

#### Standard

**0 — 0.022 mm (0 — 0.0009 in)**

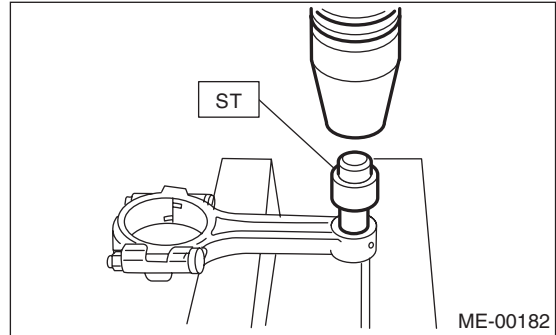


8) The replacement procedure for the connecting rod small end bushing is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with the ST after applying oil on the periphery of new bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod, and ream the inside of the bushing.

(4) After completion of reaming, clean the bushing to remove chips.

## 6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks through liquid penetrant testing, etc. If defective, replace the crankshaft.

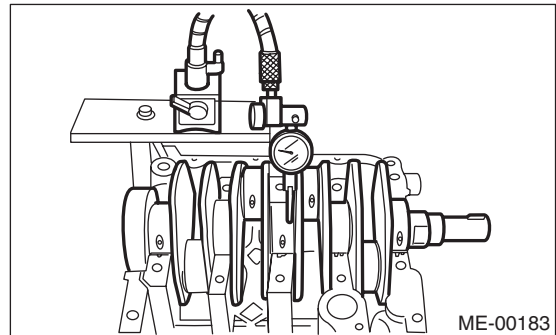
2) Measure warping of the crankshaft. If it exceeds the limit, correct or replace it.

### NOTE:

If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

### Crankshaft bend limit:

**0.035 mm (0.0014 in)**



# Cylinder Block

MECHANICAL

3) Inspect the crank journal and crank pin for wear. If they are not within the specification, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

## Crank pin:

### Out-of-roundness

0.003 mm (0.0001 in)

### Cylindricity

0.004 mm (0.0002 in)

### Grinding limit (dia.)

To 51.750 mm (2.0374 in)

## Crank journal:

### Out-of-roundness

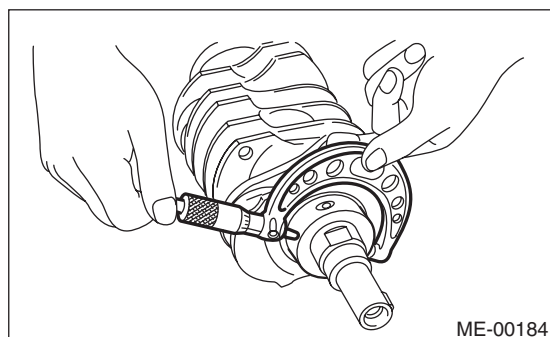
0.005 mm (0.0002 in)

### Cylindricity

0.006 mm (0.0002 in)

### Grinding limit (dia.)

To 59.758 mm (2.3527 in)



		Unit: mm (in)		
		Crank journal diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.490 — 1.502 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

# Cylinder Block

## MECHANICAL

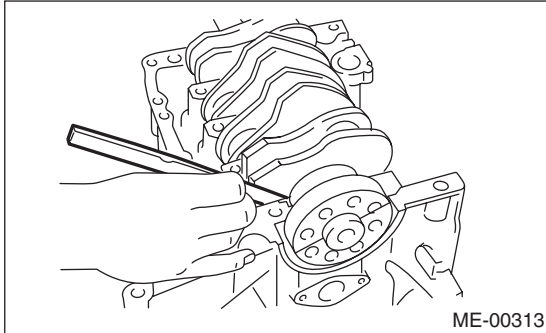
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4) Measure the thrust clearance of crankshaft at center bearing by using thickness gauge. If clearance exceeds the standard, replace the bearing.

### ***Crankshaft thrust clearance:***

#### ***Standard***

***0.030 — 0.115 mm (0.0012 — 0.0045 in)***



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or grind to correct the crankshaft as necessary.

### ***Crankshaft oil clearance:***

#### ***Standard***

***0.010 — 0.030 mm (0.0004 — 0.0012 in)***

## 21. Intake and Exhaust Valve

### A: SPECIFICATION

Refer to "Cylinder Head" for removal and installation procedures of intake and exhaust valves. <Ref. to ME(H4DOTC)-59, REMOVAL, Cylinder Head.>  
<Ref. to ME(H4DOTC)-60, INSTALLATION, Cylinder Head.>

## 22.Piston

### A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons. <Ref. to ME(H4DOTC)-68, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-72, INSTALLATION, Cylinder Block.>

## 23.Connecting Rod

### A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of connecting rod.

<Ref. to ME(H4DOTC)-68, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-72, INSTALLATION, Cylinder Block.>

## 24.Crankshaft

### A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of crankshaft. <Ref. to ME(H4DOTC)-68, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-72, INSTALLATION, Cylinder Block.>

## 25.Engine Trouble in General

### A: INSPECTION

NOTE:

The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Very often" to "Rarely".

A — Very often

B — Sometimes

C — Rarely

Symptom	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch or neutral switch	C
		Defective starter	B
	Battery	Improper connection of terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
Incorrect valve timing		B	
Improper engine oil (low viscosity)		B	



# Engine Trouble in General

## MECHANICAL

Symptom	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
Worn or stuck piston rings, cylinder and piston		C	
Incorrect valve timing		B	
Improper engine oil (low viscosity)	B		
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
Incorrect valve timing		B	
Improper engine oil (low viscosity)	B		

# Engine Trouble in General

MECHANICAL

Symptom	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
	Lubrication system	Improper engine oil (low viscosity)	B
		Incorrect oil pressure	B
Cooling system	Defective rocker cover gasket	C	
	Overheating	C	
Others	Evaporative emission control system malfunction	A	
	Stuck or damaged throttle valve	B	

# Engine Trouble in General

## MECHANICAL

Symptom	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Lubrication system	Incorrect oil pressure	B
Cooling system	Overheating	C	
	Over-cooling	C	
Others	Evaporative emission control system malfunction	A	
4. Surging	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Improper engine oil (low viscosity)	B	
	Cooling system	Overheating	B
Others	Evaporative emission control system malfunction	C	

# Engine Trouble in General

MECHANICAL

Symptom	Problem parts etc.	Possible cause	RANK
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Overheating	B
	Others	Evaporative emission control system malfunction	B
7. After burning in exhaust system	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
Lubrication system	Incorrect oil pressure	C	
Cooling system	Over-cooling	C	
Others	Evaporative emission control system malfunction	C	
8. Knocking	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
	Cooling system	Overheating	A
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
	Lubrication system	Loosened oil pump attaching bolts and defective gasket	B
		Defective oil filter gasket	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
	Loosened oil pan fitting bolts or defective oil pan	B	

# Engine Trouble in General

## MECHANICAL

Symptom	Problem parts etc.	Possible cause	RANK	
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A	
	Intake system	Dirty air cleaner element	A	
	Timing belt	Defective timing	B	
	Compression	Incorrect valve clearance		B
		Loosened spark plug or defective gasket		C
		Loosened cylinder head bolt or defective gasket		C
		Improper valve sealing		B
		Defective valve stem		C
		Worn or broken valve spring		C
		Worn or stuck piston rings, cylinder and piston		B
		Incorrect valve timing		B
	Lubrication system	Incorrect oil pressure		C
	Cooling system	Over-cooling		C

## 26.Engine Noise

### A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> <li>• Valve mechanism is defective.</li> <li>• Incorrect valve clearance</li> <li>• Worn camshaft</li> <li>• Broken valve spring</li> </ul>
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
	Oil pressure is normal.	<ul style="list-style-type: none"> <li>• Loosened flywheel mounting bolt</li> <li>• Damaged engine mounting</li> </ul>
High-pitched clank	Sound is noticeable when accelerating with an overload condition.	<ul style="list-style-type: none"> <li>• Ignition timing advanced</li> <li>• Accumulation of carbon inside combustion chamber</li> <li>• Wrong spark plug</li> <li>• Improper gasoline</li> </ul>
Clank when engine speed is between 1,000 and 2,000 rpm.	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn cylinder liner and piston ring</li> <li>• Broken or stuck piston ring</li> <li>• Worn piston pin and hole at piston end of connecting rod</li> </ul>
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	<ul style="list-style-type: none"> <li>• Unusually worn valve lifter</li> <li>• Worn cam sprocket</li> <li>• Worn camshaft journal bore in cylinder head</li> </ul>
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Poor contact of generator brush and rotor
Gear scream when starting engine	—	<ul style="list-style-type: none"> <li>• Defective ignition starter switch</li> <li>• Worn gear and starter pinion</li> </ul>
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> <li>• Loose V-belt</li> <li>• Defective water pump shaft</li> </ul>
Hissing sound	—	<ul style="list-style-type: none"> <li>• Insufficient compression</li> <li>• Air leakage in air intake system, hose, connection or manifold</li> </ul>
Timing belt noise	—	<ul style="list-style-type: none"> <li>• Loose timing belt</li> <li>• Belt contacting with case/adjacent part</li> </ul>
Valve noise	—	Incorrect valve clearance

**NOTE\*)**

When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

# Engine Noise

MECHANICAL

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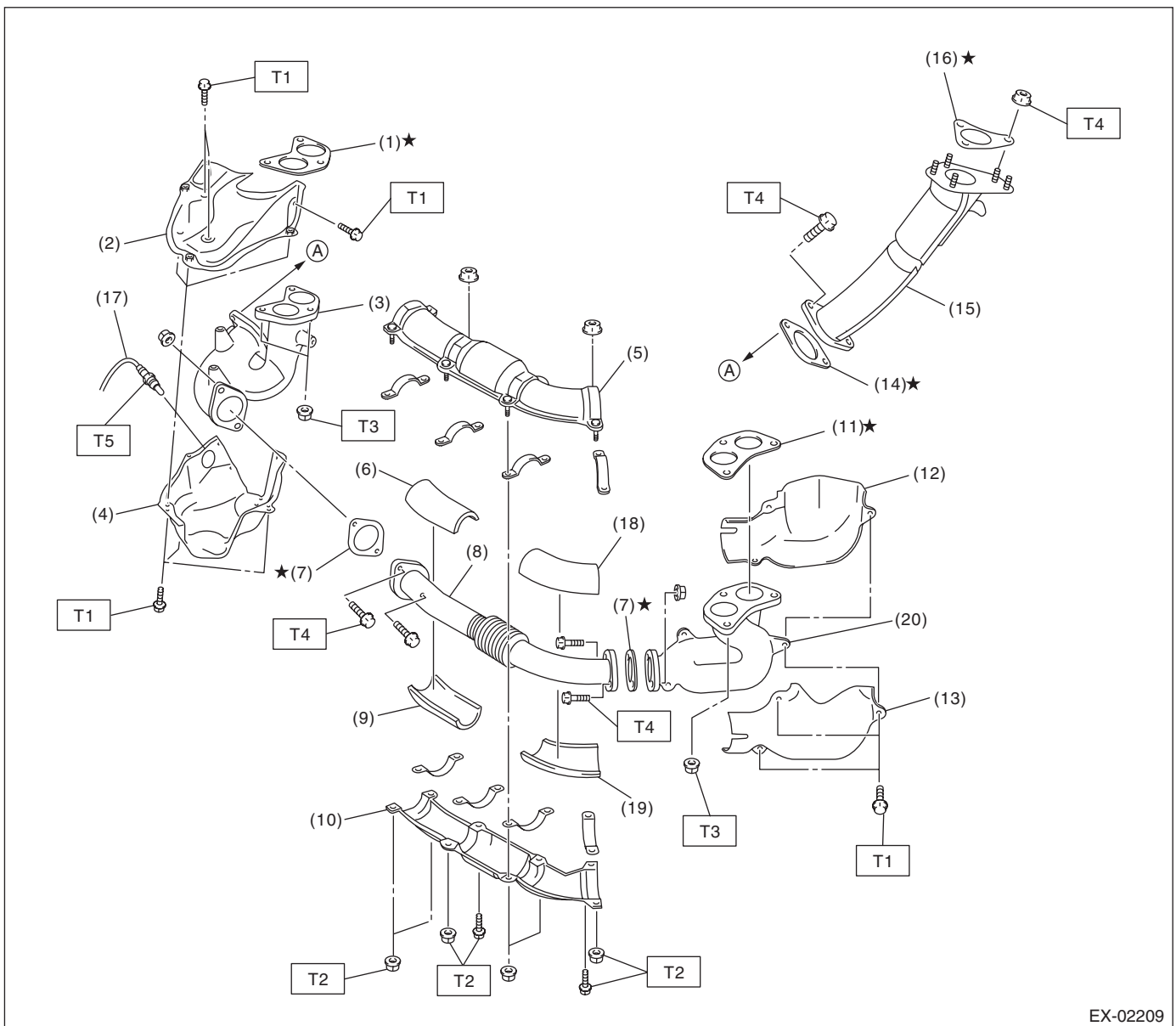
# General Description

EXHAUST

## 1. General Description

A: COMPONENT

### 1. FRONT EXHAUST PIPE



EX-02209



# General Description

EXHAUST

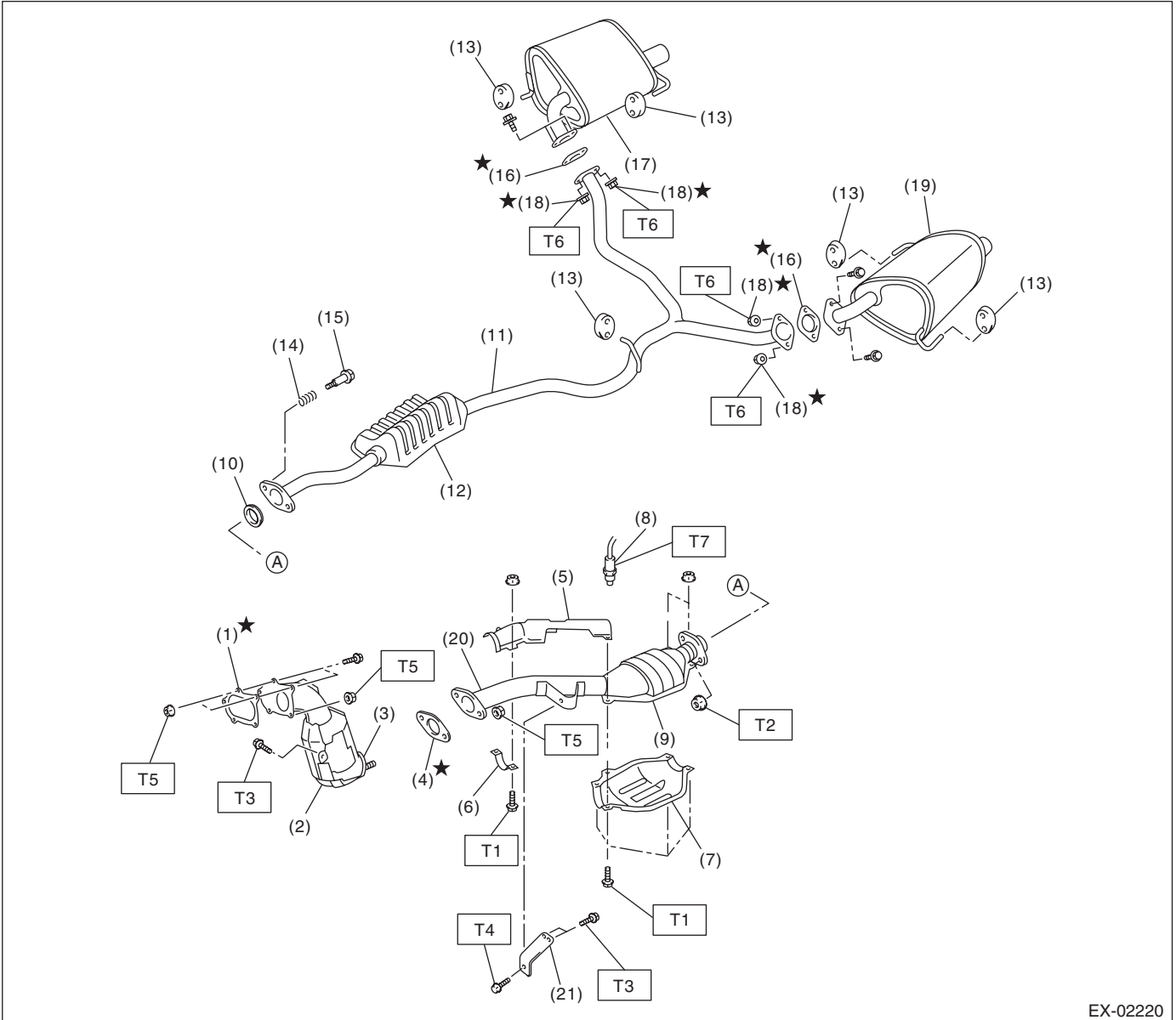
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(1) Gasket	(10) Front exhaust pipe lower cover	(20) Exhaust manifold (LH)
(2) Exhaust manifold upper cover (RH)	(11) Gasket	
(3) Exhaust manifold (RH)	(12) Exhaust manifold upper cover (LH)	<hr/> <b>Tightening torque:N-m (kgf-m, ft-lb)</b>
(4) Exhaust manifold lower cover (RH)	(13) Exhaust manifold outer cover (LH)	<b>T1: 19 (1.9, 14.0)</b>
(5) Front exhaust pipe upper cover	(14) Gasket	<b>T2: 25 (2.5, 18.4)</b>
(6) Front exhaust pipe upper insulator (RH)	(15) Turbocharger joint pipe	<b>T3: 40 (4.1, 29.5)</b>
(7) Gasket	(16) Gasket	<b>T4: 42.5 (4.3, 31.3)</b>
(8) Front exhaust pipe	(17) Front oxygen (A/F) sensor	<b>T5: &lt;Ref. to FU(H4DOTC)-41, INSTALLATION, Front Oxygen (A/F) Sensor.&gt;</b>
(9) Front exhaust pipe lower insulator (RH)	(18) Front exhaust pipe upper insulator (LH)	<hr/>
	(19) Front exhaust pipe lower insulator (LH)	

# General Description

## EXHAUST

### 2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER



EX-02220

- |  |                                 |
|--|---------------------------------|
| (1) Gasket                               | (11) Rear exhaust pipe          |
| (2) Front catalytic converter            | (12) Chamber                    |
| (3) Center exhaust pipe (Front)          | (13) Cushion rubber             |
| (4) Gasket                               | (14) Spring                     |
| (5) Center pipe upper cover (Rear)       | (15) Bolt                       |
| (6) Clamp                                | (16) Gasket                     |
| (7) Rear catalytic converter lower cover | (17) Muffler (RH)               |
| (8) Rear oxygen sensor                   | (18) Self-locking nut           |
| (9) Rear catalytic converter             | (19) Muffler (LH)               |
| (10) Gasket                              | (20) Center exhaust pipe (Rear) |
|  | (21) Bracket                    |

#### **Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 13 (1.3, 9.6)**

**T2: 18 (1.8, 13.3)**

**T3: 30 (3.1, 22.1)**

**T4: 35 (3.6, 26.0)**

**T5: 42.5 (4.3, 31.3)**

**T6: 48 (4.9, 35.4)**

**T7: <Ref. to FU(H4DOTC)-42, INSTALLATION, Rear Oxygen Sensor.>**

### **B: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

# Front Exhaust Pipe

## EXHAUST

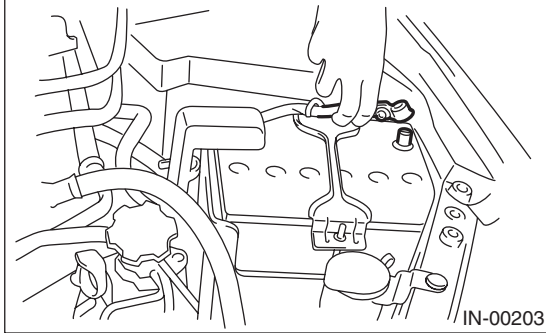
### 2. Front Exhaust Pipe

#### A: REMOVAL

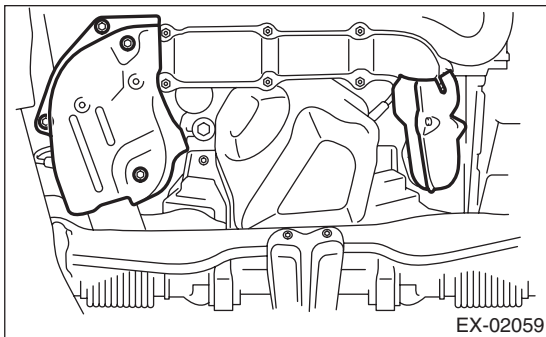
##### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

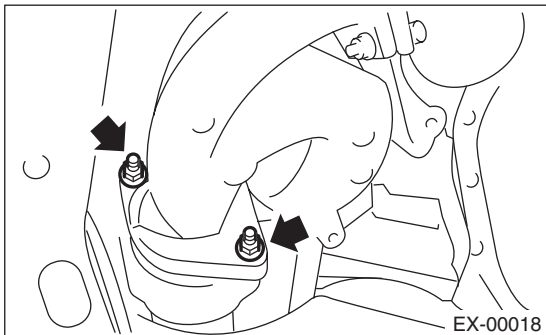
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



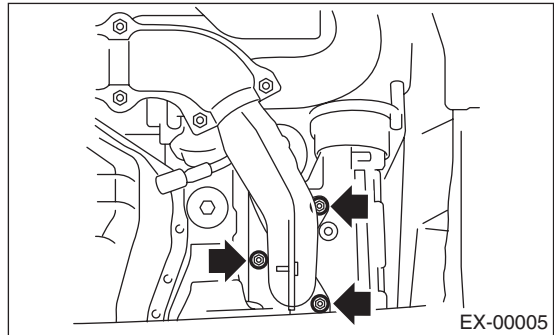
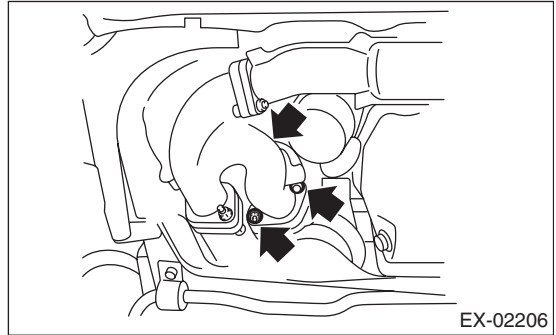
- 3) Remove the front oxygen (A/F) sensor.  
<Ref. to FU(H4DOTC)-40, REMOVAL, Front Oxygen (A/F) Sensor.>
- 4) Remove the under cover.
- 5) Remove the exhaust manifold lower cover (RH) and the exhaust manifold cover (LH).



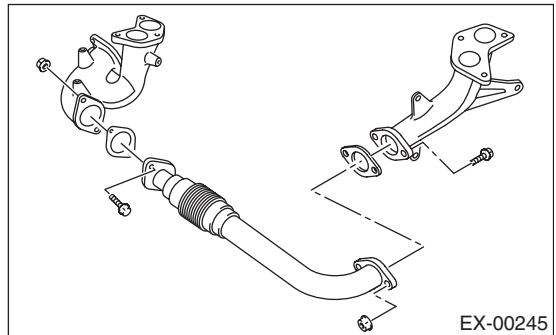
- 6) Remove the bolts and nuts which hold front exhaust pipe assembly onto turbocharger joint pipe.



- 7) While holding the front exhaust pipe assembly with one hand, remove the nuts which hold the front exhaust pipe assembly to cylinder head exhaust port.



- 8) Remove the front exhaust pipe assembly.
- 9) Remove the covers from exhaust manifold and front exhaust pipe.
- 10) Separate the front exhaust pipe from exhaust manifolds.



## B: INSTALLATION

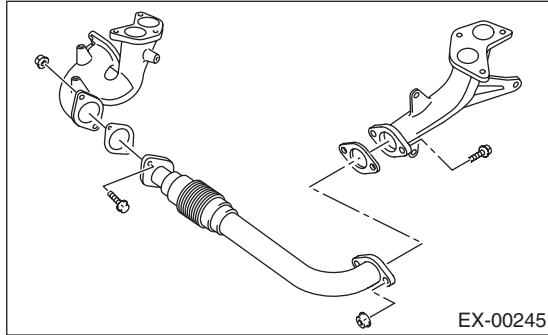
1) Install the front exhaust pipe and the exhaust manifold.

NOTE:

Use a new gasket.

**Tightening torque:**

**42.5 N·m (4.3 kgf-m, 31.3 ft-lb)**



2) Install the front exhaust pipe cover.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

3) Install the exhaust manifold upper cover (RH).

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

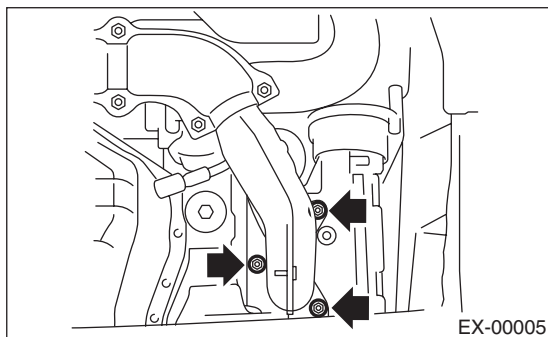
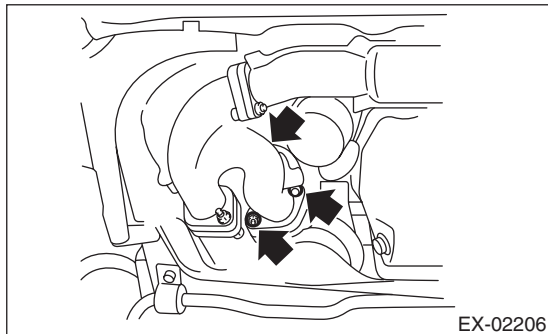
4) Install the front exhaust pipe assembly.

NOTE:

Use a new gasket.

**Tightening torque:**

**40 N·m (4.1 kgf-m, 29.5 ft-lb)**



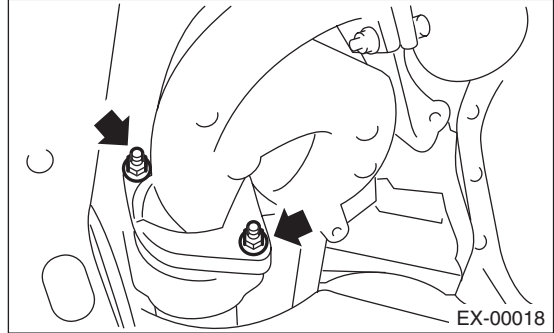
5) Connect the exhaust manifold (RH) to turbo-charger joint pipe.

NOTE:

Use a new gasket.

**Tightening torque:**

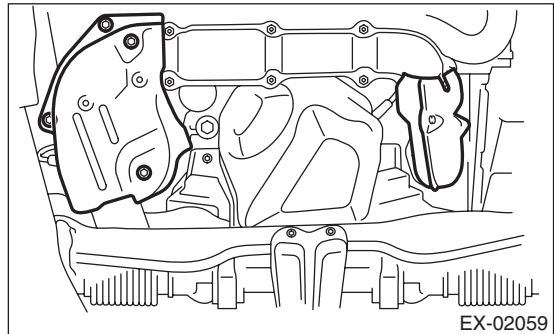
**42.5 N·m (4.3 kgf-m, 31.3 ft-lb)**



6) Install the exhaust manifold lower cover (RH) and the exhaust manifold cover (LH).

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



7) Install the front oxygen (A/F) sensor.

<Ref. to FU(H4DOTC)-41, INSTALLATION, Front Oxygen (A/F) Sensor.>

8) Install the under cover.

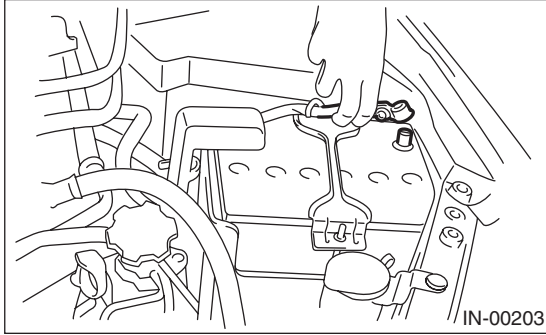
9) Lower the vehicle.

## Front Exhaust Pipe

### EXHAUST

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10) Connect the battery ground cable to battery.



### **C: INSPECTION**

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

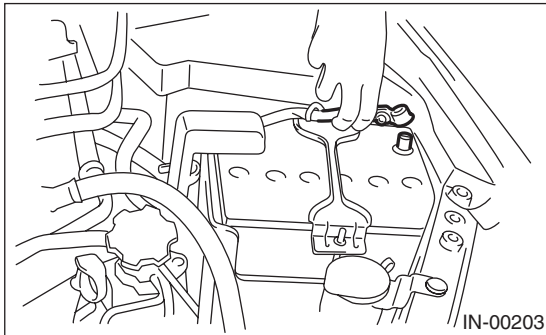
### 3. Center Exhaust Pipe

#### A: REMOVAL

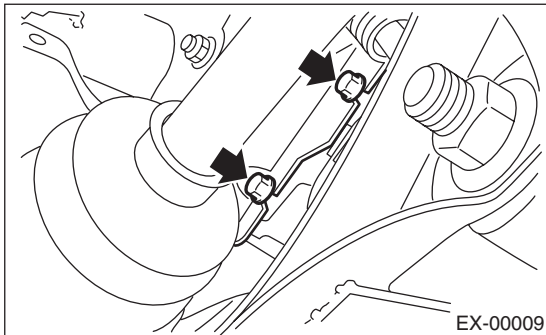
##### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

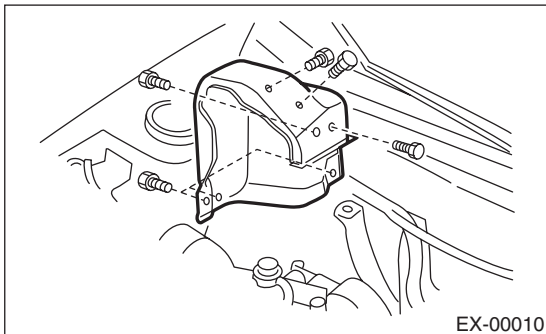
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



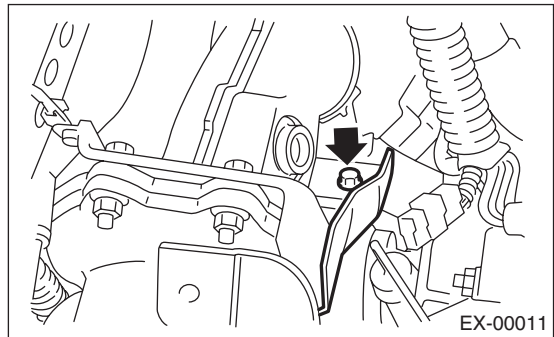
- 4) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 5) Remove the intercooler bracket.
- 6) Lift up the vehicle.
- 7) Remove the under cover.
- 8) Remove the bolts which install the lower side of turbocharger lower cover.



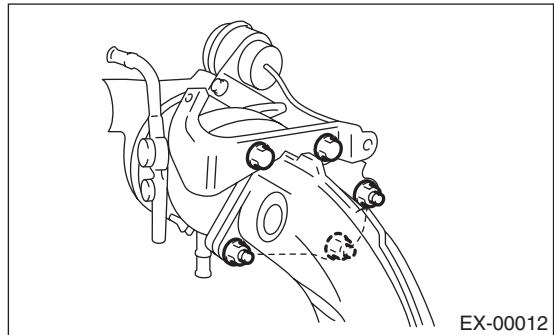
- 9) Lower the vehicle.
- 10) Remove the turbocharger upper cover.



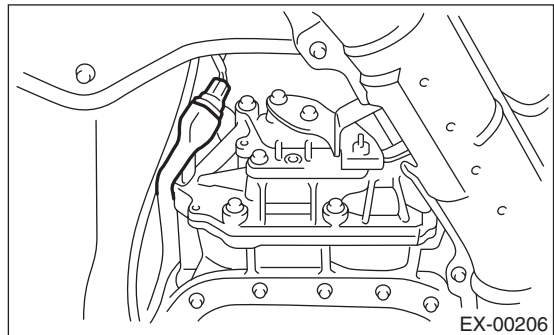
- 11) Remove the bolts which hold the turbocharger lower cover and center exhaust pipe.



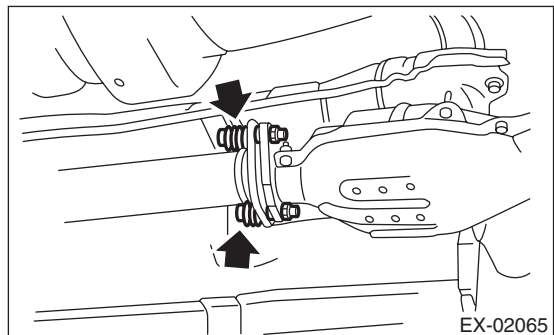
- 12) Separate the center exhaust pipe from turbocharger.



- 13) Lift up the vehicle.
- 14) Disconnect the connector from the rear oxygen sensor.



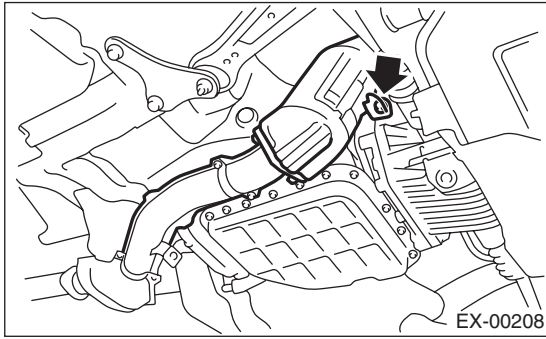
- 15) Separate the center exhaust pipe from rear exhaust pipe.



# Center Exhaust Pipe

## EXHAUST

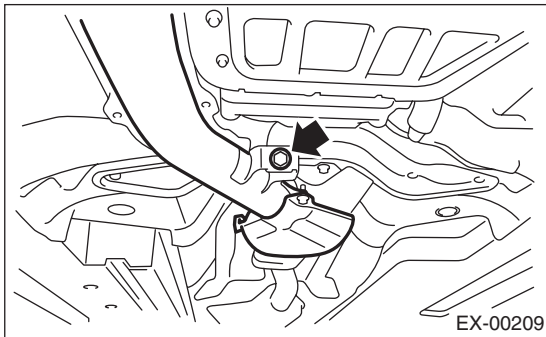
- 16) Remove the bolt which holds center exhaust pipe bracket to transmission.



- 17) Remove the bolt which holds center exhaust pipe to hanger bracket.

### CAUTION:

Be careful not to pull down the center exhaust pipe.



- 18) Remove the center exhaust pipe.



## B: INSTALLATION

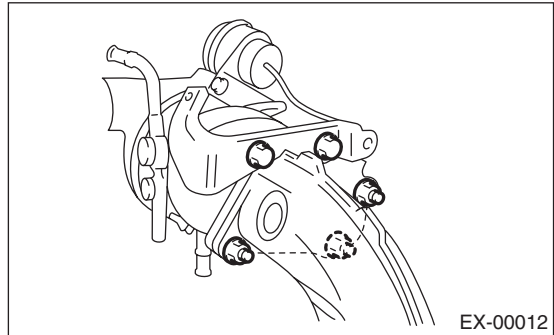
- 1) Install the center exhaust pipe and temporarily tighten the bolt which holds center exhaust pipe to hanger bracket.
- 2) Temporarily tighten the bolt which holds the center pipe to transmission.
- 3) Connect the center exhaust pipe to turbocharger.

### NOTE:

Use a new gasket.

### Tightening torque:

**42.5 N·m (4.3 kgf-m, 31.3 ft-lb)**



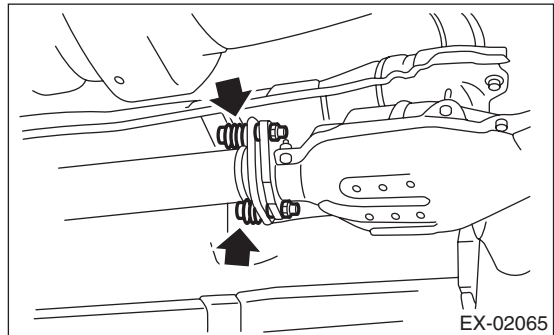
- 4) Install the center exhaust pipe to rear exhaust pipe.

### NOTE:

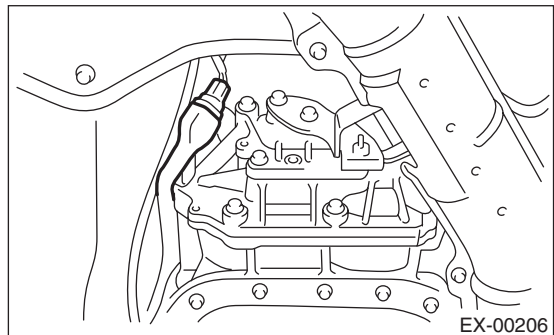
Use a new gasket.

### Tightening torque:

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



- 5) Connect the connector to rear oxygen sensor.

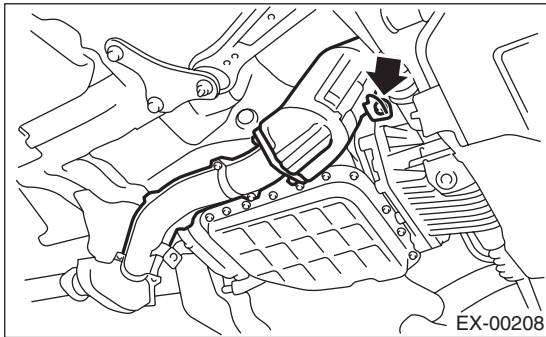




6) Tighten the bolt which holds center exhaust pipe bracket to transmission.

**Tightening torque:**

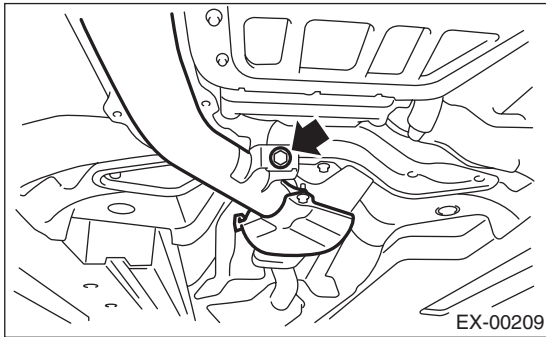
**30 N·m (3.1 kgf·m, 22.1 ft·lb)**



7) Tighten the bolt which holds center exhaust pipe to hanger bracket.

**Tightening torque:**

**35 N·m (3.6 kgf·m, 25.8 ft·lb)**

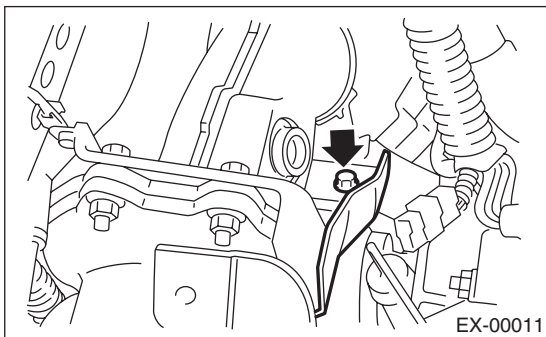


8) Lower the vehicle.

9) Position the turbocharger lower cover, and tighten the bolts which hold the lower cover and center exhaust pipe.

**Tightening torque:**

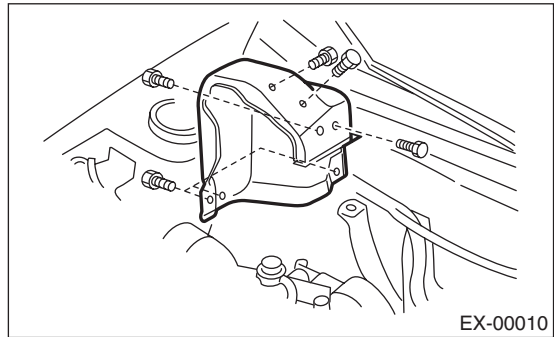
**7.5 N·m (0.8 kgf·m, 5.5 ft·lb)**



10) Position the turbocharger upper cover, and tighten the bolts which install the upper cover.

**Tightening torque:**

**7.5 N·m (0.8 kgf·m, 5.5 ft·lb)**

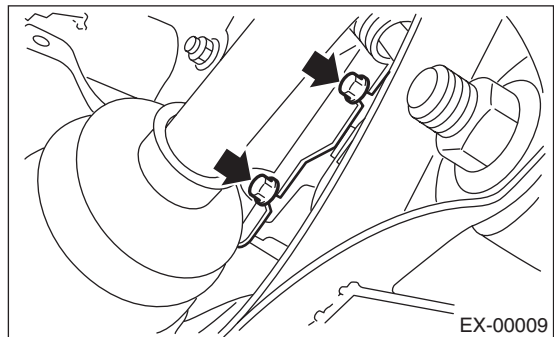


11) Lift up the vehicle.

12) Tighten the bolts which install the under side of turbocharger lower cover.

**Tightening torque:**

**7.5 N·m (0.8 kgf·m, 5.5 ft·lb)**



13) Install the under cover.

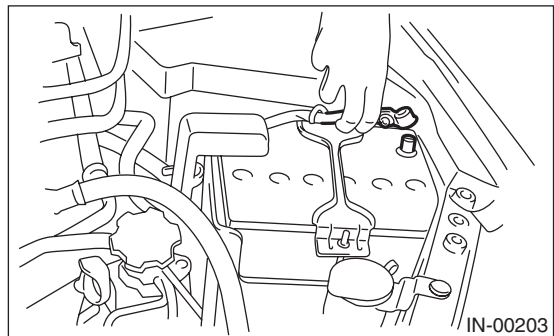
14) Lower the vehicle.

15) Install the intercooler bracket.

16) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

17) Install the collector cover.

18) Connect the battery ground cable to battery.



## C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

# Joint Pipe

EXHAUST

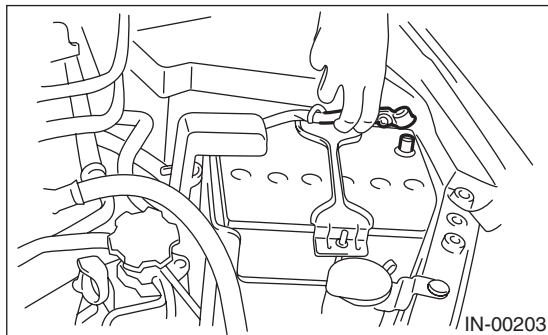
## 4. Joint Pipe

### A: REMOVAL

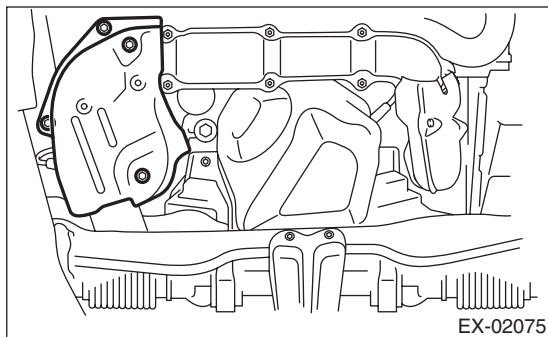
#### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

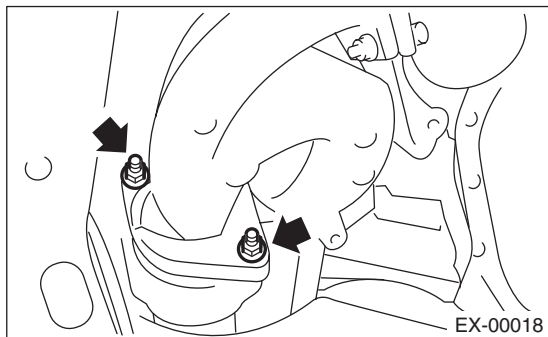
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Remove the front oxygen (A/F) sensor.  
<Ref. to FU(H4DOTC)-40, REMOVAL, Front Oxygen (A/F) Sensor.>
- 5) Remove the under cover.
- 6) Remove the exhaust manifold lower cover (RH).



- 7) Remove the bolts and nuts which hold the front exhaust manifold to joint pipe.



- 8) Remove the center exhaust pipe.  
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 9) Remove the turbocharger. <Ref. to IN(H4DOTC)-14, REMOVAL, Turbocharger.>
- 10) Take off the joint pipe in the upward direction.

### B: INSTALLATION

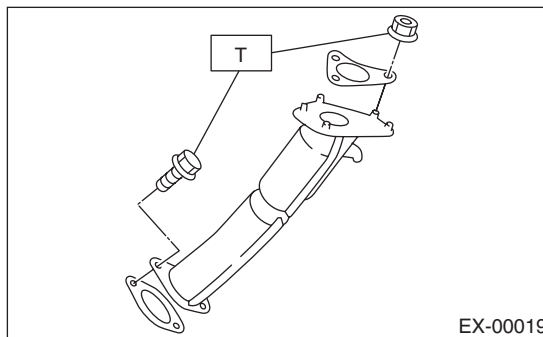
Install in the reverse order of removal.

#### NOTE:

Use a new gasket.

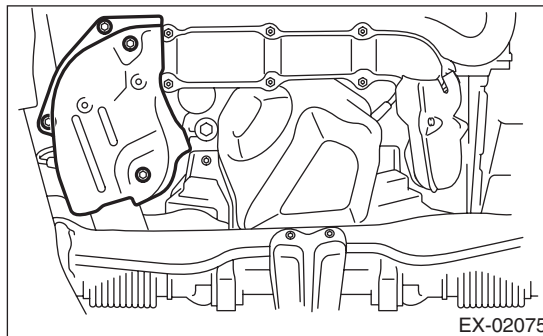
#### Tightening torque:

**T: 42.5 N·m (4.3 kgf·m, 31.3 ft·lb)**



#### Tightening torque:

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

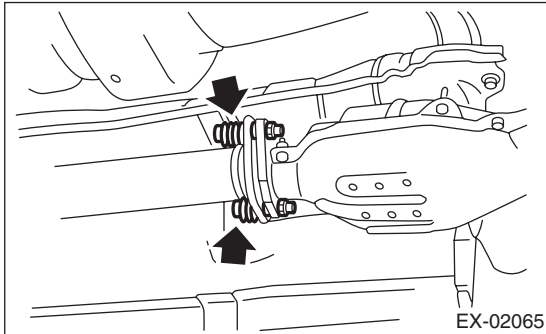
## 5. Rear Exhaust Pipe

### A: REMOVAL

**CAUTION:**

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

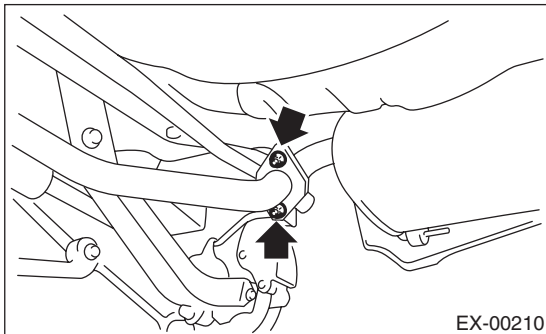
- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the rear exhaust pipe from center exhaust pipe.



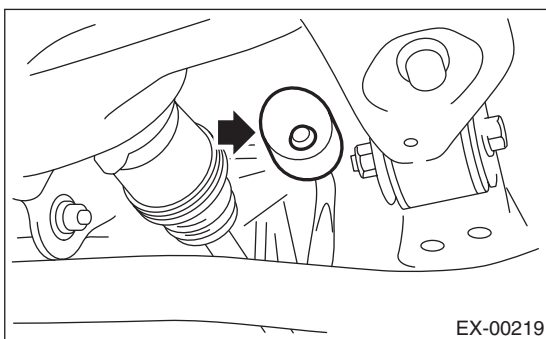
- 4) Separate the rear exhaust pipe from both mufflers.

**CAUTION:**

Be careful not to pull down the rear exhaust pipe.



- 5) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 6) Remove the rear exhaust pipe bracket from cushion rubber.



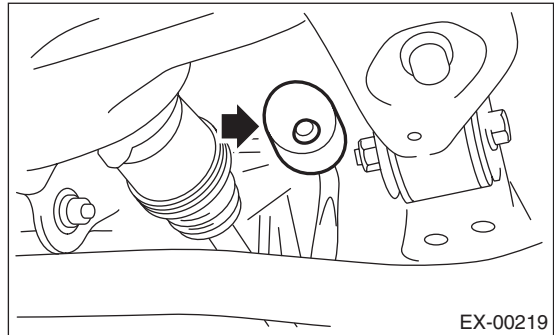
- 7) Remove the rear exhaust pipe.

### B: INSTALLATION

- 1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 2) Install the rear exhaust pipe bracket to cushion rubber.

**NOTE:**

After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.



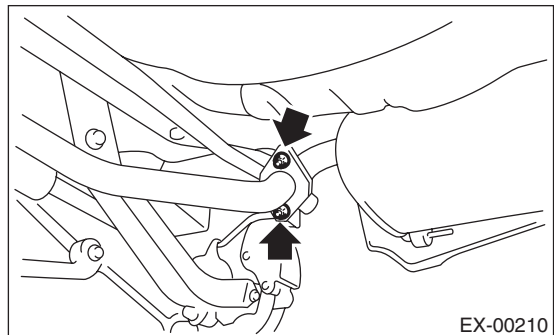
- 3) Install the rear exhaust pipe to both mufflers.

**NOTE:**

Use a new gasket and self-locking nut.

**Tightening torque:**

**48 N·m (4.9 kgf·m, 35.4 ft·lb)**



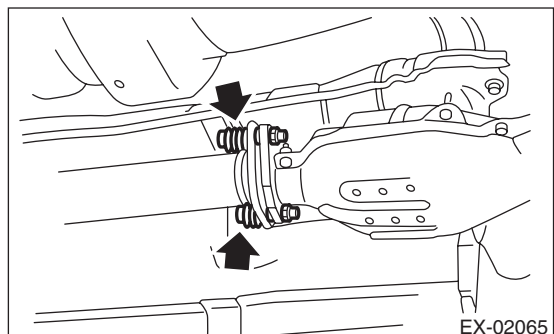
- 4) Install the rear exhaust pipe to center exhaust pipe.

**NOTE:**

Use a new gasket.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



- 5) Lower the vehicle.

## Rear Exhaust Pipe

EXHAUST

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### **C: INSPECTION**

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

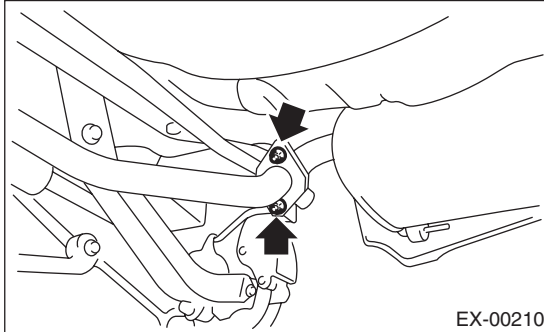
## 6. Muffler

### A: REMOVAL

#### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

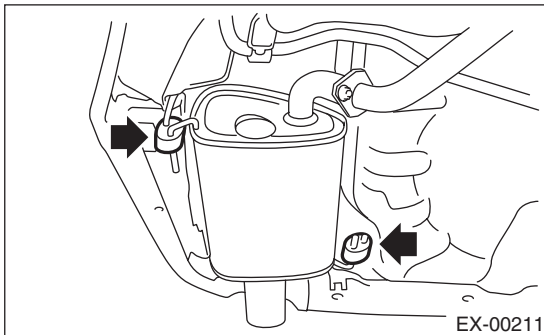
- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the muffler (RH) from the rear exhaust pipe.



- 4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 5) Remove the cushion rubber, and remove the muffler.

#### CAUTION:

Be careful not to drop the muffler during removal.



- 6) Perform the same procedures for the muffler (LH).

### B: INSTALLATION

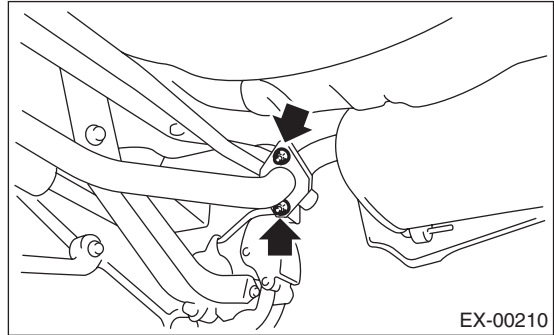
Install in the reverse order of removal.

#### NOTE:

- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

#### Tightening torque:

**48 N·m (4.9 kgf-m, 35.4 ft-lb)**



### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

# Muffler

EXHAUST

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# General Description

COOLING

## 1. General Description

### A: SPECIFICATION

Cooling system		Electric fan + Forced engine coolant circulation system		
Total engine coolant capacity		ℓ (US qt, Imp qt)	MT: approx. 7.3 (7.7, 6.4) AT: approx. 7.2 (7.6, 6.3)	
Water pump	Type	Centrifugal impeller type		
	Discharge performance I	Discharge rate	ℓ (US gal, Imp gal) /min. 20 (5.3, 4.4)	
		Pump speed — Discharge pressure	760 rpm — 2.9 kPa (0.3 mAq)	
		Engine coolant temperature	80°C (176°F)	
	Discharge performance II	Discharge rate	ℓ (US gal, Imp gal) /min. 100 (26.4, 22.0)	
		Pump speed — Discharge pressure	3,000 rpm — 49.0 kPa (5.0 mAq)	
		Engine coolant temperature	80°C (176°F)	
	Discharge performance III	Discharge rate	ℓ (US gal, Imp gal) /min. 200 (52.8, 44.0)	
		Pump speed — Discharge pressure	6,000 rpm — 225.4 kPa (23.0 mAq)	
		Engine coolant temperature	80°C (176°F)	
Impeller diameter	mm (in)	76 (2.99)		
Number of impeller vanes		8		
Pump pulley diameter	mm (in)	60 (2.36)		
Clearance between impeller and case	Standard	mm (in)	0.5 — 1.5 (0.020 — 0.059)	
Thermostat	Type	Wax pellet type		
	Starting temperature to open	76 — 80°C (169 — 176°F)		
	Fully opens	91°C (196°F)		
	Valve lift	mm (in)	9.0 (0.354) or more	
	Valve bore	mm (in)	35 (1.38)	
Radiator fan	Motor input	Main fan	W 120	
		Sub fan	W 120	
	Fan diameter / Blade	Main fan	320 mm (12.6 in)/5	
		Sub fan	320 mm (12.6 in)/7	
Radiator	Type	Down flow		
	Core dimensions	Width × Height × Thickness	mm (in) 687.4 × 340 × 16 (27.06 × 13.39 × 0.63)	
	Pressure range in which cap valve is open	Coolant filler tank side	kPa (kg/cm <sup>2</sup> , psi)	Above: 108±15 (1.1±0.15, 16±2) Below: -1.0 to -4.9 (-0.01 — -0.05, -0.1 — -0.7)
		Radiator side	kPa (kg/cm <sup>2</sup> , psi)	Above only: 137±14.7 (1.40±0.15, 20±2.1)
	Fins	Corrugated fin type		
Reservoir tank	Capacity	ℓ (US qt, Imp qt)	0.45 (0.48, 0.40)	

# General Description

COOLING

Coolant	Recommended materials	Item number	Alternative
Coolant	SUBARU coolant	000016218	Phosphoric acid (non-amine) type
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	None

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 94°C (201°F) or less Decrease: 91°C (196°F) or less	Increase: 95 — 96°C (203 — 205°F) Decrease: 92 — 94°C (198 — 201°F)	Increase: 97°C (207°F) or more Decrease: 95°C (203°F) or more
		Radiator fan operation	Radiator fan operation	Radiator fan operation
During acceleration: 19 km/h (12 MPH) or less During deceleration: 10 km/h (6 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 20 — 69 km/h (12 — 43 MPH) During deceleration: 11 — 64 km/h (7 — 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 70 — 105 km/h (43 — 65 MPH) During deceleration: 65 — 103 km/h (40 — 64 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 106 km/h (66 MPH) or more During deceleration: 104 km/h (65 MPH) or more	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed

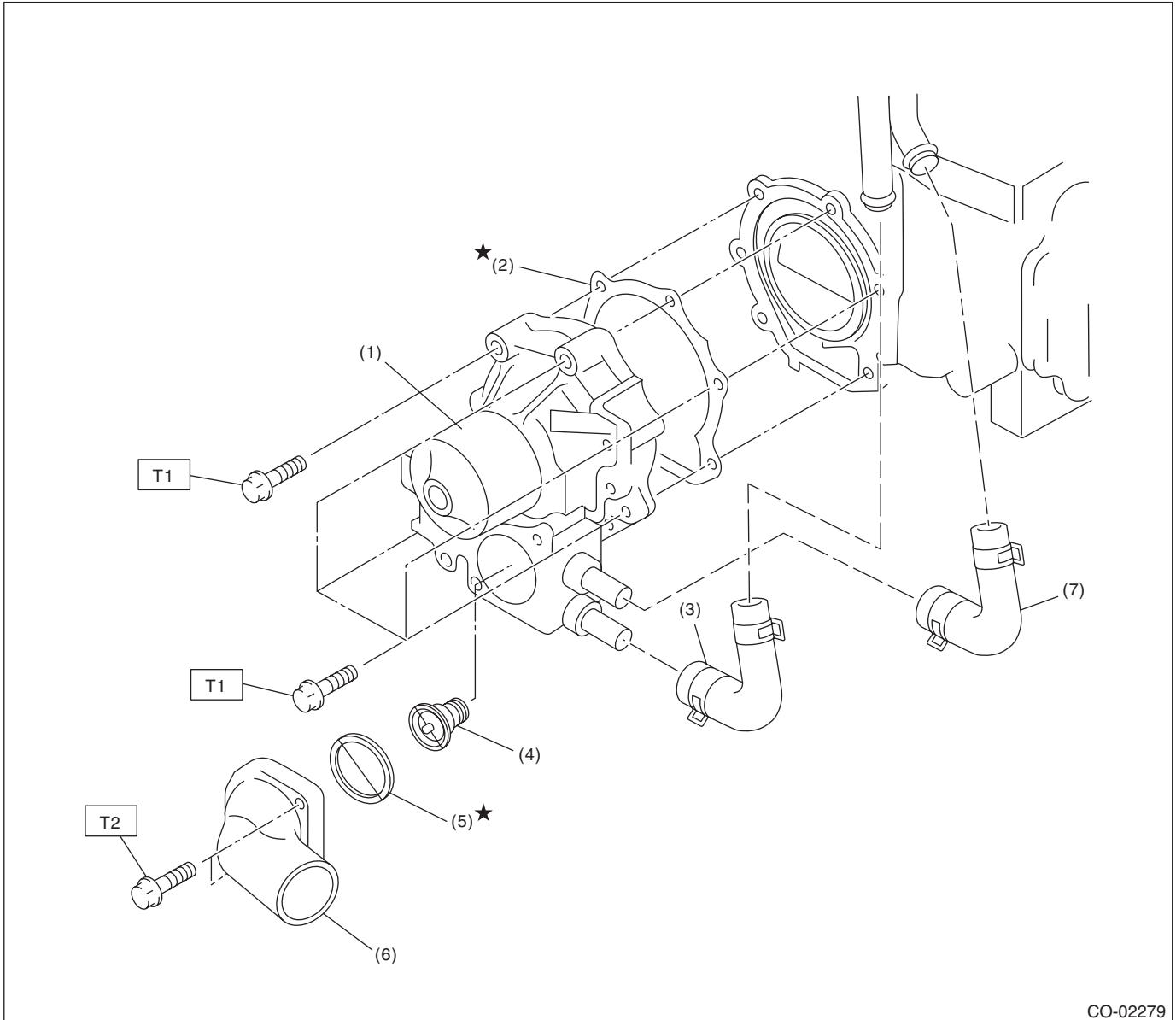


# General Description

COOLING

## B: COMPONENT

### 1. WATER PUMP



(1) Water pump ASSY

(2) Gasket

(3) Heater by-pass hose

(4) Thermostat

(5) Gasket

(6) Thermostat cover

(7) Coolant filler tank by-pass hose

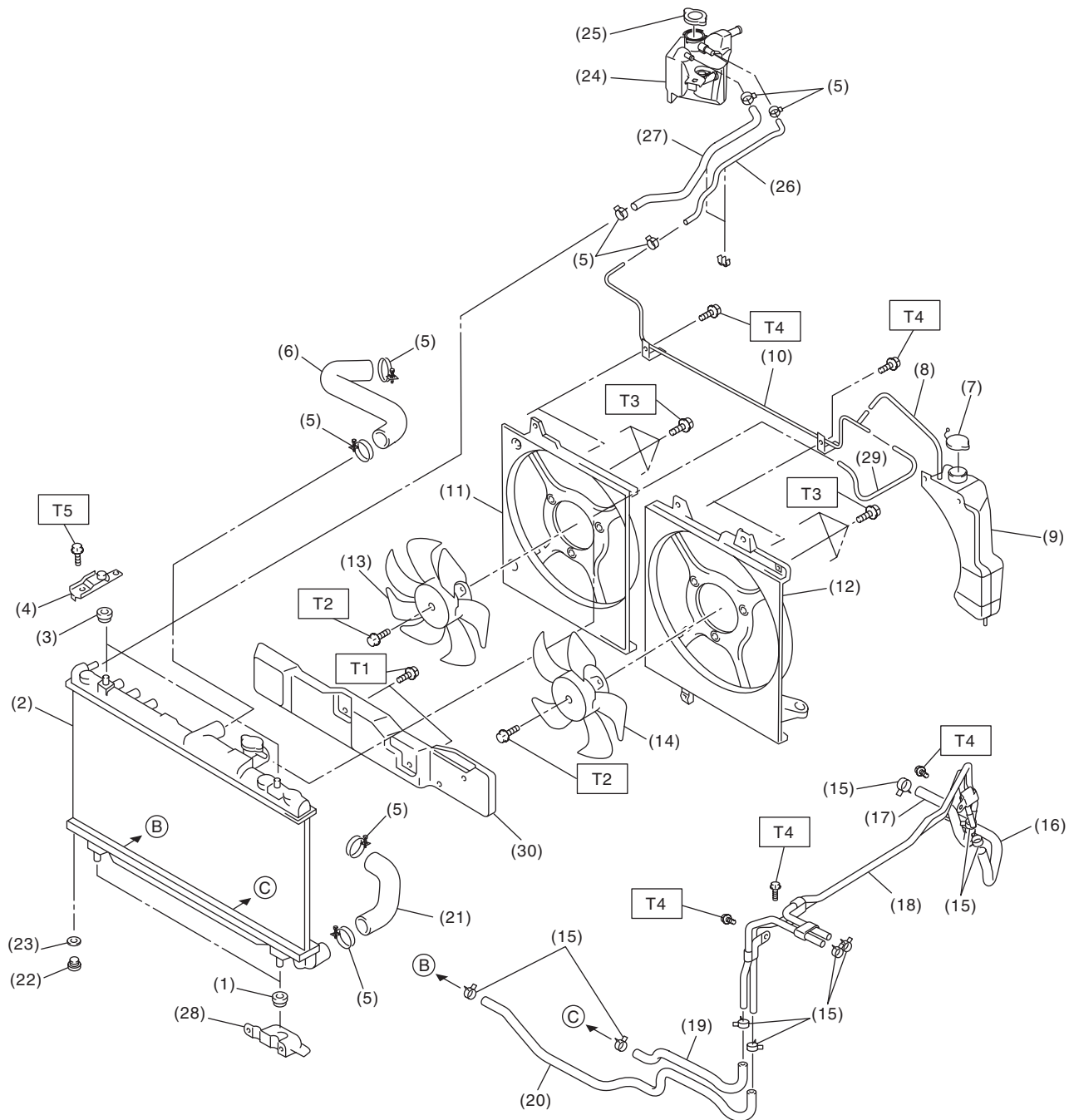
**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: First 12 (1.2, 8.9)**

**Second 12 (1.2, 8.9)**

**T2: 12 (1.2, 8.9)**

## 2. RADIATOR AND RADIATOR FAN



CO-02354

# General Description

## COOLING

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(1) Radiator lower cushion	(14) Radiator main fan ASSY	(26) Coolant filler tank hose A
(2) Radiator	(15) ATF hose clamp (AT model)	(27) Coolant filler tank hose B
(3) Radiator upper cushion	(16) ATF hose A (AT model)	(28) Radiator lower bracket
(4) Radiator upper bracket	(17) ATF hose B (AT model)	(29) Over flow hose B
(5) Clamp	(18) ATF pipe (AT model)	(30) Heat shield cover (AT model)
(6) Radiator hose A	(19) ATF hose C (AT model)	
(7) Engine coolant reservoir tank cap	(20) ATF hose D (AT model)	
(8) Over flow hose A	(21) Radiator hose B	
(9) Engine coolant reservoir tank	(22) Radiator drain plug	
(10) Over flow pipe	(23) O-ring	
(11) Radiator sub fan shroud	(24) Engine coolant filler tank	
(12) Radiator main fan shroud	(25) Radiator cap	
(13) Radiator sub fan ASSY	(Engine coolant filler tank cap)	

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**Tightening torque:N-m (kgf-m, ft-lb)****T1: 3 (0.3, 2.2)****T2: 3.4 (0.35, 2.5)****T3: 5 (0.5, 3.7)****T4: 7.5 (0.76, 5.5)****T5: 12 (1.2, 8.9)**

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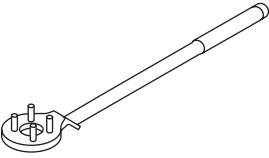
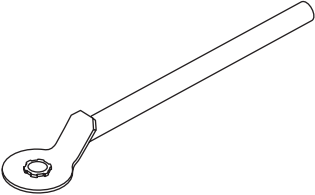
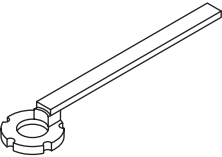
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

# General Description

COOLING

## D: PREPARATION TOOL

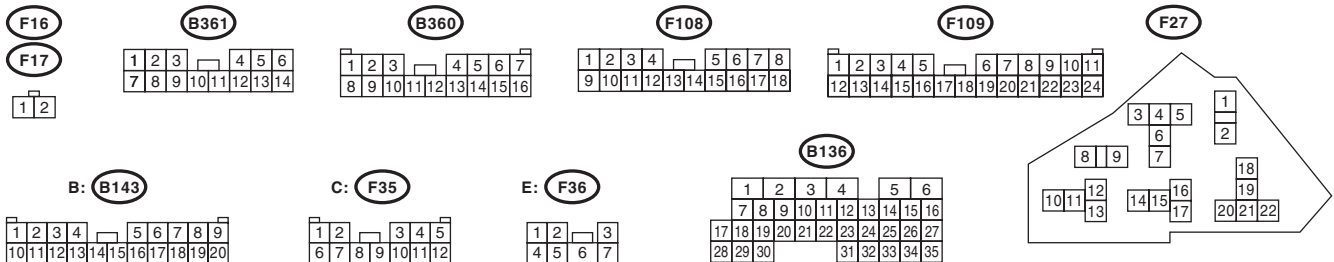
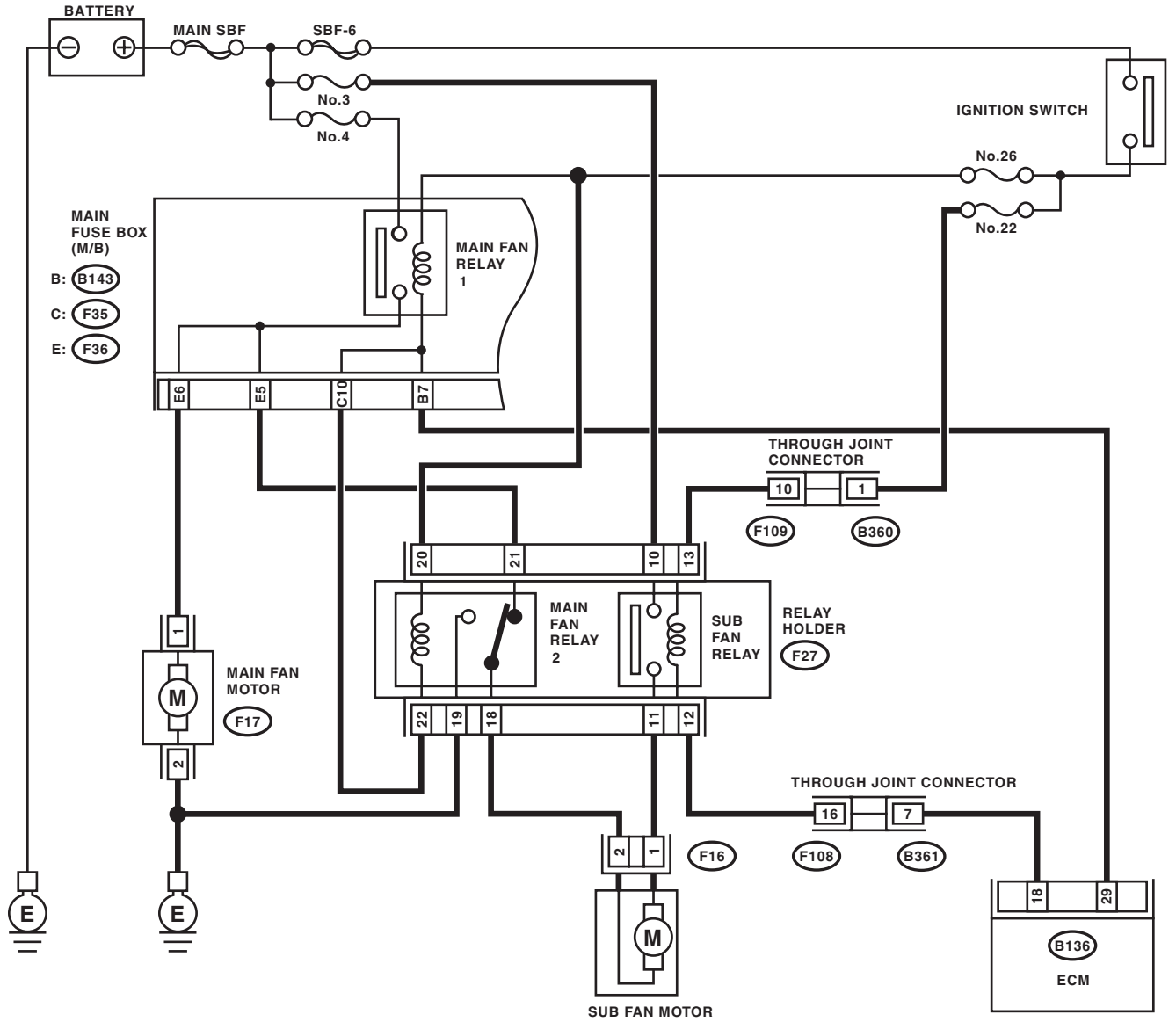
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 ST-499207400	499207400	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.

# Radiator Fan System

COOLING

## 2. Radiator Fan System

### A: WIRING DIAGRAM



CO-02317

## B: INSPECTION

### DETECTING CONDITION:

- Engine coolant temperature is 96°C (205°F) or more.
- Vehicle speed is 19 km/h (12 MPH) or less.

### TROUBLE SYMPTOMS:

Radiator main fan and sub fan do not rotate under the above conditions.

Step	Check	Yes	No
<b>1 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detail procedures. <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at low speed?	Go to step 2.	Go to step 3.
<b>2 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detail procedures. <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step 27.
<b>3 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from the relay holder. 3) Measure the voltage between the sub fan relay terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(F27) No. 10 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Go to step 5.
<b>4 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the sub fan relay terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(F27) No. 13 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 7.	Go to step 6.

# Radiator Fan System

## COOLING

Step	Check	Yes	No
<b>5 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
<b>6 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
<b>7 CHECK SUB FAN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. <i>Terminals</i> <i>No. 10 — No. 11:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Replace the sub fan relay.
<b>8 CHECK SUB FAN RELAY.</b> 1) Connect the battery to terminals No. 12 and No. 13 of the sub fan relay. 2) Measure the resistance between sub fan relay terminals. <i>Terminals</i> <i>No. 10 — No. 11:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 9.	Replace the sub fan relay.
<b>9 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector. <i>Connector &amp; terminal</i> <i>(F16) No. 1 — (F27) No. 11:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 10.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
<b>10 CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.</b> 1) Remove the main fan relay 2 from the relay holder. 2) Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector. <i>Connector &amp; terminal</i> <i>(F16) No. 2 — (F27) No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 11.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
<b>11 CHECK POOR CONTACT.</b> Check for poor contact of sub fan motor connector.	Is there poor contact in the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step 12.
<b>12 CHECK SUB FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (-) terminal to terminal No. 2.	Does the sub fan rotate?	Go to step 13.	Replace the sub fan motor.
<b>13 CHECK MAIN FAN RELAY 2.</b> Measure the resistance of main fan relay 2. <i>Terminals</i> <i>No. 21 — No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 14.	Replace the main fan relay 2.

# Radiator Fan System

COOLING

Step	Check	Yes	No
<b>14 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 terminal and main fan motor connector. <b>Connector &amp; terminal</b> <b>(F17) No. 1 — (F27) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 15.	Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.
<b>15 CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.</b> Measure the resistance between main fan motor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(F17) No. 2 — Chassis ground:</b>	Is resistance less than 5 $\Omega$ ?	Go to step 16.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
<b>16 CHECK POOR CONTACT.</b> Check poor contact of main fan motor connector.	Is there poor contact in the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step 17.
<b>17 CHECK MAIN FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (-) terminal to terminal No. 2.	Does the main fan rotate?	Go to step 18.	Replace the main fan motor.
<b>18 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. <b>Connector &amp; terminal</b> <b>(B136) No. 18 — (F27) No. 12:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 19.	Repair the open circuit of harness between sub fan relay terminal and ECM.
<b>19 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact of the ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-44, Read Diagnostic Trouble Code (DTC).>
<b>20 CHECK MAIN FAN RELAY 1.</b> 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance of terminal in main fan relay 1 switch.	Is the resistance 1 M $\Omega$ or more?	Go to step 21.	Replace the main fan relay 1.
<b>21 CHECK MAIN FAN RELAY 1.</b> 1) Connect the main fan relay 1 coil side terminal to the battery. 2) Measure the resistance between terminals of main fan relay 1 switch.	Is resistance less than 1 $\Omega$ ?	Go to step 22.	Replace the main fan relay 1.
<b>22 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.</b> 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 terminal and main fan motor connector. <b>Connector &amp; terminal</b> <b>(F17) No. 1 — (F36) No. 6:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 23.	Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.



# Radiator Fan System

## COOLING

Step	Check	Yes	No
<b>23 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. <b>Connector &amp; terminal</b> <b>(B136) No. 29 — (B143) No. 7:</b>	Is resistance less than 1 Ω?	Go to step 24.	Repair the open circuit of the harness between main fan relay 1 terminal and ECM.
<b>24 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.</b> Measure the resistance between main fan relay 2 terminal and ECM connector. <b>Connector &amp; terminal</b> <b>(B136) No. 29 — (F27) No. 22:</b>	Is resistance less than 1 Ω?	Go to step 25.	Repair the open circuit of the harness between main fan relay 2 terminal and ECM.
<b>25 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 4 and 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 26.
<b>26 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact of the ECM connector.	Repair the power supply circuit to the main fuse box.
<b>27 CHECK OPERATION OF RADIATOR FAN.</b> If the both fans do not rotate at high speed in the condition of step 2, check whether the sub fan is rotating.	Does the sub fan rotate?	Go to step 20.	Go to step 28.
<b>28 CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.</b> 1) Remove the main fan relay 2 from the relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 19 — Chassis ground:</b>	Is resistance less than 1 Ω?	Go to step 29.	Repair the open circuit of harness between main fan relay 2 and chassis ground.
<b>29 CHECK POWER SUPPLY TO MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 20 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 30.	Repair the power supply line.
<b>30 CHECK MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. <b>Terminals</b> <b>(F27) No. 18 — (F27) No. 19:</b>	Is the resistance 1 MΩ or more?	Go to step 31.	Replace the main fan relay 2.
<b>31 CHECK MAIN FAN RELAY 2.</b> 1) Connect the battery to main fan relay 2 terminals No. 20 and No. 22. 2) Measure the resistance of main fan relay 2. <b>Terminals</b> <b>(F27) No. 18 — (F27) No. 19:</b>	Is resistance less than 1 Ω?	Go to step 23.	Replace the main fan relay 2.

## 3. Engine Coolant

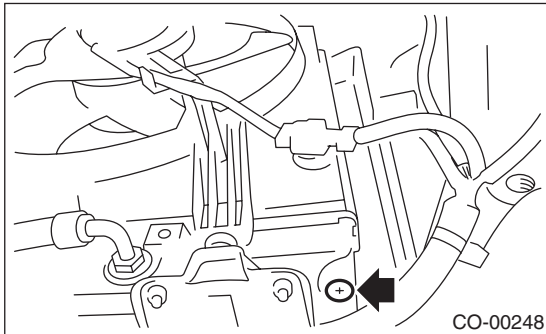
### A: REPLACEMENT

#### 1. DRAINING OF ENGINE COOLANT

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Remove the drain plug to drain engine coolant into container.

**NOTE:**

Remove the coolant filler tank cap so that engine coolant will drain faster.



- 5) Install the drain plug.

#### 2. FILLING OF ENGINE COOLANT

- 1) Remove the collector cover.
- 2) Pour cooling system conditioner through the filler neck.

**Cooling system protective agent:**

Refer to “SPECIFICATION” for the cooling system protective agent. <Ref. to CO(H4DOTC)-2, SPECIFICATION, General Description.>

- 3) Fill the engine coolant into coolant filler tank up to the filler neck position.

**Recommended engine coolant:**

Refer to “SPECIFICATION” for the recommended engine coolant. <Ref. to CO(H4DOTC)-2, SPECIFICATION, General Description.>

**Coolant level:**

Refer to “SPECIFICATION” for the recommended engine coolant. <Ref. to CO(H4DOTC)-2, SPECIFICATION, General Description.>

**CAUTION:**

Do not confuse the cap of coolant filler tank and cap of radiator.

**NOTE:**

When pouring the engine coolant, the radiator side cap must not be removed.

- 4) Fill engine coolant into the reservoir tank up to “FULL” level.

- 5) Close the coolant filler tank cap, and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)

- 6) Wait for one minute after the engine stops, then open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into the coolant filler tank up to the filler neck position.

- 7) Perform the procedures 5) and 6) again.

- 8) Install the coolant filler tank cap and reservoir tank cap properly.

- 9) Start the engine and operate the heater at maximum hot position and the blower speed setting to “LO”.

- 10) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

**NOTE:**

Be careful with the engine coolant temperature gauge to prevent overheating.

- 11) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.

- 12) Open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into the coolant filler tank up to the filler neck position and the reservoir tank to “FULL” level.

- 13) Install the coolant filler tank cap and reservoir tank cap properly.

- 14) Set the heater setting to maximum hot position and the blower speed setting to “LO” and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard from heater core, repeat the procedures from step 10).

- 15) Install the collector cover.

## B: INSPECTION

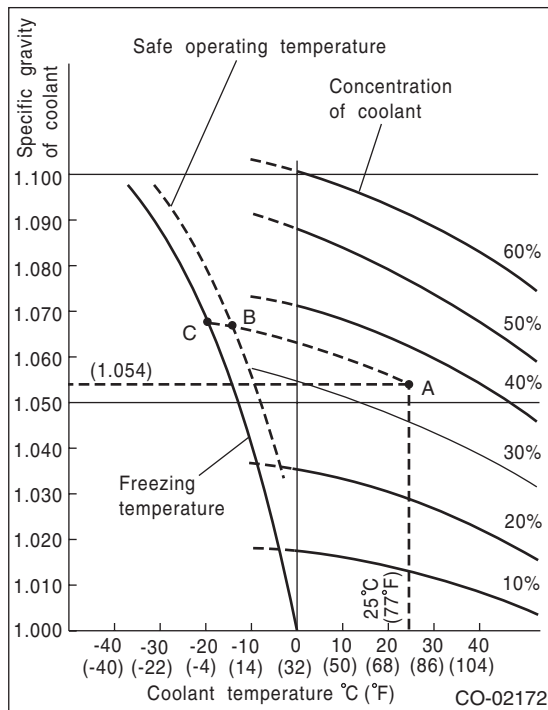
### 1. RELATIONSHIP OF ENGINE COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of engine coolant is shown in the diagram 1. Measuring the temperature and specific gravity of the coolant will provide this information.

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).

- Diagram 1



### 2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of coolant according to temperature, find the proper engine coolant concentration in the diagram 1 and replace the necessary amount of coolant with an undiluted solution of engine coolant (concentration 50%).

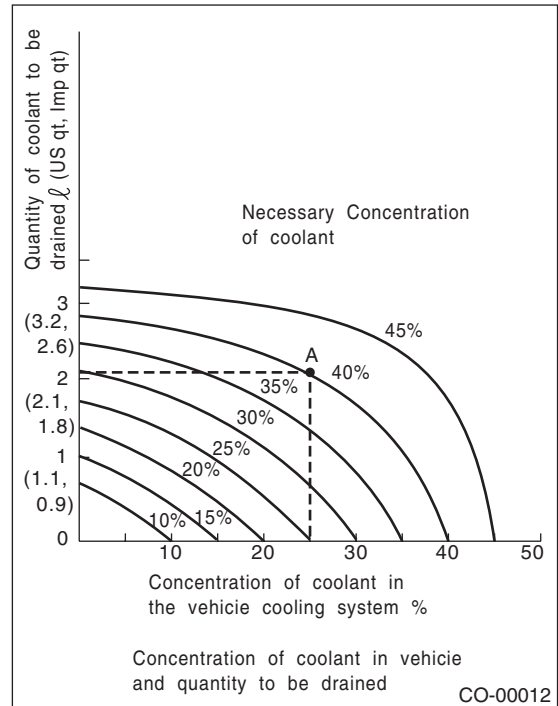
The amount of engine coolant that should be replaced can be determined using the diagram 2.

[Example]

Assume that the engine coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of engine coolant concentration intersects with the 40% curve of the necessary engine coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 ℓ (2.2 US qt, 1.8 Imp qt). Drain 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 ℓ (2.2 US qt, 1.8 Imp qt) undiluted engine coolant.

If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.

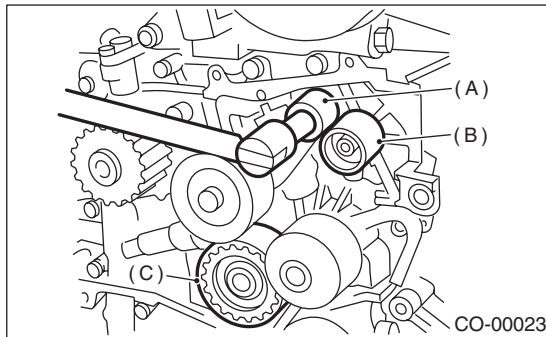
- Diagram 2



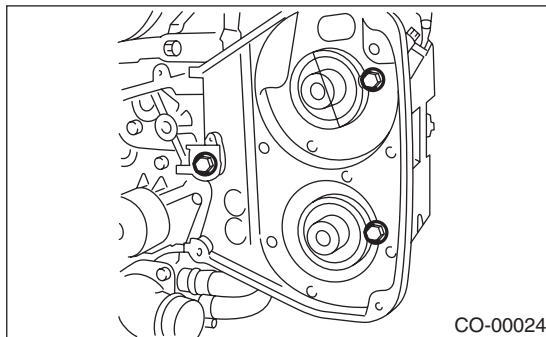
## 4. Water Pump

### A: REMOVAL

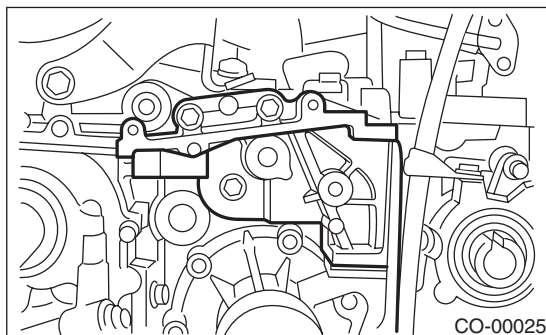
- 1) Remove the collector cover.
- 2) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 3) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>
- 4) Remove the crank pulley. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>
- 5) Remove the timing belt. <Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>
- 6) Remove the automatic belt tension adjuster (A).
- 7) Remove the belt idler (B).
- 8) Remove the belt idler No. 2 (C).



- 9) Remove the cam sprocket (LH) using ST. <Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 10) Remove the belt cover (LH) No. 2.

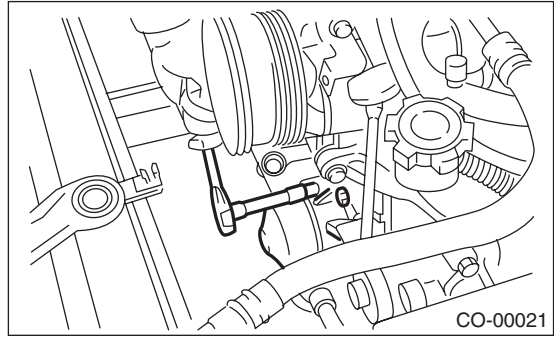


- 11) Remove the tensioner bracket.



- 12) Disconnect the hose from water pump.

- 13) Remove the water pump.



### B: INSTALLATION

- 1) Install the water pump onto cylinder block (LH).

#### NOTE:

- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

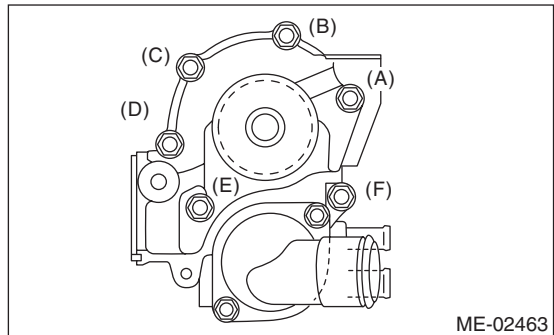
#### Tightening torque:

##### First:

**12 N·m (1.2 kgf-m, 8.9 ft-lb)**

##### Second:

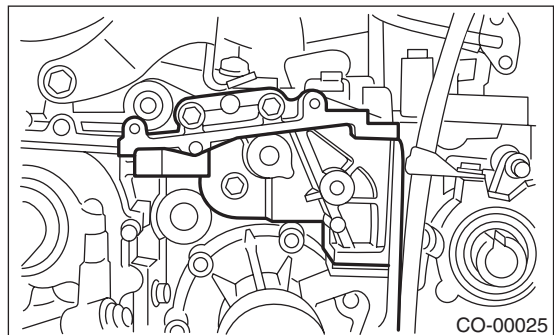
**12 N·m (1.2 kgf-m, 8.9 ft-lb)**



- 2) Install the hose to water pump.
- 3) Install the tensioner bracket.

#### Tightening torque:

**24.5 N·m (2.5 kgf-m, 18.1 ft-lb)**



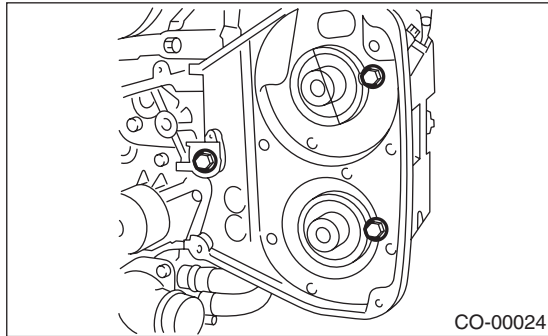
# Water Pump

## COOLING

4) Install the belt cover No. 2 (LH).

**Tightening torque:**

**5 N·m (0.5 kgf·m, 3.7 ft·lb)**



5) Install the cam sprocket (LH) using ST. <Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

6) Install the belt idler No. 2 (C).

**Tightening torque:**

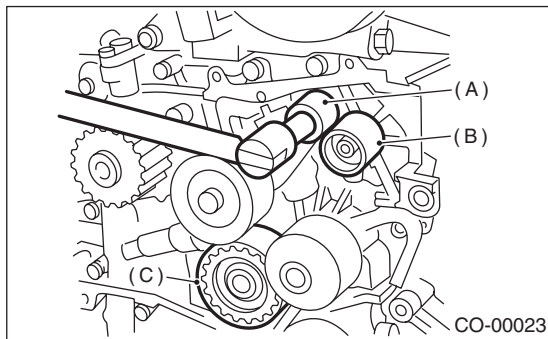
**39 N·m (4.0 kgf·m, 28.8 ft·lb)**

7) Install the belt idler (B).

**Tightening torque:**

**39 N·m (4.0 kgf·m, 28.8 ft·lb)**

8) Install the automatic belt tension adjuster (A) which has a tension rod held by a pin. <Ref. to ME(H4DOTC)-44, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>



9) Install the timing belt. <Ref. to ME(H4DOTC)-45, TIMING BELT, INSTALLATION, Timing Belt.>

10) Install the crank pulley. <Ref. to ME(H4DOTC)-40, INSTALLATION, Crank Pulley.>

11) Install the V-belts. <Ref. to ME(H4DOTC)-38, INSTALLATION, V-belt.>

12) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>

13) Install the collector cover.

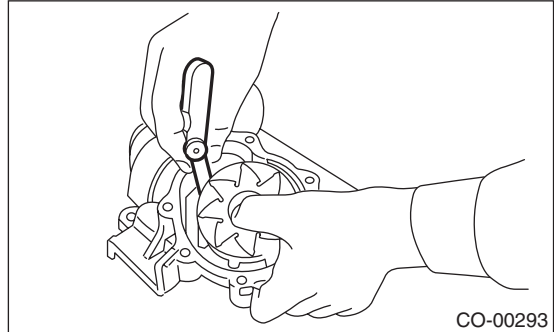
## C: INSPECTION

- 1) Check the water pump bearing for smooth rotation.
- 2) Check the water pump pulley for abnormalities.
- 3) Make sure the impeller is not deformed or damaged.
- 4) Inspect the clearance between impeller and pump case.

**Clearance between impeller and pump case:**

**Standard**

**0.5 — 1.5 mm (0.020 — 0.059 in)**

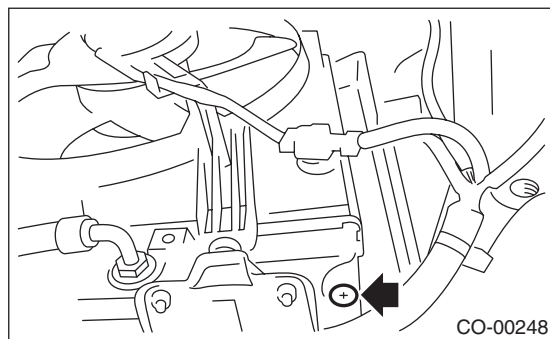


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

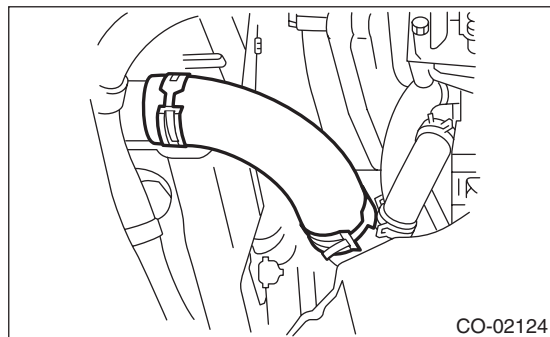
## 5. Thermostat

### A: REMOVAL

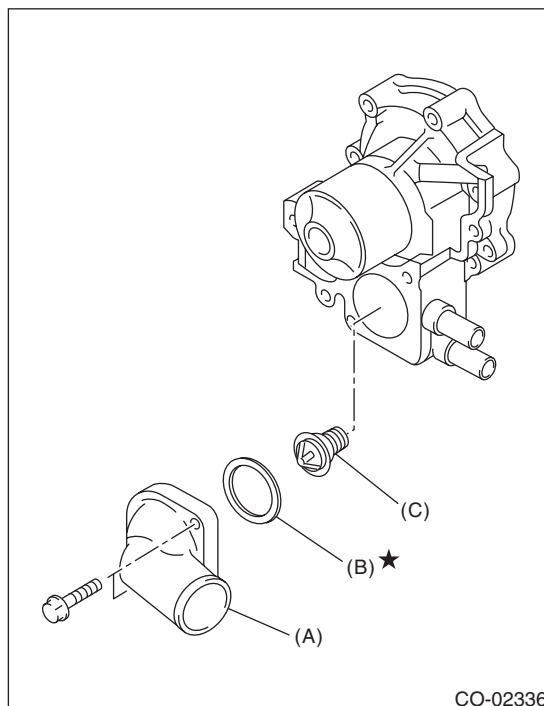
- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely.  
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



- 5) Disconnect the radiator outlet hose from thermostat cover.



- 6) Remove the thermostat cover, and then remove the gasket and thermostat.



- (A) Thermostat cover
- (B) Gasket
- (C) Thermostat

# Thermostat

## COOLING

### B: INSTALLATION

1) Install a gasket to thermostat.

#### NOTE:

Use a new gasket.

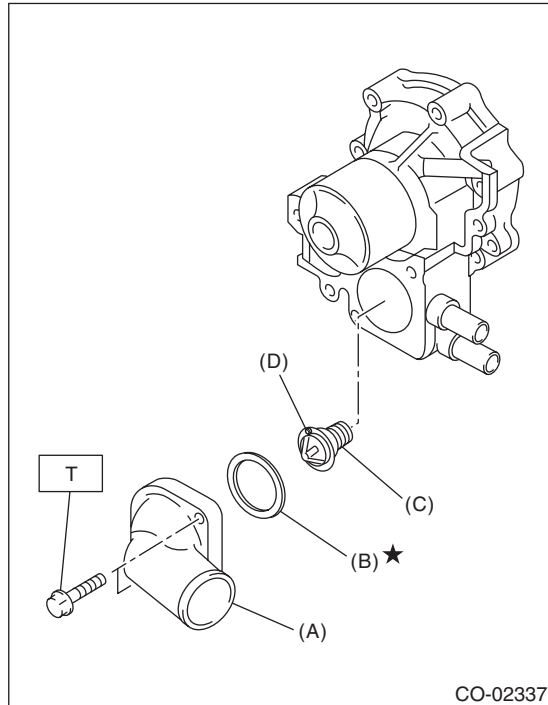
2) Install the thermostat and thermostat cover.

#### NOTE:

The thermostat must be installed with the jiggle pin facing upward.

#### Tightening torque:

**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- (A) Thermostat cover
- (B) Gasket
- (C) Thermostat
- (D) Jiggle pin

3) Connect the radiator outlet hose to thermostat cover.

4) Install the under cover.

5) Lower the vehicle.

6) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

### C: INSPECTION

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.

#### • Inspection method

Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measured value should meet the specification.

#### NOTE:

- Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

#### Starting temperature to open:

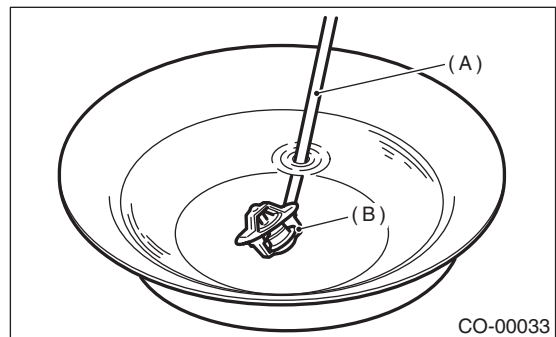
**76 — 80°C (169 — 176°F)**

#### Fully opens:

**91°C (196°F)**

#### Valve lift:

**9.0 mm (0.354 in) or more**



- (A) Thermometer
- (B) Thermostat

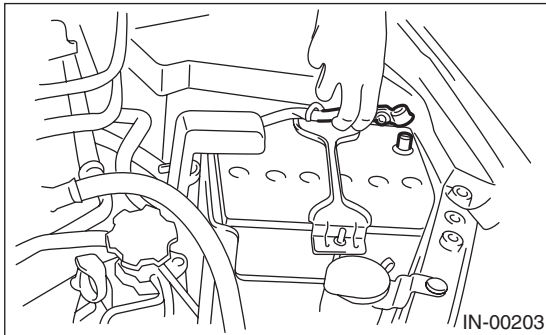
## 6. Radiator

### A: REMOVAL

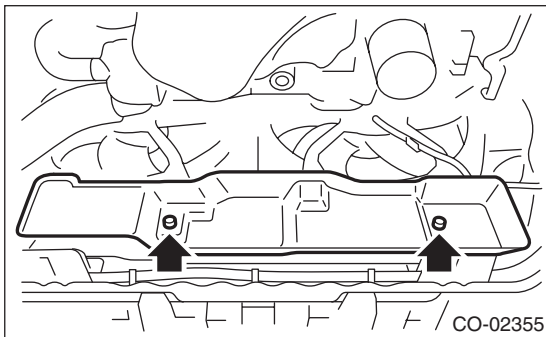
#### CAUTION:

Wait until engine cools down before working on the radiator because the radiator is pressurized.

- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.

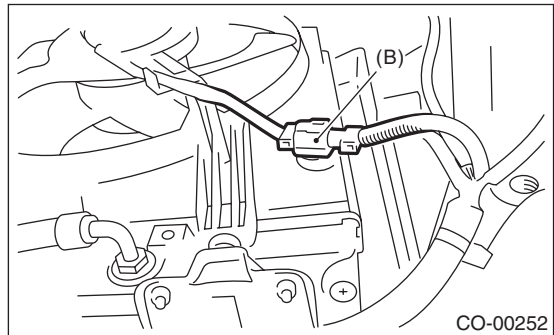
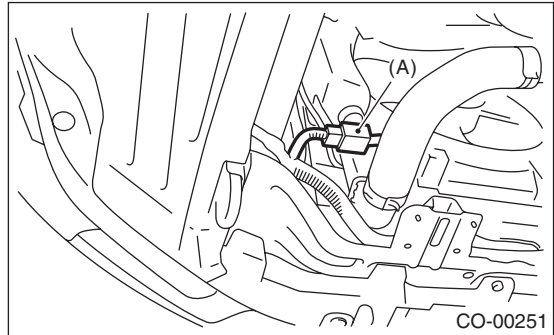


- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Remove the heat shield cover from radiator. (AT model)

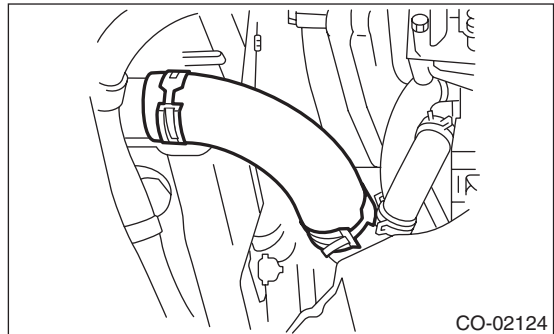


- 7) Drain engine coolant completely.  
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

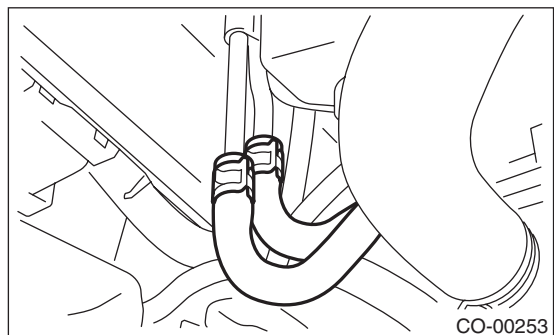
- 8) Disconnect the connectors of radiator main fan (A) and sub fan motor (B).



- 9) Disconnect the radiator outlet hose from thermostat cover.



- 10) Disconnect the ATF cooler hoses from ATF pipes.  
Plug the ATF pipe to prevent ATF from leaking. (AT model)



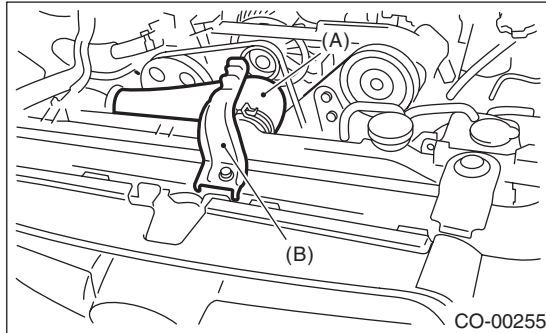
- 11) Lower the vehicle.
- 12) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 13) Disconnect the over flow hose.



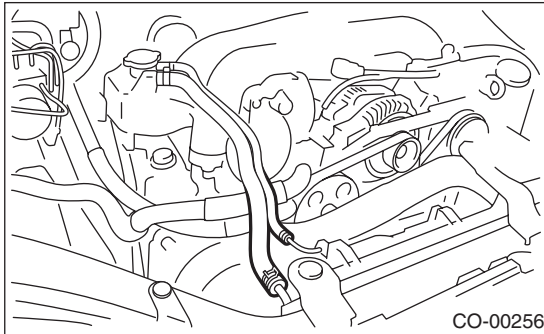
# Radiator

## COOLING

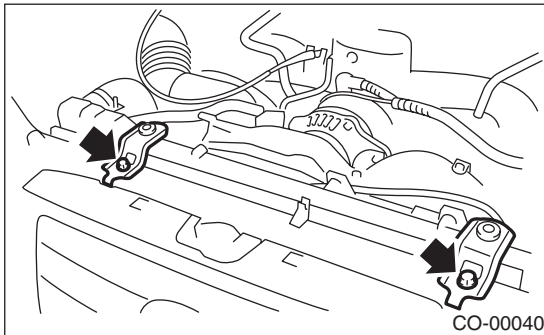
- 14) Remove the reservoir tank. <Ref. to CO(H4DOTC)-28, REMOVAL, Reservoir Tank.>
- 15) Disconnect the radiator inlet hose (A) from the radiator.
- 16) Remove the hood stay holder (B).



- 17) Disconnect the two coolant filler tank hoses from the radiator.



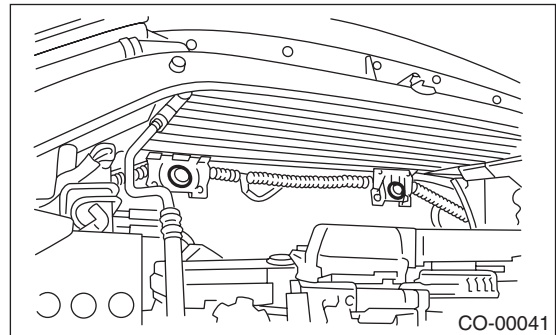
- 18) Remove the radiator upper brackets.



- 19) Move the radiator to the left while lifting it upward.
- 20) Lift the radiator up and away from vehicle.

## B: INSTALLATION

- 1) Attach the radiator lower cushion to the hole on the radiator lower bracket.



- 2) Install the radiator to vehicle.

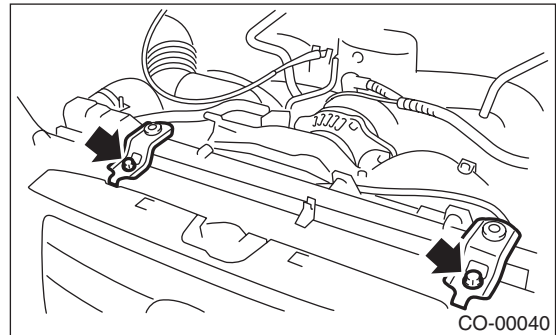
### NOTE:

Make pins on the lower side of radiator be fitted into the radiator lower cushions on body side.

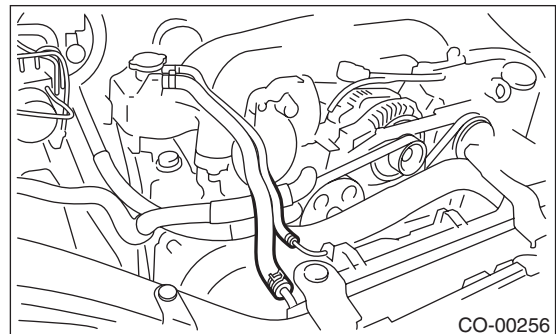
- 3) Install the radiator upper brackets and tighten the bolts.

### Tightening torque:

**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- 4) Connect the two coolant filler tank hoses to the radiator.

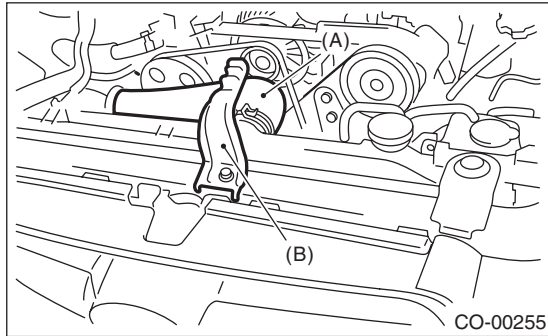


- 5) Connect the radiator inlet hose (A).

6) Install the hood stay holder (B).

**Tightening torque:**

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



7) Install the reservoir tank. <Ref. to CO(H4DOTC)-28, INSTALLATION, Reservoir Tank.>

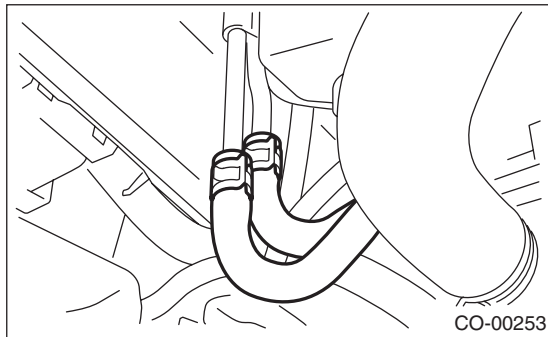
8) Connect the over flow hose.

9) Install the air intake duct.

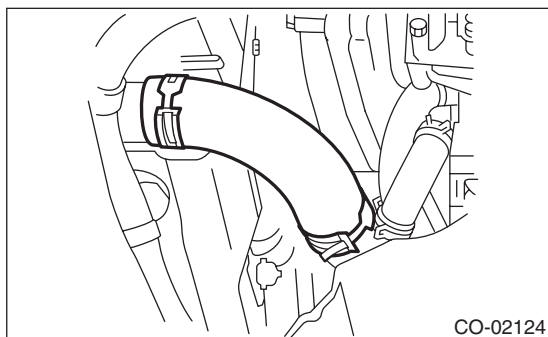
<Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>

10) Lift up the vehicle.

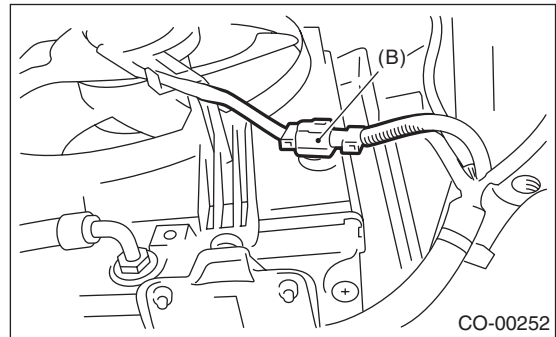
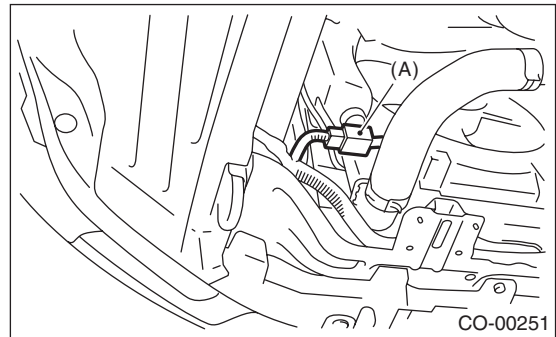
11) Connect the ATF cooler hoses. (AT model)



12) Connect the radiator outlet hose.



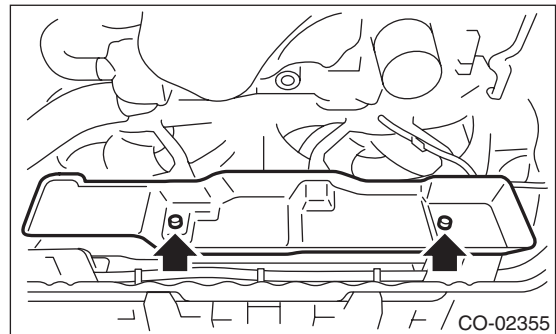
13) Connect the connectors to the radiator main fan motor (A) and sub fan motor (B).



14) Install the heat shield cover to the radiator. (AT model)

**Tightening torque:**

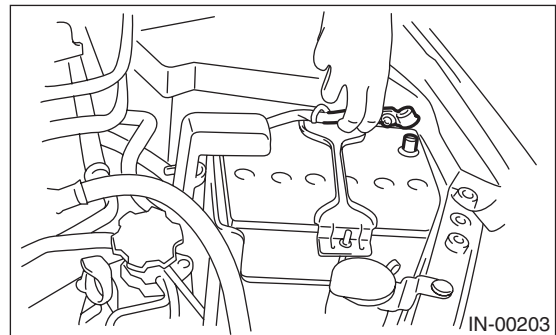
**3 N·m (0.3 kgf·m, 2.2 ft·lb)**



15) Install the under cover.

16) Lower the vehicle.

17) Connect the battery ground cable to battery.



18) Fill engine coolant.

<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

## COOLING

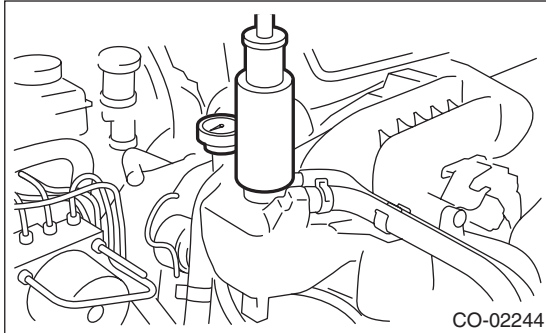
---

19) Check the ATF level. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

20) Install the collector cover.

### C: INSPECTION

1) Remove the coolant filler tank cap, fill the coolant filler tank with engine coolant, then install the tester to the installation position of the cap.



2) Apply a pressure of 122 kPa (1.2 kg/cm<sup>2</sup>, 18 psi) to the radiator and check the following points:

- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

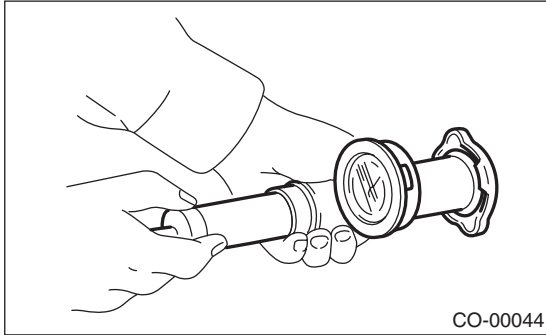
#### CAUTION:

- **Inspection must be carried out at the side of coolant filler tank, not at the side of radiator.**
- **Engine should be turned off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful of the spurt of engine coolant when removing the tester.**
- **Be careful not to deform the filler neck of the coolant filler tank when installing and removing the tester.**

## 7. Radiator Cap

### A: INSPECTION

1) Attach the radiator cap to tester.



2) Increase pressure until the tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds. Remove the cap if it is opened under a pressure less than the service limit value

#### **Coolant filler tank side**

##### **Specification:**

**93 — 123 kPa**

**(0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)**

##### **Service limit:**

**83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)**

#### **Radiator side**

##### **Specification:**

**122 — 152 kPa**

**(1.24 — 1.55 kg/cm<sup>2</sup>, 18 — 22 psi)**

##### **Service limit:**

**112 kPa (1.14 kg/cm<sup>2</sup>, 16 psi)**

#### **CAUTION:**

- Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.
- Do not confuse the cap of coolant filler tank and cap of radiator.

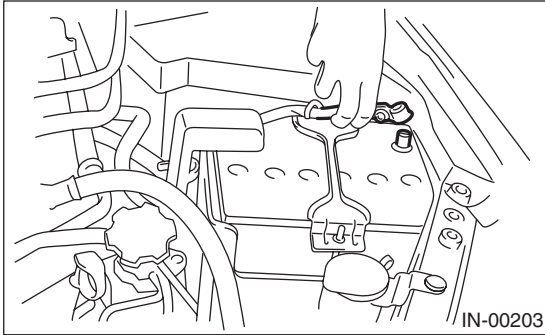
# Radiator Main Fan and Fan Motor

## COOLING

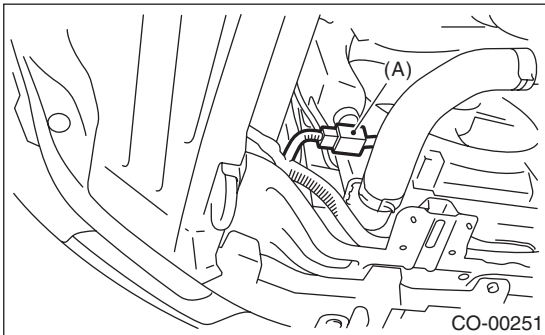
### 8. Radiator Main Fan and Fan Motor

#### A: REMOVAL

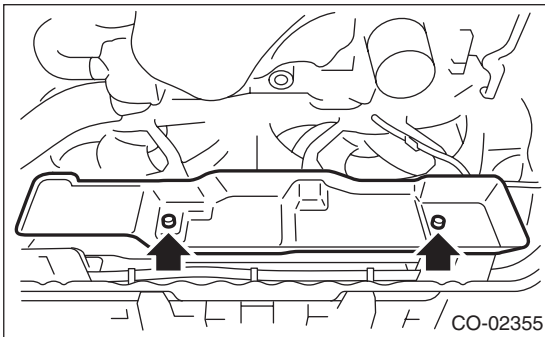
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Disconnect the main fan motor connector (A).

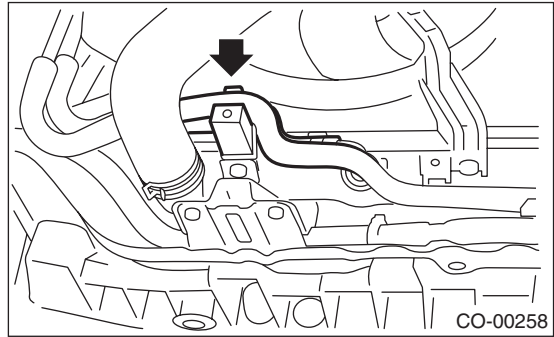


- 7) Remove the heat shield cover from radiator. (AT model)

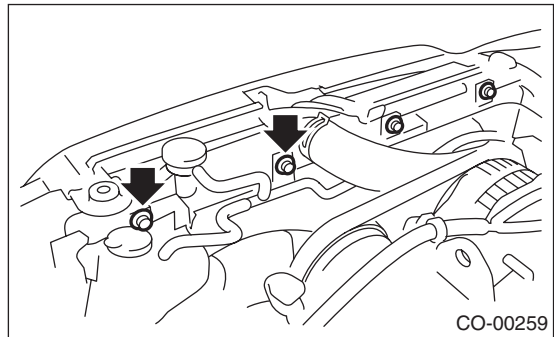


- 8) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

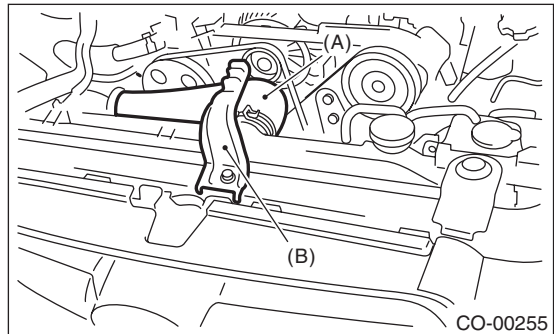
- 9) Remove the ATF hose from the clip of the radiator main fan motor assembly. (AT model)



- 10) Lower the vehicle.
- 11) Remove the air intake duct.
- 12) Disconnect the over flow hose.
- 13) Remove the over flow pipe.
- 14) Remove the reservoir tank. <Ref. to CO(H4DOTC)-28, REMOVAL, Reservoir Tank.>
- 15) Remove the mounting bolts from radiator main fan motor assembly.



- 16) Disconnect the radiator inlet hose (A) from the radiator.
- 17) Remove the hood stay holder (B).



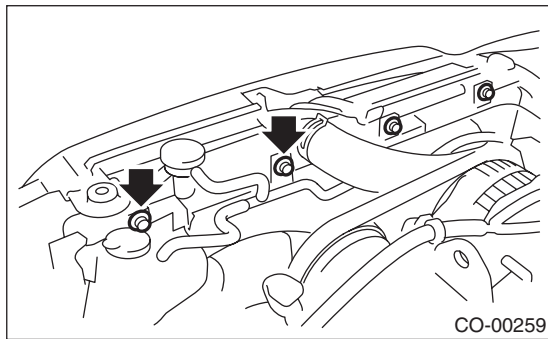
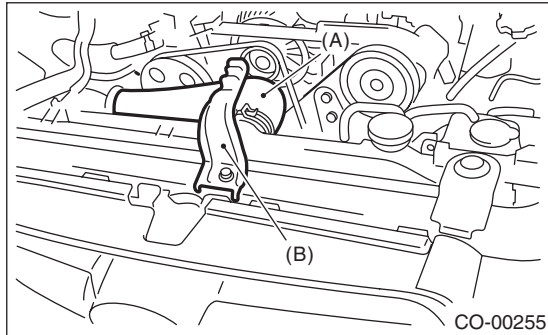
- 18) Remove the radiator main fan motor assembly from vehicle.

## B: INSTALLATION

Install in the reverse order of removal.

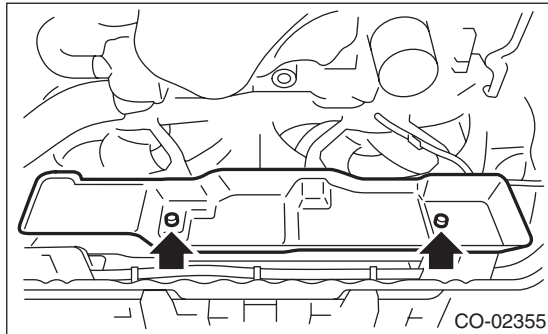
**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



**Tightening torque:**

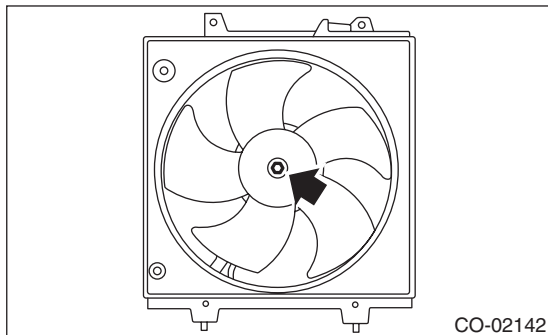
**3 N·m (0.3 kgf-m, 2.2 ft-lb)**



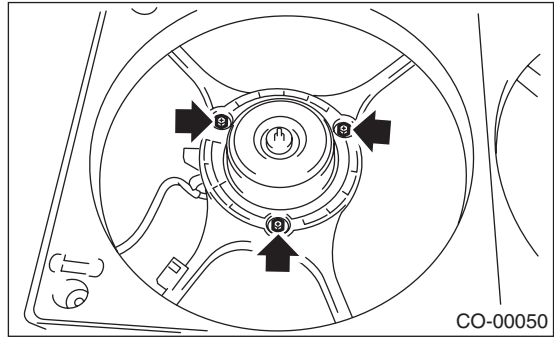
## C: DISASSEMBLY

1) Remove the clip which holds the fan motor connector onto the shroud.

2) Remove the nuts which hold the fan to the fan motor.



3) Remove the bolts which hold fan motor onto shroud.

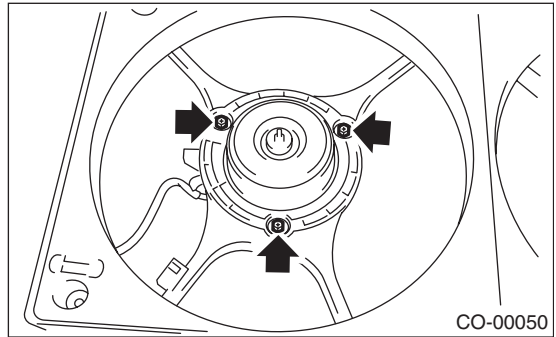


## D: ASSEMBLY

Assemble in the reverse order of disassembly.

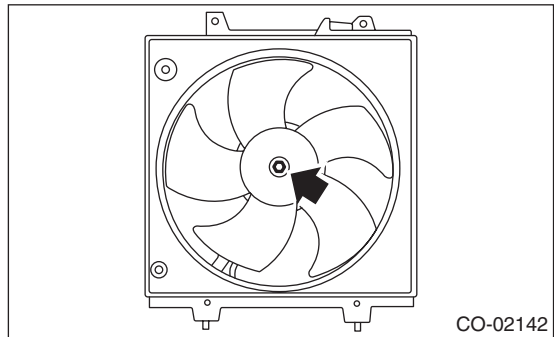
**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



**Tightening torque:**

**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**



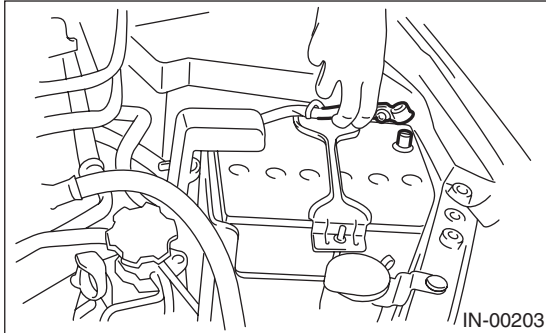
# Radiator Sub Fan and Fan Motor

## COOLING

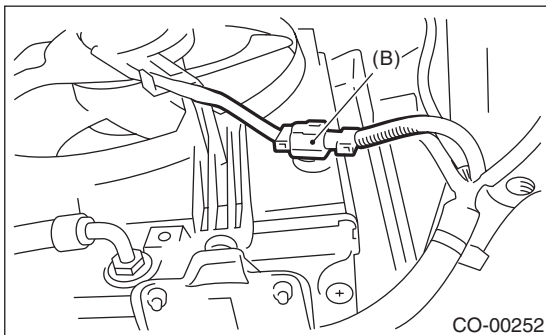
### 9. Radiator Sub Fan and Fan Motor

#### A: REMOVAL

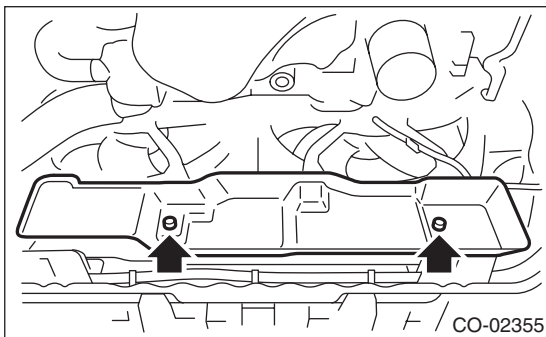
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Disconnect the sub fan motor connector (B).

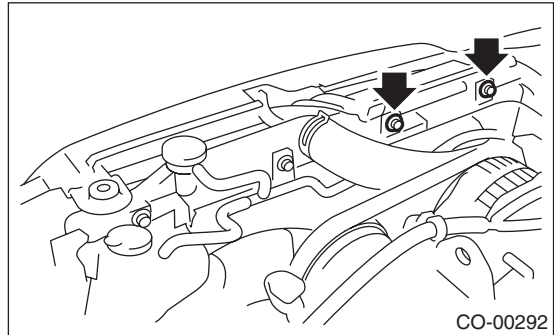


- 7) Remove the heat shield cover from radiator. (AT model)

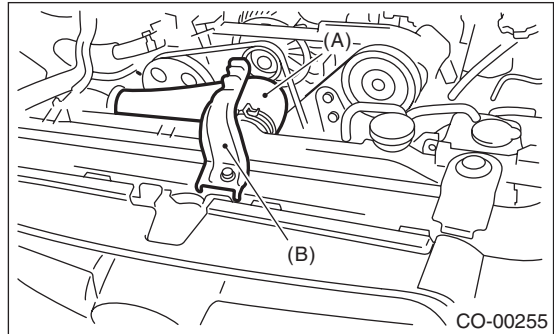


- 8) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 9) Remove the ATF hose from the clip of the radiator sub fan motor assembly. (AT model)
- 10) Lower the vehicle.
- 11) Remove the air intake duct.
- 12) Disconnect the over flow hose.
- 13) Remove the over flow pipe.

- 14) Remove the reservoir tank. <Ref. to CO(H4DOTC)-28, REMOVAL, Reservoir Tank.>
- 15) Remove the mounting bolts from the radiator sub fan motor assembly.



- 16) Disconnect the radiator inlet hose (A) from the radiator.
- 17) Remove the hood stay holder (B).



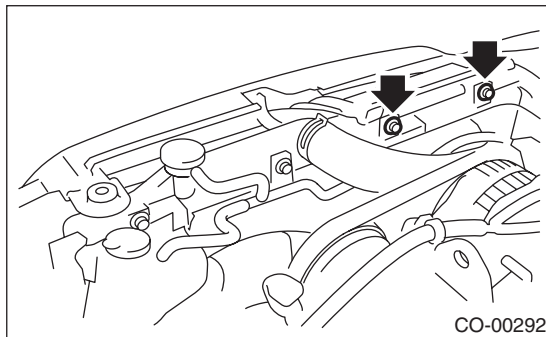
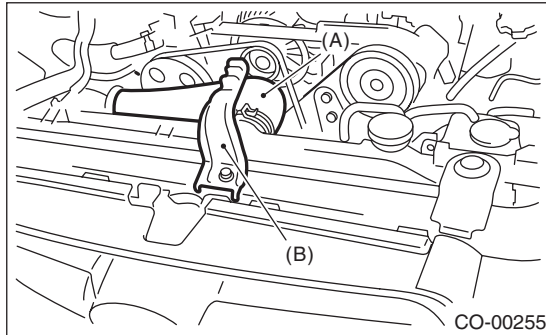
- 18) Remove the radiator sub fan motor assembly from the vehicle.

## B: INSTALLATION

Install in the reverse order of removal.

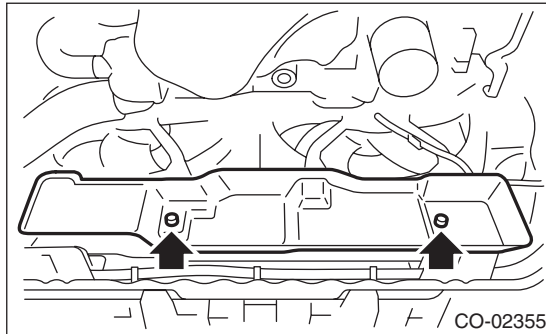
**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



**Tightening torque:**

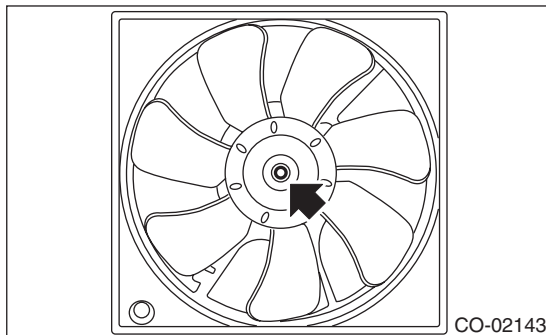
**3 N·m (0.3 kgf-m, 2.2 ft-lb)**



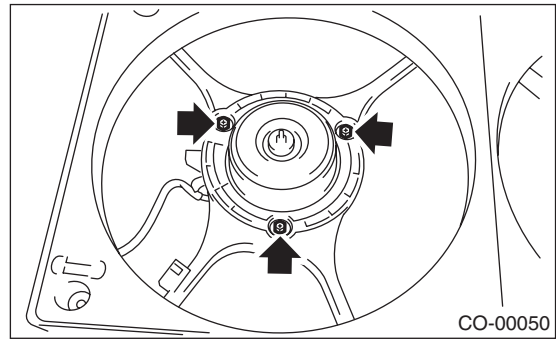
## C: DISASSEMBLY

1) Remove the clip which holds the fan motor connector onto the shroud.

2) Remove the nuts which hold the fan to the fan motor.



3) Remove the bolts which hold fan motor onto shroud.

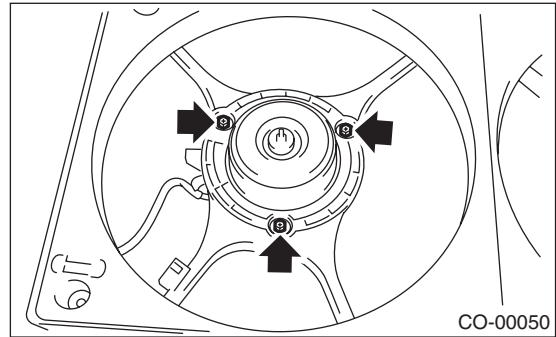


## D: ASSEMBLY

Assemble in the reverse order of disassembly.

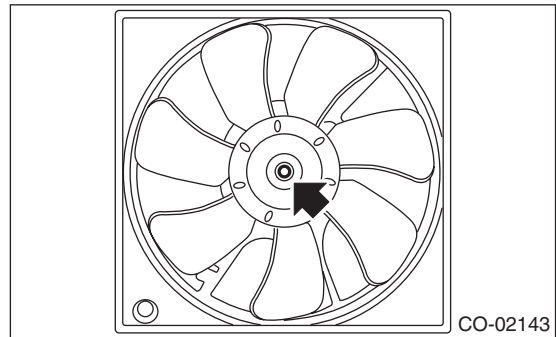
**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



**Tightening torque:**

**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**

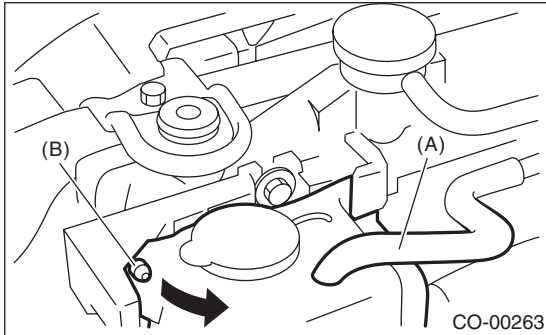




## 10. Reservoir Tank

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the over flow hose (A).
- 3) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Make sure the engine coolant level is between "FULL" and "LOW".

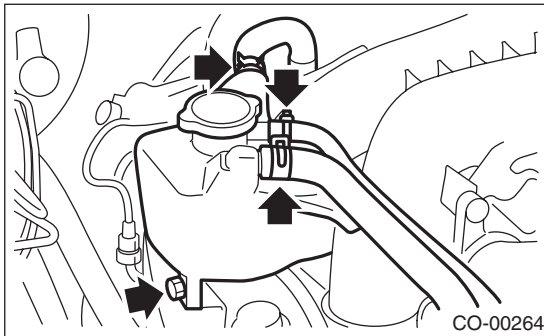
## 11. Coolant Filler Tank

### A: REMOVAL

#### WARNING:

The radiator is pressurized. Wait until engine cools down before working on the radiator.

- 1) Remove the collector cover.
- 2) Drain the coolant about 3.0 ℓ (3.2 US qt, 2.6 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 3) Disconnect the engine coolant hoses from coolant filler tank.
- 4) Remove the bolts which install the coolant filler tank.
- 5) Disconnect the engine coolant hose which connects the under side of coolant filler tank.
- 6) Remove the coolant filler tank.

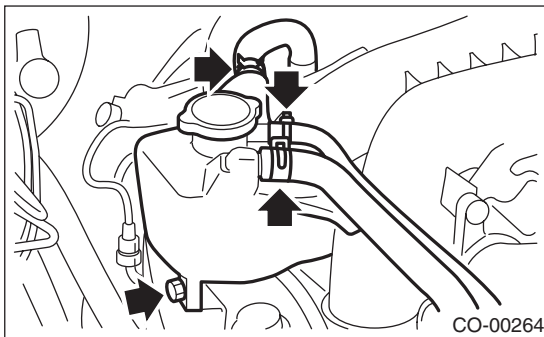


### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### Tightening torque:

**16 N·m (1.6 kgf·m, 11.8 ft·lb)**



- 2) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

# Engine Cooling System Trouble in General

COOLING

## 12.Engine Cooling System Trouble in General

### A: INSPECTION

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Engine oil mixed in engine coolant	Replace the engine coolant. If it is ineffective, inspect and repair the engine side.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Correct or replace.
	n. Dragging brake	Adjust.
o. Defective radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them.	
Over-cooling	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Correct or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Correct or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and cylinder block	Correct or replace.
	f. Damaged or cracked thermostat case	Correct or replace.
	g. Leakage from radiator	Correct or replace.
Noise	a. Timing belt problem	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

# General Description

## LUBRICATION

### 1. General Description

#### A: SPECIFICATION

Lubrication method			Forced lubrication		
Oil pump	Pump type		Trochoid type		
	Number of teeth	Inner rotor	9		
		Outer rotor	10		
	Outer rotor diameter × thickness		mm (in)	78 × 10 (3.07 × 0.47)	
	Tip clearance between inner and outer rotors		mm (in)	0.04 — 0.14 (0.0016 — 0.0055)	
	Side clearance between inner rotor and pump case		mm (in)	0.02 — 0.07 (0.0008 — 0.0028)	
	Case clearance between outer rotor and pump case		Standard mm (in)	0.10 — 0.175 (0.0039 — 0.0069)	
	Performance (Oil temperature 80°C (176°F))	600 rpm	Discharge pressure	kPa (kg/cm <sup>2</sup> , psi)	98 (1.0, 14)
			Discharge rate	ℓ (US qt, Imp qt)/min.	4.6 (4.9, 4.0) or more
		5,000 rpm	Discharge pressure	kPa (kg/cm <sup>2</sup> , psi)	294 (3.0, 43)
Discharge rate			ℓ (US qt, Imp qt)/min.	47.0 (49.7, 41.4) or more	
Relief valve working pressure		kPa (kg/cm <sup>2</sup> , psi)	588 (6.0, 85)		
Oil filter	Filter type		Full-flow filter type		
	Filtration area	cm <sup>2</sup> (sq in)	Outer diameter: 68 mm (2.68 in)	800 (124)	
			Outer diameter: 65 mm (2.56 in)	470 (72.9)	
	By-pass valve opening pressure		kPa (kg/cm <sup>2</sup> , psi)	160 (1.63, 23.2)	
	Outer diameter × width	mm (in)	Outer diameter: 68 mm (2.68 in)	68 × 65 (2.68 × 2.56)	
			Outer diameter: 65 mm (2.56 in)	65 × 74.4 (2.56 × 2.93)	
Installation screw specifications			M 20 × 1.5		
Oil pressure switch	Type		Immersed contact point type		
	Operating voltage — power consumption		12 V — 3.4 W or less		
	Warning light operating pressure		kPa (kg/cm <sup>2</sup> , psi)	14.7 (0.15, 2.1)	
	Proof pressure		kPa (kg/cm <sup>2</sup> , psi)	981 (10, 142) or more	
Engine oil	Total capacity (Overhaul)		ℓ (US qt, Imp qt)	5.0 (5.3, 4.4)	
	When replacing engine oil and oil filter		ℓ (US qt, Imp qt)	4.3 (4.5, 3.8)	
	When replacing engine oil only		ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)	

**Recommended oil:**

**Items having the API standard SM “Energy Conserving” logo or ILSAC standard GF-4 Starburst mark label on the container**

SAE (1)							
(°C)	-30	-20	-15	0	15	30	40
(°F)	-22	-4	5	32	59	86	104

LU-02329

- (1) SAE viscosity No. and applicable temperature
- (2) Recommended

The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

**CAUTION:**

**It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.**

**NOTE:**

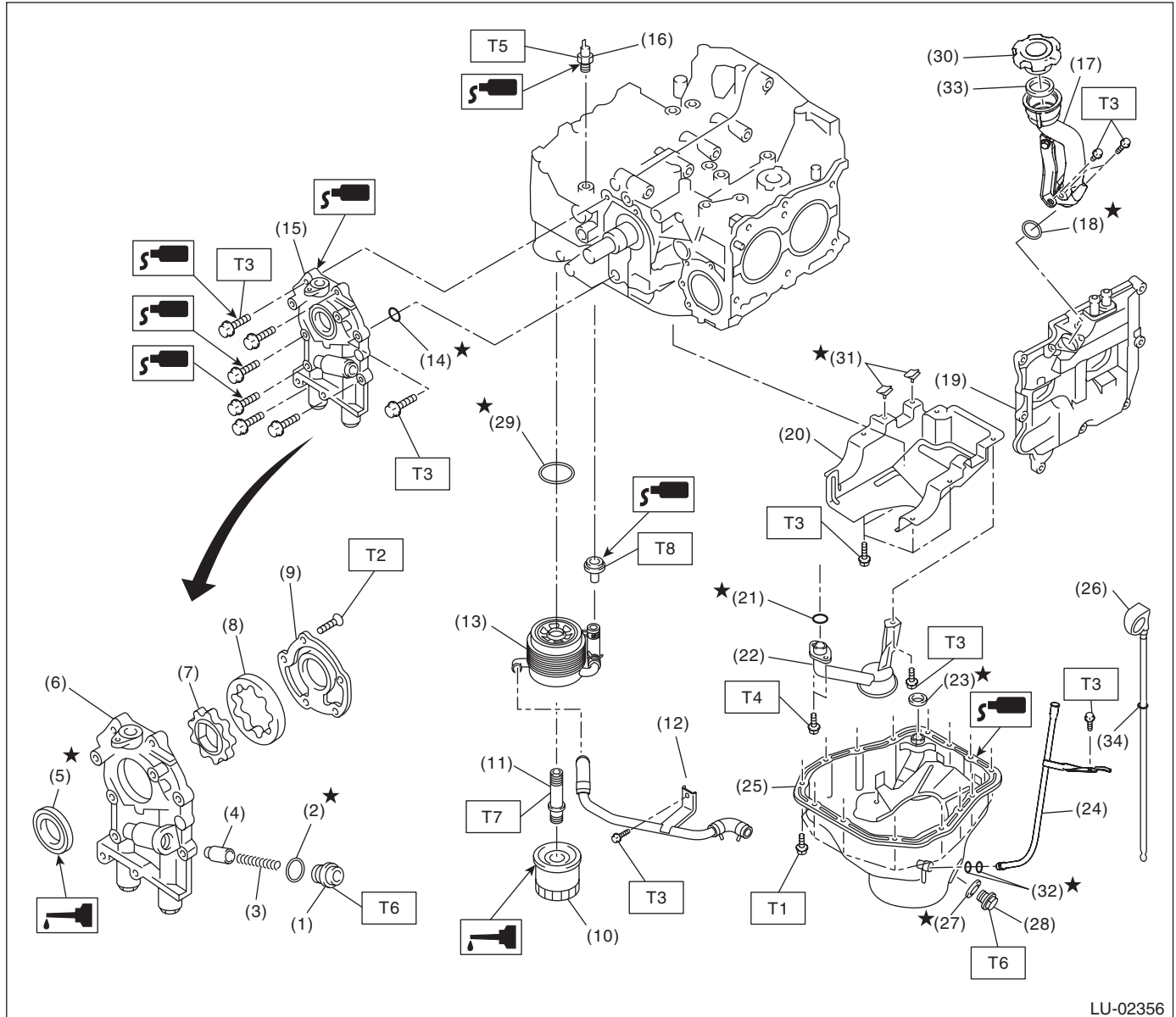
If the vehicle is used in regions with high temperatures or in other severe environments, use oil with the viscosities shown below. API standard: SM or SL

SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

# General Description

LUBRICATION

## B: COMPONENT



LU-02356

- |                           |                            |
|---------------------------|----------------------------|
| (1) Plug                  | (16) Oil pressure switch   |
| (2) Gasket                | (17) Oil filler duct       |
| (3) Relief valve spring   | (18) O-ring                |
| (4) Relief valve          | (19) Rocker cover          |
| (5) Front oil seal        | (20) Baffle plate          |
| (6) Oil pump case         | (21) O-ring                |
| (7) Inner rotor           | (22) Oil strainer          |
| (8) Outer rotor           | (23) Gasket                |
| (9) Oil pump cover        | (24) Oil level gauge guide |
| (10) Oil filter           | (25) Oil pan               |
| (11) Oil cooler connector | (26) Oil level gauge       |
| (12) Water by-pass pipe   | (27) Drain plug gasket     |
| (13) Oil cooler           | (28) Drain plug            |
| (14) O-ring               | (29) Gasket                |
| (15) Oil pump ASSY        | (30) Oil filler cap        |

- |             |
|-------------|
| (31) Seal   |
| (32) O-ring |
| (33) Gasket |
| (34) O-ring |

### Tightening torque: N·m (kgf·m, ft·lb)

- |                            |
|----------------------------|
| <b>T1: 5 (0.5, 3.7)</b>    |
| <b>T2: 5.4 (0.55, 4.0)</b> |
| <b>T3: 6.4 (0.65, 4.7)</b> |
| <b>T4: 10 (1.0, 7.0)</b>   |
| <b>T5: 25 (2.5, 18.4)</b>  |
| <b>T6: 44 (4.5, 32.5)</b>  |
| <b>T7: 54 (5.5, 40)</b>    |
| <b>T8: 69 (7.0, 50.9)</b>  |

LU(H4DOTC)-4

### **C: CAUTION**

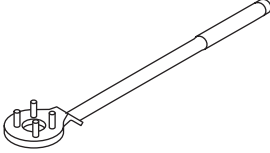
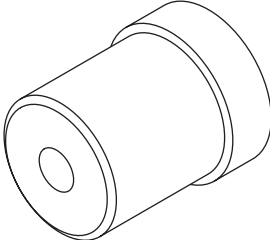
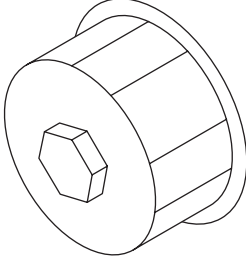
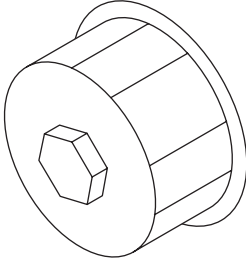
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

# General Description

LUBRICATION

## D: PREPARATION TOOL

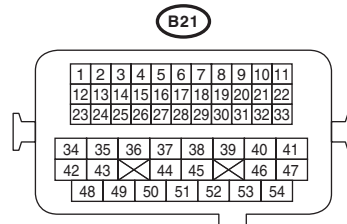
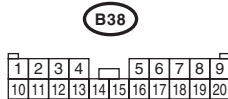
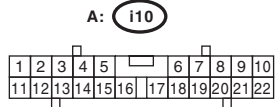
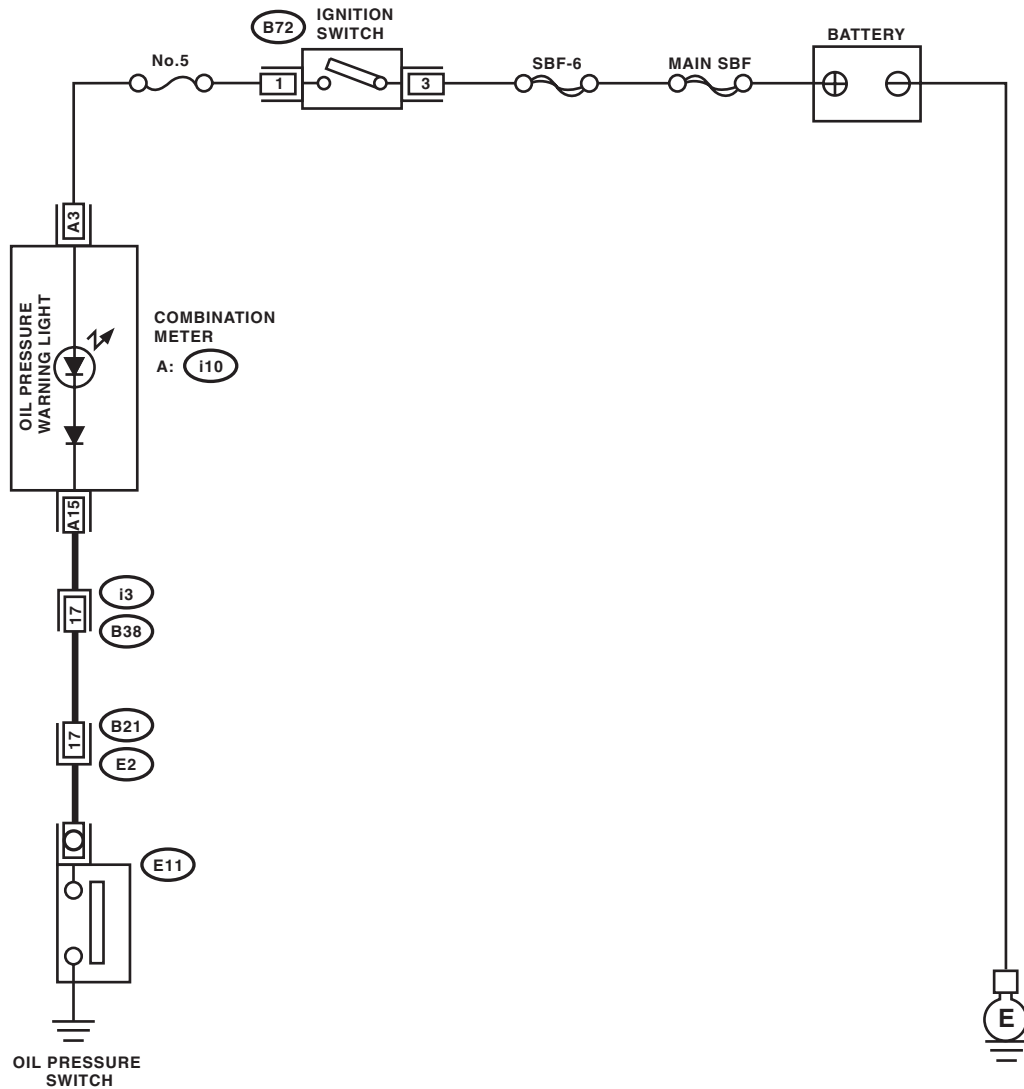
### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 <p style="text-align: center;">ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil seal into oil pump.
 <p style="text-align: center;">ST18332AA000</p>	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))
 <p style="text-align: center;">ST18332AA010</p>	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))



## 2. Oil Pressure System

### A: WIRING DIAGRAM



LU-02357

# Oil Pressure System

LUBRICATION

## B: INSPECTION

Step	Check	Yes	No
<b>1</b> <b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Check the warning light in the combination meter.	Does the warning light illuminate?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
<b>2</b> <b>CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between oil pressure switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E11) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Replace the oil pressure switch.	Go to step 3.
<b>3</b> <b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. <b>Terminals</b> <b>(i10) No. 3 — No. 15:</b>	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between combination meter and oil pressure switch</li> <li>• Poor contact in combination meter connector</li> <li>• Poor contact in oil pressure switch connector</li> <li>• Poor contact of coupling connector</li> </ul>	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>

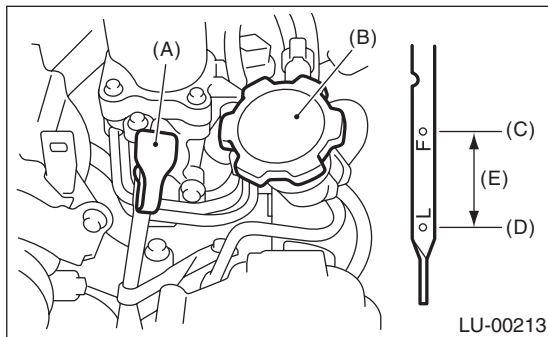
## 3. Engine Oil

### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe away the oil.
- 3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
- 4) Remove the oil level gauge again and check the reading. If the engine oil level is below "L" line, add oil to bring the level up to "F" line.
- 5) Start the engine and warm it up for a time.
- 6) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.
- 7) Just after driving or while the engine is warm, engine oil level shows in the range between "F" line and cutout portion. This is caused by thermal expansion of engine oil.

**NOTE:**

- To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
- As the oil level gauge is used for daily inspection, standard of upper and lower level of the oil level gauge is set for the condition that engine is cold.



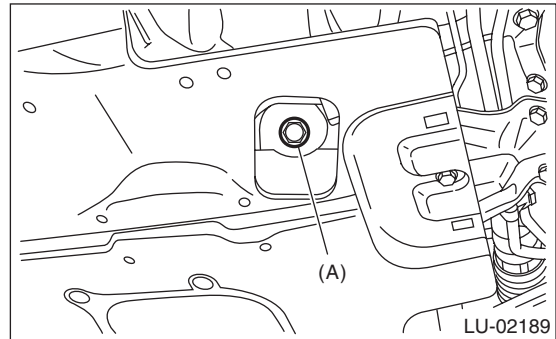
- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

### B: REPLACEMENT

- 1) Set the vehicle on a lift.
- 2) Open the engine oil filler cap for quick draining of engine oil.
- 3) Lift up the vehicle.
- 4) Drain engine oil by loosening the engine oil drain plug.

**NOTE:**

Prepare the container for draining of engine oil.



- 5) Tighten the engine oil drain plug after draining engine oil.

**CAUTION:**

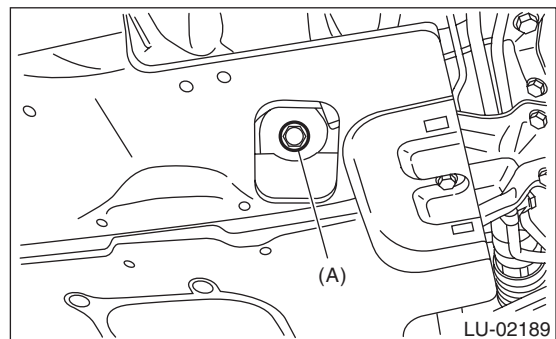
**If the engine oil is spilled over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.**

**NOTE:**

Use a new drain plug gasket.

**Tightening torque:**

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**



- 6) Using engine oil of proper quality and viscosity, fill engine oil through the oil filler duct to the "F" line on oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

**Recommended oil:**

**Refer to "SPECIFICATION" for the recommended oil. <Ref. to LU(H4DOTC)-2, SPECIFICATION, General Description.>**

**Engine oil capacity:**

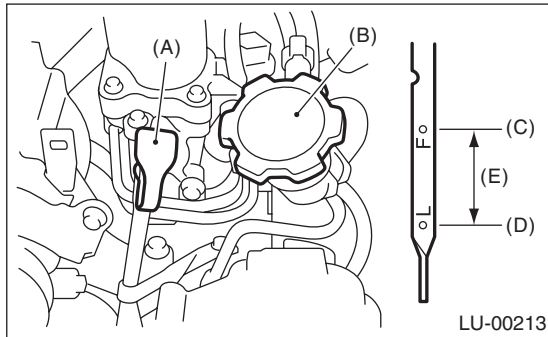
**Refer to "SPECIFICATION" for the engine oil capacity. <Ref. to LU(H4DOTC)-2, SPECIFICATION, General Description.>**

# Engine Oil

## LUBRICATION

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- 7) Close the engine oil filler cap.
- 8) Start the engine and warm it up for a time.
- 9) After the engine stops, recheck the oil level. If necessary, add engine oil up to the "F" line on oil level gauge.

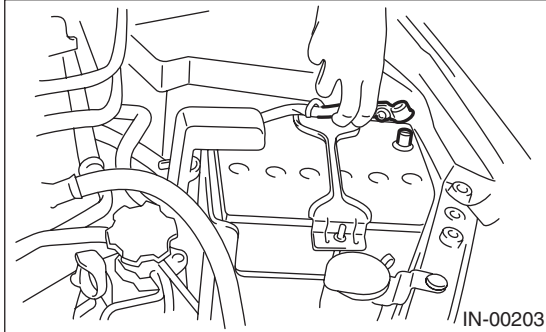


- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

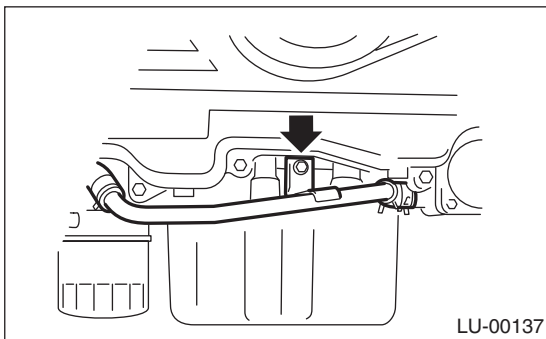
## 4. Oil Pump

### A: REMOVAL

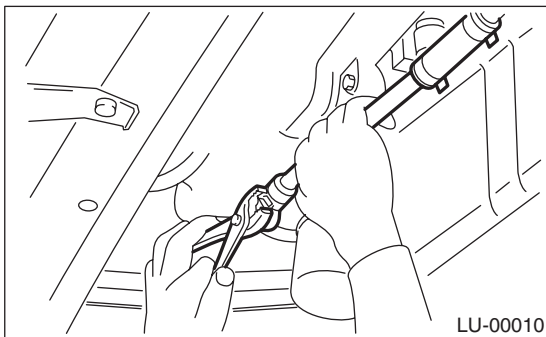
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Remove the bolts which install water pipe of oil cooler to oil pump.

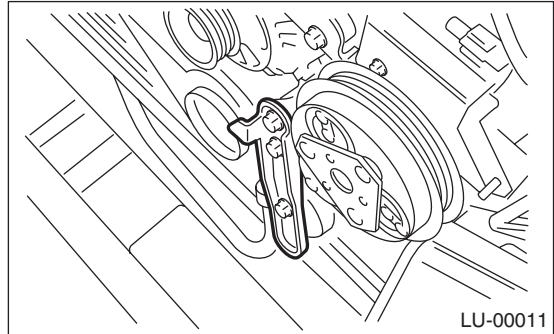


- 7) Remove the water pipe and hoses between oil cooler and water pump.

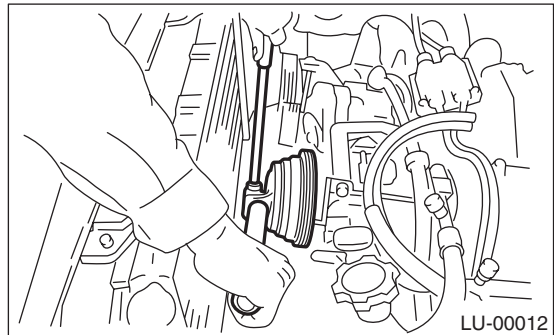


- 8) Lower the vehicle.
- 9) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 10) Remove the crankshaft position sensor. <Ref. to FU(H4DOTC)-26, REMOVAL, Crankshaft Position Sensor.>
- 11) Remove the V-belts. <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.>

- 12) Remove the belt tensioner.

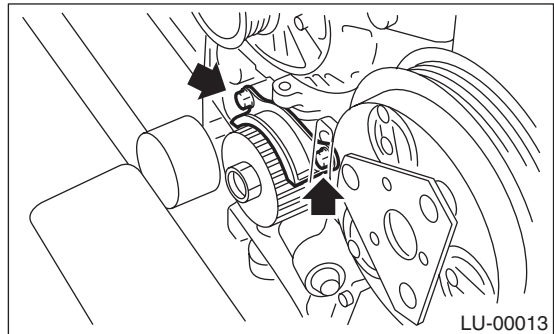


- 13) Remove the crank pulley using ST. <Ref. to ME(H4DOTC)-40, REMOVAL, Crank Pulley.>

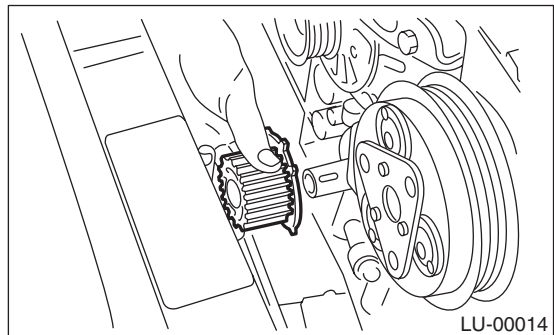


- 14) Remove the water pump. <Ref. to CO(H4DOTC)-15, REMOVAL, Water Pump.>

- 15) Remove the timing belt guide. (MT model)



- 16) Remove the crank sprocket.



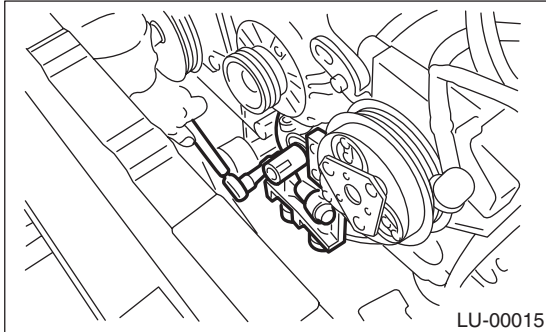
# Oil Pump

## LUBRICATION

17) Remove the bolts which install oil pump onto cylinder block.

### NOTE:

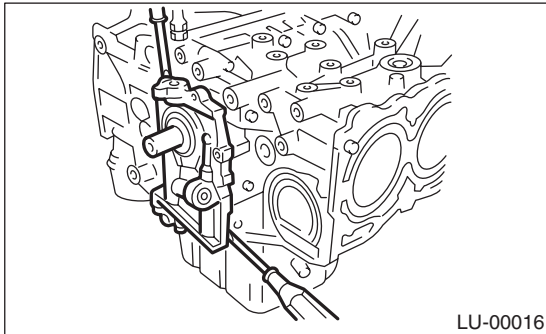
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



18) Remove the oil pump by using flat tip screwdriver.

### CAUTION:

Be careful not to scratch mating surfaces of cylinder block and oil pump.



19) Remove the front oil seal from the oil pump.

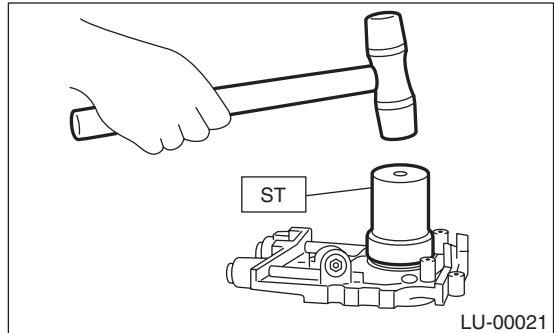
## B: INSTALLATION

Install in the reverse order of removal.  
Perform the following.

1) Using the ST, install the front oil seal.  
ST 499587100 OIL SEAL INSTALLER

### NOTE:

Use a new front oil seal.



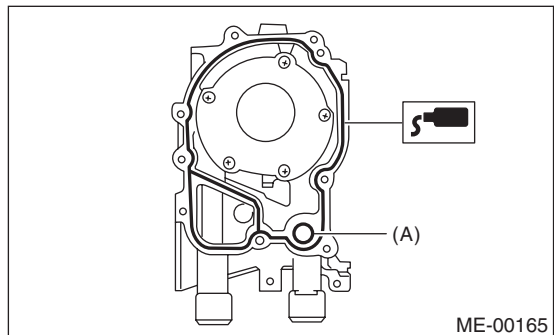
2) Apply liquid gasket to the mating surfaces of oil pump.

### NOTE:

Install within 5 min. after applying liquid gasket.

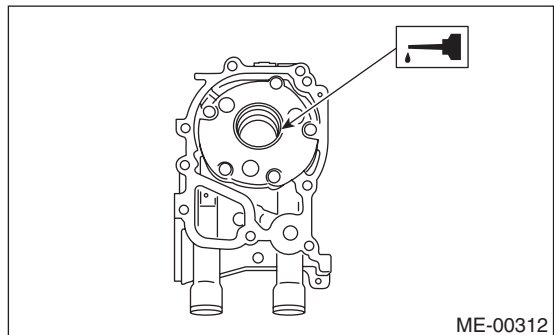
### Liquid gasket:

**THREE BOND 1217G (Part No. K0877Y0100)**  
or equivalent



(A) O-ring

3) Apply a coat of engine oil to the inside of oil seal.



4) Install the oil pump to cylinder block. Be careful not to damage the oil seal during installation.

**NOTE:**

- Make sure the front oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings.

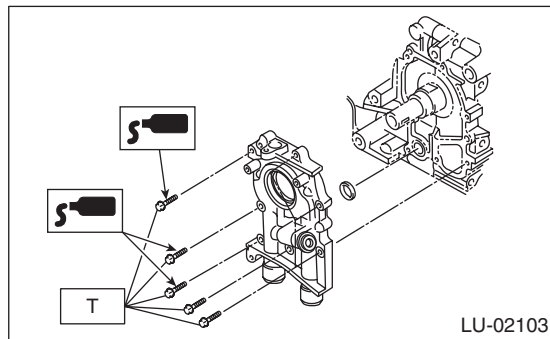
5) Apply liquid gasket to the three bolts thread shown in figure. (when reuse the bolts)

**Liquid gasket:**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

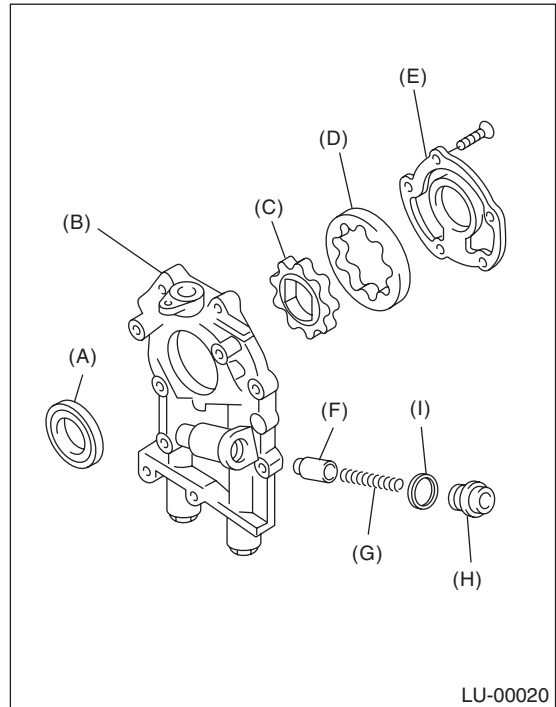


## C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

**NOTE:**

Before disassembling the oil pump, remove the relief valve.



- (A) Front oil seal
- (B) Oil pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Oil pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

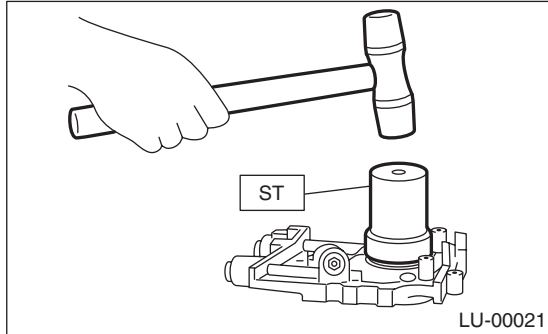
# Oil Pump

## LUBRICATION

### D: ASSEMBLY

1) Using the ST, install the front oil seal.  
ST 499587100 OIL SEAL INSTALLER

NOTE:  
Use a new front oil seal.



- 2) Apply a coat of engine oil to inner and outer rotors.
- 3) Assemble the inner and outer rotors in their original positions.
- 4) Assemble the oil relief valve and install relief valve spring and plug.

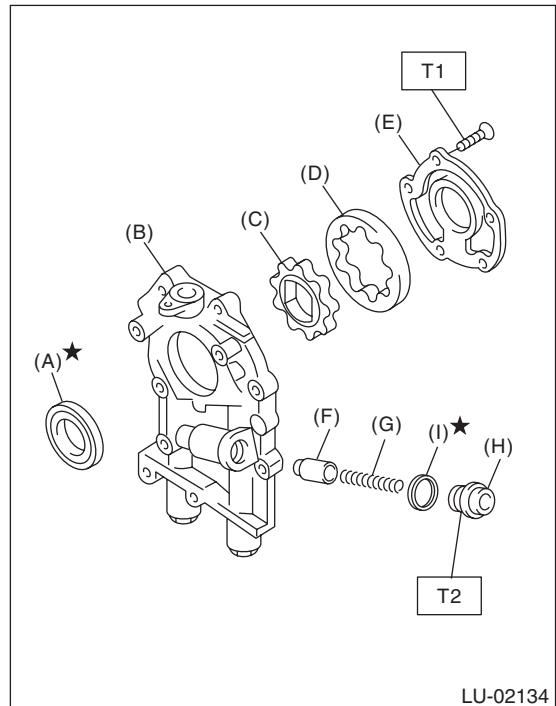
NOTE:  
Use a new gasket.

5) Install the oil pump cover.

#### **Tightening torque:**

**T1: 5.4 N·m (0.55 kgf-m, 4.0 ft-lb)**

**T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)**



- (A) Front oil seal
- (B) Oil pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Oil pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

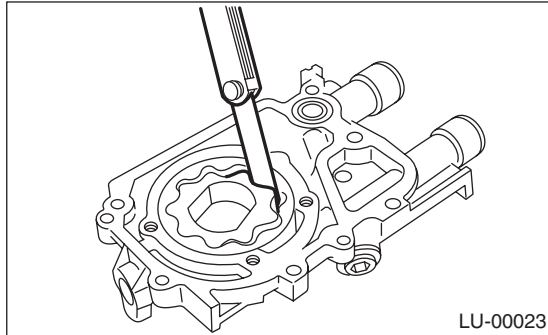


**E: INSPECTION****1. TIP CLEARANCE**

Measure the tip clearance of rotors. If the clearance is out of specification, replace the rotors as a set.

**Tip clearance:****Standard**

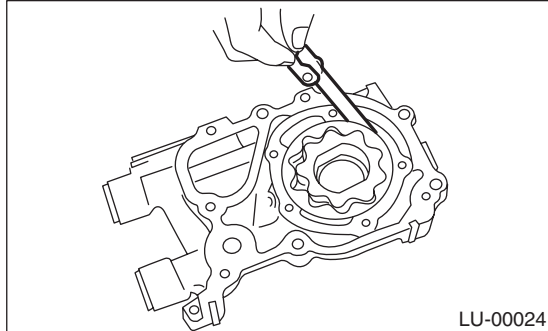
**0.04 — 0.14 mm (0.0016 — 0.0055 in)**

**2. CASE CLEARANCE**

Measure the clearance between the outer rotor and the oil pump case. If clearance is out of standard, replace the oil pump case.

**Case clearance:****Standard**

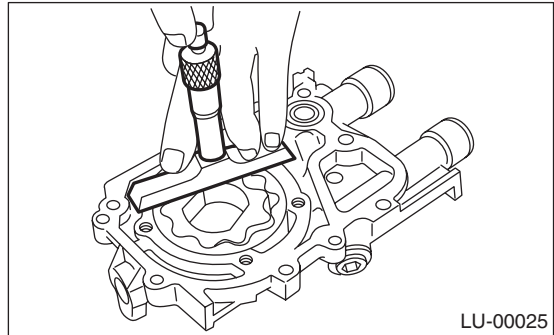
**0.10 — 0.175 mm (0.0039 — 0.0069 in)**

**3. SIDE CLEARANCE**

Measure the clearance between the inner rotor and the oil pump cover by checking the step between the inner rotor and the oil pump cover as shown in the following figure. If the clearance is out of specification, replace the rotors and the oil pump case.

**Side clearance:****Standard**

**0.02 — 0.07 mm (0.0008 — 0.0028 in)**

**4. OIL RELIEF VALVE**

Check the valve for assembly condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

**Relief valve spring:****Free length**

**73.7 mm (2.902 in)**

**Installed length**

**54.7 mm (2.154 in)**

**Load when installed**

**93.1 N (9.49 kgf, 20.88 lbf)**

**5. OIL PUMP CASE**

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

**6. OIL SEAL**

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

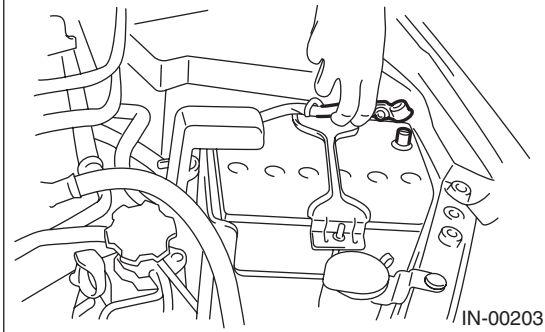
# Oil Pan and Strainer

## LUBRICATION

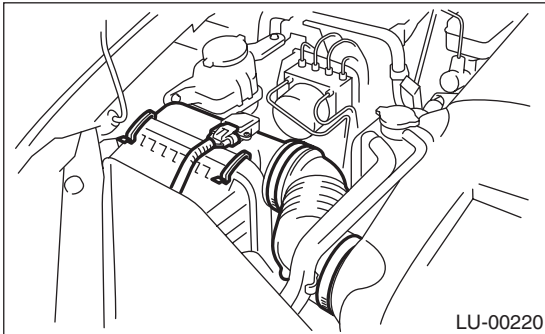
### 5. Oil Pan and Strainer

#### A: REMOVAL

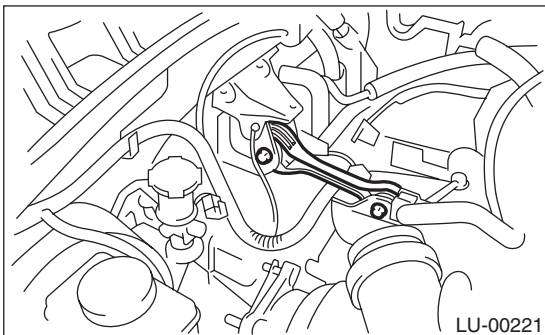
- 1) Set the vehicle on a lift.
- 2) Remove the front wheels.
- 3) Remove the collector cover.
- 4) Disconnect the ground cable from the battery.



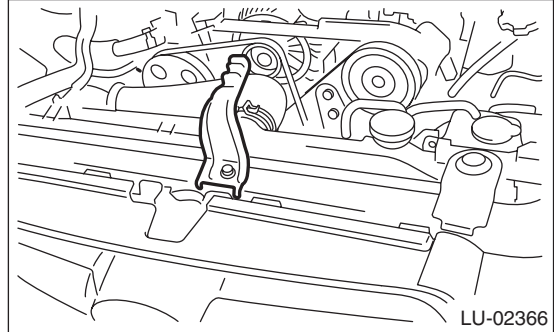
- 5) Disconnect the connectors from the mass air flow and intake air temperature sensor.
- 6) Remove the air intake boot and air cleaner case (rear).



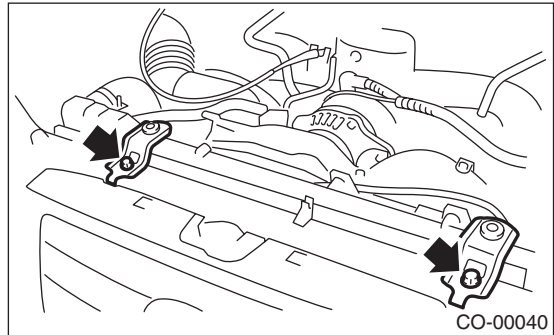
- 7) Remove the intercooler.  
<Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 8) Remove the pitching stopper.



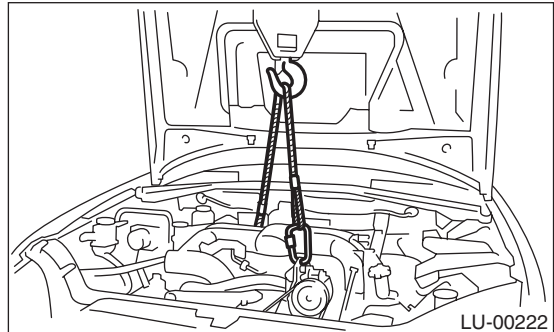
- 9) Remove the hood stay holder.



- 10) Remove the radiator upper brackets.



- 11) Support the engine with a lifting device and wire ropes.



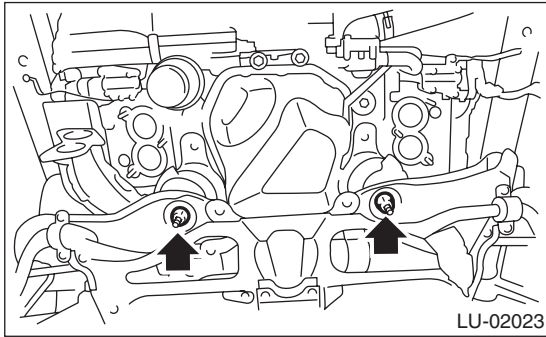
- 12) Lift up the vehicle.

#### CAUTION:

**When lifting up the vehicle, raise up wire ropes at the same time.**

- 13) Remove the under cover.
- 14) Drain the engine oil.
- 15) Remove the front exhaust pipe.  
<Ref. to EX(H4DOTC)-6, REMOVAL, Front Exhaust Pipe.>

16) Remove the nuts which install front cushion rubber onto front crossmember.

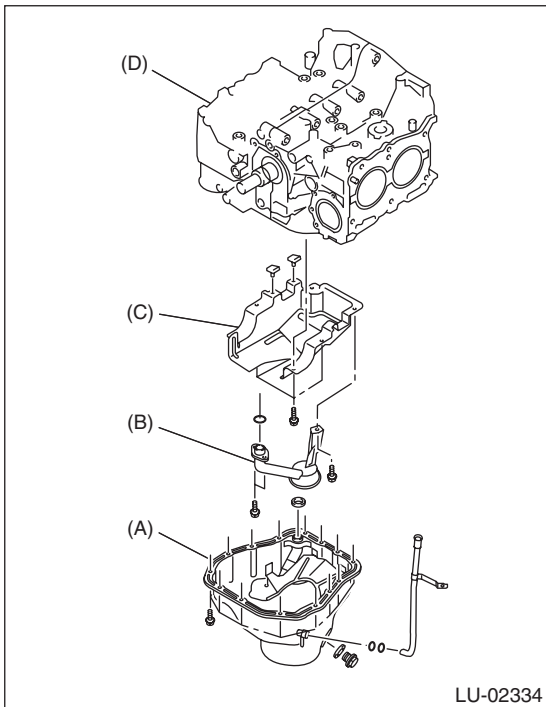


17) Remove the bolts which install oil pan on cylinder block with the engine raised up.  
 18) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

**CAUTION:**

**Do not use a screwdriver or similar tool in place of oil pan cutter.**

19) Remove the oil strainer.  
 20) Remove the baffle plate.



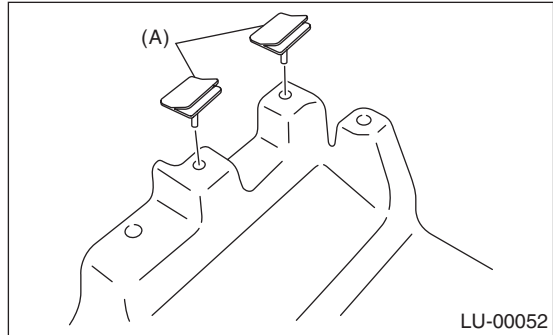
- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

## B: INSTALLATION

**NOTE:**

Before installing the oil pan, clean the mating surface of oil pan and engine block.

1) Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.



2) Install the baffle plate.

**Tightening torque:**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

3) Install the oil strainer to the cylinder block.

**NOTE:**

Use new O-rings.

**Tightening torque:**

**10 N-m (1.0 kgf-m, 7.2 ft-lb)**

4) Tighten the oil strainer stay together with the baffle plate.

**Tightening torque:**

**6.4 N-m (0.65 kgf-m, 4.7 ft-lb)**

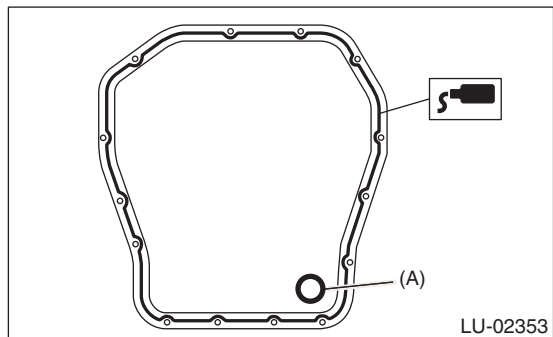
5) Apply liquid gasket to the mating surfaces, and install the oil pan.

**NOTE:**

- Use a new gasket.
- Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**



(A) Gasket

# Oil Pan and Strainer

## LUBRICATION

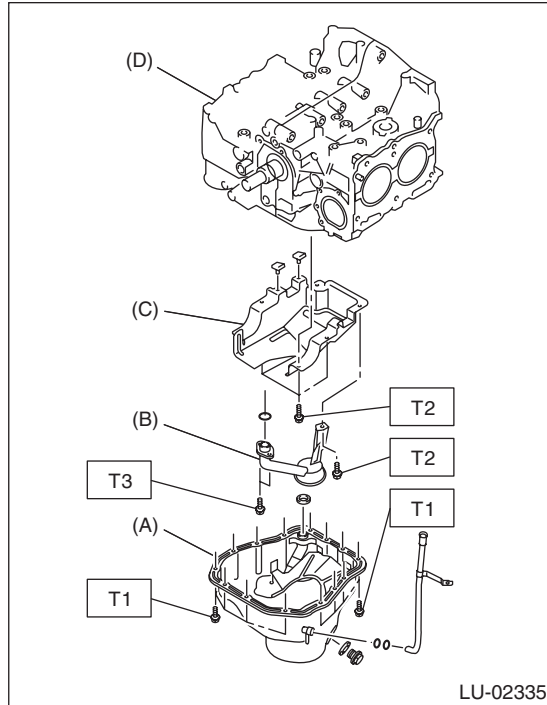
6) Tighten the bolts which install oil pan to cylinder block.

**Tightening torque:**

**T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)**

**T2: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

**T3: 10 N·m (1.0 kgf-m, 7.2 ft-lb)**



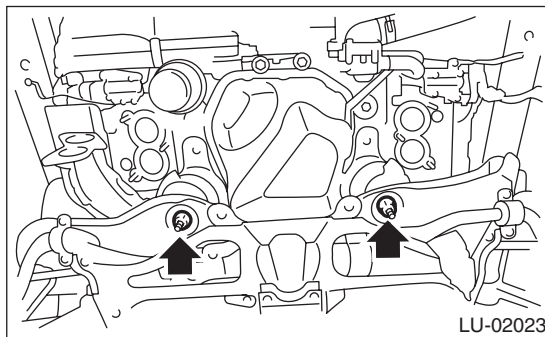
- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

7) Lower the engine onto front crossmember.

8) Tighten the nuts which install front cushion rubber onto front crossmember.

**Tightening torque:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**



9) Install the front exhaust pipe. <Ref. to EX(H4DOTC)-7, INSTALLATION, Front Exhaust Pipe.>

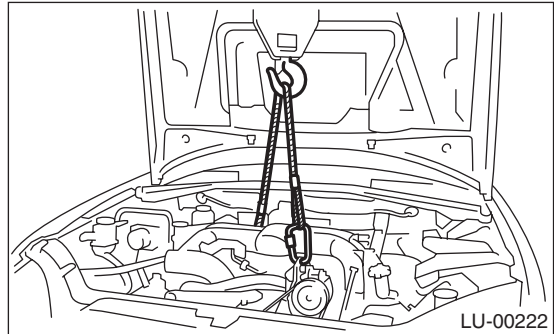
10) Install the under cover.

11) Lower the vehicle.

**CAUTION:**

**When lowering the vehicle, lower the lift up device and wire ropes at the same time.**

12) Remove the lifting device and wire ropes.

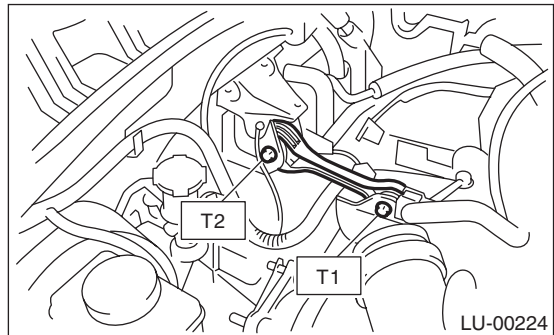


13) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

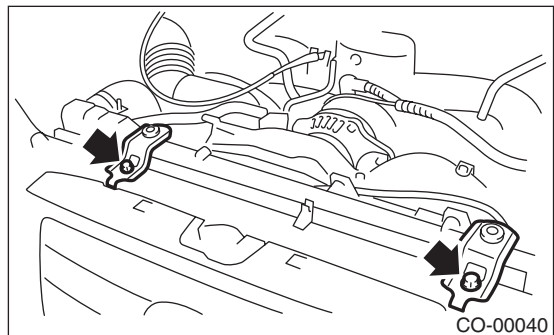
**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



14) Install the radiator upper brackets.

**Tightening torque:**

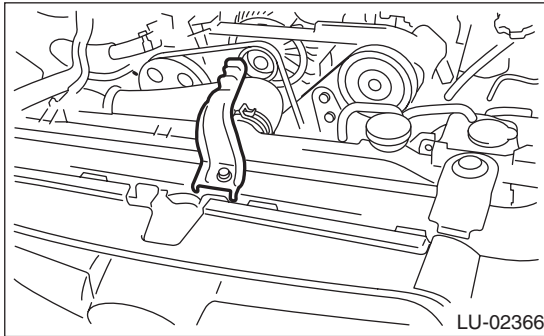
**12 N·m (1.2 kgf-m, 8.9 ft-lb)**



15) Install the hood stay holder.

**Tightening torque:**

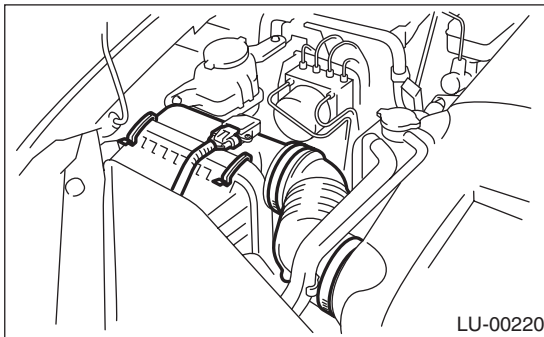
**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



16) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

17) Install the air intake boot and air cleaner case (rear).

18) Connect the connector to the mass air flow and intake air temperature sensor.



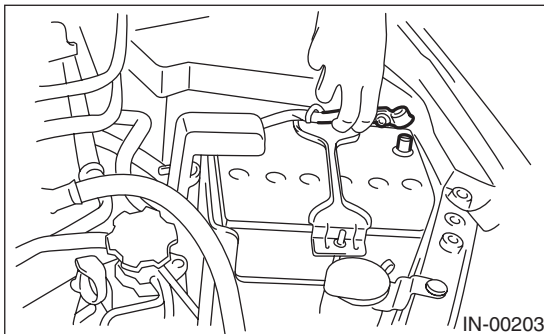
19) Install the front wheels.

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

20) Install the collector cover.

21) Connect the battery ground cable to battery.



22) Refill the engine oil. <Ref. to LU(H4DOTC)-9, INSPECTION, Engine Oil.>

**C: INSPECTION**

Visually check that the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

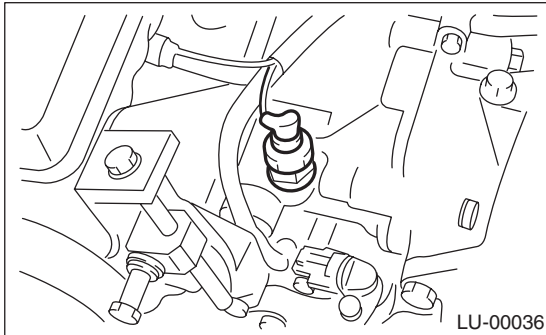
# Oil Pressure Switch

## LUBRICATION

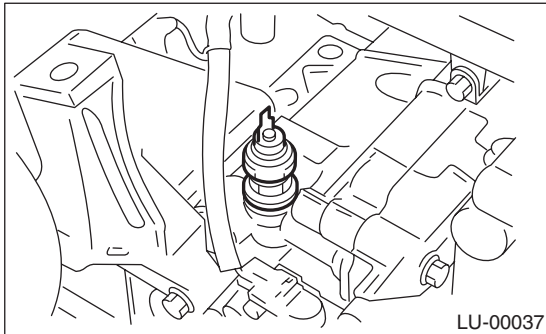
### 6. Oil Pressure Switch

#### A: REMOVAL

- 1) Remove the collector cover.
- 2) Remove the generator from the bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 3) Disconnect the terminal from oil pressure switch.



- 4) Remove the oil pressure switch.

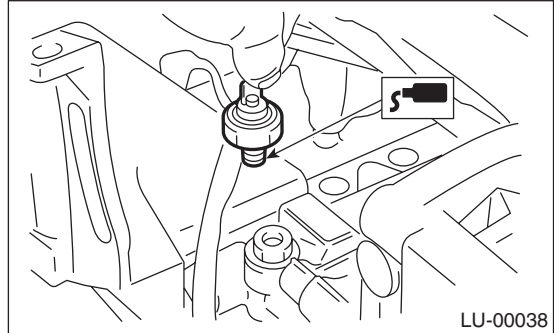


#### B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

##### Liquid gasket:

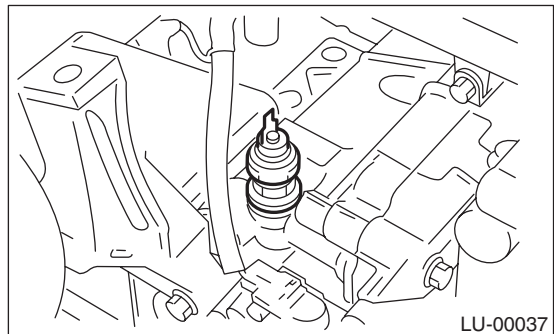
**THREE BOND 1324 (Part No. 004403007) or equivalent**



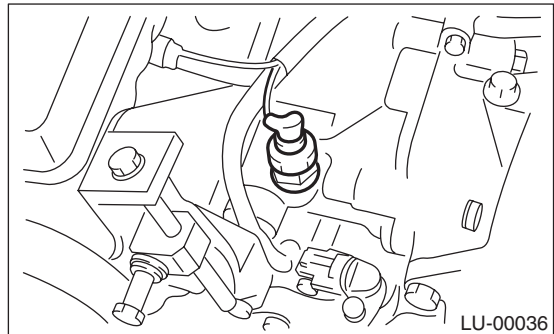
- 2) Install the oil pressure switch to the cylinder block.

##### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- 3) Connect the terminal to the oil pressure switch.



- 4) Install the generator to the bracket. <Ref. to SC(H4SO)-15, INSTALLATION, Generator.>
- 5) Install the collector cover.

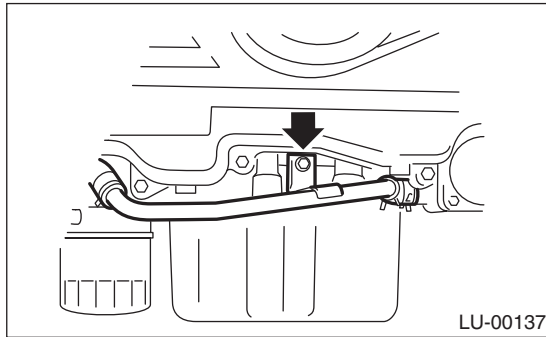
#### C: INSPECTION

Check the oil pressure switch installation portion for oil leakage and oil seepage.

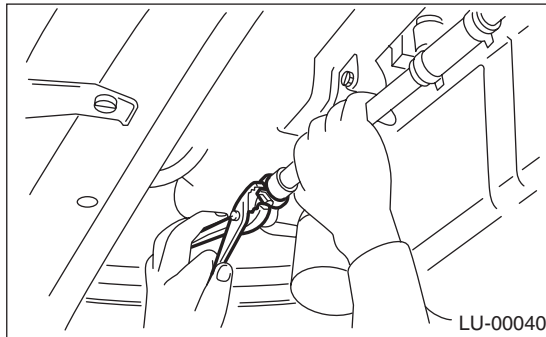
## 7. Engine Oil Cooler

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain the engine oil.
- 5) Drain engine coolant.
- 6) Remove the bolts which install water pipe of oil cooler to oil pump.

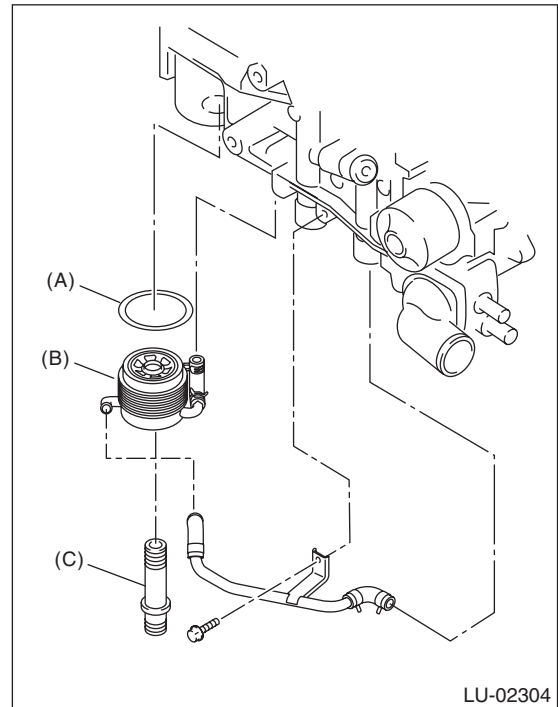


- 7) Remove the water by-pass pipe and hose between oil cooler and water pump.



- 8) Remove the engine oil filter. <Ref. to LU(H4DOTC)-23, REMOVAL, Engine Oil Filter.>

- 9) Remove the oil cooler connector and remove the oil cooler.



- (A) Gasket
- (B) Oil cooler
- (C) Oil cooler connector

# Engine Oil Cooler

## LUBRICATION

### B: INSTALLATION

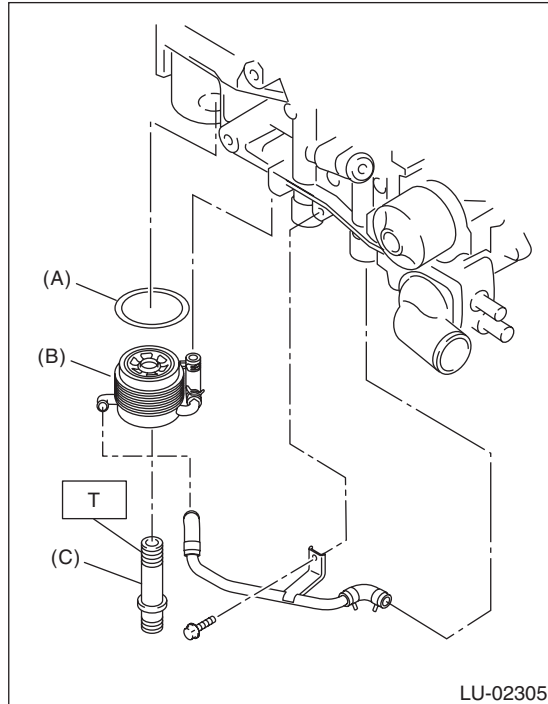
Install in the reverse order of removal.

NOTE:

Use a new gasket.

**Tightening torque:**

**T: 54 N·m (5.5 kgf-m, 40 ft-lb)**



- (A) Gasket
- (B) Oil cooler
- (C) Oil cooler connector

### C: INSPECTION

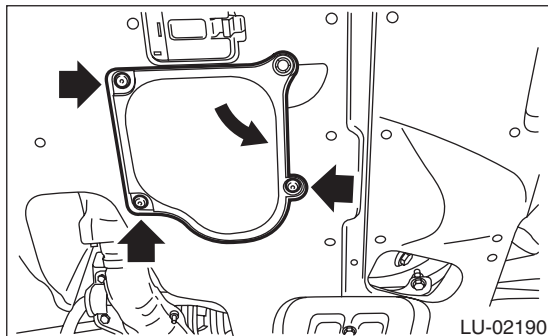
- 1) Check the coolant paths for clogs while spraying compressed air.
- 2) Check the mating surfaces of cylinder block, gasket groove and oil filter for damage.



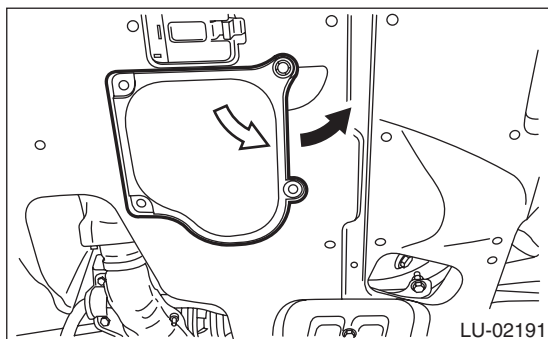
## 8. Engine Oil Filter

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the clip.



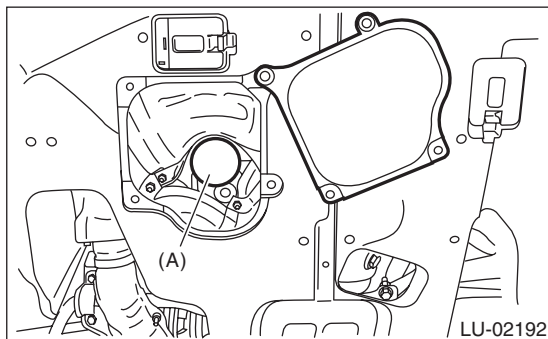
- 4) Rotate the service hole cover in the direction of the arrow.



- 5) Remove the oil filter using ST.

ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in) for oil filter)

ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in) for oil filter)



(A) Oil filter

### B: INSTALLATION

#### CAUTION:

**Do not tighten excessively, or oil may leak.**

- 1) Clean the oil filter installation surface on cylinder block or oil cooler.
- 2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 3) Install the oil filter turning it by hand, being careful not to damage the seal rubber.
  - Tighten the oil filter 65 mm (2.56 in) in diameter (approx. 2/3 — 3/4 rotation) after the seal rubber of the oil filter comes in contact with cylinder block or oil cooler. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.7 ft-lb).
  - Tighten the oil filter 68 mm (2.68 in) in diameter (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with cylinder block or oil cooler. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
- 4) Return the service hole cover to the original position.
- 5) Lower the vehicle.

### C: INSPECTION

- 1) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

#### NOTE:

The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level. <Ref. to LU(H4DOTC)-9, INSPECTION, Engine Oil.>

#### CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

# Engine Lubrication System Trouble in General

## LUBRICATION

### 9. Engine Lubrication System Trouble in General

#### A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Symptoms	Possible cause		Corrective action
1. Warning light remains ON.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Clean or replace.
		Malfunction of oil relief valve in oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil (degradation, etc.)	Replace.
		Broken pipe of oil strainer	Replace.
Stuck oil pump rotor		Replace.	
2. Warning light does not turn on.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact of terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed 1) — 2).

## 1. General Description

### A: SPECIFICATION

Specifications for the turbo model are the same as the SOHC model. <Ref. to SP(H4SO)-2, General Description.>

# General Description

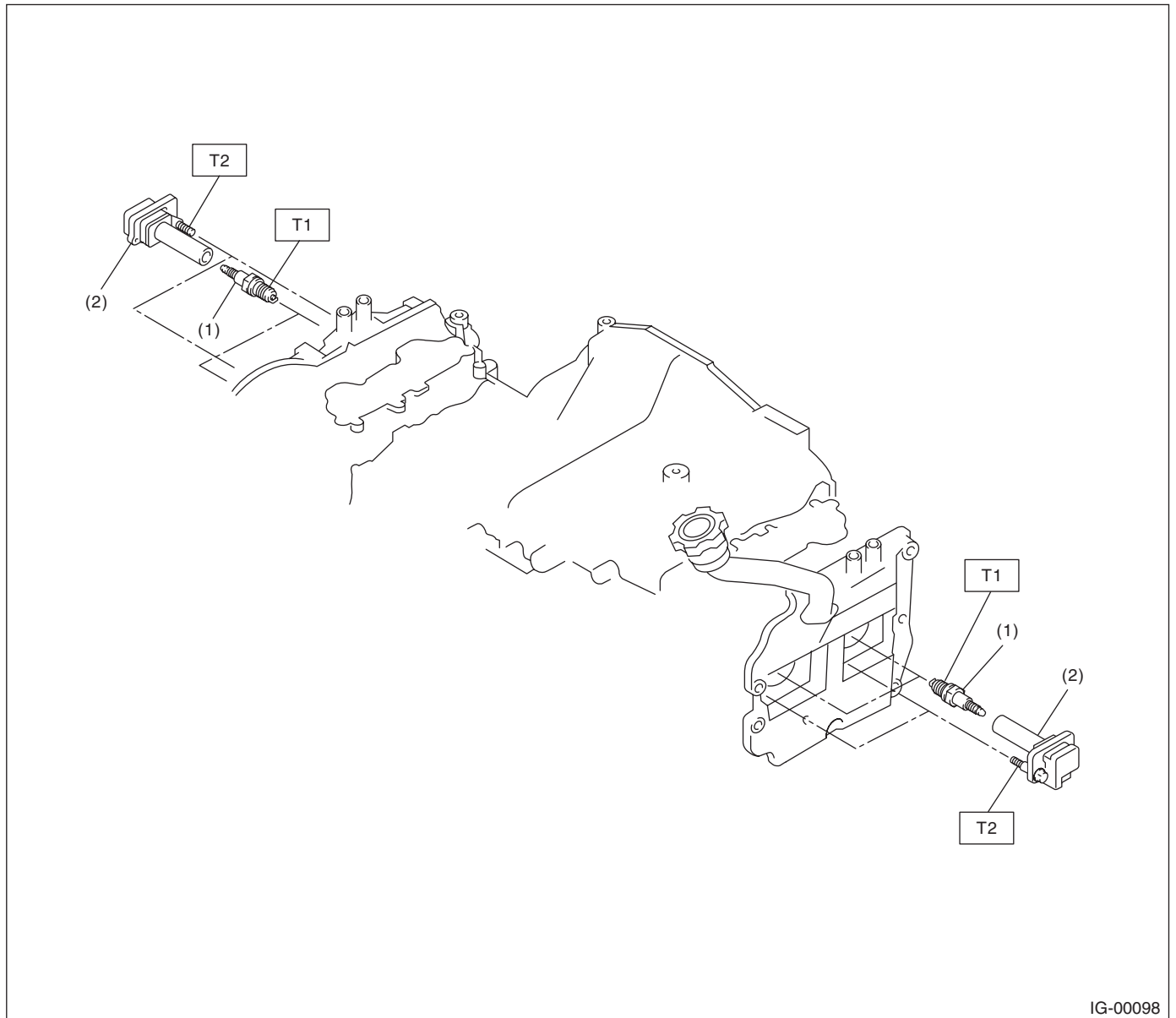
## IGNITION

### 1. General Description

#### A: SPECIFICATION

Item		Specification
Ignition coil	Type	FK0186/FK0334
	Ignition system	Independent ignition coil
	Manufacturer	Diamond Electric
Spark plug	Manufacturer and type	NGK: SILFR6A
	Thread size (diameter, pitch, length)	mm 14, 1.25, 26.5
	Spark plug gap	mm (in) 0.7 — 0.8 (0.028 — 0.031)
	Electrode	Iridium

#### B: COMPONENT



- (1) Spark plug
- (2) Ignition coil

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T1: 21 (2.1, 15.5)**  
**T2: 16 (1.6, 11.8)**

### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

# Spark Plug

## IGNITION

### 2. Spark Plug

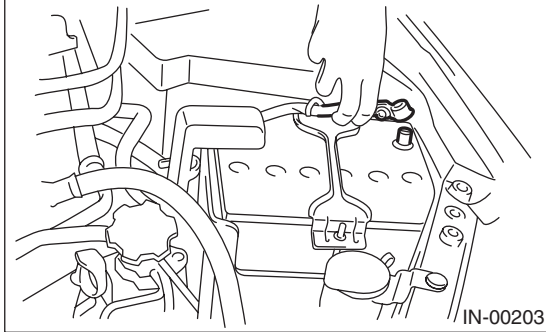
#### A: REMOVAL

##### Spark plug:

Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(H4DOTC)-2, SPECIFICATION, General Description.>

#### 1. RH SIDE

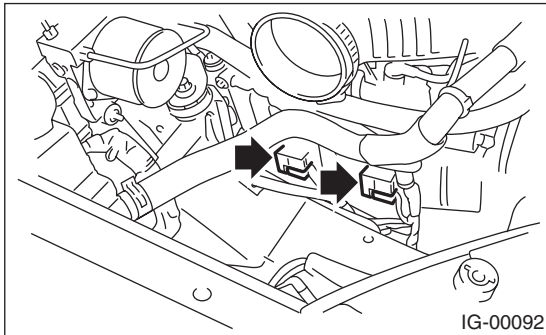
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air cleaner case. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 4) Disconnect the connector from ignition coil.
- 5) Remove the ignition coil.

##### NOTE:

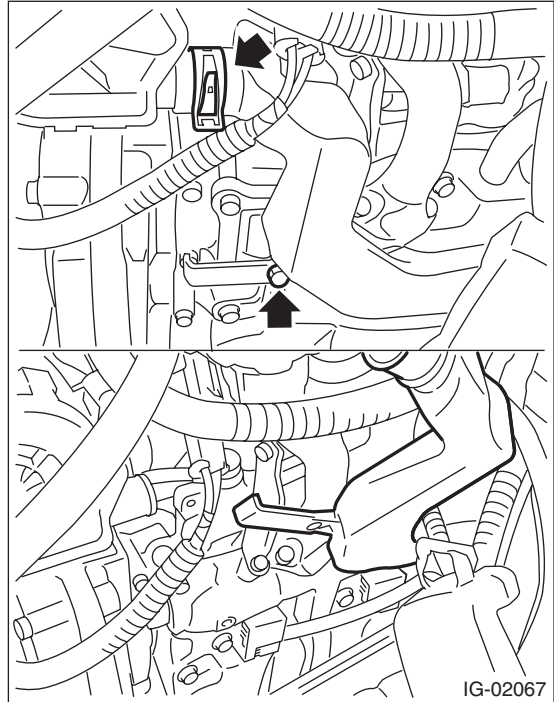
Turn #3 ignition coil by 180 degrees to remove it.



- 6) Remove the spark plug with a spark plug socket.

#### 2. LH SIDE

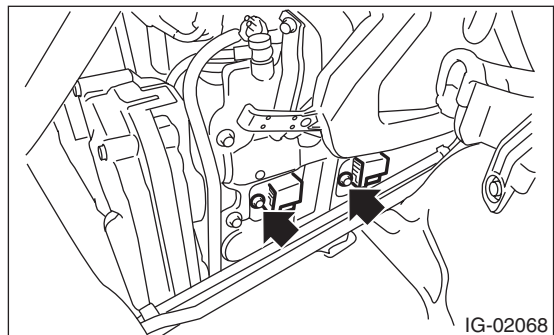
- 1) Remove the collector cover.
- 2) Remove the battery and battery carrier.
- 3) Disconnect the secondary air pump duct from the secondary air pump. <Ref. to EC(H4DOTC)-20, REMOVAL, Secondary Air Pump.>
- 4) Remove the bolts that attach the secondary air pump duct to the rocker cover (LH), and raise the secondary air pump duct.



- 5) Disconnect the connector from ignition coil.
- 6) Remove the ignition coil.

##### NOTE:

Turn #4 ignition coil by 180 degrees to remove it.



- 7) Remove the spark plug with a spark plug socket.

## B: INSTALLATION

### 1. RH SIDE

Install in the reverse order of removal.

**Tightening torque (Spark plug):**  
**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

**Tightening torque (Ignition coil):**  
**16 N·m (1.6 kgf-m, 11.8 ft-lb)**

### 2. LH SIDE

Install in the reverse order of removal.

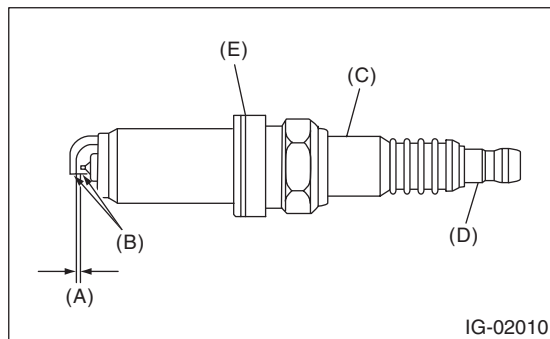
**Tightening torque (Spark plug):**  
**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

**Tightening torque (Ignition coil):**  
**16 N·m (1.6 kgf-m, 11.8 ft-lb)**

**Tightening torque (secondary air pump duct):**  
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

## C: INSPECTION

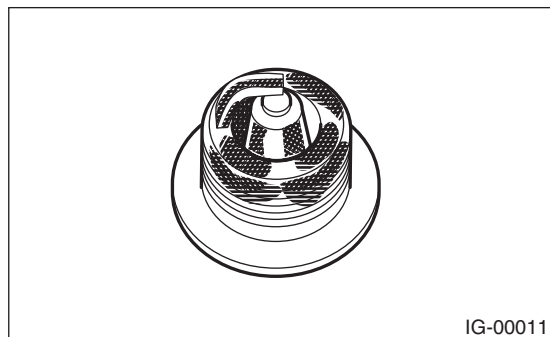
Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Spark plug gap
- (B) Carbon accumulation or wear
- (C) Crack
- (D) Damage
- (E) Damaged gasket

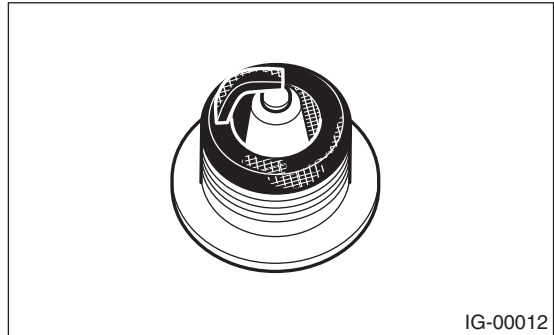
### 1) Normal:

Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



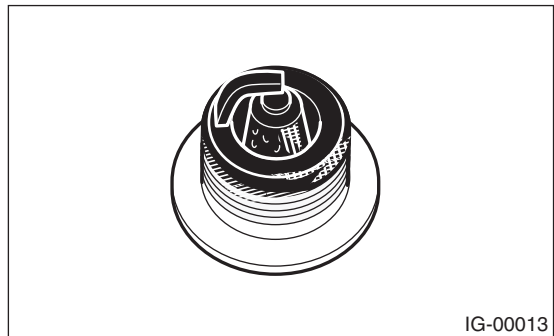
### 2) Carbon fouled:

Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture and dirty air cleaner.



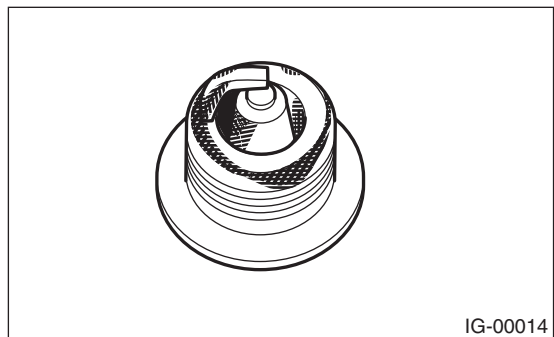
### 3) Oil fouled:

Wet black deposits show oil entrance into the combustion chamber through worn rings and excessive clearance between valve guides and stems.



### 4) Overheating:

White or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, incorrect ignition timing, wrong selection of fuel, and loose spark plugs.



# Spark Plug

IGNITION

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## D: ADJUSTMENT

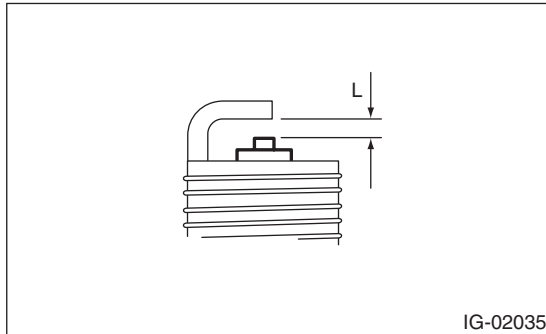
Clean up the spark plug using nylon brush or equivalent. Clean and remove the carbon or oxide deposits. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, measure the spark plug gap using a gap gauge.

NOTE:

- Never use a plug cleaner.
- Never use a metal brush because it makes insulator worn.

**Spark plug gap : L**

**0.7 — 0.8 mm (0.028 — 0.031 in)**



IG-02035



### 3. Ignition Coil

#### A: REMOVAL

Direct ignition type has been adopted. Refer to “Removing Spark Plugs” for removal procedure. <Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.>

#### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**16 N·m (1.6 kgf-m, 11.8 ft-lb)**

#### C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H4DOTC)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

# Ignition Coil

IGNITION

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# General Description

STARTING/CHARGING SYSTEMS

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## 1. General Description

### A: SPECIFICATION

Specifications for the turbo model are included in the SC(H4SO) section. <Ref. to SC(H4SO)-2, General Description.>

# Basic Diagnostic Procedure

ENGINE (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### 1. ENGINE

	Step	Check	Yes	No
1	<p><b>CHECK ENGINE START FAILURE.</b></p> <p>1) Ask the customer when and how the trouble occurred using the interview checklist. &lt;Ref. to EN(H4DOTC)(diag)-3, CHECK, Check List for Interview.&gt;</p> <p>2) Start the engine.</p>	Does the engine start?	Go to step 2.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4DOTC)(diag)-71, Diagnostics for Engine Starting Failure.>
2	<p><b>CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.</b></p>	Does the malfunction indicator light illuminate?	Go to step 3.	Inspection using "General Diagnostic Table" <Ref. to EN(H4DOTC)(diag)-372, General Diagnostic Table.>
3	<p><b>CHECK INDICATION OF DTC ON SCREEN.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Connect the Subaru Select Monitor or general scan tool to data link connector.</p> <p>3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool.</p> <p>4) Read DTC using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>Refer to "Read Diagnostic Trouble Code" for detailed operation procedure. &lt;Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Record the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H4DOTC)(diag)-62, Malfunction Indicator Light.>
4	<p><b>PERFORM DIAGNOSIS.</b></p> <p>1) Perform the Clear Memory Mode. &lt;Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.&gt;</p> <p>2) Perform the Inspection Mode. &lt;Ref. to EN(H4DOTC)(diag)-45, Inspection Mode.&gt;</p>	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-91, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Check List for Interview

ENGINE (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

#### 1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of purchase		Fuel brand	
Date of repair		Odometer reading	km
V.I.N.			miles
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Various/Others:		
Ambient air temperature	°C ( °F)		
	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold		
Place	<input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner city <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Rough road <input type="checkbox"/> Others:		
	<input type="checkbox"/> Cold <input type="checkbox"/> Warming-up <input type="checkbox"/> After warming-up <input type="checkbox"/> Any temperature <input type="checkbox"/> Others:		
Engine speed	rpm		
Vehicle speed	km/h (MPH)		
Driving conditions	<input type="checkbox"/> Not affected <input type="checkbox"/> At starting <input type="checkbox"/> While idling <input type="checkbox"/> At racing <input type="checkbox"/> While accelerating <input type="checkbox"/> While cruising <input type="checkbox"/> While decelerating <input type="checkbox"/> While turning (RH/LH)		
Headlight	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Rear defogger	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Blower	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Audio	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
A/C compressor	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	CD/Cassette	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Radiator fan	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Car phone	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Front wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Wireless device	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Rear wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF		

# Check List for Interview

## ENGINE (DIAGNOSTICS)

---

### 2. CHECK LIST NO. 2

Check the following item about the vehicle's state when malfunction indicator light illuminates.

#### NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators illuminate. <input type="checkbox"/> Yes / <input type="checkbox"/> No
<input type="checkbox"/> Low fuel warning light <input type="checkbox"/> Charge indicator light <input type="checkbox"/> AT diagnostic indicator light <input type="checkbox"/> ABS warning light <input type="checkbox"/> Oil pressure indicator light
b) Fuel level
• Lack of gasoline: <input type="checkbox"/> Yes / <input type="checkbox"/> No • Indicator position of fuel gauge: • Experienced running out of fuel: <input type="checkbox"/> Yes / <input type="checkbox"/> No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
d) Intentional connecting or disconnecting of hoses: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
e) Installing of parts other than genuine parts: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What: • Where:
f) Occurrence of noise: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
g) Occurrence of smell: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: <input type="checkbox"/> Yes / <input type="checkbox"/> No
i) Troubles occurred
<input type="checkbox"/> Engine does not start. <input type="checkbox"/> Engine stalls during idling. <input type="checkbox"/> Engine stalls while driving. <input type="checkbox"/> Engine speed decreases. <input type="checkbox"/> Engine speed does not decrease. <input type="checkbox"/> Rough idling <input type="checkbox"/> Poor acceleration <input type="checkbox"/> Back fire <input type="checkbox"/> After fire <input type="checkbox"/> Does not shift. <input type="checkbox"/> Excessive shift shock

## 3. General Description

### A: CAUTION

1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

#### CAUTION:

- All the airbag system wiring harnesses and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.

2) Never connect the battery in reverse polarity. Failure to do so will damage the ECM instantly, and the fuel injector and other parts will also be damaged.

3) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.

4) Before disconnecting the connectors of each sensor and ECM, be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>

5) Measure the voltage or resistance of individual sensor or all electrical control modules using a tapered pin with a diameter of less than 0.6 mm (0.024 in). Do not insert the pin 4 mm (0.16 in) or more into the part.

#### CAUTION:

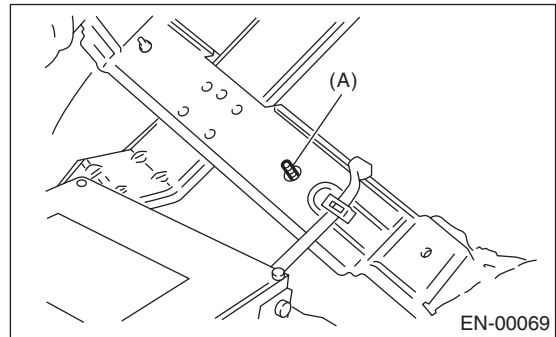
**When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.**

#### NOTE:

When replacing the ECM of the models with Immobilizer, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the "IMMOBILIZER TEACHING OPERATION MANUAL".

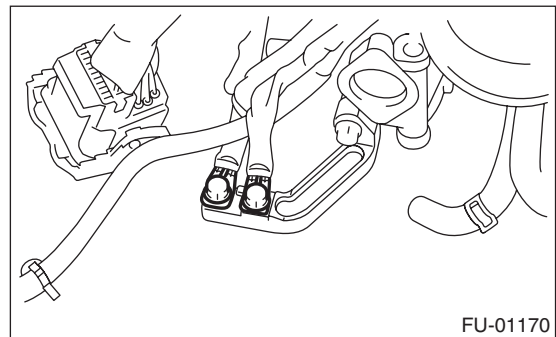
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.

7) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

8) Use the engine ground terminal or engine assembly as the grounding point to chassis when measuring the voltage and resistance in engine compartment.



9) Every MFI-related part is a precision part. Do not drop them.

10) Observe the following cautions when installing a radio in MFI equipped models.

#### CAUTION:

- The antenna must be kept as far apart as possible from control unit. (The ECM is located under the passenger's seat floor mat.)
- The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.
- Carefully adjust the antenna for correct matching.
- When mounting a large power type radio, pay special attention to the three items mentioned above.
- Incorrect installation of the radio may affect the operation of ECM.

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

# General Description

## ENGINE (DIAGNOSTICS)

12) For the model with ABS, the ABS warning light may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clear procedure of self-diagnosis function.

### B: INSPECTION

Before performing diagnostics, check the following item which might affect engine problems.

#### 1. BATTERY

1) Measure the battery voltage and specific gravity of the electrolyte.

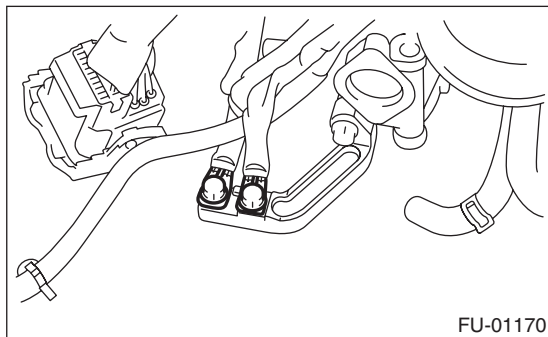
**Standard voltage: 12 V**

**Specific gravity: 1.260 or more**

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

#### 2. ENGINE GROUND

Check if the engine ground terminal is properly connected to engine.



### C: NOTE

#### 1. GENERAL DESCRIPTION

- The on-board diagnostic (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
- Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
- The OBD system incorporated with the vehicles within this type of engine complies with OBD-II regulations. The OBD system monitors the components and the system malfunction listed in "Engine Section" which affects on emissions.

- When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
- The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer first when it detects a malfunction.
- If the OBD system detects malfunctions such as the fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
- When the malfunction does not occur again for three consecutive driving cycles, malfunction indicator light is turned off, but DTC remains at on-board computer.
- When troubleshooting the vehicle which complies with OBD-II regulations, connect the Subaru Select Monitor or general scan tool to the vehicle.

#### 2. ENGINE AND EMISSION CONTROL SYSTEM

- The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.

With this system, the fuel which is pressurized at a constant pressure is injected into the intake air passage of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system, where the electro-magnetic injection valve (fuel injector) opens for a short period of time depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.

- Furthermore, all operating conditions of the engine are converted into electronic signals, and this enables additional system features with greatly improved adaptability, making it easier to add compensation features.

The MFI system also has the following features:

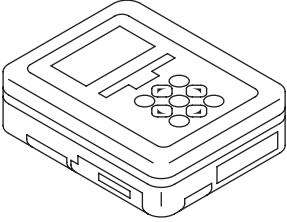
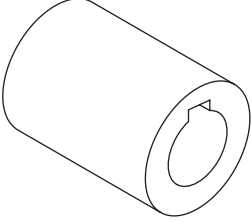
- Reduced emission of harmful exhaust gases.
- Reduction in fuel consumption
- Increased engine output.
- Superior acceleration and deceleration
- Superior startability and warm-up performance in cold weather since compensation is made for engine coolant and intake air temperature



# General Description

ENGINE (DIAGNOSTICS)

## D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

# Electrical Component Location

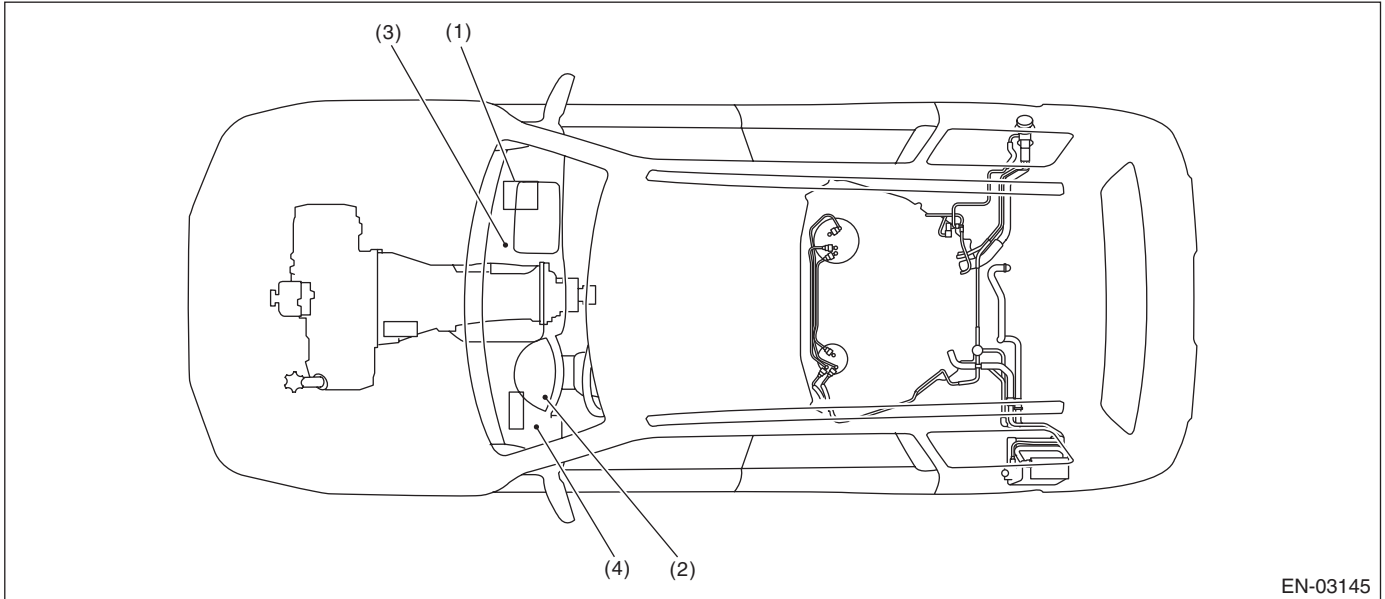
ENGINE (DIAGNOSTICS)

## 4. Electrical Component Location

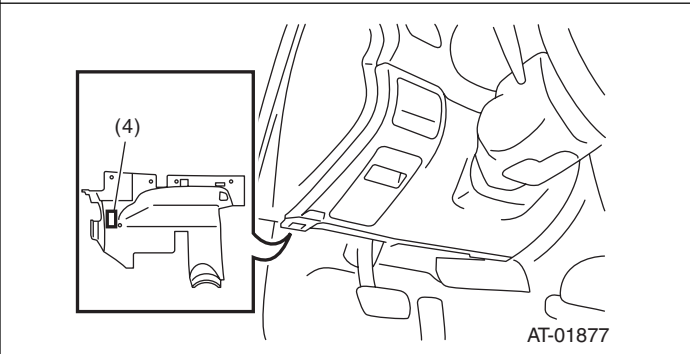
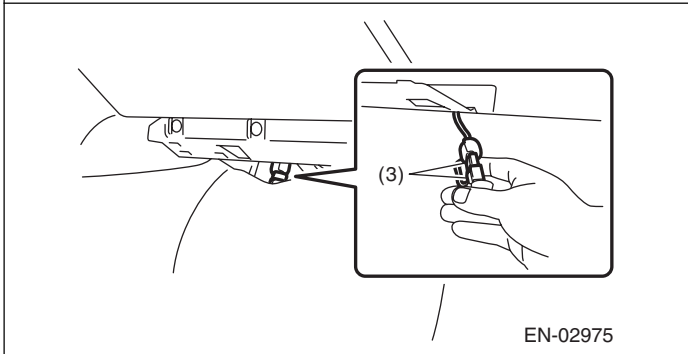
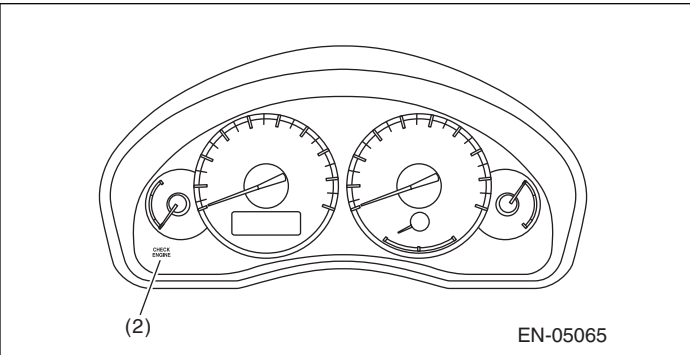
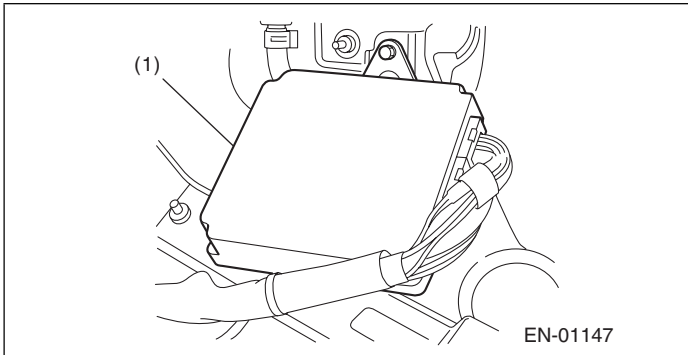
### A: LOCATION

#### 1. ENGINE

- Control module



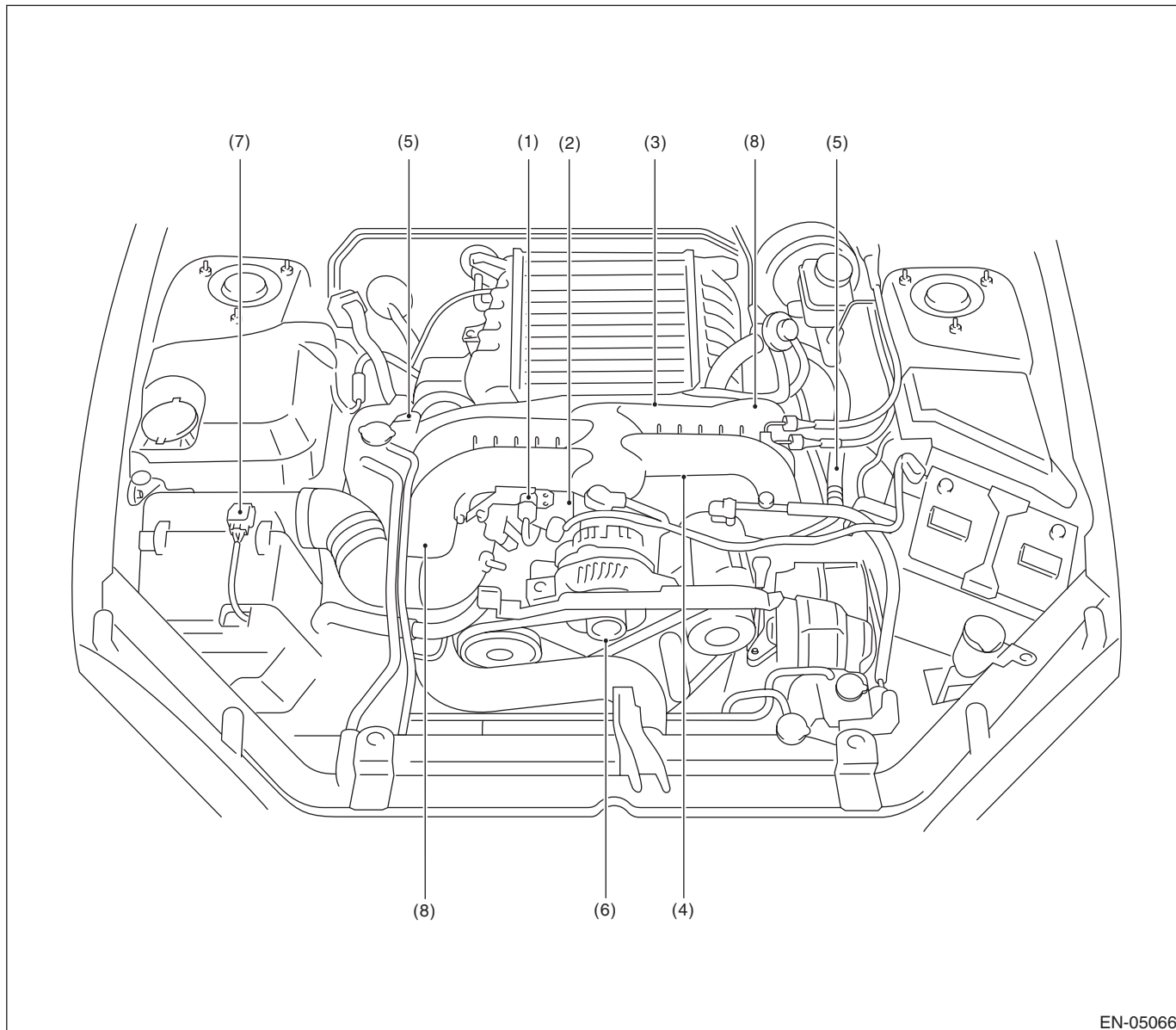
- (1) Engine control module (ECM)      (3) Delivery (test) mode connector      (4) Data link connector  
(2) Malfunction indicator light



# Electrical Component Location

ENGINE (DIAGNOSTICS)

- Sensor



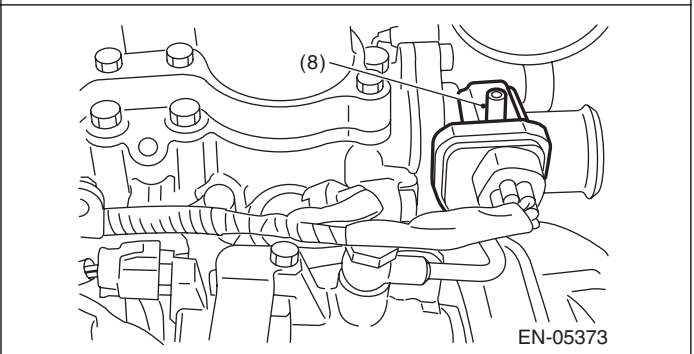
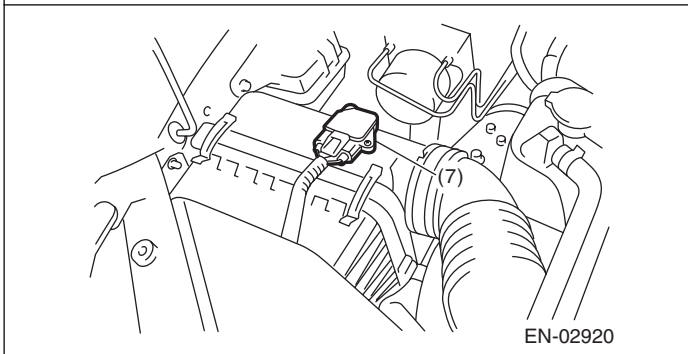
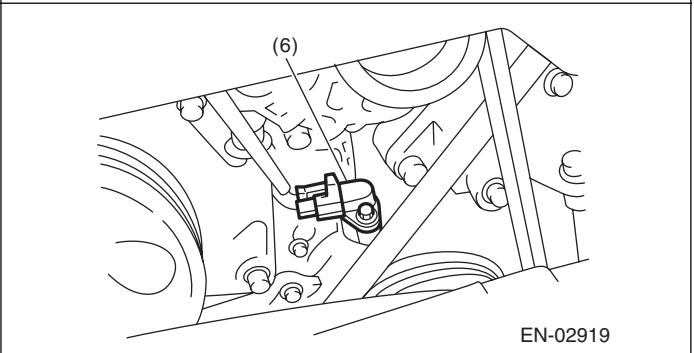
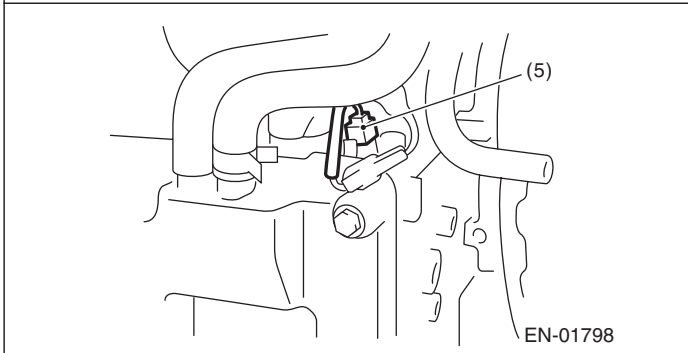
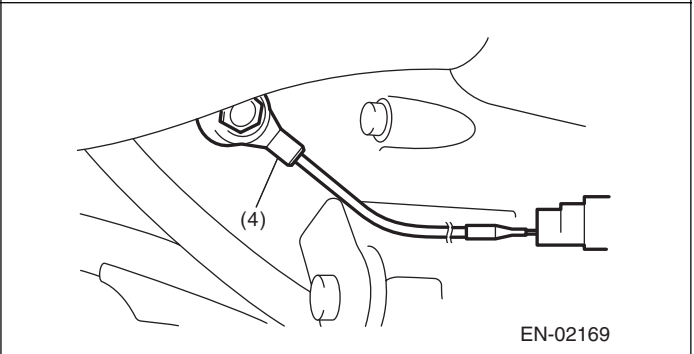
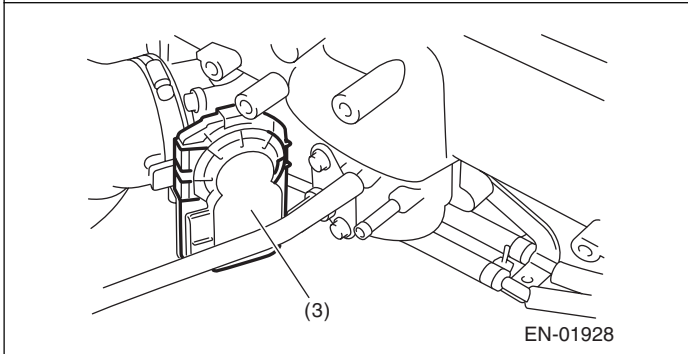
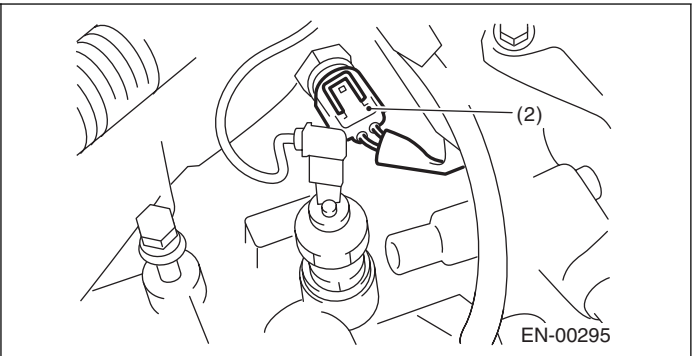
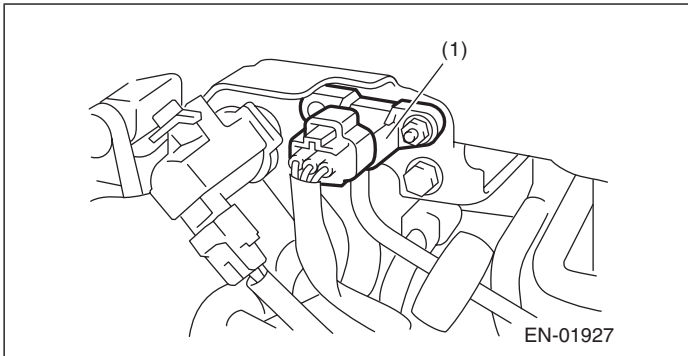
- (1) Manifold absolute pressure sensor
- (2) Engine coolant temperature sensor
- (3) Electronic throttle control

- (4) Knock sensor
- (5) Intake camshaft position sensor
- (6) Crankshaft position sensor

- (7) Mass air flow and intake air temperature sensor
- (8) Tumble generator valve ASSY

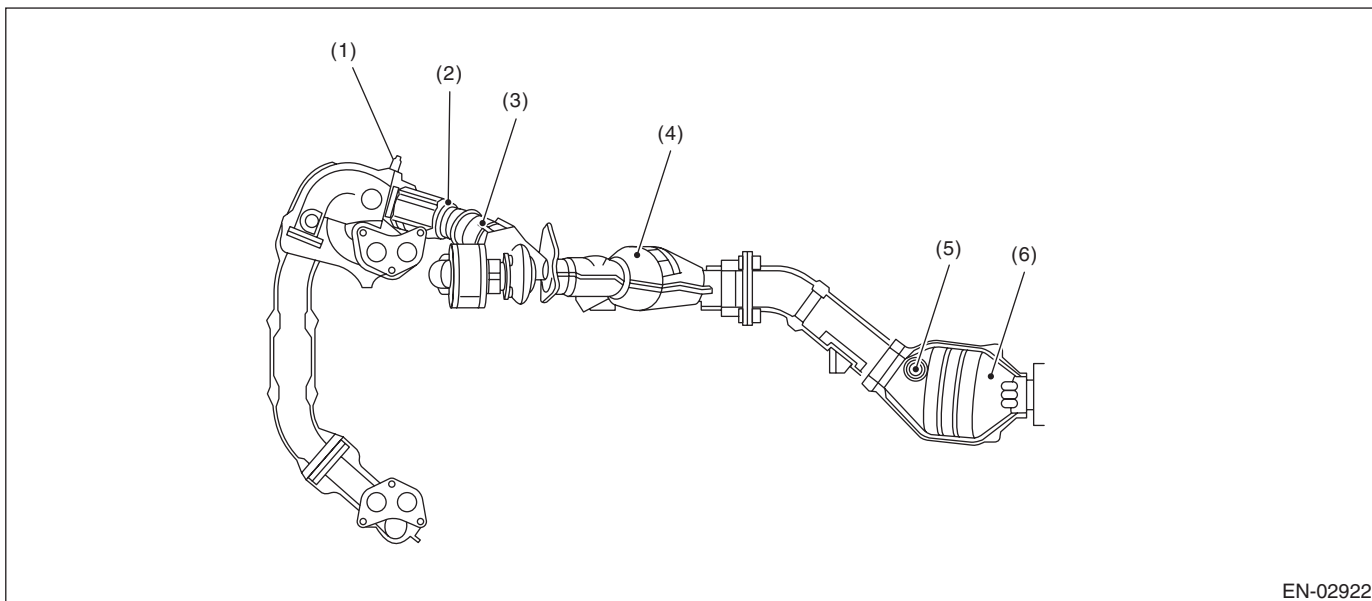
# Electrical Component Location

## ENGINE (DIAGNOSTICS)

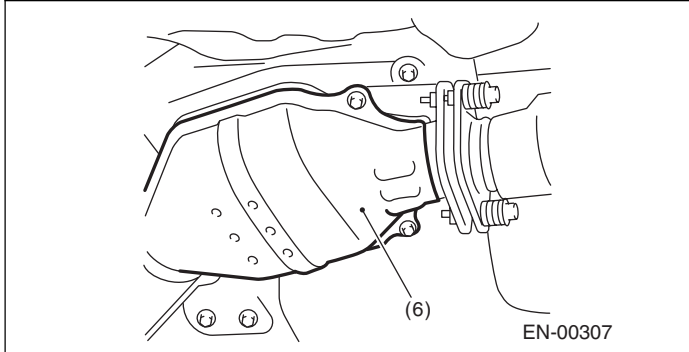
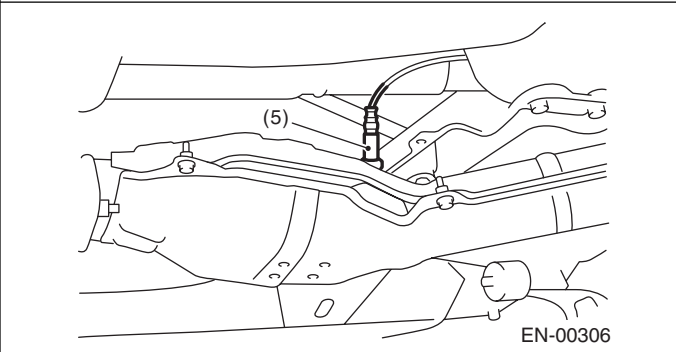
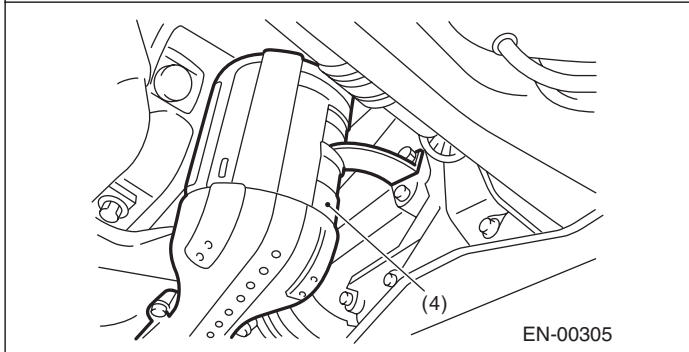
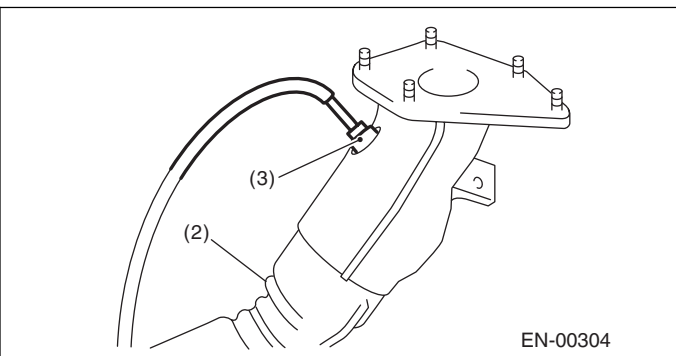
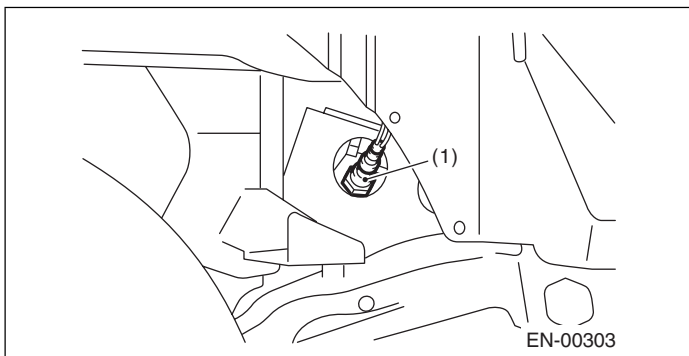


# Electrical Component Location

ENGINE (DIAGNOSTICS)

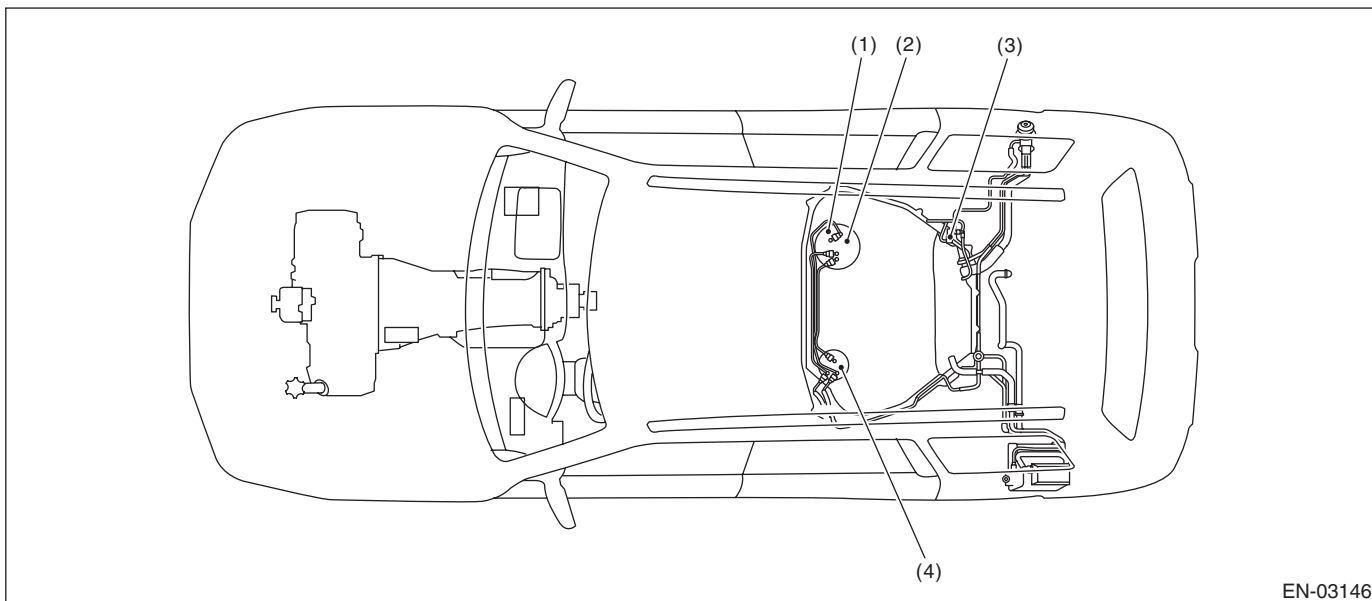


- |                               |                                |                              |
|-------------------------------|--------------------------------|------------------------------|
| (1) Front oxygen (A/F) sensor | (3) Exhaust temperature sensor | (5) Rear oxygen sensor       |
| (2) Precatalytic converter    | (4) Front catalytic converter  | (6) Rear catalytic converter |



# Electrical Component Location

## ENGINE (DIAGNOSTICS)

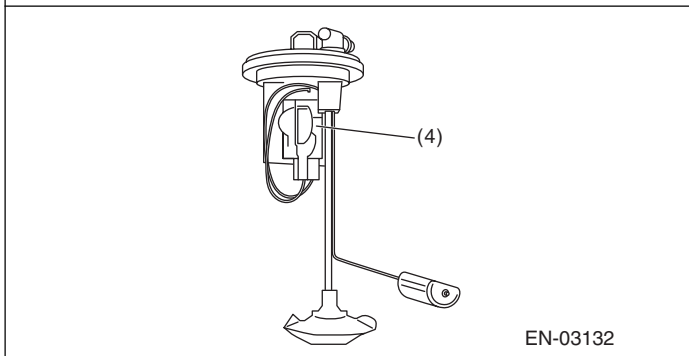
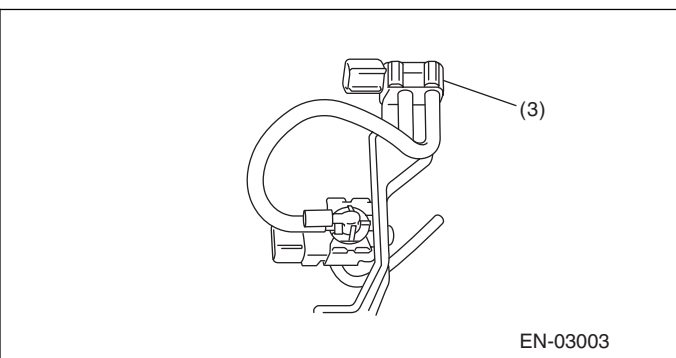
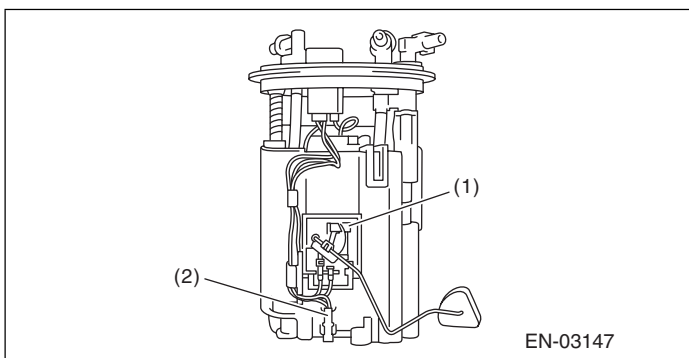


(1) Fuel level sensor

(3) Fuel tank pressure sensor

(4) Fuel sub level sensor

(2) Fuel temperature sensor

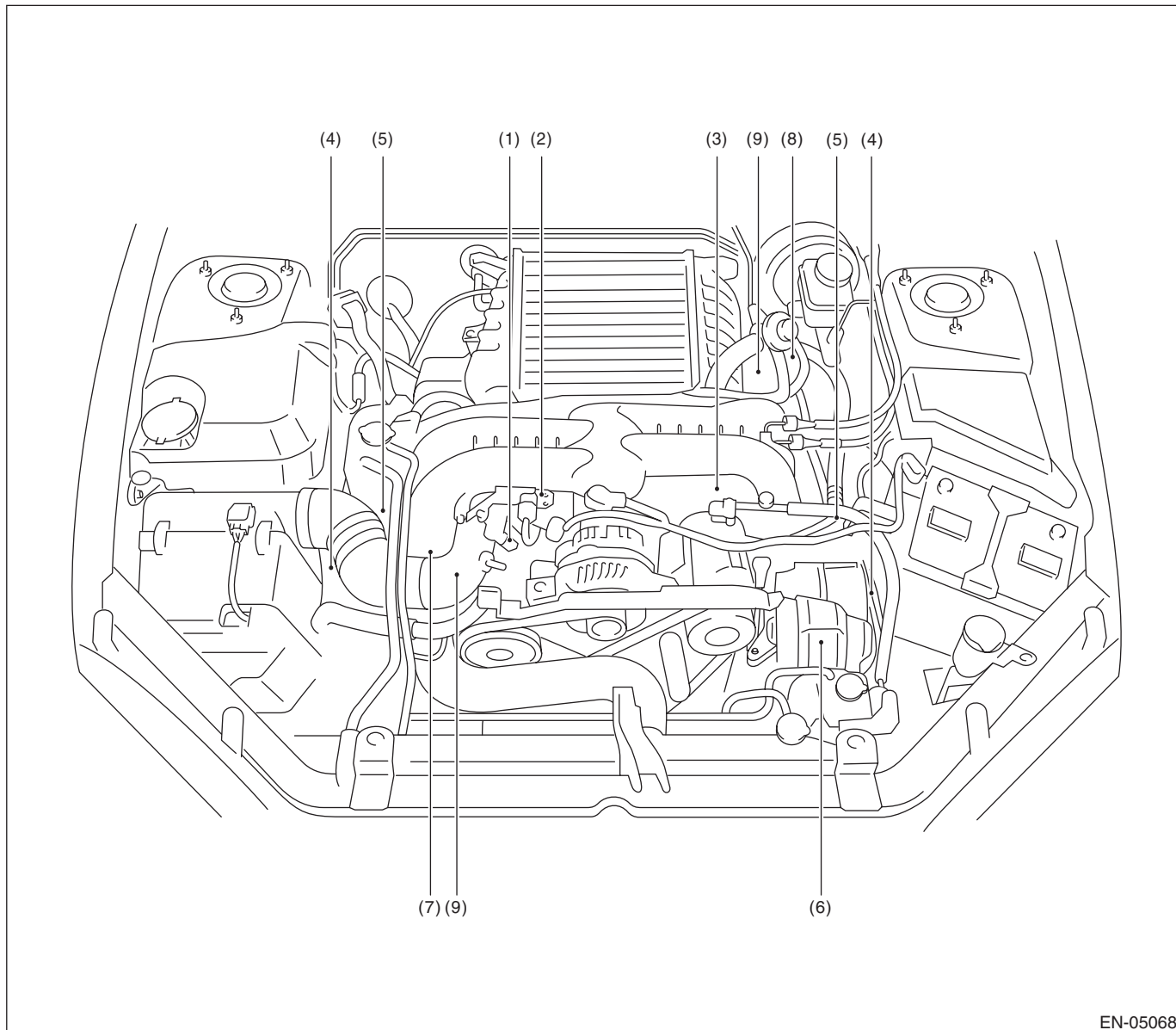


SUBARU.

# Electrical Component Location

ENGINE (DIAGNOSTICS)

- Solenoid valve, actuator, emission control system parts and ignition system parts

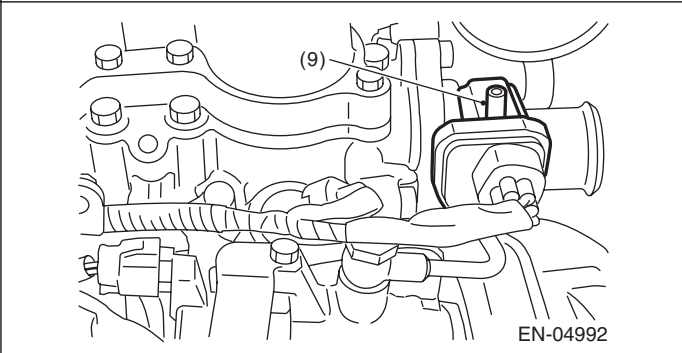
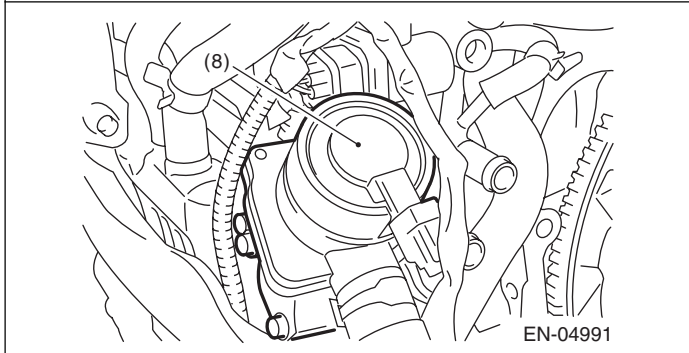
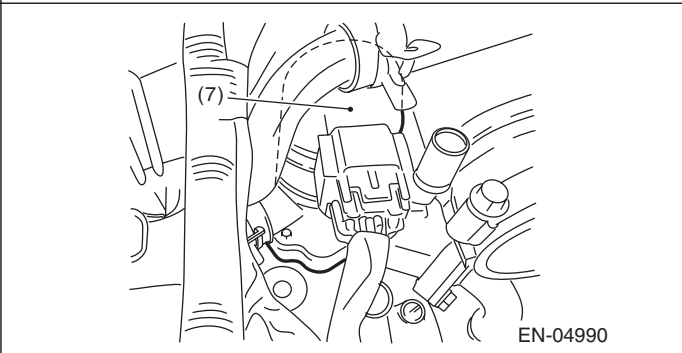
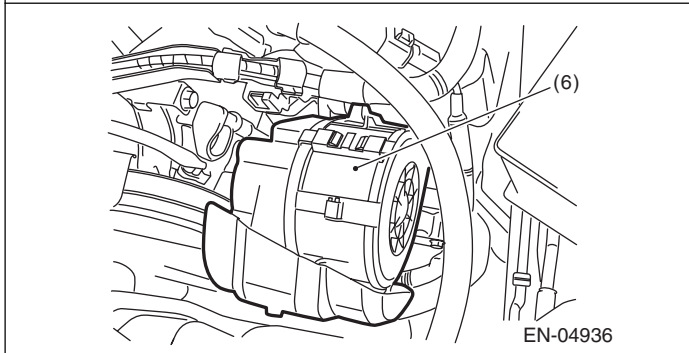
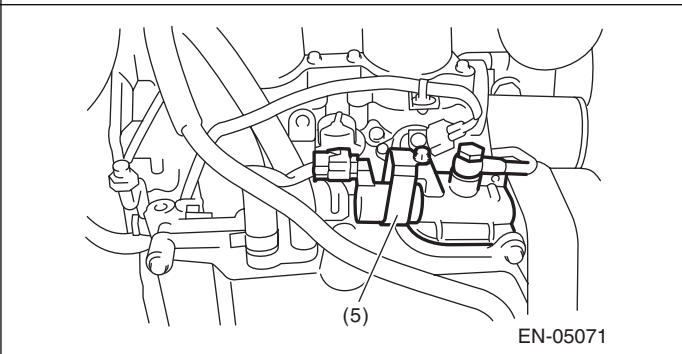
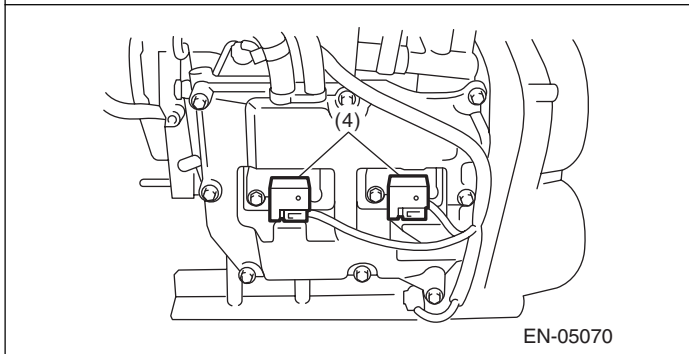
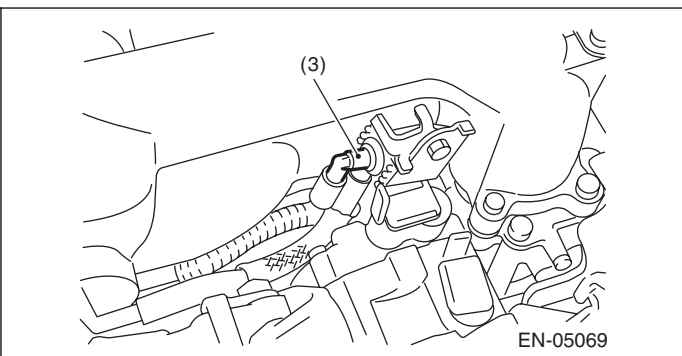
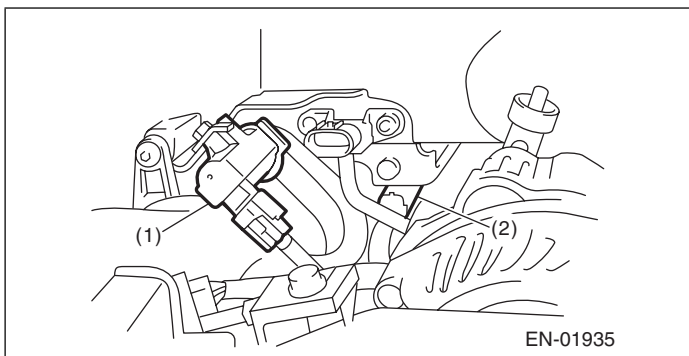


EN-05068

- |                                      |  |  |
|--------------------------------------|--|--|
| (1) Wastegate control solenoid valve | (5) Intake oil flow control solenoid valve | (8) Secondary air combination valve LH |
| (2) Purge control solenoid valve 2   | (6) Secondary air pump                     | (9) Tumble generator valve ASSY        |
| (3) Purge control solenoid valve 1   | (7) Secondary air combination valve RH     |  |
| (4) Ignition coil                    |  |  |

# Electrical Component Location

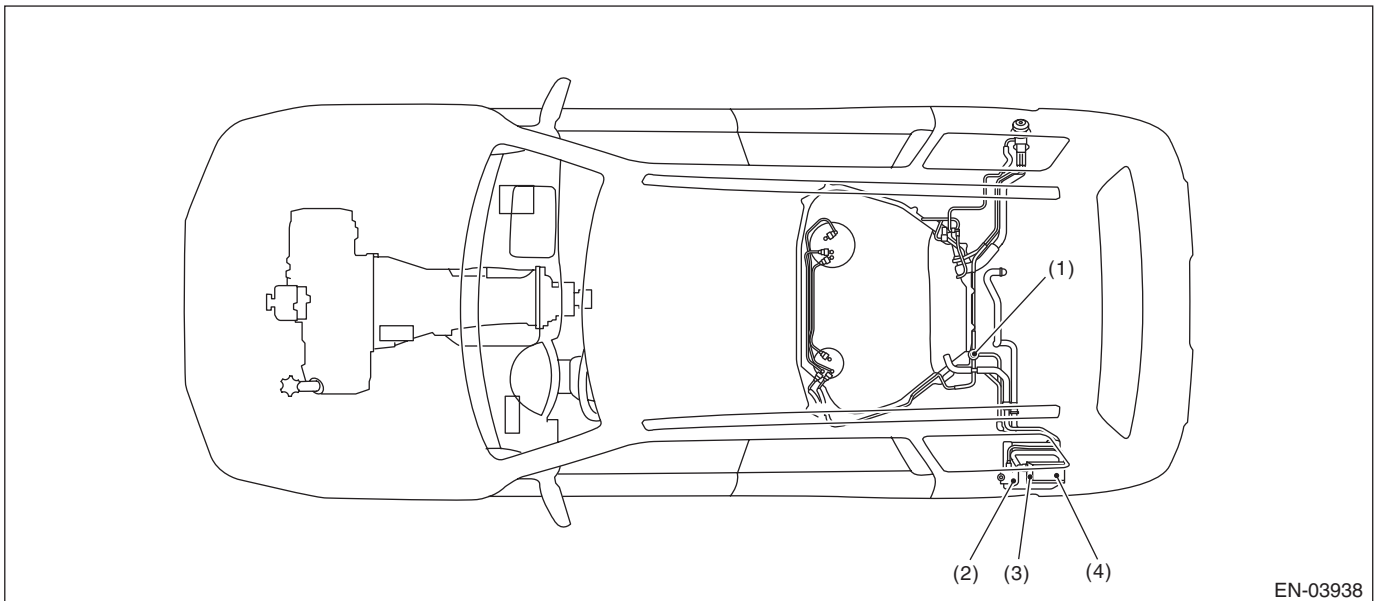
## ENGINE (DIAGNOSTICS)



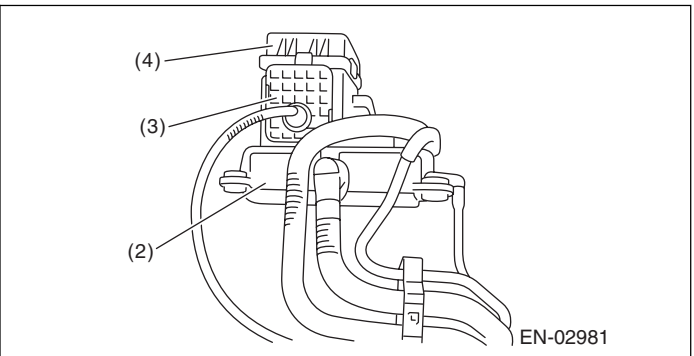
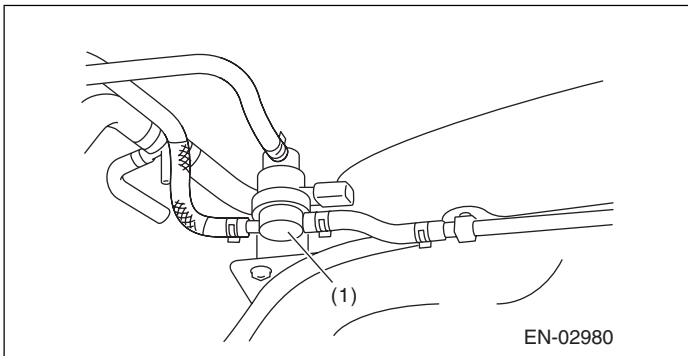


# Electrical Component Location

ENGINE (DIAGNOSTICS)

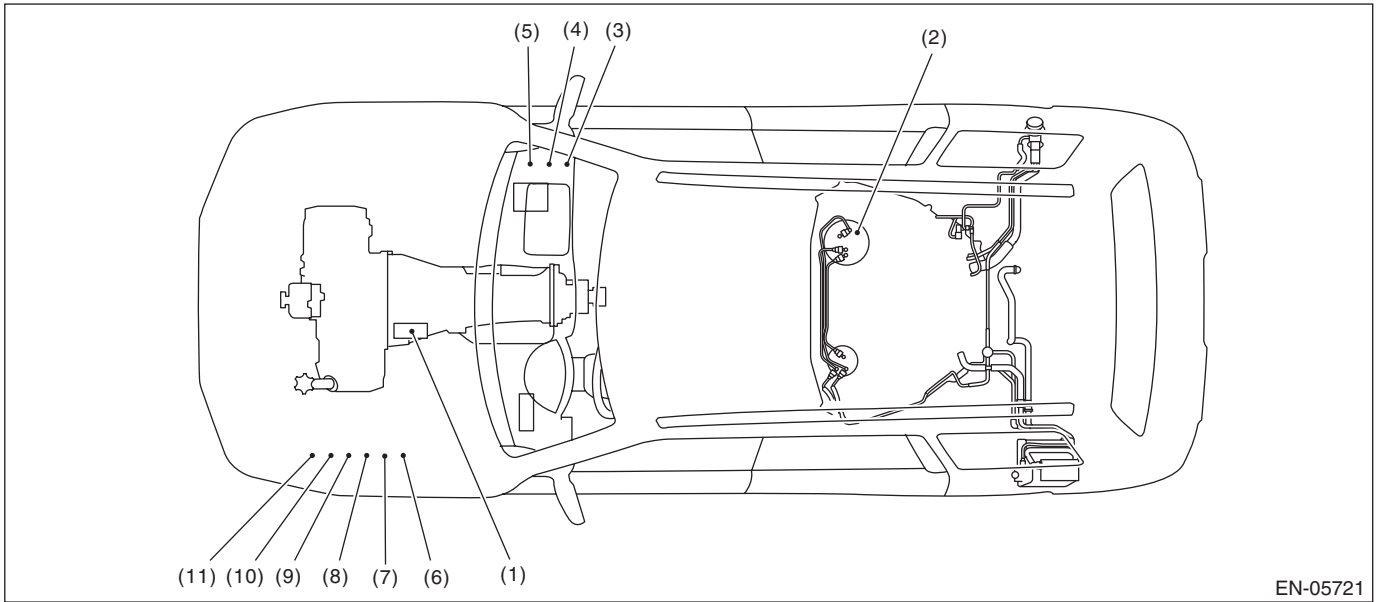


- (1) Pressure control solenoid valve
- (2) Canister
- (3) Drain valve
- (4) Drain filter

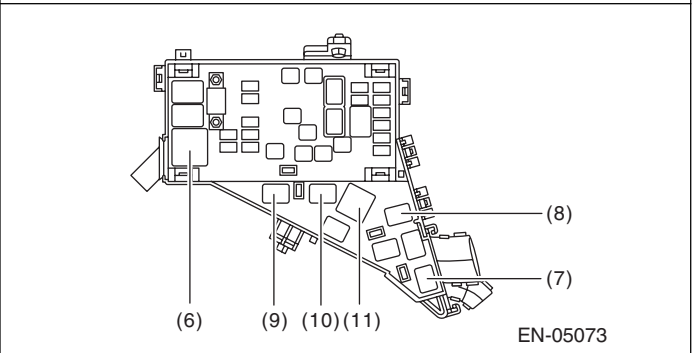
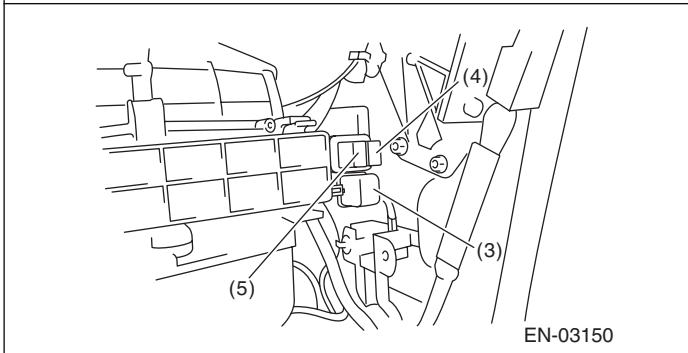
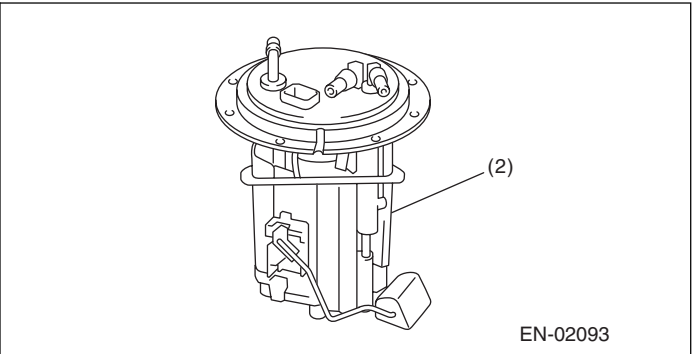
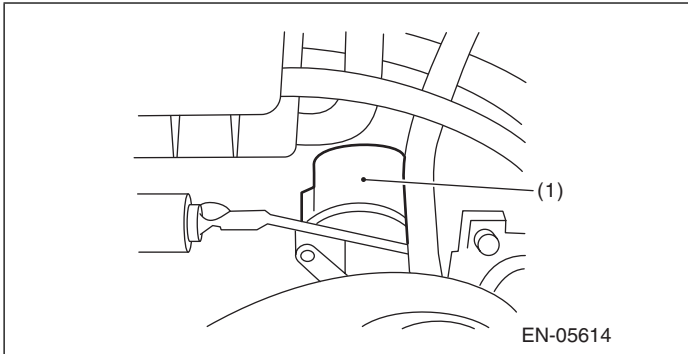


# Electrical Component Location

## ENGINE (DIAGNOSTICS)

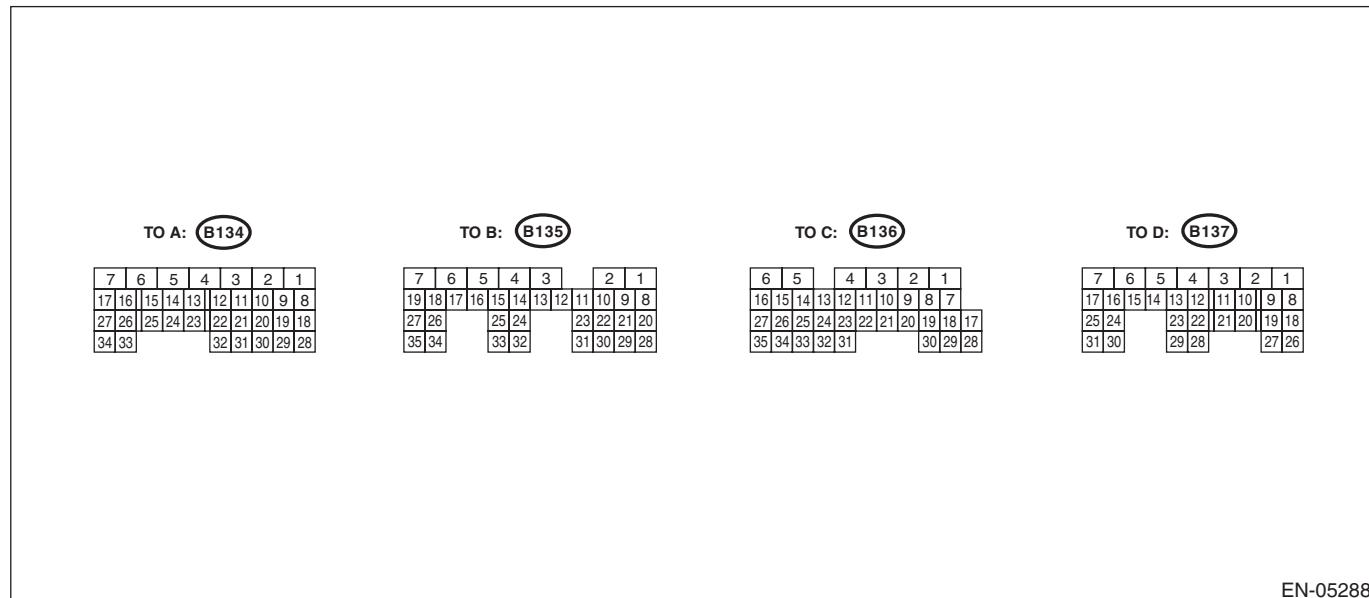


- |                                       |   |  |
|---------------------------------------|---|--|
| (1) Starter                           | (6) Radiator main fan relay 1               | (10) Secondary air combination valve relay 2 |
| (2) Fuel pump                         | (7) Radiator sub fan relay                  | (11) Secondary air pump relay                |
| (3) Main relay                        | (8) Radiator main fan relay 2               |  |
| (4) Fuel pump relay                   | (9) Secondary air combination valve relay 1 |  |
| (5) Electronic throttle control relay |   |  |



## 5. Engine Control Module (ECM) I/O Signal

### A: ELECTRICAL SPECIFICATION



EN-05288

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Crankshaft position sensor	Signal (+)	B134	13	0	-7 — +7	Waveform
	Signal (-)	B134	14	0	0	—
	Shield	B134	24	0	0	—
Rear oxygen sensor	Signal	B135	4	0	0 — 0.9	—
	Shield	B135	1	0	0	—
	GND (sensor)	B135	30	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B136	3	—	—	Waveform
	Signal 2	B136	2	—	—	Waveform
Rear oxygen sensor heater signal		B136	4	0 — 13	12 — 14	Waveform
Engine coolant temperature sensor	Signal	B134	34	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.
	GND (sensor)	B134	29	0	0	After engine is warmed-up.
Air flow sensor	Signal	B135	26	—	0.3 — 4.5	—
	Shield	B135	35	0	0	—
	GND	B135	34	0	0	—
Intake air temperature sensor signal		B135	18	0.3 — 4.6	0.3 — 4.6	—
Wastegate control solenoid valve		B137	27	0 or 10 — 13	0 or 12 — 14	Waveform
Starter switch		B136	32	0	0	Cranking: 8 — 14
A/C switch		B136	24	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
Ignition switch		B135	19	10 — 13	12 — 14	—
Neutral position switch (AT / MT)		B136	31	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Delivery (test) mode connector		B135	27	10 — 13	13 — 14	When connected: 0

# Engine Control Module (ECM) I/O Signal

## ENGINE (DIAGNOSTICS)

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Knock sensor	Signal	B134	15	2.8	2.8	—
	Shield	B134	25	0	0	—
Back-up power supply		B135	5	10 — 13	12 — 14	Ignition switch "OFF" : 10 — 13
Control module power supply		B134	7	10 — 13	12 — 14	—
		B135	2	10 — 13	12 — 14	—
Sensor power supply		B134	19	5	5	—
Ignition control	#1	B137	18	0	12 — 14	Waveform
	#2	B137	19	0	12 — 14	Waveform
	#3	B137	20	0	12 — 14	Waveform
	#4	B137	21	0	12 — 14	Waveform
Fuel injector	#1	B137	8	10 — 13	1 — 14	Waveform
	#2	B137	9	10 — 13	1 — 14	Waveform
	#3	B137	10	10 — 13	1 — 14	Waveform
	#4	B137	11	10 — 13	1 — 14	Waveform
Fuel pump control unit	Signal 1	B135	33	10 — 13	12 — 14	—
	Signal 2	B136	12	0 or 5	0 or 5	Waveform
A/C relay control		B136	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Radiator fan relay 1 control		B136	18	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Radiator fan relay 2 control		B136	29	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	Model with A/C only
Malfunction indicator light		B136	11	—	—	Light "ON": 1 or less Light "OFF": 10 — 14
Engine speed output		B136	22	—	0 — 13 or more	Waveform
Purge control solenoid valve 1		B137	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Waveform
Purge control solenoid valve 2		B136	7	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Waveform
Manifold absolute pressure sensor	Signal	B134	6	1.7 — 2.4	1.1 — 1.6	—
	Power supply	B134	19	5	5	
	GND (sensor)	B134	29	0	0	
Power steering oil pressure switch		B134	33	10 — 13	ON: 0 OFF: 12 — 14	—
Front oxygen (A/F) sensor signal (+)		B135	9	2.8 — 3.2	2.8 — 3.2	—
Front oxygen (A/F) sensor signal (-)		B135	8	2.4 — 2.7	2.4 — 2.7	—
Front oxygen (A/F) sensor shield		B135	1	0	0	—
SSM communication line		B136	16	1 or less ↔ 4 or more	1 or less ↔ 4 or more	—
Intake camshaft position sensor (LH)		B134	21	0 or 5	0 or 5	Waveform
Intake camshaft position sensor (RH)		B134	11	0 or 5	0 or 5	Waveform
Intake camshaft position sensor ground		B134	22	0	0	—

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Electric throttle control	Main	B134	18	0.64 — 0.72 Fully opened: 3.96	0.64 — 0.72 (After engine is warmed-up.)	Fully closed: 0.6 Fully opened: 3.96
	Sub	B134	28	1.51 — 1.58 Fully opened: 4.17	1.51 — 1.58 (After engine is warmed-up.)	Fully closed: 1.48 Fully opened: 4.17
	Power supply	B134	19	5	5	—
	GND (sensor)	B134	29	0	0	—
Electronic throttle control motor (+)		B137	5	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (-)		B137	4	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B136	1	10 — 13	12 — 14	—
Electronic throttle control motor relay		B136	21	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	When ignition switch is turned to ON: ON
Intake AVCS solenoid (LH)	Signal (+)	B137	15	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
	Signal (-)	B137	14	0	0	—
Intake AVCS solenoid (RH)	Signal (+)	B137	17	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
	Signal (-)	B137	16	0	0	—
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 1 Fully opened: 3.3	Fully closed: 1 Fully opened: 3.3	—
	Main power supply	B135	21	5	5	—
	GND (main sensor)	B135	29	0	0	—
	Shield	B136	6	0	0	—
	Sub sensor signal	B135	31	Fully closed: 1 Fully opened: 3.3	Fully closed: 1 Fully opened: 3.3	—
	Sub power supply	B135	22	5	5	—
	GND (sub sensor)	B135	30	0	0	—
Starter relay		B136	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	ON: cranking
A/C middle pressure switch		B136	33	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Clutch switch		B136	25	When clutch pedal is depressed: 0 When brake pedal is released: 10 — 13	When clutch pedal is depressed: 0 When brake pedal is released : 12 — 14	—
Brake switch 1		B135	20	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released : 12 — 14	—

# Engine Control Module (ECM) I/O Signal

## ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
Brake switch 2	B135	28	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed : 12 — 14 When brake pedal is released: 0	—	
Cruise control command switch	B135	24	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC : 2.5 — 3.5 When operating SET/COAST : 0.5 — 1.5 When operating CANCEL: 0 — 0.5	—	
Cruise control main switch	B135	12	ON: 0 OFF: 5	ON: 0 OFF: 5	—	
Fuel tank pressure sensor	B135	32	2.3 — 2.7	2.3 — 2.7	—	
Pressure control solenoid valve	B136	28	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Drain valve	B136	17	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Fuel temperature sensor	B135	17	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (77°F)	
Immobilizer	Signal 1	B136	26	—	—	
	Signal 2	B136	34	—	—	
CAN communication (+)	B136	27	—	—	—	
CAN communication (-)	B136	35	—	—	—	
AT/MT identification	B136	15	0	0	—	
Blow-by leak diagnosis signal	B134	30	0	0	At the time of open circuit (fault): 5	
Tumble generator valve position sensor signal (RH)	B134	26	Fully closed: 0.4 — 1.2 Fully opened : 2.8 — 4.6	Fully closed : 0.4 — 1.2 Fully opened : 2.8 — 4.6	—	
Tumble generator valve position sensor signal (LH)	B134	16	Fully closed: 0.4 — 1.2 Fully opened : 2.8 — 4.6	Fully closed : 0.4 — 1.2 Fully opened : 2.8 — 4.6	—	
Tumble generator valve RH (closed)	B137	23	0 or 10 — 13	0 or 12 — 14	—	
Tumble generator valve LH (closed)	B137	13	0 or 10 — 13	0 or 12 — 14	—	
Tumble generator valve RH (open)	B137	22	0 or 10 — 13	0 or 12 — 14	—	
Tumble generator valve LH (open)	B137	12	0 or 10 — 13	0 or 12 — 14	—	
Secondary air pipe pressure sensor	Signal	B134	27	2.2 — 2.8	2.2 — 2.8	When secondary air is inducted: 3.2 — 4.9
	Power supply	B134	19	5.12	5.12	—
	GND (sensor)	B134	29	0	0	—

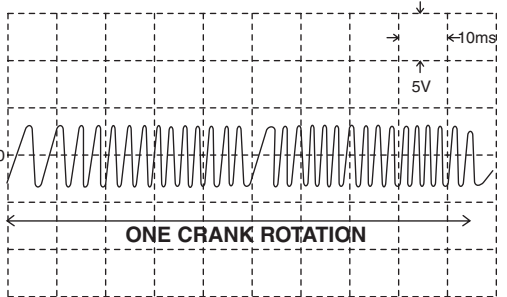
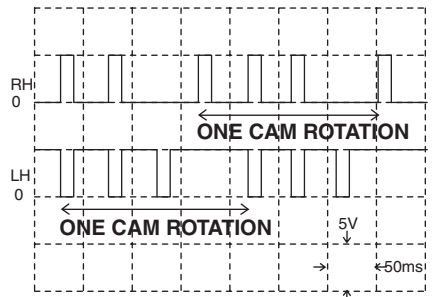
# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note
			Ignition SW ON (engine OFF)	Engine ON (idling)	
Secondary air combination valve relay 1	B136	30	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Secondary air combination valve relay 2	B136	19	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Secondary air pump relay	B136	8	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Self-shutoff control	B136	23	10 — 13	12 — 14	—
GND (ignition system)	B137	26	0	0	—
	B137	6	0	0	—
Ground (engine 1)	B134	5	0	0	—
Ground (engine 2)	B137	7	0	0	—
Ground (engine 3)	B137	2	0	0	—
Ground (engine 4)	B137	1	0	0	—
Ground (engine 5)	B137	3	0	0	—
Ground (body)	B136	6	0	0	—

# Engine Control Module (ECM) I/O Signal

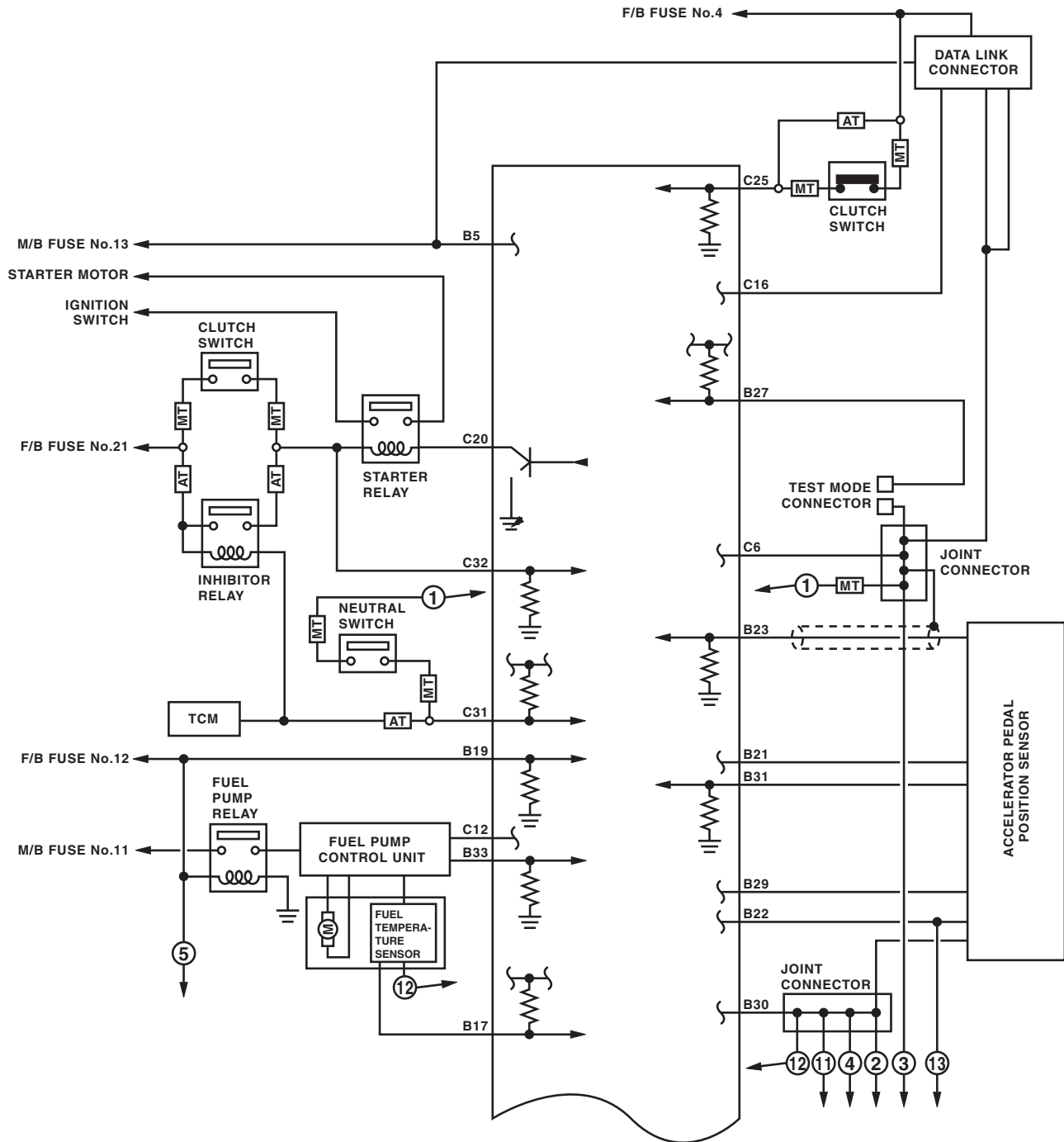
## ENGINE (DIAGNOSTICS)

Input/output name	Measuring condition	Waveform
1. Crankshaft position sensor	During idling	 <p style="text-align: right;">EN-05322</p>
2. Camshaft position sensor	During idling	 <p style="text-align: right;">EN-05359</p>



# Engine Control Module (ECM) I/O Signal

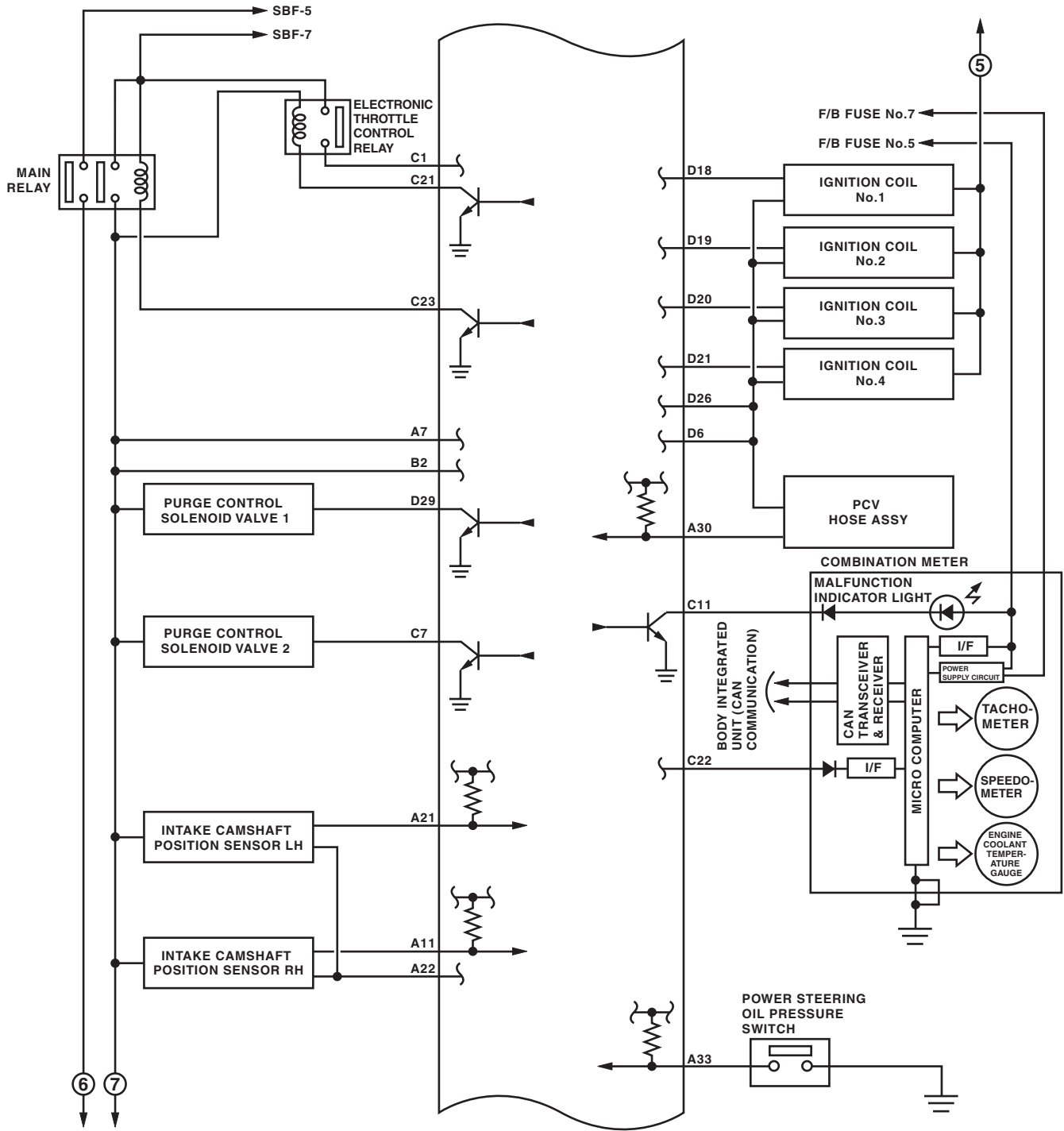
ENGINE (DIAGNOSTICS)



EN-05714

# Engine Control Module (ECM) I/O Signal

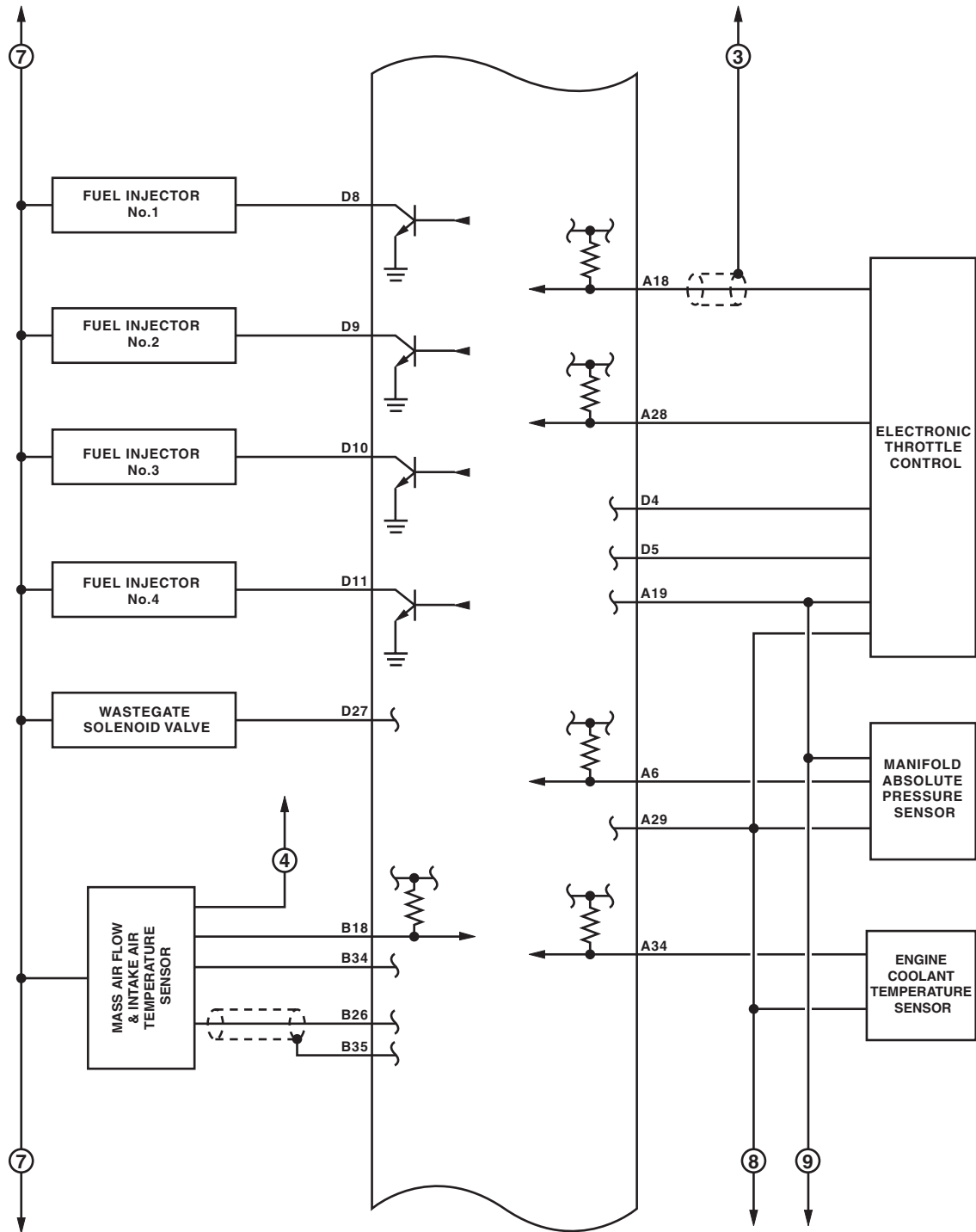
ENGINE (DIAGNOSTICS)



EN-05715

# Engine Control Module (ECM) I/O Signal

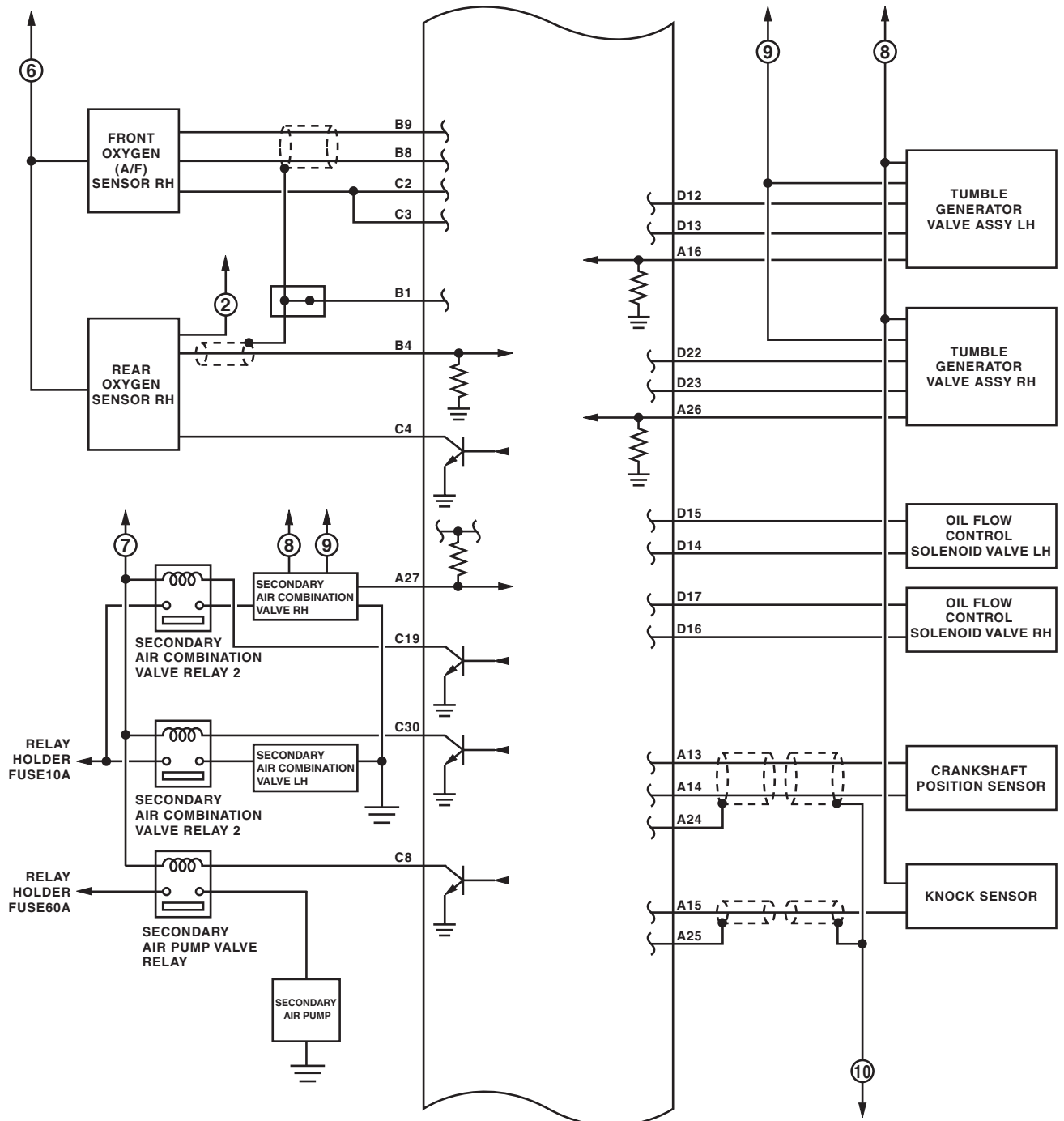
ENGINE (DIAGNOSTICS)



EN-05716

# Engine Control Module (ECM) I/O Signal

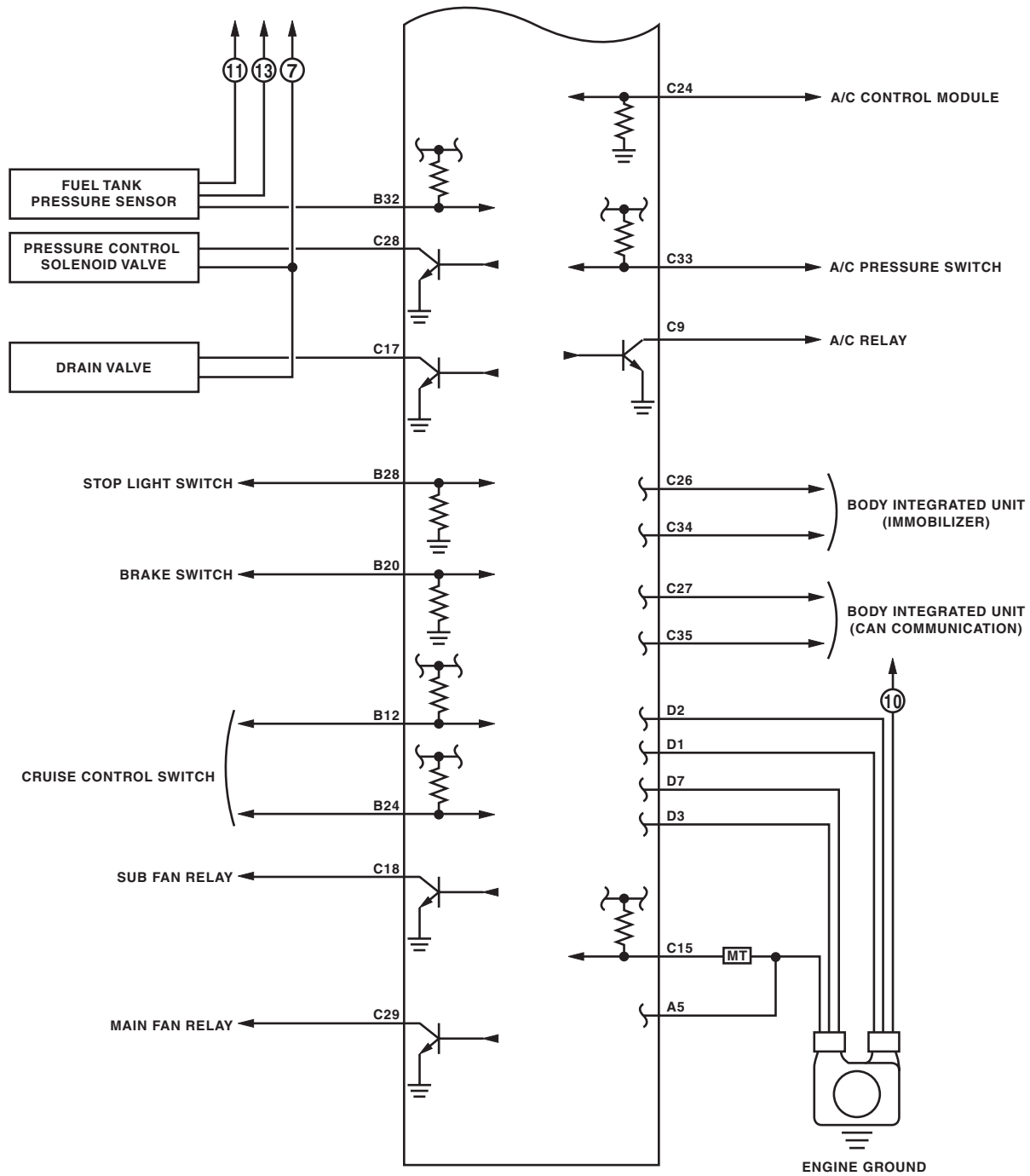
ENGINE (DIAGNOSTICS)



EN-05717

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)



EN-05718

# Engine Condition Data

ENGINE (DIAGNOSTICS)

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## 6. Engine Condition Data

### A: ELECTRICAL SPECIFICATION

Contents	Specification
Engine Load	17.6 — 35.64 (%): Idling
	13.2 — 26.73 (%): 2,500 rpm racing

Measuring condition:

- After engine is warmed-up.
- Gear position is in “N” or “P” range.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

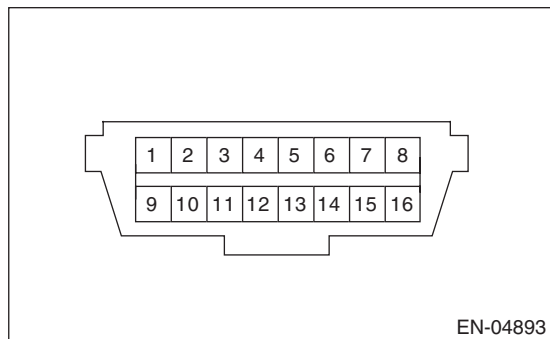
## 7. Data Link Connector

### A: NOTE

This connector is used for Subaru Select Monitor.

### CAUTION:

**Do not connect any scan tools except Subaru Select Monitor or general scan tool because the circuit for Subaru Select Monitor may be damaged.**



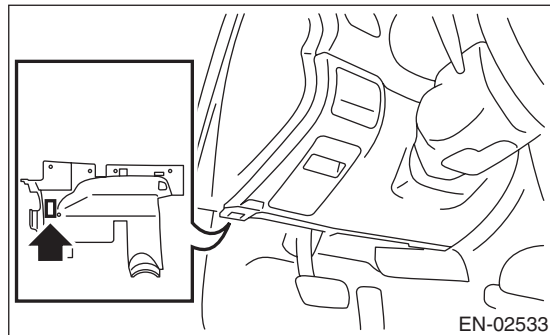
Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	Blank
3	Blank	11	Blank
4	Ground	12	Blank
5	Ground	13	Blank
6	CAN communication (+)	14	CAN communication (-)
7	Subaru Select Monitor signal	15	Blank
8	Blank	16	Power supply

### 8. General Scan Tool

#### A: OPERATION

##### 1. HOW TO USE GENERAL SCAN TOOL

- 1) Prepare a scan tool (general scan tool) required by SAE J1978.
- 2) Open the cover and connect the general scan tool to the data link connector located in the lower portion of instrument panel (on the driver's side).



- 3) Using the general scan tool, call up DTC and freeze frame data.

General scan tool functions consist of:

- (1) MODE \$01: Current powertrain diagnostic data
- (2) MODE \$02: Powertrain freeze frame data
- (3) MODE \$03: Emission-related powertrain DTC
- (4) MODE \$04: Clear/Reset emission-related diagnostic information
- (5) MODE \$06: Request on-board monitoring test results for intermittently monitored systems
- (6) MODE \$07: Request on-board monitoring test results for continuously monitored systems
- (7) MODE \$09: Request vehicle information

Read out the data according to repair procedures.  
(For detailed operation procedure, refer to the general scan tool instruction manual.)

#### NOTE:

For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>



# General Scan Tool

ENGINE (DIAGNOSTICS)

## 2. MODE \$01 (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.

A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$01	Number of emission-related powertrain DTC, and malfunction indicator light status and diagnosis support information	—
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C
\$06	Short term fuel trim	%
\$07	Long term fuel trim	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	MPH
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C
\$10	Air flow rate from mass air flow sensor	gm/s
\$11	Throttle valve absolute opening angle	%
\$12	Secondary air control status	—
\$13	Check whether oxygen sensor is installed.	—
\$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor	V and %
\$1C	Supporting OBD system	—
\$1F	Elapsed time after starting the engine	sec
\$21	Running distance after MIL turns on	miles
\$24	A/F value and A/F sensor output voltage	— and V
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$30	Number of warm ups after DTC clear	—
\$31	Travel distance after DTC clear	km
\$32	Fuel tank pressure	mmHg
\$33	Atmospheric pressure	mmHg
\$34	A/F sensor $\lambda$ value, current	—, A
\$3C	Catalyzer temperature	°C
\$41	Diagnostic monitor of each drive cycle	—
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%
\$4D	Engine operation time during MIL on	min
\$4E	Elapsed time after DTC clear	min
\$51	Fuel used	—
\$5A	Relative accelerator opening angle	%

### NOTE:

Refer to general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE \$01).

# General Scan Tool

## ENGINE (DIAGNOSTICS)

### 3. MODE \$02 (POWERTRAIN FREEZE FRAME DATA)

Refer to data denoting the operating condition when trouble is detected by on-board diagnosis system. A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$02	DTC that caused the freeze frame data storage required by CARB.	—
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C
\$06	Short term fuel trim	%
\$07	Long term fuel trim	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	MPH
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C
\$10	Air flow rate from mass air flow sensor	gm/s
\$11	Throttle valve absolute opening angle	%
\$12	Secondary air control status	—
\$13	Air fuel ratio sensor	—
\$15	Rear oxygen sensor voltage, compensation value	V, —
\$1C	Supporting OBD system	—
\$1F	Elapsed time after starting the engine	sec
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$32	Fuel tank pressure	mmHg
\$33	Atmospheric pressure	mmHg
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%

#### NOTE:

Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE \$02).

### 4. MODE \$03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

### 5. MODE \$04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refer to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

#### NOTE:

Refer to general scan tool manufacturer's instruction manual to clear the emission-related diagnostic information (MODE \$04).

# General Scan Tool

ENGINE (DIAGNOSTICS)

## 6. MODE \$06

Refer to test value of troubleshooting and data of test limit indicated on the support data bit sequence table. A list of the support data is shown in the following table.

OBDMID	TID	SID	Diagnostic item
\$01	\$81	\$0A	A/F sensor conduction abnormal (B1S1)
	\$82	\$8D	
	\$83	\$14	
	\$84	\$1E	A/F sensor range abnormal (B1S1)
	\$85	\$1E	
	\$86	\$20	
\$02	\$87	\$0B	Oxygen sensor circuit abnormal (B1S2)
	\$88	\$0B	
	\$07	\$0B	Oxygen sensor drop abnormal (B1S2)
	\$08	\$0B	
	\$A5	\$0B	
	\$05	\$10	Oxygen sensor response abnormal (B1S2)
	\$06	\$10	
\$21	\$89	\$20	Catalyst degradation diagnosis (B1)
\$39	\$93	\$FE	Evaporative emission control system leak detected (Fuel filler cap off)
\$3B	\$94	\$FE	Evaporative emission control system (0.04 inch leak)
	\$95	\$FE	
\$3C	\$96	\$FE	Evaporative emission control system (0.02 inch leak)
	\$97	\$FE	
\$3D	\$98	\$FE	Evaporative emission control system (Purge flow)
\$41	\$99	\$24	A/F sensor heater abnormal (B1S1)
	\$9A	\$24	
	\$9B	\$14	A/F sensor heater characteristic abnormal (B1S1)
\$42	\$9C	\$24	Oxygen sensor heater abnormal (B1S2)
	\$9D	\$24	
\$71	\$9E	\$17	Secondary air system (whole system)
	\$9F	\$0B	
	\$A0	\$0B	
	\$B0	\$17	Secondary air system (relay 2 — combination valve 2)
	\$B1	\$0B	
	\$B1	\$17	
	\$B2	\$0B	
	\$B2	\$17	
	\$B3	\$0B	
	\$B4	\$0B	
	\$B5	\$0B	
	\$B6	\$31	
	\$B7	\$31	
\$A1	\$0B	\$24	Misfire monitoring (All cylinders)
	\$0C	\$24	
\$A2	\$0B	\$24	Misfire monitoring (#1 cylinder)
	\$0C	\$24	
\$A3	\$0B	\$24	Misfire monitoring (#2 cylinder)
	\$0C	\$24	
\$A4	\$0B	\$24	Misfire monitoring (#3 cylinder)
	\$0C	\$24	

# General Scan Tool

## ENGINE (DIAGNOSTICS)

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OBDMID	TID	SID	Diagnostic item
\$A5	\$0B	\$24	Misfire monitoring (#4 cylinder)
	\$0C	\$24	
\$E1	\$A6	\$FE	Purge control solenoid valve 2 close seized

### 7. MODE \$07

Refer to the data of DTC (pending code) for troubleshooting result about emission in the first time.

### 8. MODE \$09

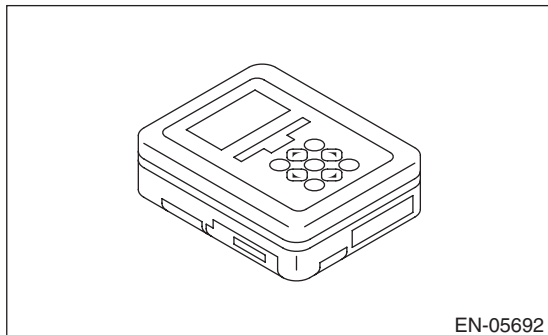
Refer to the data of vehicle specification (V.I.N., calibration ID, etc.).

## 9. Subaru Select Monitor

### A: OPERATION

#### 1. HOW TO USE THE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

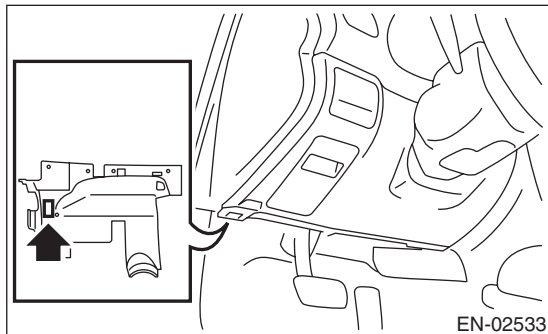
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

8) Call up DTC and data, then record them.

#### NOTE:

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

#### 2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to display a DTC. <Ref. to EN(H4DOTC)(diag)-44, Read Diagnostic Trouble Code (DTC).>

#### 3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (OBD MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to display a DTC. <Ref. to EN(H4DOTC)(diag)-44, Read Diagnostic Trouble Code (DTC).>

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

### 4. READ CURRENT DATA FOR ENGINE (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Current Data Display & Save}.
- 5) On the «Current Data Display & Save» display screen, select the {Normal sampling}.
- 6) Using the scroll key, scroll the display screen up or down until the desired data is shown.

- A list of the support data is shown in the following table.

Contents	Display	Unit of measure	Note (at idling)
Engine Load	Engine Load	%	21.0%
Engine coolant temperature signal	Coolant Temp.	°C or °F	80 — 100°C or 176 — 212°F
A/F correction 1	A/F Correction #1	%	-10 — +10%
A/F learning 1	A/F Learning #1	%	-15 — +15%
Intake manifold absolute pressure	Mani. Absolute Pressure	mmHg, kPa, inHg or psig	220 — 275 mmHg, 29.5 — 37 kPa, 8.7 — 10 inHg or 4.2 — 5.3 psig
Engine speed signal	Engine Speed	rpm	630 — 770 rpm (Agree with the tachometer indication)
Meter vehicle speed signal	Meter Vehicle Speed	km/h or MPH	0 km/h or 0 MPH (at parking)
Ignition timing signal	Ignition Timing	deg	10 — 15 deg
Intake air temperature signal	Intake Air Temp.	°C or °F	20 — 50°C or 68 — 122°F
Amount of intake air	Mass Air Flow	g/s or lb/m	2.1 — 3.1 g/s or 0.35 — 0.40 lb/m
Throttle opening angle signal	Throttle Opening Angle	%	2.0 — 2.4%
Rear oxygen sensor voltage	Rear O2 Sensor	V	0 — 1.0 V
Battery voltage	Battery Voltage	V	12 — 15 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1.0 — 1.7 V
Injection 1 pulse width	Fuel Injection #1 Pulse	ms	1.2 — 2.2 ms
Barometric pressure	Atmosphere Pressure	mmHg, kPa, inHg or psig	—
Intake manifold relative pressure	Mani. Relative Pressure	mmHg, kPa, inHg or psig	(Intake manifold absolute pressure — atmosphere pressure)
Ignition learning value	Learned Ignition Timing	deg	0 deg
Acceleration opening angle signal	Accel. Opening Angle	%	0.0%
Fuel temperature signal	Fuel Temp.	°C or °F	+28°C or 82°F
Primary supercharged pressure control signal	Primary Control	%	0.0%
Purge control solenoid duty ratio	Purge control solenoid duty ratio	%	0 — 25%
Tumble generator valve RH opening signal	TGV Position Sensor R	V	0.81 V
Tumble generator valve LH opening signal	TGV Position Sensor L	V	0.81 V
Fuel pump duty ratio	Fuel Pump Duty	%	30 — 40%
AVCS advance angle amount RH	AVCS advance angle amount RH	deg	5 deg
AVCS advance angle amount LH	AVCS advance angle amount LH	deg	5 deg
Oil flow control solenoid valve duty RH (AVCS)	OCV Duty R	%	0 — 20%
Oil flow control solenoid valve duty LH (AVCS)	OCV Duty L	%	0 — 20%
Oil flow control solenoid valve current RH	OCV Current R	mA	40 — 100 mA

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
Oil flow control solenoid valve current LH	OCV Current L	mA	40 — 100 mA
A/F sensor current value 1	A/F Sensor #1 Current	mA	-20 — 20 mA
A/F sensor resistance value 1	A/F Sensor #1 Resistance	Ω	27 — 35 mA
A/F sensor output lambda 1	A/F Sensor #1	—	1.0
A/F correction 3	A/F Correction #3	%	0.00%
A/F learning 3	A/F learning 3	%	0.00%
Throttle motor duty	Throttle Motor Duty	%	-5%
Throttle power supply voltage	Throttle Motor Voltage	V	12 — 15 V
Sub throttle sensor voltage	Sub-throttle Sensor	V	1.5 V
Main throttle sensor voltage	Main-throttle Sensor	V	0.6 V
Sub accelerator sensor voltage	Sub-accelerator Sensor	V	1.1 V
Main accelerator sensor voltage	Main-accelerator Sensor	V	1.0 V
Secondary air supply piping pressure signal	Secondary air supply piping pressure	mmHg, kPa, inHg or psig	765 mmHg, 102 kPa, 30.1 inHg or 14.8 psig
Secondary airflow signal	Secondary airflow amount	g/s or lb/m	0.00 g/s or 0.00 lb/m
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	—
Fuel level sensor resistance	Fuel level resistance	Ω	4 — 96 Ω
Odd Meter	Estimated Cumulative Driving Distance	km	—
#1 cylinder roughness monitor	Roughness Monitor #1	—	0
#2 cylinder roughness monitor	Roughness Monitor #2	—	0
#3 cylinder roughness monitor	Roughness Monitor #3	—	0
#4 cylinder roughness monitor	Roughness Monitor #4	—	0
Knock sensor compensation	Knock Correction	deg	0.0 deg
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig	+8.8 mmHg, +1.2 kPa, +0.4 inHg or +0.2 psig
AT/MT identification terminal	AT Vehicle ID Signal	—	AT/MT
Delivery (test) mode terminal	Test Mode Terminal	—	U check
D check request flag	D-check Flag	—	OFF
Delivery (test) mode terminal	Delivery Mode Connector	—	OFF
Neutral position switch signal	Neutral Position Switch	—	Neutral
Soft idle switch signal	Soft Idle Switch Signal	—	At idle
Ignition switch signal	Ignition Switch	—	ON input
Power steering switch signal	P/S Switch	—	OFF input (At OFF)
Air conditioning switch signal	A/C Switch	—	OFF input (At OFF)
Starter switch signal	Starter Switch	—	OFF input
Rear oxygen monitor	Rear O2 Rich Signal	—	Rich/Lean
Knocking signal	Knock Signal	—	None
Crankshaft position sensor signal	Crankshaft Position Sig.	—	Provided
Camshaft position sensor signal	Camshaft Position Sig.	—	Provided
Rear defogger switch signal	Rear Defogger SW	—	OFF input (At OFF)
Blower fan switch signal	Blower Fan SW	—	OFF input (At OFF)
Light switch signal	Light Switch	—	OFF input (At OFF)
A/C middle pressure switch signal	A/C Mid Pressure Switch	—	OFF input (At OFF)
Air conditioner compressor relay output signal	A/C Compressor Signal	—	OFF output (At OFF)
Radiator fan relay 1 signal	Radiator Fan Relay #1	—	OFF output (At OFF)
Radiator fan relay 2 signal	Radiator Fan Relay #2	—	OFF output (At OFF)

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
PCV hose assembly diagnosis signal	Blow-by Leak Connector	—	Connected
Pressure control solenoid valve signal	PCV Solenoid	—	OFF output (At OFF)
Tumble generator valve output signal	TGV Output	—	None
Tumble generator valve drive signal	TGV Drive	—	Opening direction
Drain valve signal	Vent Control Solenoid	—	OFF output (At OFF)
Purge control solenoid valve 2 signal	CPC Solenoid 2	—	OFF (At OFF)
AT coordinate retard angle demand signal	Retard Signal from AT	—	None
AT coordinate fuel cut demand signal	Fuel Cut Signal from AT	—	None
Vehicle dynamics control (VDC) torque down prohibition output	Ban of Torque Down	—	Permission
Vehicle dynamics control (VDC) torque down demand	Request Torque Down	—	None
AT coordinate permission signal	AT coordinate permission signal	—	ON/OFF
ETC motor relay signal	ETC Motor Relay	—	ON
Clutch switch signal	Clutch Switch	—	OFF (At OFF)
Stop light switch signal	Stop Light Switch	—	OFF (At OFF)
SET/COAST switch signal	SET/COAST Switch	—	OFF (At OFF)
RES/ACC switch signal	RESUME/ACCEL Switch	—	OFF (At OFF)
Brake switch signal	Brake Switch	—	OFF (At OFF)
Main switch signal	Main Switch	—	OFF (At OFF)
Body int. unit data reception	Body Int. Unit Data	—	Provided
Integrated unit data update	Body Int. Unit Count	—	Provided
Secondary air combination valve relay 2 signal	Sec. Air Combi V Relay 2	—	OFF (At OFF)
Secondary air pump relay signal	Sec. Air Pump Relay	—	OFF (At OFF)
Secondary air combination valve relay 1 signal	Sec. Air Combi V Relay 1	—	OFF (At OFF)
Cruise control cancel switch signal	CC Cancel SW	—	OFF (At OFF)
Malfunction indicator light signal	MIL Lit	—	Off (when unlit)
SI drive mode	SI Drive mode	—	I, S or S#

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.



## 5. READ CURRENT DATA FOR ENGINE (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Current Data Display & Save}.
  - 6) On the «Current Data Display & Save» display screen, select the {All Data Display}.
  - 7) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Referential value (at idling)	Unit of measure
Number of diagnosis code	Number of Diag. Code:	0	—
Condition of malfunction indicator light	MI (MIL)	OFF	—
Monitoring test of misfire	Misfire Monitoring (Supp)	YES	—
Monitoring test of misfire	Misfire Monitoring (Rdy)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Supp)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Rdy)	YES	—
Monitoring test of comprehensive component	Component monitoring (Supp)	YES	—
Monitoring test of comprehensive component	Component monitoring (Rdy)	YES	—
Test of catalyst	Catalyst Diagnosis (Supp)	YES	—
Test of catalyst	Catalyst Diagnosis (Rdy)	NO	—
Test of heating-type catalyst	Heated catalyst (Supp)	NO	—
Test of heating-type catalyst	Heated catalyst (Rdy)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Supp)	YES	—
Test of evaporative emission purge control system	Evaporative purge system (Rdy)	NO	—
Secondary air system test	Secondary air system (Supp)	YES	—
Secondary air system test	Secondary air system (Rdy)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Supp)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Rdy)	N/A	—
Test of oxygen sensor	O2 Heater Diagnosis (Supp)	YES	—
Test of oxygen sensor	O2 Heater Diagnosis (Rdy)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Supp)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Rdy)	YES	—
Test of EGR system	EGR system (Supp)	NO	—
Test of EGR system	EGR system (Rdy)	N/A	—
Air fuel ratio control system for bank 1	Fuel System for Bank 1	Normal CLOSE	—
Engine load data	Calculated load value	19.2	%
Engine coolant temperature signal	Coolant Temp.	96	°C
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	Short term fuel trim B1	17.2	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	5.5	%

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Intake manifold absolute pressure signal	Mani. Absolute Pressure	248	mmHg
Engine speed signal	Engine Speed	846	rpm
Vehicle speed signal	Vehicle Speed	0	km/h
#1 Cylinder ignition timing	Ignition timing adv. #1	13.5	°
Intake air temperature signal	Intake Air Temp.	44	°C
Amount of intake air	Mass Air Flow	3.6	g/s
Throttle position signal	Throttle Opening Angle	13	%
Secondary air control status	Secondary air system	Stop	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen Sensor #12	0.1 — 0.7	V
A/F correction (Bank 1 Sensor 2)	A/F Correction #12	0.0	%
On-board diagnostic system	OBD System	OBD/OBD2	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen Sensor #11	Support	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen Sensor #12	Support	—
Time elapsed after engine start	Elapsed Time After Starting Engine	—	sec
Driving distance after the malfunction indicator light illuminates	Time while MIL lighted	—	km
A/F lambda signal (Bank 1 Sensor 1)	A/F sensor #11	0.951	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F sensor #11	2.468	V
Evaporative purge	Evaporative purge	0	%
Fuel level signal	Fuel level	—	%
Number of warm ups after DTC clear	Number Of Warm Ups After DTC Clear	—	—
Driving distance after DTC clear	Time since DTC cleared	—	km
Fuel tank pressure signal	Fuel Tank Pressure	9.664	mmHg
Barometric pressure signal	Atmospheric Pressure	Barometric pressure	mmHg
A/F lambda signal (Bank 1 Sensor 1)	A/F sensor #11	0.957	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F sensor #11	-0.18	mA
Catalyst temperature #1	Catalyst Temperature #11	—	°C
Monitoring test of misfire	Misfire Monitoring (Enable)	YES	—
Monitoring test of misfire	Misfire Monitoring (Comp)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Enable)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Comp)	NO	—
Monitoring test of comprehensive component	Component monitoring (Enable)	NO	—
Monitoring test of comprehensive component	Component monitoring (Comp)	NO	—
Test of catalyst	Catalyst Diagnosis (Enable)	YES	—
Test of catalyst	Catalyst Diagnosis (Comp)	NO	—
Test of heating-type catalyst	Heated catalyst (Enable)	N/A	—
Test of heating-type catalyst	Heated catalyst (Comp)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Enable)	YES	—
Test of evaporative emission purge control system	Evaporative purge system (Comp)	NO	—

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Secondary air system test	Secondary air system (Enable)	YES	—
Secondary air system test	Secondary air system (Comp)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Enable)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Comp)	N/A	—
Test of oxygen sensor	Oxygen sensor (Enable)	YES	—
Test of oxygen sensor	Oxygen sensor (Comp)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Enable)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Comp)	YES	—
Test of EGR system	EGR system (Enable)	N/A	—
Test of EGR system	EGR system (Comp)	N/A	—
ECM power voltage	ECM power voltage	13.848	V
Absolute load	Absolute load	21	%
A/F ratio target lambda	A/F target lambda	0.993	—
Relative throttle opening angle	Relative throttle position	2	%
Ambient temperature	Ambient temperature	Ambient temperature	°C
Absolute throttle opening angle 2	Absolute throttle opening angle 2	31	%
Absolute accelerator opening angle 1	Absolute accelerator opening angle 1	13	%
Absolute accelerator opening angle 2	Absolute accelerator opening angle 2	13	%
Target throttle opening angle	Target throttle opening angle	0	%
Engine operating time while malfunction indicator lit	Engine operating time dur- ing MIL illuminates	—	min
Time elapsed after DTC clear	Elapsed time after DTC clear	—	min
Fuel used	Fuel used	GAS	—
Relative accelerator opening angle	Relative accelerator open- ing angle	0	%

**NOTE:**

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

### 6. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Freeze Frame Data Display}.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
DTC of freeze frame data	Freeze frame data	Diagnostic code
Air fuel ratio control system for bank 1	Fuel system for Bank1	—
Engine load data	Calculated load value	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani.Absolute Pressure	mmHg, kPa, inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing #1	Ignition timing adv. #1	°
Intake air temperature	Intake Air Temp.	°C
Amount of intake air	Mass Air Flow	g/s
Throttle opening angle	Throttle Opening Angle	%
Secondary air control status	Secondary air system	—
Oxygen sensor #12	Oxygen sensor #12	V
A/F correction #12	A/F correction #12	%
OBD system	OBD System	—
Oxygen sensor #11	Oxygen sensor #11	Support
Oxygen sensor #12	Oxygen sensor #12	Support
Elapsed time after starting the engine	Elapsed Time After Starting Engine	sec
Evaporative purge	Evaporative purge	%
Fuel level	Fuel level	%
Fuel tank pressure	Tank pressure	mmHg, kPa, inHg or psig
Atmospheric pressure	Atmospheric Pressure	mmHg, kPa, inHg or psig
ECM power voltage	ECM power voltage	V
Absolute load	Absolute load	%
A/F target lambda	A/F target lambda	—
Relative throttle opening angle	Relative throttle position	%
Ambient temperature	Ambient temperature	°C or °F
Absolute throttle opening angle 2	Absolute throttle opening angle 2	%
Absolute accelerator opening angle 1	Absolute accelerator opening angle 1	%
Absolute accelerator opening angle 2	Absolute accelerator opening angle 2	%
Target throttle opening angle	Target throttle opening angle	%

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 7. V.I.N. REGISTRATION

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {V.I.N. Registration}.
- 5) Perform the procedures shown on the display screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Read Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

---

## 10. Read Diagnostic Trouble Code (DTC)

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Diagnostic Code(s) Display}.
- 5) On the «Diagnostic Code(s) Display» screen, select the {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Diagnostic Code(s) Display}.
- 6) Make sure DTC is shown on the screen.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### 3. GENERAL SCAN TOOL

Refer to data denoting emission-related powertrain DTC.

For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

#### NOTE:

Refer to general scan tool manufacturer’s instruction manual to access powertrain DTC (MODE \$03).

## 11. Inspection Mode

### A: PROCEDURE

Perform the diagnosis shown in the following DTC table.

When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer to the item on the drive cycle. <Ref. to EN(H4DOTC)(diag)-50, Drive Cycle.>

DTC	Item	Condition
P0011	Intake Camshaft Position - Timing Over-Advanced Or System Performance (Bank 1)	—
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1)	—
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2)	—
P0021	Intake Camshaft Position - Timing Over-Advanced Or System Performance (Bank 2)	—
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	—
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	—
P0112	Intake Air Temperature Sensor 1 Circuit Low	—
P0113	Intake Air Temperature Sensor 1 Circuit High	—
P0117	Engine Coolant Temperature Circuit Low	—
P0118	Engine Coolant Temperature Circuit High	—
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	—
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	—
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	—
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	—
P0182	Fuel Temperature Sensor “A” Circuit Low Input	—
P0183	Fuel Temperature Sensor “A” Circuit High Input	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0230	Fuel Pump Primary Circuit	—
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	—
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	—
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	—
P0335	Crankshaft Position Sensor “A” Circuit	—
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	—
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	—
P0345	Camshaft Position Sensor “A” Circuit (Bank 2 or Single Sensor)	—
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	—
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	—
P0418	Secondary Air Injection System Control “A” Circuit	—
P0447	Evaporative Emission Control System Vent Control Circuit Open	—
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	—
P0452	Evaporative Emission Control System Pressure Sensor Low Input	—
P0453	Evaporative Emission Control System Pressure Sensor High Input	—

## Inspection Mode

### ENGINE (DIAGNOSTICS)

DTC	Item	Condition
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor "A" Circuit Low	—
P0463	Fuel Level Sensor "A" Circuit High	—
P0500	Vehicle Speed Sensor "A"	—
P0512	Starter Request Circuit	—
P0513	Incorrect Immobilizer Key	—
P0600	Serial Communication Link	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0607	Control Module Performance	—
P0638	Throttle Actuator Control Range/Performance (Bank 1)	—
P0700	Transmission Control System (MIL Request)	—
P0851	Park/Neutral Switch Input Circuit Low	—
P0852	Park/Neutral Switch Input Circuit High	—
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	—
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	—
P1160	Return Spring Failure	—
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	—
P1410	Secondary Air Injection System Switching Valve Stuck Open	—
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	—
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	—
P1560	Backup power supply	—
P1570	Antenna	—
P1571	Reference Code Incompatibility	—
P1572	IMM Circuit Failure	—
P1574	Key Communication Failure	—
P1576	EGI Control Module EEPROM	—
P1577	IMM Control Module EEPROM	—
P1578	Meter Failure	—
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	—
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	—
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	—
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	—
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	—
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	—
P2016	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 1)	—
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	—
P2021	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 2)	—
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	—
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	—
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	—
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	—
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	—
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	—
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	—
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	—
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	—



DTC	Item	Condition
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	—
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	—
P2419	Evaporative Emission System Switching Valve Control Circuit Low	—
P2420	Evaporative Emission System Switching Valve Control Circuit High	—
P2431	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Range/Performance	—
P2432	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Low	—
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	—
P2444	Secondary Air Injection System Pump Stuck ON	—

## 1. PREPARATION FOR THE INSPECTION MODE

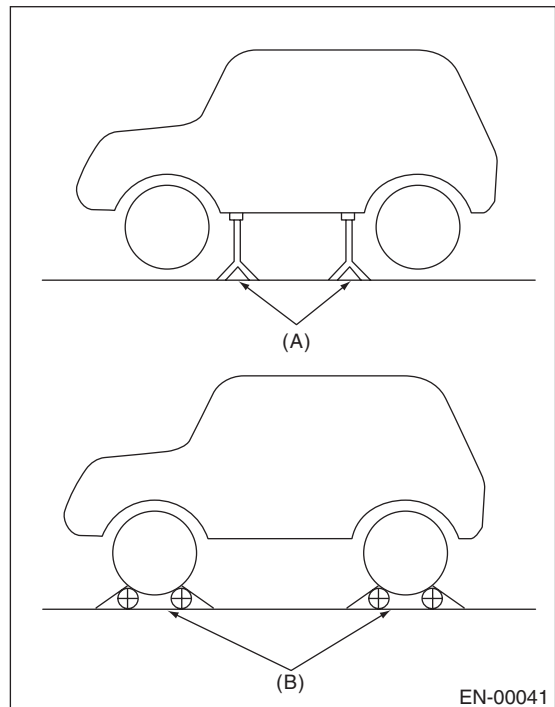
1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].

2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

### WARNING:

- Before raising the vehicle, ensure parking brakes are applied.
- Do not use a pantograph jack in place of a rigid rack.
- Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.
- Do not abruptly depress/release clutch pedal or accelerator pedal during works even when the engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the rigid racks and vehicle.

- Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



- (A) Rigid racks
- (B) Free rollers

# Inspection Mode

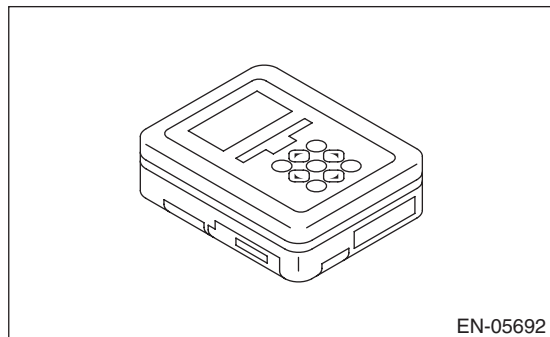
## ENGINE (DIAGNOSTICS)

### 2. SUBARU SELECT MONITOR

1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>

2) Warm-up the engine.

3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



4) Prepare the personal computer which has been installed the Subaru Select Monitor.

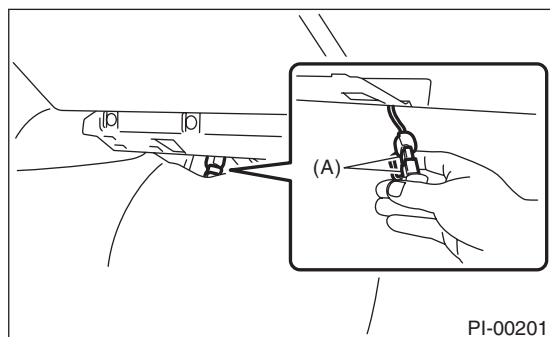
5) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

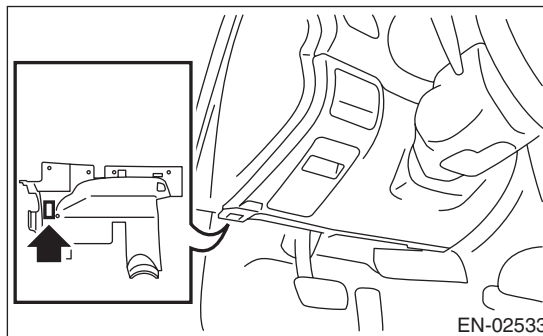
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to the SDI.

7) Connect the delivery (test) mode connector (A) located under the glove box.



8) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

9) Start up the personal computer.

10) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

11) On the «Main Menu» display screen, select the {Each System Check}.

12) On the «System Selection Menu» display screen, select the {Engine Control System}.

13) Click the [OK] button after the information of engine type has been displayed.

14) On the «Engine Diagnosis» display screen, select the {D Check}.

15) When the «Perform Inspection (Dealer Check) Mode» is shown on the screen, click the [Next] button.

16) Perform subsequent procedures as instructed on the display screen.

• If trouble still remains in the memory, the corresponding DTC appears on the display screen.

#### NOTE:

• For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

• For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".

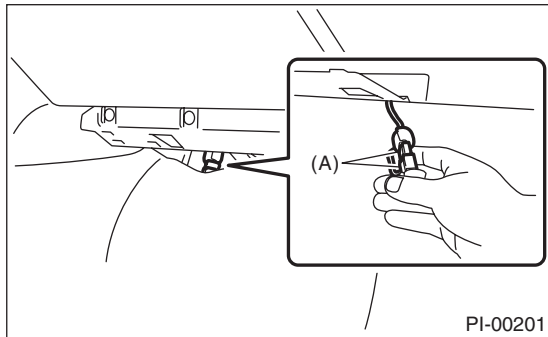
<Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

• Release the parking brake.

• The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When engine control diagnosis is finished, perform the ABS memory clearance procedure of the self-diagnosis system. <Ref. to ABS(diag)-24, Clear Memory Mode.>

## 3. GENERAL SCAN TOOL

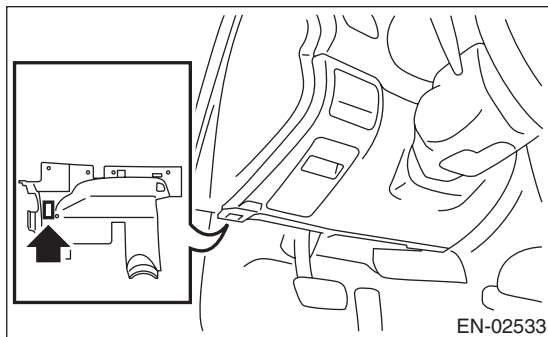
- 1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>
- 2) Warm-up the engine.
- 3) Connect the delivery (test) mode connector (A) located under the glove box.



- 4) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).

### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**



- 5) Start the engine.

### NOTE:

- Make sure the select lever is placed in the “P” position before starting. (AT model)
- Depress the clutch pedal when starting engine. (MT model)

- 6) Using the select lever or shift lever, turn the “P” position switch and “N” position switch on.

- 7) Depress the brake pedal to turn the brake switch ON. (AT model)

- 8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.

- 9) Place the select lever or shift lever in “D” position (AT model) or “1st gear” (MT model) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

### NOTE:

- For AWD model, release the parking brake.
- The speed difference between front and rear wheels may illuminate the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system. <Ref. to ABS(diag)-24, Clear Memory Mode.>

- 10) Using the general scan tool, check DTC and record the result(s).

### NOTE:

- For detailed operation procedures, refer to the general scan tool operation manual.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.

<Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>

## 12. Drive Cycle

### A: PROCEDURE

For the troubleshooting, there are driving patterns described below. Driving in the specified pattern allows to diagnose malfunctioning items listed below. After the repair of the following trouble items, be sure to drive the vehicle with the specified drive patterns to check whether the function is resumed correctly.

#### 1. PREPARATION FOR DRIVE CYCLE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].

2) After performing the diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>

3) Disconnect the delivery (test) mode connector.

#### NOTE:

- Perform the diagnosis after warming up the engine except when the engine coolant temperature at starting is specified.
- Perform the diagnosis twice if the DTC marked with \*. After completing the first diagnosis, stop the engine and perform second diagnosis in same condition.

# Drive Cycle

ENGINE (DIAGNOSTICS)

## 2. DRIVE CYCLE A — DRIVE THE VEHICLE WITH 80 KM/H (50 MPH) FOR 20 MINUTES, AND THEN IDLE THE ENGINE FOR A MINUTE.)

DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Engine coolant temperature at engine start is less than 20°C (68°F).
*P0126	Insufficient Engine Coolant Temperature for Stable Operation	—
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	Engine coolant temperature at engine start is less than 55°C (131°F).
*P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P0172	System Too Rich (Bank 2)	Diagnosis completes in drive cycle B or C as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0441	Evaporative Emission System Incorrect Purge Flow	—
*P0442	Evaporative Emission Control System Leak Detected (Small Leak)	Engine coolant temperature at engine start is less than 25°C (77°F).
*P0451	Evaporative Emission Control System Pressure Sensor	—
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Engine coolant temperature at engine start is less than 25°C (77°F).
*P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/ Off)	Engine coolant temperature at engine start is less than 25°C (77°F).
P0459	Evaporative Emission System Purge Control Valve Circuit High	—
P1443	Vent Control Solenoid Valve Function Problem	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle B or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle B or C as well.

# Drive Cycle

## ENGINE (DIAGNOSTICS)

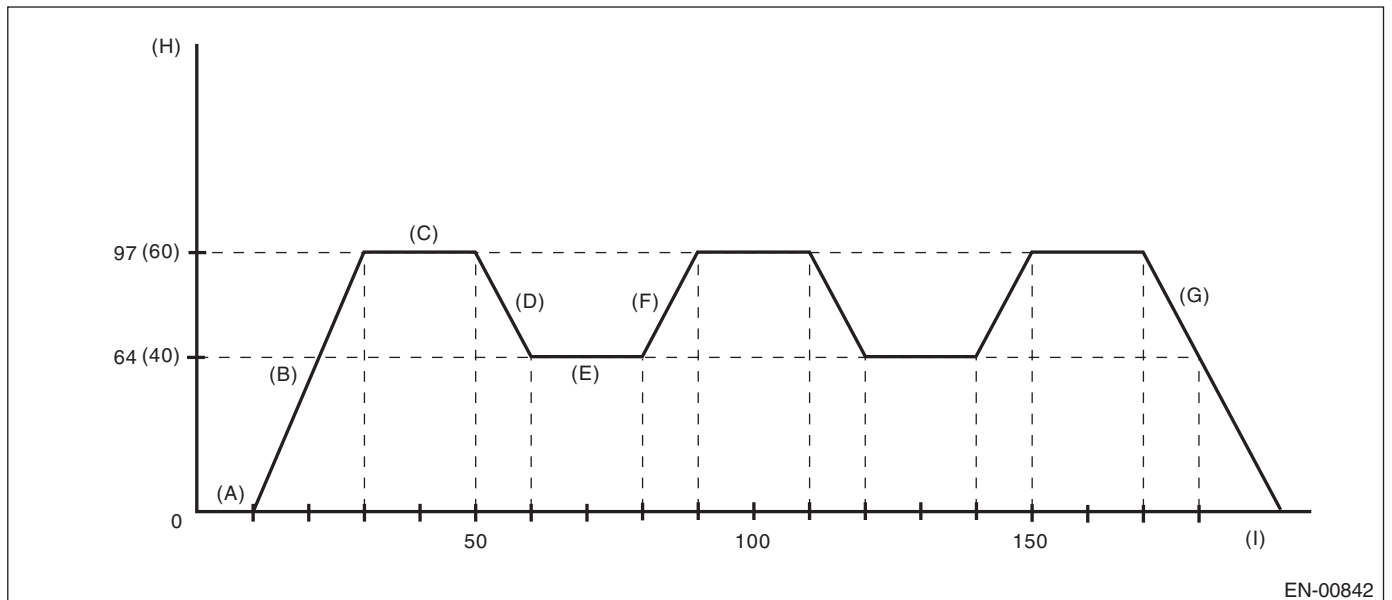
### 3. DRIVE CYCLE B — 10 MINUTES IDLING

**NOTE:**

Drive the vehicle at 10 km/h (6 MPH) or faster before diagnosis.

DTC	Item	Condition
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0172	System Too Rich (Bank 2)	Diagnosis completes in drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0464	Fuel Level Sensor Circuit Intermittent	—
*P0506	Idle Air Control System RPM Lower Than Expected	—
*P0507	Idle Air Control System RPM Higher Than Expected	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or C as well.

### 4. DRIVE CYCLE C — DRIVE THE VEHICLE WITH FOLLOWING DRIVE PATTERNS



EN-00842

- |   |  |  |
|---|--|--|
| (A) Idle the engine for 10 seconds or more.               | (D) Decelerate with fully closed throttle to 64 km/h (40 MPH). | (G) Stop the vehicle with throttle fully closed. |
| (B) Accelerate to 97 km/h (60 MPH) within 20 seconds.     | (E) Drive the vehicle at 64 km/h (40 MPH) for 20 seconds.      | (H) Vehicle speed km/h (MPH)                     |
| (C) Drive the vehicle at 97 km/h (60 MPH) for 20 seconds. | (F) Accelerate to 97 km/h (60 MPH) within 10 seconds.          | (I) Sec.   |

# Drive Cycle

## ENGINE (DIAGNOSTICS)

DTC	Item	Condition
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
P0068	MAP/MAF - Throttle Position Correlation	—
*P0101	Mass Or Volume Air Flow Circuit Range/Performance	—
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0172	System Too Rich (Bank 2)	Diagnosis completes in drive cycle A or B as well.
*P0244	Turbo/Super Charger Wastegate Solenoid "A" Range/Performance	—
P0246	Turbo/Super Charger Wastegate Solenoid "A" High	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	—
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or B as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or B as well.

## 5. DRIVE CYCLE D

### DRIFT DIAGNOSIS

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Make sure that fuel remains 10 ℓ (2.6 US gal, 2.2 Imp gal) or more and the battery voltage is 10.9 V or more.
- 3) Start the engine, and check that the engine coolant temperature increases by 10°C (18°F) or more, and reaches 75°C (167°F) or more, when the engine is warmed up.
- 4) Idle the engine for 120 seconds or more in the condition of step 3.

### STUCK DIAGNOSIS

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>
- 3) Drive the vehicle for the distance equal to the fuel of 50 ℓ (13.2 US gal, 11 Imp gal).

#### NOTE:

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	—

# Drive Cycle

## ENGINE (DIAGNOSTICS)

### 6. DRIVE CYCLE E

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>
- 3) Drive the vehicle for the distance equal to the fuel of 30 ℓ (7.9 US gal, 6.6 Imp gal).

#### NOTE:

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0461	Fuel Level Sensor "A" Circuit Range/Performance	—

### 7. DRIVE CYCLE F

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Start the engine, and warm it up until engine coolant temperature increases over 95°C (203°F).
- 3) After the engine has reached the state of procedure 2), idle the engine for 10 minutes or more.

#### NOTE:

Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	—

### 8. DRIVE CYCLE G

- 1) Remove the battery negative terminal, and reconnect after 10 seconds have passed.
- 2) Start the engine and warm-up engine until coolant temperature is 80°C (176°F).
- 3) Start the engine and warm-up engine until coolant temperature is 40°C (104°F) or less.

#### NOTE:

Do not let engine coolant temperature drop below 5°C (41°F).

- 4) Start the engine and warm-up engine until coolant temperature is 80°C (176°F).
- 5) Start the engine and warm-up engine until coolant temperature is 40°C (104°F) or less.

#### NOTE:

Do not let engine coolant temperature drop below 5°C (41°F).

- 6) Start and idle the engine.

DTC	Item	Condition
*P0410	Secondary Air Injection System	—
*P0411	Secondary Air Injection System Incorrect Flow Detected	—
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	—
P0417	Secondary Air Injection System Switching Valve "B" Circuit Shorted	—
P1418	Secondary Air Injection System Control "A" Circuit	—
*P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank 1)	—
*P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank 1)	—
*P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank 2)	—
*P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank 2)	—



## 9. DRIVE CYCLE H

- 1) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>
- 2) With the ignition switch ON, read the engine coolant temperature, intake air temperature and fuel temperature. <Ref. to EN(H4DOTC)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
- 3) If the values from step 2) satisfy the following two conditions, start the engine.

**Condition:**

***|Engine coolant temperature — intake air temperature| ≤ 5°C (41°F)***

***|Engine coolant temperature — fuel temperature| ≤ 2°C (36°F)***

**NOTE:**

- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
  - Start AT vehicles in the P range, and MT vehicles in the N position.
- 4) Idle the engine for 1 minute under the conditions in step 3).

DTC	Item	Condition
*P1602	Control Module Programming Error	—

## 13. Clear Memory Mode

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Clear Memory}.
- 5) When the “Clear Memory?” is shown on the screen, click the [Yes] button.
- 6) When “Done” and “Turn ignition switch to OFF” is shown on the display screen, turn the ignition switch to OFF.

NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Clear Diagnostic Code?}.
- 6) When the “Clear Diagnostic Code?” is shown on the screen, click the [Yes] button.
- 7) When “Done” and “Turn ignition switch to OFF” is shown on the display screen, turn the ignition switch to OFF.

NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

#### 3. GENERAL SCAN TOOL

For procedures clearing memory using the general scan tool, refer to the general scan tool operation manual.

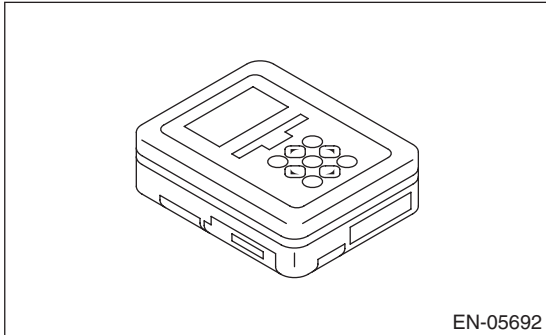
NOTE:

Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.

## 14. Compulsory Valve Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

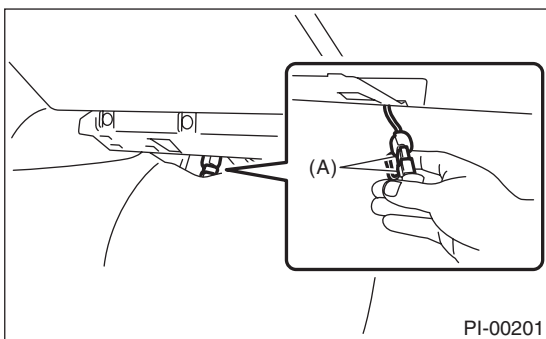
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

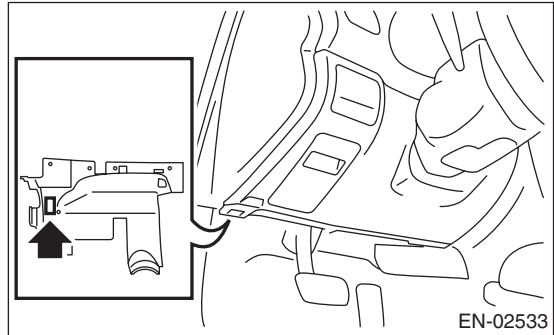
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the delivery (test) mode connector (A) located under the glove box.



6) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

7) Start up the personal computer.

8) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

9) On the «Main Menu» display screen, select the {Each System Check}.

10) On the «System Selection Menu» display screen, select the {Engine Control System}.

11) Click the [OK] button after the information of engine type has been displayed.

12) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

13) On the «System Operation Check Mode» display screen, select the {Actuator ON/OFF Operation}.

14) Select the desired compulsory actuator on the «Actuator ON/OFF Operation» display screen and click the [Next] button.

# Compulsory Valve Operation Check Mode

## ENGINE (DIAGNOSTICS)

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15) Clicking the [Finished] button completes the compulsory valve operation check mode. The display will then return to the «Actuator ON/OFF Operation» screen.

- A list of the support data is shown in the following table.

Description	Display
Compulsory fuel pump relay operation check	Fuel Pump
Compulsory purge control solenoid valve operation check	CPC Solenoid
Compulsory purge control solenoid valve 2 operation check	CPC Solenoid 2
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay
Compulsory wastegate control solenoid valve operation check	Wastegate control Solenoid
Compulsory pressure control solenoid valve operation check	PCV solenoid
Compulsory drain valve operation check	Vent Control Solenoid
Compulsory secondary air combination valve 1 operation check	Secondary Air Combination Valve 1
Compulsory secondary air combination valve 2 operation check	Secondary Air Combination Valve 2
Compulsory secondary air pump relay operation check	Secondary air pump relay

### NOTE:

- The following parts will be displayed but not functional.

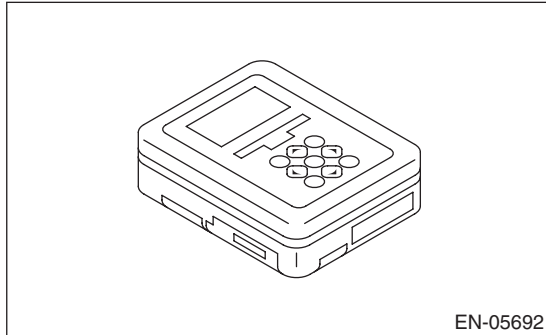
Display
EGR Solenoid
ASV Solenoid
FICD Solenoid
Pressure Switching Sol.1
Pressure Switching Sol.2
AAI Solenoid
Fuel Tank Sensor Control Valve
EXH. Bypass Control Permit Flag

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 15. System Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

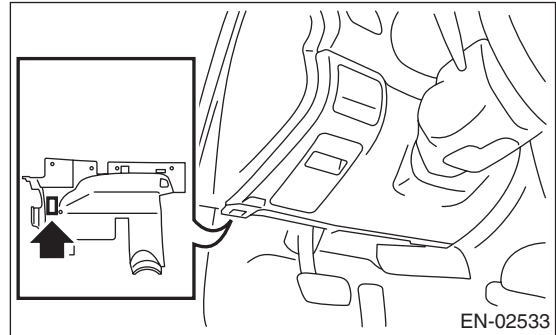
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

**NOTE:**

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

8) On the «Main Menu» display screen, select the {Each System Check}.

9) On the «System Selection Menu» display screen, select the {Engine Control System}.

10) Click the [OK] button after the information of engine type has been displayed.

11) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

12) The following items will be displayed on screen.

Display
Actuator ON/OFF Operation
Security System
Fuel Pump Control
Idling Ignition Timing Fixed
Idle Speed Control
Injector Control

# System Operation Check Mode

ENGINE (DIAGNOSTICS)

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## 1. FUEL PUMP CONTROL (OFF DRIVE)

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

- 1) On the «System Operation Check Mode» display, select the {Fuel Pump Control}.
- 2) On the «Fuel Pump Control» display screen, select the {OFF Operation}.
- 3) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 4) Click the [Cancel] button to end the OFF drive. The screen will return to the «Fuel Pump Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 2. FUEL PUMP CONTROL (ON/OFF DRIVE)

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

- 1) On the «System Operation Check Mode» display, select the {Fuel Pump Control}.
- 2) On the «Fuel Pump Control» display screen, select the {ON/OFF Operation}.
- 3) On the «Turn Ignition Switch ON with Engine Stalled» display screen, turn the ignition switch to ON and click the [OK] button.
- 4) Click the [Cancel] button to end the ON/OFF drive. The screen will return to the «Fuel Pump Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 3. IDLING IGNITION TIMING FIXED

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

- 1) On the «System Operation Check Mode» display screen, select the {Fixed Idle Ignition Timing }.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) Click the [Cancel] button to end the idle ignition timing fixed. The screen will return to the «System Operation Check Mode» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 4. IDLE SPEED CONTROL

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

- 1) On the «System Operation Check Mode» display screen, select the {Idle Speed Control}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) In the «Idle Engine Speed Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button. Setting is possible in a range between 500 rpm — 2,000 rpm, in increments of 50 rpm. However, the engine speed that can actually be controlled will vary depending on the vehicle.
- 4) Click the [Cancel] button to end the idle speed control. The screen will return to the «System Operation Check Mode» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 5. INJECTOR CONTROL. (INJECTION STOP MODE)

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

- 1) On the «System Operation Check Mode» display, select the {Injector Control}.
- 2) On the «Injector Control» display screen, select the {Injection Stop Mode}.
- 3) Select the desired injector number on the «Injection Stop Mode» screen, and click the [OK] button.
- 4) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 5) Click the [Cancel] button to return the «Injection Stop Mode» display screen.
- 6) On the «Injection Stop Mode» display screen, click the [Return] button to end the «Injection Stop Mode». The screen will return to the «Injector Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 6. INJECTOR CONTROL. (INJECTION QUANTITY CONTROL)

### CAUTION:

After executing the operation check mode, execute the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>.

1) On the «System Operation Check Mode» display, select the {Injector Control}.

2) On the «Injector Control» display screen, select the {Injection Quantity Control}.

3) On the «Start the Engine» display screen, start the engine and click the [OK] button.

4) In the «Injection Quantity Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.

Setting is possible in a range between 0 — 20%, in increments of 1%.

5) Click the [Cancel] button to end the injection quantity control. The screen will return to the «Injector Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

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## 16. Malfunction Indicator Light

### A: PROCEDURE

1. Activation of malfunction indicator light. <Ref. to EN(H4DOTC)(diag)-63, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on. <Ref. to EN(H4DOTC)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off. <Ref. to EN(H4DOTC)(diag)-66, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink. <Ref. to EN(H4DOTC)(diag)-67, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light keep blinking. <Ref. to EN(H4DOTC)(diag)-69, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

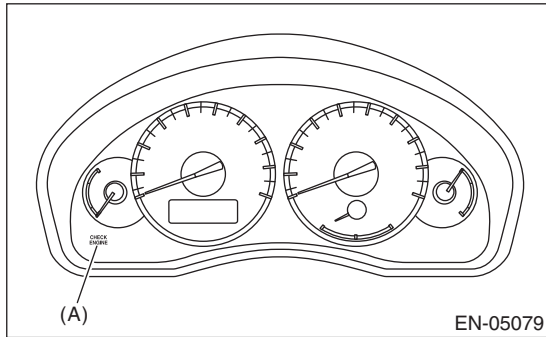


## B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

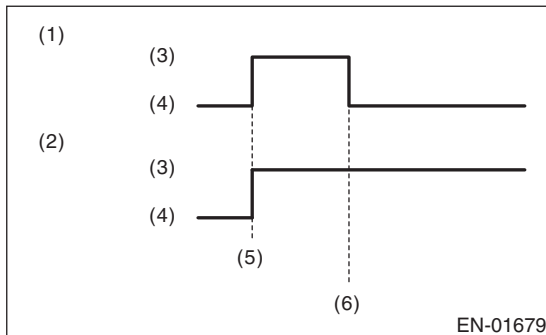
1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

**NOTE:**

If the malfunction indicator light does not illuminate, perform diagnostics of the CHECK ENGINE light circuit or the combination meter circuit. <Ref. to EN(H4DOTC)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>



2) After starting the engine, the malfunction indicator light goes out. If it does not go off, either the engine or emission control system has malfunction.



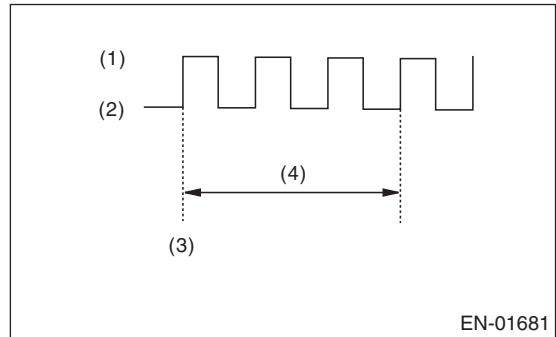
- (1) No DTC
- (2) Trouble occurs
- (3) ON
- (4) OFF
- (5) Ignition switch ON
- (6) Engine start

3) Turn the ignition switch to OFF and connect the delivery (test) mode connector.

(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.

(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.



- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) 1 second

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

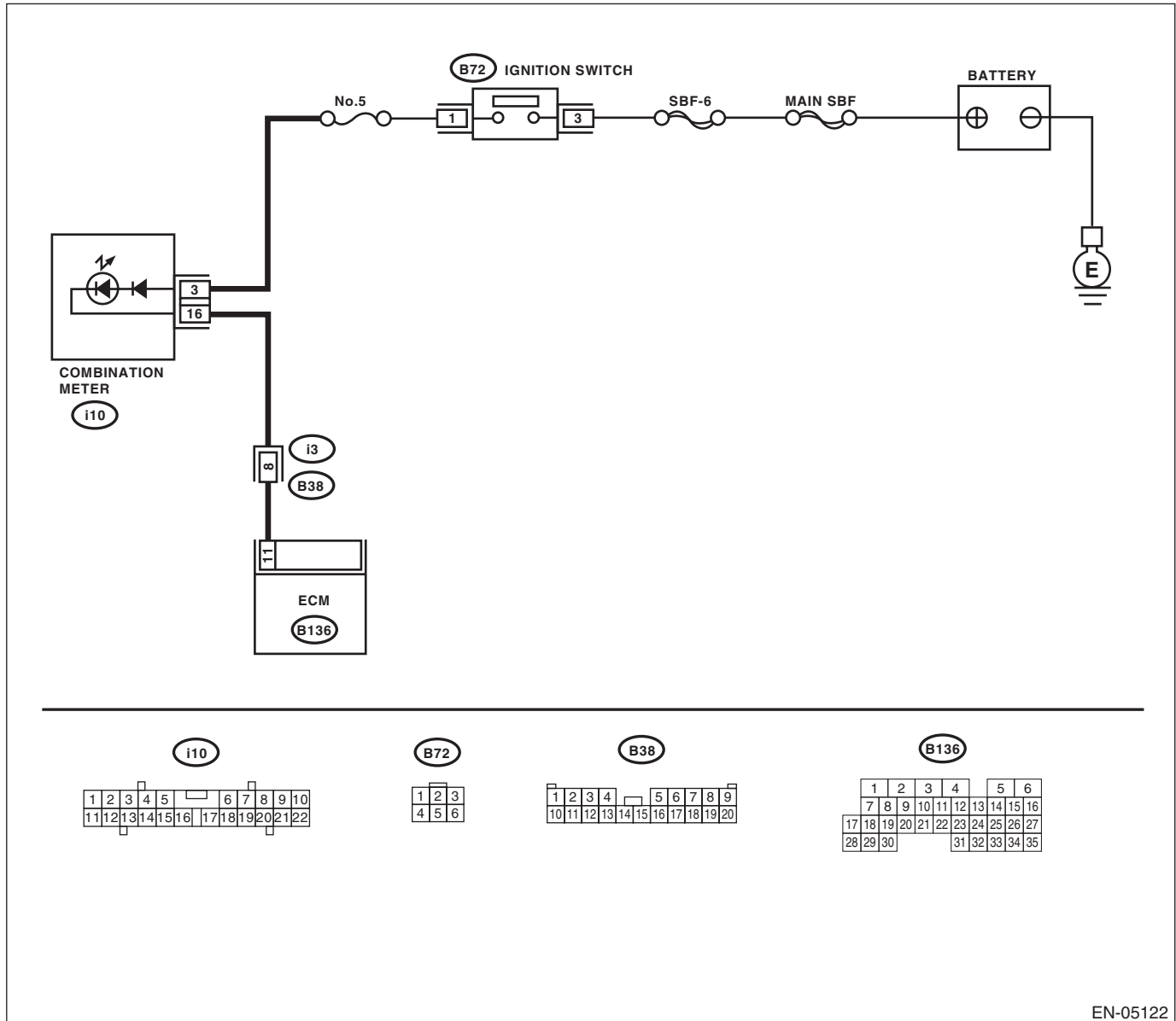
### DIAGNOSIS:

The malfunction indicator light circuit is open or shorted.

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not come on.

### WIRING DIAGRAM:



EN-05122

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 11 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.
2	<b>CHECK POOR CONTACT.</b> Check for poor connection by shaking or pulling ECM connector and harness.	Does the malfunction indicator light illuminate?	Repair poor contact of the ECM connector.	Go to step 3.
3	<b>CHECK ECM CONNECTOR.</b> Check the connection of ECM connector.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>	Repair the connection of ECM connector.
4	<b>CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-19, Combination Meter.> 3) Disconnect the connector from the ECM and combination meter. 4) Measure the resistance of harness between ECM and combination meter connector. <b>Connector &amp; terminal</b> <b>(B136) No. 11 — (i10) No. 16:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and combination meter connector • Poor contact of coupling connector
5	<b>CHECK POOR CONTACT.</b> Check poor contact of combination meter connector.	Is there poor contact in combination meter connector?	Repair the poor contact of combination meter connector.	Go to step 6.
6	<b>CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i10) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Replace the combination meter circuit board. <Ref. to IDI-19, Combination Meter.>	Check the following item and repair if necessary. NOTE: • Blown out of fuse (No. 5) • Open or short circuit in harness between fuse (No. 5) and battery terminal • Poor contact of ignition switch connector

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

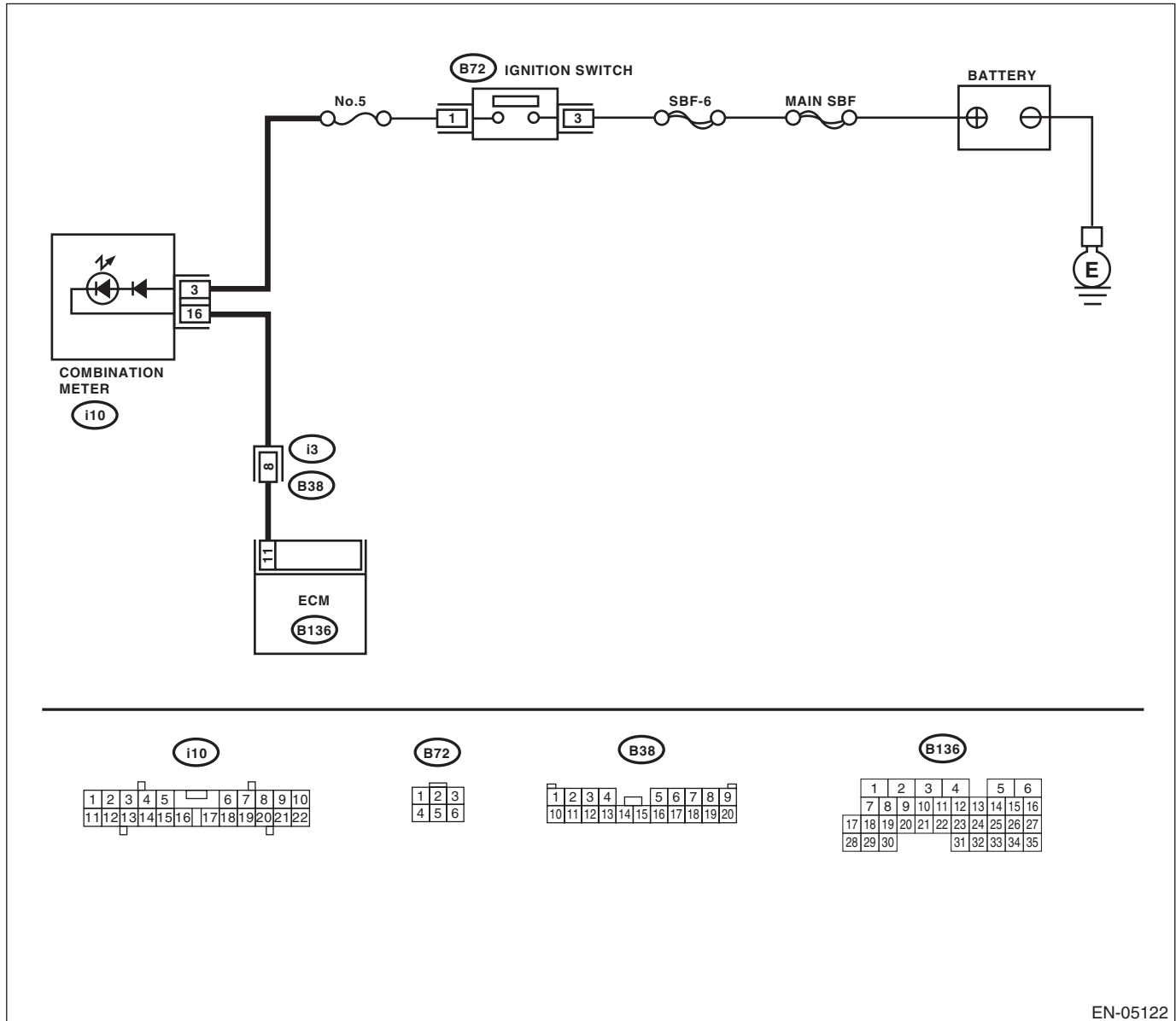
### DIAGNOSIS:

The malfunction indicator light circuit is shorted.

### TROUBLE SYMPTOM:

Although malfunction indicator light illuminates when the engine runs, DTC is not shown on the Subaru Select Monitor display.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN COMBINATION METER AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>

# Malfunction Indicator Light

## E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

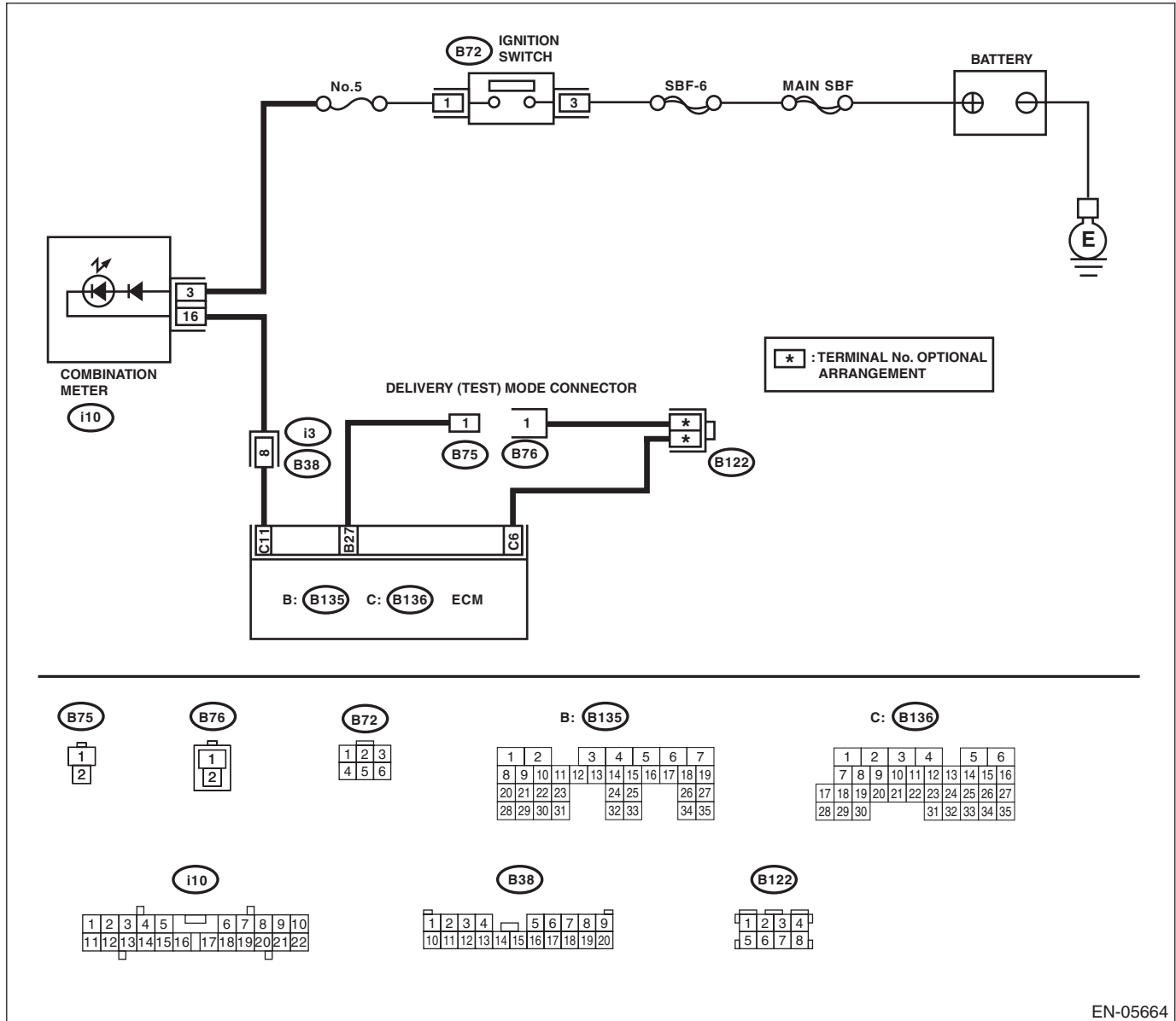
### DIAGNOSIS:

- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

### TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

### WIRING DIAGRAM:



EN-05664

# Malfunction Indicator Light

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector. 3) Turn the ignition switch to ON. (engine OFF)	Does the malfunction indicator light illuminate?	Go to step 2.	Repair the malfunction indicator light circuit. <Ref. to EN(H4DOTC)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
<b>2 CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the ground short circuit of harness between ECM and combination meter connector.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and delivery (test) mode connector. <b>Connector &amp; terminal</b> <b>(B76) No. 1 — (B136) No. 6:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and delivery (test) mode connector • Poor contact of joint connector
<b>4 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Go to step 5.
<b>5 CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.</b> 1) Connect the delivery (test) mode connector. 2) Measure the resistance of harness between ECM terminals. <b>Connector &amp; terminal</b> <b>(B135) No. 27 — (B136) No. 6:</b>	Is the resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between ECM and delivery (test) mode connector.
<b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>

## F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

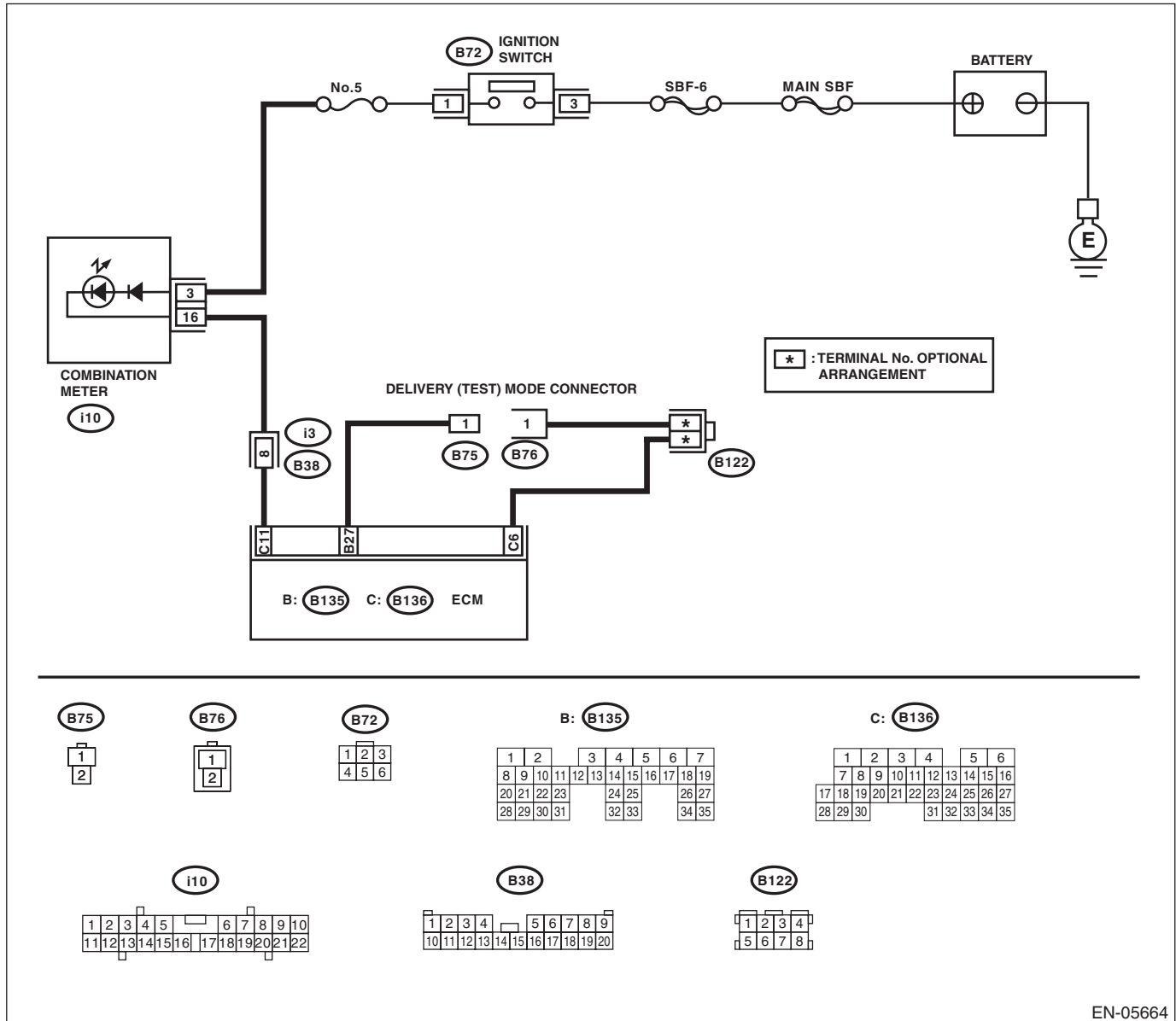
### DIAGNOSIS:

The delivery (test) mode connector circuit is shorted.

### TROUBLE SYMPTOM:

Malfunction indicator light blinks when delivery (test) mode connector is not connected.

### WIRING DIAGRAM:



EN-05664

# Malfunction Indicator Light

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DELIVERY (TEST) MODE CONNECTOR.</b> 1) Disconnect the delivery (test) mode connector. 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step 2.	System is normal. NOTE: Malfunction indicator light blinks when delivery (test) mode connector is connected.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND CHASSIS GROUND TERMINAL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 27 — Chassis ground:</b>	Is the resistance less than 5 Ω?	Repair the short circuit of harness between ECM and delivery (test) mode connector.	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>



## 17. Diagnostics for Engine Starting Failure

### A: PROCEDURE

1. Check for fuel amount.
↓
2. Inspection of starter motor circuit. <Ref. to EN(H4DOTC)(diag)-72, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line. <Ref. to EN(H4DOTC)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system. <Ref. to EN(H4DOTC)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit. <Ref. to EN(H4DOTC)(diag)-80, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit. <Ref. to EN(H4DOTC)(diag)-81, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

# Diagnostics for Engine Starting Failure

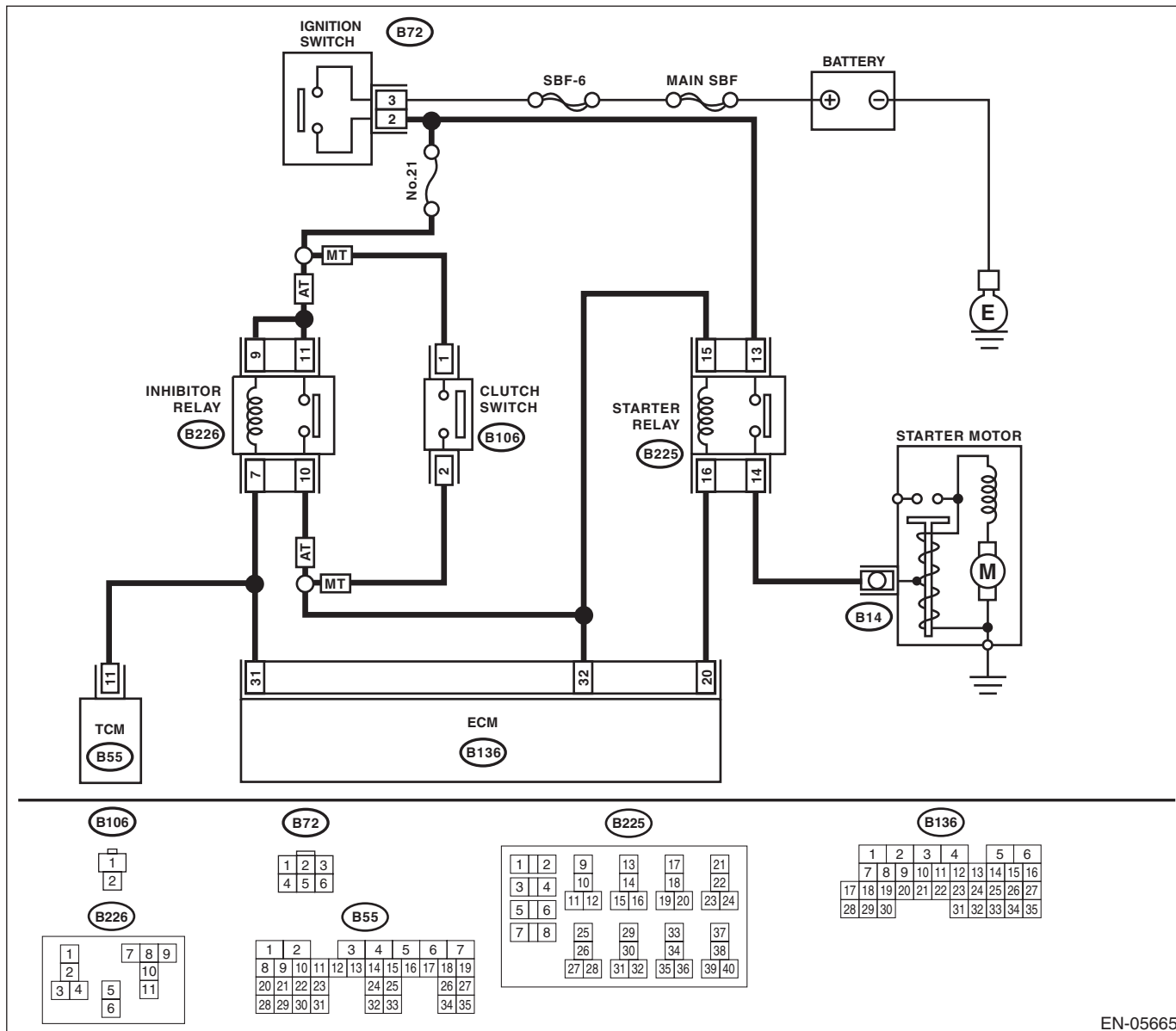
ENGINE (DIAGNOSTICS)

## B: STARTER MOTOR CIRCUIT

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05665

Step	Check	Yes	No
1	<b>CHECK BATTERY.</b> Check the battery voltage.	Go to step 2.	Charge or replace the battery.
2	<b>CHECK OPERATION OF STARTER MOTOR.</b>	Go to step 3.	Go to step 4.

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
<b>3</b>	<b>CHECK DTC.</b>	Is DTC displayed? <Ref. to EN(H4DOTC)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	The circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.
<b>4</b>	<b>CHECK INPUT SIGNAL FOR STARTER MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) On AT models, set the select lever to the "P" or "N" range, and on MT models, depress the clutch pedal. 4) Turn the ignition switch to START. 5) Measure the voltage between the starter motor connector and the engine ground. <b>Connector &amp; terminal</b> <b>(B14) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4SO)-6, Starter.>	Go to step 5.
<b>5</b>	<b>CHECK INPUT SIGNAL FOR STARTER MOTOR.</b> 1) On AT models, set the select lever to the "P" or "N" range, and on MT models, depress the clutch pedal. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B225) No. 14 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the open circuit of the harness between starter relay connector and starter motor.	Go to step 6.
<b>6</b>	<b>CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition switch. 3) Measure the voltage between ignition switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B72) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 7.	Check the following item and repair if necessary. • Blown out of fuse • Open or ground short circuit of harness between ignition switch connector and battery
<b>7</b>	<b>CHECK IGNITION SWITCH.</b> Measure the resistance between ignition switch terminals after turning the ignition switch to START position. <b>Terminals</b> <b>No. 2 — No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 8.	Replace the ignition switch. <Ref. to SL-48, REPLACEMENT, Ignition Key Lock.>

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>8 CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Remove the starter relay. 2) Connect the connector to ignition switch. 3) Turn the ignition switch to START. 4) Measure the voltage between starter relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B225) No. 13 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 9.	Repair open circuit of harness between starter relay connector and ignition switch connector.
<b>9 CHECK STARTER RELAY.</b> 1) Connect the battery to starter relay terminals No. 15 and No. 16. 2) Measure the resistance between starter relay terminals. <b>Terminals</b> <b>No. 13 — No. 14:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 10.	Replace the starter relay.
<b>10 CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and starter relay connector. <b>Connector &amp; terminal</b> <b>(B136) No. 20 — (B225) No. 16:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 11.	Repair the open circuit of harness between ECM and starter relay connector.
<b>11 CHECK TRANSMISSION TYPE.</b>	Is the transmission type AT?	Go to step 16.	Go to step 12.
<b>12 CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Depress the clutch pedal. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B225) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 13.	Go to step 14.
<b>13 CHECK HARNESS BETWEEN ECM AND CLUTCH SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the clutch switch connector. 3) Measure the resistance of harness between ECM and clutch switch connector. <b>Connector &amp; terminal</b> <b>(B136) No. 32 — (B106) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Check the ECM power supply and ground line. <Ref. to EN(H4DOTC)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of harness between ECM and clutch switch connector.
<b>14 CHECK INPUT VOLTAGE OF CLUTCH SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the clutch switch connector. 3) Turn the ignition switch to START. 4) Measure the voltage between the clutch switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B106) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 15.	Check the following item and repair if necessary. <ul style="list-style-type: none"> <li>• Blown out of fuse</li> <li>• Open or ground short circuit of harness between ignition switch connector and clutch switch connector</li> </ul>

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>15 CHECK CLUTCH SWITCH.</b> Measure the resistance between clutch switch terminals while depressing the clutch pedal. <i>Terminals</i> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the open circuit of harness between clutch switch connector and starter relay connector.	Replace the clutch switch. <Ref. to CL-35, Clutch Switch.>
<b>16 CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Place the select lever in the "P" or "N" range. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. <i>Connector &amp; terminal</i> <b>(B225) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 17.	Go to step 18.
<b>17 CHECK HARNESS BETWEEN ECM AND INHIBITOR RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the inhibitor relay connector. 3) Measure the resistance of harness between ECM and inhibitor relay connector. <i>Connector &amp; terminal</i> <b>(B136) No. 31 — (B226) No. 7:</b> <b>(B136) No. 32 — (B226) No. 10:</b>	Is the resistance less than 1 $\Omega$ ?	Check the ECM power supply and ground line. <Ref. to EN(H4DOTC)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of harness between ECM and inhibitor relay connector.
<b>18 CHECK INPUT VOLTAGE OF INHIBITOR RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the inhibitor relay connector. 3) Turn the ignition switch to START. 4) Measure the voltage between inhibitor relay connector and chassis ground. <i>Connector &amp; terminal</i> <b>(B226) No. 9 (+) — Chassis ground (-):</b> <b>(B226) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 19.	Check the following item and repair if necessary. <ul style="list-style-type: none"> <li>• Blown out of fuse</li> <li>• Open or ground short circuit of harness between ignition switch connector and inhibitor relay connector</li> </ul>
<b>19 CHECK INHIBITOR RELAY.</b> 1) Connect the battery to inhibitor relay terminals No. 7 and No. 9. 2) Measure the resistance between inhibitor relay terminals. <i>Terminals</i> <b>No. 10 — No. 11:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 20.	Replace the inhibitor relay.
<b>20 CHECK HARNESS BETWEEN INHIBITOR RELAY CONNECTOR AND STARTER RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between inhibitor relay connector and starter relay connector. <i>Connector &amp; terminal</i> <b>(B226) No. 10 — (B225) No. 15:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the open circuit of harness between TCM and inhibitor relay connector.	Repair the open circuit of harness between inhibitor relay connector and starter relay connector.

# Diagnostics for Engine Starting Failure

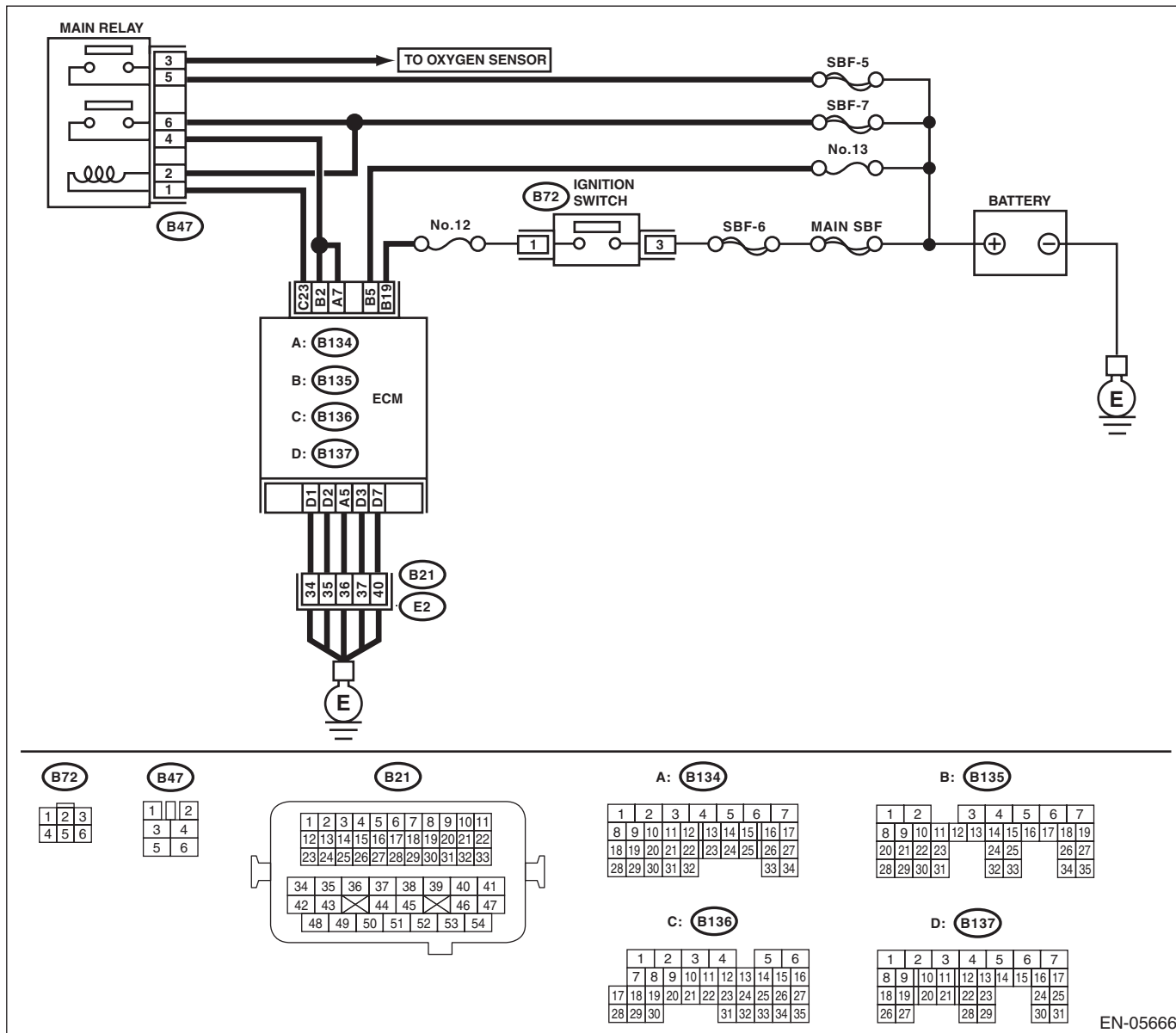
ENGINE (DIAGNOSTICS)

## C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05666

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK MAIN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. <b>Terminals</b> <b>No. 3 — No. 5:</b> <b>No. 4 — No. 6:</b>	Is the resistance less than 10 Ω?	Go to step 2.	Replace the main relay. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>2</b> <b>CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the open circuit of harness between the ECM and engine ground terminal.
<b>3</b> <b>CHECK INPUT VOLTAGE OF ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 5 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 4.	Repair the open or ground short circuit of power supply circuit.
<b>4</b> <b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 19 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 5.	Repair the open or ground short circuit of power supply circuit.
<b>5</b> <b>CHECK INPUT VOLTAGE OF MAIN RELAY.</b> Measure the voltage between main relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B47) No. 2 (+) — Chassis ground (-):</b> <b>(B47) No. 5 (+) — Chassis ground (-):</b> <b>(B47) No. 6 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 6.	Repair the open or ground short circuit of harness of power supply circuit.
<b>6</b> <b>CHECK INPUT VOLTAGE OF ECM.</b> 1) Connect the main relay connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 7 (+) — Chassis ground (-):</b> <b>(B135) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H4DOTC)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the open or ground short circuit of harness between ECM and main relay connector.

# Diagnostics for Engine Starting Failure

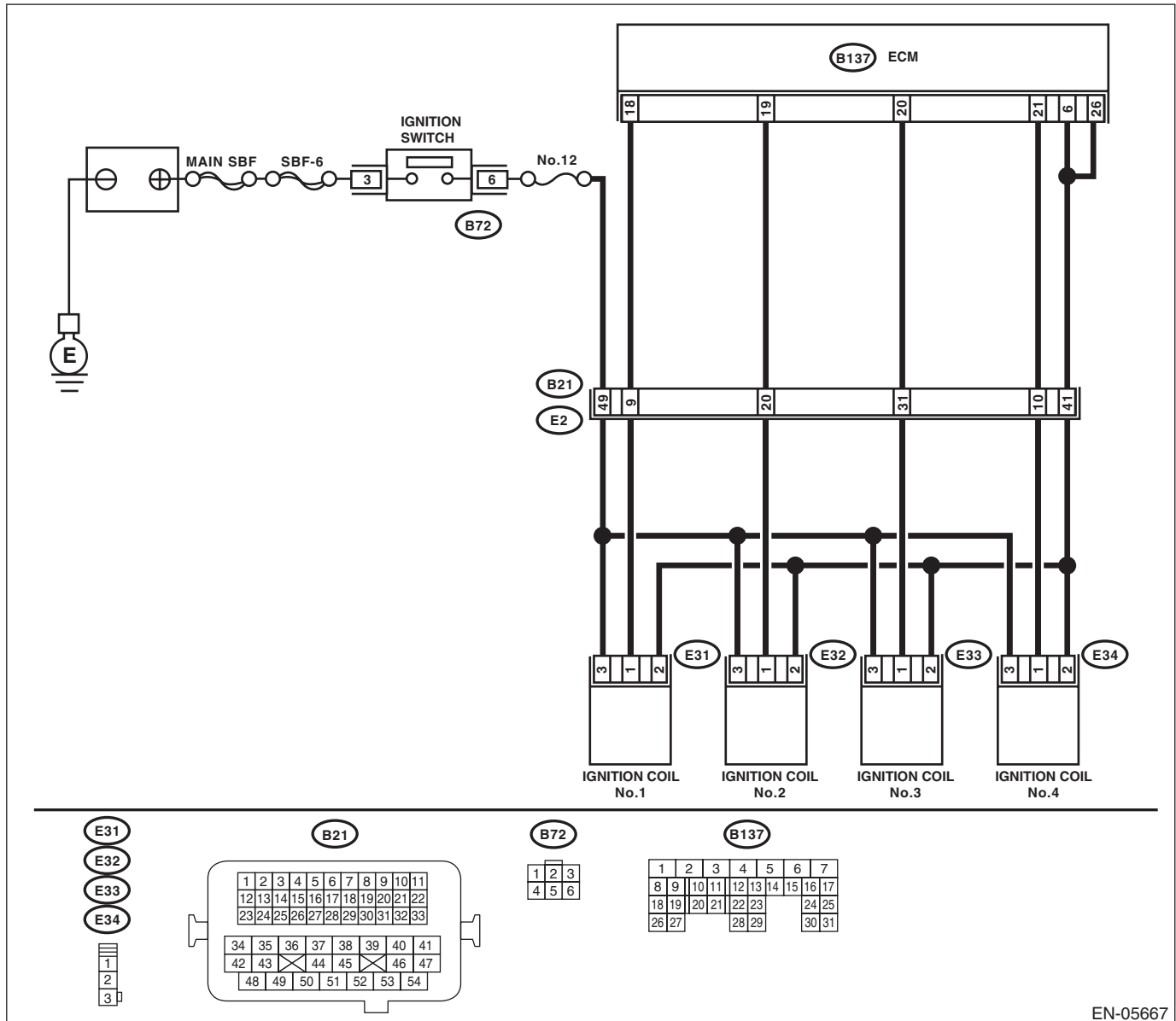
ENGINE (DIAGNOSTICS)

## D: IGNITION CONTROL SYSTEM

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05667

Step	Check	Yes	No
<b>1 CHECK SPARK PLUG CONDITION.</b> 1) Remove the spark plug. <Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4DOTC)-5, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Go to step 2.	Replace the spark plug. <Ref. to IG(H4DOTC)-4, Spark Plug.>



# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>2</b></p> <p><b>CHECK IGNITION SYSTEM FOR SPARKS.</b>                      1) Connect the spark plug to ignition coil.                      2) Release the fuel pressure. &lt;Ref. to FU(H4DOTC)-50, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.&gt;                      3) Contact the spark plug thread portion to engine.                      4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder.</p>	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4DOTC)(diag)-80, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 3.
<p><b>3</b></p> <p><b>CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ignition coil.                      3) Turn the ignition switch to ON.                      4) Measure the power supply voltage between ignition coil connector and engine ground.  <b>Connector &amp; terminal</b>                      (E31) No. 3 (+) — Engine ground (-):                      (E32) No. 3 (+) — Engine ground (-):                      (E33) No. 3 (+) — Engine ground (-):                      (E34) No. 3 (+) — Engine ground (-):</p>	Is the voltage 10 V or more?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ignition coil and ignition switch connector • Poor contact of coupling connector
<p><b>4</b></p> <p><b>CHECK HARNESS OF IGNITION COIL GROUND CIRCUIT.</b>                      1) Turn the ignition switch to OFF.                      2) Measure the resistance between ECM and ignition coil connector.  <b>Connector &amp; terminal</b>                      (E31) No. 2 — (B137) No. 6:                      (E32) No. 2 — (B137) No. 6:                      (E33) No. 2 — (B137) No. 6:                      (E34) No. 2 — (B137) No. 6:                      (E31) No. 2 — (B137) No. 26:                      (E32) No. 2 — (B137) No. 26:                      (E33) No. 2 — (B137) No. 26:                      (E34) No. 2 — (B137) No. 26:</p>	Is the resistance less than 5 Ω?	Go to step 5.	Repair the harness and connector.  NOTE: In this case, repair the following item: Open circuit of harness between the ECM and ignition coil connector
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and ignition coil.                      3) Measure the resistance of harness between the ECM and ignition coil connector.  <b>Connector &amp; terminal</b>                      (B137) No. 18 — (E31) No. 1:                      (B137) No. 19 — (E32) No. 1:                      (B137) No. 20 — (E33) No. 1:                      (B137) No. 21 — (E34) No. 1:</p>	Is the resistance less than 1 Ω?	Go to step 6.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and ignition coil connector • Poor contact of coupling connector
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.</b>                      Measure the resistance of harness between ECM and engine ground.  <b>Connector &amp; terminal</b>                      (B137) No. 18 — Engine ground:                      (B137) No. 19 — Engine ground:                      (B137) No. 20 — Engine ground:                      (B137) No. 21 — Engine ground:</p>	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the ground short circuit of harness between the ECM and ignition coil connector.
<p><b>7</b></p> <p><b>CHECK POOR CONTACT.</b>                      Check for poor contact of the ECM connector.</p>	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Replace the ignition coil.

# Diagnostics for Engine Starting Failure

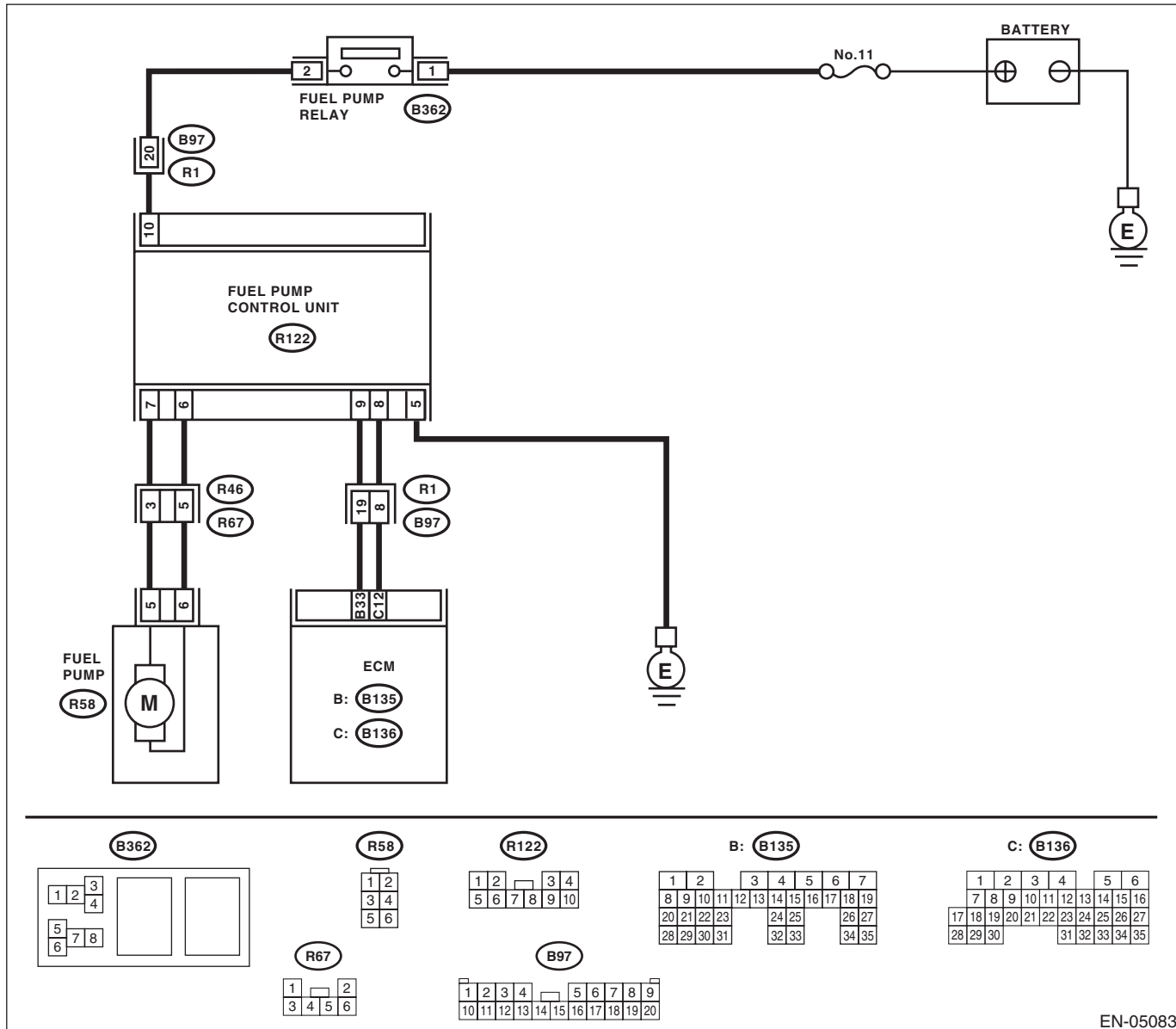
ENGINE (DIAGNOSTICS)

## E: FUEL PUMP CIRCUIT

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



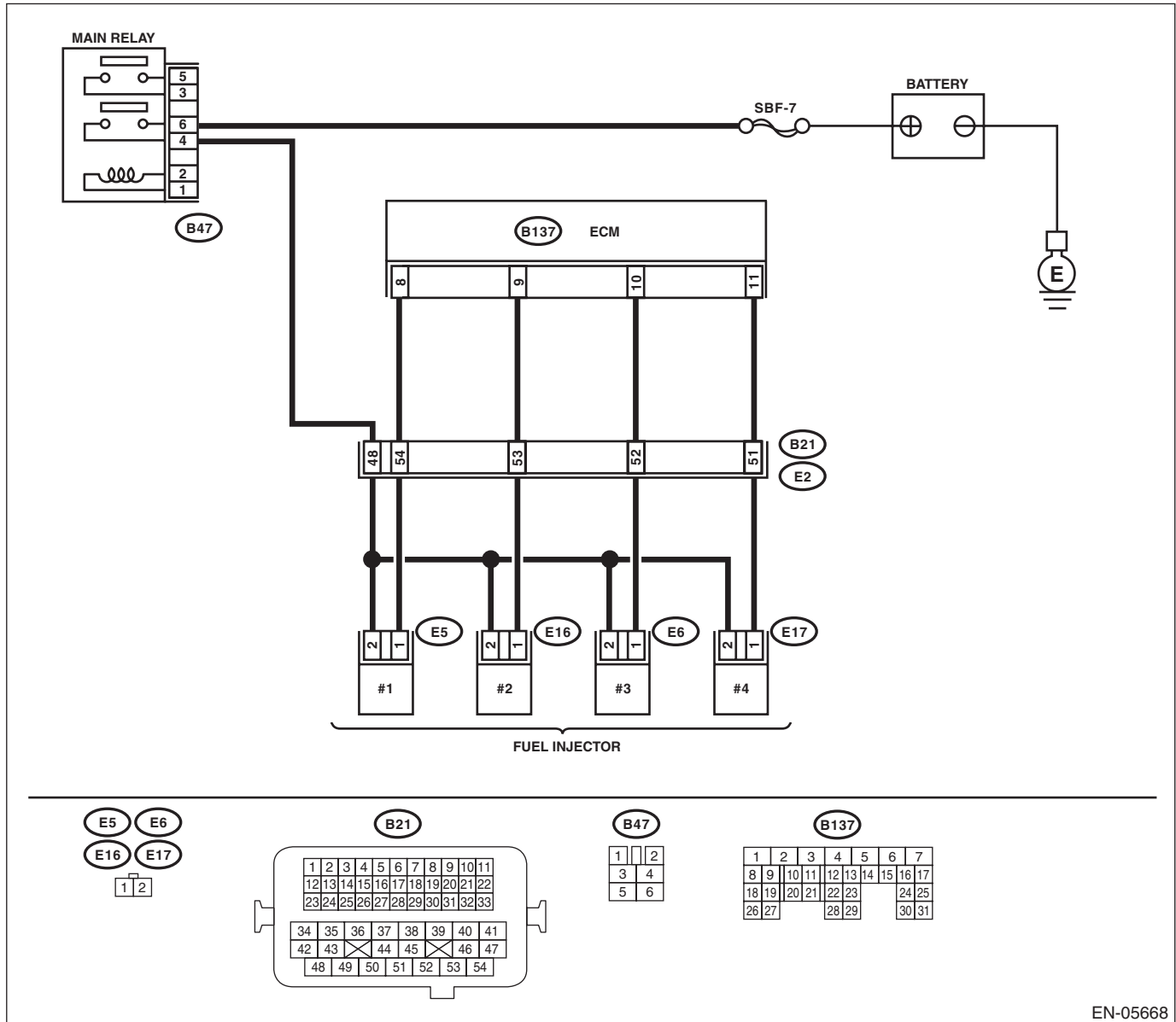
Step	Check	Yes	No	
1	<p><b>CHECK OPERATING SOUND OF FUEL PUMP.</b></p> <p>Make sure that the fuel pump operates for two seconds when turning the ignition switch to ON.</p> <p>NOTE: Fuel pump operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". &lt;Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.&gt;</p>	Does the fuel pump emit operating sound?	<p>Check the fuel injector circuit. &lt;Ref. to EN(H4DOTC)(diag)-81, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.&gt;</p>	<p>Display the DTC. &lt;Ref. to EN(H4DOTC)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p>

## F: FUEL INJECTOR CIRCUIT

### CAUTION:

- Check or repair only faulty parts.
- After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05668

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OPERATION OF EACH FUEL INJECTOR.</b> While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector for this check.	Does the fuel injector emit operating sound?	Check the fuel pressure. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.>	Go to step 2.
<b>2 CHECK POWER SUPPLY TO EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between fuel injector terminal and engine ground. <b>Connector &amp; terminal</b> #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-):	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and fuel injector connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of fuel injector connector</li> </ul>
<b>3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. <b>Connector &amp; terminal</b> (B137) No. 8 — (E5) No. 1: (B137) No. 9 — (E16) No. 1: (B137) No. 10 — (E6) No. 1: (B137) No. 11 — (E17) No. 1:	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> (B137) No. 8 — Chassis ground: (B137) No. 9 — Chassis ground: (B137) No. 10 — Chassis ground: (B137) No. 11 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and fuel injector connector.
<b>5 CHECK EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. <b>Terminals</b> No. 1 — No. 2:	Is the resistance between 5 — 20 Ω?	Go to step 6.	Replace the faulty fuel injector.
<b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Inspection using “General Diagnostic Table” <Ref. to EN(H4DOTC)(diag)-372, INSPECTION, General Diagnostic Table.>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 18.List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Item	Reference
P0011	Intake Camshaft Position - Timing Over-Advanced Or System Performance (Bank 1)	<Ref. to EN(H4DOTC)(diag)-91, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1)	<Ref. to EN(H4DOTC)(diag)-92, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2)	<Ref. to EN(H4DOTC)(diag)-93, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to EN(H4DOTC)(diag)-94, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-95, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-97, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-99, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-101, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-103, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to EN(H4DOTC)(diag)-105, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-107, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-109, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H4DOTC)(diag)-111, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-113, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H4DOTC)(diag)-115, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-117, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H4DOTC)(diag)-119, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to EN(H4DOTC)(diag)-121, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H4DOTC)(diag)-123, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H4DOTC)(diag)-125, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	<Ref. to EN(H4DOTC)(diag)-127, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	<Ref. to EN(H4DOTC)(diag)-129, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H4DOTC)(diag)-131, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to EN(H4DOTC)(diag)-132, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4DOTC)(diag)-133, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-134, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-136, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-138, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-140, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-142, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-144, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-146, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to EN(H4DOTC)(diag)-148, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System Too Rich (Bank 1)	<Ref. to EN(H4DOTC)(diag)-151, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-154, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-156, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-158, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	<Ref. to EN(H4DOTC)(diag)-160, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	<Ref. to EN(H4DOTC)(diag)-162, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0230	Fuel Pump Primary Circuit	<Ref. to EN(H4DOTC)(diag)-164, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0244	Turbo/Super Charger Wastegate Solenoid "A" Range/Performance	<Ref. to EN(H4DOTC)(diag)-167, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0245	Turbo/Super Charger Wastegate Solenoid "A" Low	<Ref. to EN(H4DOTC)(diag)-169, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0246	Turbo/Super Charger Wastegate Solenoid "A" High	<Ref. to EN(H4DOTC)(diag)-171, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-172, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-172, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-172, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-173, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-179, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-181, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to EN(H4DOTC)(diag)-183, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-185, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-187, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	<Ref. to EN(H4DOTC)(diag)-189, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0410	Secondary Air Injection System	<Ref. to EN(H4DOTC)(diag)-191, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0411	Secondary Air Injection System Incorrect Flow Detected	<Ref. to EN(H4DOTC)(diag)-195, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0413	Secondary Air Injection System Switching Valve "A" Circuit Open	<Ref. to EN(H4DOTC)(diag)-198, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-201, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0416	Secondary Air Injection System Switching Valve "B" Circuit Open	<Ref. to EN(H4DOTC)(diag)-204, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0417	Secondary Air Injection System Switching Valve "B" Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-207, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0418	Secondary Air Injection System Control "A" Circuit	<Ref. to EN(H4DOTC)(diag)-210, DTC P0418 SECONDARY AIR INJECTION SYSTEM CONTROL "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4DOTC)(diag)-213, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0441	Evaporative Emission System Incorrect Purge Flow	<Ref. to EN(H4DOTC)(diag)-217, DTC P0441 EVAPORATIVE EMISSION SYSTEM INCORRECT PURGE FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to EN(H4DOTC)(diag)-218, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to EN(H4DOTC)(diag)-221, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-223, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to EN(H4DOTC)(diag)-225, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to EN(H4DOTC)(diag)-227, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H4DOTC)(diag)-229, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H4DOTC)(diag)-231, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to EN(H4DOTC)(diag)-234, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H4DOTC)(diag)-237, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to EN(H4DOTC)(diag)-239, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor "A" Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-240, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to EN(H4DOTC)(diag)-240, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to EN(H4DOTC)(diag)-241, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H4DOTC)(diag)-241, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor "A"	<Ref. to EN(H4DOTC)(diag)-242, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to EN(H4DOTC)(diag)-243, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to EN(H4DOTC)(diag)-245, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4DOTC)(diag)-247, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0600	Serial Communication Link	<Ref. to EN(H4DOTC)(diag)-248, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4DOTC)(diag)-249, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4DOTC)(diag)-250, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Control Module Performance	<Ref. to EN(H4DOTC)(diag)-251, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to EN(H4DOTC)(diag)-252, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H4DOTC)(diag)-252, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to EN(H4DOTC)(diag)-253, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4DOTC)(diag)-255, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to EN(H4DOTC)(diag)-257, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to EN(H4DOTC)(diag)-259, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4DOTC)(diag)-260, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4DOTC)(diag)-261, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P1410	Secondary Air Injection System Switching Valve Stuck Open	<Ref. to EN(H4DOTC)(diag)-263, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1418	Secondary Air Injection System Control "A" Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-266, DTC P1418 SECONDARY AIR INJECTION SYSTEM CONTROL "A" CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to EN(H4DOTC)(diag)-269, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to EN(H4DOTC)(diag)-271, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to EN(H4DOTC)(diag)-273, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up Voltage Circuit Malfunction	<Ref. to EN(H4DOTC)(diag)-275, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-19, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1574	Key Communication Failure	<Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	<Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1602	Control Module Programming Error	<Ref. to EN(H4DOTC)(diag)-277, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-287, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-287, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to EN(H4DOTC)(diag)-288, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to EN(H4DOTC)(diag)-288, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-289, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-291, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-293, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-295, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2016	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-297, DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	<Ref. to EN(H4DOTC)(diag)-299, DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2021	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-301, DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	<Ref. to EN(H4DOTC)(diag)-303, DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-305, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to EN(H4DOTC)(diag)-307, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-309, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to EN(H4DOTC)(diag)-311, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to EN(H4DOTC)(diag)-312, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to EN(H4DOTC)(diag)-313, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H4DOTC)(diag)-325, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H4DOTC)(diag)-327, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to EN(H4DOTC)(diag)-328, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-329, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-331, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-333, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-335, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	<Ref. to EN(H4DOTC)(diag)-337, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	<Ref. to EN(H4DOTC)(diag)-340, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to EN(H4DOTC)(diag)-342, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to EN(H4DOTC)(diag)-344, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2431	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-346, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/ PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2432	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Low	<Ref. to EN(H4DOTC)(diag)-349, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	<Ref. to EN(H4DOTC)(diag)-352, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank1)	<Ref. to EN(H4DOTC)(diag)-355, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank1)	<Ref. to EN(H4DOTC)(diag)-359, DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank2)	<Ref. to EN(H4DOTC)(diag)-360, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank2)	<Ref. to EN(H4DOTC)(diag)-364, DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2444	Secondary Air Injection System Pump Stuck On	<Ref. to EN(H4DOTC)(diag)-365, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## 19. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### TROUBLE SYMPTOM:

- Engine stalls.
- Erroneous idling

#### CAUTION:

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>**

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b>                      1) Start the engine and let it idle.                      2) Measure the AVCS system operating angle using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the AVCS system operating angle approx. 0°?</p>	<p>Go to step 2.</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>
<p><b>2</b></p> <p><b>CHECK CURRENT DATA.</b>                      1) Drive (accelerate or decelerate) the vehicle at 80 km/h (50 MPH) or less.</p> <p>NOTE:                      Drive the vehicle so that duty output of the oil flow control solenoid valve increases.                      2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>When the oil flow control solenoid valve duty output exceeds 10%, is the AVCS system operating angle approx. 0°?</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.                      &lt;Ref. to LU(H4DOTC)-9, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H4DOTC)-23, Engine Oil Filter.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## B: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-13, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the AVCS system operating angle approx. 0°, and oil flow control solenoid valve duty output approx. 10%?</p>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H4DOTC)-9, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H4DOTC)-23, Engine Oil Filter.&gt;</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> <li>• Timing belt (matching of timing mark)</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## C: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-15, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the AVCS system operating angle approx. 0°, and oil flow control solenoid valve duty output approx. 10%?</p>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H4DOTC)-9, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H4DOTC)-23, Engine Oil Filter.&gt;</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"><li>• Oil pipe (clog)</li><li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li><li>• Intake camshaft (dirt, damage of camshaft)</li><li>• Timing belt (matching of timing mark)</li></ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## D: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-15, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the AVCS system operating angle approx. 0°?	Go to step 2.	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>
2	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Drive (accelerate or decelerate) the vehicle at 80 km/h (50 MPH) or less.</p> <p>NOTE:</p> <p>Drive the vehicle so that duty output of the oil flow control solenoid valve increases.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	When the oil flow control solenoid valve duty output exceeds 10%, is the AVCS system operating angle approx. 0°?	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H4DOTC)-9, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H4DOTC)-23, Engine Oil Filter.&gt;</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## E: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

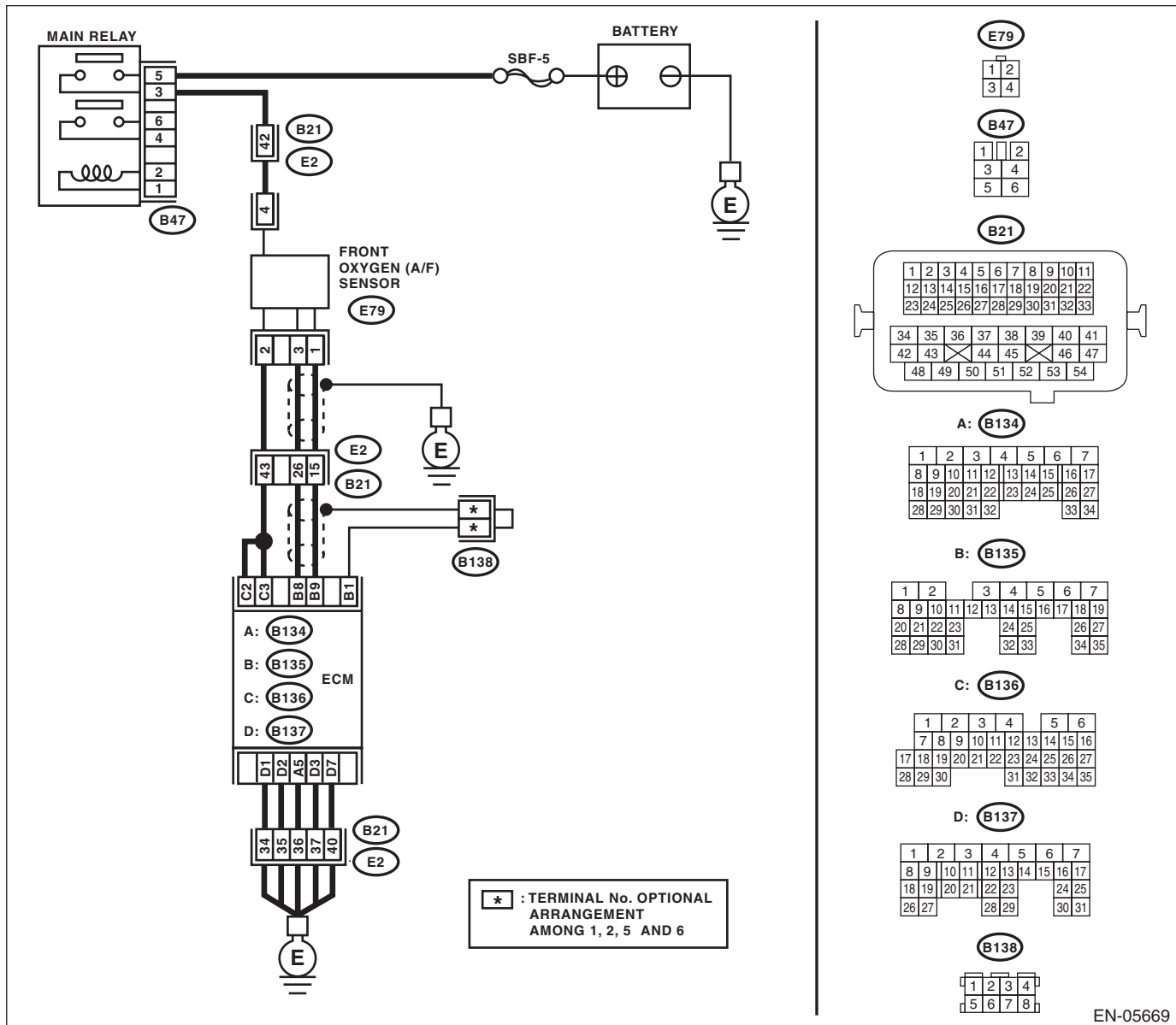
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-16, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05669

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Start and warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 3 — (E79) No. 2:</b></i> <i><b>(B136) No. 2 — (E79) No. 2:</b></i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>2 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 9 — (E79) No. 1:</b></i> <i><b>(B135) No. 8 — (E79) No. 3:</b></i>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3 CHECK FRONT OXYGEN (A/F) SENSOR.</b> Measure the resistance between front oxygen (A/F) sensor connector terminals. <i><b>Terminals</b></i> <i><b>No. 4 — No. 2:</b></i>	Is the resistance less than 2 — 3 Ω?	Go to step 4.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>
<b>4 CHECK POOR CONTACT.</b> Check poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## F: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

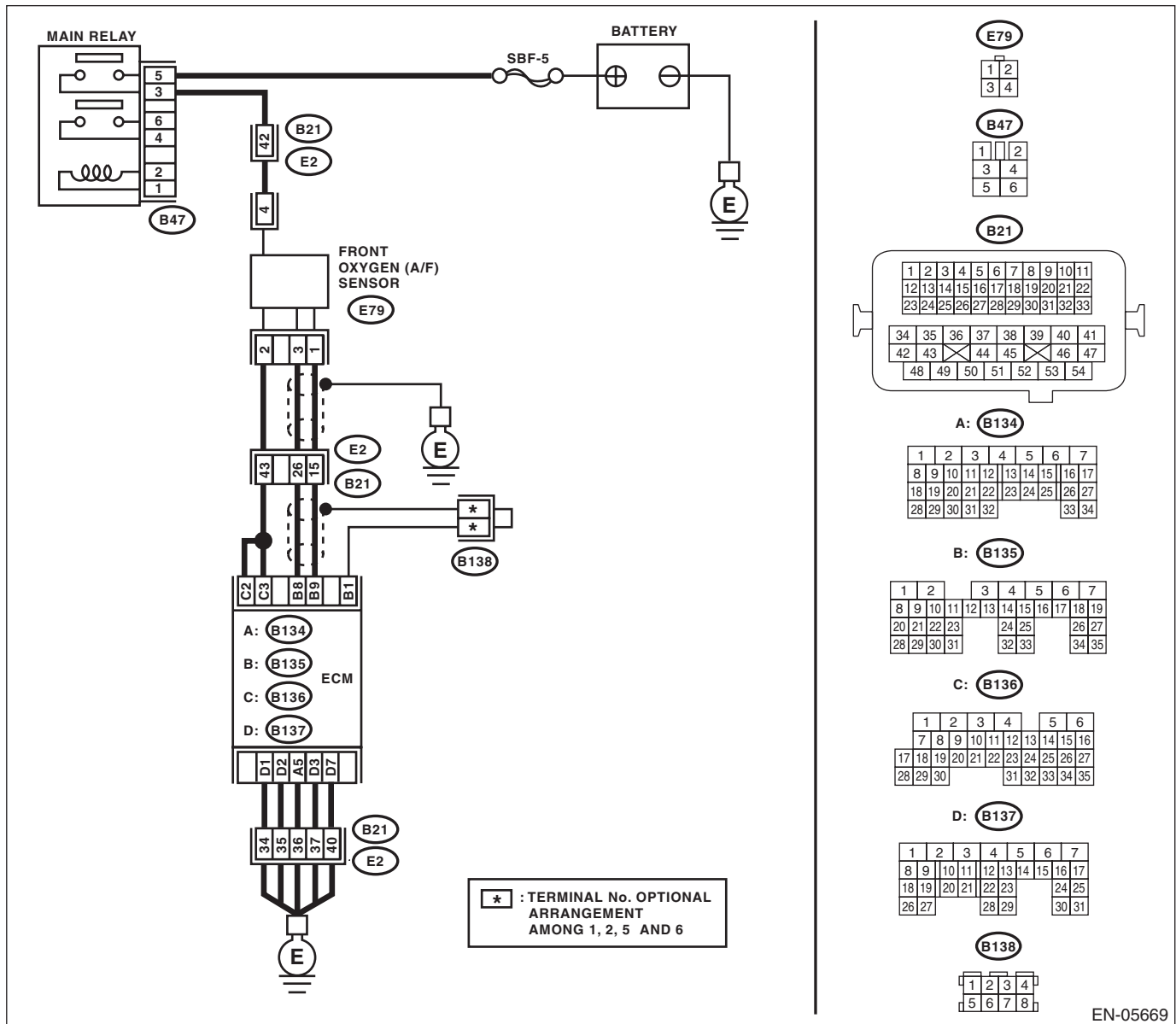
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-18, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from front oxygen (A/F) sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E79) No. 4 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	<p>Repair the power supply line.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and front oxygen (A/F) sensor connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact in coupling connector</li> <li>• Malfunction in main relay</li> </ul>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 3 — (E79) No. 2:</b> <b>(B136) No. 2 — (E79) No. 2:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor.
3	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>Measure the resistance of harness between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK FRONT OXYGEN (A/F) SENSOR.</b></p> <p>Measure the resistance between front oxygen (A/F) sensor connector terminals.</p> <p><b>Terminals</b> <b>No. 2 — No. 1:</b></p>	Is the resistance between 2 — 3 $\Omega$ ?	Repair poor contact of the ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## G: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

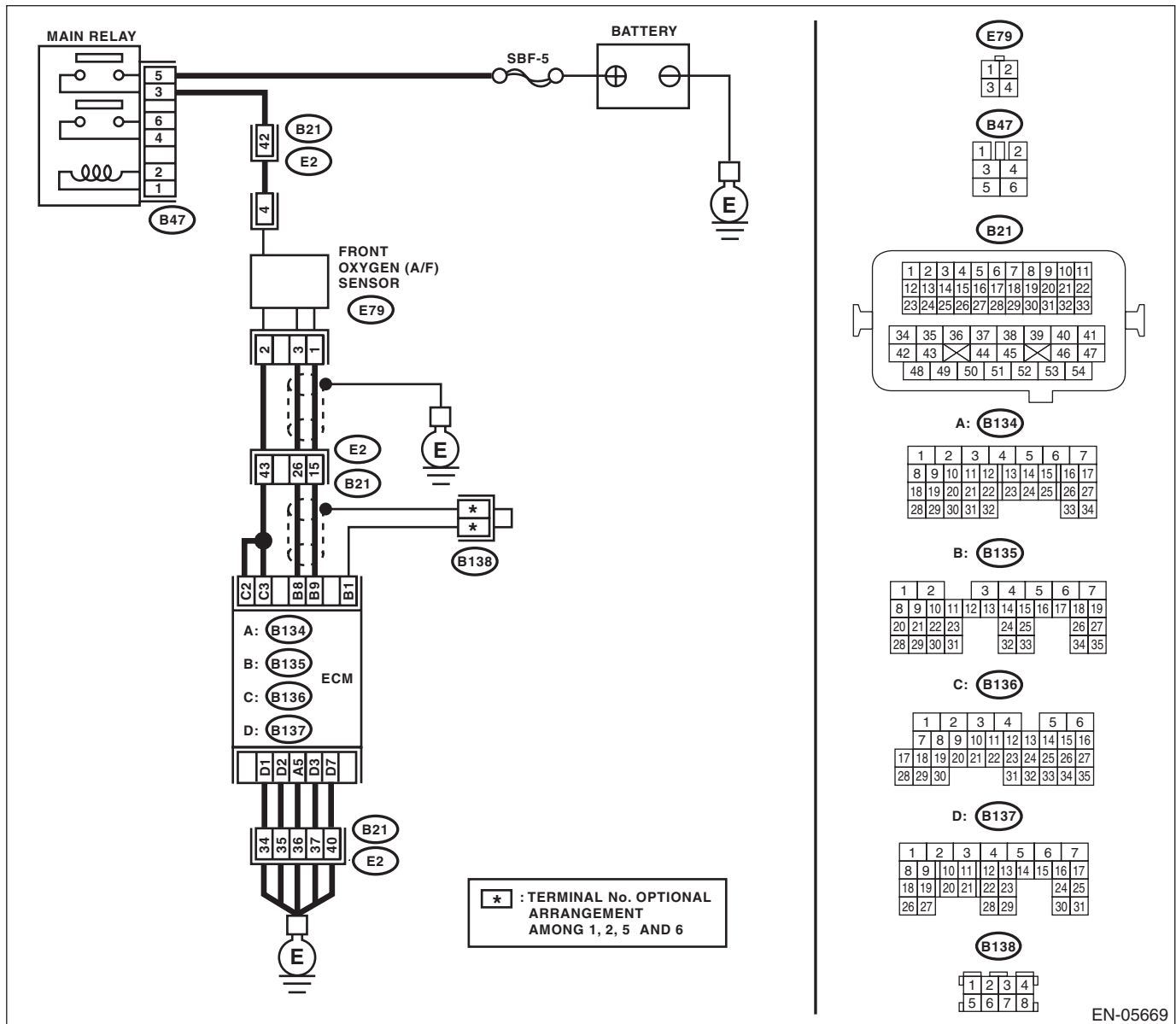
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-20, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B136) No. 3 (+) — Chassis ground (-):</b>  <b>(B136) No. 2 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.</p>	<p>Go to step 2.</p>
<p><b>2</b>    <b>CHECK GROUND CIRCUIT FOR ECM.</b>            1) Disconnect the connectors from the ECM.            2) Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:  <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul> </p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## H: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

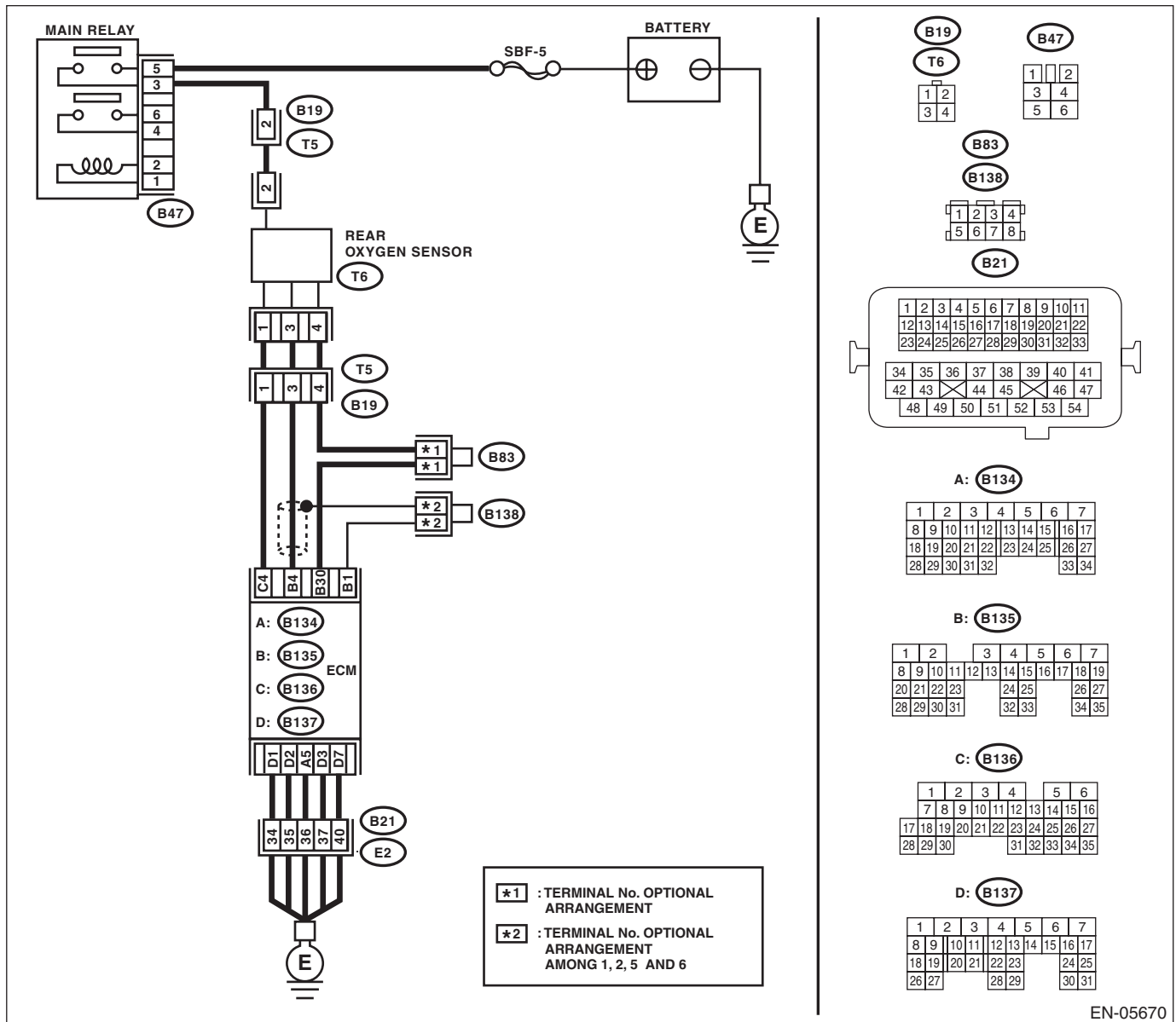
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-22, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the rear oxygen sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between rear oxygen sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(T6) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	<p>Repair the power supply line.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and rear oxygen sensor</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact in coupling connector</li> <li>• Malfunction in main relay</li> </ul>
2	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM and oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 4 — (T6) No. 1:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of the harness between ECM and rear oxygen sensor.
3	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>Measure the resistance of harness between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK REAR OXYGEN SENSOR.</b></p> <p>Measure the resistance between rear oxygen sensor connector terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	Is the resistance between 5 — 7 $\Omega$ ?	Repair poor contact of the ECM connector.	<p>Replace the rear oxygen sensor.</p> <p>&lt;Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.&gt;</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## I: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

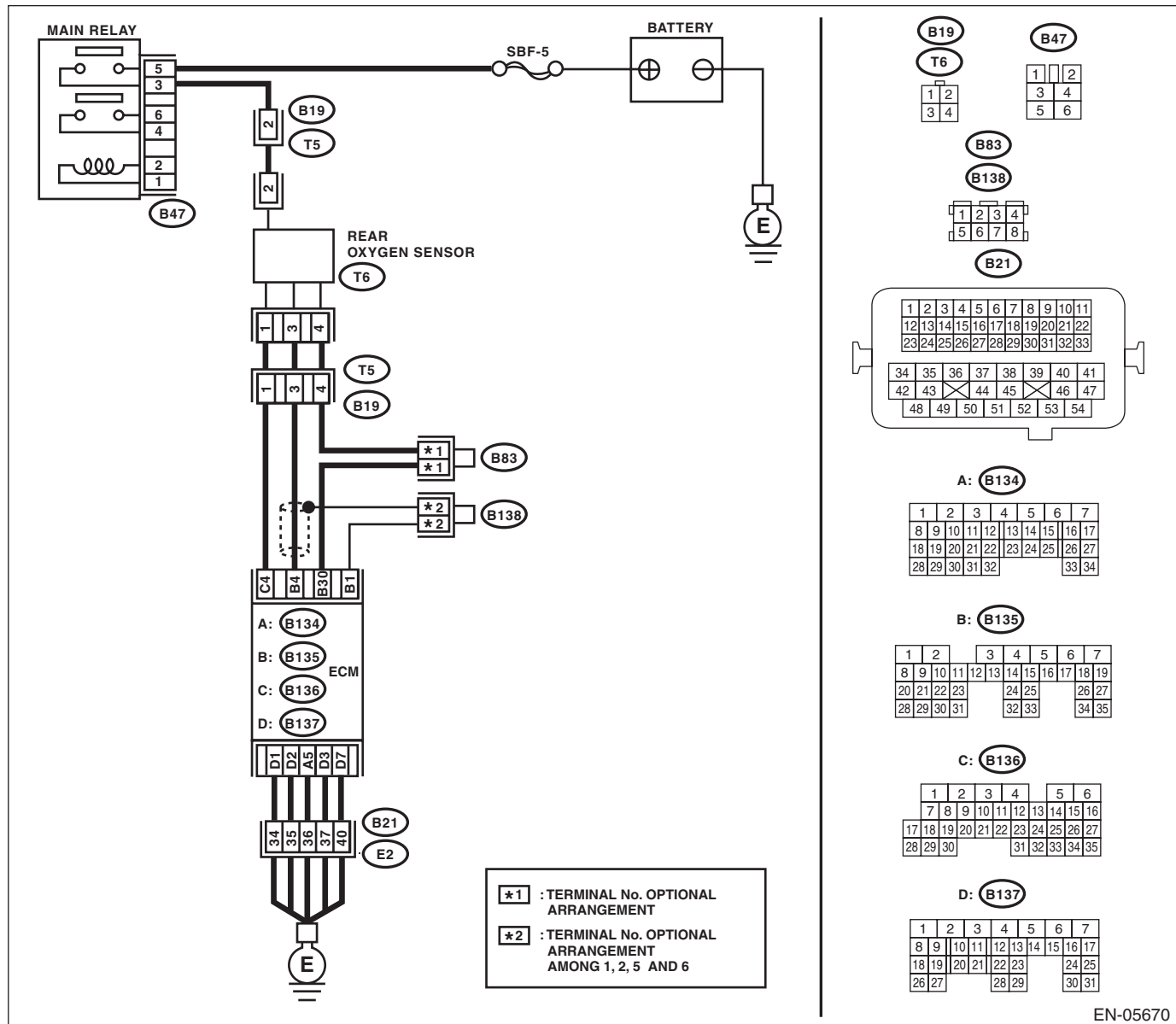
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-24, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector.	Go to step 2.
<b>2 CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## J: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

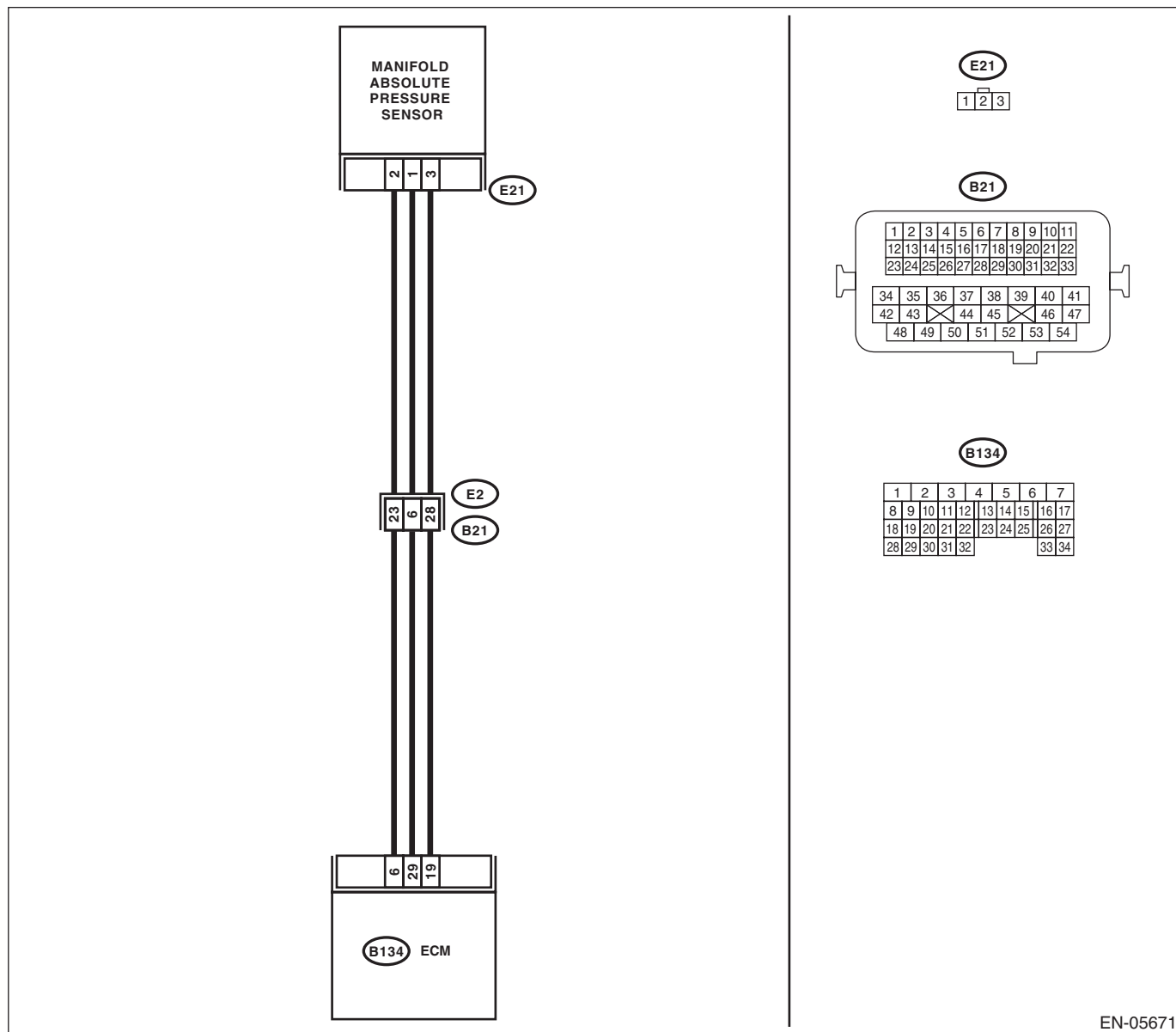
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-26, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05671

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
<b>1</b>	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 2.
<b>2</b>	<b>CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) during idling?	Go to step 3.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-31, Manifold Absolute Pressure Sensor.>
<b>3</b>	<b>CHECK THROTTLE OPENING ANGLE.</b> Read the data of throttle position signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value less than 5% when throttle is fully closed?	Go to step 4.	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>
<b>4</b>	<b>CHECK THROTTLE OPENING ANGLE.</b>	Is the measured value 85% or more when throttle is fully open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-31, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>

## K: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-29, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

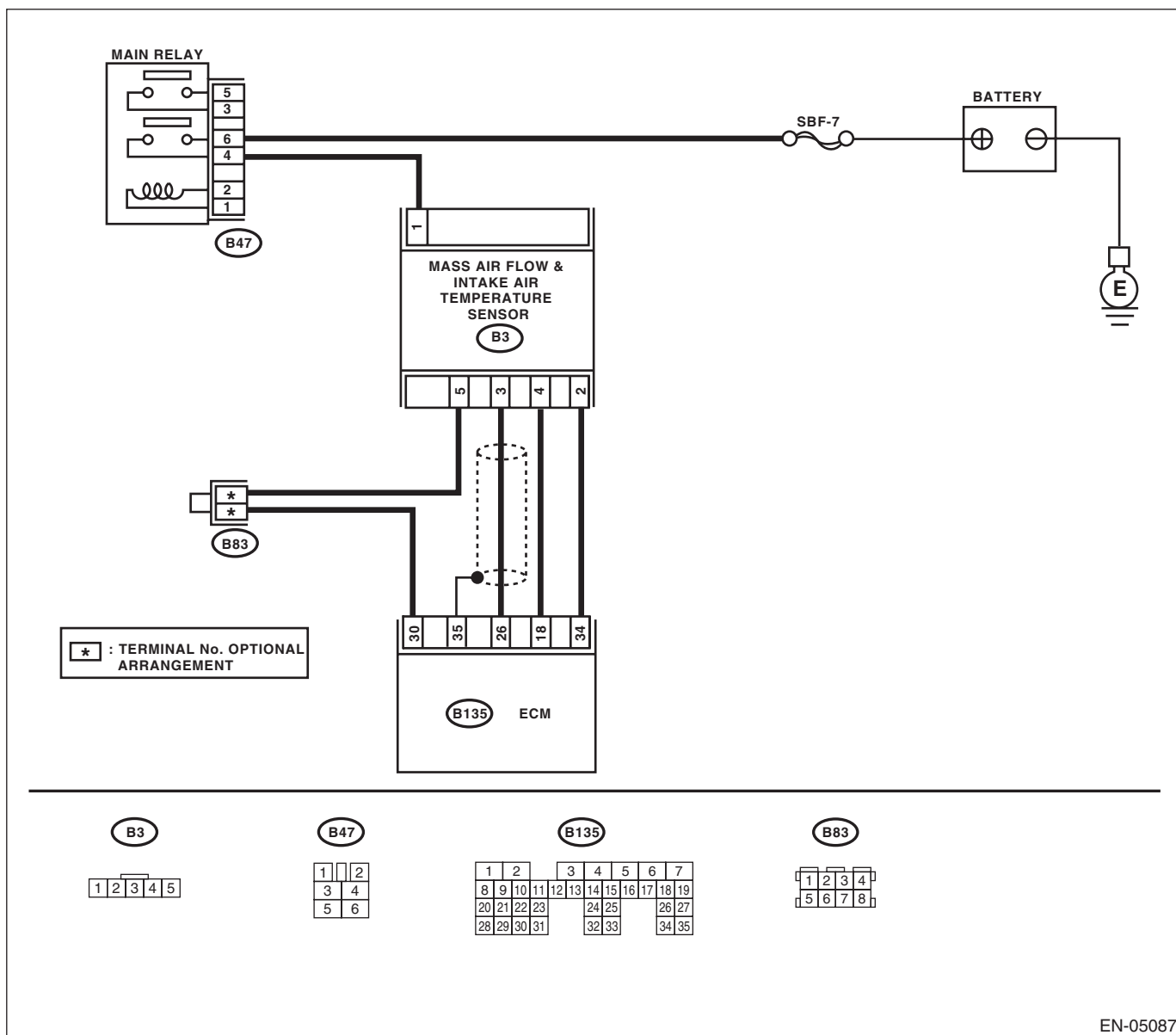
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## L: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-32, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

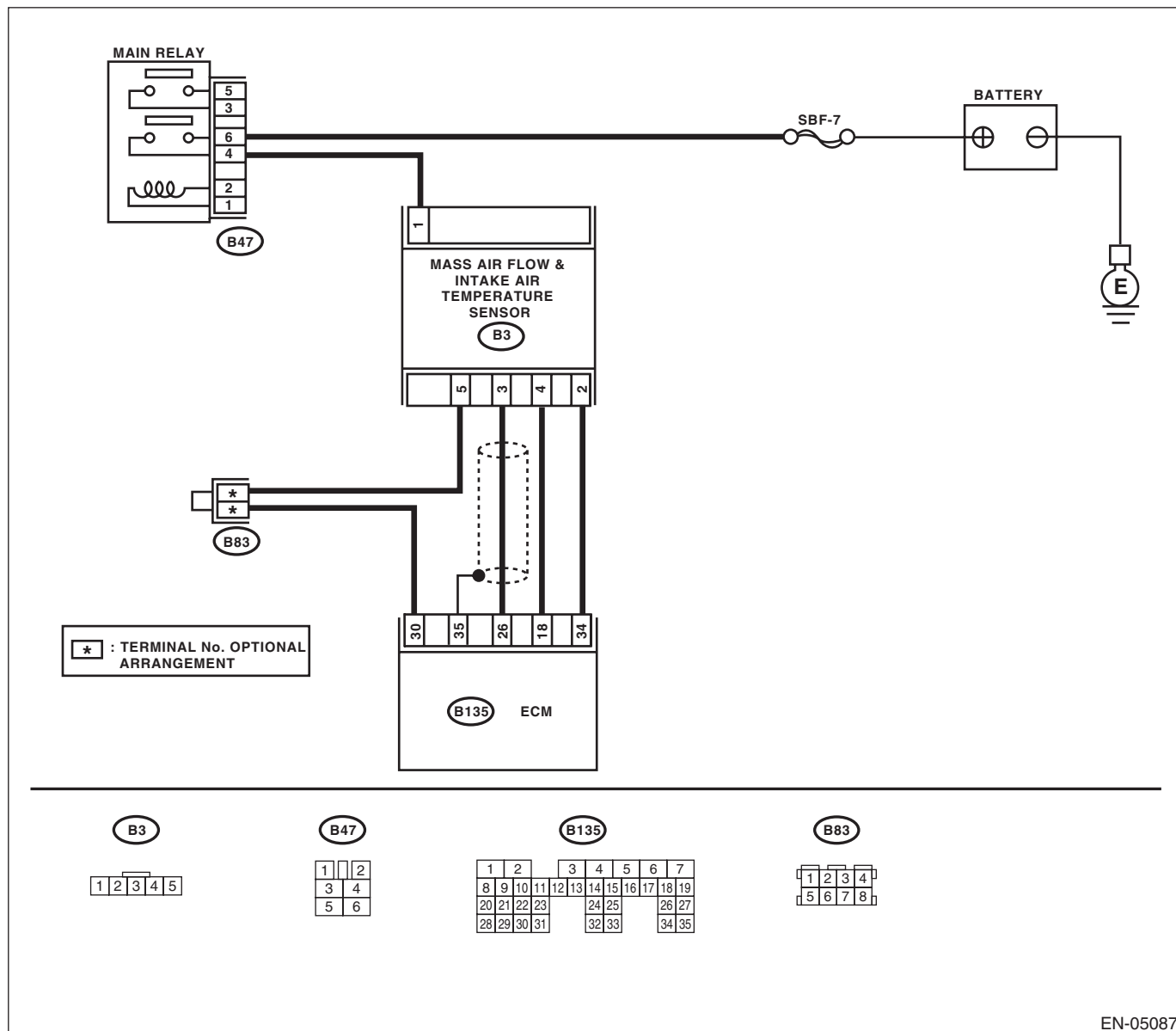
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage less than 0.2 V?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the mass air flow and intake air temperature sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(B3) No. 1 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and the mass air flow and intake air temperature sensor connector.</li> <li>• Poor contact of main relay connector</li> </ul>
3	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 26 — (B3) No. 3:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 26 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
5	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for any poor contact in the ECM or the mass air flow &amp; intake air temperature sensor connectors.</p>	Is there poor contact in the ECM or the mass air flow & intake air temperature sensor connectors?	Repair any poor contact in the ECM or the mass air flow & intake air temperature sensor connectors.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>



## M: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-34, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

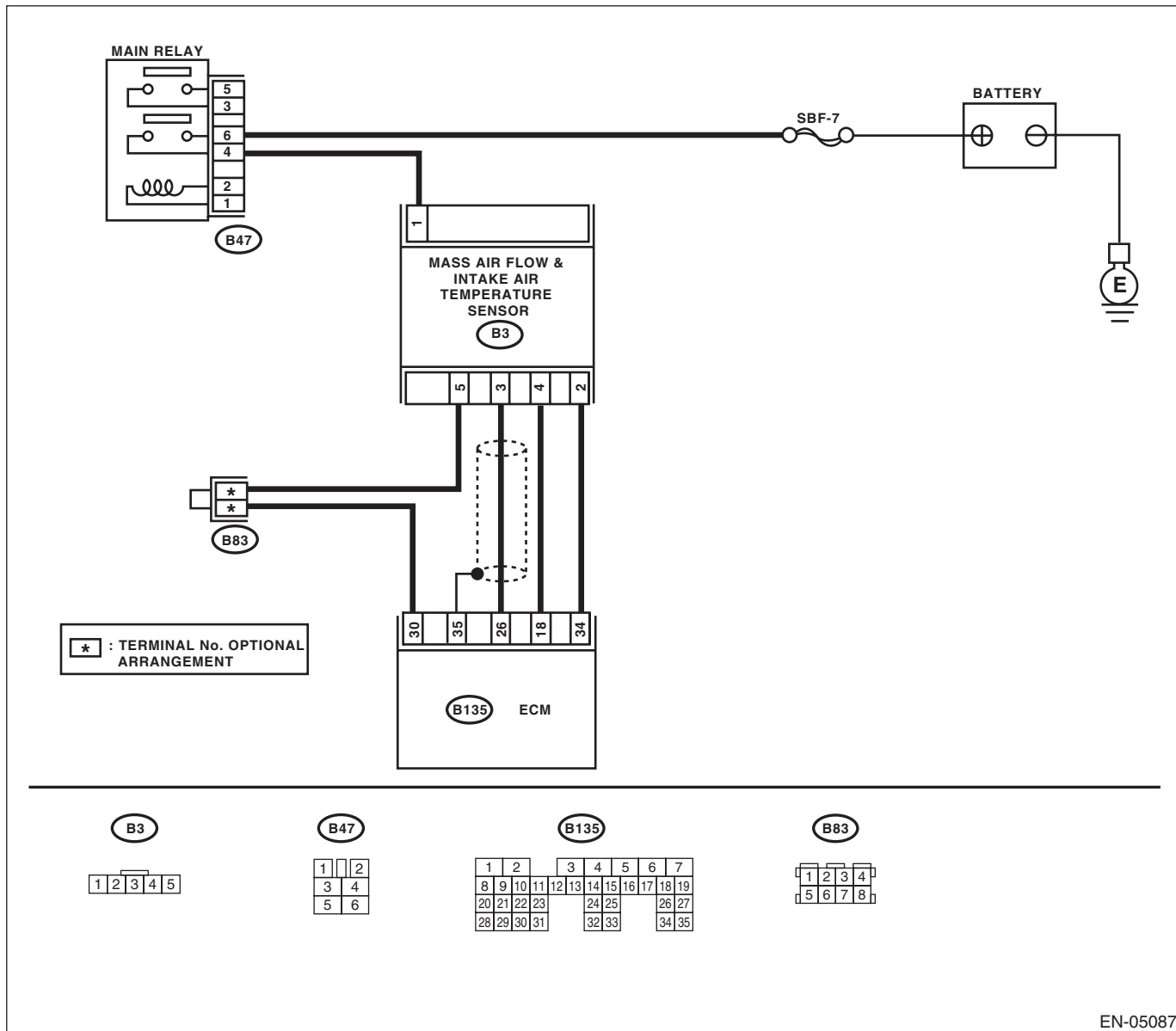
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the mass air flow and intake air temperature sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow & intake air temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between the mass air flow and intake air temperature sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(B3) No. 2 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>OPEN CIRCUIT OF HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</li> <li>Poor contact in ECM connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for any poor contact between the mass air flow and intake air temperature sensor connectors.</p>	Is there poor contact in the mass air flow and intake air temperature sensor connectors?	Repair any poor contact of the mass air flow and intake air temperature sensor connectors.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## N: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

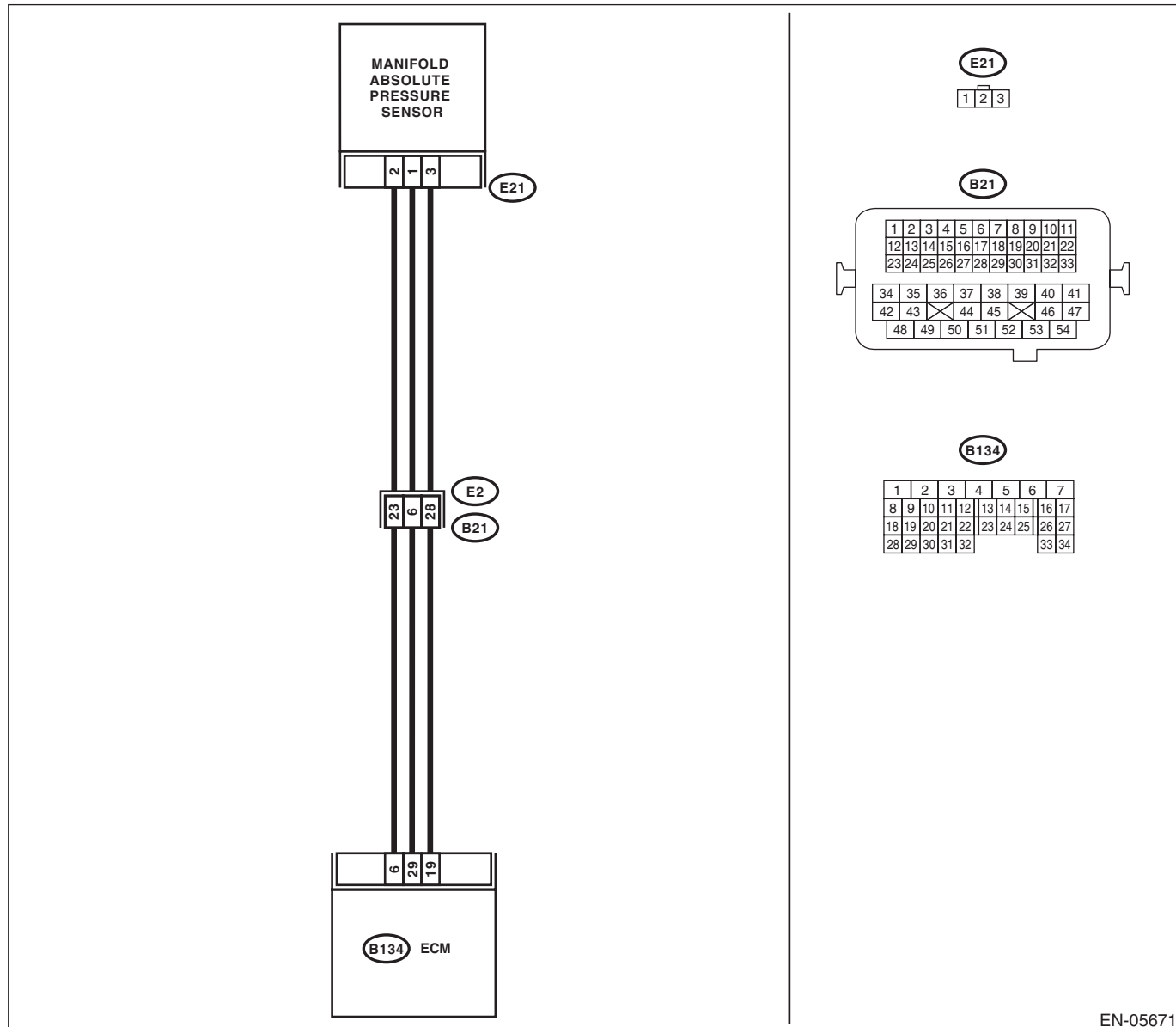
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-36, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05671

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK POWER SUPPLY OF THE MANIFOLD ABSOLUTE PRESSURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground.  <b>Connector &amp; terminal</b> <b>(E21) No. 3 (+) — Engine ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact in ECM connector • Poor contact of coupling connector
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector.  <b>Connector &amp; terminal</b> <b>(B134) No. 6 — (E21) No. 2:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact of coupling connector
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b> <b>(B134) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair ground short circuit of harness between ECM and manifold absolute pressure sensor connector.
<b>5</b> <b>CHECK POOR CONTACT.</b> Check for poor contact between the ECM and manifold pressure sensor connector.	Is there poor contact in the ECM or manifold absolute pressure sensor connector?	Repair the poor contact in the ECM or manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-31, Manifold Absolute Pressure Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## O: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

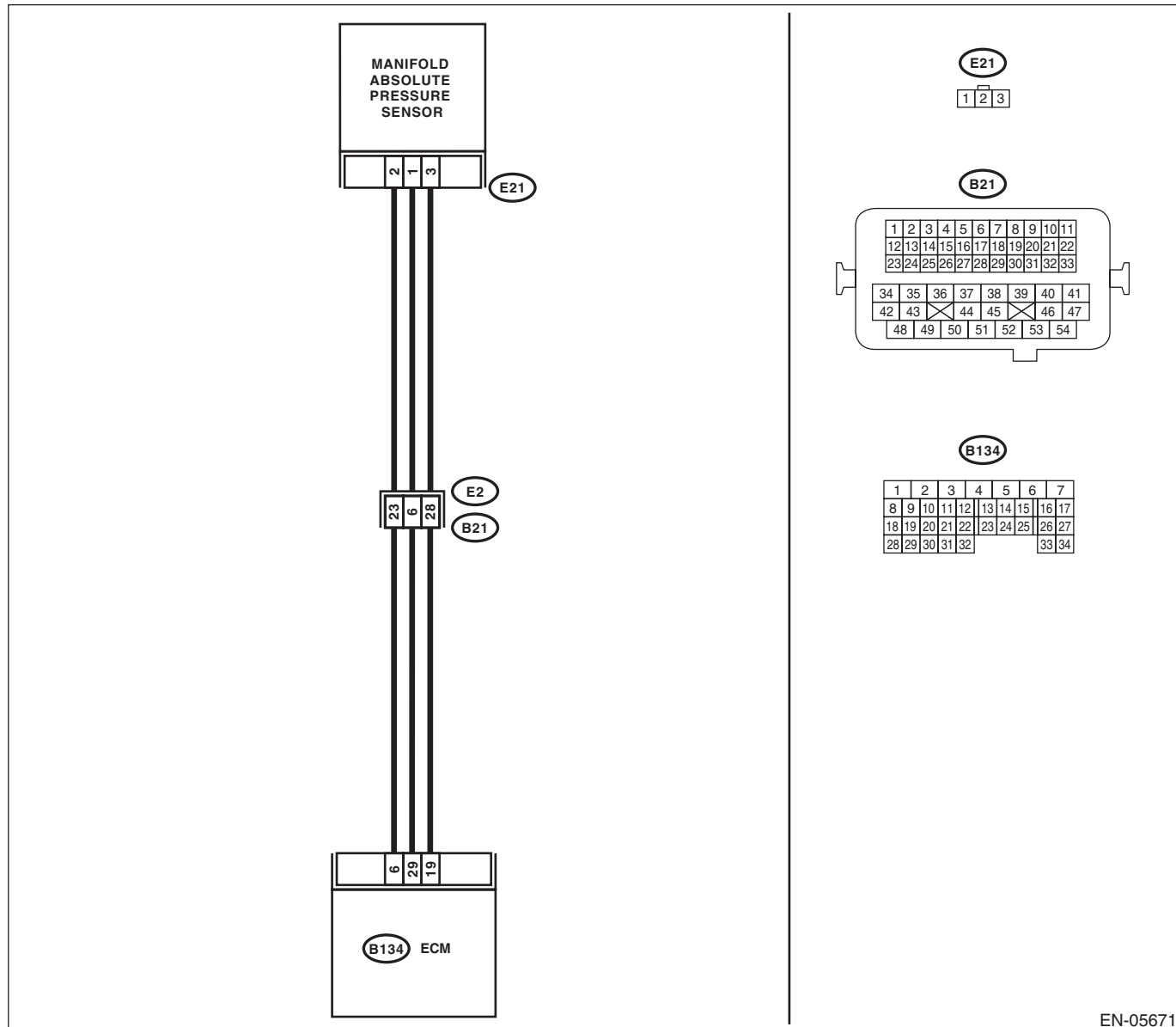
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-38, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05671

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Start the engine. 4) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Repair the short circuit to power in the harness between ECM and manifold absolute pressure sensor connector.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground.  <b>Connector &amp; terminal</b> <b>(E21) No. 1 — Engine ground:</b>	Is the resistance less than 5 Ω?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact in ECM connector • Poor contact of coupling connector
<b>4</b> <b>CHECK POOR CONTACT.</b> Check for poor contact of the manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair the poor contact of manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-31, Manifold Absolute Pressure Sensor.>

## P: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-40, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

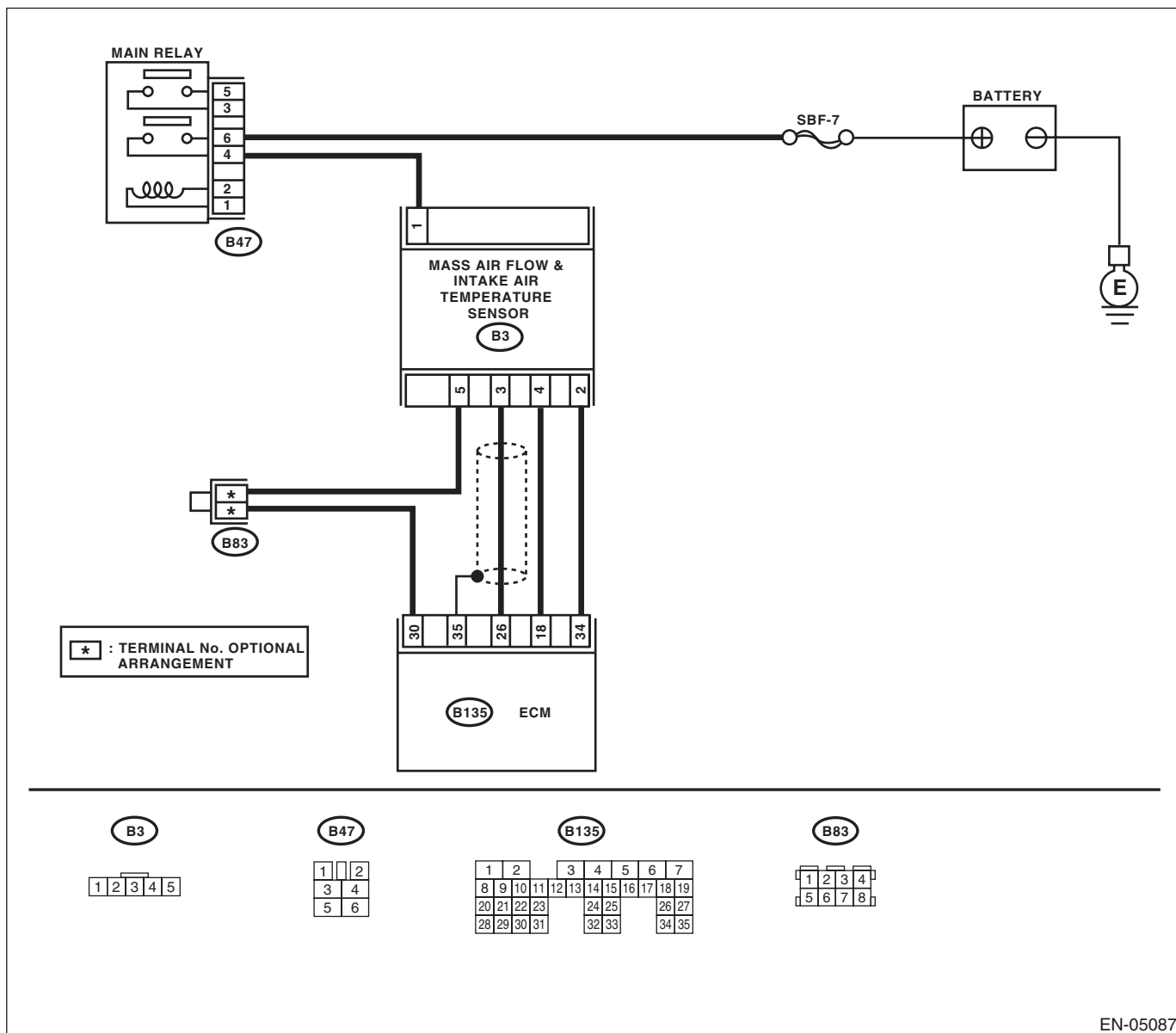
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK ENGINE COOLANT TEMPERATURE.</b></p> <p>1) Start the engine and warm-up completely. 2) Measure the engine coolant temperature using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature 75°C (167°F) or higher?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>	Check DTC P0125 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Q: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-42, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

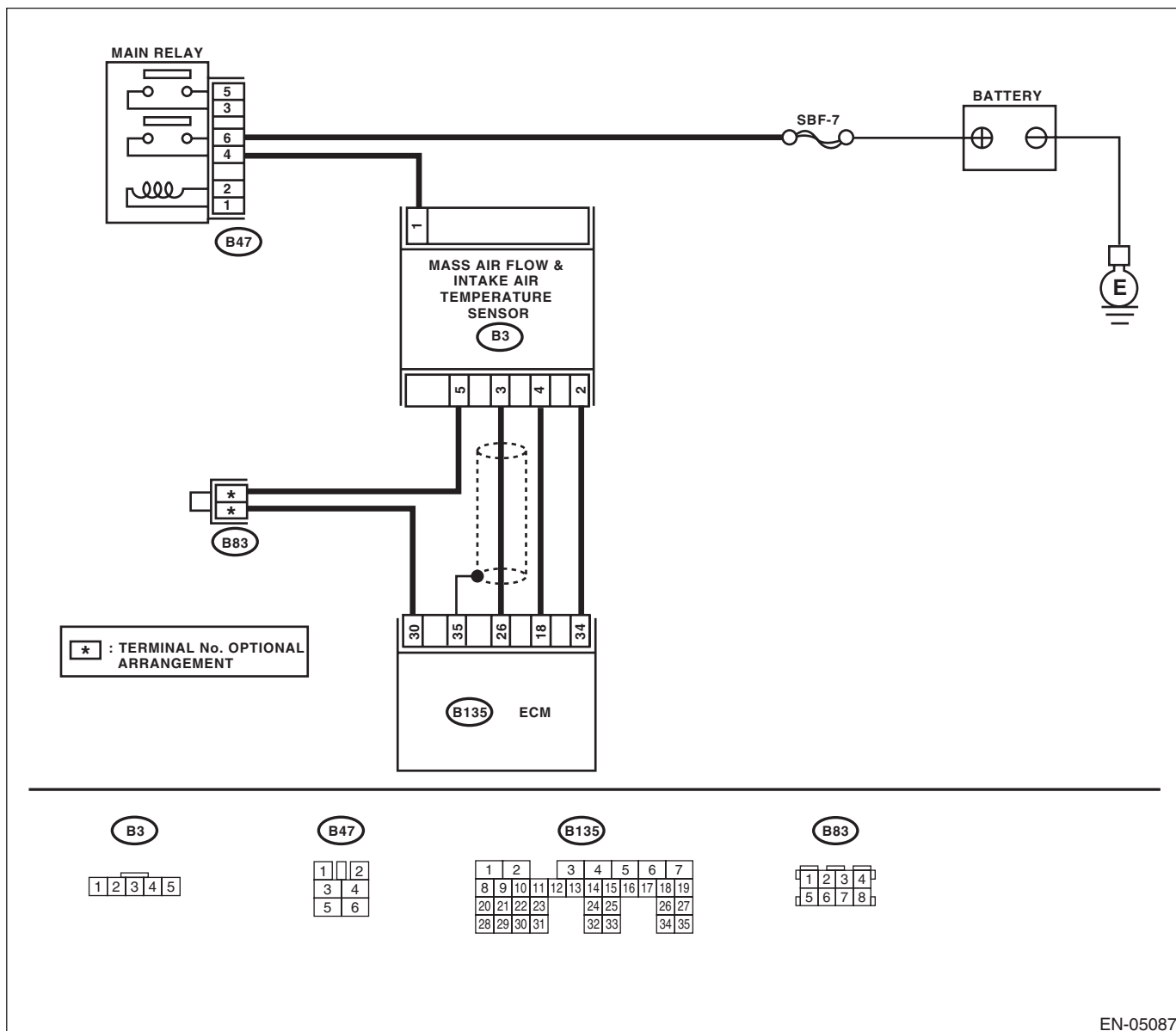
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the intake air temperature 120°C (248°F) or more?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and the mass air flow &amp; intake air temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 18 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the ground short circuit of harness between the ECM and the mass air flow & intake air temperature sensor connectors.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## R: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-44, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

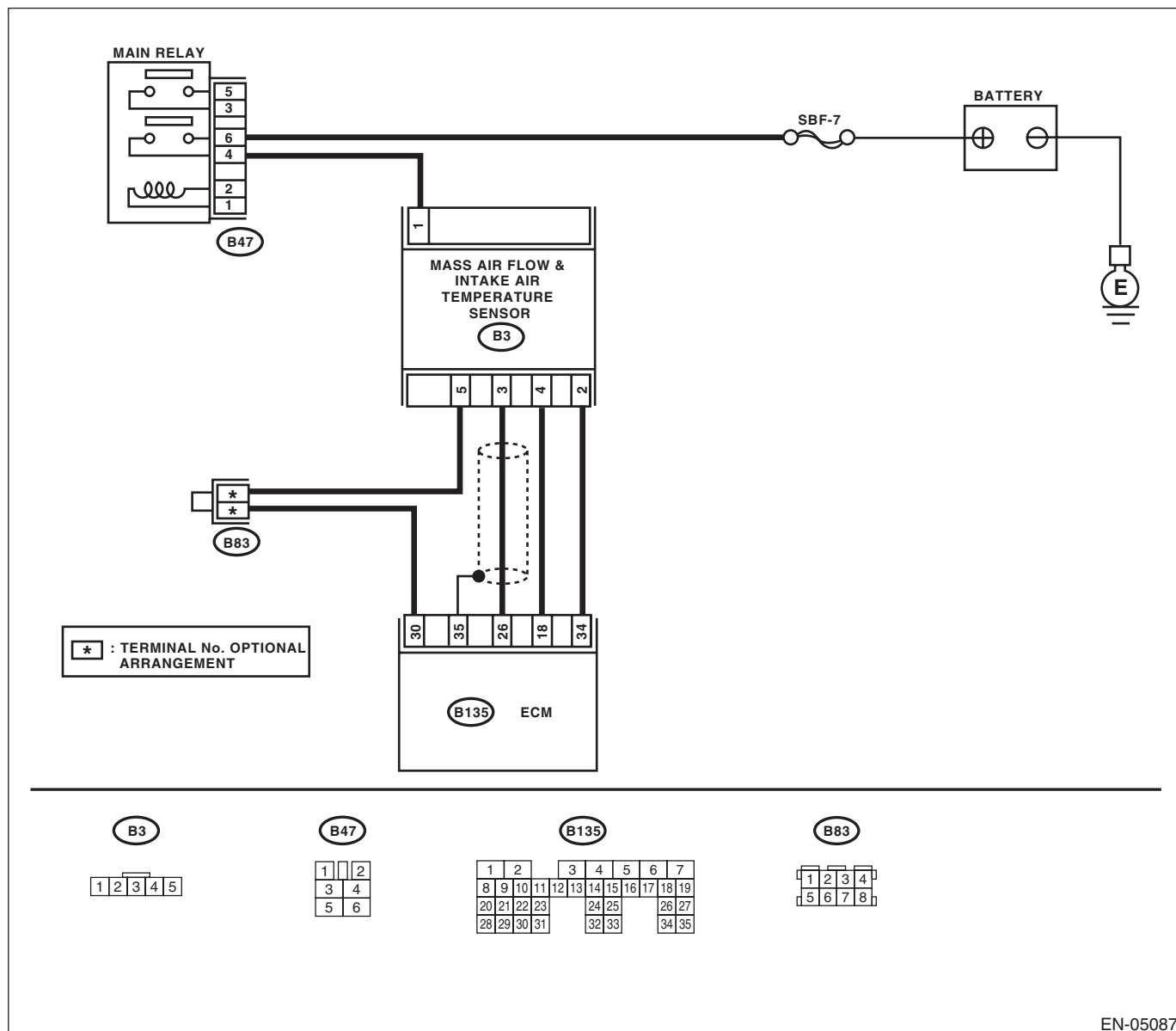
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05087

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.  <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the intake air temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  <b>NOTE:</b> In this case, there may be a temporary connector contact failure.
<b>2 CHECK POOR CONTACT.</b> Repair any poor contact between the ECM and the mass air flow & intake air temperature sensor connectors.	Is there poor contact in the ECM or the mass air flow & intake air temperature sensor connectors?	Repair any poor contact between the ECM and the mass air flow & intake air temperature sensor connectors.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and the mass air flow & intake air temperature sensor. 3) Measure the resistance of harness between ECM and mass air flow & intake air temperature sensor connectors.  <b>Connector &amp; terminal</b> <b>(B135) No. 18 — (B3) No. 4:</b> <b>(B135) No. 30 — (B3) No. 5:</b>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of harness between the ECM and mass air flow & intake air temperature sensor connectors.
<b>4 CHECK HARNESS BETWEEN ECM, MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTORS.</b> 1) Connect all connectors. 2) Turn the ignition switch to OFF. 3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b> <b>(B135) No. 18 (+) — Chassis ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow & intake air temperature sensor connectors.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## S: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-46, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

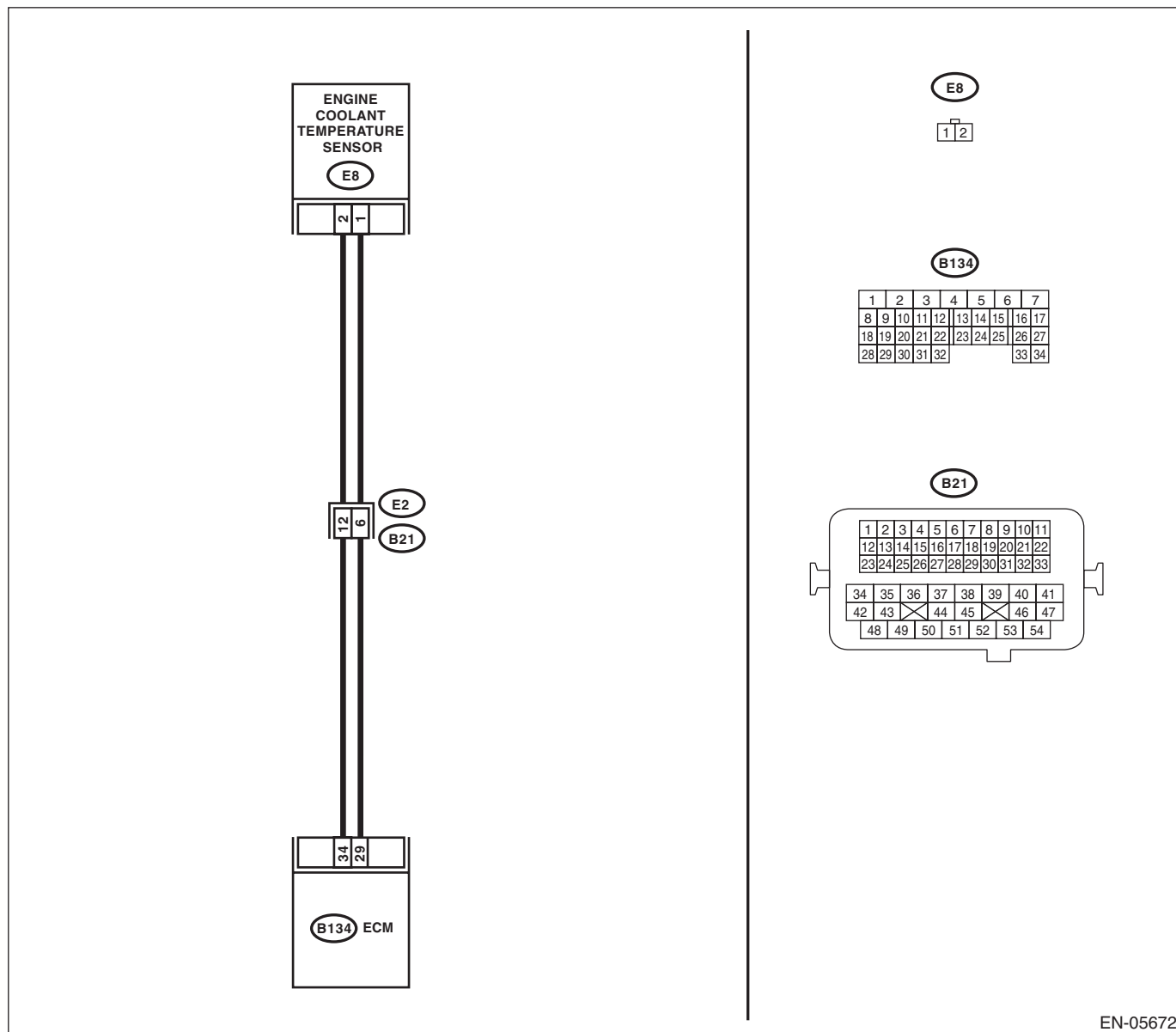
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05672

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature 150°C (302°F) or higher?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and engine coolant temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 34 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.>	Repair the ground short circuit of the harness between the ECM and engine coolant temperature sensor.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## T: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-48, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

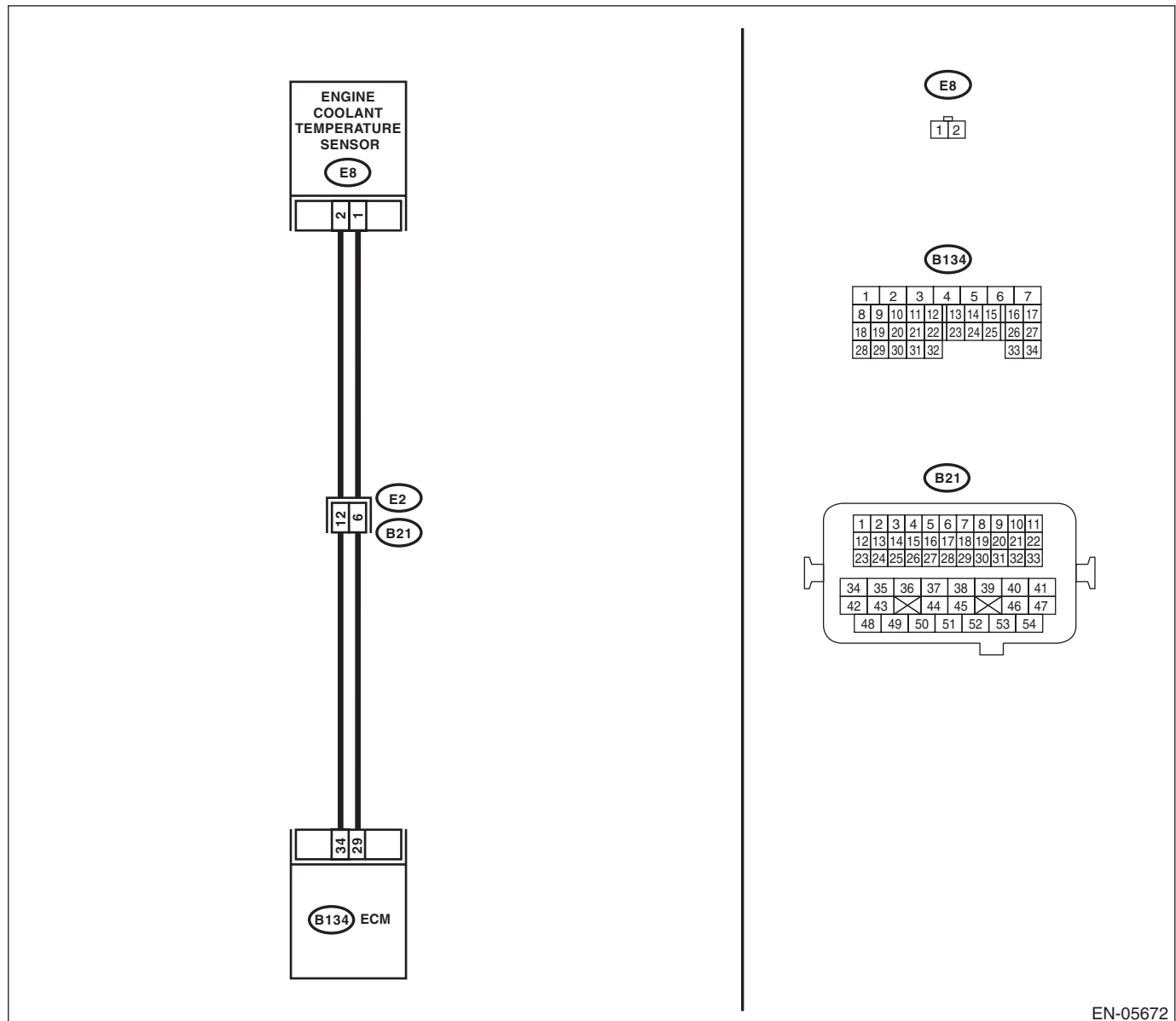
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05672

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine.</li> <li>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Repair any poor contact between the ECM and engine coolant temperature sensor connectors.</p>	Is there poor contact in the ECM or engine coolant temperature sensor connectors?	Repair any poor contact between the ECM and engine coolant temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connectors from the ECM and engine coolant temperature sensor.</li> <li>3) Measure the resistance of the harness between the ECM and engine coolant temperature sensor connector.</li> </ol> <p><b>Connector &amp; terminal</b></p> <p><b>(B134) No. 34 — (E8) No. 2:</b></p> <p><b>(B134) No. 29 — (E8) No. 1:</b></p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and engine coolant temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <ol style="list-style-type: none"> <li>1) Connect all connectors.</li> <li>2) Turn the ignition switch to ON.</li> <li>3) Measure the voltage between ECM and chassis ground.</li> </ol> <p><b>Connector &amp; terminal</b></p> <p><b>(B134) No. 34 (+) — Chassis ground (-):</b></p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and engine coolant temperature sensor connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## U: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-50, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

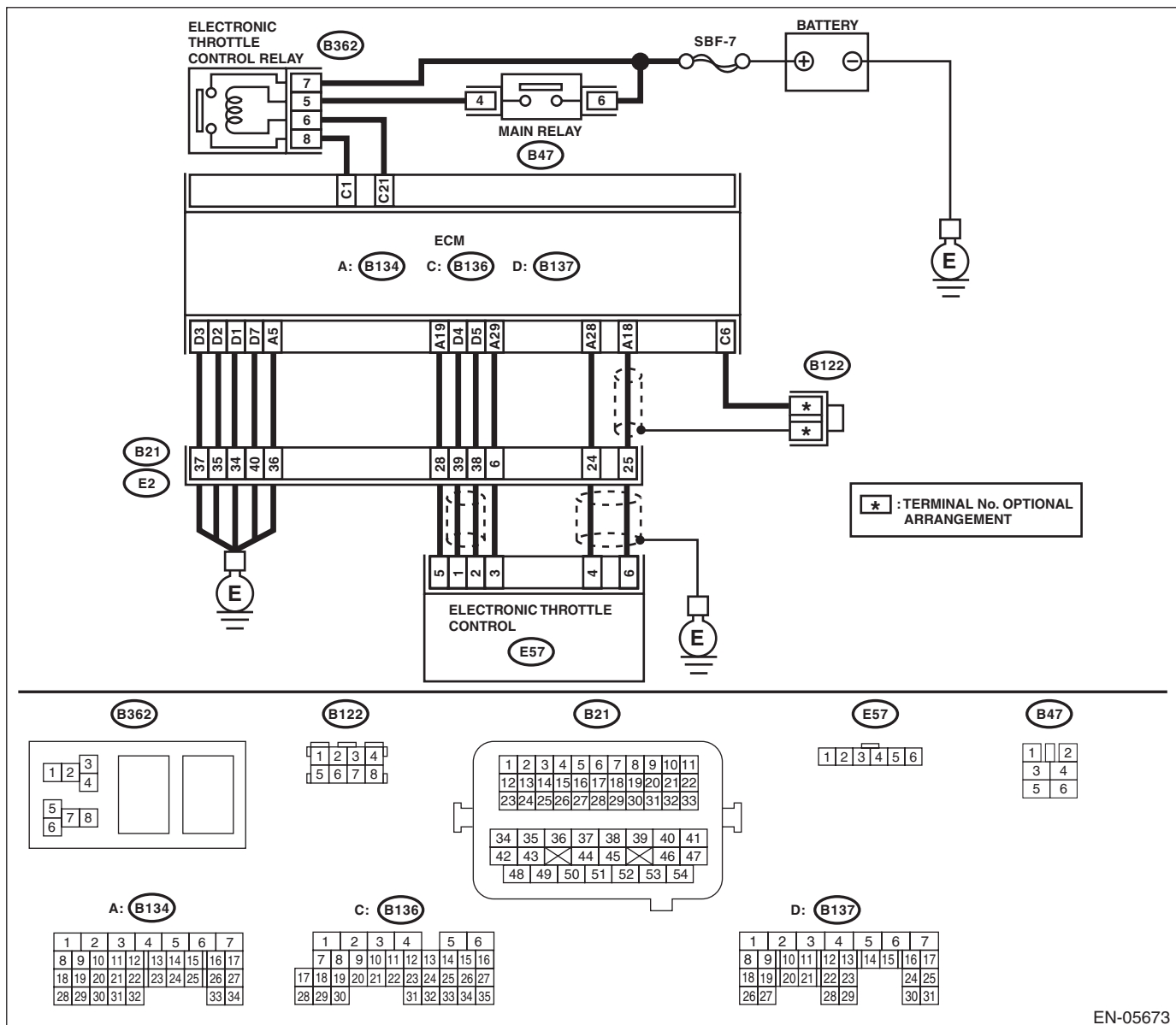
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from ECM and electronic throttle control.                      3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 18 — Chassis ground:</b>  <b>(B134) No. 18 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.                      2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 18 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H4DOTC)-11, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.                      Replace the ECM if defective. &lt;Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## V: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-52, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

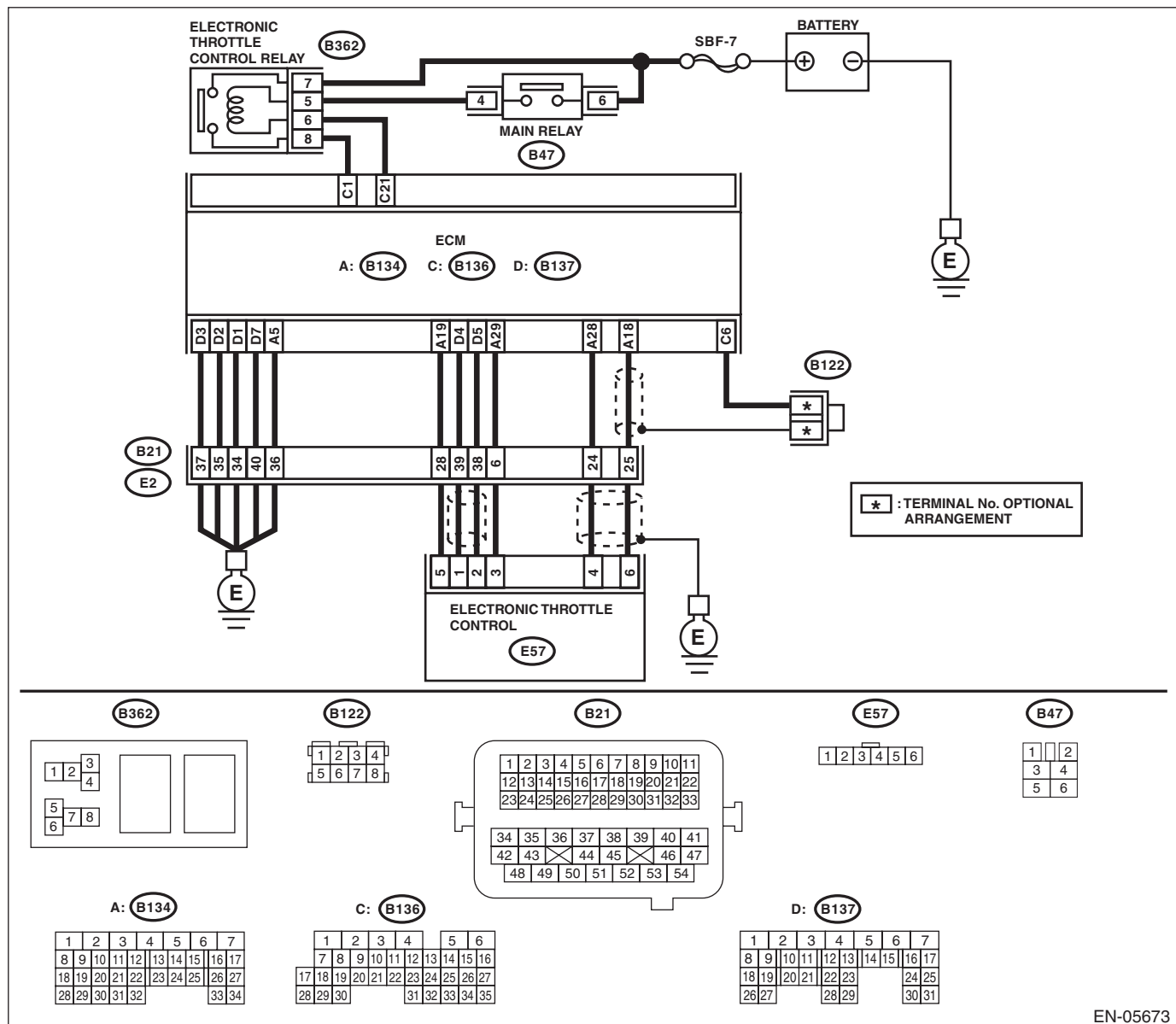
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DOTC)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## W: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-54, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

Engine does not return to idle.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK TIRE SIZE.</b>	Is the tire size as specified? and the same size as other three wheels?	Go to step 2.	Replace the tire.
2	<b>CHECK ENGINE COOLANT.</b> Check the following items: <ul style="list-style-type: none"><li>• Amount of engine coolant</li><li>• Engine coolant freeze</li><li>• Contamination of engine coolant</li></ul>	Is the engine coolant normal?	Go to step 3.	Fill or replace the engine coolant. <Ref. to CO(H4DOTC)-14, INSPECTION, Engine Coolant.>
3	<b>CHECK THERMOSTAT.</b>	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H4DOTC)-17, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## X: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-57, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

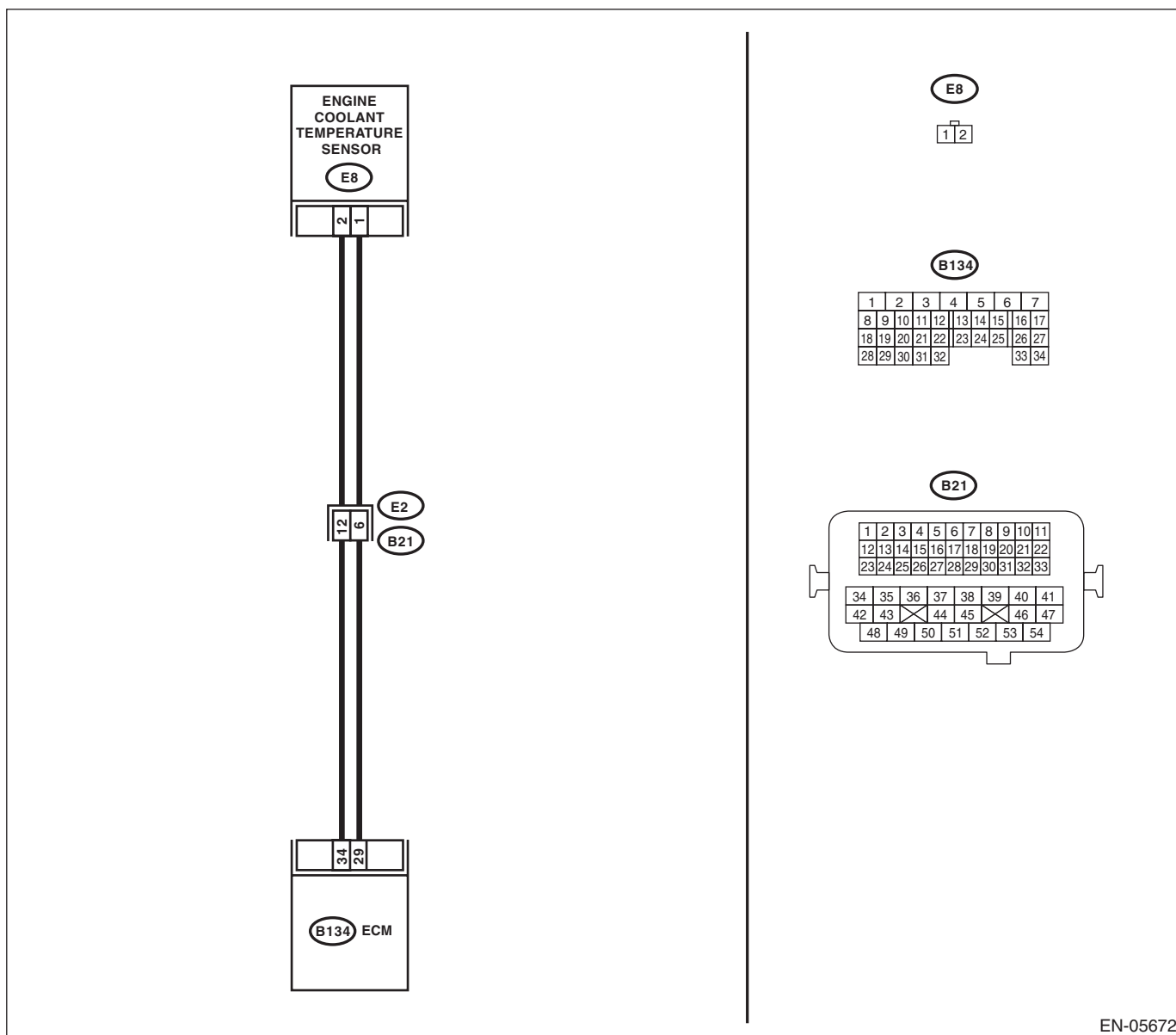
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05672

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed-up. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed-up?	Repair the poor contact of the ECM connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.>

## Y: DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-59, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

Thermostat remains open.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK ENGINE COOLANT.</b>	Are the coolant level and mixture ratio of engine coolant to anti-freeze solution correct?	Go to step 2.	Replace the engine coolant. <Ref. to CO(H4DOTC)-13, REPLACEMENT, Engine Coolant.>
2	<b>CHECK RADIATOR FAN.</b> 1) Start the engine. 2) Check the radiator fan operation.	Does the radiator fan continuously rotate for 3 minutes or more during idling?	Repair radiator fan circuit. <Ref. to CO(H4DOTC)-24, Radiator Main Fan and Fan Motor.>and <Ref. to CO(H4DOTC)-26, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H4DOTC)-17, Thermostat.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Z: DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

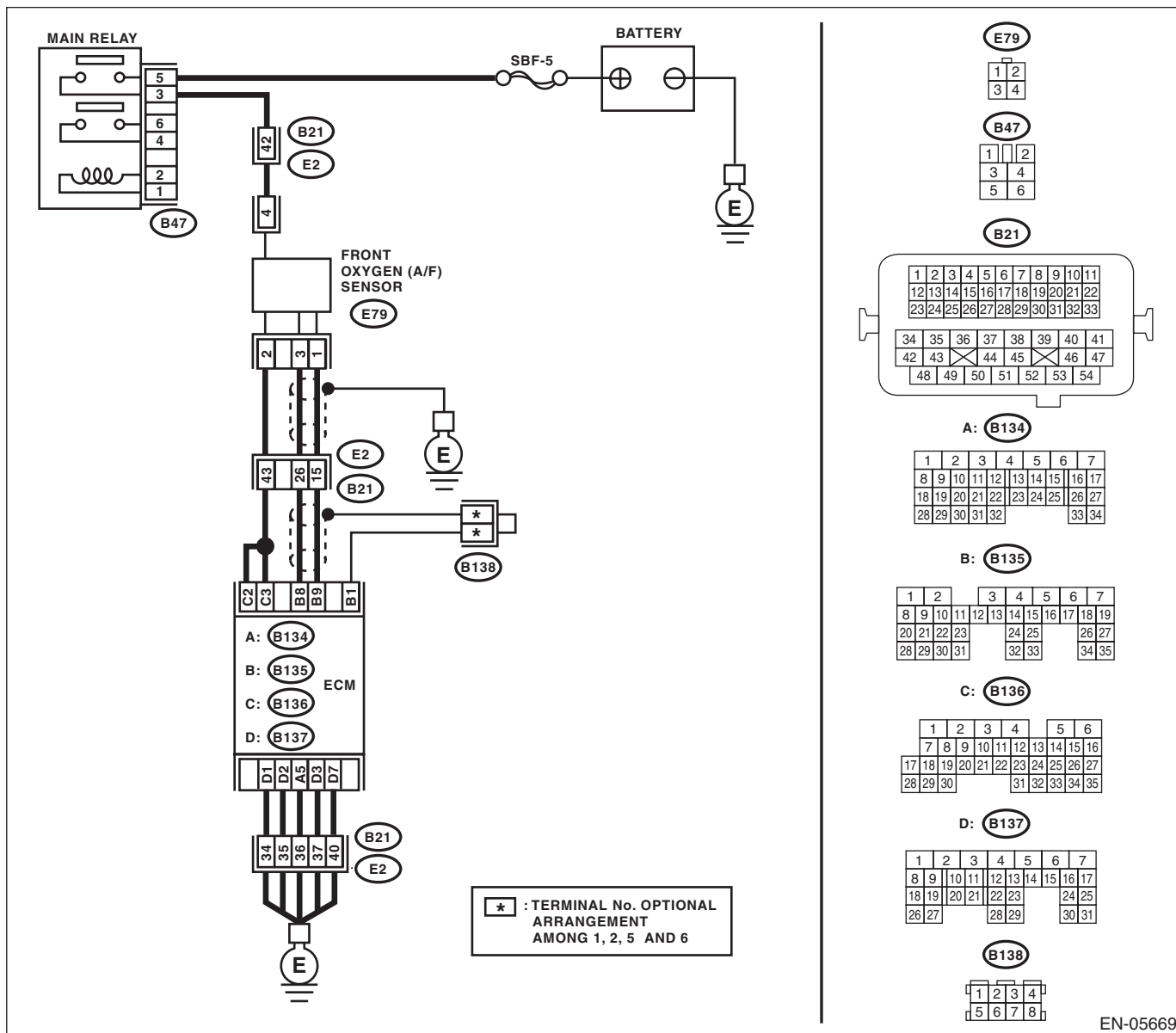
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-61, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	<b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AA:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

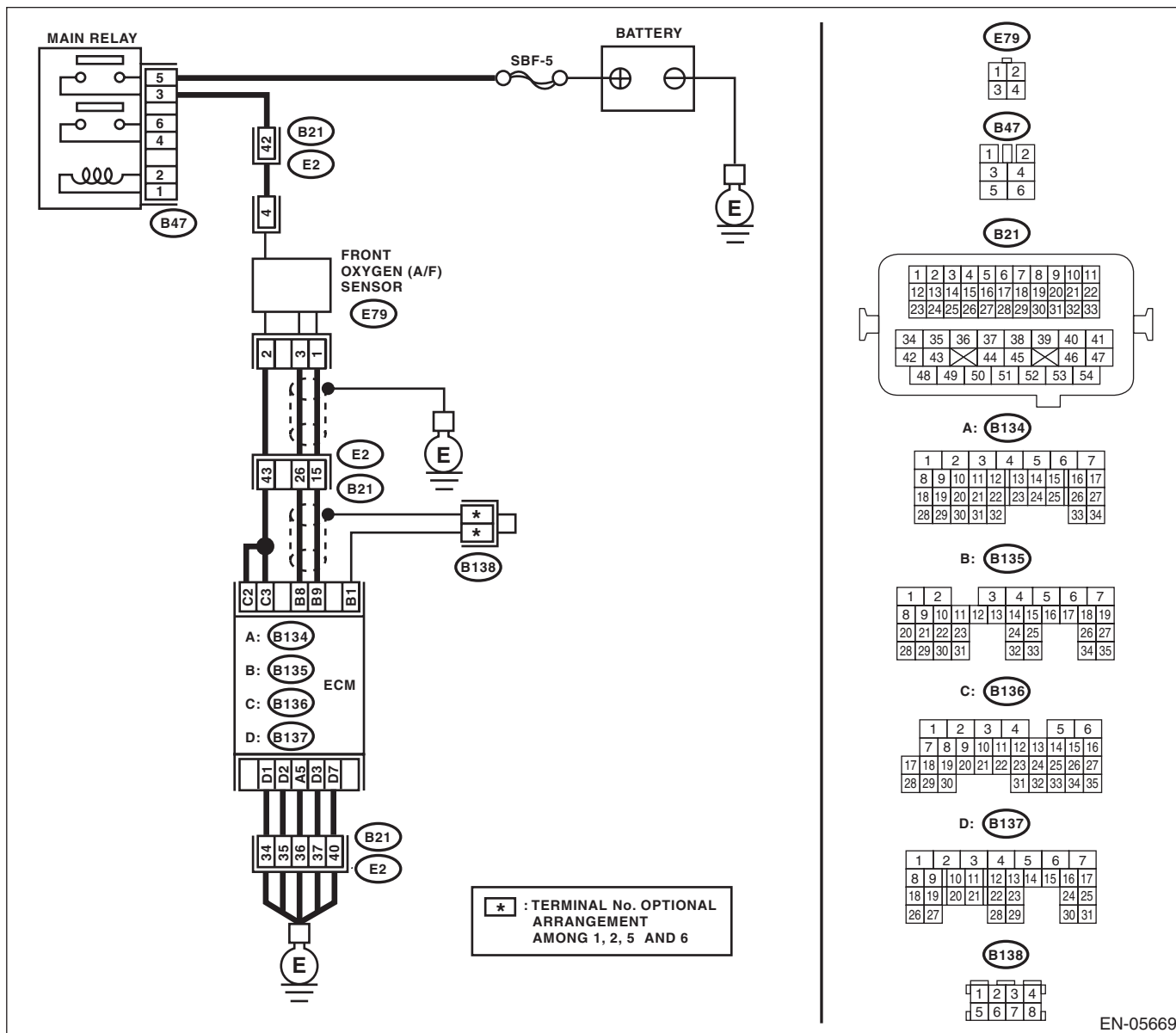
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-63, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AB:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

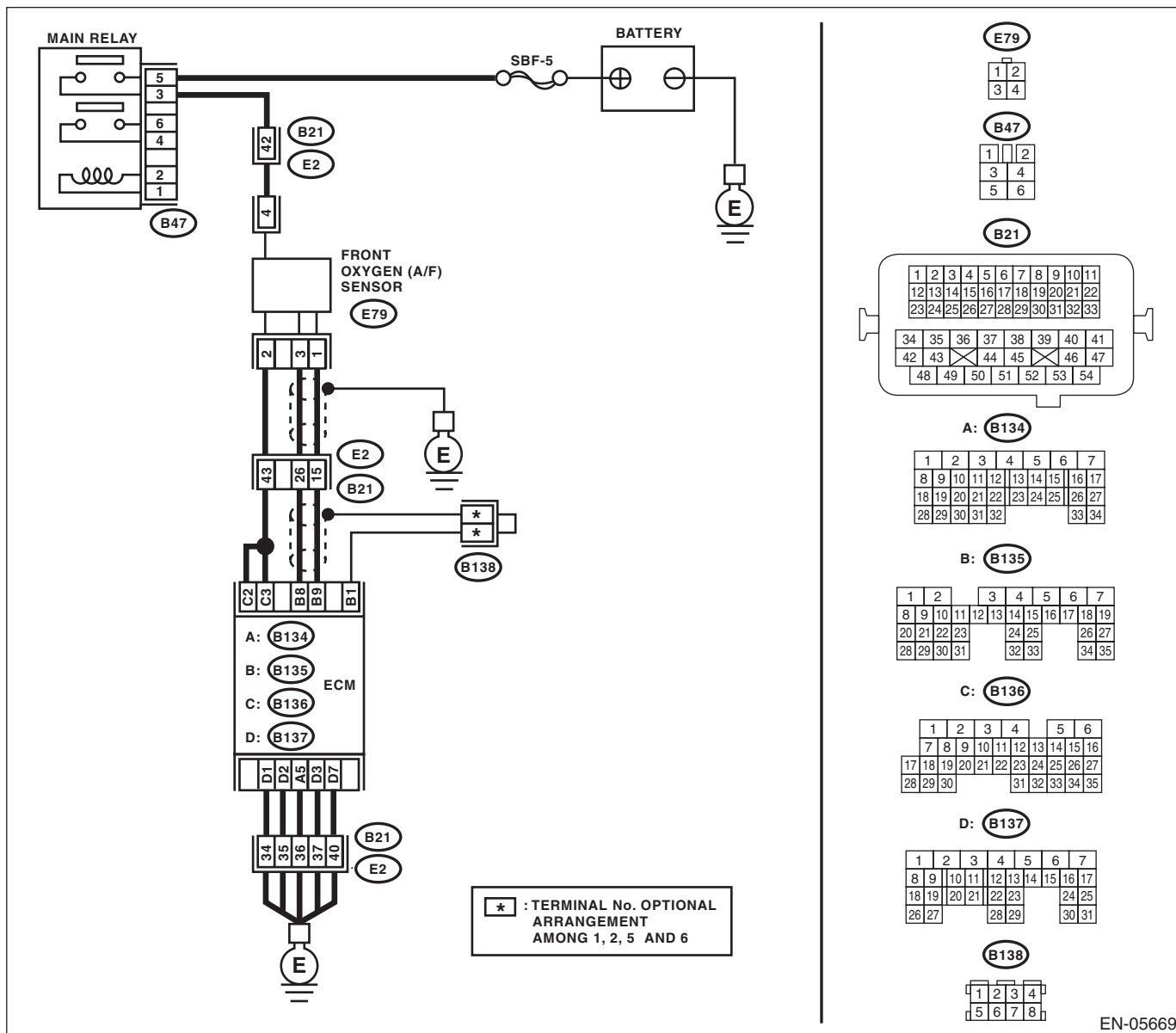
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-65, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
1	<b>CHECK EXHAUST SYSTEM.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Loose installation of front portion of exhaust pipe onto cylinder heads</li><li>• Loose connection between front exhaust pipe and front catalytic converter</li><li>• Damage of exhaust pipe resulting in a hole</li></ul>	Is there any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AC:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

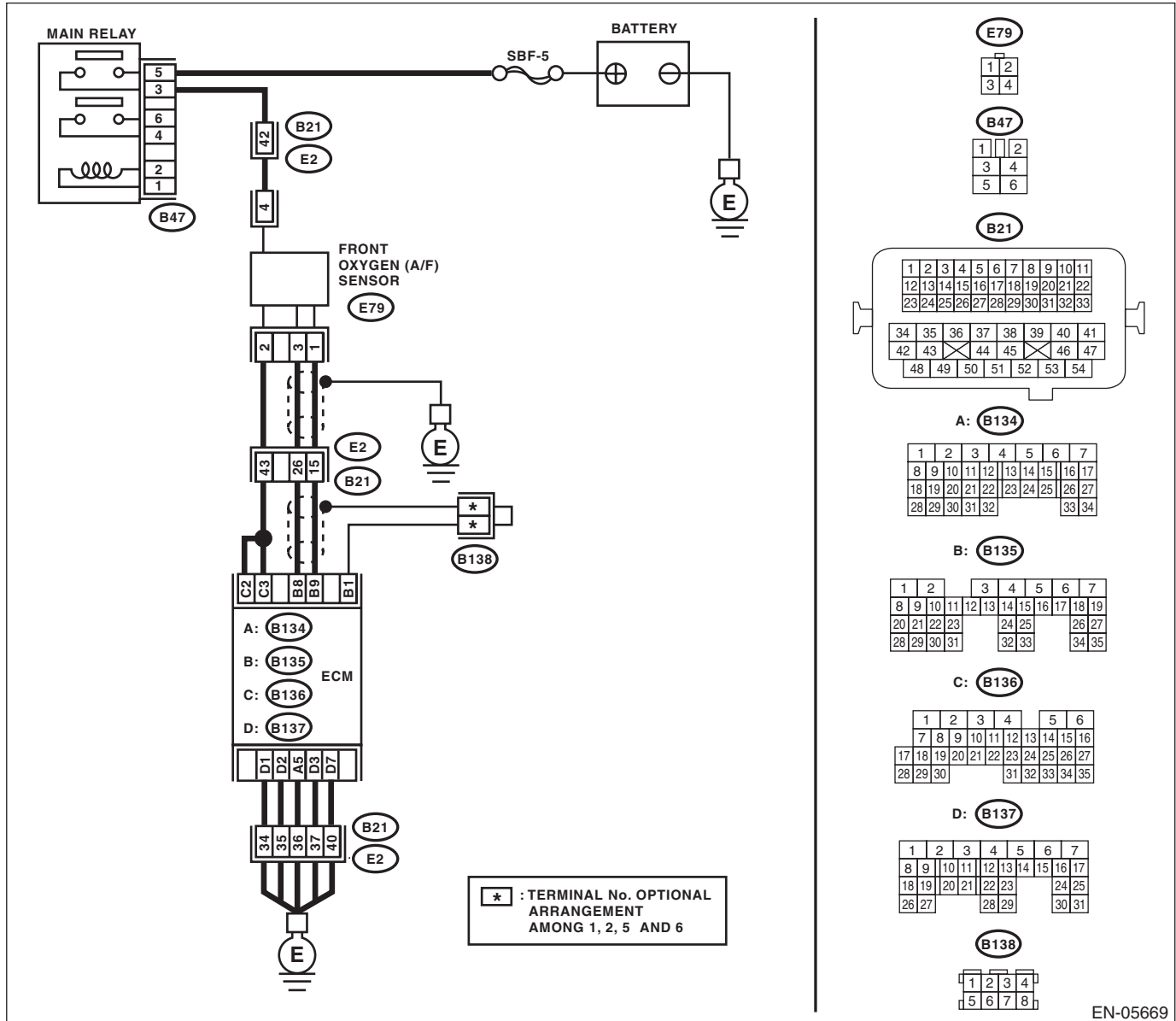
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-68, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 9 — (E79) No. 1:</b>  <b>(B135) No. 8 — (E79) No. 3:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Check poor contact of ECM and front oxygen (A/F) sensor connector.</p>	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AD:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

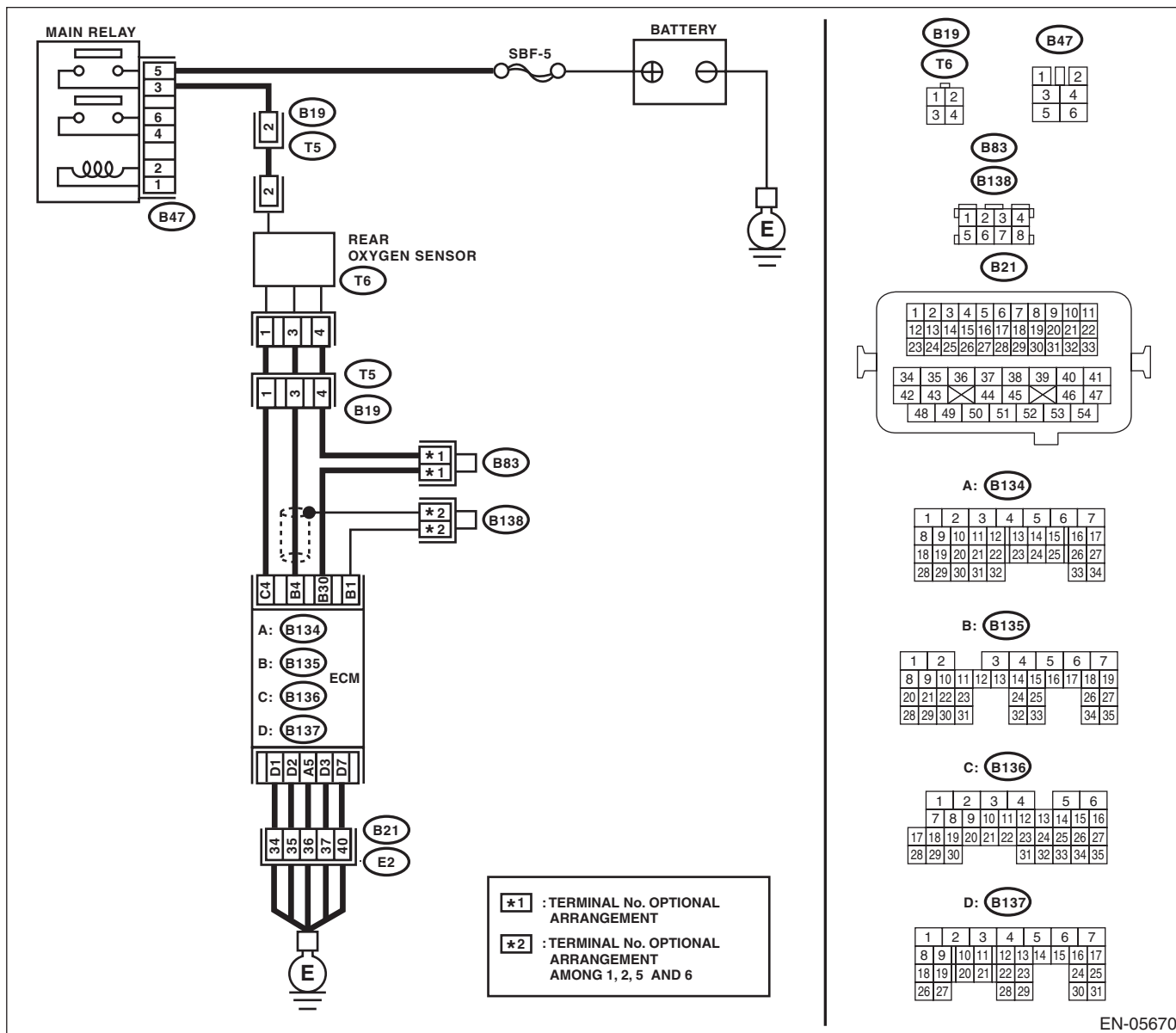
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-70, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <i>Connector &amp; terminal</i> <i>(B135) No. 4 — (T6) No. 3:</i> <i>(B135) No. 30 — (T6) No. 4:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <i>Connector &amp; terminal</i> <i>(T6) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AE:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

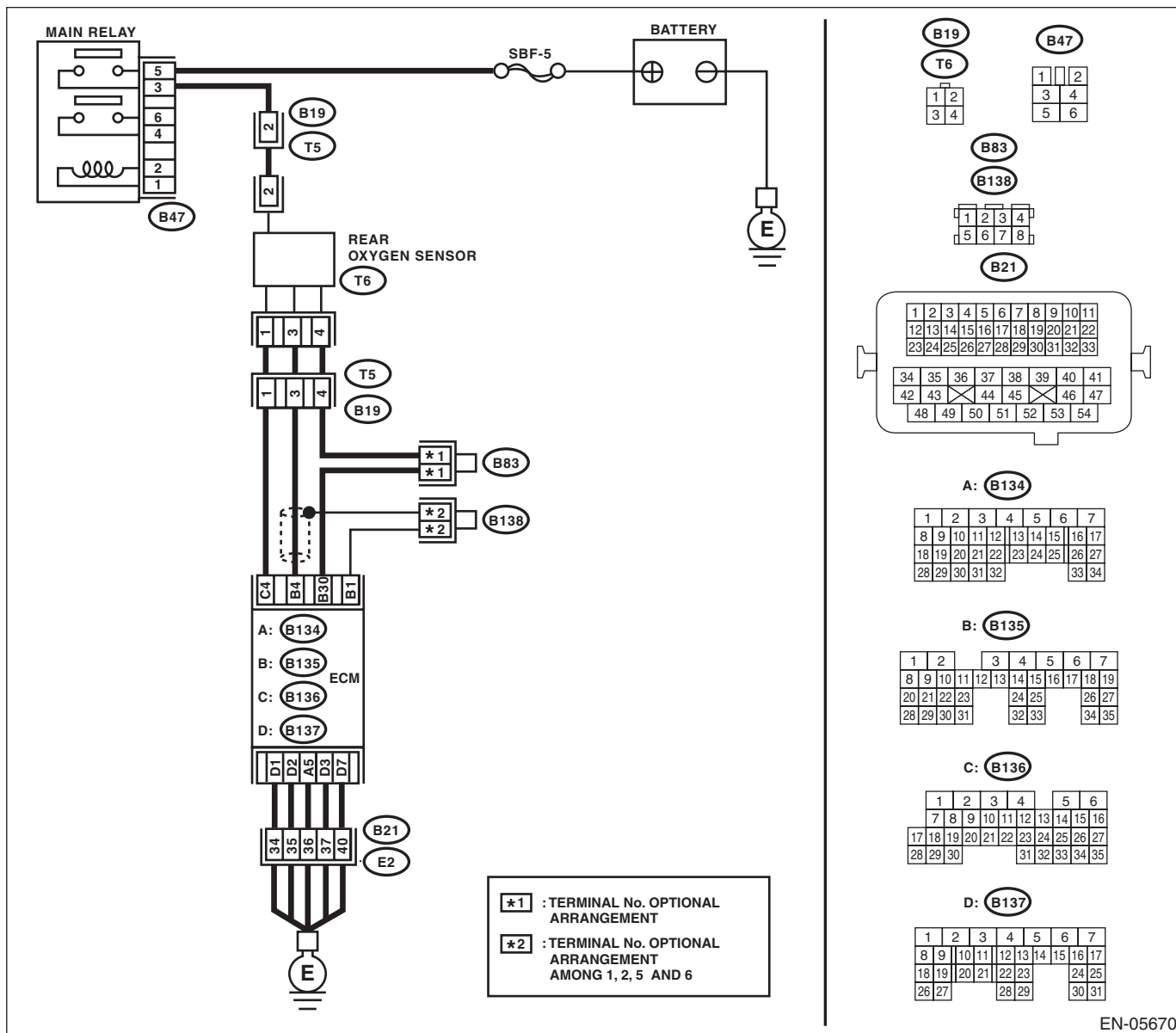
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-73, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (T6) No. 3:</b> <b>(B135) No. 30 — (T6) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(T6) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AF:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

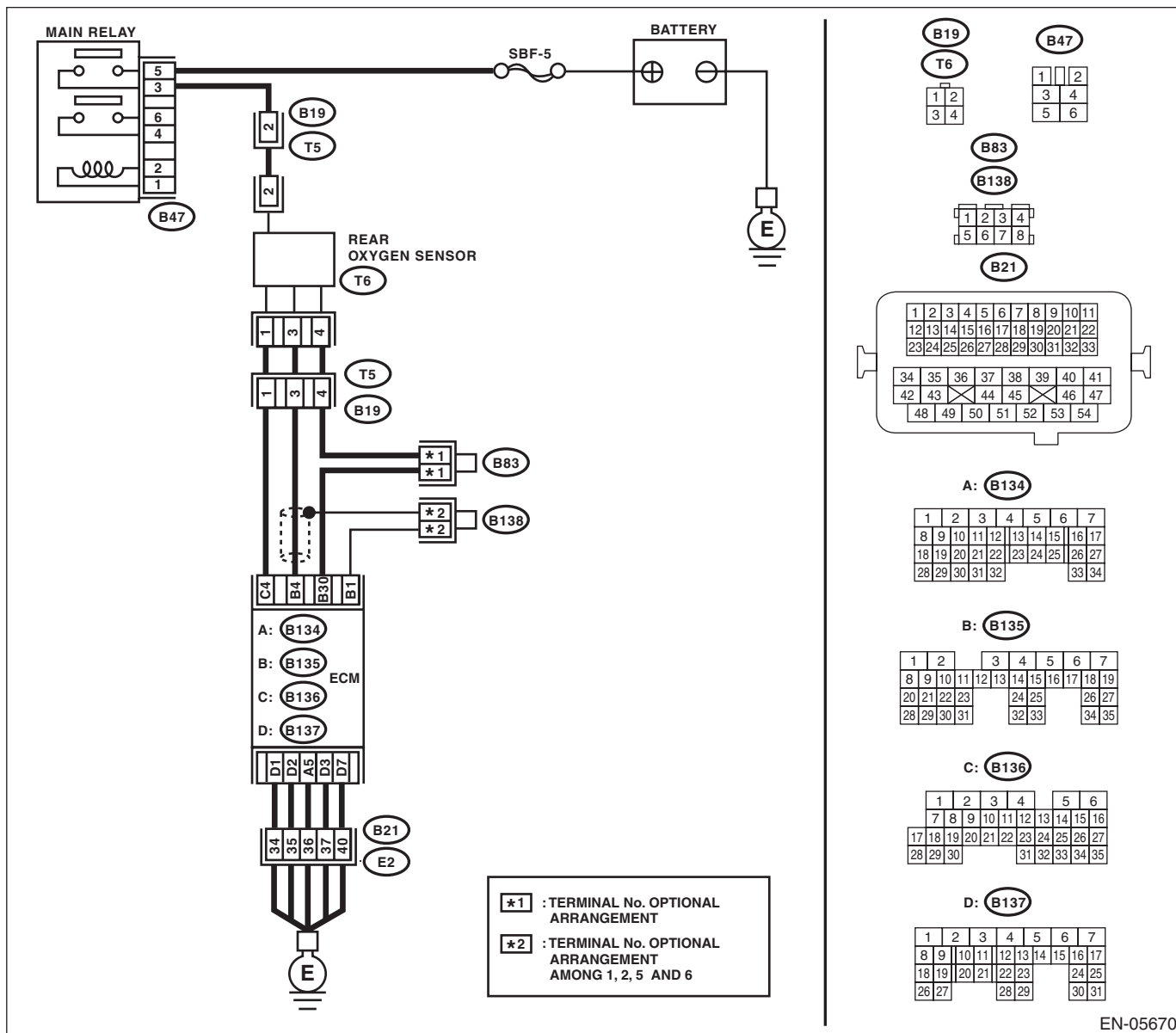
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-74, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and rear oxygen sensor.                      3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 4 — (T6) No. 3:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
2	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      Measure the resistance between rear oxygen sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(T6) No. 3 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and rear oxygen sensor connector.
3	<p><b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor terminals.  <b>Terminals</b>  <b>No. 3 — No. 4</b></p>	Is the resistance less than 1 Ω?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AG:DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

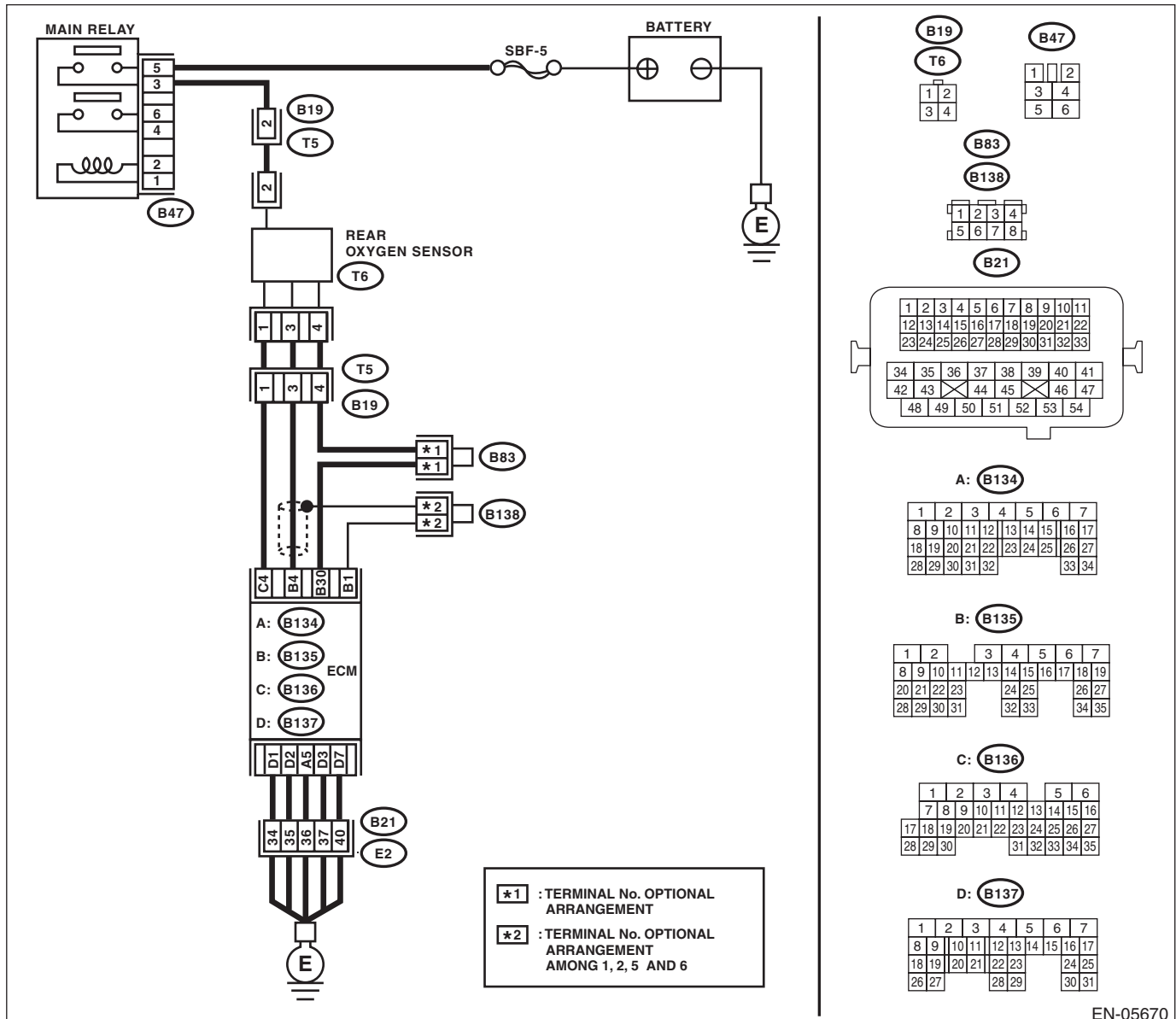
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-81, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 6.	Go to step 2.
<b>2</b> <b>CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 6.	Go to step 3.
<b>3</b> <b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (T6) No. 3:</b> <b>(B135) No. 30 — (T6) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(T6) No. 3 (+) — Chassis ground (-):</b></p>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<p><b>6</b></p> <p><b>CHECK EXHAUST SYSTEM.</b></p> <p>Check exhaust system parts.</p> <p>NOTE: Check the following items.</p> <ul style="list-style-type: none"> <li>• Loose part and incomplete installation of exhaust system</li> <li>• Damage (crack, hole etc.) of parts</li> <li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li> </ul>	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>

### AH:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4DOTC)(diag)-151, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AI: DTC P0172 SYSTEM TOO RICH (BANK 1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-84, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system. Go to step 2.
2	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system. Go to step 3.
3	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place "NO OPEN FLAMES" signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kg/cm <sup>2</sup> , 41 — 46 psi)?	Go to step 4.  Repair the following item. Fuel pressure is too high: • Clogged fuel return line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel supply line
4	<b>CHECK FUEL PRESSURE.</b> After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kg/cm <sup>2</sup> , 33 — 38 psi)?	Go to step 5.  Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up completely.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Go to step 6.</p>	<p>Replace the engine coolant temperature sensor. &lt;Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.&gt;</p>
<p><b>6</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 7.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
7	<p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Open the front hood.</li> <li>6) Measure the ambient temperature.</li> <li>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AJ:DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE /PERFORMANCE

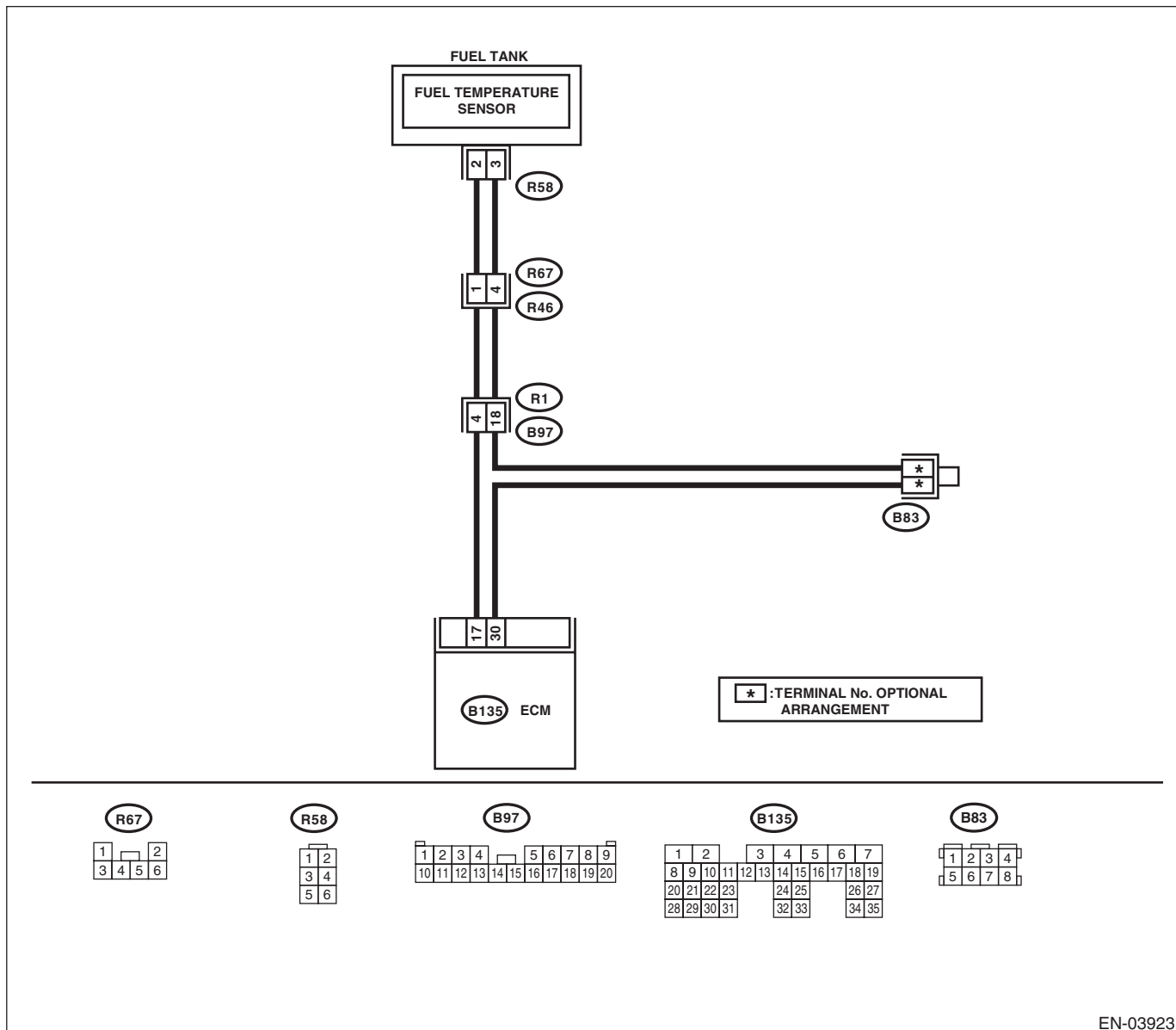
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-86, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03923

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-12, Fuel Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AK:DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT

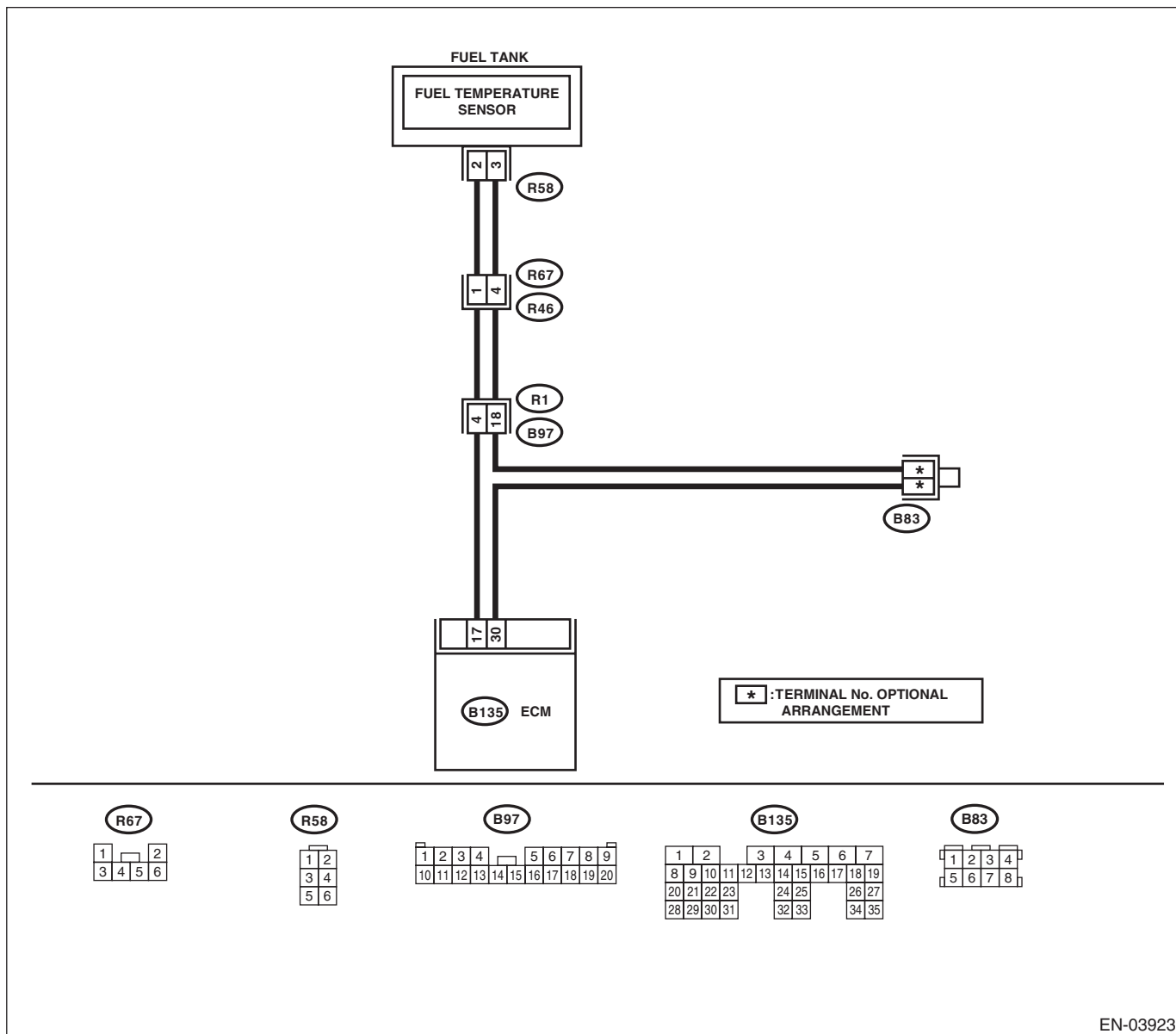
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-89, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.</p> <p>NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p>	Is the temperature 120°C (248°F) or higher?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE: In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and fuel temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 17 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-12, Fuel Temperature Sensor.>	Repair the ground short circuit of harness between ECM and fuel pump.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AL:DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT

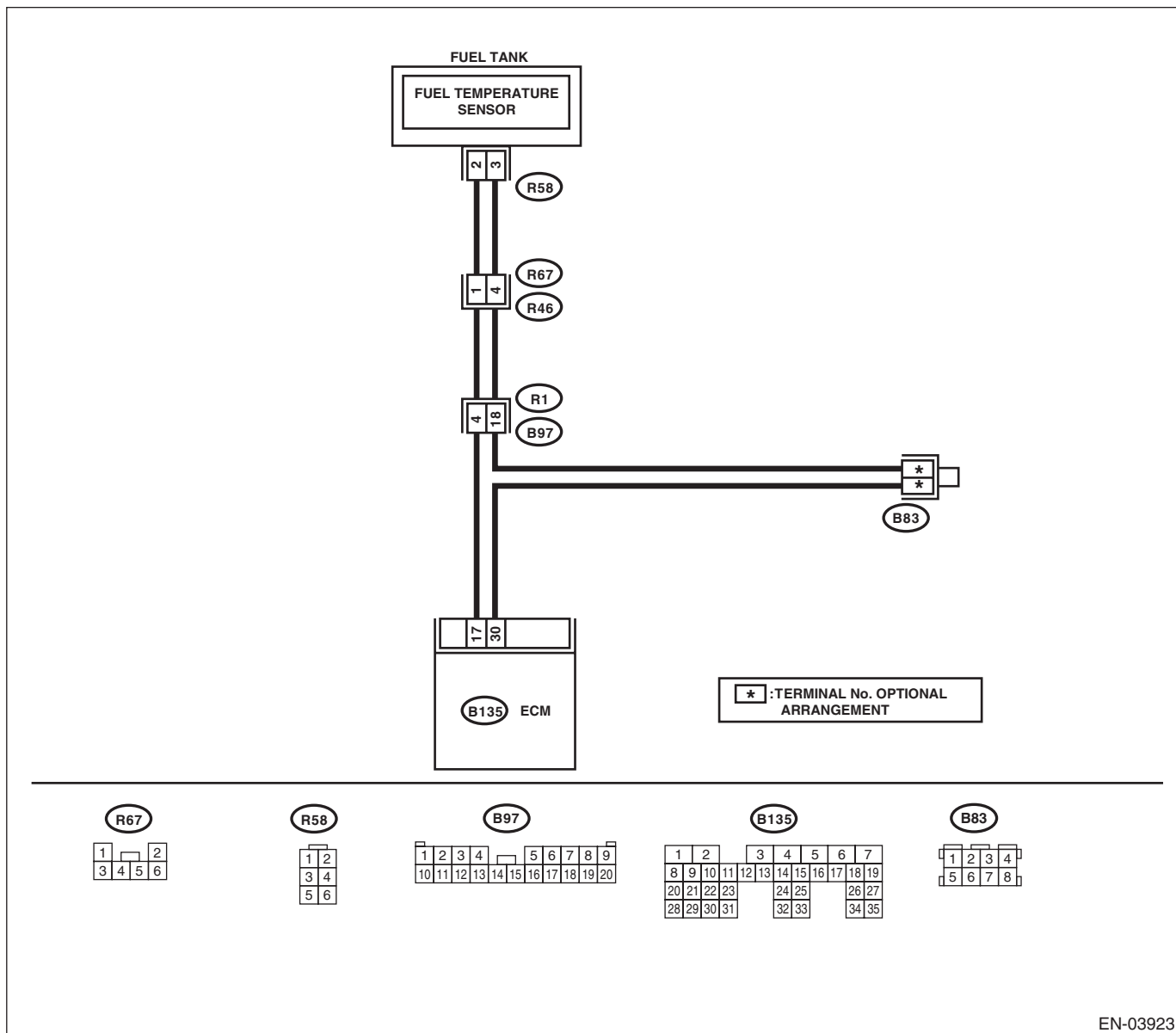
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-91, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03923



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.</p> <p>NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p>	Is the temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ )?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE: In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Repair any poor contact between the ECM and fuel temperature sensor connectors.</p>	Is there poor contact in the ECM or fuel temperature sensor connectors?	Repair any poor contact between the ECM and fuel temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and fuel temperature sensor.</p> <p>3) Measure the resistance of the harness between the ECM and fuel temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> (B135) No. 17 — (R58) No. 2: (B135) No. 30 — (R58) No. 3:</p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and fuel temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON.</p> <p>3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> (B135) No. 17 (+) — Chassis ground (-):</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and fuel temperature sensor connector.	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-12, Fuel Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AM:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-93, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

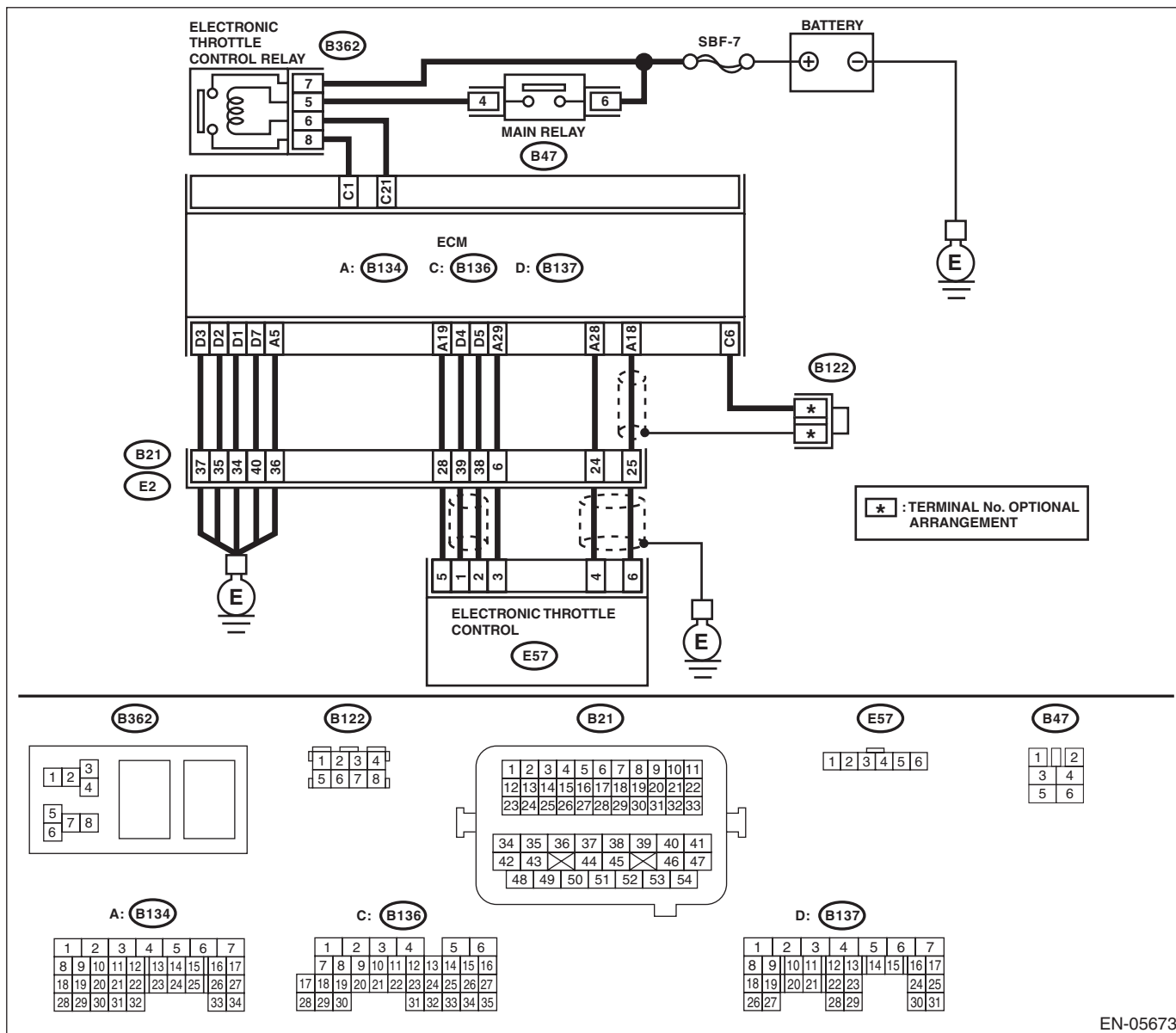
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from ECM and electronic throttle control.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 28 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E57) No. 4 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H4DOTC)-11, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p> <p>Replace the ECM if defective. &lt;Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AN:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-95, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

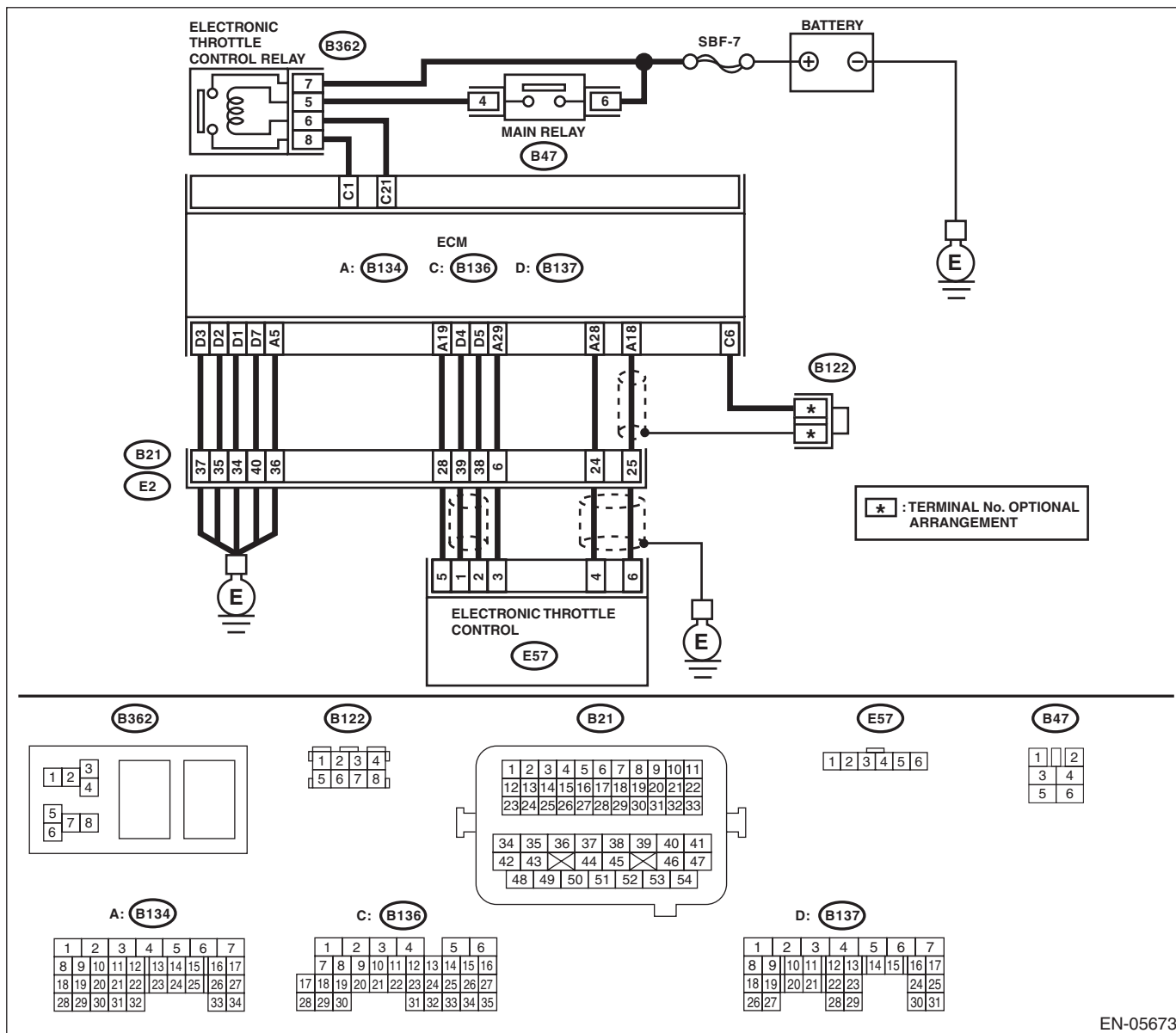
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DOTC)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AO:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

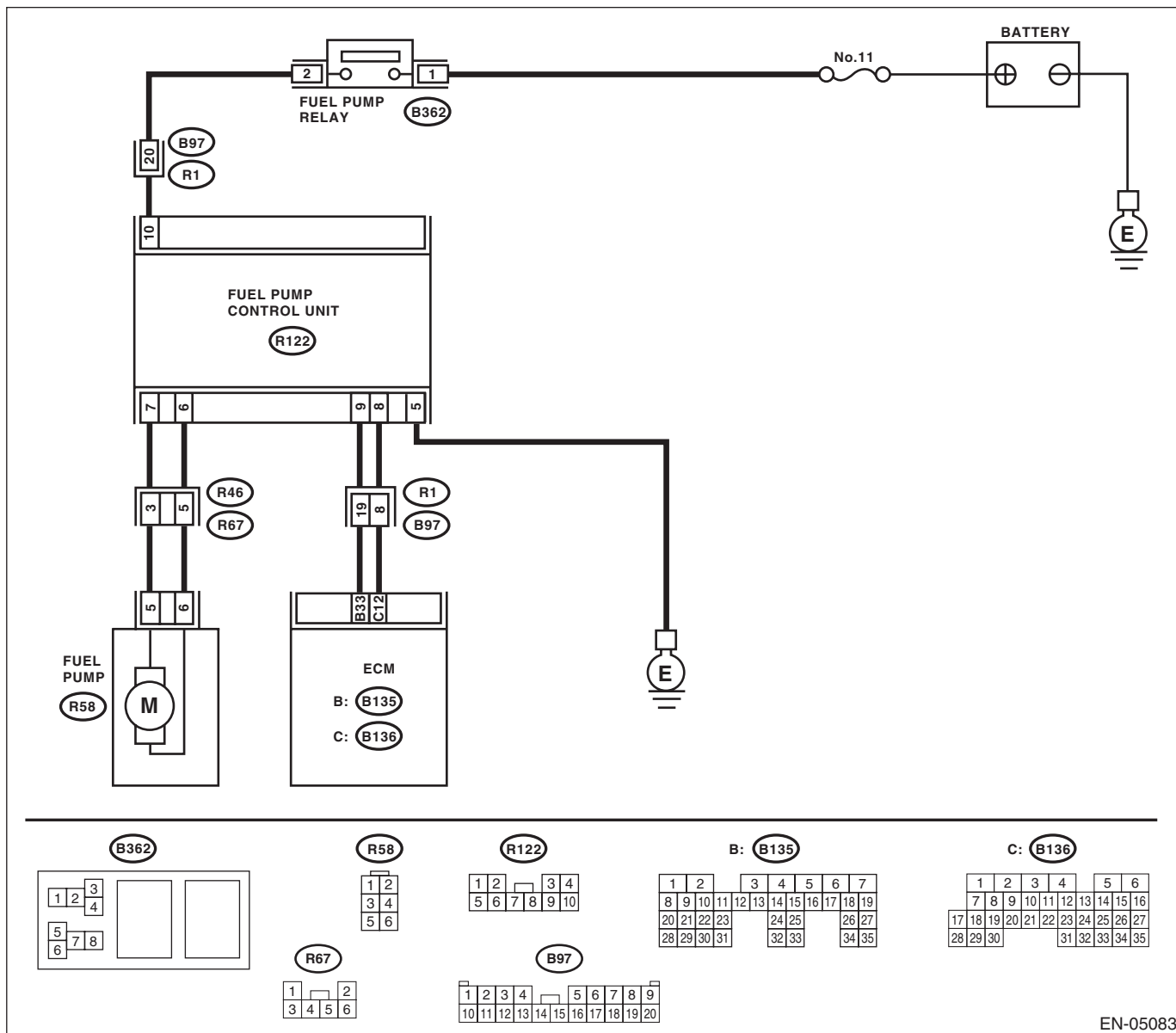
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-97, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05083

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY CIRCUIT TO FUEL PUMP CONTROL UNIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel pump control unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 10 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 2.</p>	<p>Repair the power supply circuit.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open or ground short circuit of harness between fuel pump relay and fuel pump control unit</li> <li>• Poor contact of fuel pump control unit connector</li> <li>• Poor contact of fuel pump relay connector</li> </ul>
<p><b>2</b></p> <p><b>CHECK GROUND CIRCUIT OF FUEL PUMP CONTROL UNIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 5 — Chassis ground:</b></p>	<p>Is the resistance less than 5 <math>\Omega</math>?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit between fuel pump control unit and chassis ground</li> <li>• Poor contact of fuel pump control unit connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.</b></p> <p>1) Disconnect the connector from fuel pump. 2) Measure the resistance of harness between fuel pump control unit and fuel pump connector.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 7 — (R58) No. 5:</b> <b>(R122) No. 6 — (R58) No. 6:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 4.</p>	<p>Repair the open circuit between fuel pump control unit and fuel pump.</p>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.</b></p> <p>Measure the resistance between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 7 — Chassis ground:</b> <b>(R122) No. 6 — Chassis ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Go to step 5.</p>	<p>Repair the ground short circuit of harness between fuel pump control unit and fuel pump.</p>
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Measure the resistance of the harness between the ECM and fuel pump control unit.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 33 — (R122) No. 9:</b> <b>(B136) No. 12 — (R122) No. 8:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 6.</p>	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit between the ECM and fuel pump control unit</li> <li>• Poor contact between ECM and fuel pump control unit</li> </ul>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT.</b> Measure the resistance between fuel pump control unit and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R122) No. 9 — Chassis ground:</b></i> <i><b>(R122) No. 8 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and fuel pump control unit.
<b>7</b> <b>CHECK POOR CONTACT.</b> Check poor contact of ECM and fuel pump control unit connector.	Is there poor contact of ECM and fuel pump control unit connector?	Repair the poor contact of ECM and fuel pump control unit connector.	Go to step 8.
<b>8</b> <b>CHECK EXPERIENCE OF RUNNING OUT OF FUEL.</b>	Has the vehicle experienced running out of fuel?	Finish the diagnosis. NOTE: DTC may be recorded as a result of fuel pump idling while running out of fuel.	Replace the fuel pump control unit. <Ref. to FU(H4DOTC)-49, Fuel Pump Control Unit.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AP:DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" RANGE/PERFORMANCE

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-99, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

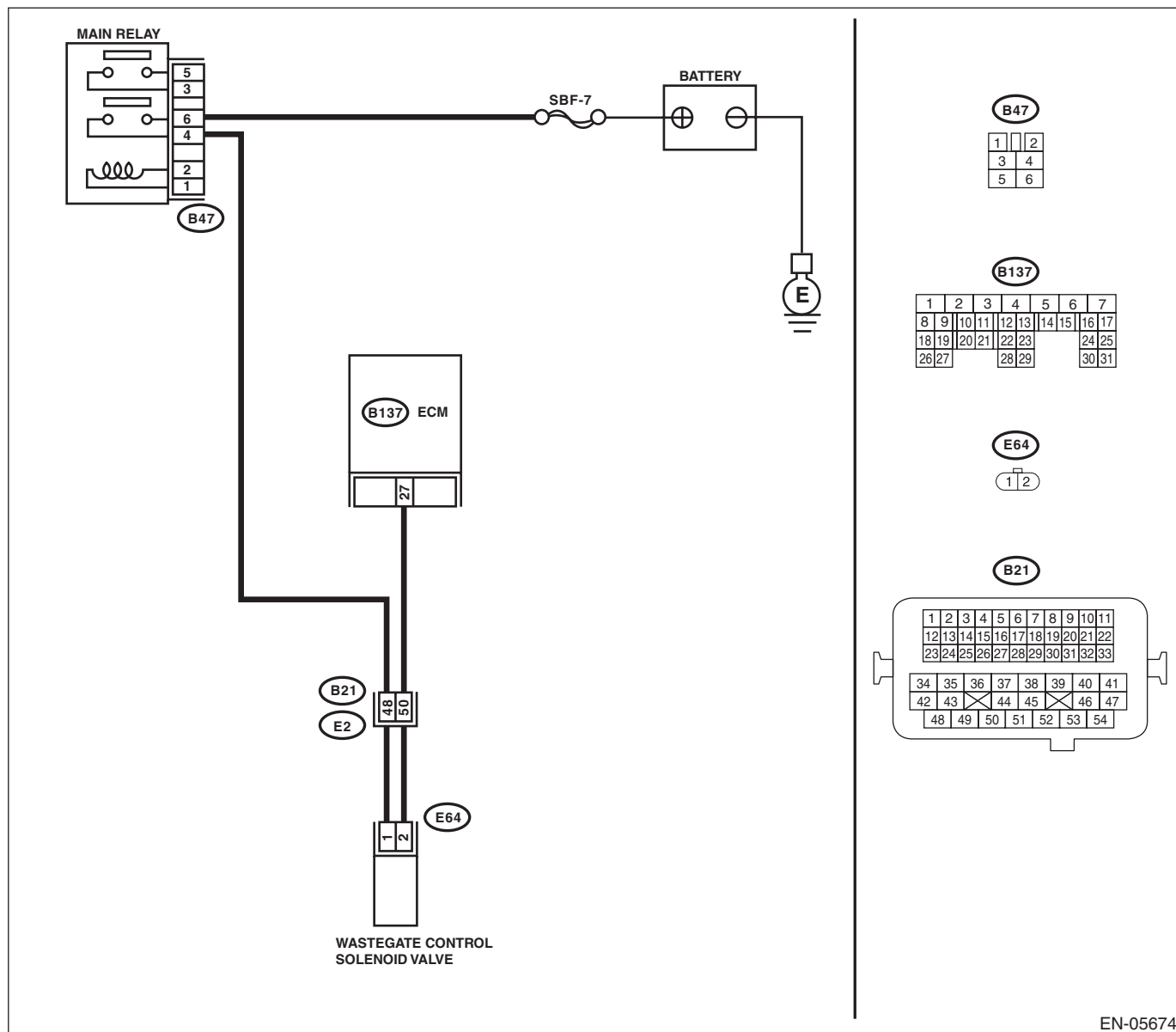
### TROUBLE SYMPTOM:

Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05674

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-39, Wastegate Control Solenoid Valve.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AQ:DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-101, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

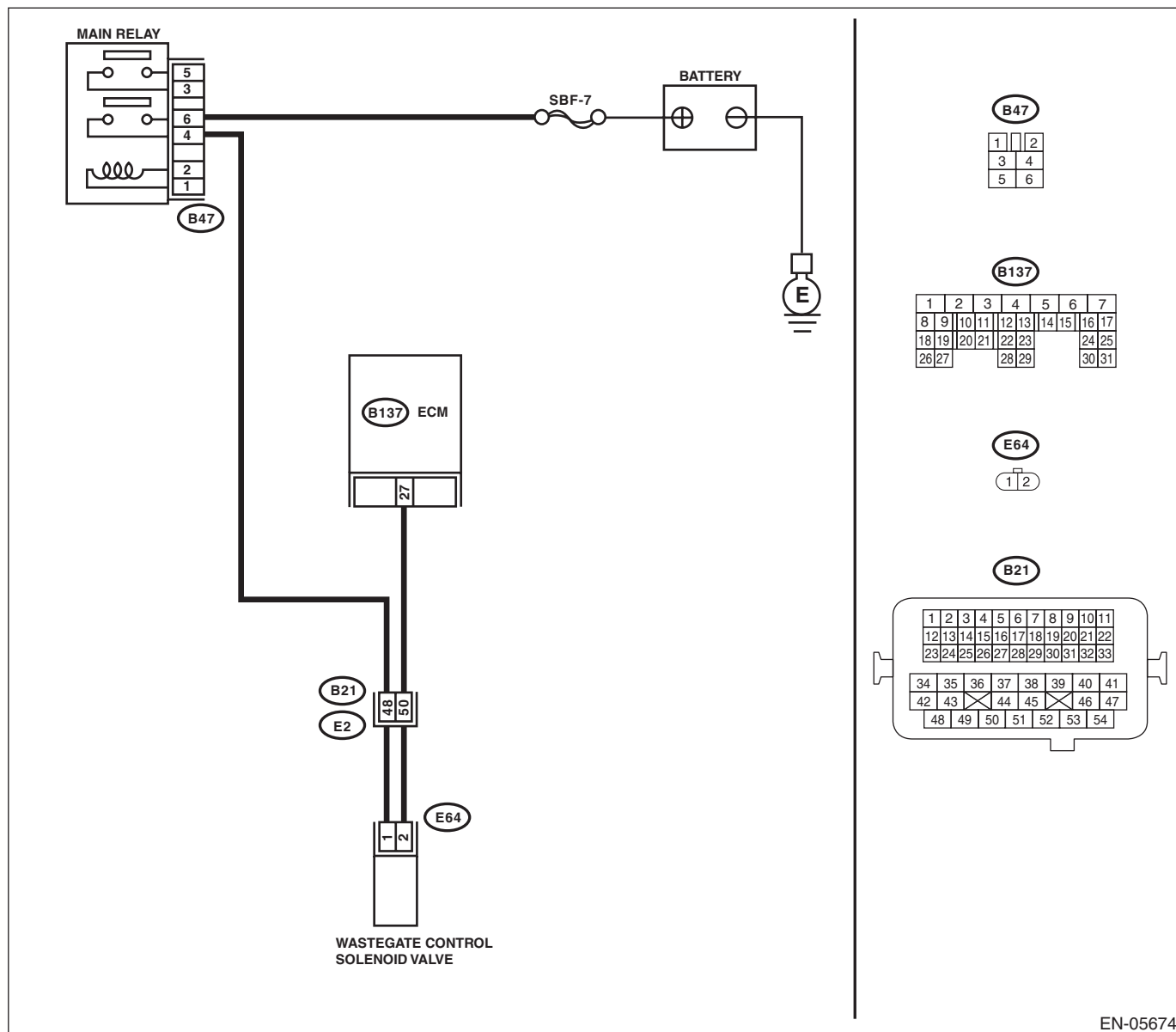
### TROUBLE SYMPTOM:

Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05674

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B137) No. 27 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and wastegate control solenoid valve. 3) Measure the resistance between wastegate control solenoid valve connector and engine ground. <i><b>Connector &amp; terminal</b></i> <i><b>(E64) No. 2 — Engine ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair ground short circuit of harness between ECM and wastegate control solenoid valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and wastegate control solenoid valve connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B137) No. 27 — (E64) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and wastegate control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK WASTEGATE CONTROL SOLENOID VALVE.</b> 1) Remove the wastegate control solenoid valve. 2) Measure the resistance between wastegate control solenoid valve terminals. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-39, Wastegate Control Solenoid Valve.>
<b>5 CHECK POWER SUPPLY TO WASTEGATE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between wastegate control solenoid valve and engine ground. <i><b>Connector &amp; terminal</b></i> <i><b>(E64) No. 1 (+) — Engine ground (-):</b></i>	Is the voltage 10 V or more?	Repair poor contact in wastegate control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and wastegate control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AR:DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-103, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

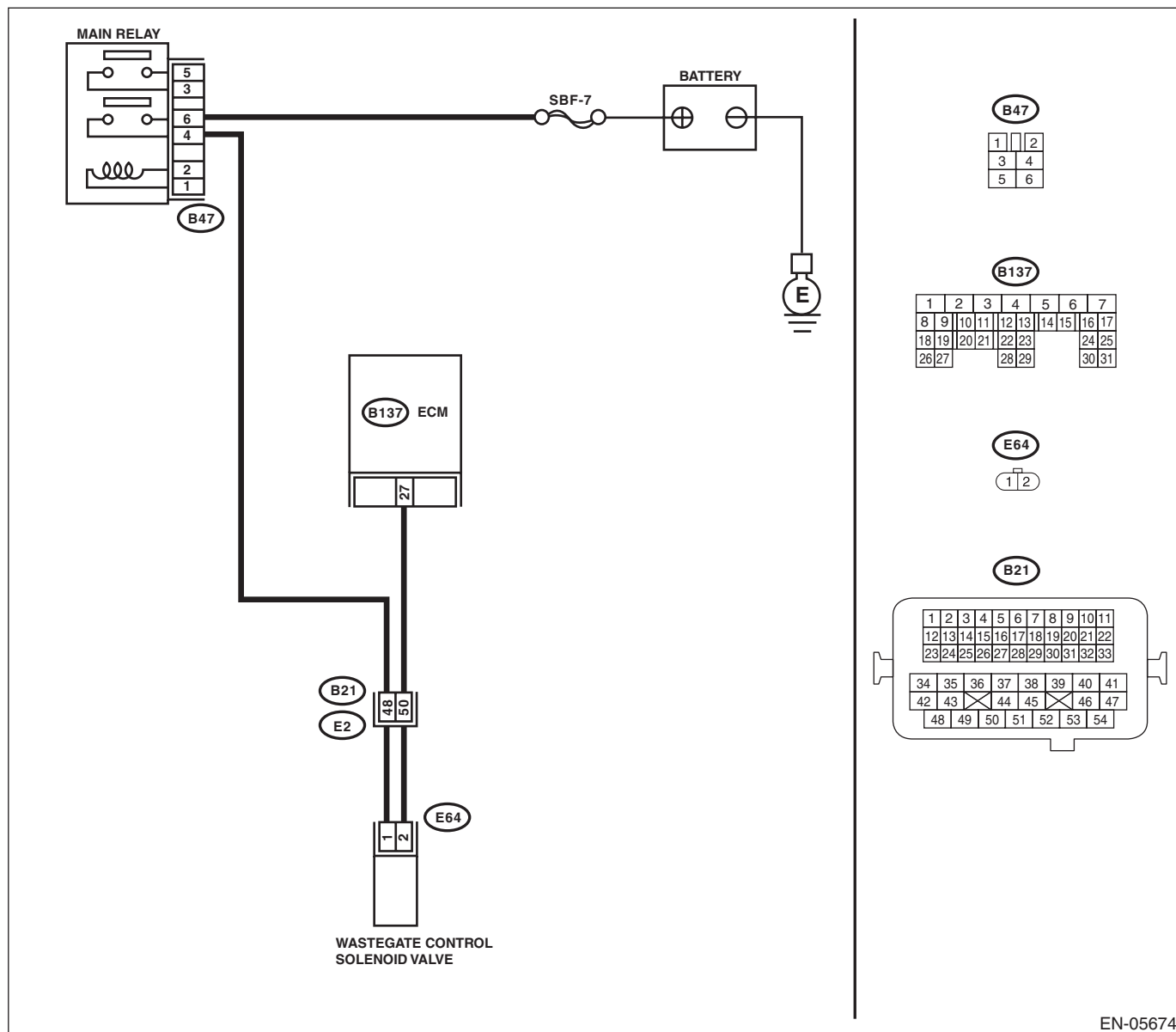
### TROUBLE SYMPTOM:

Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05674

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and wastegate control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 27 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair short circuit to power in the harness between ECM and wastegate control solenoid valve connector.	Go to step 2.
2	<b>CHECK WASTEGATE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between wastegate control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-39, Wastegate Control Solenoid Valve.>	Repair the poor contact of the ECM connector.

## AS:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-173, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AT:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-173, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AU:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-173, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## AV:DTC P0304 CYLINDER 4 MISFIRE DETECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-111, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

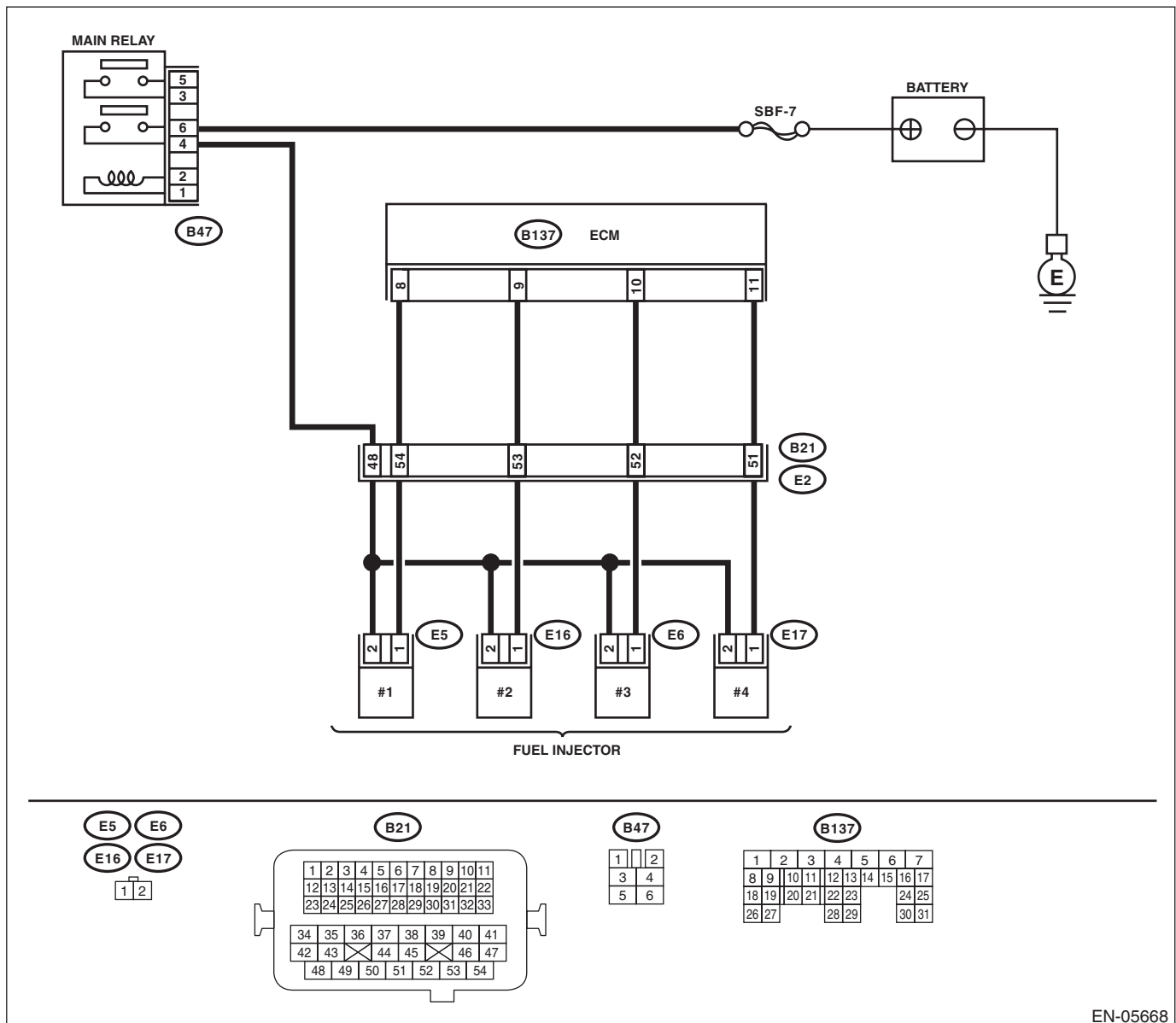
### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling
- Rough driving

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (B137) No. 8 (+) — Chassis ground (-):</i> <i>#2 (B137) No. 9 (+) — Chassis ground (-):</i> <i>#3 (B137) No. 10 (+) — Chassis ground (-):</i> <i>#4 (B137) No. 11 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 6.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (E5) No. 1 — Engine ground:</i> <i>#2 (E16) No. 1 — Engine ground:</i> <i>#3 (E6) No. 1 — Engine ground:</i> <i>#4 (E17) No. 1 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and fuel injector.
<b>3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> Measure the resistance of harness between the ECM and fuel injector on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (B137) No. 8 — (E5) No. 1:</i> <i>#2 (B137) No. 9 — (E16) No. 1:</i> <i>#3 (B137) No. 10 — (E6) No. 1:</i> <i>#4 (B137) No. 11 — (E17) No. 1:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK FUEL INJECTOR.</b> Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <i>No. 1 — No. 2:</i>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 5.	Replace the faulty fuel injector. <Ref. to FU(H4DOTC)-32, Fuel Injector.>
<b>5 CHECK POWER SUPPLY LINE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (E5) No. 2 (+) — Engine ground (-):</i> <i>#2 (E16) No. 2 (+) — Engine ground (-):</i> <i>#3 (E6) No. 2 (+) — Engine ground (-):</i> <i>#4 (E17) No. 2 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and fuel injector connector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 (+) — Chassis ground (-):</b> <b>#2 (B137) No. 9 (+) — Chassis ground (-):</b> <b>#3 (B137) No. 10 (+) — Chassis ground (-):</b> <b>#4 (B137) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 7.
<b>7 CHECK FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H4DOTC)-32, Fuel Injector.>	Go to step 8.
<b>8 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 9.
<b>9 CHECK CRANK SPROCKET.</b> Remove the timing belt cover.	Is the crank sprocket rusted or does it have damaged teeth?	Replace the crank sprocket. <Ref. to ME(H4DOTC)-52, Crank Sprocket.>	Go to step 10.
<b>10 CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block.	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4DOTC)-42, Timing Belt.>	Go to step 11.
<b>11 CHECK FUEL LEVEL.</b>	Is the fuel meter indication higher than the "Lower" level?	Go to step 12.	Replenish fuel so that fuel meter indication is higher than the "Lower" level. After refueling, Go to step 12.
<b>12 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.> 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step 14.	Go to step 13.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
13	<b>CHECK CAUSE OF MISFIRE.</b>	Was the cause of misfire identified when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact in ECM connector • Poor contact of coupling connector
14	<b>CHECK AIR INTAKE SYSTEM.</b>	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step 15.
15	<b>CHECK MISFIRE SYMPTOM.</b> 1) Turn the ignition switch to ON. 2) Read the DTC. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step 20.	Go to step 16.
16	<b>CHECK DTC.</b>	Are DTCs P0301 and P0302 displayed on the Subaru Select Monitor or general scan tool?	Go to step 21.	Go to step 17.
17	<b>CHECK DTC.</b>	Are DTCs P0303 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step 22.	Go to step 18.
18	<b>CHECK DTC.</b>	Are DTCs P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step 23.	Go to step 19.
19	<b>CHECK DTC.</b>	Are DTCs P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step 24.	Go to step 25.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>20</b> <b>ONLY ONE CYLINDER.</b>	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Spark plug cord</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
<b>21</b> <b>GROUP OF #1 AND #2 CYLINDERS.</b>	Are there any faults in #1 and #2 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4DOTC)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
<b>22</b> <b>GROUP OF #3 AND #4 CYLINDERS.</b>	Are there any faults in #3 and #4 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4DOTC)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
23	<b>GROUP OF #1 AND #3 CYLINDERS.</b>	Are there any faults in #1 and #3 cylinders?  Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing belt teeth</li> </ul>	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	<b>GROUP OF #2 AND #4 CYLINDERS.</b>	Are there any faults in #2 and #4 cylinders?  Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing belt teeth</li> </ul>	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	<b>CYLINDER AT RANDOM.</b>	Is the engine idle rough?  Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-150, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AW:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-112, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

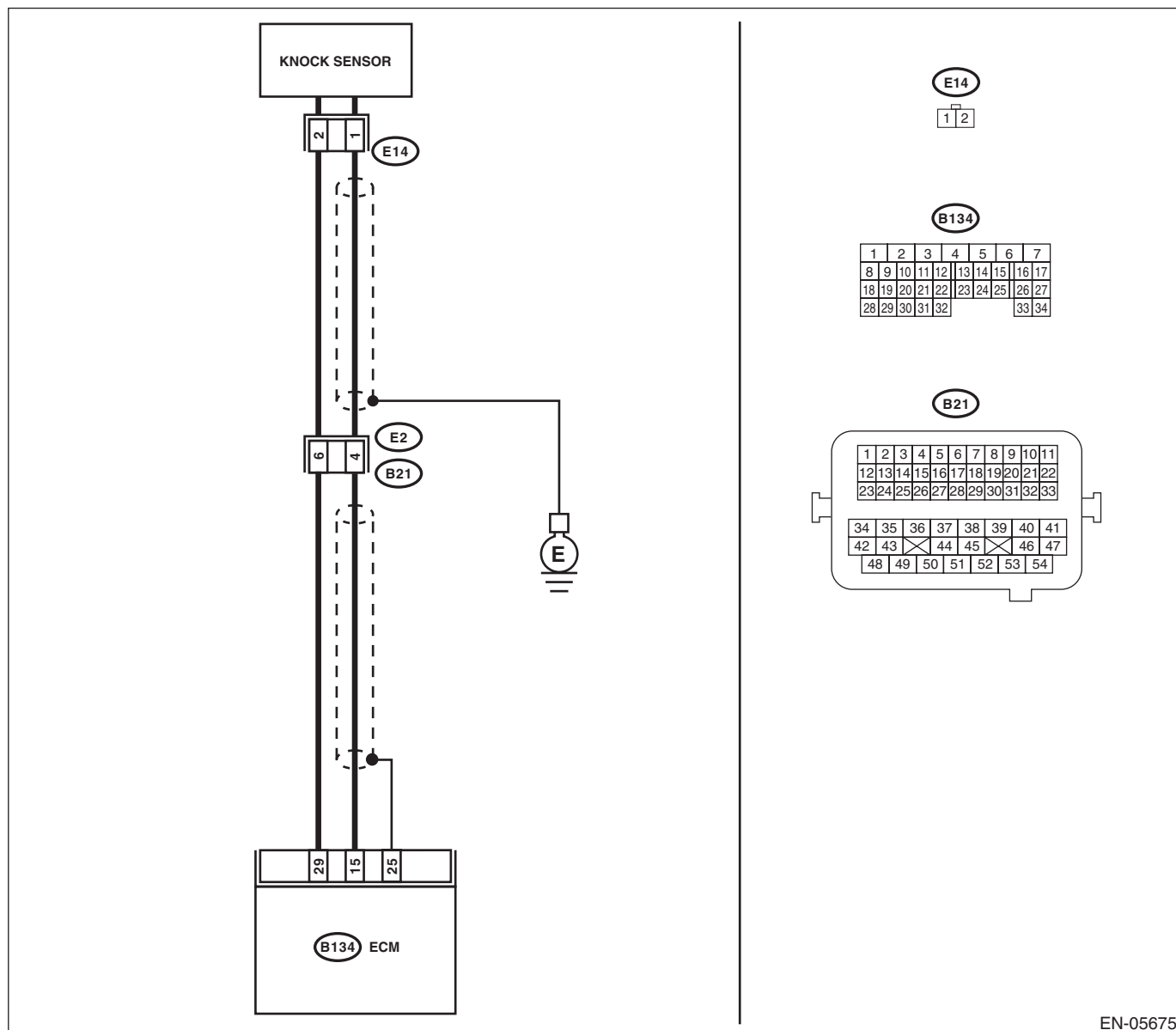
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05675

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 15 — (B134) No. 29:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair poor contact of the ECM connector.</p>
2	<p><b>CHECK KNOCK SENSOR.</b></p> <p>1) Disconnect the connector from knock sensor.</p> <p>2) Measure the resistance between knock sensor terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H4DOTC)-28, Knock Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and knock sensor</li> <li>• Poor contact of knock sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AX:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-114, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

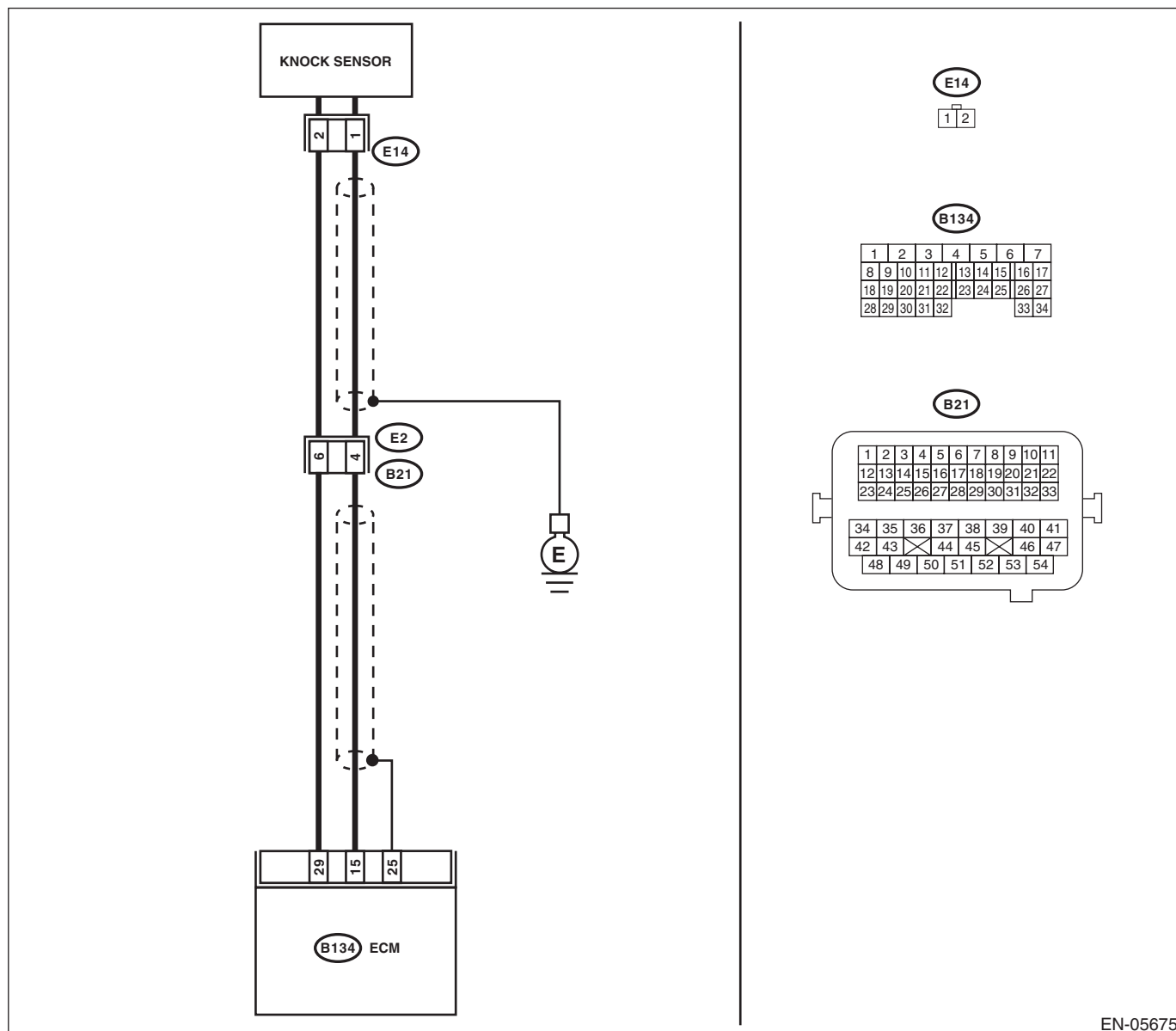
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05675

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 15 — (B134) No. 29:</b></i>	Is the resistance less than 500 kΩ?	Go to step 2.	Go to step 3.
<b>2 CHECK KNOCK SENSOR.</b> 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connectors. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance less than 500 kΩ?	Replace the knock sensor. <Ref. to FU(H4DOTC)-28, Knock Sensor.>	Repair the ground short circuit of harness between the ECM and knock sensor connector.  NOTE: The harness between both connectors are shielded. Remove the shield and repair the short circuit of the harness circuit.
<b>3 CHECK INPUT SIGNAL OF ECM.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 15 (+) — Chassis ground (-):</b></i>	Is the voltage 2 V or more?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.	Repair poor contact of the ECM connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AY:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-116, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

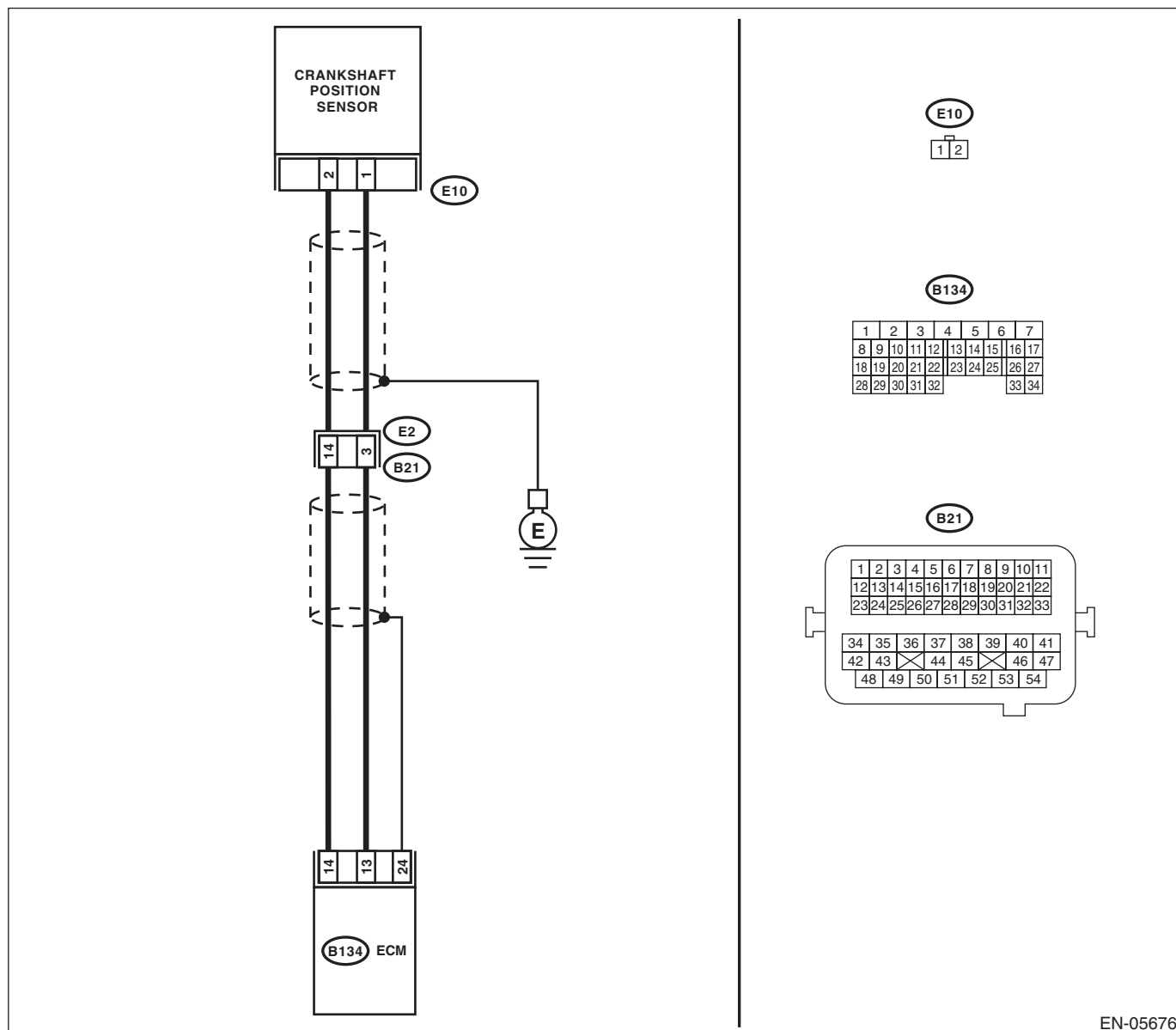
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05676

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.</b>	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.	Tighten the crankshaft position sensor installation bolt securely.
<b>2</b> <b>CHECK CRANKSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the crankshaft position sensor. 3) Measure the resistance between connector terminals of crankshaft position sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 1 — 4 k $\Omega$ ?	Go to step 3.	Replace the crankshaft position sensor. <Ref. to FU(H4DOTC)-26, Crankshaft Position Sensor.>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND CRANK SHAFT POSITION SENSOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between the ECM and crankshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 13 — (E10) No. 1:</b> <b>(B134) No. 14 — (E10) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM and crankshaft position sensor connector.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and crankshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

## AZ:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE /PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-118, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

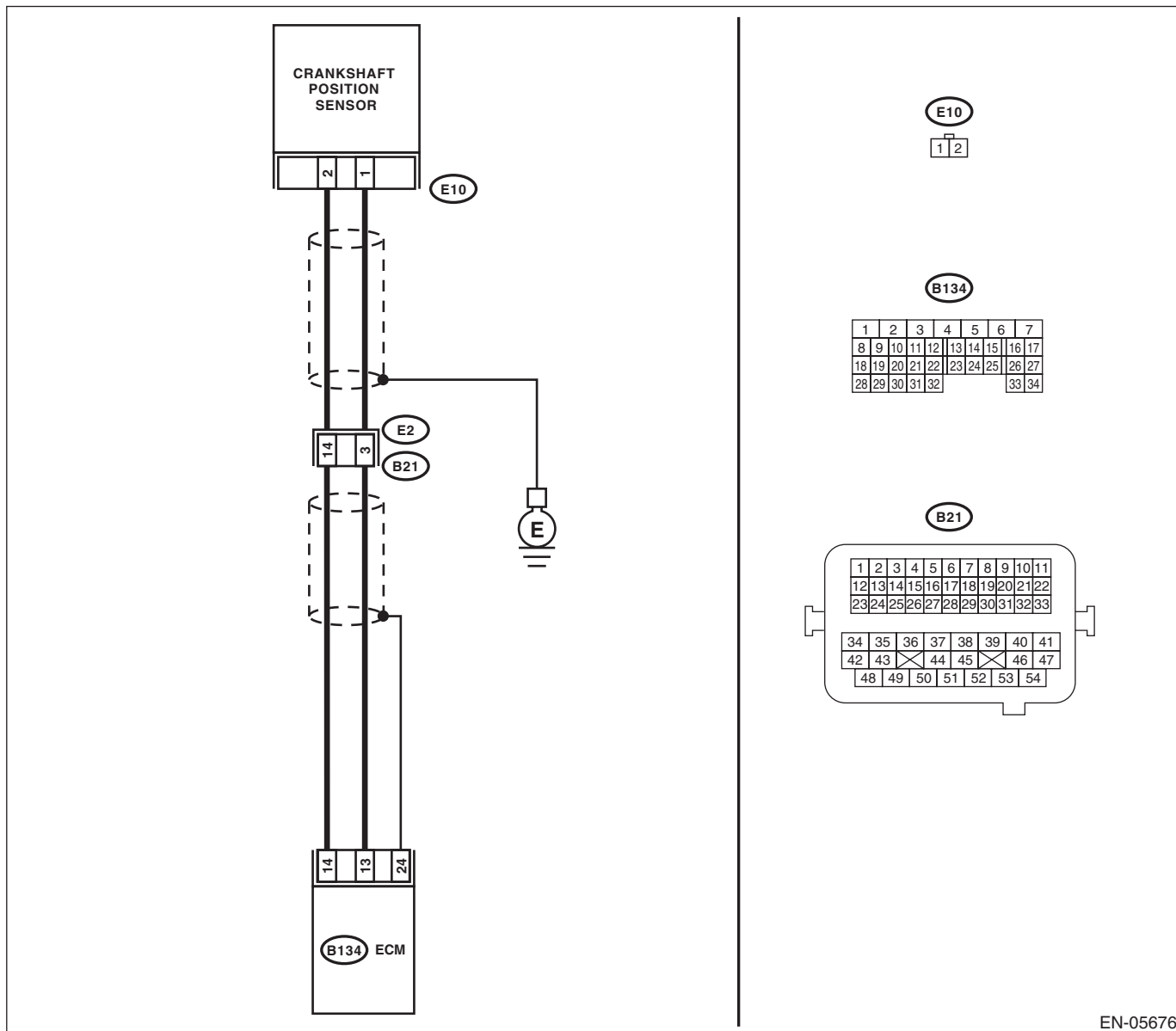
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05676

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.</b> Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.	Tighten the crankshaft position sensor installation bolt securely.
<b>2</b>	<b>CHECK CRANK SPROCKET.</b> Remove the timing belt cover.	Are crank sprocket teeth cracked or damaged?	Replace the crank sprocket. <Ref. to ME(H4DOTC)-52, Crank Sprocket.>	Go to step 3.
<b>3</b>	<b>CHECK INSTALLATION CONDITION OF TIMING BELT.</b> Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block.	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4DOTC)-42, Timing Belt.>	Replace the crankshaft position sensor. <Ref. to FU(H4DOTC)-26, Crankshaft Position Sensor.>

## BA:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-120, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

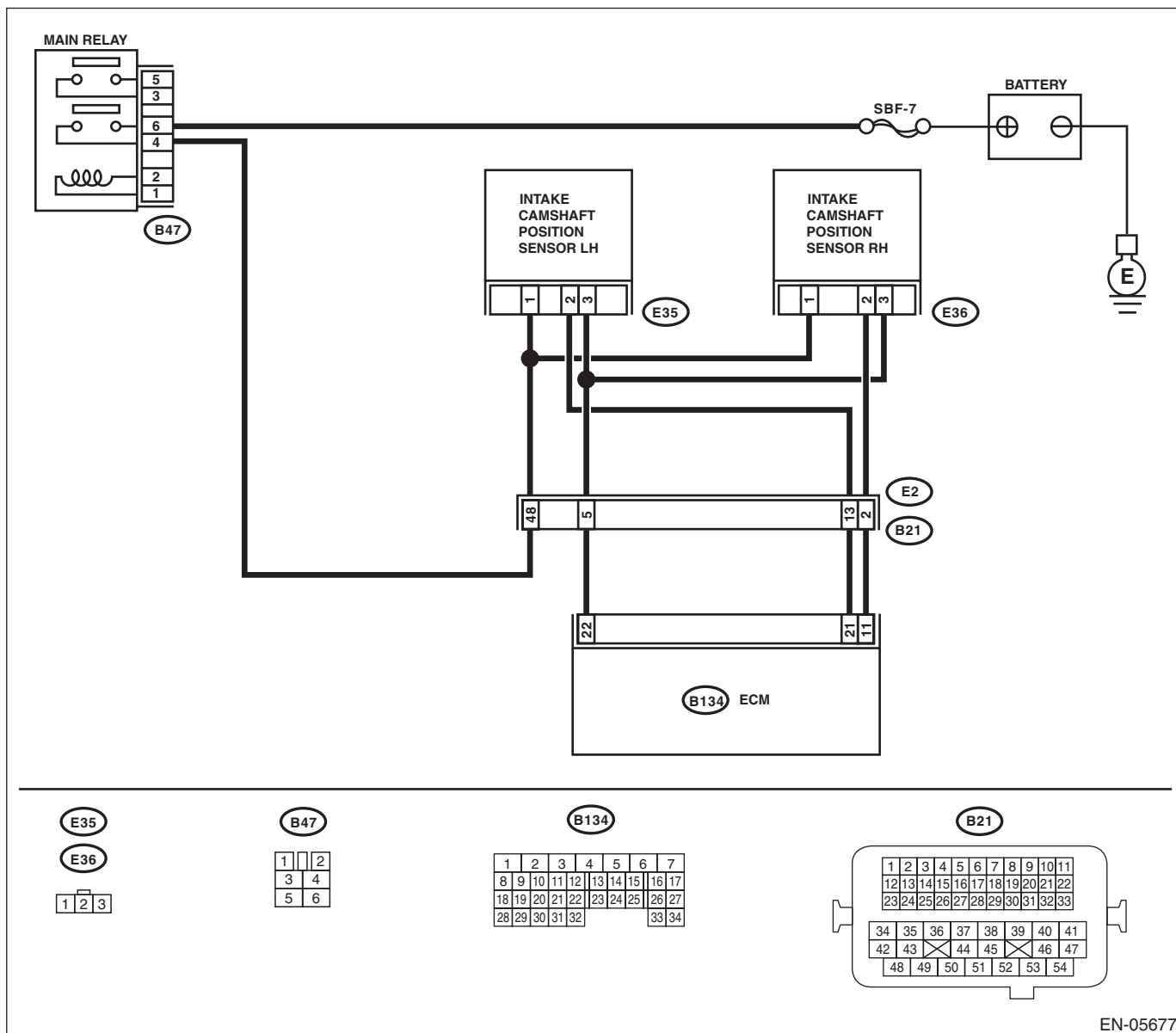
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05677

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E36) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the open or ground short circuit of harness between main relay connector and camshaft position sensor connector.
<b>2 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between the ECM and camshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 11 — (E36) No. 2:</b> <b>(B134) No. 22 — (E36) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between the ECM and camshaft position sensor.
<b>3 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the resistance between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E36) No. 2 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit to ground of harness between the ECM and camshaft position sensor.
<b>4 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E36) No. 2 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and camshaft position sensor.	Go to step 5.
<b>5 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 6.	Tighten the camshaft position sensor installation bolt securely.
<b>6 CHECK CAMSHAFT POSITION SENSOR.</b> Check waveform of camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-17, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-27, Camshaft Position Sensor.>	Repair the following item. <ul style="list-style-type: none"> <li>• Poor contact in ECM connector</li> <li>• Poor contact of camshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BB:DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-122, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

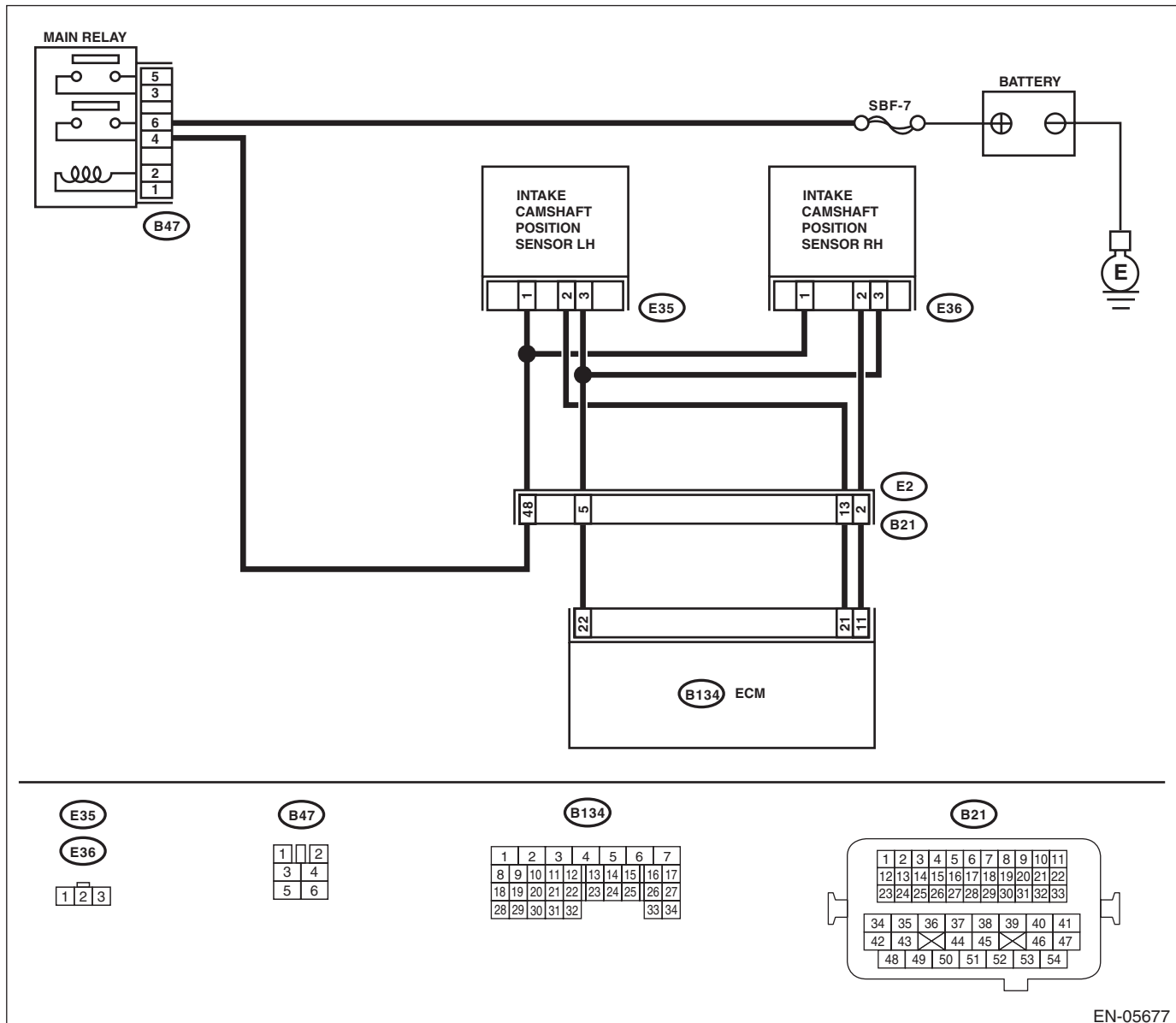
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05677

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E35) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the open or ground short circuit of harness between main relay connector and camshaft position sensor connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between the ECM and camshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 21 — (E35) No. 2:</b> <b>(B134) No. 22 — (E35) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between the ECM and camshaft position sensor.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the resistance between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E35) No. 2 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit to ground of harness between the ECM and camshaft position sensor.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E35) No. 2 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and camshaft position sensor.	Go to step 5.
<b>5</b> <b>CHECK CONDITION OF CAMSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 6.	Tighten the camshaft position sensor installation bolt securely.
<b>6</b> <b>CHECK CAMSHAFT POSITION SENSOR.</b> Check waveform of camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-17, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-27, Camshaft Position Sensor.>	Repair the following item. <ul style="list-style-type: none"> <li>• Poor contact in ECM connector</li> <li>• Poor contact of camshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>



## **BC:DTC P0410 SECONDARY AIR INJECTION SYSTEM**

### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

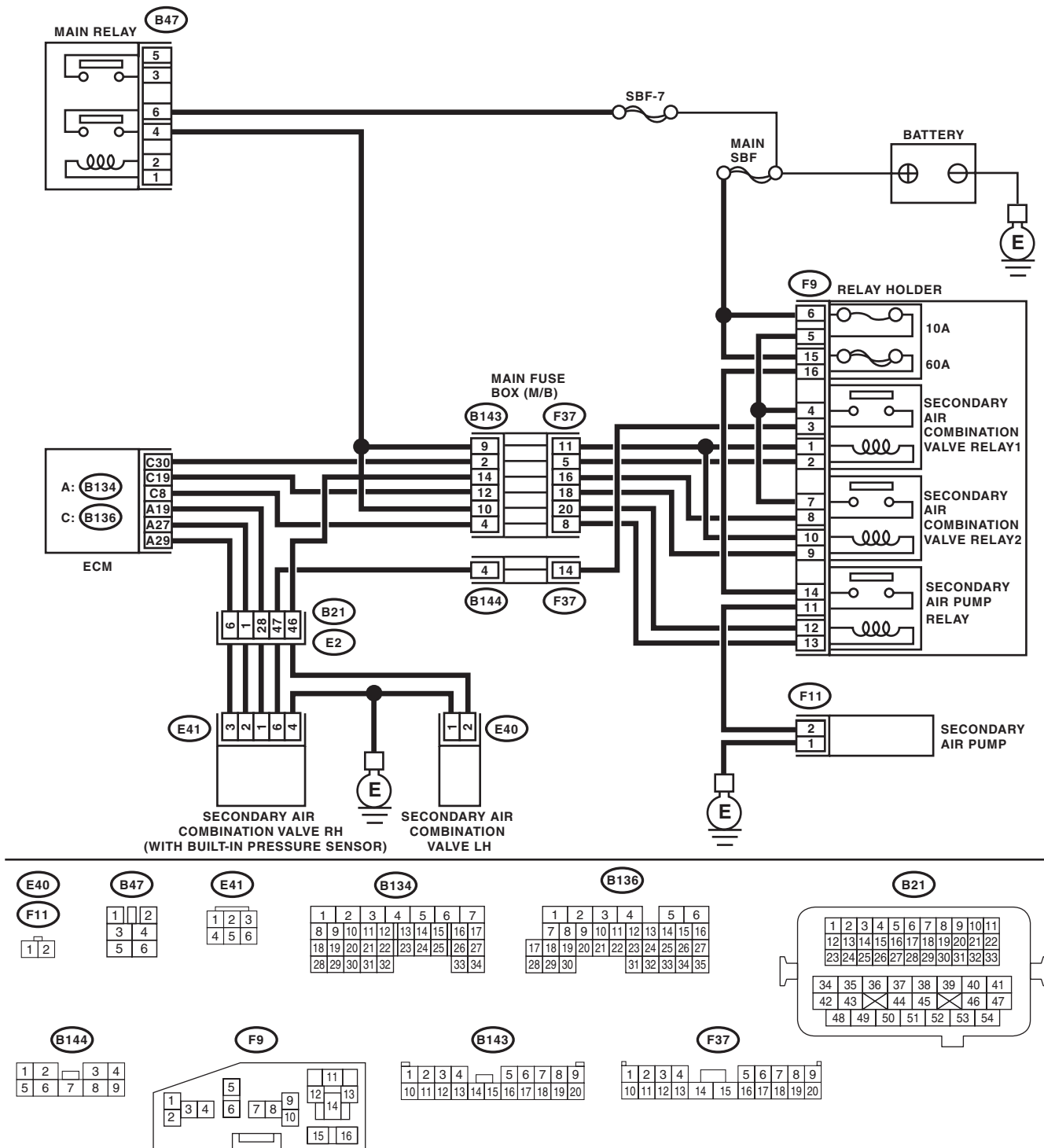
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK SECONDARY AIR PUMP FUSE.</b> Check if the secondary air pump fuse (60 A) is blown out.	Is the fuse blown out?	Go to step 2.	Go to step 3.
2	<b>CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR PUMP.</b> 1) Remove the secondary air pump fuse from the fuse box. 2) Disconnect the secondary air pump connector. 3) Measure the resistance between the secondary air pump fuse and secondary air pump connector, and chassis ground. <b>Connector &amp; terminal</b> <b>(F9) No. 16 — Chassis ground:</b> <b>(F11) No. 2 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air pump connector. Go to step 3.	Repair ground short of the harness between the fuse box and the secondary air pump.
3	<b>CHECK SECONDARY AIR PUMP OPERATION.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the Clear Memory Mode. 4) Perform operation check for the secondary air pump using the Subaru Select Monitor. NOTE: • Subaru Select Monitor Refer to “Clear Memory Mode” <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.> and “Compulsory Valve Operation Check Mode” <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.> for more operation procedures. • The compulsory operation using the Subaru Select Monitor is performed only for 5 seconds in order to protect the secondary air pump. When operating again, perform the Clear Memory Mode.	Does the secondary air pump operate?	Go to step 4.	Go to step 5.
4	<b>CHECK DUCT BETWEEN SECONDARY AIR PUMP AND COMBINATION VALVE.</b> Check the duct between the secondary air pump and combination valve.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Replace the secondary air combination valve LH. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.>
5	<b>CHECK POWER SUPPLY TO SECONDARY AIR PUMP.</b> 1) Perform the Clear Memory Mode. 2) Turn the ignition switch to OFF. 3) Disconnect the secondary air pump connector. 4) In the condition of step 3, measure the voltage between the secondary air pump connector and the chassis ground. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.> <b>Connector &amp; terminal</b> <b>(F11) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Replace the secondary air pump. <Ref. to EC(H4DOTC)-20, Secondary Air Pump.>	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6 CHECK HARNESS BETWEEN SECONDARY AIR PUMP RELAY AND SECONDARY AIR PUMP CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the secondary air pump relay. 3) Measure the resistance of harness between secondary air pump relay and secondary air pump connector. <i><b>Connector &amp; terminal</b></i> <i><b>(F9) No. 11 — (F11) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 7.	Repair the open circuit of harness between secondary air pump relay and secondary air pump connector.
<b>7 CHECK HARNESS BETWEEN SECONDARY AIR PUMP CONNECTOR AND CHASSIS GROUND.</b> Measure the resistance of the harness between secondary air pump connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(F11) No. 1 — Chassis ground:</b></i>	Is the resistance less than 5 $\Omega$ ?	Go to step 8.	Repair the open circuit of the harness between secondary air pump connector and chassis ground.
<b>8 CHECK SECONDARY AIR PUMP RELAY.</b> 1) Connect the battery to terminals No. 12 and No. 13 of the secondary air pump relay. 2) Measure the resistance between secondary air pump relay terminals. <i><b>Terminals</b></i> <i><b>No. 14 — No. 11:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Replace the secondary air pump relay. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>9 CHECK SECONDARY AIR PUMP RELAY POWER SOURCE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air pump relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(F9) No. 14 (+) — Chassis ground (-):</b></i> <i><b>(F9) No. 12 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 10.	Repair the open or ground short circuit of power supply circuit.
<b>10 CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector of ECM. 3) Measure the resistance of harness between ECM and secondary air pump relay connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 8 — (F9) No. 13:</b></i>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the open circuit of harness between ECM and secondary air pump relay connector.

## **BD:DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED**

### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-132, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

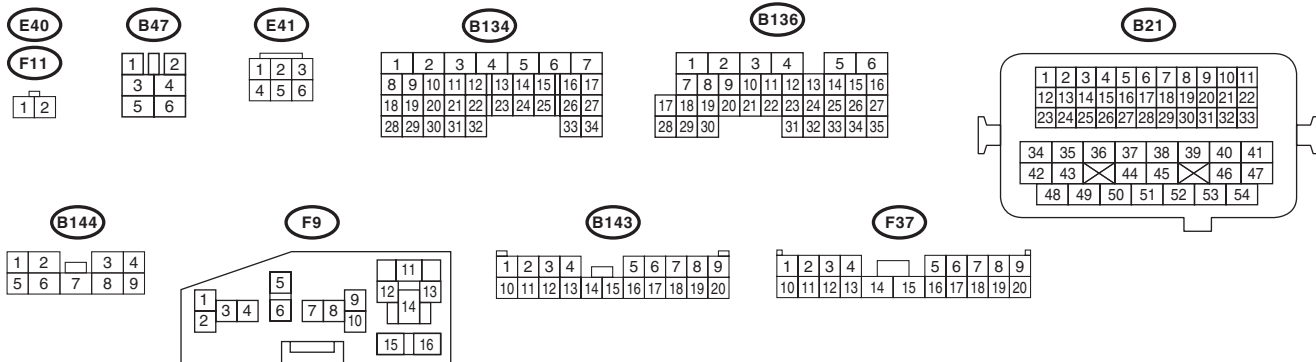
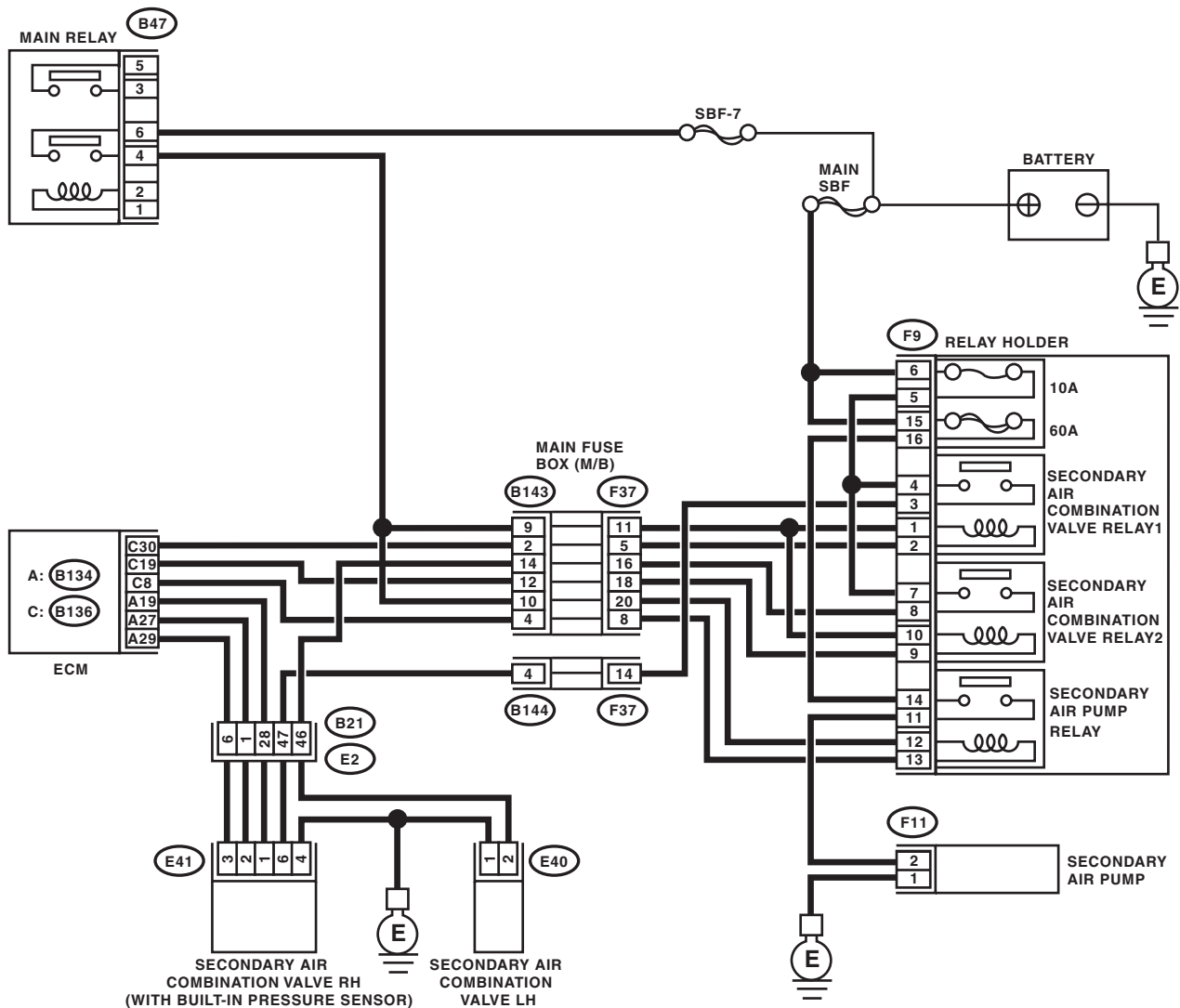
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK SECONDARY AIR COMBINATION VALVE.</b> Inspection of the pipe between the secondary air combination valve and cylinder head.	Is there damage or disconnection of the pipe?	Replace the pipe between secondary air combination valve and cylinder head.	Go to step 2.
<b>2</b> <b>CHECK SECONDARY AIR COMBINATION VALVE.</b> Race the engine at 2,000 rpm to check whether or not the exhaust leak is heard.	Is there any exhaust leak?	Replace the pipe between secondary air combination valve and cylinder head.	Repair the poor contact of the ECM connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **BE:DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-133, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **CAUTION:**

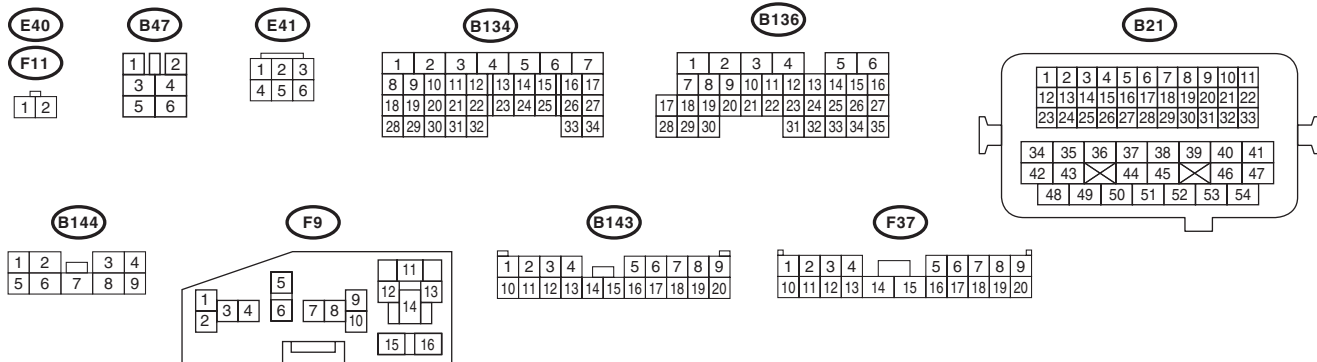
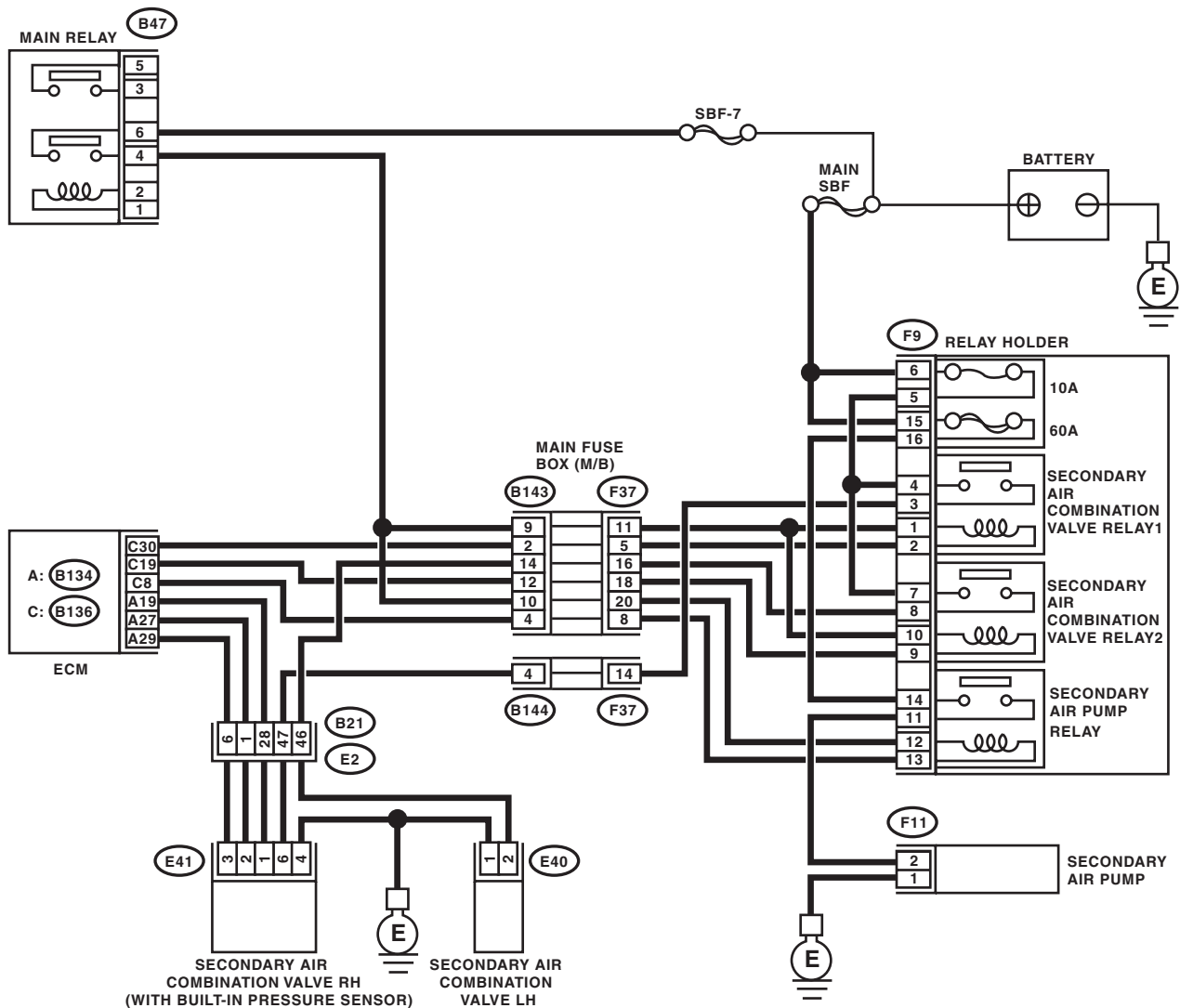
**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and secondary air combination valve relay 1.                      3) Measure the resistance of harness between ECM and secondary air combination valve relay 1.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 30 — (F9) No. 2:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and secondary air combination valve relay 1.
2	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 30 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p><b>NOTE:</b>                      In this case, there may be a temporary connector contact failure.</p>	Repair the ground short circuit of harness between ECM and secondary air combination valve relay 1.

## **BF:DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-134, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

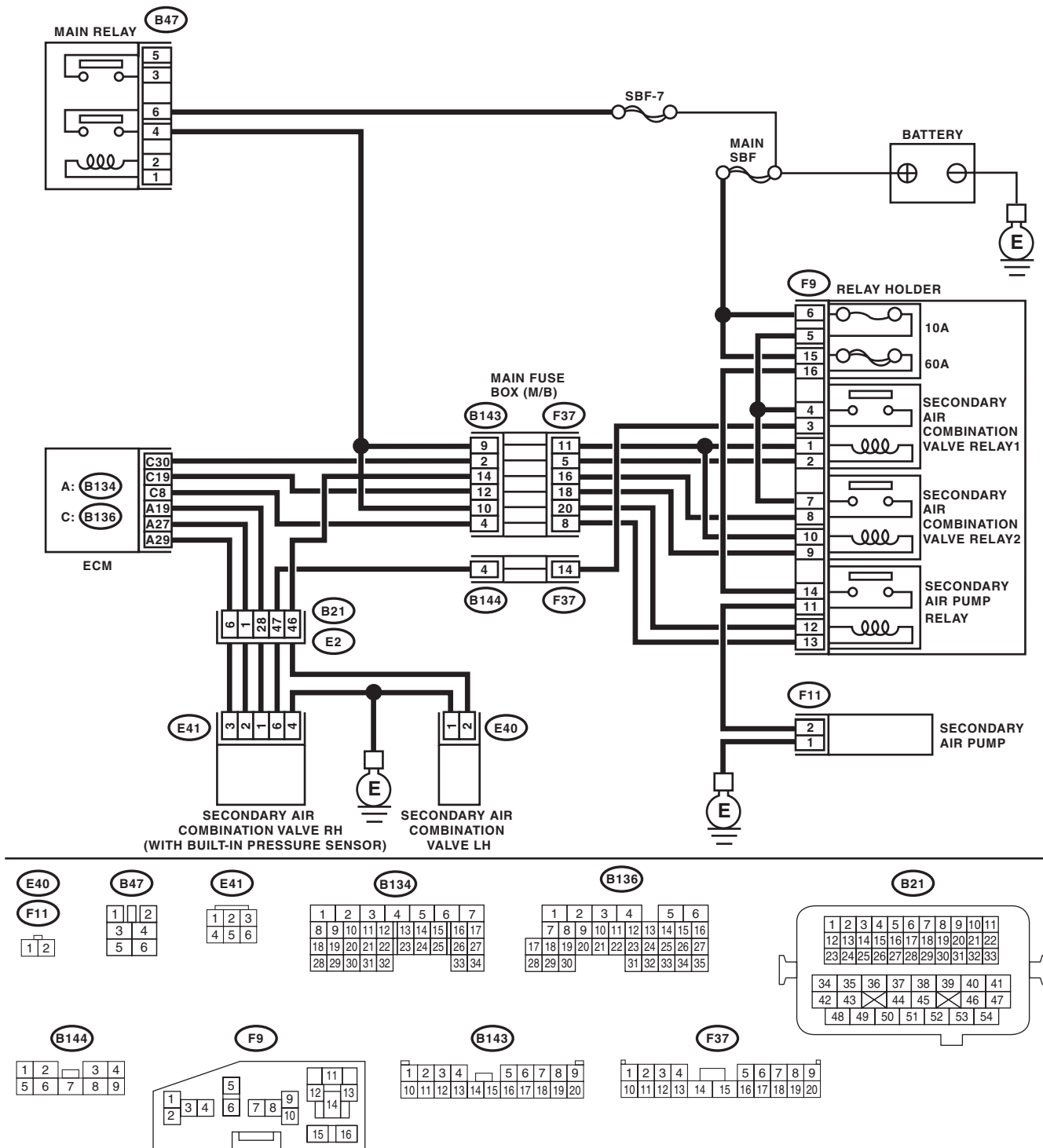
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
1	<b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and secondary air combination valve relay 1. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 30 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and secondary air combination valve relay 1.	Repair the poor contact of the ECM connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **BG:DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-135, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

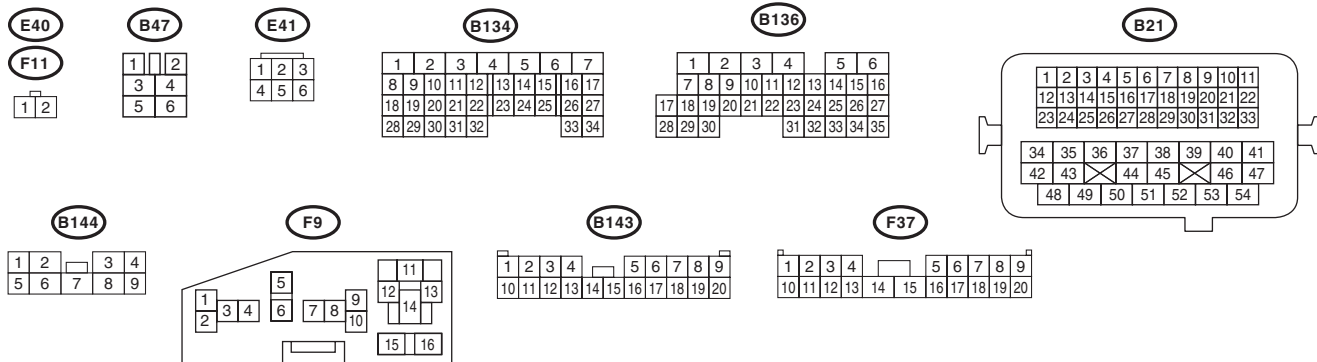
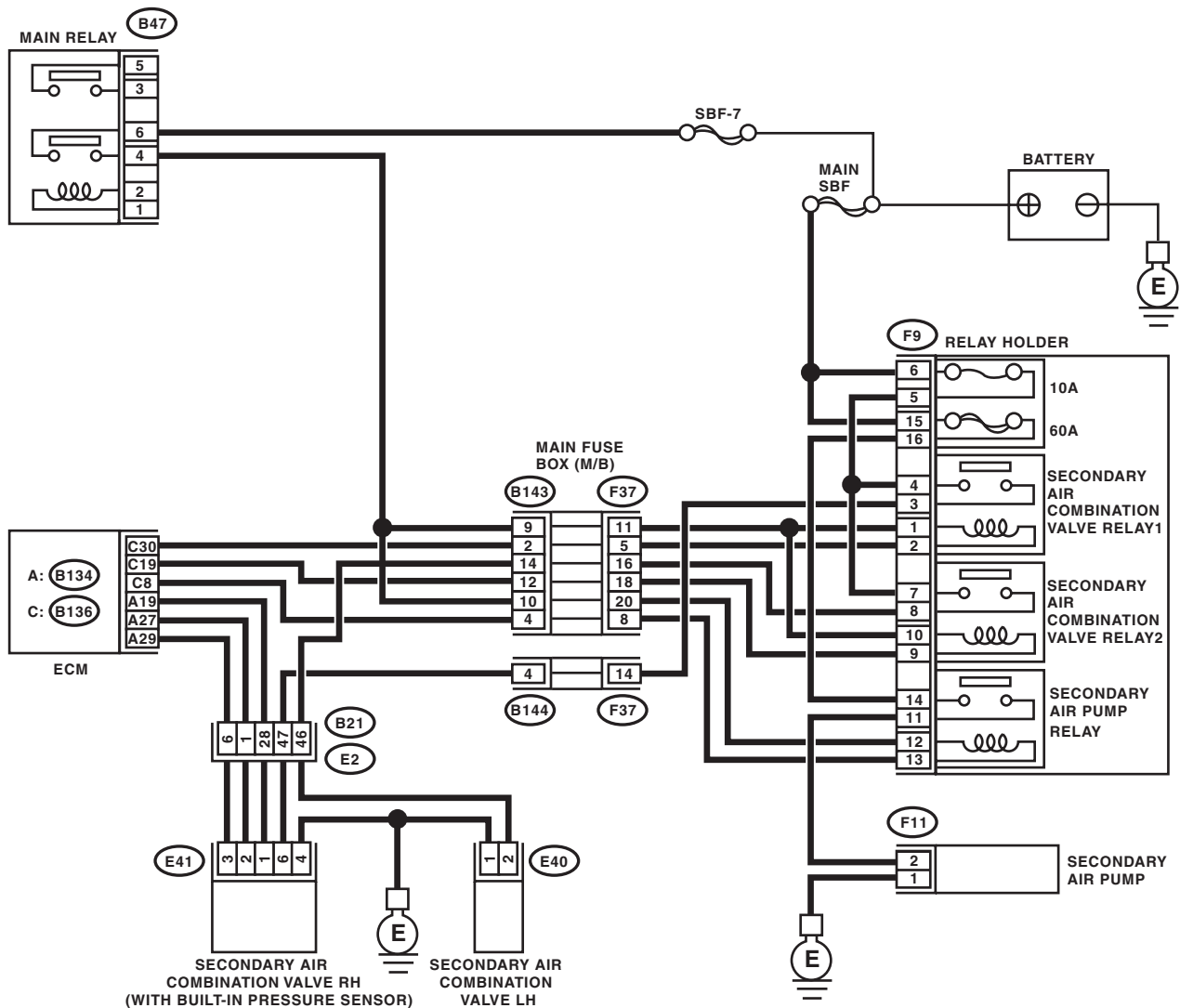
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2.</b></p> <p>1) Turn the ignition switch to OFF.            2) Disconnect the connector from ECM and secondary air combination valve relay 2.            3) Measure the resistance of harness between ECM and secondary air combination valve relay 2.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 19 — (F9) No. 9:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and secondary air combination valve relay 2.
2	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 19 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p><b>NOTE:</b>            In this case, there may be a temporary connector contact failure.</p>	Repair the ground short circuit of harness between ECM and secondary air combination valve relay 2.



## **BH:DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-135, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

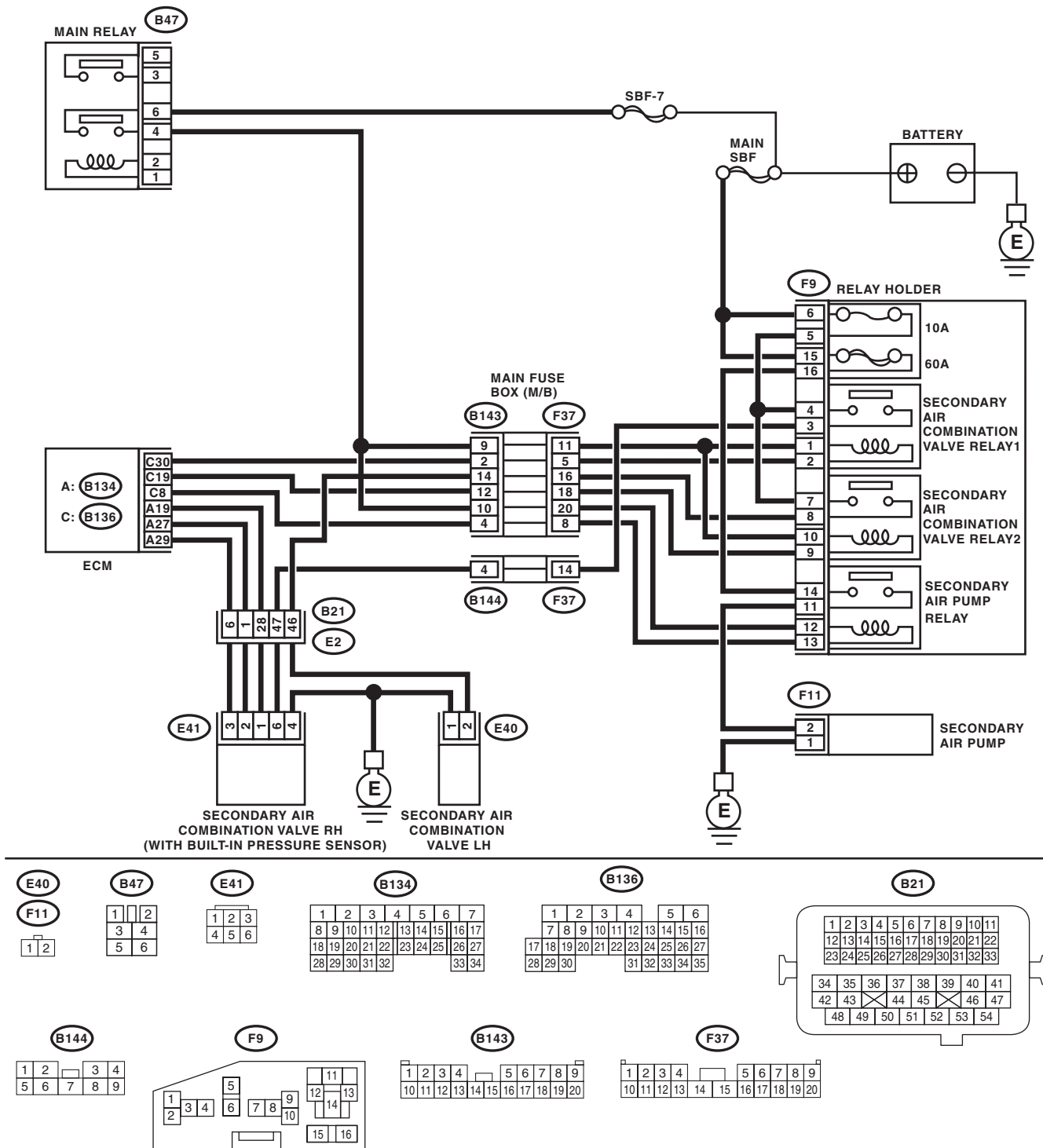
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
1	<b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and secondary air combination valve relay 2. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 19 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and secondary air combination valve relay 2.	Repair the poor contact of the ECM connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **BI: DTC P0418 SECONDARY AIR INJECTION SYSTEM CONTROL “A” CIRCUIT**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-136, DTC P0418 SECONDARY AIR INJECTION SYSTEM CONTROL “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

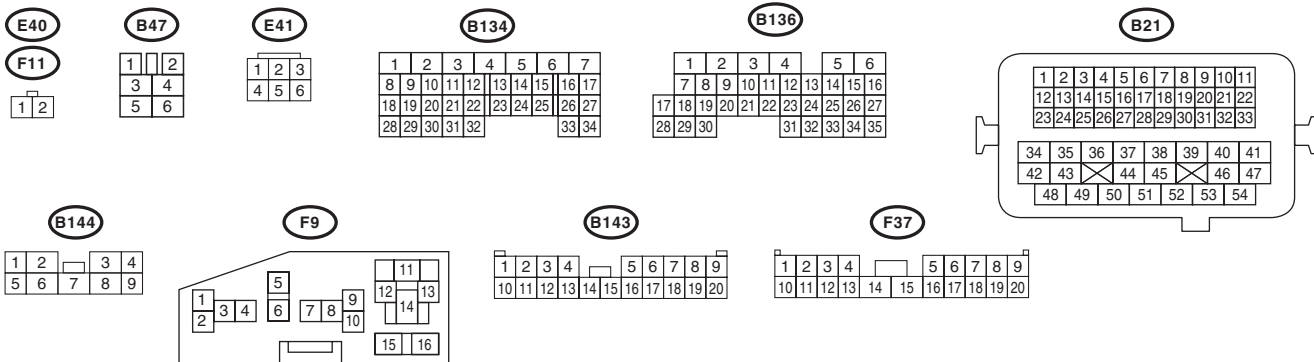
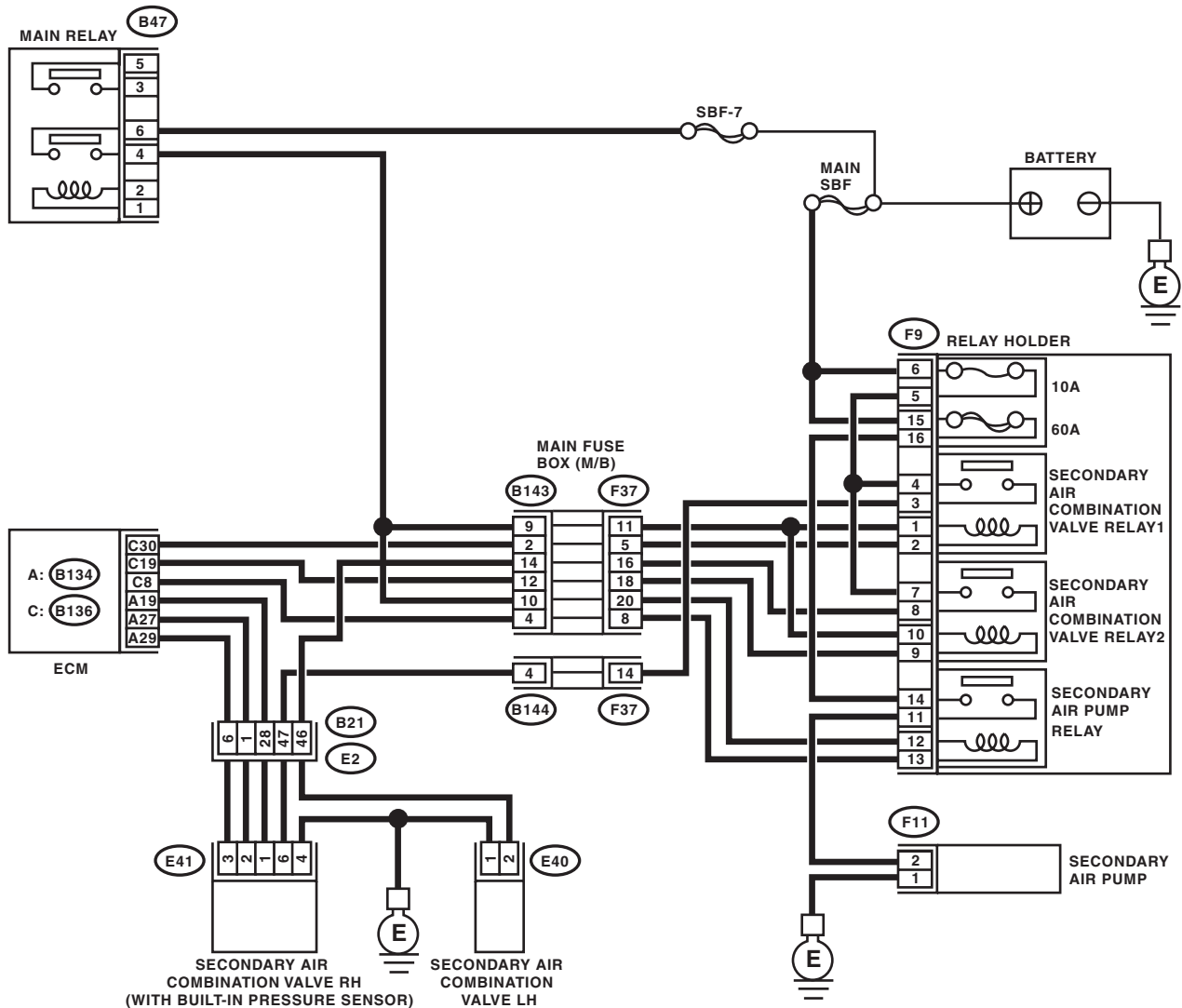
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the ECM and secondary air pump relay.                      3) Measure the resistance of harness between ECM and secondary air pump relay.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 8 — (F9) No. 13:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and secondary air pump relay.
2	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 8 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p><b>NOTE:</b>                      In this case, there may be a temporary connector contact failure.</p>	Repair the ground short circuit of harness between ECM and secondary air pump relay.

## BJ:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-137, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

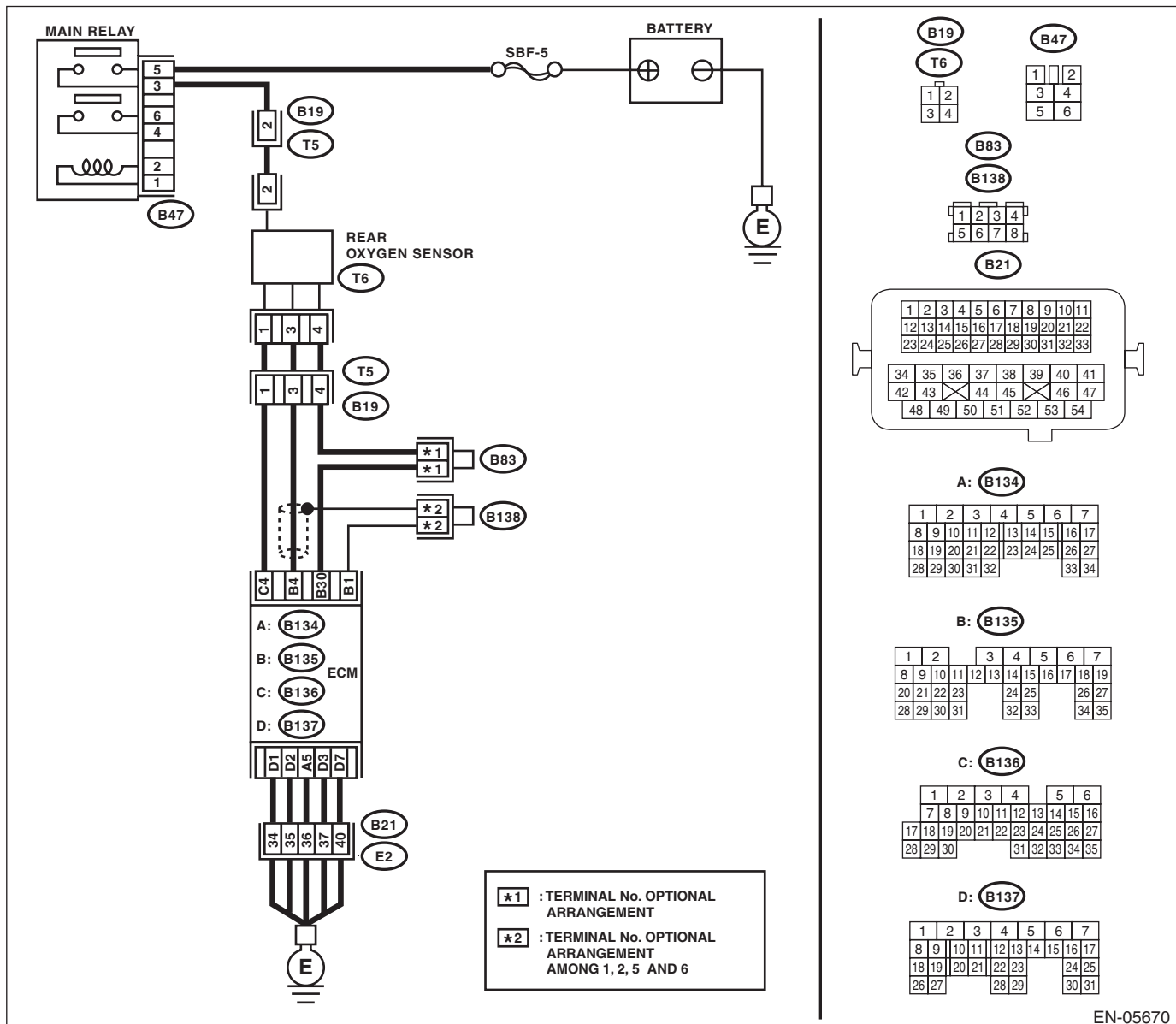
### TROUBLE SYMPTOM:

- Engine stalls.
- Idle mixture is out of specifications.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

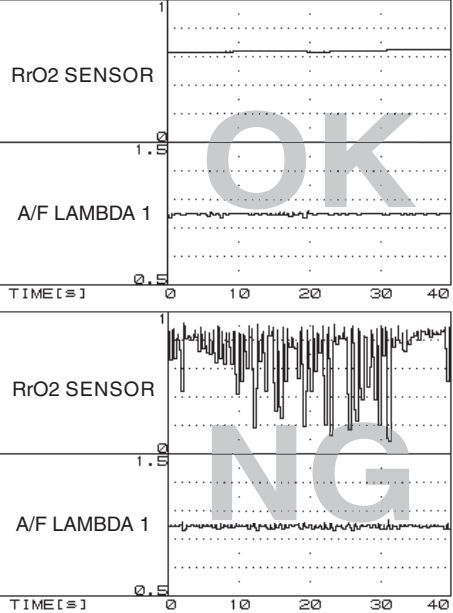
### WIRING DIAGRAM:



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK EXHAUST SYSTEM.</b> Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes.</p> <p>NOTE: Check the following positions.</p> <ul style="list-style-type: none"> <li>• Between cylinder head and front exhaust pipe</li> <li>• Between front exhaust pipe and front catalytic converter</li> <li>• Between front catalytic converter and rear catalytic converter</li> <li>• Loose or improperly attached front oxygen (A/F) sensor or rear oxygen sensor</li> </ul>	<p>Is there any fault in exhaust system?</p>	<p>Repair or replace the exhaust system. &lt;Ref. to EX(H4DOTC)-2, General Description.&gt;</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).</b></p> <p>1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH).</p> <p>2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data.</p> <div style="display: flex; flex-direction: column; align-items: center;">  <p style="margin-top: 10px;">EN-04895</p> </div>	<p>Is a normal waveform displayed?</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.</p> <p>NOTE: In this case, temporary poor contact of connector may be the cause.</p>	<p>Go to step 3.</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>3</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).</b></p> <p>1) Run the engine at idle. 2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data.</p> <div> </div> <div> </div> <p style="text-align: right;">EN-04896</p>	<p>Is a normal waveform displayed?</p>	<p>Go to step 4.</p>	<p>Go to step 5.</p>
<p><b>4</b></p> <p><b>CHECK CATALYTIC CONVERTER.</b></p>	<p>Is the catalytic converter damaged?</p>	<p>Replace the catalytic converter. &lt;Ref. to EC(H4DOTC)-5, Front Catalytic Converter.&gt;</p>	<p>Go to step 5.</p>
<p><b>5</b></p> <p><b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	<p>Has water entered the connector?</p>	<p>Completely remove any water inside.</p>	<p>Go to step 6.</p>
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 4 — (T6) No. 3:</b> <b>(B135) No. 30 — (T6) No. 4:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 7.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(T6) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Go to step 8.	Repair the harness and connector. <b>NOTE:</b> Repair the following locations. <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the ECM and rear oxygen sensor</li> <li>• Poor contact in ECM connector</li> </ul>
<b>8</b> <b>CHECK REAR OXYGEN SENSOR SHIELD.</b> 1) Turn the ignition switch to OFF. 2) Expose the rear oxygen sensor connector body side harness sensor shield. 3) Measure the resistance between the sensor shield and chassis ground.	Is the resistance less than 1 $\Omega$ ?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>	Repair the open circuit in the rear oxygen sensor harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BK:DTC P0441 EVAPORATIVE EMISSION SYSTEM INCORRECT PURGE FLOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-139, DTC P0441 EVAPORATIVE EMISSION SYSTEM INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 <b>CHECK PURGE LINE OF THE PURGE CONTROL SOLENOID VALVE 2.</b>	Is there any clogging, flattened part or bent in the purge line of purge control solenoid valve 2?	Repair or replace the purge line of purge control solenoid valve 2.	Go to step 3.
3 <b>CHECK PURGE CONTROL SOLENOID VALVE 2.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the purge control solenoid valve 2 using the Subaru Select Monitor. <b>NOTE:</b> Purge control solenoid valve 2 can be operated using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve 2 operate?	Repair the poor contact of the ECM connector.	Replace the purge control solenoid valve 2. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BL:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-140, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

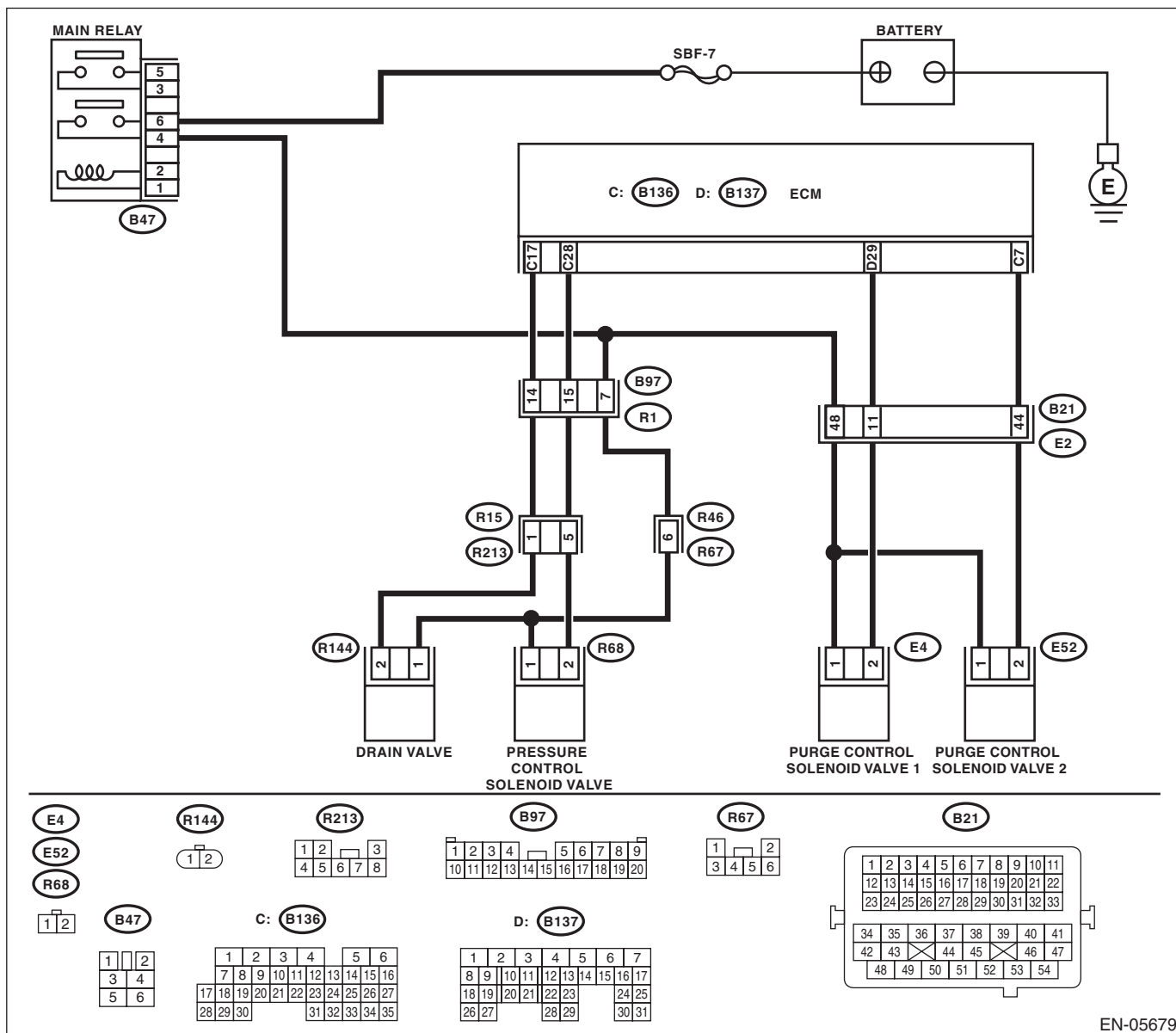
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2</b> <b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
<b>3</b> <b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4DOTC)-59, Fuel Filler Pipe.>	Go to step 4.
<b>4</b> <b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>
<b>5</b> <b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>
<b>6</b> <b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4DOTC)-15, Pressure Control Solenoid Valve.>
<b>7</b> <b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DOTC)-69, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>8</b>	<b>CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4DOTC)-7, Canister.>	Go to step <b>9</b> .
<b>9</b>	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Go to step <b>10</b> .
<b>10</b>	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 1.0 mm (0.04 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BM:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

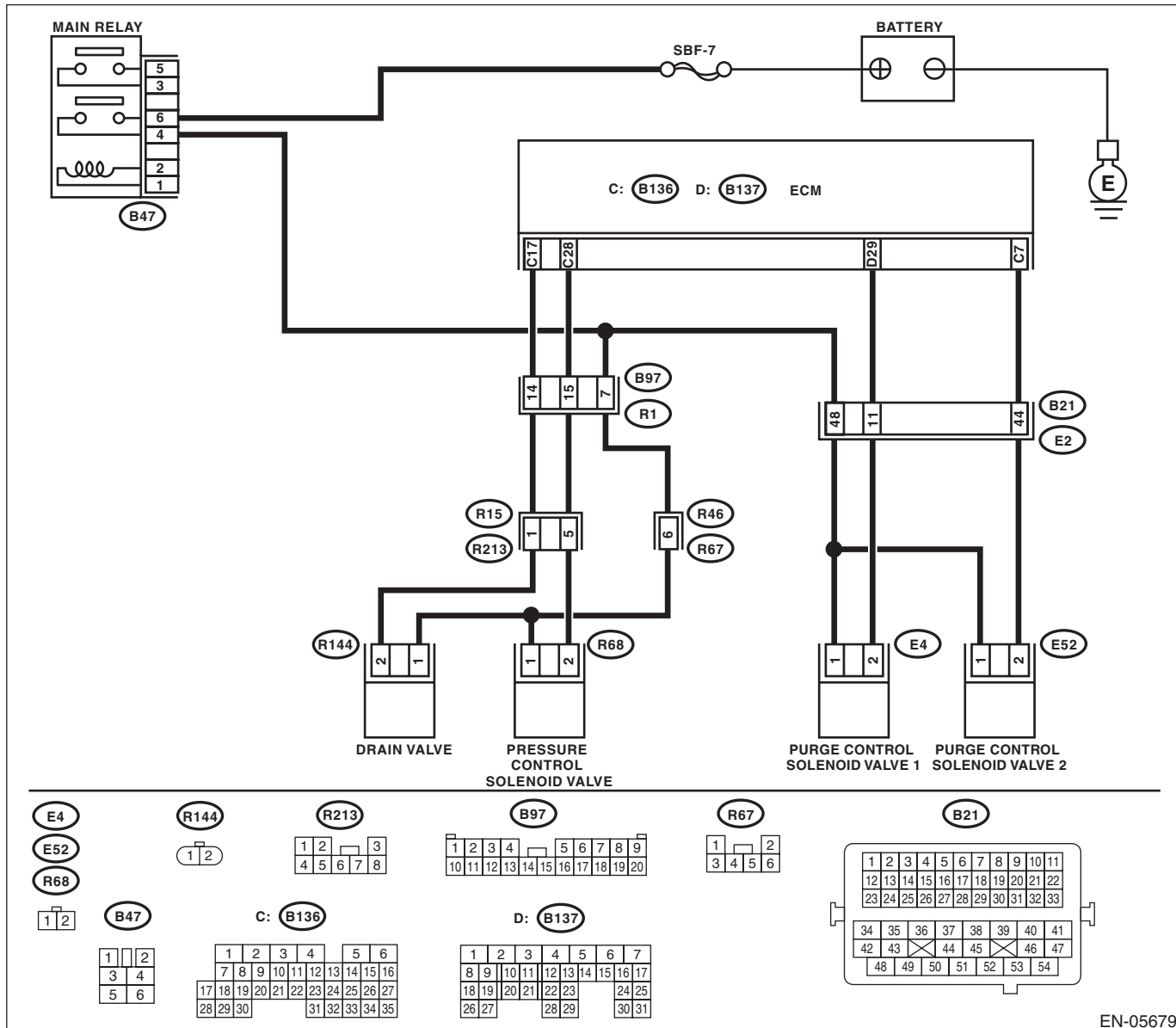
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-157, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Measure the resistance between the drain valve connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 2 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and drain valve connector.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> Measure the resistance of harness between ECM and drain valve connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 — (R144) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and drain valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4</b> <b>CHECK DRAIN VALVE.</b> Measure the resistance between drain valve terminals. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>
<b>5</b> <b>CHECK POWER SUPPLY TO DRAIN VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between drain valve and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 1 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair the poor contact of drain valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and drain valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BN:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

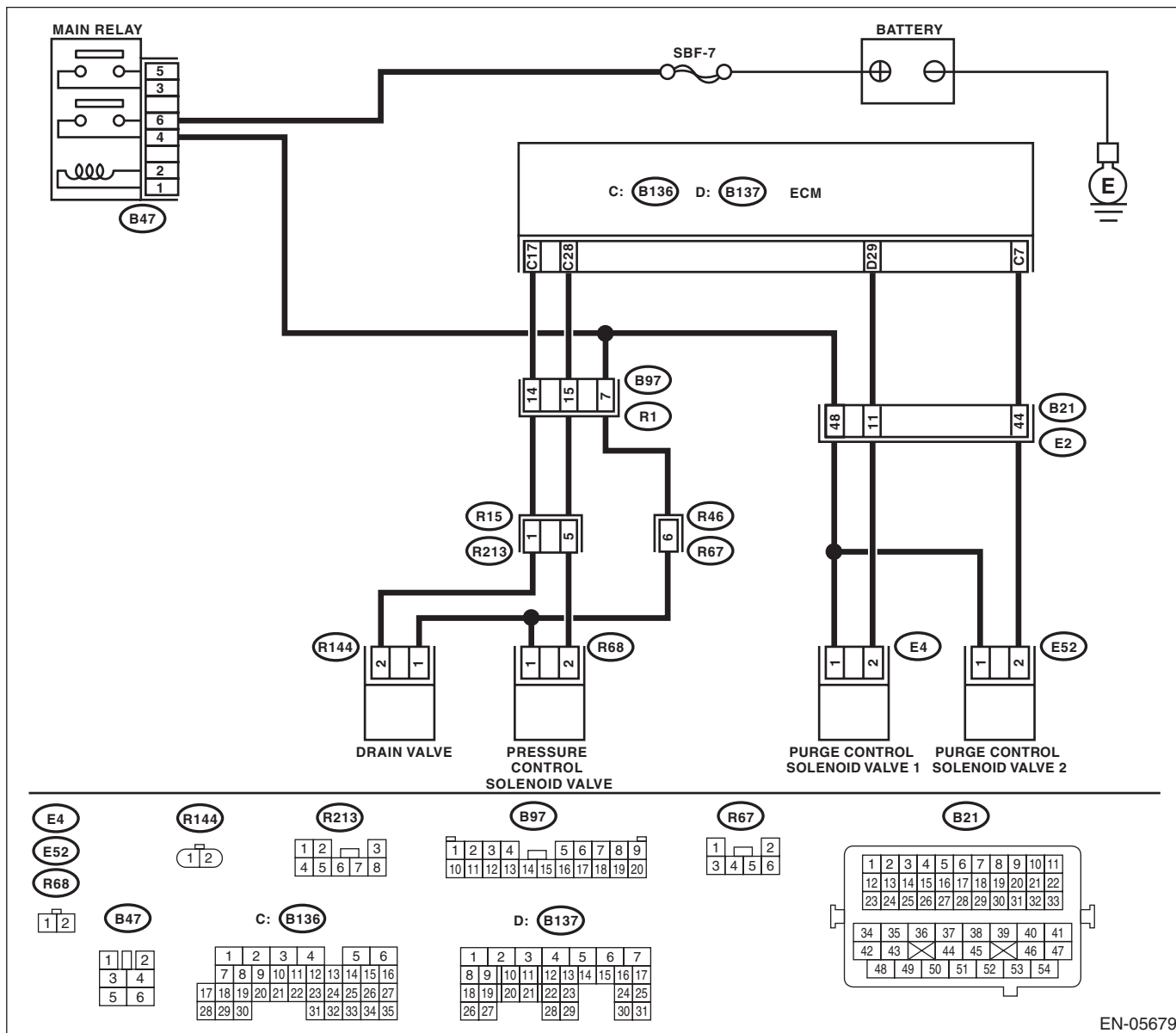
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-159, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 17 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and drain valve connector.	Go to step 2.
2	<b>CHECK DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between drain valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>	Repair the poor contact of the ECM connector.

## BO:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

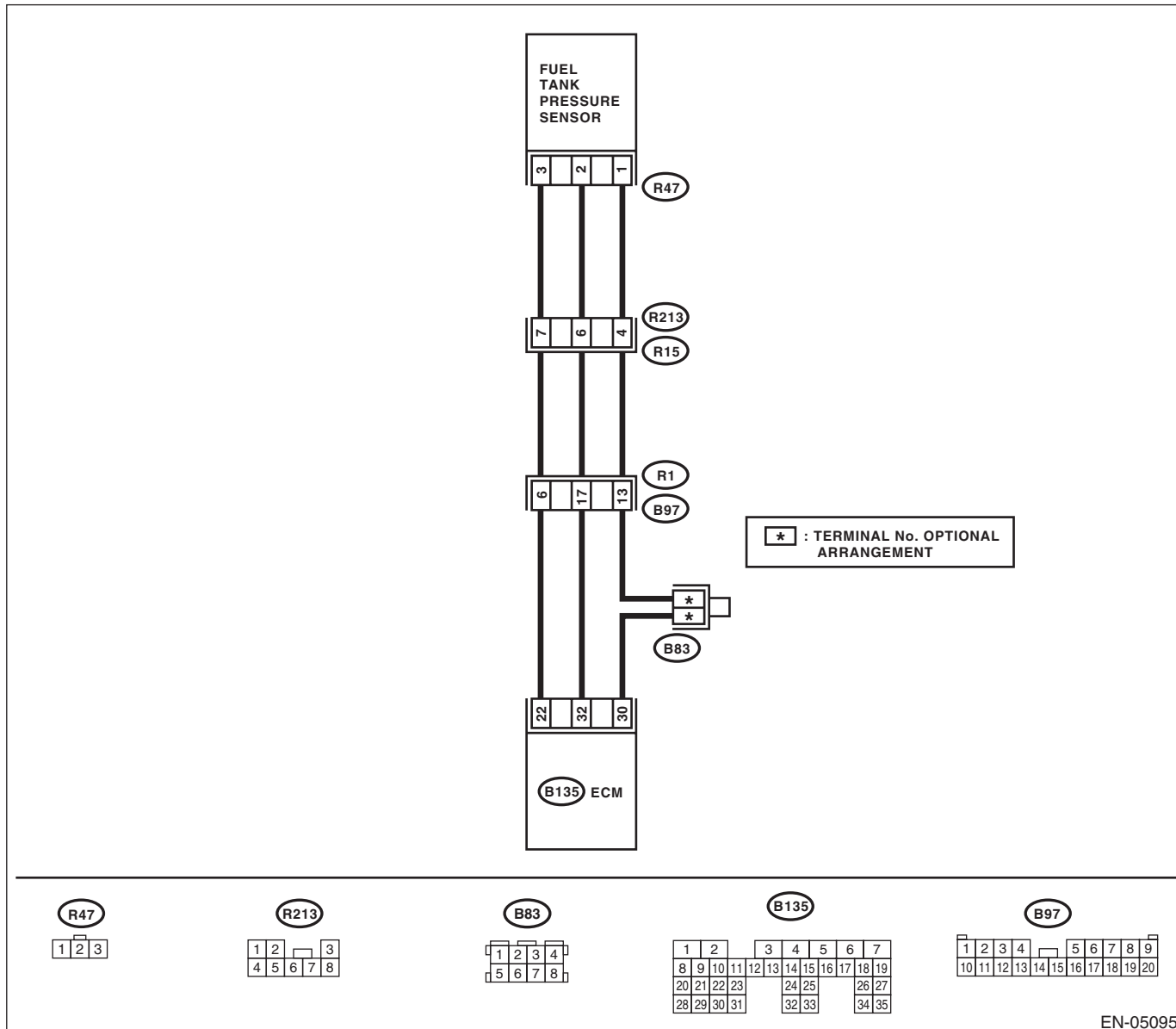
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-161, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05095

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2</b>	<b>CHECK PRESSURE VACUUM LINE.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank</li><li>• Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank</li></ul>	Is there any fault in pressure/vacuum line?	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H4DOTC)-14, Fuel Tank Pressure Sensor.>

## BP:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

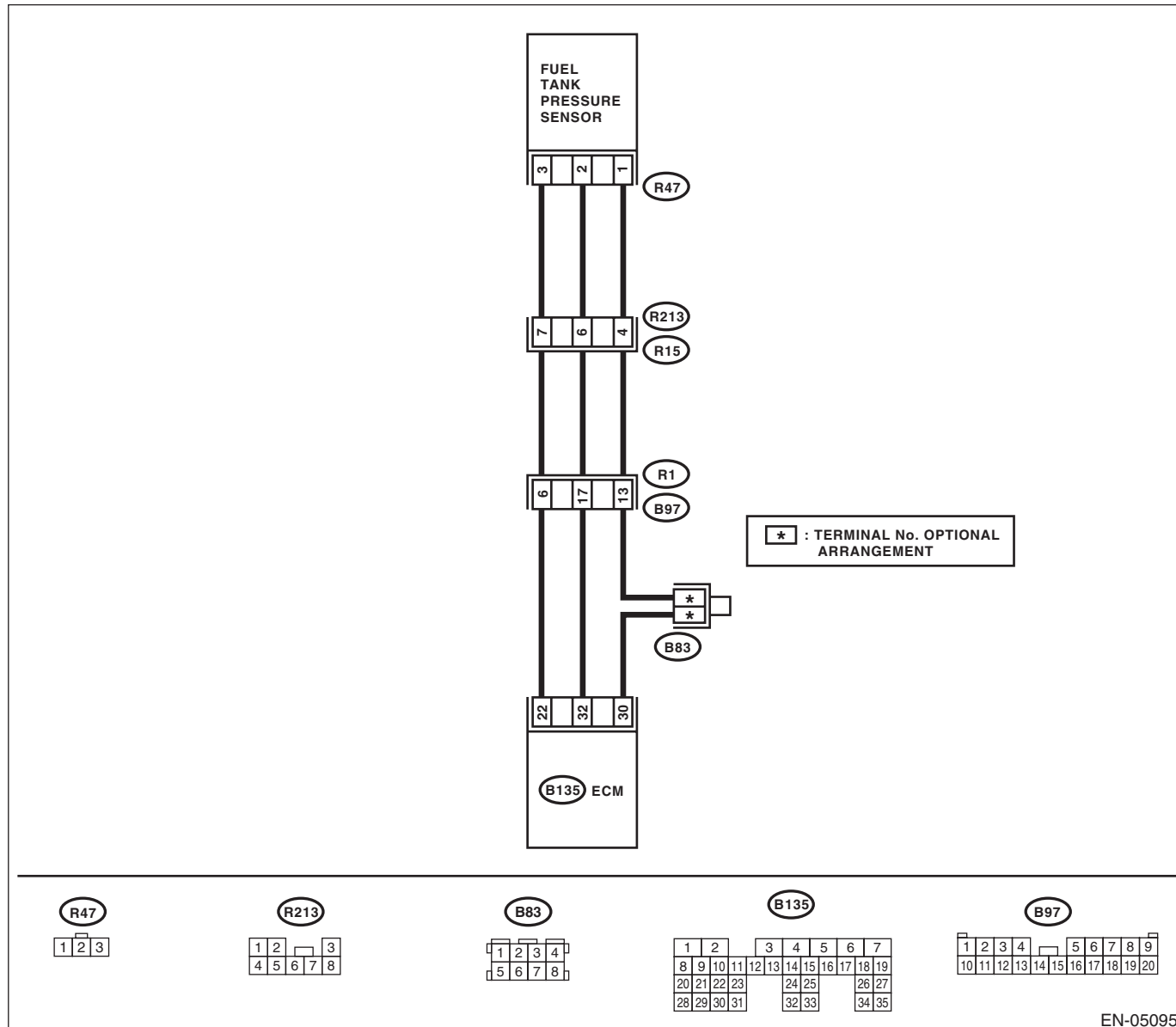
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-163, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK CURRENT DATA.</b>                      1) Turn the ignition switch to ON.                      2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value less than -7.45 kPa (-55.89 mmHg, -2.2003 inHg) ?</p>	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:                      In this case, there may be a temporary connector contact failure.</p>
<p><b>2 CHECK FUEL TANK PRESSURE SENSOR POWER SOURCE.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the fuel tank pressure sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between the fuel tank pressure sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(R47) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.5 V or more?</p>	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:                      • Open circuit of harness between ECM and fuel tank pressure sensor connector                      • Poor contact in ECM connector                      • Poor contact of coupling connector</p>
<p><b>3 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance of harness between the ECM and fuel tank pressure sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 32 — (R47) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:                      • Open circuit of harness between ECM and fuel tank pressure sensor connector                      • Poor contact of coupling connector</p>
<p><b>4 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b>                      Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 32 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	Go to step 5.	<p>Repair the ground short circuit of harness between ECM and fuel tank pressure sensor connector.</p>
<p><b>5 CHECK POOR CONTACT.</b>                      Check for poor contact between the ECM and fuel tank pressure sensor connector.</p>	<p>Is there poor contact in the ECM or fuel tank pressure sensor connector?</p>	<p>Repair the poor contact in the ECM or fuel tank pressure sensor connector.</p>	<p>Replace the fuel tank pressure sensor. &lt;Ref. to EC(H4DOTC)-14, Fuel Tank Pressure Sensor.&gt;</p>

## BQ:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

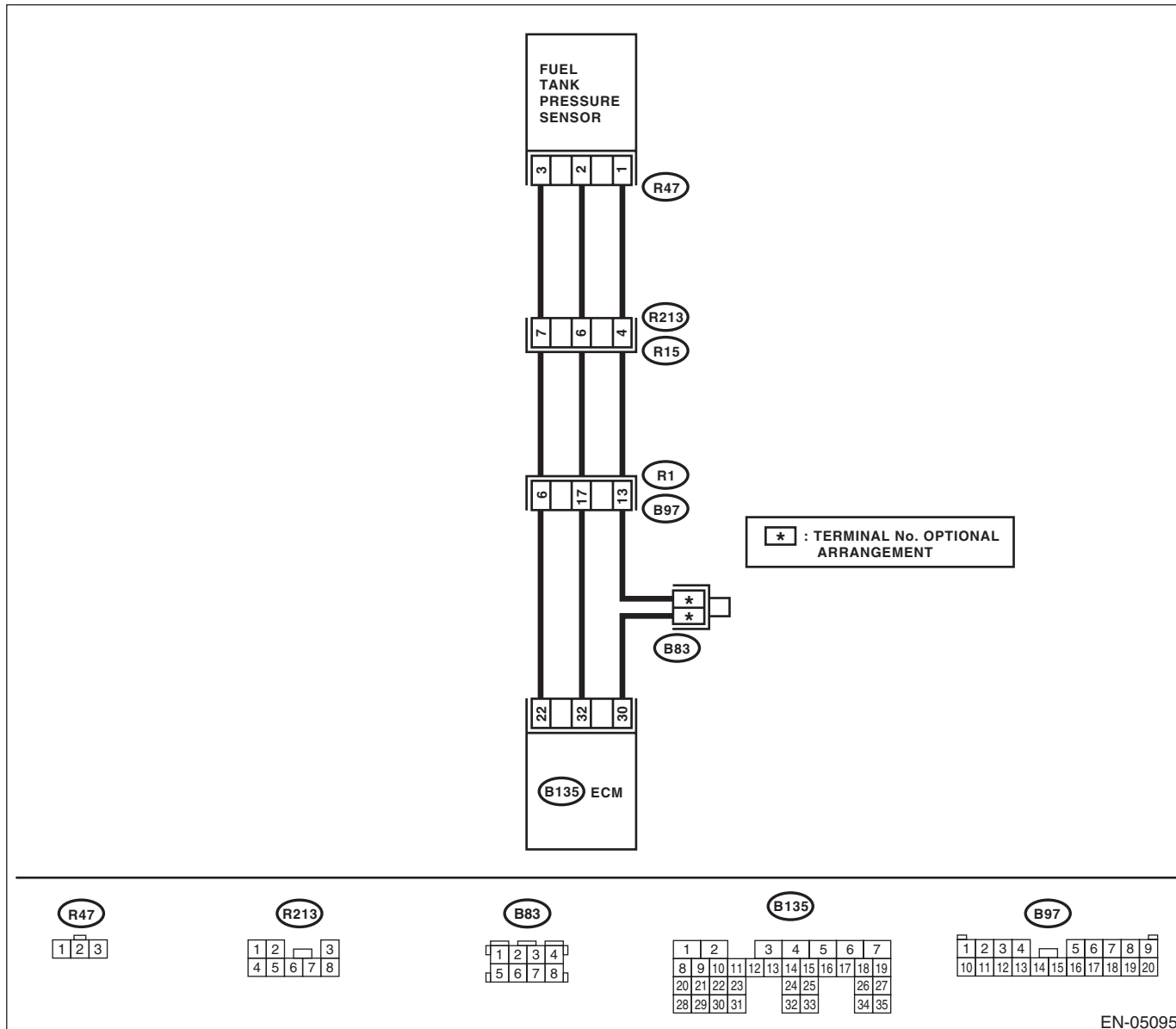
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-165, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Turn the ignition switch to ON. 2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 7.98 kPa (59.86 mmHg, 2.357 inHg) or more?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the fuel tank pressure sensor. 3) Turn the ignition switch to ON. 4) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 7.98 kPa (59.86 mmHg, 2.357 inHg) or more?	Repair the short circuit to power in the harness between ECM and fuel tank pressure sensor connector.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel tank pressure sensor connector and engine ground.  <b>Connector &amp; terminal</b> <b>(R47) No. 1 — Engine ground:</b>	Is the resistance less than 5 Ω?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and fuel tank pressure sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
<b>4</b> <b>CHECK POOR CONTACT.</b> Check for poor contact of the fuel tank pressure sensor connector.	Is there poor contact in fuel tank pressure sensor connector?	Repair the poor contact in fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4DOTC)-14, Fuel Tank Pressure Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BR:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-166, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

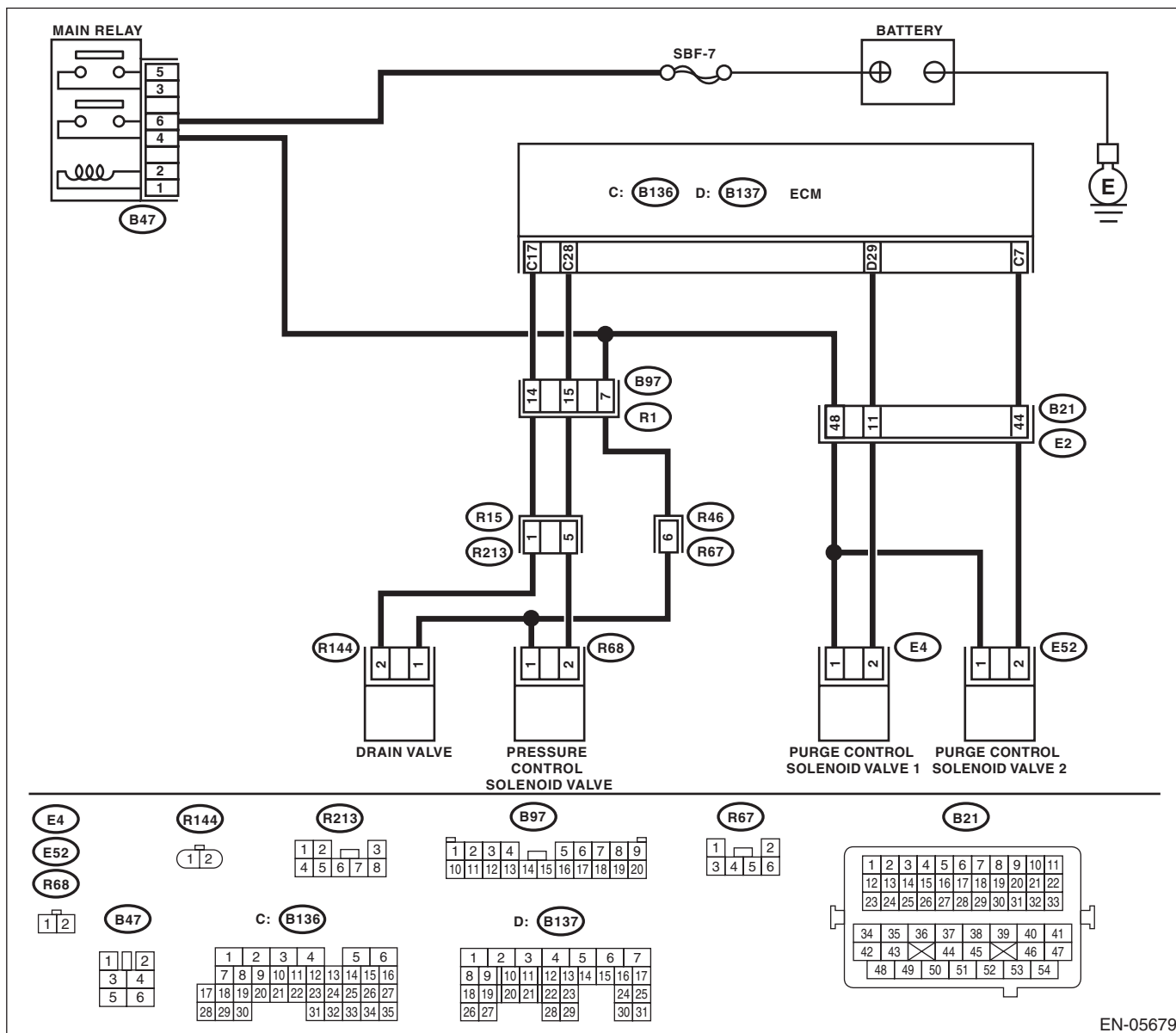
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4DOTC)-59, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve can be operated using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4DOTC)-15, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DOTC)-69, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
8	<b>CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4DOTC)-7, Canister.>	Go to step 9.
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 0.5 mm (0.020 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BS:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-166, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

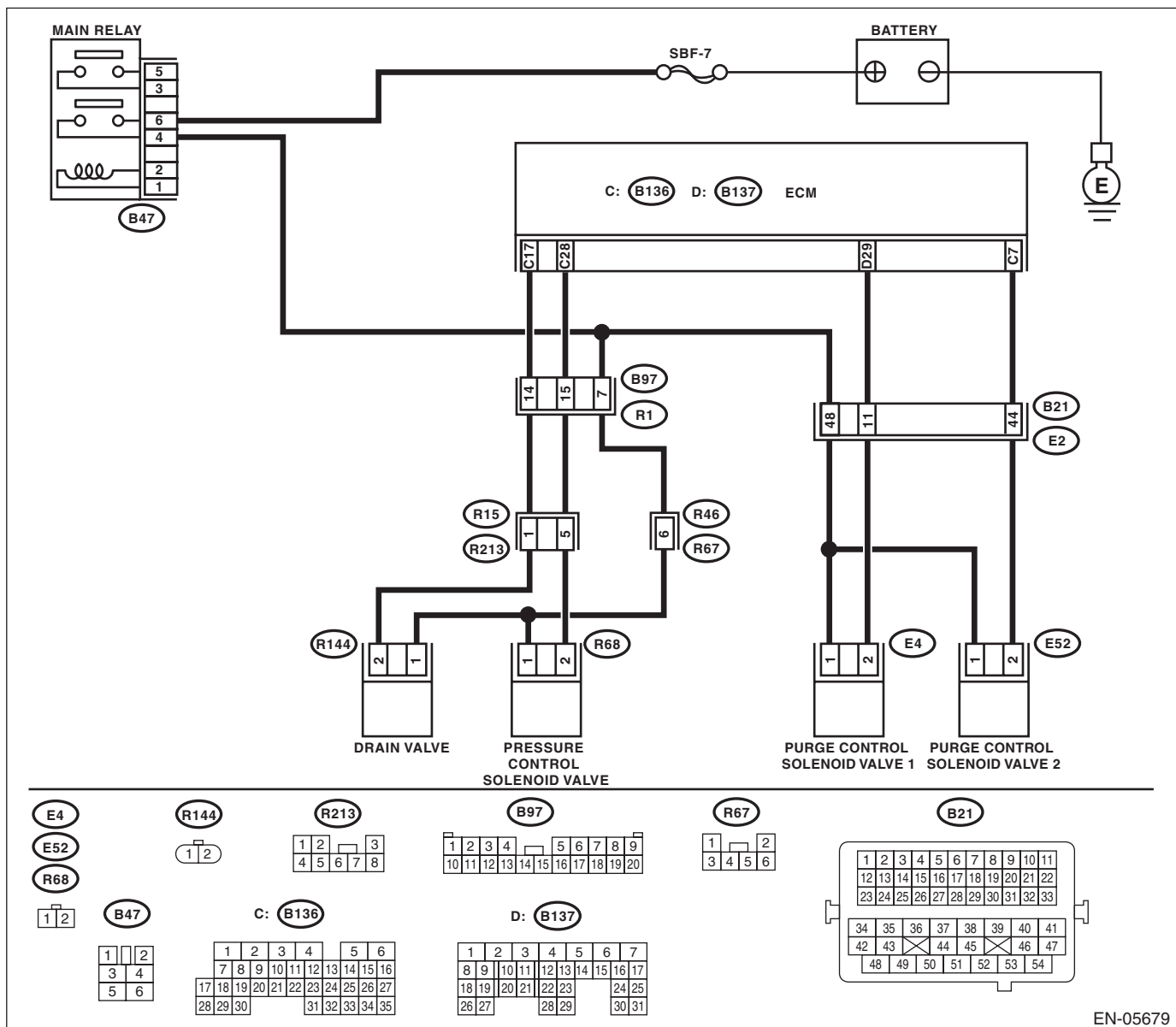
### TROUBLE SYMPTOM:

- Fuel odor
- Fuel filler cap loose or lost

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4DOTC)-59, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H4DOTC)-15, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any disconnection, damage or clogging on the evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DOTC)-69, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
8	<b>CHECK CANISTER.</b>	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H4DOTC)-7, Canister.>	Go to step 9.
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H4DOTC)-52, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Are there holes, cracks, clogging, or disconnections, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BT:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-167, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

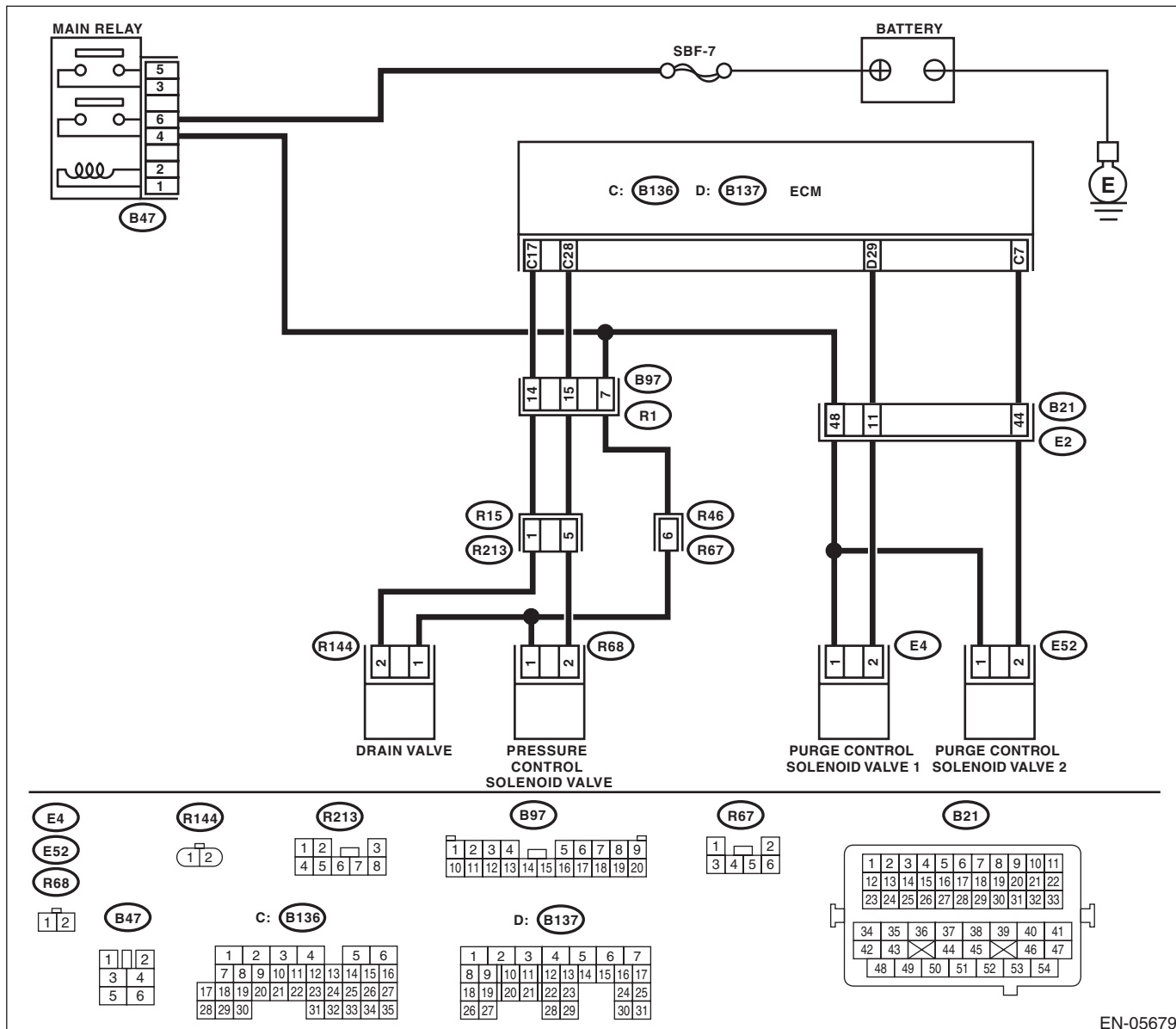
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 29 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Measure the resistance between the purge control solenoid valve connector and engine ground. <b>Connector &amp; terminal</b> <b>(E4) No. 2 — Engine ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and purge control solenoid valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and purge control solenoid valve. <b>Connector &amp; terminal</b> <b>(B137) No. 29 — (E4) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and purge control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>
<b>5 CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. <b>Connector &amp; terminal</b> <b>(E4) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of purge control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and purge control solenoid valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BU:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-169, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

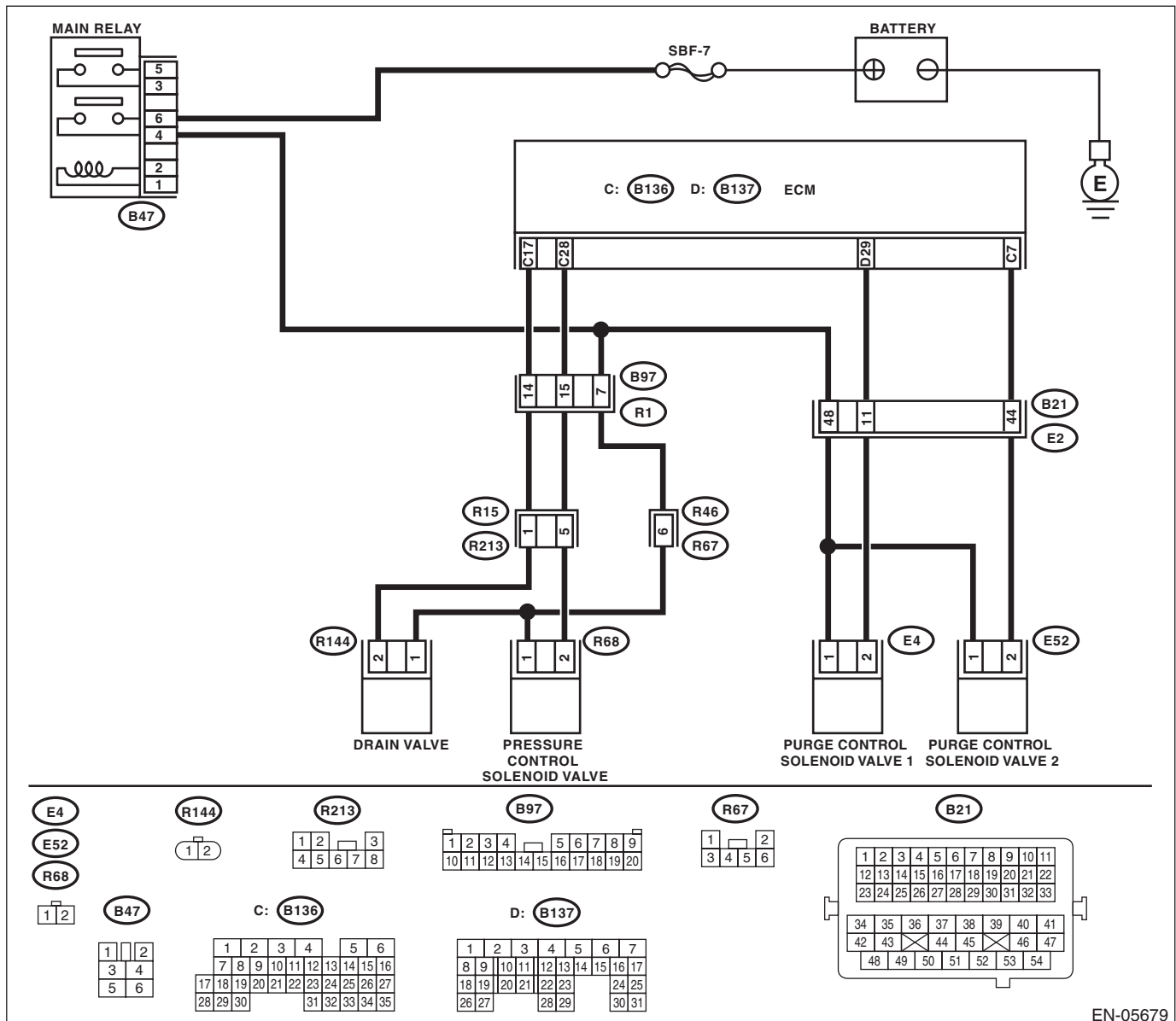
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 29 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and purge control solenoid valve connector.	Go to step 2.
<b>2 CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>	Repair the poor contact of the ECM connector.

### BV:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-171, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
<b>1 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H4DOTC)-65, Fuel Level Sensor.> <Ref. to FU(H4DOTC)-66, Fuel Sub Level Sensor.>

### BW:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

#### NOTE:

For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4DOTC)(diag)-241, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BX:DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-175, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is DTC P0462 or P0463 displayed on the Subaru Select Monitor?	Check the combination meter. <Ref. to IDI-13, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

## BY:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-177, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is DTC P0464 displayed on the display?	Check the combination meter. <Ref. to IDI-13, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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## BZ:DTC P0500 VEHICLE SPEED SENSOR “A”

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-180, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK DTC OF ABS.</b> Check DTC of ABS.	Is DTC of ABS displayed?	Perform the diagnosis according to DTC. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CA:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-182, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

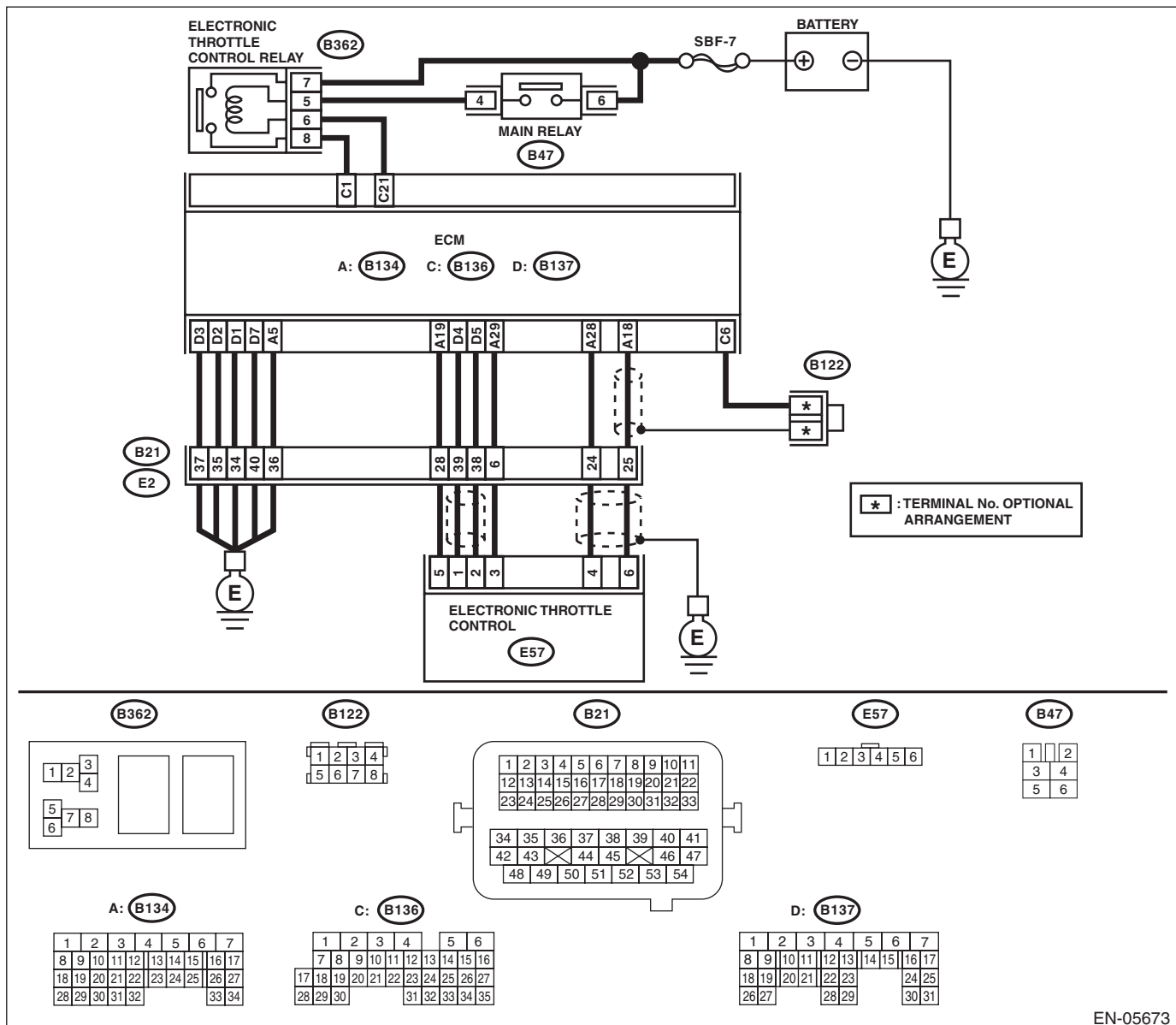
### TROUBLE SYMPTOM:

- Hard to start the engine.
- Engine does not start.
- Improper idling
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2</b> <b>CHECK AIR CLEANER ELEMENT.</b> 1) Turn the ignition switch to OFF. 2) Check the air cleaner element.	Is there excessive clogging on air cleaner element?	Replace the air cleaner element. <Ref. to IN(H4DOTC)-7, Air Cleaner Element.>	Go to step 3.
<b>3</b> <b>CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Remove the electronic throttle control. <Ref. to FU(H4DOTC)-11, REMOVAL, Throttle Body.> 2) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CB:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-184, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

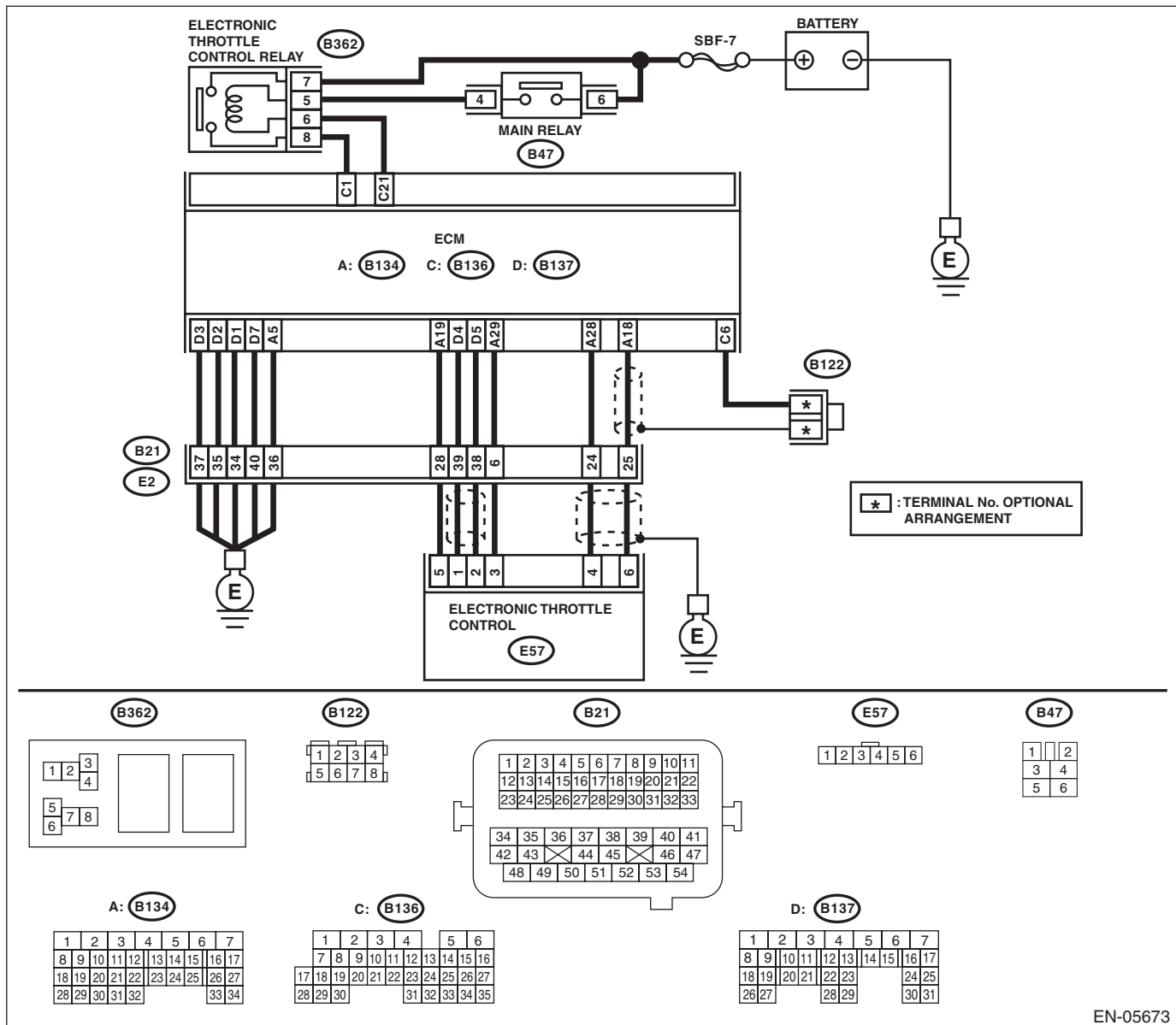
### TROUBLE SYMPTOM:

Engine keeps running at higher speed than specified idle speed.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2 CHECK AIR INTAKE SYSTEM.</b> 1) Start and idle the engine. 2) Check the following items. <ul style="list-style-type: none"> <li>• Loose installation of intake manifold and throttle body</li> <li>• Cracks of intake manifold gasket and throttle body gasket</li> <li>• Disconnection of vacuum hoses</li> </ul>	Is there any fault in air intake system?	Repair air suction and leaks.	Go to step 3.
<b>3 CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control. <Ref. to FU(H4DOTC)-11, REMOVAL, Throttle Body.> 3) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



## CC:DTC P0512 STARTER REQUEST CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-186, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

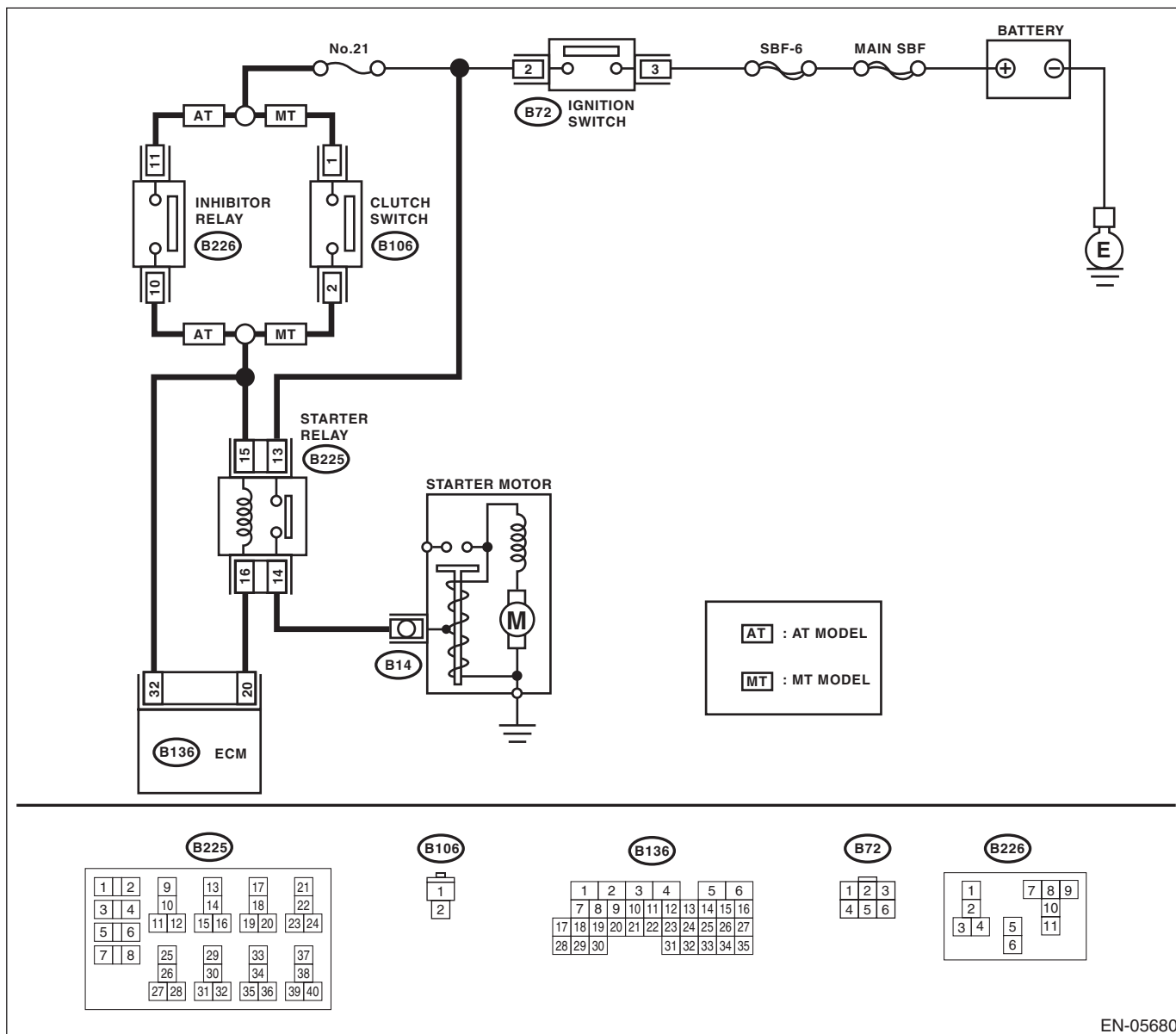
### TROUBLE SYMPTOM:

Failure of engine to start

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND IGNITION SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 32 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and ignition switch.	Repair the poor contact of the ECM connector.

## CD:DTC P0600 SERIAL COMMUNICATION LINK

NOTE:

For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CE:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-190, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

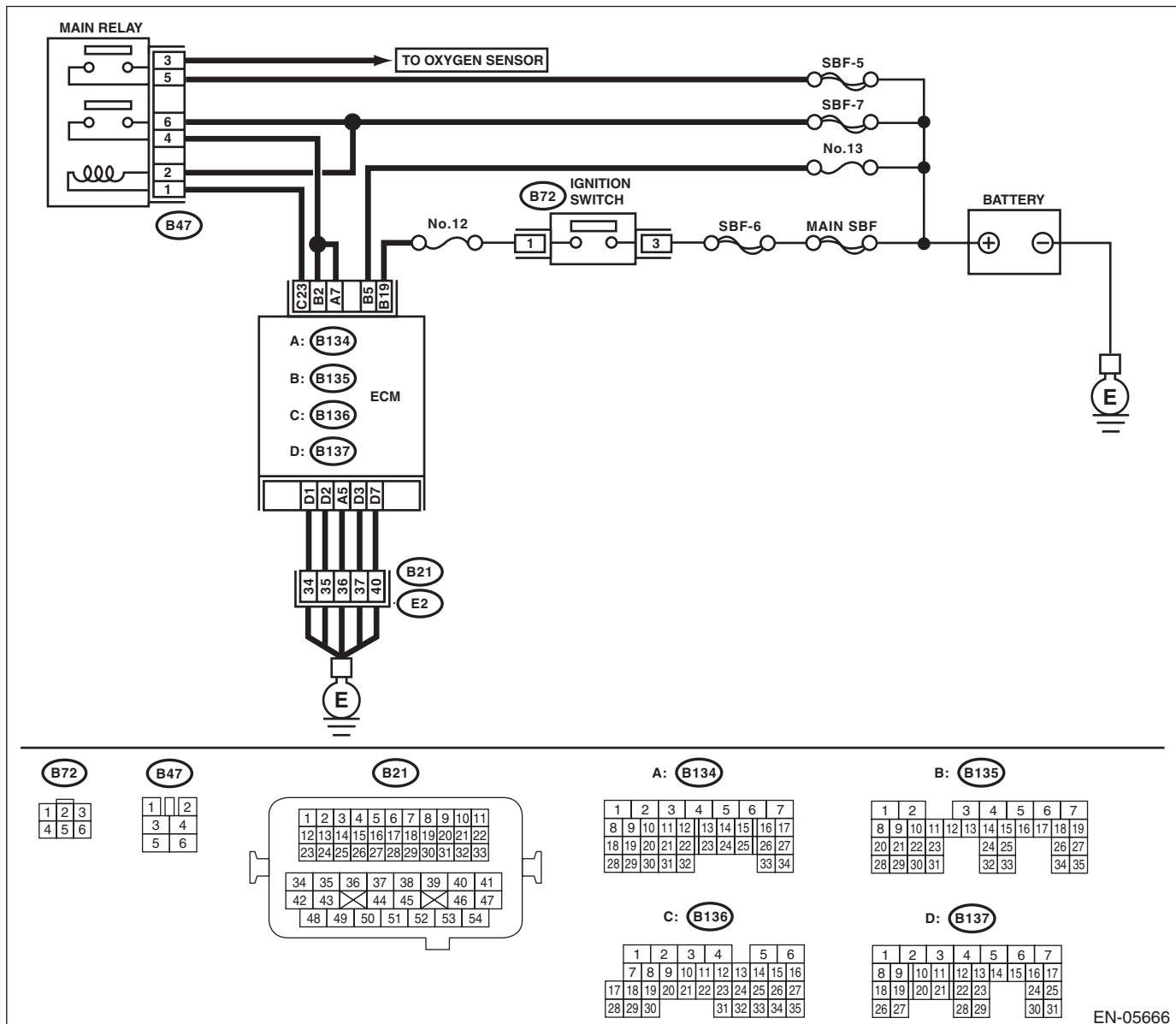
### TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05666

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

## CF:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

NOTE:

For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4DOTC)(diag)-251, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## CG:DTC P0607 CONTROL MODULE PERFORMANCE

### DTC DETECTING CONDITION:

- Depending on the content of malfunction, adapt either of the followings.
- Immediately at fault recognition
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-192, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

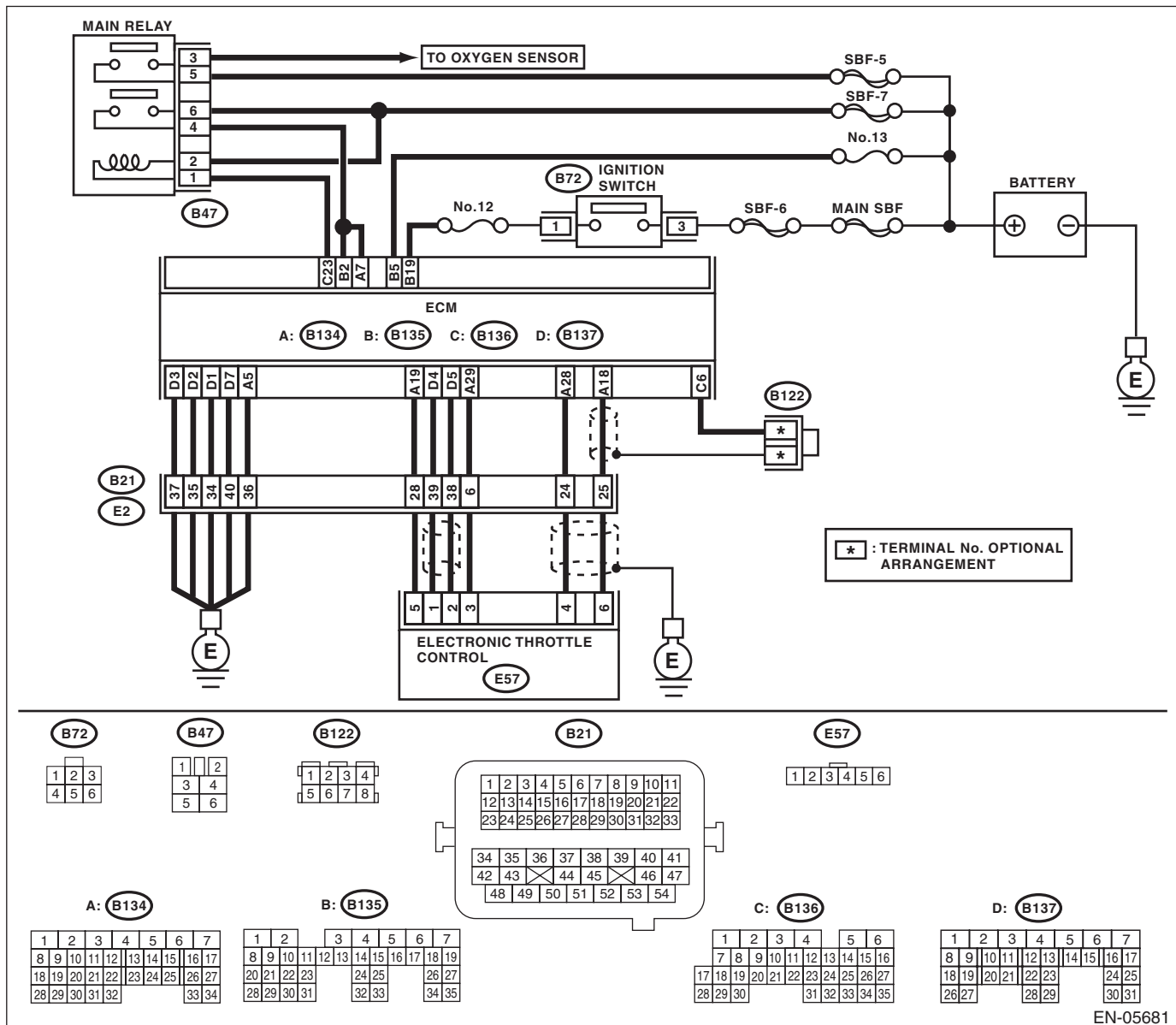
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 7 (+) — Chassis ground (-):</i> <i>(B135) No. 2 (+) — Chassis ground (-):</i>	Is the voltage 10 — 13 V?	Go to step 2.	Repair the open or ground short circuit of power supply circuit.
<b>2 CHECK INPUT VOLTAGE OF ECM.</b> 1) Start the engine. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 7 (+) — Chassis ground (-):</i> <i>(B135) No. 2 (+) — Chassis ground (-):</i>	Is the voltage 13 — 15 V?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<b>3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B134) No. 19 — (E57) No. 5:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>4 CHECK ECM GROUND HARNESS.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 5 (+) — Chassis ground (-):</i> <i>(B137) No. 1 (+) — Chassis ground (-):</i> <i>(B137) No. 2 (+) — Chassis ground (-):</i> <i>(B137) No. 3 (+) — Chassis ground (-):</i> <i>(B137) No. 7 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Repair the following item. • Further tightening of the engine ground terminal • Poor contact of coupling connector

### CH:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### CI: DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>

### CJ:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CK:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-199, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

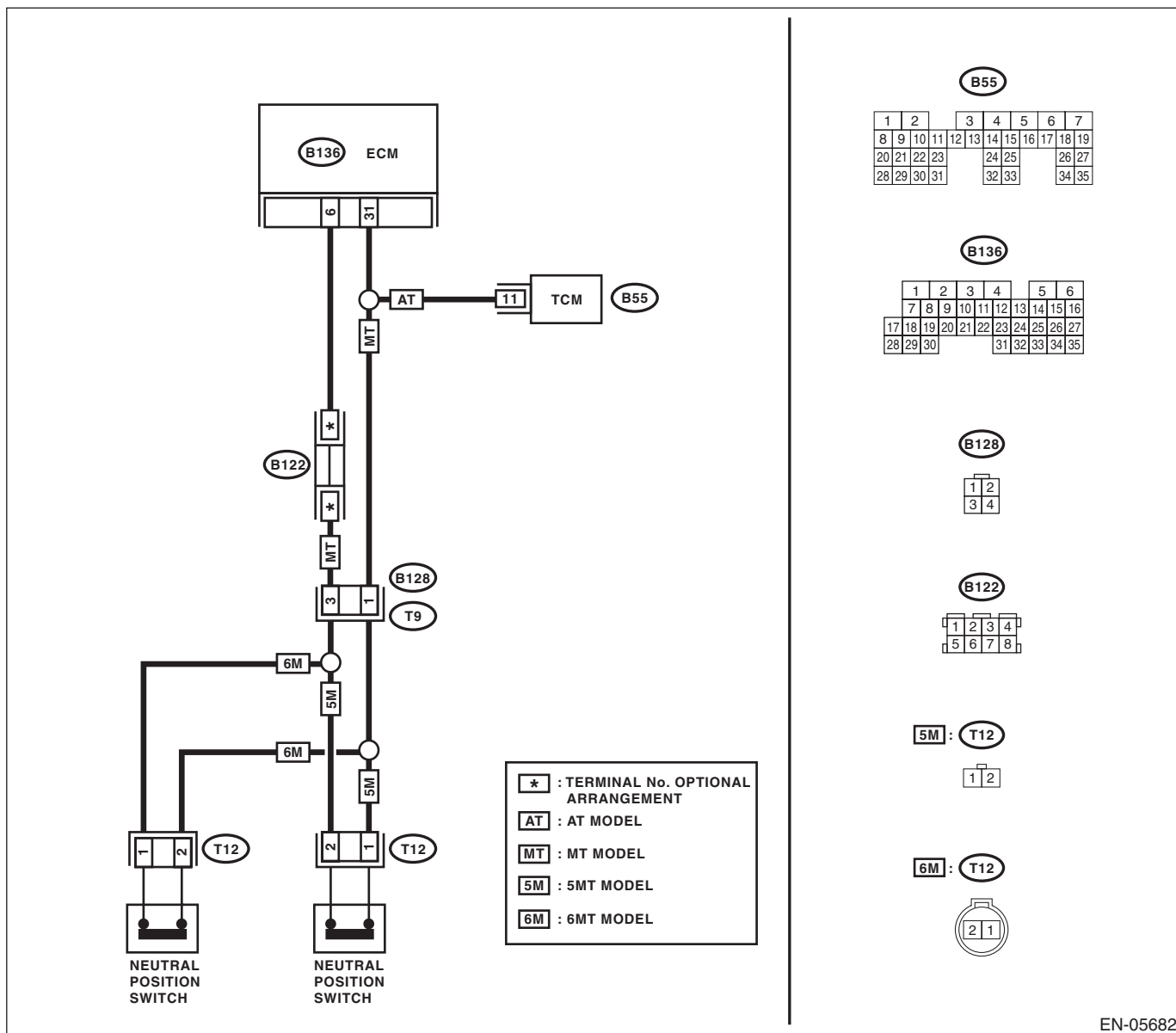
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05682

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Place the shift lever in a position except for neutral. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect connectors from the ECM and transmission harness connector (T9). 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Repair the short circuit of transmission harness, or replace the neutral position switch.	Repair the ground short circuit of harness between ECM and transmission harness connector.

## CL:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CM:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-202, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

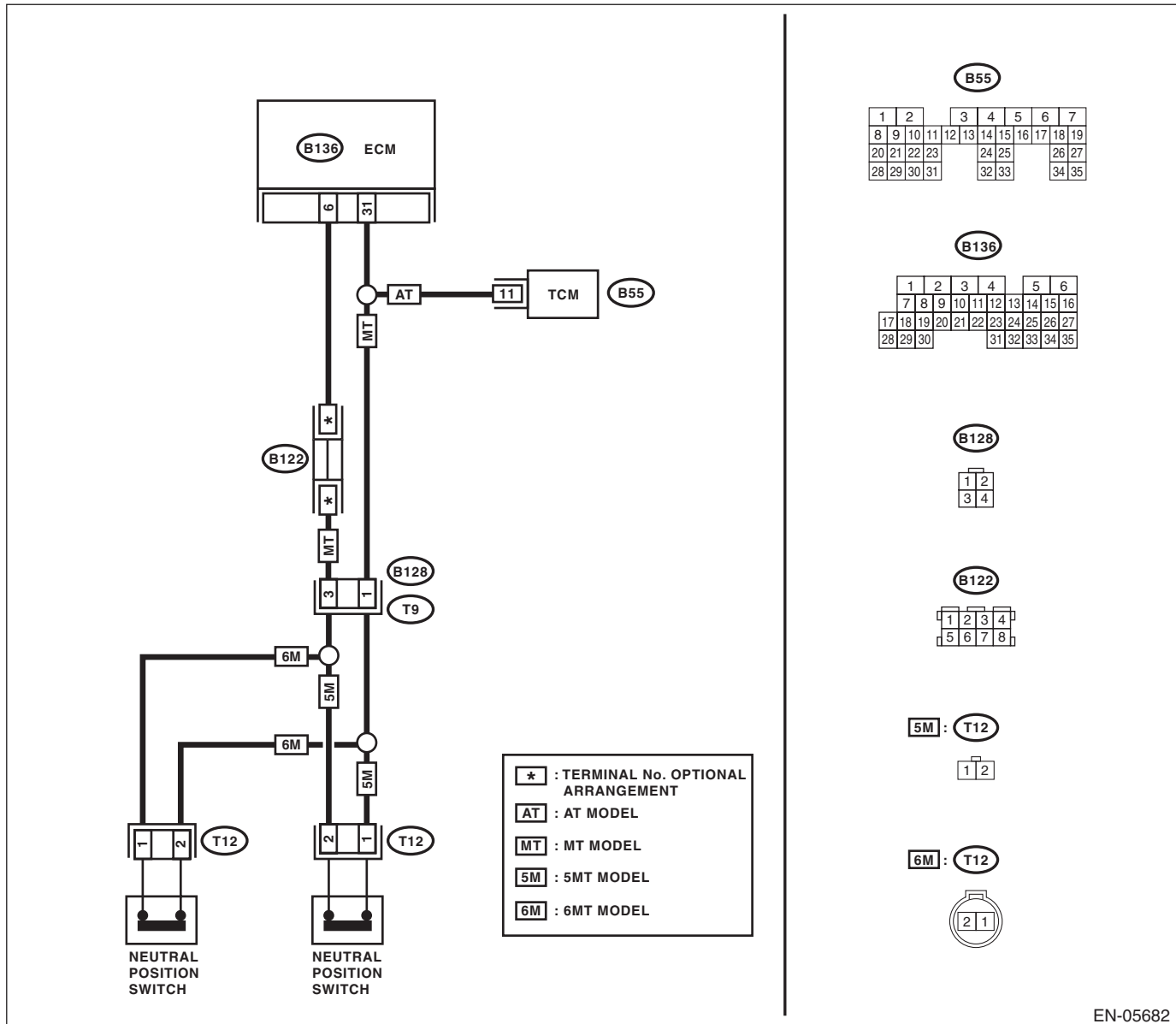
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05682

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 31 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect connectors from the ECM and transmission harness connector (T9). 3) Measure the resistance of harness between ECM and transmission harness connector. <b>Connector &amp; terminal</b> <b>(B136) No. 31 — (B128) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and transmission harness connector.
3	<b>CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR.</b> Measure the resistance of harness between ECM and transmission harness connector. <b>Connector &amp; terminal</b> <b>(B128) No. 3 — (B136) No. 6:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and transmission harness connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<b>CHECK NEUTRAL SWITCH.</b> 1) Place the shift lever in neutral. 2) Measure the resistance between transmission harness connector terminals. <b>Connector &amp; terminal</b> <b>(T9) No. 1 — No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of transmission harness connector.	Repair the open circuit of transmission harness, or replace the neutral switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CN:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

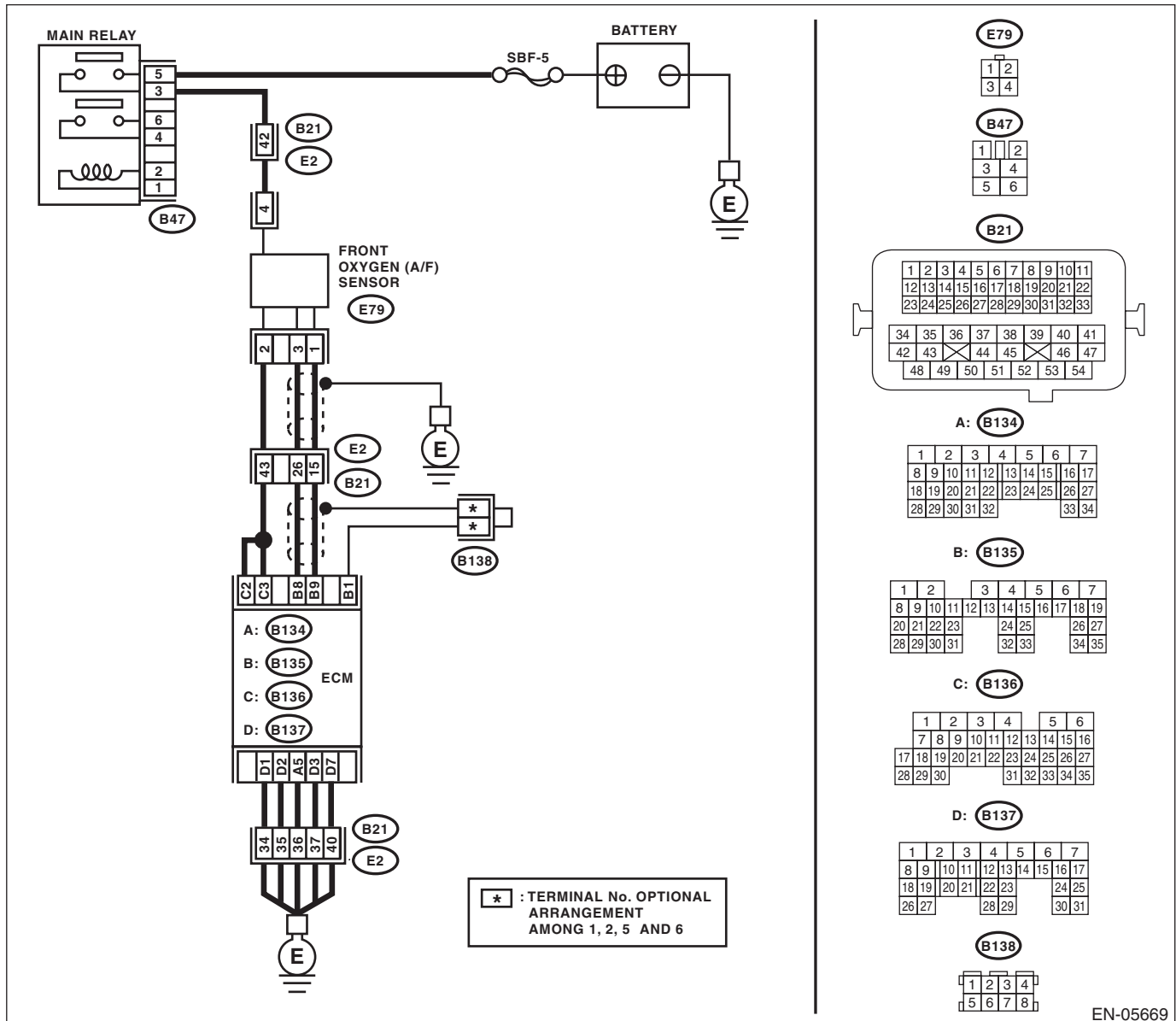
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-204, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E79) No. 1:</b> <b>(B135) No. 8 — (E79) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CO:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

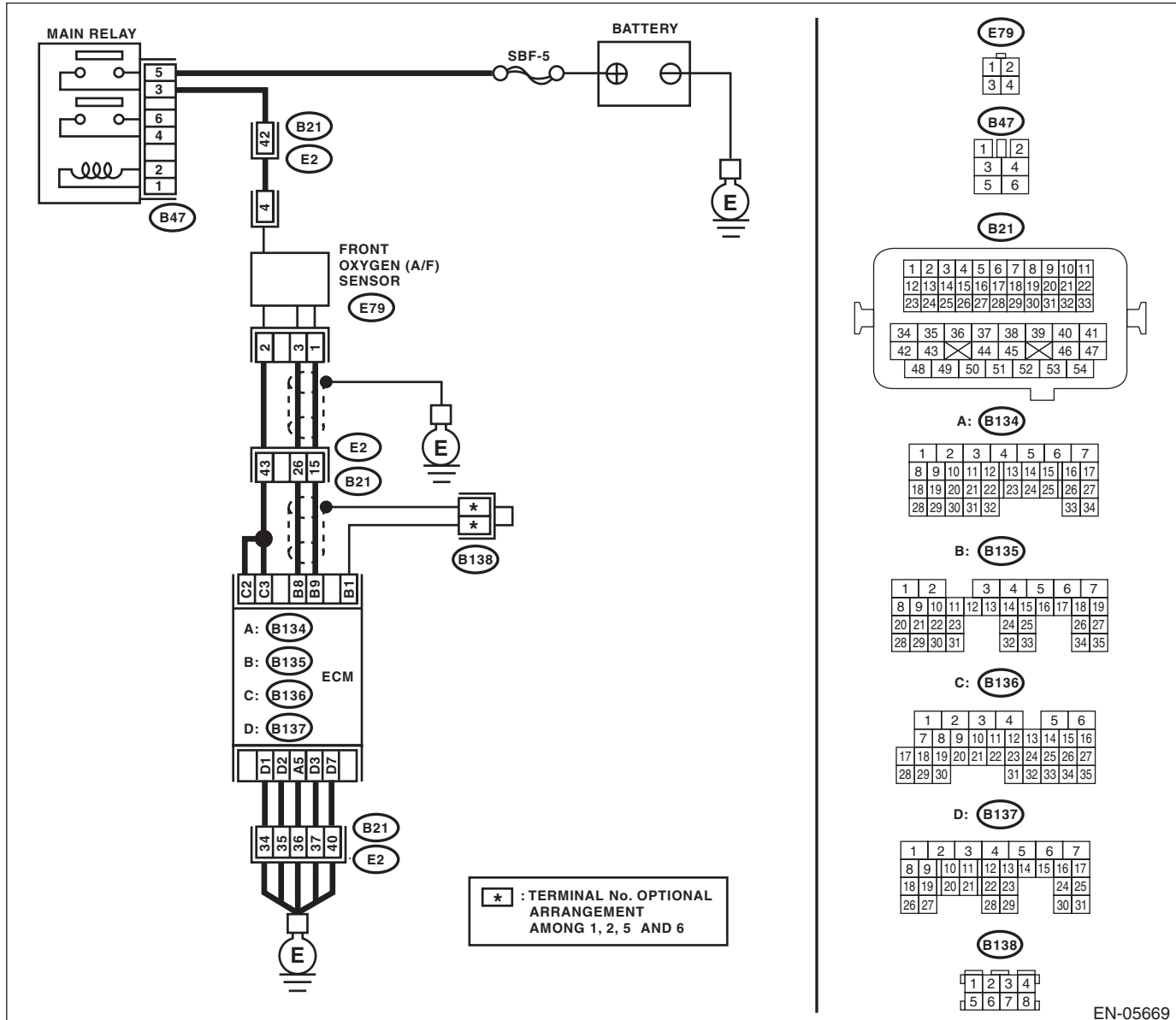
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-207, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05669

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 5.	Go to step 4.
4	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.

### CP:DTC P1160 RETURN SPRING FAILURE

#### NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CQ:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

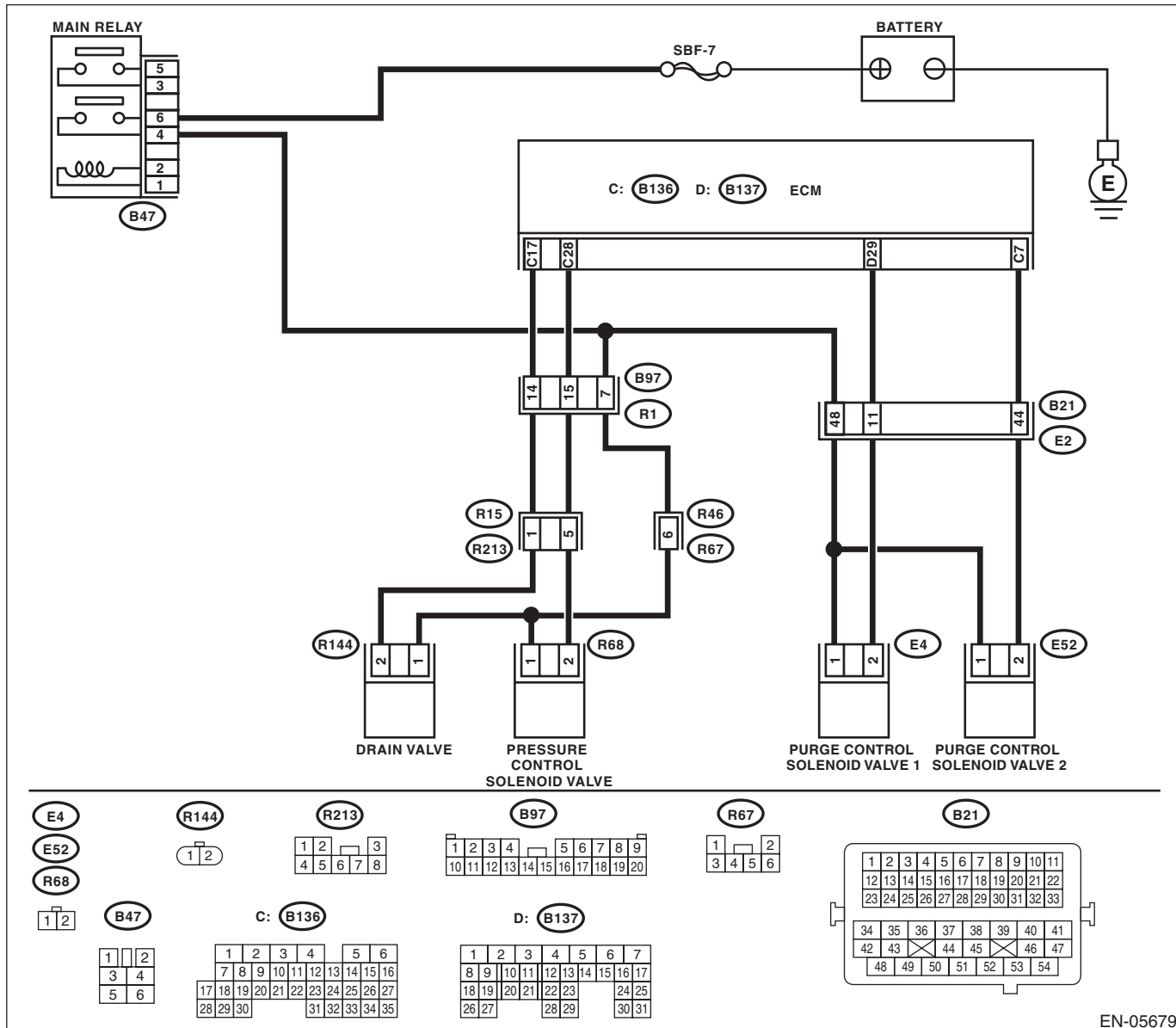
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-212, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 28 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Measure the resistance between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 2 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and pressure control solenoid valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and pressure control solenoid valve connector. <i>Connector &amp; terminal</i> <i>(B136) No. 28 — (R68) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance between pressure control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the pressure control solenoid valve. <Ref. to EC(H4DOTC)-15, Pressure Control Solenoid Valve.>
<b>5 CHECK POWER SUPPLY TO THE PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of pressure control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between main relay and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>



## **CR:DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-214, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

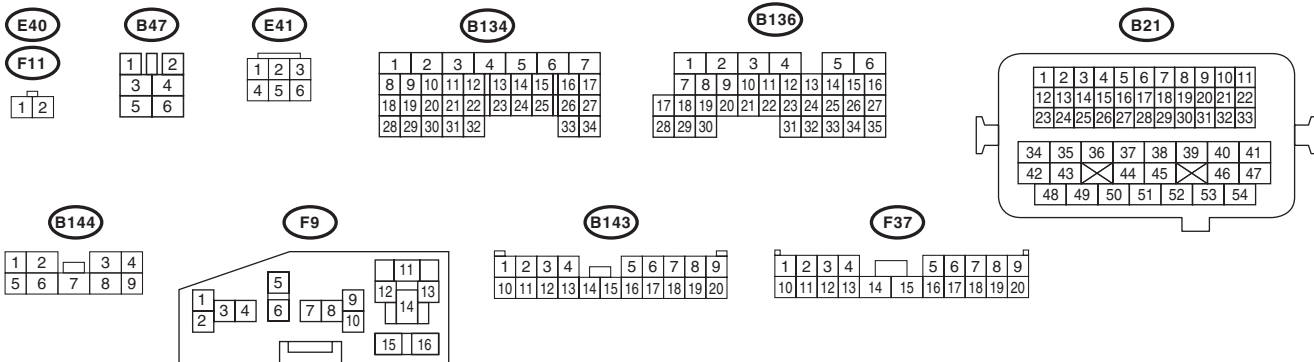
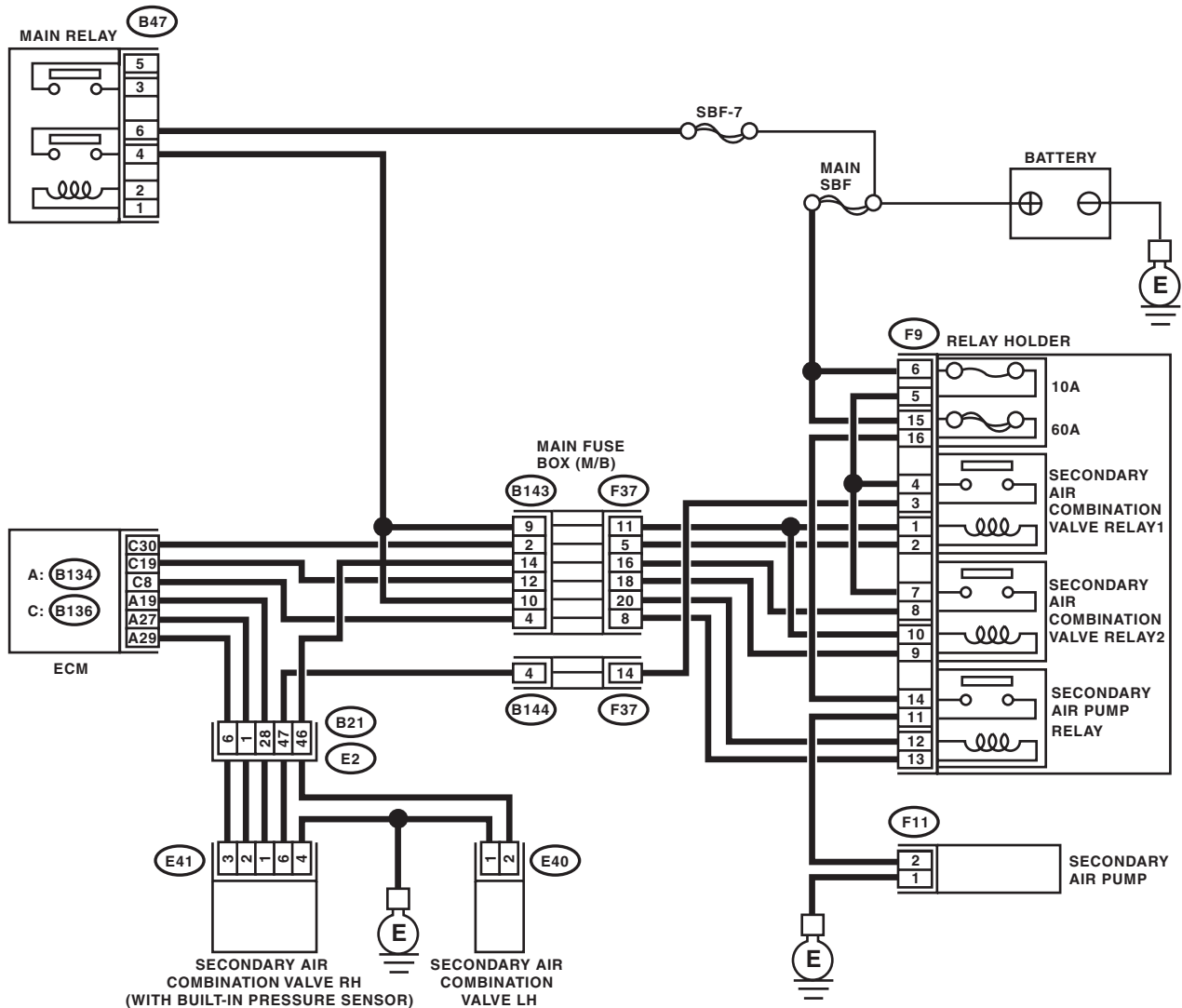
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK SECONDARY AIR COMBINATION VALVE.</b> 1) Remove the secondary air combination valve. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.> 2) Blow in air from the secondary air combination valve air inlet, and check whether there are leaks at the pipe connections.	Are there air leaks from the pipe connections?	Replace the secondary air combination valve on the side with the air leak. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **CS:DTC P1418 SECONDARY AIR INJECTION SYSTEM CONTROL “A” CIRCUIT SHORTED**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-216, DTC P1418 SECONDARY AIR INJECTION SYSTEM CONTROL “A” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

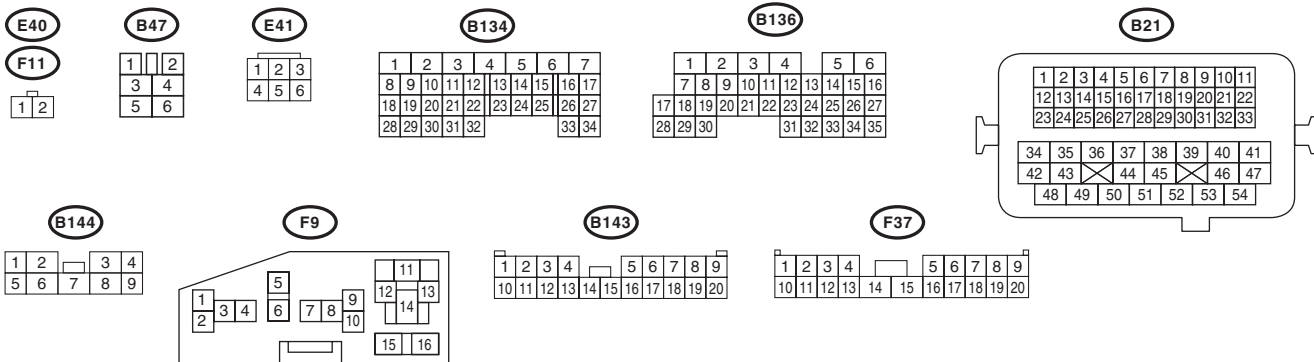
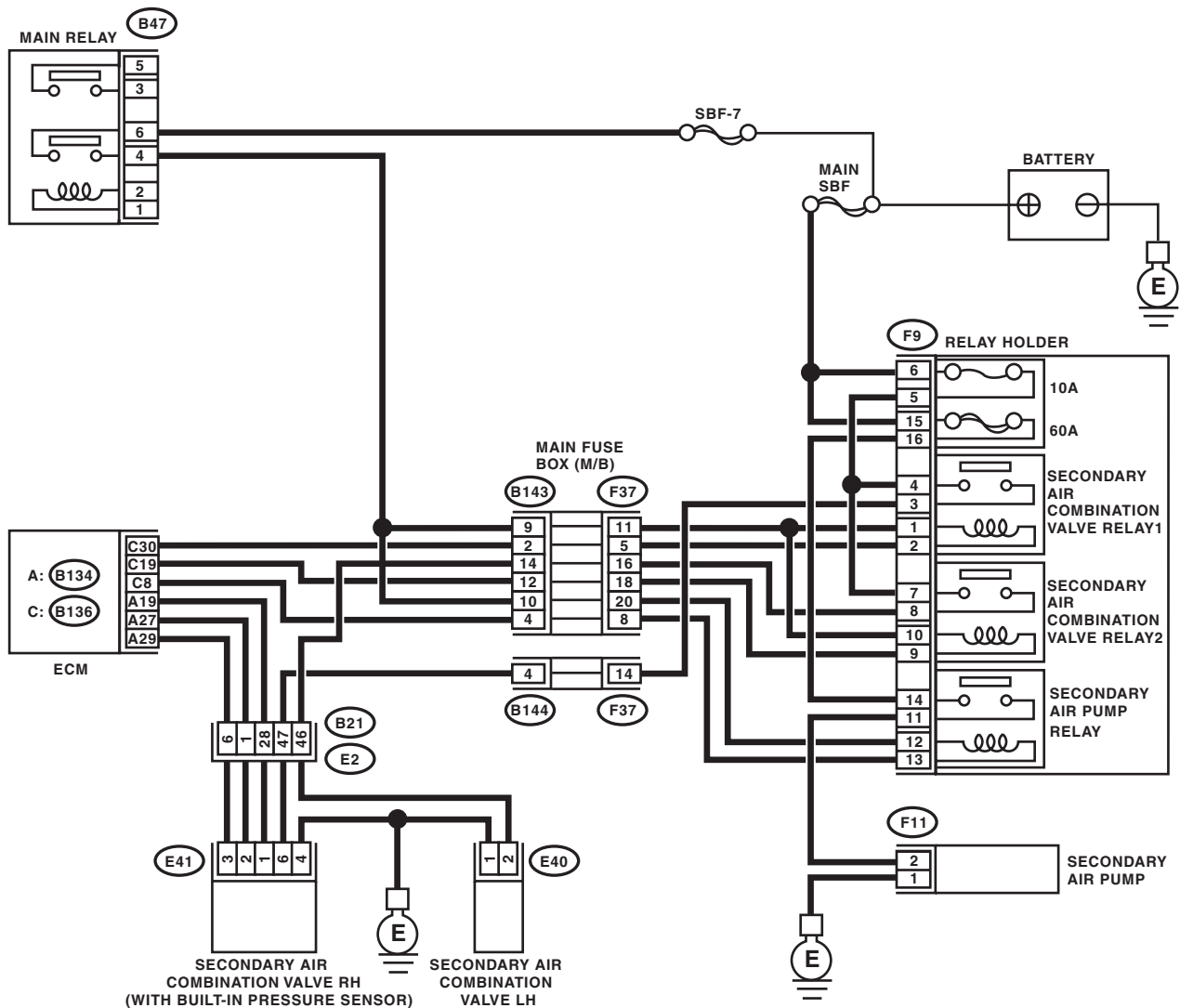
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and secondary air pump relay. 3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 8 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and secondary air pump relay.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.</p> <p><b>NOTE:</b> In this case, temporary poor contact of connector may be the cause.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CT:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

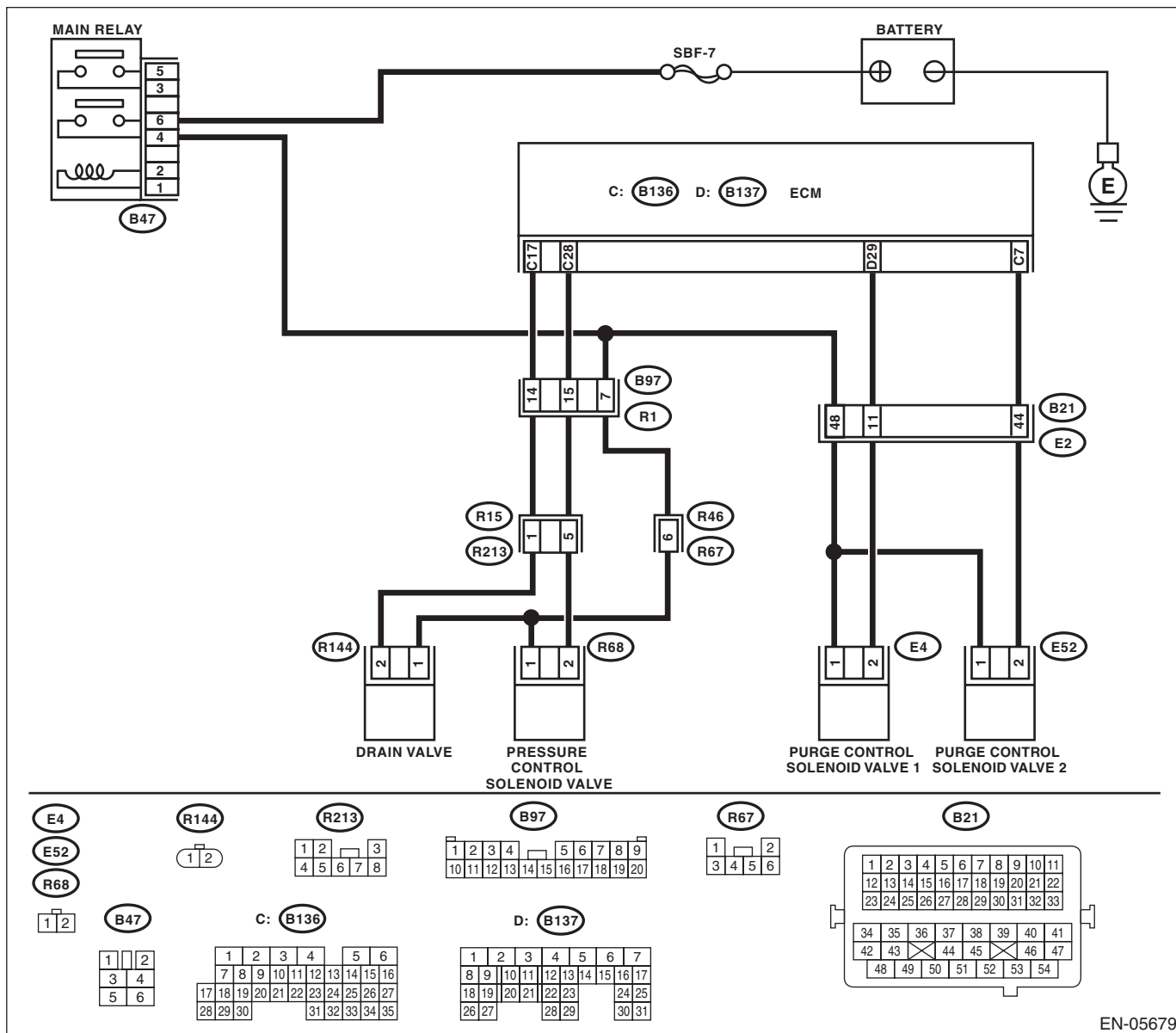
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-217, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the ECM and pressure control solenoid valve.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 28 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Measure the resistance between pressure control solenoid valve terminals.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Replace the pressure control solenoid valve. &lt;Ref. to EC(H4DOTC)-15, Pressure Control Solenoid Valve.&gt;</p>	<p>Repair the poor contact of the ECM connector.</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CU:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-219, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

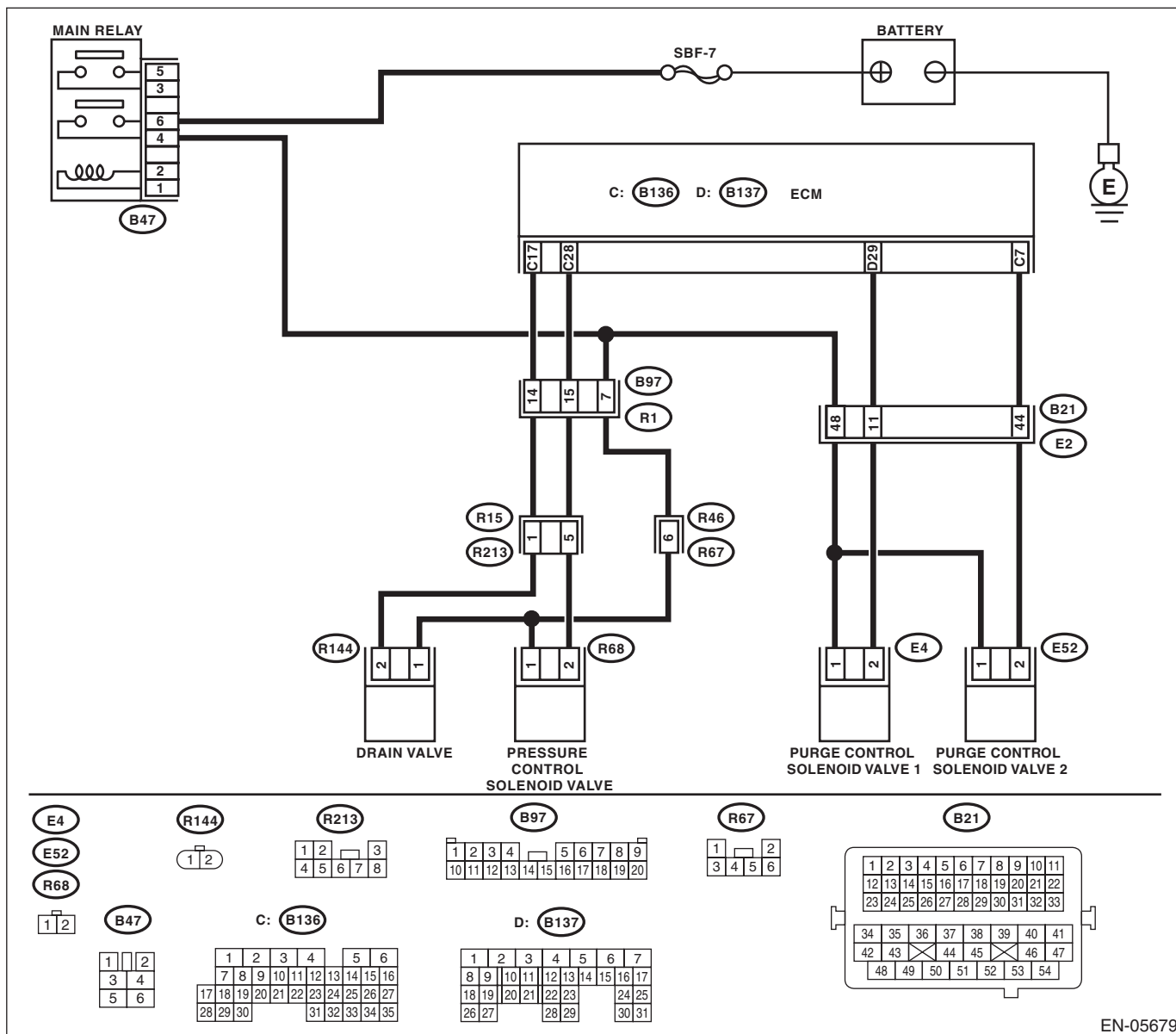
### TROUBLE SYMPTOM:

Improper fuel supply

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK DRAIN HOSE.</b> Check the drain hose for clogging.	Is there clogging in the drain hose?	Replace the drain hose.	Go to step 3.
3	<b>CHECK DRAIN VALVE OPERATION.</b> 1) Turn the ignition switch to OFF. 2) Connect the delivery (test) mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) Operate the drain valve.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Repair the poor contact of the ECM connector.	Replace the drain valve. <Ref. to EC(H4DOTC)-18, Drain Valve.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CV:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-221, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

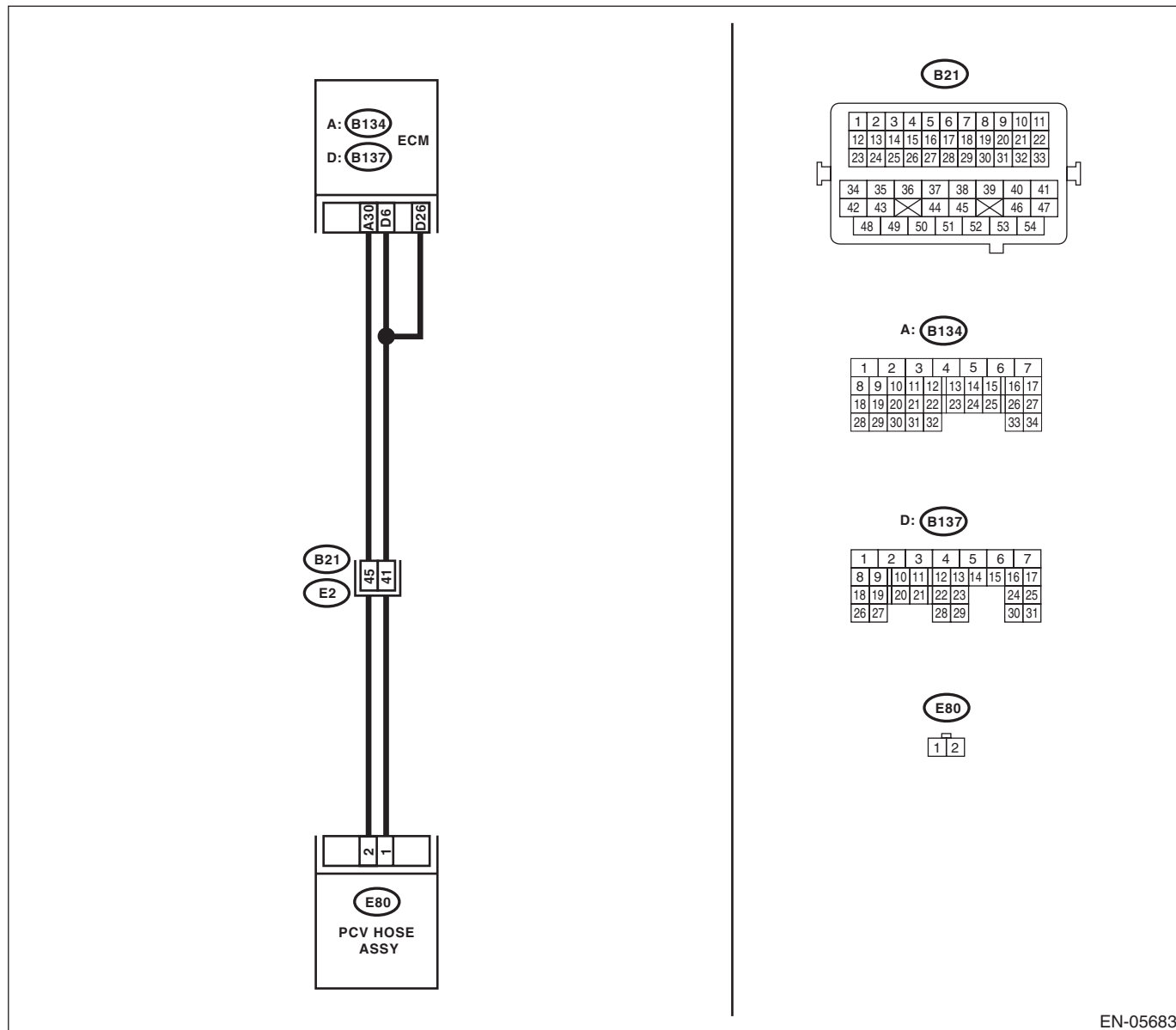
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05683

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK BLOW-BY HOSE.</b> Check the blow-by hose condition.	Is there any disconnection or crack in blow-by hose?	Repair or replace the blow-by hose.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and PCV hose assembly. 3) Measure the resistance of harness between ECM and PCV hose assembly. <b>Connector &amp; terminal</b> <b>(B134) No. 30 — (E80) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and PCV hose assembly.
<b>3 CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.</b> Measure the resistance between PCV hose assembly and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 30 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 4.	Repair the ground short circuit of harness between ECM and PCV hose assembly.
<b>4 CHECK GROUND CIRCUIT OF PCV HOSE ASSEMBLY.</b> Measure the resistance of harness between PCV hose assembly and engine ground. <b>Connector &amp; terminal</b> <b>(E80) No. 1 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between PCV hose assembly and engine ground.
<b>5 CHECK THE PCV HOSE ASSEMBLY.</b> Measure the resistance between the PCV hose assembly terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact in ECM and PCV hose assembly connector.	Replace the PCV hose assembly.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CW:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

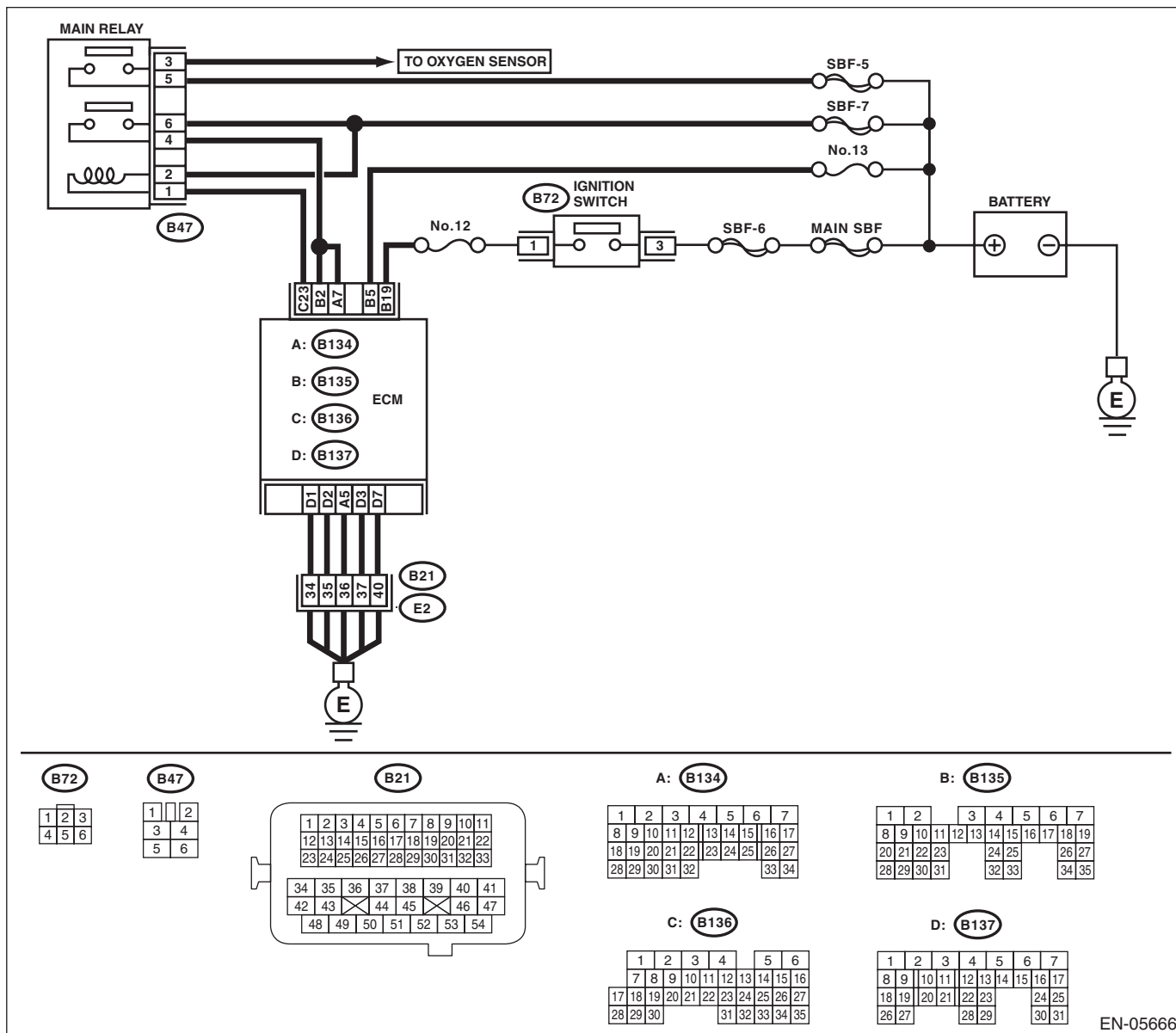
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-223, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05666

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 5 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 5 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and battery terminal.
<b>3</b> <b>CHECK FUSE NO. 13.</b>	Is the fuse blown out?	Replace the fuse.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and battery</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of battery terminal</li> </ul>

## **CX:DTC P1602 CONTROL MODULE PROGRAMMING ERROR**

### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-225, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **TROUBLE SYMPTOM:**

- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

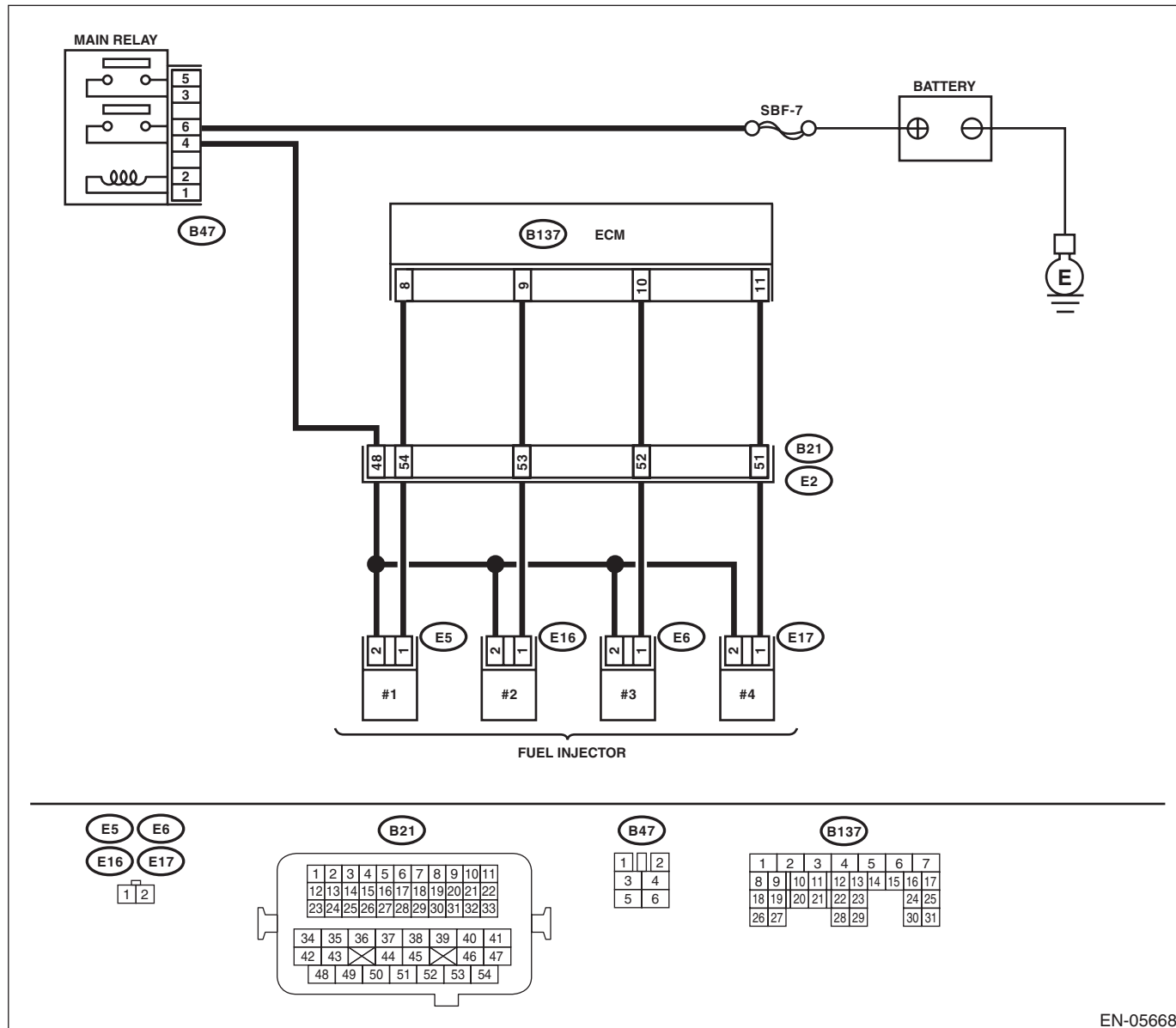
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:

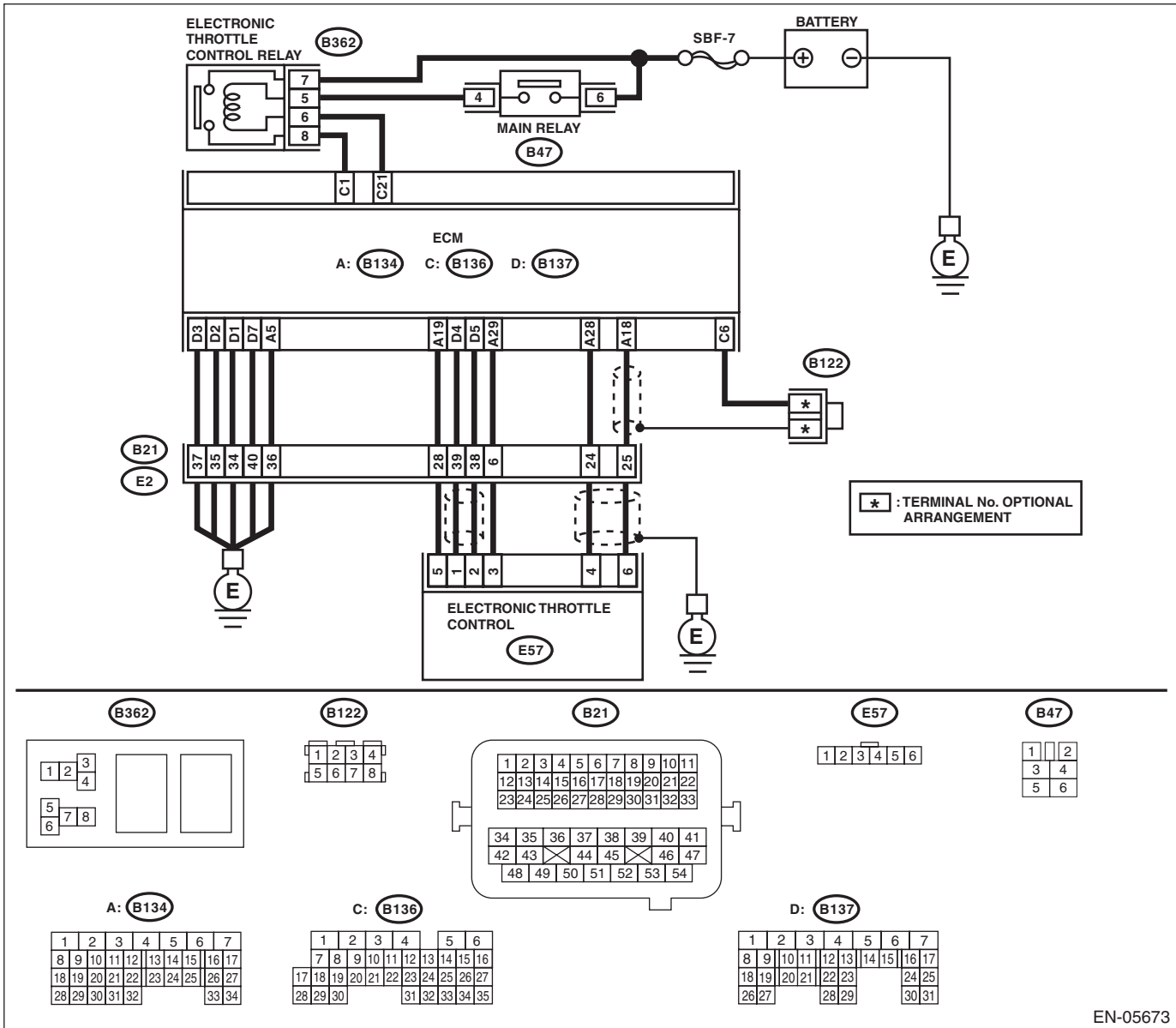


EN-05668



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)



EN-05673

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK ENGINE OIL.</b> Is there a proper amount of engine oil?	Go to step 3.	Replace engine oil. <Ref. to LU(H4SO)-9, REPLACEMENT, Engine Oil.>
3	<b>CHECK EXHAUST SYSTEM.</b> Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 4.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>4</b> <b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 5.
<b>5</b> <b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. <b>NOTE:</b> If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kg/cm <sup>2</sup> , 41 — 46 psi)?	Go to step 6.	Repair the following item. Fuel pressure is too high: <ul style="list-style-type: none"> <li>• Clogged fuel return line or bent hose</li> </ul> Fuel pressure is too low: <ul style="list-style-type: none"> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel supply line</li> </ul>
<b>6</b> <b>CHECK FUEL PRESSURE.</b> After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. <b>NOTE:</b> <ul style="list-style-type: none"> <li>• If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.</li> <li>• If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.</li> </ul>	Is the measured value 230 — 260 kPa (2.35 — 2.65 kg/cm <sup>2</sup> , 33 — 38 psi)?	Go to step 7.	Repair the following item. Fuel pressure is too high: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Clogged fuel return line or bent hose</li> </ul> Fuel pressure is too low: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel supply line</li> </ul>
<b>7</b> <b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step 8.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>8</b>      <b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 70°C (158°F).</p> <p>2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 9.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>9</b>      <b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 70°C (158°F).</p> <p>2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Go to step 10.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>10</b>     <b>CHECK OUTPUT SIGNAL OF ECM.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Measure the voltage between the ECM and chassis ground for faulty cylinders.</p> <p><b>Connector &amp; terminal</b></p> <p><b>#1 (B137) No. 8 (+) — Chassis ground (-):</b></p> <p><b>#2 (B137) No. 9 (+) — Chassis ground (-):</b></p> <p><b>#3 (B137) No. 10 (+) — Chassis ground (-):</b></p> <p><b>#4 (B137) No. 11 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 15.</p>	<p>Go to step 11.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>11 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (E5) No. 1 — Engine ground:</b> <b>#2 (E16) No. 1 — Engine ground:</b> <b>#3 (E6) No. 1 — Engine ground:</b> <b>#4 (E17) No. 1 — Engine ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 12.	Repair the ground short circuit of harness between ECM and fuel injector.
<b>12 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> Measure the resistance of harness between the ECM and fuel injector on faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 — (E5) No. 1:</b> <b>#2 (B137) No. 9 — (E16) No. 1:</b> <b>#3 (B137) No. 10 — (E6) No. 1:</b> <b>#4 (B137) No. 11 — (E17) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 13.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>13 CHECK FUEL INJECTOR.</b> Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 14.	Replace the faulty fuel injector. <Ref. to FU(H4DOTC)-32, Fuel Injector.>
<b>14 CHECK POWER SUPPLY LINE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (E5) No. 2 (+) — Engine ground (-):</b> <b>#2 (E16) No. 2 (+) — Engine ground (-):</b> <b>#3 (E6) No. 2 (+) — Engine ground (-):</b> <b>#4 (E17) No. 2 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and fuel injector connector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>15 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (B137) No. 8 (+) — Chassis ground (-):</b>  <b>#2 (B137) No. 9 (+) — Chassis ground (-):</b>  <b>#3 (B137) No. 10 (+) — Chassis ground (-):</b>  <b>#4 (B137) No. 11 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 16.
<p><b>16 CHECK FUEL INJECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H4DOTC)-32, Fuel Injector.>	Go to step 17.
<p><b>17 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b></p>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 18.
<p><b>18 CHECK CRANK SPROCKET.</b></p> <p>Remove the timing belt cover.</p>	Is the crank sprocket rusted or does it have damaged teeth?	Replace the crank sprocket. <Ref. to ME(H4DOTC)-52, Crank Sprocket.>	Go to step 19.
<p><b>19 CHECK INSTALLATION CONDITION OF TIMING BELT.</b></p> <p>Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block.</p>	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4DOTC)-42, Timing Belt.>	Go to step 20.
<p><b>20 CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals.</p> <p><b>Terminals</b>  <b>No. 7 — No. 8:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 21.	Replace the electronic throttle control relay. <Ref. to FU(H4DOTC)-48, Electronic Throttle Control Relay.>
<p><b>21 CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E362) No. 7 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 22.	Repair the open or ground short circuit of power supply circuit.
<p><b>22 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 6 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 23.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>23 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 — Chassis ground:</i> <i>(B362) No. 8 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 24.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<b>24 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the resistance between the ECM and electronic throttle control relay connector. <i>Connector &amp; terminal</i> <i>(B136) No. 21 — (B362) No. 6:</i> <i>(B136) No. 1 — (B362) No. 8:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 25.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<b>25 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 19 — Chassis ground:</i> <i>(B134) No. 18 — Chassis ground:</i> <i>(B134) No. 18 — (B136) No. 6:</i> <i>(B134) No. 28 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 26.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.
<b>26 CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(B57) No. 6 — Engine ground:</i> <i>(B57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 27.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>
<b>27 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 28.	Repair the open circuit of harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>28 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b>                      1) Connect the ECM.                      2) Measure the resistance between electronic throttle control connector and engine ground.  <b>Connector &amp; terminal</b>  <b>(E57) No. 3 — Engine ground:</b></p>	<p>Is the resistance less than 5 <math>\Omega</math>?</p>	<p>Go to step <b>29</b>.</p>	<p>Repair the harness and connector.                      NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>29 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b>                      1) Turn the ignition switch to ON.                      2) Measure the voltage between electronic throttle control connector and engine ground.  <b>Connector &amp; terminal</b>  <b>(E57) No. 6 (+) — Engine ground (-):</b>  <b>(E57) No. 4 (+) — Engine ground (-):</b></p>	<p>Is the voltage 4.85 V or more?</p>	<p>Repair the short circuit to power in the harness between ECM and electronic throttle control connector.</p>	<p>Go to step <b>30</b>.</p>
<p><b>30 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B134) No. 19 — (B134) No. 18:</b>  <b>(B134) No. 19 — (B134) No. 28:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Go to step <b>31</b>.</p>	<p>Repair the short circuit to power in the harness between ECM and electronic throttle control connector.</p>
<p><b>31 CHECK SENSOR OUTPUT.</b>                      1) Connect all connectors.                      2) Turn the ignition switch to ON.                      3) Read the data of main throttle sensor signal using Subaru Select Monitor.                      NOTE:                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p>	<p>Is the voltage 0.81 — 0.87 V?</p>	<p>Go to step <b>32</b>.</p>	<p>Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective.                      &lt;Ref. to FU(H4DOTC)-11, Throttle Body.&gt;</p>
<p><b>32 CHECK SENSOR OUTPUT.</b>                      Read the data of sub throttle sensor signal using Subaru Select Monitor.                      NOTE:                      Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p>	<p>Is the voltage 1.64 — 1.70 V?</p>	<p>Go to step <b>33</b>.</p>	<p>Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective.                      &lt;Ref. to FU(H4DOTC)-11, Throttle Body.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>33 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B137) No. 5 — (E57) No. 2:</i> <i>(B137) No. 4 — (E57) No. 1:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 34.	Repair the open circuit of harness between ECM and electronic throttle control.
<b>34 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 (+) — Engine ground (-):</i> <i>(E57) No. 1 (+) — Engine ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step 35.
<b>35 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — Engine ground:</i> <i>(E57) No. 1 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 36.	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>36 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — (E57) No. 1:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 37.	Repair the short circuit of harness between ECM and electronic throttle control.
<b>37 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 5 — Chassis ground:</i> <i>(B137) No. 1 — Chassis ground:</i> <i>(B137) No. 2 — Chassis ground:</i> <i>(B137) No. 3 — Chassis ground:</i> <i>(B137) No. 7 — Chassis ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 38.	Repair the open circuit of the harness between the ECM and engine ground.
<b>38 CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance 50 $\Omega$ or less?	Go to step 39.	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>
<b>39 CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CY:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-227, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 <b>CHECK TUMBLE GENERATOR VALVE RH.</b> 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Assembly.>

## CZ:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-228, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the **Clear Memory Mode** <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 <b>CHECK TUMBLE GENERATOR VALVE LH.</b> 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Assembly.>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

### DA:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-229, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK TUMBLE GENERATOR VALVE RH.</b> 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?  Clean the tumble generator valve.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Assembly.>

### DB:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-230, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK TUMBLE GENERATOR VALVE LH.</b> 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?  Clean the tumble generator valve.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Assembly.>

## DC:DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1)

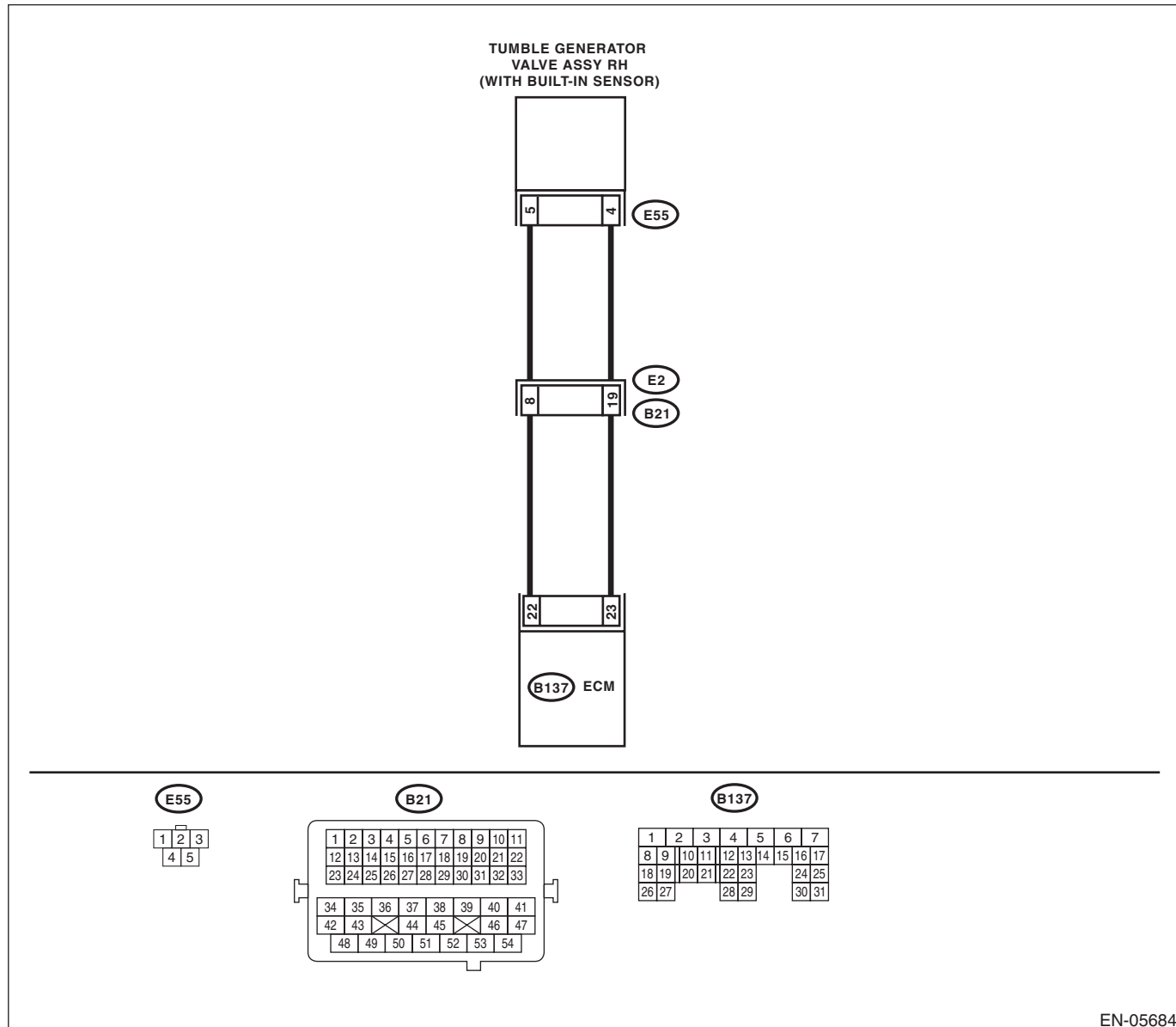
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-231, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and tumble generator valve assembly.                      3) Measure the resistance of harness between ECM and tumble generator valve assembly.</p> <p><b>Connector &amp; terminal</b>  <b>(B137) No. 22 — (E55) No. 5:</b>  <b>(B137) No. 23 — (E55) No. 4:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and tumble generator valve assembly connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B137) No. 22 — Chassis ground:</b>  <b>(B137) No. 23 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and tumble generator valve assembly connector.</p>
<p><b>3</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of tumble generator valve assembly connector.</p>	<p>Is there poor contact in the tumble generator valve assembly connector?</p>	<p>Repair the poor contact of tumble generator valve assembly connector.</p>	<p>Replace the tumble generator valve assembly. &lt;Ref. to FU(H4DOTC)-36, Tumble Generator Valve Actuator.&gt;</p>

## DD:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

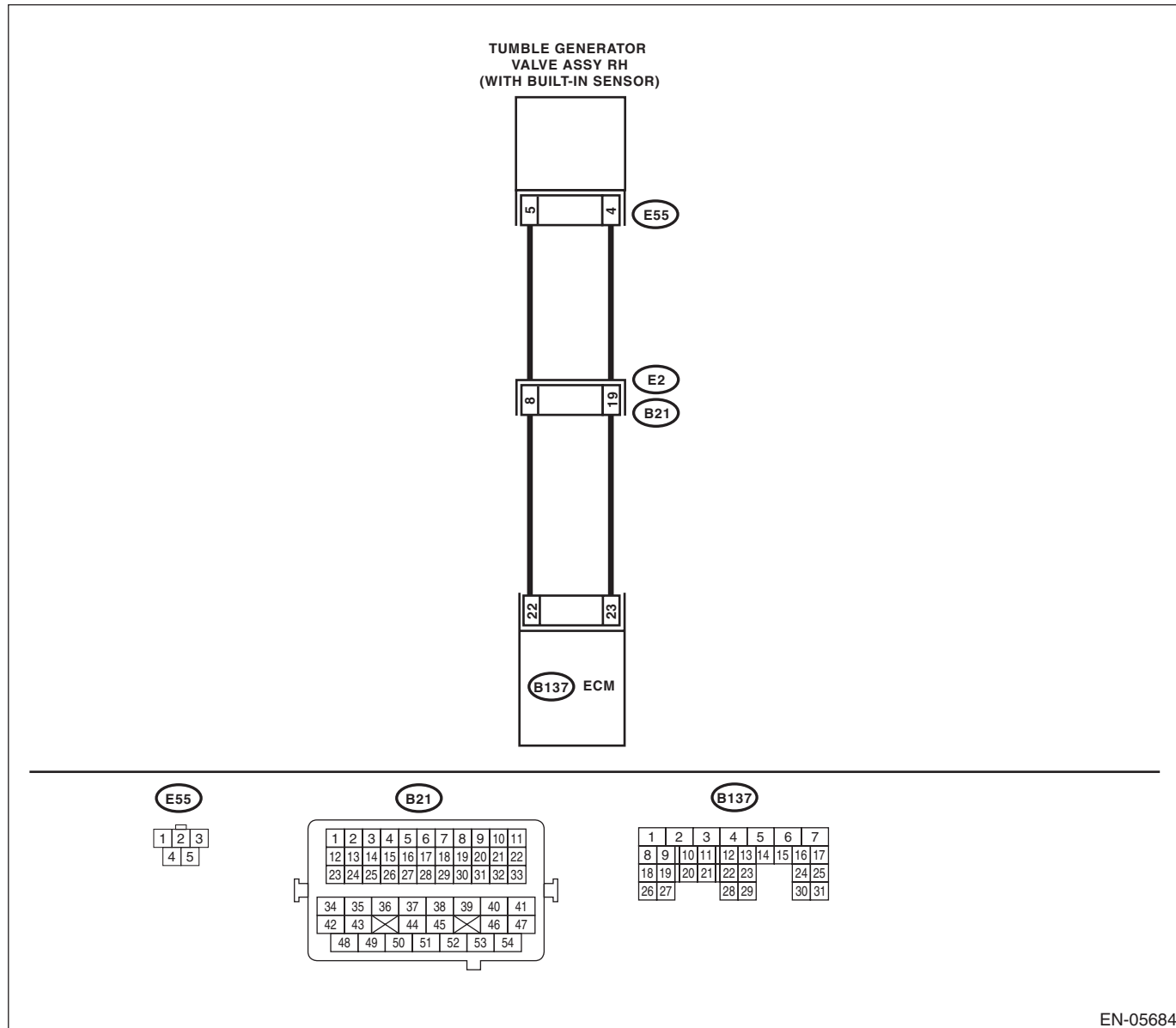
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-233, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 22 (+) — Chassis ground (-):</b> <b>(B137) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and tumble generator valve assembly.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Actuator.>

## DE:DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2)

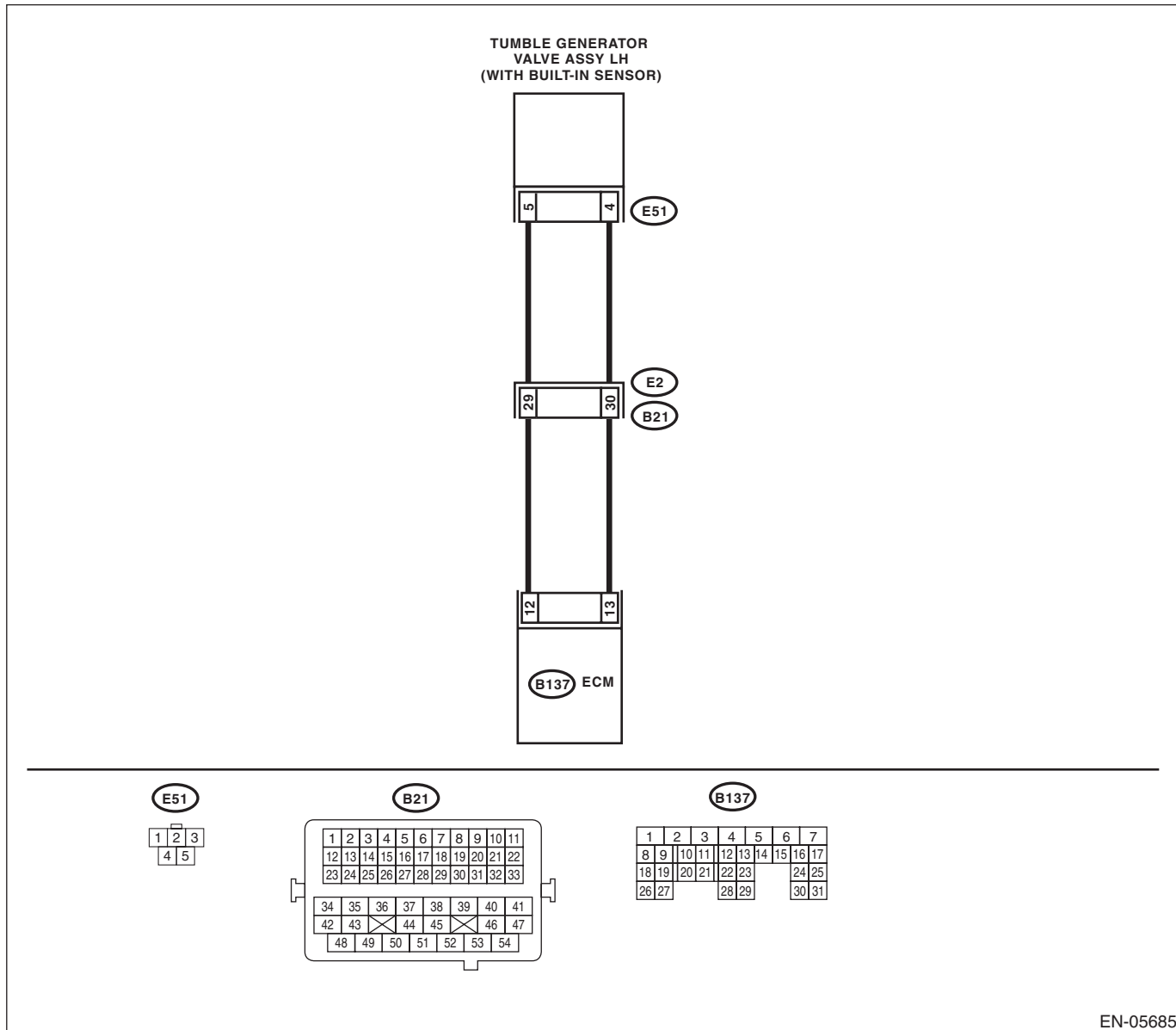
**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-235, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and tumble generator valve assembly.                      3) Measure the resistance of harness between ECM and tumble generator valve assembly.</p> <p><b>Connector &amp; terminal</b>  <b>(B137) No. 12 — (E51) No. 5:</b>  <b>(B137) No. 13 — (E51) No. 4:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and tumble generator valve assembly connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B137) No. 12 — Chassis ground:</b>  <b>(B137) No. 13 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and tumble generator valve assembly connector.</p>
<p><b>3</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of tumble generator valve assembly connector.</p>	<p>Is there poor contact in the tumble generator valve assembly connector?</p>	<p>Repair the poor contact of tumble generator valve assembly connector.</p>	<p>Replace the tumble generator valve assembly. &lt;Ref. to FU(H4DOTC)-36, Tumble Generator Valve Actuator.&gt;</p>



## DF:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

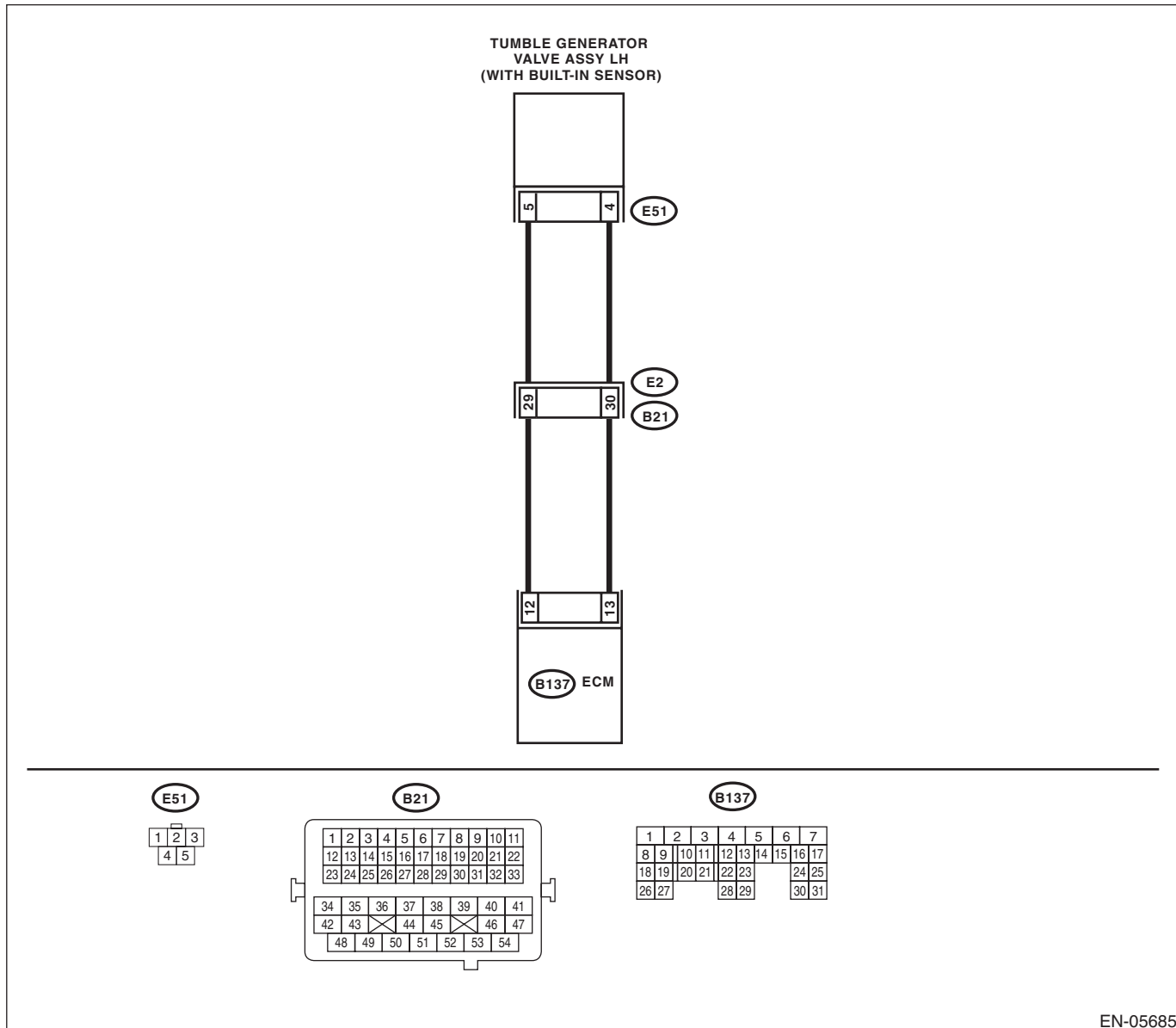
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-237, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B137) No. 12 (+) — Chassis ground (-):</b> <b>(B137) No. 13 (+) — Chassis ground (-):</b></p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and tumble generator valve assembly.	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Actuator.>

## DG:DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-239, DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

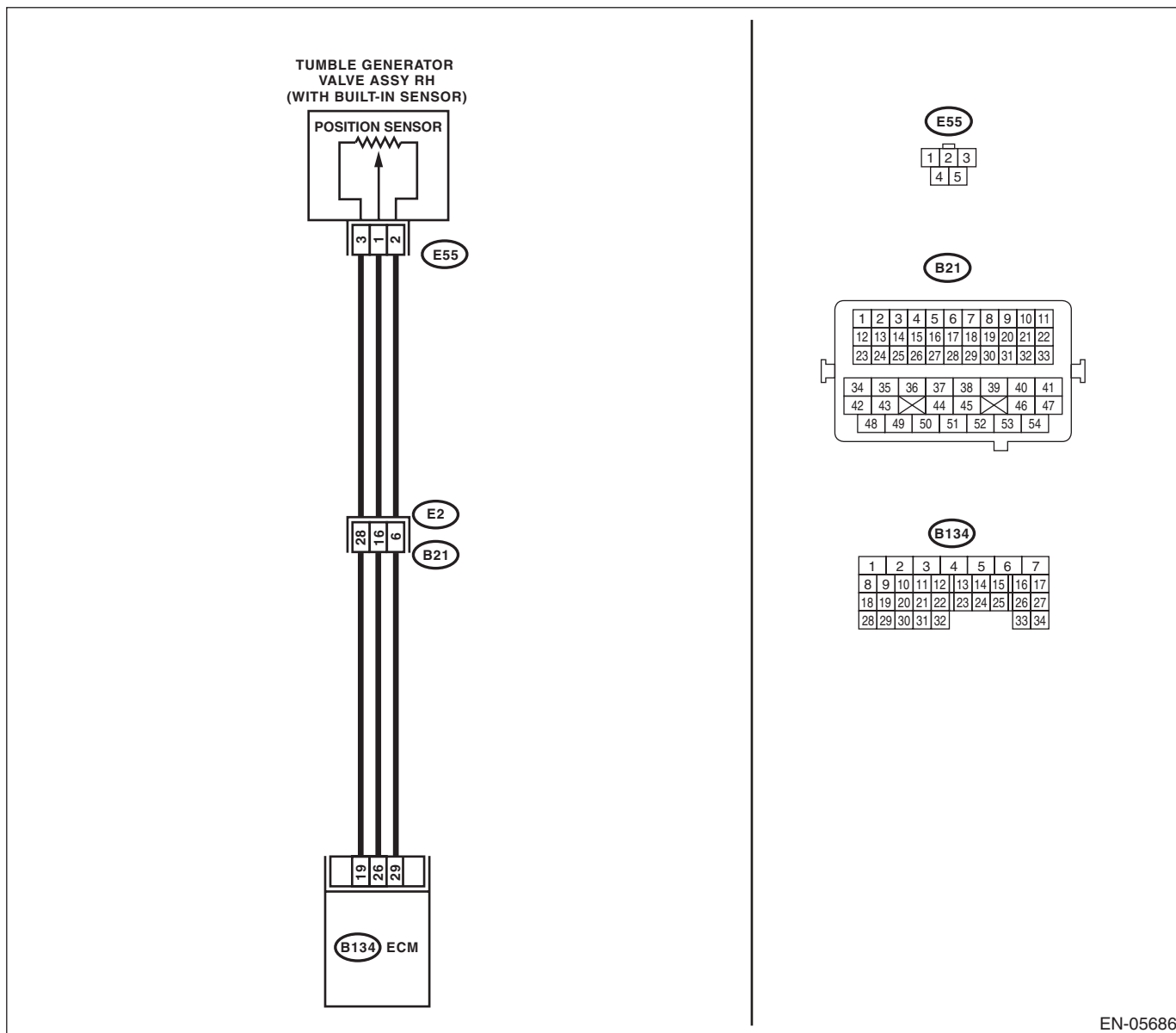
**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



EN-05686

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage less than 0.2 V?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK POWER SUPPLY OF TUMBLE GENERATOR VALVE POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from tumble generator valve position sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between tumble generator valve position sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E55) No. 3 (+) — Engine ground (-):</b></p>	Is the voltage 4.5 V or more?	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
3	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance of harness between ECM and tumble generator valve position sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 26 — (E55) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 26 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	<p>Repair the ground short circuit of harness between ECM and tumble generator valve position sensor connector.</p>
5	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact in ECM and tumble generator valve position sensor connector.</p>	Is there poor contact in ECM and tumble generator valve position sensor connector?	Repair the poor contact in ECM or tumble generator valve position sensor connector.	<p>Replace the tumble generator valve position sensor.</p> <p>&lt;Ref. to FU(H4DOTC)-37, Tumble Generator Valve Position Sensor.&gt;</p>

## DH:DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-241, DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

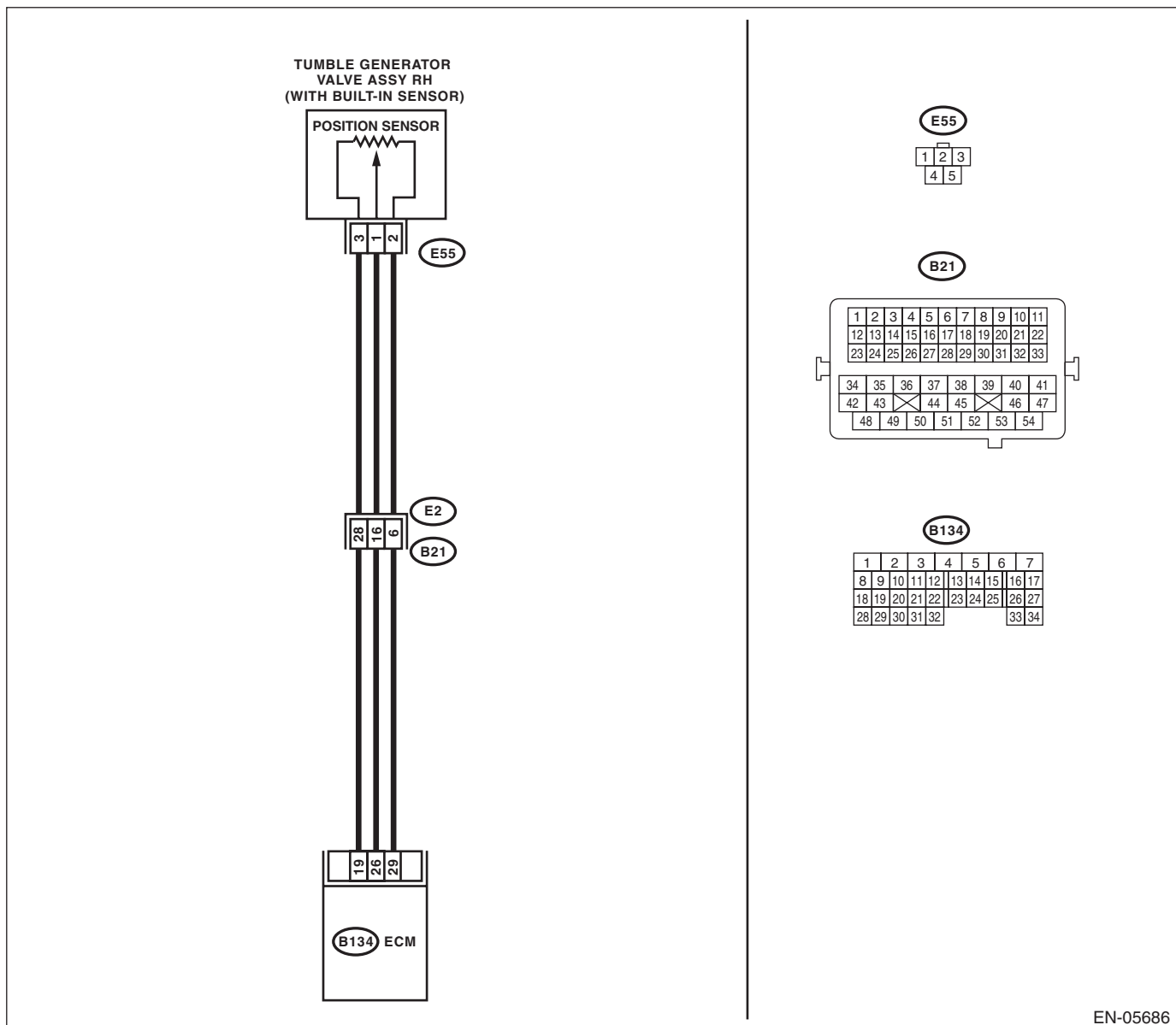
**TROUBLE SYMPTOM:**

- Improper idling
- Engine stalls.
- Poor driving performance

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from tumble generator valve position sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and tumble generator valve position sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between tumble generator valve position sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E55) No. 2 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact in the tumble generator valve position sensor connector.</p>	Is there poor contact in the tumble generator valve position sensor connector?	Repair the poor contact of the tumble generator valve position sensor connector.	<p>Replace the tumble generator valve position sensor.</p> <p>&lt;Ref. to FU(H4DOTC)-37, Tumble Generator Valve Position Sensor.&gt;</p>

## DI: DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-243, DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

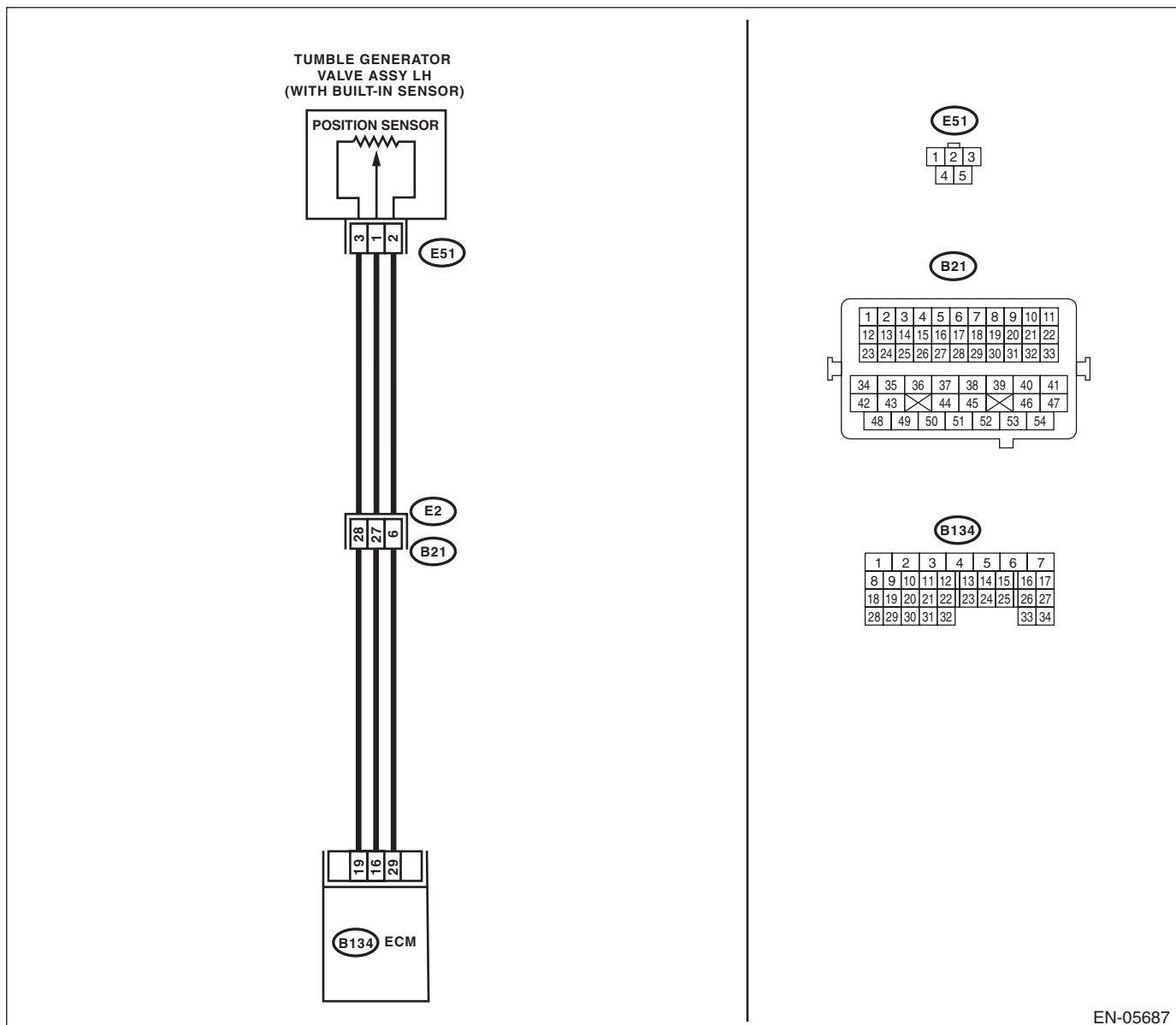
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05687

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage less than 0.2 V?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2 CHECK POWER SUPPLY OF TUMBLE GENERATOR VALVE POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from tumble generator valve position sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between tumble generator valve position sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E51) No. 3 (+) — Engine ground (-):</b></p>	Is the voltage 4.5 V or more?	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3 CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance of harness between ECM and tumble generator valve position sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 16 — (E51) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>4 CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 16 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	<p>Repair the ground short circuit of harness between ECM and tumble generator valve position sensor connector.</p>
<p><b>5 CHECK POOR CONTACT.</b></p> <p>Check for poor contact in ECM and tumble generator valve position sensor connector.</p>	Is there poor contact in ECM and tumble generator valve position sensor connector?	Repair the poor contact in ECM or tumble generator valve position sensor connector.	<p>Replace the tumble generator valve position sensor.</p> <p>&lt;Ref. to FU(H4DOTC)-37, Tumble Generator Valve Position Sensor.&gt;</p>



## DJ:DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-245, DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

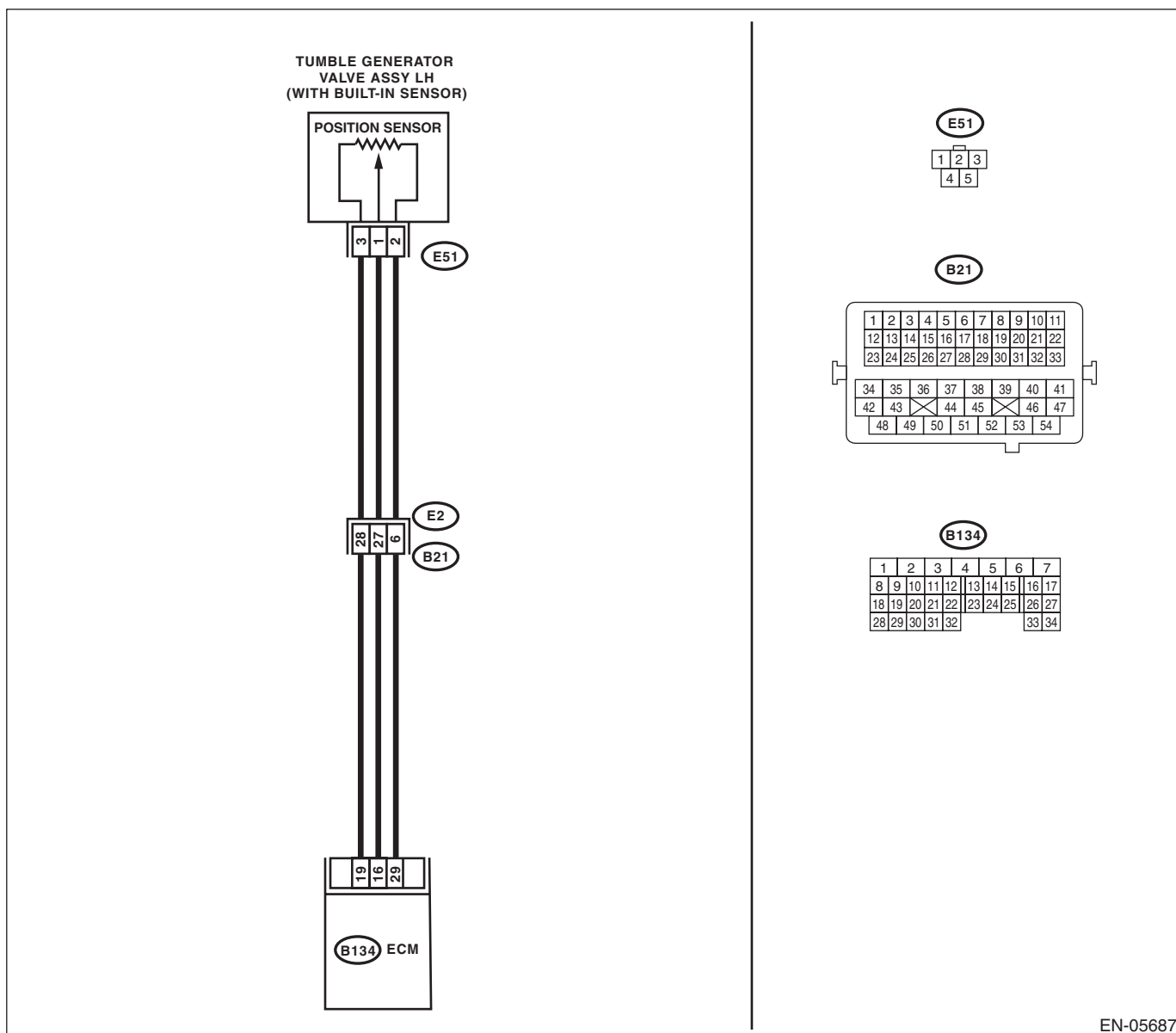
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05687

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from tumble generator valve position sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and tumble generator valve position sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between tumble generator valve position sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E51) No. 2 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and tumble generator valve position sensor connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact in the tumble generator valve position sensor connector.</p>	Is there poor contact in the tumble generator valve position sensor connector?	Repair the poor contact of the tumble generator valve position sensor connector.	<p>Replace the tumble generator valve position sensor.</p> <p>&lt;Ref. to FU(H4DOTC)-37, Tumble Generator Valve Position Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DK:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-247, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

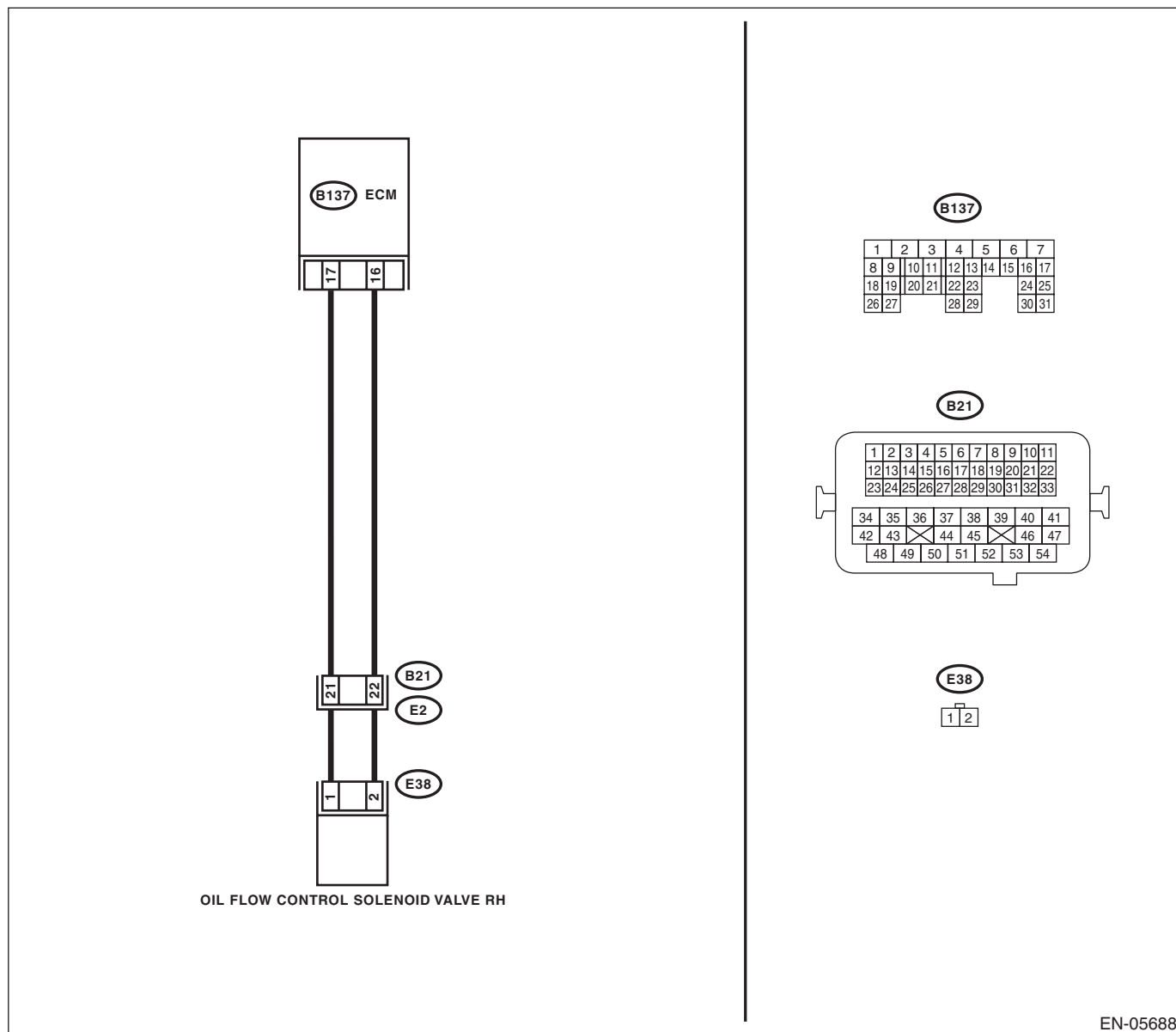
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05688

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from ECM and oil flow control solenoid valve.            3) Measure the resistance of harness between ECM and oil flow control solenoid valve.  <b>Connector &amp; terminal</b>  <b>(B137) No. 17 — (E38) No. 1:</b>  <b>(B137) No. 16 — (E38) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of the harness between the ECM and oil flow control solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>2</b>     <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b>            Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 17 — Chassis ground:</b>  <b>(B137) No. 16 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and oil flow control solenoid valve connector.</p>
<p><b>3</b>     <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b>            Measure the resistance between oil flow control solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of the ECM and oil flow control solenoid valve connector.</p>	<p>Replace the oil flow control solenoid valve. &lt;Ref. to ME(H4DOTC)-53, Camshaft.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DL:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-249, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

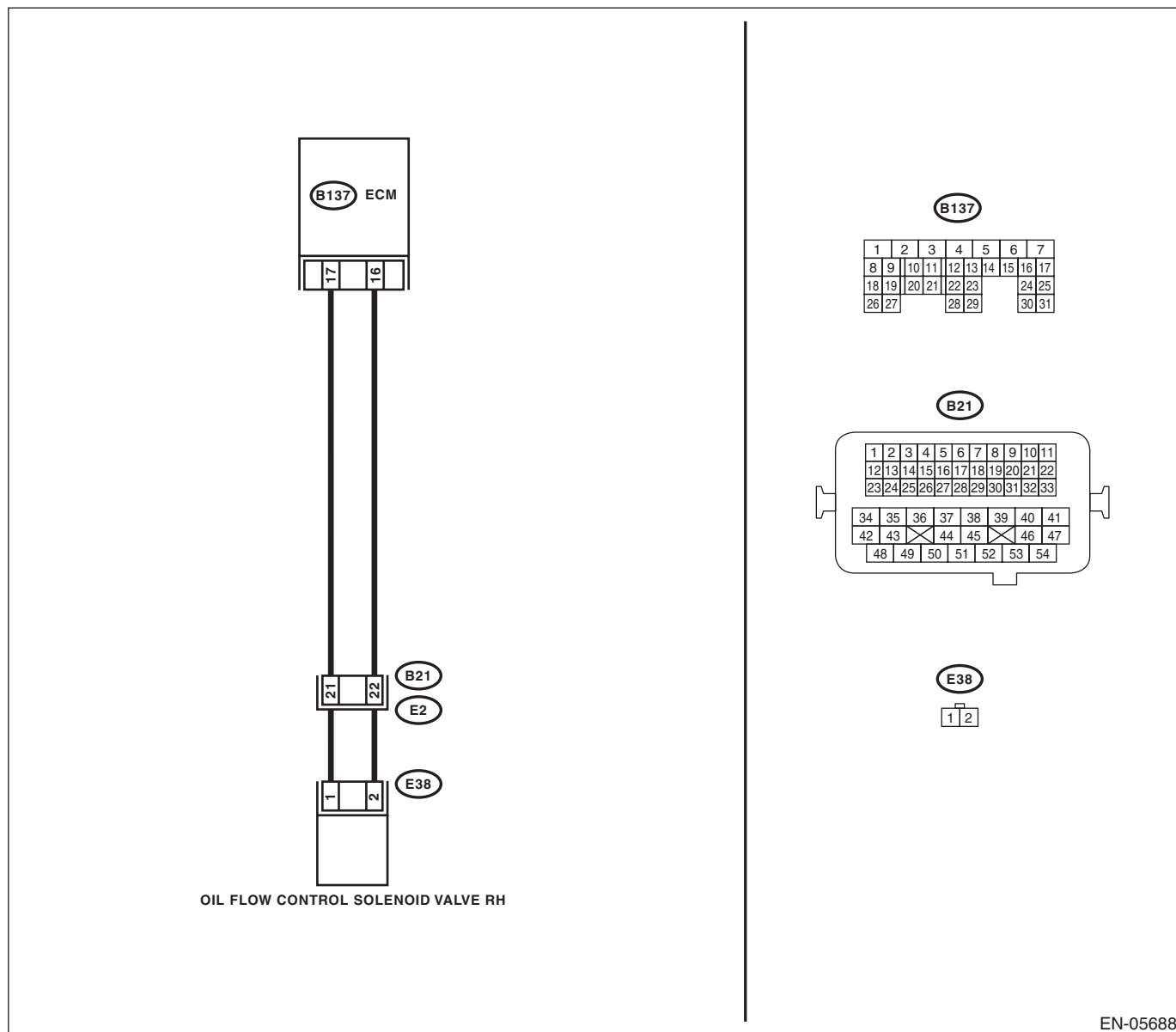
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05688

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 17 (+) — Chassis ground (-):</b> <b>(B137) No. 16 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 2.	Repair the short circuit to power in the harness between the ECM and oil flow control solenoid valve connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and oil flow control solenoid valve connector. <b>Connector &amp; terminal</b> <b>(B137) No. 17 — (E38) No. 1:</b> <b>(B137) No. 16 — (E38) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and oil flow control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 6 — 12 $\Omega$ ?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

## DM:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-250, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

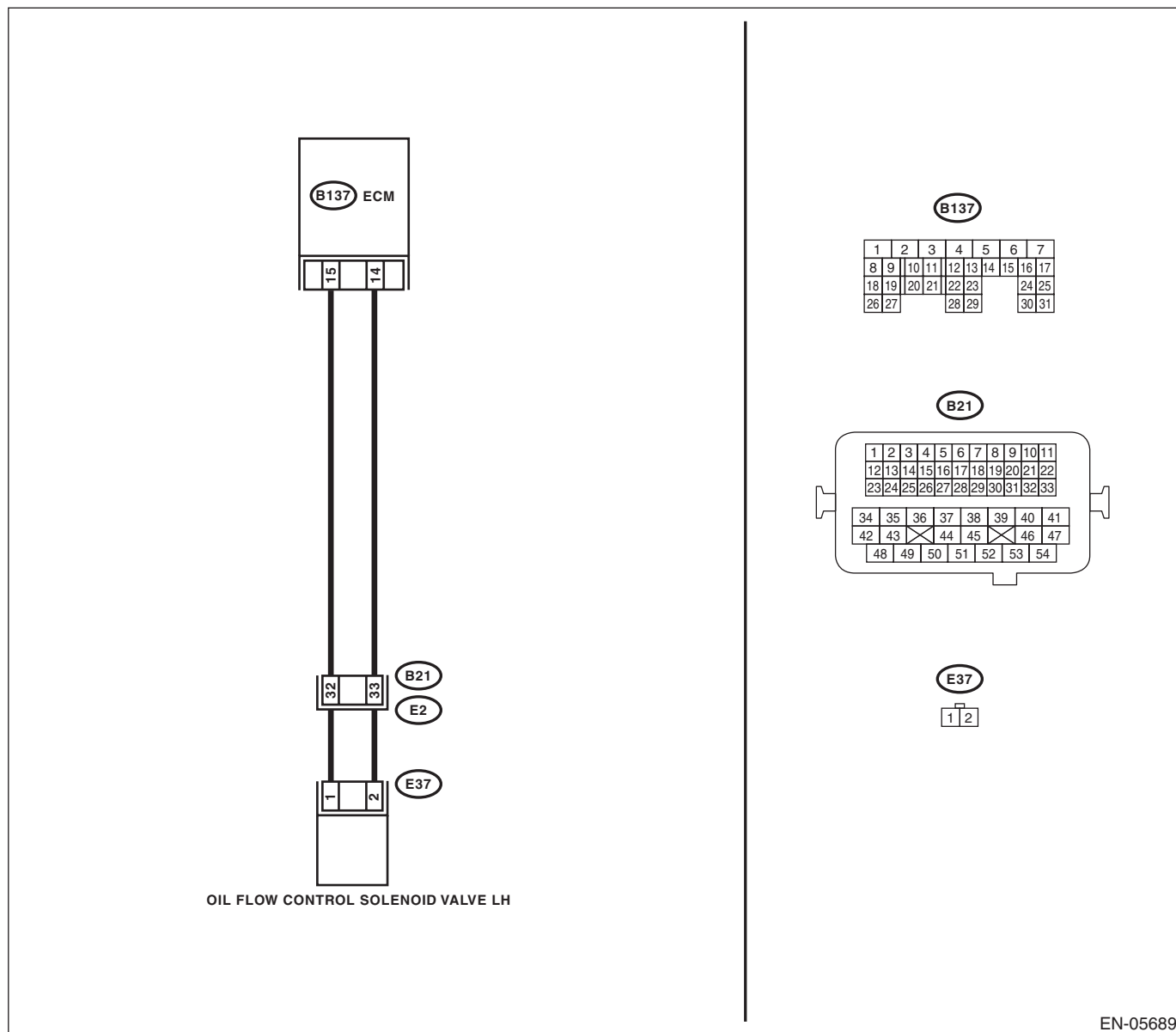
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve. <b>Connector &amp; terminal</b> <b>(B137) No. 15 — (E37) No. 1:</b> <b>(B137) No. 14 — (E37) No. 2:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and oil flow control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 15 — Chassis ground:</b> <b>(B137) No. 14 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and oil flow control solenoid valve connector.
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 6 — 12 Ω?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DN:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-250, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

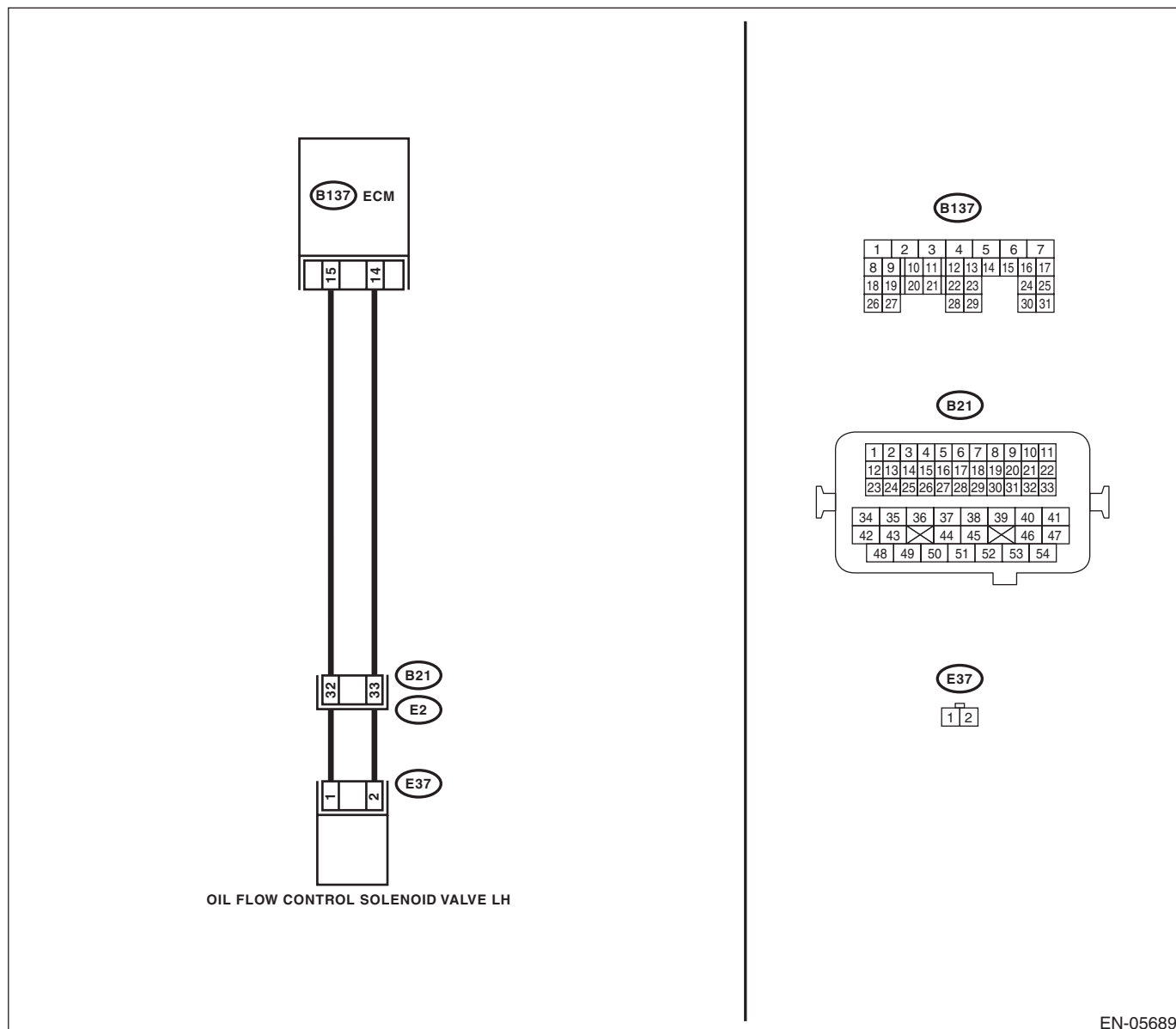
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B137) No. 15 (+) — Chassis ground (-):</i> <i>(B137) No. 14 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Go to step 2.	Repair the short circuit to power in the harness between the ECM and oil flow control solenoid valve connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and oil flow control solenoid valve connector. <i>Connector &amp; terminal</i> <i>(B137) No. 15 — (E37) No. 1:</i> <i>(B137) No. 14 — (E37) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of the harness between the ECM and oil flow control solenoid valve connector • Poor contact of coupling connector
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 6 — 12 Ω?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

### DO:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

Refer to DTC P2097 for diagnostic procedure. <Ref. to EN(H4DOTC)(diag)-313, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DP:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

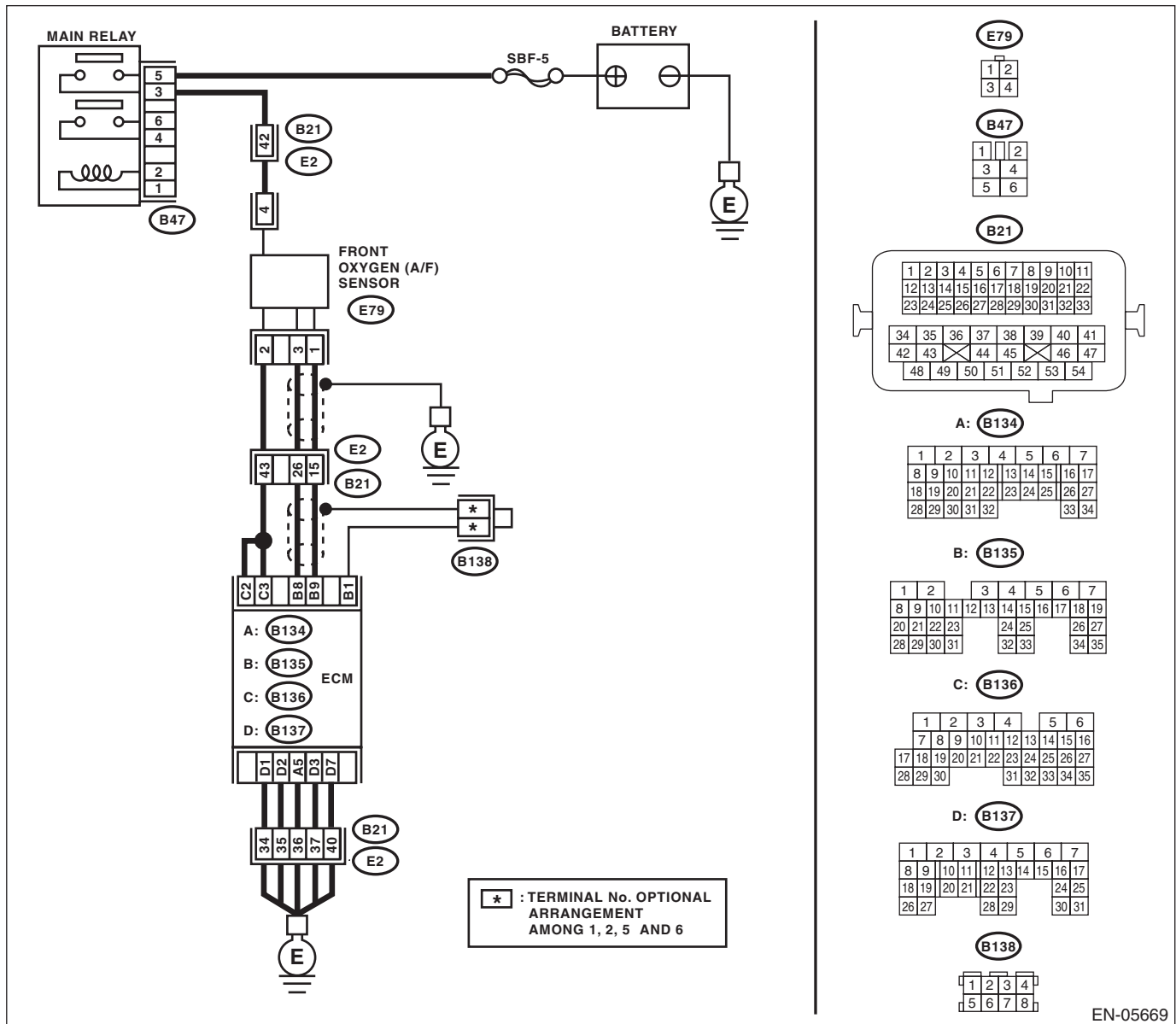
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-253, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

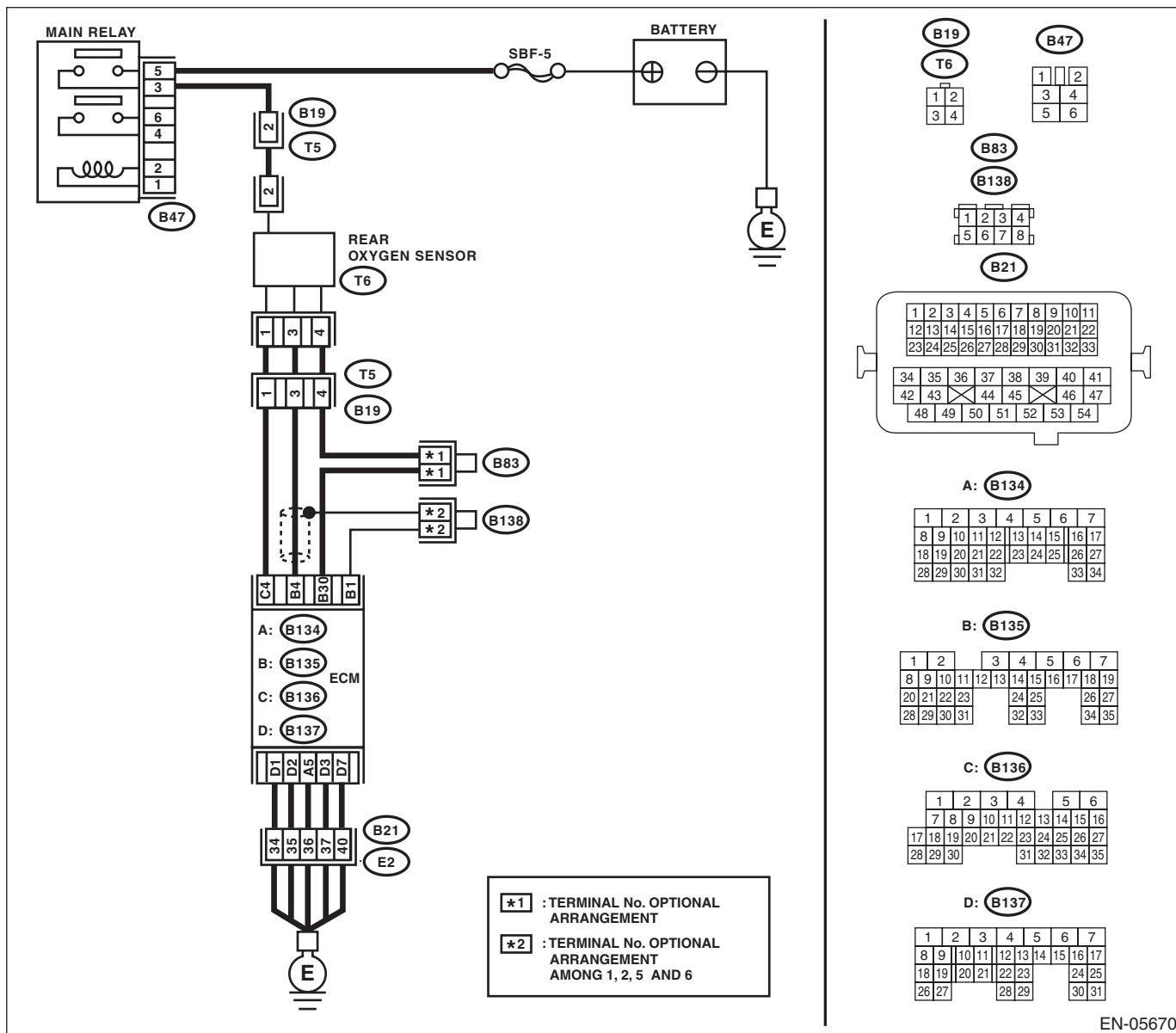
After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)



EN-05670

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
3	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E79) No. 1:</b> <b>(B135) No. 8 — (E79) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
4	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E79) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 7.	Go to step 6.
6	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E79) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 7.	Go to step 8.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> (E79) No. 1 (+) — Chassis ground (—): (E79) No. 3 (+) — Chassis ground (—):	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.
<b>8</b> <b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 9.
<b>9</b> <b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 10.
<b>10</b> <b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kgf/cm <sup>2</sup> , 41 — 46 psi)?	Go to step 11.	Repair the following item. Fuel pressure is too high: <ul style="list-style-type: none"> <li>• Clogged fuel return line or bent hose</li> </ul> Fuel pressure is too low: <ul style="list-style-type: none"> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel supply line</li> </ul>
<b>11</b> <b>CHECK FUEL PRESSURE.</b> After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(H4DOTC)-24, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge. NOTE: <ul style="list-style-type: none"> <li>• If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.</li> <li>• If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.</li> </ul>	Is the measured value 230 — 260 kPa (2.35 — 2.65 kgf/cm <sup>2</sup> , 33 — 38 psi)?	Go to step 12.	Repair the following item. Fuel pressure is too high: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Clogged fuel return line or bent hose</li> </ul> Fuel pressure is too low: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel supply line</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>12 CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Go to step 13.</p>	<p>Replace the engine coolant temperature sensor. &lt;Ref. to FU(H4DOTC)-25, Engine Coolant Temperature Sensor.&gt;</p>
<p><b>13 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/s) ?</p>	<p>Go to step 14.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>14 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) For AT models, set the select lever to the “P” or “N” range, and for MT models, place the shift lever in the neutral position.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	Go to step 15.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-30, Mass Air Flow and Intake Air Temperature Sensor.>
<p><b>15 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 490 mV or more?	Go to step 16.	Go to step 17.
<p><b>16 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Depress the clutch pedal. (MT model)</li> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 18.	Go to step 17.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
17	<b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.
18	<b>CHECK FRONT OXYGEN (A/F) SENSOR AND REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-40, Front Oxygen (A/F) Sensor.>
19	<b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (T6) No. 3:</b> <b>(B135) No. 30 — (T6) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 20.
20	<b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(T6) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-42, Rear Oxygen Sensor.>
			Repair the open circuit of harness between ECM and rear oxygen sensor connector.  Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact in ECM connector • Poor contact of coupling connector

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DQ:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-255, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

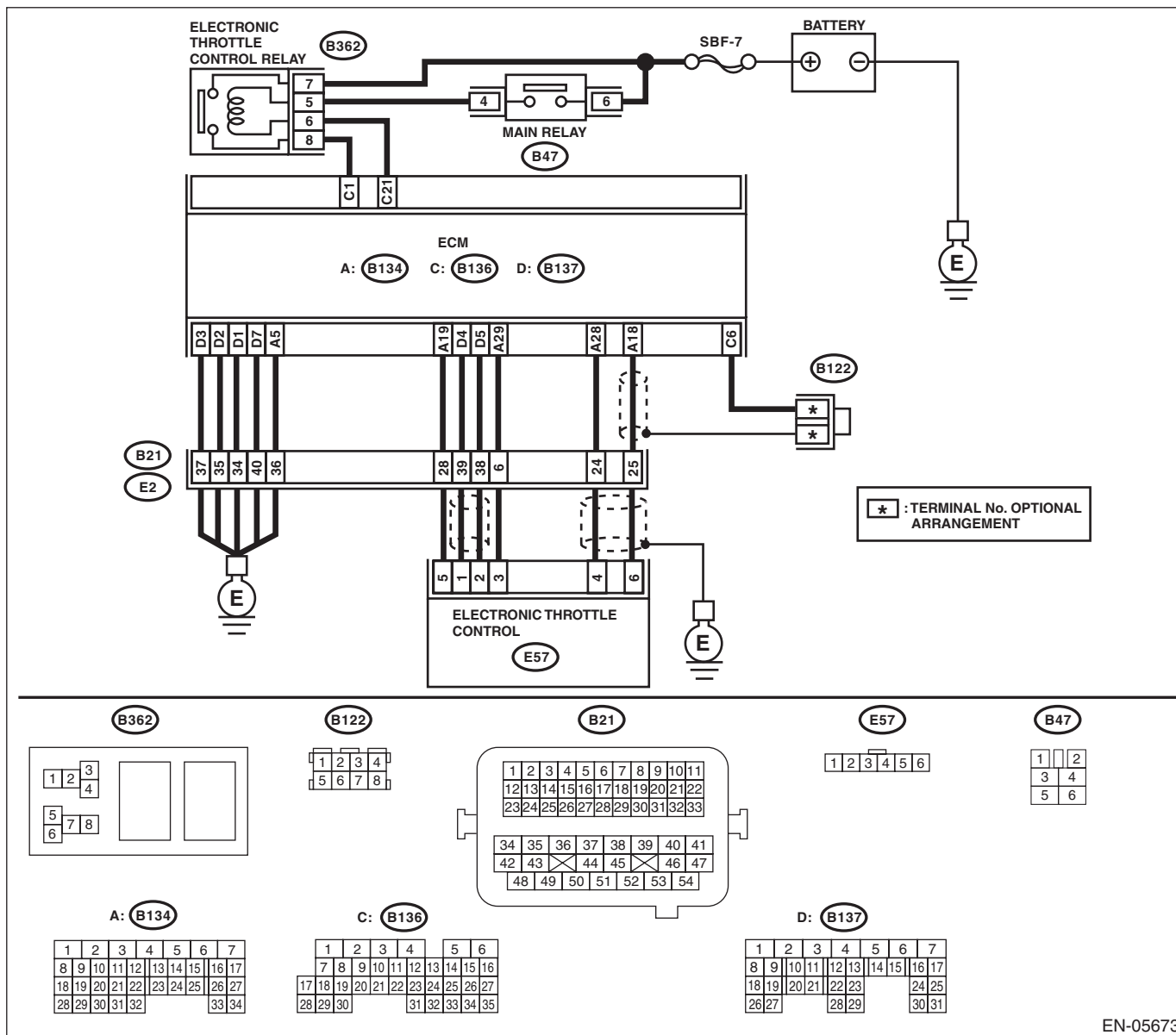
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to FU(H4DOTC)-48, Electronic Throttle Control Relay.>
<b>2</b> <b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 — Chassis ground:</i> <i>(B362) No. 8 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<b>5</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the resistance between the ECM and electronic throttle control relay connector. <i>Connector &amp; terminal</i> <i>(B136) No. 21 — (B362) No. 6:</i> <i>(B136) No. 1 — (B362) No. 8:</i>	Is the resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<b>6</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from electronic throttle control. 3) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 19 — Chassis ground:</i> <i>(B134) No. 18 — Chassis ground:</i> <i>(B134) No. 18 — (B136) No. 6:</i> <i>(B134) No. 28 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7 CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 — Engine ground:</i> <i>(E57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>
<b>8 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>9 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 3 — Engine ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 10.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<b>10 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 (+) — Engine ground (-):</i> <i>(E57) No. 4 (+) — Engine ground (-):</i>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 11.
<b>11 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <i>(B134) No. 19 — (B134) No. 18:</i> <i>(B134) No. 19 — (B134) No. 28:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 12.	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.
<b>12 CHECK SENSOR OUTPUT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step 13.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DOTC)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>13 CHECK SENSOR OUTPUT.</b> Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step 14.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DOTC)-11, Throttle Body.>
<b>14 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B137) No. 5 — (E57) No. 2:</b> <b>(B137) No. 4 — (E57) No. 1:</b>	Is the resistance less than 1 Ω?	Go to step 15.	Repair the open circuit of harness between ECM and electronic throttle control.
<b>15 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 2 (+) — Engine ground (-):</b> <b>(E57) No. 1 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step 16.
<b>16 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 2 — Engine ground:</b> <b>(E57) No. 1 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 17.	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>17 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <b>Connector &amp; terminal</b> <b>(E57) No. 2 — (E57) No. 1:</b>	Is the resistance 1 MΩ or more?	Go to step 18.	Repair the short circuit of harness between ECM and electronic throttle control control.
<b>18 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 Ω?	Go to step 19.	Repair the open circuit of the harness between the ECM and engine ground.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
19	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance 50 $\Omega$ or less?	Go to step 20.	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>
20	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4DOTC)-11, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DR:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-257, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

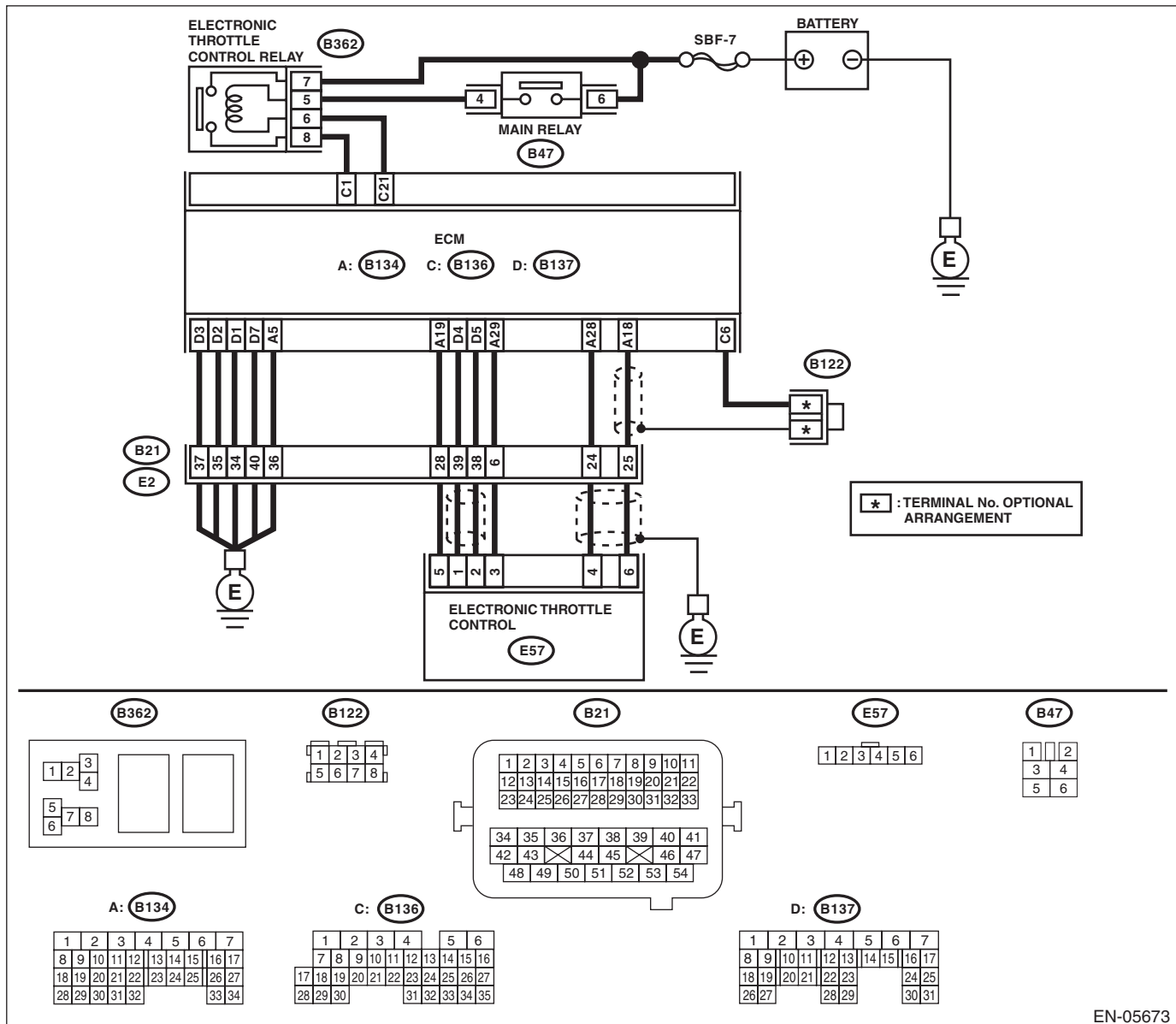
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. <b>Terminals</b> <b>No. 7 — No. 8:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to FU(H4DOTC)-48, Electronic Throttle Control Relay.>
<b>2</b> <b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the voltage between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 6 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 6 — Chassis ground:</b> <b>(B362) No. 8 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<b>5</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the resistance between the ECM and electronic throttle control relay connector. <b>Connector &amp; terminal</b> <b>(B136) No. 21 — (B362) No. 6:</b> <b>(B136) No. 1 — (B362) No. 8:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the open circuit of harness between ECM and electronic throttle control relay.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DS:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

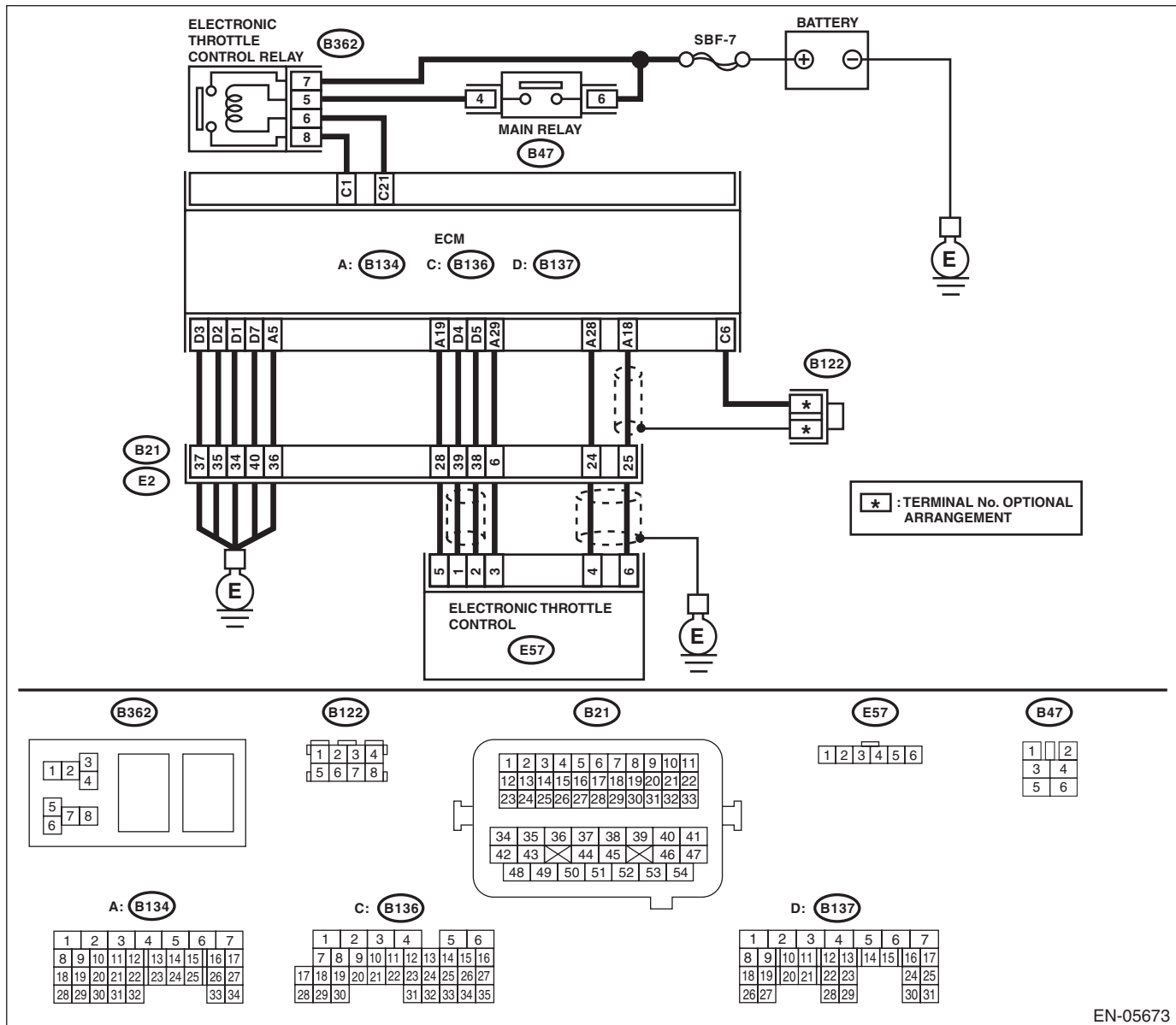
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-259, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Measure the resistance between electronic throttle control relay terminals. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to FU(H4DOTC)-48, Electronic Throttle Control Relay.>
<b>2 CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 8 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 21 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Repair the poor contact of the ECM connector.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.

### DT:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## DU:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-263, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

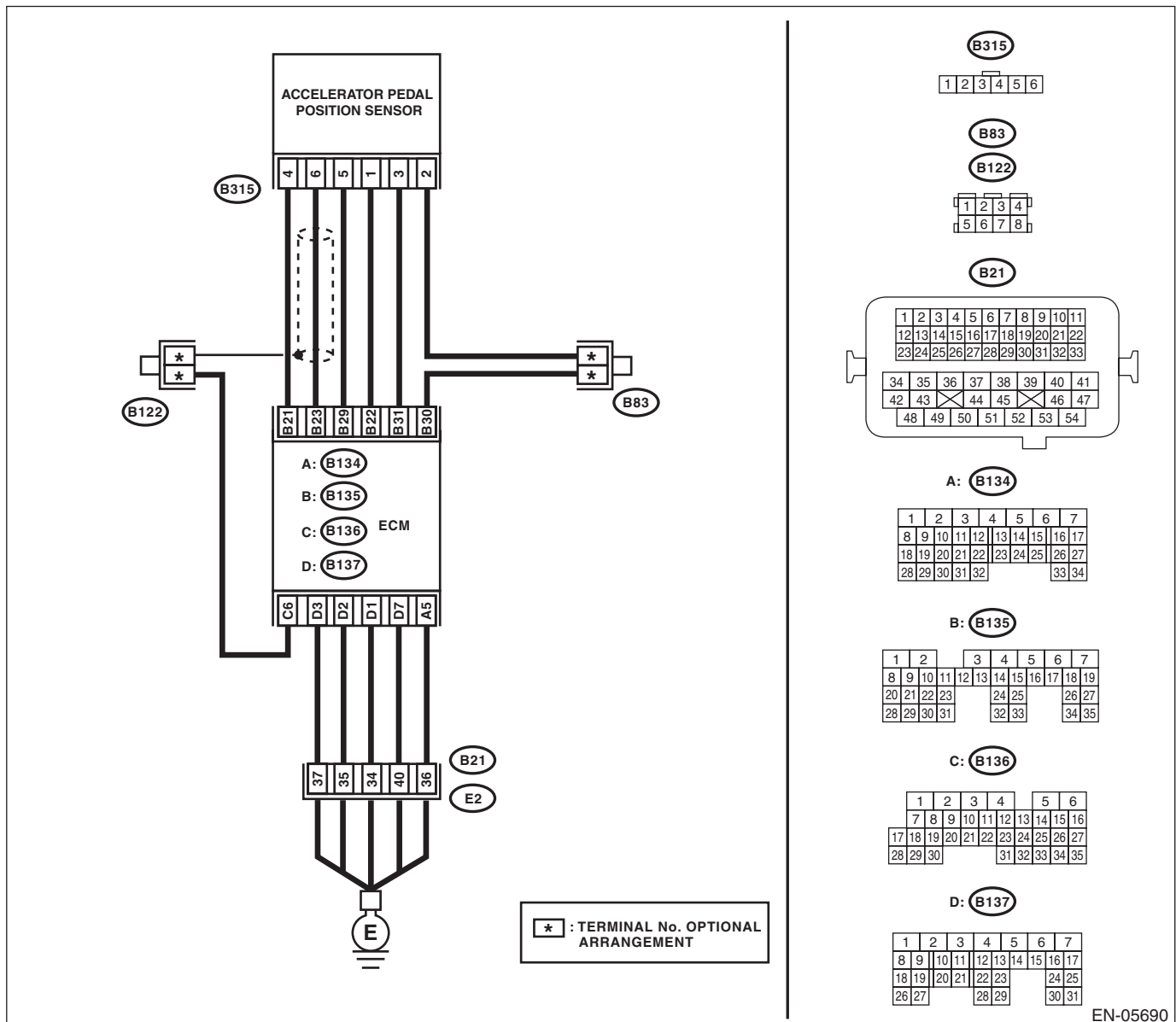
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05690

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 21 — Chassis ground:</b>  <b>(B135) No. 23 — Chassis ground:</b>  <b>(B135) No. 23 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 6 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).&gt;</p>

## DV:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-265, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

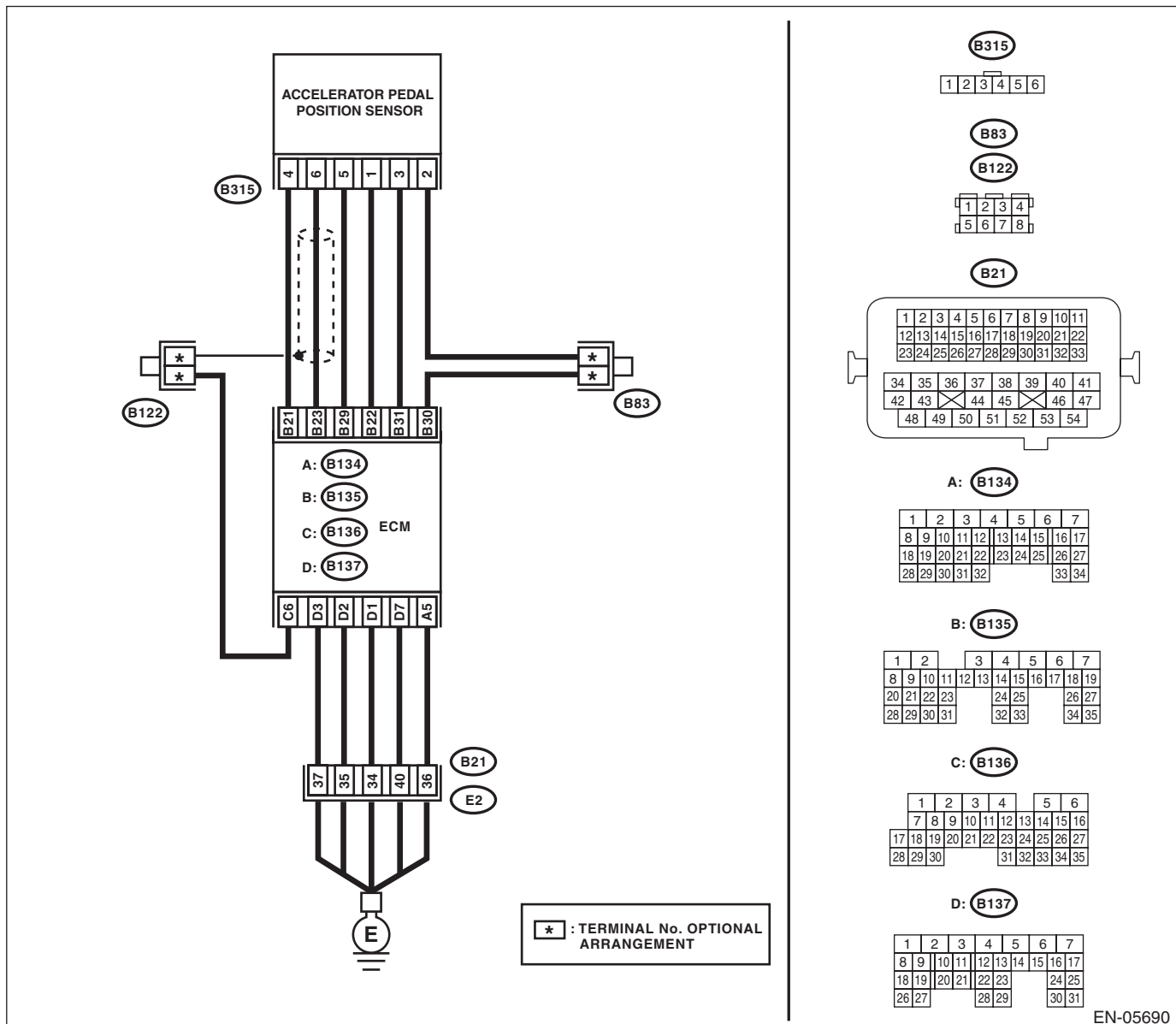
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05690

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from the ECM and accelerator pedal position sensor.            3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 23 — (B315) No. 6:</b>  <b>(B135) No. 29 — (B315) No. 5:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Connect the ECM.            2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 5 — Chassis ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to ON.            2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 6 (+) — Chassis ground (-):</b></p>	Is the voltage 4.85 V or more?	Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.	Go to step 4.
<p><b>4</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 21 — (B135) No. 23:</b></p>	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-3, Accelerator Pedal.>	Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DW:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-267, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

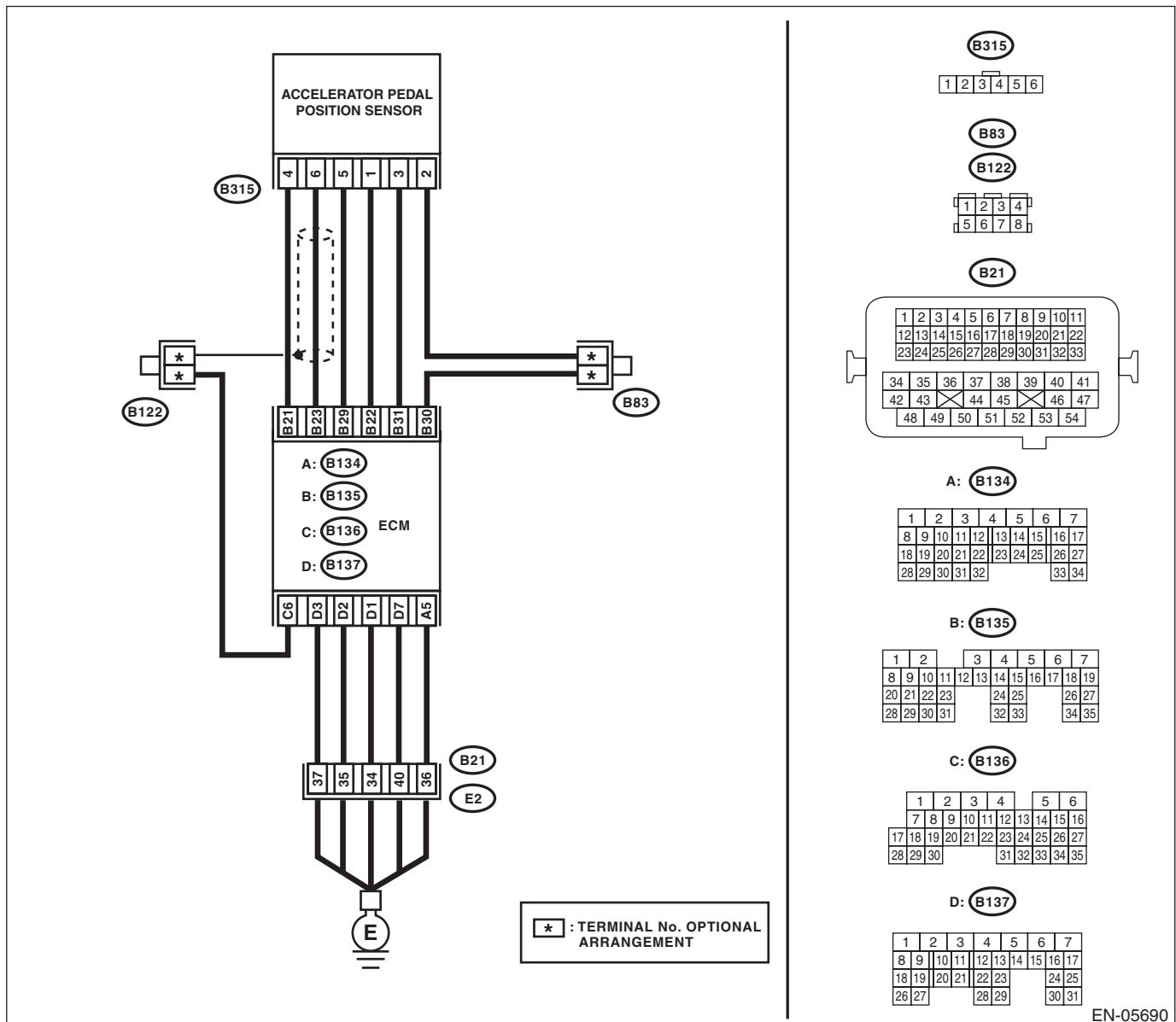
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05690

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 22 — Chassis ground:</b>  <b>(B135) No. 31 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 3 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).&gt;</p>



## DX:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-269, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

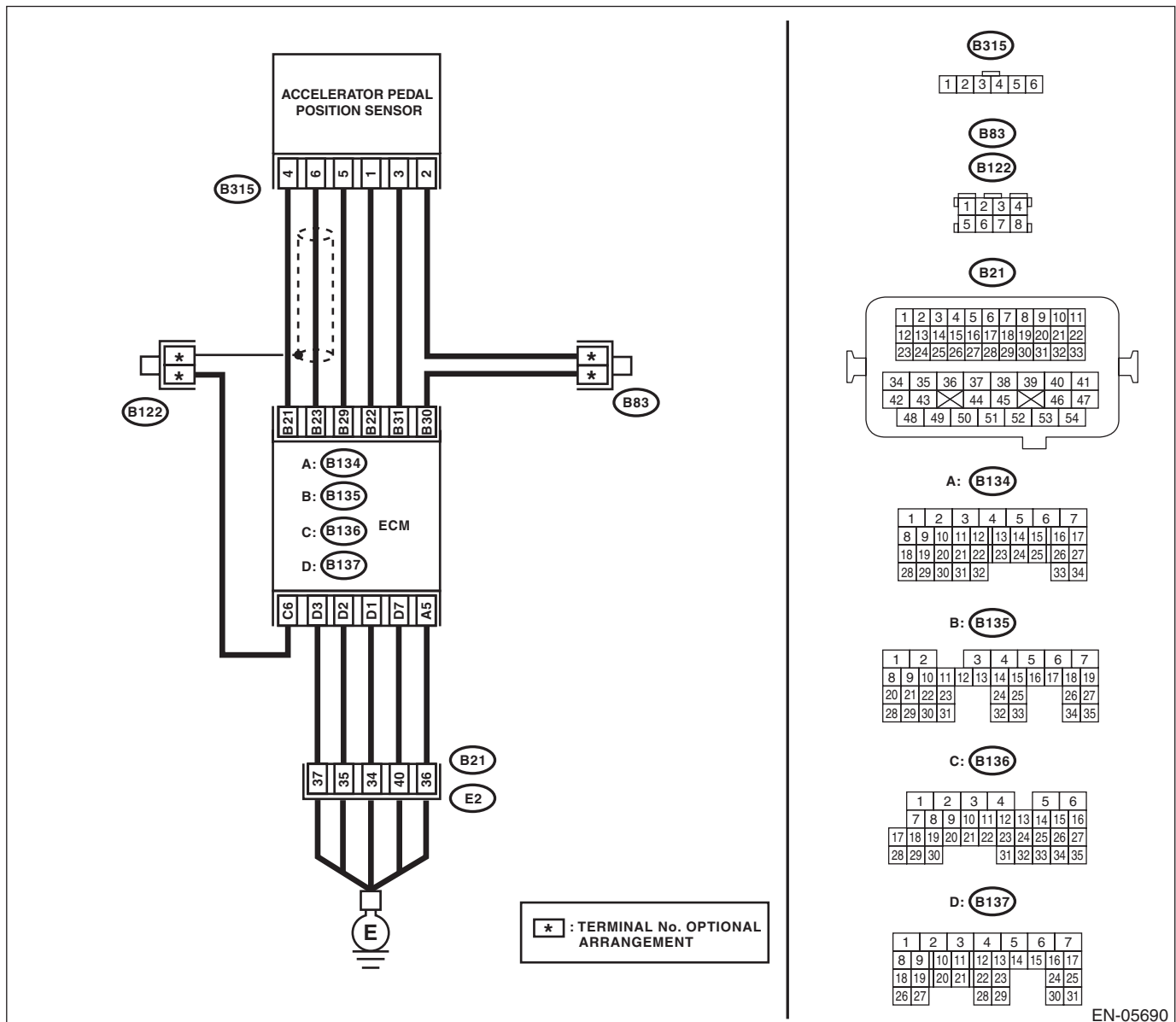
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05690

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and accelerator pedal position sensor. 3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 31 — (B315) No. 3:</b> <b>(B135) No. 30 — (B315) No. 2:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.
<p><b>2 CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Connect the ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 2 — Chassis ground:</b></p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<p><b>3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 3 (+) — Chassis ground (-):</b></p>	Is the voltage 4.85 V or more?	Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.	Go to step 4.
<p><b>4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 22 — (B135) No. 31:</b></p>	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-3, Accelerator Pedal.>	Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DY:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-271, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

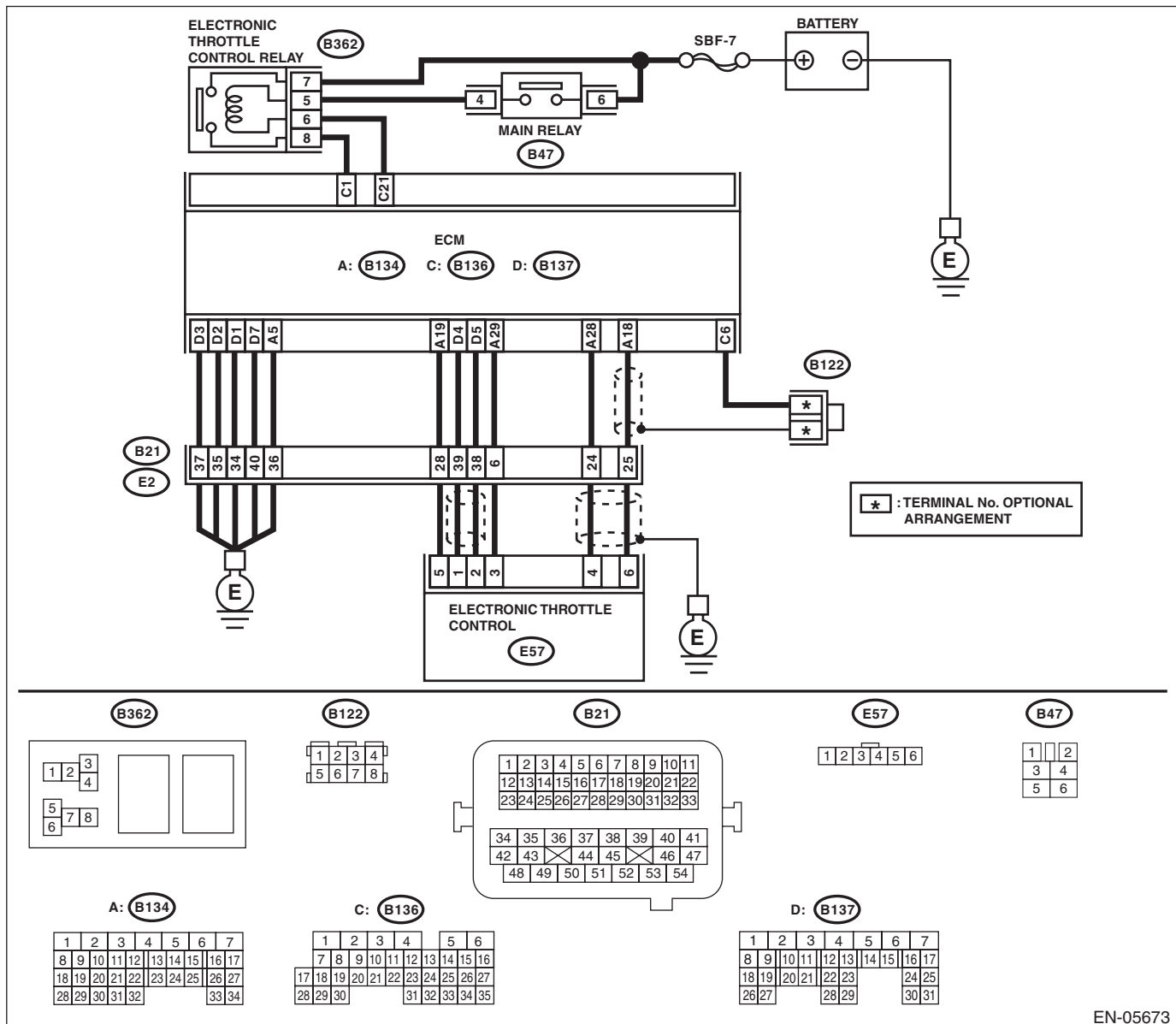
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05673

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — Chassis ground:</b> <b>(B134) No. 18 — Chassis ground:</b> <b>(B134) No. 18 — (B136) No. 6:</b> <b>(B134) No. 28 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 — Engine ground:</b> <b>(E57) No. 4 — Engine ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>5</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
6	<b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DOTC)-11, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DZ:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-273, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

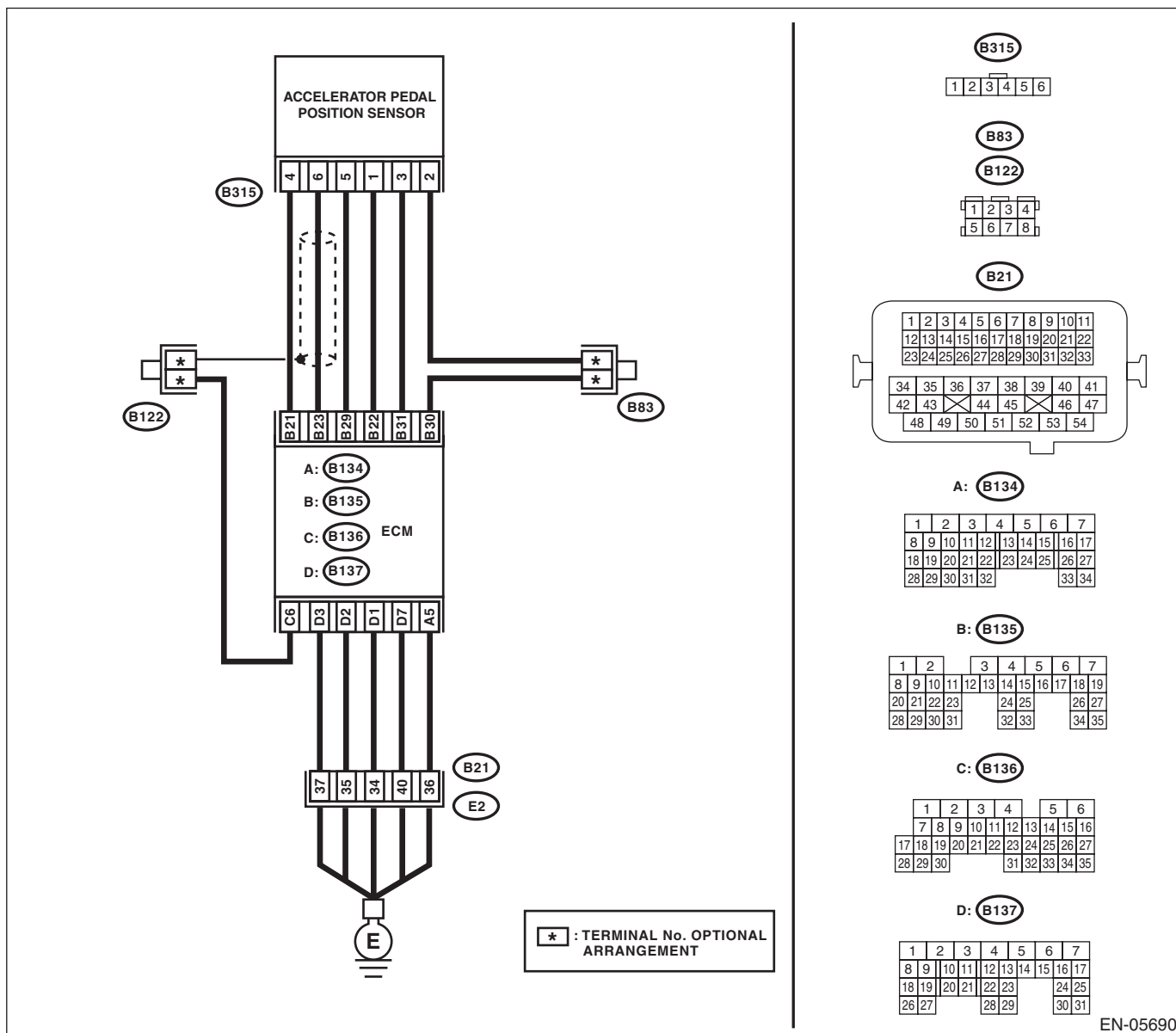
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05690

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>Main accelerator pedal position sensor signal</b> <b>(B135) No. 23 (+) — Chassis ground (-):</b> <b>Sub accelerator pedal position sensor signal</b> <b>(B135) No. 31 (+) — Chassis ground (-):</b></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Go to step 3.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b></p> <p>1) Measure the voltage between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 6 (+) — Chassis ground (-):</b> <b>(B315) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H4SO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Ground short circuit of harness between the ECM and accelerator pedal position sensor connectors.</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.</b></p> <p>Check the resistance of harness between the accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B315) No. 5 — Chassis ground:</b> <b>(B315) No. 2 — Chassis ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Repair poor contact of the ECM connector.</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EA:DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-275, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

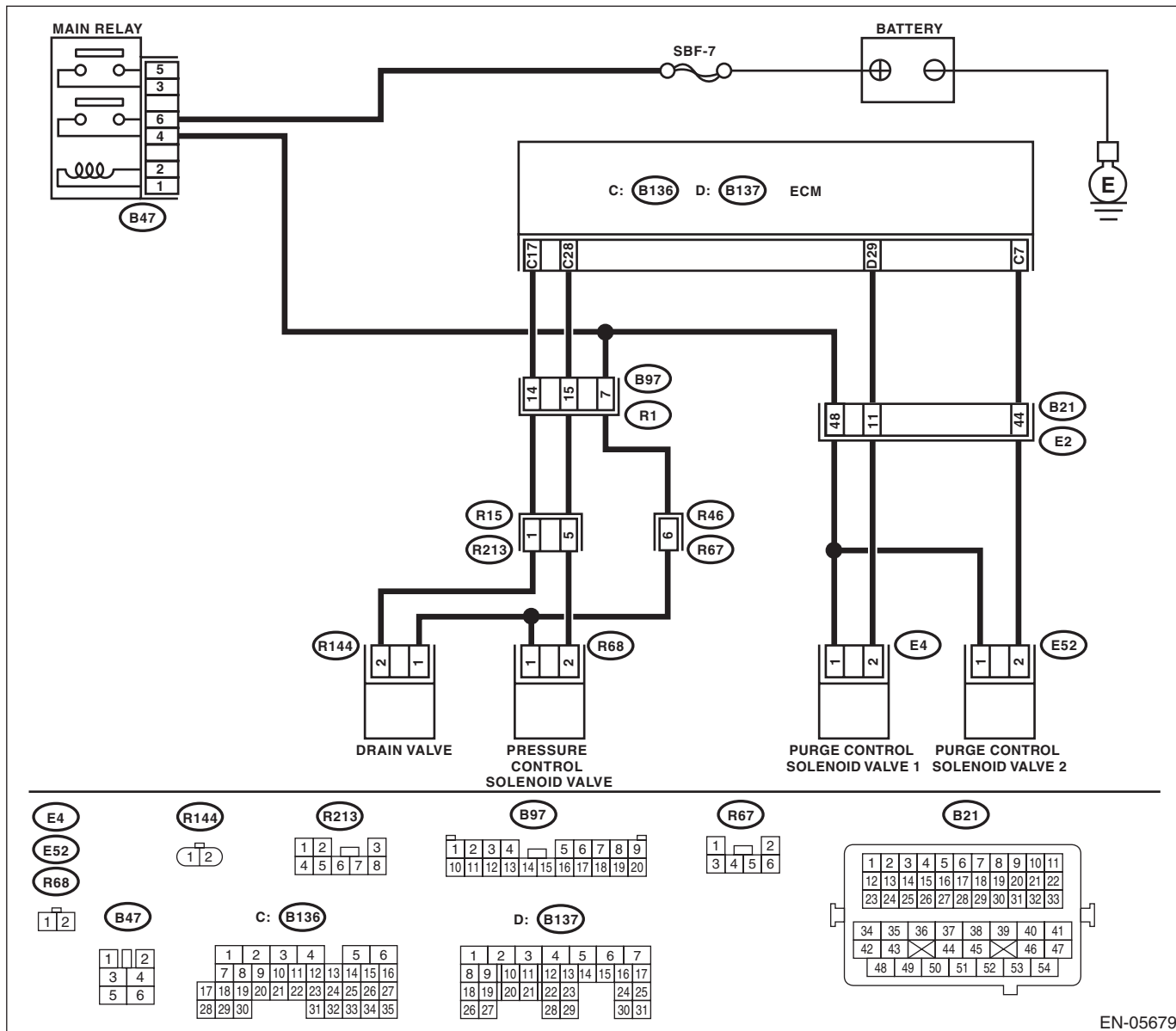
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05679



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE 2.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve 2. 3) Measure the resistance between the purge control solenoid valve 2 connector and engine ground. <i>Connector &amp; terminal</i> <i>(E52) No. 2 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and purge control solenoid valve 2 connector.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE 2.</b> Measure the resistance of harness between ECM and purge control solenoid valve 2. <i>Connector &amp; terminal</i> <i>(B136) No. 7 — (E52) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and purge control solenoid valve 2 connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4</b> <b>CHECK PURGE CONTROL SOLENOID VALVE 2.</b> 1) Remove the purge control solenoid valve 2. 2) Measure the resistance between purge control solenoid valve 2 terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the purge control solenoid valve 2. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>
<b>5</b> <b>CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE 2.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve 2 and engine ground. <i>Connector &amp; terminal</i> <i>(E52) No. 1 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact in the purge control solenoid valve 2 connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and purge control solenoid valve 2</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EB:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-276, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

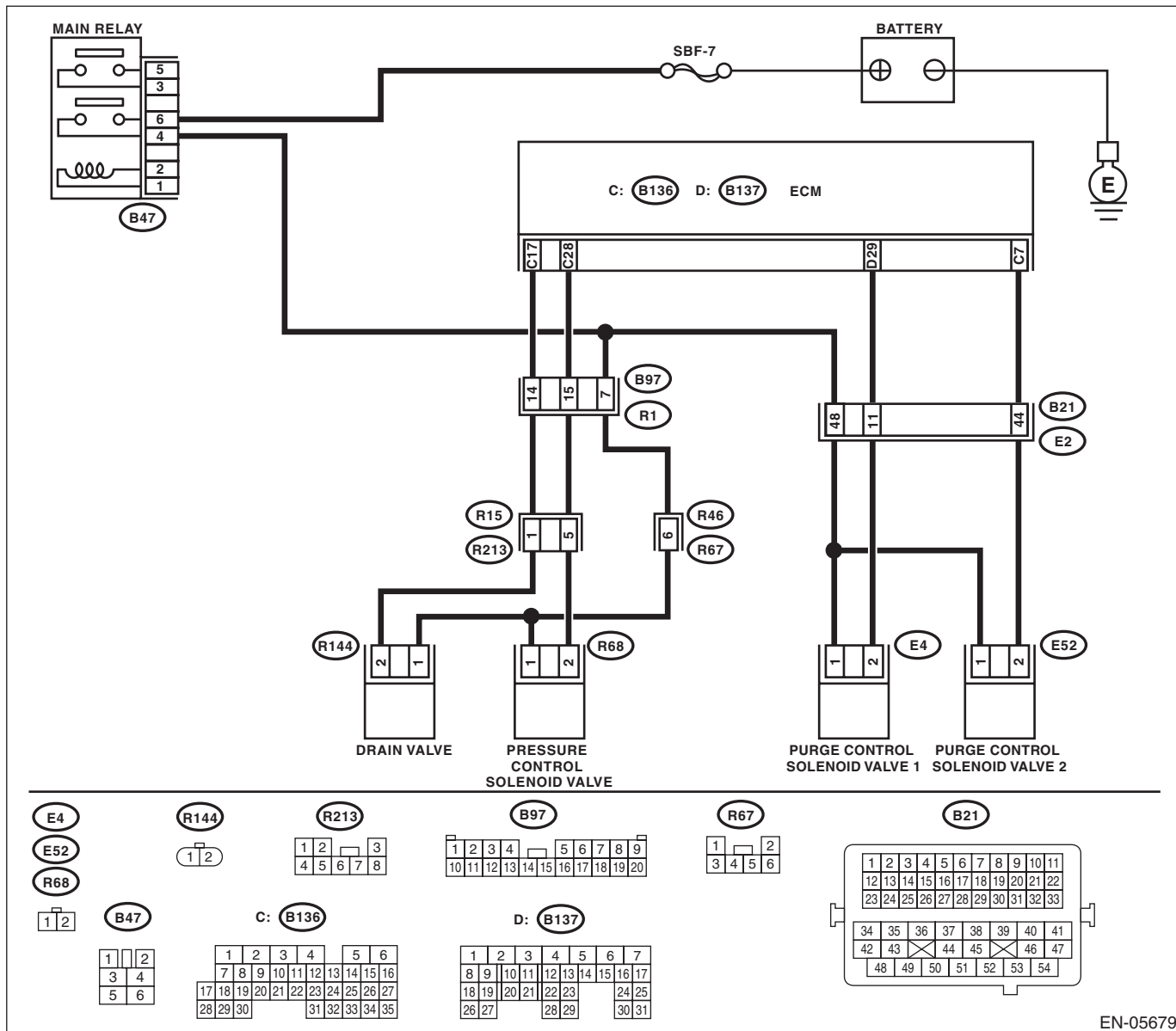
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>

### WIRING DIAGRAM:



EN-05679

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE 2.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve 2. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short to power in the harness between ECM and purge control solenoid valve 2 connector.	Go to step 2.
2	<b>CHECK PURGE CONTROL SOLENOID VALVE 2.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve 2 terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the purge control solenoid valve 2. <Ref. to EC(H4DOTC)-8, Purge Control Solenoid Valve.>	Repair the poor contact of the ECM connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **EC:DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE**

#### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-277, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

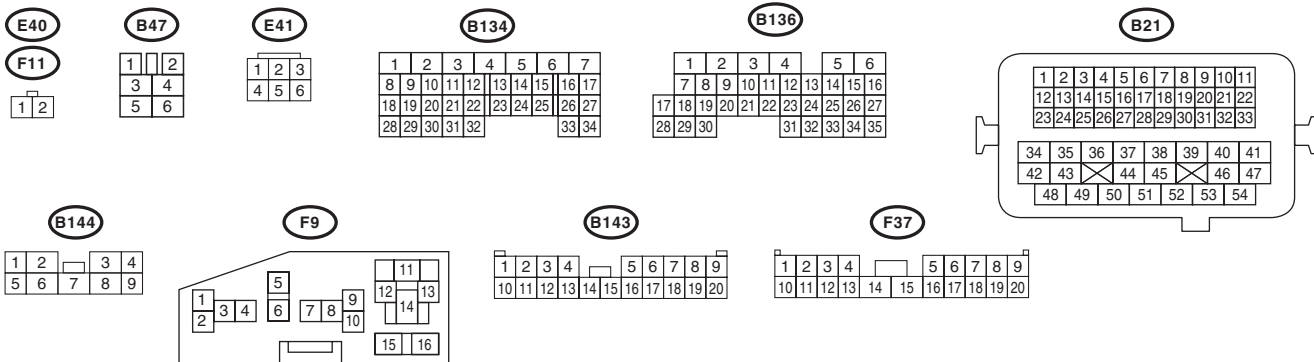
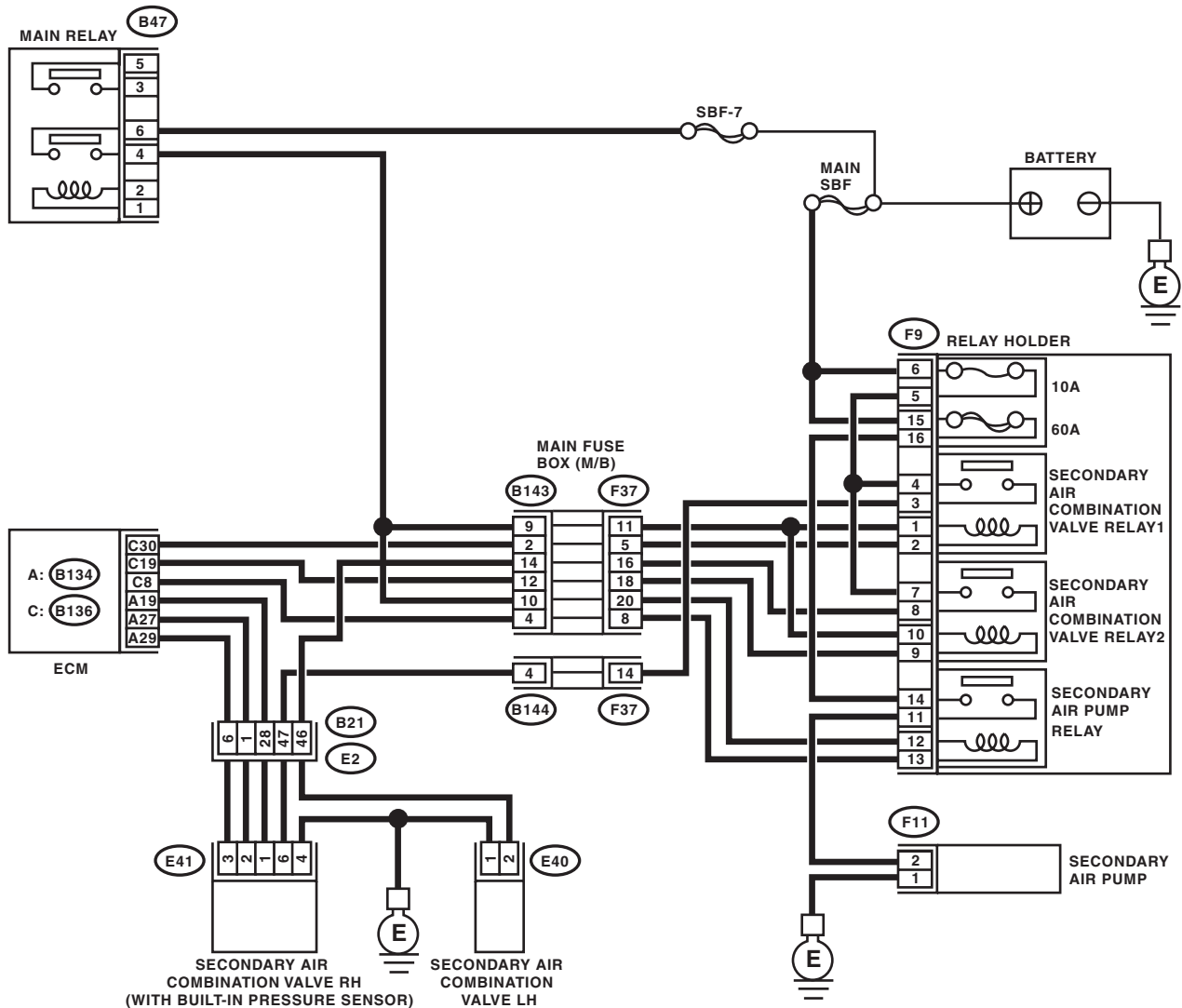
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK CURRENT DATA.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Using the Subaru Select Monitor, read secondary air piping pressure, intake pipe absolute pressure and atmospheric pressure, and compare with the actual atmospheric pressure. <b>NOTE:</b> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.>	Is the actual difference with atmospheric pressure 200 mmHg (27 kPa, 8 inHg, 3.9 psig) or more?	Replace the secondary air combination valve RH. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

## **ED:DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-278, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

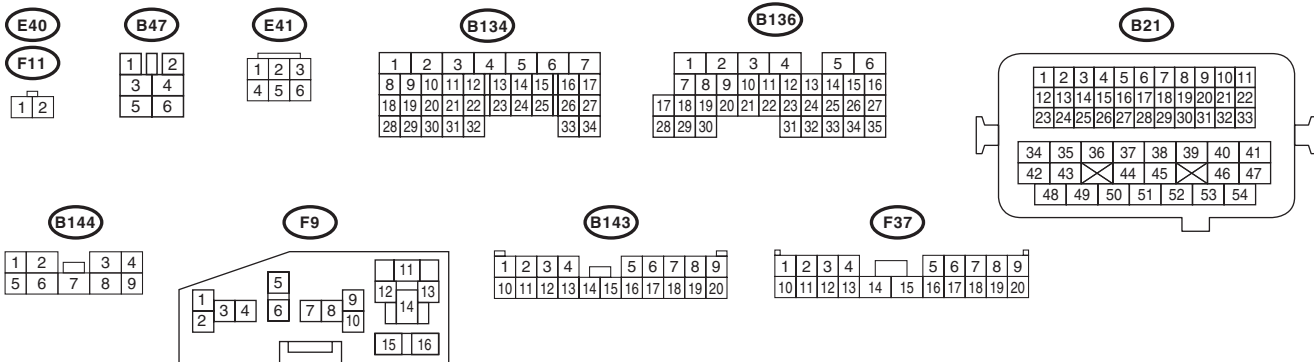
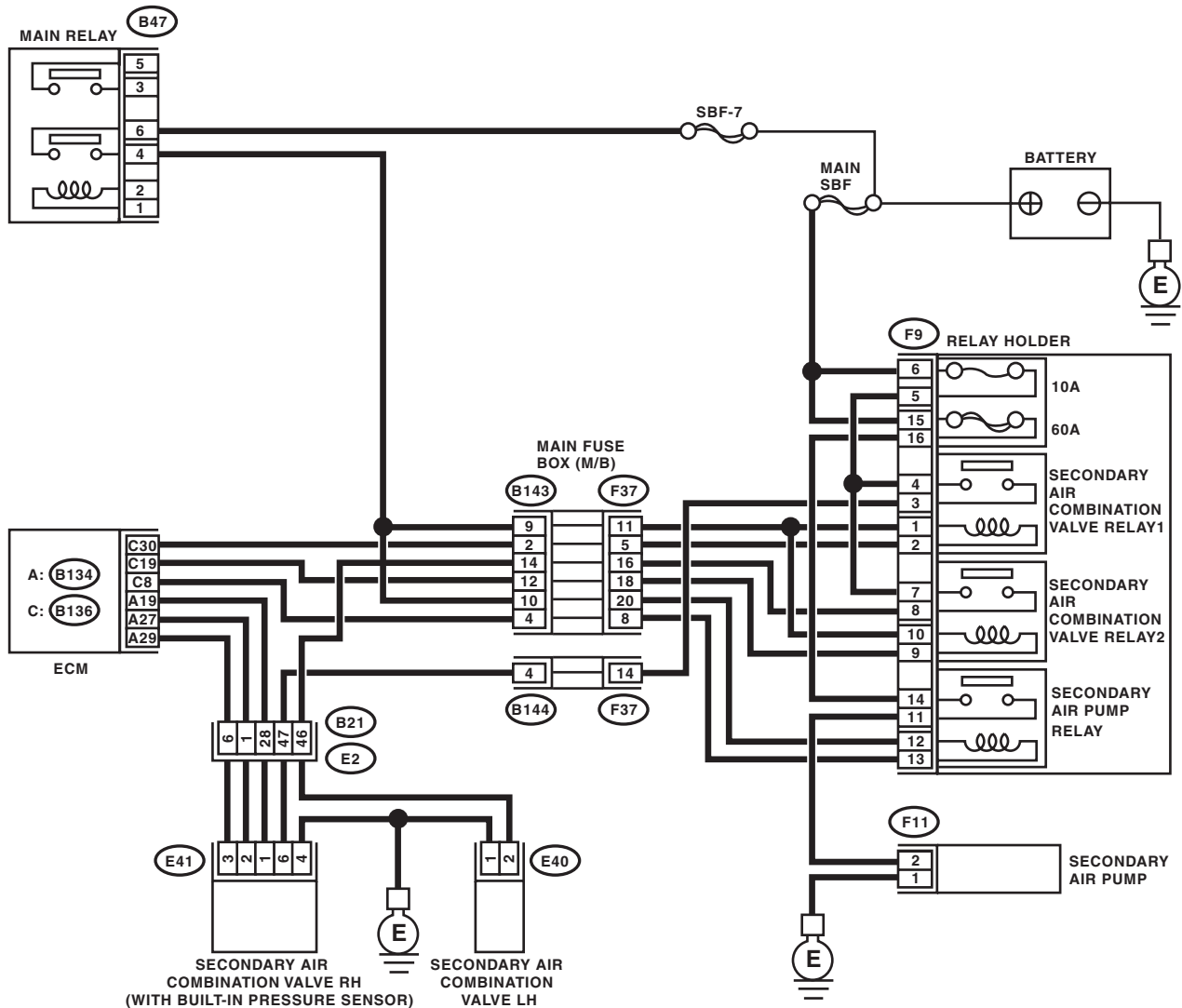
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Read the data of secondary air pipe pressure signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value less than 53.3 kPa (400 mmHg, 15.8 inHg) ?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK SECONDARY AIR COMBINATION VALVE RH POWER SOURCE.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the secondary air combination valve RH.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between the secondary air combination valve RH connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(E41) No. 6 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.5 V or more?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit in harness between ECM and secondary air combination valve RH connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance of the harness between the ECM and secondary air combination valve RH connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 27 — (E41) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit in harness between ECM and secondary air combination valve RH connector</li> <li>Poor contact of coupling connector</li> </ul>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 27 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 5.</p>	<p>Repair the ground short circuit of harness between ECM and secondary air combination valve RH connector.</p>
<p><b>5</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact in the ECM and secondary air combination valve RH connector.</p>	<p>Is there poor contact in the ECM or secondary air combination valve RH connector?</p>	<p>Repair the poor contact in the ECM or secondary air combination valve RH connector.</p>	<p>Replace the secondary air combination valve RH. &lt;Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.&gt;</p>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **EE:DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-279, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

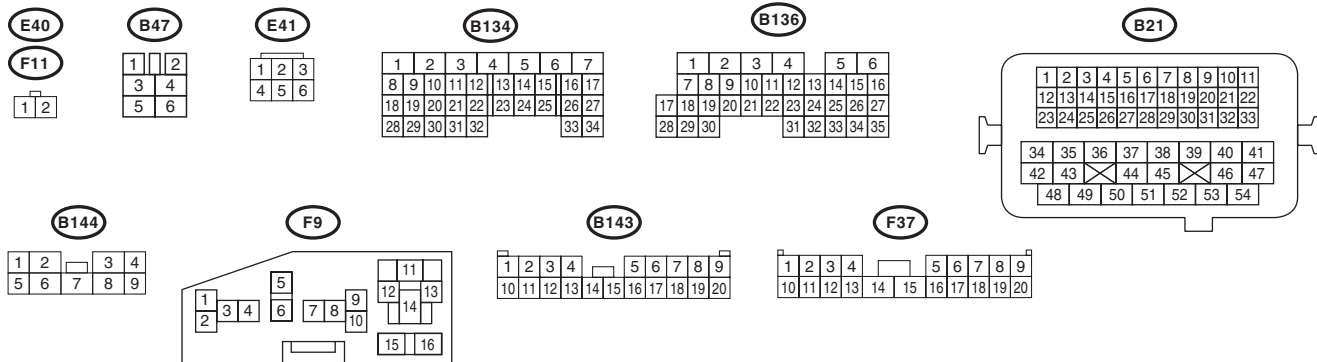
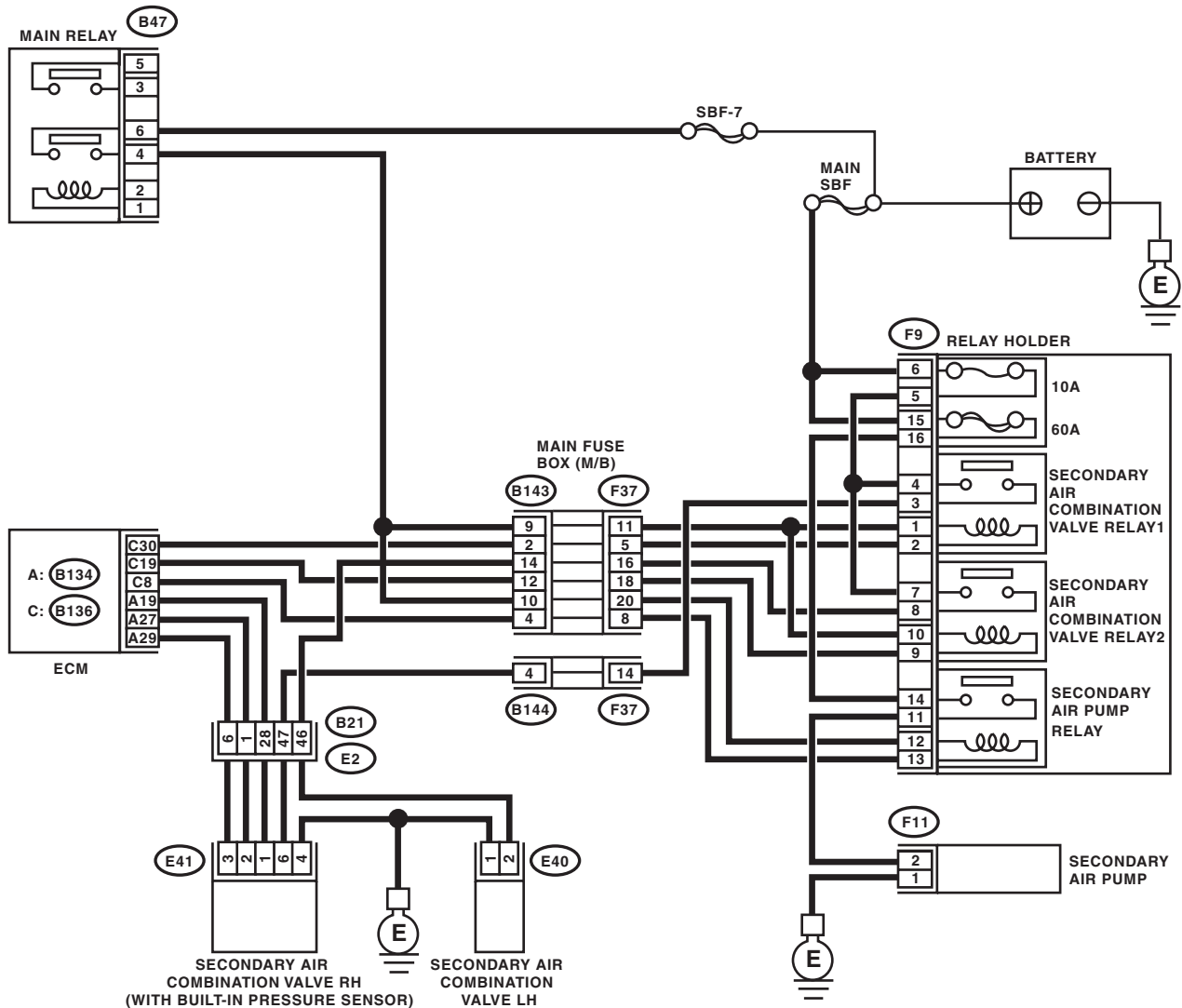
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Read the data of secondary air pipe pressure signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the measured value 133.3 kPa (1000 mmHg, 39.4 inHg) or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the secondary air combination valve RH.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Read the data of secondary air pipe pressure signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the measured value 133.3 kPa (1000 mmHg, 39.4 inHg) or more?	Repair the short circuit to power in the harness between ECM and secondary air combination valve RH connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of the harness between the secondary air combination valve RH connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E41) No. 3 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit in harness between ECM and secondary air combination valve RH connector</li> <li>Poor contact in ECM connector</li> <li>Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the secondary air combination valve RH connector.</p>	Is there poor contact of the secondary air combination valve RH connector?	Repair the poor contact of the secondary air combination valve RH connector.	<p>Replace the secondary air combination valve RH.</p> <p>&lt;Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.&gt;</p>

## **EF:DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1)**

### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-280, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

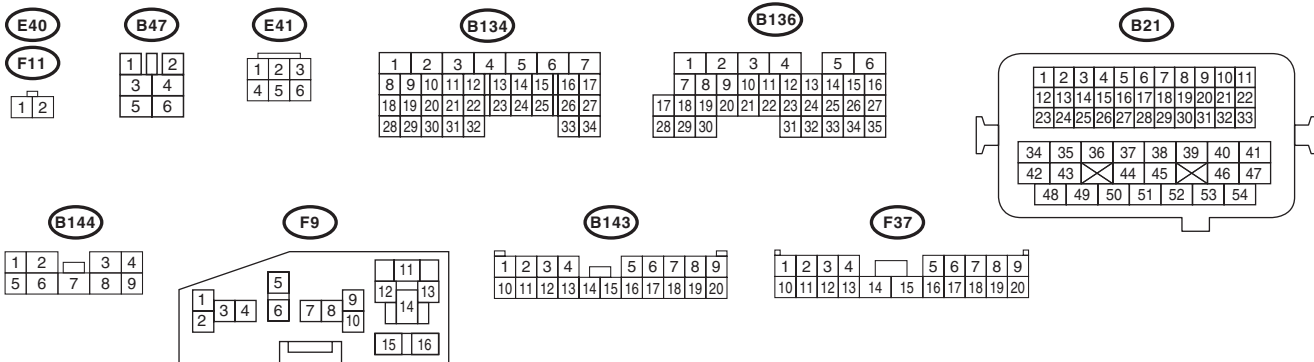
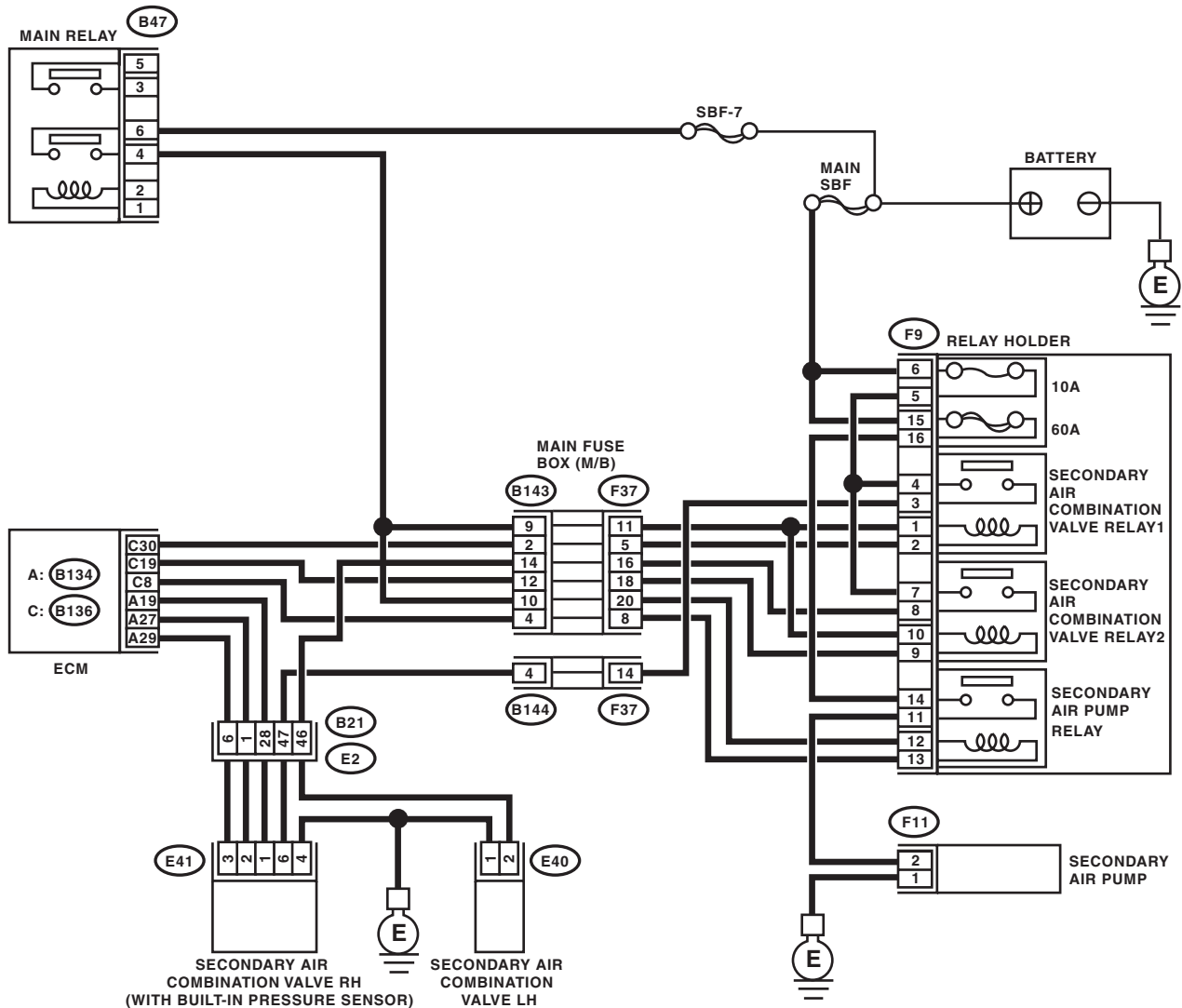
### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK SECONDARY AIR COMBINATION VALVE FUSE.</b> Check if the secondary air combination valve fuse (10 A) is blown out.	Is the fuse blown out?	Go to step 2.	Go to step 3.
2	<b>CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR COMBINATION VALVE RH.</b> 1) Remove the secondary air combination valve fuse (10 A) from the fuse box. 2) Disconnect the connector from the secondary air combination valve RH. 3) Measure the resistance between the secondary air combination valve fuse and secondary air combination valve RH connector, and chassis ground. <b>Connector &amp; terminal</b> <b>(F9) No. 5 — Chassis ground:</b> <b>(E41) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air combination valve RH connector. Go to step 3.	Repair the ground short circuit of harness between the fuse box and the secondary air combination valve RH.
3	<b>CHECK SECONDARY AIR COMBINATION VALVE RH OPERATION.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the secondary air combination valve RH using the Subaru Select Monitor. NOTE: Refer to “Compulsory Valve Operation Check Mode” for more operation procedures. <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the secondary air combination valve RH repeatedly switch to ON and OFF?	Go to step 4.	Go to step 6.
4	<b>CHECK DUCT BETWEEN SECONDARY AIR PUMP AND SECONDARY AIR COMBINATION VALVE RH.</b> Check the duct between the secondary air pump and secondary air combination valve RH.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Go to step 5.
5	<b>CHECK PIPE BETWEEN SECONDARY AIR COMBINATION VALVE RH AND CYLINDER HEAD.</b> Check the pipe between the secondary air combination valve RH and cylinder head.	Is there damage, clog or disconnection of the pipe?	Replace, clean or connect the pipe.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6 CHECK POWER SUPPLY TO SECONDARY AIR COMBINATION VALVE RH.</b> 1) Disconnect the connector from the secondary air combination valve RH. 2) In the condition of step 3, measure the voltage between the secondary air combination valve RH and the chassis ground. <i>Connector &amp; terminal</i> <i>(E41) No. 6 (+) — Chassis ground (-):</i>	Does the voltage repeatedly change between 10 V and 0 V?	Replace the secondary air combination valve RH. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.>	Go to step 7.
<b>7 CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RH AND CHASSIS GROUND.</b> Measure the resistance between the secondary air combination valve RH connector and chassis ground. <i>Connector &amp; terminal</i> <i>(E41) No. 4 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Go to step 8.	Repair the open circuit of harness between secondary air combination valve RH and chassis ground.
<b>8 CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 1 AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 1 from the relay box. 3) Measure the resistance of the harness between the secondary air combination valve relay 1 and secondary air combination valve RH connector. <i>Connector &amp; terminal</i> <i>(F9) No. 3 — (E41) No. 6:</i>	Is the resistance less than 1 Ω?	Go to step 9.	Repair the open circuit of the harness between the secondary air combination valve relay 1 and secondary air combination valve RH connector.
<b>9 CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.</b> 1) Connect the battery to terminals No. 1 and No. 2 of the secondary air combination valve relay 1. 2) Measure the resistance between the secondary air combination valve relay 1 terminals. <i>Terminals</i> <i>No. 3 — No. 4:</i>	Is the resistance less than 1 Ω?	Go to step 10.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>10 CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.</b> Measure the resistance between the secondary air combination valve relay 1 terminals with the battery disconnected. <i>Terminals</i> <i>No. 3 — No. 4:</i>	Is the resistance 1 MΩ or more?	Go to step 11.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>11 CHECK SECONDARY AIR COMBINATION VALVE RELAY 1 POWER SOURCE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 1 connector and chassis ground. <i>Connector &amp; terminal</i> <i>(F9) No. 4 (+) — Chassis ground (-):</i> <i>(F9) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 12.	Repair the open or ground short circuit of power supply circuit.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>12</b> <b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector of ECM. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 1 connector. <i>Connector &amp; terminal</i> <i>(B136) No. 30 — (F9) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 13.	Repair the open circuit of harness between ECM and secondary air combination valve relay 1 connector.
<b>13</b> <b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.</b> Measure the resistance between the secondary air combination valve relay 1 connector and chassis ground. <i>Connector &amp; terminal</i> <i>(F9) No. 2 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Repair the poor contact of the ECM connector.	Repair the ground short circuit of harness between ECM and secondary air combination valve relay 1 connector.

## EG:DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK 1)

### NOTE:

For the diagnostic procedure, refer to DTC P2440. <Ref. to EN(H4DOTC)(diag)-355, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **EH:DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2)**

#### **DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-280, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

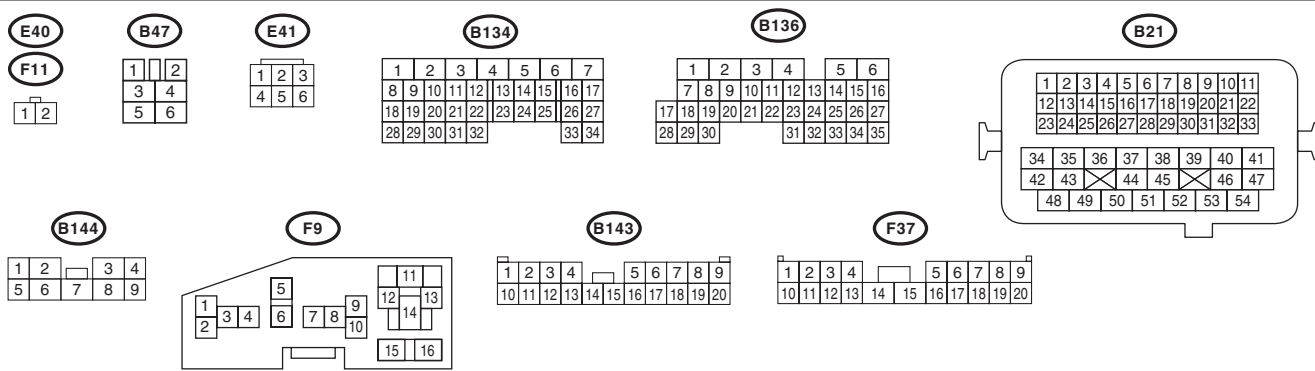
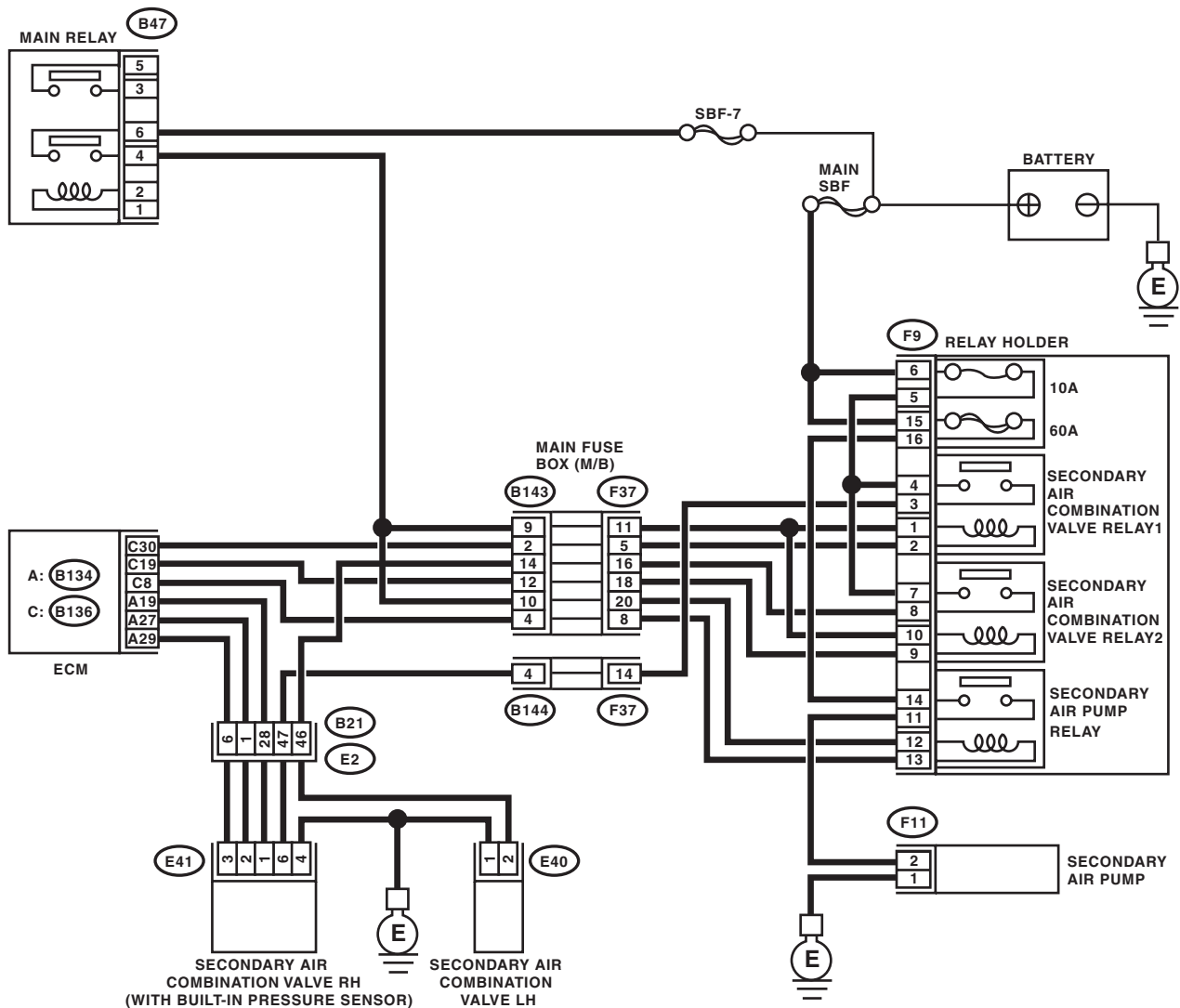
#### **CAUTION:**

**After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK SECONDARY AIR COMBINATION VALVE FUSE.</b> Check if the secondary air combination valve fuse (10 A) is blown out.	Is the fuse blown out?	Go to step 2.	Go to step 3.
<b>2 CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR COMBINATION VALVE LH.</b> 1) Remove the secondary air combination valve fuse (10 A) from the fuse box. 2) Disconnect the connector from the secondary air combination valve LH. 3) Measure the resistance between the secondary air combination valve fuse and secondary air combination valve LH connector, and chassis ground. <b>Connector &amp; terminal</b> <b>(F9) No. 5 — Chassis ground:</b> <b>(E40) No. 2 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air combination valve LH connector. Go to step 3.	Repair the ground short circuit of harness between the fuse box and the secondary air combination valve LH.
<b>3 CHECK SECONDARY AIR COMBINATION VALVE LH OPERATION.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the secondary air combination valve LH using the Subaru Select Monitor. NOTE: Refer to “Compulsory Valve Operation Check Mode” for more operation procedures. <Ref. to EN(H4DOTC)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the secondary air combination valve LH repeatedly switch to ON and OFF?	Go to step 4.	Go to step 6.
<b>4 CHECK DUCT BETWEEN SECONDARY AIR PUMP AND SECONDARY AIR COMBINATION VALVE LH.</b> Check the duct between the secondary air pump and secondary air combination valve LH.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Go to step 5.
<b>5 CHECK PIPE BETWEEN SECONDARY AIR COMBINATION VALVE LH AND CYLINDER HEAD.</b> Check the pipe between the secondary air combination valve LH and cylinder head.	Is there damage, clog or disconnection of the pipe?	Replace, clean or connect the pipe.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6 CHECK POWER SUPPLY TO SECONDARY AIR COMBINATION VALVE LH.</b> 1) Disconnect the connector from the secondary air combination valve LH. 2) In the condition of step 3, measure the voltage between the secondary air combination valve LH and the chassis ground. <i>Connector &amp; terminal</i> <i>(E40) No. 2 (+) — Chassis ground (-):</i>	Does the voltage repeatedly change between 10 V and 0 V?	Replace the secondary air combination valve LH. <Ref. to EC(H4DOTC)-21, Secondary Air Combination Valve.>	Go to step 7.
<b>7 CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE LH AND CHASSIS GROUND.</b> Measure the resistance between the secondary air combination valve LH connector and chassis ground. <i>Connector &amp; terminal</i> <i>(E40) No. 1 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Go to step 8.	Repair the open circuit of harness between secondary air combination valve LH and chassis ground.
<b>8 CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 2 AND SECONDARY AIR COMBINATION VALVE LH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 2 from the relay box. 3) Measure the resistance of the harness between the secondary air combination valve relay 2 and secondary air combination valve LH connector. <i>Connector &amp; terminal</i> <i>(F9) No. 8 — (E40) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 9.	Repair the open circuit of the harness between the secondary air combination valve relay 2 and secondary air combination valve LH connector.
<b>9 CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.</b> 1) Connect the battery to terminals No. 10 and No. 9 of the secondary air combination valve relay 2. 2) Measure the resistance between the secondary air combination valve relay 2 terminals. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance less than 1 Ω?	Go to step 10.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>10 CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.</b> Measure the resistance between the secondary air combination valve relay 2 terminals with the battery disconnected. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance 1 MΩ or more?	Go to step 11.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
<b>11 CHECK SECONDARY AIR COMBINATION VALVE RELAY 2 POWER SOURCE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 2 connector and chassis ground. <i>Connector &amp; terminal</i> <i>(F9) No. 7 (+) — Chassis ground (-):</i> <i>(F9) No. 10 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 12.	Repair the open or ground short circuit of power supply circuit.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>12</b> <b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector of ECM. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 2 connector. <b>Connector &amp; terminal</b> <b>(B136) No. 19 — (F9) No. 9:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 13.	Repair the open circuit of harness between ECM and secondary air combination valve relay 2 connector.
<b>13</b> <b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.</b> Measure the resistance between the secondary air combination valve relay 2 connector and chassis ground. <b>Connector &amp; terminal</b> <b>(F9) No. 9 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Repair the poor contact of the ECM connector.	Repair the ground short circuit of harness between ECM and secondary air combination valve relay 2 connector.

### EI: DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2)

NOTE:

For the diagnostic procedure, refer to DTC P2442. <Ref. to EN(H4DOTC)(diag)-360, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **EJ:DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-281, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Trouble Code (DTC) Detecting Criteria.>

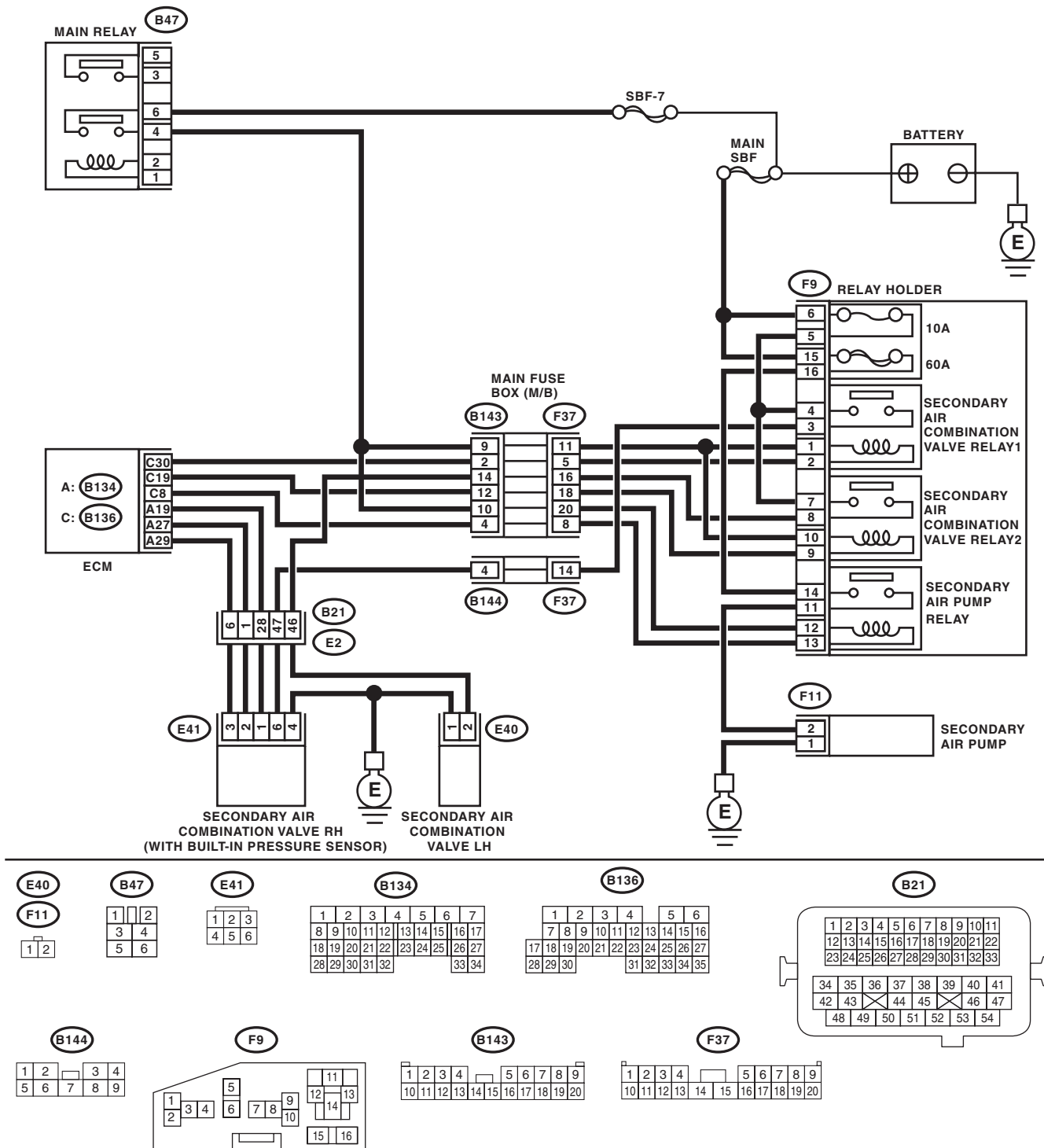
### **CAUTION:**

After repairing or replacing the defective part, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-45, PROCEDURE, Inspection Mode.>.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05678



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK SECONDARY AIR PIPING PRESSURE.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, read secondary air piping pressure data, and compare with the actual barometric pressure. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-35, Subaru Select Monitor.>	Is the actual difference with atmospheric pressure 50 mmHg (6.7 kPa, 2.0 inHg, 0.97 psig) or more?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK SECONDARY AIR PUMP.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) Check whether or not the secondary air pump is operating.	Is the secondary air pump operating?	Go to step 3.	Replace the secondary air combination valve LH. <Ref. to EC(H4DOTC)-21, INSPECTION, Secondary Air Combination Valve.>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the secondary air pump relay from the relay box. 3) Measure the resistance between the secondary air pump relay connector and engine ground terminals. <b>Connector &amp; terminal</b> <b>(F9) No. 13 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the ground short circuit of harness between ECM and secondary air pump relay connector.
<b>4</b> <b>CHECK SECONDARY AIR PUMP RELAY.</b> Measure the resistance between the secondary air pump relay terminals. <b>Terminals</b> <b>No. 14 — No. 11:</b>	Is the resistance 1 MΩ or more?	Repair the short circuit to power in the harness between secondary air pump relay and secondary air pump connector.	Replace the secondary air pump relay. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

## Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### 20. Diagnostic Procedure without Diagnostic Trouble Code (DTC)

#### A: CHECK SI-DRIVE (SUBARU Intelligent Drive) SYSTEM

##### DIAGNOSIS:

SI-DRIVE mode will not change.

##### CAUTION:

Note that the SI-DRIVE system performs the following control when changing modes.

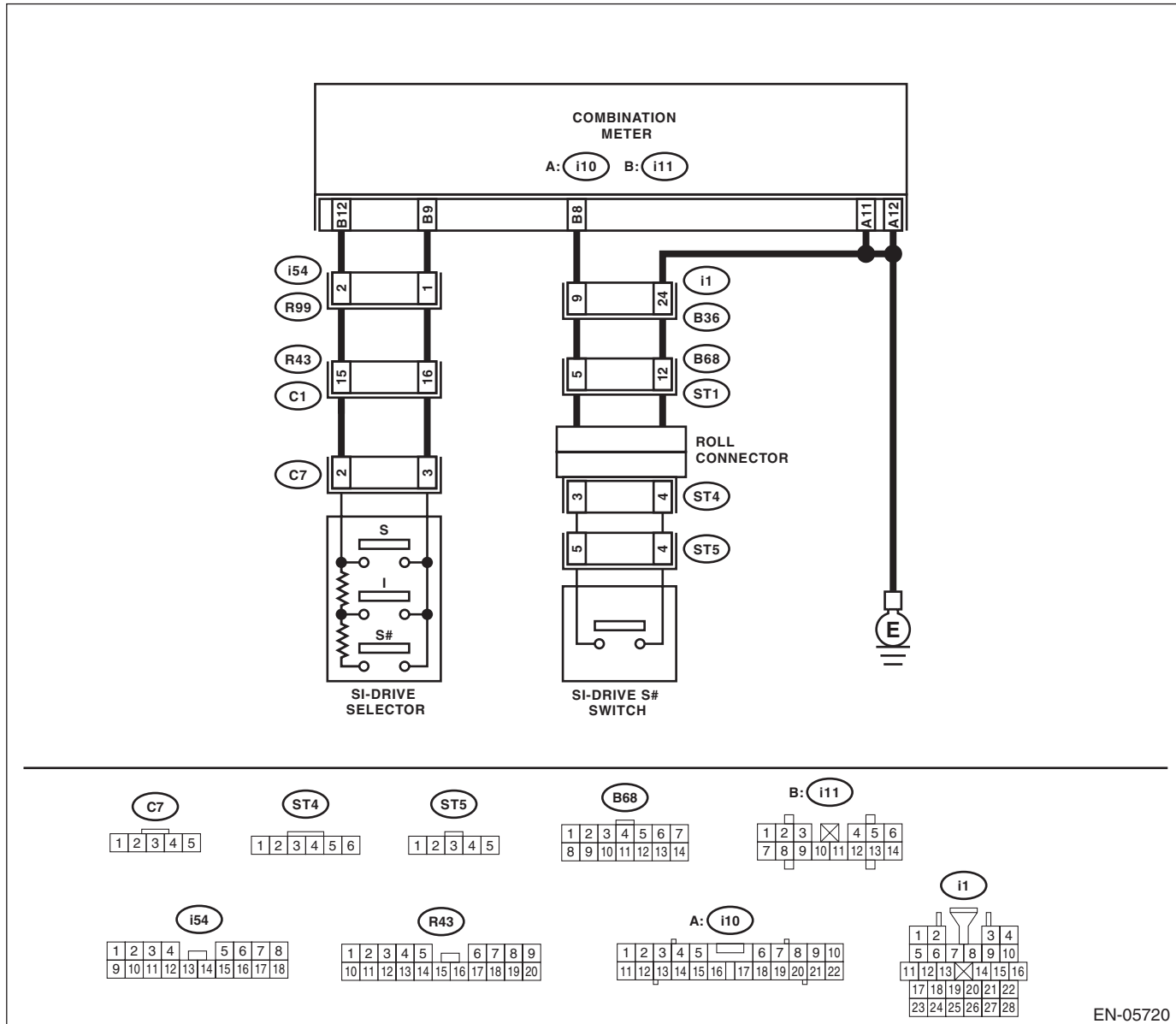
1. When the engine is cold, the low coolant temperature display will light in the multi-information display meter. In this case, it will not be possible to change to the S# (sports sharp) mode.
2. If the engine is stopped in the S# (sports sharp) mode, it will be in the S (sports) mode when the engine is restarted.
3. If the engine is stopped in the S (sports) or I (intelligent) mode, then restarted, it will enter the mode it was on before stopping the engine.
4. If the malfunction indicator light becomes lit while the engine is running, it will enter the S (sports) mode. In this case, it will not be possible to change to the S# (sports sharp) or I (intelligent) mode.
5. If there is a possible engine coolant temperature overheat condition, it will not be possible to switch to the S# (sports sharp) mode. When driving in the S# (sports sharp) mode, it will enter the S (sports) mode.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 1. EVEN WHEN THE SI-DRIVE MODE IS CHANGED, THE MULTI INFORMATION DISPLAY DOES NOT CHANGE, AND THE MODE DOES NOT SWITCH

### WIRING DIAGRAM:



EN-05720

Step	Check	Yes	No
<b>1 CHECK SI-DRIVE SELECTOR.</b> 1) Disconnect the connector from the multi information display meter. 2) Measure the resistance between connectors when the SI-DRIVE selector is operated. <b>Connector &amp; terminal</b> <i>(i11) No. 9 — (i11) No. 12:</i>	Does the resistance change as shown below? S#: 2.14 — 3.2 kΩ I: 0.8 — 1.2 kΩ S: less than 10 Ω	Go to step 2.	Go to step 5.
<b>2 CHECK SI-DRIVE S# SWITCH.</b> 1) Hold down the SI-DRIVE S# switch on the steering wheel. 2) Measure the resistance of harness between the multi-information display meter connector and chassis ground. <b>Connector &amp; terminal</b> <i>(i11) No. 8 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Go to step 6.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>3 CHECK POOR CONTACT.</b> Check the following items. <ul style="list-style-type: none"> <li>• Cracked or improperly connected connector</li> <li>• Broken connector pin</li> <li>• Disconnection of connector terminal</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 4.
<b>4 RECHECK FAULT.</b> 1) Connect all connectors. 2) Change the SI-DRIVE mode.	Is there any abnormal condition?	Replace the multi information display meter. <Ref. to IDI-19, Combination Meter.>	The circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  <b>NOTE:</b> In this case, there may be a temporary connector contact failure.
<b>5 CHECK SI-DRIVE SELECTOR HARNESS AND CONNECTOR.</b> Check the following items. <ul style="list-style-type: none"> <li>• Short or open circuit in the harness</li> <li>• Improperly connected or loose terminal in the SI-DRIVE selector connector</li> <li>• Improperly connected or loose terminal in coupling connector</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 7.
<b>6 CHECK SI-DRIVE S# SWITCH HARNESS AND CONNECTOR.</b> Check the following items. <ul style="list-style-type: none"> <li>• Short or open circuit in the harness</li> <li>• Improperly connected or loose terminal in steering roll connector</li> <li>• Improperly connected or loose terminal in coupling connector</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 7.
<b>7 RECHECK FAULT.</b> 1) Connect all connectors. 2) Change the SI-DRIVE mode.	Is there any abnormal condition?	Replace the SI-DRIVE selector. <Ref. to FU(H4DOTC)-43, SI-DRIVE (SUB-ARU Intelligent Drive) Selector.>	The circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 2. WHEN THE SI-DRIVE MODE IS CHANGED, “MODE CHANGE ERROR” APPEARS IN THE MULTI INFORMATION DISPLAY APPROXIMATELY 5 SECONDS LATER

Step	Check	Yes	No
1 <b>CHECK DTC.</b>	Is DTC displayed?	Check for the corresponding DTC using the “List of Diagnostic Trouble Code (DTC)” for each unit.	Go to step 2.
2 <b>CHECK DISPLAY OF MULTI INFORMATION DISPLAY METER.</b> Check whether there are other errors displayed other than the “Mode Change Error”. Example: • “Err” is displayed in the external temperature or fuel consumption displays. • FUEL gauge, TEMP gauge or ECO gauge does not move.	Is there other errors displayed other than the “Mode Change Error”?	For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Go to step 3.
3 <b>CHECK MULTI INFORMATION DISPLAY METER AND ECM.</b>	Is the multi information display meter and ECM part numbers correct?	Replace the multi-information display meter. <Ref. to IDI-19, Combination Meter.>	Replace the multi information display meter and/or ECM to that of the correct part number. <Ref. to IDI-19, Combination Meter.> or <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>

## 3. WHEN THE SI-DRIVE MODE IS CHANGED, “MODE CHANGE ERROR” IS NOT DISPLAYED IN MULTI INFORMATION DISPLAY, AND “S#”, “I”, “S” FLASHES

NOTE:

In this case, there may be a problem outside the SI-DRIVE system.

Step	Check	Yes	No
1 <b>CHECK MALFUNCTION INDICATOR LIGHT.</b> 1) Start the engine. 2) Check whether the malfunction indicator light is lit or not.	Does the malfunction indicator light illuminate?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 <b>CHECK ENGINE COOLANT TEMPERATURE GAUGE.</b> 1) Turn the ignition switch to ON. 2) Check the engine coolant temperature gauge.	Is it overheating?	Investigate and repair the cause of the overheating.	Go to step 3.
3 <b>CHECK DISPLAY OF MULTI INFORMATION DISPLAY.</b> 1) Turn the ignition switch to ON. 2) Change the SI-DRIVE mode. 3) Check the display of the multi information display.	Do the displays “S#”, “I”, “S” of the multi information display flash?	Replace the multi information display meter. <Ref. to IDI-19, Combination Meter.>	Perform test operation, and check the malfunction indicator and the coolant temperature gauge. If they are operating normally, end the diagnosis.

# General Diagnostic Table

ENGINE (DIAGNOSTICS)

## 21. General Diagnostic Table

### A: INSPECTION

#### 1. ENGINE

NOTE:

Malfunction of parts other than those listed is also possible. <Ref. to ME(H4DOTC)-95, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Electronic throttle control 2) Manifold absolute pressure sensor 3) Mass air flow and intake air temperature sensor 4) Ignition parts (*1) 5) Engine coolant temperature sensor (*2) 6) Crankshaft position sensor (*3) 7) Camshaft position sensor (*3) 8) Fuel injection parts (*4)
2. Rough idling	1) Electronic throttle control 2) Manifold absolute pressure sensor 3) Mass air flow and intake air temperature sensor 4) Engine coolant temperature sensor (*2) 5) Ignition parts (*1) 6) Air intake system (*5) 7) Fuel injection parts (*4) 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Electronic throttle control 2) Engine coolant temperature sensor 3) Manifold absolute pressure sensor 4) Mass air flow sensor
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Electronic throttle control 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) A/C switch and A/C cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1)
5. Engine stalls, hesitates, or sputters at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Fuel pump and fuel pump relay
6. Surging	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Throttle position sensor 8) Fuel pump and fuel pump relay

# General Diagnostic Table

ENGINE (DIAGNOSTICS)

Symptom	Problem parts
7. Spark knock	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay
8. After burning in exhaust system	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

\*1: Check ignition coil and spark plug.

\*2: Indicate the symptom occurring only in cold temperatures.

\*3: Ensure the secure installation.

\*4: Check fuel injector, fuel pressure regulator and fuel filter.

\*5: Inspect air leak in air intake system.

# General Diagnostic Table

ENGINE (DIAGNOSTICS)

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# List of Diagnostic Trouble Code (DTC)

## GENERAL DESCRIPTION

### 1. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Index
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to GD(H4DOTC)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to GD(H4DOTC)-13, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to GD(H4DOTC)-15, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to GD(H4DOTC)-15, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-16, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-18, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-20, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-22, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-24, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to GD(H4DOTC)-26, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4DOTC)-29, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H4DOTC)-32, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H4DOTC)-34, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4DOTC)-36, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4DOTC)-38, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H4DOTC)-40, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H4DOTC)-42, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to GD(H4DOTC)-44, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H4DOTC)-46, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H4DOTC)-48, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0122	Throttle/Pedal Position Sensor/ Switch "A" Circuit Low	<Ref. to GD(H4DOTC)-50, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/ Switch "A" Circuit High	<Ref. to GD(H4DOTC)-52, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to GD(H4DOTC)-54, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Engine Coolant Tem- perature for Stable Operation	<Ref. to GD(H4DOTC)-57, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Cool- ant Temperature Below Thermo- stat Regulating Temperature)	<Ref. to GD(H4DOTC)-59, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-61, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-63, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-65, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-68, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-70, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-73, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-74, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to GD(H4DOTC)-81, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4DOTC)-83, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4DOTC)-84, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor "A" Cir- cuit Range/Performance	<Ref. to GD(H4DOTC)-86, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor "A" Cir- cuit Low Input	<Ref. to GD(H4DOTC)-89, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor "A" Cir- cuit High Input	<Ref. to GD(H4DOTC)-91, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0222	Throttle/Pedal Position Sensor/ Switch "B" Circuit Low	<Ref. to GD(H4DOTC)-93, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/ Switch "B" Circuit High	<Ref. to GD(H4DOTC)-95, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P0230	Fuel Pump Primary Circuit	<Ref. to GD(H4DOTC)-97, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0244	Turbo/Super Charger Wastegate Solenoid "A" Range/Performance	<Ref. to GD(H4DOTC)-99, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0245	Turbo/Super Charger Wastegate Solenoid "A" Low	<Ref. to GD(H4DOTC)-101, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0246	Turbo/Super Charger Wastegate Solenoid A High	<Ref. to GD(H4DOTC)-103, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4DOTC)-105, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4DOTC)-111, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4DOTC)-111, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4DOTC)-111, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-112, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-114, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to GD(H4DOTC)-116, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to GD(H4DOTC)-118, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-120, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	<Ref. to GD(H4DOTC)-122, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0410	Secondary Air Injection System	<Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0411	Secondary Air Injection System Incorrect Flow Detected	<Ref. to GD(H4DOTC)-132, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0413	Secondary Air Injection System Switching Valve "A" Circuit Open	<Ref. to GD(H4DOTC)-133, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	<Ref. to GD(H4DOTC)-134, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0416	Secondary Air Injection System Switching Valve "B" Circuit Open	<Ref. to GD(H4DOTC)-135, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0417	Secondary Air Injection System Switching Valve "B" Circuit Shorted	<Ref. to GD(H4DOTC)-135, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0418	Secondary Air Injection System Control "A" Circuit Open	<Ref. to GD(H4DOTC)-136, DTC P0418 SECONDARY AIR INJECTION SYSTEM CONTROL "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4DOTC)-137, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0441	Evaporative Emission System Incorrect Purge Flow	<Ref. to GD(H4DOTC)-139, DTC P0441 EVAPORATIVE EMISSION SYSTEM INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H4DOTC)-140, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H4DOTC)-157, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H4DOTC)-159, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to GD(H4DOTC)-161, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H4DOTC)-163, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H4DOTC)-165, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4DOTC)-166, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to GD(H4DOTC)-166, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H4DOTC)-167, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to GD(H4DOTC)-169, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor "A" Circuit Range/Performance	<Ref. to GD(H4DOTC)-171, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to GD(H4DOTC)-173, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to GD(H4DOTC)-175, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4DOTC)-177, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor "A"	<Ref. to GD(H4DOTC)-180, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H4DOTC)-182, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to GD(H4DOTC)-184, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4DOTC)-186, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P0513	Incorrect Immobilizer Key	<Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0600	Serial Communication Link	<Ref. to GD(H4DOTC)-188, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4DOTC)-190, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H4DOTC)-191, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0607	Control Module Performance	<Ref. to GD(H4DOTC)-192, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to GD(H4DOTC)-195, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0700	Transmission Control System (MIL Request)	<Ref. to GD(H4DOTC)-197, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to GD(H4DOTC)-198, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to GD(H4DOTC)-199, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to GD(H4DOTC)-201, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to GD(H4DOTC)-202, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-204, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-207, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4DOTC)-210, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4DOTC)-212, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1410	Secondary Air Injection System Switching Valve Stuck Open	<Ref. to GD(H4DOTC)-214, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1418	Secondary Air Injection System Control "A" Circuit Shorted	<Ref. to GD(H4DOTC)-216, DTC P1418 SECONDARY AIR INJECTION SYSTEM CONTROL "A" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4DOTC)-217, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H4DOTC)-219, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to GD(H4DOTC)-221, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P1560	Back-up voltage circuit malfunction	<Ref. to GD(H4DOTC)-223, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1570	Antenna	<Ref. to GD(H4DOTC)-224, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1571	Reference Code Incompatibility	<Ref. to GD(H4DOTC)-224, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1572	IMM Circuit Failure (Except Antenna Curcuit)	<Ref. to GD(H4DOTC)-224, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1574	Key Communication Failure	<Ref. to GD(H4DOTC)-224, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1576	EGI Control Module EEPROM	<Ref. to GD(H4DOTC)-224, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1577	IMM Control Module EEPROM	<Ref. to GD(H4DOTC)-224, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1578	Meter Failure	<Ref. to GD(H4DOTC)-224, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1602	Control Module Programming Error	<Ref. to GD(H4DOTC)-225, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to GD(H4DOTC)-227, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to GD(H4DOTC)-228, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to GD(H4DOTC)-229, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to GD(H4DOTC)-230, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	<Ref. to GD(H4DOTC)-231, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-233, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	<Ref. to GD(H4DOTC)-235, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-237, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2016	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-239, DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	<Ref. to GD(H4DOTC)-241, DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2021	Intake Manifold Runner Position Sensor / Switch Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-243, DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	<Ref. to GD(H4DOTC)-245, DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-247, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to GD(H4DOTC)-249, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-250, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to GD(H4DOTC)-250, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H4DOTC)-251, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H4DOTC)-253, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H4DOTC)-255, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H4DOTC)-257, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4DOTC)-259, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to GD(H4DOTC)-261, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to GD(H4DOTC)-263, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to GD(H4DOTC)-265, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to GD(H4DOTC)-267, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	<Ref. to GD(H4DOTC)-269, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	<Ref. to GD(H4DOTC)-271, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	<Ref. to GD(H4DOTC)-273, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to GD(H4DOTC)-275, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to GD(H4DOTC)-276, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance	<Ref. to GD(H4DOTC)-277, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	<Ref. to GD(H4DOTC)-278, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	<Ref. to GD(H4DOTC)-279, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank 1)	<Ref. to GD(H4DOTC)-280, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank 1)	<Ref. to GD(H4DOTC)-280, DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank 2)	<Ref. to GD(H4DOTC)-280, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank 2)	<Ref. to GD(H4DOTC)-280, DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2444	Secondary Air Injection System Pump Stuck On	<Ref. to GD(H4DOTC)-281, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Trouble Code (DTC) Detecting Criteria.>



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

## 2. Diagnostic Trouble Code (DTC) Detecting Criteria

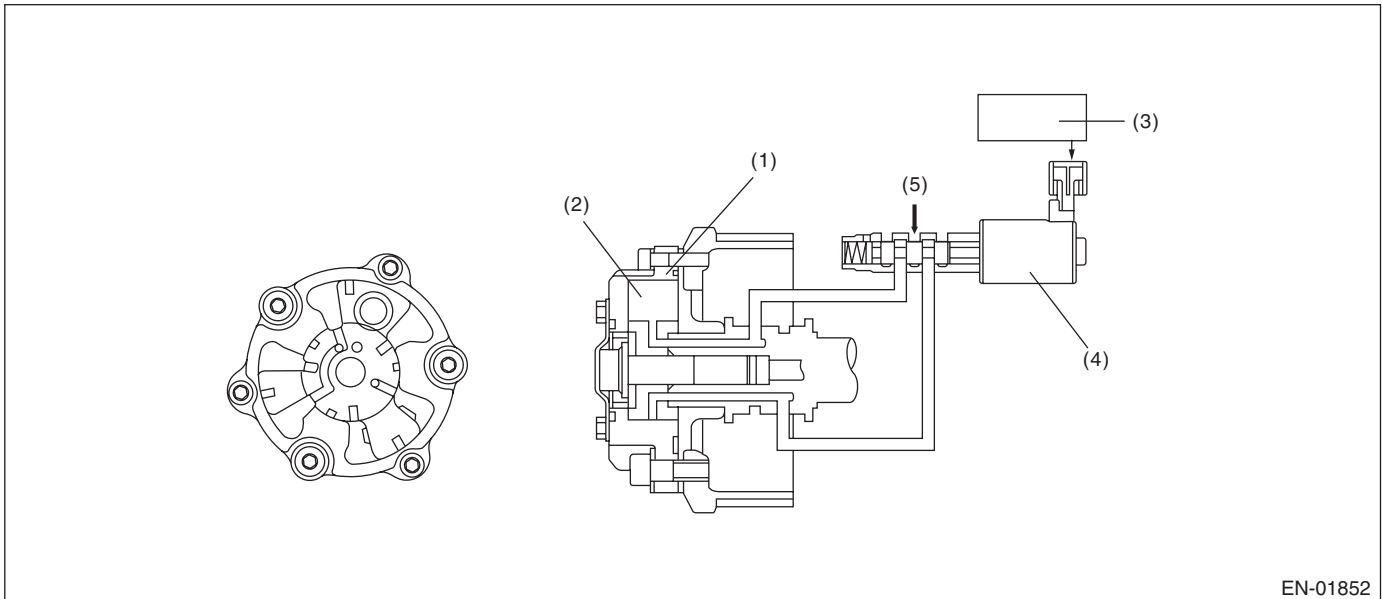
### A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.

#### 2. COMPONENT DESCRIPTION



(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	$\geq 3000$ ms
Battery voltage	$\geq 10.9$ V
Engine speed	$\geq 1300$ rpm
Engine coolant temperature	$\geq 60$ °C (140 °F)
AVCS control	Operation
Target advance angle	$\geq 0$ °CA
Target timing advance change amount (per 64 ms)	$< 1.07$ °CA

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after warming up when the engine speed increases and AVCS operates.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

- 1) When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.
- 2) When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.

### • Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	> 8000 °CA (AT model) (Bank 1) > 8000 °CA (AT model) (Bank 2) > 5300 °CA (MT model) (Bank 1) > 5300 °CA (MT model) (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	< -8000 °CA (AT model) (Bank 1) < -8000 °CA (AT model) (Bank 2) < -5300 °CA (MT model) (Bank 1) < -5300 °CA (MT model) (Bank 2)

### Time Needed for Diagnosis:

- AT model: 30000 ms
- MT model: 20000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 8000$ °CA (AT model) (Bank 1) $\leq 8000$ °CA (AT model) (Bank 2) $\leq 5300$ °CA (MT model) (Bank 1) $\leq 5300$ °CA (MT model) (Bank 2)
	and
	$\geq -8000$ °CA (AT model) (Bank 1) $\geq -8000$ °CA (AT model) (Bank 2) $\geq -5300$ °CA (MT model) (Bank 1) $\geq -5300$ °CA (MT model) (Bank 2)

### Time Needed for Diagnosis:

- AT model: 30000 ms
- MT model: 20000 ms

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0° CA) to the compensation value of the partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control: Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
- ISC feedback compensation: Do not perform the AVCS actual timing advance compensation. Make the OCV driving Duty to be the given value (9.36%).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

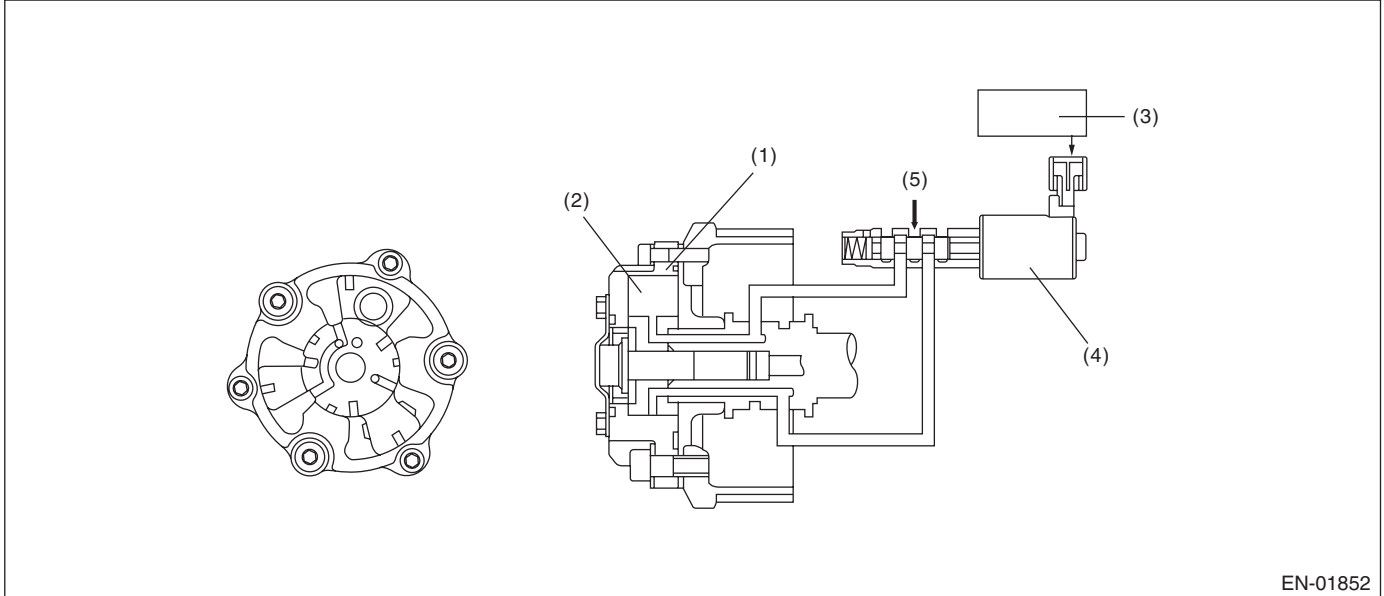
## B: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

### 1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge as NG when the timing advance is outside the normal range.

### 2. COMPONENT DESCRIPTION



EN-01852

(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine coolant temperature	≥ 60 °C (140 °F)
AVCS control	Not in operation
Target timing advance	0°CA

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine and while AVCS is not operating.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

Judge as NG when the camshaft sensor input position is not within the normal range.

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft input position	< BTDC 17 °CA (Bank 1) < BTDC 17 °CA (Bank 2) or > BTDC 55 °CA (Bank 1) > BTDC 55 °CA (Bank 2)

**Time Needed for Diagnosis:** 20000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft input position	≥ BTDC 17 °CA (Bank 1) ≥ BTDC 17 °CA (Bank 2) and ≤ BTDC 55 °CA (Bank 1) ≤ BTDC 55 °CA (Bank 2)

**Time Needed for Diagnosis:** 1000 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0° CA) to the compensation value of the partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control: Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
- ISC feedback compensation: Do not perform the AVCS actual timing advance compensation. Determine the OCV Driving Duty is the given value (9.36%).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

### **C: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)**

#### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0016. <Ref. to GD(H4DOTC)-13, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **D: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)**

#### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0011. <Ref. to GD(H4DOTC)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

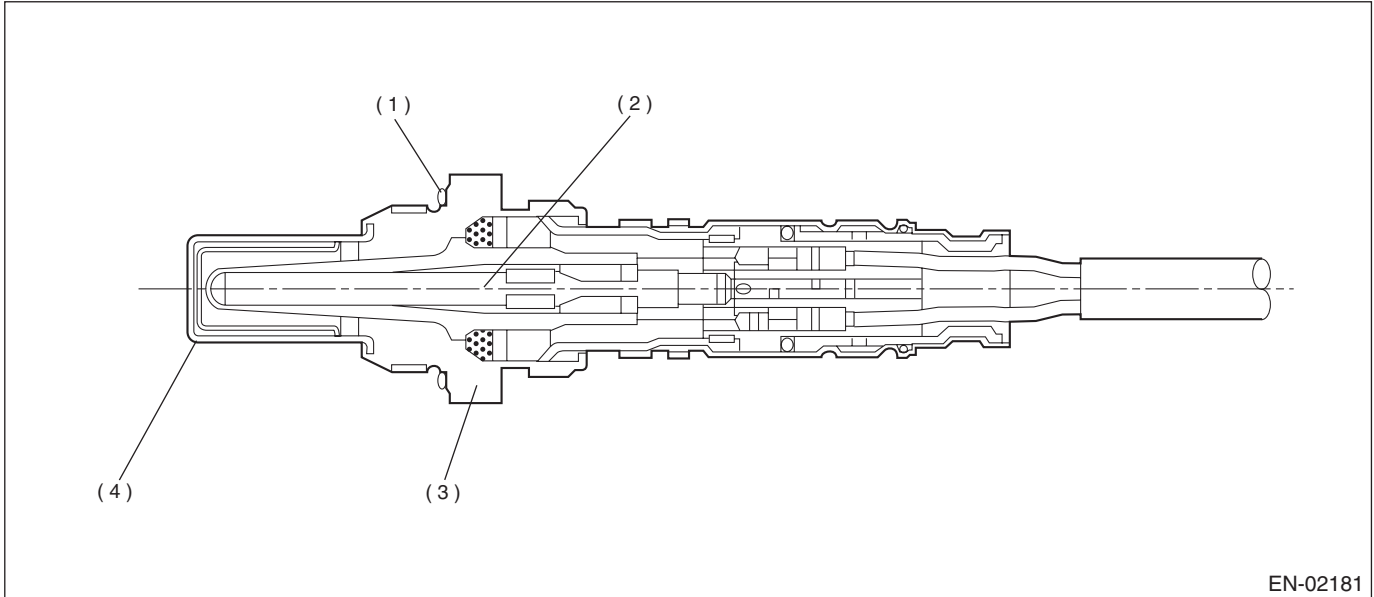
### E: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.

Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

#### 2. COMPONENT DESCRIPTION



EN-02181

(1) Gasket

(3) Sensor housing

(4) Protection tube

(2) Ceramic heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Condition established time	$\geq 42000$ ms
Battery voltage	$\geq 10.9$ V
Heater current	Permitted
Control duty $\geq 35$ %	Experienced
After fuel cut	$\geq 20000$ ms

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms or more have passed since the engine started.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	$\leq$ 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.06  $\rightarrow$  0.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### F: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

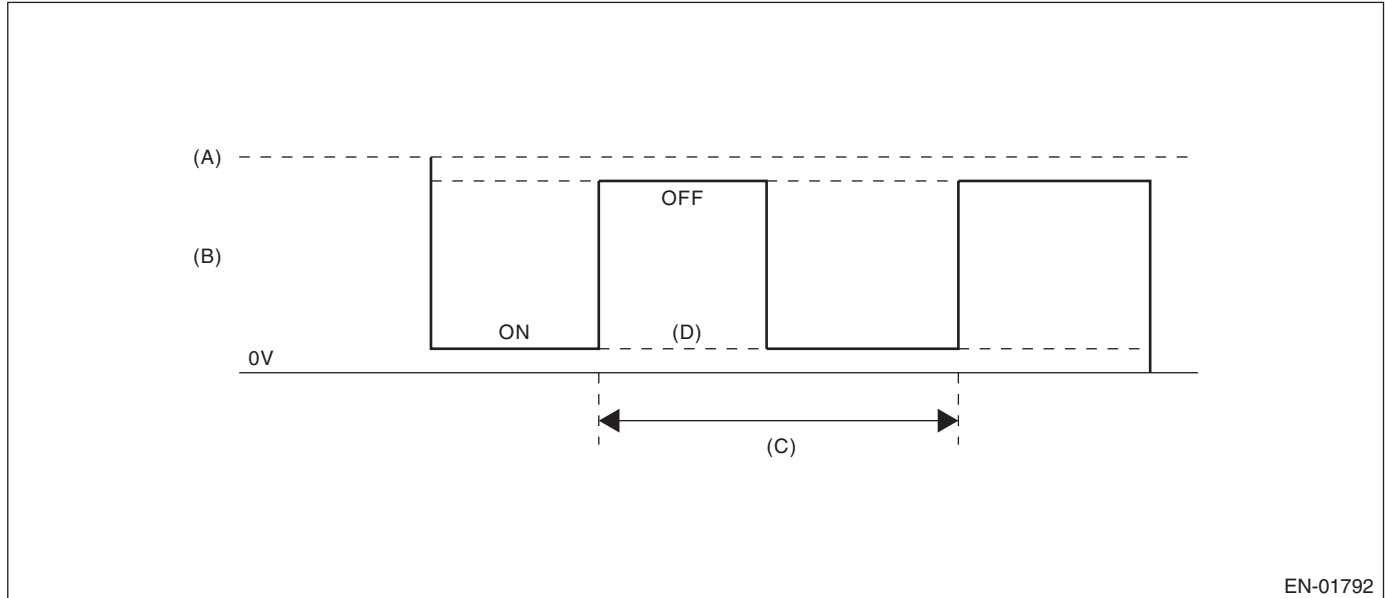
#### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 128 milliseconds

(D) Low error

(B) Front oxygen (A/F) sensor heater  
output voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Front oxygen (A/F) sensor heater control duty	< 87.5 %

**Time Needed for Diagnosis:** 4 ms × 250 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3 → 0, normally.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### G: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

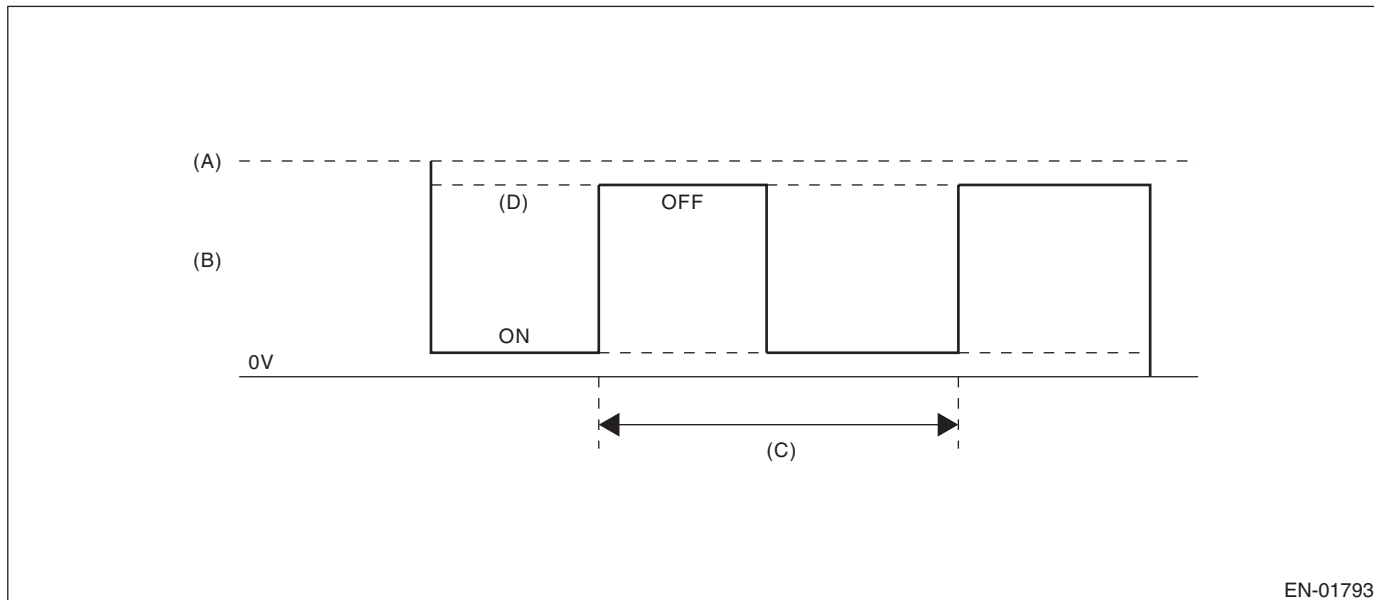
#### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 128 milliseconds

(D) High error

(B) Front oxygen (A/F) sensor heater output voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Front oxygen (A/F) sensor heater control duty	$\geq 12.5 \%$

**Time Needed for Diagnosis:** 4 ms  $\times$  500 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3  $\rightarrow$  0, normally.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### H: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

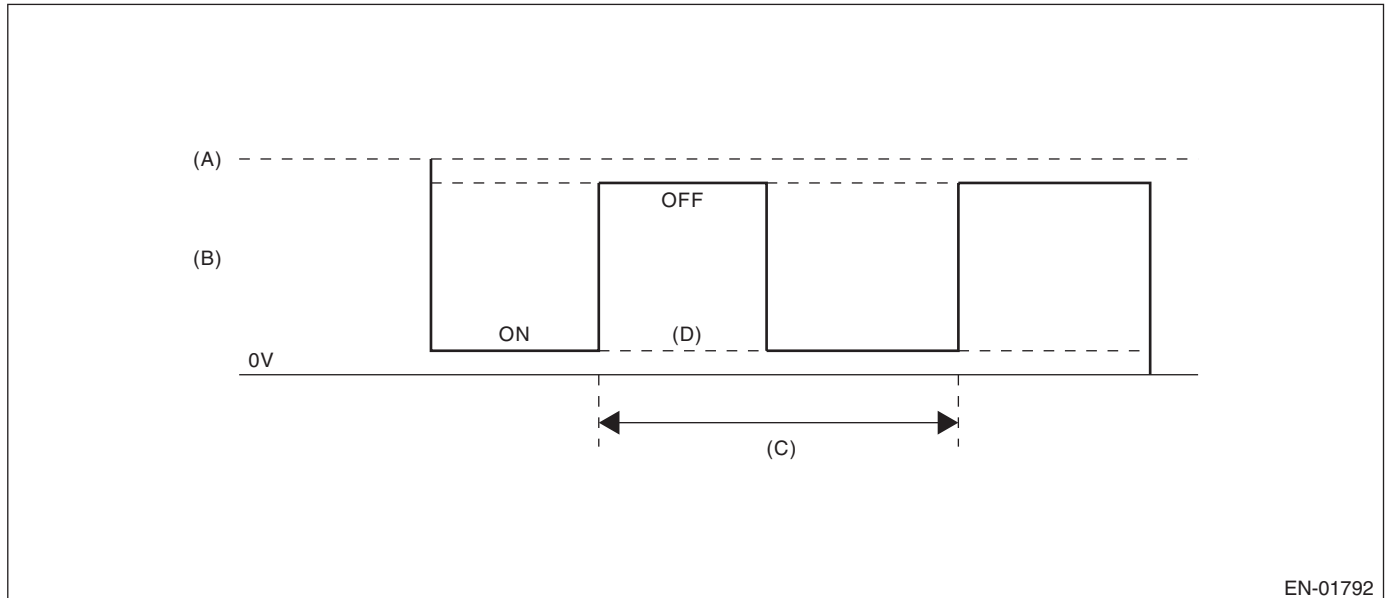
#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) Low error

(B) Output voltage of the rear oxygen sensor heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 8000$ rpm

#### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Rear oxygen sensor heater control duty	< 75 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### I: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

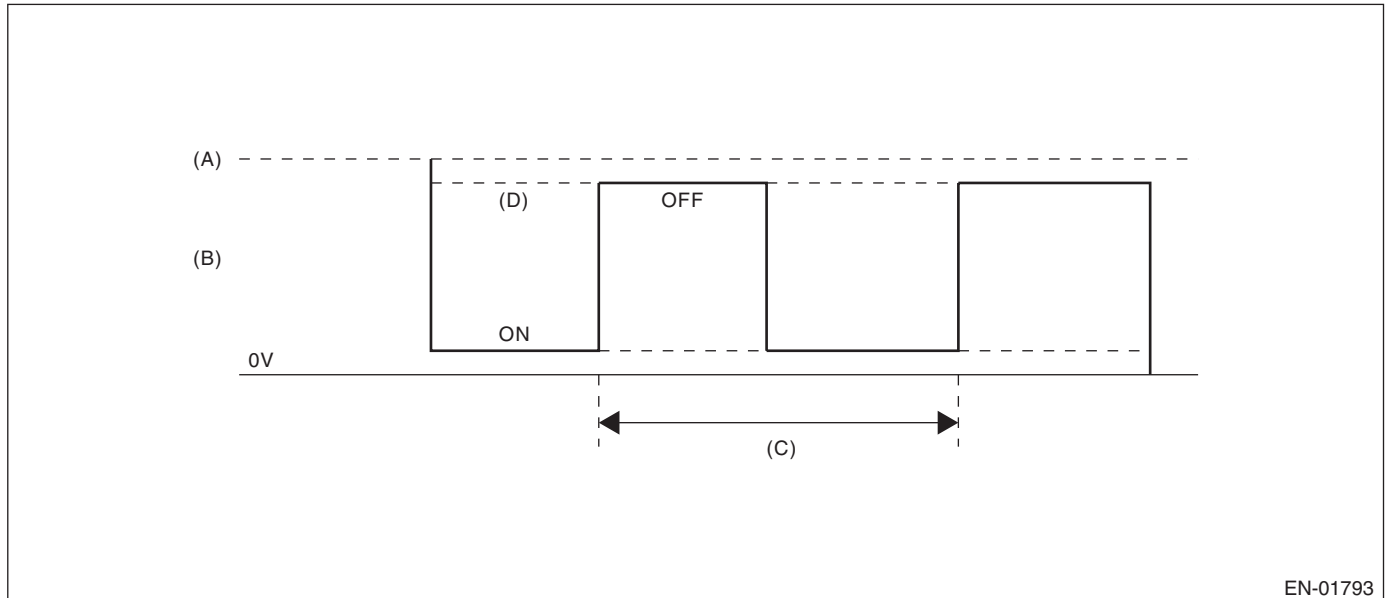
#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

#### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) High error

(B) Output voltage of the rear oxygen sensor heater

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 8000$ rpm

#### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	≥ 25 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

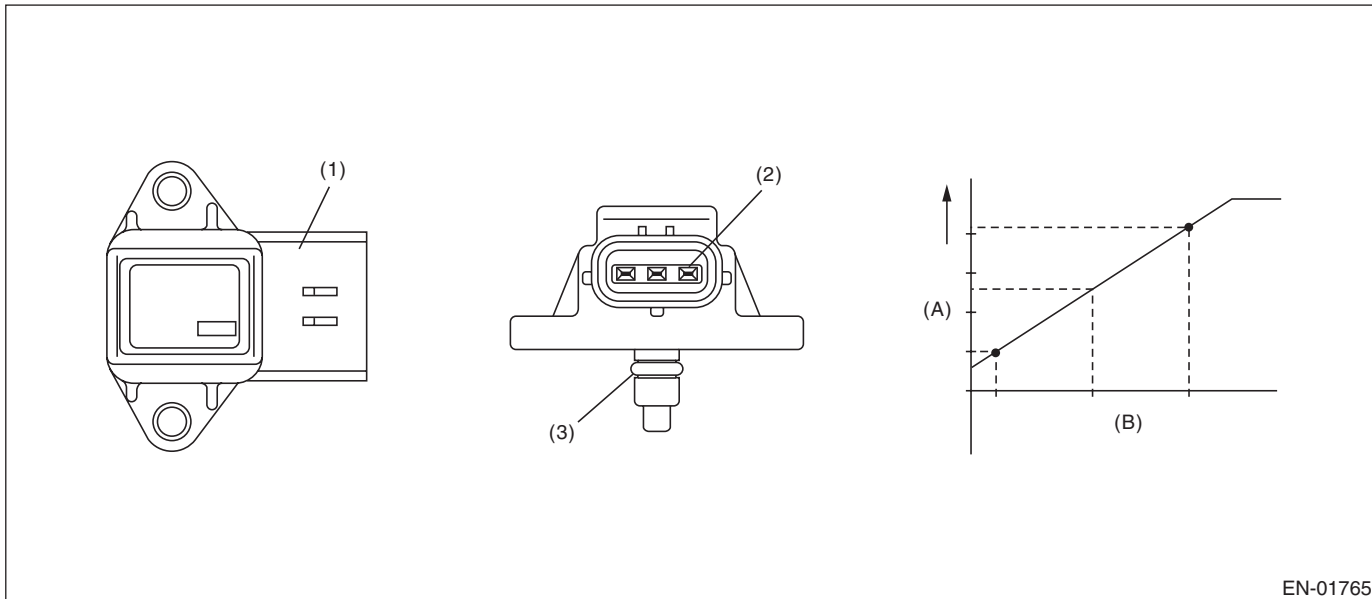
### J: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

#### 1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.

Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

#### 2. COMPONENT DESCRIPTION



- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

EN-01765

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 70\text{ }^{\circ}\text{C}$ (158 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 10 deg
Output voltage	< 1 V
Engine load	> 1.356 g/rev (0.048 oz/rev)
<b>High</b>	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.75 deg
Output voltage	≥ 2.36 V
Engine load	< 0.4 g/rev (0.014 oz/rev)

### Time Needed for Diagnosis:

Low side: 3000 msec

High side: 3000 msec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

If the duration of time while the following conditions are met is longer than the time indicated, judge as OK.

### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 10 deg
Output voltage	≥ 1 V
Engine load	> 1.356 g/rev (0.048 oz/rev)
<b>High</b>	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.75 deg
Output voltage	< 2.36 V
Engine load	< 0.4 g/rev (0.014 oz/rev)

### Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

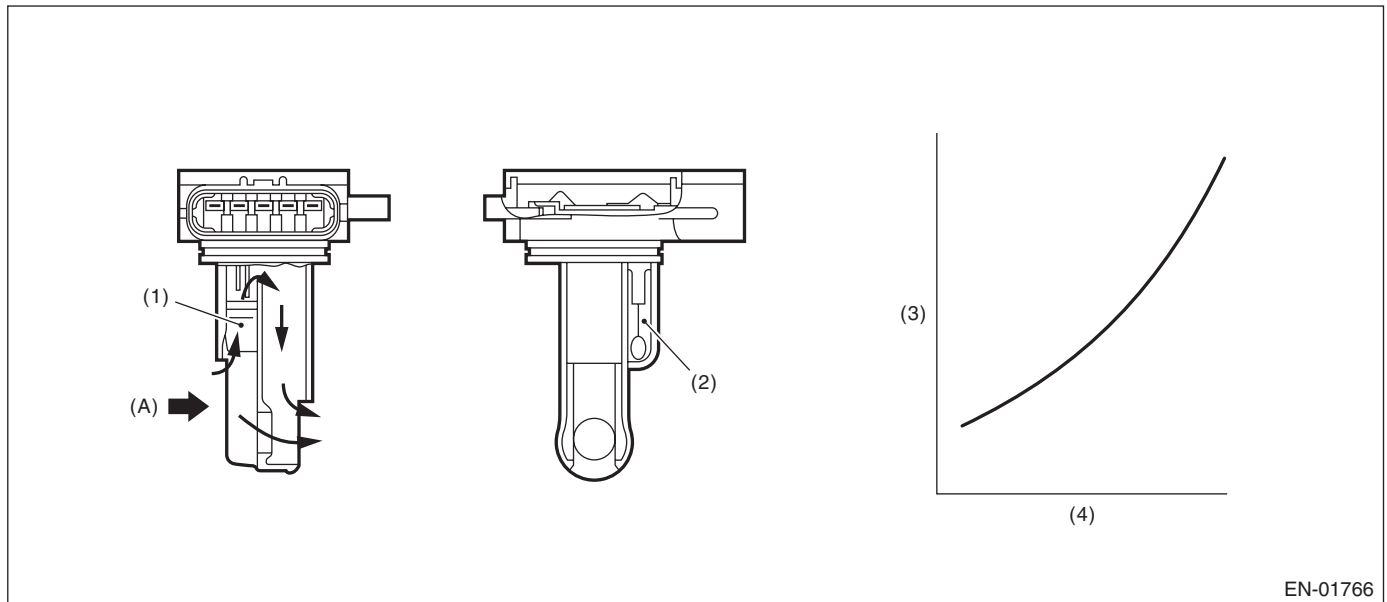
## K: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

### 2. COMPONENT DESCRIPTION



EN-01766

(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 70\text{ }^{\circ}\text{C}$ (158 °F)

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Output voltage	< 1.5 V
Engine speed	≥ 2500 rpm
Throttle opening angle	≥ 15 deg
Intake manifold pressure	≥ 53.32 kPa (400 mmHg, 15.748 inHg)
<b>High (1)</b>	
Output voltage	≥ 1.95 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 deg
Intake manifold pressure	≥ 52.65 kPa (395 mmHg, 15.551 inHg)
<b>High (2)</b>	
Output voltage	≥ 1.70 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 deg
Intake manifold pressure	≥ 52.65 kPa (395 mmHg, 15.551 inHg)
Fuel system diagnosis	Rich side malfunction

#### Time Needed for Diagnosis:

Low: 3000 ms

High: 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

## Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Output voltage	≥ 1.5 V
Engine speed	≥ 2500 rpm
Throttle opening angle	≥ 15 deg
Intake manifold pressure	≥ 53.32 kPa (400 mmHg, 15.748 inHg)
<b>High</b>	
Output voltage	< 1.95 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 deg
Intake manifold pressure	< 52.65 kPa (395 mmHg, 15.551 inHg)
Fuel system diagnosis	Rich side normal

## Time Needed for Diagnosis:

Low: Less than 1 second

High: Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

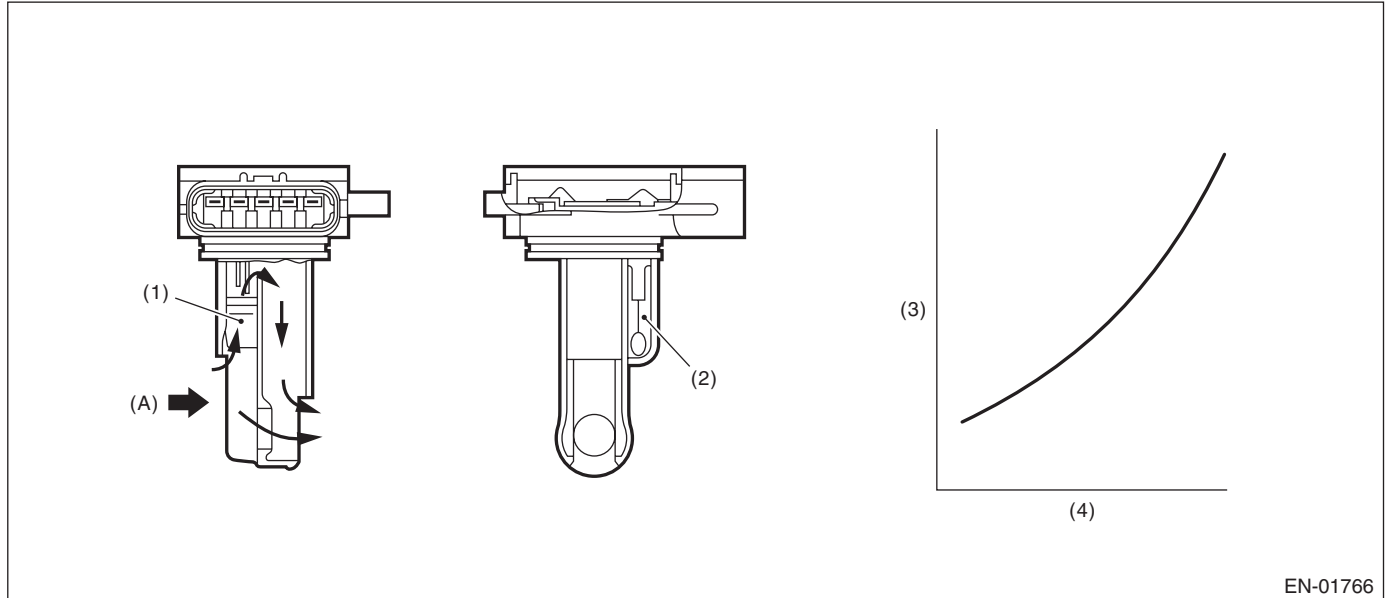
## GENERAL DESCRIPTION

### L: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.2 \text{ V}$

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> 0.2 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knock compensation:
  - Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
  - When normal: Knock compensation value = Fixed at 0°CA
  - Failure: Knock compensation value ≠ Fixed at 0° CA (When knock: Max. 12°CA retard)
  - Whole learning compensation coefficient update not allowed
  - Portional learning zone compensation value calculation not allowed
- ISC control: Open loop compensation is set to (1 g (0.04 oz)/s). Stop calculation of throttle sensor temperature compensation (hold previous value)
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

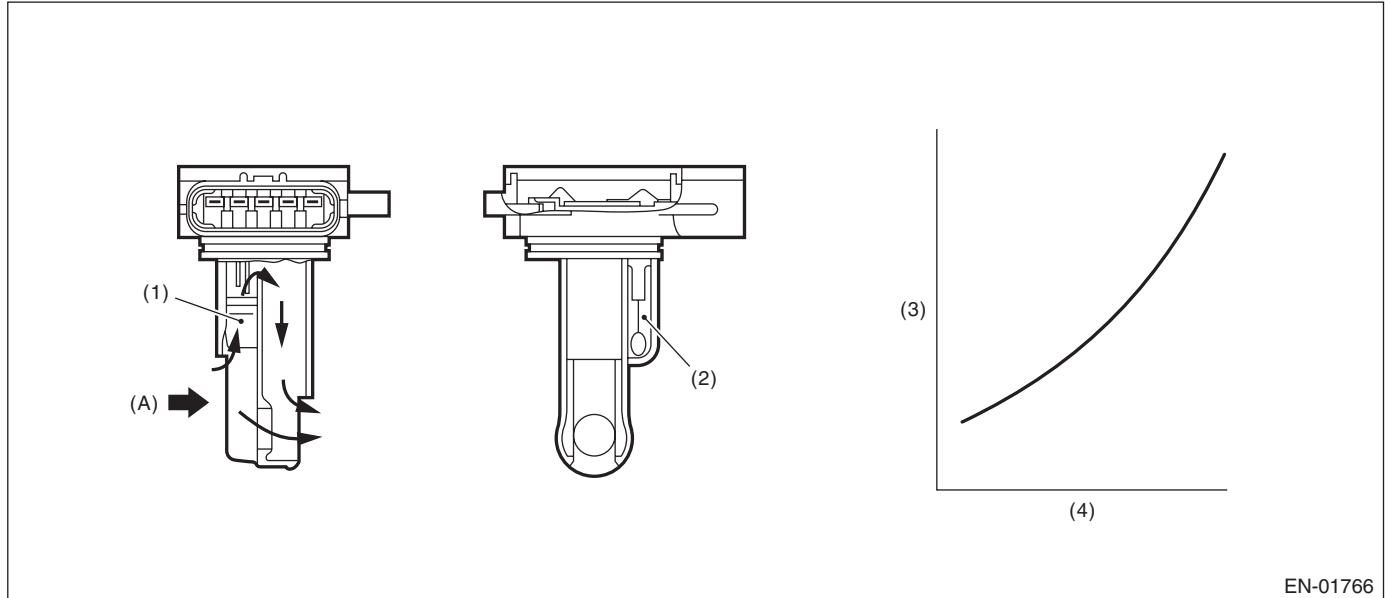
## GENERAL DESCRIPTION

### M: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.985$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.985$ V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knock compensation:
  - Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
  - When normal: Knock compensation value = Fixed at 0°CA
  - Failure: Knock compensation value ≠ Fixed at 0° CA (When knock: Max. 12°CA retard)
  - Whole learning compensation coefficient update not allowed
  - Portional learning zone compensation value calculation not allowed
- ISC control: Open loop compensation is set to (1 g (0.04 oz)/s). Stop calculation of throttle sensor temperature compensation (hold previous value)
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

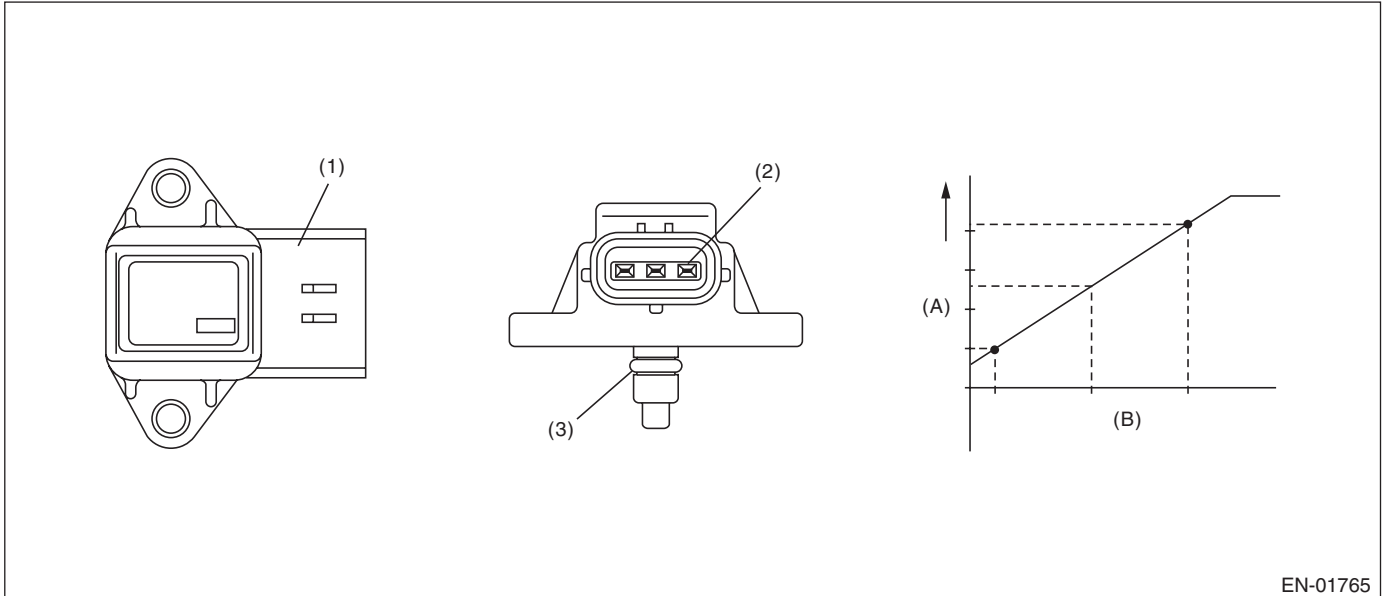
## GENERAL DESCRIPTION

### N: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.568$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> 0.568$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

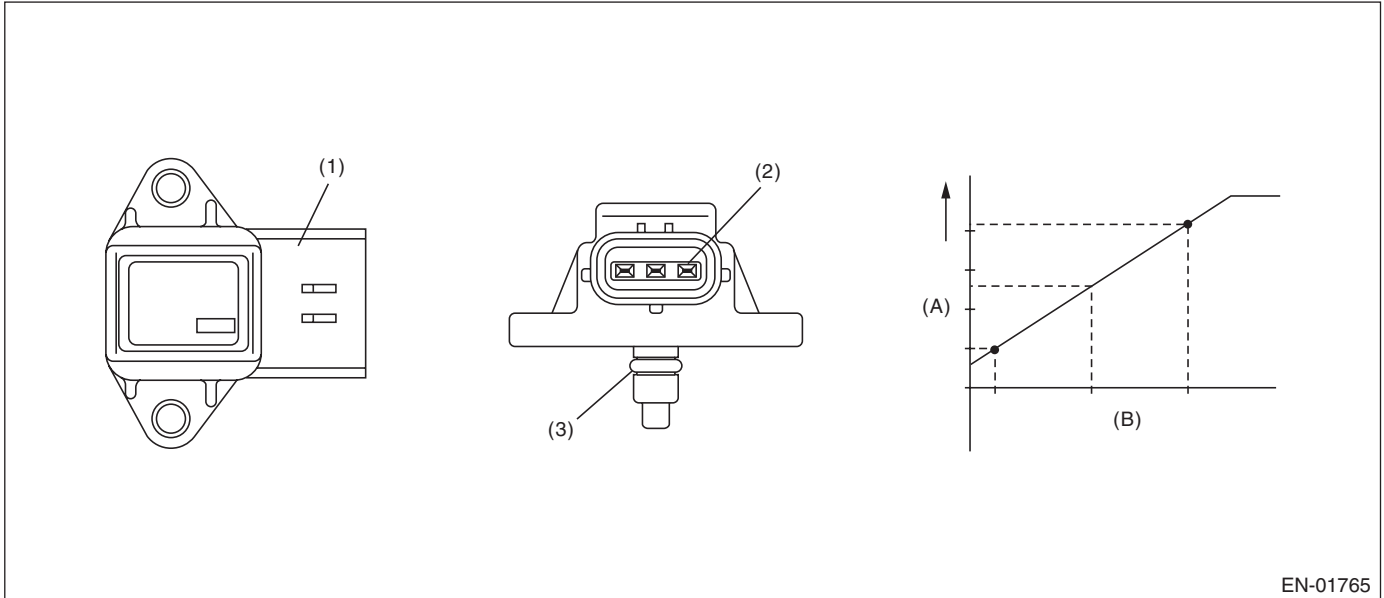
## GENERAL DESCRIPTION

### O: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.590499682$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.590499682$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

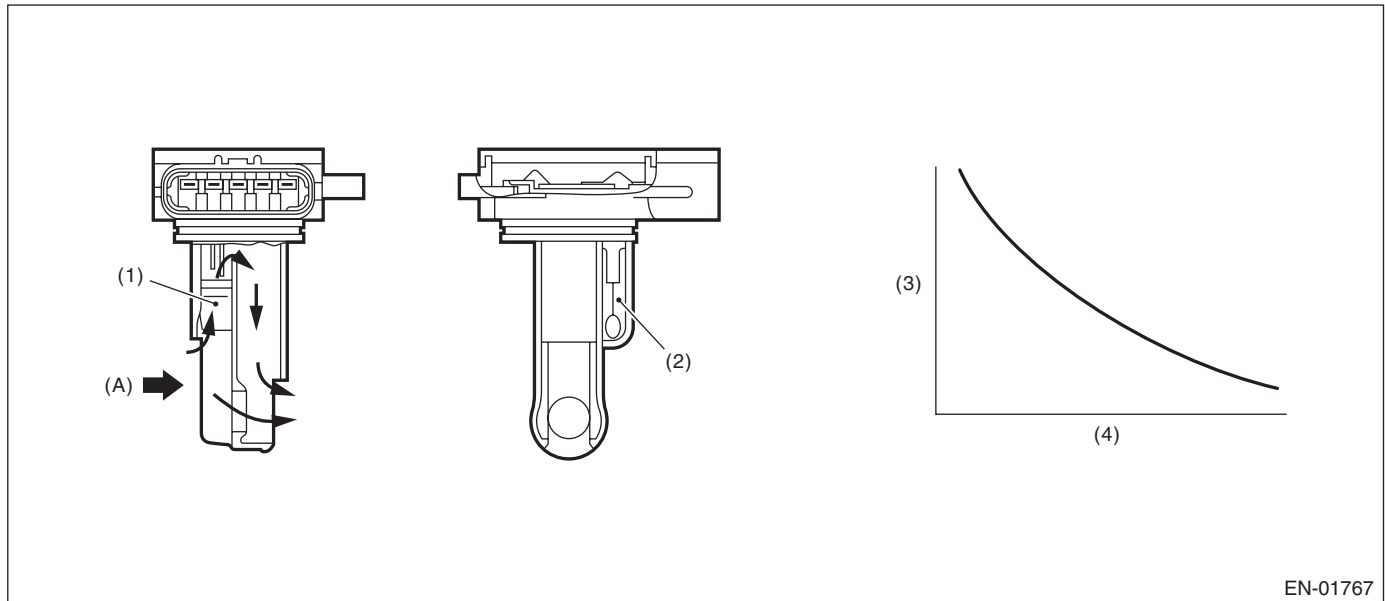
### P: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

#### 2. COMPONENT DESCRIPTION



EN-01767

(1) Air flow sensor

(3) Resistance value ( $\Omega$ )

(A) Air

(2) Intake air temperature sensor

(4) Intake air temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< 30 °C (86 °F)
Engine coolant temperature	$\geq$ 95 °C (203 °F)
Battery voltage	$\geq$ 10.9 V
Continuous time when the vehicle speed is less than 60 km/h (37.3 MPH)	$\geq$ 600 sec

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 0.02 V (Equivalent to approximately 0.5°C (0.9°F) near 25°C)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	≥ 0.02 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

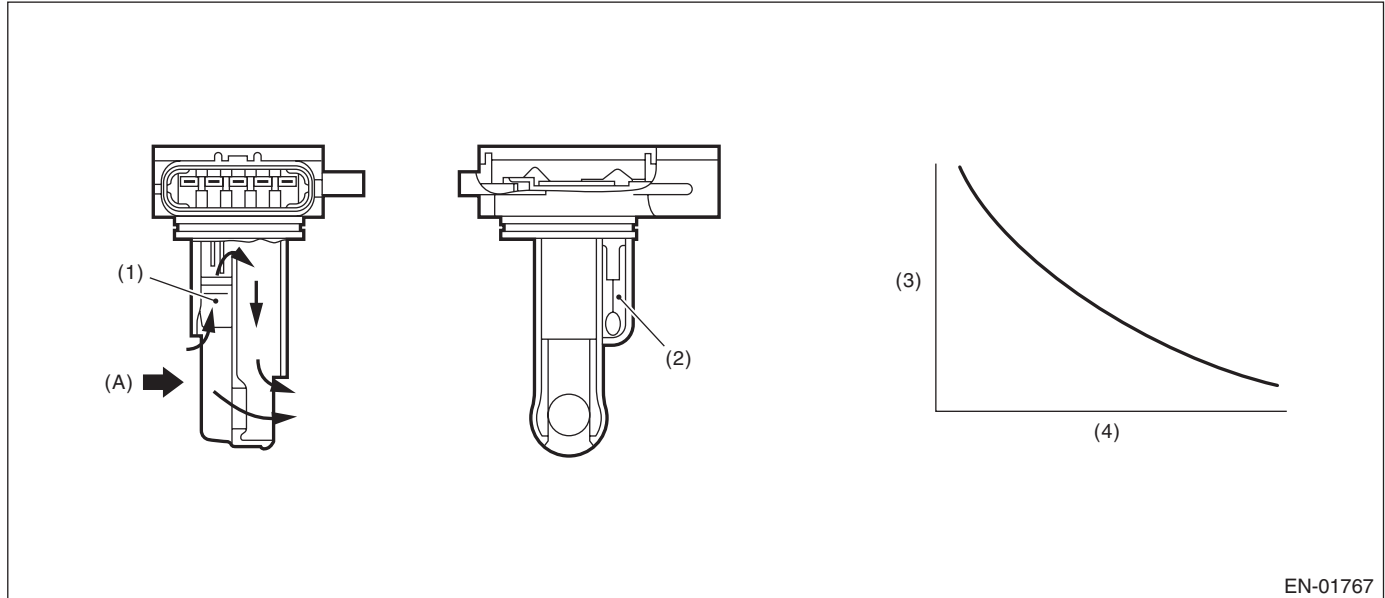
## GENERAL DESCRIPTION

### Q: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-01767

- (1) Air flow sensor  
 (2) Intake air temperature sensor  
 (3) Resistance value ( $\Omega$ )  
 (4) Intake air temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )  
 (A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 0.230975449 \text{ V}$

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.230975449 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

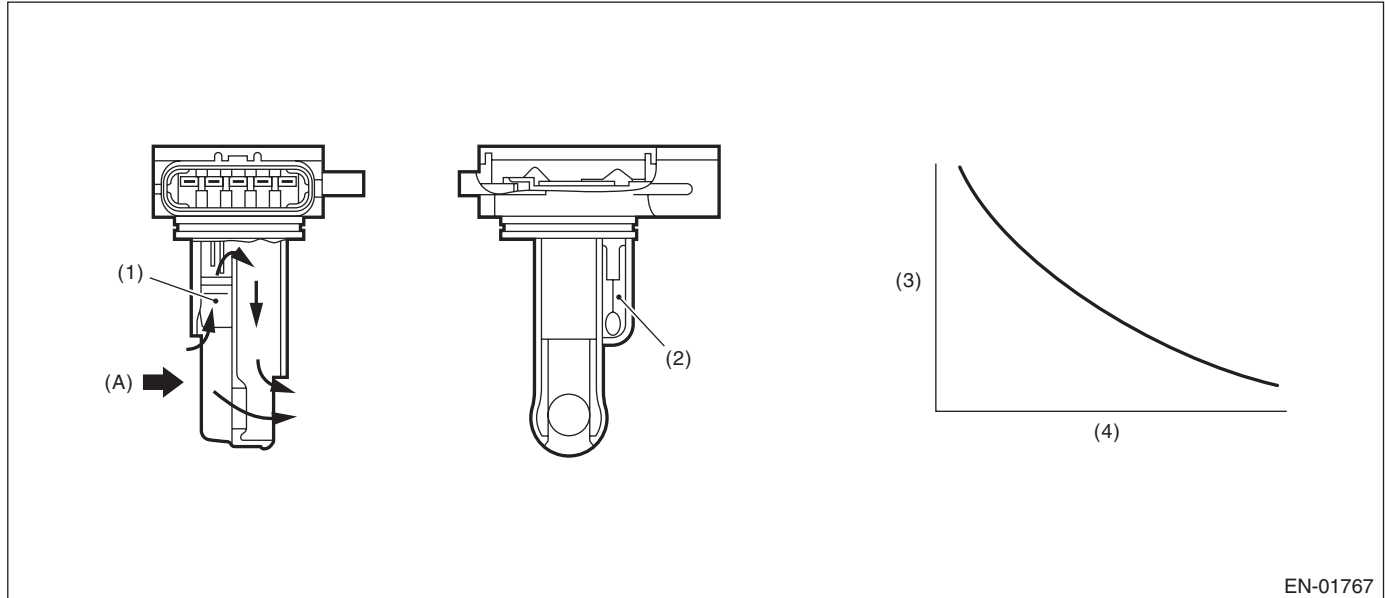
## GENERAL DESCRIPTION

### R: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-01767

- (1) Air flow sensor
- (2) Intake air temperature sensor
- (3) Resistance value (Ω)
- (4) Intake air temperature °C (°F)
- (A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

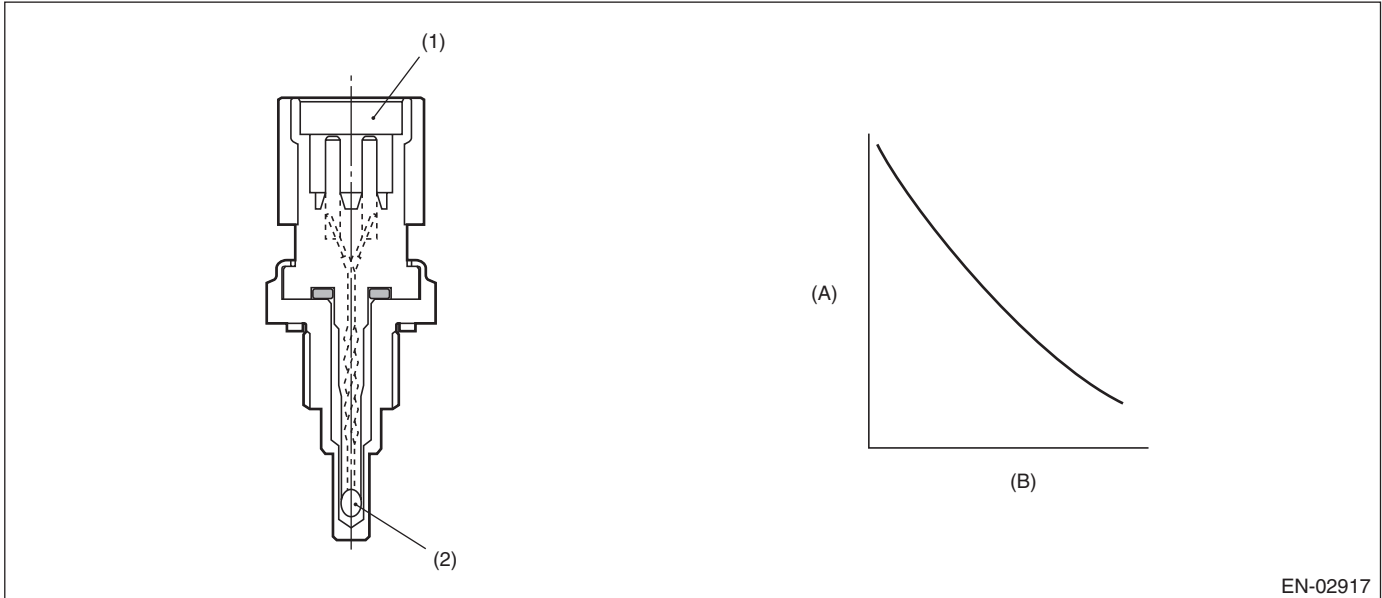
## GENERAL DESCRIPTION

### S: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-02917

- (1) Connector
- (2) Thermistor element

- (A) Resistance value (kΩ)
- (B) Temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.264738528 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.264738528 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.
- AVCS Control: Oil flow control solenoid valve drive output duty = 0 %.
- Tumble generator valve control: Open the tumble generator valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

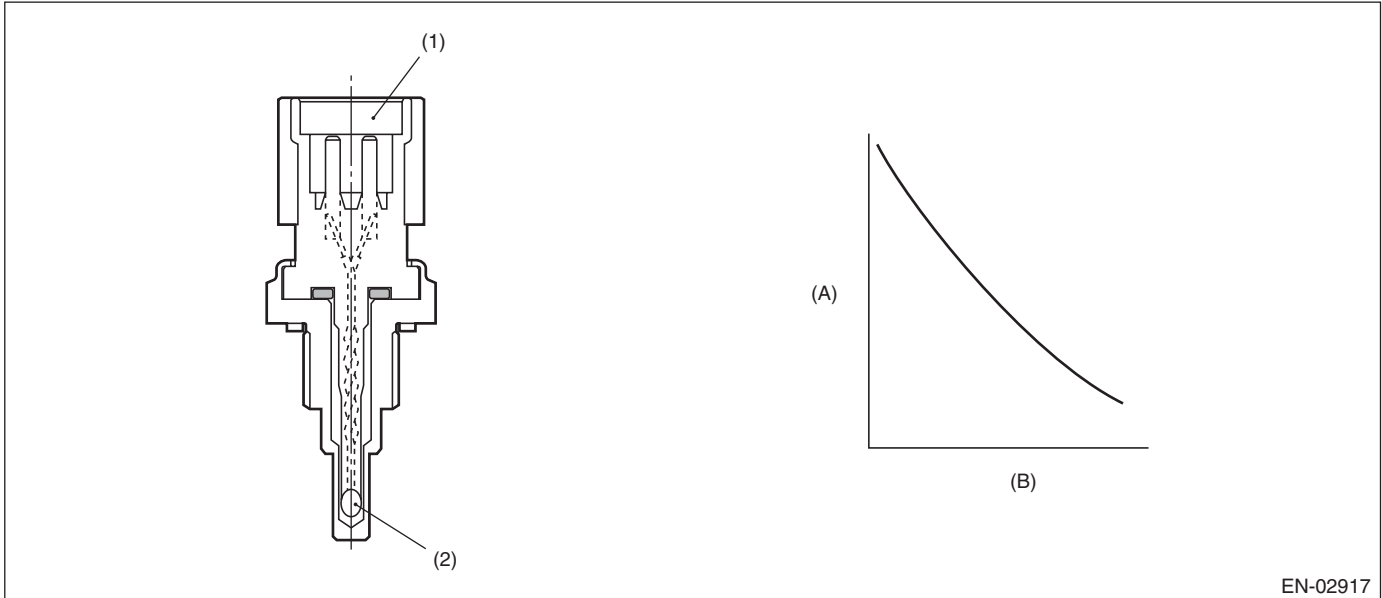
## GENERAL DESCRIPTION

### T: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-02917

- (1) Connector
- (2) Thermistor element

- (A) Resistance value (kΩ)
- (B) Temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.
- AVCS Control: Oil flow control solenoid valve drive output duty = 0 %.
- Tumble generator valve control: Open the tumble generator valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

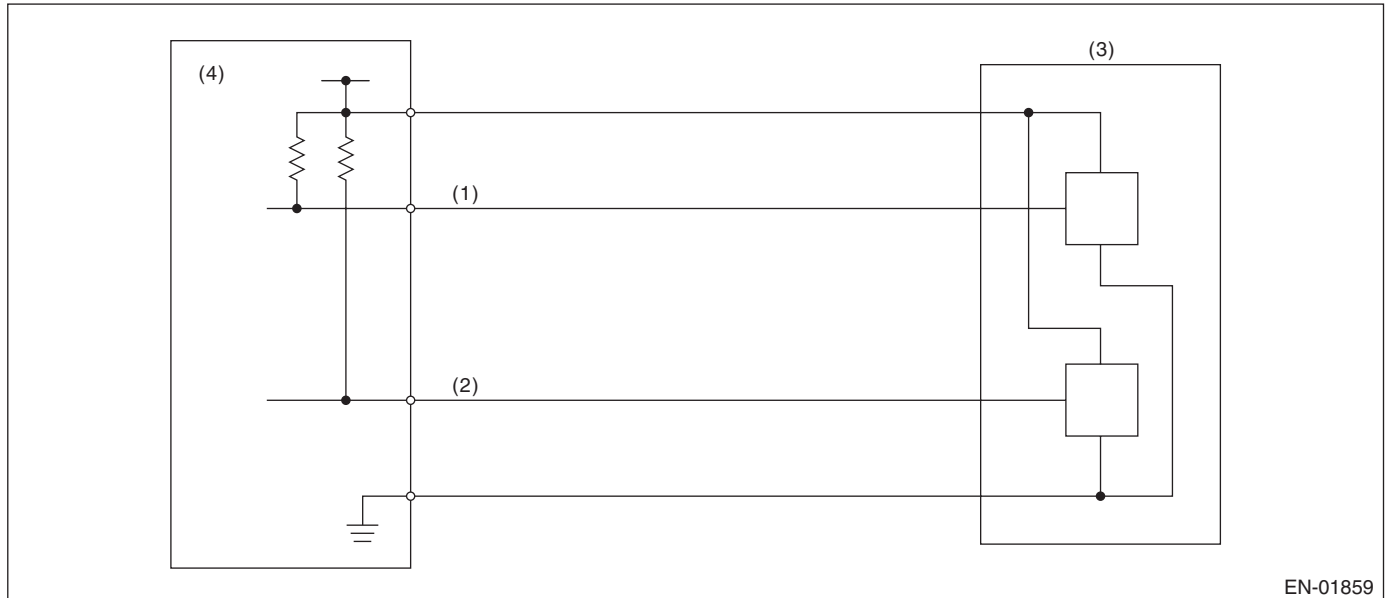
## GENERAL DESCRIPTION

### U: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal      (3) Throttle position sensor      (4) Engine control module (ECM)  
(2) Throttle position sensor 2 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\leq 0.224$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$> 0.224$ V

**Time Needed for Diagnosis:** 24 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

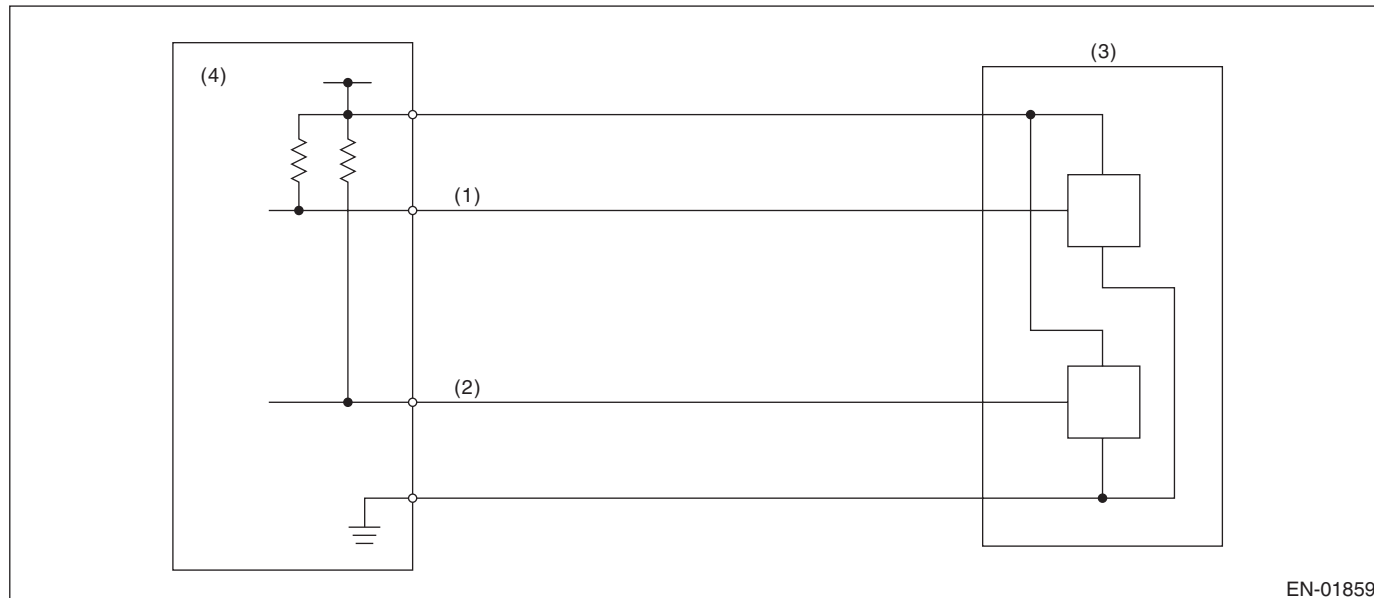
### V: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\geq 4.851$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.851$ V

**Time Needed for Diagnosis:** 24 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

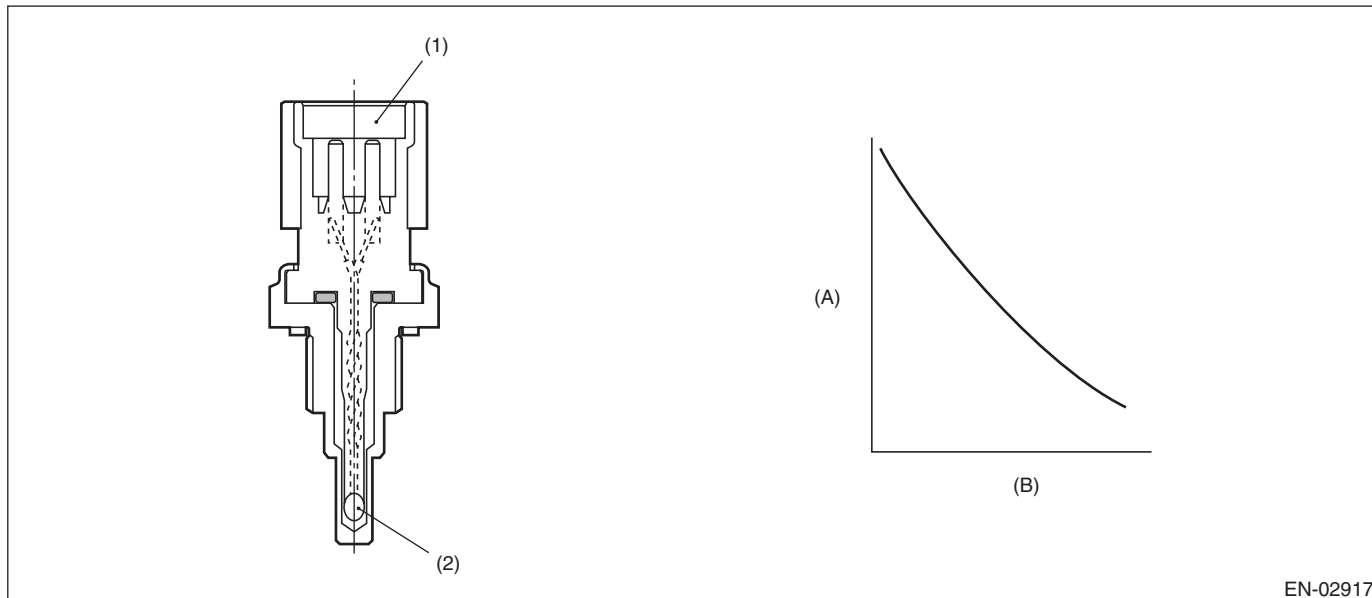
### W: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.

Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

#### 2. COMPONENT DESCRIPTION



EN-02917

- (1) Connector
- (2) Thermistor element

- (A) Resistance value (k $\Omega$ )
- (B) Temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	$\geq 500$ rpm
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG if the criteria below are met.

### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgment value of timer after engine start

Timer for diagnosis after engine start

- Timer stop at fuel cut
- During the driving conditions except a) above, timer counts up as follows.  
64 milliseconds + TWCNT milliseconds (the time of at 64 milliseconds)

TWCNT is defined as follows,

TWCNT = 0 at idle switch ON,

TWCNT show on the following table at idle switch OFF.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-20 (-4)	0.000 ms	37.136 ms	74.272 ms	111.41 ms	126.66 ms	141.91 ms	163.59 ms	185.26 ms
	-10 (14)	0.000 ms	27.391 ms	54.782 ms	82.173 ms	99.65 ms	117.13 ms	135.96 ms	154.8 ms
	0 (32)	0.000 ms	17.646 ms	35.292 ms	52.938 ms	72.64 ms	92.341 ms	108.34 ms	124.33 ms
	10 (50)	0.000 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms
	20 (68)	0.000 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms

Judgment value of timer after engine starting

$$t = 451056 \text{ ms} - 25870 \text{ ms}/^{\circ}\text{C} \times T_i$$

$T_i$  : The lowest coolant temperature after engine start

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 20 °C (68 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.
- AVCS Control: Oil flow control solenoid valve drive output duty = 0 %.
- Tumble generator valve control: Open the tumble generator valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

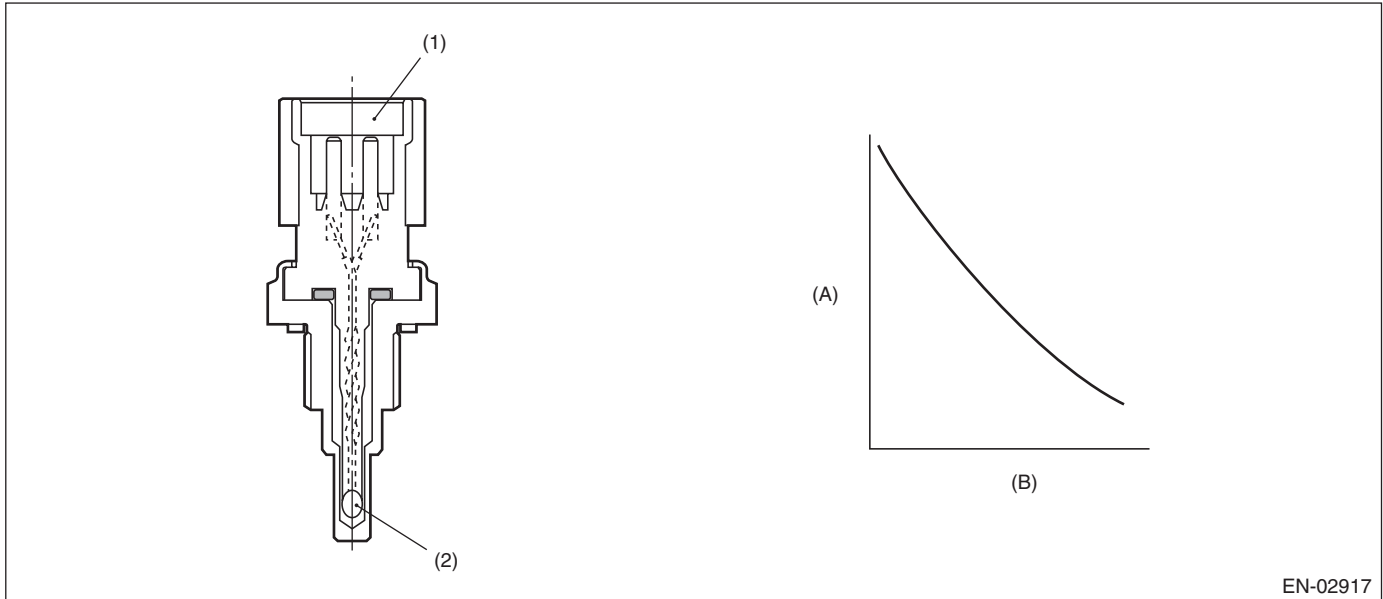
## X: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

### 2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (k $\Omega$ )

(B) Temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )

(1) Connector

(2) Thermistor element

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Refueling from the last engine stop till the current engine start	None
Fuel level	$\geq 15 \text{ L (3.963 US gal, 3.3 Imp gal)}$
Engine coolant temperature at the last engine stop	$\geq 70 \text{ }^{\circ}\text{C (158 }^{\circ}\text{F)}$

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	< 2.5 °C (36.5 °F)
Fuel temperature at the last engine stop — fuel temperature	≥ 5 °C (41 °F)
Intake air temperature — fuel temperature	< 2.5 °C (36.5 °F)
Fuel temperature	< 35 °C (95 °F)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	≥ 2.5 °C (36.5 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

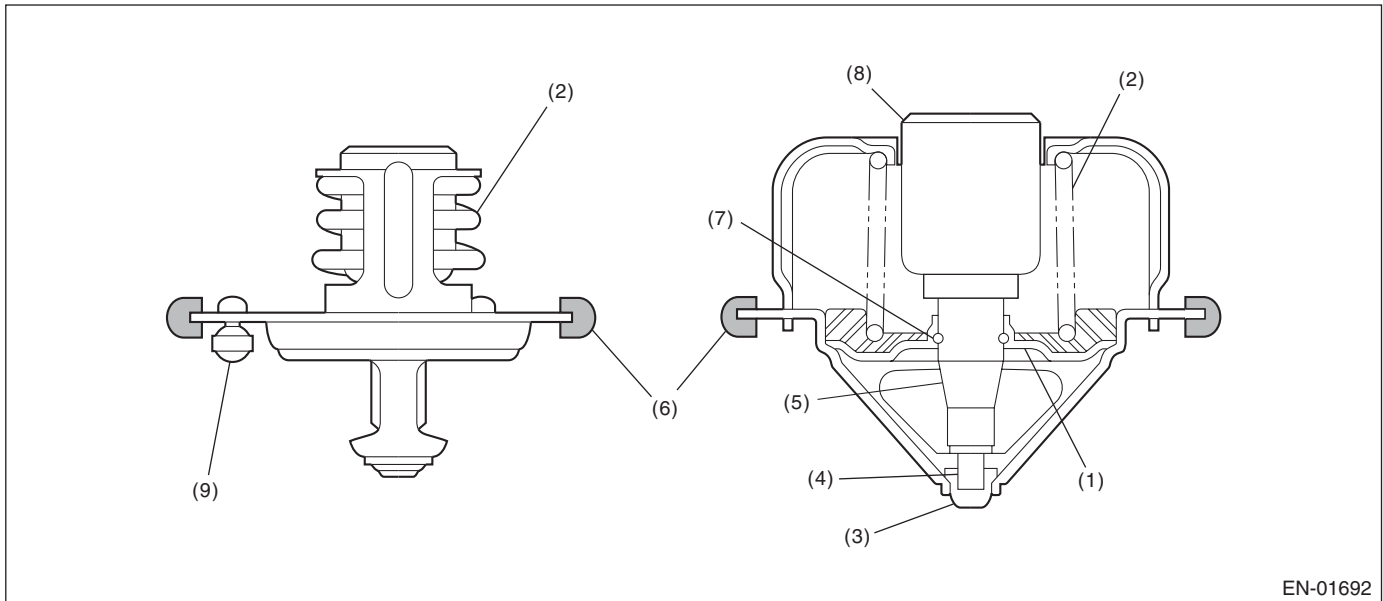
## Y: DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.

Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 75°C (167°F), and the difference is small, before judging NG.

### 2. COMPONENT DESCRIPTION



EN-01692

- |             |                 |                  |
|-------------|-----------------|------------------|
| (1) Valve   | (4) Piston      | (7) Stop ring    |
| (2) Spring  | (5) Guide       | (8) Wax element  |
| (3) Stopper | (6) Rubber seal | (9) Jiggle valve |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^\circ\text{C}$ (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^\circ\text{C}$ (131 °F)
Estimated coolant temperature	$\geq 70 \text{ }^\circ\text{C}$ (158 °F)
Engine coolant temperature	$\leq 70 \text{ }^\circ\text{C}$ (158 °F)
(Estimated – Measured) Engine coolant temperature	$> 30 \text{ }^\circ\text{C}$ (86 °F)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)

**Time Needed for Diagnosis:** 64 ms  $\times$  3 time  $\times$  152 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^\circ\text{C}$ (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^\circ\text{C}$ (131 °F)
Engine coolant temperature	$\geq 70 \text{ }^\circ\text{C}$ (158 °F)
(Estimated – Measured) Engine coolant temperature	$\leq 30 \text{ }^\circ\text{C}$ (86 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

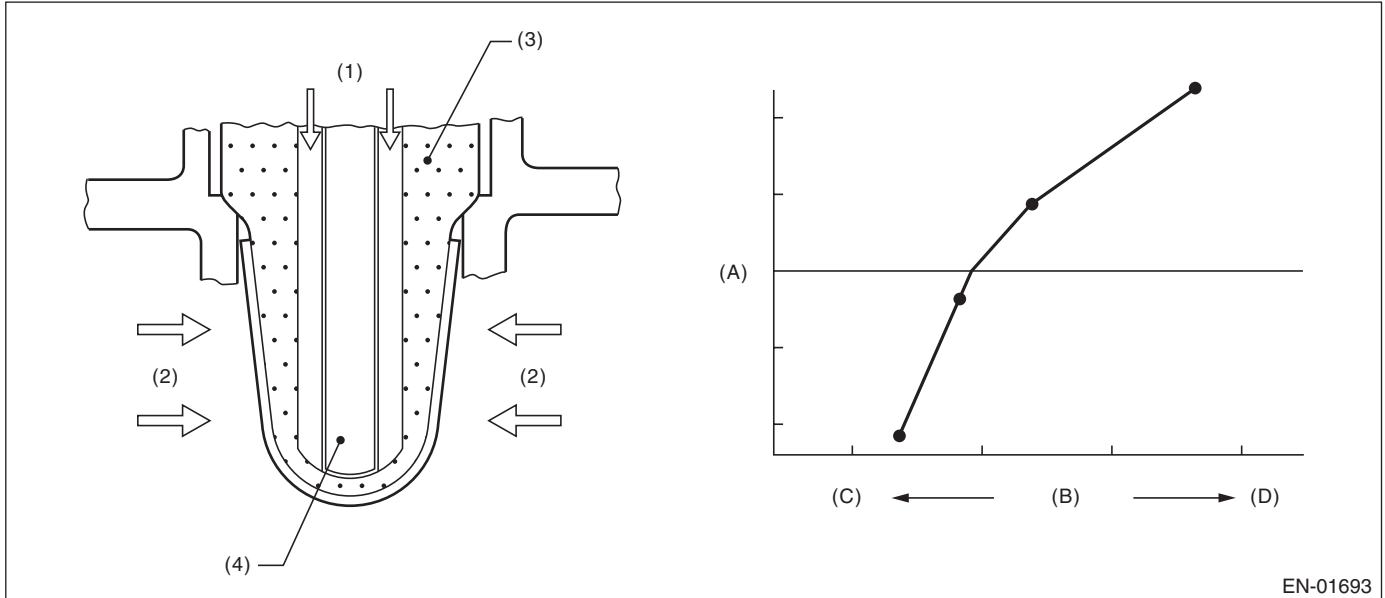
## Z: DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG when the element applied voltage is out of range, or the element current is out of range.

### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage or Input current	< 1.8 V  < -0.01 A

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage Input current	$\geq 1.8$ V $\geq -0.01$ A

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3 → 0, normally.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

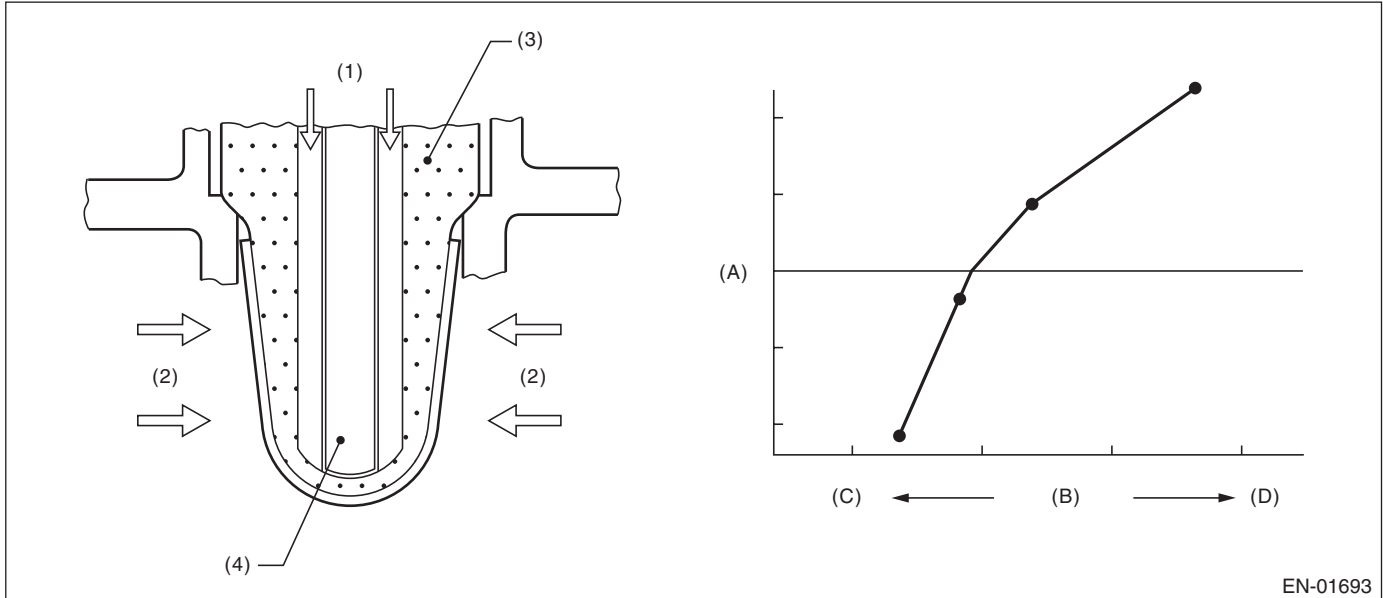
## AA:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG when the element applied voltage is out of range, or the element current is out of range.

### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage or Input current	> 3.8 V  > 0.01 A

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Input voltage Input current	$\leq 3.8$ V $\leq 0.01$ A

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3 → 0, normally.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

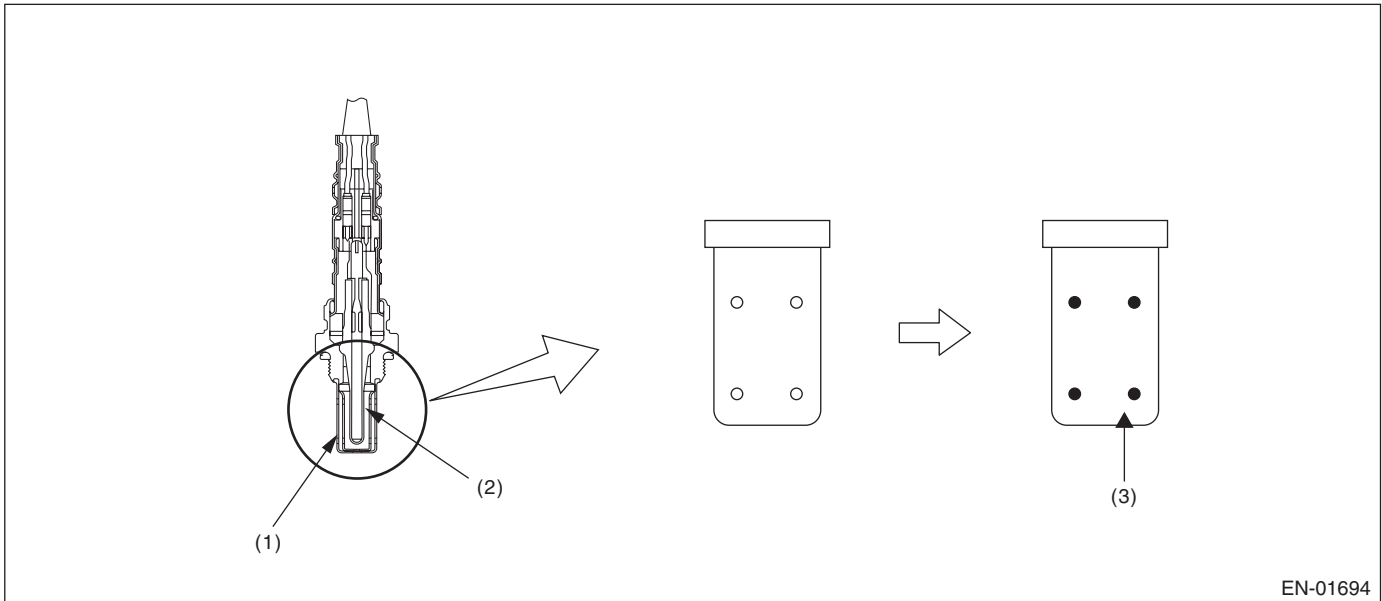
## AB:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.

When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs. Judge as NG when the actual movement in comparison to the ECM control amount is slow.



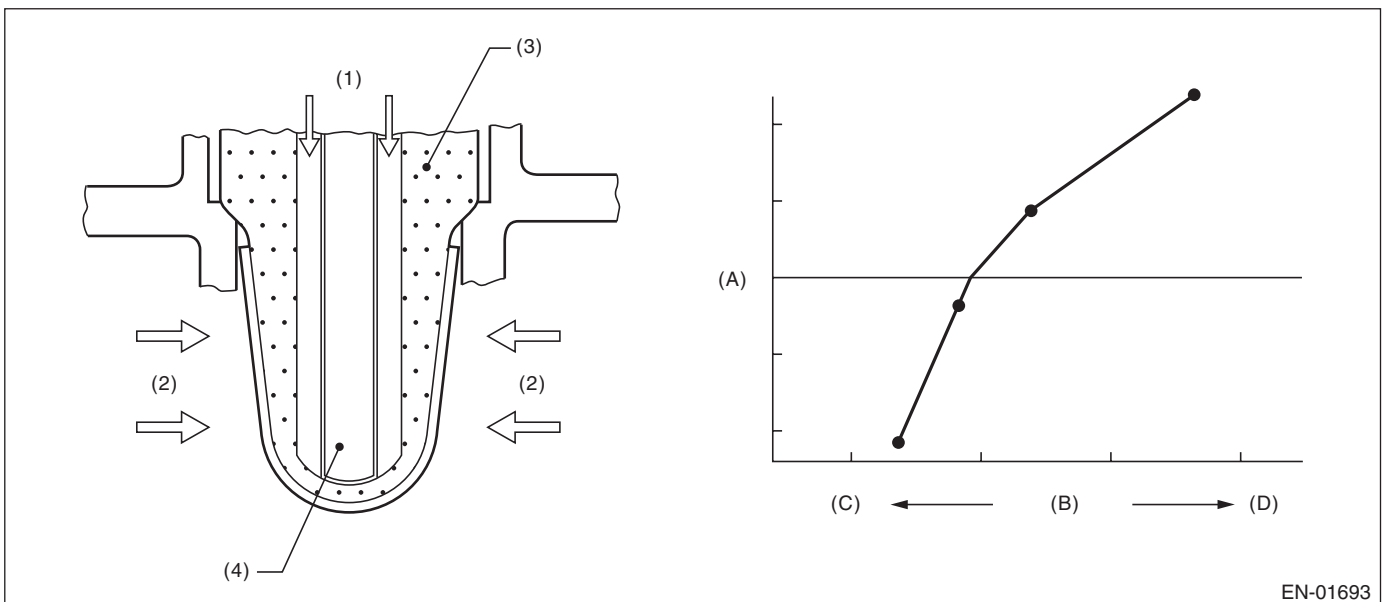
EN-01694

(1) Cover

(2) Zirconia

(3) Clogging

### 2. COMPONENT DESCRIPTION



EN-01693

(1) Atmosphere

(2) Exhaust gas

(3)  $ZrO_2$

(4) Ceramic heater

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 1024$ ms
Battery voltage	$\geq 10.9$ V
Barometric pressure	$> 75.05$ kPa (563 mmHg, 22.165 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	$0 \Omega$ — $50 \Omega$
Elapsed time after starting the engine	$\geq 120000$ ms
Engine coolant temperature	$\geq 70$ °C (158 °F)
Engine speed	1000 rpm — 3200 rpm
Vehicle speed	10 km/h — 120 km/h (6.2 MPH — 74.6 MPH)
Amount of intake air	10 g/s — 31 g/s (0.353 oz/s — 1.093 oz/s)
Engine load	$< 0.02$ g/rev (0.001 oz/rev)
Learning value of EVAP conc. during purge	$< 0.2$
Total time of operating canister purge	$\geq 19.9$ sec

### 4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

### 5. DIAGNOSTIC METHOD

Calculate  $faf$  difference and the  $\lambda$  value difference every  $32\text{ms} \times 4$ . Calculate the diagnosis value after calculating 1640 time.

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
$\text{parafca} = \text{td2faf}/\text{td2lmd}$  where, $\text{td2faf} (N) = \text{td2faf} (n-1) +  \text{d2faf} (n) $ $\text{td2lmd} (N) = \text{td2lmd} (n-1) +  \text{d2lmd} (n) $ add up to $32 \text{ ms} \times 4 \times 1640$ time. $\text{d2faf} (n) = (\text{faf} (n) - \text{faf} (n-1)) - (\text{faf} (n-1) - \text{faf} (n-2))$ $\text{d2lmd} (n) = (\text{lmd} (n) - \text{lmd} (n-1)) - (\text{lmd} (n-1) - \text{lmd} (n-2))$ $\text{faf}$ = main feedback compensation coefficient every 128 milliseconds $\text{lmd}$ = output lambda every 128 milliseconds	$> 0.644$ (AT model) $> 0.444$ (MT model)

**Time Needed for Diagnosis:**  $32 \text{ ms} \times 4 \times 1640$  time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$\text{para}fca = \text{td}2faf/\text{td}2lmd$  where, $\text{td}2faf(N) = \text{td}2faf(n-1) +  \text{d}2faf(n) $ $\text{td}2lmd(N) = \text{td}2lmd(n-1) +  \text{d}2lmd(n) $ add up to $32 \text{ ms} \times 4 \times 1640$ time. $\text{d}2faf(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $\text{d}2lmd(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	$\leq 0.644$ (AT model) $\leq 0.444$ (MT model)

**Time Needed for Diagnosis:**  $32 \text{ ms} \times 4 \times 1640$  time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value  $0.3 \rightarrow 0$ .
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

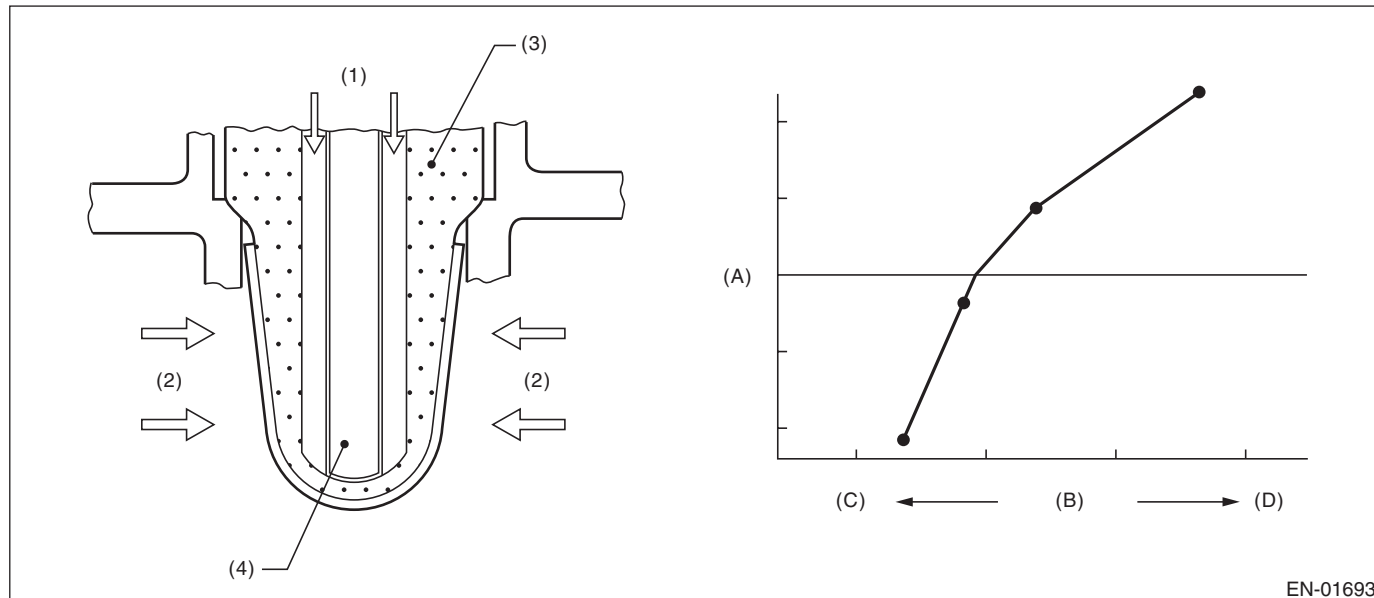
### AC:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.

Judge as NG when the impedance of the element is large.

#### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Time of heater control duty at 70 % or more	$\geq 36000$ ms
Front oxygen (A/F) sensor impedance.	$> 500$ $\Omega$

**Time Needed for Diagnosis:** 5000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Front oxygen (A/F) sensor impedance.	$\leq 500$ $\Omega$

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3  $\rightarrow$  0, normally.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

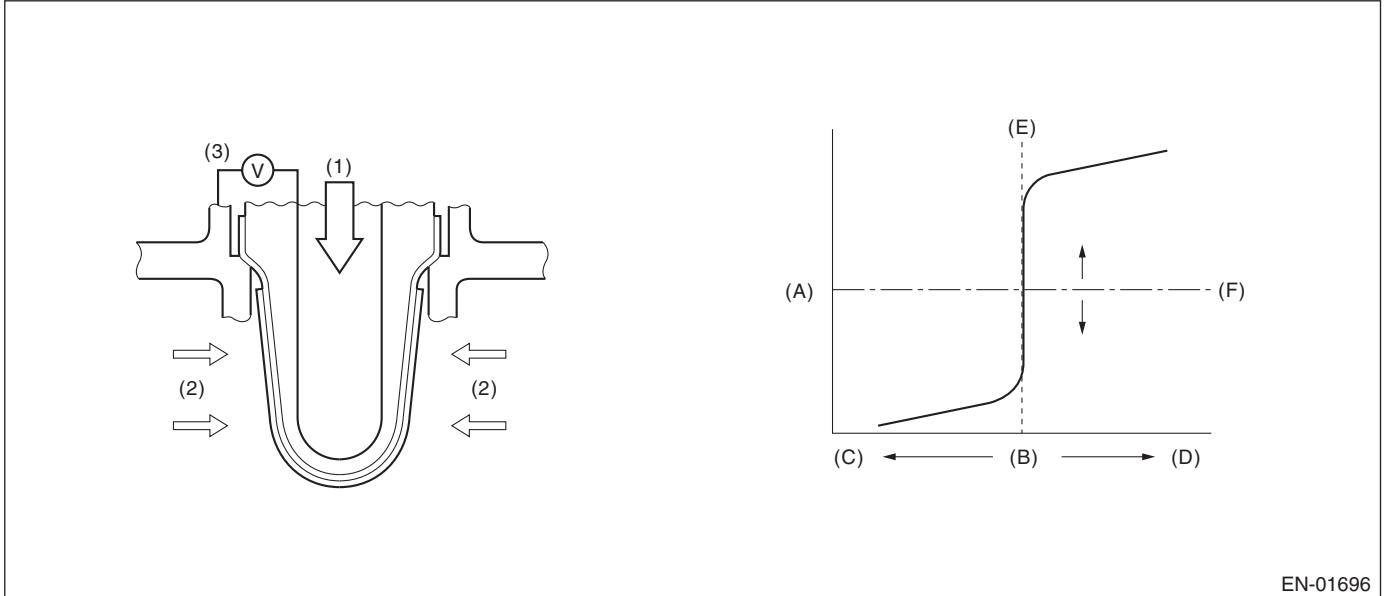
## GENERAL DESCRIPTION

### AD:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

#### 2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force

(B) Air fuel ratio

(1) Atmosphere

(C) Rich

(D) Lean

(2) Exhaust gas

(E) Theoretical air fuel ratio

(F) Comparative voltage

(3) Electromotive force

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

### Used for abnormality judgment

Secondary Parameters	Enable Conditions
<b>High</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 5 time Not in limit value ≥ 10.9 V ≥ 70 °C (158 °F)
<b>Low (1)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air	Not in operation In operation < 5 time Not in limit value ≥ 10.9 V ≥ 70 °C (158 °F) ≥ 10 g/s (0.353 oz/s)
<b>Low (2)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater	Not in operation In operation < 5 time Not in limit value ≥ 10.9 V ≥ 70 °C (158 °F) < 10 g/s (0.353 oz/s) ≥ 25000 ms
<b>Low (3)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater Fuel cut	Not in operation In operation < 5 time Not in limit value ≥ 10.9 V ≥ 70 °C (158 °F) < 10 g/s (0.353 oz/s) ≥ 25000 ms Experienced

### Used for normality judgment

Secondary Parameters	Enable Conditions
Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 5 time Not in limit value ≥ 10.9 V ≥ 70 °C (158 °F)

## 4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
<b>High</b>		P0138
Sensor output voltage	> 1.2 V	P0158
<b>Low</b>		P0137
Sensor output voltage	<0.03 V	P0157

#### Time Needed for Diagnosis

- High: 2500 ms
- Low (1): 20000 ms
- Low (2): 150000 ms
- Low (3): Value from Map

#### Map

Fuel Cut Time (millisecond)	0	2000	10000
Time needed for diagnosis (millisecond)	150000	150000	150000

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
<b>High</b>		P0138
Sensor output voltage	$\leq 1.2$ V	P0158
<b>Low</b>		P0137
Sensor output voltage	$\geq 0.03$ V	P0157

#### Time Needed for Diagnosis

- High: Less than 1 second
- Low (1): Less than 1 second
- Low (2): Less than 1 second
- Low (3): Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Sub feedback control: Not allowed

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## **AE:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P0137. <Ref. to GD(H4DOTC)-70, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### AF:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.

Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and Judge as OK if both are OK.

[Rich → lean diagnosis response]

1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK.

2. Judge as NG when the oxygen sensor voltage is large (rich) when recovering from a deceleration fuel cut.

[Lean → rich diagnosis response]

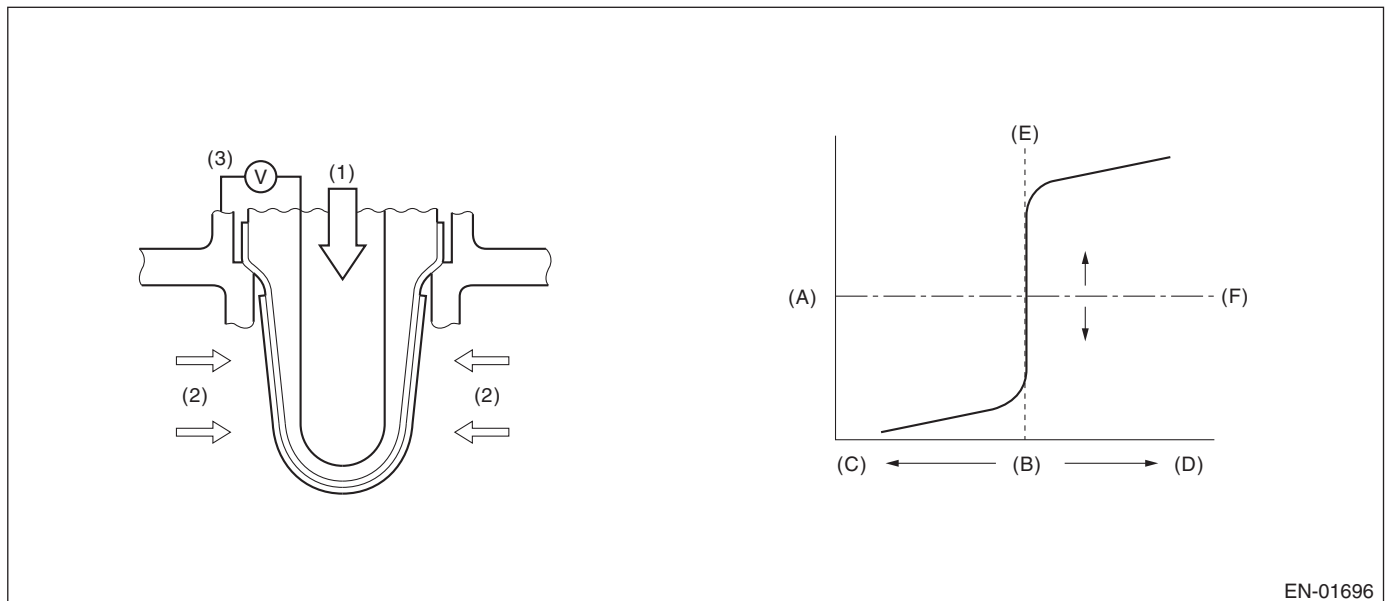
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

#### DIAGNOSTIC METHOD

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured response time is larger than the threshold value.

#### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 5000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 60000 ms
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Estimated catalyst temperature	≥ 400 °C (752 °F)
Number of deceleration fuel cut	≥ 1 time

## 4. GENERAL DRIVING CYCLE

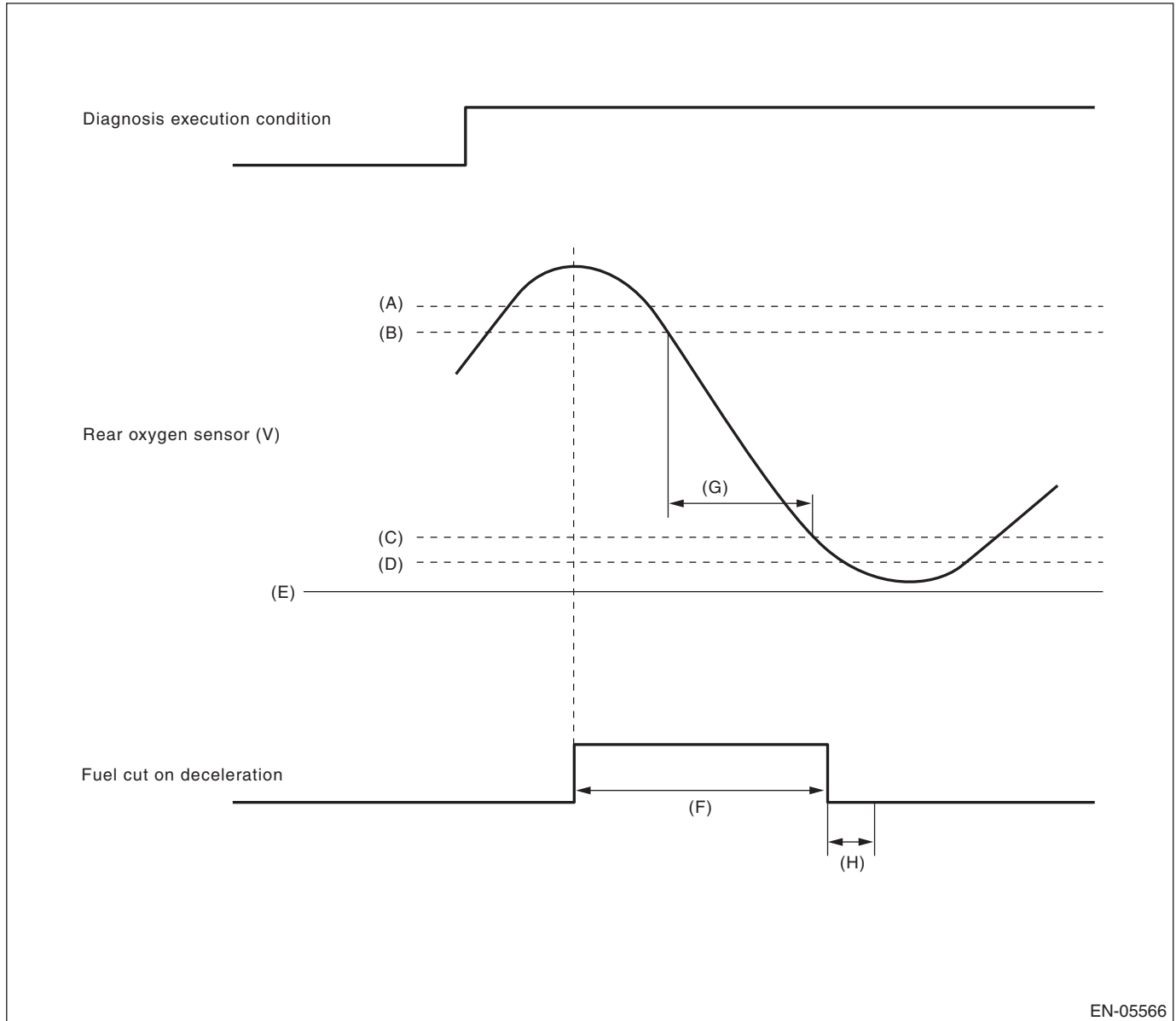
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 5. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.



EN-05566

- (A) 0.55 V
- (B) 0.5 V
- (C) 0.2 V
- (D) 0.15 V

- (E) 0 V
- (F) More than 5000 ms
- (G) Measure the response time.

- (H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.  
Response time (diagnosis value) > threshold value → abnormal

NOTE:

Variation time of rear oxygen sensor output voltage is short during fuel cut in deceleration. NG judgment should be performed after deceleration fuel cut. Even without deceleration fuel cut, judge as OK if the value is below the threshold.

When the deceleration fuel cut time is 5000 ms or more, judge as NG if the following criteria are met 2000 ms after recovering from the deceleration fuel cut.

2) Judge as NG when the oxygen sensor voltage at recovery from a deceleration fuel cut, is large.

If the fuel cut time in a deceleration fuel cut is long (5000 ms or more), and even after recovering from a deceleration fuel cut, the oxygen sensor voltage is high (0.55 V or more), judge as NG.

## Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V or Longest time over 0.55 V	> 837 ms  ≥ 2000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

## • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

## Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	≤ 837 ms

**Time Needed for Diagnosis:** 1 time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 10.ENABLE CONDITION

Lean → rich response diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more. After fuel cut	Experienced ≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 0 ms
Current continuation time of the rear oxygen sensor heater	≥ 0 ms
Estimated catalyst temperature	≥ 0 °C (32 °F)
Number of deceleration fuel cut	≥ 1 time

### 11.GENERAL DRIVING CYCLE

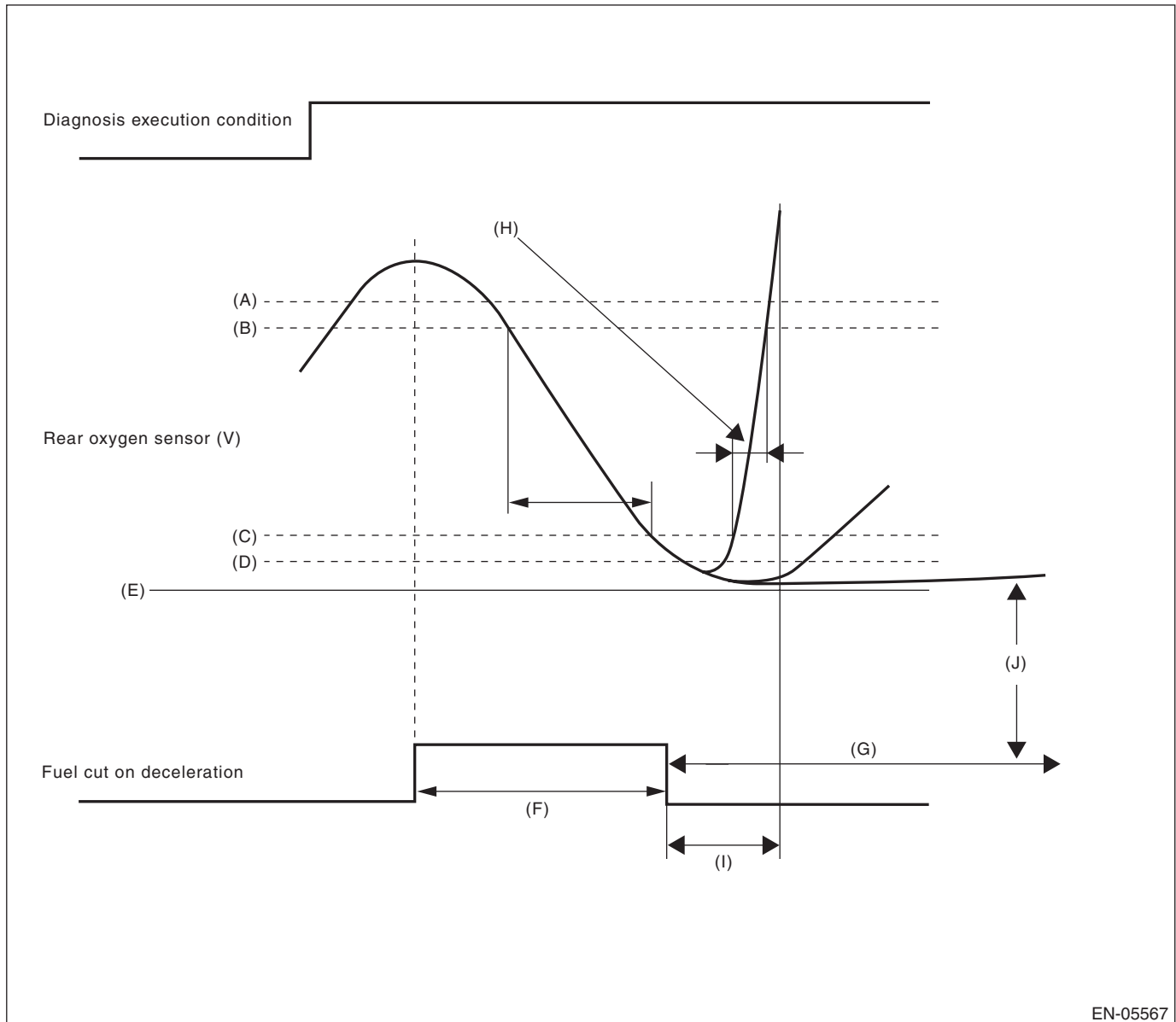
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 12. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.



EN-05567

- (A) 0.55 V
- (B) 0.5 V
- (C) 0.3 V
- (D) 0.25 V
- (E) 0 V
- (F) More than 5 seconds

- (G) More than 120000 ms
- (H) Measure the response time (diagnostic value).
- (I) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- (J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.

Response time (diagnosis value) > threshold value → abnormal

2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V or Longest time under 0.25 V	> 2000 ms  ≥ 120000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	≤ 2000 ms

**Time Needed for Diagnosis:** 1 time

## 13.DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 15.FAIL SAFE

Sub feedback control: Not allowed

## 16.ECM OPERATION AT DTC SETTING

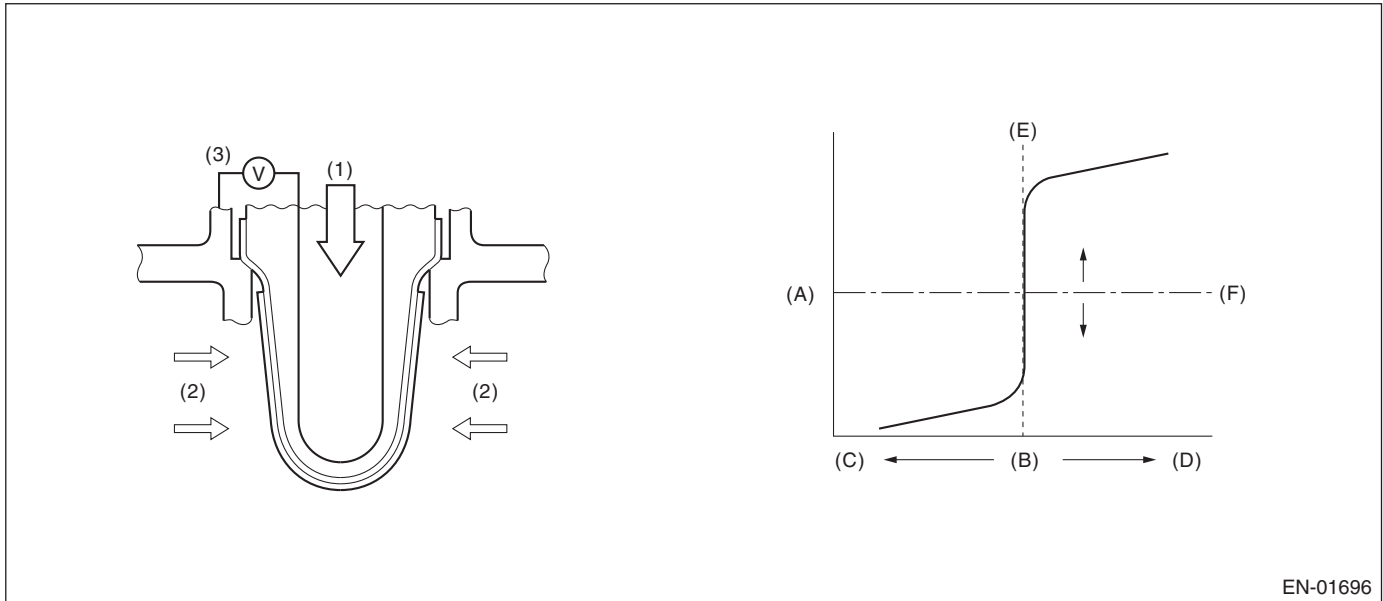
- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## AG:DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

### 2. COMPONENT DESCRIPTION



EN-01696

- |                         |                 |                                |
|-------------------------|-----------------|--------------------------------|
| (A) Electromotive force | (C) Rich        | (E) Theoretical air fuel ratio |
| (B) Air fuel ratio      | (D) Lean        | (F) Comparative voltage        |
| (1) Atmosphere          | (2) Exhaust gas | (3) Electromotive force        |

### 3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control at the rear oxygen sensor	In operation
Target output voltage of rear oxygen sensor	$\geq 0.55 \text{ V} + 0.05 \text{ V}$
Amount of intake air	$\geq 10 \text{ g/s (0.353 oz/s)}$
Engine coolant temperature	$\geq 70 \text{ }^\circ\text{C (158 }^\circ\text{F)}$
Misfire detection every 200 rotations	$< 5 \text{ time}$
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9 \text{ V}$
Deceleration fuel cut of 5000 ms or more.	Experienced

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage or Maximum output voltage	> 0.15 V  < 0.55 V

**Time Needed for Diagnosis:** 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	$\leq 0.15$ V
Maximum output voltage	$\geq 0.55$ V

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## AH:DTC P0171 SYSTEM TOO LEAN (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

### DIAGNOSTIC METHOD

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	$\geq 70\text{ }^{\circ}\text{C}$ (158 °F)
Engine load change	$< 0.02\text{ g/rev}$ (0.001 oz/rev)
Engine load	$\geq$ Value of Map 1

#### Map1

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g(oz)/rev)	Non-turbo	0.228 (0.008)	0.22 (0.008)	0.22 (0.008)	0.22 (0.008)	0.228 (0.008)	0.23 (0.008)	0.234 (0.008)	0.242 (0.009)	0.25 (0.009)	0.25 (0.009)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec  $\times$  5 time or more, judge that there is a fault in the fuel system.

#### Judgment Value

Malfunction Criteria	Threshold Value
$\text{fsobd} = (\text{sglmd} - \text{tglm da}) + \text{faf} + \text{flaf}$ In this case: sglmd = measured lambda tglm da = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	$\geq$ Value of Map 2

#### Map2

Amount of air (g (oz)/s)	0 (0)	2.34375 (0.083)	4.6875 (0.165)	7.03125 (0.248)	9.375 (0.331)	11.71875 (0.413)	14.0625 (0.496)
fsobdL1 (%)	1.4	1.4	1.368623	1.319185	1.26975	1.265	1.265

**Time Needed for Diagnosis:** 10 sec  $\times$  5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	< 1.2

**Time Needed for Diagnosis:** 10 sec

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 7. FAIL SAFE

Rich side malfunction

- Purge control solenoid valve control: Not allowed to purge.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## AI: DTC P0172 SYSTEM TOO RICH (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

#### Diagnostic method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	$\geq 70 \text{ }^\circ\text{C}$ (158 $^\circ\text{F}$ )
Engine load change	$\leq 0.02 \text{ g/rev}$ (0.001 oz/rev)
Learning value of EVAP conc.	< 0.1
Cumulative time of canister purge after engine start	$\geq 20 \text{ sec}$
Continuous period after canister purge starting	$\geq 29884 \text{ ms}$
Engine load	$\geq \text{Value of Map 1}$

#### Map1

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g(oz)/rev)	Non-turbo	0.228 (0.008)	0.22 (0.008)	0.22 (0.008)	0.22 (0.008)	0.228 (0.008)	0.23 (0.008)	0.234 (0.008)	0.242 (0.009)	0.25 (0.009)	0.25 (0.009)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec × 5 time or more, judge that there is a fault in the fuel system.

### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	< Value of Map 2

### Map2

Amount of air (g (oz)/s)	0 (0)	2.34375 (0.083)	4.6875 (0.165)	7.03125 (0.248)	9.375 (0.331)	11.71875 (0.413)	14.0625 (0.496)
fsobdL1 (%)	0.6	0.6	0.63137	0.68082	0.73025	0.73025	0.73025

**Time Needed for Diagnosis:** 10 sec × 5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK when the malfunction criteria below continues for 10 seconds.

### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	≥ 0.8

**Time Needed for Diagnosis:** 10 sec

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When “Clear Memory” is performed

## 7. FAIL SAFE

Rich side malfunction

- Purge control solenoid valve control: Not allowed to purge.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### AJ:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect faults in the fuel temperature sensor output properties.

Diagnosis is performed in two methods (drift diagnosis and stack diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

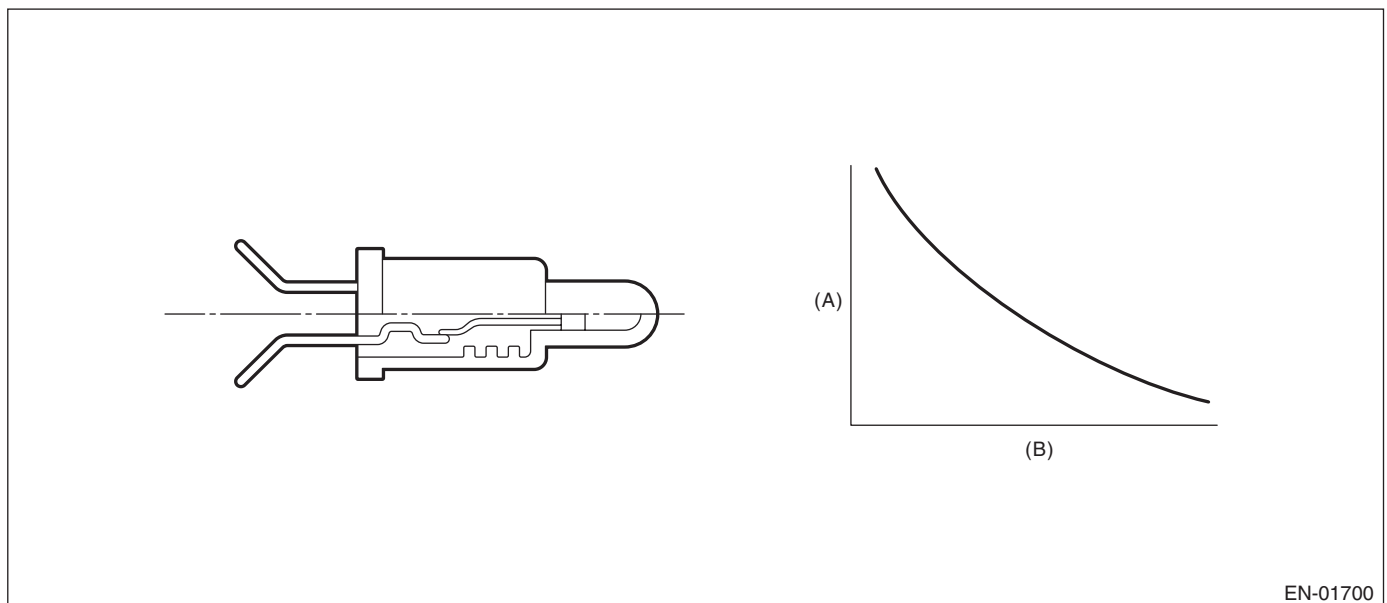
##### Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and judged as NG.

##### Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

#### 2. COMPONENT DESCRIPTION



EN-01700

(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

#### 3. ENABLE CONDITION

##### DRIFT DIAGNOSIS

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	≥ 10 °C (50 °F)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 120 sec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	< 10 °C (50 °F)
Battery voltage	≥ 10.9 V
Engine coolant temperature	< 70 °C (158 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## 10. ENABLE CONDITION

### Stuck Diagnosis

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 20000 ms
Battery voltage	≥ 10.9 V

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 11.GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

### 12.DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 551043 g (19435.287 oz)
Fuel temperature difference between Max. and Min.	< 2 °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel temperature difference between Max. and Min.	≥ 2 °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 13.DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 15.FAIL SAFE

None

### 16.ECM OPERATION AT DTC SETTING

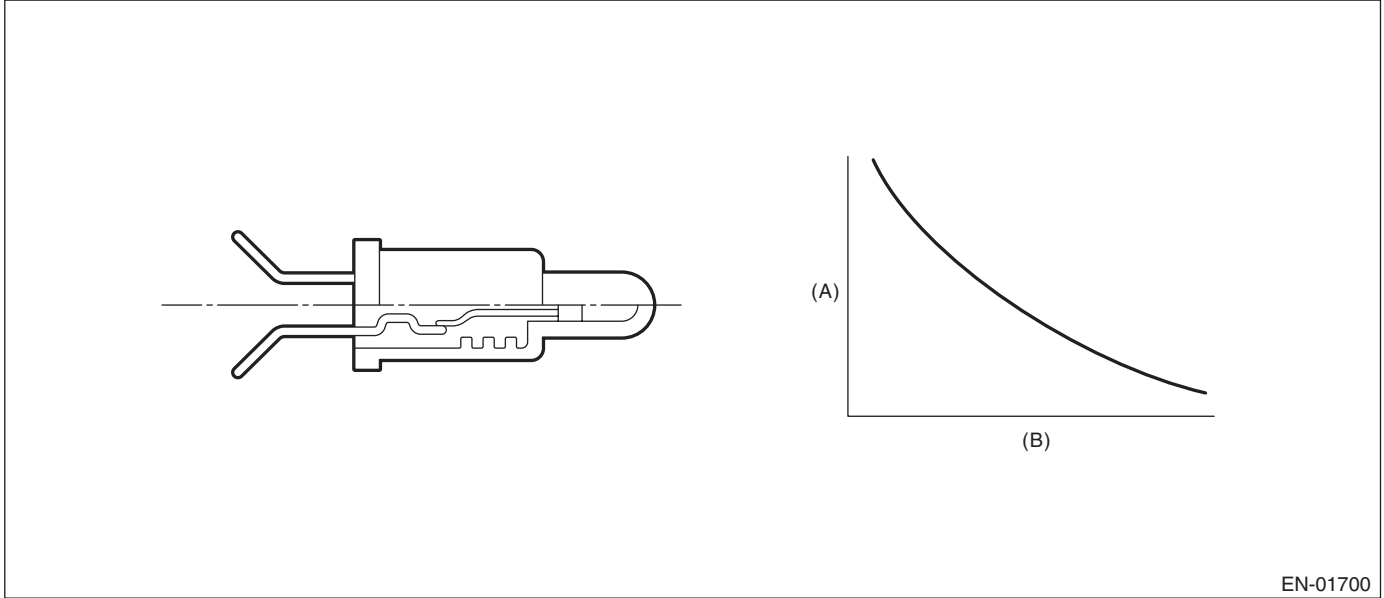
Memorize the freeze frame data. (For test mode \$02)

## AK:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01700

(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.343951474 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.343951474 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

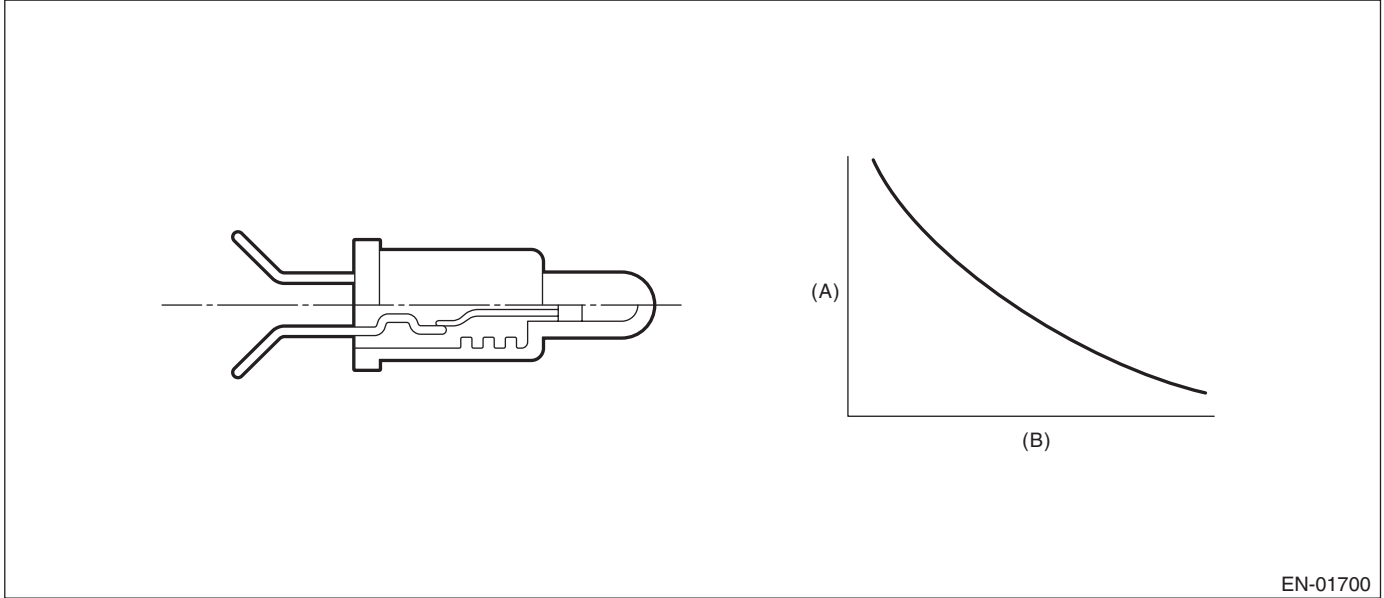
Memorize the freeze frame data. (For test mode \$02)

## AL:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** Within 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

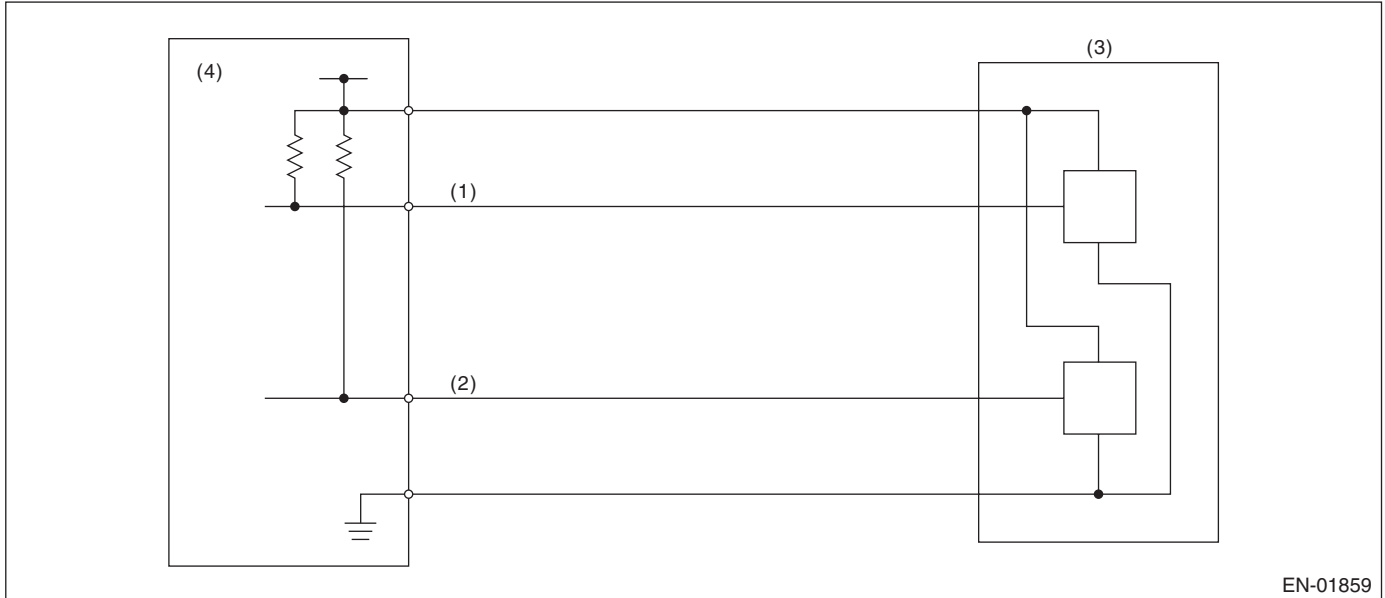
Memorize the freeze frame data. (For test mode \$02)

## AM:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal      (3) Throttle position sensor      (4) Engine control module (ECM)  
 (2) Throttle position sensor 2 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\leq 0.926$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$> 0.926$ V

**Time Needed for Diagnosis:** 24 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

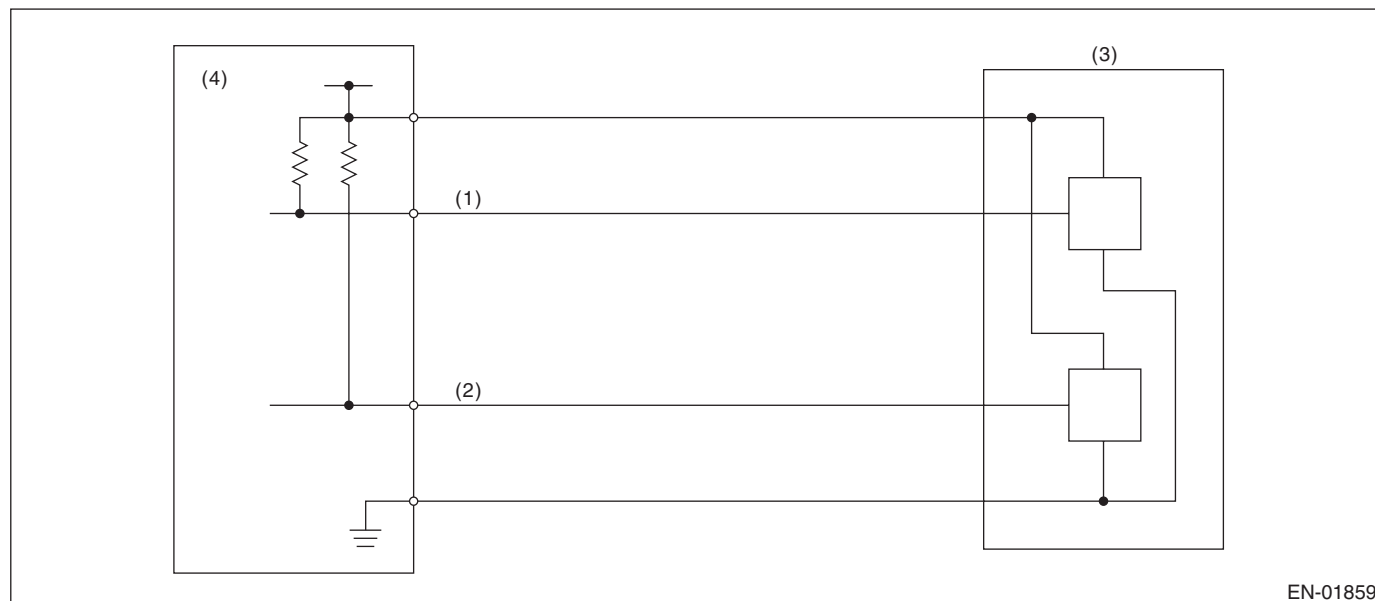
## AN:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.

Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal
- (2) Throttle position sensor 2 signal
- (3) Throttle position sensor
- (4) Engine control module (ECM)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 4.851$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$< 4.851$ V

**Time Needed for Diagnosis:** 24 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## AO:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

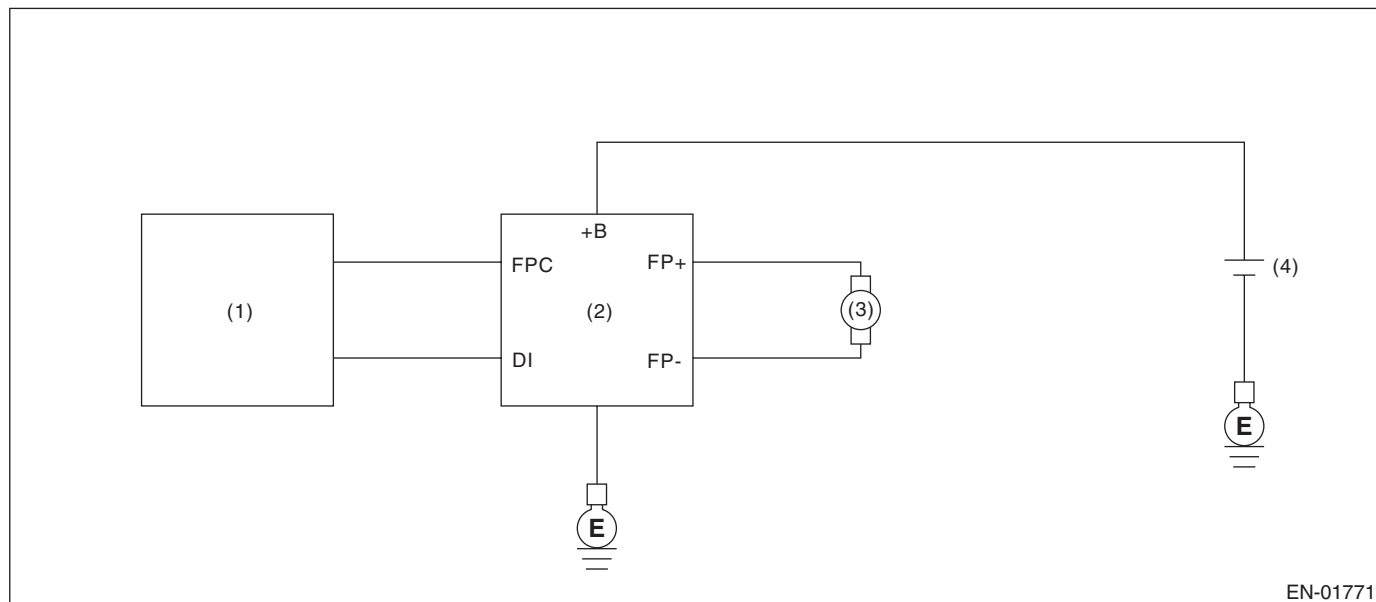
### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit.

Judge as NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit.

Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel pump

(4) Battery

(2) Fuel pump control unit

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	Low
Fuel level	≥ 10 L (2.642 US gal, 2.2 Imp gal)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	High
Fuel level	≥ 10 L (2.642 US gal, 2.2 Imp gal)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

OFF setting may be needed depending on the NG portion.

### 9. ECM OPERATION AT DTC SETTING

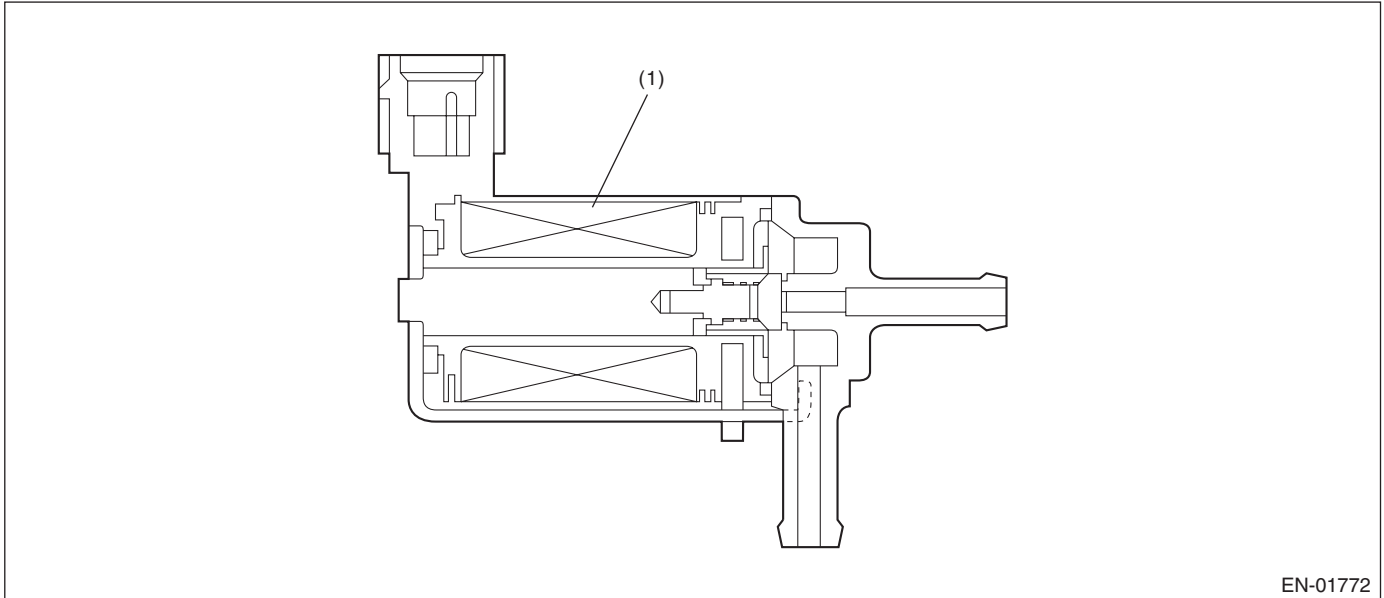
Memorize the freeze frame data. (For test mode \$02)

## AP:DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of wastegate control solenoid valve function.  
Judge as NG when becoming high wastegate pressure.

### 2. COMPONENT DESCRIPTION



(1) Coil

### 3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Intake manifold pressure	≥ Value from Map

#### Map

Pa (kPa (mmHg, inHg))	58.65 kPa (440 mmHg, 17.323 inHg)	77.31 kPa (580 mmHg, 22.835 inHg)	89.31 kPa (670 mmHg, 26.378 inHg)	95.98 kPa (720 mmHg, 28.346 inHg)	98.64 kPa (740 mmHg, 29.134 inHg)	101.31 kPa (760 mmHg, 29.921 inHg)
Abnormal threshold (kPa (mmHg, inHg))	143.43 kPa (1076 mmHg, 42.362 inHg)	172.62 kPa (1295 mmHg, 50.984 inHg)	204.54 kPa (1534 mmHg, 60.411 inHg)	216.22 kPa (1622 mmHg, 63.86 inHg)	221.28 kPa (1660 mmHg, 65.354 inHg)	221.28 kPa (1660 mmHg, 65.354 inHg)

**Time Needed for Diagnosis:** 2000 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Intake manifold pressure	< Value from Map – 22.39 kPa (168 mmHg, 6.614 inHg)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

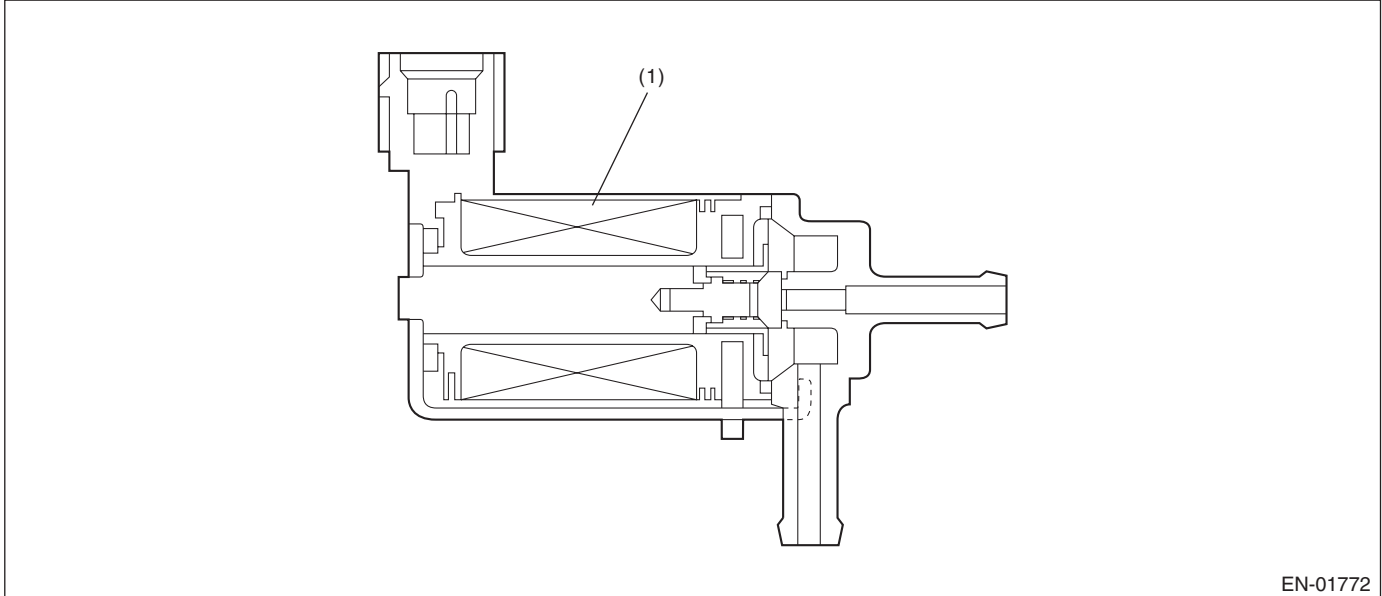
Memorize the freeze frame data. (For test mode \$02)

## AQ:DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the wastegate control solenoid valve.  
 Judge as NG when the terminal output voltage remains Low during outputting the duty signal.

### 2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

### 5. DIAGNOSTIC METHOD

#### Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low
Duty ratio of wastegate control	< 75%

**Time Needed for Diagnosis:** 4 ms × 160 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

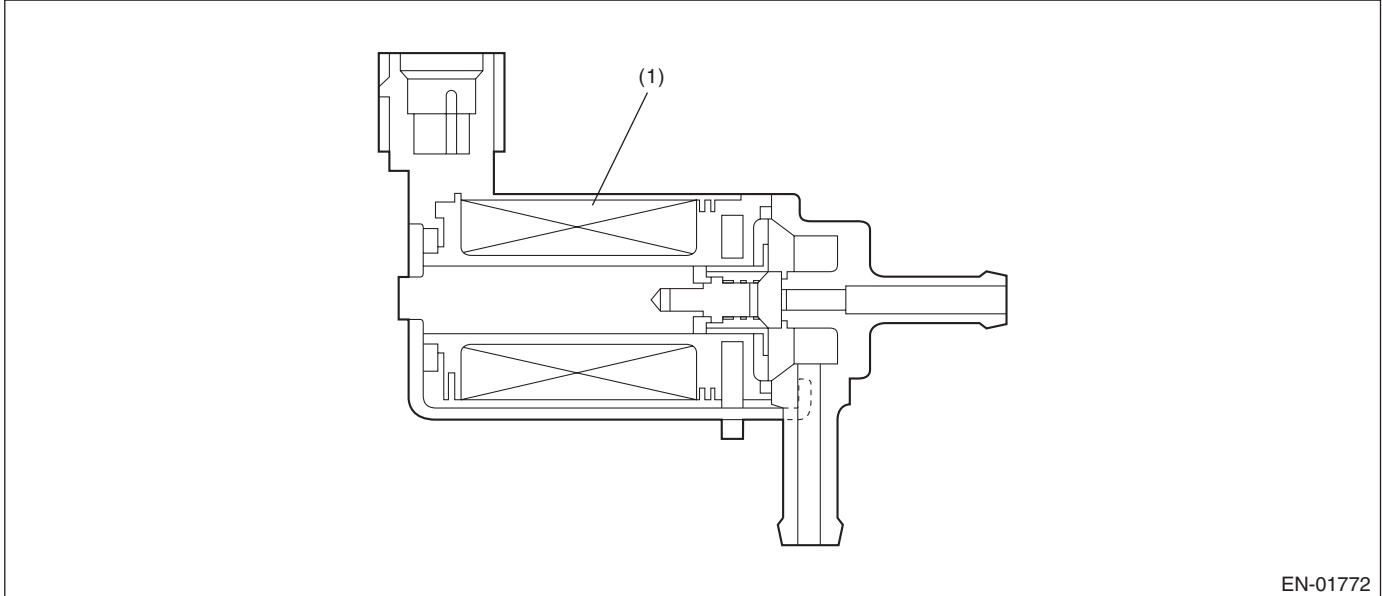
## AR:DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the wastegate control solenoid valve.

Judge as NG when the terminal output voltage remains Low or High during outputting the duty signal.

### 2. COMPONENT DESCRIPTION



(1) Coil

EN-01772

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

### 5. DIAGNOSTIC METHOD

#### Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High
Duty ratio of wastegate control	≥ 25%

**Time Needed for Diagnosis:** 4 ms × 160 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## AS:DTC P0301 CYLINDER 1 MISFIRE DETECTED

### 1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)

Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below. :

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire

- 180° Interval Difference Method (MT: 1,800 rpm or less, AT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 1024 ms
Intake manifold pressure change at 180° CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 14 deg (AT model) < 14 deg (MT model)
Fuel shut-off function	Not in operation
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	500 rpm — 6500 rpm
Intake manifold pressure	≥ Value from Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine load change during 32 milliseconds	< 1000 rpm

#### Map1

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66	26.66
(mmHg, inHg)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(200, 7.874)

- MT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33
(mmHg, inHg)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)	(100, 3.937)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Map2

- AT model (Tumble generator valve open)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	29.33	26.66	26.66	26.66	27.33	27.99	29.53	31.33	32.73	34.12	38.19	43.99	49.52	53.32
(mmHg, inHg)	(220, 8.661)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(205, 8.071)	(210, 8.268)	(221.5, 8.72)	(235, 9.252)	(245.5, 9.665)	(256, 10.079)	(286.5, 11.28)	(330, 12.992)	(371.5, 14.626)	(400, 15.748)

- AT model (Tumble generator valve closed)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	29.33	26.66	26.66	26.66	27.33	27.99	29.53	31.33	32.73	34.12	38.19	43.99	49.52	53.32
(mmHg, inHg)	(220, 8.661)	(200, 7.874)	(200, 7.874)	(200, 7.874)	(205, 8.071)	(210, 8.268)	(221.5, 8.72)	(235, 9.252)	(245.5, 9.665)	(256, 10.079)	(286.5, 11.28)	(330, 12.992)	(371.5, 14.626)	(400, 15.748)

- MT model (Tumble generator valve open)

### Vehicle speed < 64 km/h (39.8 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	27.33	23.33	23.59	23.33	23.99	24.39	28.79	29.99	31.59	32.53	37.06	41.86	46.92	51.05
(mmHg, inHg)	(205, 8.071)	(175, 6.89)	(177, 6.968)	(175, 6.89)	(180, 7.087)	(183, 7.205)	(216, 8.504)	(225, 8.858)	(237, 9.331)	(244, 9.606)	(278, 10.945)	(314, 12.362)	(352, 13.858)	(383, 15.079)

### Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	25.06	24.79	25.59	39.99	40.79	42.12	43.99	44.52	47.32	54.65	54.65	54.65	54.65	54.65
(mmHg, inHg)	(188, 7.402)	(186, 7.323)	(192, 7.559)	(300, 11.811)	(306, 12.047)	(316, 12.441)	(330, 12.992)	(334, 13.15)	(355, 13.976)	(410, 16.142)	(410, 16.142)	(410, 16.142)	(410, 16.142)	(410, 16.142)

- MT model (Tumble generator valve closed)

### Vehicle speed < 64 km/h (39.8 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	27.33	23.33	23.59	23.33	23.99	24.39	28.79	29.99	31.59	32.53	37.06	41.86	46.92	51.05
(mmHg, inHg)	(205, 8.071)	(175, 6.89)	(177, 6.968)	(175, 6.89)	(180, 7.087)	(183, 7.205)	(216, 8.504)	(225, 8.858)	(237, 9.331)	(244, 9.606)	(278, 10.945)	(314, 12.362)	(352, 13.858)	(383, 15.079)

### Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa	25.06	24.79	25.59	39.99	40.79	42.12	43.99	44.52	47.32	54.65	54.65	54.65	54.65	54.65
(mmHg, inHg)	(188, 7.402)	(186, 7.323)	(192, 7.559)	(300, 11.811)	(306, 12.047)	(316, 12.441)	(330, 12.992)	(334, 13.15)	(355, 13.976)	(410, 16.142)	(410, 16.142)	(410, 16.142)	(410, 16.142)	(410, 16.142)

## 3. GENERAL DRIVING CYCLE

- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
- Perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

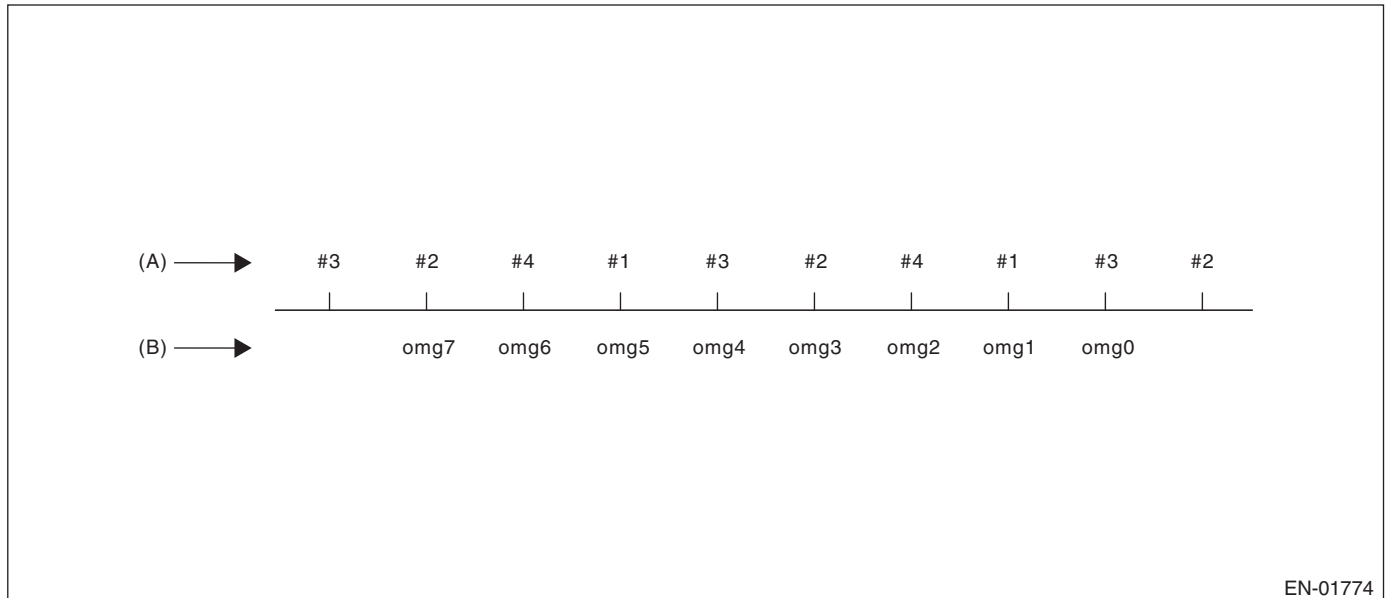
GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decreased and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Counting the number of misfires. If the misfire ratio is higher during 1000 revs. or 200 revs., Judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment)
	<ul style="list-style-type: none"> <li>• 180° Interval Difference Method</li> <li>• 360° Interval Difference Method</li> <li>• 720° Interval Difference Method</li> </ul>	<ul style="list-style-type: none"> <li>• FTP 1.5 times misfire NG judgment</li> <li>• Catalyst damage misfire NG judgment</li> </ul>

As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



EN-01774

(A) Ignition order

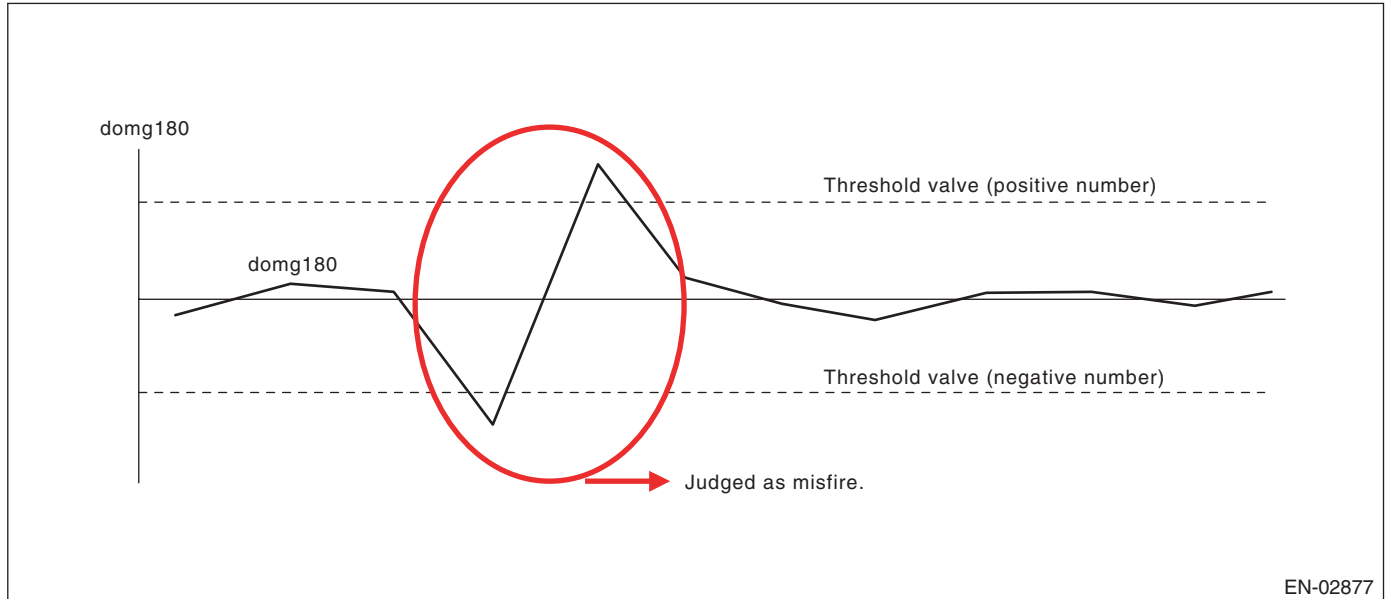
(B) Crankshaft position speed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

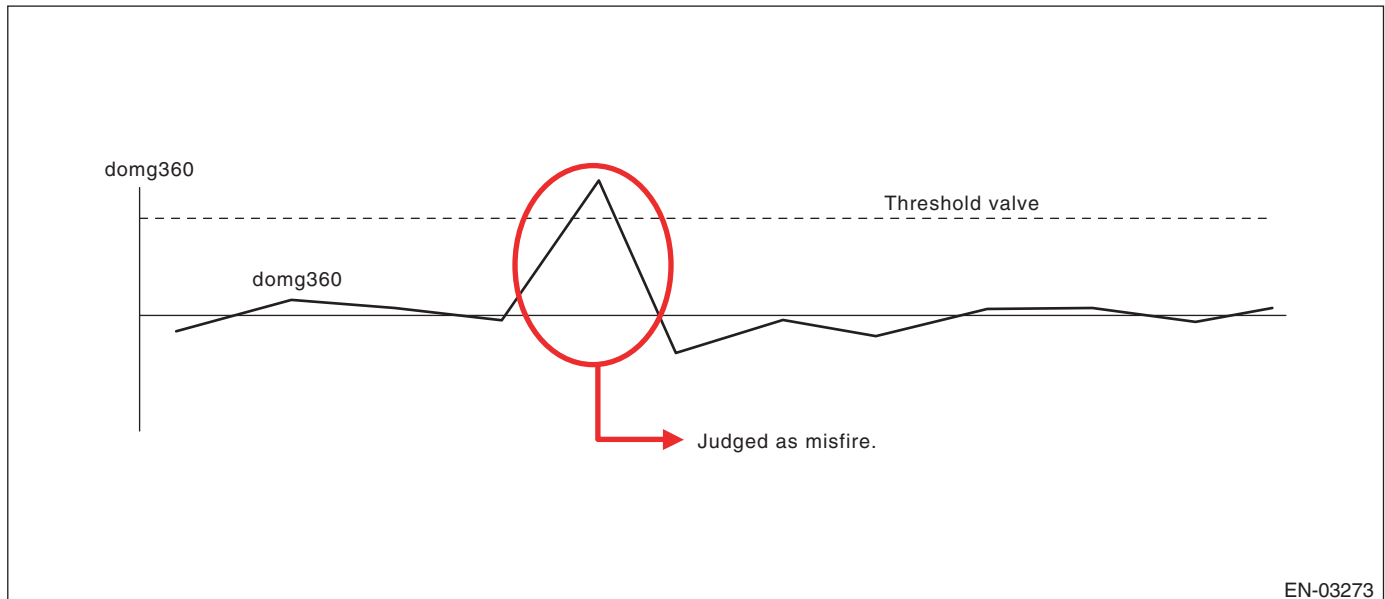
### 180° Interval Difference Method

Diagnostic value	$\text{domg } 180 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 5 - \text{omg } 1)/4$
Misfire judgment	$\text{domg } 180 > \text{judgment value of positive side}$ $\text{domg } 180 \leq \text{judgment value of negative side}$ (Judgment value before 180° CA)



### 360° Interval Difference Method

Diagnostic value	$\text{domg } 360 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 3 - \text{omg } 2)$
Misfire judgment	$\text{domg } 360 > \text{Judgment value} \rightarrow \text{Judge as misfire}$

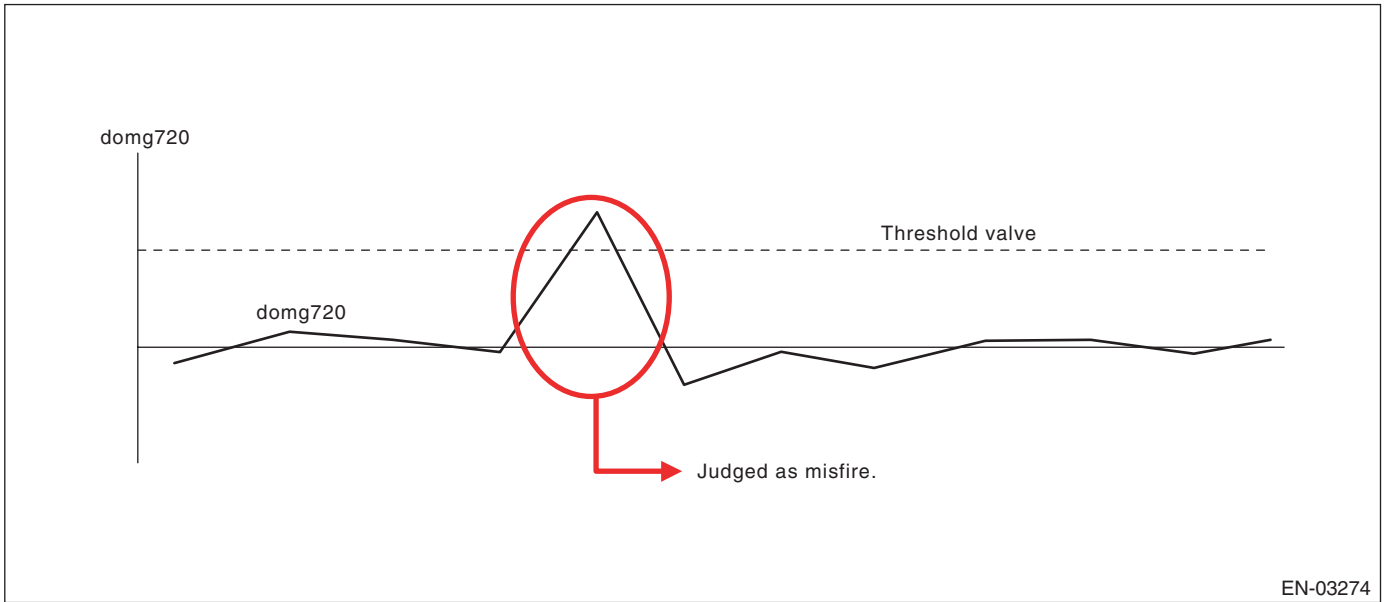


# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 720° Interval Difference Method

Diagnostic value	$\text{domg } 720 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 5 - \text{omg } 4)$
Misfire judgment	$\text{domg } 720 > \text{Judgment value} \rightarrow \text{Judge as misfire}$



EN-03274

- FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)
- Abnormality Judgment

**Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)**

Malfunction Criteria	Threshold Value
FTP emission judgment value	$\geq 20 \times 100/2000\%$ in 1000 revs.

**Time Needed for Diagnosis:** 1000 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- Normality Judgment

**Judgment Value**

Malfunction Criteria	Threshold Value
FTP emission judgment value	$< 20 \times 100/2000\%$ in 1000 revs.

**Time Needed for Diagnosis:** 1000 engine revs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

- Catalyst damage misfire (Misfire occurrence level damaging catalyst)
- Abnormality Judgment

### Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	≥ Value from Map 3

### Map 3

		Intake air (g(oz)/rev)									
		0.2 (0.007)	0.4 (0.014)	0.6 (0.021)	0.8 (0.028)	1 (0.035)	1.2 (0.042)	1.4 (0.049)	1.6 (0.056)	1.8 (0.063)	2 (0.071)
Engine speed (rpm)	700	148	128	116	106	100	90	90	90	90	90
	1000	148	128	114	104	92	85	85	85	85	85
	1500	140	118	102	90	85	85	85	72	72	72
	2000	128	90	90	73	58	43	40	36	32	20
	2500	116	87	57	45	39	36	34	32	30	20
	3000	108	87	58	39	36	36	32	30	28	20
	3500	98	74	43	27	23	22	20	20	20	20
	4000	69	61	40	27	22	20	20	20	20	20
	4500	60	55	34	25	20	20	20	20	20	20
	5000	55	55	34	23	20	20	20	20	20	20
	5500	54	54	33	22	20	20	20	20	20	20
	6000	52	52	32	21	20	20	20	20	20	20
	6500	50	50	30	20	20	20	20	20	20	20
6700	50	50	30	20	20	20	20	20	20	20	

**Time Needed for Diagnosis:** 200 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- Normality Judgment

### Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	< Value from Map 3

**Time Needed for Diagnosis:** 200 engine revs.

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## **AT:DTC P0302 CYLINDER 2 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-105, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **AU:DTC P0303 CYLINDER 3 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-105, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **AV:DTC P0304 CYLINDER 4 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-105, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

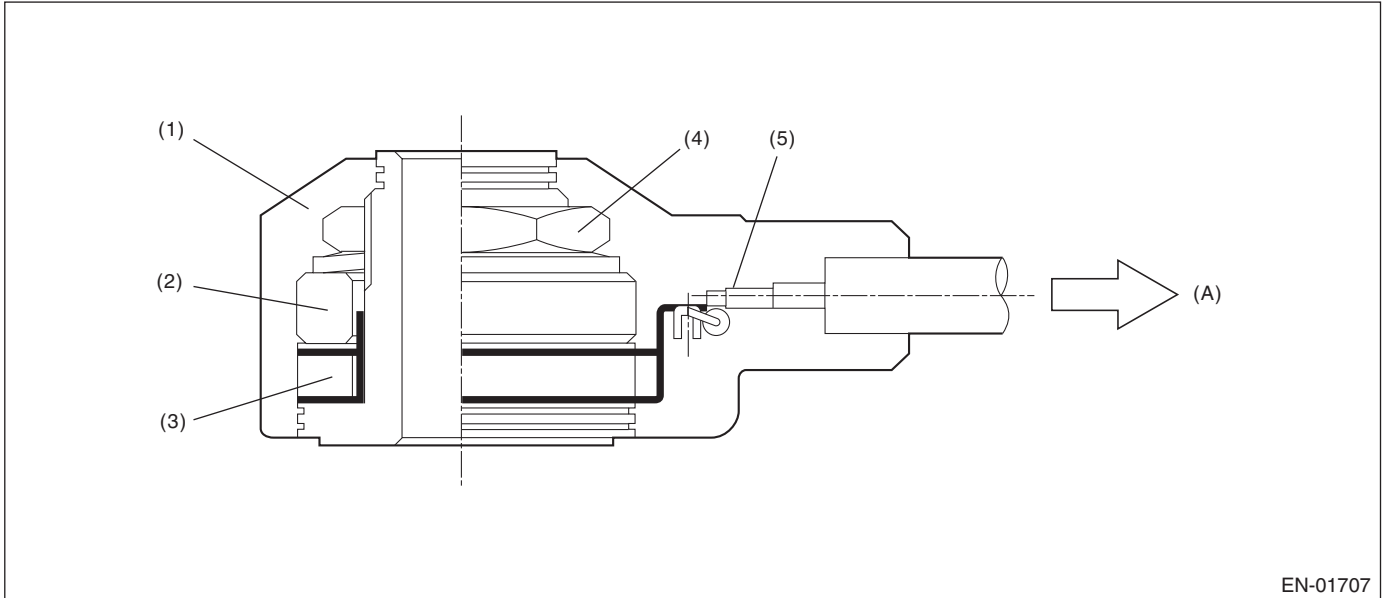
## GENERAL DESCRIPTION

### AW:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.238 V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.238$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Knock compensation:

- Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
- When normal: Knock compensation value = Fixed at 0°CA
- Failure: Knock compensation value = -5°CA (5°CA retard)
- Whole learning compensation coefficient update not allowed
- Portional learning zone compensation value calculation not allowed

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

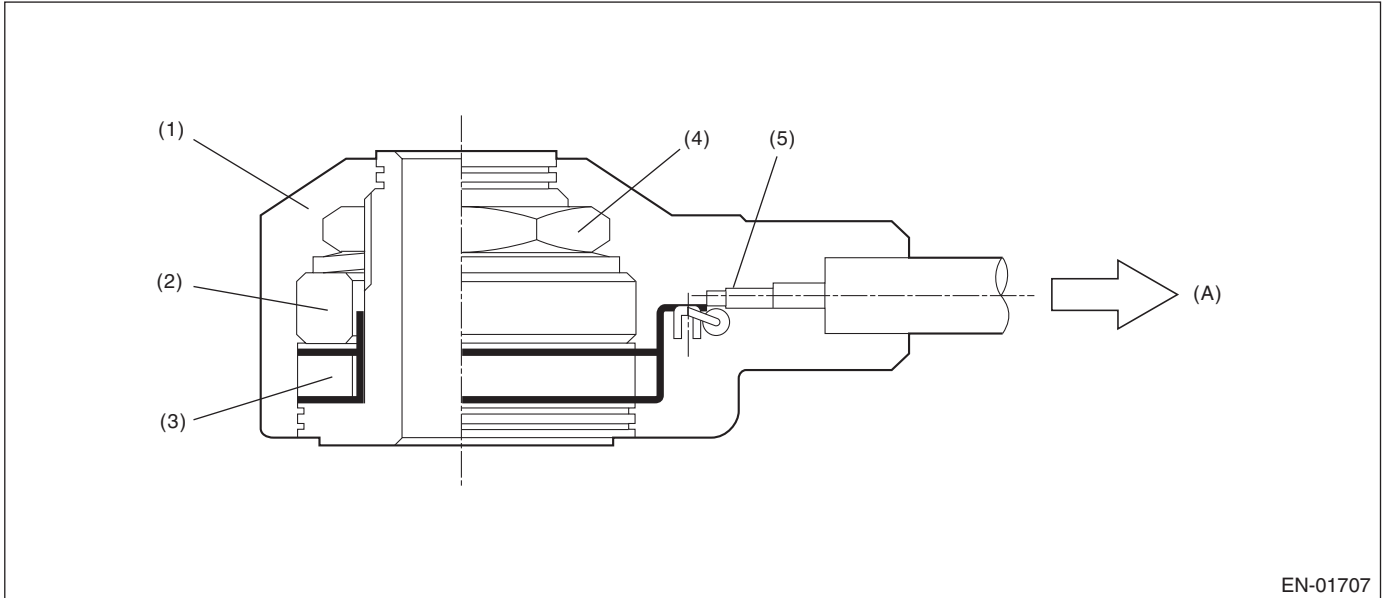
## GENERAL DESCRIPTION

### AX:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.714$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.714$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Knock compensation:

- Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
- When normal: Knock compensation value = Fixed at  $0^{\circ}\text{CA}$
- Failure: Knock compensation value =  $-5^{\circ}\text{CA}$  ( $5^{\circ}\text{CA}$  retard)
- Whole learning compensation coefficient update not allowed
- Portional learning zone compensation value calculation not allowed

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

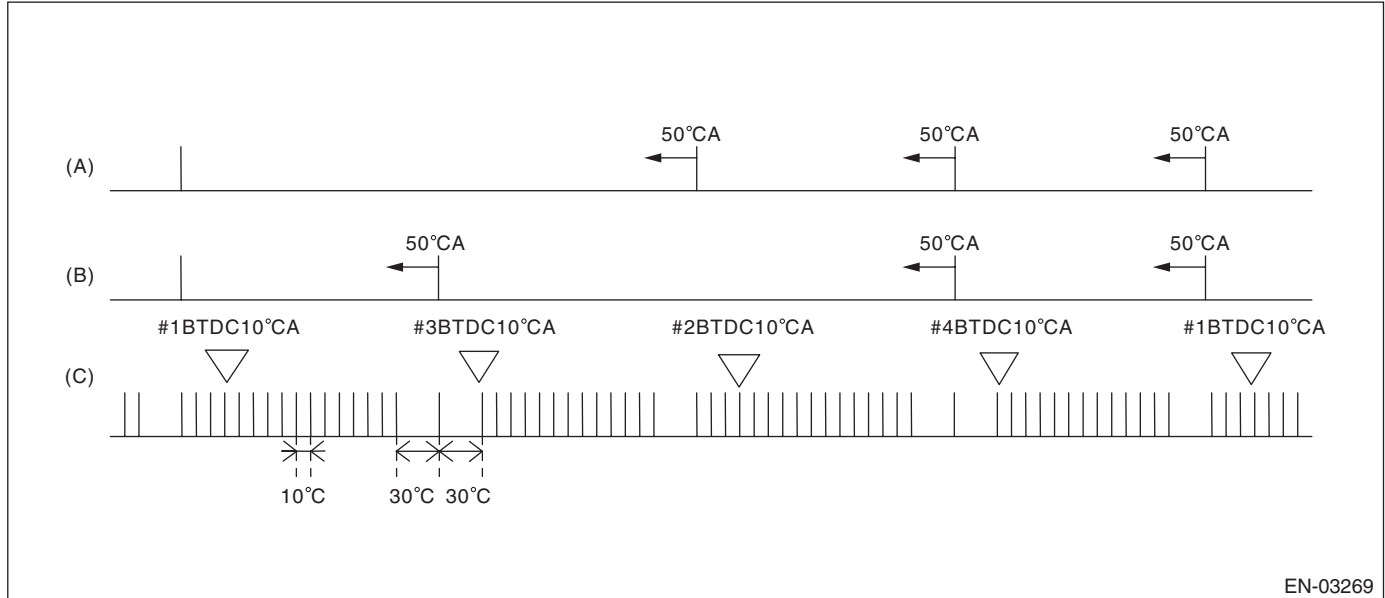
### AY:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.

Judge as NG when the crank signal is not input even though the starter was rotated.

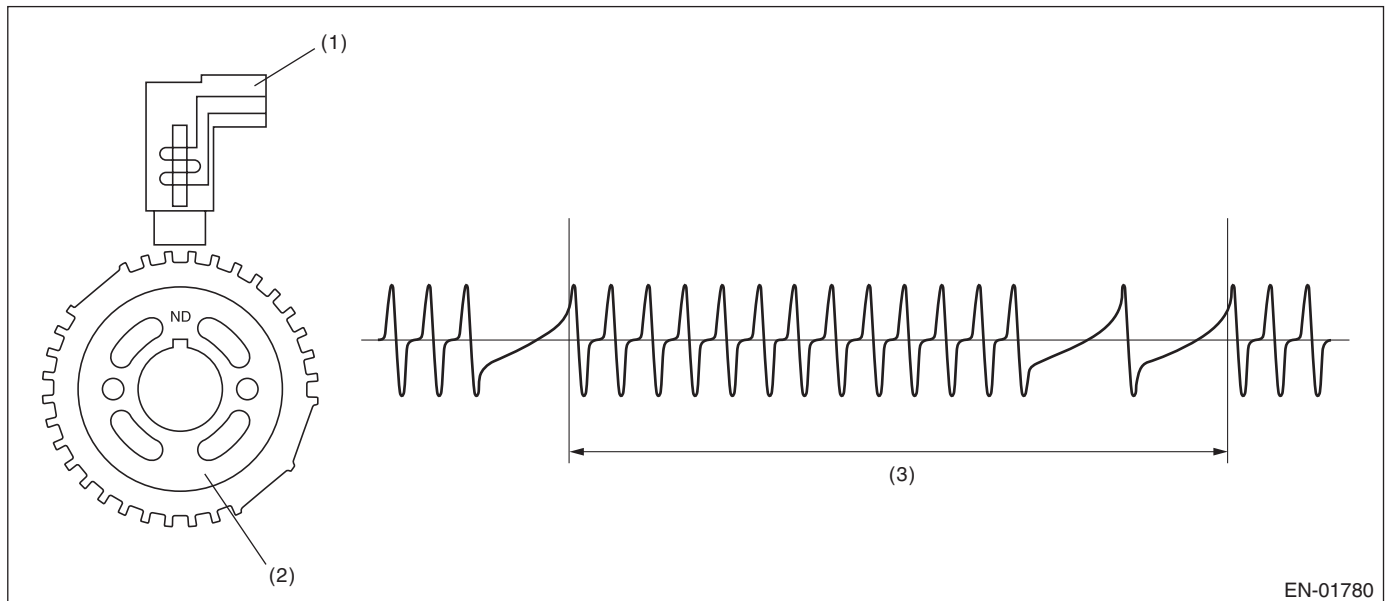
#### 2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Starter switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

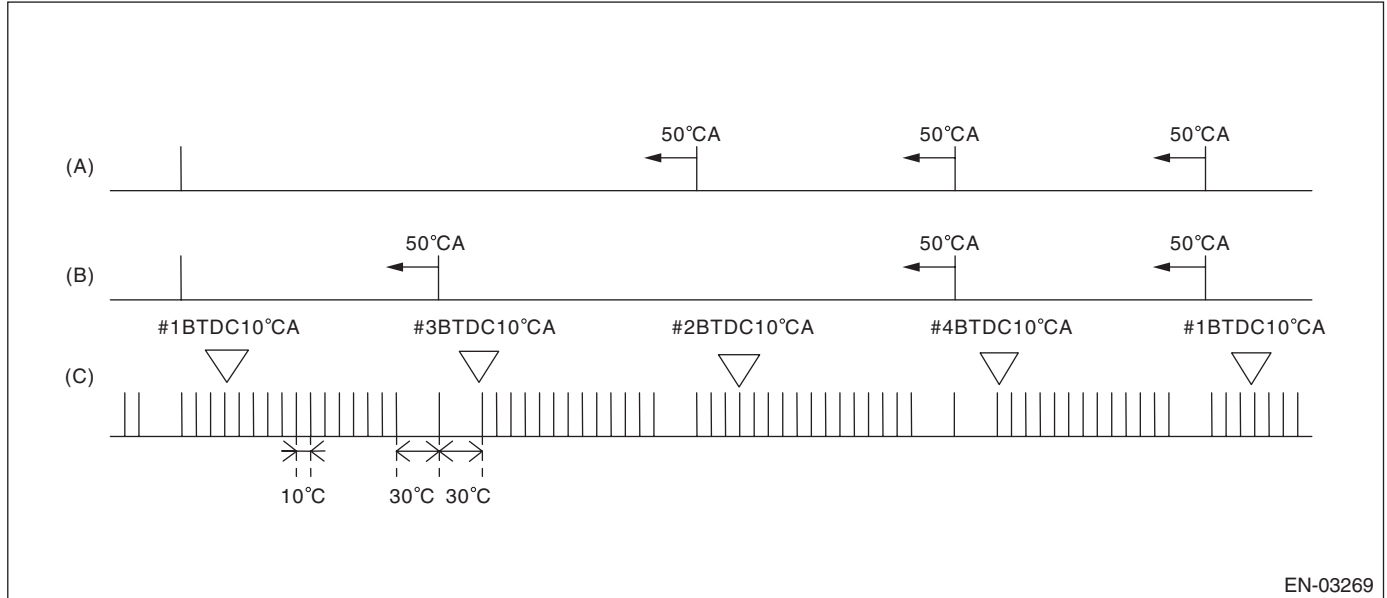
### AZ:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

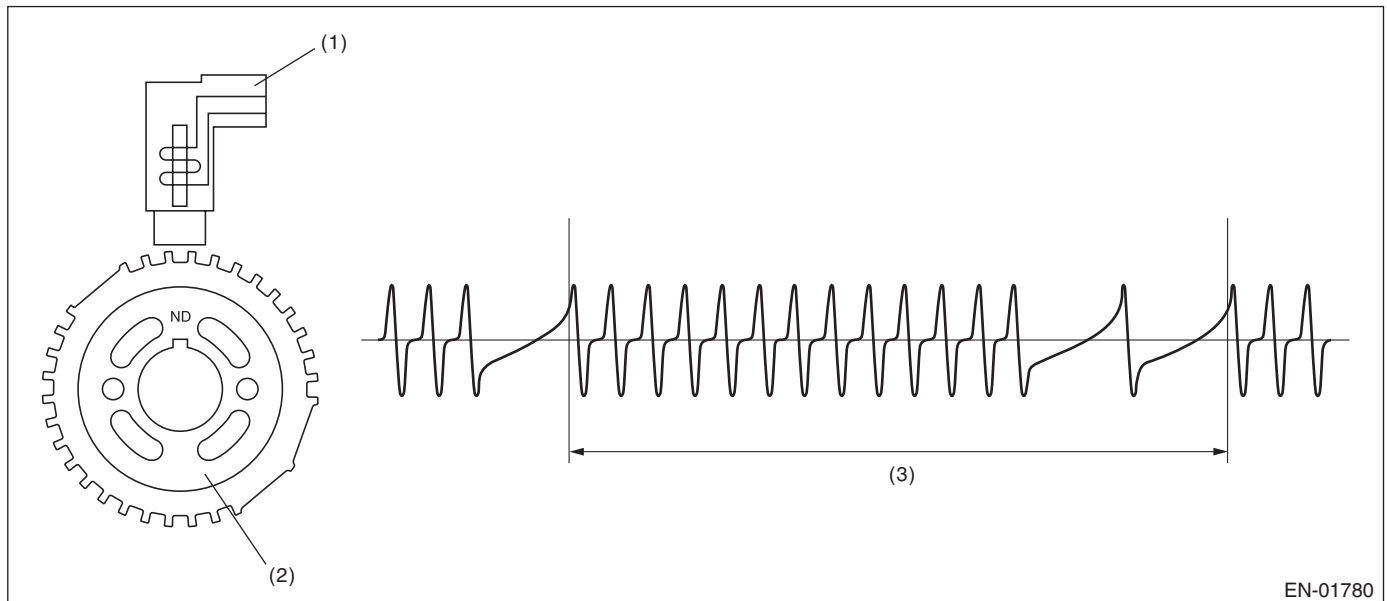
#### 2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	< 3000 rpm

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	Not = 30

**Time Needed for Diagnosis:** 10 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	= 30

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

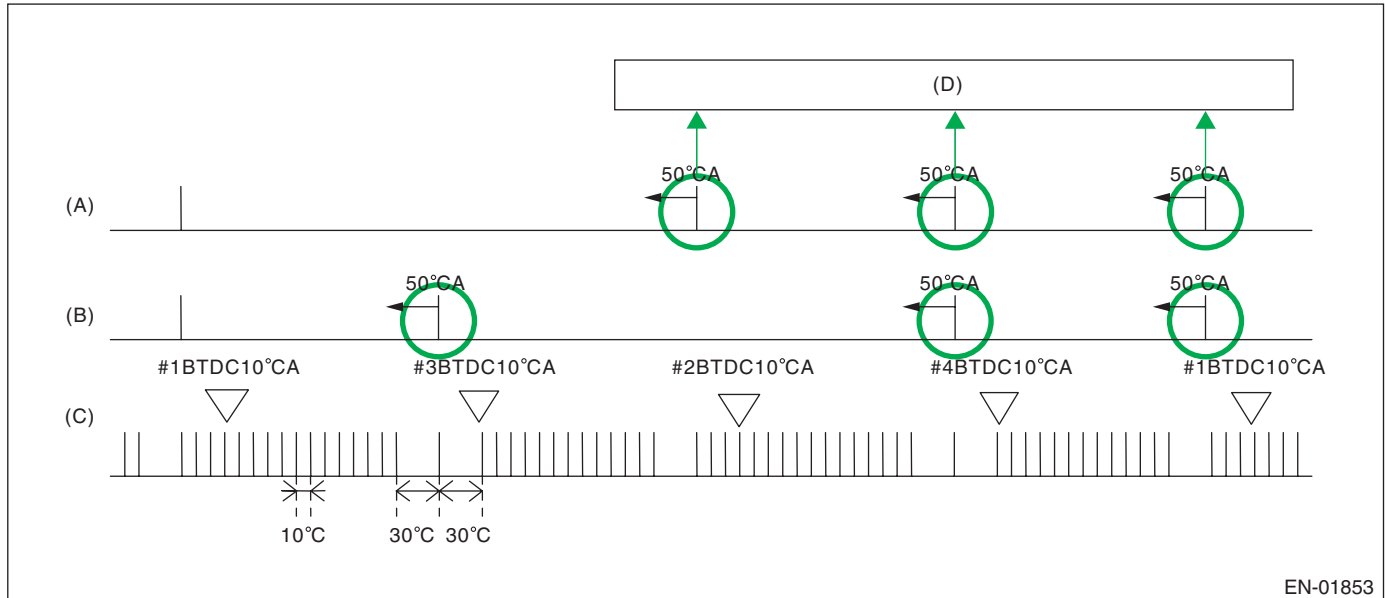
## GENERAL DESCRIPTION

### BA:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.  
Judge as NG when the number of camshaft signals remains abnormal.

#### 2. COMPONENT DESCRIPTION



EN-01853

(A) Camshaft signal (RH)

(C) Crankshaft signal

(D) Number of camshaft position signals = When normal, there will be 3 cam signals for every 2 engine revolutions.

(B) Camshaft signal (LH)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment 1

Judge as NG when the condition where the number of camshaft position sensor signals are less than 3 time during 2 engine revs. continues.

##### Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs.	< 3 time

**Time Needed for Diagnosis:** Two engine revolutions × 50 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgement 1

Judge as OK and clear the NG when the malfunction criteria below are met.

### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	≥ 3 time

**Time Needed for Diagnosis:** Two engine revolutions

## • Abnormality Judgment 2

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Starter	ON
Camshaft position sensor signal	No input

**Time Needed for Diagnosis:** 3000 ms

## • Normality Judgement 2

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	Input exists

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0° CA) to the compensation value of the partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control:
  - Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
  - ⇒ ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  - Make the OCV driving Duty to be the given value (9.36%).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

---

## **BB:DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2)**

### **1. OUTLINE OF DIAGNOSIS**

#### NOTE:

For the detection standard, refer to DTC P0340. <Ref. to GD(H4DOTC)-120, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BC:DTC P0410 SECONDARY AIR INJECTION SYSTEM

### 1. OUTLINE OF DIAGNOSIS

Detect NG judging from secondary air delivery pipe pressure, pulse of secondary air delivery pipe pressure and secondary air pipe airflow amount.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
<b>Pump supply pressure check</b> Estimate ambient temperature Battery voltage Barometric pressure  Engine Amount of intake air Secondary air pump Combination valve	$\geq 4.4$ °C $\geq 10.9$ V $\geq 75.05$ kPa (563 mmHg, 22.165 inHg)  In operation $\geq 2$ g/s (0.071 oz/s) Operating Bank open (Except with both banks closed)
<b>Combination valve both closed pulse diagnosis</b> Estimate ambient temperature Battery voltage Barometric pressure  Engine Engine load  After fuel cut	$\geq 4.4$ °C $\geq 10.9$ V $\geq 75.05$ kPa (563 mmHg, 22.165 inHg)  In operation $\geq 0.2$ g/rev (0.007 oz/rev)  $\geq 1000$ ms
<b>Combination valve changeover pressure diagnosis</b> Estimate ambient temperature Battery voltage Barometric pressure  Engine Amount of intake air  Engine speed After fuel cut	$\geq 4.4$ °C $\geq 10.9$ V $\geq 75.05$ kPa (563 mmHg, 22.165 inHg)  In operation $> 2$ g/s (0.071 oz/s) and $< 25$ g/s (0.882 oz/s)  $< 4000$ rpm $\geq 1000$ ms
<b>Overflow diagnosis</b> Estimate ambient temperature Battery voltage Barometric pressure  Engine	$\geq 4.4$ °C $\geq 10.9$ V $\geq 75.05$ kPa (563 mmHg, 22.165 inHg)  In operation

### 3. GENERAL DRIVING CYCLE

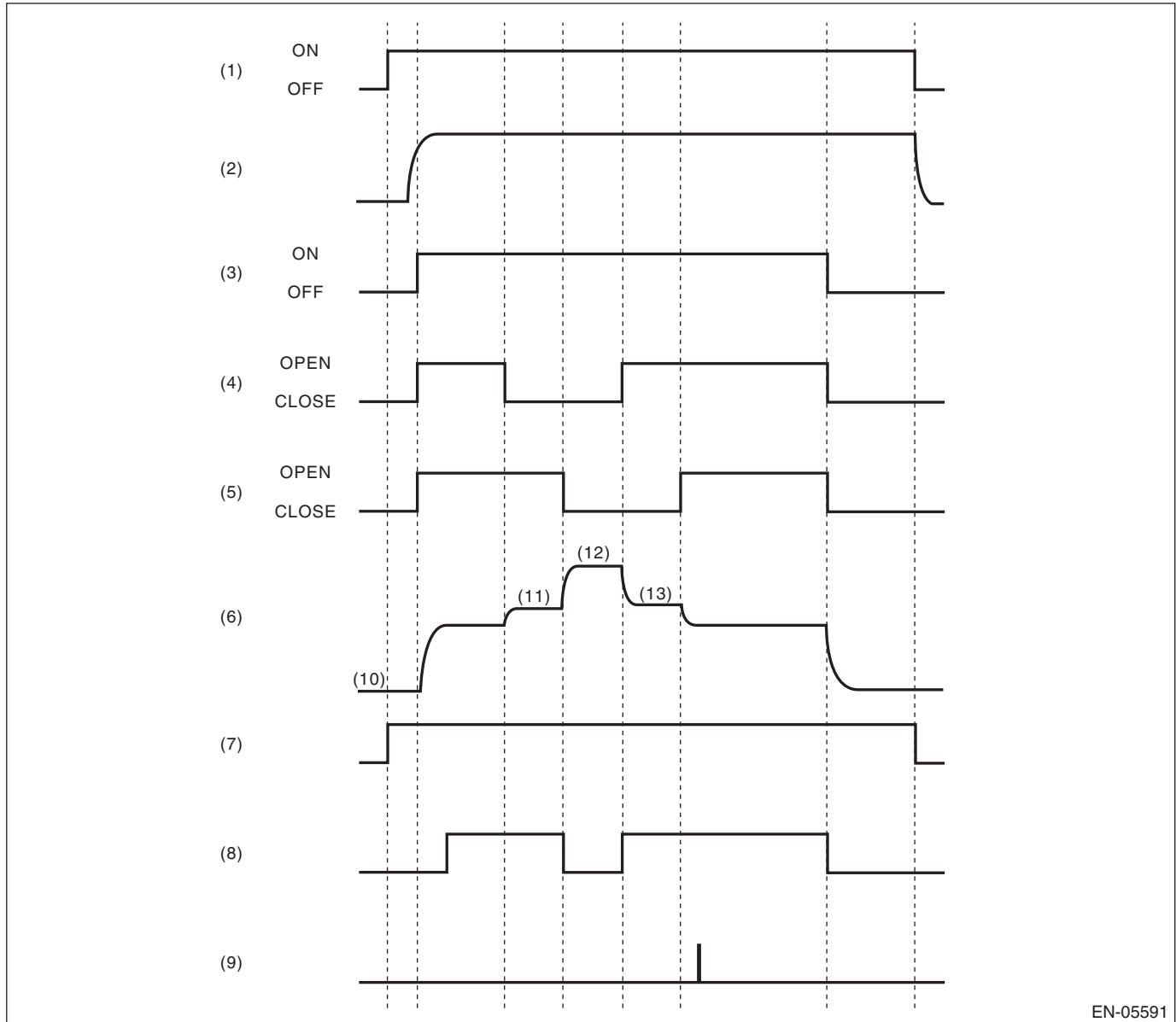
Perform diagnosis during secondary air pump operation

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 4. DIAGNOSTIC METHOD

Measure secondary air delivery pipe pressure, pulse of secondary air delivery pipe pressure and secondary air pipe airflow amount.



EN-05591

- |  |   |  |
|--|---|--|
| (1) IG   | (7) Diagnosis enable condition  | (11) Right bank all closed pressure (POR) measurement  |
| (2) Ne   | (8) Pump supply pressure check (judgment)                               | (12) Both banks all closed pressure (PORL) measurement |
| (3) Secondary air pump operating status        | (9) Flow amount check (judgment)  | (13) Left bank all closed pressure (POL) measurement   |
| (4) E-COMB valve (right hand) status           | (10) Barometric pressure (Pas) measurement before secondary air control |  |
| (5) E-COMB valve (left hand) status            |   |  |
| (6) Secondary air delivery pipe pressure (psi) |   |  |

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Pump supply pressure check

Perform the system function diagnosis with how much the pressure rises when the secondary air pump is turned from OFF to ON.

Judge as NG if delivery pipe pressure does not rise though it should when the secondary air pump turns OFF → ON.

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Secondary air supply pipe pressure (after barometric pressure compensation)	< 0.93 kPa (7 mmHg, 0.276 inHg)	P0410

**Time Needed for Diagnosis:** 1984 ms + 2816 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Secondary air supply pipe pressure (after barometric pressure compensation)	≥ 0.93 kPa (7 mmHg, 0.276 inHg)	P0410

**Time Needed for Diagnosis:** 1984 ms + 2816 ms

## Combination valve both closed pulse diagnosis

Perform open stuck diagnosis of both combination valves using delivery pipe pressure pulse when both combination valves are closed. Determine which side of valves is stuck open by comparing secondary air flow amount when RH combination valve is closed with that when LH combination valve is closed.

Calculate voltage pulse of the pump supply pipe pressure when both combination valves are closed. The calculation should be small because there is no pulse from supply pipe pressure with both combination valves closed. When the calculation is large, determine that either of the combination valves is stuck open.

Determine which side of valves is stuck open by comparing secondary air flow amount when the RH combination valve is closed with that when the LH combination valve is closed. Air flow amount is larger on the open stuck valve.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pulse calculation value when both combination valves are closed Air flow amount when the right bank is closed (value from Map 2)	> Value of Map 1 ≥ Air flow amount when the left bank is closed (value from Map 3)	P2440
Pulse calculation value when both combination valves are closed Air flow amount when the left bank is closed (value from Map 3)	> Value of Map 1 > Air flow amount when the right bank is closed (value from Map 2)	P2442

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pulse calculation value when both combination valves are closed	≤ Value of Map 1	P2440, P2442

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

### Combination valve changeover pressure diagnosis

Perform the RH combination valve stuck closed diagnosis with the variation of delivery pipe pressure when the RH combination valve turns closed → open.

Delivery pipe pressure should vary when the RH combination valve turns closed → open. When the variation is small, determine that the RH combination valve is stuck closed.

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure variation value when the RH combination valve is switched	< Value of Map 4	P2441

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure variation value when the RH combination valve is switched	≥ Value of Map 4	P2441

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

Perform the LH combination valve stuck closed diagnosis with the variation of delivery pipe pressure when the LH combination valve turns open → closed.

Delivery pipe pressure should vary when the LH combination valve turns open → closed. When the variation is small, determine that the LH combination valve is stuck closed.

## • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure variation value when the LH combination valve is switched	< Value of Map 5	P2443

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure variation value when the LH combination valve is switched	≥ Value of Map 5	P2443

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

## Overflow diagnosis

Perform secondary air system flow abnormality diagnosis using both sides of combination valves secondary air amount when both are closed.

Judge as secondary air system flow abnormality either if there is excessive secondary air flow amount with the RH combination valve closed, or if there is excessive secondary air flow amount with the LH combination valve closed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Air flow amount when the right bank is closed (value from Map 2) or Air flow amount when the left bank is closed (value from Map 3)	> Value of Map 6  > Value of Map 7	P0411
Voltage at PORL measurement – Voltage at POR measurement	≤ 4 V	
Voltage at PORL measurement – Voltage at POL measurement	≤ 4 V	

PORL: Both banks all closed pressure

POR: Right bank all closed pressure

POL: Left bank all closed pressure

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Air flow amount when the right bank is closed (value from Map 2) or Air flow amount when the left bank is closed (value from Map 3)	≤ Value of Map 6  ≤ Value of Map 7	P0411
Voltage at PORL measurement – Voltage at POR measurement	≤ 4 V	
Voltage at PORL measurement – Voltage at POL measurement	≤ 4 V	

PORL: Both banks all closed pressure

POR: Right bank all closed pressure

POL: Left bank all closed pressure

**Time Needed for Diagnosis:** 4000 ms + 992 ms + 992 ms + 992 ms

### Map1

Intake air (g (oz)/rev)	0.1 (0.004)	0.25 (0.009)	0.3 (0.011)	1 (0.035)
Threshold value (V)	13	13	3.25	3.25

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Map2

Secondary air pressure in the pipe when both comb. valve is closing kPa (mmHg, inHg)	69.32 (520, 20.472)	74.65 (560, 22.047)	79.98 (600, 23.622)	85.31 (640, 25.197)	90.64 (680, 26.772)	95.98 (720, 28.346)	101.31 (760, 29.921)	106.64 (800, 31.496)	111.97 (840, 33.071)	117.3 (880, 34.646)	122.64 (920, 36.22)	127.97 (960, 37.795)	133.3 (1000, 39.37)	138.63 (1040, 40.945)	143.96 (1080, 42.52)	149.3 (1120, 44.094)
Secondary air pressure in the pipe when LH comb. valve is closing kPa (mmHg, inHg)	69.32 (520, 20.472)	74.65 (560, 22.047)	79.98 (600, 23.622)	85.31 (640, 25.197)	90.64 (680, 26.772)	95.98 (720, 28.346)	101.31 (760, 29.921)	106.64 (800, 31.496)	111.97 (840, 33.071)	117.3 (880, 34.646)	122.64 (920, 36.22)	127.97 (960, 37.795)	133.3 (1000, 39.37)	138.63 (1040, 40.945)	143.96 (1080, 42.52)	149.3 (1120, 44.094)
	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400	2400
	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400
	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400
	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400
	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200
	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000
	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800
	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600
	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400
	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200
	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000
	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800
	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600
	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400
	-2400	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200
	-2400	-2400	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0

(L/min)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Map 3

Secondary air pressure in the pipe when both comb. valve is closing kPa (mmHg, inHg)	69.32 (520, 20.472)	74.65 (560, 22.047)	79.98 (600, 23.622)	85.31 (640, 25.197)	90.64 (680, 26.772)	95.98 (720, 28.346)	101.31 (760, 29.921)	106.64 (800, 31.496)	111.97 (840, 33.071)	117.3 (880, 34.646)	122.64 (920, 36.22)	127.97 (960, 37.795)	133.3 (1000, 39.37)	138.63 (1040, 40.945)	143.96 (1080, 42.52)	149.3 (1120, 44.094)
Secondary air pressure in the pipe when RH comb. valve is closing kPa (mmHg, inHg)	69.32 (520, 20.472)	74.65 (560, 22.047)	79.98 (600, 23.622)	85.31 (640, 25.197)	90.64 (680, 26.772)	95.98 (720, 28.346)	101.31 (760, 29.921)	106.64 (800, 31.496)	111.97 (840, 33.071)	117.3 (880, 34.646)	122.64 (920, 36.22)	127.97 (960, 37.795)	133.3 (1000, 39.37)	138.63 (1040, 40.945)	143.96 (1080, 42.52)	149.3 (1120, 44.094)
	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400	2400
	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400
	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400
	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400
	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200
	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800	2000
	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600	1800
	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400	1600
	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200	1400
	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000	1200
	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800	1000
	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600	800
	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400	600
	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200	400
	-2400	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0	200
	-2400	-2400	-2400	-2400	-2200	-2000	-1800	-1600	-1400	-1200	-1000	-800	-600	-400	-200	0

(L/min)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Map4

Amount of intake air when RH comb. valve switches (g (oz)/s)	10 (0.353)	15 (0.529)	20 (0.705)	25 (0.882)	26 (0.917)
Battery voltage when RH comb. valve switches (V)					
11	0.025	0.025	0.025	0.005	0
12	0.035	0.035	0.035	0.015	0
13	0.05	0.05	0.05	0.025	0
14	0.05	0.05	0.05	0.025	0
					(V)

## Map 5

Amount of intake air when LH comb. valve switches (g (oz)/s)	10 (0.353)	15 (0.529)	20 (0.705)	25 (0.882)	26 (0.917)
Battery voltage when LH comb. valve switches (V)					
11	0.025	0.025	0.025	0.005	0
12	0.035	0.035	0.035	0.015	0
13	0.05	0.05	0.05	0.025	0
14	0.05	0.05	0.05	0.025	0
					(V)

## Map6

Amount of intake air when P0R is measuring (g (oz)/s)	2 (0.071)	25 (0.882)
Battery voltage when P0R measuring (V)		
11.5	345	345
12.5	345	345
13.5	345	345
14.5	390	390
15.5	420	420
		(L/min)

## Map7

Amount of intake air when P0L is measuring (g (oz)/s)	2 (0.071)	25 (0.882)
Battery voltage when P0L measuring (V)		
11.5	345	345
12.5	345	345
13.5	345	345
14.5	390	390
15.5	420	420
		(L/min)

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## **BD:DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BE:DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	LOW

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	HIGH

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BF:DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs ON signal	HIGH

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs ON signal	LOW

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## **BG:DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P0413. <Ref. to GD(H4DOTC)-133, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BH:DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P0414. <Ref. to GD(H4DOTC)-134, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BI: DTC P0418 SECONDARY AIR INJECTION SYSTEM CONTROL “A” CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	LOW

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	HIGH

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## BJ:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

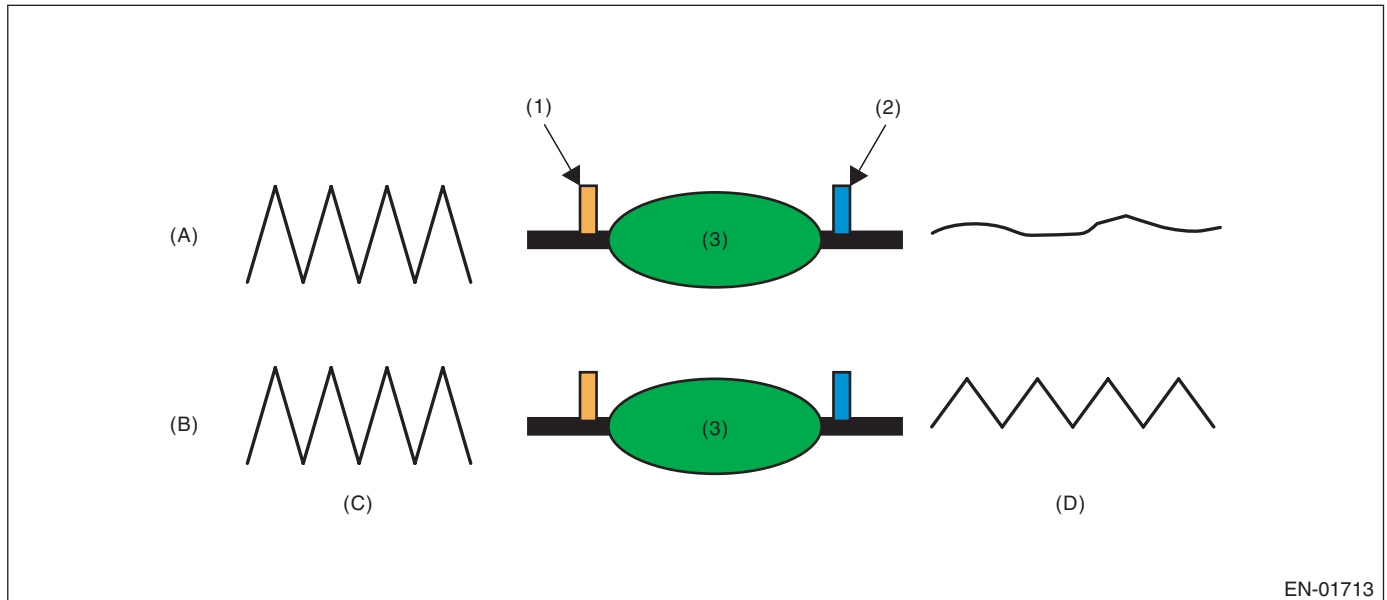
### 1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.

For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

### 2. COMPONENT DESCRIPTION



EN-01713

(A) Normal

(B) Deterioration

(C) Output waveform from the front oxygen (A/F) sensor

(D) Output waveform from the rear oxygen Sensor

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Engine coolant temperature	≥ 70 °C (158 °F)
Estimated catalyst temperature	≥ 500 °C (932 °F)
Misfire detection every 200 rotations	< 5 time
Learning value of evaporation gas density	< 0.2
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 1000 ms
Vehicle speed	> 60 km/h (37.3 MPH)
Amount of intake air	≥ 10 g/s (0.353 oz/s) and < 40 g/s (1.411 oz/s)
Engine load change every 0.5 engine revs.	< 0.02 g/rev (0.001 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 200 sec
Purge execution calculated time	≥ 5 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 60 km/h (37.3 MPH) or higher.

### 5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) and rear oxygen sensor output voltage deviation cumulative value ( $\sum |(ro2sad_n - ro2sad_{n-1})|$ ) per 32 milliseconds  $\times 4$ , and when the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) becomes the predetermined value or more, calculate the diagnostic value.

#### • Abnormality Judgment

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
$\sum  (ro2sad_n - ro2sad_{n-1})  / \sum  (sglmd_n - sglmd_{n-1}) $	> 11 (AT model) > 9 (MT model)

**Time Needed for Diagnosis:** 30 — 55 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
$\sum  (ro2sad_n - ro2sad_{n-1})  / \sum  (sglmd_n - sglmd_{n-1}) $	≤ 11 (AT model) ≤ 9 (MT model)

**Time Needed for Diagnosis:** 30 — 55 seconds

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## **BK:DTC P0441 EVAPORATIVE EMISSION SYSTEM INCORRECT PURGE FLOW**

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H4DOTC)-140, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

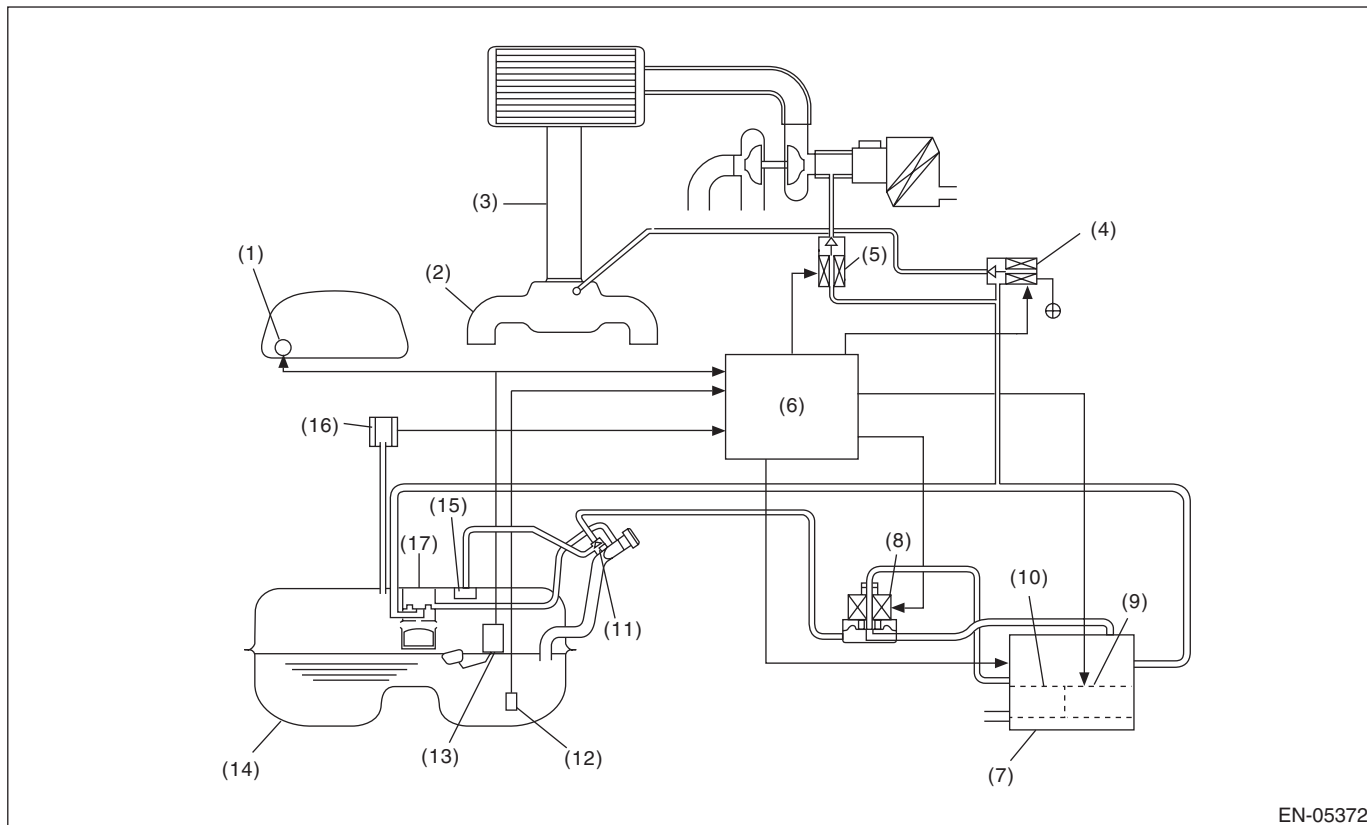
# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BL:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

#### 1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.



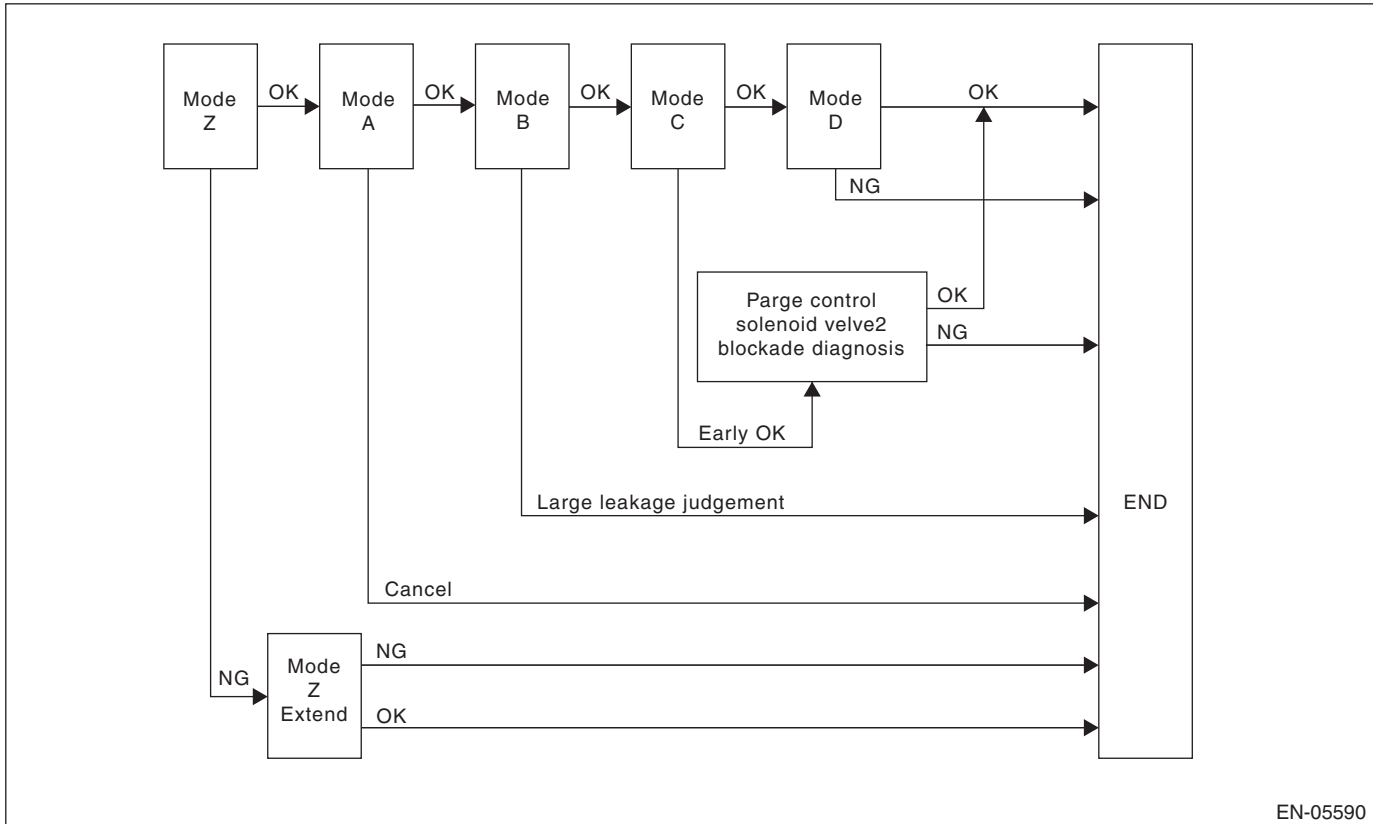
- |                                    |                              |                                |
|------------------------------------|------------------------------|--------------------------------|
| (1) Fuel gauge                     | (7) Canister                 | (13) Fuel level sensor         |
| (2) Intake manifold                | (8) Pressure control valve   | (14) Fuel tank                 |
| (3) Throttle body                  | (9) Drain valve              | (15) Fuel cut valve            |
| (4) Purge control solenoid valve   | (10) Drain filter            | (16) Fuel tank pressure sensor |
| (5) Purge control solenoid valve 2 | (11) Shut-off valve          | (17) Vent valve                |
| (6) Engine control module (ECM)    | (12) Fuel temperature sensor |                                |

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 0.04-inch Diagnosis



Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve opening failure diagnosis)	Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start.	0 ms + 3000 ms — 0 ms + 3000 ms + 13000 ms
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	10000 ms
Mode B (Sealed negative pressure, large leakage judgment)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak.	0 — 10000 ms + 25000 ms
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment.	0 — 17000 ms
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value.	0 ms + 10000 ms

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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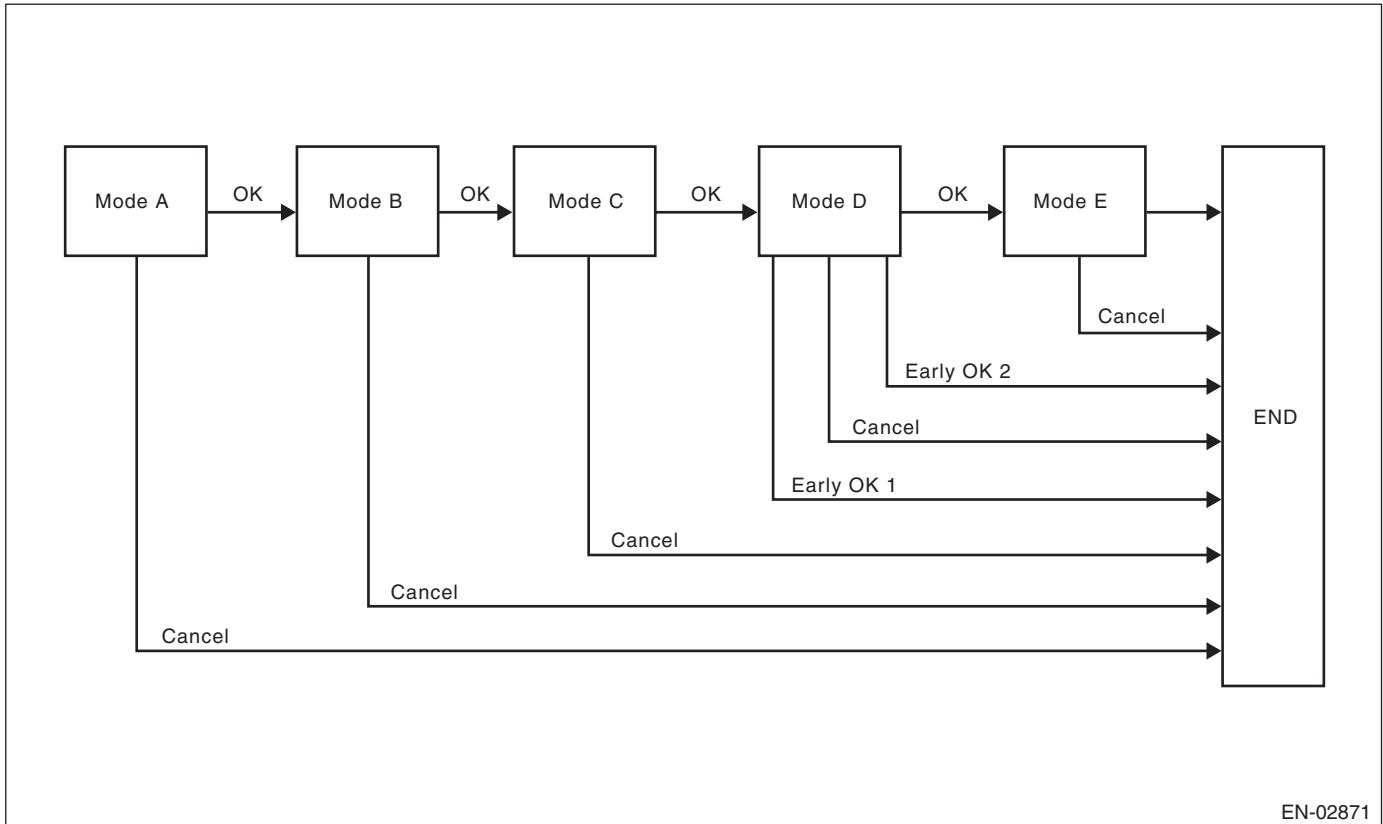
### Mode Table for Evaporative Emission Control System Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg))	Purge control solenoid valve is judged to be open.	P0457
Mode A	Pressure is in proportion to amount of evaporative emission.	—	None
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leak	P0457
Mode C	Reaches target pressure	—	None
Mode D	Pressure change is small.	EVAP system large leak determination. [1.0 mm (0.04 in)]	P0442

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 0.02-inch Diagnosis



EN-02871

Mode	Mode Description	Diagnosis Period
Mode A (0 point compensation)	When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg).	0 — Value of Map 1
Mode B (Negative pressure introduced)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank.	0 — Value of Map 2
Mode C (Negative pressure maintained)	Wait until the tank pressure returns to the target (start level of P2 calculation).	0 — 20000 ms + 0 + Value from Map 2
Mode D (Negative pressure change calculated)	Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment.	0 — 0 ms + 200000 ms
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + 200000 ms + Value from Map 3

### Map1

Fuel level ( ℓ , US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	12000	12000	11000	10000	7500	5000	5000

### Map2

Fuel level ( ℓ , US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	21500	21500	22250	23000	23500	24000	24000

### Map 3

Fuel level ( ℓ , US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	60000	60000	60000	60000	60000	60000	60000

# Diagnostic Trouble Code (DTC) Detecting Criteria

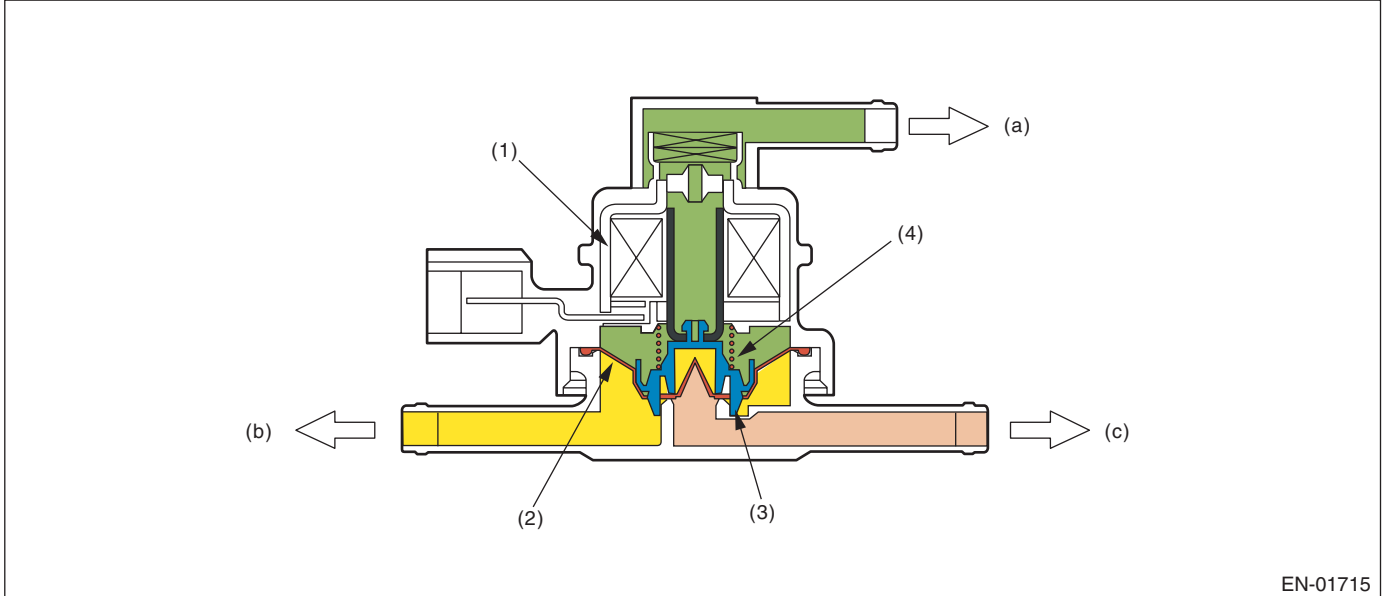
## GENERAL DESCRIPTION

### 2. COMPONENT DESCRIPTION

#### Pressure control solenoid valve

PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.

The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.



EN-01715

- |               |            |                         |
|---------------|------------|-------------------------|
| (1) Solenoid  | (3) Valve  | (a) Barometric pressure |
| (2) Diaphragm | (4) Spring | (b) Fuel tank           |
|               |            | (c) Canister            |

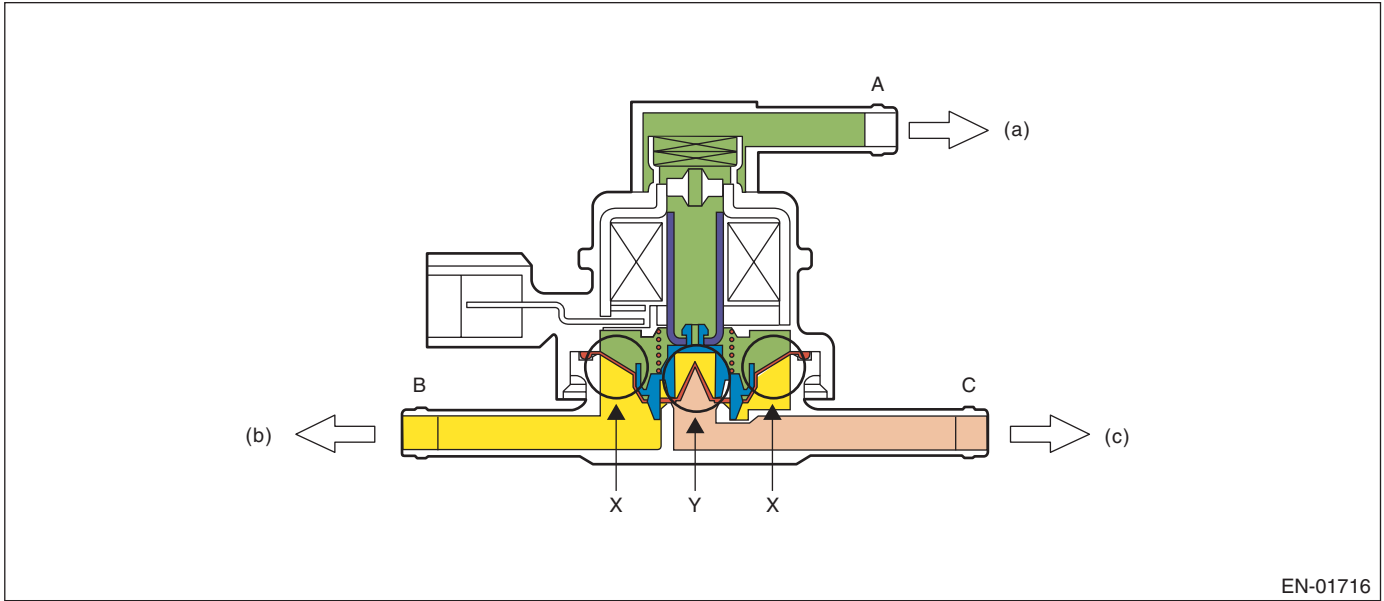
#### Valve Operation and Air Flow

In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



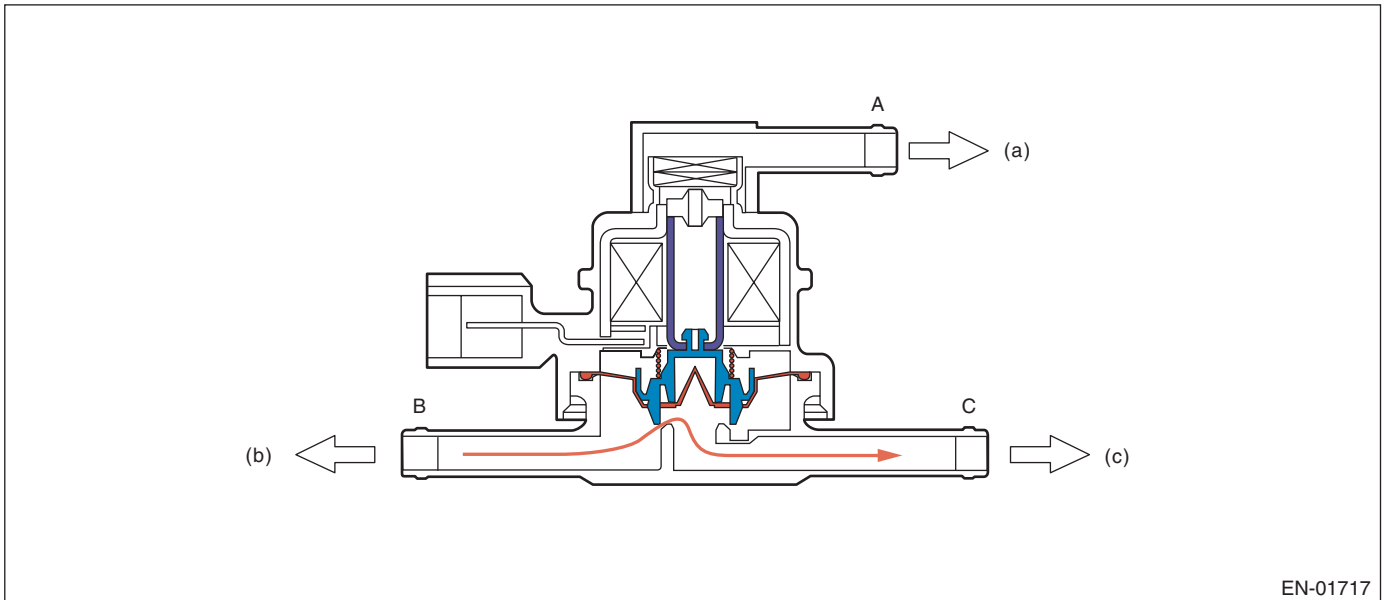
(a) Barometric pressure

(b) Fuel tank

(c) Canister

Condition of pressure	Flow
$A < B$ (solenoid OFF)	$B \rightarrow C$
$B < C$ (solenoid OFF)	$C \rightarrow B$
Solenoid ON	$B \leftrightarrow C$

## When $A < B$ (solenoid OFF)



(a) Barometric pressure

(b) Fuel tank

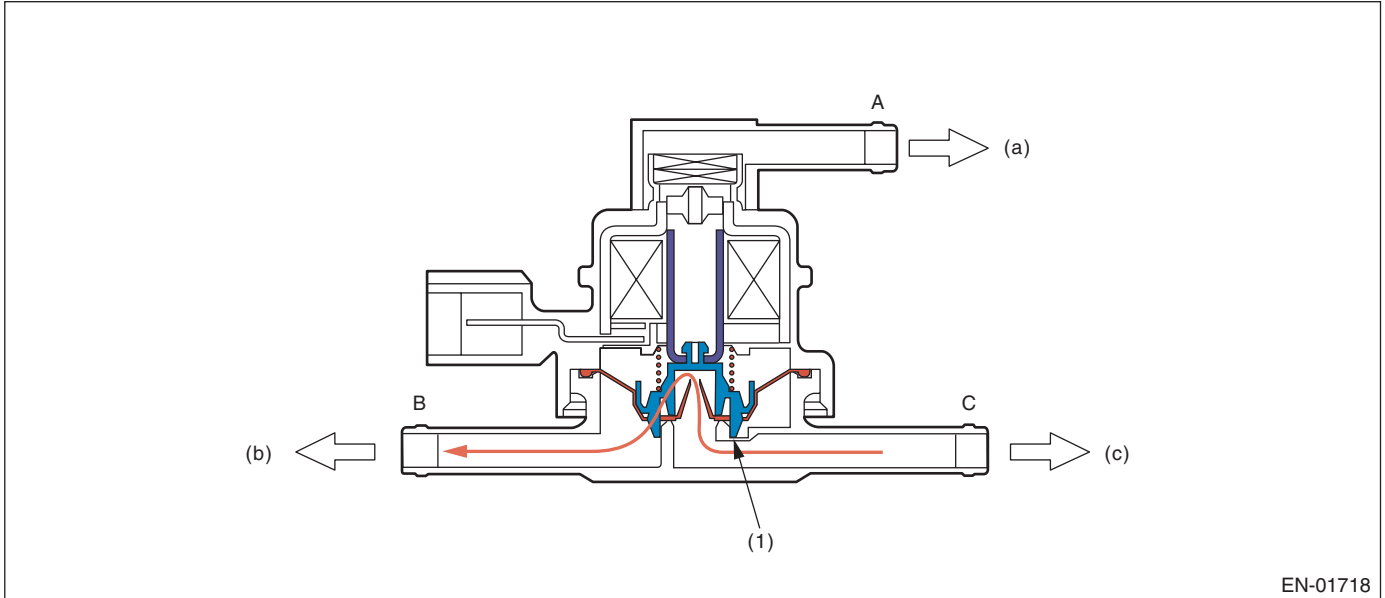
(c) Canister



# Diagnostic Trouble Code (DTC) Detecting Criteria

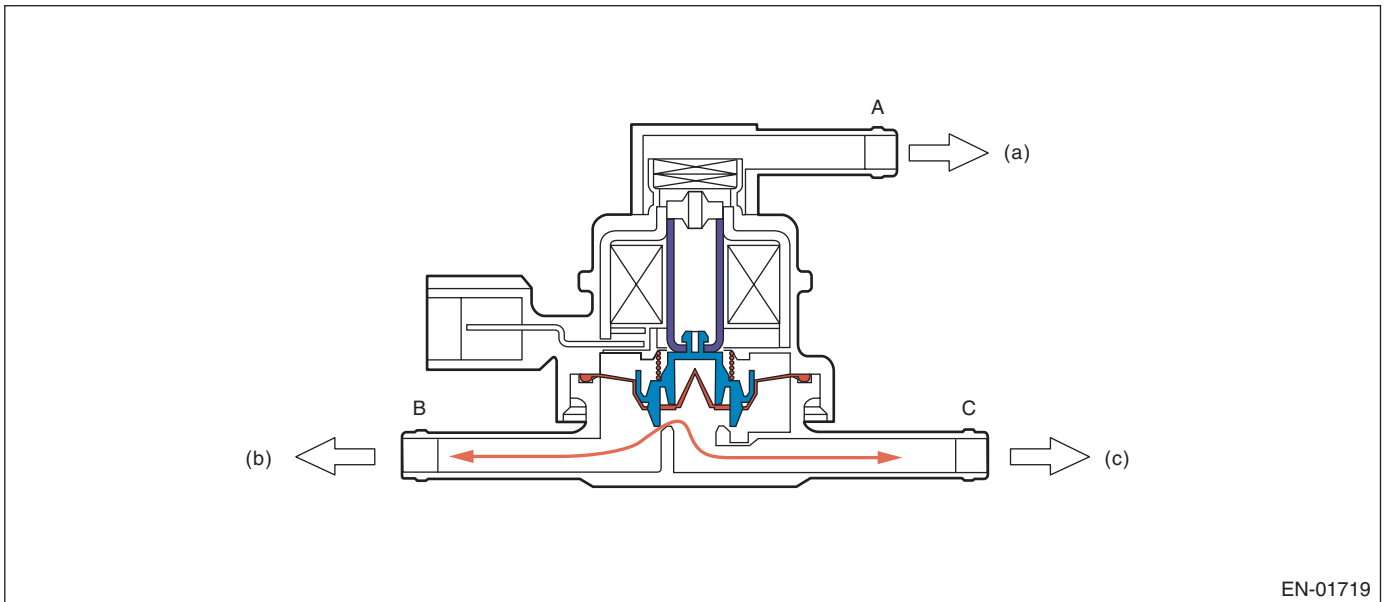
## GENERAL DESCRIPTION

### When $B < C$ (solenoid OFF)



- (1) Valve
- (a) Barometric pressure
- (b) Fuel tank
- (c) Canister

### When Solenoid is ON



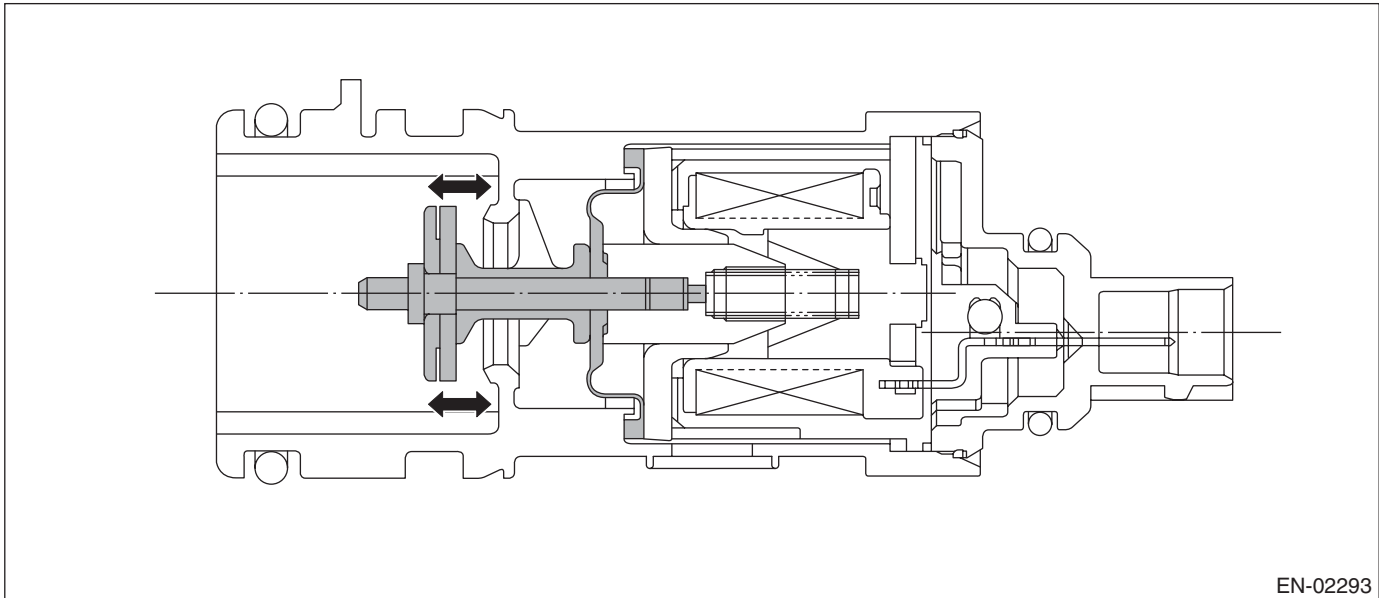
- (a) Barometric pressure
- (b) Fuel tank
- (c) Canister

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Drain valve

Drain valve controls the ambient air to be introduced to the canister.



EN-02293

## 3. ENABLE CONDITION

### 0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Barometric pressure	$\geq 75.05$ kPa (563 mmHg, 22.165 inHg)
Total time of canister purge operation	$\geq 120000$ ms
Elapsed time after starting the engine	$\geq 856$ sec
Learning value of evaporation gas density	$< 0.08$
Engine speed	1050 rpm — 6500 rpm
Fuel tank pressure	$\geq -4$ kPa (-30 mmHg, -1.181 inHg)
Intake manifold relative vacuum (relative pressure)	$\geq -13.33$ kPa (-100 mmHg, -3.937 inHg)
Vehicle speed	$\geq 32$ km/h (19.9 MPH)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Closed air/fuel ratio control	In operation
Fuel temperature	$-10$ °C (14 °F) — 45 °C (113 °F)
Intake air temperature	$\geq -10$ °C (14 °F)
Pressure change every one second	$< 1.7$ mmHg (Mode A) $< 1.7$ mmHg (Mode D)
Minimum pressure change value every one second – Maximum pressure change value every one second	$< 1.7$ mmHg (Mode A)
Change of fuel level per 128 milliseconds	$< 1.7$ mmHg (Mode D)
Air fuel ratio	$< 2$ L (0.528 US gal, 0.44 Imp gal) 0.76 — 1.25

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
<b>At starting a diagnosis</b>	
Evap. diagnosis	Incomplete
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	> 120000 ms
When cancelling in other than mode A	> 600000 ms
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 120 sec
Fuel temperature	-10 °C (14 °F) — 55 °C (131 °F)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Intake manifold relative vacuum (relative pressure)	≥ - 13.33 kPa (- 100 mmHg, - 3.937 inHg)
Fuel tank pressure	-0.43 kPa (-3.2 mmHg, -0.126 inHg) — 1.43 kPa (10.7 mmHg, 0.421 inHg)
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 6000 rpm
<b>During diagnosis</b>	
Change of fuel level	≤ Value of Map 4
Pressure change every one second	< 0.06 kPa (0.44 mmHg, 0.017 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 0.07 kPa (0.51 mmHg, 0.02 inHg) (Mode D)
Pressure change in tank every second	≤ 0.1 kPa (0.75 mmHg, 0.03 inHg)
Barometric pressure change	-0.48 kPa (-3.6 mmhg, -0.142 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode D) -0.32 kPa (-2.4 mmhg, -0.094 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode E)

### Map4

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Change (ℓ, US gal, Imp gal)	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1

## 4. GENERAL DRIVING CYCLE

### 0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

### 0.02-inch Diagnosis

- Perform the diagnosis 125 seconds or more at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### Purge control solenoid valve stuck open fault diagnosis

DTC

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

#### Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

#### DIAGNOSTIC METHOD

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

##### • Abnormality Judgment

If OK judgment cannot be made, extend Mode Z 16, and Judge as NG when the following conditions are established after predetermined amount of time.

#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	> 0.6 kPa (4.5 mmHg, 0.177 inHg)	P0457
evptezini	≤ 1.43 kPa (10.7 mmHg, 0.421 inHg)	
Time of 2 L (0.528 US gal, 0.44 Imp gal) or more fuel no sloshing	≥ 40000 ms	

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 13000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

##### • Normality Judgment

Judge as OK and change to Mode A when the following conditions are established after predetermined time has passed since Mode Z started.

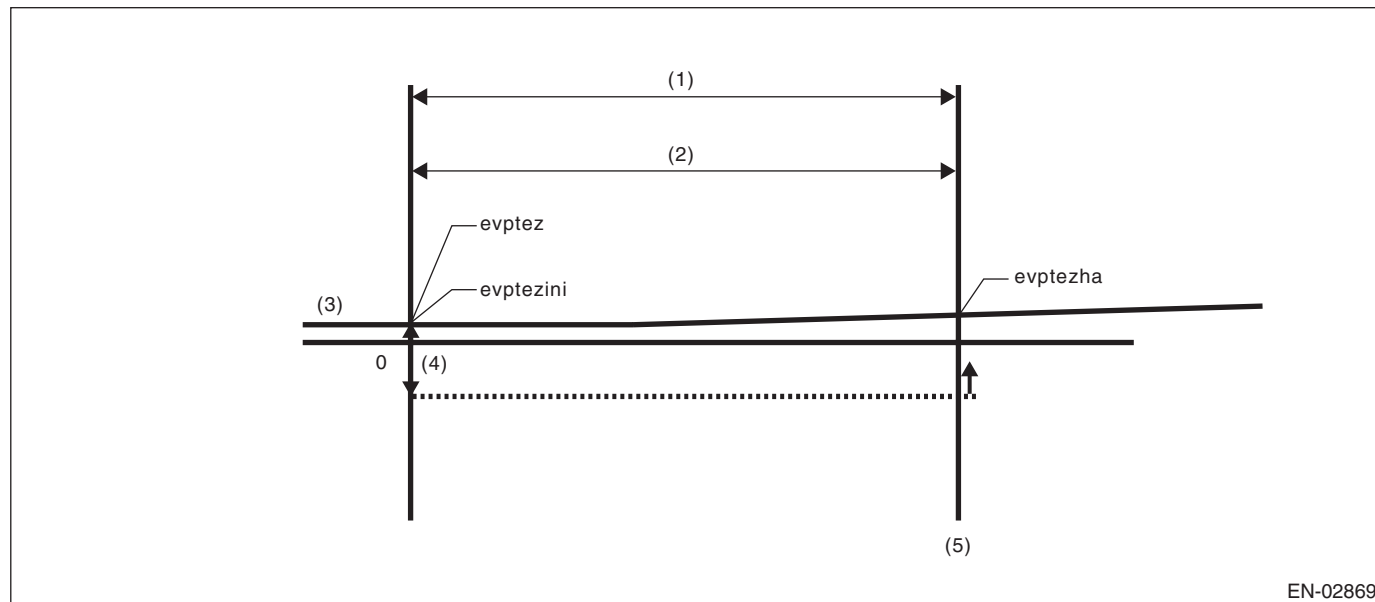
#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	≤ 0.4 kPa (3 mmHg, 0.118 inHg)	P0457

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Normal



- (1) Mode Z
- (2) 3000 ms

- (3) Fuel tank pressure
- (4) 0.4 kPa (3 mmHg, 0.118 inHg)

- (5) OK judgment

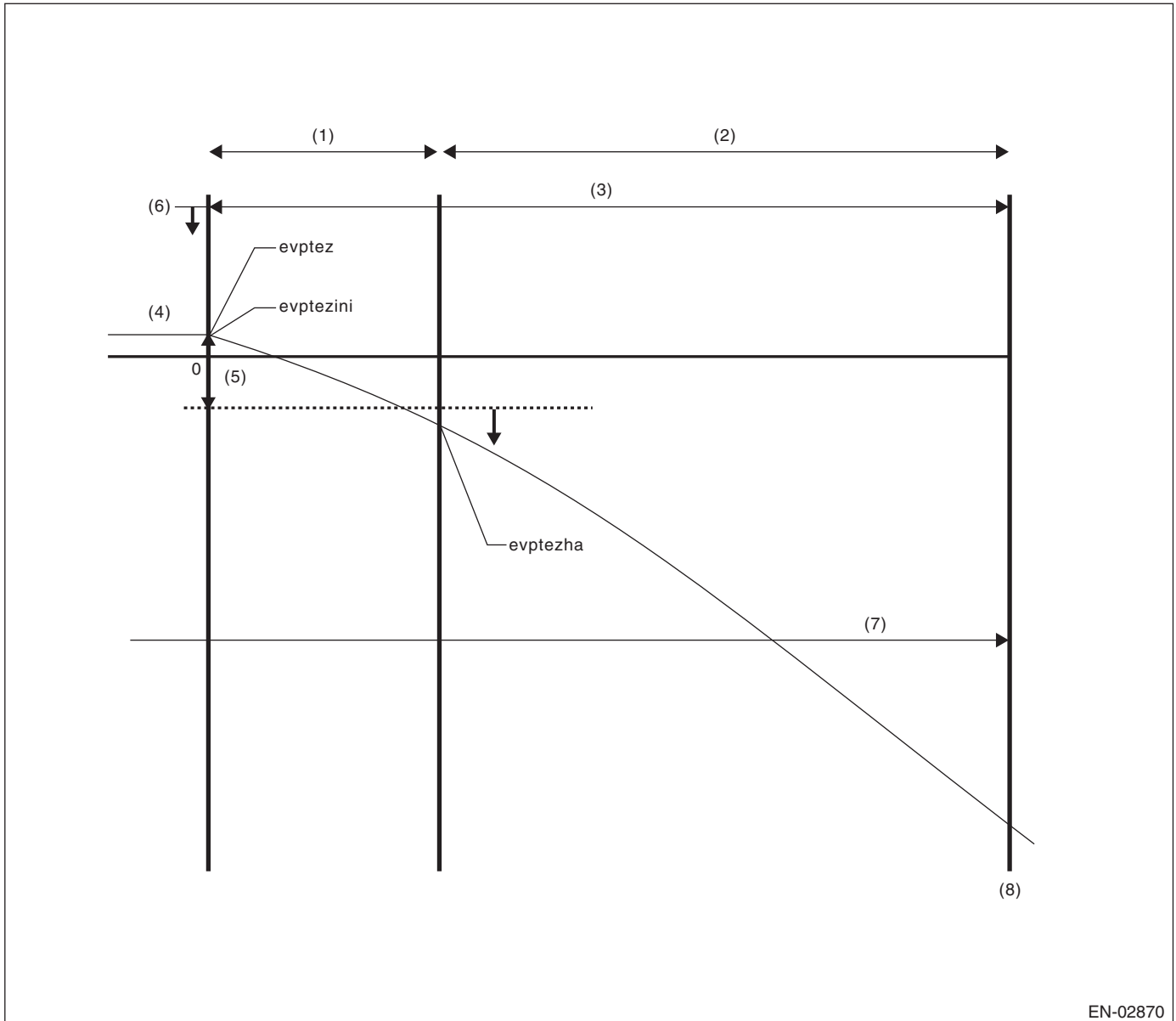
$evptez - evptezha \leq 0.4 \text{ kPa (3 mmHg, 0.118 inHg)}$  Normal when above is established

**Time Needed for Diagnosis:** 0 ms + 3000 ms

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Purge control solenoid valve Open Fixation



EN-02870

- |                        |                                    |                               |
|------------------------|------------------------------------|-------------------------------|
| (1) Mode Z             | (5) 0.6 kPa (4.5 mmHg, 0.177 inHg) | (7) 40000 ms no fuel sloshing |
| (2) Extended mode Z    | (6) 1.43 kPa                       | (8) NG judgment               |
| (3) 3000 ms + 13000 ms | (10.7 mmHg, 0.421 inHg)            |                               |
| (4) Fuel tank pressure |                                    |                               |

- $evptezini \leq 1.43 \text{ kPa}$  (10.7 mmHg, 0.421 inHg)
  - $evptez - evptezha > 0.6 \text{ kPa}$  (4.5 mmHg, 0.177 inHg)
  - No fuel sloshing of over 2 L (0.528 US gal, 0.44 Imp gal) lasts for more than 40000 ms.
- Judge as abnormal when all are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Leak Diagnosis

DTC

P0441 Evaporative emission system incorrect purge flow

P0442 Evaporative Emission Control System Leak Detected (Small Leak)

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

#### Mode A: (Estimated evaporation gas amount)

Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.

#### Mode B: (Negative pressure sealed)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -1.4 kPa (0 → -10.5 mmHg, 0 → -0.413 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.

#### Abnormality Judgment

Judge as NG (large leakage) when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time to reach target negative pressure or Mode B time (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started)	≥ 10000 ms + 25000 ms  ≥ 10000 ms > -0.33 kPa (-2.5 mmHg, -0.098 inHg)	P0457

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms

#### Mode C: (Check pressure rise)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D when the tank pressure returns to the start level of P2 calculation.

Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

Tank pressure when starting calculation of P2	Time for advanced OK judgment
-1.3 kPa (-9.75 mmHg, -0.384 inHg)	17000 ms

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 17000 ms

#### Mode D: (Measure amount of negative pressure change)

Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.

After calculating P2, perform a small leak diagnosis according to the items below.

#### When Mode D is ended

Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

## Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 - × P1 P2: Tank pressure that changes every 10000 ms in mode D P1: Tank pressure that changes every 10000 ms in mode A	> Value of Map 5	P0442

\*1.5 -: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

## Map 5 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	40 °C (104 °F)	45 °C (113 °F)
0 L (0 US gal, 0 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.35 kPa (2.6 mmHg, 0.102 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.41 kPa (3.05 mmHg, 0.12 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.45 kPa (3.35 mmHg, 0.132 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)

## Purge control solenoid valve 2 stuck close diagnosis

Perform purge control solenoid valve 2 stuck close diagnosis using the variation gap between the tank pressure at the end of mode C and after mode C.

Malfunction Criteria	Threshold Value	DTC
Elapsed time after completion of mode C advanced OK judgement	= 3500 ms	P0441
Tank pressure variation after completion of mode C advanced OK judgement	< 0.758 mmHg	

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 17000 ms + 10000 ms  
**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Leak Diagnosis

#### DTC

P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

#### Mode A: (0 point compensation)

When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.

#### Mode B: (Negative pressure introduced)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -2 kPa (0 → -15 mmHg, 0 → -0.591 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.

#### Mode C: (Negative pressure maintained)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the predetermined amount of time has passed.

#### Mode D: (Calculate the amount of negative pressure change)

Monitor the tank pressure in mode D, calculate (P2) the pressure change in the tank, and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis.

#### Normality Judgment

Judge as OK when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
<b>Advanced OK judgment 1</b>	
Mode D time	≥ 0 ms + 20000 ms
Tank internal pressure	≤ Value of Map 6
<b>Advanced OK judgment 2</b>	
Mode D time	≥ 0 ms + 200000 ms
P2	≤ Value of Map 7

#### Map6

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	-1.85, -13.9, -0.547	-1.85, -13.9, -0.547	-1.84, -13.8, -0.543	-1.83, -13.7, -0.539	-1.81, -13.6, -0.535	-1.8, -13.5, -0.531	-1.8, -13.5, -0.531

#### Map7

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	0.93, 7, 0.276	0.93, 7, 0.276	0.94, 7.05, 0.278	0.95, 7.1, 0.28	1.09, 8.2, 0.323	1.28, 9.6, 0.378	1.28, 9.6, 0.378

#### Mode E: (Evaporation occurrence amount calculation)

Calculate the change of tank pressure with the time evpdset to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• **Abnormality Judgment**

Judge as NG when the following conditions are established.

**Judgment Value**

Malfunction Criteria	Threshold Value
P1	< Value of Map 8

**Map 8 Malfunction criteria limit for evaporation diagnosis**

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.25 kPa (1.85 mmHg, 0.073 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)
50 L (13.21 US gal, 11 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Normality Judgment

Judge as OK when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
P1	> Value of Map 9

### Map 9 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.4 kPa (3 mmHg, 0.118 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.3 kPa (2.25 mmHg, 0.089 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

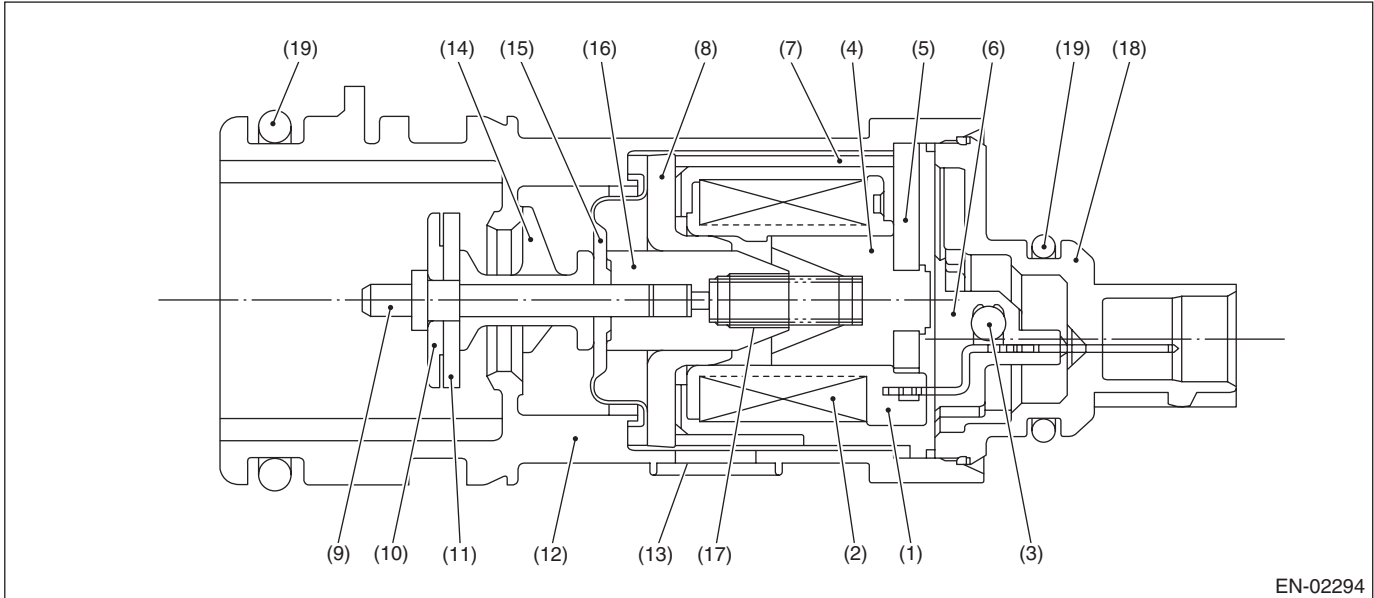
## BM:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

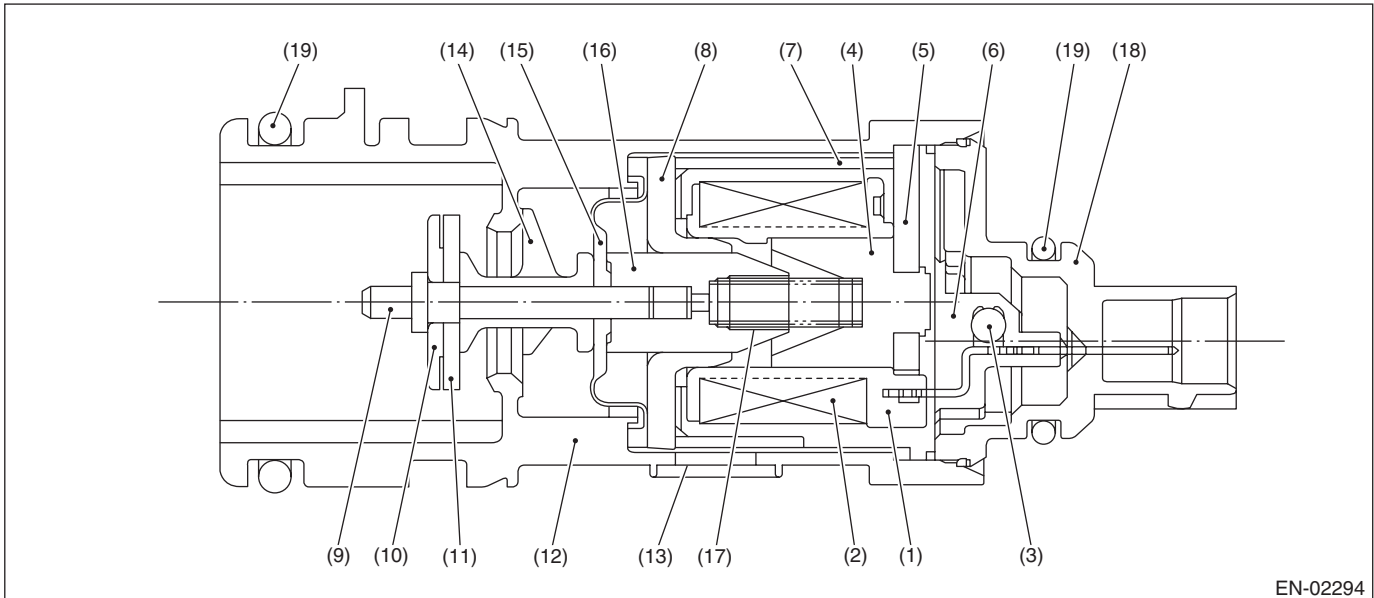
## BN:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

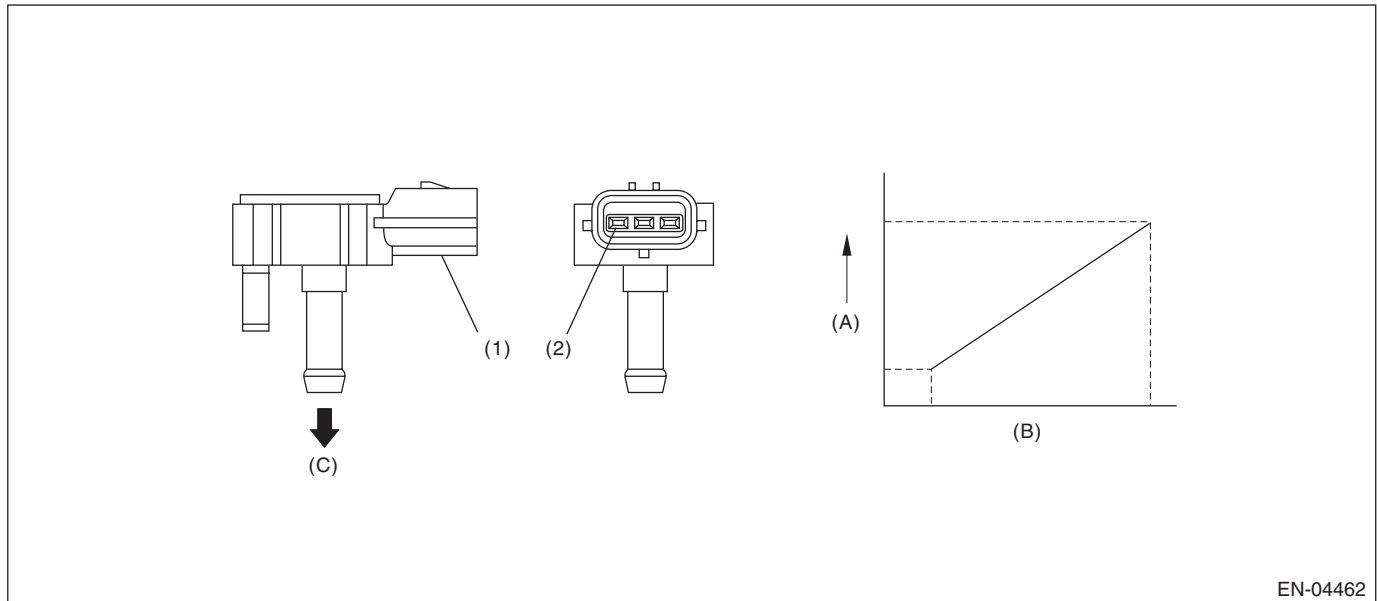
## BO:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

### 1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.

Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 60 sec
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Fuel temperature	< 35 °C (95 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)

### 4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 sec have passed since the engine started.
- Pay attention to the fuel level and temperature.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Number of times that the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more (with enable condition established)	≥ 16 time
Maximum – Minimum tank pressure (with enable condition completed)	< 0.05 kPa (0.375 mmHg, 0.015 inHg)
Maximum – Minimum fuel temperature (with enable condition completed)	≥ 7 °C (44.6 °F)

If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is less than 2 L (0.528 US gal, 0.44 Imp gal), extend 60 sec and make judgment with the Max. and Min. values for the fuel level in 60 sec × 2. If a difference does not appear, extend the time (60 sec × 3, 60 sec × 4, 60 sec × 5) and continue the judgment. If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

**Time Needed for Diagnosis:** 60 sec × 16 time or more

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Maximum – Minimum tank pressure	≥ 0.05 kPa (0.375 mmHg, 0.015 inHg)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

### 9. ECM OPERATION AT DTC SETTING

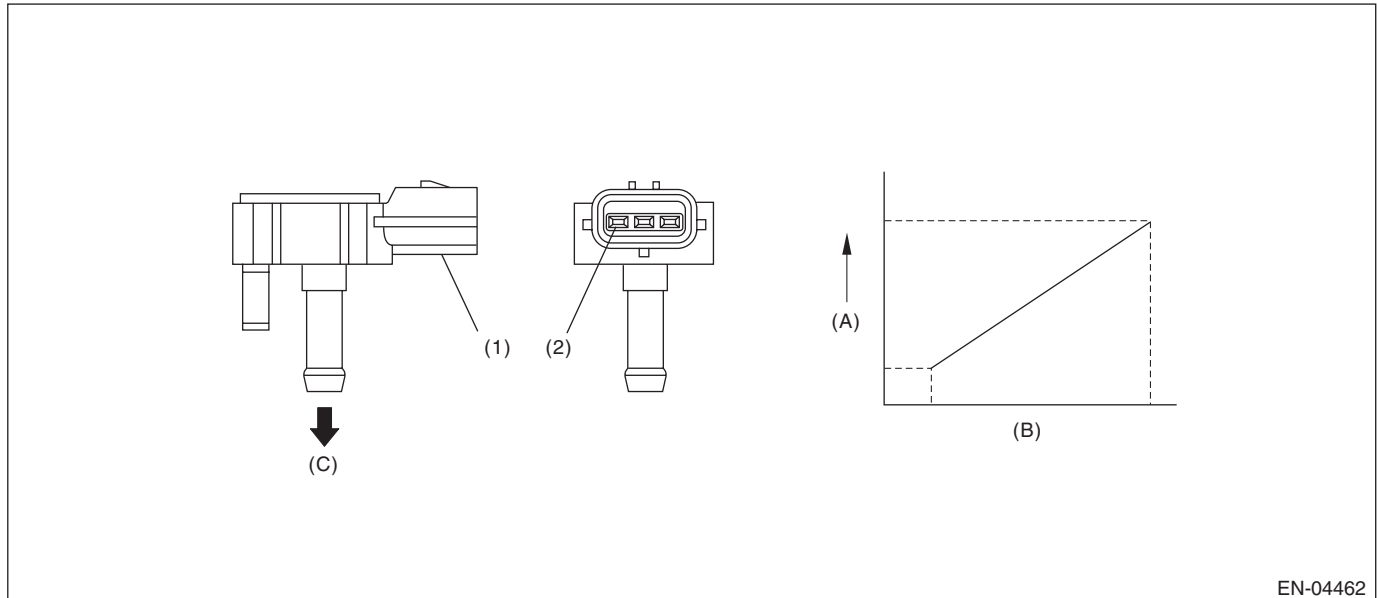
Memorize the freeze frame data. (For test mode \$02)

## BP:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-04462

- |               |                    |                  |
|---------------|--------------------|------------------|
| (1) Connector | (A) Output voltage | (C) To fuel tank |
| (2) Terminals | (B) Input voltage  |                  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< -7.44 kPa (-55.85 mmHg, -2.199 inHg)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$\geq -7.44$ kPa ( $-55.85$ mmHg, $-2.199$ inHg)
Battery voltage	$\geq 10.9$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

### 9. ECM OPERATION AT DTC SETTING

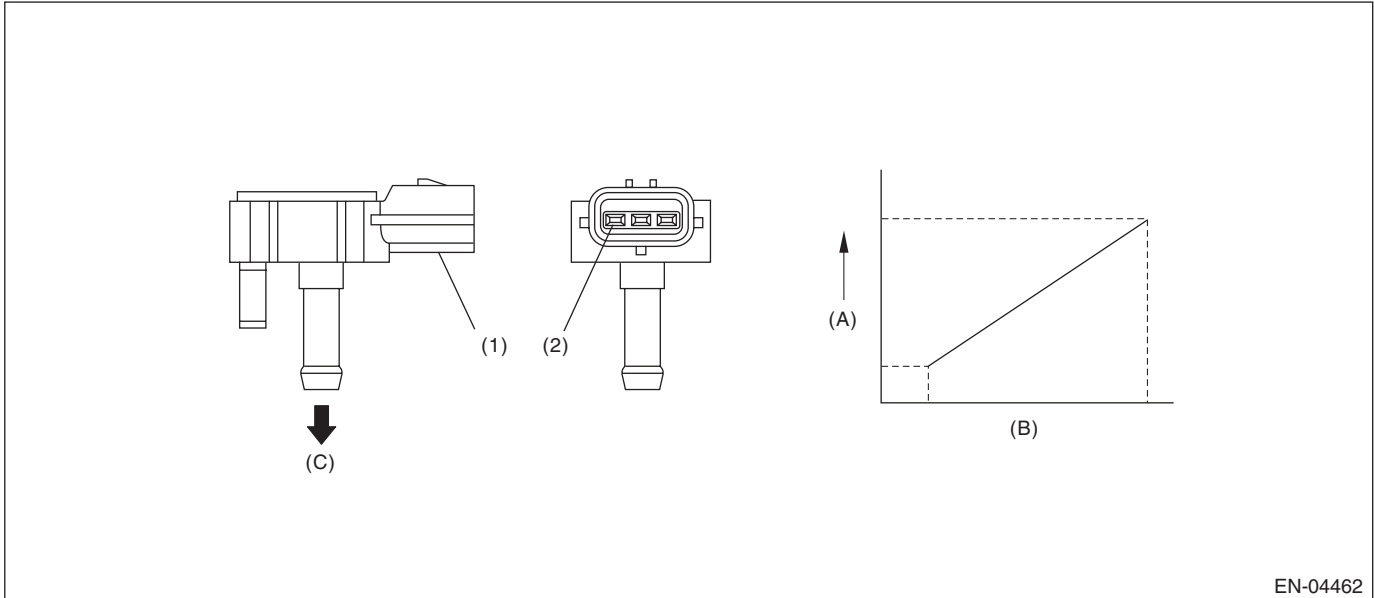
Memorize the freeze frame data. (For test mode \$02)

## BQ:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 5000$ ms
Vehicle speed	$\geq 2$ km/h (1.2 MPH)
All conditions of EVAP canister purge	Completed
Learning value of evaporation gas concentration (left and right)	$< 0.08$
Main feedback compensation coefficient (left and right)	$\geq 0.9$
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ 7.98 kPa (59.85 mmHg, 2.356 inHg)
Fuel temperature	< 35 °C (95 °F)
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< 7.98 kPa (59.85 mmHg, 2.356 inHg)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **BR:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H4DOTC)-140, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BS:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H4DOTC)-140, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

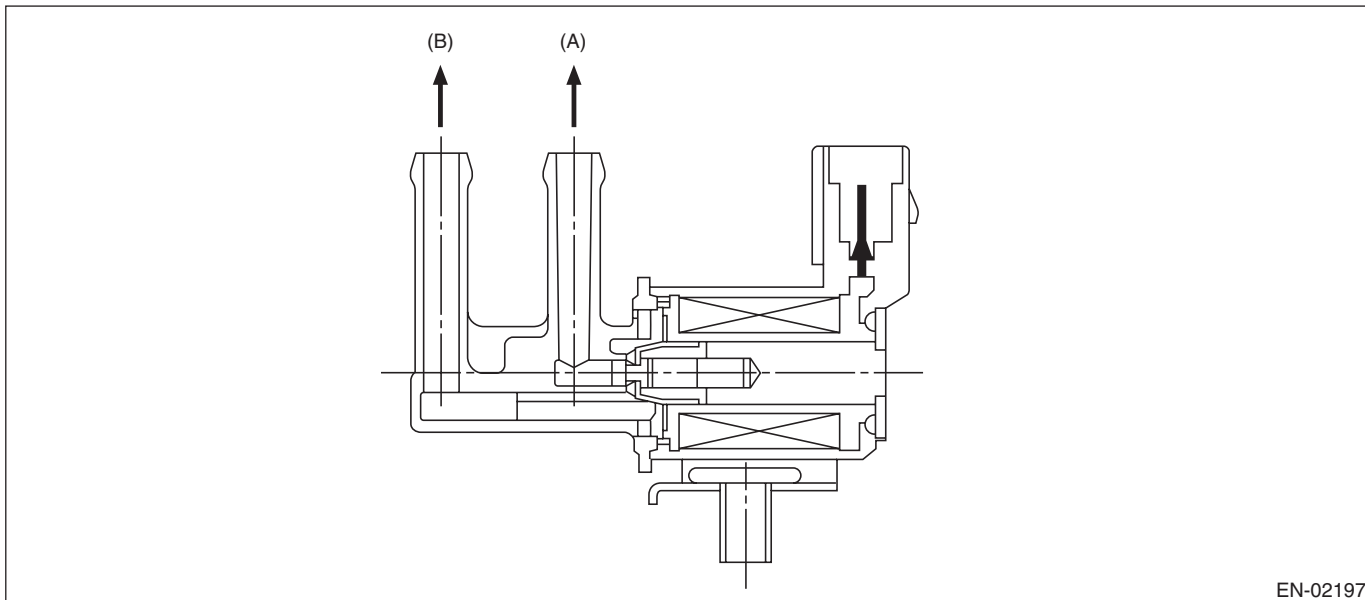
## BT:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	< 0.75
Terminal output voltage	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

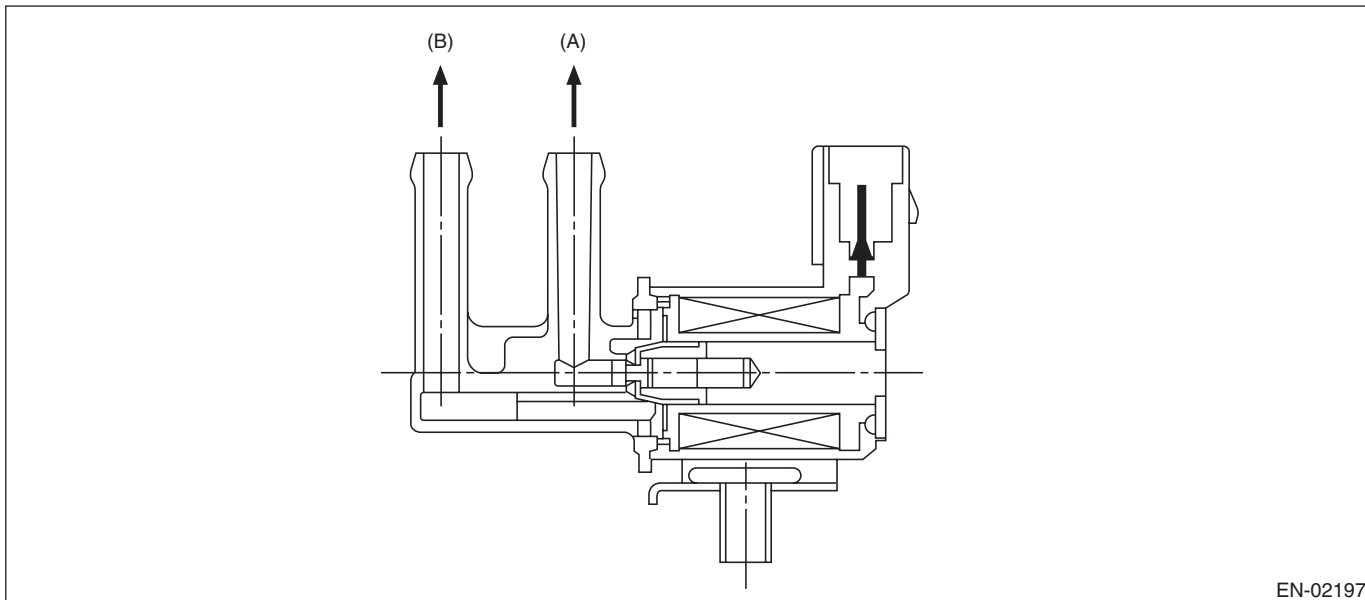
## BU:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	$\geq 0.25$
Terminal output voltage	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

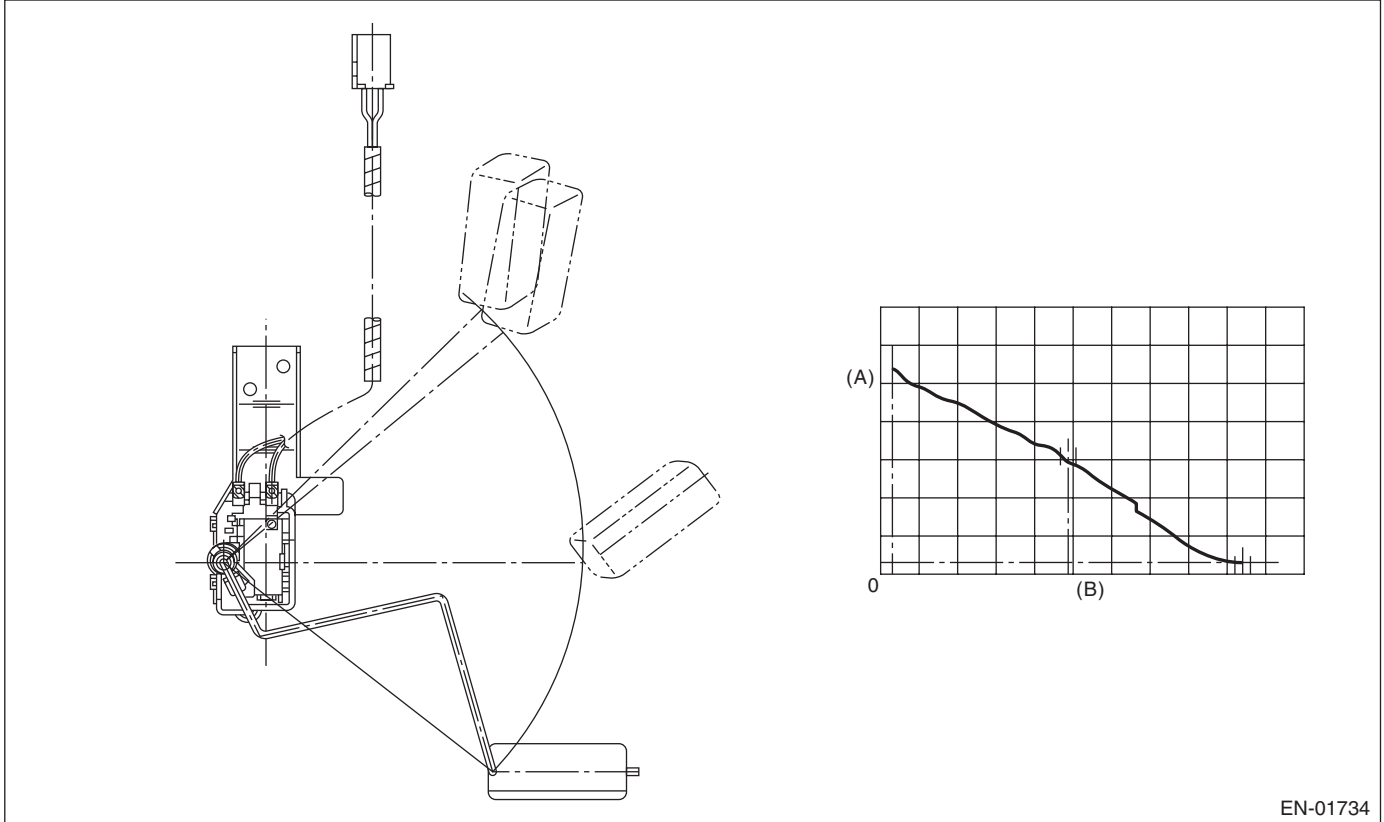
## BV:DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

### 2. COMPONENT DESCRIPTION



EN-01734

(A) Fuel level

(B) Resistance

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	< 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6500 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	≥ 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6500 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

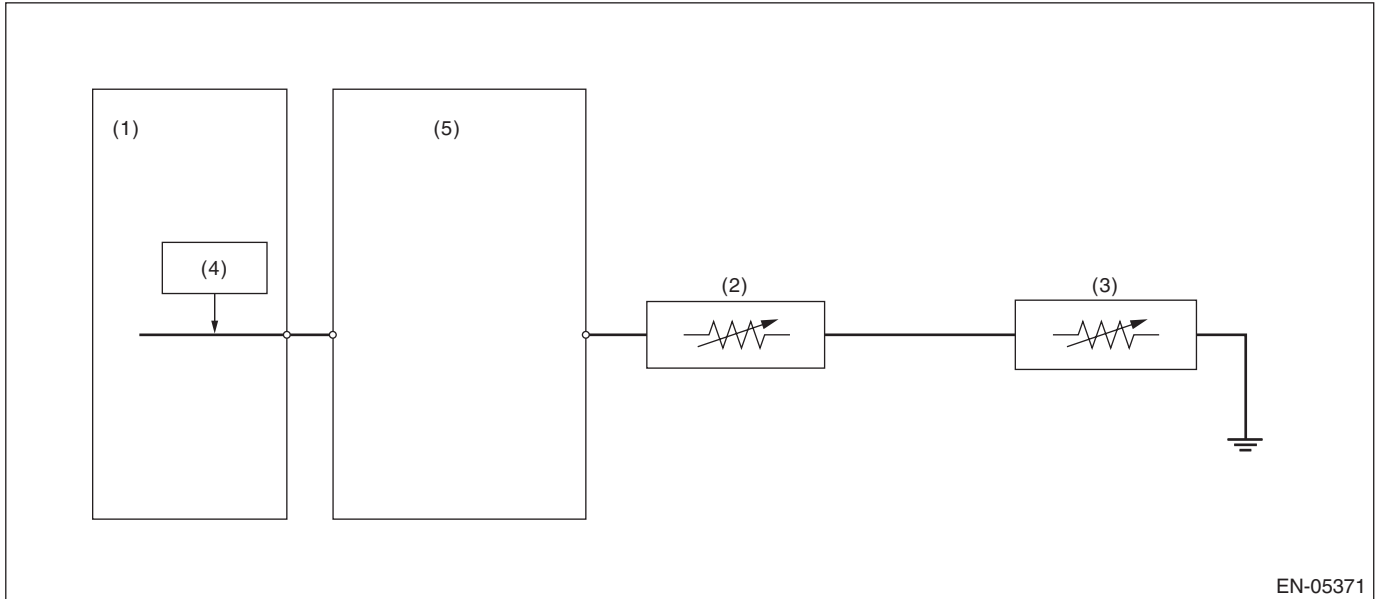
GENERAL DESCRIPTION

## BW:DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel sub level sensor

(4) Detecting circuit

(2) Fuel level sensor

(5) Body integrated unit

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 0.173$ V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 0.173$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

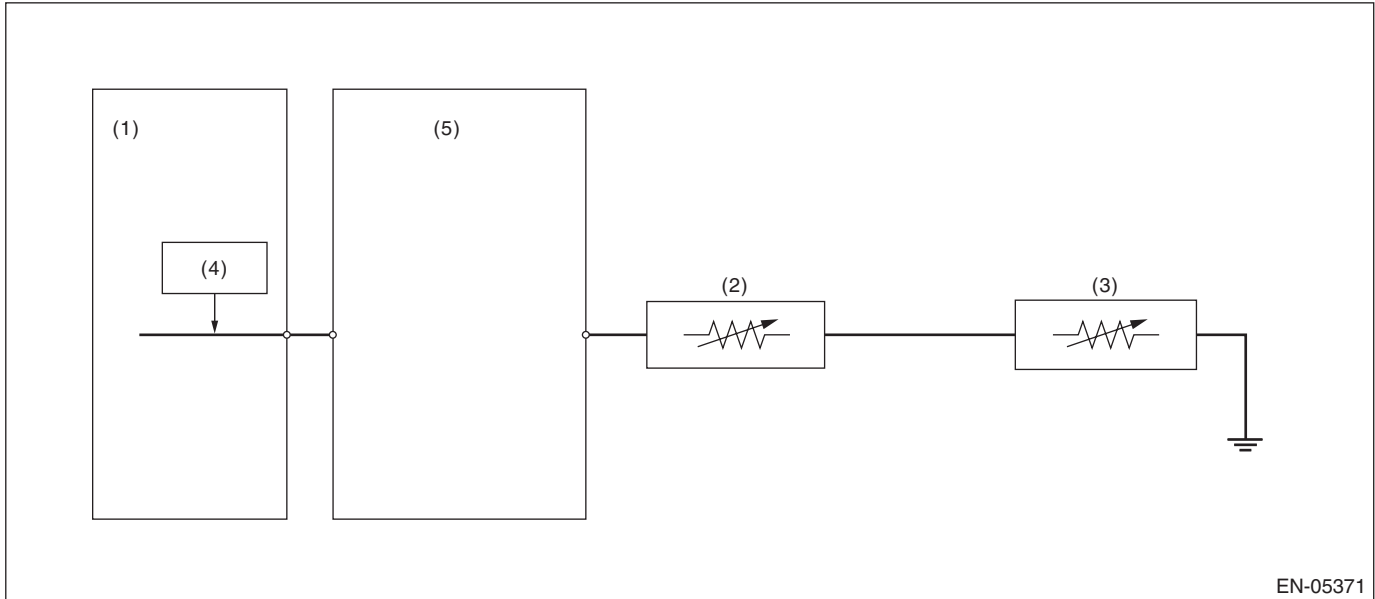
Memorize the freeze frame data. (For test mode \$02)

## BX:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |                                 |                           |                       |
|---------------------------------|---------------------------|-----------------------|
| (1) Engine control module (ECM) | (3) Fuel sub level sensor | (4) Detecting circuit |
| (2) Fuel level sensor           | (5) Body integrated unit  |                       |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 7.212$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 7.212$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BY:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

### 1. OUTLINE OF DIAGNOSIS

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

### 2. ENABLE CONDITION

Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal) and < 54.4 L (14.372 US gal, 11.968 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

### 3. GENERAL DRIVING CYCLE

- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

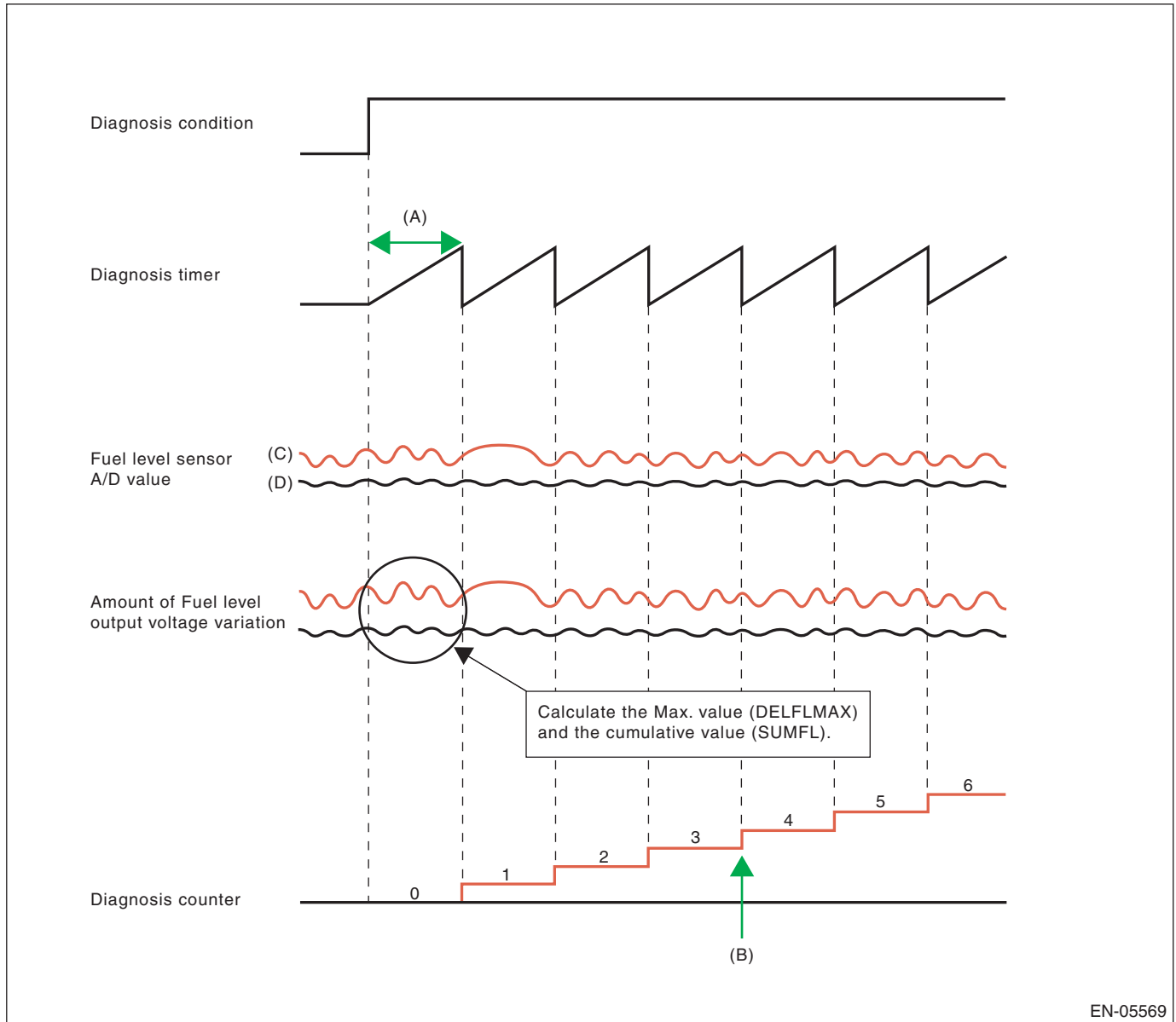


# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 4. DIAGNOSTIC METHOD

Calculate the Max. value (DELFLMAX) and cumulative value (SUMFL) of output voltage variation of fuel level sensor during 12.2 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time.



- (A) 12288 ms
- (B) NG at 4 time

(C) Malfunction

(D) Normal

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, DELFLMAX or SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	$\geq 4$ time $\geq$ Value from Map $\geq 25.92$ V

### Map

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Measured voltage (V)	0.27	0.27	0.426	0.582	0.738	0.894	0.894

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

Maximum value – Minimum value of change of tank pressure for 12288 ms	$\geq 0.05$ kPa (0.375 mmHg, 0.015 inHg)
Maximum value – Minimum value of battery voltage for 12288 ms	$\geq 0.969$ V

**Time Needed for Diagnosis:** 12288 ms × 4 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
DELFLMAX SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	$<$ Value from Map $< 25.92$ V

**Time Needed for Diagnosis:** 12288 ms

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BZ:DTC P0500 VEHICLE SPEED SENSOR “A”

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.

Judge NG when the received data from ABSCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

#### 2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the ABS control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the ABS control module and hydraulic control unit.

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 2000 ms

#### 4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Front ABS wheel speed sensor status	Malfunction
Either of the following is established	
Front left wheel speed	≥ 300 km/h (186.4 MPH)
Front right wheel speed	≥ 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 512 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Front left wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)
Front right wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 512 ms

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Accelerator sensor signal process: Not allowed full closed point learning (hold the previous value)
- ABS wheel speed sensor signal process: Vehicle speed = 10 km/h (6 MPH)
- Fuel cut control: Not allowed vehicle speed 0 km/h (0 MPH) fuel cut. Normally the high vehicle speed fuel cut performs on vehicle speed condition and engine speed, but perform the fuel cut only on engine speed condition (4400 rpm or more).
- ISC control: Open loop compensation is set to (1 g (0.04 oz) oz/s) Not allowed ISC feedback volume calculation.
- Air conditioner control: Not allowed air conditioner cut at accelerating.
- Radiator fan control: Both main and sub fan ON drive
- Gear ratio judgment: Gear = Control as fixed in sixth gear
- Tumble generator valve control: Open the tumble generator valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CA:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 70 °C (158 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 and < 1.1
After switching air conditioner to ON/ OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed — Targeted engine speed	< -100 rpm
Feedback value for ISC	Max.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed — Targeted engine speed	≥ -100 rpm

**Time Needed for Diagnosis:** 10 sec

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CB:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 70 °C (158 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	≥ 200 rpm
Feedback value for ISC	Min.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	< 200 rpm

**Time Needed for Diagnosis:** 10 sec

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### CC:DTC P0512 STARTER REQUEST CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.

Judge as ON NG when the starter SW signal remains ON.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Engine condition	After engine starting
Starter OFF signal	Not detected
Battery voltage	$\geq 8\text{ V}$

**Time Needed for Diagnosis:** 180000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Starter OFF signal	Detected
Battery voltage	$\geq 8\text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CD:DTC P0513 INCORRECT IMMOBILIZER KEY

### 1. OUTLINE OF DIAGNOSIS

DTC	Item	Outline of Diagnosis
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
P1570	Antenna	Faulty antenna
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
P1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
P1574	Key Communication Failure	Failure of body integrated unit to verify key (transponder) ID code or transponder failure
P1576	EGI Control Module EEPROM	ECM malfunctioning
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
P1578	Meter Failure	Reference code incompatibility between body integrated unit and combination meter

### 2. ENABLE CONDITION

When starting the engine.

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

### 4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### CE:DTC P0600 SERIAL COMMUNICATION LINK

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

When CAN communications is not possible, and CAN communications with AT is not possible, judge as NG if data from the AT is not normal.

#### 2. COMPONENT DESCRIPTION

ECM and TCM are connected by high speed CAN.

##### *(Common Specifications)*

***CAN Protocol 2.0 B (Active)***

***Frame Format: 11 Bit ID Frame (Standard Frame)***

##### *(High speed CAN)*

***Conforms to ISO11898***

***Communication Speed: 500 kbps***

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge as NG when the following conditions are established.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	set (error)
or	
ID received from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milliseconds
or	
Data updated from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milliseconds

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	clear (No error)
ID received from body integrated unit, TCM, ABSCM and VDCCM	Yes
Data updated from body integrated unit, TCM, ABSCM and VDCCM	Yes

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Accelerator pedal position sensor request target throttle opening calculation: AT protection torque guard is normally obtained from CAN communication. Preset value is 408 N·m (42 kgf-m, 301 ft-lb).

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### CF:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

When there is a problem in the main CPU normal RAM, or the sub CPU normal RAM, judge as NG. Judge as OK when both are operating properly.

If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge as NG when the following conditions are established.

##### Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value to RAM and then read.	The written value cannot be read.

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

##### Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value to RAM and then read.	The written value can be read.

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CG:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

#### Time Needed for Diagnosis:

- Main CPU: 16 milliseconds × 32 time
- Sub CPU: 16 milliseconds × 2 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

#### Time Needed for Diagnosis:

- Main CPU: 16 milliseconds × 125 time
- Sub CPU: 16 milliseconds × 2 time

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

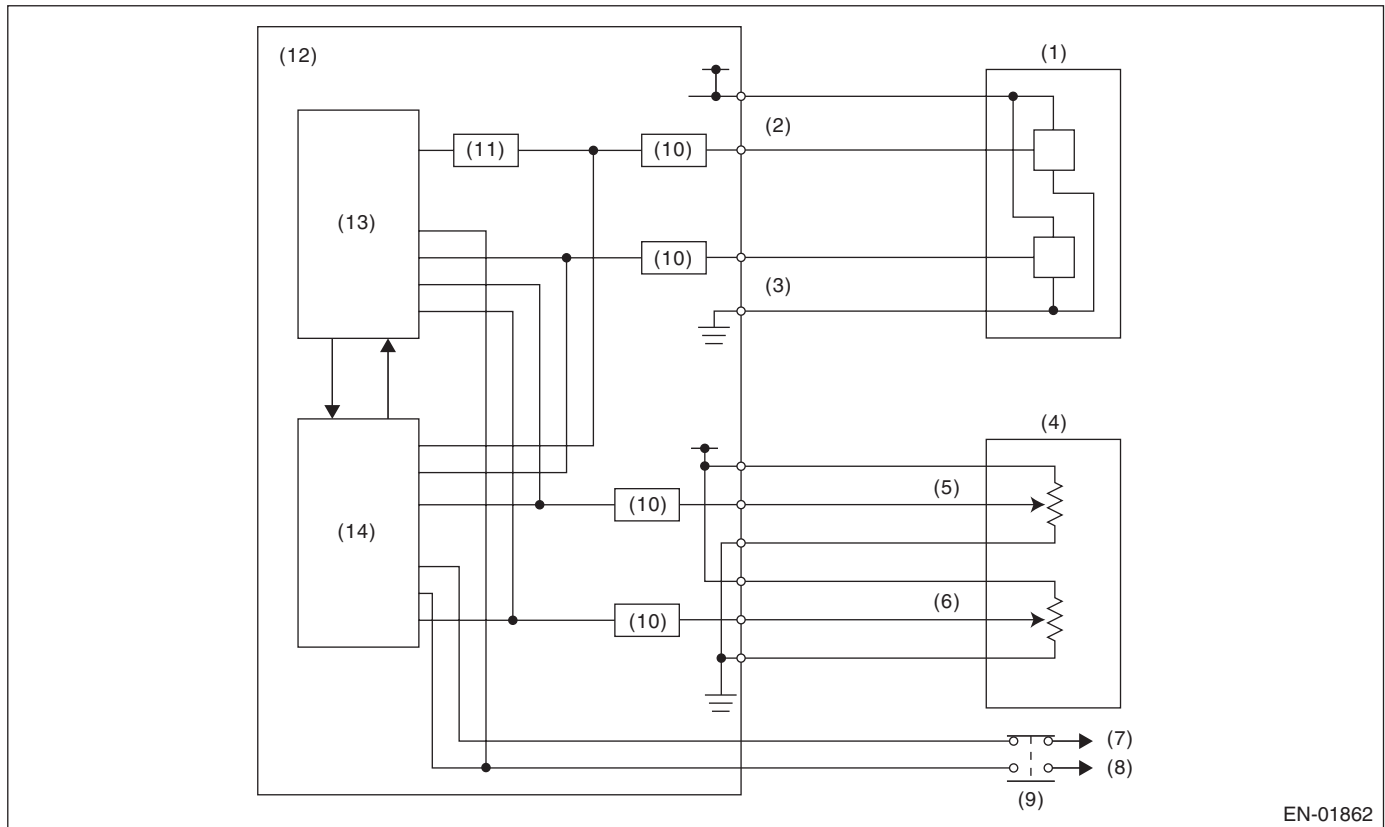
### CH:DTC P0607 CONTROL MODULE PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.

- (1) When the read value of throttle position sensor 1 signal is mismatched between main CPU and sub CPU.
- (2) When the read value of accelerator pedal position sensor 1 signal is mismatched between main CPU and sub CPU.
- (3) When the sub CPU operates abnormally.
- (4) When the communication between main CPU ← → sub CPU is abnormal.
- (5) When the input amplifier circuit of throttle position sensor 1 is abnormal.
- (6) When the cruise control cannot be canceled correctly.
- (7) When the signal of brake SW1 and 2 is mismatched.

#### 2. COMPONENT DESCRIPTION



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- |   |   |                                  |
|---|---|----------------------------------|
| (1) Throttle position sensor            | (6) Accelerator pedal position sensor 2 | (11) Amplifier circuit           |
| (2) Throttle position sensor 1          | (7) Battery                             | (12) Engine control module (ECM) |
| (3) Throttle position sensor 2          | (8) Stop light                          | (13) Sub CPU                     |
| (4) Accelerator pedal position sensor   | (9) Brake switch                        | (14) Main CPU                    |
| (5) Accelerator pedal position sensor 1 | (10) I/F circuit                        |                                  |

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(1) Battery voltage	$\geq 6\text{ V}$
(2) Ignition switch	ON
(2) Battery voltage	$\geq 6\text{ V}$
(3) Ignition switch	ON
(3) Battery voltage	$\geq 6\text{ V}$
(4) Ignition switch	ON
(4) Battery voltage	$\geq 6\text{ V}$
(5) Throttle opening angle	
(5) Ignition switch	ON
(5) Battery voltage	$\geq 6\text{ V}$
(6) Brake switch (only with cruise control)	ON
(6) Ignition switch	ON
(6) Battery voltage	$\geq 6\text{ V}$
(7) Ignition switch	ON
(7) Battery voltage	$\geq 6\text{ V}$

## 4. GENERAL DRIVING CYCLE

- (1) — (4): Always perform the diagnosis continuously.  
 (5): Always perform the diagnosis continuously when idling.  
 (6): Perform the diagnosis when the brake pedal is depressed.  
 (7): Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
(1) Difference of CPU reading value of the throttle position sensor signal	$\geq 0.4058\text{ V}$
(2) Difference of CPU read value of the accelerator pedal position sensor signal	$\geq 0.127542424\text{ V}$
(3) WD pulse from sub CPU	No WD pulse occur
(4) Communication between CPU	Not possible to communicate
(5)  Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	$\geq 3\text{ deg}$
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal OFF
(7) Brake switch 1, 2 signal	SW 1 and 2 are not matched

### Time Needed for Diagnosis:

- (1): 600 msec  
 (2): 830 msec  
 (3): 200 msec  
 (4): 200 msec  
 (5): 24 msec  
 (6): 250 msec  
 (7): 200 ms



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
(1) Difference of CPU reading value of the throttle position sensor signal	< 0.4058 V
(2) Difference of CPU read value of the accelerator pedal position sensor signal	< 0.127542424 V
(3) WD pulse from sub CPU	WD pulse occur
(4) Communication between CPU	Possible to communicate
(5)  Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	< 3 deg
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal ON
(7) Brake switch 1, 2 signal	SW 1 and 2 are matched

### Time Needed for Diagnosis:

- (1): 2000 msec
- (2): 2000 msec
- (3): 2000 msec
- (4): 2000 msec
- (5): 24 msec
- (6): 2000 msec
- (7): 2000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

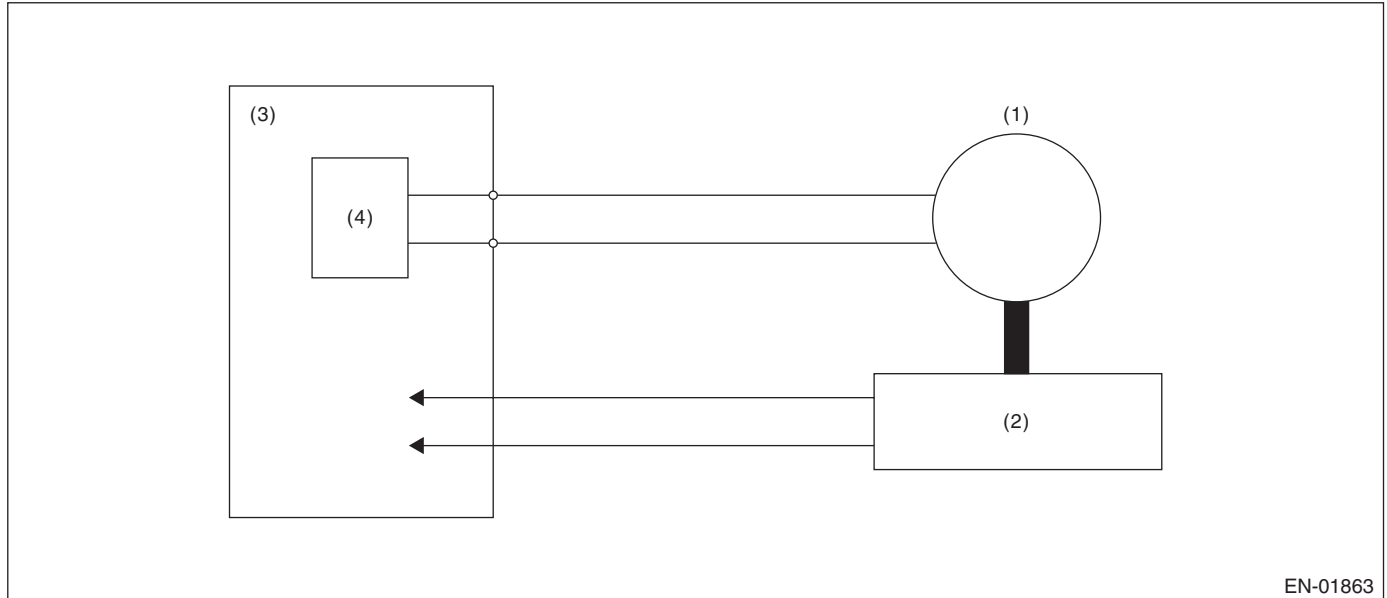
Memorize the freeze frame data. (For test mode \$02)

## CI: DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

### 2. COMPONENT DESCRIPTION



- (1) Motor
- (2) Throttle position sensor
- (3) Engine control module (ECM)
- (4) Drive circuit

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Normal operation of electric throttle control	ON

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electric throttle control is operating.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	≥ Value of Map 1
Output duty to drive circuit	≥ 95%

#### Map1

Target throttle opening angle (°) = d	0 ≤ d < 6.15	6.15 ≤ d < 9.65	9.65 ≤ d < 14.65	14.65 ≤ d < 26.65	26.65 ≤ d
Difference between target opening angle and actual opening angle (°)	3.5	5	12	25	25

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle: 1000 milliseconds (when target opening angle > actual opening angle) or value of Map 2 (when target opening angle ≤ actual opening angle)
- Output duty to drive circuit: value of Map 3

### Map2

Throttle position sensor 1 opening angle (°) = d	0 ≤ d < 5.5	5.5 ≤ d < 9	9 ≤ d < 13	13 ≤ d < 22	22 ≤ d
Judgment time (milliseconds)	1000	400	300	250	250

### Map 3

Voltage to drive circuit (V)	6	8	10	12	14	16
Judgment time (milliseconds)	2000	2000	2000	2000	2000	2000

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	< Value of Map 1
Output duty to drive circuit	< 95%

### Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle: 2000 msec
- Output duty to drive circuit: 2000 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CJ:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the AT and there is a MIL lighting request.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
MIL lighting request from TCM	Yes

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
MIL lighting request from TCM	None

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CK:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge as NG when the neutral terminal input in ECM differs from the received data from TCM.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Starter relay	OFF

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after two seconds have passed since the engine started.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "OFF" and when the other switches are "ON"	LOW (ON)

**Time Needed for Diagnosis:** 100 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "OFF" and when the other switches are "ON"	HIGH (OFF)

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CL:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

### 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	LOW (ON) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed ≥ 0 km/h (0 MPH)	

**Time Needed for Diagnosis:** 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to HIGH (OFF).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed ≥ 0 km/h (0 MPH)	

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **7. FAIL SAFE**

Cruise control: Not allowed to command cruise control.

### **8. ECM OPERATION AT DTC SETTING**

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CM:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

### 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "ON" and when the other switches are "OFF"	HIGH (OFF)

**Time Needed for Diagnosis:** 100 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "ON" and when the other switches are "OFF"	LOW (ON)

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CN:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

#### 1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Starter relay	OFF

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	HIGH (OFF) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

##### Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to LOW (ON).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed $\geq 0$ km/h (0 MPH)	

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CO:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

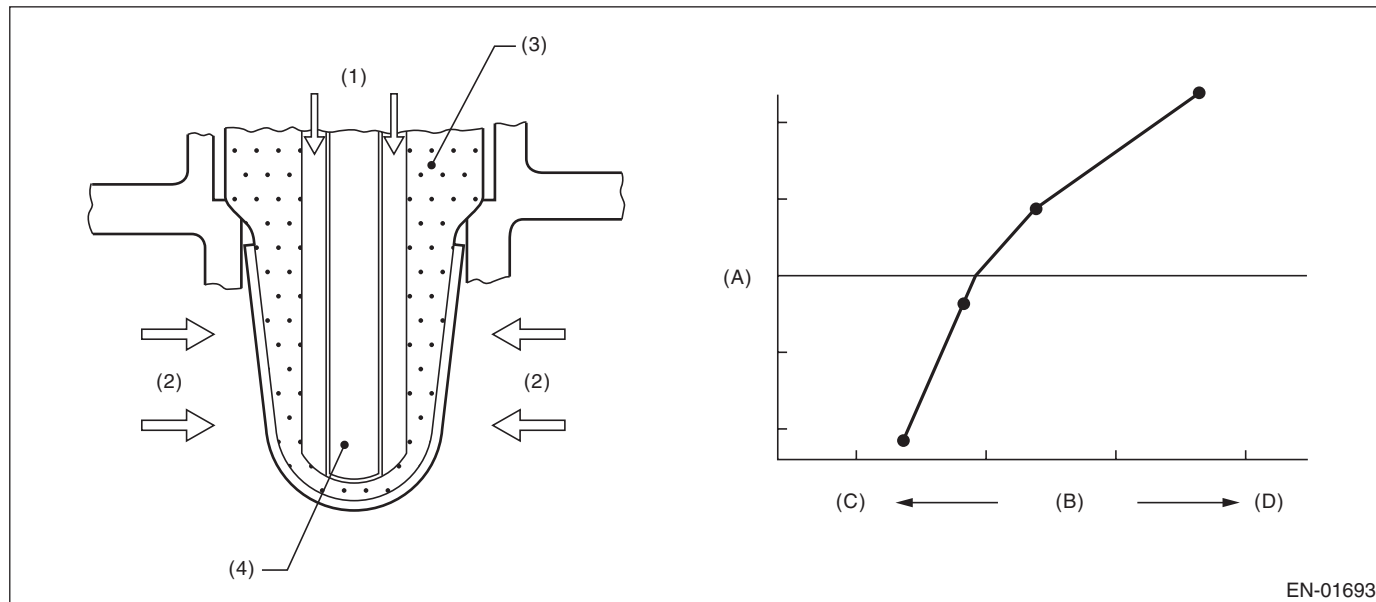
#### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains low.

Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio  
 $\lambda > 1$ : Lean  
 $\lambda < 1$ : Rich

#### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

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# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	–0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 70 °C (158 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.212 oz/s)
180°Load change at CA	< 0.02 g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 sec
Targeted lambda value load compensation coefficient	–1 — 1

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
λ value	< 0.85

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
λ value	≥ 0.85

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## CP:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

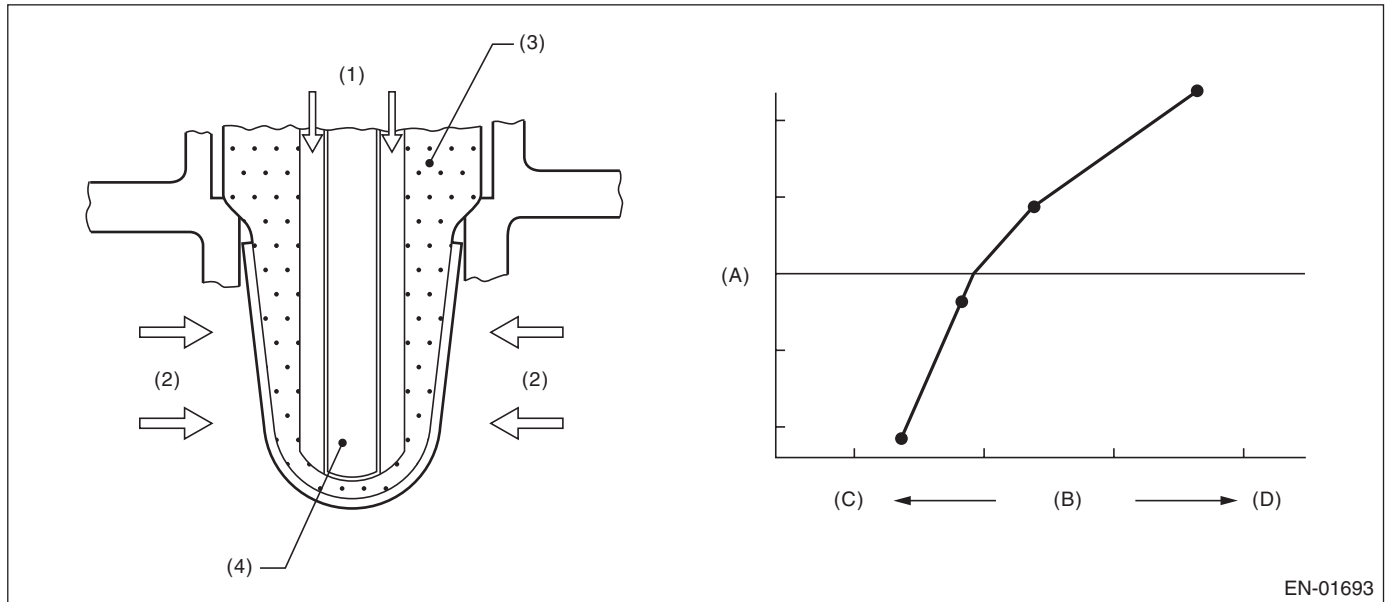
### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains high.

Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio  
 $\lambda > 1$ : Lean  
 $\lambda < 1$ : Rich

### 2. COMPONENT DESCRIPTION



- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	–0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 70 °C (158 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.212 oz/s)
180°Load change at CA	< 0.02 g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 sec
Targeted lambda value load compensation coefficient	–1 — 1

### 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
λ value	> 1.15

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
λ value	≤ 1.15

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

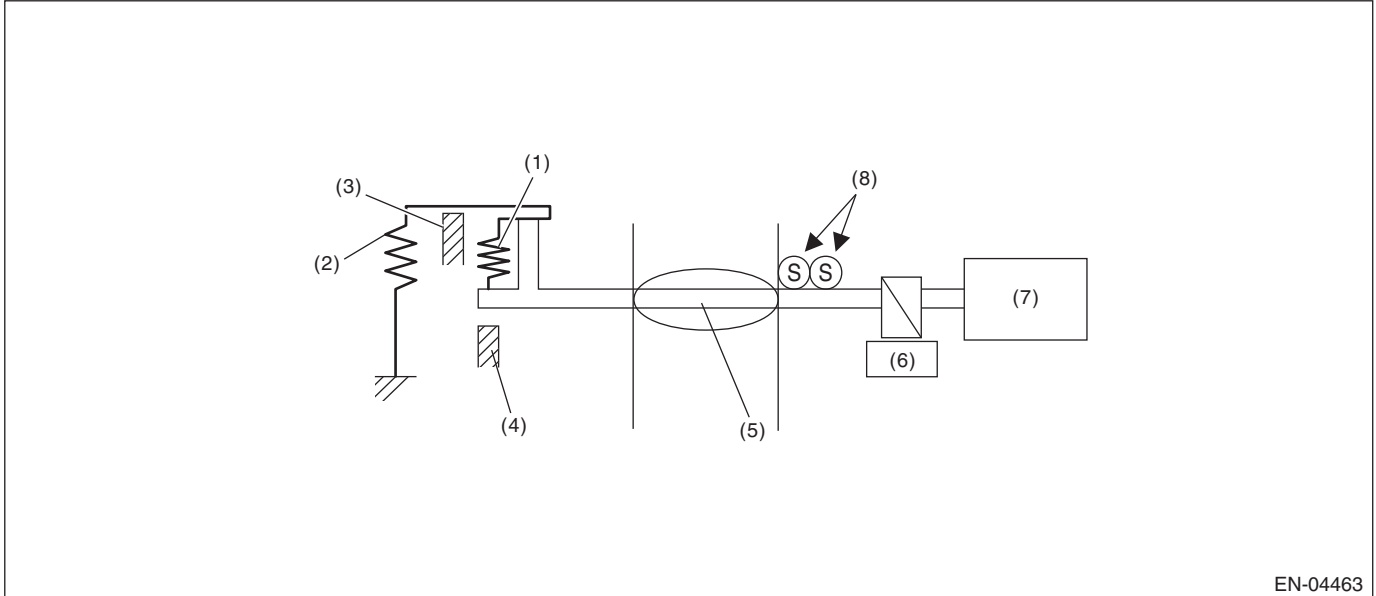
## GENERAL DESCRIPTION

### CQ:DTC P1160 RETURN SPRING FAILURE

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

#### 2. COMPONENT DESCRIPTION



EN-04463

- |                          |                         |   |
|--------------------------|-------------------------|---|
| (1) Opener spring        | (4) Full closed stopper | (7) DC motor                              |
| (2) Return spring        | (5) Throttle valve      | (8) Main and sub throttle position sensor |
| (3) Intermediate stopper | (6) Gear                |   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 6\text{ V}$
Throttle position sensor	Normal

#### 4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	< 2 deg

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	$\geq 2$ deg

**Time Needed for Diagnosis:** 3400 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

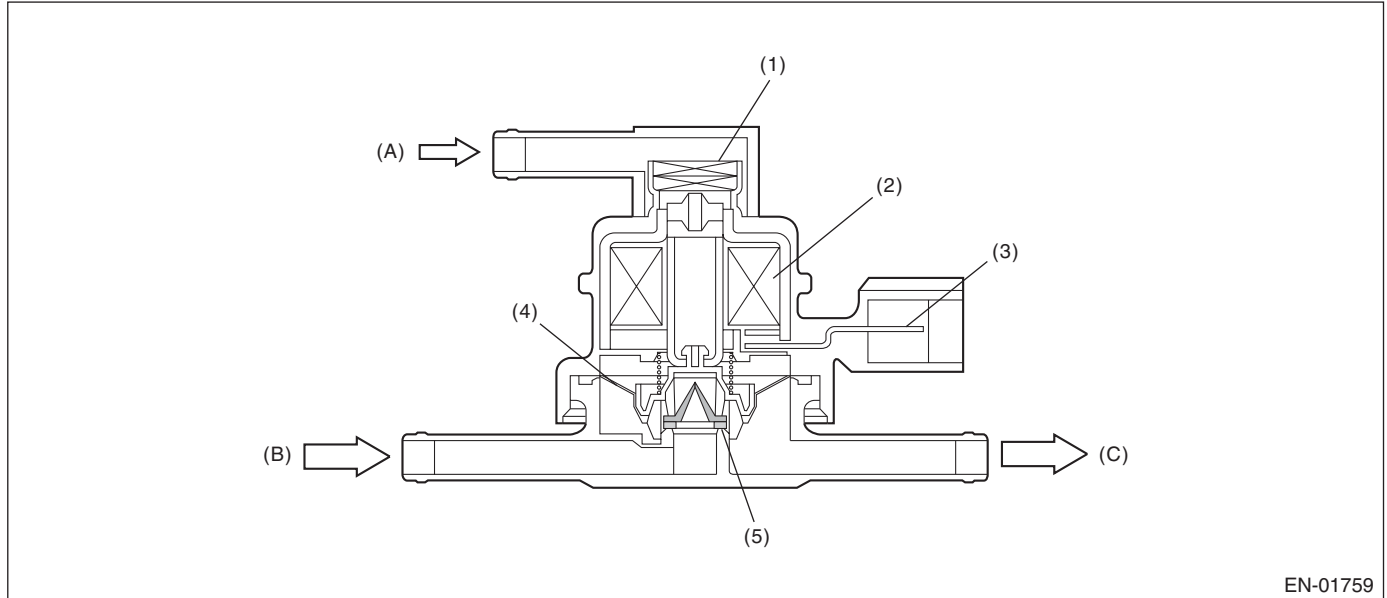
### CR:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

#### 2. COMPONENT DESCRIPTION



- |                        |               |                         |
|------------------------|---------------|-------------------------|
| (1) Filter             | (4) Diaphragm | (A) Barometric pressure |
| (2) Coil               | (5) Valve     | (B) Shut-off valve      |
| (3) Connector terminal |               | (C) To fuel tank        |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### CS:DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN

#### 1. OUTLINE OF DIAGNOSIS

Always detect abnormally that both combination valve electromagnetic valve and the reed valve are open failure.

Calculate the integrated value of Max./Min. value and output voltage deviation of the secondary air delivery pipe pressure sensor output voltage in a given time after engine start. Judge as NG if the integrated value and the difference between Max. and Min. values are large.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm and < 10000 rpm
Elapsed time after starting the engine	≥ 9000 ms
After secondary air system stops	≥ 9000 ms
Amount of intake air	≥ 2 g/s (0.071 oz/s) and < 400 g/s (14.108 oz/s)
Battery voltage	≥ 10.9 V
Engine load	> 0 g/rev
After fuel cut	≥ 1000 ms

#### 3. GENERAL DRIVING CYCLE

Perform continuous diagnosis when air flow amount is large during the secondary air pump stop after engine start.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

When both combination valve electromagnetic valve and the reed valve are open failure, the failure appears as pulses in the secondary air delivery pipe pressure sensor output. Detect abnormality by capturing these pulses using the following method.

### • Abnormality Judgment

Calculate Max./Min. value of the secondary air delivery pipe pressure sensor output voltage and the sum of the output voltage deviation for the given time. Compare the difference between Max. and Min. values with threshold value and also compare the sum value with the threshold value. If both values exceed the threshold value, count up NG counter and then judge as NG if the counter reaches the given times.

### Judgment Value

Malfunction Criteria	Threshold Value
Pipe inner pressure difference between Max. and Min.	> 0.05 V
Sum of the pipe inner pressure variation value every 4 milliseconds	> 5 V
Barometric pressure variation value	< 26.66 kPa (200 mmHg, 7.874 inHg)

**Time Needed for Diagnosis:** 2000 ms × 20 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear NG if neither exceeds the threshold value, or if either of the two exceeds the threshold value.

### Judgment Value

Malfunction Criteria	Threshold Value
Pipe inner pressure difference between Max. and Min.	≤ 0.05 V
Sum of the pipe inner pressure variation value every 4 milliseconds	≤ 5 V

**Time Needed for Diagnosis:** 2000 ms

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CT:DTC P1418 SECONDARY AIR INJECTION SYSTEM CONTROL "A" CIRCUIT SHORTED

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs ON signal	HIGH

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Ignition	ON
Terminal output voltage when ECM outputs ON signal	LOW

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

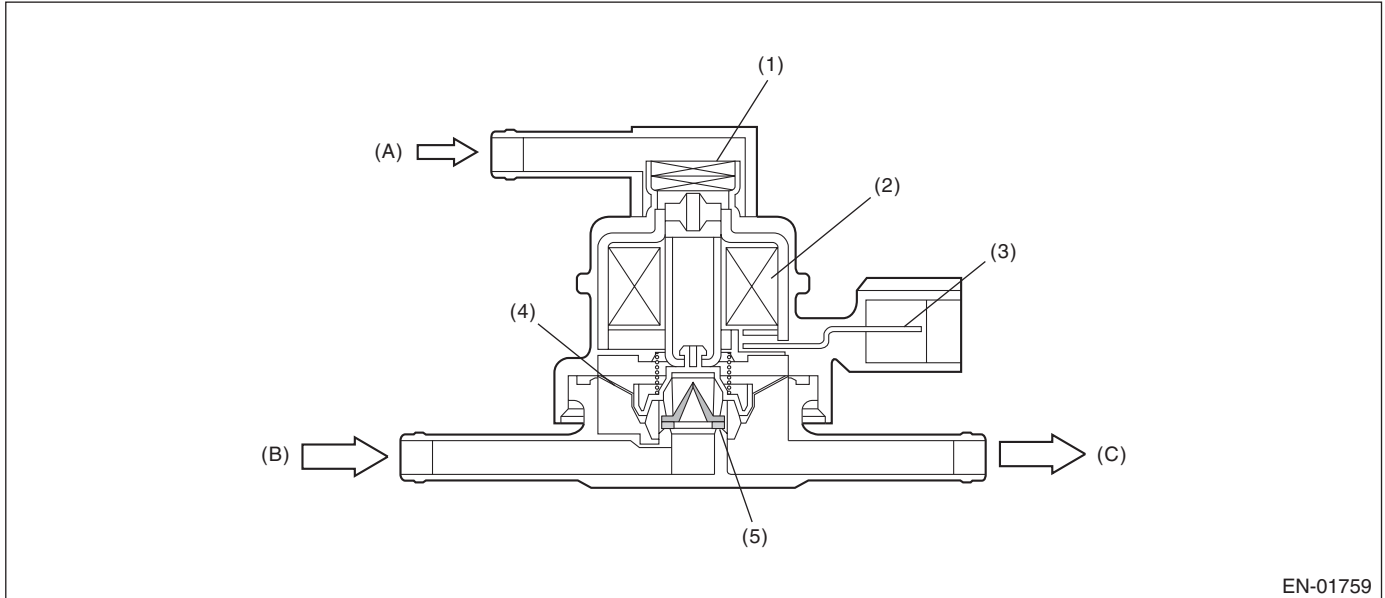
## CU:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

### 2. COMPONENT DESCRIPTION



- |                        |               |                         |
|------------------------|---------------|-------------------------|
| (1) Filter             | (4) Diaphragm | (A) Barometric pressure |
| (2) Coil               | (5) Valve     | (B) Shut-off valve      |
| (3) Connector terminal |               | (C) To fuel tank        |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

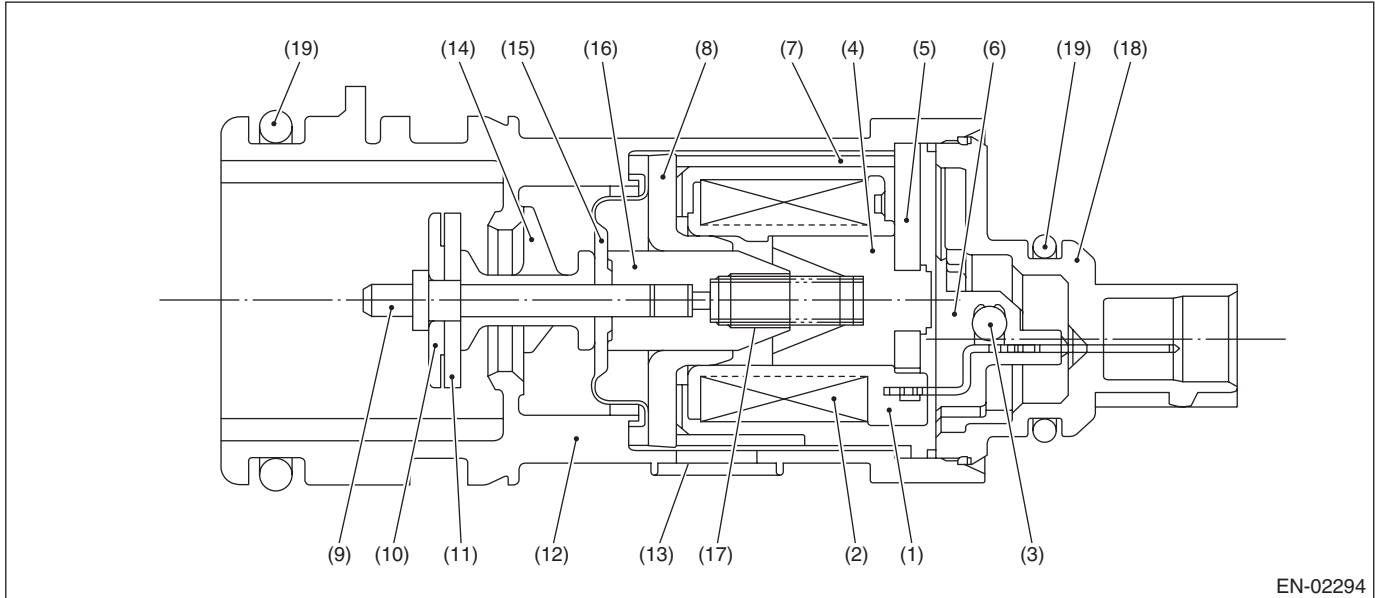
Memorize the freeze frame data. (For test mode \$02)

## CV:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

### 1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.  
 Judge as NG when fuel tank pressure is low.

### 2. COMPONENT DESCRIPTION



- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Drain valve	Open
Battery voltage	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75.05 \text{ kPa}$ (563 mmHg, 22.165 inHg)
Tank pressure when starter is OFF → ON	$-0.43 \text{ kPa}$ ( $-3.2 \text{ mmHg}$ , $-0.126 \text{ inHg}$ ) and $1.43 \text{ kPa}$ (10.7 mmHg, 0.421 inHg)

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$\leq -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$> -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)
Cumulative time when all the malfunction criteria below are met.	$\geq 30000$ ms
Purge control solenoid valve duty	Not = 0
Fuel temperature	$-10$ °C ( $14$ °F) — $55$ °C ( $131$ °F)
Intake manifold relative pressure	$\geq -26.66$ kPa ( $-200$ mmHg, $-7.874$ inHg)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

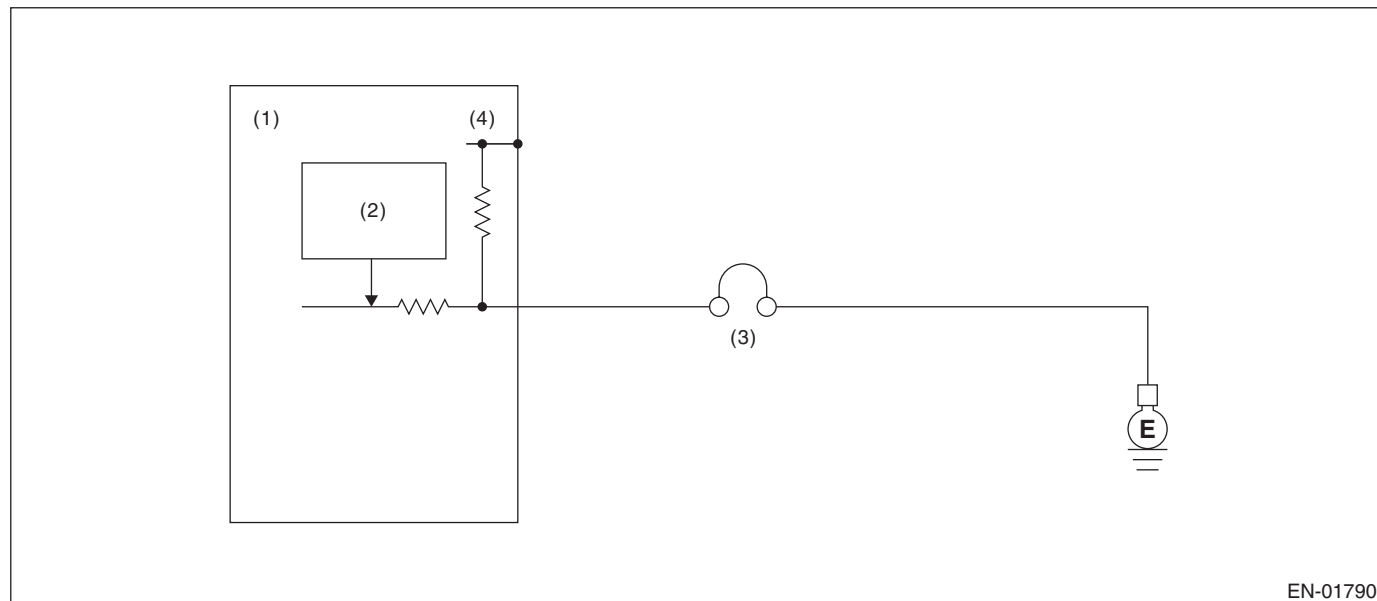
## CW:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

### 1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose release abnormality.

Judge as NG when the diagnosis terminal voltage is high.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) PCV diagnosis connector

(4) 5 V

(2) Detecting circuit

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CX:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.  
Judge as NG when the backup power voltage is low.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	Low
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	High
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **CY:DTC P1570 ANTENNA**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **CZ:DTC P1571 REFERENCE CODE INCOMPATIBILITY**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DA:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DB:DTC P1574 KEY COMMUNICATION FAILURE**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DC:DTC P1576 EGI CONTROL MODULE EEPROM**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DD:DTC P1577 IMM CONTROL MODULE EEPROM**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **DE:DTC P1578 METER FAILURE**

#### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DF:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.

Judge as NG if there is exhaust gas temperature diagnosis and idle speed diagnosis and if either of them is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Battery voltage	≥ 10.9 V
Cold start diagnosis	Incomplete
Vehicle speed	< 2 km/h (1.2 MPH)
Misfire within 200 engine revs.	< 5
Time after starting	= 14 seconds

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

### 4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

#### Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value from Map

#### Map

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	45 °C (113 °F)
Threshold value (AT model)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	98 °C (208.4 °F)	98 °C (208.4 °F)	97 °C (206.6 °F)	93 °C (199.4 °F)	89 °C (192.2 °F)	88 °C (190.4 °F)
Threshold value (MT model)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	86.45830052 °C (187.6 °F)	83.45699292 °C (182.2 °F)	82.13981981 °C (179.9 °F)	77.22136721 °C (171 °F)	74.07767676 °C (165.3 °F)	73.24222051 °C (163.8 °F)

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	≥ Value from Map

**Time Needed for Diagnosis:** Less than 1 second

### • Idle speed diagnosis

### Abnormality Judgment

Judge as NG when the following conditions are established after the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –100 rpm)	≥ 6000 ms
Continuous time of (actual retard amount > 30 °CA)	≥ 0 ms

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –100 rpm)	< 6000 ms
Continuous time of (actual retard amount > 30 °CA)	< 0 ms

**Time Needed for Diagnosis:** Less than 1 second

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DG:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Engine coolant temperature	$\geq -30$ °C (-22 °F)
Ambient air temperature	$\geq -30$ °C (-22 °F)

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	$\geq 64.3$ deg
Tumble generator valve "close" signal output	$\geq 3200$ ms

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	$< 64.3$ deg
Tumble generator valve "close" signal output	$\geq 3200$ ms

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

Tumble generator valve control

- Output the open signal.

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### DH:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ -30 °C (-22 °F)
Ambient air temperature	≥ -30 °C (-22 °F)

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	≥ 64.3 deg
Tumble generator valve "close" signal output	≥ 3200 ms

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	< 64.3 deg
Tumble generator valve "close" signal output	≥ 3200 ms

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

Tumble generator valve control

- Output the open signal.

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DI: DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ -30 °C (-22 °F)
Ambient air temperature	≥ -30 °C (-22 °F)

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	< 64.3 deg
Tumble generator valve "open" signal output	≥ 4600 ms

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	≥ 64.3 deg
Tumble generator valve "open" signal output	≥ 4600 ms

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

Tumble generator valve control

- Output the close signal.

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### DJ:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Engine coolant temperature	$\geq -30$ °C ( $-22$ °F)
Ambient air temperature	$\geq -30$ °C ( $-22$ °F)

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	$< 64.3$ deg
Tumble generator valve "open" signal output	$\geq 4600$ ms

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening	$\geq 64.3$ deg
Tumble generator valve "open" signal output	$\geq 4600$ ms

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

Tumble generator valve control

- Output the close signal.

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

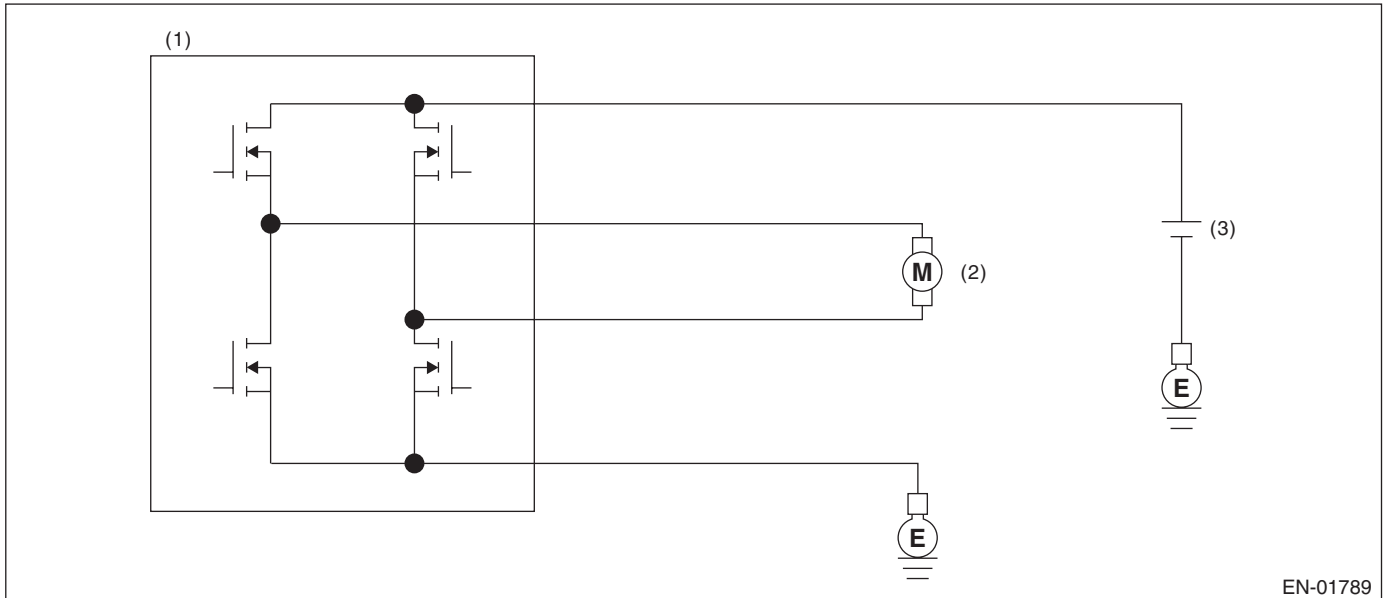
## DK:DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 msec × 20 time in a row.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	Low
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** 96 msec × 20 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Tumble generator valve control: Not allowed to move tumble generator valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

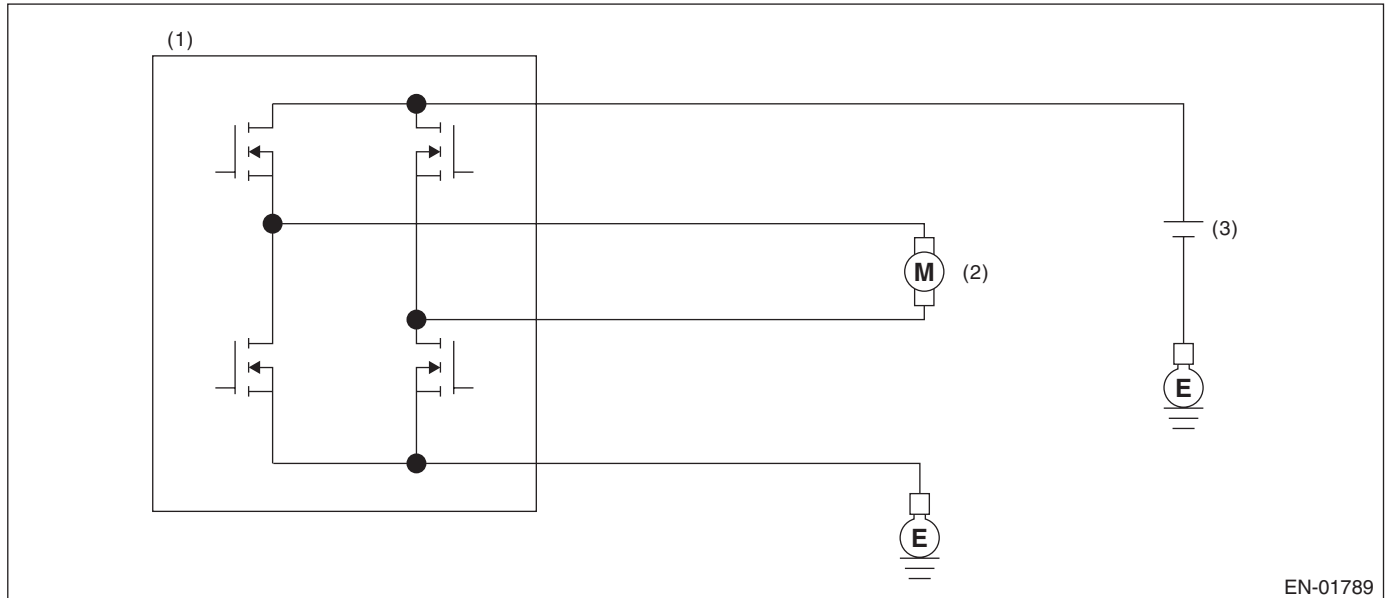
## DL:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

### 2. COMPONENT DESCRIPTION



EN-01789

(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge overcurrent NG when the overcurrent NG signal is sent 96 msec × 10 time in a row.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	Low

**Time Needed for Diagnosis:** 96 msec × 10 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Tumble generator valve control: Not allowed to move tumble generator valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

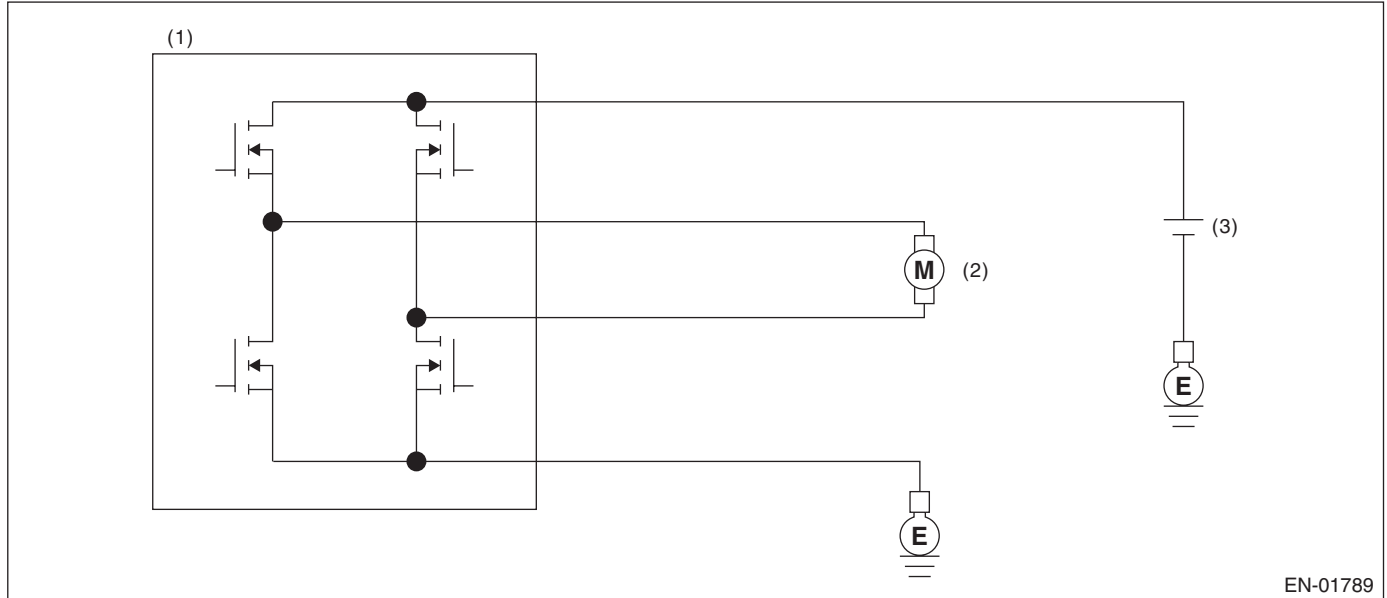
## DM:DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 msec × 20 time in a row.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	Low
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** 96 msec × 20 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Tumble generator valve control: Not allowed to move tumble generator valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

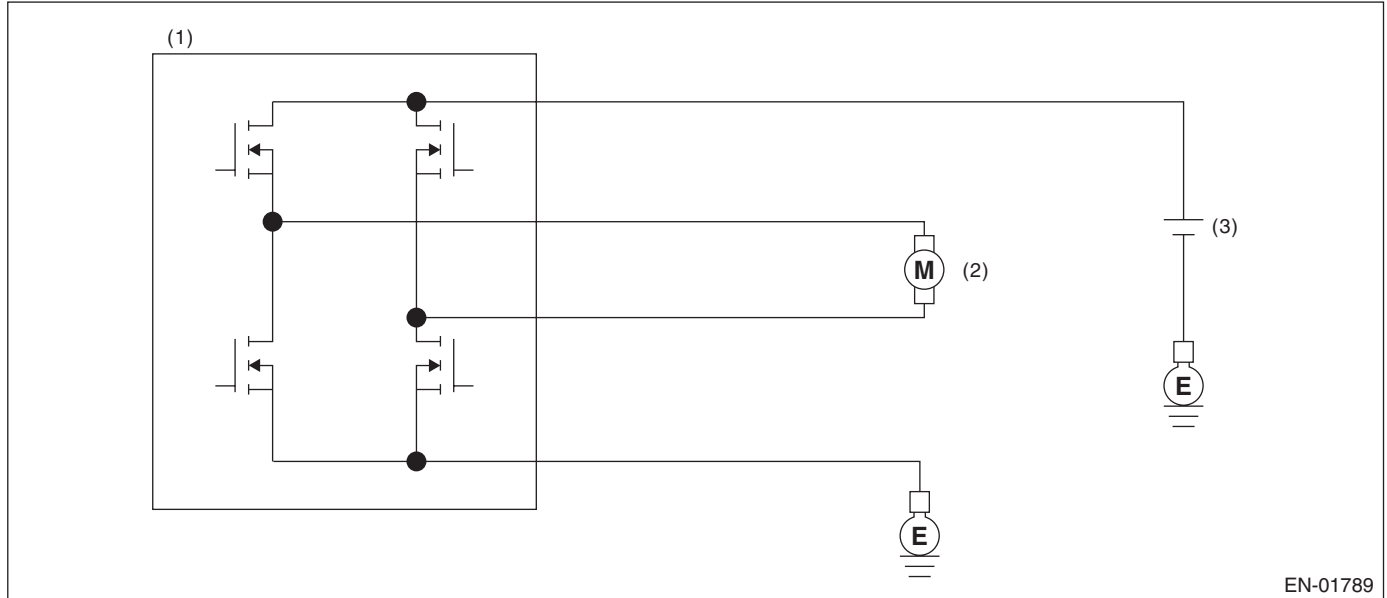
## DN:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

### 2. COMPONENT DESCRIPTION



EN-01789

(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge overcurrent NG when the overcurrent NG signal is sent 96 msec × 10 time in a row.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	Low

**Time Needed for Diagnosis:** 96 msec × 10 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

#### Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Tumble generator valve control: Not allowed to move tumble generator valve.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

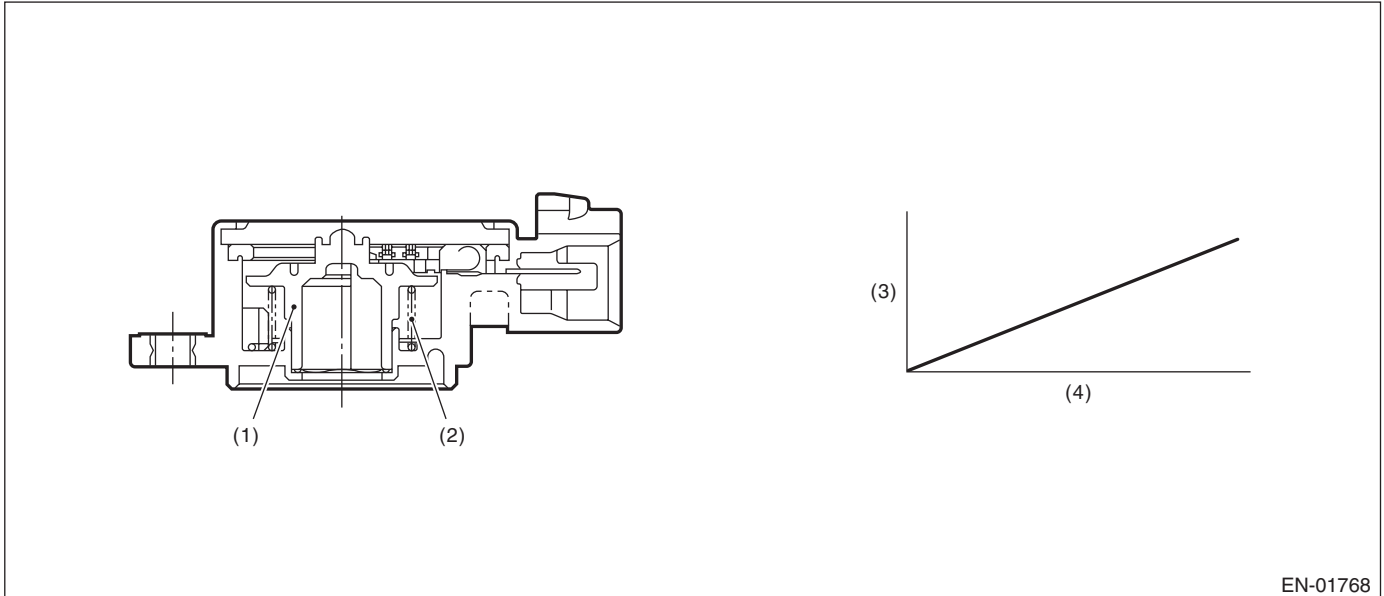
GENERAL DESCRIPTION

## DO:DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(2) Return spring

(3) Voltage (V)

(4) Tumble generator valve opening  
(°)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.217 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.217$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

### 9. ECM OPERATION AT DTC SETTING

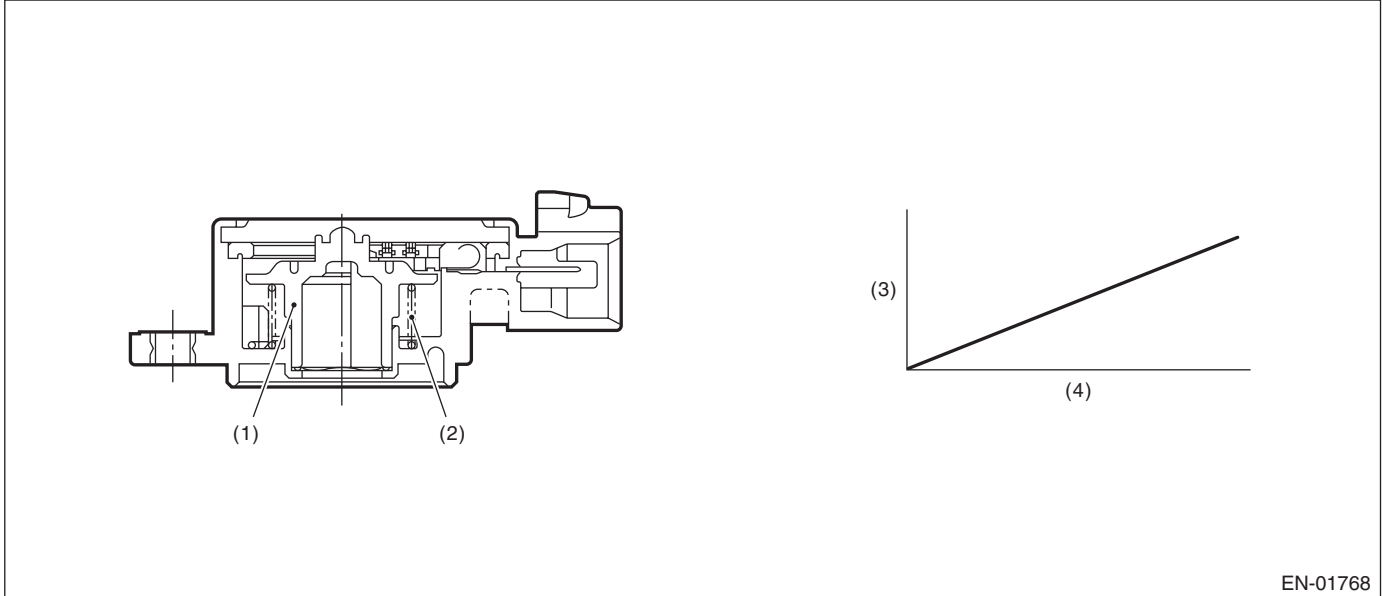
Memorize the freeze frame data. (For test mode \$02)

## DP:DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- (1) Rotor
- (2) Return spring

(3) Voltage (V)

(4) Throttle valve opening angle (°)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.783$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.783$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

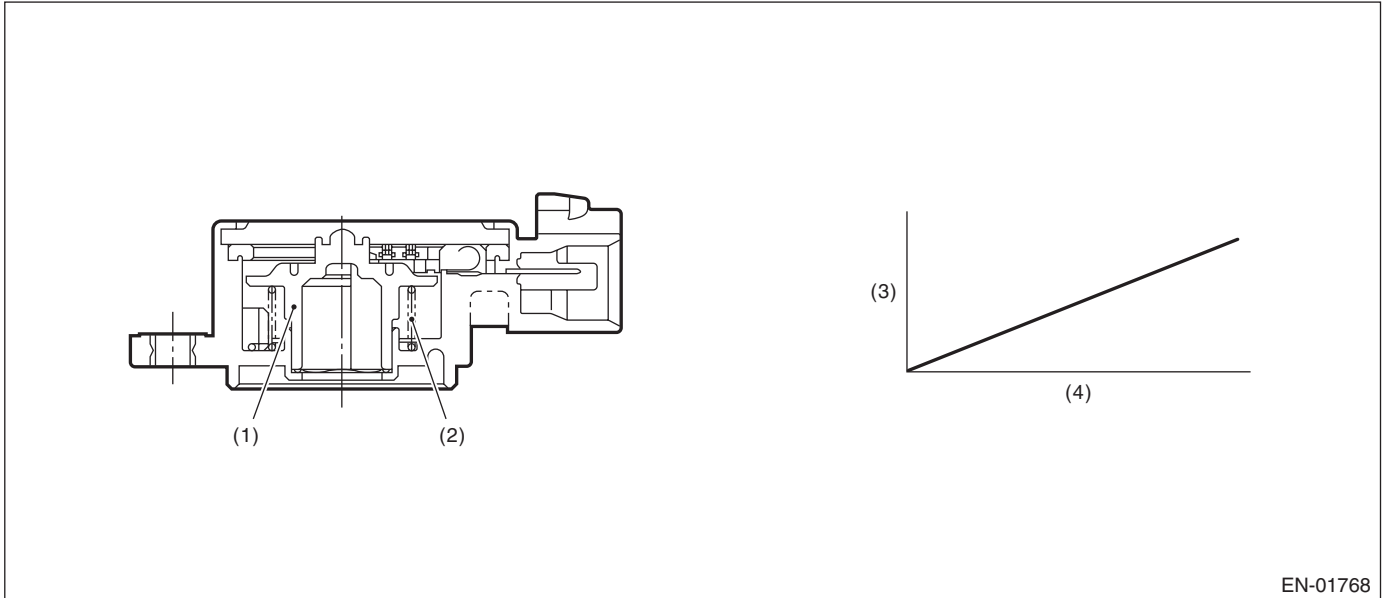
GENERAL DESCRIPTION

## DQ:DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(2) Return spring

(3) Voltage (V)

(4) Tumble generator valve opening  
(°)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.217 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.217 V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

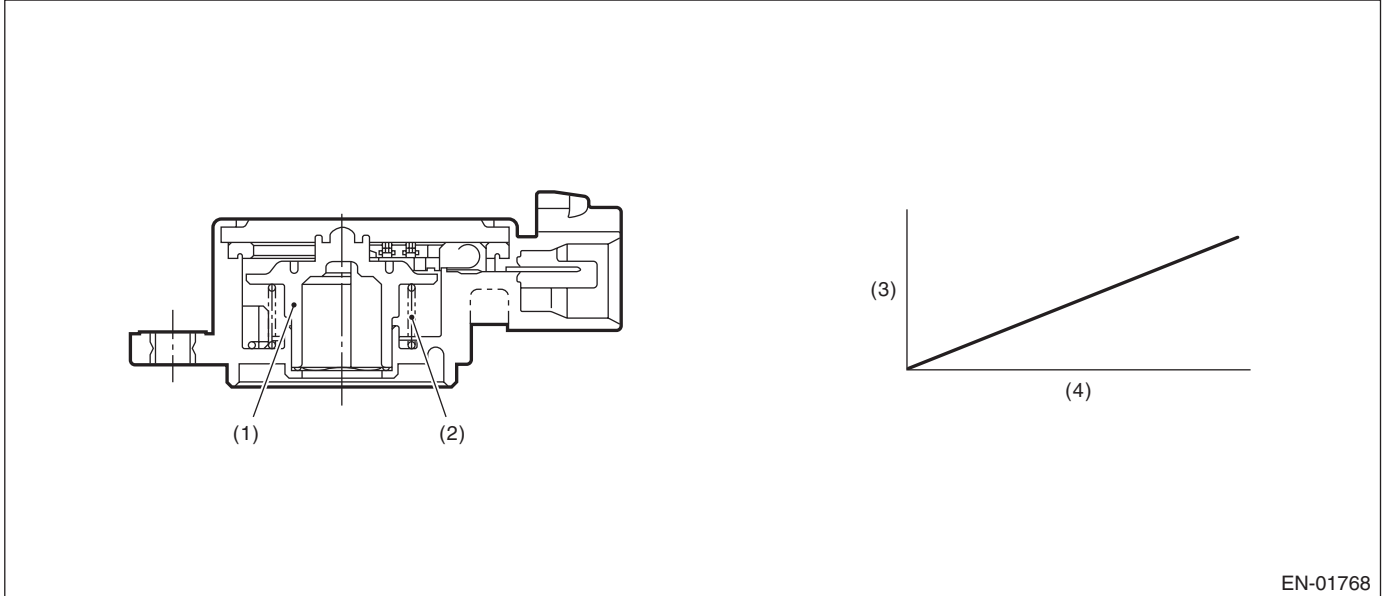
GENERAL DESCRIPTION

## DR:DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(2) Return spring

(3) Voltage (V)

(4) Tumble generator valve opening (°)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.783$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.783$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Tumble generator valve opening

- For tumble generator valve full closing points learning, not allowed to update to closing side.
- For tumble generator valve full opening points learning, not allowed to update to opening side.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DS:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil flow control solenoid valve.  
Judge as NG when the current is small even though the duty signal is large.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Oil flow control solenoid valve control duty	$\geq 99.61$ %
Oil control solenoid valve control present current	$< 0.306$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Target current value of the oil flow control solenoid valve	$\geq 0.14$ A
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 7. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment → abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control:
  - Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
  - ⇒ ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  - Make the oil flow control solenoid valve driving duty a predetermined value (9.36%).

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## DT:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control solenoid valve.

Judge as NG when the current is large even though the duty signal is small.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Oil flow control solenoid valve control duty	$< 0.39$ %
Oil control solenoid valve control present current	$\geq 0.306$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 7. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment → abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control:
  - Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
  - ⇒ ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  - Make the oil flow control solenoid valve driving duty a predetermined value (9.36%).

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **DV:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P2088. <Ref. to GD(H4DOTC)-247, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DV:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P2089. <Ref. to GD(H4DOTC)-249, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

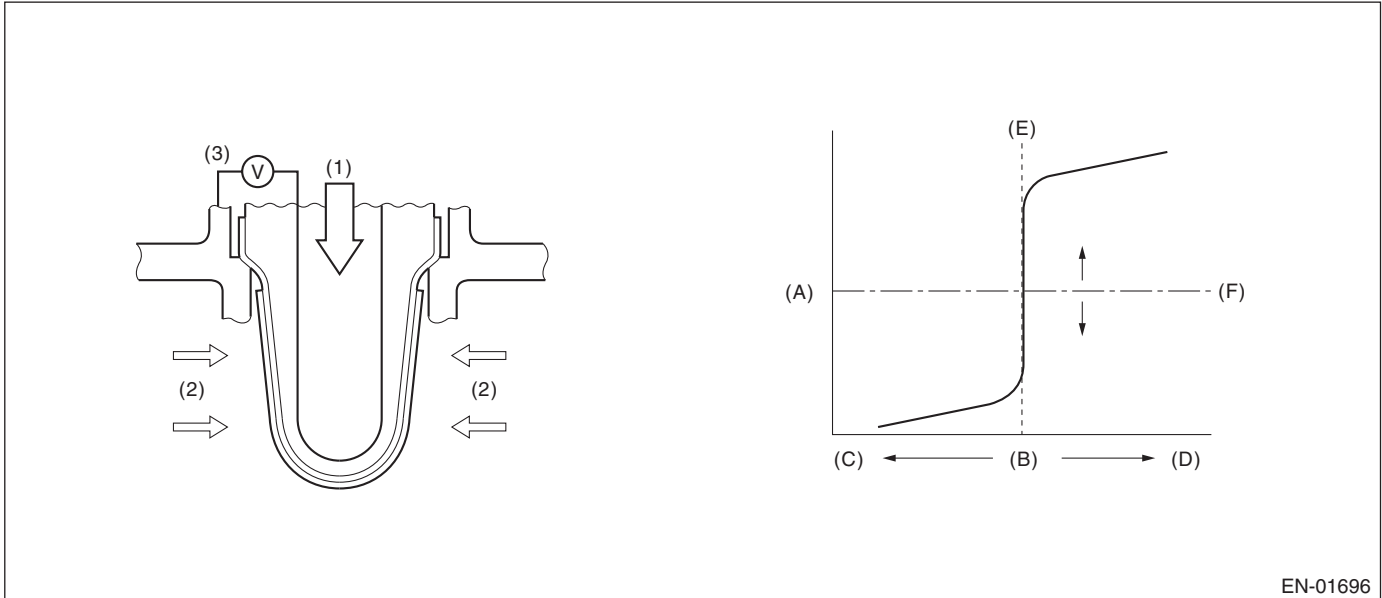
GENERAL DESCRIPTION

## DW:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.  
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

### 2. COMPONENT DESCRIPTION



EN-01696

- |                         |                         |                                |
|-------------------------|-------------------------|--------------------------------|
| (1) Atmosphere          | (A) Electromotive force | (D) Lean                       |
| (2) Exhaust gas         | (B) Air fuel ratio      | (E) Theoretical air fuel ratio |
| (3) Electromotive force | (C) Rich                | (F) Comparative voltage        |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.02 (AT model) < -0.02 (MT model)

**Time Needed for Diagnosis:** 5 sec × 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ -0.02 + 0.005 (AT model) ≥ -0.02 + 0 (MT model)

**Time Needed for Diagnosis:** 5 sec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

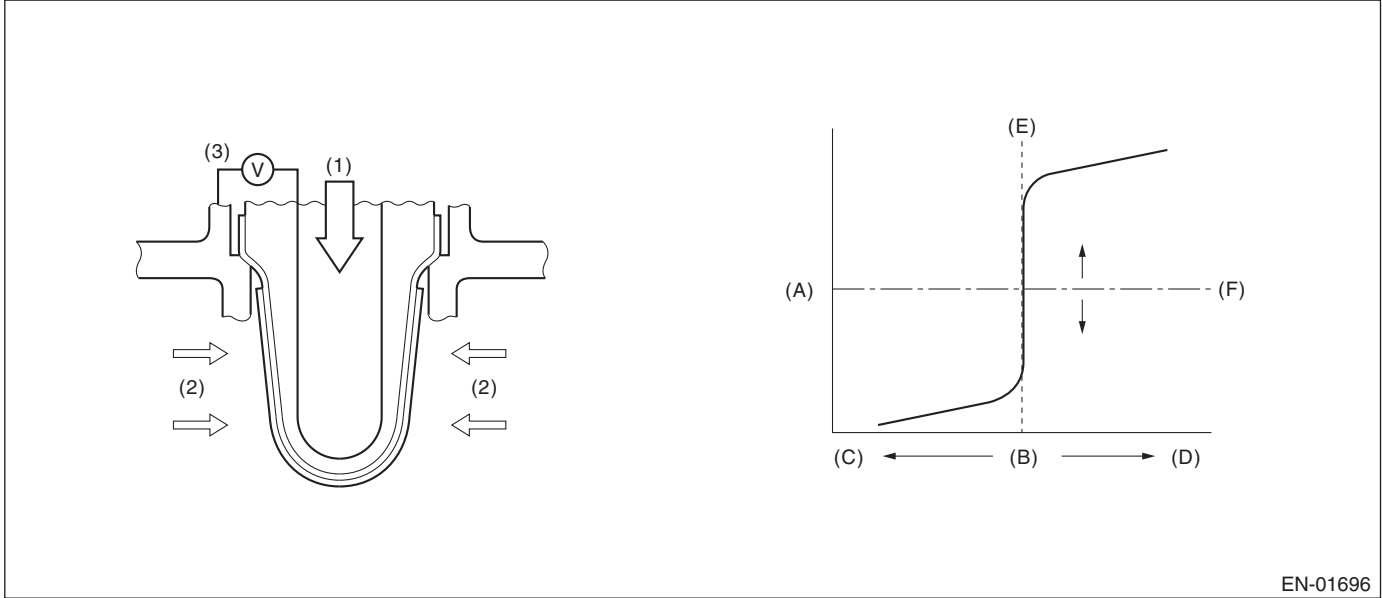
## DX:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.

Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	$\geq 0.04$ (AT model) $\geq 0.04$ (MT model)

**Time Needed for Diagnosis:** 5 sec  $\times$  1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.04 + -0.005$ (AT model) $< 0.04 + 0$ (MT model)

**Time Needed for Diagnosis:** 5 sec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

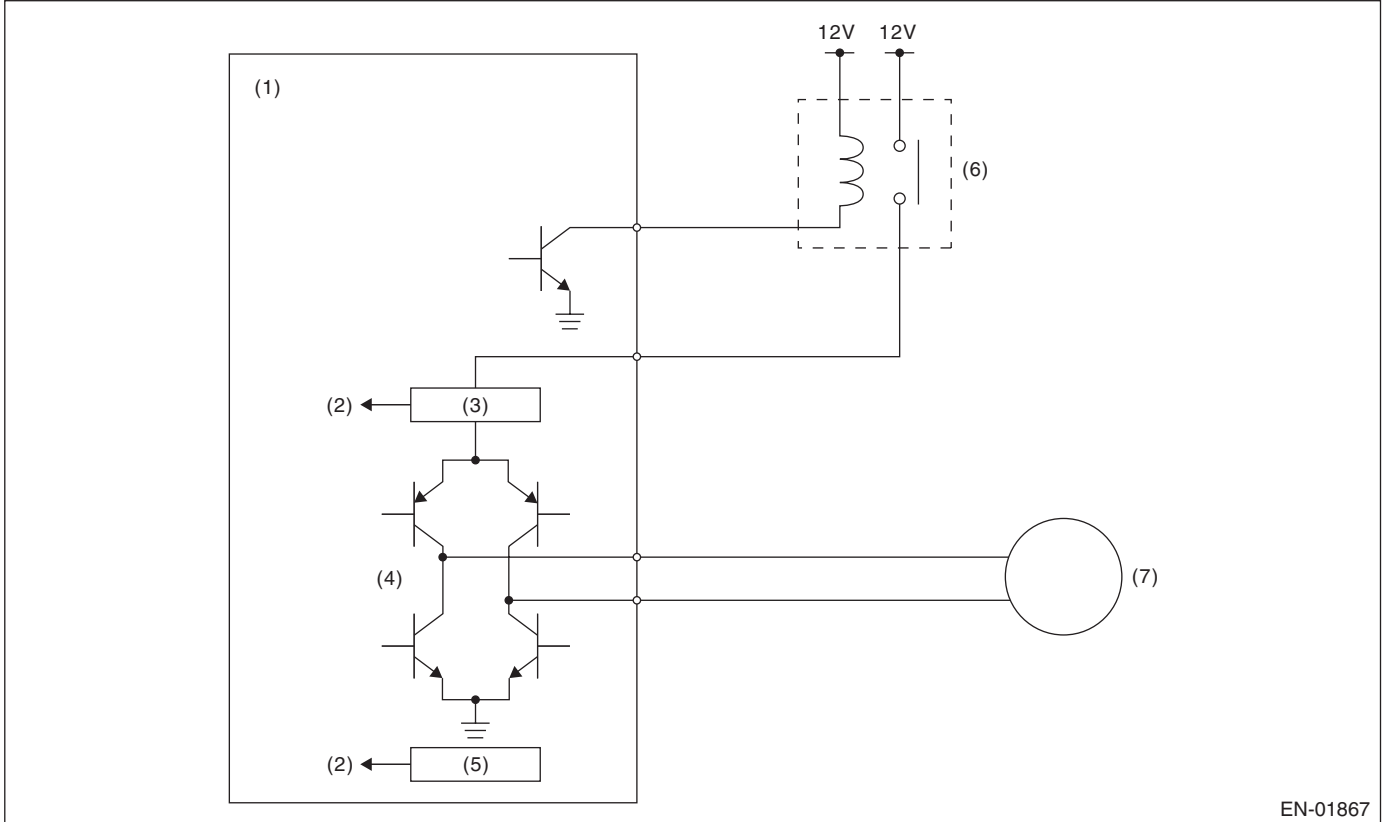
Memorize the freeze frame data. (For test mode \$02)

## DY:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

### 2. COMPONENT DESCRIPTION



EN-01867

- |                                   |                                   |                                       |
|-----------------------------------|-----------------------------------|---------------------------------------|
| (1) Engine control module (ECM)   | (4) Drive circuit                 | (6) Electronic throttle control relay |
| (2) Detecting circuit             | (5) Temperature detection circuit | (7) Motor                             |
| (3) Overcurrent detection circuit |                                   |                                       |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON
CPU communication line sub → main normal judgment	Normal

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor current or Drive circuit inner temperature	> 8 A  > 175°C (347°F)

**Time Needed for Diagnosis:** 500 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor current Drive circuit inner temperature	$\leq 8$ A $\leq 175^\circ\text{C}$ (347°F)

**Time Needed for Diagnosis:** 2000 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

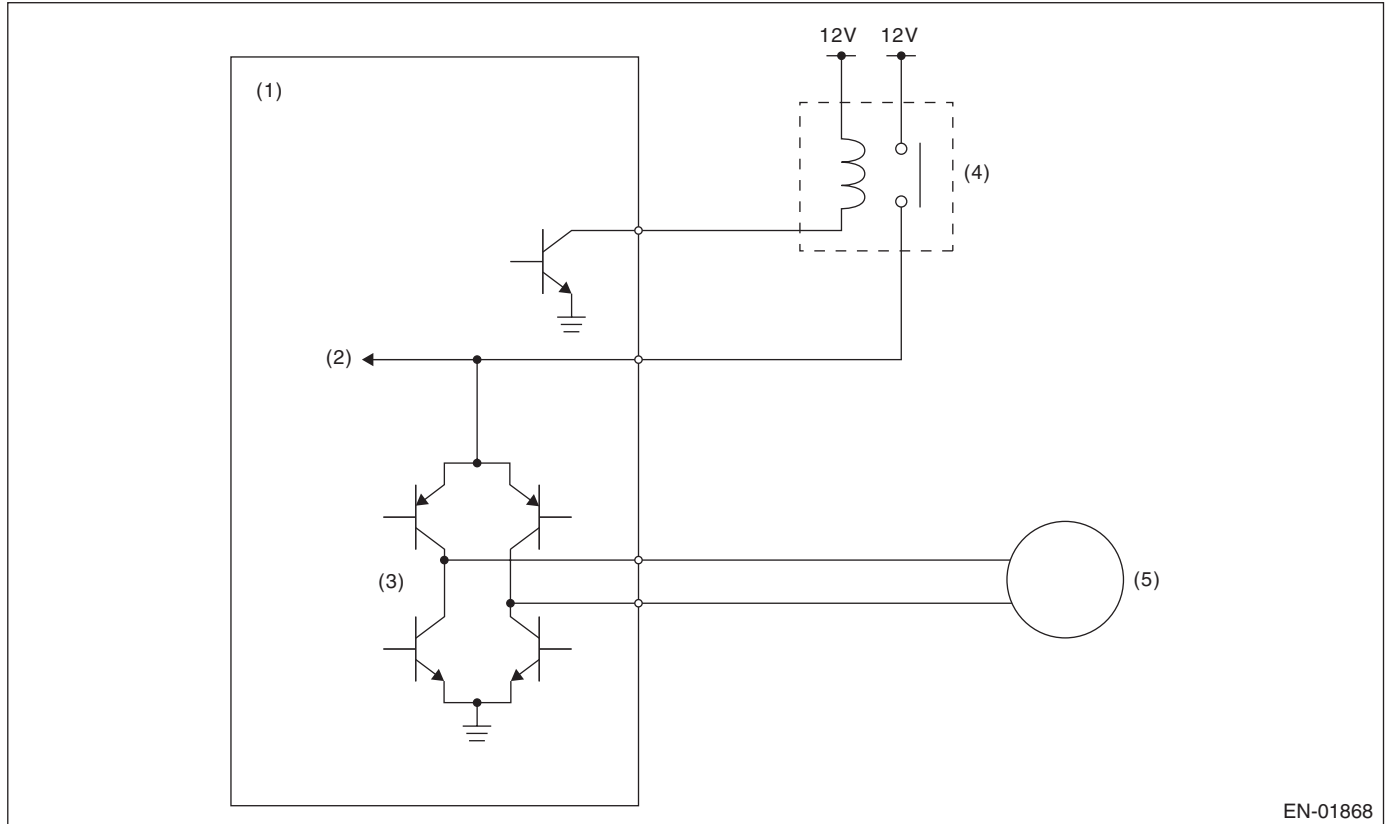
Memorize the freeze frame data. (For test mode \$02)

## DZ:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

### 2. COMPONENT DESCRIPTION



- |                                 |                                       |           |
|---------------------------------|---------------------------------------|-----------|
| (1) Engine control module (ECM) | (3) Drive circuit                     | (5) Motor |
| (2) Voltage detection circuit   | (4) Electronic throttle control relay |           |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 11 \text{ V}$
Electronic throttle control relay output	ON

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$\leq 5$ V

**Time Needed for Diagnosis:** 400 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$> 5$ V

**Time Needed for Diagnosis:** 2000 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

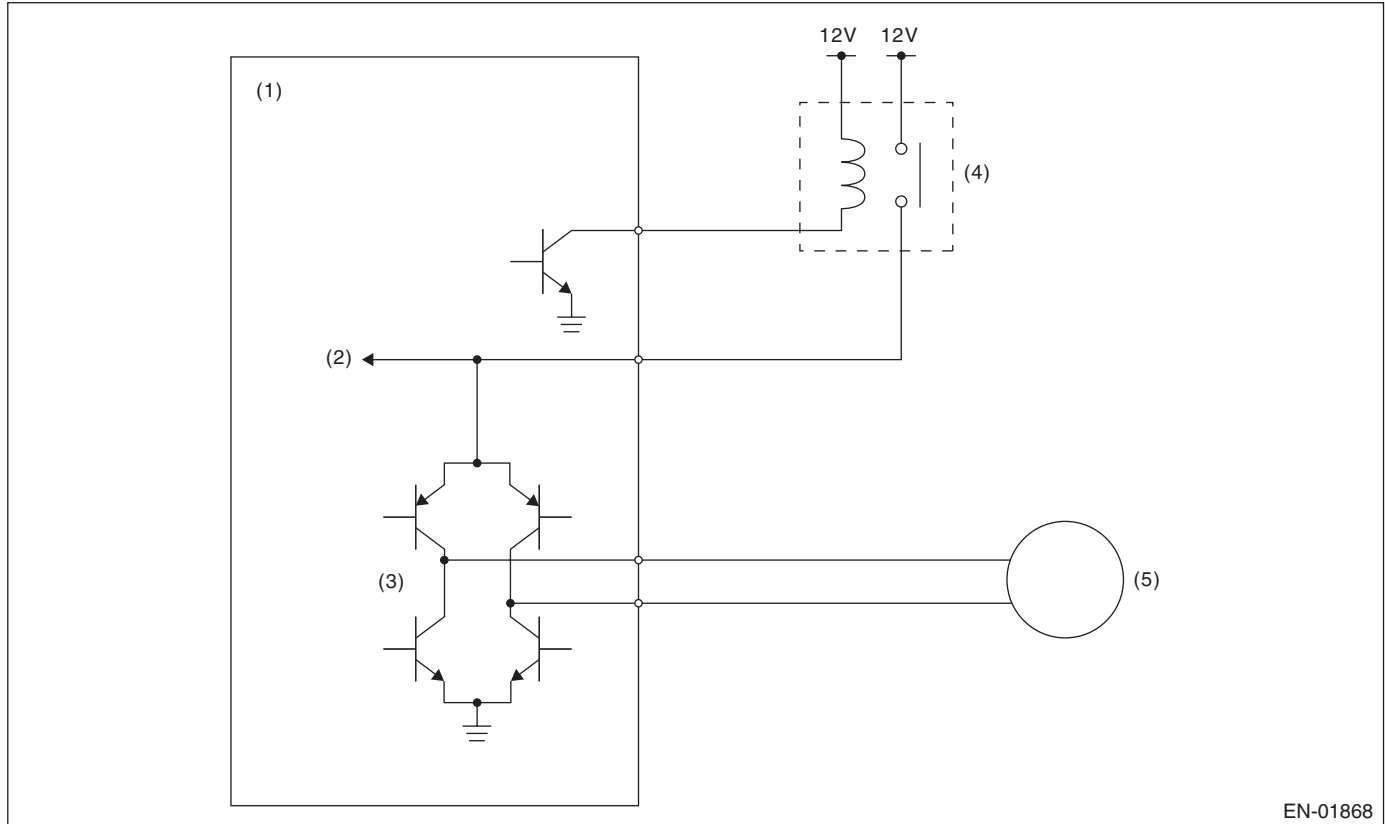
Memorize the freeze frame data. (For test mode \$02)

## EA:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

### 2. COMPONENT DESCRIPTION



- |                                 |                                       |           |
|---------------------------------|---------------------------------------|-----------|
| (1) Engine control module (ECM) | (3) Drive circuit                     | (5) Motor |
| (2) Voltage detection circuit   | (4) Electronic throttle control relay |           |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Electronic throttle control relay output	OFF

### 4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$\geq 5$ V

**Time Needed for Diagnosis:** 600 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$< 5$ V

**Time Needed for Diagnosis:** 400 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

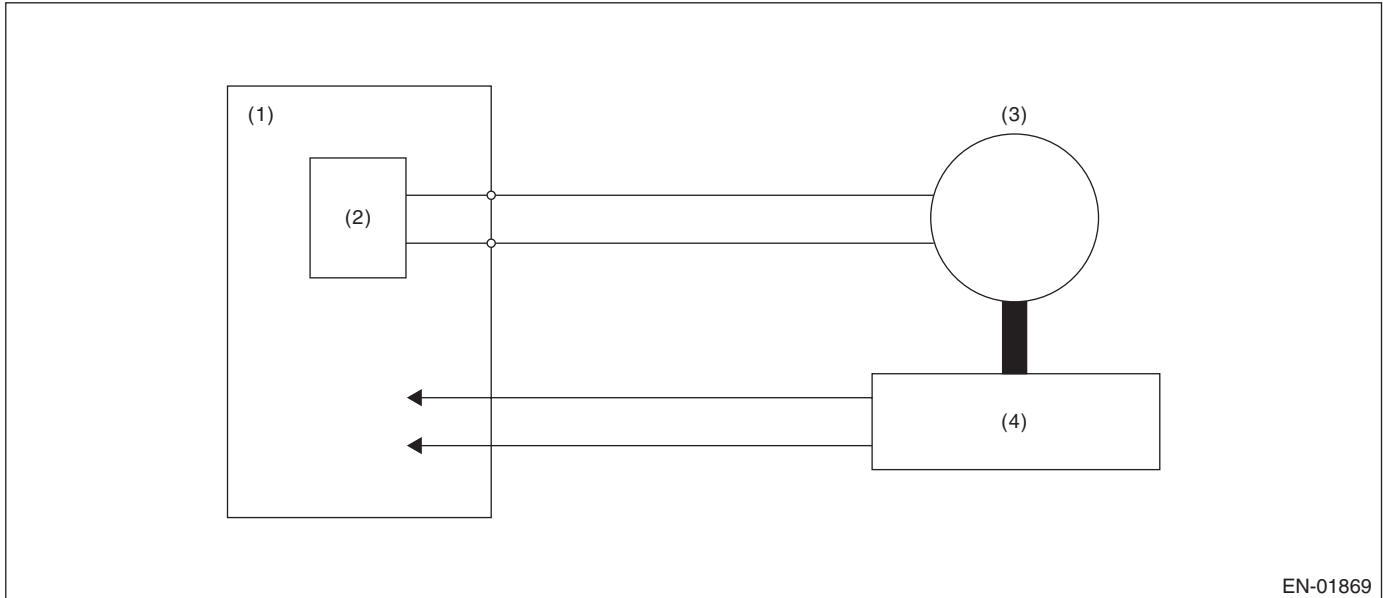
GENERAL DESCRIPTION

## EB:DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot be conducted or an abnormal value is detected.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Motor

(4) Throttle position sensor

(2) Drive circuit

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON → OFF
Ignition switch (only after clear memory)	OFF → ON

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	< 10.127 deg
	or
	> 19.872 deg
or	
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	< 1.683 deg

**Time Needed for Diagnosis:** 8 msec — 80 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	$\geq 10.127$ deg
	and
	$\leq 19.872$ deg
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	$\geq 1.683$ deg

**Time Needed for Diagnosis:** 8 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

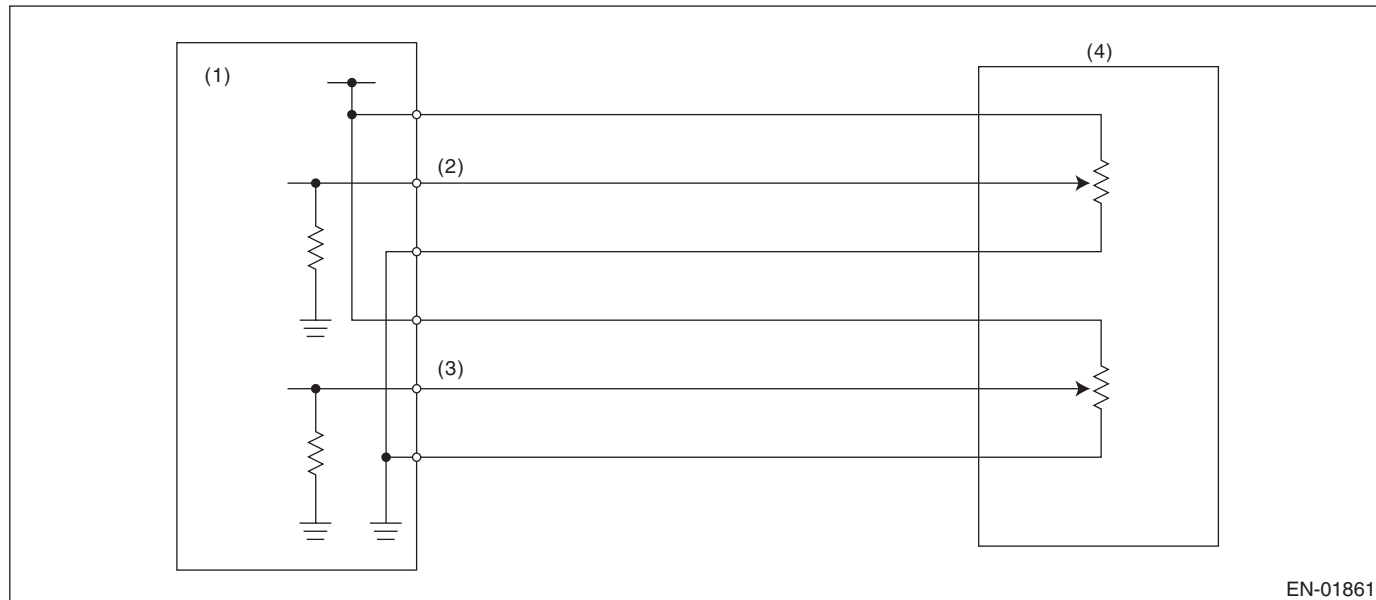
## EC:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.

Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01861

- |  |  |  |
|--|--|--|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 signal |
| (2) Accelerator pedal position sensor 1 signal |  |  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 0.219 V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.219 V

**Time Needed for Diagnosis:** 100 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

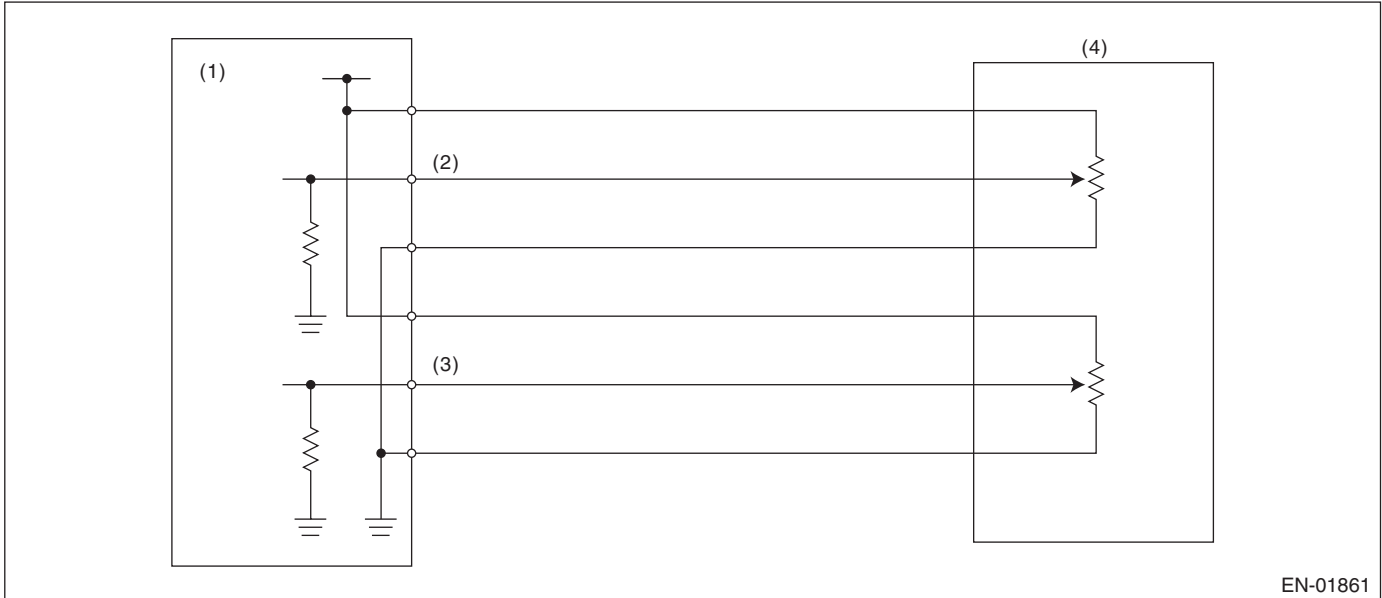
Memorize the freeze frame data. (For test mode \$02)

## ED:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |  |  |                                       |
|--|--|---------------------------------------|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor |
| (2) Accelerator pedal position sensor 1 signal |  |                                       |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$\geq 4.781$ V

**Time Needed for Diagnosis:** 32 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.781$ V

**Time Needed for Diagnosis:** 32 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

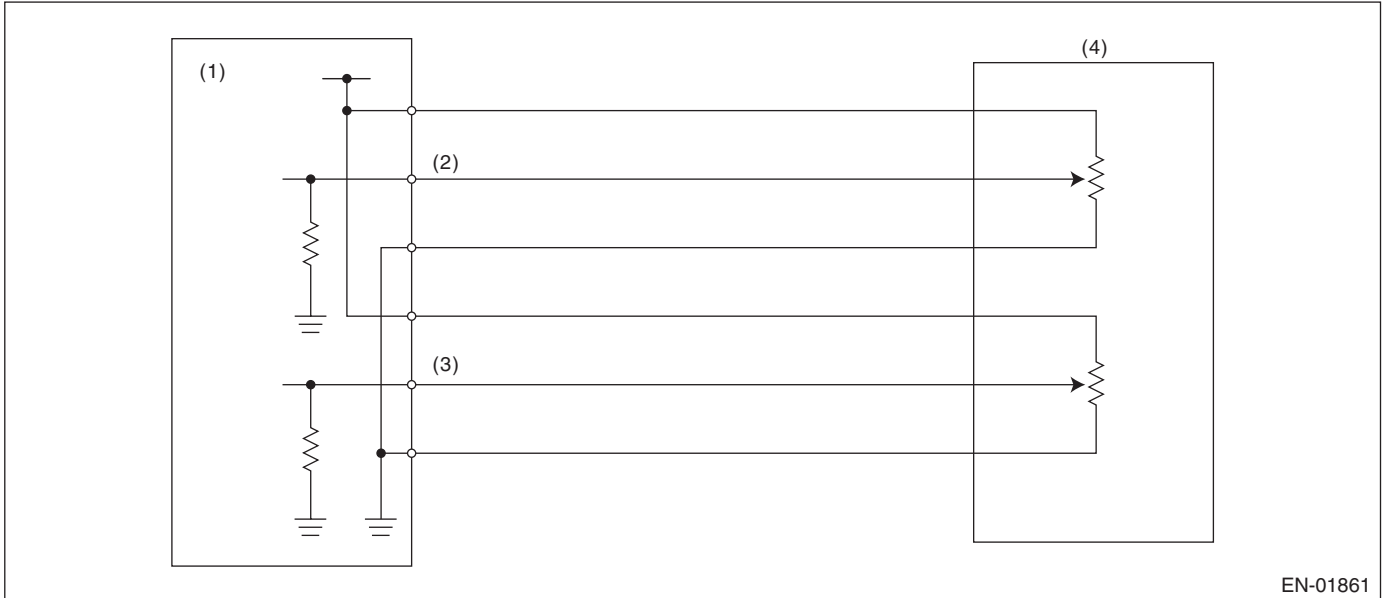
Memorize the freeze frame data. (For test mode \$02)

## EE:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |  |  |  |
|--|--|--|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 signal |
| (2) Accelerator pedal position sensor 1 signal |  |  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 0.219 V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 0.219$ V

**Time Needed for Diagnosis:** 100 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

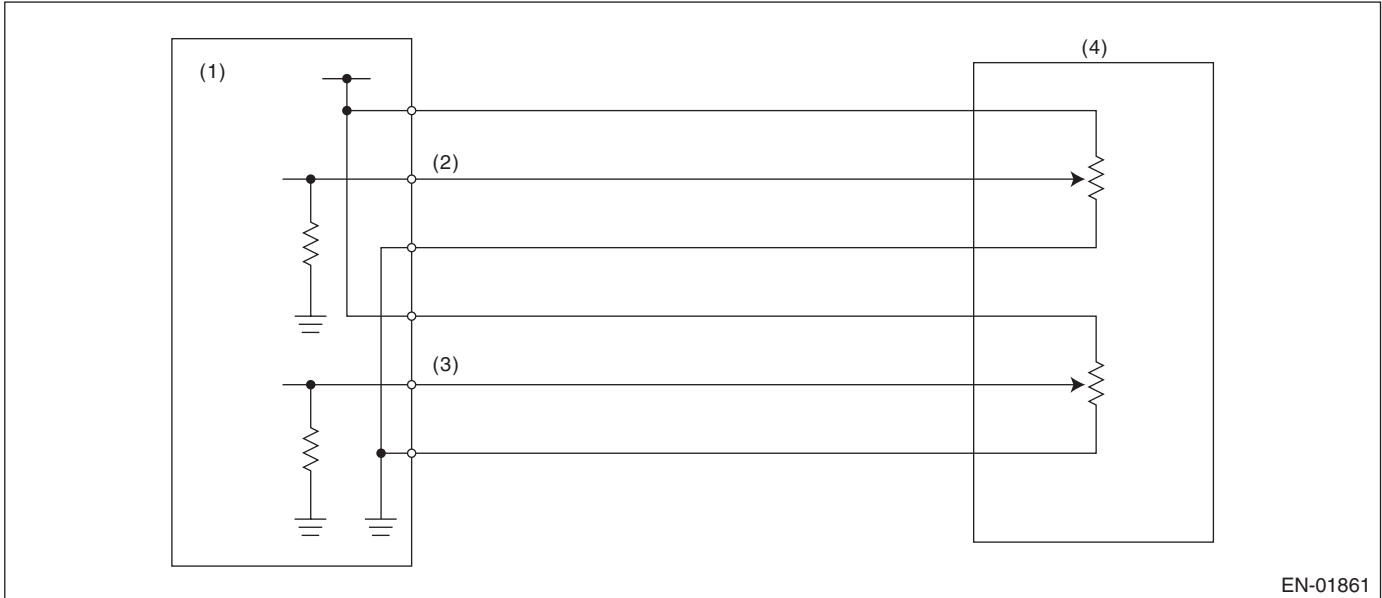
Memorize the freeze frame data. (For test mode \$02)

## EF:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.  
 Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |  |  |  |
|--|--|--|
| (1) Engine control module (ECM)                | (3) Accelerator pedal position sensor 2 signal | (4) Accelerator pedal position sensor 2 signal |
| (2) Accelerator pedal position sensor 1 signal |  |  |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\geq 4.781$ V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$< 4.781$ V

**Time Needed for Diagnosis:** 100 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

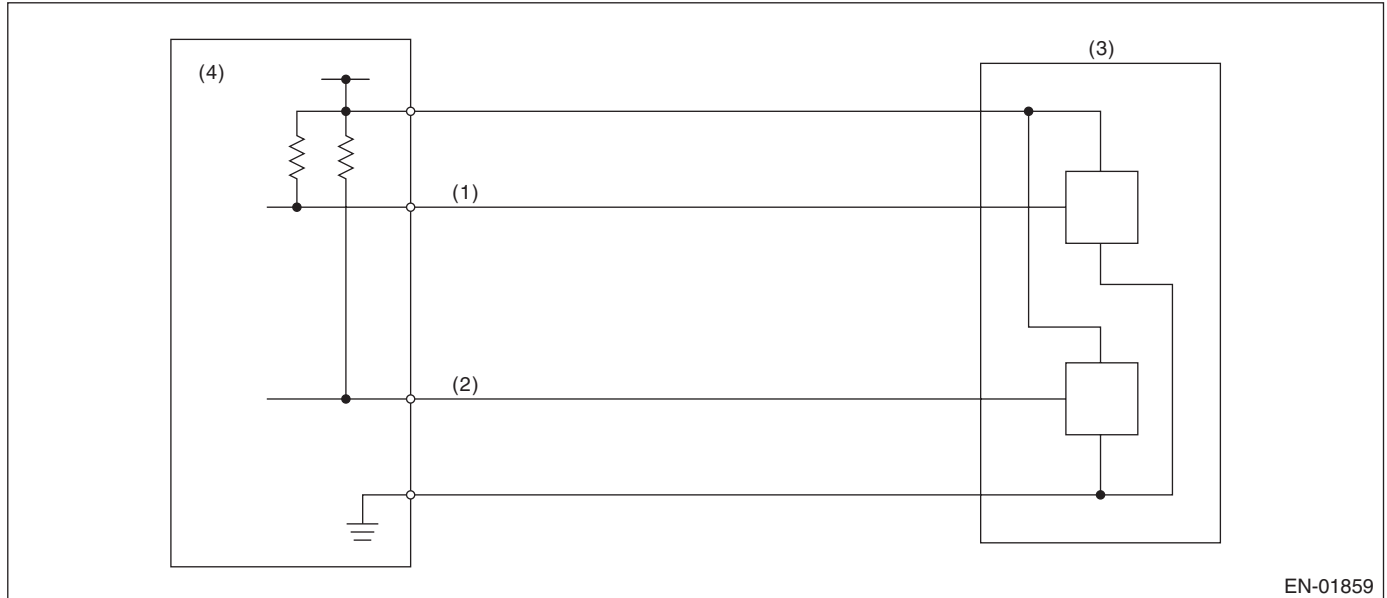
GENERAL DESCRIPTION

## EG:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

### 2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal  
(2) Throttle position sensor 2 signal

- (3) Throttle position sensor

- (4) Engine control module (ECM)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Value from Map

#### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 2.125 \text{ deg}$	$2.125 \text{ deg} \leq d < 4.25 \text{ deg}$	$4.25 \text{ deg} \leq d < 9 \text{ deg}$	$9 \text{ deg} \leq d < 31.625 \text{ deg}$	$31.625 \text{ deg} \leq d$
Sensor output difference (°)	4.5 deg	5.5 deg	7.625 deg	9.75 deg	11.75 deg

**Time Needed for Diagnosis:** 212 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq$ Value from Map

**Time Needed for Diagnosis:** 24 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

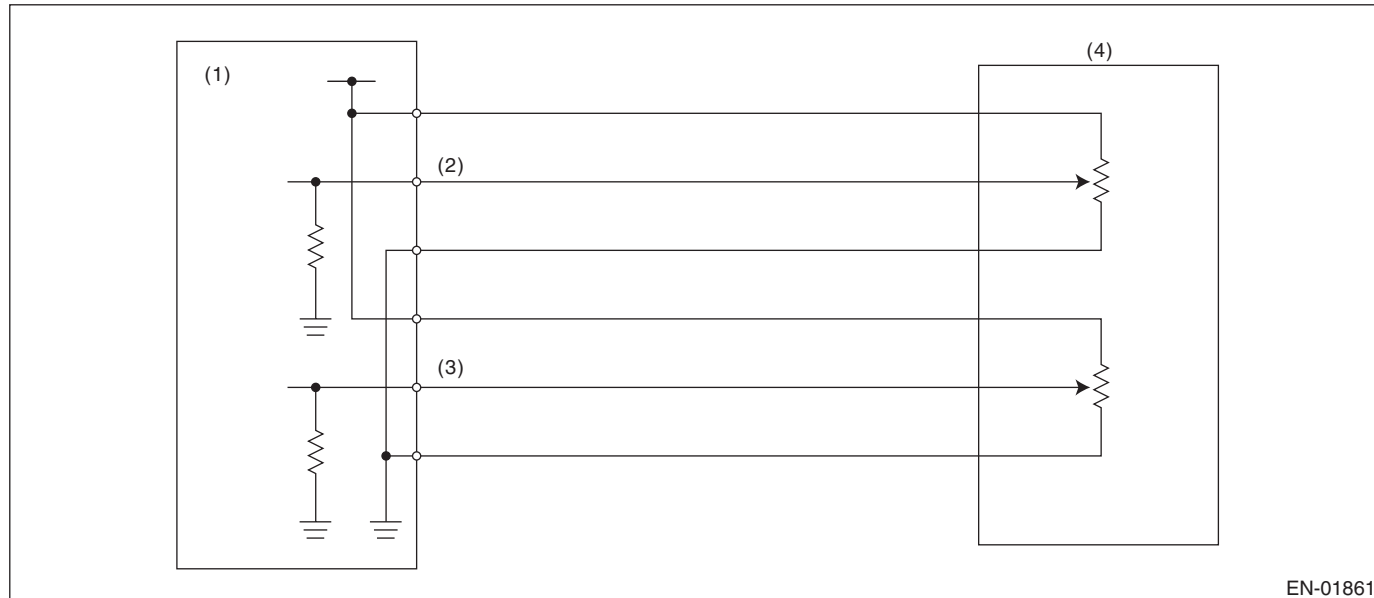
GENERAL DESCRIPTION

## EH:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

### 2. COMPONENT DESCRIPTION



EN-01861

- (1) Engine control module (ECM)      (3) Accelerator pedal position sensor 2 signal      (4) Accelerator pedal position sensor 2 signal
- (2) Accelerator pedal position sensor 1 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Map

#### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 0.6 \text{ deg}$	$0.6 \text{ deg} \leq d < 1.2 \text{ deg}$	$1.2 \text{ deg} \leq d < 2 \text{ deg}$	$2 \text{ deg} \leq d < 4 \text{ deg}$	$4 \text{ deg} \leq d$
Sensor output difference (°)	1.465 deg	1.597 deg	1.663 deg	2.455 deg	3.116 deg

**Time Needed for Diagnosis:** 116 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq \text{Map}$

**Time Needed for Diagnosis:** 116 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## EI: DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.  
Judge as NG when the ECM output level differs from the actual terminal level.

### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### EJ: DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.  
Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## EK:DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of secondary air pressure sensor output property.

Judge as NG when the secondary air pressure sensor output is largely different from the intake manifold pressure at engine start.

### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)
After secondary air system stops	≥ 2976 ms

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis with ignition switch ON.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Secondary air pipe pressure – Intake manifold pressure	≥ 26.66 kPa (200 mmHg, 7.874 inHg)
Intake manifold pressure at engine start – Intake manifold pressure	< 1.33 kPa (9.99 mmHg, 0.393 inHg)

**Time Needed for Diagnosis:** 328 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Secondary air pipe pressure – Intake manifold pressure	< 26.66 kPa (200 mmHg, 7.874 inHg)

**Time Needed for Diagnosis:** 262 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### EL:DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG if out of specification.

#### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	< 0.568 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	≥ 0.568 V

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## EM:DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Judge as NG if out of specification.

### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	> 4.921 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	≤ 4.921 V

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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#### **EN:DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK 1)**

##### **1. OUTLINE OF DIAGNOSIS**

###### **NOTE:**

For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **EO:DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK 1)**

##### **1. OUTLINE OF DIAGNOSIS**

###### **NOTE:**

For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **EP:DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### **NOTE:**

For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **EQ:DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### **NOTE:**

For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-123, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## ER:DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON

### 1. OUTLINE OF DIAGNOSIS

Detect the secondary air pump malfunction (always ON).

After the secondary air pump turns to OFF, judge as NG if the secondary air pipe pressure is higher than that before the secondary air pump operation.

### 2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 7$ V
Engine	In operation

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Time since secondary air control completion	$\geq 3000$ ms
	and
	$\leq 8000$ ms
Secondary air pipe pressure	$> 6.67$ kPa (50 mmHg, 1.969 inHg)

**Time Needed for Diagnosis:** 8000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Time since secondary air control completion	$\geq 3000$ ms
	and
	$\leq 8000$ ms
Secondary air pipe pressure	$\leq 6.67$ kPa (50 mmHg, 1.969 inHg)

**Time Needed for Diagnosis:** 8000 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)



# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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# General Description

FUEL INJECTION (FUEL SYSTEMS)

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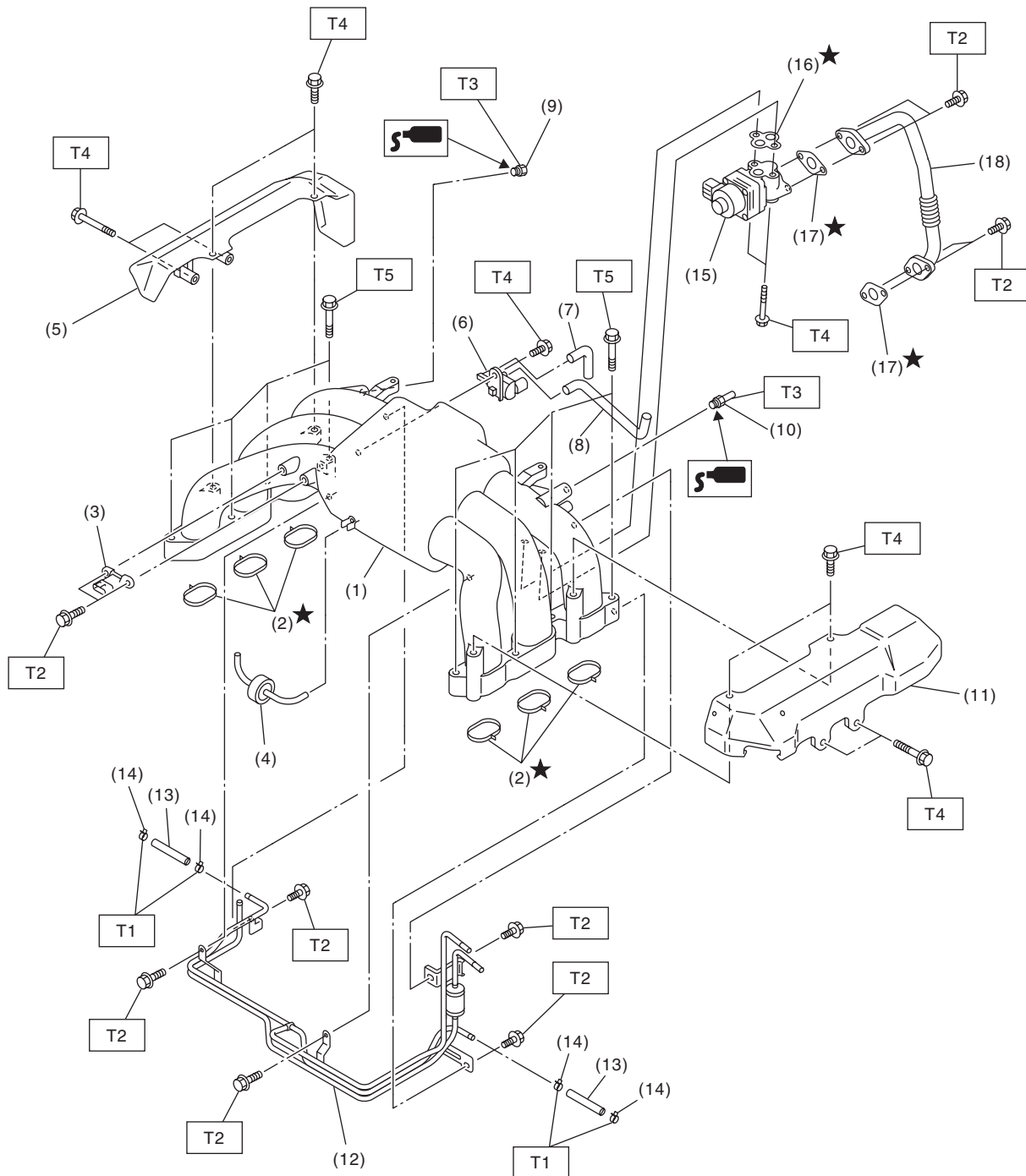
## 1. General Description

### A: SPECIFICATION

Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	550 — 850 kPa (5.61 — 8.67 kg/cm <sup>2</sup> , 79.8 — 123.3 psi)
	Discharge rate	155 ℓ (41 US gal, 34.1 Imp gal)/h or more. [12 V at 300 kPa (3.06 kg/cm <sup>2</sup> , 43.5 psi)]
Fuel filter		In-tank type

### B: COMPONENT

#### 1. INTAKE MANIFOLD



FU-03215

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

- |                                       |                             |               |
|---------------------------------------|-----------------------------|---------------|
| (1) Intake manifold                   | (10) Nipple                 | (18) EGR pipe |
| (2) O-ring                            | (11) Fuel pipe protector LH |               |
| (3) Manifold absolute pressure sensor | (12) Fuel pipe ASSY         |               |
| (4) Filter                            | (13) Hose                   |               |
| (5) Fuel pipe protector RH            | (14) Clamp                  |               |
| (6) Purge control solenoid valve      | (15) EGR valve              |               |
| (7) Hose                              | (16) Gasket                 |               |
| (8) Hose                              | (17) Gasket                 |               |
| (9) Plug                              |                             |               |

---

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 1.5 (0.15, 1.1)**

**T2: 6.4 (0.65, 4.7)**

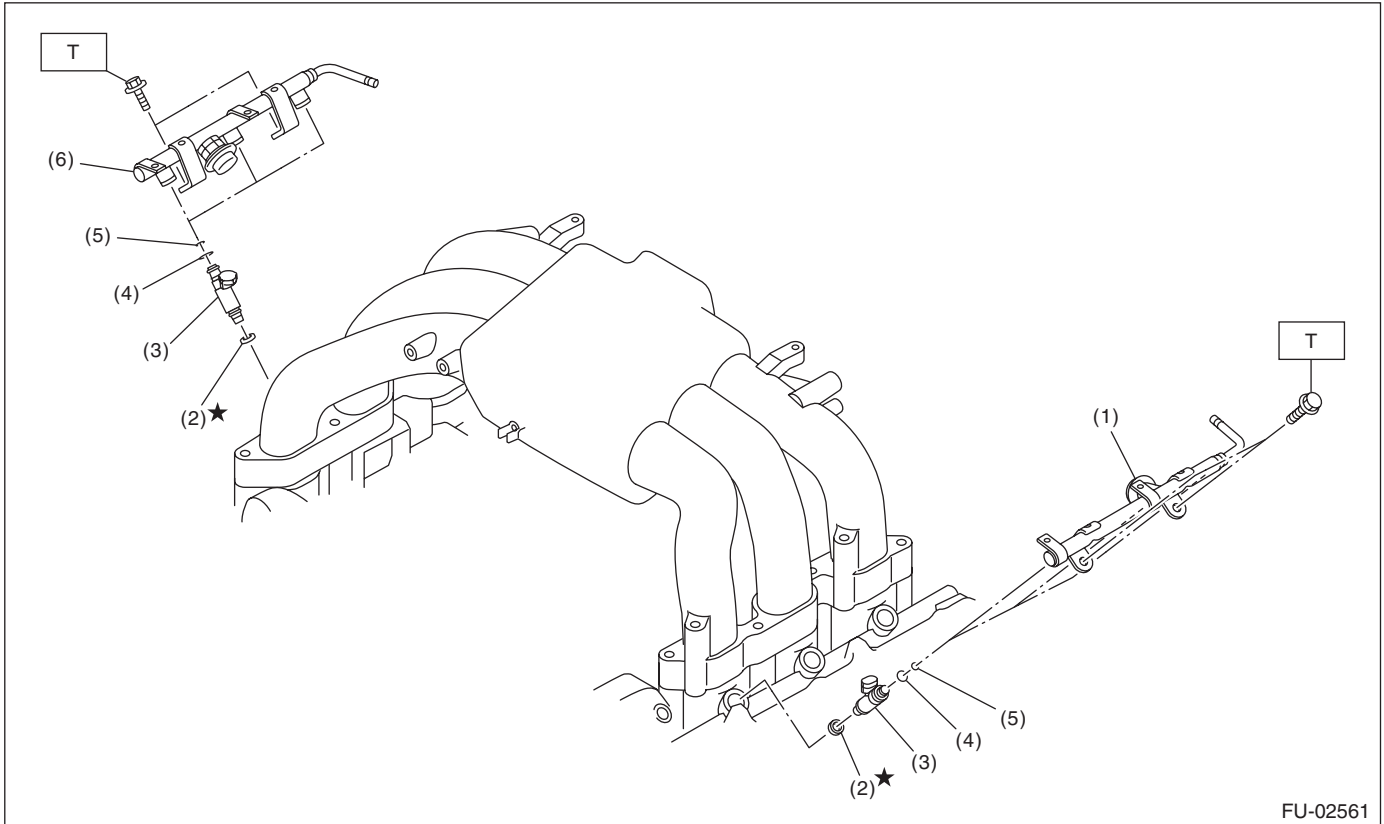
**T3: 17 (1.7, 12.5)**

**T4: 19 (1.9, 14.0)**

**T5: 25 (2.5, 18.4)**

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## 2. FUEL INJECTOR



- |                           |                           |
|---------------------------|---------------------------|
| (1) Fuel injector pipe LH | (4) Injection rubber      |
| (2) Insulator             | (5) O-ring                |
| (3) Fuel injector         | (6) Fuel injector pipe RH |

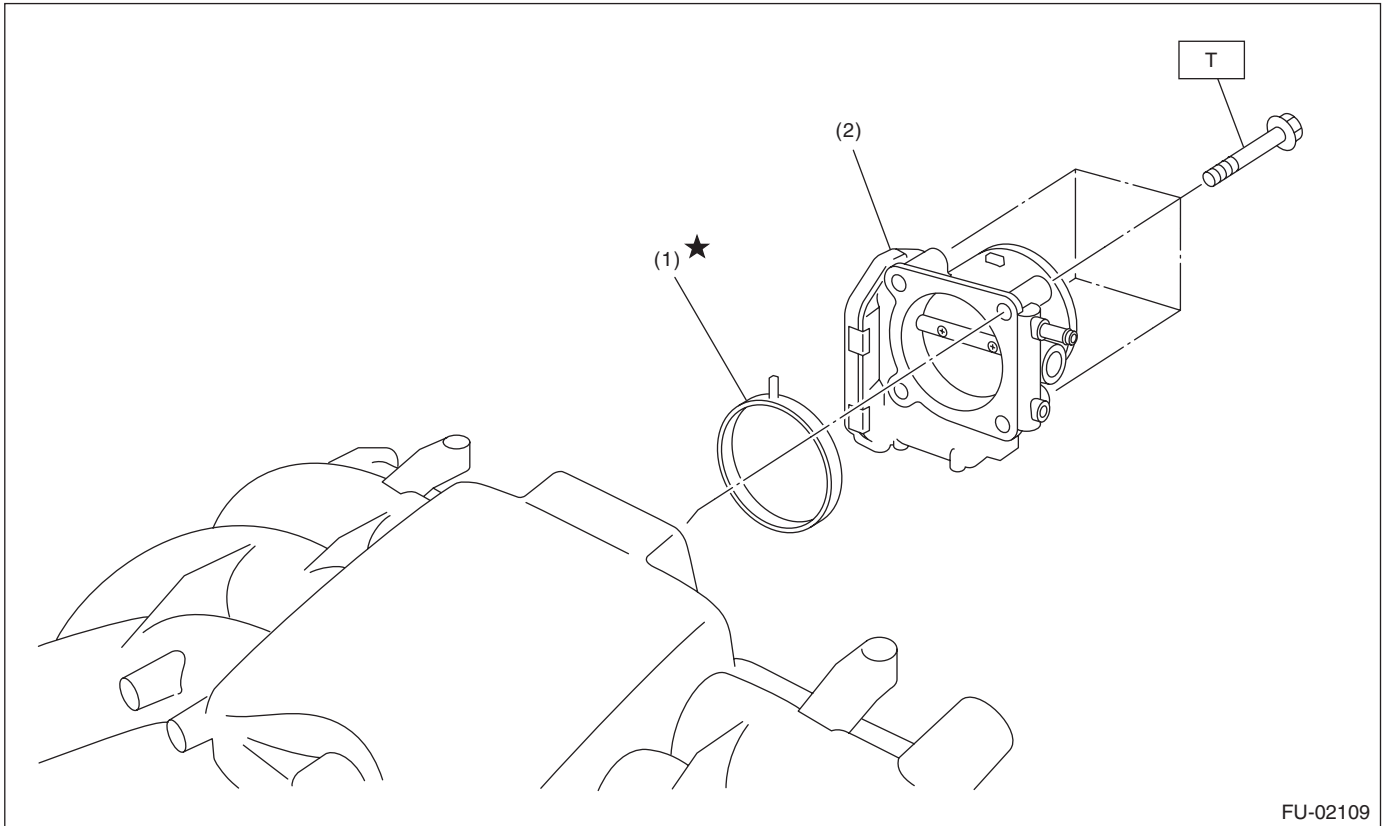
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**Tightening torque:N·m (kgf·m, ft·lb)**

**T: 19 (1.9, 14.0)**

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## 3. AIR INTAKE SYSTEM



(1) O-ring

(2) Throttle body

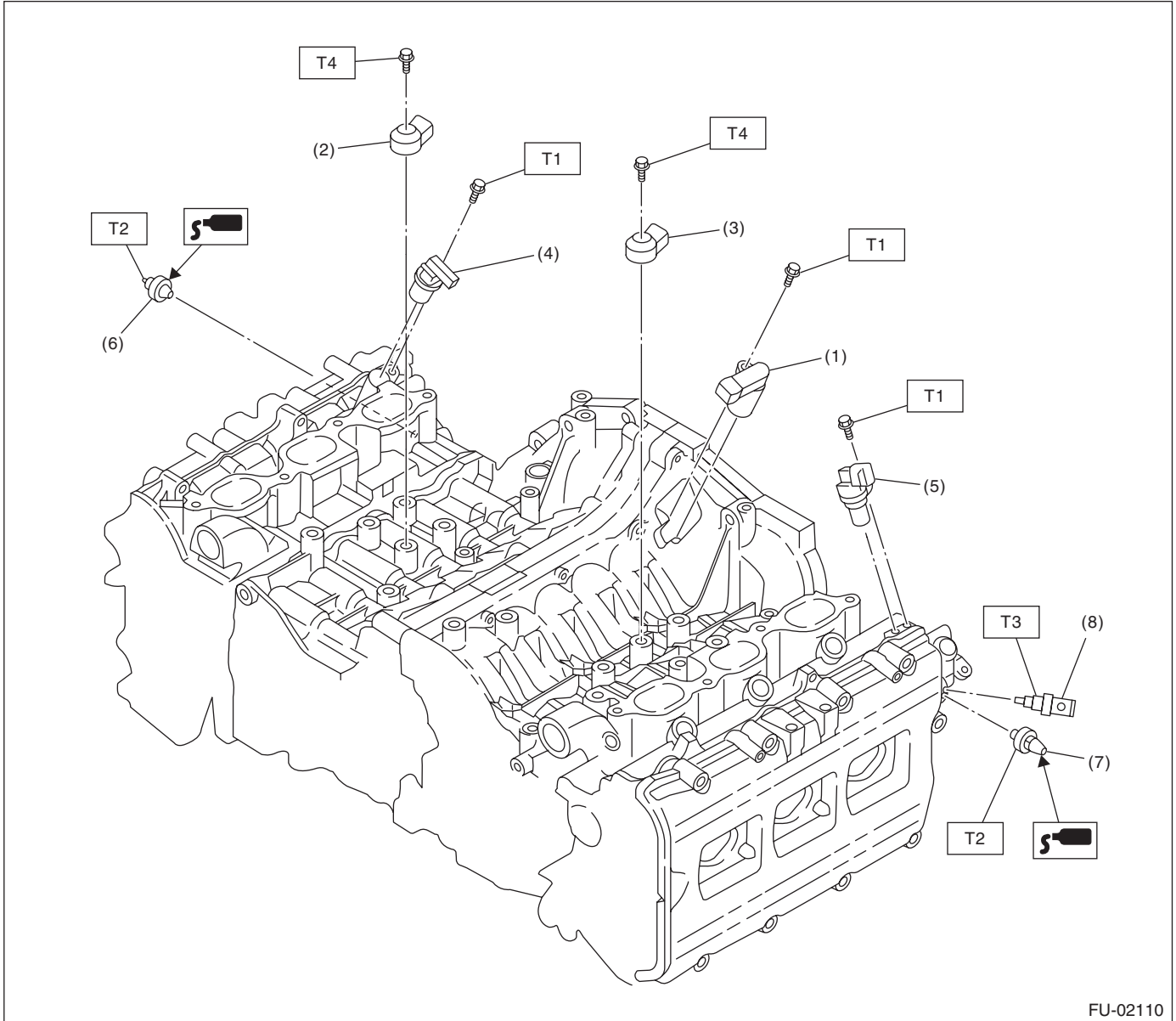
**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 8 (0.8, 5.9)**

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

### 4. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



FU-02110

- |                                 |  |
|---------------------------------|--|
| (1) Crankshaft position sensor  | (6) Variable valve lift diagnosis oil pressure switch RH |
| (2) Knock sensor RH             | (7) Variable valve lift diagnosis oil pressure switch LH |
| (3) Knock sensor LH             | (8) Oil temperature sensor                               |
| (4) Camshaft position sensor RH |  |
| (5) Camshaft position sensor LH |  |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 17 (1.7, 12.5)**

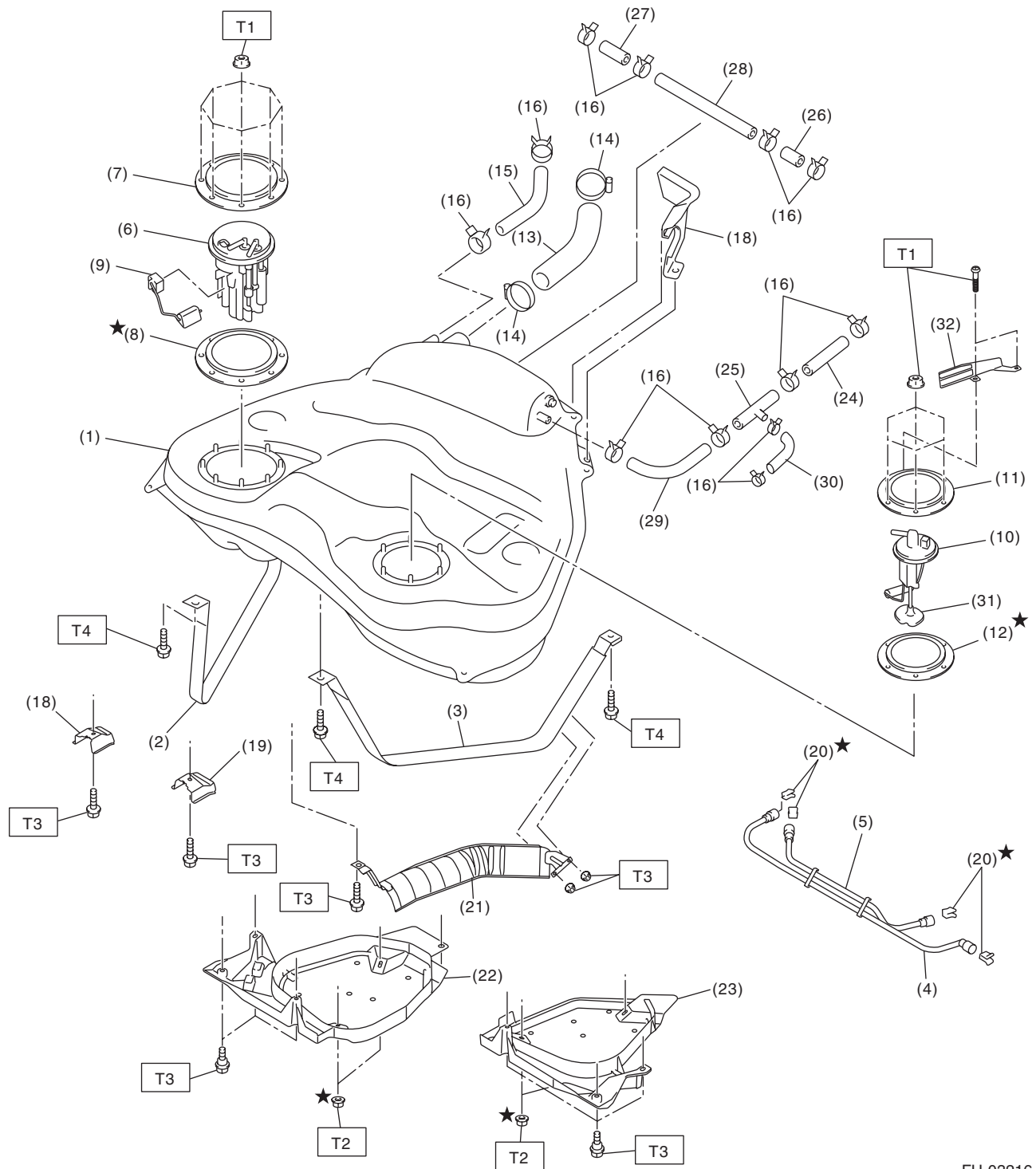
**T3: 22 (2.2, 16.2)**

**T4: 25 (2.5, 18.4)**

# General Description

FUEL INJECTION (FUEL SYSTEMS)

## 5. FUEL TANK



FU-03216

## General Description

### FUEL INJECTION (FUEL SYSTEMS)

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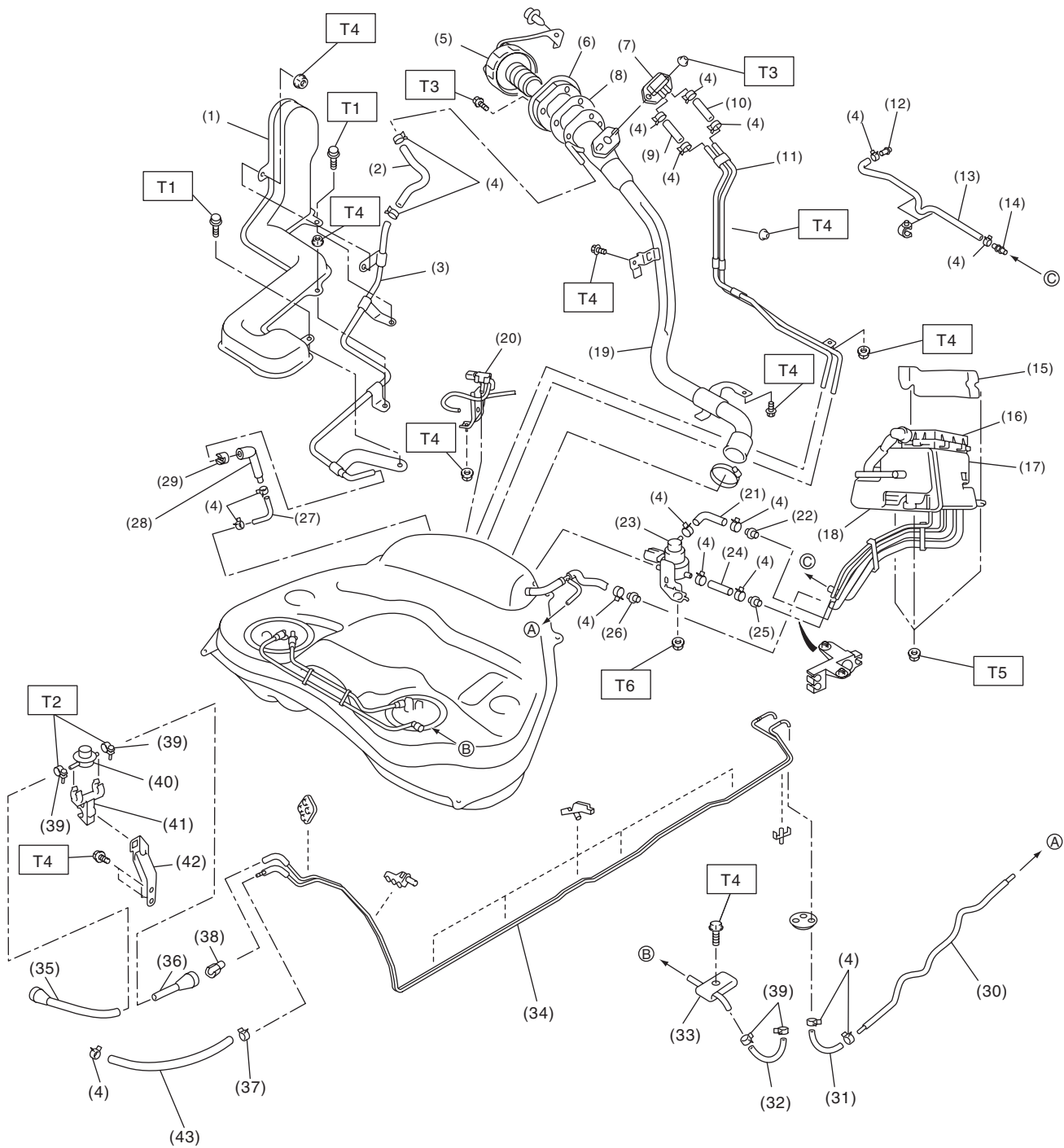
(1) Fuel tank	(14) Clamp	(27) Evaporation hose D
(2) Fuel tank band RH	(15) Evaporation hose A	(28) Evaporation pipe
(3) Fuel tank band LH	(16) Clip	(29) Evaporation hose E
(4) Delivery tube	(17) Fuel tank protector LH (Rear)	(30) Evaporation hose F
(5) Jet pump tube	(18) Stopper RH	(31) Fuel sub level sensor filter
(6) Fuel pump ASSY	(19) Stopper LH	(32) Fuel sub level sensor protector
(7) Fuel pump upper plate	(20) Retainer	
(8) Fuel pump gasket	(21) Heat shield cover	<hr/> <b>Tightening torque:N·m (kgf-m, ft-lb)</b>
(9) Fuel level sensor	(22) Fuel tank protector RH (Front)	<b>T1: 4.4 (0.45, 3.2)</b>
(10) Fuel sub level sensor	(23) Fuel tank protector LH (Front)	<b>T2: 9 (0.9, 6.6)</b>
(11) Fuel sub level sensor upper plate	(24) Evaporation hose B	<b>T3: 17.5 (1.78, 12.9)</b>
(12) Fuel sub level sensor gasket	(25) Connector	<b>T4: 33 (3.4, 24.3)</b>
(13) Fuel filler hose	(26) Evaporation hose C	<hr/>



# General Description

FUEL INJECTION (FUEL SYSTEMS)

## 6. FUEL LINE



FU-03217

FU(H6DO)-9

# General Description

## FUEL INJECTION (FUEL SYSTEMS)

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(1) Evaporation pipe protector	(18) Canister	(35) Fuel delivery hose A
(2) Evaporation hose D	(19) Fuel filler pipe	(36) Fuel delivery hose B
(3) Evaporation pipe B	(20) Fuel tank pressure sensor	(37) Clamp
(4) Clip	(21) Canister hose B	(38) Quick connector check cover
(5) Fuel filler cap	(22) Connector B	(39) Clip
(6) Filler ring	(23) Pressure control solenoid valve	(40) Fuel damper
(7) Shut valve	(24) Canister hose A	(41) Fuel damper holder
(8) Gasket	(25) Connector B	(42) Fuel damper bracket
(9) Evaporation hose C	(26) Connector A	(43) Evaporation hose A
(10) Evaporation hose C	(27) Evaporation hose E	
(11) Evaporation pipe A	(28) Evaporation tube	
(12) Drain hose connector	(29) Retainer	
(13) Drain hose	(30) Purge pipe	
(14) Connector A	(31) Purge hose C	
(15) Canister protector	(32) Fuel hose	
(16) Drain filter	(33) Connector	
(17) Drain valve	(34) Fuel pipe ASSY	

---

**Tightening torque:N·m (kgf-m, ft-lb)****T1: 1.0 (0.1, 0.7)****T2: 1.25 (0.13, 0.94)****T3: 4.4 (0.45, 3.2)****T4: 7.5 (0.76, 5.5)****T5: 8 (0.8, 5.9)****T6: 17.6 (1.8, 13)**

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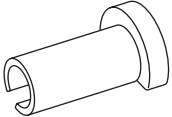
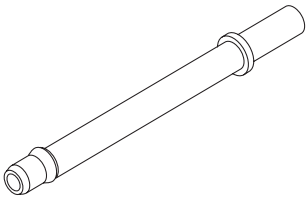
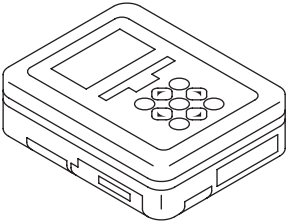
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

# General Description

FUEL INJECTION (FUEL SYSTEMS)

## D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for disconnecting quick connector of the engine compartment.
 ST18471AA000	18471AA000 (Newly adopted tool)	FUEL PIPE ADAPTER	Used for draining fuel.
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for draining fuel.

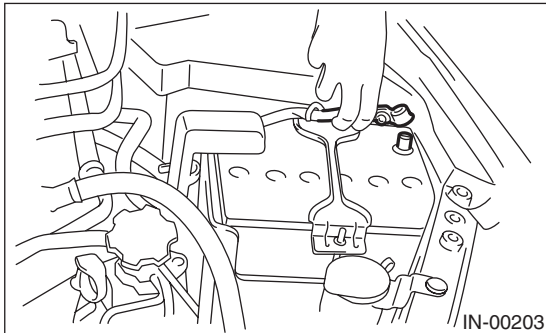
# Throttle Body

## FUEL INJECTION (FUEL SYSTEMS)

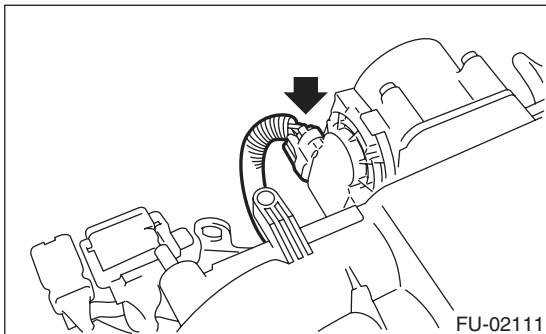
### 2. Throttle Body

#### A: REMOVAL

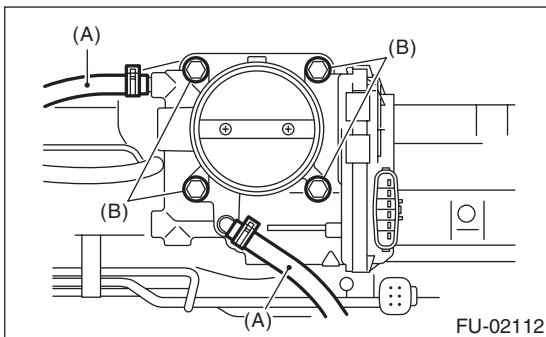
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the connector from throttle body.



- 5) Disconnect the engine coolant hoses (A) from the throttle body.
- 6) Remove the bolts (B) which secure throttle body to intake manifold.



#### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Use new O-rings.

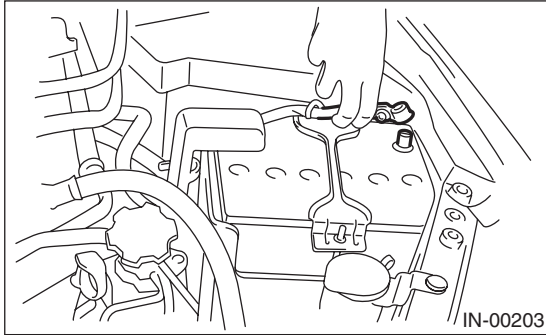
#### **Tightening torque:**

**8 N·m (0.8 kgf·m, 5.9 ft·lb)**

## 3. Intake Manifold

### A: REMOVAL

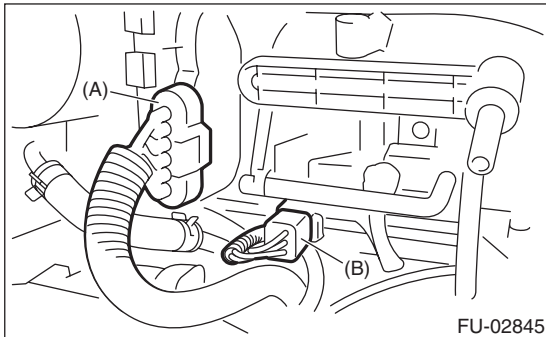
- 1) Remove the collector cover.
- 2) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Disconnect the ground cable from the battery.



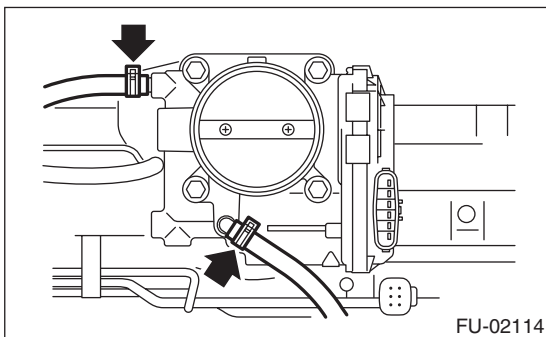
- 5) Remove the air cleaner case and air intake chamber. <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.> <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>

- 6) Disconnect the connector (A) from the throttle body.

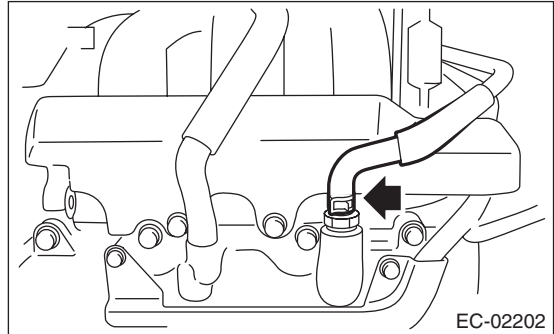
- 7) Disconnect the engine harness connector (B).



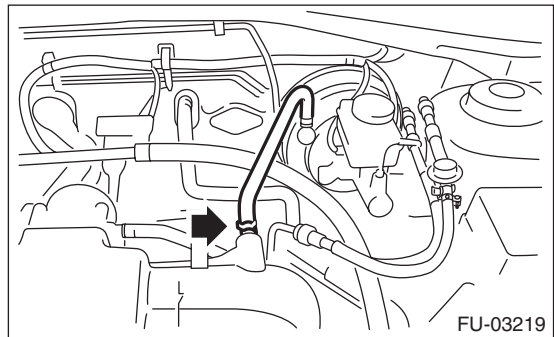
- 8) Disconnect the engine coolant hose from throttle body.



- 9) Disconnect the PCV hose.



- 10) Disconnect the brake booster hose.



- 11) Disconnect the fuel hoses from the fuel pipe.

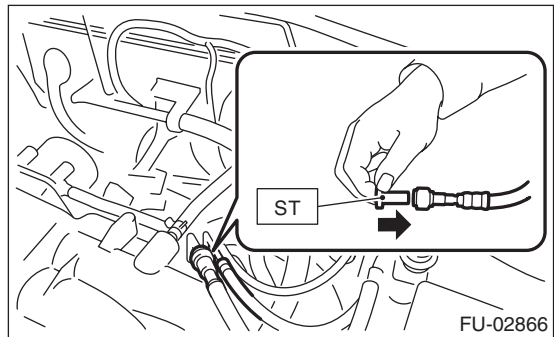
- (1) Disconnect the connector of fuel pipe by pushing the ST in the direction of arrow.

ST 42099AE000 CONNECTOR REMOVER

- (2) Remove the clip and disconnect the evaporation hose from the pipe.

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



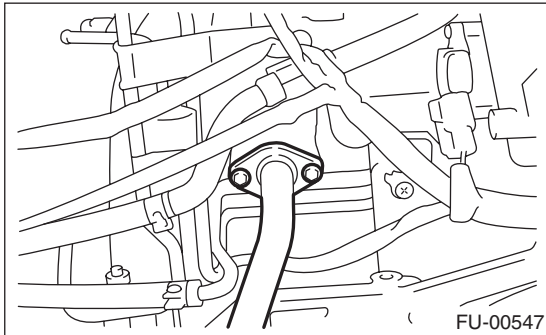
# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

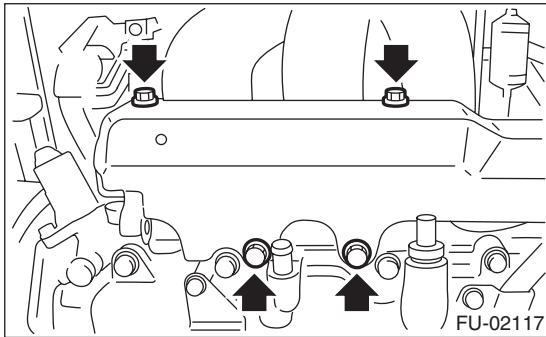
12) Remove the EGR pipe from the EGR valve.

NOTE:

Be careful not to drop the gasket.

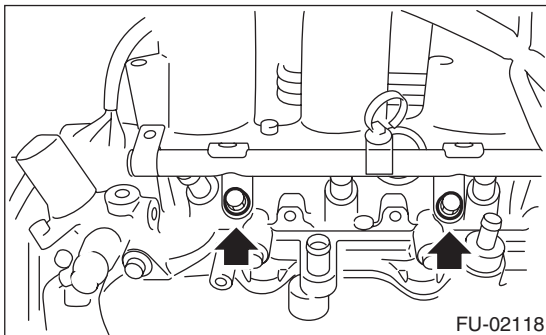


13) Remove the fuel pipe protector LH.

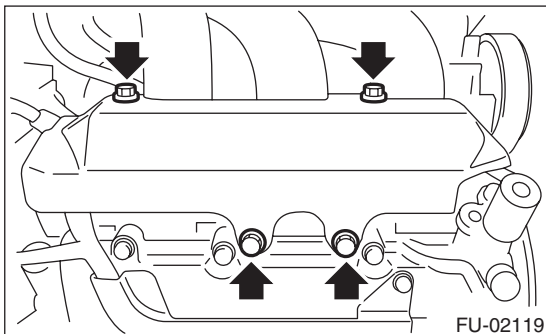


14) Remove the engine harness from the fuel injector pipe LH.

15) Remove the bolts which hold fuel injector pipe LH to cylinder head.

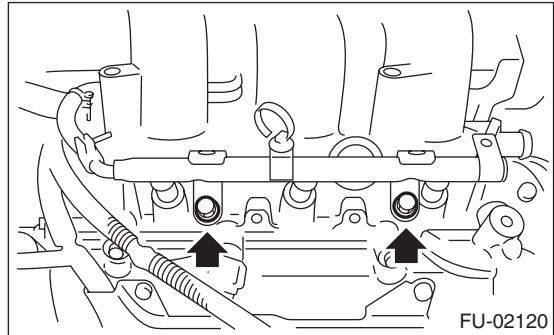


16) Remove the fuel pipe protector RH.



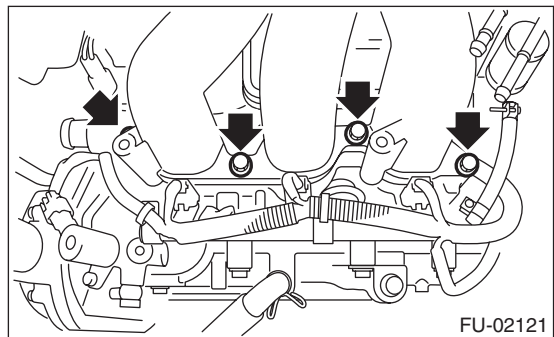
17) Remove the engine harness from the fuel injector pipe RH.

18) Remove the bolts which hold the fuel injector pipe RH to the cylinder head.

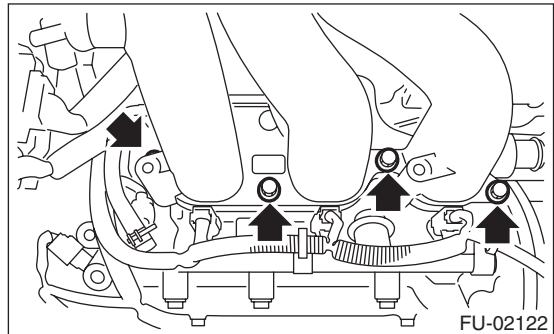


19) Remove the bolts which hold the intake manifold to the cylinder head.

• LH side



• RH side



20) Remove the intake manifold.

## B: INSTALLATION

1) Install the intake manifold onto cylinder heads.

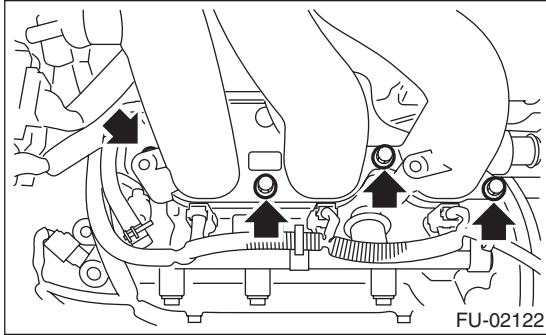
**NOTE:**

Use new O-rings.

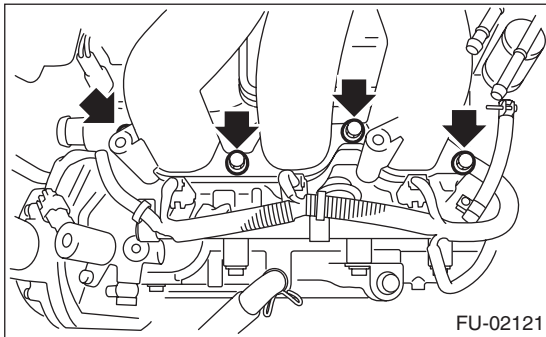
**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

- RH side



- LH side



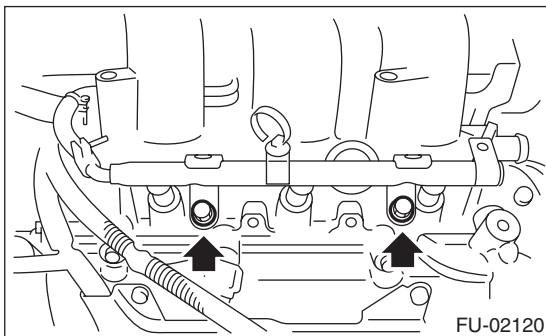
2) Install the bolts which hold fuel injector pipe RH to cylinder head.

**NOTE:**

Use new O-rings.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

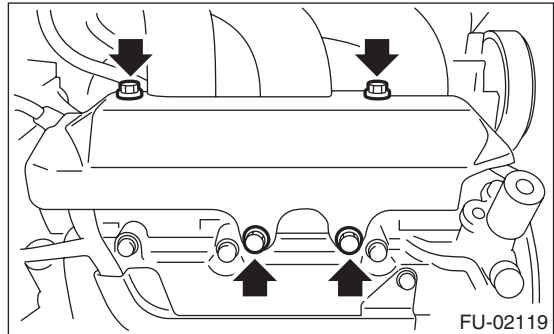


3) Install the engine harness to fuel injector pipe RH.

4) Install the fuel pipe protector RH.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



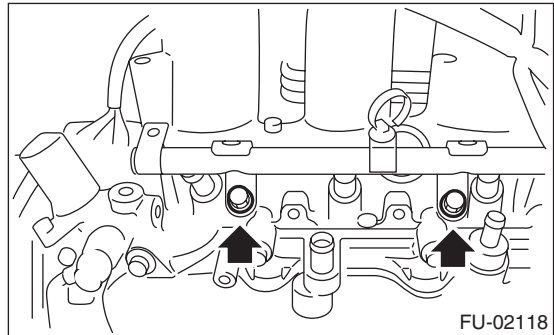
5) Install the bolts which hold fuel injector pipe LH to cylinder head.

**NOTE:**

Use new O-rings.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

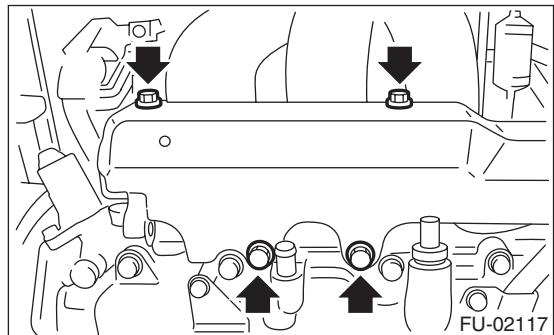


6) Install the engine harness to fuel injector pipe LH.

7) Install the fuel pipe protector LH.

**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



# Intake Manifold

## FUEL INJECTION (FUEL SYSTEMS)

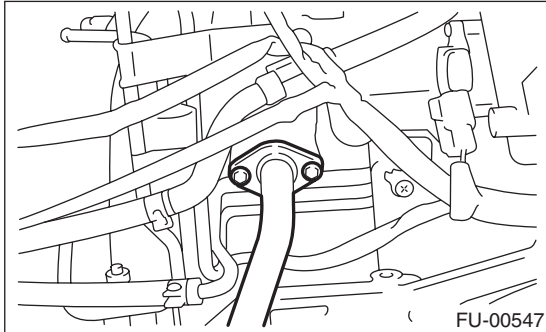
8) Install the EGR pipe to the EGR valve.

NOTE:

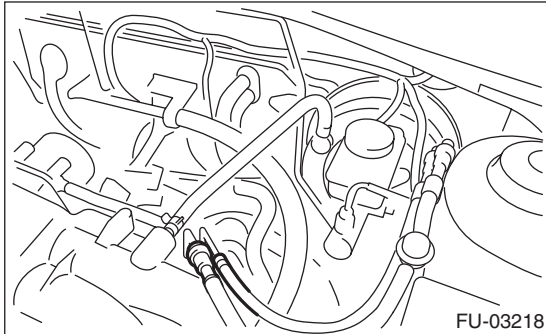
Use a new gasket.

**Tightening torque**

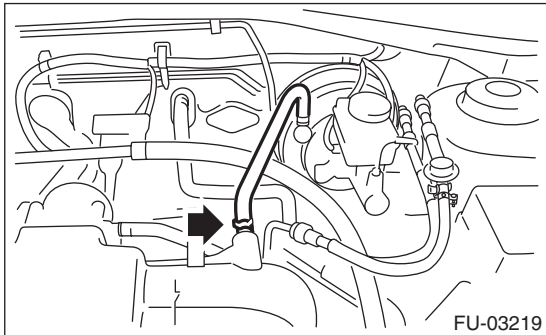
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



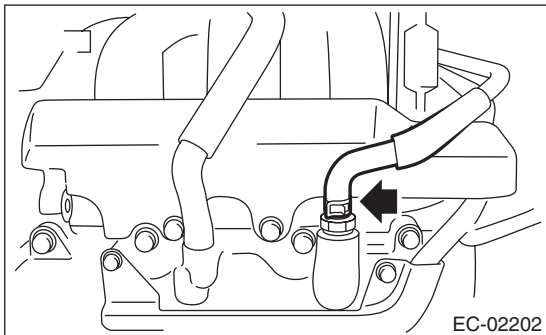
9) Connect the fuel hoses to fuel pipe.



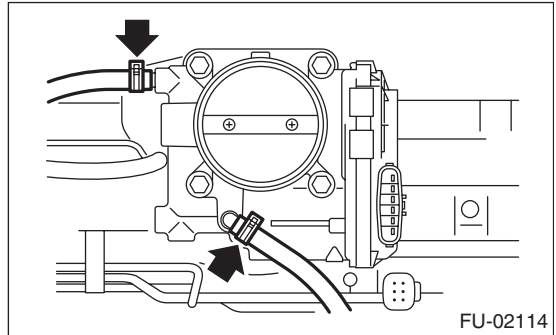
10) Connect the brake booster hose.



11) Connect the PCV hose.

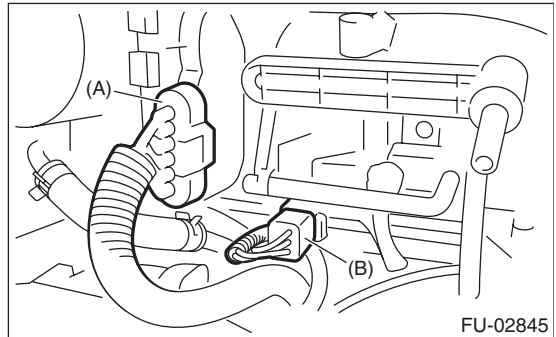


12) Connect the engine coolant hoses to throttle body.



13) Connect the connector (A) to throttle body.

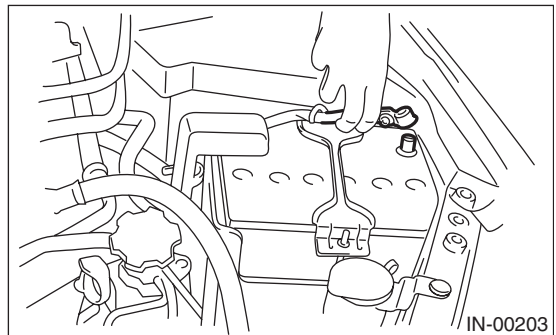
14) Connect the engine harness connector (B).



15) Install the air cleaner case and air intake chamber. <Ref. to IN(H6DO)-6, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>

16) Install the fuse of fuel pump to the main fuse box.

17) Connect the battery ground cable to battery.

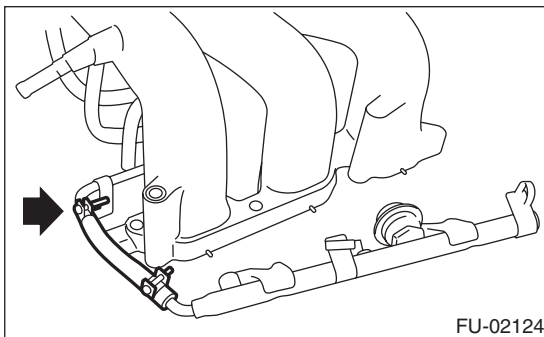


18) Install the collector cover.

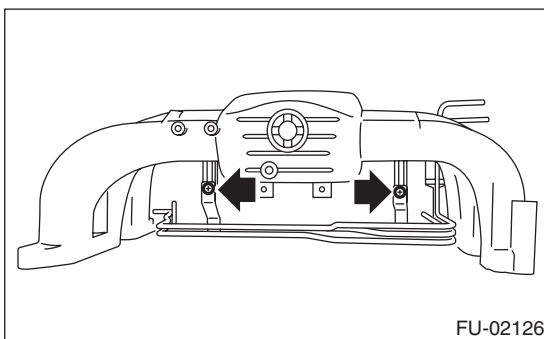
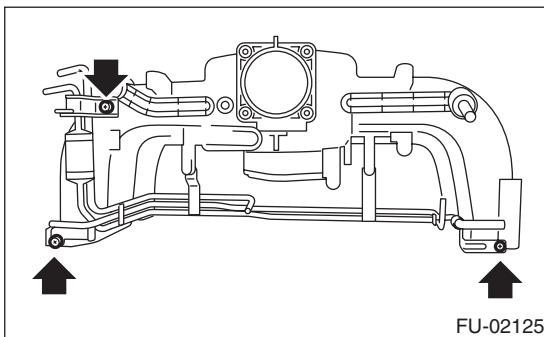


## C: DISASSEMBLY

- 1) Remove the engine harness from intake manifold.
- 2) Remove the throttle body. <Ref. to FU(H6DO)-12, REMOVAL, Throttle Body.>
- 3) Remove the EGR valve. <Ref. to FU(H6DO)-26, REMOVAL, EGR Valve.>
- 4) Remove the manifold absolute pressure sensor. <Ref. to FU(H6DO)-24, REMOVAL, Manifold Absolute Pressure Sensor.>
- 5) Remove the purge control solenoid valve. <Ref. to EC(H6DO)-7, REMOVAL, Purge Control Solenoid Valve.>
- 6) Loosen the clamp which holds fuel injector pipe to the fuel hose, and then disconnect the pipe from fuel hose.



- 7) Remove the bolts which install fuel pipes on intake manifold.



## D: ASSEMBLY

### NOTE:

When assembling the nipple, apply liquid gasket.

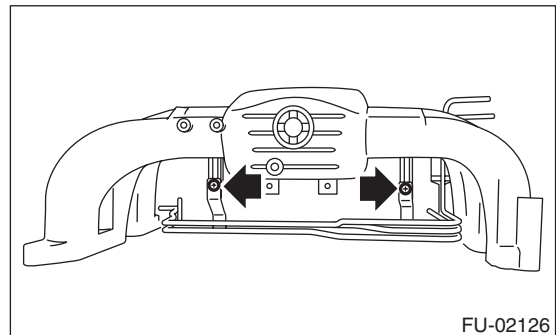
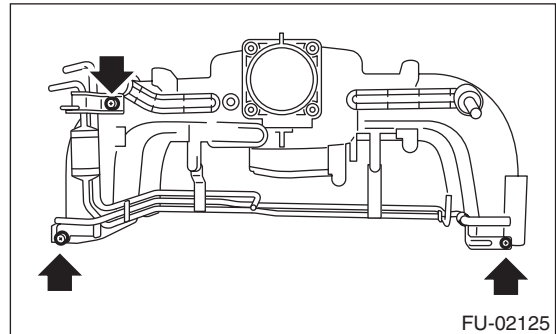
### Liquid gasket:

**THREE BOND 1105 (Part No. 004403010) or equivalent**

- 1) Tighten the bolts which install fuel pipes on intake manifold.

### Tightening torque:

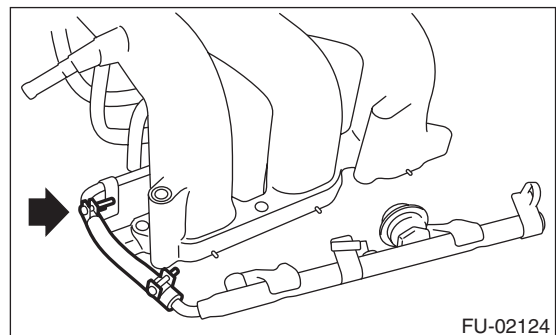
**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- 2) Connect the fuel injector pipe to fuel hose, and tighten the clamp screw.

### Tightening torque:

**1.5 N·m (0.15 kgf·m, 1.1 ft·lb)**



- 3) Install the purge control solenoid valve. <Ref. to EC(H6DO)-7, INSTALLATION, Purge Control Solenoid Valve.>

- 4) Install the manifold absolute pressure sensor. <Ref. to FU(H6DO)-24, INSTALLATION, Manifold Absolute Pressure Sensor.>

- 5) Install the EGR valve. <Ref. to FU(H6DO)-26, INSTALLATION, EGR Valve.>

## Intake Manifold

### FUEL INJECTION (FUEL SYSTEMS)

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- 6) Install the throttle body to intake manifold. <Ref. to FU(H6DO)-12, INSTALLATION, Throttle Body.>
- 7) Install the engine harness to the intake manifold.

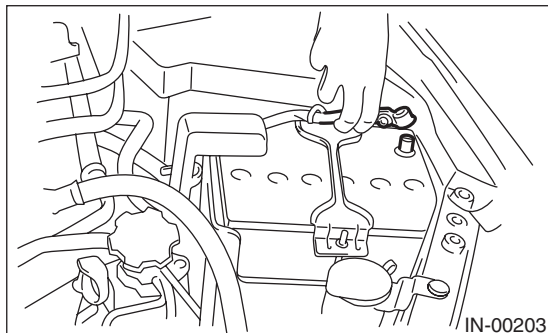
### **E: INSPECTION**

Make sure the fuel pipe and fuel hoses are not damaged and the connections are tightened firmly.

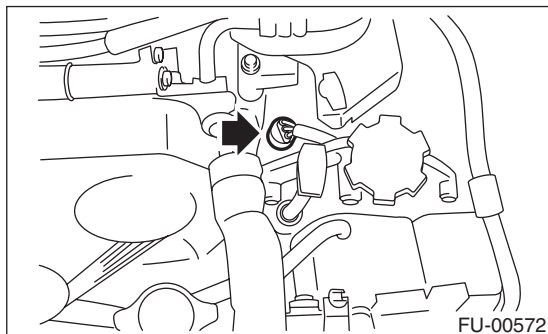
## 4. Engine Coolant Temperature Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Disconnect the connectors from the engine coolant temperature sensor.
- 4) Remove the engine coolant temperature sensor.

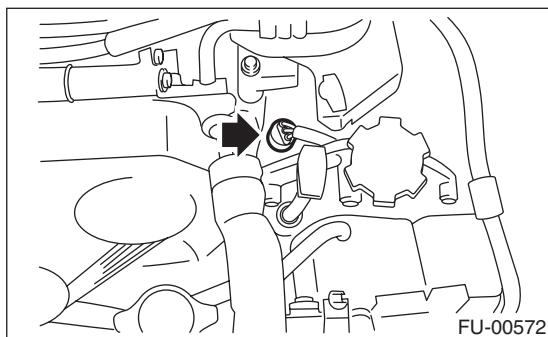


### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**22 N·m (2.2 kgf-m, 16.2 ft-lb)**



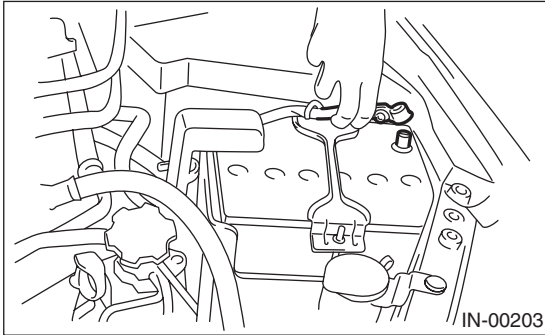
# Crankshaft Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

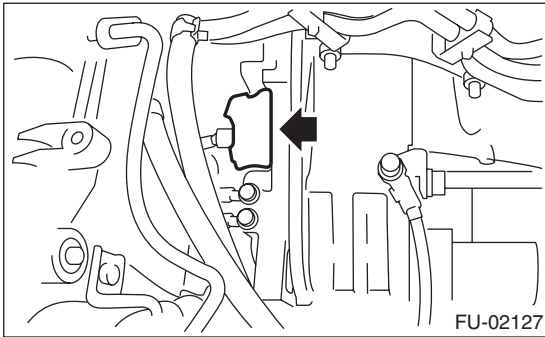
## 5. Crankshaft Position Sensor

### A: REMOVAL

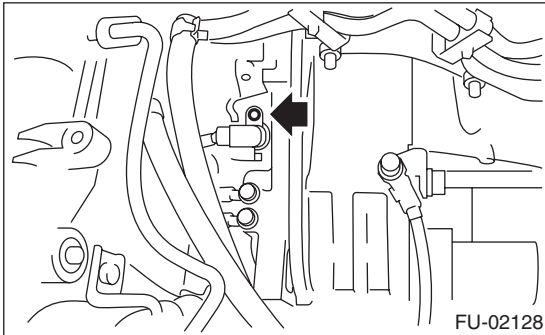
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Remove the service hole cover.



- 5) Remove the crankshaft position sensor.



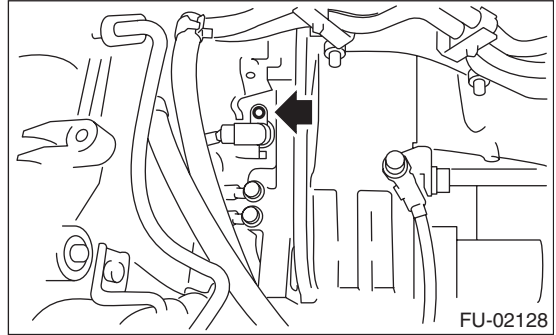
- 6) Disconnect the connector from crankshaft position sensor.

### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

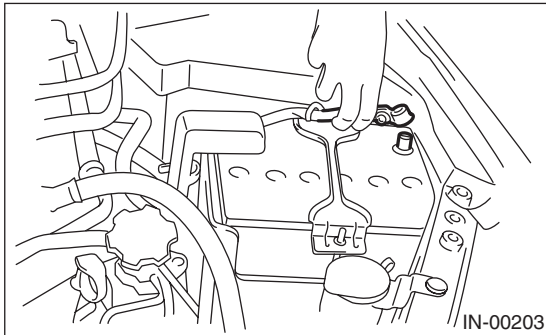
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



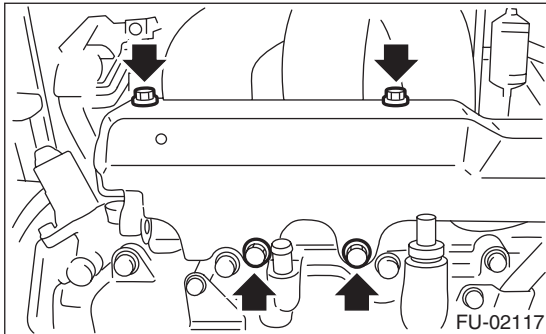
## 6. Camshaft Position Sensor

### A: REMOVAL

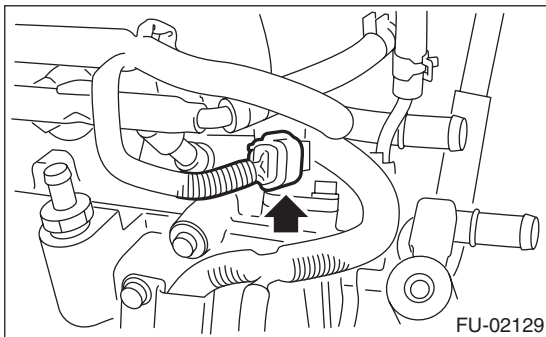
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



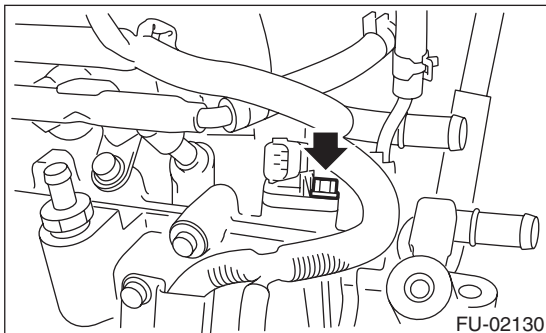
- 3) Remove the generator harness from the fuel pipe protector LH.
- 4) Remove the fuel pipe protector LH.



- 5) Disconnect the connector from camshaft position sensor LH.



- 6) Remove the camshaft position sensor LH.



- 7) Remove the camshaft position sensor RH in the same procedure as LH.

### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**Camshaft position sensor**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

**Fuel pipe protector**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**

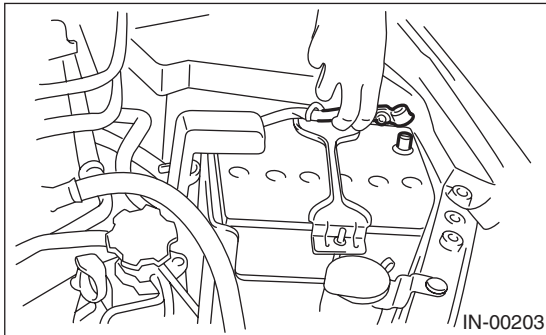
# Knock Sensor

## FUEL INJECTION (FUEL SYSTEMS)

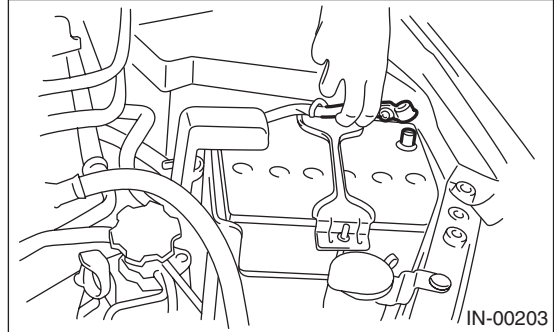
### 7. Knock Sensor

#### A: REMOVAL

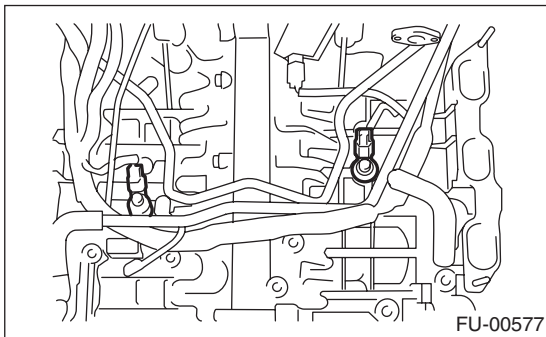
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 4) Connect the battery ground cable to battery.



- 3) Remove the intake manifold. <Ref. toFU(H6DO)-13, REMOVAL, Intake Manifold.>
- 4) Disconnect the knock sensor connector.
- 5) Remove the knock sensor from the cylinder block.



- 5) Install the collector cover.

#### B: INSTALLATION

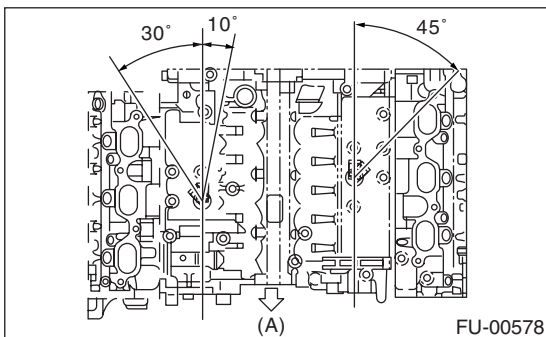
- 1) Install the knock sensor to cylinder block.

#### **Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

#### NOTE:

For the knock sensor installation angle, refer to the figure below.



(A) Front side

- 2) Connect the knock sensor connector.
- 3) Install the intake manifold. <Ref. to FU(H6DO)-15, INSTALLATION, Intake Manifold.>

## 8. Throttle Position Sensor

### A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body. Refer to "Throttle Body" for removal and installation procedure. <Ref. to FU(H6DO)-12, REMOVAL, Throttle Body.> <Ref. to FU(H6DO)-12, INSTALLATION, Throttle Body.>

# Manifold Absolute Pressure Sensor

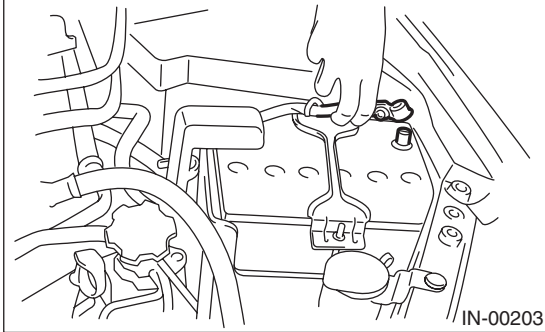
FUEL INJECTION (FUEL SYSTEMS)

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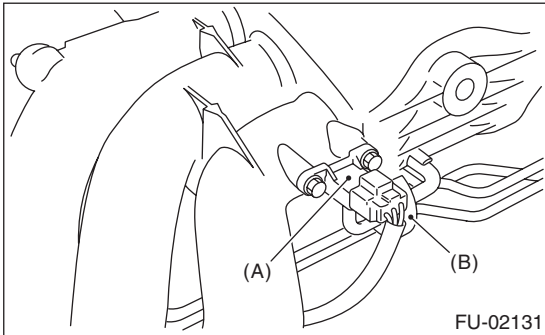
## 9. Manifold Absolute Pressure Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Disconnect the connector from the manifold absolute pressure sensor (A), and remove the filter assembly (B) from the intake manifold.



- 4) Remove the manifold absolute pressure sensor from intake manifold.

### B: INSTALLATION

Install in the reverse order of removal.

#### ***Tightening torque:***

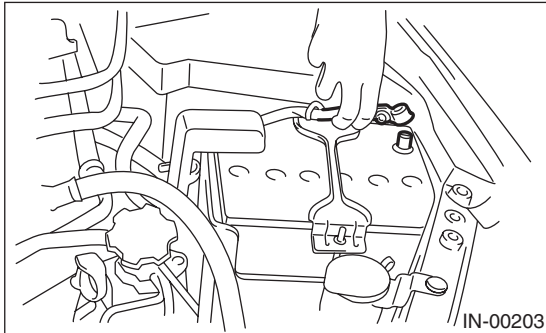
***6.4 N·m (0.65 kgf-m, 4.7 ft-lb)***



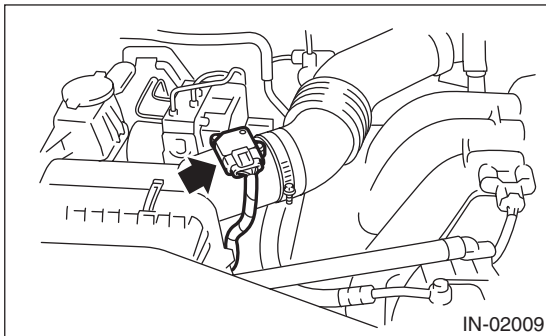
## 10. Mass Air Flow and Intake Air Temperature Sensor

### A: REMOVAL

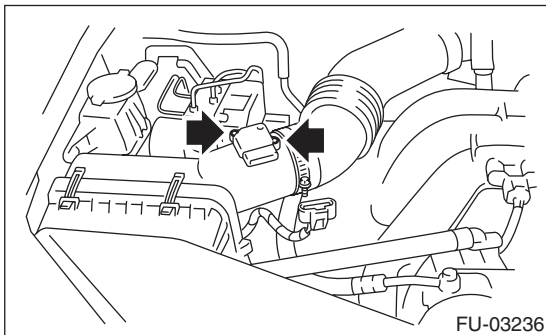
- 1) Disconnect the ground cable from the battery.



- 2) Disconnect the connectors from the mass air flow and intake air temperature sensor.



- 3) Remove the mass air flow and intake air temperature sensor.



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**1 N·m (0.1 kgf·m, 0.7 ft·lb)**

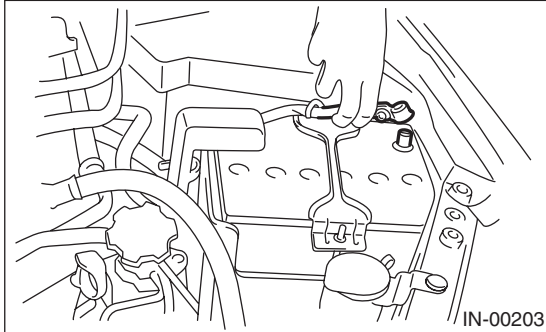
# EGR Valve

## FUEL INJECTION (FUEL SYSTEMS)

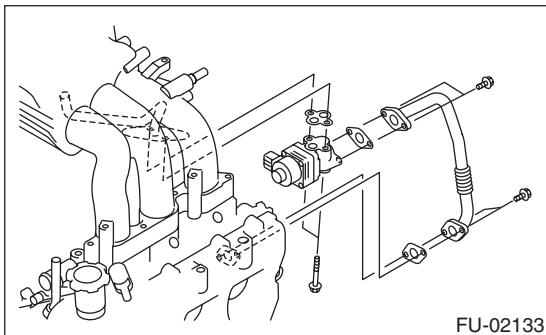
### 11.EGR Valve

#### A: REMOVAL

- 1) Remove the collector cover and the engine side cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
- 5) Remove the EGR pipe from the EGR valve and the cylinder head.
- 6) Remove the EGR valve from intake manifold.



- 7) Disconnect the connector from the EGR valve.

#### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Use a new gasket.

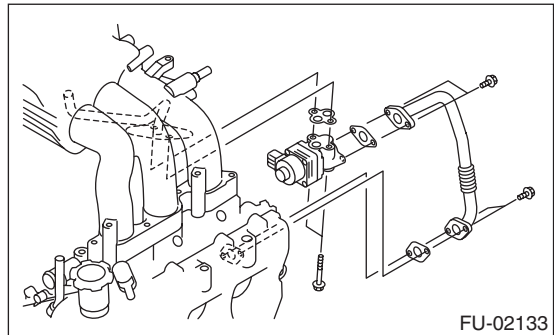
#### Tightening torque:

**EGR valve**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

**EGR pipe**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

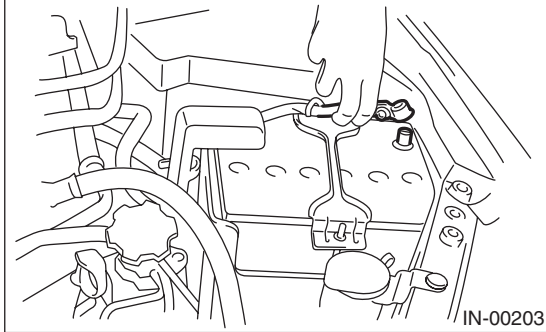


## 12. Fuel Injector

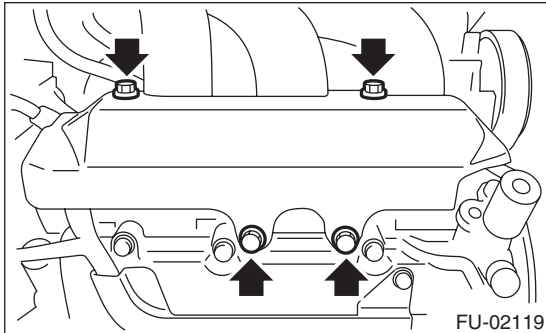
### A: REMOVAL

#### 1. RH SIDE

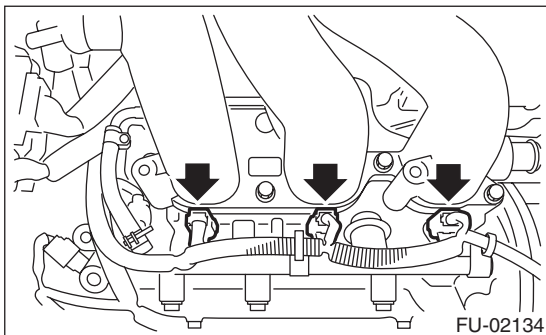
- 1) Remove the collector cover.
- 2) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Disconnect the ground cable from the battery.



- 5) Remove the air cleaner case. <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.>
- 6) Remove the fuel pipe protector RH.

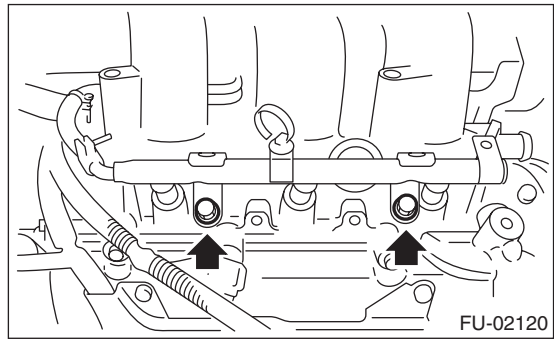


- 7) Disconnect the connector from fuel injector.



- 8) Remove the engine harness from the fuel injector pipe RH.

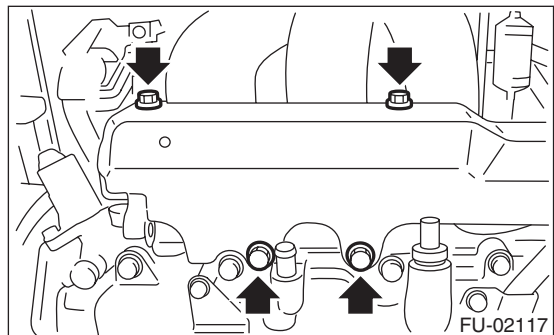
- 9) Remove the bolts which hold fuel injector pipe to the cylinder head.



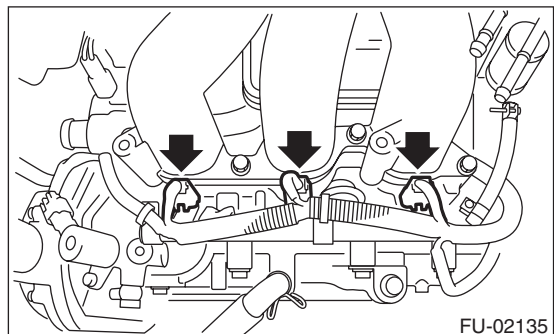
- 10) Remove the fuel injector while lifting up the fuel injector pipe.

#### 2. LH SIDE

- 1) Remove the collector cover.
- 2) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Remove the battery.
- 5) Remove the generator harness from the fuel pipe protector LH.
- 6) Remove the fuel pipe protector LH.



- 7) Disconnect the connector from fuel injector.

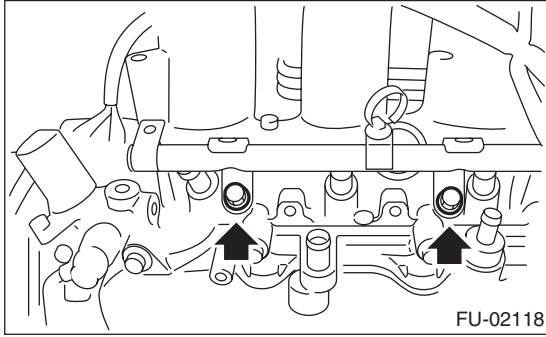


- 8) Remove the engine harness from the fuel injector pipe LH.

# Fuel Injector

## FUEL INJECTION (FUEL SYSTEMS)

9) Remove the bolts which hold fuel injector pipe to the cylinder head.



10) Remove the fuel injector while lifting up the fuel injector pipe.

## B: INSTALLATION

### 1. RH SIDE

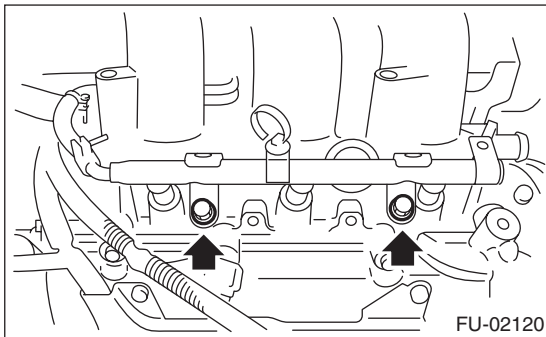
Install in the reverse order of removal.

NOTE:

Use new O-rings.

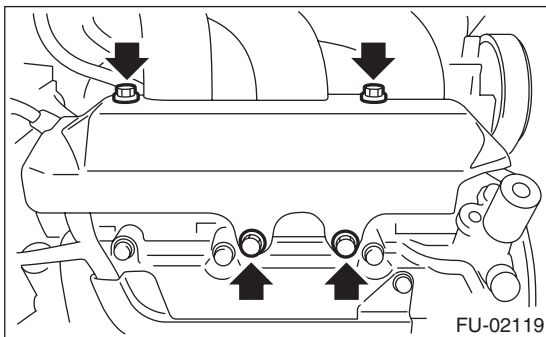
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



### 2. LH SIDE

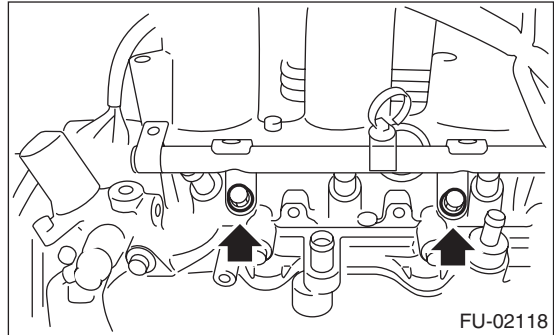
Install in the reverse order of removal.

NOTE:

Use new O-rings.

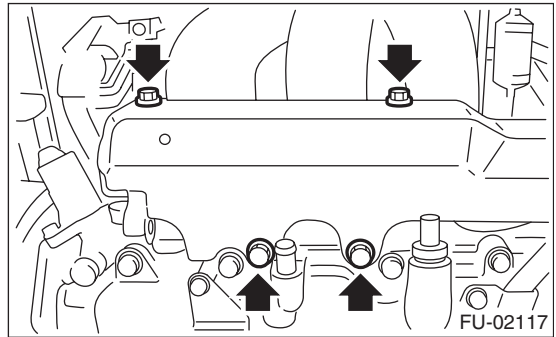
**Tightening torque:**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



**Tightening torque:**

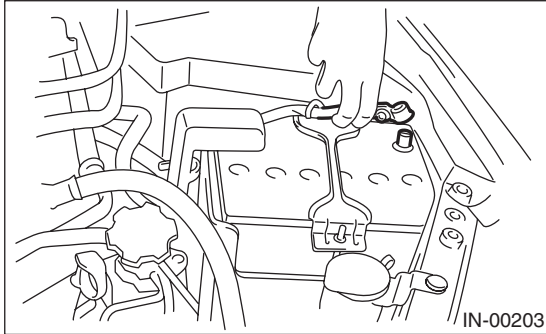
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**



## 13. Variable Valve Lift Diagnosis Oil Pressure Switch

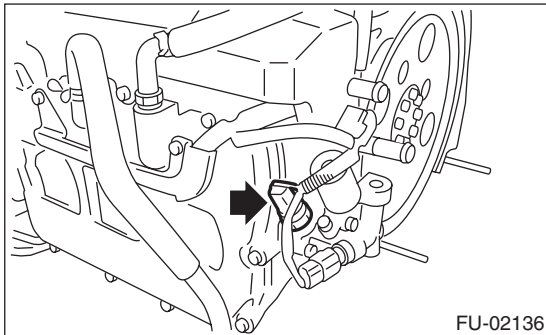
### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.

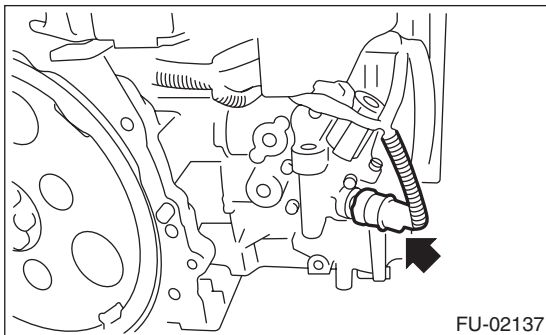


- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.
- 5) Remove the variable valve lift diagnosis oil pressure switch.

- LH side



- RH side



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Apply liquid gasket to the variable valve lift diagnosis oil pressure switch threads.

#### Liquid gasket:

**THREE BOND 1324 (Part No. 004403042) or equivalent**

#### Tightening torque:

**17 N·m (1.7 kgf·m, 12.5 ft·lb)**

# Oil Temperature Sensor

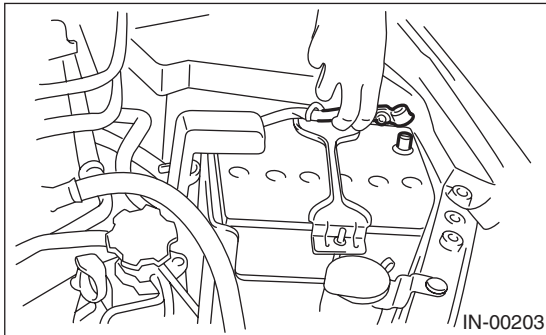
FUEL INJECTION (FUEL SYSTEMS)

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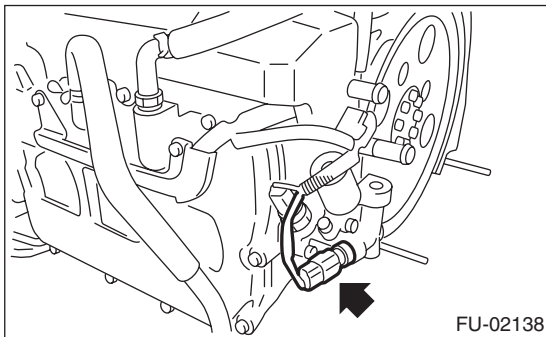
## 14. Oil Temperature Sensor

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the connector from the oil temperature sensor.
- 5) Remove the oil temperature sensor.



### B: INSTALLATION

Install in the reverse order of removal.

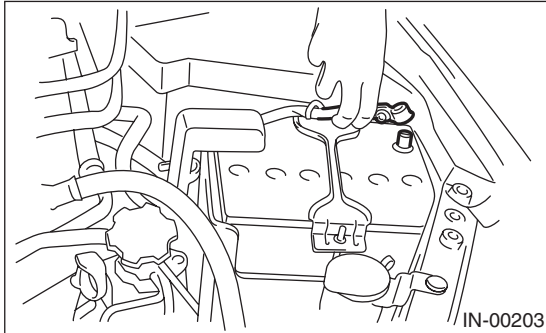
**Tightening torque:**

**22 N·m (2.2 kgf·m, 16.2 ft·lb)**

## 15. Front Oxygen (A/F) Sensor

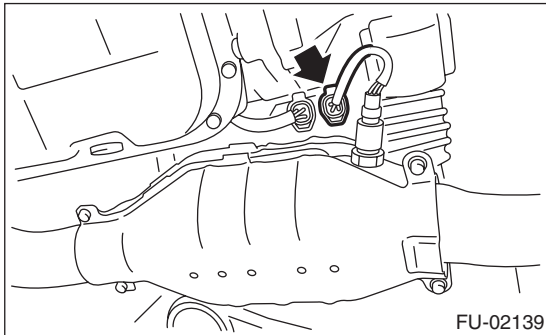
### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.

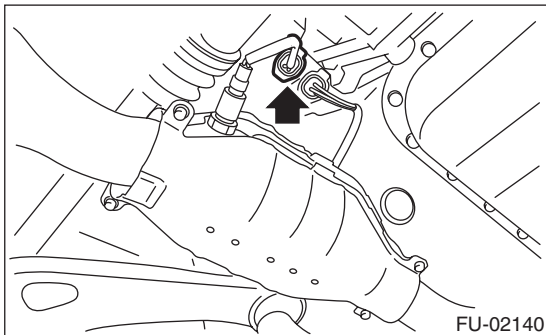


- 3) Lift up the vehicle.
- 4) Disconnect the connector of front oxygen (A/F) sensor.

- LH side



- RH side



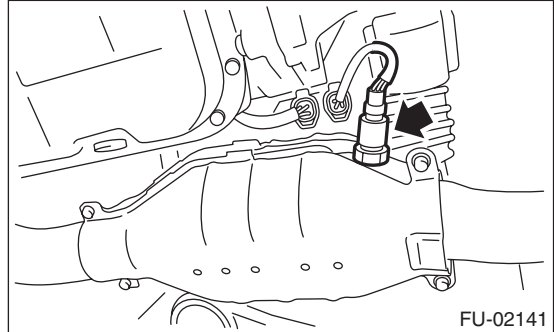
- 5) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

- 6) Remove the front oxygen (A/F) sensor.

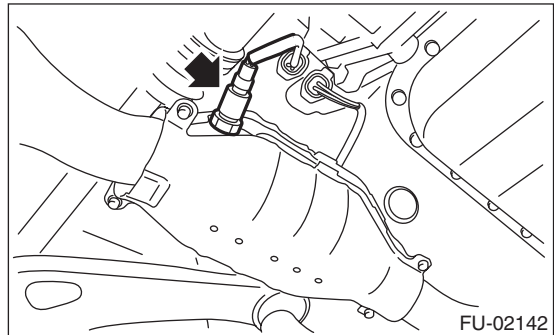
### CAUTION:

When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.

- LH side



- RH side



### B: INSTALLATION

- 1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

#### Anti-seize compound:

**NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent**

### CAUTION:

Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

# Front Oxygen (A/F) Sensor

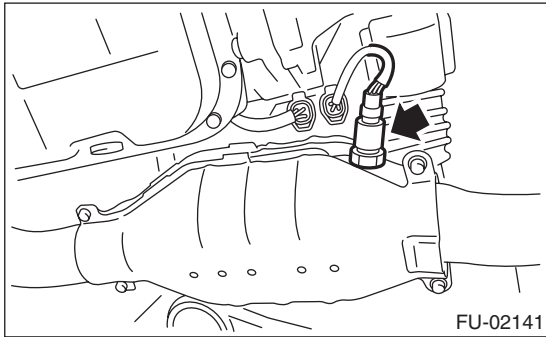
## FUEL INJECTION (FUEL SYSTEMS)

2) Install the front oxygen (A/F) sensor.

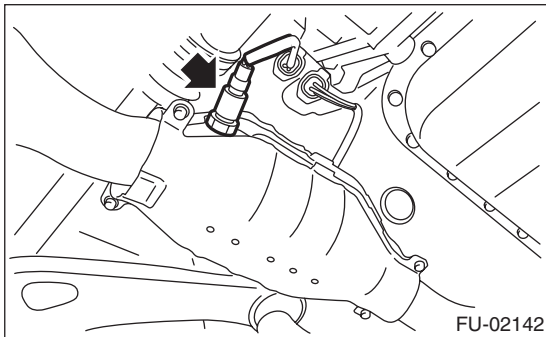
### **Tightening torque:**

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

- LH side

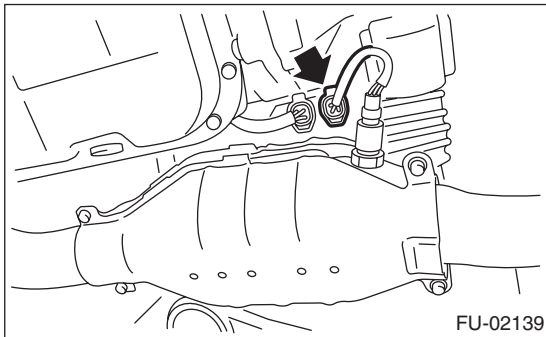


- RH side

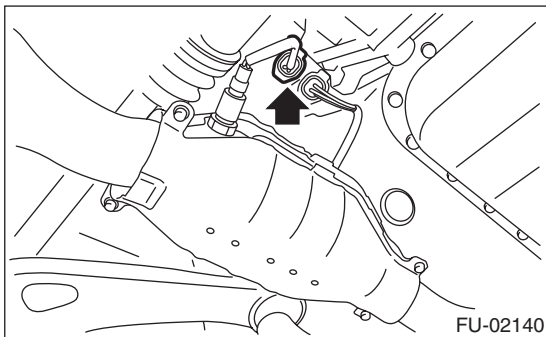


3) Connect the connector of front oxygen (A/F) sensor.

- LH side

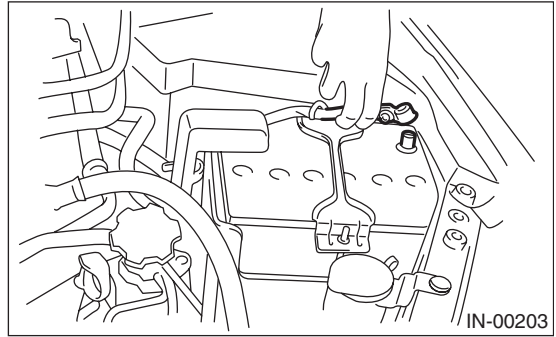


- RH side



4) Lower the vehicle.

5) Connect the battery ground cable to battery.

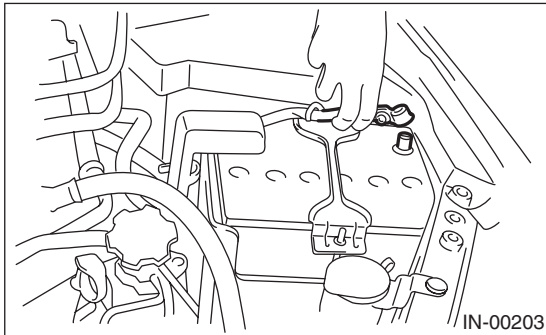




## 16. Rear Oxygen Sensor

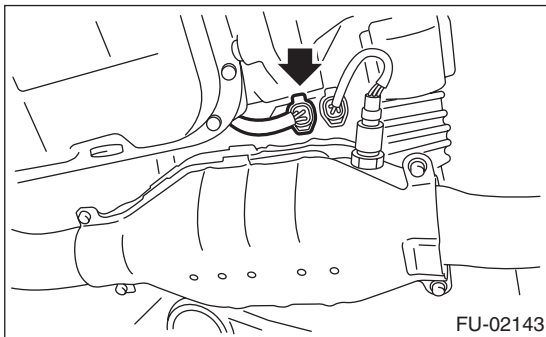
### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.

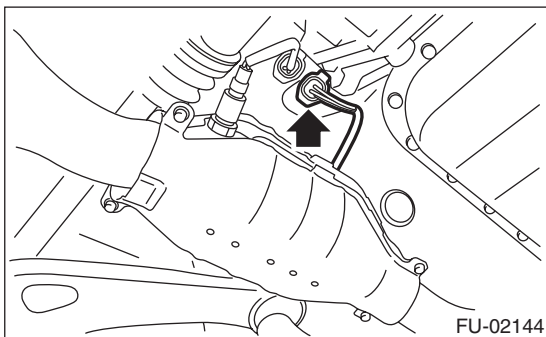


- 3) Lift up the vehicle.
- 4) Disconnect the connector from rear oxygen sensor.

- LH side



- RH side



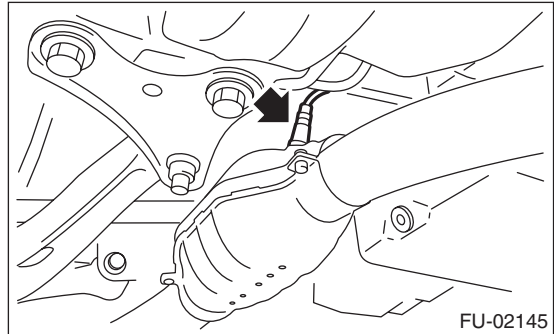
- 5) Remove the clip holding the harness.
- 6) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

- 7) Remove the rear oxygen sensor.

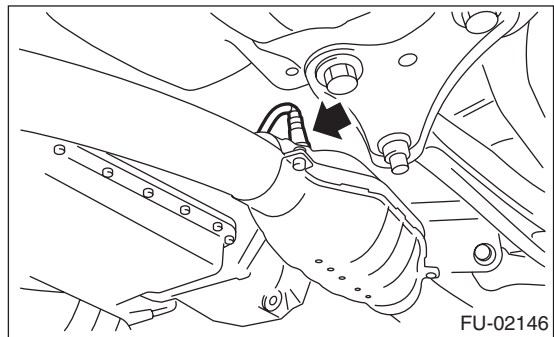
### CAUTION:

When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.

- LH side



- RH side



# Rear Oxygen Sensor

FUEL INJECTION (FUEL SYSTEMS)

## B: INSTALLATION

1) Before installing rear oxygen sensor, apply the anti-seize compound only to the threaded portion of rear oxygen sensor to make the next removal easier.

**Anti-seize compound:**

**NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent**

**CAUTION:**

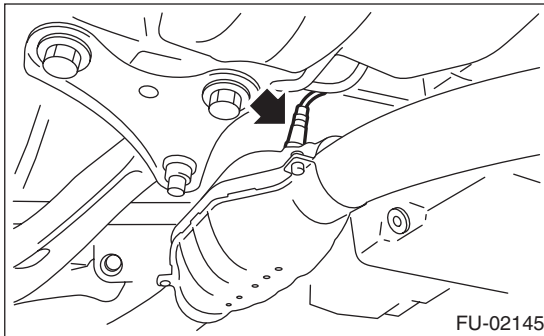
**Never apply anti-seize compound to the protector of rear oxygen sensor.**

2) Install the rear oxygen sensor.

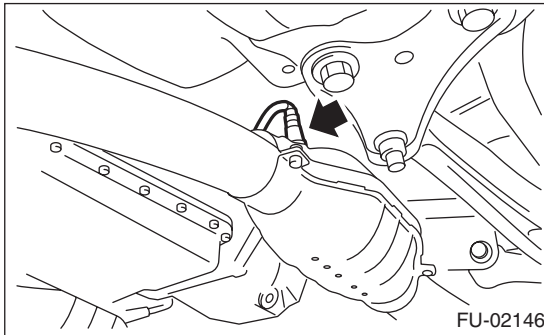
**Tightening torque:**

**21 N·m (2.1 kgf-m, 15.5 ft-lb)**

- LH side



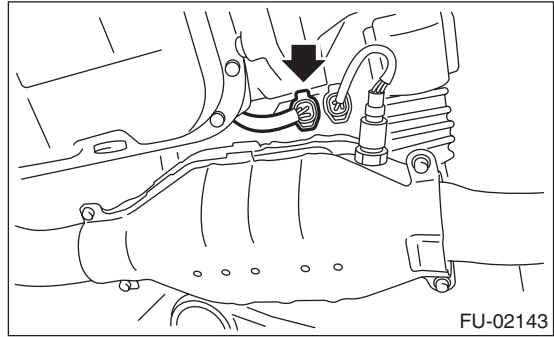
- RH side



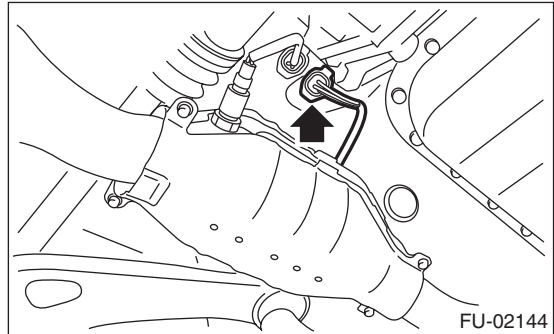
3) Hold the harness with clip.

4) Connect the connector to rear oxygen sensor.

- LH side

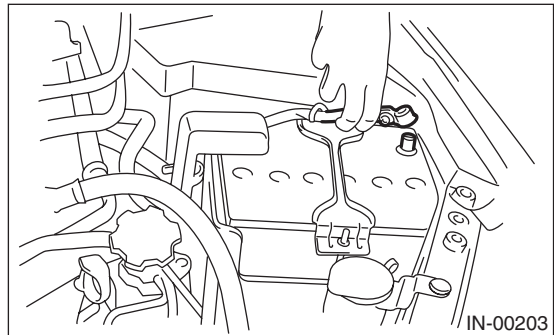


- RH side



5) Lower the vehicle.

6) Connect the battery ground cable to battery.



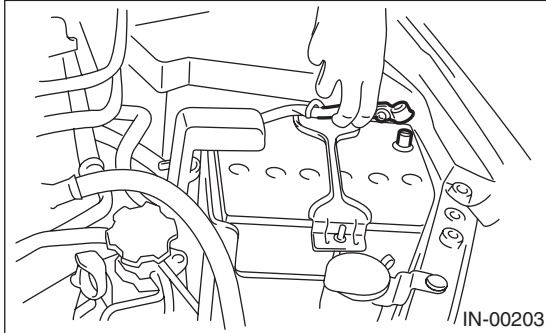
# SI-DRIVE (SUBARU Intelligent Drive) Selector

FUEL INJECTION (FUEL SYSTEMS)

## 17. SI-DRIVE (SUBARU Intelligent Drive) Selector

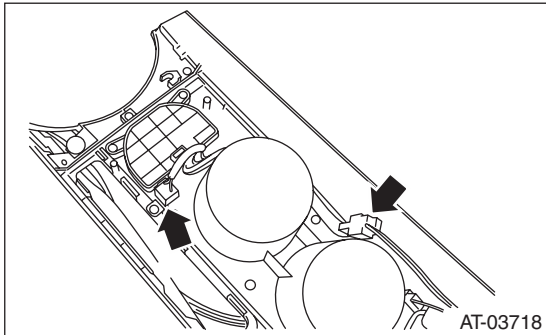
### A: REMOVAL

1) Disconnect the ground cable from the battery.

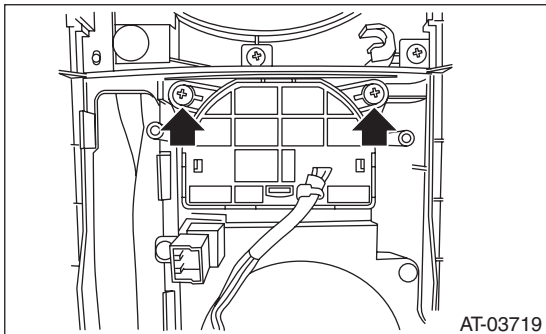


2) Remove the console box. <Ref. to EI-52, REMOVAL, Glove Box.>

3) Disconnect the connectors from the SI-DRIVE selector.



4) Remove the screws securing the upper side of the SI-DRIVE selector to the console box.



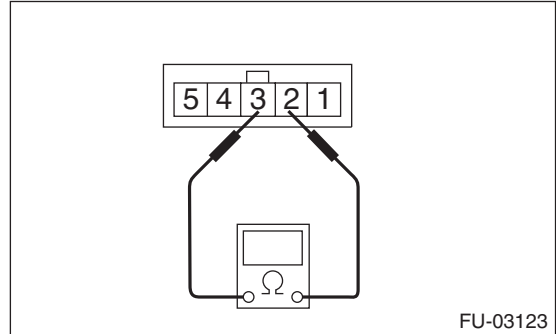
5) Remove the screws which secure the cup holder to the console box, then remove the SI-DRIVE selector.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between SI-DRIVE selector terminals.



Switch position	Terminal No.	Standard value
Sport (when turning the SI-DRIVE selector to the left)	2 and 3	Less than 10 $\Omega$
Intelligent (when pushing the SI-DRIVE selector)		0.8 — 1.2 k $\Omega$
Sport Sharp (when turning the SI-DRIVE selector to the right)		2.14 — 3.2 k $\Omega$

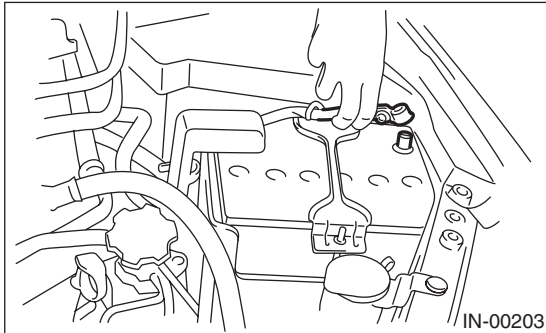
# SI-DRIVE (SUBARU Intelligent Drive) S# Switch

FUEL INJECTION (FUEL SYSTEMS)

## 18. SI-DRIVE (SUBARU Intelligent Drive) S# Switch

### A: REMOVAL

1) Disconnect the ground cable from the battery.

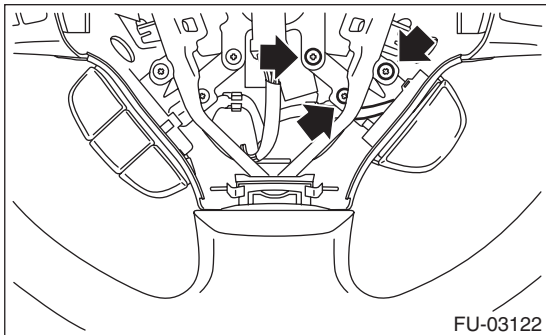


2) Remove the airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

#### WARNING:

**Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>**

3) Remove the screw which holds SI-DRIVE S# switch to the steering wheel, and disconnect the connector from the SI-DRIVE S# switch.

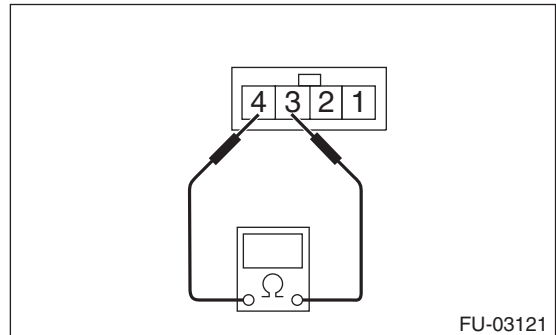


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between SI-DRIVE S# switch terminals.

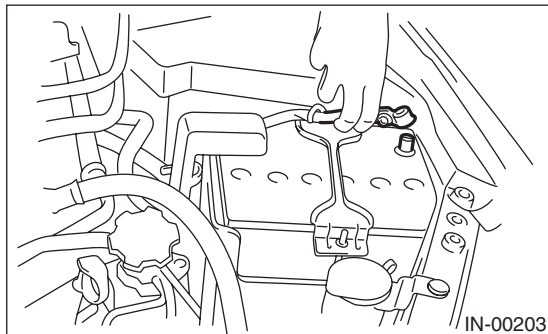


Switch position	Terminal No.	Standard value
ON (When the SI-DRIVE S# switch is pressed)	3 and 4	Less than 10 Ω
OFF		1 MΩ or more

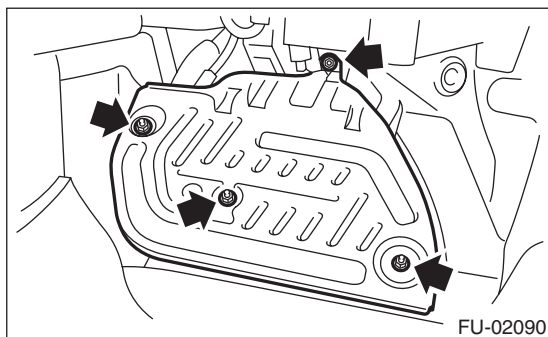
## 19.Engine Control Module (ECM)

### A: REMOVAL

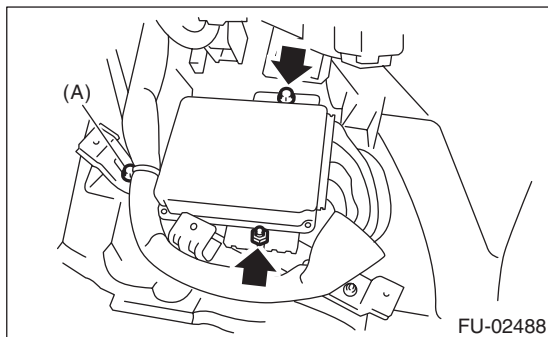
- 1) Disconnect the ground cable from the battery.



- 2) Remove the lower inner trim of passenger's side. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>
- 3) Detach the floor mat of passenger's seat.
- 4) Remove the protect cover.



- 5) Remove the bolts and nuts which hold the ECM to the bracket.
- 6) Remove the clip (A) from bracket.



- 7) Disconnect the ECM connectors, and take out the ECM.

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

- When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.
- When replacing the ECM, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the "IMMOBILIZER TEACHING OPERATION MANUAL".

#### Tightening torque:

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

# Main Relay

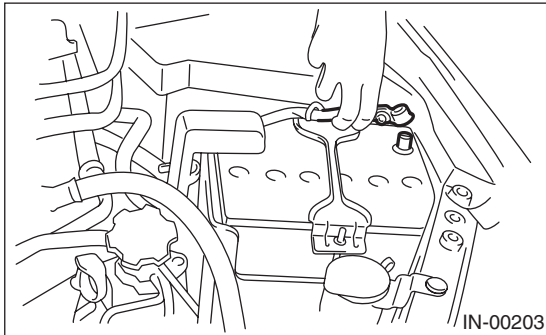
FUEL INJECTION (FUEL SYSTEMS)

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## 20.Main Relay

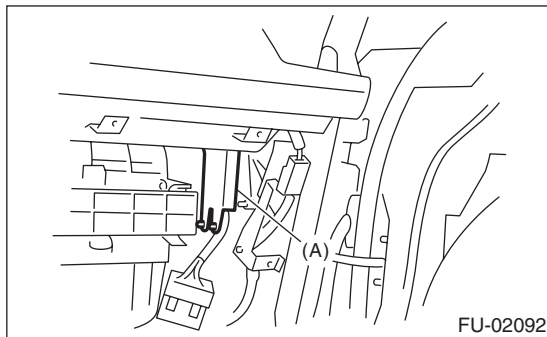
### A: REMOVAL

1) Disconnect the ground cable from the battery.

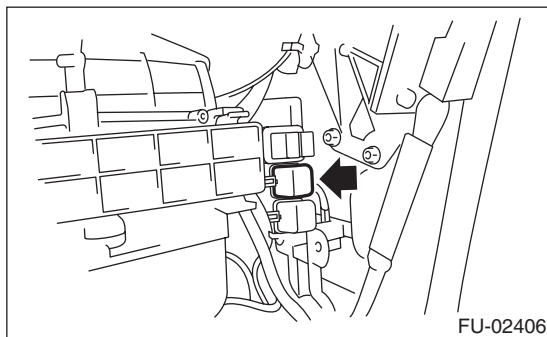


2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>

3) Remove the harness cover (A).



4) Disconnect the connectors from main relay.



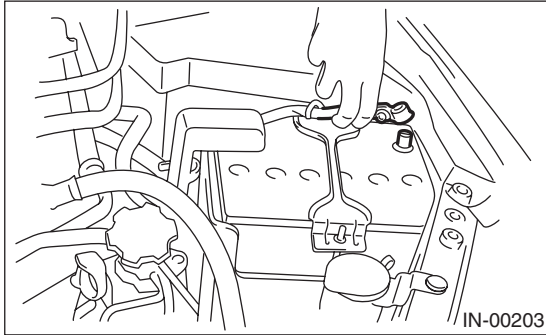
### B: INSTALLATION

Install in the reverse order of removal.

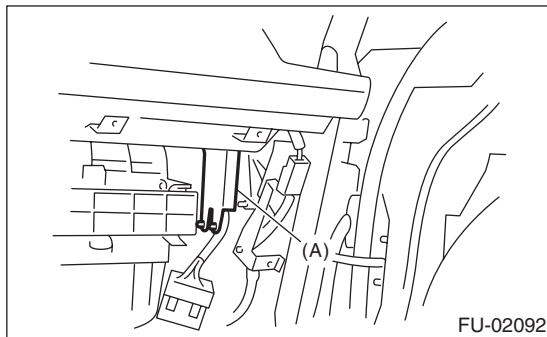
## 21. Fuel Pump Relay

### A: REMOVAL

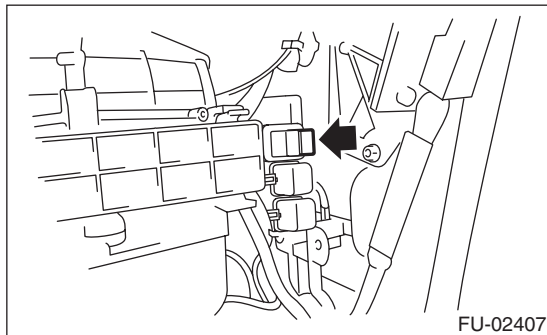
- 1) Disconnect the ground cable from the battery.



- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from fuel pump relay.



### B: INSTALLATION

Install in the reverse order of removal.

# Electronic Throttle Control Relay

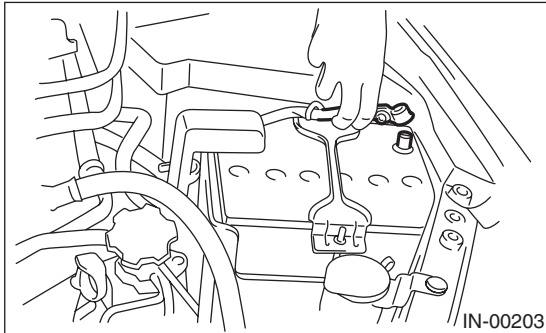
FUEL INJECTION (FUEL SYSTEMS)

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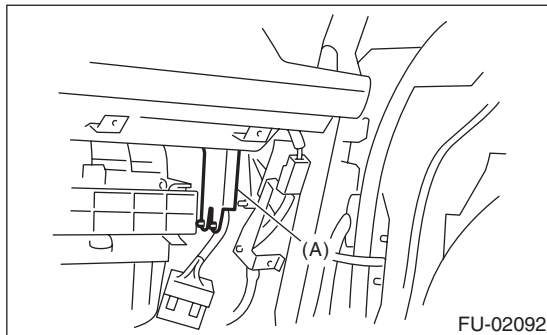
## 22. Electronic Throttle Control Relay

### A: REMOVAL

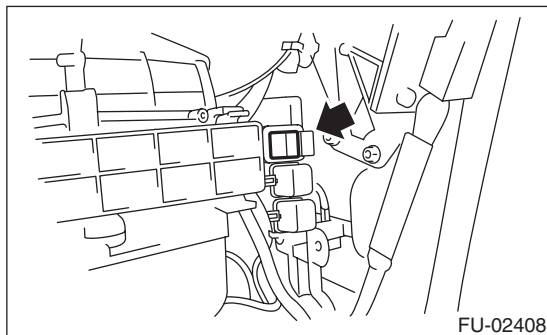
- 1) Disconnect the ground cable from the battery.



- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from electric throttle control relay.



### B: INSTALLATION

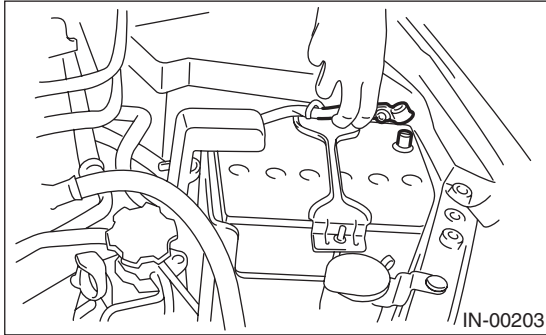
Install in the reverse order of removal.



## 23. Fuel Pump Control Unit

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.

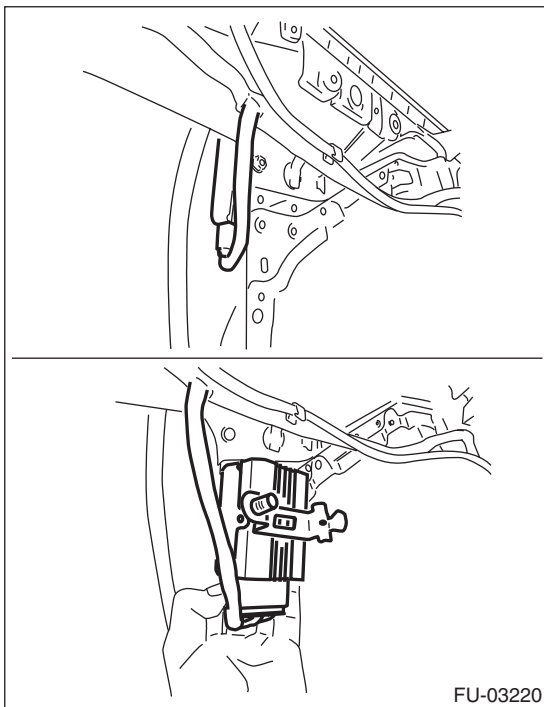


- 2) Remove the rear quarter trim of the left side. (Wagon model) <Ref. to EI-63, REMOVAL, Rear Quarter Trim.>

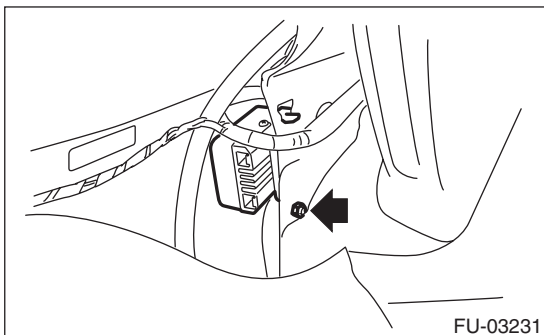
- 3) Peel the trunk side trim of the left side. (Sedan model)

- 4) Remove the fuel pump control unit.

- Wagon model



- Sedan model



- 5) Disconnect the connector from fuel pump control unit.

### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

### 24. Fuel

#### A: PROCEDURE

##### 1. RELEASING OF FUEL PRESSURE

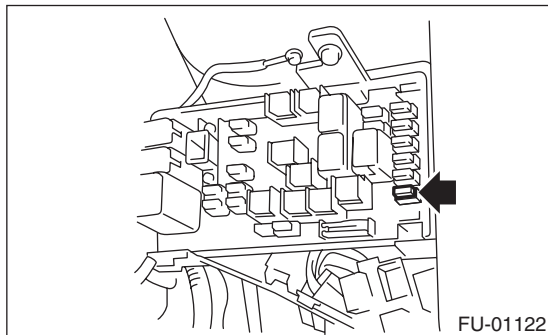
###### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

###### CAUTION:

**Be careful not to spill fuel.**

1) Remove the fuse of fuel pump from main fuse box.



- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn the ignition switch to OFF.

##### 2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

###### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

###### CAUTION:

**Be careful not to spill fuel.**

###### NOTE:

- If the fuel pump cannot be actuated, refer to DRAINING FUEL (THROUGH THE FUEL FILLER HOSE) <Ref. to FU(H6DO)-43, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
- Be careful not to allow the battery to go flat.

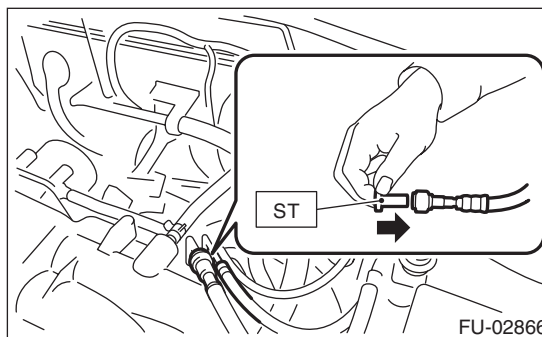
- 1) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

- 2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.

ST 42099AE000 CONNECTOR REMOVER

###### CAUTION:

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



- 3) Connect ST to the fuel delivery hose.  
ST 18471AA000 FUEL PIPE ADAPTER
- 4) Connect the gasoline proof hose to ST, and put the hose end into the container.
- 5) Actuate the fuel pump and drain the fuel using Subaru Select Monitor. <Ref. to EN(H6DO)(diag)-59, FUEL PUMP CONTROL (ON/OFF OPERATION), OPERATION, System Operation Check Mode.>

###### CAUTION:

**Be careful not to spill fuel.**

### 3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

**WARNING:**

Place “NO OPEN FLAMES” signs near the working area.

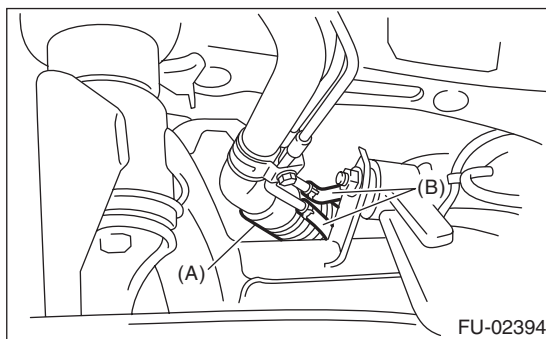
**CAUTION:**

- Be careful not to spill fuel.
- Fuel may remain in the fuel filler pipe. Perform the work after draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 4) Open the fuel filler flap lid, and remove the fuel filler cap.
- 5) Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
- 6) Disconnect the fuel filler hose (A) from the fuel filler pipe.

**CAUTION:**

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



- (A) Fuel filler hose  
(B) Evaporation hose

- 7) Set a container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

**CAUTION:**

Be careful not to spill fuel.

# Fuel Tank

FUEL INJECTION (FUEL SYSTEMS)

## 25. Fuel Tank

### A: REMOVAL

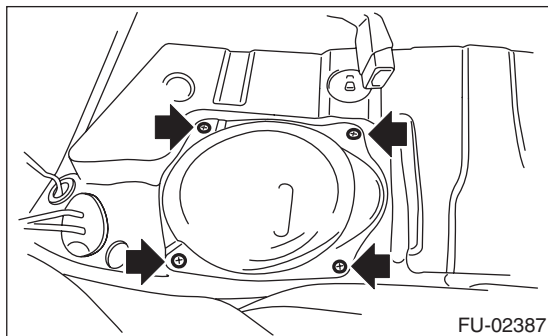
#### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

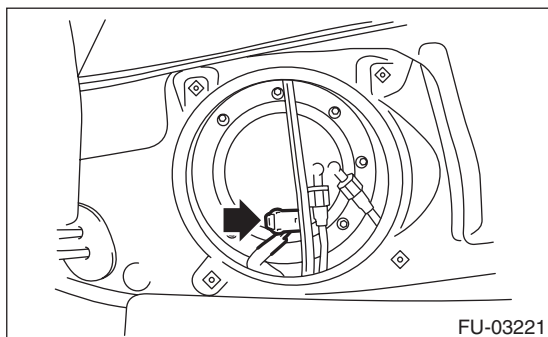
#### CAUTION:

Be careful not to spill fuel.

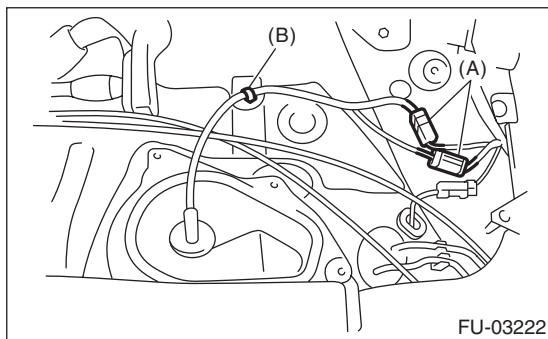
- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Drain fuel from fuel tank. <Ref. to FU(H6DO)-42, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 4) Remove the rear seat.
- 5) Remove the service hole cover of fuel pump.



- 6) Disconnect the connector from fuel pump.

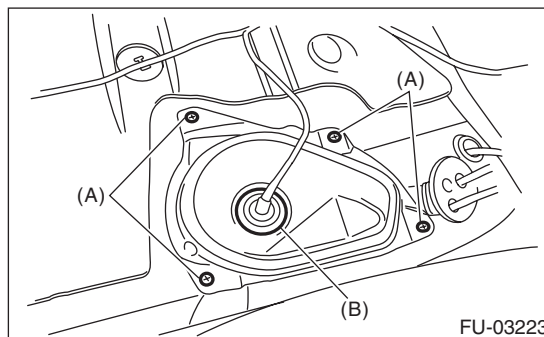


- 7) Remove the connector (A) and clip (B).



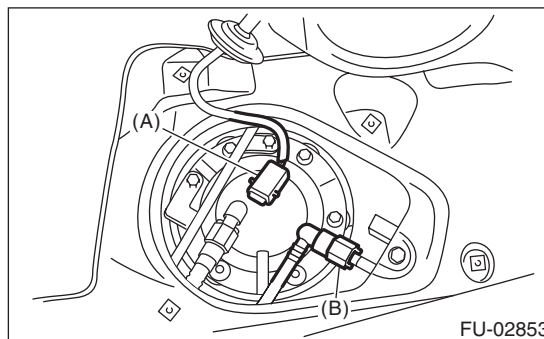
- 8) Remove the service hole cover of fuel sub level sensor.

- (1) Remove the bolt (A).
- (2) Push the grommet (B) down and remove the service hole cover.



- 9) Disconnect connector (A) from fuel sub level sensor.

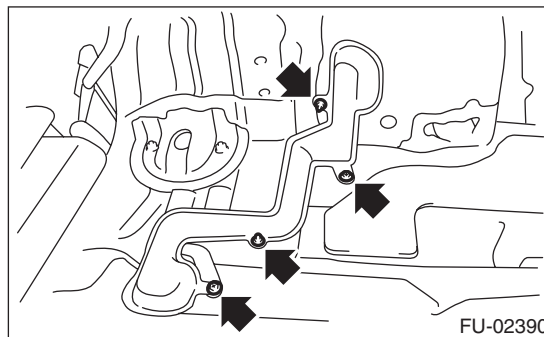
- 10) Disconnect the quick connector on the fuel delivery hose (B). <Ref. to FU(H6DO)-60, REMOVAL, Fuel Delivery and Evaporation Lines.>



- 11) Remove the trunk room trim. (Sedan model) <Ref. to EI-70, REMOVAL, Trunk Room Trim.>

- 12) Remove the rear quarter trim. (Wagon model) <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>

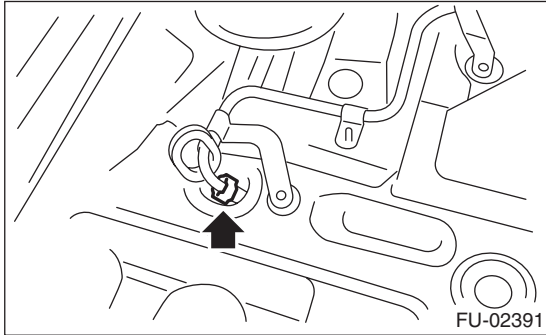
- 13) Remove the pipe protector.



# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

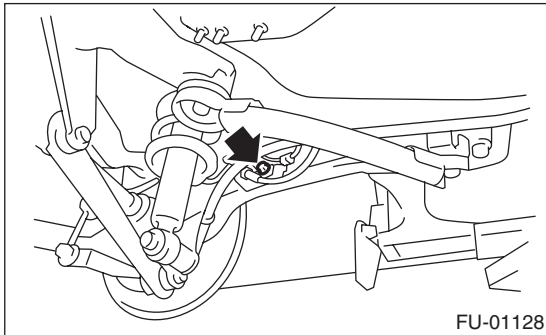
14) Remove the grommet and disconnect the quick connector of the evaporation pipe. <Ref. to FU(H6DO)-60, REMOVAL, Fuel Delivery and Evaporation Lines.>



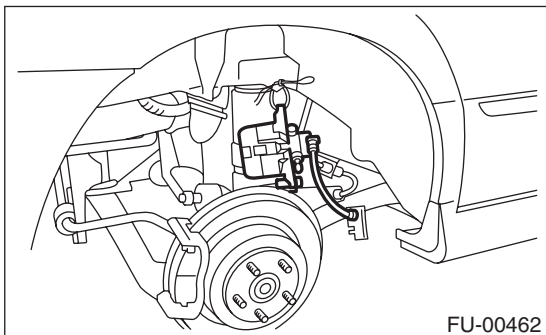
15) Remove the rear wheels.

16) Lift up the vehicle.

17) Remove the bolts which secure the rear brake hose mounting bracket.



18) Remove the rear brake caliper and tie it to the body side of the vehicle.



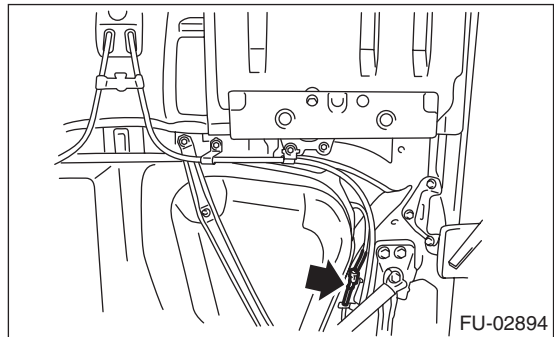
19) Remove the parking brake cable from the parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

20) Remove the rear exhaust pipe. <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.>

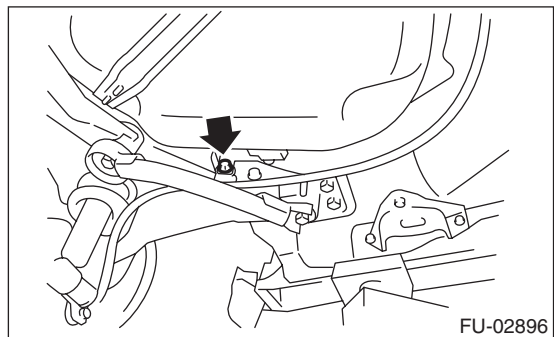
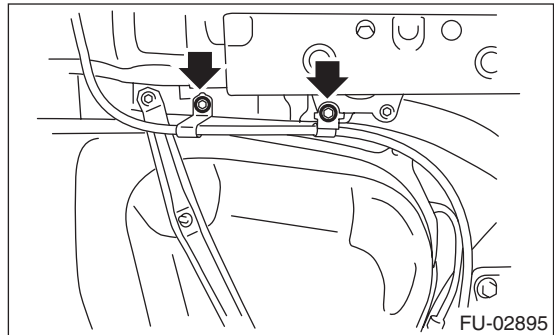
21) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

22) Remove the heat shield cover.

23) Disconnect the connector from the rear ABS wheel speed sensor.



24) Remove the bolts securing the parking brake cable clamp.



# Fuel Tank

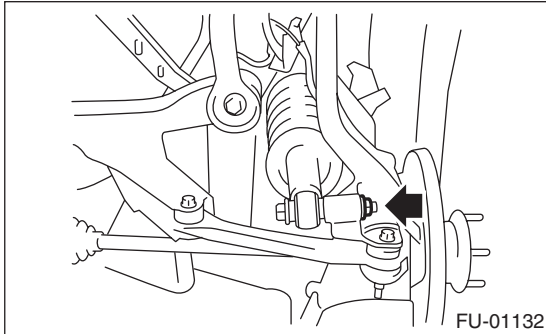
## FUEL INJECTION (FUEL SYSTEMS)

25) Remove the rear suspension assembly.

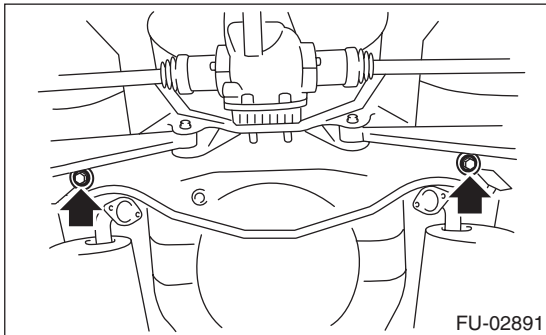
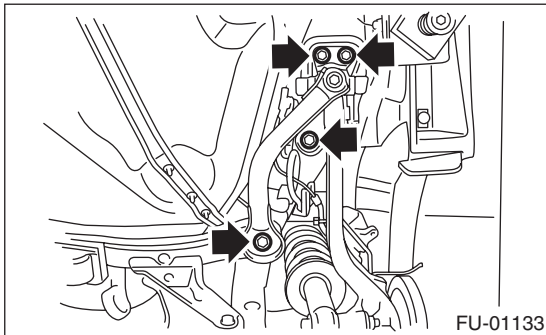
### CAUTION:

**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Remove the bolts which hold the rear shock absorber to the rear suspension arm.

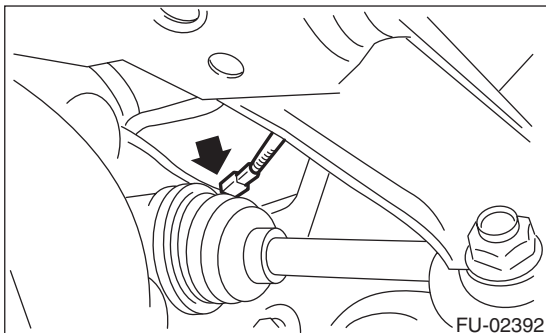


- (3) Remove the bolts which secure the rear suspension assembly to the body.

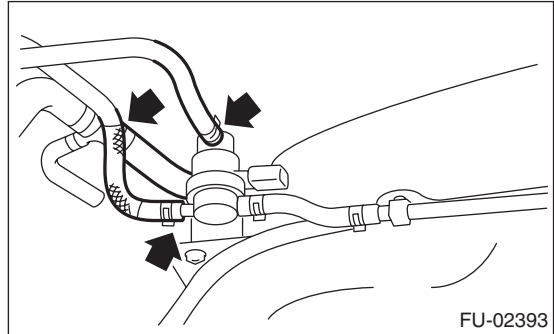


- (4) Remove the rear suspension assembly.

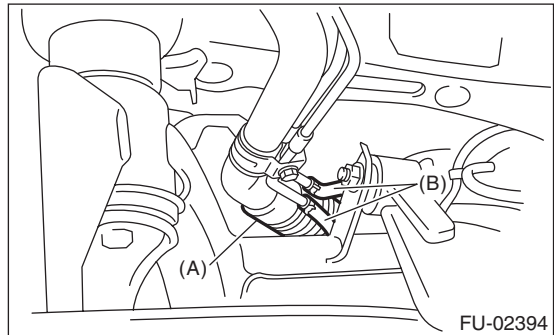
26) Disconnect the connector.



27) Disconnect the evaporation hose.



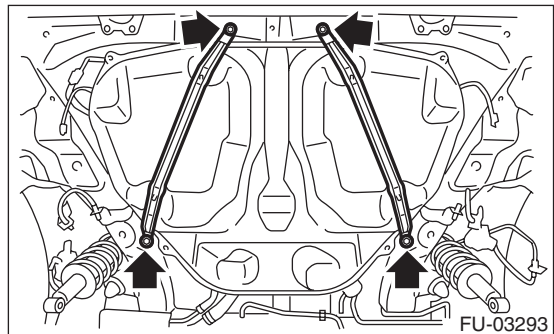
28) Disconnect the fuel filler hose (A) and evaporation hose (B).



29) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

### WARNING:

- A helper is required to perform this work.
- Fuel may remain in the fuel tank. Be careful not to let the fuel tank fall off when removing as it is bad balance on either side.

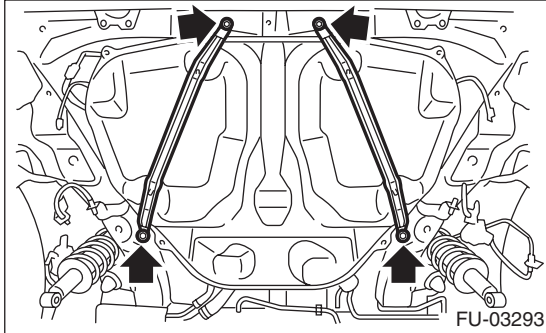


### B: INSTALLATION

1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

#### WARNING:

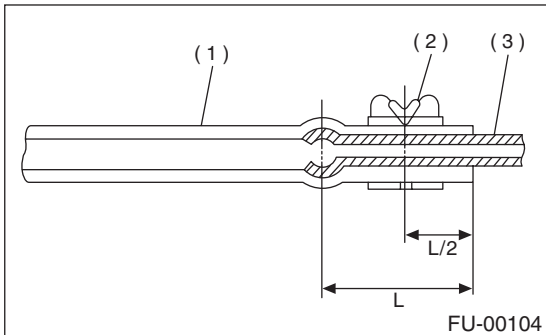
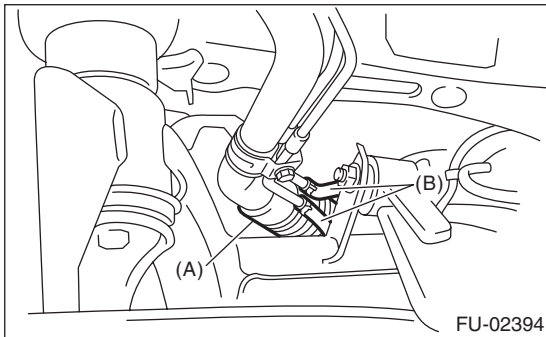
**A helper is required to perform this work.**



2) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.

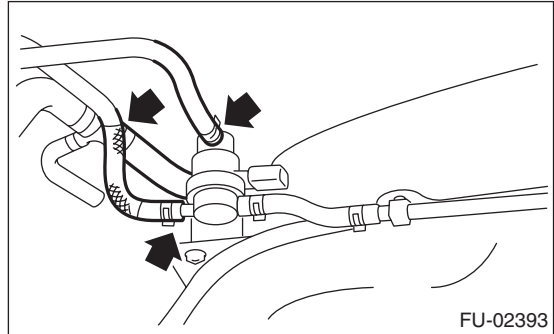
#### Tightening torque:

**2.5 N·m (0.25 kgf·m, 1.8 ft·lb)**



- (1) Hose
- (2) Clip or clamp
- (3) Pipe

3) Connect the evaporation hose.

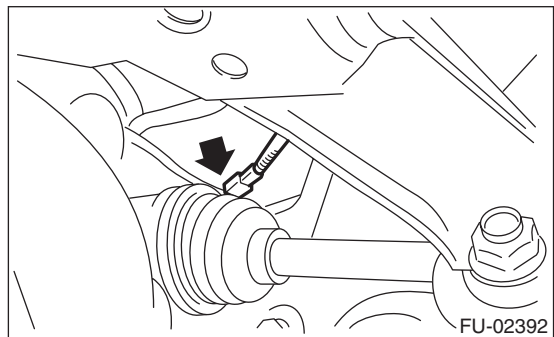


4) Tighten the fuel tank band bolts.

#### Tightening torque:

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**

5) Connect the connector.



# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

6) Install the rear suspension assembly.

### CAUTION:

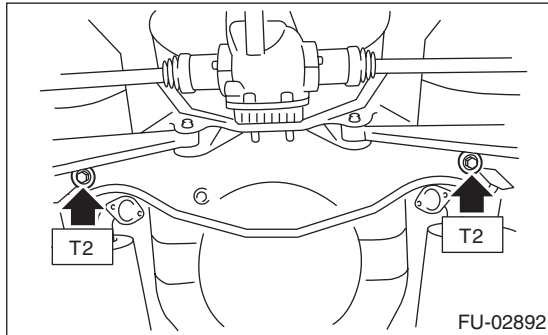
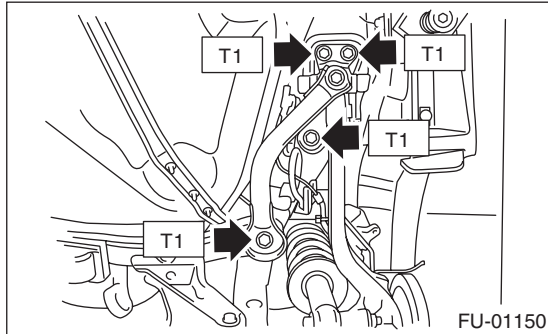
**A helper is required to perform this work.**

- (1) Support the rear differential with the transmission jack.
- (2) Support the rear suspension assembly, and tighten the bolts which secure the rear suspension assembly to the body.

### Tightening torque:

**T1: 125 N·m (12.7 kgf-m, 92.2 ft-lb)**

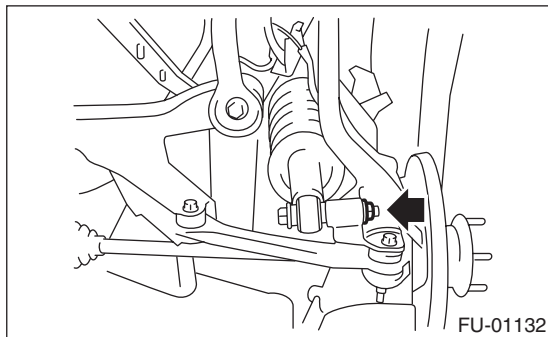
**T2: 175 N·m (17.8 kgf-m, 129 ft-lb)**



- (3) Tighten the bolts which hold the rear shock absorber to the rear suspension arm. <Ref. to RS-10, INSTALLATION, Rear Arm.>

### Tightening torque:

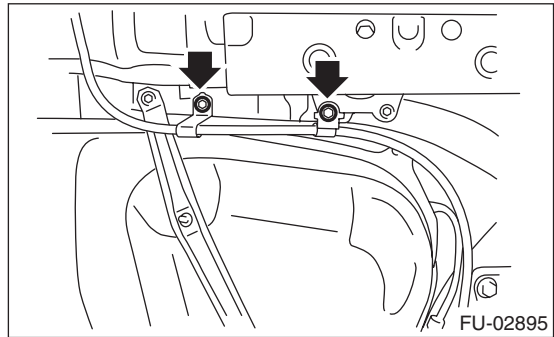
**62 N·m (6.3 kgf-m, 46 ft-lb)**



7) Tighten the bolts holding the parking brake cable clamp.

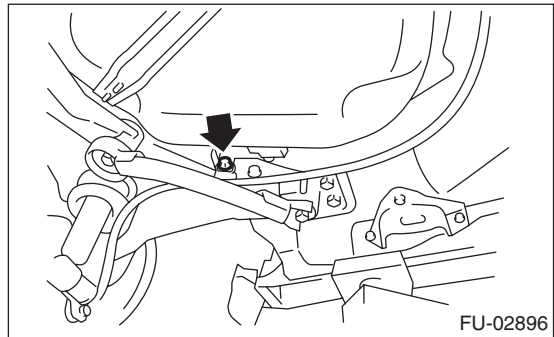
### Tightening torque:

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

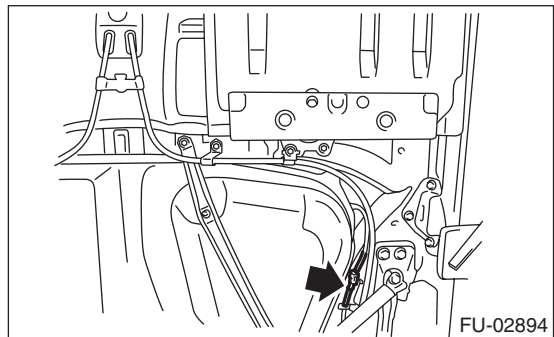


### Tightening torque:

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**



8) Connect the connector to the rear ABS wheel speed sensor.



9) Install the heat shield cover.

10) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

11) Install the rear exhaust pipe. <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.>

12) Lower the vehicle.

13) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>

14) Install the rear brake caliper.



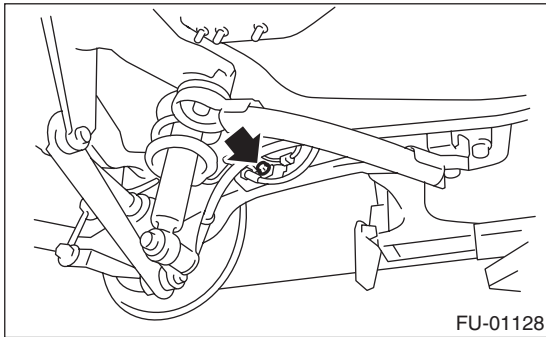
# Fuel Tank

## FUEL INJECTION (FUEL SYSTEMS)

15) Tighten the bolts which secure the rear brake hose mounting bracket.

**Tightening torque:**

**33 N·m (3.4 kgf·m, 24.3 ft·lb)**

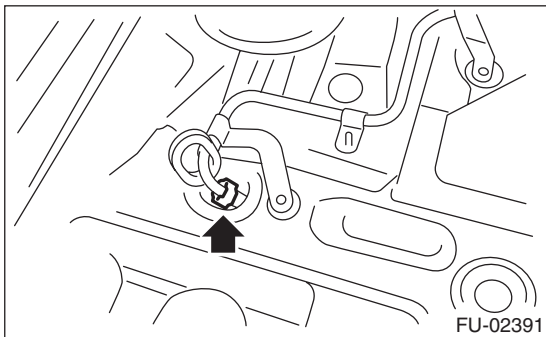


16) Install the rear wheels.

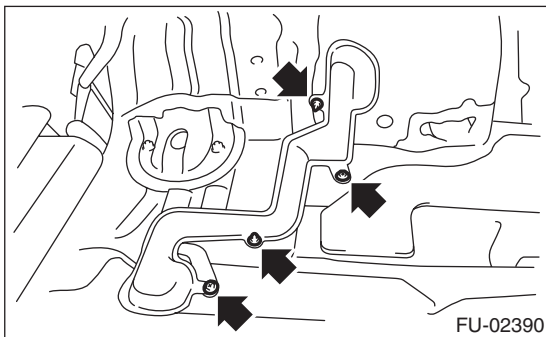
**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

17) Connect the quick connector of the evaporation pipe. <Ref. to FU(H6DO)-61, INSTALLATION, Fuel Delivery and Evaporation Lines.>



18) Install the pipe protector.

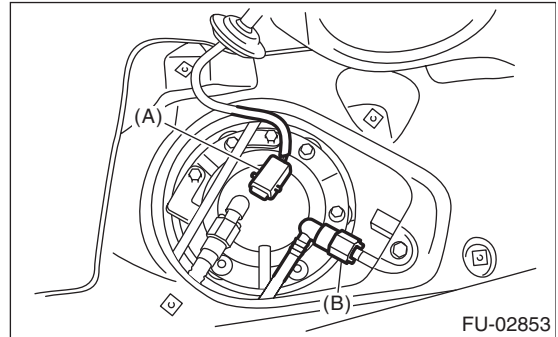


19) Install the trunk room trim. (Sedan model) <Ref. to EI-71, INSTALLATION, Trunk Room Trim.>

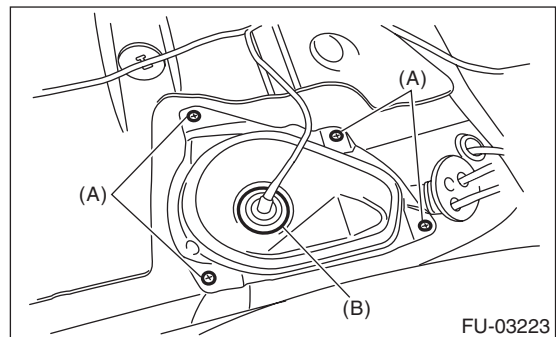
20) Install the rear quarter trim. (Wagon model) <Ref. to EI-64, INSTALLATION, Rear Quarter Trim.>

21) Connect connector (A) to the fuel sub level sensor.

22) Connect the quick connector (B) of the fuel delivery hose. <Ref. to FU(H6DO)-61, INSTALLATION, Fuel Delivery and Evaporation Lines.>

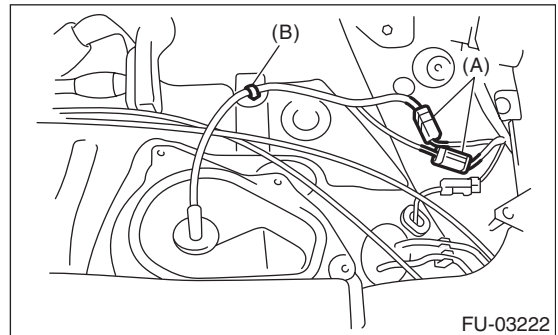


23) Install the service hole cover of fuel sub level sensor.

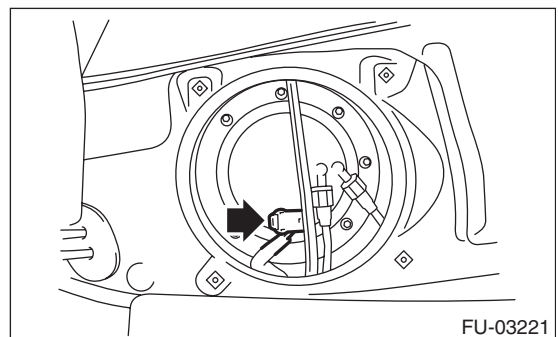


(A) Bolt  
(B) Grommet

24) Connect connector (A), and install clip (B).



25) Connect the connector to the fuel pump.

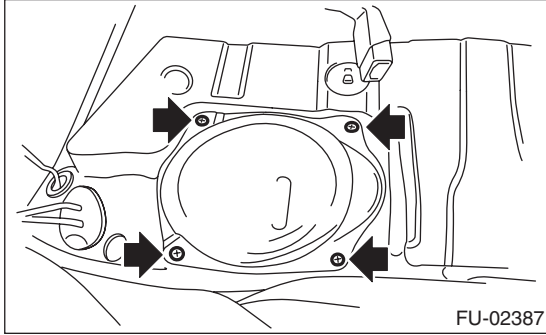


## Fuel Tank

### FUEL INJECTION (FUEL SYSTEMS)

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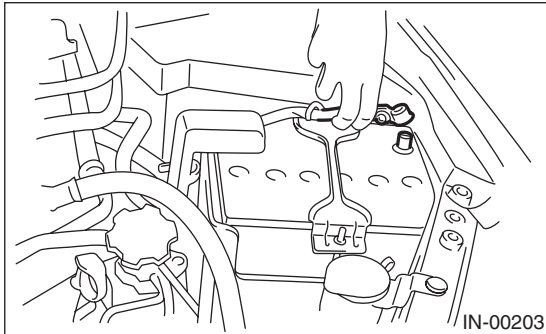
26) Install the service hole cover of fuel pump.



27) Install the rear seat.

28) Install the fuse of fuel pump to the main fuse box.

29) Connect the battery ground cable to battery.



30) Inspect the wheel alignment and adjust if necessary.

### C: INSPECTION

- 1) Check that the fuel tank does not have holes, cracks or is damaged in any way.
- 2) Make sure that the fuel pipe and fuel hose are not cracked and that the connections are tight.

## 26. Fuel Filler Pipe

### A: REMOVAL

**WARNING:**

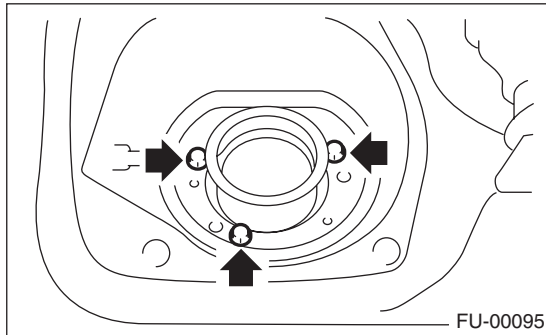
Place "NO OPEN FLAMES" signs near the working area.

**CAUTION:**

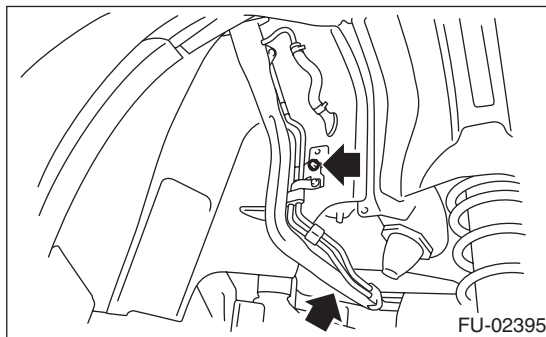
Be careful not to spill fuel.

1) Drain fuel from fuel tank. <Ref. to FU(H6DO)-42, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>

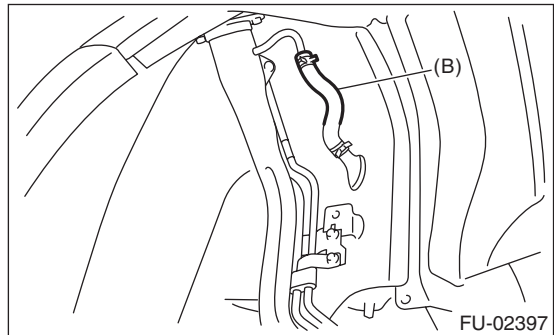
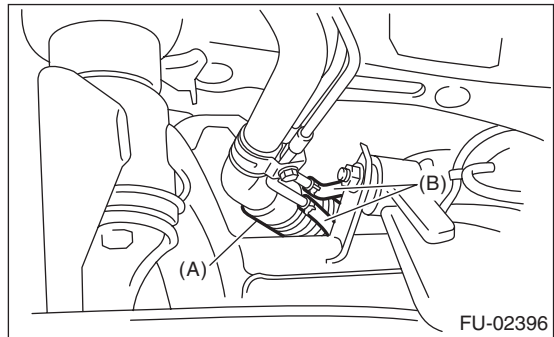
2) Remove the screws which secure gasket.



- 3) Remove the rear wheel RH.
- 4) Lift up the vehicle.
- 5) Remove the mud guard. <Ref. to EI-29, REMOVAL, Mud Guard.>
- 6) Remove the rear sub frame. <Ref. to RS-21, REMOVAL, Rear Sub Frame.>
- 7) Remove the bolts which hold fuel filler pipe bracket on the body.



8) Loosen the clamp, and disconnect the fuel filler hose (A) and evaporation hose (B).



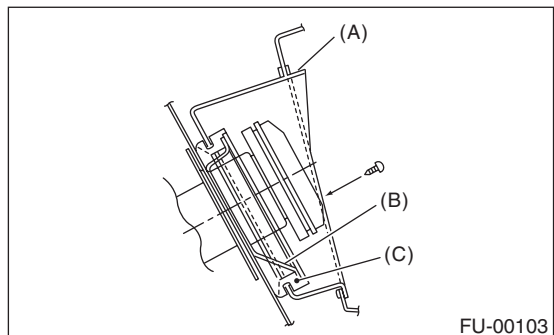
9) Remove the fuel filler pipe to the underside of the vehicle.

### B: INSTALLATION

- 1) Open the fuel filler flap lid.
- 2) Set the fuel saucer (A) with rubber seal (C), and insert the fuel filler pipe into hole from the inner side of apron.
- 3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

**NOTE:**

If the edges of rubber seal are folded toward inside, straighten it with a flat tip screwdriver.



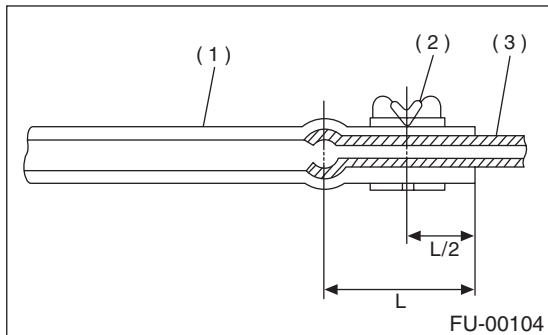
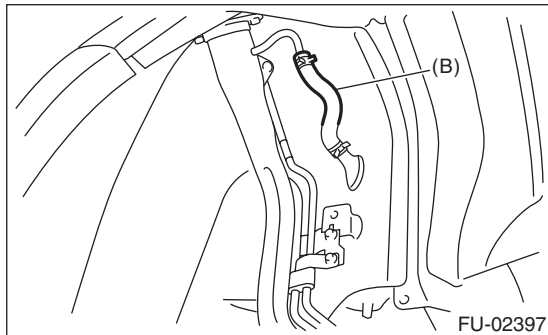
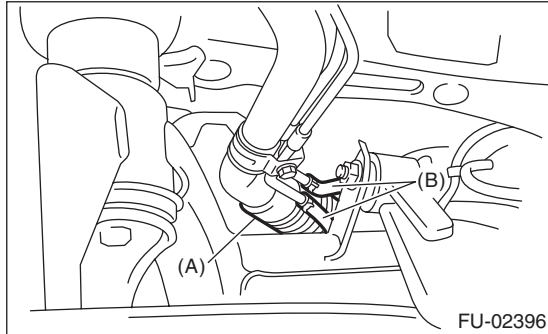
# Fuel Filler Pipe

## FUEL INJECTION (FUEL SYSTEMS)

4) Securely insert the fuel filler hose (A) and evaporation hose (B) to the specified position, then tighten the clamp.

**Tightening torque:**

**(A) 2.5 N·m (0.3 kgf-m, 1.8 ft-lb)**

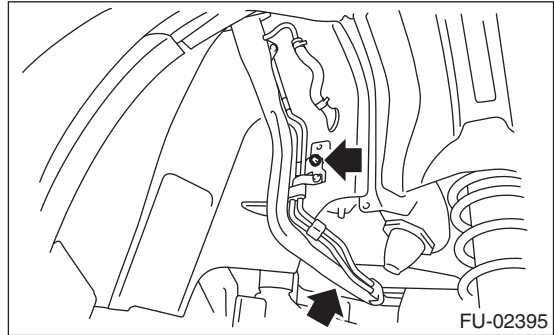


- (1) Hose
- (2) Clip or clamp
- (3) Pipe

5) Tighten the bolts which hold fuel filler pipe bracket on the body.

**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



6) Install the rear sub frame. <Ref. to RS-21, INSTALLATION, Rear Sub Frame.>

7) Install the mud guard. <Ref. to EI-29, INSTALLATION, Mud Guard.>

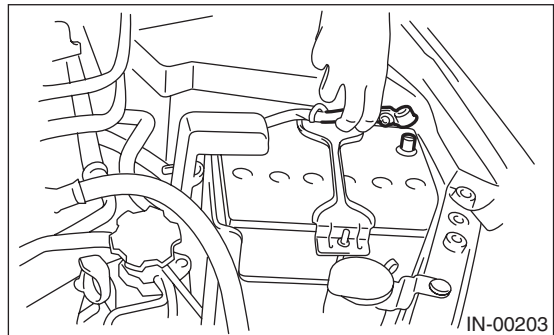
8) Lower the vehicle.

9) Install the rear wheel RH.

**Tightening torque:**

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

10) Connect the battery ground cable to battery.

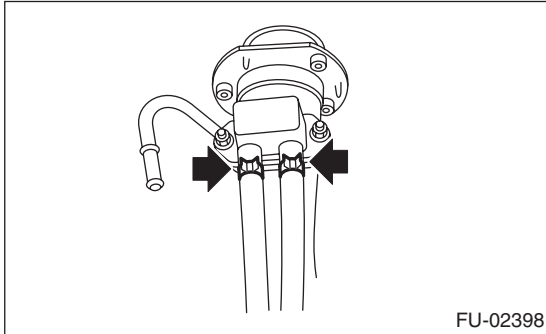


## C: INSPECTION

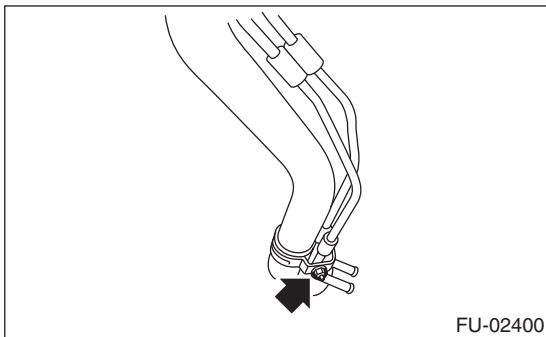
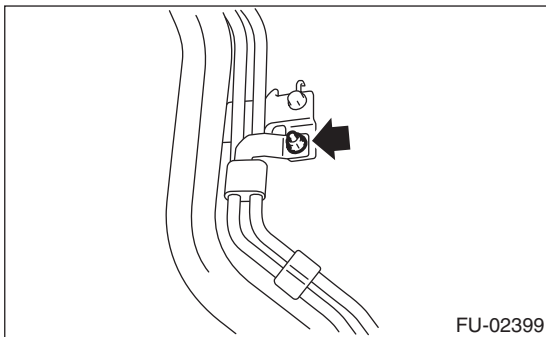
- 1) Check that the fuel tank does not have holes, cracks or is damaged in any way.
- 2) Make sure that the fuel hose is not cracked and that the connections are tight.

## D: DISASSEMBLY

1) Move the clamp and disconnect the evaporation hose from the shut valve.



2) Remove the nut which holds the evaporation pipe assembly to the fuel filler pipe.



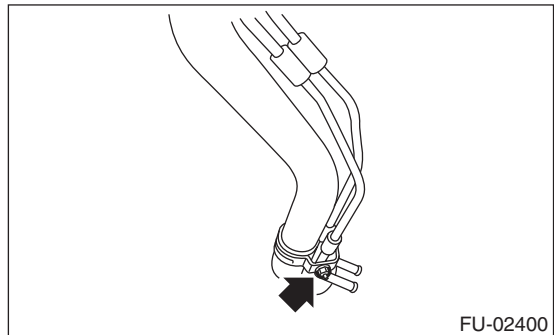
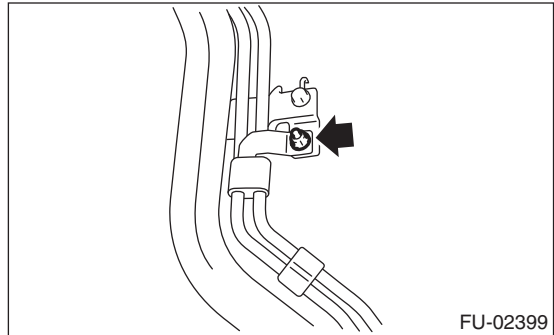
3) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-14, REMOVAL, Shut Valve.>

## E: ASSEMBLY

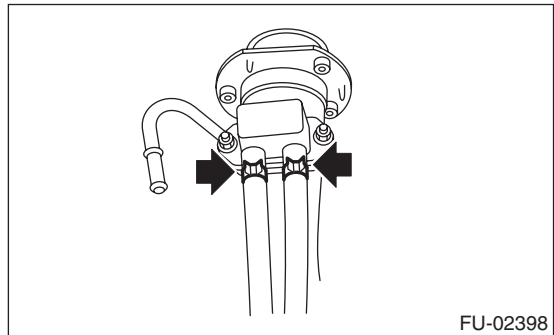
1) Install the shut valve to the fuel filler pipe. <Ref. to EC(H4SO)-14, INSTALLATION, Shut Valve.>  
2) Tighten the nuts which secure the evaporation pipe assembly to the fuel filler pipe.

**Tightening torque:**

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



3) Connect the evaporation hose to the shut valve.



# Fuel Pump

## FUEL INJECTION (FUEL SYSTEMS)

### 27. Fuel Pump

#### A: REMOVAL

##### WARNING:

Place "NO OPEN FLAMES" signs near the working area.

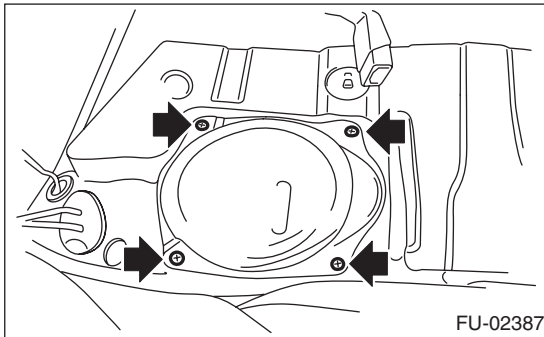
##### CAUTION:

- Be careful not to spill fuel.
- When the fuel meter indication is higher than two third of the total, perform the work after draining the fuel not to spill the fuel.

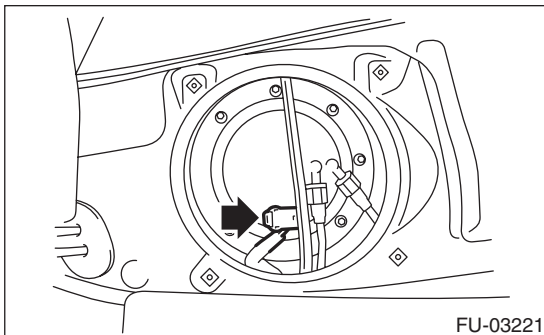
##### NOTE:

Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

- 1) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Drain fuel. <Ref. to FU(H6DO)-42, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
- 3) Remove the rear seat.
- 4) Remove the service hole cover.

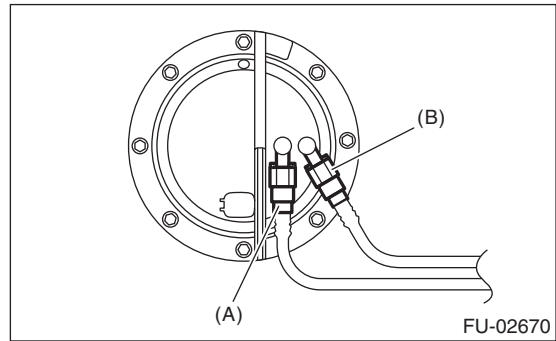


- 5) Disconnect the connector from fuel pump.



- 6) Disconnect the quick connector, and then disconnect the fuel delivery hose and jet pump hose. <Ref. to FU(H6DO)-60, REMOVAL, Fuel Delivery and Evaporation Lines.>

- 7) Remove the nuts which install fuel pump assembly onto fuel tank.



- (A) Delivery hose  
(B) Jet pump hose

- 8) Remove the fuel pump assembly from the fuel tank.

#### B: INSTALLATION

Install in the reverse order of removal while being careful of the following.

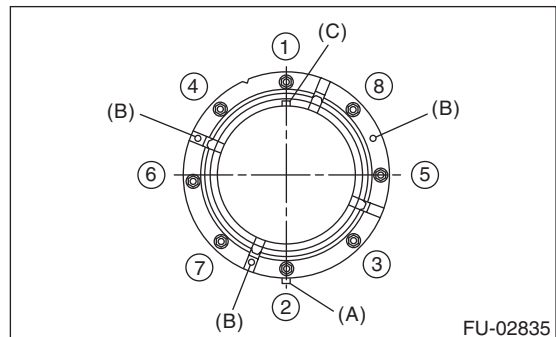
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Install so that the protrusion (A) of gasket is pointed towards the front of the vehicle.
- Insert the protrusion (B) of the gasket into the upper plate. (3 places)
- Align the protrusion (C) of fuel pump assembly with the cutout on the upper plate.
- Tighten the nuts to the specified torque in the order as shown in the figure.

##### NOTE:

Use a new gasket and a retainer.

##### Tightening torque:

**4.4 N·m (0.45 kgf·m, 3.2 ft·lb)**

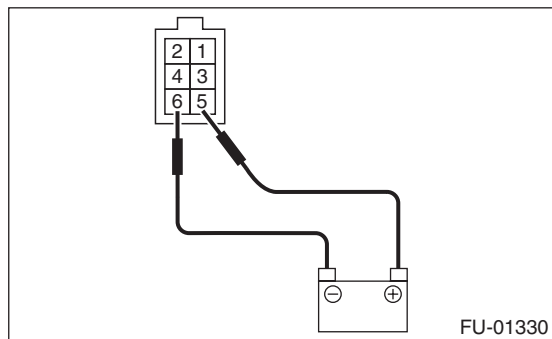


## C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump, and apply the battery power supply to check whether the pump operates.

### CAUTION:

- Wipe off fuel completely.
- Keep the battery as far apart from fuel pump as possible.
- Be sure to perform the ON/OFF operation on the battery side.
- Do not run the fuel pump for a long time under non-load condition.



# Fuel Level Sensor

FUEL INJECTION (FUEL SYSTEMS)

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## 28. Fuel Level Sensor

### A: REMOVAL

#### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

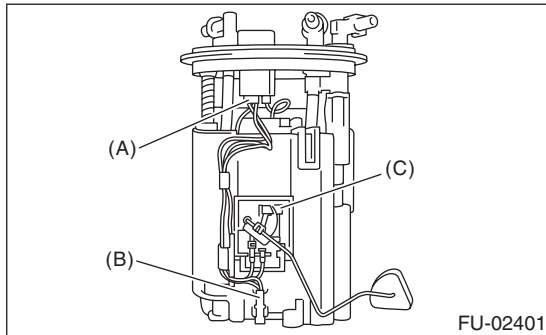
#### CAUTION:

- Be careful not to spill fuel.
- When the fuel meter indication is higher than two thirds of the total, perform the work after draining the fuel not to spill the fuel.

#### NOTE:

The fuel level sensor is built in fuel pump assembly.

- 1) Remove the fuel pump assembly. <Ref. to FU(H6DO)-54, REMOVAL, Fuel Pump.>
- 2) Disconnect the connector from fuel pump bracket.
- 3) Remove the fuel temperature sensor.
- 4) Remove the fuel level sensor.



- (A) Connector  
(B) Fuel temperature sensor  
(C) Fuel level sensor

### B: INSTALLATION

Install in the reverse order of removal.



## 29. Fuel Sub Level Sensor

### A: REMOVAL

**WARNING:**

Place "NO OPEN FLAMES" signs near the working area.

**CAUTION:**

- Be careful not to spill fuel.
- When the fuel meter indication is higher than two third of the total, perform the work after draining the fuel not to spill the fuel.

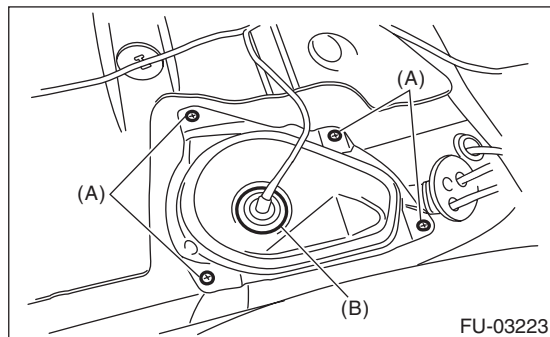
1) Drain fuel. <Ref. to FU(H6DO)-42, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>

2) Remove the rear seat.

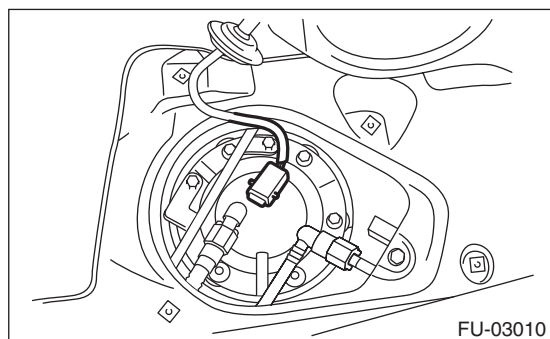
3) Remove the service hole cover.

(1) Remove bolt (A).

(2) Push the grommet (B) down and remove the service hole cover.

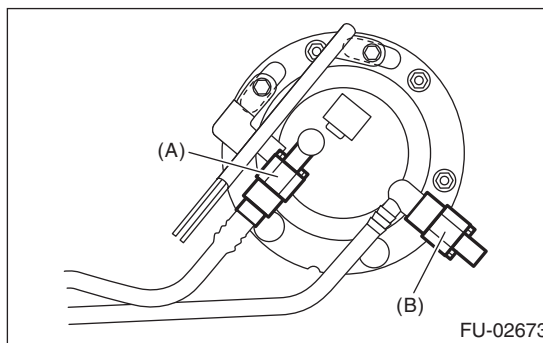


4) Disconnect the connector from the fuel sub level sensor.



5) Disconnect the quick connector, and then disconnect the fuel delivery hose and jet pump hose. <Ref. to FU(H6DO)-60, REMOVAL, Fuel Delivery and Evaporation Lines.>

6) Remove the nuts and bolts which install fuel sub level sensor on fuel tank.



(A) Jet pump hose

(B) Delivery hose

7) Remove the fuel sub level sensor.

### B: INSTALLATION

Install in the reverse order of removal while being careful of the following.

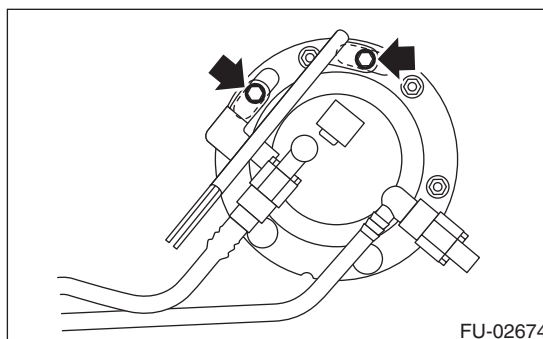
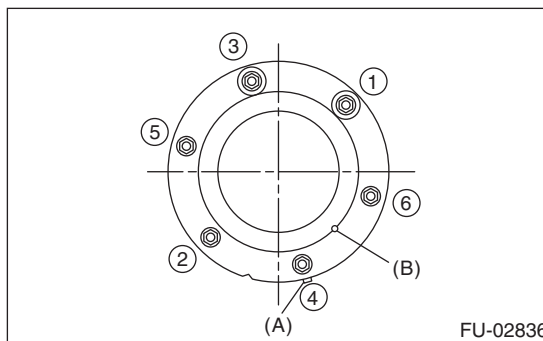
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align the protrusion (A) of gasket with the position shown in the figure.
- Align the protrusion (B) of fuel sub level sensor with the cutout on the upper plate of fuel sub level sensor.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.

**NOTE:**

Use a new gasket and retainer.

**Tightening torque:**

**4.4 N·m (0.45 kgf-m, 3.2 ft-lb)**



### **30.Fuel Filter**

#### **A: SPECIFICATION**

Fuel filter forms a single unit with fuel pump. Refer to "Fuel Pump" for removal and installation. <Ref. to FU(H6DO)-54, REMOVAL, Fuel Pump.> <Ref. to FU(H6DO)-54, INSTALLATION, Fuel Pump.>

## 31. Fuel Damper Valve

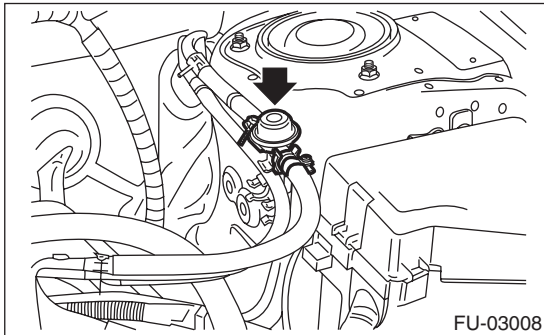
### A: REMOVAL

#### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Remove the fuel damper valve from the fuel delivery line.



### B: INSTALLATION

#### CAUTION:

If fuel hoses or clamps are damaged, replace them with new parts.

Install in the reverse order of removal.

#### *Tightening torque:*

**1.25 N·m (0.13 kgf·m, 0.94 ft·lb)**

# Fuel Delivery and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

## 32. Fuel Delivery and Evaporation Lines

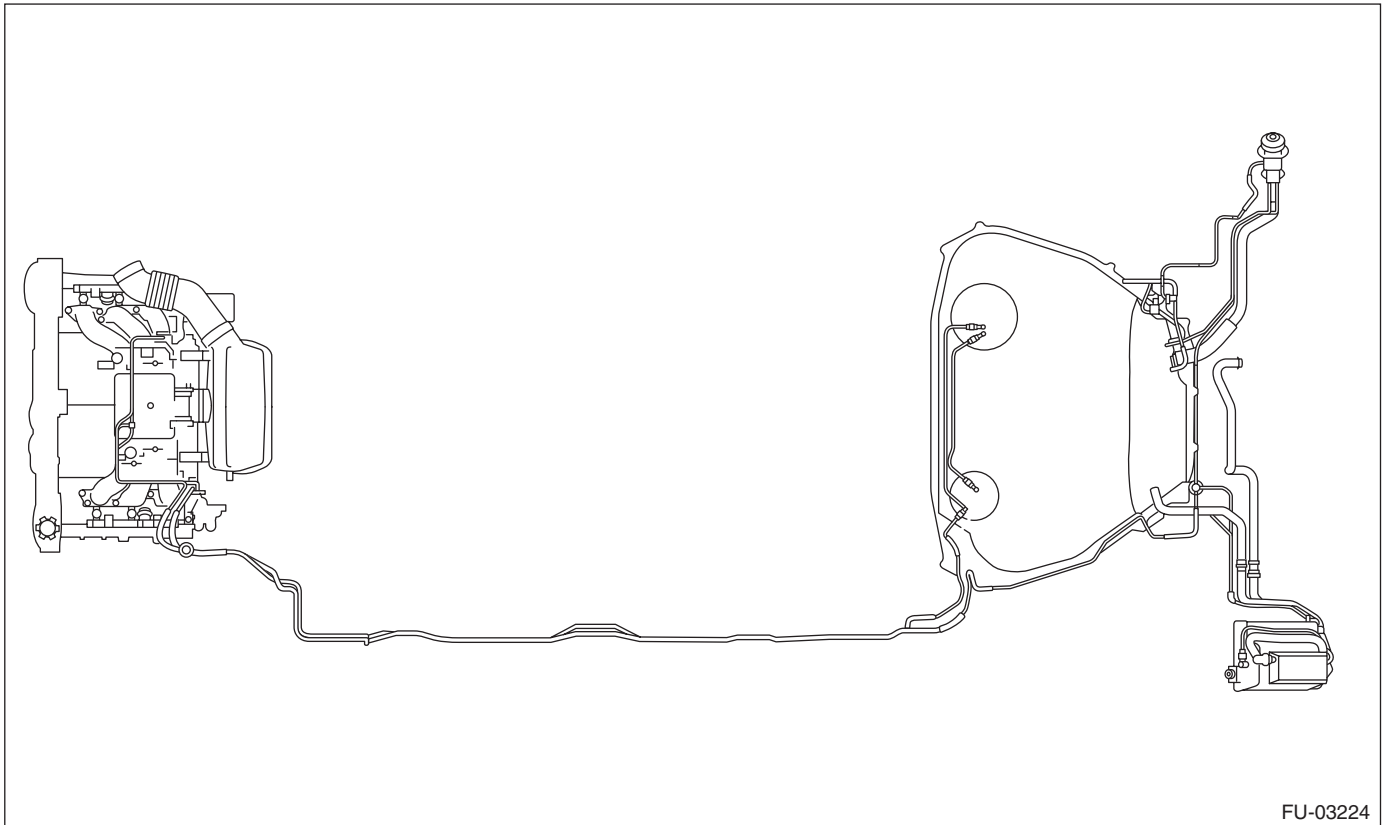
### A: REMOVAL

#### WARNING:

Place “NO OPEN FLAMES” signs near the working area.

#### CAUTION:

- Be careful not to spill fuel.
  - Catch the fuel from hoses using a container or cloth.
- 1) Set the vehicle on a lift.
  - 2) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
  - 3) Open the fuel filler flap lid, and remove the fuel filler cap.
  - 4) Remove the floor mat. <Ref. to EI-72, REMOVAL, Floor Mat.>
  - 5) Disconnect the fuel delivery pipes and hoses, and then disconnect the evaporation pipes and hoses.



# Fuel Delivery and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

6) In the engine compartment, disconnect the fuel delivery hoses and evaporation hose.

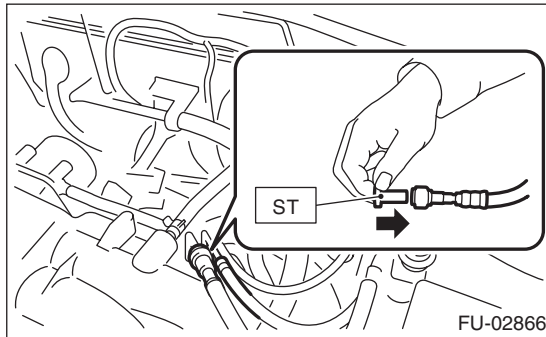
(1) Disconnect the quick connector of the fuel delivery line by pushing the ST in the direction of the arrow.

ST 42099AE000 CONNECTOR REMOVER

(2) Remove the clip and disconnect the evaporation hose from the pipe.

### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.



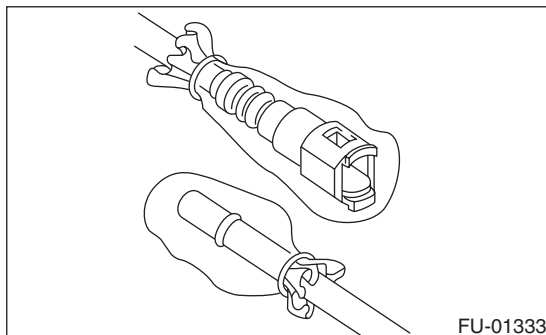
7) Lift up the vehicle.

8) Remove the fuel tank. <Ref. to FU(H6DO)-44, REMOVAL, Fuel Tank.>

9) Separate the quick connector of fuel line.

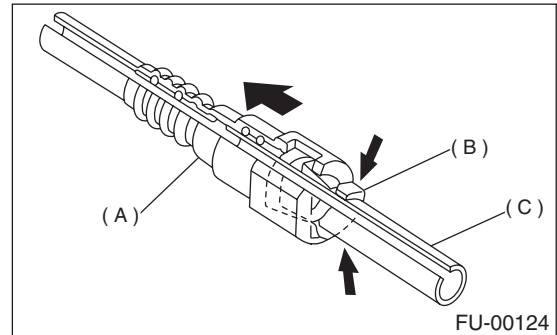
(1) Clean the pipe and connector, if they are covered with dust.

(2) To prevent from damaging or entering foreign matter, wrap the pipes and connectors with plastic bag etc.



(3) Hold the connector (A) and push the retainer (B) down.

(4) Pull out the connector (A) from the retainer (B).



- (A) Connector
- (B) Retainer
- (C) Pipe

## B: INSTALLATION

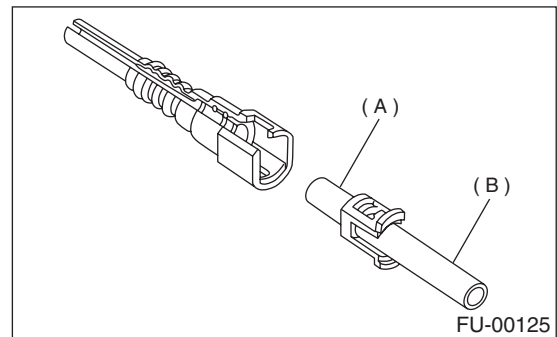
1) Connect the quick connector on fuel line.

### CAUTION:

Make sure there is no damage or dust on the connections. If necessary, clean seal surface of pipe.

### NOTE:

Use a new retainer.

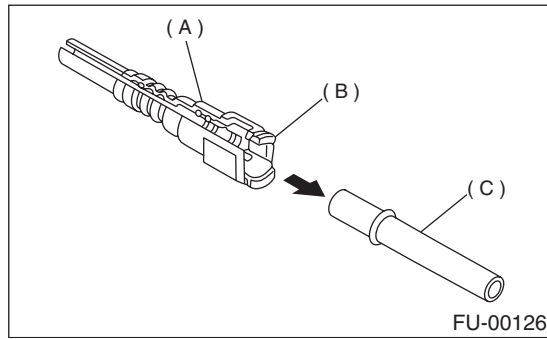


- (A) Seal surface
- (B) Pipe

# Fuel Delivery and Evaporation Lines

## FUEL INJECTION (FUEL SYSTEMS)

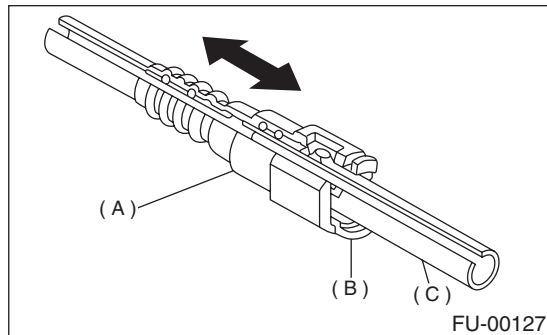
- (1) Set the new retainer (B) to connector (A).
- (2) Push the pipe into the connector completely.



- (A) Connector
- (B) Retainer
- (C) Pipe

### CAUTION:

- Pull the connector to ensure it is connected securely.
- Make sure the two retainer pawls are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
- (B) Retainer
- (C) Pipe

- 2) Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the amount to be inserted is specified.

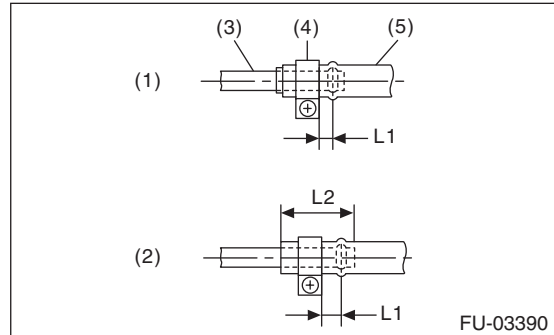
Type B: When the amount to be inserted is not specified.

**L1:  $2.5 \pm 1.5$  mm (0.098  $\pm$  0.059 in)**

**L2:  $22.5 \pm 2.5$  mm (0.886  $\pm$  0.098 in)**

### CAUTION:

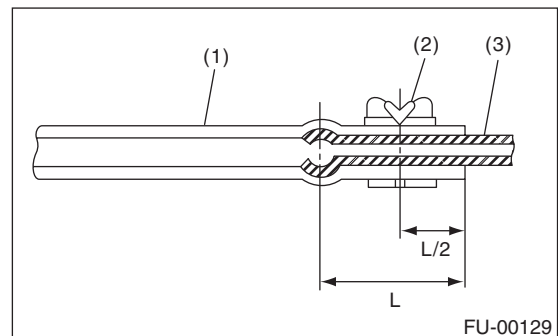
**Be sure to inspect hoses and their connections for any leakage of fuel.**



- (1) Type A
- (2) Type B
- (3) Pipe
- (4) Clamp
- (5) Hose

- 3) Connect the evaporation hose to the pipe with an overlap of 15 to 20 mm (0.59 to 0.79 in).

**L =  $17.5 \pm 2.5$  mm (0.689  $\pm$  0.098 in)**



- (1) Hose
- (2) Clip
- (3) Pipe

## C: INSPECTION

- 1) Make sure that there are no cracks on the fuel pipes and fuel hoses.
- 2) Make sure the fuel pipe and fuel hose connections are tightened firmly.

# Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

## 33. Fuel System Trouble in General

### A: INSPECTION

Trouble and possible cause		Corrective action
<b>1. Insufficient fuel supply to injector</b>		
1)	Fuel pump does not operate.	
	○ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	○ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
2)	Decline of fuel pump function	Replace the fuel pump.
3)	Clogged fuel filter	Replace the fuel pump and clean or replace the fuel tank.
4)	Clogged or bent fuel pipe or hose	Clean, correct or replace the fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent air breather tube or pipe	Clean, correct or replace the air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator	Replace.
<b>2. Leakage or blow out of fuel</b>		
1)	Loose joints of the fuel pipe	Retighten.
2)	Cracked fuel pipe, hose and fuel tank	Replace.
3)	Defective welding part on the fuel tank	Replace.
4)	Clogged or bent air breather tube or air vent tube	Clean, correct or replace the air breather tube or air vent tube.
<b>3. Gasoline smell inside of compartment</b>		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe	Retighten.
2)	Problem in tightness of the fuel saucer gasket air	Correct or replace the gasket.
3)	Inoperative fuel pump modulator or circuit	Replace.
<b>4. Defective fuel meter indicator</b>		
1)	Defective operation of fuel level sensor	Replace.
2)	Defective operation of fuel meter	Replace.
<b>5. Noise</b>		
1)	Large operation noise or vibration of fuel pump	Replace.

#### NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
- In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
- When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
- Before using water removing agent, follow the cautions noted on the bottle.

# Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

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## General Description

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### 1. General Description

#### A: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.

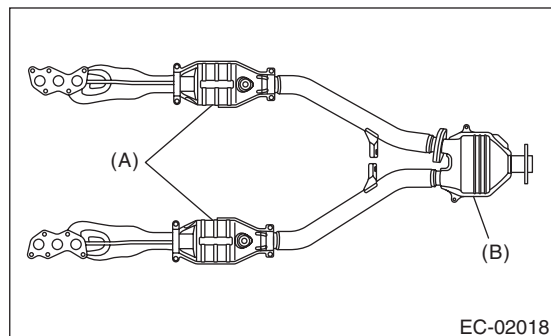
# Front Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. Front Catalytic Converter

### A: REMOVAL

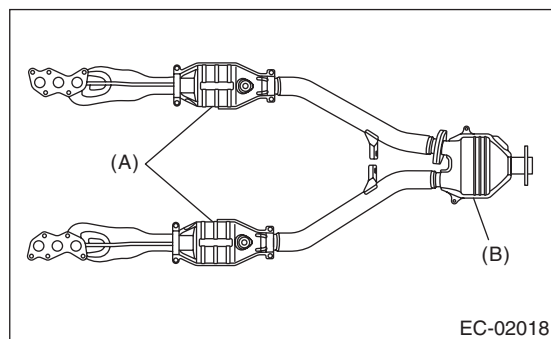
The front and rear catalytic converters are integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

### B: INSTALLATION

The front and rear catalytic converters are integrated into front exhaust pipe as one unit; therefore, refer to “Front Exhaust Pipe” for installation procedure. <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check for hole or rust.

# Rear Catalytic Converter

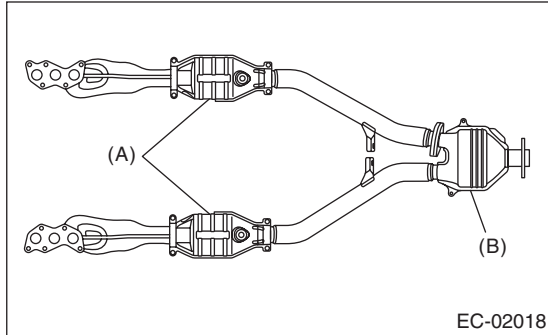
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 3. Rear Catalytic Converter

### A: REMOVAL

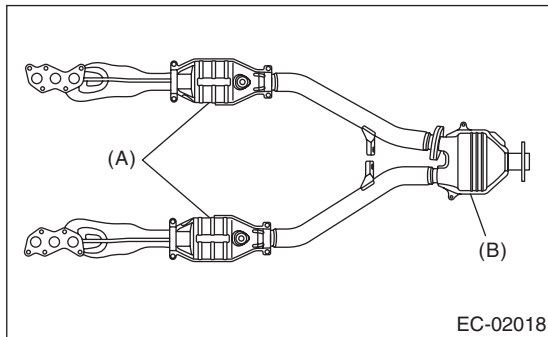
The front and rear catalytic converters are integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure.  
<Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

### B: INSTALLATION

The front and rear catalytic converters are integrated into front exhaust pipe as one unit; therefore, refer to “Front Exhaust Pipe” for installation procedure.  
<Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>



- (A) Front catalytic converter
- (B) Rear catalytic converter

### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check for hole or rust.

# EGR Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 4. EGR Valve

### A: SPECIFICATION

Refer to “EGR valve” for the removal and installation procedure. <Ref. to FU(H6DO)-26, EGR Valve.>

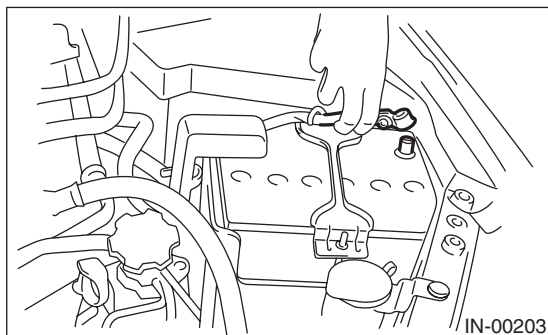
# Canister

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

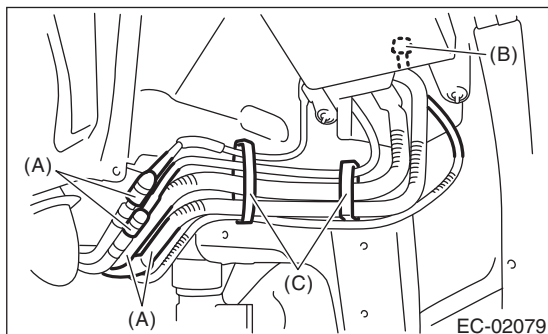
## 5. Canister

### A: REMOVAL

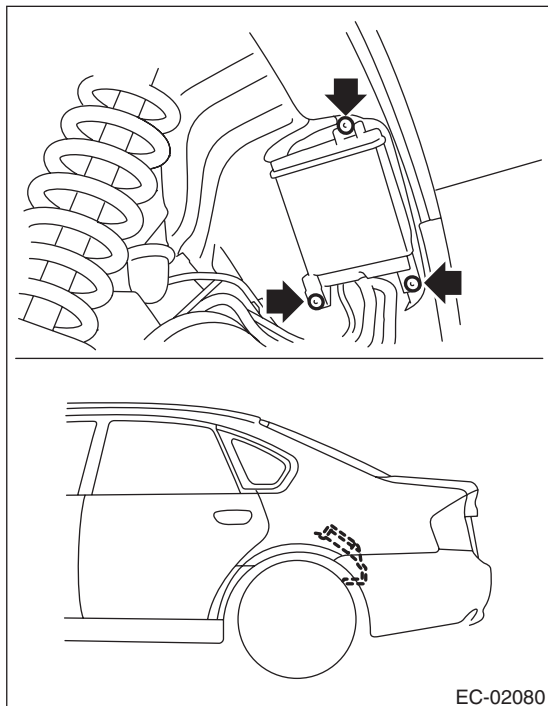
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift up the vehicle.
- 4) Remove the rear wheel LH.
- 5) Remove the rear mud guard LH.
- 6) Disconnect quick connector (A).
- 7) Disconnect the drain valve connector (B).
- 8) Remove clip (C).



- 9) Remove the canister from body.



### B: INSTALLATION

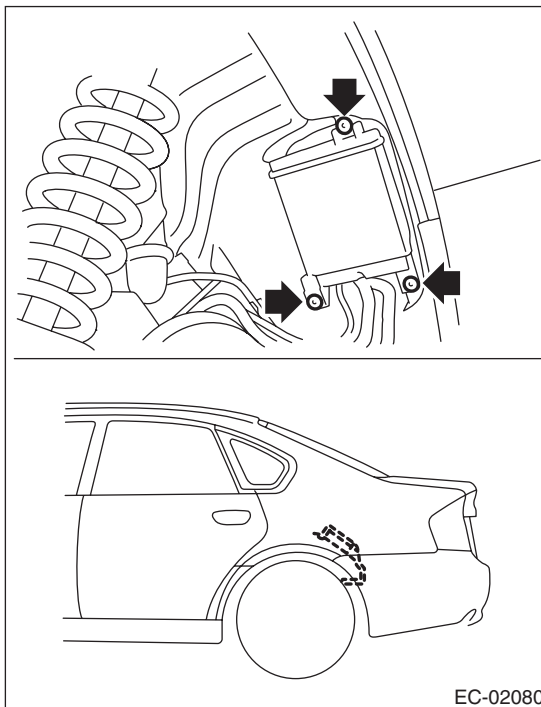
Install in the reverse order of removal.

#### NOTE:

Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.

#### Tightening torque:

**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**



### C: INSPECTION

Make sure the canister and canister hoses are not cracked or loose.

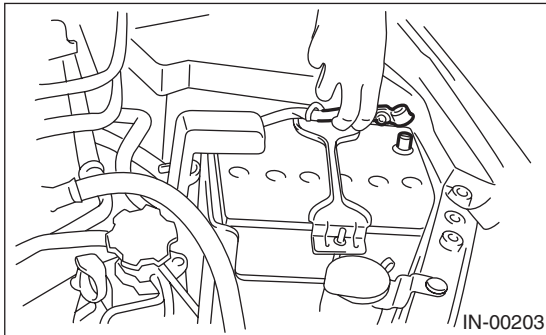
# Purge Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

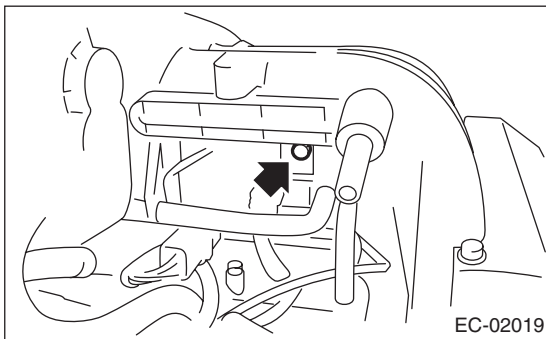
## 6. Purge Control Solenoid Valve

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the connector and hoses of purge control solenoid valve, and then remove the purge control solenoid valve.

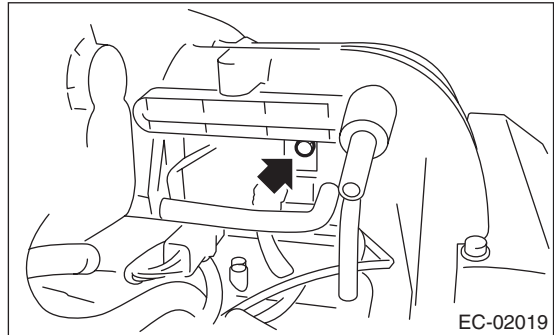


### B: INSTALLATION

Install in the reverse order of removal.

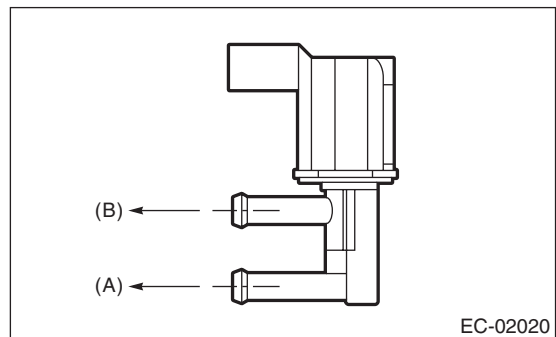
#### **Tightening torque:**

**19 N·m (1.9 kgf·m, 14.0 ft·lb)**



#### **NOTE:**

Connect the evaporation hose as shown in the figure.



(A) To fuel pipe (evaporation line)

(B) To intake manifold

### C: INSPECTION

Make sure the hoses are not cracked or loose.

# Fuel Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 7. Fuel Level Sensor

### A: REMOVAL

For removal procedure, refer to "FU(H6DO)" section. <Ref. to FU(H6DO)-56, REMOVAL, Fuel Level Sensor.>

### B: INSTALLATION

For installation procedure, refer to "FU(H6DO)" section. <Ref. to FU(H6DO)-56, INSTALLATION, Fuel Level Sensor.>

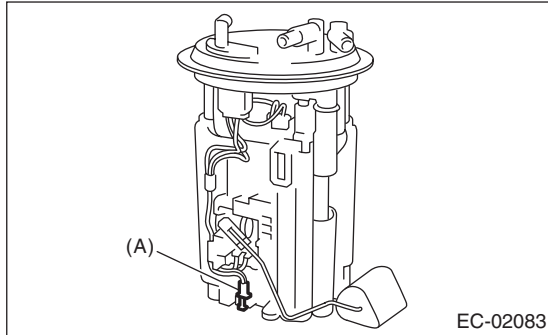
# Fuel Temperature Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 8. Fuel Temperature Sensor

### A: REMOVAL

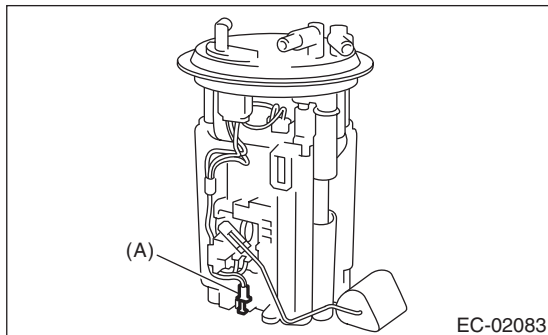
The fuel temperature sensor is integrated into fuel level sensor as one unit; therefore, refer to "Fuel Level Sensor" for removal procedure. <Ref. to FU(H6DO)-56, REMOVAL, Fuel Level Sensor.>



(A) Fuel temperature sensor

### B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to "Fuel Level Sensor" for installation procedure. <Ref. to FU(H6DO)-56, INSTALLATION, Fuel Level Sensor.>



(A) Fuel temperature sensor



## Fuel Sub Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### 9. Fuel Sub Level Sensor

#### A: REMOVAL

For removal procedure, refer to "FU(H6DO)" section. <Ref. to FU(H6DO)-57, REMOVAL, Fuel Sub Level Sensor.>

#### B: INSTALLATION

For installation procedure, refer to "FU(H6DO)" section. <Ref. to FU(H6DO)-57, INSTALLATION, Fuel Sub Level Sensor.>

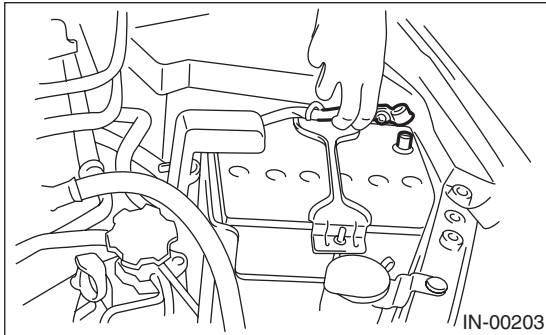
# Fuel Tank Pressure Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

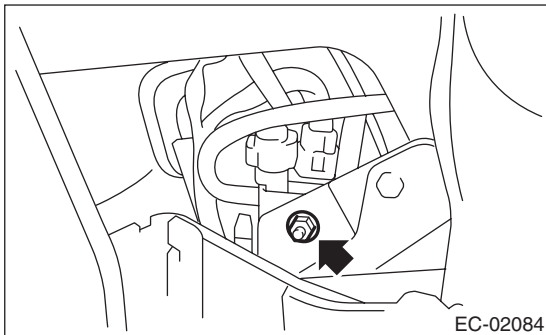
## 10. Fuel Tank Pressure Sensor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the fuel filler flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



- 4) Lift up the vehicle.
- 5) Disconnect the connector from the fuel tank pressure sensor.
- 6) Disconnect the pressure hose from the fuel tank pressure sensor.
- 7) Remove the fuel tank pressure sensor along with the bracket.

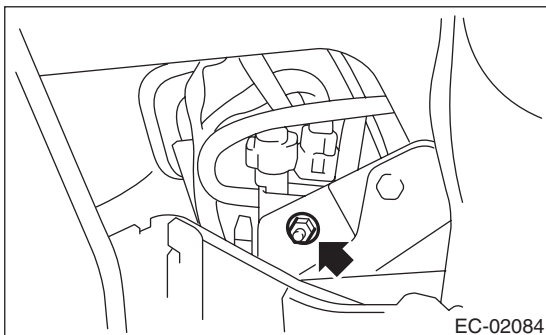


### B: INSTALLATION

Install in the reverse order of removal.

#### ***Tightening torque:***

***7.4 N·m (0.75 kgf-m, 5.4 ft-lb)***



### C: INSPECTION

Make sure the hoses are not cracked or loose.

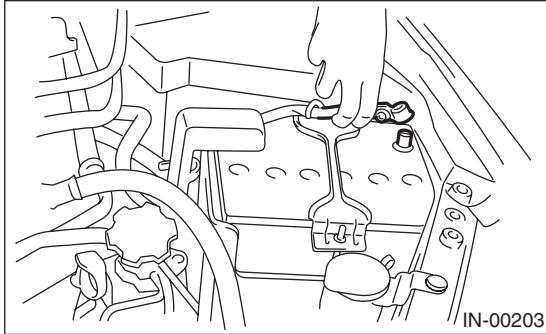
# Pressure Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

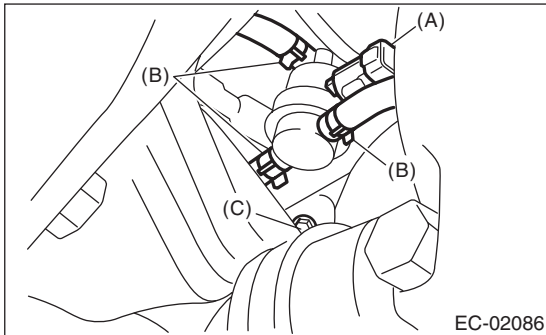
## 11. Pressure Control Solenoid Valve

### A: REMOVAL

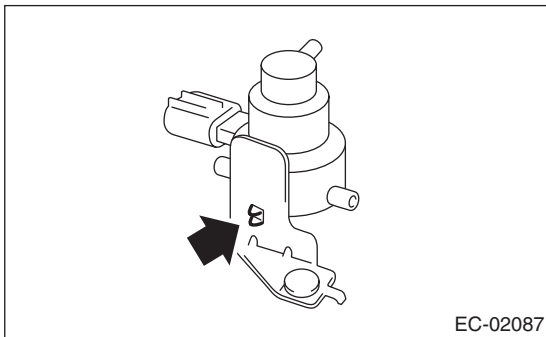
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift up the vehicle.
- 4) Disconnect connector (A) from the pressure control solenoid valve.
- 5) Disconnect the evaporation hose (B) from the pressure control solenoid valve.
- 6) Remove the bolts (C) which secure the bracket to the fuel tank.



- 7) Remove the pressure control solenoid valve from the bracket.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**7.35 N·m (0.75 kgf-m, 5.4 ft-lb)**

### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 12.Drain Filter

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain filter from canister. Refer to “Canister” for removal and installation procedure. <Ref. to EC(H6DO)-6, INSTALLATION, Canister.>

# Shut Valve

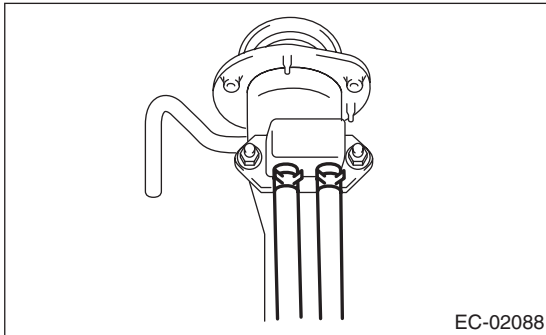
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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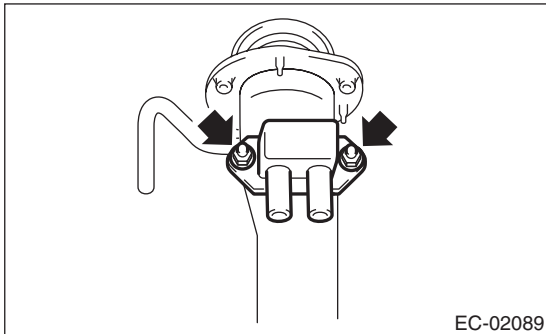
## 13. Shut Valve

### A: REMOVAL

- 1) Remove the fuel filler pipe. <Ref. to FU(H6DO)-51, REMOVAL, Fuel Filler Pipe.>
- 2) Disconnect the evaporation hose from the shut valve.



- 3) Remove the shut valve from the fuel filler pipe.

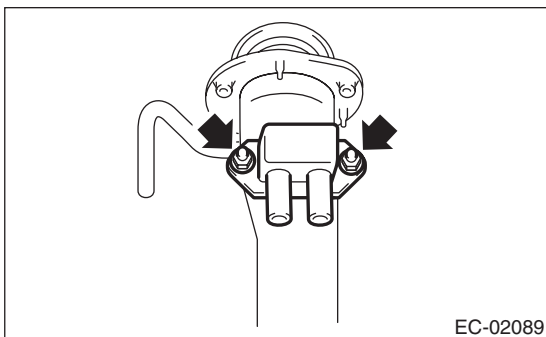


### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**4.5 N·m (0.46 kgf·m, 3.3 ft·lb)**



### C: INSPECTION

Make sure the hoses are not cracked or loose.

### 14.Drain Valve

#### A: SPECIFICATION

Canister is a non-disassembled part, so do not remove the drain valve from canister. Refer to “Canister” for removal and installation procedure. <Ref. to EC(H6DO)-6, REMOVAL, Canister.> <Ref. to EC(H6DO)-6, INSTALLATION, Canister.>

# PCV Valve

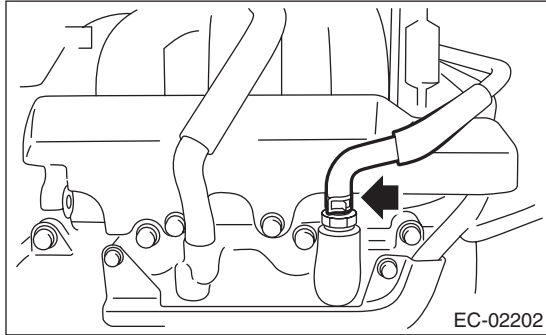
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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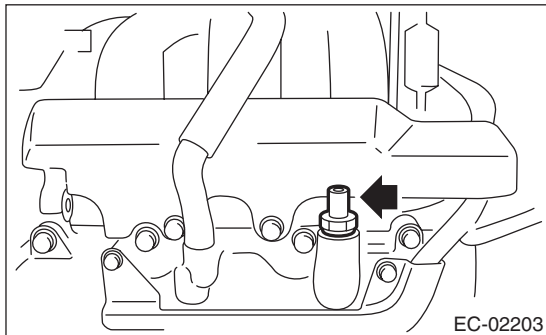
## 15.PCV Valve

### A: REMOVAL

1) Disconnect the PCV hose.



2) Remove the PCV valve from rocker cover.



### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Apply liquid gasket to the bolt threads of PCV valve.

**Liquid gasket:**

**THREE BOND 1141 (Part No. 004403006) or equivalent**

**Tightening torque:**

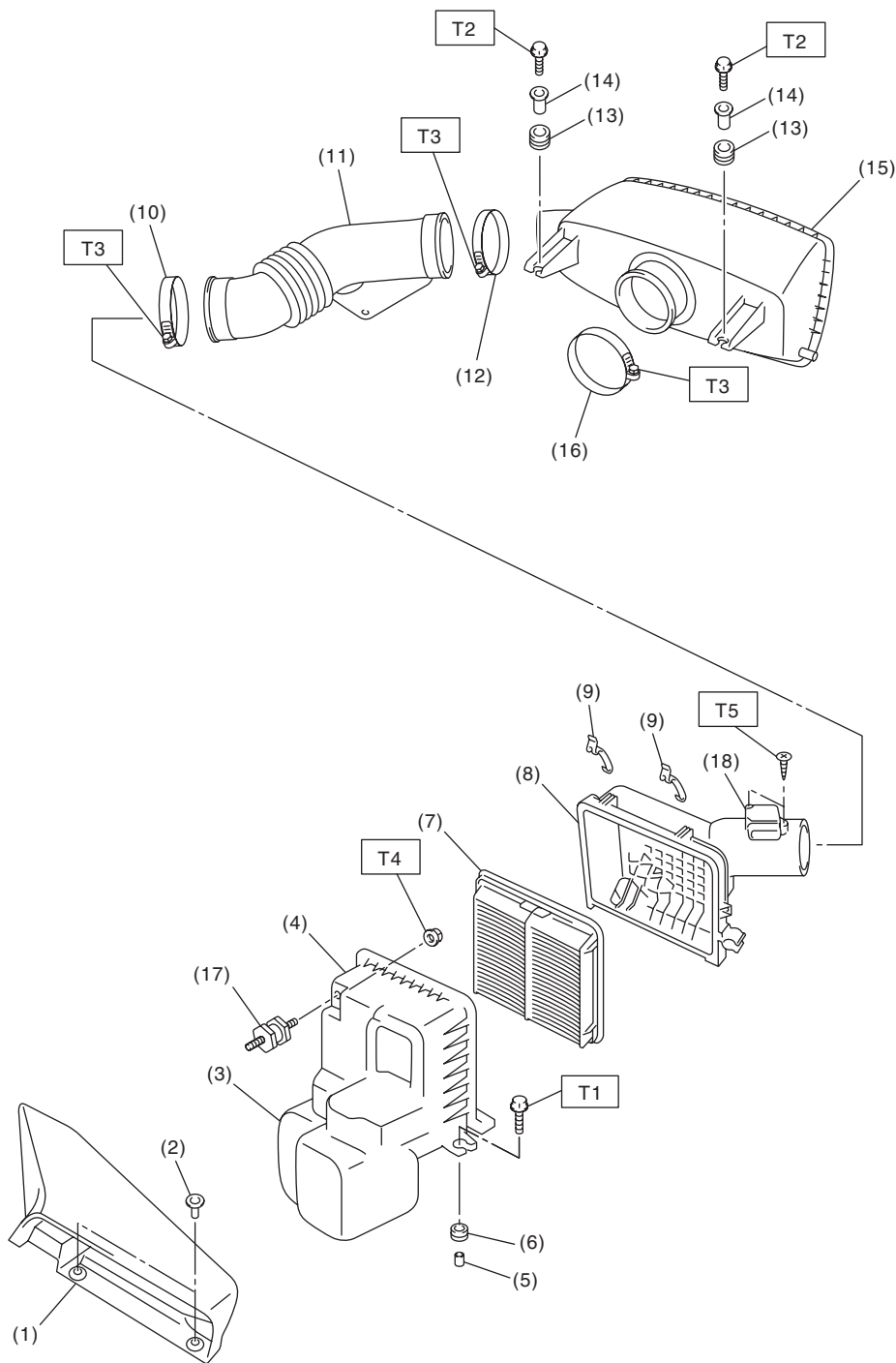
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

# General Description

INTAKE (INDUCTION)

## 1. General Description

### A: COMPONENT



IN-02212



# General Description

INTAKE (INDUCTION)

(1) Air intake duct	(11) Intake boot
(2) Clip	(12) Clamp
(3) Resonator chamber	(13) Cushion
(4) Air cleaner case (front)	(14) Spacer
(5) Spacer	(15) Air intake chamber
(6) Cushion	(16) Clamp
(7) Air cleaner element	(17) Cushion
(8) Air cleaner case (rear)	(18) Mass air flow and intake air temperature sensor
(9) Clip	
(10) Clamp	

---

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 6.0 (0.6, 4.4)**

**T2: 6.5 (0.66, 4.8)**

**T3: 3.0 (0.3, 2.2)**

**T4: 7.5 (0.76, 5.5)**

**T5: 1.0 (0.10, 0.7)**

---

## B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

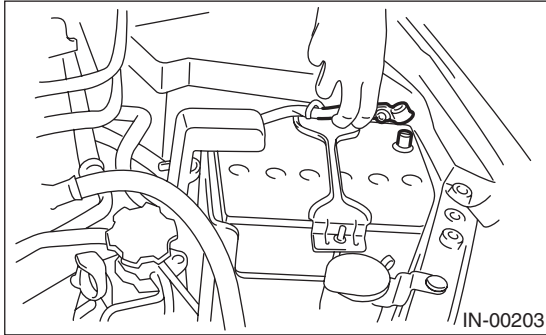
# Air Cleaner Element

INTAKE (INDUCTION)

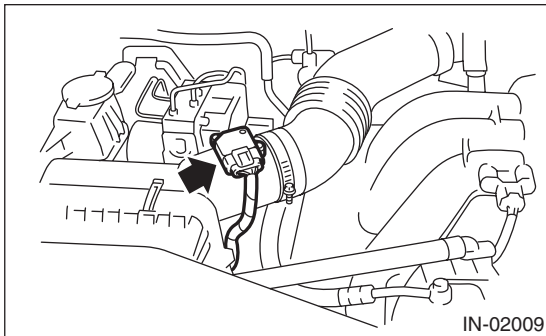
## 2. Air Cleaner Element

### A: REMOVAL

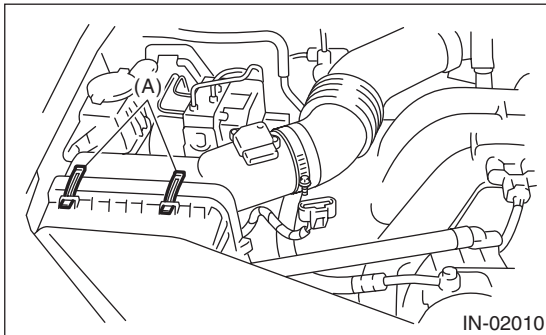
- 1) Disconnect the ground cable from the battery.



- 2) Disconnect the connector from mass air flow and intake air temperature sensor.



- 3) Remove the clip (A) securing upper side of air cleaner case.



- 4) Pull the air cleaner case (rear) backward of the vehicle, and remove the air cleaner element.

### NOTE:

Be careful of the power steering hose fixed to the bottom of the air cleaner case (rear).

### B: INSTALLATION

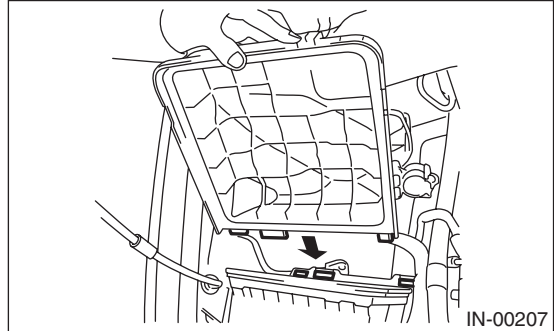
Install in the reverse order of removal.

### CAUTION:

Be sure to use **SUBARU** genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Otherwise engine performance may be damaged.

### NOTE:

Fasten with a clip after inserting the lower tab of case.



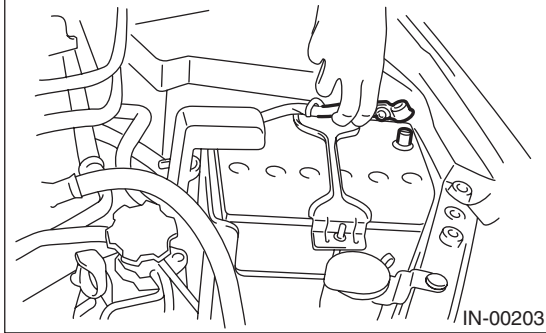
### C: INSPECTION

Replace if excessively damaged or dirty.

## 3. Air Cleaner Case

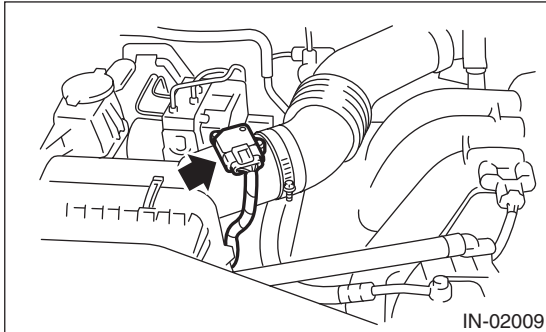
### A: REMOVAL

1) Disconnect the ground cable from the battery.



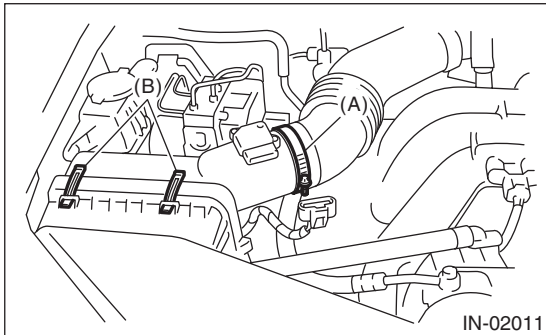
2) Remove the air intake duct. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.>

3) Disconnect the connector from mass air flow and intake air temperature sensor.

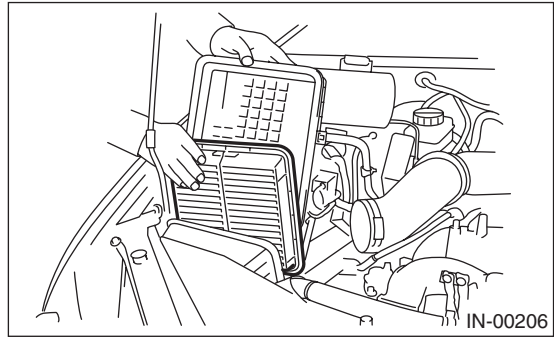


4) Loosen the clamps (A) which connect the air cleaner case and the intake boot.

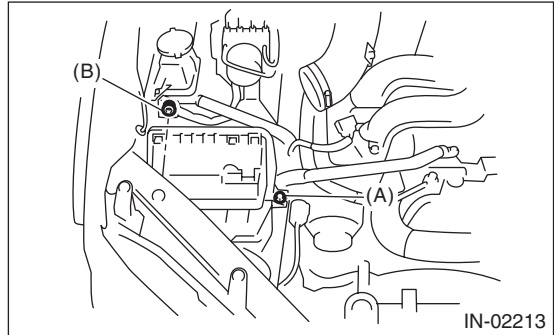
5) Remove the clip (B) securing the upper side of air cleaner case.



6) Remove the air cleaner case (rear) and air cleaner element.



7) Remove the bolts (A) and nut (B) which secure the air cleaner case to body.



8) Remove the air cleaner case (front).

# Air Cleaner Case

INTAKE (INDUCTION)

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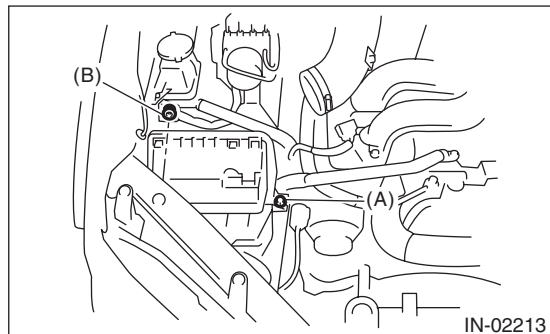
## B: INSTALLATION

Install in the reverse order of removal.

### *Tightening torque:*

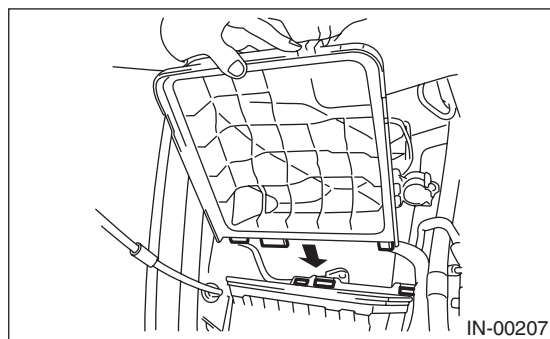
**Bolt (A): 6.0 N·m (0.6 kgf-m, 4.4 ft-lb)**

**Nut (B): 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



### NOTE:

Fasten with a clip after inserting the lower tab of case.



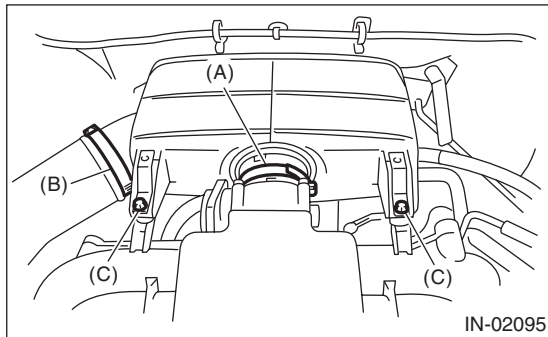
## C: INSPECTION

Check for cracks or loose connections.

## 4. Air Intake Chamber

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Loosen the clamp (A) which connects air intake chamber to throttle body.
- 3) Loosen the clamp (B) which connects intake boot to air intake chamber.
- 4) Remove the bolt (C) which secures air intake chamber to the stay.



- 5) Disconnect the blow-by hoses, then remove the air intake chamber.

### B: INSTALLATION

Install in the reverse order of removal.

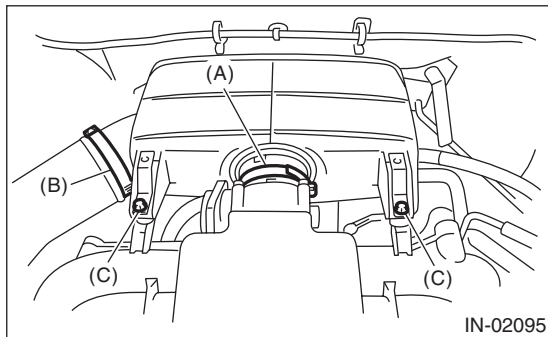
#### *Tightening torque:*

**Clamp (A), (B)**

**3.0 N·m (0.3 kgf·m, 2.2 ft·lb)**

**Bolt (C)**

**6.5 N·m (0.66 kgf·m, 4.8 ft·lb)**



### C: INSPECTION

- 1) Check for cracks or loose connections.
- 2) Check that no foreign matter is mixed in air intake chamber.

# Air Intake Duct

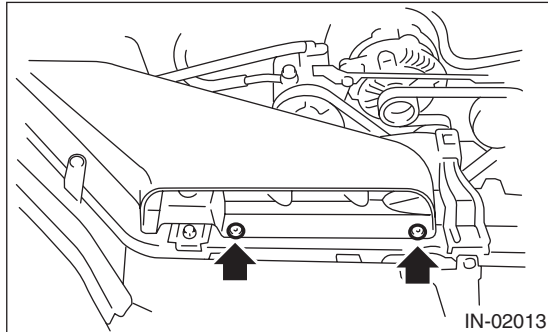
INTAKE (INDUCTION)

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## 5. Air Intake Duct

### A: REMOVAL

- 1) Remove the clip which installs the air intake duct on the front side of body.
- 2) Remove the air intake duct.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Check for cracks or loose connections.
- 2) Check that no foreign matter is mixed in air intake duct.

## 6. Resonator Chamber

### A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for removal procedure. <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.>

### B: INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for installation procedure. <Ref. to IN(H6DO)-6, INSTALLATION, Air Cleaner Case.>

### C: INSPECTION

Check for cracks or loose connections.

# Resonator Chamber

INTAKE (INDUCTION)

---

IN(H6DO)-10



# General Description

MECHANICAL

## 1. General Description

### A: SPECIFICATION

Engine	Cylinder arrangement		Horizontally opposed, liquid cooled, 6-cylinder, 4-stroke gasoline engine	
	Valve system mechanism		Chain driven, double overhead camshaft, 4-valve/cylinder	
	Bore × Stroke	mm (in)	89.2 × 80 (3.512 × 3.150)	
	Displacement	cm <sup>3</sup> (cu in)	3,000 (183)	
	Compression ratio		10.7	
	Compression pressure (350 rpm and fully open throttle):		kPa (kgf/cm <sup>2</sup> , psi)	1,275 — 1,471 (13.0 — 15.0, 185 — 213)
	Number of piston rings		Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Min. advance	Open	BTDC 47°
			Close	ABDC 23°
		Max. retard	Open	ATDC 3°
			Close	ABDC 73°
	Exhaust valve timing	Open	BBDC 46°	
		Close	ATDC 6°	
	Valve clearance	Intake	0.20 <sup>+0.04</sup> <sub>-0.06</sub> (0.0079 <sup>+0.0016</sup> <sub>-0.0024</sub> )	
		Exhaust	0.35±0.05 (0.0138±0.0020)	
Idle rpm ["P" or "N" range]	rpm	No load	650±50	
		A/C ON	770±50	
Ignition order		1 → 6 → 3 → 2 → 5 → 4		
Ignition timing		BTDC/rpm	15°±8°/650	

NOTE:

OS: Oversize US: Undersize

# General Description

MECHANICAL

Camshaft	Side clearance	mm (in)	Intake		Standard	0.075 — 0.135 (0.0030 — 0.0053)
			Exhaust		Standard	0.030 — 0.090 (0.0012 — 0.0035)
	Cam lobe height	mm (in)	Intake	HIGH	Standard	42.09 — 42.19 (1.6571 — 1.6610)
				LOW1	Standard	38.14 — 38.24 (1.5016 — 1.5055)
				LOW2	Standard	38.14 — 38.24 (1.5016 — 1.5055)
			Exhaust		Standard	40.45 — 40.55 (1.5925 — 1.5965)
	Cam base circle diameter	mm (in)	Intake	HIGH	Standard	32.00 (1.2598)
				LOW1	Standard	31.84 (1.2535)
				LOW2	Standard	31.84 (1.2535)
			Exhaust		Standard	32.00 (1.2598)
Journal O.D.	mm (in)	Front		Standard	37.946 — 37.963 (1.4939 — 1.4946)	
		Except for front		Standard	25.946 — 25.963 (1.0215 — 1.0222)	
Oil clearance		mm (in)	Standard		0.037 — 0.072 (0.0015 — 0.0028)	
Cylinder head	Warping limit (Mating with cylinder block)		mm (in)	Standard	0.02 (0.0008)	
	Inner diameter of valve lifter hole			mm (in)	32.994 — 33.016 (1.2990 — 1.2998)	
	Standard height			mm (in)	124±0.05 (4.88±0.0020)	
Valve seat	Seating angle				90°	
	Contacting width	mm (in)	Intake		Standard	1.0 (0.039)
Exhaust			Standard	1.5 (0.059)		
Valve guide	Inside diameter			mm (in)	5.500 — 5.512 (0.2165 — 0.2170)	
	Protrusion above head			mm (in)	11.4 — 11.8 (0.449 — 0.465)	
Valve	Head edge thickness	mm (in)	Intake		Standard	1.0 (0.039)
			Exhaust		Standard	1.2 (0.047)
	Stem outer diameter	mm (in)	Intake		5.455 — 5.470 (0.2148 — 0.2154)	
			Exhaust		5.445 — 5.460 (0.2144 — 0.2150)	
	Stem oil clearance	mm (in)	Intake		Standard	0.030 — 0.057 (0.0012 — 0.0022)
			Exhaust		Standard	0.040 — 0.067 (0.0016 — 0.0026)
Overall length	mm (in)	Intake		99.7 (3.925)		
		Exhaust		105.2 (4.142)		
Outer diameter of valve lifter			mm (in)	32.959 — 32.975 (1.2976 — 1.2982)		
Valve spring	Free length	mm (in)	Intake	Inner	39.55 (1.5571)	
				Outer	41.18 (1.6213)	
			Exhaust		46.32 (1.8236)	
	Squareness			Intake	Inner	2.5°, 1.7 mm (0.067 in) or less
Outer					2.5°, 1.8 mm (0.071 in) or less	
			Exhaust	2.5°, 2.0 mm (0.079 in) or less		
Cylinder block	Standard height			mm (in)	202 (7.95)	
	Warping limit (Mating with cylinder head)		mm (in)	Standard	0.02 (0.0008)	
	Cylinder inner diameter	mm (in)	Standard	A	89.205 — 89.215 (3.5120 — 3.5124)	
				B	89.195 — 89.205 (3.5116 — 3.5120)	
	Cylindricity		mm (in)	Standard	0.030 (0.0012)	
	Out-of-roundness		mm (in)	Standard	0.010 (0.0004)	
	Piston clearance		mm (in)	Standard	-0.010 — 0.010 (-0.0004 — 0.0004)	
Cylinder inner diameter boring limit (diameter)			mm (in)	To 89.715 (3.5321)		
Piston	Outer diameter	mm (in)	Standard	A	89.205 — 89.215 (3.5120 — 3.5124)	
				B	89.195 — 89.205 (3.5116 — 3.5120)	
			0.25 (0.0098) OS		89.445 — 89.465 (3.5215 — 3.5222)	
			0.50 (0.0197) OS		89.695 — 89.715 (3.5313 — 3.5321)	
Inner diameter of piston pin hole		mm (in)	Standard	22.000 — 22.006 (0.8661 — 0.8664)		

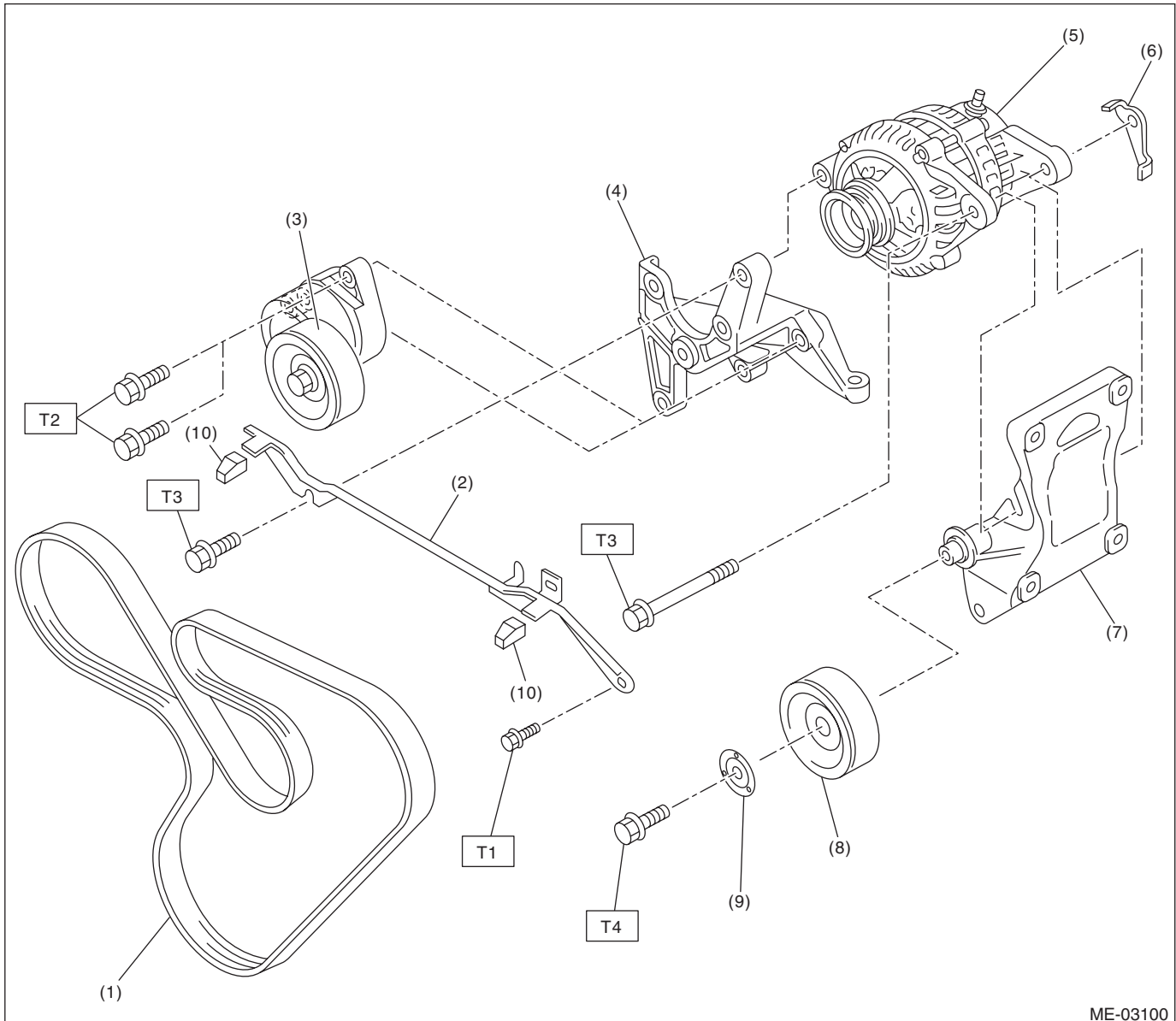
# General Description

## MECHANICAL

Piston pin	Outer diameter		mm (in)	Standard	21.994 — 22.000 (0.8659 — 0.8661)	
	Standard clearance between piston and piston pin		mm (in)	Standard	0.004 — 0.008 (0.0002 — 0.0003)	
Piston ring	Ring closed gap	mm (in)	Top ring	Standard	0.20 — 0.35 (0.0079 — 0.0138)	
			Second ring	Standard	0.35 — 0.50 (0.0138 — 0.0197)	
			Oil ring	Standard	0.20 — 0.60 (0.0079 — 0.0236)	
	Ring groove gap	mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)	
			Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)	
			Oil ring	Standard	0.045 — 0.125 (0.0018 — 0.0049)	
Connecting rod	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance		mm (in)	Standard	0.016 — 0.043 (0.0006 — 0.0017)	
	Bearing size (Thickness at center)	mm (in)	Standard		1.490 — 1.506 (0.0587 — 0.0593)	
			0.03 (0.0012) US		1.509 — 1.513 (0.0594 — 0.0596)	
			0.05 (0.0020) US		1.519 — 1.523 (0.0598 — 0.0600)	
0.25 (0.0098) US				1.619 — 1.623 (0.0637 — 0.0639)		
Bushing of small end	Clearance between piston pin and bushing		mm (in)	Standard	0 — 0.022 (0 — 0.0009)	
Crankshaft	Crank pin and crank journal		Out-of-roundness	mm (in)	0.005 (0.0002)	
			Cylindricity	mm (in)	0.006 (0.0002)	
	Crank pin outer diameter		mm (in)	Standard	51.984 — 52.000 (2.0466 — 2.0472)	
				0.03 (0.0012) US	51.954 — 51.970 (2.0454 — 2.0461)	
				0.05 (0.0020) US	51.934 — 51.950 (2.0446 — 2.0453)	
				0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)	
	Crank journal outer diameter		mm (in)	#1, #3, #5, #7	Standard	63.992 — 64.008 (2.5194 — 2.5200)
					0.03 (0.0012) US	63.962 — 63.978 (2.5182 — 2.5188)
					0.05 (0.0020) US	63.942 — 63.958 (2.5174 — 2.5180)
					0.25 (0.0098) US	63.742 — 63.758 (2.5095 — 2.5102)
			#2, #4, #6	Standard	63.992 — 64.008 (2.5194 — 2.5200)	
				0.03 (0.0012) US	63.962 — 63.978 (2.5182 — 2.5188)	
				0.05 (0.0020) US	63.942 — 63.958 (2.5174 — 2.5180)	
				0.25 (0.0098) US	63.742 — 63.758 (2.5095 — 2.5102)	
Thrust clearance		mm (in)	Standard	0.030 — 0.115 (0.0012 — 0.0045)		
Oil clearance		mm (in)	Standard	0.010 — 0.030 (0.0004 — 0.0012)		
Main bearing	Bearing size (Thickness at center)		mm (in)	#1, #3, #5, #7	Standard	1.992 — 2.005 (0.0784 — 0.0789)
					0.03 (0.0012) US	2.011 — 2.014 (0.0792 — 0.0793)
					0.05 (0.0020) US	2.021 — 2.024 (0.0796 — 0.0797)
					0.25 (0.0098) US	2.121 — 2.124 (0.0835 — 0.0836)
			#2, #4, #6	Standard	1.996 — 2.009 (0.0786 — 0.0791)	
				0.03 (0.0012) US	2.015 — 2.018 (0.0793 — 0.0794)	
				0.05 (0.0020) US	2.025 — 2.028 (0.0797 — 0.0798)	
				0.25 (0.0098) US	2.125 — 2.128 (0.0837 — 0.0838)	

## B: COMPONENT

### 1. V-BELT



ME-03100

- |                                 |                         |
|---------------------------------|-------------------------|
| (1) V-belt                      | (6) Generator plate     |
| (2) Collector cover bracket     | (7) A/C compressor stay |
| (3) Belt tension adjuster ASSY  | (8) Idler pulley        |
| (4) Power steering pump bracket | (9) Idler pulley cover  |
| (5) Generator                   | (10) Cushion            |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 20 (2.0, 14.8)**

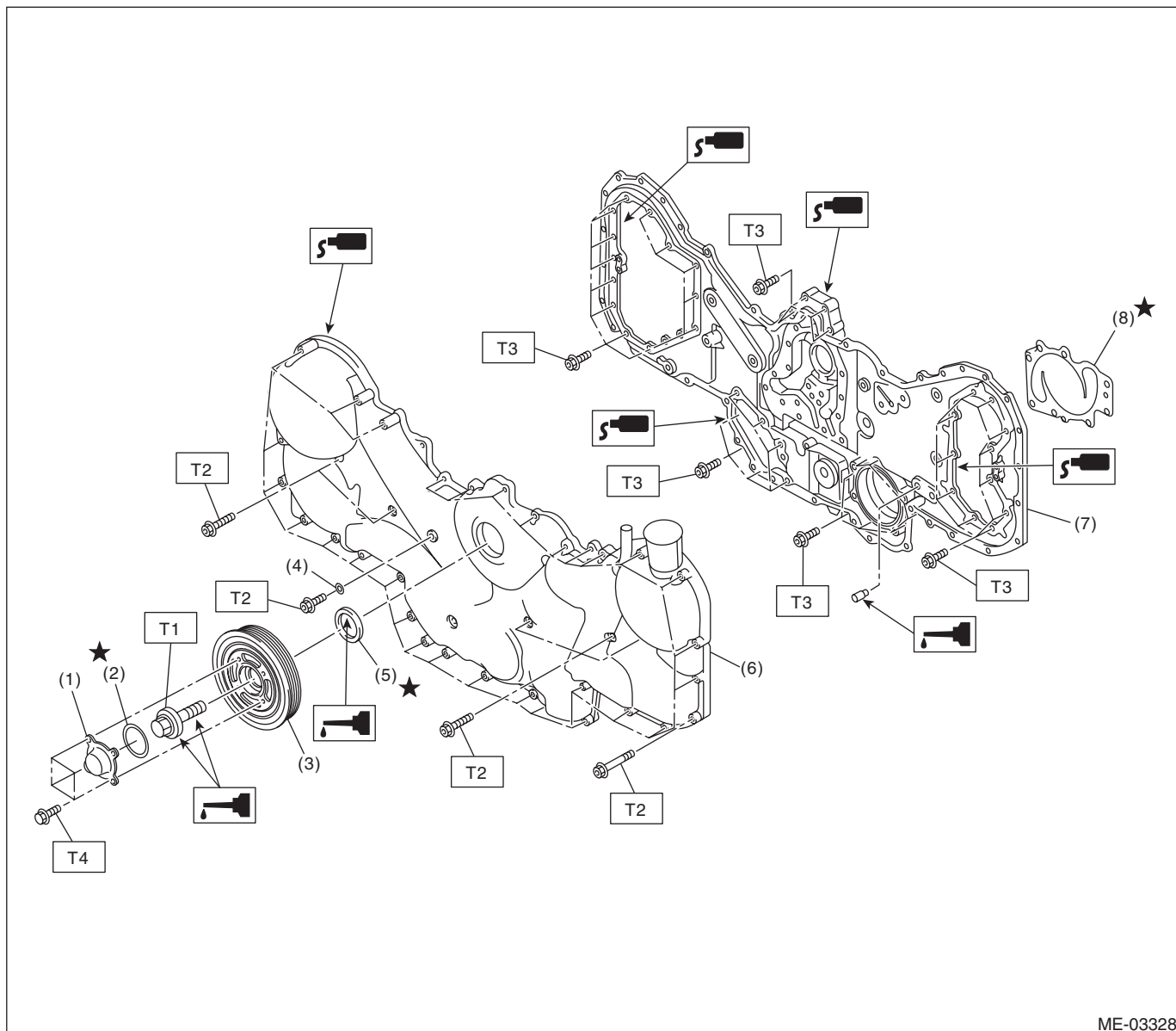
**T3: 25 (2.5, 18.4)**

**T4: 33 (3.4, 25)**

# General Description

MECHANICAL

## 2. TIMING CHAIN COVER



ME-03328

- |                        |                       |
|------------------------|-----------------------|
| (1) Crank pulley cover | (5) Oil seal          |
| (2) O-ring             | (6) Front chain cover |
| (3) Crank pulley       | (7) Rear chain cover  |
| (4) Sealing washer     | (8) Water pump gasket |

**Tightening torque:N·m (kgf·m, ft·lb)**

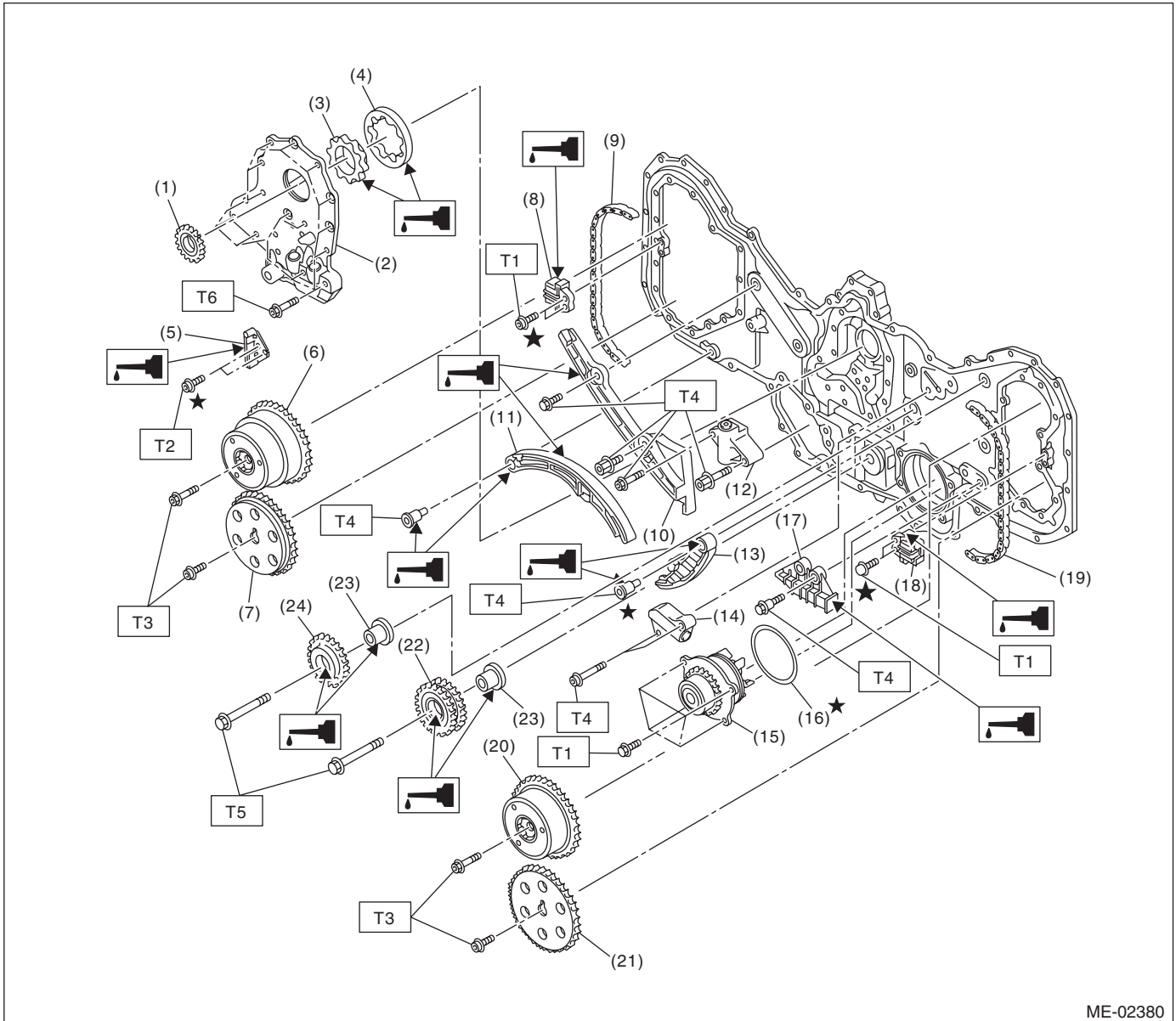
**T1:** <Ref. to ME(H6DO)-41, Crank Pulley.>

**T2:** <Ref. to ME(H6DO)-42, Front Chain Cover.>

**T3:** <Ref. to ME(H6DO)-52, Rear Chain Cover.>

**T4:** 6.4 (0.65, 4.7)

## 3. TIMING CHAIN



ME-02380

- |                                    |                                     |                             |
|------------------------------------|-------------------------------------|-----------------------------|
| (1) Crank sprocket                 | (12) Chain tensioner (RH)           | (23) Idler sprocket collar  |
| (2) Oil relief case                | (13) Chain tensioner lever (LH)     | (24) Idler sprocket (upper) |
| (3) Inner rotor                    | (14) Chain tensioner (LH)           |                             |
| (4) Outer rotor                    | (15) Water pump                     |                             |
| (5) Chain guide (center)           | (16) O-ring                         |                             |
| (6) Intake cam sprocket (RH)       | (17) Chain guide (LH)               |                             |
| (7) Exhaust cam sprocket (RH)      | (18) Chain guide (LH: between cams) |                             |
| (8) Chain guide (RH: between cams) | (19) Timing chain (LH)              |                             |
| (9) Timing chain (RH)              | (20) Intake cam sprocket (LH)       |                             |
| (10) Chain guide (RH)              | (21) Exhaust cam sprocket (LH)      |                             |
| (11) Chain tensioner lever (RH)    | (22) Idler sprocket (lower)         |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 7.8 (0.8, 5.8)**

**T3: <Ref. to ME(H6DO)-50, Cam Sprocket.>**

**T4: 16 (1.6, 11.8)**

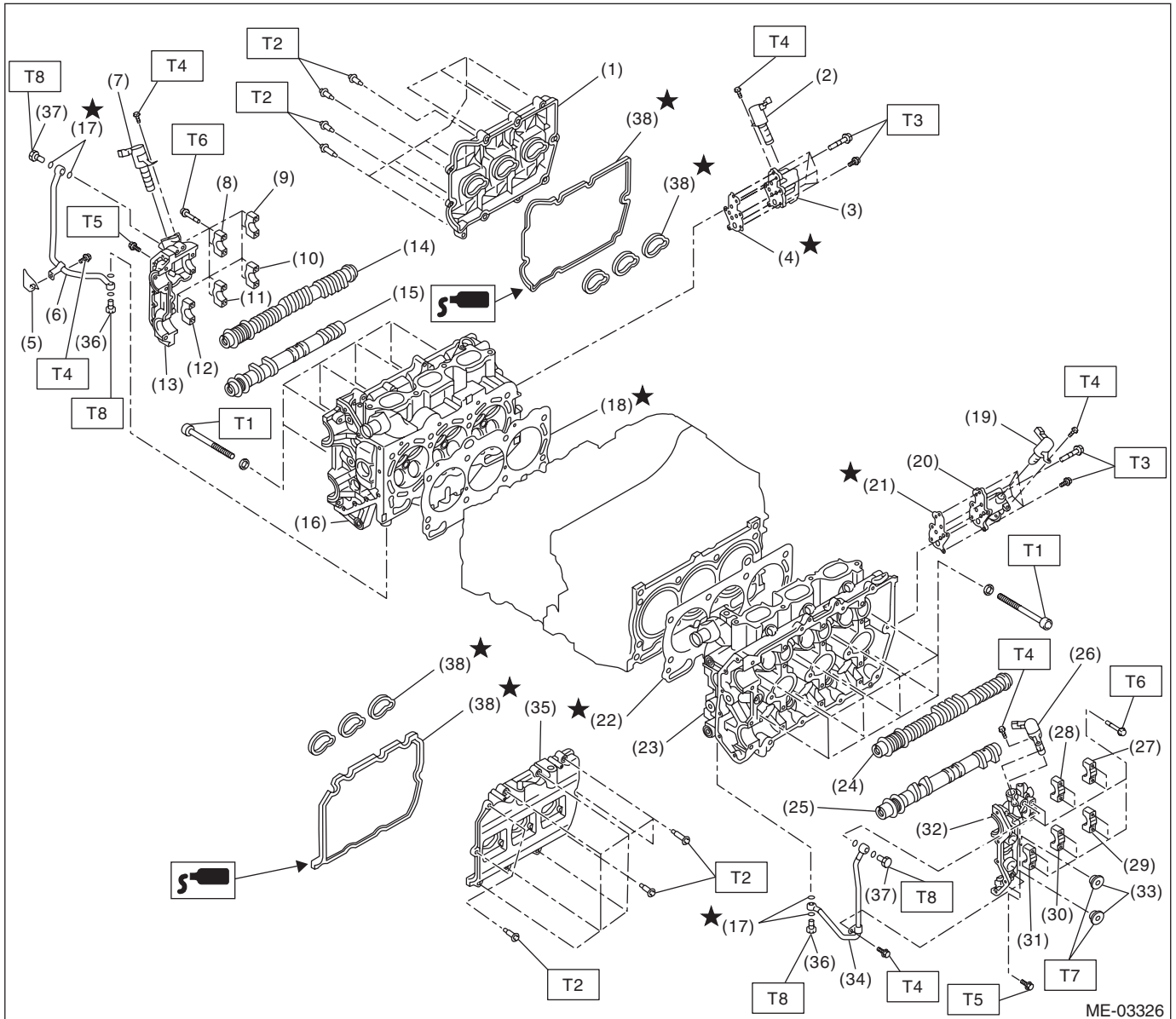
**T5: 69 (7.0, 50.9)**

**T6: <Ref. to LU(H6DO)-8, Oil Pump.>**

# General Description

MECHANICAL

## 4. CYLINDER HEAD AND CAMSHAFT



ME(H6DO)-8

# General Description

MECHANICAL

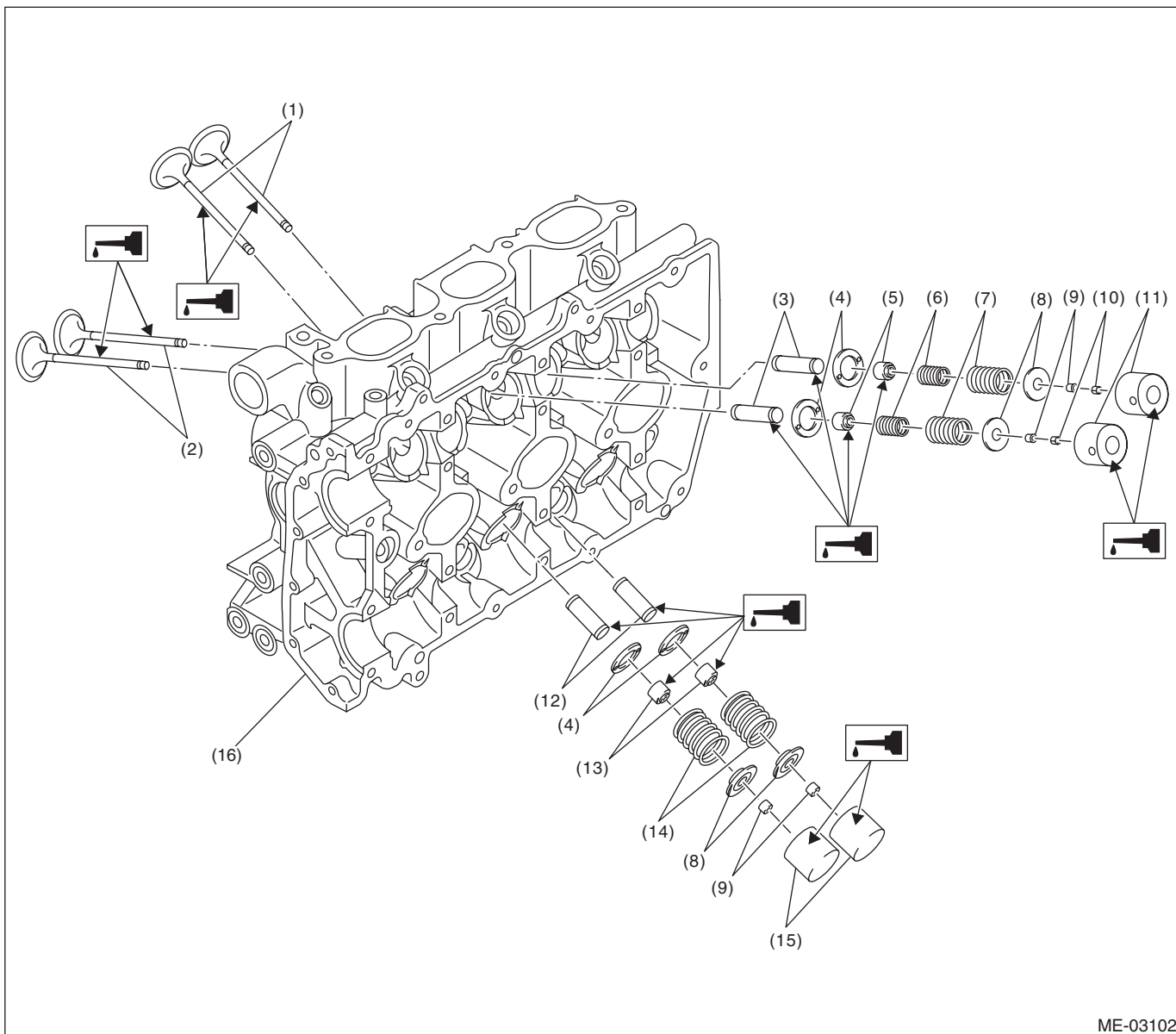
(1) Rocker cover (RH)	(17) Gasket	(34) Oil pipe (LH)
(2) Oil switching solenoid valve (RH)	(18) Cylinder head gasket (RH)	(35) Rocker cover (LH)
(3) Oil switching solenoid valve holder (RH)	(19) Oil switching solenoid valve (LH)	(36) Union screw with filter (with protrusion)
(4) Oil switching solenoid valve gasket (RH)	(20) Oil switching solenoid valve holder (LH)	(37) Union screw without filter (without protrusion)
(5) Front chain cover	(21) Oil switching solenoid valve gasket (LH)	(38) Rocker cover gasket
(6) Oil pipe (RH)	(22) Cylinder head gasket (LH)	
(7) Oil flow control solenoid valve (RH)	(23) Cylinder head (LH)	<b>Tightening torque:N-m (kgf-m, ft-lb)</b>
(8) Intake camshaft cap (Center RH)	(24) Intake camshaft (LH)	<b>T1: &lt;Ref. to ME(H6DO)-58, Cylinder Head.&gt;</b>
(9) Intake camshaft cap (Rear RH)	(25) Exhaust camshaft (LH)	<b>T2: &lt;Ref. to ME(H6DO)-54, Camshaft.&gt;</b>
(10) Exhaust camshaft cap (Rear RH)	(26) Oil flow control solenoid valve (LH)	<b>T3: &lt;Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.&gt;</b>
(11) Exhaust camshaft cap (Center RH)	(27) Intake camshaft cap (Rear LH)	<b>T4: 6.4 (0.65, 4.7)</b>
(12) Exhaust camshaft cap (Front RH)	(28) Intake camshaft cap (Center LH)	<b>T5: 9.75 (1.0, 7.2)</b>
(13) Front camshaft cap (RH)	(29) Exhaust camshaft cap (Rear LH)	<b>T6: 16 (1.6, 11.8)</b>
(14) Intake camshaft (RH)	(30) Exhaust camshaft cap (Center LH)	<b>T7: 60 (6.1, 44)</b>
(15) Exhaust camshaft (RH)	(31) Exhaust camshaft cap (Front LH)	<b>T8: 29 (3.0, 21.4)</b>
(16) Cylinder head (RH)	(32) Front camshaft cap (LH)	
	(33) Plug	



# General Description

MECHANICAL

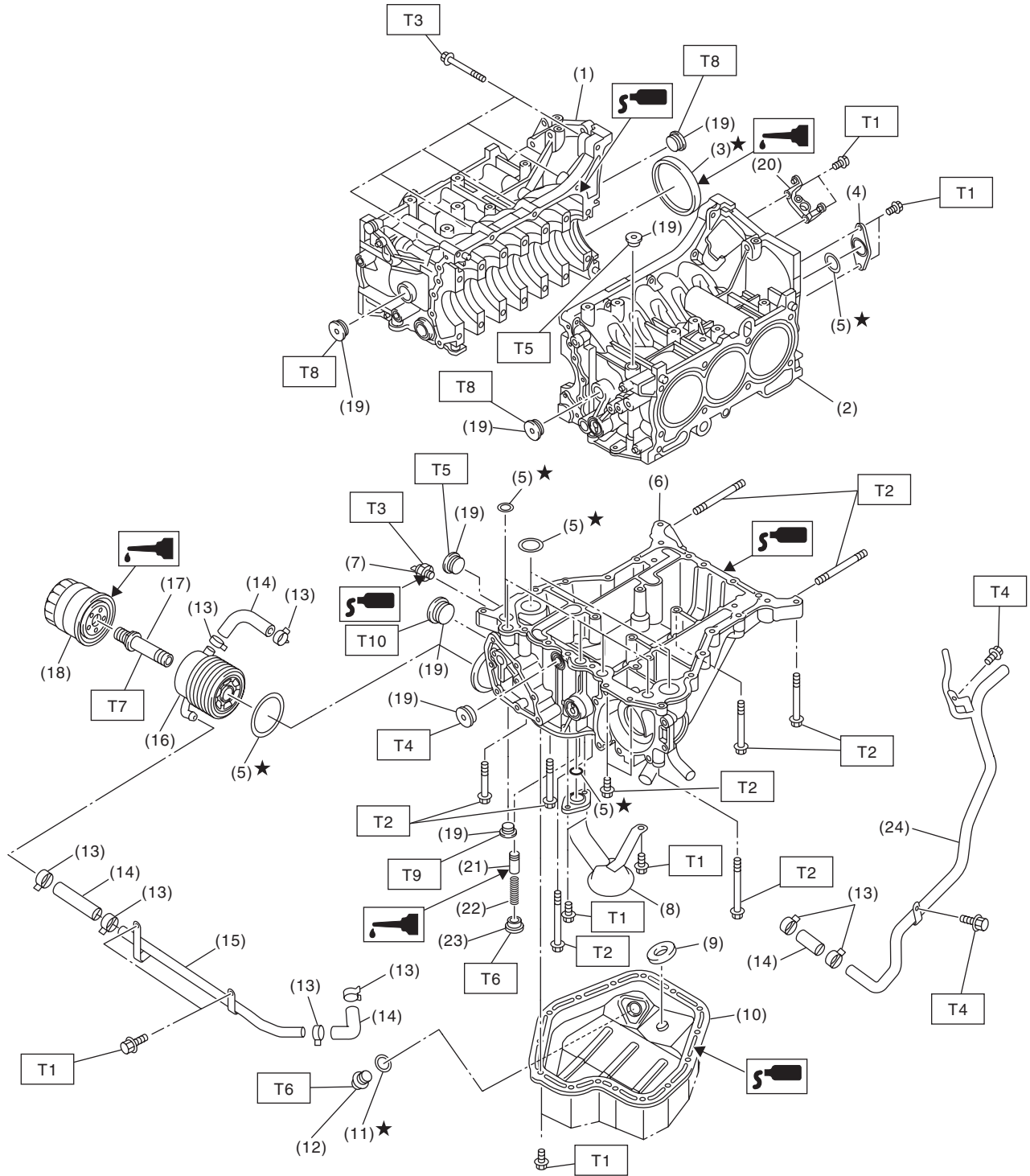
## 5. CYLINDER HEAD AND VALVE ASSEMBLY



ME-03102

- |                            |                            |                              |
|----------------------------|----------------------------|------------------------------|
| (1) Exhaust valve          | (7) Valve spring (Outer)   | (13) Exhaust valve stem seal |
| (2) Intake valve           | (8) Retainer               | (14) Valve spring            |
| (3) Intake valve guide     | (9) Retainer key           | (15) Valve lifter (Exhaust)  |
| (4) Valve spring seat      | (10) Shim                  | (16) Cylinder head           |
| (5) Intake valve stem seal | (11) Valve lifter (Intake) |                              |
| (6) Valve spring (Inner)   | (12) Exhaust valve guide   |                              |

## 6. CYLINDER BLOCK



ME-03327

## General Description

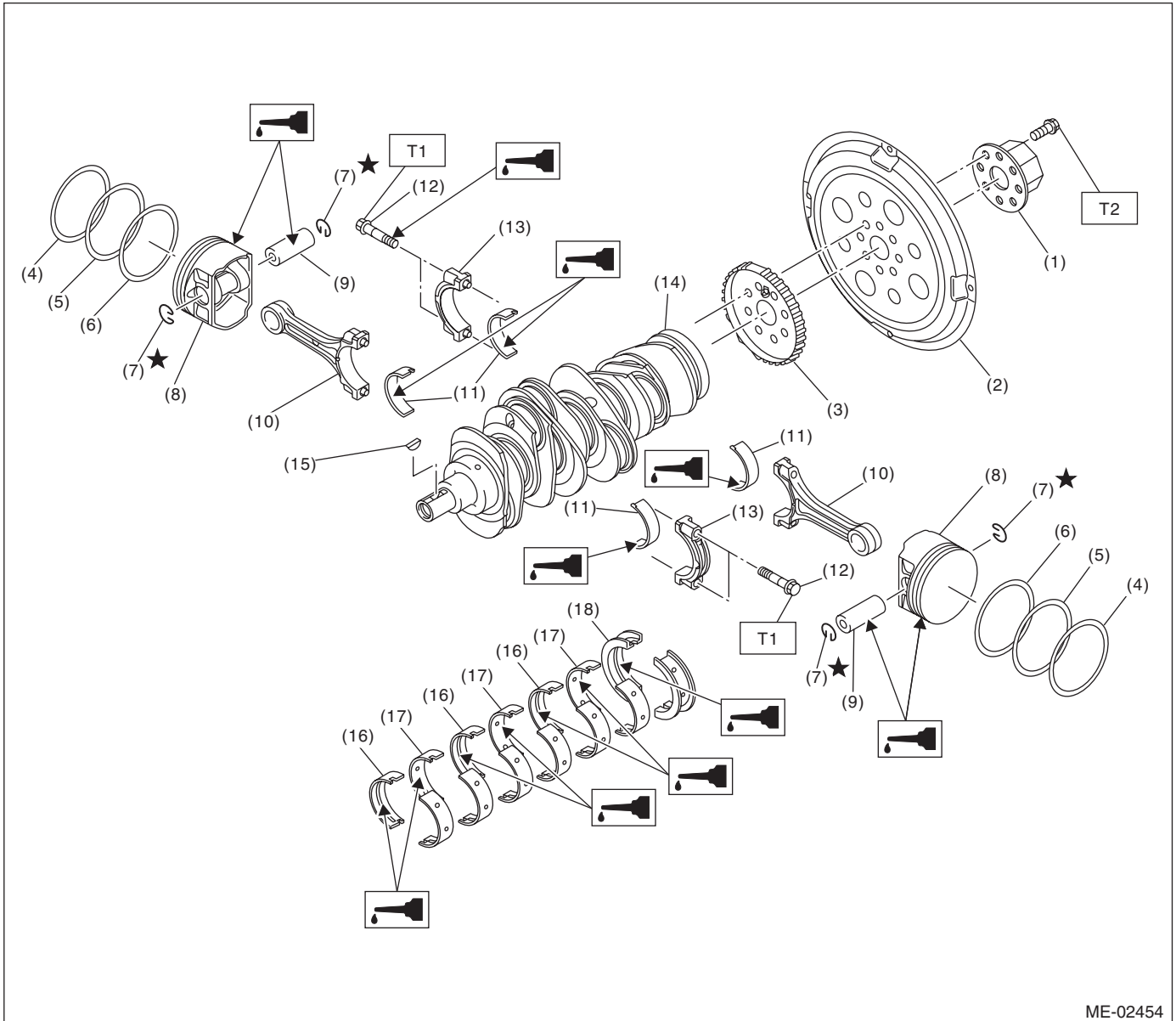
### MECHANICAL

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(1) Cylinder block (RH)	(13) Clamp	<b><i>Tightening torque:N-m (kgf-m, ft-lb)</i></b>
(2) Cylinder block (LH)	(14) Hose	<b><i>T1: 6.4 (0.65, 4.7)</i></b>
(3) Rear oil seal	(15) Oil cooler pipe	<b><i>T2: 18 (1.8, 13.3)</i></b>
(4) Service hole cover	(16) Oil cooler	<b><i>T3: 25 (2.5, 18.4)</i></b>
(5) O-ring	(17) Connector	<b><i>T4: 16 (1.6, 11.8)</i></b>
(6) Oil pan upper	(18) Oil filter	<b><i>T5: 37 (3.8, 27)</i></b>
(7) Oil pressure switch	(19) Plug	<b><i>T6: 44 (4.5, 32.5)</i></b>
(8) Oil strainer	(20) Crankshaft position sensor holder	<b><i>T7: 54 (5.5, 40)</i></b>
(9) Magnet	(21) Relief valve	<b><i>T8: 70 (7.1, 51.6)</i></b>
(10) Oil pan lower	(22) Relief valve spring	<b><i>T9: 23 (2.3, 17)</i></b>
(11) Metal gasket	(23) Plug	<b><i>T10: 90 (9.2, 67)</i></b>
(12) Drain plug	(24) Water pipe	

---

## 7. CRANKSHAFT AND PISTON



ME-02454

- |                             |                                    |                                    |
|-----------------------------|------------------------------------|------------------------------------|
| (1) Reinforcement           | (9) Piston pin                     | (17) Crankshaft bearing #2, #4, #6 |
| (2) Drive plate             | (10) Connecting rod                | (18) Crankshaft bearing #7         |
| (3) Crankshaft sensor plate | (11) Connecting rod bearing        |                                    |
| (4) Top ring                | (12) Connecting rod bolt           |                                    |
| (5) Second ring             | (13) Connecting rod cap            |                                    |
| (6) Oil ring                | (14) Crankshaft                    |                                    |
| (7) Snap ring               | (15) Woodruff key                  |                                    |
| (8) Piston                  | (16) Crankshaft bearing #1, #3, #5 |                                    |

**Tightening torque: N·m (kgf·m, ft·lb)**

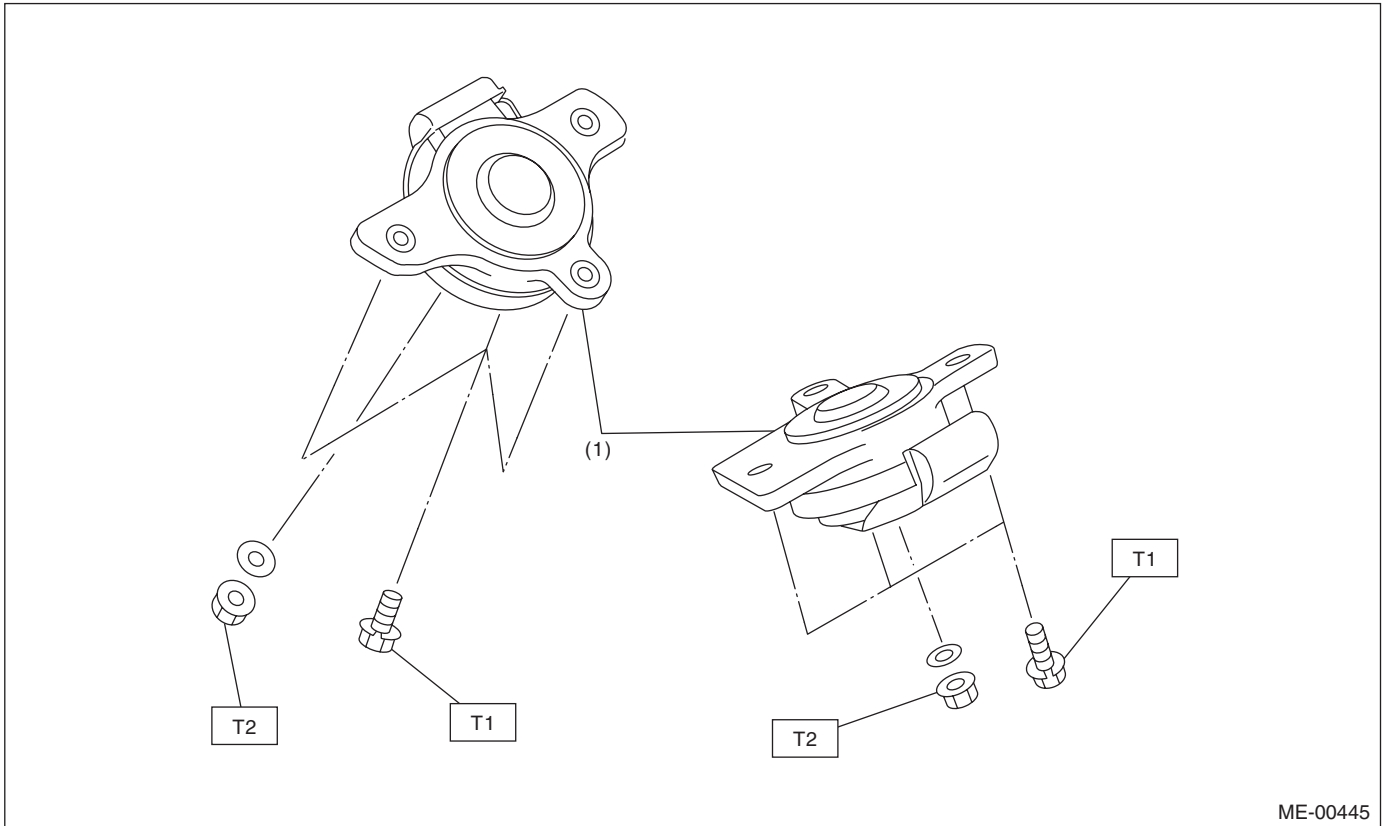
**T1: 53 (5.4, 39)**

**T2: 81 (8.3, 60)**

# General Description

MECHANICAL

## 8. ENGINE MOUNTING



ME-00445

(1) Front cushion rubber

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 35 (3.6, 25.8)**

**T2: 85 (8.7, 62.7)**

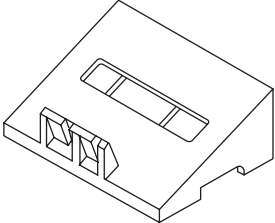
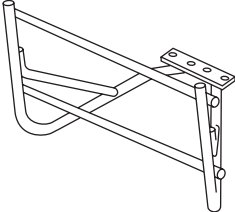
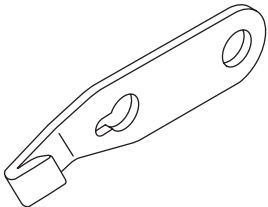
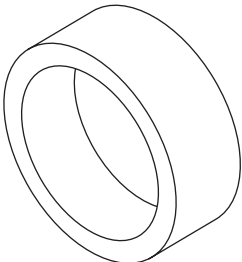
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- All parts should be thoroughly cleaned, paying special attention to engine oil passages, pistons and bearings.

- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- All removed parts, if to be reused, should be re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new parts as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
- Prior to starting work, prepare the following:  
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift up or lower the vehicle when necessary. Make sure to support the correct positions.

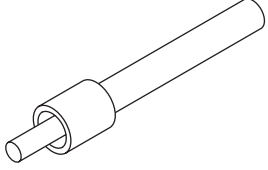
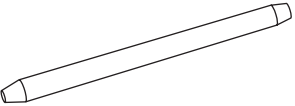
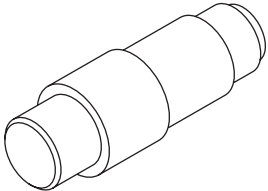
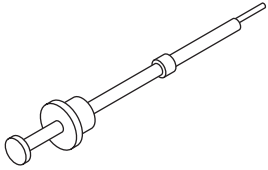
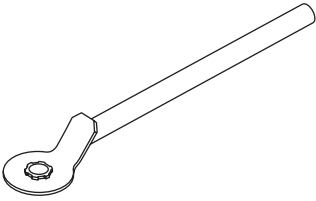
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18250AA010</p>	18250AA010	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> <li>• Used for replacing valve guides.</li> <li>• Used for removing and installing valve spring.</li> </ul>
 <p style="text-align: center;">ST18232AA000</p>	18232AA000	ENGINE STAND	Used for disassembling and assembling engine.
 <p style="text-align: center;">ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for removing and installing the drive plate.
 <p style="text-align: center;">ST18254AA000</p>	18254AA000	PISTON GUIDE	Used for installing piston in cylinder.

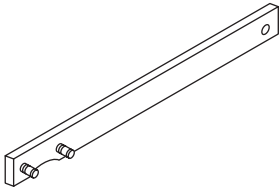
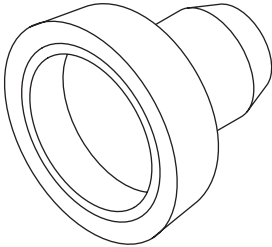
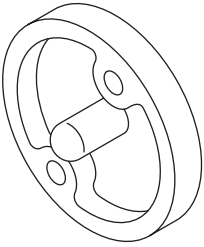
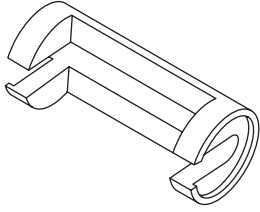
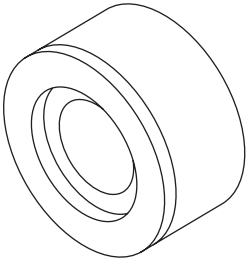
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499585500</p>	499585500	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 <p style="text-align: center;">ST18253AA000</p>	18253AA000	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p style="text-align: center;">ST18350AA000</p>	18350AA000	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
 <p style="text-align: center;">ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 <p style="text-align: center;">ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.

# General Description

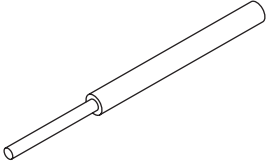
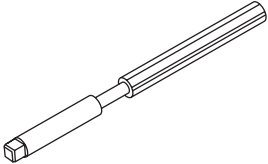
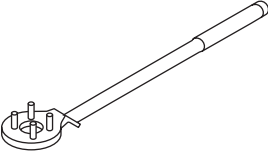
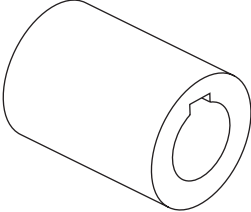
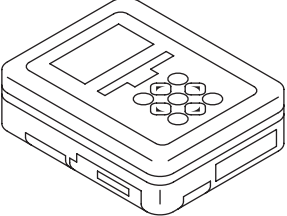
MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18231AA020</p>	18231AA020	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.
 <p>ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL GUIDE (499597100).</li> </ul>
 <p>ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing crankshaft oil seal.</li> <li>• Used together with the CRANKSHAFT OIL SEAL INSTALLER (499587200).</li> </ul>
 <p>ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 <p>ST18251AA040</p>	18251AA040	VALVE GUIDE ADJUSTER	Used for installing valve guides.



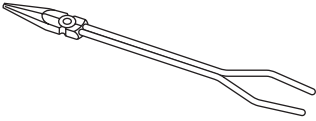
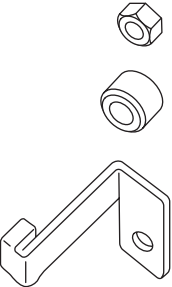
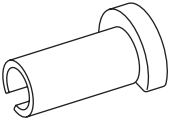
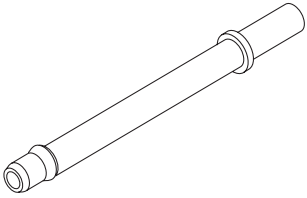
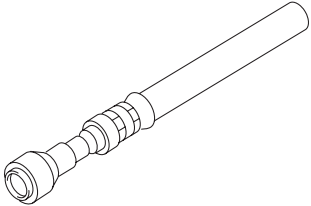
# General Description

## MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499765700</p>	499765700	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p style="text-align: center;">ST-499765900</p>	499765900	VALVE GUIDE REAMER	Used for reaming valve guides.
 <p style="text-align: center;">ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening/tightening crank pulley bolt.
 <p style="text-align: center;">ST18252AA000</p>	18252AA000	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p style="text-align: center;">ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

# General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18233AA000</p>	18233AA000	PISTON PIN SNAP RING PLIERS	Used for removing and installing snap ring of piston pin.
 <p>ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 <p>ST42099AE000</p>	42099AE000	CONNECTOR REMOVER	Used for disconnecting quick connector of the engine compartment.
 <p>ST18471AA000</p>	18471AA000	FUEL PIPE ADAPTER	Used for fuel pressure.
 <p>ST42075AG690</p>	42075AG690	FUEL HOSE	<ul style="list-style-type: none"> <li>• Used for fuel pressure.</li> <li>• This is the SUBARU genuine part.</li> </ul>

# General Description

MECHANICAL

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## 2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.

## E: PROCEDURE

It is possible to conduct the following service procedures with engine on vehicle, however, the procedures described in this section are based on the condition that the engine is removed from vehicle.

- V-belt
- Timing chain
- Camshaft
- Cylinder head

## 2. Compression

### A: INSPECTION

**CAUTION:**

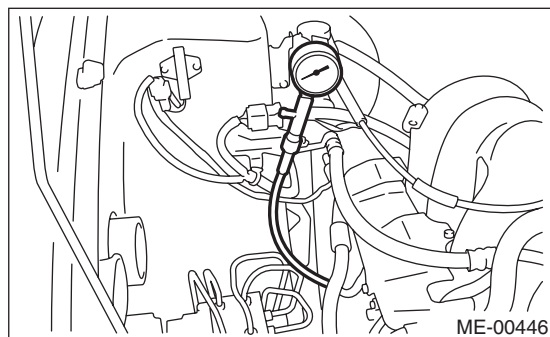
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) After warming-up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG(H6DO)-4, REMOVAL, Spark Plug.>
- 5) Check the starter motor for satisfactory performance and operation.
- 6) Hold the compression gauge tightly against the spark plug hole.

**NOTE:**

When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.

- 7) Fully open the throttle valve.
- 8) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.



- 9) Perform at least two measurements per cylinder, and make sure that the values are correct.

**Compression (350 rpm and fully open throttle):**

**Standard:**

**1,275 — 1,471 kPa (13.0 — 15.0 kgf/cm<sup>2</sup>,  
185 — 213 psi)**

**Service limit:**

**1,128 kPa (11.5 kgf/cm<sup>2</sup>, 164 psi)**

## 3. Idle Speed

### A: INSPECTION

1) Before checking the idle speed, check the following item:

(1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H6DO)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

4) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

***Idle speed [No load and gears in P or N range]:***

***650±50 rpm***

5) Check the idle speed when loaded. (Turn the A/C switch to "ON" and operate the compressor for at least one minute before measurement.)

***Idle speed [A/C ON and gears in P or N range]:***

***770±50 rpm***

NOTE:

Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the prescribed idle speed cannot be maintained, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>

## 4. Ignition Timing

### A: INSPECTION

#### CAUTION:

After warming-up, engine becomes very hot.  
Be careful not to burn yourself at measurement.

#### 1. METHOD WITH SUBARU SELECT MONITOR

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H6DO)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

#### **Ignition timing [BTDC/rpm]:**

**$15^{\circ} \pm 8^{\circ} / 650$**

If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>

#### 2. METHOD WITH TIMING LIGHT

1) Before checking the ignition timing, check the following item:

(1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.

(2) Check the malfunction indicator light does not illuminate.

2) Warm-up the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Remove the air cleaner case. <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.>

5) Connect the timing light to the power wire of #1 ignition coil.

6) Install the air cleaner case. <Ref. to IN(H6DO)-6, INSTALLATION, Air Cleaner Case.>

7) Start the engine, turn the timing light to the crank pulley, and check the ignition timing by means of crank pulley indicator.

#### **Ignition timing [BTDC/rpm]:**

**$15^{\circ} \pm 8^{\circ} / 650$**

If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>

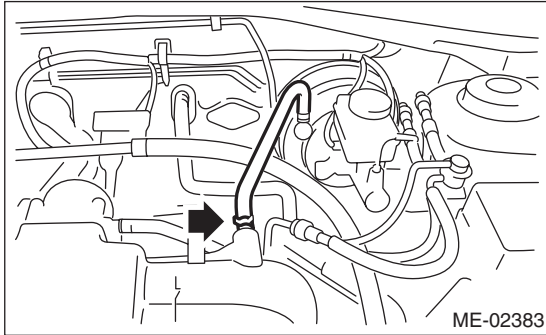
# Intake Manifold Vacuum

MECHANICAL

## 5. Intake Manifold Vacuum

### A: INSPECTION

- 1) Warm-up the engine.
- 2) Disconnect the brake vacuum hose from the intake manifold, and install the vacuum gauge.
- 3) Keep the engine at idle speed and read the vacuum gauge indication. By observing the vacuum gauge needle movement, internal condition of the engine can be diagnosed as described below.



**Vacuum pressure (at idling, A/C OFF):**  
**Less than  $-60.0$  kPa ( $-450$  mmHg,  $-17.72$  inHg)**

Diagnosis of engine condition by measurement of intake manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Air leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
3. Needle drops suddenly and intermittently from normal position.	Sticky valve
4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
5. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

## 6. Engine Oil Pressure

### A: INSPECTION

- 1) Remove the oil pressure switch from the cylinder block. <Ref. to LU(H6DO)-14, REMOVAL, Oil Pressure Switch.>
- 2) Connect the oil pressure gauge hose to the cylinder block.
- 3) Connect the battery ground cable to the battery.
- 4) Start the engine, and measure the oil pressure.

#### ***OIL PRESSURE (at oil temperature of 80°C (176°F)):***

##### ***Standard:***

***135 kPa (1.4 kgf/cm<sup>2</sup>, 20 psi) or more  
(at 600 rpm)***

***500 kPa (5.1 kgf/cm<sup>2</sup>, 73 psi) or more  
(at 5,000 rpm)***

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H6DO)-18, INSPECTION, Engine Lubrication System Trouble in General.>
  - If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H6DO)-18, INSPECTION, Engine Lubrication System Trouble in General.>
- 5) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H6DO)-14, INSTALLATION, Oil Pressure Switch.>

##### ***Tightening torque:***

***25 N·m (2.5 kgf-m, 18.4 ft-lb)***



## 7. Fuel Pressure

### A: INSPECTION

**WARNING:**

Before removing the fuel pressure gauge, release the fuel pressure.

**CAUTION:**

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

**NOTE:**

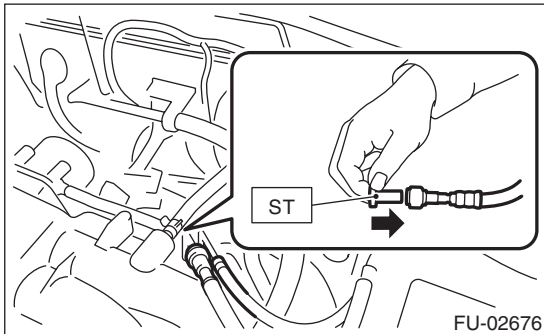
Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard value.

1) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Disconnect the fuel delivery hose and connect fuel pressure gauge.

(1) Disconnect the fuel delivery hose using the ST1.

ST1 42099AE000 CONNECTOR REMOVER



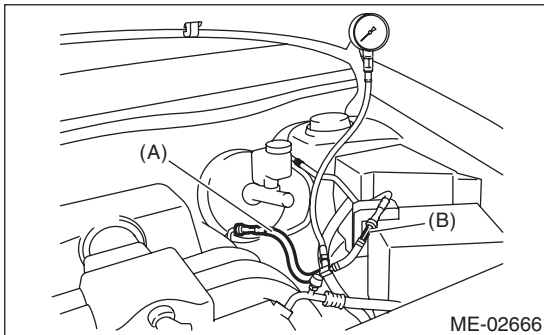
(2) Connect the fuel pressure gauge with ST2 and ST3.

**NOTE:**

ST2 is the SUBARU genuine part.

ST2 42075AG690 FUEL HOSE

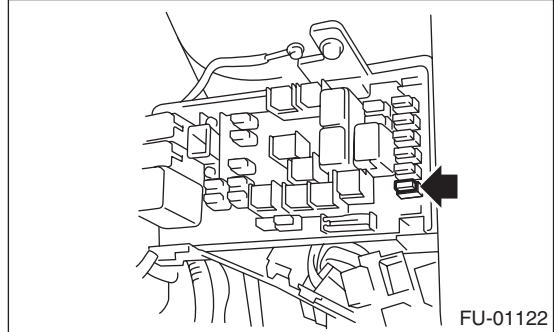
ST3 18471AA000 FUEL PIPE ADAPTER



(A) ST2

(B) ST3

3) Install the fuse of fuel pump to the main fuse box.



4) Start the engine.

5) Measure the fuel pressure after warming up the engine.

**Fuel pressure:**

**Standard: 338 — 348 kPa (3.4 — 3.5 kgf/cm<sup>2</sup>, 49 — 50.5 psi)**

**NOTE:**

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm<sup>2</sup>, 1 to 3 psi) higher than standard values during high-altitude operations.

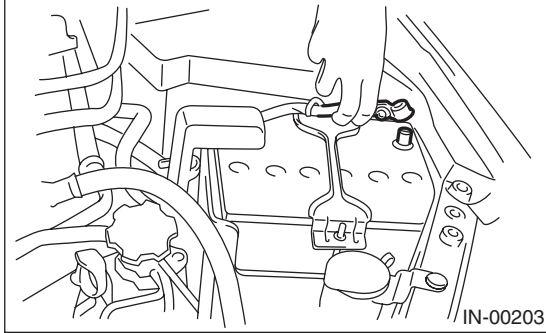
## 8. Valve Clearance

### A: INSPECTION

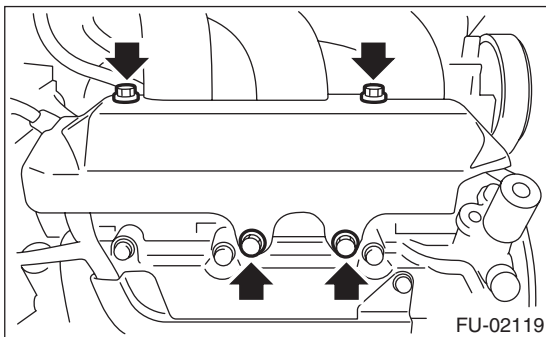
**NOTE:**

Inspection and adjustment of valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from battery.

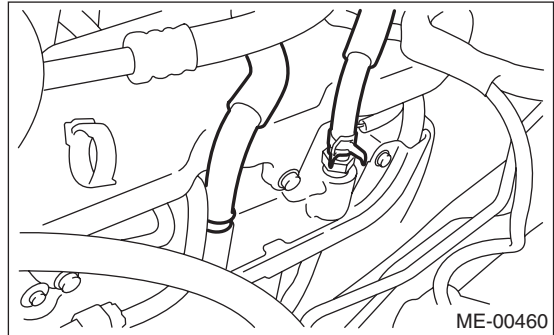


- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Lower the vehicle.
- 7) When inspecting RH side cylinders:
  - (1) Remove the air intake duct and air cleaner case. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.>
  - (2) Remove the fuel pipe protector (RH).

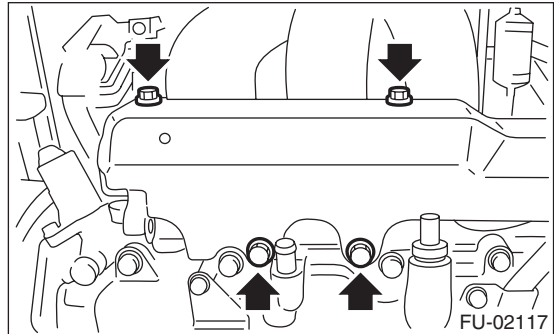


- (3) Disconnect the connector of oil pressure switch.
- (4) Remove the ignition coil. <Ref. to IG(H6DO)-7, REMOVAL, Ignition Coil.>
- (5) Remove the rocker cover (RH).

- 8) When inspecting LH side cylinders:
  - (1) Disconnect the battery cable, and then remove the battery and battery carrier.
  - (2) Disconnect the PCV hose and blow-by hose from the rocker cover (LH).



- (3) Remove the fuel pipe protector (LH).

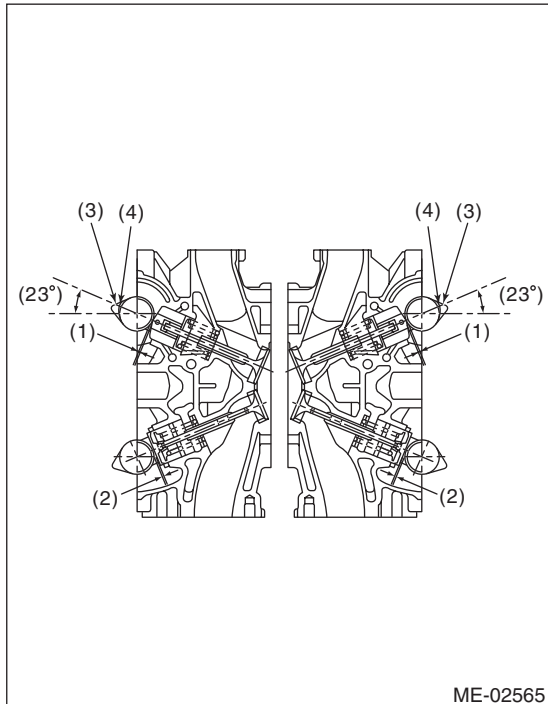


- (4) Remove the ignition coil. <Ref. to IG(H6DO)-7, REMOVAL, Ignition Coil.>
- (5) Remove the rocker cover (LH).

# Valve Clearance

## MECHANICAL

9) Turn the crankshaft clockwise until the cam is set to position shown in the figure.



- (1) Valve clearance (Intake side)
- (2) Valve clearance (Exhaust side)
- (3) High lift cam
- (4) Low lift cam

10) Measure the clearance of intake valve and exhaust valve using thickness gauge (A).

### NOTE:

- Measure it within the range of  $\pm 30^\circ$  from specified position shown in the figure.
- Measure it in low lift cam for intake side.
- Insert a thickness gauge in a direction as horizontal as possible with respect to the valve lifter.

### Valve clearance

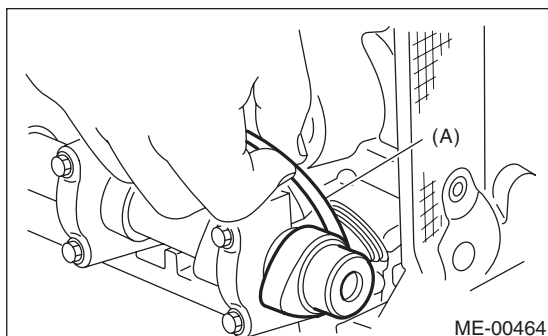
#### Intake:

$0.20^{+0.04}_{-0.06}$  mm ( $0.0079^{+0.0016}_{-0.0024}$  in)

#### Exhaust:

$0.35 \pm 0.05$  mm ( $0.0138 \pm 0.0020$  in)

- If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.



11) If necessary, adjust the valve clearance. <Ref. to ME(H6DO)-28, ADJUSTMENT, Valve Clearance.>

12) Further turn the crank pulley clockwise and then measure the valve clearances again.

13) After inspection, install the related parts in the reverse order of removal.

## B: ADJUSTMENT

### 1. INTAKE SIDE

#### NOTE:

- Adjustment of valve clearance should be performed while engine is cold.
- Do not wear gloves during removal and installation of valve lifter.
- Do not use valve lifters that were dropped or otherwise exposed to strong impacts.
- When installing the valve lifter, align the anti-rotation of valve lifter with groove on cylinder head, and insert the valve lifter.

1) Measure all the valve clearances. <Ref. to ME(H6DO)-27, INSPECTION, Valve Clearance.>

#### NOTE:

- Record each valve clearance after measurement.
- 2) Remove the camshaft. <Ref. to ME(H6DO)-54, REMOVAL, Camshaft.>
- 3) Remove the valve lifter.
- 4) Remove the shim from valve lifter.
- 5) Check the thickness of the shim from the markings on the side of the shim that was removed.

# Valve Clearance

MECHANICAL

6) Select a shim of suitable thickness from the following table using the measured valve clearance and shim thickness.

Unit: mm (in)
$S = (V + T) - 0.20$ (0.0079)
S: Required shim thickness
V: Measured valve clearance
T: Shim thickness to be used

Part No.	Thickness mm (in)
13218AK890	1.92 (0.0756)
13218AK900	1.94 (0.0764)
13218AK910	1.96 (0.0772)
13218AK920	1.98 (0.0780)
13218AK930	2.00 (0.0787)
13218AK940	2.02 (0.0795)
13218AK950	2.04 (0.0803)
13218AK960	2.06 (0.0811)
13218AK970	2.07 (0.0815)
13218AK980	2.08 (0.0819)
13218AK990	2.09 (0.0823)
13218AL000	2.10 (0.0827)
13218AL010	2.11 (0.0831)
13218AL020	2.12 (0.0835)
13218AL030	2.13 (0.0839)
13218AL040	2.14 (0.0843)
13218AL050	2.15 (0.0846)
13218AL060	2.16 (0.0850)
13218AL070	2.17 (0.0854)
13218AL080	2.18 (0.0858)
13218AL090	2.19 (0.0862)
13218AL100	2.20 (0.0866)
13218AL110	2.21 (0.0870)
13218AL120	2.22 (0.0874)
13218AL130	2.23 (0.0878)
13218AL140	2.24 (0.0882)
13218AL150	2.25 (0.0886)
13218AL160	2.26 (0.0890)
13218AL170	2.27 (0.0894)
13218AL180	2.28 (0.0898)
13218AL190	2.29 (0.0902)
13218AL200	2.30 (0.0906)
13218AL210	2.31 (0.0909)
13218AL220	2.32 (0.0913)
13218AL230	2.33 (0.0917)
13218AL240	2.34 (0.0921)
13218AL250	2.35 (0.0925)
13218AL260	2.36 (0.0929)
13218AL270	2.37 (0.0933)
13218AL280	2.38 (0.0937)
13218AL290	2.39 (0.0941)

Part No.	Thickness mm (in)
13218AL300	2.40 (0.0945)
13218AL310	2.41 (0.0949)
13218AL320	2.42 (0.0953)
13218AL330	2.43 (0.0957)
13218AL340	2.44 (0.0961)
13218AL350	2.45 (0.0965)
13218AL360	2.46 (0.0969)
13218AL370	2.47 (0.0972)
13218AL380	2.48 (0.0976)
13218AL390	2.49 (0.0980)
13218AL400	2.50 (0.0984)
13218AL410	2.51 (0.0988)
13218AL420	2.52 (0.0992)
13218AL430	2.53 (0.0996)
13218AL440	2.54 (0.1000)
13218AL450	2.55 (0.1004)
13218AL460	2.56 (0.1008)
13218AL470	2.57 (0.1012)
13218AL480	2.58 (0.1016)
13218AL490	2.59 (0.1020)
13218AL500	2.60 (0.1024)
13218AL510	2.61 (0.1028)
13218AL520	2.62 (0.1032)
13218AL530	2.64 (0.1039)
13218AL540	2.66 (0.1047)
13218AL550	2.68 (0.1055)
13218AL560	2.70 (0.1063)
13218AL570	2.72 (0.1071)
13218AL580	2.74 (0.1079)
13218AL590	2.76 (0.1087)

# Valve Clearance

## MECHANICAL

### 2. EXHAUST SIDE

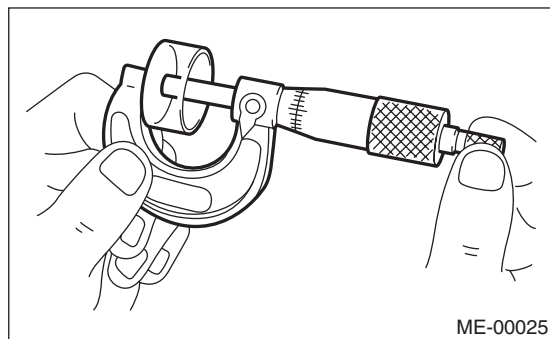
#### NOTE:

- Adjustment of valve clearance should be performed while engine is cold.
- Do not wear gloves during removal and installation of valve lifter.
- Do not use valve lifters that were dropped or otherwise exposed to strong impacts.

1) Measure all the valve clearances. <Ref. to ME(H6DO)-27, INSPECTION, Valve Clearance.>

#### NOTE:

- Record each valve clearance after measurement.
- 2) Remove the camshaft. <Ref. to ME(H6DO)-54, REMOVAL, Camshaft.>
- 3) Remove the valve lifter.
- 4) Measure the thickness of valve lifter using micrometer.



5) Select a valve lifter of suitable thickness from the following table using the measured valve clearance and valve lifter thickness.

Unit: mm (in)
$S = (V + T) - 0.35 (0.0138)$
S: Valve lifter thickness required
V: Measured valve clearance
T: Valve lifter thickness to be used

Part No.	Thickness mm (in)
13228AD181	4.32 (0.1701)
13228AD191	4.34 (0.1709)
13228AD201	4.36 (0.1717)
13228AD211	4.38 (0.1724)
13228AD221	4.40 (0.1732)
13228AD231	4.42 (0.1740)
13228AD241	4.44 (0.1748)
13228AD251	4.46 (0.1756)
13228AD261	4.48 (0.1764)
13228AD271	4.50 (0.1772)
13228AD281	4.52 (0.1780)
13228AD291	4.54 (0.1787)
13228AD301	4.56 (0.1795)
13228AD311	4.58 (0.1803)
13228AD321	4.60 (0.1811)

Part No.	Thickness mm (in)
13228AC581	4.62 (0.1819)
13228AC591	4.63 (0.1823)
13228AC601	4.64 (0.1827)
13228AC611	4.65 (0.1831)
13228AC621	4.66 (0.1835)
13228AC631	4.67 (0.1839)
13228AC641	4.68 (0.1843)
13228AC651	4.69 (0.1846)
13228AC661	4.70 (0.1850)
13228AC671	4.71 (0.1854)
13228AC681	4.72 (0.1858)
13228AC691	4.73 (0.1862)
13228AC701	4.74 (0.1866)
13228AC711	4.75 (0.1870)
13228AC721	4.76 (0.1874)
13228AC731	4.77 (0.1878)
13228AC741	4.78 (0.1882)
13228AC751	4.79 (0.1886)
13228AC761	4.80 (0.1890)
13228AC771	4.81 (0.1894)
13228AC781	4.82 (0.1898)
13228AC791	4.83 (0.1902)
13228AC801	4.84 (0.1906)
13228AC811	4.85 (0.1909)
13228AC821	4.86 (0.1913)
13228AC831	4.87 (0.1917)
13228AC841	4.88 (0.1921)
13228AC851	4.89 (0.1925)
13228AC861	4.90 (0.1929)
13228AC871	4.91 (0.1933)
13228AC881	4.92 (0.1937)
13228AC891	4.93 (0.1941)
13228AC901	4.94 (0.1945)
13228AC911	4.95 (0.1949)
13228AC921	4.96 (0.1953)
13228AC931	4.97 (0.1957)
13228AC941	4.98 (0.1961)
13228AC951	4.99 (0.1965)
13228AC961	5.00 (0.1969)
13228AC971	5.01 (0.1972)
13228AC981	5.02 (0.1976)
13228AC991	5.03 (0.1980)
13228AD001	5.04 (0.1984)
13228AD011	5.05 (0.1988)
13228AD021	5.06 (0.1992)
13228AD031	5.07 (0.1996)
13228AD041	5.08 (0.2000)
13228AD051	5.09 (0.2004)
13228AD061	5.10 (0.2008)
13228AD071	5.11 (0.2012)

# Valve Clearance

MECHANICAL

Part No.	Thickness mm (in)
13228AD081	5.12 (0.2016)
13228AD091	5.13 (0.2020)
13228AD101	5.14 (0.2024)
13228AD111	5.15 (0.2028)
13228AD121	5.16 (0.2032)
13228AD131	5.17 (0.2035)
13228AD141	5.18 (0.2039)
13228AD151	5.19 (0.2043)
13228AD161	5.20 (0.2047)
13228AD171	5.21 (0.2051)
13228AD331	5.23 (0.2059)
13228AD341	5.25 (0.2067)
13228AD351	5.27 (0.2075)
13228AD361	5.29 (0.2083)
13228AD371	5.31 (0.2091)
13228AD381	5.33 (0.2098)
13228AD391	5.35 (0.2106)
13228AD401	5.37 (0.2114)
13228AD411	5.39 (0.2122)
13228AD421	5.41 (0.2130)
13228AD431	5.43 (0.2138)
13228AD441	5.45 (0.2146)
13228AD451	5.47 (0.2154)
13228AD461	5.49 (0.2161)
13228AD471	5.51 (0.2169)
13228AD481	5.53 (0.2177)
13228AD491	5.55 (0.2185)
13228AD501	5.57 (0.2193)
13228AD511	5.59 (0.2201)

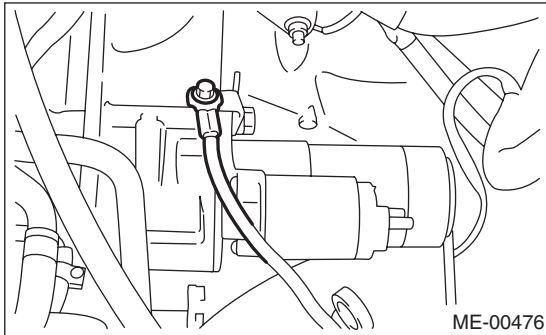
# Engine Assembly

MECHANICAL

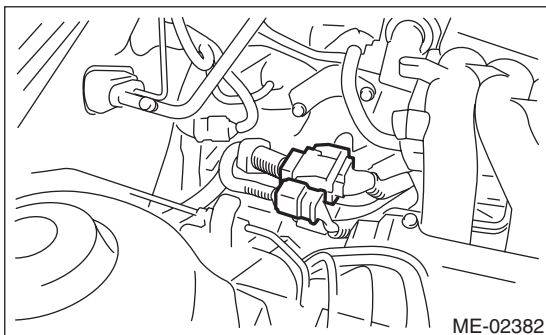
## 9. Engine Assembly

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully and support with the front hood stay.
- 3) Remove the collector cover.
- 4) Collect the refrigerant from the A/C system. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 5) Release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 6) Remove the fuel filler cap.
- 7) Remove the battery from vehicle.
- 8) Remove the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.> <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 9) Remove the radiator from vehicle. <Ref. to CO(H6DO)-16, REMOVAL, Radiator.>
- 10) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 11) Disconnect the A/C pressure hoses from the A/C compressor. <Ref. to AC-39, REMOVAL, Hose and Tube.>
- 12) Remove the engine ground terminal.

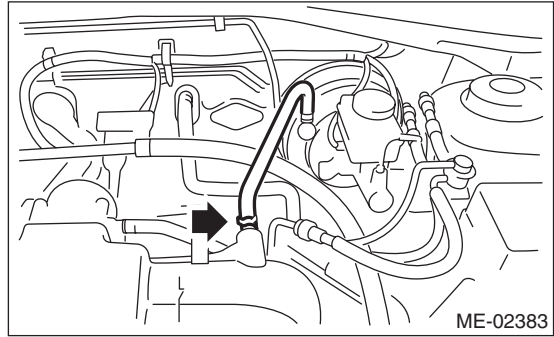


- 13) Disconnect the following connector.
  - (1) Engine harness connectors



- (2) Generator connector and terminal
- (3) A/C compressor connector
- (4) Power steering switch connector

- 14) Disconnect the following hoses.
  - (1) Brake booster vacuum hose

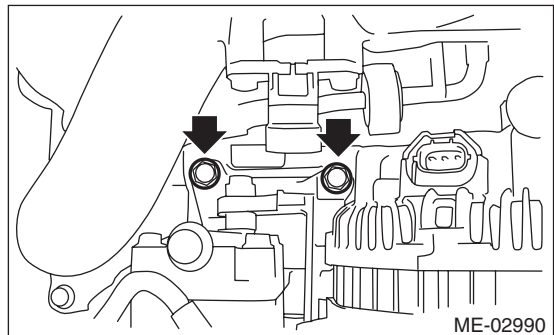
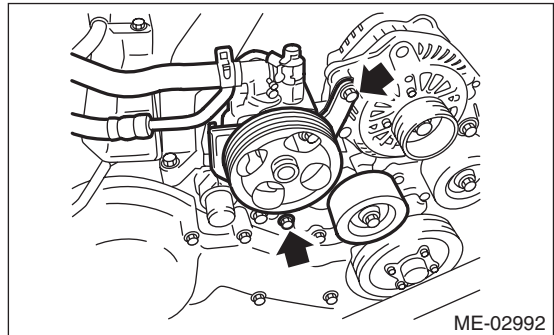


- (2) Heater inlet and outlet hoses
- (3) Pressure regulator vacuum hose

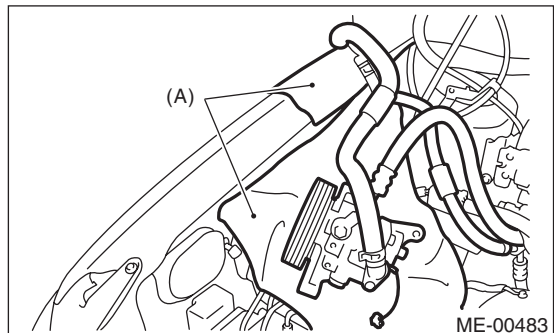
- 15) Remove the power steering pump together with the bracket.

#### NOTE:

Do not disconnect the hose and pipe from the pump body.



- 16) Place the power steering pump on the right side wheel apron.



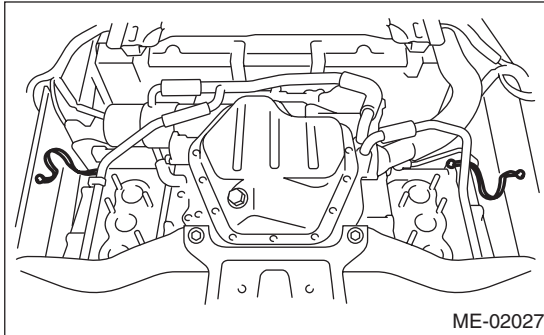
(A) Cloth

- 17) Lift up the vehicle.
- 18) Remove the under cover.
- 19) Remove the front exhaust pipe. <Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>

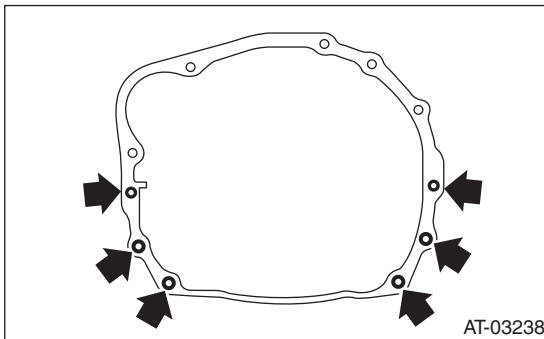
**NOTE:**

Be careful not to let the front exhaust pipe interfere with water pipes on engine side.

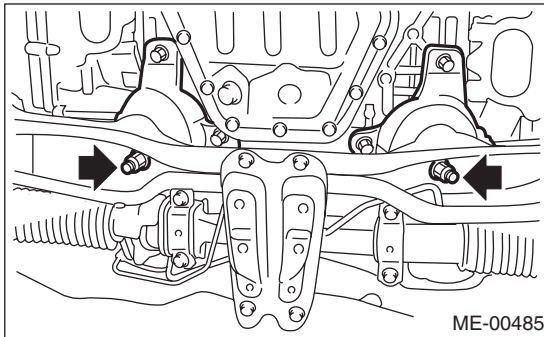
- 20) Remove the ground cable.



- 21) Remove the bolts and nuts which hold lower side of transmission to engine.



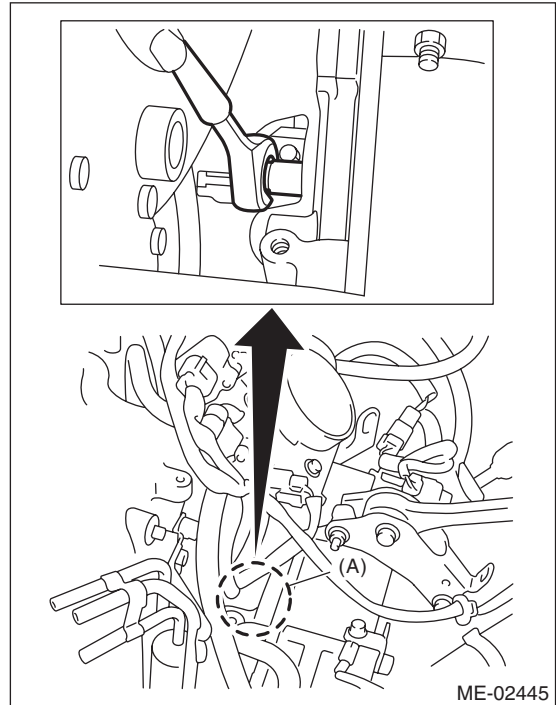
- 22) Remove the nuts which install front cushion rubber onto front crossmember.



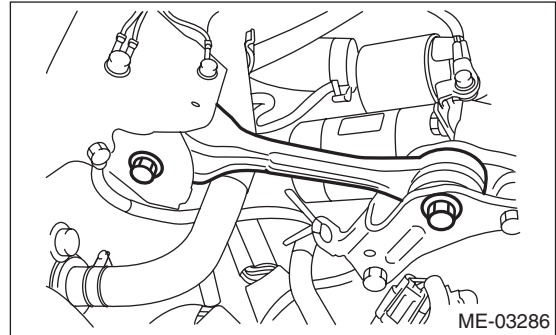
- 23) Separate the torque converter clutch from drive plate.

- (1) Lower the vehicle.
- (2) Remove the service hole plug (A).
- (3) Remove the bolts which hold torque converter clutch to drive plate.

- (4) Remove other bolts while rotating the crankshaft using socket wrench.



- 24) Remove the pitching stopper.





# Engine Assembly

## MECHANICAL

25) Disconnect the fuel delivery hose and evaporation hose.

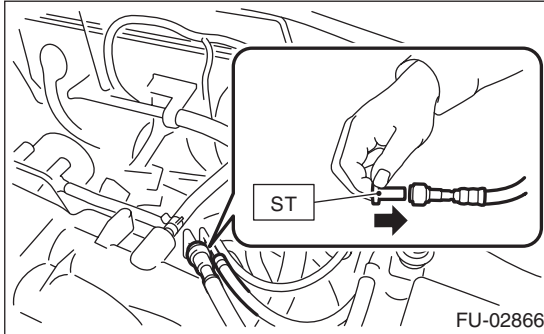
### CAUTION:

- Be careful not to spill fuel.
- Catch the fuel from hoses using a container or cloth.

(1) Disconnect the connector of fuel pipe by pushing the ST in the direction of arrow.

ST 42099AE000 CONNECTOR REMOVER

(2) Remove the clip, and disconnect the evaporation hose from the pipe.

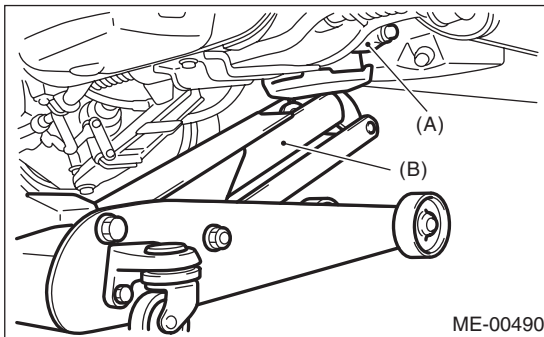


26) Support the engine with a lifting device and wire ropes.

27) Support the transmission with a garage jack.

### CAUTION:

Doing this is very important to prevent the transmission from lowering due to its own weight.



(A) Transmission

(B) Garage jack

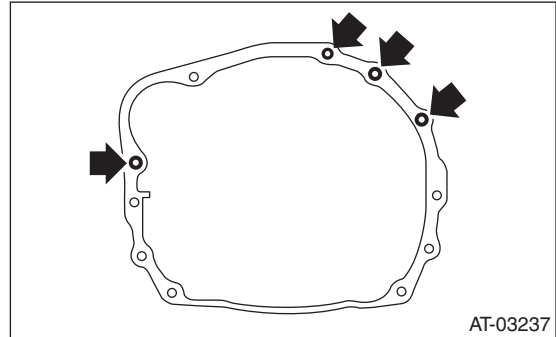
### CAUTION:

Before removing the engine away from transmission, check to be sure no work has been overlooked.

28) Separation of engine and transmission:

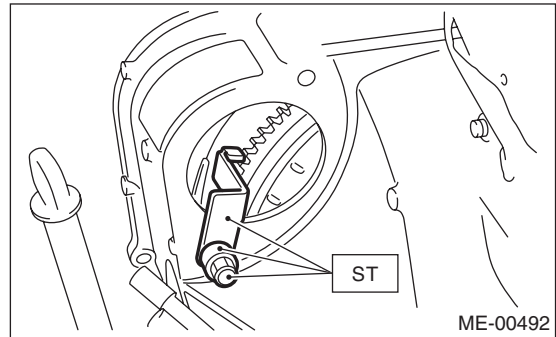
(1) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>

(2) Remove the bolts which hold upper side of transmission to engine.



29) Attach the ST to the converter case.

ST 498277200 STOPPER SET



30) Remove the engine from vehicle.

(1) Slightly raise the engine.

(2) Raise the transmission with garage jack.

(3) Slowly move the engine away from engine compartment.

### NOTE:

Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

31) Remove the front cushion rubbers.

## B: INSTALLATION

1) Install the front cushion rubbers.

**Tightening torque:**

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

2) Position the engine in engine compartment and align it with transmission.

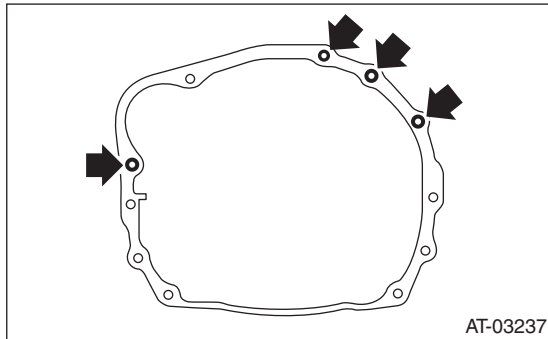
**NOTE:**

Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

3) Tighten the bolts which hold upper side of transmission to engine.

**Tightening torque:**

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



4) Remove the lifting device and wire ropes.

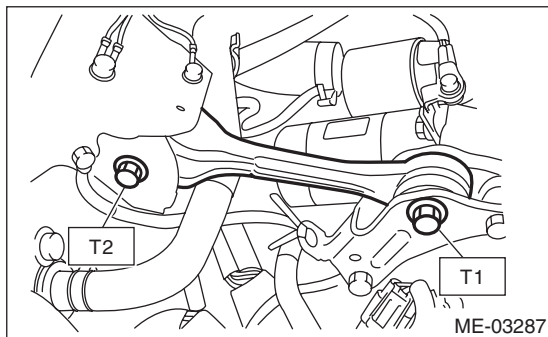
5) Remove the garage jack.

6) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



7) Remove the ST from converter case.

**NOTE:**

Be careful not to drop the ST into the converter case when removing the ST.

ST 498277200 STOPPER SET

8) Install the starter. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>

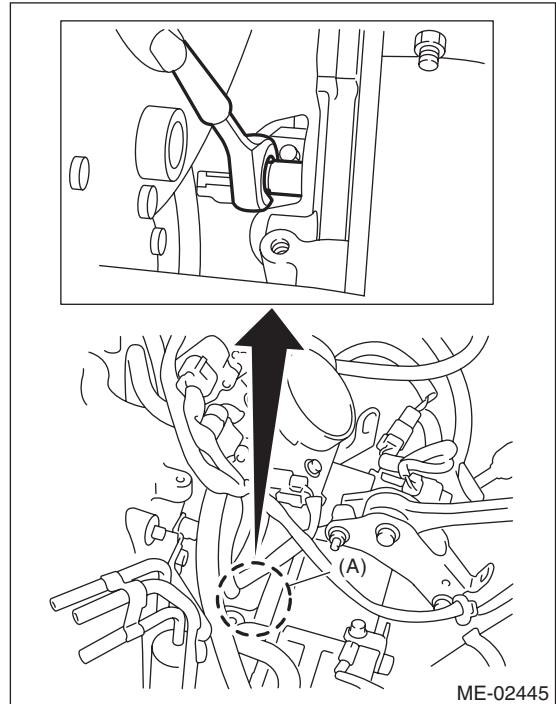
9) Install the torque converter clutch to drive plate.  
(1) Tighten the bolts which hold torque converter clutch to drive plate.

(2) Tighten other bolts while rotating the crankshaft using socket wrench.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

(3) Install the service hole plug (A) to prevent getting foreign matter inside.



# Engine Assembly

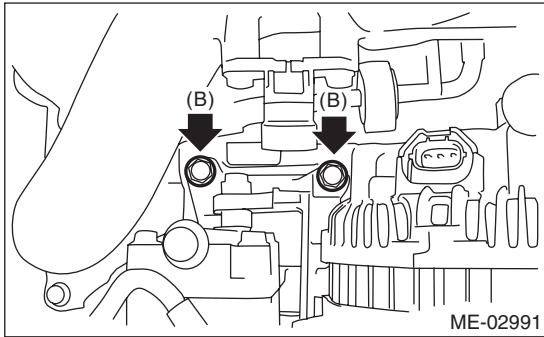
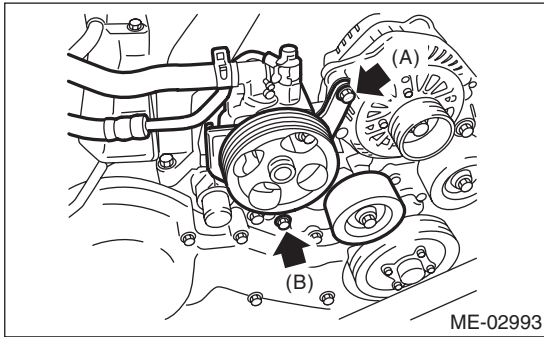
## MECHANICAL

10) Install the power steering pump.

**Tightening torque:**

**(A) 25 N·m (2.5 kgf·m, 18.4 ft·lb)**

**(B): 33 N·m (3.4 kgf·m, 24.3 ft·lb)**

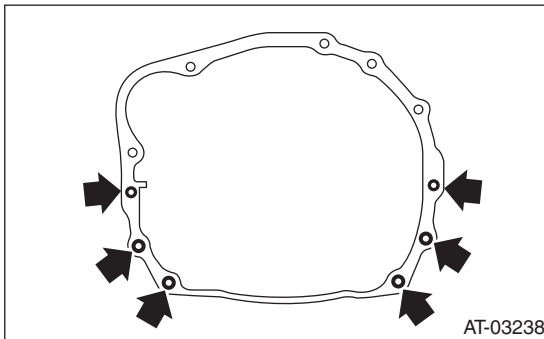


11) Lift up the vehicle.

12) Tighten the bolts and nuts which hold lower side of the transmission to engine.

**Tightening torque:**

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**



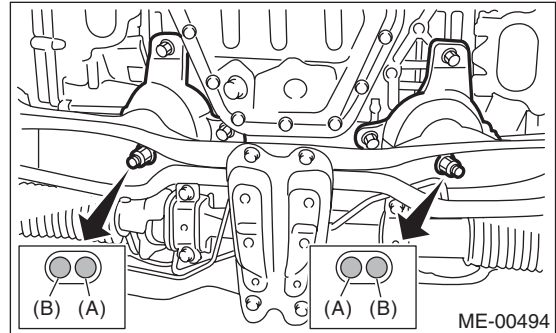
13) Tighten the nuts which install the front cushion rubber onto crossmember.

**Tightening torque:**

**85 N·m (8.7 kgf·m, 62.7 ft·lb)**

**NOTE:**

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.

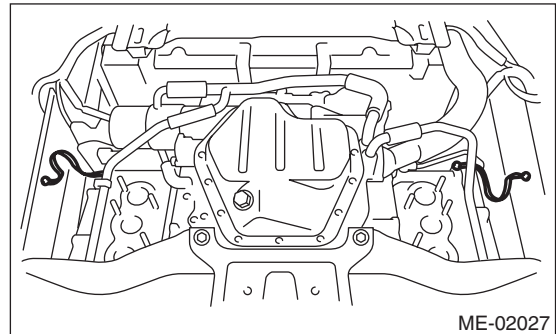


14) Install the front exhaust pipe. <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>

**NOTE:**

- Be care not to let the front exhaust pipe interfere with water pipes and crossmember on engine side.
- Be care not to scratch the flange surface of front exhaust pipe with stud bolt on engine.

15) Connect the ground cable.



16) Install the under cover.

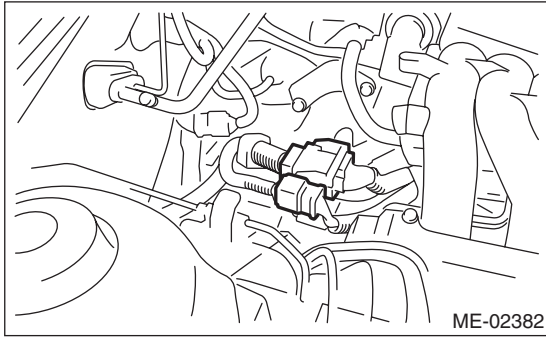
17) Lower the vehicle.

18) Connect the following hoses.

- (1) Fuel delivery hose and evaporation hose
- (2) Heater inlet and outlet hoses
- (3) Brake booster vacuum hose
- (4) Pressure regulator vacuum hose

19) Connect the following connectors.

(1) Engine harness connectors



(2) Generator connector and terminal

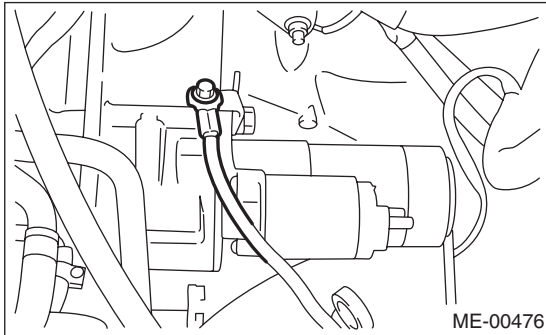
(3) A/C compressor connector

(4) Power steering switch connector

20) Install the engine ground terminals.

**Tightening torque:**

**14 N·m (1.4 kgf·m, 10.1 ft·lb)**



21) Install the A/C pressure hoses. <Ref. to AC-39, INSTALLATION, Hose and Tube.>

22) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

23) Install the radiator to vehicle. <Ref. to CO(H6DO)-17, INSTALLATION, Radiator.>

24) Install the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H6DO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H6DO)-6, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>

25) Install the battery in the vehicle, and connect cables.

26) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

27) Check the ATF level and replenish it if necessary. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

28) Charge the A/C system with refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>

29) Install the collector cover.

30) Remove the front hood stay, and close the front hood.

31) Lower the vehicle from the lift.

## C: INSPECTION

1) Check the pipes and hoses are installed firmly.  
2) Check the engine coolant and ATF are at specified levels.

3) Start the engine and check for leaks of fuel, exhaust gas, engine coolant, etc. Also check for noise and vibrations.

## 10.Engine Mounting

### A: REMOVAL

- 1) Remove the engine unit. <Ref. to ME(H6DO)-32, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

##### *Engine mounting:*

*35 N·m (3.6 kgf·m, 25.8 ft·lb)*

### C: INSPECTION

Make sure that no crack or other damages do not exist.

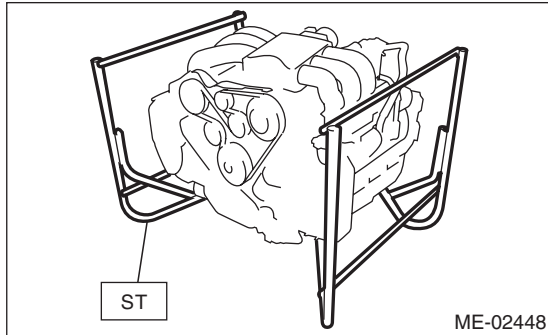
## 11. Preparation for Overhaul

### A: REMOVAL

1) Remove the engine assembly from the body.  
<Ref. to ME(H6DO)-32, REMOVAL, Engine Assembly.>

2) Set the engine on ST.

ST 18232AA000 ENGINE STAND



3) Before servicing overhaul, remove the sensor, pipe and hose that installed to engine.

(1) Remove the intake manifold. <Ref. to FU(H6DO)-13, REMOVAL, Intake Manifold.>

(2) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>

(3) Remove the A/C compressor. <Ref. to AC-35, REMOVAL, Compressor.>

(4) Disconnect the water pipe and hose.

(5) Disconnect the engine harness.

(6) Remove the spark plug. <Ref. to IG(H6DO)-4, REMOVAL, Spark Plug.>

(7) Remove the camshaft position sensor. <Ref. to FU(H6DO)-21, REMOVAL, Camshaft Position Sensor.>

(8) Remove the crankshaft position sensor. <Ref. to FU(H6DO)-20, REMOVAL, Crankshaft Position Sensor.>

(9) Remove the knock sensor. <Ref. to FU(H6DO)-22, REMOVAL, Knock Sensor.>

(10) Remove the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, REMOVAL, Engine Coolant Temperature Sensor.>

(11) Remove the oil pressure switch. <Ref. to LU(H6DO)-14, REMOVAL, Oil Pressure Switch.>

(12) Remove the oil filter. <Ref. to LU(H6DO)-15, REMOVAL, Engine Oil Filter.>

(13) Remove the oil cooler. <Ref. to LU(H6DO)-16, REMOVAL, Oil Cooler.>

# V-belt

MECHANICAL

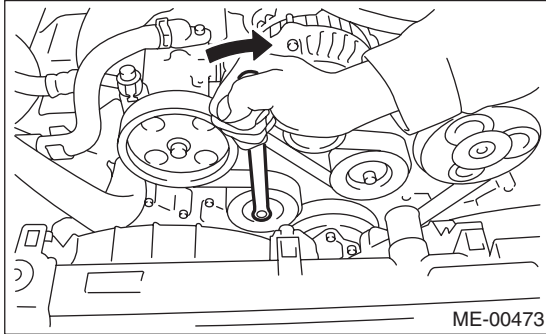
## 12.V-belt

### A: REMOVAL

NOTE:

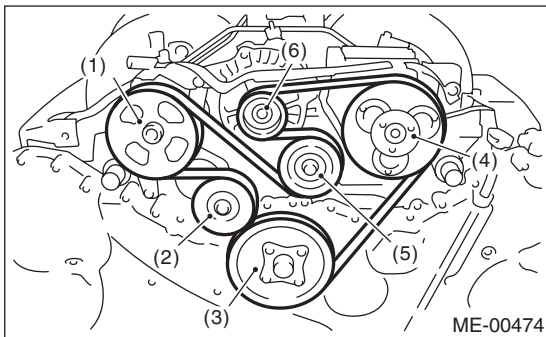
Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the collector cover.
- 2) Install the tool to belt tension adjuster assembly installation bolt.
- 3) Rotate the tool clockwise and loosen the V-belt to remove.



### B: INSTALLATION

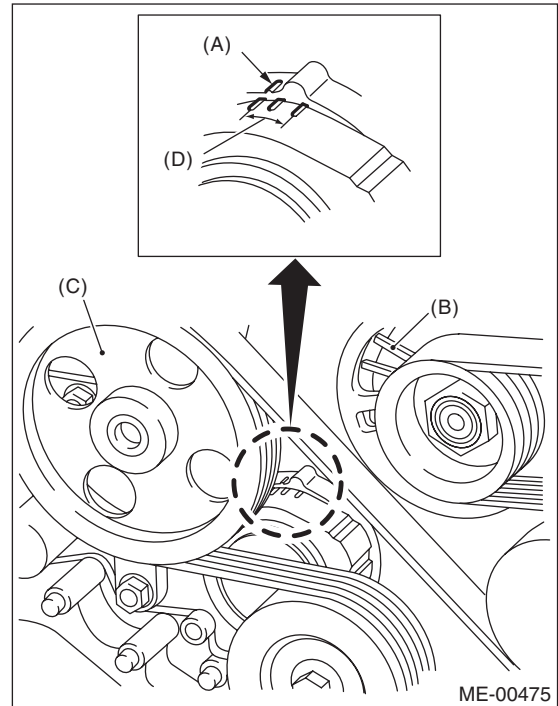
Install in the reverse order of removal.



- (1) Power steering oil pump pulley
- (2) Belt tension adjuster ASSY
- (3) Crank pulley
- (4) A/C compressor
- (5) Belt idler
- (6) Generator

### C: INSPECTION

- 1) Replace the V-belt, if cracks, fraying or wear is found.
- 2) Make sure that the V-belt automatic belt tension indicator (A) is within the range (D).



- (A) Indicator
- (B) Generator
- (C) Power steering oil pump pulley
- (D) Service limit

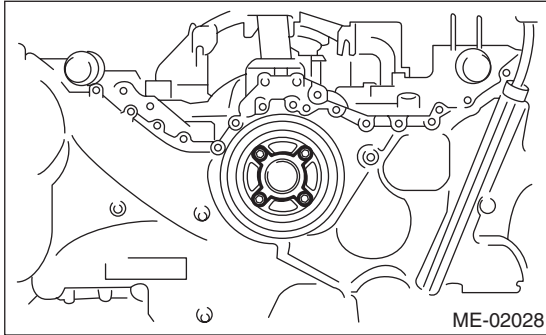
## 13.Crank Pulley

### A: REMOVAL

**NOTE:**

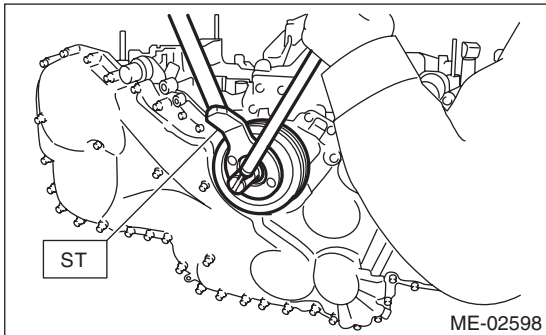
Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley cover.



- 3) Remove the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH



- 4) Remove the crank pulley.

### B: INSTALLATION

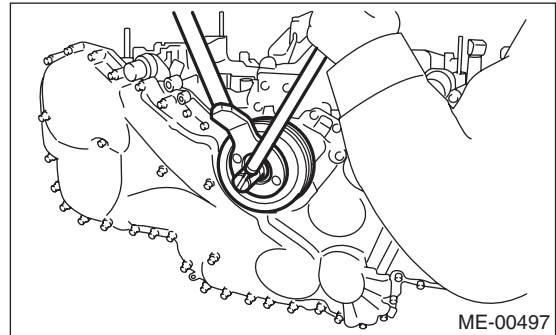
- 1) Install the crank pulley.
- 2) Install the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANK PULLEY WRENCH

- (1) Clean the crankshaft thread using compressed air.
- (2) Apply engine oil to the crank pulley bolt seat and thread.
- (3) Tighten the crank pulley bolts.

**Tightening torque:**

**178 N·m (18.1 kgf-m, 131 ft-lb)**



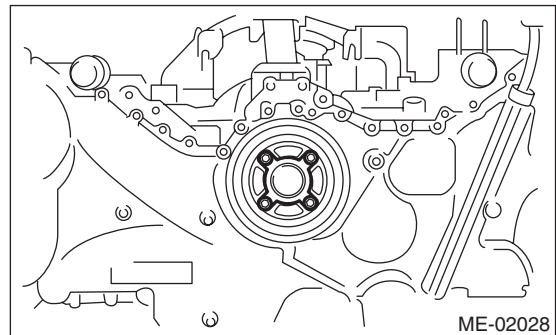
- 3) Install the crank pulley cover.

**NOTE:**

Use new O-rings.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- 4) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Check the crank pulley cover for oil and air leakage.
- 2) Check the crank pulley for looseness.



# Front Chain Cover

MECHANICAL

## 14. Front Chain Cover

### A: REMOVAL

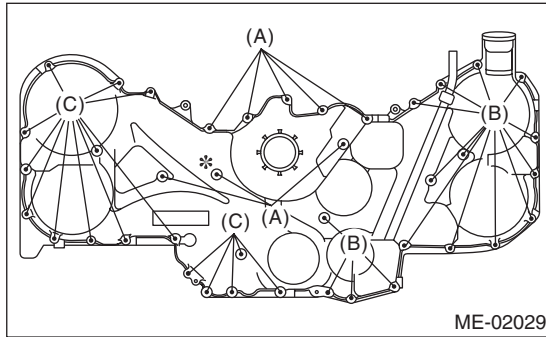
NOTE:

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the bolts which install oil pipe (RH) onto the front chain cover.
- 4) Remove the front chain cover.

NOTE:

Chain cover installation bolt has three different sizes. To prevent the confusion in installation, keep these bolts on container individually.



- (A) M6 × 16
- (B) M6 × 30
- (C) M6 × 45
- \*: Sealing washer

### B: INSTALLATION

- 1) Remove the used liquid gasket from mating surface, and degrease it.
- 2) Apply liquid gasket to the mating surface of front chain cover.

NOTE:

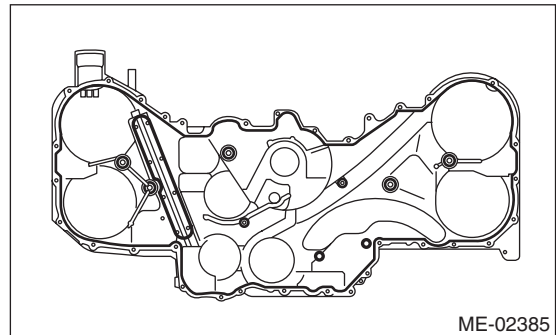
Install within 5 min. after applying liquid gasket.

**Liquid gasket**

**THREE BOND 1217G (Part No. K0877Y0100)  
or equivalent**

**Applying liquid gasket diameter**

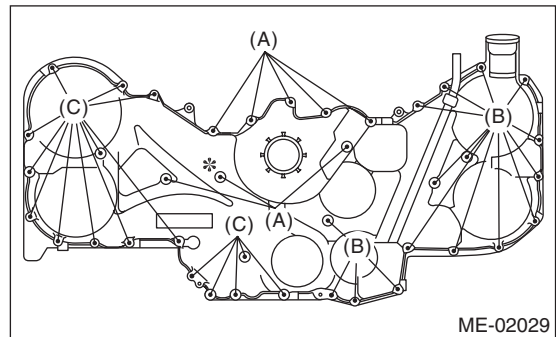
**2.5±0.5 mm (0.098±0.020 in)**



- 3) Install the front chain cover. Temporarily tighten the bolts.

**CAUTION:**

**Do not install the bolts in wrong place.**

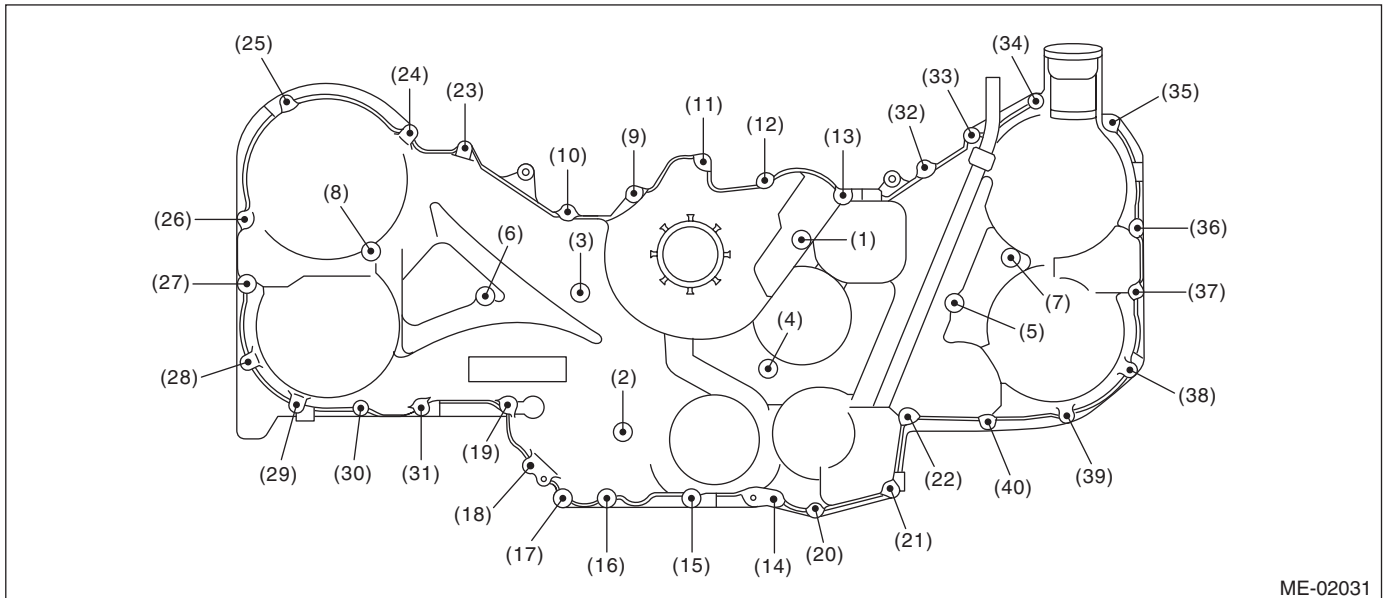


- (A) M6 × 16
- (B) M6 × 30
- (C) M6 × 45
- \*: Sealing washer

4) Tighten the bolts in the numerical order as shown in the figure.

**Tightening torque:**

**6.6 N·m (0.67 kgf·m, 4.8 ft-lb)**



ME-02031

5) Tighten the bolts which install oil pipe (RH) onto the front chain cover.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft-lb)**

6) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>

7) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

## C: INSPECTION

Check the cover surface for scratch and damage.  
 Check for oil leakage on cover mating surface and installation part of crank pulley.

# Timing Chain Assembly

MECHANICAL

## 15. Timing Chain Assembly

### A: REMOVAL

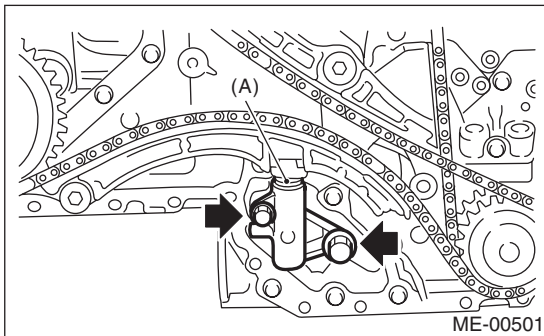
NOTE:

Perform the work with the engine installed to body when replacing a single part.

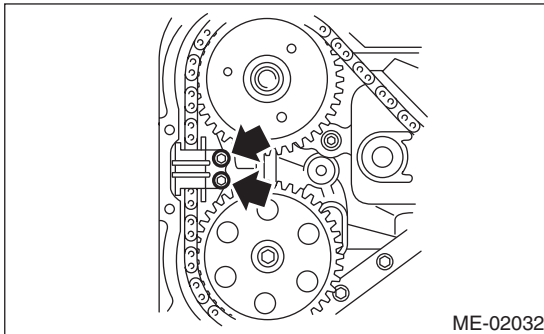
- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the chain tensioner (RH).

NOTE:

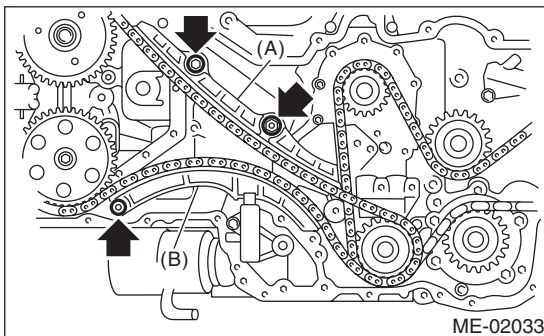
Be careful not to come out the plunger (A).



- 5) Remove the chain guide (RH: between cams).



- 6) Remove the chain guide (RH).
- 7) Remove the chain tensioner lever (RH).



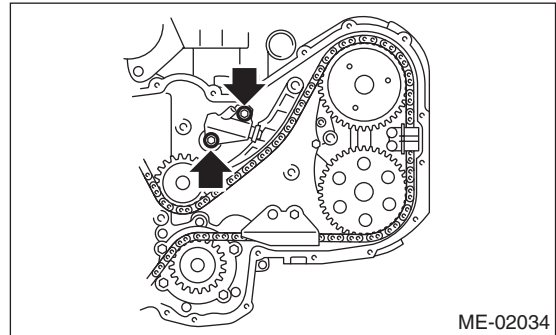
- (A) Chain guide (RH)
- (B) Chain tensioner lever (RH)

- 8) Remove the timing chain (RH).

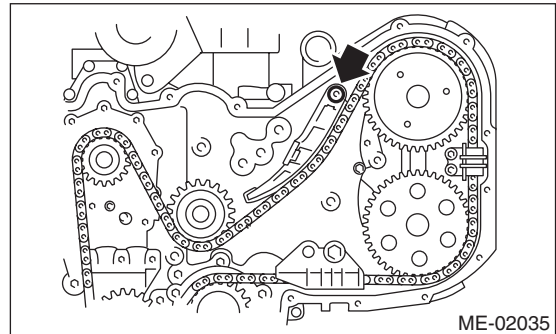
- 9) Remove the chain tensioner (LH).

NOTE:

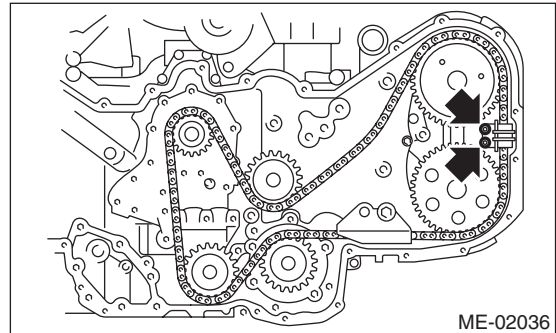
Be careful not to come out the plunger.



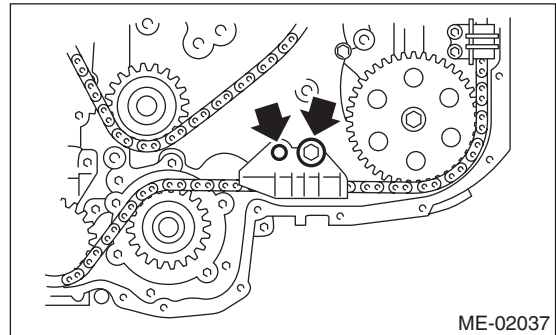
- 10) Remove the chain tensioner lever (LH).



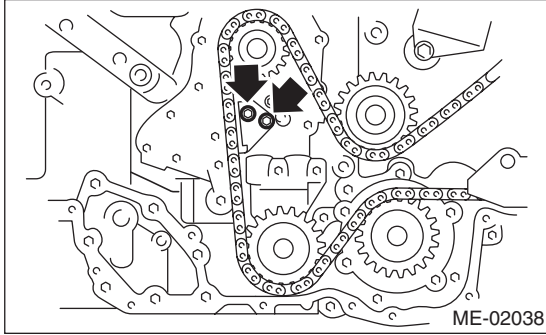
- 11) Remove the chain guide (LH: between cams).



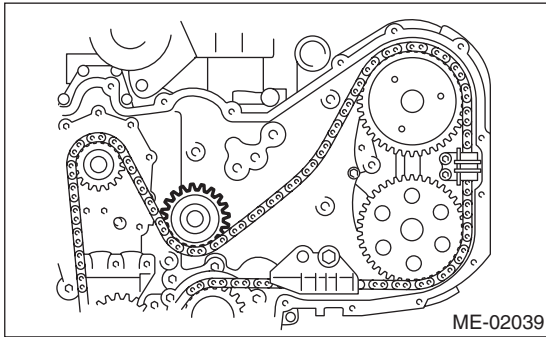
- 12) Remove the chain guide (LH).



13) Remove the chain guide (center).

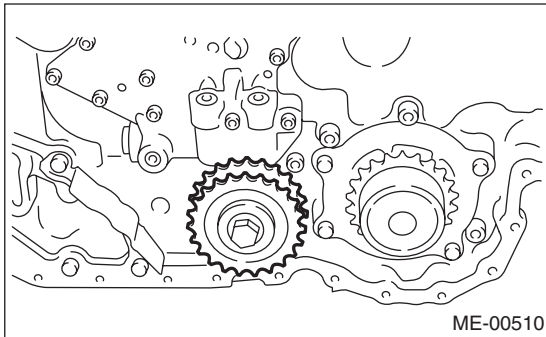


14) Remove the idler sprocket (upper).



15) Remove the timing chain (LH).

16) Remove the idler sprocket (lower).



## B: INSTALLATION

### NOTE:

- Be careful that the foreign matter is not into or onto assembled component during installation.
- Apply engine oil to the chain guide, chain tensioner lever and idler sprocket when installing.

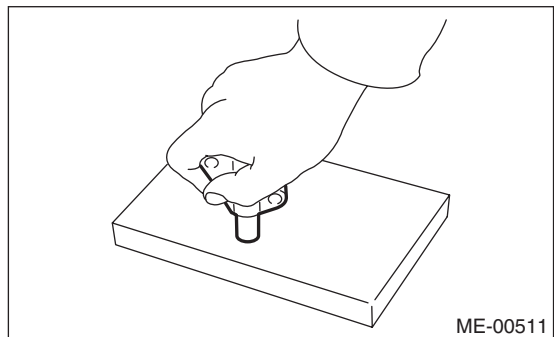
### 1) Preparation for chain tensioner installation

(1) Insert the screw, spring pin and tension rod into tensioner body.

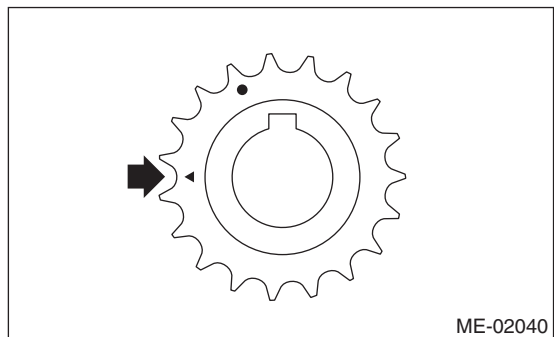
(2) While depressing the tensioner onto rubber mat, twist it to shorten tension rod. Then insert the thin pin into the hole between tension rod and tension body to keep it.

### NOTE:

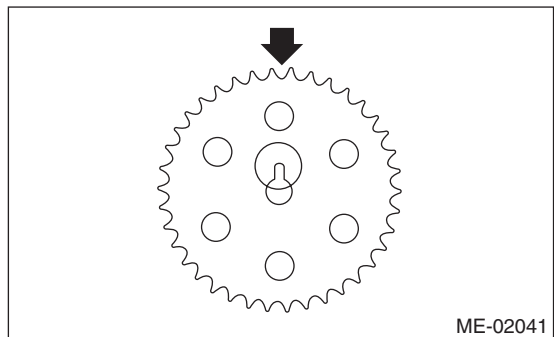
Work on the rubber mat or other anti-skid materials.



2) Using the ST, align the "Top mark" on crank sprocket to 9 o'clock position as shown in the figure  
ST 18252AA000 CRANKSHAFT SOCKET



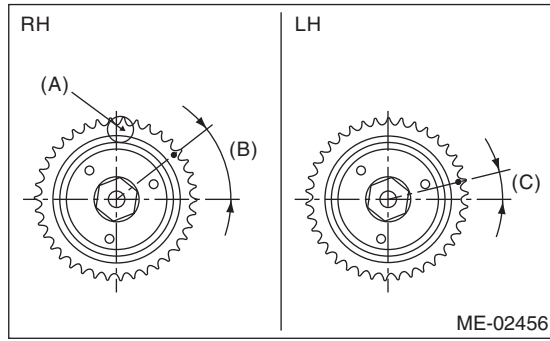
3) Align the key groove on exhaust cam sprocket to 12 o'clock position as shown in the figure.



# Timing Chain Assembly

## MECHANICAL

4) Align the intake cam sprocket as shown in the figure.



- (A) Top mark
- (B) 40°
- (C) 15°

5) Turn the crank sprocket clockwise, align the "Top mark" to 12 o'clock position. (Piston #1 is in TDC position)

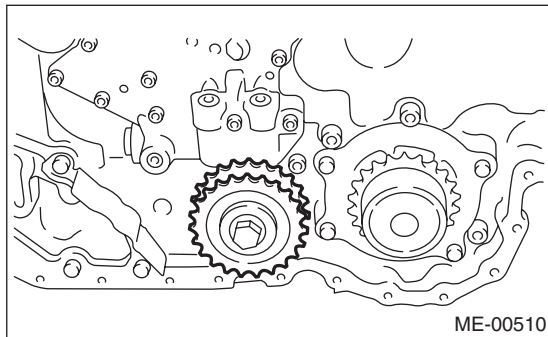
### NOTE:

Do not rotate the crank shaft and cam sprocket before completing timing chain installation.

6) Install the idler sprocket (lower).

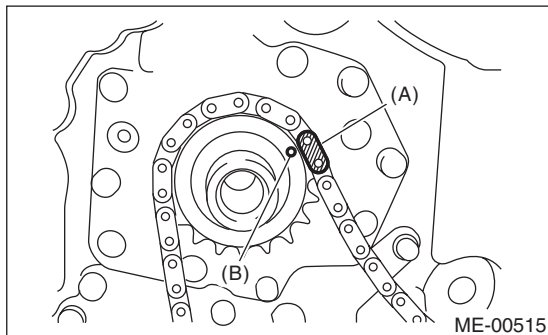
### Tightening torque:

**69 N·m (7.0 kgf·m, 50.9 ft·lb)**



7) Install the timing chain (LH).

(1) Align the timing mark (B) on the crank sprocket with mark (A) on the timing chain (LH).

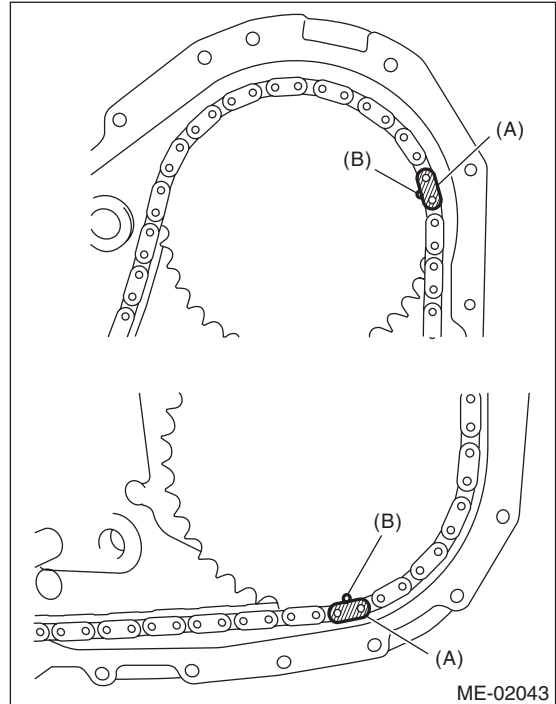


- (A) Gold
- (B) Mark

(2) Install the timing chain (LH) to the idler sprocket (lower), water pump, exhaust cam sprocket (LH) and intake cam sprocket (LH) in this order.

### NOTE:

Check that the mark on timing chain (A) and cam sprocket (B) is aligned as same as aligned on crank sprocket.

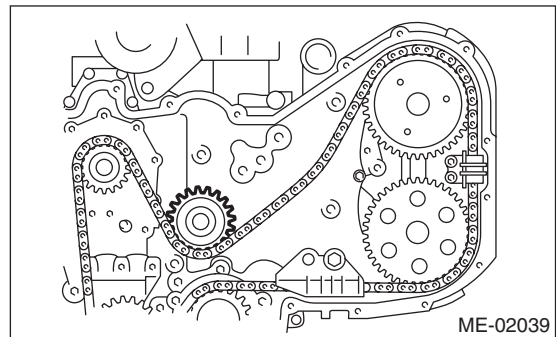


- (A) Blue
- (B) Mark

(3) Install the idler sprocket (upper).

### Tightening torque:

**69 N·m (7.0 kgf·m, 50.9 ft·lb)**



# Timing Chain Assembly

MECHANICAL

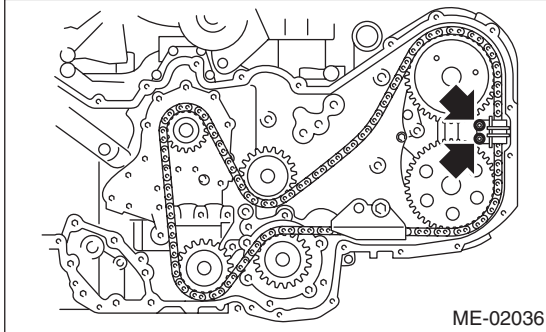
(4) Install the chain guide (LH: between cams).

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**

NOTE:

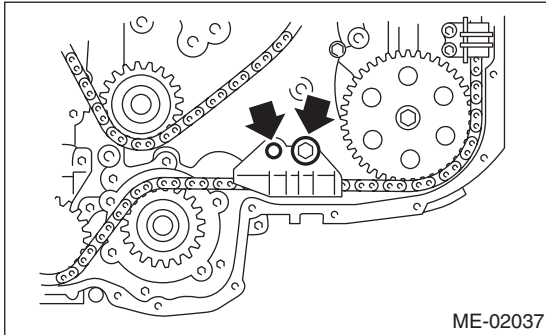
Use a new installing bolt.



(5) Install the chain guide (LH).

**Tightening torque:**

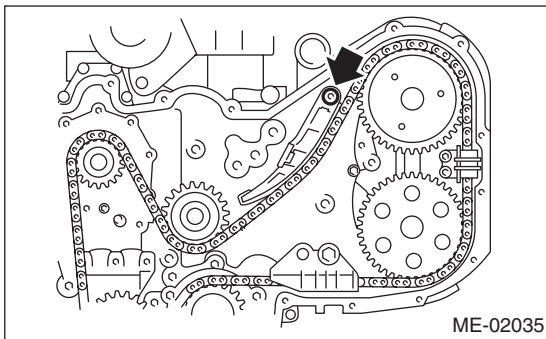
**16 N·m (1.6 kgf-m, 12 ft-lb)**



(6) Install the chain tensioner lever (LH).

**Tightening torque:**

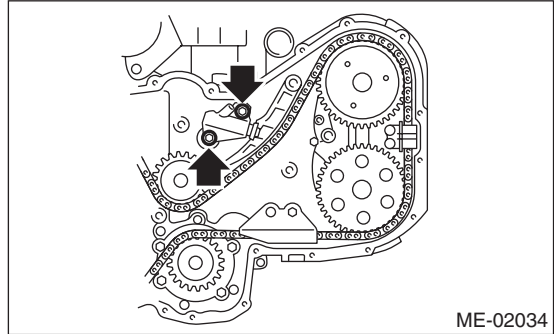
**16 N·m (1.6 kgf-m, 12 ft-lb)**



(7) Install the chain tensioner (LH).

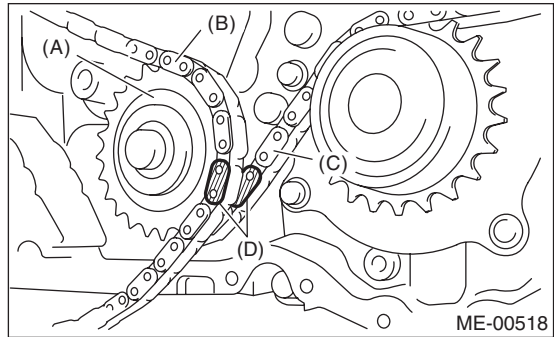
**Tightening torque:**

**16 N·m (1.6 kgf-m, 12 ft-lb)**



8) Install the timing chain (RH).

(1) Align the marks of timing chain LH and RH on the idler sprocket (lower).



(A) Idler sprocket (lower)

(B) Timing chain (RH)

(C) Timing chain (LH)

(D) Blue

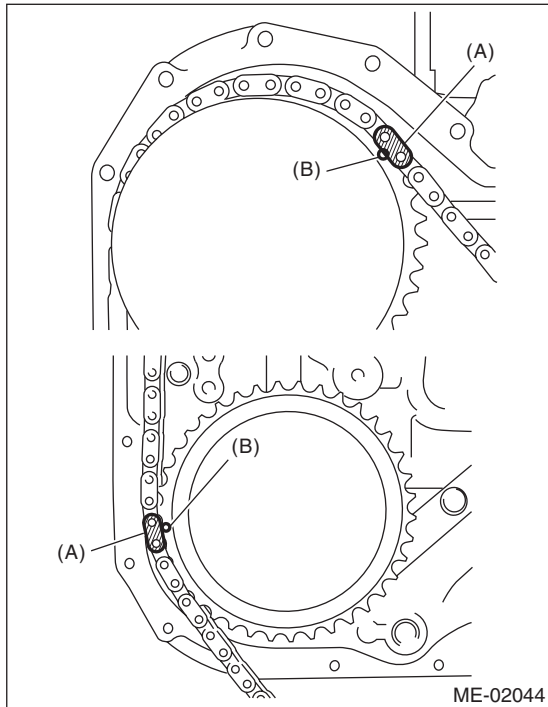
# Timing Chain Assembly

## MECHANICAL

(2) Install the timing chain (RH) to the intake cam sprocket (RH) and exhaust cam sprocket (RH) in this order.

### NOTE:

Check that the mark on timing chain (A) and cam sprocket (B) is aligned as same as aligned on crank sprocket.

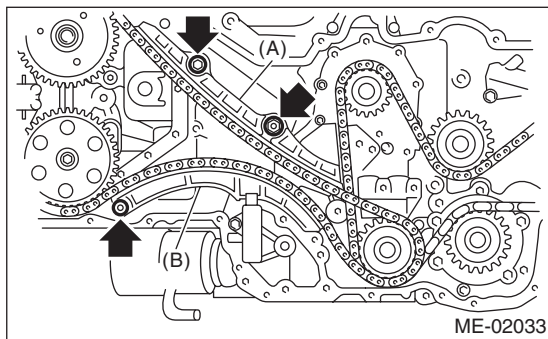


- (A) Gold
- (B) Mark

(3) Install the chain guide (RH).  
(4) Install the chain tensioner lever (RH).

### Tightening torque:

**16 N·m (1.6 kgf·m, 12 ft·lb)**



- (A) Chain guide (RH)
- (B) Chain tensioner lever (RH)

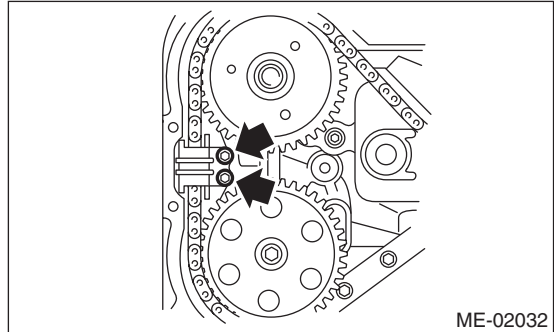
(5) Install the chain guide (RH: between cams).

### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

### NOTE:

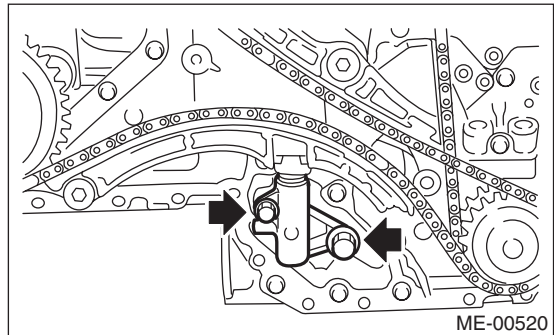
Use a new installing bolt.



(6) Install the chain tensioner (RH).

### Tightening torque:

**16 N·m (1.6 kgf·m, 12 ft·lb)**



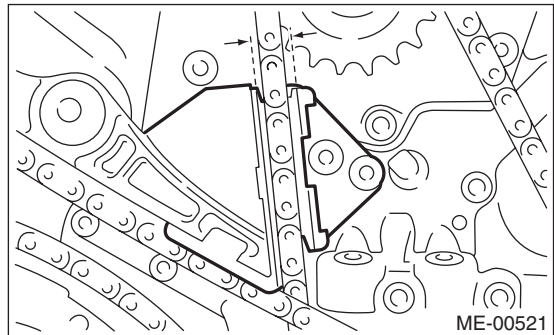
(7) Adjust the clearance between chain guide (RH) and chain guide (center) within 8.4 — 8.6 mm (0.331 — 0.339 in). Install the chain guide (center).

### Tightening torque:

**7.8 N·m (0.8 kgf·m, 5.9 ft·lb)**

### NOTE:

Use a new installing bolt.



(8) Check that each mark on the sprocket and timing chain is matched, and then draw out the stopper pin from chain tensioner.

- 9) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>
- 10) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>
- 11) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>



# Cam Sprocket

MECHANICAL

## 16. Cam Sprocket

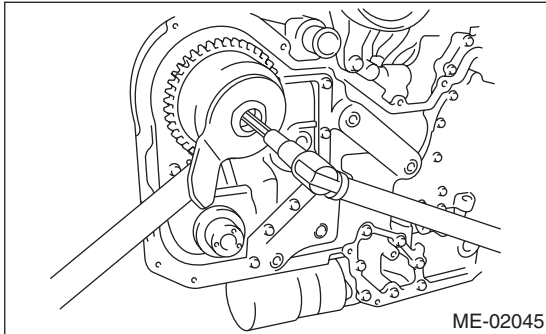
### A: REMOVAL

NOTE:

Perform the work with the engine installed to body when replacing a single part.

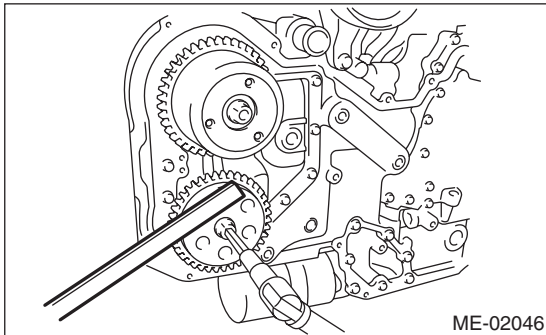
- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. To lock the camshaft, use the ST.

ST 499977500 CAM SPROCKET WRENCH



ME-02045

ST 18231AA020 CAM SPROCKET WRENCH



ME-02046

### B: INSTALLATION

- 1) Install the cam sprocket. To lock the camshaft, use the ST.

**Tightening torque:**

**29.5 N·m (3.0 kgf·m, 21.8 ft·lb)**

- 2) Further tighten the bolt.

**Tightening angle:**

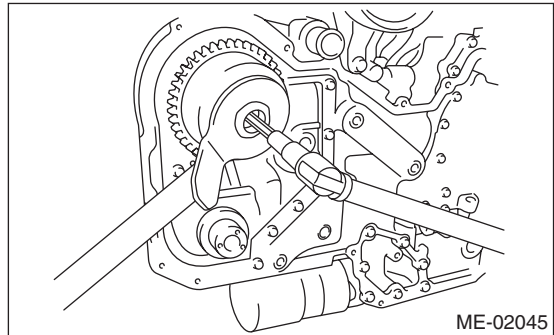
**Intake side**

**45°±5°**

**Exhaust side**

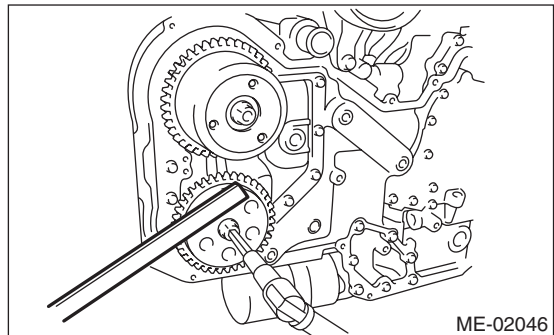
**25°±5°**

ST 499977500 CAM SPROCKET WRENCH



ME-02045

ST 18231AA020 CAM SPROCKET WRENCH



ME-02046

- 3) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>

- 4) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>

- 5) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>

- 6) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Check the cam sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between cam sprocket and key.

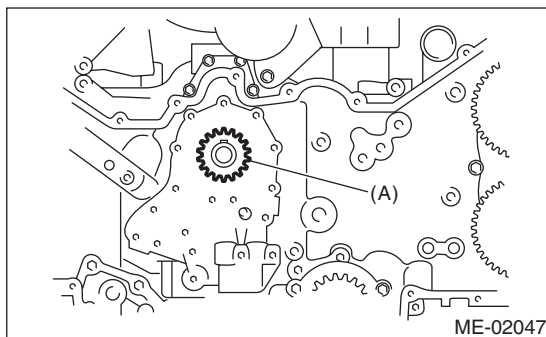
## 17.Crank Sprocket

### A: REMOVAL

#### NOTE:

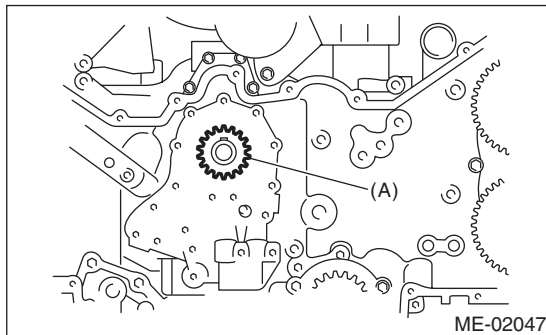
Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the crank sprocket (A).



### B: INSTALLATION

- 1) Install the crank sprocket (A).



- 2) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>
- 3) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>
- 4) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

### C: INSPECTION

- 1) Check the crank sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between crank sprocket and key.

# Rear Chain Cover

MECHANICAL

## 18.Rear Chain Cover

### A: REMOVAL

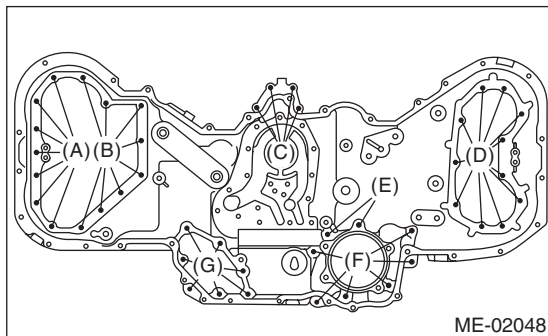
NOTE:

Perform the work with the engine installed to body when replacing a single part.

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-50, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-51, REMOVAL, Crank Sprocket.>
- 7) Remove the oil pump. <Ref. to LU(H6DO)-8, REMOVAL, Oil Pump.>
- 8) Remove the water pump. <Ref. to CO(H6DO)-13, REMOVAL, Water Pump.>
- 9) Remove the rear chain cover.

NOTE:

Installation bolt has seven different sizes. To prevent the confusion in installation, keep these bolts on container individually.



- (A) M6 × 14
- (B) M6 × 18 (Light green coating)
- (C) M6 × 30
- (D) M6 × 18
- (E) M8 × 40
- (F) M8 × 30
- (G) M6 × 22

### B: INSTALLATION

NOTE:

When replacing the rear chain cover, suitable size cover must be selected. <Ref. to LU(H6DO)-9, INSPECTION, Oil Pump.>

- 1) Remove the used liquid gasket from mating surface, and degrease it.
- 2) Apply liquid gasket to the mating surface of rear chain cover.

NOTE:

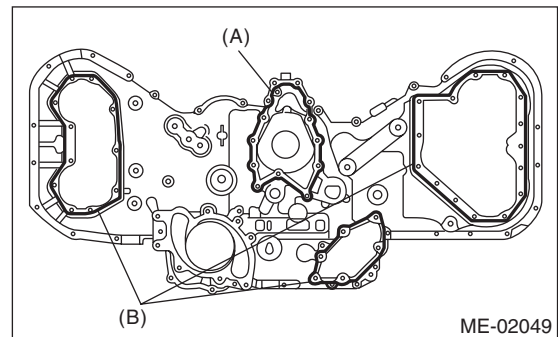
Install within 5 min. after applying liquid gasket.

**Liquid gasket**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

**Applying liquid gasket diameter**

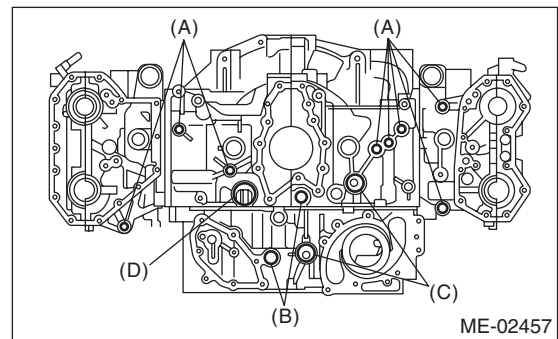
- (A)  $1.0 \pm 0.5$  mm ( $0.039 \pm 0.020$  in)
- (B)  $3.0 \pm 1.0$  mm ( $0.118 \pm 0.039$  in)



- 3) Install the O-ring.

NOTE:

- Use new O-rings.
- Do not install the O-ring in wrong place.



- (A) 14.2 × 1.9
- (B) 19.2 × 2.4
- (C) 25 × 2
- (D) 31.2 × 1.9

- 4) Install the water pump gasket.

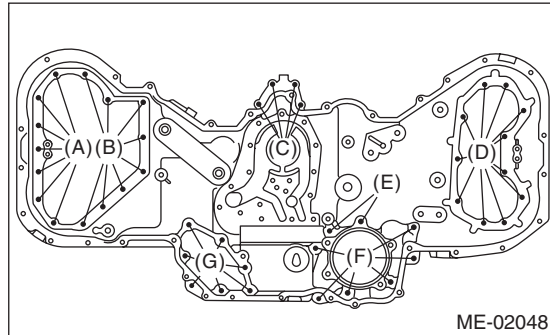
NOTE:

Use a new gasket.

5) Temporarily tighten the rear chain cover.

**NOTE:**

Do not install the bolts in wrong place.



- (A) M6 × 14
- (B) M6 × 18 (Light green coating)
- (C) M6 × 30
- (D) M6 × 18
- (E) M8 × 40
- (F) M8 × 30
- (G) M6 × 22

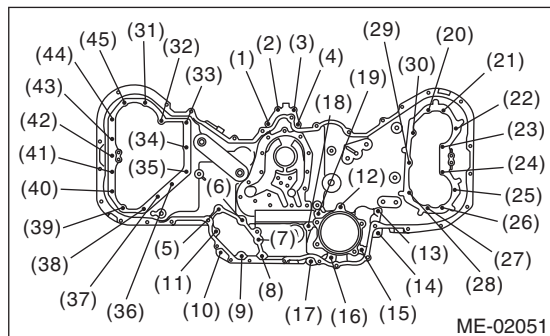
13) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>

14) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

6) Tighten the bolts in the numerical order as shown in the figure.

**Tightening torque:**

(1) — (11)	9 N·m (0.9 kgf·m, 6.5 ft·lb)
(12) — (19)	20 N·m (2.0 kgf·m, 14.8 ft·lb)
(20) — (30)	9 N·m (0.9 kgf·m, 6.5 ft·lb)
(31) — (38)	12 N·m (1.2 kgf·m, 8.7 ft·lb)
(39) — (45)	9 N·m (0.9 kgf·m, 6.5 ft·lb)



7) Install the water pump. <Ref. to CO(H6DO)-13, INSTALLATION, Water Pump.>

8) Install the oil pump. <Ref. to LU(H6DO)-8, INSTALLATION, Oil Pump.>

9) Install the crank sprocket. <Ref. to ME(H6DO)-51, INSTALLATION, Crank Sprocket.>

10) Install the cam sprocket. <Ref. to ME(H6DO)-50, INSTALLATION, Cam Sprocket.>

11) Install the timing chain. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>

12) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>

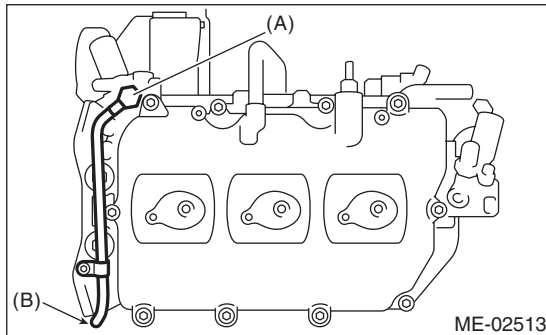
## 19. Camshaft

### A: REMOVAL

**NOTE:**

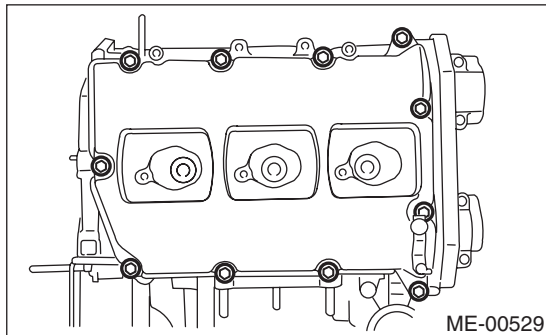
Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H6DO)-27, Valve Clearance.>

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-50, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-51, REMOVAL, Crank Sprocket.>
- 7) Remove the rear chain cover. <Ref. to ME(H6DO)-52, REMOVAL, Rear Chain Cover.>
- 8) Disconnect the oil pipe.

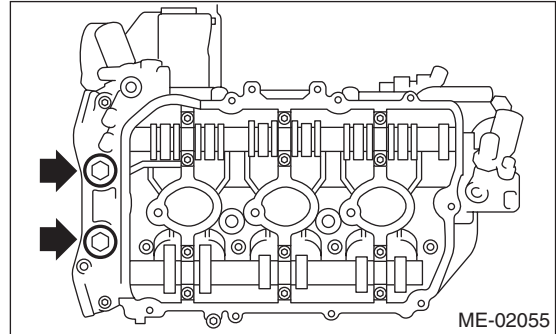


- (A) Bolt without filter (without protrusion)
- (B) Bolt with filter (with protrusion)

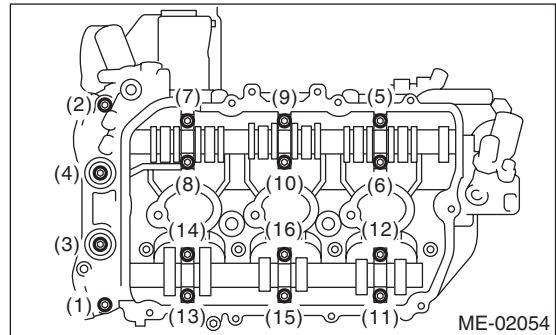
- 9) Remove the rocker cover (LH).



- 10) Remove the plugs (LH).



- 11) Loosen the camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



- 12) Remove the camshaft caps and camshaft (LH).

**NOTE:**

Arrange camshaft caps in order so that they can be installed in their original positions.

- 13) Similarly, remove the camshafts (RH) and related parts.

## B: INSTALLATION

- 1) Apply engine oil to camshaft journals, and install the camshaft.
- 2) Install the camshaft cap.
  - (1) Apply liquid gasket sparingly to back side of front camshaft cap as shown in the figure.

**CAUTION:**

**Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward cam journal, resulting in engine seizure.**

**NOTE:**

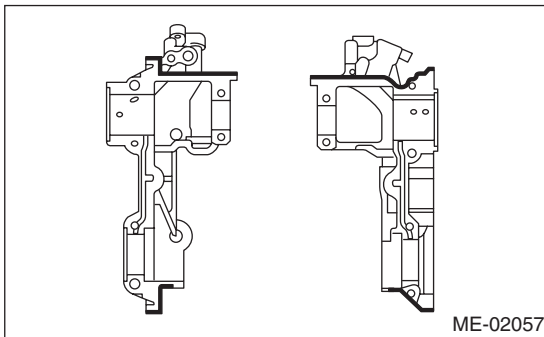
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

**Applying liquid gasket diameter:**

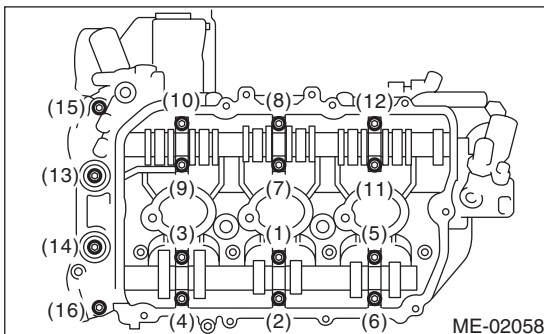
**2.0±0.5 mm (0.079±0.020 in)**



- (2) Apply engine oil to cap bearing surface, and install the cap to camshaft.
- (3) Tighten the rocker cover bolts in the numerical order as shown in the figure.

**Tightening torque:**

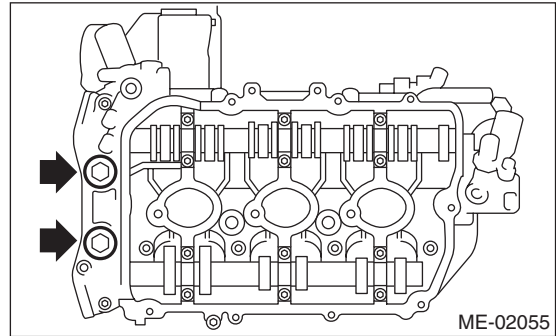
- (1) — (12): 16 N·m (1.6 kgf·m, 12 ft·lb)**  
**(13) — (16): 9.75 N·m (1.0 kgf·m, 7.2 ft·lb)**



- 3) Install the plugs.

**Tightening torque:**

**60 N·m (6.1 kgf·m, 44 ft·lb)**



- 4) Install the rocker cover.
  - (1) Install the rocker cover gasket to the rocker cover.

**NOTE:**

Use a new rocker cover gasket.

- (2) Apply liquid gasket sparingly to the mating surface of cylinder head and rocker cover as shown in the figure.

**CAUTION:**

**Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward cam journal, resulting in engine seizure.**

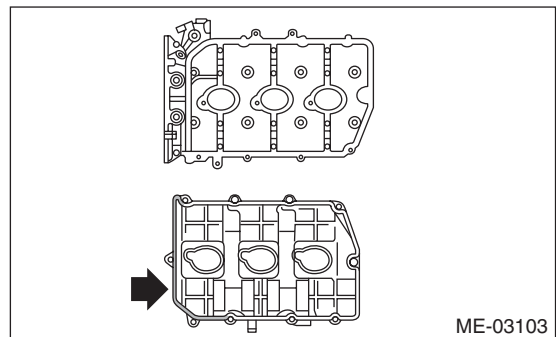
**NOTE:**

Install within 5 min. after applying liquid gasket.

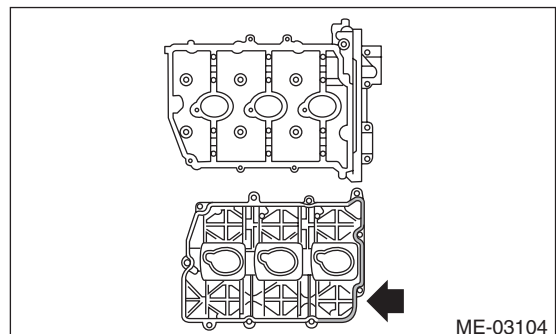
**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

- LH side



- RH side



# Camshaft

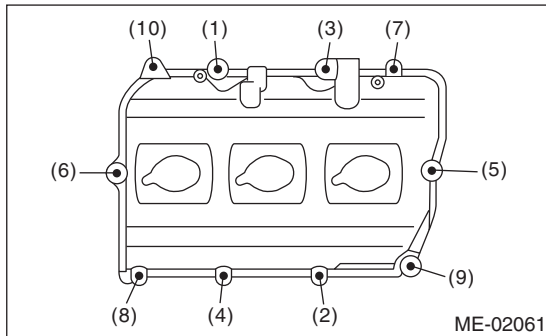
## MECHANICAL

(3) Tighten the rocker cover bolts in the numerical order as shown in the figure.

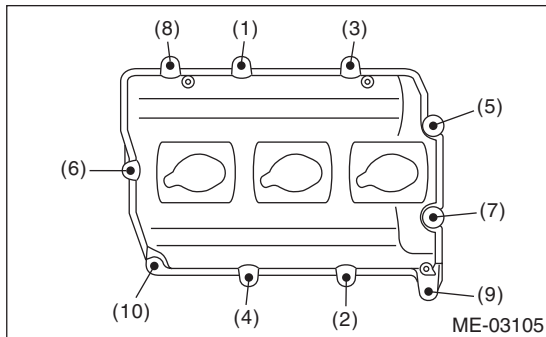
### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

- LH side



- RH side



5) Connect the oil pipe.

### NOTE:

- Be careful not to mistake the location of (A) and (B).
- Use a new gasket.

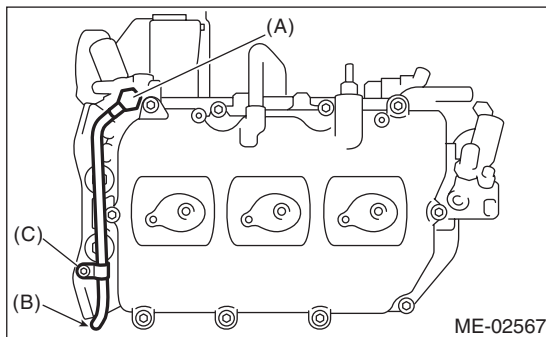
### Tightening torque:

**(A), (B)**

**29 N·m (3.0 kgf·m, 21.4 ft·lb)**

**(C)**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- (A) Bolt without filter (without protrusion)
- (B) Bolt with filter (with protrusion)
- (C) Oil pipe bolt

6) Install the rear chain cover. <Ref. to ME(H6DO)-52, INSTALLATION, Rear Chain Cover.>

7) Install the crank sprocket. <Ref. to ME(H6DO)-51, INSTALLATION, Crank Sprocket.>

8) Install the cam sprocket. <Ref. to ME(H6DO)-50, INSTALLATION, Cam Sprocket.>

9) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>

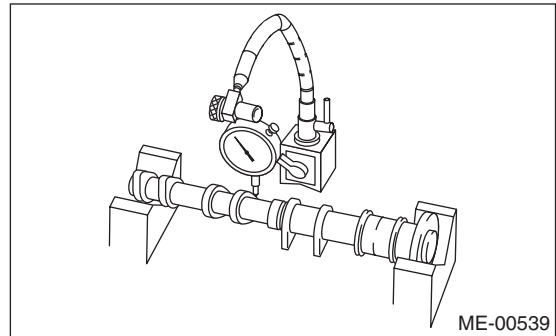
10) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>

11) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>

12) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

## C: INSPECTION

1) Measure the bend of camshaft. Repair or replace if bended.



2) Check the journal for damage and wear. Replace if faulty.

3) Check the cutout portion used for camshaft sensor for damage. Replace if faulty.

4) Measure the outside diameter of camshaft journal. If the journal diameter is not within specification, check the oil clearance.

	Camshaft journal	
	Front	Except for front
Standard mm (in)	37.946 — 37.963 (1.4939 — 1.4946)	25.946 — 25.963 (1.0215 — 1.0222)

5) Measurement of the camshaft journal oil clearance:

- (1) Clean the bearing caps and camshaft journals.
- (2) Place the camshafts on cylinder head. (Without installing the valve rocker.)
- (3) Place a plastigauge across each camshaft journals.
- (4) Install the bearing cap.

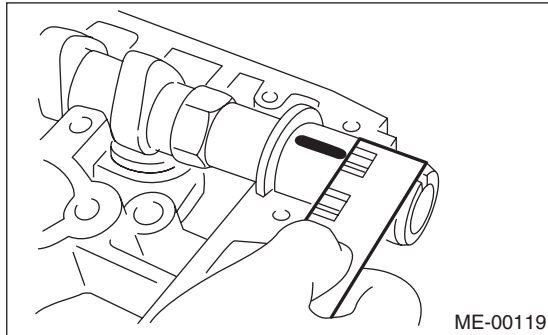
NOTE:

Do not turn the camshaft.

- (5) Remove the bearing caps.
- (6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the standard, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

**Standard:**

**0.037 — 0.072 mm (0.0015 — 0.0028 in)**



(7) Completely remove the plastigauge.

6) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H. If it exceeds the standard or offset wear occurs, replace it.

**Cam height H:**

**Standard**

**Intake**

**HIGH 42.09 — 42.19 mm**

**(1.6571 — 1.6610 in)**

**LOW1 38.14 — 38.24 mm**

**(1.5016 — 1.5055 in)**

**LOW2 38.14 — 38.24 mm**

**(1.5016 — 1.5055 in)**

**Exhaust**

**40.45 — 40.55 mm (1.5925 — 1.5965 in)**

**Cam base circle diameter A:**

**Intake**

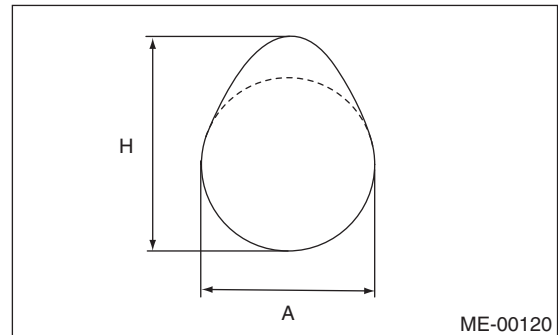
**HIGH 32.0 mm (1.2598 in)**

**LOW1 31.84 mm (1.2535 in)**

**LOW2 31.84 mm (1.2535 in)**

**Exhaust**

**32.0 mm (1.2598 in)**



7) Measure the side clearance of the camshaft with a dial gauge. If the side clearance exceeds the standard or there is offset wear, replace the caps and cylinder head as a set. If necessary replace the camshaft.

**Standard**

**Intake**

**0.075 — 0.135 mm (0.0030 — 0.0053 in)**

**Exhaust**

**0.030 — 0.090 mm (0.0012 — 0.0035 in)**



# Cylinder Head

MECHANICAL

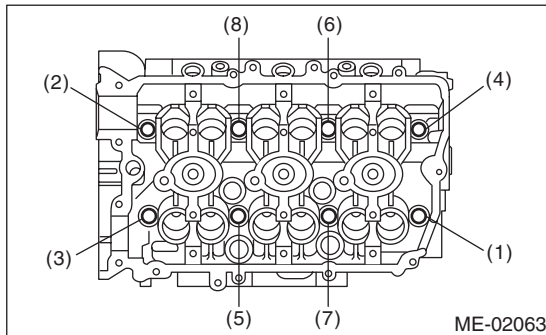
## 20. Cylinder Head

### A: REMOVAL

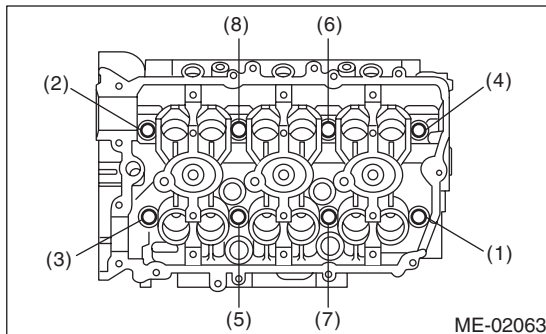
#### NOTE:

Perform the work with the engine installed to body when replacing a single part. Refer to "Valve Clearance" for preparation. <Ref. to ME(H6DO)-27, Valve Clearance.>

- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-50, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-51, REMOVAL, Crank Sprocket.>
- 7) Remove the rear chain cover. <Ref. to ME(H6DO)-52, REMOVAL, Rear Chain Cover.>
- 8) Remove the camshaft. <Ref. to ME(H6DO)-54, REMOVAL, Camshaft.>
- 9) Remove the cylinder head bolts in the numerical order as shown in the figure.  
Leave bolts (2) and (4) engaged by three or four threads to prevent the cylinder head from falling.



- 10) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.
- 11) Remove the bolts (2) and (4) to remove cylinder head.



- 12) Remove the cylinder head gasket.

#### CAUTION:

**Be careful not to scratch the mating surface of cylinder head and cylinder block.**

- 13) Similarly, remove the cylinder head (RH).

### B: INSTALLATION

- 1) Install the cylinder head and gaskets on cylinder block.

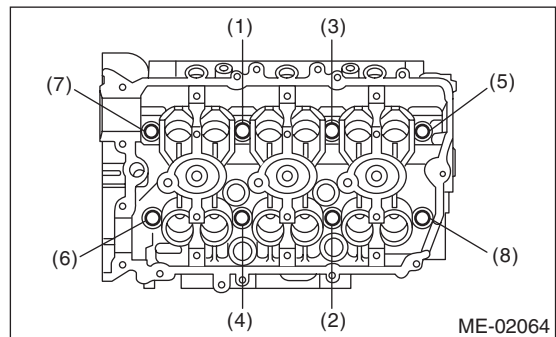
#### CAUTION:

**Be careful not to scratch the mating surface of cylinder head and cylinder block.**

#### NOTE:

Use a new cylinder head gasket.

- 2) Tighten the cylinder head bolts.
  - (1) Apply a coat of engine oil to washers and cylinder head bolt threads.
  - (2) Install the cylinder head to cylinder block, and then tighten the bolts with torque of 20 N·m (2.0 kgf·m, 14.8 ft·lb) in numerical sequence as shown in the figure.
  - (3) Tighten the bolts with torque of 50 N·m (5.1 kgf·m, 36.9 ft·lb) in numerical sequence as shown in the figure.
  - (4) Loosen all the bolts by 180° in reverse order of installation, and loosen again by 180°.
  - (5) Tighten the bolts with torque of 20 N·m (2.0 kgf·m, 14.8 ft·lb) in numerical sequence as shown in the figure.
  - (6) Tighten the bolts (1) — (4) with torque of 48 N·m (4.9 kgf·m, 35.4 ft·lb) in numerical sequence.
  - (7) Tighten the bolts (5) — (8) with torque of 44 N·m (4.5 kgf·m, 32.5 ft·lb) in numerical sequence.
  - (8) Tighten all bolts 90° in the numerical order as shown in the figure.
  - (9) Tighten the bolt (1) — (4) by 45° in the numerical order.



- 3) Install the camshaft. <Ref. to ME(H6DO)-55, INSTALLATION, Camshaft.>
- 4) Install the rear chain cover. <Ref. to ME(H6DO)-52, INSTALLATION, Rear Chain Cover.>

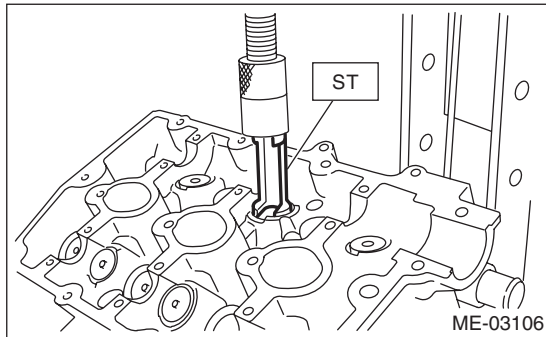
- 5) Install the crank sprocket. <Ref. to ME(H6DO)-51, INSTALLATION, Crank Sprocket.>
- 6) Install the cam sprocket. <Ref. to ME(H6DO)-50, INSTALLATION, Cam Sprocket.>
- 7) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>
- 8) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>
- 9) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>
- 10) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

## C: DISASSEMBLY

- 1) Set the cylinder head on ST.  
ST 18250AA010 CYLINDER HEAD TABLE
- 2) Remove the valve lifter.
- 3) Set the ST on valve spring retainer. Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.  
ST 499718000 VALVE SPRING REMOVER

### NOTE:

- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.



## D: ASSEMBLY

- 1) Installation of valve spring and valve:
  - (1) Set the cylinder head on ST.  
ST 18250AA010 CYLINDER HEAD TABLE
  - (2) Coat the stem of each valve with engine oil and insert the valve into the valve guide.

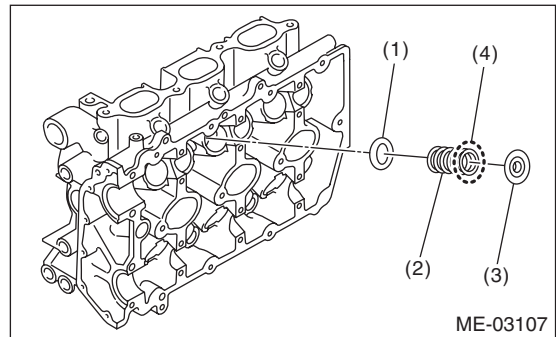
### NOTE:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (3) Install the valve spring and retainer.

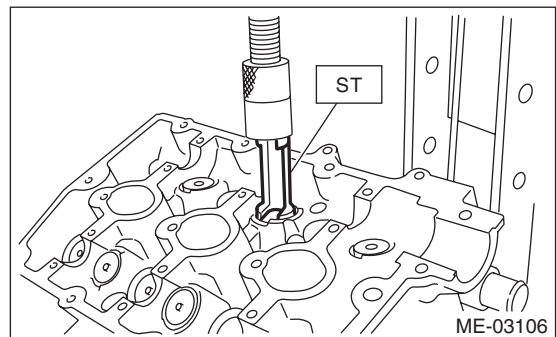
### NOTE:

- Be sure to install the valve spring with its close-coiled end facing the seat on cylinder head.
- For the valve spring on intake side, install two of them (inner and outer).
- Install the valve spring with the painted side facing to retainer.



- (1) Valve spring seat
- (2) Valve spring
- (3) Retainer
- (4) Painted face

- (4) Set the ST on valve spring.  
ST 499718000 VALVE SPRING REMOVER



- (5) Compress the valve spring and fit the valve spring retainer key.
- (6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.
- 2) Apply oil to the surface of valve lifter and valve shim.
- 3) Install the valve lifter and valve shim.

# Cylinder Head

MECHANICAL

## E: INSPECTION

### 1. CYLINDER HEAD

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

2) Set the cylinder head on ST.

ST 18250AA010 CYLINDER HEAD TABLE

3) Inspect the cylinder head surface that mates with cylinder block for warping by using a straight edge (A) and thickness gauge (B). If the warping exceeds the limit, replace the cylinder head.

**Warping limit:**

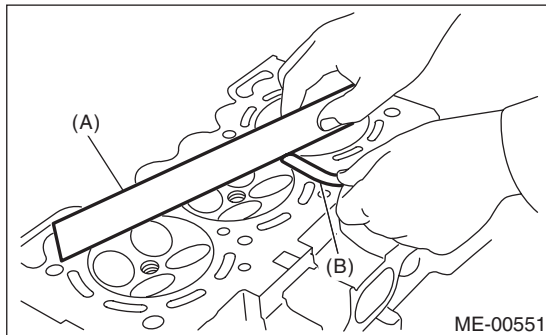
**0.02 mm (0.0008 in)**

**Standard height of cylinder head:**

**124±0.05 mm (4.88±0.0020 in)**

NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.



### 2. VALVE SEAT

Inspect the intake and exhaust valve seats. Correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

**Valve seat width W:**

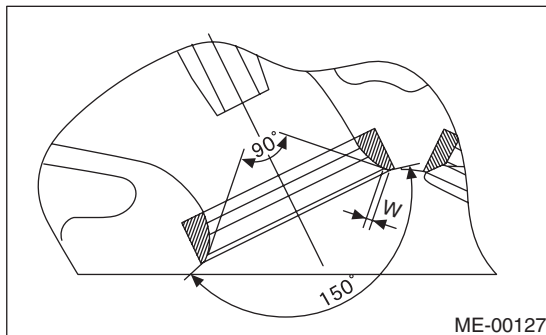
**Standard**

**Intake**

**1.0 mm (0.039 in)**

**Exhaust**

**1.5 mm (0.059 in)**



### 3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the valve stem outer diameter with a micrometer and valve guide inner diameter with a caliper gauge respectively.

**Clearance between the valve guide and valve stem:**

**Standard**

**Intake**

**0.030 — 0.057 mm (0.0012 — 0.0022 in)**

**Exhaust**

**0.040 — 0.067 mm (0.0016 — 0.0026 in)**

2) If the clearance between valve guide and stem exceeds the standard, replace the valve guide or valve itself whichever shows greater amount of wear or damaged and etc. See the following procedure for valve guide replacement.

**Valve guide inner diameter:**

**5.500 — 5.512 mm (0.2165 — 0.2170 in)**

**Valve stem outer diameters:**

**Intake**

**5.455 — 5.470 mm (0.2148 — 0.2154 in)**

**Exhaust**

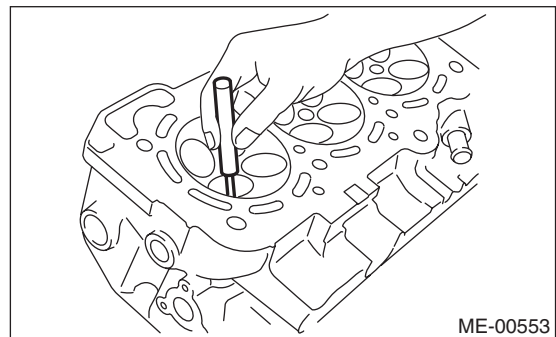
**5.445 — 5.460 mm (0.2144 — 0.2150 in)**

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

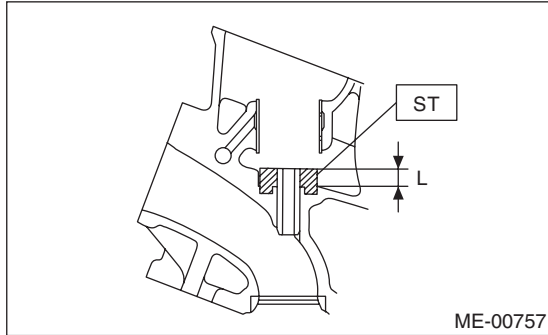
ST1 18250AA010 CYLINDER HEAD TABLE

ST2 499765700 VALVE GUIDE REMOVER



(3) Turn the cylinder head upside down and place the ST as shown in the figure.

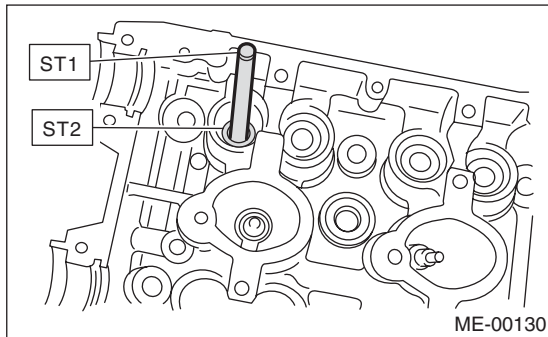
ST 18251AA040 VALVE GUIDE ADJUSTER



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499765700 VALVE GUIDE REMOVER  
ST2 18251AA040 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

### Valve guide protrusion L:

**11.4 — 11.8 mm (0.449 — 0.465 in)**

(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

ST 499765900 VALVE GUIDE REAMER

### NOTE:

- Apply engine oil to the ST when reaming.
- If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.
- If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.

(8) After reaming, clean the valve guide to remove chips.

(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

## 4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of the valve, and replace if damaged, worn, or deformed, or if "H" is outside of the standard.

### Head edge thickness H:

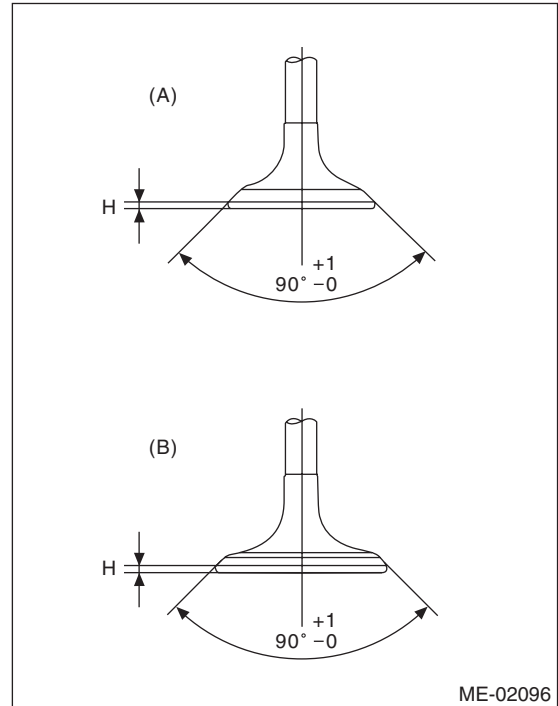
#### Standard

**Intake (A)**

**1.0 mm (0.039 in)**

**Exhaust (B)**

**1.2 mm (0.047 in)**



2) Put a small amount of grinding compound on the seat surface, and lap the valve and valve seat. Install a new valve oil seal after lapping.

### NOTE:

It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

### Valve overall length:

**Intake**

**99.7 mm (3.925 in)**

**Exhaust**

**105.2 mm (4.142 in)**

# Cylinder Head

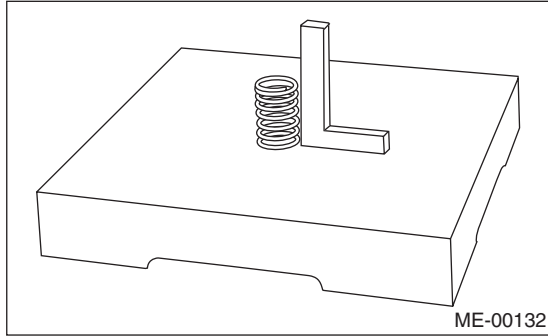
## MECHANICAL

### 5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.

Free length	mm (in)	Intake	Inner	39.55 (1.5571)
			Outer	41.18 (1.6213)
		Exhaust	46.32 (1.8236)	
Squareness		Intake	Inner	2.5°, 1.7 mm (0.067 in) or less
			Outer	2.5°, 1.8 mm (0.071 in) or less
		Exhaust	2.5°, 2.0 mm (0.079 in) or less	

2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top of spring using a try square.



### 6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part.

- When the lip is damaged
- When the spring is out of the specified position
- When readjusting the surfaces of valve and valve seat
- When replacing the valve guide

2) Set the cylinder head on ST1.

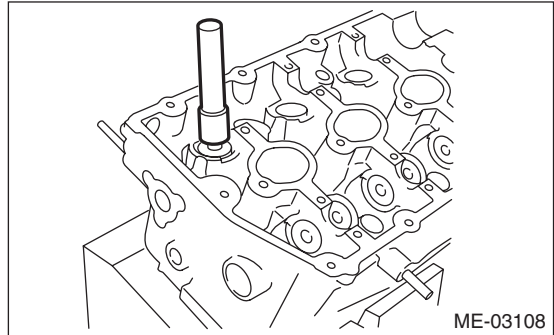
3) Using the ST2, press in the oil seal.

ST1 18250AA010 CYLINDER HEAD TABLE

ST2 499585500 VALVE OIL SEAL GUIDE

NOTE:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.

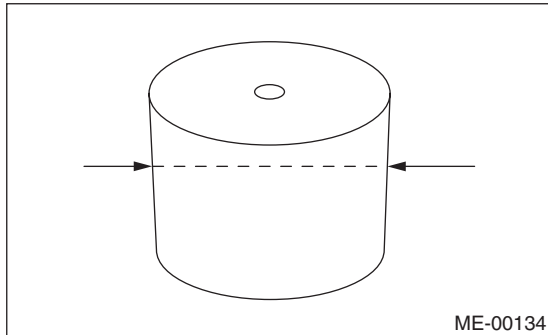


## 7. VALVE LIFTER

- 1) Check the valve lifter visually.
- 2) Measure the outer diameter of valve lifter.

### **Outer diameter:**

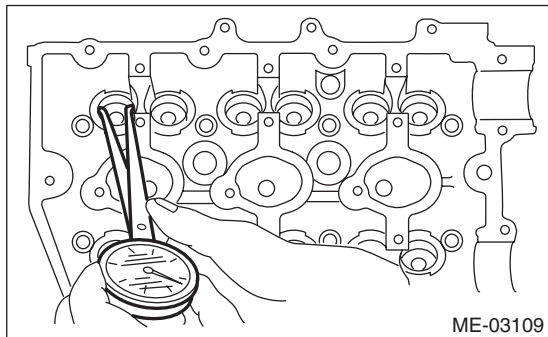
**32.959 — 32.975 mm (1.2976 — 1.2982 in)**



- 3) Measure the inner diameter of valve lifter hole of cylinder head.

### **Inner diameter:**

**32.994 — 33.016 mm (1.2990 — 1.2998 in)**



### **NOTE:**

If difference between outer diameter of valve lifter and inner diameter of valve lifter hole is out of the standard or offset wearing is emitted, replace the cylinder head.

### **Standard:**

**0.019 — 0.057 mm (0.0007 — 0.0022 in)**

# Cylinder Block

MECHANICAL

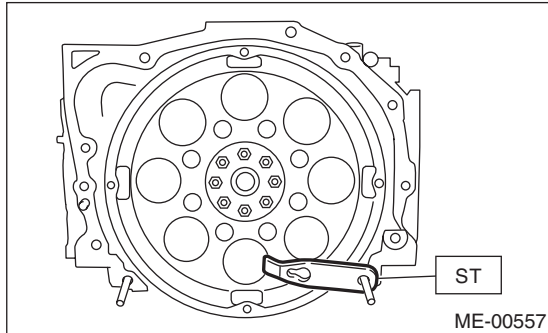
## 21. Cylinder Block

### A: REMOVAL

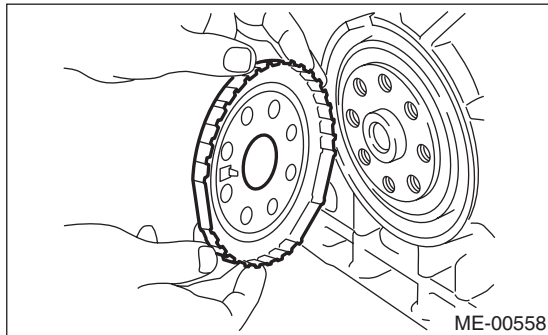
#### NOTE:

Before conducting this procedure, drain the engine oil completely.

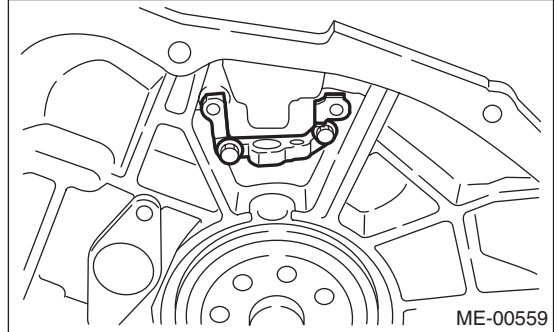
- 1) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 3) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-50, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-51, REMOVAL, Crank Sprocket.>
- 7) Remove the rear chain cover. <Ref. to ME(H6DO)-52, REMOVAL, Rear Chain Cover.>
- 8) Remove the camshaft. <Ref. to ME(H6DO)-54, REMOVAL, Camshaft.>
- 9) Remove the cylinder head. <Ref. to ME(H6DO)-58, REMOVAL, Cylinder Head.>
- 10) Remove the drive plate using the ST.  
ST 498497100 CRANKSHAFT STOPPER



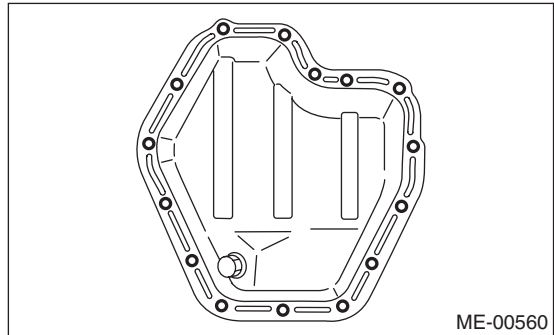
- 11) Remove the crankshaft position sensor plate.



- 12) Remove the crankshaft position sensor bracket.



- 13) Rotate the engine to set oil pan upper.
- 14) Remove the bolts which secure oil pan lower to oil pan upper.

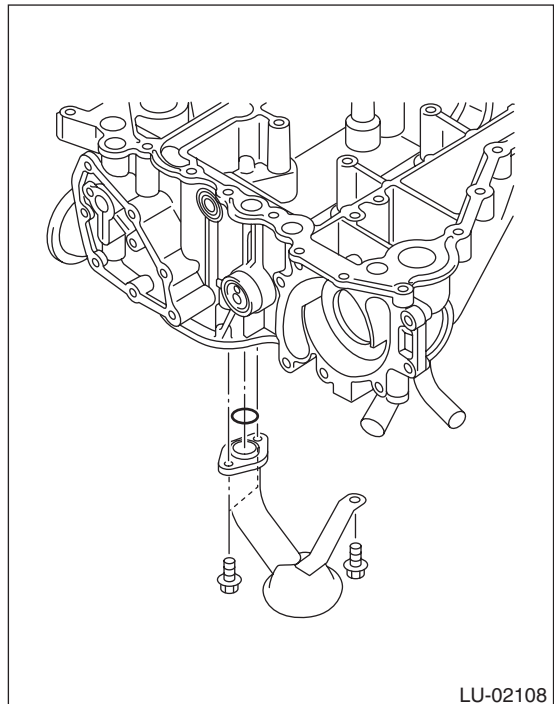


- 15) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

#### CAUTION:

**Do not use a screwdriver or similar tools in place of oil pan cutter.**

- 16) Remove the oil strainer.



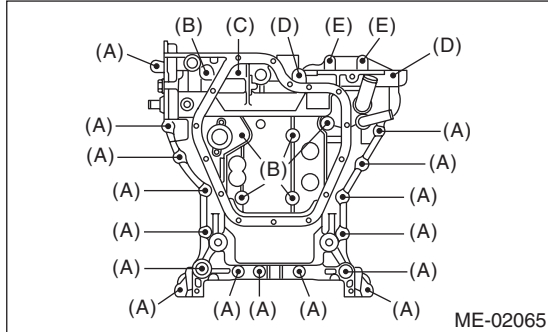
# Cylinder Block

MECHANICAL

17) Remove the bolts which install oil pan upper onto cylinder block.

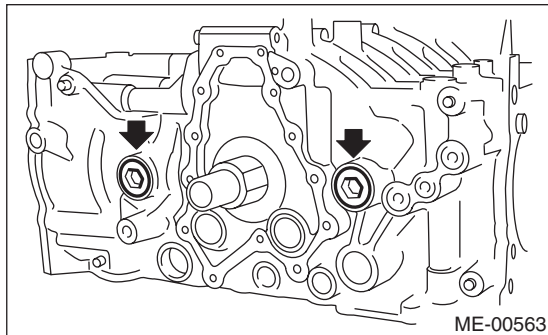
**NOTE:**

Installation bolt has five different sizes. To prevent the confusion in installation, keep these bolts on container individually.



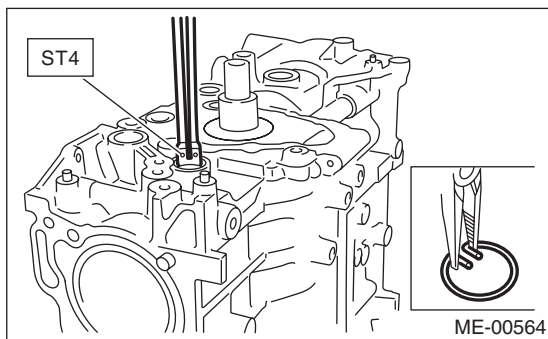
- (A) M8 × 40
- (B) M8 × 65
- (C) M8 × 85
- (D) M8 × 130.5
- (E) M8 × 24

18) Remove the service hole cover and service hole plugs using a hexagon wrench.



19) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then, using the ST, remove the piston snap ring through service hole of #1 and #2 cylinders.

ST 18233AA000 PISTON PIN SNAP RING PLIERS

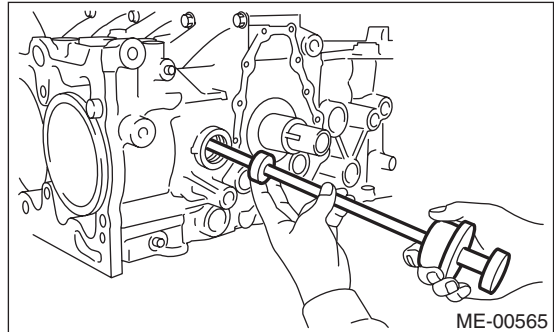


20) Draw out the piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

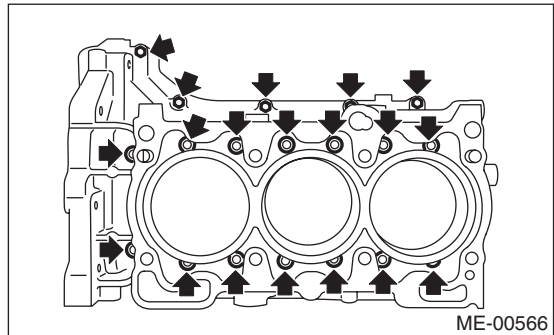
**NOTE:**

Be careful not to confuse the original combination of piston, piston pin and cylinder.



21) Similarly remove the piston pins from #3, #4, #5, and #6 pistons.

22) Remove the cylinder block connecting bolts.



23) Separate the cylinder block (LH) and (RH).

**NOTE:**

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.

24) Remove the rear oil seal.

25) Remove the crankshaft together with connecting rod.

26) Remove the crankshaft bearings from cylinder block using a hammer handle.

**NOTE:**

- Be careful not to confuse the crankshaft bearing combination.
- Press the bearing at the end opposite to locking lip.

27) Draw out each piston from cylinder block using wooden bar or hammer handle.

**NOTE:**

Be careful not to confuse the original combination of piston and cylinder.



# Cylinder Block

MECHANICAL

## B: INSTALLATION

1) After setting the cylinder block to ST, install the crankshaft bearing.

ST 18232AA000 ENGINE STAND

NOTE:

Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.

2) Position the crankshaft on the cylinder block (RH).

3) Apply liquid gasket to the mating surfaces of cylinder block (RH), and position the cylinder block (LH).

NOTE:

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

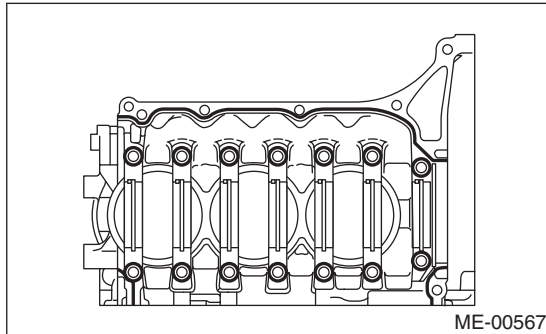
**THREE BOND 1217G (Part No. K0877Y0100)  
or equivalent**

NOTE:

Do not allow liquid gasket to run over to oil passages, bearing grooves, etc.

**Applying liquid gasket diameter:**

**$1.0 \pm 0.2$  mm ( $0.039 \pm 0.008$  in)**



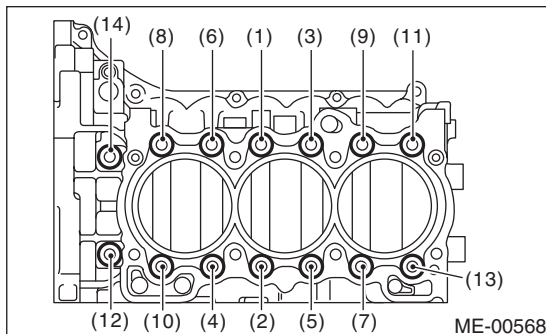
4) Apply a coat of engine oil to the washer and bolt thread.

5) Tighten all bolts in the numerical order as shown in the figure.

**Tightening torque:**

**(1) — (11), (13): 25 N·m (2.5 kgf·m, 18.4 ft·lb)**

**(12), (14): 20 N·m (2.0 kgf·m, 14.8 ft·lb)**

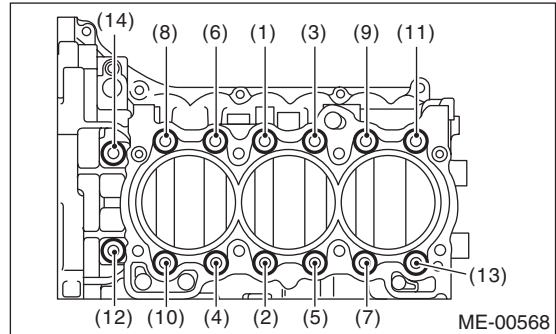


6) Retighten all bolts in the numerical order as shown in the figure.

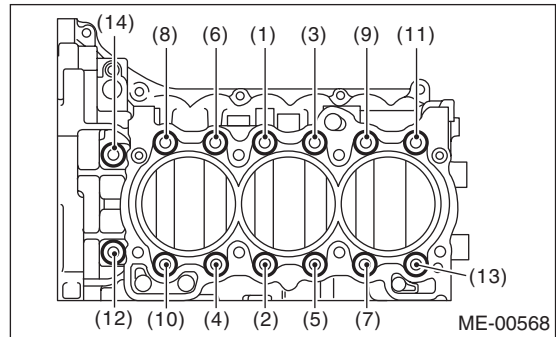
**Tightening torque:**

**(1) — (11), (13): 25 N·m (2.5 kgf·m, 18.4 ft·lb)**

**(12), (14): 20 N·m (2.0 kgf·m, 14.8 ft·lb)**



7) Tighten all bolts 90° — 110° in the numerical order as shown in the figure.



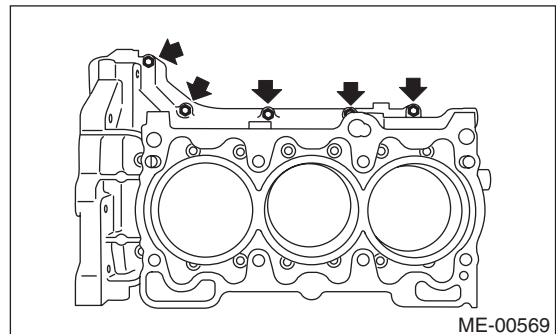
8) Install the upper bolt to cylinder block.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

NOTE:

After tightening the cylinder block connecting bolts, remove the liquid gasket which is running over to the sealing surface for rear chain cover and oil pan upper.



# Cylinder Block

MECHANICAL

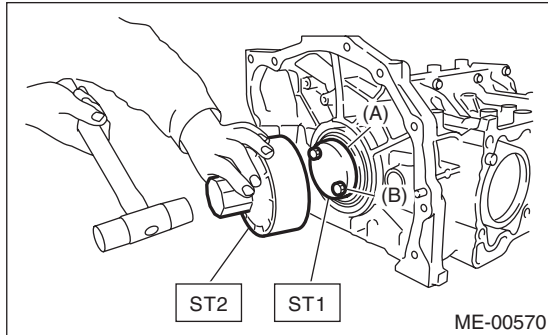
9) Apply a coat of engine oil to the oil seal periphery, then install the rear oil seal using ST1 and ST2.

**NOTE:**

Use a new rear oil seal.

ST1 499597100 CRANKSHAFT OIL SEAL GUIDE

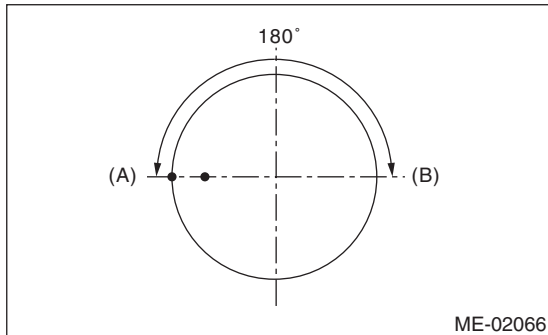
ST2 499587200 CRANKSHAFT OIL SEAL INSTALLER



- (A) Rear oil seal
- (B) Drive plate installation bolt

10) Position the top ring gap at (A) in the figure.

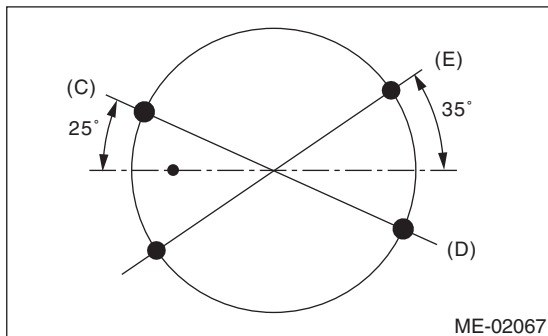
11) Position the second ring gap at (B) in the figure.



12) Position the upper rail gap at (C) in the figure.

13) Position the expander gap at (D) in the figure.

14) Position the lower rail gap at (E) in the figure.



**CAUTION:**

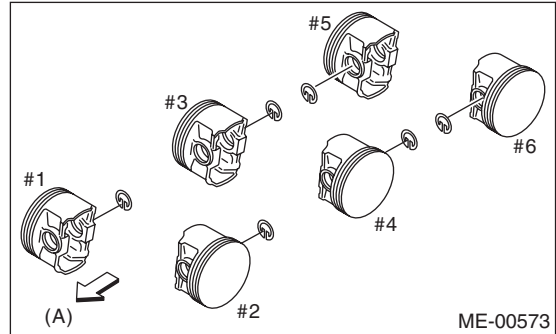
- Make sure ring gaps do not face the same direction.
- Make sure ring gaps are not within the piston skirt area.
- Assemble it so that R mark faces to top side of piston.

15) Install the snap ring.

Install the snap rings in the piston holes located opposite to the service holes in cylinder block when positioning all pistons in corresponding cylinders.

**NOTE:**

Use new snap rings.

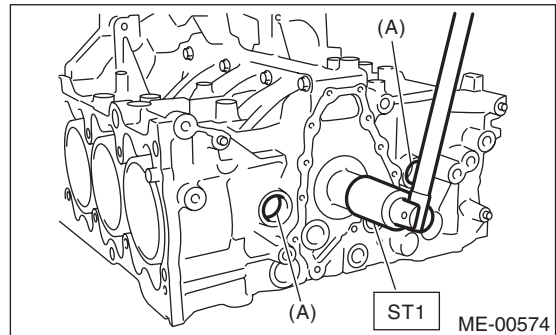


(A) Front side of vehicle

16) Installing piston:

(1) Using the ST1, turn the crankshaft so that #3 and #4 connecting rod small ends are set on the service hole (A).

ST1 18252AA000 CRANKSHAFT SOCKET



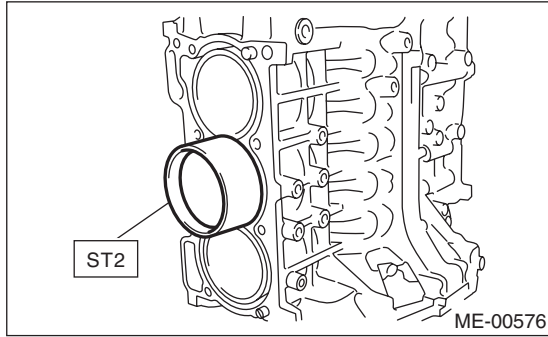
(2) Apply a thin coat of engine oil to piston and cylinder.

# Cylinder Block

## MECHANICAL

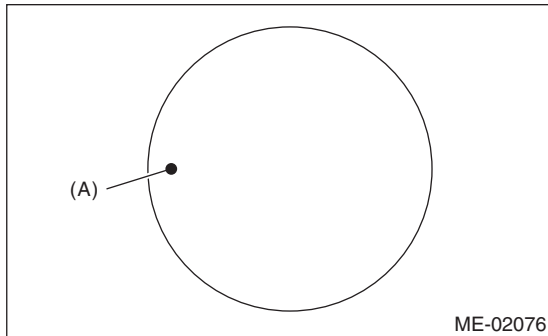
(3) Using the ST2, press-fit the piston into cylinder.

ST2 18254AA000 PISTON GUIDE



**NOTE:**

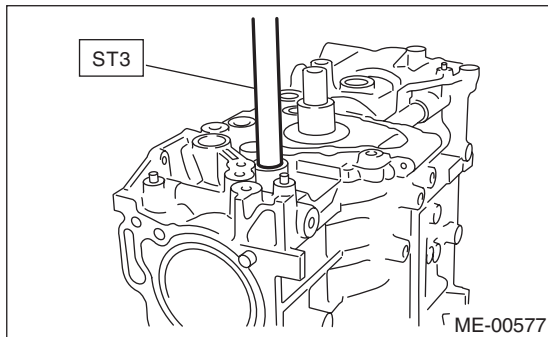
Let the piston front mark (A) face towards the front of engine.



17) Installing piston pin:

(1) Apply a coat of engine oil to ST3 before insertion, and then insert it into the service hole to align piston pin hole with connecting rod small end.

ST3 18253AA000 PISTON PIN GUIDE



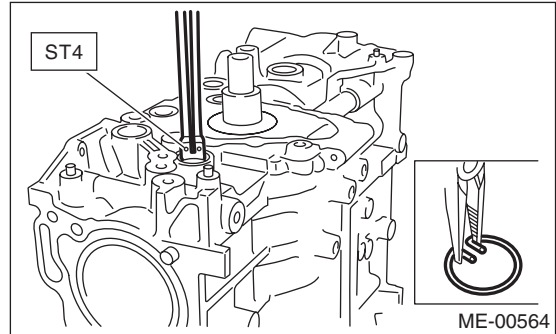
(2) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.

(3) Using the ST4, install the snap ring.

ST4 18233AA000 PISTON PIN SNAP RING PLIERS

**NOTE:**

Use new snap rings.



(4) Similarly install the #1, #2, #5 and #6 pistons.

18) Install the service hole plug and O-ring.

**NOTE:**

Use new O-rings.

19) Apply liquid gasket to the mating surface of oil pan upper.

**NOTE:**

Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

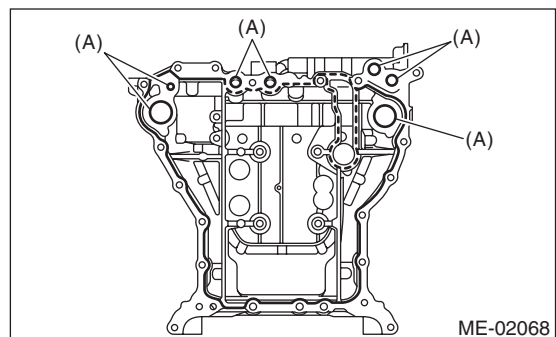
**Applying liquid gasket diameter:**

**Full line part**

**3.0±1.0 mm (0.12±0.04 in)**

**Broken line part**

**1.0 mm (0.04 in)**



(A) O-ring

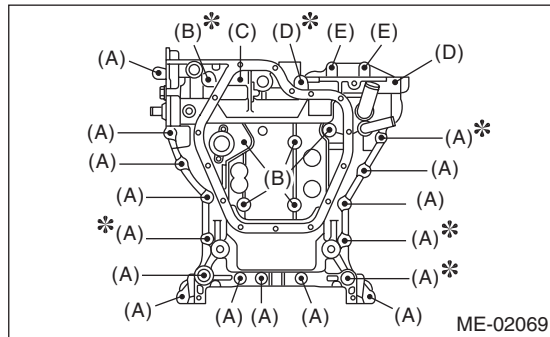
**NOTE:**

Use new O-rings.

20) Temporarily tighten the oil pan upper.

NOTE:

Do not install the bolts in wrong place.

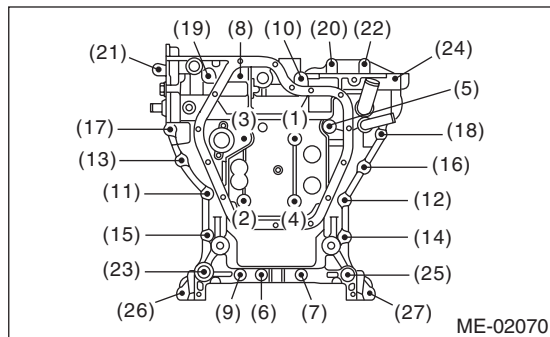


- (A) M8 × 40
- (B) M8 × 65
- (C) M8 × 85
- (D) M8 × 130.5
- (E) M8 × 24
- \*: Coating

21) Tighten the oil pan upper installing bolts in the numerical order as shown in the figure.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



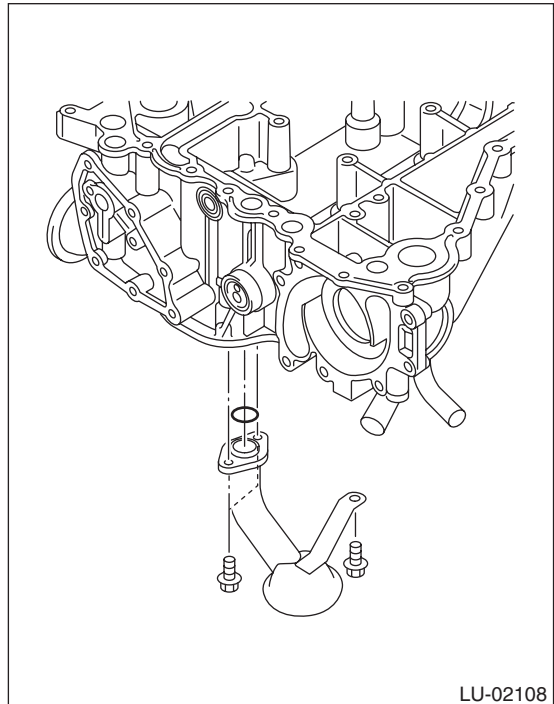
22) Install the oil strainer.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

NOTE:

Use new O-rings.



23) Apply liquid gasket to the matching surface of oil pan lower.

NOTE:

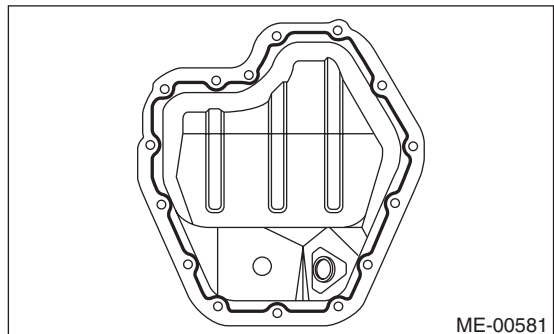
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100) or equivalent**

**Applying liquid gasket diameter:**

**5.0±1.0 mm (0.20±0.04 in)**



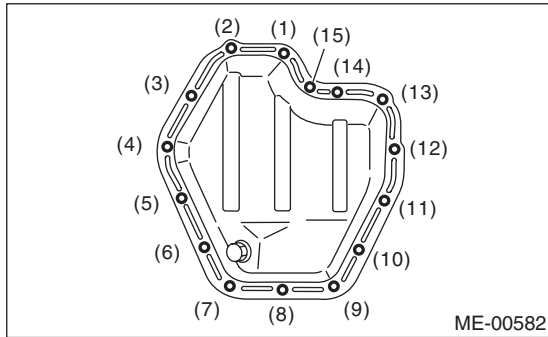
# Cylinder Block

## MECHANICAL

24) Tighten the oil pan lower installing bolts in the numerical order as shown in the figure.

**Tightening torque:**

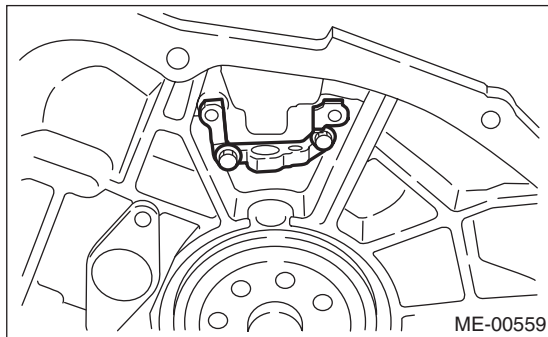
**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



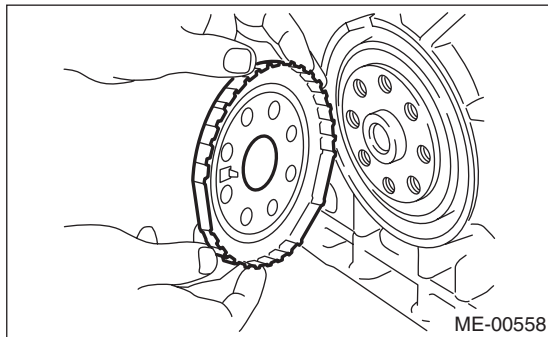
25) Install the crankshaft position sensor holder.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



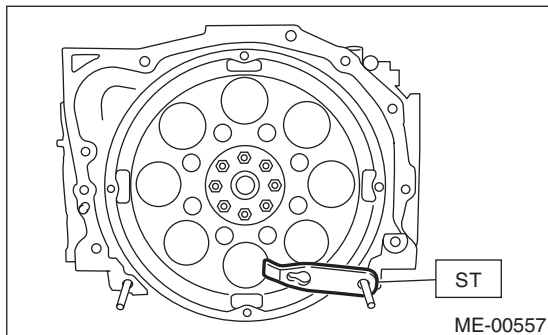
26) Install the crankshaft sensor plate.



27) Using the ST, install the drive plate.  
ST 498497100 CRANKSHAFT STOPPER

**Tightening torque:**

**81 N·m (8.3 kgf·m, 60 ft·lb)**



28) Install the cylinder head. <Ref. to ME(H6DO)-58, INSTALLATION, Cylinder Head.>

29) Install the camshaft. <Ref. to ME(H6DO)-55, INSTALLATION, Camshaft.>

30) Install the rear chain cover. <Ref. to ME(H6DO)-52, INSTALLATION, Rear Chain Cover.>

31) Install the crank sprocket. <Ref. to ME(H6DO)-51, INSTALLATION, Crank Sprocket.>

32) Install the cam sprocket. <Ref. to ME(H6DO)-50, INSTALLATION, Cam Sprocket.>

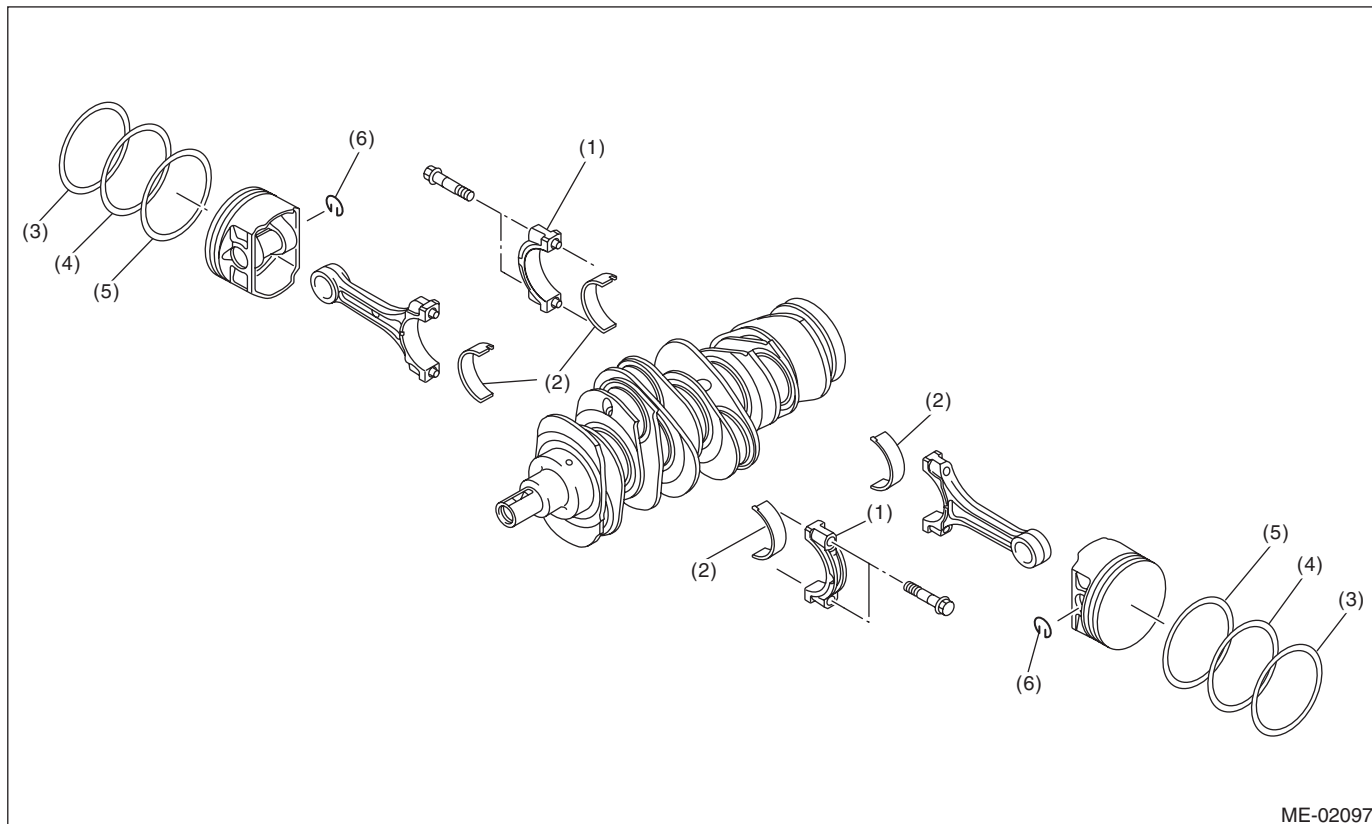
33) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>

34) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>

35) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>

36) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>

## C: DISASSEMBLY



- |                            |                 |               |
|----------------------------|-----------------|---------------|
| (1) Connecting rod cap     | (3) Top ring    | (5) Oil ring  |
| (2) Connecting rod bearing | (4) Second ring | (6) Snap ring |

- 1) Remove the connecting rod cap.
- 2) Remove the connecting rod bearing.

**NOTE:**

Arrange the removed connecting rod, connecting rod cap and bearing in order, to prevent confusion.

3) Remove the piston rings using piston ring expander.

4) Remove the oil ring by hand.

**NOTE:**

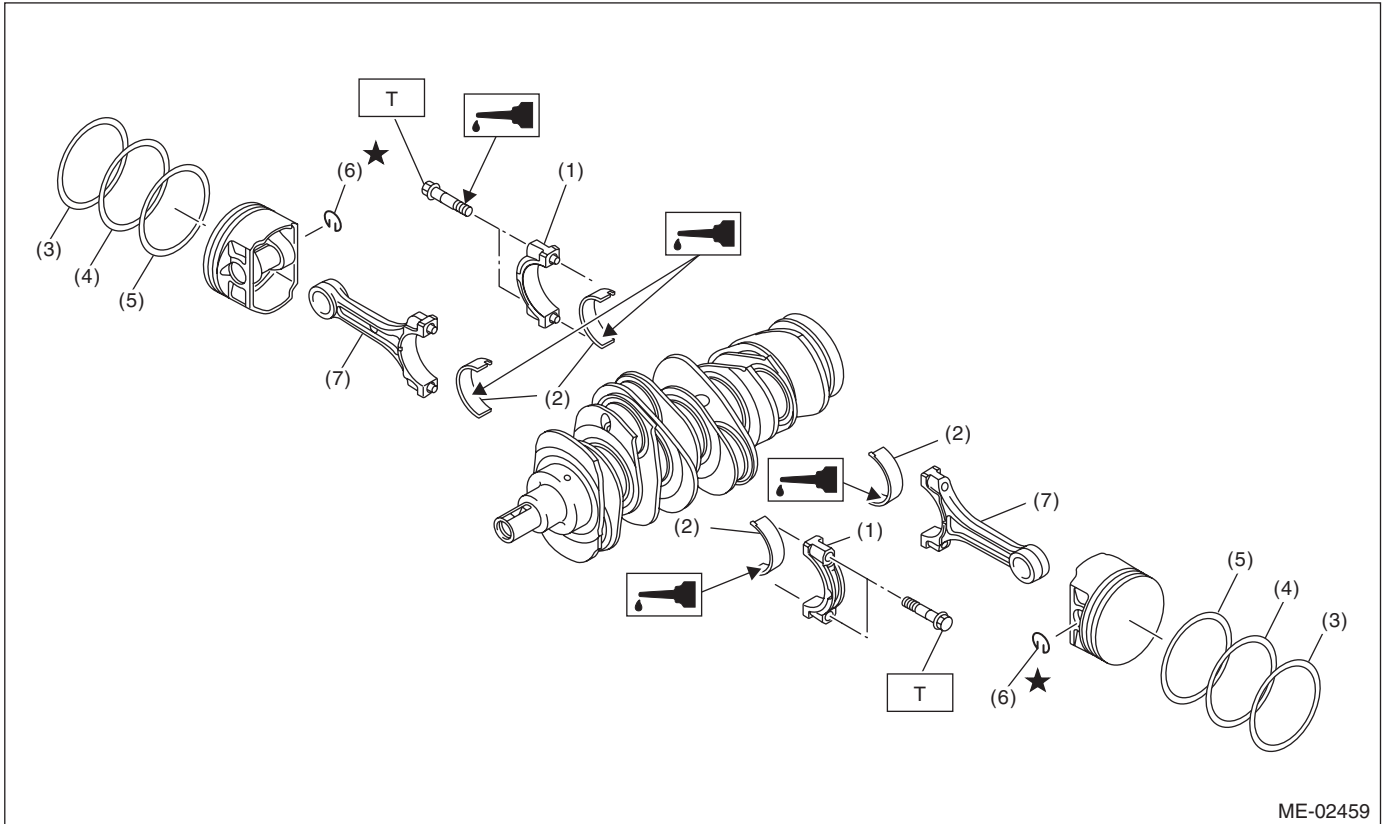
Arrange the removed piston rings in proper order, to prevent confusion.

5) Remove the snap ring.

# Cylinder Block

MECHANICAL

## D: ASSEMBLY



ME-02459

- |                            |                    |
|----------------------------|--------------------|
| (1) Connecting rod cap     | (5) Oil ring       |
| (2) Connecting rod bearing | (6) Snap ring      |
| (3) Top ring               | (7) Connecting rod |
| (4) Second ring            |                    |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 53 (5.4, 39)**

- 1) Apply oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
- 2) Position each connecting rod with the marking side facing forward.
- 3) Install the connecting rod cap. Make sure the arrow mark on connecting rod cap facing front during installation.

### CAUTION:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod bolts, apply oil on the threads and flange end.

### Tightening torque:

**53 N·m (5.4 kgf·m, 39 ft·lb)**

- 4) Install the oil ring spacer, upper rail and lower rail by hand.
- 5) Install the second ring and top ring using piston ring expander.

## E: INSPECTION

### 1. CYLINDER BLOCK

- 1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
- 2) Check the oil passages for clogging.
- 3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge. If the warping exceeds the limit, replace the cylinder block.

**Warping limit:**  
**0.02 mm (0.0008 in)**

**Standard height of cylinder block:**  
**202 mm (7.95 in)**

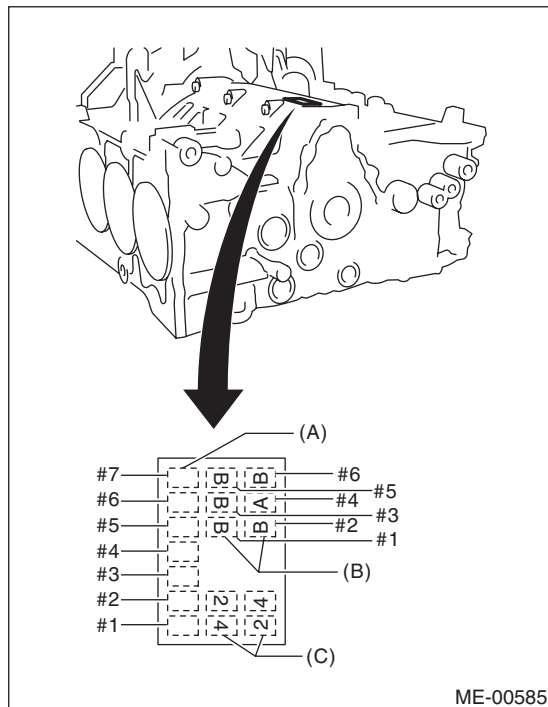
### 2. CYLINDER AND PISTON

- 1) The cylinder bore size is stamped on the front upper face of the cylinder block.

**NOTE:**

- Measurement should be performed at a temperature of 20°C (68°F).
- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.

**Standard diameter:**  
**A: 89.205 — 89.215 mm (3.5120 — 3.5124 in)**  
**B: 89.195 — 89.205 mm (3.5116 — 3.5120 in)**



- (A) Main journal size mark
- (B) Cylinder bore size mark
- (C) Cylinder block (RH) - (LH) combination mark

- 2) How to measure the inner diameter of each cylinder:

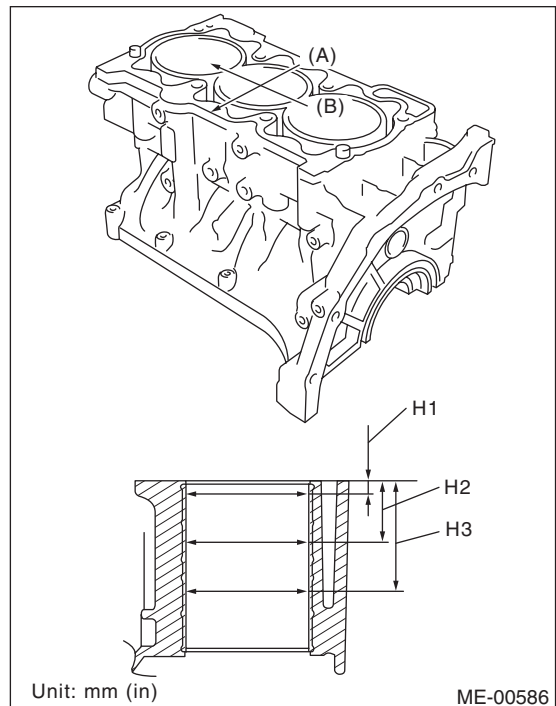
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

**NOTE:**

Measurement should be performed at a temperature of 20°C (68°F).

**Cylindricity:**  
**Standard**  
**0.030 mm (0.0012 in)**

**Out-of-roundness:**  
**Standard**  
**0.010 mm (0.0004 in)**



- (A) Piston pin direction
- (B) Thrust direction
- H1: 10 mm (0.39 in)
- H2: 45 mm (1.77 in)
- H3: 80 mm (3.15 in)

- 3) When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.



# Cylinder Block

## MECHANICAL

4) How to measure the outer diameter of each piston:

Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

**NOTE:**

Measurement should be performed at a temperature of 20°C (68°F).

**Piston grade point H:**  
**37.3 mm (1.4685 in)**

**Piston outer diameter:**

**Standard**

**A: 89.205 — 89.215 mm (3.5120 — 3.5124 in)**

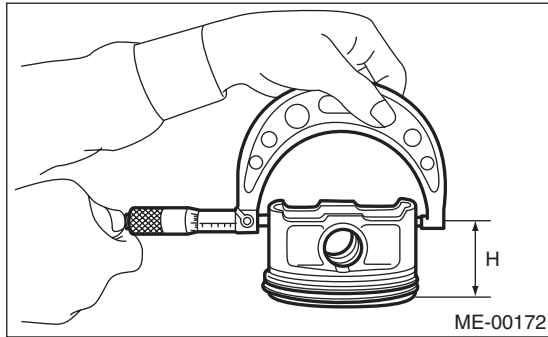
**B: 89.195 — 89.205 mm (3.5116 — 3.5120 in)**

**0.25 mm (0.0098 in) oversize**

**89.445 — 89.465 mm (3.5215 — 3.5222 in)**

**0.50 mm (0.0197 in) oversize**

**89.695 — 89.715 mm (3.5313 — 3.5321 in)**



5) Calculate the clearance between cylinder and piston.

**NOTE:**

Measurement should be performed at a temperature of 20°C (68°F).

**Cylinder to piston clearance at 20°C (68°F):**

**Standard**

**-0.010 — 0.010 mm (-0.0004 — 0.0004 in)**

6) Boring and honing:

(1) If the value of cylindrically, out-of-roundness, or cylinder-to-piston clearance measured is out of standard or if there is any damage on the cylinder wall, rebores it to use an oversize piston.

**CAUTION:**

• When any of the cylinders needs reboring, other cylinders must be bored at the same time, and replaced with oversize pistons.

• Do not perform boring on one cylinder only. Do not replace only a single cylinder for an oversize piston.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

**Cylinder inner diameter boring limit (diameter):**  
**To 89.715 mm (3.5321 in)**

**NOTE:**

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

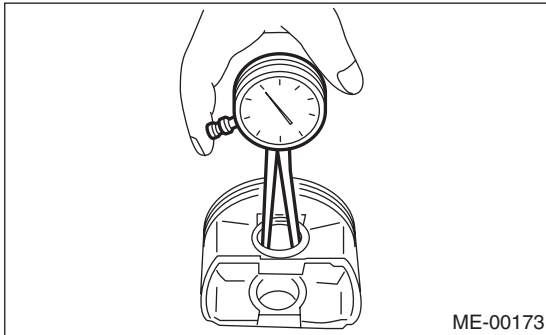
### 3. PISTON AND PISTON PIN

- 1) Check the piston and piston pin for breaks, cracks or wear. Replace if faulty.
- 2) Check the piston ring groove for wear or damage. Replace if faulty.
- 3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

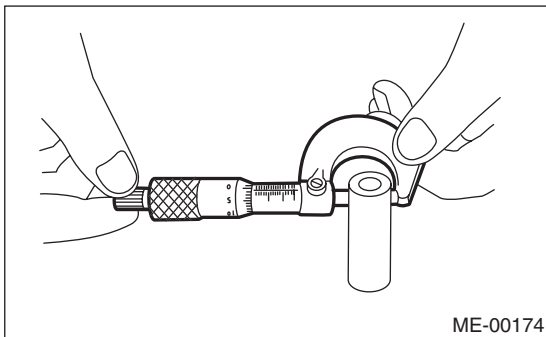
**Standard clearance between piston pin and hole in piston:**

**Standard**

**0.004 — 0.008 mm (0.0002 — 0.0003 in)**

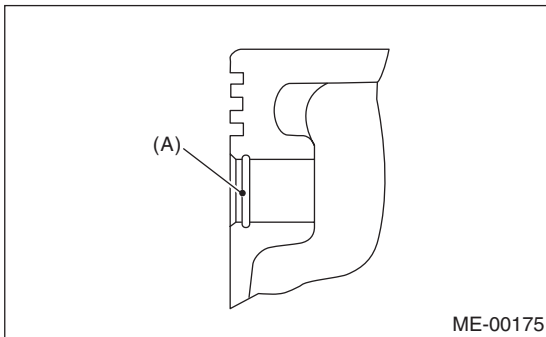


ME-00173



ME-00174

- 4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.



ME-00175

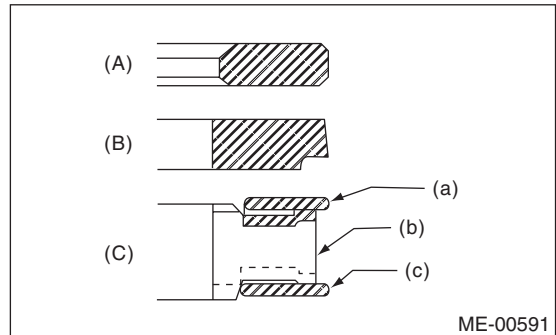
- 5) Check the piston pin snap ring for distortion, cracks and wear.

### 4. PISTON RING

- 1) If the piston ring is broken, damaged or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new part of the same size as piston.

**NOTE:**

- The top ring and second ring have the mark to determine the direction to install on them. When installing the ring to piston, face this mark to the top side.
- Oil ring consists of the upper rail, expander and lower rail. When installing on the piston, be careful of the direction of each rail.

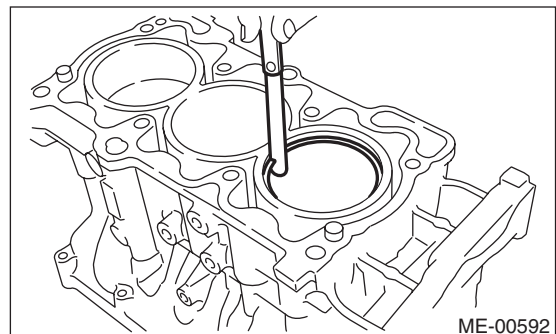


ME-00591

- (A) Top ring
- (B) Second ring
- (C) Oil ring
- (a) Upper rail
- (b) Expander
- (c) Lower rail

- 2) Squarely place the piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

		Standard mm (in)
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)
	Second ring	0.35 — 0.50 (0.0138 — 0.0197)
	Oil ring	0.20 — 0.60 (0.0079 — 0.0236)



ME-00592

# Cylinder Block

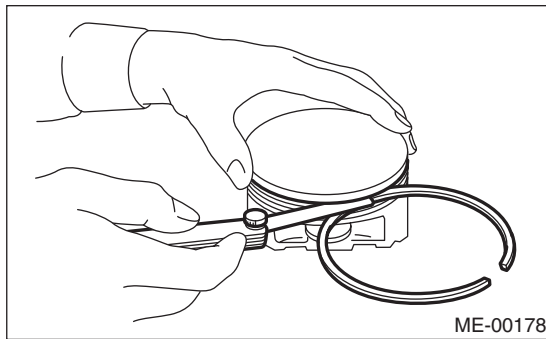
## MECHANICAL

3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

### NOTE:

Before measuring the clearance, clean the piston ring groove and piston ring.

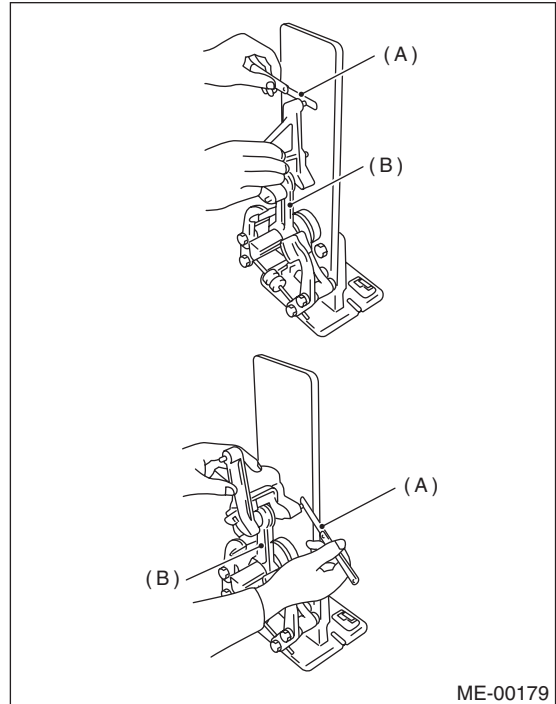
		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)
Clearance between oil ring and oil ring groove		0.045 — 0.125 (0.0018 — 0.0049)



## 5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.

2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if it has the bend or twist.



(A) Thickness gauge

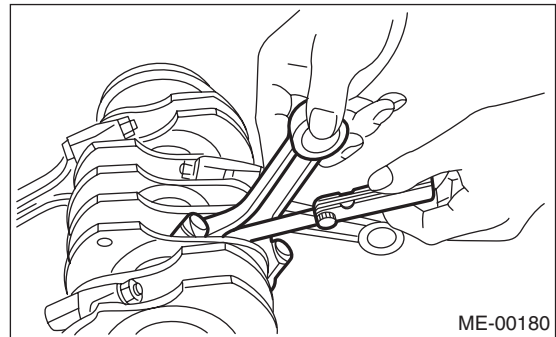
(B) Connecting rod

3) Install the connecting rod fitted with bearing to crankshaft and measure the thrust clearance. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

### **Connecting rod thrust clearance:**

#### **Standard**

**0.070 — 0.330 mm (0.0028 — 0.0130 in)**



4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or under-size as necessary. (See the table below.)

**Connecting rod oil clearance:**

**Standard**

**0.016 — 0.043 mm (0.0006 — 0.0017 in)**

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.506 (0.0587 — 0.0593)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.509 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.519 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.619 — 1.623 (0.0637 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

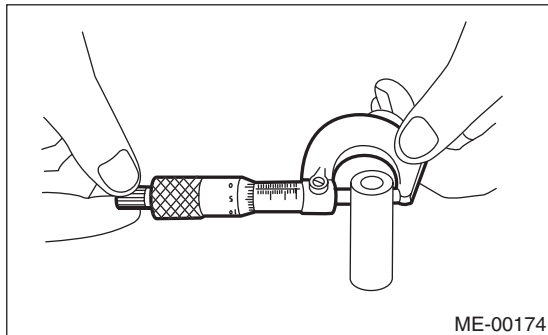
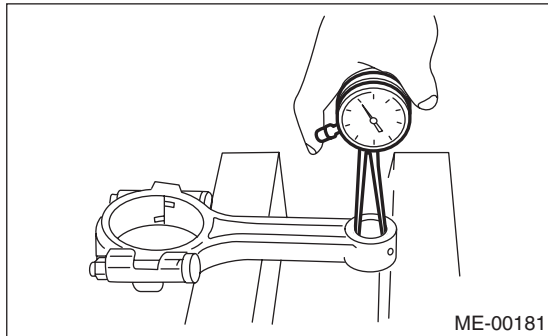
6) Inspect the bushing at connecting rod small end, and replace if worn or damaged.

7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace it with a new part.

**Clearance between piston pin and bushing:**

**Standard**

**0 — 0.022 mm (0 — 0.0009 in)**

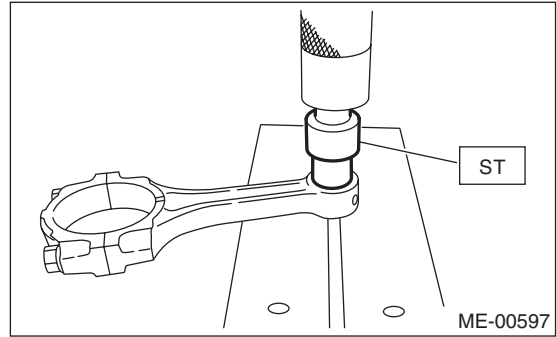


8) The replacement procedure for the connecting rod small end bushing is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with ST after applying oil on the periphery of bushing.

ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in the pressed bushing by aligning with the pre-manufactured holes on the connecting rod, and ream the inside of the bushing.

(4) After completion of reaming, clean the bushing to remove chips.

# Cylinder Block

MECHANICAL

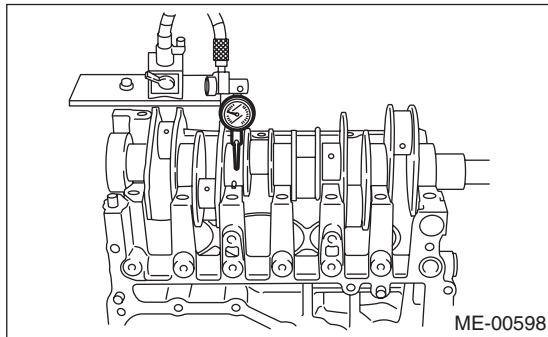
## 6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. Replace if defective.

2) Check the crankshaft for bend, and repair or replace if needed. Repair or replace if bended.

### NOTE:

If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on these bearings, and then check the crankshaft bend using a dial gauge.



3) Inspect the crank journal and crank pin for wear. If they are not within the specification, replace the bearing with a suitable (undersize) one, and replace or readjust crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

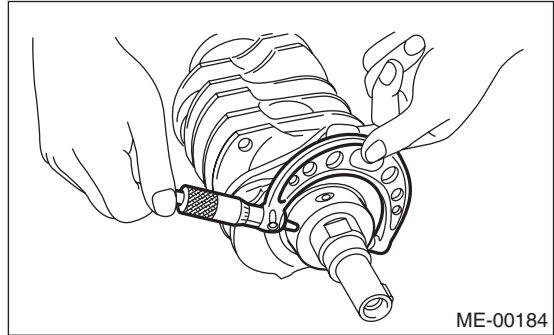
### Crank pin and crank journal:

#### Out-of-roundness

**0.005 mm (0.0002 in)**

#### Cylindricity

**0.006 mm (0.0002 in)**



		Crank journal diameter		Crank pin outer diameter
		#1, #3, #5, #7	#2, #4, #6	
Standard	Journal O.D.	63.992 — 64.008 (2.5194 — 2.5200)		51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.992 — 2.005 (0.0784 — 0.0789)	1.996 — 2.009 (0.0786 — 0.0791)	1.490 — 1.506 (0.0587 — 0.0593)
0.03 (0.0012) undersize	Journal O.D.	63.962 — 63.978 (2.5182 — 2.5188)		51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.011 — 2.014 (0.0792 — 0.0793)	2.015 — 2.018 (0.0793 — 0.0794)	1.509 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) undersize	Journal O.D.	63.942 — 63.958 (2.5174 — 2.5180)		51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.021 — 2.024 (0.0796 — 0.0797)	2.025 — 2.028 (0.0797 — 0.0798)	1.519 — 1.523 (0.0598 — 0.0600)
0.25 (0.0098) undersize	Journal O.D.	63.742 — 63.758 (2.5095 — 2.5102)		51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.121 — 2.124 (0.0835 — 0.0836)	2.125 — 2.128 (0.0837 — 0.0838)	1.619 — 1.623 (0.0637 — 0.0639)

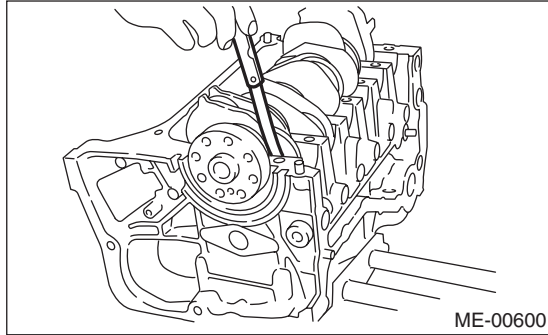
Unit: mm (in)

4) Measure the thrust clearance of crankshaft at center bearing by using thickness gauge. If the thrust clearance is not within the standard, replace the bearing.

**Crankshaft thrust clearance:**

**Standard**

**0.030 — 0.115 mm (0.0012 — 0.0045 in)**



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.

6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or recondition the crankshaft as necessary.

**Crankshaft oil clearance:**

**Standard**

**0.010 — 0.030 mm (0.0004 — 0.0012 in)**

## 22. Oil Flow Control Solenoid Valve

### A: REMOVAL

Oil flow control solenoid valve is a unit with camshaft cap. Refer to "Camshaft" for removal procedure.  
<Ref. to ME(H6DO)-54, REMOVAL, Camshaft.>

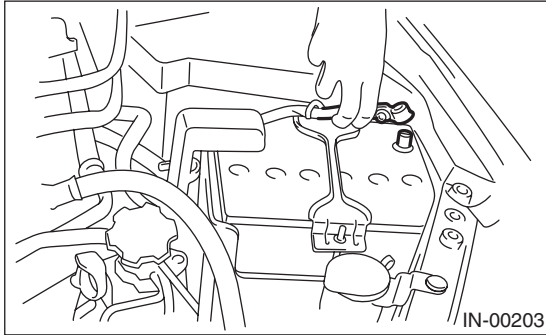
### B: INSTALLATION

Install in the reverse order of removal.

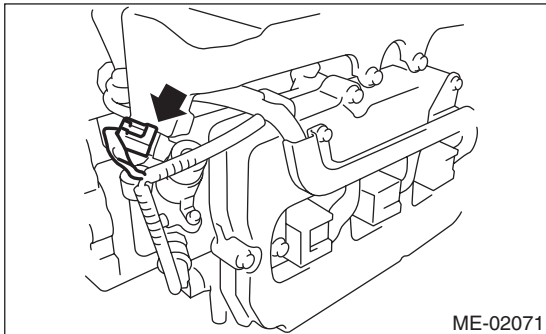
## 23.Oil Switching Solenoid Valve

### A: REMOVAL

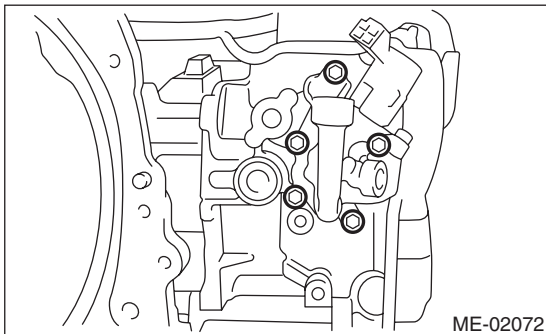
- 1) Disconnect the ground cable from battery.



- 2) Remove the air intake chamber. <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 3) Disconnect the connector from the oil switching solenoid valve.



- 4) Remove the oil switching solenoid valve.
- 5) Remove the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H6DO)-29, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>
- 6) Remove the oil temperature sensor. <Ref. to FU(H6DO)-30, REMOVAL, Oil Temperature Sensor.>
- 7) Remove the oil switching solenoid valve holder from the cylinder head.



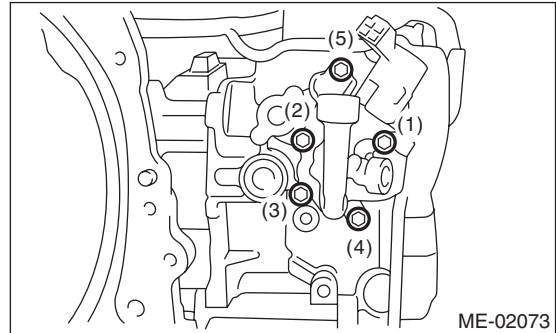
### B: INSTALLATION

- 1) Install the oil switching solenoid valve holder.

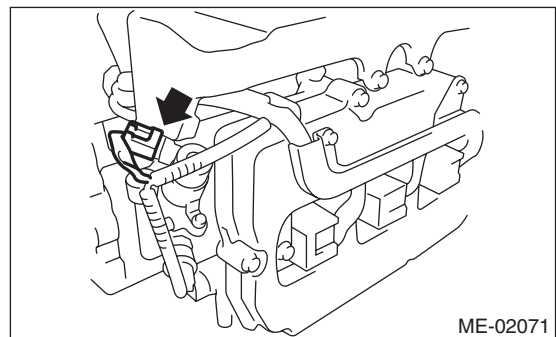
#### NOTE:

Use a new gasket.

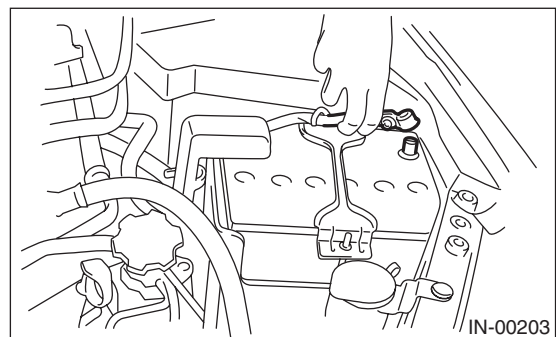
- (1) Temporarily tighten the bolts by tightening torque of 5 — 10 N·m (0.5 — 1.0 kgf·m, 3.7 — 7.4 ft·lb) in order shown in the figure.
- (2) Tighten the bolts by tightening torque of  $10 \pm 0.5$  N·m ( $1.0 \pm 0.05$  kgf·m,  $7.4 \pm 0.37$  ft·lb) in order shown in the figure.



- 2) Install the oil temperature sensor. <Ref. to FU(H6DO)-30, INSTALLATION, Oil Temperature Sensor.>
- 3) Install the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H6DO)-29, INSTALLATION, Variable Valve Lift Diagnosis Oil Pressure Switch.>
- 4) Install the oil switching solenoid valve.
- 5) Connect the connector to oil switching solenoid valve.



- 6) Install the air intake chamber. <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>
- 7) Connect the battery ground cable to the battery.





## 24. Intake and Exhaust Valve

### A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of intake and exhaust valves. <Ref. to ME(H6DO)-58, REMOVAL, Cylinder Head.>  
<Ref. to ME(H6DO)-58, INSTALLATION, Cylinder Head.>

## 25.Piston

### A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons. <Ref. to ME(H6DO)-64, REMOVAL, Cylinder Block.> <Ref. to ME(H6DO)-66, INSTALLATION, Cylinder Block.>

## 26.Connecting Rod

### A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(H6DO)-64, REMOVAL, Cylinder Block.> <Ref. to ME(H6DO)-66, INSTALLATION, Cylinder Block.>

## 27.Crankshaft

### A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of crankshaft. <Ref. to ME(H6DO)-64, REMOVAL, Cylinder Block.> <Ref. to ME(H6DO)-66, INSTALLATION, Cylinder Block.>

# Engine Trouble in General

MECHANICAL

## 28.Engine Trouble in General

### A: INSPECTION

NOTE:

The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Most likely" to "Rarely".

A — Very often

B — Sometimes

C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch or neutral switch	C
		Defective starter	B
	Battery	Improper connection of terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B
Trouble of valve lifter		C	
Trouble of valve lifter. In case noise occurs with valve moving. Or when the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.		B	

# Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
Improper engine oil (low viscosity)		B	
Trouble of valve lifter		C	
Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.	B		
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
Worn or broken valve spring		B	
Worn or stuck piston rings, cylinder and piston		C	
Incorrect valve timing		B	
Improper engine oil (low viscosity)		B	
Trouble of valve lifter		C	
Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.	B		

# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of or insufficient fuel	B
	Timing chain	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
		Trouble of valve lifter	C
		Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.	B
	Lubrication system	Incorrect oil pressure	B
		Defective rocker cover gasket	C
Cooling system	Overheat	C	
Others	Evaporative emission control system malfunction	A	
	Stuck or damaged throttle valve	B	

# Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing chain	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
		Trouble of valve lifter	C
Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.		B	
Lubrication system	Incorrect oil pressure	B	
Cooling system	Overheat	C	
	Over-cooling	C	
Others	Evaporative emission control system malfunction	A	



# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
4. Surging	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of or insufficient fuel	C
	Timing chain	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
Incorrect valve timing		A	
Improper engine oil (low viscosity)		B	
Trouble of valve lifter		C	
Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.		B	
Cooling system	Overheat	B	
Others	Evaporative emission control system malfunction	C	
5. Engine does not return to idle.	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Overheat	B
	Others	Evaporative emission control system malfunction	B

# Engine Trouble in General

MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK
7. After burning in exhaust system	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing chain	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
Trouble of valve lifter		C	
Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.	B		
Lubrication system	Incorrect oil pressure	C	
Cooling system	Over-cooling	C	
Others	Evaporative emission control system malfunction	C	
8. Knocking	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing chain	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
		Trouble of valve lifter	C
		Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.	B
Cooling system	Overheat	A	
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
		Lubrication system	Loosened oil pump attaching bolts and defective gasket
	Defective oil filter O-ring		B
	Defective crankshaft oil seal		B
	Defective rocker cover gasket		B
Loosened oil drain plug or defective gasket	B		
Loosened oil pan fitting bolts or defective oil pan	B		

# Engine Trouble in General

## MECHANICAL

Symptoms	Problem parts etc.	Possible cause	RANK	
10. Excessive fuel consumption	Engine control system <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>		A	
	Intake system	Dirty air cleaner element	A	
	Timing chain	Defective timing	B	
	Compression	Incorrect valve clearance		B
		Loosened spark plug or defective gasket		C
		Loosened cylinder head bolt or defective gasket		C
		Improper valve sealing		B
		Defective valve stem		C
		Worn or broken valve spring		C
		Worn or stuck piston rings, cylinder and piston		B
		Incorrect valve timing		B
		Trouble of valve lifter		C
		Trouble of valve lifter. In case noise occurs with valve moving. Or the harness involved to oil switching solenoid valve, variable valve lift diagnosis oil pressure switch and variable valve lift has trouble in a past.		B
	Lubrication system	Incorrect oil pressure	C	
Cooling system	Over-cooling	C		

## 29.Engine Noise

### A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> <li>• Valve mechanism is defective.</li> <li>• Incorrect valve clearance</li> <li>• Worn camshaft</li> <li>• Broken valve spring</li> <li>• Trouble of valve lifter</li> </ul>
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
	Oil pressure is normal.	Damaged engine mounting
High-pitched clank	Sound is noticeable when accelerating with an overload condition.	<ul style="list-style-type: none"> <li>• Ignition timing advanced</li> <li>• Accumulation of carbon inside combustion chamber</li> <li>• Wrong spark plug</li> <li>• Improper gasoline</li> </ul>
Clank when engine speed is between 1,000 and 2,000 rpm.	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn crankshaft main bearing</li> <li>• Worn connecting rod bearing (large end)</li> </ul>
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> <li>• Worn cylinder liner and piston ring</li> <li>• Broken or stuck piston ring</li> <li>• Worn piston pin and hole at piston end of connecting rod</li> </ul>
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	<ul style="list-style-type: none"> <li>• Unusually worn valve lifter</li> <li>• Worn cam gear</li> <li>• Worn camshaft journal bore in cylinder head</li> </ul>
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Poor contact of generator brush and rotor
Gear scream when starting engine	—	<ul style="list-style-type: none"> <li>• Defective ignition starter switch</li> <li>• Worn gear and starter pinion</li> </ul>
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> <li>• Loose drive belt</li> <li>• Defective water pump shaft</li> </ul>
Hissing sound	—	<ul style="list-style-type: none"> <li>• Insufficient compression</li> <li>• Air leakage in air intake system, hose, connection or manifold</li> </ul>
Timing chain noise	—	<ul style="list-style-type: none"> <li>• Loose timing chain</li> <li>• Chain contacting with case/adjacent part</li> </ul>
Valve noise	—	<ul style="list-style-type: none"> <li>• Incorrect valve clearance</li> <li>• Trouble of valve lifter</li> </ul>

**NOTE\*)**

When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

# Engine Noise

MECHANICAL

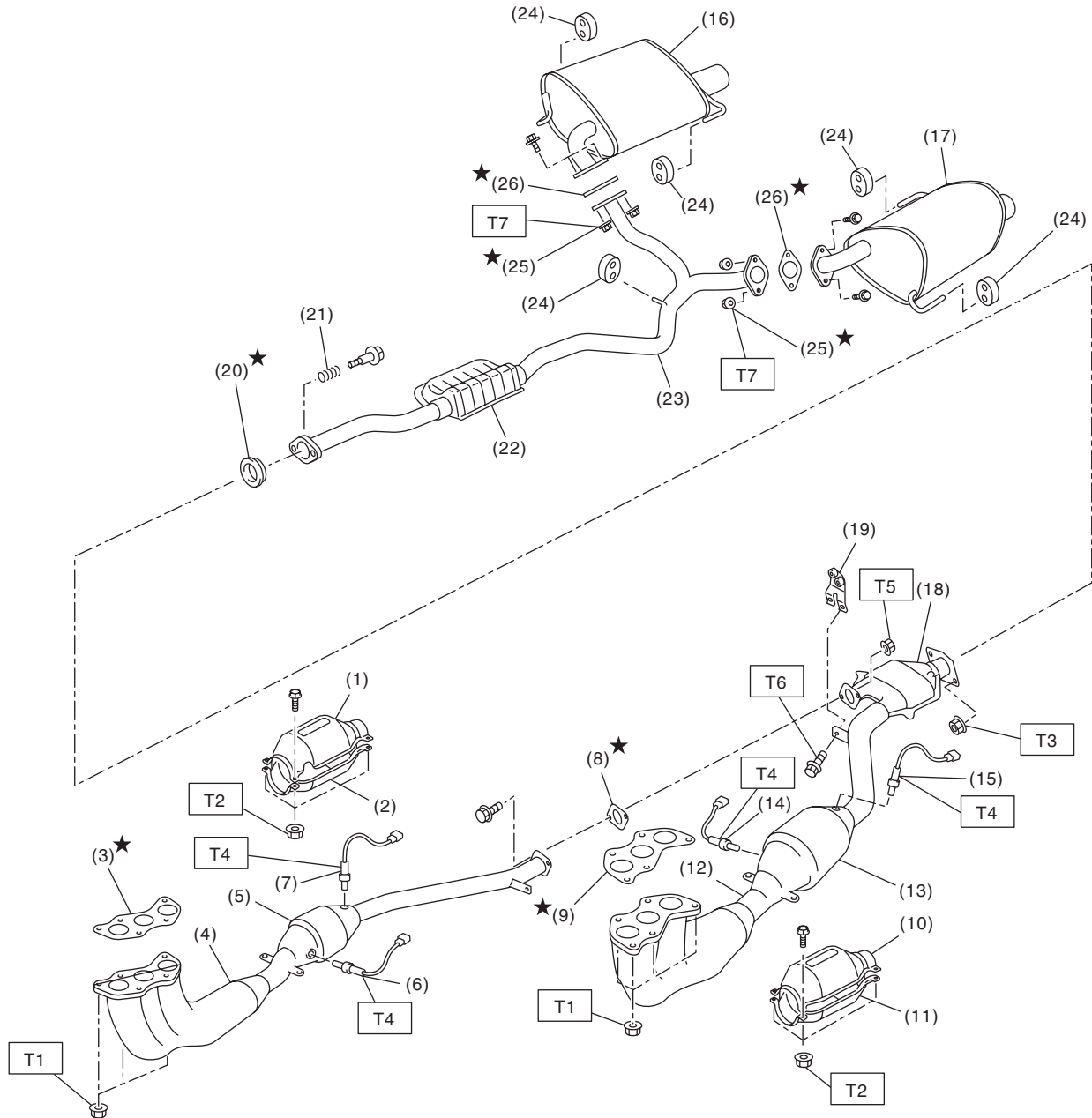
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# General Description

EXHAUST

## 1. General Description

### A: COMPONENT



EX-02208

EX(H6DO)-2

# General Description

EXHAUST

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(1) Front catalytic converter upper cover (RH)	(11) Front catalytic converter lower cover (LH)	(23) Rear exhaust pipe
(2) Front catalytic converter lower cover (RH)	(12) Front exhaust pipe (LH)	(24) Cushion rubber
(3) Gasket	(13) Front catalytic converter (LH)	(25) Self-locking nut
(4) Front exhaust pipe (RH)	(14) Front oxygen (A/F) sensor (LH)	(26) Gasket
(5) Front catalytic converter (RH)	(15) Rear oxygen sensor (LH)	
(6) Front oxygen (A/F) sensor (RH)	(16) Muffler (RH)	
(7) Rear oxygen sensor (RH)	(17) Muffler (LH)	
(8) Gasket	(18) Rear catalytic converter	
(9) Gasket	(19) Bracket	
(10) Front catalytic converter upper cover (LH)	(20) Gasket	
	(21) Spring	
	(22) Chamber	

---

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 70 (7.1, 51.6)**

**T2: 13 (1.3, 9.4)**

**T3: 18 (1.8, 13.3)**

**T4: 21 (2.1, 15.5)**

**T5: 30 (3.1, 22.1)**

**T6: 35 (3.6, 26.0)**

**T7: 48 (4.9, 35.4)**

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## B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

# Front Exhaust Pipe

## EXHAUST

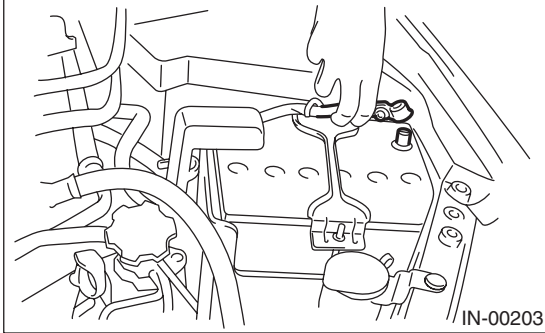
### 2. Front Exhaust Pipe

#### A: REMOVAL

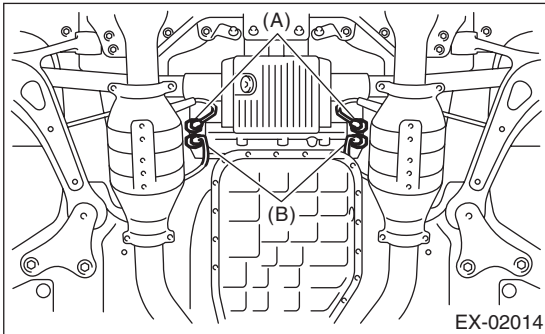
##### CAUTION:

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

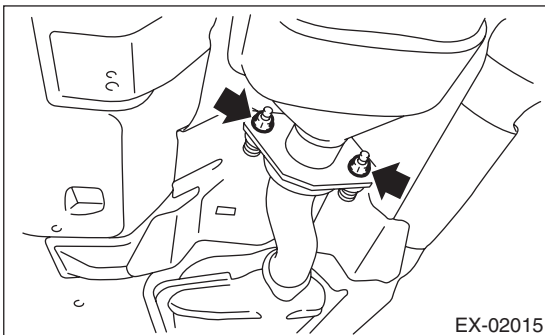
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).



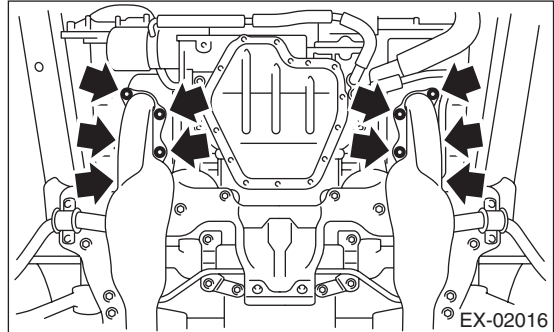
- 6) Separate the front exhaust pipe assembly from the rear exhaust pipe.



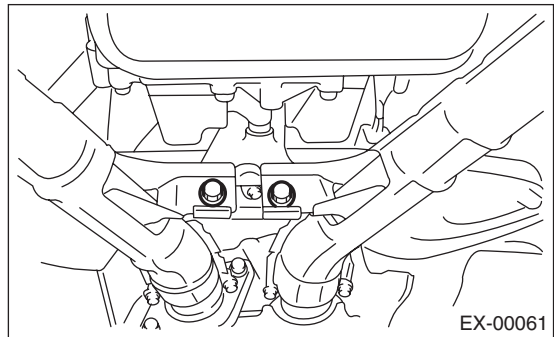
- 7) Remove the nuts which hold front exhaust pipe assembly onto cylinder heads.

##### CAUTION:

Be careful not to pull down the front exhaust pipe assembly.



- 8) Remove the bolts which hold front exhaust pipe assembly to hanger bracket.

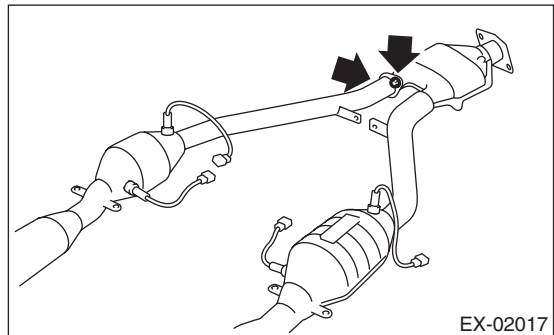


- 9) Remove the front exhaust pipe assembly from vehicle.

##### CAUTION:

- Be careful not to let the front exhaust pipe assembly fall off when removing, since it is very heavy.
- After removing the front exhaust pipe assembly, do not apply excessive pulling force on the rear exhaust pipe.

- 10) Separate the front exhaust pipe (RH) from front exhaust pipe assembly.



- 11) Remove the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H6DO)-31, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H6DO)-33, REMOVAL, Rear Oxygen Sensor.>



## B: INSTALLATION

1) Install the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H6DO)-31, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H6DO)-34, INSTALLATION, Rear Oxygen Sensor.>

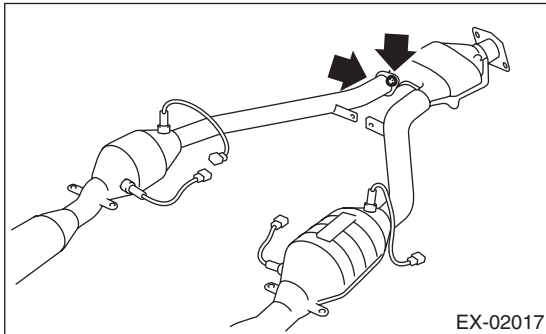
2) Install the front exhaust pipe (RH) to front exhaust pipe (LH).

NOTE:

Use a new gasket.

**Tightening torque:**

**30 N·m (3.1 kgf·m, 22.1 ft·lb)**

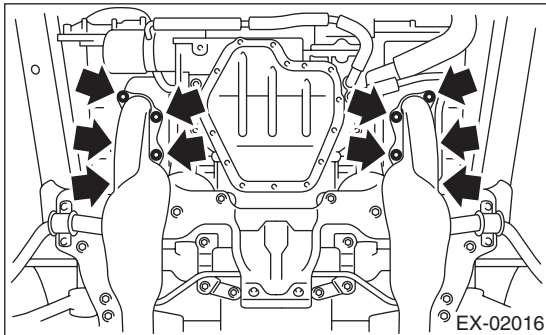


3) Install the front exhaust pipe assembly to vehicle.

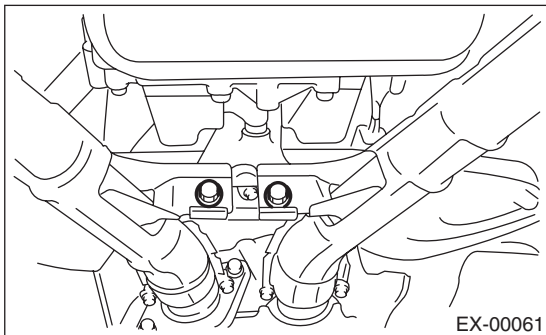
4) Temporarily tighten the nuts which hold front exhaust pipe assembly onto cylinder heads.

NOTE:

Use a new gasket.



5) Temporarily tighten the bolts which hold front exhaust pipe assembly to hanger bracket.



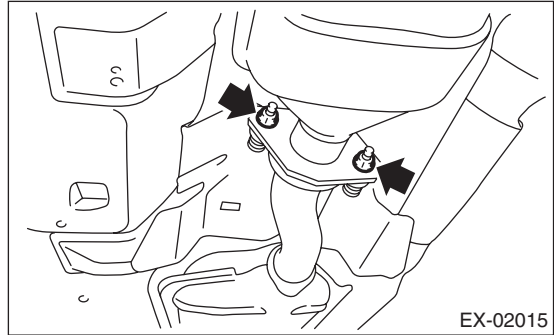
6) Tighten the bolts which install front exhaust pipe to rear exhaust pipe.

NOTE:

Use a new gasket.

**Tightening torque:**

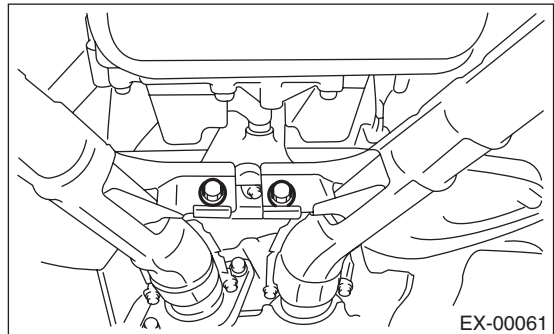
**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



7) Tighten the bolts which hold front exhaust pipe assembly to hanger bracket.

**Tightening torque:**

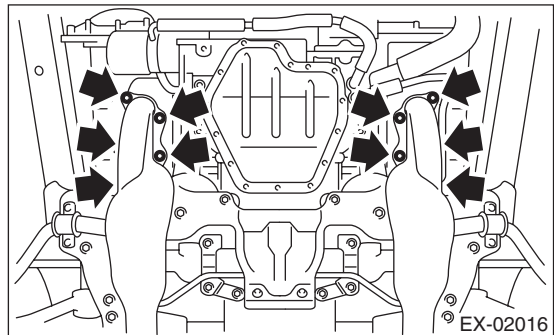
**35 N·m (3.6 kgf·m, 25.8 ft·lb)**



8) Tighten the nuts which hold front exhaust pipe to cylinder heads.

**Tightening torque:**

**70 N·m (7.1 kgf·m, 51.6 ft·lb)**



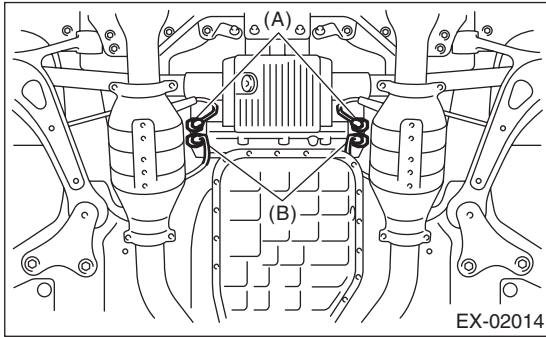
9) Install the under cover.

## Front Exhaust Pipe

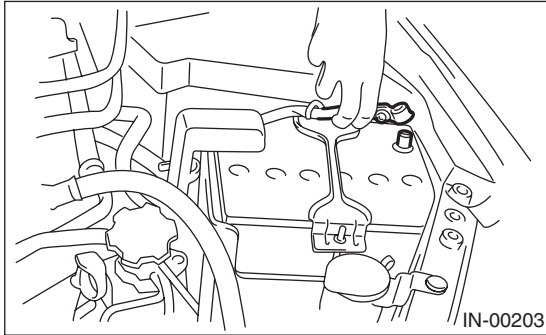
### EXHAUST

---

- 10) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).



- 11) Lower the vehicle.
- 12) Connect the battery ground cable to battery.



### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.

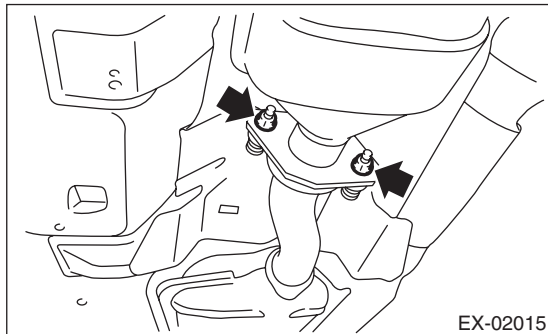
## 3. Rear Exhaust Pipe

### A: REMOVAL

**CAUTION:**

Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the rear exhaust pipe from front exhaust pipe assembly.

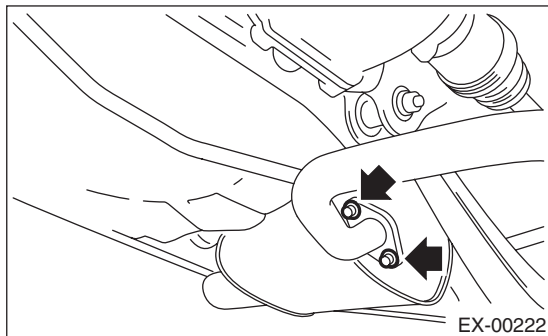


- 4) Separate the rear exhaust pipe from muffler.

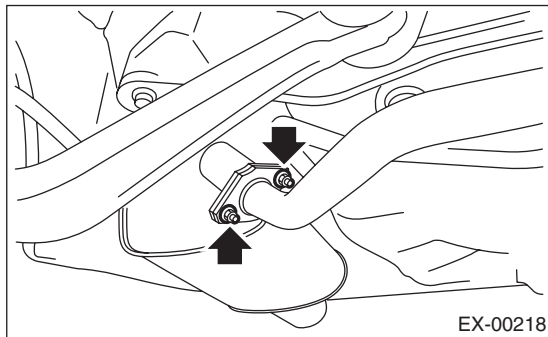
**CAUTION:**

Be careful not to pull down the rear exhaust pipe.

- LH side

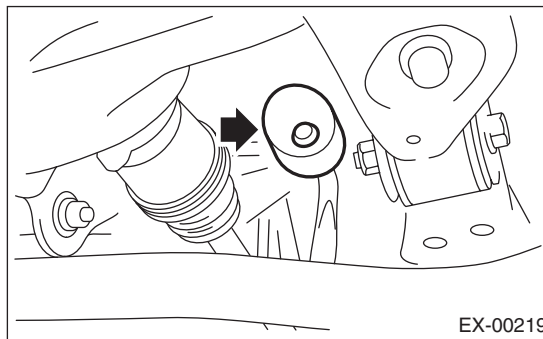


- RH side



- 5) Apply a coat of spray type lubricant to the mating area of cushion rubber.

- 6) Remove the rear exhaust pipe bracket from cushion rubber.



# Rear Exhaust Pipe

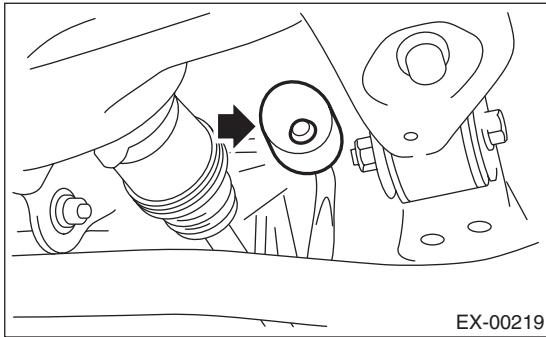
## EXHAUST

### B: INSTALLATION

- 1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
- 2) Install the rear exhaust pipe bracket to cushion rubber.

**NOTE:**

After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.



- 3) Install the rear exhaust pipe to muffler.

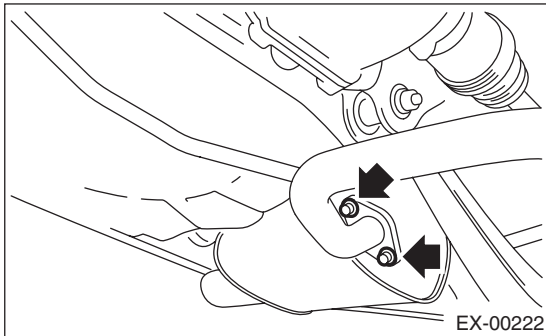
**NOTE:**

Use a new gasket and self-locking nut.

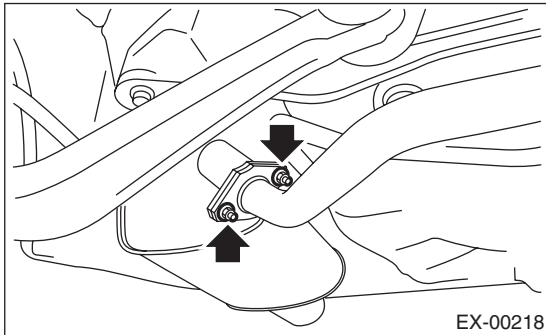
**Tightening torque:**

**48 N·m (4.9 kgf·m, 35.4 ft·lb)**

- LH side



- RH side



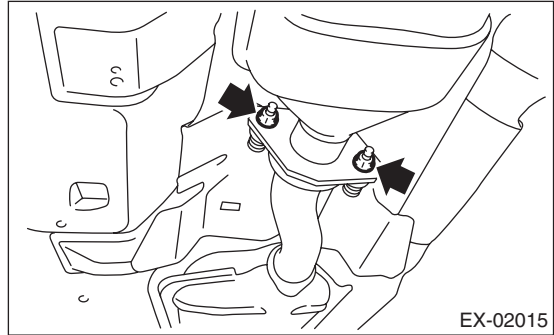
- 4) Install the rear exhaust pipe assembly to center exhaust pipe.

**NOTE:**

Use a new gasket.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

## 4. Muffler

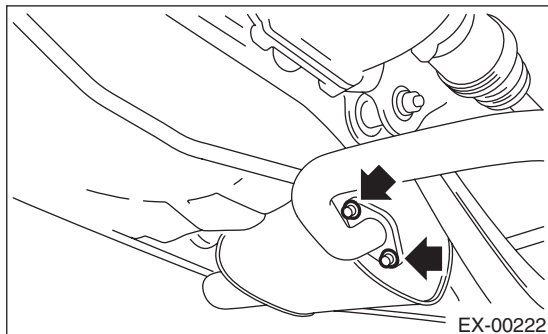
### A: REMOVAL

#### CAUTION:

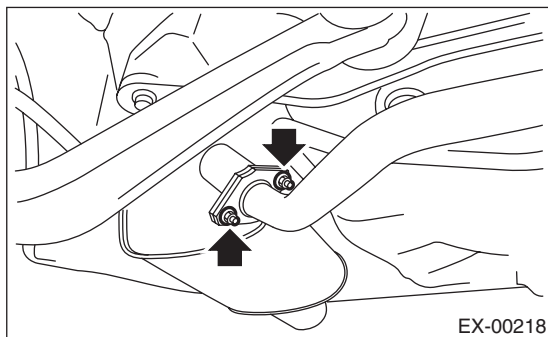
Be careful not to burn yourself, because the exhaust pipe becomes extremely hot after running.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Separate the muffler from rear exhaust pipe.

- LH side

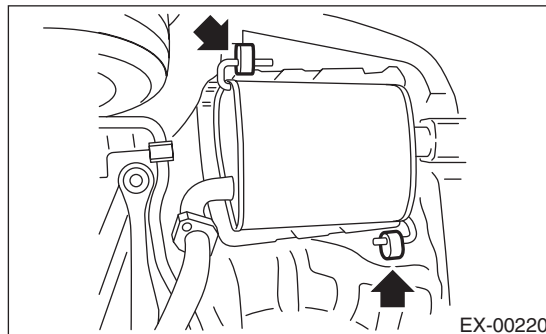


- RH side

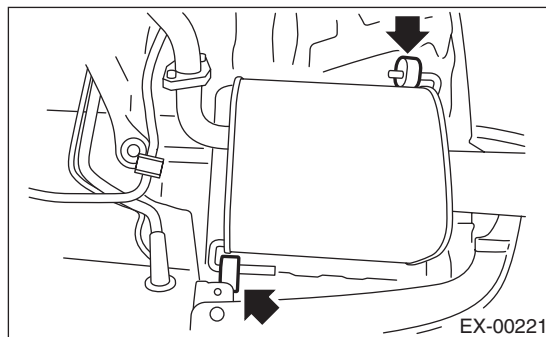


- 4) Apply a coat of spray type lubricant to the mating area of cushion rubber.

- LH side



- RH side



- 5) Remove the front and rear cushion rubber, and then remove the muffler.

# Muffler

## EXHAUST

---

### B: INSTALLATION

Install in the reverse order of removal.

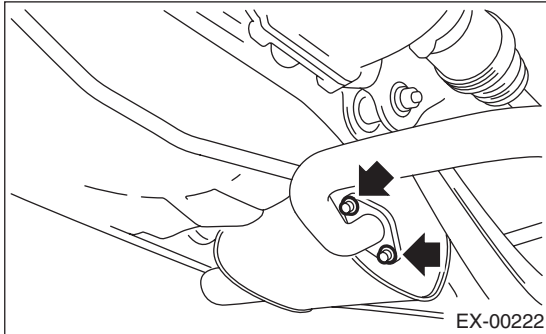
#### NOTE:

- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/ installing.

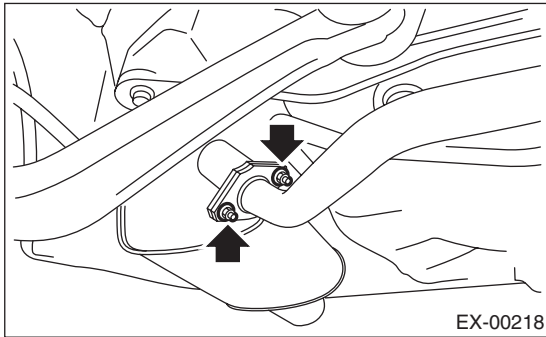
#### **Tightening torque:**

**48 N·m (4.9 kgf·m, 35.4 ft·lb)**

- LH side



- RH side



### C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Make sure there are no holes or rusting.
- 3) Check the cushion rubber for wear or crack.

# General Description

## COOLING

### 1. General Description

#### A: SPECIFICATION

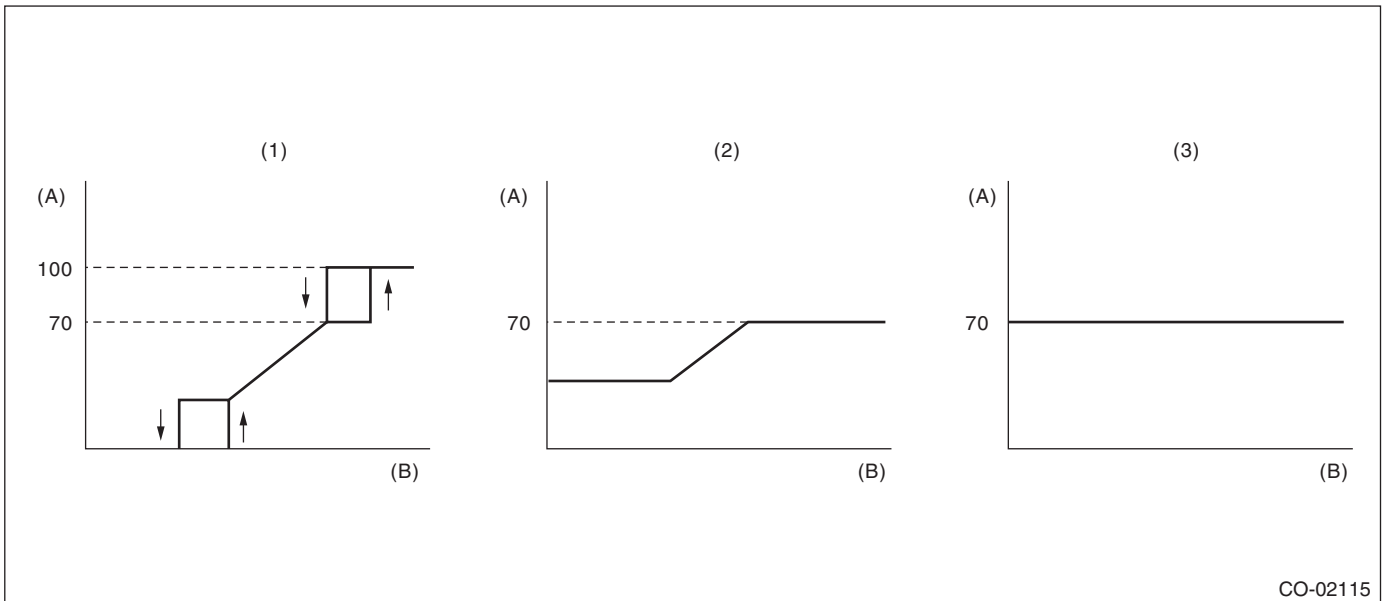
Cooling system		Electric fan + Forced engine coolant circulation system	
Total engine coolant capacity		ℓ (US qt, Imp qt)	
		Approx. 7.2 (7.6, 6.3)	
Water pump	Type		Centrifugal impeller type
	Discharge performance I	Discharge rate ℓ (US gal, Imp gal)/min.	320 (84.5, 70.4)
		Pump speed — Discharge pressure	5,500 rpm — 176.5 kPa (18 mAq)
		Engine coolant temperature	80°C (176°F)
	Impeller diameter mm (in)		73.2 (2.88)
	Number of impeller vanes		6
	Number of pump sprocket teeth		22
Thermostat	Type		Wax pellet type
	Starting temperature to open		80 — 84°C (176 — 183°F)
	Fully opens		95°C (203°F)
	Valve lift	mm (in)	9.0 (0.354) or more
	Valve bore	mm (in)	35 (1.38)
Radiator fan	Motor input	Main fan W	160
		Sub fan W	160
	Fan diameter / Blade	Main fan	320 mm (12.6 in)/5
		Sub fan	320 mm (12.6 in)/7
Radiator	Type		Down flow, pressure type
	Core dimensions	Width × Height × Thickness mm (in)	690 × 349 × 16 (27.17 × 13.74 × 0.63)
	Pressure range in which cap valve is open kPa (kgf/cm <sup>2</sup> , psi)		Above: 108±14.7 (1.1±0.15, 16±2) Below: The atmospheric pressure or less
	Fins		Corrugated fin type
Reservoir tank	Capacity		ℓ (US qt, Imp qt)
		0.45 (0.48, 0.40)	

Coolant	Recommended materials	Item number	Alternative
Coolant	SUBARU coolant	000016218	Phosphoric acid (non-amine) type
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	None

A/C compressor	A/C middle pressure switch	Engine coolant temperature		
		Increase: less than 95°C (203°F) Decrease: less than 93°C (199°F)	Increase: 95 — 101°C (203 — 214°F) Decrease: 93 — 99°C (199 — 210°F)	Increase: 102°C (216°F) or more Decrease: 100°C (212°F) or more
OFF		0%	Refer to fig. (1)	100%
ON	OFF	Refer to fig. (2)		100%
	ON	Refer to fig. (3)		100%

# General Description

COOLING



(A) Fan speed (%)

(B) Water temperature

(1) A/C OFF control

(2) A/C ON control (A/C middle pressure switch OFF)

(3) A/C ON control (A/C middle pressure switch ON)

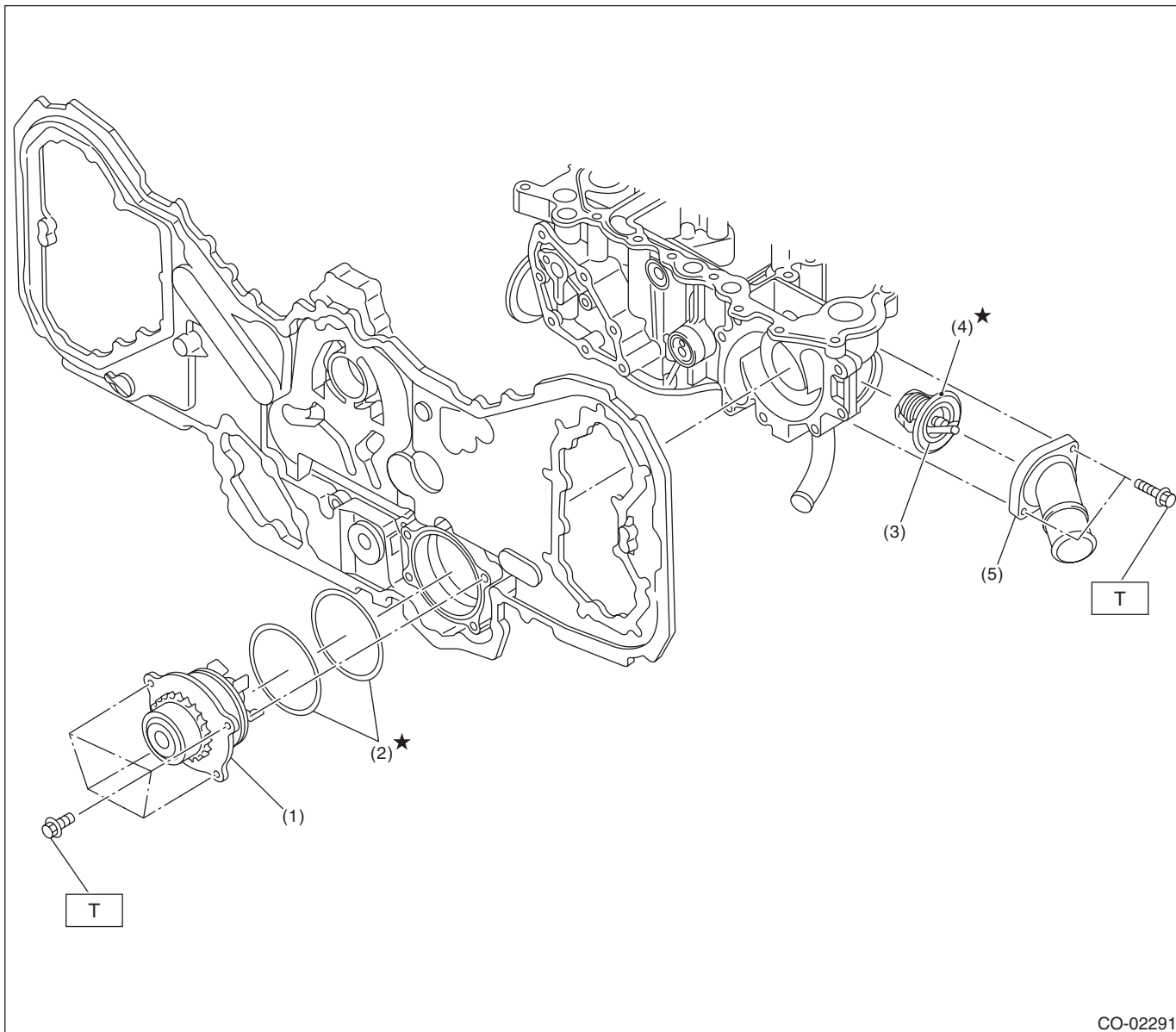


# General Description

COOLING

## B: COMPONENT

### 1. WATER PUMP

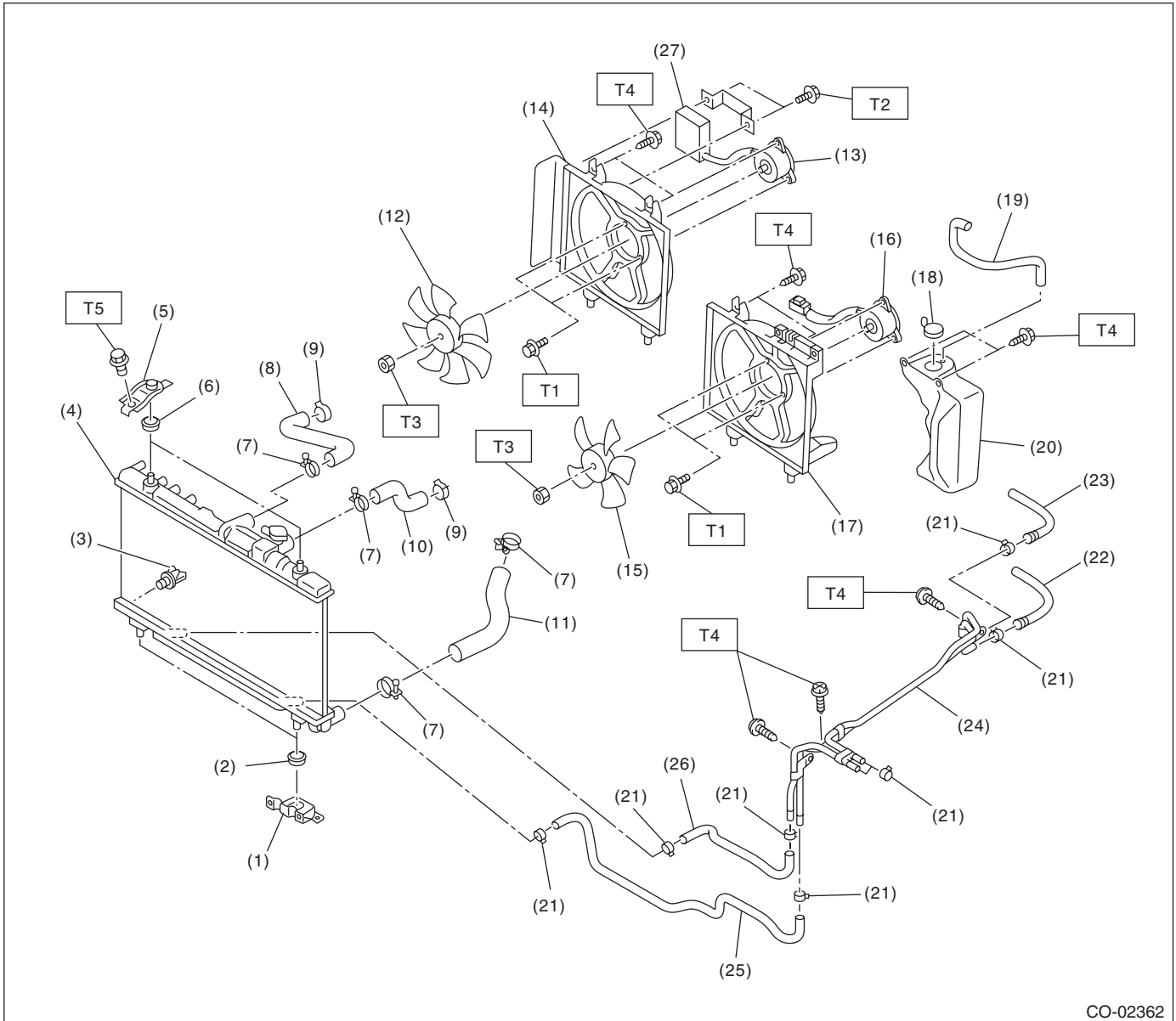


- (1) Water pump ASSY
- (2) O-ring
- (3) Thermostat

- (4) Gasket
- (5) Thermostat cover

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 6.4 (0.65, 4.7)**

## 2. RADIATOR AND RADIATOR FAN



CO-02362

- |                               |  |                                |
|-------------------------------|--|--------------------------------|
| (1) Radiator lower bracket    | (13) Radiator sub fan motor            | (25) ATF hose C                |
| (2) Radiator lower cushion    | (14) Radiator sub fan shroud           | (26) ATF hose D                |
| (3) Engine coolant drain plug | (15) Radiator main fan                 | (27) Radiator fan control unit |
| (4) Radiator                  | (16) Radiator main fan motor           |                                |
| (5) Radiator upper bracket    | (17) Radiator main fan shroud          |                                |
| (6) Radiator upper cushion    | (18) Engine coolant reservoir tank cap |                                |
| (7) Clamp                     | (19) Over flow hose                    |                                |
| (8) Radiator hose A           | (20) Engine coolant reservoir tank     |                                |
| (9) Clamp                     | (21) ATF hose clamp                    |                                |
| (10) Radiator hose B          | (22) ATF hose A                        |                                |
| (11) Radiator hose C          | (23) ATF hose B                        |                                |
| (12) Radiator sub fan         | (24) ATF pipe                          |                                |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 3.8 (0.39, 2.8)**

**T2: 5.4 (0.55, 4.0)**

**T3: 6.2 (0.63, 4.6)**

**T4: 7.5 (0.76, 5.5)**

**T5: 12 (1.2, 8.9)**

# General Description

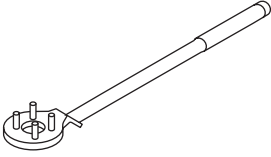
## COOLING

### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

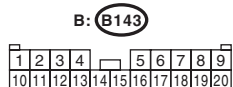
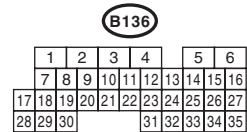
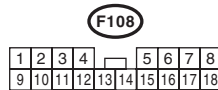
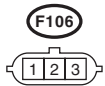
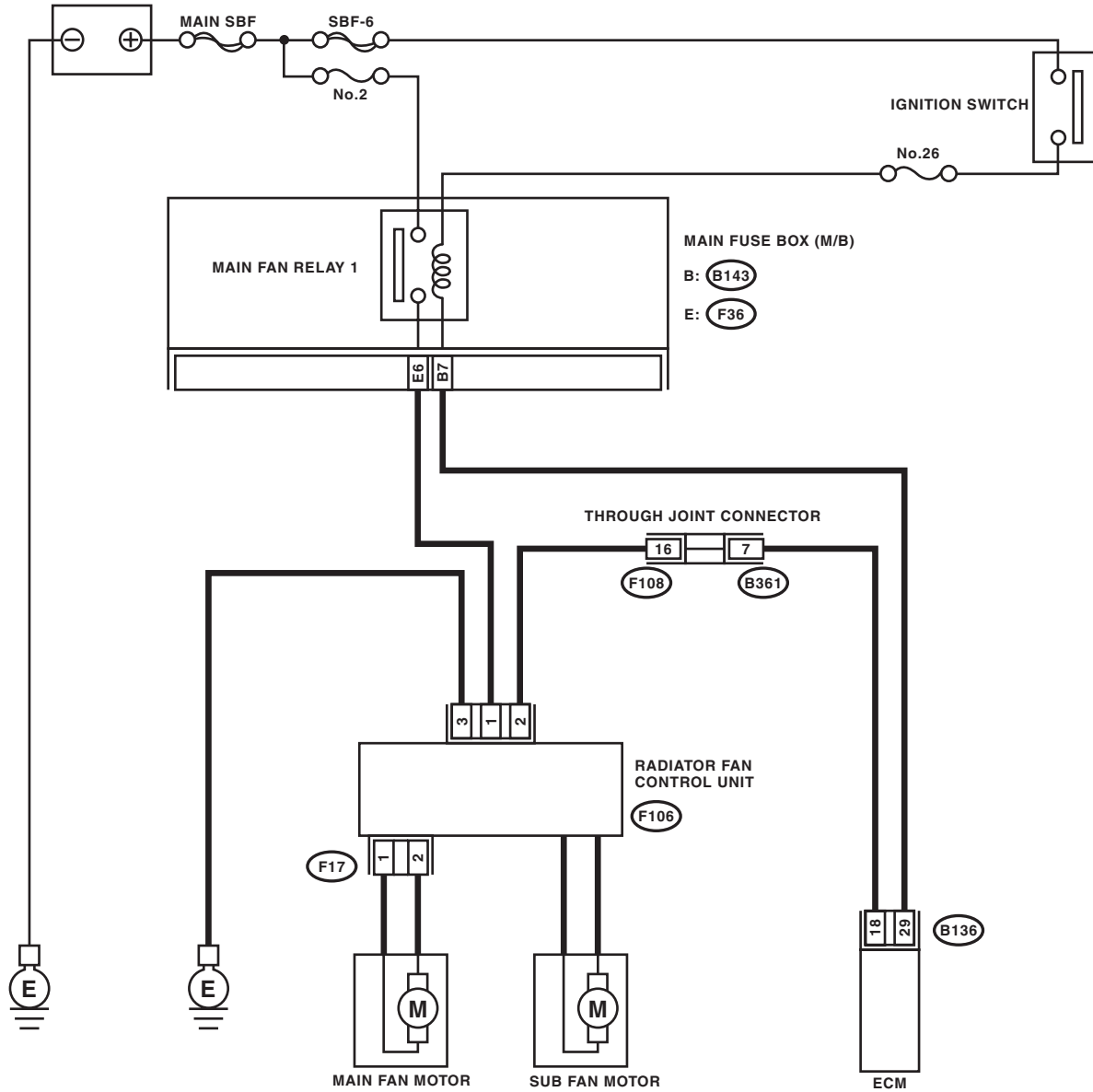
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening and tightening crank pulley bolts.

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Radiator cap tester	Used for measuring pressure.

## 2. Radiator Fan System

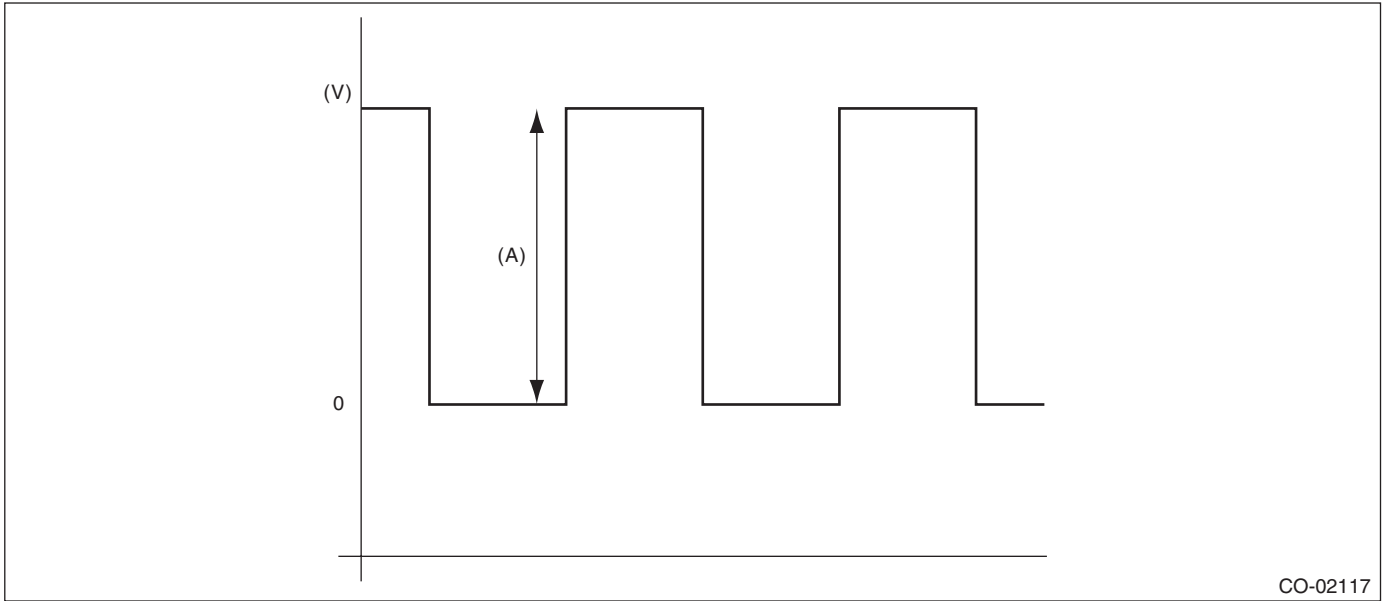
### A: WIRING DIAGRAM



# Radiator Fan System

COOLING

## B: RADIATOR FAN CONTROL OUTPUT WAVEFORM



(A) 5 V

CO-02117

## C: INSPECTION

### DETECTING CONDITION:

- Engine coolant temperature is 93°C (199°F) or more.
- A/C switch is turned OFF.
- Vehicle speed is 19 km/h (12 MPH) or less.

### TROUBLE SYMPTOMS:

Radiator main and sub fans do not rotate under the above conditions.

Step	Check	Yes	No
<b>1 CHECK MAIN FAN RELAY 1.</b> 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance of terminal in main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step 2.	Replace the main fan relay 1.
<b>2 CHECK MAIN FAN RELAY 1.</b> 1) Connect the battery to the main fan relay 1 coil side terminal. 2) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step 3.	Replace the main fan relay 1.
<b>3 CHECK POWER SUPPLY FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. <i>Connector &amp; terminal (B136) No. 29 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Repair the power supply line.
<b>4 CHECK POWER SUPPLY FOR RADIATOR FAN CONTROL UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to ECM. 3) Disconnect the connector from radiator fan control unit. 4) Turn the ignition switch to ON. 5) Measure the voltage between radiator fan control unit connector and chassis ground. <i>Connector &amp; terminal (F106) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 5.	Repair the power supply line.
<b>5 CHECK HARNESS BETWEEN ECM AND RADIATOR FAN CONTROL UNIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between radiator fan control unit and ECM connector. <i>Connector &amp; terminal (B136) No. 18 — (F106) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between ECM and radiator fan control unit.
<b>6 CHECK RADIATOR FAN CONTROL UNIT AND GROUND CIRCUIT.</b> 1) Connect the connector to ECM and radiator fan control unit. 2) Measure the resistance between radiator fan control unit connector and chassis ground. <i>Connector &amp; terminal (F106) No. 3 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Go to step 7.	Repair the open circuit of harness between radiator fan control unit connector and chassis ground.
<b>7 CHECK SUB FAN MOTOR.</b> 1) Disconnect the connector from radiator fan control unit. 2) Connect the battery positive (+) terminal to terminal No. 1 of the radiator fan control unit, and the ground (-) terminal to terminal No. 3.	Does the fan motor rotate?	Go to step 8.	Replace the fan motor which does not rotate.

# Radiator Fan System

## COOLING

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>8</b>	<b>CHECK OUTPUT SIGNAL FROM ECM.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Check the output waveform using oscilloscope. <Ref. to CO(H6DO)-8, RADIATOR FAN CONTROL OUTPUT WAVEFORM, Radiator Fan System.> <b>Connector &amp; terminal</b> <b>(B136) No. 18 (+) — Chassis ground (-):</b>	Is waveform being output?	Replace the radiator fan control unit. <Ref. to CO(H6DO)-27, Radiator Fan Control Unit.>	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

## 3. Engine Coolant

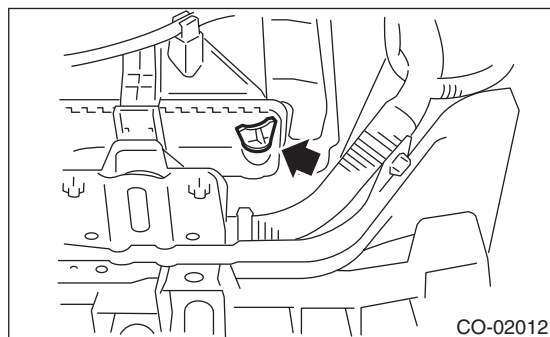
### A: REPLACEMENT

#### 1. DRAINING OF ENGINE COOLANT

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Remove the drain plug to drain engine coolant into container.

**NOTE:**

Remove the radiator cap so that engine coolant will drain faster.



- 5) Install the drain plug.

#### 2. FILLING OF ENGINE COOLANT

- 1) Pour cooling system conditioner through the filler neck.

**Cooling system protective agent:**

Refer to "SPECIFICATION" for the cooling system protective agent. <Ref. to CO(H6DO)-2, SPECIFICATION, General Description.>

- 2) Pour engine coolant into the radiator up to the filler neck position.

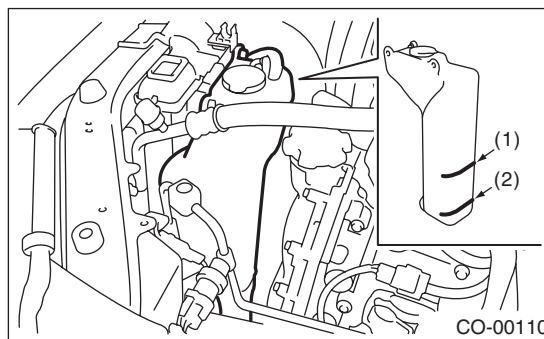
**Recommended engine coolant:**

Refer to "SPECIFICATION" for the recommended engine coolant. <Ref. to CO(H6DO)-2, SPECIFICATION, General Description.>

**Coolant level:**

Refer to "SPECIFICATION" for the coolant level. <Ref. to CO(H6DO)-2, SPECIFICATION, General Description.>

- 3) Fill engine coolant into the reservoir tank up to "FULL" level.



- (1) FULL
- (2) LOW

- 4) Close the radiator cap and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)

- 5) Wait for one minute after the engine stops, open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.

- 6) Perform the procedures 4) and 5) again.

- 7) Attach the radiator cap and reservoir tank cap properly.

- 8) Start the engine and operate the heater at maximum hot position and the blower speed setting to "LO".

- 9) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

**NOTE:**

Be careful with the engine coolant temperature gauge to prevent overheating.

- 10) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.

- 11) Open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position and reservoir tank to the "FULL" level.

- 12) Attach the radiator cap and reservoir tank cap properly.

- 13) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard from heater core, repeat the procedures from step 9).



# Engine Coolant

## COOLING

### B: INSPECTION

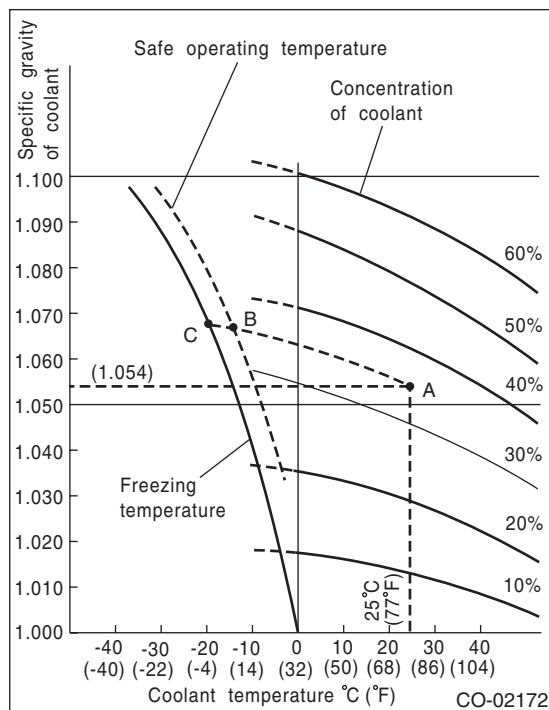
#### 1. RELATIONSHIP OF COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of coolant is shown in the diagram 1. Measuring the temperature and specific gravity of the coolant will provide this information.

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).

- Diagram 1



#### 2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of coolant according to temperature, find the proper fluid concentration in the diagram 1 and replace the necessary amount of coolant with an undiluted solution of coolant (concentration 50%).

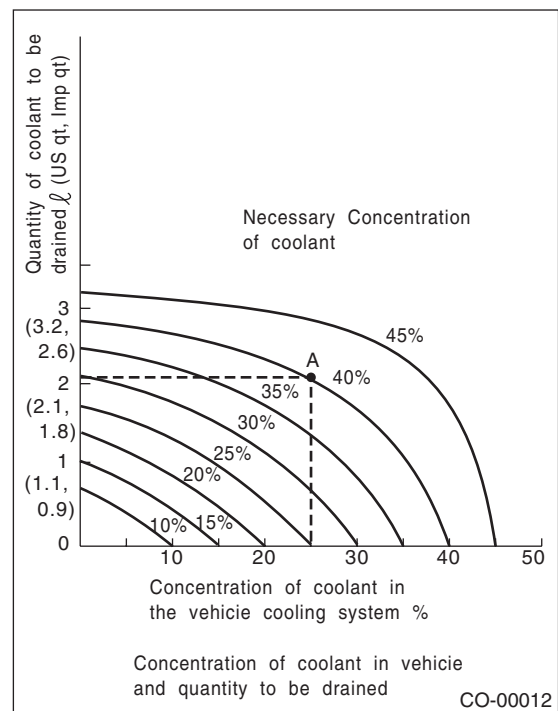
The amount of engine coolant that should be replaced can be determined using the diagram 2.

[Example]

Assume that the engine coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of engine coolant concentration intersects with the 40% curve of the necessary engine coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 ℓ (2.2 US qt, 1.8 Imp qt). Drain 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 ℓ (2.2 US qt, 1.8 Imp qt) undiluted coolant solution.

If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.

- Diagram 2



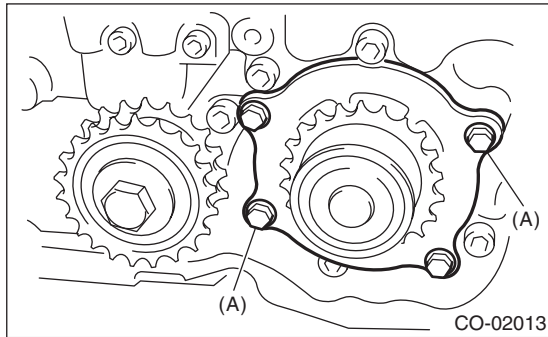
## 4. Water Pump

### A: REMOVAL

- 1) Remove the radiator. <Ref. to CO(H6DO)-16, REMOVAL, Radiator.>
- 2) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H6DO)-41, REMOVAL, Crank Pulley.>
- 4) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 5) Remove the timing chain assembly. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 6) Remove the water pump.

#### NOTE:

When the water pump cannot be removed easily, screw-in the bolt (A) to the threaded end to remove water pump.



### B: INSTALLATION

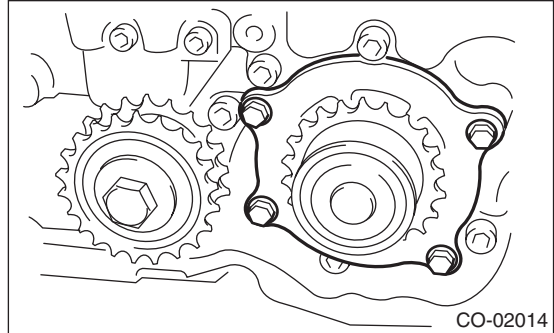
- 1) Install the water pump to rear chain cover.

#### NOTE:

- Use new O-rings.
- Apply engine coolant to O-ring.

#### Tightening torque

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- 2) Install the timing chain assembly. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>
- 3) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>
- 4) Install the crank pulley. <Ref. to ME(H6DO)-41, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>
- 6) Install the radiator. <Ref. to CO(H6DO)-17, INSTALLATION, Radiator.>
- 7) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

### C: INSPECTION

- 1) Check the water pump bearing for smooth rotation.
- 2) Check the water pump sprocket for abnormalities.

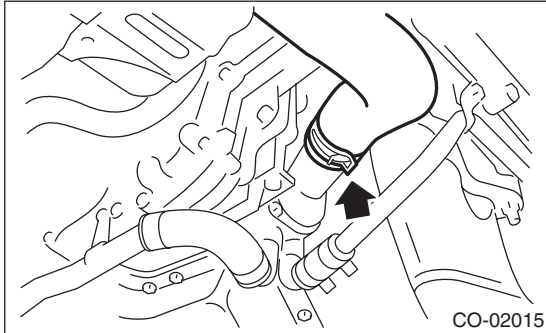
# Thermostat

## COOLING

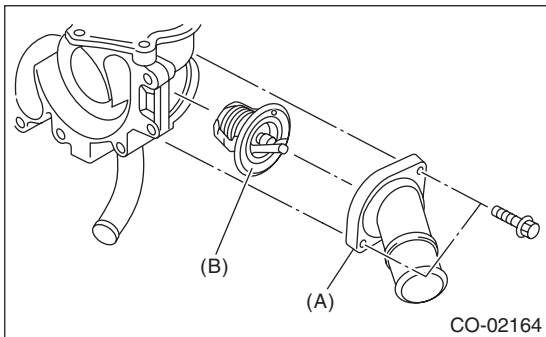
### 5. Thermostat

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely. <Ref. to CO(H6DO)-11, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Disconnect the radiator outlet hose from thermostat cover.



- 6) Remove the thermostat cover, and then remove the thermostat.



- (A) Thermostat cover
- (B) Thermostat

#### B: INSTALLATION

- 1) Install a gasket to thermostat.

#### NOTE:

Use a new gasket.

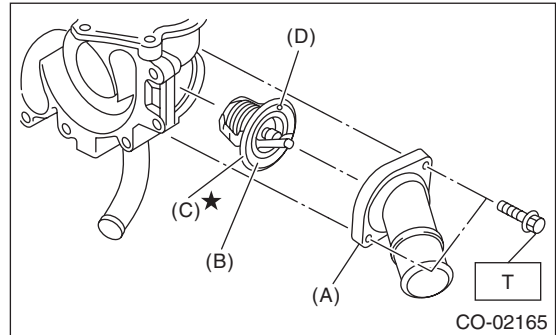
- 2) Install the thermostat and thermostat cover.

#### NOTE:

The jiggle pin must face upward when installing.

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- (A) Thermostat cover
- (B) Thermostat
- (C) Gasket
- (D) Jiggle pin

- 3) Connect the radiator outlet hose to thermostat cover.

- 4) Install the under cover.

- 5) Lower the vehicle.

- 6) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

**C: INSPECTION**

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.

- Inspection method

Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measured value should meet the specification.

**NOTE:**

- Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

**Starting temperature to open:**

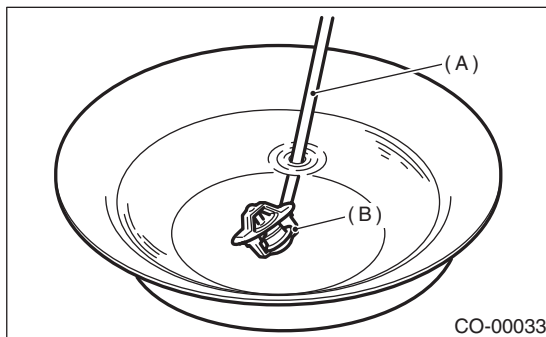
**80 — 84°C (176 — 183°F)**

**Fully opens:**

**95°C (203°F)**

**Valve lift:**

**9.0 mm (0.354 in) or more**



(A) Thermometer

(B) Thermostat

# Radiator

## COOLING

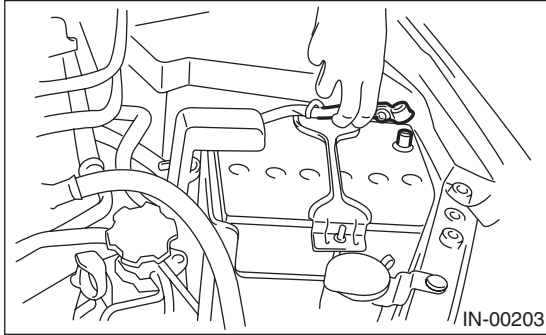
### 6. Radiator

#### A: REMOVAL

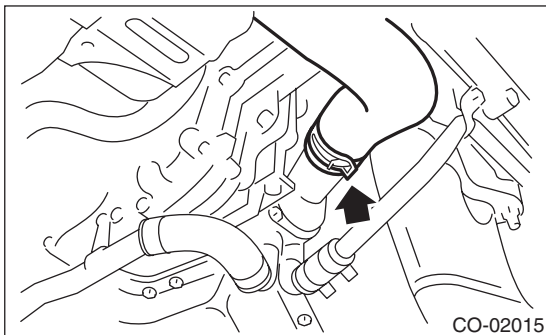
##### CAUTION:

The radiator is pressurized. Wait until engine cools down before working on the radiator.

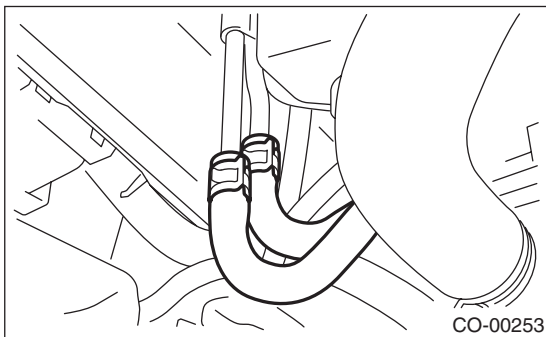
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Drain engine coolant completely. <Ref. to CO(H6DO)-11, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 7) Disconnect the radiator outlet hose from the radiator.

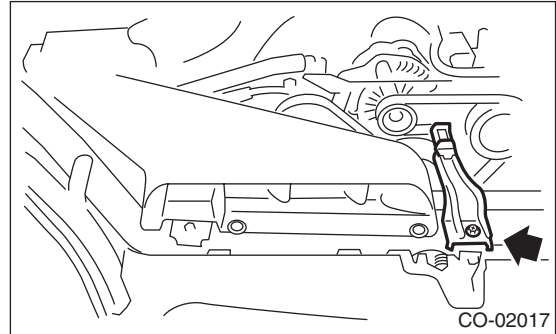


- 8) Disconnect the ATF cooler hose from the radiator.



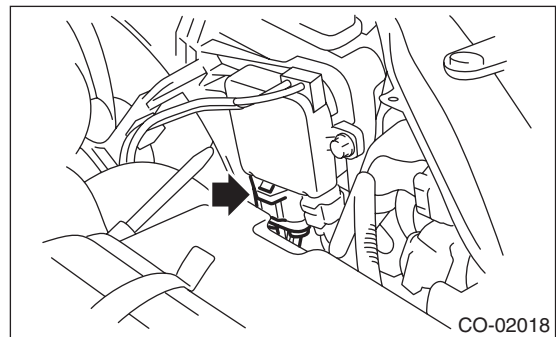
- 9) Lower the vehicle.

- 10) Remove the hood stay holder.



- 11) Remove the air intake duct. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.>

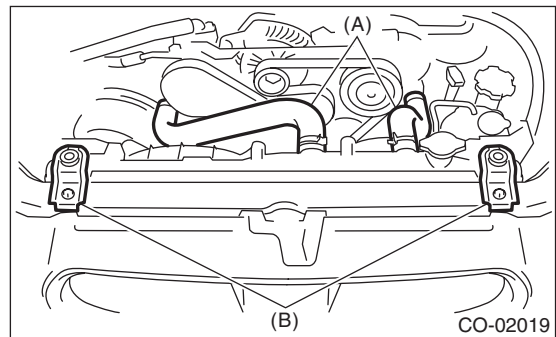
- 12) Disconnect the connector from radiator fan control unit.



- 13) Remove the reservoir tank. <Ref. to CO(H6DO)-26, REMOVAL, Reservoir Tank.>

- 14) Disconnect the radiator inlet hose from radiator.

- 15) Remove the radiator upper brackets.

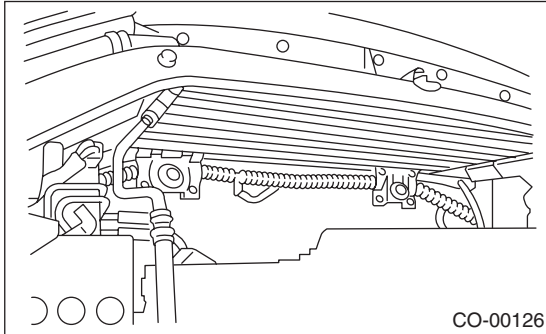


- (A) Radiator inlet hose  
(B) Radiator upper bracket

- 16) Lift the radiator up and away from vehicle.

## B: INSTALLATION

1) Attach the radiator lower cushions to holes on the vehicle.



2) Install the radiator to vehicle.

**NOTE:**

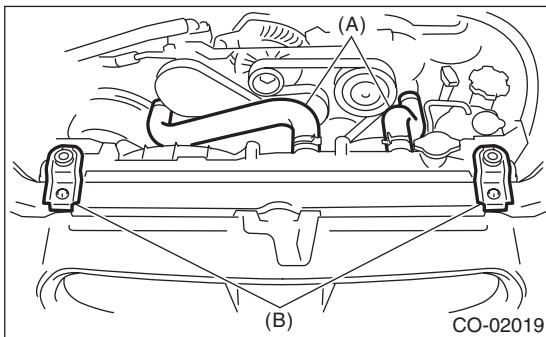
Make pins on the lower side of radiator be fitted into the radiator lower cushions on body side.

3) Install the radiator upper brackets and tighten the bolts.

**Tightening torque:**

**12 N·m (1.2 kgf-m, 8.9 ft-lb)**

4) Connect the radiator inlet hose.

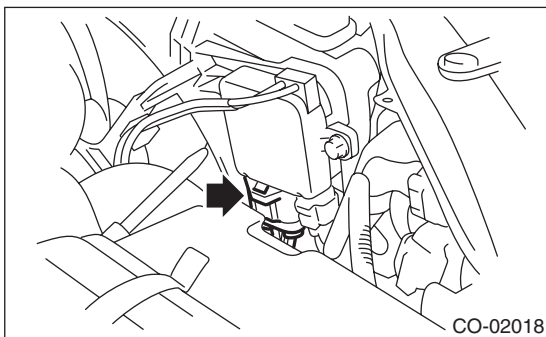


(A) Radiator inlet hose

(B) Radiator upper bracket

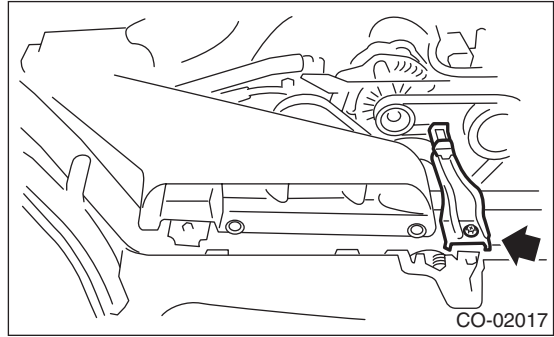
5) Install the reservoir tank. <Ref. to CO(H6DO)-26, INSTALLATION, Reservoir Tank.>

6) Connect the connector to the radiator fan control unit.



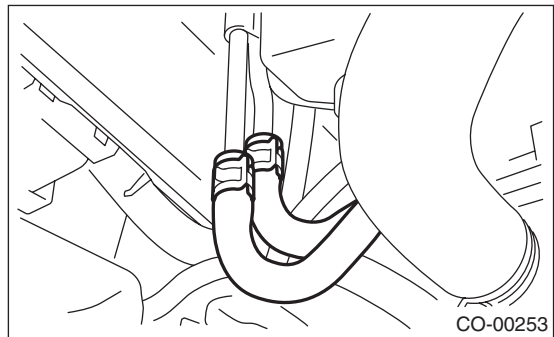
7) Install the air intake duct. <Ref. to IN(H6DO)-8, INSTALLATION, Air Intake Duct.>

8) Install the hood stay holder.

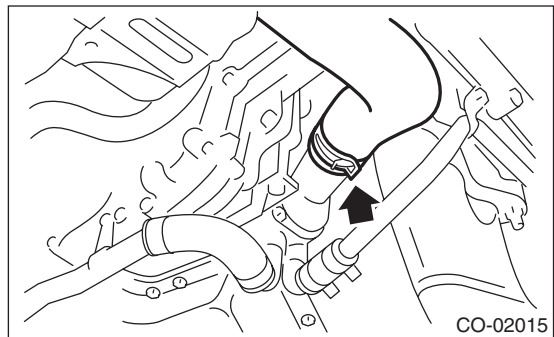


9) Lift up the vehicle.

10) Connect the ATF cooler hoses.



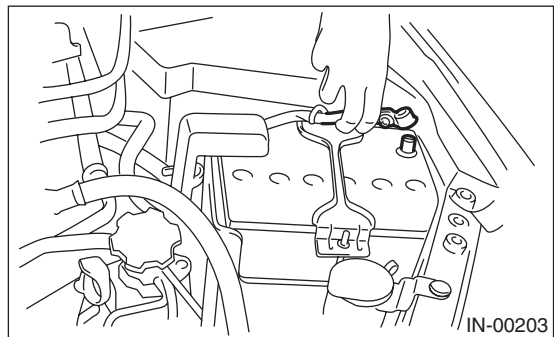
11) Connect the radiator outlet hose.



12) Install the under cover.

13) Lower the vehicle.

14) Connect the battery ground cable to battery.



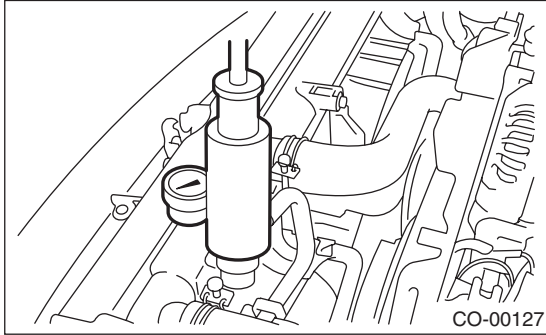
15) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

16) Check the ATF level. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

17) Install the collector cover.

### C: INSPECTION

1) Remove the radiator cap, fill the radiator with engine coolant, and then install the tester to the installation position of cap.



2) Apply a pressure of 157 kPa (1.6 kgf/cm<sup>2</sup>, 23 psi) to the radiator and check the following points:

- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

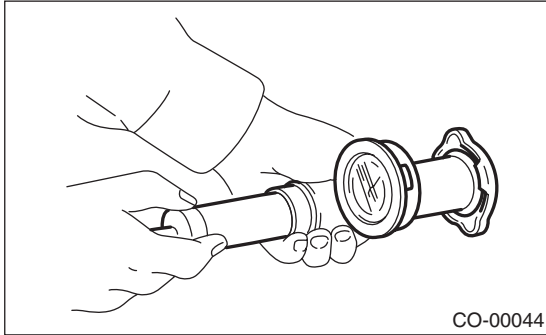
#### **CAUTION:**

- **Engine should be turned off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful of the spurt of engine coolant when removing the tester.**
- **Be careful not to deform the filler neck of radiator when installing and removing the tester.**

## 7. Radiator Cap

### A: INSPECTION

1) Attach the radiator cap to tester.



2) Increase pressure until the tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds. Replace the cap if it is opened under a pressure less than the service limit value.

**Specification:**

**93 — 123 kPa (0.95 — 1.25 kgf/cm<sup>2</sup>, 14 — 18 psi)**

**Service limit:**

**83 kPa (0.85 kgf/cm<sup>2</sup>, 12 psi)**

**CAUTION:**

Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.



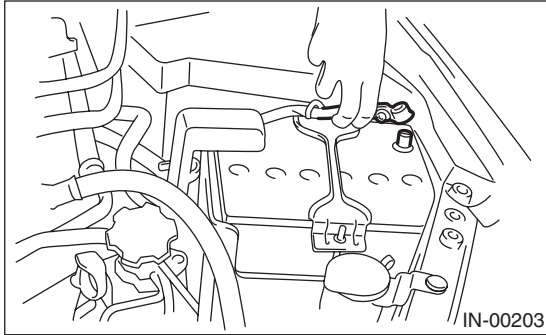
# Radiator Main Fan and Fan Motor

## COOLING

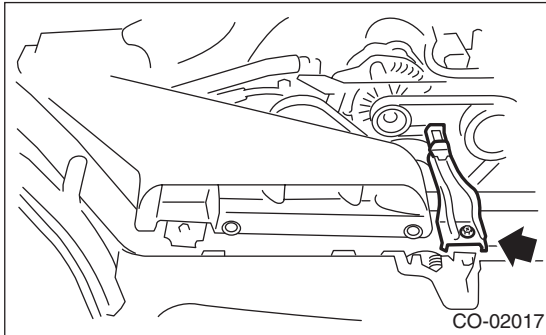
### 8. Radiator Main Fan and Fan Motor

#### A: REMOVAL

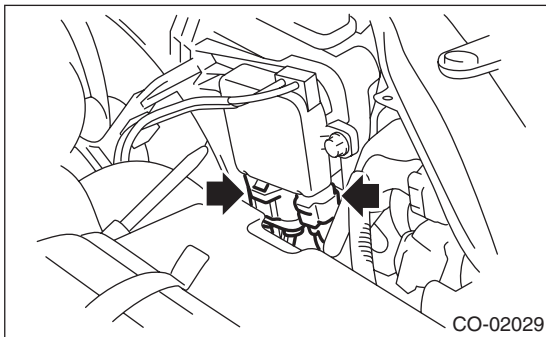
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



- 4) Remove the hood stay holder.



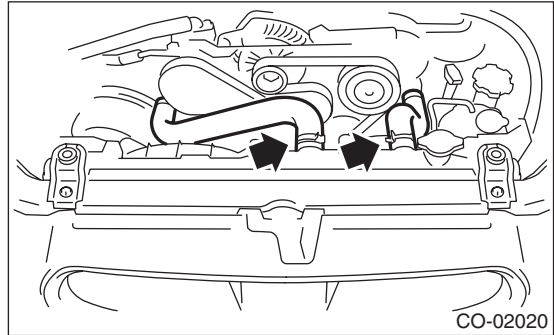
- 5) Remove the air intake duct. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.>
- 6) Disconnect the connector from radiator fan control unit.



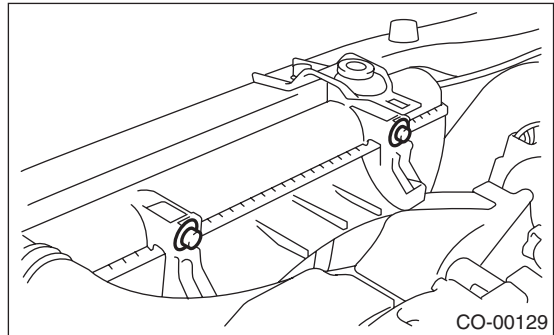
- 7) Lift up the vehicle.
- 8) Remove the under cover.
- 9) Drain engine coolant completely. <Ref. to CO(H6DO)-11, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 10) Remove the ATF hose from the clip of the radiator main fan shroud.
- 11) Remove the radiator main fan motor harness from the clip.
- 12) Lower the vehicle.

- 13) Remove the reservoir tank. <Ref. to CO(H6DO)-26, REMOVAL, Reservoir Tank.>

- 14) Disconnect the inlet hose from radiator.



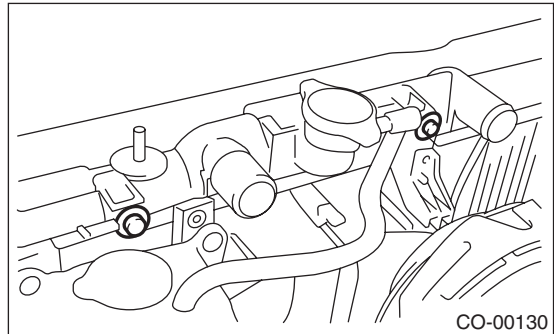
- 15) Remove the radiator sub fan motor assembly.



- 16) Remove the radiator main fan motor assembly.

#### NOTE:

When removing the main fan assembly with lifting it up, the main fan shroud contacts to inlet part of engine coolant. To avoid contacting it, move the main fan assembly to sub fan assembly side before removal.

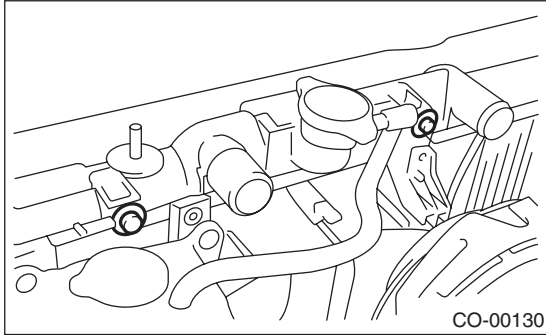


## B: INSTALLATION

Install in the reverse order of removal.

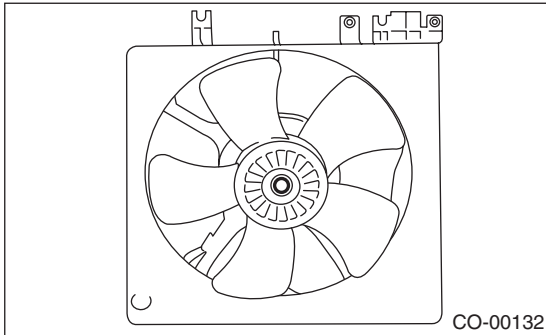
**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

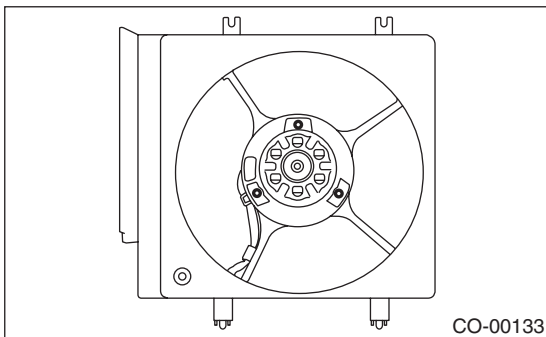


## C: DISASSEMBLY

1) Remove the nut which holds fan to fan motor and shroud assembly.



2) Remove the clip which holds the fan motor onto the shroud.

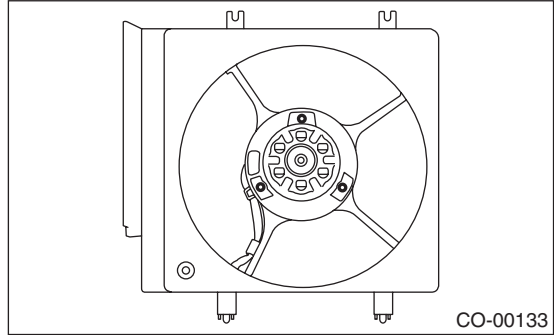


## D: ASSEMBLY

Assemble in the reverse order of disassembly.

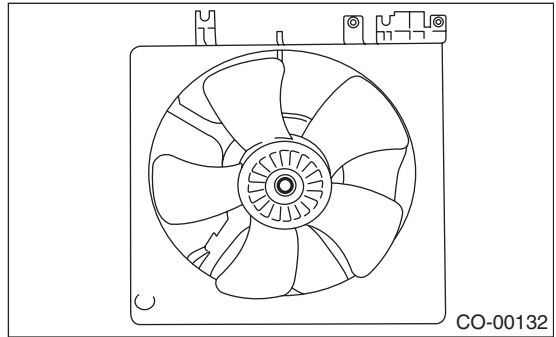
**Tightening torque:**

**3.8 N·m (0.39 kgf-m, 2.8 ft-lb)**



**Tightening torque:**

**6.2 N·m (0.63 kgf-m, 4.6 ft-lb)**



# Radiator Main Fan and Fan Motor

## COOLING

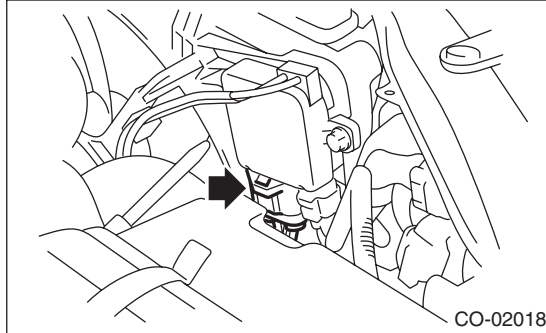
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### E: INSPECTION

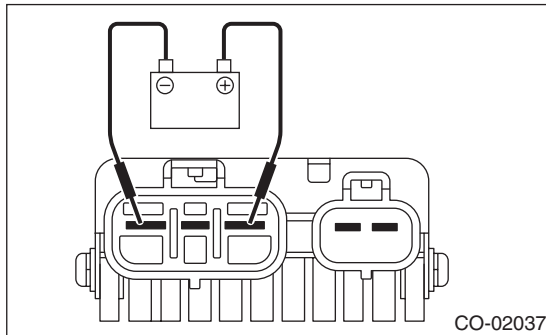
1) Disconnect the connector from radiator fan control unit.

#### NOTE:

Do not remove the main fan motor harness connector.



2) Connect the battery to radiator fan control unit as shown in the figure.

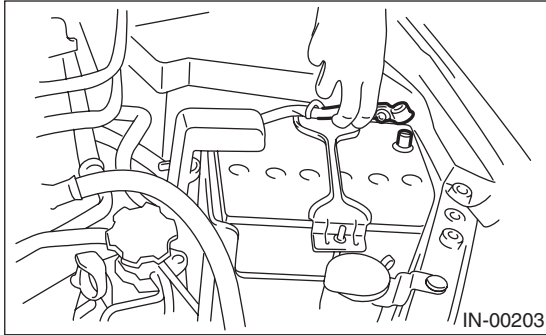


3) Check the fan motor for operations. If it does not operate, check the fan motor.

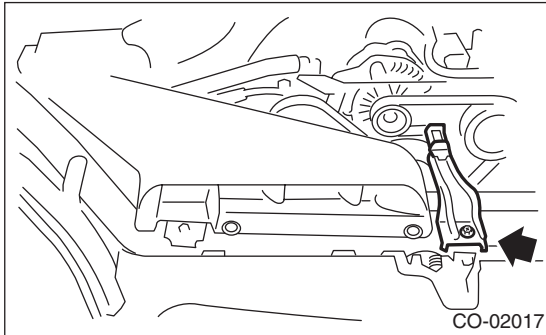
## 9. Radiator Sub Fan and Fan Motor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.

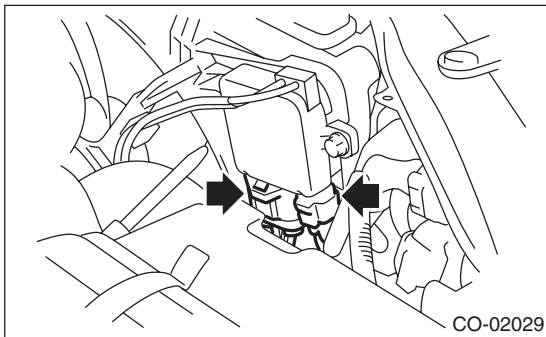


- 4) Remove the hood stay holder.

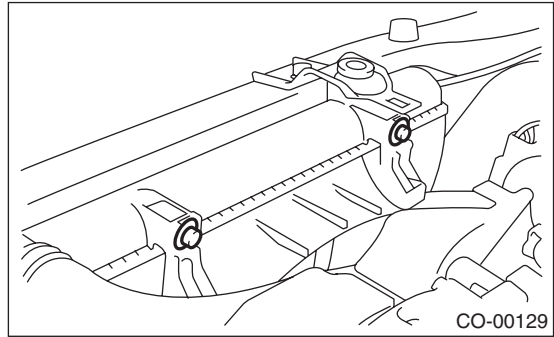


- 5) Remove the air intake duct. <Ref. to IN(H6DO)-8, REMOVAL, Air Intake Duct.>

- 6) Disconnect the connector from radiator fan control unit.



- 7) Remove the bolts which hold the sub shroud to the radiator.



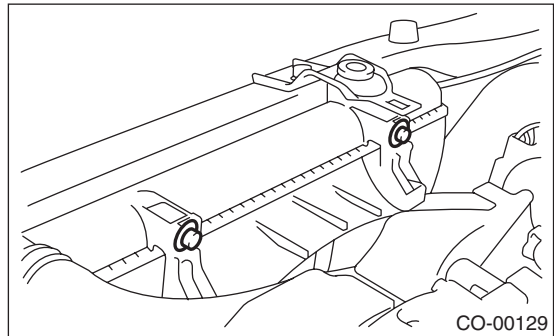
- 8) Lift up the vehicle.
- 9) Remove the under cover.
- 10) Remove the radiator sub fan shroud through the under side of vehicle.

### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

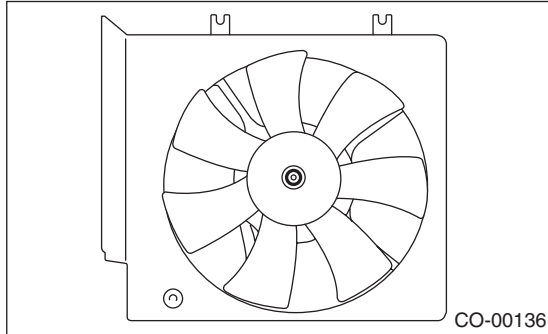


# Radiator Sub Fan and Fan Motor

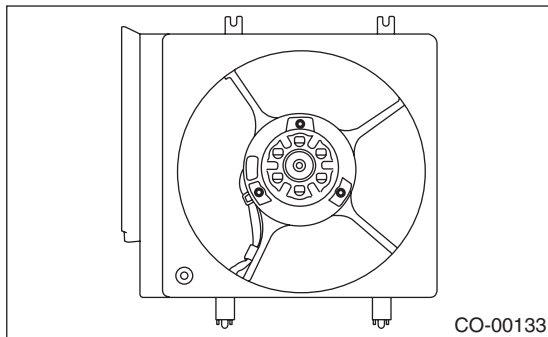
COOLING

## C: DISASSEMBLY

1) Remove the nut which holds fan to fan motor and shroud assembly.



2) Remove the clip which holds the fan motor onto the shroud.



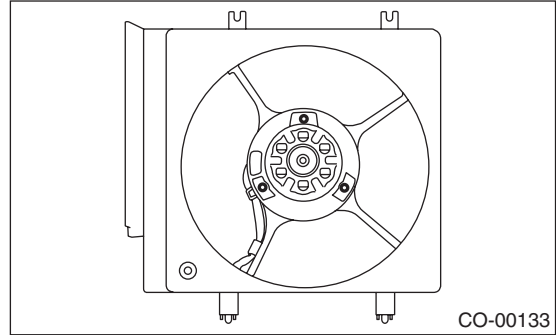
3) Remove the bolts which hold the radiator fan control unit to the shroud.

## D: ASSEMBLY

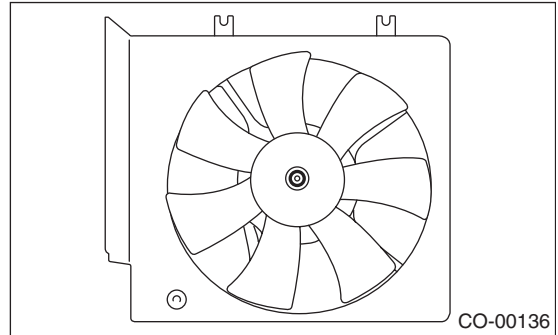
Assemble in the reverse order of disassembly.

**Radiator fan control unit bolt tightening torque:  
5.4 N·m (0.55 kgf·m, 4.0 ft·lb)**

**Tightening torque:  
3.8 N·m (0.39 kgf·m, 2.8 ft·lb)**



**Tightening torque:  
6.2 N·m (0.63 kgf·m, 4.6 ft·lb)**

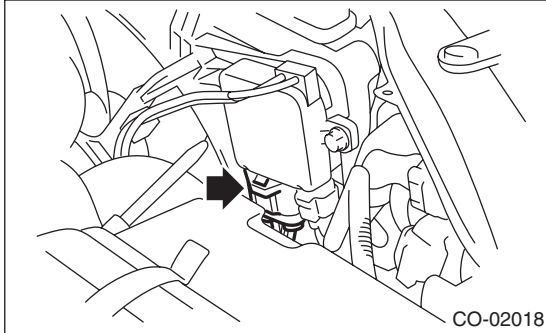


## E: INSPECTION

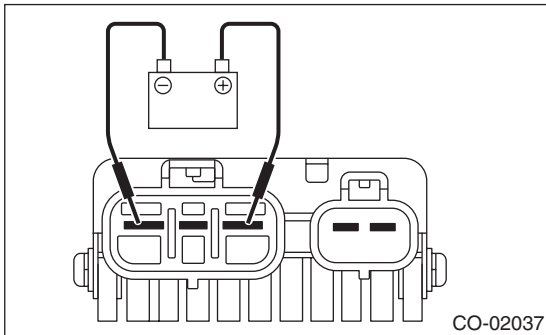
1) Disconnect the connector from radiator fan control unit.

### NOTE:

Do not remove the main fan motor harness connector.



2) Connect the battery to radiator fan control unit as shown in the figure.

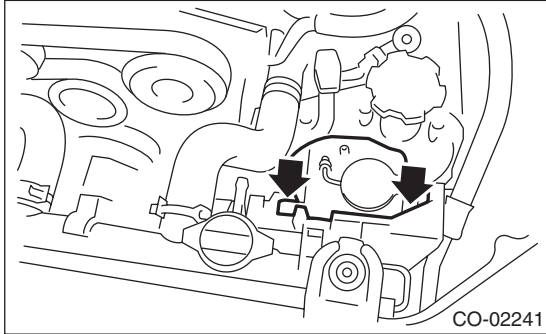


3) Check the fan motor for operations. If it does not operate, check the fan motor.

## 10. Reservoir Tank

### A: REMOVAL

- 1) Disconnect the over flow hose.
- 2) Remove the bolts which hold the reservoir tank to the fan shroud, then remove the reservoir tank.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

***7.5 N·m (0.76 kgf·m, 5.5 ft·lb)***

### C: INSPECTION

Make sure the engine coolant level is between "FULL" and "LOW".

## 11. Radiator Fan Control Unit

### A: SPECIFICATION

Radiator fan control unit forms a unit with radiator sub fan motor. Refer to “Radiator Sub Fan and Fan Motor” for removal and installation procedure. <Ref. to CO(H6DO)-23, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(H6DO)-23, INSTALLATION, Radiator Sub Fan and Fan Motor.> <Ref. to CO(H6DO)-24, DISASSEMBLY, Radiator Sub Fan and Fan Motor.> <Ref. to CO(H6DO)-24, ASSEMBLY, Radiator Sub Fan and Fan Motor.>



# Engine Cooling System Trouble in General

COOLING

## 12.Engine Cooling System Trouble in General

### A: INSPECTION

Trouble	Possible cause	Corrective action
Overheat	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Defective thermostat	Replace.
	c. Malfunction of water pump	Replace.
	d. Clogged engine coolant passage	Clean.
	e. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN(H6DO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	f. Clogged or leaking radiator	Clean, repair or replace.
	g. Improper engine oil in engine coolant	Replace the engine coolant. If still no improvement, inspect, repair or replace the engine related parts.
	h. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H6DO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	i. Excessive back pressure in exhaust system	Clean or replace.
	j. Insufficient clearance between piston and cylinder	Adjust or replace.
	k. Slipping clutch	Correct or replace.
	l. Dragging brake	Adjust.
	m. Faulty transmission gear oil	Replace.
	n. Malfunction of radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them.
Over-cooling	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Correct or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Correct or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and cylinder block	Correct or replace.
	f. Damaged or cracked thermostat case	Correct or replace.
	g. Leakage from radiator	Correct or replace.
Noise	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

# General Description

## LUBRICATION

### 1. General Description

#### A: SPECIFICATION

Lubrication method		Forced lubrication	
Oil pump	Pump type	Trochoid type	
	Number of teeth	Inner rotor	7
		Outer rotor	8
	Outer rotor diameter × thickness	mm (in)	86 × 13 (3.39 × 0.51)
	Tip clearance between inner and outer rotors	mm (in)	0.04 — 0.14 (0.0016 — 0.0055)
	Side clearance between inner rotor and pump case	mm (in)	0.020 — 0.046 (0.0008 — 0.0018)
Case clearance between outer rotor and pump case	mm (in)	0.110 — 0.175 (0.0043 — 0.0069)	
Oil filter	Filter type	Full-flow filter type	
	Filtration area	cm <sup>2</sup> (sq in)	1,300 (201.5)
	By-pass valve opening pressure	kPa (kg/cm <sup>2</sup> , psi)	160 (1.63, 23.2)
	Outer diameter × width	mm (in)	80 × 75 (3.15 × 2.95)
	Installation screw specifications		M 20 × 1.5
Relief valve working pressure	kPa (kg/cm <sup>2</sup> , psi)	708 (7.2, 102.7)	
Oil pressure switch	Type	Immersed contact point type	
	Operating voltage — power consumption		12 V — 3.4 W or less
	Warning light operating pressure	kPa (kg/cm <sup>2</sup> , psi)	15 (0.15, 2.2)
	Proof pressure	kPa (kg/cm <sup>2</sup> , psi)	980 (10.0, 142) or more
Engine oil	Total capacity (Overhaul)	ℓ (US qt, Imp qt)	7.0 (7.4, 6.2)
	When replacing engine oil and oil filter	ℓ (US qt, Imp qt)	5.7 (6.0, 5.0)
	When replacing engine oil only	ℓ (US qt, Imp qt)	5.5 (5.8, 4.8)

#### Recommended oil:

**Items having the API standard SM “Energy Conserving” logo or ILSAC standard GF-4 Starburst mark label on the container**

SAE (1)	
(°C)	-30 -20 -15 0 15 30 40
(°F)	-22 -4 5 32 59 86 104
LU-02329	

(1) SAE viscosity No. and applicable temperature

(2) Recommended

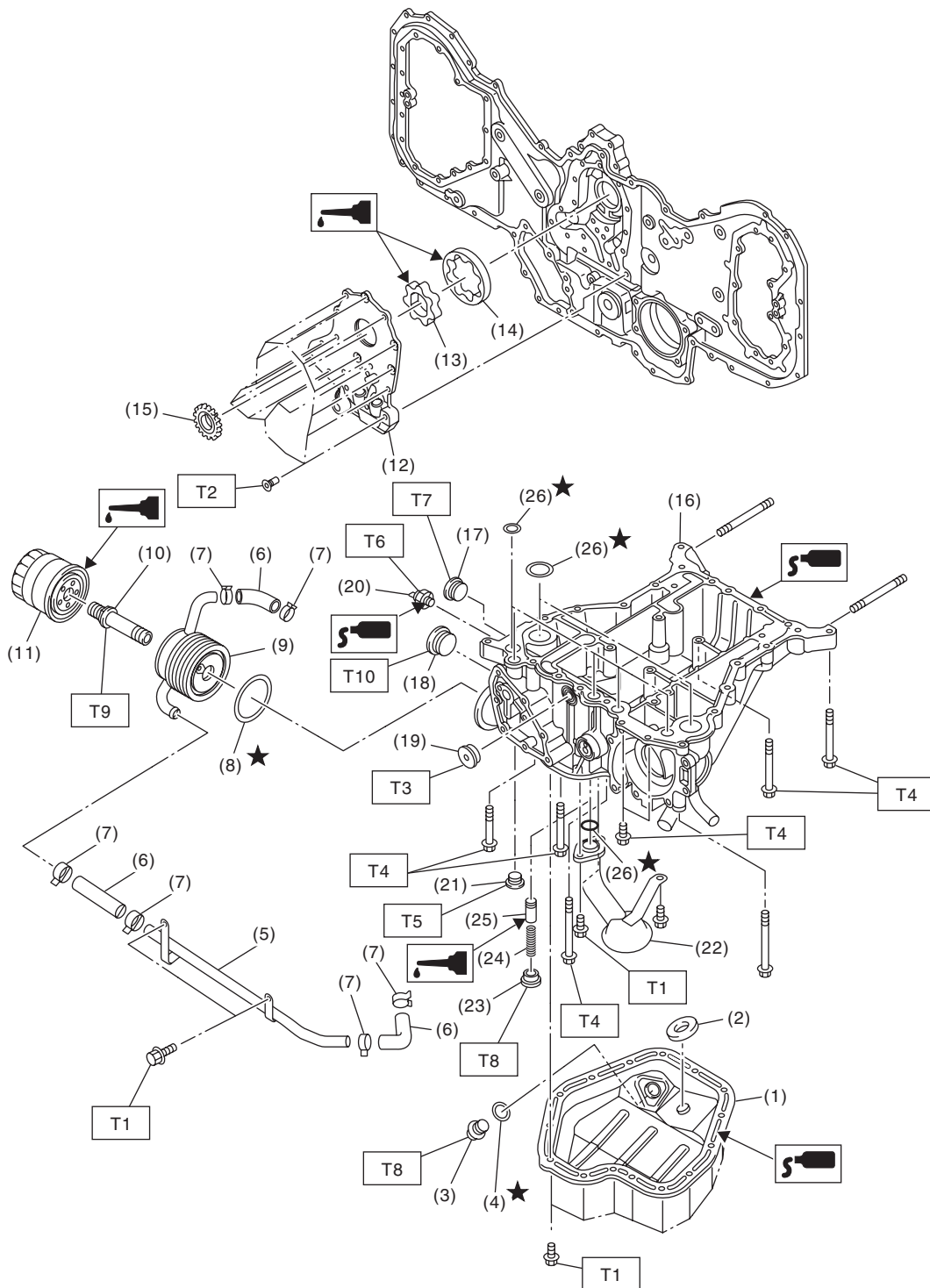
#### CAUTION:

It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.

#### NOTE:

If the vehicle is used in regions of high temperatures or in other severe environments, use oil with the viscosities shown below. API standard: SM or SL  
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

## B: COMPONENT



LU-02368

# General Description

## LUBRICATION

(1) Oil pan lower	(14) Outer rotor
(2) Magnet	(15) Crank sprocket
(3) Drain plug	(16) Oil pan upper
(4) Gasket	(17) Plug
(5) Oil cooler pipe	(18) Plug
(6) Hose	(19) Plug
(7) Clamp	(20) Oil pressure switch
(8) Gasket	(21) Plug
(9) Oil cooler	(22) Oil strainer
(10) Oil cooler connector	(23) Plug
(11) Oil filter	(24) Relief valve spring
(12) Oil pump cover	(25) Relief valve
(13) Inner rotor	(26) O-ring

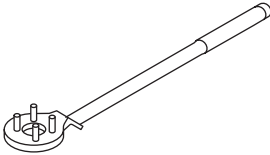
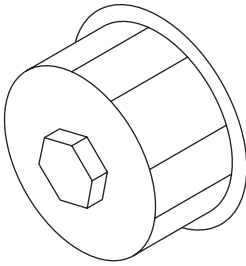
<b>Tightening torque:N-m (kgf-m, ft-lb)</b>	
<b>T1:</b>	<b>6.4 (0.65, 4.7)</b>
<b>T2:</b>	<b>&lt;Ref. to LU(H6DO)-8, INSTALLATION, Oil Pump.&gt;</b>
<b>T3:</b>	<b>16 (1.6, 11.8)</b>
<b>T4:</b>	<b>18 (1.8, 13.3)</b>
<b>T5:</b>	<b>23 (2.3, 17)</b>
<b>T6:</b>	<b>25 (2.5, 18.4)</b>
<b>T7:</b>	<b>37 (3.8, 27)</b>
<b>T8:</b>	<b>44 (4.5, 32.5)</b>
<b>T9:</b>	<b>54 (5.5, 40)</b>
<b>T10:</b>	<b>90 (9.2, 66)</b>

## C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

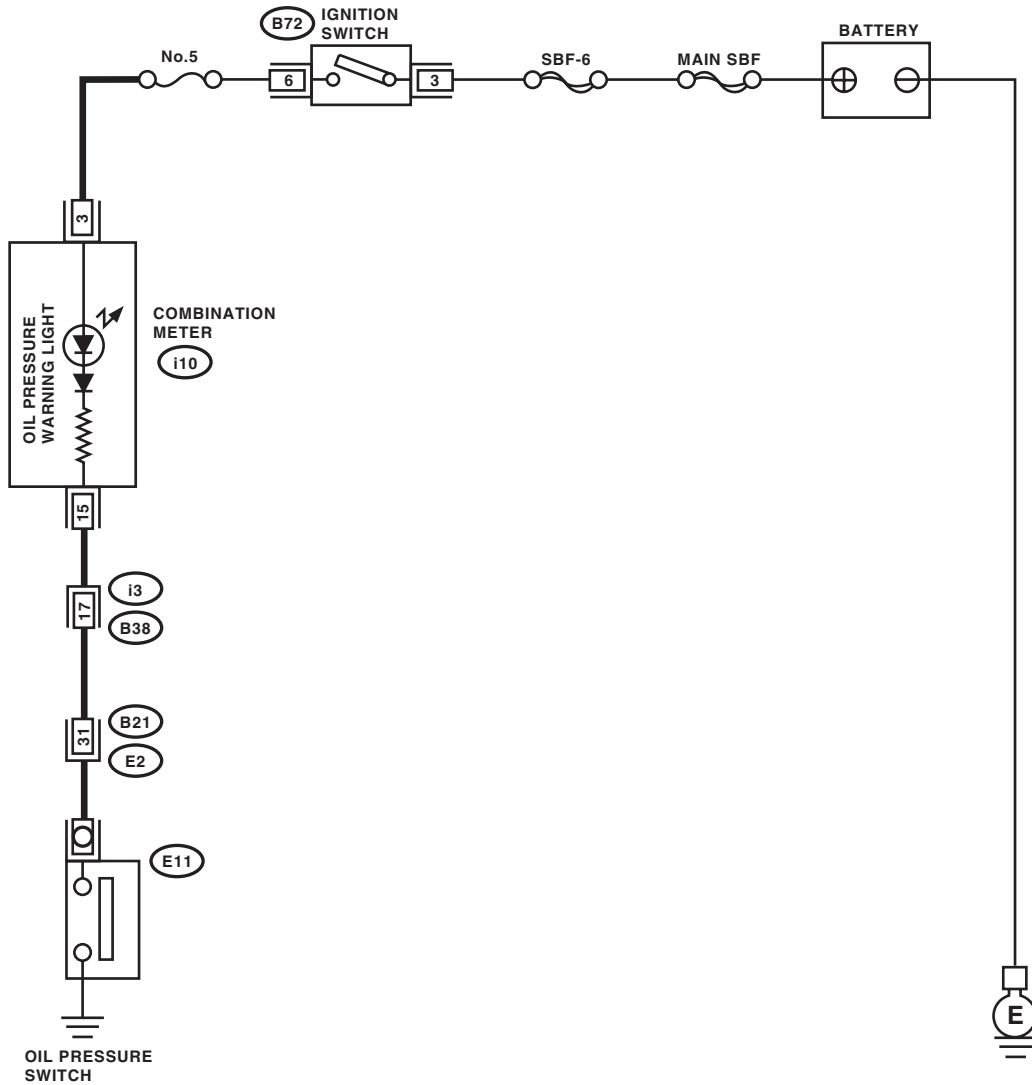
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 <p>ST-498547000</p>	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.

## 2. Oil Pressure System

### A: WIRING DIAGRAM



**B72**

1	2	3
4	5	6

**i10**

1	2	3	4	5	6	7	8	9	10		
11	12	13	14	15	16	17	18	19	20	21	22

**B38**

1	2	3	4	5	6	7	8	9		
10	11	12	13	14	15	16	17	18	19	20

**B21**

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

LU-02306

# Oil Pressure System

LUBRICATION

## B: INSPECTION

Step	Check	Yes	No
<b>1</b> <b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Check the warning light of combination meter.	Does the warning light illuminate?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
<b>2</b> <b>CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage between the oil pressure switch connector and the engine ground. <b>Connector &amp; terminal</b> <b>(E11) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(H6DO)-14, Oil Pressure Switch.>	Go to step 3.
<b>3</b> <b>CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. <b>Terminals</b> <b>(i10) No. 3 — (i10) No. 15:</b>	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between combination meter and oil pressure switch</li> <li>• Poor contact in combination meter connector</li> <li>• Poor contact in oil pressure switch connector</li> <li>• Poor contact of coupling connector</li> </ul>	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>

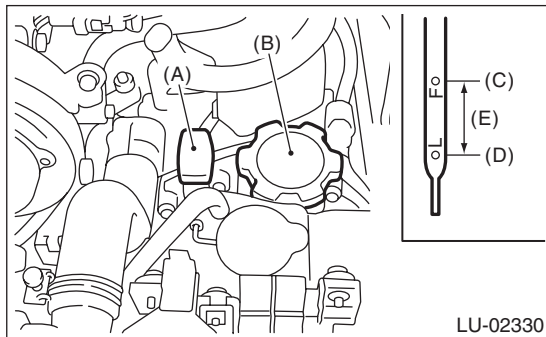
## 3. Engine Oil

### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe away the oil.
- 3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
- 4) Remove it again and check the reading. If the engine oil level is below “L” line, add oil to bring the level up to “F” line.
- 5) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the oil level.

**NOTE:**

To prevent overfilling of engine oil, do not add oil above “F” line when the engine is cold.



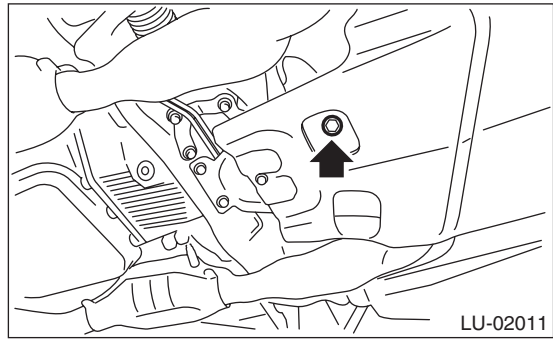
- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) “F” line
- (D) “L” line
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

### B: REPLACEMENT

- 1) Set the vehicle on a lift.
- 2) Open the engine oil filler cap for quick draining of engine oil.
- 3) Lift up the vehicle.
- 4) Drain engine oil by loosening the engine oil drain plug.

**NOTE:**

Prepare the container for draining of engine oil.



- 5) Tighten the engine oil drain plug after draining engine oil.

**NOTE:**

Use a new drain plug gasket.

**Tightening torque:**

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**

- 6) Lower the vehicle.
- 7) Using engine oil of proper quality and viscosity, fill engine oil through the oil filler duct to the “F” line on level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

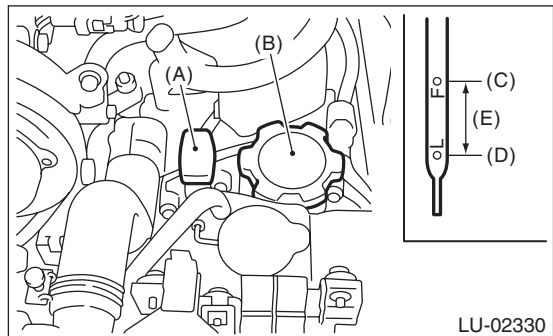
**Recommended oil:**

**Refer to “SPECIFICATION” for the recommended oil. <Ref. to LU(H6DO)-2, SPECIFICATION, General Description.>**

**Engine oil capacity:**

**Refer to “SPECIFICATION” for the engine oil capacity. <Ref. to LU(H6DO)-2, SPECIFICATION, General Description.>**

- 8) Close the engine oil filler cap.
- 9) Start the engine and circulate the engine oil.
- 10) After the engine stops, recheck the oil level. If necessary, add engine oil up to the “F” line on level gauge.

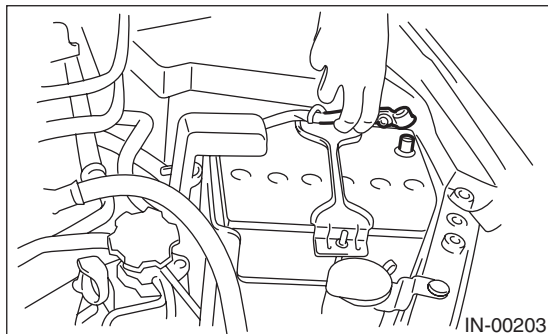


- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) “F” line
- (D) “L” line
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

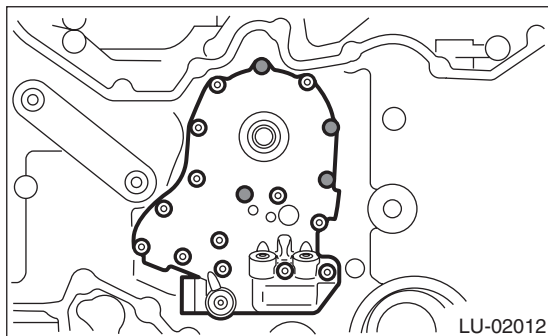
## 4. Oil Pump

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from the battery.



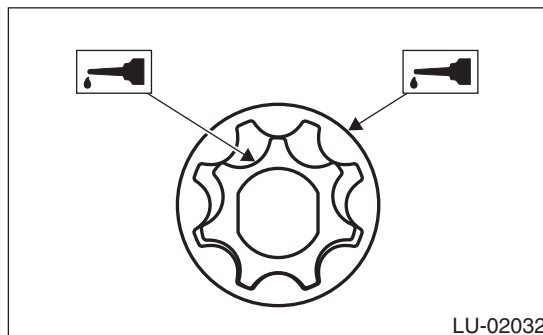
- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Drain engine coolant. <Ref. to CO(H6DO)-11, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 7) Lower the vehicle.
- 8) Remove the radiator. <Ref. to CO(H6DO)-16, REMOVAL, Radiator.>
- 9) Remove the V-belts. <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 10) Remove the front chain cover. <Ref. to ME(H6DO)-42, REMOVAL, Front Chain Cover.>
- 11) Remove the timing chain. <Ref. to ME(H6DO)-44, REMOVAL, Timing Chain Assembly.>
- 12) Remove the crank sprocket.
- 13) Remove the oil pump cover.



- 14) Remove the inner rotor and outer rotor.

### B: INSTALLATION

- 1) Apply a coat of engine oil to the whole area of inner rotor and outer rotor.



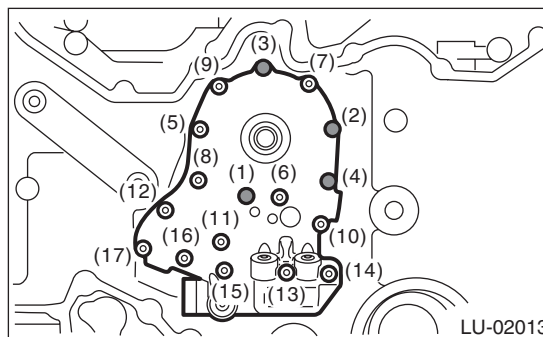
- 2) Install the inner rotor to the crank shaft, then assemble the outer rotor.
- 3) Install the oil pump cover.
- 4) Tighten the bolts in the numerical order as shown in the figure.

#### CAUTION:

**Make sure that the bolt is installed in correct position.**

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



Bolt installing position	Bolt dimension
(1) and (3)	6 × 14 × 14
(2) and (4)	6 × 35 × 18
(5), (6), (7), (8), (9), (10) and (11)	6 × 35 × 15
(12), (15), (16) and (17)	6 × 16 × 16
(13) and (14)	6 × 26 × 15

- 5) Install the crank sprocket.
- 6) Install the timing chain. <Ref. to ME(H6DO)-45, INSTALLATION, Timing Chain Assembly.>
- 7) Install the front chain cover. <Ref. to ME(H6DO)-42, INSTALLATION, Front Chain Cover.>
- 8) Install the V-belts. <Ref. to ME(H6DO)-40, INSTALLATION, V-belt.>
- 9) Install the radiator. <Ref. to CO(H6DO)-17, INSTALLATION, Radiator.>
- 10) Lift up the vehicle.
- 11) Install the under cover.
- 12) Lower the vehicle.



13) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

## C: INSPECTION

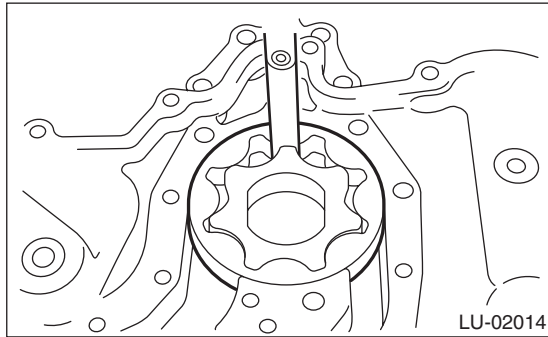
### 1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds specification, replace the rotors as a matched set.

**Tip clearance:**

**Standard**

**0.04 — 0.14 mm (0.0016 — 0.0055 in)**



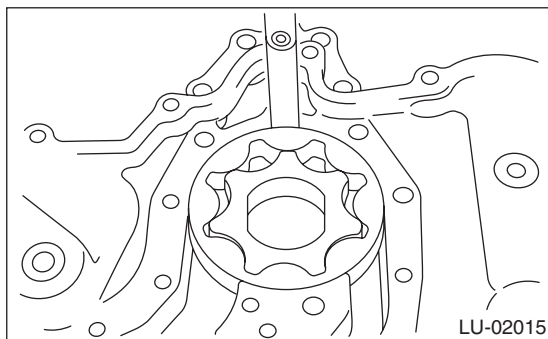
### 2. CASE CLEARANCE

Measure the clearance between the outer rotor and rear chain cover rotor housing. If the clearance exceeds the standard value, replace the outer rotor.

**Case clearance:**

**Standard**

**0.110 — 0.175 mm (0.0043 — 0.0069 in)**



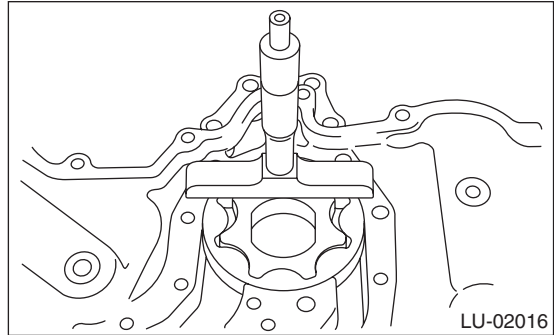
### 3. SIDE CLEARANCE

Measure the clearance between oil pump inner rotor and rear chain cover. If the clearance exceeds specification, replace the rotors as a matched set.

**Side clearance:**

**Standard**

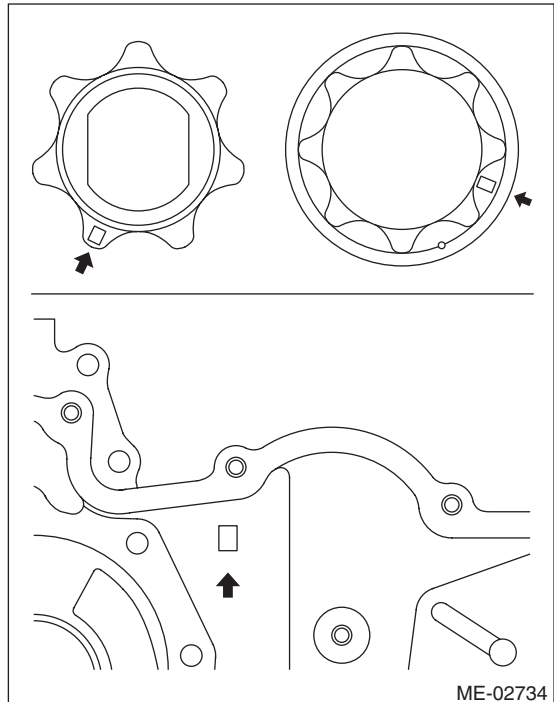
**0.020 — 0.046 mm (0.0008 — 0.0018 in)**



Perform the replacement parts selection as follows.

- When replacing all inner rotor, outer rotor and rear chain cover with new parts

On the inner rotor, outer rotor and the rear chain cover, there are identification marks in locations shown on the figure. When replacing, use those with matching identification marks.



# Oil Pump

## LUBRICATION

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- When replacing any one of the inner rotor, outer rotor and rear chain cover with new part, select suitable size from the following table so that side clearance meets the standard.

### Inner rotor

Classification	Part No.	Rotor thickness mm (in)
A	15015AA250	12.993 — 13.006 (0.51153 — 0.51205)
No	15015AA300	12.980 — 12.993 (0.51102 — 0.51153)
C	15015AA310	12.967 — 12.980 (0.51051 — 0.51102)

### Outer rotor

Classification	Part No.	Rotor thickness mm (in)
A	15016AA250	12.993 — 13.006 (0.51153 — 0.51205)
No	15016AA300	12.980 — 12.993 (0.51102 — 0.51153)
C	15016AA310	12.967 — 12.980 (0.51051 — 0.51102)

### Rear chain cover

Classification	Part No.	Rotor thickness mm (in)
A	13119AA020	13.026 — 13.039 (0.51295 — 0.51335)
B	13119AA050	13.013 — 13.026 (0.51232 — 0.51284)
C	13119AA060	13.000 — 13.013 (0.51181 — 0.51232)

## 4. OIL PUMP CASE

Check the worn shaft hole, clogged oil passage, crank and other parts for faults.

## 5. Oil Pump Relief Valve

### A: REMOVAL

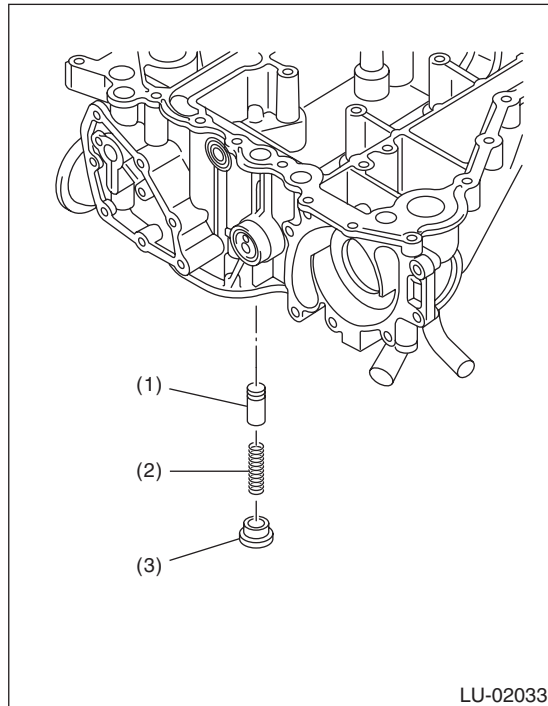
#### 1. REAR CHAIN COVER SIDE

Oil pump relief valve is integrated into oil pump cover as one unit; therefore, refer to "Oil Pump" for removal procedure. <Ref. to LU(H6DO)-8, REMOVAL, Oil Pump.>

#### 2. OIL PAN UPPER SIDE

1) Remove the oil pan. <Ref. to LU(H6DO)-12, REMOVAL, Oil Pan and Strainer.>

2) Remove the plug, relief valve spring and relief valve.



- (1) Relief valve
- (2) Relief valve spring
- (3) Plug

### B: INSTALLATION

#### 1. REAR CHAIN COVER SIDE

Oil pump relief valve is integrated into oil pump cover as one unit; therefore, refer to "Oil Pump" for installation procedure. <Ref. to LU(H6DO)-8, INSTALLATION, Oil Pump.>

#### 2. OIL PAN UPPER SIDE

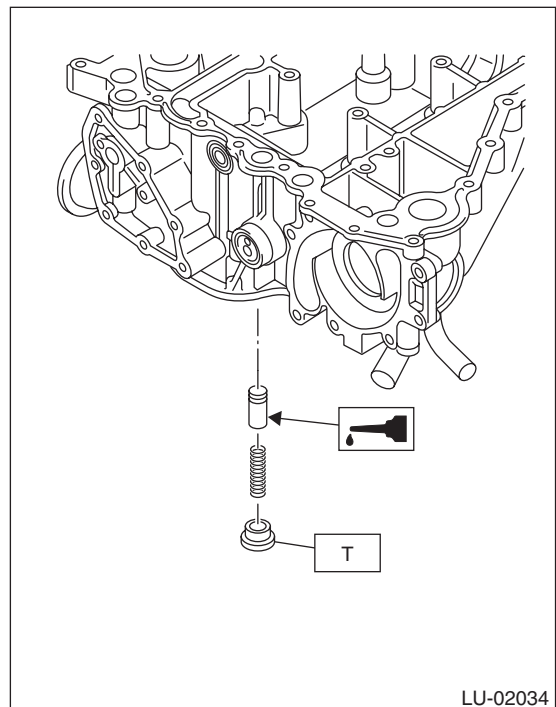
1) Install the relief valve, relief valve spring and plug.

NOTE:

Apply engine oil to the relief valve.

**Tightening torque:**

**T: 44 N·m (4.5 kgf-m, 32.5 ft-lb)**



2) Install the oil pan. <Ref. to LU(H6DO)-12, INSTALLATION, Oil Pan and Strainer.>

### C: INSPECTION

Check the worn shaft hole of oil pump relief valve case, clogged oil passage, crank and other parts for faults.

# Oil Pan and Strainer

LUBRICATION

## 6. Oil Pan and Strainer

### A: REMOVAL

NOTE:

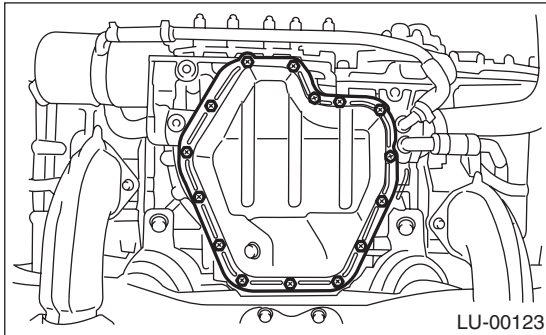
Before removing the oil pan upper, remove the engine from vehicle. <Ref. to ME(H6DO)-32, REMOVAL, Engine Assembly.> <Ref. to ME(H6DO)-64, REMOVAL, Cylinder Block.>

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain the engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.>
- 5) Insert the oil pan cutter blade between oil pan upper and oil pan lower.

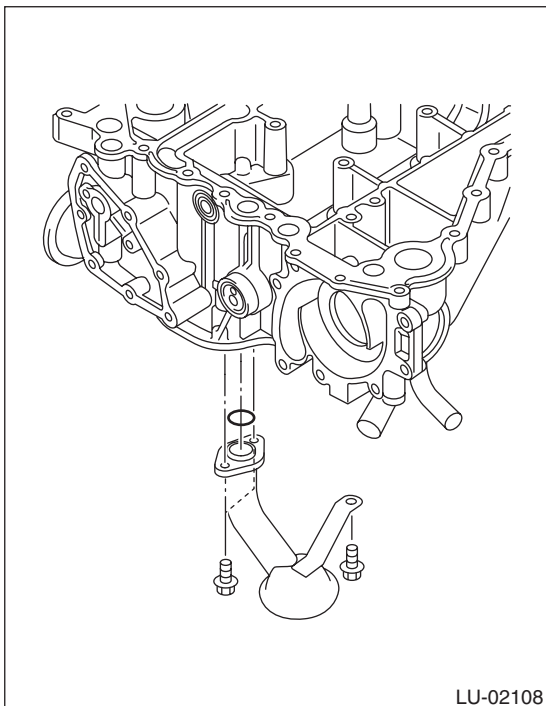
**CAUTION:**

**Do not use a screwdriver or similar tool in place of oil pan cutter.**

- 6) Remove the oil pan lower.



- 7) Remove the oil strainer.



### B: INSTALLATION

NOTE:

Before installing the oil pan, wipe clean the mating surface of oil pan lower and oil pan upper.

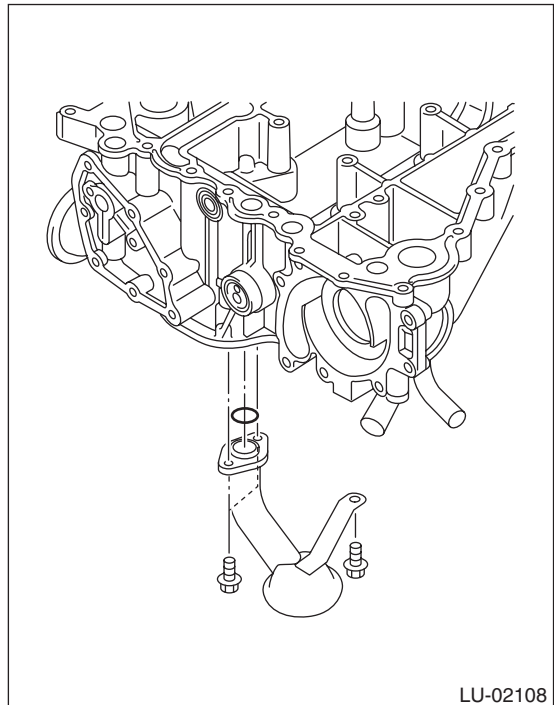
- 1) Install the oil strainer onto oil pan upper.

NOTE:

Use new O-rings.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- 2) Apply liquid gasket to the mating surfaces, and install the oil pan.

NOTE:

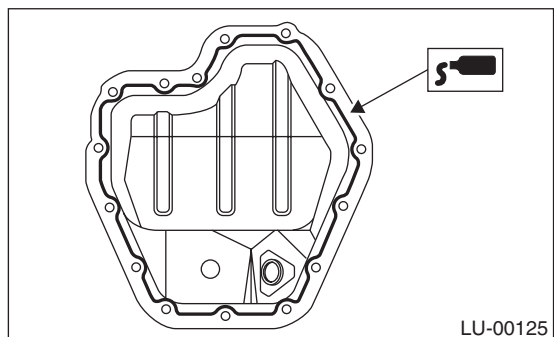
Install within 5 min. after applying liquid gasket.

**Liquid gasket:**

**THREE BOND 1217G (Part No. K0877Y0100)  
or equivalent**

**Applying liquid gasket diameter:**

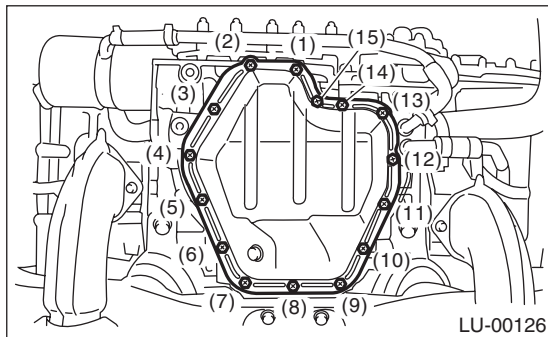
**5.0±1.0 mm (0.197±0.039 in)**



3) Tighten the oil pan lower installing bolts in the numerical order as shown in the figure.

**Tightening torque:**

**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



4) Install the under cover.

5) Lower the vehicle.

6) Refill the engine oil. <Ref. to LU(H6DO)-7, INSPECTION, Engine Oil.>

## C: INSPECTION

Visually check that the oil pan, oil strainer and oil strainer stay are not damaged.

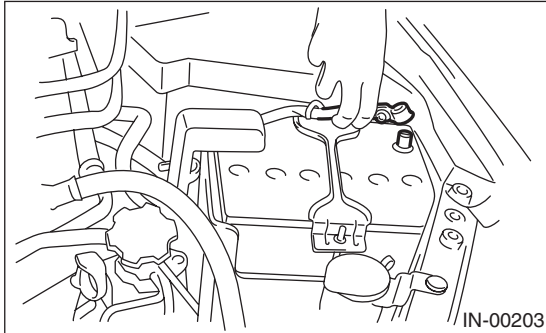
# Oil Pressure Switch

## LUBRICATION

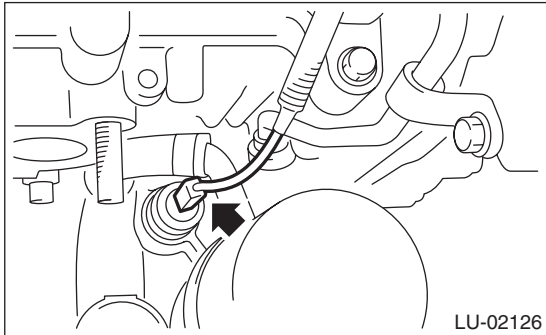
### 7. Oil Pressure Switch

#### A: REMOVAL

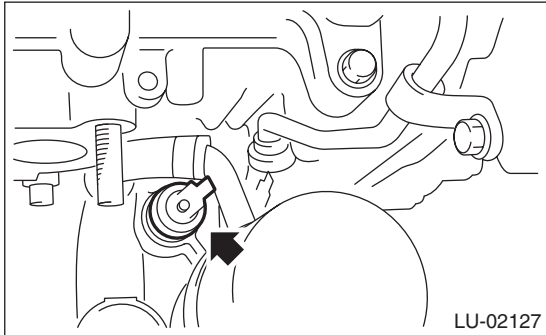
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the terminal from oil pressure switch.



- 6) Remove the oil pressure switch.

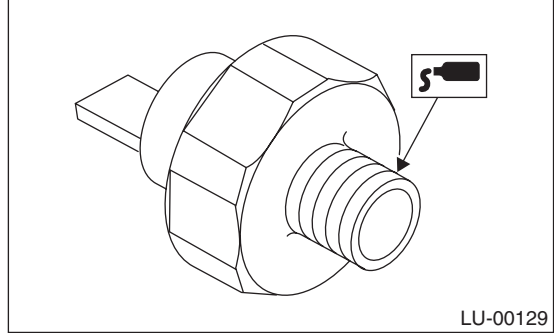


#### B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

##### Liquid gasket:

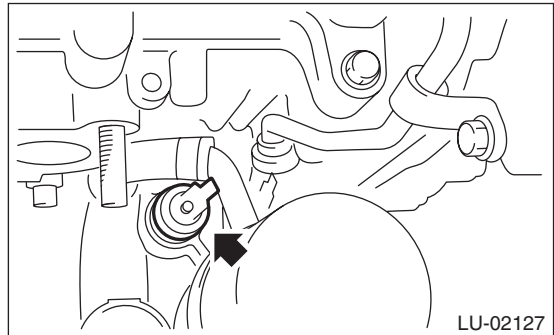
**THREE BOND 1324 (Part No. 004403042) or equivalent**



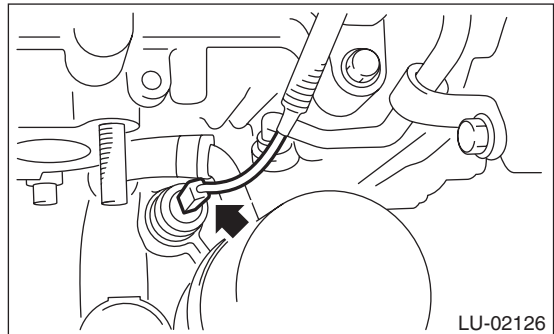
- 2) Install the oil pressure switch.

##### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- 3) Connect the terminal of the oil pressure switch.



- 4) Install the under cover.

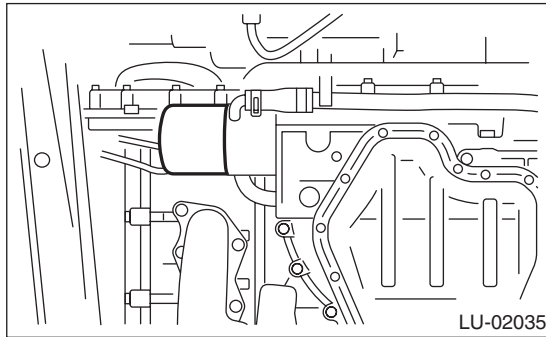
#### C: INSPECTION

Make sure oil does not leak or seep from where the oil pressure switch is installed.

## 8. Engine Oil Filter

### A: REMOVAL

- 1) Set the vehicle on a lift.
  - 2) Lift up the vehicle.
  - 3) Remove the under cover.
  - 4) Drain the engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.>
  - 5) Remove the oil filter using the ST.
- ST 4985447000 OIL FILTER WRENCH



### B: INSTALLATION

#### CAUTION:

**Do not overtighten. Doing so may cause an oil leak.**

- 1) Clean the oil filter installing surface of oil cooler.
- 2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 3) Install the oil filter turning it by hand, being careful not to damage the seal rubber.
- 4) Tighten more (approx. 3/4 turn) after the seal rubber contacts the oil cooler. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
- 5) Install the under cover.
- 6) Lower the vehicle.
- 7) Refill the engine oil. <Ref. to LU(H6DO)-7, INSPECTION, Engine Oil.>

### C: INSPECTION

- 1) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

#### NOTE:

The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level. <Ref. to LU(H6DO)-7, INSPECTION, Engine Oil.>

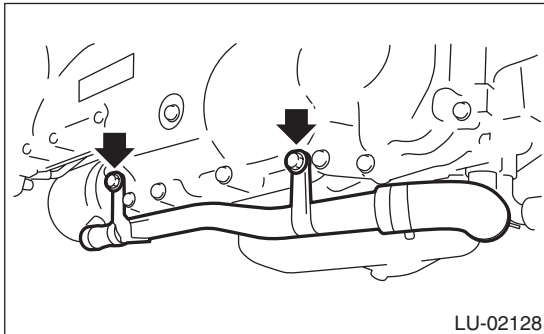
# Oil Cooler

## LUBRICATION

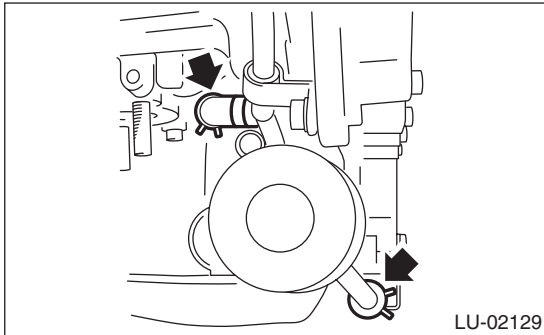
### 9. Oil Cooler

#### A: REMOVAL

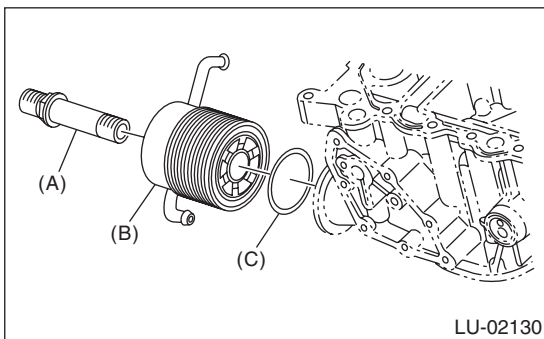
- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant. <Ref. to CO(H6DO)-11, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Drain the engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.>
- 6) Remove the bolts which hold the water pipe to engine.



- 7) Disconnect the water hose from oil cooler.



- 8) Remove the oil filter using the ST. <Ref. to LU(H6DO)-15, REMOVAL, Engine Oil Filter.>
- 9) Remove the oil cooler connector and remove the oil cooler.



- (A) Oil cooler connector
- (B) Oil cooler
- (C) Gasket

#### B: INSTALLATION

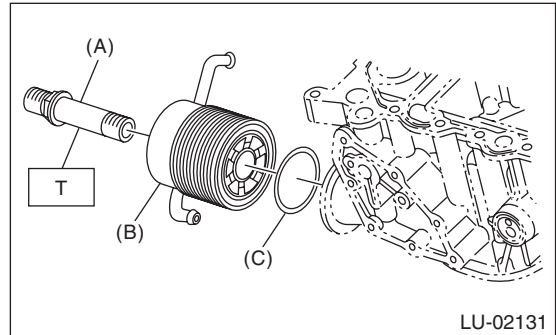
- 1) Install the oil cooler to oil pan upper with oil cooler connector.

#### NOTE:

Use a new gasket.

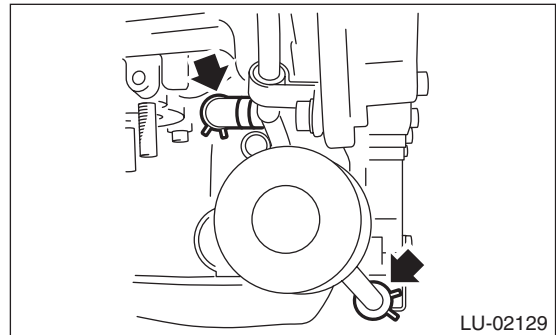
#### Tightening torque:

**T: 54 N·m (5.5 kgf·m, 40 ft·lb)**



- (A) Oil cooler connector
- (B) Oil cooler
- (C) Gasket

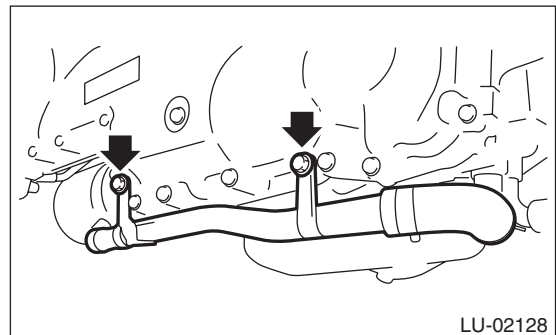
- 2) Install the oil filter. <Ref. to LU(H6DO)-15, INSTALLATION, Engine Oil Filter.>
- 3) Connect the water hose.



- 4) Install the water pipe onto engine.

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



- 5) Lower the vehicle.
- 6) Refill the engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.>



7) Fill engine coolant. <Ref. to CO(H6DO)-11, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

8) Check the engine oil level. <Ref. to LU(H6DO)-7, INSPECTION, Engine Oil.>

## **C: INSPECTION**

1) Check that coolant passages are not clogged using an compressed air.

2) Check that the oil pan upper and O-ring installing surface of oil filter are not damaged.

# Engine Lubrication System Trouble in General

## LUBRICATION

### 10.Engine Lubrication System Trouble in General

#### A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Symptom	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Clean or replace.
		Malfunction of oil relief valve in oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil (including deterioration)	Replace.
		Broken pipe of oil strainer	Replace.
Stuck oil pump rotor		Replace.	
2. Warning light does not turn on.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact of terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed 1. — 2).

# General Description

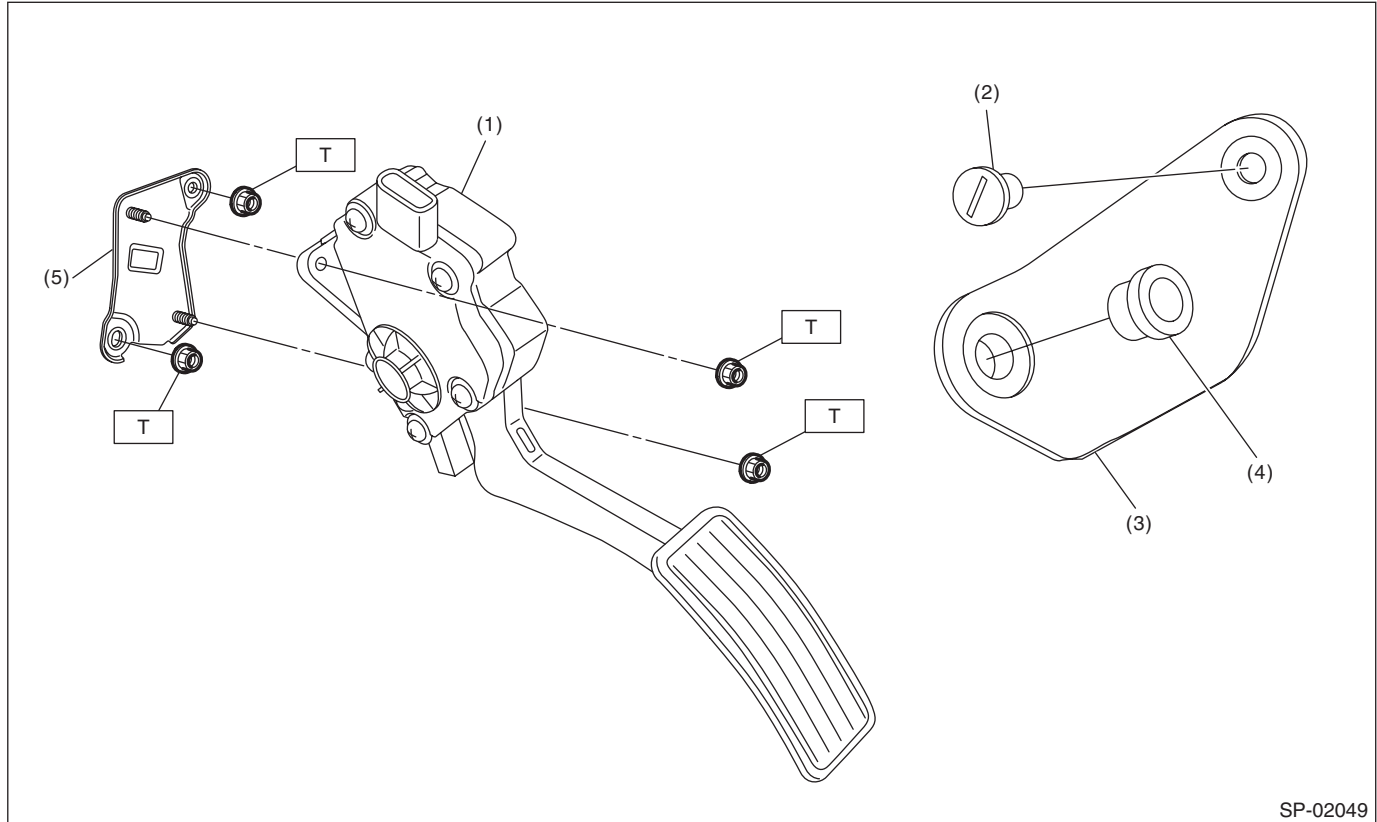
## SPEED CONTROL SYSTEMS

### 1. General Description

#### A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	52 — 57 mm (2.05 — 2.24 in)
-------------------	--------	--------------	-----------------------------

#### B: COMPONENT



- |                            |                               |
|----------------------------|-------------------------------|
| (1) Accelerator pedal ASSY | (4) Stopper                   |
| (2) Clip                   | (5) Accelerator pedal bracket |
| (3) Accelerator plate      |                               |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 18 (1.8, 13.3)**

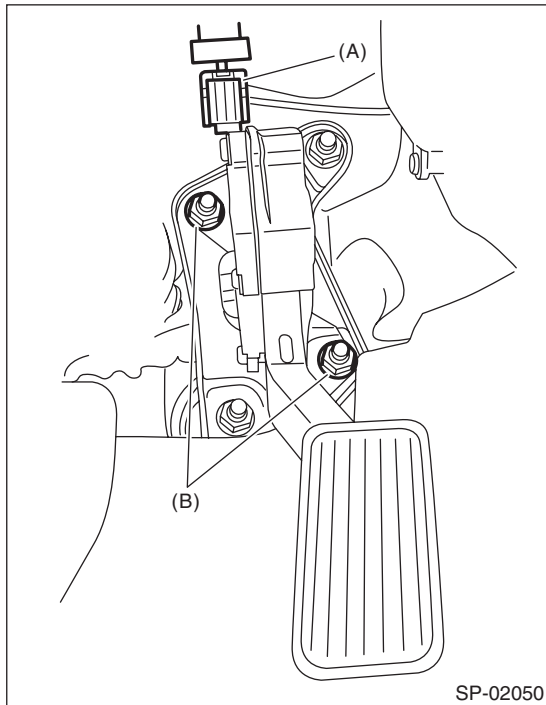
#### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal or installation.
- Keep the parts in order and protect them from dust and dirt.
- Before removal or installation, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

## 2. Accelerator Pedal

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the connector (A).
- 3) Remove the nut (B) securing accelerator pedal assembly.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

### C: DISASSEMBLY

NOTE:

The accelerator pedal cannot be disassembled.

# Accelerator Pedal

SPEED CONTROL SYSTEMS

---

# General Description

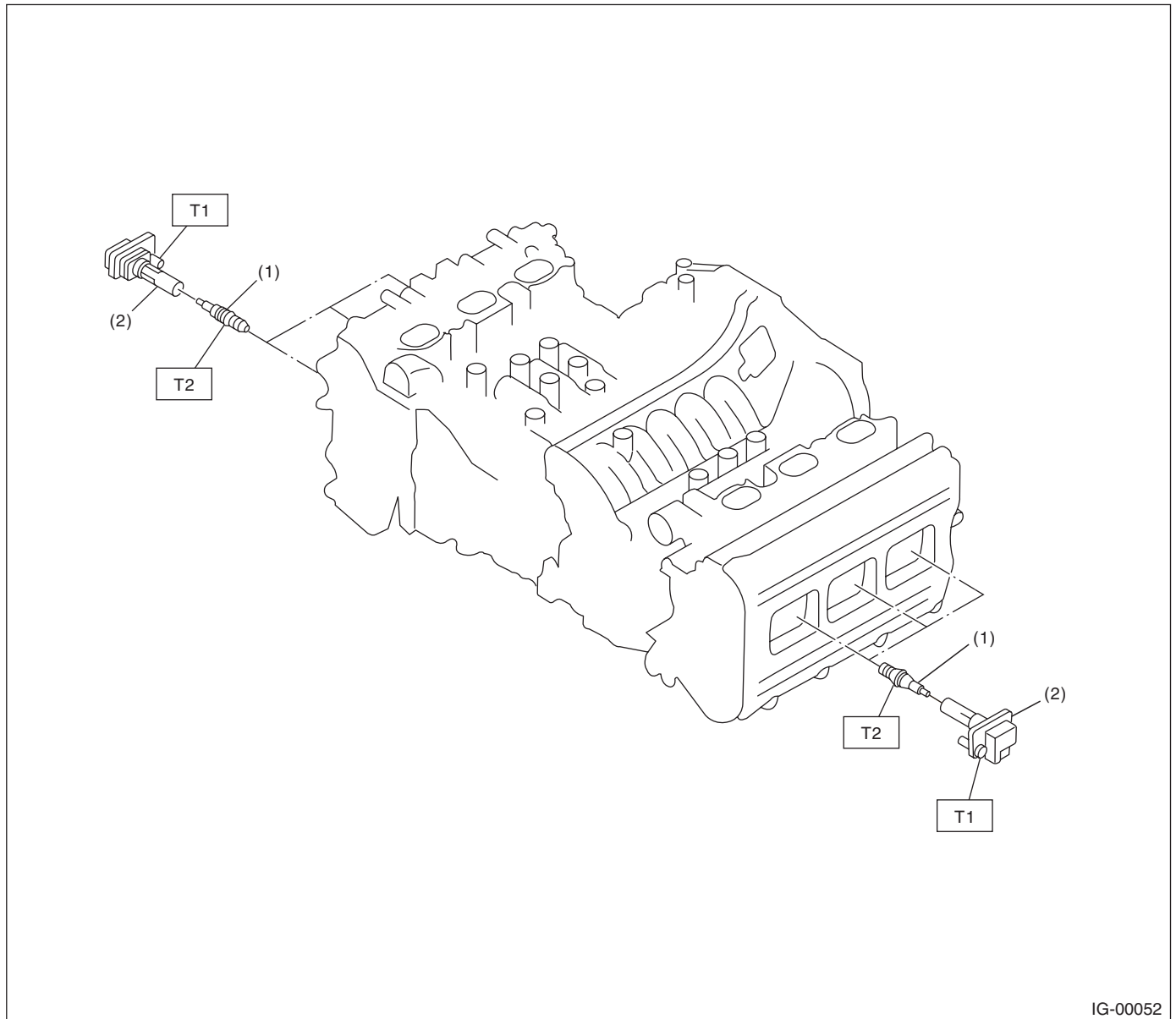
## IGNITION

### 1. General Description

#### A: SPECIFICATION

Item		Specification
Ignition coil	Type	FK0140
	Ignition system	Independent ignition coil
	Manufacturer	Diamond Electric
Spark plug	Manufacturer and type	NGK: ILFR6B
	Thread size (diameter, pitch, length) mm	14, 1.25, 26.5
	Spark plug gap mm (in)	0.7 — 0.8 (0.028 — 0.031)
	Electrode	Iridium

#### B: COMPONENT



(1) Spark plug

(2) Ignition coil

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 16 (1.6, 11.8)**

**T2: 21 (2.1, 15.5)**

### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

# Spark Plug

## IGNITION

### 2. Spark Plug

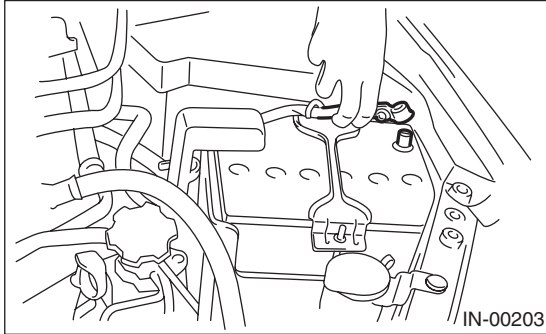
#### A: REMOVAL

##### Spark plug:

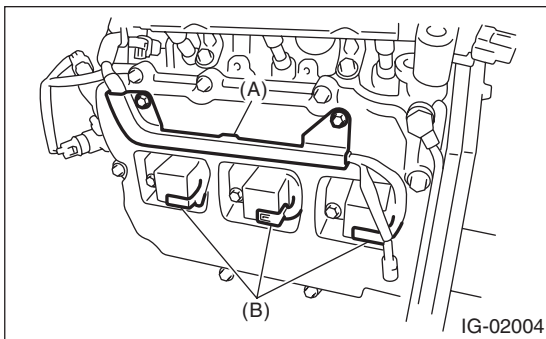
Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(H6DO)-2, SPECIFICATION, General Description.>

#### 1. RH SIDE

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from the battery.



- 3) Remove the air cleaner case. <Ref. to IN(H6DO)-5, REMOVAL, Air Cleaner Case.>
- 4) Remove the bracket (A).
- 5) Disconnect the connector (B) from ignition coil.

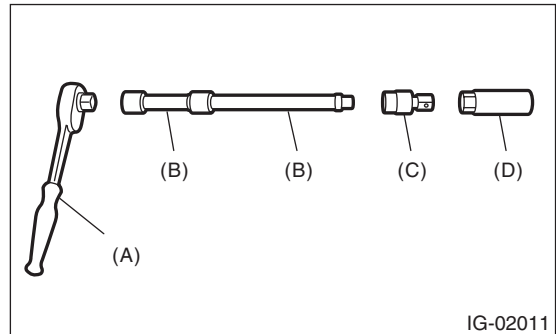
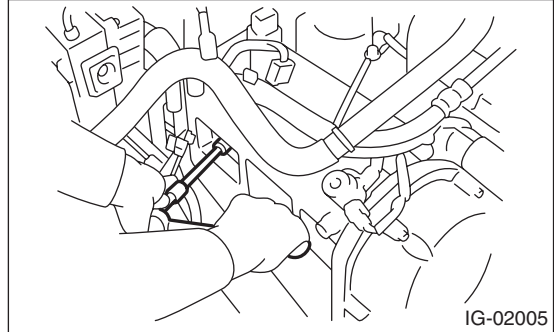


- 6) Remove the ignition coil.

#### NOTE:

Turn the #5 ignition coil to remove it.

- 7) Remove the spark plug with a spark plug socket.

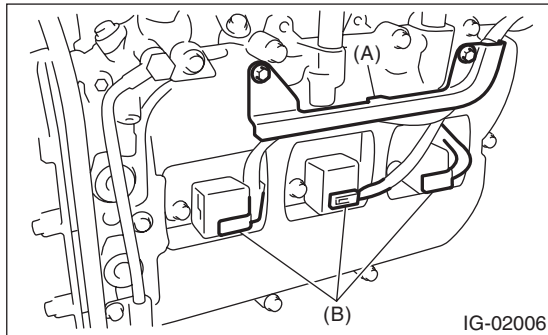


- (A) Ratchet handle
- (B) Extension bar
- (C) Universal joint
- (D) Spark plug socket



## 2. LH SIDE

- 1) Remove the collector cover.
- 2) Remove the battery and battery carrier.
- 3) Remove the bracket (A).
- 4) Disconnect the connector (B) from ignition coil.

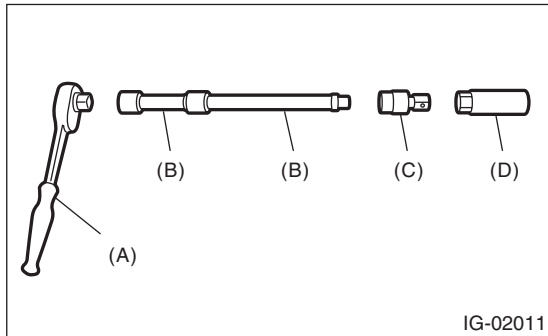
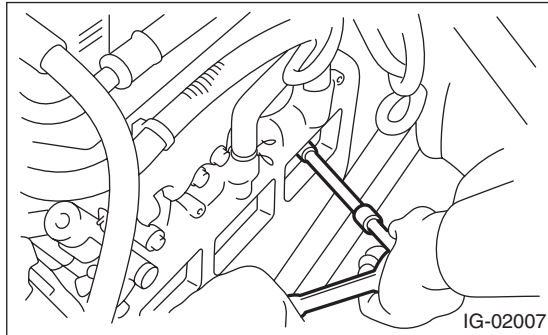


- 5) Remove the ignition coil.

### NOTE:

Turn the #6 ignition coil to remove it.

- 6) Remove the spark plug with a spark plug socket.



- (A) Ratchet handle
- (B) Extension bar
- (C) Universal joint
- (D) Spark plug socket

## B: INSTALLATION

### 1. RH SIDE

Install in the reverse order of removal.

**Tightening torque (Spark plug):**  
21 N·m (2.1 kgf-m, 15.5 ft-lb)

**Tightening torque (Ignition coil):**  
16 N·m (1.6 kgf-m, 11.8 ft-lb)

### 2. LH SIDE

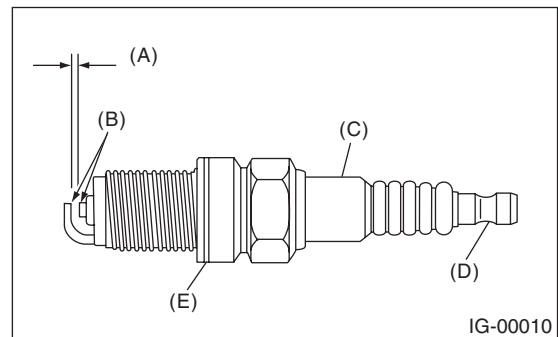
Install in the reverse order of removal.

**Tightening torque (Spark plug):**  
21 N·m (2.1 kgf-m, 15.5 ft-lb)

**Tightening torque (Ignition coil):**  
16 N·m (1.6 kgf-m, 11.8 ft-lb)

## C: INSPECTION

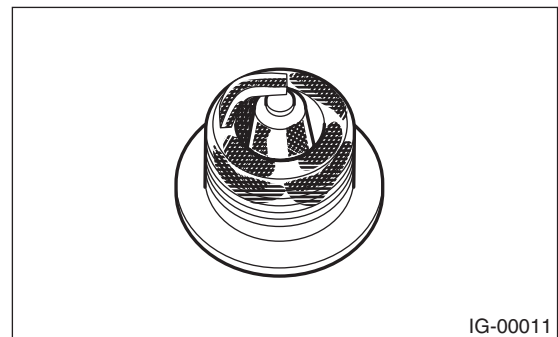
Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Spark plug gap
- (B) Carbon accumulation or wear
- (C) Crack
- (D) Damage
- (E) Damaged gasket

### 1) Normal:

Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

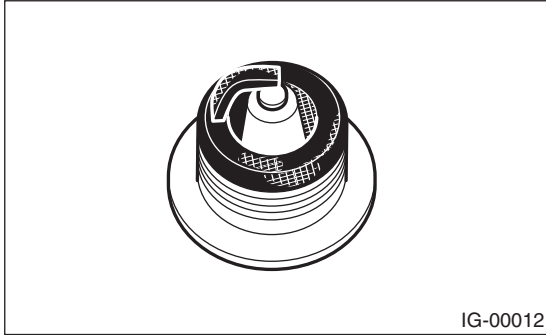


# Spark Plug

## IGNITION

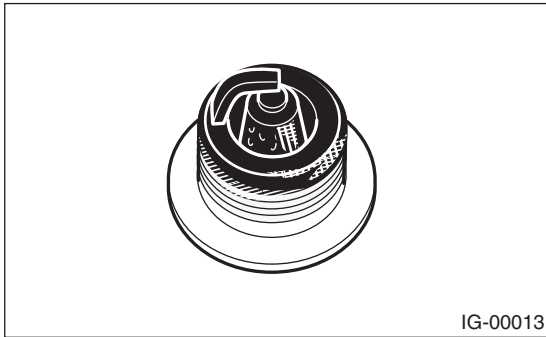
### 2) Carbon fouled:

Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture and dirty air cleaner.



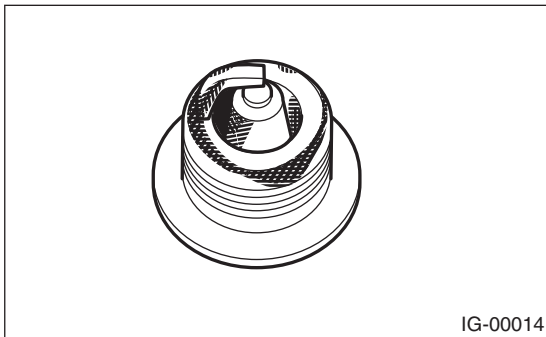
### 3) Oil fouled:

Wet black deposits show oil entrance into the combustion chamber through worn rings and excessive clearance between valve guides and stems.



### 4) Overheating:

White or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, incorrect ignition timing, wrong selection of fuel, and loose spark plugs.



## D: ADJUSTMENT

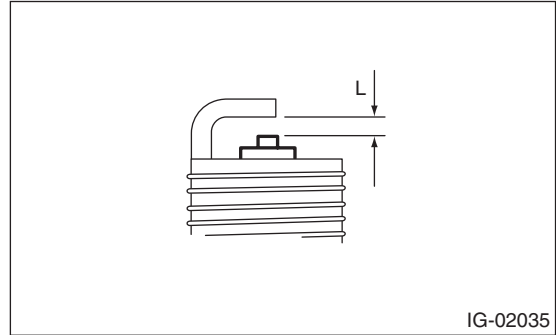
Clean up the spark plug using nylon brush or equivalent. Clean and remove the carbon or oxide deposits. If deposits are too stubborn, replace the spark plugs.

### NOTE:

- Never use a plug cleaner.
- Never use a metal brush because it makes insulator worn.

### Spark plug gap L:

**0.7 — 0.8 mm (0.028 — 0.031 in)**



### 3. Ignition Coil

#### A: REMOVAL

Direct ignition type has been adopted. Refer to “Spark Plug” for removal procedure. <Ref. to IG(H6DO)-4, REMOVAL, Spark Plug.>

#### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**16 N·m (1.6 kgf-m, 11.8 ft-lb)**

#### C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

# Ignition Coil

IGNITION

---

IG(H6DO)-8

### 1. General Description

#### A: SPECIFICATION

Specifications for the 3.0 L DOHC non-turbo model are included in the SC(H4SO) section. <Ref. to SC(H4SO)-2, General Description.>

# Basic Diagnostic Procedure

ENGINE (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### 1. ENGINE

	Step	Check	Yes	No
1	<b>CHECK ENGINE START FAILURE.</b> 1) Ask the customer when and how the trouble occurred using the interview checklist. <Ref. to EN(H6DO)(diag)-3, CHECK, Check List for Interview.> 2) Start the engine.	Does the engine start?	Go to step 2.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H6DO)(diag)-71, Diagnostics for Engine Starting Failure.>
2	<b>CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.</b>	Does the malfunction indicator light illuminate?	Go to step 3.	Inspection using "General Diagnostic Table". <Ref. to EN(H6DO)(diag)-356, INSPECTION, General Diagnostic Table.>
3	<b>CHECK INDICATION OF DTC ON DISPLAY.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to data link connector. 3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool. 4) Read DTC using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor Refer to "Read Diagnostic Trouble Code" for detailed operation procedure. <Ref. to EN(H6DO)(diag)-44, Read Diagnostic Trouble Code (DTC).> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Record the DTC. Repair the trouble cause. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H6DO)(diag)-62, Malfunction Indicator Light.>
4	<b>PERFORM DIAGNOSIS.</b> 1) Perform the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.> 2) Perform the Inspection Mode. <Ref. to EN(H6DO)(diag)-45, Inspection Mode.>	Is DTC displayed on the Subaru Select Monitor or general scan tool?	Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-92, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Check List for Interview

ENGINE (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

#### 1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of purchase		Fuel brand	
Date of repair		Odometer reading	km
V.I.N.			miles
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Various/Others:		
Ambient air temperature	°C ( °F)		
	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold		
Place	<input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner city <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Rough road <input type="checkbox"/> Others:		
	<input type="checkbox"/> Cold <input type="checkbox"/> Warming-up <input type="checkbox"/> After warming-up <input type="checkbox"/> Any temperature <input type="checkbox"/> Others:		
Engine speed	rpm		
Vehicle speed	km/h (MPH)		
Driving conditions	<input type="checkbox"/> Not affected <input type="checkbox"/> At starting <input type="checkbox"/> While idling <input type="checkbox"/> At racing <input type="checkbox"/> While accelerating <input type="checkbox"/> While cruising <input type="checkbox"/> While decelerating <input type="checkbox"/> While turning (RH/LH)		
Headlight	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Rear defogger	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Blower	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Audio	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
A/C compressor	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	CD/Cassette	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Radiator fan	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Car phone	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Front wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF	Wireless device	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF
Rear wiper	<input type="checkbox"/> ON/ <input type="checkbox"/> OFF		

# Check List for Interview

## ENGINE (DIAGNOSTICS)

---

### 2. CHECK LIST NO. 2

Check the following item about the vehicle's state when malfunction indicator light illuminates.

#### NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators illuminate. <input type="checkbox"/> Yes / <input type="checkbox"/> No
<input type="checkbox"/> Low fuel warning light <input type="checkbox"/> Charge indicator light <input type="checkbox"/> AT diagnostic indicator light <input type="checkbox"/> ABS warning light <input type="checkbox"/> Oil pressure indicator light
b) Fuel level
• Lack of gasoline: <input type="checkbox"/> Yes / <input type="checkbox"/> No • Indicator position of fuel gauge: • Experienced running out of fuel: <input type="checkbox"/> Yes / <input type="checkbox"/> No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
d) Intentional connecting or disconnecting of hoses: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What:
e) Installing of parts other than genuine parts: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• What: • Where:
f) Occurrence of noise: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
g) Occurrence of smell: <input type="checkbox"/> Yes / <input type="checkbox"/> No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: <input type="checkbox"/> Yes / <input type="checkbox"/> No
i) Troubles occurred
<input type="checkbox"/> Engine does not start. <input type="checkbox"/> Engine stalls during idling. <input type="checkbox"/> Engine stalls while driving. <input type="checkbox"/> Engine speed decreases. <input type="checkbox"/> Engine speed does not decrease. <input type="checkbox"/> Rough idling <input type="checkbox"/> Poor acceleration <input type="checkbox"/> Back fire <input type="checkbox"/> After fire <input type="checkbox"/> Does not shift. <input type="checkbox"/> Excessive shift shock



## 3. General Description

### A: CAUTION

1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

#### CAUTION:

- All airbag system wiring harnesses and connectors are yellow. Do not use electrical test equipment on these circuits.

- Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.

2) Never connect the battery in reverse polarity. Failure to do so will damage the ECM instantly, and the fuel injector and other parts will also be damaged.

3) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.

4) Before disconnecting the connectors of each sensor and ECM, be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4DOTC)(diag)-56, Clear Memory Mode.>

5) Measure the voltage or resistance of individual sensor or all electrical control modules using a tapered pin with a diameter of less than 0.6 mm (0.024 in). Do not insert the pin 4 mm (0.16 in) or more into the part.

#### CAUTION:

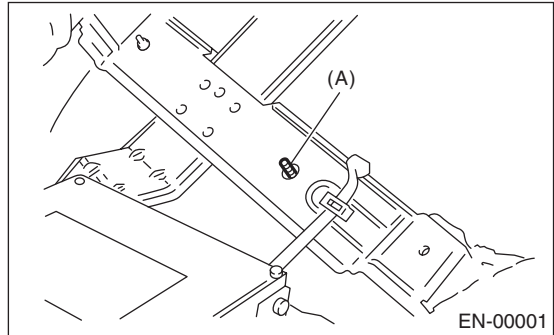
**When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.**

#### NOTE:

When replacing the ECM of the models with Immobilizer, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the "IMMOBILIZER TEACHING OPERATION MANUAL".

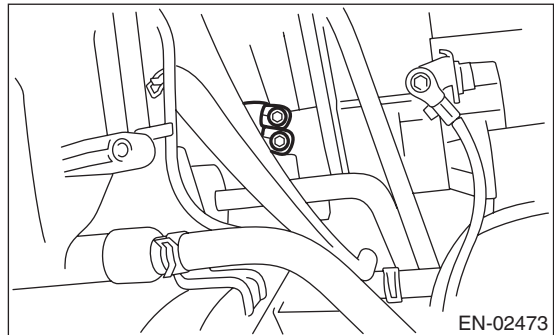
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.

7) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

8) Use the engine ground terminal or engine assembly as the grounding point to chassis when measuring the voltage and resistance in engine compartment.



9) Every MFI-related part is a precision part. Do not drop them.

10) Observe the following cautions when installing a radio in MFI equipped models.

#### CAUTION:

- The antenna must be kept as far apart as possible from control unit. (The ECM is located under the passenger's seat floor mat.)

- The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.

- Carefully adjust the antenna for correct matching.

- When mounting a large power type radio, pay special attention to the three items mentioned above.

- Incorrect installation of the radio may affect the operation of ECM.

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H6DO)-42, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

# General Description

## ENGINE (DIAGNOSTICS)

12) For the model with ABS, the ABS warning light may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clear procedure of self-diagnosis function.

### B: INSPECTION

Before performing diagnostics, check the following item which might affect engine problems.

#### 1. BATTERY

1) Measure the battery voltage and specific gravity of the electrolyte.

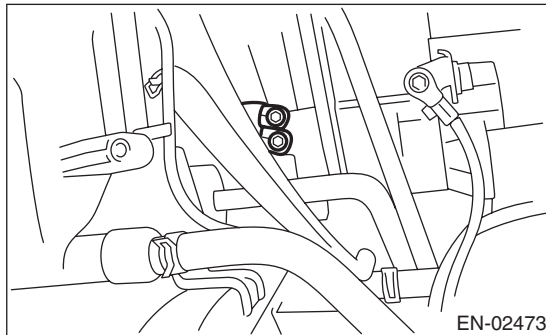
**Standard voltage: 12 V**

**Specific gravity: 1.260 or more**

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

#### 2. ENGINE GROUND

Check if the engine ground terminal is properly connected to engine.



### C: NOTE

#### 1. GENERAL DESCRIPTION

- The on-board diagnostic (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic throttle control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
- Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
- The OBD system incorporated with the vehicles within this type of engine complies with OBD-II regulations. The OBD system monitors the components and the system malfunction listed in "Engine Section" which affects on emissions.
- When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
- The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer first when it detects a malfunction.
- If the OBD system detects malfunctions such as the fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
- When the malfunction does not occur again for three consecutive driving cycles, malfunction indicator light is turned off, but DTC remains at on-board computer.
- When troubleshooting the vehicle which complies with OBD-II regulations, connect the Subaru Select Monitor or general scan tool to the vehicle.

## 2. ENGINE AND EMISSION CONTROL SYSTEM

- The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.

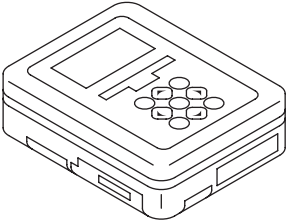
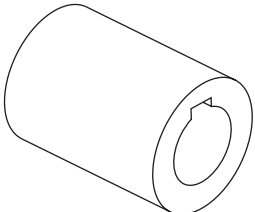
With this system, the fuel which is pressurized at a constant pressure is injected into the intake air passage of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system, where the electro-magnetic injection valve (fuel injector) opens for a short period of time depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.

- Furthermore, all operating conditions of the engine are converted into electronic signals, and this enables additional system features with greatly improved adaptability, making it easier to add compensation features.

The MFI system also has the following features:

- Reduced emission of harmful exhaust gases
- Reduction in fuel consumption
- Increased engine output
- Superior acceleration and deceleration
- Superior startability and warm-up performance in cold weather since compensation is made for engine coolant and intake air temperature

## D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 ST18252AA000	18252AA000	CRANKSHAFT SOCKET	Used for rotating crankshaft.

# Electrical Component Location

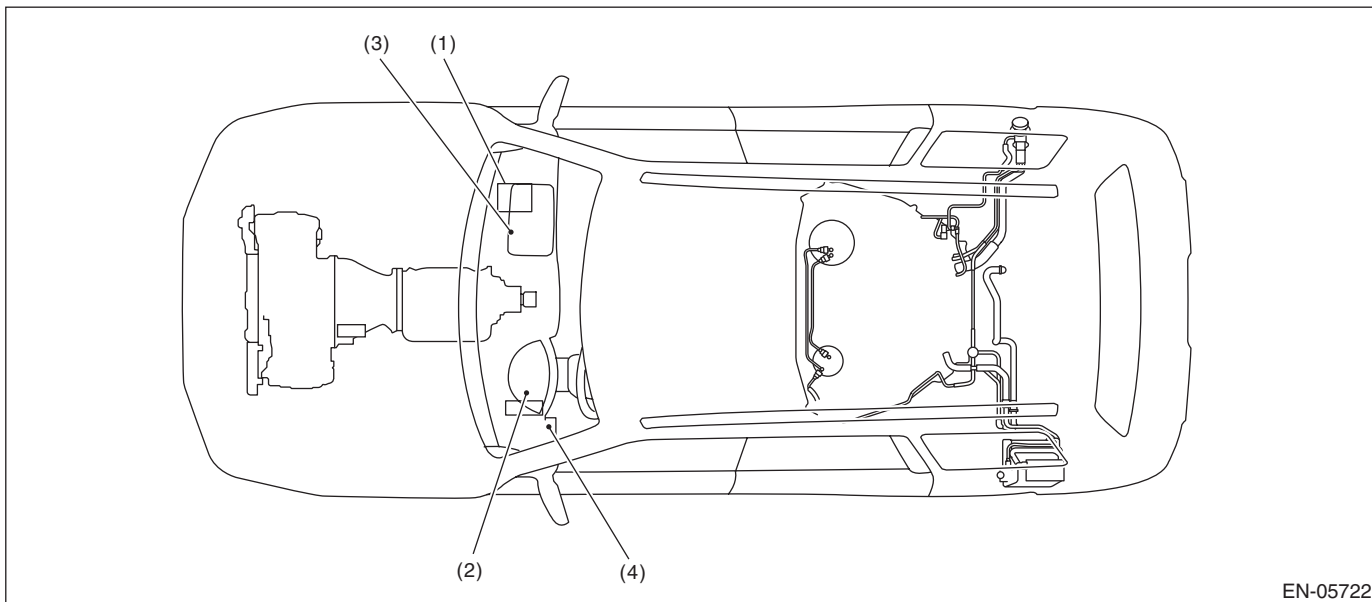
ENGINE (DIAGNOSTICS)

## 4. Electrical Component Location

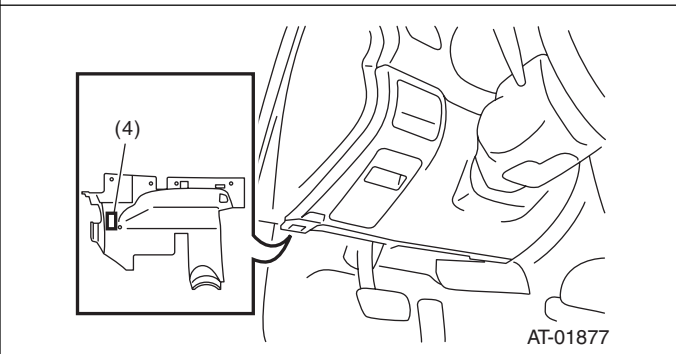
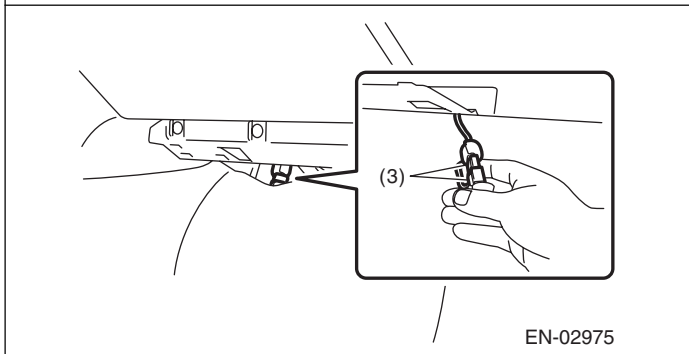
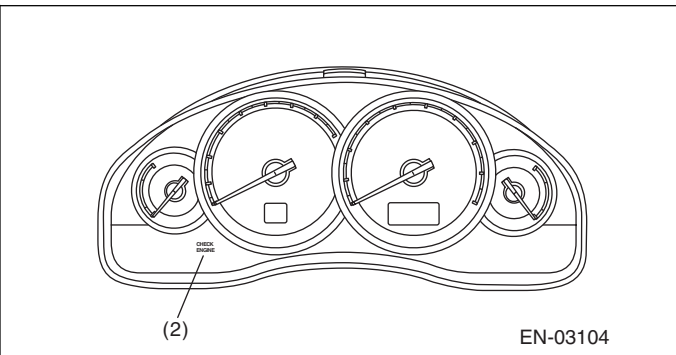
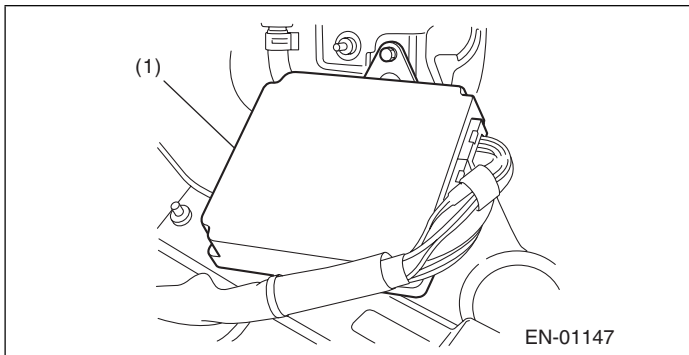
### A: LOCATION

#### 1. ENGINE

- Control module



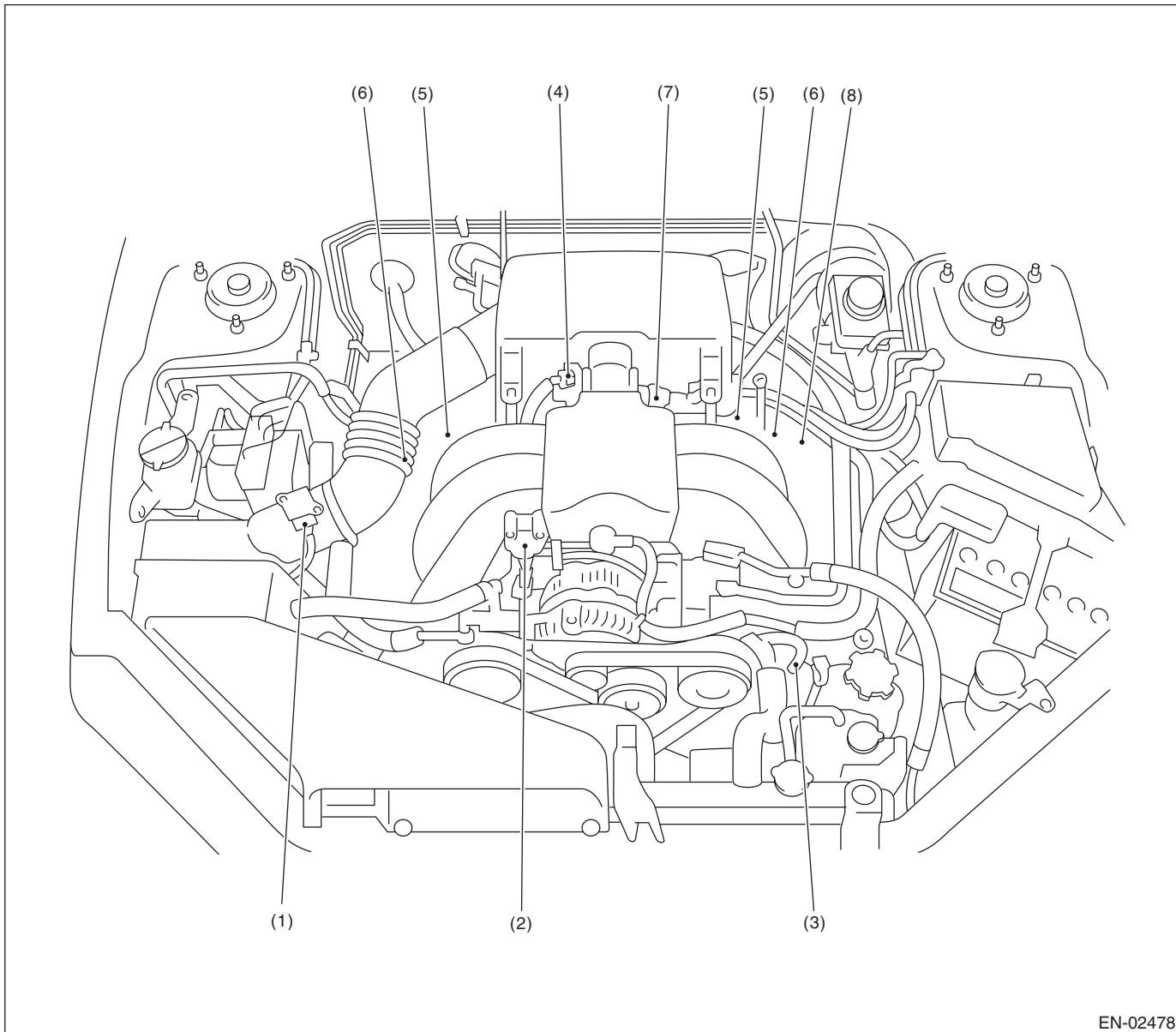
- (1) Engine control module (ECM)      (3) Delivery (test) mode connector      (4) Data link connector  
(2) Malfunction indicator light



# Electrical Component Location

ENGINE (DIAGNOSTICS)

- Sensor



EN-02478

(1) Mass air flow and intake air temperature sensor

(3) Engine coolant temperature sensor

(6) Camshaft position sensor

(2) Manifold absolute pressure sensor

(4) Electronic throttle control

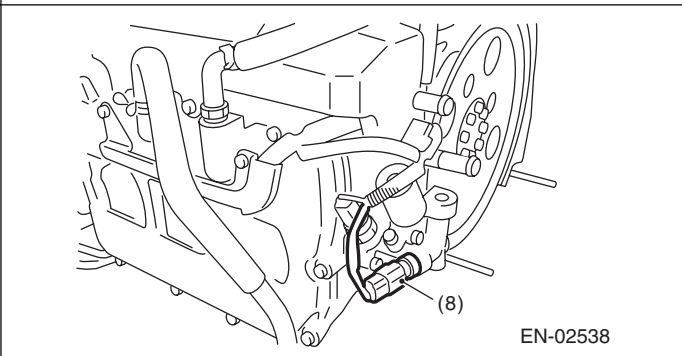
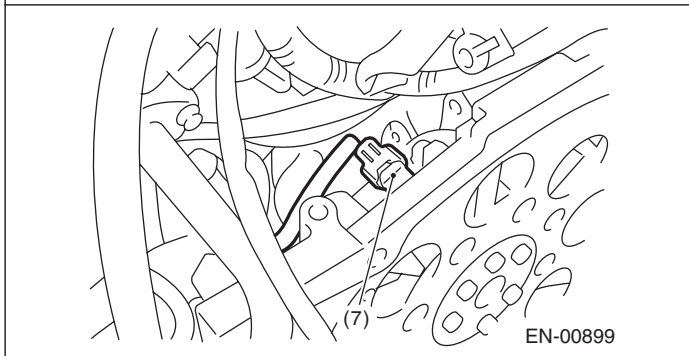
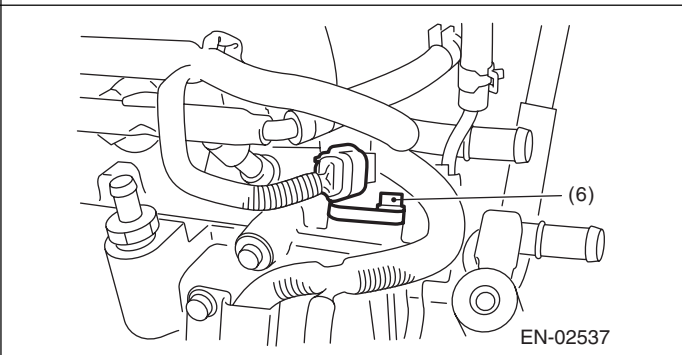
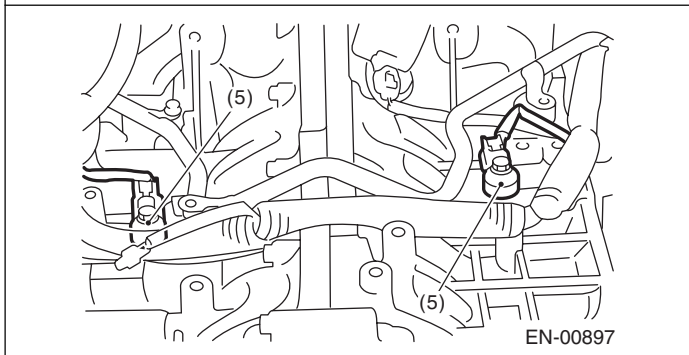
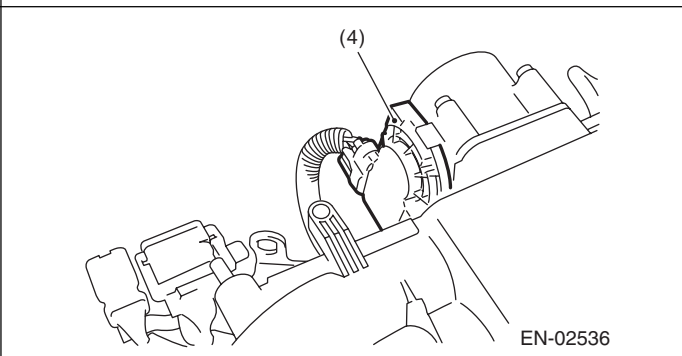
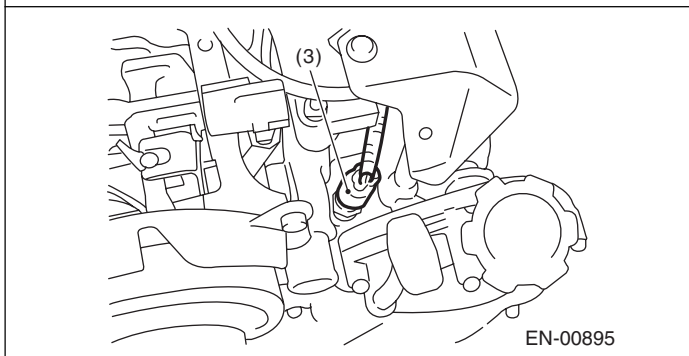
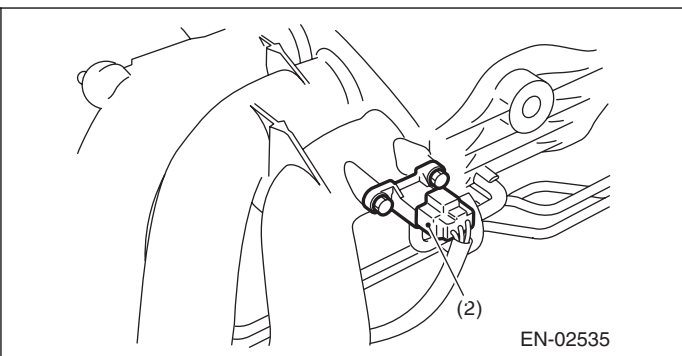
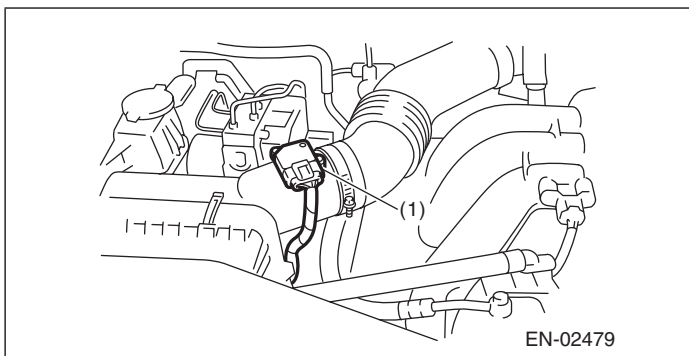
(7) Crankshaft position sensor

(5) Knock sensor

(8) Oil temperature sensor

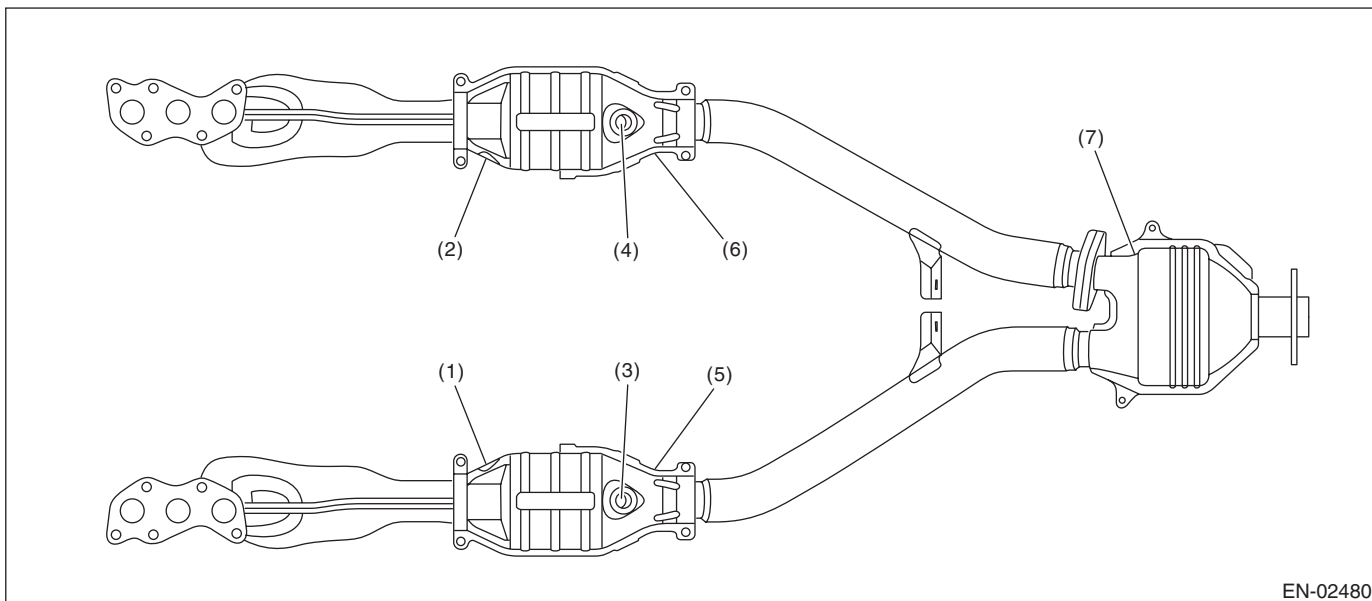
# Electrical Component Location

## ENGINE (DIAGNOSTICS)

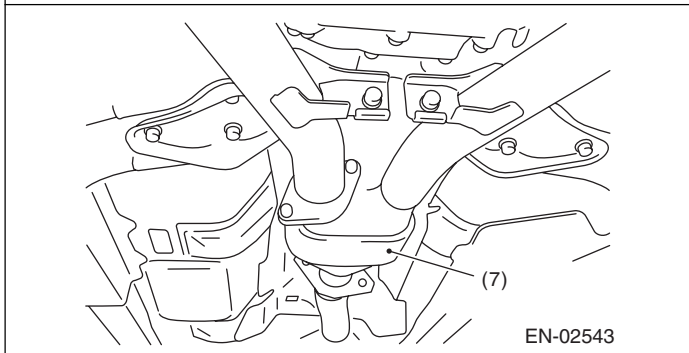
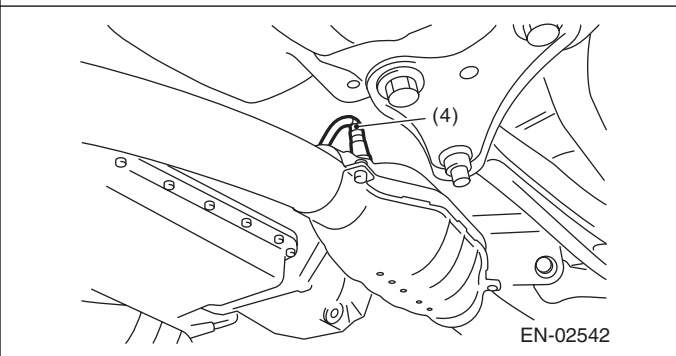
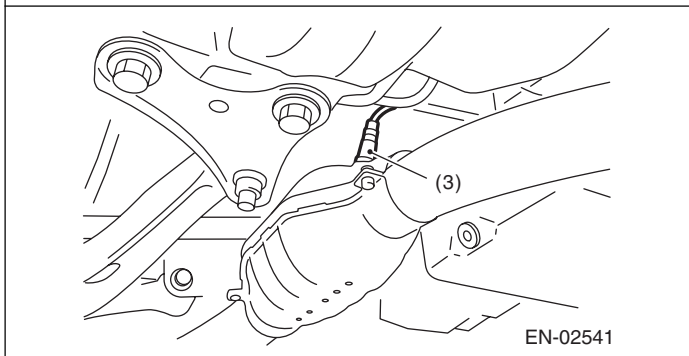
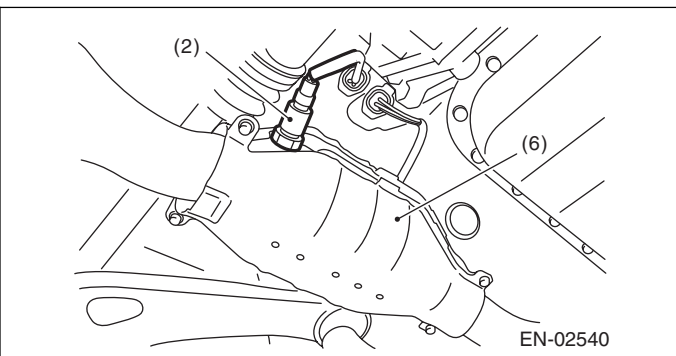
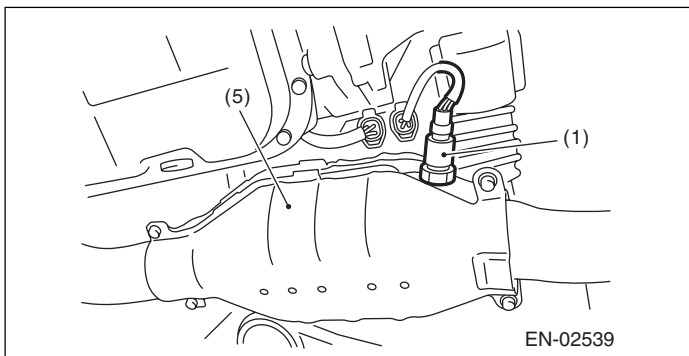


# Electrical Component Location

ENGINE (DIAGNOSTICS)

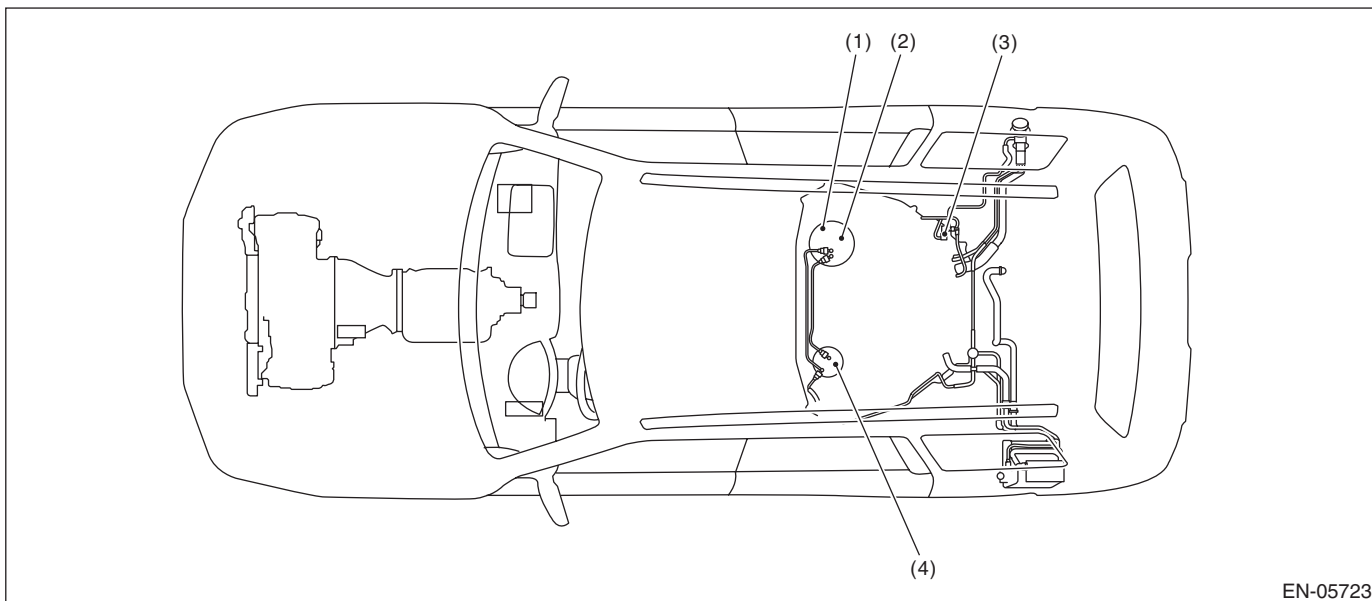


- |                                  |                                  |                                  |
|----------------------------------|----------------------------------|----------------------------------|
| (1) Front oxygen (A/F) sensor LH | (4) Rear oxygen sensor RH        | (6) Front catalytic converter RH |
| (2) Front oxygen (A/F) sensor RH | (5) Front catalytic converter LH | (7) Rear catalytic converter     |
| (3) Rear oxygen sensor LH        |                                  |                                  |



# Electrical Component Location

## ENGINE (DIAGNOSTICS)

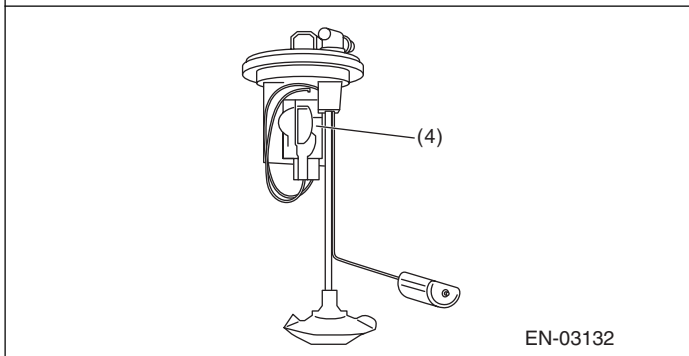
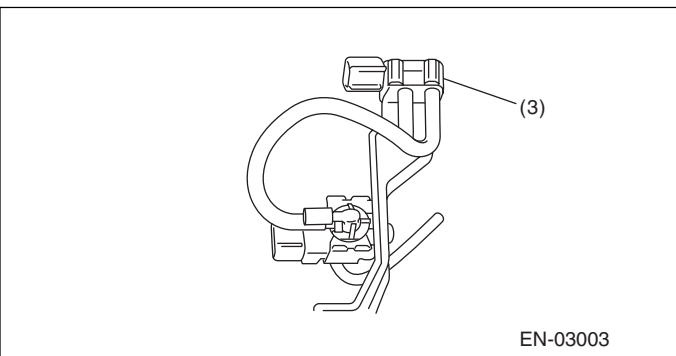
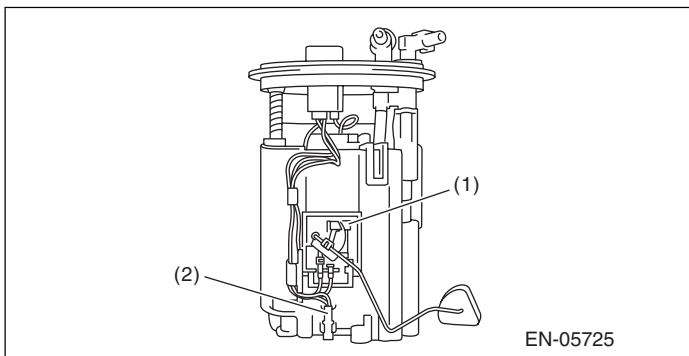


(1) Fuel level sensor

(3) Fuel tank pressure sensor

(4) Fuel sub level sensor

(2) Fuel temperature sensor



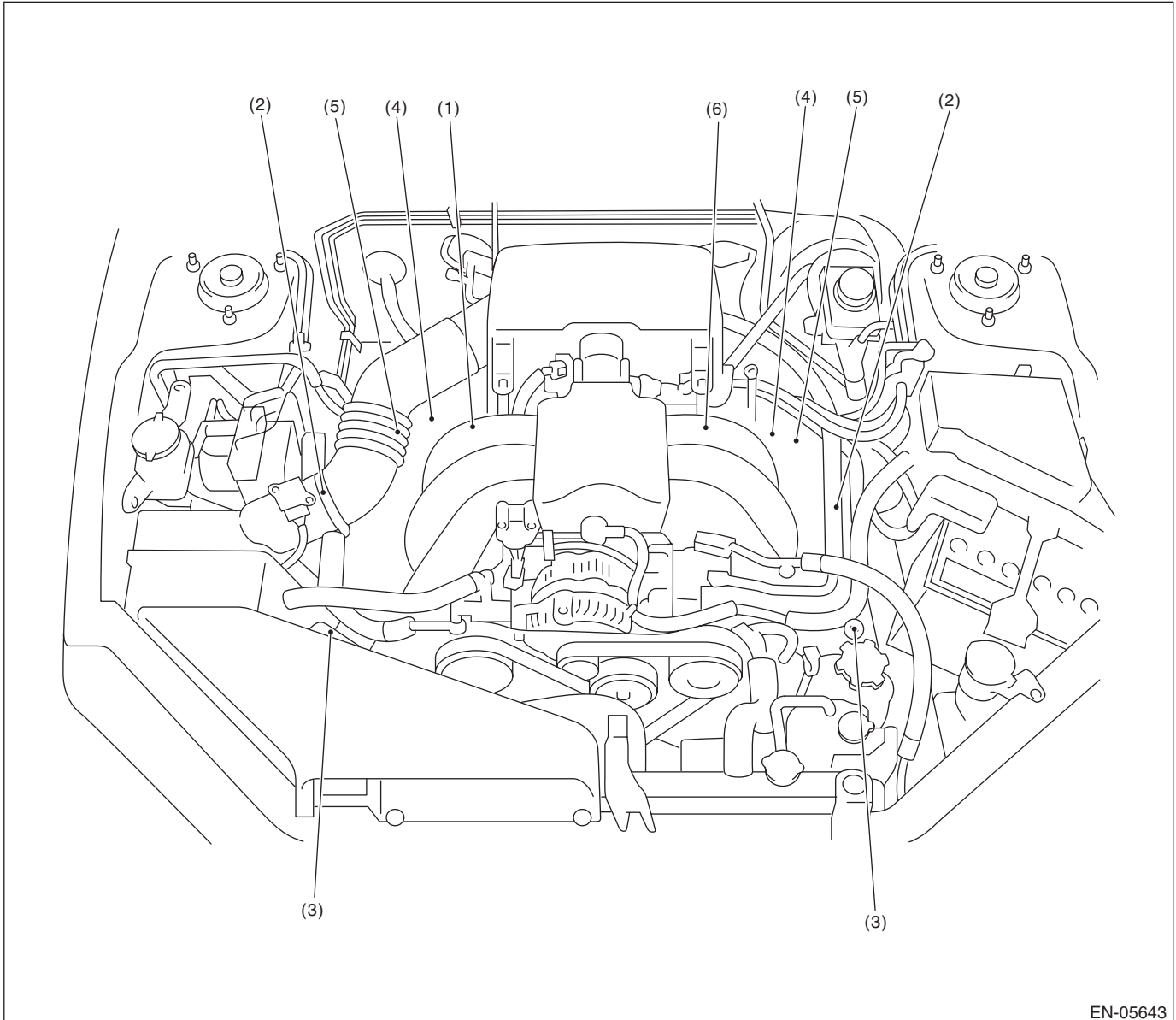
**SUBARU.**



# Electrical Component Location

ENGINE (DIAGNOSTICS)

- Solenoid valve, actuator, emission control system parts and ignition system parts

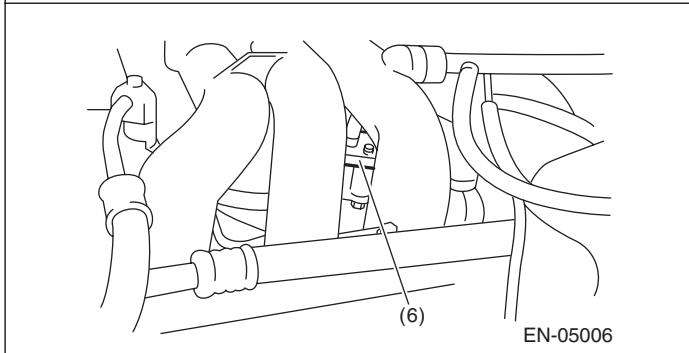
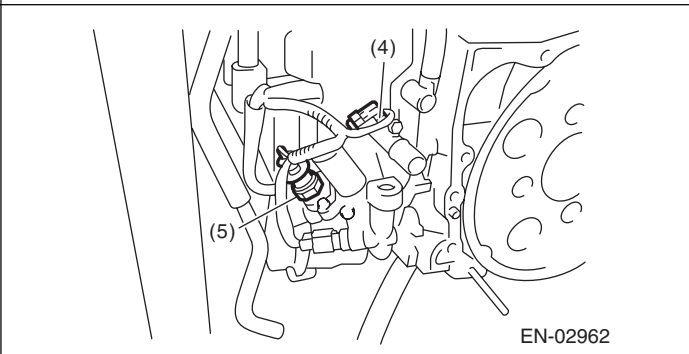
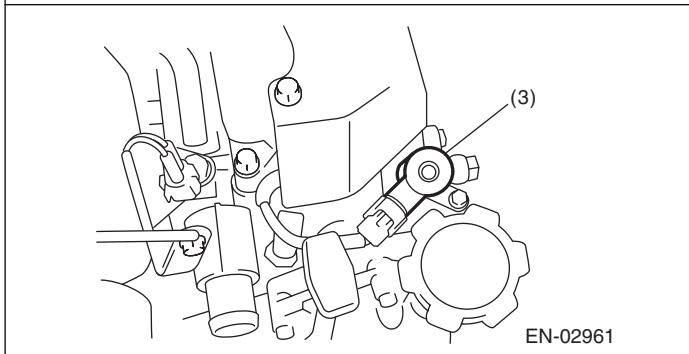
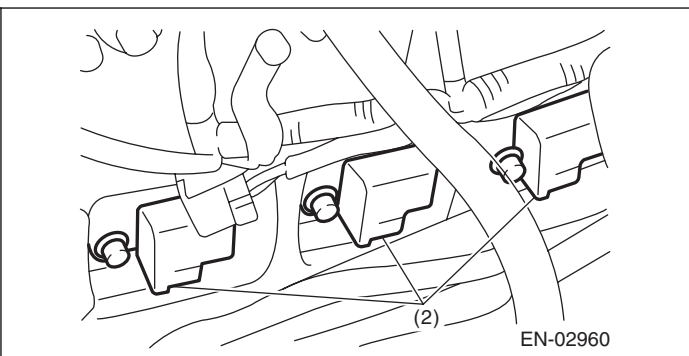
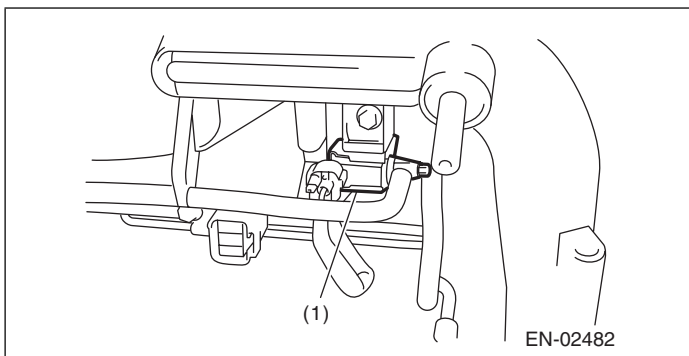


EN-05643

- |                                     |   |               |
|-------------------------------------|---|---------------|
| (1) Purge control solenoid valve    | (4) Oil switching solenoid valve                      | (6) EGR valve |
| (2) Ignition coil and ignitor ASSY  | (5) Variable valve lift diagnosis oil pressure switch |               |
| (3) Oil flow control solenoid valve |   |               |

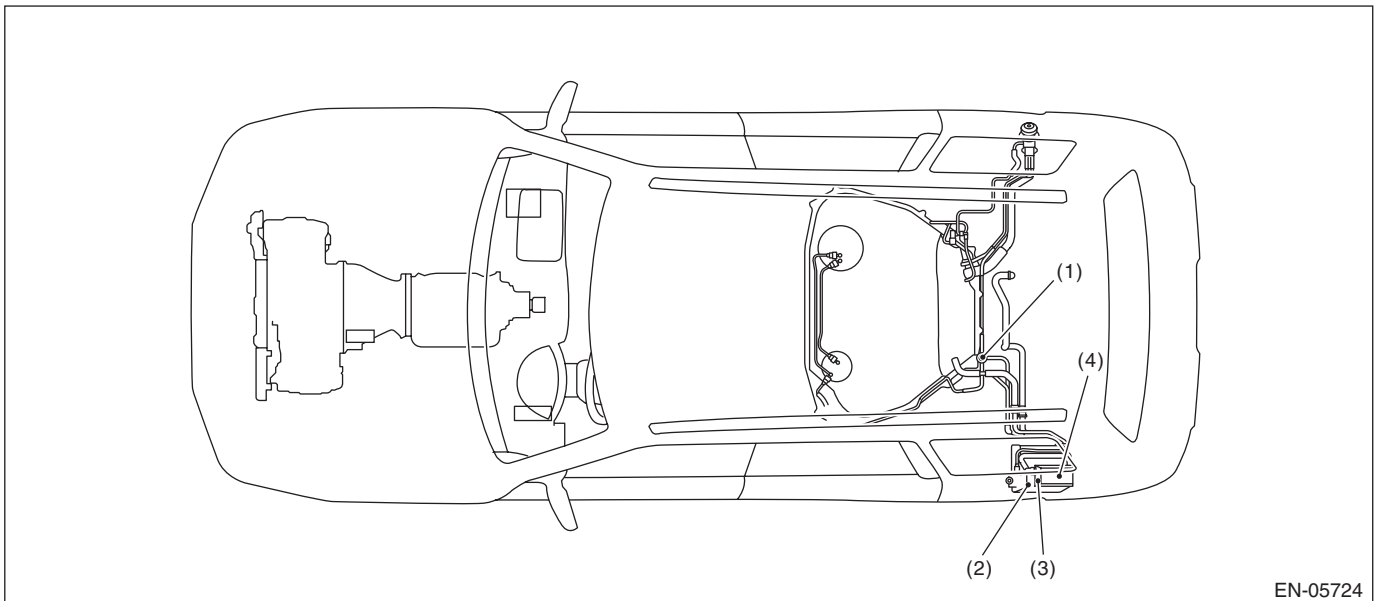
# Electrical Component Location

## ENGINE (DIAGNOSTICS)

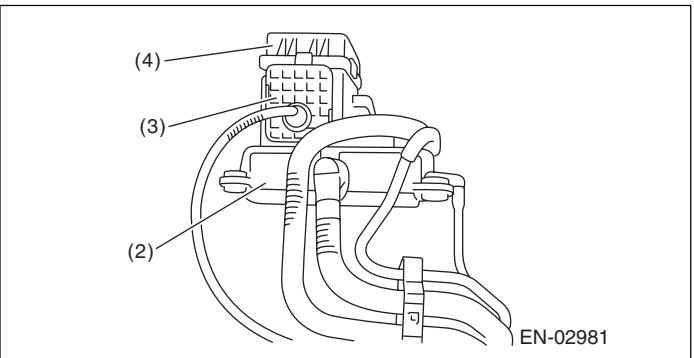
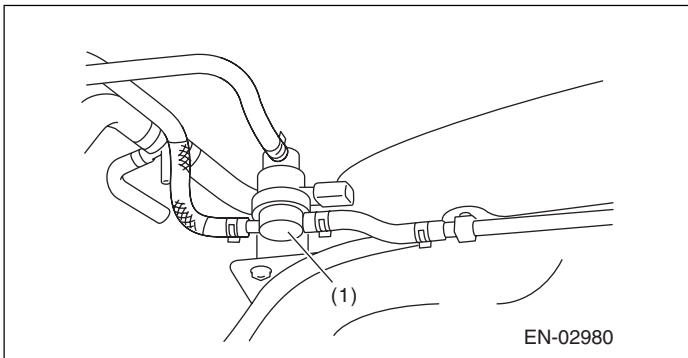


# Electrical Component Location

ENGINE (DIAGNOSTICS)

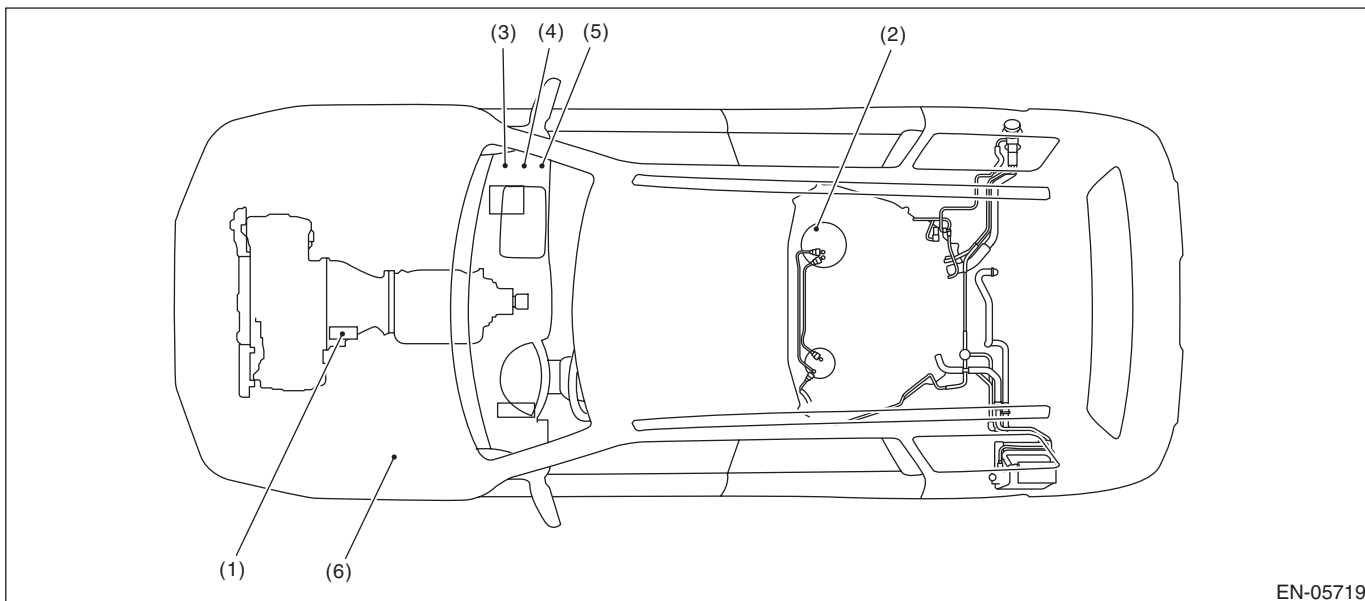


- (1) Pressure control solenoid valve
- (2) Canister
- (3) Drain valve
- (4) Drain filter



# Electrical Component Location

## ENGINE (DIAGNOSTICS)



(1) Starter

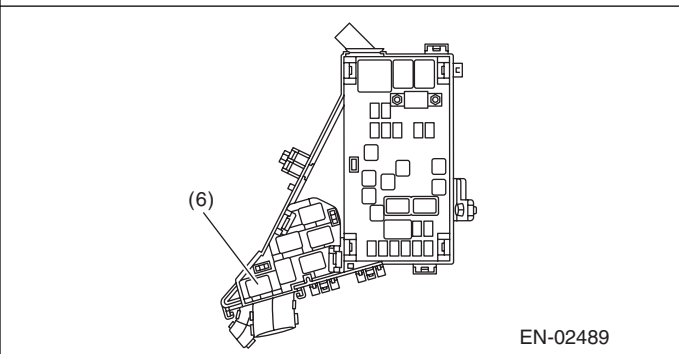
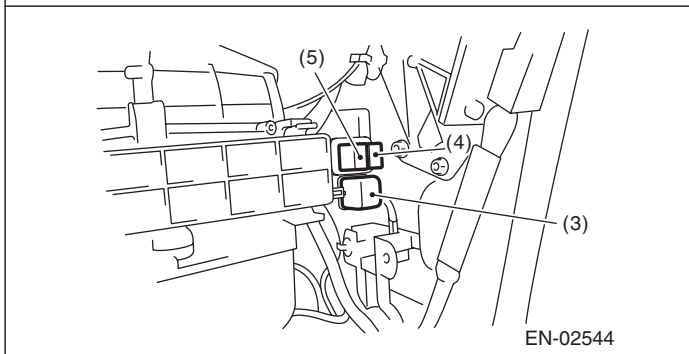
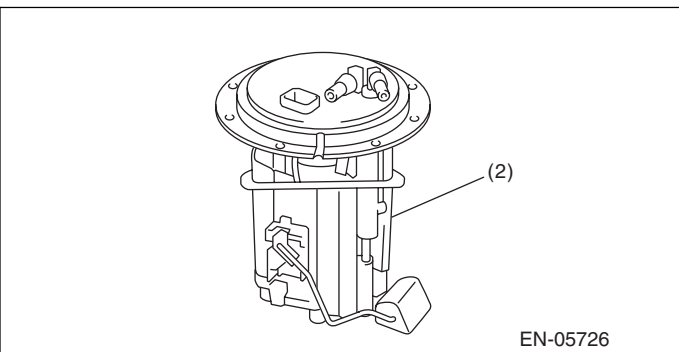
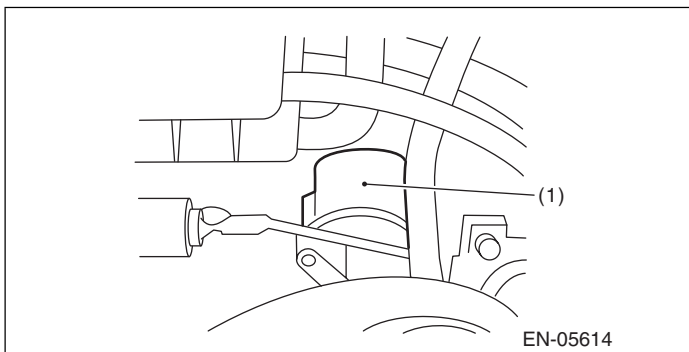
(2) Fuel pump

(3) Main relay

(4) Fuel pump relay

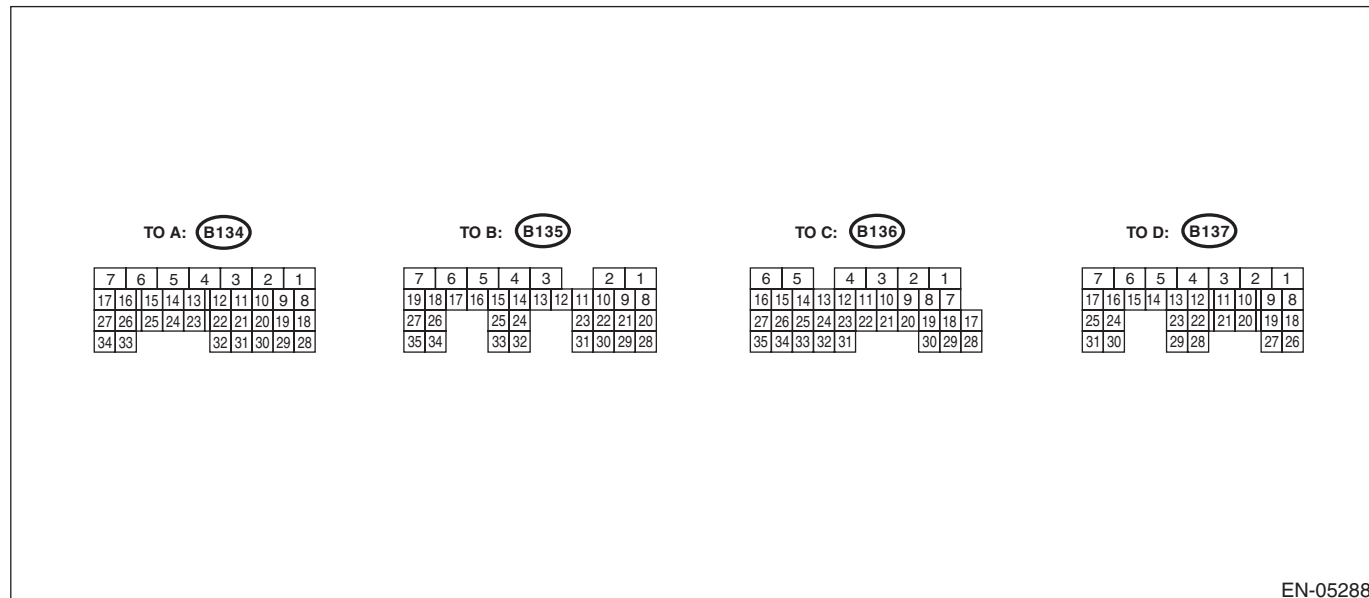
(5) Electronic throttle control relay

(6) Radiator fan relay



## 5. Engine Control Module (ECM) I/O Signal

### A: ELECTRICAL SPECIFICATION



EN-05288

Contents	Conne- ctor No.	Termi- nal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
Crankshaft position sensor	Signal (+)	B134	13	0	-7 — +7	Waveform
	Signal (-)	B134	14	0	0	—
	Shield	B134	24	0	0	—
Camshaft position sensor (LH)	Power supply	B134	21	0.275	0 or 5	Waveform
	GND	B134	22	0	0	—
Camshaft position sensor (RH)	Power supply	B134	11	0.275	0 or 5	Waveform
	GND	B134	22	0	0	—
Electronic throttle control	Main	B134	18	0.64 — 0.94 Fully opened: 4.01	0.64 — 0.72 (After engine is warmed-up.)	Fully closed: 0.6 Fully opened: 4.01
	Sub	B134	28	1.51 — 1.76 Fully opened: 4.23	1.51 — 1.58 (After engine is warmed-up.)	Fully closed: 1.48 Fully opened: 4.23
Electronic throttle control motor (+)	B137	5	Duty waveform	Duty waveform	Drive frequency: 500 Hz	
Electronic throttle control motor (-)	B137	4	Duty waveform	Duty waveform	Drive frequency: 500 Hz	
Electronic throttle control motor power supply	B136	1	10 — 13	12 — 14	—	
Electronic throttle control motor relay	B136	21	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	When ignition switch is turned to ON: ON	
EGR solenoid valve	Signal A+	B134	8	10 — 13	12 — 14	—
	Signal A-	B134	9	10 — 13	12 — 14	—
	Signal B+	B134	10	10 — 13	12 — 14	—
	Signal B-	B134	20	10 — 13	12 — 14	—

# Engine Control Module (ECM) I/O Signal

## ENGINE (DIAGNOSTICS)

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 1 Fully opened: 3.6	Fully closed: 1 Fully opened: 3.3	—
	Main power supply	B135	21	5	5	—
	GND (main sensor)	B135	29	0	0	—
	Sub sensor signal	B135	31	Fully closed: 1 Fully opened: 3.7	Fully closed: 1 Fully opened: 3.3	—
	Sub power supply	B135	22	5	5	—
	GND (sub sensor)	B135	30	0	0	—
Engine coolant temperature sensor		B134	34	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.
Starter switch		B136	32	0	0	Cranking: 8 — 14
Starter relay		B136	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
A/C switch		B136	24	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
A/C lock sensor		B135	14	Duty waveform	Duty waveform	—
A/C middle pressure switch		B136	33	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Ignition switch		B135	19	10 — 13	12 — 14	—
Neutral position switch		B136	31	ON: 0 OFF: 12±0.5		Switch is ON when select lever is shifted into "P" or "N" range.
Delivery (test) mode connector		B135	27	12 — 14	12 — 14	When connected: 0
Knock sensor 1	Signal	B134	15	2.4	2.4	—
	Shield	B134	25	0	0	—
Knock sensor 2	Signal	B134	16	2.4	2.4	—
	Shield	B134	25	0	0	—
Back-up power supply		B135	5	10 — 13	12 — 14	Ignition switch "OFF": 10 — 13
Control module power supply		B135	2	10 — 13	12 — 14	—
		B134	7	10 — 13	12 — 14	—
Sensor power supply		B134	19	5	5	—
Ignition control	#1	B137	18	0	0 — 14	Waveform
	#2	B137	19	0	0 — 14	Waveform
	#3	B137	20	0	0 — 14	Waveform
	#4	B137	21	0	0 — 14	Waveform
	#5	B137	22	0	0 — 14	Waveform
	#6	B137	23	0	0 — 14	Waveform
Fuel injector	#1	B137	8	10 — 13	1 — 14	Waveform
	#2	B137	9	10 — 13	1 — 14	Waveform
	#3	B137	10	10 — 13	1 — 14	Waveform
	#4	B137	11	10 — 13	1 — 14	Waveform
	#5	B137	12	10 — 13	1 — 14	Waveform
	#6	B137	13	10 — 13	1 — 14	Waveform

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
A/C relay control	B136	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Radiator fan control	B136	18	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Radiator fan control power supply	B136	29	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—	
Self-shutoff control	B136	23	0	0	—	
Malfunction indicator light	B136	11	—	—	Light "ON": 1 or less Light "OFF": 10 — 14	
Engine speed output	B136	22	—	0 — 13 or more	Waveform	
Purge control solenoid valve	B137	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Power steering switch	B134	33	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Manifold absolute pressure sensor	B134	6	3.5 — 4.8	1.1 — 1.9	—	
Air flow sensor	Signal	B135	26	0.74	0.3 — 4.5	—
	Shield	B135	35	0	0	—
	GND	B135	34	0	0	—
Intake air temperature sensor	B135	18	3.15 — 3.33	3.15 — 3.33	Intake air temperature: 25°C (77°F)	
Front oxygen (A/F) sensor RH	Signal (+)	B135	9	2.8 — 3.2	2.8 — 3.2	—
	Signal (-)	B135	8	2.4 — 2.7	2.4 — 2.7	—
	Shield	B135	1	0	0	—
Front oxygen (A/F) sensor heater RH	Signal 1	B136	3	12 — 14	—	Waveform
	Signal 2	B136	2	12 — 14	—	Waveform
Front oxygen (A/F) sensor LH	Signal (+)	B135	11	2.8 — 3.2	2.8 — 3.2	—
	Signal (-)	B135	10	2.4 — 2.7	2.4 — 2.7	—
	Shield	B135	1	0	0	—
Front oxygen (A/F) sensor heater LH	Signal 1	B135	7	12 — 14	—	Waveform
	Signal 2	B135	6	12 — 14	—	Waveform
Rear oxygen sensor RH	Signal	B135	4	0	0 — 0.9	—
	Shield	B135	1	0	0	—
Rear oxygen sensor heater RH signal	B136	4	12 — 14	—	Waveform	
Rear oxygen sensor LH	Signal	B135	15	0	0 — 0.9	—
	Shield	B135	1	0	0	—
Rear oxygen sensor heater LH signal	B136	5	12 — 14	—	Waveform	
Immobilizer communication 1	B136	26	10	10	—	
Immobilizer communication 2	B136	34	10	10	—	
Fuel pump control unit	Signal 1	B135	33	0	12 — 14	—
	Signal 2	B136	12	0	0 or 5	—
Brake switch 1	B135	20	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released: 12 — 14	—	
Brake switch 2	B135	28	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed: 12 — 14 When brake pedal is released: 0	—	

# Engine Control Module (ECM) I/O Signal

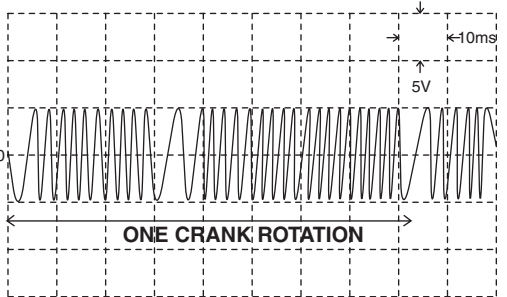
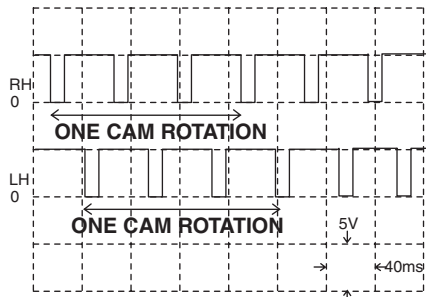
## ENGINE (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)		Note	
			Ignition SW ON (engine OFF)	Engine ON (idling)		
Cruise control command switch	B135	24	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating cancel: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating cancel: 0 — 0.5	—	
Cruise control main switch	B135	12	ON: 0 OFF: 5	ON: 0 OFF: 5	—	
Oil flow control solenoid valve RH	Signal (+)	B137	17	0	0.6	—
	Signal (-)	B137	16	0	0	—
Oil flow control solenoid valve LH	Signal (+)	B137	15	0	0.6	—
	Signal (-)	B137	14	0	0	—
Oil switching solenoid valve RH	Signal (+)	B137	25	0	1.9	—
	Signal (-)	B137	24	0	0	—
Oil switching solenoid valve LH	Signal (+)	B137	31	0	1.9	—
	Signal (-)	B137	30	0	0	—
Oil temperature sensor signal	B134	23	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.	
Variable valve lift diagnosis oil pressure switch RH	B134	31	0	0	—	
Variable valve lift diagnosis oil pressure switch LH	B134	32	0	0	—	
Generator control	B136	10	0 — 6.5	0 — 6.5	—	
SSM communication line	B136	16	1 or less ←→ 4 or more	1 or less ←→ 4 or more	—	
GND (sensor)	B135	30	0	0	—	
GND (ignition system)	Ignition 1	B137	26	0	0	—
	Ignition 2	B137	6	0	0	—
GND	Engine 1	B134	5	0	0	—
	Engine 2	B137	7	0	0	—
	Engine 3	B137	2	0	0	—
	Engine 4	B137	1	0	0	—
	Engine 5	B137	3	0	0	—
	Engine 6	B134	3	0	0	—
	Body	B136	6	0	0	—
Sensor GND (engine side)	B134	29	0	0	—	
Fuel tank pressure sensor	B135	32	2.3	2.7	—	
Pressure control solenoid valve	B136	28	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Drain valve	B136	17	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—	
Fuel temperature sensor	B135	17	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (77°F)	
CAN communication (+)	B136	27	2.0 — 4.5	2.0 — 4.5	Waveform	
CAN communication (-)	B136	35	0.5 — 3.0	0.5 — 3.0	Waveform	



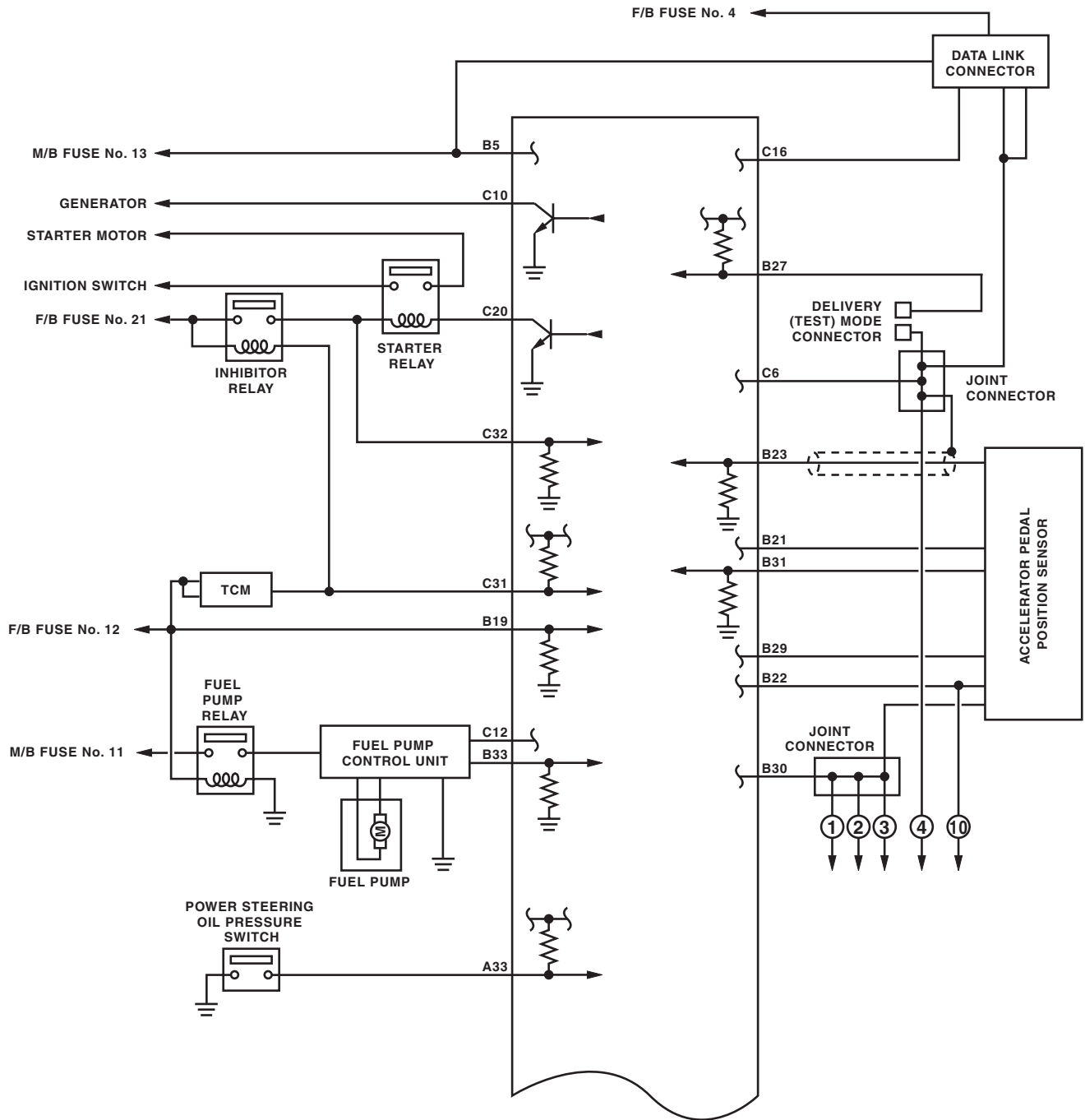
# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Input/output name	Measuring condition	Waveform
1. Crankshaft position sensor	During idling	 <p style="text-align: right;">EN-05357</p>
2. Camshaft position sensor	During idling	 <p style="text-align: right;">EN-05358</p>

# Engine Control Module (ECM) I/O Signal

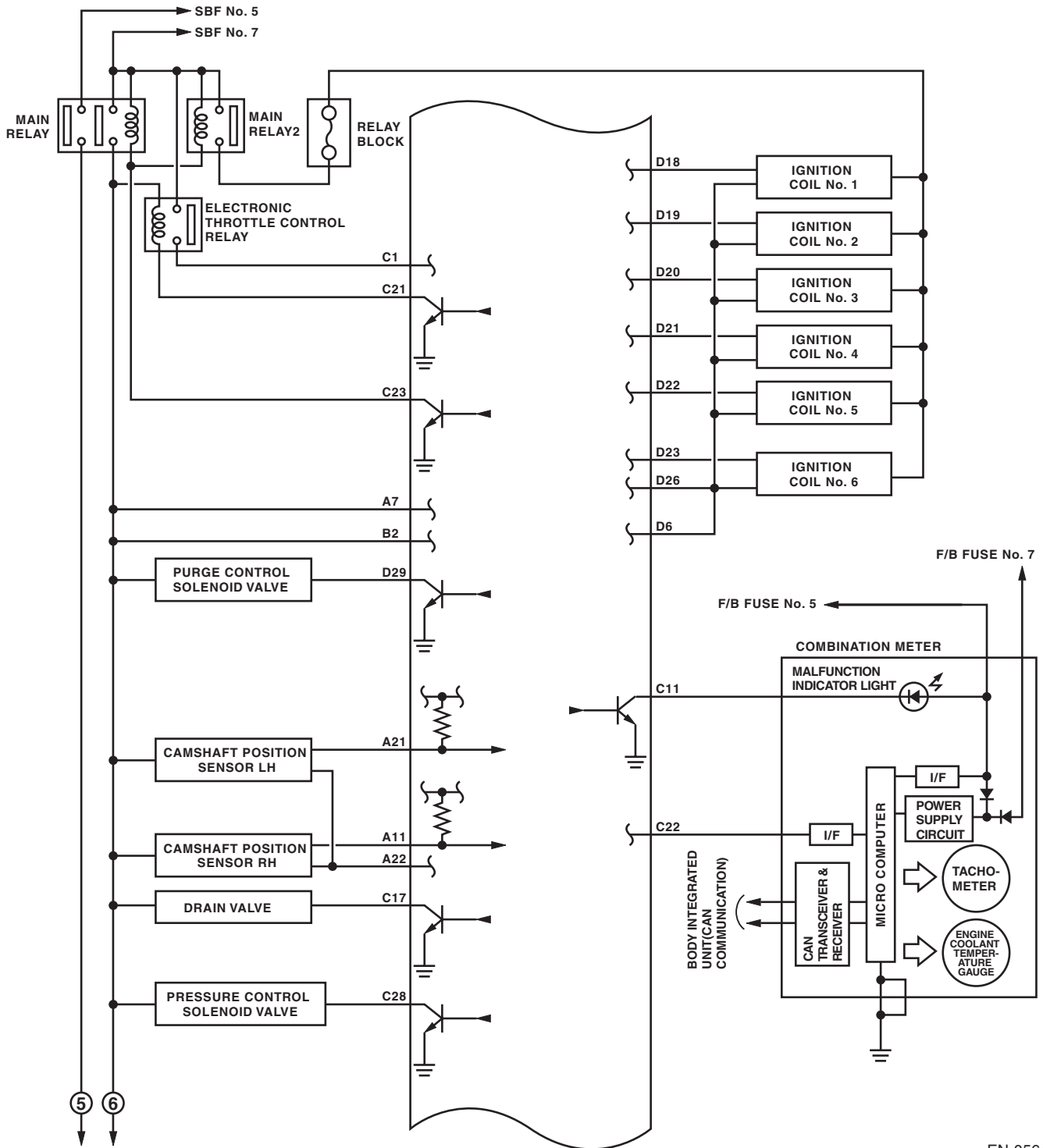
ENGINE (DIAGNOSTICS)



EN-05644

# Engine Control Module (ECM) I/O Signal

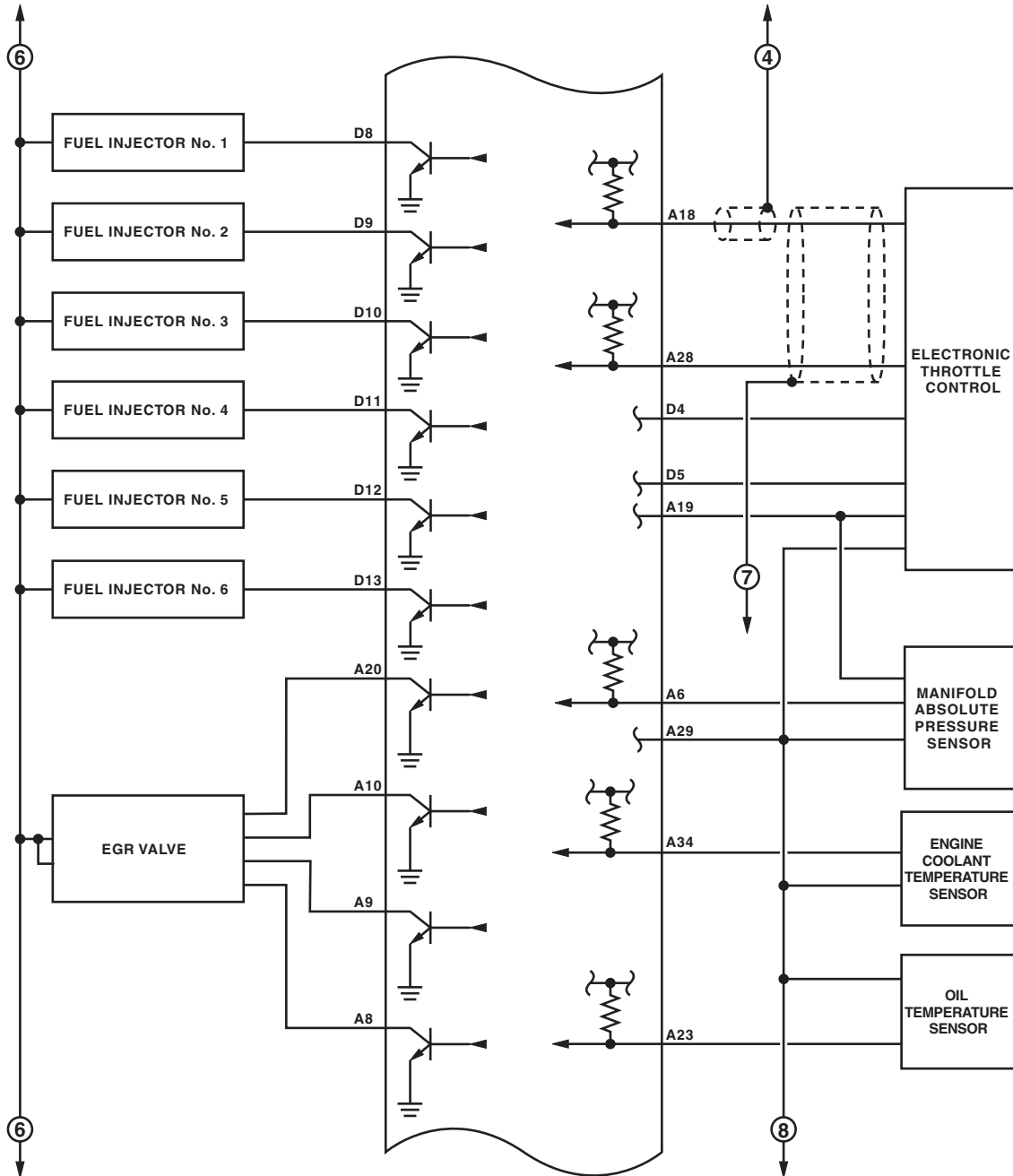
ENGINE (DIAGNOSTICS)



EN-05645

# Engine Control Module (ECM) I/O Signal

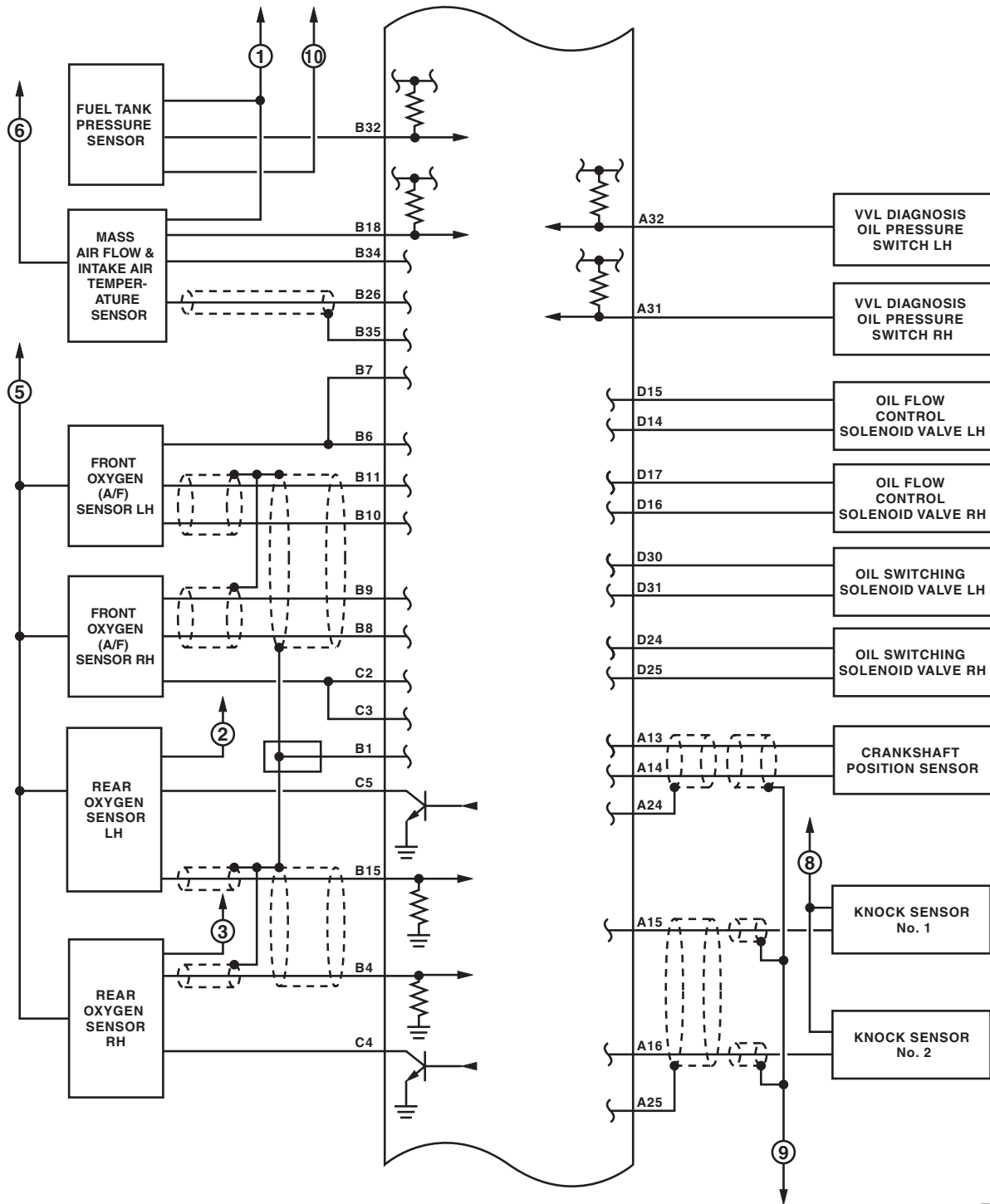
ENGINE (DIAGNOSTICS)



EN-05646

# Engine Control Module (ECM) I/O Signal

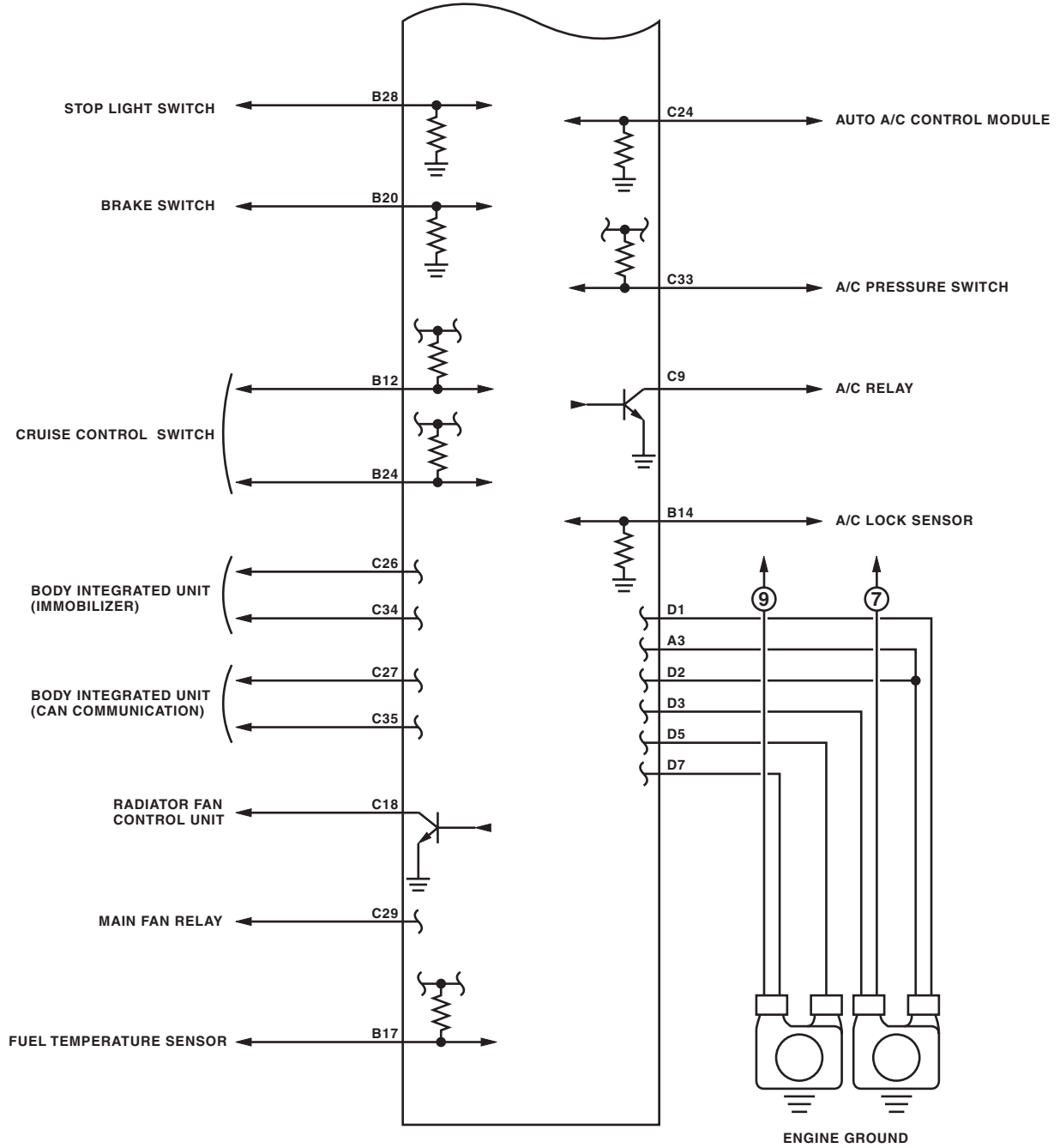
ENGINE (DIAGNOSTICS)



EN-05647

# Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)



EN-05648

## 6. Engine Condition Data

### A: ELECTRICAL SPECIFICATION

Contents	Specification
Engine load	17.9 — 38.8(%): Idling
	16.6 — 33.7(%): 2,500 rpm racing

Measuring condition:

- After engine is warmed-up.
- Gear position is in “N” or “P” range.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

# Data Link Connector

ENGINE (DIAGNOSTICS)

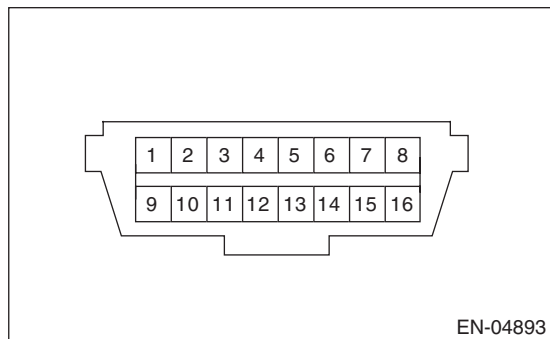
## 7. Data Link Connector

### A: NOTE

This connector is used for Subaru Select Monitor.

### CAUTION:

**Do not connect any scan tools except Subaru Select Monitor or general scan tool because the circuit for Subaru Select Monitor may be damaged.**



Terminal No.	Contents	Terminal No.	Contents
1	Blank	9	Blank
2	Blank	10	Blank
3	Blank	11	Blank
4	Ground	12	Blank
5	Ground	13	Blank
6	CAN communication (+)	14	CAN communication (-)
7	Subaru Select Monitor signal	15	Blank
8	Blank	16	Power supply

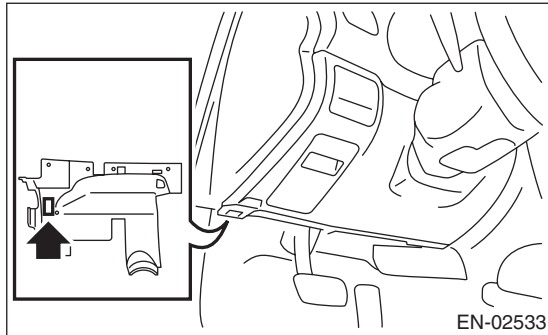


## 8. General Scan Tool

### A: OPERATION

#### 1. HOW TO USE GENERAL SCAN TOOL

- 1) Prepare a scan tool (general scan tool) required by SAE J1978.
- 2) Open the cover and connect the general scan tool to the data link connector located in the lower portion of instrument panel (on the driver's side).



- 3) Using the general scan tool, call up DTC and freeze frame data.

General scan tool functions consist of:

- (1) MODE \$01: Current powertrain diagnostic data
  - (2) MODE \$02: Powertrain freeze frame data
  - (3) MODE \$03: Emission-related powertrain DTC
  - (4) MODE \$04: Clear/Reset emission-related diagnostic information
  - (5) MODE \$06: Request on-board monitoring test results for intermittently monitored systems
  - (6) MODE \$07: Request on-board monitoring test results for continuously monitored systems
  - (7) MODE \$09: Request vehicle information
- Read out the data according to repair procedures. (For detailed operation procedure, refer to the general scan tool instruction manual.)

#### NOTE:

For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

# General Scan Tool

## ENGINE (DIAGNOSTICS)

### 2. MODE \$01 (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.

A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$01	Number of emission-related powertrain DTC and malfunction indicator light status	ON/OFF
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C or °F
\$06	Short term fuel trim (Bank 1)	%
\$07	Long term fuel trim (Bank 1)	%
\$08	Short term fuel trim (Bank 2)	%
\$09	Long term fuel trim (Bank 2)	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	km/h, MPH
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C or °F
\$10	Air flow rate of manifold absolute pressure sensor	g/sec
\$11	Throttle valve opening angle	%
\$13	Check whether oxygen sensor is installed.	—
\$15	Oxygen sensor output voltage (Bank 1 Sensor 2)	V
\$15	Oxygen sensor compensation (Bank 1 Sensor 2)	%
\$19	Oxygen sensor output voltage (Bank 2 Sensor 2)	V
\$19	Oxygen sensor compensation (Bank 2 Sensor 2)	%
\$1C	On-board diagnostic system	—
\$1F	Elapsed time after starting the engine	sec
\$21	Travel distance after the malfunction indicator light illuminates	km
\$24	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (bank 1)	V and %
\$28	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (bank 2)	V and %
\$2C	Target EGR	%
\$2D	EGR deviation	%
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$30	Number of warm ups after DTC clear	—
\$31	Travel distance after DTC clear	km
\$32	Fuel tank pressure	mmHg
\$33	Atmospheric pressure	mmHg
\$34	A/F sensor lambda value (Bank 1 Sensor 1)	—
\$34	A/F sensor current value (Bank 1 Sensor 1)	mA
\$38	A/F sensor lambda value (Bank 2 Sensor 1)	—
\$38	A/F sensor current value (Bank 2 Sensor 1)	mA
\$3C	Catalyst temperature #1	°C
\$3D	Catalyst temperature #2	°C
\$41	Diagnostic monitor of each drive cycle	—
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%

# General Scan Tool

ENGINE (DIAGNOSTICS)

PID	Data	Unit of measure
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%
\$4D	Engine operating time while malfunction indicator light lit	min
\$4E	Elapsed time after DTC clear	min
\$51	Fuel used	—
\$5A	Relative accelerator opening angle	%

**NOTE:**

Refer to general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE \$01).

# General Scan Tool

## ENGINE (DIAGNOSTICS)

### 3. MODE \$02 (POWERTRAIN FREEZE FRAME DATA)

Refer to data denoting the operating condition when trouble is detected by on-board diagnosis system. A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
\$02	DTC that caused the freeze frame data storage required by CARB	—
\$03	Fuel system control status	—
\$04	Calculated engine load value	%
\$05	Engine coolant temperature	°C
\$06	Short term fuel trim (Bank 1)	%
\$07	Long term fuel trim (Bank 1)	%
\$08	Short term fuel trim (Bank 2)	%
\$09	Long term fuel trim (Bank 2)	%
\$0B	Intake manifold absolute pressure	kPa
\$0C	Engine speed	rpm
\$0D	Vehicle speed	km/h
\$0E	Ignition timing advance	°
\$0F	Intake air temperature	°C or °F
\$10	Air flow rate of manifold absolute pressure sensor	g/sec
\$11	Throttle valve opening angle	%
\$13	Air fuel ratio sensor	—
\$15	Oxygen sensor output voltage (Bank 1 Sensor 2)	V
\$15	Oxygen sensor compensation (Bank 1 Sensor 2)	%
\$19	Oxygen sensor output voltage (Bank 2 Sensor 2)	V
\$19	Oxygen sensor compensation (Bank 2 Sensor 2)	%
\$1C	On-board diagnostic system	—
\$1F	Elapsed time after starting the engine	sec
\$2C	Target EGR	%
\$2D	EGR deviation	%
\$2E	Evaporative purge	%
\$2F	Fuel level	%
\$32	Fuel tank pressure	mmHg
\$33	Atmospheric pressure	mmHg
\$42	ECM power voltage	V
\$43	Absolute load	%
\$44	A/F target lambda	—
\$45	Relative throttle opening angle	%
\$46	Ambient temperature	°C
\$47	Absolute throttle opening angle 2	%
\$49	Absolute accelerator opening angle 1	%
\$4A	Absolute accelerator opening angle 2	%
\$4C	Target throttle opening angle	%

#### NOTE:

Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE \$02).

### 4. MODE \$03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

# General Scan Tool

ENGINE (DIAGNOSTICS)

## 5. MODE \$04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refer to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

### NOTE:

Refer to general scan tool manufacturer's instruction manual to clear the emission-related diagnostic information (MODE \$04).

## 6. MODE \$06

Refer to test value of troubleshooting and data of test limit indicated on the support data bit sequence table. A list of the support data is shown in the following table.

OBDMID	TID	SID	Diagnostic item
\$01	\$81	\$0A	A/F sensor conduction abnormal (Bank 1 Sensor 1)
	\$82	\$8D	
	\$83	\$14	
	\$84	\$1E	A/F sensor range abnormal (Bank 1 Sensor 1)
	\$85	\$1E	
	\$86	\$20	A/F sensor response abnormal (Bank 1 Sensor 1)
\$02	\$87	\$0B	Oxygen sensor circuit abnormal (Bank 1 Sensor 2)
	\$88	\$0B	
	\$07	\$0B	Oxygen sensor drop abnormal (Bank 1 Sensor 2)
	\$08	\$0B	
	\$A5	\$0B	
	\$05	\$10	Oxygen sensor response abnormal (Bank 1 Sensor 2)
	\$06	\$10	
\$05	\$81	\$0A	A/F sensor conduction abnormal (Bank 2 Sensor 1)
	\$82	\$8D	
	\$83	\$14	
	\$84	\$1E	A/F sensor range abnormal (Bank 2 Sensor 1)
	\$85	\$1E	
	\$86	\$20	A/F sensor response abnormal (Bank 2 Sensor 1)
\$06	\$87	\$0B	Oxygen sensor circuit abnormal (Bank 2 Sensor 2)
	\$88	\$0B	
	\$07	\$0B	Oxygen sensor drop abnormal (Bank 2 Sensor 2)
	\$08	\$0B	
	\$A5	\$0B	
	\$05	\$10	Oxygen sensor response abnormal (Bank 2 Sensor 2)
	\$06	\$10	
\$21	\$89	\$20	Catalyst degradation diagnosis (Bank 1)
\$31	\$8A	\$FD	EGR system diagnosis
\$39	\$93	\$FE	Evaporative emission control system (Cap off)
\$3B	\$94	\$FE	Evaporative emission control system (0.04 inch leak)
	\$95	\$FE	
\$3C	\$96	\$FE	Evaporative emission control system (0.02 inch leak)
	\$97	\$FE	
\$3D	\$98	\$FE	Evaporative emission control system (Purge flow)
\$41	\$99	\$24	A/F sensor heater abnormal (Bank 1 Sensor 1)
	\$9A	\$24	
	\$9B	\$14	A/F sensor heater characteristic abnormal (Bank 1 Sensor 1)
\$42	\$9C	\$24	Oxygen sensor heater abnormal (Bank 1 Sensor 2)
	\$9D	\$24	

# General Scan Tool

## ENGINE (DIAGNOSTICS)

OBDMID	TID	SID	Diagnostic item
\$45	\$99	\$24	A/F sensor heater abnormal (Bank 2 Sensor 1)
	\$9A	\$24	
	\$9B	\$14	A/F sensor heater characteristic abnormal (Bank 2 Sensor 1)
\$46	\$9C	\$24	Oxygen sensor heater abnormal (Bank 2 Sensor 2)
	\$9D	\$24	
\$A1	\$0B	\$24	Misfire monitoring (All cylinders)
	\$0C	\$24	
\$A2	\$0B	\$24	Misfire monitoring (#1 cylinder)
	\$0C	\$24	
\$A3	\$0B	\$24	Misfire monitoring (#2 cylinder)
	\$0C	\$24	
\$A4	\$0B	\$24	Misfire monitoring (#3 cylinder)
	\$0C	\$24	
\$A5	\$0B	\$24	Misfire monitoring (#4 cylinder)
	\$0C	\$24	
\$A6	\$1B	\$24	Misfire monitoring (#5 cylinder)
	\$1C	\$24	
\$A7	\$1B	\$24	Misfire monitoring (#6 cylinder)
	\$1C	\$24	

### 7. MODE \$07

Refer to the data of DTC (pending code) for troubleshooting result about emission in the first time.

### 8. MODE \$09

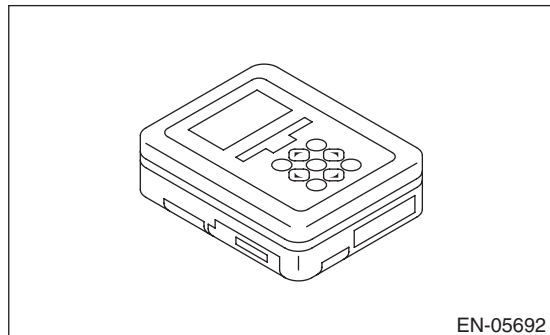
Refer to the data of vehicle specification (V.I.N., calibration ID, diagnosis frequency, etc.).

## 9. Subaru Select Monitor

### A: OPERATION

#### 1. HOW TO USE THE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

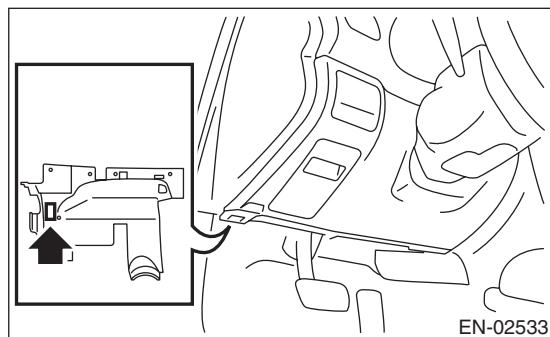
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

8) Call up DTC and data, then record them.

#### NOTE:

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

#### 2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to indicate DTC. <Ref. to EN(H6DO)(diag)-44, Read Diagnostic Trouble Code (DTC).>

#### 3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (OBD MODE)

Refer to "Read Diagnostic Trouble Code" for information about how to indicate DTC. <Ref. to EN(H6DO)(diag)-44, Read Diagnostic Trouble Code (DTC).>

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

### 4. READ CURRENT DATA FOR ENGINE (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {Current Data Display & Save}.
  - 5) On the «Current Data Display & Save» display screen, select the {Normal sampling}.
  - 6) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure	Note (at idling)
Engine load	Engine Load	%	2.4%
Engine coolant temperature signal	Coolant Temp.	°C or °F	≥ 85°C or 185°F (After engine is warmed-up.)
A/F correction 1	A/F Compensation #1	%	-10% — +10%
A/F learning 1	A/F Learning #1	%	-10% — +10%
A/F correction 2	A/F Compensation #2	%	-10% — +10%
A/F learning 2	A/F Learning #2	%	-10% — +10%
Intake manifold absolute pressure	Mani. Absolute Pressure	mmHg, kPa, inHg or psig	210 mmHg, 28 kPa, 8.3 inHg or 4.1 psig
Engine speed signal	Engine Speed	rpm	600 — 800 rpm (After engine is warmed-up.)
Meter vehicle speed signal	Vehicle Speed	km/h or MPH	0 km/h or 0 MPH
Ignition timing signal	Ignition Timing	deg	13 — 15 deg
Intake air temperature signal	Intake Air Temp.	°C or °F	(Ambient air temperature)
Amount of intake air	Mass Air Flow	g/s or lb/m	2.5 g/s — 5.0 g/s or 0.31 lb/m — 0.71 lb/m
Throttle opening angle signal	Throttle Opening Angle	%	2%
Front oxygen sensor voltage value 1	Front oxygen sensor voltage value 1	V	0.900 V
Front oxygen sensor voltage value 2	Front oxygen sensor voltage value 2	V	0.900 V
Battery voltage	Battery Voltage	V	12 — 13 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1.2 — 1.3 V
Injection 1 pulse width	Injection 1 pulse width	ms	2.5 ms — 3.5 ms
Injection 2 pulse width	Injection 2 pulse width	ms	2.5 ms — 3.5 ms
Atmospheric pressure signal	Atmosphere pressure	mmHg, kPa, inHg or psig	(Atmosphere pressure)
Intake manifold relative pressure	Mani. Relative Pressure	mmHg, kPa, inHg or psig	(Intake manifold absolute pressure — atmosphere pressure)
Ignition learning value	Learned Ignition Timing	deg	+0.0 deg
Acceleration opening angle signal	Accel. Opening Angle	%	0%
Purge control solenoid valve duty ratio	CPC duty	%	18%
Fuel pump duty	Fuel pump duty	%	33%
Variable valve timing advance angle amount R	VVT advance angle amount R	deg	+0 deg — +1 deg
Variable valve timing advance angle amount L	VVT advance angle amount L	deg	+0 deg — +1 deg
Oil flow control solenoid valve duty R	OCV duty R	%	9.4%
Oil flow control solenoid valve duty L	OCV duty L	%	9.4%
Oil flow control solenoid valve current R	OCV current R	mA	64 mA
Oil flow control solenoid valve current L	OCV current L	mA	64 mA



# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
Front oxygen (A/F) sensor current value 1	A/F Sensor #1 Current	mA	0.0 mA
Front oxygen (A/F) sensor current value 2	A/F Sensor #2 Current	mA	0.0 mA
Front oxygen (A/F) sensor resistance value 1	A/F Sensor #1 Resistance	Ω	31 Ω
Front oxygen (A/F) sensor resistance value 2	A/F Sensor #2 Resistance	Ω	31 Ω
Front oxygen (A/F) sensor output lambda 1	A/F sensor output lambda 1	—	1.01
Front oxygen (A/F) sensor output lambda 2	A/F sensor output lambda 2	—	1.01
A/F correction 3	A/F Correction #3	%	0% — 1%
Throttle motor duty	Throttle Motor Duty	%	-20% — +20%
Throttle power supply voltage	Throttle Motor Voltage	V	(Battery voltage)
Sub throttle sensor voltage	Sub-throttle Sensor	V	1.4 V — 1.5 V
Main throttle sensor voltage	Main-throttle Sensor	V	0.62 V — 0.70 V
Sub accelerator sensor voltage	Sub-accelerator Sensor	V	1.0 V — 1.2 V
Main accelerator sensor voltage	Main-accelerator Sensor	V	0.9 V — 1.1 V
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	0 km/h or 0 MPH
A/F correction 4	A/F Correction #4	%	-1% — 1%
Fuel level sensor resistance	Fuel level resistance	Ω	4 — 96 Ω
Engine oil temperature	Oil Temperature	°C or °F	≥ 85°C or 185°F (After engine is warmed-up.)
Oil switching solenoid valve duty R	OSV Duty R	%	18.4%
Oil switching solenoid valve duty L	OSV Duty L	%	18.8%
Oil switching solenoid valve current R	OSV Current R	mA	192 mA
Oil switching solenoid valve current L	OSV Current L	mA	192 mA
#1 cylinder roughness monitor	Roughness Monitor #1	—	0
#2 cylinder roughness monitor	Roughness Monitor #2	—	0
#3 cylinder roughness monitor	Roughness Monitor #3	—	0
#4 cylinder roughness monitor	Roughness Monitor #4	—	0
#5 cylinder roughness monitor	Roughness Monitor #5	—	0
#6 cylinder roughness monitor	Roughness Monitor #6	—	0
Knock sensor correction	Knock Correction	deg	0 deg
AT/MT identification	AT Vehicle ID Signal	—	OFF
Delivery (test) mode terminal	Test Mode Terminal	—	U check
System operation check mode	D-check Require Flag	—	OFF
Delivery (test) mode terminal	Delivery Mode Connector (Test Mode Connector)	—	OFF
Neutral position switch signal	Neutral SW	—	Neutral
Idle switch signal	Soft idle SW	—	At idle
Ignition switch signal	Ignition SW	—	ON input
Power steering switch signal	P/S Switch	—	OFF input (when OFF)
Air conditioning switch signal	A/C SW	—	OFF input (when OFF)
Starter switch signal	Starter Switch	—	OFF input
Front oxygen monitor 1	Front oxygen monitor 1	—	Rich, Lean
Front oxygen monitor 2	Front oxygen monitor 2	—	Rich, Lean
Knocking signal	Knock Signal	—	None
Crankshaft position sensor signal	Crankshaft angle signal	—	Provided

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure	Note (at idling)
Camshaft position sensor signal	Camshaft angle signal	—	Provided
Rear defogger switch signal	Rear Defogger SW	—	OFF input (when OFF)
Blower fan switch signal	Blower fan SW	—	OFF input (when OFF)
Light switch signal	Light SW	—	OFF input (when OFF)
A/C middle pressure switch signal	A/C middle pressure SW	—	OFF input (when air conditioner is OFF)
A/C compressor relay signal	A/C compressor relay output	—	OFF output (when air conditioner is OFF)
Variable valve lift diagnosis oil pressure switch signal 1	Oil Pressure SW1	—	ON
Variable valve lift diagnosis oil pressure switch signal 2	Oil Pressure SW2	—	ON
AT coordinate retard angle demand signal	AT coordinate retard angle demand	—	None
AT coordinate fuel cut demand signal	AT coordinate fuel cut demand	—	None
Vehicle dynamics control (VDC) torque down prohibition output	VDC torque down prohibition output	—	Permission
Vehicle dynamics control (VDC) torque down demand	VDC torque down demand	—	None
AT cooperative permission signal	Torque Control Permission Signal	—	Permission
Electronic throttle control motor relay signal	ETC Motor Relay	—	ON
Stop light switch signal	Stop light SW	—	OFF (when brake is OFF)
SET/COAST switch signal	SET/CST SW	—	OFF (when levers are not operated)
RESUME/ACCEL switch signal	RES/ACC SW	—	OFF (when levers are not operated)
Brake switch signal	Brake SW	—	OFF (when brake is OFF)
Main switch signal	Main SW	—	OFF (when levers are not operated)
Body integrated unit data reception	Body Int. Unit Data	—	ON
Body integrated unit counter update	Body Int. Unit Count	—	ON
Cruise control cancel switch signal	CC Cancel SW	—	OFF (when levers are not operated)
Malfunction indicator light flag	MIL Lit Flag	—	Light OFF
Radiator fan output	Radiator fan output	%	0% (Water temperature 90°C (194°F) when air conditioner is OFF)
Fuel temperature signal	Fuel Temp	°C or °F	+28°C or +82°F
A/F learning 3	A/F Learning #3	%	0.0%
A/F learning 4	A/F Learning #4	%	0.0%
SI drive mode	SI Drive mode	—	I, S or S#
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig	7.5 mmHg, 1 kPa, 0.3 inHg or 0.14 psi
Drain valve signal	Vent. Solenoid Valve	—	OFF output (when OFF)
No. of EGR steps	No. of EGR Steps	STEP	0 STEP
Variable valve lift mode	VVL Lift Mode	—	1
A/C lock signal	A/C lock signal	—	OFF input
Pressure control solenoid valve signal	PCV Solenoid Valve	—	OFF output (when OFF)
Clutch switch signal	Clutch SW	—	OFF (when clutch is OFF)

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

**5. READ CURRENT DATA FOR ENGINE (OBD MODE)**

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Current Data Display & Save}.
  - 6) On the «Current Data Display & Save» display screen, select the {All Data Display}.
  - 7) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A list of the support data is shown in the following table.

Contents	Display	Referential value (at idling)	Unit of measure
Number of diagnosis code	Number of Diag. Code:	0	—
Condition of malfunction indicator light	MI (MIL)	OFF	—
Monitoring test of misfire	Misfire monitoring (Supp)	YES	—
Monitoring test of misfire	Misfire monitoring (Rdy)	YES	—
Monitoring test of fuel system	Fuel System Monitoring (Supp)	YES	—
Monitoring test of fuel system	Fuel System Monitoring (Rdy)	YES	—
Monitoring test of comprehensive component	Component monitoring (Supp)	YES	—
Monitoring test of comprehensive component	Component monitoring (Rdy)	YES	—
Test of catalyst	Catalyst Diagnosis (Supp)	YES	—
Test of catalyst	Catalyst Diagnosis (Rdy)	NO	—
Test of heating-type catalyst	Heated catalyst (Supp)	NO	—
Test of heating-type catalyst	Heated catalyst (Rdy)	N/A	—
Test of evaporative emission purge control system	Evaporative purge sys- tem (Supp)	YES	—
Test of evaporative emission purge control system	Evaporative purge sys- tem (Rdy)	NO	—
Secondary air system test	Secondary air system (Supp)	NO	—
Secondary air system test	Secondary air system (Rdy)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Supp)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Rdy)	N/A	—
Test of oxygen sensor	Oxygen sensor (Supp)	YES	—
Test of oxygen sensor	Oxygen sensor (Rdy)	NO	—
Test of oxygen sensor heater	Oxygen Heater Diagnosis (Supp)	YES	—
Test of oxygen sensor heater	Oxygen Heater Diagnosis (Rdy)	NO	—
Test of EGR system	EGR system (Supp)	NO	—
Test of EGR system	EGR system (Rdy)	N/A	—
Air fuel ratio control system for bank 1	Fuel system for Bank 1	Normal CLOSE	—
Air fuel ratio control system for bank 2	Fuel system for Bank 2	Normal CLOSE	—
Engine load data	Load	21.0	%
Engine coolant temperature signal	Coolant Temp.	91	°C
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	A/F Compensation #1	17.2	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	A/F Learning #1	5.5	%

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Short term fuel trim by front oxygen (A/F) sensor (Bank 2)	A/F Compensation #2	17.2	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 2)	A/F Learning #2	5.5	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	233	mmHg
Engine speed signal	Engine Speed	700	rpm
Vehicle speed signal	Vehicle Speed	0	km/h
#1 Cylinder ignition timing	Ignition Timing #1	16.5	°
Intake air temperature signal	Intake Air Temp.	54	°C
Amount of intake air	Mass Air Flow	2.8	g/s
Throttle position signal	Throttle Opening Angle	13	%
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	0.1 — 0.7	V
A/F correction (Bank 1 Sensor 2)	Short term fuel trim #12	0.0	%
Oxygen sensor (Bank 2 Sensor 2)	Oxygen sensor #22	0.1 — 0.7	V
A/F correction (Bank 2 Sensor 2)	Short term fuel trim #22	0.0	%
On-board diagnostic system	OBD System	OBD/OBD2	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	Support	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	Support	—
Front oxygen (A/F) sensor (Bank 2 Sensor 1)	Oxygen sensor #21	Support	—
Oxygen sensor (Bank 2 Sensor 2)	Oxygen sensor #22	Support	—
Elapsed time after engine start	Time Since Engine Start	—	sec
Driving distance after the malfunction indicator light illuminates	Lighted MI lamp History	—	km
A/F lambda signal (Bank 1 Sensor 1)	A/F Sensor #11	1.001	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F Sensor #11	2.805	V
A/F lambda signal (Bank 2 Sensor 1)	A/F Sensor #21	1.001	—
A/F sensor output signal (Bank 2 Sensor 1)	A/F Sensor #21	2.805	V
Evaporative purge	Commanded Evap Purge	0	%
Fuel level signal	Fuel Level	—	%
Number of warm ups after DTC clear	Number of warm-ups	—	—
Travel distance after DTC clear	Meter since DTC cleared	—	km
Fuel tank pressure signal	Fuel Tank Pressure	8.8	mmHg
Barometric pressure signal	Atmospheric pressure	Atmospheric pressure	mmHg
A/F lambda signal (Bank 1 Sensor 1)	A/F sensor #11	0.999	—
A/F sensor current (Bank 1 Sensor 1)	A/F sensor #11	0.02	mA
A/F lambda signal (Bank 2 Sensor 1)	A/F sensor #21	0.999	—
A/F sensor current (Bank 2 Sensor 1)	A/F sensor #21	0.02	mA
Catalyst temperature #1	Catalyst Temperature #1	—	°C
Catalyst temperature #2	Catalyst Temperature #2	—	°C
Monitoring test of misfire	Misfire monitoring (Enable)	YES	—
Monitoring test of misfire	Misfire monitoring (Comp)	NO	—
Monitoring test of fuel system	Fuel system monitoring (Enable)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Comp)	NO	—
Monitoring test of comprehensive component	Component monitoring (Enable)	YES	—
Monitoring test of comprehensive component	Component monitoring (Comp)	NO	—

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

Contents	Display	Referential value (at idling)	Unit of measure
Test of catalyst	Catalyst Diagnosis (Enable)	YES	—
Test of catalyst	Catalyst Diagnosis (Enable)	NO	—
Test of heating-type catalyst	Heated catalyst (Enable)	N/A	—
Test of heating-type catalyst	Heated catalyst (Comp)	N/A	—
Test of evaporative emission purge control system	Evaporative purge sys- tem (Enable)	NO	—
Test of evaporative emission purge control system	Evaporative purge sys- tem (Comp)	NO	—
Secondary air system test	Secondary air system (Enable)	N/A	—
Secondary air system test	Secondary air system (Comp)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Enable)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Comp)	N/A	—
Test of oxygen sensor	Oxygen sensor (Enable)	YES	—
Test of oxygen sensor	Oxygen sensor (Comp)	NO	—
Test of oxygen sensor heater	Oxygen sensor heater (Enable)	YES	—
Test of oxygen sensor heater	Oxygen sensor heater (Comp)	NO	—
Test of EGR system	EGR system (Enable)	N/A	—
Test of EGR system	EGR system (Comp)	N/A	—
ECM power voltage	Control module voltage	13.789	V
Absolute load	Absolute Load Value	22	%
A/F target lambda	Target Equivalence Ratio	0.976	—
Relative throttle opening angle	Relative Throttle Pos.	2	%
Ambient temperature	Ambient Temperature	Ambient air temperature	°C
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	32	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	13	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	13	%
Target throttle opening angle	Target Throt. Act. Cont.	0	%
Engine operating time while malfunction indicator light lit	Time while MIL lighted	—	min
Elapsed time after DTC clear	Time since DTC cleared	—	min
Fuel used	Type of fuel	GAS	—
Relative accelerator opening angle	Relative Accelera. Pos.	0	%

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Subaru Select Monitor

## ENGINE (DIAGNOSTICS)

### 6. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
  - 3) Click the [OK] button after the information of engine type has been displayed.
  - 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
  - 5) On the «OBD Menu» display screen, select the {Freeze Frame Data Display}.
- A list of the support data is shown in the following table.

Contents	Display	Unit of measure
DTC of freeze frame data	Freeze frame data	DTC
Air fuel ratio control system for bank 1	Fuel system for Bank1	—
Air fuel ratio control system for bank 2	Fuel system for Bank2	—
Engine load data	Engine Load	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	%
Short term fuel trim by front oxygen (A/F) sensor (Bank 2)	Short term fuel trim B2	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 2)	Long term fuel trim B2	%
Intake manifold absolute pressure signal	Mani.Absolute Pressure	mmHg, kPa, inHg or psig
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing adv. #1	Ignition timing adv. #1	°
Intake air temperature	Intake Air Temp.	°C or °F
Amount of intake air	Mass Air Flow	g/s
Throttle opening angle	Throttle Opening Angle	%
Oxygen sensor #12	Oxygen sensor #12	V
A/F correction value #12	Short term fuel trim #12	%
Oxygen sensor #22	Oxygen sensor #22	V
A/F correction value #22	Short term fuel trim #22	%
On-board diagnostic system	OBD System	—
Oxygen sensor #11	Oxygen sensor #11	Support
Oxygen sensor #12	Oxygen sensor #12	Support
Oxygen sensor #21	Oxygen sensor #21	Support
Oxygen sensor #22	Oxygen sensor #22	Support
Elapsed time after engine start	Time Since Engine Start	sec
Target EGR	Target EGR	%
EGR deviation	EGR Error	%
Evaporative purge	Commanded Evap Purge	%
Fuel level signal	Fuel Level	%
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig
Atmospheric pressure	Atmospheric pressure	mmHg, kPa, inHg or psig
ECM power voltage	Control module voltage	V
Absolute load	Absolute Load Value	%
A/F target lambda	Target Equivalence Ratio	—
Relative throttle opening angle	Relative Throttle Pos.	%
Ambient temperature	Ambient Temperature	°C or °F
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	%
Target throttle opening angle	Target Throt. Act. Cont.	%

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 7. V.I.N. REGISTRATION

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {V.I.N. Registration}.
- 5) Perform the procedures shown on the display screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Read Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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## 10. Read Diagnostic Trouble Code (DTC)

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Diagnostic Code(s) Display}.
- 5) On the «Diagnostic Code(s) Display» screen, select the {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Diagnostic Code(s) Display}.
- 6) Make sure DTC is shown on the screen.

#### NOTE:

- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

#### 3. GENERAL SCAN TOOL

Refer to the data denoting emission-related powertrain DTC.

For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

#### NOTE:

Refer to the general scan tool manufacturer’s operation manual to access powertrain DTC (MODE \$03).



## 11. Inspection Mode

### A: PROCEDURE

Perform the diagnosis shown in the following DTC table.

When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer the item on the drive cycle. <Ref. to EN(H6DO)(diag)-50, Drive Cycle.>

DTC	Item	Condition
P0011	Intake Camshaft Position - Timing Over-Advanced Or System Performance (Bank 1)	—
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1)	—
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2)	—
P0021	Intake Camshaft Position - Timing Over-Advanced Or System Performance (Bank 2)	—
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	—
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	—
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	—
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	—
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	—
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	—
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	—
P0112	Intake Air Temperature Sensor 1 Circuit Low	—
P0113	Intake Air Temperature Sensor 1 Circuit High	—
P0117	Engine Coolant Temperature Circuit Low	—
P0118	Engine Coolant Temperature Circuit High	—
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	—
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	—
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	—
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	—
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	—
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	—
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	—
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	—
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	—
P0182	Fuel Temperature Sensor “A” Circuit Low Input	—
P0183	Fuel Temperature Sensor “A” Circuit High Input	—
P0197	Engine Oil Temperature Sensor Low	—
P0198	Engine Oil Temperature Sensor High	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0230	Fuel Pump Primary Circuit	—
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	—

## Inspection Mode

### ENGINE (DIAGNOSTICS)

DTC	Item	Condition
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	—
P0332	Knock Sensor 2 Circuit Low (Bank 1 or Single Sensor)	—
P0333	Knock Sensor 2 Circuit High (Bank 1 or Single Sensor)	—
P0335	Crankshaft Position Sensor "A" Circuit	—
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	—
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	—
P0345	Camshaft Position Sensor "A" Circuit (Bank 2 or Single Sensor)	—
P0400	Exhaust Gas Recirculation Flow	—
P0447	Evaporative Emission Control System Vent Control Circuit Open	—
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	—
P0452	Evaporative Emission Control System Pressure Sensor Low Input	—
P0453	Evaporative Emission Control System Pressure Sensor High Input	—
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor "A" Circuit Low	—
P0463	Fuel Level Sensor "A" Circuit High	—
P0500	Vehicle Speed Sensor "A"	—
P0512	Starter Request Circuit	—
P0513	Incorrect Immobilizer Key	—
P0600	Serial Communication Link	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0607	Control Module Performance	—
P0638	Throttle Actuator Control Range/Performance (Bank 1)	—
P0700	Transmission Control System (MIL Request)	—
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	—
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	—
P1154	O2 Sensor Circuit Range/Performance (Low) (Bank 2 Sensor 1)	—
P1155	O2 Sensor Circuit Range/Performance (High) (Bank 2 Sensor 1)	—
P1160	Return Spring Failure	—
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	—
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	—
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	—
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	—
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	—
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	—
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	—
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	—
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	—
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	—
P1560	Backup power supply	—
P1570	Antenna	—
P1571	Reference Code Incompatibility	—
P1572	IMM Circuit Failure (Except Antenna Circuit)	—
P1574	Key Communication Failure	—
P1576	EGI Control Module EEPROM	—
P1577	IMM Control Module EEPROM	—
P1578	Meter Failure	—
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	—
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	—
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	—

DTC	Item	Condition
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	—
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	—
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	—
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	—
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	—
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	—
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	—
P2227	Barometric Pressure Circuit Range/Performance	—
P2228	Barometric Pressure Circuit Low	—
P2229	Barometric Pressure Circuit High	—

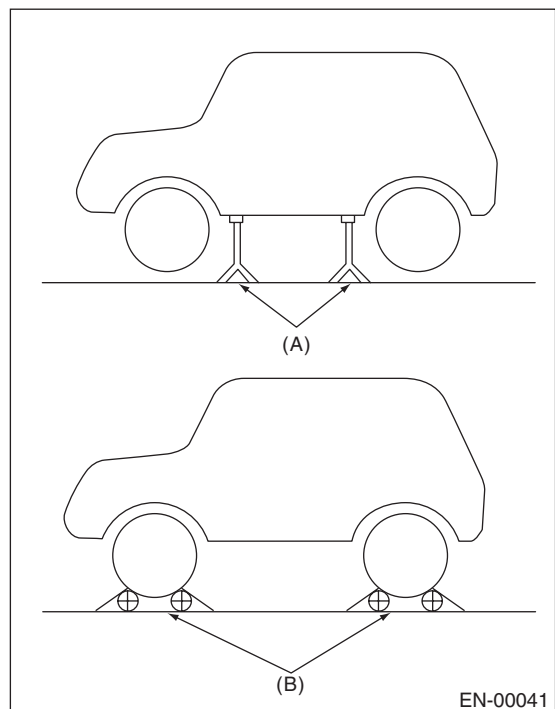
## 1. PREPARATION FOR THE INSPECTION MODE

- 1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
- 2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

### WARNING:

- Before raising the vehicle, ensure parking brakes are applied.
- Do not use a pantograph jack in place of a rigid rack.
- Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.
- Do not abruptly depress/release clutch pedal or accelerator pedal during works even when the engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the rigid racks and vehicle.

- Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



- (A) Rigid rack
- (B) Free roller

# Inspection Mode

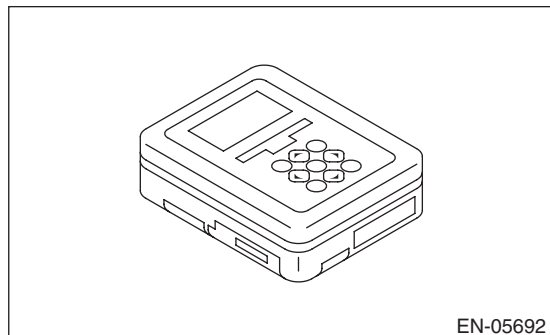
## ENGINE (DIAGNOSTICS)

### 2. SUBARU SELECT MONITOR

1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>

2) Warm-up the engine.

3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>



4) Prepare the personal computer which has been installed the Subaru Select Monitor.

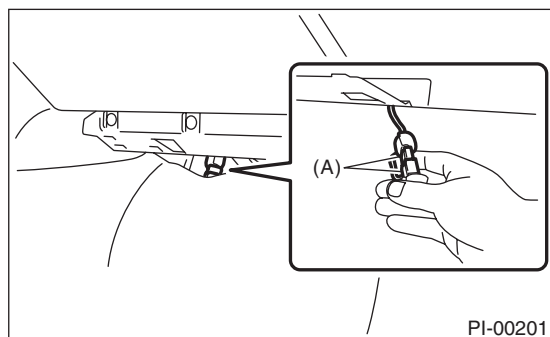
5) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

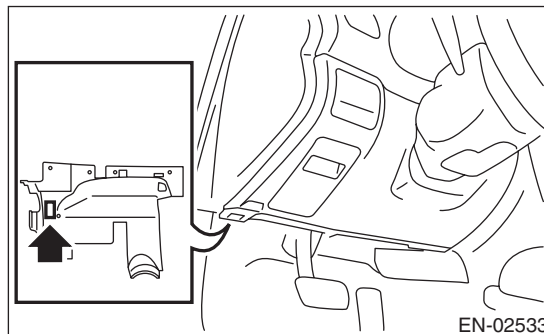
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to the SDI.

7) Connect the delivery (test) mode connector (A) located under the glove box.



8) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

9) Start up the personal computer.

10) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

11) On the «Main Menu» display screen, select the {Each System Check}.

12) On the «System Selection Menu» display screen, select the {Engine Control System}.

13) Click the [OK] button after the information of engine type has been displayed.

14) On the «Engine Diagnosis» display screen, select the {D Check}.

15) When the «Perform Inspection (Dealer Check) Mode» is shown on the screen, click the [Next] button.

16) Perform subsequent procedures as instructed on the display screen.

• If trouble still remains in the memory, the corresponding DTC appears on the display screen.

#### NOTE:

• For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

• For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

• Release the parking brake.

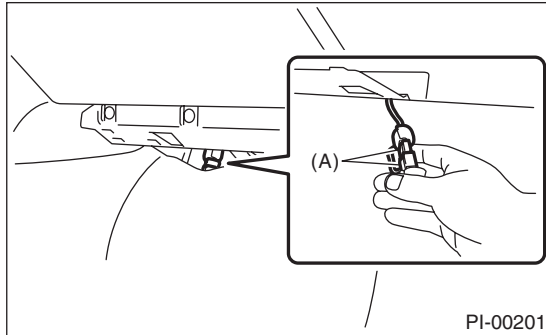
• The speed difference between front and rear wheels may illuminate the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis function. <Ref. to ABS(diag)-24, Clear Memory Mode.>

## 3. GENERAL SCAN TOOL

1) After performing the diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>

2) Warm-up the engine.

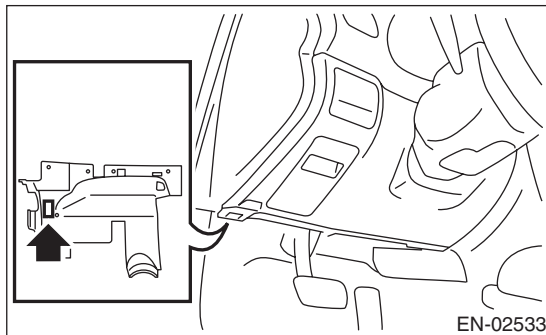
3) Connect the delivery (test) mode connector (A) located under the glove box.



4) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).

### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**



5) Start the engine.

### NOTE:

Ensure the selector lever is placed in "P" range before starting.

6) Using the select lever, turn the "P" position switch and the "N" position switch to ON.

7) Depress the brake pedal to turn the brake switch ON.

8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.

9) Shift the select lever in the "D" range and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

### NOTE:

- For AWD model, release the parking brake.
- The speed difference between front and rear wheels may illuminate the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of the self-diagnosis system. <Ref. to ABS(diag)-24, Clear Memory Mode.>

10) Using the general scan tool, check for DTC and record the result(s).

### NOTE:

- For detailed operation procedure, refer to the general scan tool operation manual.
- For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".

<Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

## 12. Drive Cycle

### A: PROCEDURE

For the troubleshooting, there are driving patterns described below. Driving in the specified pattern allows to diagnose malfunctioning items listed below. After the repair of the following trouble items, be sure to drive the vehicle with the specified drive patterns to check whether the function is resumed correctly.

#### 1. PREPARATION FOR DRIVE CYCLE

- 1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
- 2) After performing the diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>
- 3) Disconnect the delivery (test) mode connector.

#### NOTE:

- Perform the diagnosis after warming up the engine except when the engine coolant temperature at starting is specified.
- Perform the diagnosis twice if the DTC marked with \*. After completing the first diagnosis, stop the engine and perform second diagnosis in same condition.

# Drive Cycle

ENGINE (DIAGNOSTICS)

## 2. DRIVE CYCLE A — DRIVE THE VEHICLE WITH 80 KM/H (50 MPH) FOR 20 MINUTES, AND THEN IDLE THE ENGINE FOR A MINUTE.

DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Engine coolant temperature at engine start is less than 20°C (68°F).
*P0126	Insufficient Engine Coolant Temperature for Stable Operation	—
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	—
*P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	—
*P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P0174	System Too Lean (Bank 2)	Diagnosis completes in drive cycle B or C as well.
*P0175	System Too Rich (Bank 2)	Diagnosis completes in drive cycle B or C as well.
*P0196	Engine Oil Temperature Sensor Circuit Range/Performance	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0305	Cylinder 5 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0306	Cylinder 6 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0442	Evaporative Emission Control System Leak Detected (Small Leak)	Engine coolant temperature at engine start is less than 25°C (77°F).
*P0451	Evaporative Emission Control System Pressure Sensor	—
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Engine coolant temperature at engine start is less than 25°C (77°F).
*P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	Engine coolant temperature at engine start is less than 25°C (77°F).
*P0464	Fuel Level Sensor Circuit Intermittent	—
P1443	Vent Control Solenoid Valve Function Problem	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle B or C as well.
*P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	Diagnosis completes in drive cycle B or C as well.
*P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	Diagnosis completes in drive cycle B or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle B or C as well.

## Drive Cycle

### ENGINE (DIAGNOSTICS)

### 3. DRIVE CYCLE B — 10 MINUTES IDLING

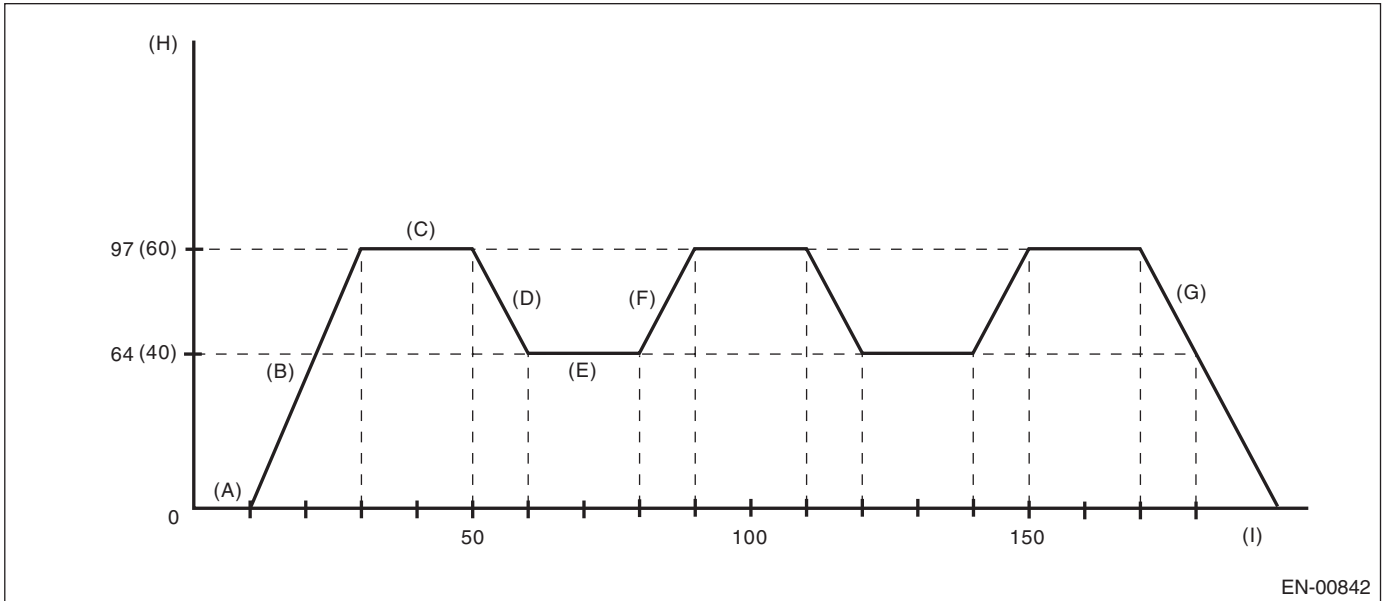
**NOTE:**

Drive the vehicle at 10 km/h (6 MPH) or faster before diagnosis.

DTC	Item	Condition
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0174	System Too Lean (Bank 2)	Diagnosis completes in drive cycle A or C as well.
*P0175	System Too Rich (Bank 2)	Diagnosis completes in drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0305	Cylinder 5 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0306	Cylinder 6 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0459	Evaporative Emission System Purge Control Valve Circuit High	—
*P0483	Fan Rationality Check	—
*P0506	Idle Air Control System RPM Lower Than Expected	—
*P0507	Idle Air Control System RPM Higher Than Expected	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or C as well.
*P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	Diagnosis completes in drive cycle A or C as well.
*P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	Diagnosis completes in drive cycle A or C as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or C as well.



## 4. DRIVE CYCLE C — DRIVE THE VEHICLE WITH FOLLOWING DRIVE PATTERNS



- |   |  |  |
|---|--|--|
| (A) Idle the engine for 10 seconds or more.                       | (D) Decelerate the vehicle to 64 km/h (40 MPH) with throttle fully closed. | (G) Stop the vehicle with throttle fully closed. |
| (B) Accelerate the vehicle to 97 km/h (60 MPH) within 20 seconds. | (E) Drive the vehicle at 64 km/h (40 MPH) for 20 seconds.                  | (H) Vehicle speed km/h (MPH)                     |
| (C) Drive the vehicle at 97 km/h (60 MPH) for 20 seconds.         | (F) Accelerate the vehicle to 97 km/h (60 MPH) within 10 seconds.          | (I) Sec.   |

# Drive Cycle

## ENGINE (DIAGNOSTICS)

DTC	Item	Condition
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	—
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	—
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
*P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	—
*P0068	MAP/MAF - Throttle Position Correlation	—
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	—
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	—
*P0101	Mass Or Volume Air Flow Circuit Range/Performance	—
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	—
*P0159	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0174	System Too Lean (Bank 2)	Diagnosis completes in drive cycle A or B as well.
*P0175	System Too Rich (Bank 2)	Diagnosis completes in drive cycle A or B as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0305	Cylinder 5 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0306	Cylinder 6 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0400	Exhaust Gas Recirculation Flow	—
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	—
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	—
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	—
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	—
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	—
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	—
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	—
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis completes in drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis completes in drive cycle A or B as well.
*P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	Diagnosis completes in drive cycle A or B as well.
*P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	Diagnosis completes in drive cycle A or B as well.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis completes in drive cycle A or B as well.

## 5. DRIVE CYCLE D

### DRIFT DIAGNOSIS

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Make sure that fuel remains 10 ℓ (2.6 US gal, 2.2 Imp gal) or more and the battery voltage is 10.9 V or more.
- 3) Start the engine, and check that the engine coolant temperature increases by 10°C (50°F) or more, and reaches 75°C (167°F) or more, when the engine is warmed up.
- 4) Idle the engine for 120 seconds or more in the condition of step 3.

### STUCK DIAGNOSIS

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>
- 3) Drive for approximately 50 ℓ (13.2 US gal, 11 Imp gal) of fuel.

**NOTE:**

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	—

## 6. DRIVE CYCLE E

- 1) Make sure that the battery voltage is 10.9 V or more.
- 2) Perform the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>
- 3) Drive for approximately 30 ℓ (7.9 US gal, 6.6 Imp gal) of fuel.

**NOTE:**

- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0461	Fuel Level Sensor "A" Circuit Range/Performance	—

## 7. DRIVE CYCLE F

- 1) Check that the engine coolant temperature at engine start is less than 30°C (86°F).
- 2) Start the engine, and warm it up until engine coolant temperature reaches to 95°C (203°F) or more.
- 3) After the engine has reached the state of procedure 2), idle the engine for 10 minutes or more.

**NOTE:**

Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

DTC	Item	Condition
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	—

# Drive Cycle

## ENGINE (DIAGNOSTICS)

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### 8. DRIVE CYCLE H

- 1) Perform the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>
- 2) With the ignition switch ON, read the engine coolant temperature, intake air temperature and fuel temperature. <Ref. to EN(H6DO)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
- 3) If the values from step 2) satisfy the following two conditions, start the engine.

**Condition:**

***|Engine coolant temperature — intake air temperature| ≤ 5°C (41°F)***

***|Engine coolant temperature — fuel temperature| ≤ 2°C (36°F)***

**NOTE:**

- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
  - Start AT vehicles in the P range, and MT vehicles in the N position.
- 4) Idle the engine for 1 minute under the conditions in step 3).

DTC	Item	Condition
*P1602	Control Module Programming Error	—

## 13. Clear Memory Mode

### A: OPERATION

#### 1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {Clear Memory}.
- 5) When the «Clear Memory?» is shown on the screen, click the [Yes] button.
- 6) When «Done» and «Turn ignition switch to OFF» is shown on the display screen, turn the ignition switch to OFF.

#### NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

#### 2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Engine Control System}.
- 3) Click the [OK] button after the information of engine type has been displayed.
- 4) On the «Engine Diagnosis» display screen, select the {OBD System}.
- 5) On the «OBD Menu» display screen, select the {Clear Diagnostic Code?}.
- 6) When the «Clear Diagnostic Code?» is shown on the screen, click the [Yes] button.
- 7) When «Done» and «Turn ignition switch to OFF» are shown on the display screen, click the [OK] button.

#### NOTE:

- Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.
- For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 3. GENERAL SCAN TOOL

For procedures clearing memory using the general scan tool, refer to the general scan tool operation manual.

#### NOTE:

Initial diagnosis of electronic throttle control is performed after memory clearance. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.

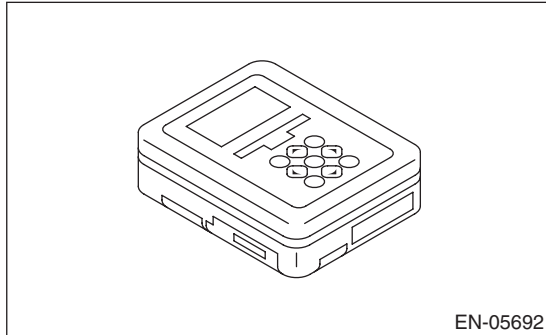
# Compulsory Valve Operation Check Mode

ENGINE (DIAGNOSTICS)

## 14. Compulsory Valve Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

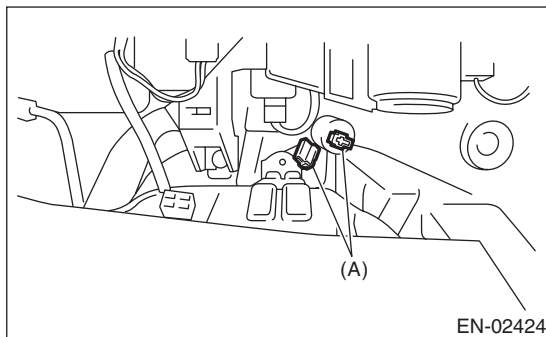
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

#### NOTE:

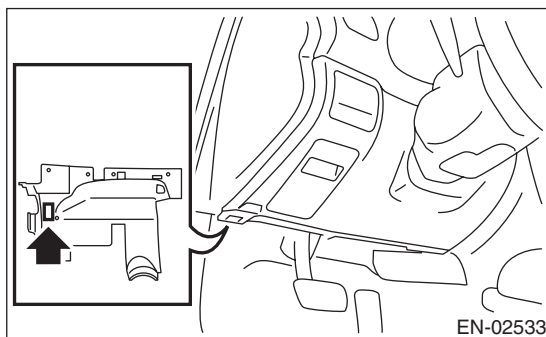
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the delivery (test) mode connector (A) located under the glove box.



6) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

Do not connect the scan tools except for Subaru Select Monitor and general scan tool.

7) Start up the personal computer.

8) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor".

9) On the «Main Menu» display screen, select the {Each System Check}.

10) On the «System Selection Menu» display screen, select the {Engine Control System}.

11) Click the [OK] button after the information of engine type has been displayed.

12) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

13) On the «System operation check mode» display screen, select the {Actuator ON/OFF Operation}.

14) Select the desired actuator on the «Actuator ON/OFF Operation» display screen and click the [Next] button.

15) Clicking the [Finished] button completes the compulsory valve operation check mode. The display will then return to the «Actuator ON/OFF Operation» screen.

• A list of the support data is shown in the following table.

Description	Display
Compulsory fuel pump relay operation check	Fuel Pump
Compulsory purge control solenoid valve operation check	CPC Solenoid
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay

#### NOTE:

• The following parts will be displayed but not functional.

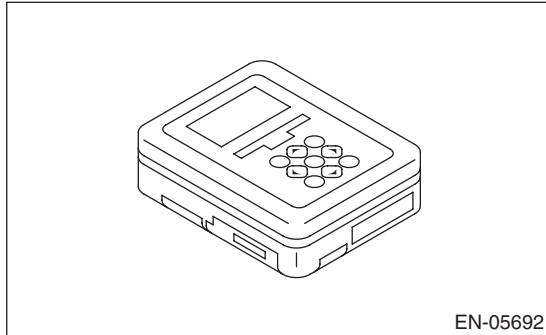
Display
EGR Solenoid
ASV Solenoid
PCV Solenoid Valve
Vent Solenoid Valve
FICD Solenoid
Pressure Switching Sol.1
Pressure Switching Sol.2
AAI Solenoid
Fuel Tank Sensor Control Valve
Wastegate solenoid
Exhaust Bypass Valve Control Permit Flag
Secondary Air Combination Valve 1

• For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

## 15. System Operation Check Mode

### A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>



2) Prepare the personal computer which has been installed the Subaru Select Monitor.

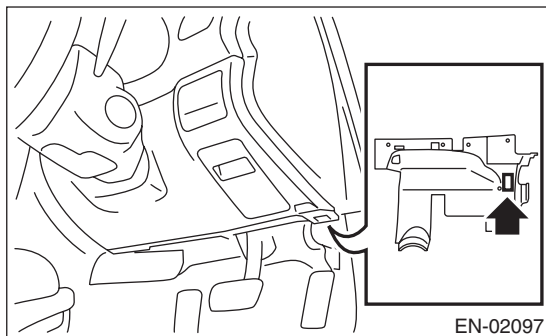
3) Connect the USB cable between SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

**NOTE:**

The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect the scan tools except for Subaru Select Monitor and general scan tool.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF), and run the "Application for Subaru Select Monitor".

8) On the «Main Menu» display screen, select the {Each System Check}.

9) On the «System Selection Menu» display screen, select the {Engine Control System}.

10) Click the [OK] button after the information of engine type has been displayed.

11) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode}.

12) The following items will be displayed on screen.

Display
Actuator ON/OFF Operation
Security System
Fuel Pump Control
Idling Ignition Timing Fixed
Idle Speed Control
Injector Control
EGR Valve Control

### 1. FUEL PUMP CONTROL (OFF OPERATION)

**CAUTION:**

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

1) On the «System operation check mode» display, select the {Fuel Pump Control}.

2) On the «Fuel Pump Control» display screen, select the {OFF Operation}.

3) On the «Start the Engine» display screen, start the engine and click the [OK] button.

4) Click the [Cancel] button to end the OFF drive. The screen will return to the «Fuel Pump Control» screen.

**NOTE:**

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

### 2. FUEL PUMP CONTROL (ON/OFF OPERATION)

**CAUTION:**

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

1) On the «System operation check mode» display, select the {Fuel Pump Control}.

2) On the «Fuel Pump Control» display screen, select the {ON/OFF Operation}.

3) On the «Turn Ignition Switch ON with Engine Stalled» display screen, turn the ignition switch to ON and click the [OK] button.

4) Click the [Cancel] button to end the ON/OFF drive. The screen will return to the «Fuel Pump Control» screen.

**NOTE:**

For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

# System Operation Check Mode

ENGINE (DIAGNOSTICS)

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## 3. IDLING IGNITION TIMING FIXED

### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

- 1) On the «System operation check mode» display screen, select the {Idling Ignition Timing Fixed}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) Click the [Cancel] button to end the idle ignition timing fixed. The screen will return to the «System Operation Check Mode» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 4. IDLE SPEED CONTROL

### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

- 1) On the «System operation check mode» display screen, select the {Idle Speed Control}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) In the «Idle Engine Speed Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.

Setting is possible in a range between 500 rpm — 2000 rpm, in increments of 50 rpm. However, the engine speed that can actually be controlled will vary depending on the vehicle or auxiliary load condition.

- 4) Click the [Cancel] button to end the idle speed control. The screen will return to the «System Operation Check Mode» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 5. INJECTOR CONTROL (INJECTION STOP MODE)

### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

- 1) On the «System operation check mode» display, select the {Injector Control}.
- 2) On the «Injector Control» display screen, select the {Injection Stop Mode}.
- 3) Select the desired injector number on the «Injection Stop Mode» screen, and click the [OK] button.
- 4) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 5) Click the [Cancel] button to return the «Injection Stop Mode» display screen.
- 6) On the «Injection Stop Mode» display screen, click the [Return] button to end the «Injection Stop Mode». The screen will return to the «Injector Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 6. INJECTOR CONTROL (INJECTION QUANTITY CONTROL)

### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

- 1) On the «System operation check mode» display, select the {Injector Control}.
- 2) On the «Injector Control» display screen, select the {Injection Quantity Control}.
- 3) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 4) In the «Injection Quantity Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.  
Setting is possible in a range between 0 — 20%, in increments of 1%.
- 5) Click the [Cancel] button to end the injection quantity control. The screen will return to the «Injector Control» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.



## 7. EGR VALVE CONTROL

### CAUTION:

**After executing the operation check mode, execute the Clear Memory Mode. <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>**

- 1) On the «System operation check mode» display, select the {EGR Valve Control}.
- 2) On the «Start the Engine» display screen, start the engine and click the [OK] button.
- 3) In the «EGR Valve Control» screen, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.  
Setting is possible in 1 STEP increments. However, the number of STEPs that can actually be controlled will vary depending on the vehicle.
- 4) Click the [Cancel] button to end the EGR valve control. The screen will return to the «System Operation Check Mode» screen.

### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

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## 16. Malfunction Indicator Light

### A: PROCEDURE

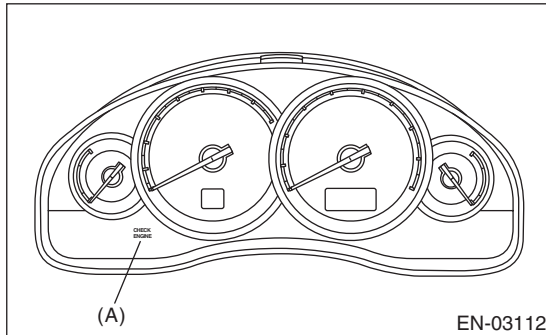
1. Activation of malfunction indicator light. <Ref. to EN(H6DO)(diag)-63, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on. <Ref. to EN(H6DO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off. <Ref. to EN(H6DO)(diag)-66, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink. <Ref. to EN(H6DO)(diag)-67, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking. <Ref. to EN(H6DO)(diag)-69, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

## B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

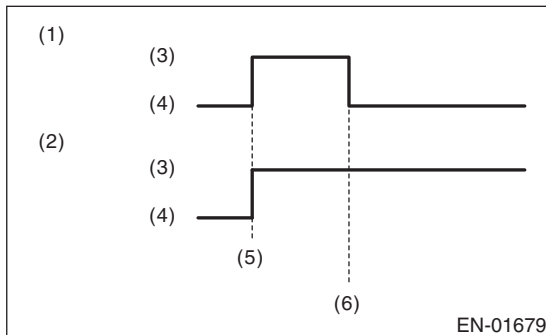
1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

**NOTE:**

If the malfunction indicator light does not illuminate, perform diagnostics of the malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H6DO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>



2) After starting the engine, the malfunction indicator light goes out. If it does not go off, either the engine or emission control system has malfunction.



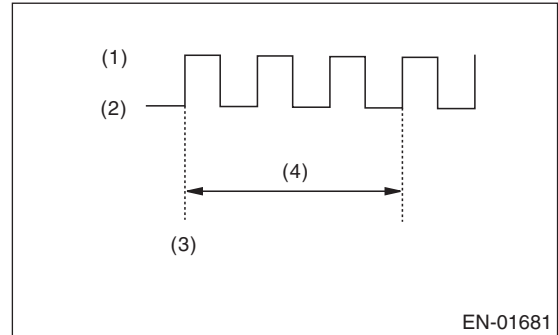
- (1) No faulty
- (2) Trouble occurs
- (3) ON
- (4) OFF
- (5) Ignition switch ON
- (6) Engine start

3) Turn the ignition switch to OFF and connect the delivery (test) mode connector.

(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.

(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.



- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) 1 second

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

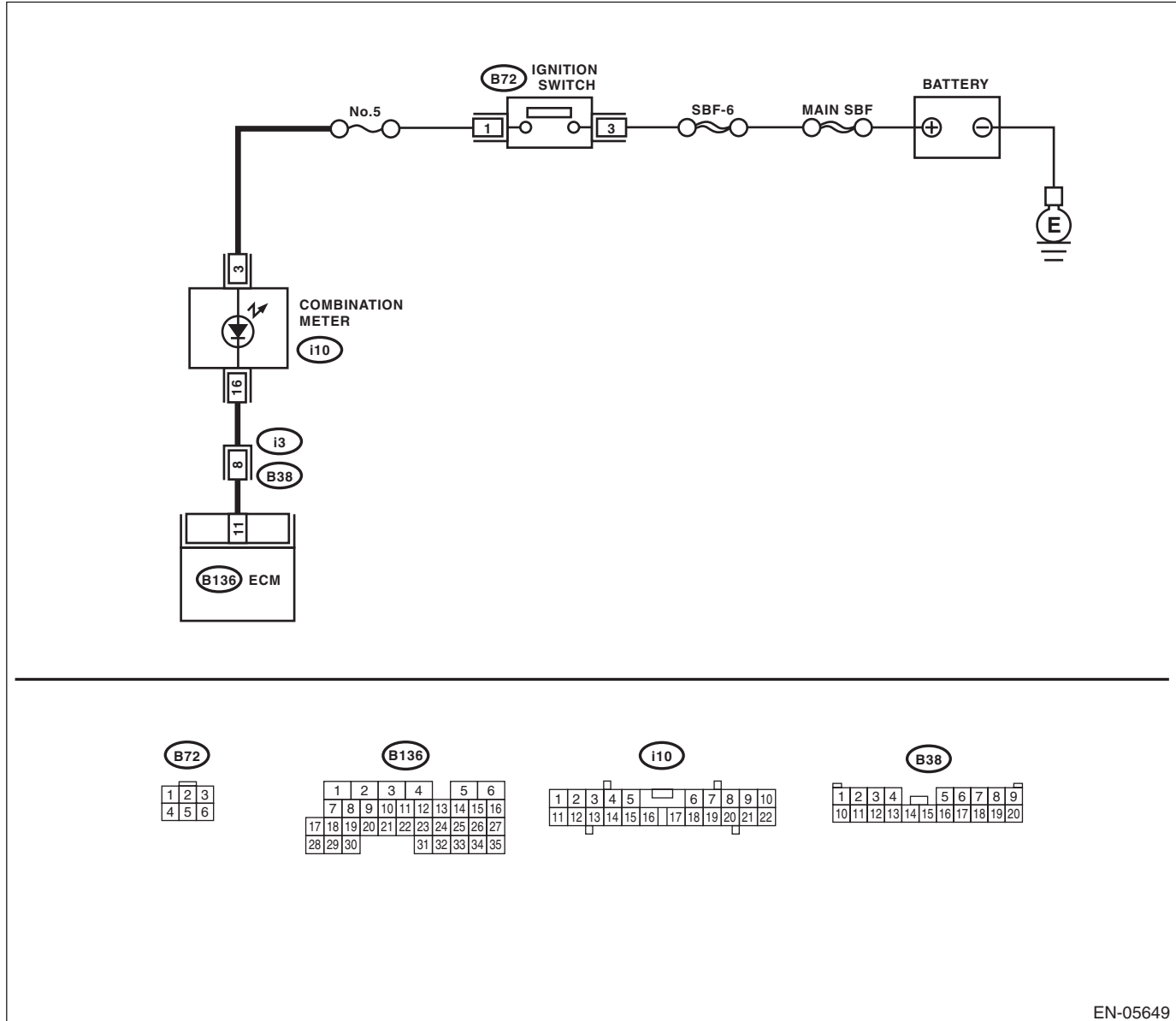
### DIAGNOSIS:

The malfunction indicator light circuit is open or shorted.

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not come on.

### WIRING DIAGRAM:



EN-05649

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 11 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.
2	<b>CHECK POOR CONTACT.</b> Check for poor connection by shaking or pulling ECM connector and harness.	Does the malfunction indicator light illuminate?	Repair poor contact of the ECM connector.	Go to step 3.
3	<b>CHECK ECM CONNECTOR.</b> Check the connection of ECM connector.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Repair the connection of ECM connector.
4	<b>CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-19, Combination Meter.> 3) Disconnect the connector from ECM and combination meter. 4) Measure the resistance of harness between ECM connector and combination meter connector. <b>Connector &amp; terminal</b> <b>(B136) No. 11 — (i10) No. 16:</b>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and combination meter connector • Poor contact of coupling connector
5	<b>CHECK POOR CONTACT.</b> Check poor contact of combination meter connector.	Is there poor contact in combination meter connector?	Repair the poor contact of combination meter connector.	Go to step 6.
6	<b>CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i10) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Replace the combination meter circuit board. <Ref. to IDI-19, Combination Meter.>	Check the following item and repair if necessary. NOTE: • Blown out of fuse (No. 5) • Open or short circuit of harness between fuse (No. 5) and battery terminal • Poor contact of ignition switch connector

# Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

## D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

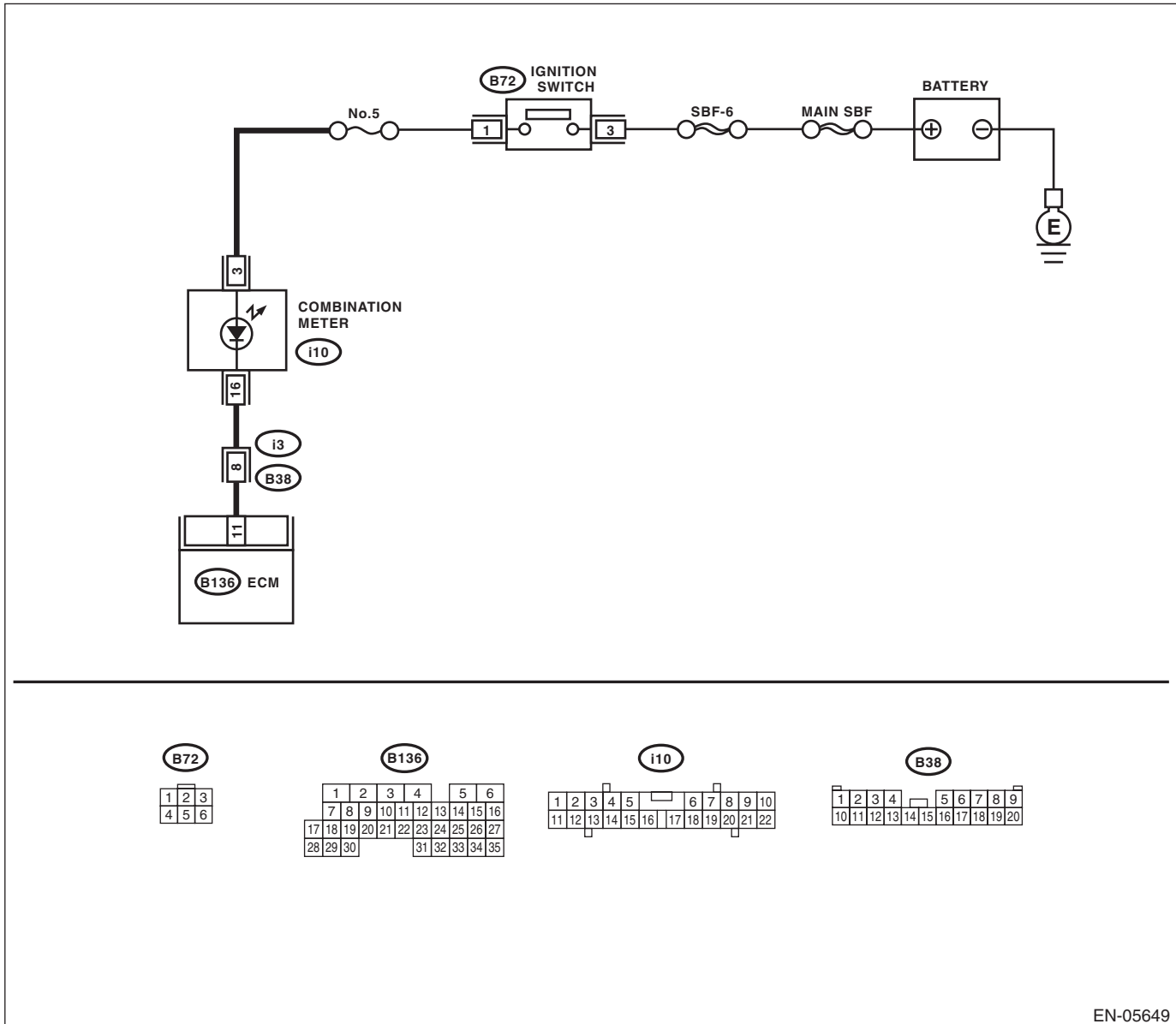
### DIAGNOSIS:

The malfunction indicator light circuit is shorted.

### TROUBLE SYMPTOM:

Although malfunction indicator light illuminates when the engine runs, DTC is not shown on the Subaru Select Monitor display.

### WIRING DIAGRAM:



EN-05649

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

## E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

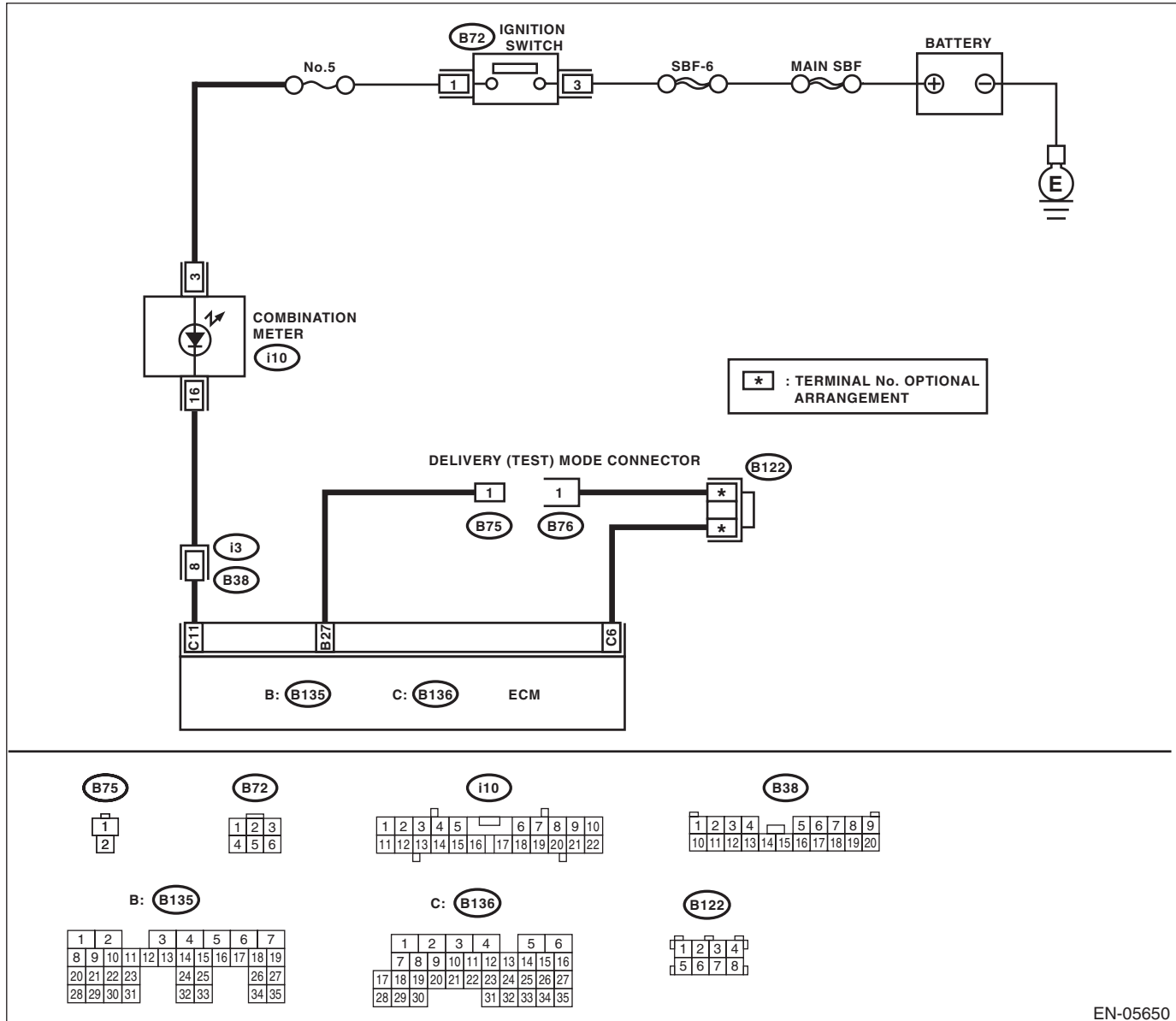
### DIAGNOSIS:

- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

### TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

### WIRING DIAGRAM:



# Malfunction Indicator Light

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector. 3) Turn the ignition switch to ON. (engine OFF)	Does the malfunction indicator light illuminate?	Go to step 2.	Repair the malfunction indicator light circuit. <Ref. to EN(H6DO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
<b>2 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between combination meter and ECM connector.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN DELIVERY (TEST) MODE CONNECTOR AND ECM CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between delivery (test) mode connector and ECM connector.  <i>Connector &amp; terminal (B76) No. 1 — (B136) No. 6</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between delivery (test) mode connector and chassis ground</li> </ul>
<b>4 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Go to step 5.
<b>5 CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.</b> 1) Connect the delivery (test) mode connector. 2) Measure the resistance of harness between ECM and chassis ground.  <i>Connector &amp; terminal (B135) No. 27 — Chassis ground:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between ECM and delivery (test) mode connector.
<b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>



## F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

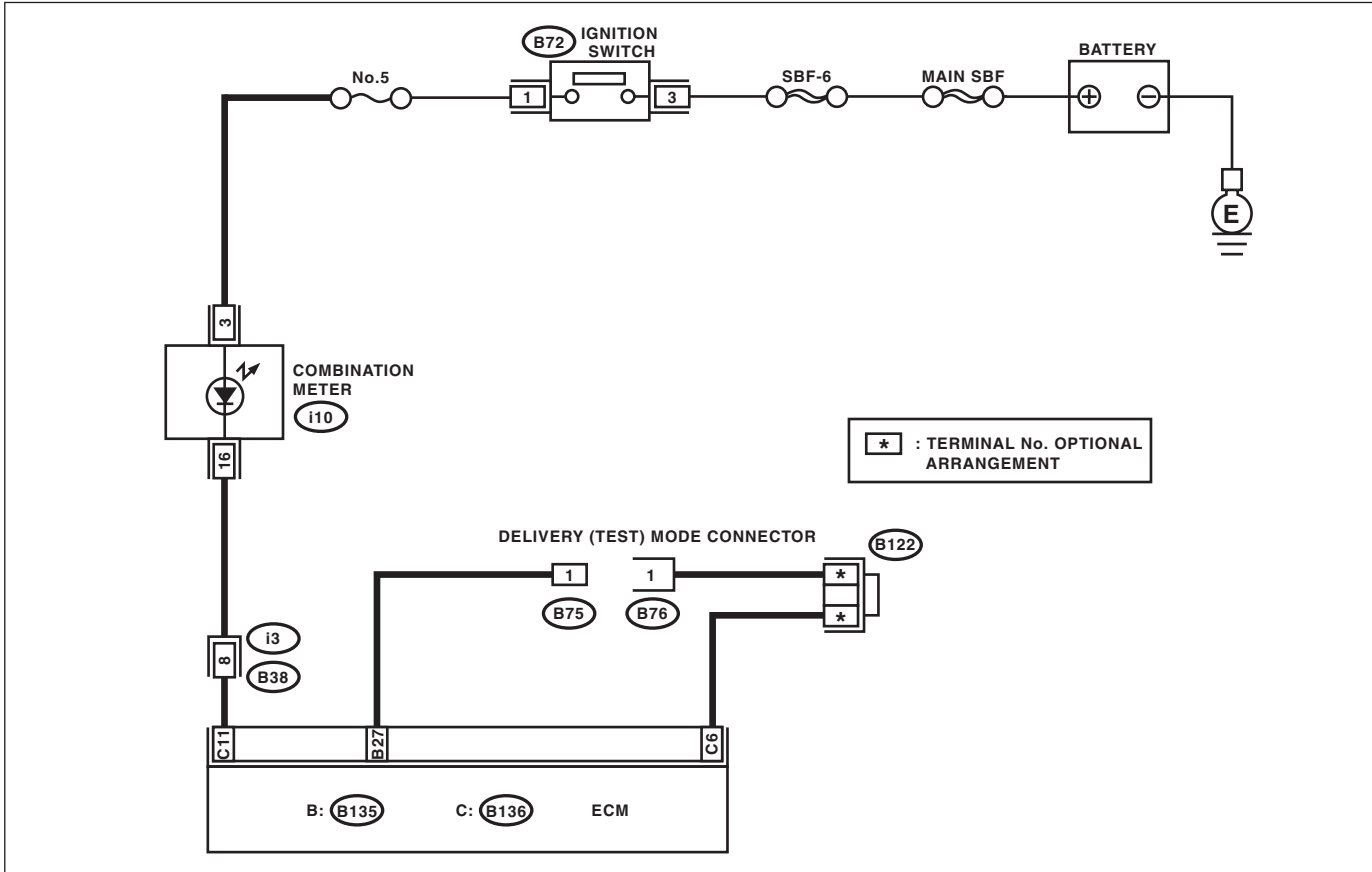
### DIAGNOSIS:

The delivery (test) mode connector circuit is shorted.

### TROUBLE SYMPTOM:

Malfunction indicator light blinks when delivery (test) mode connector is not connected.

### WIRING DIAGRAM:



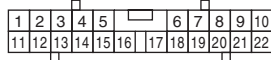
B75



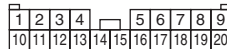
B72



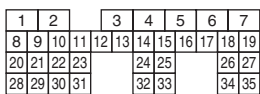
i10



B38



B: B135



C: B136



B122



# Malfunction Indicator Light

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DELIVERY (TEST) MODE CONNECTOR.</b> 1) Disconnect the delivery (test) mode connector. 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step 2.	System is normal. NOTE: Malfunction indicator light blinks when delivery (test) mode connector is connected.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM CONNECTOR AND CHASSIS GROUND TERMINAL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 27 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Repair the short circuit of harness between ECM and delivery (test) mode connector.	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

## 17. Diagnostics for Engine Starting Failure

### A: PROCEDURE

1. Check of the fuel amount
↓
2. Inspection of starter motor circuit. <Ref. to EN(H6DO)(diag)-72, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line. <Ref. to EN(H6DO)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system. <Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit <Ref. to EN(H6DO)(diag)-81, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel indicator circuit <Ref. to EN(H6DO)(diag)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

# Diagnostics for Engine Starting Failure

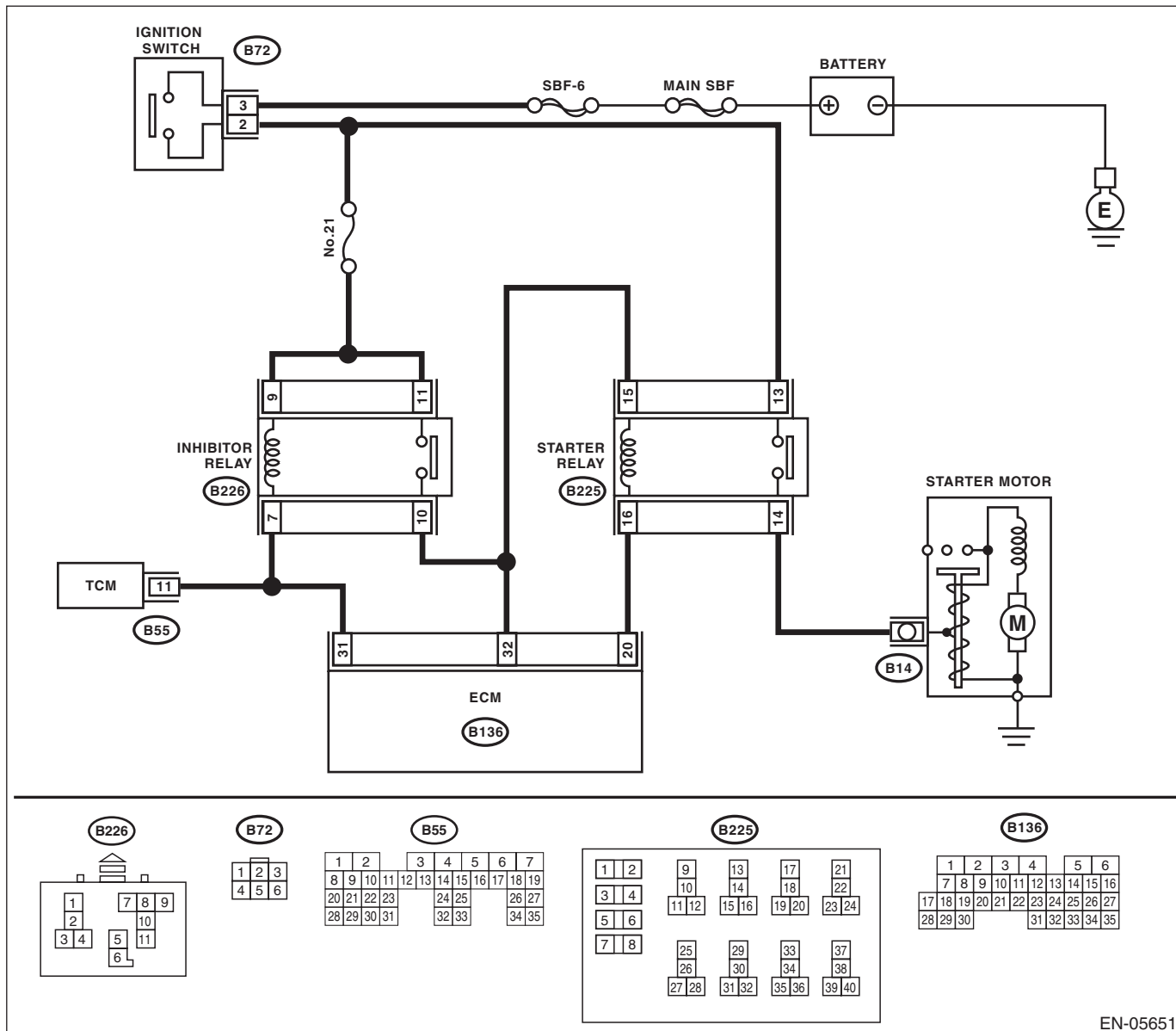
ENGINE (DIAGNOSTICS)

## B: STARTER MOTOR CIRCUIT

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05651

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK BATTERY.</b> Check the battery voltage.	Is the voltage 12 V or more?	Go to step 2.	Charge or replace the battery.
2	<b>CHECK OPERATION OF STARTER MOTOR.</b>	Does the starter motor operate?	Go to step 3.	Go to step 4.
3	<b>CHECK DTC.</b>	Is DTC displayed? <Ref. to EN(H6DO)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	The circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.
4	<b>CHECK INPUT SIGNAL FOR STARTER MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Place the select lever in "P" or "N" range. 4) Turn the ignition switch to START. 5) Measure the voltage between the starter motor connector and the engine ground. <b>Connector &amp; terminal</b> <b>(B14) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4SO)-6, Starter.>	Go to step 5.
5	<b>CHECK INPUT SIGNAL FOR STARTER MOTOR.</b> 1) Place the select lever in "P" or "N" range. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B225) No. 14 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the open circuit of the harness between starter relay connector and starter motor.	Go to step 6.
6	<b>CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition switch. 3) Measure the voltage between ignition switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B72) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 7.	Check the following item and repair if necessary. • Blown out of fuse • Open or ground short circuit of harness between ignition switch connector and battery
7	<b>CHECK IGNITION SWITCH.</b> Measure the resistance between ignition switch terminals after turning the ignition switch to START position. <b>Terminals</b> <b>No. 2 — No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 8.	Replace the ignition switch. <Ref. to SL-48, REPLACEMENT, Ignition Key Lock.>

# Diagnostics for Engine Starting Failure

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>8 CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Remove the starter relay. 2) Connect the connector to ignition switch. 3) Turn the ignition switch to START. 4) Measure the voltage between starter relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B225) No. 13 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 9.	Repair the open circuit of harness between starter relay connector and ignition switch connector.
<b>9 CHECK STARTER RELAY.</b> 1) Connect the battery to starter relay terminals No. 15 and No. 16. 2) Measure the resistance between starter relay terminals. <i><b>Terminals</b></i> <i><b>No. 13 — No. 14:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 10.	Replace the starter relay.
<b>10 CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and starter relay connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 20 — (B225) No. 16:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 11.	Repair the open circuit of harness between ECM and starter relay connector.
<b>11 CHECK INPUT VOLTAGE OF STARTER RELAY.</b> 1) Place the select lever in "P" or "N" range. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B225) No. 15 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 12.	Go to step 13.
<b>12 CHECK HARNESS BETWEEN ECM AND INHIBITOR RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the inhibitor relay connector. 3) Measure the resistance of harness between ECM and inhibitor relay connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 31 — (B226) No. 7:</b></i> <i><b>(B136) No. 32 — (B226) No. 10:</b></i>	Is the resistance less than 1 $\Omega$ ?	Check the ECM power supply and ground line. <Ref. to EN(H6DO)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of harness between ECM and inhibitor relay connector.
<b>13 CHECK INPUT VOLTAGE OF INHIBITOR RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the inhibitor relay connector. 3) Turn the ignition switch to START. 4) Measure the voltage between inhibitor relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B226) No. 9 (+) — Chassis ground (-):</b></i> <i><b>(B226) No. 11 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 14.	Check the following item and repair if necessary. <ul style="list-style-type: none"> <li>• Blown out of fuse</li> <li>• Open or ground short circuit of harness between ignition switch connector and inhibitor relay connector</li> </ul>

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>14</b> <b>CHECK INHIBITOR RELAY.</b> 1) Connect the battery to inhibitor relay terminals No. 7 and No. 9. 2) Measure the resistance between inhibitor relay terminals. <i>Terminals</i> <i>No. 10 — No. 11:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 15.	Replace the inhibitor relay.
<b>15</b> <b>CHECK HARNESS BETWEEN INHIBITOR RELAY CONNECTOR AND STARTER RELAY CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between inhibitor relay connector and starter relay connector. <i>Connector &amp; terminal</i> <i>(B226) No. 10 — (B225) No. 15:</i>	Is the resistance less than 1 $\Omega$ ?	Repair the open circuit of harness between TCM and inhibitor relay connector.	Repair the open circuit of harness between inhibitor relay connector and starter relay connector.

# Diagnostics for Engine Starting Failure

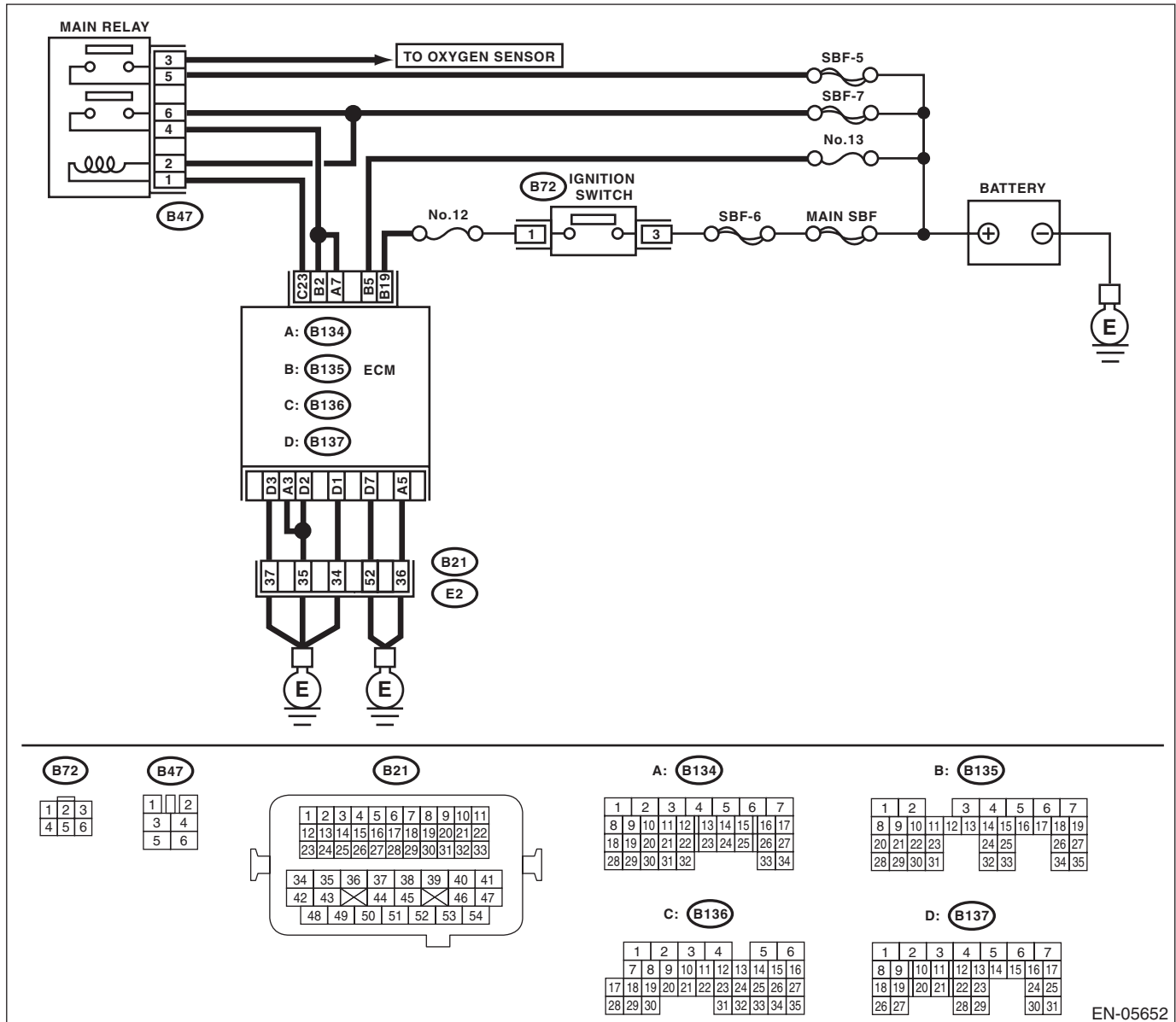
ENGINE (DIAGNOSTICS)

## C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1</b> <b>CHECK MAIN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. <b>Terminals</b> <b>No. 3 — No. 5:</b> <b>No. 4 — No. 6:</b>	Is the resistance less than 10 Ω?	Go to step 2.	Replace the main relay. <Ref. to EN(H6DO)(diag)-8, Electrical Component Location.>



# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>2 CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 3 — Chassis ground:</b></i> <i><b>(B134) No. 5 — Chassis ground:</b></i> <i><b>(B137) No. 1 — Chassis ground:</b></i> <i><b>(B137) No. 2 — Chassis ground:</b></i> <i><b>(B137) No. 3 — Chassis ground:</b></i> <i><b>(B137) No. 7 — Chassis ground:</b></i>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the open circuit of harness between ECM connector and engine grounding terminal.
<b>3 CHECK INPUT VOLTAGE OF ECM.</b> Measure the voltage between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 5 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 4.	Repair the open or ground short circuit of power supply circuit.
<b>4 CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 19 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 5.	Repair the open or ground short circuit of power supply circuit.
<b>5 CHECK INPUT VOLTAGE OF MAIN RELAY.</b> Measure the voltage between main relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B47) No. 2 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 6.	Repair the open circuit of harness between ECM connector and main relay connector.
<b>6 CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connectors to ECM and main relay. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 23 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 7.	Repair the open or ground short circuit of harness between ECM connector and main relay connector.
<b>7 CHECK INPUT VOLTAGE OF MAIN RELAY.</b> Measure the voltage between main relay connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B47) No. 5 (+) — Chassis ground (-):</b></i> <i><b>(B47) No. 6 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 8.	Repair the open or ground short circuit of harness of power supply circuit.
<b>8 CHECK INPUT VOLTAGE OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 7 (+) — Chassis ground (-):</b></i> <i><b>(B135) No. 2 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the open or ground short circuit of harness between ECM connector and main relay connector.

# Diagnostics for Engine Starting Failure

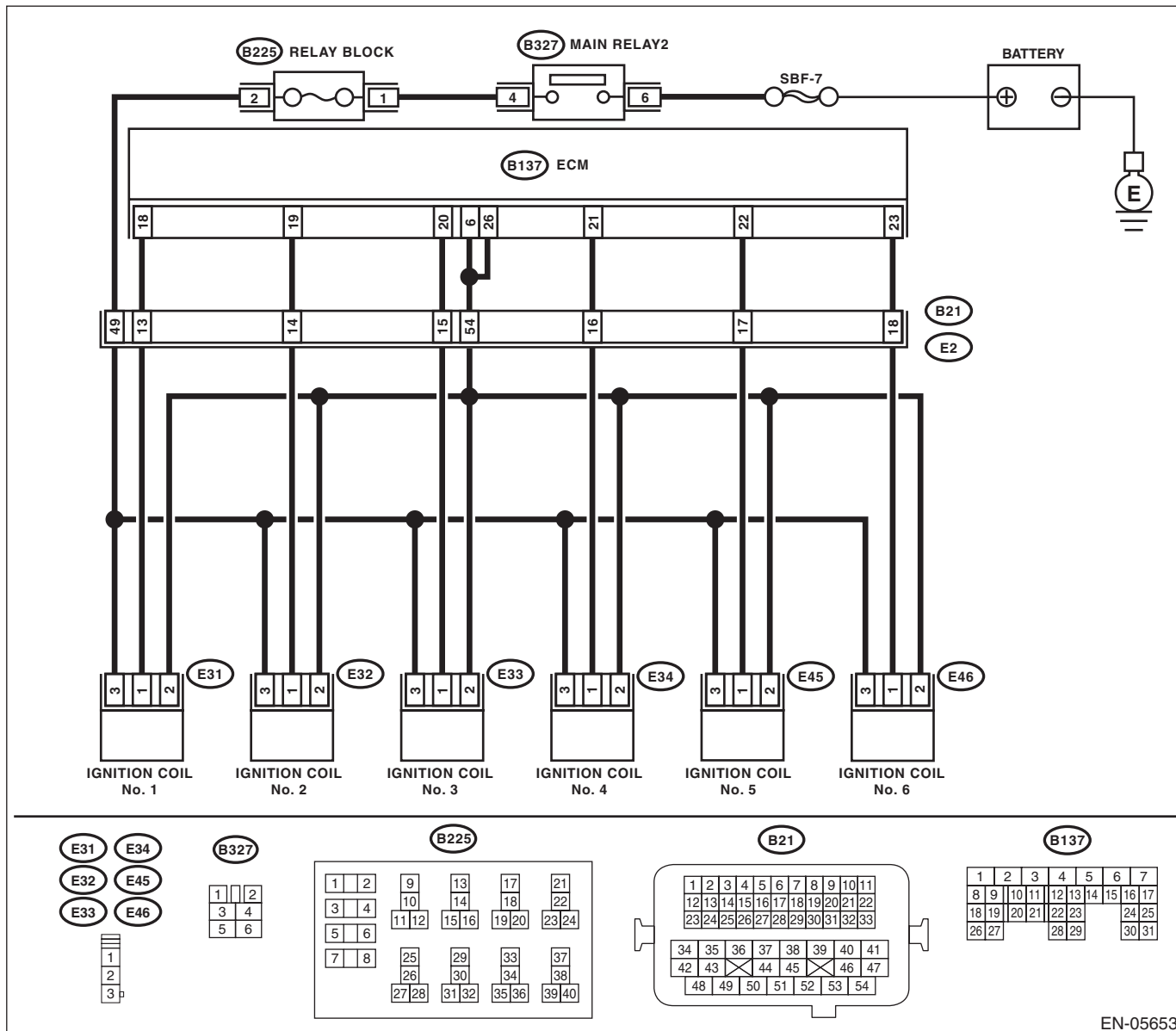
ENGINE (DIAGNOSTICS)

## D: IGNITION CONTROL SYSTEM

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05653

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK SPARK PLUG CONDITION.</b> 1) Remove the spark plug. <Ref. to IG(H6DO)-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H6DO)-5, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Go to step 2.	Replace the spark plug.
<b>2 CHECK IGNITION SYSTEM FOR SPARKS.</b> 1) Connect the spark plug to ignition coil. 2) Release the fuel pressure. 3) Contact the spark plug thread portion to engine. 4) While opening the throttle valve fully, start the engine to check if spark occurs at each cylinder.	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H6DO)(diag)-81, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 3.
<b>3 CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL AND IGNITOR ASSEMBLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ignition coil and ignitor assembly. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil and ignitor assembly connector and engine ground. <b>Connector &amp; terminal</b> (E31) No. 3 (+) — Engine ground (-): (E32) No. 3 (+) — Engine ground (-): (E33) No. 3 (+) — Engine ground (-): (E34) No. 3 (+) — Engine ground (-): (E45) No. 3 (+) — Engine ground (-): (E46) No. 3 (+) — Engine ground (-):	Is the voltage 10 V or more?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the ignition coil and ignitor assembly and ignition switch connector • Poor contact of coupling connector
<b>4 CHECK HARNESS OF IGNITION COIL AND IGNITOR ASSEMBLY GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ignition coil and ignitor assembly connector and engine ground. <b>Connector &amp; terminal</b> (E31) No. 2 — (B137) No. 6: (E32) No. 2 — (B137) No. 6: (E33) No. 2 — (B137) No. 6: (E34) No. 2 — (B137) No. 6: (E45) No. 2 — (B137) No. 6: (E46) No. 2 — (B137) No. 6: (E31) No. 2 — (B137) No. 26: (E32) No. 2 — (B137) No. 26: (E33) No. 2 — (B137) No. 26: (E34) No. 2 — (B137) No. 26: (E45) No. 2 — (B137) No. 26: (E46) No. 2 — (B137) No. 26:	Is the resistance less than 5 Ω?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ignition coil and ignitor assembly connector and engine grounding terminal

## Diagnostics for Engine Starting Failure

### ENGINE (DIAGNOSTICS)

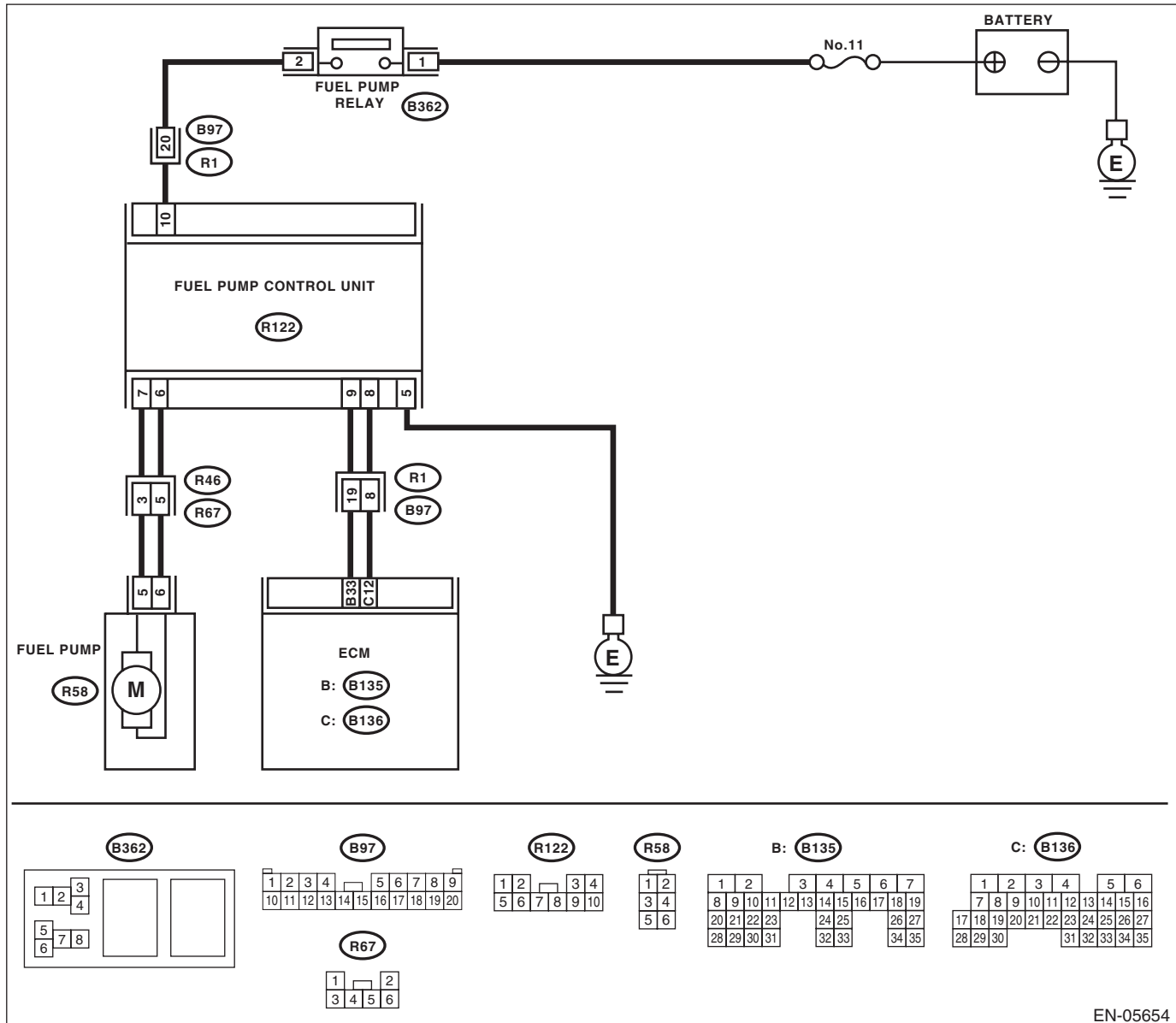
Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Disconnect the connector from the ignition coil and ignitor assembly.                      4) Measure the resistance of harness between ECM and ignition coil and ignitor assembly connector.</p> <p><b>Connector &amp; terminal</b>                      (B137) No. 18 — (E31) No. 1:                      (B137) No. 19 — (E32) No. 1:                      (B137) No. 20 — (E33) No. 1:                      (B137) No. 21 — (E34) No. 1:                      (B137) No. 22 — (E45) No. 1:                      (B137) No. 23 — (E46) No. 1:</p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 6.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and ignition coil and ignitor assembly connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.</b></p> <p>Measure the resistance of harness between ECM connector and engine ground.</p> <p><b>Connector &amp; terminal:</b>                      (B137) No. 18 — Engine ground:                      (B137) No. 19 — Engine ground:                      (B137) No. 20 — Engine ground:                      (B137) No. 21 — Engine ground:                      (B137) No. 22 — Engine ground:                      (B137) No. 23 — Engine ground:</p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 7.</p>	<p>Repair the ground short circuit of harness between ECM and ignition coil and ignitor assembly connector.</p>
<p><b>7</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the ECM connector.</p>	<p>Is there poor contact in ECM connector?</p>	<p>Repair poor contact of the ECM connector.</p>	<p>Check the fuel pump circuit. &lt;Ref. to EN(H6DO)(diag)-81, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.&gt;</p>

## E: FUEL PUMP CIRCUIT

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK OPERATING SOUND OF FUEL PUMP.</b></p> <p>Make sure that the fuel pump operates for two seconds when turning the ignition switch to ON.</p> <p>NOTE: Fuel pump operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". &lt;Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.&gt;</p>	<p>Does the fuel pump emit operating sound?</p>	<p>Check the fuel injector circuit. &lt;Ref. to EN(H6DO)(diag)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.&gt;</p>	<p>Display the DTC. &lt;Ref. to EN(H6DO)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p>

# Diagnostics for Engine Starting Failure

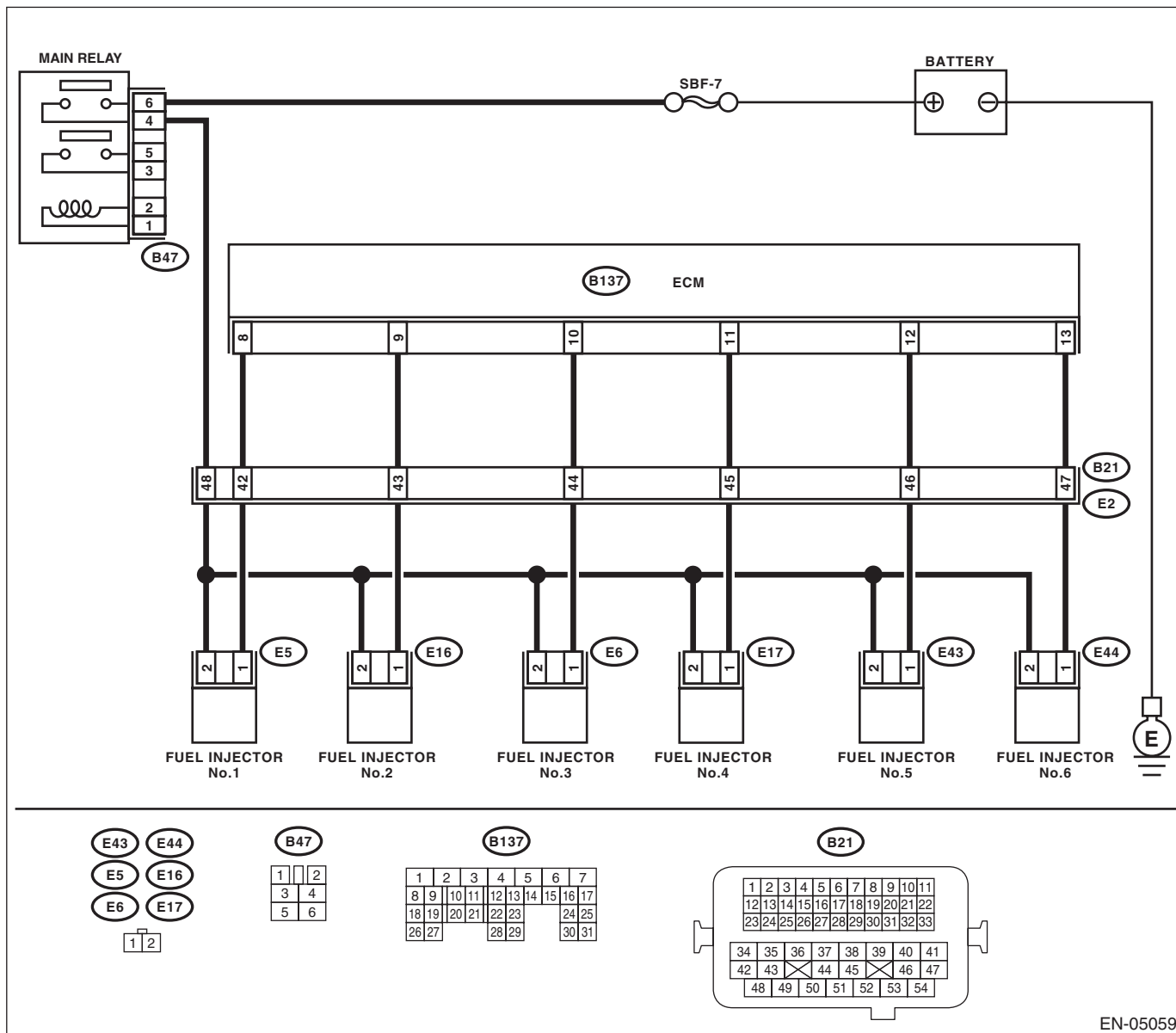
ENGINE (DIAGNOSTICS)

## F: FUEL INJECTOR CIRCUIT

### CAUTION:

- Check or repair only faulty parts.
- After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05059

# Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK OPERATION OF EACH FUEL INJECTOR.</b> While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector for this check.</p>	Does the fuel pump emit operating sound?	Check the fuel pressure. <Ref. to ME(H6DO)-26, INSPECTION, Fuel Pressure.>	Go to step 2.
<p><b>2 CHECK POWER SUPPLY TO EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between fuel injector terminal and engine ground. <b>Connector &amp; terminal</b> #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-): #5 (E43) No. 2 (+) — Engine ground (-): #6 (E44) No. 2 (+) — Engine ground (-):</p>	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and fuel injector connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of fuel injector connector</li> </ul>
<p><b>3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. <b>Connector &amp; terminal</b> #1 (B137) No. 8 — (E5) No. 1: #2 (B137) No. 9 — (E16) No. 1: #3 (B137) No. 10 — (E6) No. 1: #4 (B137) No. 11 — (E17) No. 1: #5 (B137) No. 12 — (E43) No. 1: #6 (B137) No. 13 — (E44) No. 1:</p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.</b> Measure the resistance of harness between ECM and fuel injector connector. <b>Connector &amp; terminal</b> #1 (B137) No. 8 — Chassis ground: #2 (B137) No. 9 — Chassis ground: #3 (B137) No. 10 — Chassis ground: #4 (B137) No. 11 — Chassis ground: #5 (B137) No. 12 — Chassis ground: #6 (B137) No. 13 — Chassis ground:</p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and fuel injector connector.
<p><b>5 CHECK EACH FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. <b>Terminals</b> No. 1 — No. 2:</p>	Is the resistance between 5 — 20 Ω?	Go to step 6.	Replace the faulty fuel injector.
<p><b>6 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.</p>	Is there poor contact in ECM connector?	Repair poor contact of the ECM connector.	Inspection using “General Diagnostic Table”. <Ref. to EN(H6DO)(diag)-356, INSPECTION, General Diagnostic Table.>

## List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

### 18. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Reference
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to EN(H6DO)(diag)-92, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to EN(H6DO)(diag)-93, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to EN(H6DO)(diag)-94, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to EN(H6DO)(diag)-95, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to EN(H6DO)(diag)-96, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to EN(H6DO)(diag)-98, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-100, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-102, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-104, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H6DO)(diag)-106, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H6DO)(diag)-108, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-110, DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-112, DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-114, DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	<Ref. to EN(H6DO)(diag)-116, DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	<Ref. to EN(H6DO)(diag)-118, DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to EN(H6DO)(diag)-120, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to EN(H6DO)(diag)-122, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to EN(H6DO)(diag)-124, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to EN(H6DO)(diag)-126, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to EN(H6DO)(diag)-128, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-130, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H6DO)(diag)-132, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H6DO)(diag)-134, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H6DO)(diag)-136, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H6DO)(diag)-138, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-140, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H6DO)(diag)-142, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to EN(H6DO)(diag)-144, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H6DO)(diag)-146, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H6DO)(diag)-148, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	<Ref. to EN(H6DO)(diag)-150, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	<Ref. to EN(H6DO)(diag)-152, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H6DO)(diag)-154, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to EN(H6DO)(diag)-155, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H6DO)(diag)-156, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-157, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-159, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-161, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H6DO)(diag)-163, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H6DO)(diag)-165, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H6DO)(diag)-167, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H6DO)(diag)-169, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to EN(H6DO)(diag)-171, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-174, DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-176, DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-178, DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-180, DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	<Ref. to EN(H6DO)(diag)-182, DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	<Ref. to EN(H6DO)(diag)-184, DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0159	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)	<Ref. to EN(H6DO)(diag)-186, DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0160	O2 Sensor Circuit No Activity Detected (Bank2 Sensor2)	<Ref. to EN(H6DO)(diag)-188, DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H6DO)(diag)-190, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System Too Rich (Bank 1)	<Ref. to EN(H6DO)(diag)-190, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0174	System Too Lean (Bank 2)	<Ref. to EN(H6DO)(diag)-190, DTC P0174 SYSTEM TOO LEAN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0175	System Too Rich (Bank 2)	<Ref. to EN(H6DO)(diag)-191, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-193, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to EN(H6DO)(diag)-195, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to EN(H6DO)(diag)-197, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-199, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0197	Engine Oil Temperature Sensor Low	<Ref. to EN(H6DO)(diag)-201, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0198	Engine Oil Temperature Sensor High	<Ref. to EN(H6DO)(diag)-203, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	<Ref. to EN(H6DO)(diag)-205, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	<Ref. to EN(H6DO)(diag)-207, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0230	Fuel Pump Primary Circuit	<Ref. to EN(H6DO)(diag)-209, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H6DO)(diag)-211, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H6DO)(diag)-211, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H6DO)(diag)-211, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H6DO)(diag)-211, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0305	Cylinder 5 Misfire Detected	<Ref. to EN(H6DO)(diag)-211, DTC P0305 CYLINDER 5 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0306	Cylinder 6 Misfire Detected	<Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to EN(H6DO)(diag)-219, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to EN(H6DO)(diag)-221, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0332	Knock Sensor 2 Circuit Low (Bank 2)	<Ref. to EN(H6DO)(diag)-223, DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0333	Knock Sensor 2 Circuit High (Bank 2)	<Ref. to EN(H6DO)(diag)-225, DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to EN(H6DO)(diag)-227, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-229, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H6DO)(diag)-231, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	<Ref. to EN(H6DO)(diag)-233, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0400	Exhaust Gas Recirculation Flow	<Ref. to EN(H6DO)(diag)-235, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H6DO)(diag)-237, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to EN(H6DO)(diag)-241, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to EN(H6DO)(diag)-244, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to EN(H6DO)(diag)-246, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to EN(H6DO)(diag)-248, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to EN(H6DO)(diag)-250, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H6DO)(diag)-252, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H6DO)(diag)-254, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to EN(H6DO)(diag)-257, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H6DO)(diag)-260, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to EN(H6DO)(diag)-262, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor "A" Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-264, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to EN(H6DO)(diag)-264, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to EN(H6DO)(diag)-264, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H6DO)(diag)-265, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor "A"	<Ref. to EN(H6DO)(diag)-265, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to EN(H6DO)(diag)-266, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to EN(H6DO)(diag)-268, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H6DO)(diag)-270, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0600	Serial Communication Link	<Ref. to EN(H6DO)(diag)-271, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H6DO)(diag)-272, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H6DO)(diag)-273, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Control Module Performance	<Ref. to EN(H6DO)(diag)-274, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to EN(H6DO)(diag)-275, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H6DO)(diag)-275, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to EN(H6DO)(diag)-276, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to EN(H6DO)(diag)-278, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1154	O2 Sensor Circuit Range/Performance (Low) (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-280, DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1155	O2 Sensor Circuit Range/Performance (High) (Bank 2 Sensor 1)	<Ref. to EN(H6DO)(diag)-282, DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H6DO)(diag)-283, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H6DO)(diag)-284, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to EN(H6DO)(diag)-286, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to EN(H6DO)(diag)-288, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to EN(H6DO)(diag)-290, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to EN(H6DO)(diag)-291, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to EN(H6DO)(diag)-294, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up Voltage Circuit Malfunction	<Ref. to EN(H6DO)(diag)-296, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-19, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1574	Key Communication Failure	<Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	<Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1602	Control Module Programming Error	<Ref. to EN(H6DO)(diag)-298, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to EN(H6DO)(diag)-307, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to EN(H6DO)(diag)-309, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to EN(H6DO)(diag)-311, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to EN(H6DO)(diag)-313, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to EN(H6DO)(diag)-314, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Reference
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to EN(H6DO)(diag)-315, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	<Ref. to EN(H6DO)(diag)-320, DTC P2098 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	<Ref. to EN(H6DO)(diag)-321, DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H6DO)(diag)-332, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H6DO)(diag)-334, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to EN(H6DO)(diag)-335, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to EN(H6DO)(diag)-336, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to EN(H6DO)(diag)-338, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to EN(H6DO)(diag)-340, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	<Ref. to EN(H6DO)(diag)-342, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correlation	<Ref. to EN(H6DO)(diag)-344, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	<Ref. to EN(H6DO)(diag)-347, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2227	Barometric Pressure Circuit Range/Performance	<Ref. to EN(H6DO)(diag)-349, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2228	Barometric Pressure Circuit Low	<Ref. to EN(H6DO)(diag)-349, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2229	Barometric Pressure Circuit High	<Ref. to EN(H6DO)(diag)-350, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 19. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### TROUBLE SYMPTOM:

- Engine stalls.
- Erroneous idling

#### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b> 1) Start the engine and let it idle. 2) Measure the AVCS system operating angle using the Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the AVCS system operating angle approx. 0°?	Go to step 2.	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)
<p><b>2</b></p> <p><b>CHECK CURRENT DATA.</b> 1) Drive (accelerate or decelerate) the vehicle at 80 km/h (50 MPH) or less. NOTE: Drive the vehicle so that duty output of the oil flow control solenoid valve increases. 2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	When the oil flow control solenoid valve duty output exceeds 10%, is the AVCS system operating angle approx. 0°?	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.> <Ref. to LU(H6DO)-15, Engine Oil Filter.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## B: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-12, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the AVCS system operating angle approx. 0°, and oil flow control solenoid valve duty output approx. 10%?</p>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H6DO)-15, Engine Oil Filter.&gt;</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"><li>• Oil pipe (clog)</li><li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li><li>• Intake camshaft (dirt, damage of camshaft)</li><li>• Timing chain (matching of timing mark)</li></ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## C: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-13, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the AVCS system operating angle approx. 0°, and oil flow control solenoid valve duty output approx. 10%?</p>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H6DO)-15, Engine Oil Filter.&gt;</p>	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> <li>• Timing chain (matching of timing mark)</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## D: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-14, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine and let it idle.</p> <p>2) Measure the AVCS system operating angle using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the AVCS system operating angle approx. 0°?	Go to step 2.	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>
2	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Drive (accelerate or decelerate) the vehicle at 80 km/h (50 MPH) or less.</p> <p>NOTE:</p> <p>Drive the vehicle so that duty output of the oil flow control solenoid valve increases.</p> <p>2) Measure the AVCS system operating angle and oil flow control solenoid valve duty output using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	When the oil flow control solenoid valve duty output exceeds 10%, is the AVCS system operating angle approx. 0°?	<p>Check the following item and repair or replace if necessary.</p> <ul style="list-style-type: none"> <li>• Oil pipe (clog)</li> <li>• Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring)</li> <li>• Intake camshaft (dirt, damage of camshaft)</li> </ul>	<p>Perform the following procedures, and clean the oil routing.</p> <p>Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.</p> <p>&lt;Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.&gt; &lt;Ref. to LU(H6DO)-15, Engine Oil Filter.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## E: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/ PERFORMANCE (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-14, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

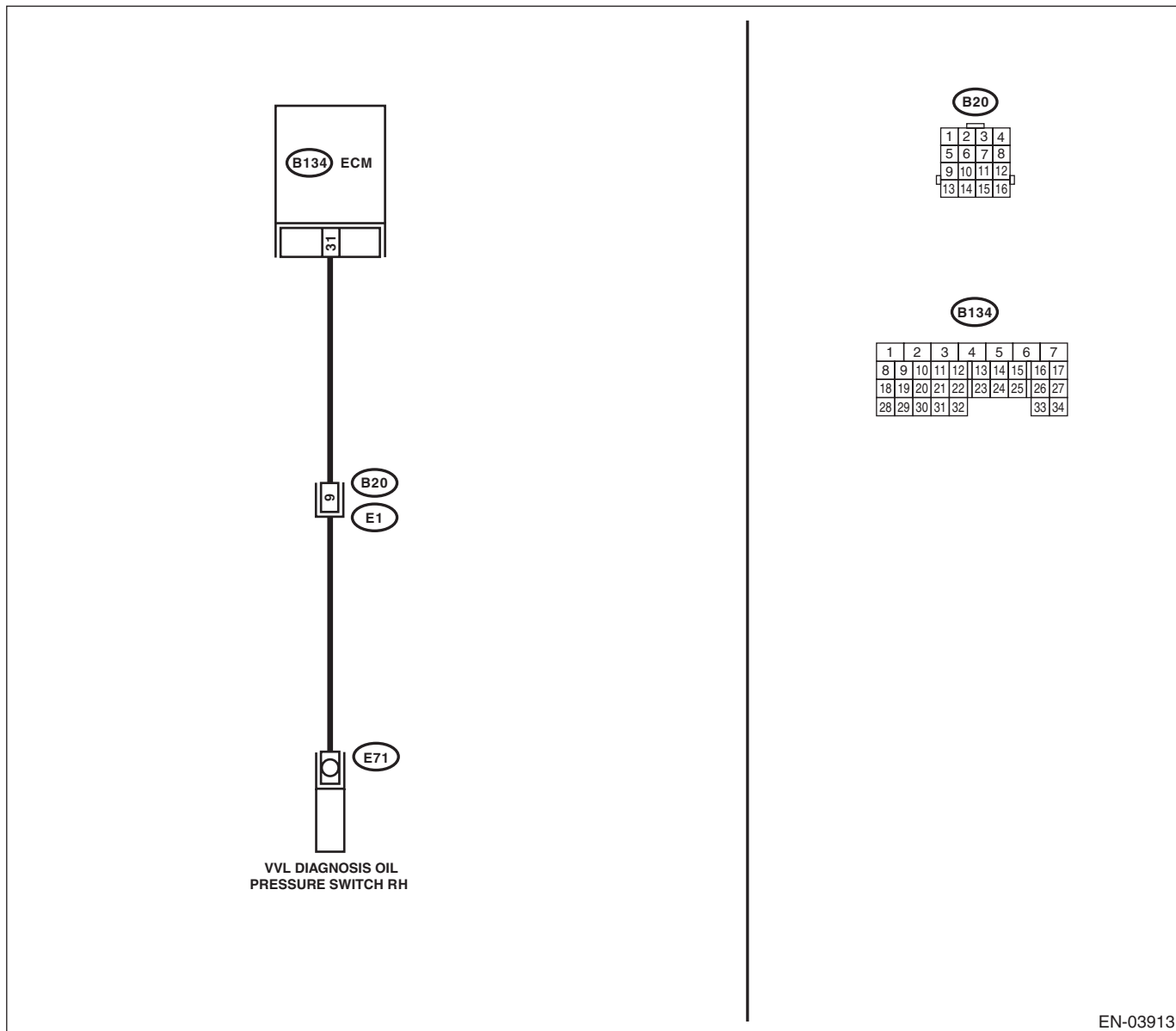
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03913

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 31 — (E71) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>Measure the resistance between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E71) No. 1 — Engine ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E71) No. 1 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power of the harness between the ECM and variable valve lift diagnosis oil pressure switch connector.	Go to step 4.
<p><b>4</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Replace the oil switching solenoid valve. <Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.> Go to step 5.	END
<p><b>5</b></p> <p><b>CHECK DTC.</b></p> <p>1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC.</p> <p>NOTE: For detailed procedures, refer to “Clear Memory Mode”. &lt;Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.&gt;</p>	Is DTC displayed?	Check for oil routing.	END.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## F: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/ PERFORMANCE (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-17, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

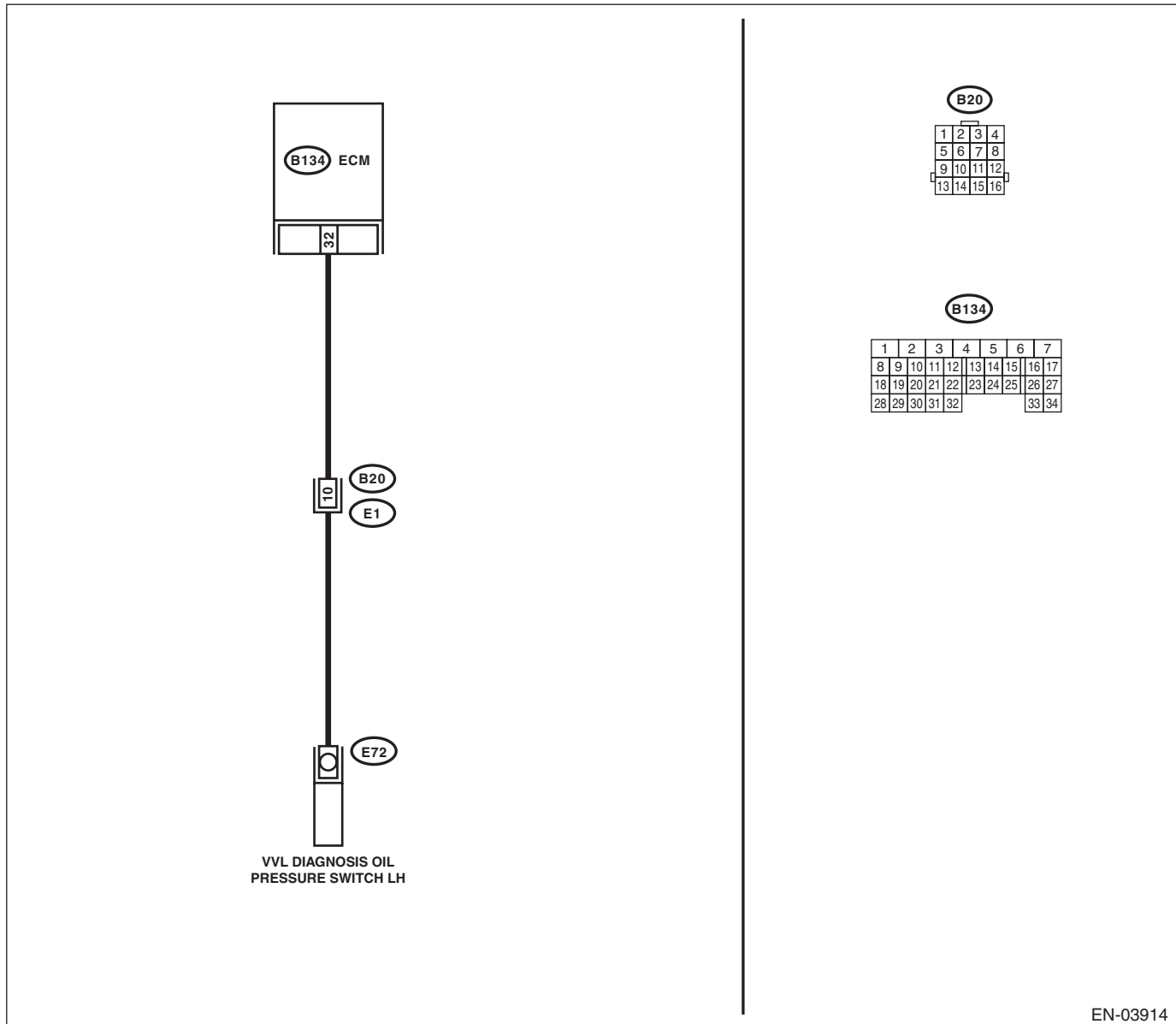
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03914

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b> 1) Warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch connector. <b>Connector &amp; terminal</b> <b>(B134) No. 32 — (E72) No. 1:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b> Measure the resistance between the variable valve lift diagnosis oil pressure switch connector and engine ground. <b>Connector &amp; terminal</b> <b>(E72) No. 1 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and variable valve lift diagnosis oil pressure switch connector.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch connector and engine ground. <b>Connector &amp; terminal</b> <b>(E72) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power of the harness between the ECM and variable valve lift diagnosis oil pressure switch connector.	Go to step 4.
<b>4</b> <b>CHECK DTC.</b> 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>	Is DTC displayed?	Replace the oil switching solenoid valve. <Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.> Go to step 5.	END
<b>5</b> <b>CHECK DTC.</b> 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H6DO)(diag)-57, Clear Memory Mode.>	Is DTC displayed?	Check for oil routing.	END.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## G: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

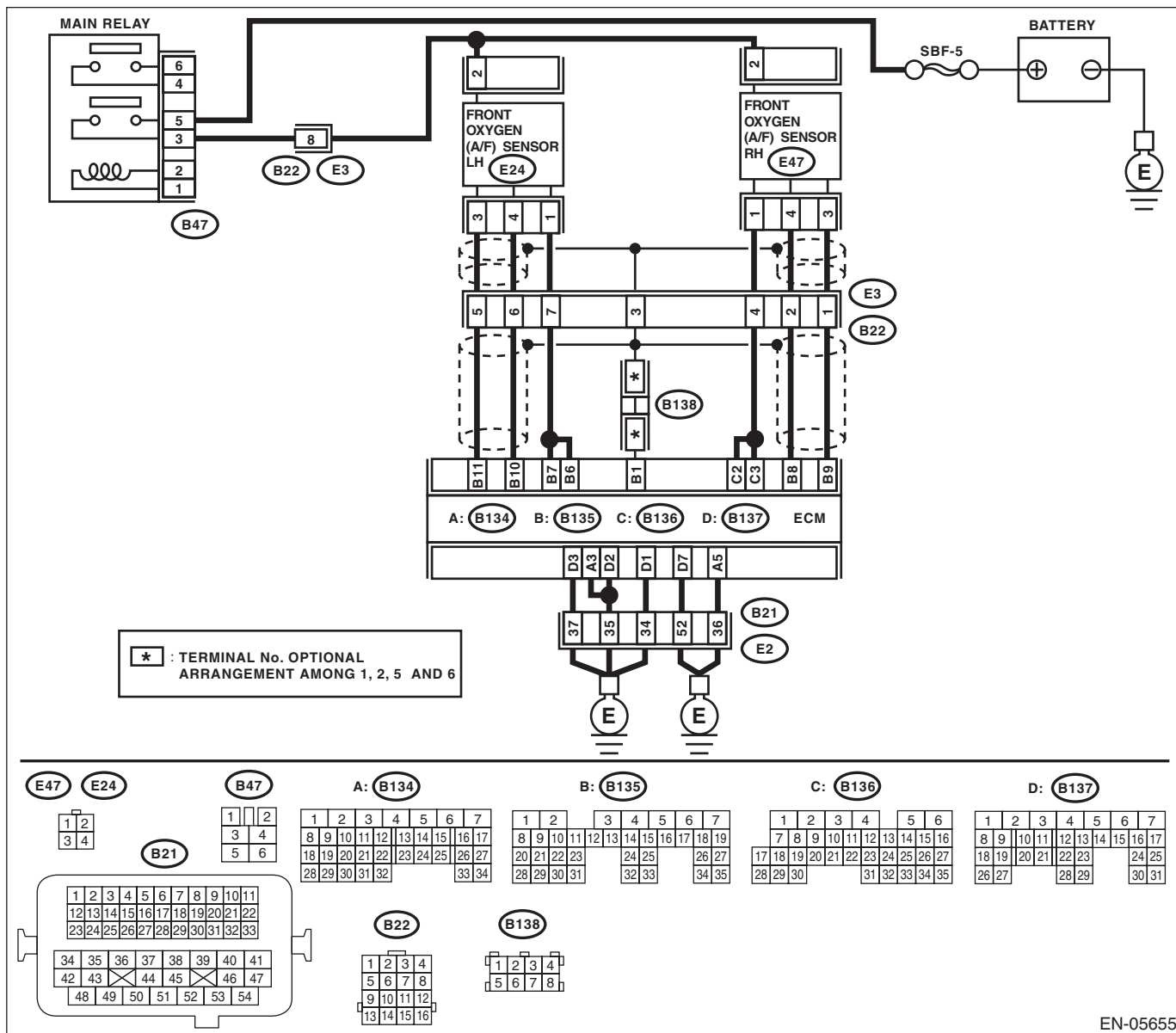
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-17, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Start and warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 2 — (E47) No. 1:</b></i> <i><b>(B136) No. 3 — (E47) No. 1:</b></i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>2 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B135) No. 9 — (E47) No. 3:</b></i> <i><b>(B135) No. 8 — (E47) No. 4:</b></i>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3 CHECK FRONT OXYGEN (A/F) SENSOR.</b> Measure the resistance between front oxygen (A/F) sensor connector terminals. <i><b>Terminals</b></i> <i><b>No. 2 — No. 1:</b></i>	Is the resistance between 2 — 3 Ω?	Go to step 4.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>
<b>4 CHECK POOR CONTACT.</b> Check poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## H: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

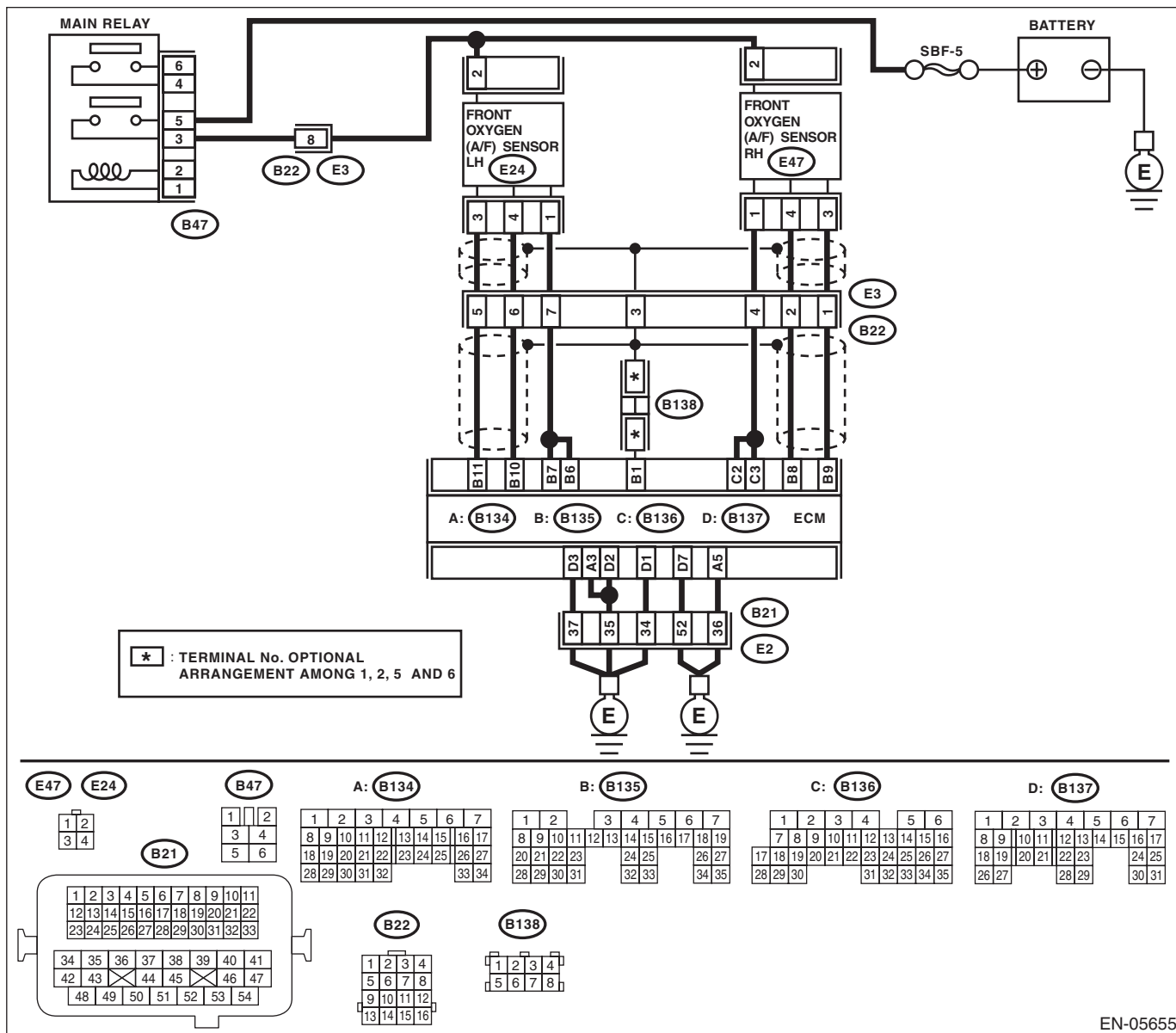
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-19, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from front oxygen (A/F) sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E47) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	Repair the power supply line. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and front oxygen (A/F) sensor connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact in coupling connector</li> <li>• Malfunction in main relay</li> </ul>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 2 — (E47) No. 1:</b>  <b>(B136) No. 3 — (E47) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor.
3	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>Measure the resistance of harness between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 3 — Chassis ground:</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<p><b>CHECK FRONT OXYGEN (A/F) SENSOR.</b></p> <p>Measure the resistance between front oxygen (A/F) sensor connector terminals.</p> <p><b>Terminals</b>  <b>No. 2 — No. 1:</b></p>	Is the resistance between 2 — 3 Ω?	Repair poor contact of the ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## I: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

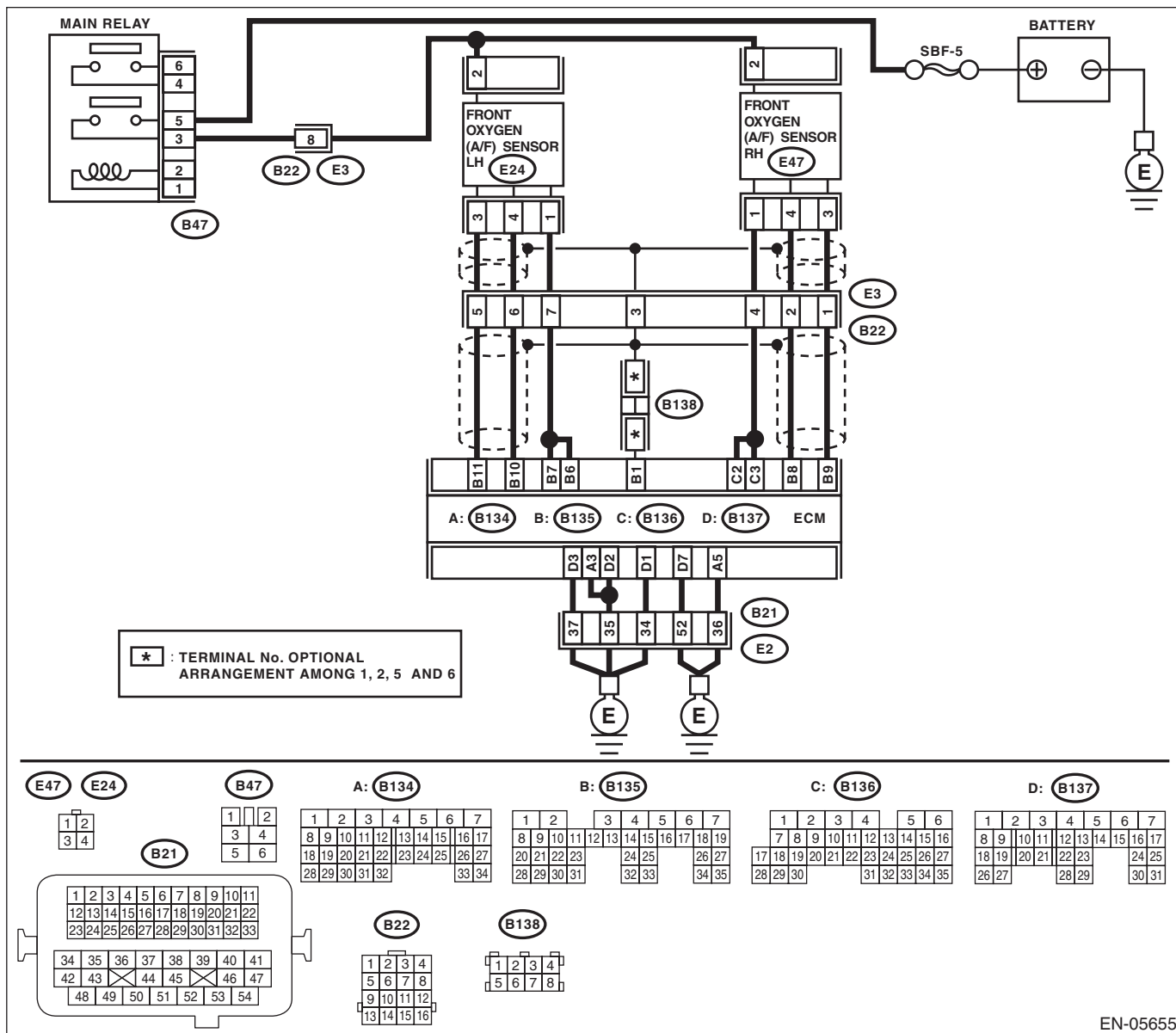
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-21, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 2 (+) — Chassis ground (-):</i> <i>(B136) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Go to step 2.
<b>2 CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 3 — Chassis ground:</i> <i>(B134) No. 5 — Chassis ground:</i> <i>(B137) No. 1 — Chassis ground:</i> <i>(B137) No. 2 — Chassis ground:</i> <i>(B137) No. 3 — Chassis ground:</i> <i>(B137) No. 7 — Chassis ground:</i>	Is the resistance less than 5 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## J: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

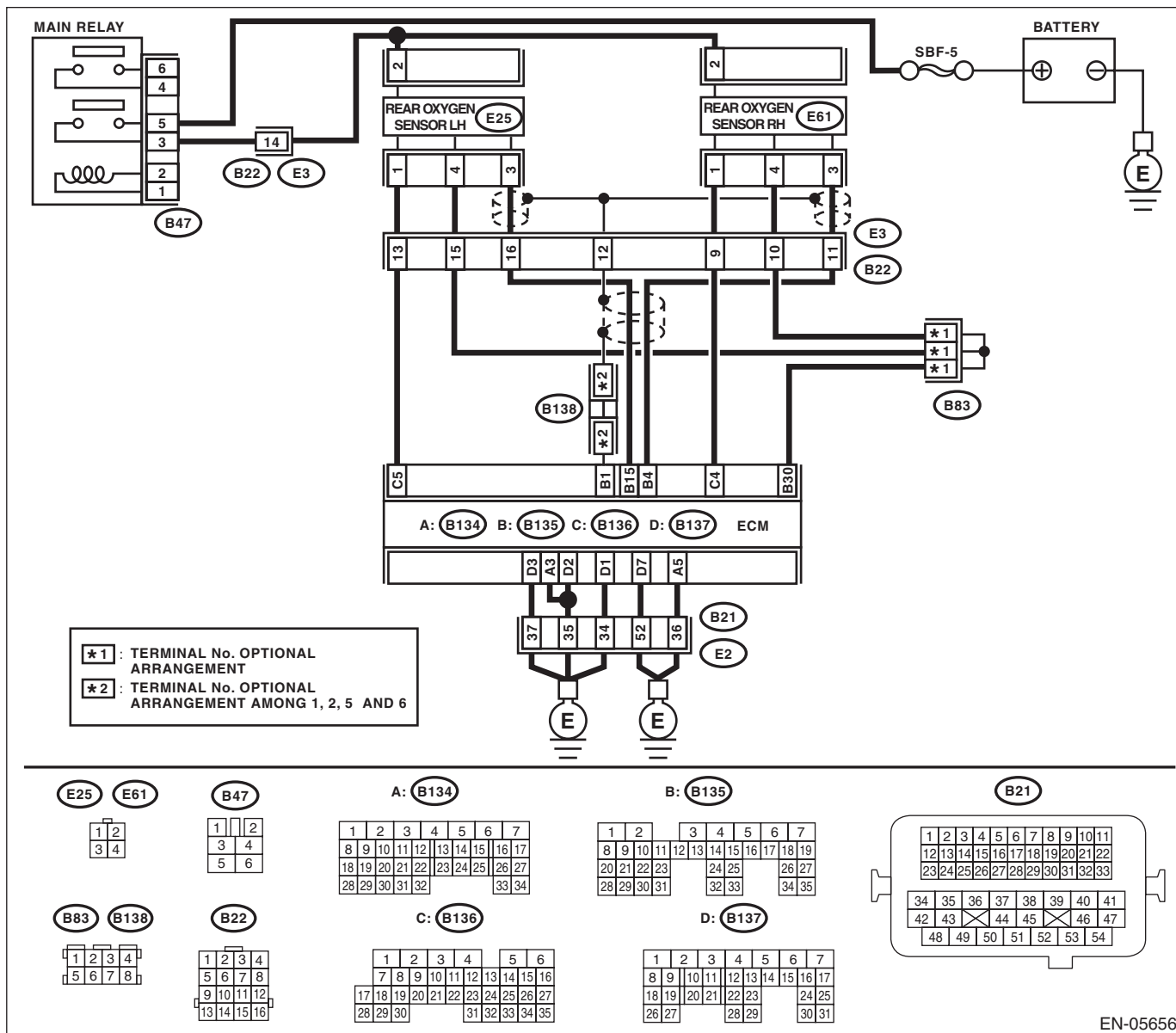
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-23, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>      <b>CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and engine ground.  <b>Connector &amp; terminal</b>  <b>(E61) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	Repair the power supply line. NOTE: In this case, repair the following item: • Open circuit of harness between main relay and rear oxygen sensor • Poor contact of main relay connector • Poor contact in coupling connector • Malfunction in main relay
<p><b>2</b>      <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance between ECM and oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B136) No. 4 — (E61) No. 1:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of the harness between ECM and rear oxygen sensor.
<p><b>3</b>      <b>CHECK GROUND CIRCUIT FOR ECM.</b>                      Measure the resistance of harness between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B134) No. 3 — Chassis ground:</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<p><b>4</b>      <b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor connector terminals.  <b>Terminals</b>  <b>No. 2 — No. 1:</b></p>	Is the resistance between 5 — 7 $\Omega$ ?	Repair poor contact of the ECM connector.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## K: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

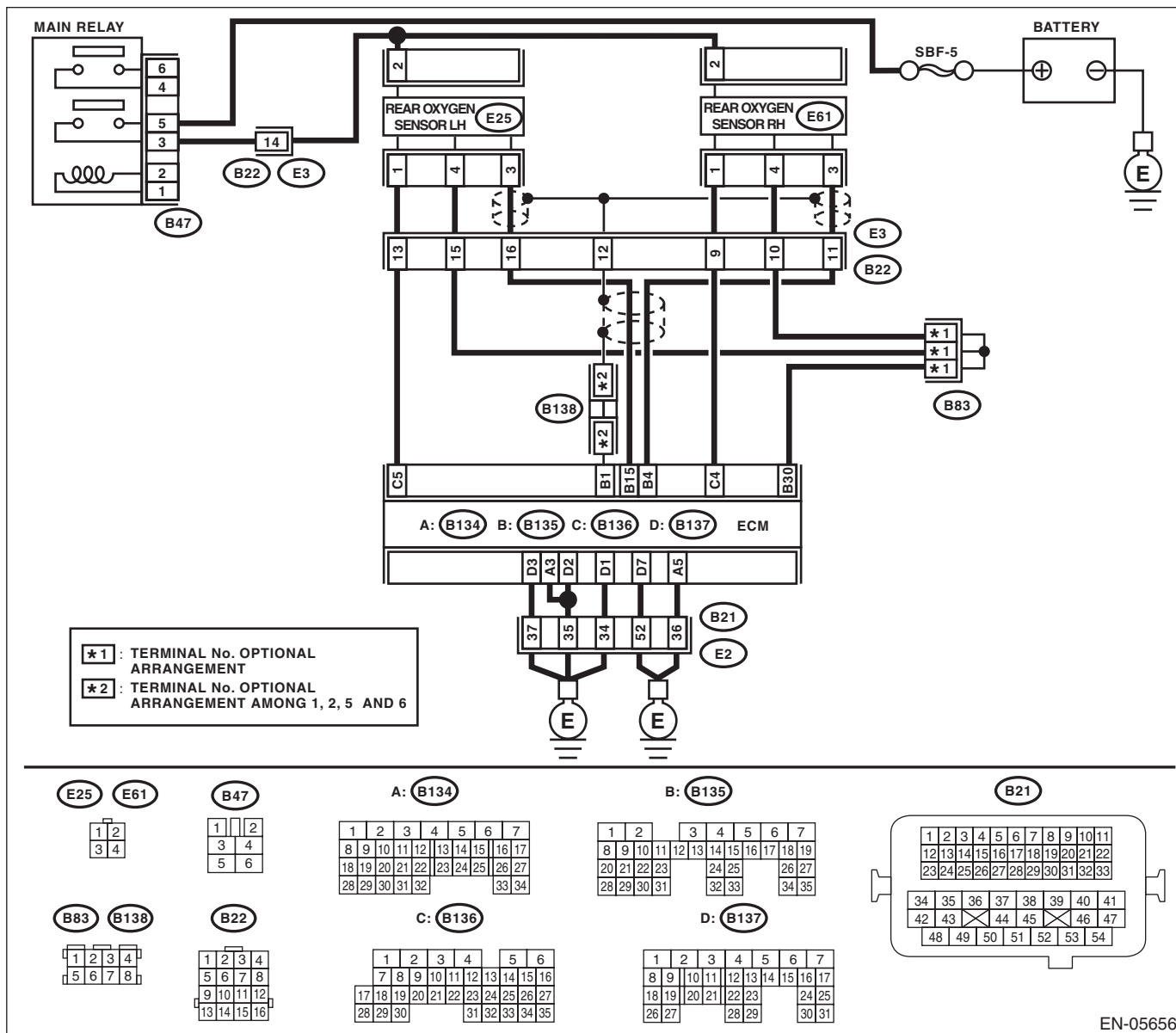
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-25, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector.	Go to step 2.
<b>2</b> <b>CHECK GROUND CIRCUIT FOR ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 3 — Chassis ground:</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## L: DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1)

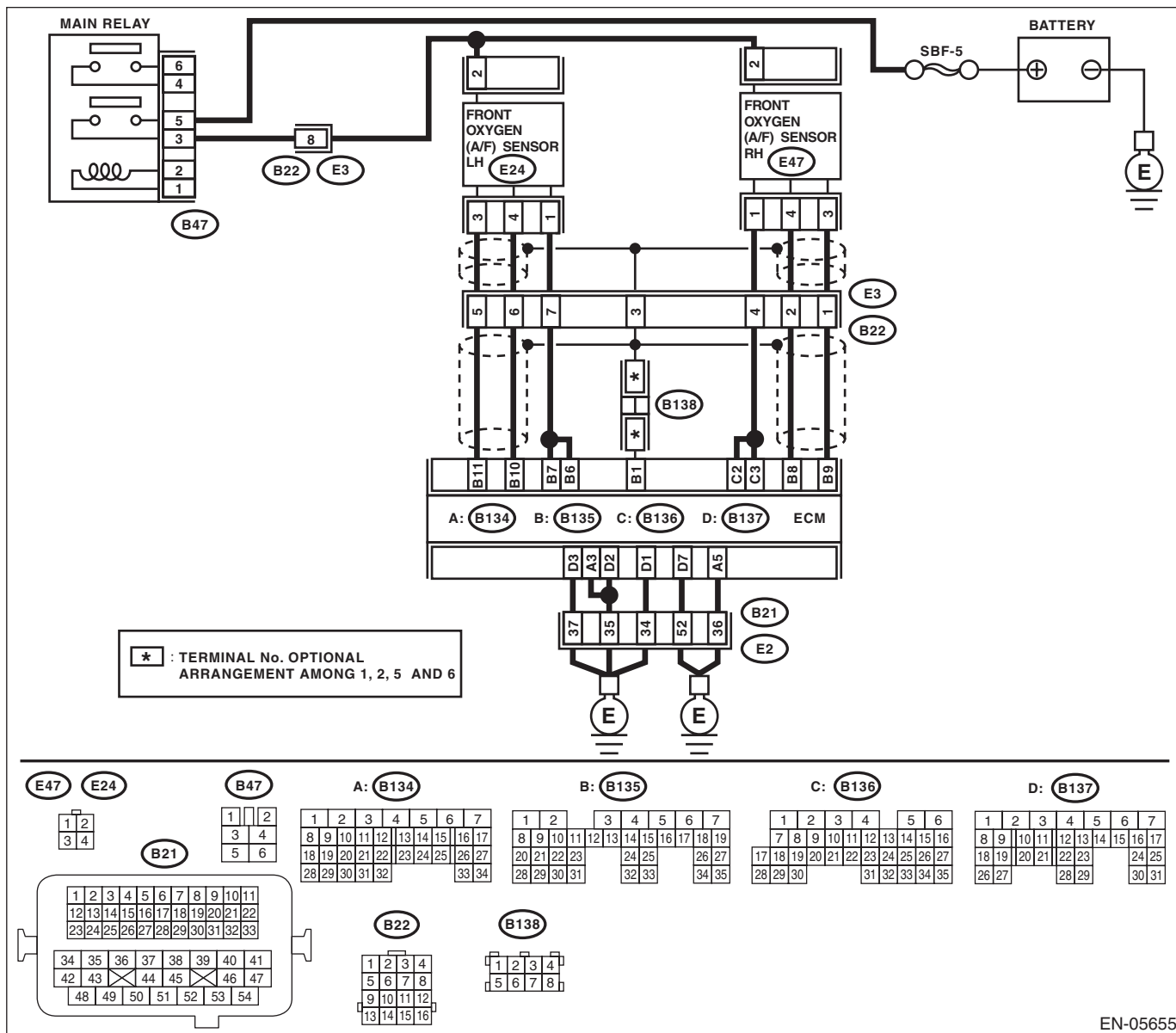
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-27, DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Start and warm-up the engine.                      2) Turn the ignition switch to OFF.                      3) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>                      (B135) No. 6 — (E24) No. 1:                      (B135) No. 7 — (E24) No. 1:</p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
2	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>                      (B135) No. 11 — (E24) No. 3:                      (B135) No. 10 — (E24) No. 4:</p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	<p><b>CHECK FRONT OXYGEN (A/F) SENSOR.</b></p> <p>Measure the resistance between front oxygen (A/F) sensor connector terminals.</p> <p><b>Terminals</b>                      No. 2 — No. 1:</p>	Is the resistance less than 2 — 3 Ω?	Go to step 4.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check poor contact of ECM and front oxygen (A/F) sensor connector.</p>	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## M: DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1)

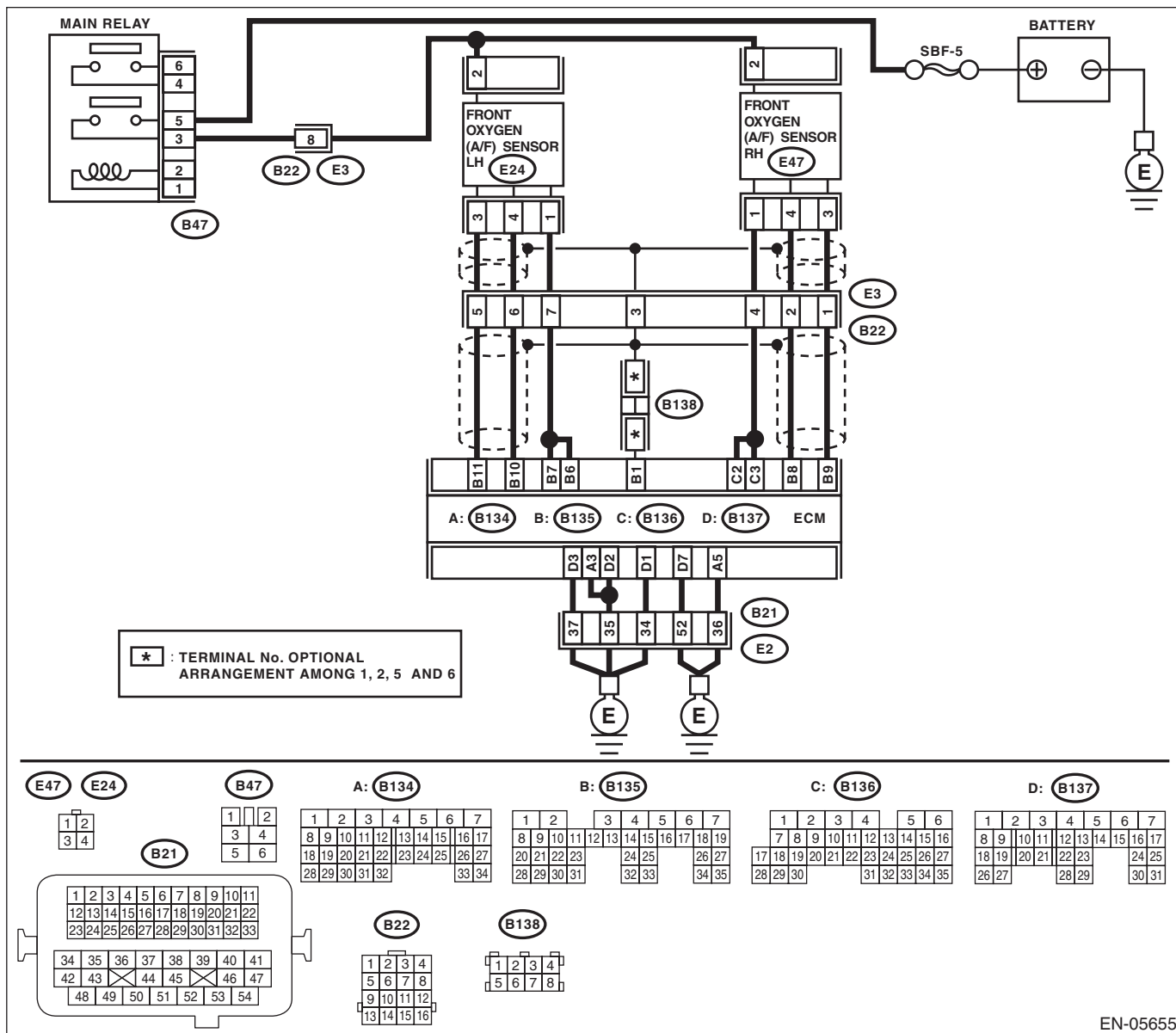
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-27, DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E24) No. 2 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the power supply line. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and front oxygen (A/F) sensor connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact in coupling connector</li> <li>• Malfunction in main relay</li> </ul>
<b>2 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 6 — (E24) No. 1:</b> <b>(B135) No. 7 — (E24) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor.
<b>3 CHECK GROUND CIRCUIT FOR ECM.</b> Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 3 — Chassis ground:</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK FRONT OXYGEN (A/F) SENSOR.</b> Measure the resistance between front oxygen (A/F) sensor connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance between 2 — 3 $\Omega$ ?	Repair poor contact of the ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## N: DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1)

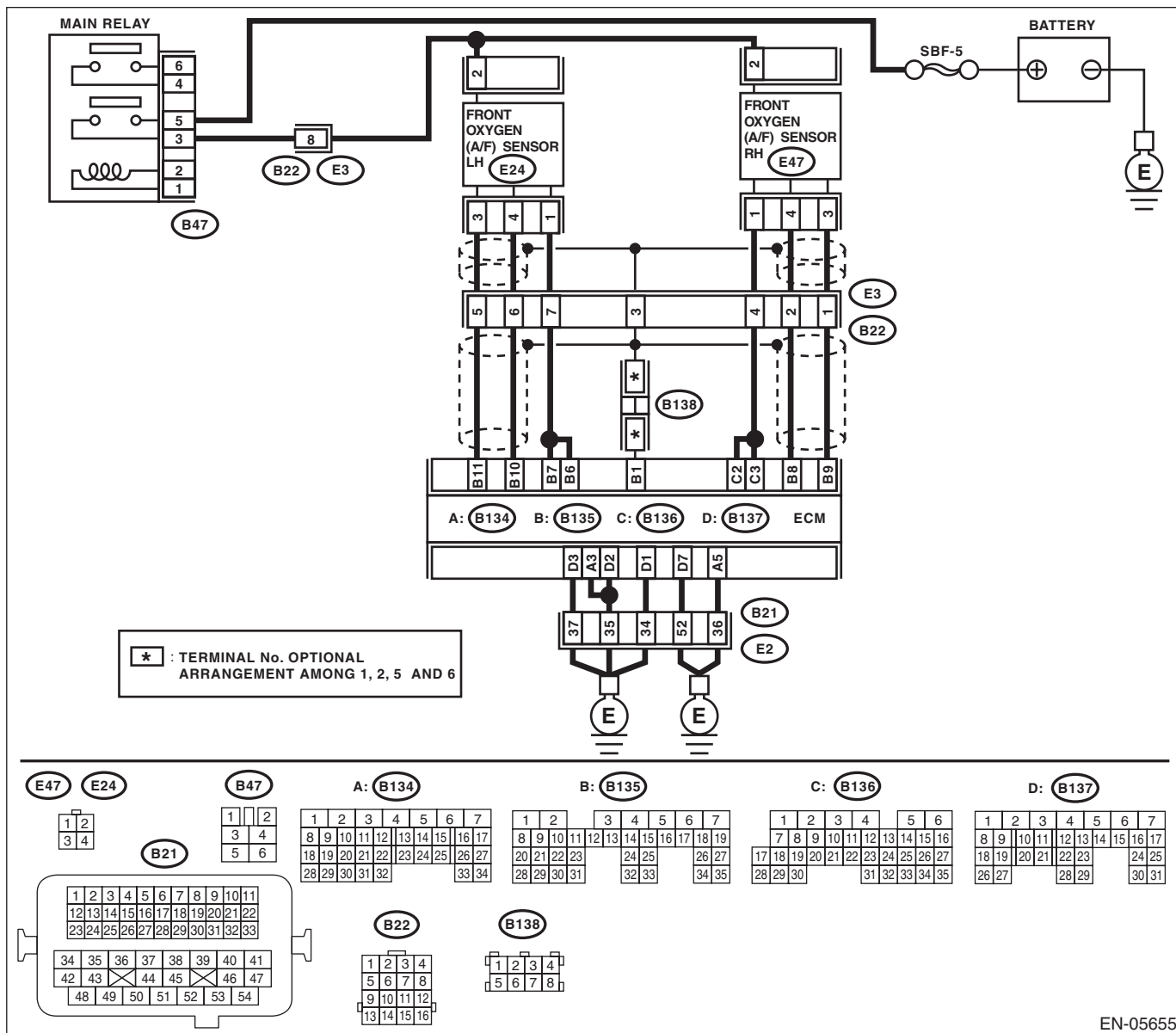
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-27, DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 6 (+) — Chassis ground (-):</b>  <b>(B135) No. 7 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Go to step 2.
2	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>1) Disconnect the connectors from the ECM.</p> <p>2) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 3 — Chassis ground:</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 Ω?	Repair the poor contact of the ECM connector.	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>            In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## O: DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2)

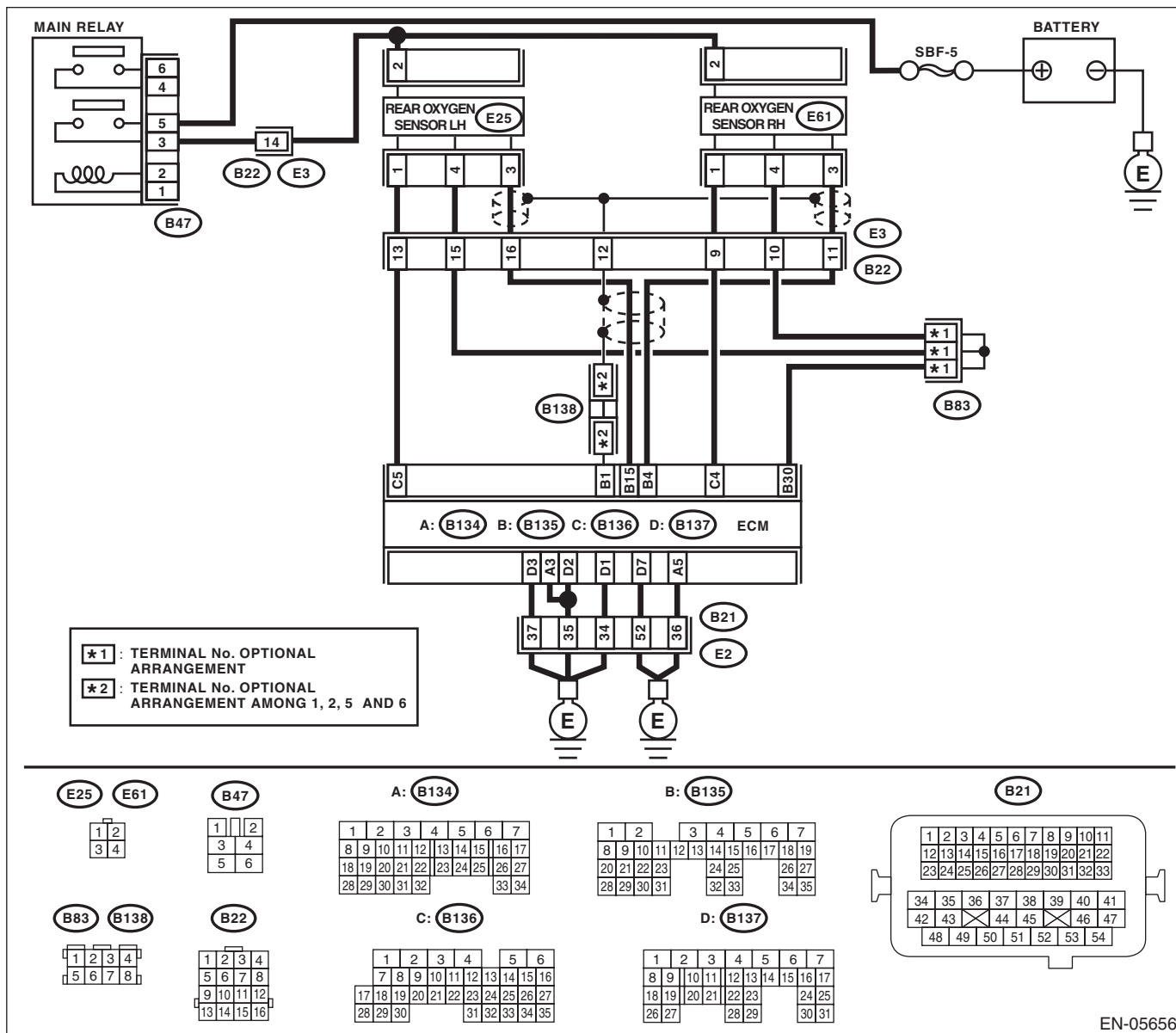
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-27, DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E25) No. 2 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the power supply line. NOTE: In this case, repair the following item: • Open circuit of harness between main relay and rear oxygen sensor • Poor contact of main relay connector • Poor contact in coupling connector • Malfunction in main relay
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B136) No. 5 — (E25) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of the harness between ECM and rear oxygen sensor.
<b>3</b> <b>CHECK GROUND CIRCUIT FOR ECM.</b> Measure the resistance of harness between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 3 — Chassis ground:</b> <b>(B134) No. 5 — Chassis ground:</b> <b>(B137) No. 1 — Chassis ground:</b> <b>(B137) No. 2 — Chassis ground:</b> <b>(B137) No. 3 — Chassis ground:</b> <b>(B137) No. 7 — Chassis ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact in ECM connector • Poor contact of coupling connector
<b>4</b> <b>CHECK REAR OXYGEN SENSOR.</b> Measure the resistance between rear oxygen sensor connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance between 5 — 7 $\Omega$ ?	Repair poor contact of the ECM connector.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## P: DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2)

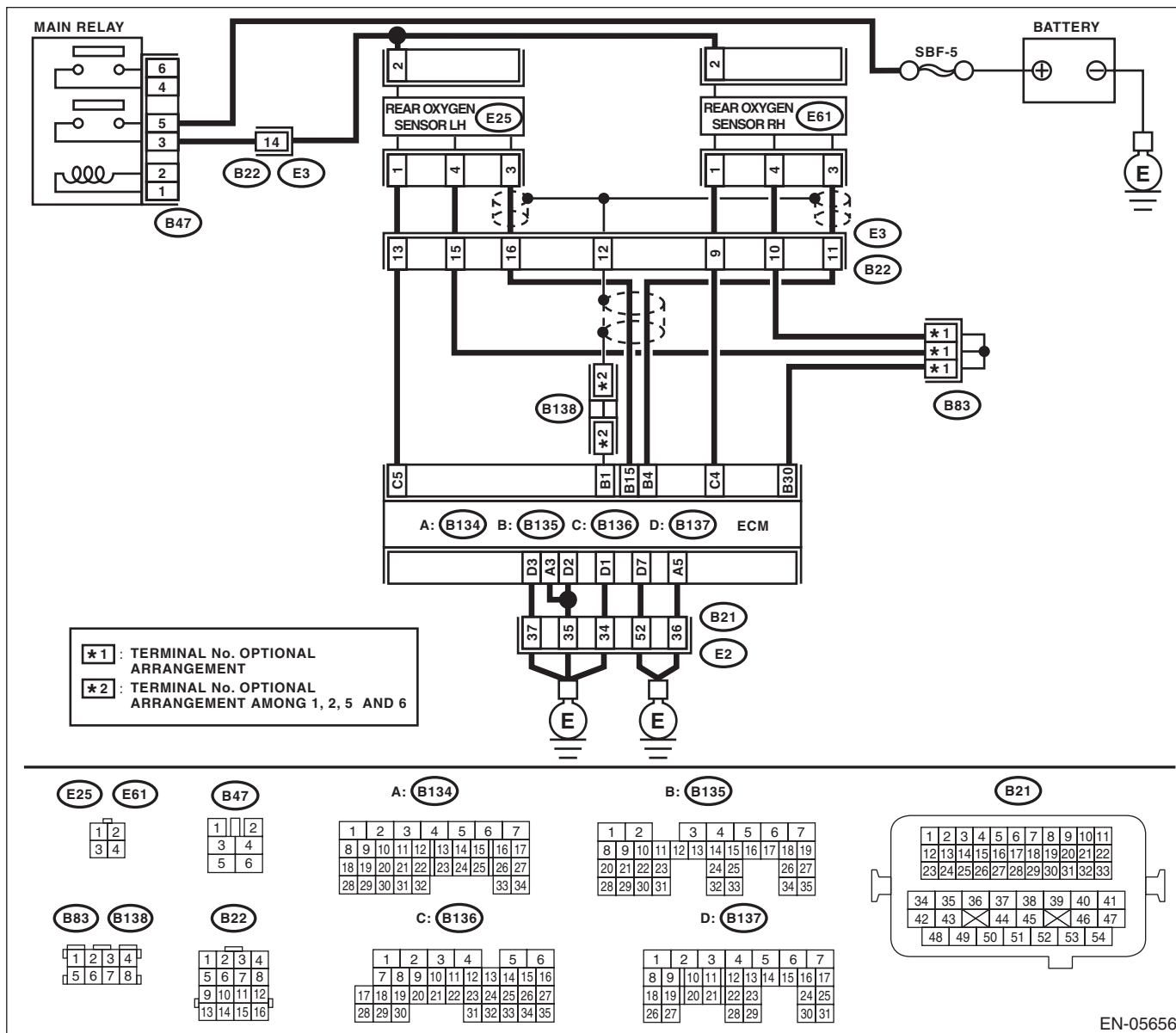
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-27, DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 5 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector.	Go to step 2.
2	<p><b>CHECK GROUND CIRCUIT FOR ECM.</b></p> <p>1) Disconnect the connectors from the ECM.</p> <p>2) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 3 — Chassis ground:</b>  <b>(B134) No. 5 — Chassis ground:</b>  <b>(B137) No. 1 — Chassis ground:</b>  <b>(B137) No. 2 — Chassis ground:</b>  <b>(B137) No. 3 — Chassis ground:</b>  <b>(B137) No. 7 — Chassis ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Repair the poor contact of the ECM connector.	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>            In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Q: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

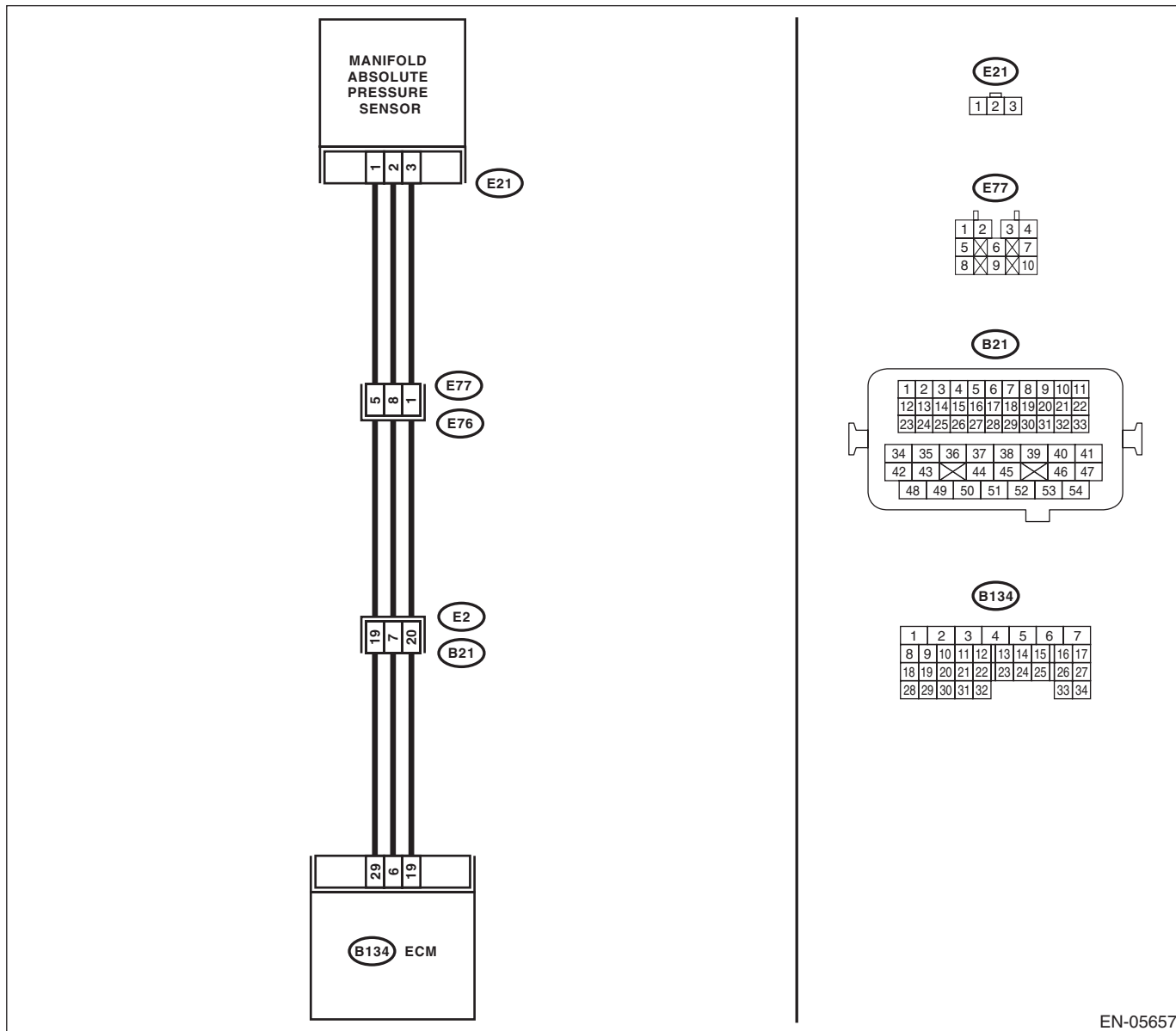
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-28, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05657

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 2.
2	<b>CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.</b> 1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to the "P" or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) during idling?	Go to step 3.	Replace the manifold absolute pressure sensor. <Ref. to FU(H6DO)-24, Manifold Absolute Pressure Sensor.>
3	<b>CHECK THROTTLE OPENING ANGLE.</b> Read the data of throttle position signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value less than 5% when throttle is fully closed?	Go to step 4.	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>
4	<b>CHECK THROTTLE OPENING ANGLE.</b>	Is the measured value 85% or more when throttle is fully open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H6DO)-24, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## R: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-31, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

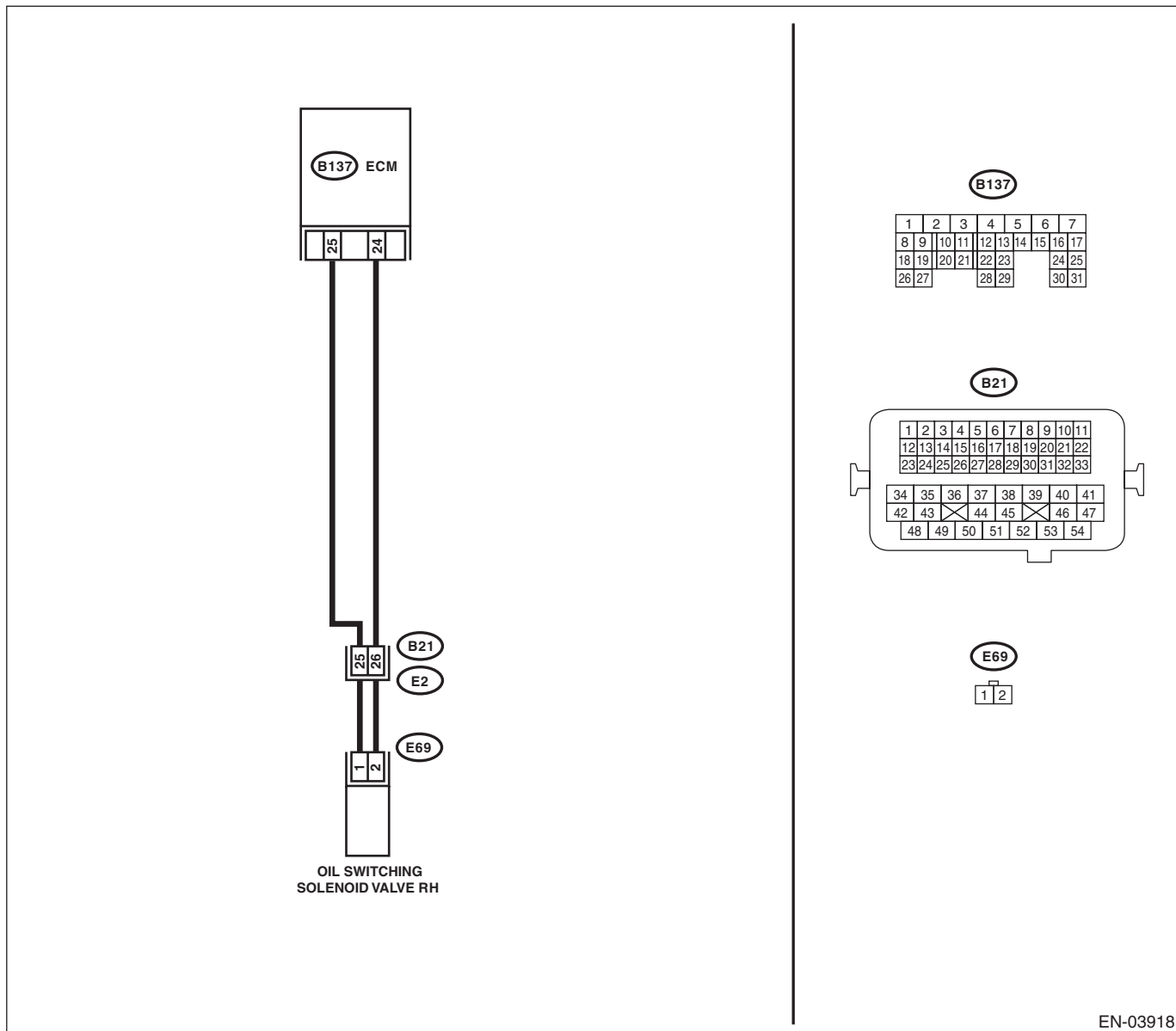
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03918

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the resistance of harness between ECM and oil switching solenoid valve.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — (E69) No. 1:</b>  <b>(B137) No. 24 — (E69) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.   <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — Chassis ground:</b>  <b>(B137) No. 24 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and oil switching solenoid valve connector.</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## S: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-32, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

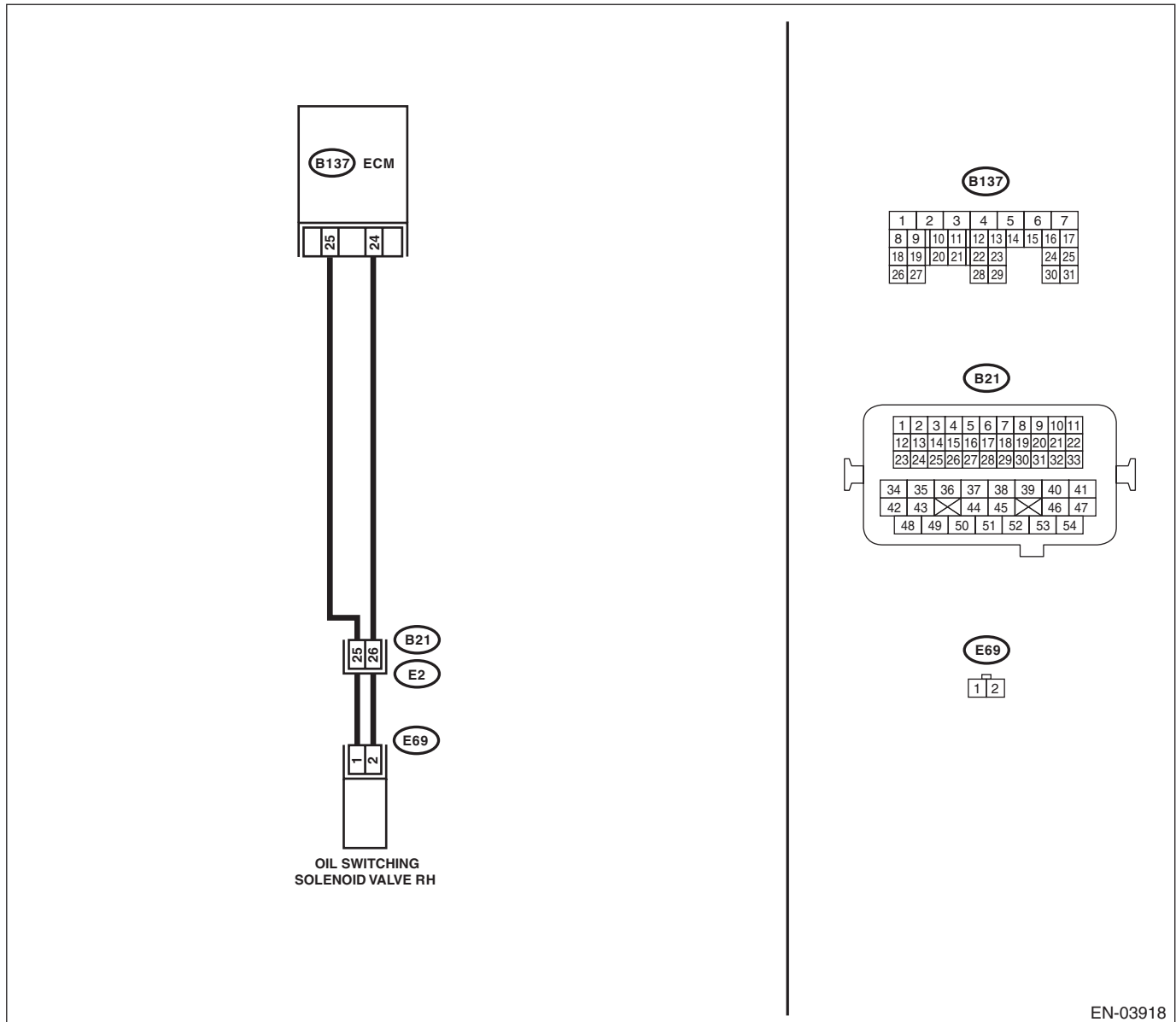
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03918



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 (+) — Chassis ground (-):</b>  <b>(B137) No. 24 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V?</p>	<p>Go to step 2.</p>	<p>Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance of harness between ECM and oil switching solenoid valve connector.  <b>Connector &amp; terminal</b>  <b>(B137) No. 25 — (E69) No. 1:</b>  <b>(B137) No. 24 — (E69) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## T: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-32, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

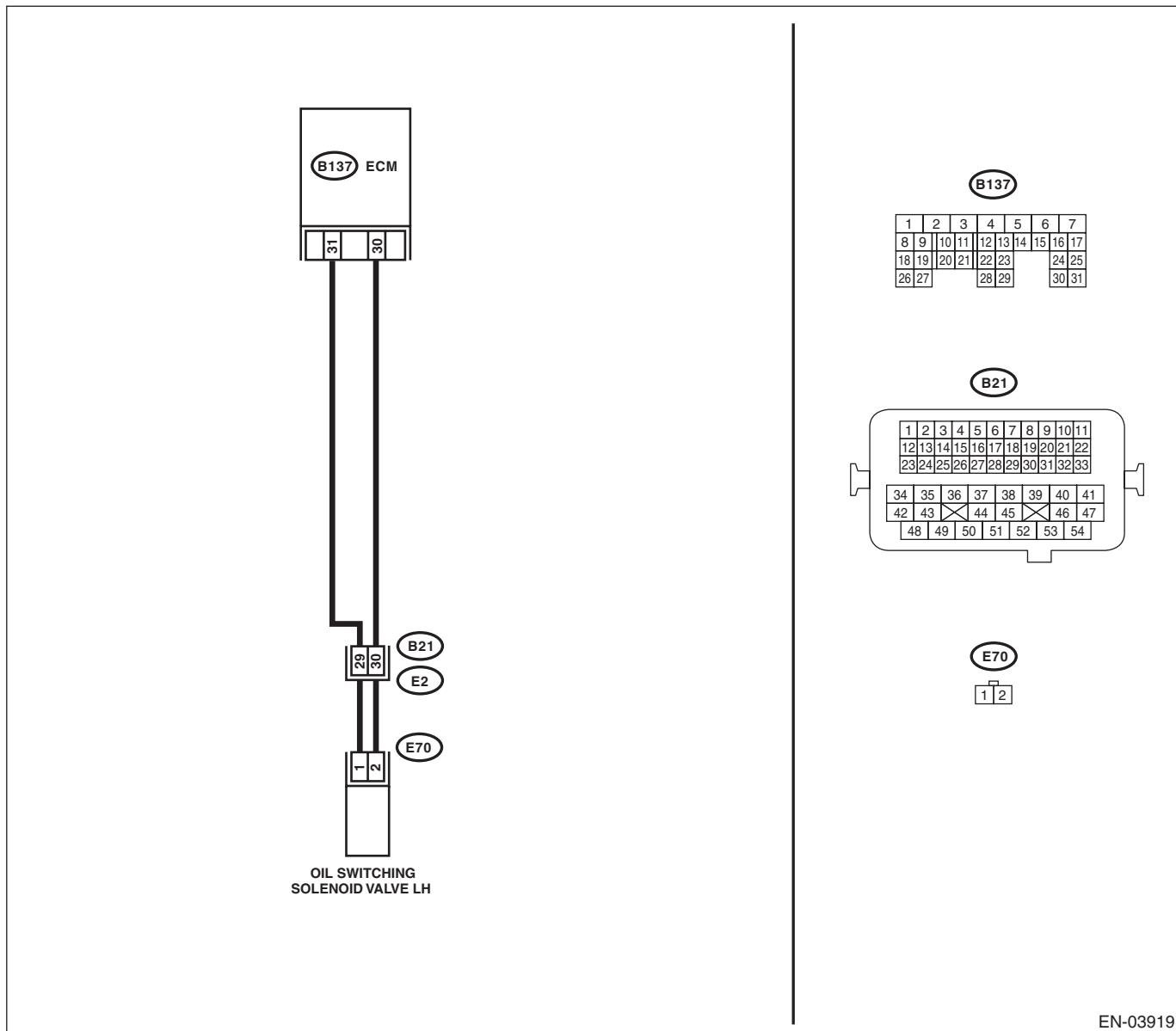
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03919

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the resistance between ECM and oil switching solenoid valve.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — (E70) No. 1:</b>  <b>(B137) No. 30 — (E70) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — Chassis ground:</b>  <b>(B137) No. 30 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and oil switching solenoid valve connector.</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## U: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-33, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

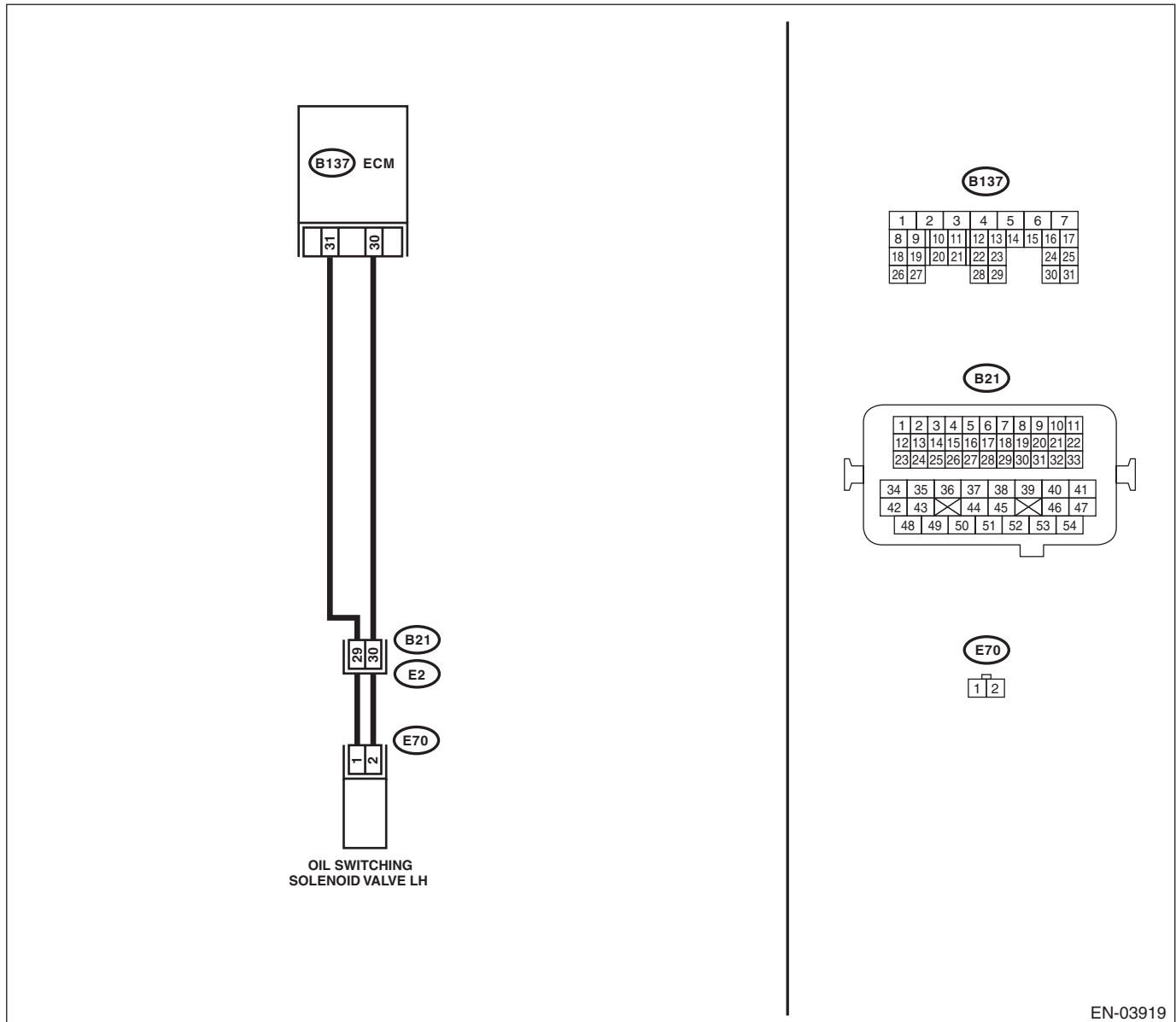
### TROUBLE SYMPTOM:

Erroneous idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03919

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM and oil switching solenoid valve.            3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 (+) — Chassis ground (-):</b>  <b>(B137) No. 30 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V?</p>	<p>Go to step 2.</p>	<p>Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between the ECM and oil switching solenoid valve connector.  <b>Connector &amp; terminal</b>  <b>(B137) No. 31 — (E70) No. 1:</b>  <b>(B137) No. 30 — (E70) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:            • Open circuit of harness between ECM and oil switching solenoid valve connector            • Poor contact of coupling connector</p>
<p><b>3</b>    <b>CHECK OIL SWITCHING SOLENOID VALVE.</b>            Measure the resistance between oil switching solenoid valve terminals.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of ECM and oil switching solenoid valve connector.</p>	<p>Replace the oil switching solenoid valve. &lt;Ref. to ME(H6DO)-81, Oil Switching Solenoid Valve.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## V: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/ PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-34, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

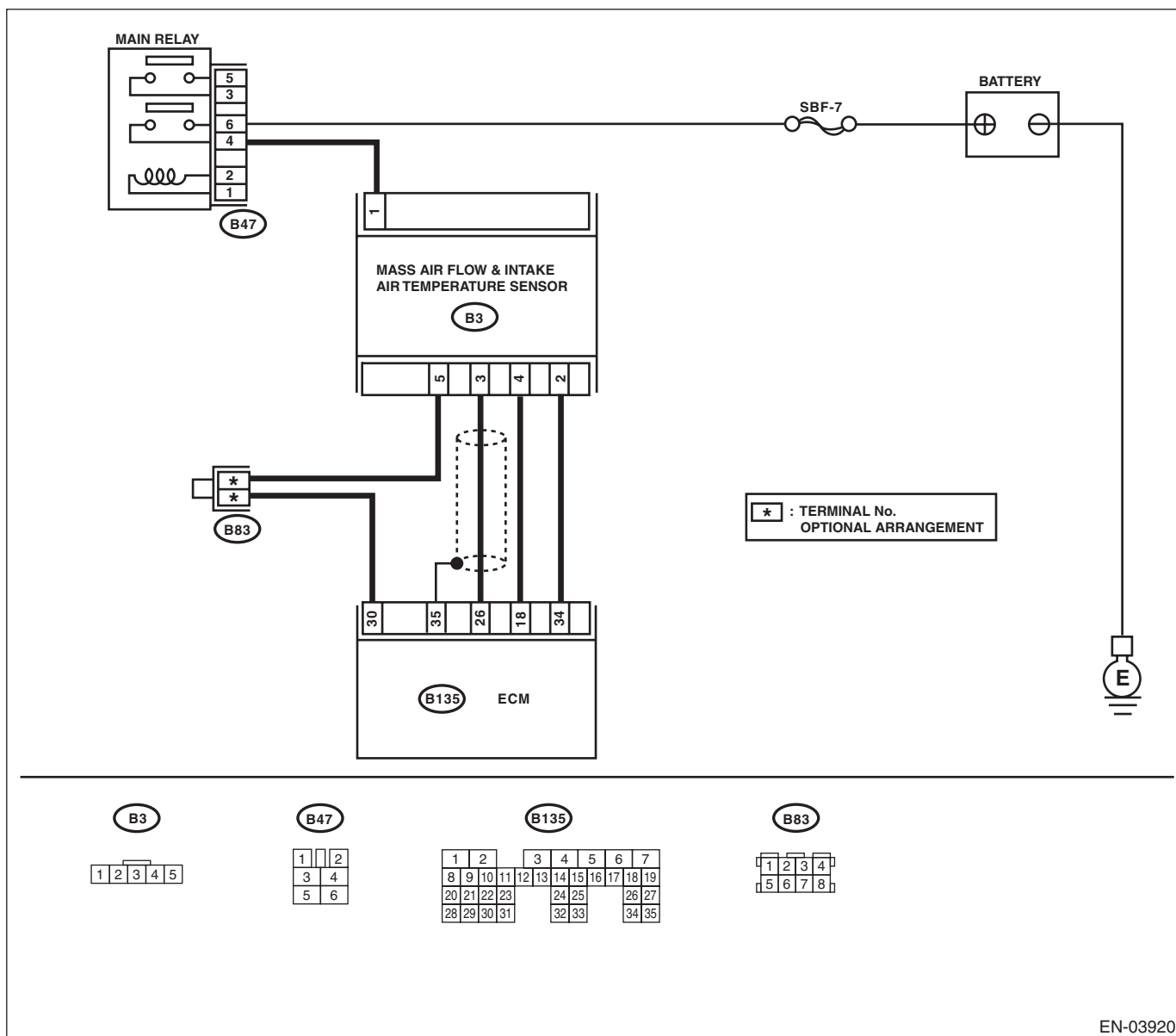
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	CHECK FOR ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## W: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-37, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

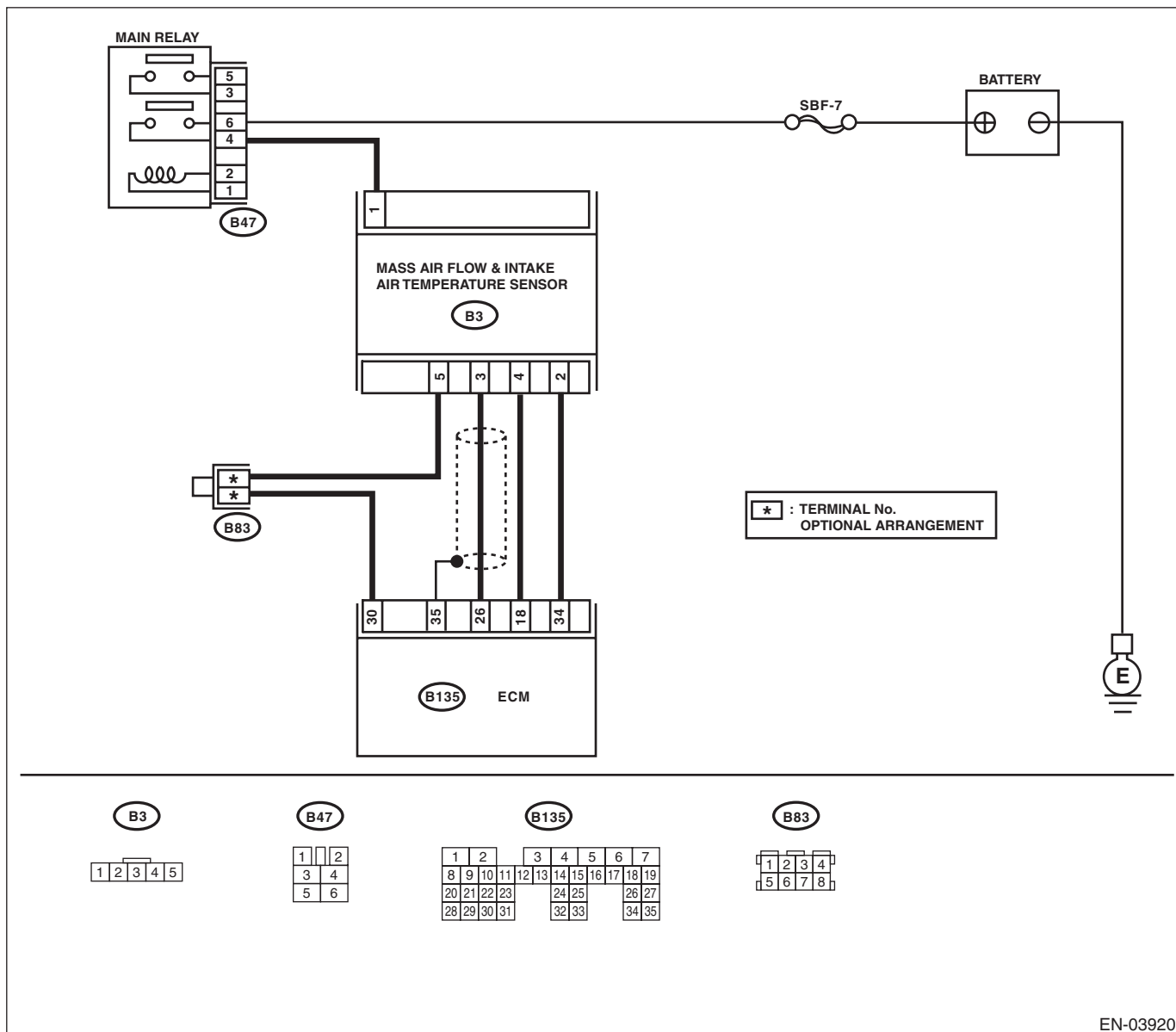
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage less than 0.2 V?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then reperform the diagnosis again. NOTE: In this case, temporary poor contact of connector may be the cause.
<b>2 CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the mass air flow and intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. <i>Connector &amp; terminal</i> <i>(B3) No. 1 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the main relay and the mass air flow and intake air temperature sensor connector. • Poor contact of main relay connector
<b>3 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector. <i>Connector &amp; terminal</i> <i>(B135) No. 26 — (B3) No. 3:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 26 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the ground short circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
<b>5 CHECK POOR CONTACT.</b> Check for any poor contact in the ECM or the mass air flow and intake air temperature sensor connector.	Is there poor contact in the ECM or the mass air flow and intake air temperature sensor connector?	Repair any poor contact in the ECM or the mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## X: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-39, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

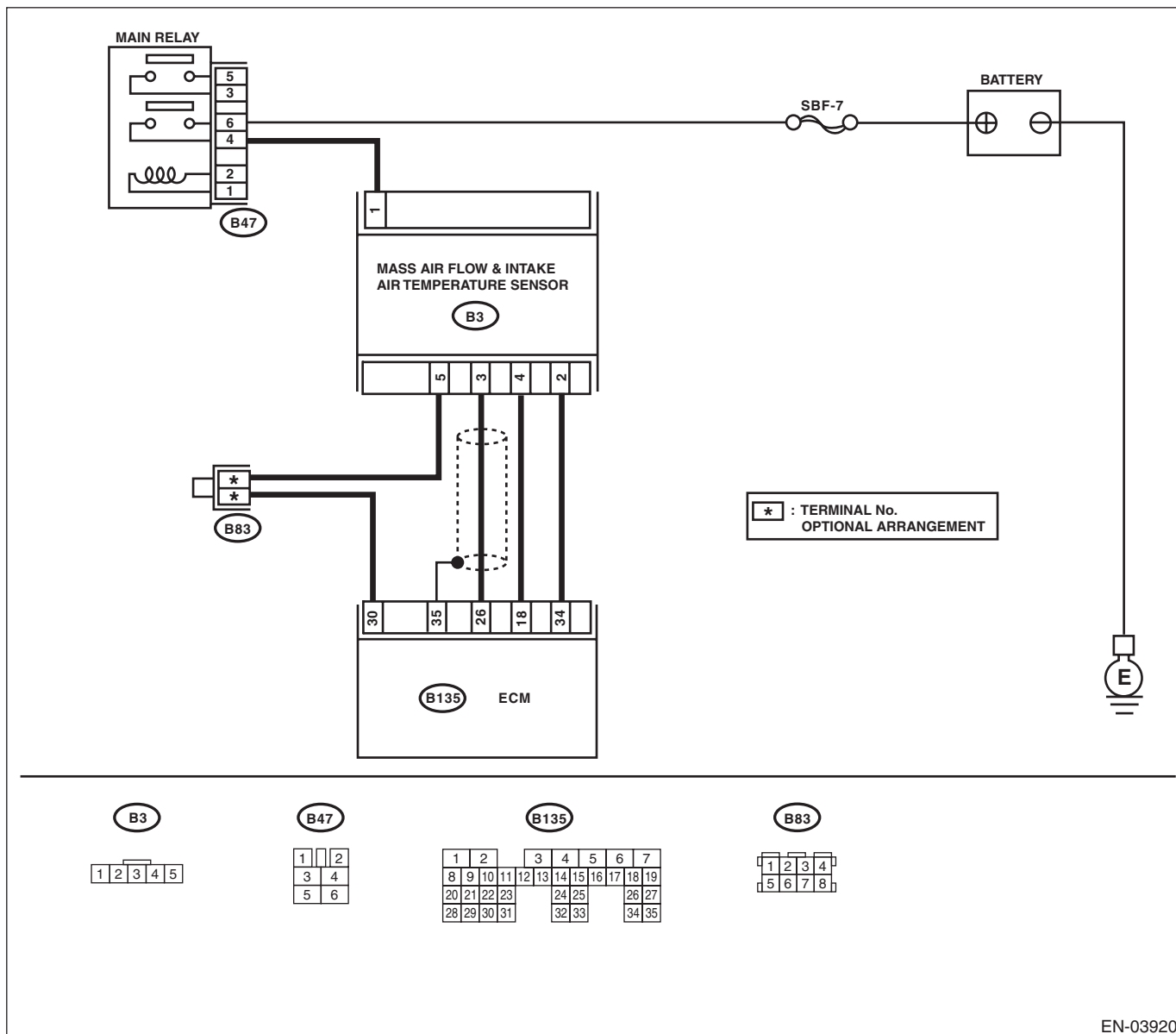
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then reperform the diagnosis again.</p> <p>NOTE:</p> <p>In this case, temporary poor contact of connector may be the cause.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the mass air flow and intake air temperature sensor.</p> <p>3) Start the engine.</p> <p>4) Read the data of air flow sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow and intake air temperature sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between mass air flow and intake air temperature sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(B3) No. 2 — Engine ground:</b></p>	Is the resistance less than 5 Ω?	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>Open circuit of harness between ECM and the mass air flow and intake air temperature sensor connector.</li> <li>Poor contact in ECM connector</li> </ul>
4	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for any poor contact in the mass air flow and intake air temperature sensor connector.</p>	Is there poor contact in the mass air flow and intake air temperature sensor connector?	Repair any poor contact of the mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Y: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

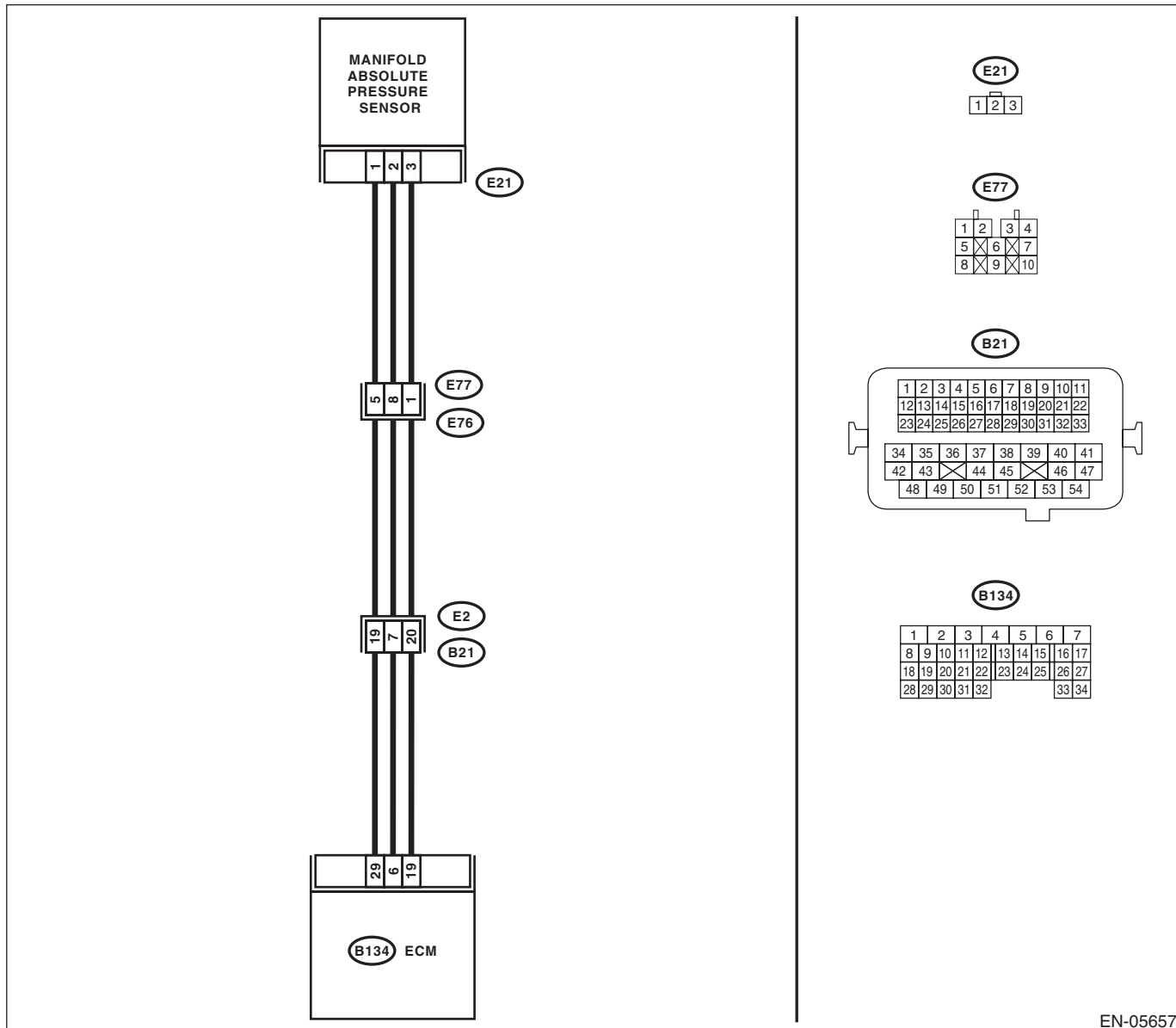
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-41, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05657

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then reperform the diagnosis again.  NOTE: In this case, temporary poor contact of connector may be the cause.
<b>2 CHECK POWER SUPPLY OF THE MANIFOLD ABSOLUTE PRESSURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground.  <b>Connector &amp; terminal</b> <b>(E21) No. 3 (+) — Engine ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact in ECM connector • Poor contact of coupling connector
<b>3 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector.  <b>Connector &amp; terminal</b> <b>(B134) No. 6 — (E21) No. 2:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the harness and connector.  NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact of coupling connector
<b>4 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground.  <b>Connector &amp; terminal</b> <b>(B134) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair ground short circuit of harness between ECM and manifold absolute pressure sensor connector.
<b>5 CHECK POOR CONTACT.</b> Check for poor contact between the ECM and manifold pressure sensor connector.	Is there poor contact in the ECM or manifold absolute pressure sensor connector?	Repair the poor contact in the ECM or manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H6DO)-24, Manifold Absolute Pressure Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## Z: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

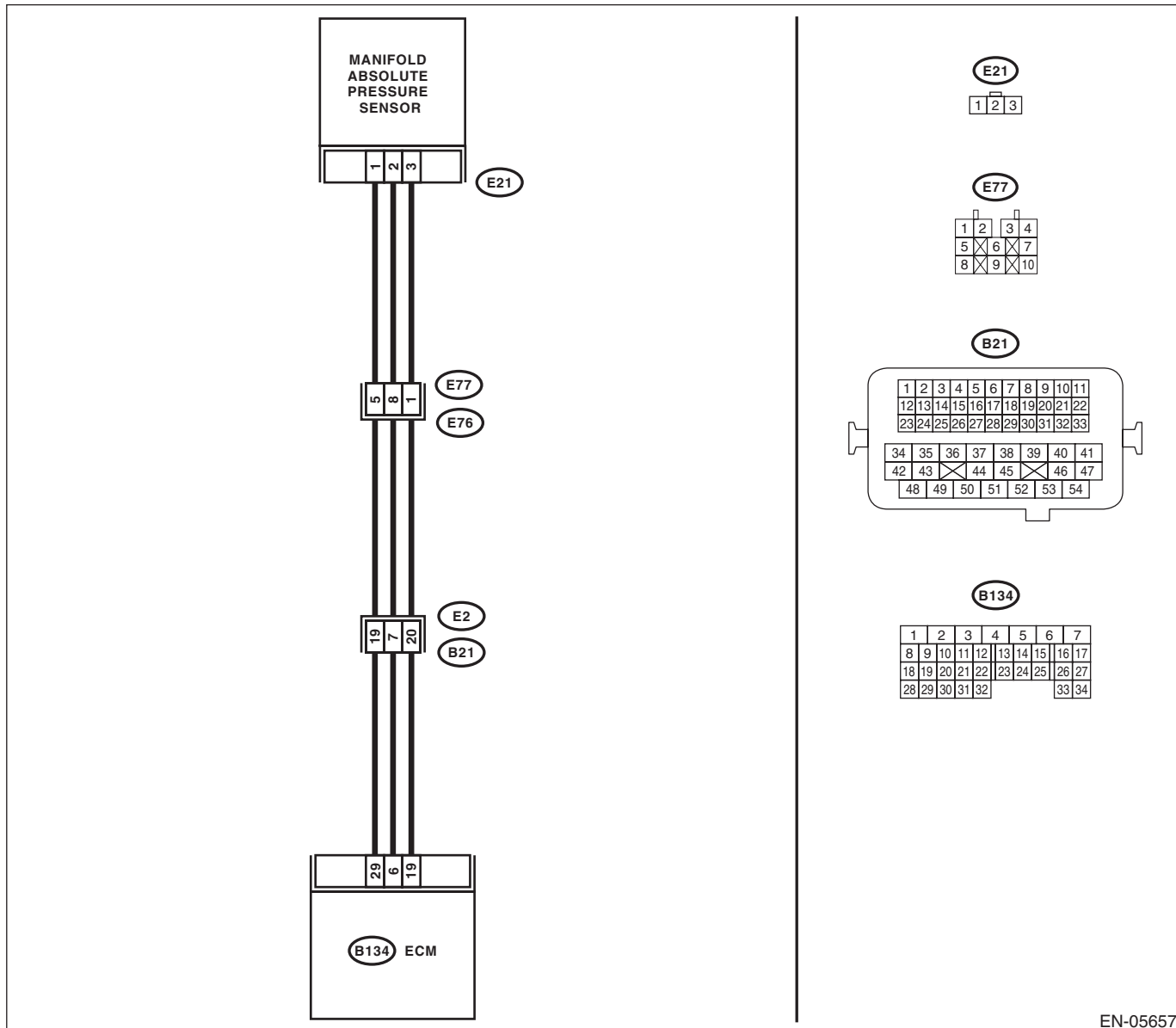
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-43, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05657

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK CURRENT DATA.</b></p> <p>1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then reperform the diagnosis again. NOTE: In this case, temporary poor contact of connector may be the cause.</p>
<p><b>2 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Start the engine. 4) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?</p>	<p>Repair the short circuit to power in the harness between ECM and manifold absolute pressure sensor connector.</p>	<p>Go to step 3.</p>
<p><b>3 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(E21) No. 1 — Engine ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact in ECM connector • Poor contact of coupling connector</p>
<p><b>4 CHECK POOR CONTACT.</b> Check for poor contact of the manifold absolute pressure sensor connector.</p>	<p>Is there poor contact in manifold absolute pressure sensor connector?</p>	<p>Repair the poor contact of manifold absolute pressure sensor connector.</p>	<p>Replace the manifold absolute pressure sensor. &lt;Ref. to FU(H6DO)-24, Manifold Absolute Pressure Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AA:DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/ PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-45, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

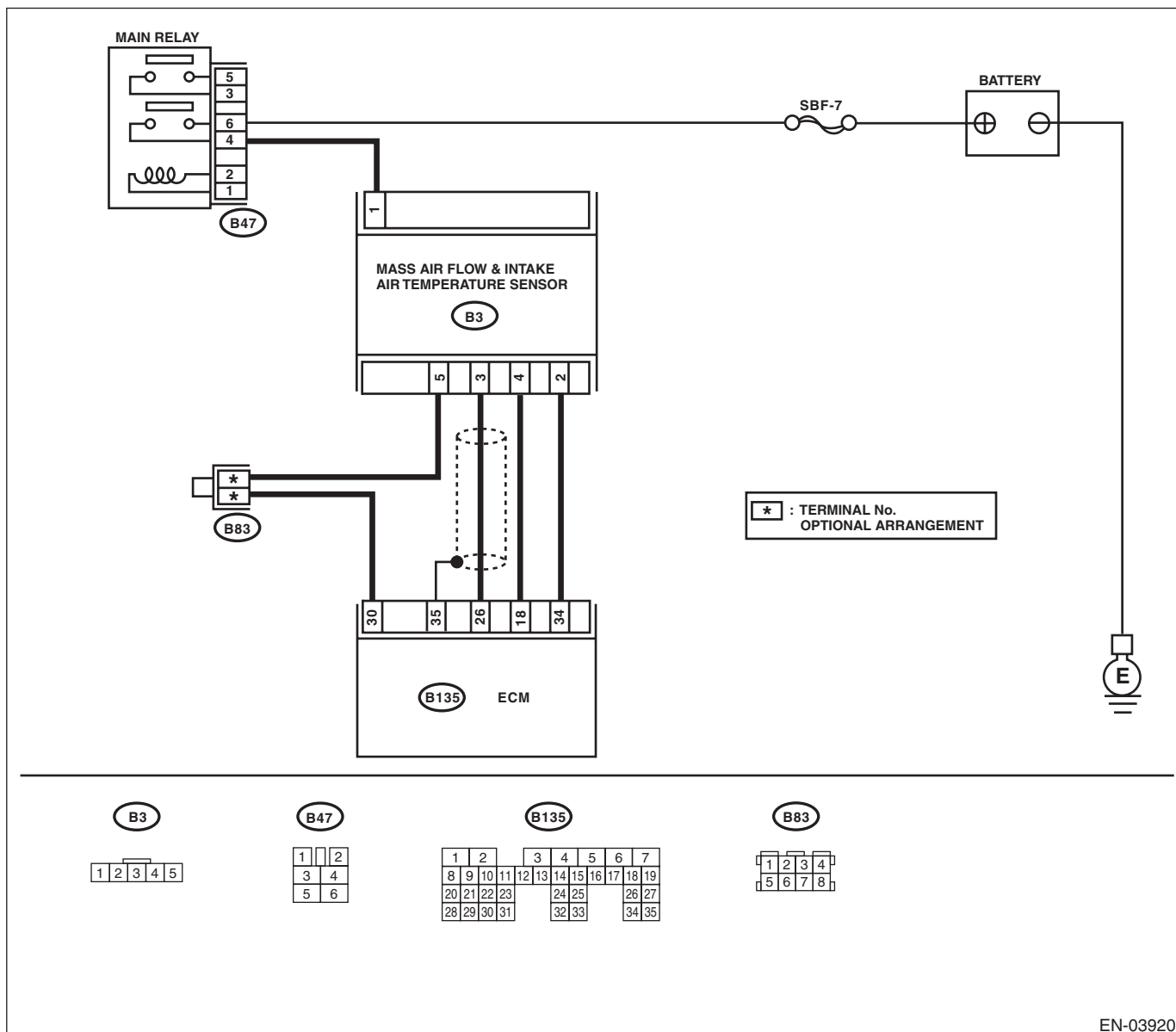
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK ENGINE COOLANT TEMPERATURE.</b></p> <p>1) Start the engine and warm-up completely. 2) Measure the engine coolant temperature using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"><li>• Subaru Select Monitor</li></ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"><li>• General scan tool</li></ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>	<p>Check DTC P0125 using "List of Diagnostic Trouble Code (DTC)". &lt;Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AB:DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-47, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

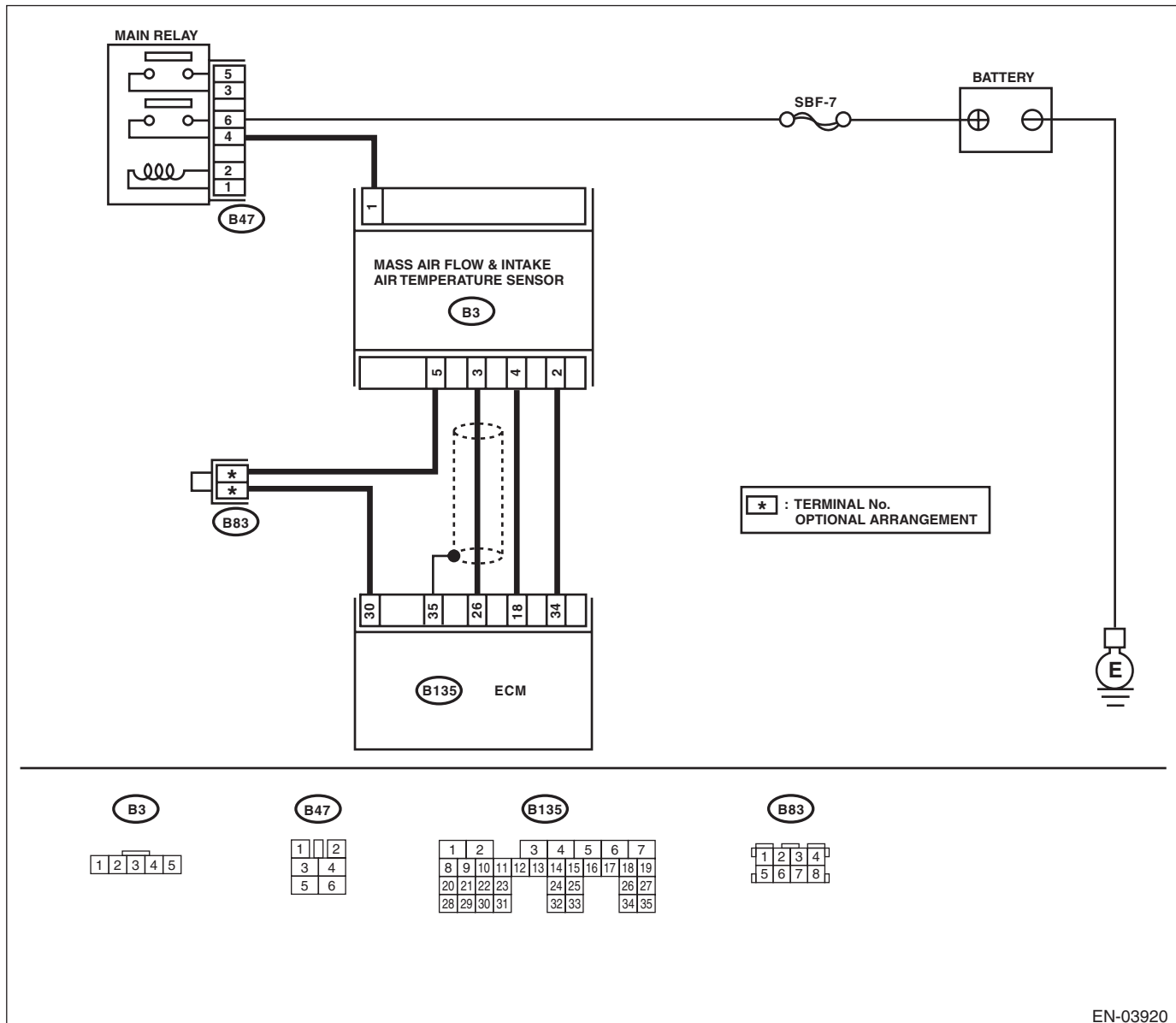
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the intake air temperature 120°C (248°F) or higher?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and the mass air flow and intake air temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 18 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AC:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-49, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

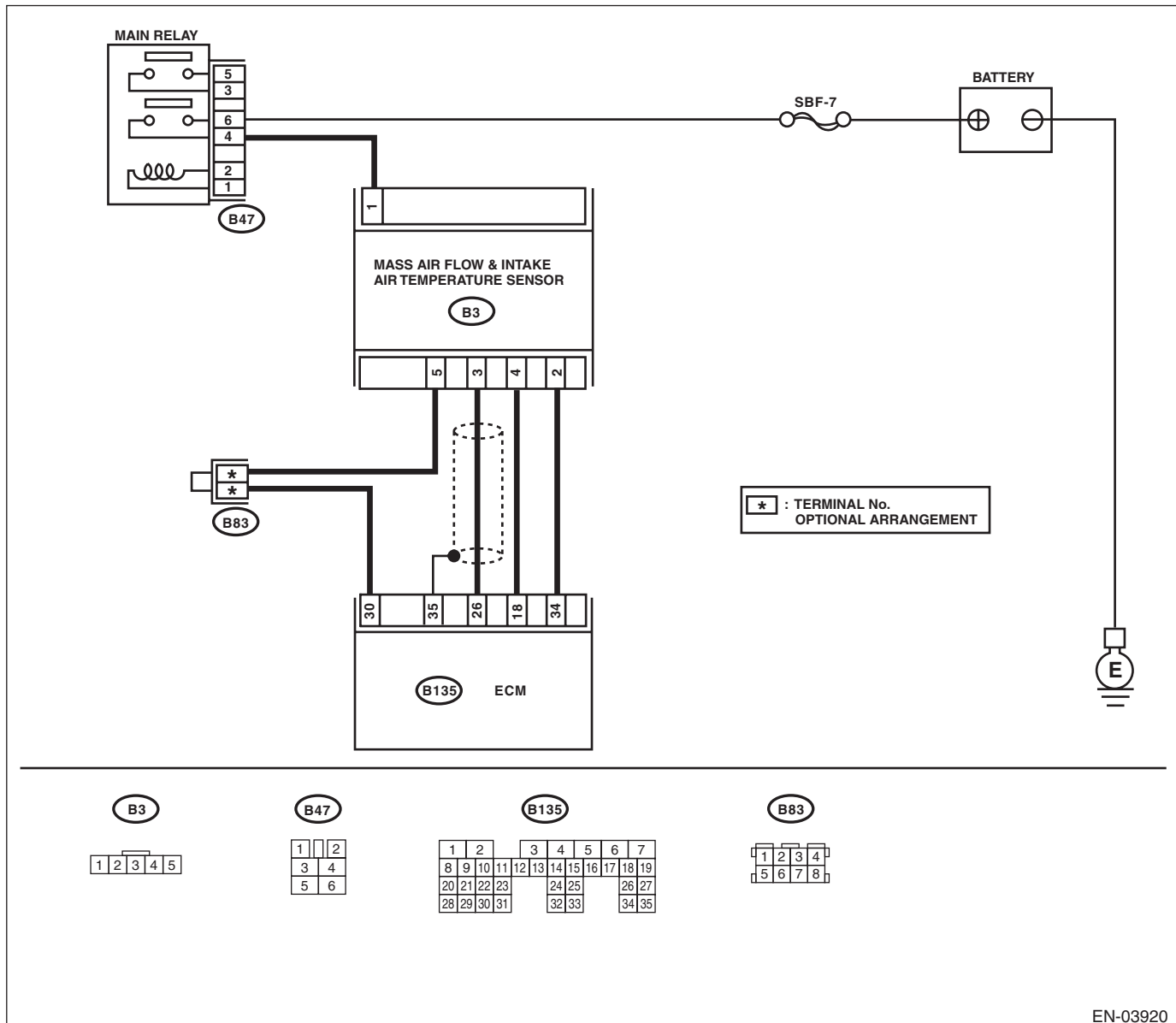
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03920

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or general scan tool.  NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the intake air temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK POOR CONTACT.</b> Check for poor contact in the ECM or the mass air flow and intake air temperature sensor connector.	Is there poor contact in the ECM or the mass air flow and intake air temperature sensor connector?	Check for poor contact in the ECM or the mass air flow and intake air temperature sensor connector.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and the mass air flow and intake air temperature sensor. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector.  <b>Connector &amp; terminal</b> <b>(B135) No. 18 — (B3) No. 4:</b> <b>(B135) No. 30 — (B3) No. 5:</b>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of harness between the ECM and the mass air flow and intake air temperature sensor connector.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Disconnect the connector from the mass air flow and intake air temperature sensor. 4) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b> <b>(B135) No. 18 (+) — Chassis ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and the mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AD:DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-51, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

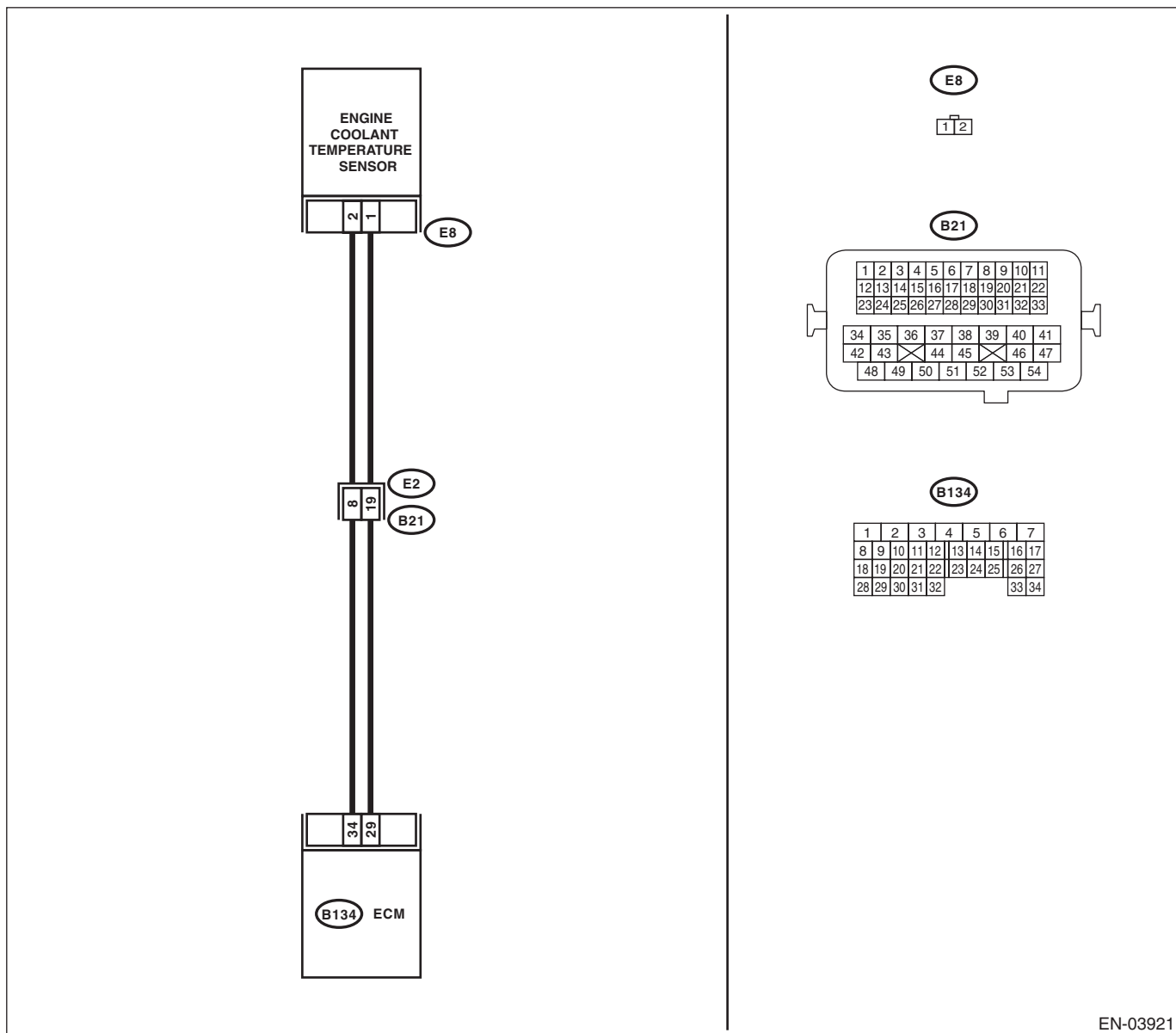
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03921

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 150°C (302°F) or higher?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and engine coolant temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 34 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the engine coolant temperature sensor. &lt;Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.&gt;</p>	<p>Repair the ground short circuit of the harness between the ECM and engine coolant temperature sensor.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AE:DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-53, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

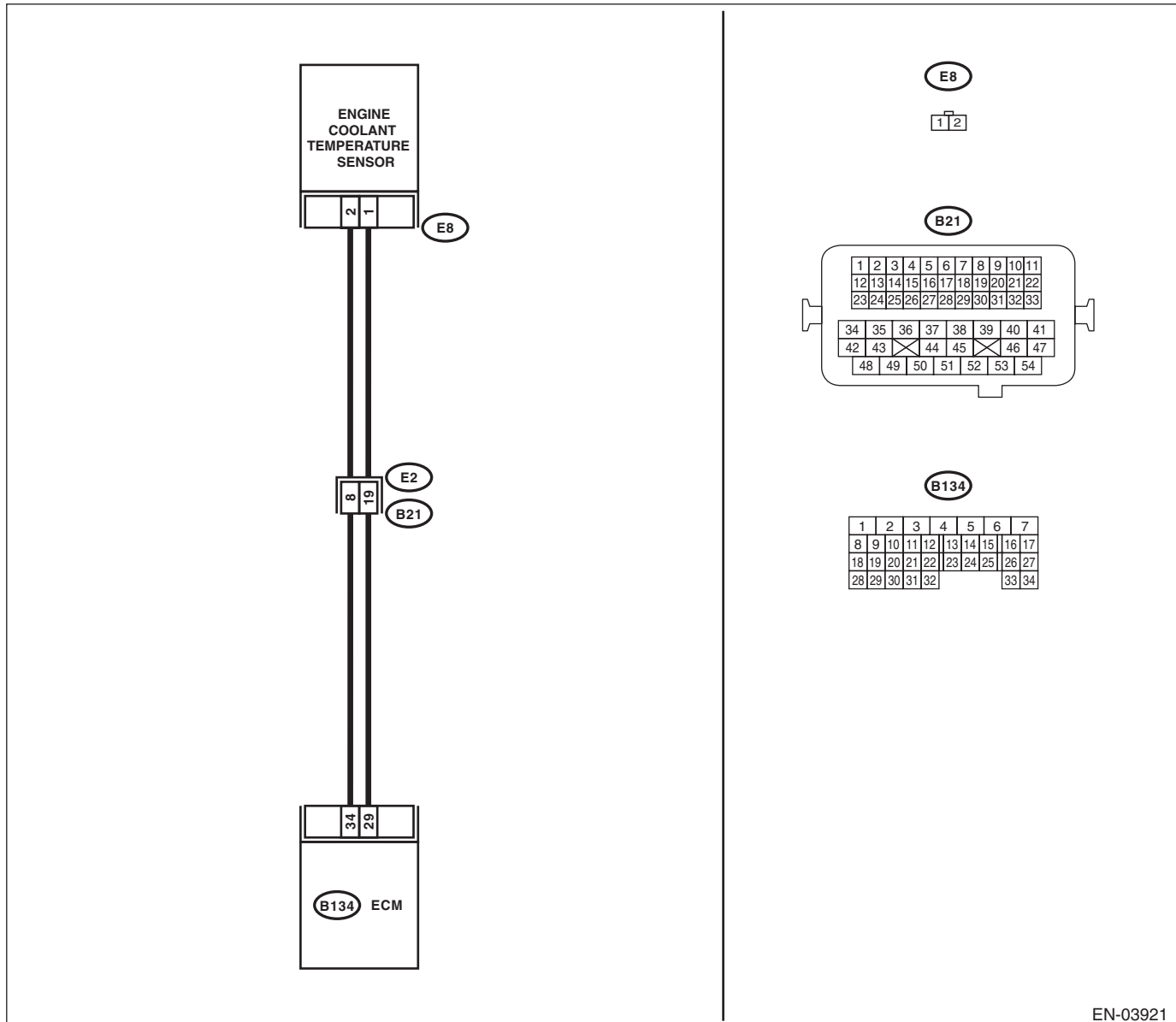
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03921



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt; • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the engine coolant temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ ) ?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Repair any poor contact between the ECM and engine coolant temperature sensor connectors.</p>	Is there poor contact in the ECM or engine coolant temperature sensor connectors?	Repair any poor contact between the ECM and engine coolant temperature sensor connectors.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and engine coolant temperature sensor. 3) Measure the resistance of the harness between the ECM and engine coolant temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 34 — (E8) No. 2:</b> <b>(B134) No. 29 — (E8) No. 1:</b></p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and engine coolant temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 34 (+) — Chassis ground (-):</b></p>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and engine coolant temperature sensor connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from ECM and electronic throttle control.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 18 — Chassis ground:</b>  <b>(B134) No. 18 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the connector to ECM.</p> <p>2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 18 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H6DO)-12, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. &lt;Ref. to FU(H6DO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AG:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-57, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

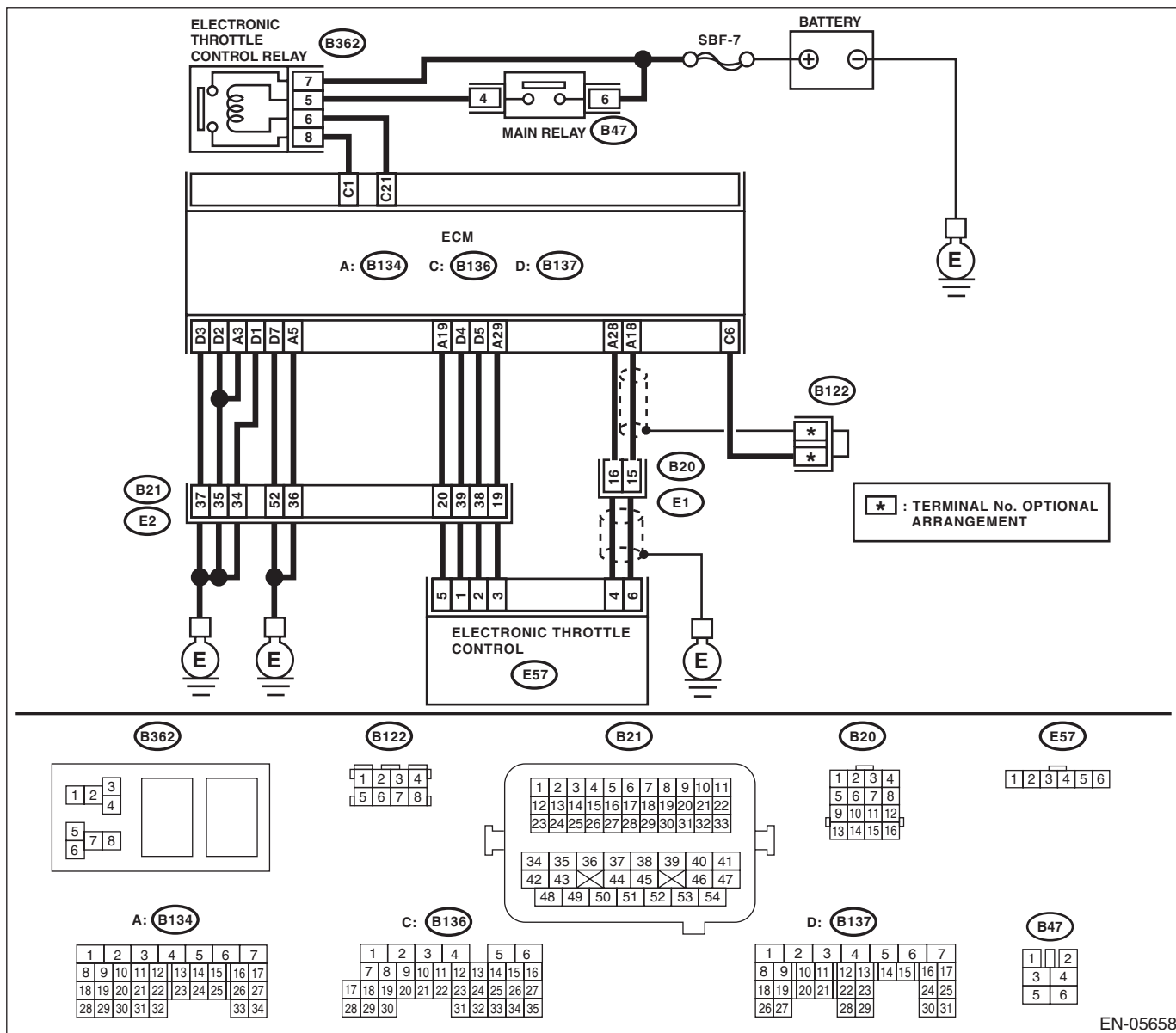
### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b>	Is the resistance 1 MΩ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AH:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-59, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

Engine does not return to idle.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK TIRE SIZE.</b>	Is the tire size as specified, and the same size as other three wheels?	Go to step 2.	Replace the tire.
2	<b>CHECK ENGINE COOLANT.</b> Check the following items: <ul style="list-style-type: none"><li>• Amount of engine coolant</li><li>• Engine coolant freeze</li><li>• Contamination of engine coolant</li></ul>	Is the engine coolant normal?	Go to step 3.	Fill or replace the engine coolant. <Ref. to CO(H6DO)-12, INSPECTION, Engine Coolant.>
3	<b>CHECK THERMOSTAT.</b>	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H6DO)-14, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>

## AI: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-62, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

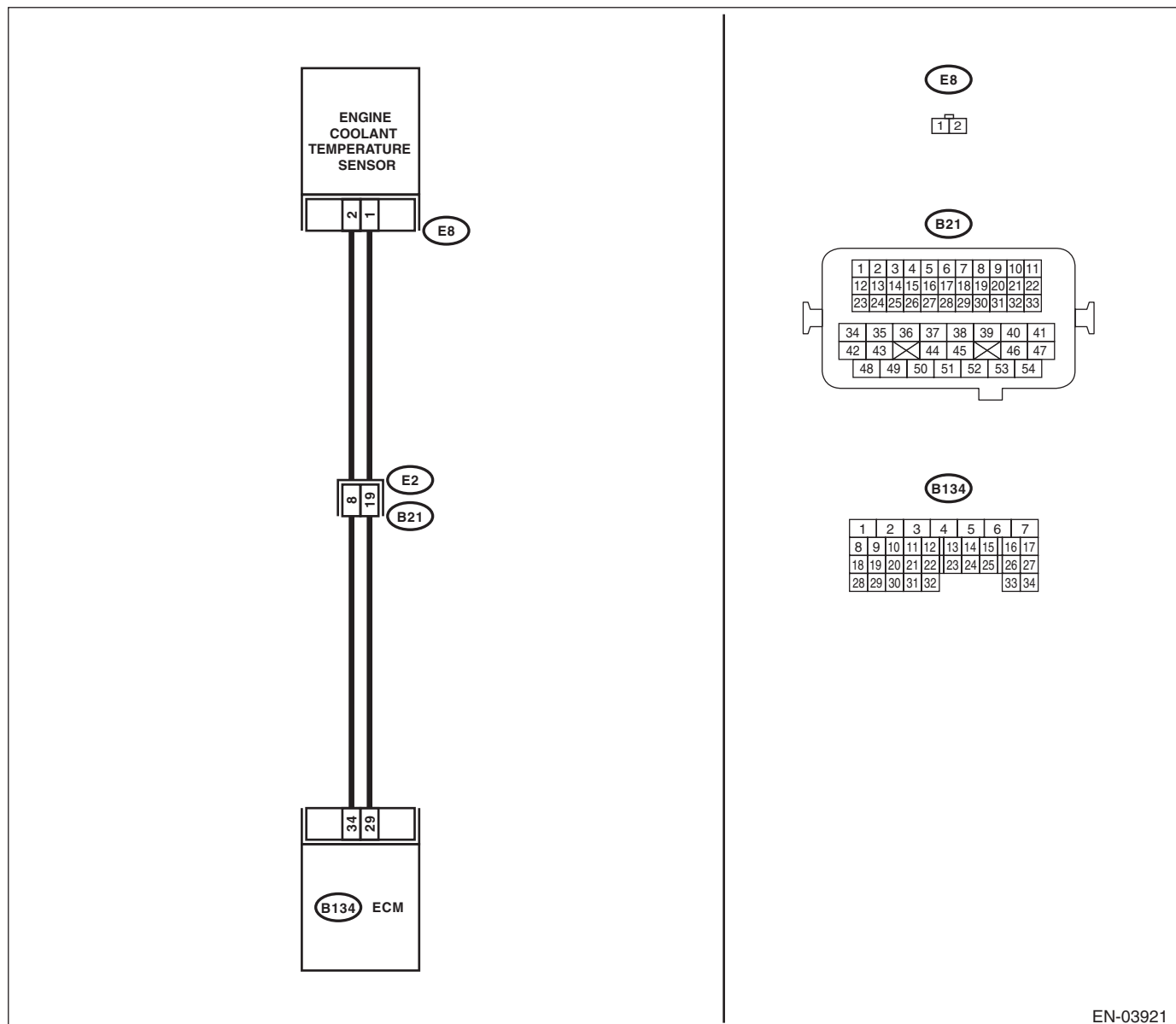
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed-up. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed-up?	Repair the poor contact of the ECM connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>

### AJ:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-64, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### TROUBLE SYMPTOM:

Thermostat remains open.

#### CAUTION:

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

Step	Check	Yes	No
<b>1 CHECK ENGINE COOLANT.</b>	Are the coolant level and mixture ratio of engine coolant to anti-freeze solution correct?	Go to step 2.	Replace the engine coolant. <Ref. to CO(H6DO)-11, REPLACEMENT, Engine Coolant.>
<b>2 CHECK RADIATOR FAN.</b> 1) Start the engine. 2) Check the radiator fan operation.	Does the radiator fan continuously rotate for 3 minutes or more during idling?	Repair radiator fan circuit. <Ref. to CO(H6DO)-20, Radiator Main Fan and Fan Motor.>and <Ref. to CO(H6DO)-23, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H6DO)-14, Thermostat.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AK:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

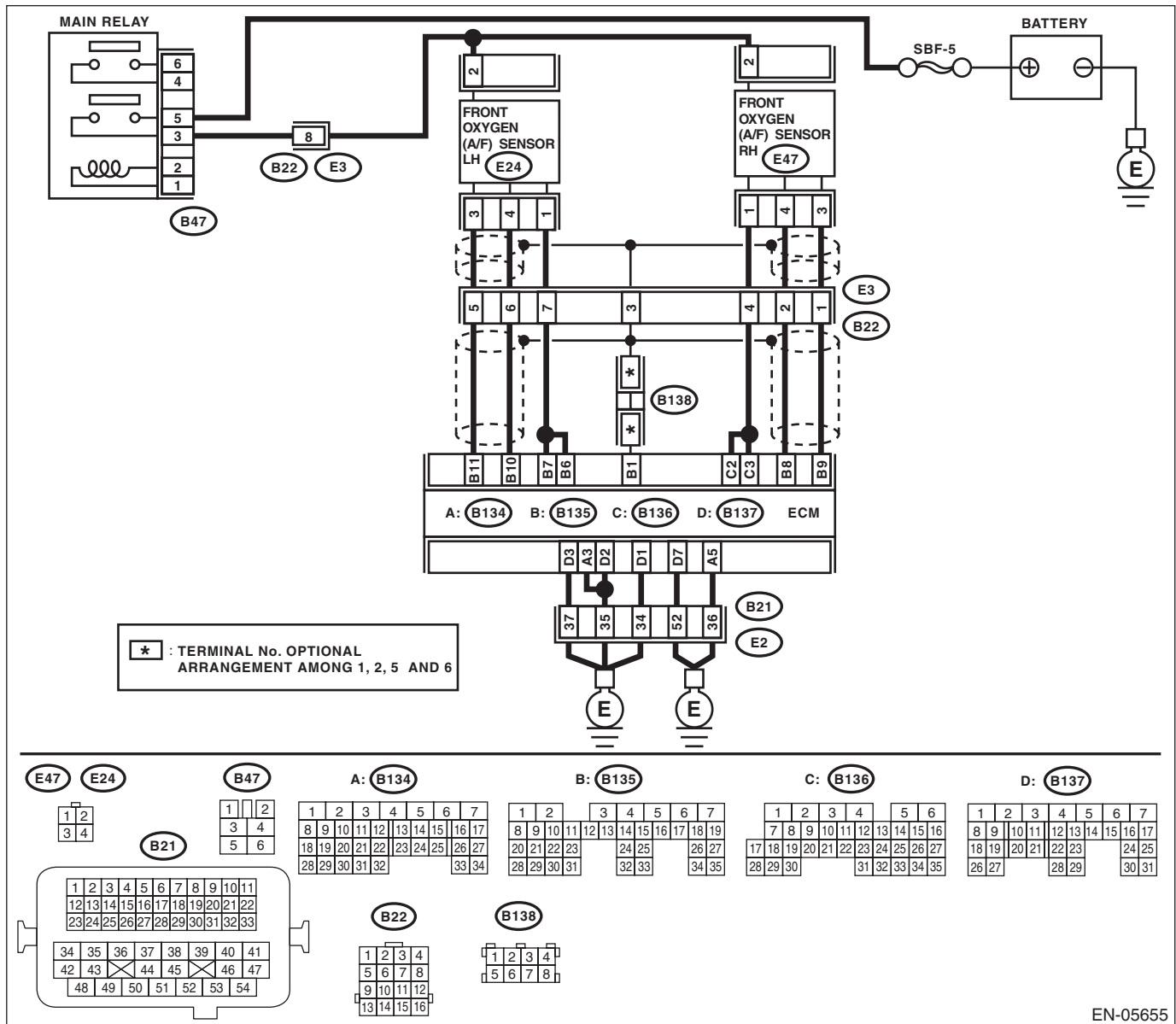
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-66, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AL:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

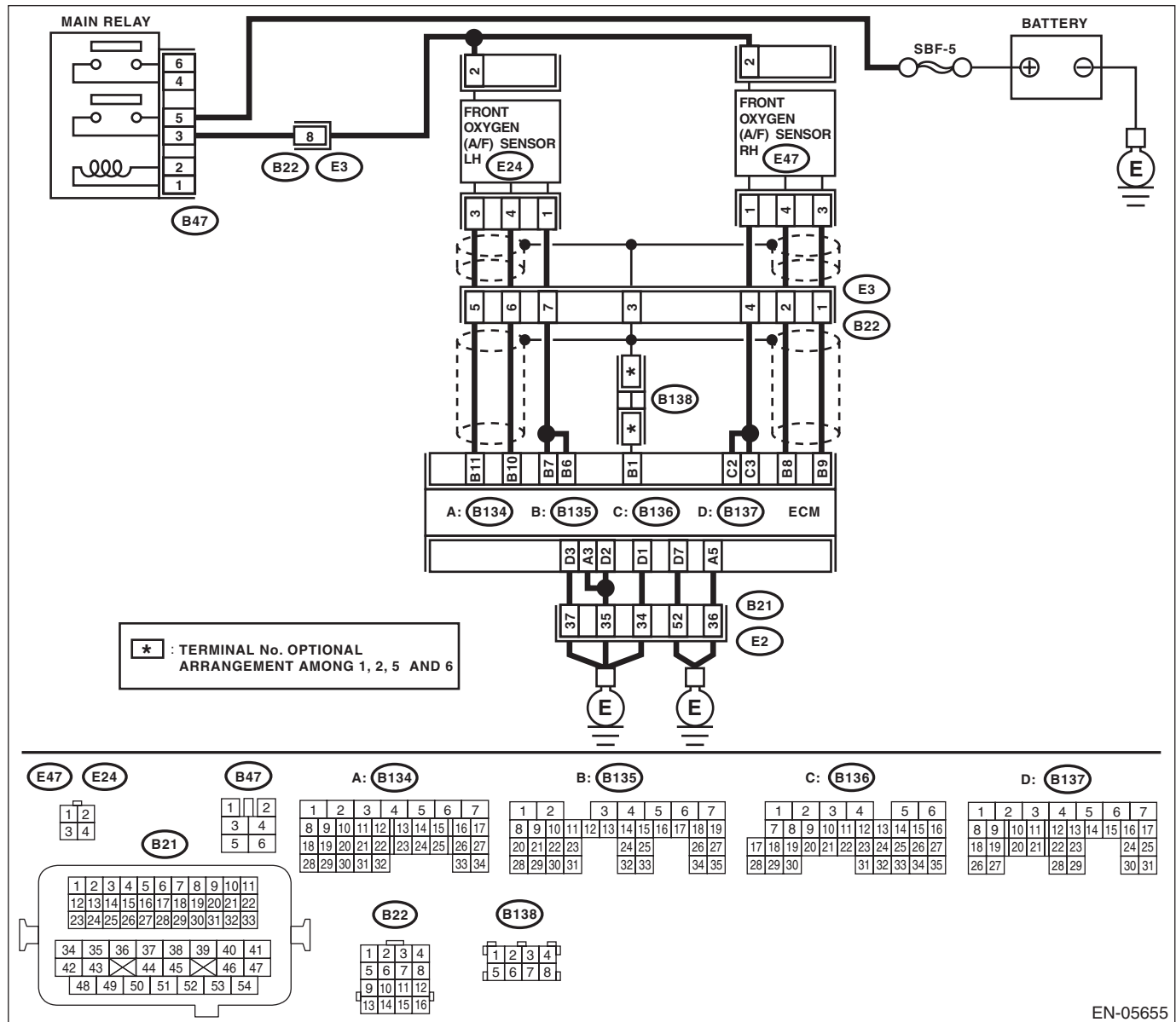
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-68, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AM:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

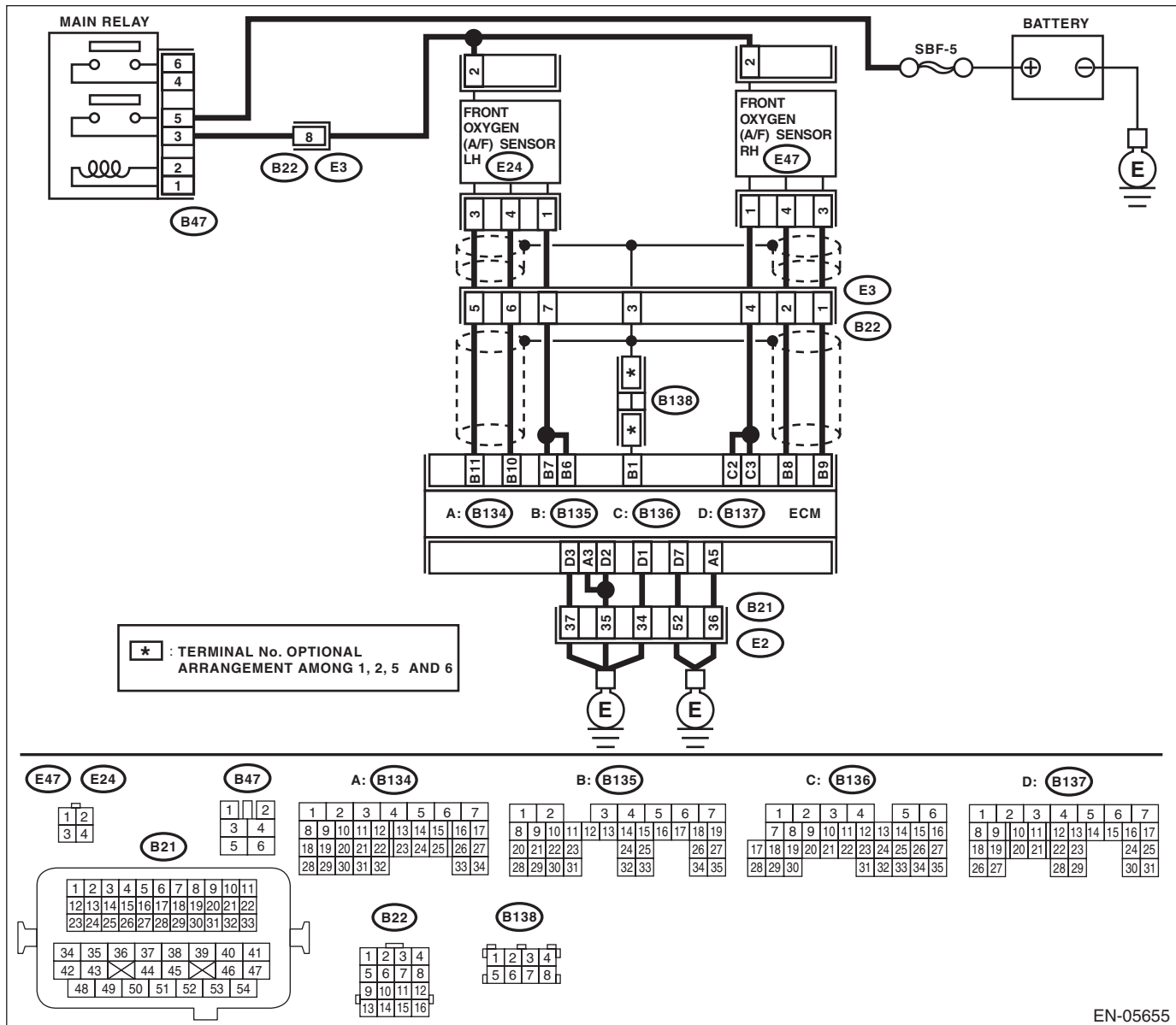
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-70, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK EXHAUST SYSTEM.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Loose installation of front portion of exhaust pipe onto cylinder heads</li><li>• Loose connection between front exhaust pipe and front catalytic converter</li><li>• Damage of exhaust pipe resulting in a hole</li></ul>	Is there any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AN:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

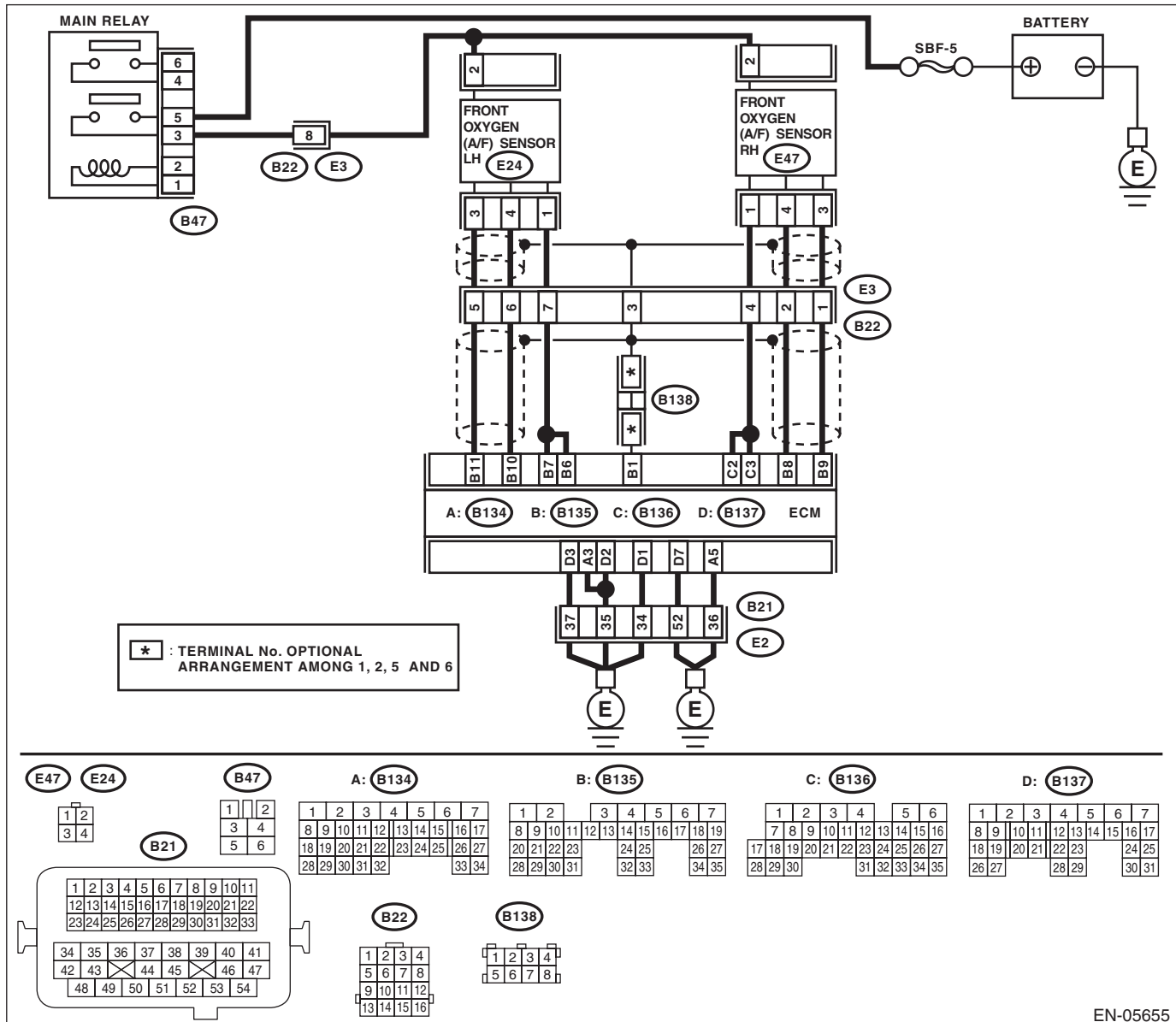
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-73, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 9 — (E47) No. 3:</b>  <b>(B135) No. 8 — (E47) No. 4:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 2.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>2</b></p> <p><b>CHECK POOR CONTACT.</b>                      Check poor contact of ECM and front oxygen (A/F) sensor connector.</p>	<p>Is there poor contact in ECM or front oxygen (A/F) sensor connector?</p>	<p>Repair the poor contact of ECM or front oxygen (A/F) sensor connector.</p>	<p>Replace the front oxygen (A/F) sensor. &lt;Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.&gt;</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AO:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

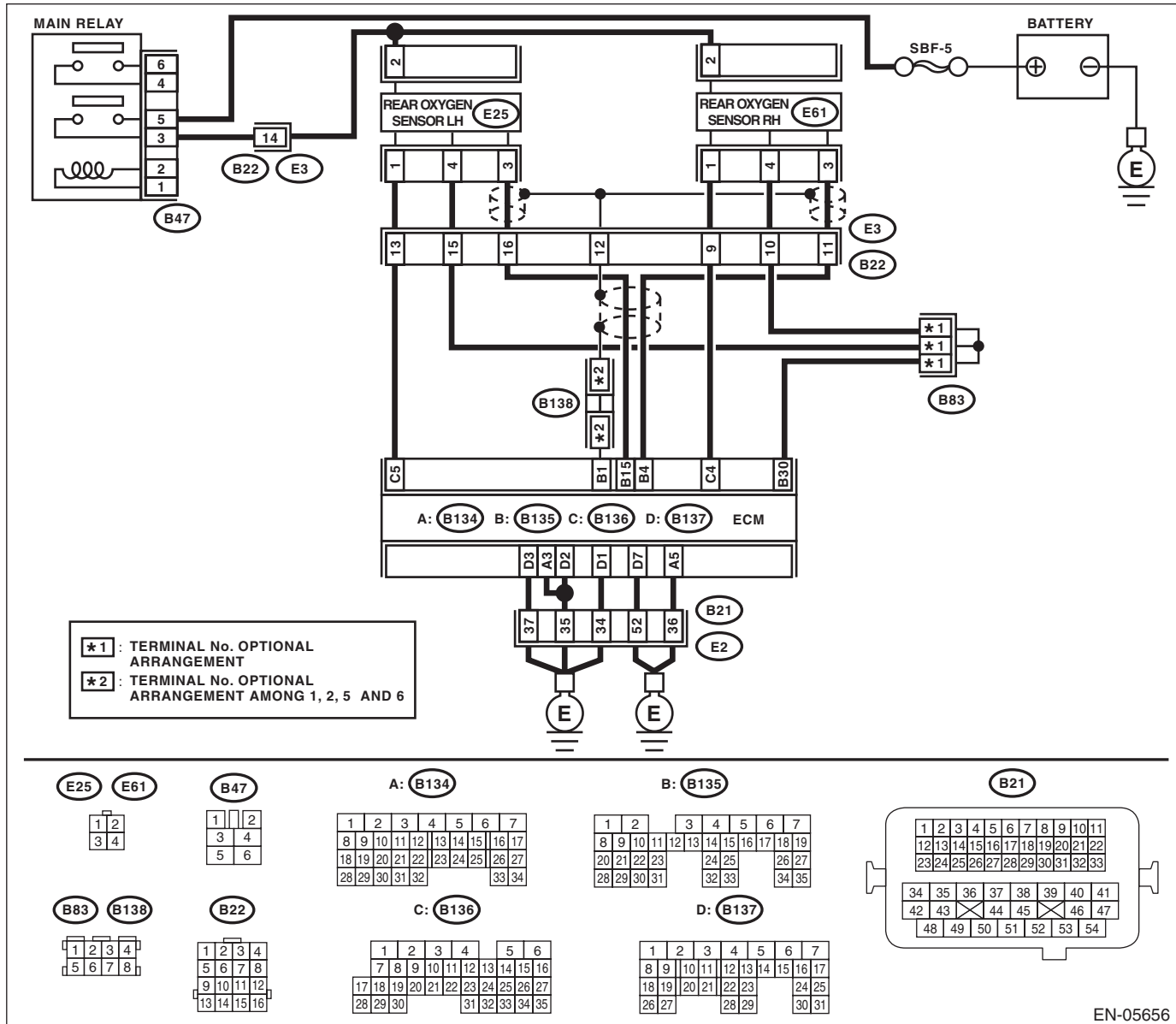
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 4 — (E61) No. 3:</b> <b>(B135) No. 30 — (E61) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E61) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the rear oxygen sensor connector</li> <li>• Poor contact in ECM connector</li> </ul>
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Loose part and incomplete installation of exhaust system</li> <li>• Damage (crack, hole etc.) of parts</li> <li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li> </ul>	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AP:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

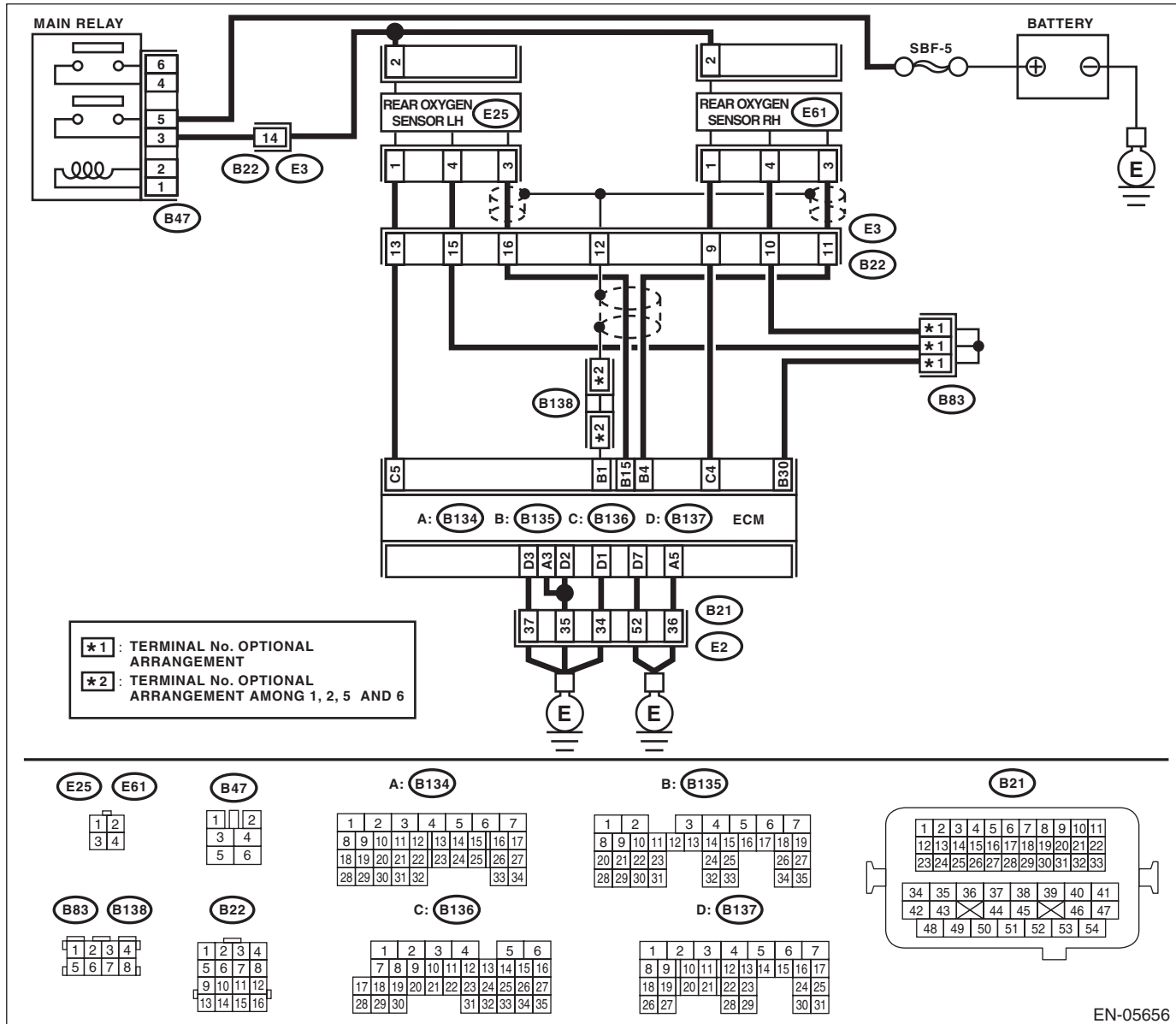
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-78, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <i>Connector &amp; terminal</i> <i>(B135) No. 4 — (E61) No. 3:</i> <i>(B135) No. 30 — (E61) No. 4:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <i>Connector &amp; terminal</i> <i>(E61) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AQ:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

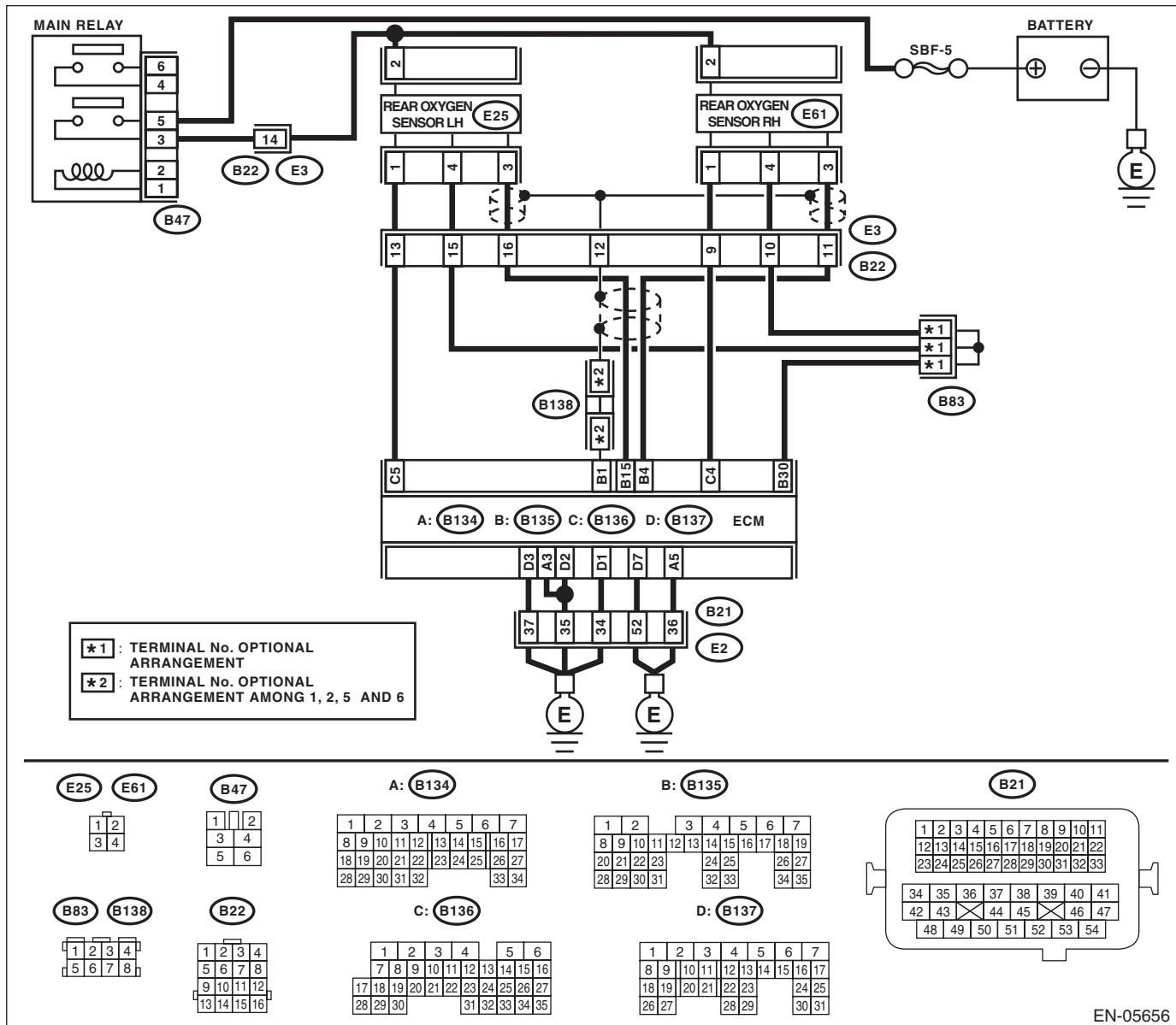
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-79, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and rear oxygen sensor.                      3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 4 — (E61) No. 3:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      Measure the resistance between rear oxygen sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(E61) No. 3 — Chassis ground</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>3</b></p> <p><b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor terminals.  <b>Terminals</b>  <b>No. 3 — No. 4</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H6DO)-33, Rear Oxygen Sensor.&gt;</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.                       NOTE:                      In this case, there may be a temporary connector contact failure.</p>

## AR:DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

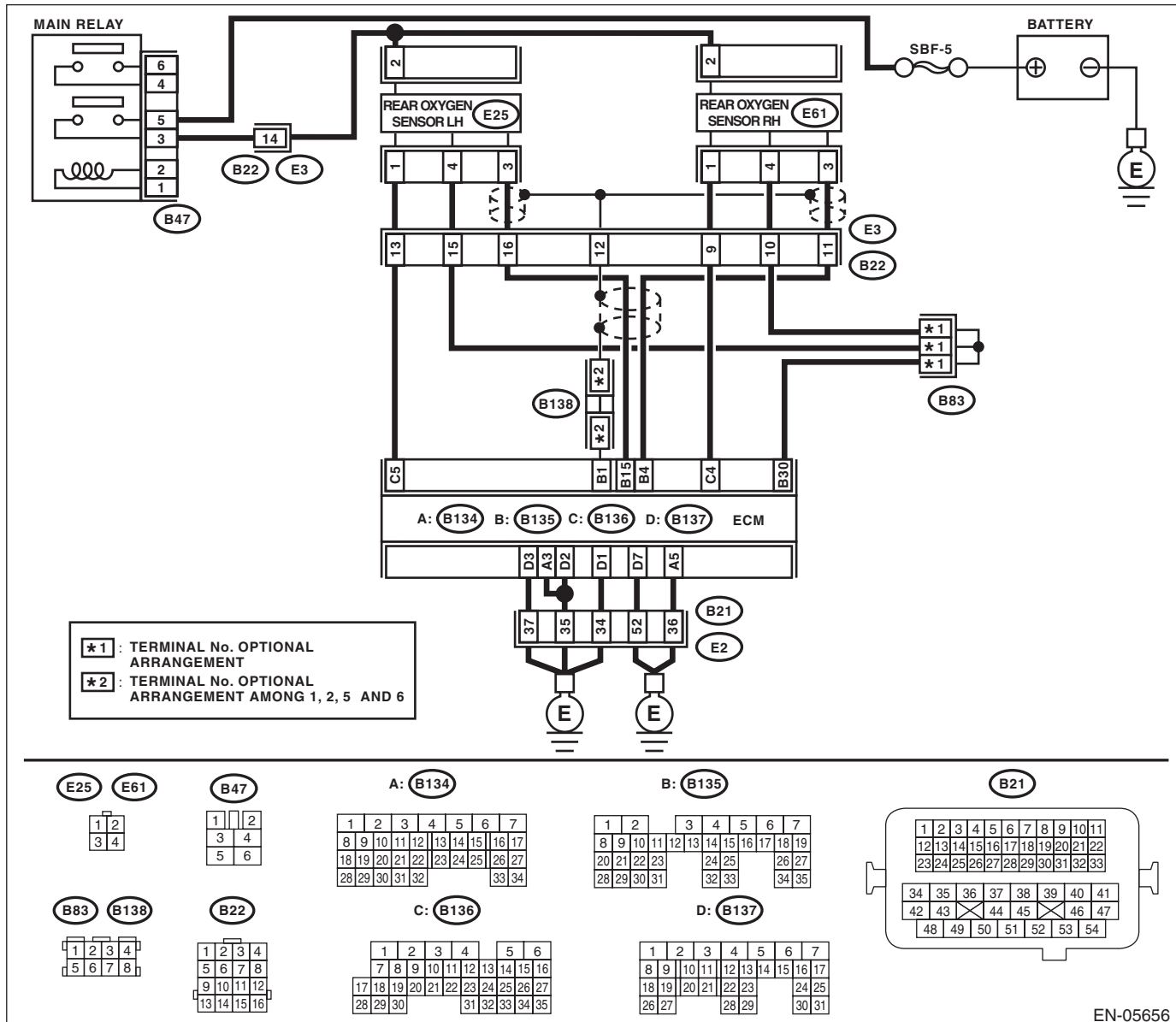
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-86, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 490 mV or more?	Go to step 6.	Go to step 2.
2	<p><b>CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 6.	Go to step 3.
3	<p><b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	Has water entered the connector?	Completely remove any water inside.	Go to step 4.
4	<p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from ECM and rear oxygen sensor.</p> <p>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B135) No. 4 — (E61) No. 3:</b></p> <p><b>(B135) No. 30 — (E61) No. 4:</b></p>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E61) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 0.2 — 0.5 V?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H6DO)-33, Rear Oxygen Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b>                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the rear oxygen sensor connector</li> <li>• Poor contact in ECM connector</li> </ul>
<p><b>6</b></p> <p><b>CHECK EXHAUST SYSTEM.</b>                      Check exhaust system parts.</p> <p><b>NOTE:</b>                      Check the following items.</p> <ul style="list-style-type: none"> <li>• Loose part and incomplete installation of exhaust system</li> <li>• Damage (crack, hole etc.) of parts</li> <li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li> </ul>	<p>Is there any fault in exhaust system?</p>	<p>Repair or replace faulty parts.</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H6DO)-33, Rear Oxygen Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AS:DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1)

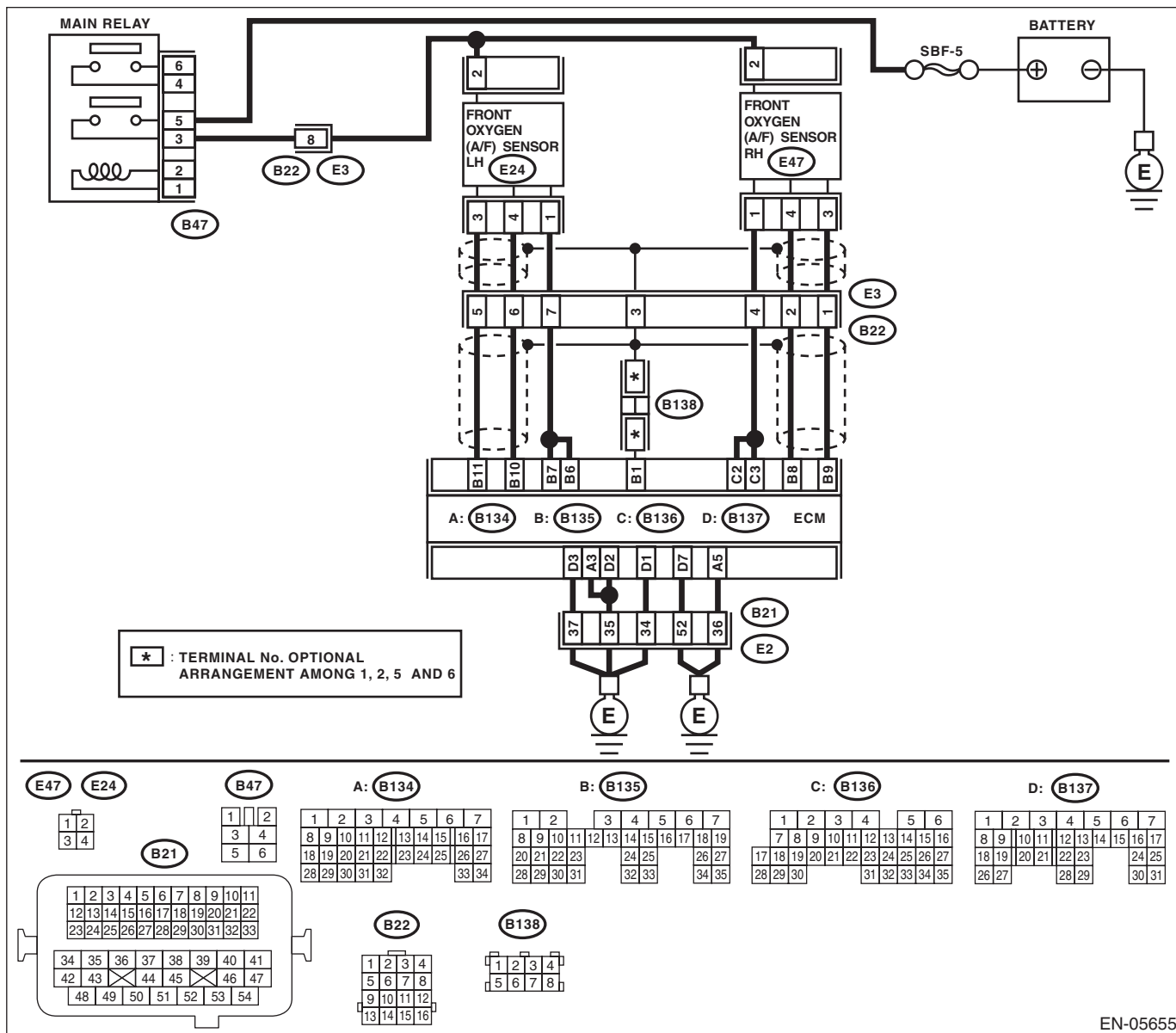
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-87, DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 — Chassis ground:</b> <b>(B135) No. 10 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AT:DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1)

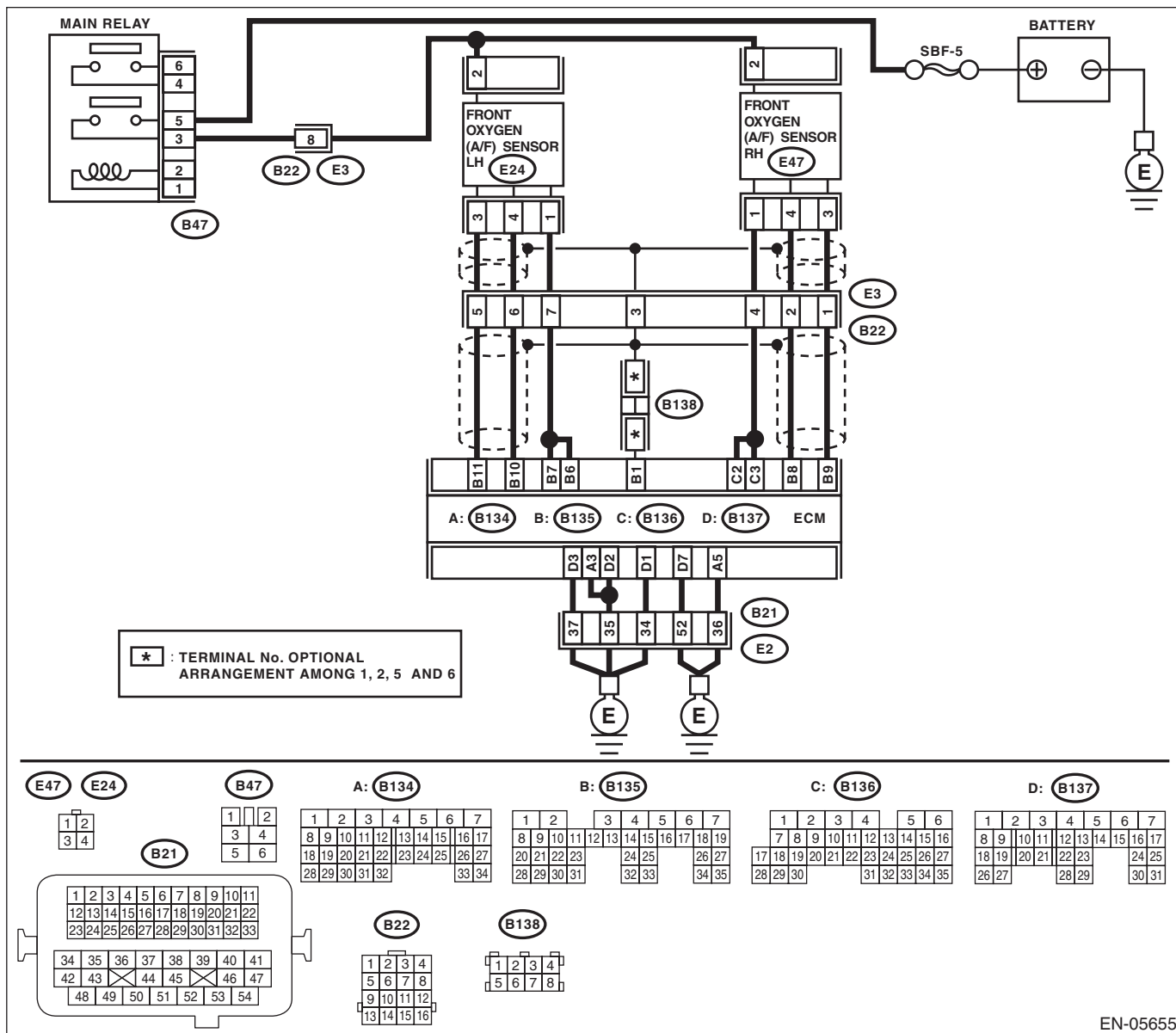
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-87, DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 (+) — Chassis ground (-):</b> <b>(B135) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AU:DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1)

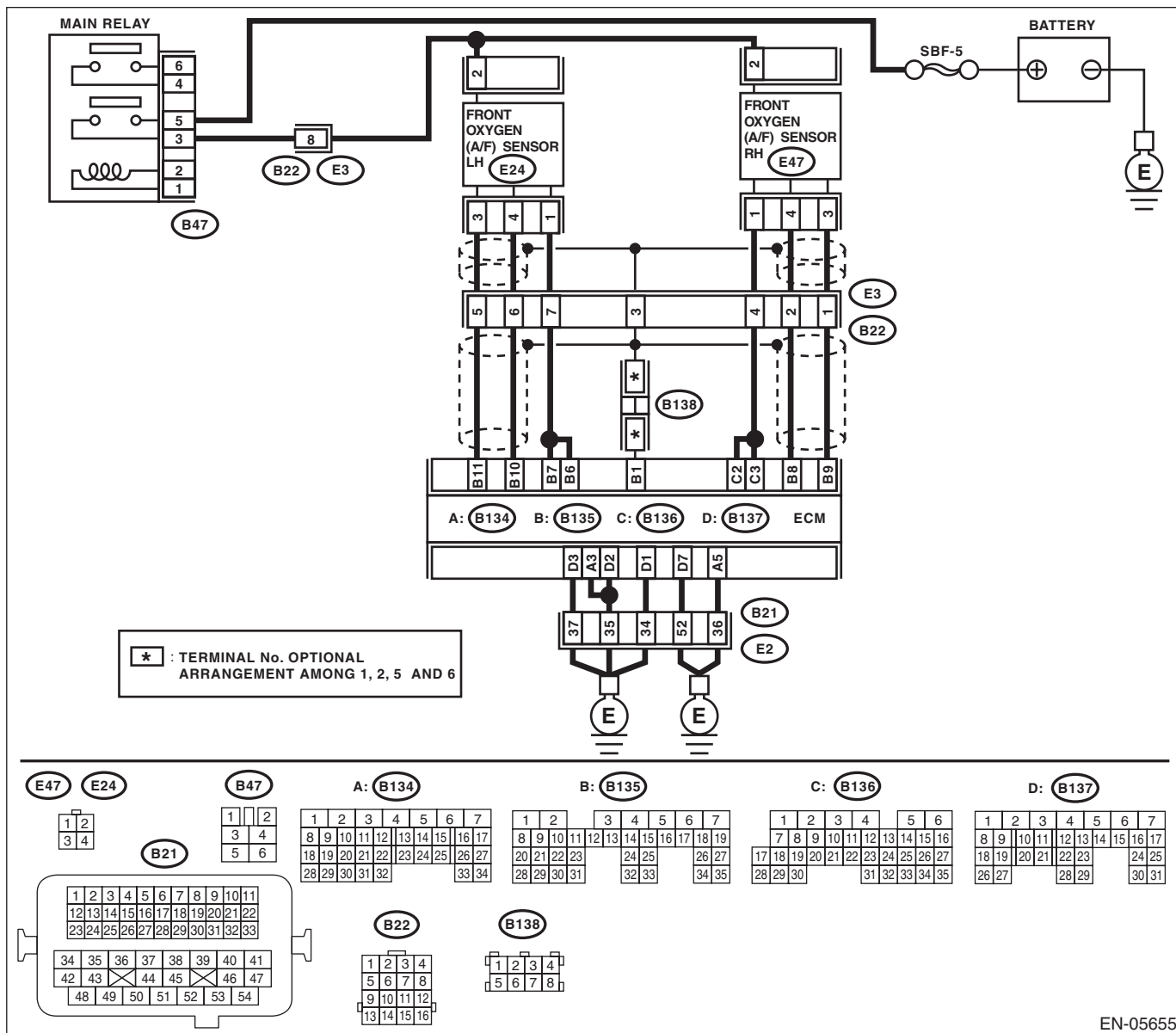
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK EXHAUST SYSTEM.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Loose installation of front portion of exhaust pipe onto cylinder heads</li><li>• Loose connection between front exhaust pipe and front catalytic converter</li><li>• Damage of exhaust pipe resulting in a hole</li></ul>	Is there any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AV:DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1)

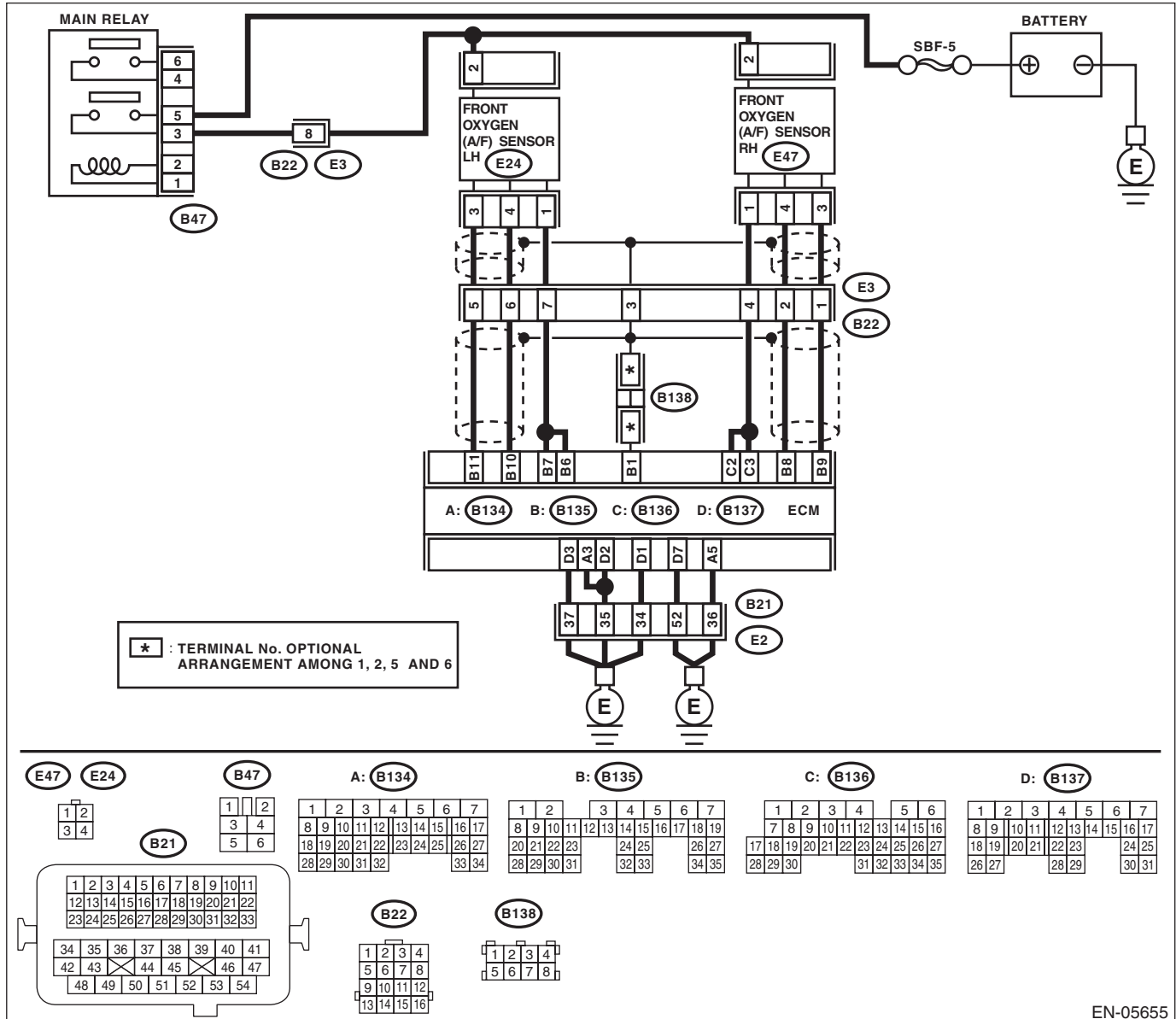
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 11 — (E24) No. 3:</b>  <b>(B135) No. 10 — (E24) No. 4:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Check poor contact of ECM and front oxygen (A/F) sensor connector.</p>	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AW:DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2)

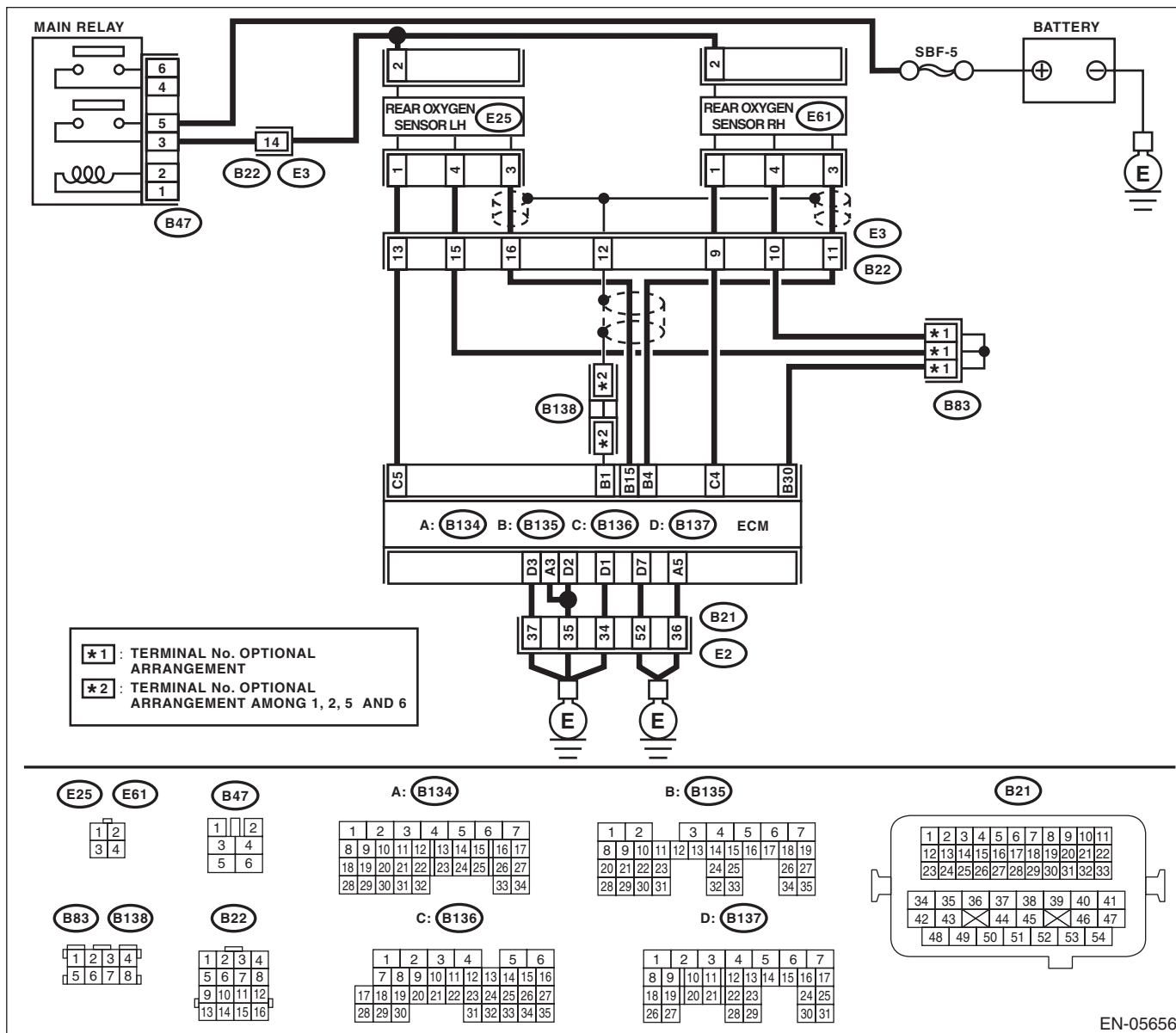
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 15 — (E25) No. 3:</b> <b>(B135) No. 30 — (E25) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E25) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AX:DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2)

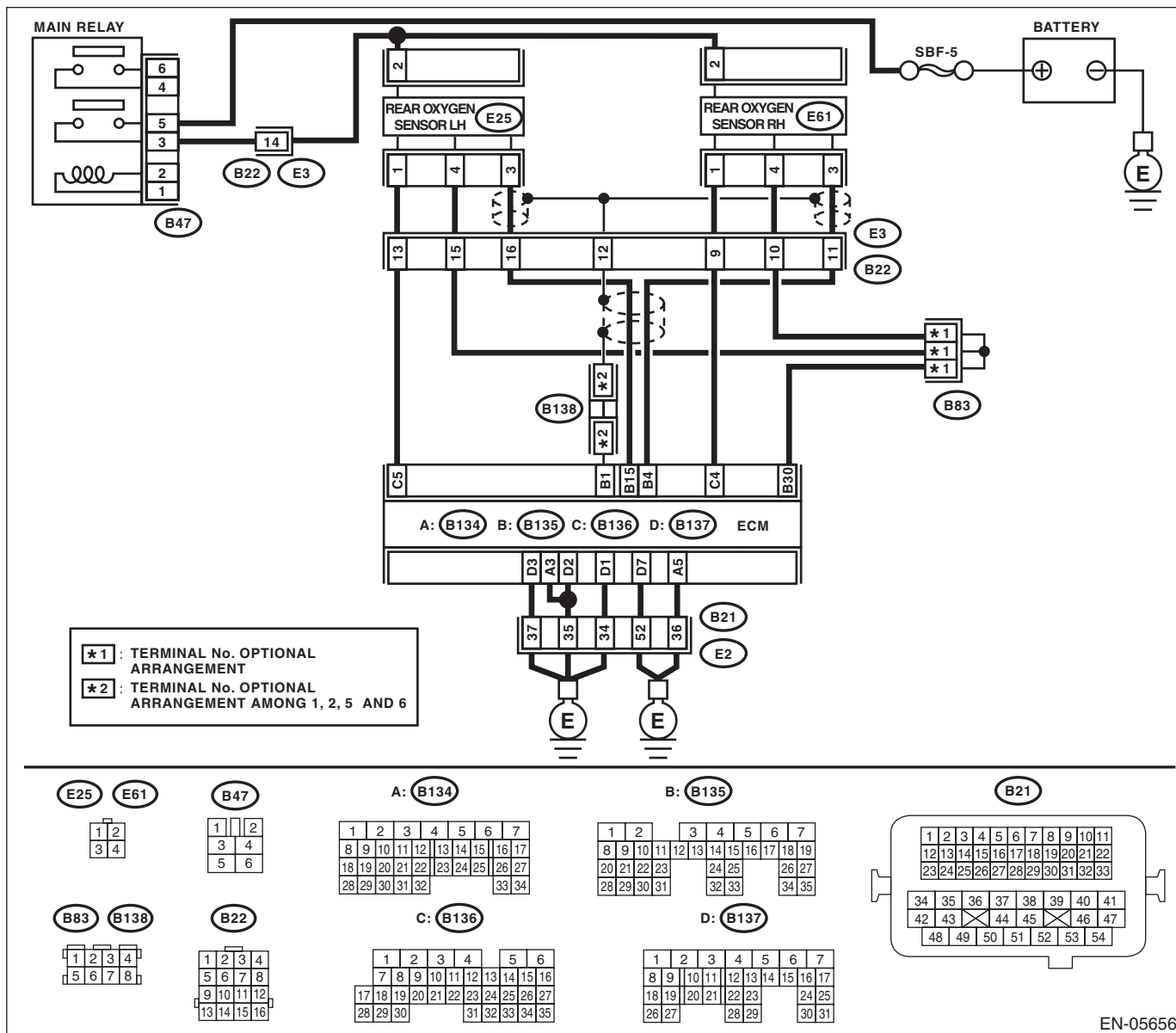
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step 5.	Go to step 2.
<b>2 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 3.
<b>3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 15 — (E25) No. 3:</b> <b>(B135) No. 30 — (E25) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>4 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E25) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact of the rear oxygen sensor connector • Poor contact in ECM connector
<b>5 CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. • Loose part and incomplete installation of exhaust system • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AY:DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2)

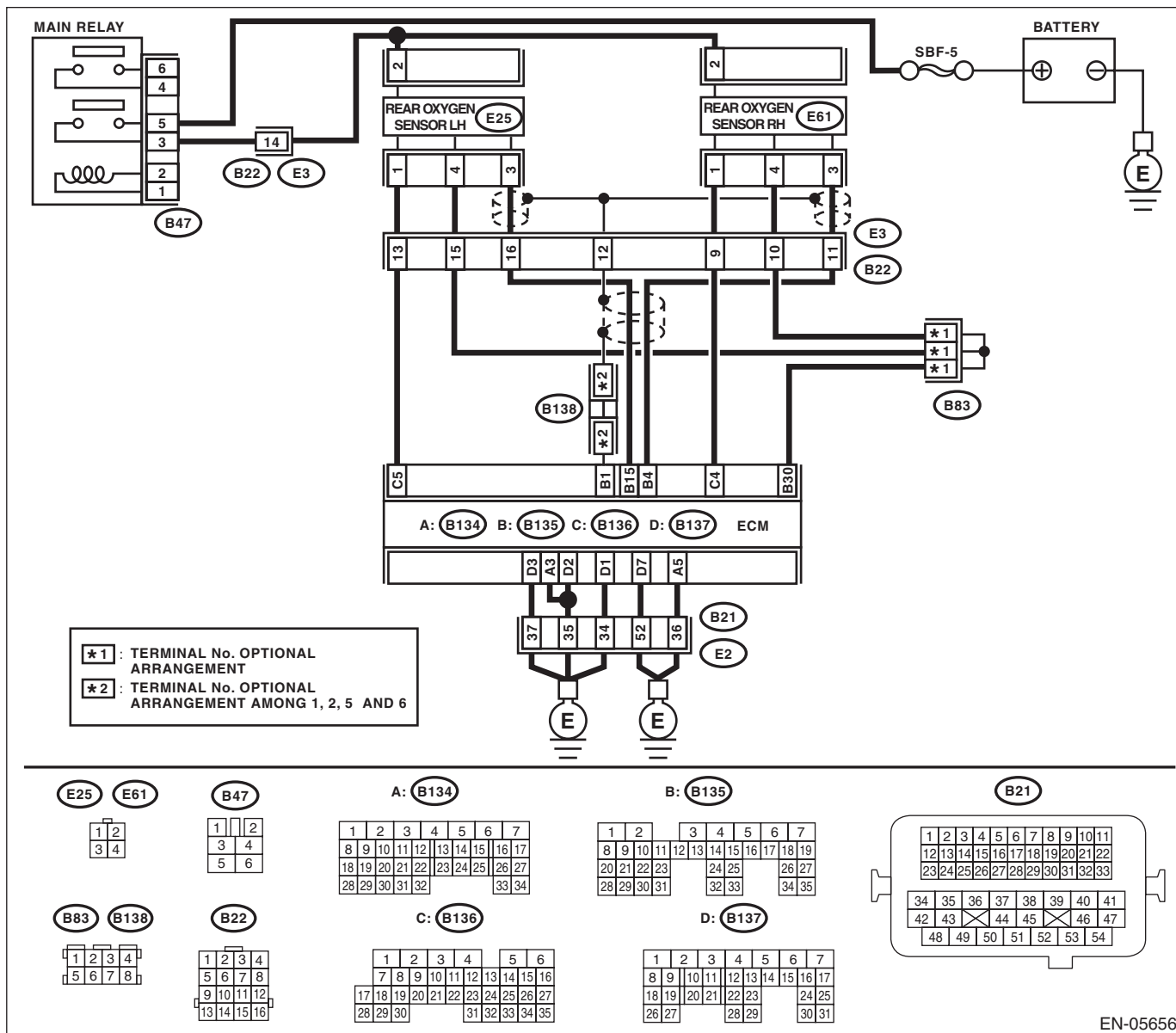
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and rear oxygen sensor.                      3) Measure the resistance of harness between ECM and rear oxygen sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 15 — (E25) No. 3:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      Measure the resistance between rear oxygen sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B25) No. 3 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 3.</p>	<p>Repair the ground short circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>3</b></p> <p><b>CHECK REAR OXYGEN SENSOR.</b>                      Measure the resistance between rear oxygen sensor terminals.  <b>Terminals</b>  <b>No. 3 — No. 4</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H6DO)-33, Rear Oxygen Sensor.&gt;</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.                      NOTE:                      In this case, there may be a temporary connector contact failure.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## AZ:DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 2)

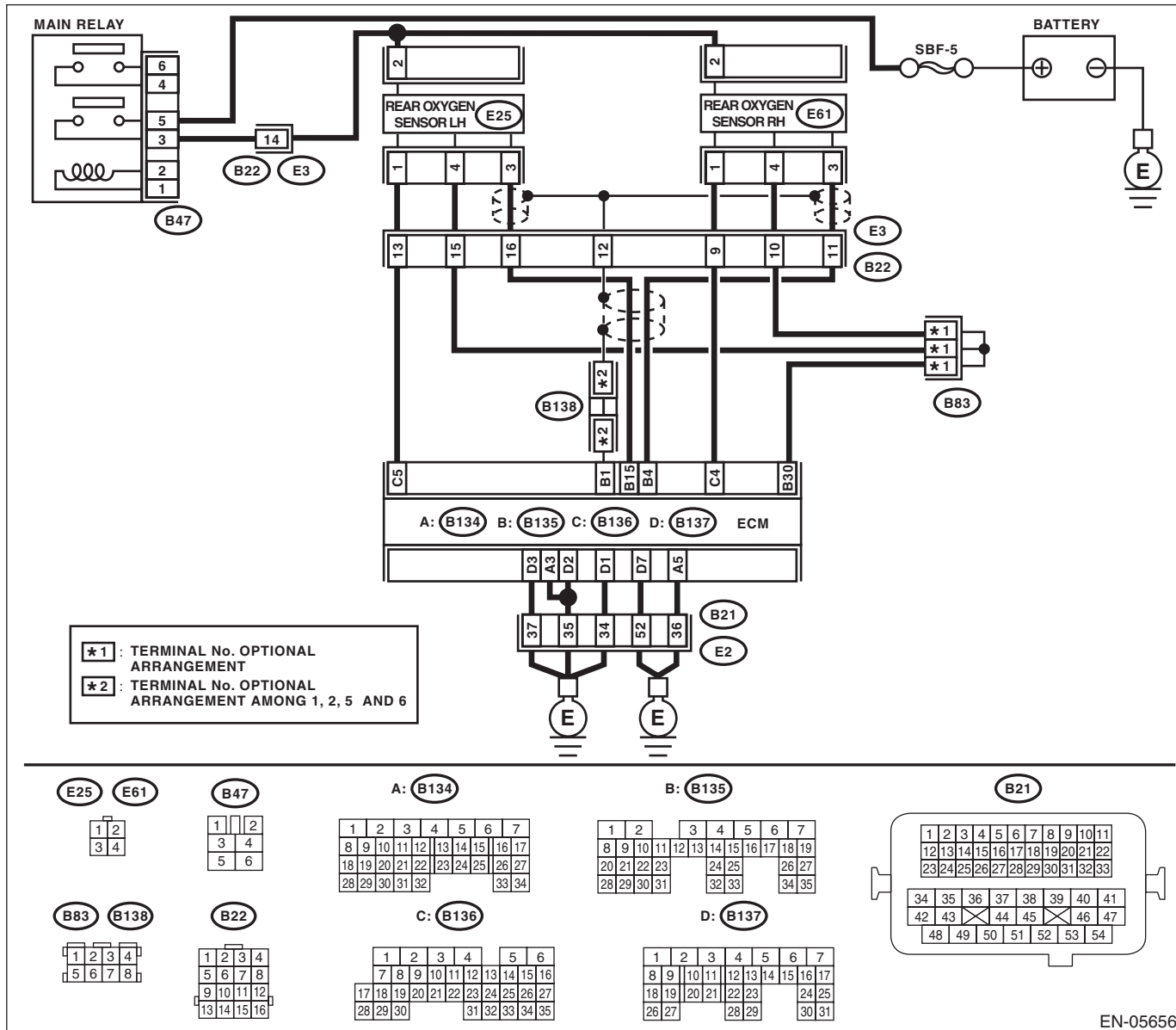
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-88, DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05656



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK REAR OXYGEN SENSOR DATA.</b>                      1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)                      2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the voltage 490 mV or more?</p>	<p>Go to step 6.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK REAR OXYGEN SENSOR DATA.</b>                      1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.                      2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the voltage 250 mV or less?</p>	<p>Go to step 6.</p>	<p>Go to step 3.</p>
<p><b>3</b></p> <p><b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	<p>Has water entered the connector?</p>	<p>Completely remove any water inside.</p>	<p>Go to step 4.</p>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from ECM and rear oxygen sensor.                      3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b>                      (B135) No. 15 — (E25) No. 3:                      (B135) No. 30 — (E25) No. 4:</p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 5.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the rear oxygen sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>                      (E25) No. 3 (+) — Chassis ground (-):</p>	<p>Is the voltage 0.2 — 0.5 V?</p>	<p>Replace the rear oxygen sensor.                      &lt;Ref. to FU(H6DO)-33, Rear Oxygen Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:                      • Open circuit of harness between the ECM and rear oxygen sensor                      • Poor contact of the rear oxygen sensor connector                      • Poor contact in ECM connector</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
6	<b>CHECK EXHAUST SYSTEM.</b> Check exhaust system parts. NOTE: Check the following items. <ul style="list-style-type: none"><li>• Loose part and incomplete installation of exhaust system</li><li>• Damage (crack, hole etc.) of parts</li><li>• Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor</li></ul>	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>

### **BA:DTC P0171 SYSTEM TOO LEAN (BANK 1)**

#### NOTE:

Refer to DTC P0175 for diagnostic procedure. <Ref. to EN(H6DO)(diag)-191, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **BB:DTC P0172 SYSTEM TOO RICH (BANK 1)**

#### NOTE:

Refer to DTC P0175 for diagnostic procedure. <Ref. to EN(H6DO)(diag)-191, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **BC:DTC P0174 SYSTEM TOO LEAN (BANK 2)**

#### NOTE:

Refer to DTC P0175 for diagnostic procedure. <Ref. to EN(H6DO)(diag)-191, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BD:DTC P0175 SYSTEM TOO RICH (BANK 2)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-92, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 2.
2	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 3.
3	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place "NO OPEN FLAMES" signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. Measure the fuel pressure. <Ref. to ME(H6DO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 333 — 363 kPa (3.4 — 3.7 kgf/cm <sup>2</sup> , 48 — 53 psi)?	Go to step 4.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
4	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step 5.	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR SIGNAL.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) Place the select lever in “P” or “N” range.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 6.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>6</b></p> <p><b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) Place the select lever in “P” or “N” range.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

## BE:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE

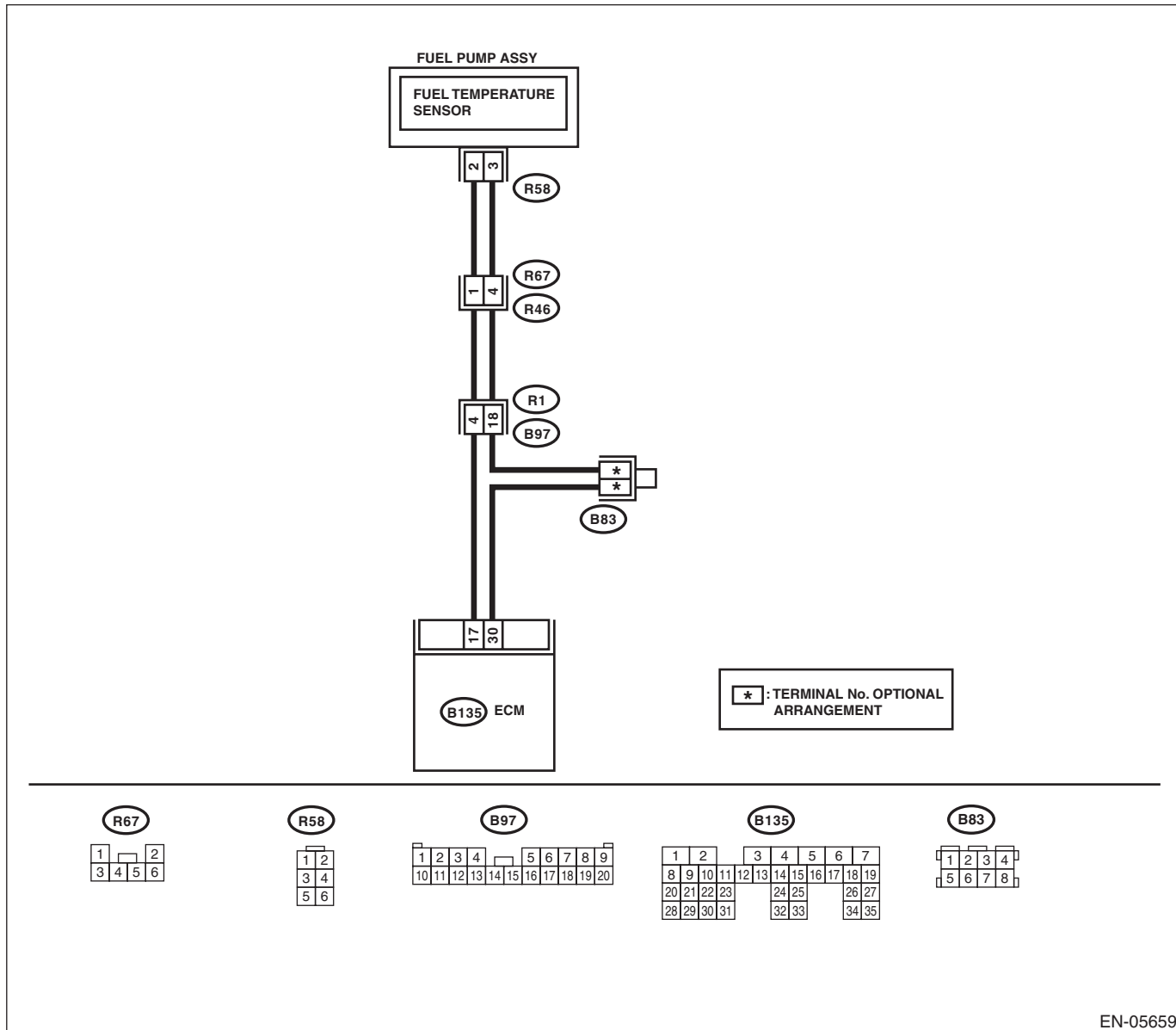
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-93, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the fuel temperature sensor. <Ref. to EC(H6DO)-9, Fuel Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BF:DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT

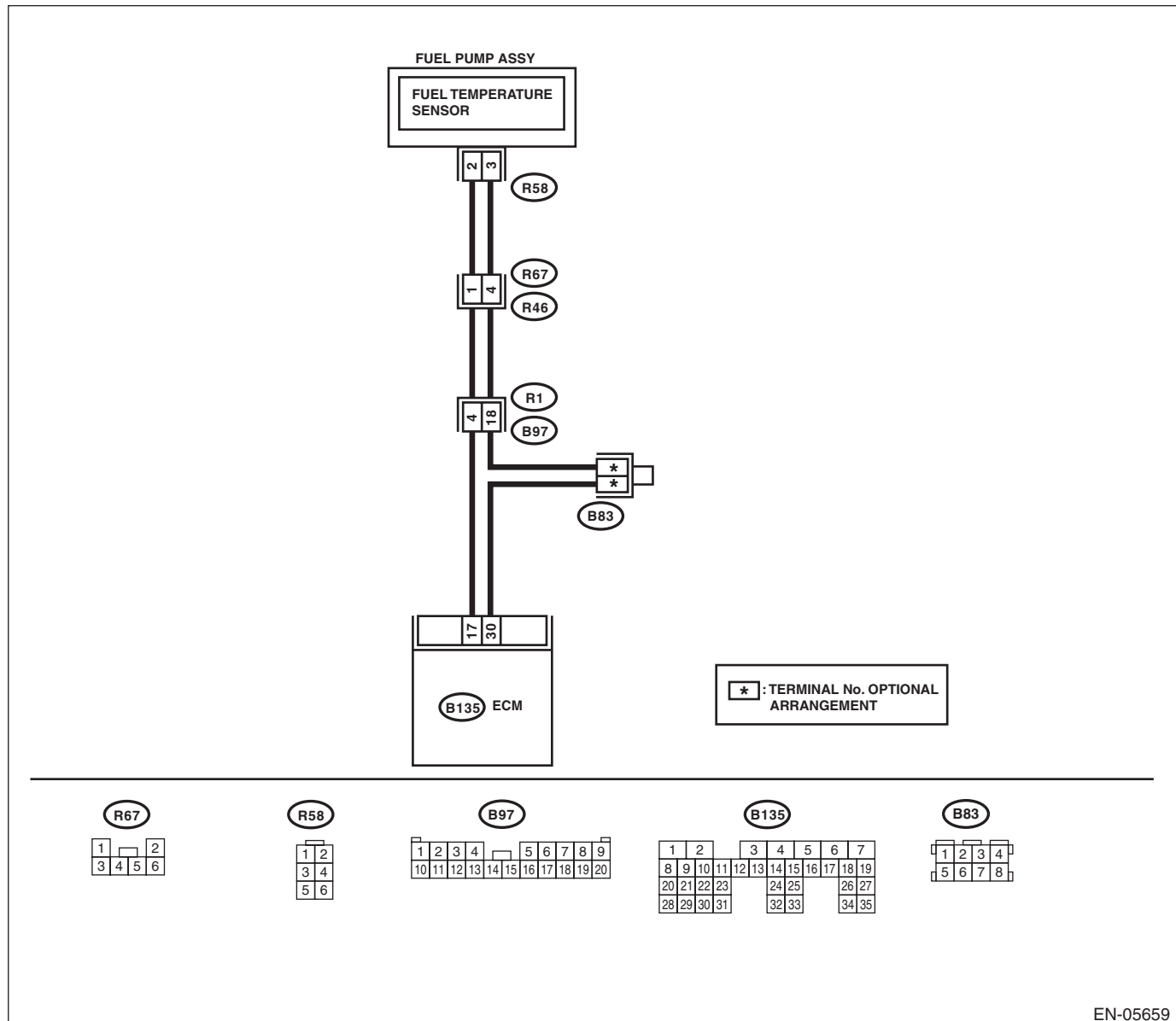
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-96, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of fuel temperature sensor signal using Subaru Select Monitor.</p> <p>NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p>	Is the temperature 120°C (248°F) or higher?	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE: In this case, there may be a temporary connector contact failure.</p>
2	<p><b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM and fuel temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B135) No. 17 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the fuel temperature sensor. <Ref. to EC(H6DO)-9, Fuel Temperature Sensor.>	Repair the ground short circuit of harness between ECM and fuel pump.



## BG:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

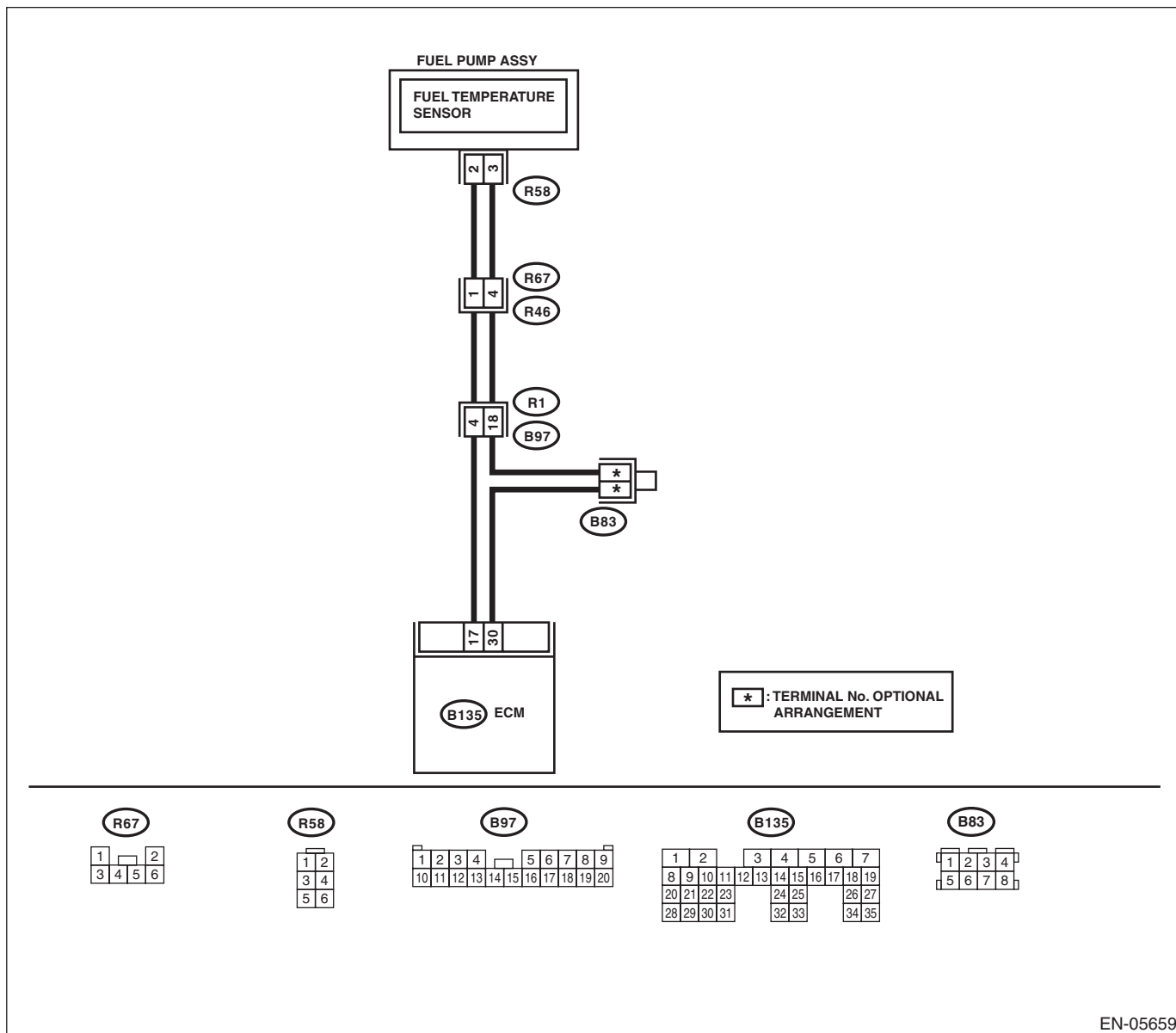
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-98, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read the data of fuel temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ )?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
<b>2</b> <b>CHECK POOR CONTACT.</b> Repair any poor contact between the ECM and fuel temperature sensor connectors.	Is there poor contact in the ECM or fuel temperature sensor connectors?	Repair any poor contact between the ECM and fuel temperature sensor connectors.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and fuel temperature sensor. 3) Measure the resistance of the harness between the ECM and fuel temperature sensor connector. <i>Connector &amp; terminal</i> <i>(B135) No. 17 — (R58) No. 2:</i> <i>(B135) No. 30 — (R58) No. 3:</i>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of the harness between the ECM and fuel temperature sensor connector.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 17 (+) — Chassis ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and fuel temperature sensor connector.	Replace the fuel temperature sensor. <Ref. to EC(H6DO)-9, Fuel Temperature Sensor.>

## BH:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/ PERFORMANCE

**DTC DETECTING CONDITION:**

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-100, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

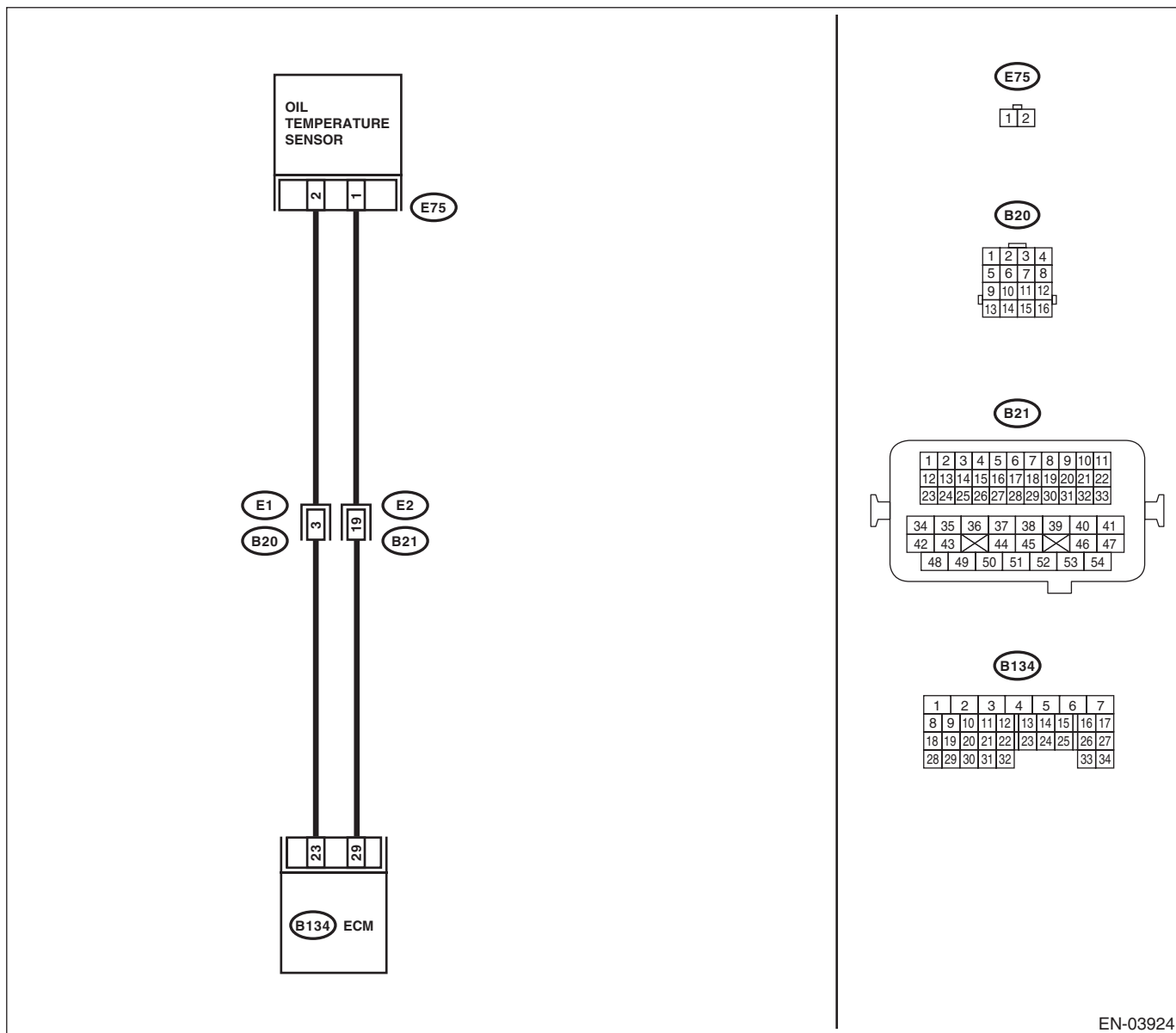
**TROUBLE SYMPTOM:**

- Hard to start
- Improper idling
- Poor driving performance

**CAUTION:**

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



EN-03924

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the oil temperature sensor. <Ref. to FU(H6DO)-30, Oil Temperature Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BI: DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-102, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

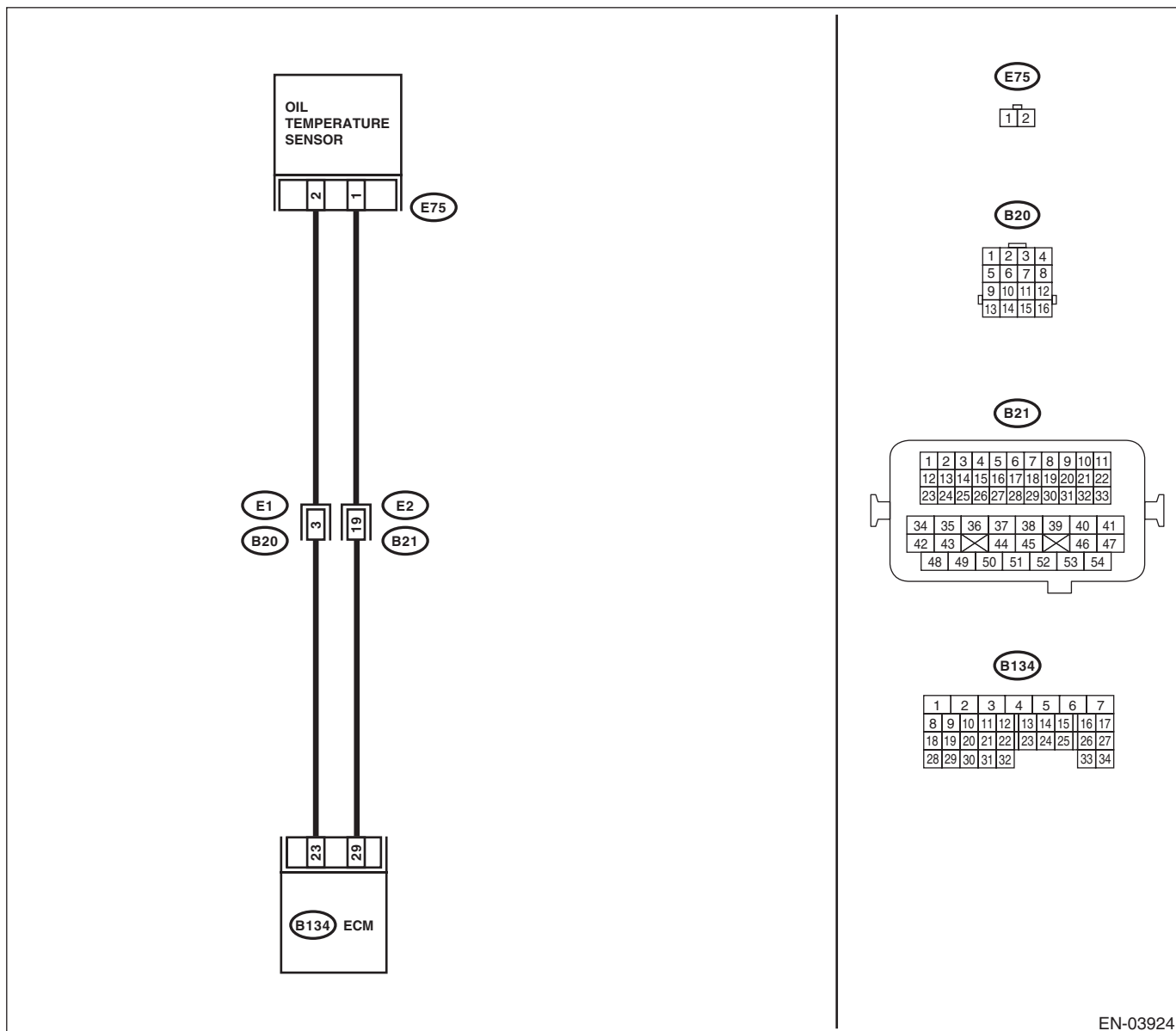
TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-03924

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the oil temperature 215°C (419°F) or more?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and oil temperature sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 23 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the oil temperature sensor. &lt;Ref. to FU(H6DO)-30, Oil Temperature Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and oil temperature sensor.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BJ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-103, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

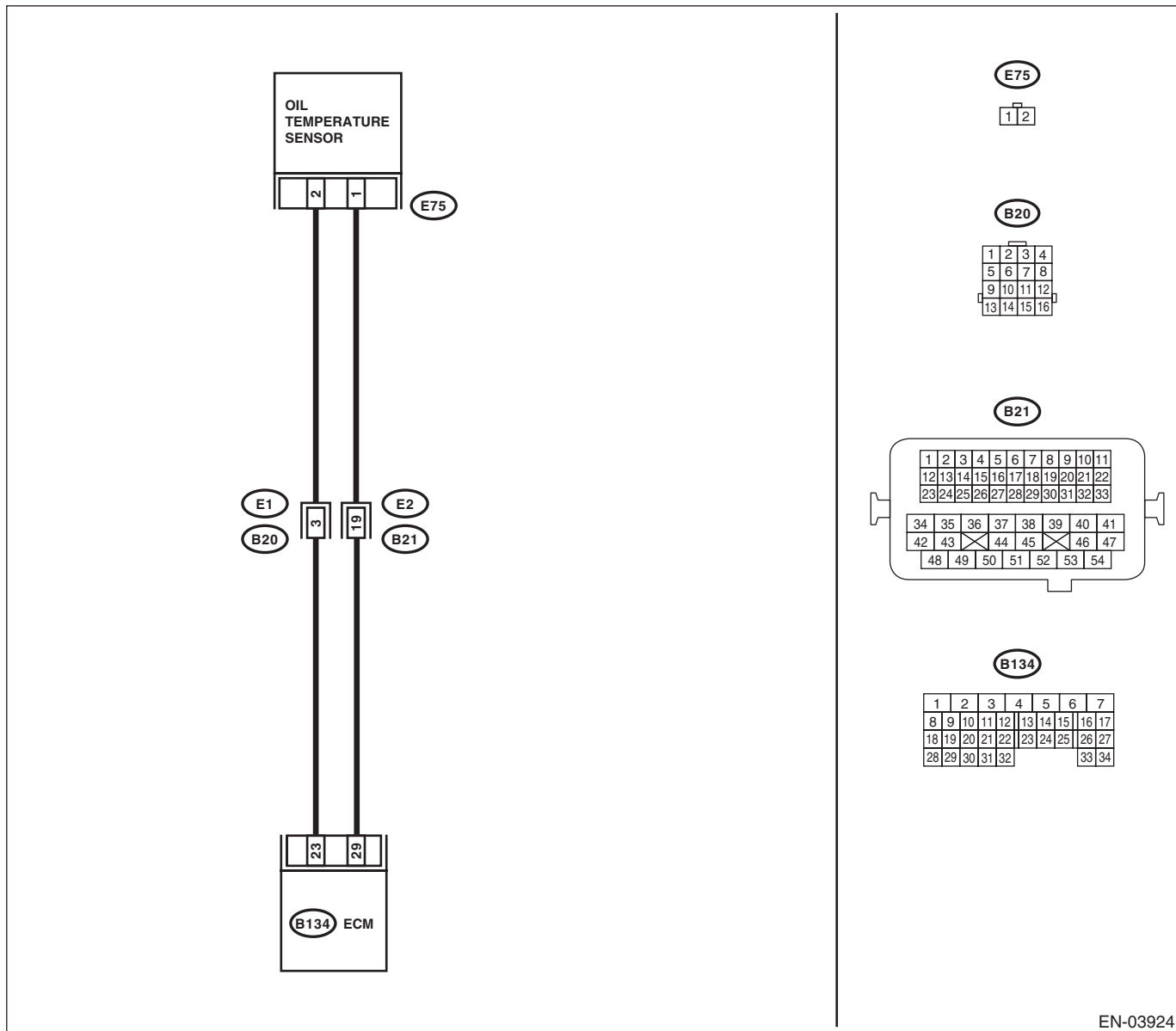
### TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03924

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK CURRENT DATA.</b></p> <p>1) Start the engine.</p> <p>2) Read the data of the oil temperature sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the oil temperature less than $-40^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ )?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. NOTE: In this case, there may be a temporary connector contact failure.
2	<p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the ECM and oil temperature sensor connector.</p>	Is there poor contact in the ECM or oil temperature sensor connector?	Repair the poor contact in the ECM or the oil temperature sensor connector.	Go to step 3.
3	<p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and oil temperature sensor.</p> <p>3) Measure the resistance of the harness between the ECM and oil temperature sensor connector.</p> <p><b>Connector &amp; terminal</b> (B134) No. 23 — (E75) No. 2: (B134) No. 29 — (E75) No. 1:</p>	Is the resistance less than $1\ \Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and oil temperature sensor connector.
4	<p><b>CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON.</p> <p>3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> (B134) No. 23 (+) — Chassis ground (-):</p>	Is the voltage 5 V or more?	Repair the short circuit to power supply in the harness between the ECM and oil temperature sensor connector.	Replace the oil temperature sensor. <Ref. to FU(H6DO)-30, Oil Temperature Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BK:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-104, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

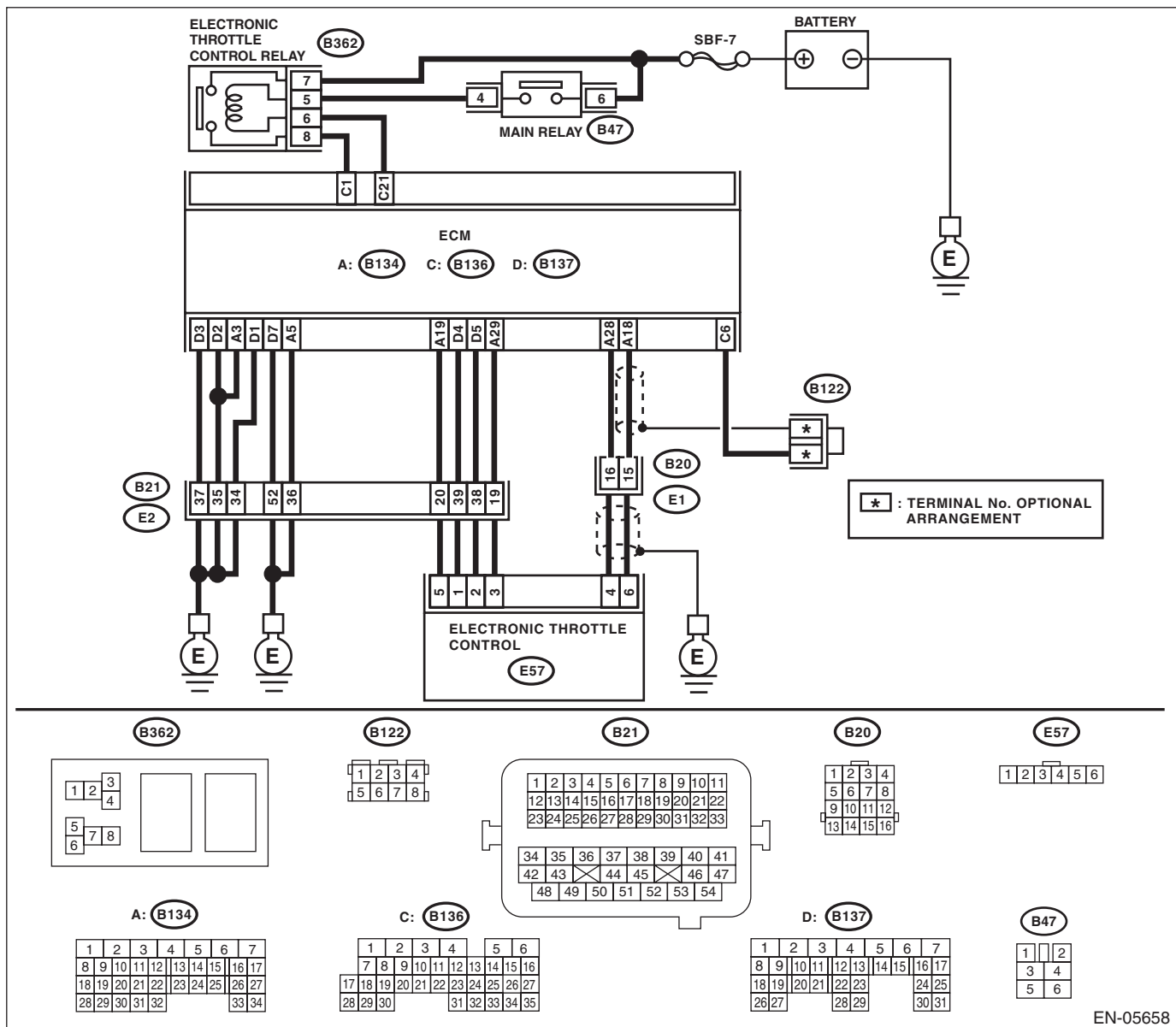
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from ECM and electronic throttle control.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 28 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the connector to ECM.</p> <p>2) Measure the resistance between electronic throttle control connector and engine ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E57) No. 4 — Engine ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the electronic throttle control. &lt;Ref. to FU(H6DO)-12, Throttle Body.&gt;</p>	<p>Repair the ground short circuit of harness between ECM and electronic throttle control connector.</p> <p>Replace the ECM if defective. &lt;Ref. to FU(H6DO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BL:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-106, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

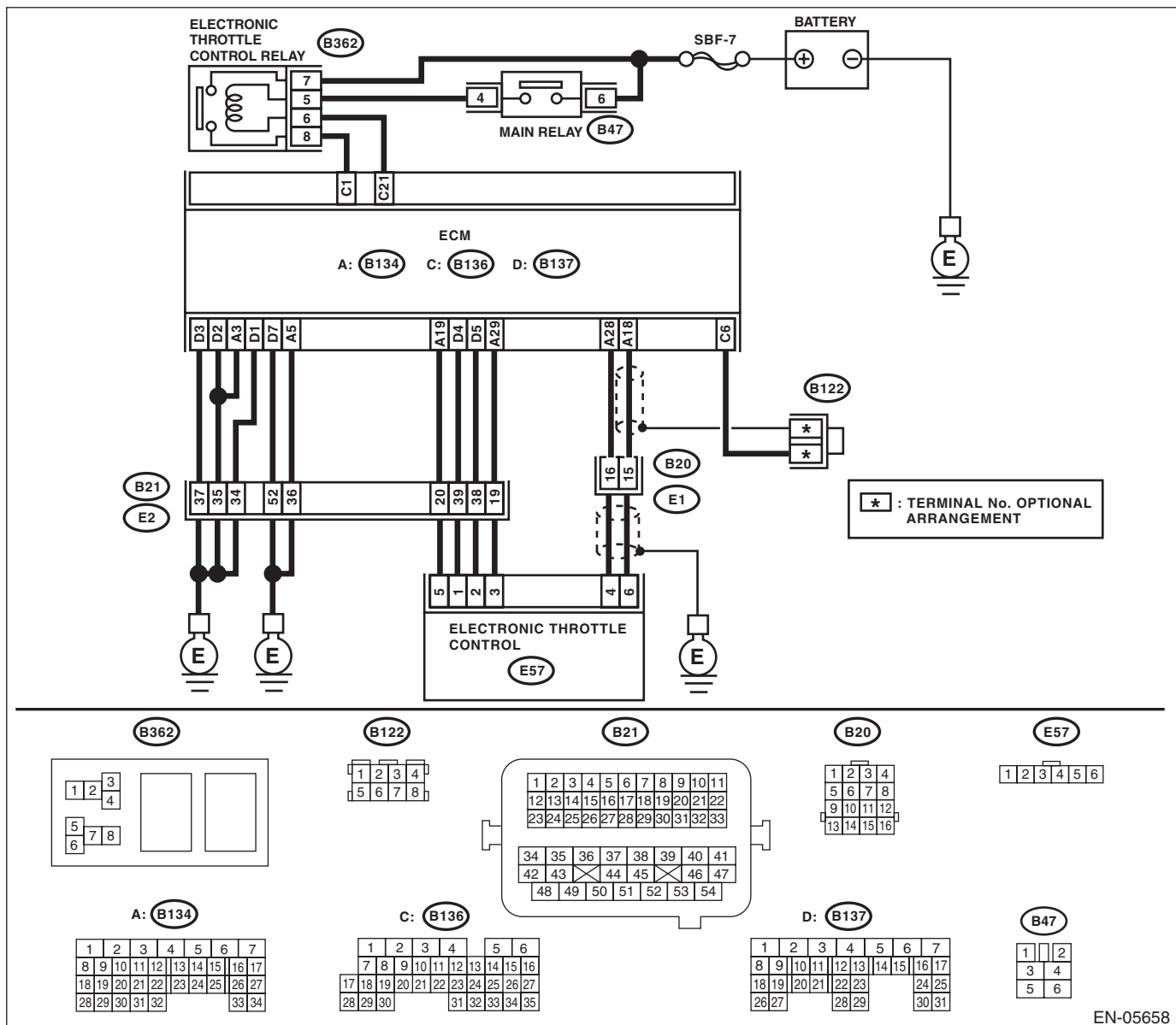
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

## BM:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

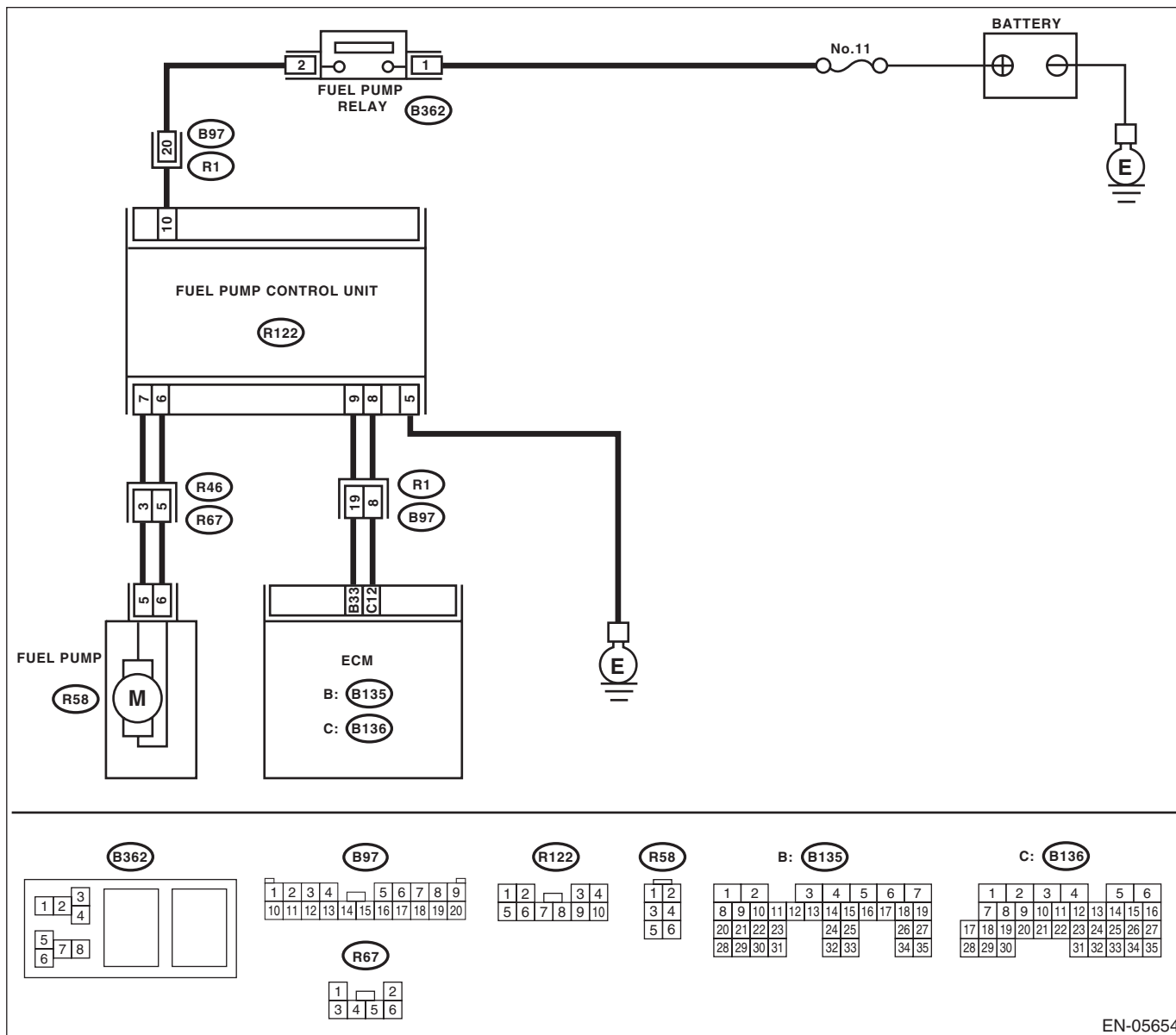
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-108, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05654

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY CIRCUIT TO FUEL PUMP CONTROL UNIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel pump control unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 10 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	<p>Repair the power supply circuit.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open or ground short circuit of harness between fuel pump relay and fuel pump control unit</li> <li>• Poor contact of fuel pump control unit connector</li> <li>• Poor contact of fuel pump relay connector</li> </ul>
<p><b>2</b></p> <p><b>CHECK GROUND CIRCUIT OF FUEL PUMP CONTROL UNIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 5 — Chassis ground:</b></p>	Is the resistance less than 5 $\Omega$ ?	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit between fuel pump control unit and chassis ground</li> <li>• Poor contact of fuel pump control unit connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.</b></p> <p>1) Disconnect the connector from fuel pump. 2) Measure the resistance of harness between fuel pump control unit and fuel pump connector.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 7 — (R58) No. 5:</b> <b>(R122) No. 6 — (R58) No. 6:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit between fuel pump control unit and fuel pump.
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.</b></p> <p>Measure the resistance between fuel pump control unit and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(R122) No. 7 — Chassis ground:</b> <b>(R122) No. 6 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between fuel pump control unit and fuel pump.
<p><b>5</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT.</b></p> <p>1) Disconnect the connectors from the ECM. 2) Measure the resistance of the harness between the ECM and fuel pump control unit.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 12 — (R122) No. 8:</b> <b>(B135) No. 33 — (R122) No. 9:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit between the ECM and fuel pump control unit</li> <li>• Poor contact between ECM and fuel pump control unit</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>6</b> <b>CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT.</b> Measure the resistance between fuel pump control unit and chassis ground. <b>Connector &amp; terminal</b> <b>(R122) No. 8 — Chassis ground:</b> <b>(R122) No. 9 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and fuel pump control unit.
<b>7</b> <b>CHECK POOR CONTACT.</b> Check poor contact of ECM and fuel pump control unit connector.	Is there poor contact of ECM and fuel pump control unit connector?	Repair the poor contact of ECM and fuel pump control unit connector.	Go to step 8.
<b>8</b> <b>CHECK EXPERIENCE OF RUNNING OUT OF FUEL.</b>	Has the vehicle experienced running out of fuel?	Finish the diagnosis. NOTE: DTC may be recorded as a result of fuel pump idling while running out of fuel.	Replace the fuel pump control unit. <Ref. to FU(H6DO)-41, Fuel Pump Control Unit.>

## **BN:DTC P0301 CYLINDER 1 MISFIRE DETECTED**

NOTE:

For the diagnostic procedure, refer to DTC P0306. <Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **BO:DTC P0302 CYLINDER 2 MISFIRE DETECTED**

NOTE:

For the diagnostic procedure, refer to DTC P0306. <Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **BP:DTC P0303 CYLINDER 3 MISFIRE DETECTED**

NOTE:

For the diagnostic procedure, refer to DTC P0306. <Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **BQ:DTC P0304 CYLINDER 4 MISFIRE DETECTED**

NOTE:

For the diagnostic procedure, refer to DTC P0306. <Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **BR:DTC P0305 CYLINDER 5 MISFIRE DETECTED**

NOTE:

For the diagnostic procedure, refer to DTC P0306. <Ref. to EN(H6DO)(diag)-212, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BS:DTC P0306 CYLINDER 6 MISFIRE DETECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-115, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

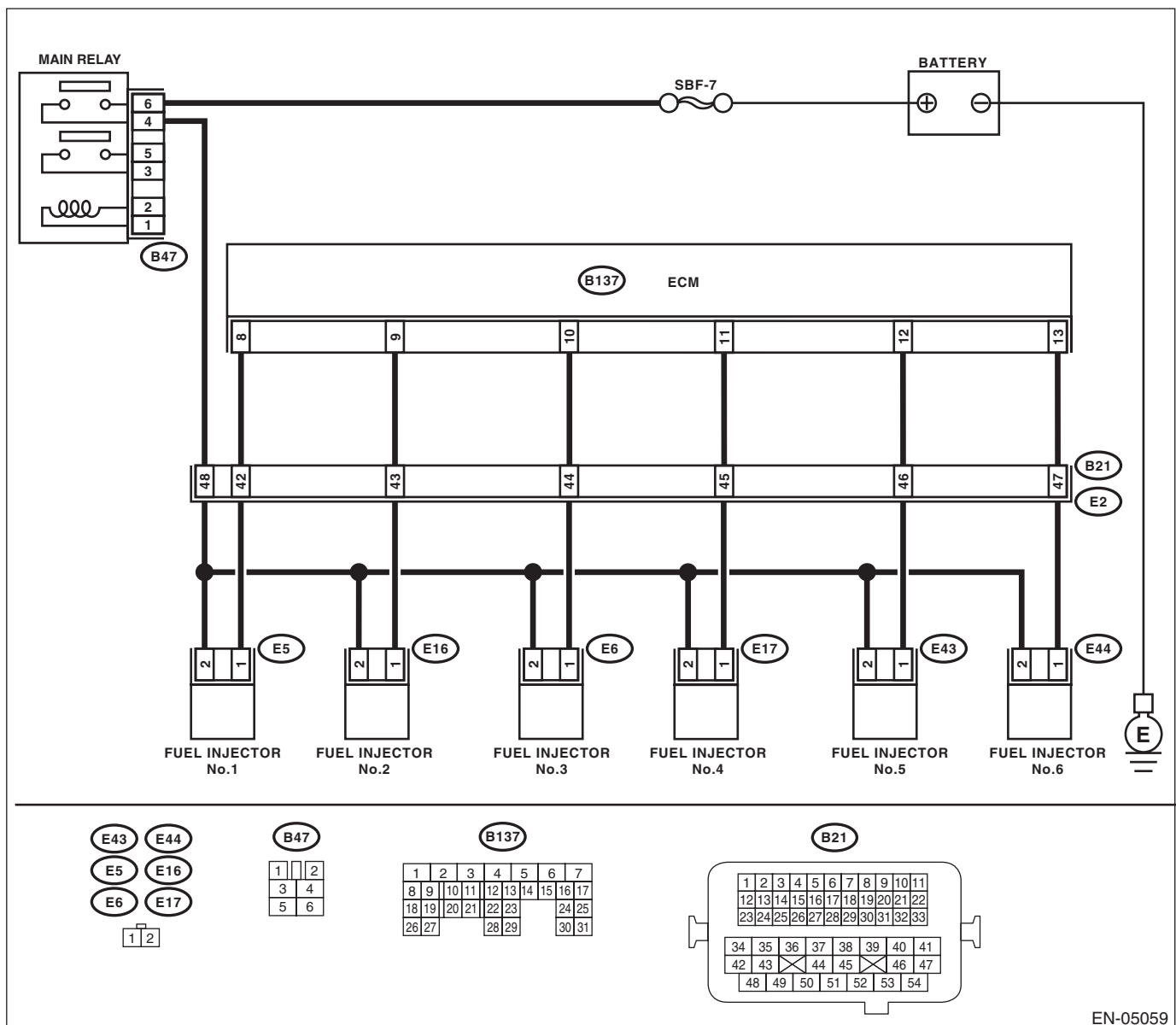
### TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling
- Rough driving

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05059



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (B137) No. 8 (+) — Chassis ground (-):</i> <i>#2 (B137) No. 9 (+) — Chassis ground (-):</i> <i>#3 (B137) No. 10 (+) — Chassis ground (-):</i> <i>#4 (B137) No. 11 (+) — Chassis ground (-):</i> <i>#5 (B137) No. 12 (+) — Chassis ground (-):</i> <i>#6 (B137) No. 13 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 6.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (E5) No. 1 — Engine ground:</i> <i>#2 (E16) No. 1 — Engine ground:</i> <i>#3 (E6) No. 1 — Engine ground:</i> <i>#4 (E17) No. 1 — Engine ground:</i> <i>#5 (E43) No. 1 — Engine ground:</i> <i>#6 (E44) No. 1 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and fuel injector.
<b>3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> Measure the resistance of harness between the ECM and fuel injector on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (B137) No. 8 — (E5) No. 1:</i> <i>#2 (B137) No. 9 — (E16) No. 1:</i> <i>#3 (B137) No. 10 — (E6) No. 1:</i> <i>#4 (B137) No. 11 — (E17) No. 1:</i> <i>#5 (B137) No. 12 — (E43) No. 1:</i> <i>#6 (B137) No. 13 — (E44) No. 1:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and fuel injector connector • Poor contact of coupling connector
<b>4 CHECK FUEL INJECTOR.</b> Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <i>No. 1 — No. 2:</i>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 5.	Replace the faulty fuel injector. <Ref. to FU(H6DO)-27, Fuel Injector.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK POWER SUPPLY LINE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (E5) No. 2 (+) — Engine ground (-):</i> <i>#2 (E16) No. 2 (+) — Engine ground (-):</i> <i>#3 (E6) No. 2 (+) — Engine ground (-):</i> <i>#4 (E17) No. 2 (+) — Engine ground (-):</i> <i>#5 (E43) No. 2 (+) — Engine ground (-):</i> <i>#6 (E44) No. 2 (+) — Engine ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and fuel injector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>
<b>6 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <i>#1 (B137) No. 8 (+) — Chassis ground (-):</i> <i>#2 (B137) No. 9 (+) — Chassis ground (-):</i> <i>#3 (B137) No. 10 (+) — Chassis ground (-):</i> <i>#4 (B137) No. 11 (+) — Chassis ground (-):</i> <i>#5 (B137) No. 12 (+) — Chassis ground (-):</i> <i>#6 (B137) No. 13 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 7.
<b>7 CHECK FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <i>No. 1 — No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H6DO)-27, Fuel Injector.>	Go to step 8.
<b>8 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 9.
<b>9 CHECK CRANK PLATE.</b>	Is the crank sprocket rusted or the teeth of crank plate broken?	Replace the crank plate. <Ref. to ME(H6DO)-64, Cylinder Block.>	Go to step 10.
<b>10 CHECK INSTALLATION CONDITION OF TIMING CHAIN.</b> Turn the crankshaft using ST, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000      CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H6DO)-44, Timing Chain Assembly.>	Go to step 11.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
11	<b>CHECK FUEL LEVEL.</b>	Is the fuel meter indication lower than the "Lower" level?	Replenish fuel so that fuel meter indication is higher than the "Lower" level. After replenishing fuel, Go to step 13.	Go to step 12.
12	<b>CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.</b> 1) Clear the memory using the Subaru Select Monitor or general scan tool. NOTE: <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual. 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step 14.	Go to step 13.
13	<b>CHECK CAUSE OF MISFIRE.</b>	Has the cause of misfire been detected while running the engine?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Poor contact of ignition coil connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
14	<b>CHECK AIR INTAKE SYSTEM.</b>	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Are there air leaks or air suction caused by loose or dislocated nuts and bolts?</li> <li>• Are there cracks or any disconnection of hoses?</li> </ul>	Go to step 15.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>15 CHECK MISFIRE SYMPTOM.</b> 1) Turn the ignition switch to ON. 2) Read the DTC. <b>NOTE:</b> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> For detailed operation procedures, refer to the general scan tool operation manual.	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step 21.	Go to step 16.
<b>16 CHECK ANY OTHER DTC ON DISPLAY.</b>	Are DTCs P0301 and P0302 displayed?	Go to step 22.	Go to step 17.
<b>17 CHECK DTC ON DISPLAY.</b>	Are DTCs P0303 and P0304 displayed?	Go to step 23.	Go to step 18.
<b>18 CHECK DTC ON DISPLAY.</b>	Are DTC P0305 and P0306 displayed?	Go to step 24.	Go to step 19.
<b>19 CHECK DTC ON DISPLAY.</b>	Are DTC P0301, P0303 and P0305 displayed?	Go to step 25.	Go to step 20.
<b>20 CHECK DTC ON DISPLAY.</b>	Are DTC P0302, P0304 and P0306 displayed?	Go to step 26.	Go to step 27.
<b>21 ONLY ONE CYLINDER.</b>	Is there any fault in the cylinder?	Repair or replace faulty parts. <b>NOTE:</b> Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>
<b>22 GROUP OF #1 AND #2 CYLINDERS.</b>	Are there any faults in #1 and #2 cylinders?	Repair or replace faulty parts. <b>NOTE:</b> <ul style="list-style-type: none"> <li>• Check the following items.               <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> </li> <li>• If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. &lt;Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.&gt;</li> </ul>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>23</b> <b>GROUP OF #3 AND #4 CYLINDERS.</b>	Are there any faults in #3 and #4 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>
<b>24</b> <b>GROUP OF #5 AND #6 CYLINDERS.</b>	Are there any faults in #5 and #6 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Ignition coil</li> <li>• Compression ratio</li> </ul> • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #5 and #6 cylinders side. <Ref. to EN(H6DO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>
<b>25</b> <b>GROUP OF #1, #3 AND #5 CYLINDERS.</b>	Is there any fault in #1, #3 and #5 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing chain teeth</li> </ul>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>26</b> <b>GROUP OF #2, #4 AND #6 CYLINDERS.</b>	Is there any fault in #2, #4 and #6 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> <li>• Skipping timing chain teeth</li> </ul>	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>
<b>27</b> <b>CYLINDER AT RANDOM.</b>	Is the engine idle rough?	Check DTC P0171, P0172, P0174 or P0175 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. <ul style="list-style-type: none"> <li>• Spark plug</li> <li>• Fuel injector</li> <li>• Compression ratio</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BT:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-116, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

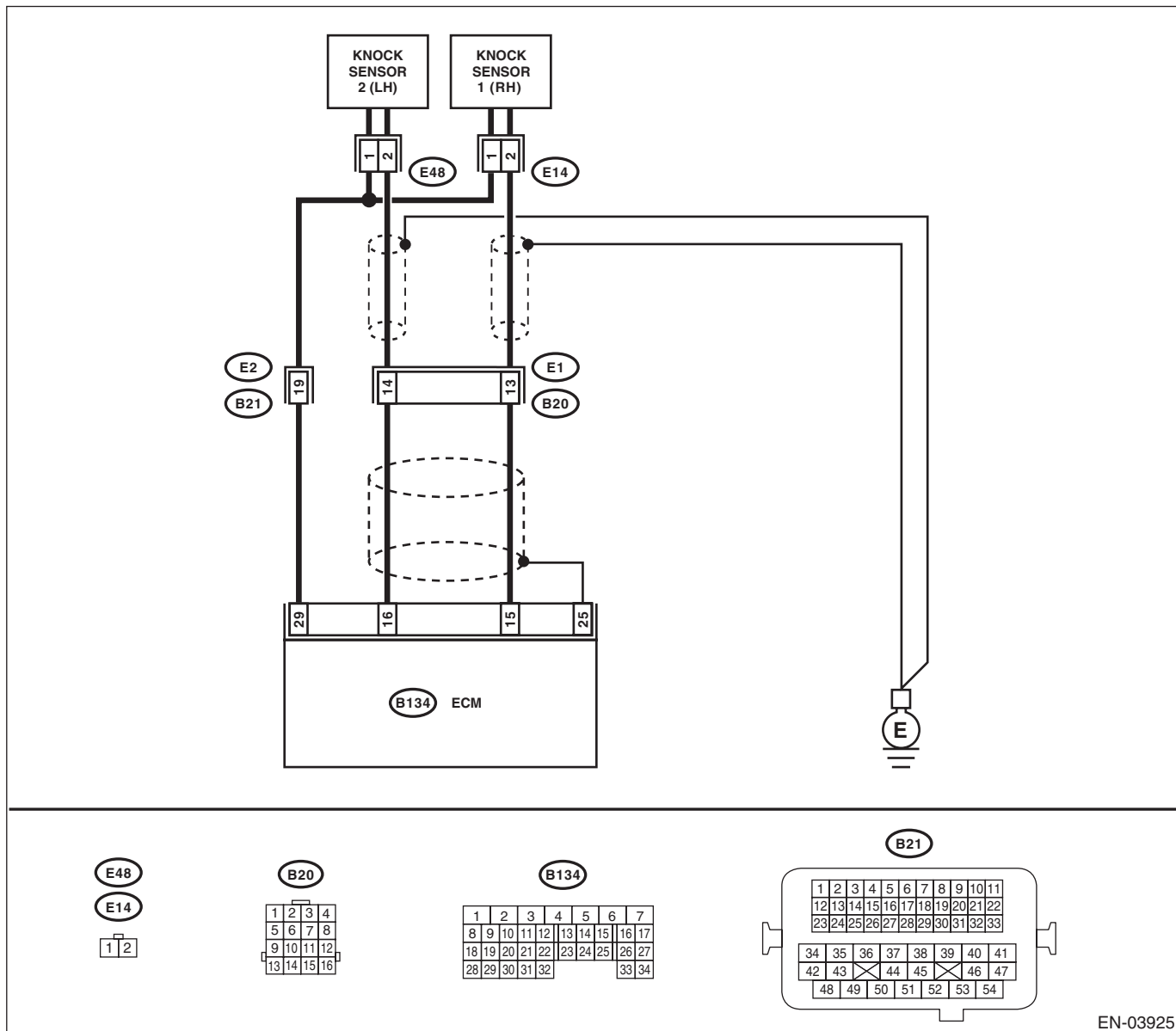
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03925

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 15 — (B134) No. 29:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair poor contact of the ECM connector.</p>
2	<p><b>CHECK KNOCK SENSOR.</b></p> <p>1) Disconnect the connector from knock sensor.</p> <p>2) Measure the resistance between knock sensor terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H6DO)-22, Knock Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and knock sensor</li> <li>• Poor contact of the knock sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BU:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-118, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

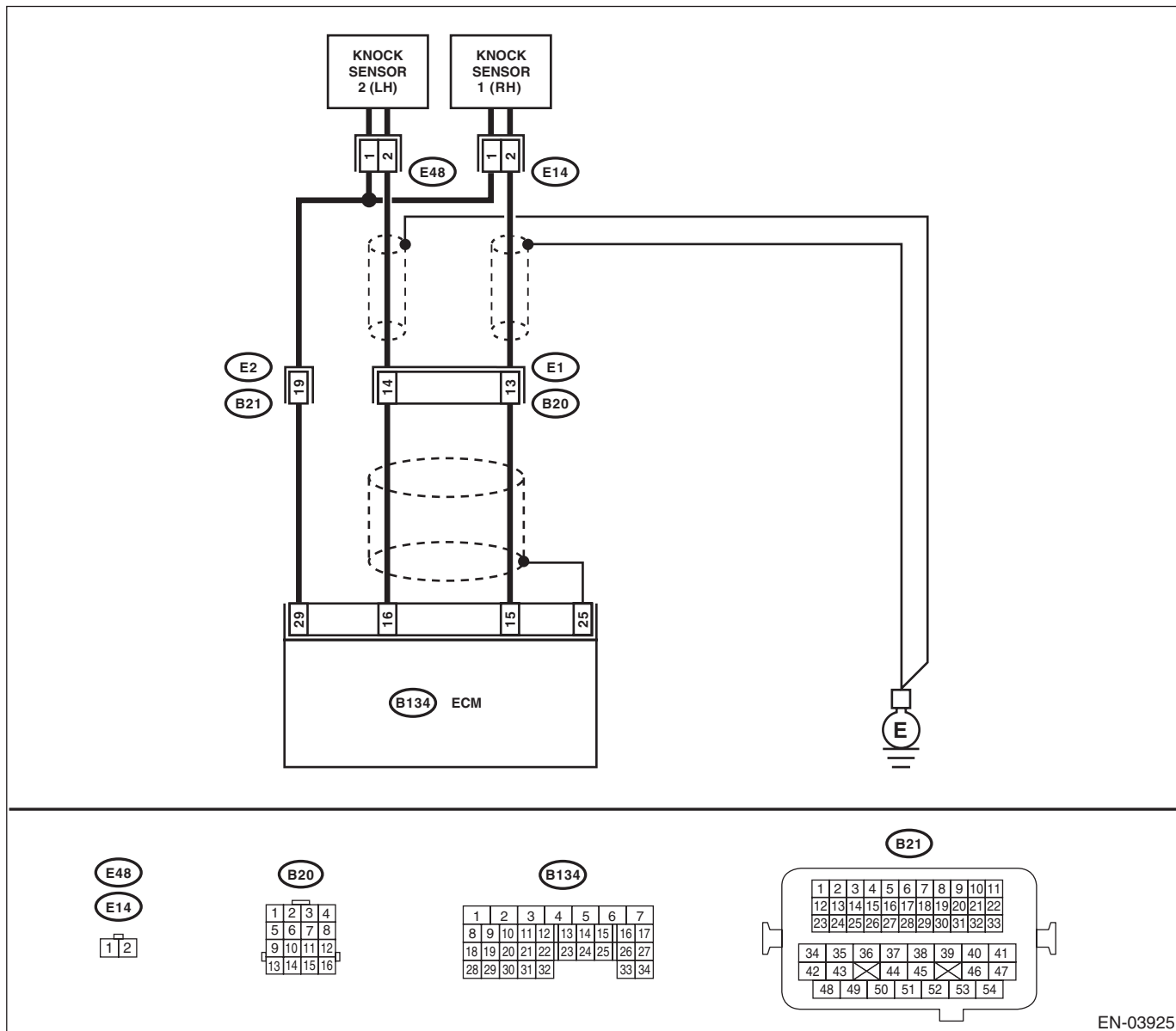
### TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03925

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 15 — (B134) No. 29:</b></i>	Is the resistance less than 500 kΩ?	Go to step 2.	Go to step 3.
<b>2</b> <b>CHECK KNOCK SENSOR.</b> 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connectors. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance less than 500 kΩ?	Replace the knock sensor. <Ref. to FU(H6DO)-22, Knock Sensor.>	Repair the ground short circuit of harness between the ECM and knock sensor connector.  NOTE: The harness between both connectors are shielded. Remove the shield and repair the short circuit of the harness circuit.
<b>3</b> <b>CHECK INPUT SIGNAL OF ECM.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B134) No. 15 (+) — Chassis ground (-):</b></i>	Is the voltage 2 V or more?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BV:DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-119, DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

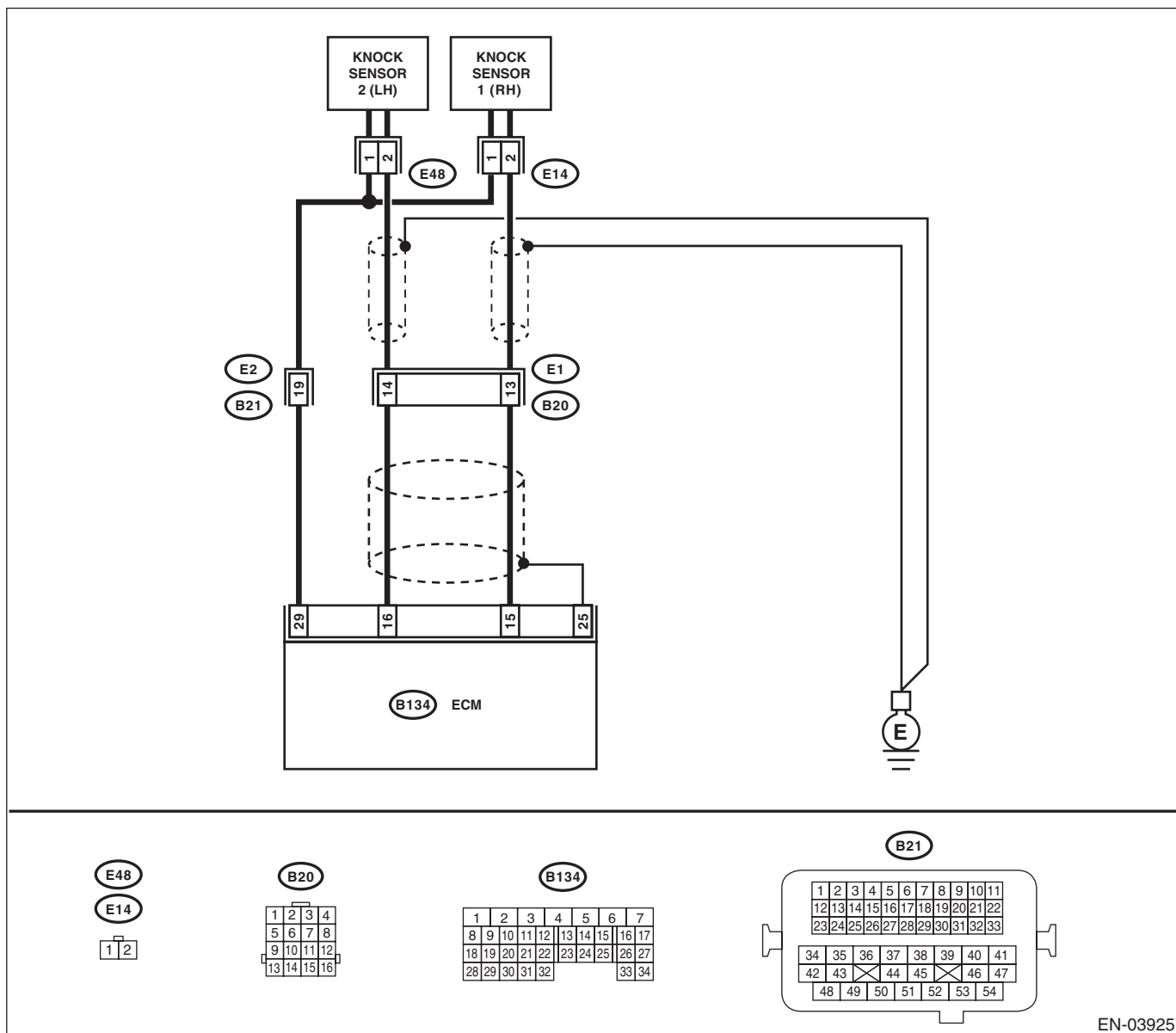
### TROUBLE SYMPTOM:

- Driving performance problem
- Knocking is occurred.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03925

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from the ECM.</p> <p>3) Measure the resistance between ECM connectors.</p> <p><b>Connector &amp; terminal</b> <b>(B134) No. 16 — (B134) No. 29:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair poor contact of the ECM connector.</p>
<p><b>2</b></p> <p><b>CHECK KNOCK SENSOR.</b></p> <p>1) Disconnect the connector from knock sensor.</p> <p>2) Measure the resistance between knock sensor terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance 600 kΩ or more?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H6DO)-22, Knock Sensor.&gt;</p>	<p>Repair the harness and connector.</p> <p><b>NOTE:</b> In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and knock sensor</li> <li>• Poor contact of the knock sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BW:DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-119, DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

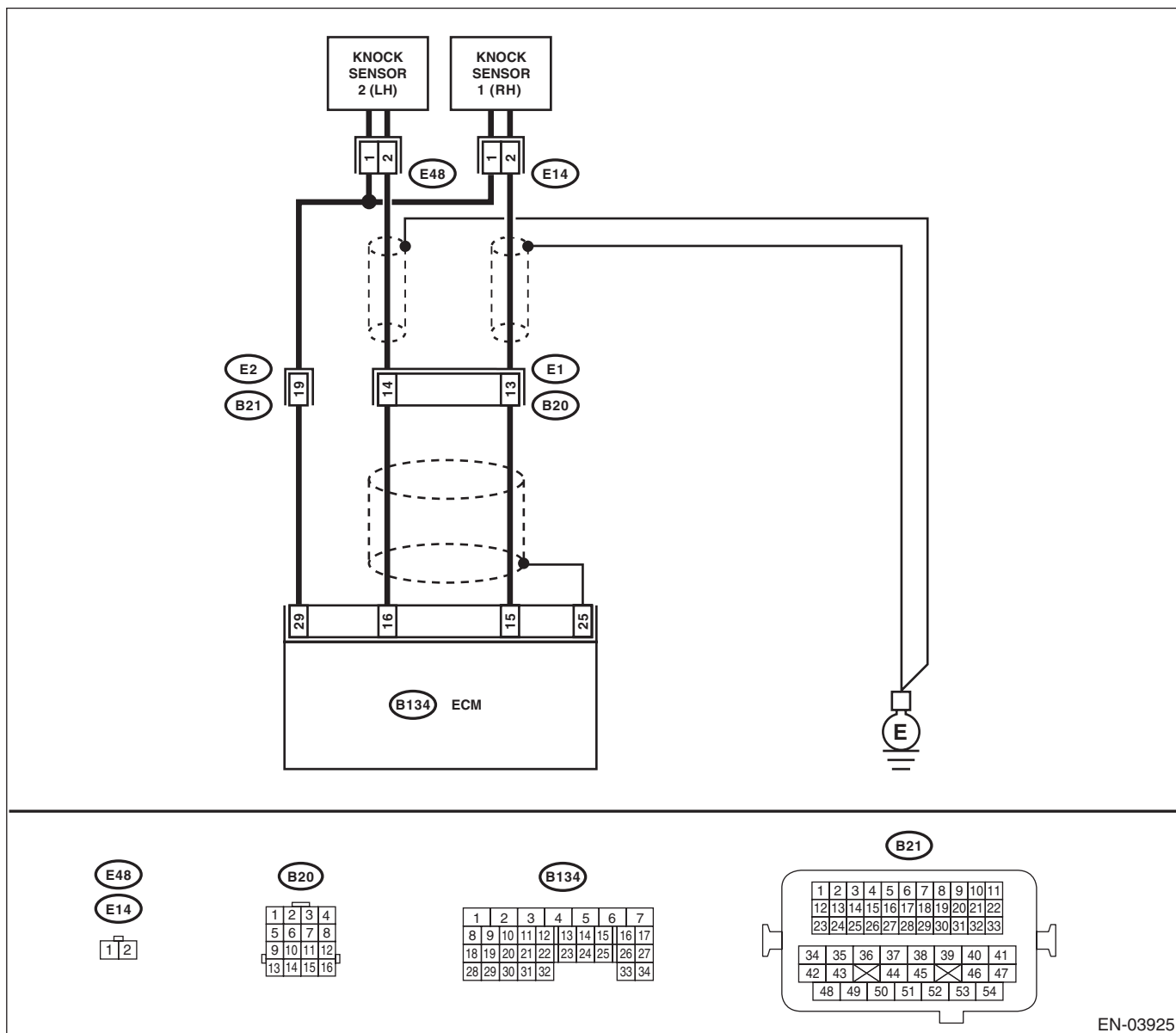
### TROUBLE SYMPTOM:

- Driving performance problem
- Knocking occurs.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03925

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>      <b>CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B134) No. 16 — (B134) No. 29:</b></p>	<p>Is the resistance less than 500 k<math>\Omega</math>?</p>	<p>Go to step 2.</p>	<p>Go to step 3.</p>
<p><b>2</b>      <b>CHECK KNOCK SENSOR.</b>            1) Disconnect the connector from knock sensor.            2) Measure the resistance between knock sensor connectors.  <b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	<p>Is the resistance less than 500 k<math>\Omega</math>?</p>	<p>Replace the knock sensor. &lt;Ref. to FU(H6DO)-22, Knock Sensor.&gt;</p>	<p>Repair the ground short circuit of harness between the ECM and knock sensor connector.  <b>NOTE:</b>            The harness between both connectors are shielded. Remove the shield and repair the short circuit of the harness circuit.</p>
<p><b>3</b>      <b>CHECK INPUT SIGNAL OF ECM.</b>            1) Connect the connector to ECM.            2) Turn the ignition switch to ON.            3) Measure the voltage between ECM and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B134) No. 16 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 2 V or more?</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  <b>NOTE:</b>            In this case, there may be a temporary connector contact failure.</p>	<p>Repair poor contact of the ECM connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BX:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-120, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

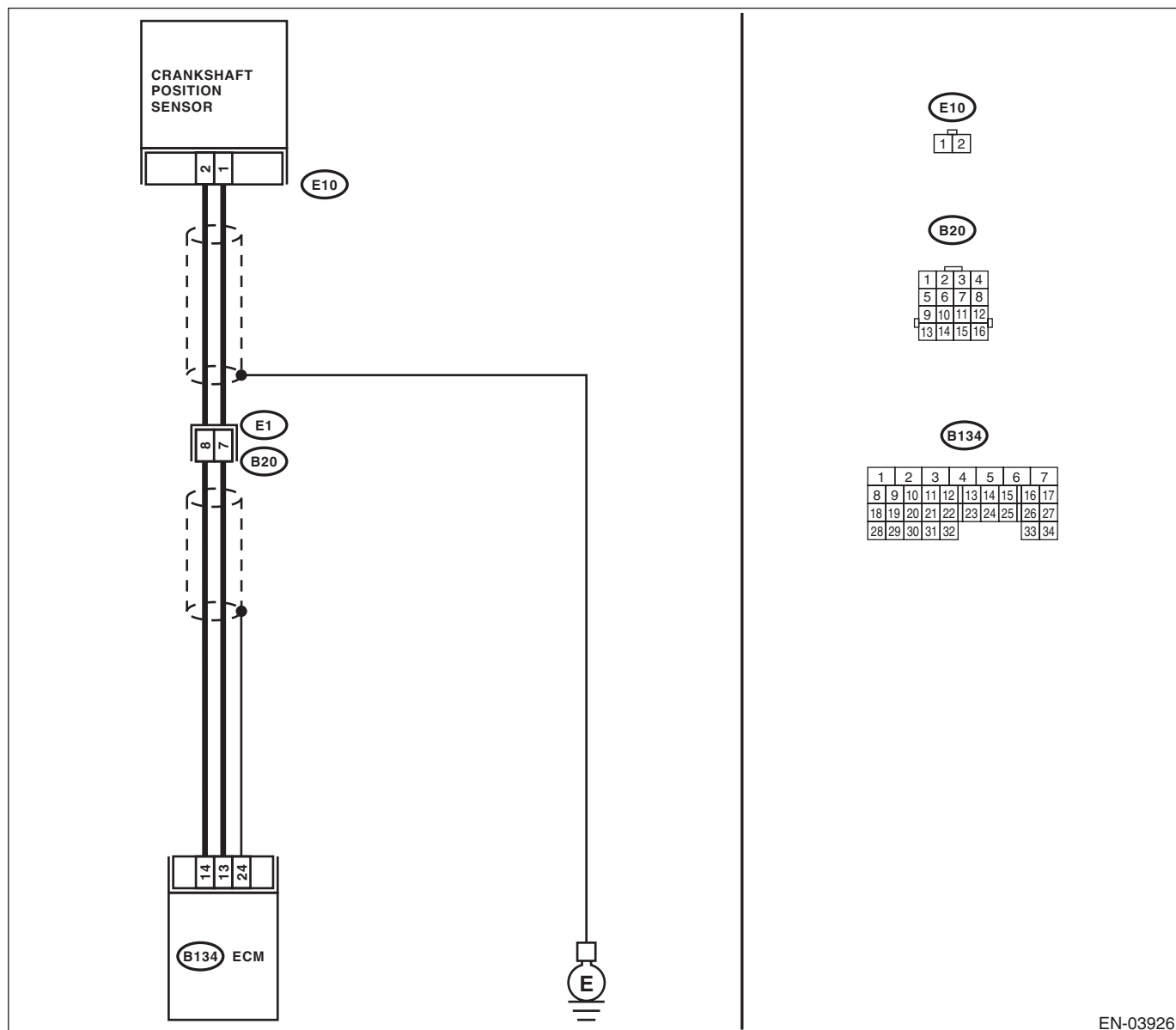
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.</b>	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.	Tighten the crankshaft position sensor installation bolt securely.
<b>2</b> <b>CHECK CRANKSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the crankshaft position sensor. 3) Measure the resistance between connector terminals of crankshaft position sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 1 — 4 k $\Omega$ ?	Go to step 3.	Replace the crankshaft position sensor. <Ref. to FU(H6DO)-20, Crankshaft Position Sensor.>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND CRANK SHAFT POSITION SENSOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between the ECM and crankshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 13 — (E10) No. 1:</b> <b>(B134) No. 14 — (E10) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM and crankshaft position sensor connector.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and crankshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BY:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/ PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-122, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

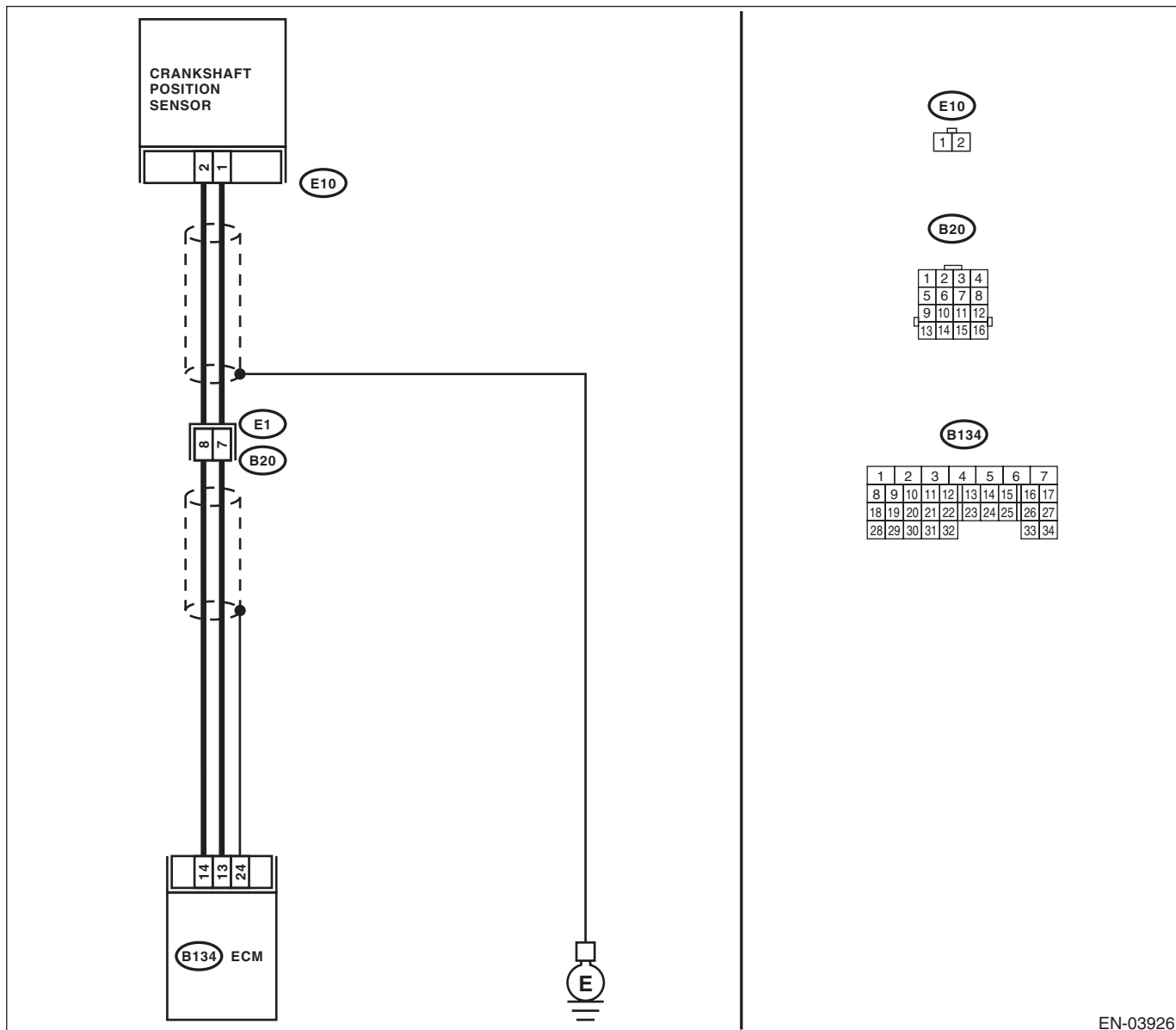
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03926

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.</b> Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 2.	Tighten the crankshaft position sensor installation bolt securely.
<b>2</b> <b>CHECK CRANKSHAFT PLATE.</b>	Are the crankshaft plate teeth cracked or damaged?	Replace the crankshaft plate.	Go to step 3.
<b>3</b> <b>CHECK INSTALLATION CONDITION OF TIMING CHAIN.</b> Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000      CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H6DO)-44, Timing Chain Assembly.>	Replace the crankshaft position sensor. <Ref. to FU(H6DO)-20, Crankshaft Position Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## BZ:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-124, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

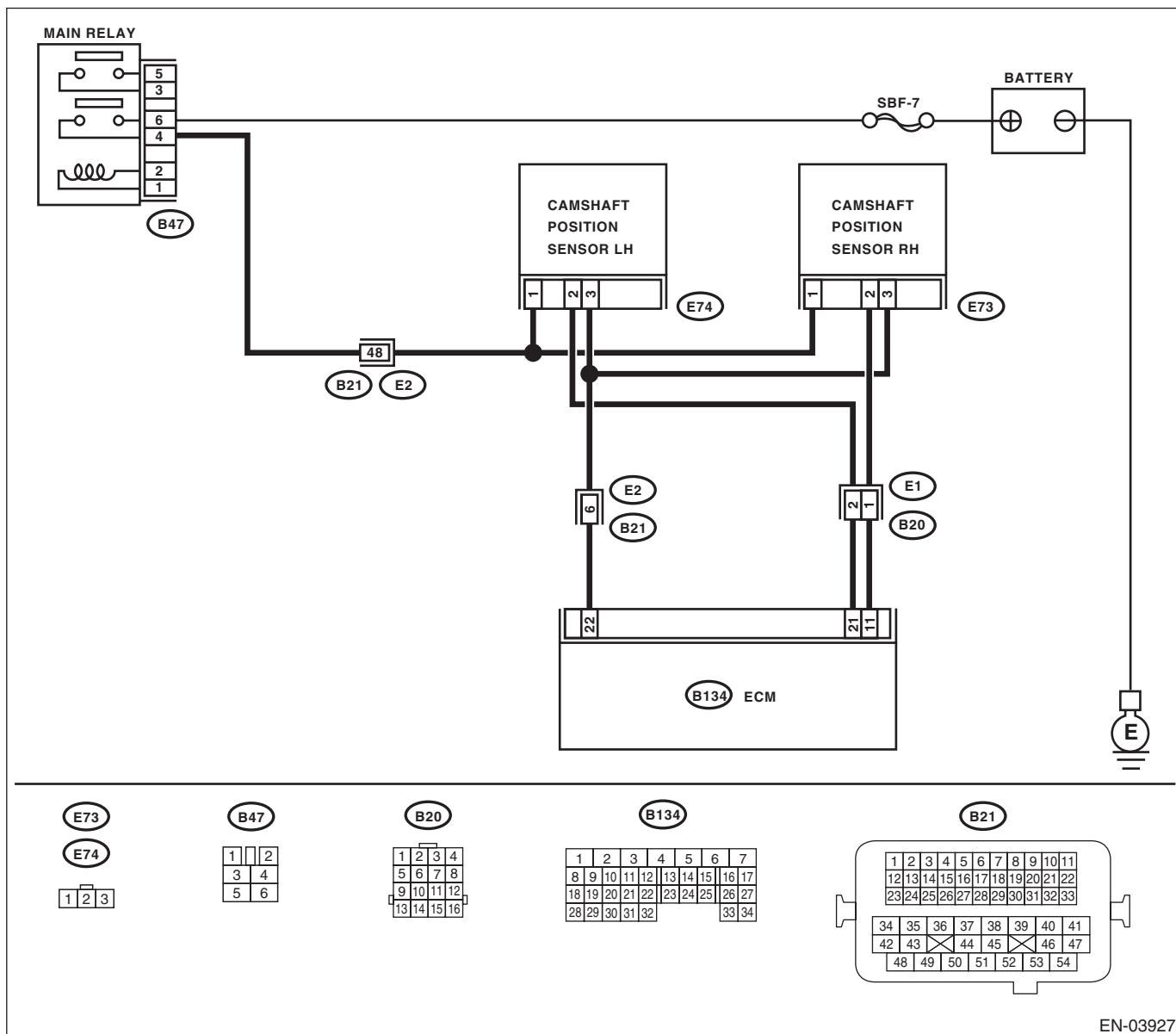
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03927

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E73) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the open or ground short circuit of harness between main relay connector and camshaft position sensor connector.
<b>2 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between the ECM and camshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 11 — (E73) No. 2:</b> <b>(B134) No. 22 — (E73) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between the ECM and camshaft position sensor.
<b>3 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the resistance between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E73) No. 2 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit to ground of harness between the ECM and camshaft position sensor.
<b>4 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E73) No. 2 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and camshaft position sensor.	Go to step 5.
<b>5 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 6.	Tighten the camshaft position sensor installation bolt securely.
<b>6 CHECK CAMSHAFT POSITION SENSOR.</b> Check the waveform of the camshaft position sensor. <Ref. to EN(H6DO)(diag)-17, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H6DO)-21, Camshaft Position Sensor.>	Repair the following item. <ul style="list-style-type: none"> <li>• Poor contact in ECM connector</li> <li>• Poor contact of camshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CA:DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-126, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

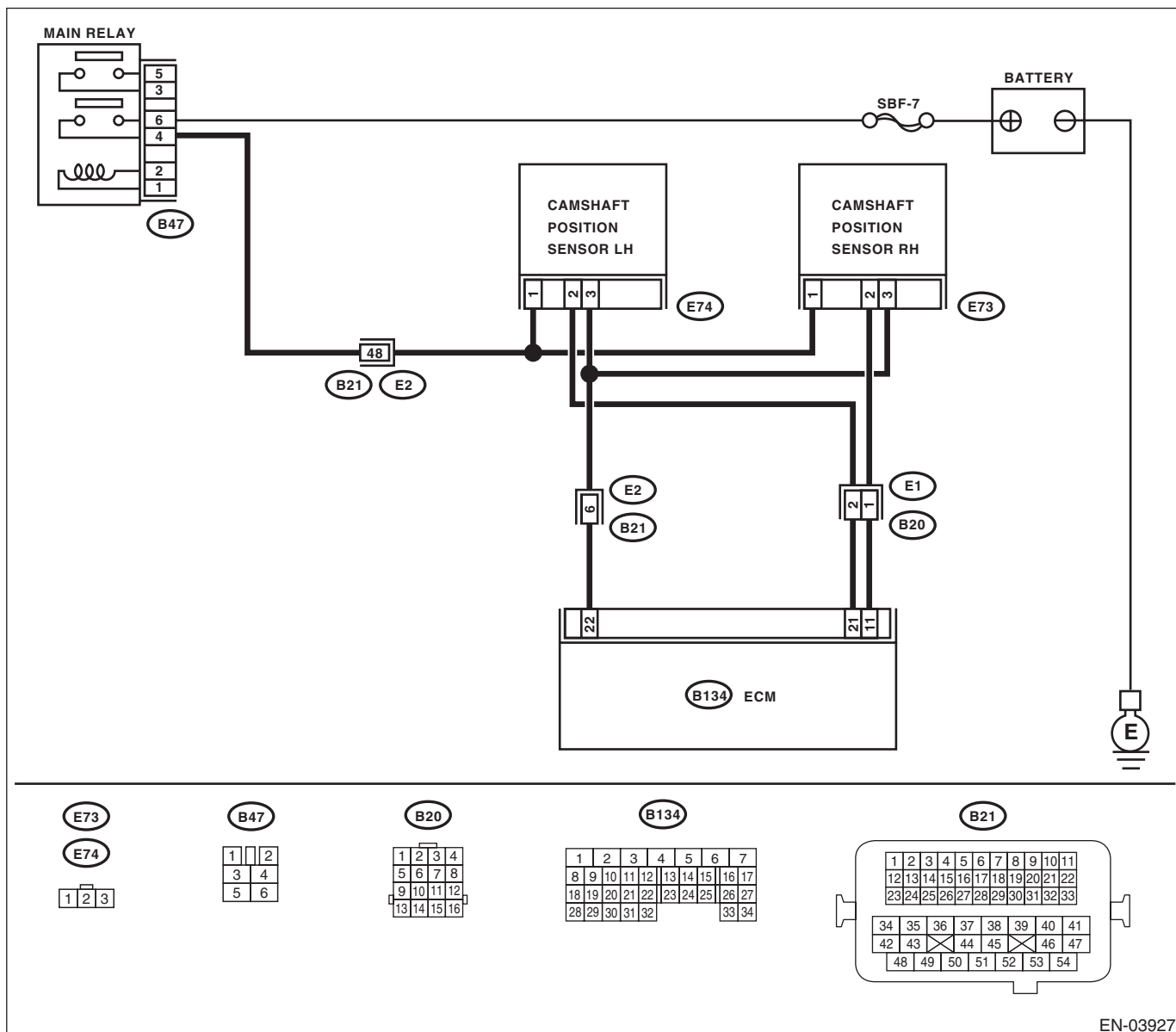
### TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03927

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E74) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the open or ground short circuit of harness between main relay connector and camshaft position sensor connector.
<b>2 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between the ECM and camshaft position sensor connector. <b>Connector &amp; terminal</b> <b>(B134) No. 21 — (E74) No. 2:</b> <b>(B134) No. 22 — (E74) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between the ECM and camshaft position sensor.
<b>3 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the resistance between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E74) No. 21 — Engine ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit to ground of harness between the ECM and camshaft position sensor.
<b>4 CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.</b> Measure the voltage between camshaft position sensor connector and engine ground. <b>Connector &amp; terminal</b> <b>(E74) No. 21 (+) — Engine ground (-):</b>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and camshaft position sensor.	Go to step 5.
<b>5 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor installation bolt tightened securely?	Go to step 6.	Tighten the camshaft position sensor installation bolt securely.
<b>6 CHECK CAMSHAFT POSITION SENSOR.</b> Check the waveform of the camshaft position sensor. <Ref. to EN(H6DO)(diag)-17, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H6DO)-21, Camshaft Position Sensor.>	Repair the following item. <ul style="list-style-type: none"> <li>• Poor contact in ECM connector</li> <li>• Poor contact of camshaft position sensor connector</li> <li>• Poor contact of coupling connector</li> </ul>

## CB:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-127, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

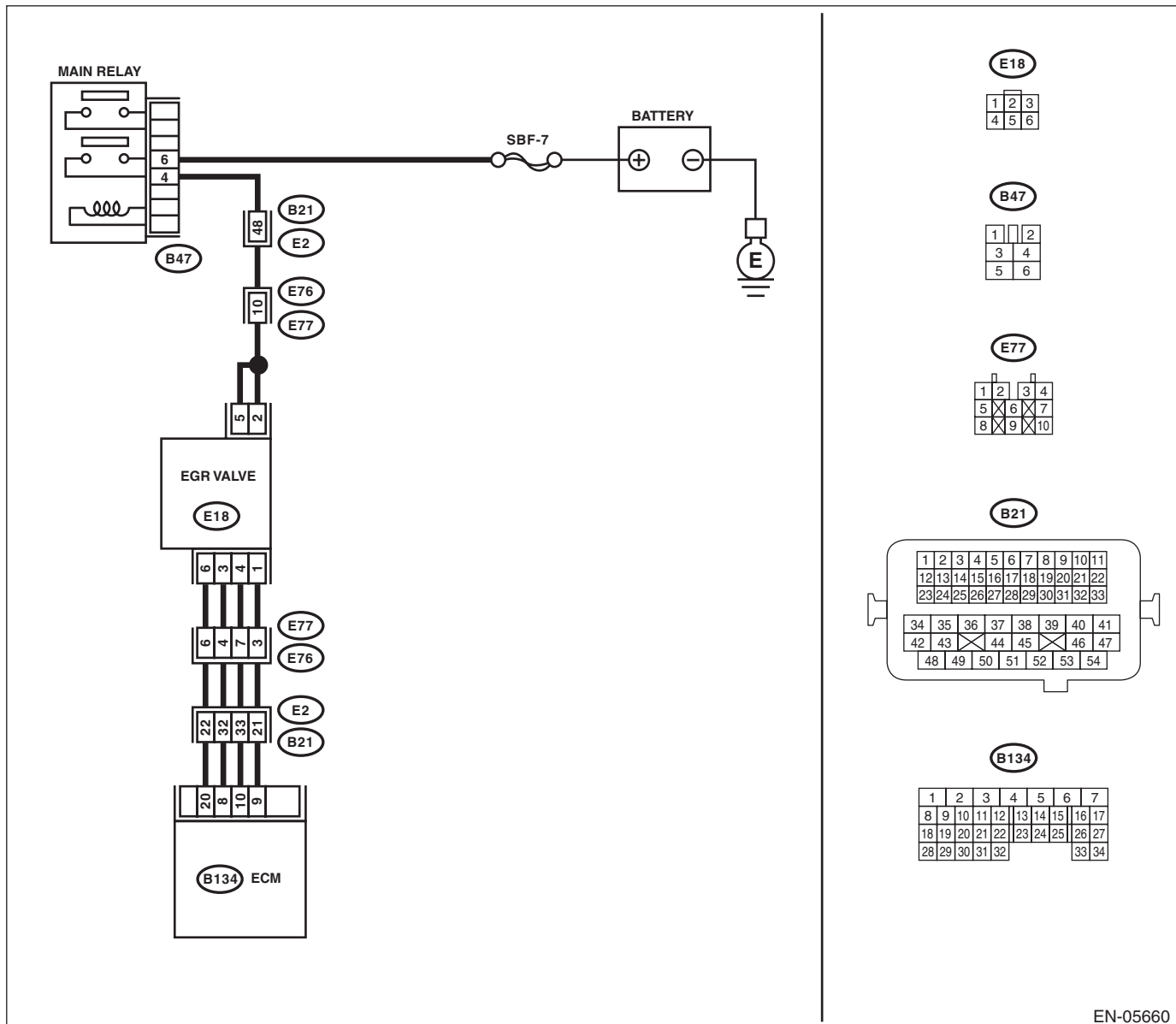
### TROUBLE SYMPTOM:

- Movement performance problem when engine is low speed.
- Erroneous idling
- Movement performance problem

### CAUTION:

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

### WIRING DIAGRAM:



EN-05660

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK CURRENT DATA.</b> 1) Start the engine. 2) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool.  NOTE: • SUBARU SELECT MONITOR For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • GENERAL SCAN TOOL For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 53.3 kPa (400 mmHg, 15.75 inHg) or more?	Make sure that the EGR valve, manifold absolute pressure sensor and throttle body are installed securely.	Go to step 2.
2	<b>CHECK EGR VALVE.</b> Remove the EGR valve.	Are there holes, plugged piping or foreign objects caught in the EGR system?	Repair the EGR system.	Replace the EGR valve. <Ref. to FU(H6DO)-26, EGR Valve.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CC:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-131, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

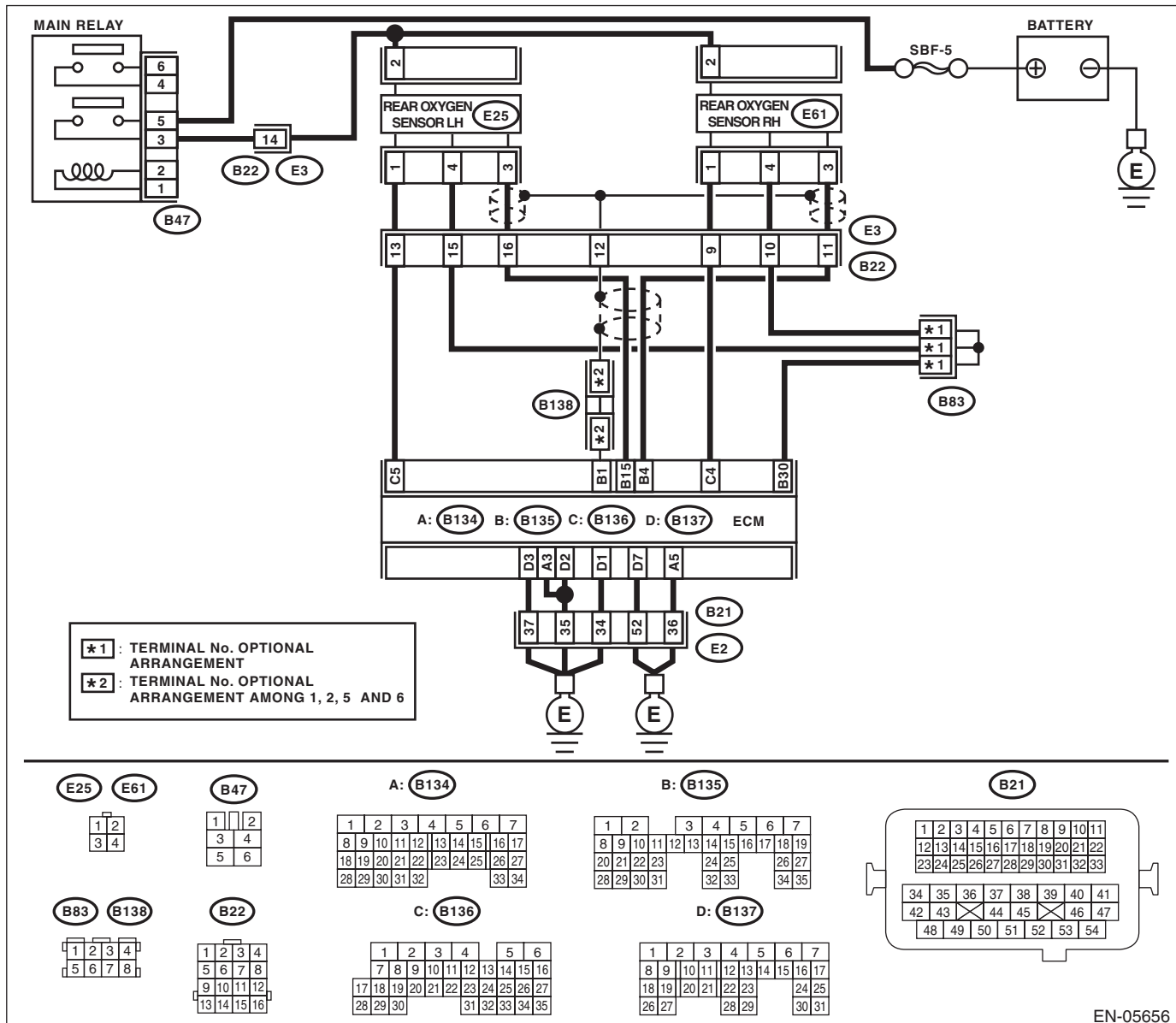
### TROUBLE SYMPTOM:

- Engine stalls.
- Idle mixture is out of specifications.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

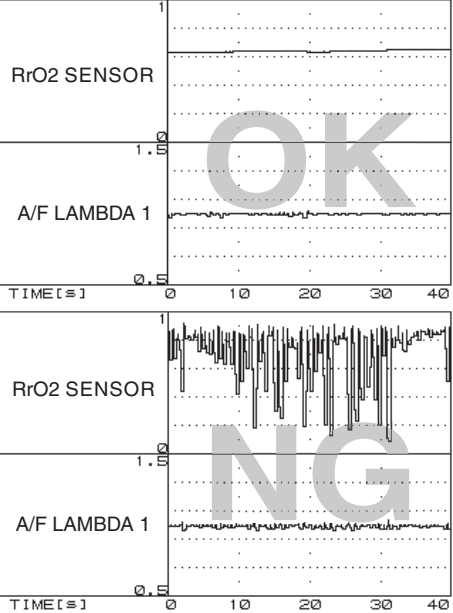
### WIRING DIAGRAM:



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK EXHAUST SYSTEM.</b> Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes.</p> <p>NOTE: Check the following positions.</p> <ul style="list-style-type: none"> <li>• Between cylinder head and front exhaust pipe</li> <li>• Between front exhaust pipe and front catalytic converter</li> <li>• Between front catalytic converter and rear catalytic converter</li> <li>• Loose or improperly attached front oxygen (A/F) sensor or rear oxygen sensor</li> </ul>	<p>Is there any fault in exhaust system?</p>	<p>Repair or replace the exhaust system. &lt;Ref. to EX(H6DO)-2, General Description.&gt;</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).</b> 1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH). 2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data.</p> <div style="display: flex; flex-direction: column; align-items: center;">  <p style="margin-top: 10px;">EN-04895</p> </div>	<p>Is a normal waveform displayed?</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again.</p> <p>NOTE: In this case, temporary poor contact of connector may be the cause.</p>	<p>Go to step 3.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>3</b></p> <p><b>CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).</b></p> <p>1) Run the engine at idle.</p> <p>2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data.</p> <div> </div> <div> </div> <p style="text-align: right;">EN-04896</p>	<p>Is a normal waveform displayed?</p>	<p>Go to step 4.</p>	<p>Go to step 5.</p>
<p><b>4</b></p> <p><b>CHECK CATALYTIC CONVERTER.</b></p>	<p>Is the catalytic converter damaged?</p>	<p>Replace the catalytic converter. &lt;Ref. to EC(H6DO)-3, Front Catalytic Converter.&gt;</p>	<p>Go to step 5.</p>
<p><b>5</b></p> <p><b>CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	<p>Has water entered the connector?</p>	<p>Completely remove any water inside.</p>	<p>Go to step 6.</p>
<p><b>6</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from ECM and rear oxygen sensor.</p> <p>3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B135) No. 4 — (E61) No. 3:</b></p> <p><b>(B135) No. 30 — (E61) No. 4:</b></p> <p><b>(B135) No. 15 — (E25) No. 3:</b></p> <p><b>(B135) No. 30 — (E25) No. 4:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 7.</p>	<p>Repair the open circuit of harness between ECM and rear oxygen sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between rear oxygen sensor connector and chassis ground. <b>Connector &amp; terminal</b> <i>(E61) No. 3 (+) — Chassis ground (-):</i> <i>(E25) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 0.2 — 0.5 V?	Go to step 8.	Repair the harness and connector. <b>NOTE:</b> Repair the following locations. <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and rear oxygen sensor</li> <li>• Poor contact of the ECM and rear oxygen sensor</li> <li>• Poor contact in ECM connector</li> </ul>
<b>8</b> <b>CHECK REAR OXYGEN SENSOR SHIELD.</b> 1) Turn the ignition switch to OFF. 2) Expose the rear oxygen sensor connector body side harness sensor shield. 3) Measure the resistance between the sensor shield and chassis ground.	Is the resistance less than 1 $\Omega$ ?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the open circuit in the rear oxygen sensor harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CD:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-134, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

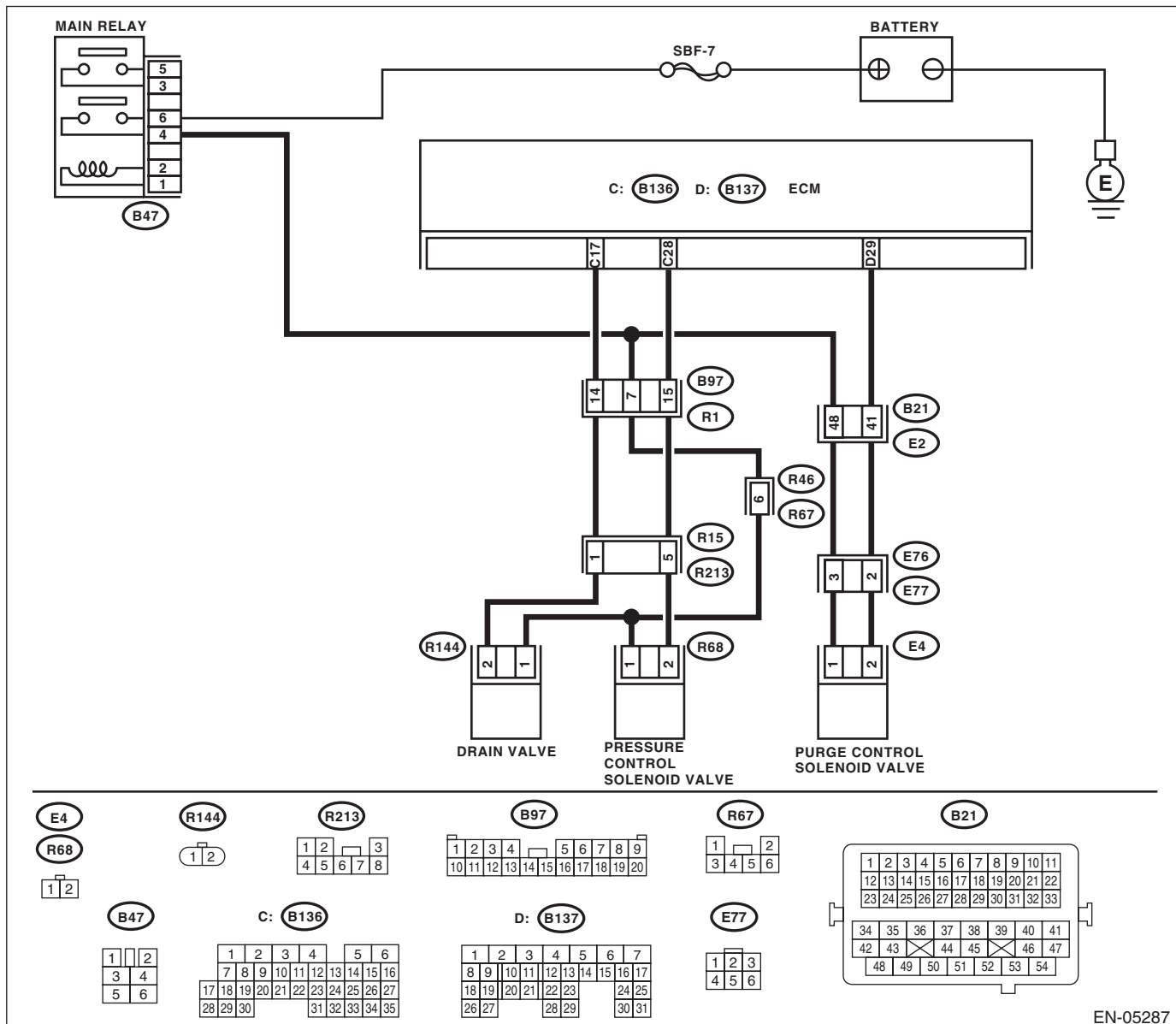
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05287

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H6DO)-51, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H6DO)-7, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H6DO)-12, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H6DO)-60, Fuel Delivery and Evaporation Lines.>	Go to step 8.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
8	<b>CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H6DO)-6, Canister.>	Go to step 9.
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 1.0 mm (0.04 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CE:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

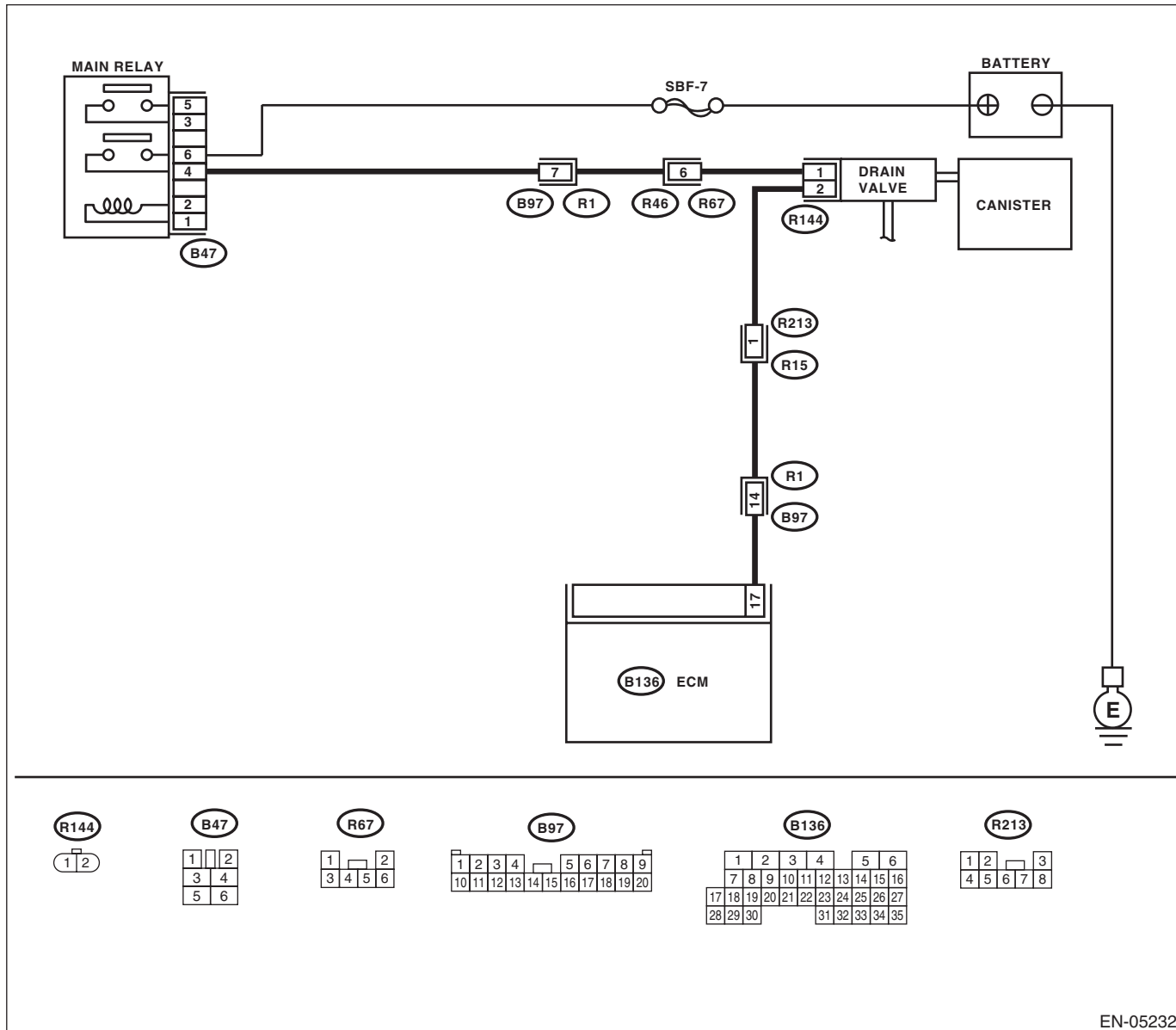
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-150, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05232



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Check for poor contact of the ECM connector.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Measure the resistance between the drain valve connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 2 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and drain valve connector.
<b>3 CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> Measure the resistance of harness between ECM and drain valve connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 17 — (R144) No. 2:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and drain valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>4 CHECK DRAIN VALVE.</b> Measure the resistance between drain valve terminals. <i><b>Terminals</b></i> <i><b>No. 1 — No. 2:</b></i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>
<b>5 CHECK POWER SUPPLY TO DRAIN VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between drain valve and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R144) No. 1 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Repair poor contact of the drain valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and drain valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CF:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

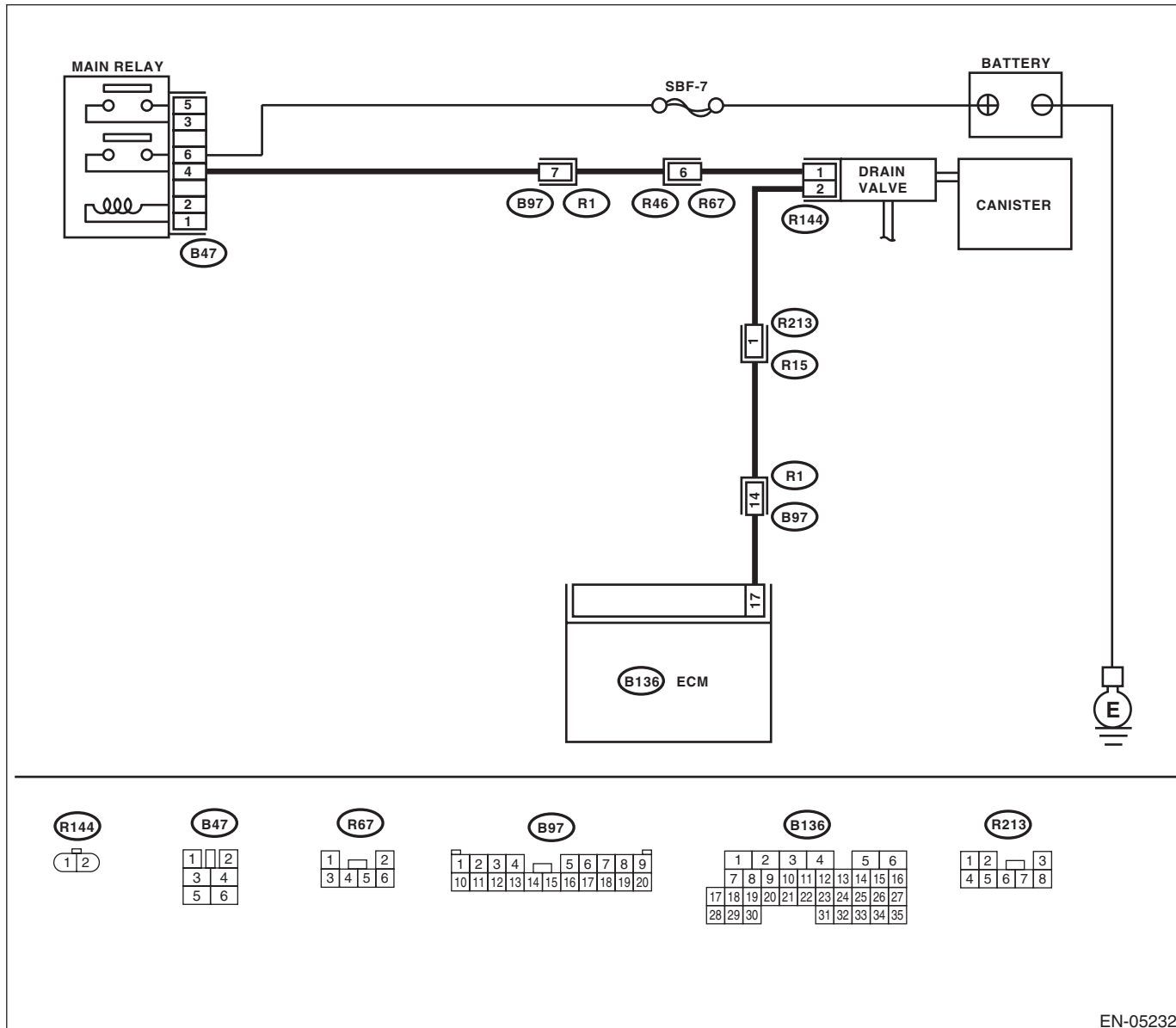
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-152, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 17 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and drain valve connector.	Go to step 2.
2	<b>CHECK DRAIN VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between drain valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CG:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

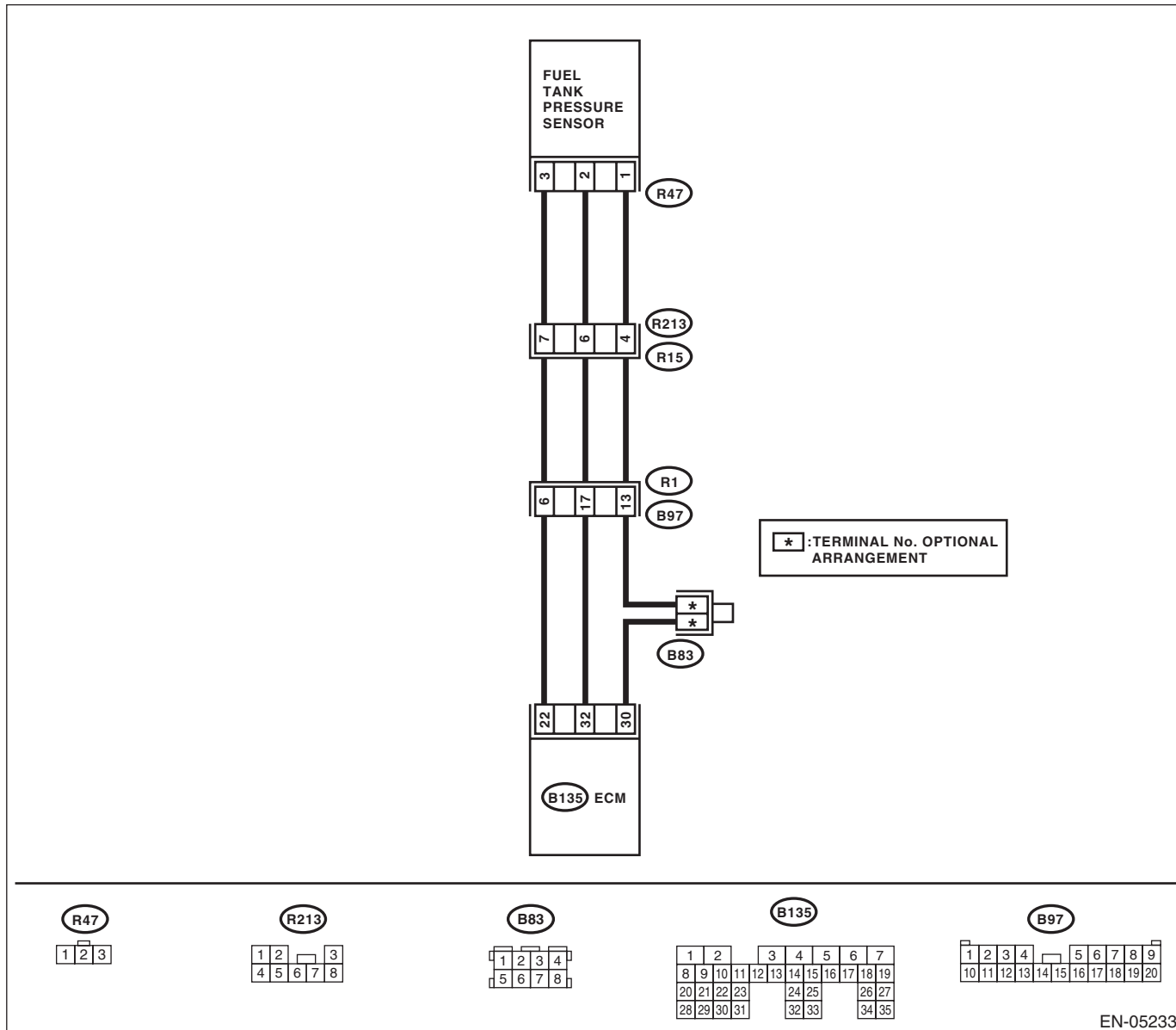
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-154, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05233

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2</b>	<b>CHECK PRESSURE VACUUM LINE.</b> NOTE: Check the following items. <ul style="list-style-type: none"><li>• Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank</li><li>• Disconnection, leakage and clogging of the air ventilation hoses and pipes between fuel filler pipe and fuel tank</li></ul>	Is there any fault in pressure/vacuum line?	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H6DO)-11, Fuel Tank Pressure Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CH:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

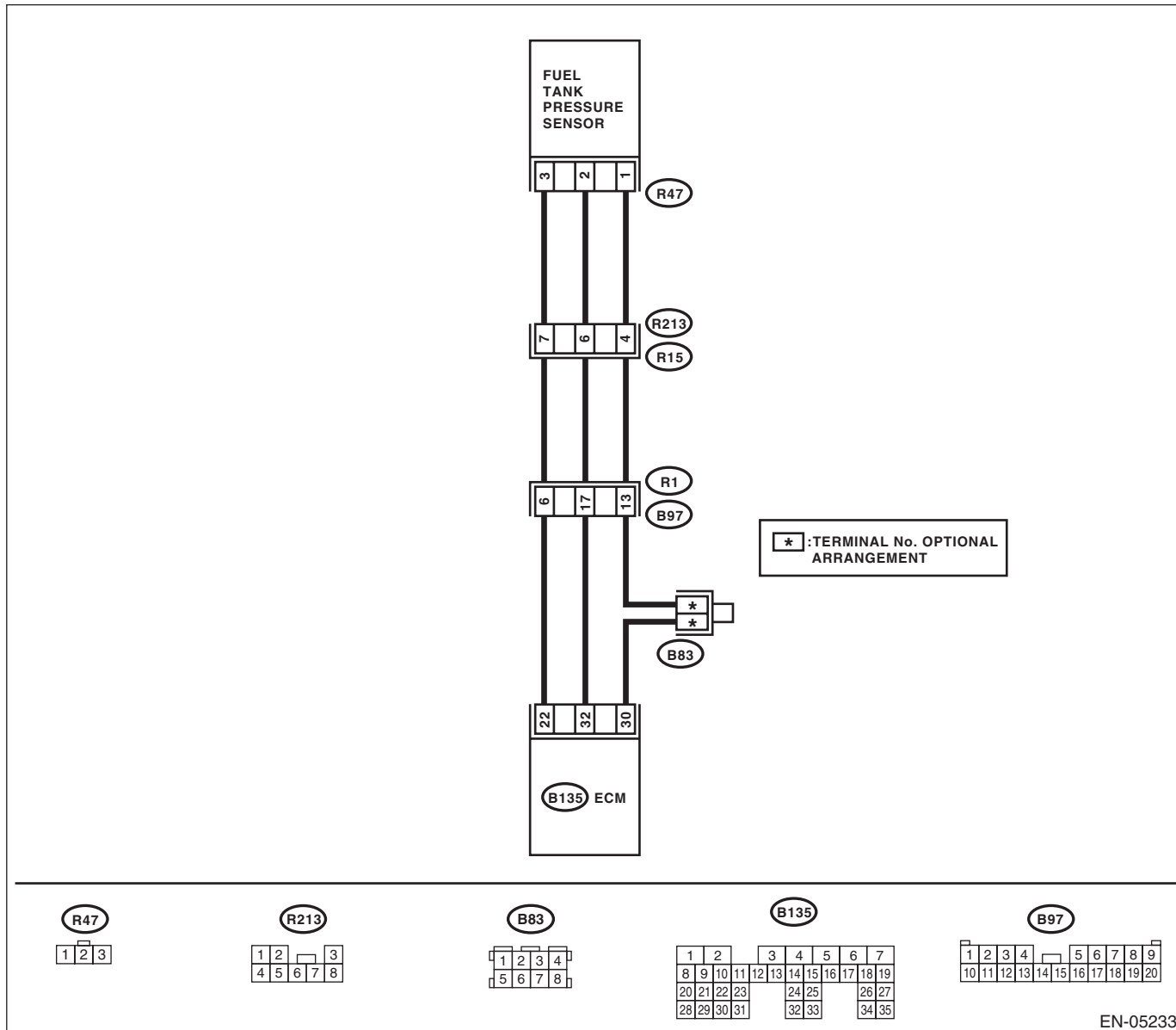
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-156, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05233

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b>                      1) Turn the ignition switch to ON.                      2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:                      • Subaru Select Monitor                      For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;                      • General scan tool                      For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value less than -7.45 kPa (-55.85 mmHg, inHg) ?</p>	Go to step 2.	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:                      In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK FUEL TANK PRESSURE SENSOR POWER SOURCE.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connector from the fuel tank pressure sensor.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between the fuel tank pressure sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(R47) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.5 V or more?</p>	Go to step 3.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:                      • Open circuit of harness between ECM and fuel tank pressure sensor connector                      • Poor contact in ECM connector                      • Poor contact of coupling connector</p>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM.                      3) Measure the resistance of harness between the ECM and fuel tank pressure sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 32 — (R47) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	Go to step 4.	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:                      • Open circuit of harness between ECM and fuel tank pressure sensor connector                      • Poor contact of coupling connector</p>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b>                      Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 32 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	Go to step 5.	<p>Repair the ground short circuit of harness between ECM and fuel tank pressure sensor connector.</p>
<p><b>5</b></p> <p><b>CHECK POOR CONTACT.</b>                      Check for poor contact between the ECM and fuel tank pressure sensor connector.</p>	<p>Is there poor contact in the ECM or fuel tank pressure sensor connector?</p>	<p>Repair the poor contact in the ECM or fuel tank pressure sensor connector.</p>	<p>Replace the fuel tank pressure sensor. &lt;Ref. to EC(H6DO)-11, Fuel Tank Pressure Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CI: DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

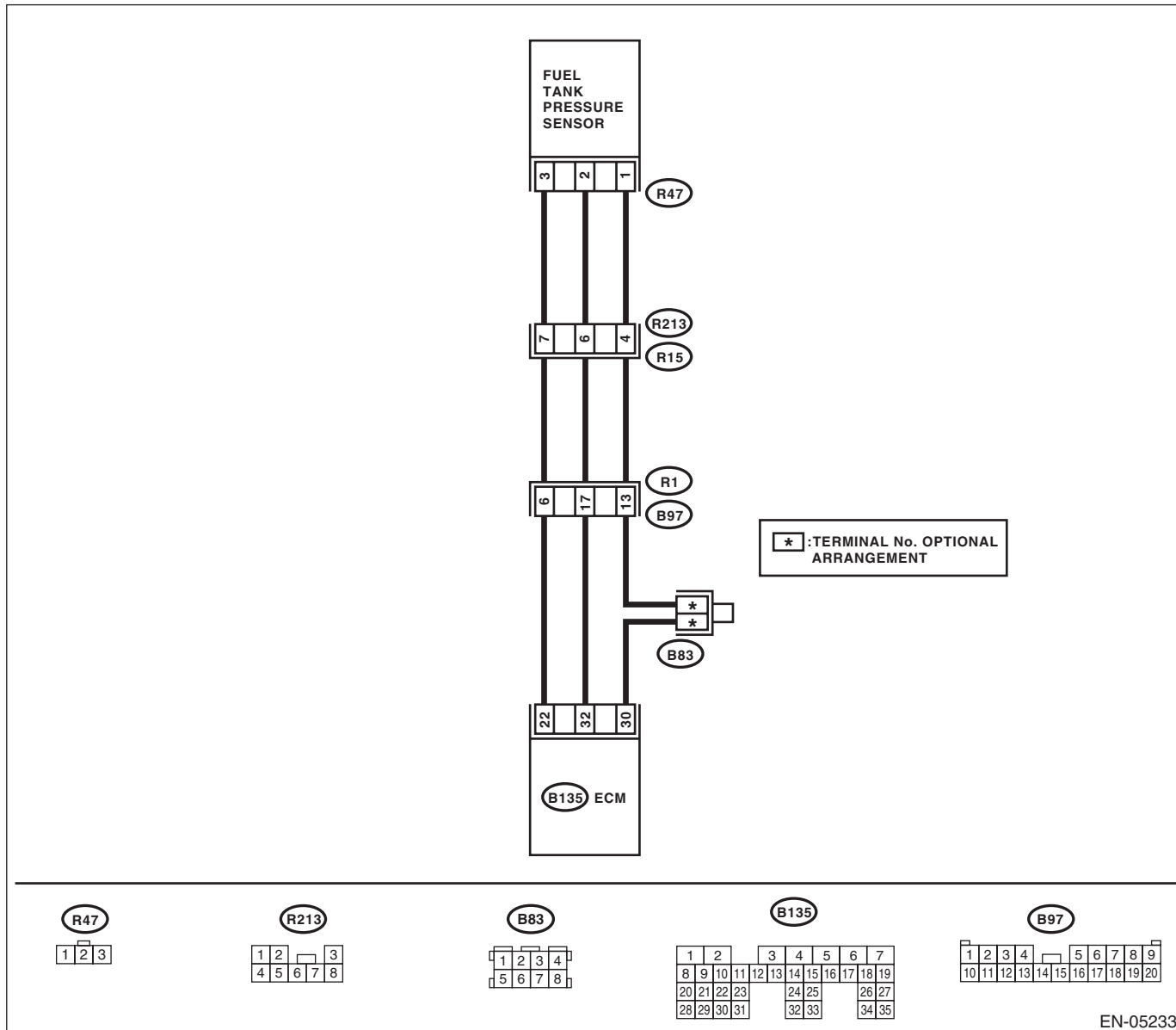
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-158, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05233



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK CURRENT DATA.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 7.98 kPa (59.85 mmHg, inHg) or more?</p>	<p>Go to step 2.</p>	<p>Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.</p> <p>NOTE:</p> <p>In this case, there may be a temporary connector contact failure.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the fuel tank pressure sensor.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Read the data of fuel tank pressure sensor signal using the Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 7.98 kPa (59.85 mmHg, inHg) or more?</p>	<p>Repair the short circuit to power in the harness between ECM and fuel tank pressure sensor connector.</p>	<p>Go to step 3.</p>
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Measure the resistance of harness between fuel tank pressure sensor connector and engine ground.</p> <p><b>Connector &amp; terminal</b> <b>(R47) No. 1 — Engine ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.</p> <p>NOTE:</p> <p>In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel tank pressure sensor connector</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>4</b></p> <p><b>CHECK POOR CONTACT.</b></p> <p>Check for poor contact of the fuel tank pressure sensor connector.</p>	<p>Is there poor contact in fuel tank pressure sensor connector?</p>	<p>Repair the poor contact in the fuel tank pressure sensor connector.</p>	<p>Replace the fuel tank pressure sensor. &lt;Ref. to EC(H6DO)-11, Fuel Tank Pressure Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CJ:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-159, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

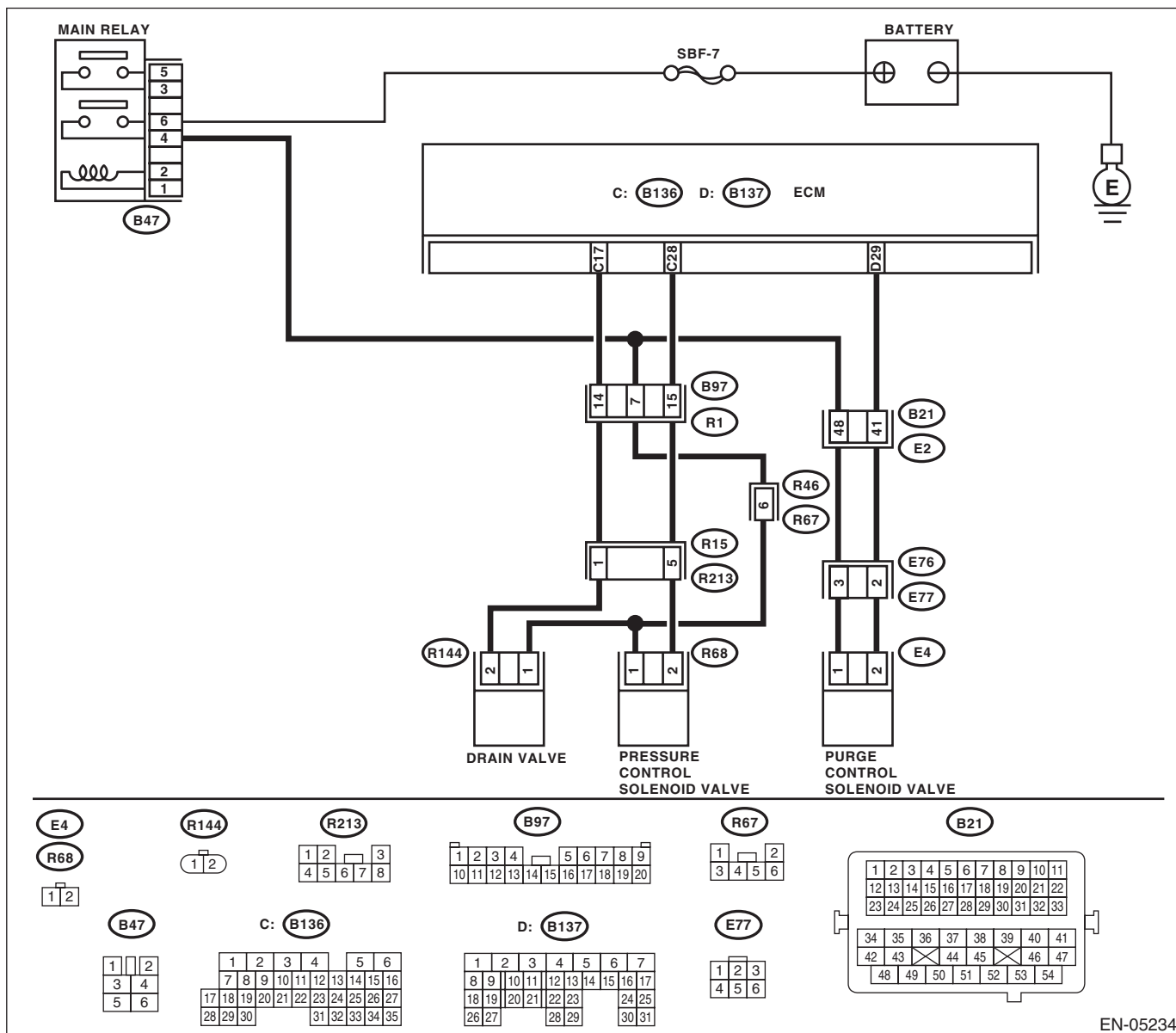
### TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05234

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
<b>2</b> <b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
<b>3</b> <b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H6DO)-51, Fuel Filler Pipe.>	Go to step 4.
<b>4</b> <b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>
<b>5</b> <b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H6DO)-7, Purge Control Solenoid Valve.>
<b>6</b> <b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H6DO)-12, Pressure Control Solenoid Valve.>
<b>7</b> <b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H6DO)-60, Fuel Delivery and Evaporation Lines.>	Go to step 8.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>8</b>	<b>CHECK CANISTER.</b>	Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H6DO)-6, Canister.>	Go to step <b>9</b> .
<b>9</b>	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Go to step <b>10</b> .
<b>10</b>	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Is there any hole of more than 0.5 mm (0.020 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CK:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-159, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

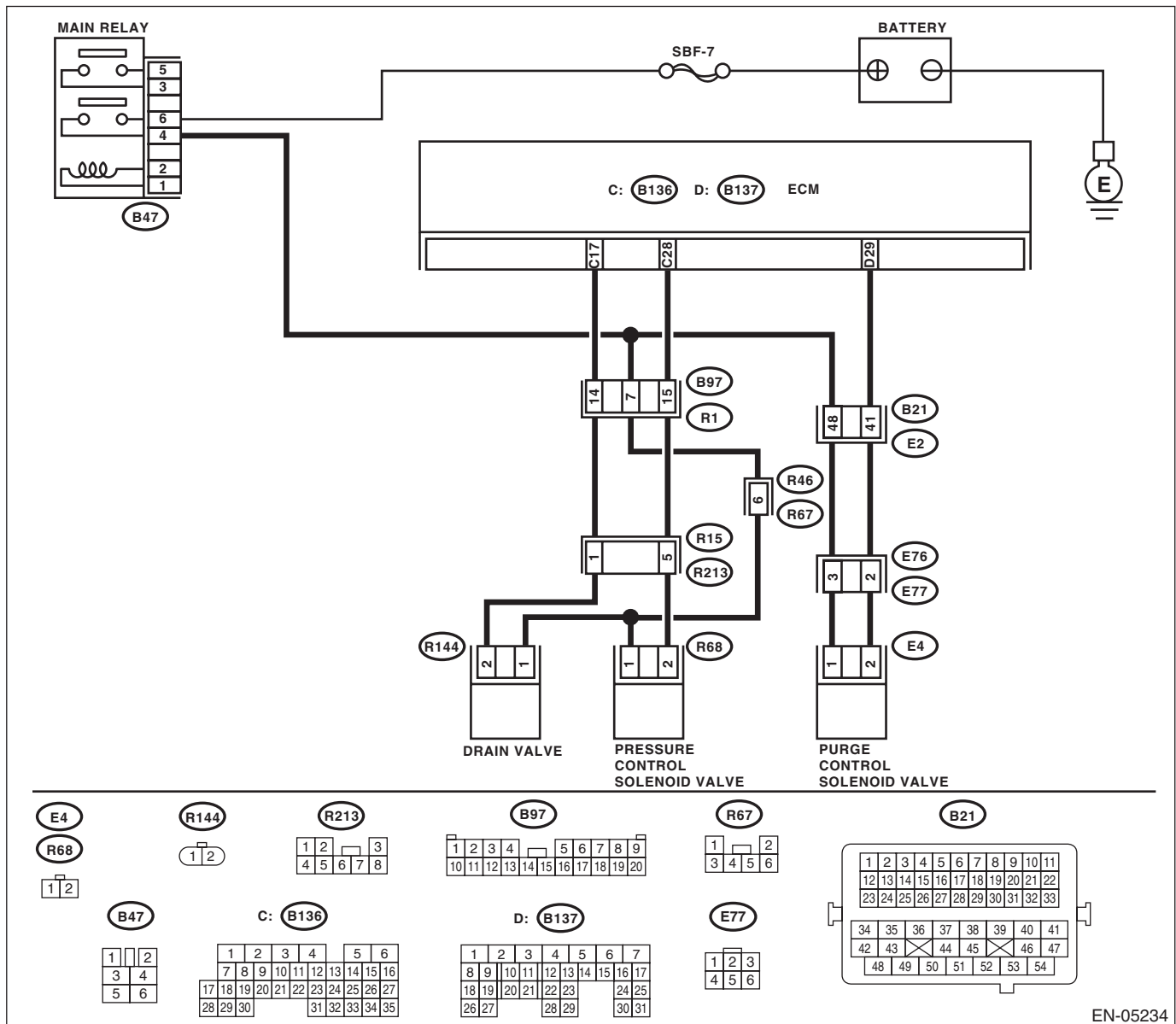
### TROUBLE SYMPTOM:

- Fuel odor
- Fuel filler cap loose or lost

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05234

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUEL FILLER CAP.</b> 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap.  NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 2.	Tighten fuel filler cap securely.
2	<b>CHECK FUEL FILLER CAP.</b>	Is the fuel filler cap genuine?	Go to step 3.	Replace with a genuine fuel filler cap.
3	<b>CHECK FUEL FILLER PIPE GASKET.</b>	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H6DO)-51, Fuel Filler Pipe.>	Go to step 4.
4	<b>CHECK DRAIN VALVE.</b> 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Operate the drain valve using the Subaru Select Monitor.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 5.	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>
5	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> Operate the purge control solenoid valve using the Subaru Select Monitor.  NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 6.	Replace the purge control solenoid valve. <Ref. to EC(H6DO)-7, Purge Control Solenoid Valve.>
6	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Operate the pressure control solenoid valve using the Subaru Select Monitor.  NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 7.	Replace the pressure control solenoid valve. <Ref. to EC(H6DO)-12, Pressure Control Solenoid Valve.>
7	<b>CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Are there any disconnected, broken or clogged evaporation lines?	Repair or replace the evaporation line. <Ref. to FU(H6DO)-60, Fuel Delivery and Evaporation Lines.>	Go to step 8.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
8	<b>CHECK CANISTER.</b>	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H6DO)-6, Canister.>	Go to step 9.
9	<b>CHECK FUEL TANK.</b> Remove the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H6DO)-44, Fuel Tank.>	Go to step 10.
10	<b>CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.</b>	Are there holes, cracks, clogging, or disconnections, mis-connection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CL:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-160, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

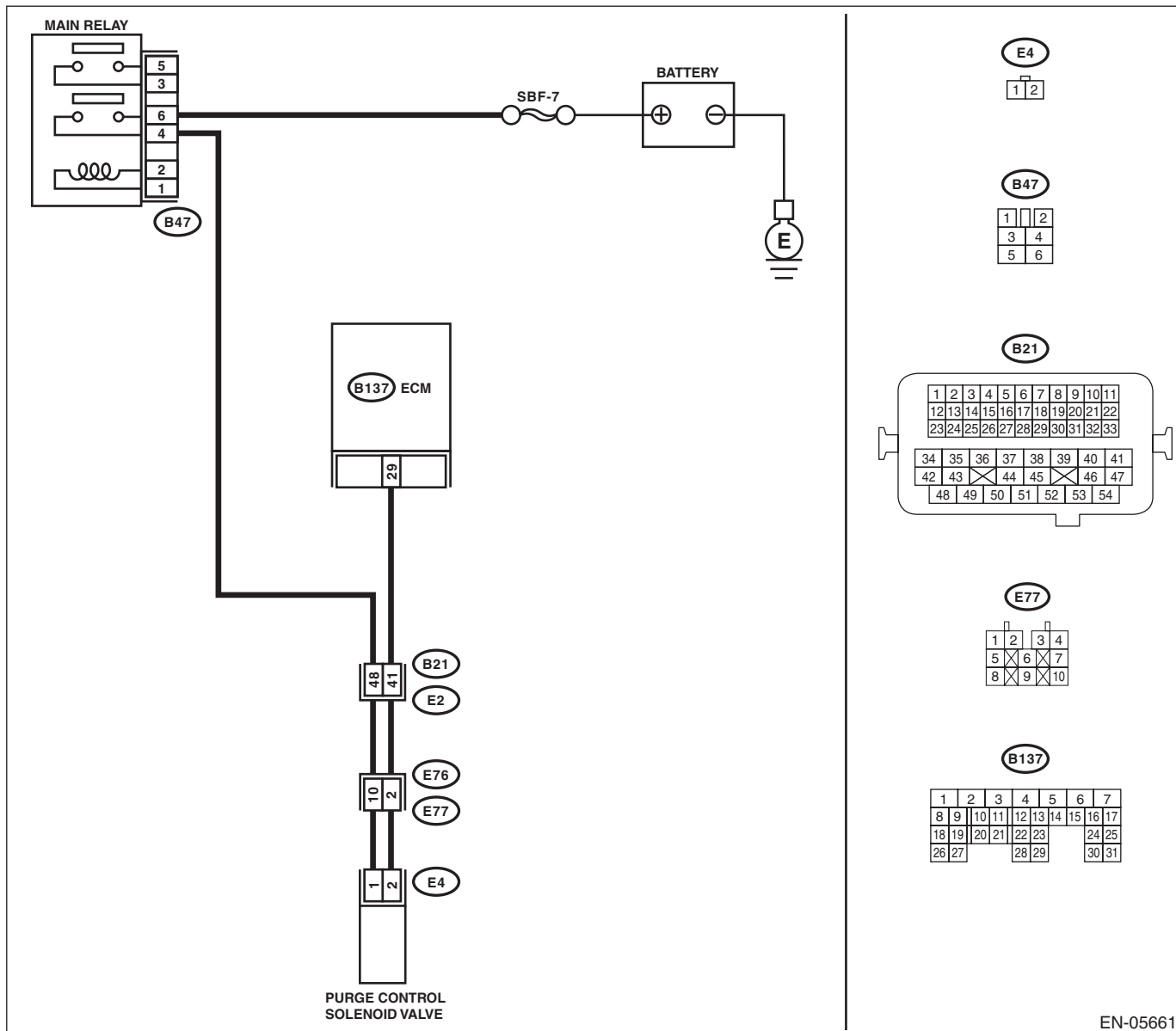
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05661



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 29 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Measure the resistance between the purge control solenoid valve connector and engine ground. <b>Connector &amp; terminal</b> <b>(E4) No. 2 — Engine ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and purge control solenoid valve connector.
3	<b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and purge control solenoid valve. <b>Connector &amp; terminal</b> <b>(B137) No. 29 — (E4) No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and purge control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H6DO)-7, Purge Control Solenoid Valve.>
5	<b>CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. <b>Connector &amp; terminal</b> <b>(E4) No. 1 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Repair the poor contact of purge control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between the main relay and purge control solenoid valve</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CM:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-162, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

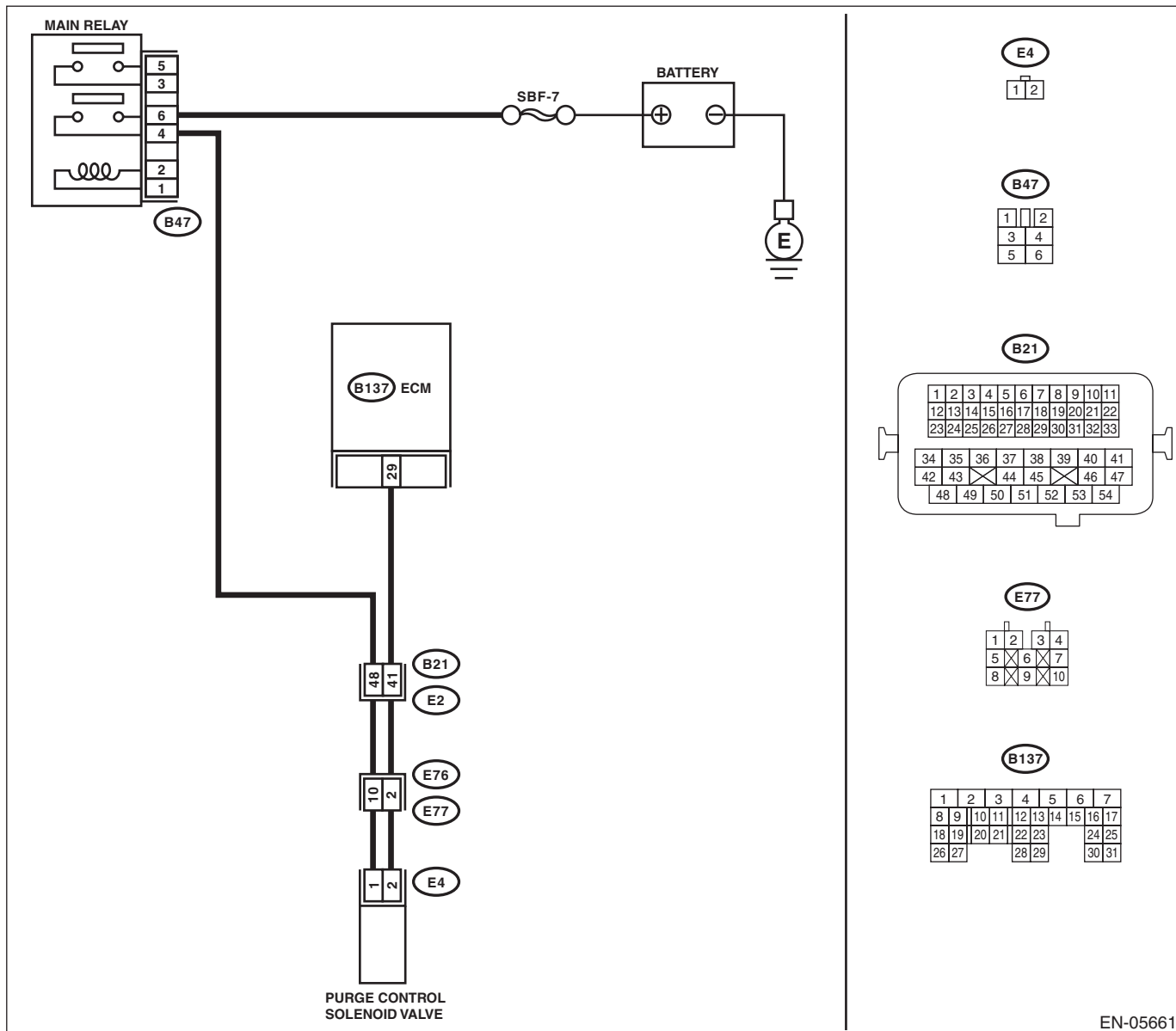
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05661

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 29 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and purge control solenoid valve connector.	Go to step 2.
2	<b>CHECK PURGE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the purge control solenoid valve. <Ref. to EC(H6DO)-7, Purge Control Solenoid Valve.>	Repair the poor contact of the ECM connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

### CN:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-164, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### CAUTION:

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H6DO)-56, Fuel Level Sensor.> <Ref. to FU(H6DO)-57, Fuel Sub Level Sensor.>

### CO:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

#### NOTE:

For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H6DO)(diag)-264, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### CP:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

#### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-168, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### CAUTION:

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is DTC P0462 or P0463 displayed on the Subaru Select Monitor?	Check the combination meter. <Ref. to IDI-4, COMBINATION METER, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CQ:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-170, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is DTC P0464 displayed on the display?	Check the combination meter. <Ref. to IDI-4, COMBINATION METER, INSPECTION, Combination Meter System.>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check.  NOTE: In this case, there may be a temporary connector contact failure.

## CR:DTC P0500 VEHICLE SPEED SENSOR "A"

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-173, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No	
1	<b>CHECK DTC OF ABS.</b> Check DTC of ABS.	Is DTC of ABS displayed?	Perform the diagnosis according to DTC. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CS:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-175, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

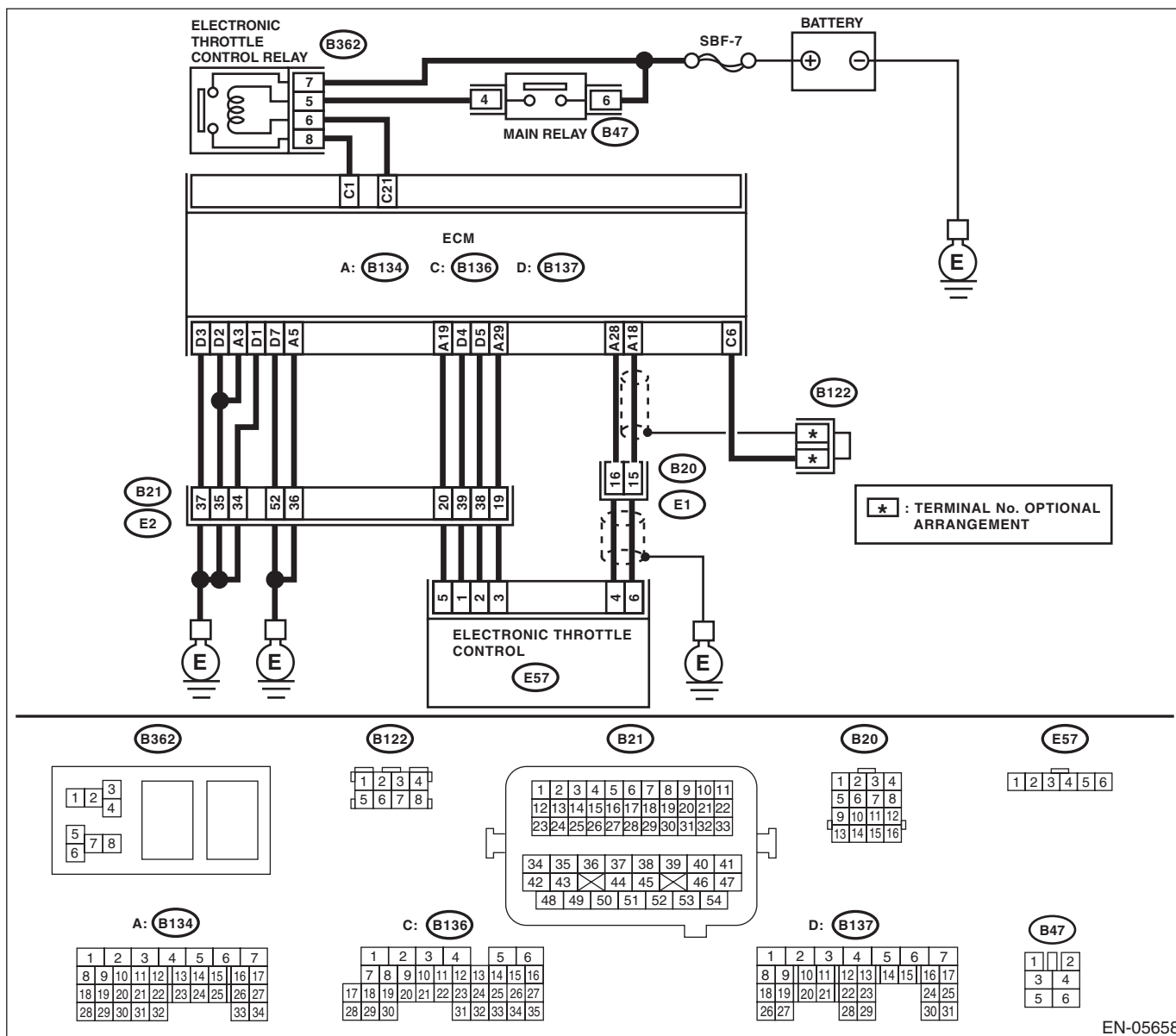
### TROUBLE SYMPTOM:

- Hard to start the engine
- Engine does not start.
- Improper idling
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK AIR CLEANER ELEMENT.</b> 1) Turn the ignition switch to OFF. 2) Check the air cleaner element.	Is there excessive clogging on air cleaner element?	Replace the air cleaner element. <Ref. to IN(H6DO)-4, Air Cleaner Element.>	Go to step 3.
3	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Remove the electronic throttle control. 2) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CT:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-177, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

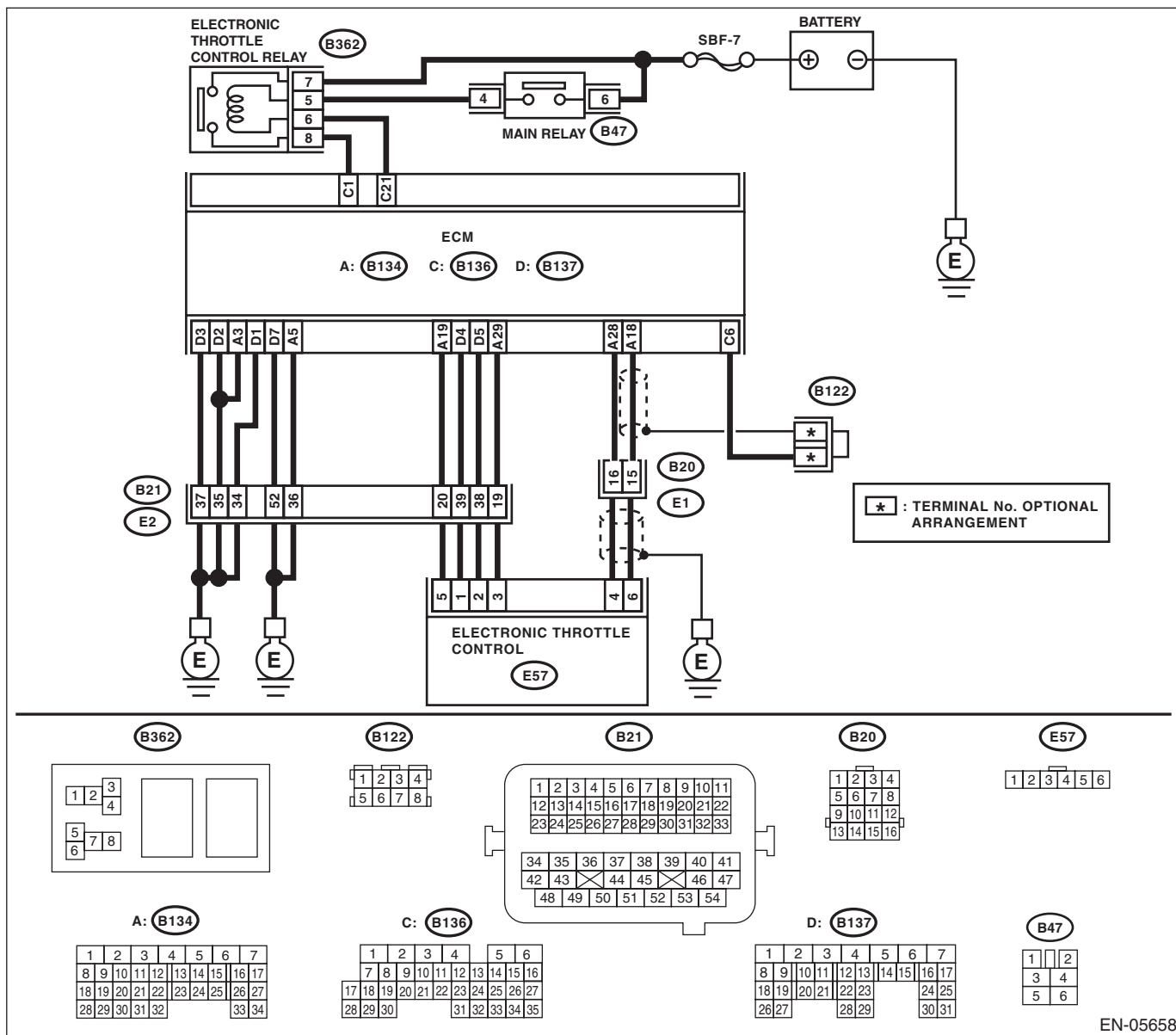
### TROUBLE SYMPTOM:

Engine keeps running at higher speed than specified idle speed.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK AIR INTAKE SYSTEM.</b> 1) Start and idle the engine. 2) Check the following items. • Loose installation of intake manifold and throttle body • Cracks of intake manifold gasket and throttle body gasket • Disconnection of vacuum hoses	Is there any fault in air intake system?	Repair air suction and leaks.	Go to step 3.
3	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control. 3) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CU:DTC P0512 STARTER REQUEST CIRCUIT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-179, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

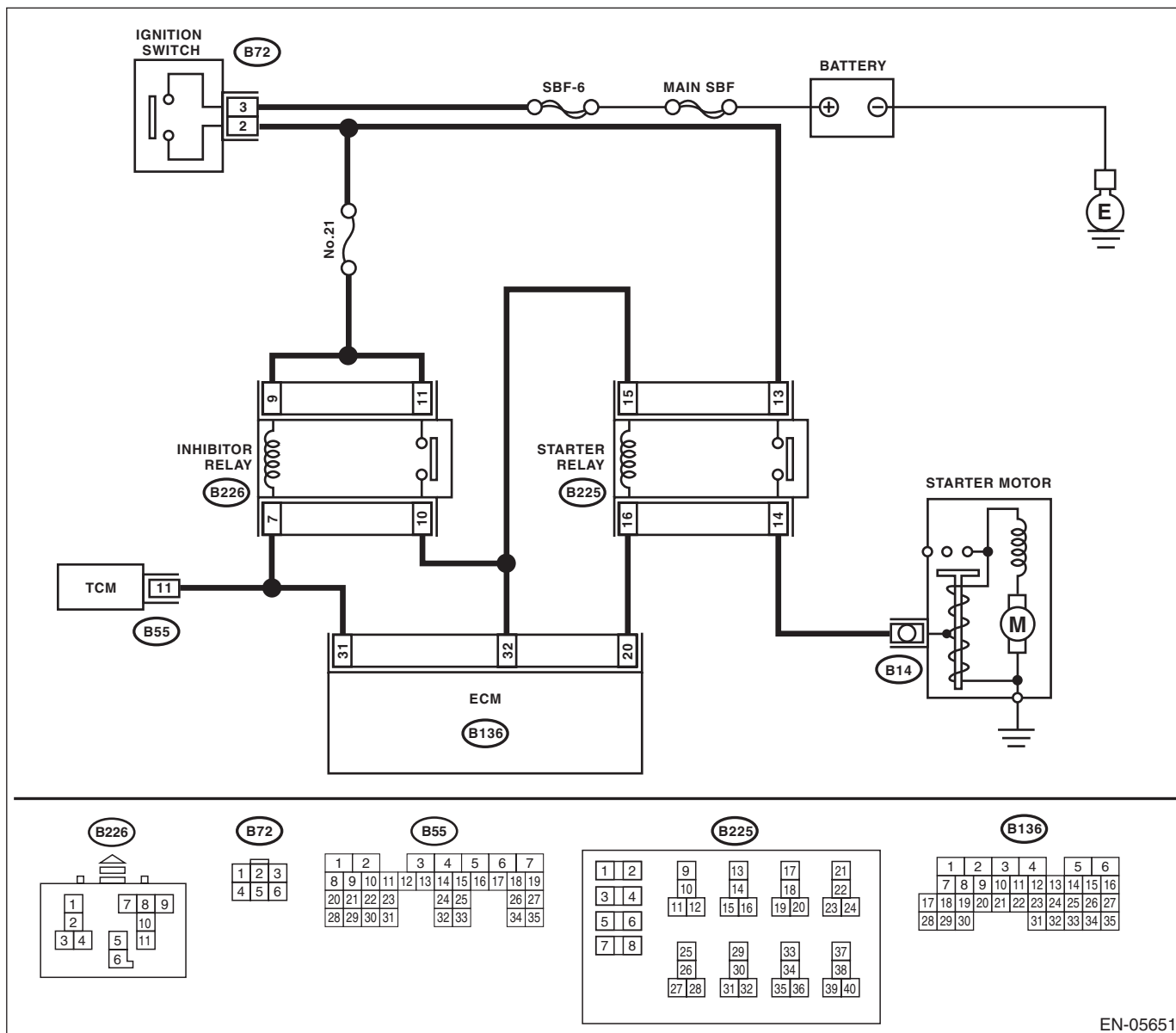
### TROUBLE SYMPTOM:

Failure of engine to start

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05651

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND IGNITION SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 32 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and ignition switch.	Repair the poor contact of the ECM connector.

## CV:DTC P0600 SERIAL COMMUNICATION LINK

NOTE:

For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CW:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-183, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

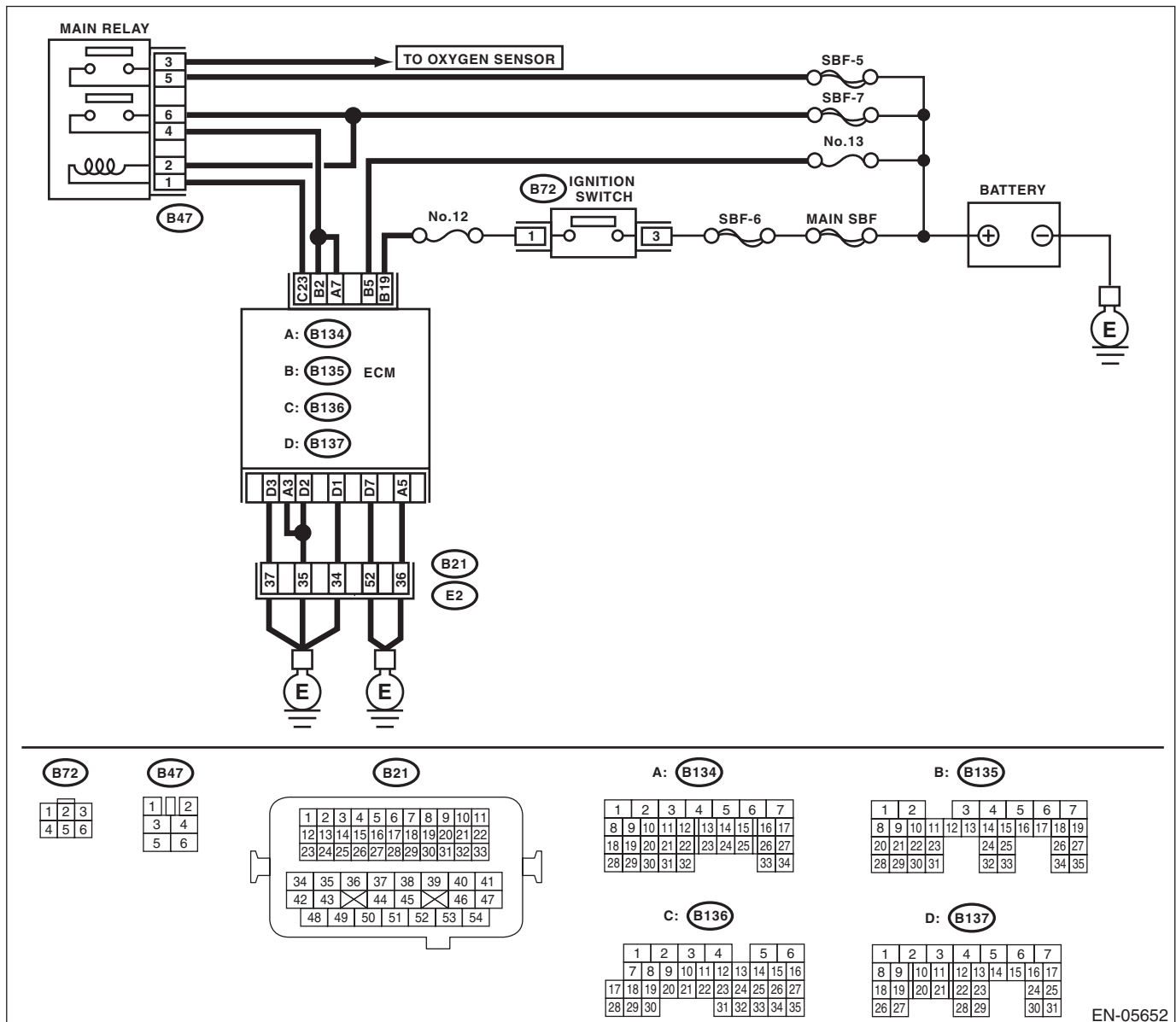
### TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05652

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. Reproduce the fault condition, and reperform the check. <b>NOTE:</b> In this case, there may be a temporary connector contact failure.

## **CX:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR**

**NOTE:**

For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H6DO)(diag)-274, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## CY:DTC P0607 CONTROL MODULE PERFORMANCE

### DTC DETECTING CONDITION:

- Depending on the content of malfunction, adapt either of the followings.
  - Immediately at fault recognition
  - Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-185, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

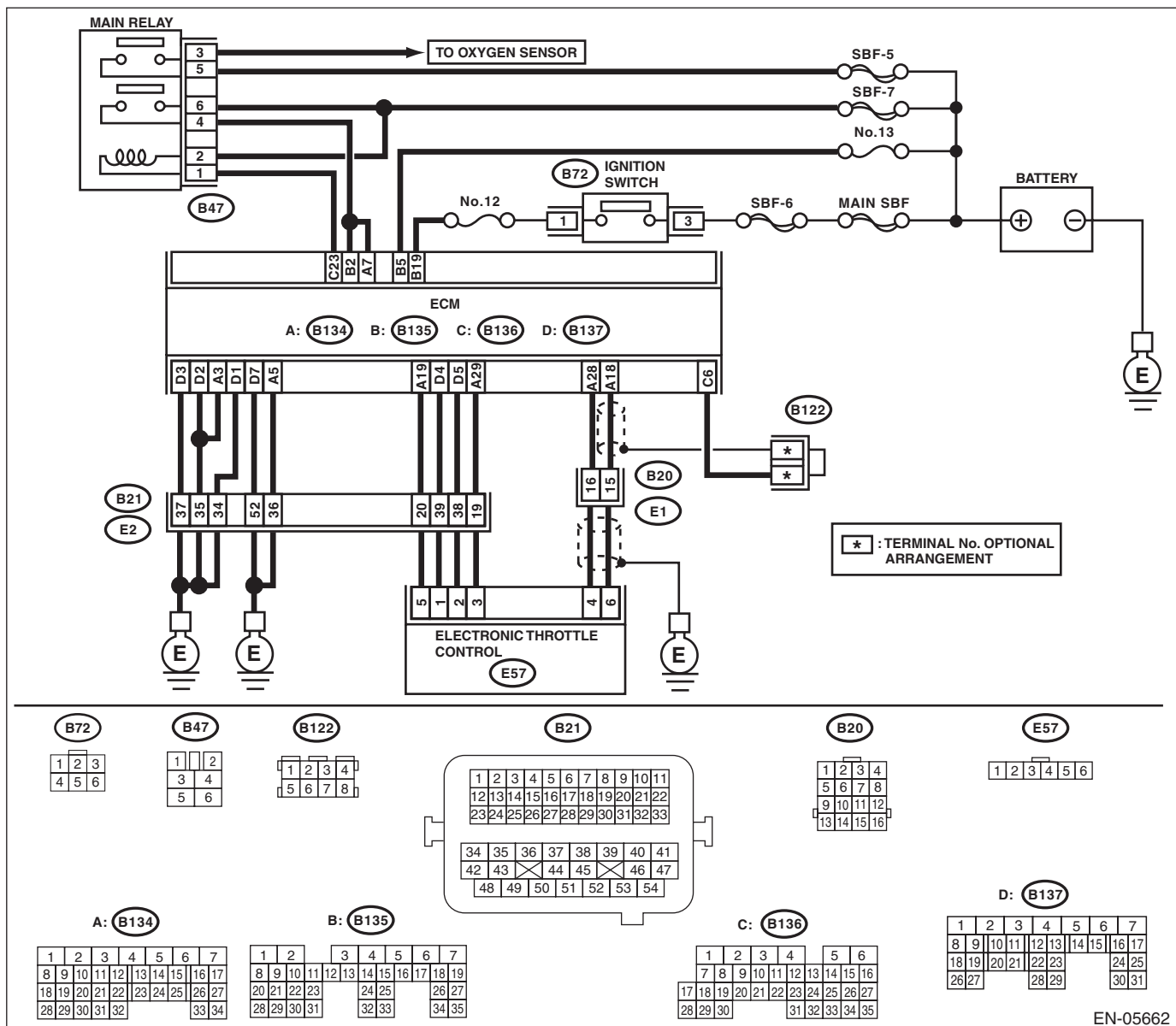
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05662

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INPUT VOLTAGE FROM ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> (B134) No. 7 (+) — Chassis ground (-): (B135) No. 2 (+) — Chassis ground (-):	Is the voltage 10 — 13 V?	Go to step 2.	Repair the open or ground short circuit of power supply circuit.
<b>2 CHECK INPUT VOLTAGE FROM ECM.</b> 1) Start the engine. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> (B134) No. 7 (+) — Chassis ground (-): (B135) No. 2 (+) — Chassis ground (-):	Is the voltage 13 — 15 V?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<b>3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> (B134) No. 19 — (E57) No. 5: (B134) No. 29 — (E57) No. 3:	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>4 CHECK ECM GROUND HARNESS.</b> Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> (B134) No. 3 (+) — Chassis ground (-): (B134) No. 5 (+) — Chassis ground (-): (B137) No. 1 (+) — Chassis ground (-): (B137) No. 2 (+) — Chassis ground (-): (B137) No. 3 (+) — Chassis ground (-): (B137) No. 7 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Repair the poor contact of the ECM connector.	Repair the following item. <ul style="list-style-type: none"> <li>• Open circuit of ground circuit</li> <li>• Retightening of engine ground terminals</li> <li>• Poor contact of coupling connector</li> </ul>

## CZ:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## DA:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DB:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

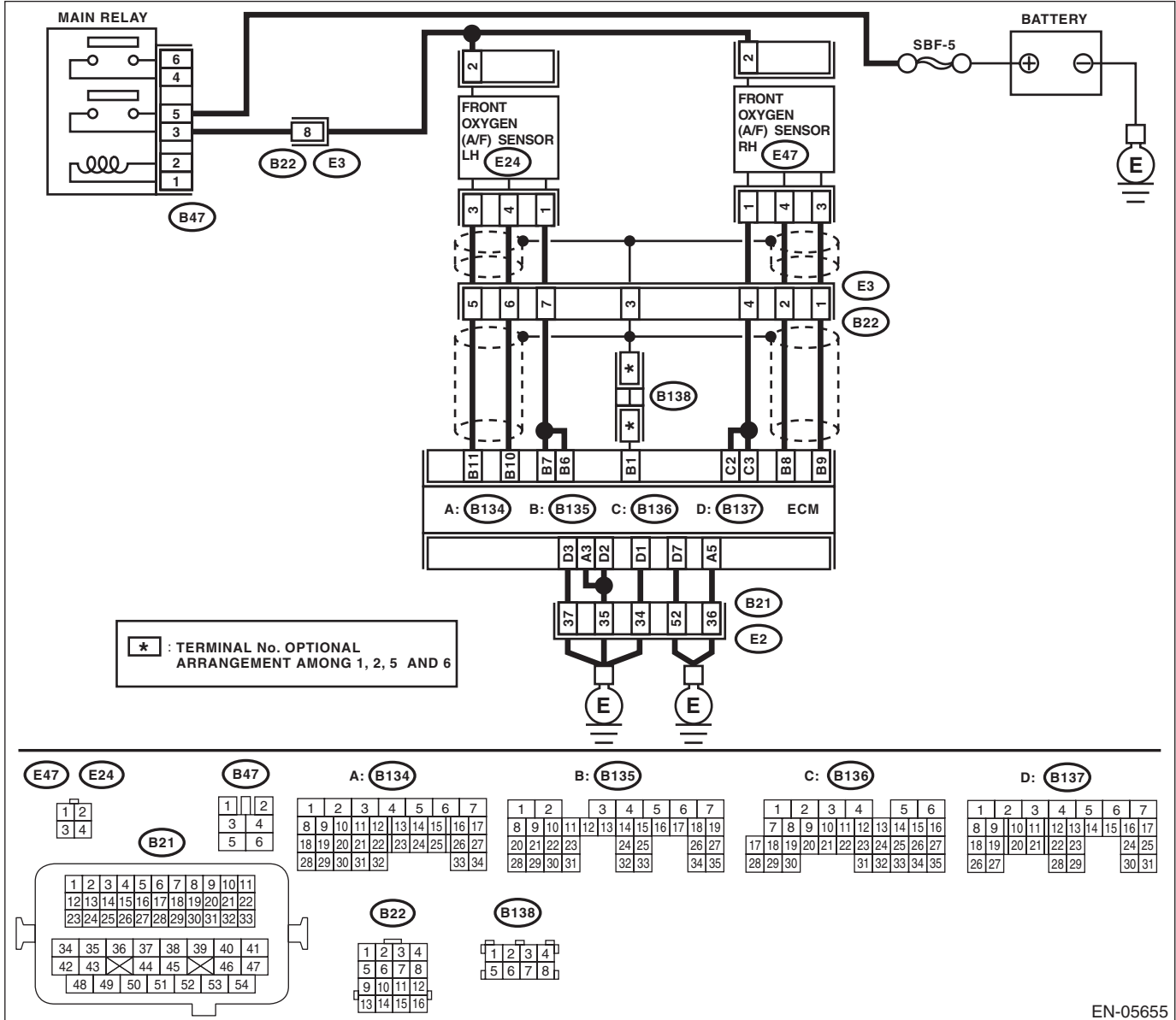
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-191, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — (E47) No. 3:</b> <b>(B135) No. 8 — (E47) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
<b>3</b> <b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DC:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

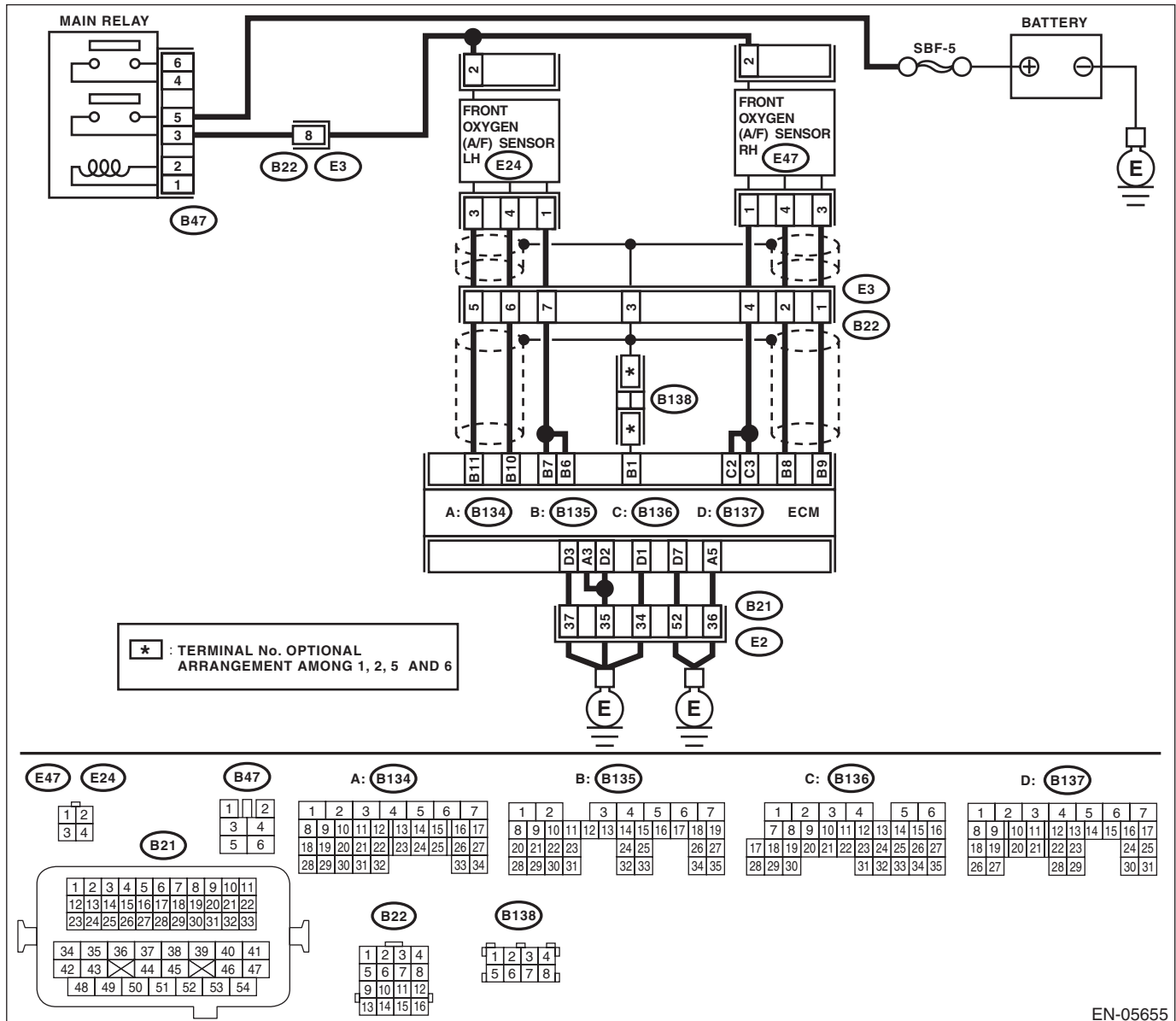
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-194, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 — Chassis ground:</b> <b>(B135) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 5.	Go to step 4.
4	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 9 (+) — Chassis ground (-):</b> <b>(B135) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DD:DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1)

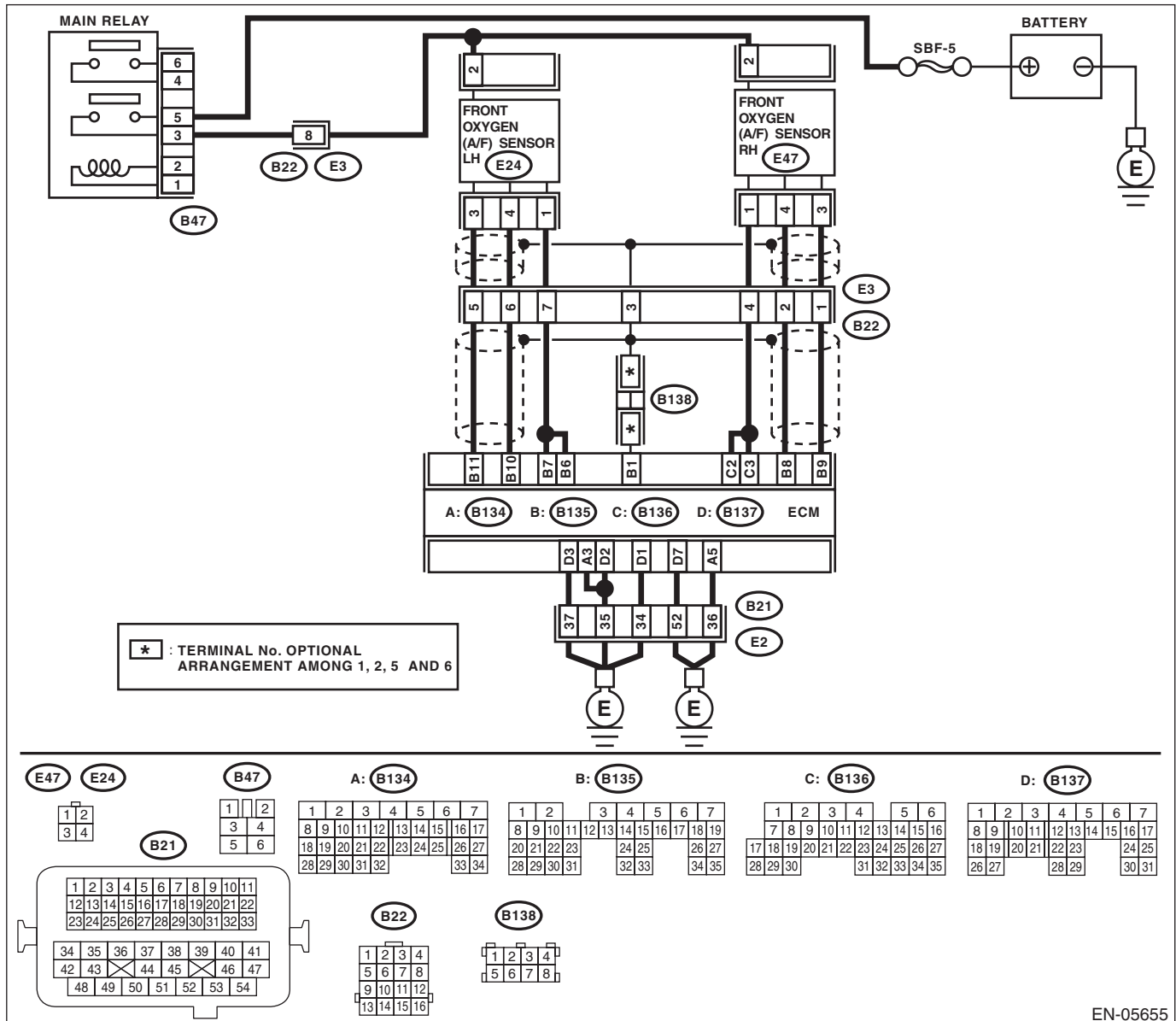
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-196, DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 11 — (E24) No. 3:</b> <b>(B135) No. 10 — (E24) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
3	<b>CHECK POOR CONTACT.</b> Check poor contact of front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair the poor contact of the front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DE:DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1)

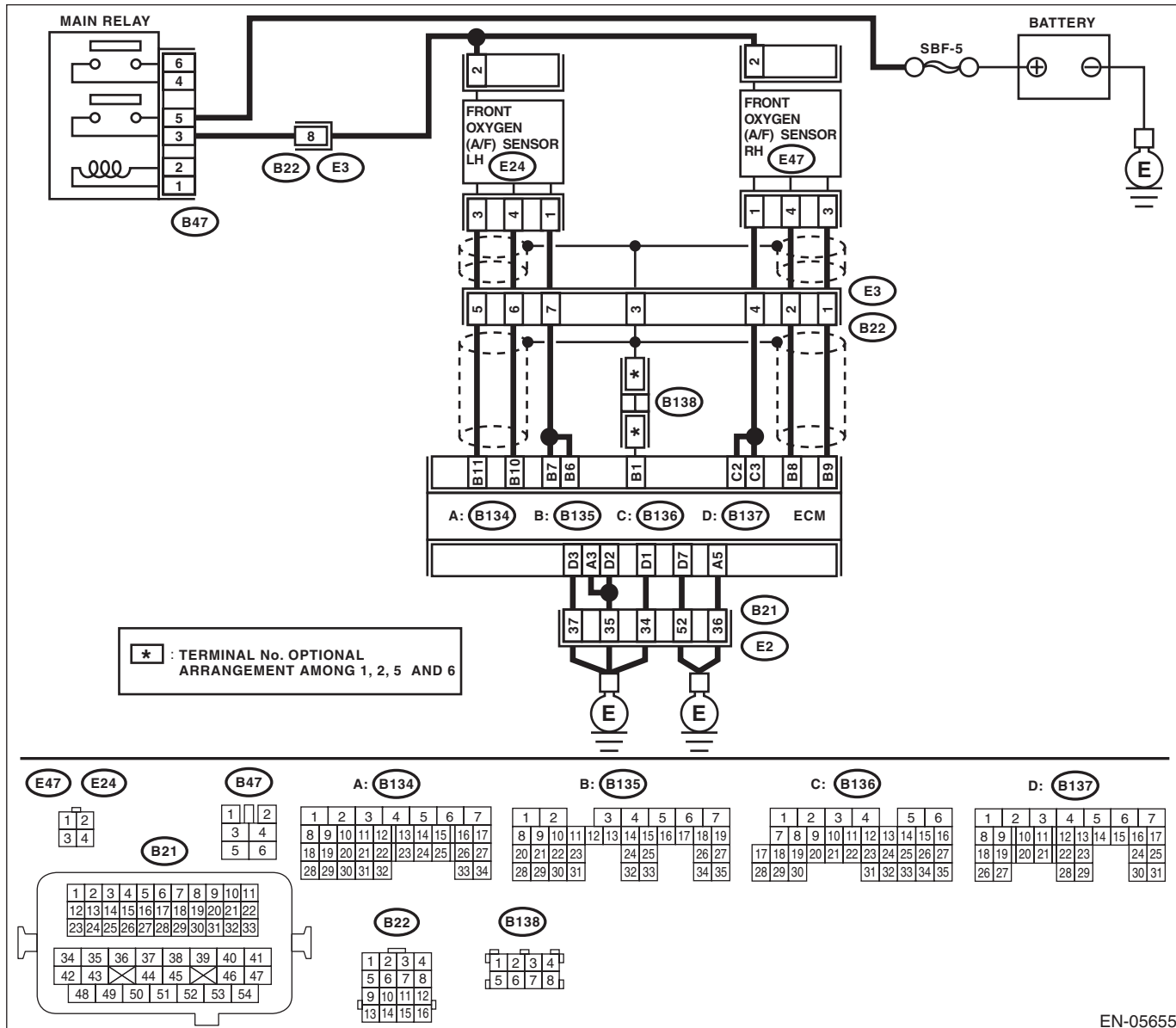
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-196, DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Completely remove any water inside.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 — Chassis ground:</b> <b>(B135) No. 10 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 5.	Go to step 4.
4	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 (+) — Chassis ground (-):</b> <b>(B135) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.

## DF:DTC P1160 RETURN SPRING FAILURE

### NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DG:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

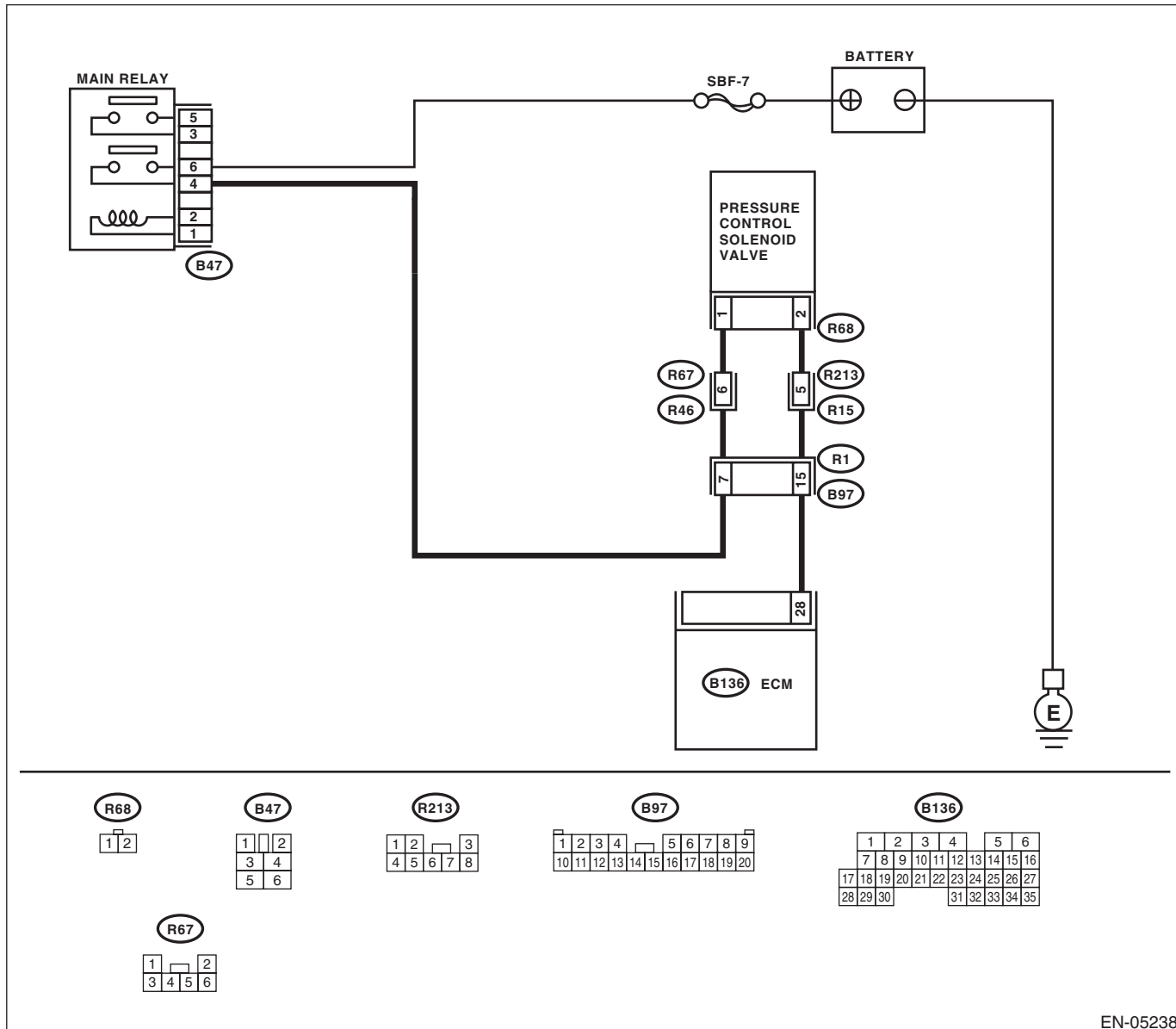
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-199, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05238



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK OUTPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B136) No. 28 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of the ECM connector.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Measure the resistance between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 2 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and pressure control solenoid valve connector.
3	<b>CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and pressure control solenoid valve connector. <i>Connector &amp; terminal</i> <i>(B136) No. 28 — (R68) No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
4	<b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b> Measure the resistance between pressure control solenoid valve terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance between 10 — 100 $\Omega$ ?	Go to step 5.	Replace the pressure control solenoid valve. <Ref. to EC(H6DO)-12, Pressure Control Solenoid Valve.>
5	<b>CHECK POWER SUPPLY TO THE PRESSURE CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between pressure control solenoid valve and chassis ground. <i>Connector &amp; terminal</i> <i>(R68) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the poor contact of pressure control solenoid valve connector.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit in harness between main relay and pressure control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DH:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

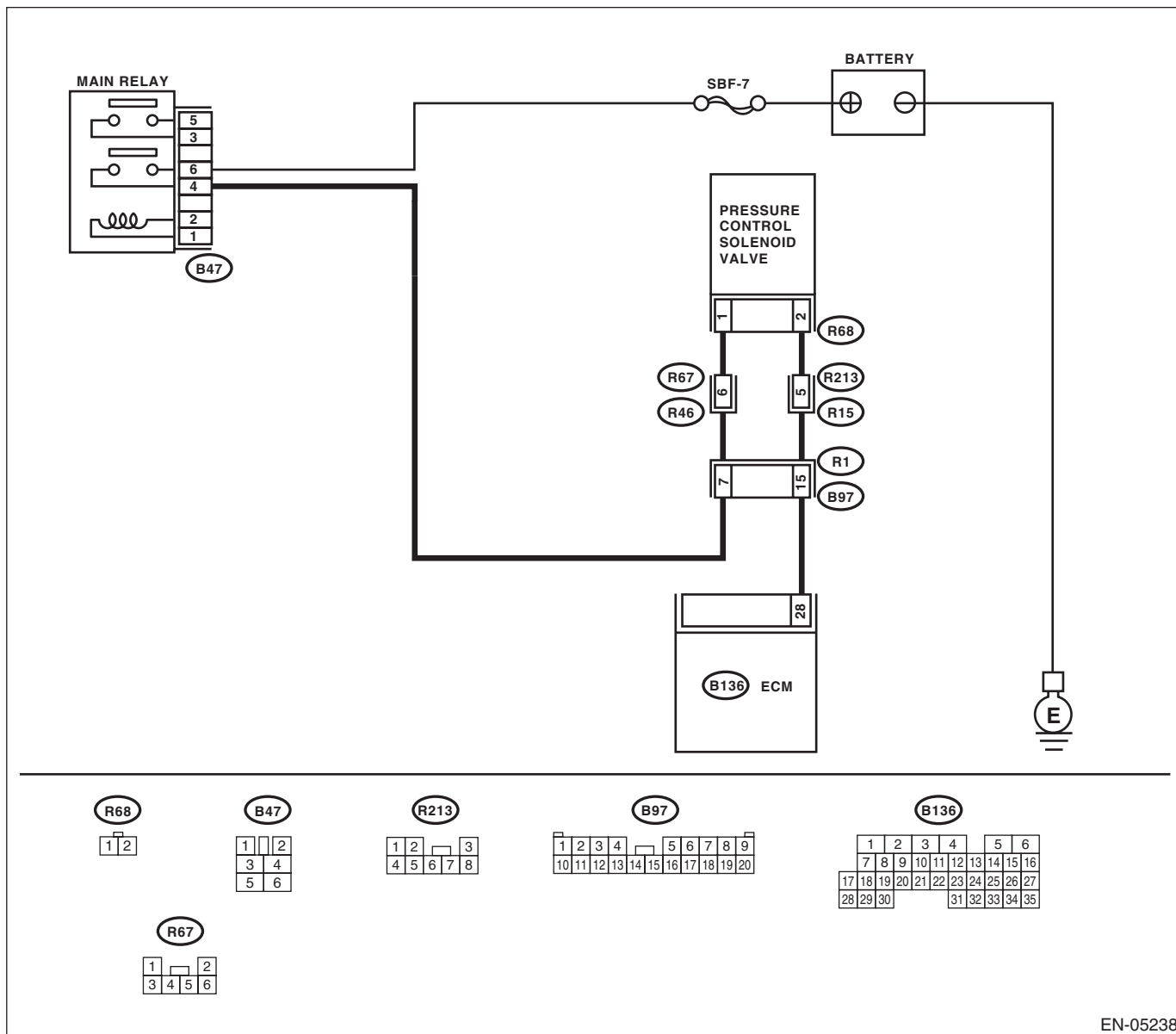
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-201, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05238

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 28 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK PRESSURE CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Replace the pressure control solenoid valve. &lt;Ref. to EC(H6DO)-12, Pressure Control Solenoid Valve.&gt;</p>	<p>Repair the poor contact of the ECM connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DI: DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-203, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

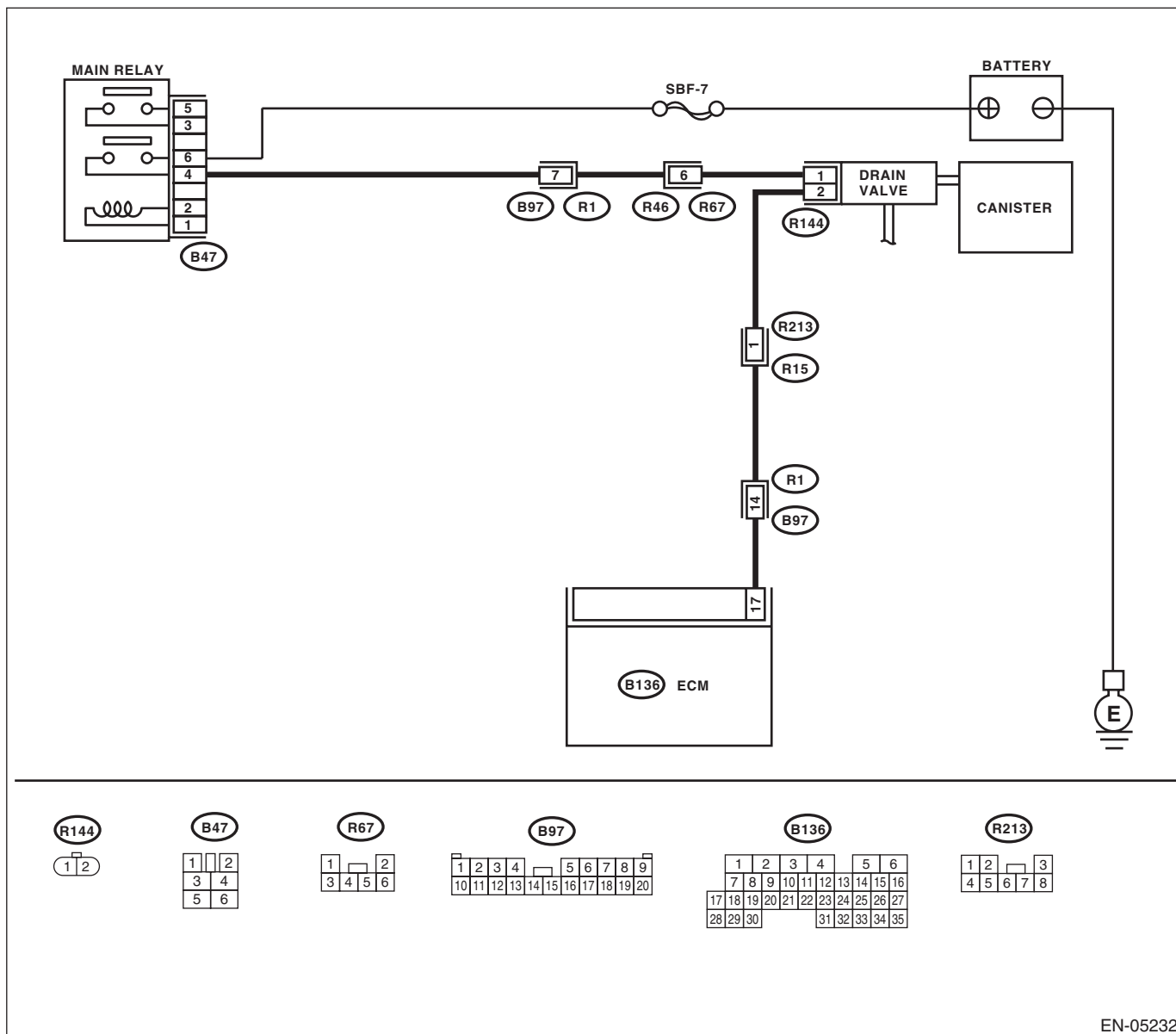
### TROUBLE SYMPTOM:

Improper fuel supply

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05232

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK DRAIN HOSE.</b> Check the drain hose for clogging.	Is there clogging in the drain hose?	Replace the drain hose.	Go to step 3.
3	<b>CHECK DRAIN VALVE OPERATION.</b> 1) Turn the ignition switch to OFF. 2) Connect the delivery (test) mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) Operate the drain valve.  NOTE: Drain valve operation can be executed using the Subaru Select Monitor. Regarding the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H6DO)(diag)-58, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Repair the poor contact of the ECM connector.	Replace the drain valve. <Ref. to EC(H6DO)-15, Drain Valve.>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **DJ:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H6DO)(diag)-291, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **DK:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H6DO)(diag)-294, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **DL:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H6DO)(diag)-291, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **DM:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H6DO)(diag)-294, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **DN:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H6DO)(diag)-291, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **DO:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H6DO)(diag)-294, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **DP:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)**

### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-205, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance
- Engine breathing

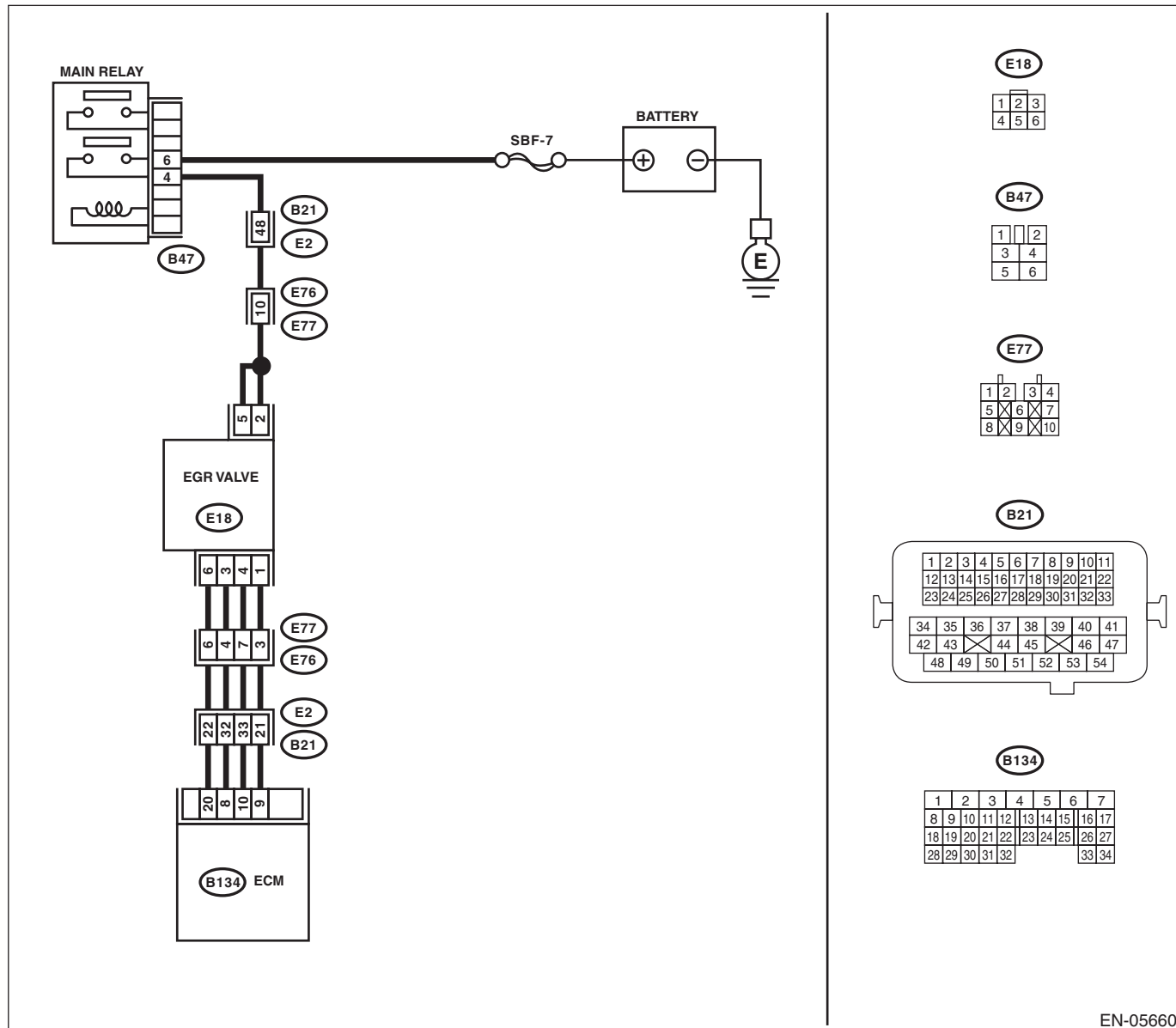
### **CAUTION:**

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05660



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY TO EGR SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from EGR solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between EGR solenoid valve connector and engine ground. <b>Connector &amp; terminal</b> <b>(E18) No. 2 (+) — Engine ground (-):</b> <b>(E18) No. 5 (+) — Engine ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and EGR solenoid valve and main relay connector • Poor contact of coupling connector
<b>2 CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and EGR solenoid valve connector. <b>Connector &amp; terminal</b> <b>DTC P1492; (B134) No. 8 — (E18) No. 3:</b> <b>DTC P1494; (B134) No. 9 — (E18) No. 1:</b> <b>DTC P1496; (B134) No. 10 — (E18) No. 4:</b> <b>DTC P1498; (B134) No. 20 — (E18) No. 6:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and EGR solenoid valve connector • Poor contact of coupling connector
<b>3 CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>DTC P1492; (B134) No. 8 — Chassis ground:</b> <b>DTC P1494; (B134) No. 9 — Chassis ground:</b> <b>DTC P1496; (B134) No. 10 — Chassis ground:</b> <b>DTC P1498; (B134) No. 20 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the ground short in harness between ECM and EGR solenoid valve connector.
<b>4 CHECK POOR CONTACT.</b> Check poor contact in ECM and EGR solenoid valve connector.	Is there poor contact in ECM or EGR solenoid valve connector?	Repair the poor contact in ECM or EGR solenoid valve connector.	Replace the EGR solenoid valve. <Ref. to FU(H6DO)-26, EGR Valve.>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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### **DQ:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)**

#### **DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-207, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H6DO)-209, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance
- Engine breathing

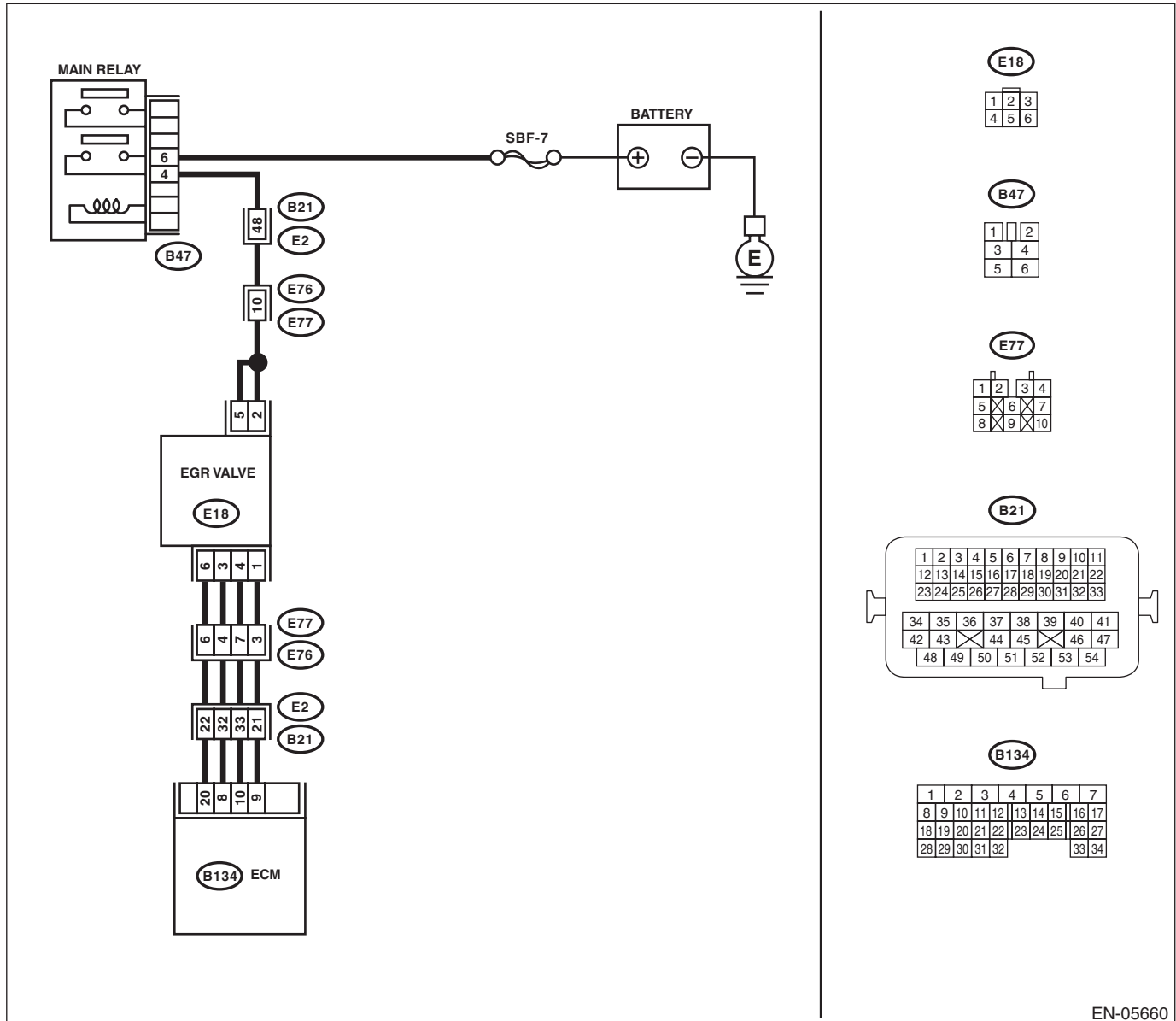
#### **CAUTION:**

**After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.**

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05660

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from EGR solenoid valve.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>                      DTC P1493; (B134) No. 8 (+) — Chassis ground (-):                      DTC P1495; (B134) No. 9 (+) — Chassis ground (-):                      DTC P1497; (B134) No. 10 (+) — Chassis ground (-):                      DTC P1499; (B134) No. 20 (+) — Chassis ground (-):</p>	<p>Is the voltage 10 V or more?</p>	<p>Repair the short circuit to power in the harness between the ECM and EGR solenoid valve connectors.</p>	<p>Repair the poor contact of the ECM connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DR:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

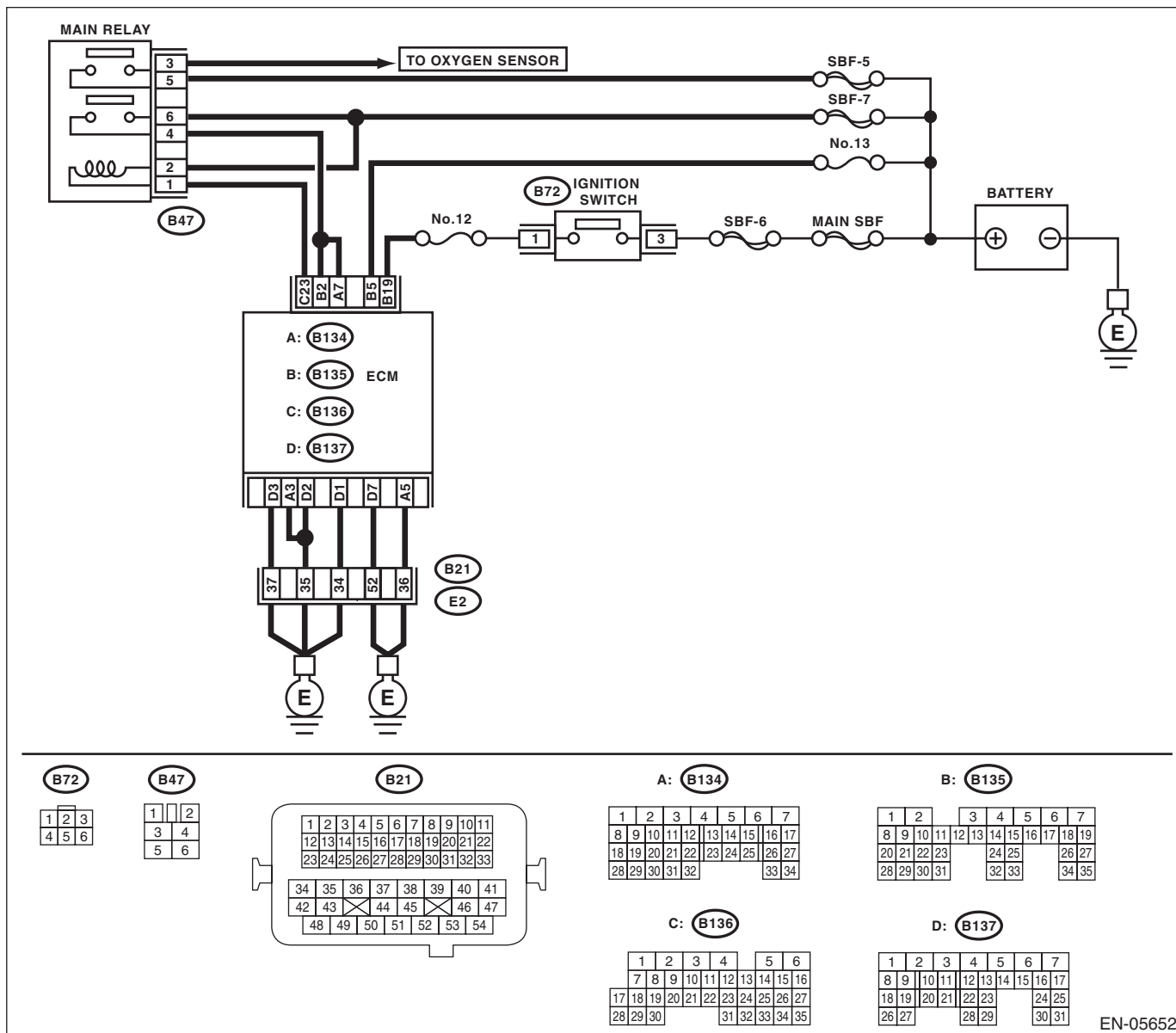
### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-210, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK INPUT SIGNAL OF ECM.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 5 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair poor contact of the ECM connector.	Go to step 2.
2	<b>CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B135) No. 5 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and battery terminal.
3	<b>CHECK FUSE NO. 13.</b>	Is the fuse blown out?	Replace the fuse.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and battery</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of battery terminal</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DS:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-212, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

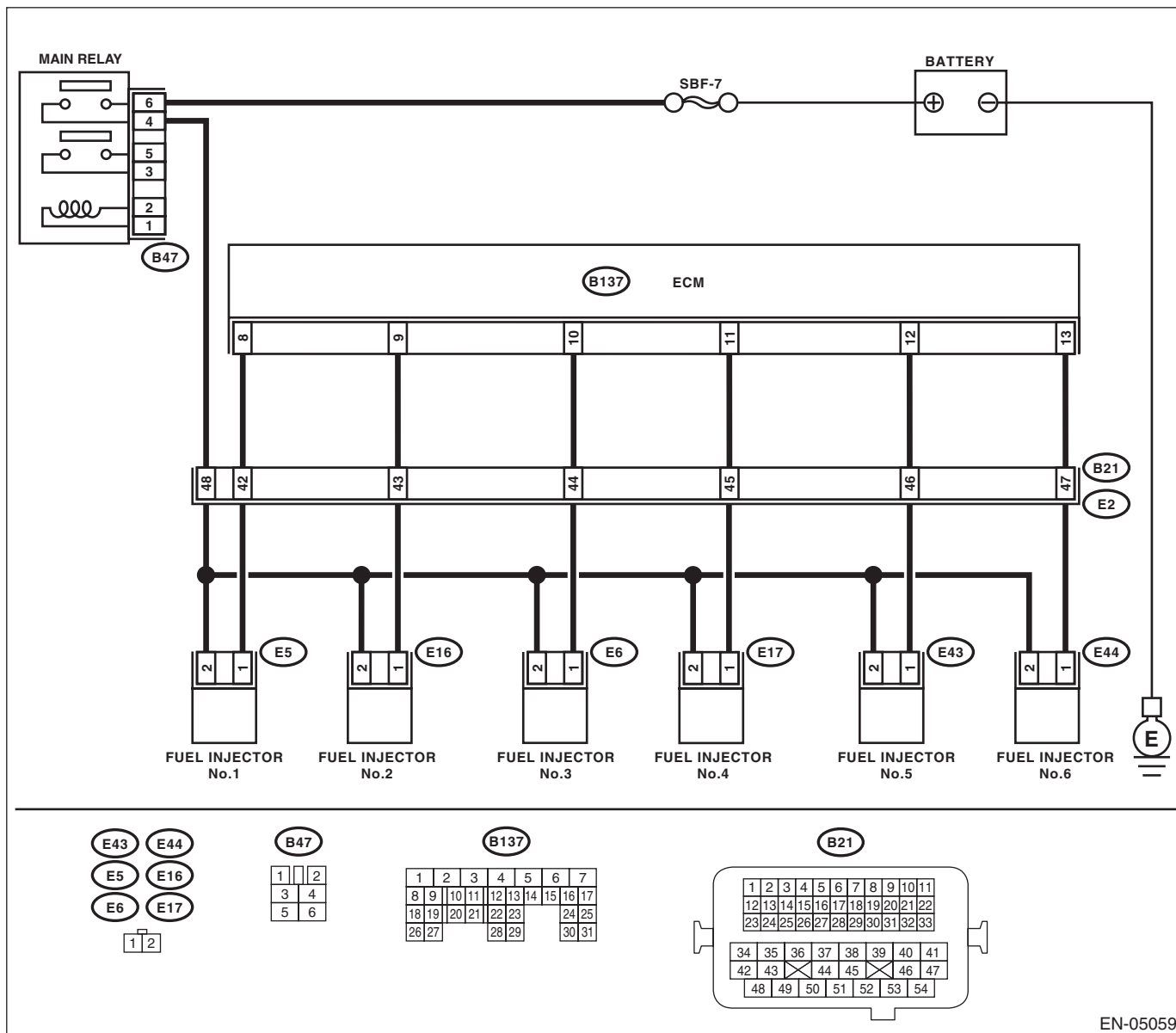
### TROUBLE SYMPTOM:

- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

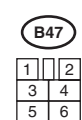
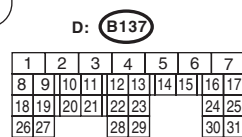
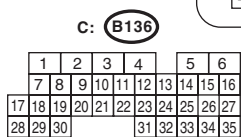
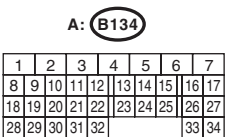
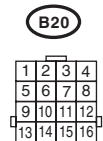
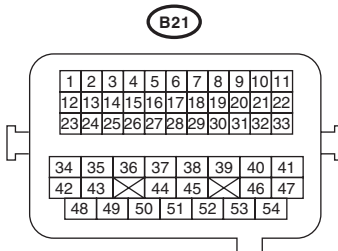
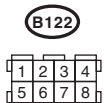
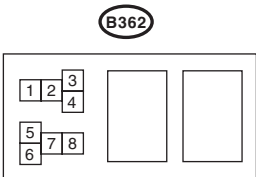
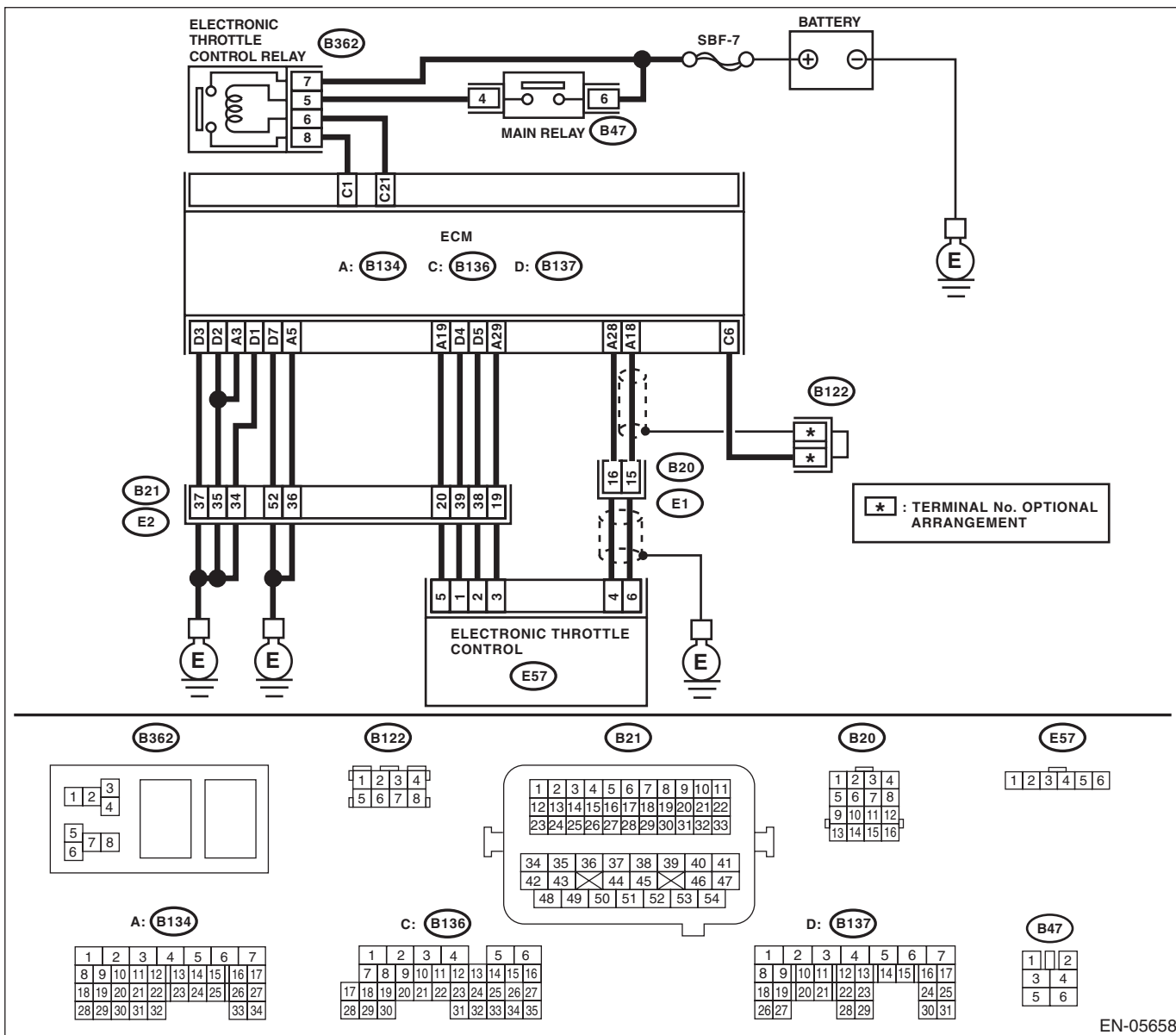
### WIRING DIAGRAM:



EN-05059

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK ENGINE OIL.</b>	Is there a proper amount of engine oil?	Go to step 3.	Replace engine oil. <Ref. to LU(H6DO)-7, REPLACEMENT, Engine Oil.>
3	<b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 4.
4	<b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 5.
5	<b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place "NO OPEN FLAMES" signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. Measure the fuel pressure. <Ref. to ME(H6DO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 333 — 363 kPa (3.4 — 3.7 kgf/cm <sup>2</sup> , 48 — 53 psi)?	Go to step 6.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
6	<b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step 7.	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b>      <b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) Place the select lever in “P” or “N” range.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 8.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>8</b>      <b>CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) Place the select lever in “P” or “N” range.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Open the front hood.</li> <li>6) Measure the ambient temperature.</li> <li>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Go to step 9.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>9</b>      <b>CHECK OUTPUT SIGNAL OF ECM.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to ON.</li> <li>2) Measure the voltage between the ECM and chassis ground for faulty cylinders.</li> </ol> <p><b>Connector &amp; terminal</b></p> <ul style="list-style-type: none"> <li>#1 (B137) No. 8 (+) — Chassis ground (-):</li> <li>#2 (B137) No. 9 (+) — Chassis ground (-):</li> <li>#3 (B137) No. 10 (+) — Chassis ground (-):</li> <li>#4 (B137) No. 11 (+) — Chassis ground (-):</li> <li>#5 (B137) No. 12 (+) — Chassis ground (-):</li> <li>#6 (B137) No. 13 (+) — Chassis ground (-):</li> </ul>	<p>Is the voltage 10 V or more?</p>	<p>Go to step 14.</p>	<p>Go to step 10.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>10 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between the fuel injector connector and engine ground on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (E5) No. 1 — Engine ground:</b>  <b>#2 (E16) No. 1 — Engine ground:</b>  <b>#3 (E6) No. 1 — Engine ground:</b>  <b>#4 (E17) No. 1 — Engine ground:</b>  <b>#5 (E43) No. 1 — Engine ground:</b>  <b>#6 (E44) No. 1 — Engine ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 11.	Repair the ground short circuit of harness between ECM and fuel injector.
<p><b>11 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b></p> <p>Measure the resistance of harness between the ECM and fuel injector on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (B137) No. 8 — (E5) No. 1:</b>  <b>#2 (B137) No. 9 — (E16) No. 1:</b>  <b>#3 (B137) No. 10 — (E6) No. 1:</b>  <b>#4 (B137) No. 11 — (E17) No. 1:</b>  <b>#5 (B137) No. 12 — (E43) No. 1:</b>  <b>#6 (B137) No. 13 — (E44) No. 1:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 12.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and fuel injector connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>12 CHECK FUEL INJECTOR.</b></p> <p>Measure the resistance between fuel injector terminals on faulty cylinder.</p> <p><b>Terminals</b>  <b>No. 1 — No. 2:</b></p>	Is the resistance between 5 — 20 $\Omega$ ?	Go to step 13.	Replace the faulty fuel injector. <Ref. to FU(H6DO)-27, Fuel Injector.>
<p><b>13 CHECK POWER SUPPLY LINE.</b></p> <p>1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders.</p> <p><b>Connector &amp; terminal</b>  <b>#1 (E5) No. 2 (+) — Engine ground (-):</b>  <b>#2 (E16) No. 2 (+) — Engine ground (-):</b>  <b>#3 (E6) No. 2 (+) — Engine ground (-):</b>  <b>#4 (E17) No. 2 (+) — Engine ground (-):</b>  <b>#5 (E43) No. 2 (+) — Engine ground (-):</b>  <b>#6 (E44) No. 2 (+) — Engine ground (-):</b></p>	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between main relay and fuel injector on faulty cylinders</li> <li>• Poor contact of coupling connector</li> <li>• Poor contact of main relay connector</li> <li>• Poor contact of fuel injector connector on faulty cylinders</li> </ul>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>14 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between the ECM and chassis ground for faulty cylinders. <b>Connector &amp; terminal</b> <b>#1 (B137) No. 8 (+) — Chassis ground (-):</b> <b>#2 (B137) No. 9 (+) — Chassis ground (-):</b> <b>#3 (B137) No. 10 (+) — Chassis ground (-):</b> <b>#4 (B137) No. 11 (+) — Chassis ground (-):</b> <b>#5 (B137) No. 12 (+) — Chassis ground (-):</b> <b>#6 (B137) No. 13 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step 15.
<b>15 CHECK FUEL INJECTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the faulty fuel injector. <Ref. to FU(H6DO)-27, Fuel Injector.>	Go to step 16.
<b>16 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.</b>	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor.	Go to step 17.
<b>17 CHECK CRANK PLATE.</b>	Is the crank sprocket rusted or the teeth of crank plate broken?	Replace the crank plate. <Ref. to ME(H6DO)-64, Cylinder Block.>	Go to step 18.
<b>18 CHECK INSTALLATION CONDITION OF TIMING CHAIN.</b> Turn the crankshaft using ST, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H6DO)-44, Timing Chain Assembly.>	Go to step 19.
<b>19 CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. <b>Terminals</b> <b>No. 7 — No. 8:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 20.	Replace the electronic throttle control relay. <Ref. to EN(H6DO)(diag)-8, Electrical Component Location.>
<b>20 CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the voltage between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 21.	Repair the open or ground short circuit of power supply circuit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>21 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 22.
<b>22 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 — Chassis ground:</i> <i>(B362) No. 8 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 23.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<b>23 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the resistance between the ECM and electronic throttle control relay connector. <i>Connector &amp; terminal</i> <i>(B136) No. 21 — (B362) No. 6:</i> <i>(B136) No. 1 — (B362) No. 8:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 24.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<b>24 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 19 — Chassis ground:</i> <i>(B134) No. 18 — Chassis ground:</i> <i>(B134) No. 18 — (B136) No. 6:</i> <i>(B134) No. 28 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 25.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.
<b>25 CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 6 — Engine ground:</i> <i>(E57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 26.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>26 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 27.	Repair the open circuit of harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>27 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step <b>28</b> .	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>28 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step <b>29</b> .
<b>29 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step <b>30</b> .	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.
<b>30 CHECK SENSOR OUTPUT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step <b>31</b> .	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>
<b>31 CHECK SENSOR OUTPUT.</b> Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step <b>32</b> .	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>32 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B137) No. 5 — (E57) No. 2:</i> <i>(B137) No. 4 — (E57) No. 1:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 33.	Repair the open circuit of harness between ECM and electronic throttle control.
<b>33 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 (+) — Engine ground (-):</i> <i>(E57) No. 1 (+) — Engine ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step 34.
<b>34 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — Engine ground:</i> <i>(E57) No. 1 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 35.	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>35 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — (E57) No. 1:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 36.	Repair the short circuit in the harness between the ECM and electronic throttle control.
<b>36 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 3 — Chassis ground:</i> <i>(B134) No. 5 — Chassis ground:</i> <i>(B137) No. 1 — Chassis ground:</i> <i>(B137) No. 2 — Chassis ground:</i> <i>(B137) No. 3 — Chassis ground:</i> <i>(B137) No. 7 — Chassis ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 37.	Repair the open circuit of the harness between the ECM and engine ground.
<b>37 CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <i>Terminals</i> <i>No. 2 — No. 1:</i>	Is the resistance 50 $\Omega$ or less?	Go to step 38.	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>
<b>38 CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>

## DT:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

**DTC DETECTING CONDITION:**

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-214, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

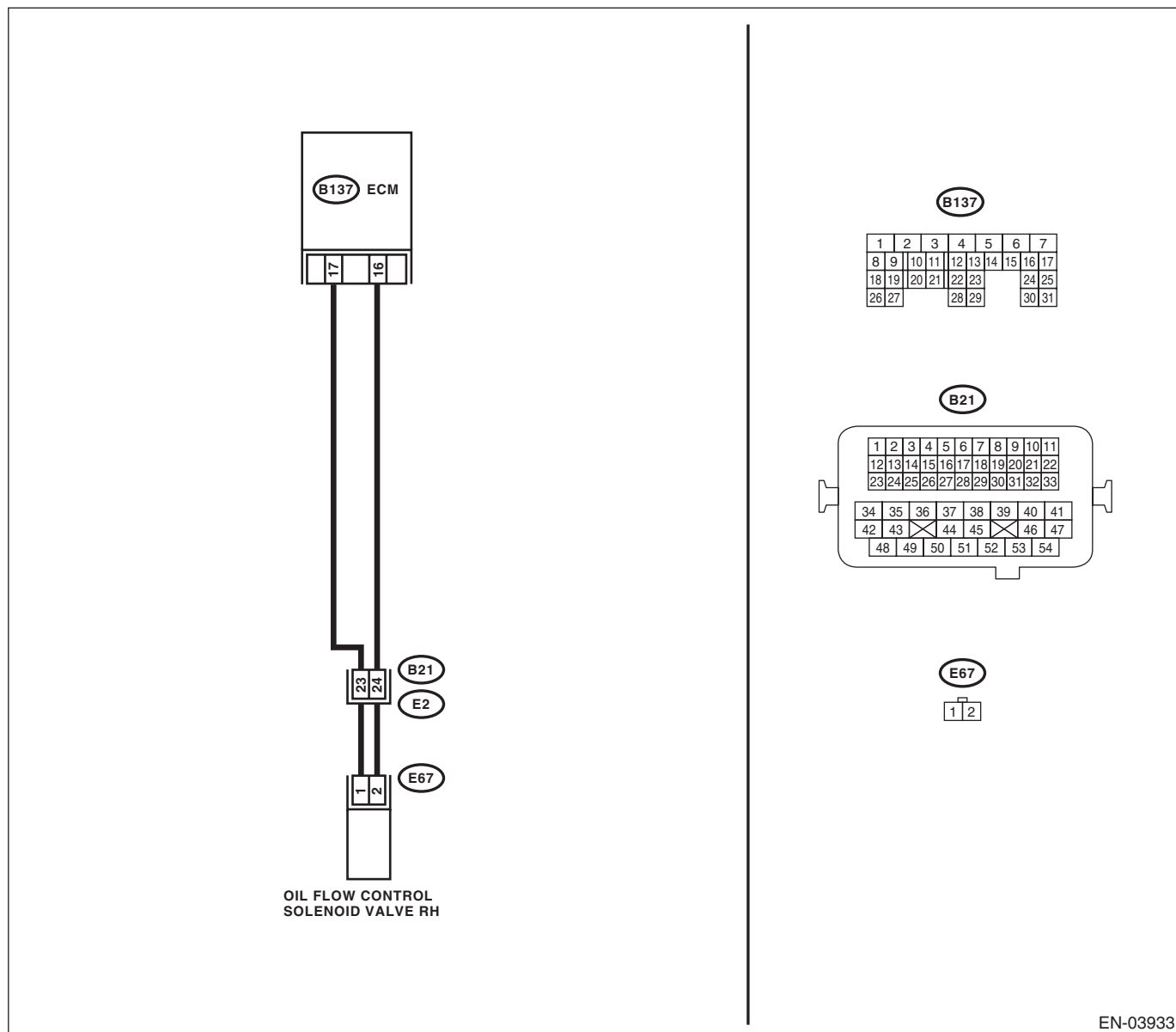
**TROUBLE SYMPTOM:**

Improper idling

**CAUTION:**

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve. <b>Connector &amp; terminal</b> <i>(B137) No. 17 — (E67) No. 1:</i> <i>(B137) No. 16 — (E67) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and oil flow control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <i>(B137) No. 17 — Chassis ground:</i> <i>(B137) No. 16 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and oil flow control solenoid valve connector.
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <b>Terminals</b> <i>No. 1 — No. 2:</i>	Is the resistance between 6 — 12 Ω?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H6DO)-80, Oil Flow Control Solenoid Valve.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DU:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-216, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

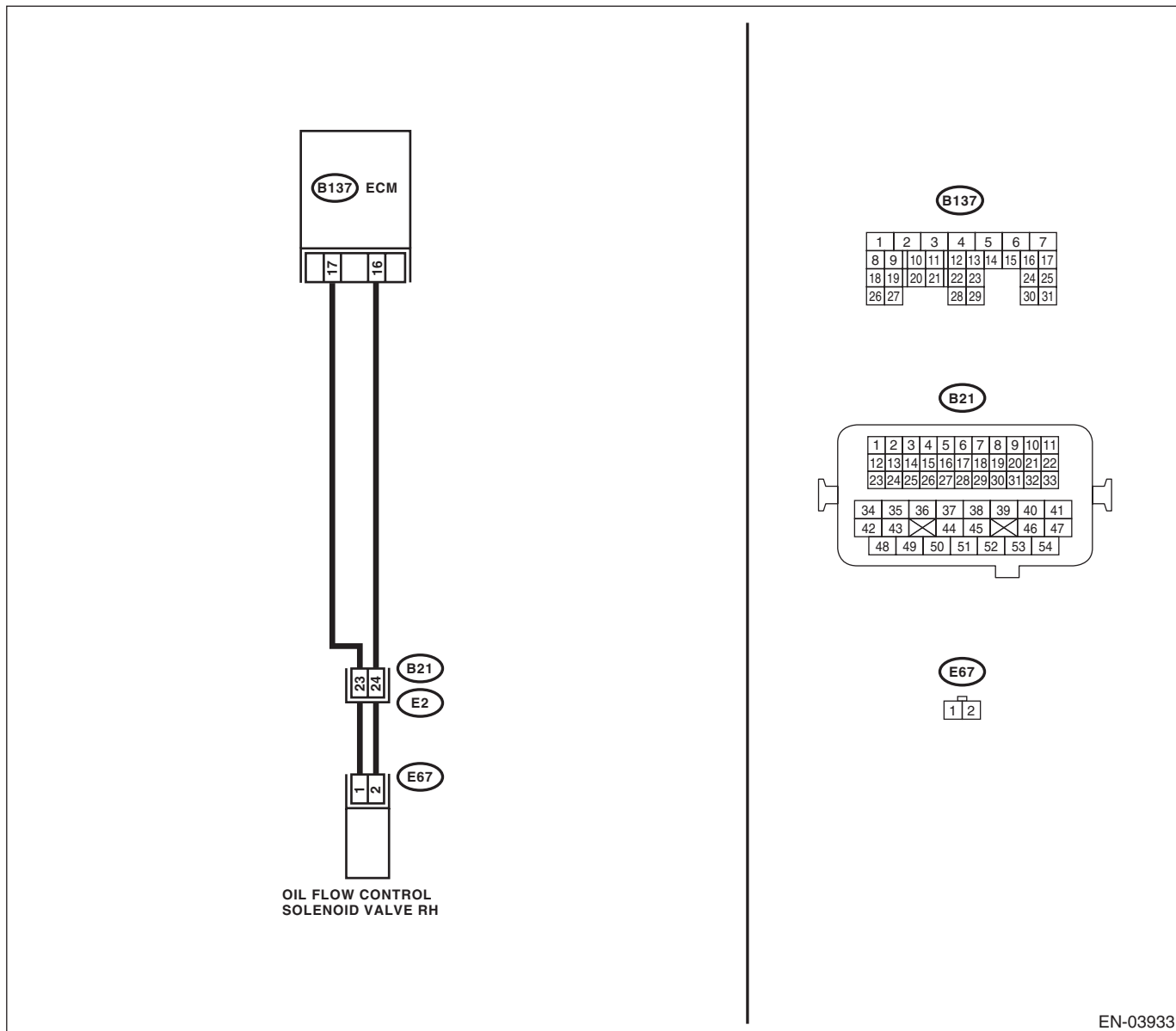
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03933

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the voltage between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B137) No. 17 (+) — Chassis ground (-):</b> <b>(B137) No. 16 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V?</p>	<p>Go to step 2.</p>	<p>Repair the short circuit to power in the harness between the ECM and oil flow control solenoid valve connector.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b></p> <p>Measure the resistance of harness between ECM and oil flow control solenoid valve connector.</p> <p><b>Connector &amp; terminal</b> <b>(B137) No. 17 — (E67) No. 1:</b> <b>(B137) No. 16 — (E67) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.</p> <p>NOTE: In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and oil flow control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3</b></p> <p><b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b></p> <p>Measure the resistance between oil flow control solenoid valve terminals.</p> <p><b>Terminals</b> <b>No. 1 — No. 2:</b></p>	<p>Is the resistance between 6 — 12 Ω?</p>	<p>Repair the poor contact of the ECM and oil flow control solenoid valve connector.</p>	<p>Replace the oil flow control solenoid valve. &lt;Ref. to ME(H6DO)-80, Oil Flow Control Solenoid Valve.&gt;</p>

## DV:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-217, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

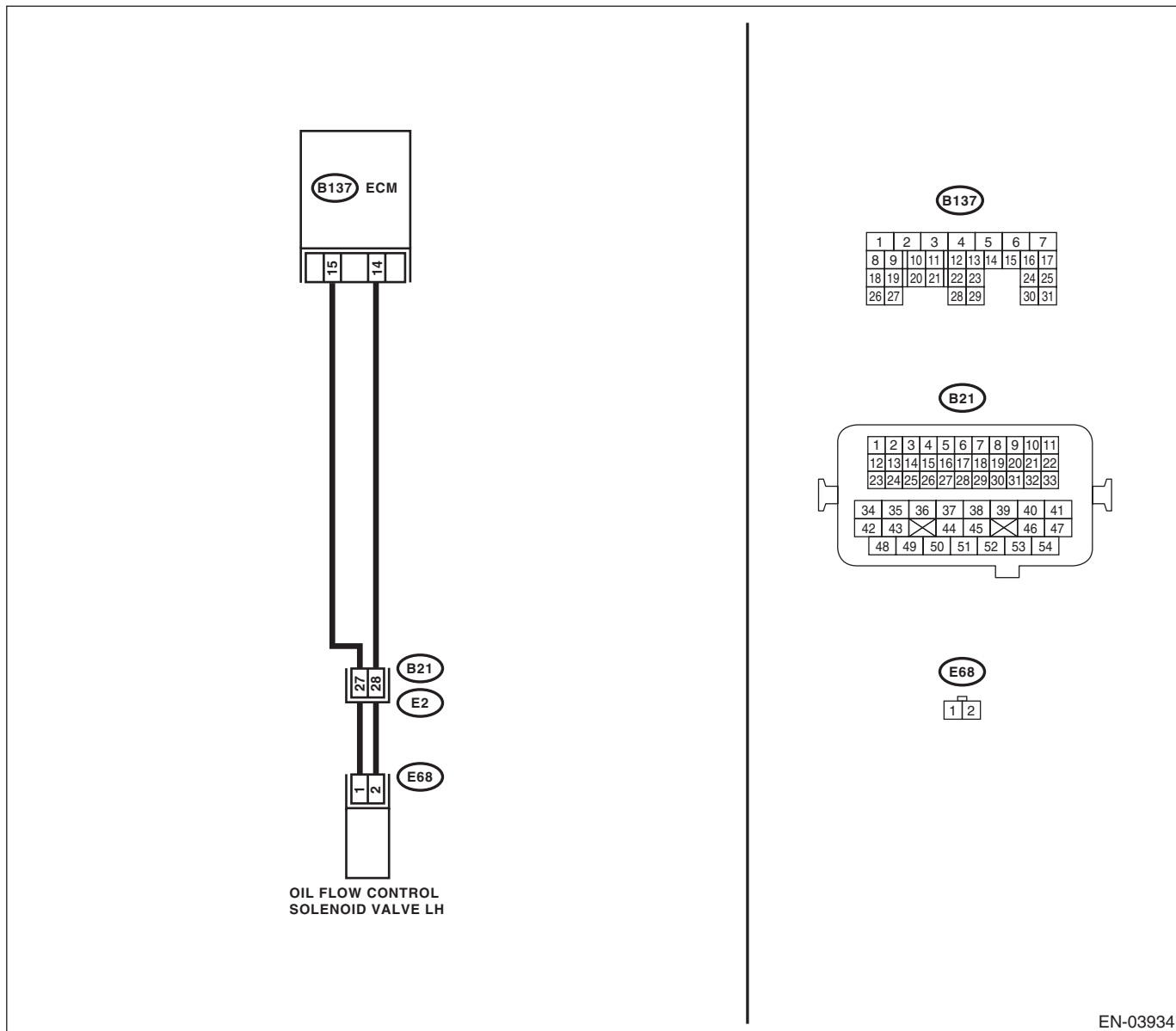
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03934

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve. <b>Connector &amp; terminal</b> <i>(B137) No. 15 — (E68) No. 1:</i> <i>(B137) No. 14 — (E68) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the harness and connector.  NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of the harness between the ECM and oil flow control solenoid valve connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <i>(B137) No. 15 — Chassis ground:</i> <i>(B137) No. 14 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and oil flow control solenoid valve connector.
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <b>Terminals</b> <i>No. 1 — No. 2:</i>	Is the resistance between 6 — 12 Ω?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H6DO)-80, Oil Flow Control Solenoid Valve.>

## DW:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-217, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

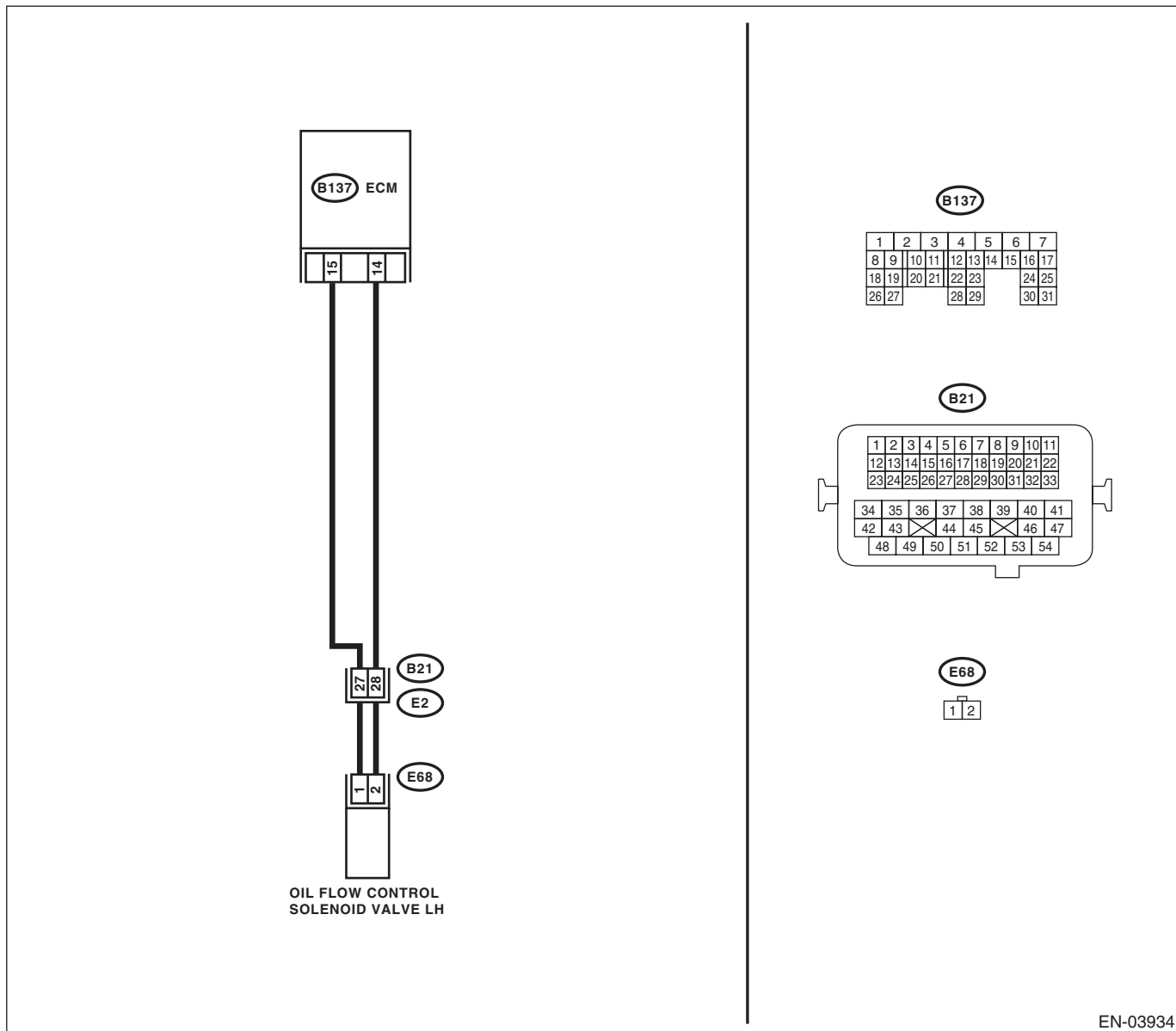
### TROUBLE SYMPTOM:

Improper idling

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-03934

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve. 3) Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B137) No. 15 (+) — Chassis ground (-):</b> <b>(B137) No. 14 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 2.	Repair the short circuit to power in the harness between the ECM and oil flow control solenoid valve connector.
<b>2</b> <b>CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance of harness between ECM and oil flow control solenoid valve connector. <b>Connector &amp; terminal</b> <b>(B137) No. 15 — (E68) No. 1:</b> <b>(B137) No. 14 — (E68) No. 2:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of the harness between the ECM and oil flow control solenoid valve connector • Poor contact of coupling connector
<b>3</b> <b>CHECK OIL FLOW CONTROL SOLENOID VALVE.</b> Measure the resistance between oil flow control solenoid valve terminals. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance between 6 — 12 Ω?	Repair the poor contact of the ECM and oil flow control solenoid valve connector.	Replace the oil flow control solenoid valve. <Ref. to ME(H6DO)-80, Oil Flow Control Solenoid Valve.>

## DX:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

NOTE:

Refer to DTC P2097 for diagnostic procedure. <Ref. to EN(H6DO)(diag)-315, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## DY:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

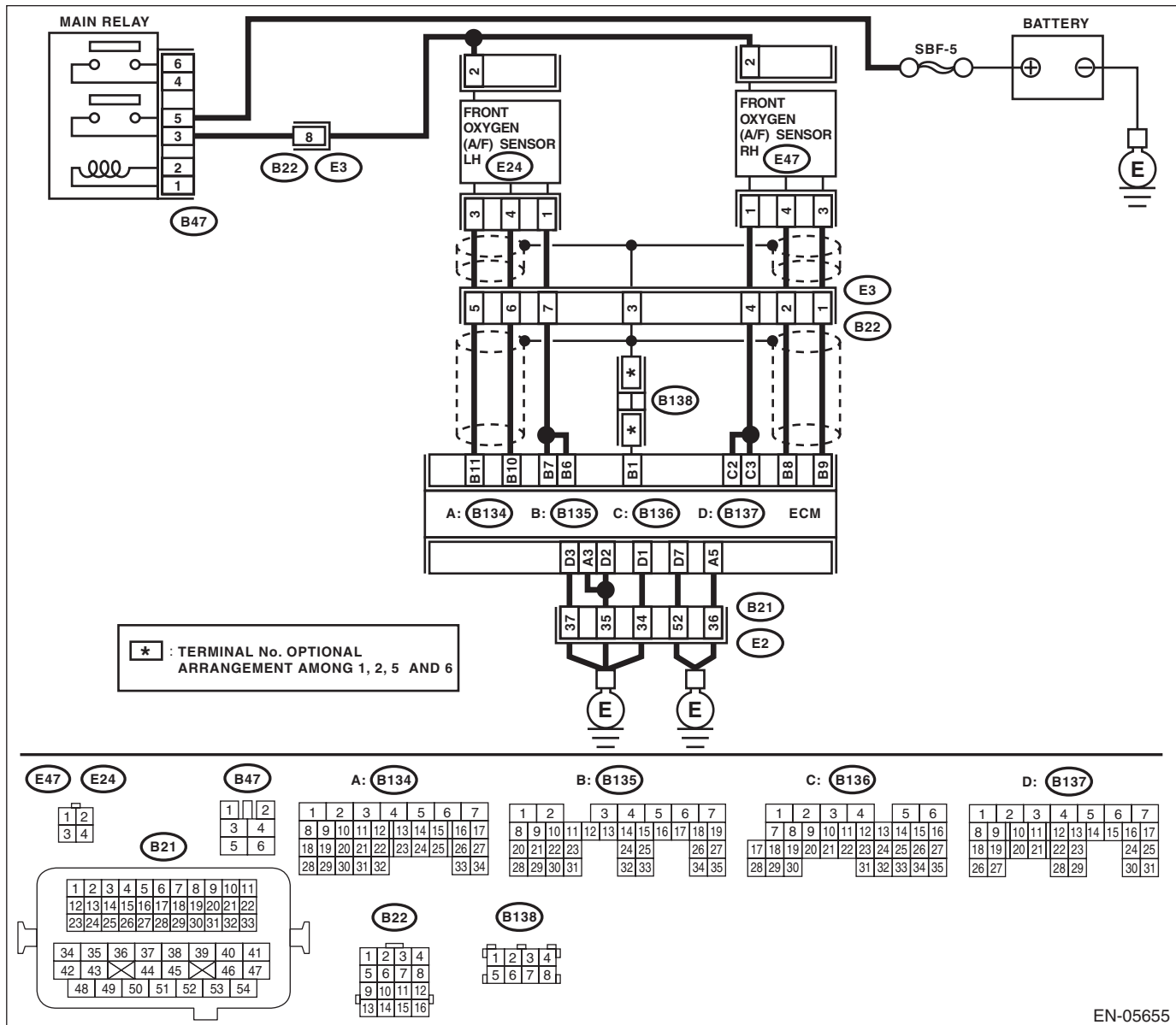
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-220, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

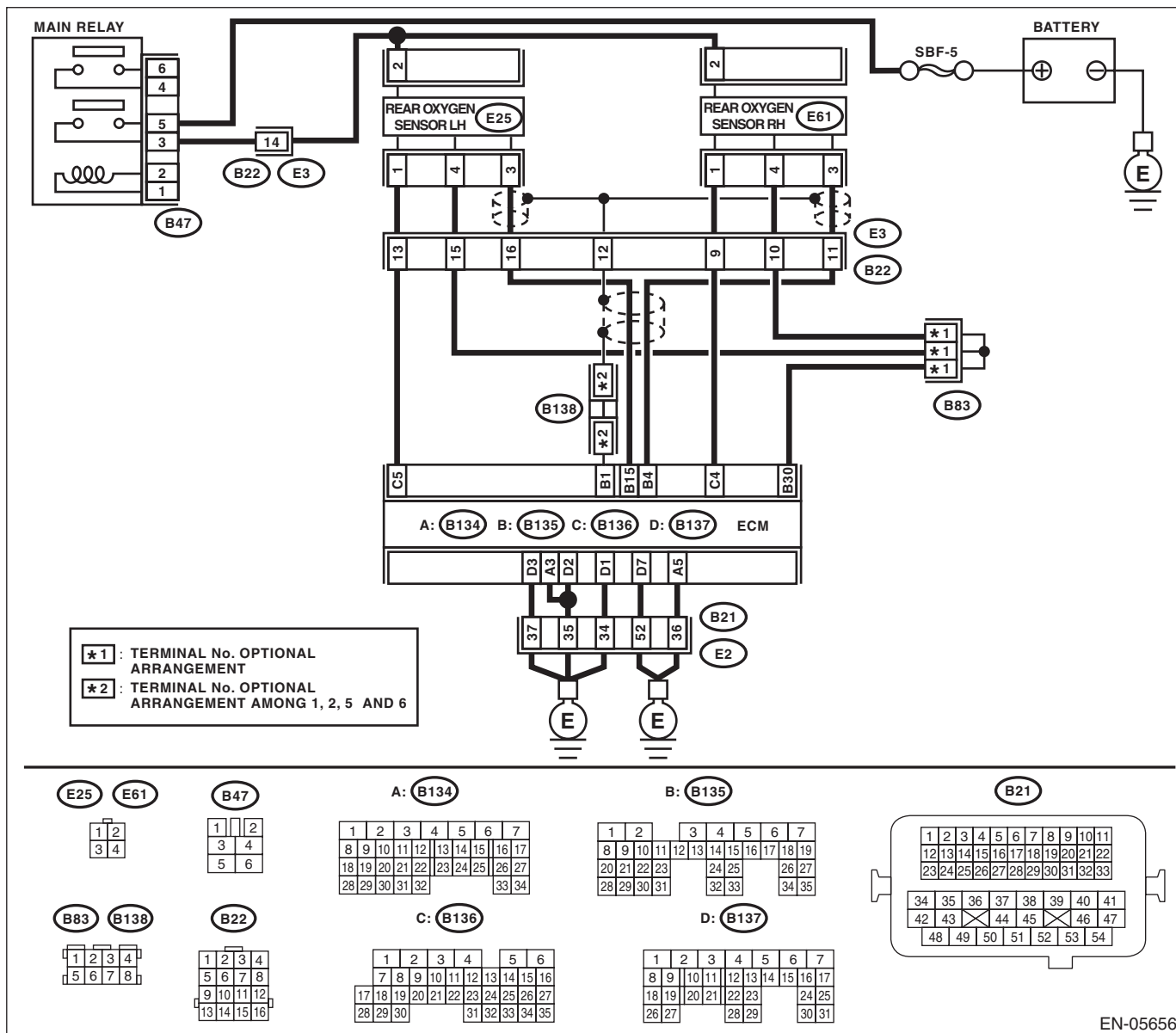
### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)



Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b> Has water entered the connector?	Completely remove any water inside.	Go to step 3.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>3</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor.                      3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 9 — (E47) No. 3:</b>  <b>(B135) No. 8 — (E47) No. 4:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness and connector.</p> <p>NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit in harness between ECM and front oxygen (A/F) sensor connector</li> <li>• Poor contact in front oxygen (A/F) sensor connector</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b></p> <p>Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 9 — Chassis ground:</b>  <b>(B135) No. 8 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 5.</p>	<p>Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.</p>
<p><b>5</b></p> <p><b>CHECK OUTPUT SIGNAL FOR ECM.</b></p> <p>1) Connect the connector to ECM.                      2) Turn the ignition switch to ON.                      3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E47) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.5 V or more?</p>	<p>Go to step 7.</p>	<p>Go to step 6.</p>
<p><b>6</b></p> <p><b>CHECK OUTPUT SIGNAL FOR ECM.</b></p> <p>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E47) No. 4 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.95 V or more?</p>	<p>Go to step 7.</p>	<p>Go to step 8.</p>
<p><b>7</b></p> <p><b>CHECK OUTPUT SIGNAL FOR ECM.</b></p> <p>Measure the voltage between front oxygen (A/F) sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E47) No. 3 (+) — Chassis ground (-):</b>  <b>(E47) No. 4 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 8 V or more?</p>	<p>Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM.                      &lt;Ref. to FU(H6DO)-37, Engine Control Module (ECM).&gt;</p>	<p>Repair poor contact of the ECM connector.</p>
<p><b>8</b></p> <p><b>CHECK EXHAUST SYSTEM.</b></p>	<p>Are there holes or loose bolts on exhaust system?</p>	<p>Repair the exhaust system.</p>	<p>Go to step 9.</p>
<p><b>9</b></p> <p><b>CHECK AIR INTAKE SYSTEM.</b></p>	<p>Are there holes, loose bolts or disconnection of hose on air intake system?</p>	<p>Repair the air intake system.</p>	<p>Go to step 10.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>10 CHECK FUEL PRESSURE.</b>  <b>WARNING:</b>            Place “NO OPEN FLAMES” signs near the working area.  <b>CAUTION:</b>            Be careful not to spill fuel.</p> <ol style="list-style-type: none"> <li>1) Connect the front oxygen (A/F) sensor connector.</li> <li>2) Measure the fuel pressure. &lt;Ref. to ME(H6DO)-26, INSPECTION, Fuel Pressure.&gt;</li> </ol> <p><b>CAUTION:</b>            Release fuel pressure before removing the fuel pressure gauge.</p>	<p>Is the measured value 333 — 363 kPa (3.4 — 3.7 kgf/cm<sup>2</sup>, 48 — 53 psi)?</p>	<p>Go to step 11.</p>	<p>Repair the following item.            Fuel pressure is too high:</p> <ul style="list-style-type: none"> <li>• Clogged fuel line or bent hose</li> </ul> <p>Fuel pressure is too low:</p> <ul style="list-style-type: none"> <li>• Improper fuel pump discharge</li> <li>• Clogged fuel line</li> </ul>
<p><b>11 CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up completely.</li> <li>2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the engine coolant temperature 75°C (167°F) or higher?</p>	<p>Go to step 12.</p>	<p>Replace the engine coolant temperature sensor. &lt;Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.&gt;</p>
<p><b>12 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) Place the select lever in the “P” or “N” range.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 13.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>13 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <p>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</p> <p>2) Place the select lever in the “P” or “N” range.</p> <p>3) Turn the A/C switch to OFF.</p> <p>4) Turn all the accessory switches to OFF.</p> <p>5) Open the front hood.</p> <p>6) Measure the ambient temperature.</p> <p>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	Go to step 14.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.>
<p><b>14 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 490 mV or more?	Go to step 15.	Go to step 16.
<p><b>15 CHECK REAR OXYGEN SENSOR DATA.</b></p> <p>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.</p> <p>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 17.	Go to step 16.
<p><b>16 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	Has water entered the connector?	Completely remove any water inside.	Go to step 18.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>17 CHECK FRONT OXYGEN (A/F) SENSOR AND REAR OXYGEN SENSOR DATA.</b> 1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>	Go to step 18.
<b>18 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. <i>Connector &amp; terminal</i> <i>(B135) No. 4 — (E61) No. 3:</i> <i>(B135) No. 30 — (E61) No. 4:</i>	Is the resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<b>19 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. <i>Connector &amp; terminal</i> <i>(E61) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact in ECM connector • Poor contact of coupling connector

### DZ:DTC P2098 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2

#### NOTE:

Refer to DTC P2099 for diagnostic procedure. <Ref. to EN(H6DO)(diag)-321, DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EA:DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2

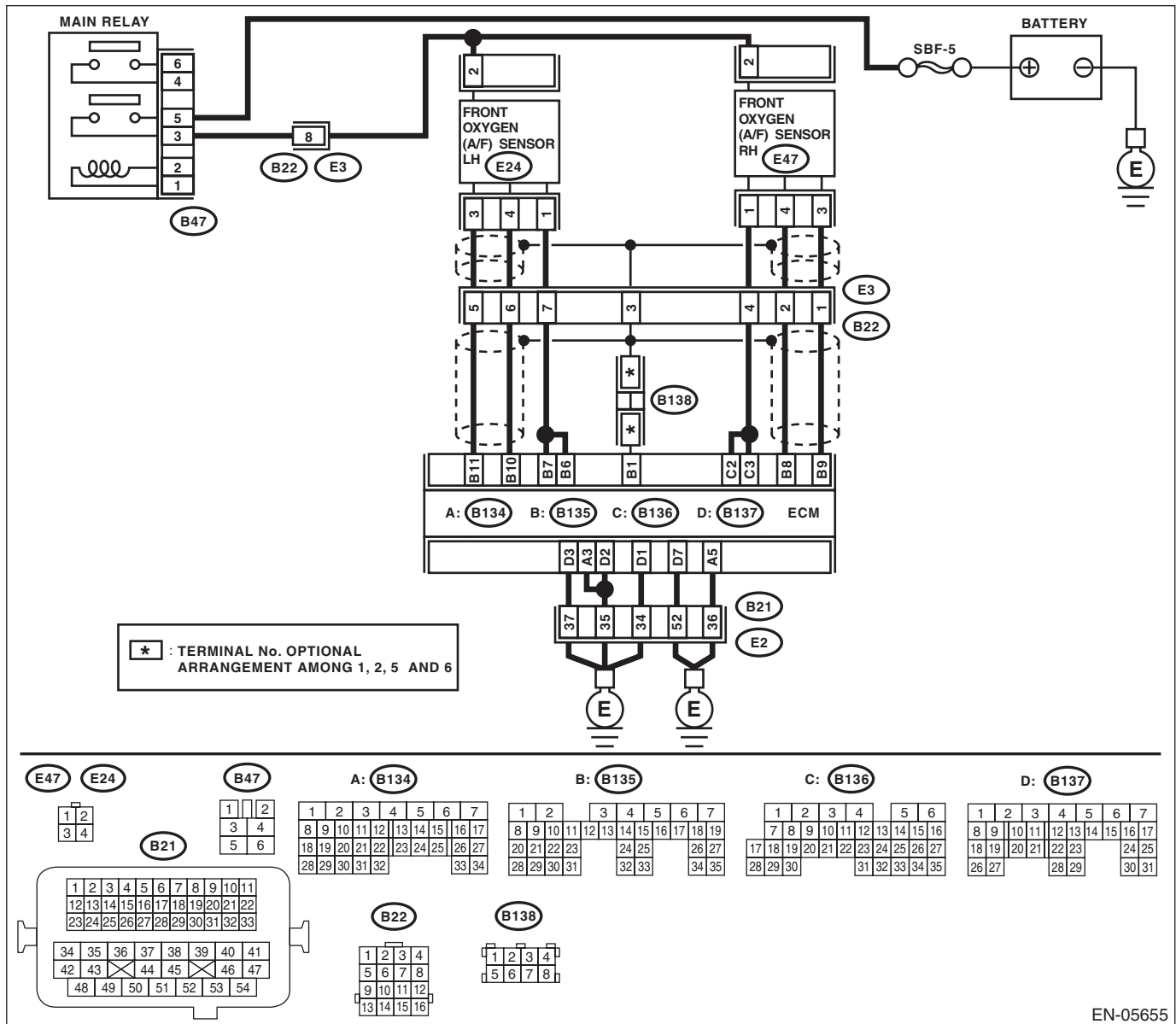
### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-221, DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

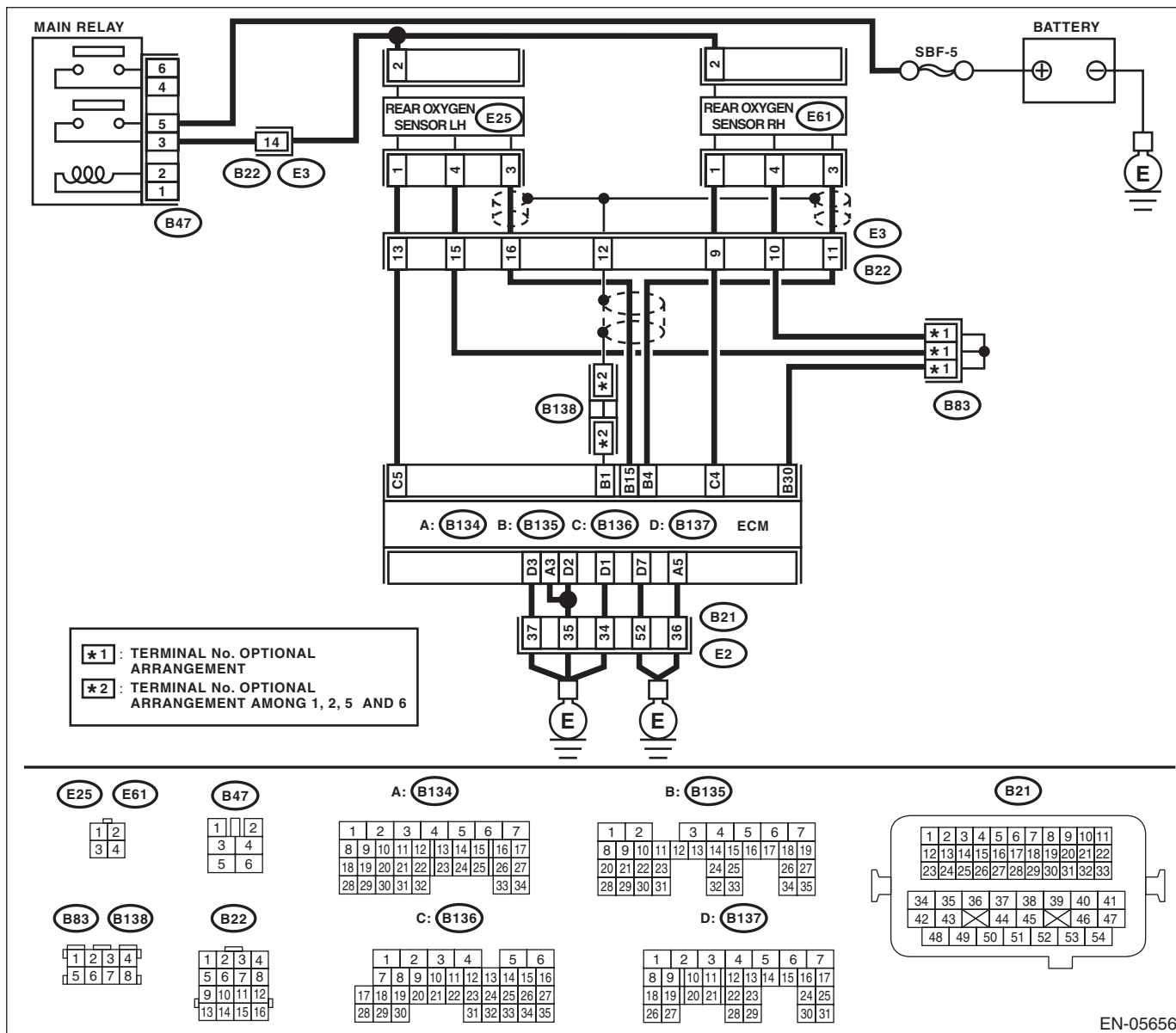
### WIRING DIAGRAM:



EN-05655

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)



EN-05656

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>
2	<b>CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.</b>	Has water entered the connector?	Go to step 2.
3	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. <b>Connector &amp; terminal</b> <b>(B135) No. 11 — (E24) No. 3:</b> <b>(B135) No. 10 — (E24) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 3. Repair the harness and connector. <b>NOTE:</b> In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector • Poor contact of coupling connector
4	<b>CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.</b> Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 11 — Chassis ground:</b> <b>(B135) No. 10 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4. Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E24) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 4.5 V or more?	Go to step 5. Go to step 6.
6	<b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>(E24) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 4.95 V or more?	Go to step 6. Go to step 7.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK OUTPUT SIGNAL FOR ECM.</b> Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. <b>Connector &amp; terminal</b> (E24) No. 3 (+) — Chassis ground (-): (E24) No. 4 (+) — Chassis ground (-):	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between the ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Repair poor contact of the ECM connector.
<b>8</b> <b>CHECK EXHAUST SYSTEM.</b>	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step 9.
<b>9</b> <b>CHECK AIR INTAKE SYSTEM.</b>	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step 10.
<b>10</b> <b>CHECK FUEL PRESSURE.</b> <b>WARNING:</b> Place “NO OPEN FLAMES” signs near the working area. <b>CAUTION:</b> Be careful not to spill fuel. 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H6DO)-26, INSPECTION, Fuel Pressure.> <b>CAUTION:</b> Release fuel pressure before removing the fuel pressure gauge.	Is the measured value 333 — 363 kPa (3.4 — 3.7 kgf/cm <sup>2</sup> , 48 — 53 psi)?	Go to step 11.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
<b>11</b> <b>CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. <b>NOTE:</b> • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step 12.	Replace the engine coolant temperature sensor. <Ref. to FU(H6DO)-19, Engine Coolant Temperature Sensor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>12 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) Place the select lever in the “P” or “N” range.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?</p>	<p>Go to step 13.</p>	<p>Replace the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>13 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Start the engine and warm-up engine until coolant temperature is higher than 75°C (167°F).</li> <li>2) Place the select lever in the “P” or “N” range.</li> <li>3) Turn the A/C switch to OFF.</li> <li>4) Turn all the accessory switches to OFF.</li> <li>5) Open the front hood.</li> <li>6) Measure the ambient temperature.</li> <li>7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Subtract ambient temperature from intake air temperature. Is the obtained value -10 — 50°C (-18 — 90°F)?</p>	<p>Go to step 14.</p>	<p>Check the mass air flow and intake air temperature sensor. &lt;Ref. to FU(H6DO)-25, Mass Air Flow and Intake Air Temperature Sensor.&gt;</p>
<p><b>14 CHECK REAR OXYGEN SENSOR DATA.</b></p> <ol style="list-style-type: none"> <li>1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum)</li> <li>2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</li> </ol> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Subaru Select Monitor</li> </ul> <p>For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;</p> <ul style="list-style-type: none"> <li>• General scan tool</li> </ul> <p>For detailed operation procedures, refer to the general scan tool operation manual.</p>	<p>Is the voltage 490 mV or more?</p>	<p>Go to step 15.</p>	<p>Go to step 16.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>15 CHECK REAR OXYGEN SENSOR DATA.</b>            1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm.            2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:            • Subaru Select Monitor            For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;            • General scan tool            For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is the voltage 250 mV or less?	Go to step 17.	Go to step 16.
<p><b>16 CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.</b></p>	Has water entered the connector?	Completely remove any water inside.	Go to step 18.
<p><b>17 CHECK FRONT OXYGEN (A/F) SENSOR AND REAR OXYGEN SENSOR DATA.</b>            1) Warm-up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more.            2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.</p> <p>NOTE:            • Subaru Select Monitor            For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". &lt;Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.&gt;            • General scan tool            For detailed operation procedures, refer to the general scan tool operation manual.</p>	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H6DO)-31, Front Oxygen (A/F) Sensor.>	Go to step 18.
<p><b>18 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from ECM and rear oxygen sensor.            3) Measure the resistance of harness between ECM and rear oxygen sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 15 — (E25) No. 3:</b>  <b>(B135) No. 30 — (E25) No. 4:</b></p>	Is the resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between ECM and rear oxygen sensor connector.
<p><b>19 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.</b>            1) Connect the connector to ECM.            2) Turn the ignition switch to ON.            3) Measure the voltage between rear oxygen sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(E25) No. 3 (+) — Chassis ground (-):</b></p>	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H6DO)-33, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between the ECM and rear oxygen sensor • Poor contact in ECM connector • Poor contact of coupling connector

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EB:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-222, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

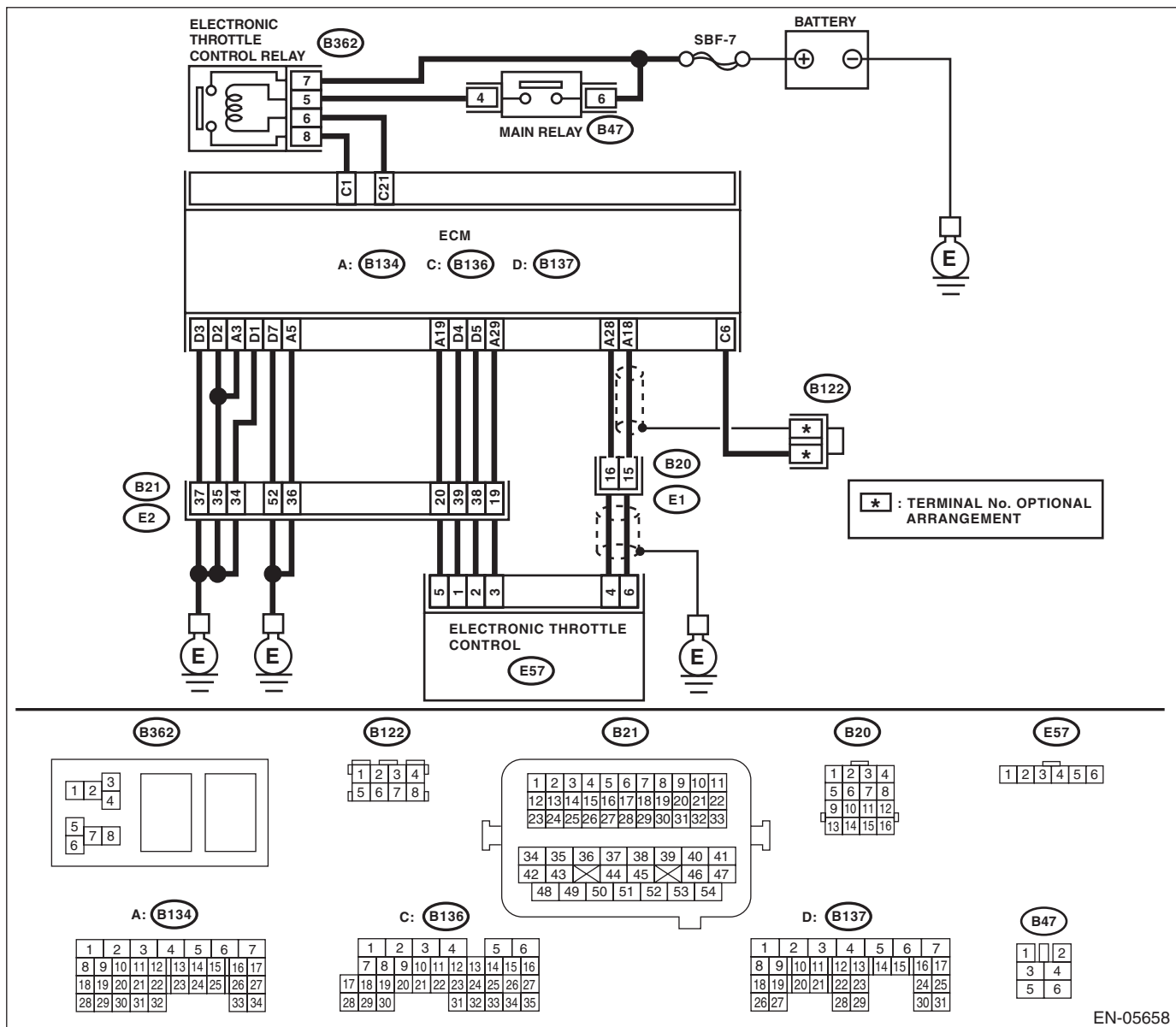
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>     <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b>            1) Turn the ignition switch to OFF.            2) Remove the electronic throttle control relay.            3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay.            4) Measure the resistance between electronic throttle control relay terminals.</p> <p><b>Terminals</b>  <b>No. 7 — No. 8:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to EN(H6DO)(diag)-8, Electrical Component Location.>
<p><b>2</b>     <b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b>            Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 7 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<p><b>3</b>     <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b>            1) Disconnect the connectors from the ECM.            2) Turn the ignition switch to ON.            3) Measure the voltage between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 6 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 4.
<p><b>4</b>     <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b>            1) Turn the ignition switch to OFF.            2) Measure the resistance between electronic throttle control relay connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B362) No. 6 — Chassis ground:</b>  <b>(B362) No. 8 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<p><b>5</b>     <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b>            Measure the resistance between the ECM and electronic throttle control relay connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B136) No. 21 — (B362) No. 6:</b>  <b>(B136) No. 1 — (B362) No. 8:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between ECM and electronic throttle control relay.
<p><b>6</b>     <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from electronic throttle control.            3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B134) No. 19 — Chassis ground:</b>  <b>(B134) No. 18 — Chassis ground:</b>  <b>(B134) No. 18 — (B136) No. 6:</b>  <b>(B134) No. 28 — Chassis ground:</b></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 — Engine ground:</i> <i>(E57) No. 4 — Engine ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>8</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <i>(B134) No. 18 — (E57) No. 6:</i> <i>(B134) No. 28 — (E57) No. 4:</i> <i>(B134) No. 29 — (E57) No. 3:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>9</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connectorelectronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 3 — Engine ground:</i>	Is the resistance less than 5 $\Omega$ ?	Go to step 10.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>10</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <i>(E57) No. 6 (+) — Engine ground (-):</i> <i>(E57) No. 4 (+) — Engine ground (-):</i>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 11.
<b>11</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors. <b>Connector &amp; terminal</b> <i>(B134) No. 19 — (B134) No. 18:</i> <i>(B134) No. 19 — (B134) No. 28:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 12.	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.
<b>12</b> <b>CHECK SENSOR OUTPUT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step 13.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>13 CHECK SENSOR OUTPUT.</b> Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step 14.	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H6DO)-12, Throttle Body.>
<b>14 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. <i>Connector &amp; terminal</i> <i>(B137) No. 5 — (E57) No. 2:</i> <i>(B137) No. 4 — (E57) No. 1:</i>	Is the resistance less than 1 Ω?	Go to step 15.	Repair the open circuit of harness between ECM and electronic throttle control.
<b>15 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 (+) — Engine ground (-):</i> <i>(E57) No. 1 (+) — Engine ground (-):</i>	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and electronic throttle control.	Go to step 16.
<b>16 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — Engine ground:</i> <i>(E57) No. 1 — Engine ground:</i>	Is the resistance 1 MΩ or more?	Go to step 17.	Repair the ground short circuit of harness between the ECM and electronic throttle control.
<b>17 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS.</b> Measure the resistance between the electronic throttle control connector terminals. <i>Connector &amp; terminal</i> <i>(E57) No. 2 — (E57) No. 1:</i>	Is the resistance 1 MΩ or more?	Go to step 18.	Repair the short circuit of harness between ECM and electronic throttle control.
<b>18 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.</b> Measure the resistance between ECM and chassis ground. <i>Connector &amp; terminal</i> <i>(B134) No. 3 — Chassis ground:</i> <i>(B134) No. 5 — Chassis ground:</i> <i>(B137) No. 1 — Chassis ground:</i> <i>(B137) No. 2 — Chassis ground:</i> <i>(B137) No. 3 — Chassis ground:</i> <i>(B137) No. 7 — Chassis ground:</i>	Is the resistance less than 5 Ω?	Go to step 19.	Repair the open circuit of the harness between the ECM and engine ground.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
19	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Measure the resistance between electronic throttle control terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance 50 $\Omega$ or less?	Go to step 20.	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>
20	<b>CHECK ELECTRONIC THROTTLE CONTROL.</b> Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of the ECM connector.	Replace the electronic throttle control. <Ref. to FU(H6DO)-12, Throttle Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EC:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-224, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

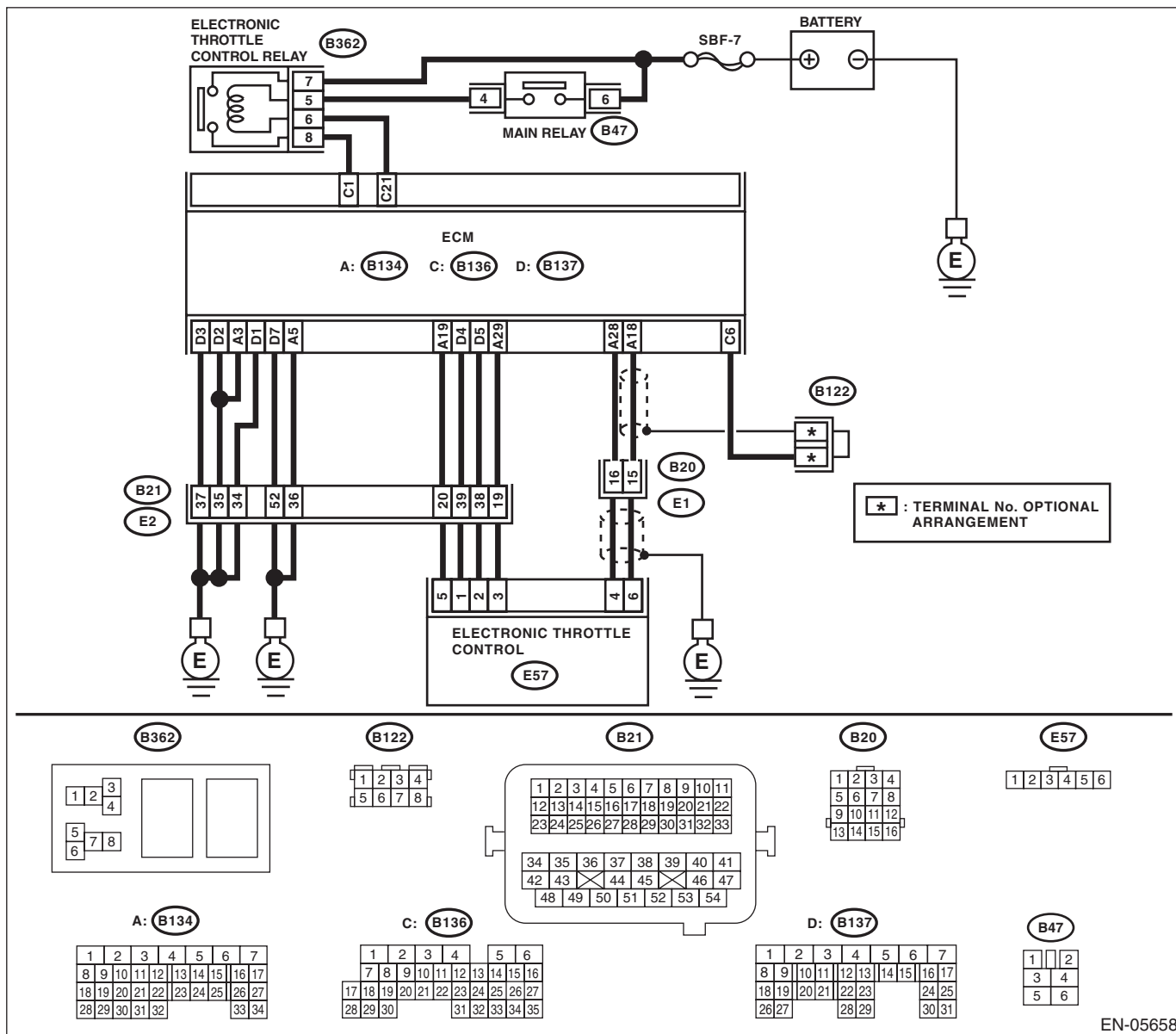
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to EN(H6DO)(diag)-8, Electrical Component Location.>
<b>2</b> <b>CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Disconnect the connectors from the ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 4.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B362) No. 6 — Chassis ground:</i> <i>(B362) No. 8 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.
<b>5</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> Measure the resistance between the ECM and electronic throttle control relay connector. <i>Connector &amp; terminal</i> <i>(B136) No. 21 — (B362) No. 6:</i> <i>(B136) No. 1 — (B362) No. 8:</i>	Is the resistance less than 1 $\Omega$ ?	Repair the poor contact of the ECM connector.	Repair the open circuit of harness between ECM and electronic throttle control relay.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## ED:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

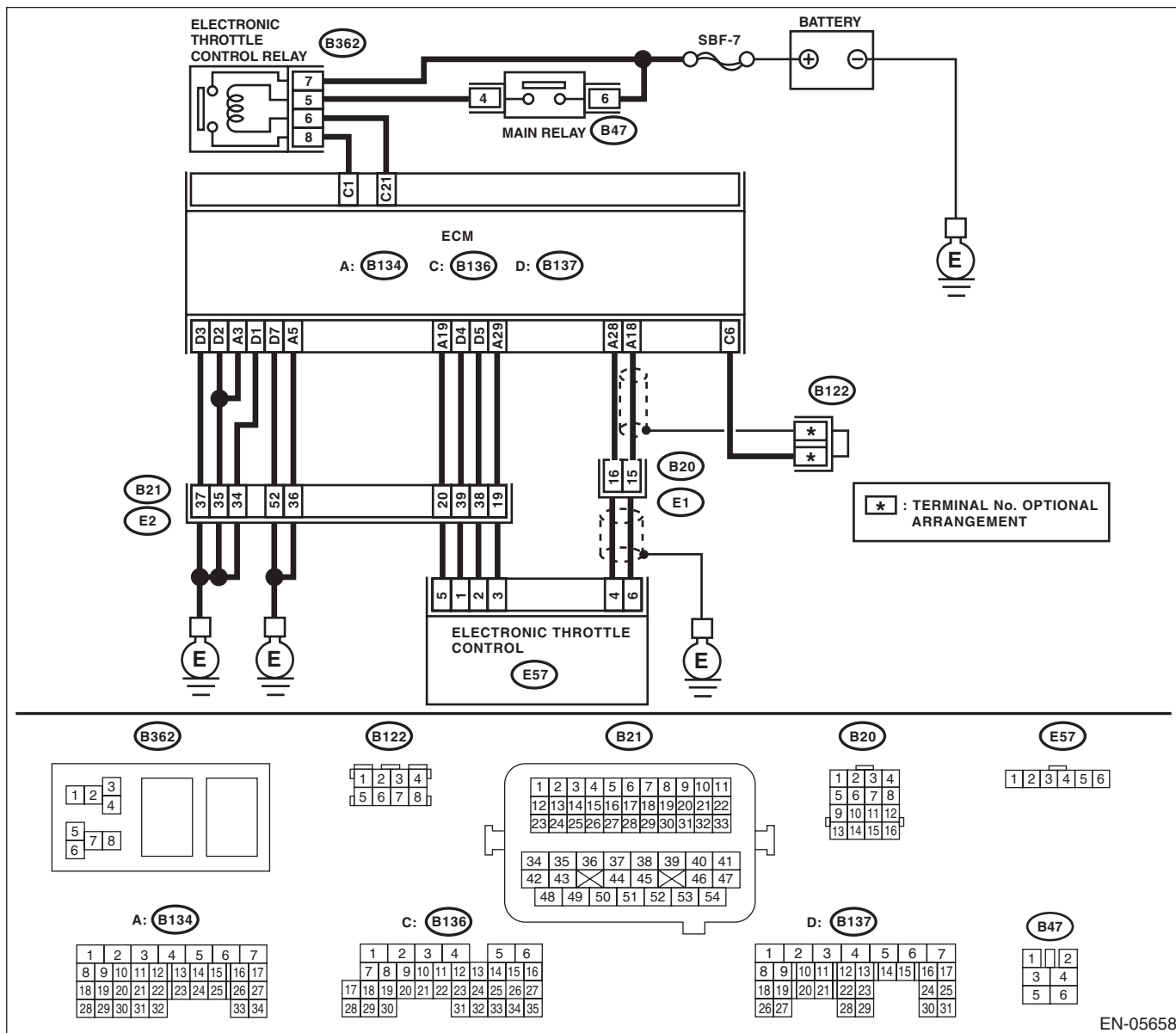
### DTC DETECTING CONDITION:

- Immediately at fault recognition. Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-226, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Measure the resistance between electronic throttle control relay terminals. <b>Terminals</b> <b>No. 7 — No. 8:</b>	Is the resistance 1 MΩ or more?	Go to step 2.	Replace the electronic throttle control relay. <Ref. to EN(H6DO)(diag)-8, Electrical Component Location.>
<b>2</b> <b>CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B362) No. 8 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay.	Go to step 3.
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 21 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Repair the poor contact of the ECM connector.	Repair the ground short circuit of harness between ECM and electronic throttle control relay.

## EE:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

### NOTE:

For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H6DO)(diag)-327, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EF:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-230, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

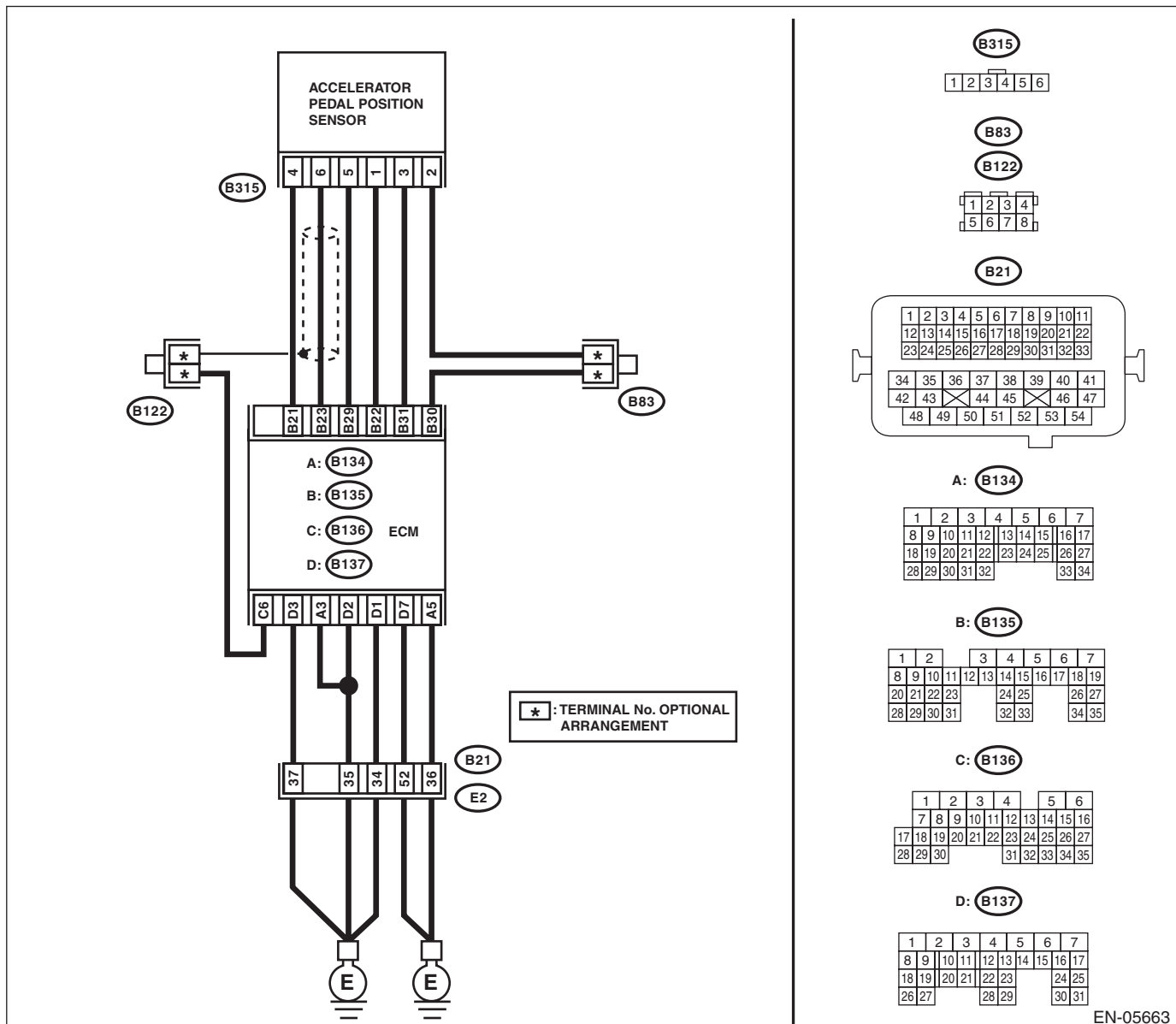
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05663

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B135) No. 21 — Chassis ground:</b></p> <p><b>(B135) No. 23 — Chassis ground:</b></p> <p><b>(B135) No. 23 — (B136) No. 6:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b></p> <p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the connector to ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(B315) No. 5 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H6DO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H6DO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EG:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-232, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

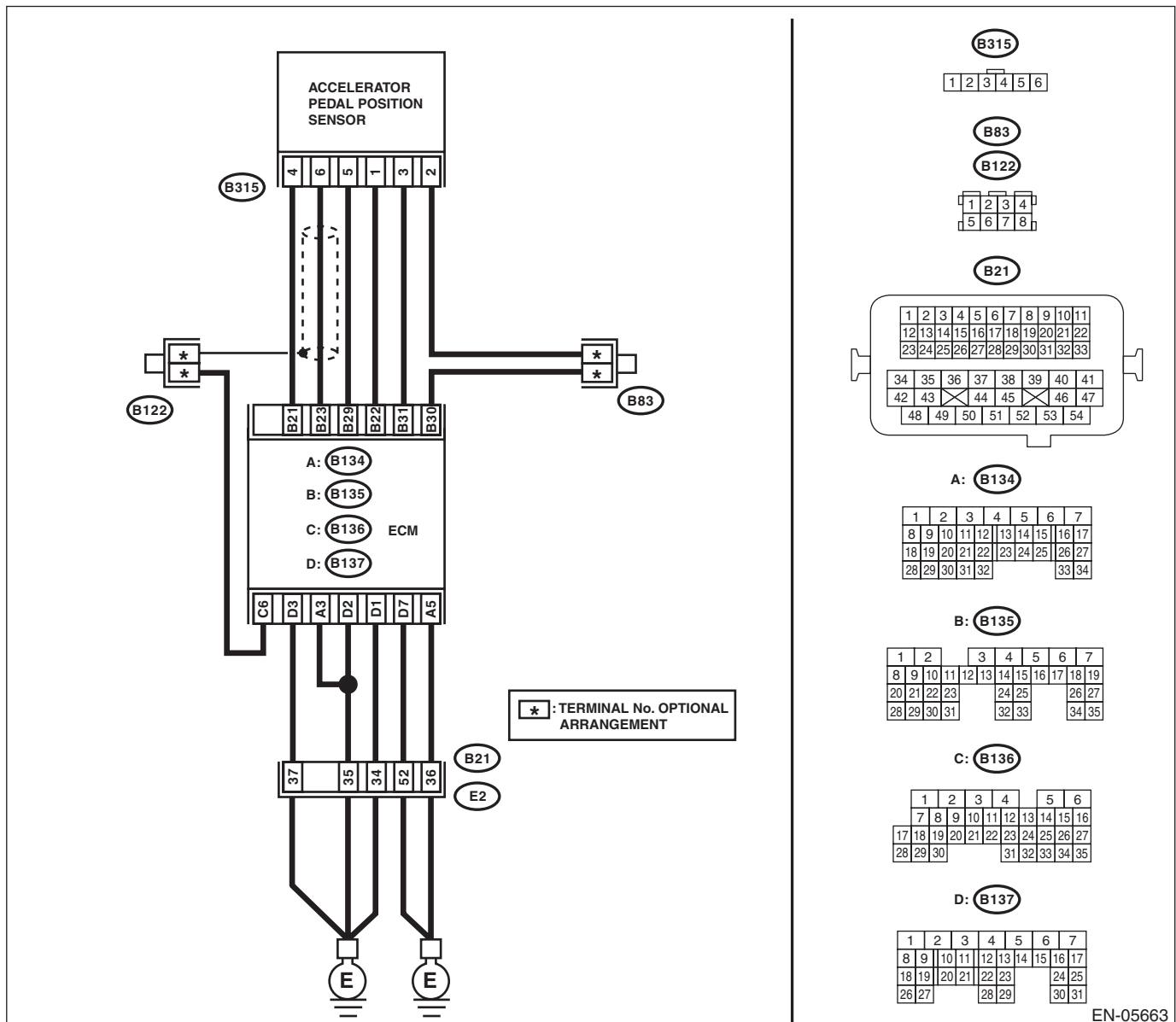
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05663

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from the ECM and accelerator pedal position sensor.            3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 23 — (B315) No. 6:</b>  <b>(B135) No. 29 — (B315) No. 5:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Connect the connector to ECM.            2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 5 — Chassis ground:</b></p>	<p>Is the resistance less than 5 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:  <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul> </p>
<p><b>3</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to ON.            2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 6 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.85 V or more?</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>	<p>Go to step 4.</p>
<p><b>4</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B135) No. 21 — (B135) No. 23:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. &lt;Ref. to SP(H6DO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EH:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-234, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

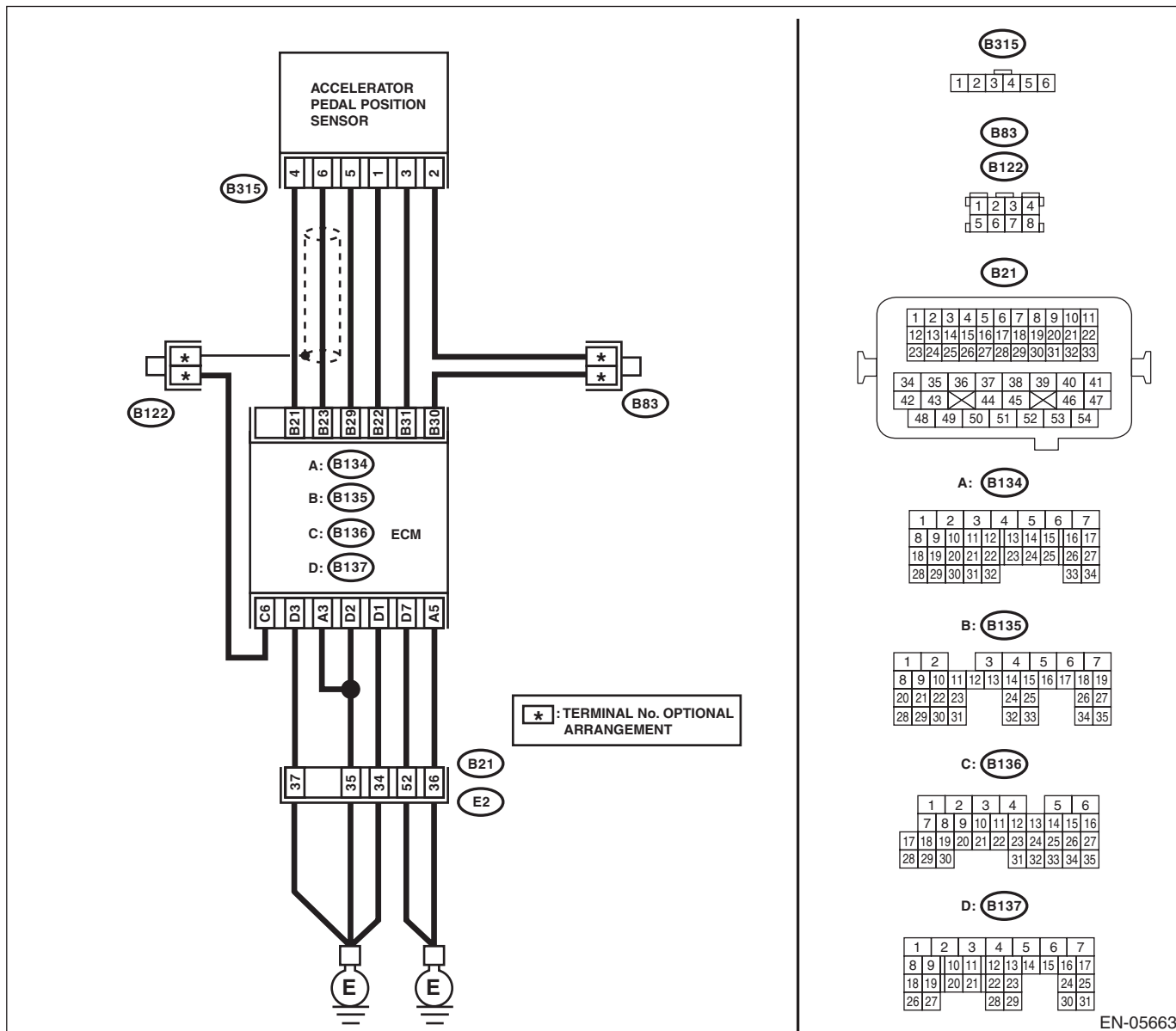
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05663



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from the ECM and accelerator pedal position sensor.</p> <p>3) Measure the resistance between ECM and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B135) No. 22 — Chassis ground:</b>  <b>(B135) No. 31 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 2.</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector.</p>
2	<p><b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b></p> <p>1) Connect the connector to ECM.</p> <p>2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B315) No. 3 — Chassis ground:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H6DO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the ground short of the harness between the ECM and accelerator pedal position sensor connector. Replace the ECM if defective. &lt;Ref. to FU(H6DO)-37, Engine Control Module (ECM).&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EI: DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-236, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

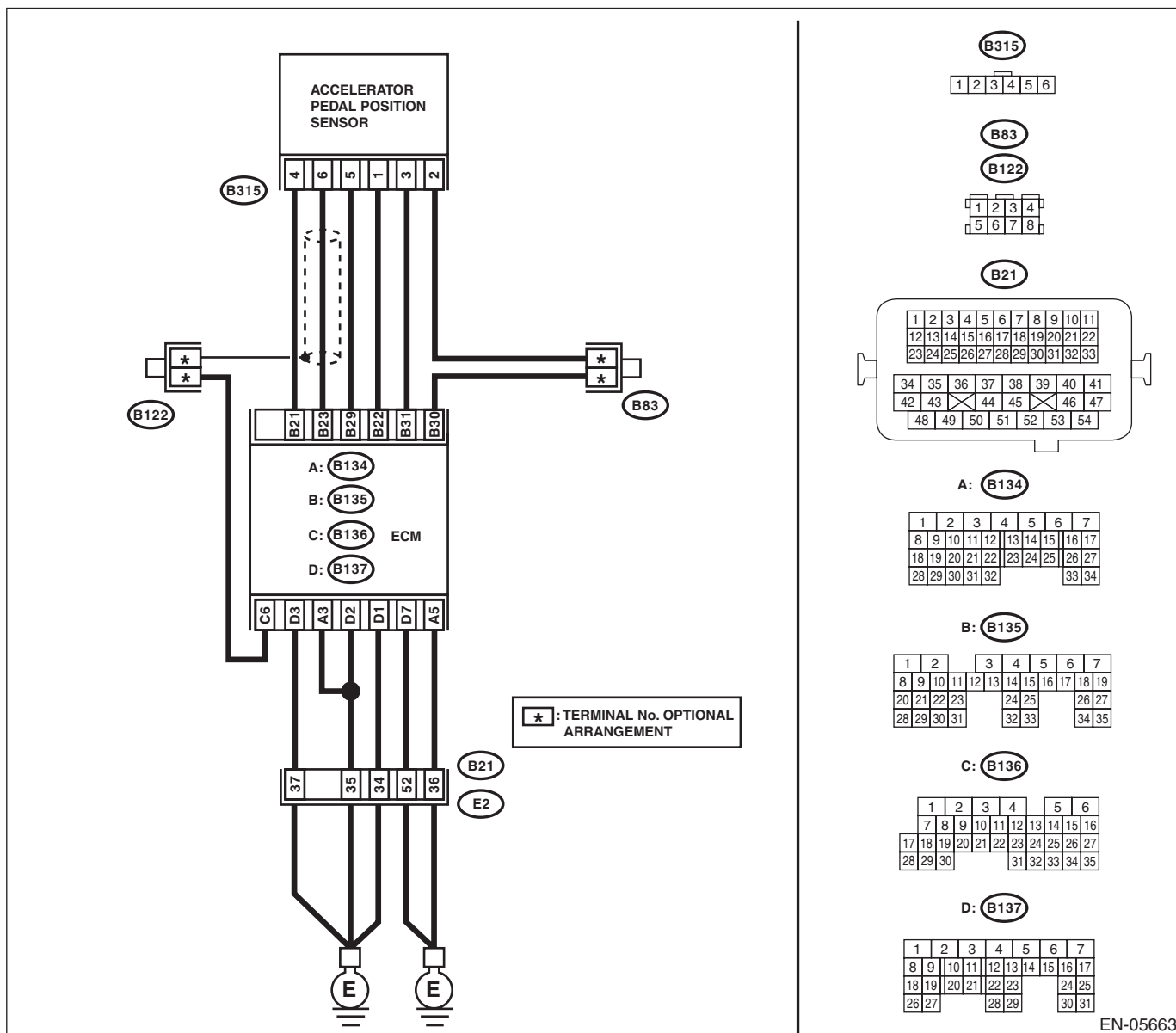
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05663

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connector from the ECM and accelerator pedal position sensor.            3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector.  <b>Connector &amp; terminal</b>  <b>(B135) No. 31 — (B315) No. 3:</b>  <b>(B135) No. 30 — (B315) No. 2:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 2.</p>	<p>Repair the open circuit of the harness between the ECM and accelerator pedal position sensor connector.</p>
<p><b>2</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Connect the connector to ECM.            2) Measure the resistance between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 5 — Chassis ground:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness and connector.  <b>NOTE:</b>            In this case, repair the following item:  <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul> </p>
<p><b>3</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to ON.            2) Measure the voltage between accelerator pedal position sensor connector and chassis ground.  <b>Connector &amp; terminal</b>  <b>(B315) No. 3 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 4.85 V or more?</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>	<p>Go to step 4.</p>
<p><b>4</b>    <b>CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR.</b>            1) Turn the ignition switch to OFF.            2) Disconnect the connectors from the ECM.            3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b>  <b>(B135) No. 22 — (B135) No. 31:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. &lt;Ref. to SP(H6DO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the short circuit to power source in the harness between the ECM and accelerator pedal position sensor connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EJ: DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-238, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

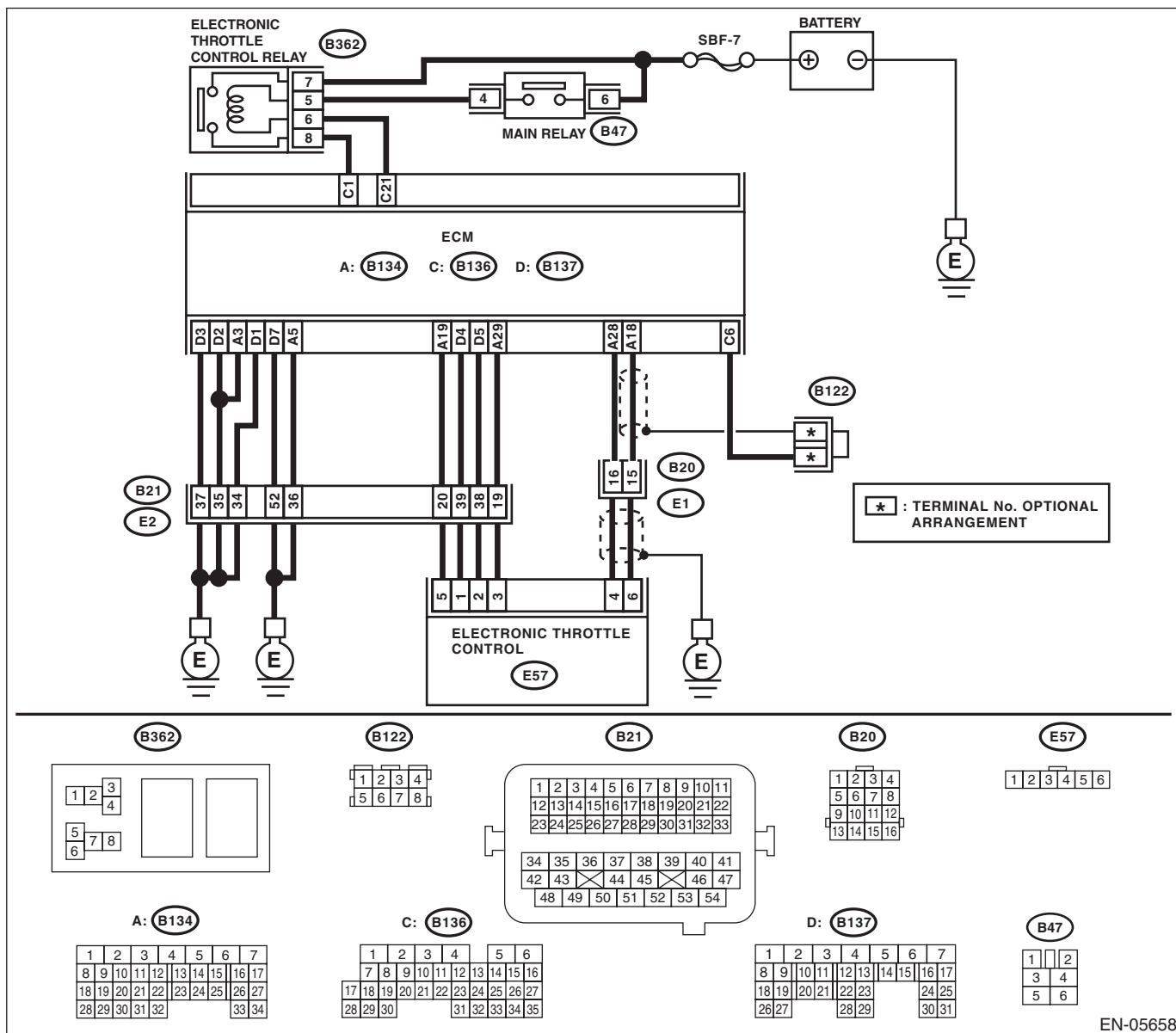
### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### WIRING DIAGRAM:



EN-05658

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B134) No. 19 — Chassis ground:</b> <b>(B134) No. 18 — Chassis ground:</b> <b>(B134) No. 18 — (B136) No. 6:</b> <b>(B134) No. 28 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Repair the ground short circuit of harness between ECM and electronic throttle control connector.
<b>2</b> <b>CHECK SHORT CIRCUIT INSIDE THE ECM.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connectorelectronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 — Engine ground:</b> <b>(E57) No. 4 — Engine ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the ground short circuit of harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>3</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. <b>Connector &amp; terminal</b> <b>(B134) No. 18 — (E57) No. 6:</b> <b>(B134) No. 28 — (E57) No. 4:</b> <b>(B134) No. 29 — (E57) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between ECM and electronic throttle control connector.
<b>4</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 3 — Engine ground:</b>	Is the resistance less than 5 $\Omega$ ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following item: <ul style="list-style-type: none"> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact in ECM connector</li> <li>• Poor contact of coupling connector</li> </ul>
<b>5</b> <b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. <b>Connector &amp; terminal</b> <b>(E57) No. 6 (+) — Engine ground (-):</b> <b>(E57) No. 4 (+) — Engine ground (-):</b>	Is the voltage 4.85 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

	Step	Check	Yes	No
6	<b>CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM. 3) Measure the resistance between ECM connectors.  <b>Connector &amp; terminal</b> <b>(B134) No. 19 — (B134) No. 18:</b> <b>(B134) No. 19 — (B134) No. 28:</b>	Is the resistance 1 M $\Omega$ or more?	Repair poor contact of the electronic throttle control connector. Replace the electronic throttle control if it is defective. <Ref. to FU(H6DO)-12, Throttle Body.>	Repair the short circuit to power in the harness between ECM and electronic throttle control connector.

## EK:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-240, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

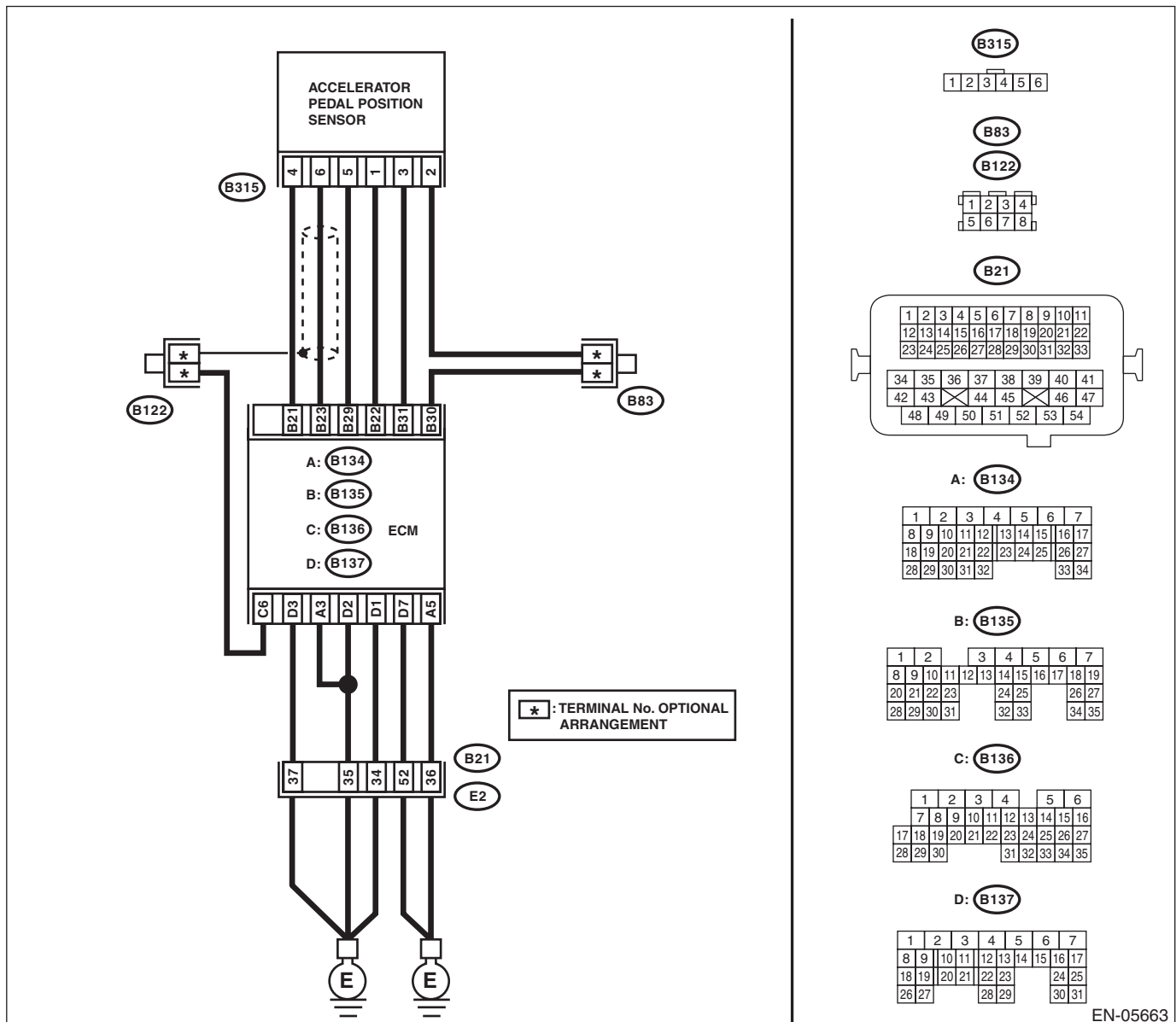
### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

### TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

### WIRING DIAGRAM:



EN-05663

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b>                      1) Turn the ignition switch to ON.                      2) Measure the voltage between ECM and chassis ground.  <i>Connector &amp; terminal</i>  <i>(B135) No. 23 (+) — Chassis ground (-):</i>  <i>(B135) No. 31 (+) — Chassis ground (-):</i></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Go to step 3.</p>	<p>Go to step 2.</p>
<p><b>2 CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.</b>                      1) Measure the voltage between accelerator pedal position sensor connector and chassis ground.  <i>Connector &amp; terminal</i>  <i>(B315) No. 6 (+) — Chassis ground (-):</i>  <i>(B315) No. 3 (+) — Chassis ground (-):</i></p>	<p>Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?</p>	<p>Replace the accelerator pedal. &lt;Ref. to SP(H6DO)-3, Accelerator Pedal.&gt;</p>	<p>Repair the harness and connector.                      NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Ground short circuit of harness between the ECM and accelerator pedal position sensor connectors.</li> <li>• Poor contact of coupling connector</li> </ul>
<p><b>3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.</b>                      Check the resistance of harness between the accelerator pedal position sensor connector and chassis ground.  <i>Connector &amp; terminal</i>  <i>(B315) No. 5 — Chassis ground:</i>  <i>(B315) No. 2 — Chassis ground:</i></p>	<p>Is the resistance less than 5 <math>\Omega</math>?</p>	<p>Repair the poor contact of the ECM connector.</p>	<p>Repair the harness and connector.                      NOTE:                      In this case, repair the following item:</p> <ul style="list-style-type: none"> <li>• Open circuit of harness between the ECM and accelerator pedal position sensor connector.</li> <li>• Open circuit of harness between ECM and engine ground</li> <li>• Poor contact of coupling connector</li> </ul>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EL:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

### DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-242, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform **Clear Memory Mode** <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).> <b>NOTE:</b> The barometric pressure sensor is built into the ECM.

## EM:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-243, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform **Clear Memory Mode** <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and **Inspection Mode** <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).> <b>NOTE:</b> The barometric pressure sensor is built into the ECM.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## EN:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

### DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H6DO)-244, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

### CAUTION:

After repair or replacement of faulty parts, perform Clear Memory Mode <Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H6DO)(diag)-45, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>  NOTE: The barometric pressure sensor is built into the ECM.

## 20. Diagnostic Procedure without Diagnostic Trouble Code (DTC)

### A: CHECK SI-DRIVE (SUBARU Intelligent Drive) SYSTEM

#### DIAGNOSIS:

SI-DRIVE mode will not change.

#### CAUTION:

Note that the SI-DRIVE system performs the following control when changing modes.

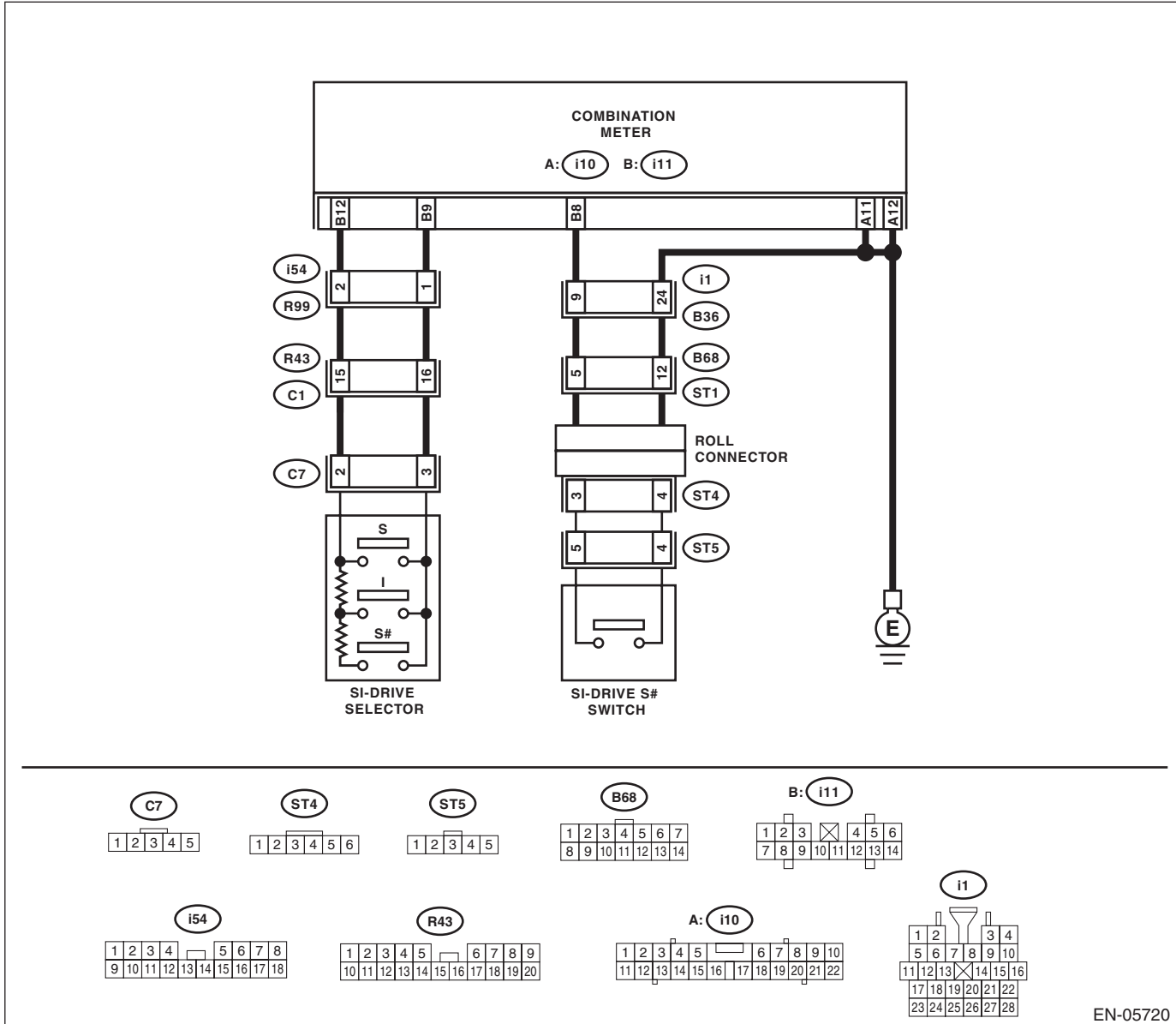
1. When the engine is cold, the low coolant temperature display will light in the multi-information display meter. In this case, it will not be possible to change to the S# (sports sharp) mode.
2. If the engine is stopped in the S# (sports sharp) mode, it will be in the S (sports) mode when the engine is restarted.
3. If the engine is stopped in the S (sports) or I (intelligent) mode, then restarted, it will enter the mode it was on before stopping the engine.
4. If the malfunction indicator light becomes lit while the engine is running, it will enter the S (sports) mode. In this case, it will not be possible to change to the S# (sports sharp) or I (intelligent) mode.
5. If there is a possible engine coolant or engine oil temperature overheat condition, it will not be possible to switch to the S# (sports sharp) mode. When driving in the S# (sports sharp) mode, it will enter the S (sports) mode.

**1. EVEN WHEN THE SI-DRIVE MODE IS CHANGED, THE MULTI-INFORMATION DISPLAY DOES NOT CHANGE, AND THE MODE DOES NOT SWITCH.**

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## WIRING DIAGRAM:



EN-05720

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK SI-DRIVE SELECTOR.</b></p> <p>1) Disconnect the connector from the multi-information display meter.</p> <p>2) Measure the resistance between connectors when the SI-DRIVE selector is operated.</p> <p><b>Connector &amp; terminal</b> <b>(i11) No. 9 — (i11) No. 12:</b></p>	<p>Does the resistance change as shown below?</p> <p>S#: 2.14 — 3.2 kΩ</p> <p>I: 0.8 — 1.2 kΩ</p> <p>S: less than 10 Ω</p>	Go to step 2.	Go to step 5.
<p><b>2</b></p> <p><b>CHECK SI-DRIVE S# SWITCH.</b></p> <p>1) Hold down the SI-DRIVE S# switch.</p> <p>2) Measure the resistance of harness between the multi-information display meter connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(i11) No. 8 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	Go to step 3.	Go to step 6.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
<b>3 CHECK POOR CONTACT.</b> Check the following items. <ul style="list-style-type: none"> <li>• Cracked or improperly connected connector</li> <li>• Broken connector pin</li> <li>• Disconnection of connector terminal</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 4.
<b>4 RECHECK FAULT.</b> 1) Connect all connectors. 2) Change the SI-DRIVE mode.	Is there any abnormal condition?	Replace the multi-information display meter. <Ref. to IDI-19, Combination Meter.>	The circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector may be the cause.
<b>5 CHECK SI-DRIVE SELECTOR HARNESS AND CONNECTOR.</b> Check the following items. <ul style="list-style-type: none"> <li>• Short or open circuit in the harness</li> <li>• Improperly connected or loose terminal in the SI-DRIVE selector connector</li> <li>• Improperly connected or loose terminal in coupling connector</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 7.
<b>6 CHECK SI-DRIVE S# SWITCH HARNESS AND CONNECTOR.</b> Check the following items. <ul style="list-style-type: none"> <li>• Short or open circuit in the harness</li> <li>• Improperly connected or loose terminal in steering roll connector</li> <li>• Improperly connected or loose terminal in coupling connector</li> </ul>	Is there any abnormal condition?	Correct the cause of trouble.	Go to step 7.
<b>7 RECHECK FAULT.</b> 1) Connect all connectors. 2) Change the SI-DRIVE mode.	Is there any abnormal condition?	Replace the SI-DRIVE selector or SI-DRIVE S# switch. <Ref. to FU(H6DO)-35, SI-DRIVE (SUBARU Intelligent Drive) Selector.> or <Ref. to FU(H6DO)-36, SI-DRIVE (SUBARU Intelligent Drive) S# Switch.>	The circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector may be the cause.

## Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

### 2. WHEN THE SI-DRIVE MODE IS CHANGED, “MODE CHANGE ERROR” APPEARS IN THE MULTI INFORMATION DISPLAY APPROXIMATELY 5 SECONDS LATER.

Step	Check	Yes	No
<b>1</b> <b>CHECK DTC.</b>	Is DTC displayed?	Check for the corresponding DTC using the “List of Diagnostic Trouble Code (DTC)” for each unit.	Go to step 2.
<b>2</b> <b>CHECK DISPLAY OF MULTI-INFORMATION DISPLAY METER.</b> Check whether there are other errors displayed other than the “Mode Change Error”. Example: <ul style="list-style-type: none"> <li>• “Err” is displayed in the external temperature or fuel consumption displays.</li> <li>• FUEL gauge, TEMP gauge or ECO gauge does not move.</li> </ul>	Is there other errors displayed other than the “Mode Change Error”?	For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Go to step 3.
<b>3</b> <b>CHECK MULTI-INFORMATION DISPLAY METER AND ECM.</b>	Is the multi-information display meter and ECM part numbers correct?	Replace the multi-information display meter. <Ref. to IDI-19, Combination Meter.>	Replace the multi-information display meter and/or ECM to that of the correct part number. <Ref. to IDI-19, Combination Meter.> or <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

## 3. WHEN THE SI-DRIVE MODE IS CHANGED, “MODE CHANGE ERROR” IS NOT DISPLAYED IN MULTI-INFORMATION DISPLAY, AND “S#”, “I”, “S” FLASHES.

### NOTE:

In this case, there may be a problem outside the SI-DRIVE system.

	Step	Check	Yes	No
1	<b>CHECK MALFUNCTION INDICATOR LIGHT.</b> 1) Start the engine. 2) Check whether the malfunction indicator light is lit or not.	Does the malfunction indicator light illuminate?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK ENGINE COOLANT TEMPERATURE GAUGE.</b> 1) Turn the ignition switch to ON. 2) Check the engine coolant temperature gauge.	Is it overheating?	Investigate and repair the cause of the overheating.	Go to step 3.
3	<b>CHECK ENGINE OIL TEMPERATURE.</b> 1) Turn the ignition switch to ON. 2) Check the engine oil temperature using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H6DO)(diag)-35, Subaru Select Monitor.>	Is the engine oil temperature 117°C (243°F) or higher?	Inspect and repair the cause of engine oil temperature rise. NOTE: Ask the customer whether the vehicle has experienced a long drive in low gear or towing of heavy load. If not, drive the vehicle again after the engine oil temperature lowers, and check if the oil temperature rises.	Go to step 4.
4	<b>CHECK DISPLAY OF MULTI-INFORMATION DISPLAY.</b> 1) Turn the ignition switch to ON. 2) Change the SI-DRIVE mode. 3) Check the display of the multi-information display.	Do the displays “S#”, “I”, “S” of the multi-information display flash?	Replace the multi-information display meter. <Ref. to IDI-19, Combination Meter.>	Perform test operation, and check the malfunction indicator, the engine coolant temperature gauge and the engine oil temperature. If they are operating normally, end the diagnosis.

# General Diagnostic Table

ENGINE (DIAGNOSTICS)

## 21. General Diagnostic Table

### A: INSPECTION

NOTE:

Malfunction of parts other than those listed is also possible. <Ref. to ME(H6DO)-86, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Ignition parts (*1) 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4)
2. Rough idling	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Ignition parts (*1) 5) Air intake system (*5) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Engine coolant temperature sensor 2) Electronic throttle control 3) Manifold absolute pressure sensor 4) Mass air flow and intake air temperature sensor 5) Accelerator pedal position sensor 6) Oil temperature sensor
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Electronic throttle control 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) A/C switch and A/C cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1) 12) Accelerator pedal position sensor 13) Oil temperature sensor
5. Engine stalls, engine sags or hesitates at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Electronic throttle control 9) Fuel pump and fuel pump relay



# General Diagnostic Table

ENGINE (DIAGNOSTICS)

Symptom	Problem parts
6. Surging	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Fuel pump and fuel pump relay
7. Spark knock	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay
8. After burning in exhaust system	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

\*1: Check ignition coil and spark plug.

\*2: Indicate the symptom occurring only in cold temperatures.

\*3: Ensure the secure installation.

\*4: Check the fuel injector and fuel pressure regulator.

\*5: Inspect air leak in air intake system.

# General Diagnostic Table

ENGINE (DIAGNOSTICS)

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# List of Diagnostic Trouble Code (DTC)

## GENERAL DESCRIPTION

### 1. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Index
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to GD(H6DO)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to GD(H6DO)-12, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to GD(H6DO)-13, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to GD(H6DO)-14, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to GD(H6DO)-14, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to GD(H6DO)-17, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-17, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-19, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-21, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H6DO)-23, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H6DO)-25, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-27, DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-27, DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-27, DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	<Ref. to GD(H6DO)-27, DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	<Ref. to GD(H6DO)-27, DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to GD(H6DO)-28, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to GD(H6DO)-31, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to GD(H6DO)-32, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to GD(H6DO)-32, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to GD(H6DO)-33, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H6DO)-34, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H6DO)-37, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H6DO)-39, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H6DO)-41, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H6DO)-43, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H6DO)-45, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H6DO)-47, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to GD(H6DO)-49, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H6DO)-51, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H6DO)-53, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	<Ref. to GD(H6DO)-55, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	<Ref. to GD(H6DO)-57, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to GD(H6DO)-59, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to GD(H6DO)-62, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H6DO)-64, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-66, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-68, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-70, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H6DO)-73, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H6DO)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H6DO)-78, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H6DO)-79, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to GD(H6DO)-86, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-87, DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-87, DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-88, DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-88, DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	<Ref. to GD(H6DO)-88, DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	<Ref. to GD(H6DO)-88, DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0159	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)	<Ref. to GD(H6DO)-88, DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0160	O2 Sensor Circuit No Activity Detected (Bank2 Sensor2)	<Ref. to GD(H6DO)-88, DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H6DO)-89, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H6DO)-91, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0174	System Too Lean (Bank 2)	<Ref. to GD(H6DO)-92, DTC P0174 SYSTEM TOO LEAN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0175	System Too Rich (Bank 2)	<Ref. to GD(H6DO)-92, DTC P0175 SYSTEM TOO RICH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to GD(H6DO)-93, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to GD(H6DO)-96, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to GD(H6DO)-98, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to GD(H6DO)-100, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0197	Engine Oil Temperature Sensor Low	<Ref. to GD(H6DO)-102, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0198	Engine Oil Temperature Sensor High	<Ref. to GD(H6DO)-103, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	<Ref. to GD(H6DO)-104, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	<Ref. to GD(H6DO)-106, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0230	Fuel Pump Primary Circuit	<Ref. to GD(H6DO)-108, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H6DO)-115, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H6DO)-115, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H6DO)-115, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0305	Cylinder 5 Misfire Detected	<Ref. to GD(H6DO)-115, DTC P0305 CYLINDER 5 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0306	Cylinder 6 Misfire Detected	<Ref. to GD(H6DO)-115, DTC P0306 CYLINDER 6 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to GD(H6DO)-116, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H6DO)-118, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0332	Knock Sensor 2 Circuit Low (Bank 2)	<Ref. to GD(H6DO)-119, DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0333	Knock Sensor 2 Circuit High (Bank 2)	<Ref. to GD(H6DO)-119, DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to GD(H6DO)-120, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to GD(H6DO)-122, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H6DO)-124, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	<Ref. to GD(H6DO)-126, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0400	Exhaust Gas Recirculation Flow	<Ref. to GD(H6DO)-127, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H6DO)-131, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H6DO)-134, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H6DO)-150, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H6DO)-152, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to GD(H6DO)-154, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H6DO)-156, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H6DO)-158, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H6DO)-159, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to GD(H6DO)-159, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H6DO)-160, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to GD(H6DO)-162, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor "A" Circuit Range/Performance	<Ref. to GD(H6DO)-164, DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor "A" Circuit Low	<Ref. to GD(H6DO)-166, DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor "A" Circuit High	<Ref. to GD(H6DO)-168, DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H6DO)-170, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor "A"	<Ref. to GD(H6DO)-173, DTC P0500 VEHICLE SPEED SENSOR "A", Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H6DO)-175, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to GD(H6DO)-177, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H6DO)-179, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0513	Incorrect Immobilizer Key	<Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0600	Serial Communication Link	<Ref. to GD(H6DO)-181, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H6DO)-183, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H6DO)-184, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0607	Control Module Performance	<Ref. to GD(H6DO)-185, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0638	Throttle Actuator Control Range/ Performance (Bank 1)	<Ref. to GD(H6DO)-188, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0700	Transmission Control System (MIL Request)	<Ref. to GD(H6DO)-190, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to GD(H6DO)-191, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to GD(H6DO)-194, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1154	O2 Sensor Circuit Range/Performance (Low) (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-196, DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1155	O2 Sensor Circuit Range/Performance (High) (Bank 2 Sensor 1)	<Ref. to GD(H6DO)-196, DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H6DO)-197, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H6DO)-199, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H6DO)-201, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H6DO)-203, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H6DO)-205, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H6DO)-207, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H6DO)-209, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H6DO)-209, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H6DO)-209, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H6DO)-209, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H6DO)-209, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H6DO)-209, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-up voltage circuit malfunction	<Ref. to GD(H6DO)-210, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1570	Antenna	<Ref. to GD(H6DO)-211, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1571	Reference Code Incompatibility	<Ref. to GD(H6DO)-211, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to GD(H6DO)-211, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>



## List of Diagnostic Trouble Code (DTC)

### GENERAL DESCRIPTION

DTC	Item	Index
P1574	Key Communication Failure	<Ref. to GD(H6DO)-211, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1576	EGI Control Module EEPROM	<Ref. to GD(H6DO)-211, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1577	IMM Control Module EEPROM	<Ref. to GD(H6DO)-211, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1578	Meter Failure	<Ref. to GD(H6DO)-211, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1602	Control Module Programming Error	<Ref. to GD(H6DO)-212, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to GD(H6DO)-214, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to GD(H6DO)-216, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to GD(H6DO)-217, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to GD(H6DO)-217, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H6DO)-218, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H6DO)-220, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	<Ref. to GD(H6DO)-221, DTC P2098 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	<Ref. to GD(H6DO)-221, DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H6DO)-222, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H6DO)-224, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H6DO)-226, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor "A" Minimum Stop Performance	<Ref. to GD(H6DO)-228, DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to GD(H6DO)-230, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to GD(H6DO)-232, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	<Ref. to GD(H6DO)-234, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P2128	Throttle/Pedal Position Sensor/ Switch "E" Circuit High Input	<Ref. to GD(H6DO)-236, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2135	Throttle/Pedal Position Sensor/ Switch "A"/"B" Voltage Correlation	<Ref. to GD(H6DO)-238, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	<Ref. to GD(H6DO)-240, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2227	Barometric Pressure Circuit Range/ Performance	<Ref. to GD(H6DO)-242, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2228	Barometric Pressure Circuit Low	<Ref. to GD(H6DO)-243, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2229	Barometric Pressure Circuit High	<Ref. to GD(H6DO)-244, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

## 2. Diagnostic Trouble Code (DTC) Detecting Criteria

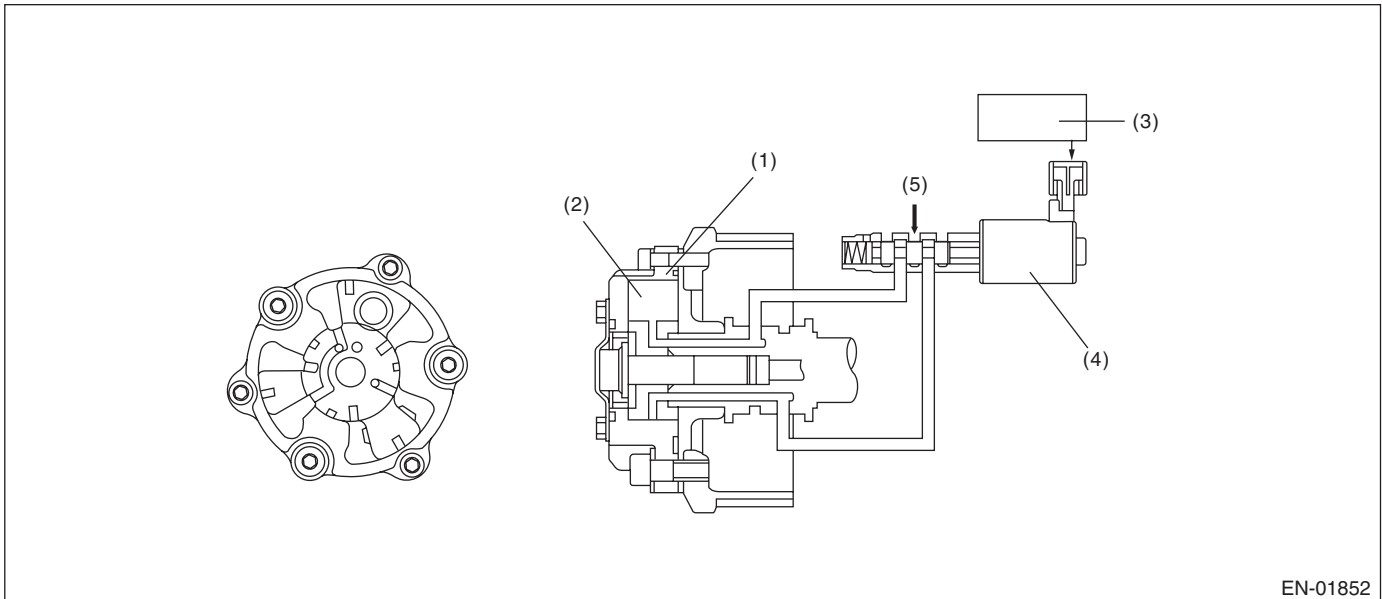
### A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.

#### 2. COMPONENT DESCRIPTION



(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	$\geq 3000$ ms
Battery voltage	$\geq 10.9$ V
Engine speed	$\geq 1500$ rpm
Engine coolant temperature	$\geq 50$ °C (122 °F)
AVCS control	Operation
Target advance angle	$\geq 0$ °CA
Target timing advance change amount (per 64 ms)	$< 1.07$ °CA

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after warming up when the engine speed increases and AVCS operates.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

- 1) When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.
- 2) When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.

### • Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
$\Sigma(\text{Target position} - \text{Actual position})$	> 8000 °CA (Bank 1) > 8000 °CA (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	< -2500 °CA (Bank 1) < -2500 °CA (Bank 2)

**Time Needed for Diagnosis:** 30000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 8000$ °CA (Bank 1) $\leq 8000$ °CA (Bank 2)
	and
	$\geq -2500$ °CA (Bank 1) $\geq -2500$ °CA (Bank 2)

**Time Needed for Diagnosis:** 30000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Fix valve lift amount to High

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

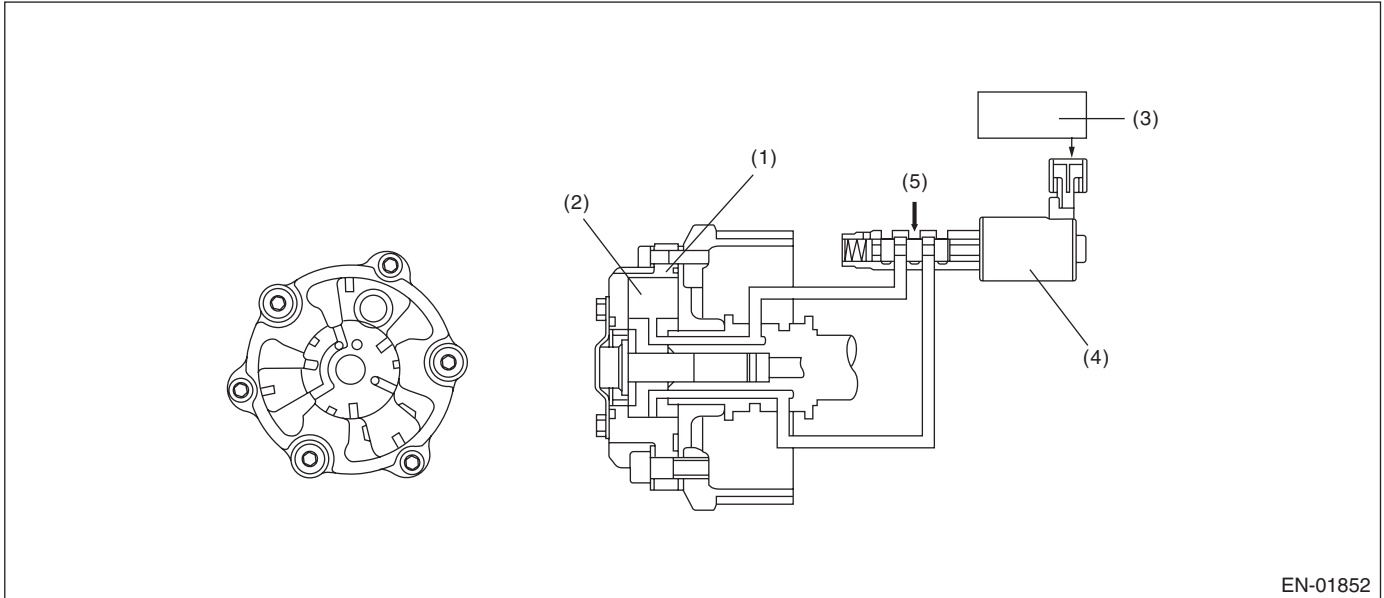
### B: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge as NG when the timing advance is outside the normal range.

#### 2. COMPONENT DESCRIPTION



(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Engine speed	$\geq 500 \text{ rpm}$
Engine coolant temperature	$\geq 50 \text{ }^\circ\text{C}$ (122 °F)
AVCS control	Not in operation
Target timing advance	0°CA

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine and while AVCS is not operating.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

Judge as NG when the camshaft sensor input position is not within the normal range.

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Camshaft input position	< BTDC 22 °CA (Bank 1) < BTDC 22 °CA (Bank 2) or > BTDC 58 °CA (Bank 1) > BTDC 58 °CA (Bank 2)

**Time Needed for Diagnosis:** 20000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Camshaft input position	≥ BTDC 22 °CA (Bank 1) ≥ BTDC 22 °CA (Bank 2) and ≤ BTDC 58 °CA (Bank 1) ≤ BTDC 58 °CA (Bank 2)

**Time Needed for Diagnosis:** 1000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Fix valve lift amount to High

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## C: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0016. <Ref. to GD(H6DO)-12, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **D: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)**

#### **1. OUTLINE OF DIAGNOSIS**

##### **NOTE:**

For the detection standard, refer to DTC P0011. <Ref. to GD(H6DO)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **E: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)**

#### **1. OUTLINE OF DIAGNOSIS**

Judge as NG with either Low NG or High NG.

A variable valve lift diagnosis oil pressure switch is installed for diagnosis. It is possible to determine whether the intake valve is in high mode (increase the amount of lift) or in low mode (suppressing the amount of lift) when the variable valve lift diagnosis oil pressure switch is turned ON or OFF.

##### **• Normal**

Oil switching solenoid valve duty	Intake valve	Variable valve lift diagnosis oil pressure switch
Large	High mode	ON
Minimum	Low mode	OFF

##### **• Low NG**

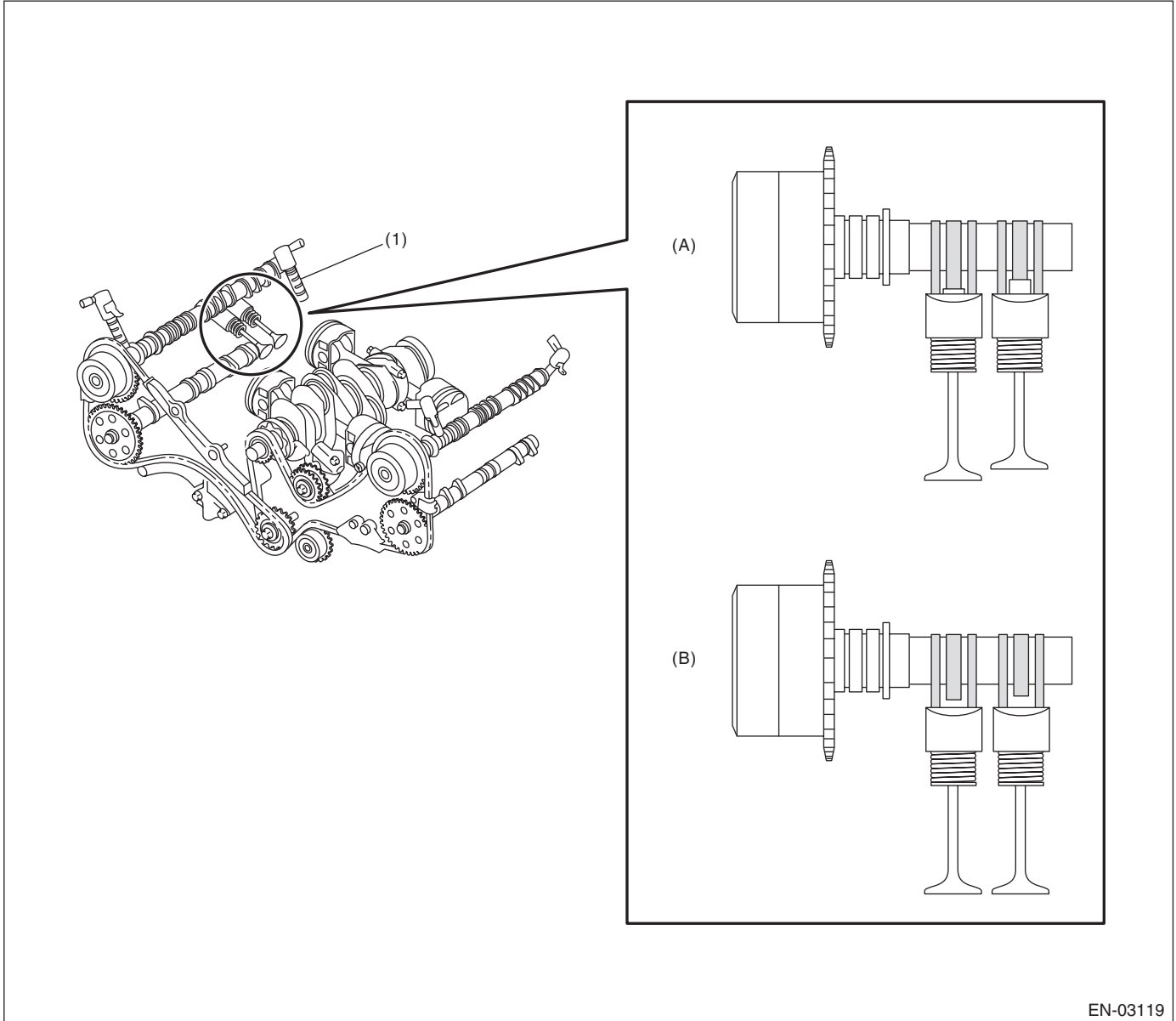
When the variable valve lift diagnosis oil pressure switch remains OFF even though the intake valve tried to enter high mode (oil switching solenoid valve duty is large), this is judged as a Low NG.

##### **• High NG**

When the variable valve lift diagnosis oil pressure switch remains ON even though the intake valve tried to enter low mode (oil switching solenoid valve duty is small), this is judged as a High NG.

## 2. COMPONENT DESCRIPTION

The variable valve lift system optimizes the intake valve lift by switching between the low lift cam and the high lift cam according to the engine speed. The amount of intake valve lift is varied by controlling the oil switching solenoid valve duty according to signals from the ECM.



EN-03119

(1) Oil switching solenoid valve

(A) When at low speed

(B) When at high speed

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
After engine starting	$\geq 6000 \text{ ms}$
Engine oil temperature	$\geq 0 \text{ }^\circ\text{C}$ (32 $^\circ\text{F}$ )
Variable valve lift control	Operation

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 6 seconds after engine start while variable valve lift is being controlled



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
<b>Low</b>	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	OFF
<b>High</b>	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	ON

#### Time Needed for Diagnosis:

Low side: 784 ms

High side: 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
<b>Low</b>	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	ON
<b>High</b>	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	OFF

#### Time Needed for Diagnosis:

Low side: 208 ms

High side: 3000 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## F: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/ PERFORMANCE (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

**NOTE:**

For the detection standard, refer to DTC P0026. <Ref. to GD(H6DO)-14, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

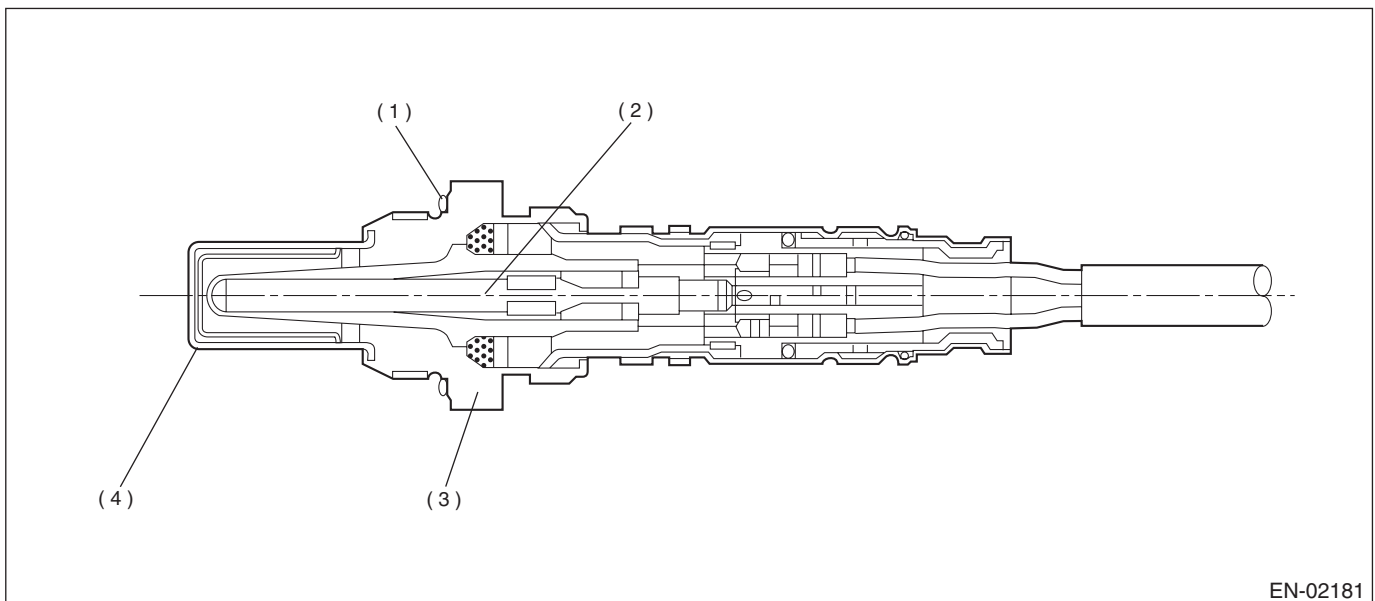
## G: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.

Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

### 2. COMPONENT DESCRIPTION



EN-02181

- |                    |                    |                     |
|--------------------|--------------------|---------------------|
| (1) Gasket         | (3) Sensor housing | (4) Protection tube |
| (2) Ceramic heater |                    |                     |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Condition established time	≥ 30000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
Control duty ≥ 35 %	Experienced
After fuel cut	≥ 20000 ms

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 30000 ms or more have passed since the engine started.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Front oxygen (A/F) sensor impedance	> 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Front oxygen (A/F) sensor impedance	$\leq$ 50 $\Omega$

**Time Needed for Diagnosis:** 10000 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Rear oxygen sensor sub learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.06  $\rightarrow$  0.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## H: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

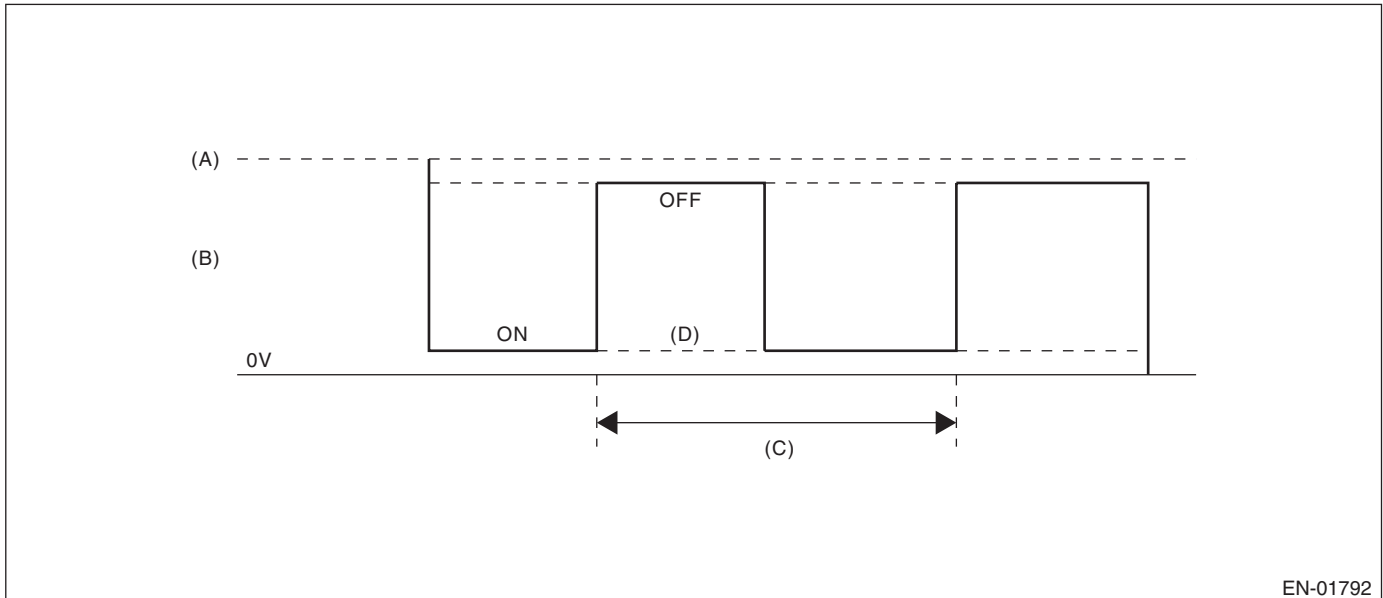
### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

### 2. COMPONENT DESCRIPTION



EN-01792

(A) Battery voltage

(C) 128 milliseconds

(D) Low error

(B) Front oxygen (A/F) sensor heater output voltage

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Front oxygen (A/F) sensor heater control duty	< 87.5 %

**Time Needed for Diagnosis:** 4 ms × 250 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3 → 0, normally.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## I: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

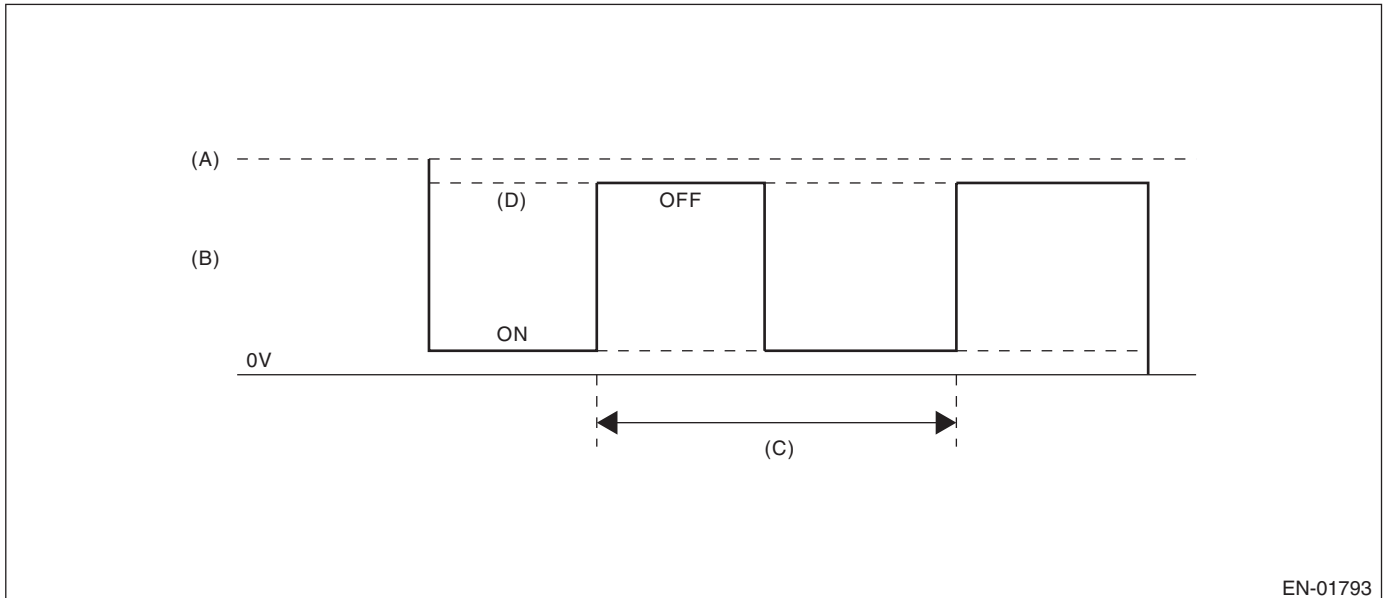
### 1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 128 milliseconds

(D) High error

(B) Front oxygen (A/F) sensor heater output voltage

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Front oxygen (A/F) sensor heater control duty	$\geq 12.5 \%$

**Time Needed for Diagnosis:** 4 ms  $\times$  250 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.3  $\rightarrow$  0, normally.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## J: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

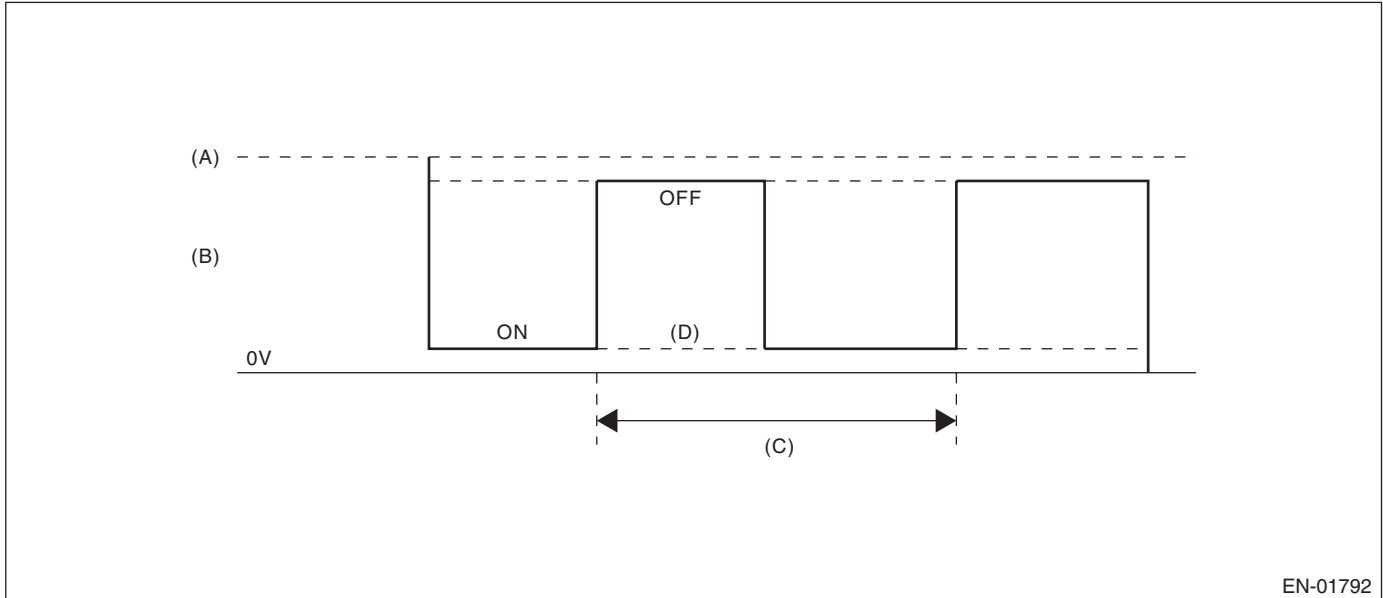
### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) Low error

(B) Output voltage of the rear oxygen sensor heater

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 4500$ rpm

### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Rear oxygen sensor heater control duty	< 75 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage level	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Sub feedback control: Not allowed

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## K: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

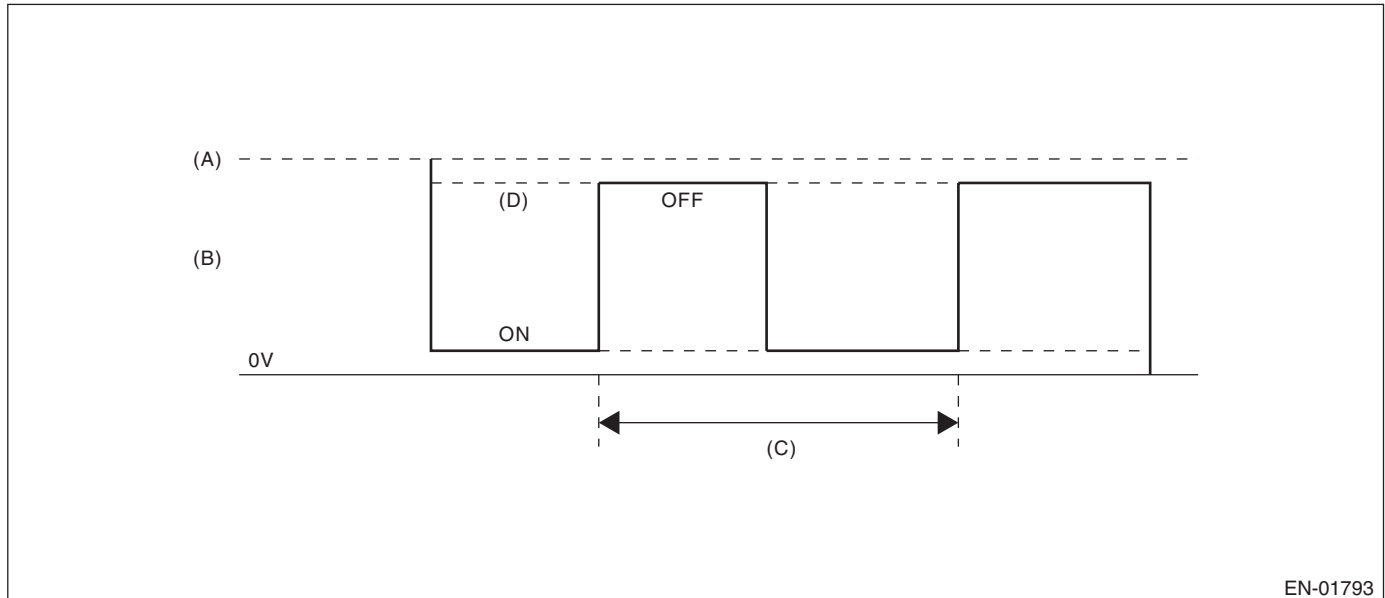
### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

### 2. COMPONENT DESCRIPTION



(A) Battery voltage

(C) 256 milliseconds (cycles)

(D) High error

(B) Output voltage of the rear oxygen sensor heater

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Elapsed time after engine starting	$\geq 1$ second
Engine speed	$< 4500$ rpm

### 4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	≥ 15 %

**Time Needed for Diagnosis:** 8 ms × 320 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage level	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Sub feedback control: Not allowed

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## **L: DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0030. <Ref. to GD(H6DO)-17, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **M: DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0031. <Ref. to GD(H6DO)-19, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **N: DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0032. <Ref. to GD(H6DO)-21, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **O: DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0037. <Ref. to GD(H6DO)-23, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **P: DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2)**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0038. <Ref. to GD(H6DO)-25, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

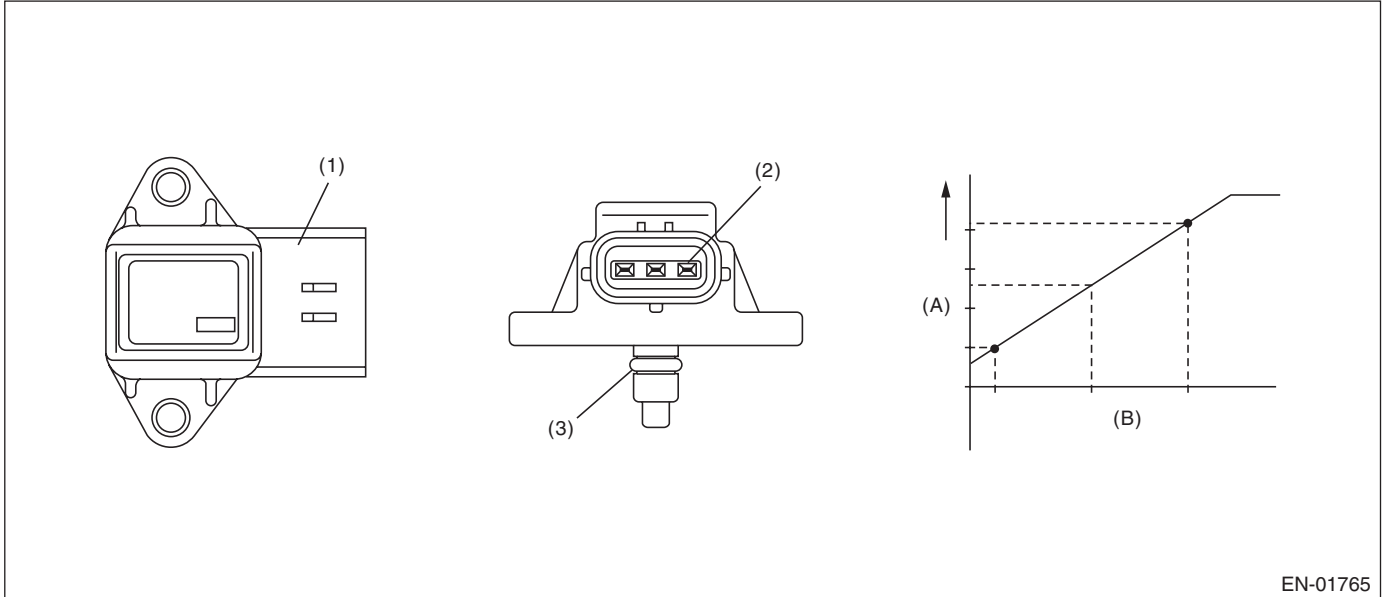
### Q: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

#### 1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.

Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

#### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 15 deg
Output voltage	< 2.12 V
Engine load	> 0.87 g/rev (0.031 oz/rev)
<b>High</b>	
Engine speed	500 rpm — 850 rpm
Throttle position	< 3.5 deg
Output voltage	≥ 2.66 V
Engine load	< 0.6 g/rev (0.021 oz/rev)

### Time Needed for Diagnosis:

Low side: 3000 msec

High side: 10000 msec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

If the duration of time while the following conditions are met is longer than the time indicated, judge as OK.

### Judgment Value

Malfunction criteria	Threshold value
<b>Low</b>	
Engine speed	< 2500 rpm
Throttle position	≥ 15 deg
Output voltage	≥ 2.12 V
Engine load	> 0.87 g/rev (0.031 oz/rev)
<b>High</b>	
Engine speed	500 rpm — 850 rpm
Throttle position	< 3.5 deg
Output voltage	< 2.66 V
Engine load	< 0.6 g/rev (0.021 oz/rev)

### Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from the engine speed and size of the throttle opening. When the throttle opening is also NG, fix at 66.7 kPa (500 mmHg, 19.69 inHg).
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Fuel cut will operate at engine high speed.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knocking compensation

When normal: Learning ignition advance angle value = knock F/B advance angle + entire learning advance angle value + portional learning advance angle value

Failure: learned ignition advance value =  $-6^{\circ}\text{CA}$ . ( $6^{\circ}\text{CA}$  retard)

Knock F/B advance angle value =  $0^{\circ}\text{CA}$

Whole learning prohibited

Portional learning prohibited

- ISC control: ISC feedback amount calculation prohibited
- Amount of ISC open-loop compensation = Fixed at 6.82%
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## R: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect the open circuit of the oil switching solenoid valve.

Judge as NG when the current is small even though the output duty is large.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Duty ratio	$\geq 30$ %
Control current	$< 0.026$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Oil switching solenoid valve target current value – Oil switching solenoid valve current value	$< 0.08$ A
Target current	$\geq 0.11$ A

**Time Needed for Diagnosis:** 2000 ms

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### S: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect short circuits of the oil switching solenoid valve.

Judge as a short NG when the current is large even though the output duty is small.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Duty ratio	$< 7$ %
Control current	$\geq 0.465$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Oil switching solenoid valve target current value – Oil switching solenoid valve current value	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

### T: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

#### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0076. <Ref. to GD(H6DO)-31, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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### **U: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)**

#### **1. OUTLINE OF DIAGNOSIS**

##### **NOTE:**

For the detection standard, refer to DTC P0077. <Ref. to GD(H6DO)-32, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

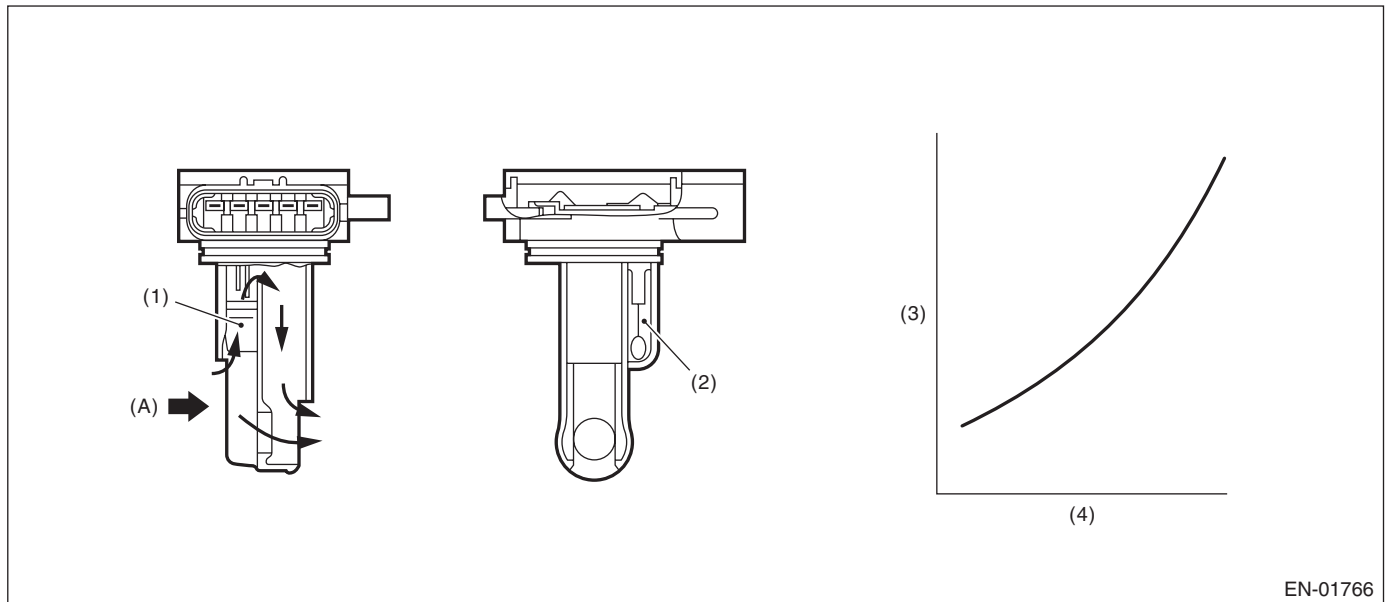
### V: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

#### 2. COMPONENT DESCRIPTION



(1) Air flow sensor

(2) Intake air temperature sensor

(3) Voltage (V)

(4) Amount of intake air (kg (lb)/s)

(A) Air

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
<b>Low</b>	
Output voltage	< 1.79 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 15 deg
Intake manifold pressure	≥ 73.32 kPa (550 mmHg, 21.654 inHg)
<b>High (1)</b>	
Output voltage	≥ 1.83 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 deg
Intake manifold pressure	≥ 46.66 kPa (350 mmHg, 13.78 inHg)
<b>High (2)</b>	
Output voltage	≥ 1.73 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 deg
Intake manifold pressure	≥ 46.66 kPa (350 mmHg, 13.78 inHg)
Fuel system diagnosis	Rich side malfunction

### Time Needed for Diagnosis:

Low: 5000 ms

High: 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
<b>Low</b>	
Output voltage	≥ 1.79 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 15 deg
Intake manifold pressure	≥ 73.32 kPa (550 mmHg, 21.654 inHg)
<b>High</b>	
Output voltage	< 1.83 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 deg
Intake manifold pressure	< 46.66 kPa (350 mmHg, 13.78 inHg)
Fuel system diagnosis	Rich side normal

### Time Needed for Diagnosis:

Low: Less than 1 second

High: Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

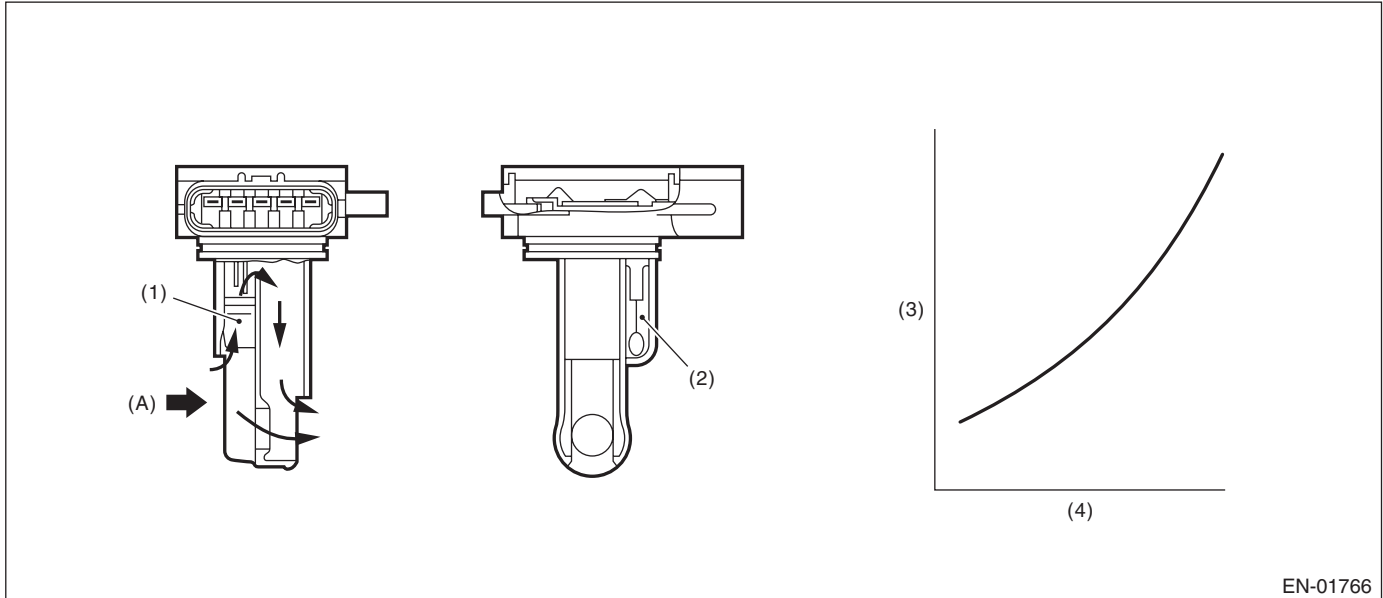
Memorize the freeze frame data. (For test mode \$02)

## W: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |                                   |                                      |         |
|-----------------------------------|--------------------------------------|---------|
| (1) Air flow sensor               | (3) Voltage (V)                      | (A) Air |
| (2) Intake air temperature sensor | (4) Amount of intake air (kg (lb)/s) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\leq 0.200$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$> 0.200$ V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knock compensation:
  - Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
  - When normal: Knock compensation value = Fixed at 0°CA
  - Failure: Knock compensation value ≠ Fixed at 0° CA (When knock: Max. 12°CA retard)
  - Whole learning compensation coefficient update not allowed
  - Portional learning zone compensation value calculation not allowed
- ISC control: Open loop compensation is set to (1 g (0.04 oz)/s). Stop calculation of throttle sensor temperature compensation (hold previous value)
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

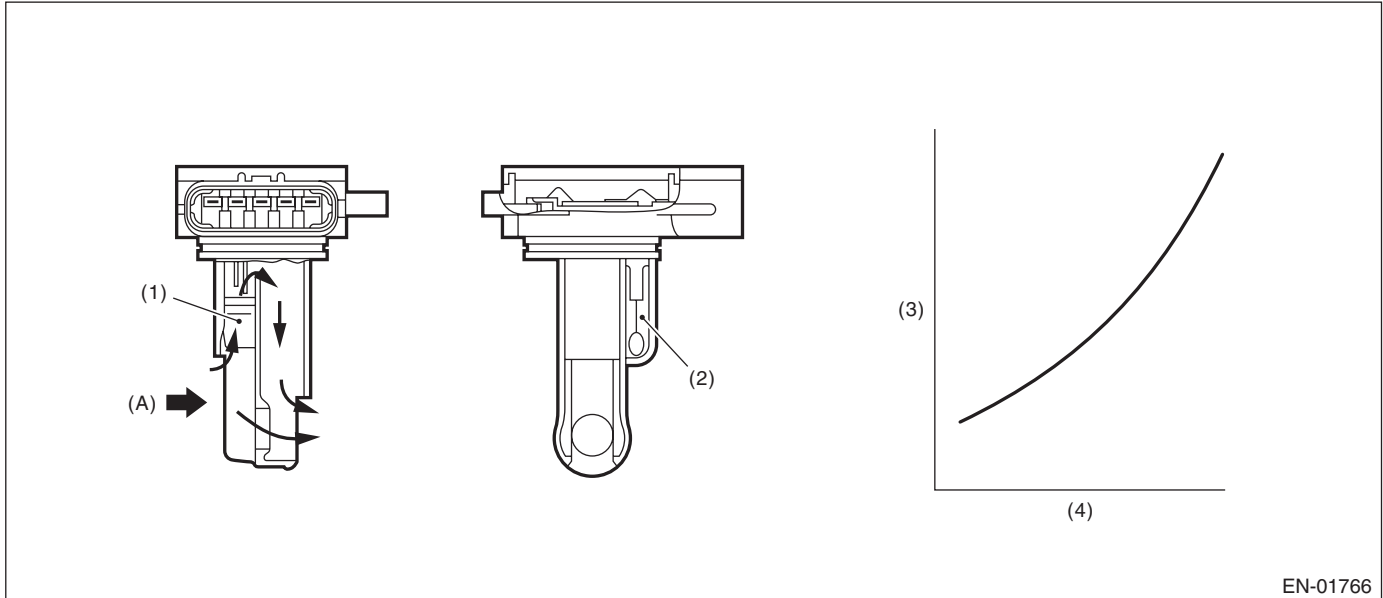
Memorize the freeze frame data. (For test mode \$02)

## X: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- |                                   |                                      |         |
|-----------------------------------|--------------------------------------|---------|
| (1) Air flow sensor               | (3) Voltage (V)                      | (A) Air |
| (2) Intake air temperature sensor | (4) Amount of intake air (kg (lb)/s) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.791$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.791$ V

**Time Needed for Diagnosis:** Less than 1 second



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knock compensation:
  - Knock compensation final advance/delay angle value = knock compensation value + whole learning compensation value + portional learning compensation value
  - When normal: Knock compensation value = Fixed at 0°CA
  - Failure: Knock compensation value ≠ Fixed at 0° CA (When knock: Max. 12°CA retard)
  - Whole learning compensation coefficient update not allowed
  - Portional learning zone compensation value calculation not allowed
- ISC control: Open loop compensation is set to (1 g (0.04 oz)/s). Stop calculation of throttle sensor temperature compensation (hold previous value)
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

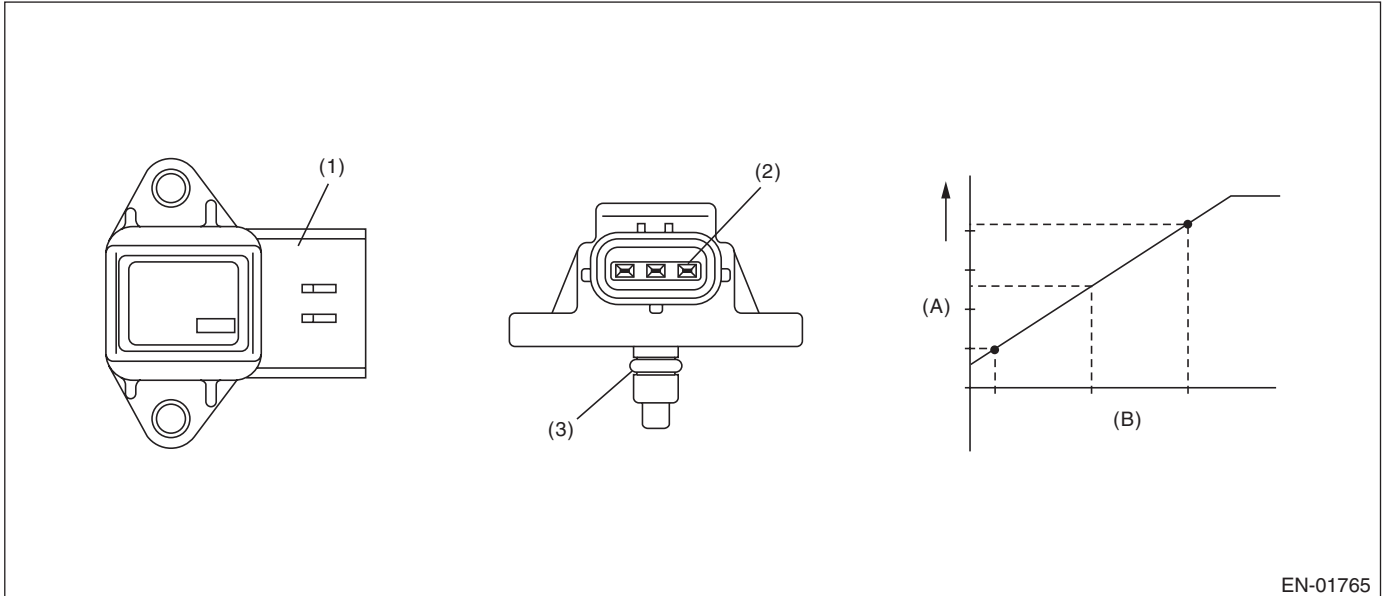
GENERAL DESCRIPTION

## Y: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\leq 0.568$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$> 0.568$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from the engine speed and size of the throttle opening. When the throttle opening is also NG, fix at 66.7 kPa (500 mmHg, 19.69 inHg).
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Fuel cut will operate at engine high speed.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knocking compensation

When normal: Learning ignition advance angle value = knock F/B advance angle + entire learning advance angle value + portional learning advance angle value

Failure: learned ignition advance value =  $-6^{\circ}\text{CA}$ . ( $6^{\circ}\text{CA}$  retard)

Knock F/B advance angle value =  $0^{\circ}\text{CA}$

Whole learning prohibited

Portional learning prohibited

- ISC control: ISC feedback amount calculation prohibited

Amount of ISC open-loop compensation = Fixed at 6.82 %

- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

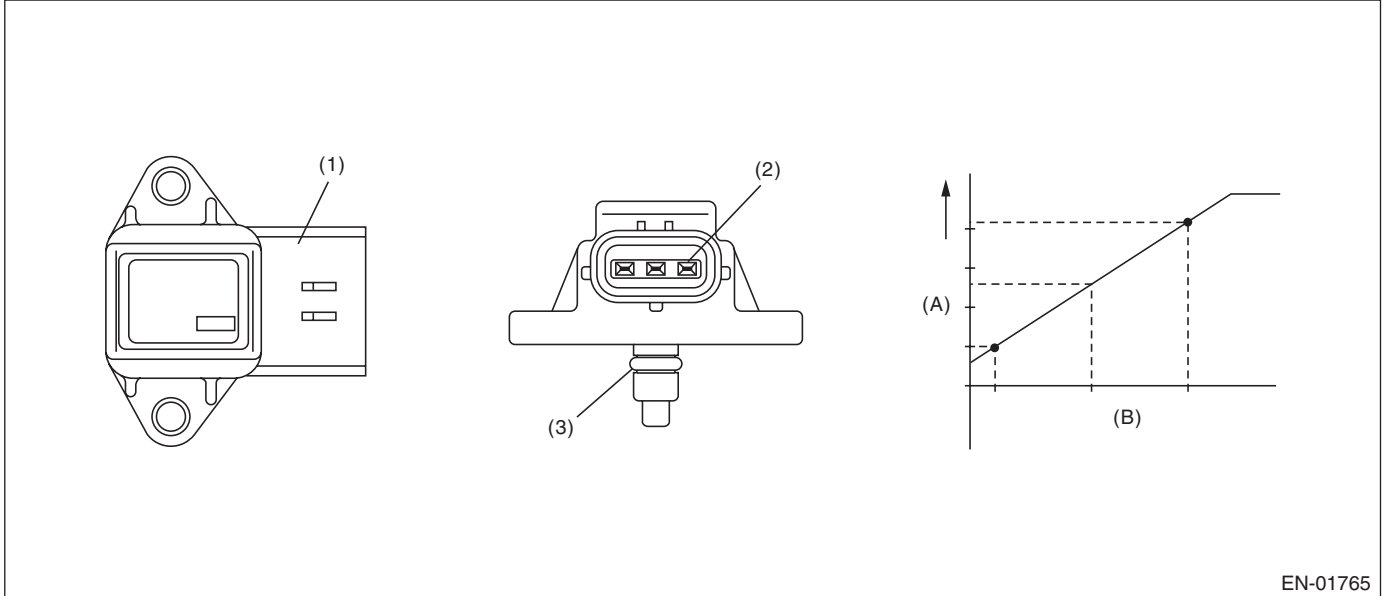
Memorize the freeze frame data. (For test mode \$02)

## Z: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01765

- (1) Connector
- (2) Terminals

- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.382$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.382$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Intake manifold pressure sensor process: Estimate the pressure from the engine speed and size of the throttle opening. When the throttle opening is also NG, fix at 66.7 kPa (500 mmHg, 19.69 inHg).
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Fuel cut will operate at engine high speed.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knocking compensation

When normal: Learning ignition advance angle value = knock F/B advance angle + entire learning advance angle value + portional learning advance angle value

Failure: learned ignition advance value =  $-6^{\circ}\text{CA}$ . ( $6^{\circ}\text{CA}$  retard)

Knock F/B advance angle value =  $0^{\circ}\text{CA}$

Whole learning prohibited

Portional learning prohibited

- ISC control: ISC feedback amount calculation prohibited

Amount of ISC open-loop compensation = Fixed at 6.82%

- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

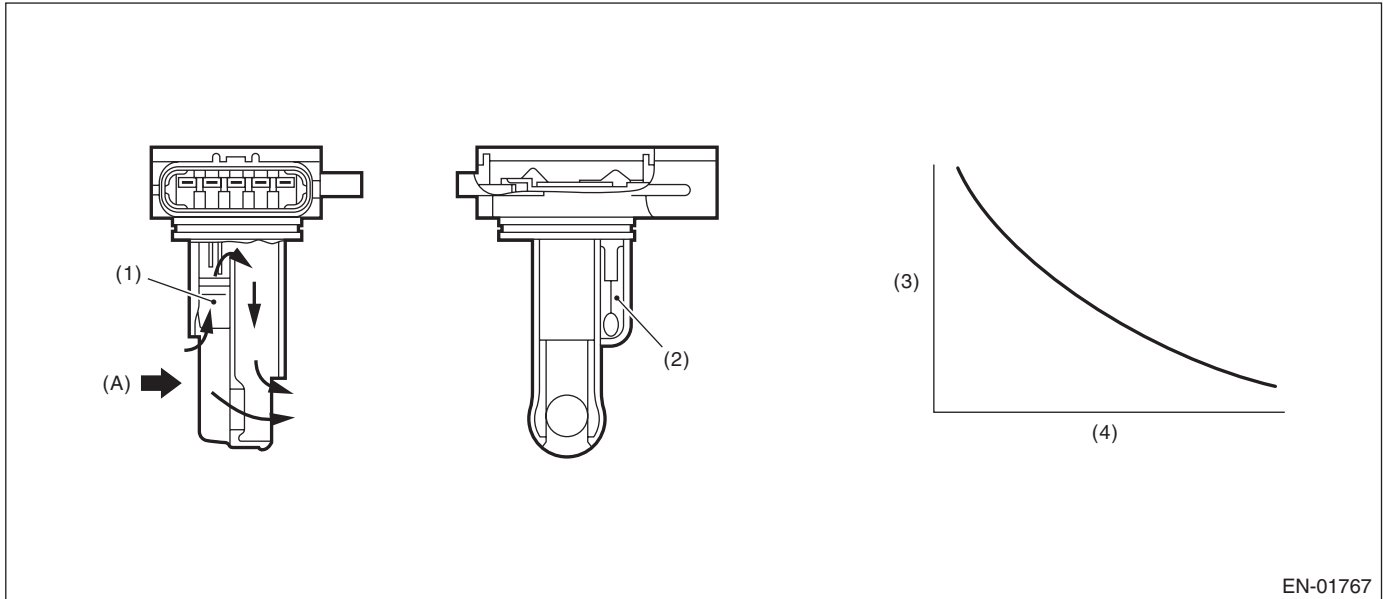
## AA:DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

### 2. COMPONENT DESCRIPTION



EN-01767

- |                                   |                                    |         |
|-----------------------------------|------------------------------------|---------|
| (1) Air flow sensor               | (3) Resistance value (Ω)           | (A) Air |
| (2) Intake air temperature sensor | (4) Intake air temperature °C (°F) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< 30 °C (86 °F)
Engine coolant temperature	≥ 95 °C (203 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 60 km/h (37.3 MPH)	≥ 600 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage difference between Max. and Min.	< 0.02 V (Equivalent to approximately 0.5°C (0.9°F) near 25°C)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage difference between Max. and Min.	≥ 0.02 V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

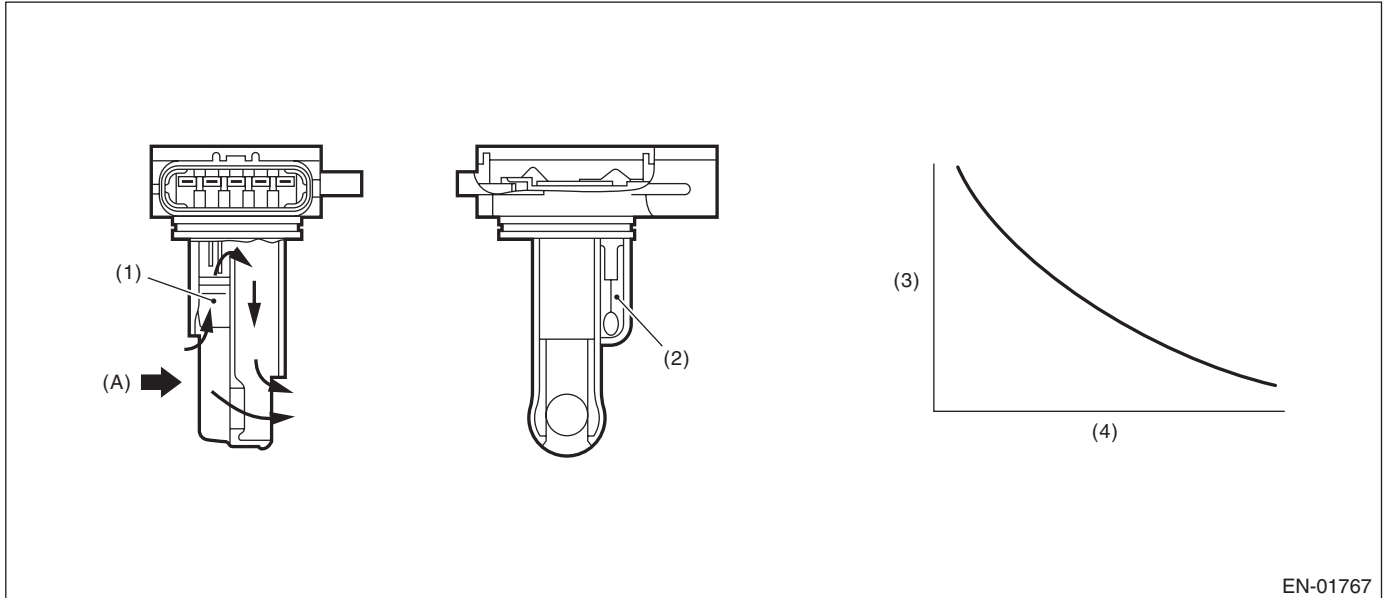
Memorize the freeze frame data. (For test mode \$02)

## AB:DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01767

- |                                   |                                    |         |
|-----------------------------------|------------------------------------|---------|
| (1) Air flow sensor               | (3) Resistance value (Ω)           | (A) Air |
| (2) Intake air temperature sensor | (4) Intake air temperature °C (°F) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 0.231 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	≥ 0.231 V

**Time Needed for Diagnosis:** Less than 1 second



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

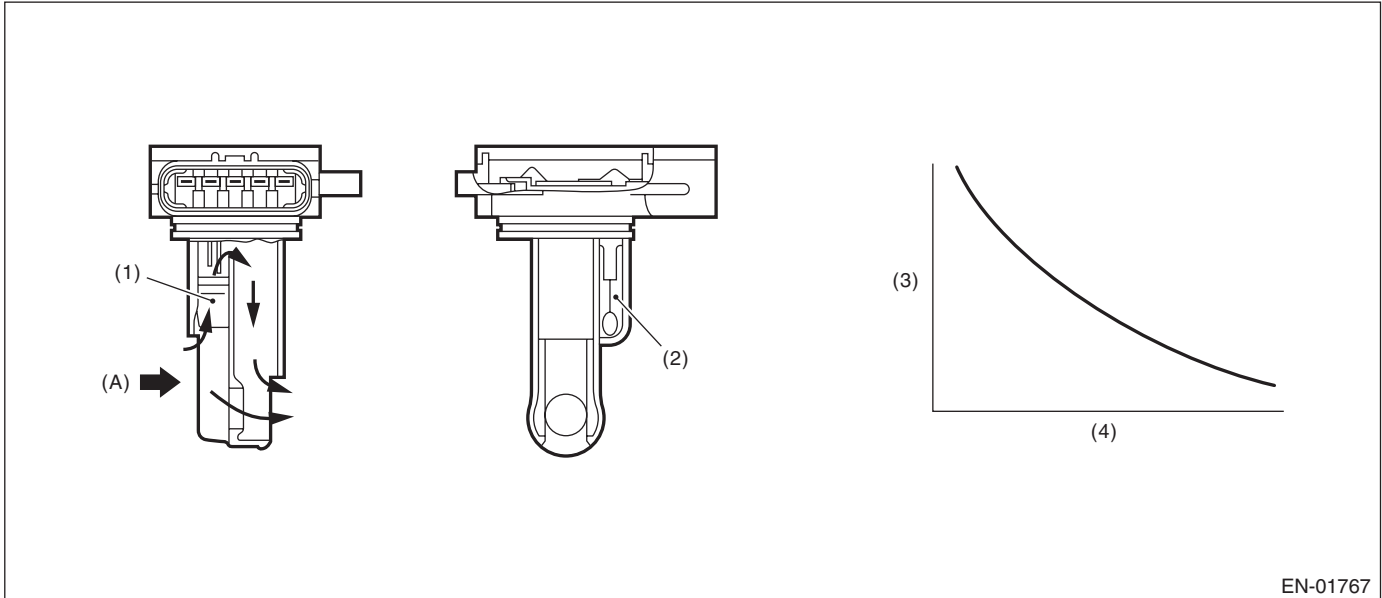
Memorize the freeze frame data. (For test mode \$02)

## AC:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01767

- |                                   |                                    |         |
|-----------------------------------|------------------------------------|---------|
| (1) Air flow sensor               | (3) Resistance value (Ω)           | (A) Air |
| (2) Intake air temperature sensor | (4) Intake air temperature °C (°F) |         |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

### 9. ECM OPERATION AT DTC SETTING

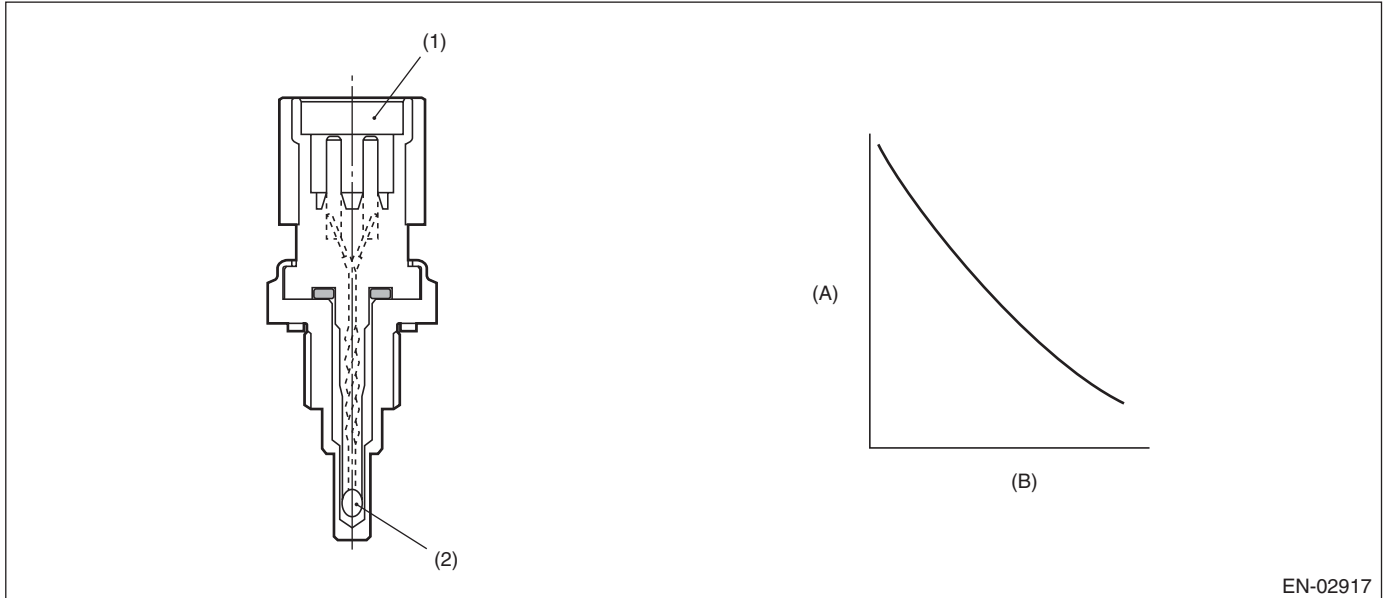
Memorize the freeze frame data. (For test mode \$02)

## AD:DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-02917

- |                        |                           |
|------------------------|---------------------------|
| (1) Connector          | (A) Resistance value (kΩ) |
| (2) Thermistor element | (B) Temperature °C (°F)   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 0.265 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	≥ 0.265 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.

### 9. ECM OPERATION AT DTC SETTING

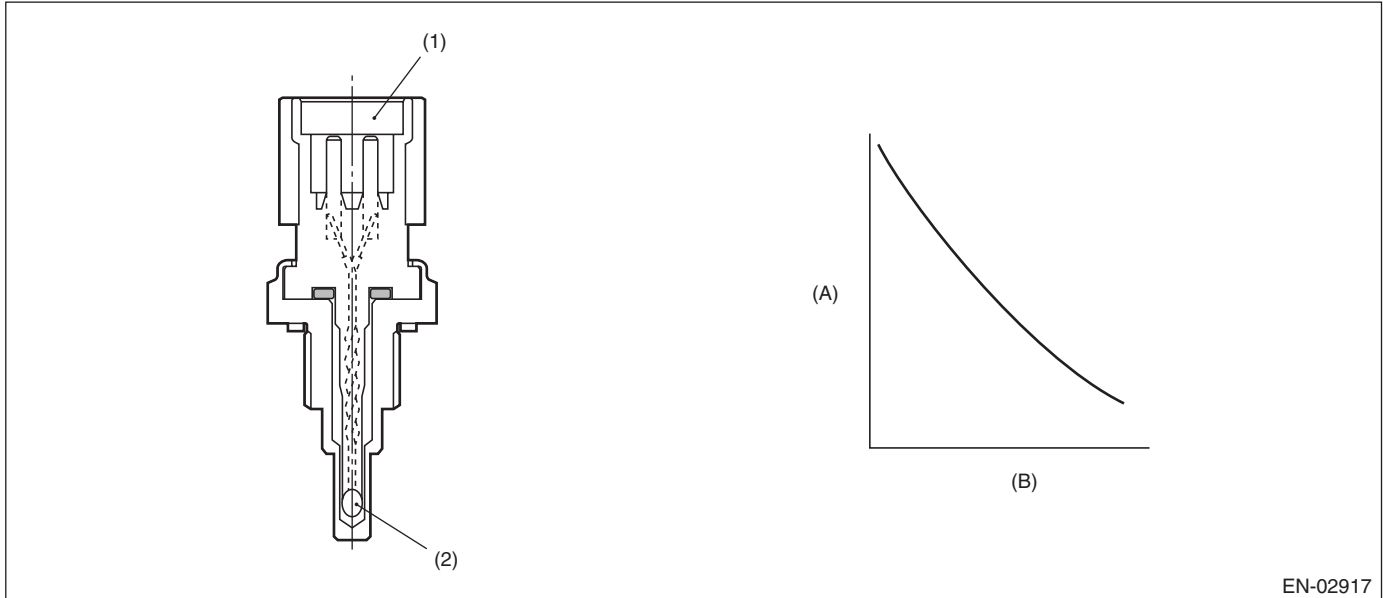
Memorize the freeze frame data. (For test mode \$02)

## AE:DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-02917

- |                        |                           |
|------------------------|---------------------------|
| (1) Connector          | (A) Resistance value (kΩ) |
| (2) Thermistor element | (B) Temperature °C (°F)   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	≥ 4.716 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 4.716 V

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.

### 9. ECM OPERATION AT DTC SETTING

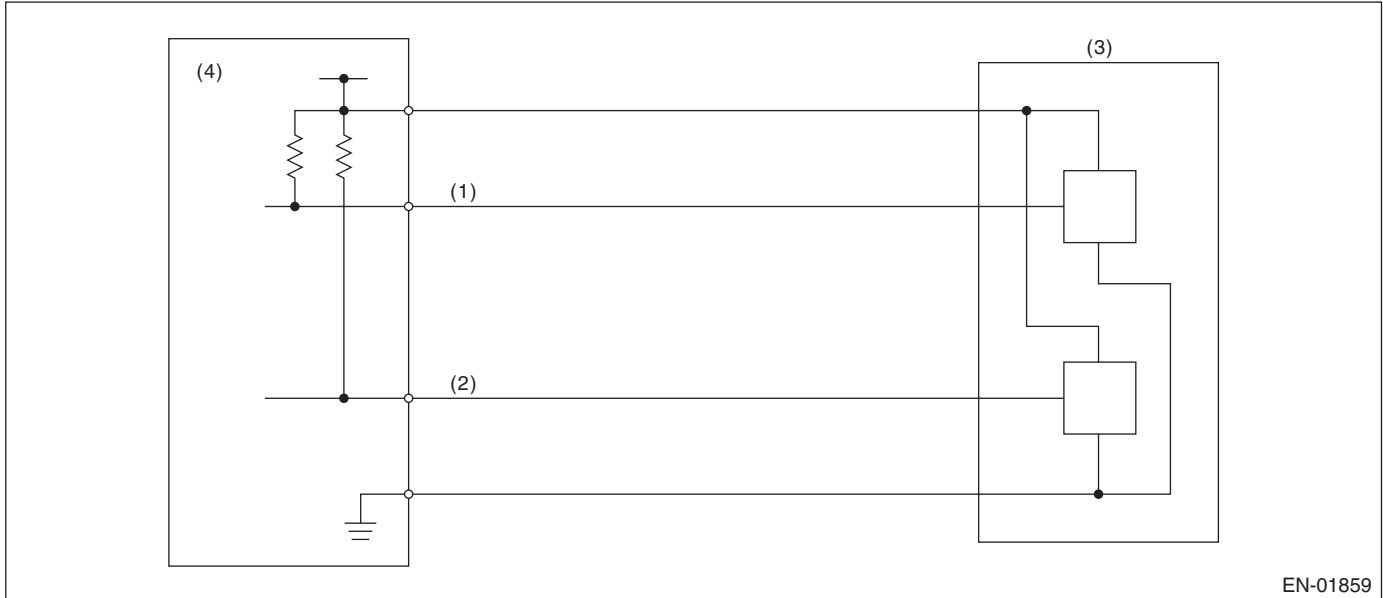
Memorize the freeze frame data. (For test mode \$02)

## AF:DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal      (3) Throttle position sensor      (4) Engine control module (ECM)  
 (2) Throttle position sensor 2 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$\leq 0.224$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$> 0.224$ V

**Time Needed for Diagnosis:** 24 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

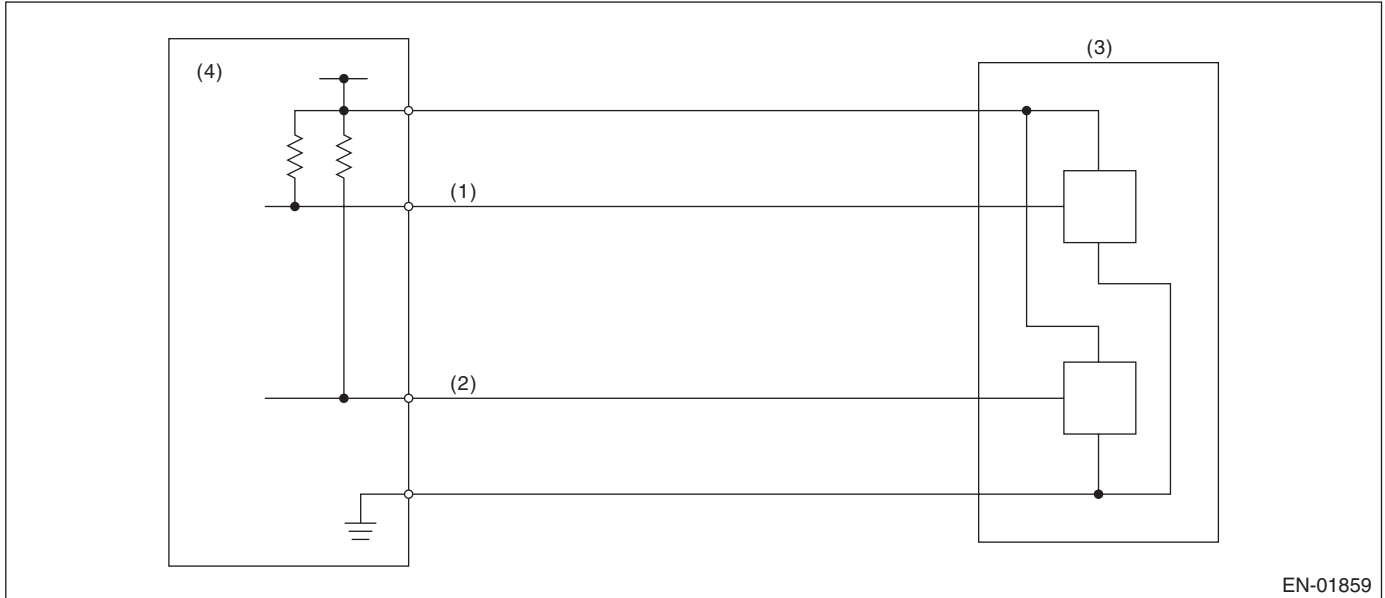
Memorize the freeze frame data. (For test mode \$02)

## AG:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal      (3) Throttle position sensor      (4) Engine control module (ECM)  
 (2) Throttle position sensor 2 signal

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 \text{ V}$

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$\geq 4.851$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$< 4.851$ V

**Time Needed for Diagnosis:** 24 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

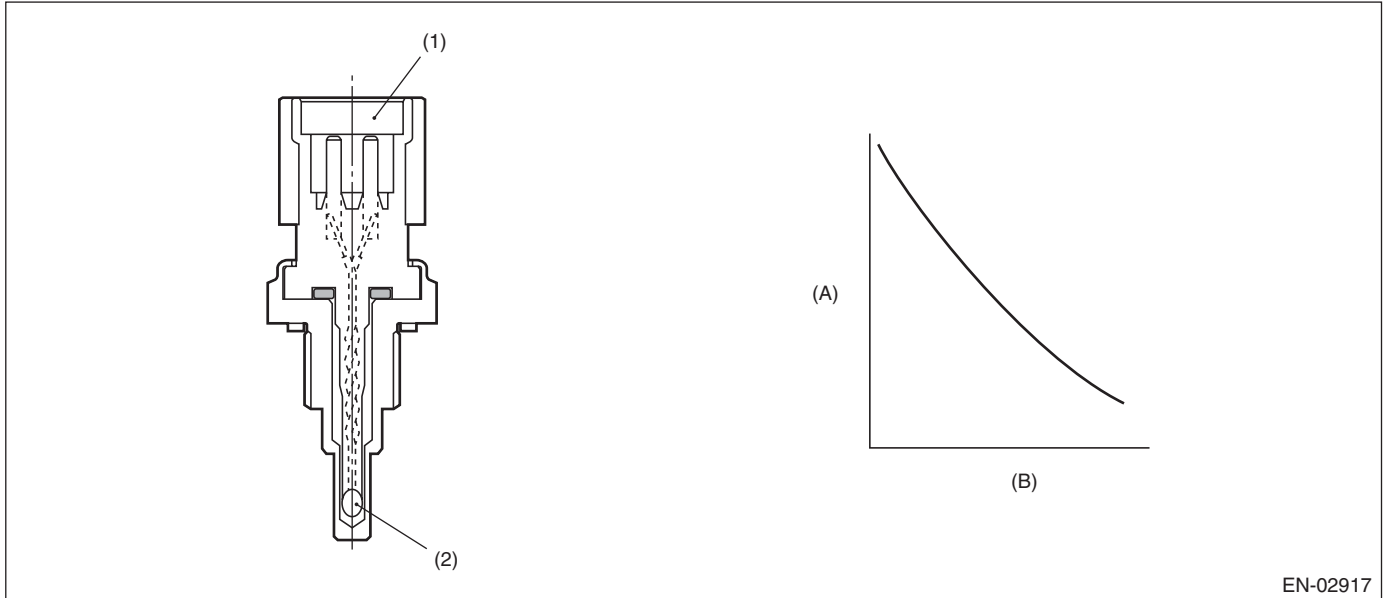
## AH:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.

Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

### 2. COMPONENT DESCRIPTION



EN-02917

- (1) Connector
- (2) Thermistor element

- (A) Resistance value (k $\Omega$ )
- (B) Temperature °C (°F)

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	$\geq$ Value from Map
Battery voltage	$\geq 10.9$ V

#### Map

Engine coolant temperature °C (°F)	-40 (-40)	110 (230)
Engine speed rpm	500	500

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG if the criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgment value of timer after engine start

Timer for diagnosis after engine start

- Timer stop at fuel cut
- During the driving conditions except a) above, timer counts up as follows.  
64 milliseconds + TWCNT milliseconds (the time of at 64 milliseconds)

TWCNT is defined as follows,

TWCNT = 0 at idle switch ON,

TWCNT show on the following table at idle switch OFF.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-20 (-4)	0 ms	37.136 ms	74.272 ms	111.41 ms	126.66 ms	141.91 ms	163.59 ms	185.26 ms
	-10 (14)	0 ms	27.391 ms	54.782 ms	82.173 ms	99.65 ms	117.13 ms	135.96 ms	154.8 ms
	0 (32)	0 ms	17.646 ms	35.292 ms	52.938 ms	72.64 ms	92.341 ms	108.34 ms	124.33 ms
	10 (50)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms
	20 (68)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms

Judgment value of timer after engine starting

$$t = 429523 \text{ ms} - 28605 \text{ ms}/^{\circ}\text{C} \times T_i$$

$T_i$  : The lowest coolant temperature after engine start

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 20 °C (68 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 8. FAIL SAFE

- Engine coolant temperature sensor process: Engine coolant temperature is fixed at 70°C (158°F).
- ISC Feedback: Calculate target engine speed as engine coolant temperature 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- High water temperature expansion compensation coefficient: Normally, mass expands with high water temperature and other conditions, but this ignores water temperature conditions and expands when other conditions are established.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

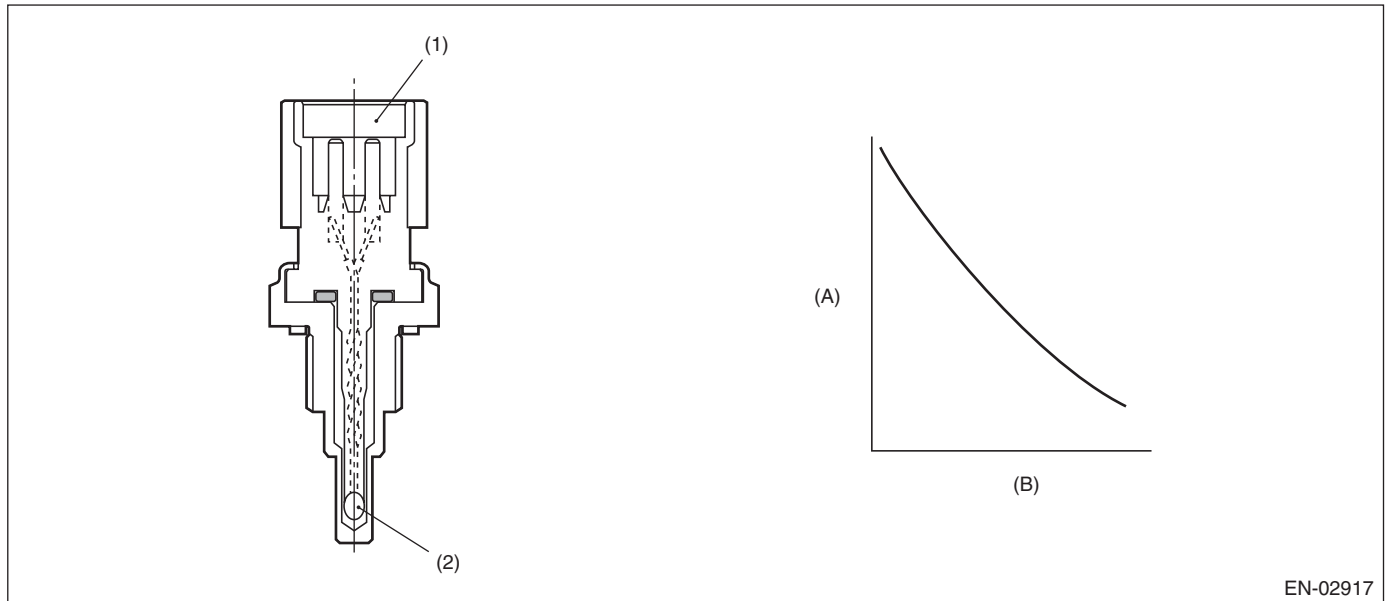
### AI: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

#### 2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (k $\Omega$ )

(B) Temperature °C (°F)

(1) Connector

(2) Thermistor element

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V
Refueling from the last engine stop till the current engine start	None
Fuel level	$\geq 15$ L (3.963 US gal, 3.3 Imp gal)
Engine coolant temperature at the last engine stop	$\geq 75$ °C (167 °F)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	< 2.5 °C (36.5 °F)
Fuel temperature at the last engine stop — fuel temperature	≥ 5 °C (41 °F)
Intake air temperature — fuel temperature	< 2.5 °C (36.5 °F)
Fuel temperature	< 35 °C (95 °F)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	≥ 2.5 °C (36.5 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

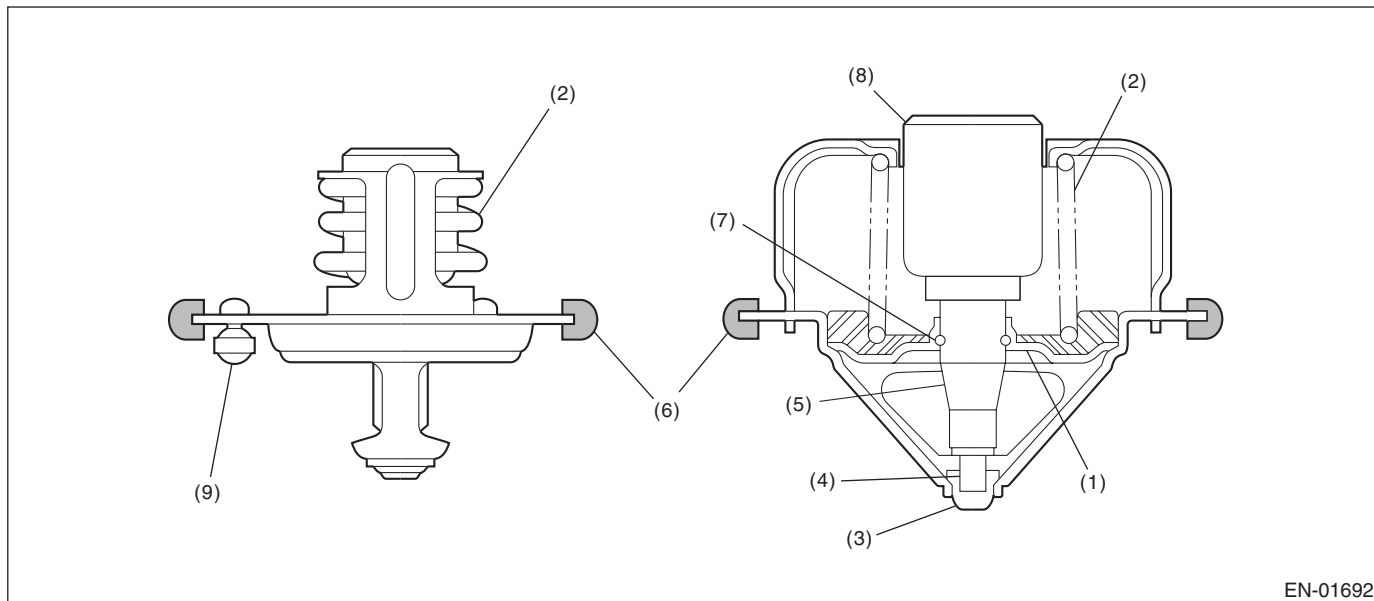
### AJ:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.

Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 75°C (167°F), and the difference is small, before judging NG.

#### 2. COMPONENT DESCRIPTION



EN-01692

- |             |                 |                  |
|-------------|-----------------|------------------|
| (1) Valve   | (4) Piston      | (7) Stop ring    |
| (2) Spring  | (5) Guide       | (8) Wax element  |
| (3) Stopper | (6) Rubber seal | (9) Jiggle valve |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Estimate ambient temperature	$\geq -7$ °C (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55$ °C (131 °F)
Estimated coolant temperature	$\geq 75$ °C (167 °F)
Engine coolant temperature (Estimated – Measured) Engine coolant temperature	$\leq 75$ °C (167 °F)
	$> 20$ °C (68 °F)
Vehicle speed	$\geq 20$ km/h (12.4 MPH)

**Time Needed for Diagnosis:** 64 ms  $\times$  3 time  $\times$  120 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Estimate ambient temperature	$\geq -7$ °C (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55$ °C (131 °F)
Engine coolant temperature (Estimated – Measured) Engine coolant temperature	$\geq 75$ °C (167 °F)
	$\leq 20$ °C (68 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

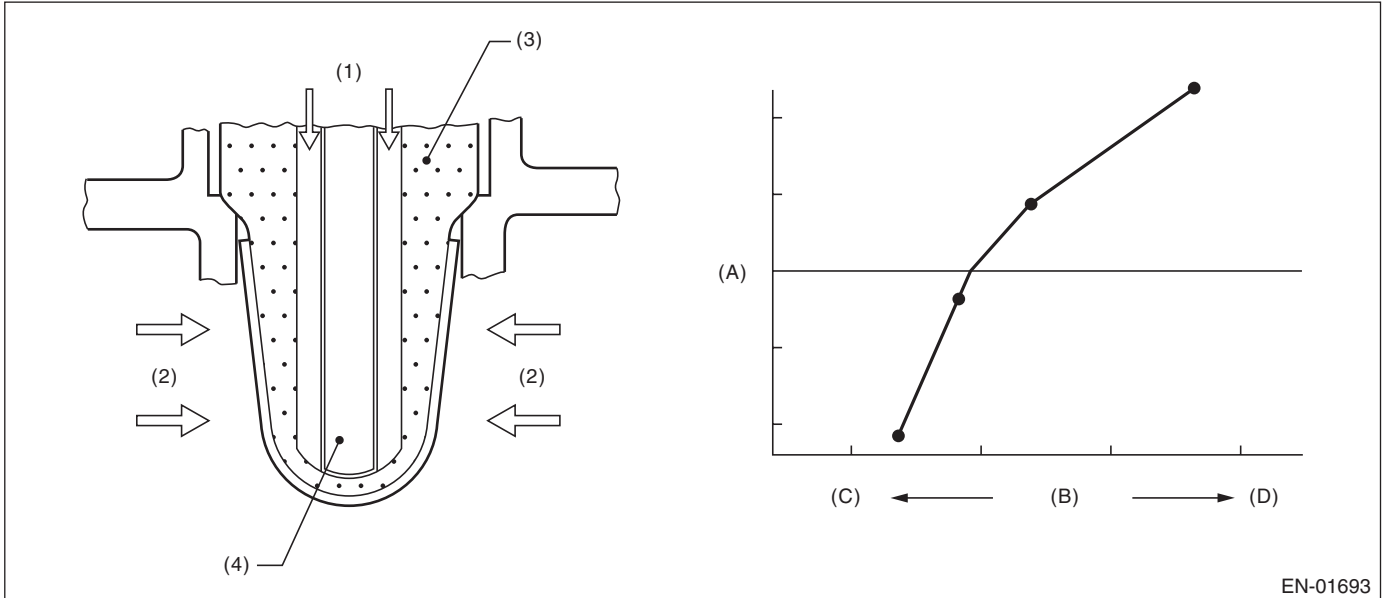
### AK:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG when the element applied voltage is out of range, or the element current is out of range.

#### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Input voltage or Input current	< 1.800 V  < -0.005 A

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Input voltage Input current	$\geq 1.800$ V $\geq -0.005$ A

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on heater.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.06 → 0, normally.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

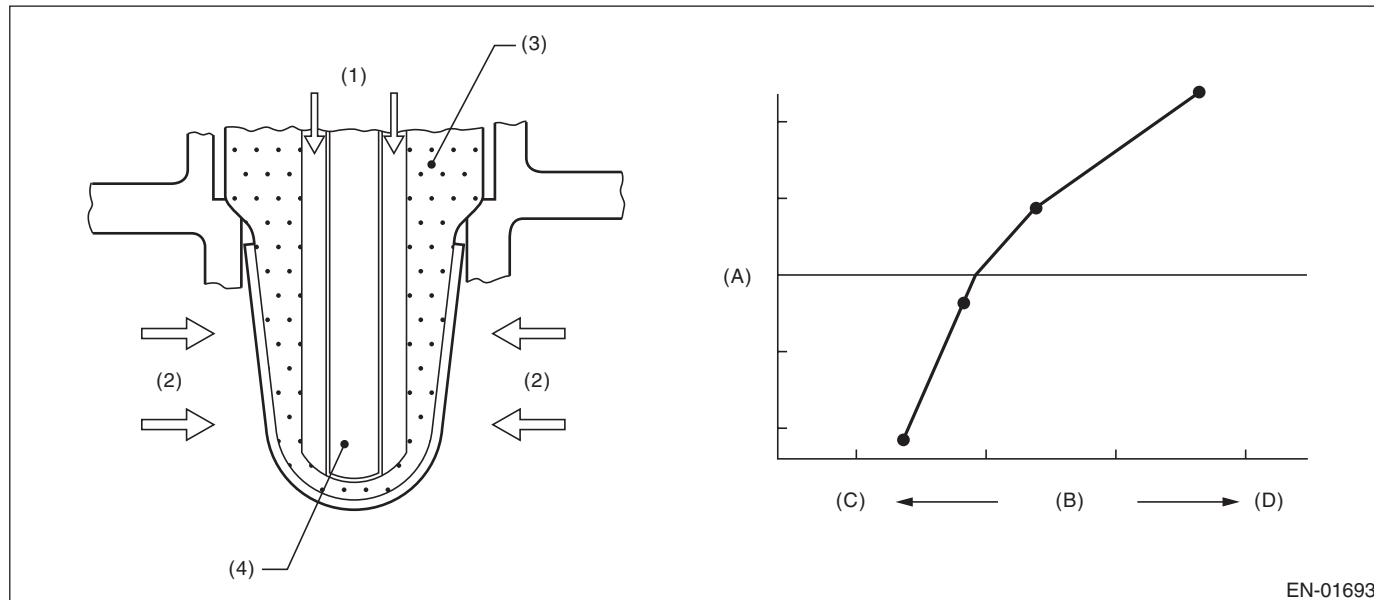
### AL:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG when the element applied voltage is out of range, or the element current is out of range.

#### 2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Input voltage or Input current	> 3.800 V  > 0.005 A

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Input voltage Input current	$\leq 3.800$ V $\leq 0.005$ A

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor heater control: Not allowed to turn on heater
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- A/F sub learning: Not allowed to calculate the A/F sub learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0.06 → 0, normally.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

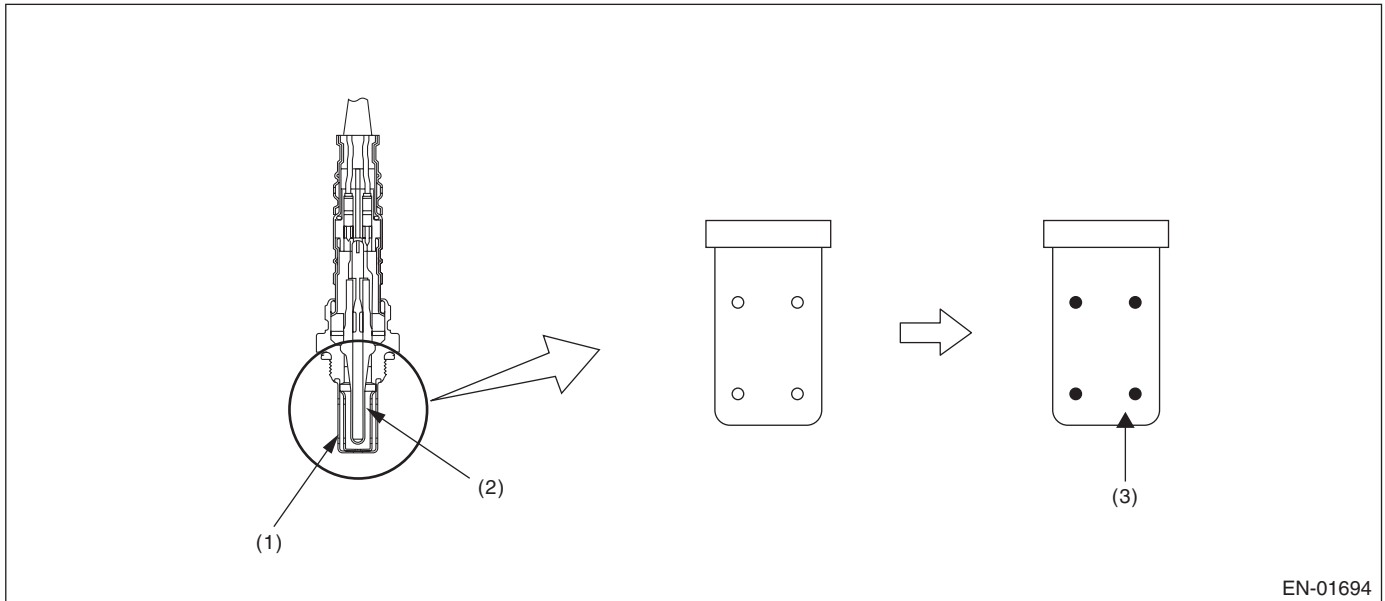
### AM:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.

When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs. Judge as NG when the actual movement in comparison to the ECM control amount is slow.



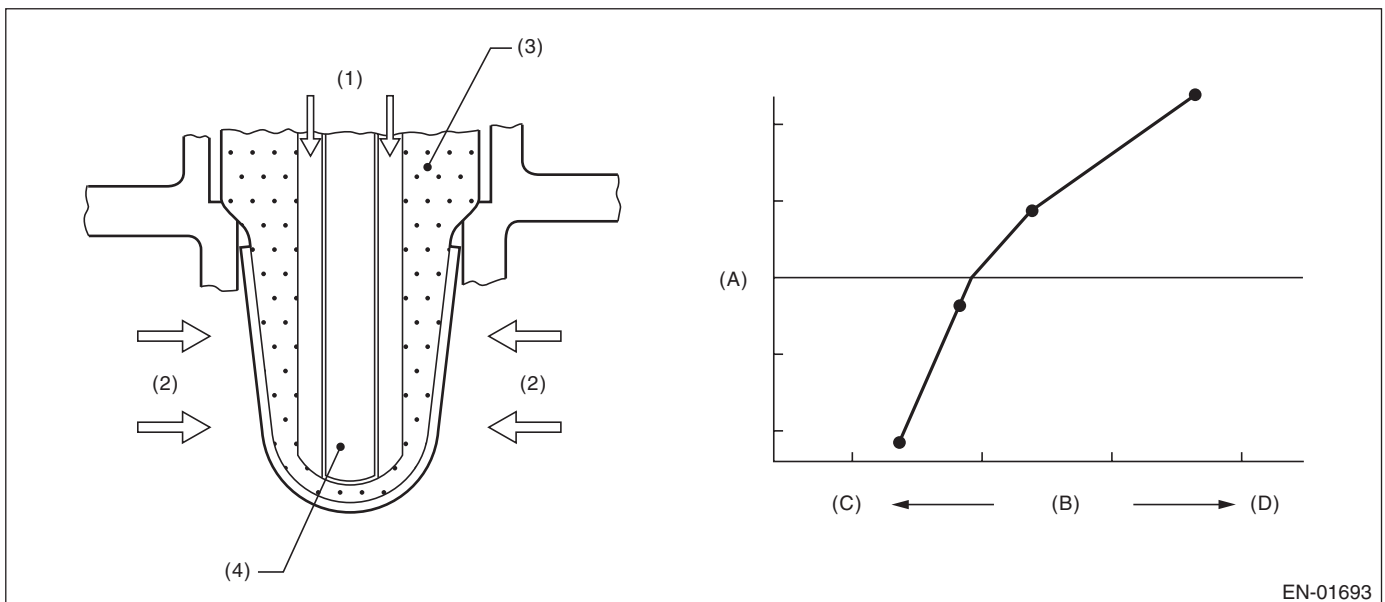
EN-01694

(1) Cover

(2) Zirconia

(3) Clogging

#### 2. COMPONENT DESCRIPTION



EN-01693

(1) Atmosphere

(2) Exhaust gas

(3)  $ZrO_2$

(4) Ceramic heater

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 1024$ ms
Battery voltage	$\geq 10.9$ V
Barometric pressure	$> 75.05$ kPa (563 mmHg, 22.165 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	$0 \Omega$ — $50 \Omega$
Elapsed time after starting the engine	$\geq 120000$ ms
Engine coolant temperature	$\geq 75$ °C (167 °F)
Engine speed	1000 rpm — 2500 rpm
Vehicle speed	10 km/h — 120 km/h (6.2 MPH — 74.6 MPH)
Amount of intake air	10 g/s — 40 g/s (0.353 oz/s — 1.411 oz/s)
Engine load	$< 0.02$ g/rev (0.001 oz/rev)
Learning value of EVAP conc. during purge	$< 0.2$
Total time of operating canister purge	$\geq 19.9$ sec

## 4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

## 5. DIAGNOSTIC METHOD

Calculate  $faf$  difference and the  $\lambda$  value difference every  $32\text{ms} \times 4$ . Calculate the diagnosis value after calculating 820 time.

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
$para_{fca} = td2_{faf}/td2_{lmd}$ where, $td2_{faf}(N) = td2_{faf}(n-1) +  d2_{faf}(n) $ $td2_{lmd}(N) = td2_{lmd}(n-1) +  d2_{lmd}(n) $ add up to $32 \text{ ms} \times 4 \times 820$ time. $d2_{faf}(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $d2_{lmd}(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ $faf$ = main feedback compensation coefficient every 128 milliseconds $lmd$ = output lambda every 128 milliseconds	$> 0.25$

**Time Needed for Diagnosis:**  $32 \text{ ms} \times 4 \times 820$  time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
para $fca = td2faf/td2lmd$ where, $td2faf(N) = td2faf(n-1) +  d2faf(n) $ $td2lmd(N) = td2lmd(n-1) +  d2lmd(n) $ add up to $32\text{ ms} \times 4 \times 820$ time. $d2faf(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $d2lmd(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	$\leq 0.25$

**Time Needed for Diagnosis:**  $32\text{ ms} \times 4 \times 820$  time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Rear oxygen sensor sub learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value  $0.06 \rightarrow 0$ .
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

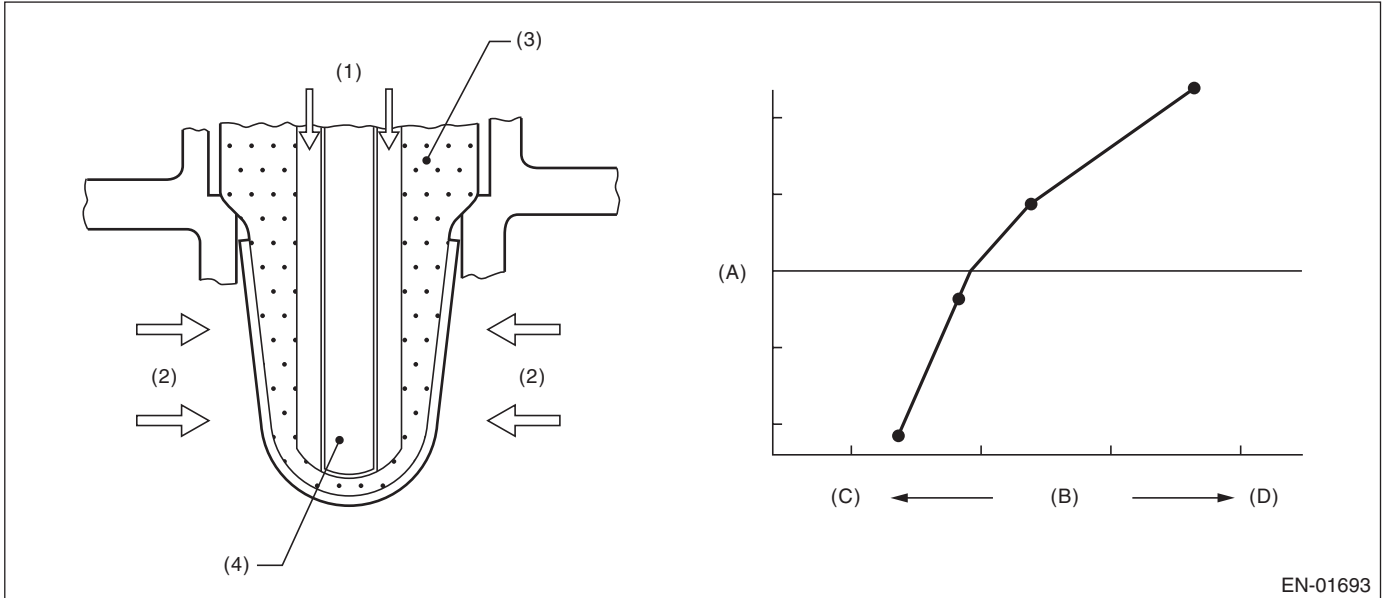
## AN:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.

Judge as NG when the impedance of the element is large.

### 2. COMPONENT DESCRIPTION



- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9 \text{ V}$
Time of heater control duty at 70 % or more	$\geq 30000 \text{ ms}$
Front oxygen (A/F) sensor impedance.	$> 500 \Omega$

**Time Needed for Diagnosis:** 5000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9 \text{ V}$
Front oxygen (A/F) sensor impedance.	$\leq 500 \Omega$

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor IC communication: Not allowed to communicate.
- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.06 → 0.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

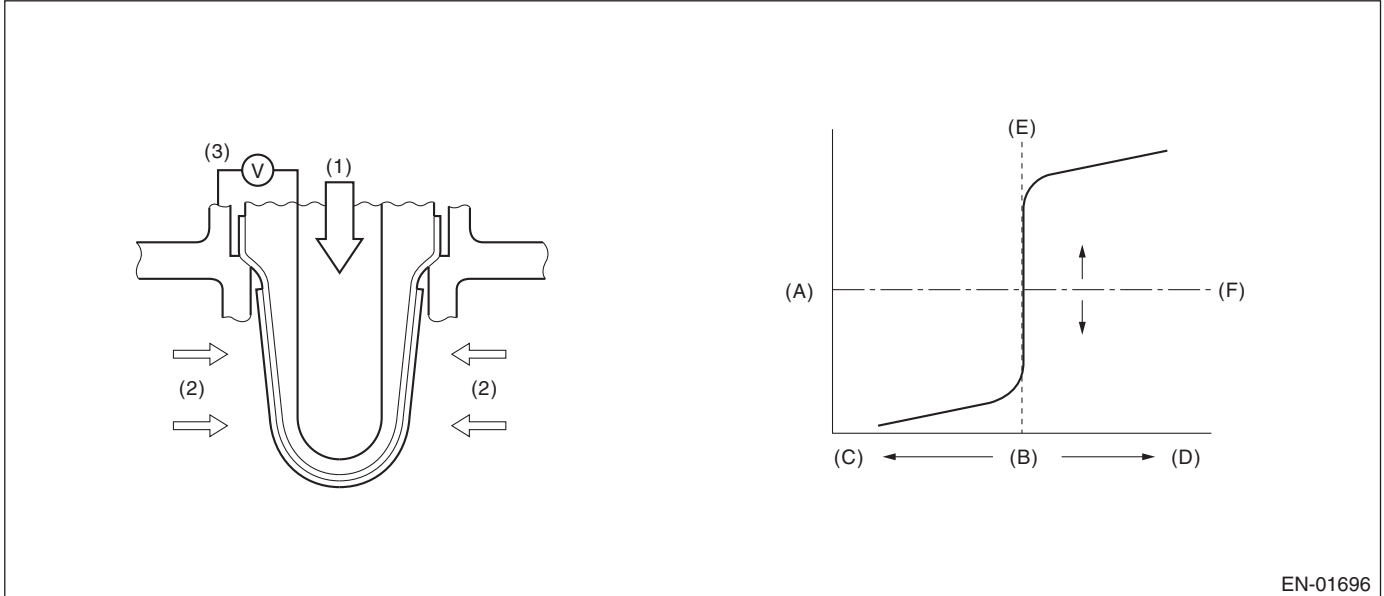
GENERAL DESCRIPTION

## AO:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

### 2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force

(B) Air fuel ratio

(1) Atmosphere

(C) Rich

(D) Lean

(2) Exhaust gas

(E) Theoretical air fuel ratio

(F) Comparative voltage

(3) Electromotive force

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

#### Used for abnormality judgment

Secondary Parameters	Enable Conditions
<b>High</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 7 time Not in limit value ≥ 10.9 V ≥ 75 °C (167 °F)
<b>Low (1)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air	Not in operation In operation < 7 time Not in limit value ≥ 10.9 V ≥ 75 °C (167 °F) ≥ 10 g/s (0.353 oz/s)
<b>Low (2)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater	Not in operation In operation < 7 time Not in limit value ≥ 10.9 V ≥ 75 °C (167 °F) < 10 g/s (0.353 oz/s) ≥ 25000 ms
<b>Low (3)</b> Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater Fuel cut	Not in operation In operation < 7 time Not in limit value ≥ 10.9 V ≥ 75 °C (167 °F) < 10 g/s (0.353 oz/s) ≥ 25000 ms Experienced

#### Used for normality judgment

Secondary Parameters	Enable Conditions
Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 7 time Not in limit value ≥ 10.9 V ≥ 75 °C (167 °F)

### 4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value	DTC
<b>High</b>		P0138
Sensor output voltage	> 1.200 V	P0158
<b>Low</b>		P0137
Sensor output voltage	<0.030 V	P0157

### Time Needed for Diagnosis

- High: 2500 ms
- Low (1): 20000 ms
- Low (2): 40000 ms
- Low (3): Value from Map

### Map

Fuel Cut Time (millisecond)	0	2000	10000
Time needed for diagnosis (millisecond)	40000	40000	60000

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value	DTC
<b>High</b>		P0138
Sensor output voltage	$\leq 1.200$ V	P0158
<b>Low</b>		P0137
Sensor output voltage	$\geq 0.030$ V	P0157

### Time Needed for Diagnosis

- High: Less than 1 second
- Low (1): Less than 1 second
- Low (2): Less than 1 second
- Low (3): Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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### **AP:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)**

#### **1. OUTLINE OF DIAGNOSIS**

##### NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H6DO)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## AQ:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

### 1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.

Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and Judge as OK if both are OK.

[Rich → lean diagnosis response]

1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK.

2. Judge as NG when the oxygen sensor voltage is large (rich) when recovering from a deceleration fuel cut.

[Lean → rich diagnosis response]

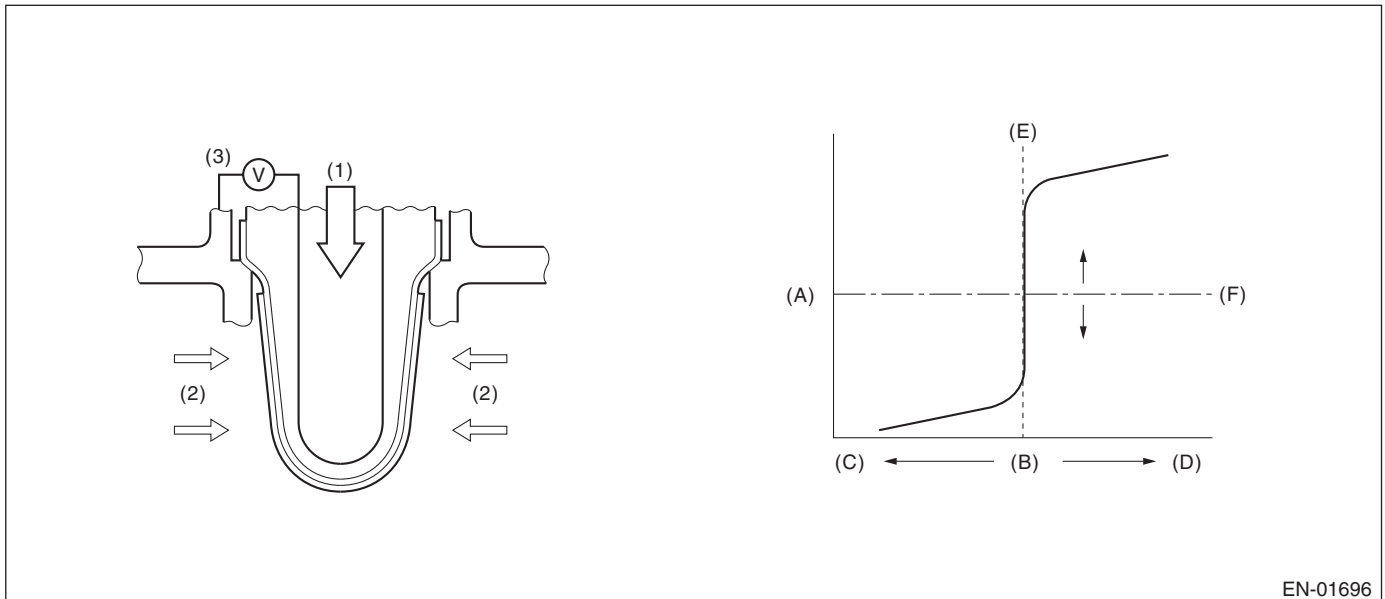
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

### Diagnostic method

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured response time is larger than the threshold value.

### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 3. ENABLE CONDITION

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 5000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 40000 ms
Current continuation time of the rear oxygen sensor heater	≥ 20000 ms
Estimated catalyst temperature	≥ 400 °C (752 °F)
Number of deceleration fuel cut	≥ 1 time

### 4. GENERAL DRIVING CYCLE

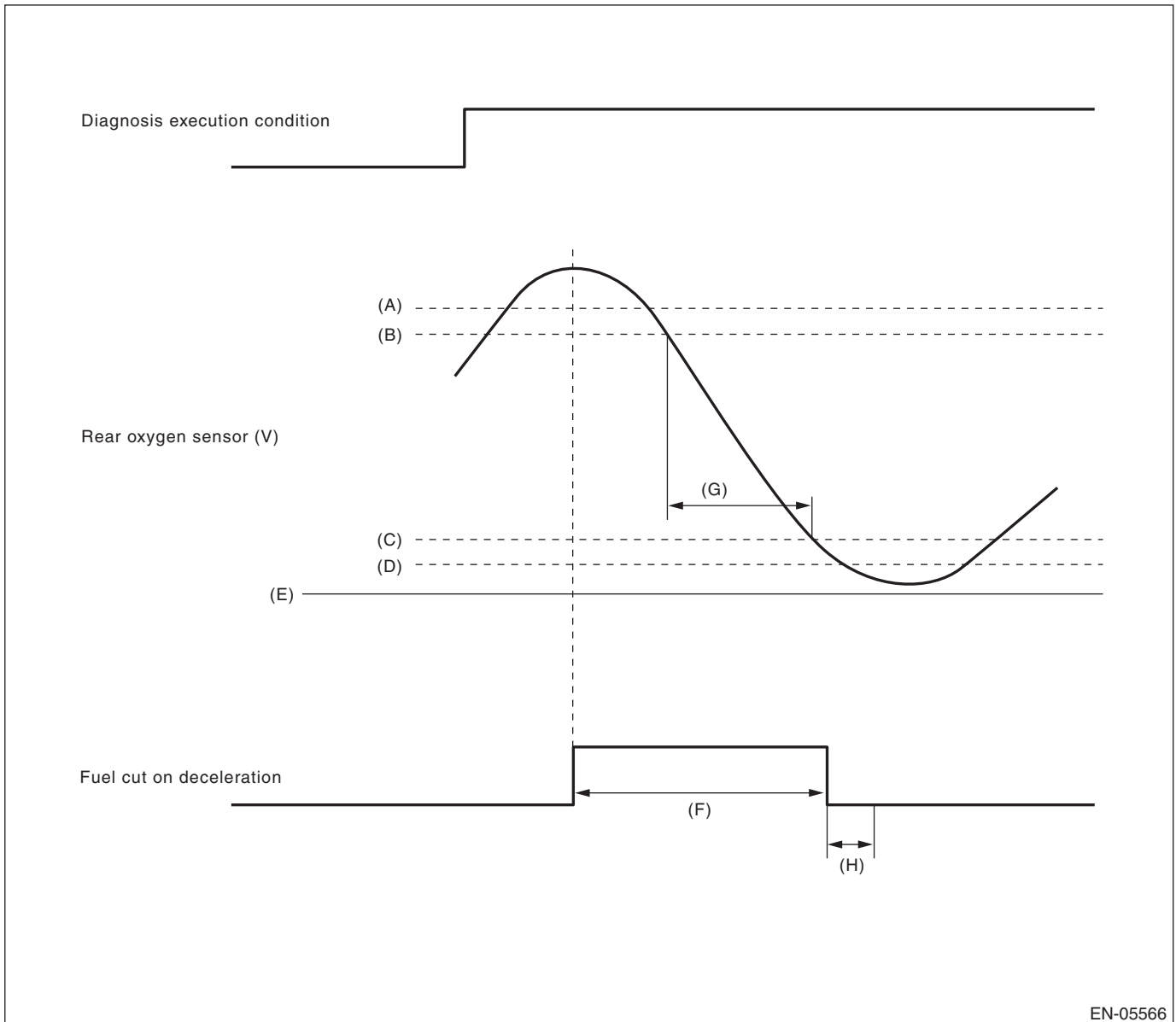
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.



- (A) 0.55 V
- (B) 0.5 V
- (C) 0.2 V
- (D) 0.15 V

- (E) 0 V
- (F) More than 5000 ms
- (G) Measure the response time.

- (H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.  
Response time (diagnosis value) > threshold value → abnormal

#### NOTE:

Variation time of rear oxygen sensor output voltage is short during fuel cut in deceleration. NG judgment should be performed after deceleration fuel cut. Even without deceleration fuel cut, judge as OK if the value is below the threshold.

When the deceleration fuel cut time is 5000 ms or more, judge as NG if the following criteria are met 2000 ms after recovering from the deceleration fuel cut.

2) Judge as NG when the oxygen sensor voltage at recovery from a deceleration fuel cut, is large.

If the fuel cut time in a deceleration fuel cut is long (5000 ms or more), and even after recovering from a deceleration fuel cut, the oxygen sensor voltage is high (0.55 V or more), judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	> 491 ms
or	
Longest time over 0.55 V	≥ 2000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
Shortest time change from rich (0.5 V O <sub>2</sub> output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	≤ 491 ms

**Time Needed for Diagnosis:** 1 time

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 10.ENABLE CONDITION

Lean → rich response diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 5000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 0 ms
Current continuation time of the rear oxygen sensor heater	≥ 0 ms
Estimated catalyst temperature	≥ 0 °C (32 °F)
Number of deceleration fuel cut	≥ 1 time

## 11.GENERAL DRIVING CYCLE

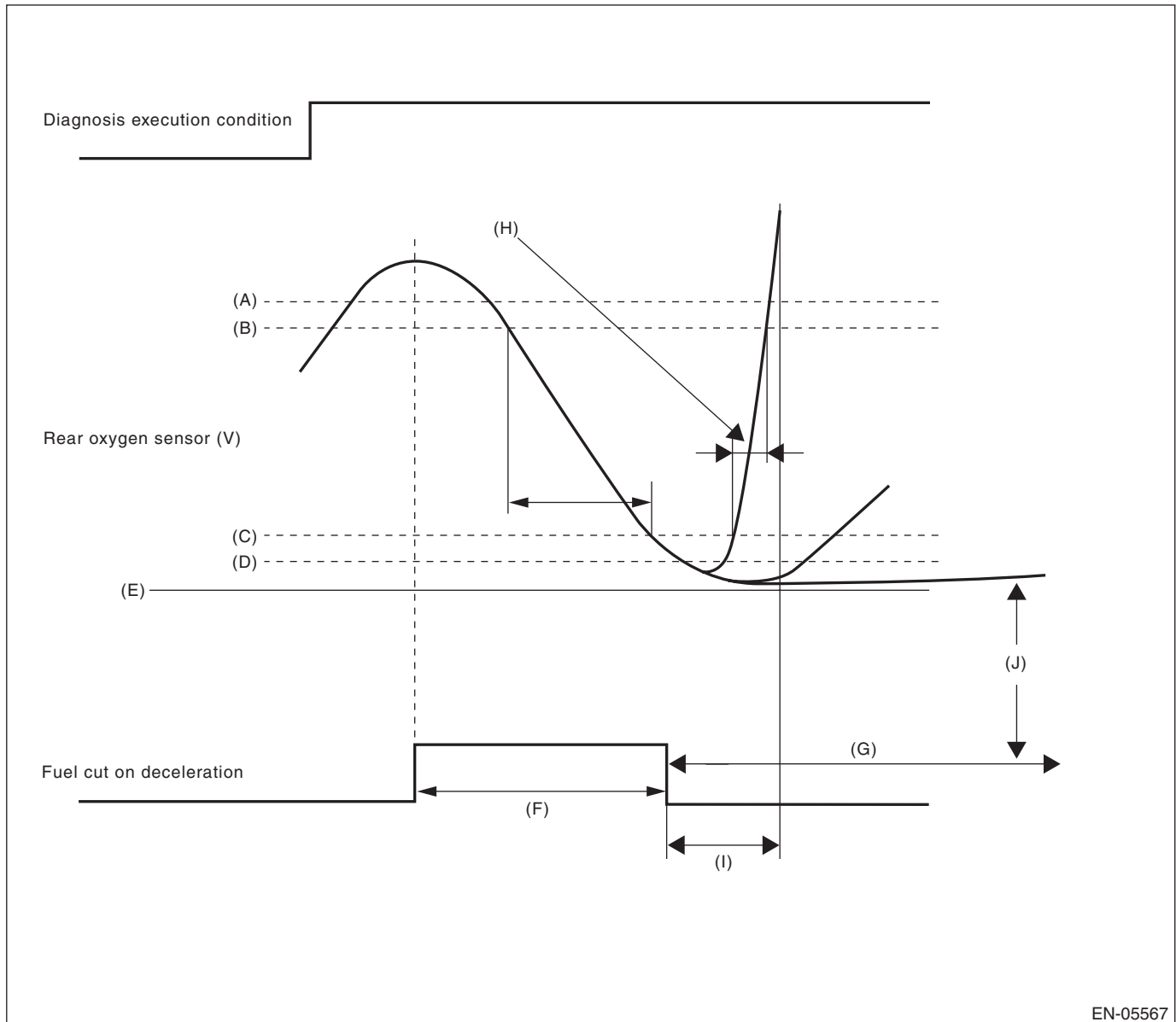
Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 12. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.



EN-05567

- (A) 0.55 V
- (B) 0.5 V
- (C) 0.3 V
- (D) 0.25 V
- (E) 0 V
- (F) More than 5 seconds

- (G) More than 120000 ms
- (H) Measure the response time (diagnostic value).
- (I) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- (J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.

Response time (diagnosis value) > threshold value → abnormal

2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

## Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V or Longest time under 0.25 V	> 2000 ms  ≥ 120000 ms

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

## • Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

Judge as OK and clear the NG if the following conditions are established.

## Judgment Value

Malfunction criteria	Threshold value
Shortest time change from lean (0.3 V O <sub>2</sub> output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	≤ 2000 ms

**Time Needed for Diagnosis:** 1 time

## 13.DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 15.FAIL SAFE

Sub feedback control: Not allowed

## 16.ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

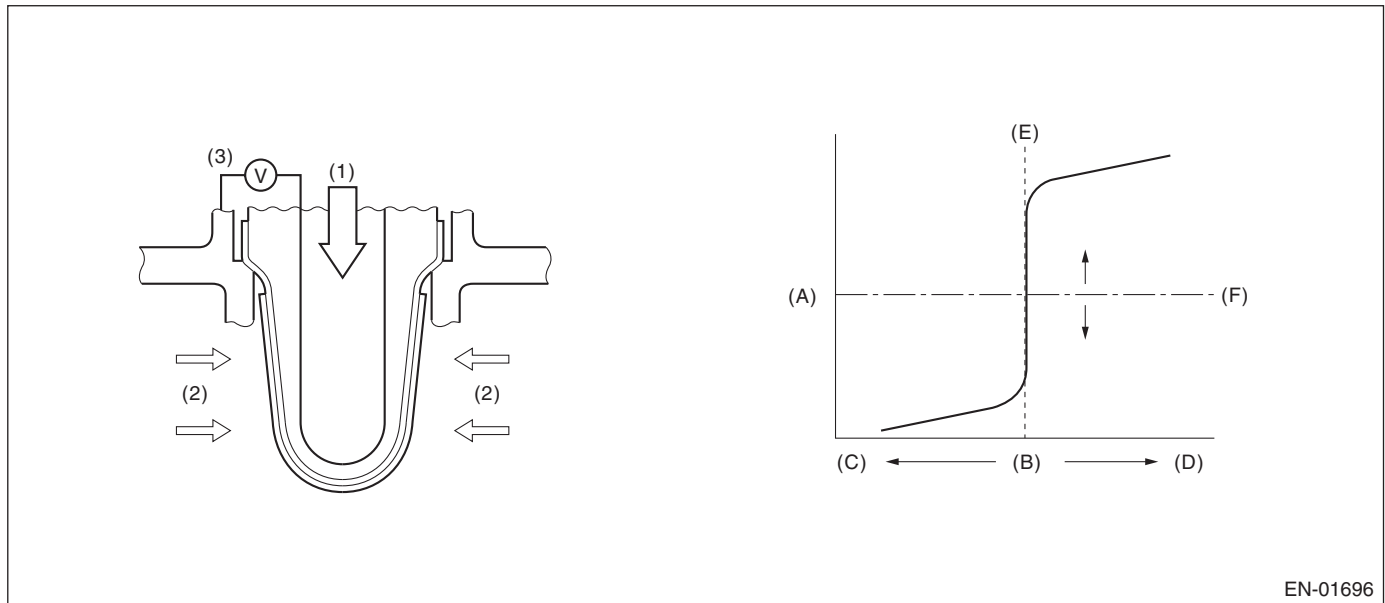
## GENERAL DESCRIPTION

### AR:DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

#### 1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

#### 2. COMPONENT DESCRIPTION



EN-01696

- |                         |                 |                                |
|-------------------------|-----------------|--------------------------------|
| (A) Electromotive force | (C) Rich        | (E) Theoretical air fuel ratio |
| (B) Air fuel ratio      | (D) Lean        | (F) Comparative voltage        |
| (1) Atmosphere          | (2) Exhaust gas | (3) Electromotive force        |

#### 3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control at the rear oxygen sensor	In operation
Target output voltage of rear oxygen sensor	$\geq 0.55 \text{ V} + 0.05 \text{ V}$
Amount of intake air	$\geq 10 \text{ g/s (0.353 oz/s)}$
Engine coolant temperature	$\geq 75 \text{ }^\circ\text{C (167 }^\circ\text{F)}$
Misfire detection every 200 rotations	$< 7 \text{ time}$
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9 \text{ V}$
Deceleration fuel cut of 5000 ms or more.	Experienced

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage or Maximum output voltage	> 0.15 V  < 0.55 V

**Time Needed for Diagnosis:** 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	$\leq 0.15$ V
Maximum output voltage	$\geq 0.55$ V

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Sub feedback control: Not allowed

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## AS:DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0131. <Ref. to GD(H6DO)-66, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## AT:DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0132. <Ref. to GD(H6DO)-68, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>



## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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#### **AU:DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0133. <Ref. to GD(H6DO)-70, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **AV:DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0134. <Ref. to GD(H6DO)-73, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **AW:DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H6DO)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **AX:DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H6DO)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **AY:DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0139. <Ref. to GD(H6DO)-79, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

#### **AZ:DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 2)**

##### **1. OUTLINE OF DIAGNOSIS**

###### NOTE:

For the detection standard, refer to DTC P0140. <Ref. to GD(H6DO)-86, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BA:DTC P0171 SYSTEM TOO LEAN (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

#### Diagnostic method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	$\geq 75\text{ }^{\circ}\text{C}$ (167 °F)
Engine load change	$< 0.02\text{ g/rev}$ (0.001 oz/rev)
Engine load	$\geq$ Value of Map 1

#### Map1

Engine speed (rpm)	Idling	700	1000	1500	2000	2500	3000	3500	4000	4500	5000
Measured value (g(oz)/rev)	Non-turbo	0.357 (0.013)	0.25 (0.009)	0.25 (0.009)	0.317 (0.011)	0.326 (0.011)	0.337 (0.012)	0.397 (0.014)	0.439 (0.015)	0.454 (0.016)	0.454 (0.016)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec  $\times$  5 time or more, judge that there is a fault in the fuel system.

#### Judgment Value

Malfunction criteria	Threshold value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	$\geq$ Value of Map 2

#### Map2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	1.4	1.4	1.332	1.265	1.265	1.265	1.265

**Time Needed for Diagnosis:** 10 sec  $\times$  5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	$< 1.2$

**Time Needed for Diagnosis:** 10 sec

## Diagnostic Trouble Code (DTC) Detecting Criteria

### GENERAL DESCRIPTION

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#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BB:DTC P0172 SYSTEM TOO RICH (BANK 1)

### 1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

#### Diagnostic method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ 75 °C (167 °F)
Engine load change	≤ 0.02 g/rev (0.001 oz/rev)
Learning value of EVAP conc.	< 0.1
Cumulative time of canister purge after engine start	≥ 20 sec
Continuous period after canister purge starting	≥ 29884 ms
Engine load	≥ Value of Map 1

#### Map1

Engine speed (rpm)	Idling	700	1000	1500	2000	2500	3000	3500	4000	4500	5000
Measured value (g(oz)/rev)	Non-turbo	0.357 (0.013)	0.25 (0.009)	0.25 (0.009)	0.317 (0.011)	0.326 (0.011)	0.337 (0.012)	0.397 (0.014)	0.439 (0.015)	0.454 (0.016)	0.454 (0.016)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 sec × 5 time or more, judge that there is a fault in the fuel system.

#### Judgment Value

Malfunction criteria	Threshold value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient every 64 milliseconds flaf = main feedback learning compensation coefficient	< Value of Map 2

#### Map2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	0.6	0.6	0.688	0.735	0.735	0.735	0.735

**Time Needed for Diagnosis:** 10 sec × 5 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK when the malfunction criteria below continues for 10 seconds.

### Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	$\geq 0.8$

**Time Needed for Diagnosis:** 10 sec

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 7. FAIL SAFE

- Purge control solenoid valve control: Not allowed to purge.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## BC:DTC P0174 SYSTEM TOO LEAN (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0171. <Ref. to GD(H6DO)-89, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## BD:DTC P0175 SYSTEM TOO RICH (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0172. <Ref. to GD(H6DO)-91, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## BE:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/ PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Detect faults in the fuel temperature sensor output properties.

Diagnosis is performed in two methods (drift diagnosis and stack diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

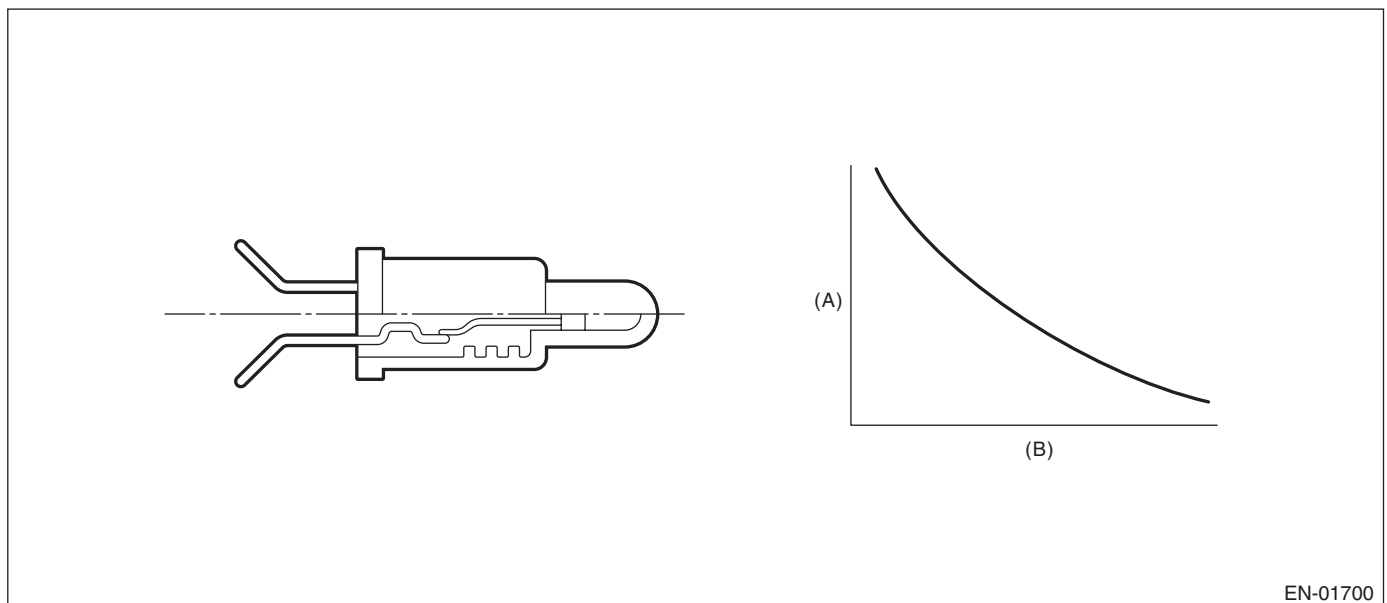
#### Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and judged as NG.

#### Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

### 2. COMPONENT DESCRIPTION



EN-01700

(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

### 3. ENABLE CONDITION

#### DRIFT DIAGNOSIS

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	≥ 10 °C (50 °F)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 120 sec

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 20 sec
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	< 10 °C (50 °F)
Battery voltage	≥ 10.9 V
Engine coolant temperature	< 75 °C (167 °F)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

### 10. ENABLE CONDITION

#### Stuck Diagnosis

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 20000 ms
Battery voltage	≥ 10.9 V

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 11. GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

## 12. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
Accumulated amount of intake air	$\geq 551043$ g (19435.287 oz)
Fuel temperature difference between Max. and Min.	$< 2$ °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
Fuel temperature difference between Max. and Min.	$\geq 2$ °C (35.6 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 13. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 14. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 15. FAIL SAFE

None

## 16. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

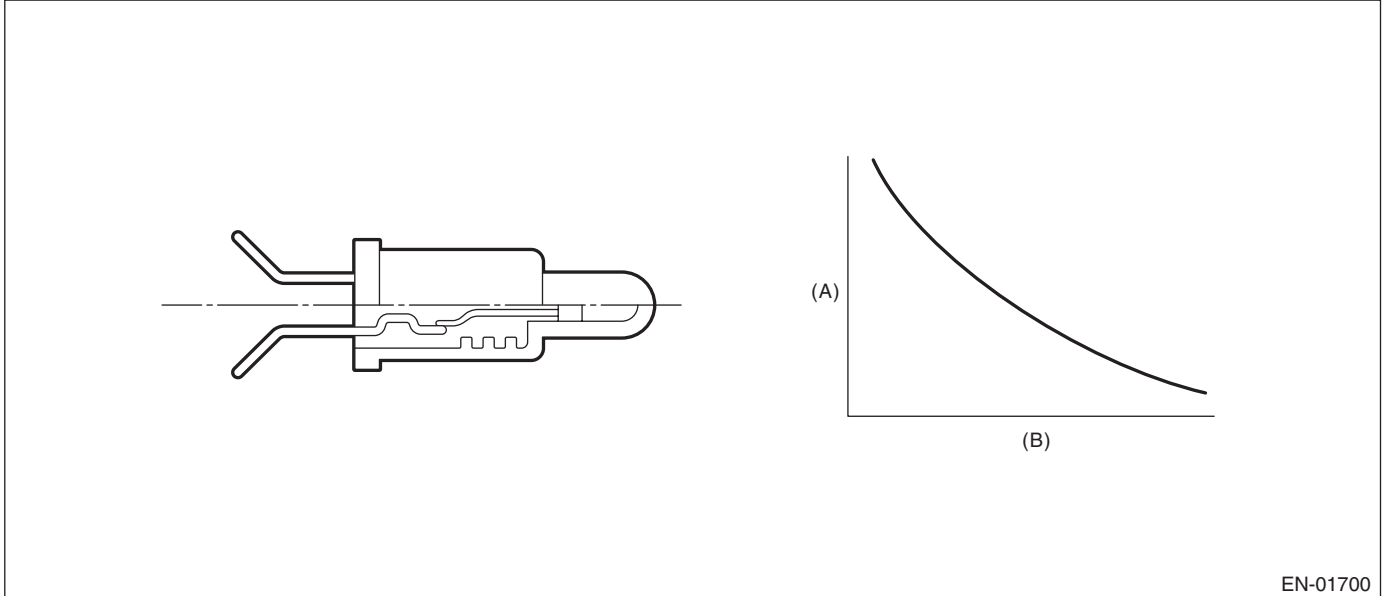
## GENERAL DESCRIPTION

### BF:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 0.344 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	≥ 0.344 V
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

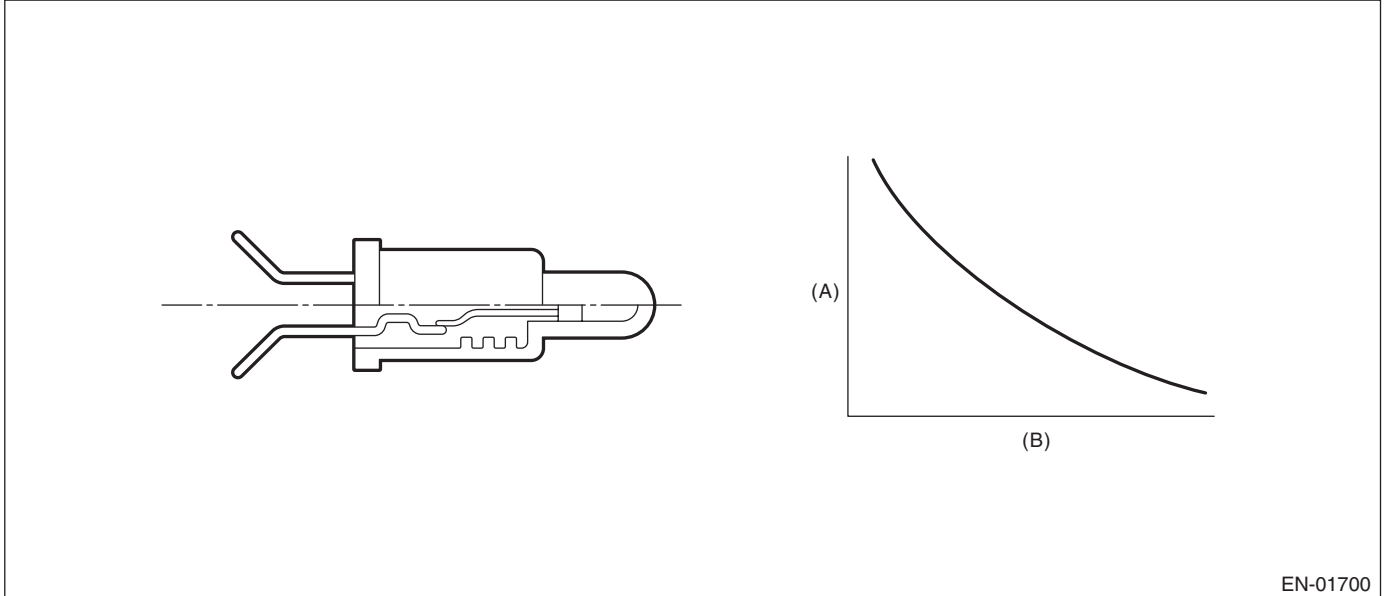
## GENERAL DESCRIPTION

### BG:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(A) Resistance value ( $\Omega$ )

(B) Fuel temperature °C (°F)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

**Time Needed for Diagnosis:** Within 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **BH:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/ PERFORMANCE**

#### **1. OUTLINE OF DIAGNOSIS**

Detect for abnormal values in the oil temperature sensor output properties.

Judge as NG when the oil temperature does not rise even though the engine is running under a condition where it should rise.

#### **2. ENABLE CONDITION**

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ Value from Map

#### **Map**

Engine coolant temperature °C (°F)	-40 (-40)	110 (230)
Engine speed rpm	500	500

#### **3. GENERAL DRIVING CYCLE**

Perform the diagnosis continuously after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 15 °C (59 °F)
After engine start oil temperature sensor characteristic diagnosis timer.	≥ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer

After engine start oil temperature sensor characteristic diagnosis timer (timer for diagnosis).

a. Timer stop at fuel cut

b. During the driving conditions except a) above, timer counts up as follows.

64 milliseconds + TOILCNT milliseconds (at the time of 64 milliseconds).

Where, TOILCNT is determined as follows,

TOILCNT = 0 at idle switch ON

For TOILCNT at Idle switch off, refer to the following table.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-40 (-40)	0 ms	32 ms	76 ms	130 ms	149 ms	171 ms	176 ms	181 ms
	-30 (-22)	67 ms	93 ms	121 ms	157 ms	170 ms	184 ms	193 ms	203 ms
	-20 (-4)	98 ms	123 ms	148 ms	184 ms	193 ms	204 ms	214 ms	226 ms
	-10 (14)	145 ms	166 ms	187 ms	208 ms	223 ms	239 ms	242 ms	245 ms
	0 (32)	161 ms	187 ms	212 ms	243 ms	252 ms	262 ms	266 ms	270 ms

After engine start oil temperature characteristic diagnosis timer judgment value (t).

$t = 2400000 \text{ ms} - 60000 \text{ ms}/^{\circ}\text{C} \times T_i$  ( $t \geq 2400000$ )

$T_i$  = The lowest coolant temperature after starting the engine.

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	≥ 15 °C (59 °F)

**Time Needed for Diagnosis:** Less than 1 second

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### BI: DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.  
Judge as NG when outside of the judgment value.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 0.166 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 0.166$ V

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## BJ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.  
Judge as NG when outside of the judgment value.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.716$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.716$ V

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Oil temperature sensor process: Engine oil temperature is fixed at 70°C (158°F).

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

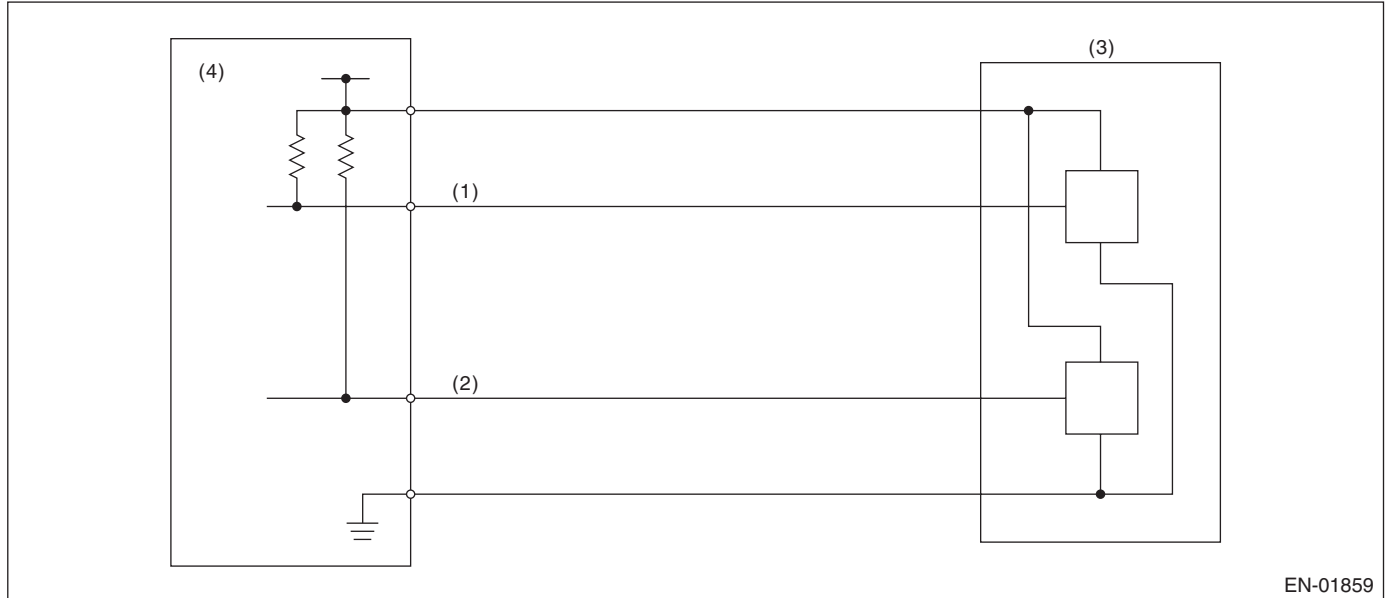
## GENERAL DESCRIPTION

### BK:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal
- (2) Throttle position sensor 2 signal

- (3) Throttle position sensor

- (4) Engine control module (ECM)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$\leq 0.926$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$> 0.926$ V

**Time Needed for Diagnosis:** 24 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

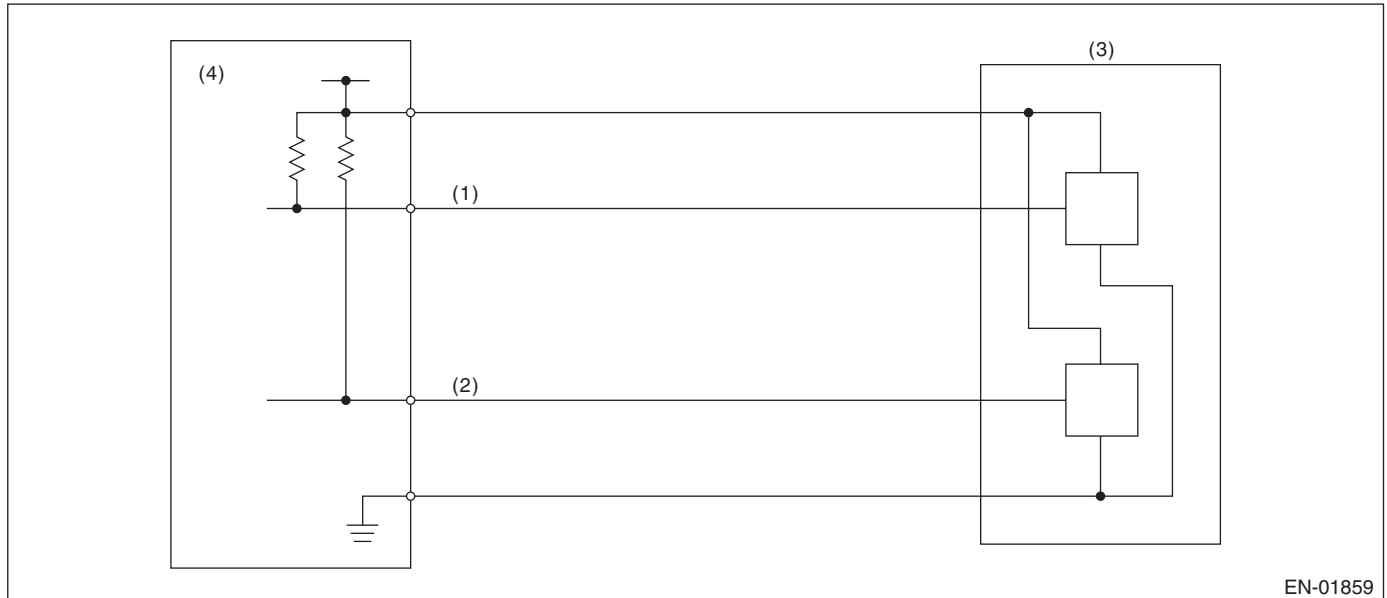
## GENERAL DESCRIPTION

### BL:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal  
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$\geq 4.851$ V

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$< 4.851$ V

**Time Needed for Diagnosis:** 24 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

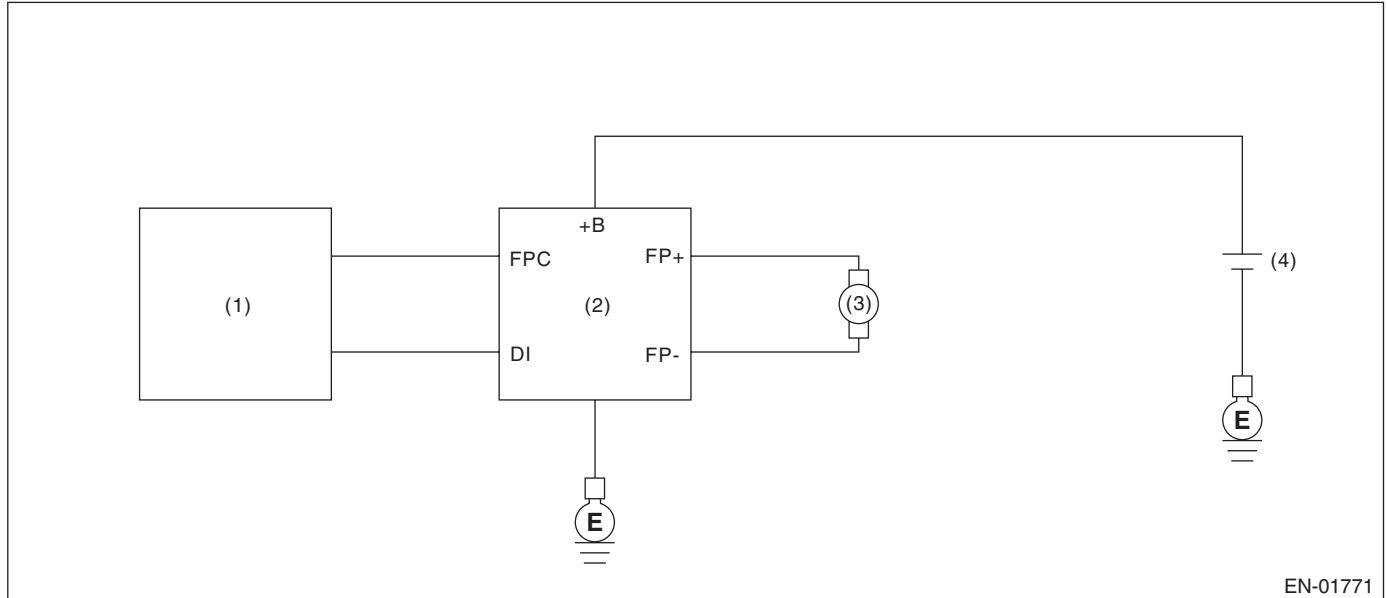
### BM:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit.

Judge as NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit. Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel pump

(4) Battery

(2) Fuel pump control unit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	Low
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	High
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

OFF setting may be needed depending on the NG portion.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### BN:DTC P0301 CYLINDER 1 MISFIRE DETECTED

#### 1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)

Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below. :

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire

- 120° Interval Difference Method
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 1024 ms
Intake manifold pressure change at 120° CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 20 deg
Fuel shut-off function	Not in operation
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	400 rpm — 8000 rpm
Intake manifold pressure	≥ Value of Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine speed change during 32 milliseconds	< 500 rpm

#### Map1

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000
kPa	20	20	20	20	20	20	20	20	20	20	20	20	20	20
(mmHg, inHg)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)	(150, 5.906)

#### Map2

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000
kPa	26.66	23.33	23.33	23.33	23.59	24.39	28.33	32.29	36.26	36.26	37.19	38.12	41.86	48.92
(mmHg, inHg)	(200.0, 7.874)	(175.0, 6.89)	(175.0, 6.89)	(175.0, 6.89)	(177.0, 6.968)	(183.0, 7.205)	(212.5, 8.366)	(242.2, 9.535)	(272.0, 10.709)	(272.0, 10.709)	(279.0, 10.984)	(286.0, 11.26)	(314.0, 12.362)	(367.0, 14.449)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. GENERAL DRIVING CYCLE

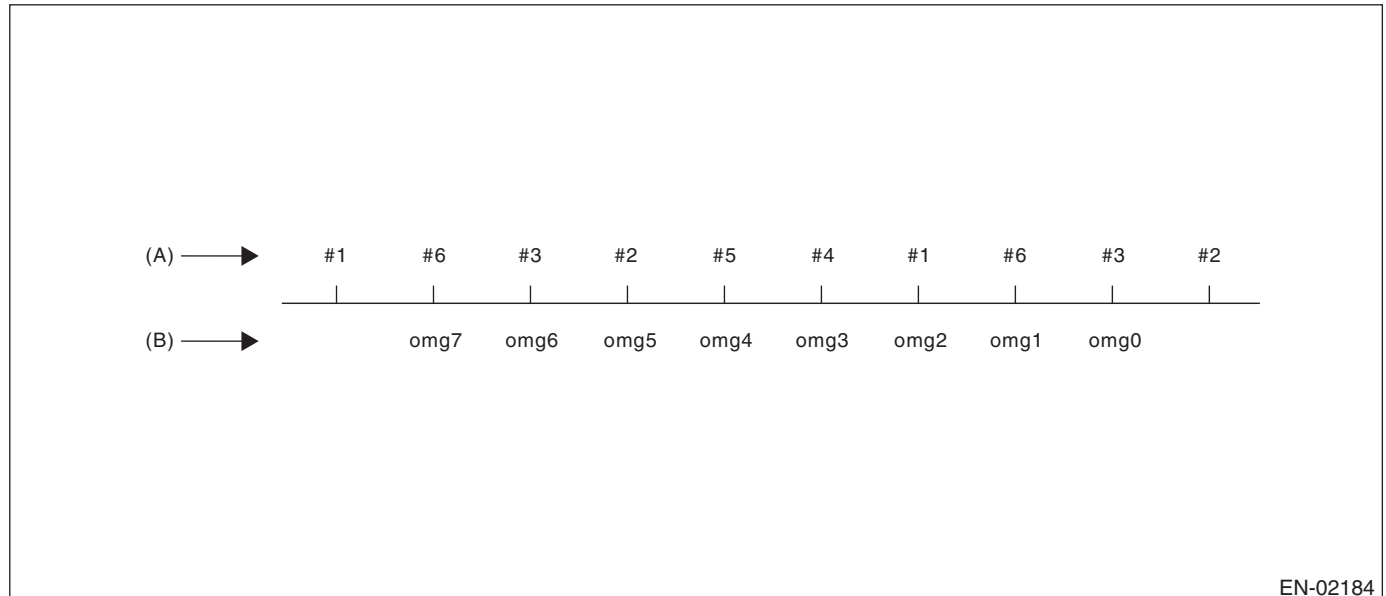
- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
- Perform the diagnosis continuously.

## 4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decreased and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Counting the number of misfires. If the misfire ratio is higher during 1000 revs. or 200 revs., Judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment)
	<ul style="list-style-type: none"> <li>• 120° Interval Difference Method</li> <li>• 360° Interval Difference Method</li> <li>• 720° Interval Difference Method</li> </ul>	<ul style="list-style-type: none"> <li>• FTP 1.5 times misfire NG judgment</li> <li>• Catalyst damage misfire NG judgment</li> </ul>

As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



EN-02184

(A) Ignition order

(B) Crankshaft position speed



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

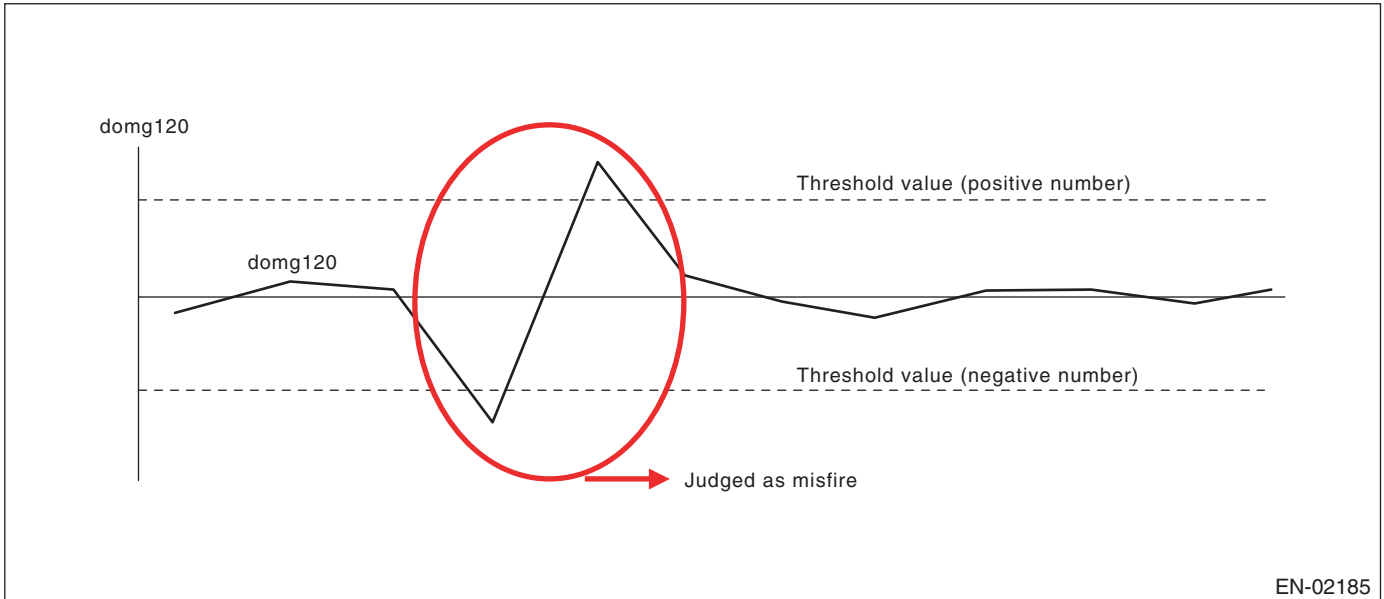
### 120° Interval Difference Method

Diagnostic value  $\text{domg } 120 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 7 - \text{omg } 1)/6$

Judge as a misfire in the following cases.

- $\text{domg } 120 > \text{judgment value of positive side}$
- $\text{domg } 121 \leq \text{judgment value of negative side}$

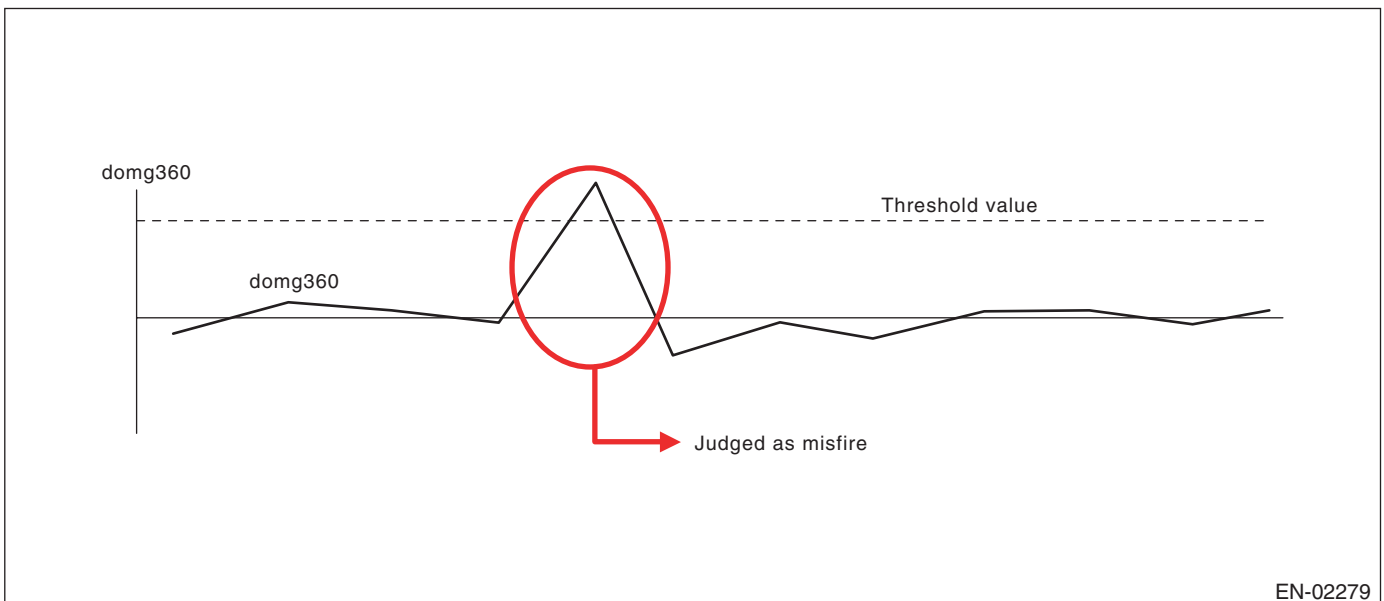
(Judgment value before 120° CA)



### 360° Interval Difference Method

Diagnostic value  $\text{domg } 360 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 4 - \text{omg } 3)$

Misfire judgment  $\text{domg } 360 > \text{Judgment value} \rightarrow \text{Judge as misfire}$

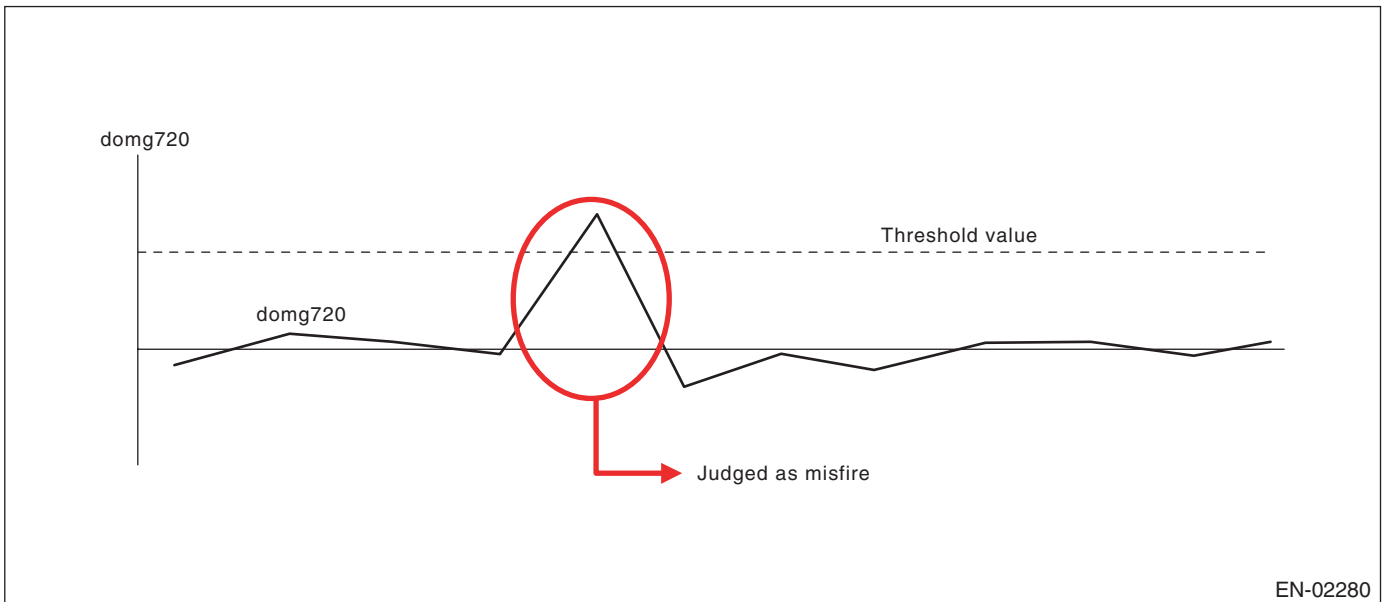


# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 720° Interval Difference Method

Diagnostic value	$\text{domg } 720 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 7 - \text{omg } 6)$
Misfire judgment	$\text{domg } 720 > \text{Judgment value} \rightarrow \text{Judge as misfire}$



- FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)
- Abnormality Judgment

**Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)**

Malfunction Criteria	Threshold Value
FTP emission judgment value	$\geq 27 \times 100/3000\%$ in 1000 revs.

**Time Needed for Diagnosis:** 1000 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

- Normality Judgment

**Judgment Value**

Malfunction criteria	Threshold value
FTP emission judgment value	$< 27 \times 100/3000\%$ in 1000 revs.

**Time Needed for Diagnosis:** 1000 engine revs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

- **Catalyst damage misfire (Misfire occurrence level damaging catalyst)**
- **Abnormality Judgment**

### Judgment Value

Malfunction criteria	Threshold value
Catalyst damage misfire judgment value	≥ Value of Map 3

### Map 3

		Intake air (g(oz)/rev)									
		0.2 (0.007)	0.4 (0.014)	0.6 (0.021)	0.8 (0.028)	1 (0.035)	1.2 (0.042)	1.4 (0.049)	1.6 (0.056)	1.8 (0.063)	2 (0.071)
Engine speed (rpm)	700	90	90	88	76	68	68	68	68	68	68
	1000	90	90	88	76	68	68	68	68	68	68
	1500	89	88	80	64	56	56	56	56	56	56
	2000	88	84	64	40	36	35	35	35	35	35
	2500	88	80	56	36	30	30	30	30	30	30
	3000	64	56	30	30	30	30	30	30	30	30
	3500	50	40	30	30	30	30	30	30	30	30
	4000	40	38	30	30	30	30	30	30	30	30
	4500	50	30	30	30	30	30	30	30	30	30
	5000	40	30	30	30	30	30	30	30	30	30
	5500	40	30	30	30	30	30	30	30	30	30
	6000	36	36	30	30	30	30	30	30	30	30
	6500	32	32	30	30	30	30	30	30	30	30
7000	32	32	30	30	30	30	30	30	30	30	

**Time Needed for Diagnosis:** 200 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

### Judgment Value

Malfunction criteria	Threshold value
Catalyst damage misfire judgment value	< Value of Map 2

**Time Needed for Diagnosis:** 200 engine revs.

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## **BO:DTC P0302 CYLINDER 2 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BP:DTC P0303 CYLINDER 3 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BQ:DTC P0304 CYLINDER 4 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BR:DTC P0305 CYLINDER 5 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BS:DTC P0306 CYLINDER 6 MISFIRE DETECTED**

### **1. OUTLINE OF DIAGNOSIS**

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-110, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

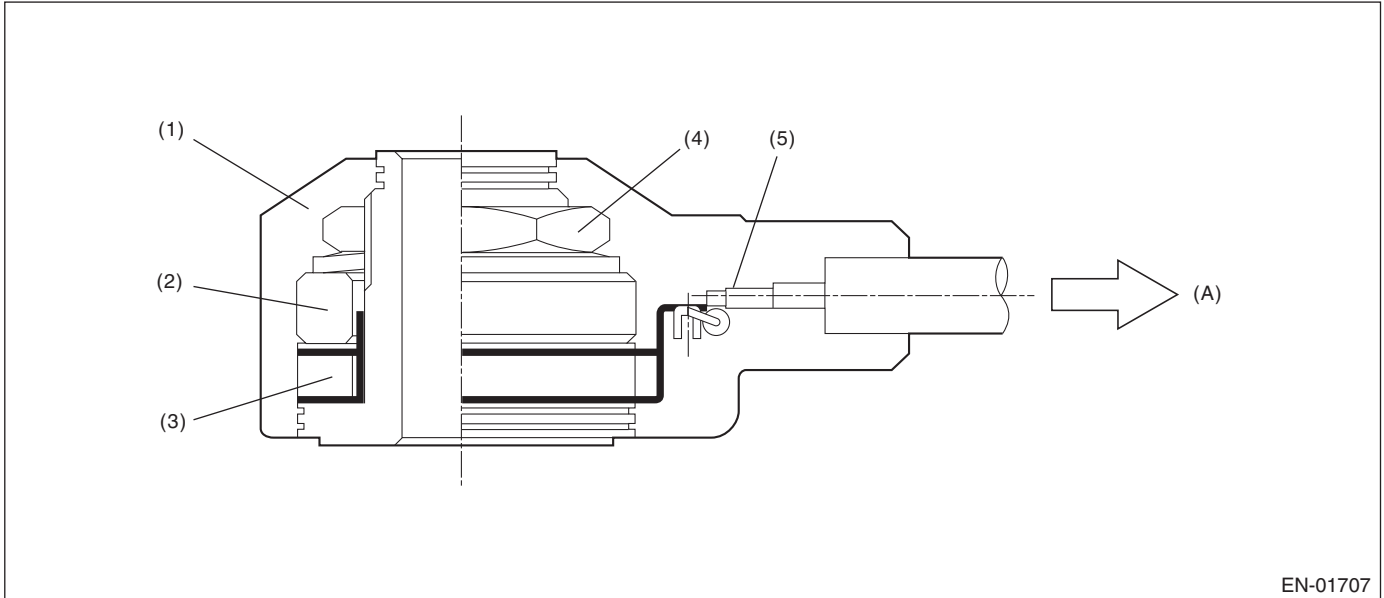
## GENERAL DESCRIPTION

### BT:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 0.238 V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 0.238$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Knocking compensation

When normal: Learning ignition advance angle value = knock F/B advance angle + entire learning advance angle value + portional learning advance angle value

Failure: learned ignition advance value =  $-6^{\circ}\text{CA}$ . ( $6^{\circ}\text{CA}$  retard)

Knock F/B advance angle value =  $0^{\circ}\text{CA}$

Whole learning prohibited

Portional learning prohibited

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

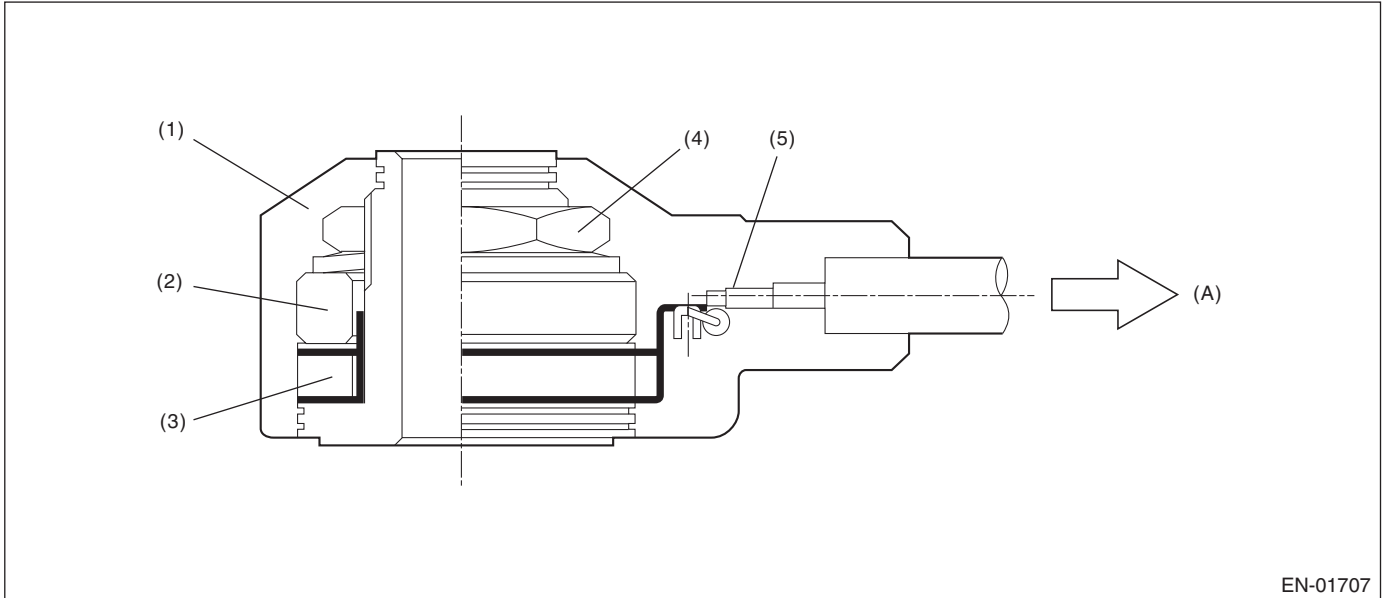
## GENERAL DESCRIPTION

### BU:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element

- (4) Nut
- (5) Resistance

- (A) To knock sensor harness

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.714$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.714$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Knocking compensation

When normal: Learning ignition advance angle value = knock F/B advance angle + entire learning advance angle value + portional learning advance angle value

Failure: learned ignition advance value =  $-6^{\circ}\text{CA}$ . ( $6^{\circ}\text{CA}$  retard)

Knock F/B advance angle value =  $0^{\circ}\text{CA}$

Whole learning prohibited

Portional learning prohibited

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **BV:DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2)**

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0327. <Ref. to GD(H6DO)-116, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **BW:DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2)**

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0328. <Ref. to GD(H6DO)-118, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

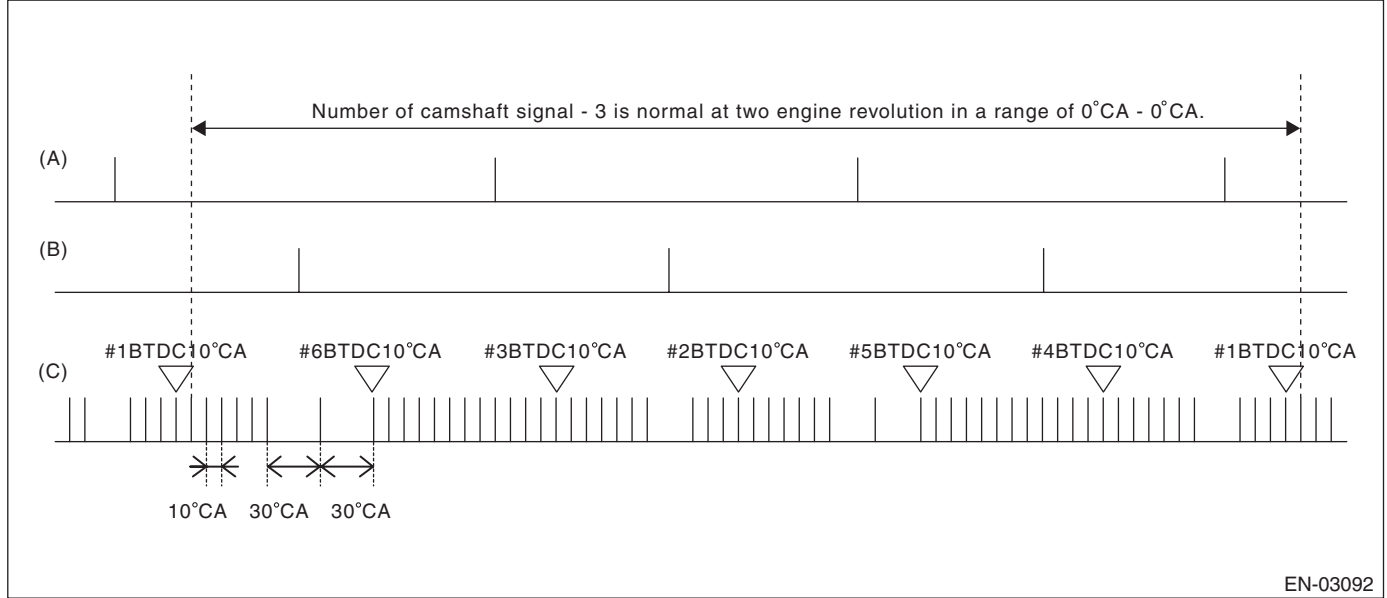
### BX:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.

Judge as NG when the crank signal is not input even though the starter was rotated.

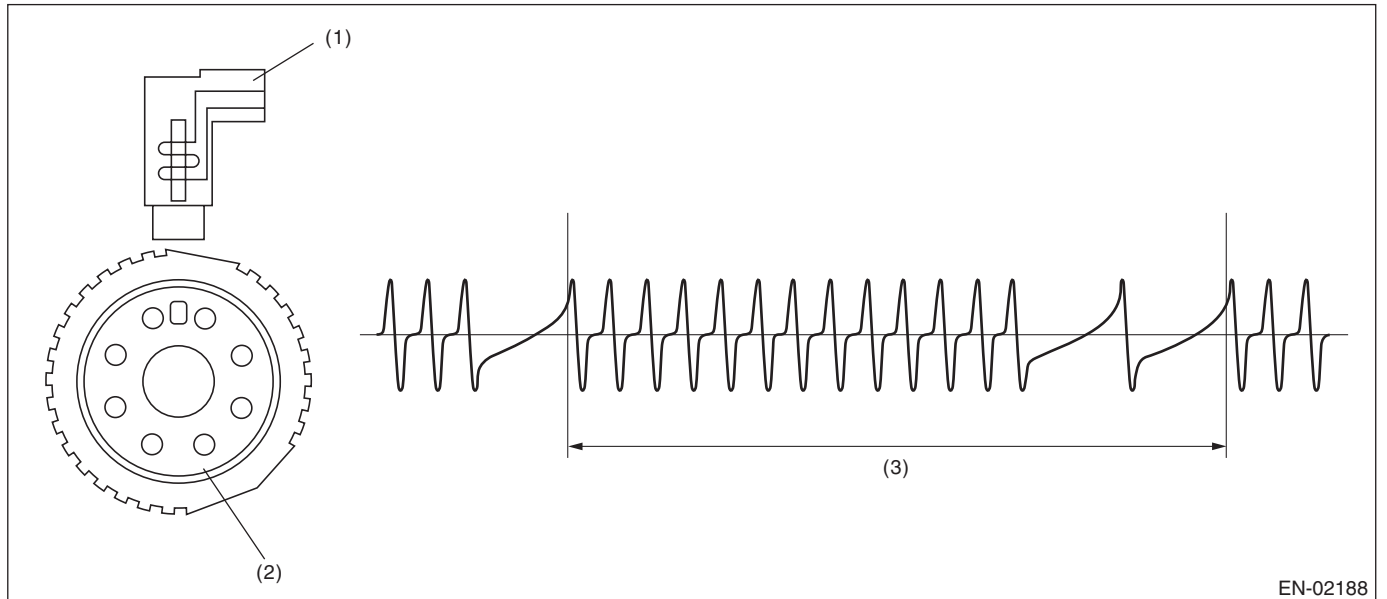
#### 2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction Criteria	Threshold Value
Starter switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

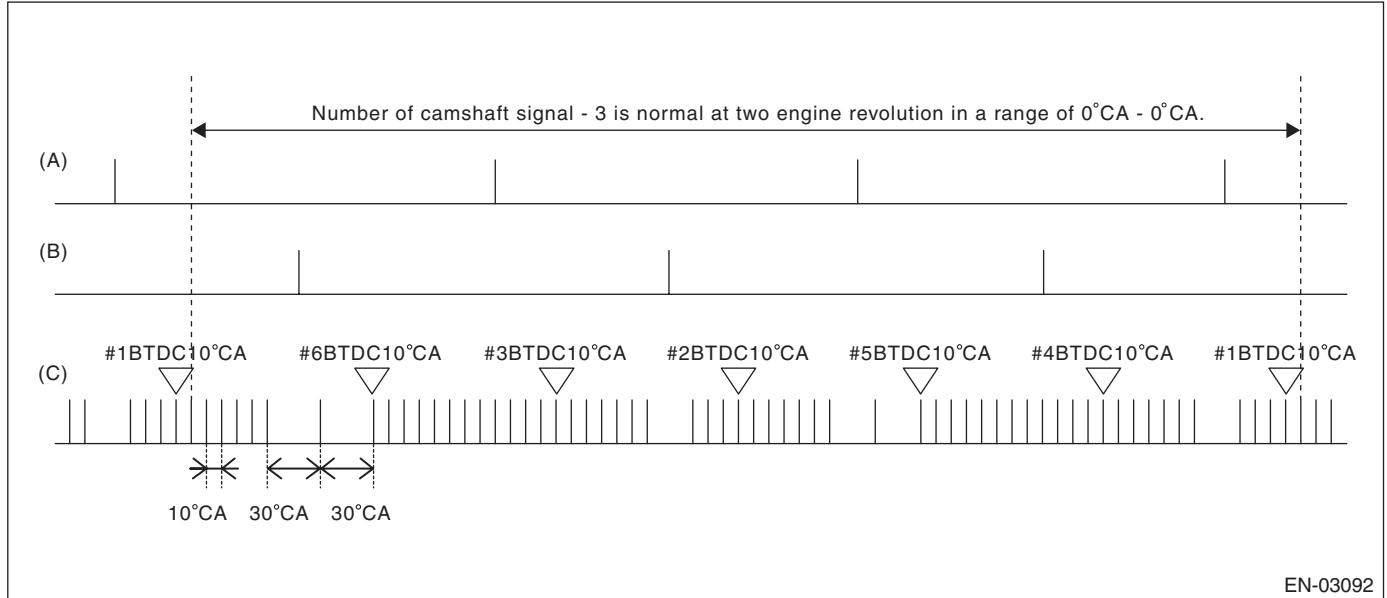
### BY:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

#### 2. COMPONENT DESCRIPTION

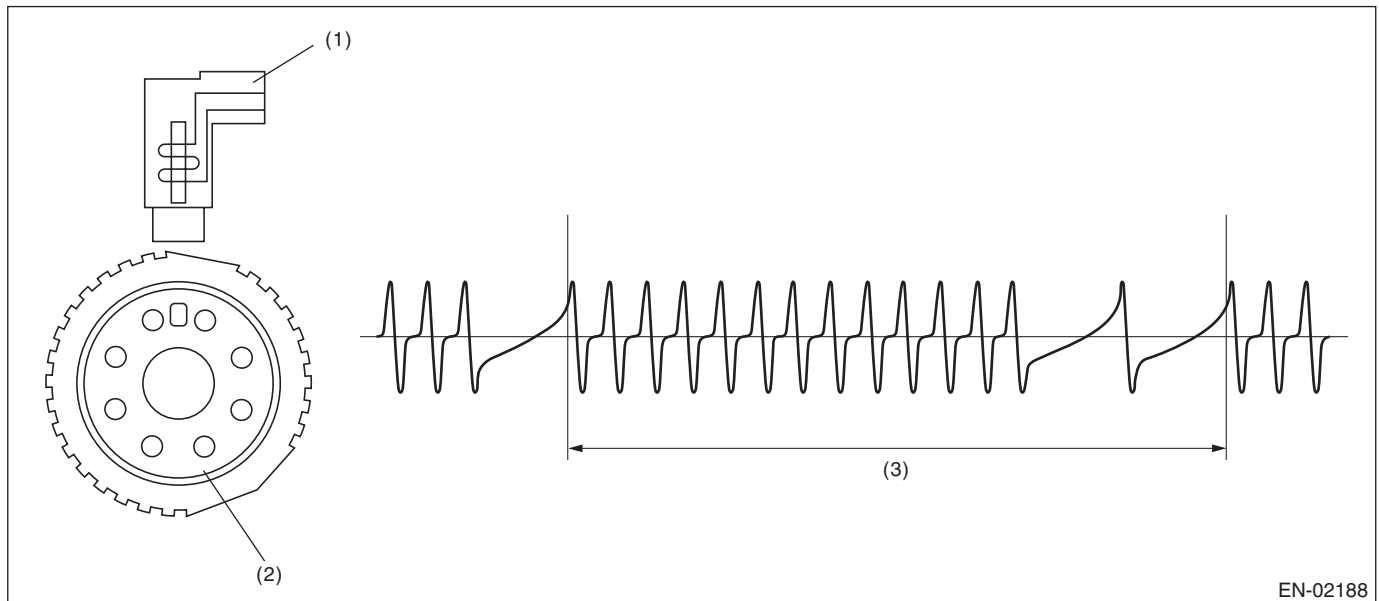


EN-03092

(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



EN-02188

(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$
Engine speed	$< 3000 \text{ rpm}$

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

### Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	Not = 30

**Time Needed for Diagnosis:** 10 engine revs.

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	= 30

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

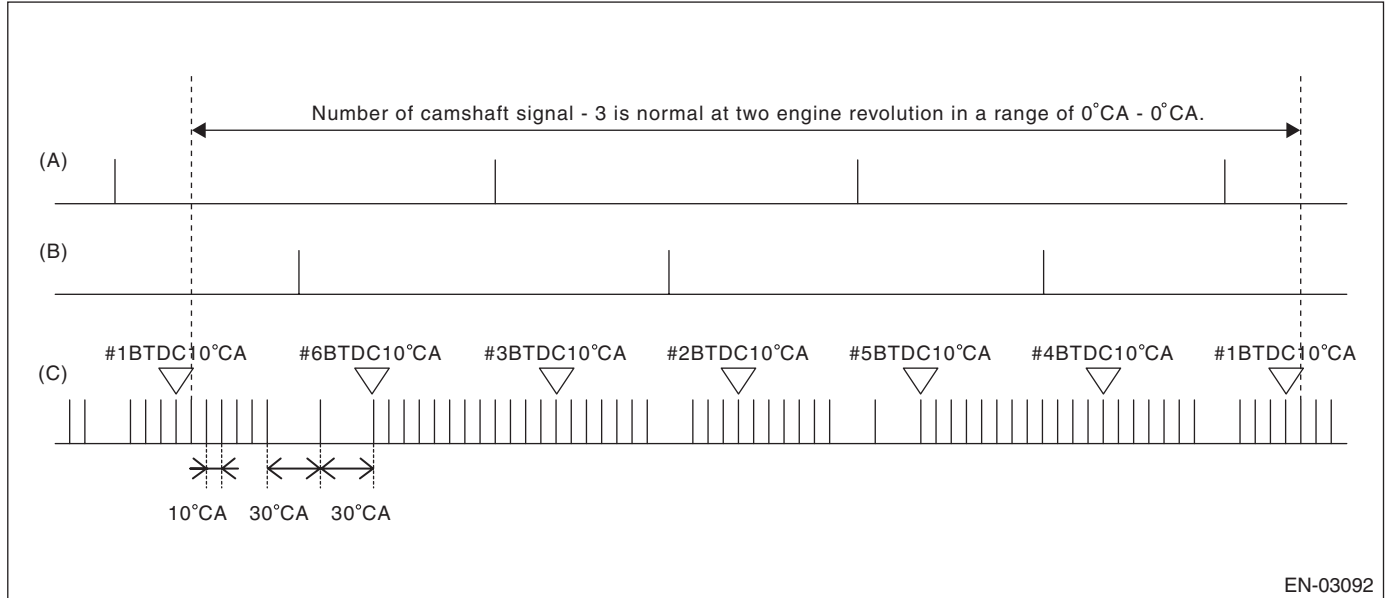
## GENERAL DESCRIPTION

### BZ:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.  
Judge as NG when the number of camshaft signals remains abnormal.

#### 2. COMPONENT DESCRIPTION

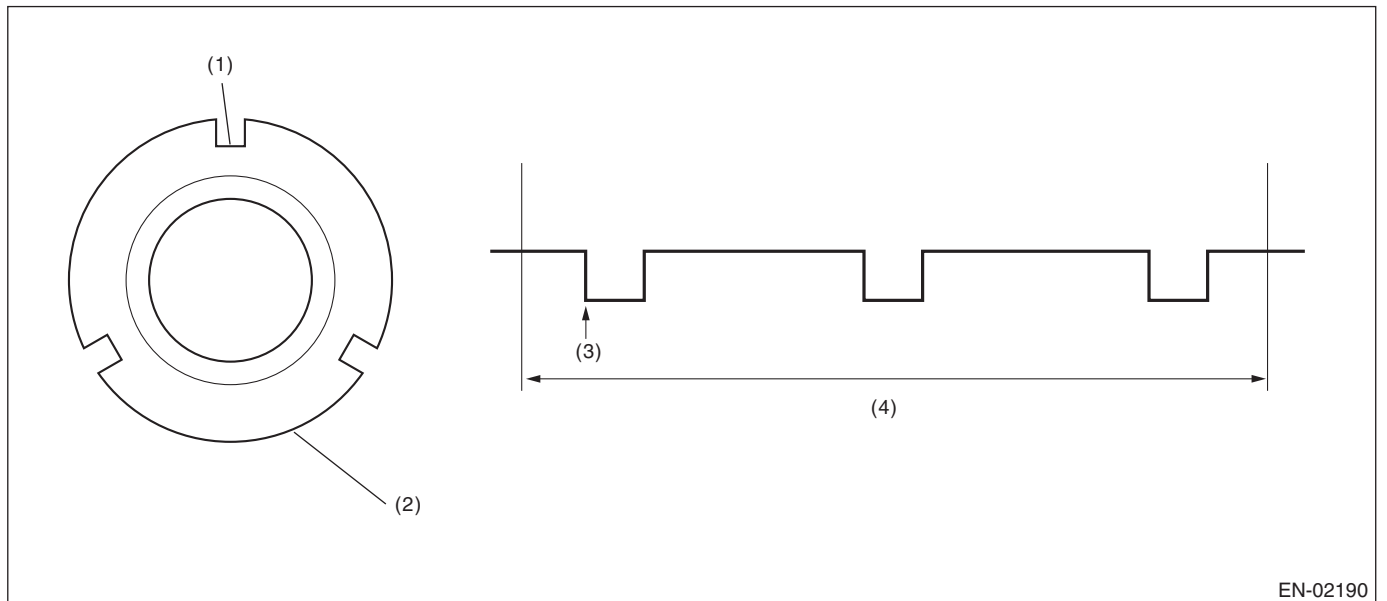


EN-03092

(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



EN-02190

(1) Throttle

(2) Camshaft plate

(3) Detecting point

(4) Camshaft one revolution (engine two revolutions)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment 1

Judge as NG when the condition where the number of camshaft position sensor signals are less than 3 times during 2 engine speed. continues.

#### Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs.	< 3.000 time

**Time Needed for Diagnosis:** Two engine revolutions × 4 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgement 1

Judge as OK and clear the NG when the malfunction criteria below are met.

#### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	≥ 3.000 time

**Time Needed for Diagnosis:** Two engine revolutions

### • Abnormality Judgment 2

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Starter	ON
Camshaft position sensor signal	No input

**Time Needed for Diagnosis:** 3000 ms

### • Normality Judgement 2

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	Input exists

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### 8. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0° CA) to the compensation value of the partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control: Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
- ISC feedback compensation: Do not perform the AVCS actual timing advance compensation. Make the OCV driving Duty to be the given value (9.36%).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## CA:DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0340. <Ref. to GD(H6DO)-124, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

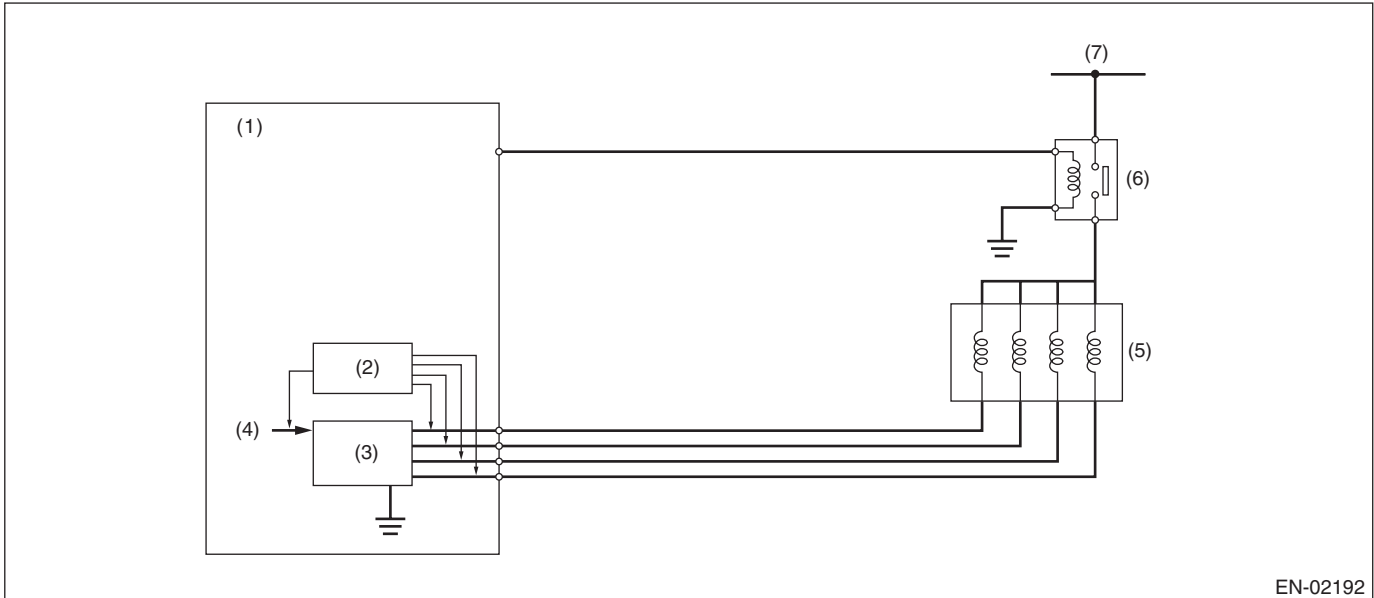
## CB:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

### 1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.

Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

### 2. COMPONENT DESCRIPTION



EN-02192

- |                       |               |                          |
|-----------------------|---------------|--------------------------|
| (1) ECM               | (4) CPU       | (6) Main relay           |
| (2) Detecting circuit | (5) EGR valve | (7) Battery power supply |
| (3) Switching circuit |               |                          |



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 40 sec
Engine coolant temperature	≥ 75 °C(167 °F)
Engine speed	1200 rpm — 3250 rpm
Intake manifold pressure (absolute pressure)	< 36.66 kPa (275 mmHg, 10.827 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 deg
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Vehicle speed	≥53 km/h (32.9 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF
After neutral switch ON/OFF change	≥ Value from Map
No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan)	≥ 5000 ms

### Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
After neutral switch change msec	0	0	0	0	0	0	0	0

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
After neutral switch change msec	0	0	0	0	0	0	0	0

### 4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once. Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

### 5. DIAGNOSTIC METHOD

Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.

1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 50 steps (nearly full open).
2. Label the intake manifold pressure value as PMON, which is observed after one second has passed since EGR target step was set to 50 steps (when the enable conditions were established), and set the EGR target step to 0.
3. Label the intake manifold pressure as PMOF2, which is observed after one second has passed since EGR target step was set to 0 (after two seconds have passed since the enable conditions were established).

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Abnormality Judgment

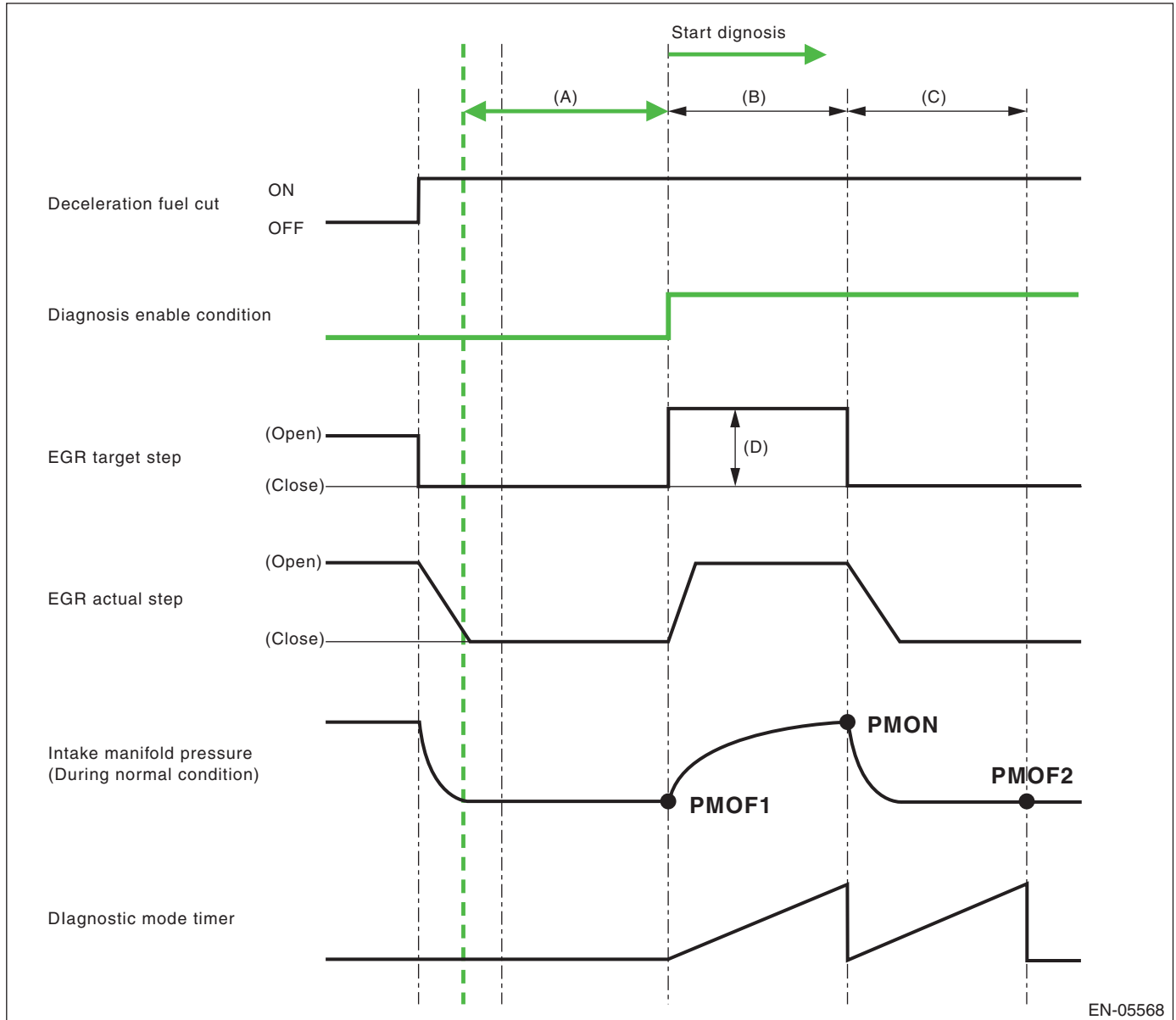
Judge as NG when the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
$PMON - (PMOF1 + PMOF2)/2$	< 1.57 kPa (11.8 mmHg, 0.465 inHg)

**Time Needed for Diagnosis:** 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.



(A) 2000 ms

(C) 1500 ms

(D) 50 STEP

(B) 1500 ms

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
PMON – (PMOF1 + PMOF2)/2	≥ 1.57 kPa (11.8 mmHg, 0.465 inHg)

**Time Needed for Diagnosis:** 1 time

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

A/F main learning = Not allowed.

Knock learning = Not allowed.

EGR control: Operation prohibited.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CC:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

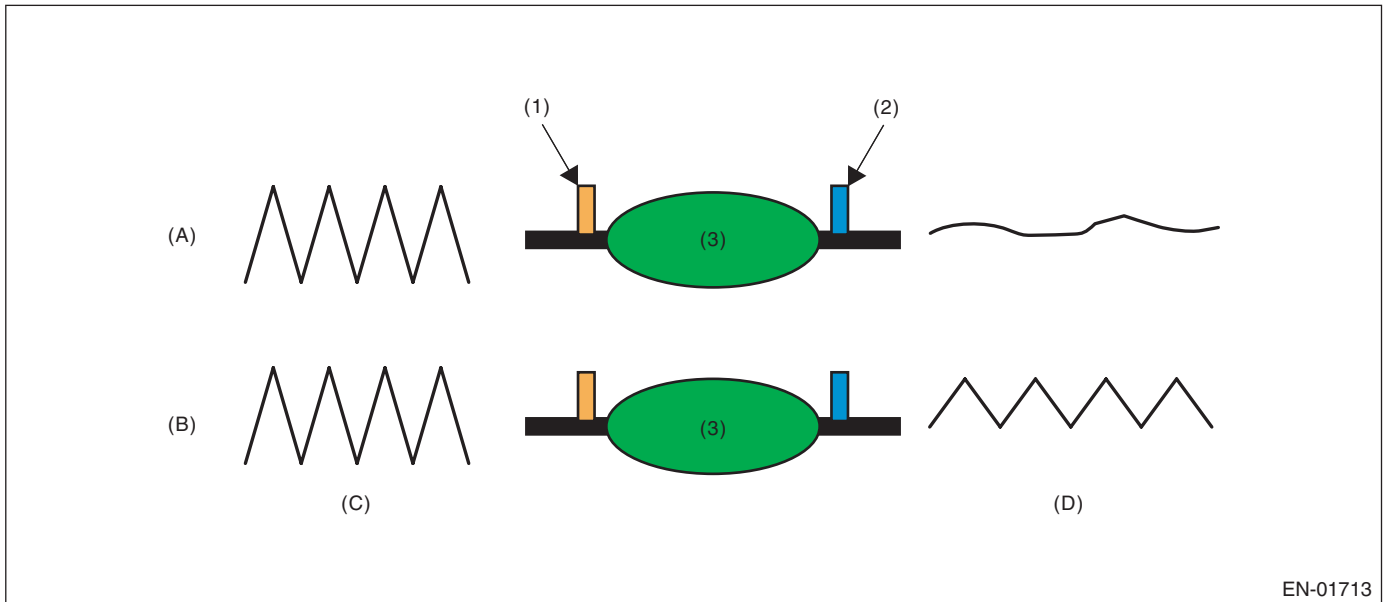
### 1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.

For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

### 2. COMPONENT DESCRIPTION



EN-01713

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter

(A) Normal

(C) Output waveform from the front oxygen (A/F) sensor

(D) Output waveform from the rear oxygen Sensor

(B) Deterioration

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Engine coolant temperature	≥ 75 °C (167 °F)
Estimated catalyst temperature	≥ 560 °C (1040 °F)
Misfire detection every 200 rotations	< 7 time
Learning value of evaporation gas density	< 0.2
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 1000 ms
Vehicle speed	> 60 km/h (37.3 MPH)
Amount of intake air	≥ 10 g/s (0.353 oz/s) and < 40 g/s (1.411 oz/s)
Engine load change every 0.5 engine speed.	< 0.02 g/rev (0.001 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 205 sec
Purge execution calculated time	≥ 5 sec

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 60 km/h (37.3 MPH) or higher.

### 5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) and rear oxygen sensor output voltage deviation cumulative value ( $\sum |(ro2sad_n - ro2sad_{n-1})|$ ) per 32 milliseconds  $\times 4$ , and when the front oxygen (A/F) sensor lambda deviation cumulative value ( $\sum |(sglmd_n - sglmd_{n-1})|$ ) becomes the predetermined value or more, calculate the diagnostic value.

#### • Abnormality Judgment

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
$\sum  (ro2sad_n - ro2sad_{n-1})  / \sum  (sglmd_n - sglmd_{n-1}) $	> 25

**Time Needed for Diagnosis:** 30 — 55 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
$\sum  (ro2sad_n - ro2sad_{n-1})  / \sum  (sglmd_n - sglmd_{n-1}) $	≤ 25

**Time Needed for Diagnosis:** 30 — 55 seconds

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

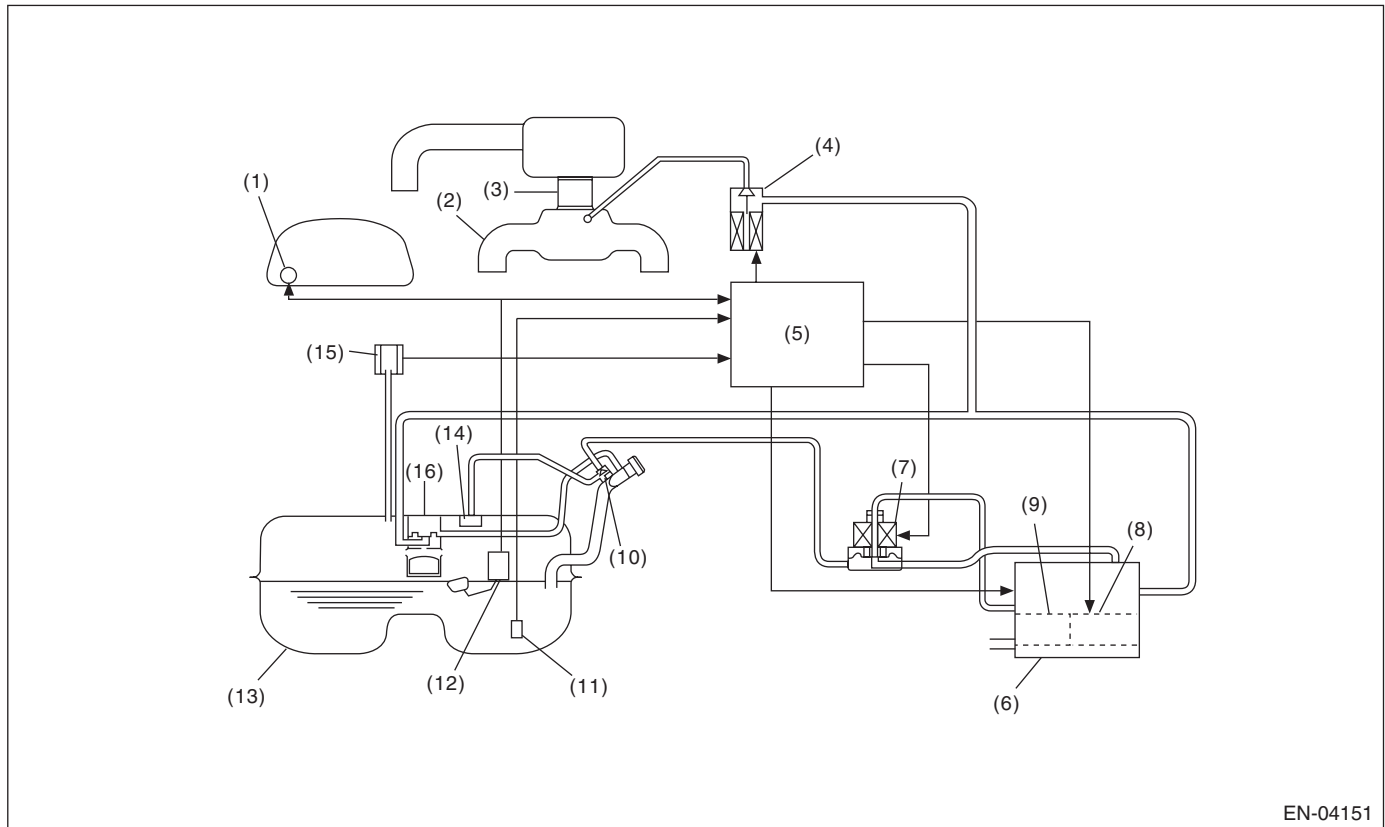
# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### CD:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

#### 1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.



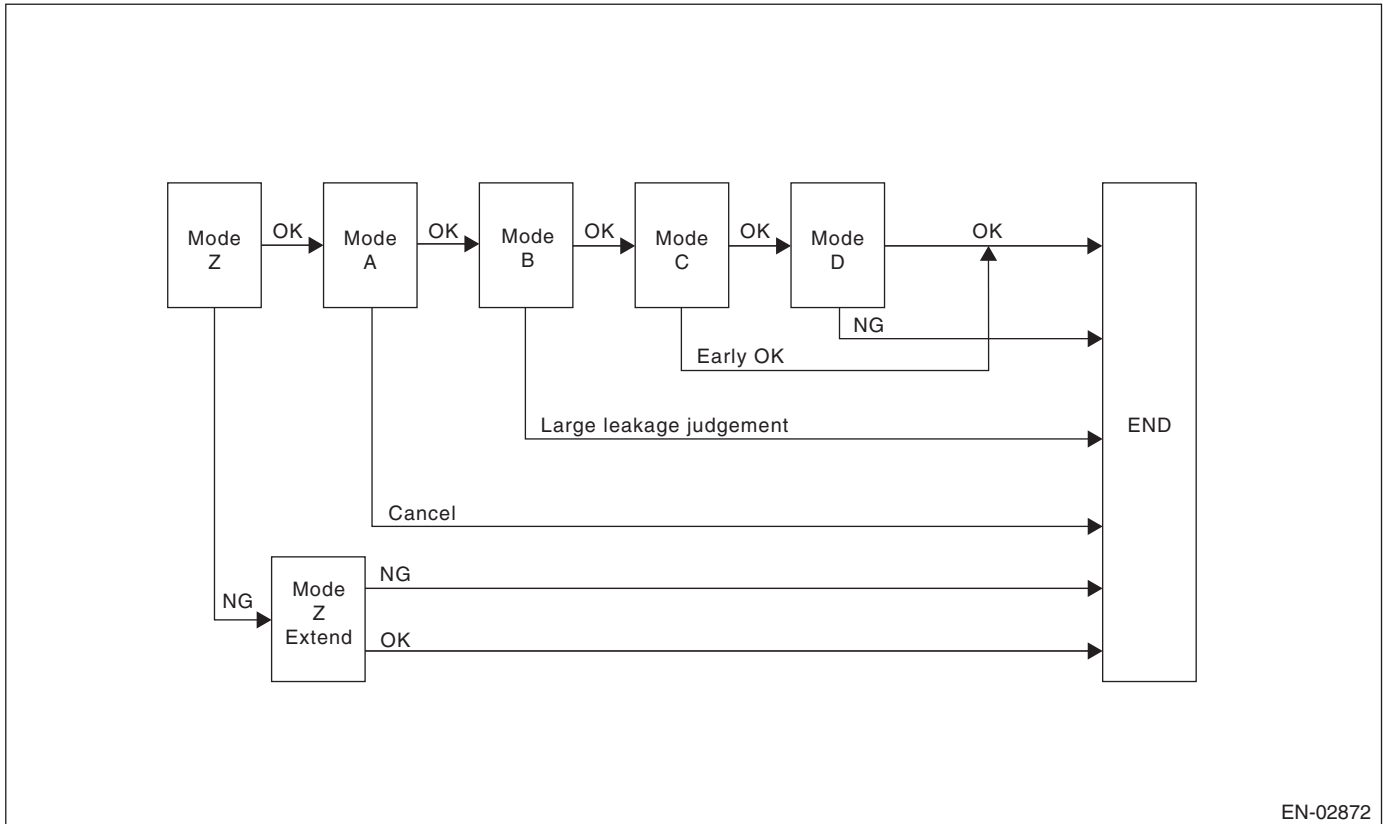
- |                                  |                              |                                |
|----------------------------------|------------------------------|--------------------------------|
| (1) Fuel gauge                   | (7) Pressure control valve   | (12) Fuel level sensor         |
| (2) Intake manifold              | (8) Drain valve              | (13) Fuel tank                 |
| (3) Throttle body                | (9) Drain filter             | (14) Fuel cut valve            |
| (4) Purge control solenoid valve | (10) Shut-off valve          | (15) Fuel tank pressure sensor |
| (5) Engine control module (ECM)  | (11) Fuel temperature sensor | (16) Vent valve                |
| (6) Canister                     |                              |                                |

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 0.04-inch Diagnosis



EN-02872

Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve opening failure diagnosis)	Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start.	0 ms + 3000 ms — 0 ms + 3000 ms + 13000 ms
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	10000 ms
Mode B (Sealed negative pressure, large leakage judgment)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak.	0 — 10000 ms + 25000 ms
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment.	0 — 17000 ms
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value.	0 ms + 10000 ms

### Mode Table for Evaporative Emission Control System Diagnosis

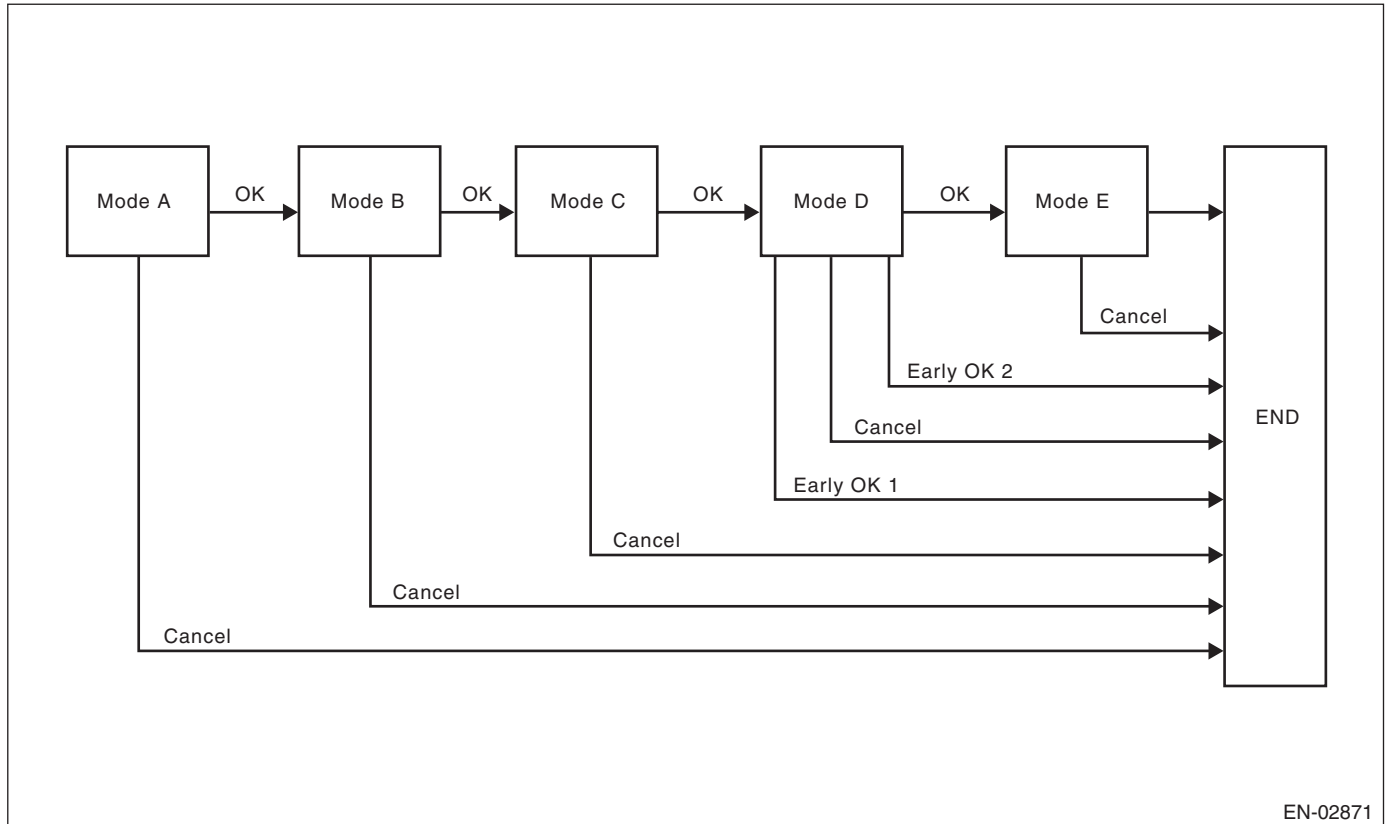
Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg))	Purge control solenoid valve is judged to be open.	P0457
Mode A	Pressure is in proportion to amount of evaporative emission.	—	None
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leak	P0457
Mode C	Reaches target pressure	—	None
Mode D	Pressure change is small.	EVAP system large leak determination. [1.0 mm (0.04 in)]	P0442



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 0.02-inch Diagnosis



Mode	Mode Description	Diagnosis Period
Mode A (0 point compensation)	When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg).	0 — Value of Map 1
Mode B (Negative pressure introduced)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank.	0 — Value of Map 2
Mode C (Negative pressure maintained)	Wait until the tank pressure returns to the target (start level of P2 calculation).	0 — 20000 ms + 0 + Value of Map 2
Mode D (Negative pressure change calculated)	Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment.	0 — 0 ms + 200000 ms
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + 200000 ms + Value of Map 3

#### Map1

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	12000	12000	11000	10000	7500	5000	5000

#### Map2

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	18500	18500	18500	18500	18500	18500	18500

#### Map 3

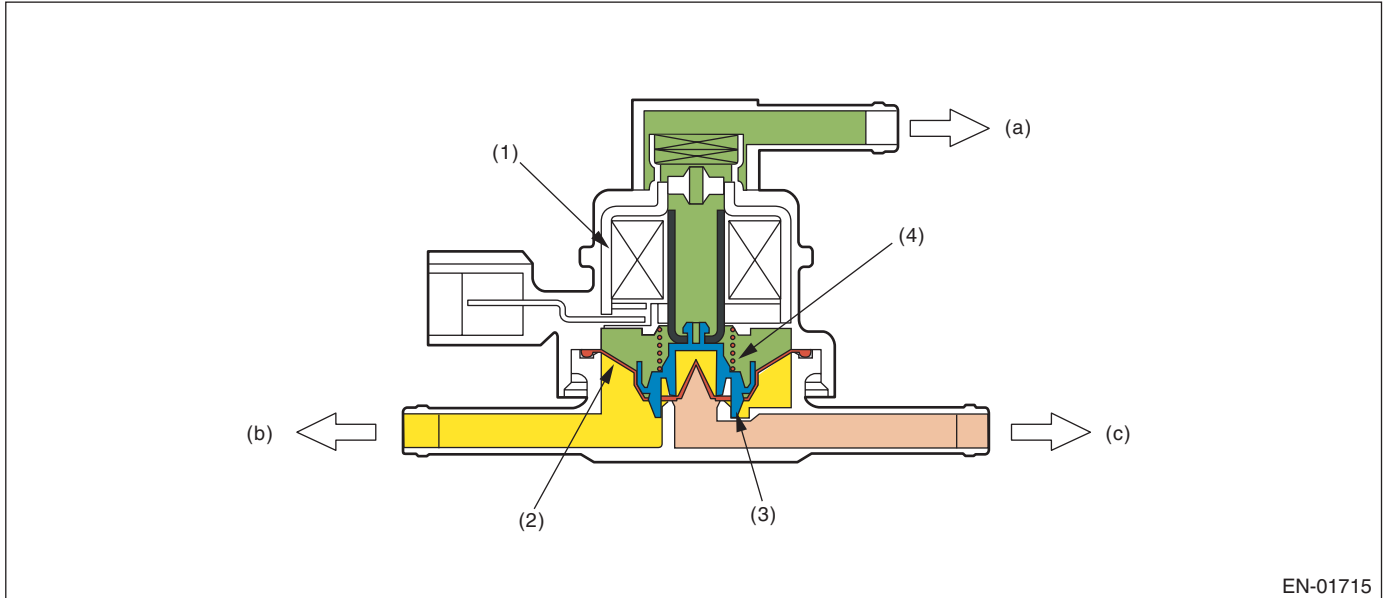
Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Time Needed for Diagnosis (ms)	60000	60000	60000	60000	60000	60000	60000

## 2. COMPONENT DESCRIPTION

### Pressure control solenoid valve

PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.

The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.



(1) Solenoid  
(2) Diaphragm

(3) Valve  
(4) Spring

(a) Barometric pressure  
(b) Fuel tank  
(c) Canister

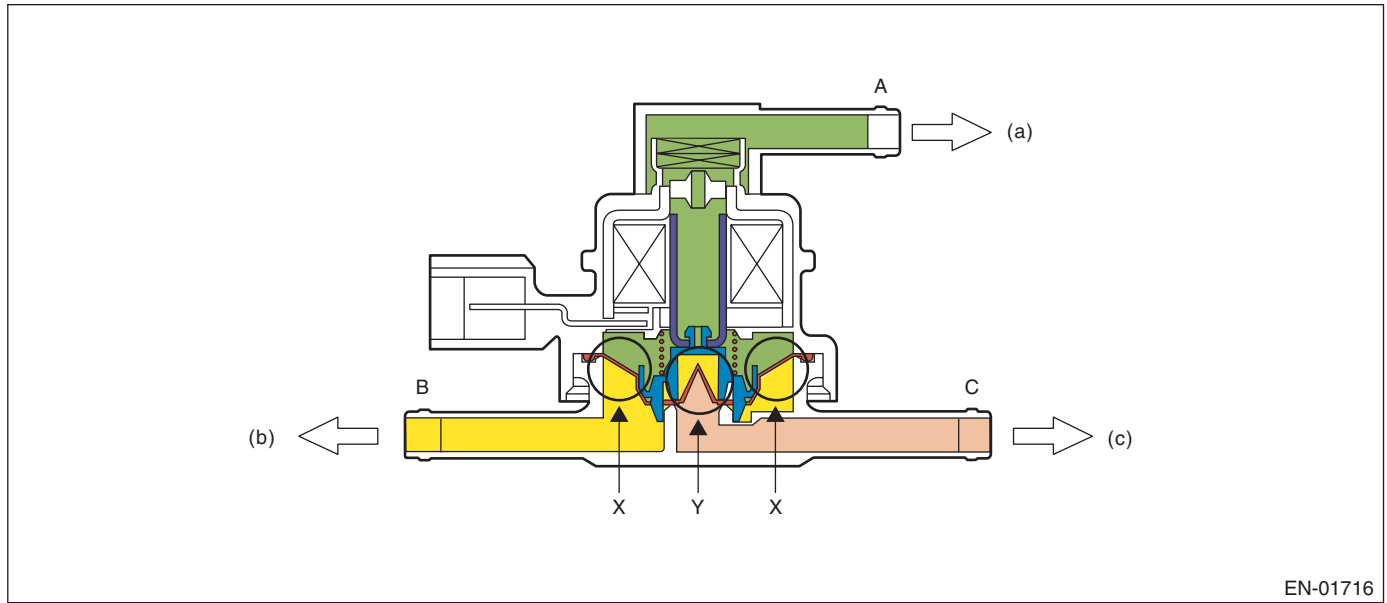
### Valve Operation and Air Flow

In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



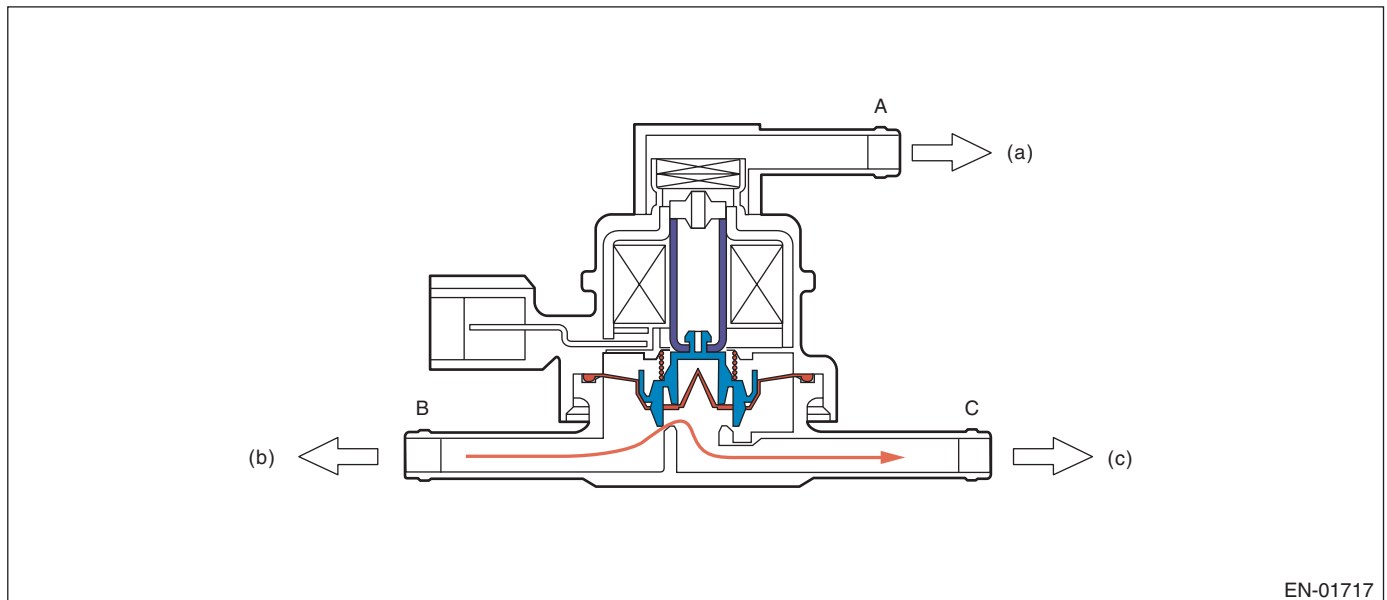
(a) Barometric pressure

(b) Fuel tank

(c) Canister

Condition of pressure	Flow
$A < B$ (solenoid OFF)	$B \rightarrow C$
$B < C$ (solenoid OFF)	$C \rightarrow B$
Solenoid ON	$B \leftrightarrow C$

### When $A < B$ (solenoid OFF)



(a) Barometric pressure

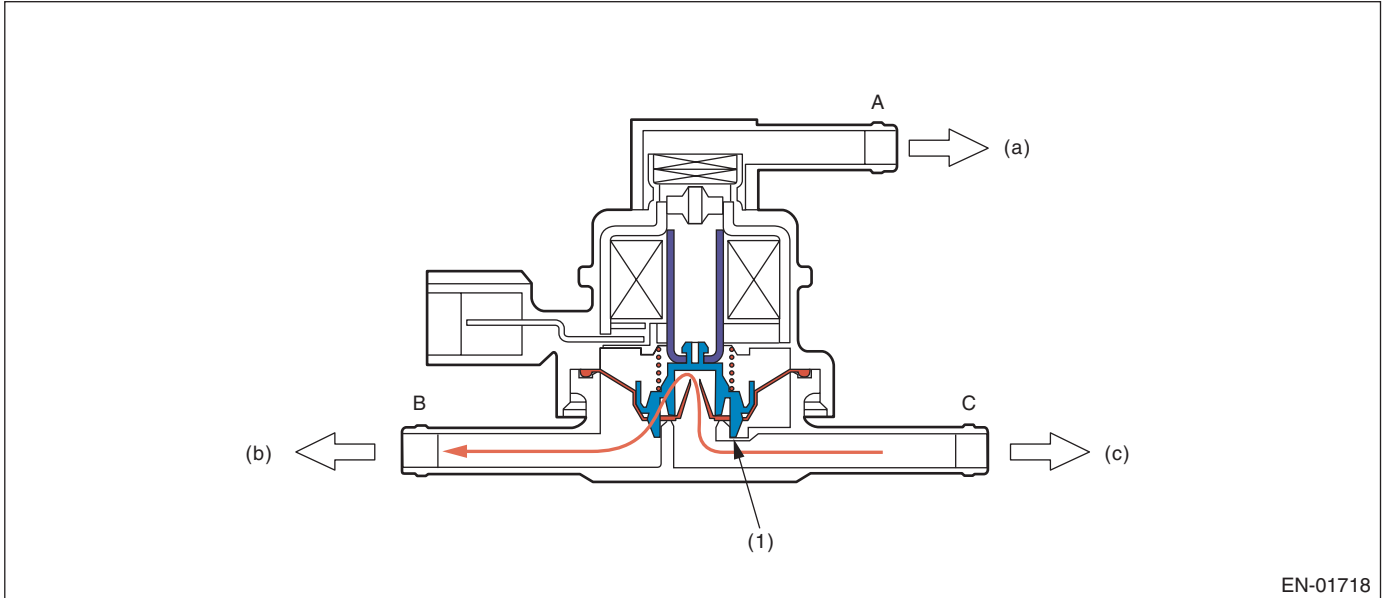
(b) Fuel tank

(c) Canister

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

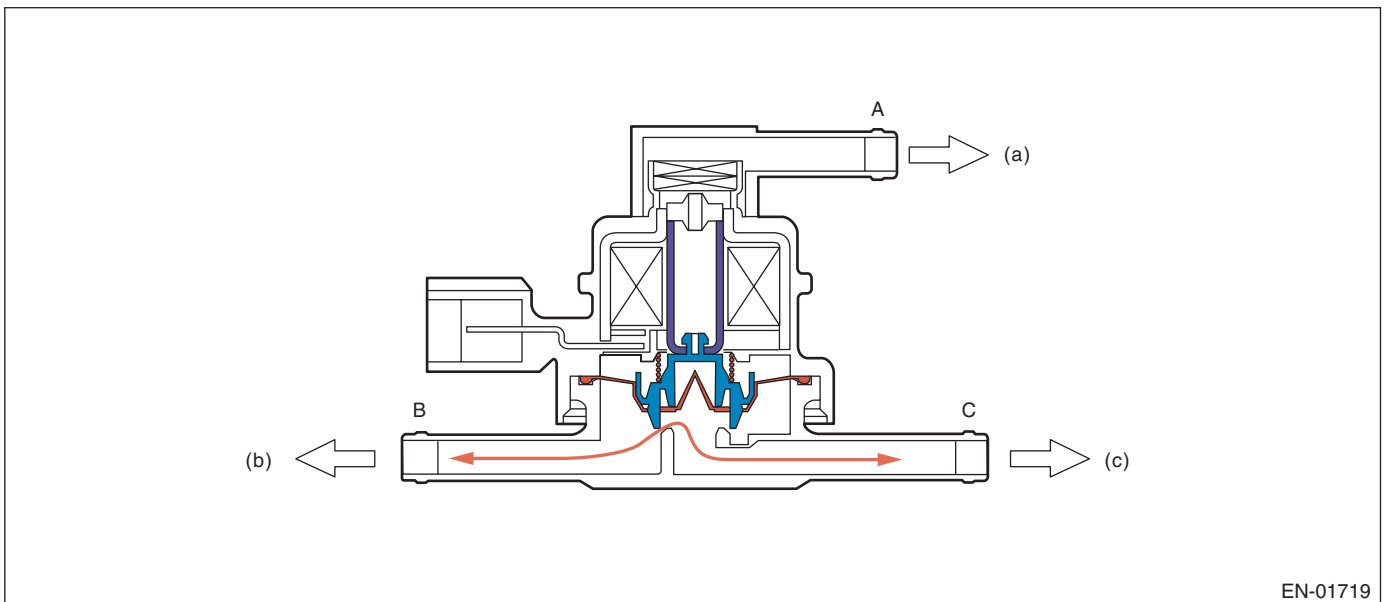
## When $B < C$ (solenoid OFF)



EN-01718

- (1) Valve
- (a) Barometric pressure
- (b) Fuel tank
- (c) Canister

## When Solenoid is ON



EN-01719

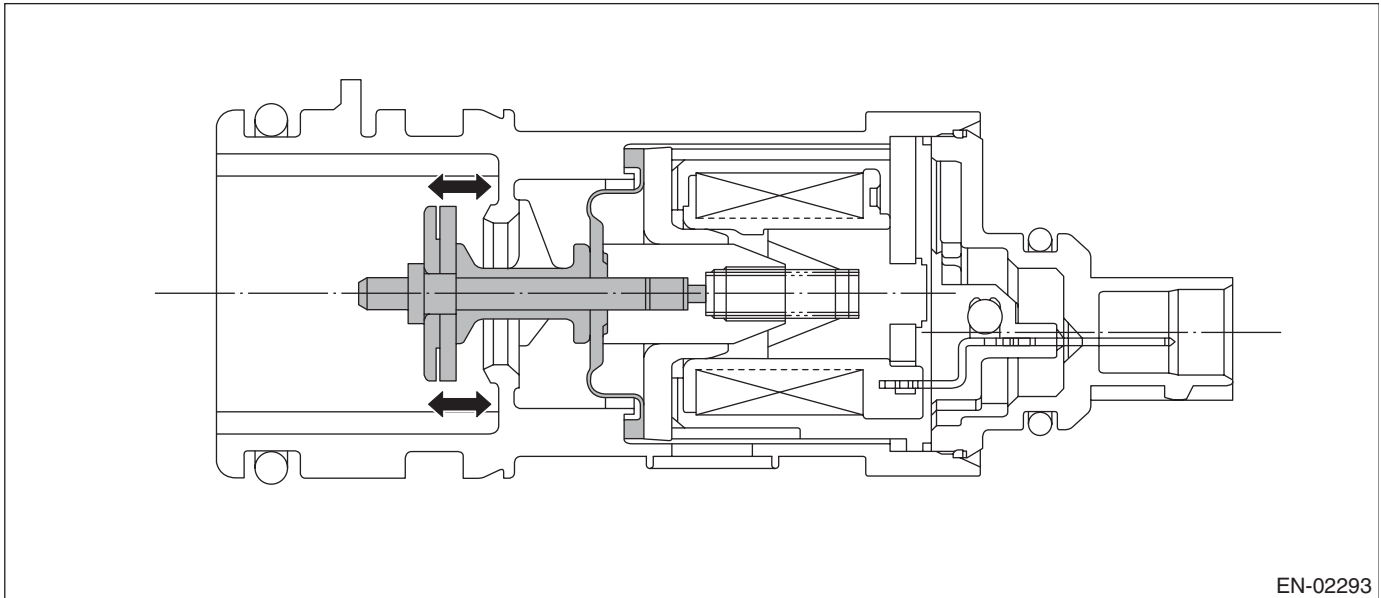
- (a) Barometric pressure
- (b) Fuel tank
- (c) Canister

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Drain valve

Drain valve controls the ambient air to be introduced to the canister.



EN-02293

## 3. ENABLE CONDITION

### 0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75.05 \text{ kPa}$ (563 mmHg, 22.165 inHg)
Total time of canister purge operation	$\geq 120000 \text{ ms}$
Elapsed time after starting the engine	$\geq 856 \text{ sec}$
Learning value of evaporation gas density	$< 0.08$
Engine speed	1050 rpm — 6500 rpm
Fuel tank pressure	$\geq -4 \text{ kPa}$ (-30 mmHg, -1.181 inHg)
Intake manifold relative vacuum (relative pressure)	$\geq -26.66 \text{ kPa}$ (-200 mmHg, -7.874 inHg)
Vehicle speed	$\geq 32 \text{ km/h}$ (19.9 MPH)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Closed air/fuel ratio control	In operation
Fuel temperature	$-10 \text{ }^\circ\text{C}$ (14 $^\circ\text{F}$ ) — $45 \text{ }^\circ\text{C}$ (113 $^\circ\text{F}$ )
Intake air temperature	$\geq -10 \text{ }^\circ\text{C}$ (14 $^\circ\text{F}$ )
Pressure change every one second	$< 1.7 \text{ mmHg}$ (Mode A) $< 1.7 \text{ mmHg}$ (Mode D)
Minimum pressure change value every one second – Maximum pressure change value every one second	$< 1.7 \text{ mmHg}$ (Mode A) $< 1.7 \text{ mmHg}$ (Mode D)
Change of fuel level per 128 milliseconds	$< 2 \text{ L}$ (0.528 US gal, 0.44 Imp gal)
Air fuel ratio	0.76 — 1.25

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
<b>At starting a diagnosis</b>	
Evap. diagnosis	Incomplete
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	> 120000 ms
When cancelling in other than mode A	> 600000 ms
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 120 sec
Fuel temperature	-10 °C (14 °F) — 55 °C (131 °F)
Fuel level	9.6 L (2.536 US gal, 2.112 Imp gal) — 54.4 L (14.372 US gal, 11.968 Imp gal)
Intake manifold relative vacuum (relative pressure)	≥ - 8 kPa (- 60 mmHg, - 2.362 inHg)
Fuel tank pressure	-0.67 kPa (-5 mmHg, -0.197 inHg) — 1.43 kPa (10.7 mmHg, 0.421 inHg)
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 7000 rpm
<b>During diagnosis</b>	
Change of fuel level	≤ Value of Map 4
Pressure change every one second	< 0.06 kPa (0.44 mmHg, 0.017 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 0.07 kPa (0.51 mmHg, 0.02 inHg) (Mode D)
Pressure change in tank every second	≤ 0.1 kPa (0.75 mmHg, 0.03 inHg)
Barometric pressure change	-0.48 kPa (-3.6 mmhg, -0.142 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode D) -0.32 kPa (-2.4 mmhg, -0.094 inHg) — 0.32 kPa (2.4 mmhg, 0.094 inHg) (Mode E)

## Map4

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Change (ℓ, US gal, Imp gal)	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1	5, 1.321, 1.1

## 4. GENERAL DRIVING CYCLE

### 0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

### 0.02-inch Diagnosis

- Perform the diagnosis when 125 seconds or more have passed at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### Purge control solenoid valve stuck open fault diagnosis

DTC

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

#### Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

#### DIAGNOSTIC METHOD

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

#### • Abnormality Judgment

If OK judgment cannot be made, extend Mode Z, and Judge as NG when the following conditions are established after predetermined amount of time.

#### Judgment Value

Malfunction criteria	Threshold value	DTC
evptez – evptezha	> 0.6 kPa (4.5 mmHg, 0.177 inHg)	P0457
evptezini	≤ 1.43 kPa (10.7 mmHg, 0.421 inHg)	
Time of 2 L (0.528 US gal, 0.44 Imp gal) or more fuel no sloshing	≥ 40000 ms	

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 13000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

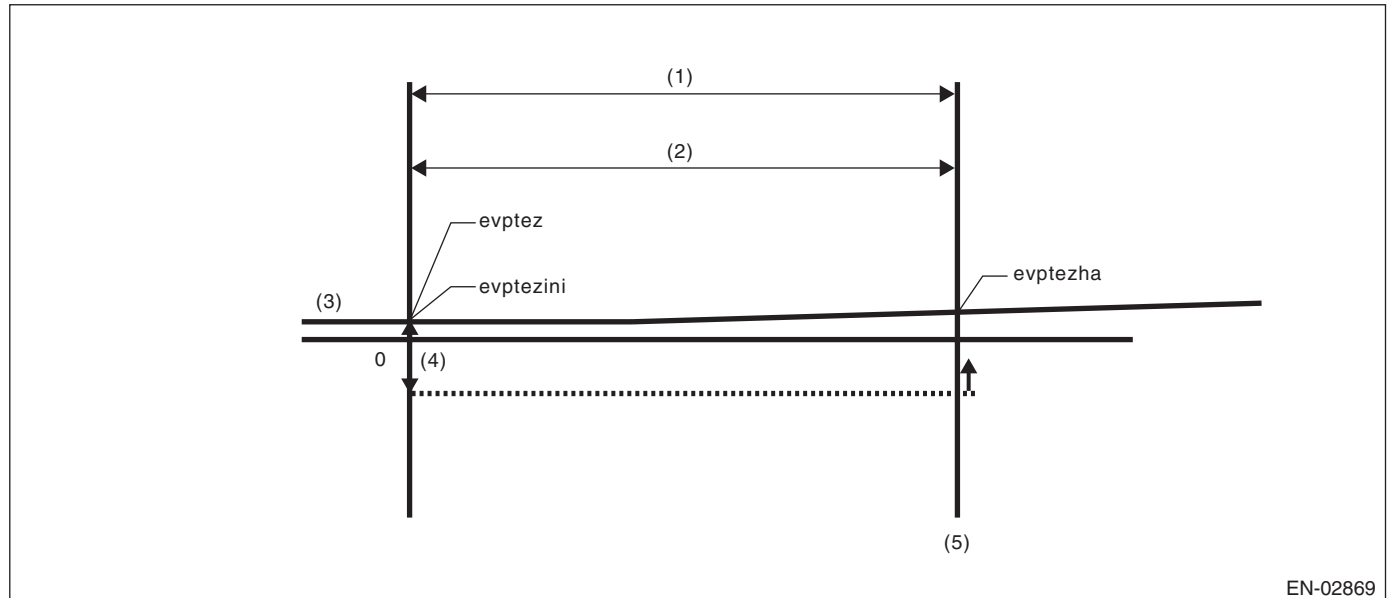
## • Normality Judgment

Judge as OK and change to Mode A when the following conditions are established after predetermined time has passed since Mode Z started.

### Judgment Value

Malfunction criteria	Threshold value	DTC
evptez – evptezha	≤ 0.4 kPa (3 mmHg, 0.118 inHg)	P0457

### Normal



- |             |                                  |                 |
|-------------|----------------------------------|-----------------|
| (1) Mode Z  | (3) Fuel tank pressure           | (5) OK judgment |
| (2) 3000 ms | (4) 0.4 kPa (3 mmHg, 0.118 inHg) |                 |

$evptez - evptezha \leq 0.4 \text{ kPa (3 mmHg, 0.118 inHg)}$  Normal when above is established

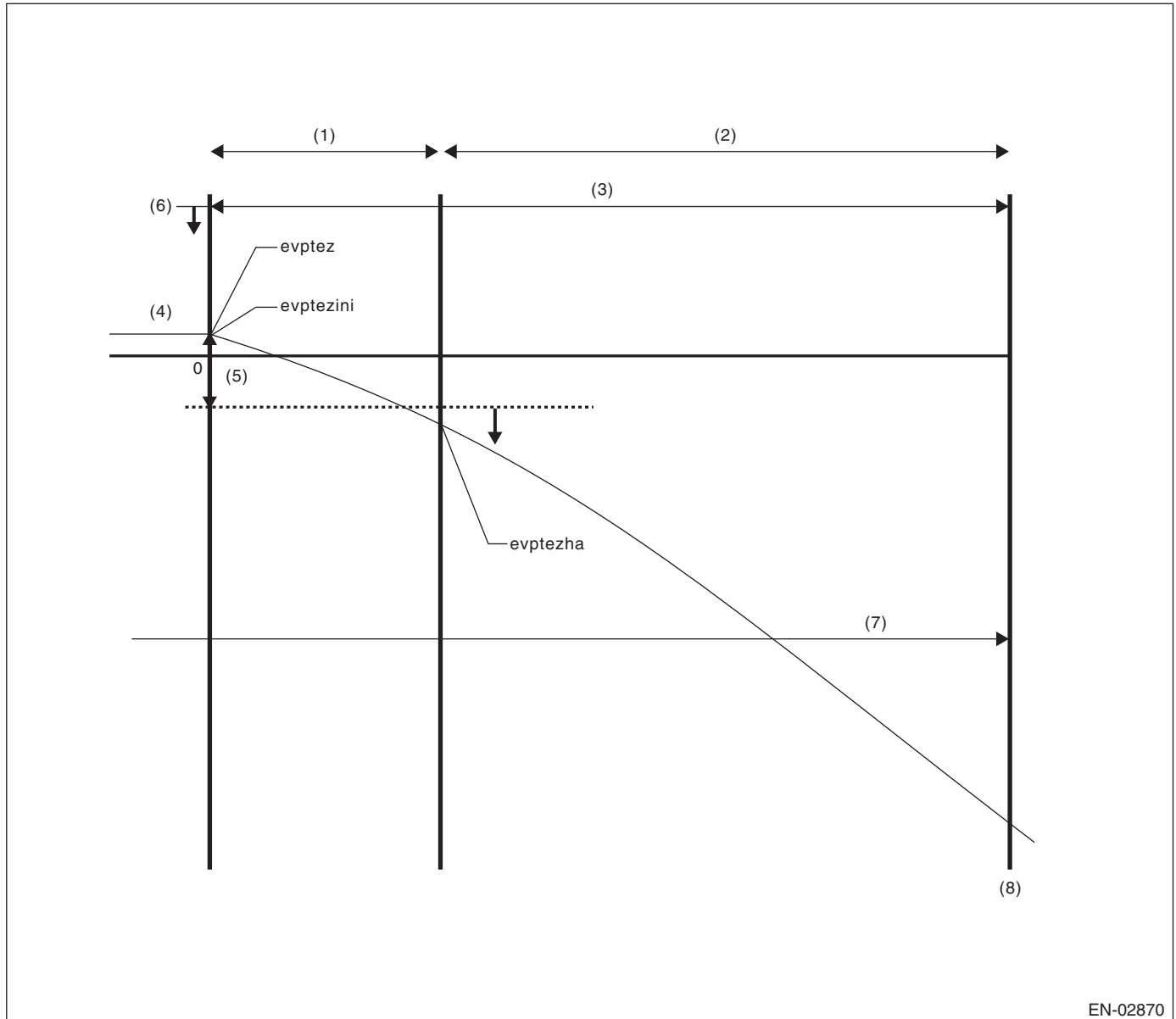
**Time Needed for Diagnosis:** 0 ms + 3000 ms



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Purge control solenoid valve Open Fixation



EN-02870

- |                        |                                      |                               |
|------------------------|--------------------------------------|-------------------------------|
| (1) Mode Z             | (4) Fuel tank pressure               | (7) 40000 ms no fuel sloshing |
| (2) Extended mode Z    | (5) 0.6 kPa (4.5 mmHg, 0.177 inHg)   | (8) NG judgment               |
| (3) 3000 ms + 13000 ms | (6) 1.43 kPa (10.7 mmHg, 0.421 inHg) |                               |

- $evptezini \leq 1.43 \text{ kPa (10.7 mmHg, 0.421 inHg)}$
  - $evptez - evptezha > 0.6 \text{ kPa (4.5 mmHg, 0.177 inHg)}$
  - No fuel sloshing of over 2 L (0.528 US gal, 0.44 Imp gal) lasts for more than 40000 ms.
- Judge as abnormal when all are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Leak Diagnosis

DTC

P0442 Evaporative Emission Control System Leak Detected (Small Leak)

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

### Mode A: (Estimated evaporation gas amount)

Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.

### Mode B: (Negative pressure sealed)

Introduce negative pressure in the intake manifold to the tank.

Approx.  $0 \rightarrow -1.4$  kPa ( $0 \rightarrow -10.5$  mmHg,  $0 \rightarrow -0.413$  inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.

### Abnormality Judgment

Judge as NG (large leakage) when the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value	DTC
Time to reach target negative pressure or Mode B time (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started)	$\geq 10000$ ms + $25000$ ms  $\geq 10000$ ms $> -0.33$ kPa ( $-2.5$ mmHg, $-0.098$ inHg)	P0457

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms

### Mode C: (Check pressure rise)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D when the tank pressure returns to the start level of P2 calculation.

Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

Tank pressure when starting calculation of P2	Time for advanced OK judgment
$-1.3$ kPa ( $-9.75$ mmHg, $-0.384$ inHg)	17000 ms

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 17000 ms

### Mode D: (Measure amount of negative pressure change)

Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.

After calculating P2, perform a small leak diagnosis according to the items below.

### When Mode D is ended

Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

### Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 - × P1 P2: Tank pressure that changes every 10000 ms in mode D P1: Tank pressure that changes every 10000 ms in mode A	> Value of Map 5	P0442

\*1.5 -: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

### Map 5 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	40 °C (104 °F)	45 °C (113 °F)
0 L (0 US gal, 0 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.28 kPa (2.1 mmHg, 0.083 inHg)	0.29 kPa (2.2 mmHg, 0.087 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.35 mmHg, 0.093 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.32 kPa (2.4 mmHg, 0.094 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.35 kPa (2.6 mmHg, 0.102 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.41 kPa (3.05 mmHg, 0.12 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.45 kPa (3.35 mmHg, 0.132 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.42 kPa (3.15 mmHg, 0.124 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.43 kPa (3.2 mmHg, 0.126 inHg)	0.44 kPa (3.3 mmHg, 0.13 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.48 kPa (3.6 mmHg, 0.142 inHg)	0.49 kPa (3.7 mmHg, 0.146 inHg)

**Time Needed for Diagnosis:** 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 17000 ms + 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Leak Diagnosis

#### DTC

P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

#### Mode A: (0 point compensation)

When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.

#### Mode B: (Negative pressure introduced)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -2 kPa (0 → -15 mmHg, 0 → -0.591 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.

#### Mode C: (Negative pressure maintained)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the pre-determined amount of time has passed.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## Mode D: (Calculate the amount of negative pressure change)

Monitor the tank pressure in mode D, calculate (P2) the pressure change in the tank, and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis.

### Normality Judgment

Judge as OK when the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
<b>Advanced OK judgment 1</b>	
Mode D time	$\geq 0 \text{ ms} + 20000 \text{ ms}$
Tank internal pressure	$\leq \text{Value of Map 6}$
<b>Advanced OK judgment 2</b>	
Mode D time	$\geq 0 \text{ ms} + 200000 \text{ ms}$
P2	$\leq \text{Value of Map 7}$

### Map6

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	-1.85, -13.9, -0.547	-1.85, -13.9, -0.547	-1.84, -13.8, -0.543	-1.83, -13.7, -0.539	-1.81, -13.6, -0.535	-1.8, -13.5, -0.531	-1.8, -13.5, -0.531

### Map7

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Tank pressure (kPa, mmHg, inHg)	0.93, 7, 0.276	0.93, 7, 0.276	0.94, 7.05, 0.278	0.95, 7.1, 0.28	1.09, 8.2, 0.323	1.28, 9.6, 0.378	1.28, 9.6, 0.378

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### Mode E: (Evaporation occurrence amount calculation)

Calculate the change of tank pressure with the time evpdset to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
P1	< Value of Map 8

#### Map 8 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.23 kPa (1.7 mmHg, 0.067 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)	0.36 kPa (2.7 mmHg, 0.106 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.25 kPa (1.85 mmHg, 0.073 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)	0.33 kPa (2.5 mmHg, 0.098 inHg)
50 L (13.21 US gal, 11 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.07 kPa (0.5 mmHg, 0.02 inHg)	0.27 kPa (2 mmHg, 0.079 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0.31 kPa (2.3 mmHg, 0.091 inHg)	0 kPa (0 mmHg, 0 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK when the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
P1	> Value of Map 9

### Map 9 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 L (0 US gal, 0 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
10 L (2.642 US gal, 2.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.47 kPa (3.5 mmHg, 0.138 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)	0.56 kPa (4.2 mmHg, 0.165 inHg)
20 L (5.284 US gal, 4.4 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.43 kPa (3.25 mmHg, 0.128 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)	0.55 kPa (4.1 mmHg, 0.161 inHg)
30 L (7.926 US gal, 6.6 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.4 kPa (3 mmHg, 0.118 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)	0.52 kPa (3.9 mmHg, 0.154 inHg)
40 L (10.568 US gal, 8.8 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.3 kPa (2.25 mmHg, 0.089 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)	0.45 kPa (3.4 mmHg, 0.134 inHg)
50 L (13.21 US gal, 11 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)
60 L (15.852 US gal, 13.2 Imp gal)	0.13 kPa (1 mmHg, 0.039 inHg)	0.2 kPa (1.5 mmHg, 0.059 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)	0.39 kPa (2.9 mmHg, 0.114 inHg)

**Time Needed for Diagnosis:** Value of Map1+ Value of Map2 + 20000 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

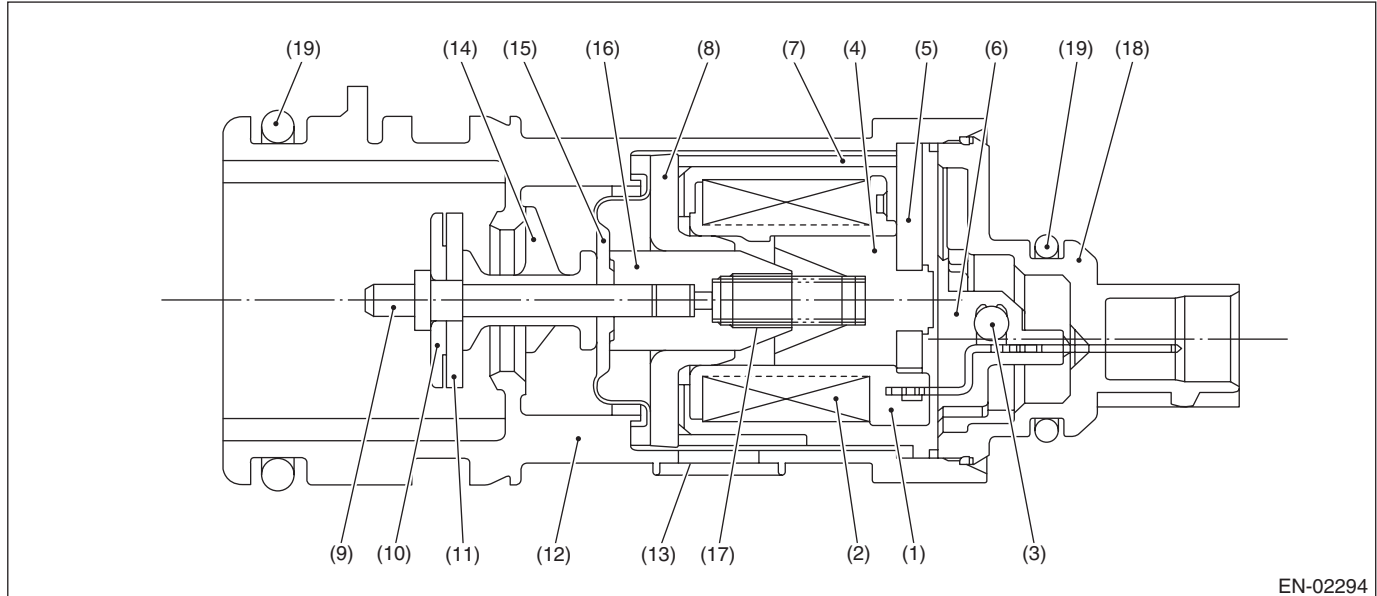
### CE:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

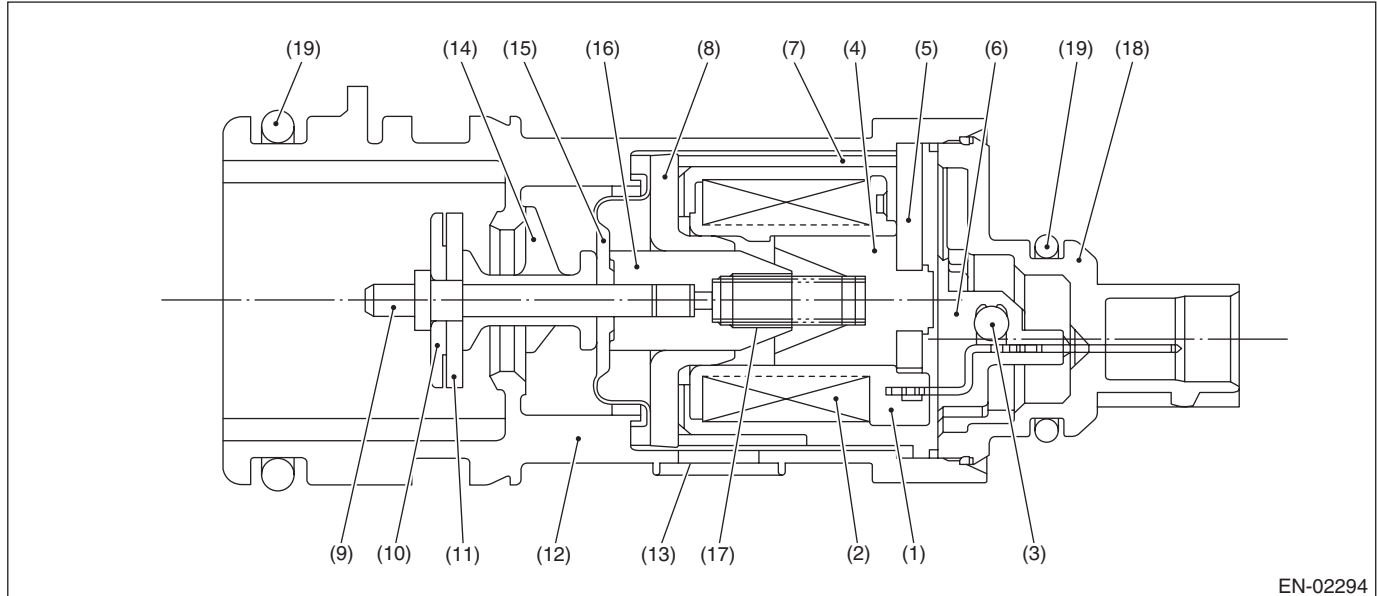
### CF:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



EN-02294

- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

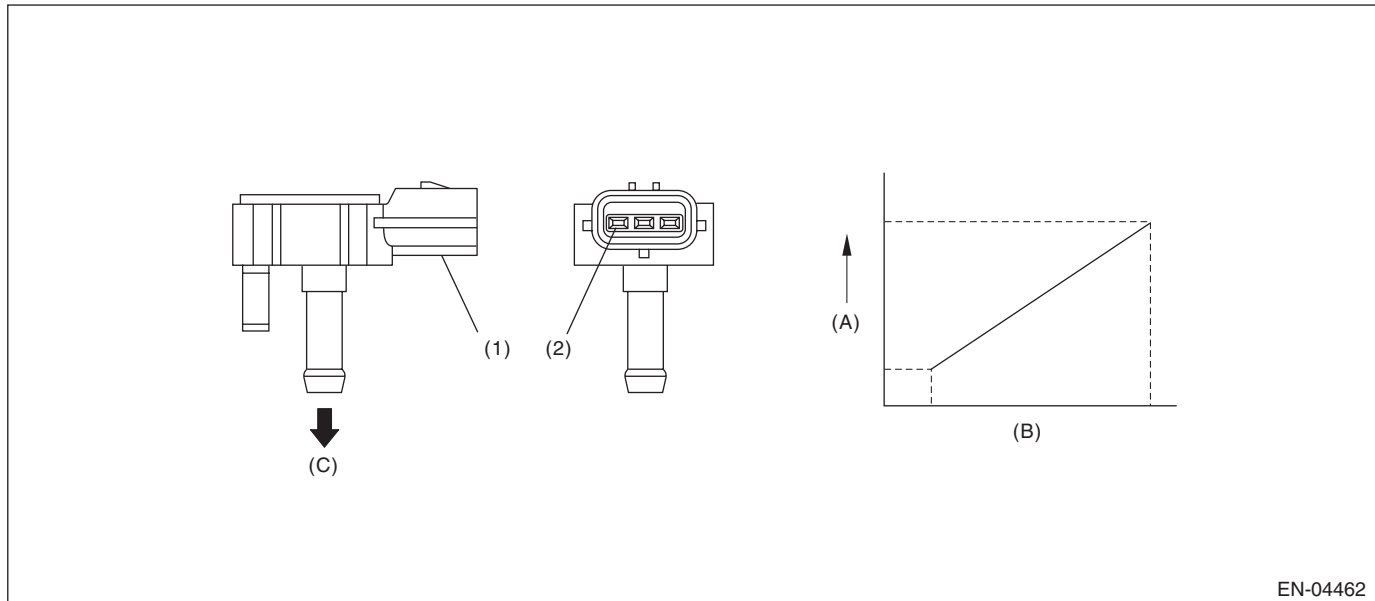
### CG:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

#### 1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.

Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

#### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	$\geq 60$ sec
Fuel level	$\geq 9.6$ L (2.536 US gal, 2.112 Imp gal)
Fuel temperature	$< 35$ °C (95 °F)
Battery voltage	$\geq 10.9$ V
Barometric pressure	$\geq 75.05$ kPa (563 mmHg, 22.165 inHg)

#### 4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 sec have passed since the engine started.
- Pay attention to the fuel level and temperature.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Number of times that the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more (with enable condition established)	≥ 16 time
Maximum – Minimum tank pressure (with enable condition completed)	< 0.05 kPa (0.375 mmHg, 0.015 inHg)
Maximum – Minimum fuel temperature (with enable condition completed)	≥ 7 °C (44.6 °F)

If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is less than 2 L (0.528 US gal, 0.44 Imp gal), extend 60 sec and make judgment with the Max. and Min. values for the fuel level in 60 sec × 2. If a difference does not appear, extend the time (60 sec × 3, 60 sec × 4, 60 sec × 5) and continue the judgment. If the difference between the Max. fuel level every 60 sec and Min. fuel level every 60 sec is 2 L (0.528 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

**Time Needed for Diagnosis:** 60 sec × 16 time or more

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Maximum – Minimum tank pressure	≥ 0.05 kPa (0.375 mmHg, 0.015 inHg)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

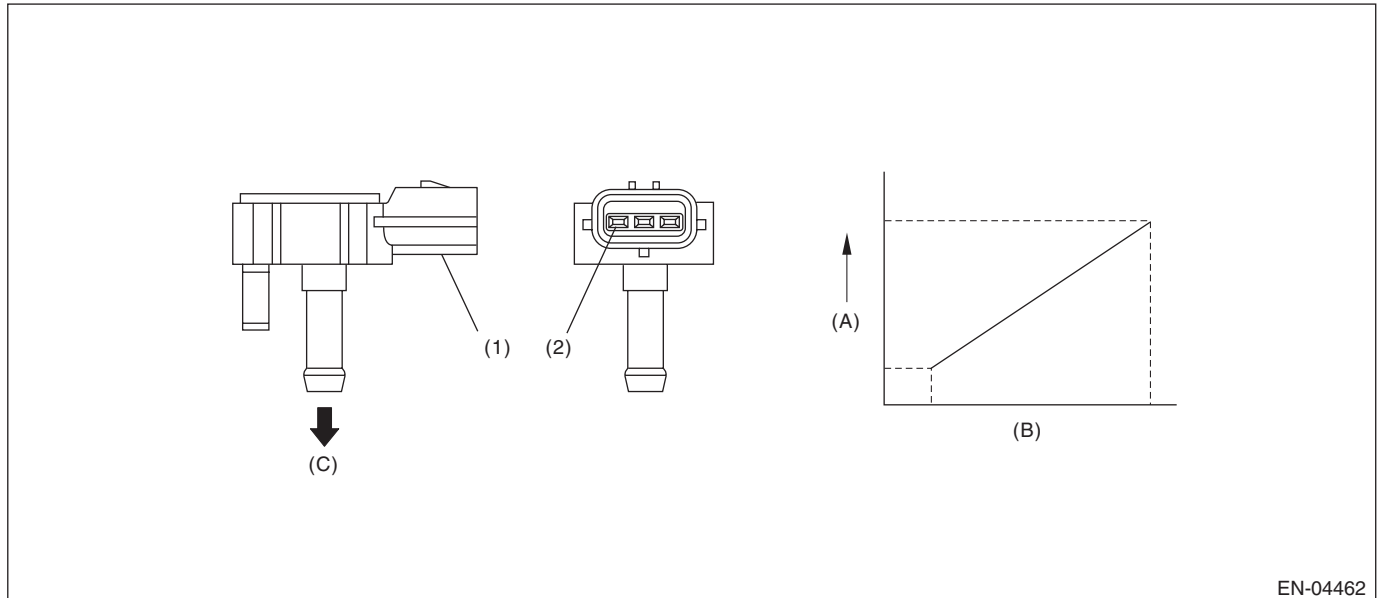
## GENERAL DESCRIPTION

### CH:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Fuel tank pressure	< -7.44 kPa (-55.85 mmHg, -2.199 inHg)
Battery voltage	≥ 10.9 V

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Fuel tank pressure	$\geq -7.44$ kPa ( $-55.85$ mmHg, $-2.199$ inHg)
Battery voltage	$\geq 10.9$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

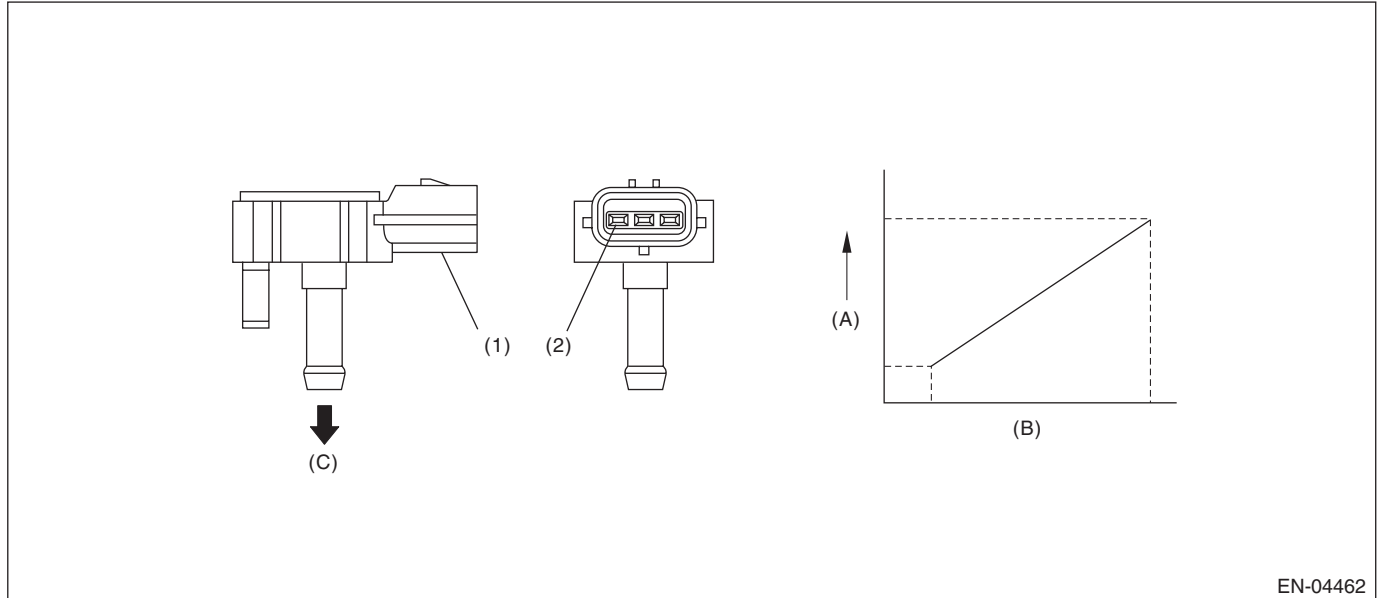
## GENERAL DESCRIPTION

### CI: DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



EN-04462

- (1) Connector
- (2) Terminals

- (A) Output voltage
- (B) Input voltage

- (C) To fuel tank

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	$\geq 5000$ ms
Vehicle speed	$\geq 2$ km/h (1.2 MPH)
All conditions of EVAP canister purge	Completed
Learning value of evaporation gas concentration (left and right)	$< 0.08$
Main feedback compensation coefficient (left and right)	$\geq 0.9$
Battery voltage	$\geq 10.9$ V

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Fuel tank pressure	≥ 7.98 kPa (59.85 mmHg, 2.356 inHg)
Fuel temperature	< 35 °C (95 °F)
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)

**Time Needed for Diagnosis:** 15000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< 7.98 kPa (59.85 mmHg, 2.356 inHg)

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Purge control solenoid valve control: Purge fixed mode is prohibited.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## CJ:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H6DO)-134, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## CK:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

### 1. OUTLINE OF DIAGNOSIS

For the detection standard, refer to DTC P0442. <Ref. to GD(H6DO)-134, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

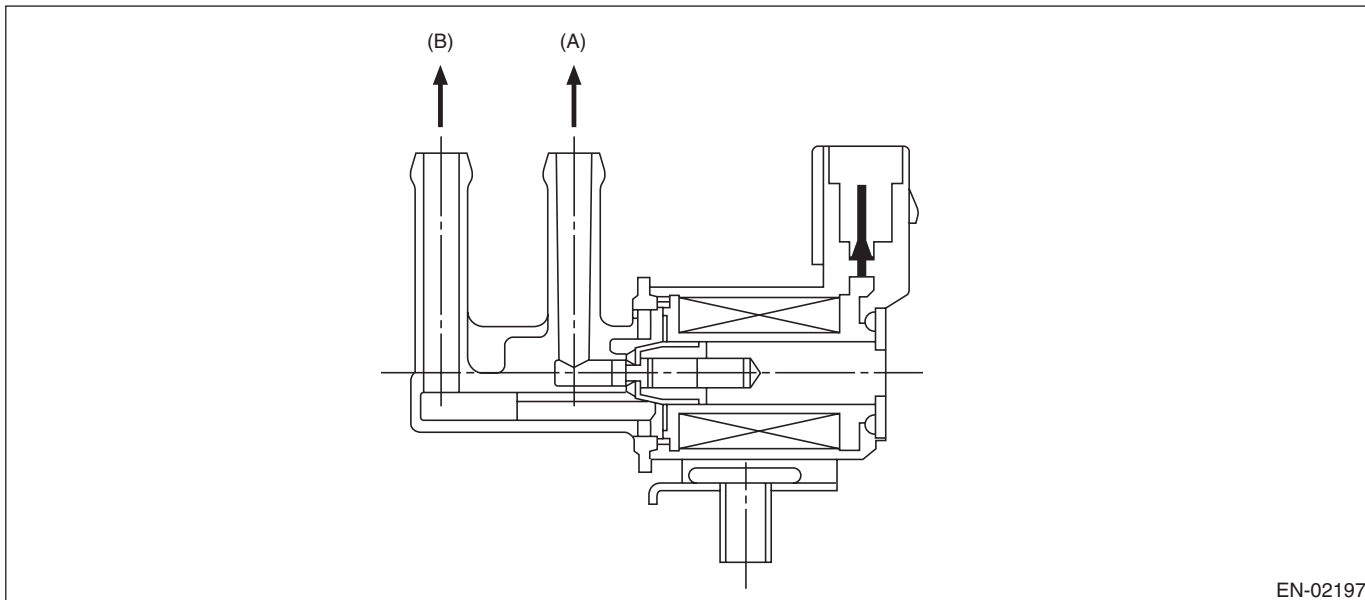
### CL:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Duty ratio of "ON"	< 0.75
Terminal output voltage	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

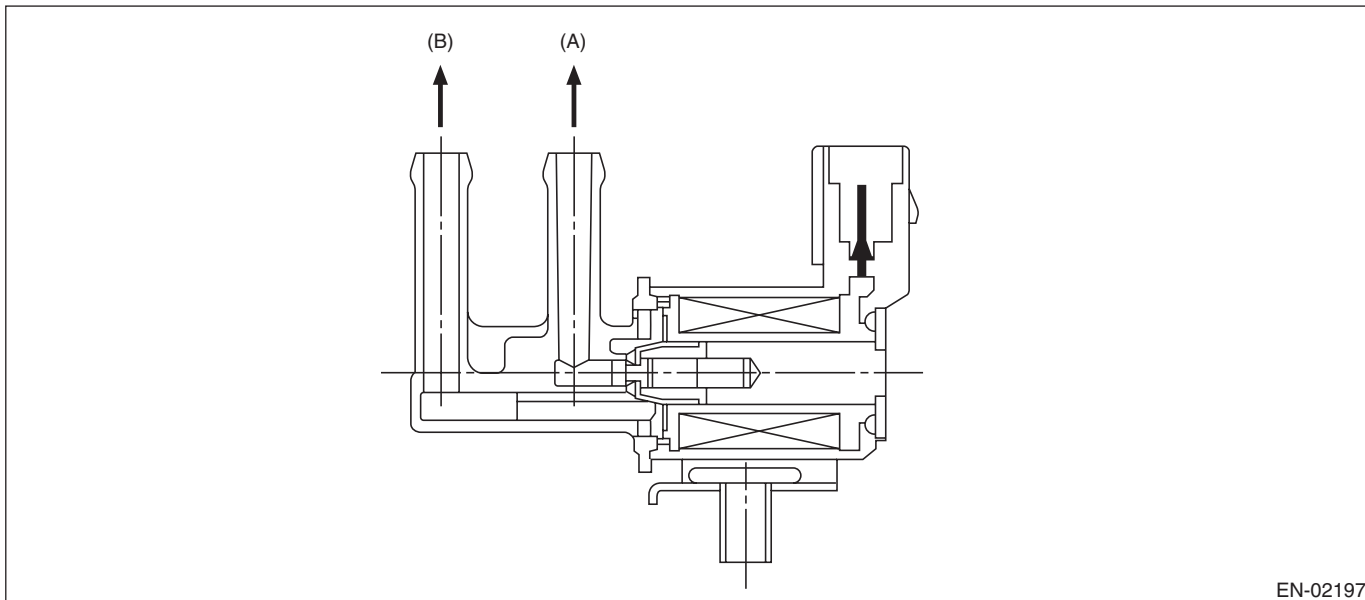
### CM:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

#### 2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Duty ratio of "ON"	≥ 0.25
Terminal output voltage	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

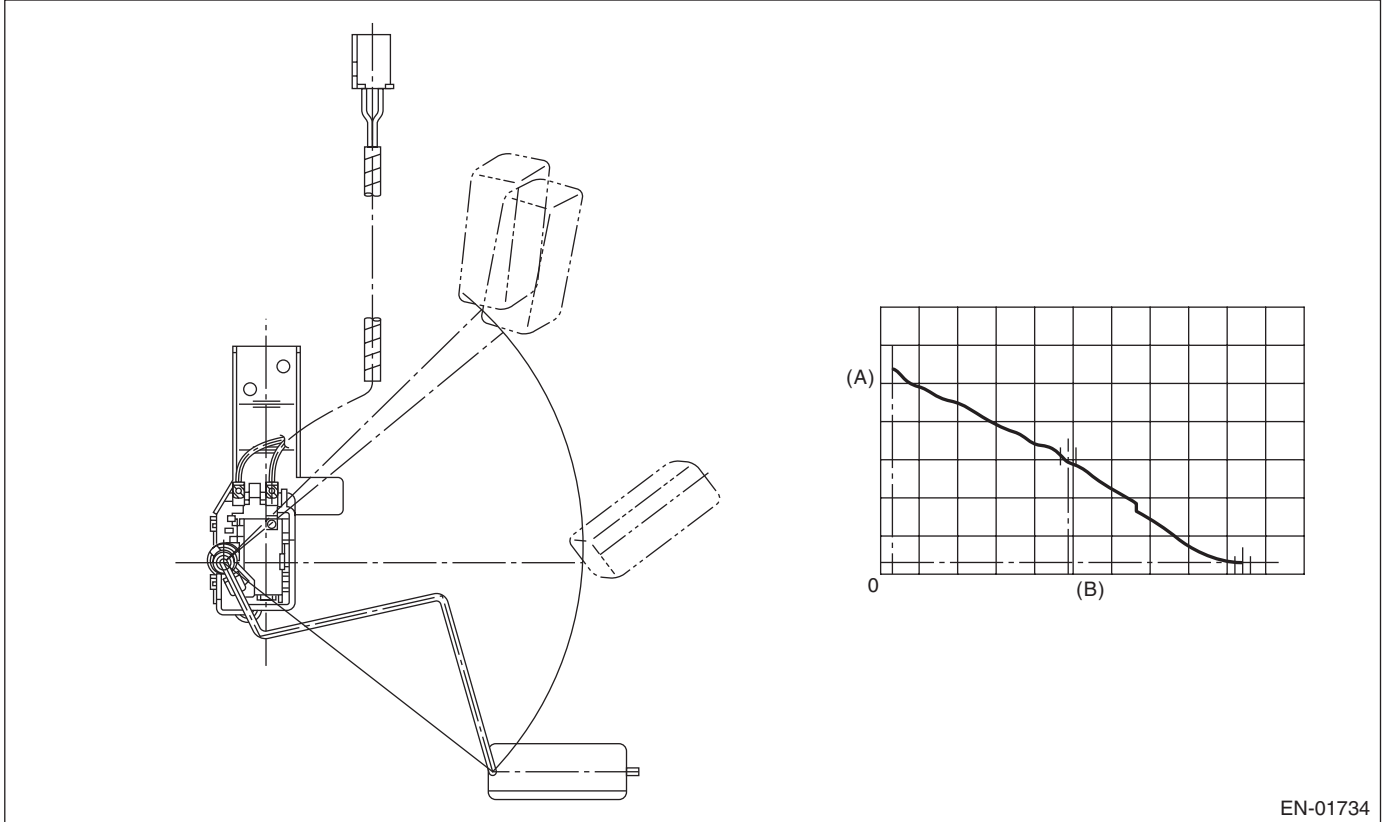
### CN:DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

#### 2. COMPONENT DESCRIPTION



EN-01734

(A) Fuel level

(B) Resistance

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	< 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6500 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Accumulated amount of intake air	≥ 330957 g (11672.853 oz)
Max. – min. values of fuel level output	≥ 2.6 L (0.687 US gal, 0.572 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6500 rpm
Elapsed time after starting the engine	≥ 5000 ms

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

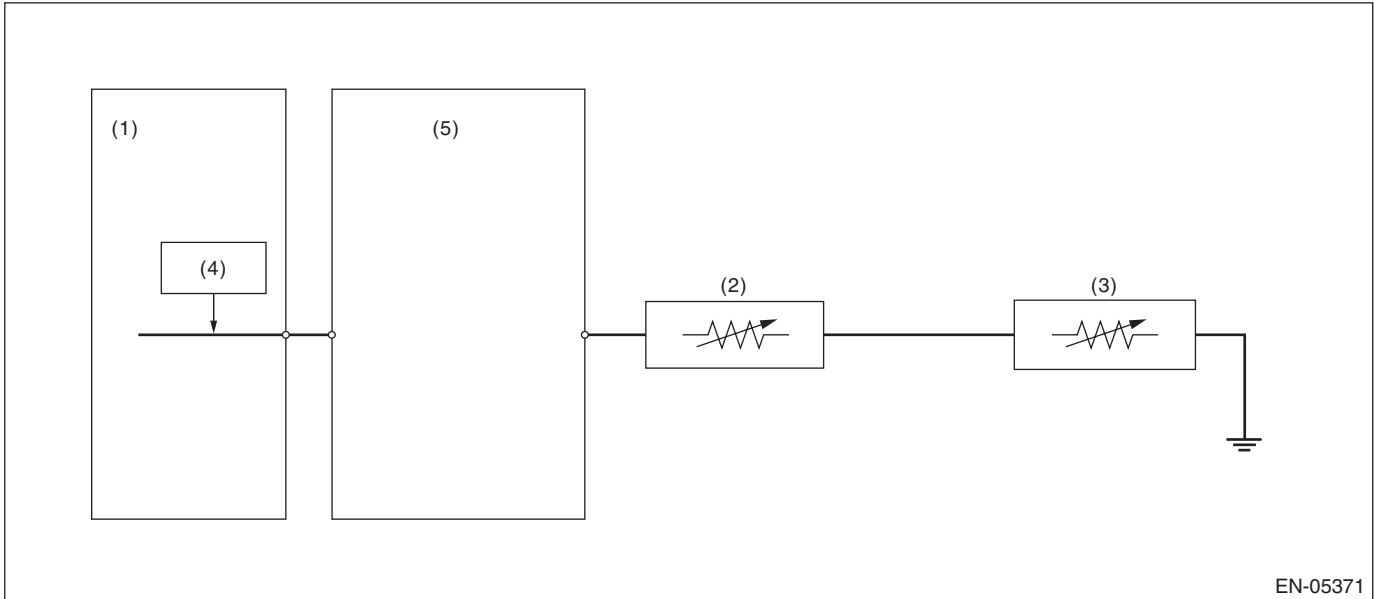
## GENERAL DESCRIPTION

### CO:DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel sub level sensor

(5) Body integrated unit

(2) Fuel level sensor

(4) Detecting circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 0.173$ V

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 0.173$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

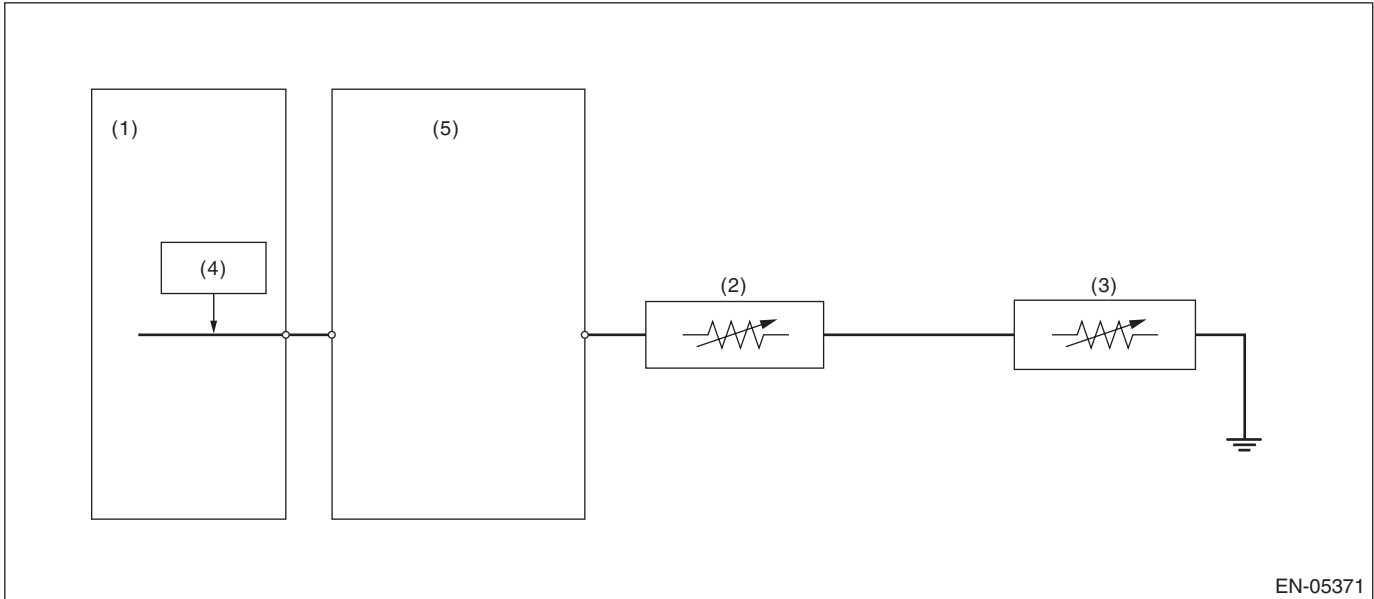
## GENERAL DESCRIPTION

### CP:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel sub level sensor

(5) Body integrated unit

(2) Fuel level sensor

(4) Detecting circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$\geq 7.212$ V

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 3000$ ms
Output voltage	$< 7.212$ V

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### **CQ:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT**

#### **1. OUTLINE OF DIAGNOSIS**

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

#### **2. ENABLE CONDITION**

Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal) and < 54.4 L (14.372 US gal, 11.968 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

#### **3. GENERAL DRIVING CYCLE**

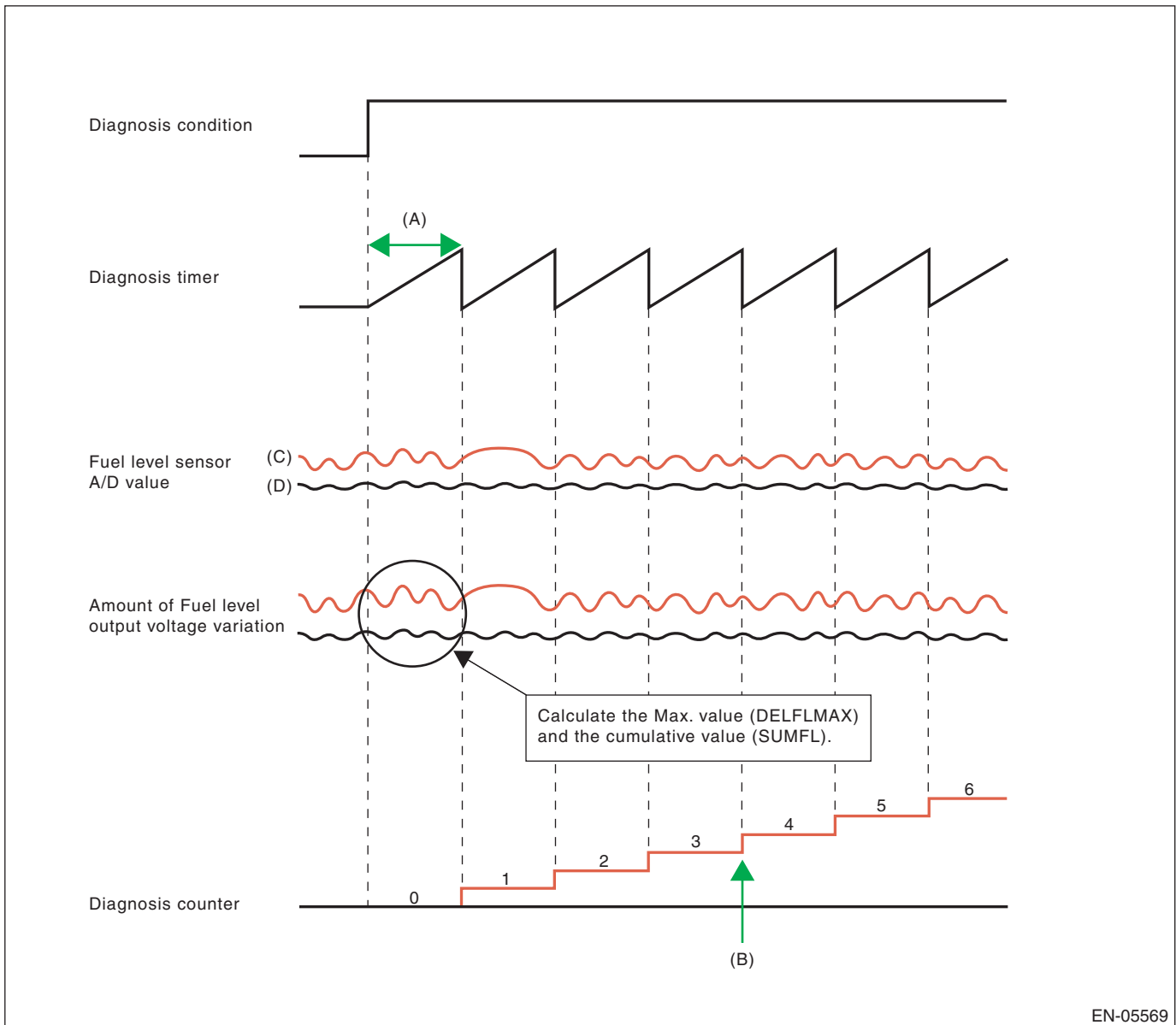
- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 4. DIAGNOSTIC METHOD

Calculate the Max. value (DELFLMAX) and cumulative value (SUMFL) of output voltage variation of fuel level sensor during 12.2 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time.



EN-05569

- (A) 12288 ms
- (B) NG at 4 time

(C) Malfunction

(D) Normal

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, DELFLMAX or SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	≥ 4 time ≥ Value from Map ≥ 25.92 V

#### Map

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.642, 2.2	20, 5.284, 4.4	30, 7.926, 6.6	40, 10.568, 8.8	50, 13.21, 11	60, 15.852, 13.2
Measured voltage (V)	0.27	0.27	0.426	0.582	0.738	0.894	0.894

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

Maximum value – Minimum value of change of tank pressure for 12288 ms	≥ 0.05 kPa (0.375031 mmHg, 0.015 inHg)
Maximum value – Minimum value of battery voltage for 12288 ms	≥ 0.609 V

**Time Needed for Diagnosis:** 12288 ms × 4 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
DELFLMAX SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	< Value from Map < 25.92 V

**Time Needed for Diagnosis:** 12288 ms

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CR:DTC P0500 VEHICLE SPEED SENSOR “A”

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.

Judge NG when the received data from ABSCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

### 2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the ABS control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the ABS control module and hydraulic control unit.

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 2000 ms

### 4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front ABS wheel speed sensor status	Malfunction
Either of the following is established	
Front left wheel speed	≥ 300 km/h (186.4 MPH)
Front right wheel speed	≥ 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Front left wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)
Front right wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)

**Time Needed for Diagnosis:** 2500 ms

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 8. FAIL SAFE

- Accelerator sensor signal process: Not allowed full closed point learning (hold the previous value)
- ABS wheel speed sensor signal process: Vehicle speed = 10 km/h (6 MPH)
- Fuel cut control: Not allowed vehicle speed 0 km/h (0 MPH) fuel cut. Normally the high vehicle speed fuel cut performs on vehicle speed condition and engine speed, but perform the fuel cut only on engine speed condition (4400 rpm or more).
- ISC control: Open loop compensation is set to (1 g (0.04 oz) oz/s) Not allowed ISC feedback volume calculation.
- Air conditioner control: Not allowed air conditioner cut at accelerating.
- Radiator fan control: Both main and sub fan ON drive
- Gear ratio judgment: Gear = Control as fixed in sixth gear

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CS:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 and < 1.1
After switching air conditioner to ON/ OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Actual engine speed — Targeted engine speed	< -100 rpm
Feedback value for ISC	Max.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Actual engine speed — Targeted engine speed	≥ -100 rpm

**Time Needed for Diagnosis:** 10 sec



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Judgment of heavy fuel: Not allowed to make the judgment of heavy fuel

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CT:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Fuel level	≥ 9.6 L (2.536 US gal, 2.112 Imp gal)
Elapsed time after starting the engine	≥ 10.49 sec
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 and < 1.1
After switching air conditioner to ON/ OFF	≥ 5.1 sec
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.181 inHg) or more.	> 5.1 sec
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 sec
Vehicle speed	0 km/h (0 MPH)

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	≥ 200 rpm
Feedback value for ISC	Min.

**Time Needed for Diagnosis:** 10 sec × 3 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	< 200 rpm

**Time Needed for Diagnosis:** 10 sec

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

Judgment of heavy fuel: Not allowed to make the judgment of heavy fuel

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CU:DTC P0512 STARTER REQUEST CIRCUIT

### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.  
Judge as ON NG when the starter SW signal remains ON.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Engine condition	After engine starting
Starter OFF signal	Not detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** 180000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Starter OFF signal	Detected
Battery voltage	$\geq 8 \text{ V}$

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### CV:DTC P0513 INCORRECT IMMOBILIZER KEY

#### 1. OUTLINE OF DIAGNOSIS

DTC	Item	Outline of diagnosis
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
P1570	Antenna	Faulty antenna
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
P1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
P1574	Key Communication Failure	Failure of body integrated unit to verify key (transponder) ID code or transponder failure
P1576	EGI Control Module EEPROM	ECM malfunctioning
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
P1578	Meter Failure	Reference code incompatibility between body integrated unit and combination meter

#### 2. ENABLE CONDITION

When starting the engine.

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

#### 4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CW:DTC P0600 SERIAL COMMUNICATION LINK

### 1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

When CAN communications is not possible, and CAN communications with AT is not possible, judge as NG if data from the AT is not normal.

### 2. COMPONENT DESCRIPTION

ECM and TCM are connected by high speed CAN.

#### *(Common Specifications)*

*CAN Protocol 2.0 B (Active)*

*Frame Format: 11 Bit ID Frame (Standard Frame)*

#### *(High speed CAN)*

*Conforms to ISO11898*

*Communication Speed: 500 kbps*

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	set (error)
or	
ID received from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milliseconds
or	
Data updated from body integrated unit, TCM, ABSCM or VDCCM	None during 500 milliseconds

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	clear (No error)
ID received from body integrated unit, TCM, ABSCM and VDCCM	Yes
Data updated from body integrated unit, TCM, ABSCM and VDCCM	Yes

**Time Needed for Diagnosis:** 1000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## CX:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

When there is a problem in the main CPU normal RAM, or the sub CPU normal RAM, judge as NG. Judge as OK when both are operating properly.

If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

### 3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

### 4. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Write the specified value to RAM and then read.	The written value cannot be read.

**Time Needed for Diagnosis:** Less than 1 second

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Write the specified value to RAM and then read.	The written value can be read.

**Time Needed for Diagnosis:** Less than 1 second

### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 7. FAIL SAFE

None

### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### CY:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

Judge as NG when the following conditions are established.

##### Judgment Value

Malfunction criteria	Threshold value
SUM value of ROM	Standard

##### Time Needed for Diagnosis:

- Main CPU: 16 milliseconds × 32 time
- Sub CPU: 16 milliseconds × 2 time

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

##### Judgment Value

Malfunction criteria	Threshold value
SUM value of ROM	Standard

##### Time Needed for Diagnosis:

- Main CPU: 16 milliseconds × 125 time
- Sub CPU: 16 milliseconds × 2 time

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

#### 7. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

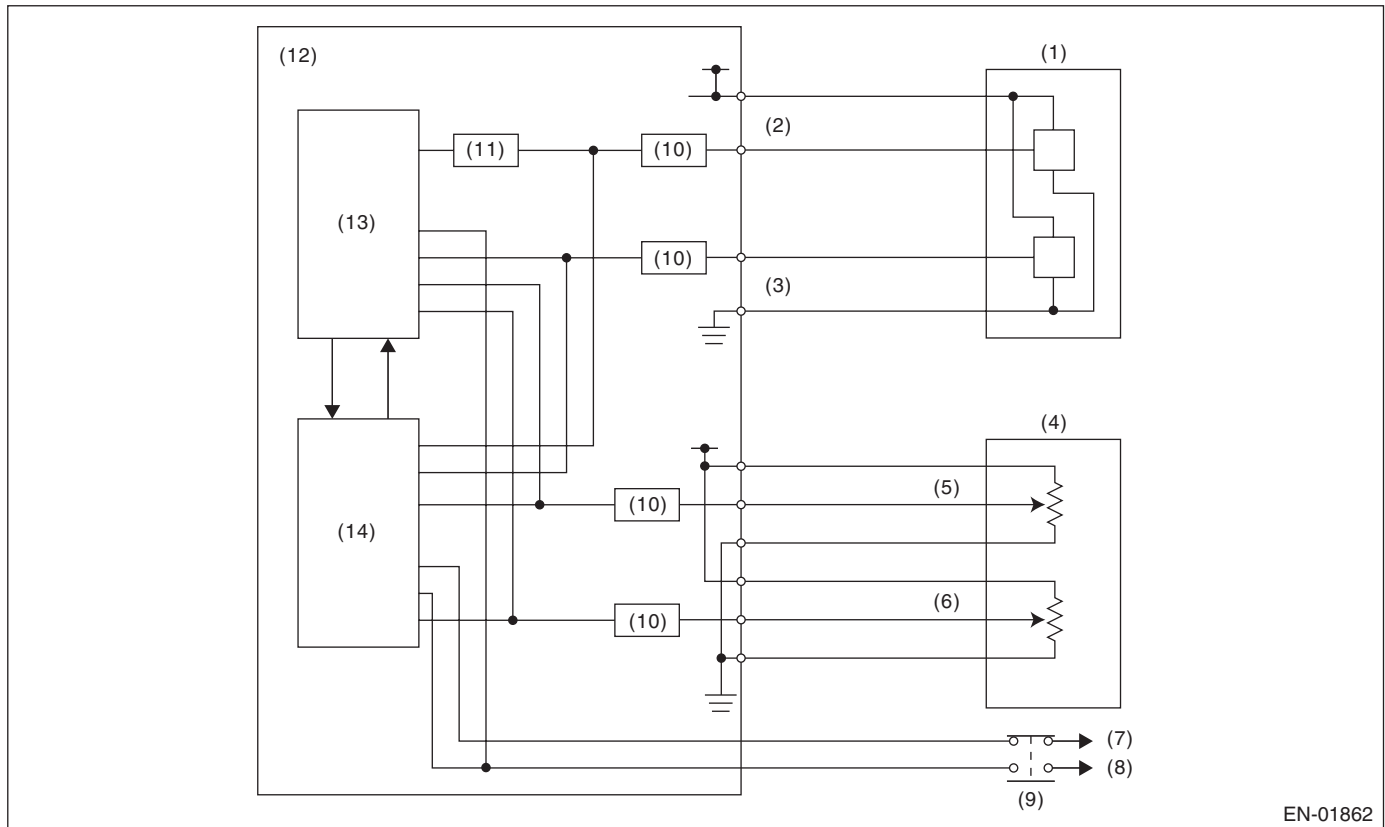
## CZ:DTC P0607 CONTROL MODULE PERFORMANCE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.

- (1) When the read value of throttle position sensor 1 signal is mismatched between main CPU and sub CPU.
- (2) When the read value of accelerator pedal position sensor 1 signal is mismatched between main CPU and sub CPU.
- (3) When the sub CPU operates abnormally.
- (4) When the communication between main CPU ← → sub CPU is abnormal.
- (5) When the input amplifier circuit of throttle position sensor 1 is abnormal.
- (6) When the cruise control cannot be canceled correctly.
- (7) When the signal of brake SW1 and 2 is mismatched.

### 2. COMPONENT DESCRIPTION



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- |   |   |                                  |
|---|---|----------------------------------|
| (1) Throttle position sensor            | (6) Accelerator pedal position sensor 2 | (11) Amplifier circuit           |
| (2) Throttle position sensor 1          | (7) Battery                             | (12) Engine control module (ECM) |
| (3) Throttle position sensor 2          | (8) Stop light                          | (13) Sub CPU                     |
| (4) Accelerator pedal position sensor   | (9) Brake switch                        | (14) Main CPU                    |
| (5) Accelerator pedal position sensor 1 | (10) I/F circuit                        |                                  |

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(1) Battery voltage	$\geq 6 \text{ V}$
(2) Ignition switch	ON
(2) Battery voltage	$\geq 6 \text{ V}$
(3) Ignition switch	ON
(3) Battery voltage	$\geq 6 \text{ V}$
(4) Ignition switch	ON
(4) Battery voltage	$\geq 6 \text{ V}$
(5) Throttle opening angle	
(5) Ignition switch	ON
(5) Battery voltage	$\geq 6 \text{ V}$
(6) Brake switch (only with cruise control)	ON
(6) Ignition switch	ON
(6) Battery voltage	$\geq 6 \text{ V}$
(7) Ignition switch	ON
(7) Battery voltage	$\geq 6 \text{ V}$

### 4. GENERAL DRIVING CYCLE

- (1) — (4): Always perform the diagnosis continuously.  
 (5): Always perform the diagnosis continuously when idling.  
 (6): Perform the diagnosis when the brake pedal is depressed.  
 (7): Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
(1) Difference of CPU reading value of the throttle position sensor signal	$\geq 0.4058 \text{ V}$
(2) Difference of CPU read value of the accelerator pedal position sensor signal	$\geq 0.127542424 \text{ V}$
(3) WD pulse from sub CPU	No WD pulse occur
(4) Communication between CPU	Not possible to communicate
(5)  Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	$\geq 3 \text{ deg}$
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal OFF
(7) Brake switch 1, 2 signal	SW 1 and 2 are not matched

#### Time Needed for Diagnosis:

- (1): 600 msec  
 (2): 830 msec  
 (3): 200 msec  
 (4): 200 msec  
 (5): 24 msec  
 (6): 250 msec  
 (7): 200 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
(1) Difference of CPU reading value of the throttle position sensor signal	< 0.4058 V
(2) Difference of CPU read value of the accelerator pedal position sensor signal	< 0.127542424 V
(3) WD pulse from sub CPU	WD pulse occur
(4) Communication between CPU	Possible to communicate
(5)  Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	< 3 deg
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal ON
(7) Brake switch 1, 2 signal	SW 1 and 2 are matched

### Time Needed for Diagnosis:

- (1): 2000 msec
- (2): 2000 msec
- (3): 2000 msec
- (4): 2000 msec
- (5): 24 msec
- (6): 2000 msec
- (7): 2000 ms

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

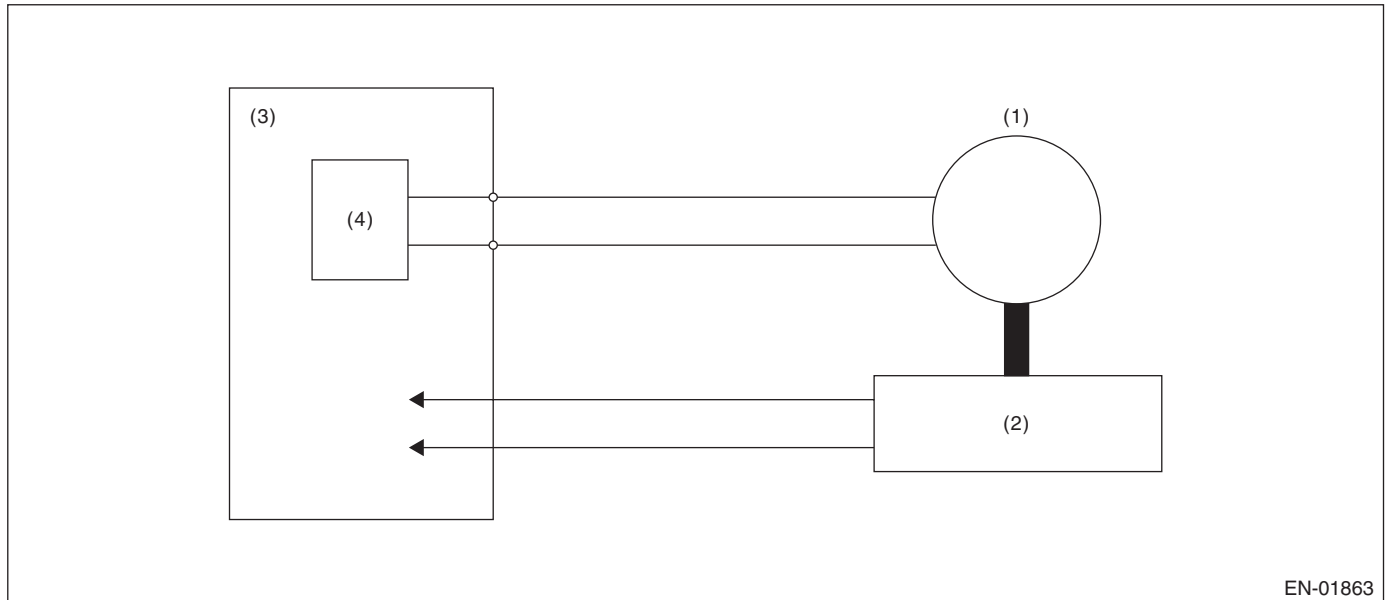
## GENERAL DESCRIPTION

### DA:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

#### 2. COMPONENT DESCRIPTION



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- (1) Motor  
(2) Throttle position sensor  
(3) Engine control module (ECM)  
(4) Drive circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Normal operation of electric throttle control	ON

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electric throttle control is operating.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Difference between target opening angle and actual opening angle	$\geq$ Value of Map 1
Output duty to drive circuit	$\geq 95\%$

#### Map1

Target throttle opening angle ( $^{\circ}$ ) = d	$0 \leq d < 6.15$	$6.15 \leq d < 9.65$	$9.65 \leq d < 14.65$	$14.65 \leq d < 26.65$	$26.65 \leq d$
Difference between target opening angle and actual opening angle ( $^{\circ}$ )	3.5	5	12	25	25

#### Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle: 1000 milliseconds (when target opening angle  $>$  actual opening angle) or value of Map 2 (when target opening angle  $\leq$  actual opening angle)
- Output duty to drive circuit: value of Map 3

#### Map2

Throttle position sensor 1 opening angle ( $^{\circ}$ ) = d	$0 \leq d < 5.5$	$5.5 \leq d < 9$	$9 \leq d < 13$	$13 \leq d < 22$	$22 \leq d$
Judgment time (milliseconds)	1000	400	300	250	250

#### Map 3

Voltage to drive circuit (V)	6	8	10	12	14	16
Judgment time (milliseconds)	2000	2000	2000	2000	2000	2000

### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Difference between target opening angle and actual opening angle	$<$ Value of Map 1
Output duty to drive circuit	$< 95\%$

#### Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle: 2000 msec
- Output duty to drive circuit: 2000 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to  $6^{\circ}$ .)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### DB:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the AT and there is a MIL lighting request.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	Yes

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	None

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## DC:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

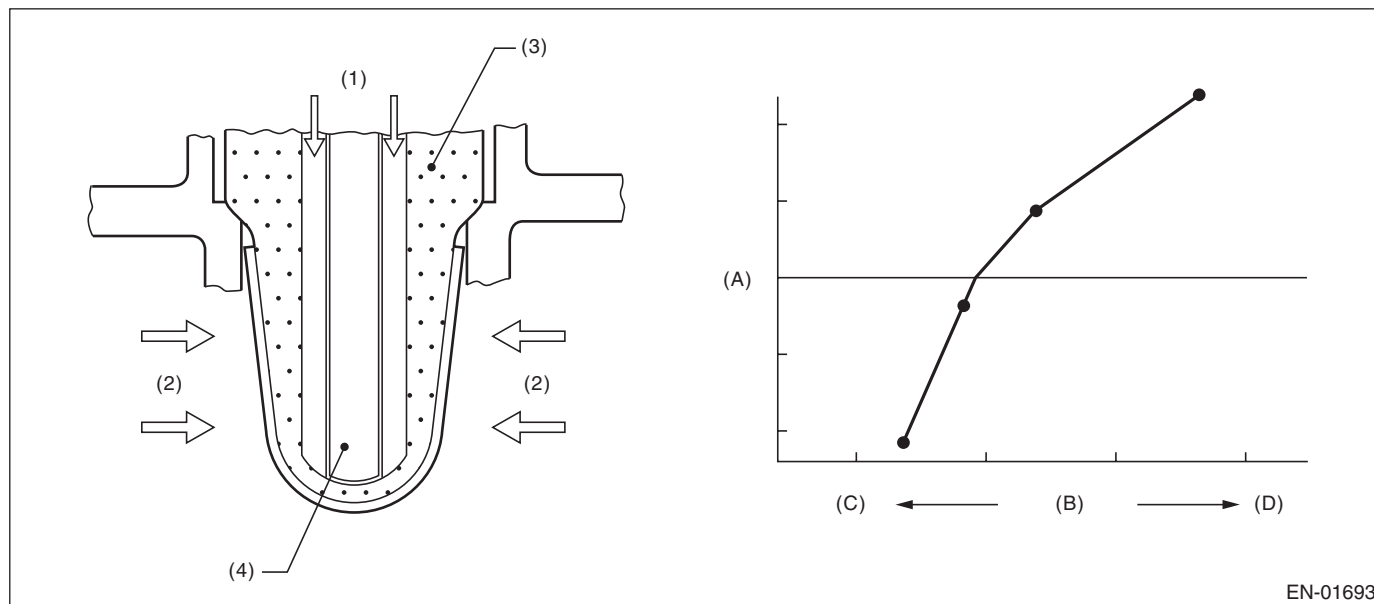
### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains low.

Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio  
 $\lambda > 1$ : Lean  
 $\lambda < 1$ : Rich

### 2. COMPONENT DESCRIPTION



- |                      |                         |
|----------------------|-------------------------|
| (1) Atmosphere       | (A) Electromotive force |
| (2) Exhaust gas      | (B) Air fuel ratio      |
| (3) ZrO <sub>2</sub> | (C) Lean                |
| (4) Ceramic heater   | (D) Rich                |

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# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	–0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 8 g/s (0.282 oz/s)
Load change at 120°C	< 0.02 g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 sec
Targeted lambda value load compensation coefficient	–0.050 — 0.050

### 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
λ value	< 0.85

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
λ value	≥ 0.85

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Rear oxygen sensor sub learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.06 → 0.
- Purge control: Not allowed to purge.

## 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### DD:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

#### 1. OUTLINE OF DIAGNOSIS

Detect that  $\lambda$  value remains high.

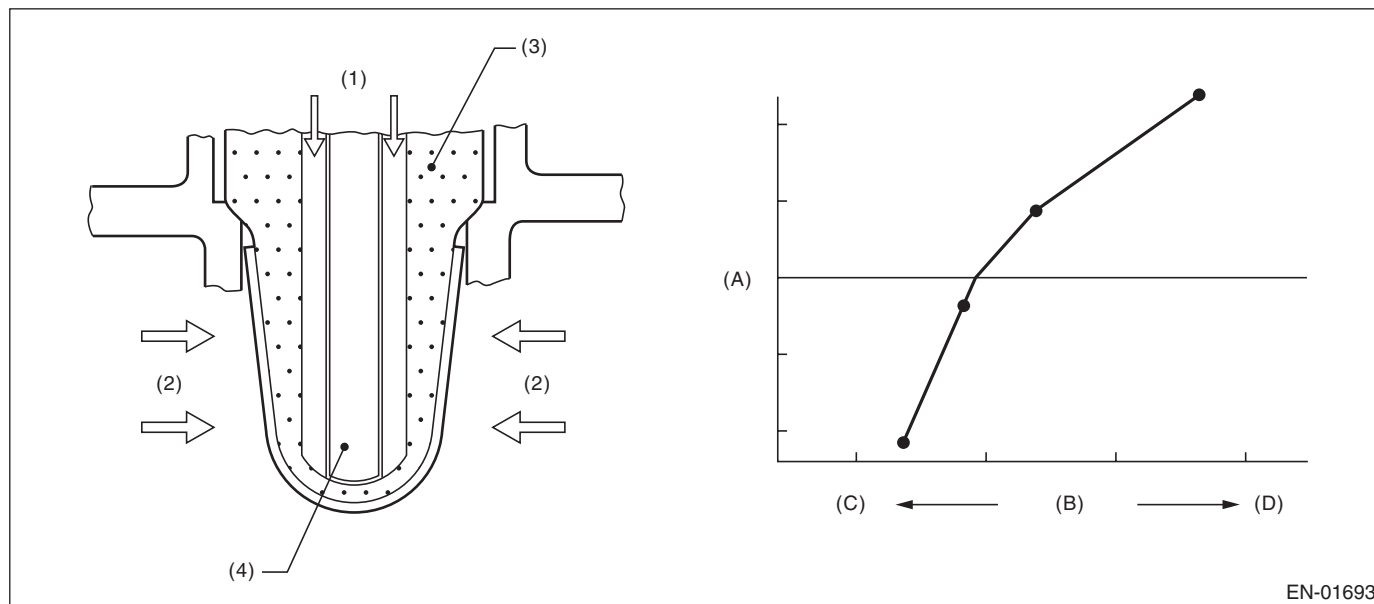
Judge as NG when lambda value is abnormal in accordance with  $\lambda$  value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

$\lambda$  value = Actual air fuel ratio/Theoretical air fuel ratio

$\lambda > 1$ : Lean

$\lambda < 1$ : Rich

#### 2. COMPONENT DESCRIPTION



EN-01693

- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO<sub>2</sub>
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	–0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 8 g/s (0.282 oz/s)
Load change at 120°CA	< 0.02 g/rev (0.001 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 sec
Targeted lambda value load compensation coefficient	–0.050 — 0.050

## 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
λ value	> 1.15

**Time Needed for Diagnosis:** 10000 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
λ value	≤ 1.15

**Time Needed for Diagnosis:** Less than 1 second

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Rear oxygen sensor sub learning compensation: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.06 → 0.
- Purge control: Not allowed to purge.

### 9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

## **DE:DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

For the detection standard, refer to DTC P1152. <Ref. to GD(H6DO)-191, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DF:DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1)**

### 1. OUTLINE OF DIAGNOSIS

#### NOTE:

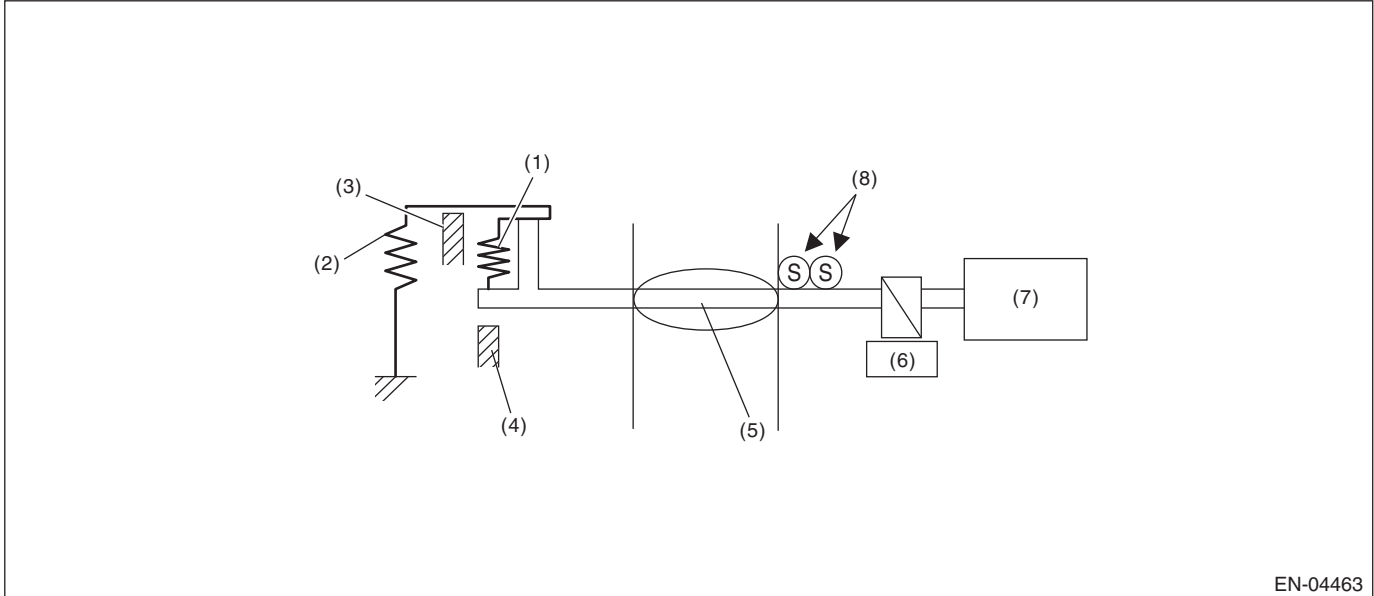
For the detection standard, refer to DTC P1153. <Ref. to GD(H6DO)-194, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## DG:DTC P1160 RETURN SPRING FAILURE

### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

### 2. COMPONENT DESCRIPTION



EN-04463

- |                          |                         |   |
|--------------------------|-------------------------|---|
| (1) Opener spring        | (4) Full closed stopper | (7) DC motor                              |
| (2) Return spring        | (5) Throttle valve      | (8) Main and sub throttle position sensor |
| (3) Intermediate stopper | (6) Gear                |   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Throttle position sensor	Normal

### 4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

Judge as NG when the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Opening variation after continuity is set to OFF	< 2 deg

**Time Needed for Diagnosis:** 24 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

#### Judgment Value

Malfunction criteria	Threshold value
Opening variation after continuity is set to OFF	$\geq 2$ deg

**Time Needed for Diagnosis:** 3400 msec

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

### 8. FAIL SAFE

Throttle opening is fixed to 6°.

### 9. ECM OPERATION AT DTC SETTING

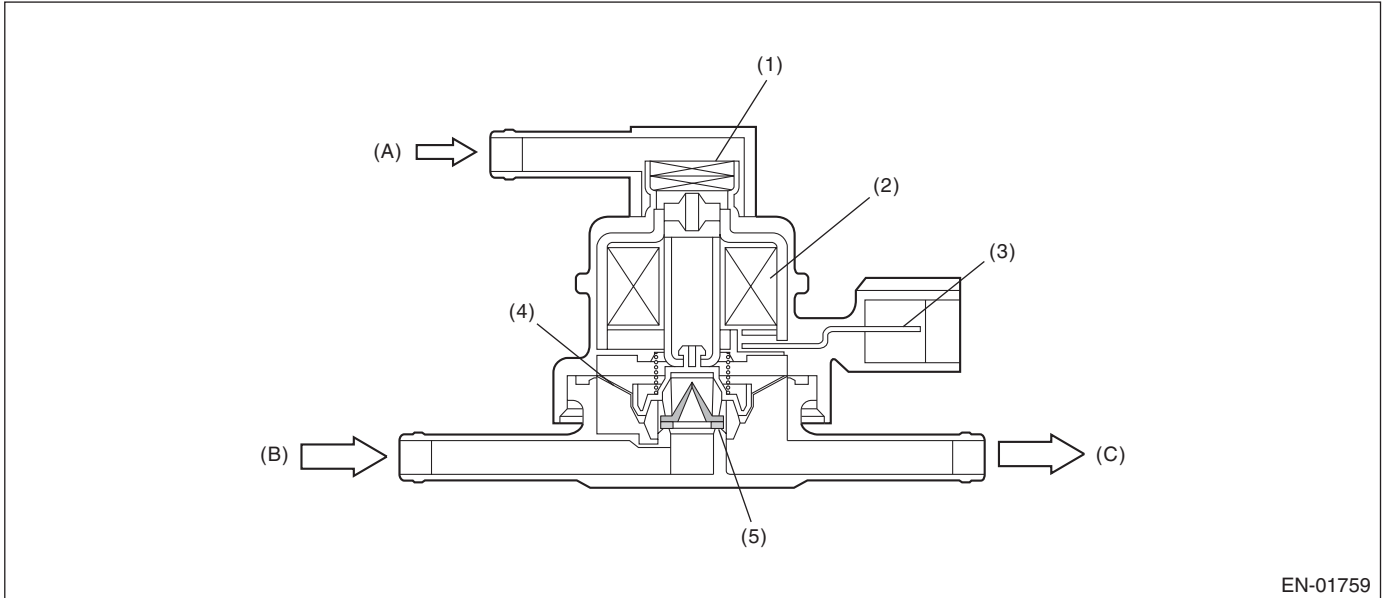
Memorize the freeze frame data. (For test mode \$02)

## DH:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.  
 Judge as NG when ECM output level is different from actual terminal level.

### 2. COMPONENT DESCRIPTION



EN-01759

- |                        |               |                         |
|------------------------|---------------|-------------------------|
| (1) Filter             | (4) Diaphragm | (A) Barometric pressure |
| (2) Coil               | (5) Valve     | (B) Shut-off valve      |
| (3) Connector terminal |               | (C) To fuel tank        |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	Low

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs OFF signal	High

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

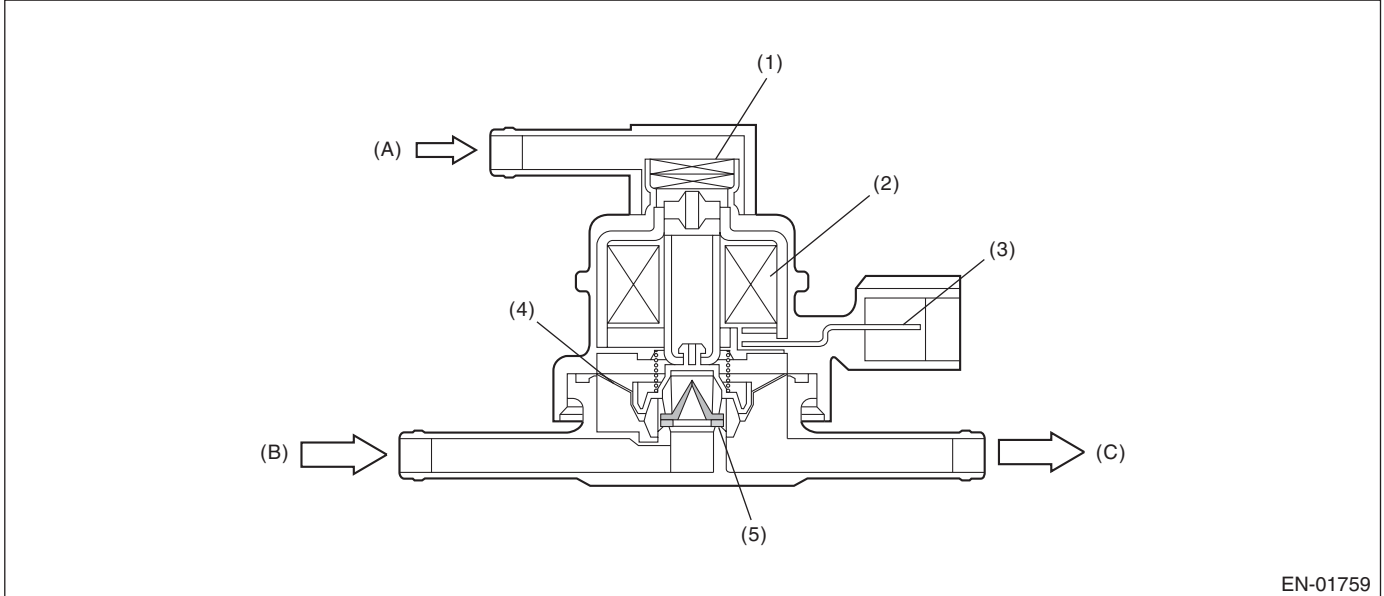
## DI: DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

### 2. COMPONENT DESCRIPTION



(1) Filter

(2) Coil

(3) Connector terminal

(4) Diaphragm

(5) Valve

(A) Barometric pressure

(B) Shut-off valve

(C) To fuel tank

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	High

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Elapsed time after starting the engine	$\geq 1$ second
Terminal output voltage when ECM outputs ON signal	Low

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

None

### 9. ECM OPERATION AT DTC SETTING

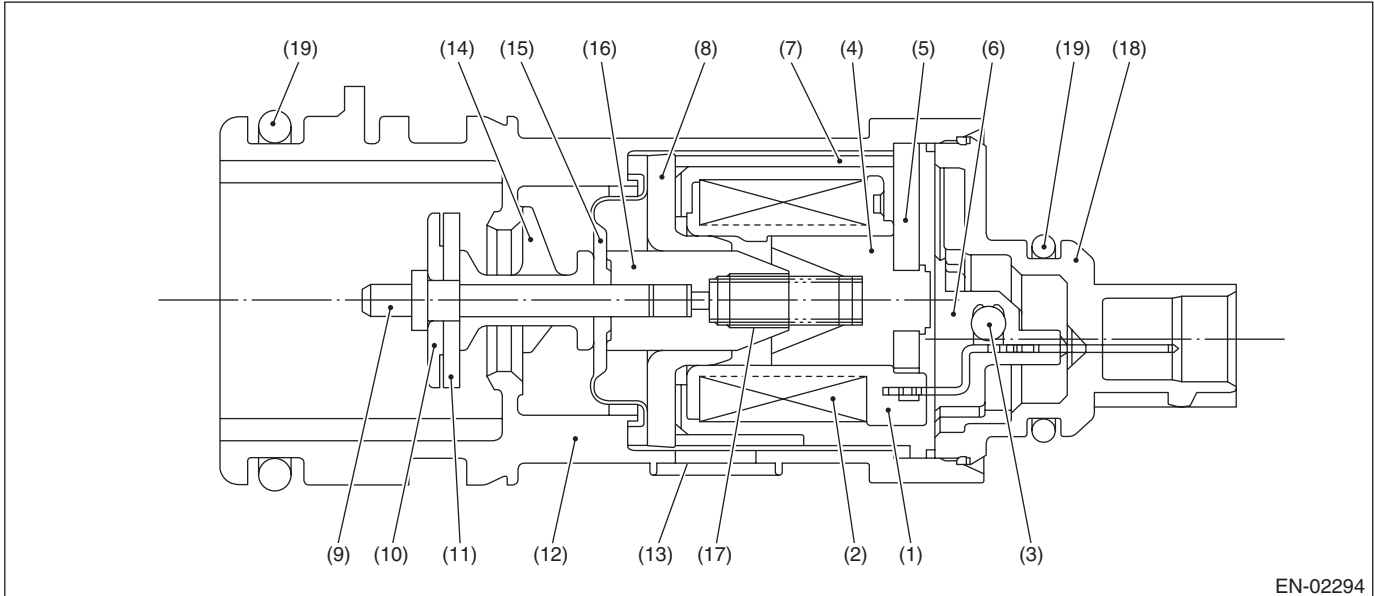
Memorize the freeze frame data. (For test mode \$02)

## DJ:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

### 1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.  
 Judge as NG when fuel tank pressure is low.

### 2. COMPONENT DESCRIPTION



- |                 |                    |                   |
|-----------------|--------------------|-------------------|
| (1) Bobbin      | (8) Magnetic plate | (14) Retainer     |
| (2) Coil        | (9) Shaft          | (15) Diaphragm    |
| (3) Diode       | (10) Plate         | (16) Movable core |
| (4) Stator core | (11) Valve         | (17) Spring       |
| (5) End plate   | (12) Housing       | (18) Cover        |
| (6) Body        | (13) Filter        | (19) O-ring       |
| (7) Yoke        |                    |                   |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Drain valve	Open
Battery voltage	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75.05 \text{ kPa}$ (563 mmHg, 22.165 inHg)
Tank pressure when starter is OFF → ON	$-0.43 \text{ kPa}$ ( $-3.2 \text{ mmHg}$ , $-0.126 \text{ inHg}$ ) and $1.43 \text{ kPa}$ (10.7 mmHg, 0.421 inHg)

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$\leq -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)

**Time Needed for Diagnosis:** 3000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	$> -4$ kPa ( $-30$ mmHg, $-1.181$ inHg)
Cumulative time when all the malfunction criteria below are met.	$\geq 30000$ ms
Purge control solenoid valve duty	Not = 0
Fuel temperature	$-10$ °C ( $14$ °F) — $55$ °C ( $131$ °F)
Intake manifold relative pressure	$\geq -26.66$ kPa ( $-200$ mmHg, $-7.874$ inHg)

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Pressure control solenoid valve control: Open the pressure control solenoid valve.

### 9. ECM OPERATION AT DTC SETTING

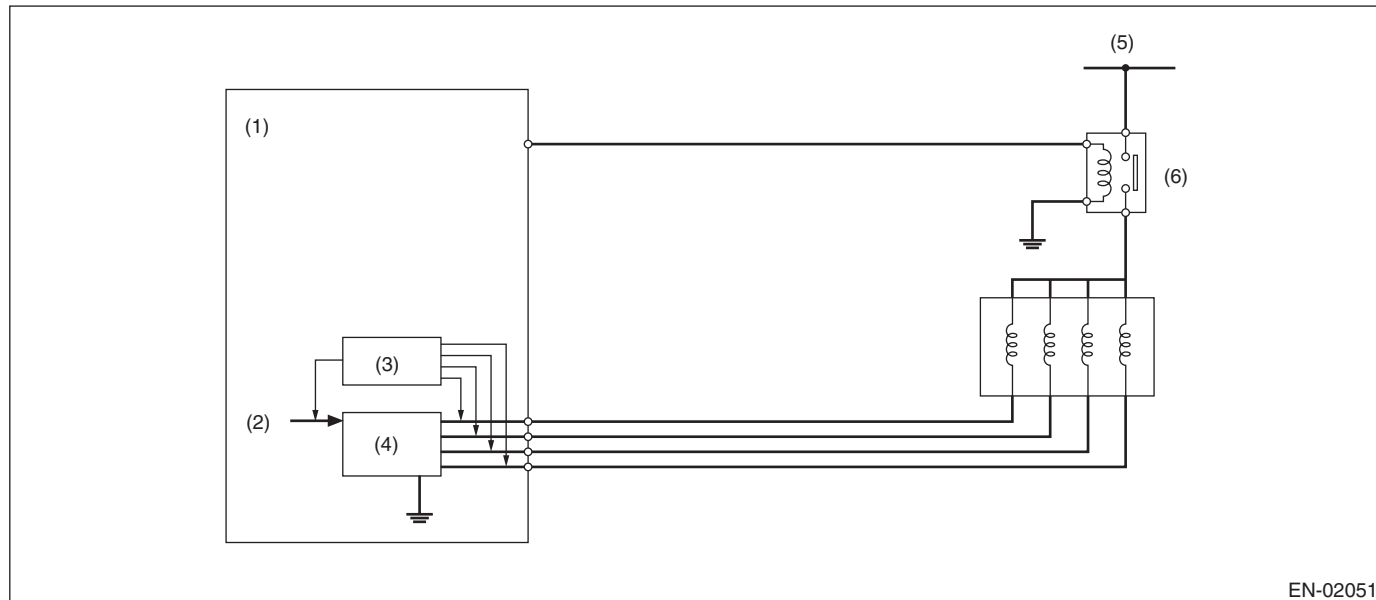
Memorize the freeze frame data. (For test mode \$02)

## DK:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

### 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



EN-02051

- |                                 |                       |                     |
|---------------------------------|-----------------------|---------------------|
| (1) Engine control module (ECM) | (3) Detecting circuit | (5) Battery voltage |
| (2) Computer unit (CPU)         | (4) Switch circuit    | (6) Main relay      |

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

### 4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Terminal voltage level when ECM outputs OFF signal	Low level

**Time Needed for Diagnosis:** 4 ms × 625 time

**Malfunction Indicator Light:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Terminal voltage level when ECM outputs OFF signal	High level

**Time Needed for Diagnosis:** 4 ms × 2 time

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Knock sensor learning compensation: Calculation prohibited.
- EGR control: Operation prohibited.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

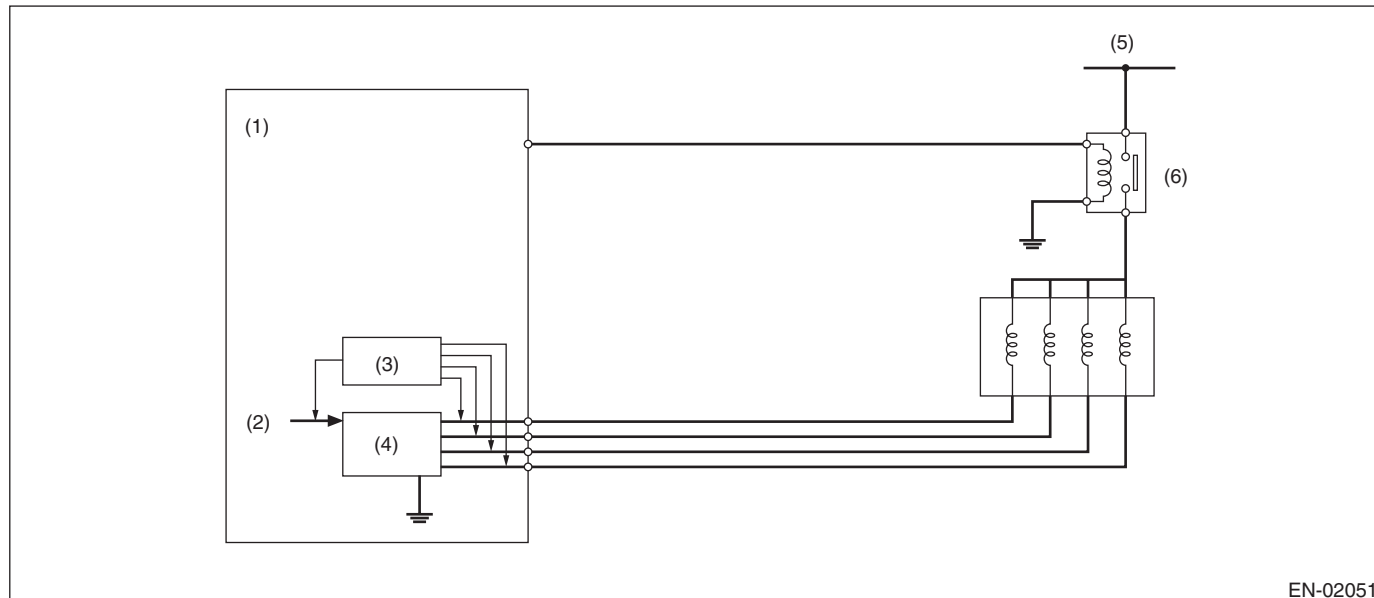
GENERAL DESCRIPTION

## DL:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

### 1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Detecting circuit

(5) Battery voltage

(2) Computer unit (CPU)

(4) Switch circuit

(6) Main relay

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	$\geq 1$ second
EGR valve target position	$> 0$ step
Battery voltage	$\geq 10.9$ V

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

---

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Terminal voltage level when ECM outputs ON signal	High level

**Time Needed for Diagnosis:** 4 ms × 625 time

**Malfunction Indicator Light:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Terminal voltage level when ECM outputs ON signal	Low level

**Time Needed for Diagnosis:** 4 ms × 2 time

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

- Front oxygen (A/F) sensor main learning compensation: Not allowed to calculate.
- Knock sensor learning compensation: Calculation prohibited.
- EGR control: Operation prohibited.

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **DM:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1492. <Ref. to GD(H6DO)-205, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DN:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1493. <Ref. to GD(H6DO)-207, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DO:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1492. <Ref. to GD(H6DO)-205, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DP:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1493. <Ref. to GD(H6DO)-207, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DQ:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1492. <Ref. to GD(H6DO)-205, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DR:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)**

### **1. OUTLINE OF DIAGNOSIS**

#### **NOTE:**

For the detection standard, refer to DTC P1493. <Ref. to GD(H6DO)-207, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### DS:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.  
Judge as NG when the backup power voltage is low.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	Low
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** 2500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	High
Battery voltage	$\geq 10.9$ V
Engine condition	After engine starting

**Time Needed for Diagnosis:** Less than 1 second

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 7. FAIL SAFE

None

#### 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## **DT:DTC P1570 ANTENNA**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DU:DTC P1571 REFERENCE CODE INCOMPATIBILITY**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DV:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DW:DTC P1574 KEY COMMUNICATION FAILURE**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DX:DTC P1576 EGI CONTROL MODULE EEPROM**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DY:DTC P1577 IMM CONTROL MODULE EEPROM**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## **DZ:DTC P1578 METER FAILURE**

### **1. OUTLINE OF DIAGNOSIS**

**NOTE:**

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-180, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### EA:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

#### 1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.

Judge as NG if there is exhaust gas temperature diagnosis and idle speed diagnosis and if either of them is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Barometric pressure	≥ 75.05 kPa (563 mmHg, 22.165 inHg)
Battery voltage	≥ 10.9 V
Cold start diagnosis	Incomplete
Vehicle speed	< 2 km/h (1.2 MPH)
Misfire within 200 engine revs.	< 7
Time after starting	= 14 seconds

#### 3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

#### 4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

##### Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Estimated exhaust gas temperature	< Value from Map

##### Map

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold Value	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	155 °C (311 °F)	150 °C (302 °F)	155 °C (311 °F)	140 °C (284 °F)	133 °C (271.4 °F)	130 °C (266 °F)

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

##### Judgment Value

Malfunction criteria	Threshold value
Estimated exhaust gas temperature	≥ Value from Map

**Time Needed for Diagnosis:** Less than 1 second

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## • Idle speed diagnosis

### Abnormality Judgment

Judge as NG when the following conditions are established after the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Continuous time of (Target engine speed – Actual engine speed > –200 rpm)	≥ 6000 ms
Continuous time of (actual retard amount > 20 °CA)	≥ 0 ms

**Time Needed for Diagnosis:** 14 seconds

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

### Judgment Value

Malfunction criteria	Threshold value
Continuous time of (Target engine speed – Actual engine speed > –200 rpm)	< 6000 ms
Continuous time of (actual retard amount > 20 °CA)	< 0 ms

**Time Needed for Diagnosis:** Less than 1 second

## 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

## 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

## 7. FAIL SAFE

None

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### EB:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil flow control solenoid valve.  
Judge as NG when the current is small even though the duty signal is large.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Oil flow control solenoid valve control duty	$\geq 99.61$ %
Oil control solenoid valve control present current	$< 0.306$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Target current value of the oil flow control solenoid valve	$\geq 0.14$ A
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

---

## 7. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment → abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control:
  - Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
  - ⇒ ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  - Make the oil flow control solenoid valve driving duty a predetermined value (9.36%).

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### EC:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

#### 1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control solenoid valve.

Judge as NG when the current is large even though the duty signal is small.

#### 2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 4. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Oil flow control solenoid valve control duty	$< 0.39$ %
Oil control solenoid valve control present current	$\geq 0.306$ A

**Time Needed for Diagnosis:** 2000 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Battery voltage	$\geq 10.9$ V
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08$ A

**Time Needed for Diagnosis:** 2000 ms

#### 5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 7. FAIL SAFE

- Ignition timing whole learning compensation:
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  - Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment → abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  - Enter the initial value (0° CA) to the compensation value of partial learning zone with IG OFF.
  - Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment → abnormality judgment.
- AVCS control:
  - Maximum timing retard learning is not complete or maximum timing retard learning completion is not experienced.
  - ⇒ ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  - Make the oil flow control solenoid valve driving duty a predetermined value (9.36%).

## 8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

### **ED:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)**

#### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2088. <Ref. to GD(H6DO)-214, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

### **EE:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)**

#### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2089. <Ref. to GD(H6DO)-216, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

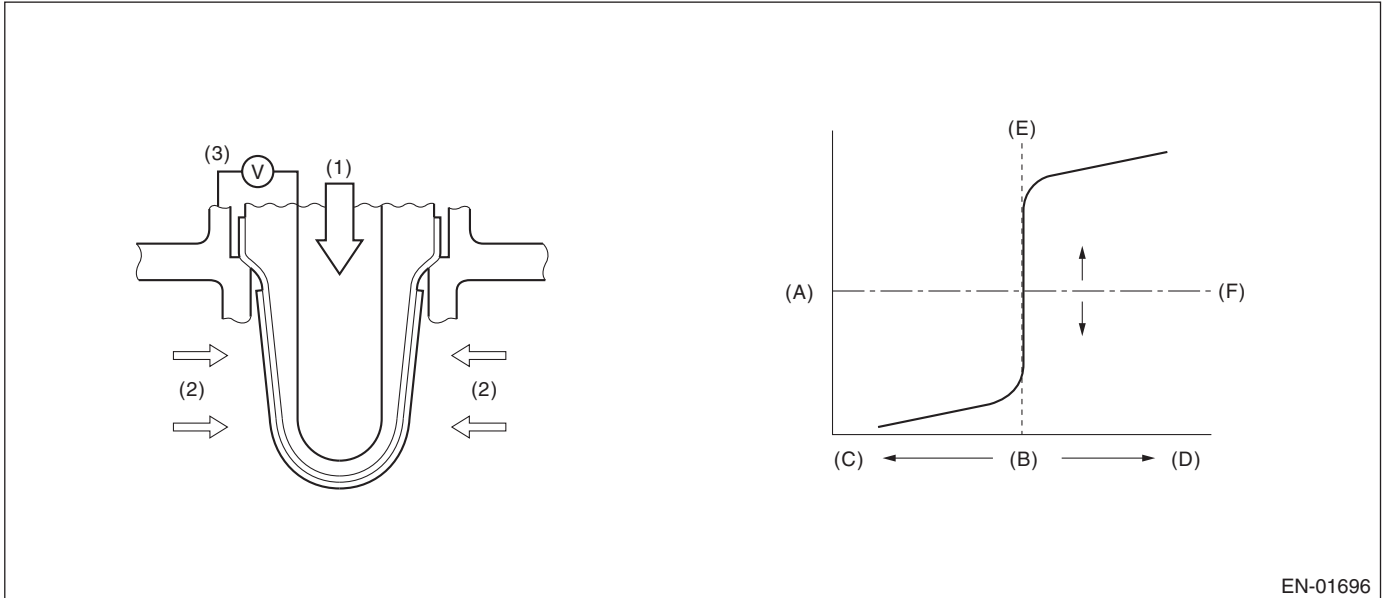
## GENERAL DESCRIPTION

### EF:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.  
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

#### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 sec

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sub feedback learning value	< -0.03

**Time Needed for Diagnosis:** 5 sec × 1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sub feedback learning value	≥ -0.03 + 0

**Time Needed for Diagnosis:** 5 sec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

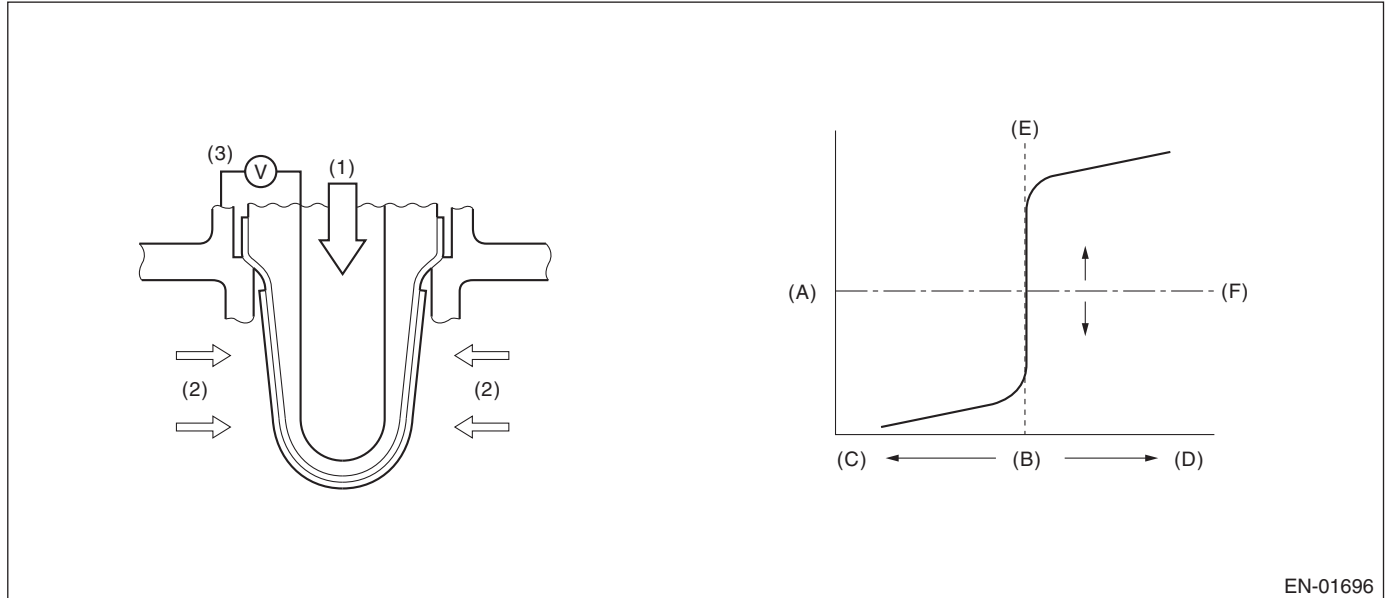
## GENERAL DESCRIPTION

### EG:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.  
Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

#### 2. COMPONENT DESCRIPTION



EN-01696

- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Rich

- (D) Lean
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 sec

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sub feedback learning value	$\geq 0.04$

**Time Needed for Diagnosis:** 5 sec  $\times$  1 time

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sub feedback learning value	$< 0.04 + 0$

**Time Needed for Diagnosis:** 5 sec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When similar driving conditions are repeated 3 times and the result is OK.
- When "Clear Memory" is performed

## 8. FAIL SAFE

None

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

## EH:DTC P2098 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2096. <Ref. to GD(H6DO)-218, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

## EI: DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2

### 1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2097. <Ref. to GD(H6DO)-220, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

# Diagnostic Trouble Code (DTC) Detecting Criteria

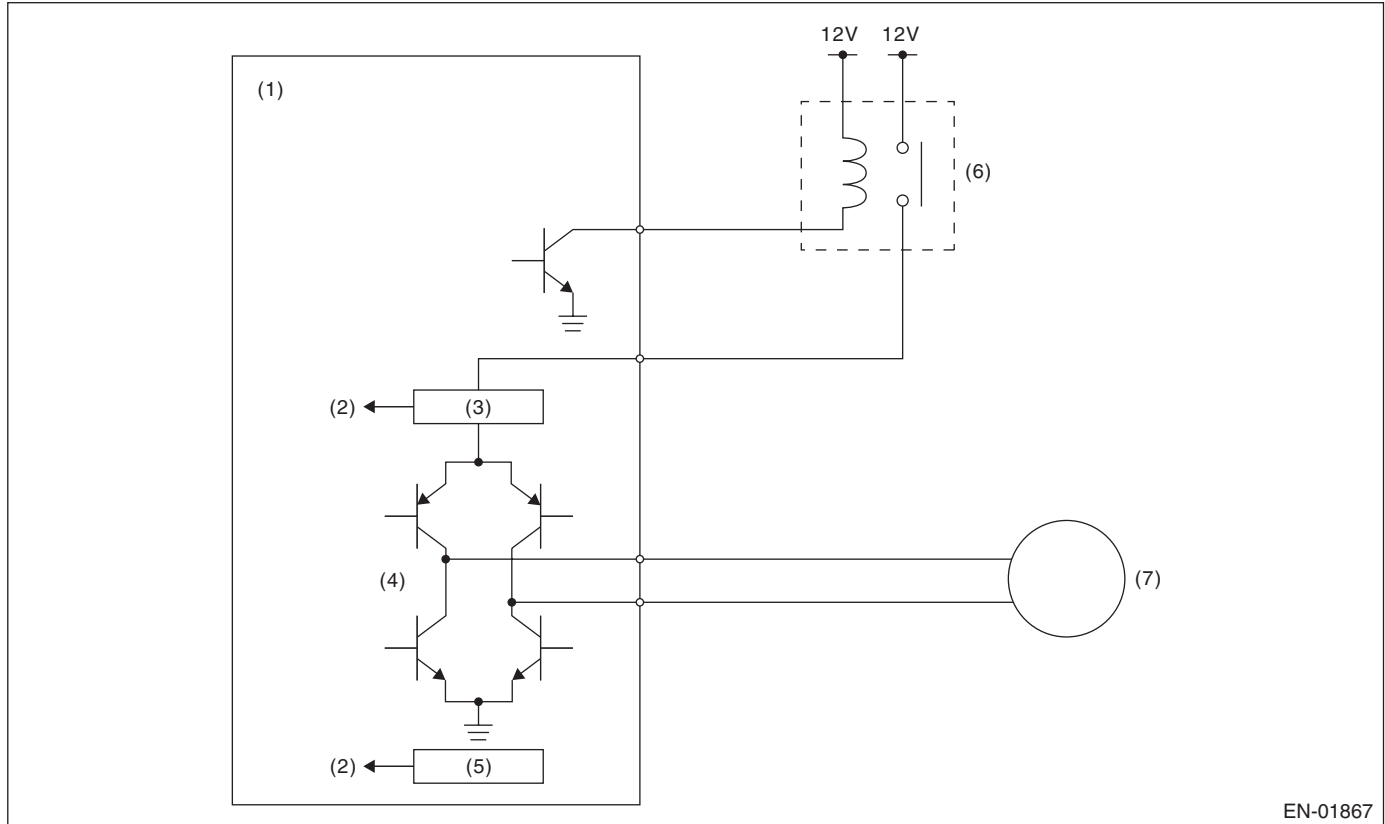
## GENERAL DESCRIPTION

### EJ:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

#### 2. COMPONENT DESCRIPTION



EN-01867

- |                                   |                                   |                                       |
|-----------------------------------|-----------------------------------|---------------------------------------|
| (1) Engine control module (ECM)   | (4) Drive circuit                 | (6) Electronic throttle control relay |
| (2) Detecting circuit             | (5) Temperature detection circuit | (7) Motor                             |
| (3) Overcurrent detection circuit |                                   |                                       |

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON
CPU communication line sub → main normal judgment	Normal

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Motor current or Drive circuit inner temperature	> 8 A  > 175°C (347°F)

**Time Needed for Diagnosis:** 500 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction Criteria	Threshold Value
Motor current Drive circuit inner temperature	≤ 8 A ≤ 175°C (347°F)

**Time Needed for Diagnosis:** 2000 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

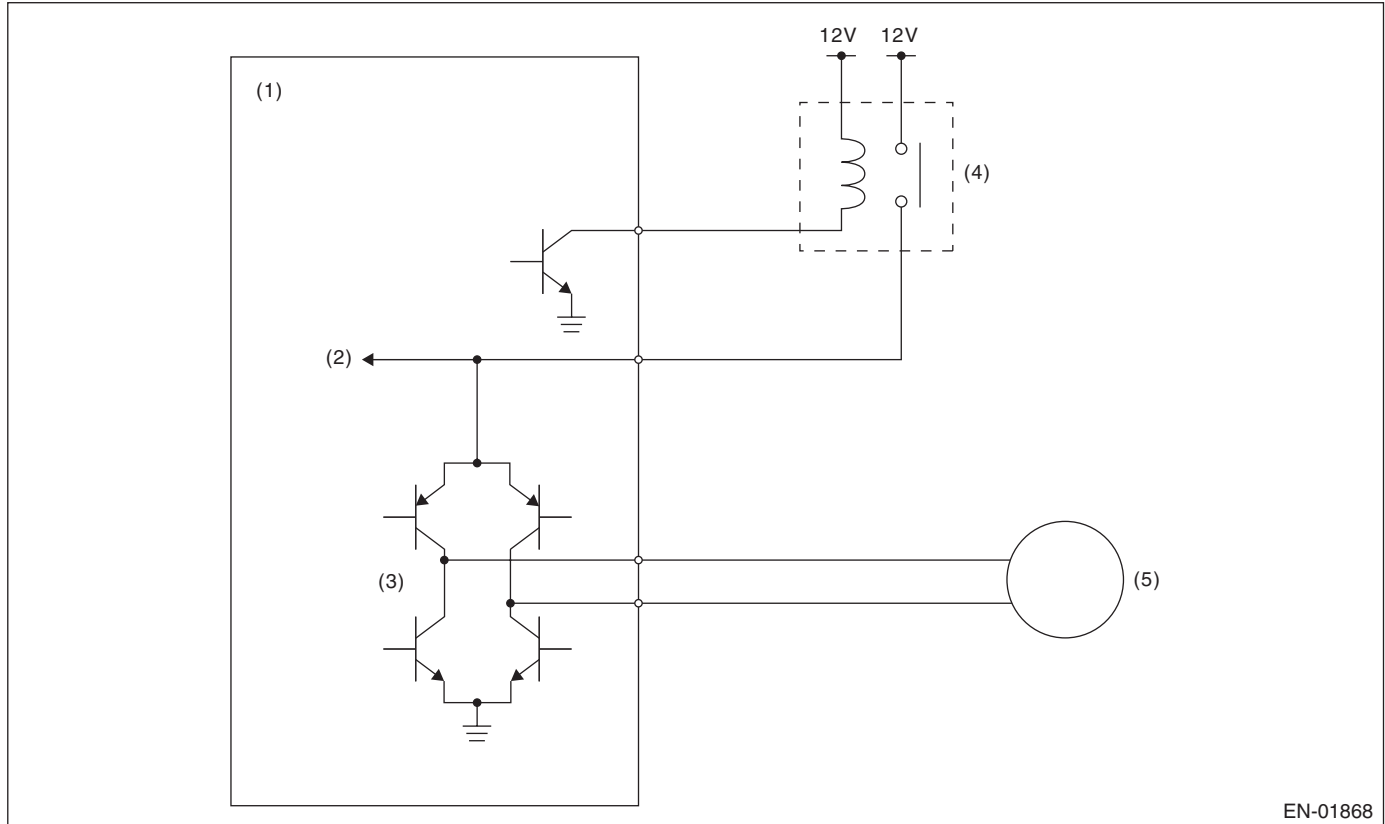
## GENERAL DESCRIPTION

### EK:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)  
(2) Voltage detection circuit

(3) Drive circuit  
(4) Electronic throttle control relay

(5) Motor

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 11$ V
Electronic throttle control relay output	ON

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Motor power voltage	$\leq 5$ V

**Time Needed for Diagnosis:** 400 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Motor power voltage	$> 5$ V

**Time Needed for Diagnosis:** 2000 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

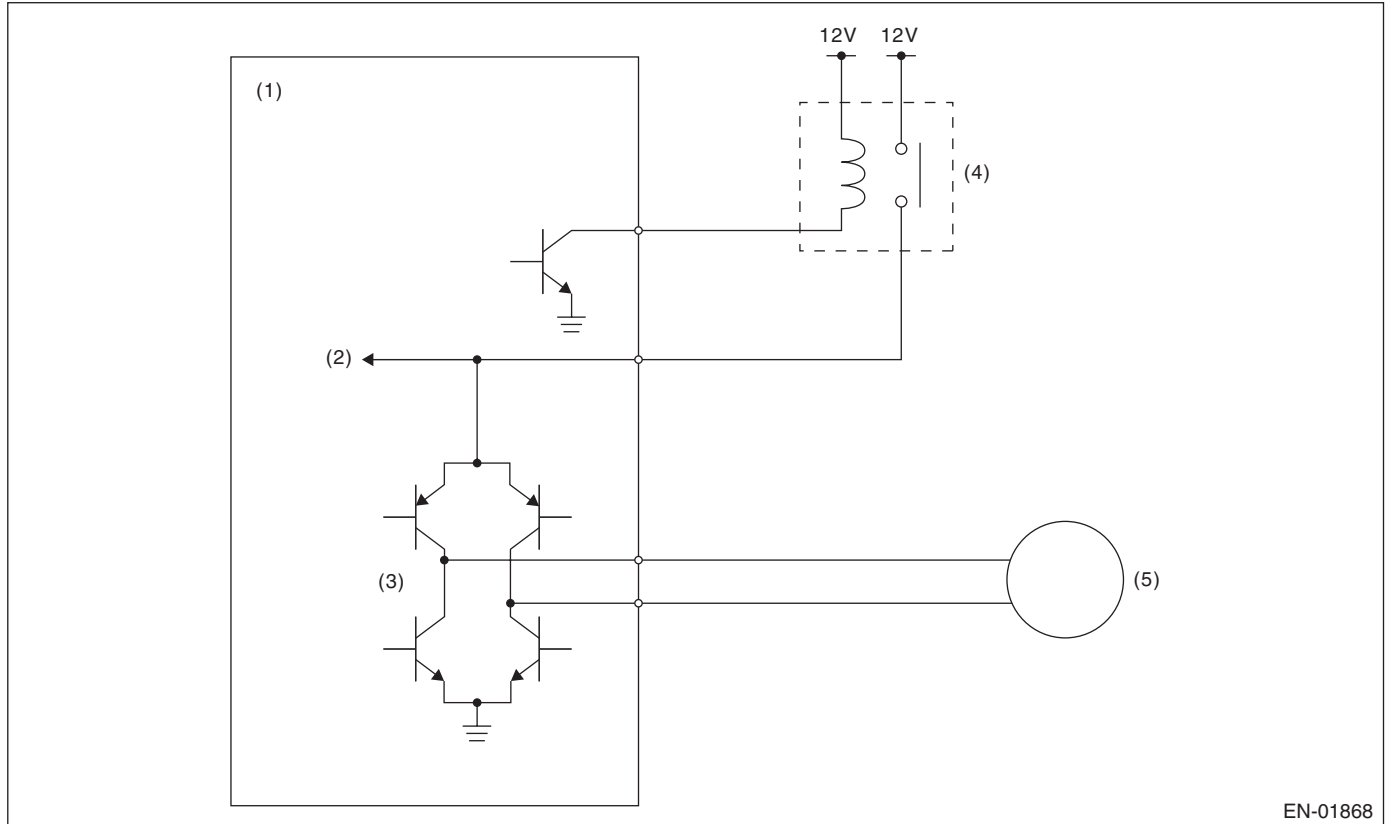
## GENERAL DESCRIPTION

### EL:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)  
(2) Voltage detection circuit

(3) Drive circuit  
(4) Electronic throttle control relay

(5) Motor

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 6\text{ V}$
Electronic throttle control relay output	OFF

#### 4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Motor power voltage	$\geq 5$ V

**Time Needed for Diagnosis:** 600 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Motor power voltage	$< 5$ V

**Time Needed for Diagnosis:** 400 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

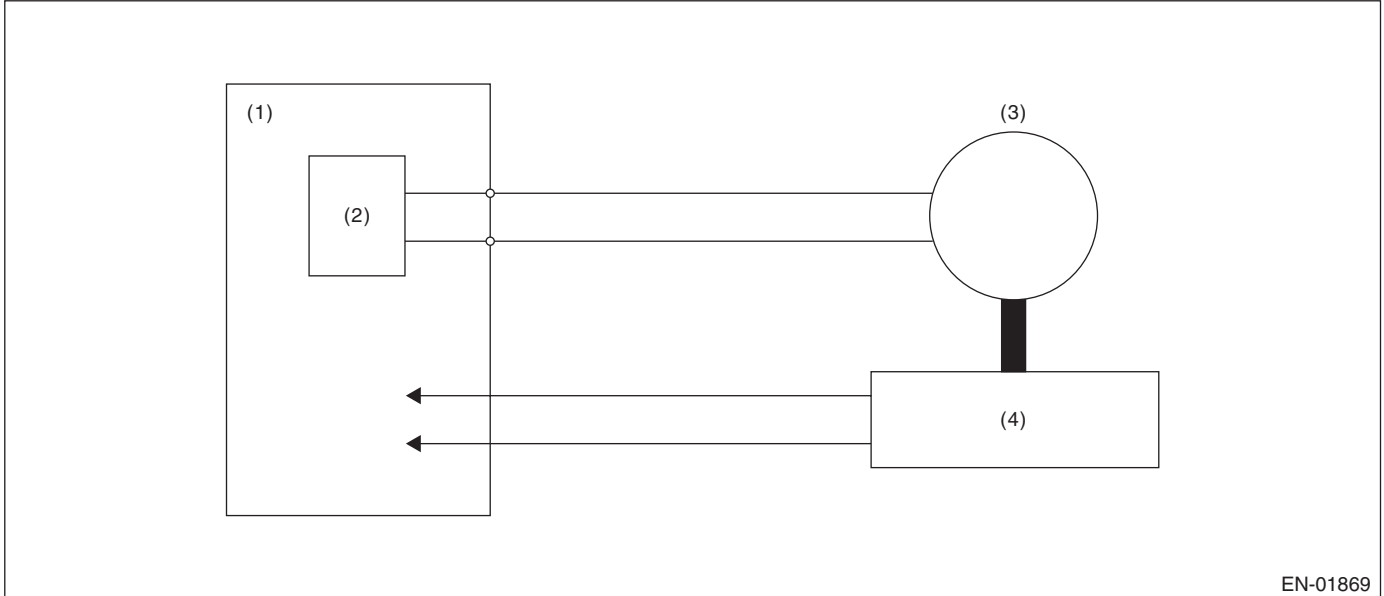
## GENERAL DESCRIPTION

### EM:DTC P2109 THROTTLE/PEDAL POSITION SENSOR "A" MINIMUM STOP PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot be conducted or an abnormal value is detected.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Motor

(4) Throttle position sensor

(2) Drive circuit

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON → OFF
Ignition switch (only after clear memory)	OFF → ON

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Throttle sensor opening angle at full close point learning	< 10.127 deg
	or
	> 19.872 deg
or	
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	< 1.683 deg

**Time Needed for Diagnosis:** 8 msec — 80 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Throttle sensor opening angle at full close point learning	≥ 10.127 deg
	and
	≤ 19.872 deg
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 1.683 deg

**Time Needed for Diagnosis:** 8 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

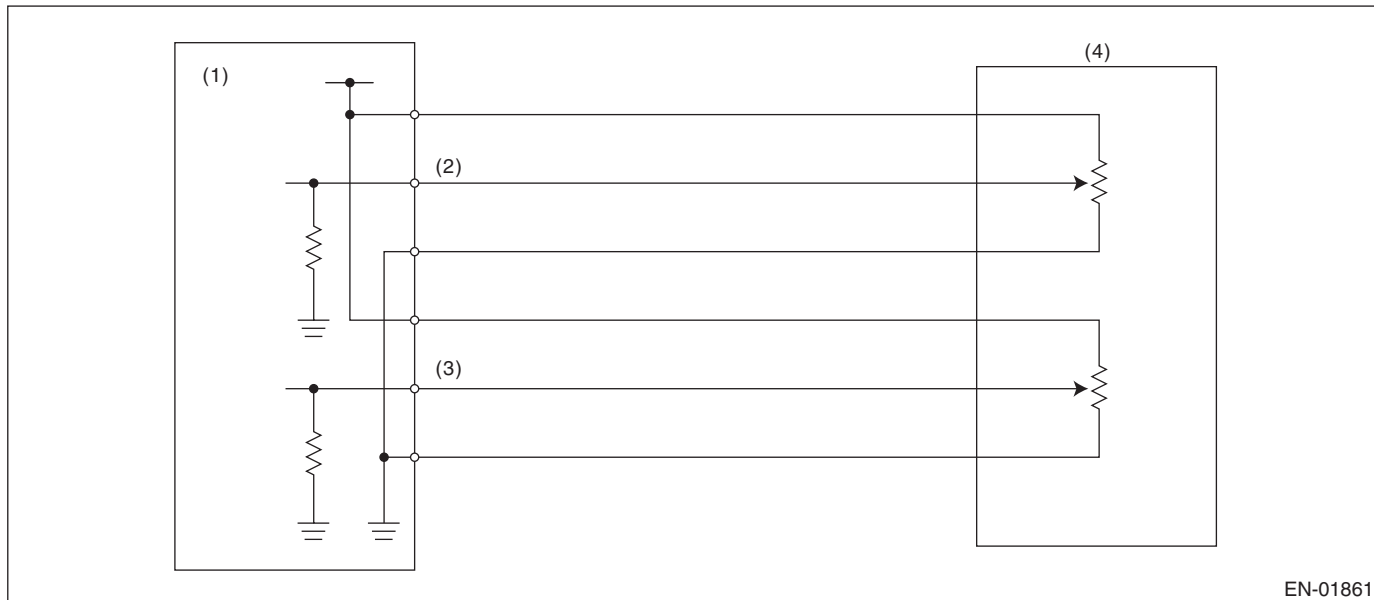
### EN:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



- (1) Engine control module (ECM)      (3) Accelerator pedal position sensor 2 signal      (4) Accelerator pedal position sensor 2 signal  
(2) Accelerator pedal position sensor 1 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 \text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	< 0.219 V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$\geq 0.219$ V

**Time Needed for Diagnosis:** 100 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

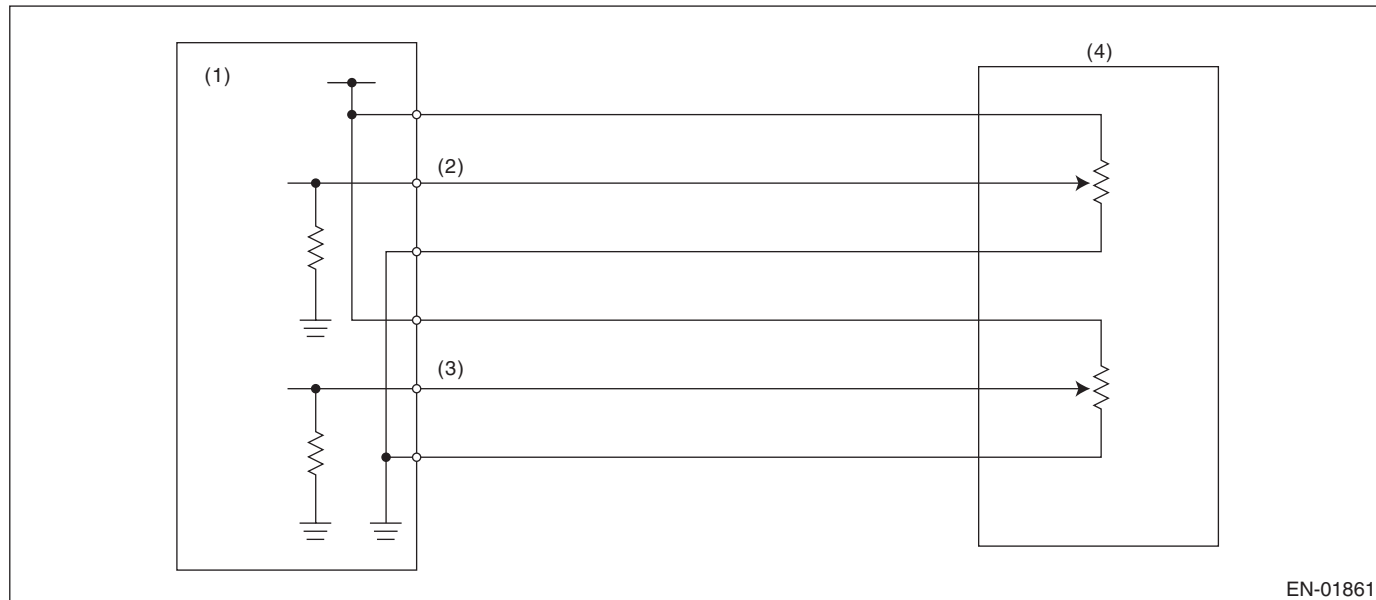
### EO:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Accelerator pedal position sensor 2 signal

(4) Accelerator pedal position sensor

(2) Accelerator pedal position sensor 1 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$\geq 4.781$ V

**Time Needed for Diagnosis:** 32 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 1 input voltage	$< 4.781$ V

**Time Needed for Diagnosis:** 32 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

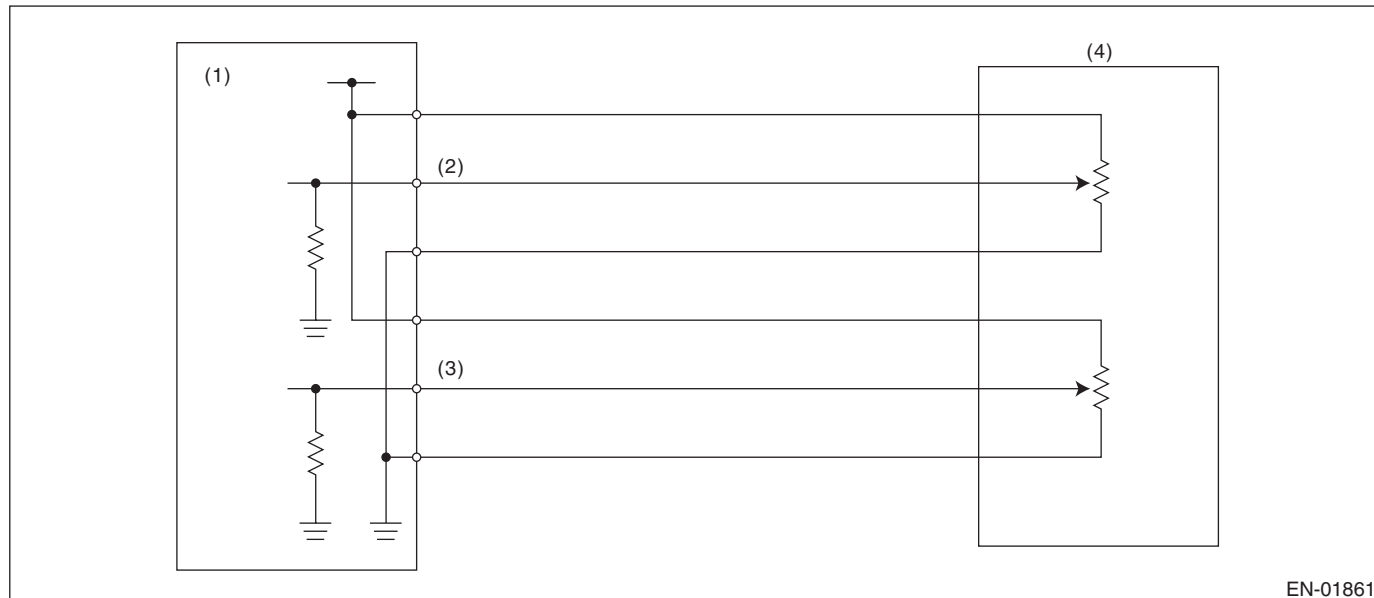
### EP:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Accelerator pedal position sensor 2 signal

(4) Accelerator pedal position sensor 2

(2) Accelerator pedal position sensor 1 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	< 0.219 V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$\geq 0.219$ V

**Time Needed for Diagnosis:** 100 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

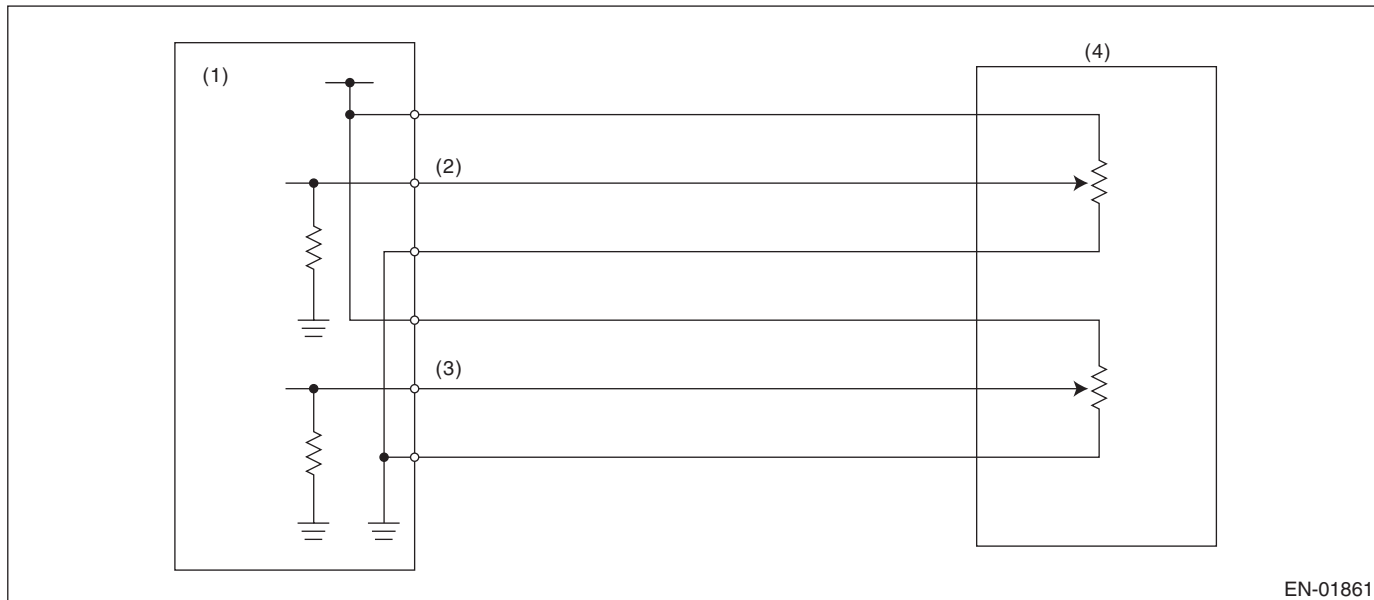
### EQ:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

#### 1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.

Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Accelerator pedal position sensor 2 signal

(4) Accelerator pedal position sensor 2

(2) Accelerator pedal position sensor 1 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$\geq 4.781$ V

**Time Needed for Diagnosis:** 100 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Sensor 2 input voltage	$< 4.781$ V

**Time Needed for Diagnosis:** 100 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Simultaneous failure: Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

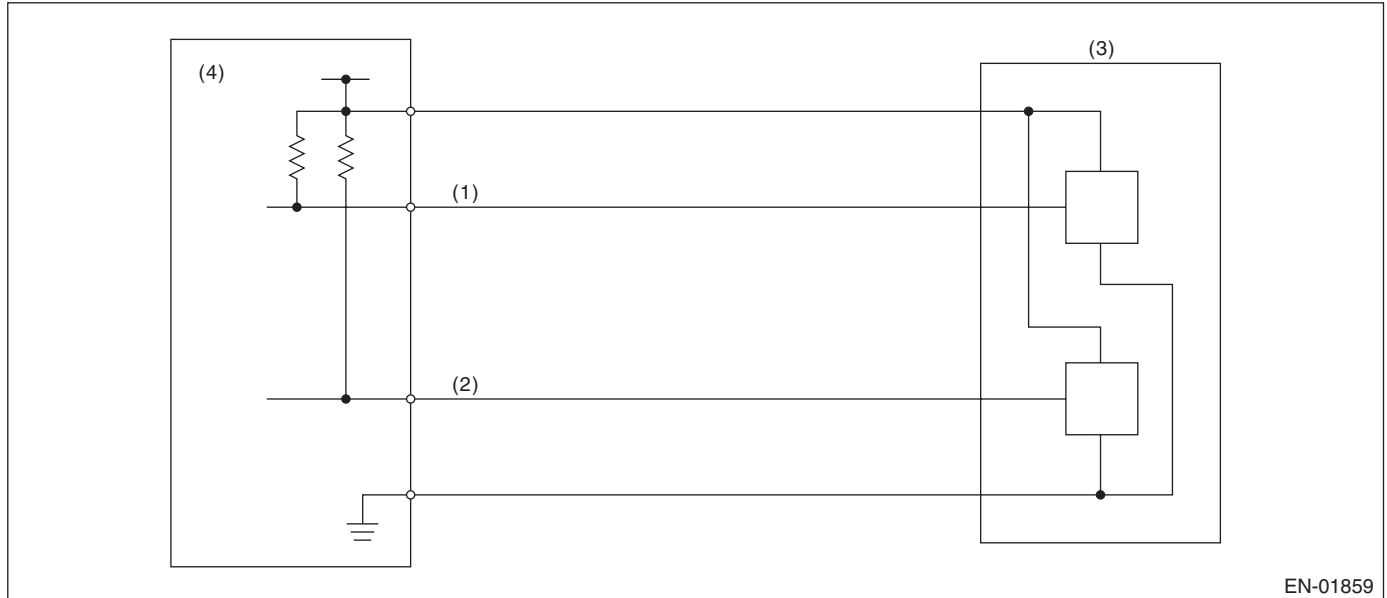
## GENERAL DESCRIPTION

### ER:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

#### 2. COMPONENT DESCRIPTION



- (1) Throttle position sensor 1 signal  
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6 \text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Signal difference between two sensors	> Value from Map

### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 2.125 \text{ deg}$	$2.125 \text{ deg} \leq d < 4.25 \text{ deg}$	$4.25 \text{ deg} \leq d < 9 \text{ deg}$	$9 \text{ deg} \leq d < 31.625 \text{ deg}$	$31.625 \text{ deg} \leq d$
Sensor output difference (°)	4.5 deg	5.5 deg	7.625 deg	9.75 deg	11.75 deg

**Time Needed for Diagnosis:** 212 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Signal difference between two sensors	$\leq$ Value from Map

**Time Needed for Diagnosis:** 24 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed (Only with engine stopped)

## 8. FAIL SAFE

Stop the continuity to the electronic throttle control motor. (Throttle opening is fixed to 6°.)

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)



# Diagnostic Trouble Code (DTC) Detecting Criteria

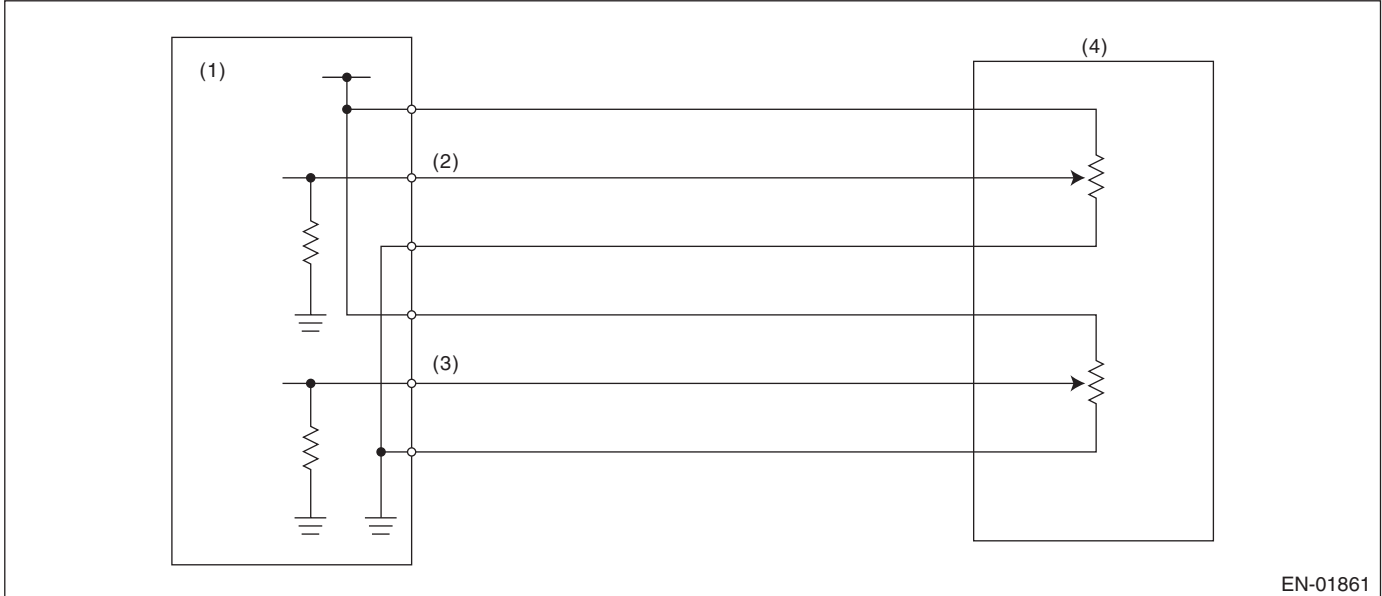
## GENERAL DESCRIPTION

### ES:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

#### 1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

#### 2. COMPONENT DESCRIPTION



EN-01861

- (1) Engine control module (ECM)      (3) Accelerator pedal position sensor 2 signal      (4) Accelerator pedal position sensor 2 signal  
 (2) Accelerator pedal position sensor 1 signal

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	$\geq 6\text{ V}$

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## 5. DIAGNOSTIC METHOD

### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

### Judgment Value

Malfunction criteria	Threshold value
Signal difference between two sensors	> Map

### Map

Throttle position sensor 1 opening angle (°) = d	$0 \leq d < 0.6 \text{ deg}$	$0.6 \text{ deg} \leq d < 1.2 \text{ deg}$	$1.2 \text{ deg} \leq d < 2 \text{ deg}$	$2 \text{ deg} \leq d < 4 \text{ deg}$	$4 \text{ deg} \leq d$
Sensor output difference (°)	1.465 deg	1.597 deg	1.663 deg	2.455 deg	3.116 deg

**Time Needed for Diagnosis:** 116 msec

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

### Judgment Value

Malfunction criteria	Threshold value
Signal difference between two sensors	$\leq$ Map

**Time Needed for Diagnosis:** 116 msec

## 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

## 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

## 8. FAIL SAFE

Throttle opening is fixed to 6°.

## 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

### ET:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

#### 1. OUTLINE OF DIAGNOSIS

Detect the malfunction of barometric pressure sensor output property.

Judge as NG when the barometric pressure sensor output is largely different from the intake manifold pressure at engine start.

#### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)

#### 4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Barometric pressure – Intake manifold pressure	≥ 26.66 kPa (200 mmHg, 7.874 inHg)
Intake manifold pressure at engine start – Intake manifold pressure	< 1.33 kPa (9.99 mmHg, 0.393 inHg)

**Time Needed for Diagnosis:** 328 ms

**Malfunction Indicator Light Illumination:** Illuminates when malfunction occurs in 2 continuous driving cycles.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Barometric pressure – Intake manifold pressure	< 26.66 kPa (200 mmHg, 7.874 inHg)

**Time Needed for Diagnosis:** 262 ms

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” is performed

#### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” is performed

#### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101 kPa (760 mmHg, 29.8 inHg).

#### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

## EU:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.  
Judge as NG if out of specification.

### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

### 5. DIAGNOSTIC METHOD

#### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	< 1.707 V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

#### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

#### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 1.707$ V

**Time Needed for Diagnosis:** Less than 1 second

### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101.3 kPa (760 mmHg, 29.9 inHg).

### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# Diagnostic Trouble Code (DTC) Detecting Criteria

## GENERAL DESCRIPTION

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### EV:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

#### 1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.  
Judge as NG if out of specification.

#### 2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

#### 3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

#### 4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

#### 5. DIAGNOSTIC METHOD

##### • Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

##### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$\geq 4.234$ V

**Time Needed for Diagnosis:** 500 ms

**Malfunction Indicator Light Illumination:** Illuminates as soon as a malfunction occurs.

##### • Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

##### Judgment Value

Malfunction criteria	Threshold value
Output voltage	$< 4.234$ V

**Time Needed for Diagnosis:** Less than 1 second

#### 6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" is performed

#### 7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITIONS

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" is performed

#### 8. FAIL SAFE

Barometric pressure sensor process: Fix the barometric pressure to 101.3 kPa (760 mmHg, 29.9 inHg).

#### 9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

# General Description

CONTROL SYSTEMS

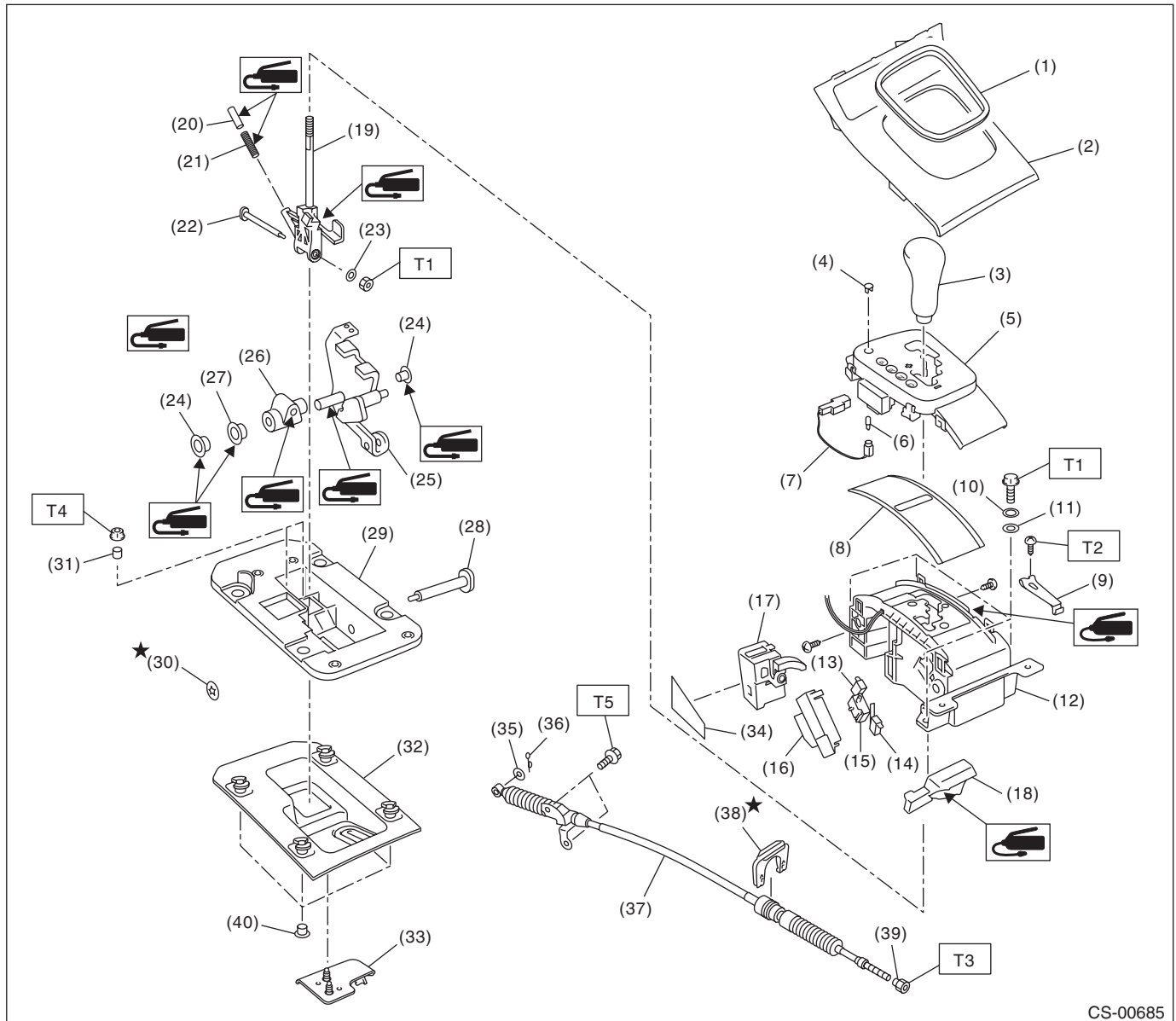
## 1. General Description

### A: SPECIFICATION

Item		Specification
Swing torque of rod against lever	N (kgf, lb)	3.7 (0.38, 0.84) or less

### B: COMPONENT

#### 1. AT SELECT LEVER



CS-00685

# General Description

## CONTROL SYSTEMS

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(1) Ring indicator	(17) Shift lock solenoid ASSY	(33) Cable bracket
(2) Front cover	(18) Check plate	(34) Seat
(3) Grip	(19) Lever ASSY	(35) Washer
(4) Release cover	(20) Check ball	(36) Snap pin
(5) Indicator ASSY	(21) Return spring	(37) Select cable
(6) Indicator bulb	(22) Shaft	(38) Clamp
(7) Valve harness	(23) Washer	(39) Nut A
(8) Blind	(24) Bushing A	(40) Bushing
(9) Detent spring	(25) Arm ASSY	
(10) Spring washer	(26) Bushing plate	
(11) Washer	(27) Bushing B	
(12) Guide plate upper	(28) Shaft	
(13) Up switch	(29) Plate lower	
(14) Down switch	(30) Clamp	
(15) SPORT mode switch	(31) Collar	
(16) Switch cover	(32) Gasket	

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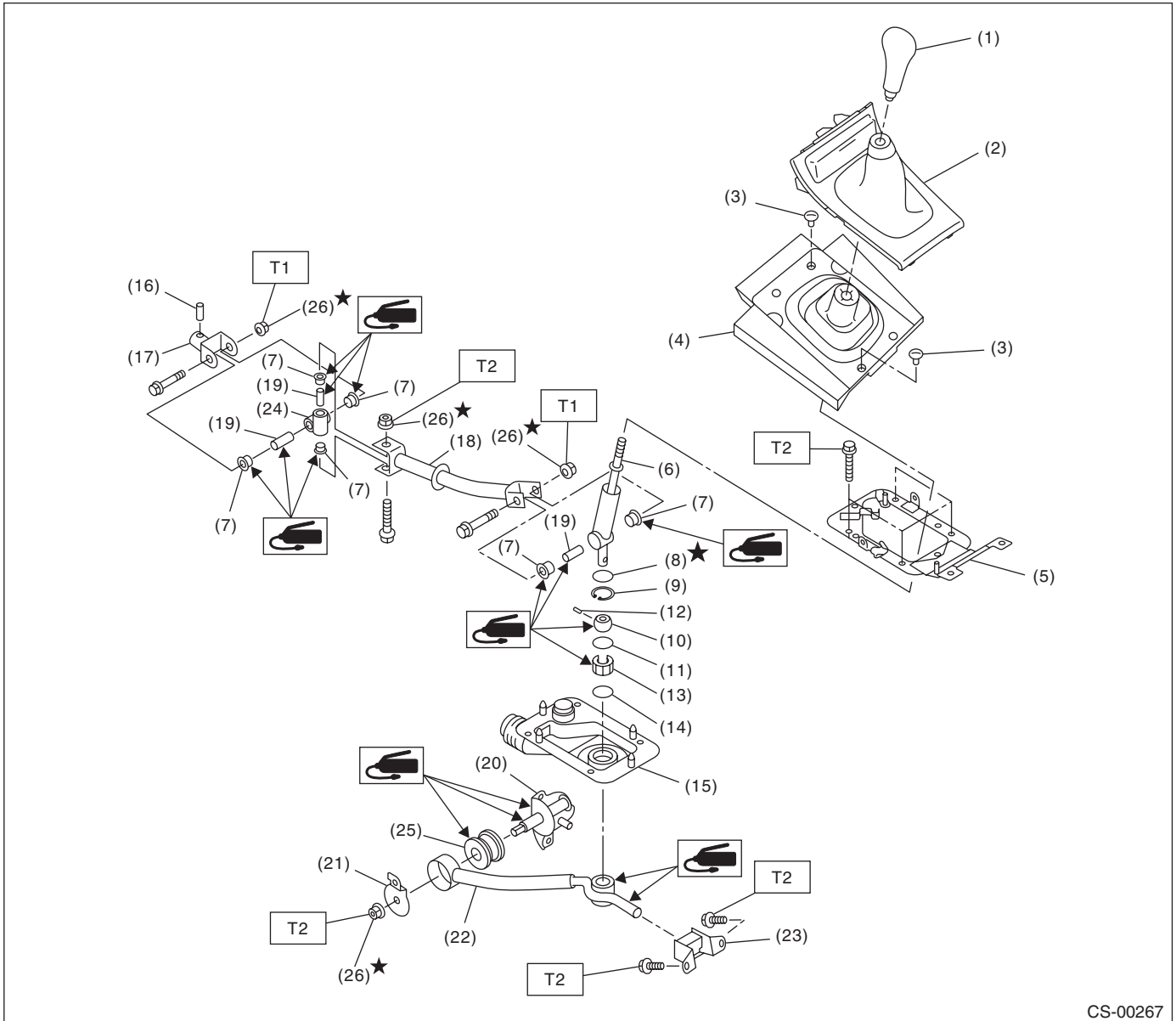
**Tightening torque:N-m (kgf-m, ft-lb)****T1: 5.1 (0.52, 3.8)****T2: 6.9 (0.70, 5.1)****T3: 7.5 (0.76, 5.5)****T4: 12.7 (1.3, 9.4)****T5: 18 (1.8, 13.3)**

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# General Description

## CONTROL SYSTEMS

### 2. 5MT GEAR SHIFT LEVER



CS-00267

- |                             |                 |                       |
|-----------------------------|-----------------|-----------------------|
| (1) Gear shift knob         | (11) O-ring     | (21) Washer           |
| (2) Front cover ASSY        | (12) Spring pin | (22) Stay             |
| (3) Clamp                   | (13) Bushing B  | (23) Cushion rubber   |
| (4) Boot and insulator ASSY | (14) O-ring     | (24) Boss             |
| (5) Plate ASSY              | (15) Boot       | (25) Bushing          |
| (6) Lever                   | (16) Spring pin | (26) Self-locking nut |
| (7) Bushing                 | (17) Joint      |                       |
| (8) Lock wire               | (18) Rod        |                       |
| (9) Snap ring               | (19) Spacer     |                       |
| (10) Bushing                | (20) Bracket    |                       |

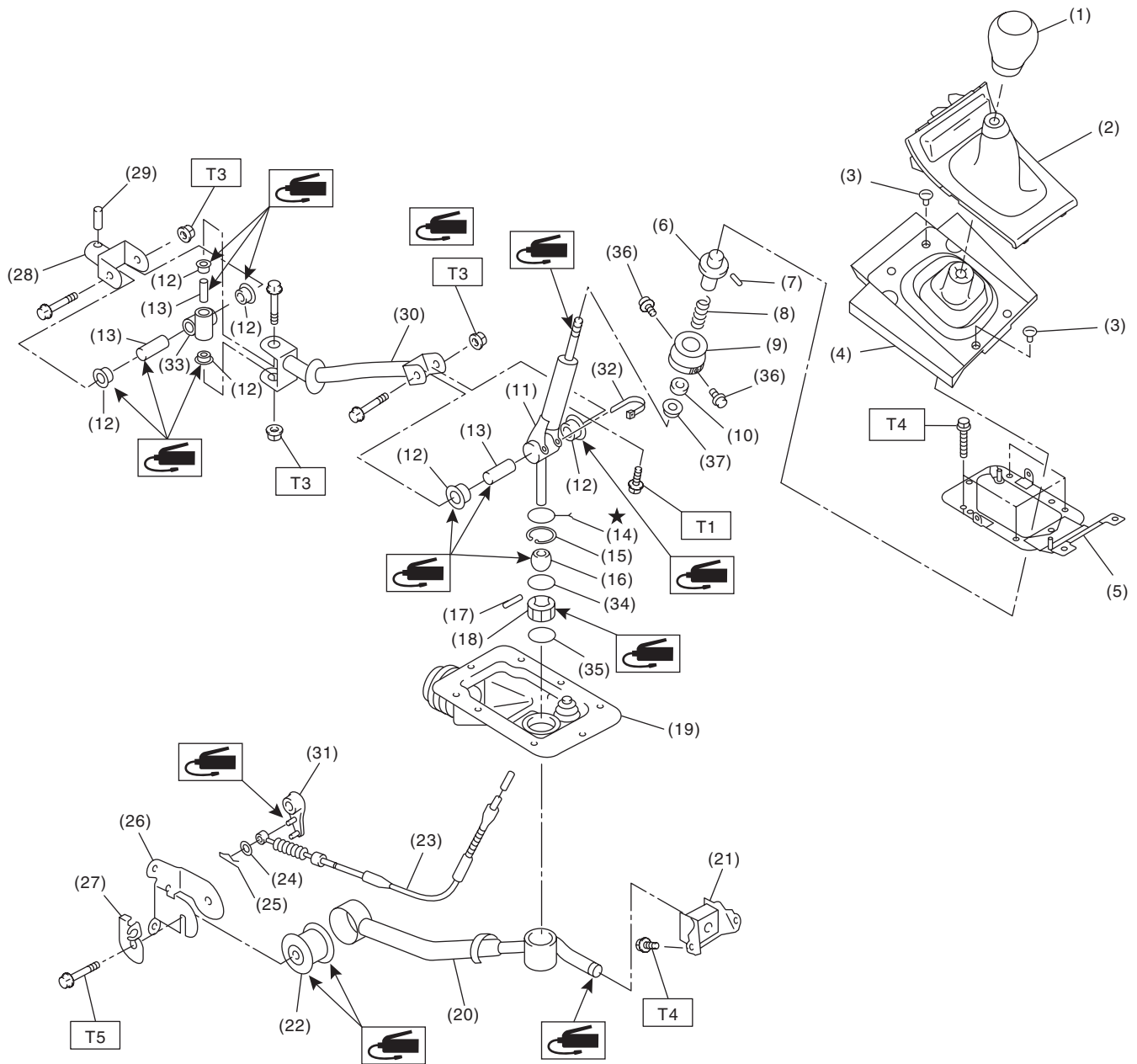
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 12 (1.2, 8.9)**

**T2: 18 (1.8, 13.3)**



## 3. 6MT GEAR SHIFT LEVER



CS-00561

# General Description

## CONTROL SYSTEMS

(1) Gear shift knob	(16) Bushing	(31) Reverse check lever
(2) Front cover ASSY	(17) Spring pin	(32) Band clip
(3) Clamp	(18) Bushing	(33) Boss
(4) Boot and insulator ASSY	(19) Boot	(34) O-ring
(5) Plate ASSY	(20) Stay	(35) O-ring
(6) Slider	(21) Cushion rubber	(36) Screw
(7) Spring pin	(22) Bushing	(37) Spring seat
(8) Spring	(23) Reverse check cable	
(9) Holder	(24) Washer	
(10) Seat cushion	(25) Snap pin	
(11) Lever	(26) Bracket	
(12) Bushing	(27) Cable plate	
(13) Spacer	(28) Joint	
(14) Lock wire	(29) Spring pin	
(15) Snap ring	(30) Rod	

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**Tightening torque:N·m (kgf-m, ft-lb)**

**T1: 1.3 (0.13, 0.96)**

**T2: 7.5 (0.76, 5.5)**

**T3: 12 (1.2, 8.9)**

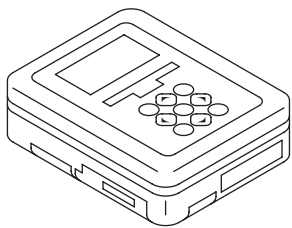
**T4: 18 (1.8, 13.3)**

**T5: 32 (3.3, 23.6)**

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## C: PREPARATION TOOL

### 1. SPECIAL TOOL

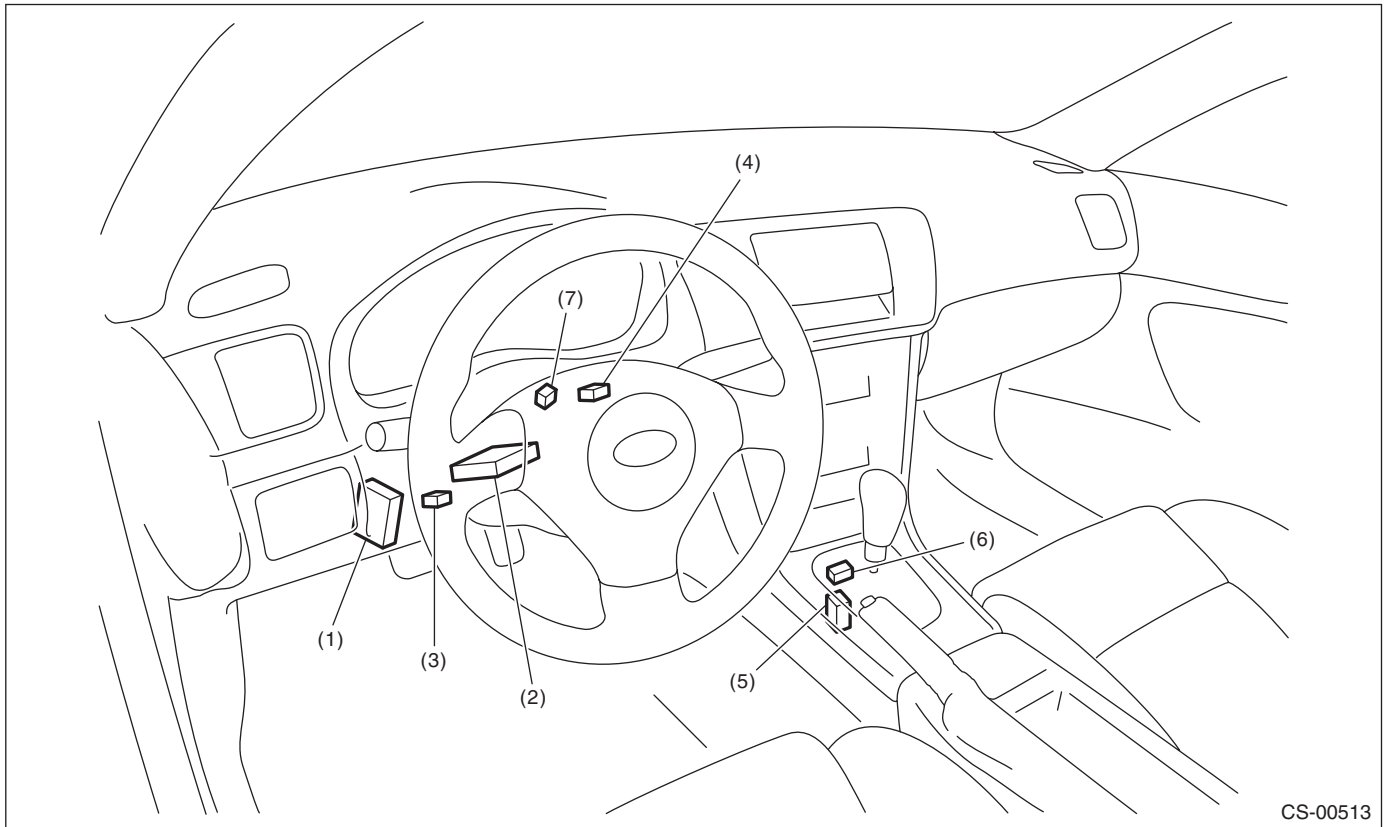
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

## D: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine fluid, grease etc. or equivalent. Do not mix fluid, grease, etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply grease onto sliding or revolving surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of fluid to avoid damage and deformation.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Before disconnecting electrical connectors, be sure to disconnect the negative terminal from battery.

## 2. AT Shift Lock Control System

### A: LOCATION



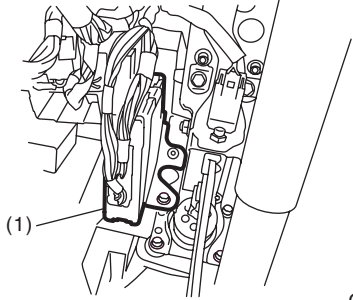
- (1) TCM ("P" range)
- (2) Body integrated unit
- (3) Stop light switch

- (4) Key cylinder  
(with built-in key warning switch)
- (5) Shift lock solenoid ASSY

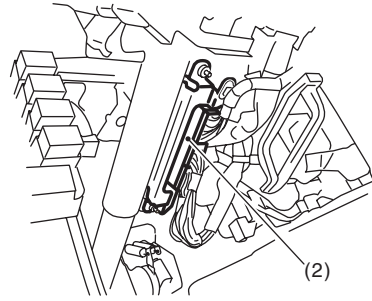
- (6) "P" range switch
- (7) Key lock solenoid

# AT Shift Lock Control System

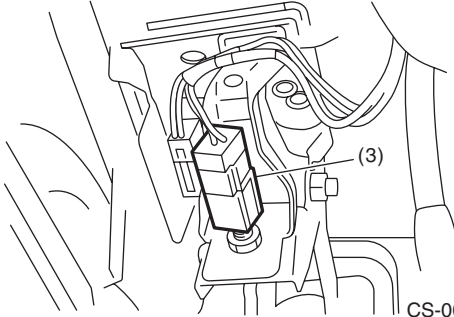
## CONTROL SYSTEMS



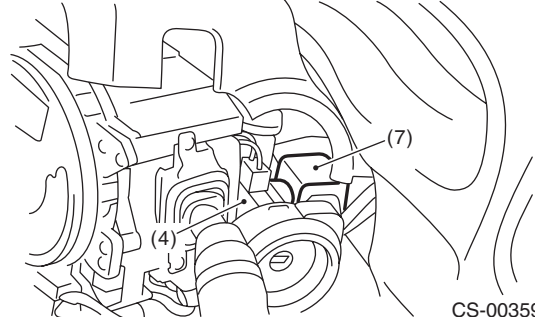
CS-00835



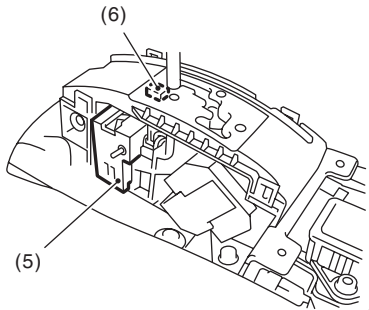
CS-00743



CS-00270



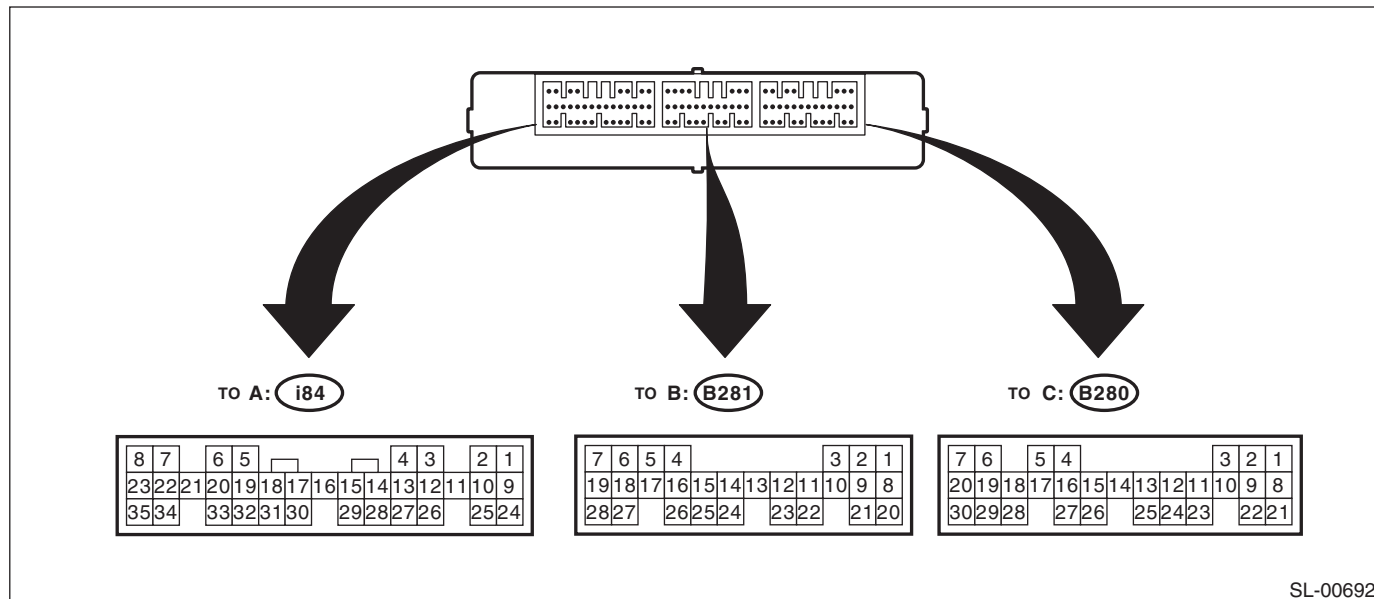
CS-00359



CS-00543

**SUBARU.**

## B: ELECTRICAL SPECIFICATION

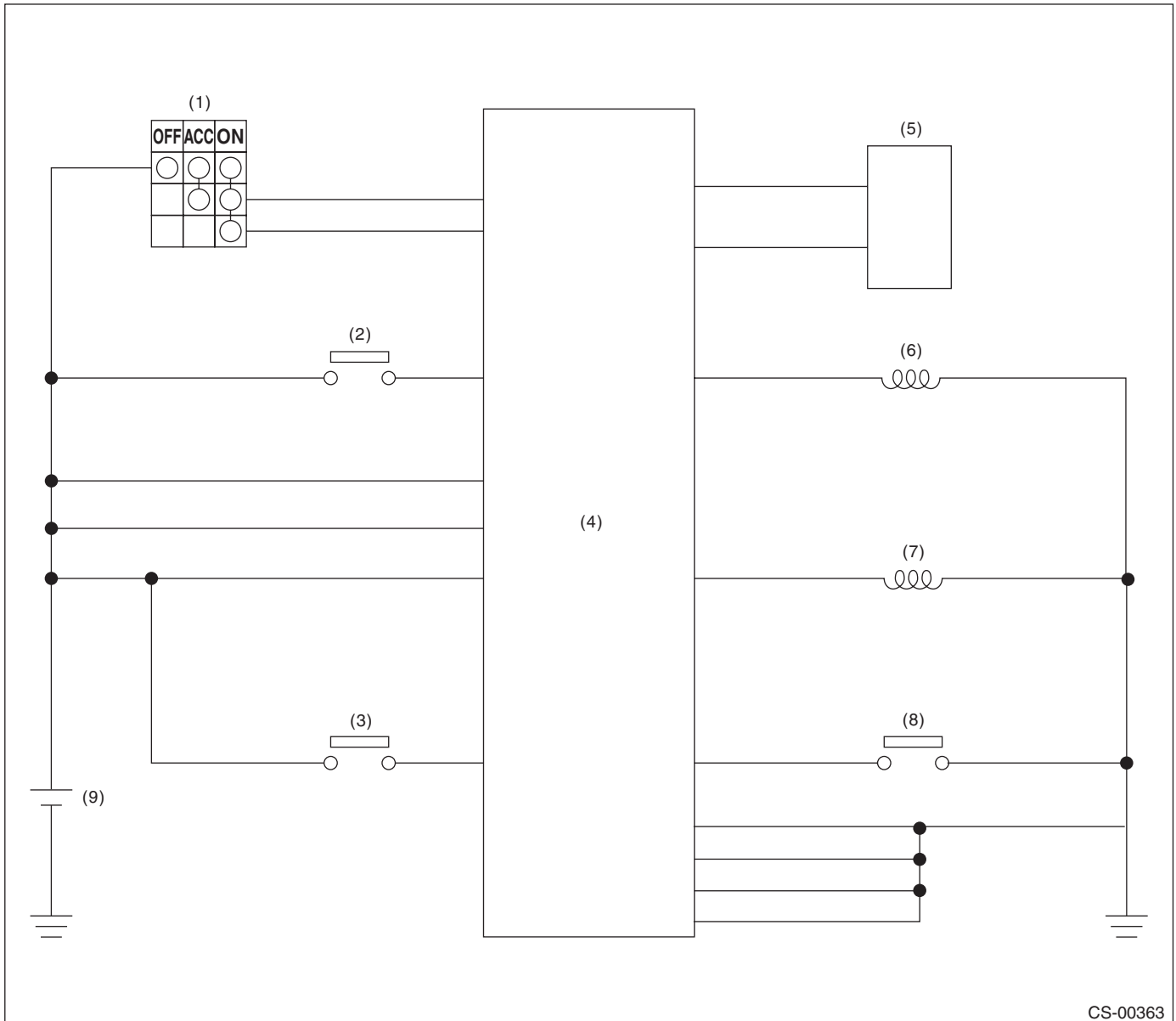


Item	Connector No.	Terminal No.	Input/Output signal
			Measured value and measuring conditions
Backup power supply	B281	1	9 — 16 V
		2	
Ignition power supply	i84	1	10 — 15 V when ignition switch is at ON or START.
	i84	24	10 — 15 V when ignition switch is at ACC.
TCM ("P" range)	B280	20	Pulse signal
	B280	30	
Stop light switch	B281	23	9 — 16 V when stop light switch is ON. 0 V when stop light switch is OFF.
"P" range switch	B281	13	0 V when select lever is in "P" range. 9 — 16 V when select lever is in other positions than "P" range.
Shift lock solenoid signal	B280	6	8.5 — 16 V when shift lock is released. 0 V when shift lock is operating.
Key warning switch signal	B281	7	9 — 16 V when key is inserted. 0 V when key is removed.
Key lock solenoid signal	B280	5	7.5 — 16 V when ignition switch is turned ON, with select lever in "P" range and brake switch ON. 0 V at other conditions than above.
Ground	B280	22	—
	i84	21	
	B281	8	
		9	

# AT Shift Lock Control System

CONTROL SYSTEMS

## C: WIRING DIAGRAM



CS-00363

- (1) Ignition switch
- (2) Stop light switch
- (3) Key warning switch

- (4) Body integrated unit
- (5) TCM ("P" range)
- (6) Key lock solenoid

- (7) Shift lock solenoid
- (8) "P" range switch
- (9) Battery

## D: INSPECTION

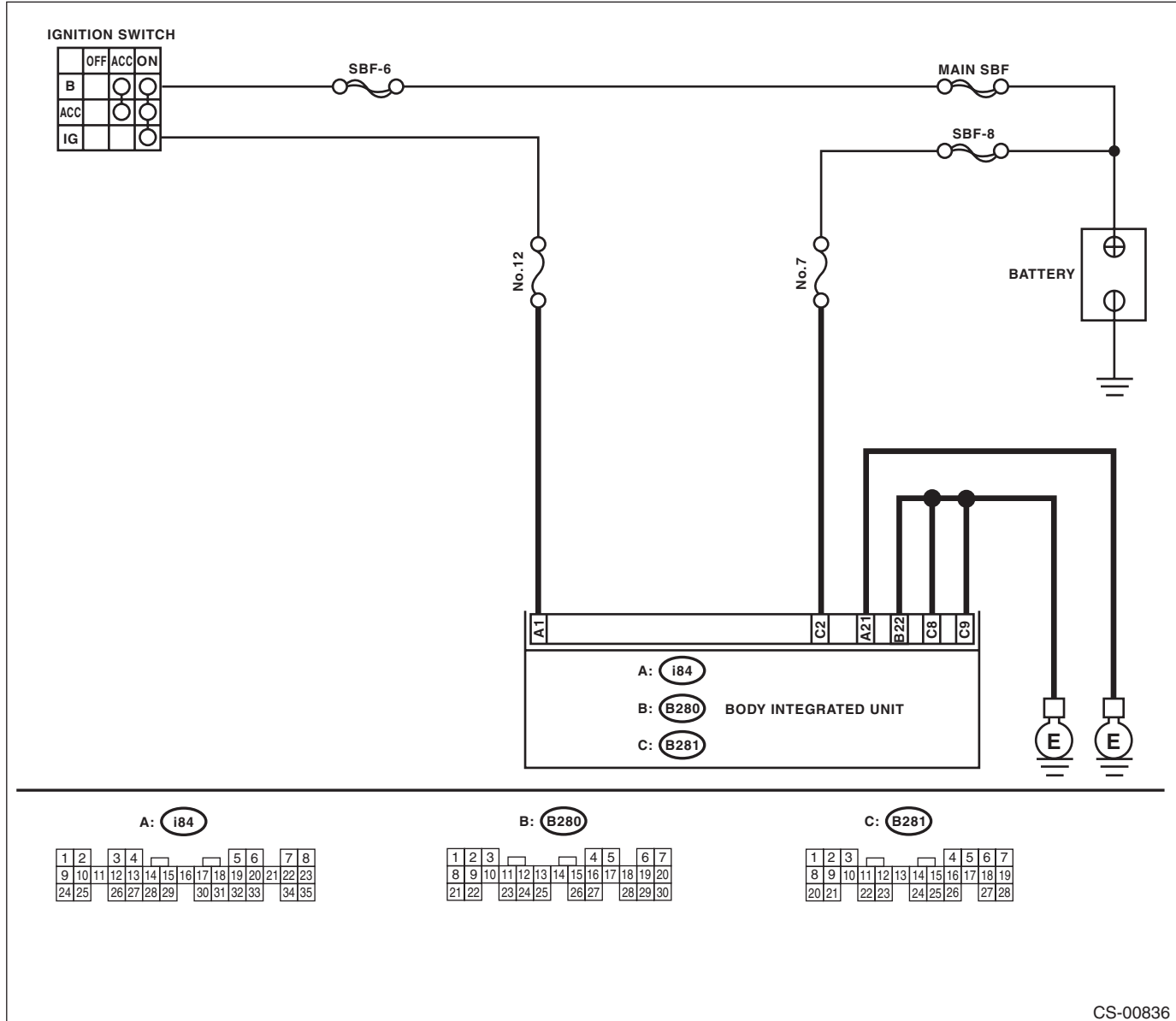
### 1. SHIFT LOCK OPERATION

Step	Check	Yes	No
<b>1</b> <b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to all systems can be executed normally.	Is the system name displayed?	Go to step 2.	Perform the inspection following the diagnostic procedure in the LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
<b>2</b> <b>CHECK SHIFT LOCK.</b> 1) Turn the ignition switch to ON. 2) Shift the select lever to the "P" range.	While brake pedal is not depressed, is it possible to move the select lever from the "P" range to other ranges?	Inspect "SELECT LEVER CANNOT BE LOCKED". <Ref. to CS-13, SELECT LEVER CANNOT BE LOCKED, INSPECTION, AT Shift Lock Control System.>	Go to step 3.
<b>3</b> <b>CHECK SHIFT LOCK.</b>	While brake pedal is depressed, is it possible to move the select lever from the "P" range to other ranges?	Go to step 4.	Inspect "SELECT LEVER SHIFT LOCK CANNOT BE RELEASED". <Ref. to CS-16, SHIFT LOCK OF SELECT LEVER CANNOT BE RELEASED., INSPECTION, AT Shift Lock Control System.>
<b>4</b> <b>CHECK KEY INTERLOCK.</b> 1) Turn the ignition switch to OFF. 2) Shift the select lever to other than "P" range.	Can the ignition key be removed?	Perform the inspection of "KEY INTERLOCK CANNOT BE LOCKED OR RELEASED". <Ref. to CS-19, KEY INTERLOCK CANNOT BE LOCKED OR RELEASED, INSPECTION, AT Shift Lock Control System.>	Go to step 5.
<b>5</b> <b>CHECK KEY INTERLOCK.</b> Shift the select lever to the "P" range.	Can the ignition key be removed?	AT shift lock system is normal.	Perform the inspection of "KEY INTERLOCK CANNOT BE LOCKED OR RELEASED". <Ref. to CS-19, KEY INTERLOCK CANNOT BE LOCKED OR RELEASED, INSPECTION, AT Shift Lock Control System.>

# AT Shift Lock Control System

## CONTROL SYSTEMS

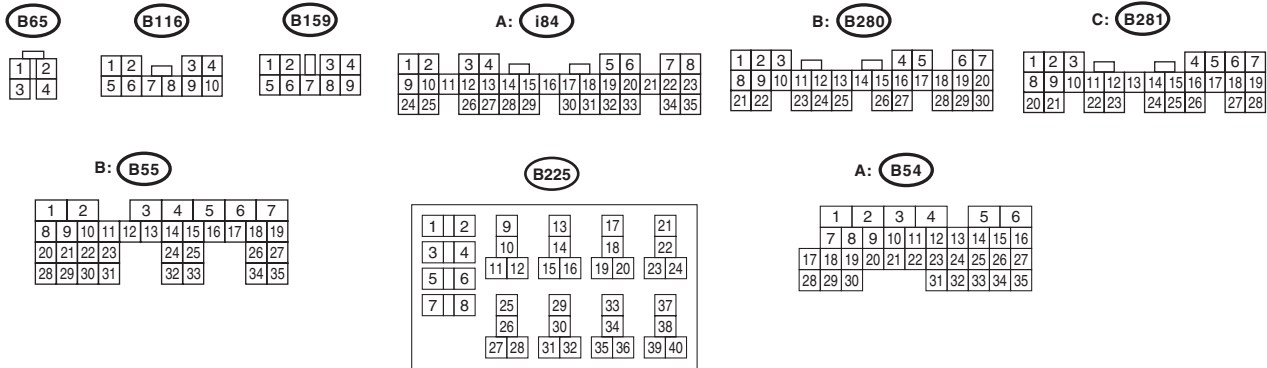
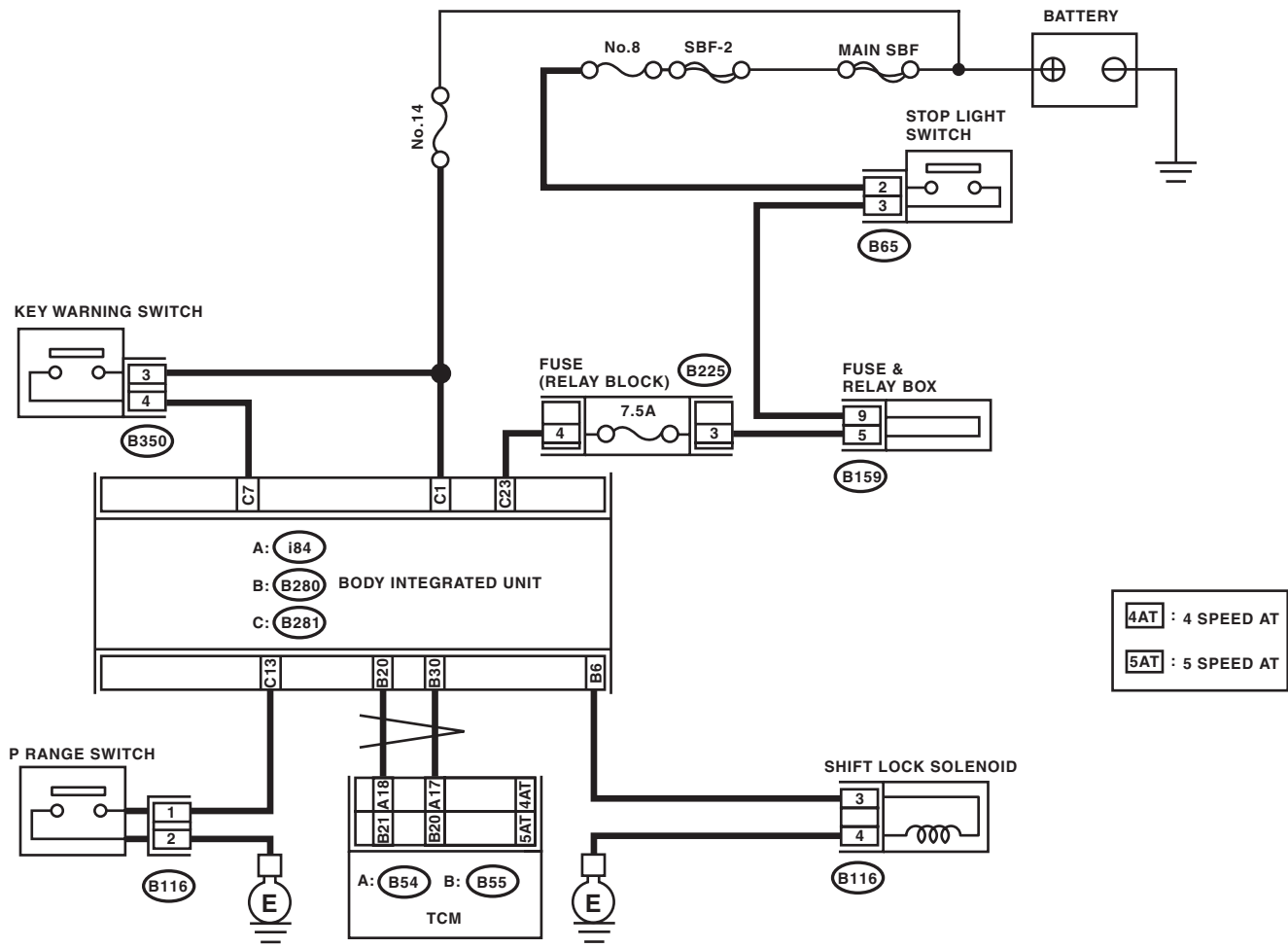
### 2. BODY INTEGRATED UNIT POWER SUPPLY AND GROUND CIRCUIT



Step	Check	Yes	No	
1	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the DTC of power line displayed on body integrated unit?	Repair or replace it according to the DTC.	Go to step 2.
2	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Measure the harness resistance between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 21 — Chassis ground:</b> <b>(B280) No. 22 — Chassis ground:</b> <b>(B281) No. 8 — Chassis ground:</b> <b>(B281) No. 9 — Chassis ground:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between the body integrated unit and chassis ground.
3	<b>CHECK POOR CONTACT.</b>	Is there poor contact in connector?	Repair the poor contact.	Check the body integrated unit.



## 3. SELECT LEVER CANNOT BE LOCKED



CS-00837

# AT Shift Lock Control System

## CONTROL SYSTEMS

Step	Check	Yes	No	
<b>1</b>	<b>CHECK IGNITION POWER.</b>	Is the voltage 9 V or more?	Go to step 2.	Check the ignition switch harness.
<b>2</b>	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to ON. 2) Read the DTC of body integrated unit using Subaru Select Monitor.	Is B1106 current malfunction?	Repair or replace it according to the DTC.	Go to step 3.
<b>3</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of shift position from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is “7” displayed in the “P” range and displayed other than “7” except in the “P” range?	Inspect the inhibitor switch and TCM.	Go to step 4.
<b>4</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of “P” range switch from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is “ON” displayed in the “P” range and displayed “OFF” except in the “P” range?	Go to step 9.	Go to step 5.
<b>5</b>	<b>CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND “P” RANGE SWITCH.</b> 1) Disconnect the connector of the “P” range switch. 2) Measure the resistance of harness between the body integrated unit and the “P” range switch. <b>Connector &amp; terminal</b> <b>(B116) No. 1 — (B281) No. 13:</b>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between the body integrated unit and the “P” range switch.	Go to step 6.
<b>6</b>	<b>CHECK HARNESS BETWEEN “P” RANGE SWITCH AND CHASSIS GROUND.</b> Measure the resistance of harness between “P” range switch and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 2 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between “P” range switch and chassis ground.	Go to step 7.
<b>7</b>	<b>CHECK “P” RANGE SWITCH.</b> 1) Shift the select lever to the “P” range. 2) Measure the resistance between “P” range switch connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance less than 1 Ω?	Go to step 8.	Replace the “P” range switch.
<b>8</b>	<b>CHECK “P” RANGE SWITCH.</b> 1) Shift the select lever to other than “P” range. 2) Measure the resistance between “P” range switch connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance 1 MΩ or more?	Replace the body integrated unit.	Replace the “P” range switch.
<b>9</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of stop light switch from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is “ON” displayed when the brake pedal is depressed and displayed “OFF” when not depressed?	Go to step 11.	Go to step 10.

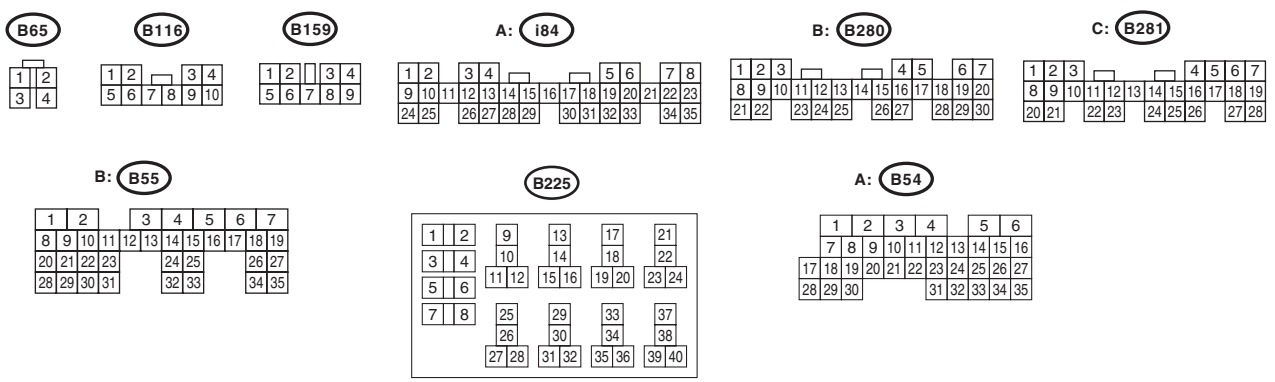
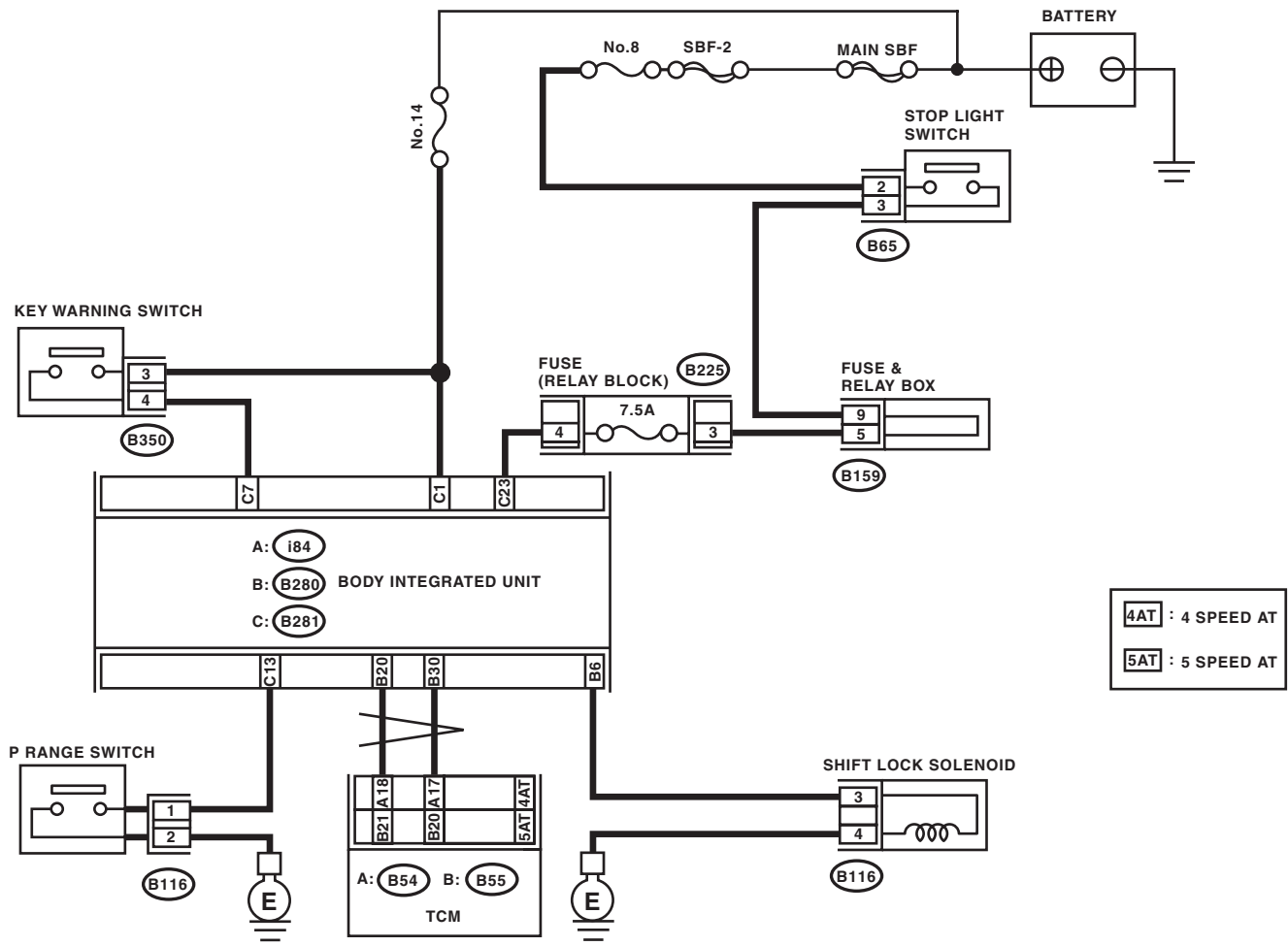
# AT Shift Lock Control System

Step	Check	Yes	No
<b>10 CHECK STOP LIGHT SWITCH INPUT SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from body integrated unit. 3) Measure the voltage between the body integrated unit connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 9 V or more when the brake pedal is depressed, and approx. 0 V when not depressed?	Replace the body integrated unit.	Check the stop light system.
<b>11 CHECK SHIFT LOCK SOLENOID.</b> 1) Disconnect the connector from the shift lock solenoid. 2) Measure the resistance of shift lock solenoid terminals. <b>Terminals</b> <b>No. 3 — No. 4:</b>	Is the resistance between 19.5 — 25.5 Ω?	Go to step 12.	Replace the shift lock solenoid.
<b>12 CHECK SHIFT LOCK SOLENOID.</b> Connect the battery to the shift lock solenoid connector terminal, and then operate the solenoid. <b>Terminals</b> <b>No. 3 (+) — No. 4 (-):</b>	Does the shift lock solenoid operate normally?	Go to step 13.	Replace the shift lock solenoid unit.
<b>13 CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> 1) Shift the select lever to the “P” range. 2) Depress the brake pedal. 3) Read the input signal of shift lock solenoid from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is “ON” displayed?	Go to step 14.	Replace the body integrated unit.
<b>14 CHECK HARNESS BETWEEN BATTERY AND BODY INTEGRATED UNIT.</b> 1) Disconnect the connector of body integrated unit. 2) Measure the voltage between body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 9 V or more?	Replace the body integrated unit.	Check the harness for open between the body integrated unit and battery or the fuse (No. 14).

# AT Shift Lock Control System

## CONTROL SYSTEMS

### 4. SHIFT LOCK OF SELECT LEVER CANNOT BE RELEASED



CS-00837

# AT Shift Lock Control System

CONTROL SYSTEMS

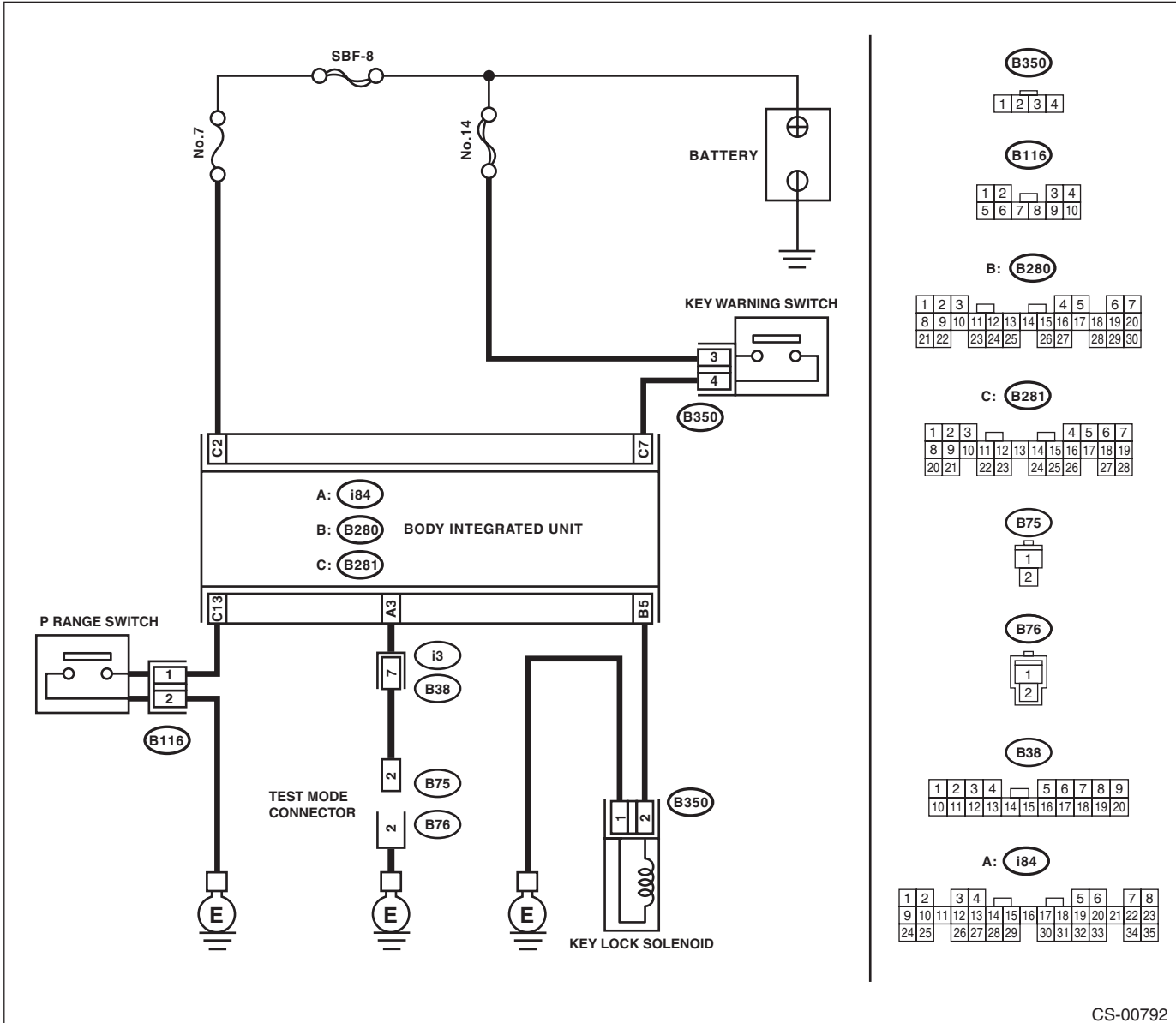
Step	Check	Yes	No	
<b>1</b>	<b>CHECK IGNITION POWER.</b>	Is the voltage 9 V or more?	Go to step 2.	Check the ignition switch harness.
<b>2</b>	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to ON. 2) Read the DTC of body integrated unit using Subaru Select Monitor.	Is B1106 current malfunction?	Repair or replace it according to the DTC.	Go to step 3.
<b>3</b>	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b>	Are U1213 and U1223 current malfunction?	Check the CAN communication system.	Go to step 4.
<b>4</b>	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b>	Are U1212 and U1222 current malfunction?	Check the CAN communication system.	Go to step 5.
<b>5</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of front wheel speed from Subaru Select Monitor.	Is the front wheel speed 10 km/h or more?	Check the VDC/ABS CM.	Go to step 6.
<b>6</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of shift position from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "7" displayed in the "P" range and displayed other than "7" except in the "P" range?	Inspect the inhibitor switch and TCM.	Go to step 7.
<b>7</b>	<b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of "P" range switch from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "ON" displayed in the "P" range and displayed "OFF" except in the "P" range?	Go to step 3.	Go to step 8.
<b>8</b>	<b>CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND "P" RANGE SWITCH.</b> 1) Disconnect the connector of the "P" range switch. 2) Measure the resistance of harness between the body integrated unit and the "P" range switch. <b>Connector &amp; terminal</b> <b>(B116) No. 1 (+) — (B281) No. 13 (-):</b>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between the body integrated unit and the "P" range switch.	Go to step 9.
<b>9</b>	<b>CHECK HARNESS BETWEEN "P" RANGE SWITCH AND CHASSIS GROUND.</b> Measure the resistance of harness between "P" range switch and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 2 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between "P" range switch and chassis ground.	Go to step 10.
<b>10</b>	<b>CHECK "P" RANGE SWITCH.</b> 1) Shift the select lever to the "P" range. 2) Measure the resistance between "P" range switch connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance less than 1 Ω?	Go to step 11.	Replace the "P" range switch.
<b>11</b>	<b>CHECK "P" RANGE SWITCH.</b> 1) Shift the select lever to other than "P" range. 2) Measure the resistance between "P" range switch connector terminals. <b>Terminals</b> <b>No. 2 — No. 1:</b>	Is the resistance 1 MΩ or more?	Replace the body integrated unit.	Replace the "P" range switch.

# AT Shift Lock Control System

## CONTROL SYSTEMS

Step	Check	Yes	No
<b>12 CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of stop light switch from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "ON" displayed when the brake pedal is depressed and displayed "OFF" when not depressed?	Go to step 14.	Go to step 13.
<b>13 CHECK STOP LIGHT SWITCH INPUT SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from body integrated unit. 3) Measure the voltage between the body integrated unit connector terminal and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B281) No. 23 (+) — Chassis ground (-):</b></i>	Is the voltage 9 V or more when the brake pedal is depressed, and approx. 0 V when not depressed?	Replace the body integrated unit.	Check the stop light system.
<b>14 CHECK SHIFT LOCK SOLENOID.</b> 1) Disconnect the connector from the shift lock solenoid. 2) Measure the resistance of shift lock solenoid terminals. <i><b>Terminals</b></i> <i><b>No. 3 — No. 4:</b></i>	Is the resistance between 19.5 — 25.5 $\Omega$ ?	Go to step 15.	Replace the shift lock solenoid.
<b>15 CHECK SHIFT LOCK SOLENOID.</b> Connect the battery to the shift lock solenoid connector terminal, and then operate the solenoid. <i><b>Terminals</b></i> <i><b>No. 3 (+) — No. 4 (-):</b></i>	Does the shift lock solenoid operate normally?	Go to step 16.	Replace the shift lock solenoid unit.
<b>16 CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Shift the select lever to the "P" range. 3) Depress the brake pedal. 4) Read the output signal of shift lock solenoid from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "ON" displayed?	Go to step 17.	Replace the body integrated unit.
<b>17 CHECK HARNESS BETWEEN BATTERY AND BODY INTEGRATED UNIT.</b> 1) Disconnect the connector of body integrated unit. 2) Measure the voltage between body integrated unit and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B281) No. 1 (+) — Chassis ground (-):</b></i>	Is the voltage 9 V or more?	Replace the body integrated unit.	Check the harness for open between the body integrated unit and battery or the fuse (No. 14).

## 5. KEY INTERLOCK CANNOT BE LOCKED OR RELEASED



CS-00792

# AT Shift Lock Control System

## CONTROL SYSTEMS

Step	Check	Yes	No
<b>1 CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Run the Subaru Select Monitor. 4) Read the input signal of the key warning switch from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "ON" displayed when the key is inserted and displayed "OFF" when removed?	Go to step 7.	Go to step 2.
<b>2 CHECK HARNESS BETWEEN BATTERY AND KEY WARNING SWITCH.</b> 1) Disconnect the connector of key warning switch. 2) Measure the voltage of harness between key warning switch and chassis ground. <b>Connector &amp; terminal</b> <b>(B350) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 9 — 16 V?	Go to step 3.	Repair the open or short circuit of harness between battery and key warning switch.
<b>3 CHECK HARNESS BETWEEN KEY WARNING SWITCH AND BODY INTEGRATED UNIT.</b> Measure the resistance between key warning switch and body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 7 — (B350) No. 4:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between key warning switch connector and body integrated unit.
<b>4 CHECK HARNESS BETWEEN KEY WARNING SWITCH AND BODY INTEGRATED UNIT.</b> Measure the resistance of harness between key warning switch and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 7 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the short circuit of harness between key warning switch and chassis ground.
<b>5 CHECK KEY WARNING SWITCH.</b> Measure the resistance between connector terminals of key warning switch. <b>Terminals</b> <b>No. 3 — No. 4:</b>	Is the resistance 1 M $\Omega$ or more?	Replace the key warning switch.	Go to step 6.
<b>6 CHECK KEY WARNING SWITCH.</b> 1) Remove the key. 2) Measure the resistance between connector terminals of key warning switch. <b>Terminals</b> <b>No. 3 — No. 4:</b>	Is the resistance 1 M $\Omega$ or more?	Replace the body integrated unit.	Replace the key warning switch.
<b>7 CHECK IGNITION POWER.</b>	Is the voltage 9 V or more?	Go to step 8.	Check the ignition switch harness.
<b>8 CHECK DTC OF BODY INTEGRATED UNIT.</b> 1) Shift the select lever to "N" range. 2) Check DTC indicated by body integrated unit using Subaru Select Monitor.	Is B1105 current malfunction?	Repair or replace it according to the DTC.	Go to step 9.
<b>9 CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> Read the input signal of "P" range switch from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "ON" displayed in the "P" range and displayed "OFF" except in the "P" range?	Go to step 14.	Go to step 10.



# AT Shift Lock Control System

CONTROL SYSTEMS

Step	Check	Yes	No
<b>10 CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND “P” RANGE SWITCH.</b> 1) Disconnect the connector of the “P” range switch. 2) Measure the resistance of harness between the body integrated unit and the “P” range switch. <i>Connector &amp; terminal (B116) No. 1 — (B281) No. 13:</i>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between the body integrated unit and the “P” range switch.	Go to step 11.
<b>11 CHECK HARNESS BETWEEN “P” RANGE SWITCH AND CHASSIS GROUND.</b> Measure the resistance of harness between “P” range switch and chassis ground. <i>Connector &amp; terminal (B116) No. 2 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Repair the open circuit of harness between “P” range switch and chassis ground.	Go to step 12.
<b>12 CHECK “P” RANGE SWITCH.</b> 1) Shift the select lever to the “P” range. 2) Measure the resistance between “P” range switch connector terminals. <i>Terminals No. 2 — No. 1:</i>	Is the resistance less than 1 Ω?	Go to step 13.	Replace the “P” range switch.
<b>13 CHECK “P” RANGE SWITCH.</b> 1) Shift the select lever to other than “P” range. 2) Measure the resistance between “P” range switch connector terminals. <i>Terminals No. 2 — No. 1:</i>	Is the resistance 1 MΩ or more?	Replace the body integrated unit.	Replace the “P” range switch.
<b>14 CHECK TEST MODE CONNECTOR.</b> 1) Check that the test mode connector is disconnected. 2) Measure the resistance between the body integrated unit and chassis ground. <i>Connector &amp; terminal (i84) No. 3 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 15.	Repair the short circuit of the harness between the body integrated unit and test mode connector.
<b>15 CHECK HARNESS BETWEEN KEY LOCK SOLENOID AND BODY INTEGRATED UNIT.</b> Measure the resistance between key lock solenoid and body integrated unit. <i>Terminals (B280) No. 5 — (B350) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 16.	Repair the open circuit of harness between key lock solenoid connector and body integrated unit.
<b>16 CHECK HARNESS BETWEEN KEY LOCK SOLENOID AND CHASSIS GROUND.</b> Measure the resistance of harness between key lock solenoid and chassis ground. <i>Terminals (B280) No. 5 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 17.	Repair short circuit of harness between key lock solenoid and chassis ground.
<b>17 CHECK KEY LOCK SOLENOID.</b> 1) Disconnect the connector from the key lock solenoid. 2) Measure the resistance of key lock solenoid connector terminals. <i>Terminals No. 2 — No. 1:</i>	Is the resistance between 12.5 — 14.5 Ω?	Go to step 18.	Replace the key lock solenoid.
<b>18 CHECK KEY LOCK SOLENOID.</b> 1) Connect all connectors. 2) Operate the key lock solenoid.	Does the key lock solenoid operate normally?	Go to step 19.	Replace the key lock solenoid.

# AT Shift Lock Control System

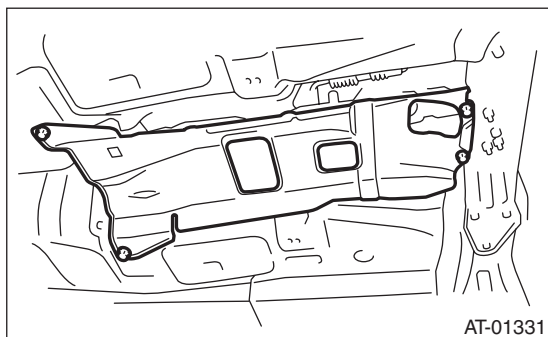
## CONTROL SYSTEMS

Step	Check	Yes	No
<b>19</b> <b>CHECK INPUT SIGNAL OF BODY INTEGRATED UNIT USING SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Read the output signal of key interlock from the Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "OFF" displayed in the "P" range and displayed "ON" except in the "P" range?	Go to step 20.	Replace the body integrated unit.
<b>20</b> <b>CHECK HARNESS BETWEEN BATTERY AND BODY INTEGRATED UNIT.</b> 1) Disconnect the connector of body integrated unit. 2) Measure the voltage between body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 9 V or more?	Replace the body integrated unit.	Check the harness for open between the body integrated unit and battery or the fuse (No. 14).

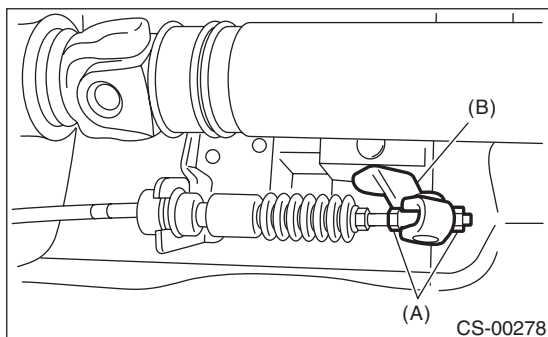
## 3. Select Lever

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Shift the select lever to "N" range.
- 4) Lift up the vehicle.
- 5) Remove the rear exhaust pipe and muffler.
  - SOHC model  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
  - DOHC 3.0 L model  
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 6) Remove the heat shield cover.

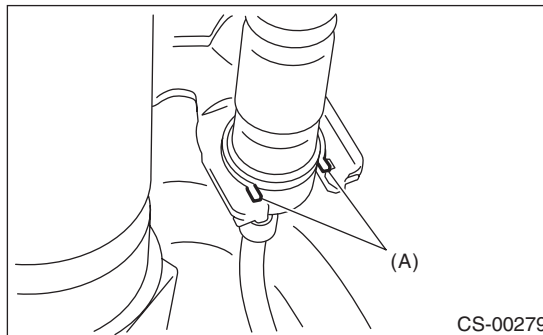


- 7) Remove the cable from arm assembly.



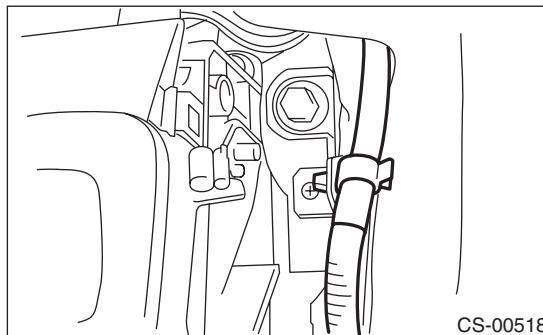
- (A) Adjusting nut
- (B) Arm ASSY

- 8) Raise the claw of clamp to remove the cable.

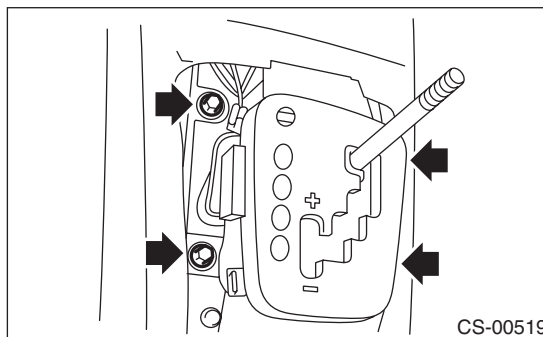


- (A) Claw

- 9) Lower the vehicle.
- 10) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 11) Remove the center console. <Ref. to EI-55, REMOVAL, Center Console.>
- 12) Remove the harness clips from the bracket.



- 13) Disconnect the connectors, and then remove the four bolts to take out the select lever assembly from vehicle body.



# Select Lever

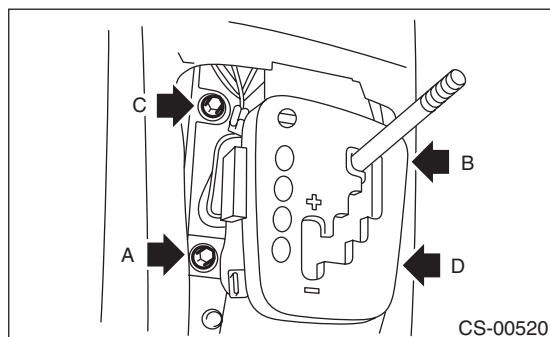
## CONTROL SYSTEMS

### B: INSTALLATION

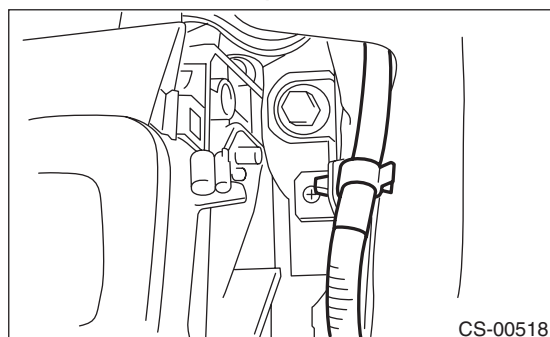
- 1) Set the select lever to vehicle body.
- 2) Tighten the four bolts to install the select lever to vehicle body, and then connect the connector.
  - (1) Temporarily tighten the bolt A.
  - (2) Tighten the bolt B.
  - (3) Tighten the bolt A.
  - (4) Tighten the bolts C and D.

#### Tightening torque:

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**



- 3) Install the harness clips to the bracket.



- 4) Install the center console. <Ref. to EI-56, INSTALLATION, Center Console.>
- 5) Install the console box. <Ref. to EI-54, INSTALLATION, Console Box.>
- 6) Shift the select lever to "N" range.
- 7) Lift up the vehicle.
- 8) Shift the range select lever to the "N" range.
- 9) Secure the cable to the bracket. <Ref. to CS-28, INSTALLATION, Select Cable.>
- 10) Adjust the select cable position. <Ref. to CS-31, ADJUSTMENT, Select Cable.>
- 11) After the completion of adjustment, confirm that the select lever operates properly at all range positions.
- 12) Install the heat shield cover.

- 13) Install the rear exhaust pipe and muffler.

- SOHC model  
<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>
- DOHC turbo model  
<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>
- DOHC 3.0 L model  
<Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>

- 14) Inspect the following items. When a malfunction is found in the inspection, adjust the select cable and inhibitor switch.

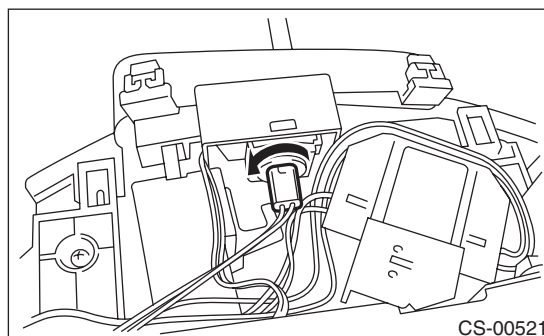
#### NOTE:

Inhibitor switch for 5AT model is not adjustable. <Ref. to CS-31, ADJUSTMENT, Select Cable.> <Ref. to 4AT-47, ADJUSTMENT, Inhibitor Switch.>

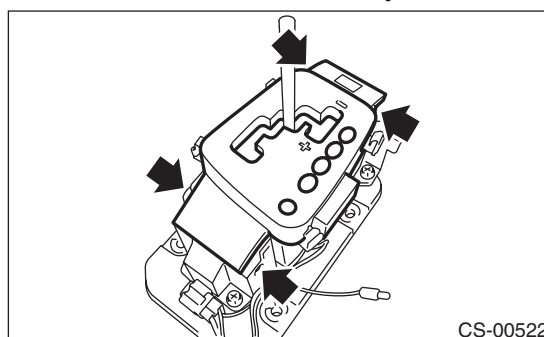
- (1) Engine starts when the select lever is in "P" and "N" range, but not in other ranges.
- (2) Back-up light illuminates when the select lever is in the "R" range, but not in other ranges.
- (3) Select lever and indicator positions are matched.

### C: DISASSEMBLY

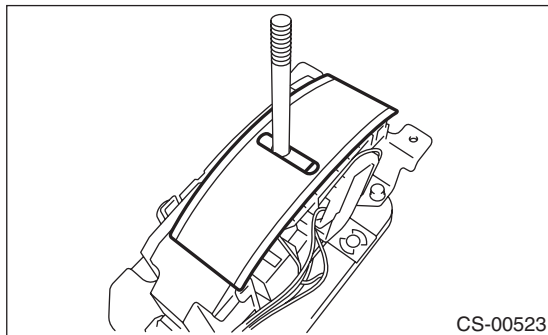
- 1) Shift the select lever to "N" range.
- 2) Remove the indicator light.



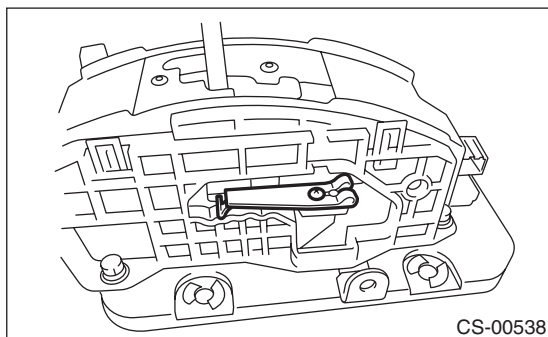
- 3) Remove the grip.
- 4) Remove the indicator assembly.



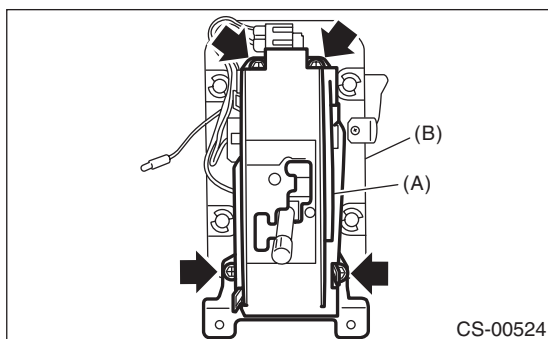
5) Remove the blind.



6) Shift the select lever to the N range, and then remove the detent spring.

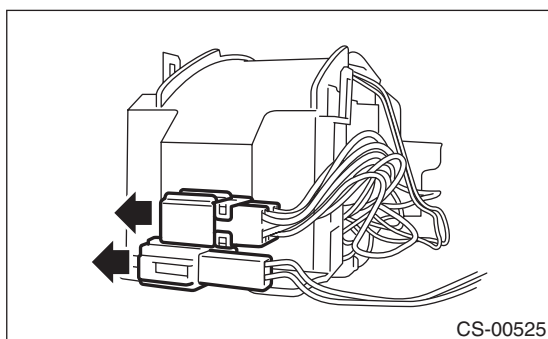


7) Remove the bolt, and separate the guide plate upper from plate lower.

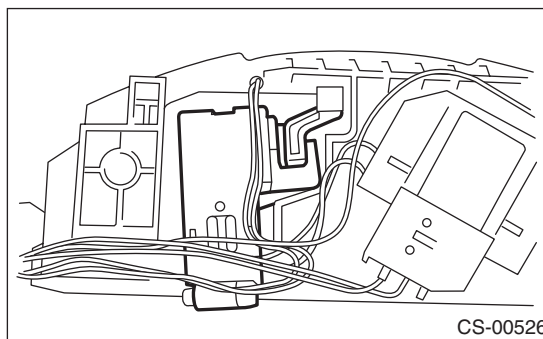


- (A) Guide plate upper
- (B) Plate lower

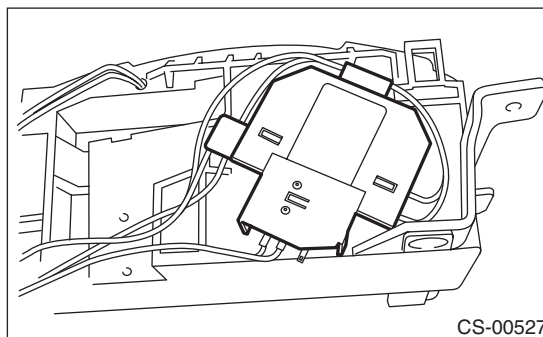
8) Remove the connector from the guide plate upper.



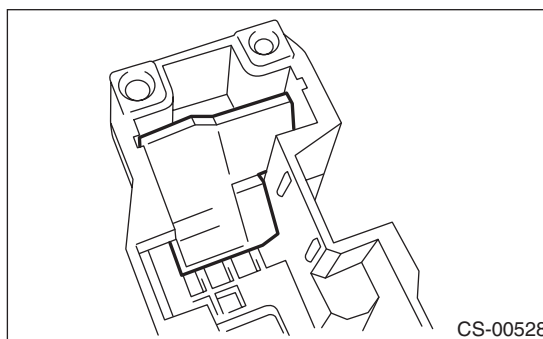
9) Remove the sheet, and remove the shift lock solenoid assembly.



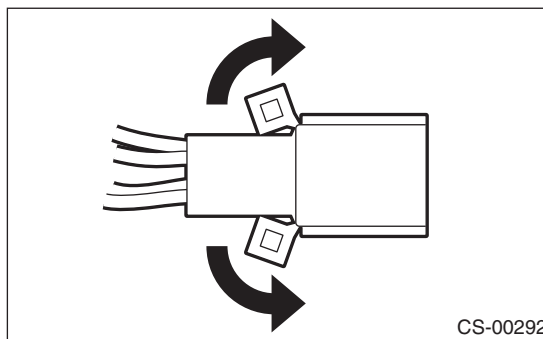
10) Remove the switch assembly.



11) Remove the check plate.



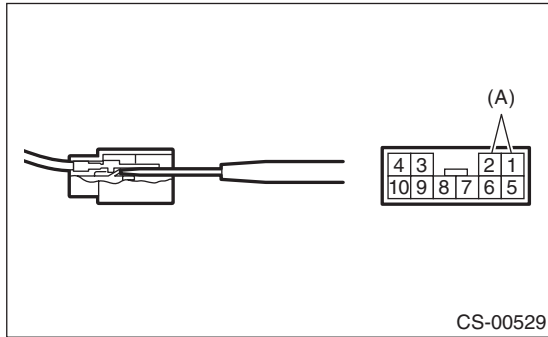
12) Raise the claw of connector.



# Select Lever

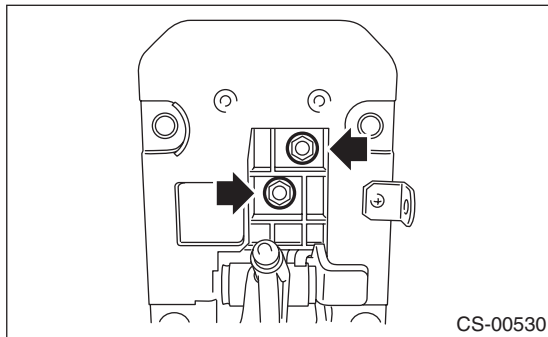
## CONTROL SYSTEMS

13) Disconnect the terminals of the SPORT mode switch and shift lock solenoid assembly from the connector, using a flat-tip screwdriver with a thin tip.

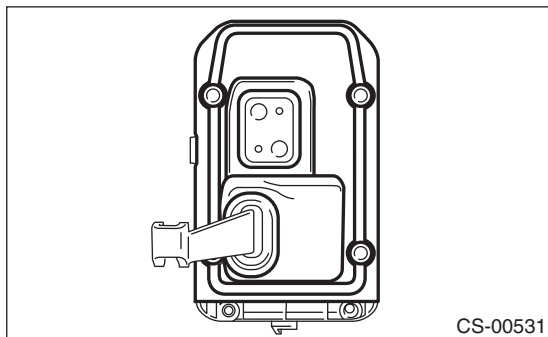


(A) "P" range switch

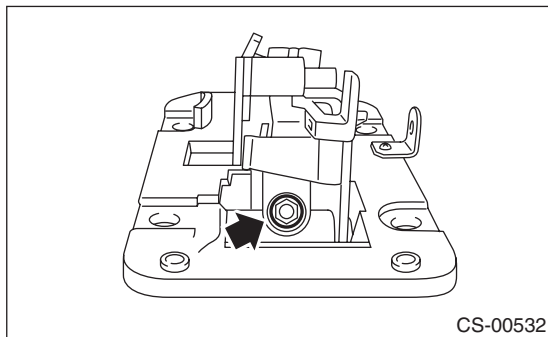
14) Remove the cable bracket.



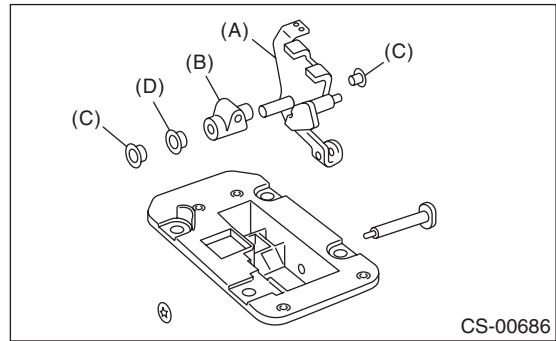
15) Remove the cover.



16) Remove the select lever assembly.



17) Remove the clamp, and remove the arm assembly and bushing plate.



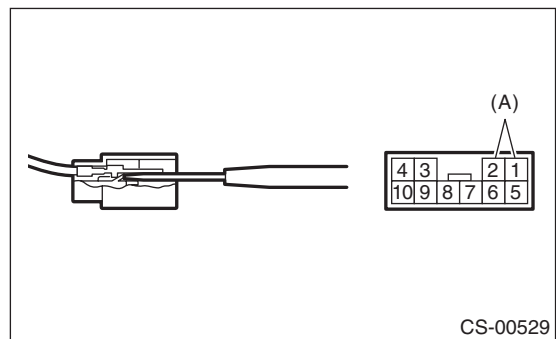
- (A) Arm ASSY
- (B) Bushing plate
- (C) Bushing A
- (D) Bushing B

## D: ASSEMBLY

- 1) Clean all the parts before assembly.
- 2) Apply NIGTIGHT LYW No. 2 grease or equivalent to each part. <Ref. to CS-2, AT SELECT LEVER, COMPONENT, General Description.>
- 3) Assemble in the reverse order of disassembly.

### NOTE:

- Refer to "COMPONENT" for each tightening torque. <Ref. to CS-2, AT SELECT LEVER, COMPONENT, General Description.>
- Connect the switch terminal to the connector.



(A) "P" range switch

4) After completing installation, shift the select lever from "P" range to "D" range, then check whether the indicator and select lever matches, whether the pointer and position mark matches and what the operating force is.

## E: INSPECTION

- 1) Inspect the removed parts by comparing with new parts for deformation, damage and wear. Repair or replace if defective.
- 2) Confirm the select lever operating condition before assembly. Normal if it operates smoothly.

## 4. Select Cable

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Shift the select lever to "N" range.
- 3) Disconnect the ground cable from the battery.
- 4) Lift up the vehicle.
- 5) Remove the front, center and rear exhaust pipes and the muffler. (SOHC and DOHC non-turbo model)

- SOHC MODEL

<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>

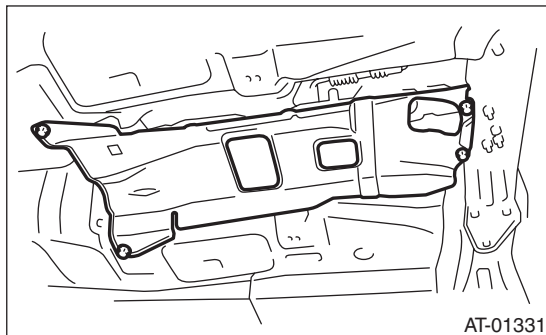
- DOHC 3.0 L model

<Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>

- 6) Remove the center and rear exhaust pipes and the muffler. (DOHC turbo model)

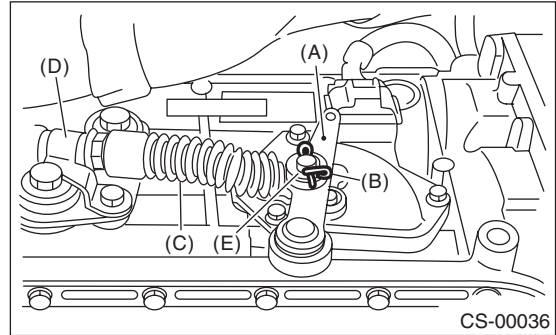
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

- 7) Remove the heat shield cover.



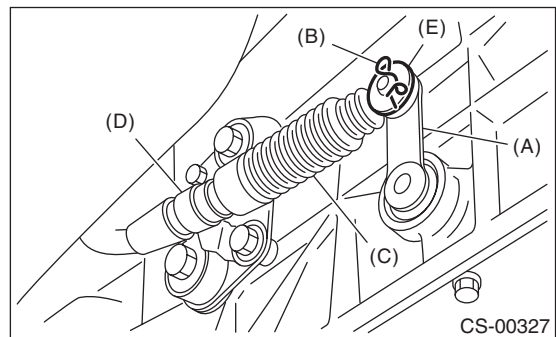
- 8) Remove the snap pin and washer from range select lever.

- 4AT



- (A) Range select lever
- (B) Snap pin
- (C) Select cable
- (D) Bracket
- (E) Washer

- 5AT



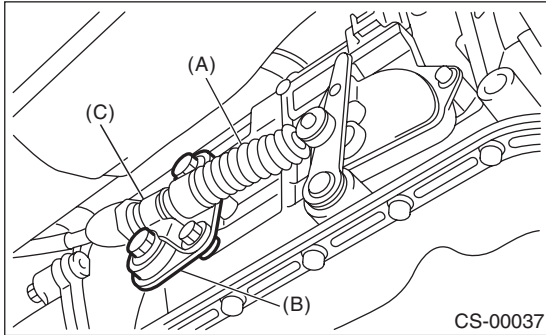
- (A) Range select lever
- (B) Snap pin
- (C) Select cable
- (D) Bracket
- (E) Washer

# Select Cable

## CONTROL SYSTEMS

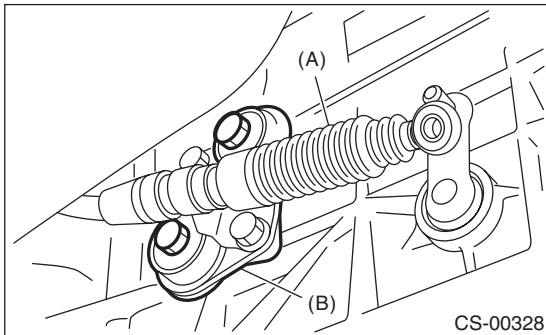
9) Remove the plate assembly from the transmission case.

• 4AT



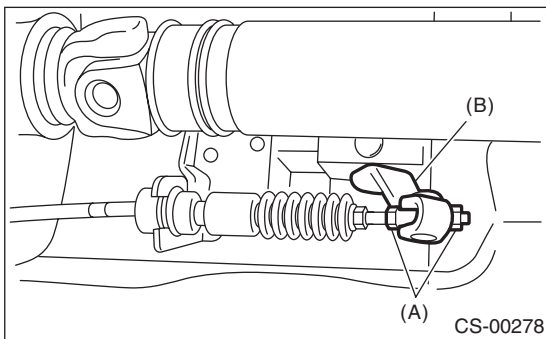
- (A) Select cable
- (B) Plate ASSY
- (C) Bracket

• 5AT



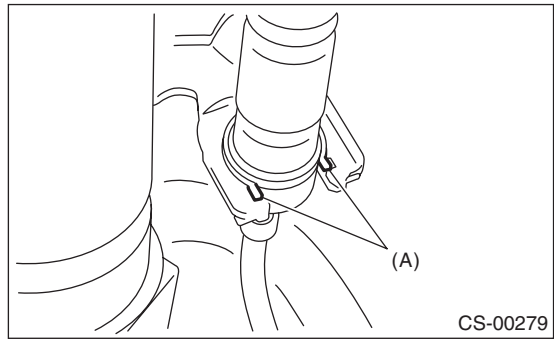
- (A) Select cable
- (B) Plate ASSY

10) Disconnect the cable from arm assembly.



- (A) Adjusting nut
- (B) Arm ASSY

11) Raise the claw of clamp to remove the cable from bracket.



- (A) Claw

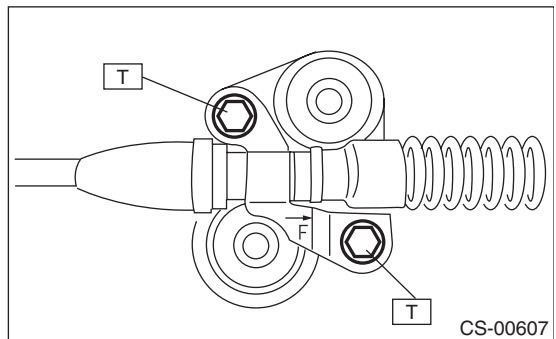
12) Remove the select cable from plate assembly.

## B: INSTALLATION

1) Install the select cable to plate assembly.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



2) Install the select cable to range select lever.

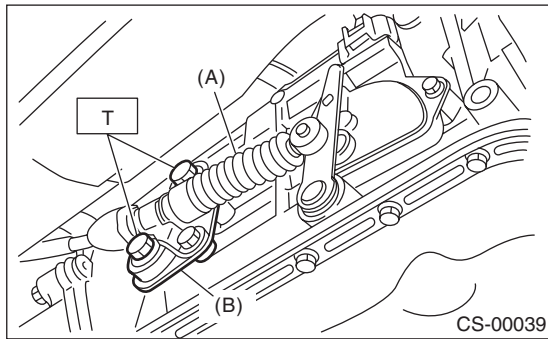


3) Install the plate assembly to transmission.

**Tightening torque:**

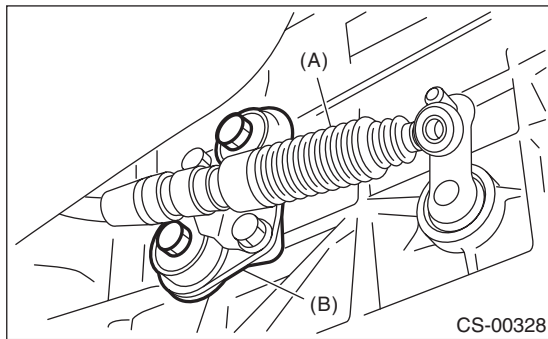
**T: 24.5 N·m (2.5 kgf-m, 18.1 ft-lb)**

- 4AT



- (A) Select cable
- (B) Plate ASSY

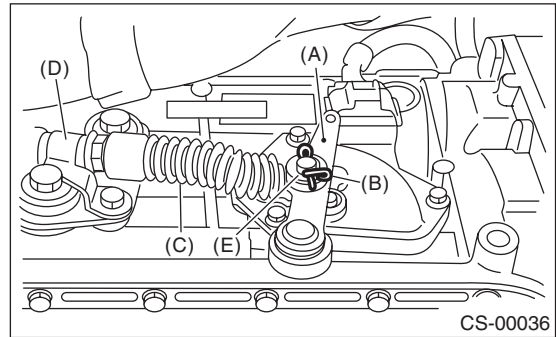
- 5AT



- (A) Select cable
- (B) Plate ASSY

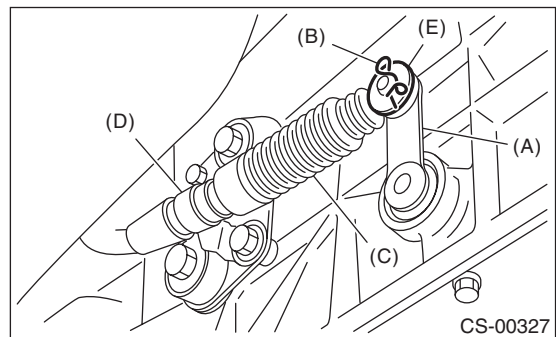
4) Install the washer and snap pin to range select lever.

- 4AT



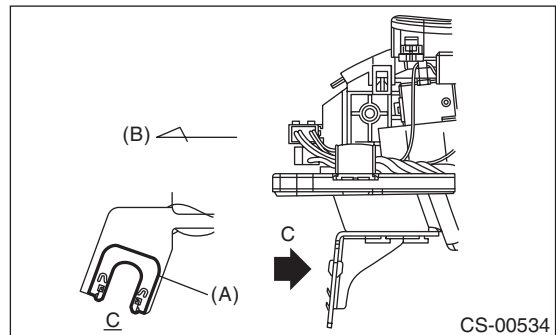
- (A) Range select lever
- (B) Snap pin
- (C) Select cable
- (D) Bracket
- (E) Washer

- 5AT



- (A) Range select lever
- (B) Snap pin
- (C) Select cable
- (D) Bracket
- (E) Washer

5) Install new clamp paying attention to the installing direction.

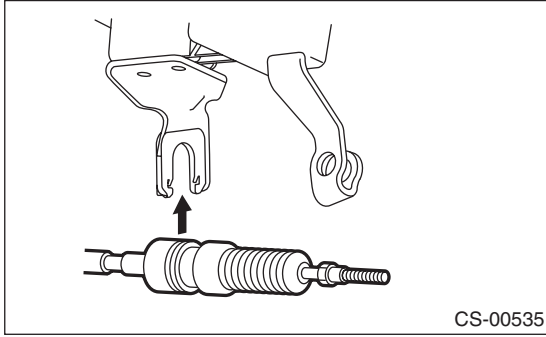


- (A) Clamp
- (B) Forward

## Select Cable

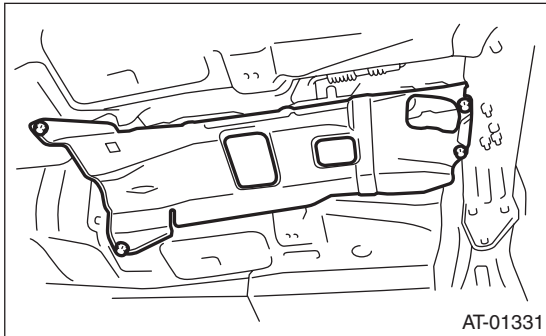
### CONTROL SYSTEMS

6) Insert the tip of inner cable into connector hole of select lever, and fix the cable to bracket.



7) Shift the select lever to the "N" range, and then adjust the select cable position. <Ref. to CS-31, ADJUSTMENT, Select Cable.>

8) Install the heat shield cover.



9) Install the front, center and rear exhaust pipes, and the muffler. (SOHC and DOHC non-turbo model)

- SOHC MODEL

<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- DOHC 3.0 L model

<Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>

10) Install the center, rear exhaust pipes and the muffler. (DOHC turbo model)

<Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

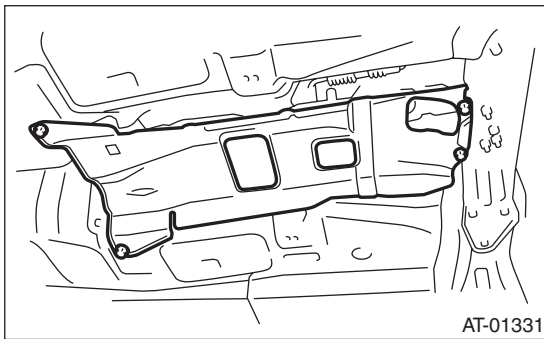
## C: INSPECTION

Check the removed cable and replace or adjust if damaged, rusty or malfunctioning.

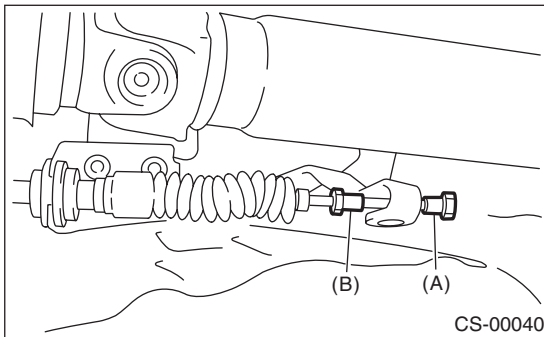
- 1) Check the cable for smooth operation.
- 2) Check the inner cable for damage and rust.
- 3) Check the outer cable for damage, bends and cracks.
- 4) Check the boot for damage, cracks and deterioration.
- 5) Move the select lever from "P" to "D" range. Check the existence of feel to contact the detents in each range. If the detents cannot be felt or the position pointer is improperly aligned, adjust the cable.
- 6) Check if the starter motor rotates when the select lever is set to "P" range.
- 7) Check the back-up light illumination when the select lever is in "R" range.
- 8) Check the parking lock operation when the select lever is in "P" range.

## D: ADJUSTMENT

- 1) Shift the select lever to "N" range.
- 2) Remove the rear exhaust pipe and muffler.
  - SOHC MODEL  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
  - DOHC 3.0 L model  
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 3) Remove the heat shield cover.

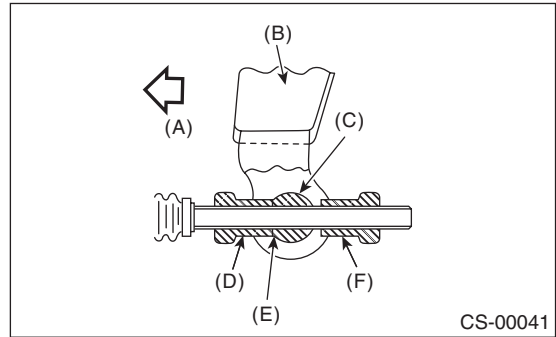


- 4) Loosen the adjusting nuts on both sides.



- (A) Adjusting nut A
- (B) Adjusting nut B

- 5) With the select lever pushed towards the rear of the vehicle, turn the adjustment nut B until it just contacts the connector. Then loosen the nut for 1/2 turn.

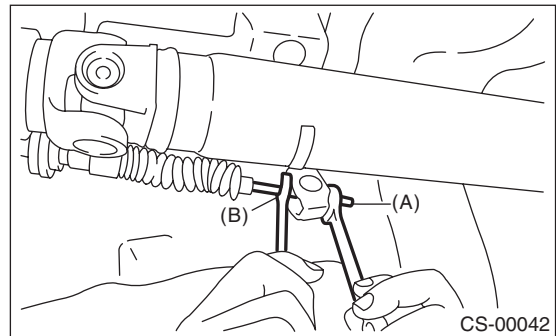


- (A) Forward side
- (B) Select lever
- (C) Connector
- (D) Adjusting nut B
- (E) Contact point
- (F) Adjusting nut A

- 6) Set a spanner wrench to adjusting nut B so that it does not rotate, and then tighten the adjusting nut A.

### Tightening torque:

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



- (A) Adjusting nut A
- (B) Adjusting nut B

- 7) After the completion of adjustment, confirm that the select lever operates normally at all ranges.
- 8) Install in the reverse order of removal.

# Paddle Shift Assembly

## CONTROL SYSTEMS

### 5. Paddle Shift Assembly

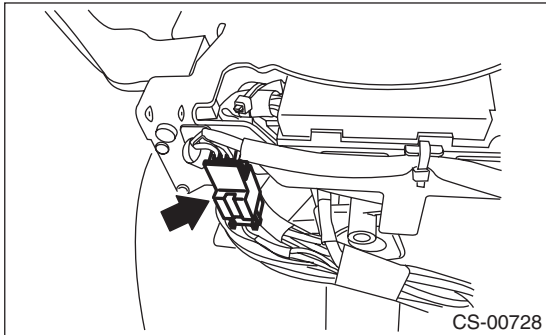
#### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Set the tire to the straight-ahead position.
- 3) Remove the airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

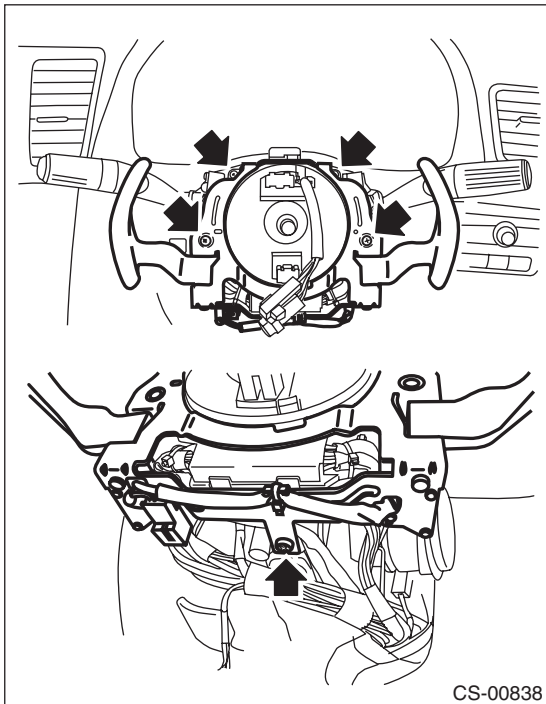
#### WARNING:

If there are airbag modules mounted, always refer to "Airbag System" when performing airbag module service. <Ref. to AB-4, CAUTION, General Description.>

- 4) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 5) Remove the column cover.
- 6) Disconnect the connector of paddle shift assembly.



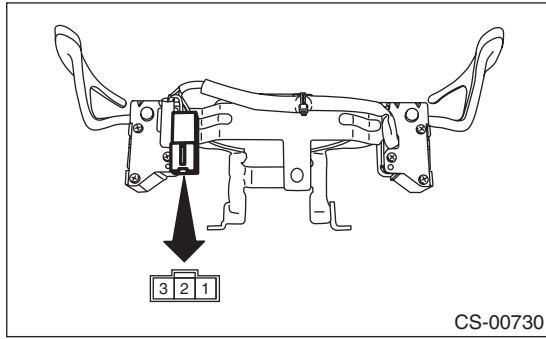
- 7) Remove the paddle shift assembly.



#### B: INSTALLATION

- 1) Clean all parts before installation.
- 2) Install in the reverse order of removal.
- 3) After completing installation, shift the select lever to the manual mode.
- 4) Operate the paddle shift assembly and confirm that "2" illuminates on the combination meter.

## C: INSPECTION



	Step	Check	Yes	No
1	<b>SHIFT-UP SWITCH CONTINUITY CHECK.</b> 1) Operate the + side of paddle shift assembly and hold it. 2) Measure the resistance between the terminals of the paddle shift assembly connector. <i>Terminals</i> <b>No. 1 — No. 2:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 2.	Replace the paddle shift assembly.
2	<b>SHIFT-DOWN SWITCH CONTINUITY CHECK.</b> 1) Operate the – side of paddle shift assembly and hold it. 2) Measure the resistance between the terminals of the paddle shift assembly connector. <i>Terminals</i> <b>No. 3 — No. 2:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 3.	Replace the paddle shift assembly.
3	<b>CHECK SHIFT SWITCH INSULATION.</b> 1) Do not operate the paddle shift assembly. 2) Measure the resistance between the terminals of the paddle shift assembly connector. <i>Terminals</i> <b>No. 2 — No. 1:</b> <b>No. 2 — No. 3:</b>	Is the resistance 1 $\Omega$ ?	Paddle shift assembly is normal.	Replace the paddle shift assembly.

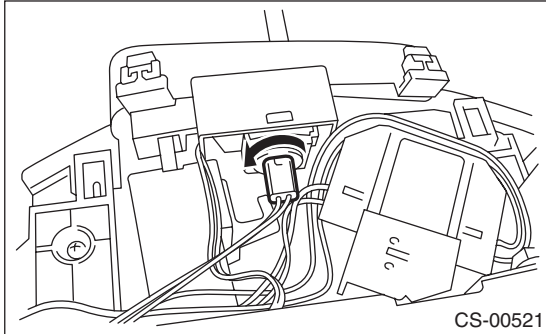
# AT Shift Lock Solenoid and "P" Range Switch

## CONTROL SYSTEMS

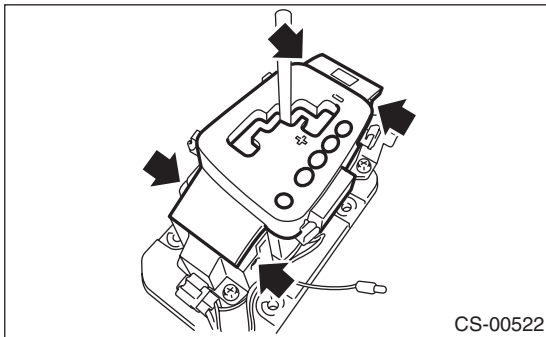
### 6. AT Shift Lock Solenoid and "P" Range Switch

#### A: REMOVAL

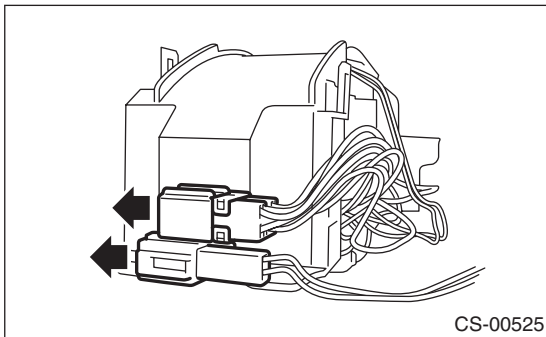
- 1) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 2) Disconnect the connector.
- 3) Remove the indicator bulb.



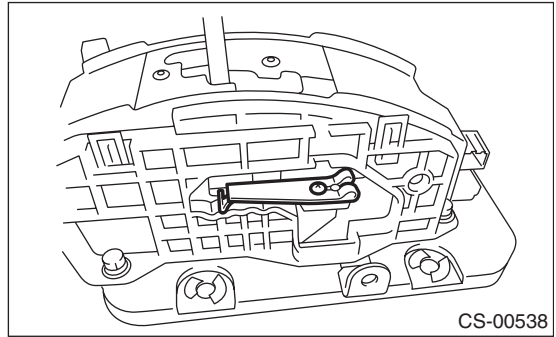
- 4) Remove the grip.
- 5) Remove the indicator cover.



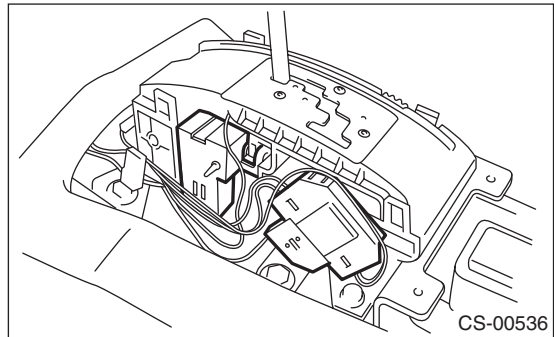
- 6) Disconnect the connector from the guide plate upper.



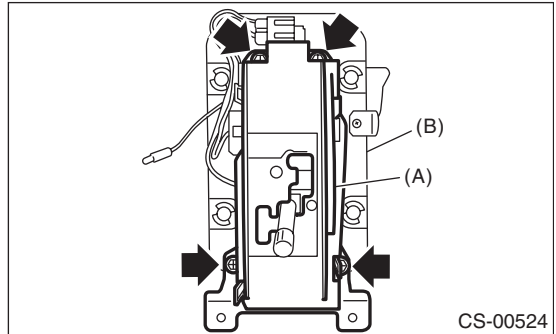
- 7) Shift the select lever to the "N" range, and then remove the detent spring.



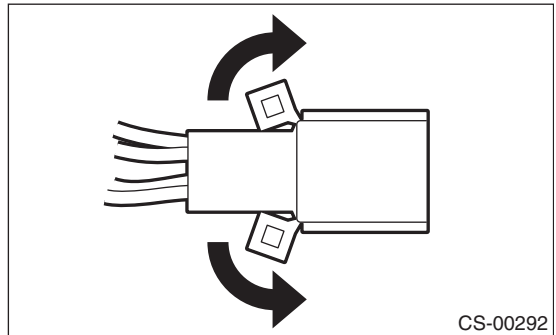
- 8) Remove the switch assembly and shift lock solenoid assembly.



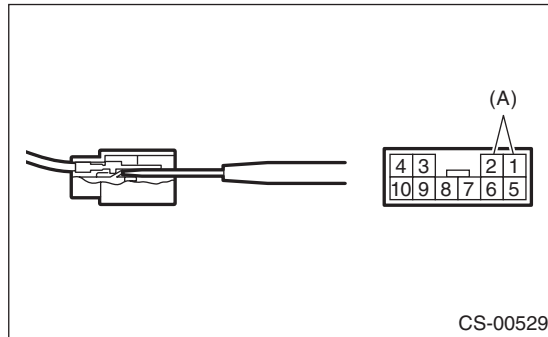
- 9) Remove the bolt to remove the guide plate upper (A) from the plate lower (B).



- 10) Raise the claw of the connector.



11) Disconnect the terminal of the “P” range switch from connector, using a flat-tip screwdriver with a thin tip.



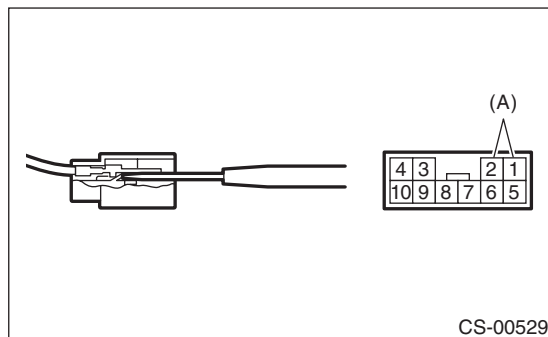
(A) “P” range switch

## B: INSTALLATION

Install in the reverse order of removal.

### NOTE:

- Refer to “COMPONENT” for each tightening torque. <Ref. to CS-2, AT SELECT LEVER, COMPONENT, General Description.>
- Connect the “P” range switch terminal to connector.



(A) “P” range switch

# AT Shift Lock Solenoid and “P” Range Switch

## CONTROL SYSTEMS

### C: INSPECTION

Step	Check	Yes	No
<b>1</b> <b>CHECK SHIFT LOCK SOLENOID.</b> Measure the resistance of shift lock solenoid connector terminals. <i>Terminals</i> <i>No. 4 — No. 3:</i>	Is the resistance between 12 — 18 $\Omega$ ?	Go to step 2.	Replace the shift lock solenoid.
<b>2</b> <b>CHECK SHIFT LOCK SOLENOID.</b> Connect the battery to shift lock solenoid connector terminal, and then operate the solenoid. <i>Terminals</i> <i>No. 3 (+) — No. 4 (-):</i>	Does the shift lock solenoid operate normally?	Go to step 3.	Replace the shift lock solenoid.
<b>3</b> <b>CHECK “P” RANGE SWITCH.</b> 1) Move the select lever to “P” range. 2) Measure the resistance between “P” range switch connector terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Replace the “P” range switch.
<b>4</b> <b>CHECK “P” RANGE SWITCH.</b> 1) Set the select lever to other than “P” range. 2) Measure the resistance between “P” range switch connector terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance 1 M $\Omega$ or more?	Normal operation	Replace the “P” range switch.



## 7. Body Integrated Unit

### A: NOTE

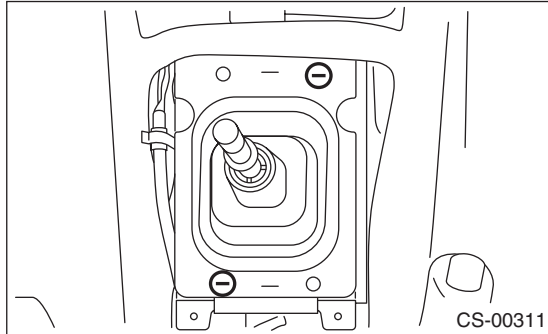
Refer to “Body Integrated Unit” for removal and installation procedure. <Ref. to SL-55, Body Integrated Unit.>

## 8. MT Gear Shift Lever

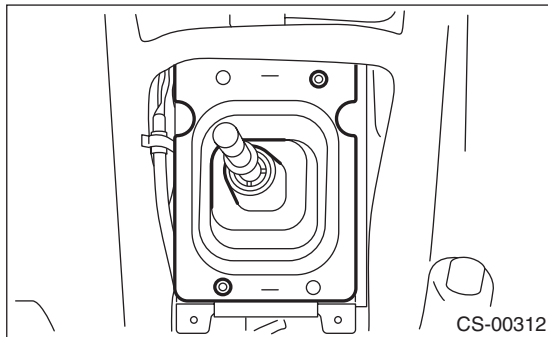
### A: REMOVAL

#### 1. 5MT MODEL

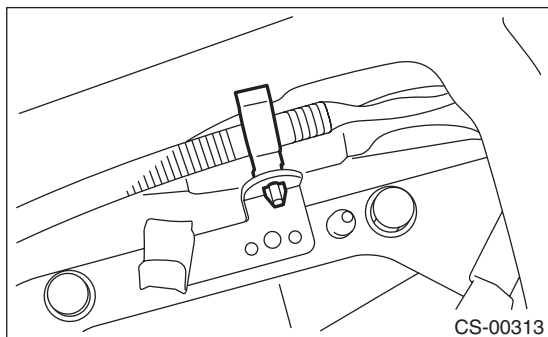
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the gear shift knob.
- 4) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 5) Remove the front cover assembly.
- 6) Remove the clamp.



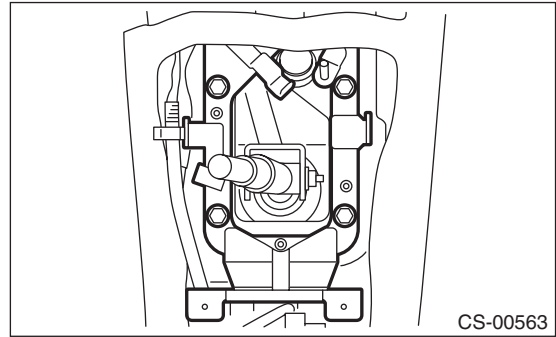
- 7) Remove the bushing and insulator assembly.



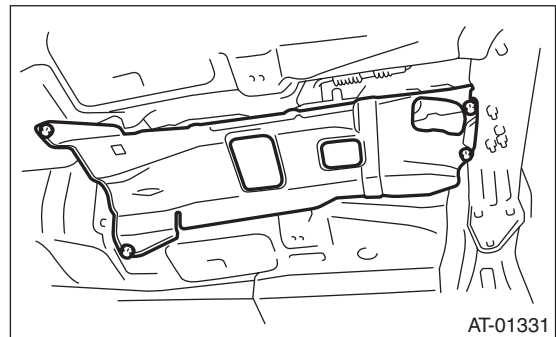
- 8) Remove the harness clamp from the plate assembly.



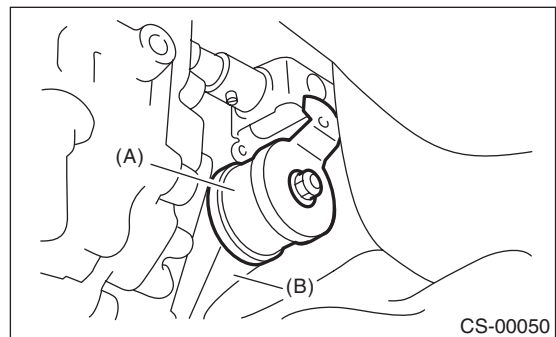
- 9) Remove the plate assembly from the vehicle body.



- 10) Lift up the vehicle.
- 11) Remove the rear exhaust pipe and muffler.
  - SOHC MODEL  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 12) Remove the heat shield cover.

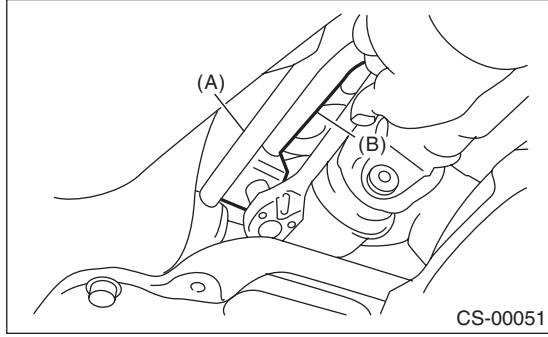


- 13) Remove the stay from transmission bracket.



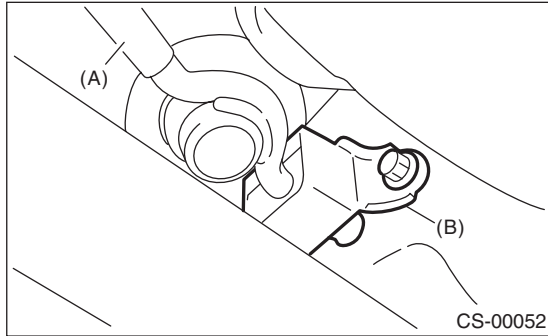
- (A) Stay
- (B) Transmission bracket

14) Remove the rod from joint.



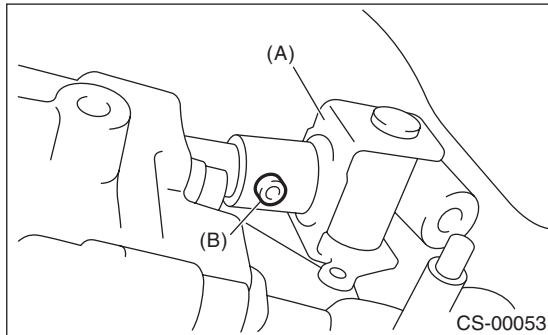
- (A) Stay
- (B) Rod

15) Remove the cushion rubber from the vehicle body.



- (A) Stay
- (B) Cushion rubber

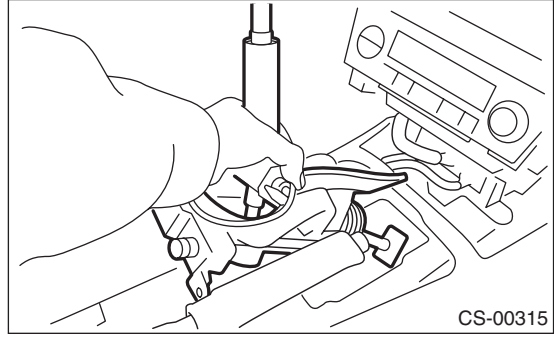
16) Extract the spring pin and remove the joint.



- (A) Joint
- (B) Spring pin

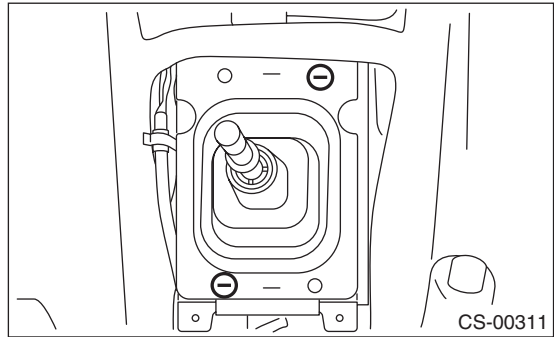
17) Lower the vehicle.

18) Remove the gear shift lever.

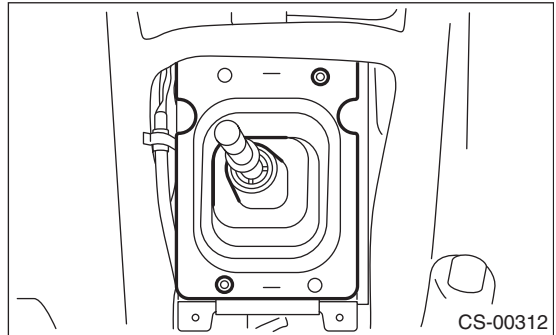


## 2. 6MT MODEL

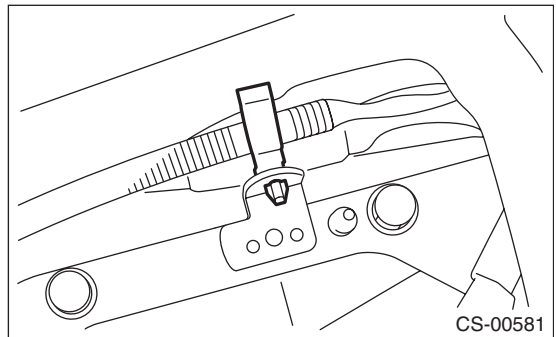
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the gear shift knob.
- 4) Remove the console box front. <Ref. to EI-54, REMOVAL, Console Box.>
- 5) Remove the front cover assembly.
- 6) Remove the clamp.



7) Remove the bushing and insulator assembly.



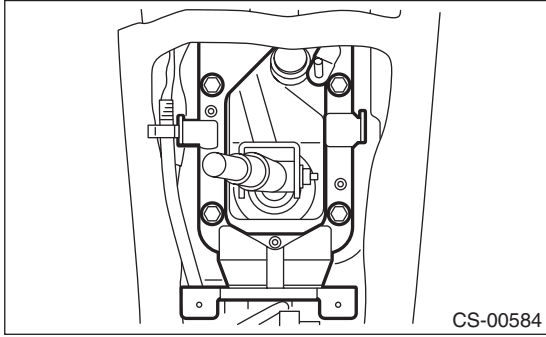
8) Remove the harness clamp from the plate assembly.



# MT Gear Shift Lever

## CONTROL SYSTEMS

9) Remove the plate assembly from the vehicle body.

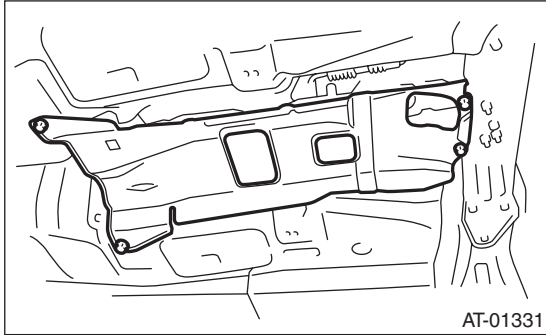


10) Lift up the vehicle.

11) Remove the under cover.

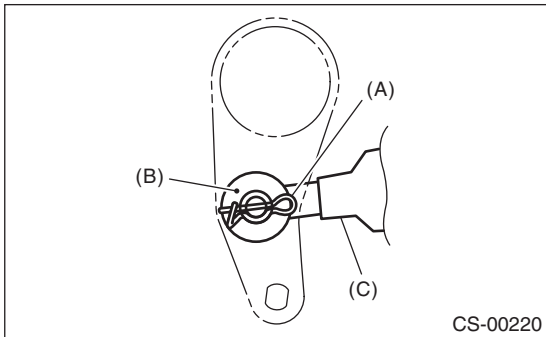
12) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

13) Remove the heat shield cover.



14) Remove the crossmember. <Ref. to 6MT-30, REMOVAL, Transmission Mounting System.>

15) Remove the snap pin and washer, and remove the reverse check cable from the reverse check lever.

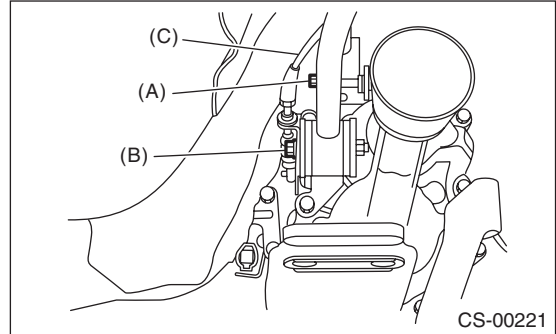


- (A) Snap pin
- (B) Washer
- (C) Reverse check cable

16) Move the transmission to the right side, and remove the joint COMPL, stay bolts and reverse check cable.

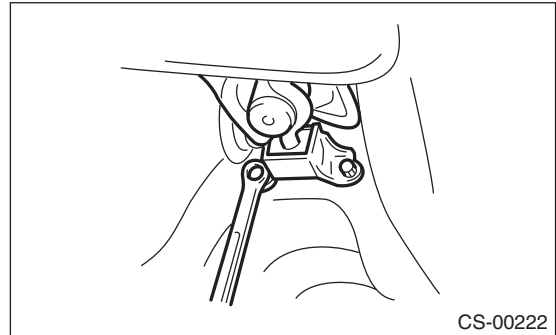
### NOTE:

If the transmission is not moved aside, the joint COMPL and stay bolts may contact the body and cause damage.



- (A) Joint COMPL bolt
- (B) Stay bolt
- (C) Reverse check cable

17) Remove the cushion rubber from the vehicle body.



18) Lower the vehicle.

19) Remove the gear shift lever.

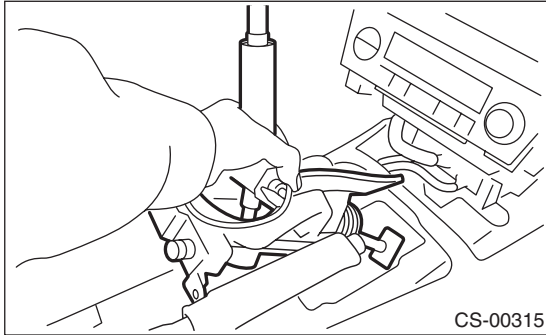
## B: INSTALLATION

### 1. 5MT MODEL

- 1) Install the joint to the transmission and secure with a spring pin.
- 2) Insert the gear shift lever from the room side.

**NOTE:**

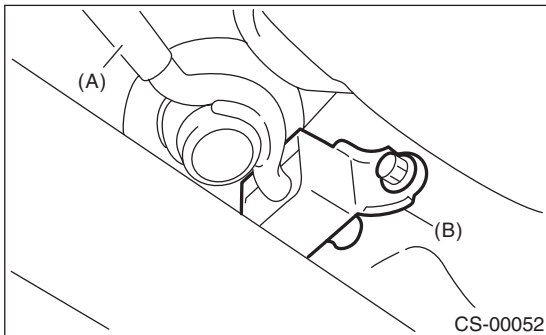
Insert the rod and the stay, and then temporarily set them onto the transmission mount.



- 3) Lift up the vehicle.
- 4) Mount the cushion rubber on the vehicle body.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

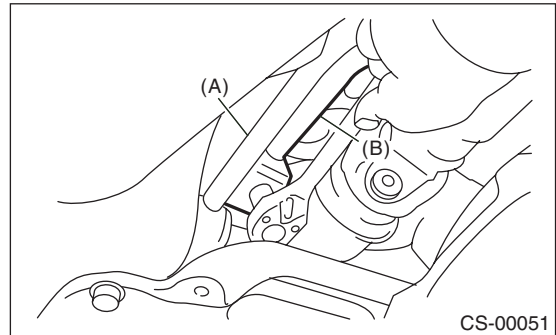


- (A) Stay
- (B) Cushion rubber

- 5) Using new self-locking nuts, connect the rod to the joint.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

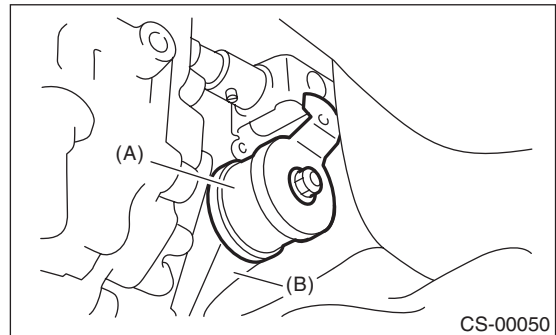


- (A) Stay
- (B) Rod

- 6) Using new self-locking nuts, connect the stay to the transmission bracket.

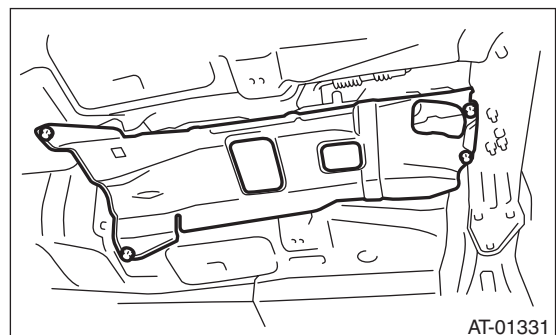
**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



- (A) Stay
- (B) Transmission bracket

- 7) Install the heat shield cover.



# MT Gear Shift Lever

## CONTROL SYSTEMS

8) Install the rear exhaust pipe and muffler.

- SOHC MODEL

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- DOHC turbo model

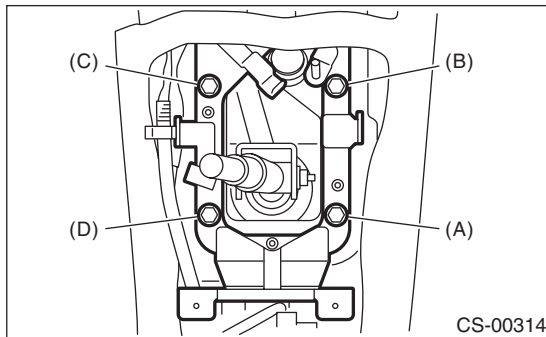
<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

9) Install the plate assembly to the vehicle body.

**Tightening torque:**

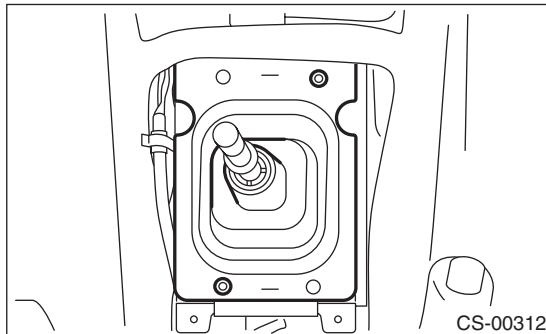
**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

- (1) Set the plate assembly to the vehicle.
- (2) Temporarily tighten the bolt (A).
- (3) Tighten the bolt (B).
- (4) Tighten the bolt (A).
- (5) Tighten the bolts (C) and (D).



10) Install the harness clamp to the plate.

11) Install the boot and insulator assembly, and secure with a clamp.



12) Install the front cover assembly.

13) Install the console box. <Ref. to EI-54, INSTALLATION, Console Box.>

## 2. 6MT MODEL

1) Insert the gear shift lever from the room side.

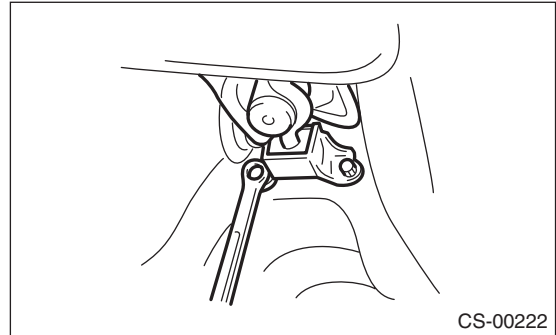
**NOTE:**

After inserting the rod and stay, temporarily put them onto transmission mount.

2) Mount the cushion rubber on the vehicle body.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.3 ft-lb)**

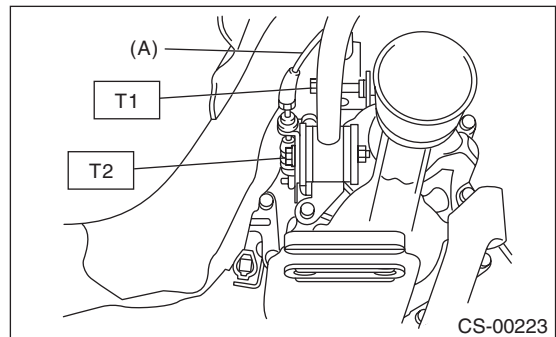


3) Move the transmission to the right side of the vehicle, and attach the joint COMPL and stay.

**Tightening torque:**

**T1: 12 N·m (1.2 kgf-m, 8.9 ft-lb)**

**T2: 32 N·m (3.3 kgf-m, 23.6 ft-lb)**



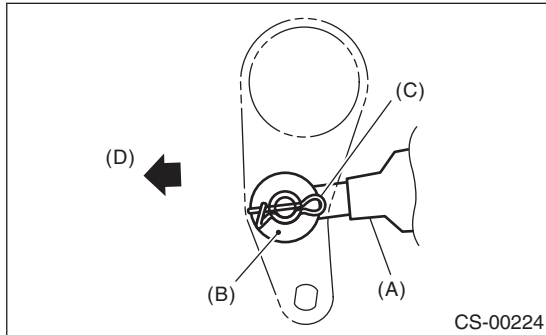
(A) Reverse check cable

4) Install the cross member. <Ref. to 6MT-30, INSTALLATION, Transmission Mounting System.>

5) Install the reverse cable end, washer and snap pin to the reverse check lever.

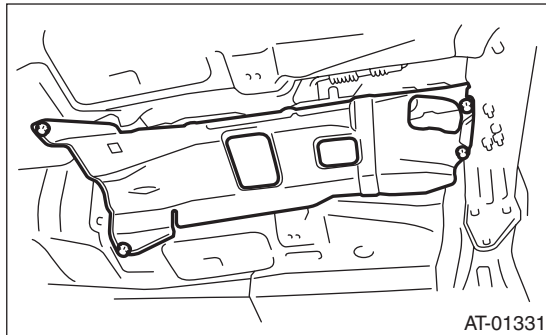
**NOTE:**

- Take care to install the snap pin in proper direction.
- Before installing, adjust the reverse check cable. <Ref. to CS-56, ADJUSTMENT, Reverse Check Cable.>



- (A) Reverse check cable
- (B) Washer
- (C) Snap pin
- (D) Front side

6) Install the heat shield cover.



7) Install the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

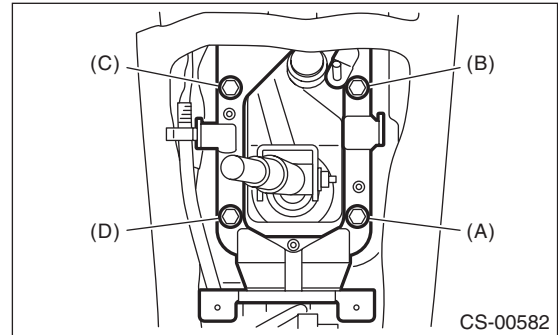
8) Install the under cover.

9) Install the plate assembly to the vehicle body.

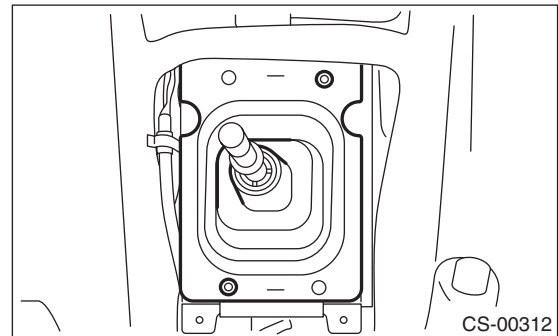
**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

- (1) Set the plate assembly to the vehicle.
- (2) Temporarily tighten the bolt (A).
- (3) Tighten the bolt (B).
- (4) Tighten the bolt (A).
- (5) Tighten the bolts (C) and (D).



- 10) Install the harness clamp to the plate assembly.
- 11) Install the boot and insulator assembly, and secure with a clamp.



12) Install the front cover assembly.

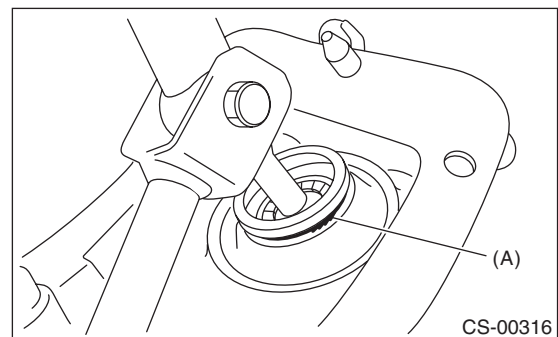
13) Install the console box. <Ref. to EI-54, INSTALLATION, Console Box.>

14) Check that the gear shift can be shifted to each gear properly.

## C: DISASSEMBLY

### 1. 5MT MODEL

1) Remove the lock wires.

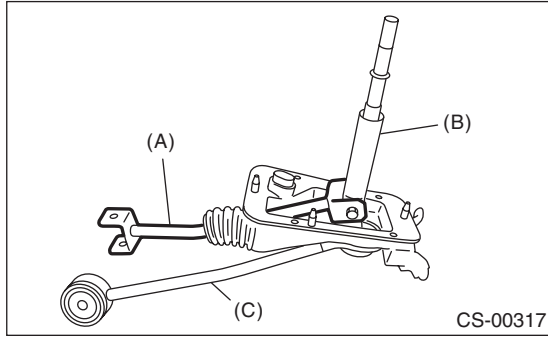


- (A) Lock wire

# MT Gear Shift Lever

## CONTROL SYSTEMS

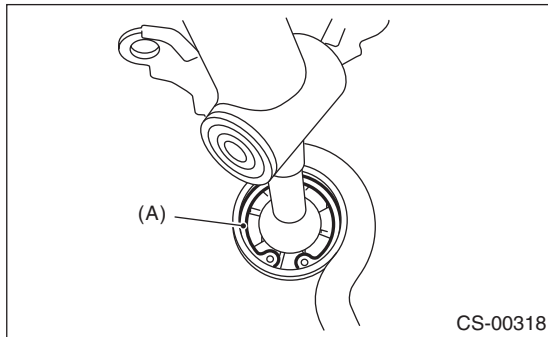
2) Remove the rod from lever.



- (A) Rod
- (B) Lever
- (C) Stay

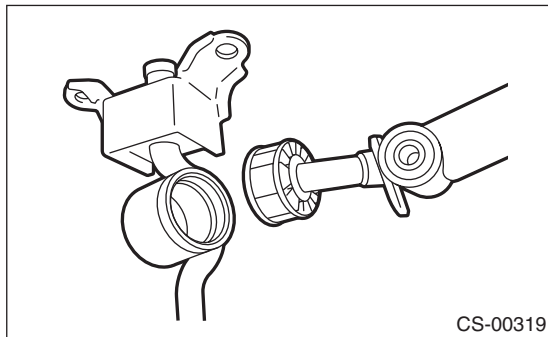
3) Separate the rod and inner boot.

4) Remove the snap ring from the stay.

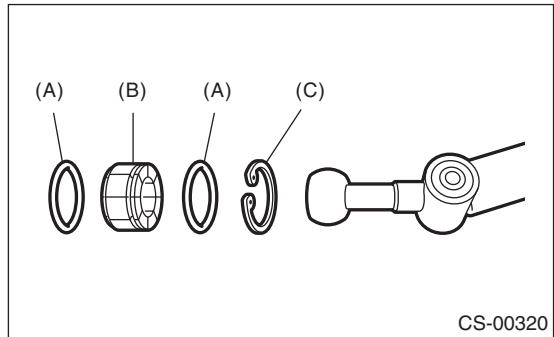


- (A) Snap ring

5) Separate the gear shift lever and the stay.

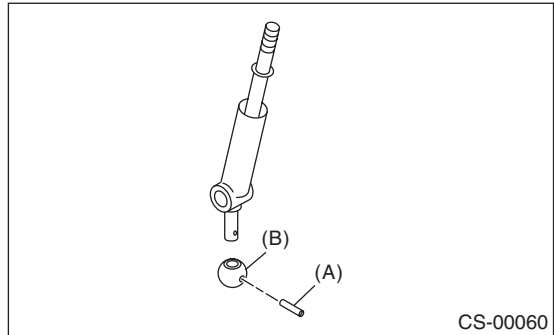


6) Remove the boot, bushing and snap ring from gear shift lever.



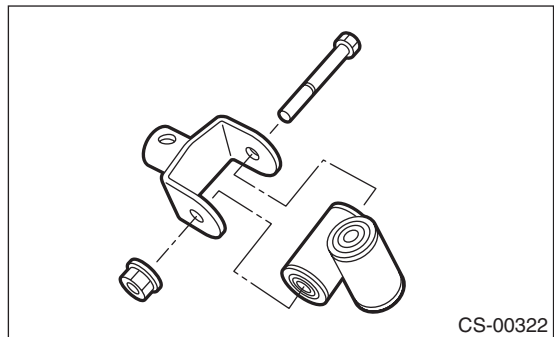
- (A) O-ring
- (B) Bushing
- (C) Snap ring

7) Remove the spring pin, and then remove the bushing and snap ring.



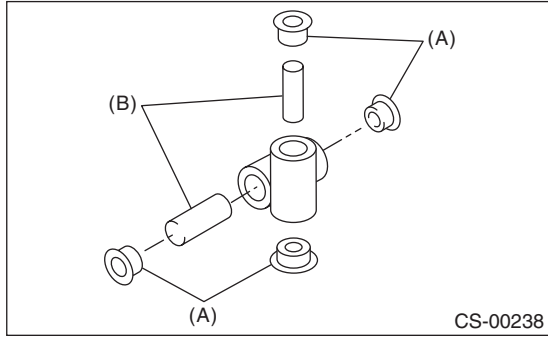
- (A) Spring pin
- (B) Bushing

8) Remove the boss from the joint.





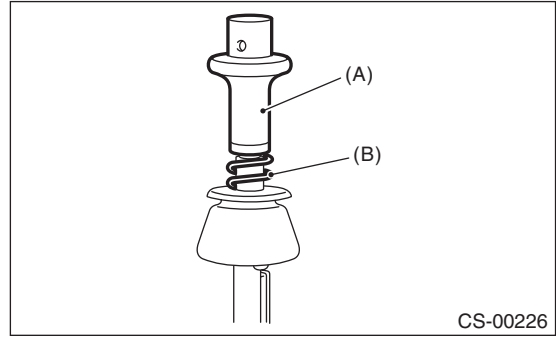
9) Remove the bushing and spacer from the boss.



- (A) Bushing
- (B) Spacer

CS-00238

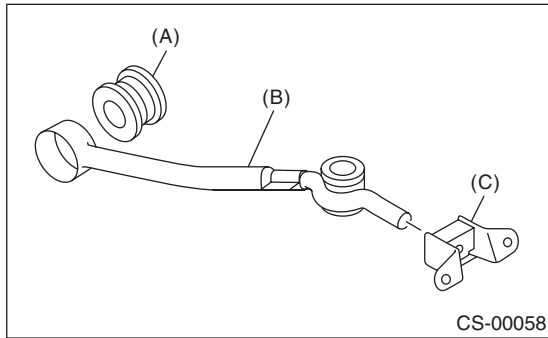
2) Remove the slider and spring.



- (A) Slider
- (B) Spring

CS-00226

10) Remove the bushing and cushion rubber from the stay.

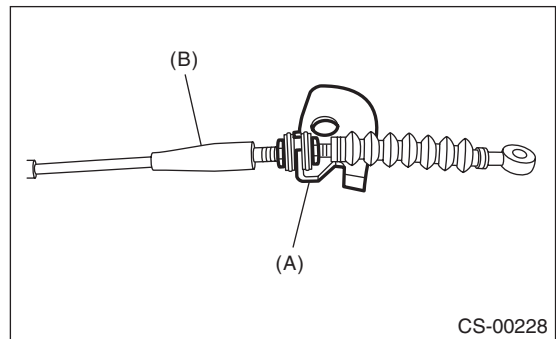


- (A) Bushing B
- (B) Stay
- (C) Cushion rubber

CS-00058

3) Cut the band clip.

4) Remove the reverse check cable from the cable plate.

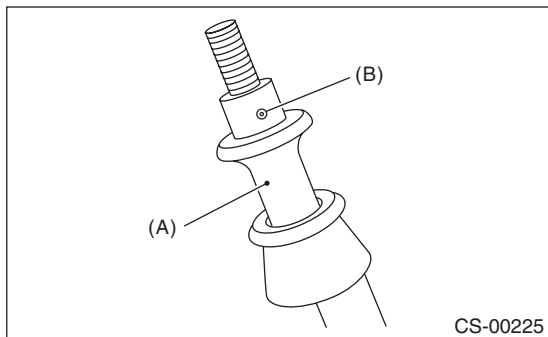


- (A) Cable plate
- (B) Reverse check cable

CS-00228

## 2. 6MT MODEL

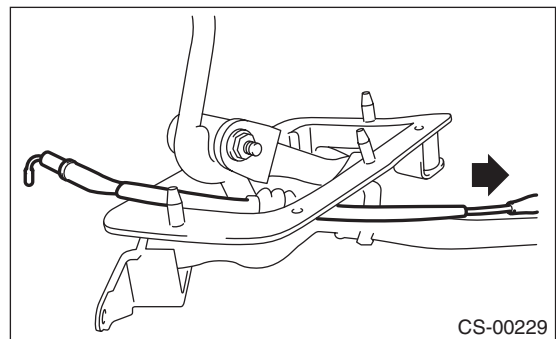
1) Remove the spring pin from the slider.



- (A) Slider
- (B) Spring pin

CS-00225

5) Remove the reverse check cable from the gear shift assembly.

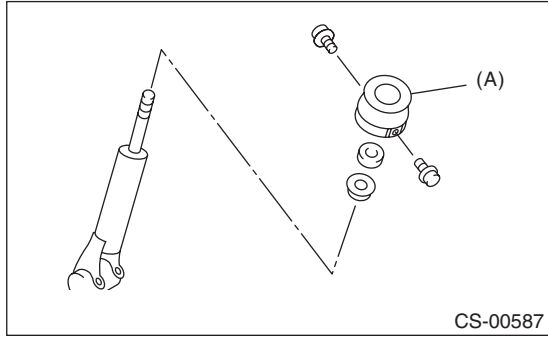


CS-00229

# MT Gear Shift Lever

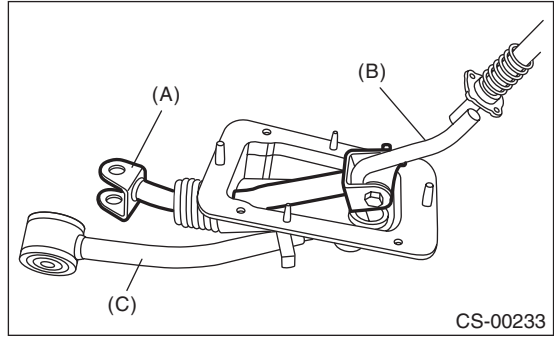
## CONTROL SYSTEMS

6) Remove the holder and spring.



(A) Holder

9) Remove the rod from lever.

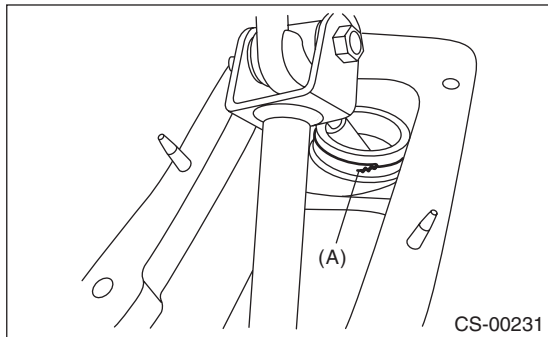


(A) Rod  
(B) Lever  
(C) Stay

7) Disassemble the lock wires.

**NOTE:**

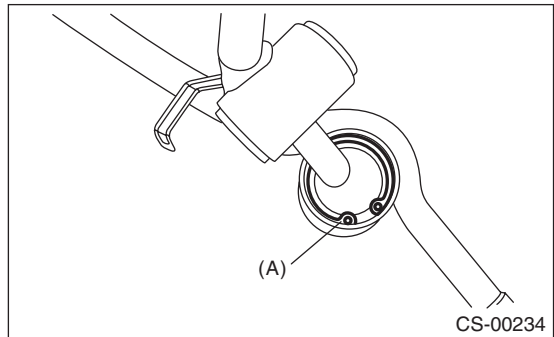
Do not reuse the lock wire.



(A) Lock wire

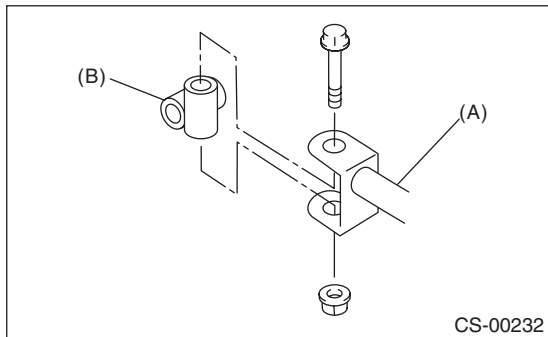
10) Separate the rod and inner boot.

11) Remove the snap ring from the stay.



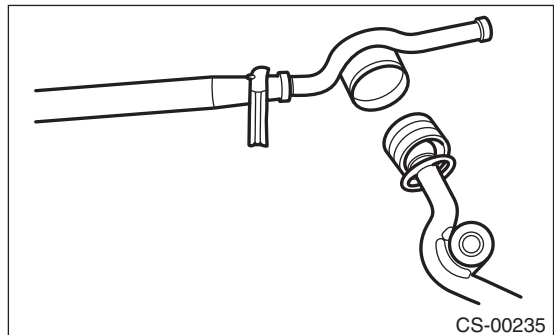
(A) Snap ring

8) Remove the boss from the rod.

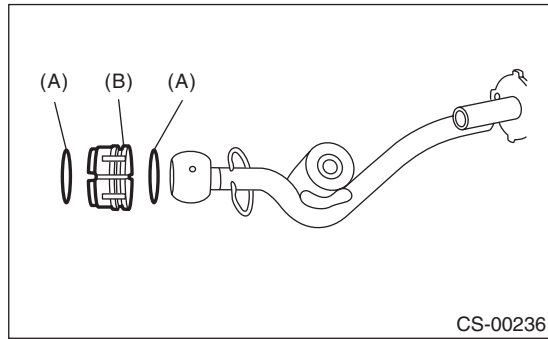


(A) Rod  
(B) Boss

12) Separate the gear shift lever and the stay.

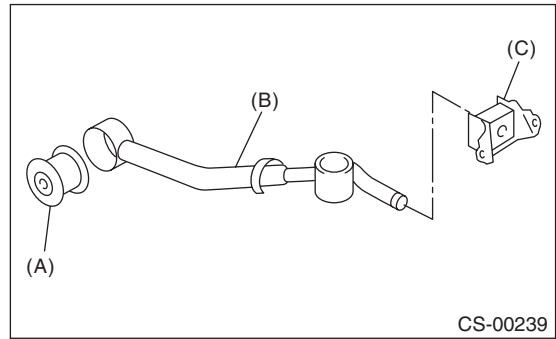


13) Remove the boot and bushing from gear shift lever.



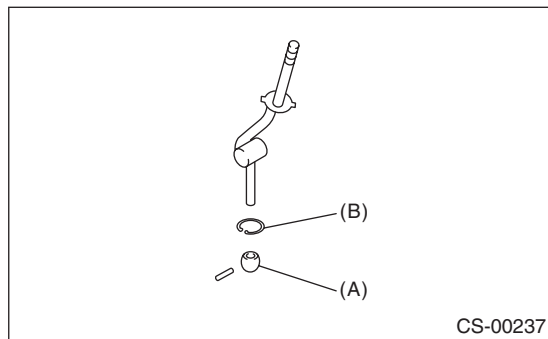
- (A) O-ring
- (B) Bushing

16) Remove the bushing and cushion rubber from the stay.



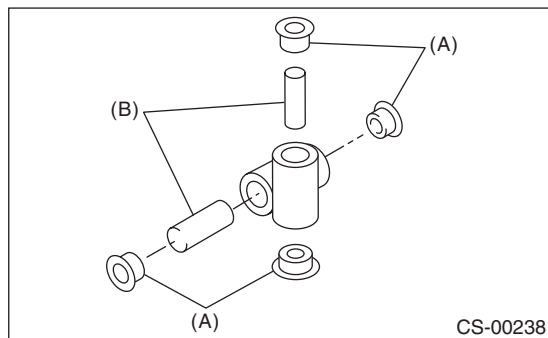
- (A) Bushing
- (B) Stay
- (C) Cushion rubber

14) Remove the spring pin, and then remove the bushing and snap ring.



- (A) Bushing
- (B) Snap ring

15) Remove the bushing and spacer from the boss.



- (A) Bushing
- (B) Spacer

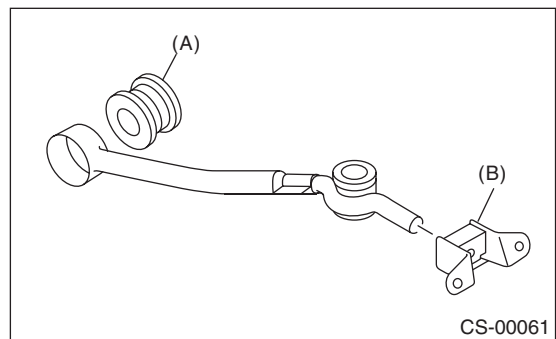
## D: ASSEMBLY

### 1. 5MT MODEL

**NOTE:**

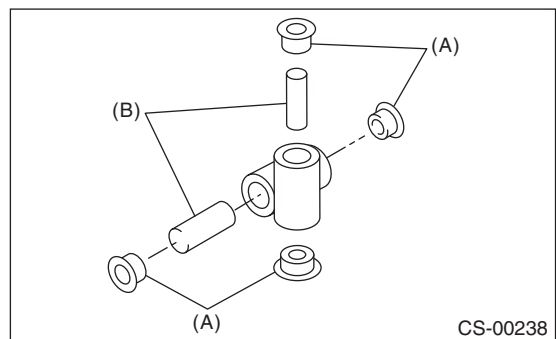
- Clean all the parts before assembly.
- Apply NIGTIGHT LYW No. 2 grease or equivalent to each part.

1) Mount the bushing and cushion rubber to the stay.



- (A) Bushing
- (B) Cushion rubber

2) Install the bushing and spacer to boss.



- (A) Bushing
- (B) Spacer

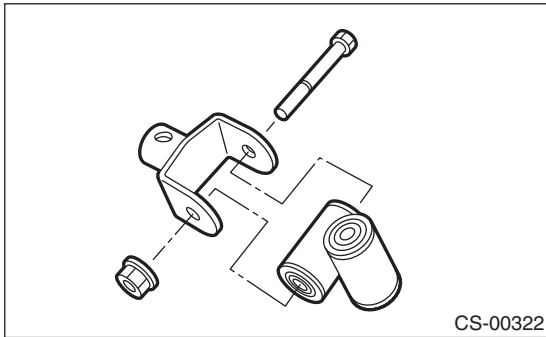
# MT Gear Shift Lever

## CONTROL SYSTEMS

3) Using new self-locking nuts, install the boss to the joint.

**Tightening torque:**

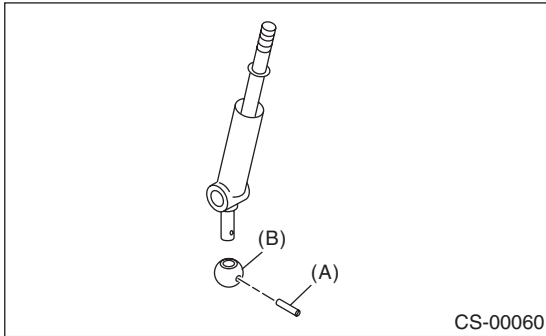
**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



4) Install the snap ring to gear shift lever and install the bushing.

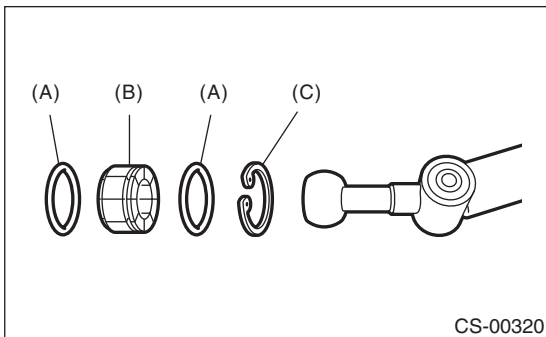
**NOTE:**

Apply grease to the bushing.



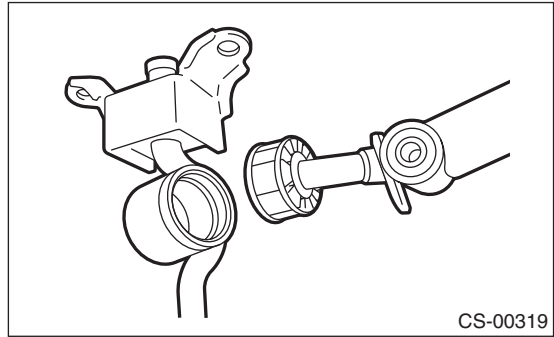
- (A) Spring pin
- (B) Bushing

5) Apply grease to the bushing and O-ring, and then install to gear shift lever.

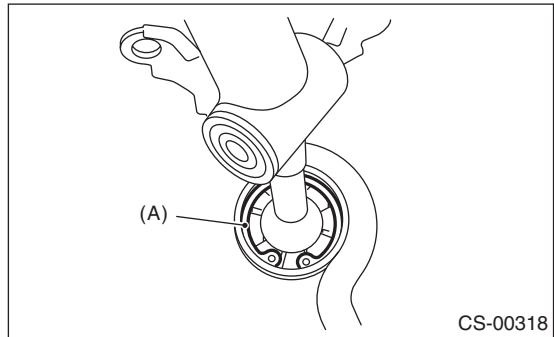


- (A) O-ring
- (B) Bushing
- (C) Snap ring

6) Apply sufficient grease into boss, and then install the gear shift lever to the stay.



7) Install the washer and snap ring.



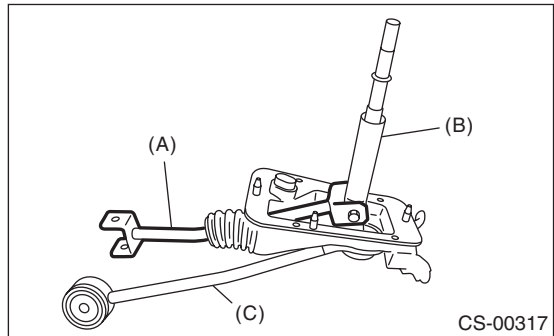
- (A) Snap ring

8) Insert the gear shift lever and rod into boot hole.

9) Install the rod.

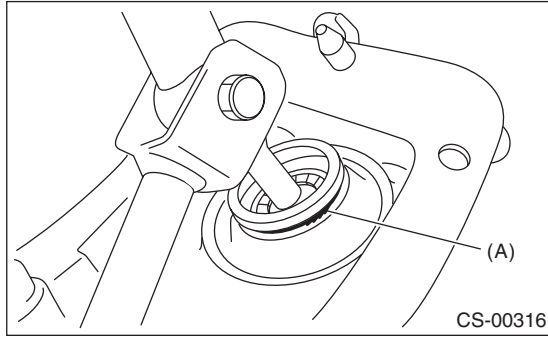
**Tightening torque:**

**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- (A) Rod
- (B) Lever
- (C) Stay

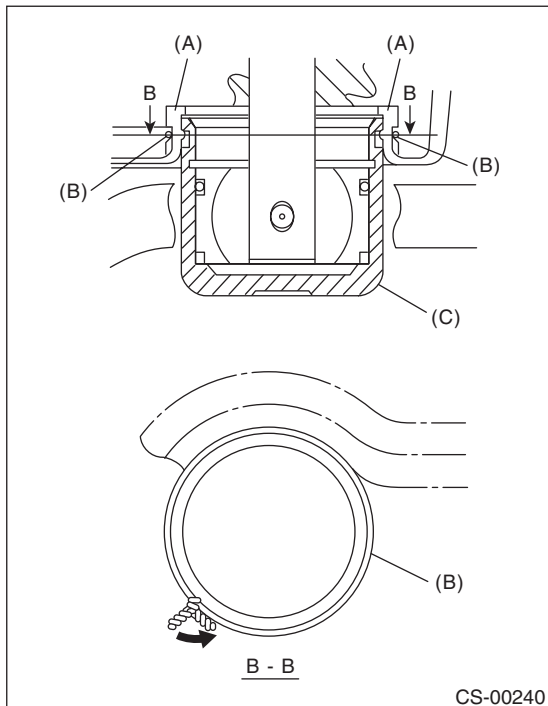
10) Install a new lock wire.



(A) Lock wire

**NOTE:**

- Install the lock wire to the stay groove.
- Bend the extra wire to the same direction of lock wire winding.



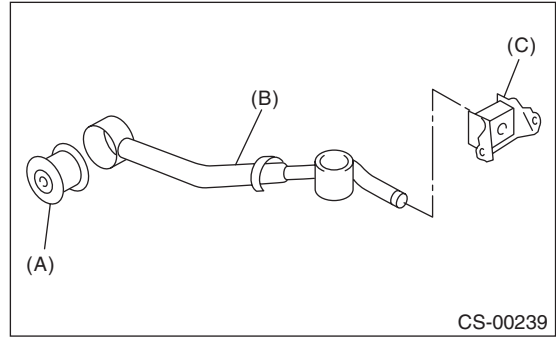
(A) Inner boot  
(B) Lock wire  
(C) Stay

## 2. 6MT MODEL

**NOTE:**

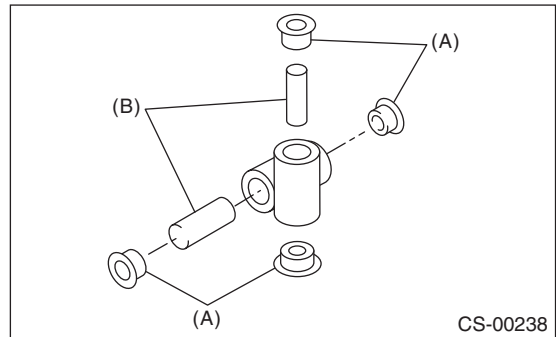
- Clean all the parts before assembly.
- Apply NIGTIGHT LYW No. 2 grease or equivalent to each part.

1) Mount the bushing and cushion rubber to the stay.



(A) Bushing  
(B) Stay  
(C) Cushion rubber

2) Install the bushing and spacer to boss.

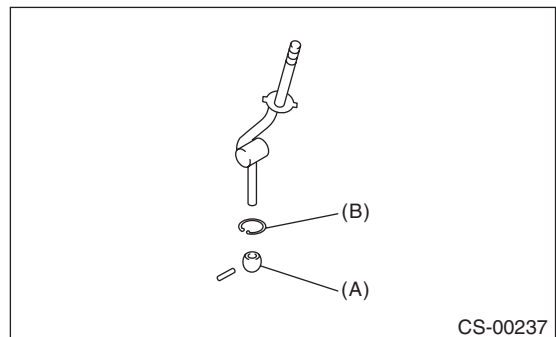


(A) Bushing  
(B) Spacer

3) Install the snap ring to gear shift lever and install the bushing.

**NOTE:**

Apply grease to the bushing.

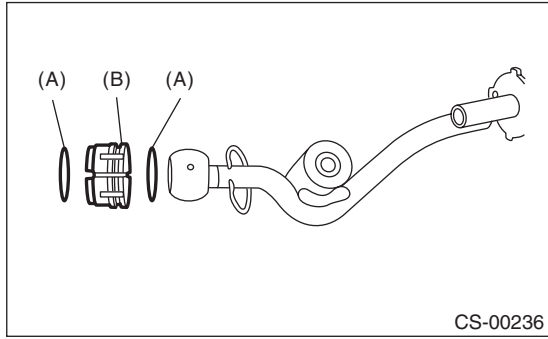


(A) Bushing  
(B) Snap ring

# MT Gear Shift Lever

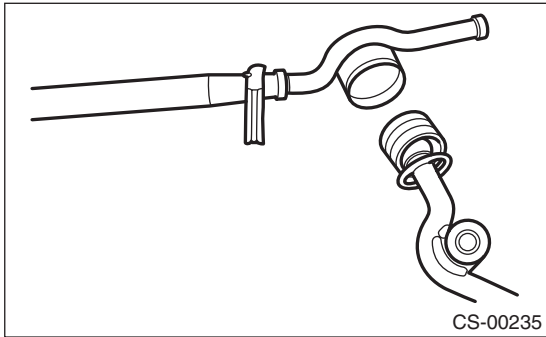
## CONTROL SYSTEMS

4) Apply grease to the bushing and O-ring, and then install to gear shift lever.

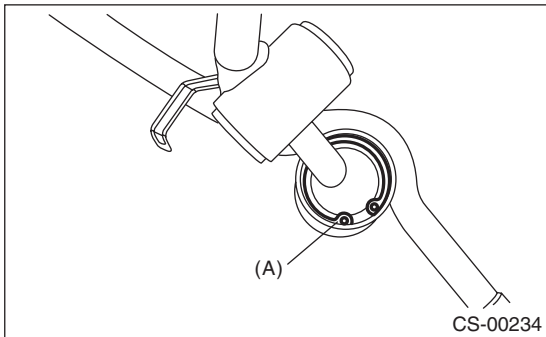


- (A) O-ring
- (B) Bushing

5) Apply sufficient grease into boss, and then install the gear shift lever to the stay.



6) Install the washer and snap ring.

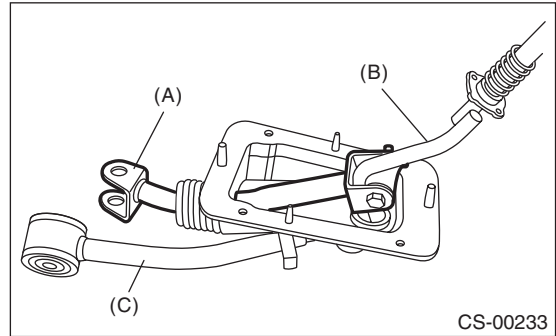


- (A) Snap ring

7) Insert the gear shift lever and rod into boot hole.

8) Install the rod.

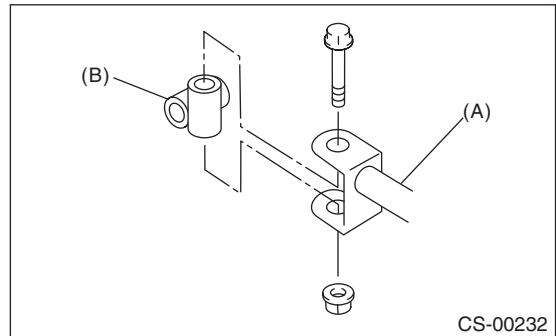
**Tightening torque:**  
**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- (A) Rod
- (B) Lever
- (C) Stay

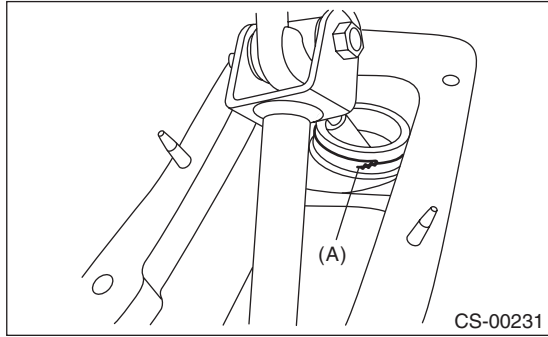
9) Install the boss to the rod.

**Tightening torque:**  
**12 N·m (1.2 kgf·m, 8.9 ft·lb)**



- (A) Rod
- (B) Boss

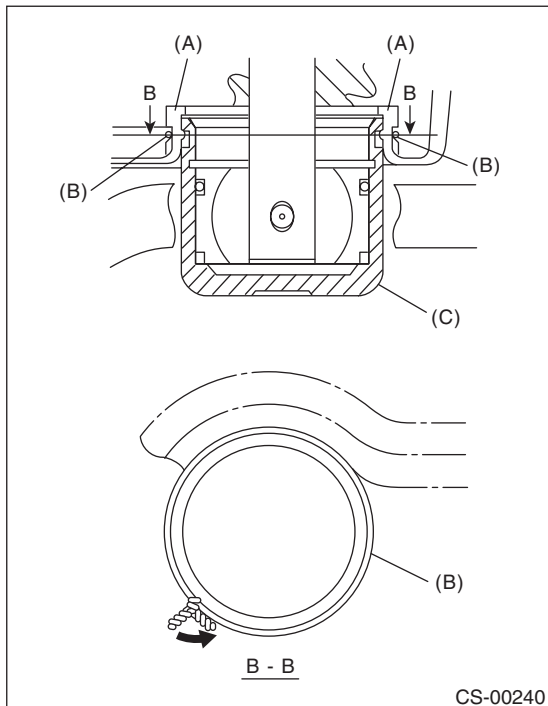
10) Install a new lock wire.



(A) Lock wire

**NOTE:**

- Install the lock wire to the stay groove.
- Bend the extra wire to the same direction of lock wire winding.

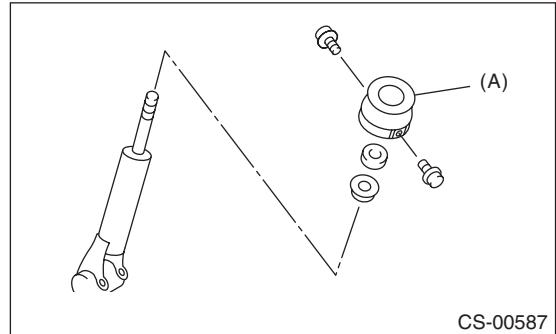


- (A) Inner boot
- (B) Lock wire
- (C) Stay

11) Install the holder.

**Tightening torque:**

**1.3 N-m (0.13 kgf-m, 0.96 ft-lb)**



(A) Holder

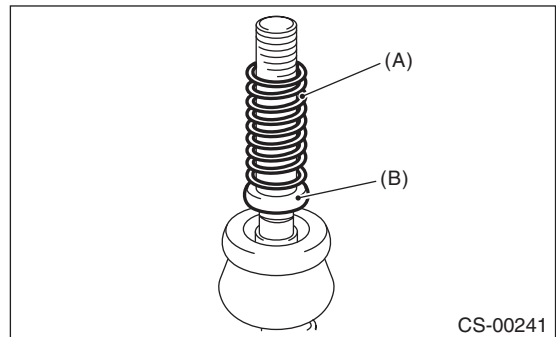
12) Insert the reverse check cable into the boot hole.

13) Insert the reverse check cable to the gear shift assembly, and affix with a band clip.

**NOTE:**

- Cut the excess band clip.
- Make sure that the reverse check cable is inserted into the gear shift lever assembly without inter-space.

14) Attach the seat cushion and spring.



- (A) Spring
- (B) Seat cushion

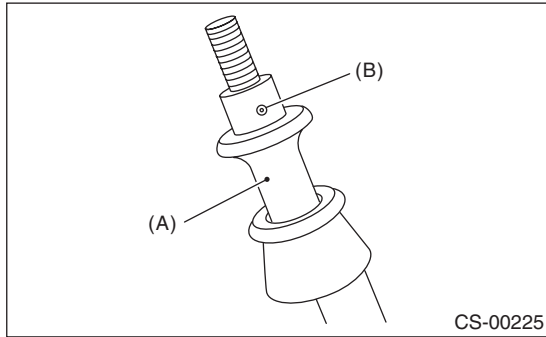
# MT Gear Shift Lever

## CONTROL SYSTEMS

15) Using the spring pin, fix the end of reverse check cable and slider.

### NOTE:

Apply grease to the moving part of slider.

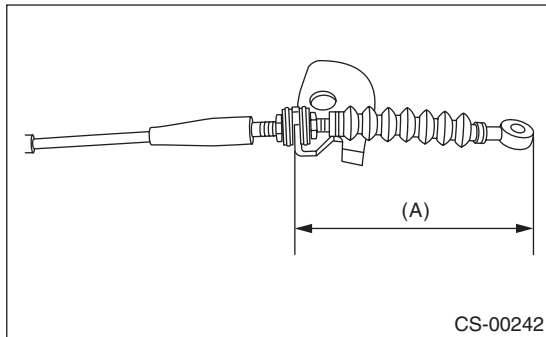


- (A) Slider
- (B) Spring pin

16) With the cable pulled (the slider is lowered), adjust the distance between the edge of cable plate and the reverse check cable to 84 mm (3.31 in), and tighten the lock nut.

### Tightening torque:

**6 N·m (0.6 kgf·m, 4.4 ft·lb)**

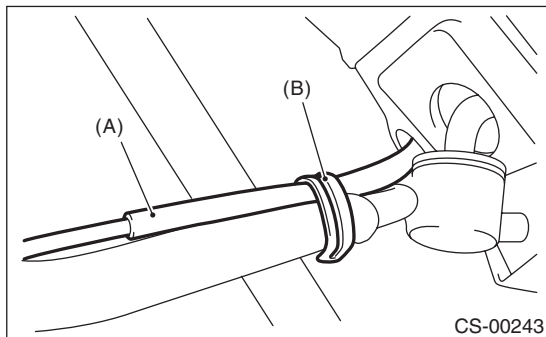


- (A) 84 mm (3.31 in)

17) Fix the reverse check cable to the stay clip.

### NOTE:

Install the reverse check cable on top of the stay.

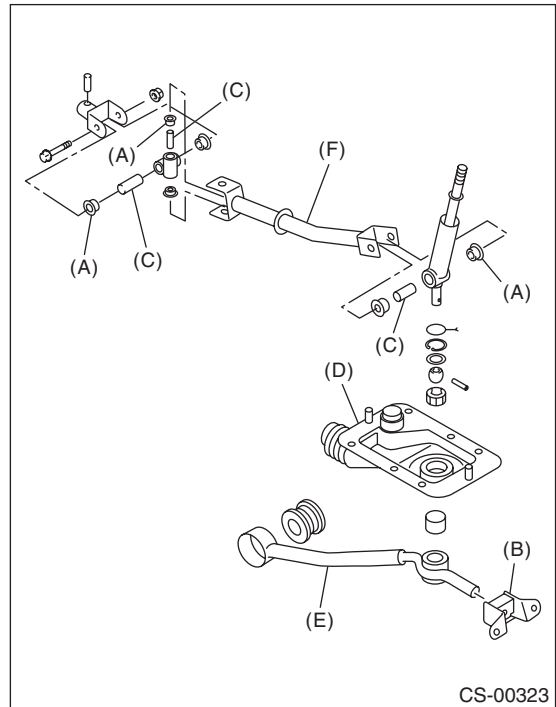


- (A) Reverse check cable
- (B) Clip

## E: INSPECTION

### 1. 5MT MODEL

1) Check the parts (bushing, cushion rubber, spacer, boot, stay and rod, etc.) for deformation, damage and wear. If necessary, correct or replace faulty parts. Compare the removed parts with new parts to judge if there are damages or not.



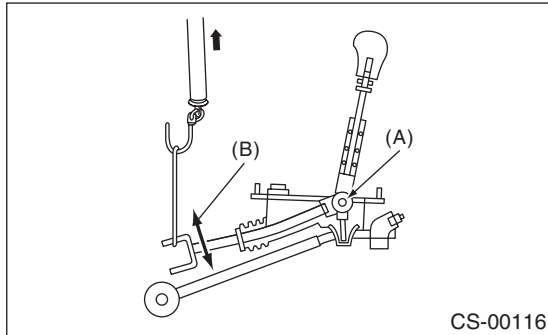
- (A) Bushing
- (B) Cushion rubber
- (C) Spacer
- (D) Boot
- (E) Stay
- (F) Rod



2) Check the swing torque of rod linked with the gear shift lever.  
If the torque exceeds the specifications, replace the bushing or retighten nuts.

**Swing torque:**

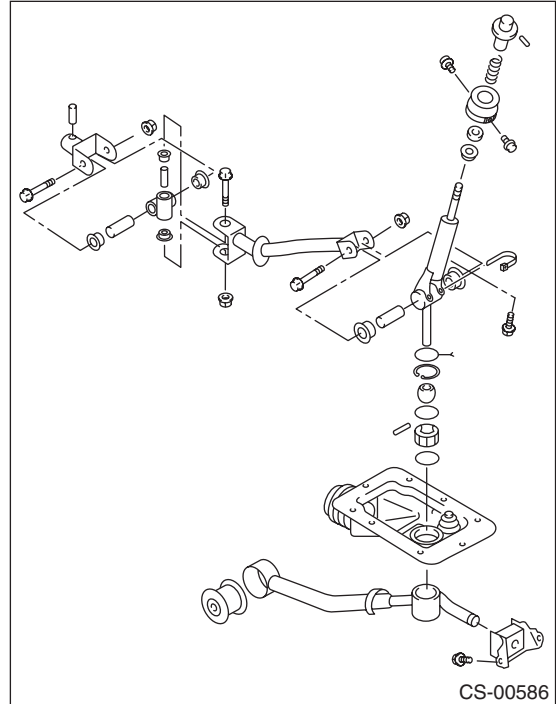
**3.7 N (0.38 kgf, 0.83 lbf) or less**



- (A) Pivot
- (B) Swing torque

## 2. 6MT MODEL

Check the parts (bushing, cushion rubber, spacer, boot, stay and rod, etc.) for deformation, damage and wear. If necessary, correct or replace faulty parts. Compare the removed parts with new parts to judge if there are damages or not.



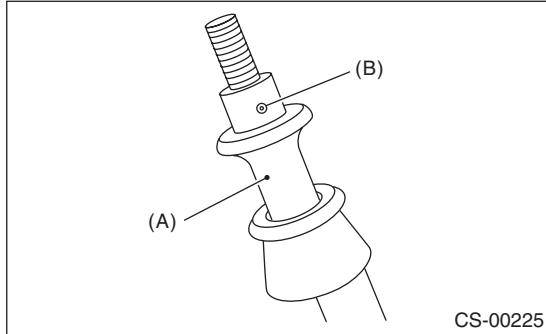
# Reverse Check Cable

## CONTROL SYSTEMS

### 9. Reverse Check Cable

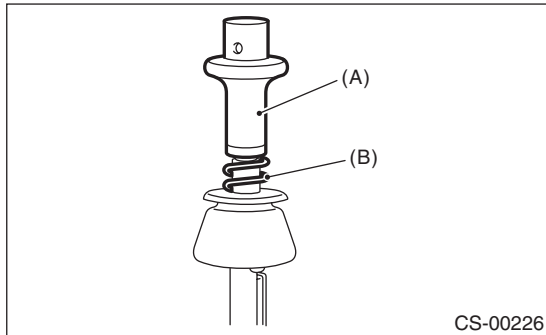
#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Remove the gear shift knob.
- 3) Remove the console box front. <Ref. to EI-54, REMOVAL, Console Box.>
- 4) Remove the front cover assembly.
- 5) Remove the spring pin from the slider.



- (A) Slider
- (B) Spring pin

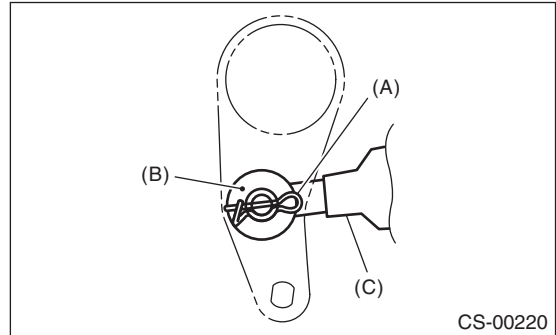
- 6) Remove the slider and spring.



- (A) Slider
- (B) Spring

- 7) Cut the band clip, and separate the reverse check cable from the gear shift lever.
- 8) Lift up the vehicle.
- 9) Remove the under cover.
- 10) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 11) Remove the crossmember. <Ref. to 6MT-30, REMOVAL, Transmission Mounting System.>

- 12) Remove the snap pin and washer, and separate the reverse check cable from the reverse check lever.

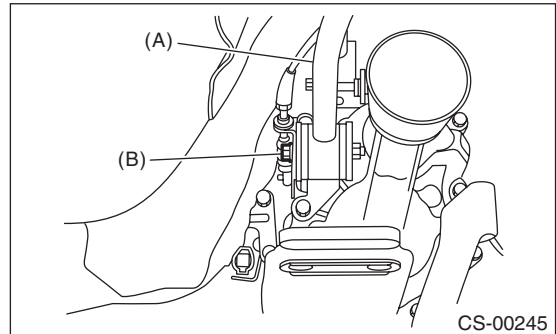


- (A) Snap pin
- (B) Washer
- (C) Reverse check cable

- 13) Move the transmission to the right side, and remove the stay bolts and reverse check cable.

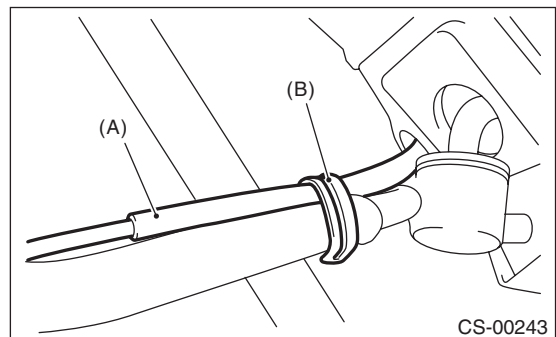
#### NOTE:

If the transmission is not moved aside, the stay bolts may contact the body and cause damage.



- (A) Stay
- (B) Stay bolt

- 14) Lift the stay clip, and separate the stay and reverse check cable.



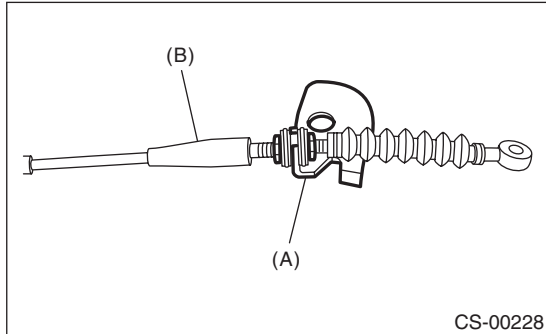
- (A) Reverse check cable
- (B) Clip

15) Pull out the reverse check cable from underside of the vehicle to remove it.

**NOTE:**

Be careful not to damage the inner boot.

16) Loosen the lock nut, and remove the reverse check cable from the cable plate.

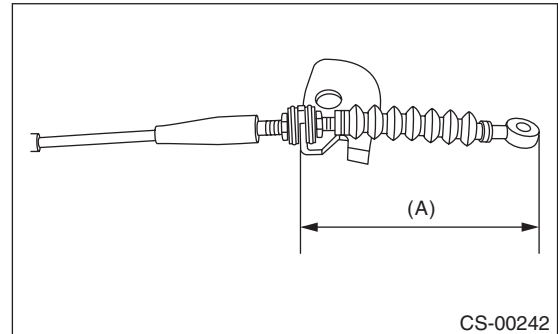


(A) Cable plate  
(B) Reverse check cable

5) With the cable pulled (the slider is lowered), adjust the distance between the edge of cable plate and the reverse check cable to 84 mm (3.31 in), and tighten the lock nut.

**Tightening torque:**

**6 N·m (0.6 kgf-m, 4.4 ft-lb)**



(A) 84 mm (3.31 in)

## B: INSTALLATION

1) Insert the reverse check cable into the inner boot hole from underside of the vehicle.

2) Insert the reverse check cable to the gear shift lever assembly, and affix with a band clip.

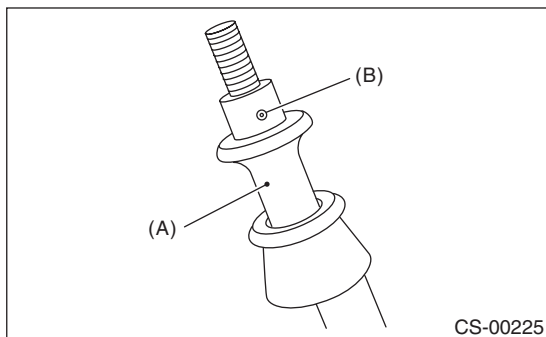
**NOTE:**

- Cut the excess band clip.
- Make sure that the reverse check cable is inserted into the gear shift lever assembly without interspace.

3) Using the spring pin, fix the end of reverse check cable and slider.

**NOTE:**

Apply grease to the moving part of slider.

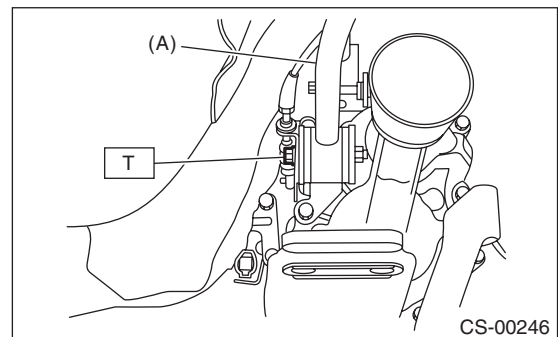


(A) Slider  
(B) Spring pin

6) Move the transmission to the right side, and attach the stay.

**Tightening torque:**

**T: 32 N·m (3.3 kgf-m, 23.6 ft-lb)**



(A) Stay

4) Lift up the vehicle.

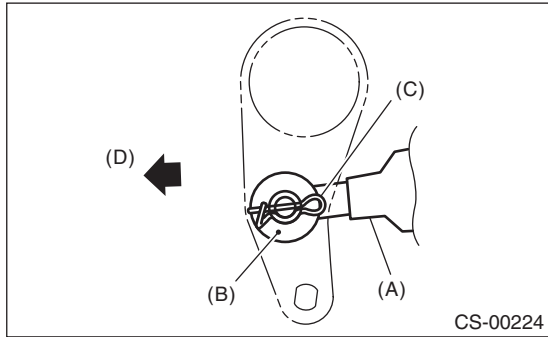
# Reverse Check Cable

## CONTROL SYSTEMS

7) Attach the reverse check cable, washer and snap pin to the reverse check lever.

### NOTE:

Take care to install the snap pin in proper direction.

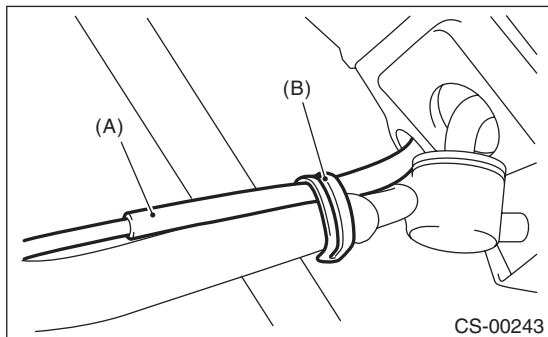


- (A) Reverse check cable
- (B) Washer
- (C) Snap pin
- (D) Front side

8) Fix the reverse check cable to the stay clip.

### NOTE:

Install the reverse check cable on top of the stay.



- (A) Reverse check cable
- (B) Clip

9) Install the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.>, <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

10) Lower the vehicle.

11) Install the front cover assembly.

12) Install the console box. <Ref. to EI-54, INSTALLATION, Console Box.>

## C: INSPECTION

1) Make sure the slider works smoothly. If it does not move, adjust the reverse check cable, or check the slider for damage. <Ref. to CS-56, ADJUSTMENT, Reverse Check Cable.>

2) Check that the gear is shifted to the reverse when the slider is lifted. If the gear is not shifted to the reverse, adjust the reverse check cable. <Ref. to CS-56, ADJUSTMENT, Reverse Check Cable.>

3) Check that the gear is not shifted to the reverse when the slider is not lifted. If the gear is shifted to the reverse, adjust or replace the reverse check cable. <Ref. to CS-56, ADJUSTMENT, Reverse Check Cable.>

## D: ADJUSTMENT

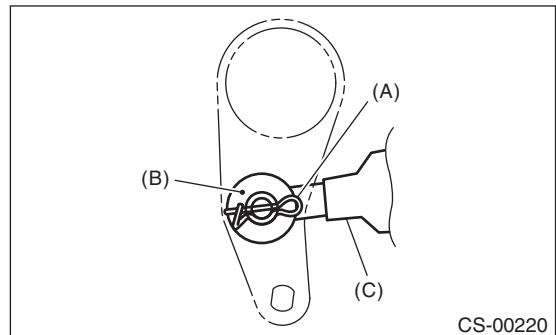
1) Set the vehicle on a lift.

2) Remove the under cover.

3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

4) Remove the crossmember. <Ref. to 6MT-30, REMOVAL, Transmission Mounting System.>

5) Remove the snap pin and washer, and separate the reverse check cable from the reverse check lever.

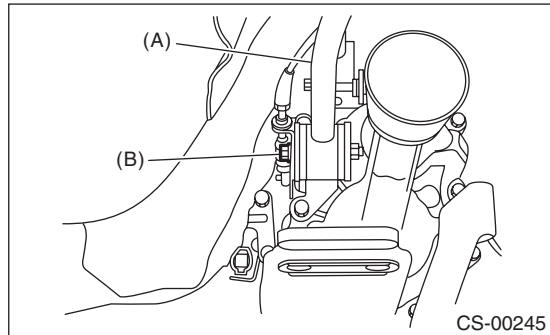


- (A) Snap pin
- (B) Washer
- (C) Reverse check cable

6) Move the transmission to the right side, and remove the stay bolts and reverse check cable.

**NOTE:**

If the transmission is not moved aside, the stay bolts may contact the body and cause damage.

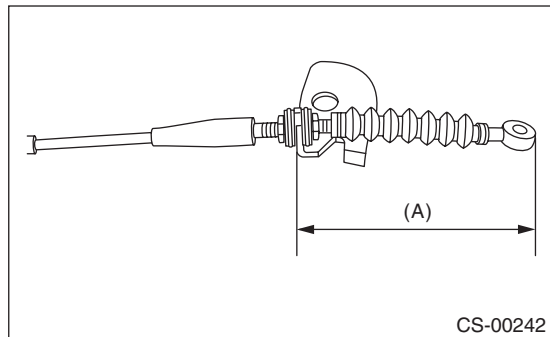


- (A) Stay
- (B) Stay bolt

7) With the cable pulled (the slider is lowered), adjust the distance between the edge of cable plate and the reverse check cable to 84 mm (3.31 in), and tighten the lock nut.

**Tightening torque:**

**6 N·m (0.6 kgf-m, 4.4 ft-lb)**

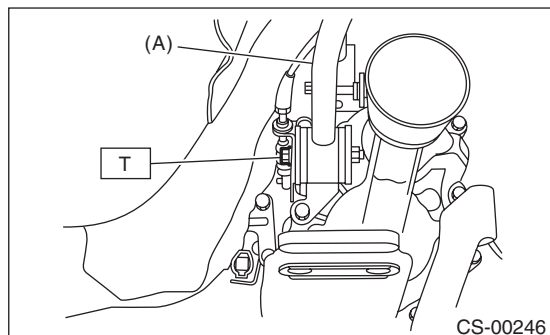


- (A) 84 mm (3.31 in)

8) Move the transmission to the right side, and attach the stay.

**Tightening torque:**

**T: 32 N·m (3.3 kgf-m, 23.6 ft-lb)**



- (A) Stay

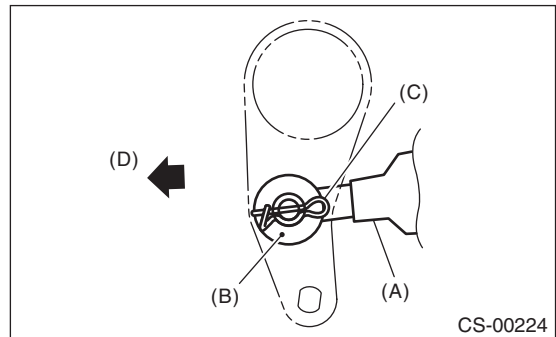
9) Install the cross member. <Ref. to 6MT-30, INSTALLATION, Transmission Mounting System.>

10) Install the rear exhaust pipe and muffler. <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

11) Attach the reverse check cable, washer and snap pin to the reverse check lever.

**NOTE:**

Take care to install the snap pin in proper direction.



- (A) Reverse check cable
- (B) Washer
- (C) Snap pin
- (D) Front side

12) Install the under cover.

# General Diagnostic Table

CONTROL SYSTEMS

## 10. General Diagnostic Table

### A: INSPECTION

Symptoms	Possible cause	Corrective action
Select lever	Starter does not run.	Adjust the select cable and inhibitor switch, or inspect the circuit.
	Back-up light does not illuminate.	Adjust the select cable and inhibitor switch, or inspect the circuit.
	AT shift lock system does not operate normally.	Adjust the select cable and inhibitor switch, or inspect the circuit.
	Manual mode can not be set.	Adjust the mode switch and select lever, or inspect the circuit.
	Up-shift is not engaged at manual mode.	Check the shift-up switch and circuit.
	Down-shift is not engaged at manual mode.	Check the shift-down switch and circuit.

# General Description

## AUTOMATIC TRANSMISSION

### 1. General Description

#### A: SPECIFICATION

##### 1. TORQUE CONVERTER

Type	Symmetric, 3 element, single stage, 2 phase torque converter
Stall torque ratio	2.05 — 2.35
Nominal diameter mm (in)	246 (9.69)
Stall speed (at sea level)	2,200 — 3,000 rpm
One-way clutch	Sprague type one-way clutch

##### 2. OIL PUMP

Type	Parachoid constant-displacement pump	
Driving method	Driven by engine	
Number of teeth	Inner rotor	9
	Outer rotor	10

##### 3. TRANSMISSION CONTROL ELEMENT

Type	4-forward, 1-reverse, double-row planetary gears
Multi-plate clutch	3 sets
Multi-plate brake	2 sets
One-way clutch (sprague type)	1 set

##### 4. TRANSMISSION GEAR RATIO

1st	2.785
2nd	1.545
3rd	1.000
4th	0.694
Rev	2.272

##### 5. PLANETARY GEAR AND PLATE

Number of front sun gear teeth	33
Number of front pinion teeth	21
Number of front internal gear teeth	75
Number of rear sun gear teeth	42
Number of rear pinion teeth	17
Number of rear internal gear teeth	75
Number of high clutch drive plates	4
Number of low clutch drive plates	5
Number of reverse clutch drive plates	2
Number of drive plates for the 2-4 brake	3
Number of drive plates for low & reverse brake	5

##### 6. SELECTOR POSITION

P (Park)	Transmission is in neutral, output member is fixed, engine start is possible
R (Reverse)	Transmission in reverse for backing up
N (Neutral)	Transmission is in neutral and engine start is possible
D (Drive)	4-forward automatic gear change 1st ← → 2nd ← → 3rd ← → 4th
SPORT mode	4-forward automatic gear change 1st ← → 2nd ← → 3rd ← → 4th
Manual mode (+)	4-forward manual gear change (shift up) 1st → 2nd → 3rd → 4th
Manual mode (-)	4-forward manual gear change (shift down) 1st ← 2nd ← 3rd ← 4th
Control method	Wire cable type

# General Description

AUTOMATIC TRANSMISSION

## 7. HYDRAULIC CONTROL AND LUBRICATION

Type	Electronic hydraulic control [4 forward gear changes made by electronic signals of vehicle speed and accelerator (throttle) opening]	
Fluid	Recommended materials	SUBARU ATF HP
	Alternative	IDEMITSU "ATF HP", Castrol "Transmax J"
Fluid capacity	ℓ (US qt, Imp qt)	9.3 — 9.6 (9.8 — 10.1, 8.2 — 8.4)
Lubrication system	Forced feed lubrication with oil pump	
Oil	Automatic transmission fluid (see above)	

## 9. TRANSFER

Model	Except for VTD models	VTD model
Transfer type	Multi-plate transfer (MPT)	Variable torque distribution (VTD)
Number of transfer clutch drives & driven plates	5	3
Control method	Electronic hydraulic type	
Lubricant	Same automatic transmission fluid as used in the automatic transmission	
Reduction gear ratio	1.000 (53/53)	

## 8. COOLING AND HARNESS

Cooling system	Liquid-cooler
Inhibitor switch	12 poles
Transmission harness	20 poles

## 10.FINAL REDUCTION GEAR

Model	Except for OUTBACK	OUTBACK
Front final reduction gear ratio	4.111 (37/9)	4.444 (40/9)

## 11.RECOMMENDED GEAR OIL

Lubrication oil		
	<p>(1) Item</p> <p>(2) Front differential gear oil</p> <p>(3) API standard</p> <p>(4) SAE viscosity No. and applicable temperature</p>	
Front differential oil capacity	ℓ (US qt, Imp qt)	1.1 — 1.3 (1.2 — 1.4, 1.0 — 1.1)

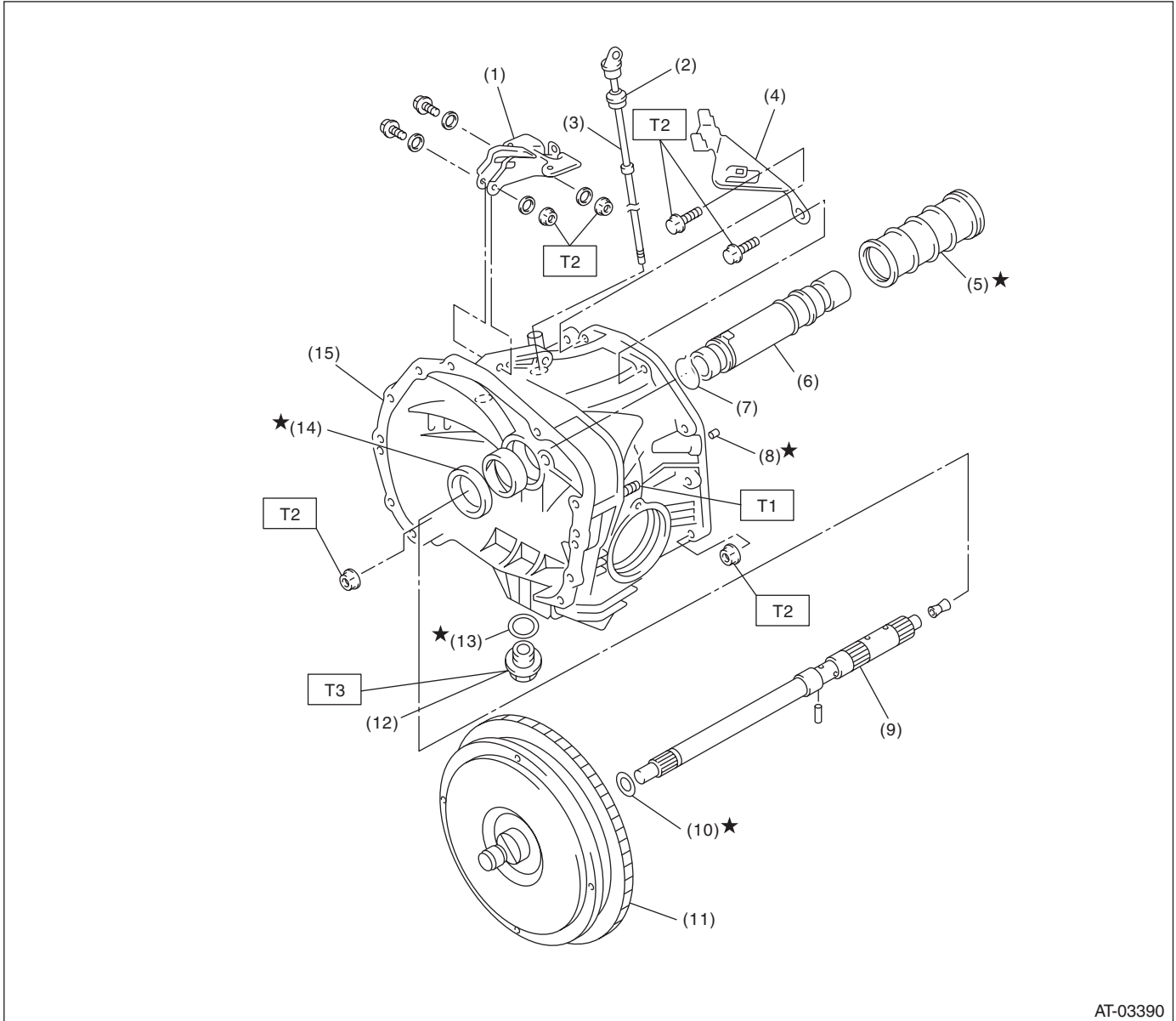


# General Description

AUTOMATIC TRANSMISSION

## B: COMPONENT

### 1. TORQUE CONVERTER AND CASE



AT-03390

- (1) Pitching stopper bracket
- (2) O-ring
- (3) Differential oil level gauge
- (4) Stay
- (5) Seal pipe
- (6) Oil pump shaft
- (7) Clip

- (8) Oil drain pipe
- (9) Input shaft
- (10) O-ring
- (11) Torque converter ASSY
- (12) Differential gear oil drain plug
- (13) Gasket
- (14) Oil seal

- (15) Converter case

**Tightening torque: N·m (kgf·m, ft·lb)**

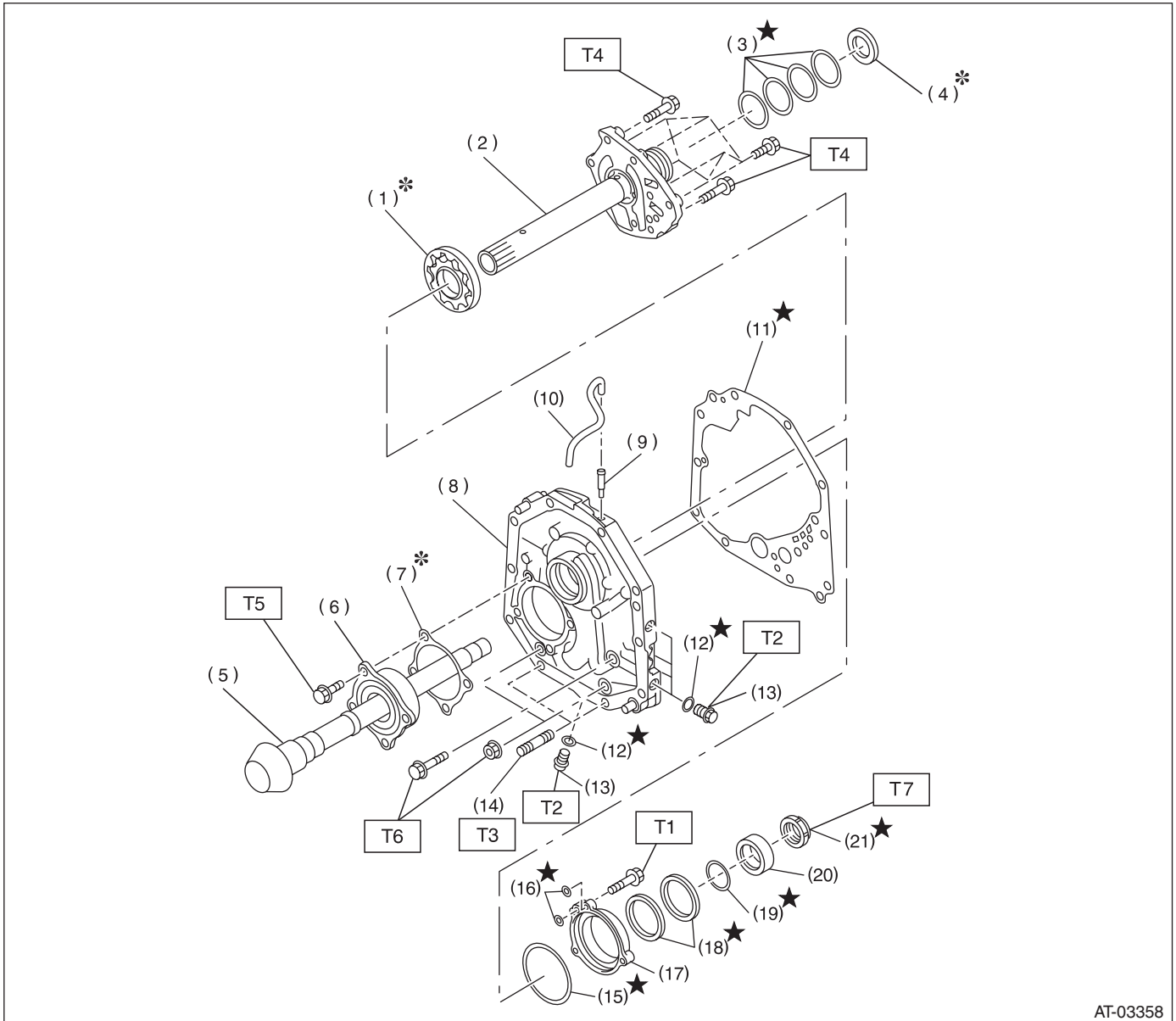
**T1: 18 (1.8, 13.3)**

**T2: 41 (4.2, 30.2)**

**T3: 44 (4.5, 32.5) (Aluminum gasket)**

**70 (7.1, 51.6) (Copper gasket)**

## 2. OIL PUMP



AT-03358

- |                           |                          |               |
|---------------------------|--------------------------|---------------|
| (1) Oil pump rotor        | (11) Gasket              | (21) Lock nut |
| (2) Oil pump cover        | (12) O-ring              |               |
| (3) Seal ring             | (13) Test plug           |               |
| (4) Thrust needle bearing | (14) Stud bolt           |               |
| (5) Drive pinion shaft    | (15) O-ring              |               |
| (6) Roller bearing        | (16) O-ring              |               |
| (7) Shim                  | (17) Oil seal retainer   |               |
| (8) Oil pump housing      | (18) Oil seal            |               |
| (9) Nipple                | (19) O-ring              |               |
| (10) Air breather hose    | (20) Drive pinion collar |               |

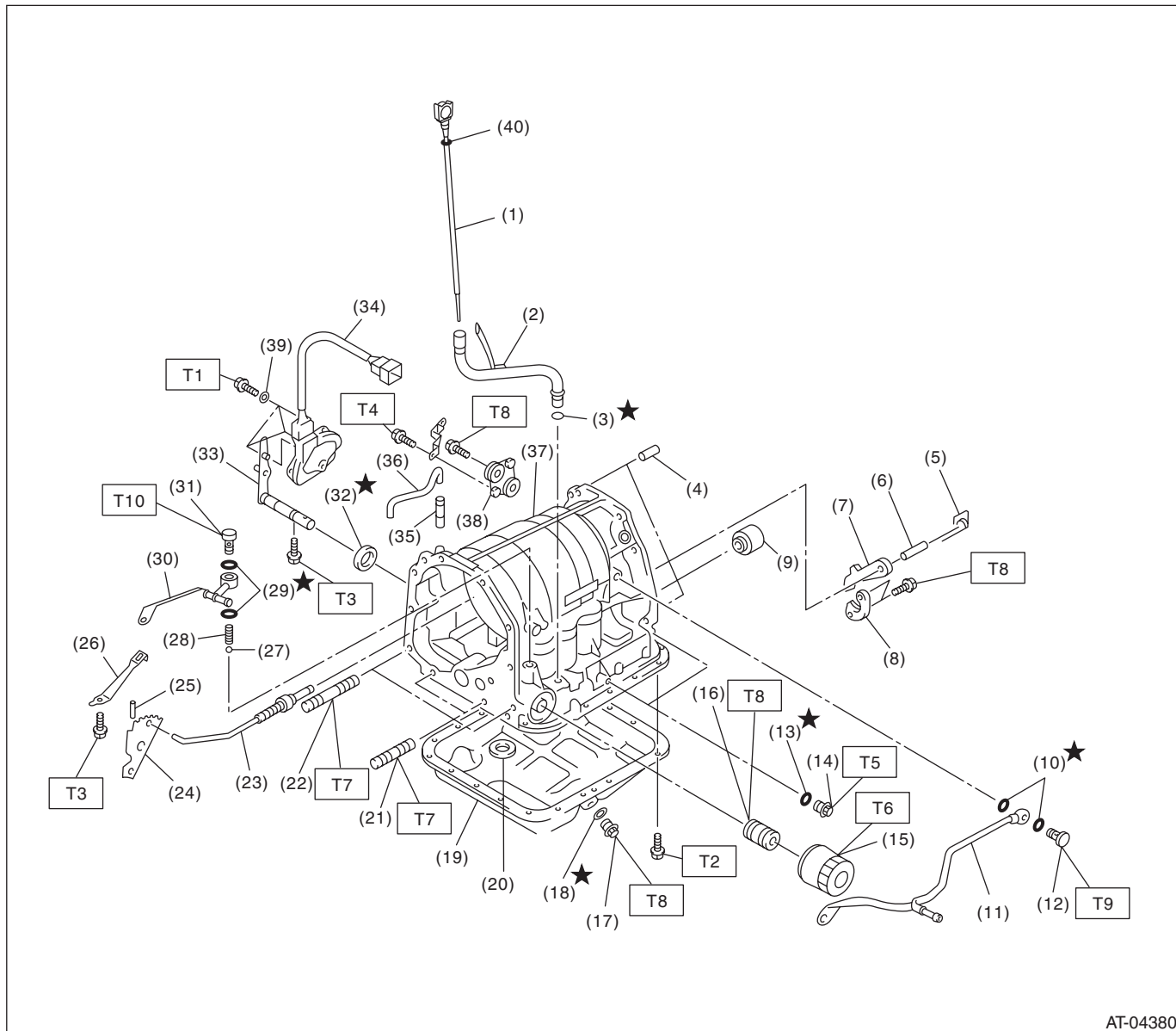
**Tightening torque: N·m (kgf·m, ft·lb)**

- T1: 7 (0.7, 5.1)**  
**T2: 13 (1.3, 9.6)**  
**T3: 18 (1.8, 13.3)**  
**T4: 25 (2.5, 18.4)**  
**T5: 40 (4.1, 29.5)**  
**T6: 42 (4.3, 31)**  
**T7: 116 (11.8, 85)**

# General Description

## AUTOMATIC TRANSMISSION

### 3. TRANSMISSION CASE AND CONTROL DEVICE



- |                     |                        |                        |
|---------------------|------------------------|------------------------|
| (1) ATF level gauge | (19) Oil pan           | (36) Air breather hose |
| (2) Oil charge pipe | (20) Magnet            | (37) Transmission case |
| (3) O-ring          | (21) Stud bolt (short) | (38) Plate ASSY        |

# General Description

AUTOMATIC TRANSMISSION

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(4) Straight pin	(22) Stud bolt (long)	(39) Washer
(5) Return spring	(23) Parking rod	(40) O-ring
(6) Shaft	(24) Manual plate	
(7) Parking pawl	(25) Spring pin	
(8) Parking support	(26) Detention spring	
(9) Bushing	(27) Ball	
(10) Gasket	(28) Spring	
(11) ATF inlet pipe	(29) Gasket	
(12) Union screw	(30) ATF outlet pipe	
(13) O-ring	(31) Union screw	
(14) Test plug	(32) Oil seal	
(15) Oil filter	(33) Range select lever	
(16) Oil filter stud bolt	(34) Inhibitor switch ASSY	
(17) Drain plug (ATF)	(35) Nipple	
(18) Gasket		

---

**Tightening torque:N·m (kgf-m, ft-lb)**

**T1: 3.4 (0.35, 2.5)**

**T2: 5 (0.5, 3.6)**

**T3: 6 (0.6, 4.4)**

**T4: 12 (1.2, 8.7)**

**T5: 13 (1.3, 9.6)**

**T6: 14 (1.4, 10.3)**

**T7: 18 (1.8, 13.3)**

**T8: 25 (2.5, 18.4)**

**T9: 40 (4.1, 29.5)**

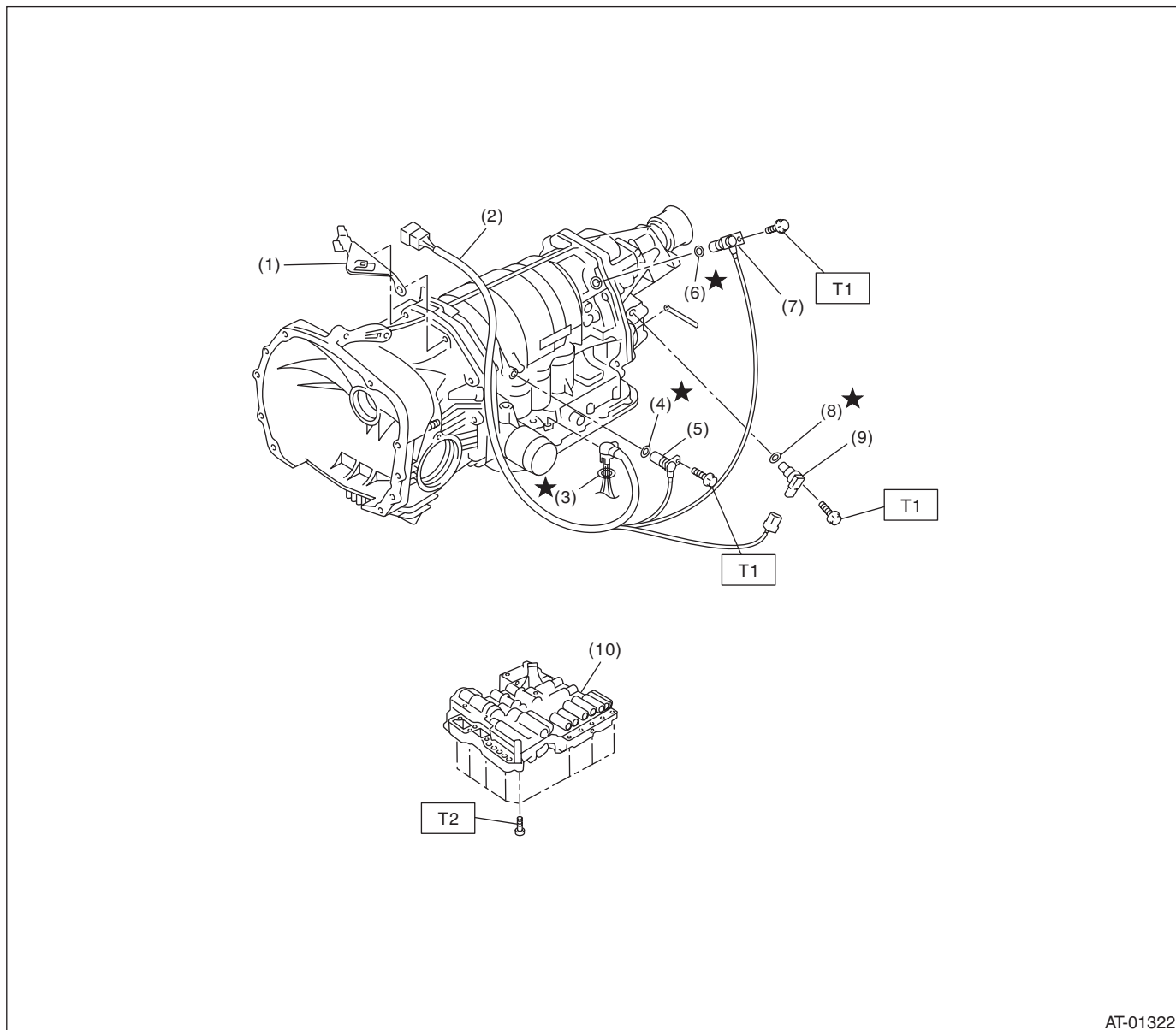
**T10: 45 (4.6, 33.2)**

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# General Description

## AUTOMATIC TRANSMISSION

### 4. CONTROL VALVE AND HARNESS ROUTING



AT-01322

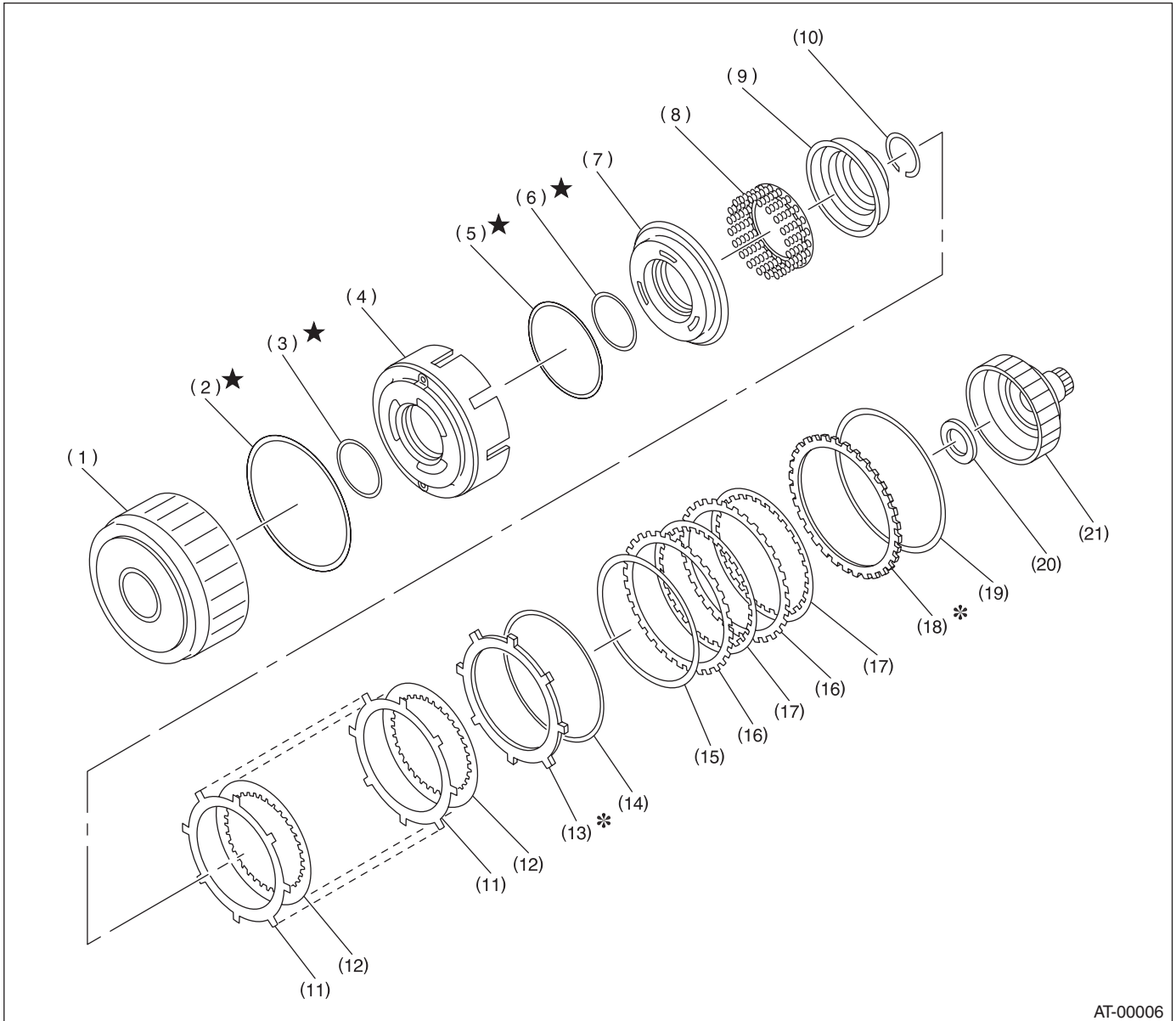
- |   |                                |
|---|--------------------------------|
| (1) Stay                                  | (6) O-ring                     |
| (2) Transmission harness                  | (7) Front vehicle speed sensor |
| (3) O-ring                                | (8) O-ring                     |
| (4) O-ring                                | (9) Rear vehicle speed sensor  |
| (5) Torque converter turbine speed sensor | (10) Control valve body        |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7 (0.7, 5.1)**

**T2: 8 (0.8, 5.8)**

## 5. HIGH CLUTCH AND REVERSE CLUTCH



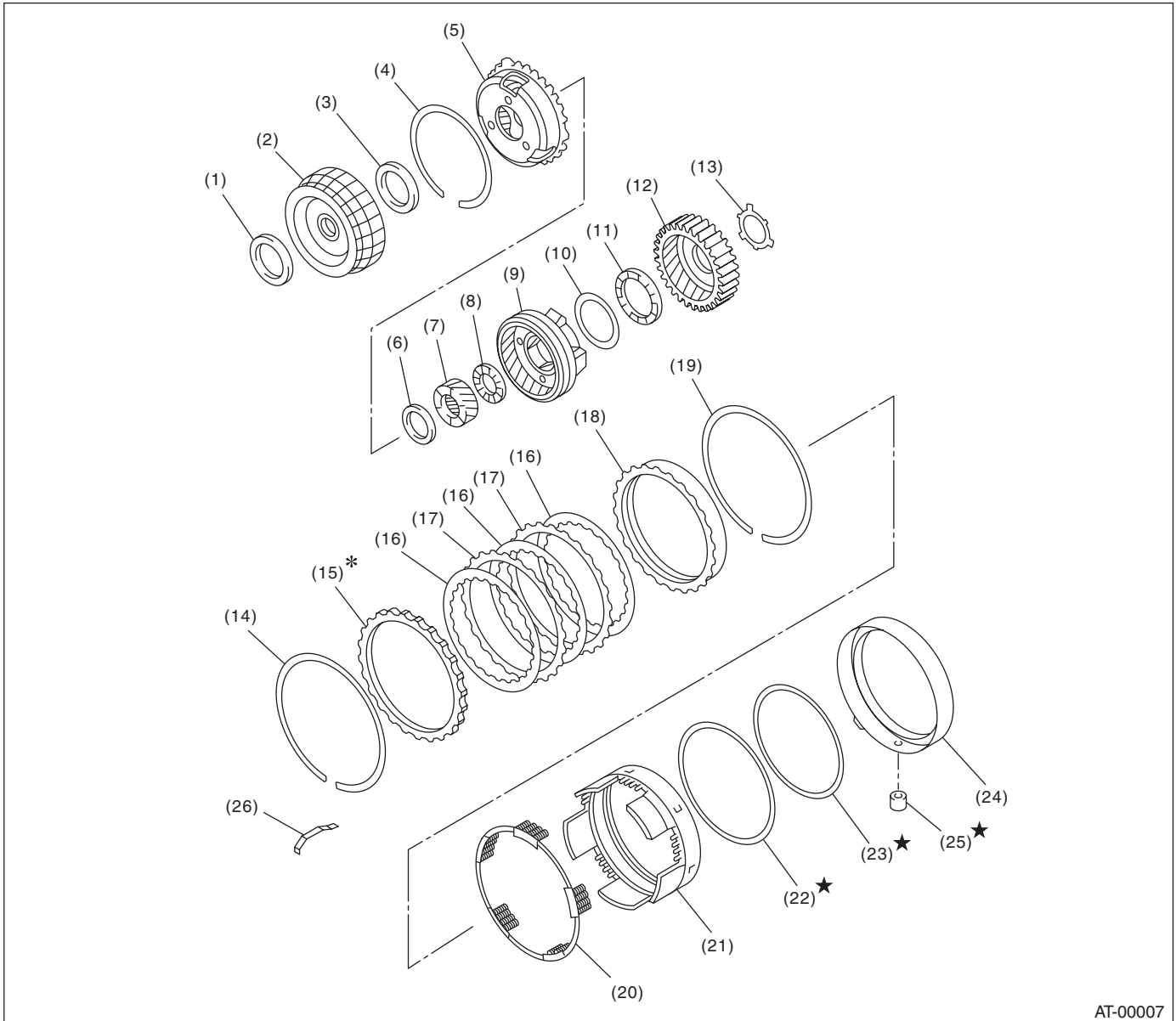
AT-00006

- |                           |                                    |                                       |
|---------------------------|------------------------------------|---------------------------------------|
| (1) High clutch drum      | (8) Spring retainer                | (15) Dish plate                       |
| (2) Lip seal              | (9) Clutch cover                   | (16) Driven plate (reverse clutch)    |
| (3) D-ring                | (10) Snap ring                     | (17) Drive plate (reverse clutch)     |
| (4) Reverse clutch piston | (11) Driven plate (high clutch)    | (18) Retaining plate (reverse clutch) |
| (5) D-ring                | (12) Drive plate (high clutch)     | (19) Snap ring                        |
| (6) D-ring                | (13) Retaining plate (high clutch) | (20) Thrust needle bearing            |
| (7) High clutch piston    | (14) Snap ring                     | (21) High clutch hub                  |

# General Description

## AUTOMATIC TRANSMISSION

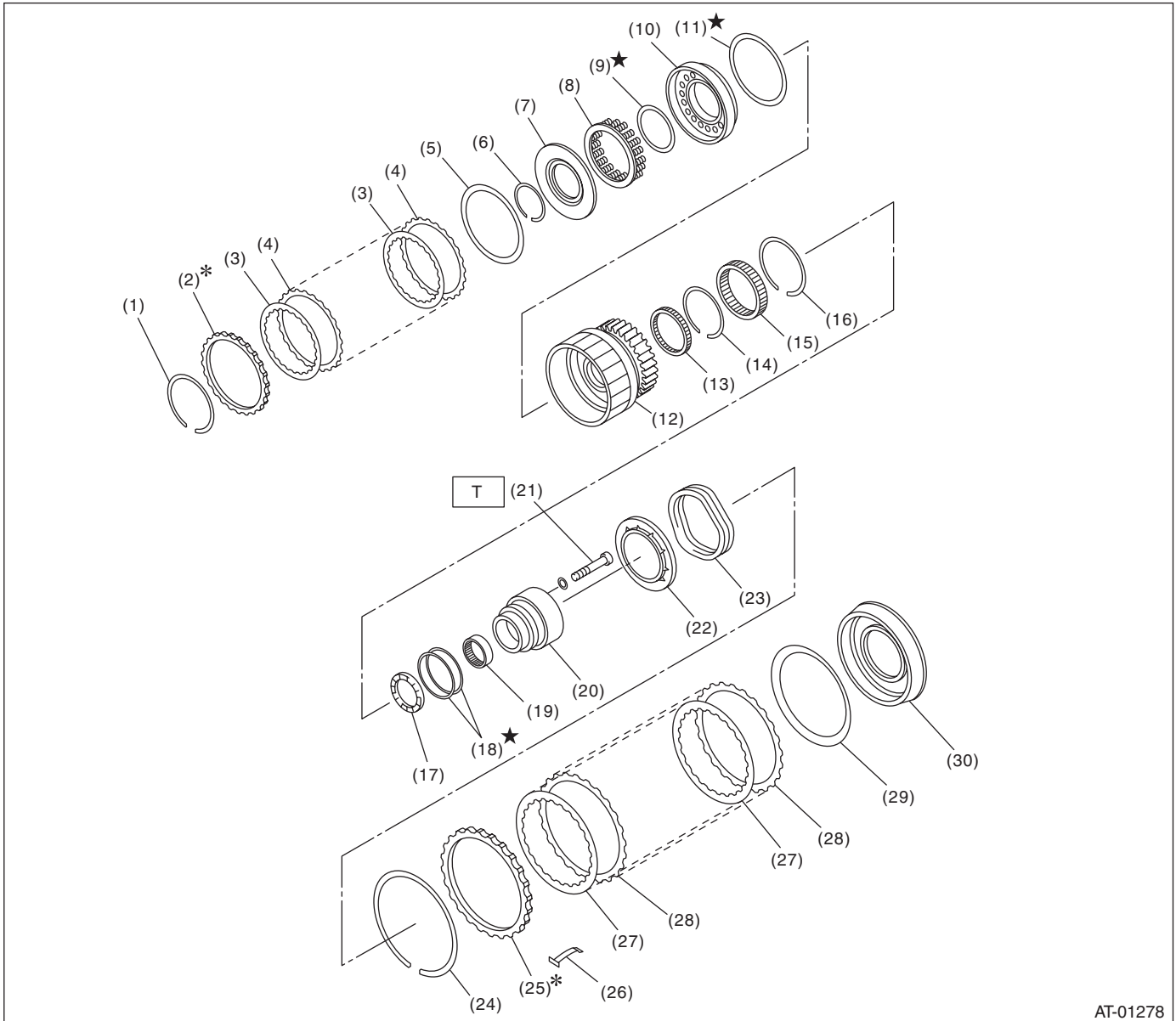
### 6. PLANETARY GEAR AND 2-4 BRAKE



AT-00007

- |                             |                            |                                |
|-----------------------------|----------------------------|--------------------------------|
| (1) Thrust needle bearing   | (10) Washer                | (19) Snap ring                 |
| (2) Front sun gear          | (11) Thrust needle bearing | (20) Spring retainer           |
| (3) Thrust needle bearing   | (12) Rear internal gear    | (21) 2-4 brake piston          |
| (4) Snap ring               | (13) Washer                | (22) D-ring                    |
| (5) Front planetary carrier | (14) Snap ring             | (23) D-ring                    |
| (6) Thrust needle bearing   | (15) Retaining plate       | (24) 2-4 brake piston retainer |
| (7) Rear sun gear           | (16) Drive plate           | (25) 2-4 brake seal            |
| (8) Thrust needle bearing   | (17) Driven plate          | (26) Leaf spring               |
| (9) Rear planetary carrier  | (18) Pressure rear plate   |                                |

## 7. LOW CLUTCH AND LOW & REVERSE BRAKE



AT-01278

- |                        |                                |                                 |
|------------------------|--------------------------------|---------------------------------|
| (1) Snap ring          | (12) Low clutch drum           | (23) Return spring              |
| (2) Retaining plate    | (13) Needle bearing            | (24) Snap ring                  |
| (3) Drive plate        | (14) Snap ring                 | (25) Retaining plate            |
| (4) Driven plate       | (15) One-way clutch            | (26) Leaf spring                |
| (5) Dish plate         | (16) Snap ring                 | (27) Drive plate                |
| (6) Snap ring          | (17) Thrust needle bearing     | (28) Driven plate               |
| (7) Cover              | (18) Seal ring                 | (29) Dish plate                 |
| (8) Spring retainer    | (19) Needle bearing            | (30) Low & reverse brake piston |
| (9) D-ring             | (20) One-way clutch inner race |                                 |
| (10) Low clutch piston | (21) Socket bolt               |                                 |
| (11) D-ring            | (22) Spring retainer           |                                 |

**Tightening torque: N·m (kgf-m, ft-lb)**

**T: 25 (2.5, 18.4)**

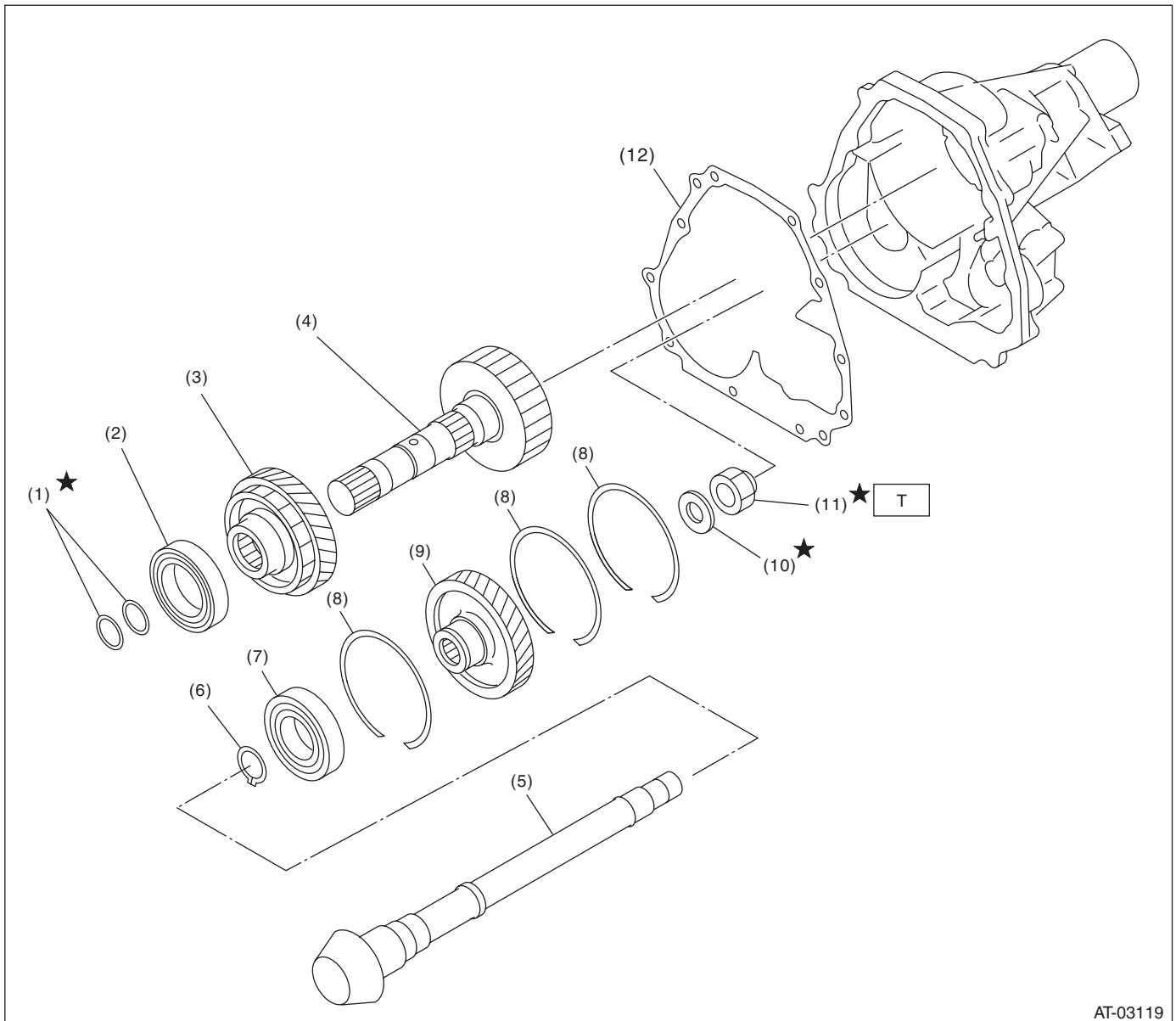


# General Description

AUTOMATIC TRANSMISSION

## 8. REDUCTION GEAR

MP-T model



AT-03119

- (1) Seal ring
- (2) Ball bearing
- (3) Reduction drive gear
- (4) Reduction drive shaft
- (5) Drive pinion shaft

- (6) Snap ring
- (7) Ball bearing
- (8) Snap ring
- (9) Reduction driven gear
- (10) Washer

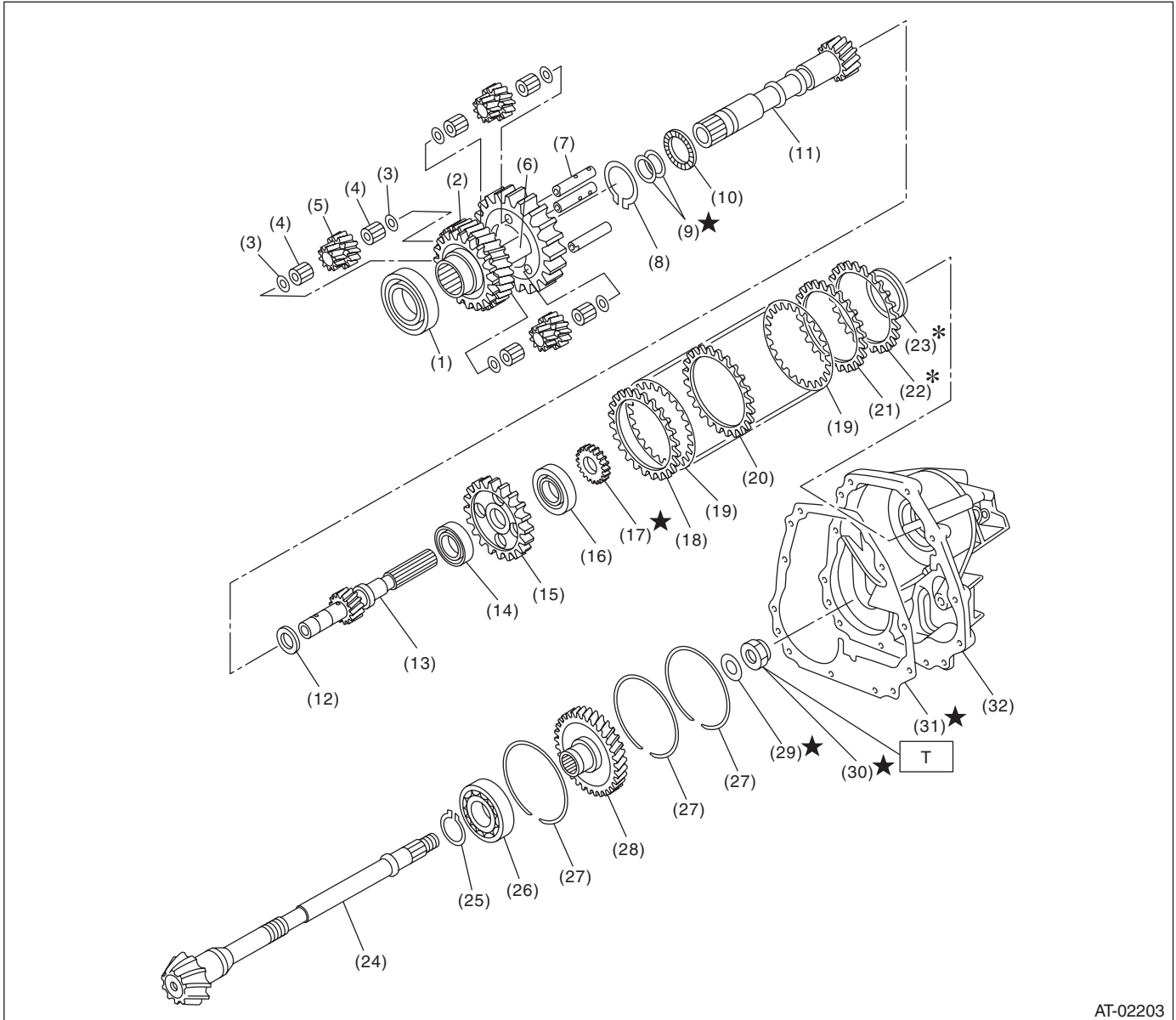
- (11) Lock nut
- (12) Gasket

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 100 (10.2, 73.8)**

# General Description

AUTOMATIC TRANSMISSION

## VTD model



AT-02203

- |                            |                             |                            |
|----------------------------|-----------------------------|----------------------------|
| (1) Ball bearing           | (13) Rear drive shaft       | (25) Snap ring             |
| (2) Reduction drive gear   | (14) Ball bearing           | (26) Ball bearing          |
| (3) Washer                 | (15) Multi-plate clutch hub | (27) Snap ring             |
| (4) Needle bearing         | (16) Ball bearing           | (28) Reduction driven gear |
| (5) Pinion gear            | (17) Revolution gear        | (29) Lock washer           |
| (6) Carrier                | (18) Driven plate (Thick)   | (30) Lock nut              |
| (7) Planetary pinion shaft | (19) Drive plate            | (31) Gasket                |
| (8) Snap ring              | (20) Driven plate (Thin)    | (32) Extension case        |
| (9) Seal ring              | (21) Driven plate (Thick)   |                            |
| (10) Thrust needle bearing | (22) Retaining plate        |                            |
| (11) Intermediate shaft    | (23) Rear drive shaft shim  |                            |
| (12) Thrust washer         | (24) Drive pinion shaft     |                            |

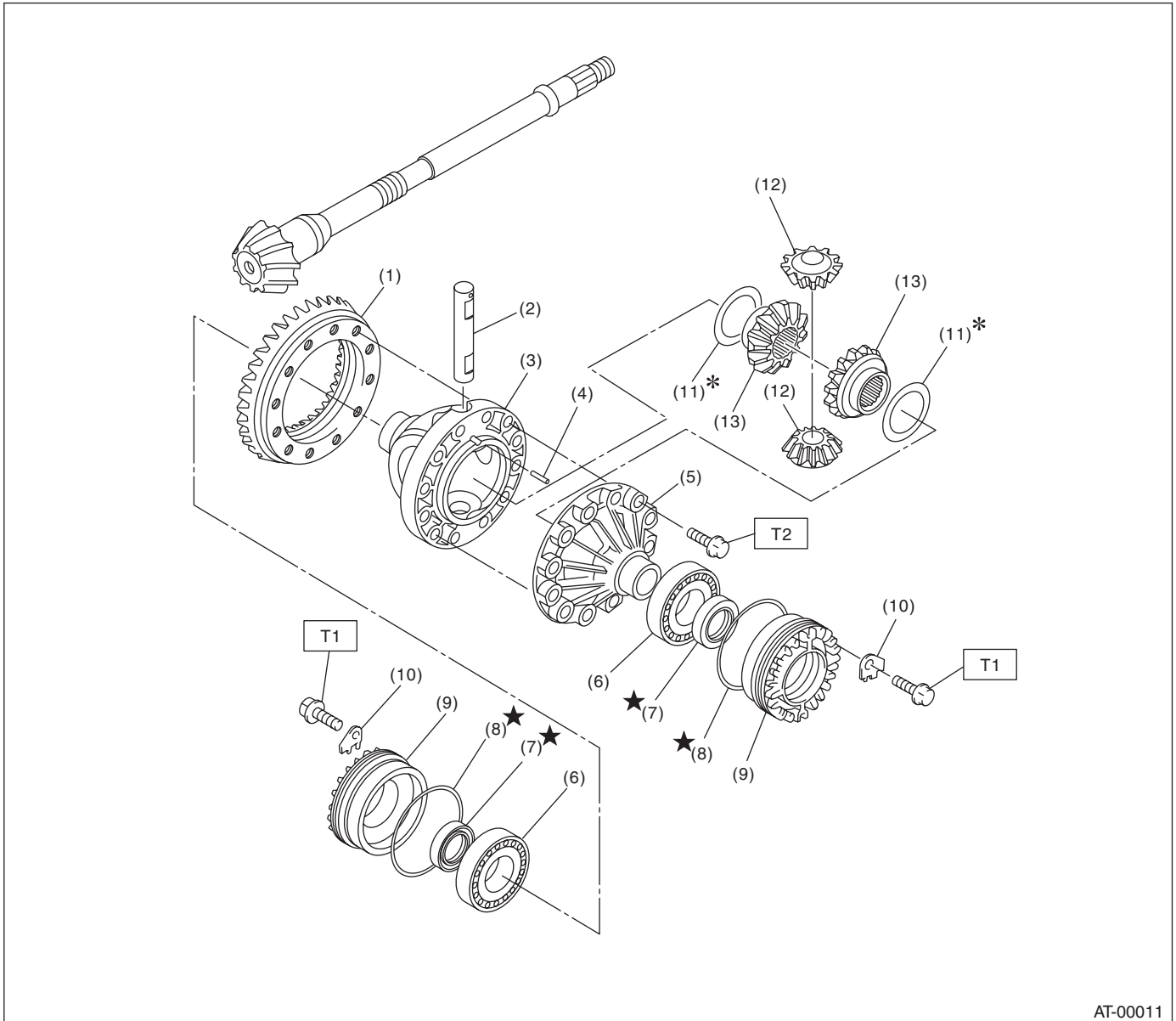
**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 100 (10.2, 73.8)**

# General Description

## AUTOMATIC TRANSMISSION

### 9. DIFFERENTIAL GEAR



AT-00011

- |                            |                                |                              |
|----------------------------|--------------------------------|------------------------------|
| (1) Hypoid driven gear     | (7) Oil seal                   | (13) Differential bevel gear |
| (2) Pinion shaft           | (8) O-ring                     |                              |
| (3) Differential case (RH) | (9) Differential side retainer |                              |
| (4) Straight pin           | (10) Lock plate                |                              |
| (5) Differential case (LH) | (11) Washer                    |                              |
| (6) Taper roller bearing   | (12) Differential bevel pinion |                              |

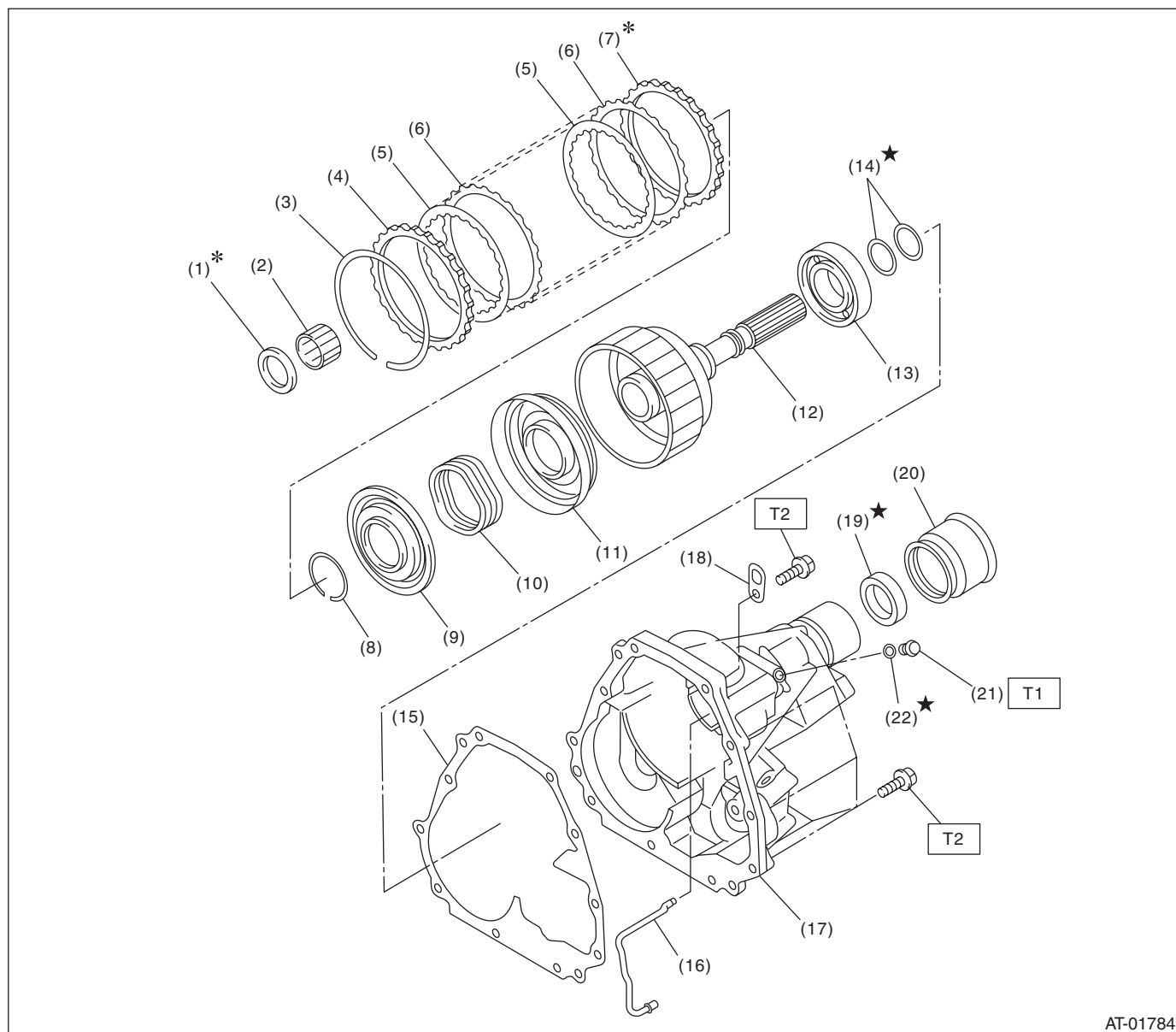
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 25 (2.5, 18.4)**

**T2: 62 (6.3, 45.7)**

## 10. TRANSFER AND EXTENSION CASE

MP-T model



AT-01784

- |                                 |                             |                 |
|---------------------------------|-----------------------------|-----------------|
| (1) Thrust needle bearing       | (10) Return spring          | (19) Oil seal   |
| (2) Needle bearing              | (11) Transfer clutch piston | (20) Dust cover |
| (3) Snap ring                   | (12) Rear drive shaft       | (21) Test plug  |
| (4) Driven plate (Thick)        | (13) Ball bearing           | (22) O-ring     |
| (5) Drive plate                 | (14) Seal ring              |                 |
| (6) Driven plate (Thin)         | (15) Gasket                 |                 |
| (7) Retaining plate             | (16) Transfer clutch pipe   |                 |
| (8) Snap ring                   | (17) Extension case         |                 |
| (9) Transfer clutch piston seal | (18) Transmission hanger    |                 |

**Tightening torque: N-m (kgf-m, ft-lb)**

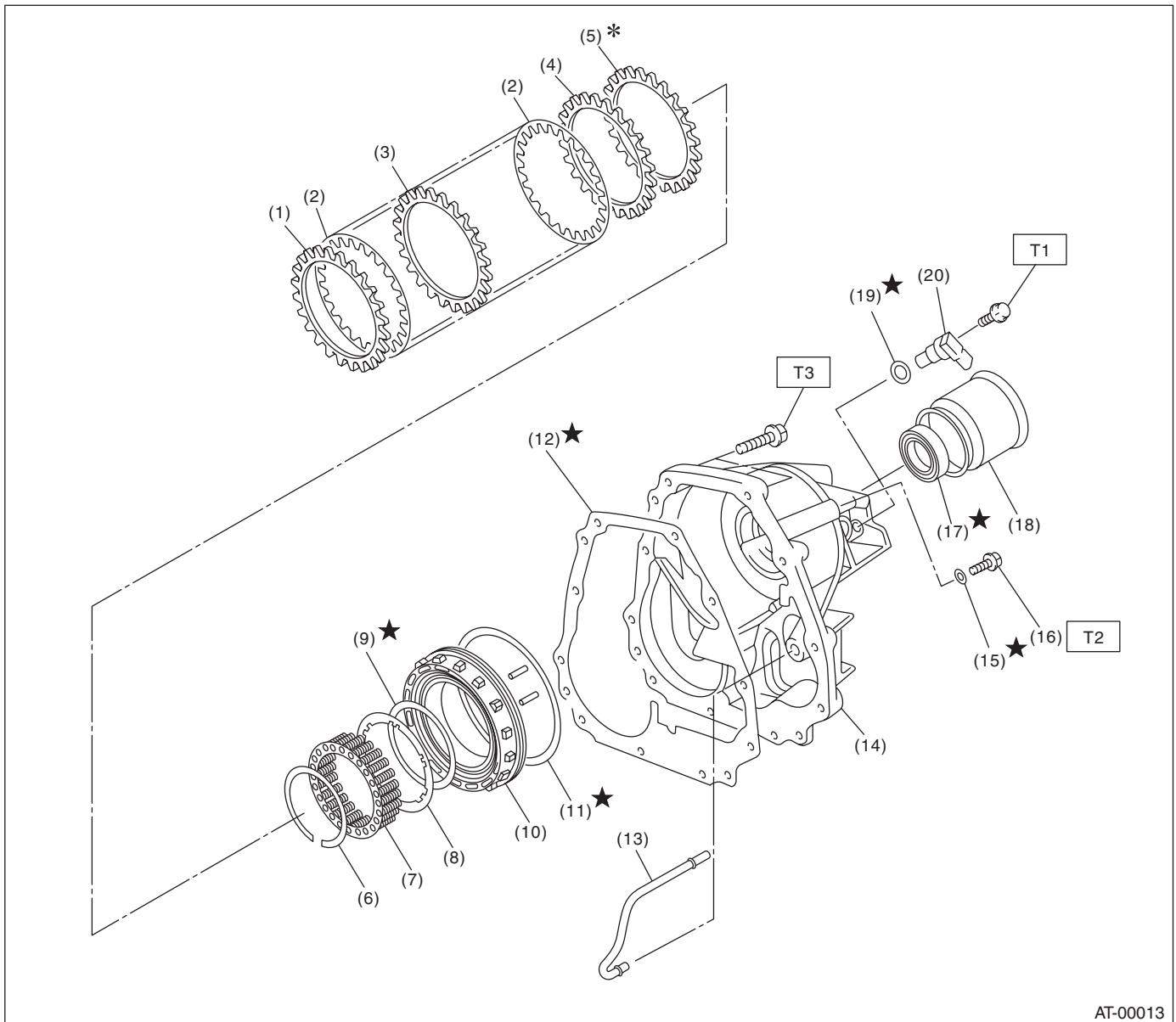
**T1: 13 (1.3, 9.6)**

**T2: 25 (2.5, 18.4)**

# General Description

## AUTOMATIC TRANSMISSION

### VTD model



AT-00013

- |                          |                                     |                                |
|--------------------------|-------------------------------------|--------------------------------|
| (1) Driven plate (Thick) | (10) Multi-plate clutch piston ASSY | (18) Dust cover                |
| (2) Drive plate          | (11) D-ring                         | (19) O-ring                    |
| (3) Driven plate (Thin)  | (12) Gasket                         | (20) Rear vehicle speed sensor |
| (4) Driven plate (Thick) | (13) Multi-plate clutch pipe        |                                |
| (5) Retaining plate      | (14) Extension case                 |                                |
| (6) Snap ring            | (15) O-ring                         |                                |
| (7) Spring retainer      | (16) Test plug                      |                                |
| (8) Plate                | (17) Oil seal                       |                                |
| (9) O-ring               |                                     |                                |

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**Tightening torque: N·m (kgf·m, ft·lb)**

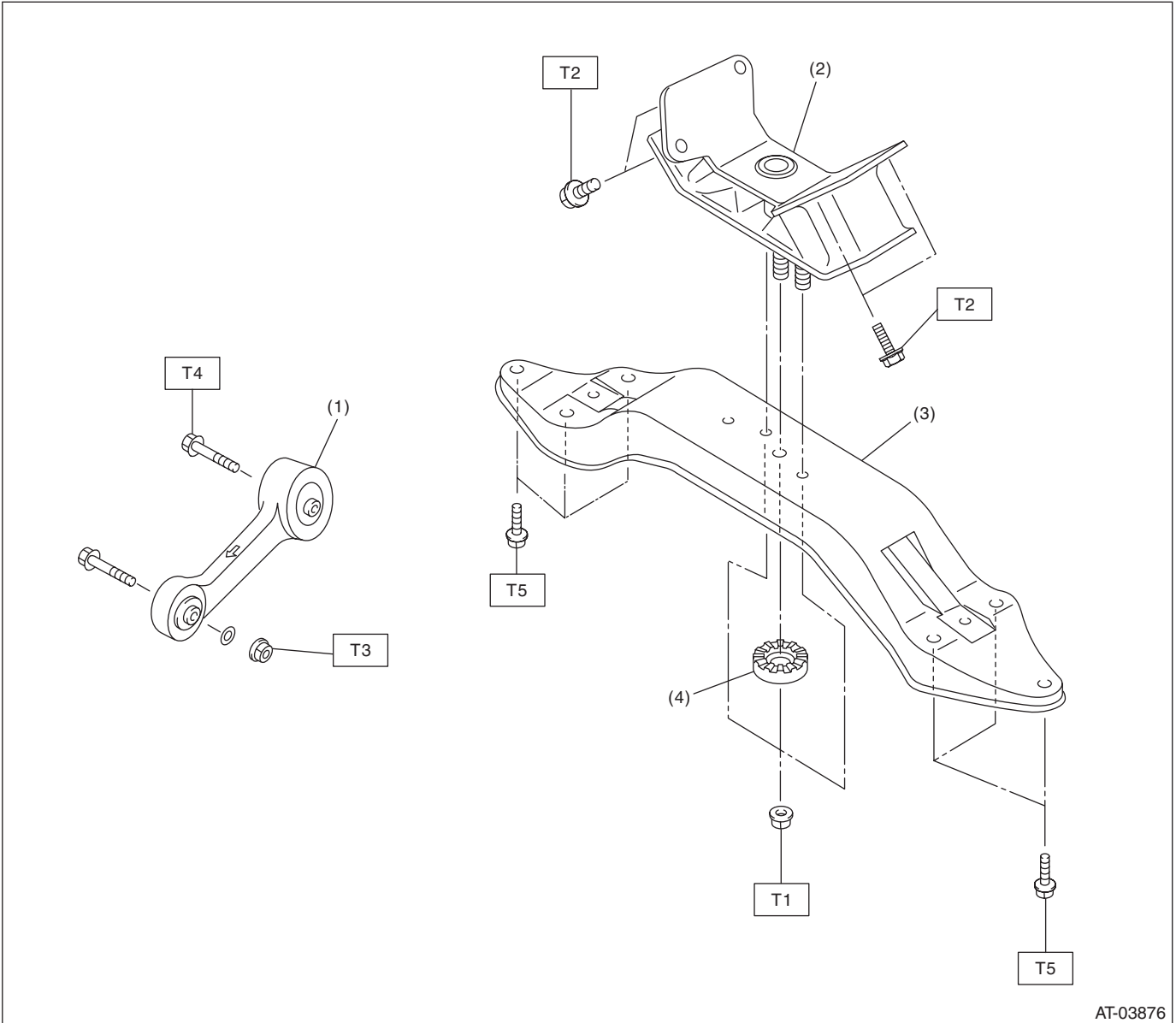
**T1: 7 (0.7, 5.1)**

**T2: 13 (1.3, 9.6)**

**T3: 25 (2.5, 18.4)**

---

## 11. TRANSMISSION MOUNTING



- |                         |                 |
|-------------------------|-----------------|
| (1) Pitching stopper    | (3) Crossmember |
| (2) Rear cushion rubber | (4) Stopper     |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 35 (3.6, 25.8)**

**T2: 40 (4.1, 29.5)**

**T3: 50 (5.1, 36.9)**

**T4: 58 (5.9, 42.8)**

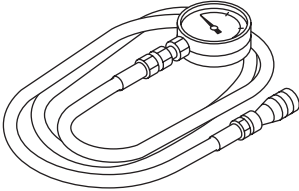
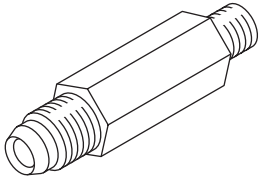
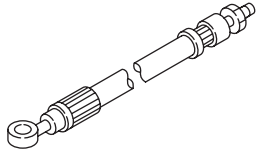
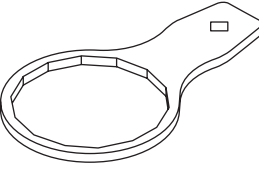
**T5: 75 (7.6, 55.3)**

#### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Do not place the oil pan with its inner side facing up until it is installed, to prevent intrusion of foreign matter into the valve body.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- When disassembling the case and other light alloy parts, use a plastic hammer to force it apart. Do not pry apart with screwdrivers or other tools.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine gear oil, grease or the equivalent. Do not mix gear oil, grease, etc. of different grades or manufacturers.
- Be sure to tighten bolts and nuts to the specified torque.
- Place lifts, shop jacks or rigid racks at the specified points.
- Apply gear oil or ATF onto sliding or revolution surfaces before installation in view of components usage.
- Replace deformed or damaged snap rings with new parts.
- Before installing O-rings or oil seals, apply sufficient amount of ATF fluid to avoid damage and deformation.
- Be careful not to incorrectly install or fail to install O-rings, snap rings and other such parts.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Avoid damaging the mating surface of the case.
- Before applying liquid gasket, completely remove the old seal.
- When disassembling the AT, be sure to use nylon gloves and paper towels. Do not use cloth gloves or waste cloth.

## D: PREPARATION TOOL

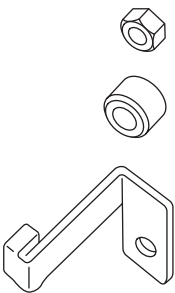
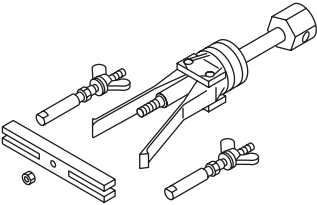
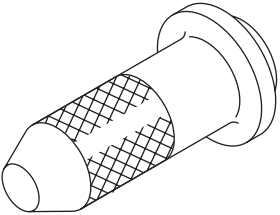
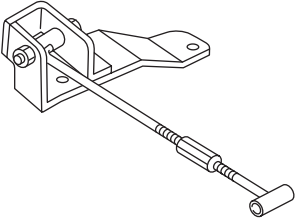
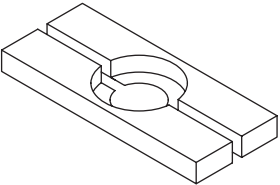
### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498575400</p>	498575400	OIL PRESSURE GAUGE ASSY	Used for measuring oil pressure.
 <p style="text-align: center;">ST-498897200</p>	498897200	OIL PRESSURE GAUGE ADAPTER	Used at the oil pump housing when measuring reverse clutch pressure and line pressure.
 <p style="text-align: center;">ST-498897700</p>	498897700	ADAPTER SET	Used for measuring transfer clutch pressure.
 <p style="text-align: center;">ST-498545400</p>	498545400	FILTER WRENCH	Used for removing and installing the ATF filter.



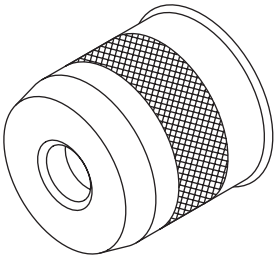
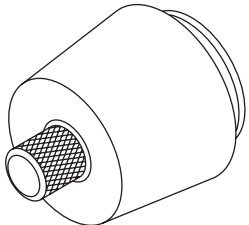
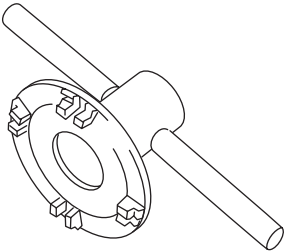
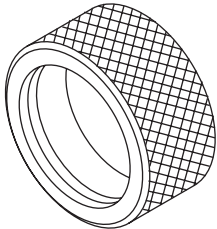
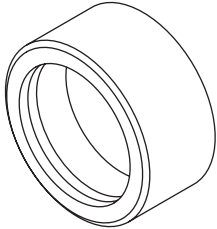
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498277200</p>	498277200	STOPPER SET	Used for removing and installing automatic transmission assembly to engine.
 <p style="text-align: center;">ST-398527700</p>	398527700	PULLER ASSY	<ul style="list-style-type: none"> <li>• Used for removing the extension case roller bearing.</li> <li>• Used for removing the extension oil seal.</li> <li>• Used for removing the front differential side retainer bearing outer race.</li> <li>• Used for removing the front differential side retainer oil seal.</li> </ul>
 <p style="text-align: center;">ST-498057300</p>	498057300	INSTALLER	Used for installing the extension oil seal.
 <p style="text-align: center;">ST41099AC000</p>	41099AC000	ENGINE SUPPORT ASSY	Used for supporting the engine.
 <p style="text-align: center;">ST-498077000</p>	498077000	REMOVER	Used for removing the differential taper roller bearing.

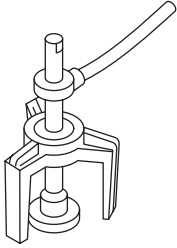
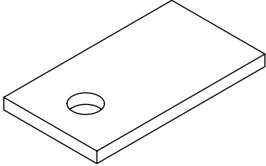
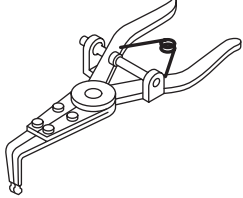
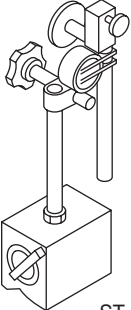
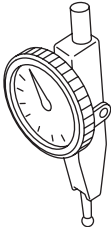
# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499247400</p>	499247400	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the transfer outer snap ring.</li> <li>• Used together with the GUIDE (499257300).</li> </ul>
 <p>ST-499257300</p>	499257300	SNAP RING OUTER GUIDE	<ul style="list-style-type: none"> <li>• Used for installing the transfer outer snap ring.</li> <li>• Used together with the INSTALLER (499247400).</li> </ul>
 <p>ST18630AA010</p>	18630AA010	WRENCH COMPL RETAINER	<ul style="list-style-type: none"> <li>• Used for removing and installing the differential side retainer.</li> <li>• WRENCH ASSEMBLY (499787000) can also be used.</li> </ul>
 <p>ST-398437700</p>	398437700	DRIFT	Used for installing the converter case oil seal.
 <p>ST-398487700</p>	398487700	INSTALLER	Used for installing the front differential taper roller bearing.

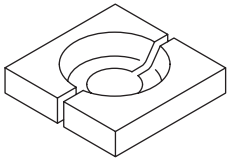
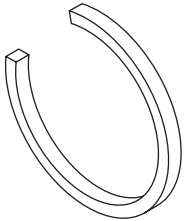
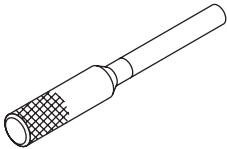
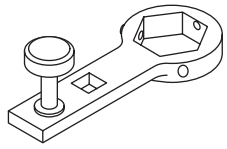
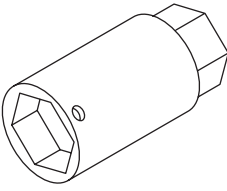
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-398673600</p>	398673600	COMPRESSOR	Used for removing and installing the clutch spring.
 <p style="text-align: center;">ST-498255400</p>	498255400	PLATE	Used for measuring the backlash of hypoid gear.
 <p style="text-align: center;">ST-399893600</p>	399893600	PLIERS	Used for removing and installing the clutch spring.
 <p style="text-align: center;">ST-498247001</p>	498247001	MAGNET BASE	<ul style="list-style-type: none"> <li>• Used for measuring the gear backlash.</li> <li>• Used together with DIAL GAUGE (498247100).</li> </ul>
 <p style="text-align: center;">ST-498247100</p>	498247100	DIAL GAUGE	<ul style="list-style-type: none"> <li>• Used for measuring the gear backlash.</li> <li>• Used together with MAGNET BASE (498247001).</li> </ul>

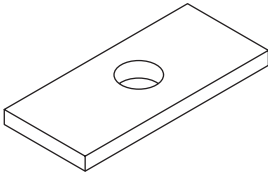
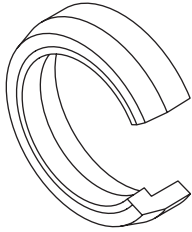
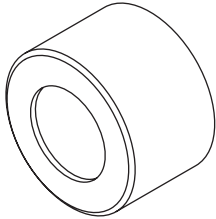
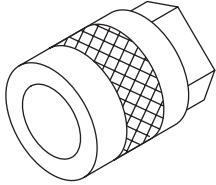
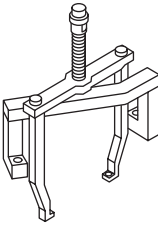
# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498517000</p>	498517000	REPLACER	Used for removing the front roller bearing.
 <p>ST-398623600</p>	398623600	SEAT	Used for removing the spring of the transfer clutch piston.
 <p>ST-499267300</p>	499267300	STOPPER PIN	Used for installing the inhibitor switch.
 <p>ST-499787700</p>	499787700	WRENCH	Used for removing and installing the drive pinion lock nut.
 <p>ST-499787500</p>	499787500	ADAPTER	Used for removing and installing the drive pinion lock nut.

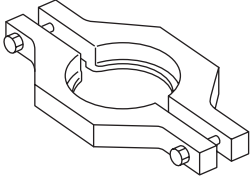
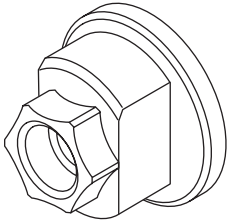
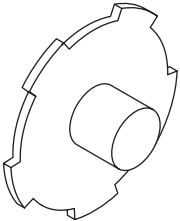
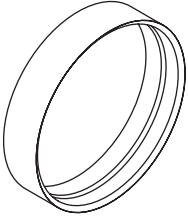
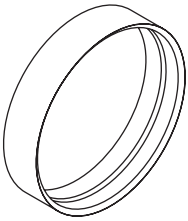
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-398643600</p>	398643600	GAUGE	Used for measuring the total end play, extension end play and drive pinion height.
 <p style="text-align: center;">ST-498627100</p>	498627100	SEAT	Used for holding the low clutch piston retainer spring when installing snap ring.
 <p style="text-align: center;">ST-499577000</p>	499577000	GAUGE	Used for measuring the mating surface of the transmission to the end face of the reduction gear.
 <p style="text-align: center;">ST-499737000</p>	499737000	PULLER	Used for removing the reduction driven gear assembly.
 <p style="text-align: center;">ST-499737100</p>	499737100	PULLER SET	Used for removing the reduction drive gear assembly.

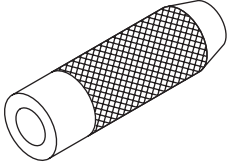
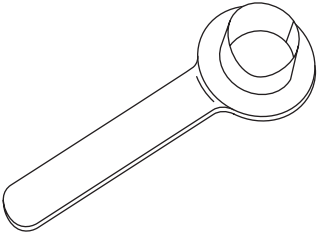
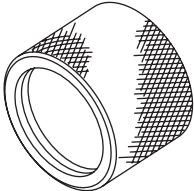
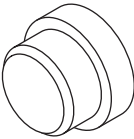
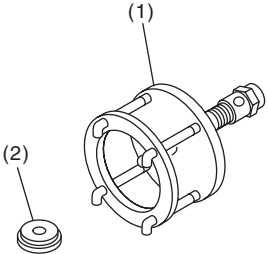
# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498077600</p>	498077600	REMOVER	Used for removing the ball bearing.
 <p>ST-498937110</p>	498937110	HOLDER	Used for removing and installing the drive pinion lock nut.
 <p>ST-498677100</p>	498677100	COMPRESSOR	Used for installing the 2-4 brake snap ring.
 <p>ST-498437000</p>	498437000	HIGH CLUTCH PISTON GUIDE	Used for installing the high clutch piston.
 <p>ST-498437100</p>	498437100	LOW CLUTCH PISTON GUIDE	Used for installing the low clutch piston.

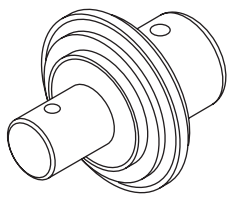
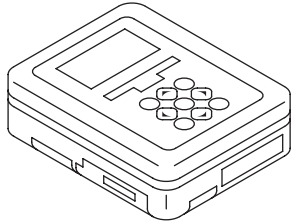
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-899580100</p>	899580100	INSTALLER	Used for press-fitting the ball bearing of the transfer clutch.
 <p style="text-align: center;">ST28399SA010</p>	28399SA010	OIL SEAL PROTECTOR	Used for installing the axle shaft.
 <p style="text-align: center;">ST18675AA000</p>	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.
 <p style="text-align: center;">ST-398497701</p>	398497701	SEAT	Used for installing the needle bearing.
 <p style="text-align: center;">ST-899524100</p>	899524100	PULLER SET	Use only the bolt. <ul style="list-style-type: none"> <li>• Used together with the PULLER SET (499737100).</li> <li>• Used together with the PULLER (499737000).               <ol style="list-style-type: none"> <li>1. Puller</li> <li>2. Cap</li> </ol> </li> </ul>

# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499247300</p>	499247300	INSTALLER	Used for installing the oil pump housing retainer oil seal.
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Depth gauge	Used for measuring the transmission end play.
Thickness gauge	Used for measuring clearance of the clutch, brake and oil pump.
Micrometer	Used for measuring thickness of the drive pinion.
Spring scale	Used for measuring the starting torque of the drive pinion.
Circuit tester	Used for measuring resistance and voltage.
TORX® T70	Used for removing and installing differential gear oil drain plug.
Push/pull gauge	Used for measuring the piston stroke of each clutch.



# Automatic Transmission Fluid

## AUTOMATIC TRANSMISSION

## 2. Automatic Transmission Fluid

### A: INSPECTION

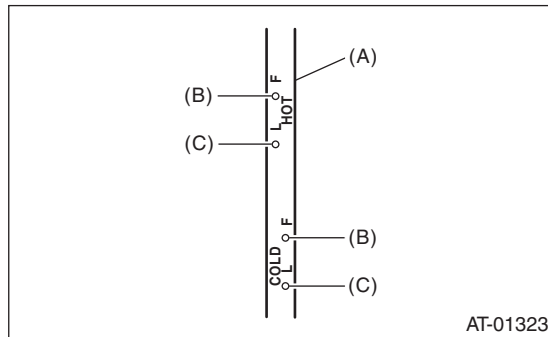
#### NOTE:

The level of ATF varies with fluid temperature. Pay attention to the ATF temperature when checking ATF level.

1) Raise the ATF temperature by driving a distance of 5 to 10 km (3 to 6 miles). Otherwise, idle the engine to raise ATF temperature to 70 — 80°C (158 — 176°F) on Subaru Select Monitor. <Ref. to 4AT(diag)-16, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

2) Park the vehicle on a level surface.

3) After selecting all positions (P, R, N, D), set the select lever in “P” range. Idle the engine for 1 or 2 minutes, and measure the ATF level.



- (A) ATF level gauge
- (B) Upper level
- (C) Lower level

4) Make sure that the ATF level is between upper and lower marks of the HOT side.

If the fluid level is below the lower mark, check the transmission for leaks. If there are leaks, it is necessary to repair or replace gaskets, oil seals, plugs or other parts.

5) If the ATF level is below the center point between upper and lower level marks, add the recommended ATF until the fluid level is above the center point between the upper and lower level marks.

#### CAUTION:

- **Be careful not to exceed the upper level.**
- **If ATF is added to the upper level while the transmission is cool, there will be too much ATF and will cause problems. Do not exceed the upper level.**

6) Check ATF level after raising ATF temperature to 70 — 80°C (158 — 176°F) by running the vehicle again or by idling the engine.

### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the drain plug (ATF) and completely drain the ATF.

#### CAUTION:

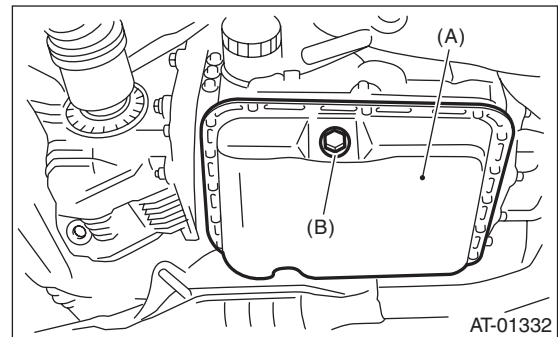
**After running the engine or after idling for a long time, the ATF is hot. Be careful not to burn yourself.**

3) Check the condition of ATF. <Ref. to 4AT-29, CONDITION CHECK, Automatic Transmission Fluid.>

4) Perform replacement with a new gasket, and tighten the drain plug (ATF).

#### Tightening torque:

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



- (A) Oil pan
- (B) Drain plug (ATF)

- 5) Lower the vehicle.
- 6) Pour ATF from the oil charge pipe.

#### Recommended fluid:

**<Ref. to RM-4, FLUID, RECOMMENDED MATERIALS, Recommended Materials.>**

#### Capacity:

**Refill with the same amount of ATF drained from the drain plug hole.**

#### Capacity when transmission is overhauled:

**9.3 — 9.6 ℓ (9.8 — 10.1 US qt, 8.2 — 8.4 Imp qt)**

- 7) Bleed the air of control valve. <Ref. to 4AT-61, Air Bleeding of Control Valve.>
- 8) Check the level and leaks of ATF. <Ref. to 4AT-28, INSPECTION, Automatic Transmission Fluid.>

## C: CONDITION CHECK

**NOTE:**

When replacing ATF, check the inside condition of transmission body by inspecting the drained ATF.

Fluid condition	Trouble and possible cause	Corrective action
Large amount of metallic pieces are found.	Excessive wear of the internal of the transmission body.	Replace ATF and check if AT operates correctly.
Thick and varnish-form fluid.	Burned clutch, etc.	Replace ATF and check the AT body or vehicle for faulty.
Clouded fluid or bubbles are found in fluid.	Water mixed in fluid.	Replace ATF and check the water entering point.

# Differential Gear Oil

## AUTOMATIC TRANSMISSION

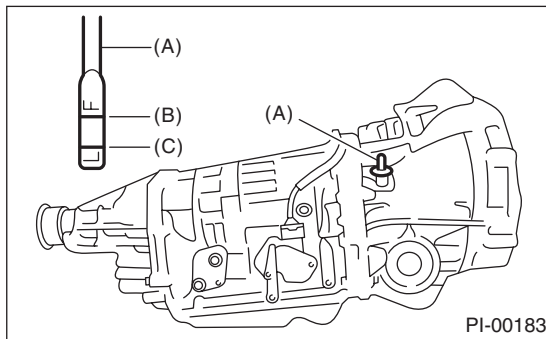
### 3. Differential Gear Oil

#### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Make sure the level gauge is inserted correctly and in the proper orientation.
- 4) Remove the oil level gauge again, and check the level of differential gear oil. If the differential gear oil level is below "L" line, add oil to bring the level up to "F" line.

#### NOTE:

To prevent overfilling the differential gear oil, do not fill oil to the "F" line or more.



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the differential gear oil drain plug using TORX® bit T70, and drain the differential gear oil completely.

#### CAUTION:

- Because the differential gear will be very hot after driving, be very careful not to receive burns.

- Be careful not to spill the differential gear oil on exhaust pipe to prevent it from emitting smoke or causing fires. If differential gear oil is spilled on the exhaust pipe, wipe it off completely.

- 3) Replace the gasket with a new part and tighten the differential gear oil drain plug using the TORX® bit T70.

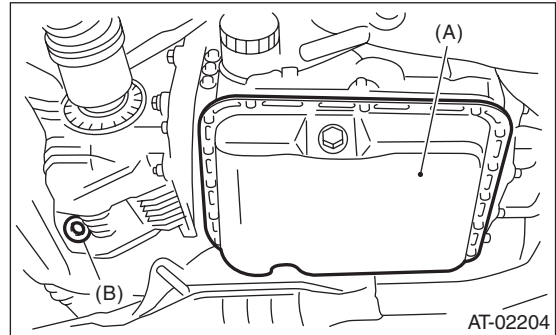
#### Tightening torque:

##### Aluminum gasket

44 N·m (4.5 kgf·m, 32.5 ft·lb)

##### Copper gasket

70 N·m (7.1 kgf·m, 51.6 ft·lb)



- (A) Oil pan
- (B) Differential gear oil drain plug

- 4) Lower the vehicle.
- 5) Fill the differential with differential gear oil from the level gauge hole.

#### Recommended gear oil:

<Ref. to 4AT-3, RECOMMENDED GEAR OIL, SPECIFICATION, General Description.>

#### Gear oil capacity:

1.1 — 1.3 ℓ (1.2 — 1.4 US qt, 1.0 — 1.1 Imp qt)

- 6) Check the level of differential gear oil.  
<Ref. to 4AT-30, INSPECTION, Differential Gear Oil.>

## 4. Road Test

### A: INSPECTION

#### 1. GENERAL PRECAUTION

Road tests should be conducted to properly diagnose the condition of automatic transmission.

##### NOTE:

When performing the test, do not exceed posted speed limit.

#### 2. D RANGE SHIFT FUNCTION

Check shifting between 1st ↔ 2nd ↔ 3rd ↔ 4th while driving on normal city streets.

#### 3. D RANGE SHIFT SHOCK

Check the shock level when shifting up during normal driving.

#### 4. KICK-DOWN FUNCTION

Check kick-down for each gear. Check the shock level during kick-down at the same time.

#### 5. ENGINE BRAKE OPERATION

- Check the 3rd gear engine brake when shifting down from 4th to 3rd range while driving in 4th gear of manual mode [50 — 60 km/h (31 — 37 MPH)].
- Check the 2nd gear engine brake when shifting down from 3rd to 2nd range while driving in 3rd gear of manual mode [40 — 50 km/h (25 — 31 MPH)].
- Check the 1st gear engine brake when shifting down from 2nd to 1st range while driving in 2nd gear of manual mode [20 — 30 km/h (12 — 19 MPH)].

#### 6. LOCK-UP FUNCTION

- When the accelerator is lightly depressed while driving on a flat road in “D” range, check that rpm does not change abruptly.
- Check slip lock-up with following procedure. Subaru Select Monitor is required for judgment. Before starting the check, make sure that no DTC is displayed using the Subaru Select Monitor. If there is a DTC, perform the corrective action according to the DTC. Recheck to see that the DTC has been cleared, then start the slip lock-up check. 1) The check is to be performed on a flat and straight road or on a free roller.

##### NOTE:

- Slip lock-up will not operate when the vehicle is lifted up off of its wheels, since there is no surface resistance.
- When checking on the free roller, the driving resistance will be slightly inadequate. It will be easier to judge if the foot brake is lightly applied while performing the check.

2) Connect the Subaru Select Monitor.

3) Check the ATF temperature using the Subaru Select Monitor.

##### NOTE:

- Make sure that the ATF temperature is between 50 — 100°C (122 — 212°F).
  - If the temperature is low, warm-up the ATF by running the vehicle.
- 4) Start the engine, and set so that the lock-up duty can be read on the data display of the Subaru Select Monitor.
- 5) Drive the vehicle at a constant speed of 35 — 40 km/h (22 — 25 MPH).
- 6) Read the lock-up duty while vehicle is running.

##### **Standard**

**25 — 45%**

##### NOTE:

- The reading may be slightly lower on a free roller.
- Slip lock-up control is not operating if the lock-up duty is 5% or less, or when the lock-up duty goes down immediately after starting to rise. In these cases, improper ATF or deterioration of the ATF may be the cause. Check the amount of ATF or replace the fluid, then recheck.

#### 7. P RANGE OPERATION

Stop the vehicle on an uphill grade of 5% or more and shift to the “P” range. Check that the vehicle does not move when the parking brake is released.

#### 8. NOISE AND VIBRATION

Check for noise and vibration while driving and during shifting.

#### 9. TRANSFER CLUTCH

Check for tight corner braking phenomenon when the vehicle is moved forward with the steering fully turned.

#### 10. OIL LEAKAGE

After the driving test, inspect for oil leaks.

# Stall Test

## AUTOMATIC TRANSMISSION

### 5. Stall Test

#### A: INSPECTION

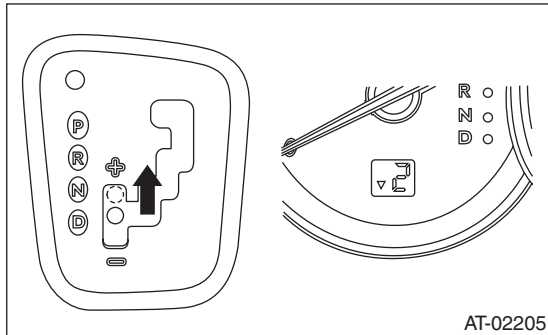
**NOTE:**

The stall test is extremely important in diagnosing the condition of an automatic transmission and engine. The test is necessary to measure the engine stall speeds in “R” and “2nd of manual mode”.

Purposes of the stall test:

- Operational check of the automatic transmission clutch
- Operational check of the torque converter clutch
- Engine performance check

- 1) Check that the throttle valve fully opens.
- 2) Check that the engine oil level is correct.
- 3) Check that the coolant level is correct.
- 4) Check that the ATF level is correct.
- 5) Check that the differential gear oil level is correct.
- 6) Increase the ATF temperature to 70 to 80°C (158 to 176°F) by idling the engine for approximately 30 minutes (with select lever set to “N” or “P”).
- 7) Place the wheel chocks at the front and rear of all wheels and apply the parking brake.
- 8) Move the manual linkage to ensure it operates properly, and then set to the “2nd gear of manual mode”.



- 9) While pressing hard on the foot brake pedal, slowly depress the accelerator pedal to full throttle.
- 10) When the engine speed stabilizes, quickly record the engine speed and release accelerator pedal.

11) Shift the select lever to “N” range, and cool down the engine by idling it for one minute or more.

12) If the stall speed in “2nd gear of manual mode” is higher than specifications, low clutch slipping and 2-4 brake slipping may occur. To identify this, conduct the same test as above in “R” range.

13) Perform the stall tests with the select lever in “D” range.

**NOTE:**

- Do not continue the stall test for 5 seconds or more at a time (from closed throttle, fully open throttle to stall speed reading). Failure to follow this instruction will cause the engine oil and ATF to deteriorate and the clutch and brake to be adversely affected.
- Be sure to cool down the engine for at least one minute after each stall test with the select lever set in the “P” or “N” range and with the idle speed of 1,200 rpm or less.
- If the stall speed is higher than the specified range, attempt to finish the stall test in as short a time as possible, in order to prevent the automatic transmission from sustaining damage.

**Stall speed (at sea level):**

**2,200 — 3,000 rpm**

Stall speed (at sea level)	Range	Cause
Below specified value	2nd gear on manual mode, R	<ul style="list-style-type: none"> <li>• Throttle valve is not fully open</li> <li>• Engine malfunction</li> <li>• One-way clutch of the torque converter is slipping</li> </ul>
Over specified value	D	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Low clutch slipping</li> <li>• One-way clutch malfunctioning</li> </ul>
	R	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Reverse clutch slipping</li> <li>• Low &amp; reverse brake slipping</li> </ul>
	2nd gear of manual mode	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Low clutch slipping</li> <li>• 2-4 brake slipping</li> </ul>

## 6. Time Lag Test

### A: INSPECTION

**NOTE:**

When the select lever is shifted while the engine is idling, there will be a certain time elapse or lag before shock is felt. This is used for checking the condition of the low clutch, reverse clutch, low & reverse brake and one-way clutch.

- Perform the test at normal operation fluid temperature of 70 — 80°C (158 — 176°F).
- Be sure to allow a one minute or more interval between tests.
- Make three measurements and take the average value.

1) Fully apply the parking brake.

2) Start the engine.

Check the idle speed (A/C OFF).

3) Shift the select lever from “N” to “D” range.

Using a stop watch, measure the time which takes from shifting the lever until the shock is felt.

Time lag: 1.2 seconds or less

If “N” → “D” time lag is longer than specified:

- Line pressure too low
- Low clutch worn
- One-way clutch not operating properly
- D-ring worn

4) In the same manner, measure the time lag of “N” → “R”.

Time lag: 1.5 seconds or less

If “N” → “R” time lag is longer than specified:

- Line pressure too low
- Reverse clutch worn
- Low & reverse brake worn
- D-ring worn

# Line Pressure Test

## AUTOMATIC TRANSMISSION

### 7. Line Pressure Test

#### A: MEASUREMENT

##### NOTE:

If the clutch or brake shows a signs of slipping or shift feel is not correct, check the line pressure.

- Excessive shock during up-shift or if shifting takes place at a higher point than for normal conditions, this may be due to the line pressure being too high.

- Slippage or inability to operate the vehicle may, in most cases, be due to insufficient oil pressure for the operation of clutch, brake or control valve.

##### 1) Line pressure measurement (under no load):

(1) Before measuring line pressure, jack-up all the wheels.

(2) Maintain the ATF temperature at approx. 70 — 80°C (158 — 176°F) during measurement.

(ATF will reach the temperature above after idling the engine for approx. 30 minutes with the select lever in “N” or “P”.)

##### 2) Line pressure measurement (under heavy load)

(1) Before measuring line pressure, apply both the foot and parking brakes with all wheels chocked (Same as for “stall” test conditions).

(2) Measure the line pressure when the select lever is in “R” or 2nd of manual mode with engine under stall conditions.

(3) Measure the line pressure within 5 seconds after shifting the select lever to each position. (If the line pressure needs to be measured again, allow the engine to idle and cool it down for more than 1 minute.)

(4) Maintain the ATF temperature at approx. 70 — 80°C (158 — 176°F) during measurement.

(ATF will reach the above temperature after idling the engine for approx. 30 minutes with the select lever in “N” or “P”.)

##### 3) Remove the test plug and attach the ST instead.

ST 498897200 OIL PRESSURE GAUGE ADAPTER

##### 4) Connect the ST1 with ST2.

ST1 498897200 OIL PRESSURE GAUGE ADAPTER

ST2 498575400 OIL PRESSURE GAUGE ASSY

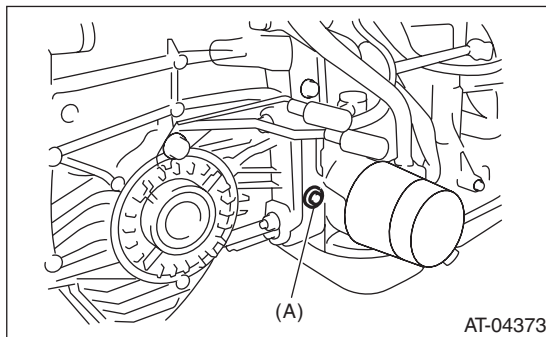
##### 5) Check for duty ratio changes by adjusting the acceleration pedal position using the Subaru Select Monitor.

Standard line pressure			
Range position	Line pressure duty ratio (%)	Throttle valve angle	Line pressure kPa (kg/cm <sup>2</sup> , psi)
Manual mode (2nd)	25 — 35	Full open	1,000 — 1,300 (10.2 — 13.3, 145 — 189)
R	15 — 25	Full open	1,500 — 1,850 (15.3 — 18.9, 217 — 268)
D	35 — 43	Full closed	500 — 800 (5.1 — 8.2, 73 — 116)

##### 6) Remove the ST and install the test plug.

##### **Tightening torque:**

**13 N·m (1.3 kgf·m, 9.6 ft·lb)**



(A) Test plug

## 8. Transfer Clutch Pressure Test

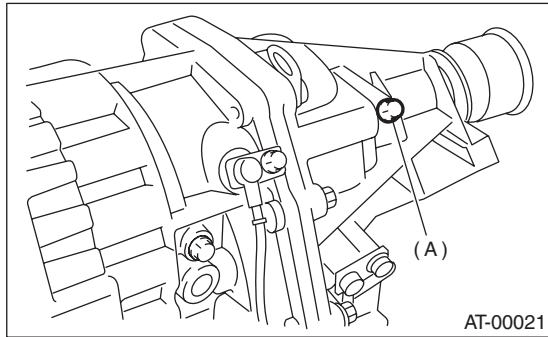
### A: INSPECTION

Check the transfer clutch pressure in accordance with the following chart in the same manner as line pressure. <Ref. to 4AT-34, Line Pressure Test.>

- ST 498897700 OIL PRESSURE ADAPTER SET
- ST 498575400 OIL PRESSURE GAUGE ASSY

**NOTE:**

- Before setting to FWD mode, install the spare fuse on the FWD mode switch. (MP-T model only)



(A) Test plug

- If no oil pressure is produced or if it does not change in AWD mode, there may be a problem in the transfer duty solenoid or control valve body.
- If oil pressure is produced in FWD mode, there is the same problem as the AWD mode. (MP-T model only)

Range position	ON duty ratio (%)	Acceleration opening angle (%)	Standard transfer clutch pressure kPa (kg/cm <sup>2</sup> , psi)	
			AWD mode	FWD mode
Manual mode (2nd)	95	Fully opened (100)	1,000 — 1,200 (10.2 — 12.2, 145 — 174)	—
	60	Adjust ON Duty ratio to 60%.	500 — 700 (5.1 — 7.1, 73 — 102)	—
	—	Fully closed (0)	—	0 (0, 0)
N or P	5	Fully closed (0)	0	—



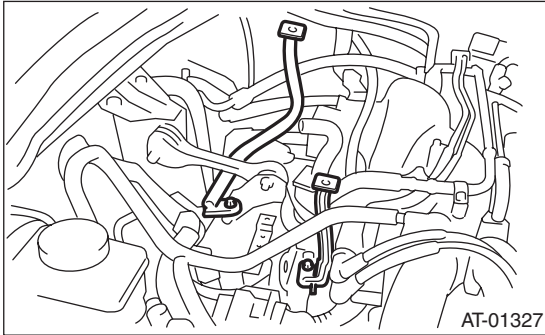
# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

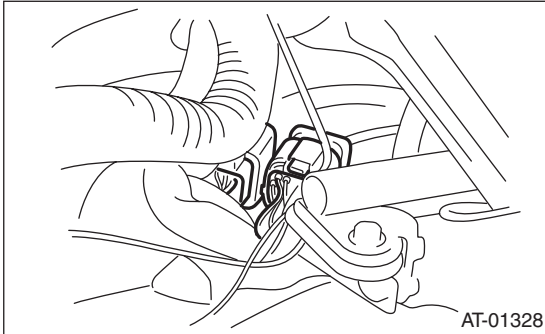
### 9. Automatic Transmission Assembly

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood and support with the hood stay.
- 3) Disconnect the ground cable from the battery.
- 4) Remove the air intake duct.  
<Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
- 5) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 6) Remove the air intake chamber stay.

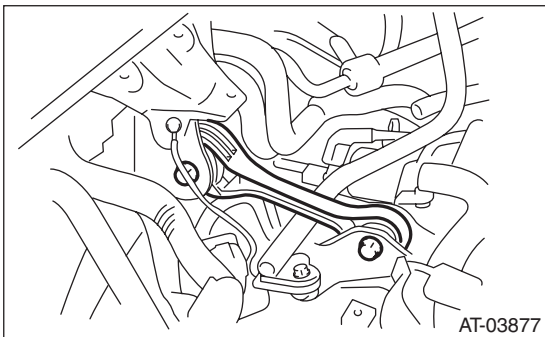


- 7) Disconnect the following connectors.
  - (1) Transmission harness connectors



- (2) Transmission ground terminal

- 8) Remove the starter.  
<Ref. to SC(H4SO)-6, REMOVAL, Starter.>
- 9) Remove the pitching stopper.

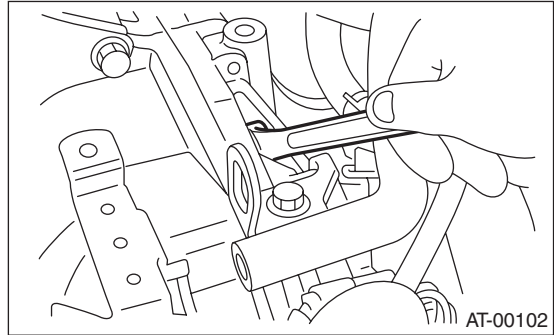


- 10) Separate the torque converter assembly from the drive plate.

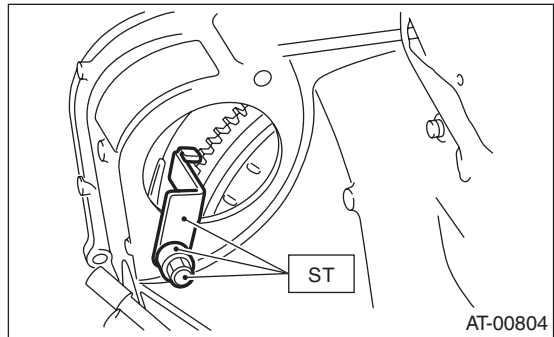
#### CAUTION:

- Be careful not to damage the mounting bolts.
- Be careful not to drop bolts into the converter case.

- (1) Remove the V-belt covers.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold the torque converter assembly to the drive plate.
- (4) Place the wrench on the crank pulley bolt, and remove all the bolts while rotating the crank pulley a little bit at a time.



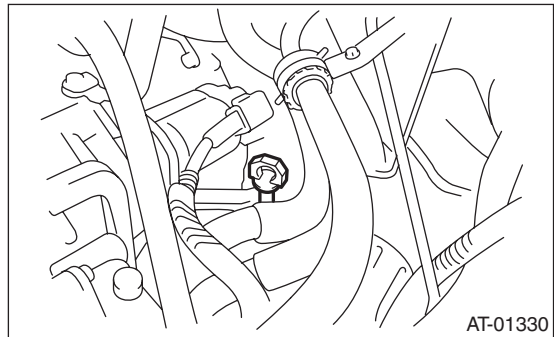
- 11) Attach the ST to the converter case.  
ST 498277200 STOPPER SET



- 12) Remove the ATF level gauge.

#### NOTE:

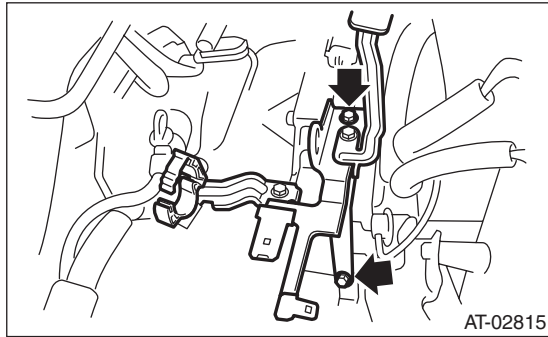
Plug the opening to prevent entry of foreign particles into the transmission fluid.



- 13) Remove the throttle body. <Ref. to FU(H4SO)-11, REMOVAL, Throttle Body.>

14) Disconnect the engine harness, then remove the harness connector from the engine harness bracket.

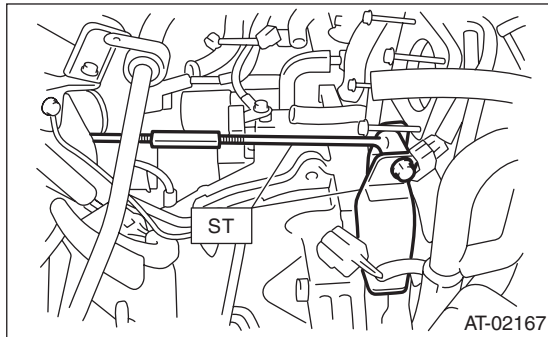
15) Remove the engine harness bracket.



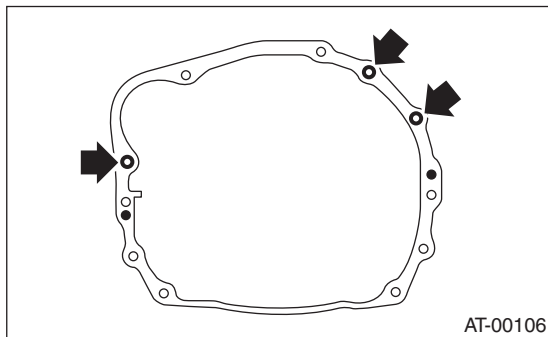
16) Remove the pitching stopper bracket.

17) Set the ST.

ST 41099AC000 ENGINE SUPPORT ASSY



18) Remove the bolts which hold upper side of transmission to engine.



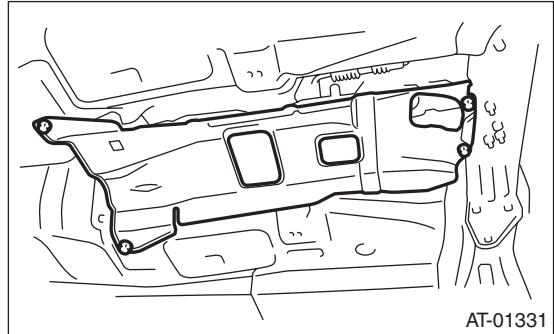
19) Lift up the vehicle.

20) Remove the under cover.

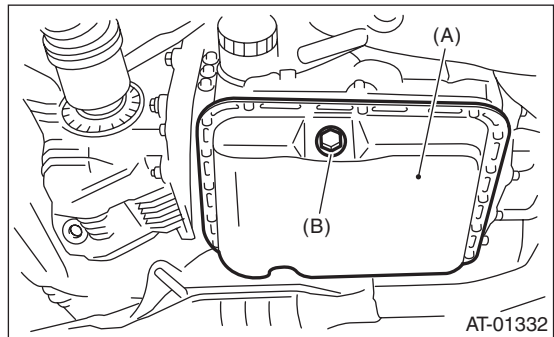
21) Remove the front, center and rear exhaust pipes and the muffler.

<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>

22) Remove the heat shield cover.



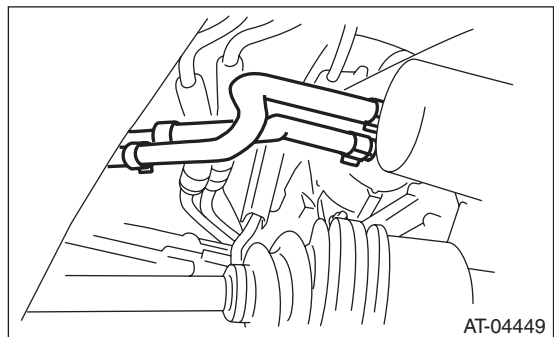
23) Remove the drain plug (ATF) to drain the ATF.



(A) Oil pan

(B) Drain plug (ATF)

24) Disconnect the ATF cooler hoses from the pipes of the transmission side, and remove the oil charge pipe.



25) Remove the propeller shaft.

<Ref. to DS-10, REMOVAL, Propeller Shaft.>

26) Remove the shift select cable.

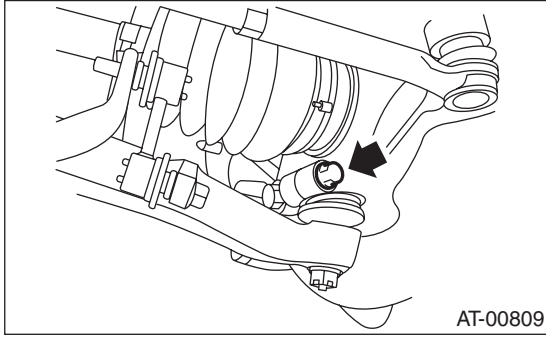
<Ref. to CS-27, REMOVAL, Select Cable.>

27) Remove the brackets (two) which hold front stabilizer.

# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

28) Remove the bolt securing the ball joint of the front arm to housing.



29) Pull out the front drive shaft from the transmission.

(1) Using a tire lever or a crow bar, etc., pull out until the front drive shaft transmission side joint slides move smoothly.

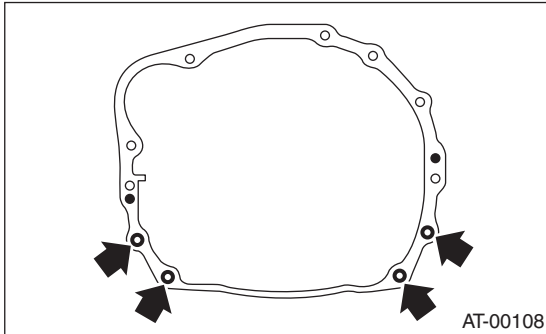
### NOTE:

Place cloth between the tire lever or bar and the transmission in order to avoid damaging the transmission side retainer.

(2) Hold the transmission side joint of the front drive shaft by hand and extract the housing from the transmission while pressing the housing outward, so as not to stretch the boot.

30) Remove the bolts which hold the clutch housing cover.

31) Remove the bolts and nuts which hold lower side of transmission to engine.

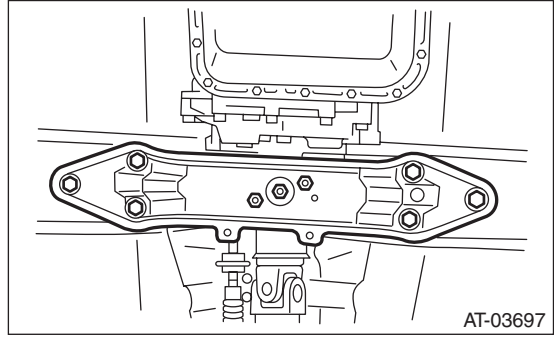


32) Place the transmission jack under the transmission.

### NOTE:

Make sure that the support plates of transmission jack do not touch the oil pan.

33) Remove the transmission rear crossmember from the vehicle.



34) While lowering the transmission jack gradually, fully retract the engine support, and then tilt the engine rearward.

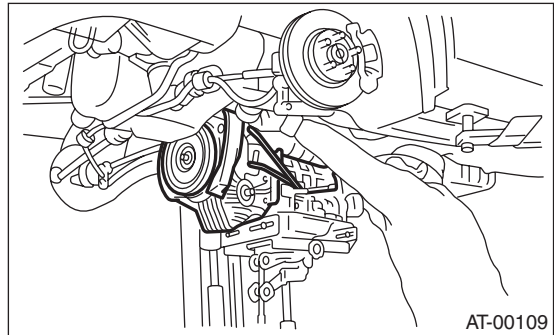
### NOTE:

Retract the support until the clearance between front crossmember and converter case becomes approx. 10 mm (0.39 in).

35) Remove the transmission.

### NOTE:

Remove the transmission and torque converter as a single unit from engine.



36) Remove the rear cushion rubber from the transmission assembly.

## B: INSTALLATION

1) Replace the differential side oil seal with a new part. <Ref. to 4AT-46, REPLACEMENT, Differential Side Retainer Oil Seal.>

### NOTE:

When a new oil seal has been installed, replacement is not required.

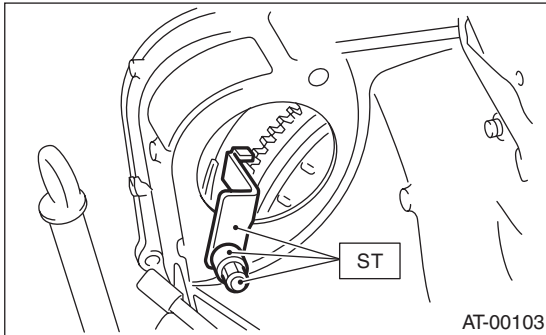
2) Install the rear cushion rubber to the transmission assembly.

### Tightening torque:

**40 N·m (4.1 kgf-m, 29.5 ft-lb)**

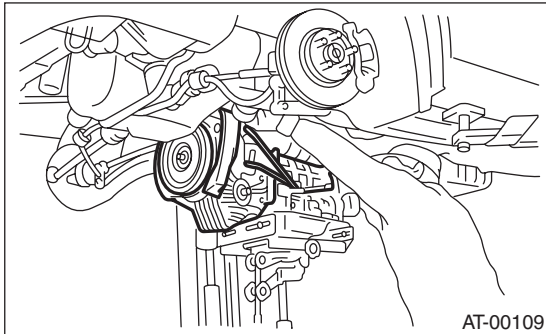
3) Attach the ST to the converter case.

ST 498277200 STOPPER SET



4) Install the transmission onto the engine.

(1) Lift up the transmission gradually using transmission jack.



(2) Insert the engine side stud bolt into the transmission bolt hole.

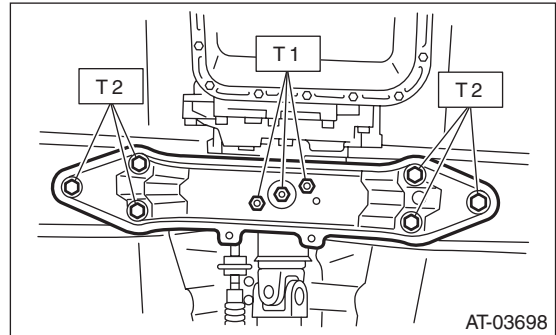
(3) While raising the transmission jack gradually, turn the screw of engine support, then tilt the engine forward and connect.

5) Install the transmission rear crossmember.

### Tightening torque:

**T1: 35 N·m (3.6 kgf-m, 25.8 ft-lb)**

**T2: 75 N·m (7.6 kgf-m, 55.3 ft-lb)**

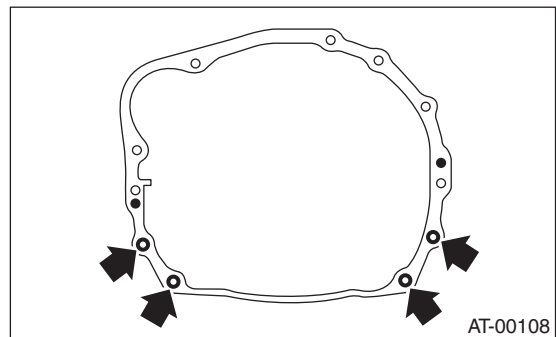


6) Remove the transmission jack.

7) Tighten the bolts and nuts which hold the lower side of transmission to the engine.

### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



8) Install the clutch housing cover bolts.

9) Lower the lift.

# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

- 10) Connect the engine and transmission.  
(1) Remove the ST from converter case.

### NOTE:

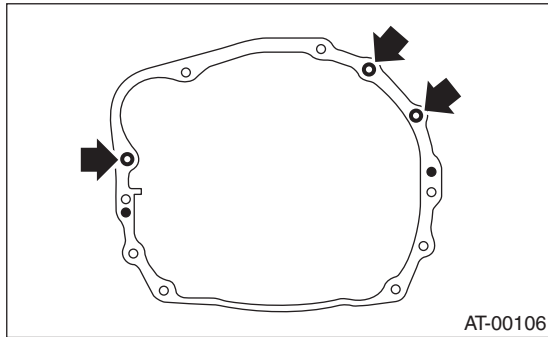
When removing the ST, be careful not to drop it into converter case.

ST 498277200 STOPPER SET

- (2) Install the starter.  
<Ref. to SC(H4SO)-6, INSTALLATION, Starter.>  
(3) Tighten the bolts which hold the upper side of the transmission to the engine.

### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



- 11) Install the torque converter assembly to the drive plate.

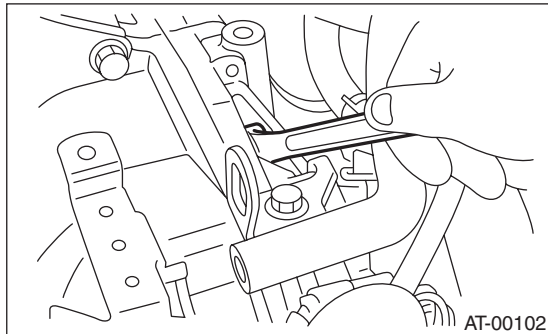
### CAUTION:

- Be careful not to damage the mounting bolts.
- Be careful not to drop bolts into the converter case.

- (1) Tighten the bolts which hold the torque converter assembly to the drive plate.  
(2) Place the wrench on the crank pulley bolt, and remove all the bolts while rotating the crank pulley a little bit at a time.

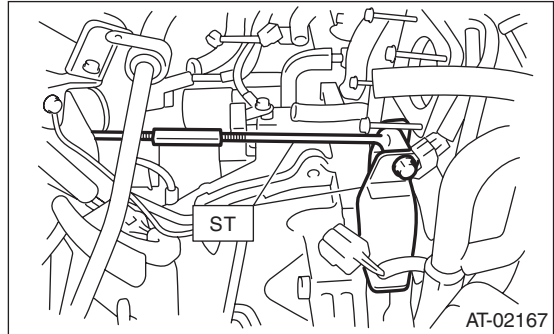
### Tightening torque:

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**



- (3) Fit the plug to service hole.  
(4) Install the V-belt cover.

- 12) Remove the ST.

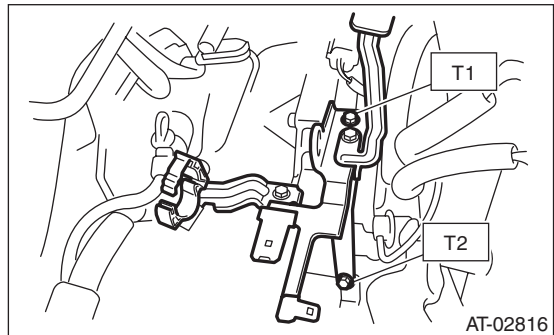


- 13) Install the engine harness bracket.

### Tightening torque:

**T1: 16 N·m (1.6 kgf-m, 11.6 ft-lb)**

**T2: 36 N·m (3.6 kgf-m, 26.0 ft-lb)**

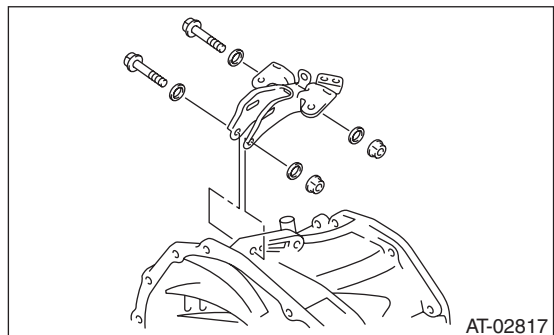


- 14) Install the harness connector to engine harness bracket, then connect the harness.

- 15) Install the pitching stopper bracket.

### Tightening torque:

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**



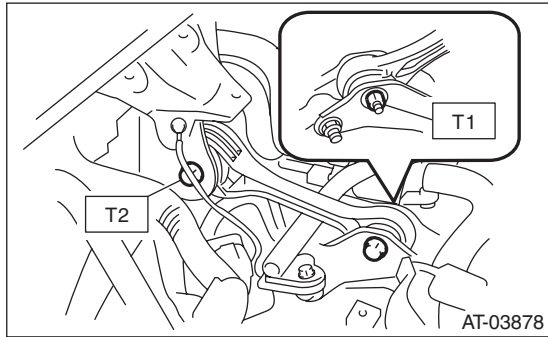
- 16) Install the throttle body. <Ref. to FU(H4SO)-11, INSTALLATION, Throttle Body.>

17) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf·m, 36.9 ft·lb)**

**T2: 58 N·m (5.9 kgf·m, 42.8 ft·lb)**



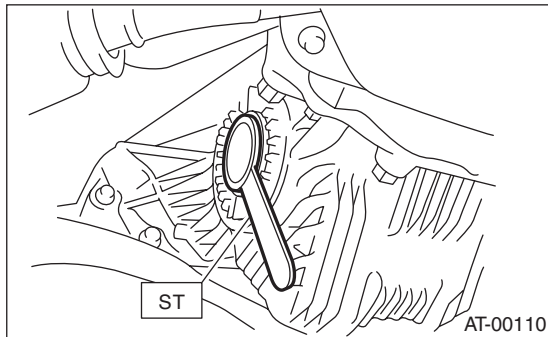
18) Lift up the vehicle.

19) Replace the circlip of the front drive shaft with a new part.

20) Apply grease to the oil seal lip.

21) Attach the ST to side retainer.

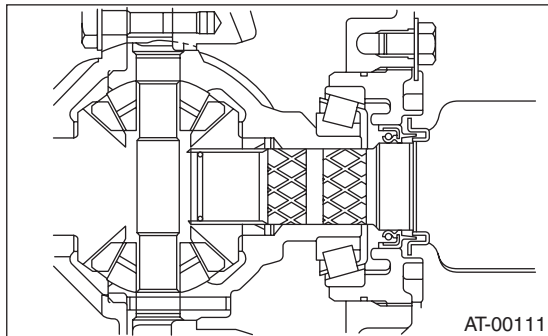
ST 28399SA010 OIL SEAL PROTECTOR



22) Align and insert the spline of the front drive shaft to the splines of the differential bevel gear, and remove the ST.

ST 28399SA010 OIL SEAL PROTECTOR

23) Insert the front drive shaft into the transmission securely by pressing the front housing from the outside.

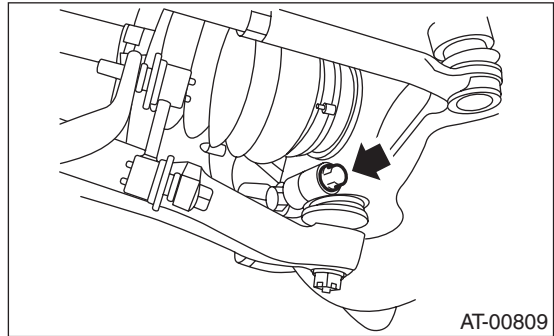


24) Install the ball joint into the housing.

25) Tighten the attachment bolts.

**Tightening torque:**

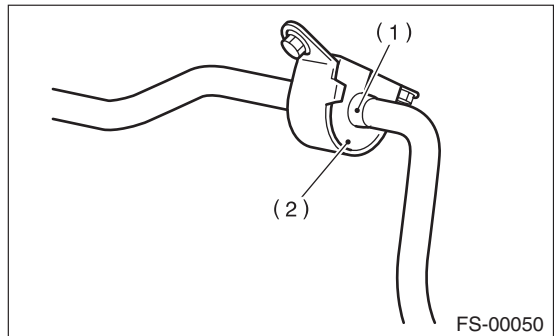
**50 N·m (5.1 kgf·m, 36.9 ft·lb)**



26) Install the stabilizer to the crossmember.

**NOTE:**

- Install the bushing (on front crossmember side) while aligning it with the paint mark on the stabilizer.
- Make sure the bushing and stabilizer are marked with the same identification colors (paint mark) when installing.



- (1) Identification mark on stabilizer
- (2) Bushing identification color

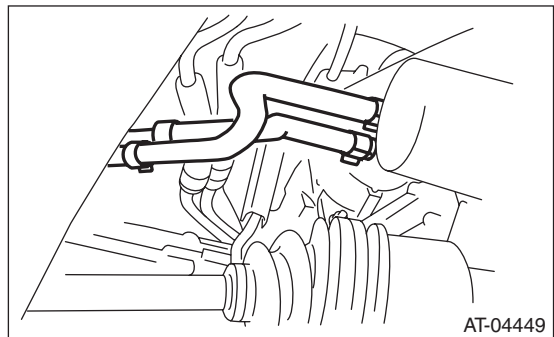
27) Always tighten the rubber bushing locations with wheels in full contact with the ground and the vehicle at curb weight.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

28) Install the shift select cable onto select lever.  
<Ref. to CS-28, INSTALLATION, Select Cable.>

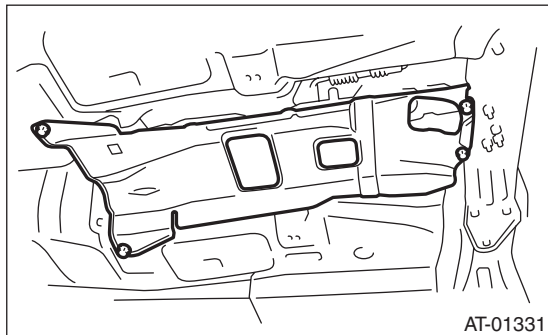
29) Install the oil charge pipe, and connect the ATF cooler hoses to the pipe.



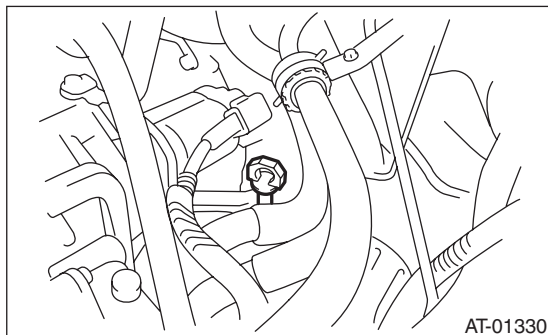
# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

- 30) Install the propeller shaft.  
<Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 31) Install the heat shield cover.



- 32) Install the rear exhaust pipe and muffler.  
<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>
- 33) Install the front and center exhaust pipe.  
<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 34) Install the under cover.
- 35) Lower the lift.
- 36) Install the ATF level gauge.



- 37) Connect the following connectors.
  - (1) Transmission harness connectors
  - (2) Transmission ground terminal
- 38) Install the air intake chamber stay.

### **Tightening torque:**

**16 N·m (1.6 kgf·m, 11.6 ft·lb)**

- 39) Install the air intake chamber.  
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
- 40) Install the air intake duct.  
<Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
- 41) From the oil charge pipe, add ATF until the fluid level is between the upper and lower level on the "COLD" side of the level gauge. <Ref. to 4AT-28, Automatic Transmission Fluid.>
- 42) Lower the vehicle from the lift.
- 43) Check the differential gear oil level. <Ref. to 4AT-30, Differential Gear Oil.>
- 44) Check the select lever operation.  
<Ref. to 4AT-47, INSPECTION, Inhibitor Switch.>

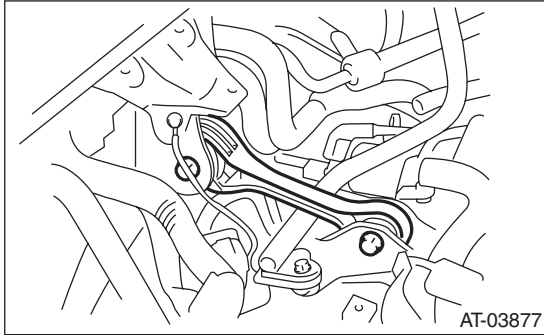
- 45) Bleed the air of control valve. <Ref. to 4AT-61, Air Bleeding of Control Valve.>
- 46) Check the ATF level. <Ref. to 4AT-28, Automatic Transmission Fluid.>
- 47) Execute the learning control promotion. <Ref. to 4AT(diag)-17, FACILITATION OF LEARNING CONTROL, OPERATION, Subaru Select Monitor.>
- 48) Perform the road test.  
<Ref. to 4AT-31, Road Test.>

## 10. Transmission Mounting System

### A: REMOVAL

#### 1. PITCHING STOPPER

- 1) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 2) Remove the pitching stopper.



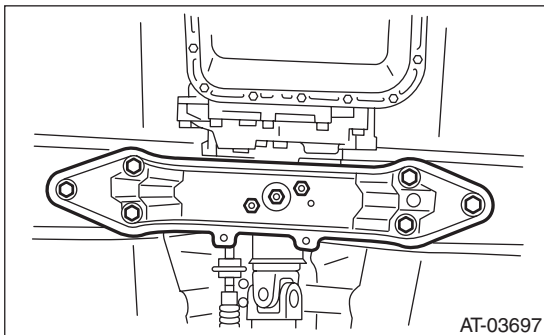
#### 2. TRANSMISSION REAR CROSSMEMBER AND REAR CUSHION RUBBER

- 1) Disconnect the ground cable from the battery.
- 2) Jack-up the vehicle and support it with rigid racks.
- 3) Remove the front, center and rear exhaust pipes and the muffler.  
<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
- 4) Remove the heat shield cover.
- 5) Set the transmission jack under transmission.

#### NOTE:

Make sure that the support plate of transmission jack does not touch the oil pan.

- 6) Remove the transmission rear crossmember.



- 7) Remove the rear cushion rubber.

### B: INSTALLATION

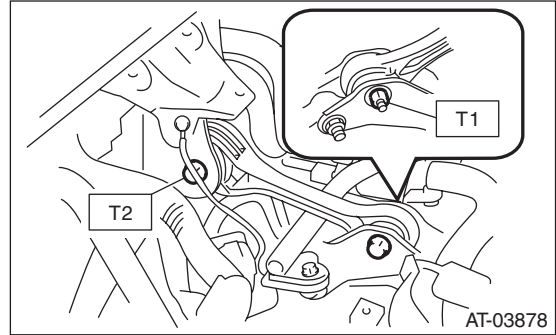
#### 1. PITCHING STOPPER

- 1) Install the pitching stopper.

#### Tightening torque:

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 2) Install the air intake chamber.  
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

#### 2. TRANSMISSION REAR CROSSMEMBER AND REAR CUSHION RUBBER

- 1) Install the rear cushion rubber.

#### Tightening torque:

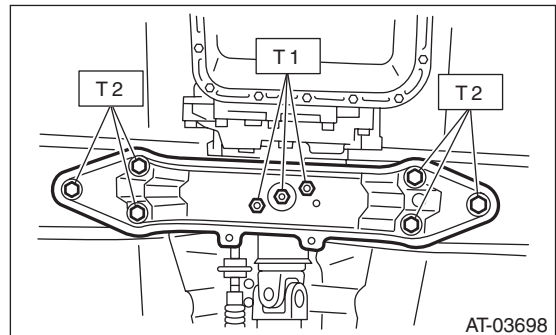
**40 N·m (4.1 kgf-m, 29.5 ft-lb)**

- 2) Install the cross member.

#### Tightening torque:

**T1: 35 N·m (3.6 kgf-m, 25.8 ft-lb)**

**T2: 75 N·m (7.6 kgf-m, 55.3 ft-lb)**



- 3) Remove the transmission jack.
- 4) Install the heat shield cover.
- 5) Install the front, center and rear exhaust pipes, and the muffler.  
<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>



# Transmission Mounting System

AUTOMATIC TRANSMISSION

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## **C: INSPECTION**

If problems are found in the following inspection, repair or replace the part.

### **1. PITCHING STOPPER**

Make sure that the pitching stopper is not bent or damaged. Check that there are no cracks, hardening or damage on rubber parts.

### **2. TRANSMISSION REAR CROSSMEMBER AND REAR CUSHION RUBBER**

Make sure that the crossmember is not bent or damaged. Check that there are no cracks, hardening, or damage on cushion rubbers.

## 11. Extension Case Oil Seal

### A: INSPECTION

Confirm that there is no ATF leakage from the joint of the transmission and propeller shaft. If a leak is found, replace the oil seal and inspect the propeller shaft. <Ref. to 4AT-45, REPLACEMENT, Extension Case Oil Seal.>

### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Clean the transmission exterior.
- 3) Remove the drain plug (ATF) and completely drain the ATF.

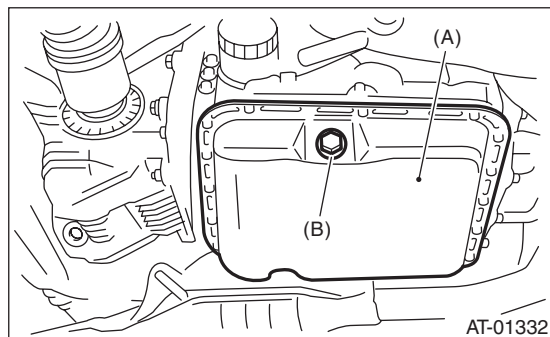
#### CAUTION:

**After running the engine or after idling for a long time, the ATF is hot. Be careful not to burn yourself.**

- 4) Perform replacement with a new gasket, and tighten the drain plug (ATF).

#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- (A) Oil pan
- (B) Drain plug (ATF)

- 5) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
- 6) Remove the heat shield cover.
- 7) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 8) Using the ST, remove the oil seal.  
ST 398527700 PULLER ASSY
- 9) Using the ST, install the oil seal.  
ST 498057300 INSTALLER
- 10) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 11) Install the heat shield cover.
- 12) Install the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- 13) Fill with ATF. <Ref. to 4AT-28, Automatic Transmission Fluid.>

- 14) Bleed the air of control valve.

<Ref. to 4AT-61, Air Bleeding of Control Valve.>

- 15) Check the level and leaks of the ATF. <Ref. to 4AT-28, Automatic Transmission Fluid.>

## Differential Side Retainer Oil Seal

AUTOMATIC TRANSMISSION

### 12. Differential Side Retainer Oil Seal

#### A: INSPECTION

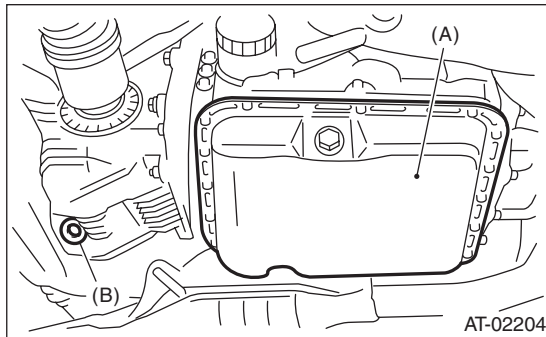
Check for leakage of gear oil from differential side retainer oil seal part. If there is an oil leak, replace the oil seal and inspect the drive shaft.

#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the front exhaust pipe and center exhaust pipe. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 3) Remove the differential gear oil drain plug using TORX® BIT T70, and then drain differential gear oil.

#### CAUTION:

- Because the differential gear will be very hot after driving, be very careful not to receive burns.
- Be careful not to spill the differential gear oil on exhaust pipe to prevent it from emitting smoke or causing fires. If differential gear oil is spilled on the exhaust pipe, wipe it off completely.



- (A) Oil pan  
(B) Differential gear oil drain plug

- 4) Perform replacement with a new gasket, and tighten the differential gear oil drain plug.

#### Tightening torque:

##### Aluminum gasket

**44 N·m (4.5 kgf-m, 32.5 ft-lb)**

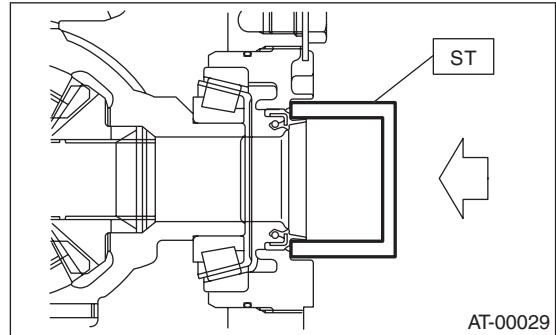
##### Copper gasket

**70 N·m (7.1 kgf-m, 51.6 ft-lb)**

- 5) Separate the front drive shaft from the transmission. <Ref. to DS-23, REMOVAL, Front Drive Shaft.>
- 6) Remove the differential side retainer oil seal using driver wrapped with vinyl tape etc.

- 7) Using the ST, install the differential side retainer oil seal by lightly tapping with a hammer.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER



- 8) Apply gear oil to the oil seal lips.
- 9) Install the front drive shaft. <Ref. to DS-23, INSTALLATION, Front Drive Shaft.>
- 10) Install the front exhaust pipe and the center exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 11) Lower the vehicle.
- 12) Fill with differential gear oil through the oil level gauge hole.

#### Recommended gear oil:

<Ref. to 4AT-3, RECOMMENDED GEAR OIL, SPECIFICATION, General Description.>

#### Gear oil capacity:

**1.1 — 1.3 ℓ (1.3 — 1.4 US qt, 1.0 — 1.1 Imp qt)**

- 13) Check the level of differential gear oil. <Ref. to 4AT-30, INSPECTION, Differential Gear Oil.>

## 13. Inhibitor Switch

### A: INSPECTION

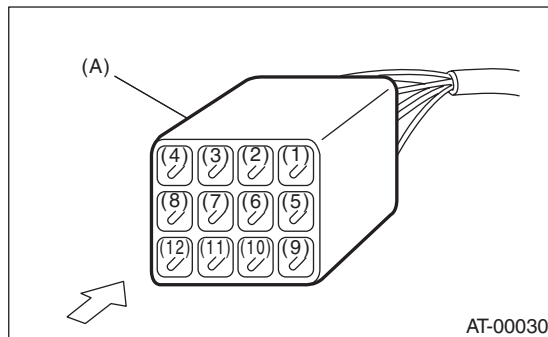
When the driving condition or starter motor operation is improper, first check the shift linkage for improper operation. If the shift linkage is functioning properly, check the inhibitor switch.

- 1) Disconnect the inhibitor switch connector.
- 2) Check continuity in inhibitor switch circuits with the select lever moved to each position.

**NOTE:**

- Also check that there is no continuity in the ignition circuit when the select lever is in the “R” and “D” ranges.
- If the inhibitor switch does not operate, check for poor contact of the connector on transmission side.

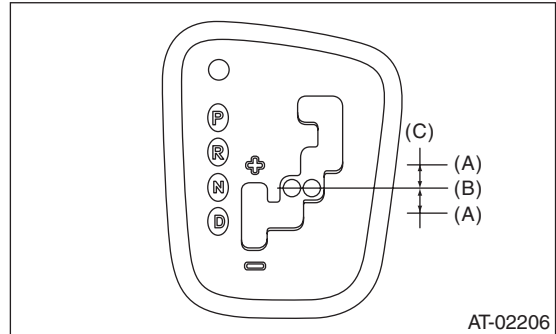
	Range	Pin No.
Signal sent to TCM	P	4 — 3
	R	4 — 2
	N	4 — 1
	D	4 — 8
Ignition circuit	P/N	12 — 11
Back-up light circuit	R	10 — 9



(A) Inhibitor switch connector

- 3) Check that there is continuity at equal points when the select lever is turned 1.5° in both directions from the “N” range.

If there is continuity in only one direction or in other points, adjust the inhibitor switch. <Ref. to 4AT-47, ADJUSTMENT, Inhibitor Switch.>

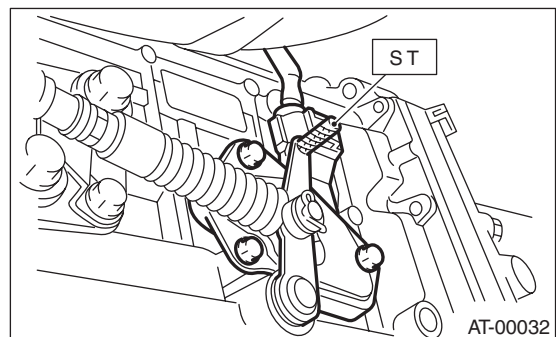


- (A) Continuity does not exist.
- (B) Continuity exists.
- (C) 1.5°

- 4) Repeat the above inspection in other gear ranges. If there are abnormalities, adjust the select cable. <Ref. to CS-31, ADJUSTMENT, Select Cable.>

### B: ADJUSTMENT

- 1) Set the select lever to “N” range.
- 2) Loosen the three inhibitor switch securing bolts.
- 3) Insert the ST as vertical as possible into the holes in the inhibitor switch lever and switch body.  
ST 499267300 STOPPER PIN



- 4) Tighten the three inhibitor switch securing bolts.

**Tightening torque:**

**3.4 N·m (0.35 kgf·m, 2.5 ft·lb)**

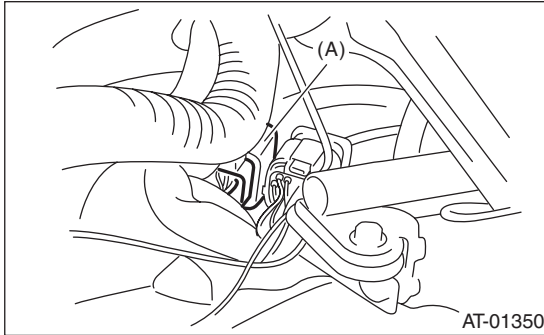
- 5) Repeat the inspection of the inhibitor switch. If the inhibitor switch is determined to be “faulty”, replace it.

# Inhibitor Switch

## AUTOMATIC TRANSMISSION

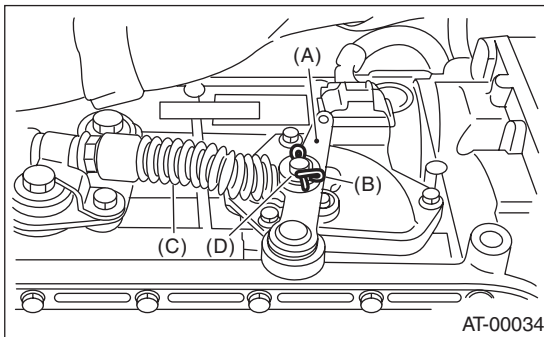
### C: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Set the select lever to "N" range.
- 3) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the inhibitor switch connector.



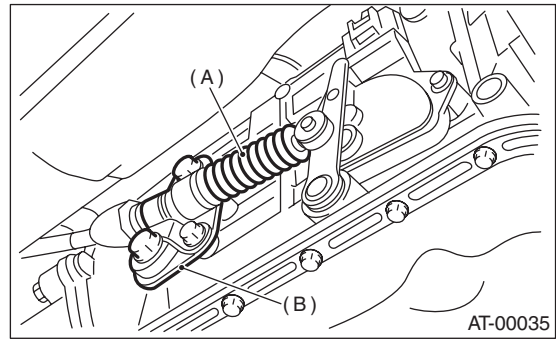
(A) Inhibitor switch connector

- 5) Remove the inhibitor switch connector from the stay.
- 6) Lift up the vehicle.
- 7) Remove the front and center exhaust pipes.  
<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 8) Remove the snap pin and washer from the range select lever.



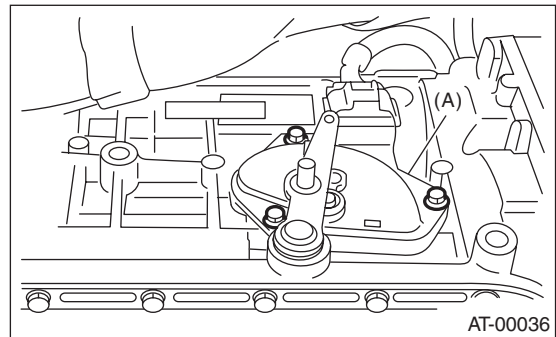
- (A) Range select lever
- (B) Snap pin
- (C) Select cable
- (D) Washer

- 9) Remove the plate assembly from the transmission case.



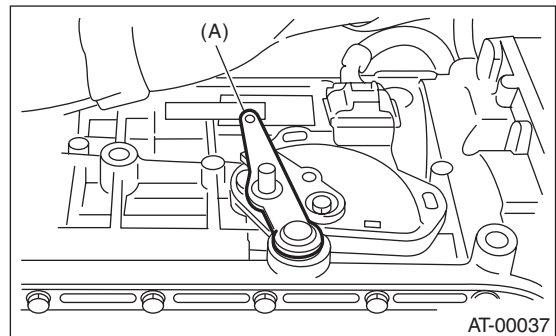
- (A) Select cable
- (B) Plate ASSY

- 10) Remove the three inhibitor switch securing bolts.



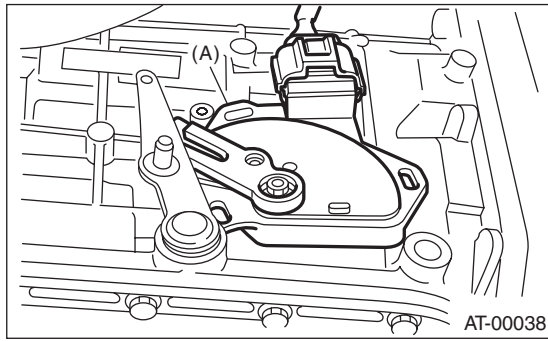
(A) Inhibitor switch

- 11) Move the range select lever to the parking position (left side).



(A) Range select lever

- 12) Remove the inhibitor switch from the transmission.

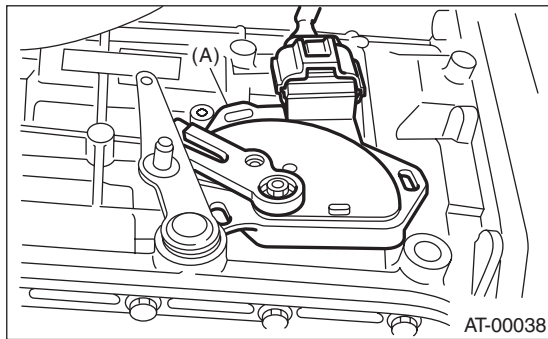


(A) Inhibitor switch

- 13) Disconnect the inhibitor switch harness connector from the inhibitor switch.

## D: INSTALLATION

- 1) Connect the inhibitor switch harness connector to the inhibitor switch.
- 2) Install the inhibitor switch to the transmission case.



(A) Inhibitor switch

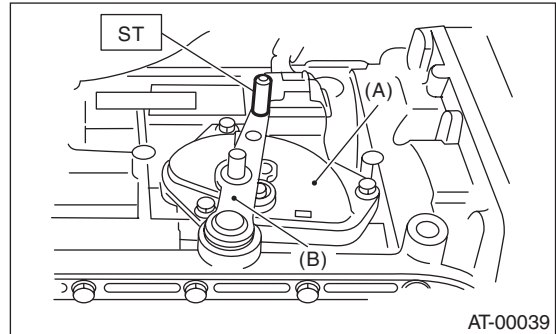
- 3) Move the range select lever to the neutral position.

- 4) Tighten the three inhibitor switch securing bolts using the ST.

ST 499267300 STOPPER PIN

**Tightening torque:**

**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**



(A) Inhibitor switch

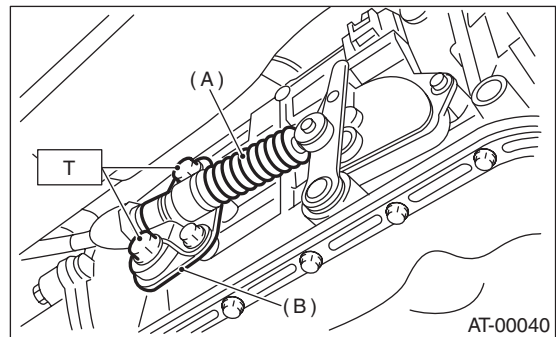
(B) Range select lever

- 5) Install the select cable to the range select lever.

- 6) Install the plate assembly to the transmission.

**Tightening torque:**

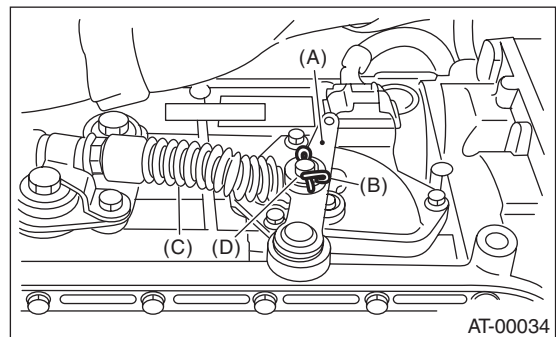
**T: 25 N·m (2.5 kgf-m, 18.4 ft-lb)**



(A) Select cable

(B) Plate ASSY

- 7) Install the washer and snap pin to the range select lever.



(A) Range select lever

(B) Snap pin

(C) Select cable

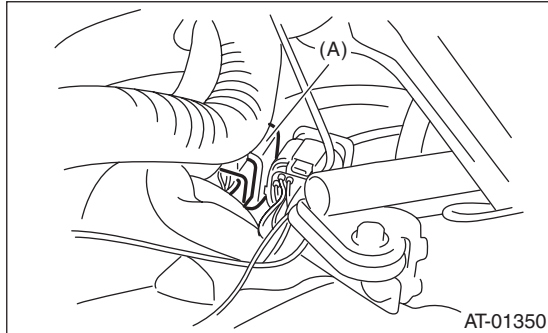
(D) Washer

## Inhibitor Switch

### AUTOMATIC TRANSMISSION

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- 8) Install the front and center exhaust pipe.  
<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>
- 9) Lower the vehicle.
- 10) Install the inhibitor switch connector to the stay.
- 11) Connect the inhibitor switch connector.



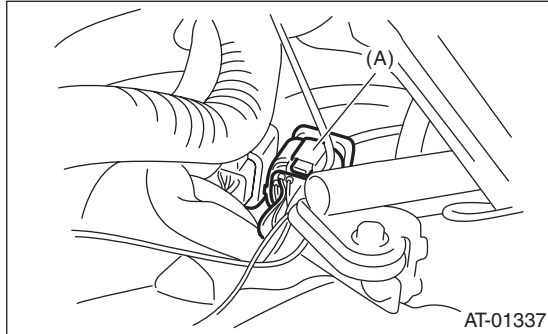
(A) Inhibitor switch connector

- 12) Install the air intake chamber.  
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
- 13) Inspect the inhibitor switch. <Ref. to 4AT-47, INSPECTION, Inhibitor Switch.>

## 14. Front Vehicle Speed Sensor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 4) Disconnect the transmission harness connector.



(A) Transmission harness connectors

- 5) Remove the pitching stopper. <Ref. to 4AT-43, REMOVAL, Transmission Mounting System.>
- 6) Remove the transmission harness connector from stay.
- 7) Lift up the vehicle.
- 8) Clean the transmission exterior.
- 9) Remove the drain plug (ATF) to drain the ATF.

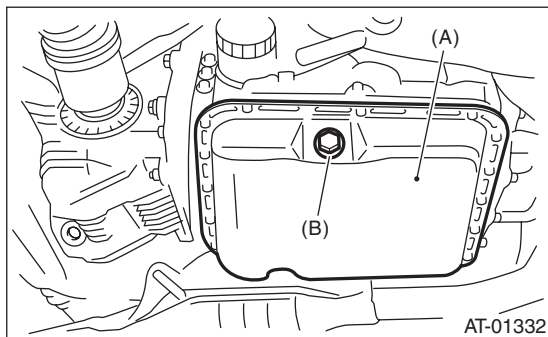
#### CAUTION:

**After running the engine or after idling for a long time, the ATF is hot. Be careful not to burn yourself.**

- 10) Perform replacement with a new gasket, and tighten the drain plug (ATF).

#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft-lb)**



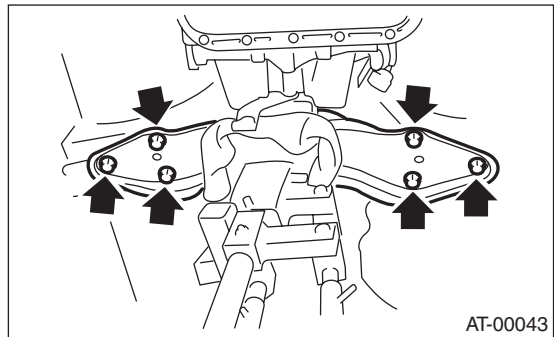
(A) Oil pan  
(B) Drain plug (ATF)

- 11) Remove the front, center and rear exhaust pipes and the muffler. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
- 12) Remove the heat shield cover.
- 13) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 14) Place the transmission jack under the transmission.

#### NOTE:

Make sure that the support plate of transmission jack does not touch the cross.

- 15) Remove the transmission rear crossmember bolt.



- 16) Lower the transmission jack.

#### NOTE:

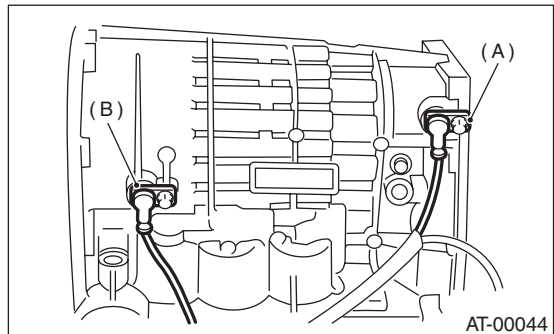
Do not separate the transmission jack and transmission.

- 17) Remove the ATF inlet and outlet pipes.

#### CAUTION:

**When removing the outlet pipe, be careful not to lose the ball and spring used together with the retaining screw.**

- 18) Remove the front vehicle speed sensor and torque converter turbine speed sensor.



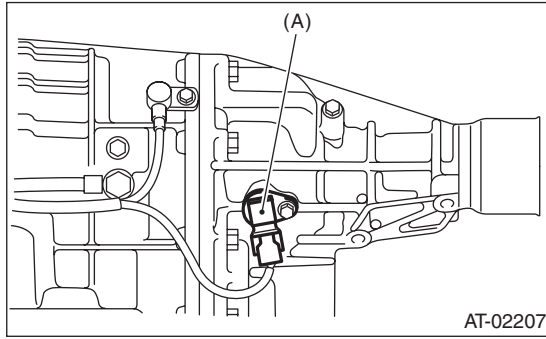
(A) Front vehicle speed sensor  
(B) Torque converter turbine speed sensor



# Front Vehicle Speed Sensor

## AUTOMATIC TRANSMISSION

19) Disconnect the connector from the rear vehicle speed sensor.



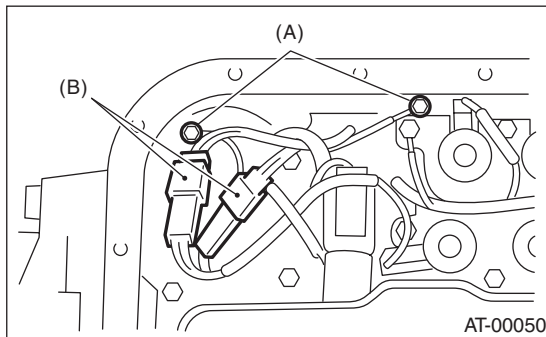
(A) Rear vehicle speed sensor

20) Remove the oil pan.

### CAUTION:

**Be careful not to allow foreign matter such as dust or dirt to enter the oil pan.**

21) Disconnect the control valve connector and transmission ground terminal.



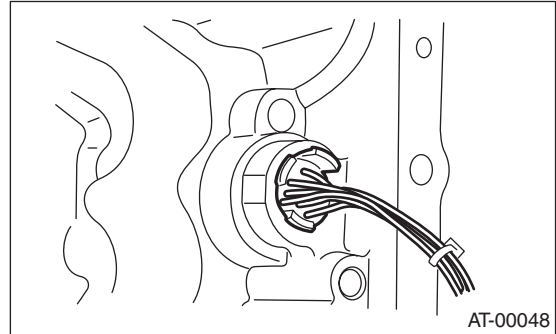
(A) Transmission ground

(B) Control valve connector

22) Remove the transmission harness assembly.

## B: INSTALLATION

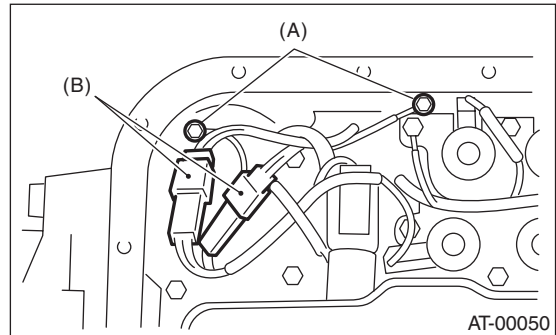
1) Pass the transmission harness assembly through the hole of the transmission case.



2) Connect the control valve connector and transmission ground.

### Tightening torque:

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**



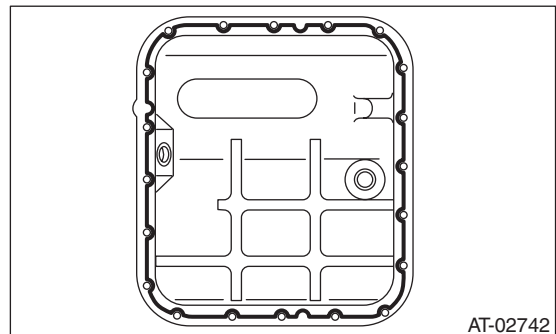
(A) Transmission ground

(B) Control valve connector

3) Apply proper amount of liquid gasket to the entire oil pan mating surface.

### Liquid gasket:

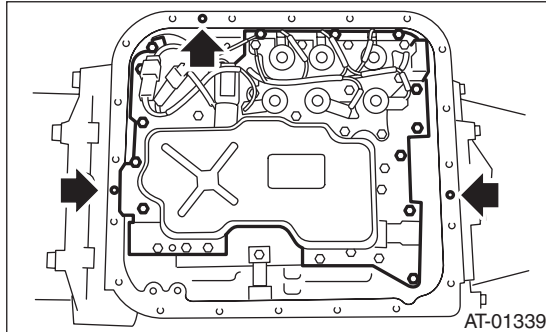
**THREE BOND 1217B (Part No. K0877YA020) or equivalent**



4) Fill the 3 locations of the transmission case excluding the bolt holes with liquid gasket.

**Liquid gasket:**

**THREE BOND 1217B (Part No. K0877YA020) or equivalent**



5) Install the oil pan by equally tightening the bolts.

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.6 ft-lb)**

6) Install the front vehicle speed sensor and torque converter turbine speed sensor.

**Tightening torque:**

**7 N·m (0.7 kgf-m, 5.1 ft-lb)**

7) Connect the connector to the rear vehicle speed sensor.

8) Install the ATF inlet and outlet pipes.

**NOTE:**

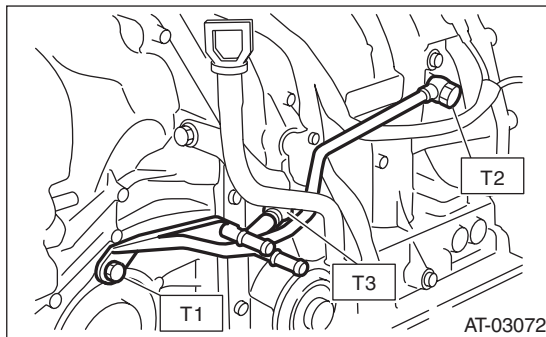
Use a new copper washer.

**Tightening torque:**

**T1: 25 N·m (2.5 kgf-m, 18.4 ft-lb)**

**T2: 40 N·m (4.1 kgf-m, 29.5 ft-lb)**

**T3: 45 N·m (4.6 kgf-m, 33.2 ft-lb)**



9) Install the transmission rear crossmember bolt.

**Tightening torque:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**

10) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

11) Install the heat shield cover.

12) Install the front, center and rear exhaust pipes, and the muffler.

<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

13) Lower the vehicle.

14) Install the transmission harness connector to the stay.

15) Install the pitching stopper. <Ref. to 4AT-43, INSTALLATION, Transmission Mounting System.>

16) Install the air intake chamber.

<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

17) Fill with the same amount of ATF as drained.

18) Bleed the air of control valve.

<Ref. to 4AT-61, Air Bleeding of Control Valve.>

19) Inspect the level of ATF. <Ref. to 4AT-28, Automatic Transmission Fluid.>

20) Execute the learning control promotion. <Ref. to 4AT(diag)-17, FACILITATION OF LEARNING CONTROL, OPERATION, Subaru Select Monitor.>

# Rear Vehicle Speed Sensor

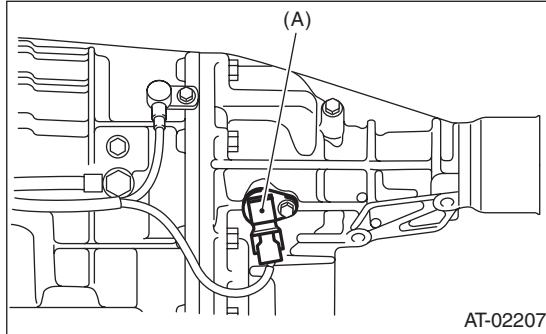
AUTOMATIC TRANSMISSION

## 15.Rear Vehicle Speed Sensor

### A: REMOVAL

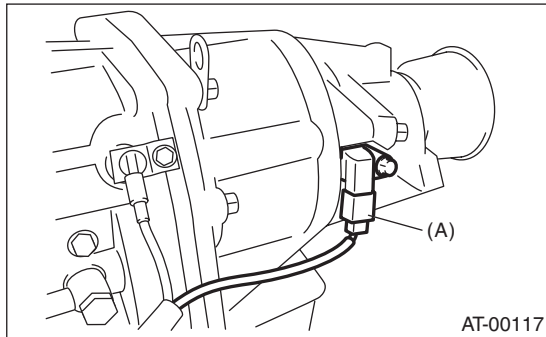
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Lift up the vehicle.
- 4) Disconnect the connector from the rear vehicle speed sensor.

- MP-T model



(A) Rear vehicle speed sensor

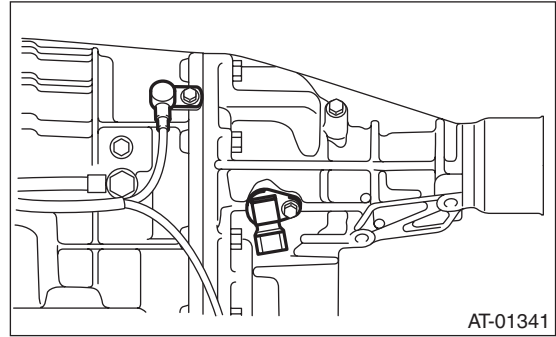
- VTD model



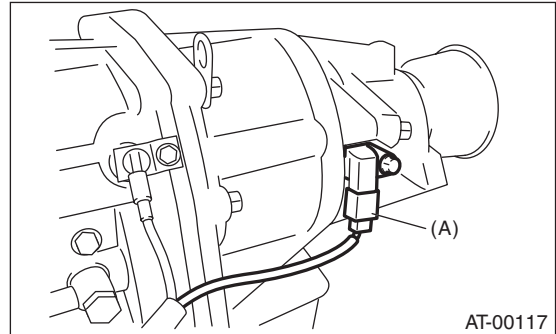
(A) Rear vehicle speed sensor

- 5) Remove the rear vehicle speed sensor.

- MP-T model



- VTD model



(A) Rear vehicle speed sensor

### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Replace the O-ring with a new part.

**Tightening torque:**

**7 N·m (0.7 kgf-m, 5.1 ft-lb)**

## 16. Torque Converter Turbine Speed Sensor

### A: REMOVAL

For removal procedure of the torque converter turbine speed sensor, refer to "Front Vehicle Speed Sensor". <Ref. to 4AT-51, REMOVAL, Front Vehicle Speed Sensor.>

### B: INSTALLATION

For installation procedure of the torque converter turbine speed sensor, refer to "Front Vehicle Speed Sensor". <Ref. to 4AT-52, INSTALLATION, Front Vehicle Speed Sensor.>

# Control Valve Strainer

AUTOMATIC TRANSMISSION

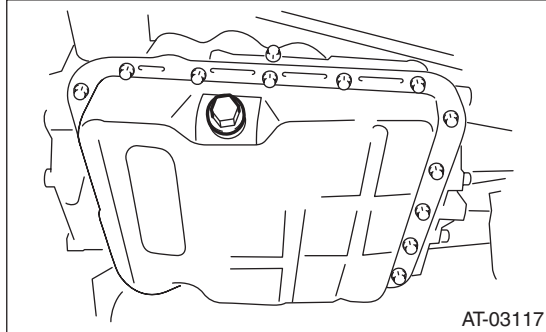
## 17. Control Valve Strainer

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Lift up the vehicle.
- 4) Clean the transmission exterior.
- 5) Remove the drain plug (ATF) to drain the ATF.

#### CAUTION:

The ATF will be extremely hot after driving. Be careful not to receive burns.



- 6) Perform replacement with a new gasket, and tighten the drain plug (ATF).

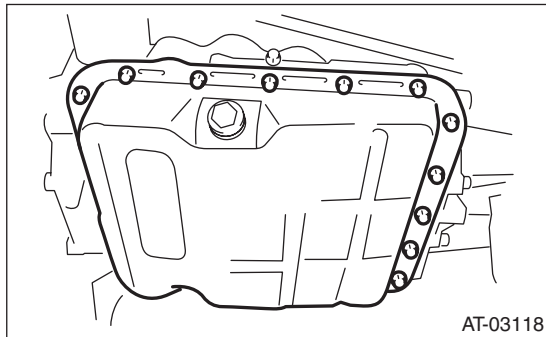
#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

- 7) Remove the oil pan.

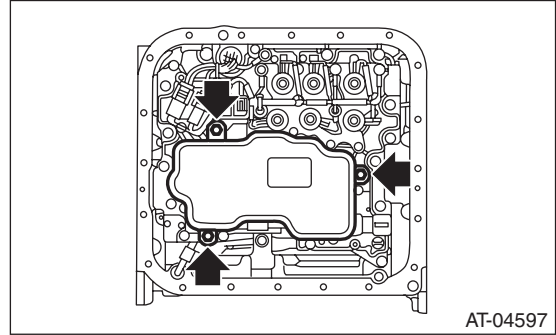
#### CAUTION:

Be careful not to allow foreign matter such as dust or dirt to enter the oil pan.



- 8) Remove the magnet.
- 9) Clean the magnet.
- 10) Completely remove the remaining liquid gasket on the transmission case and oil pan.

- 11) Remove the control valve strainer tightening bolt, and remove control valve strainer from the control valve body.



### B: INSTALLATION

- 1) Check the control valve body for dust and other foreign matter.
- 2) Mount new control valve strainer to the control valve body.

- (1) Apply ATF to the entire perimeter of the O-ring on the control valve strainer.

#### CAUTION:

Protect the O-ring from dust and dirt while applying ATF.

- (2) Install the control valve strainer to the control valve body from the O-ring side.

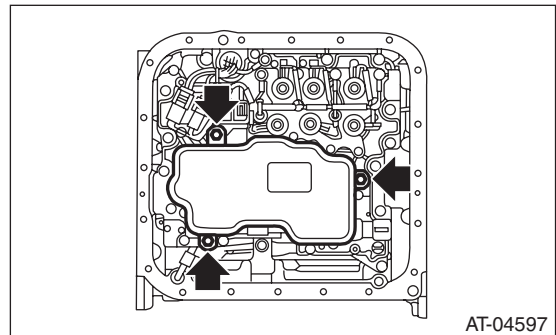
#### CAUTION:

If the control valve strainer is pushed in at an angle, the O-ring may be damaged. Be sure to push in the control valve strainer straight to install.

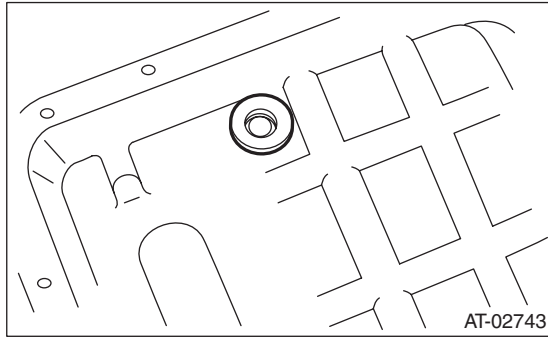
- (3) Tighten the three bolts.

#### Tightening torque:

**10 N·m (1.0 kgf·m, 7.4 ft·lb)**



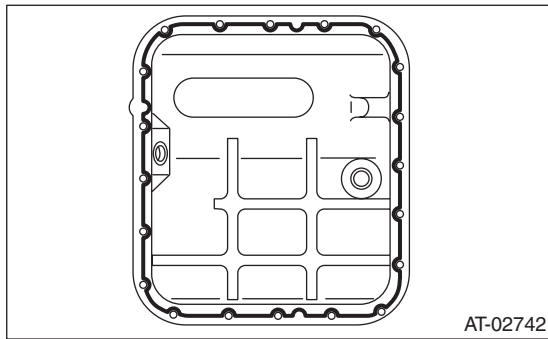
- 3) Attach the magnet at the specified position of the oil pan.



- 4) Apply proper amount of liquid gasket to the entire oil pan mating surface.

**Liquid gasket:**

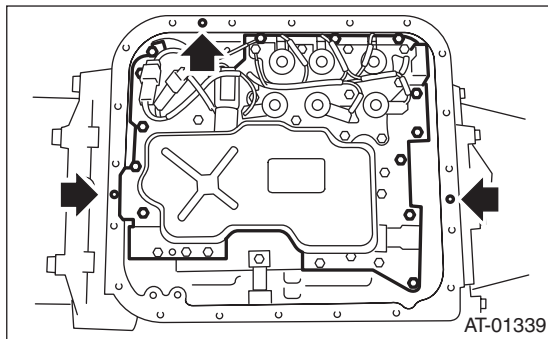
**THREE BOND 1217B (Part No. K0877YA020)  
or equivalent**



- 5) Fill the three holes aside from the bolt holes in the transmission case, with liquid gasket.

**Liquid gasket:**

**THREE BOND 1217B (Part No. K0877YA020)  
or equivalent**



- 6) Install the oil pan by equally tightening the bolts.

**Tightening torque:**

**5 N·m (0.5 kgf·m, 3.7 ft·lb)**

- 7) Fill ATF from the oil charge pipe.

**Recommended fluid:**

**<Ref. to 4AT-3, HYDRAULIC CONTROL AND LUBRICATION, SPECIFICATION, General Description.>**

**Capacity:**

**Fill with the same amount of ATF as drained.**

- 8) Bleed the air of control valve. <Ref. to 4AT-61, Air Bleeding of Control Valve.>

- 9) Check the ATF level. <Ref. to 4AT-28, Automatic Transmission Fluid.>

**C: INSPECTION**

Check the control valve strainer for holes, damages or adhesion of dust and other foreign particles.

# Control Valve Body

## AUTOMATIC TRANSMISSION

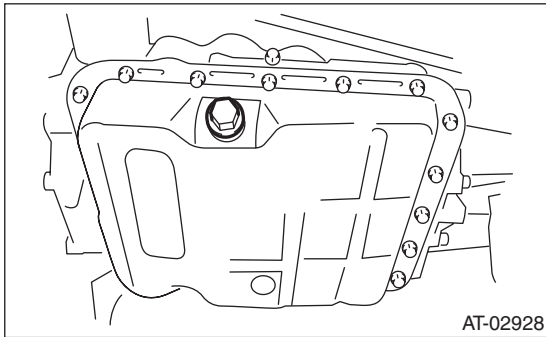
### 18. Control Valve Body

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Lift up the vehicle.
- 4) Clean the transmission exterior.
- 5) Remove the drain plug (ATF) to drain the ATF.

#### CAUTION:

After running the engine or after idling for a long time, the ATF is hot. Be careful not to burn yourself.



- 6) Perform replacement with a new gasket, and tighten the drain plug (ATF).

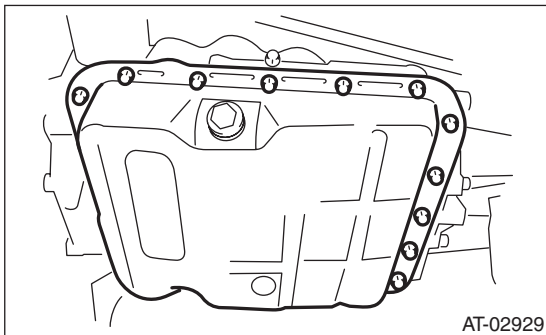
#### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

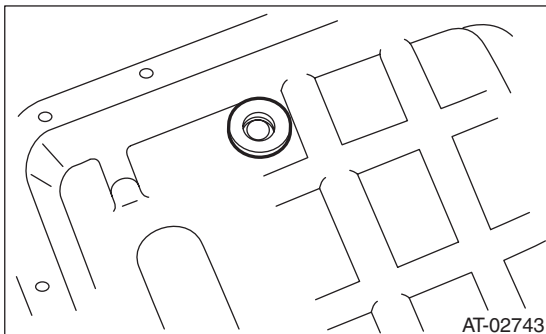
- 7) Remove the oil pan.

#### CAUTION:

Be careful not to allow foreign matter such as dust or dirt to enter the oil pan.



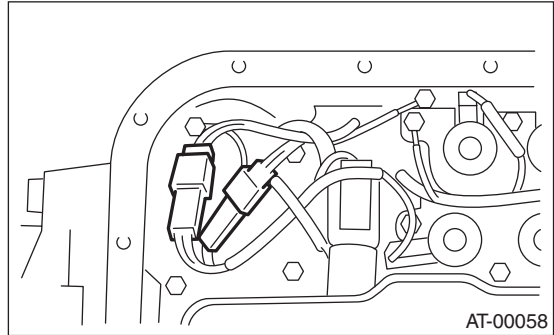
- 8) Remove the magnet.



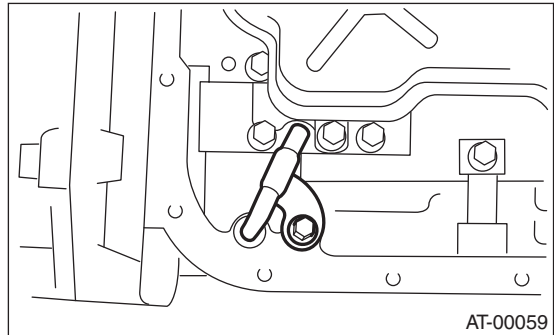
- 9) Clean the magnet.

- 10) Completely remove the remaining liquid gasket on the transmission case and oil pan.

- 11) Disconnect the control valve connector.



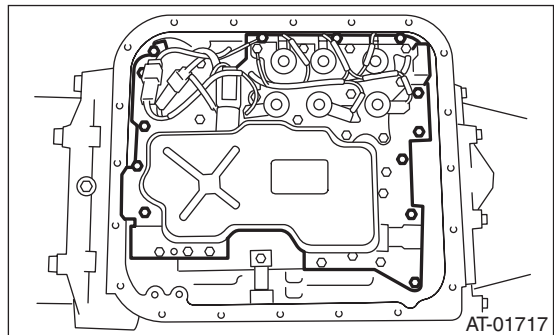
- 12) Remove the oil cooler pipe.



- 13) Remove the control valve body.

#### NOTE:

The control valve body is replaced as an assembly only, because it is a non-disassembly part.

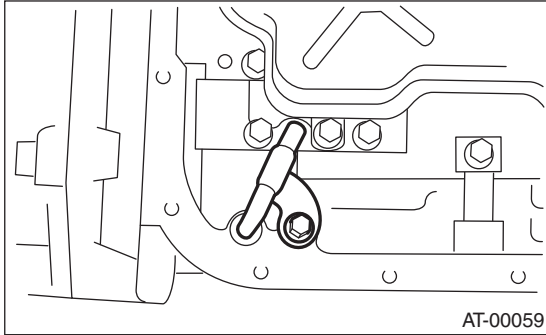


## B: INSTALLATION

- 1) Check the control valve body for dust and other foreign matter.
- 2) Temporarily install the control valve body and ground cable to the transmission, then install the oil cooler pipe.

**Tightening torque:**

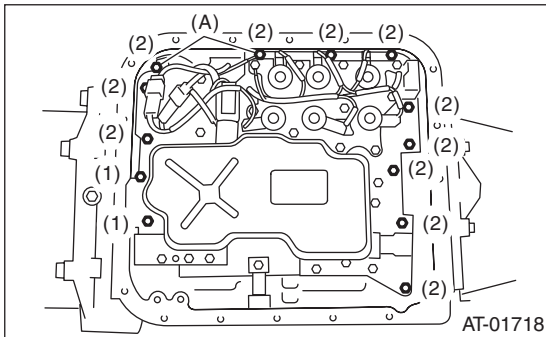
**8 N·m (0.8 kgf-m, 5.8 ft-lb)**



- 3) Tighten the bolts equally.

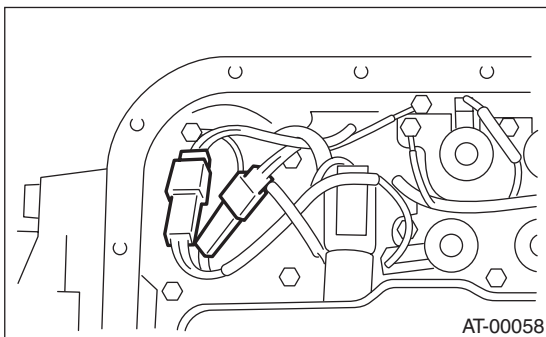
**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.8 ft-lb)**

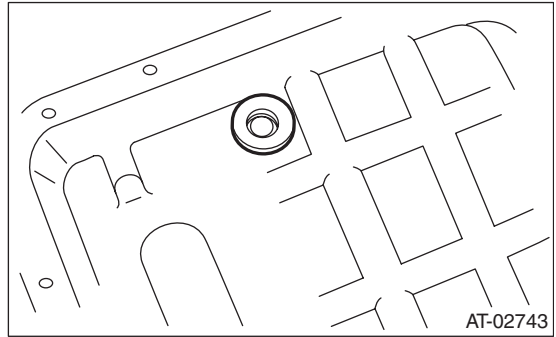


- (A) Transmission ground  
Bolt length mm (in)
- |     |           |
|-----|-----------|
| (1) | 35 (1.38) |
| (2) | 30 (1.18) |

- 4) Connect the control valve connector.



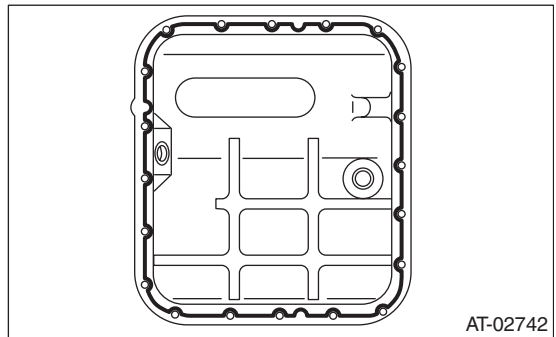
- 5) Attach the magnet at the specified position of the oil pan.



- 6) Apply proper amount of liquid gasket to the entire oil pan mating surface.

**Liquid gasket:**

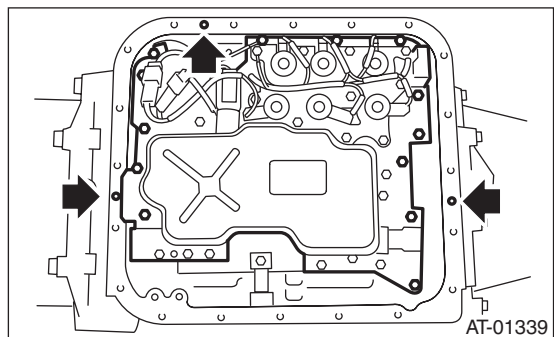
**THREE BOND 1217B (Part No. K0877YA020) or equivalent**



- 7) Fill the 3 holes aside from the bolt holes in the transmission case, with liquid gasket.

**Liquid gasket:**

**THREE BOND 1217B (Part No. K0877YA020) or equivalent**



- 8) Install the oil pan by equally tightening the bolts.

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.6 ft-lb)**



## Control Valve Body

### AUTOMATIC TRANSMISSION

---

9) Fill ATF from the oil charger pipe.

**Recommended fluid:**  
**SUBARU ATF HP**

**Substitute fluid:**  
**IDEMITSU "ATF HP", Castrol "Transmax J"**

**Capacity:**  
**Fill with the same amount of ATF as drained.**

10) Bleed the air of control valve body. <Ref. to 4AT-61, Air Bleeding of Control Valve.>

11) Check the ATF level.

<Ref. to 4AT-28, Automatic Transmission Fluid.>

12) Execute the learning control promotion. <Ref. to 4AT(diag)-17, FACILITATION OF LEARNING CONTROL, OPERATION, Subaru Select Monitor.>

### **C: INSPECTION**

Check parts for holes, damages or adhesion of dust and other foreign particles.

## 19. Air Bleeding of Control Valve

### A: GENERAL DESCRIPTION

- When ATF is drained from the automatic transmission, make sure to bleed air from the control valve after filling with the specified amount of ATF.
- Perform the procedures according to the message displayed on the Subaru Select Monitor.

### B: PROCEDURE

#### 1. PREPARATION FOR AIR BLEEDING

- 1) Cool down until the ATF temperature displayed on the Subaru Select Monitor reaches to 60°C (140° F) or lower.
- 2) Shift the select lever to “P” range.
- 3) Fully apply the parking brake.
- 4) Lift up the vehicle.

#### CAUTION:

**Be sure to keep the lowest edge of the tires 30 cm or more off the ground because the vehicle vibrates during the work.**

- 5) Connect the Subaru Select Monitor to the data link connector.
- 6) Turn the ignition switch to ON.
- 7) Turn OFF all switches, which produce an electrical load, including headlight, air conditioner, seat heater, rear defogger, etc.

#### 2. AIR BLEEDING

#### CAUTION:

**Do not turn the power of the Subaru Select Monitor to OFF or disconnect the data link connector during the operation.**

- 1) Select {Learning and inspection mode related to AT} on the «Transmission Diagnosis» display screen of Subaru Select Monitor.
- 2) Select {AT air bleeding mode} on the «Learning and inspection mode related to AT» display screen of Subaru Select Monitor.
- 3) Perform the procedures according to the message displayed on the Subaru Select Monitor.

#### NOTE:

During air bleeding in progress, SPORT indicator light in the combination meter starts flashing at a cycle of 2 Hz and air bleeding starts. The following message is displayed on the screen when the indicator light turns off.

## Air Bleeding of Control Valve

### AUTOMATIC TRANSMISSION

---

4) When “AT air bleeding normally ended.” is displayed, air bleeding is completed.

#### NOTE:

- If communication error occurs during air bleeding, retry AT air bleeding from the beginning.
- If “Execute AT learning again after fixing troubles of the vehicle” is displayed during air bleeding, select [OK] to display the “List of Diagnostics Trouble Code”. Retry AT air bleeding from the beginning after repairing the DTC detecting portion.
- If “AT air bleeding ended abnormally.” is displayed, retry AT air bleeding from the beginning.

Message	Primary cause of abnormal end
“AT air bleeding ended abnormally.”	<ul style="list-style-type: none"><li>• Fault is detected during AT air bleeding.</li><li>• The accelerator pedal is depressed during AT air bleeding.</li><li>• Operation which is not directed is performed during AT air bleeding.</li><li>• The brake pedal is not depressed fully.</li><li>• The parking brake is not applied fully.</li><li>• Abnormal idle rise occurs. Other similar causes are probable.</li></ul>

- For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 20.ATF Filter

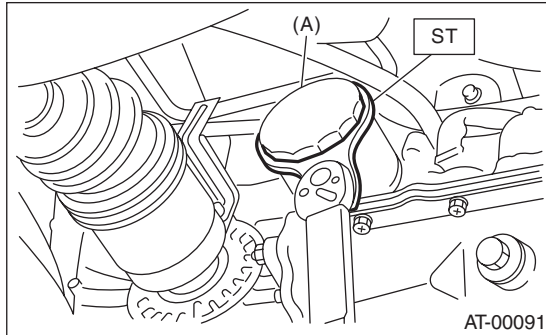
### A: REMOVAL

#### NOTE:

The ATF filter is maintenance free.

- 1) Lift up the vehicle.
- 2) Using the ST, remove the ATF filter.

ST 498545400 OIL FILTER WRENCH



(A) ATF filter

### B: INSTALLATION

- 1) Apply a thin coat of ATF to the oil seal part of new ATF filter.
  - 2) Install the ATF filter. Turn it by hand, being careful not to damage oil seal.
  - 3) Tighten the ATF filter using ST.
- Calculate the ATF filter tightening torque using following formula.

$$T2 = L2 / (L1 + L2) \times T1$$

T1: 14 N·m (1.4 kgf-m, 10.1 ft-lb)

[Required torque setting]

T2: Tightening torque

L1: ST length 78 mm (3.07 in)

L2: Torque wrench length

Example:

Torque wrench length mm (in)	Tightening torque N·m (kgf-m, ft-lb)
100 (3.94)	7.7 (0.79, 5.7)
150 (5.91)	9.0 (0.92, 6.7)
200 (7.87)	10 (1.0, 7.2)

#### NOTE:

Attach ST to the torque wrench as straight as possible.

ST 498545400 OIL FILTER WRENCH

- 4) Fill the ATF.
- 5) Inspect the level of ATF. <Ref. to 4AT-28, Automatic Transmission Fluid.>

### C: INSPECTION

Check for rusting, holes, ATF leaks or other damage.

# Transmission Control Module (TCM)

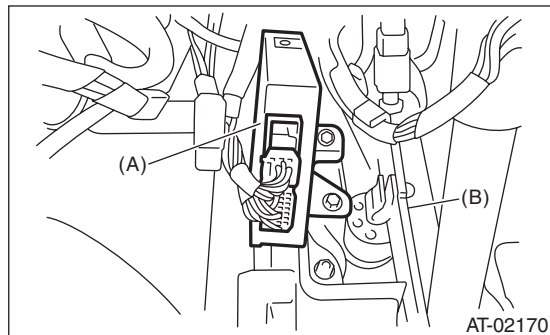
AUTOMATIC TRANSMISSION

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## 21. Transmission Control Module (TCM)

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the instrument panel lower cover and disconnect the connector.
- 3) Disconnect the connector from TCM.



- (A) Transmission control module (TCM)  
(B) Brake pedal

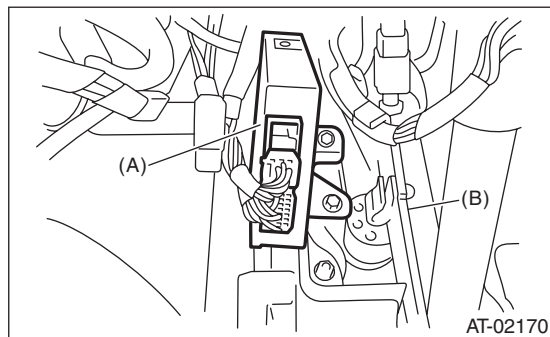
- 4) Remove the TCM.

### B: INSTALLATION

- 1) Install the TCM.

**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



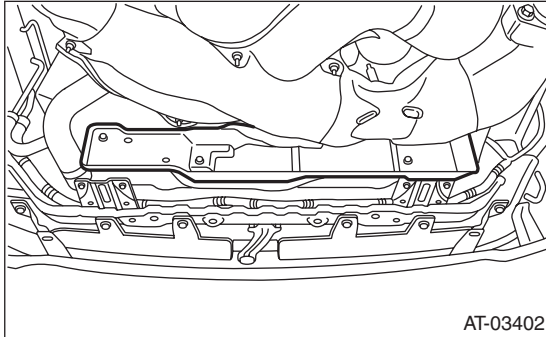
- (A) Transmission control module (TCM)  
(B) Brake pedal

- 2) Connect the connector to the TCM.
- 3) Install in the reverse order of removal.
- 4) Execute the learning control promotion. <Ref. to 4AT(diag)-17, FACILITATION OF LEARNING CONTROL, OPERATION, Subaru Select Monitor.>

## 22.ATF Cooler Pipe and Hose

### A: REMOVAL

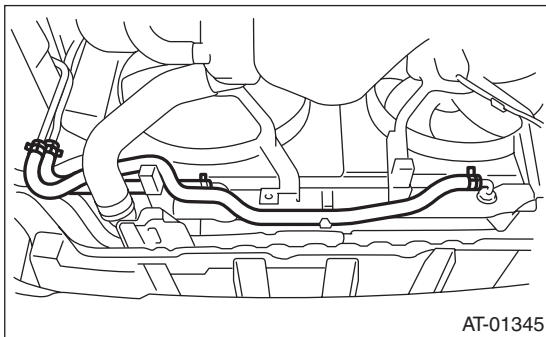
- 1) Set the vehicle on a lift.
- 2) Remove the battery.
- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the heat shield cover.



- 6) Disconnect the ATF cooler hose from the radiator.

**NOTE:**

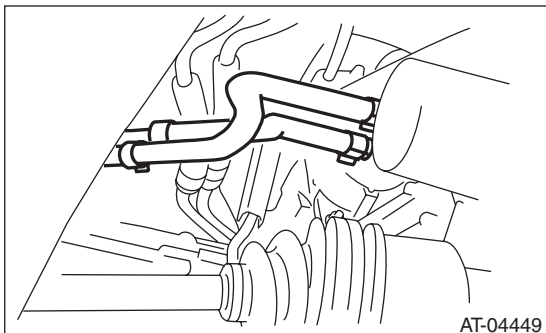
- Do not use a screwdriver or other pointed tools.
- If it is hard to remove the hose, wrap the hose with cloth to prevent from damaging it, and while turning with pliers, pull straight out by hand.



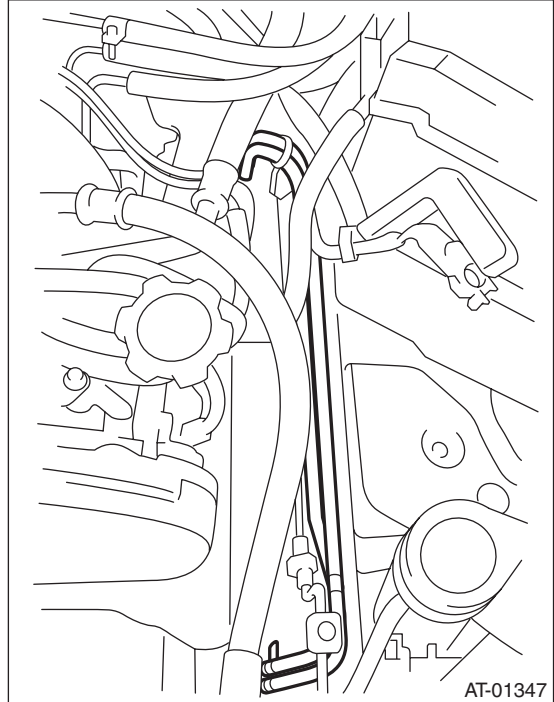
- 7) Disconnect the ATF cooler hoses from the pipes.

**NOTE:**

- Do not use a screwdriver or other pointed tools.
- If it is hard to remove the hose, wrap the hose with cloth to prevent from damaging it, and while turning with pliers, pull straight out by hand.



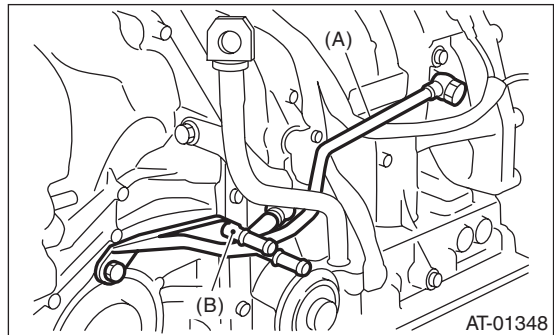
- 8) Disconnect the ATF cooler pipe from frame.



- 9) Remove the ATF inlet pipe and outlet pipe.

**CAUTION:**

**When disconnecting the outlet pipe, be careful not to lose the ball and spring used together with the retaining screw.**



- (A) ATF inlet pipe
- (B) ATF outlet pipe

# ATF Cooler Pipe and Hose

## AUTOMATIC TRANSMISSION

### B: INSTALLATION

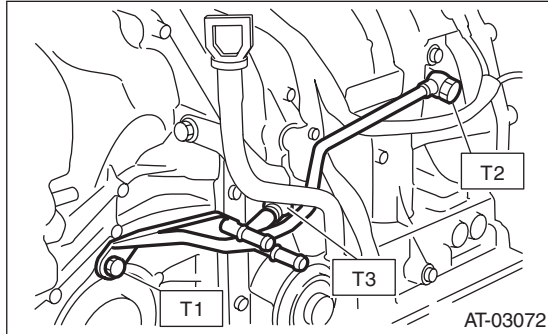
1) Install the ATF inlet pipe and outlet pipe along with new washers.

#### Tightening torque:

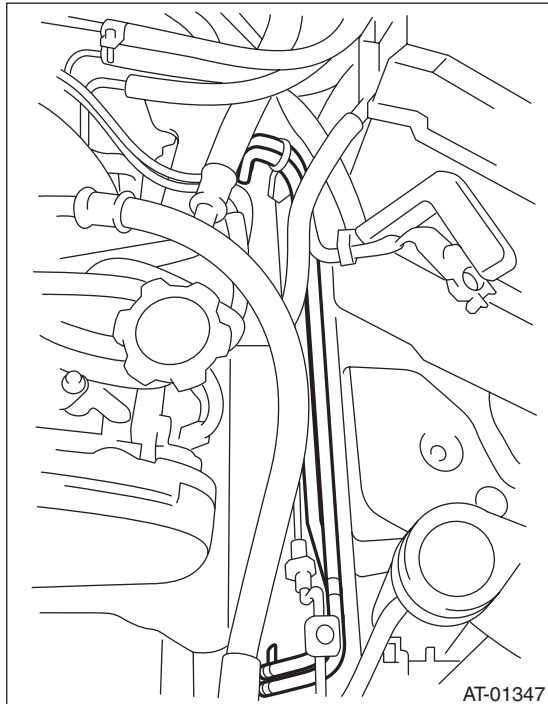
**T1: 25 N·m (2.5 kgf-m, 18.4 ft-lb)**

**T2: 40 N·m (4.1 kgf-m, 29.5 ft-lb)**

**T3: 45 N·m (4.6 kgf-m, 33.2 ft-lb)**



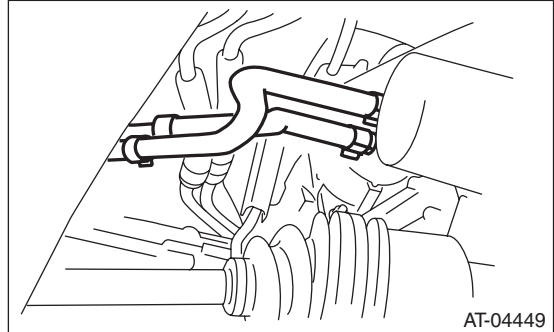
2) Install the ATF cooler pipe to frame.



3) Connect the ATF cooler hose to the pipe on the transmission side.

#### NOTE:

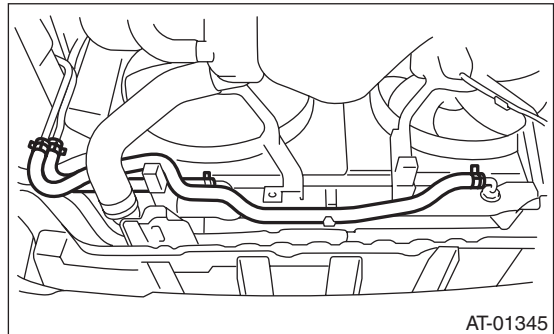
- Install so that the hose is not folded over, excessively bent or twisted.
- Insert the hose to the specified position.



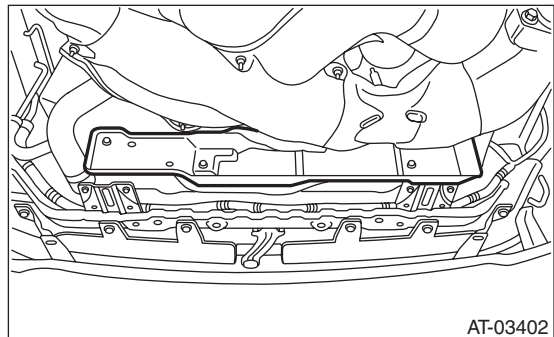
4) Connect the ATF cooler hose to the pipe on the radiator side.

#### NOTE:

- Install so that the hose is not folded over, excessively bent or twisted.
- Insert the hose to the specified position.



5) Install the heat shield cover.



6) Install the under cover.

7) Install the battery.

8) Fill the ATF. <Ref. to 4AT-28, Automatic Transmission Fluid.>

#### NOTE:

Make sure there are no ATF leaks in joints between the transmission, radiator, pipes, and hoses.

## **C: INSPECTION**

Repair or replace any faulty hoses, pipes, clamps, and washers found in the inspection below.

- 1) Check for ATF leaks in joints between the transmission, radiator, pipes, and hoses.
- 2) Check the clamp for deformation.
- 3) Lightly bend the hose and check for cracks in the surface or other damages.
- 4) Pinch the hose with your fingers and check for poor elasticity. Also check for poor elasticity in the parts where the clamp was installed by pressing with your fingernail.
- 5) Check for peeling, cracks, and deformation at the tip of the hose.



# Air Breather Hose

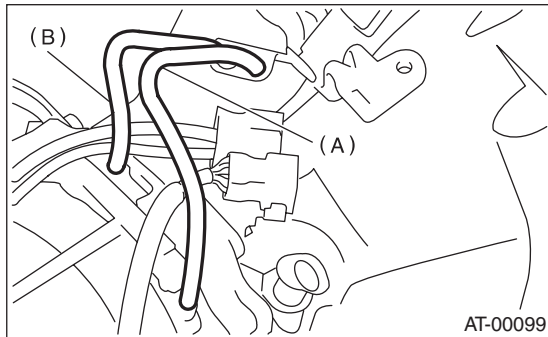
AUTOMATIC TRANSMISSION

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## 23. Air Breather Hose

### A: REMOVAL

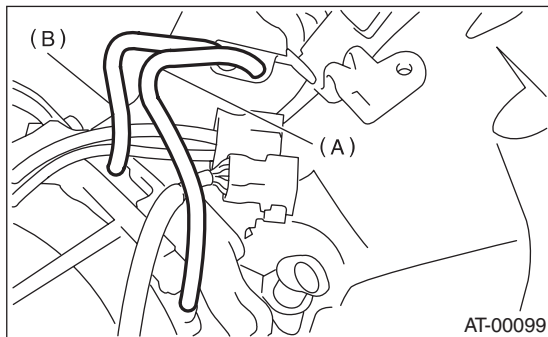
- 1) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 2) Disconnect the air breather hose.



- (A) Air breather hose (Transmission case)
- (B) Air breather hose (Oil pump housing)

### B: INSTALLATION

- 1) Install the air breather hose.



- (A) Air breather hose (Transmission case)
- (B) Air breather hose (Oil pump housing)

- 2) Install the air intake chamber.  
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

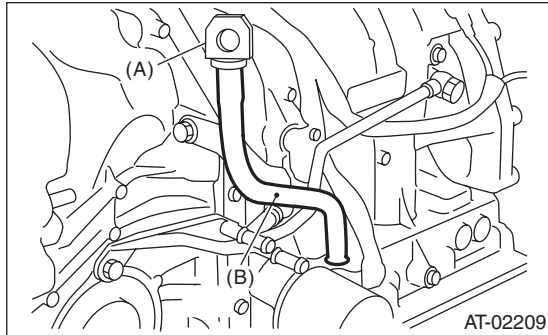
### C: INSPECTION

Make sure the hose is not cracked or clogged.

## 24.Oil Charge Pipe

### A: REMOVAL

- 1) Remove the air intake chamber.  
<Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 2) Remove the oil charge pipe, and then remove the O-ring from the flange side.



- (A) ATF level gauge
- (B) Oil charge pipe

### B: INSTALLATION

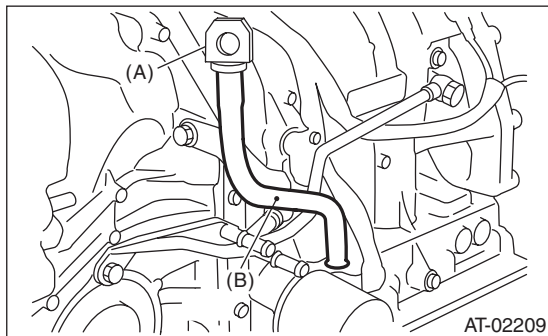
- 1) Apply ATF on a new O-ring and install together with the oil charge pipe.

**NOTE:**

Use a new bolt.

**Tightening torque:**

**38 N·m (3.9 kgf·m, 28.0 ft·lb)**



- (A) ATF level gauge
- (B) Oil charge pipe

- 2) Install the air intake chamber.  
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

### C: INSPECTION

Make sure the oil charge pipe is not deformed or damaged.

# Torque Converter Assembly

AUTOMATIC TRANSMISSION

## 25. Torque Converter Assembly

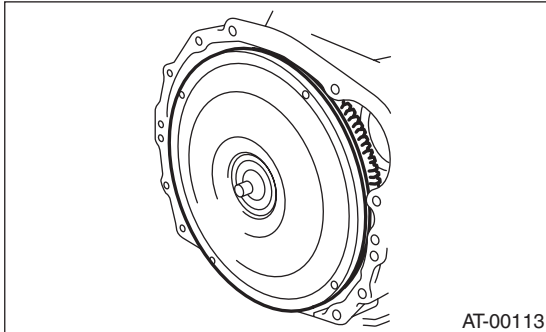
### A: REMOVAL

1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>

2) Pull out the torque converter assembly and oil pump shaft horizontally.

#### NOTE:

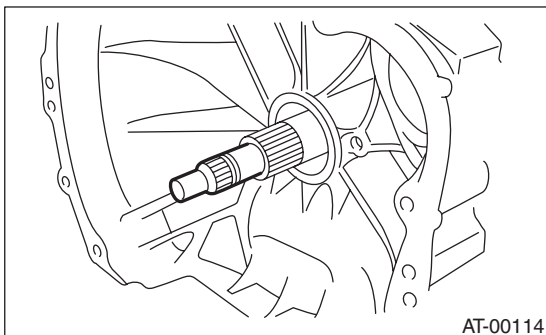
Be sure not to scratch the inside of bushing in oil pump shaft.



3) Remove the input shaft.

#### NOTE:

When the torque converter assembly is removed, the input shaft will also come off.



4) Remove the oil pump shaft from torque converter assembly as necessary.

### B: INSTALLATION

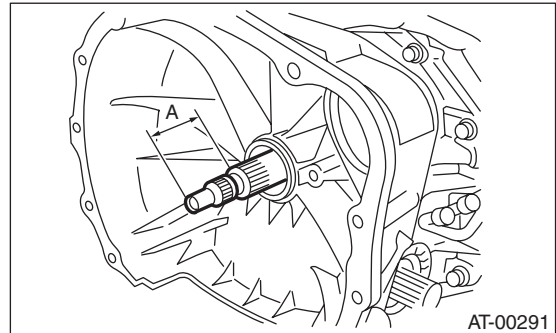
1) When the oil pump shaft is removed, install the shaft to converter case.

2) Install the oil pump shaft to the torque converter assembly, and make sure the clip is secured on the groove.

3) Apply ATF to the O-ring and insert on the input shaft while rotating the shaft slowly by hand.

#### Normal protrusion A:

**50 — 55 mm (1.97 — 2.17 in)**

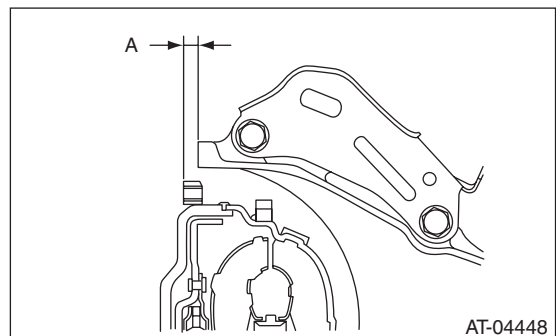


4) While holding the torque converter assembly by hand, carefully install it to the converter case. Take care not to damage the bushing. Do not allow the oil pump shaft bushing to touch the stator shaft section of the oil pump cover inappropriately.

5) Slowly rotate the shaft by hand to engage the splines securely, then check that dimension A is within the specified range.

#### Dimension A:

**2.7 — 2.9 mm (0.106 — 0.114 in)**



6) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: INSPECTION

Make sure the ring gear and protrusion of the torque converter assembly end are not deformed or damaged.

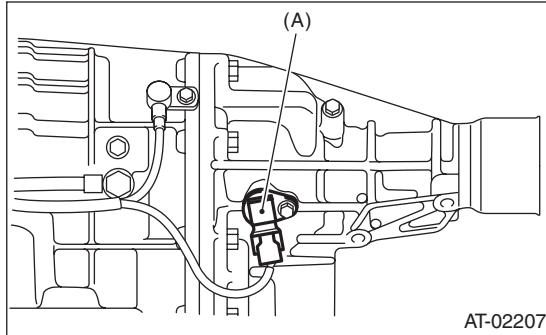
## 26.Extension Case

### A: REMOVAL

1) Remove the transmission assembly.  
 <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>

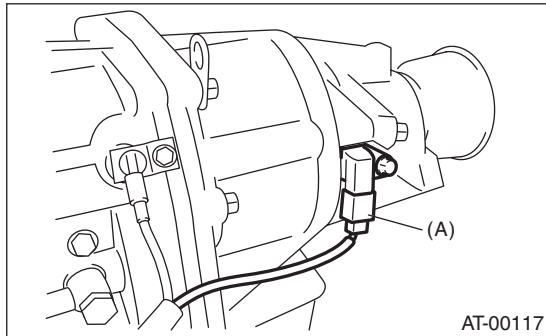
2) Remove the rear vehicle speed sensor.

- MP-T model



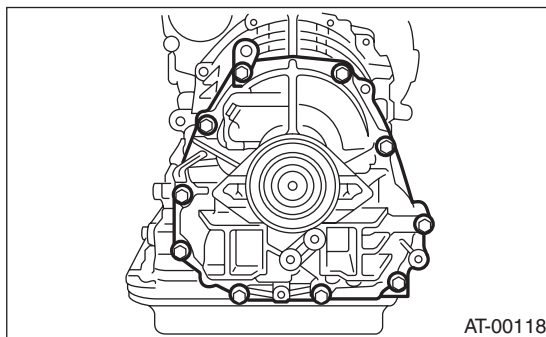
(A) Rear vehicle speed sensor

- VTD model



(A) Rear vehicle speed sensor

3) Separate the transmission case and extension case section.



### B: INSTALLATION

1) Apply vaseline to the contact surface, and attach the selected thrust needle bearing to the end surface of the reduction drive gear.

NOTE:

Install the thrust needle bearing in the correct direction.

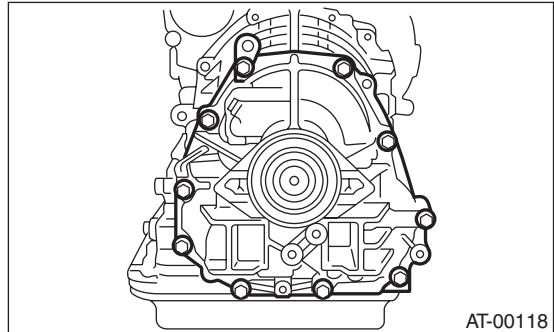
2) Install a new gasket.

3) Install the extension case to transmission case.

4) Tighten bolts to secure the extension case.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

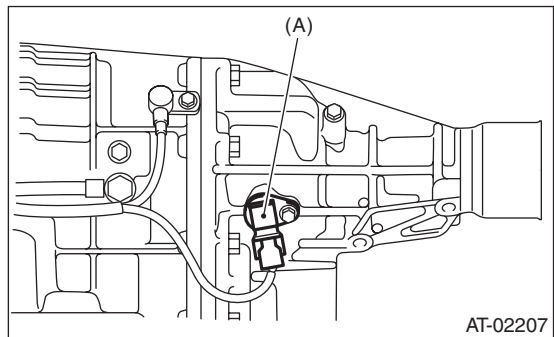


5) Install the rear vehicle speed sensor.

**Tightening torque:**

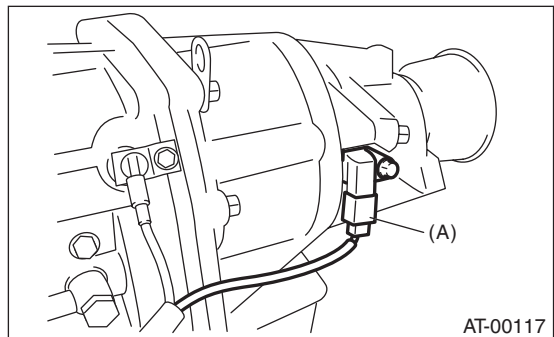
**7 N·m (0.7 kgf-m, 5.1 ft-lb)**

- MP-T model



(A) Rear vehicle speed sensor

- VTD model



(A) Rear vehicle speed sensor

6) Install the transmission assembly.

<Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

# Extension Case

## AUTOMATIC TRANSMISSION

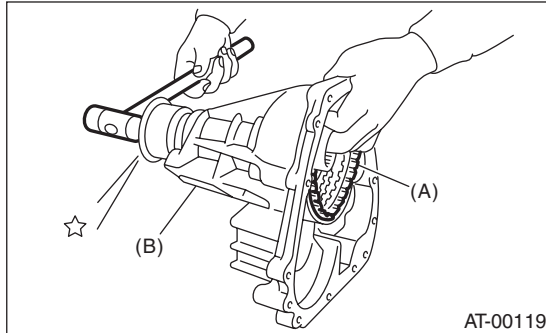
### C: DISASSEMBLY

#### 1. MP-T MODEL

1) Hit the edges of the rear drive shaft lightly with a plastic hammer, and take out the transfer clutch.

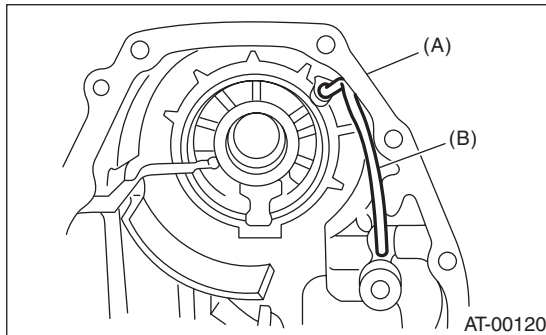
#### NOTE:

Be careful not to damage the oil seal of the extension case.



- (A) Extension case
- (B) Transfer clutch

2) Remove the transfer clutch pipe while being careful not to deform the pipe.



- (A) Extension case
- (B) Transfer clutch pipe

- 3) Remove the dust cover from extension case.
- 4) Remove the oil seal from the extension case.

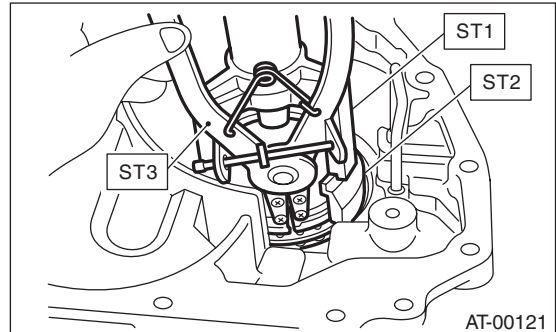
#### 2. VTD MODEL

1) Using ST1, ST2, ST3 and a press, remove the snap ring.

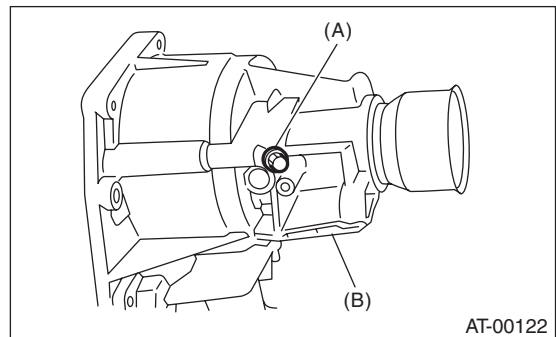
ST1 398673600 COMPRESSOR

ST2 498627100 SEAT

ST3 398663600 PLIER

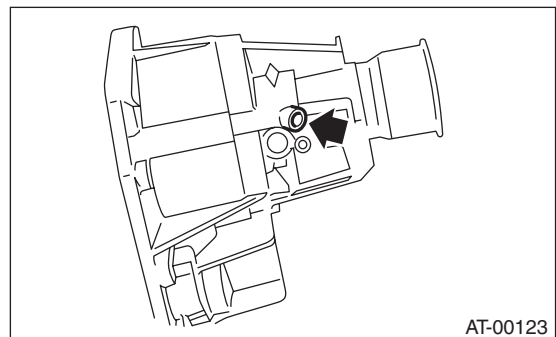


2) Remove the test plug.

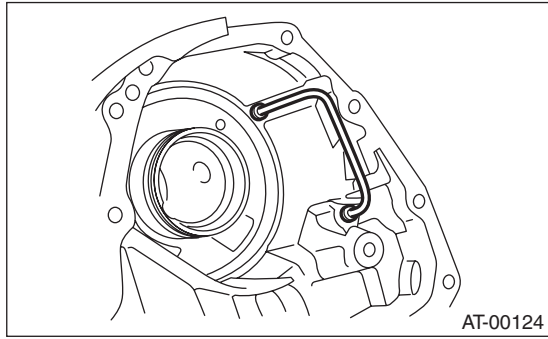


- (A) Extension case
- (B) Test plug

3) Send in compressed air, and remove the multi-plate clutch (LSD) piston.



- 4) Remove the multi-plate clutch pipe while being careful not to deform the pipe.

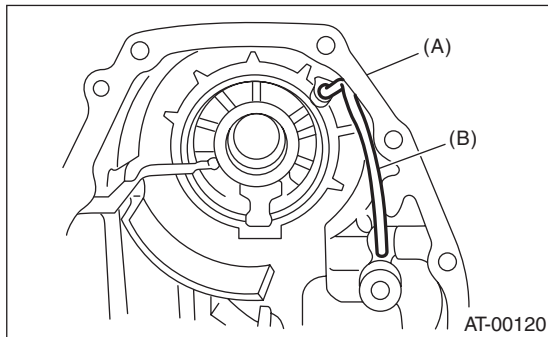


- 5) Remove the dust cover from extension case.
- 6) Remove the oil seal from the extension case.

## D: ASSEMBLY

### 1. MP-T MODEL

- 1) Press-fit the new oil seal using ST and the press. ST 498057300 INSTALLER
- 2) Press-fit the dust cover.
- 3) Install the transfer clutch pipe to the extension case while being careful not to deform the pipe.

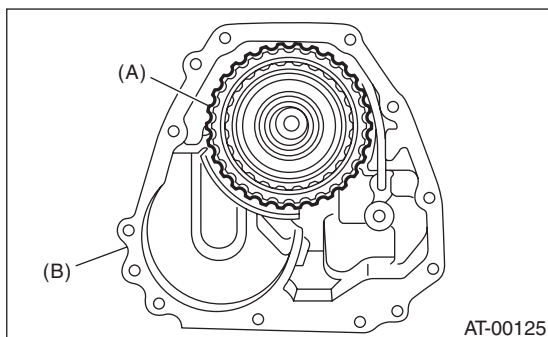


- (A) Extension case
- (B) Transfer pipe

- 4) Install the transfer clutch assembly to the case.

#### NOTE:

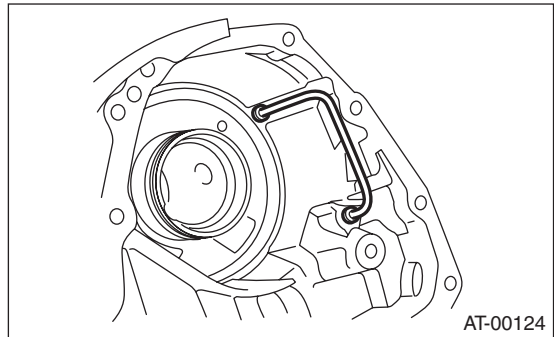
- Be careful not to damage the seal ring.
- Insert the transfer clutch assembly all the way to the bottom of the bearing shoulder.



- (A) Transfer clutch ASSY
- (B) Extension case

### 2. VTD MODEL

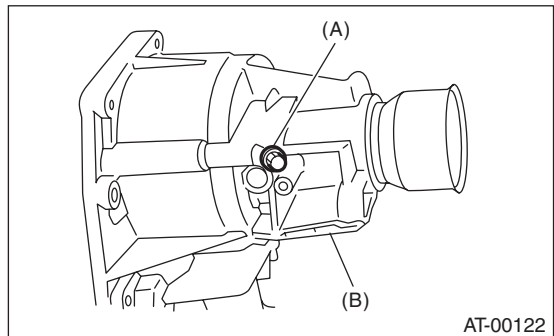
- 1) Press-fit the new oil seal using ST and the press. ST 498057300 INSTALLER
- 2) Press-fit the dust cover.
- 3) Install the multi-plate clutch (LSD) pipe to the extension case while being careful not to deform the pipe.



- 4) Apply ATF to a new O-ring and attach the test plug.

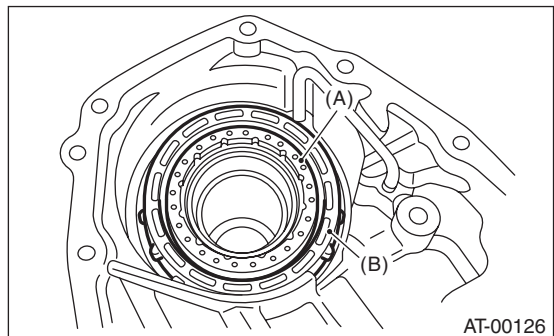
#### Tightening torque:

**13 N·m (1.3 kgf·m, 9.6 ft·lb)**



- (A) Test plug
- (B) Extension case

- 5) Insert the multi-plate clutch, drive plate, driven plate and spring retainer.



- (A) Spring retainer
- (B) Multi-plate clutch piston ASSY

## Extension Case

### AUTOMATIC TRANSMISSION

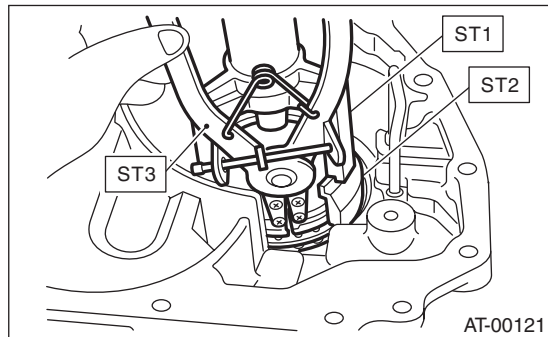
---

6) Using ST1, ST2 and ST3, attach the snap ring.

ST1 398673600 COMPRESSOR

ST2 498627100 SEAT

ST3 398663600 PLIER



### E: INSPECTION

- Blow with compressed air to make sure the transfer pipe and extension case routes are not clogged or leaking.
- Inspect the extension end play, and adjust it to within the standard value.

MP-T model:

<Ref. to 4AT-79, MP-T MODEL, ADJUSTMENT, Transfer Clutch.>

VTD model:

<Ref. to 4AT-79, VTD MODEL, ADJUSTMENT, Transfer Clutch.>

## 27. Transfer Clutch

### A: REMOVAL

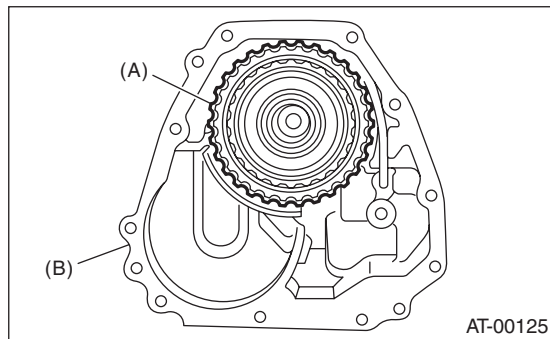
1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>

2) Remove the extension case, and then remove the transfer clutch. <Ref. to 4AT-71, REMOVAL, Extension Case.> <Ref. to 4AT-72, DISASSEMBLY, Extension Case.>

### B: INSTALLATION

1) Select the thrust needle bearing. <Ref. to 4AT-79, ADJUSTMENT, Transfer Clutch.>

2) Install the transfer clutch assembly to the case.

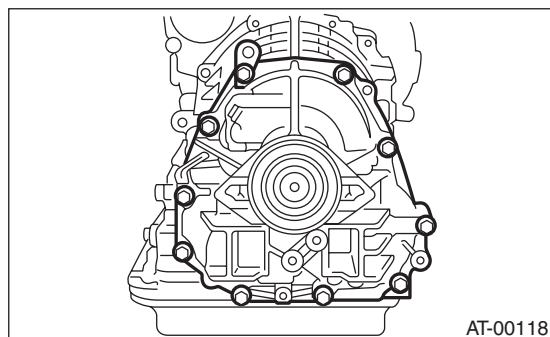


(A) Transfer clutch  
(B) Extension case

3) Tighten the bolts to secure the case.

#### **Tightening torque:**

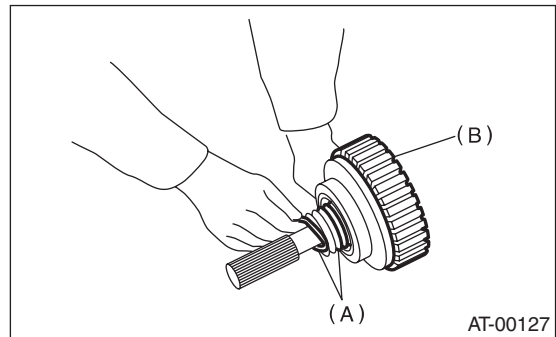
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



4) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

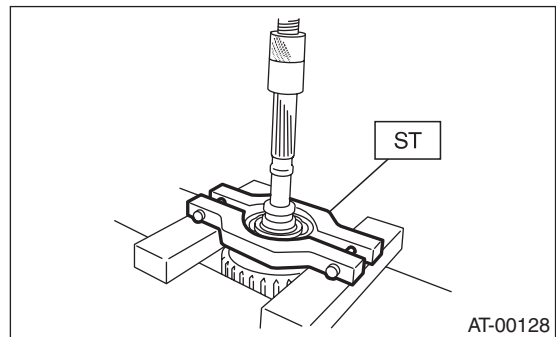
1) Remove the seal ring.



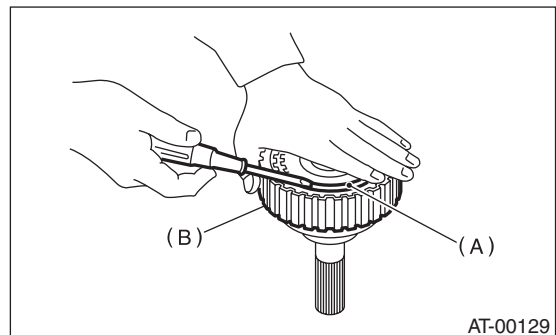
(A) Seal ring  
(B) Rear drive shaft

2) Remove the ball bearing using the ST and the press.

ST 498077600 REMOVER



3) Using a flat tip screwdriver, etc. remove the snap ring, and take out the pressure plate, retaining plate, drive plate and driven plate.



(A) Snap ring  
(B) Rear drive shaft

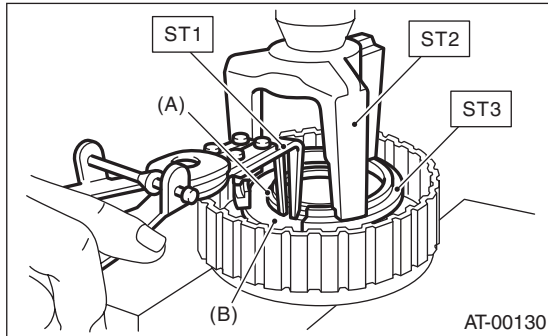


# Transfer Clutch

## AUTOMATIC TRANSMISSION

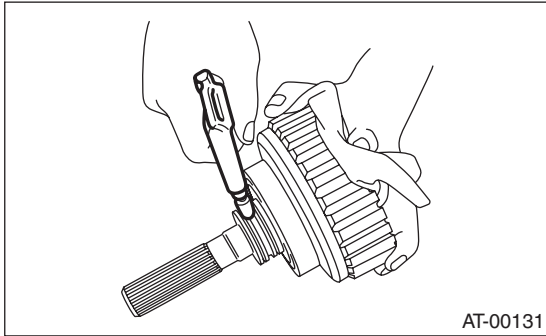
4) Using the ST1, ST2 and ST3, remove the snap ring, then take out the return spring and transfer clutch piston seal.

ST1 399893600 PLIERS  
ST2 398673600 COMPRESSOR  
ST3 398623600 SEAT



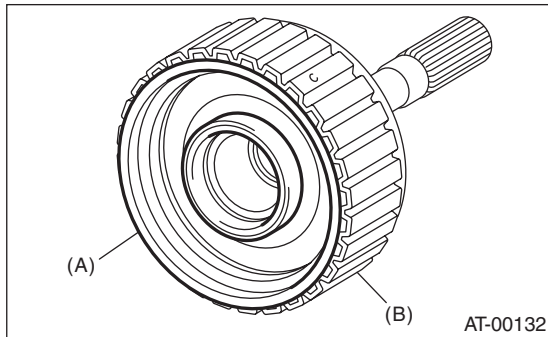
- (A) Snap ring
- (B) Transfer clutch piston seal

5) Apply compressed air to the rear drive shaft, to remove the transfer clutch piston.



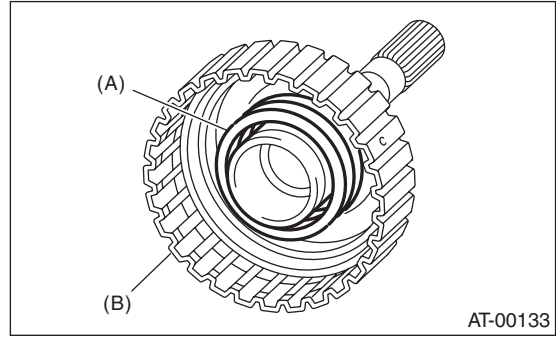
## D: ASSEMBLY

1) Install the transfer clutch piston.



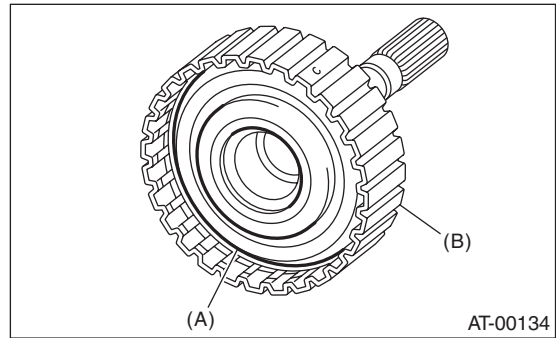
- (A) Transfer clutch piston
- (B) Rear drive shaft

2) Install the return spring to transfer clutch piston.



- (A) Return spring
- (B) Rear drive shaft

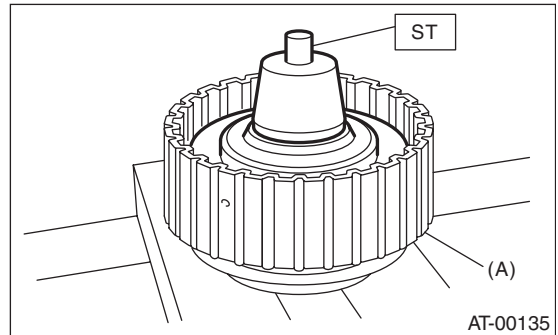
3) Apply ATF to the lip of transfer clutch piston seal, then install.



- (A) Transfer clutch piston seal
- (B) Rear drive shaft

4) Attach the ST to the rear drive shaft.

ST 499257300 SNAP RING OUTER GUIDE

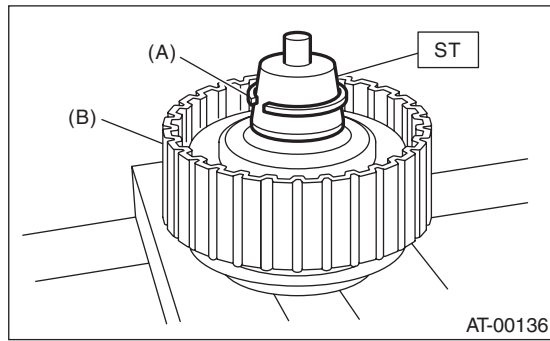


- (A) Rear drive shaft

# Transfer Clutch

AUTOMATIC TRANSMISSION

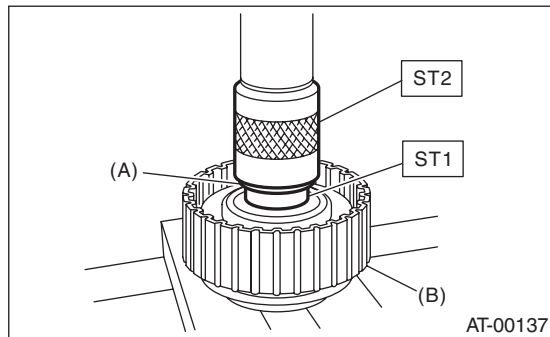
- 5) Install the snap ring to the ST.  
ST 499257300 SNAP RING OUTER GUIDE



- (A) Snap ring  
(B) Rear drive shaft

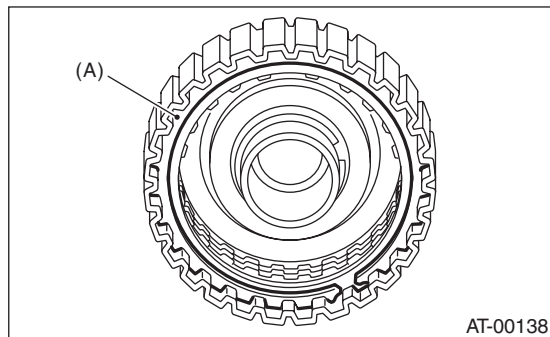
- 6) Install the snap ring to the rear drive shaft using ST1 and ST2.

ST1 499257300 SNAP RING OUTER GUIDE  
ST2 499247400 INSTALLER



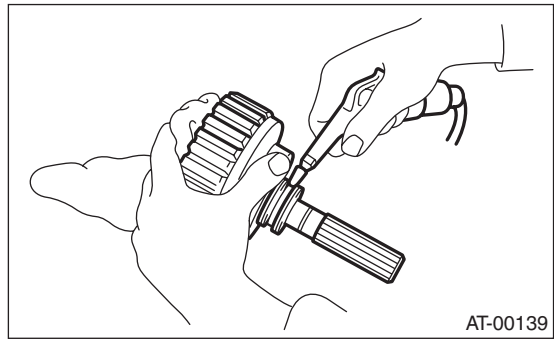
- (A) Snap ring  
(B) Rear drive shaft

- 7) Install the driven plate, drive plate, pressure plate, retaining plate and snap ring.



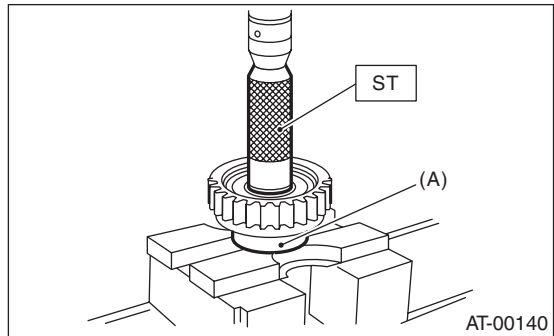
- (A) Snap ring

- 8) Apply compressed air to see if the assembled parts move smoothly.



- 9) Check clearance between the snap ring and pressure plate. <Ref. to 4AT-78, INSPECTION, Transfer Clutch.>

- 10) Press-fit new ball bearing using ST.  
ST 899580100 INSTALLER

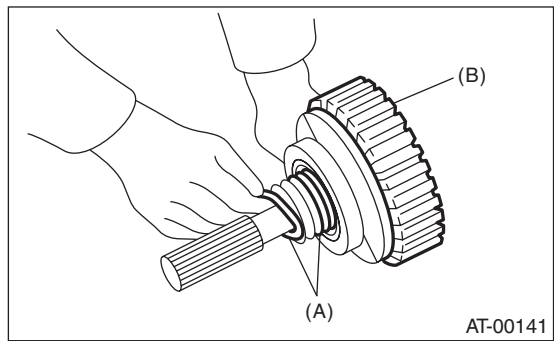


- (A) Ball bearing

- 11) Apply vaseline to a new seal ring and attach to the seal ring groove of the shaft.

## NOTE:

While installing the seal ring, not to stretch the seal ring excessively.

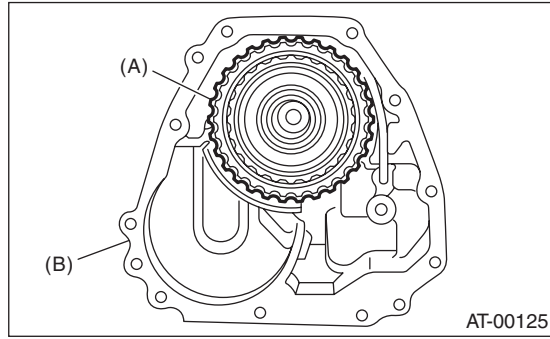


- (A) Seal ring  
(B) Rear drive shaft

# Transfer Clutch

## AUTOMATIC TRANSMISSION

12) Install the transfer clutch assembly while taking care not to damage the seal ring.



(A) Transfer clutch ASSY  
(B) Extension case

### E: INSPECTION

- Inspect the drive plate facing for wear and damage.
- Make sure the snap ring is not worn and the return spring has no permanent distortion, damage, or deformation.
- Inspect the D-ring for damage.
- Inspect the extension end play, and adjust it to within the standard value.

MP-T model:

<Ref. to 4AT-79, MP-T MODEL, ADJUSTMENT, Transfer Clutch.>

VTD model:

<Ref. to 4AT-79, VTD MODEL, ADJUSTMENT, Transfer Clutch.>

- 1) Check clearance between the snap ring and pressure plate.
- 2) Before measuring clearance, place same thickness shims on both sides to prevent the pressure plate from tilting.

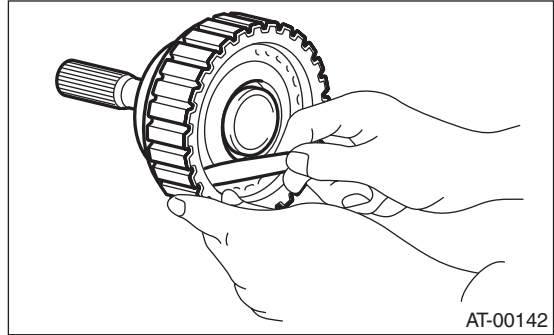
3) If the clearance exceeds the service limits, replace the plate set (drive plate and driven plate), and select and adjust a retaining plate to be within the initial standard value.

**Initial standard:**

**0.7 — 1.1 mm (0.028 — 0.043 in)**

**Limit thickness:**

**1.6 mm (0.063 in)**



Retaining plate	
Part number	Thickness mm (in)
31593AA151	3.3 (0.130)
31593AA161	3.7 (0.146)
31593AA171	4.1 (0.161)
31593AA181	4.5 (0.177)

4) Check for tight corner braking phenomenon when the vehicle is moved forward with the steering fully turned. If tight corner braking occurs, perform the following procedures.

(1) With the steering wheel held at fully turned position, drive the vehicle in "D" range and with vehicle speed at approx. 5 km/h (3 MPH) in both clockwise and counterclockwise directions for approx. ten times each, while repeating acceleration and braking intermittently.

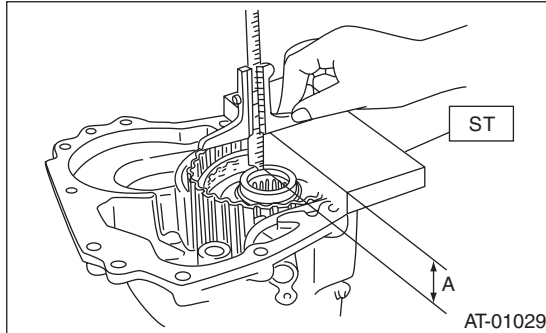
(2) If the tight corner braking phenomenon still persists, drive the vehicle again in a circle for several laps.

## F: ADJUSTMENT

### 1. MP-T MODEL

1) Measure the distance "A" from the end of ST to the rear drive shaft using the ST.

ST 398643600 GAUGE

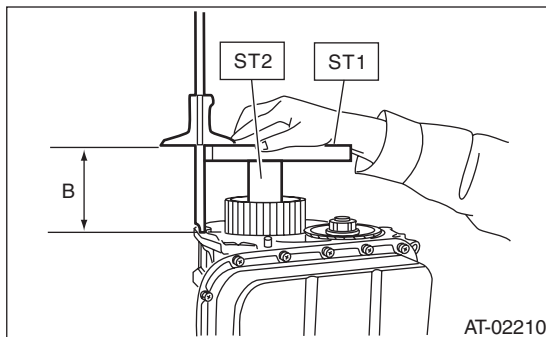


A Measured value

2) Measure distance "B" from the transmission case mating surface to the end of ST using ST1 and ST2.

ST1 398643600 GAUGE

ST2 499577000 GAUGE



B Measured value

3) Calculation formula:

$$T = A - B + 35.4 \text{ mm}$$

$$[T = A - B + 1.3937 \text{ in}]$$

T: Thrust needle bearing thickness

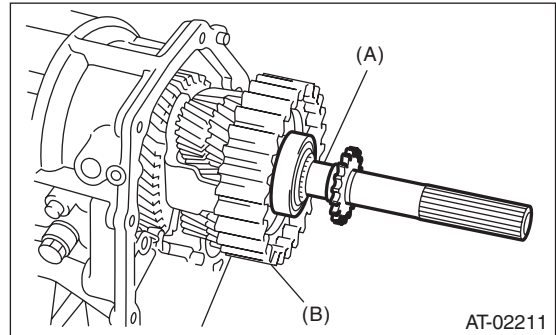
A: Distance from the end of the ST to end of rear drive shaft

B: Distance from the mating surface of the transmission case to the end of the ST

Thrust needle bearing	
Part number	Thickness mm (in)
806536020	3.8 (0.150)
806535030	4.0 (0.157)
806535040	4.2 (0.165)
806535050	4.4 (0.173)
806535060	4.6 (0.181)
806535070	4.8 (0.189)
806535090	5.0 (0.197)

### 2. VTD MODEL

1) Insert the rear drive shaft into the reduction drive gear and center differential assembly.

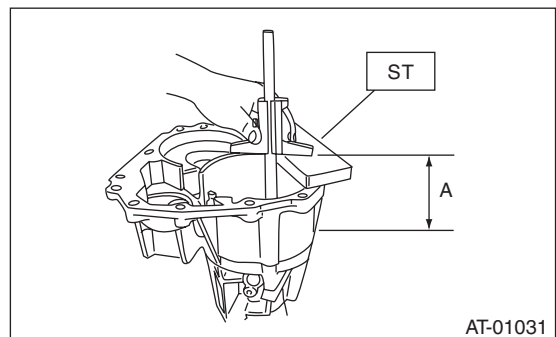


(A) Rear drive plate

(B) Center differential carrier

2) Using the ST, measure distance "A", from the mating surface of the extension case to the rear drive shaft ball bearing outer ring contact surface.

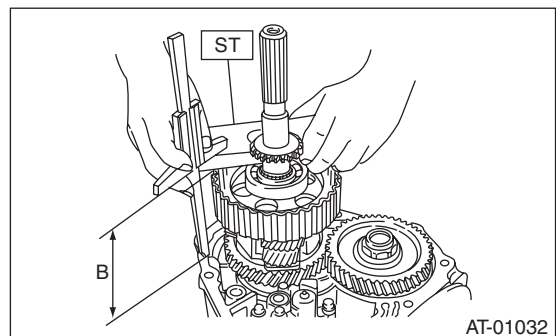
ST 398643600 GAUGE



A Measured value

3) Using the ST, measure distance "B", from the mating surface of the transmission case to the end face of the rear drive shaft ball bearing.

ST 398643600 GAUGE



B Measured value

# Transfer Clutch

## AUTOMATIC TRANSMISSION

---

### 4) Calculation formula:

When the clearance is 0.05 mm (0.0020 in), select up to 4 adjustment shims that will meet the clearance value on the table.

Calculation of "T":

When clearance is 0.05 mm (0.0020 in)

$$T = A - B + 0.40 \text{ mm}$$

$$[T = A - B + 0.0157 \text{ in}]$$

When clearance is 0.25 mm (0.0098 in)

$$T = A - B + 0.20 \text{ mm}$$

$$[T = A - B + 0.0079 \text{ in}]$$

T: Shim clearance

A: Distance from the end of the extension case to the end of rear drive shaft

B: Distance from the end of the transmission case to the end of the reduction drive gear

T: Shim thickness

0.05 — 0.25 mm (0.0020 — 0.0098 in)

Adjustment shim	
Part No.	Thickness mm (in)
33281AA001	0.2 (0.008)
33281AA011	0.5 (0.020)

## 28. Multi-plate Clutch

### A: REMOVAL

Remove the multi-plate clutch in the same manner as the extension case. <Ref. to 4AT-71, REMOVAL, Extension Case.>

### B: INSTALLATION

Install the multi-plate clutch in the same manner as the extension case. <Ref. to 4AT-71, INSTALLATION, Extension Case.>

### C: INSPECTION

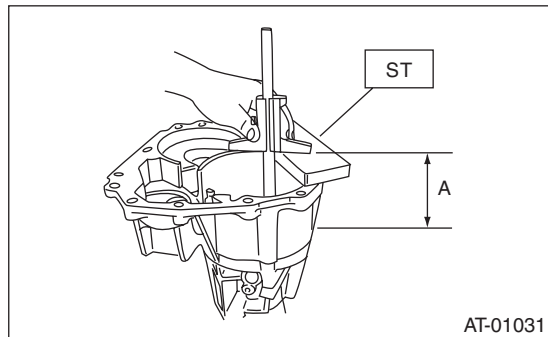
- Inspect the drive plate facing for wear and damage.
- Make sure the snap ring is not worn and the return spring has no permanent distortion, damage, or deformation.
- Inspect the D-ring for damage.
- Measure the clearance of the multi-plate clutch, and adjust so that it is within the specification range. <Ref. to 4AT-81, ADJUSTMENT, Multi-plate Clutch.>

### D: ADJUSTMENT

1) Remove the drive plate and driven plate from the center differential carrier.

2) Using the ST, measure distance “A”, from the mating surface of the extension case to the multi-plate clutch piston.

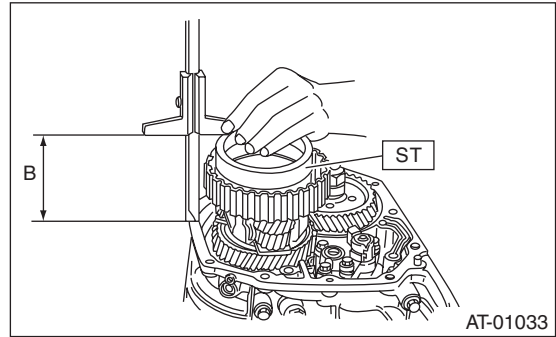
ST 398643600 GAUGE



A Measured value

3) Using the ST, measure height “B” from the transmission case mating surface to the end surface of the center differential clutch drum.

ST 398744300 PISTON GUIDE



B Measured value

4) Calculation formula:

$$T = A - B + 0.45 \text{ mm}$$

$$[T = A - B + 0.0177 \text{ in}]$$

**Initial standard:**

**0.2 — 0.6 mm (0.008 — 0.024 in)**

**Limit thickness:**

**1.6 mm (0.063 in)**

When the usage limit is exceeded, replace the plate set (drive and driven plate), select the retaining plate of the multi-plate clutch piston, and set so that it is within the standard.

Retaining plate	
Part No.	Thickness mm (in)
31589AA041	1.6 (0.063)
31589AA050	2.0 (0.079)
31589AA060	2.4 (0.094)
31589AA070	2.8 (0.110)

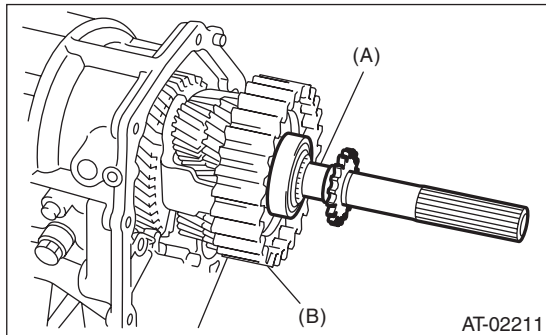
# Rear Drive Shaft

## AUTOMATIC TRANSMISSION

### 29. Rear Drive Shaft

#### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 3) Pull out the rear drive shaft from center differential assembly.



- (A) Rear drive shaft  
(B) Center differential carrier

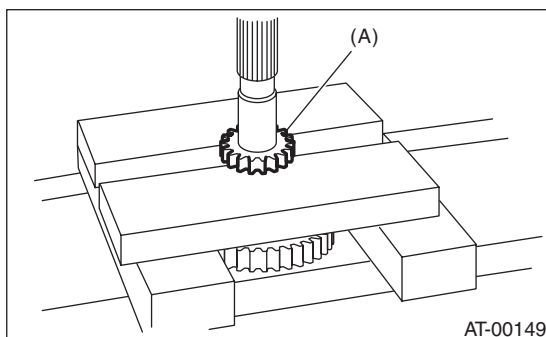
- 4) Remove the drive plate and driven plate.

#### B: INSTALLATION

- 1) Select shims. <Ref. to 4AT-79, VTD MODEL, ADJUSTMENT, Transfer Clutch.>
- 2) Install drive plate and driven plate.
- 3) Insert the rear drive shaft into the center differential assembly.
- 4) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 5) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

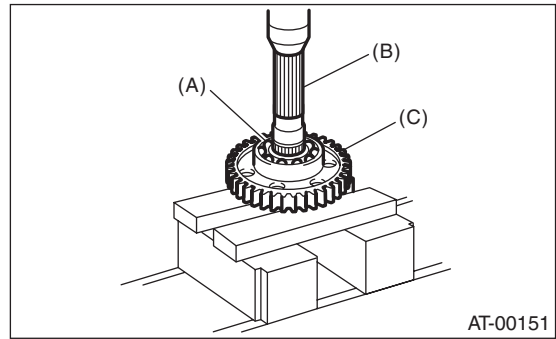
#### C: DISASSEMBLY

- 1) Using a press, remove the revolution gear.



- (A) Revolution gear

- 2) Using a press, remove the front and rear side ball bearings and the clutch hub.



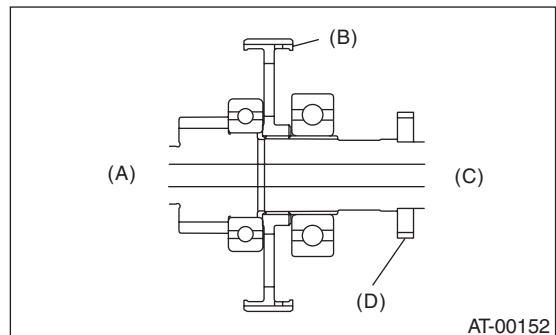
- (A) Rear ball bearing  
(B) Rear drive shaft  
(C) Clutch hub

#### D: ASSEMBLY

Assemble in the reverse order of disassembly.

#### NOTE:

- Use new rear ball bearings and revolution gear.
- Make sure the clutch hub is facing the correct direction.



- (A) Front side  
(B) Clutch hub  
(C) Rear side  
(D) Revolution gear

#### E: INSPECTION

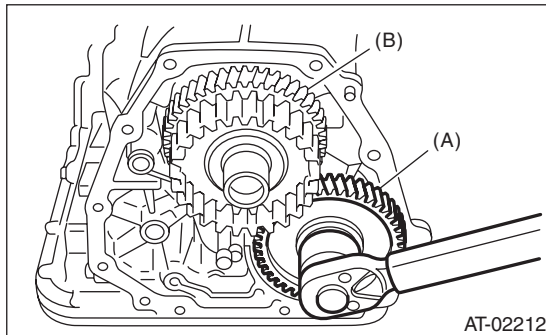
- Check each part for holes, damage or accumulation of dust.
- Inspect the play of the extension end, and adjust it to be within the standard value. <Ref. to 4AT-79, VTD MODEL, ADJUSTMENT, Transfer Clutch.>

## 30.Reduction Driven Gear

### A: REMOVAL

#### 1. MP-T MODEL

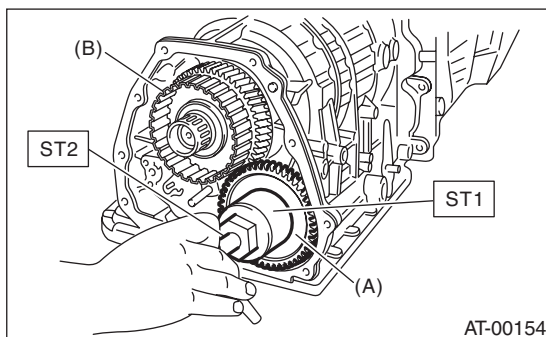
- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 3) Set the range select lever to the "P" range.
- 4) Lift the crimped section, and then remove the lock nut.



- (A) Reduction driven gear
- (B) Reduction drive gear

- 5) Using the ST1 and ST2, extract the reduction driven gear.

ST1 499737000 PULLER  
ST2 899524100 PULLER SET

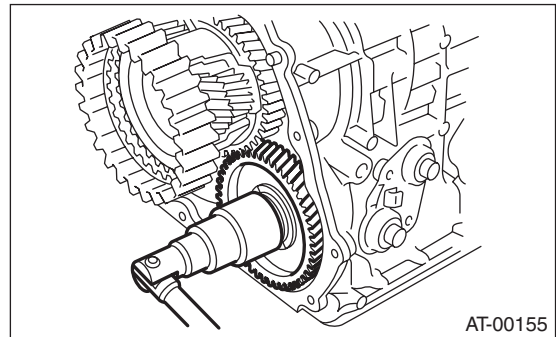


- (A) Reduction driven gear
- (B) Reduction drive gear

#### 2. VTD MODEL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 3) Remove the rear drive shaft. <Ref. to 4AT-82, REMOVAL, Rear Drive Shaft.>
- 4) Set the range select lever to the "P" range.

- 5) Lift the crimped section, and then remove the lock nut.



- 6) Using the ST1 and ST2, extract the reduction driven gear.

ST1 499737000 PULLER  
ST2 899524100 PULLER SET

- 7) Pull out the center differential assembly. <Ref. to 4AT-87, REMOVAL, Center Differential Carrier.>

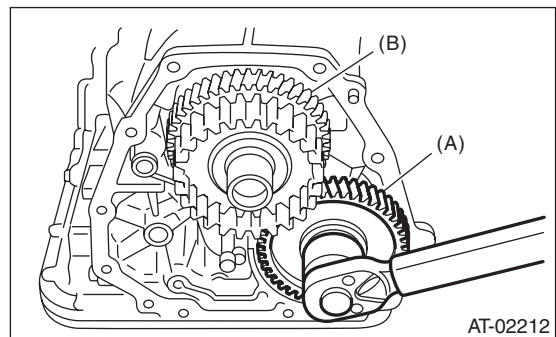
### B: INSTALLATION

#### 1. MP-T MODEL

- 1) Set the range select lever to the "P" range.
- 2) Using a plastic hammer, install the reduction driven gear assembly and the new washer, and tighten the new drive pinion lock nut.

#### Tightening torque:

**100 N·m (10.2 kgf·m, 73.8 ft·lb)**



- (A) Reduction driven gear
- (B) Reduction drive gear

- 3) After tightening, stake the lock nut securely.
- 4) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 5) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>



# Reduction Driven Gear

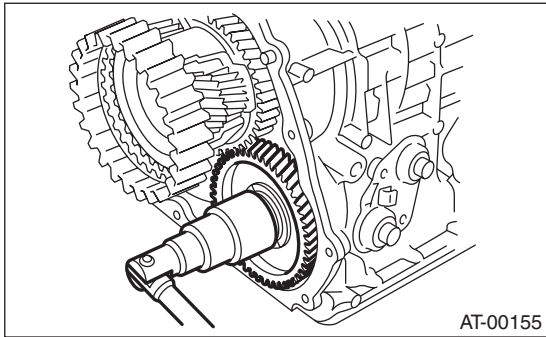
## AUTOMATIC TRANSMISSION

### 2. VTD MODEL

- 1) Set the range select lever to the "P" range.
- 2) Use a plastic hammer to install reduction driven gear assembly.
- 3) Use a plastic hammer to install the center differential.
- 4) Install a new self-locking nut and washer.

#### Tightening torque:

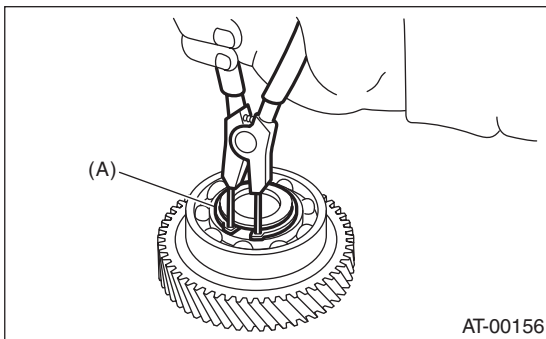
**100 N·m (10.2 kgf·m, 73.8 ft·lb)**



- 5) After tightening, stake the lock nut securely.
- 6) Insert the rear drive shaft assembly. <Ref. to 4AT-82, INSTALLATION, Rear Drive Shaft.>
- 7) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 8) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

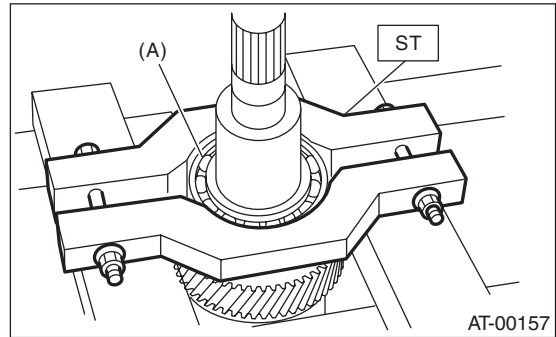
- 1) Remove the snap ring from reduction driven gear.



(A) Snap ring

- 2) Remove the ball bearing from reduction driven gear using ST.

ST 498077600 REMOVER

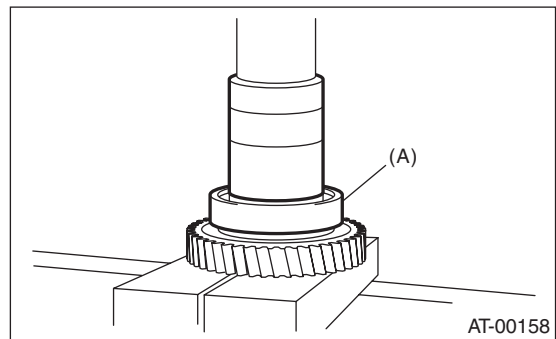


(A) Ball bearing

- 3) Remove the snap ring from reduction driven gear.

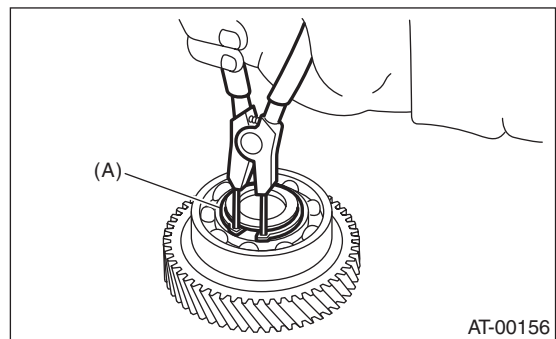
### D: ASSEMBLY

- 1) Install the snap ring to reduction driven gear.
- 2) Install the new ball bearing to reduction driven gear using press.



(A) Ball bearing

- 3) Install the snap ring to reduction driven gear.



(A) Snap ring

### E: INSPECTION

Make sure the ball bearing and gear is not deformed or damaged.

## 31.Reduction Drive Gear

### A: REMOVAL

1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>

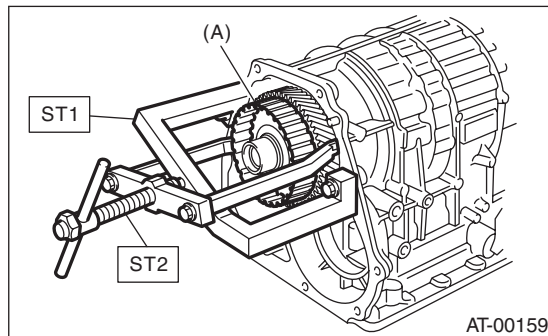
2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>

3) Remove the reduction driven gear. <Ref. to 4AT-83, REMOVAL, Reduction Driven Gear.>

4) Using the ST, extract the reduction drive gear assembly.

ST1 499737100 PULLER

ST2 899524100 PULLER SET



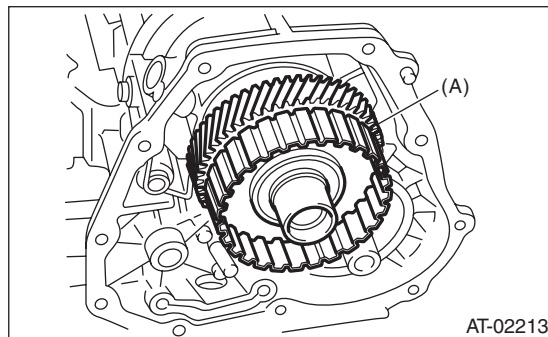
(A) Reduction drive gear ASSY

### B: INSTALLATION

1) Install the reduction drive gear assembly.

NOTE:

Press-fit it to the bottom of bearing shoulder completely.



(A) Reduction drive gear ASSY

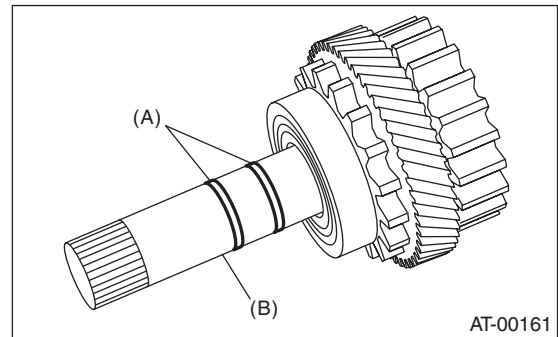
2) Install the reduction driven gear. <Ref. to 4AT-83, INSTALLATION, Reduction Driven Gear.>

3) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>

4) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

1) Take out the seal ring.

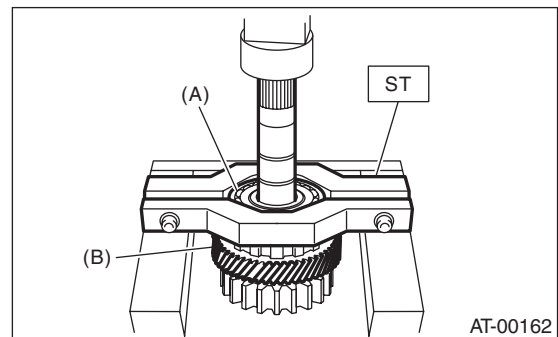


(A) Seal ring

(B) Reduction drive shaft

2) Remove the ball bearing using ST.

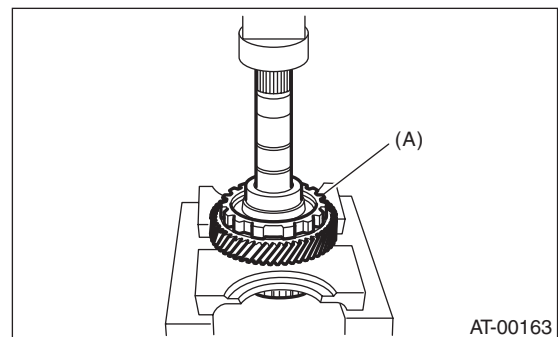
ST 498077600 REMOVER



(A) Ball bearing

(B) Reduction drive gear

3) Apply vaseline to the outer surface of seal ring and shaft groove.



(A) Reduction drive gear

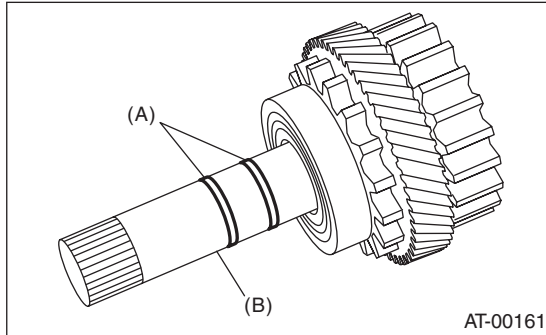
# Reduction Drive Gear

## AUTOMATIC TRANSMISSION

---

### D: ASSEMBLY

- 1) Press-fit the reduction drive gear to shaft.
- 2) Press-fit the new ball bearing into reduction drive gear.
- 3) Apply vaseline onto the seal ring outer surface and shaft grooves.
- 4) Apply ATF to new seal rings and install them.



- (A) Seal ring  
(B) Reduction drive shaft

### E: INSPECTION

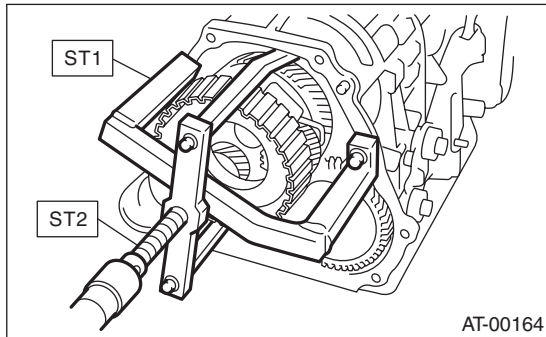
- Rotate the bearing by hand, and check that it rotates smoothly.
- Check parts for holes, damage or adhesion of dust and other foreign particles.
- Inspect the extension end play, and adjust it to the standard value. <Ref. to 4AT-79, ADJUSTMENT, Transfer Clutch.>

## 32.Center Differential Carrier

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 3) Extract the rear drive shaft. <Ref. to 4AT-82, REMOVAL, Rear Drive Shaft.>
- 4) Using ST, pull out the center differential carrier assembly.

ST1 499737100 PULLER  
ST2 899524100 PULLER SET



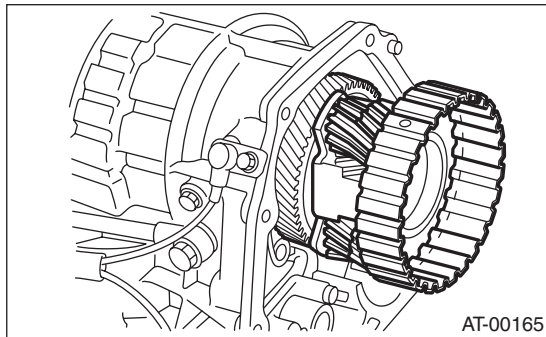
- 5) Pull out the shim(s) from transmission case.

### B: INSTALLATION

- 1) Install the center differential assembly together with shims.

#### NOTE:

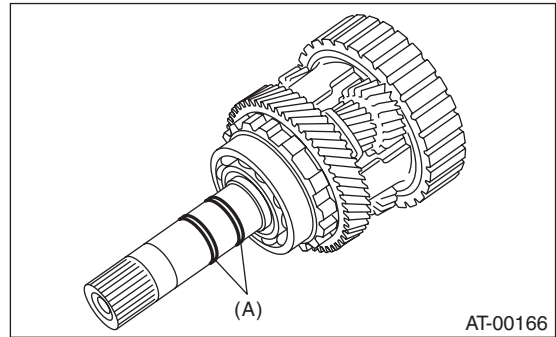
Press-fit it to the bottom of bearing shoulder completely.



- 2) Insert the rear drive shaft. <Ref. to 4AT-82, INSTALLATION, Rear Drive Shaft.>
- 3) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 4) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

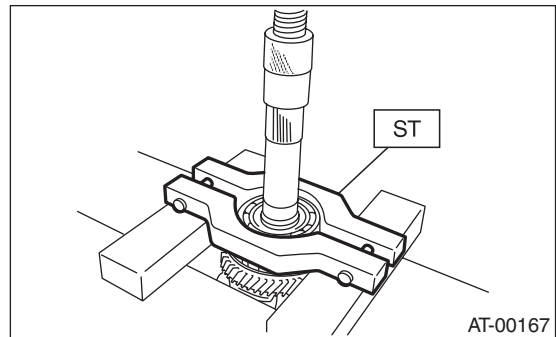
- 1) Remove the seal ring.



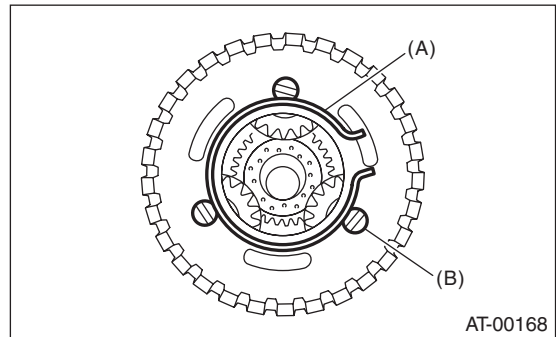
(A) Seal ring

- 2) Using a press and ST, remove the ball bearing.

ST 498077600 REMOVER



- 3) Remove the snap ring, and pull out the shaft from center differential assembly.



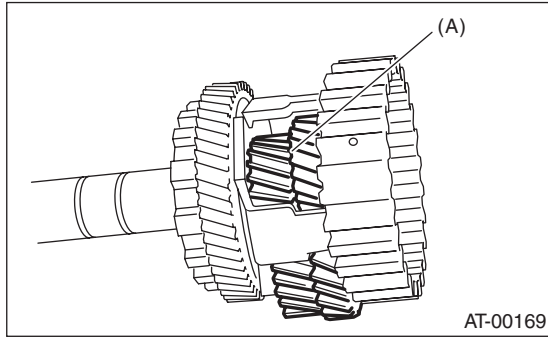
(A) Snap ring  
(B) Shaft

# Center Differential Carrier

## AUTOMATIC TRANSMISSION

---

4) Remove the thrust washers, pinion gears and washers from center differential assembly.



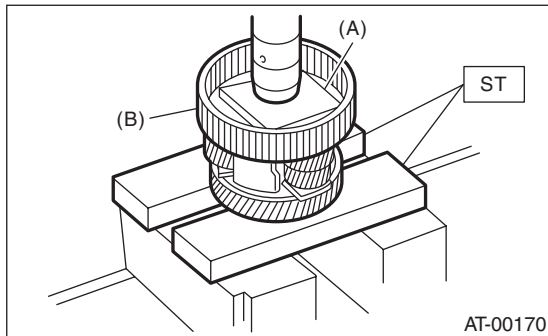
(A) Pinion gear

5) Pull out the intermediate shaft and thrust bearing.

### D: ASSEMBLY

- 1) Install the thrust washer onto intermediate shaft.
- 2) Install the thrust bearing onto intermediate shaft.
- 3) Install the pinion gears and washers.
- 4) Insert the shaft into the center differential assembly.
- 5) Install the snap ring.
- 6) Using a press, install a new ball bearing into the center differential assembly.

ST 498077000 REMOVER



(A) Plate

(B) Center differential carrier

7) Apply vaseline onto the seal ring outer surface and shaft grooves.

8) Install a new seal ring.

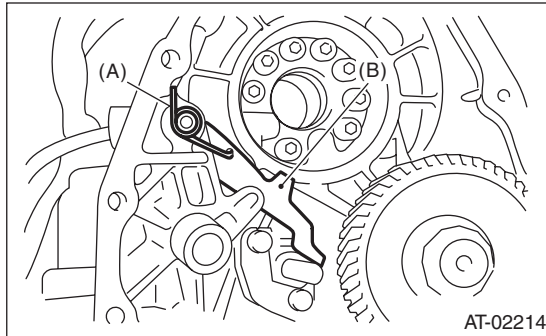
### E: INSPECTION

- Check each part for holes, damage or accumulation of dust.
- Inspect the play of the extension end, and adjust it to be within the standard value. <Ref. to 4AT-79, VTD MODEL, ADJUSTMENT, Transfer Clutch.>

## 33. Parking Pawl

### A: REMOVAL

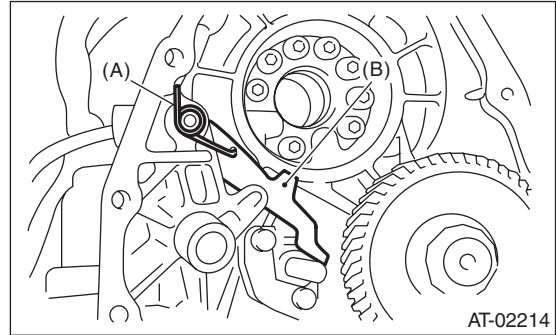
- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 3) Remove the reduction drive gear. (MP-T model) <Ref. to 4AT-85, REMOVAL, Reduction Drive Gear.>
- 4) Remove the center differential carrier. (VTD model) <Ref. to 4AT-87, REMOVAL, Center Differential Carrier.>
- 5) Remove the parking pawl, return spring and shaft.



- (A) Return spring
- (B) Parking pawl

### B: INSTALLATION

- 1) Install the parking pawl, return spring and shaft.



- (A) Return spring
- (B) Parking pawl

- 2) Install the reduction drive gear. (MP-T model) <Ref. to 4AT-85, INSTALLATION, Reduction Drive Gear.>
- 3) Install the center differential carrier. (VTD model) <Ref. to 4AT-87, INSTALLATION, Center Differential Carrier.>
- 4) Install the rear vehicle speed sensor and extension case. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 5) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: INSPECTION

Check the tab of the parking pole on the reduction gear for wear or other damage.

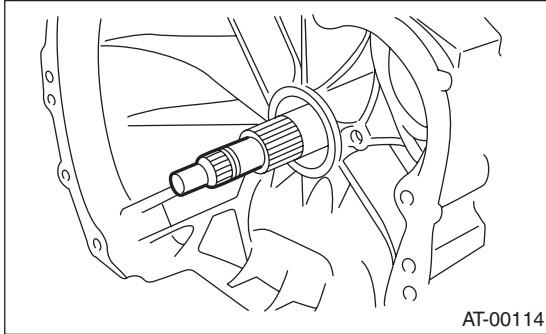
# Converter Case

## AUTOMATIC TRANSMISSION

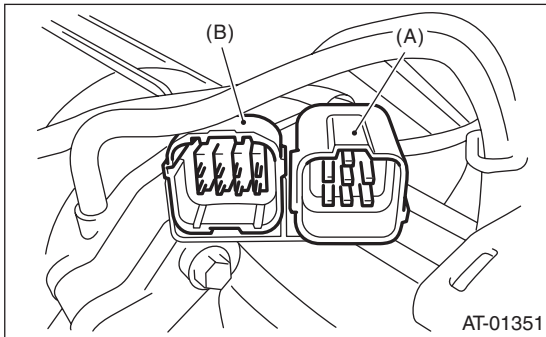
### 34. Converter Case

#### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.



- 4) Lift up the lever on the rear side of transmission harness connector, and then disconnect it from the stay.
- 5) Disconnect the inhibitor switch connector from the stay.



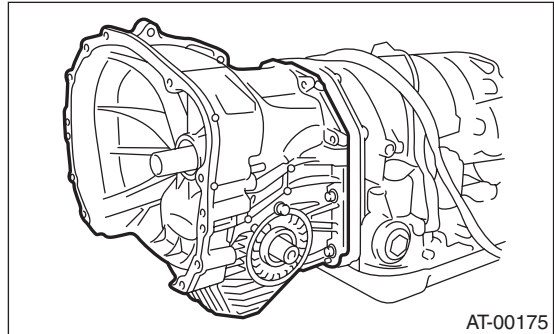
- (A) Transmission harness connectors  
(B) Inhibitor switch connector

- 6) Remove the air breather hose. <Ref. to 4AT-68, REMOVAL, Air Breather Hose.>
- 7) Remove the oil charge pipe. <Ref. to 4AT-69, REMOVAL, Oil Charge Pipe.>
- 8) Remove the ATF inlet and outlet pipes. <Ref. to 4AT-65, REMOVAL, ATF Cooler Pipe and Hose.>

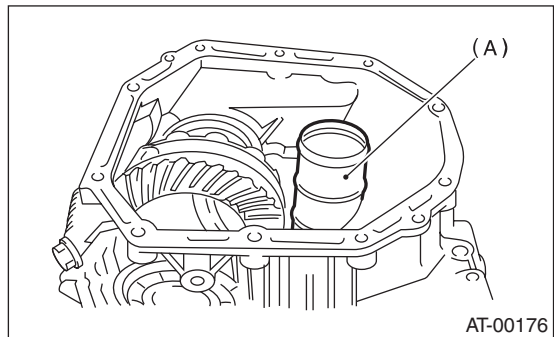
- 9) Remove the converter case alignment bolt, and then separate the transmission case and converter case by lightly tapping with a plastic hammer.

#### NOTE:

- Be careful not to damage the oil seal and bushing in the converter case with the oil pump cover.
- Do not loosen the rubber seal.



- 10) Remove the seal pipe.



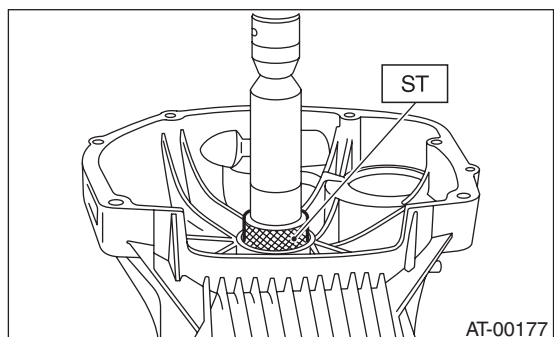
- (A) Seal pipe

- 11) Remove the front differential assembly. <Ref. to 4AT-104, REMOVAL, Front Differential Assembly.>
- 12) Remove the oil seal from converter case.

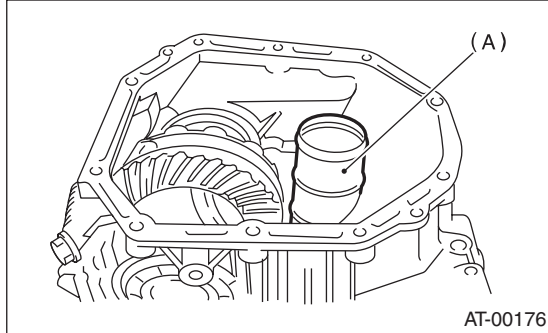
#### B: INSTALLATION

- 1) Check the appearance of each component and clean them.
- 2) Press-fit the new oil seal to the converter case using the ST.

ST 398437700 DRIFT

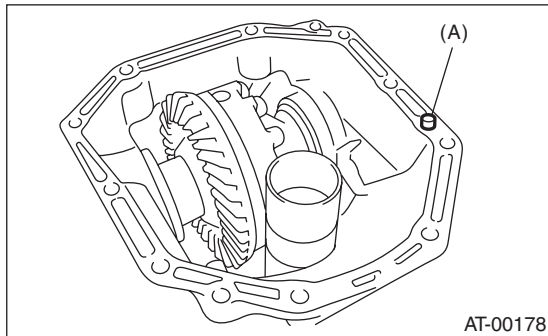


- 3) Install the front differential assembly to the case. <Ref. to 4AT-104, INSTALLATION, Front Differential Assembly.>
- 4) Install the right and left side retainers. <Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>
- 5) Install new seal pipe to converter case.



(A) Seal pipe

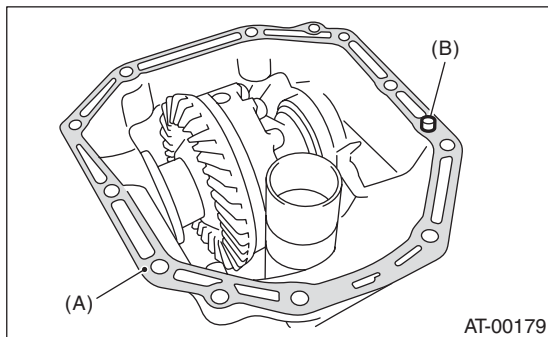
- 6) Install the rubber seal to converter case.



(A) Rubber seal

- 7) Apply proper amount of liquid gasket to the entire matching surface of converter case.

**Liquid gasket:**  
**THREE BOND 1215 (Part No. 004403007) or equivalent**



(A) THREE BOND 1215  
 (B) Rubber seal

- 8) Install the converter case without damaging bushing and oil seal.

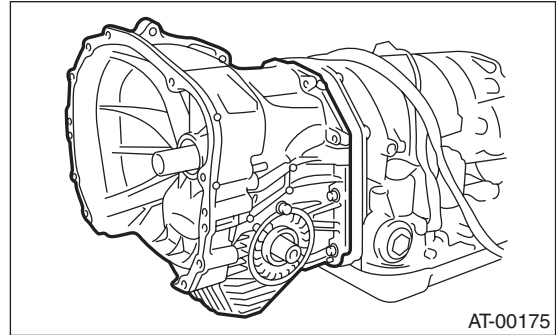
**Tightening torque:**

**Oil charge pipe section**

**38 N·m (3.9 kgf-m, 28.0 ft-lb)**

**Excluding the oil charge pipe section**

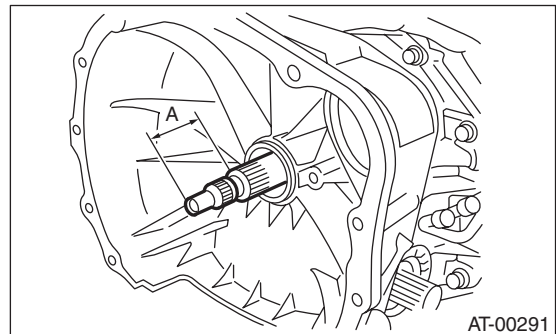
**41 N·m (4.2 kgf-m, 30.2 ft-lb)**



- 9) Insert the inhibitor switch and transmission harness connector to the stay.
- 10) Install the air breather hose. <Ref. to 4AT-68, INSTALLATION, Air Breather Hose.>
- 11) Install the ATF cooler pipe. <Ref. to 4AT-66, INSTALLATION, ATF Cooler Pipe and Hose.>
- 12) Install the oil charge pipe with O-ring. <Ref. to 4AT-69, INSTALLATION, Oil Charge Pipe.>
- 13) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

**Normal protrusion A:**

**50 — 55 mm (1.97 — 2.17 in)**



- 14) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>
- 15) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

**C: INSPECTION**

Measure the backlash, and then adjust it to be within standard values. <Ref. to 4AT-101, ADJUSTMENT, Drive Pinion Shaft Assembly.>



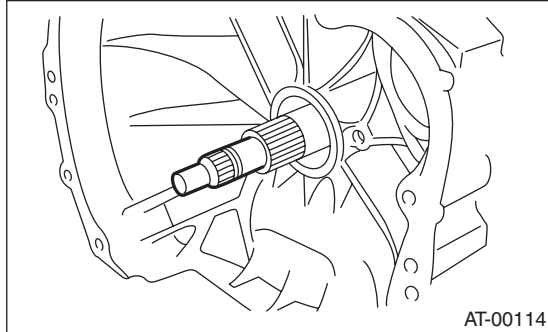
# Oil Pump Housing

AUTOMATIC TRANSMISSION

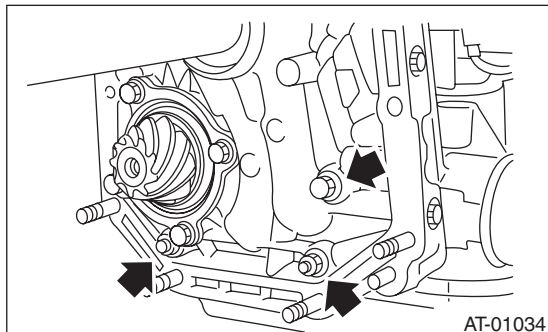
## 35. Oil Pump Housing

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.



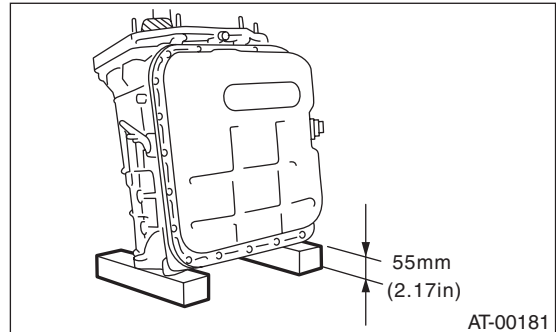
- 4) Lift up the lever on the rear side of transmission harness connector, and then remove it from the stay.
- 5) Remove the inhibitor switch connector from the stay.
- 6) Remove the oil charge pipe. <Ref. to 4AT-69, REMOVAL, Oil Charge Pipe.>
- 7) Remove the ATF inlet and outlet pipes. <Ref. to 4AT-65, REMOVAL, ATF Cooler Pipe and Hose.>
- 8) Separate the converter case and transmission case. <Ref. to 4AT-90, REMOVAL, Converter Case.>
- 9) Separate the transmission case and extension case section. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 10) Remove the reduction drive gear. (MP-T model) <Ref. to 4AT-85, REMOVAL, Reduction Drive Gear.>
- 11) Remove the center differential carrier. (VTD model) <Ref. to 4AT-87, REMOVAL, Center Differential Carrier.>
- 12) Remove the reduction driven gear. <Ref. to 4AT-83, REMOVAL, Reduction Driven Gear.>
- 13) Loosen the oil pump housing mounting bolts.



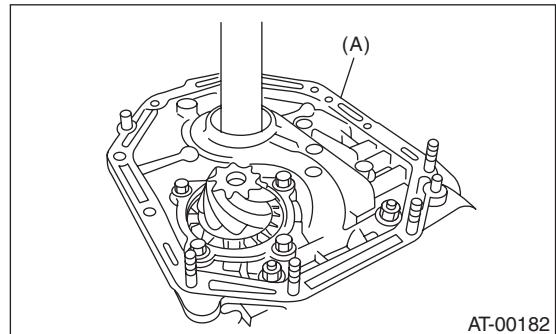
- 14) Place two wooden blocks on the workbench, and stand the transmission case with the rear end facing down.

### NOTE:

- Be careful not to scratch the rear mating surface of the transmission case.
- Check the height of the wooden blocks to avoid damaging the parking rod protruding from the mating surface, and the drive pinion.



- 15) Remove the oil pump housing and adjusting thrust washer.



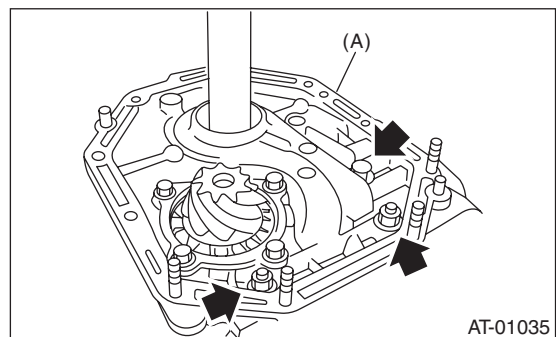
(A) Oil pump housing

### B: INSTALLATION

- 1) Secure the oil pump housing with two nuts and a bolt.

### Tightening torque:

**42 N·m (4.3 kgf-m, 31 ft-lb)**



(A) Oil pump housing

2) Install the converter case to the transmission case assembly. <Ref. to 4AT-90, INSTALLATION, Converter Case.>

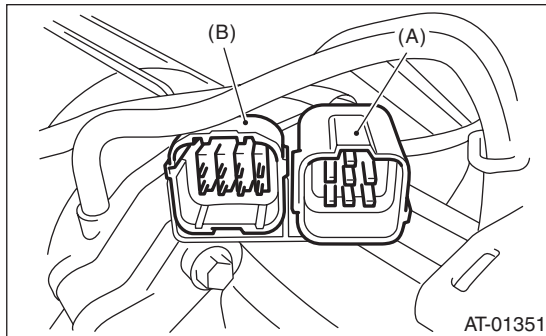
3) Install the reduction driven gear. <Ref. to 4AT-83, INSTALLATION, Reduction Driven Gear.>

4) Install the reduction drive gear. (MP-T model) <Ref. to 4AT-85, INSTALLATION, Reduction Drive Gear.>

5) Install the center differential carrier. (VTD model) <Ref. to 4AT-87, INSTALLATION, Center Differential Carrier.>

6) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>

7) Insert the inhibitor switch and transmission harness connector to the stay.



(A) Transmission harness connectors  
(B) Inhibitor switch connector

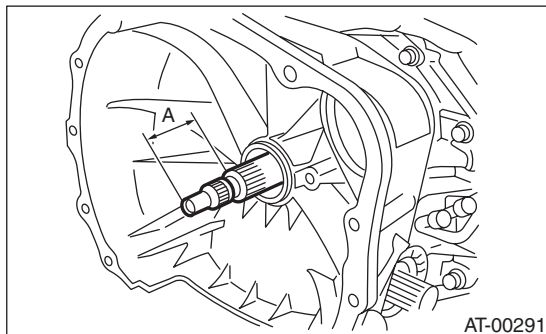
8) Install the ATF cooler pipe. <Ref. to 4AT-66, INSTALLATION, ATF Cooler Pipe and Hose.>

9) Install the oil charge pipe together with an O-ring. <Ref. to 4AT-69, INSTALLATION, Oil Charge Pipe.>

10) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

**Normal protrusion A:**

**50 — 55 mm (1.97 — 2.17 in)**



AT-00291

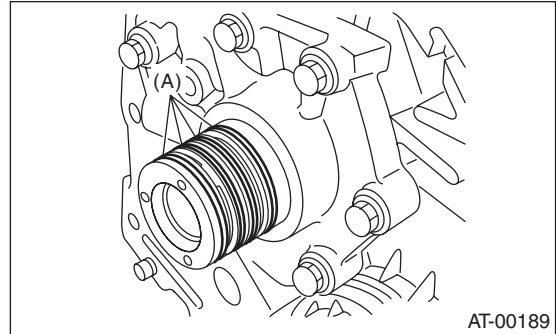
11) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>

12) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

**C: DISASSEMBLY**

**1. OIL PUMP COVER**

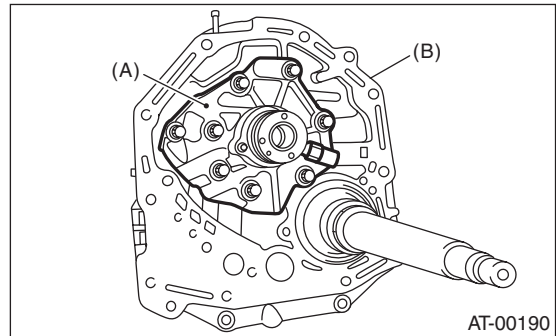
1) Remove the four seal rings.



AT-00189

(A) Seal ring

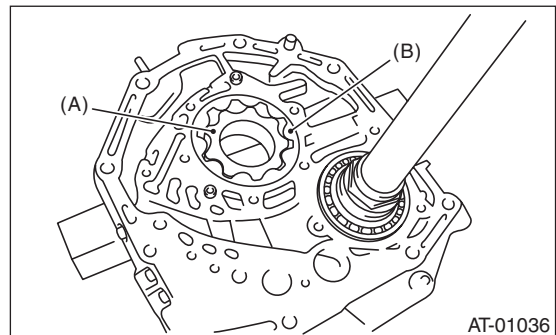
2) Remove attachment bolts, then remove the cover by lightly tapping the end of the stator shaft.



AT-00190

(A) Oil pump cover  
(B) Oil pump housing

3) Remove the oil pump inner rotor and outer rotor.



AT-01036

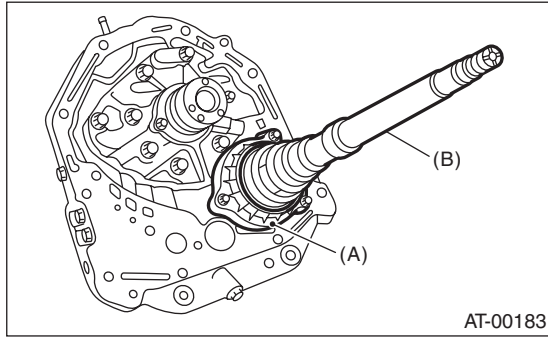
(A) Inner rotor  
(B) Outer rotor

# Oil Pump Housing

AUTOMATIC TRANSMISSION

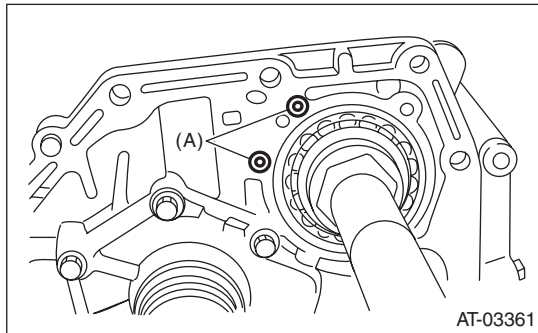
## 2. OIL SEAL RETAINER

1) Remove the oil seal retainer.



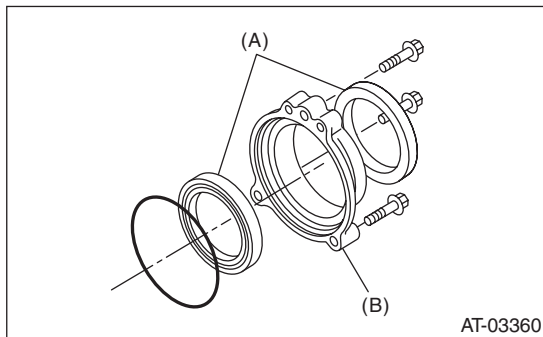
- (A) Oil seal retainer
- (B) Drive pinion shaft

2) Remove the O-ring.



- (A) O-ring

3) Remove the oil seal from the oil seal retainer.

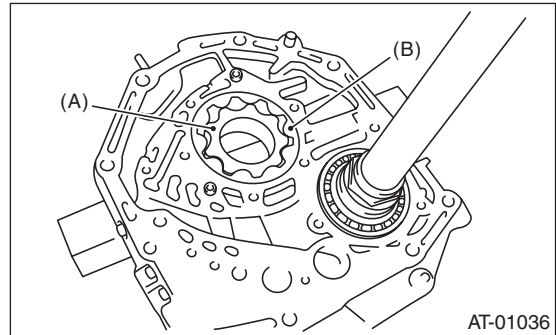


- (A) Oil seal
- (B) Oil seal retainer

## D: ASSEMBLY

### 1. OIL PUMP COVER

1) Install the oil pump rotor assembly to oil pump housing.

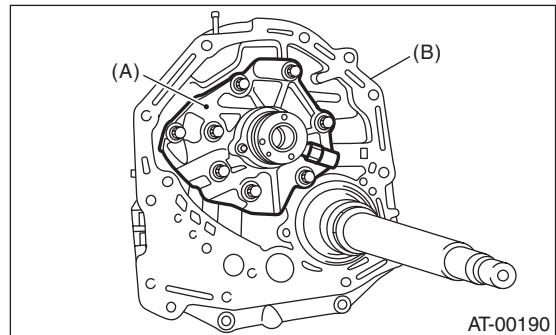


- (A) Inner rotor
- (B) Outer rotor

2) Align both pivots with the pivot holes of the cover, and then install the oil pump cover while being careful not to apply excessive force to the pivots.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



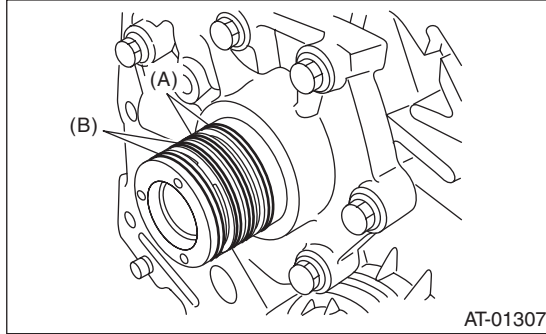
- (A) Oil pump cover
- (B) Oil pump housing

3) After assembling, turn the oil pump shaft to check for smooth rotation of rotor.

4) Apply vaseline to the oil seal retainer and new seal rings, and install them. After installing, adjust the tooth contact with the drive pinion backlash. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

**NOTE:**

There are two types of seals. They are identified by color. Install at the proper positions by referring to the figure.

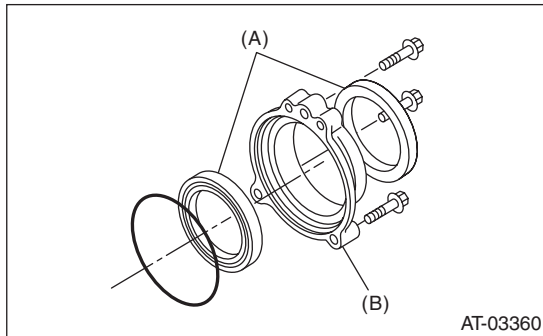


- (A) Seal ring (Black)
- (B) Seal ring (Brown)

## 2. OIL SEAL RETAINER

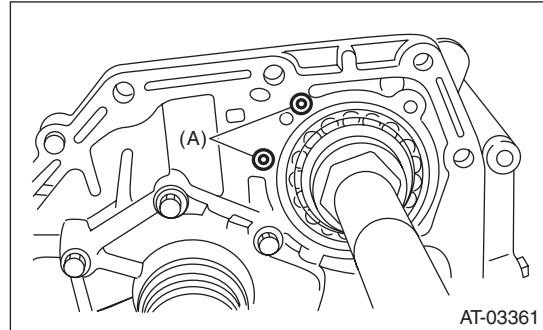
1) Apply ATF to two new oil seals and install them to the oil seal retainer in the proper direction using the ST.

ST 499247300 INSTALLER



- (A) Oil seal
- (B) Oil seal retainer

2) Apply ATF to a new O-ring and attach to the oil seal retainer. Install the seal to the oil pump housing bore.

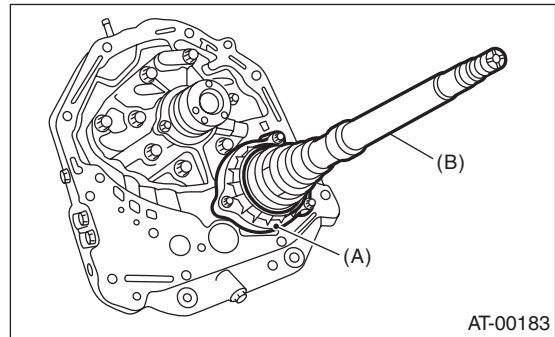


- (A) O-ring

3) Install the oil seal being careful not to damage oil seal lip, and secure it using three bolts.

**Tightening torque:**

**7 N·m (0.7 kgf-m, 5.1 ft-lb)**



- (A) Oil seal retainer
- (B) Drive pinion shaft

# Oil Pump Housing

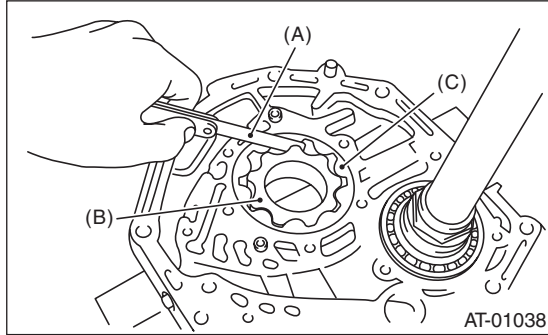
## AUTOMATIC TRANSMISSION

### E: INSPECTION

- 1) Check the seal ring and oil seal for breaks and damage.
- 2) Check other parts for dents or faults.
- 3) Oil pump rotor assembly selection
  - (1) Tip clearance  
Install the inner rotor and outer rotor to the oil pump. With rotor gears facing each other, measure the crest-to-crest clearance.

#### Tip clearance:

**0.02 — 0.15 mm (0.0008 — 0.0059 in)**



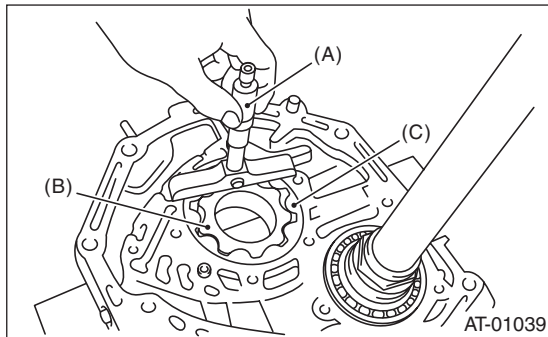
- (A) Thickness gauge
- (B) Inner rotor
- (C) Outer rotor

#### (2) Side clearance

Set a depth gauge to oil pump housing, then measure the oil pump housing-to-rotor clearance.

#### Side clearance:

**0.02 — 0.04 mm (0.0008 — 0.0016 in)**



- (A) Depth gauge
- (B) Inner rotor
- (C) Outer rotor

- (3) If the depth and/or side clearance are not within the specification, replace the rotor assembly.

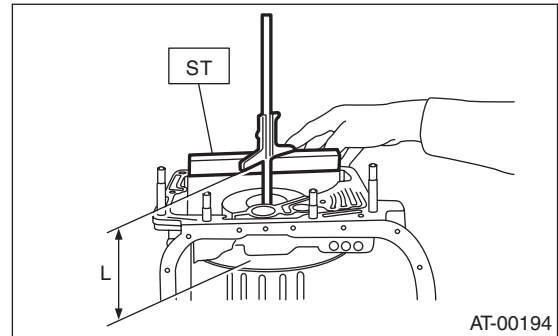
Oil pump rotor assembly	
Part number	Thickness mm (in)
15008AA060	11.37 — 11.38 (0.4476 — 0.4480)
15008AA070	11.38 — 11.39 (0.4480 — 0.4484)
15008AA080	11.39 — 11.40 (0.4484 — 0.4488)

Measure the total end play and adjust it to be within specifications. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

### F: ADJUSTMENT

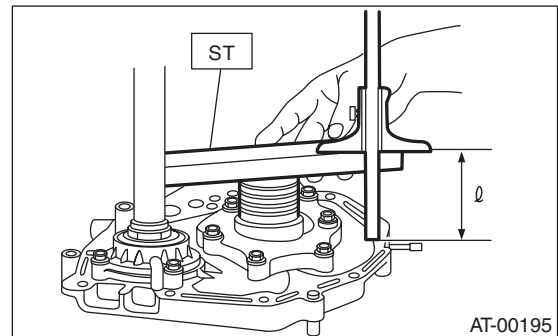
- 1) Using the ST, measure the length "L", from the mating surface of the transmission to the recessed portion of the high clutch drum.

ST 398643600 GAUGE



- 2) Using the ST, measure the length from the oil pump housing mating surface to the top surface of the oil pump cover with the thrust needle bearing.

ST 398643600 GAUGE

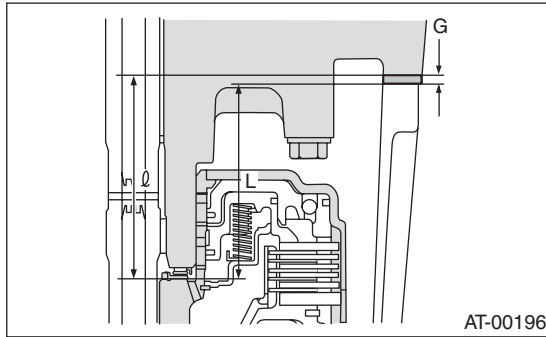


### 3) Calculation of total end play

Select a suitable bearing race from the table below so that clearance C will be within 0.25 to 0.55 mm (0.0098 to 0.0217 in).

$$C = (L + G) - \varnothing$$

C	Clearance between concave section of high clutch and end of clutch drum support
L	Length from case mating surface to the concave portion of the high clutch
G	Gasket thickness [0.28 mm (0.0110 in)]
$\varnothing$	Height from the oil pump housing mating surface to the upper surface of the oil pump cover with the thrust needle bearing.



Thrust needle bearing	
Part number	Thickness mm (in)
806528050	4.1 (0.161)
806528060	4.3 (0.169)
806528070	4.5 (0.177)
806528080	4.7 (0.185)
806528090	4.9 (0.193)
806528100	5.1 (0.201)

4) After completing the end play adjustment, insert the bearing race into the high clutch race. Apply vaseline, and install the thrust needle bearing to the oil pump cover.

5) After correctly installing the new gasket to the case mating surface, carefully install the oil pump housing assembly. Be careful to avoid hitting the drive pinion against the inside of case.

6) Install both parts with dowel pins aligned. Make sure there is no clearance at the mating surface.

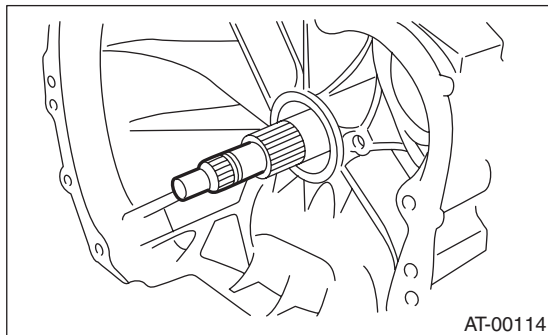
# Drive Pinion Shaft Assembly

AUTOMATIC TRANSMISSION

## 36. Drive Pinion Shaft Assembly

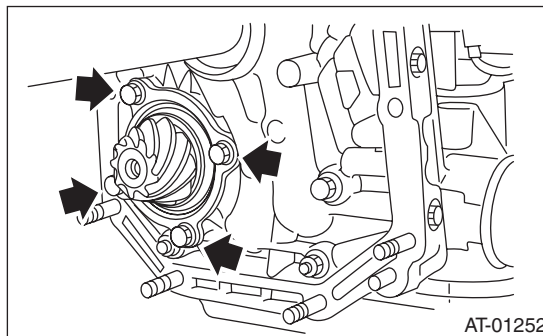
### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.



- 4) Lift up the lever on the rear side of transmission harness connector, and then disconnect it from the stay.
- 5) Disconnect the inhibitor switch connector from the stay.
- 6) Disconnect the air breather hose. <Ref. to 4AT-68, REMOVAL, Air Breather Hose.>
- 7) Remove the oil charge pipe. <Ref. to 4AT-69, REMOVAL, Oil Charge Pipe.>
- 8) Remove the ATF inlet and outlet pipes. <Ref. to 4AT-65, REMOVAL, ATF Cooler Pipe and Hose.>
- 9) Separate the converter case and transmission case. <Ref. to 4AT-90, REMOVAL, Converter Case.>
- 10) Separate the transmission case and extension case section. <Ref. to 4AT-71, REMOVAL, Extension Case.>
- 11) Remove the reduction drive gear. (MP-T model) <Ref. to 4AT-85, REMOVAL, Reduction Drive Gear.>
- 12) Remove the center differential carrier. (VTD model) <Ref. to 4AT-87, REMOVAL, Center Differential Carrier.>
- 13) Remove the reduction driven gear. <Ref. to 4AT-83, REMOVAL, Reduction Driven Gear.>

- 14) Remove the drive pinion shaft mounting bolt and remove the drive shaft assembly from oil pump housing.



### B: INSTALLATION

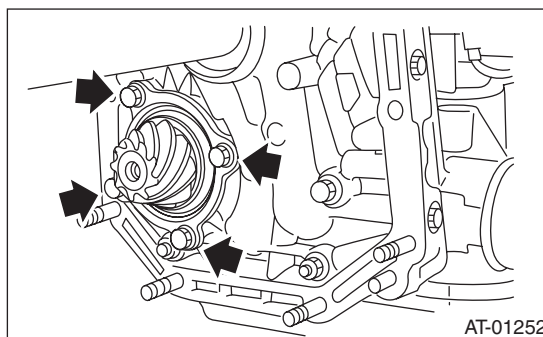
- 1) Assemble the drive pinion shaft assembly to the oil pump housing.

#### NOTE:

- Be careful not to bend the shim.
- Be careful not to press-fit the pinion into housing bore.

#### Tightening torque:

**40 N·m (4.0 kgf-m, 29.5 ft-lb)**



- 2) Join the torque converter case with the transmission case. <Ref. to 4AT-90, INSTALLATION, Converter Case.>
- 3) Install the reduction driven gear. <Ref. to 4AT-83, INSTALLATION, Reduction Driven Gear.>
- 4) Install the reduction drive gear. (MP-T model) <Ref. to 4AT-85, INSTALLATION, Reduction Drive Gear.>
- 5) Install the center differential carrier. (VTD model) <Ref. to 4AT-87, INSTALLATION, Center Differential Carrier.>
- 6) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 4AT-71, INSTALLATION, Extension Case.>
- 7) Insert the inhibitor switch and transmission harness connector to the stay.
- 8) Install the air breather hose. <Ref. to 4AT-68, INSTALLATION, Air Breather Hose.>

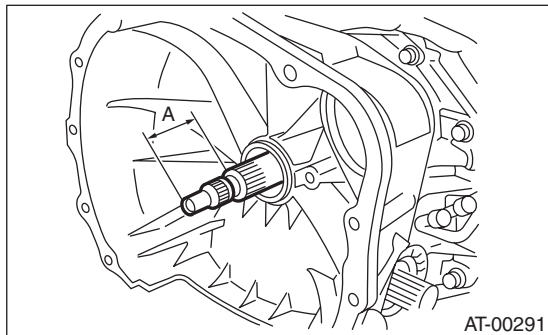
9) Install the ATF inlet and outlet pipes. <Ref. to 4AT-66, INSTALLATION, ATF Cooler Pipe and Hose.>

10) Install the oil charge pipe with O-ring.

11) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

**Normal protrusion A:**

**50 — 55 mm (1.97 — 2.17 in)**



12) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>

13) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

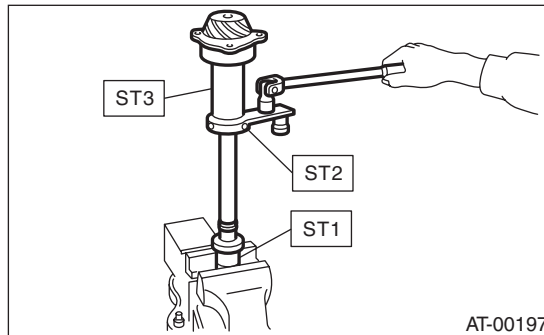
## C: DISASSEMBLY

1) Flatten the lock nut tab, and then remove the lock nut while holding the rear spline part of the drive pinion shaft using ST1 and ST2. Pull out the drive pinion collar.

ST1 498937110 HOLDER

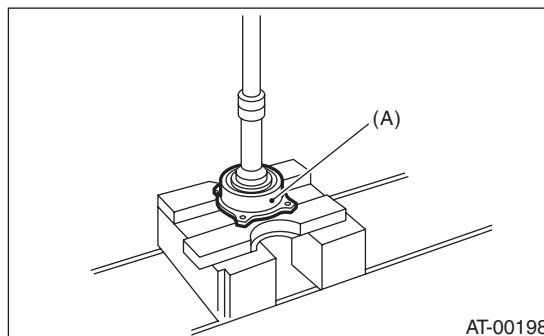
ST2 499787700 WRENCH

ST3 499787500 ADAPTER



2) Remove the O-ring.

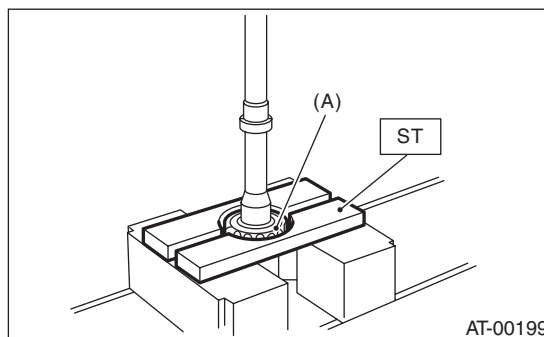
3) Separate the rear roller bearing and outer race from the drive pinion shaft using a press.



(A) Outer race

4) Separate the front roller bearing from the drive pinion shaft using a press and the ST.

ST 498517000 REPLACER



(A) Front roller bearing



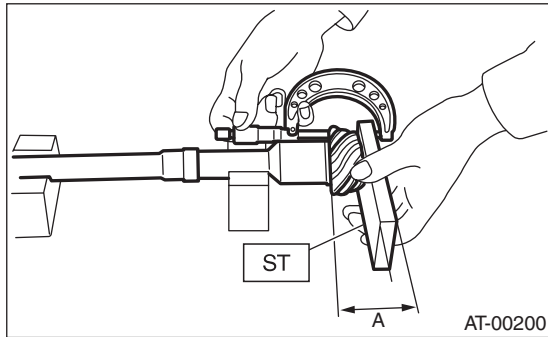
# Drive Pinion Shaft Assembly

AUTOMATIC TRANSMISSION

## D: ASSEMBLY

1) Measure the dimension "A" of the drive pinion shaft.

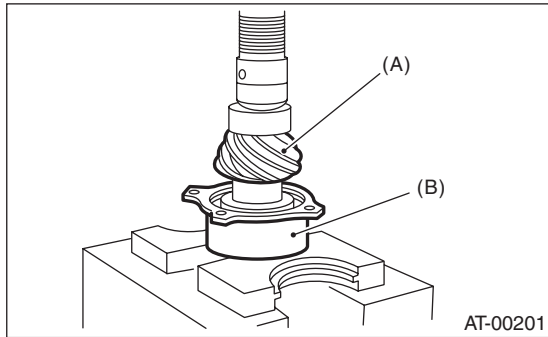
ST 398643600 GAUGE



2) Using a press, press-fit the new roller bearing into the specified position.

### CAUTION:

Damage may result if too much force is applied to the roller bearing.



(A) Drive pinion shaft  
(B) Roller bearing

3) After applying ATF to a new O-ring and attaching it to the drive pinion shaft, attach the drive pinion collar to the drive pinion shaft.

4) Install the lock washer to drive pinion shaft in the proper direction.

5) Tighten a new lock nut using the ST. Calculate the lock washer and lock nut specifications using following formula.

$$T2 = L2 / (L1 + L2) \times T1$$

T1: 116 N·m (11.8 kgf·m, 85.3 ft·lb)

[Required torque setting]

T2: Tightening torque

L1: ST2 length 0.072 m (2.83 in)

L2: Torque wrench length

Example:

Torque wrench length m (in)	Tightening torque N·m (kgf·m, ft·lb)
0.4 (15.75)	98 (10.0, 72)
0.45 (17.72)	100 (10.2, 73.8)
0.5 (19.69)	101 (10.3, 74.5)
0.55 (21.65)	102 (10.4, 75)

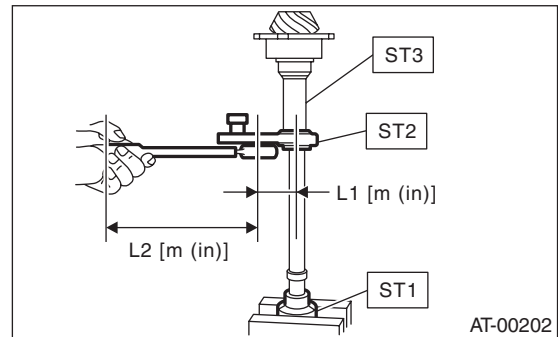
ST1 498937110 HOLDER

ST2 499787700 WRENCH

ST3 499787500 ADAPTER

### NOTE:

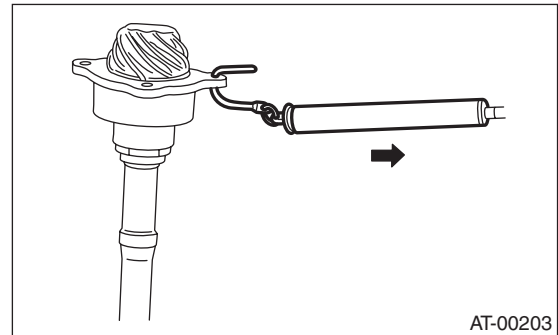
Attach ST2 to torque wrench as straight as possible.



6) Measure the starting torque of the bearing. Make sure the starting torque is within the specified range. If the torque is not within specified range, replace the roller bearing.

### Starting torque:

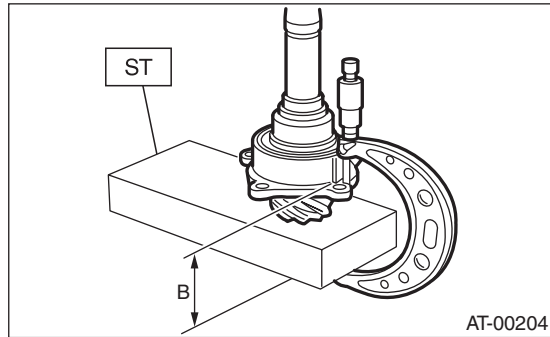
7.6 — 38.1 N (0.776 — 3.88 kgf, 1.7 — 8.6 lb)



7) Crimp the locknut in two locations.

8) Measure the dimension “B” of the drive pinion shaft.

ST 398643600 GAUGE



9) Calculate the thickness “t” (mm) of the drive pinion shim.

$$t = 6.5 \pm 0.0625 - (B - A)$$

10) Select three or less shims from following table.

Drive pinion shim	
Part number	Thickness mm (in)
31451AA050	0.150 (0.0059)
31451AA060	0.175 (0.0069)
31451AA070	0.200 (0.0079)
31451AA080	0.225 (0.0089)
31451AA090	0.250 (0.0098)
31451AA100	0.275 (0.0108)

## E: INSPECTION

- Make sure that all component parts are free of scratches, holes and other faults.
- Adjust the tooth alignment. <Ref. to 4AT-101, ADJUSTMENT, Drive Pinion Shaft Assembly.>

## F: ADJUSTMENT

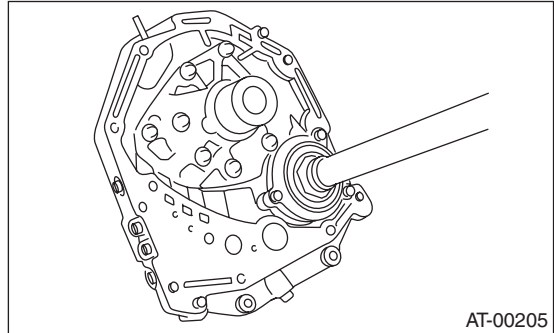
- 1) Remove the liquid gasket from the mating surface completely.
- 2) Install the oil pump housing assembly to the converter case, and secure them by tightening the four bolts evenly.

### NOTE:

Use an old gasket or aluminum washer to prevent damaging the mating surface of the housing.

### Tightening torque:

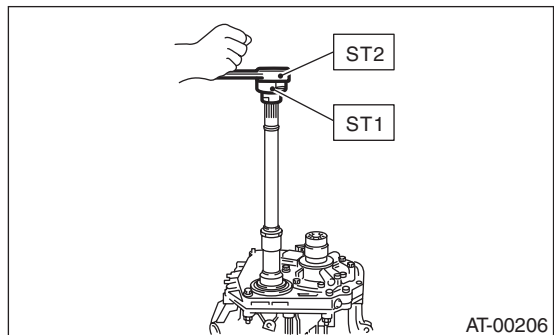
**41 N·m (4.2 kgf·m, 30.2 ft·lb)**



3) Rotate the drive pinion a few times using ST1 and ST2.

ST1 498937110 HOLDER

ST2 499787700 WRENCH



4) Adjust the drive pinion and hypoid driven gear backlash. <Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>

# Drive Pinion Shaft Assembly

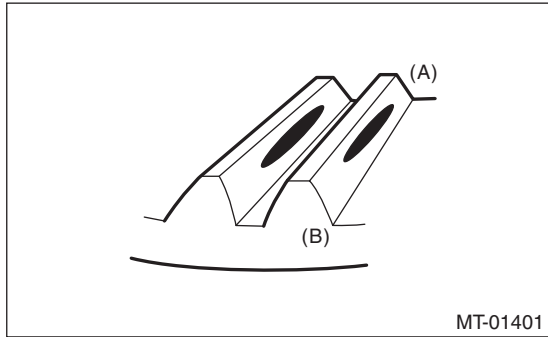
## AUTOMATIC TRANSMISSION

5) Apply lead-free red dye evenly on the surface of three to four teeth of the hypoid driven gear. Rotate the drive pinion back and forward several times. Remove the oil pump housing, and check the teeth contact pattern.

If the teeth contact is inappropriate, adjust the backlash or thickness of the shim. <Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>

- Correct tooth contact

**Check item: Tooth contact surface is slightly shifted toward the toe side under a no-load condition. (When driving, it moves towards the heel side.)**

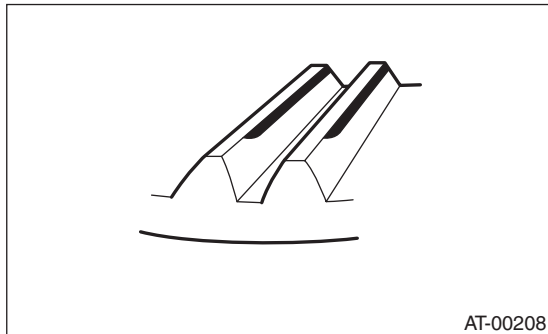


- (A) Toe side
- (B) Heel side

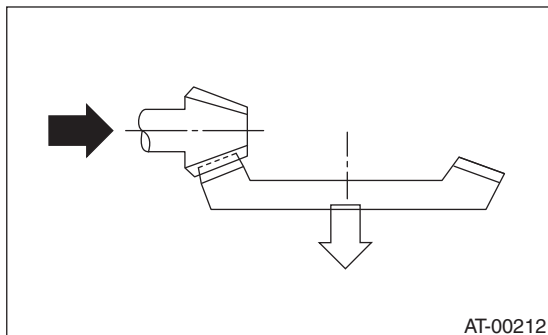
- Face contact

**Check item: Backlash is too large.**

Contact pattern



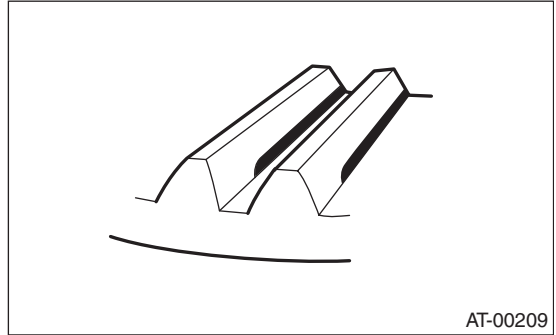
Corrective action: Increase thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion shaft closer to the hypoid driven gear.



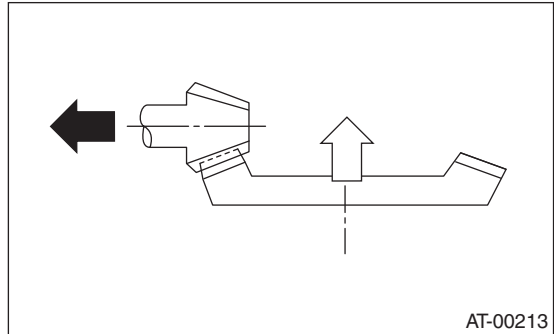
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



Corrective action: Reduce the thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion shaft away from the hypoid driven gear.



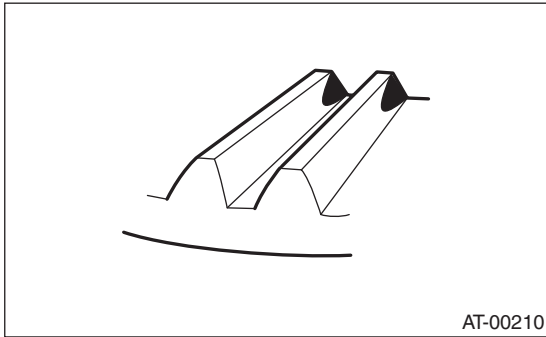
# Drive Pinion Shaft Assembly

AUTOMATIC TRANSMISSION

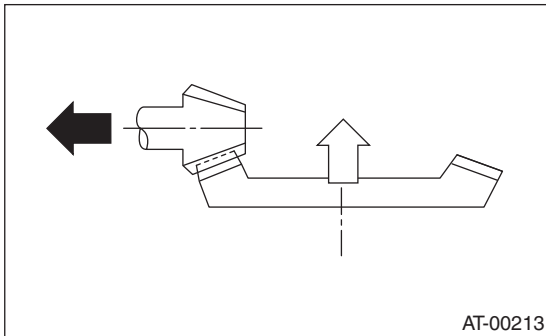
- Toe contact (inside contact)

**Check item: Teeth contact area is too small.**

Contact pattern



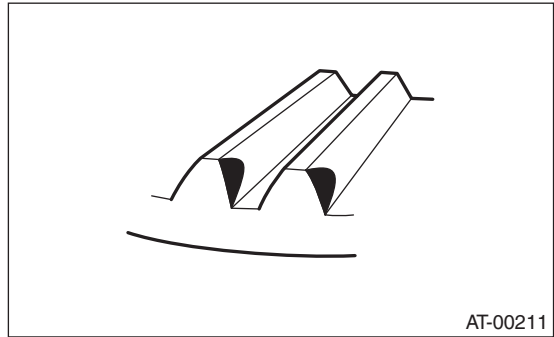
Corrective action: Reduce the thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion shaft away from the hypoid driven gear.



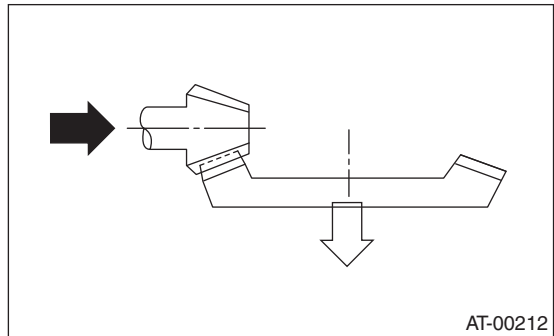
- Heel contact (outside end contact)

**Check item: Teeth contact area is too small.**

Contact pattern



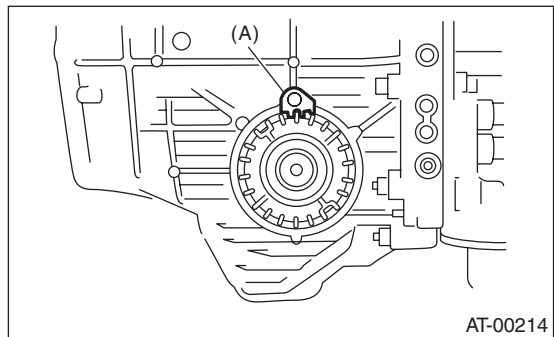
Corrective action: Increase the thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion shaft closer to the hypoid driven gear.



6) If tooth contact is correct, mark the differential side retainer position and loosen. After fitting a new O-ring and oil seal, screw in the differential side retainer to the marked position. Tighten the lock plate with specified torque.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



(A) Lock plate

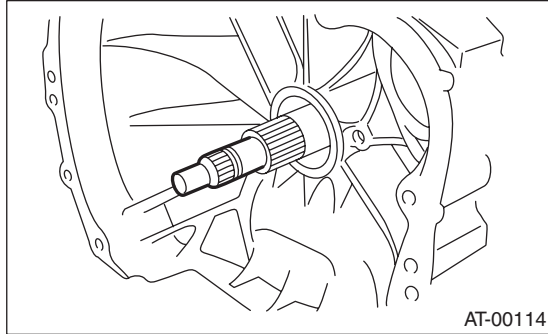
# Front Differential Assembly

AUTOMATIC TRANSMISSION

## 37. Front Differential Assembly

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.



- 4) Lift up the lever on the rear side of transmission harness connector, and then remove it from the stay.
- 5) Remove the inhibitor switch from the stay.
- 6) Remove the oil charge pipe. <Ref. to 4AT-69, REMOVAL, Oil Charge Pipe.>
- 7) Remove the ATF inlet and outlet pipes. <Ref. to 4AT-65, REMOVAL, ATF Cooler Pipe and Hose.>
- 8) Separate the converter case from the transmission case. <Ref. to 4AT-90, REMOVAL, Converter Case.>
- 9) Remove the seal pipe.
- 10) Remove the differential side retainers using ST. 18630AA010 WRENCH COMPL RETAINER

#### NOTE:

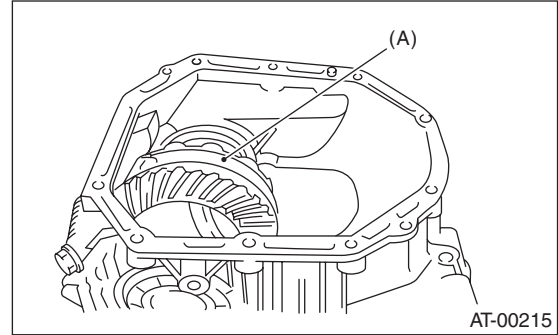
- ST WRENCH ASSEMBLY (499787000) can also be used.
  - Hold the differential case assembly by hand to avoid damaging the retainer mounting hole of the converter case.
- 11) Remove the front differential assembly while being careful not to damage the attachment part of the retainer.

### B: INSTALLATION

- 1) Install the front differential assembly to the converter case.

#### NOTE:

Be careful not to damage the inside of the converter case (especially the mating surface of the differential side retainer).



(A) Front differential ASSY

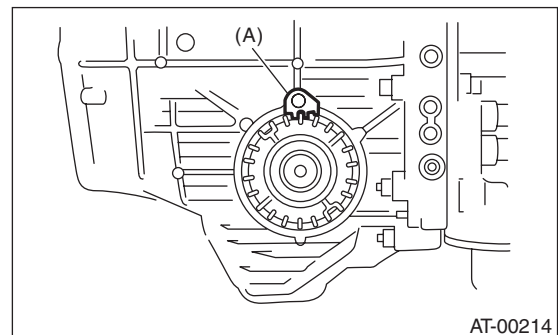
- 2) Install the O-ring to left and right side differential retainers.
- 3) Install the differential side retainers using the ST. <Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>  
ST 18630AA010 WRENCH COMPL RETAINER

#### NOTE:

- ST WRENCH ASSEMBLY (499787000) can also be used.
- 4) Adjust the backlash of the front differential. <Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>
  - 5) Install the lock plate.

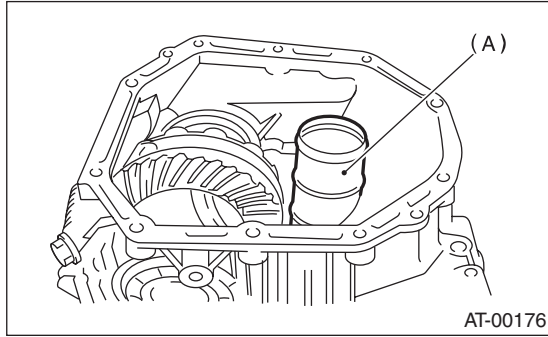
#### **Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



(A) Lock plate

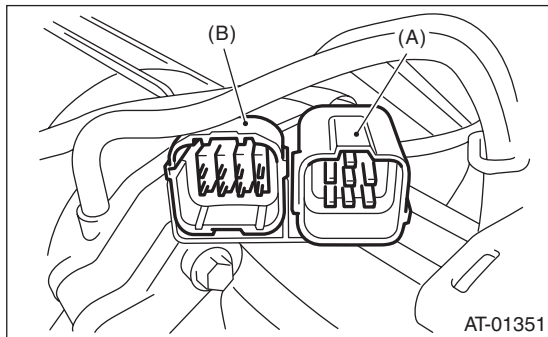
6) Install new seal pipe to converter case.



(A) Seal pipe

7) Install the converter case to the transmission case. <Ref. to 4AT-90, INSTALLATION, Converter Case.>

8) Insert the inhibitor switch and transmission harness connector to the stay.



(A) Transmission harness connectors  
(B) Inhibitor switch connector

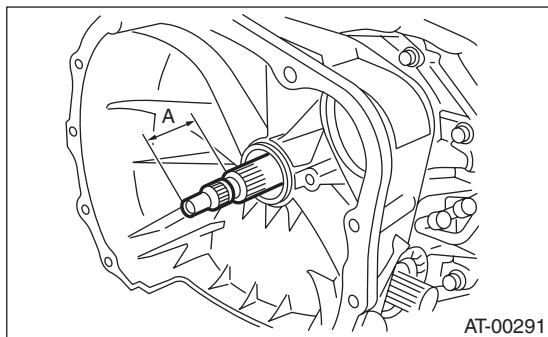
9) Install the ATF cooler pipe. <Ref. to 4AT-66, INSTALLATION, ATF Cooler Pipe and Hose.>

10) Install the oil charge pipe together with an O-ring. <Ref. to 4AT-69, INSTALLATION, Oil Charge Pipe.>

11) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

**Normal protrusion A:**

**50 — 55 mm (1.97 — 2.17 in)**



AT-00291

12) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>

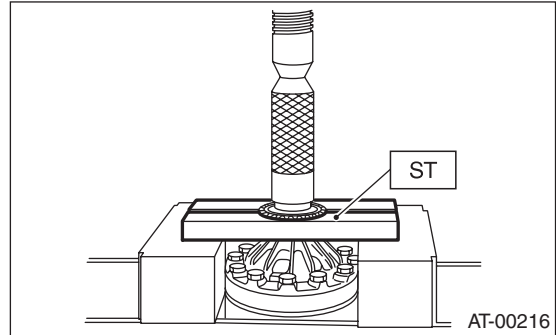
13) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

**C: DISASSEMBLY**

**1. DIFFERENTIAL CASE ASSEMBLY**

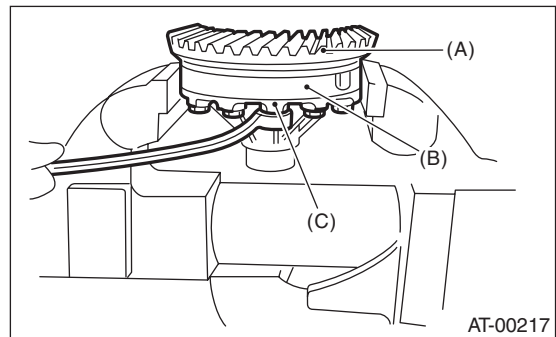
1) Remove the taper roller bearing using the ST and a press.

ST 498077000 REMOVER



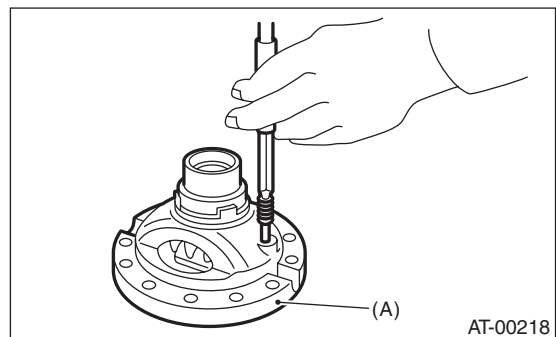
AT-00216

2) Secure the case in a vise, remove the hypoid driven gear tightening bolts, and then separate the hypoid driven gear into differential case (RH) and differential case (LH).



(A) Hypoid driven gear  
(B) Differential case (RH)  
(C) Differential case (LH)

3) Pull out the straight pin and pinion shaft, then remove the differential bevel gear, washer and differential bevel pinion.



AT-00218

(A) Differential case (RH)

# Front Differential Assembly

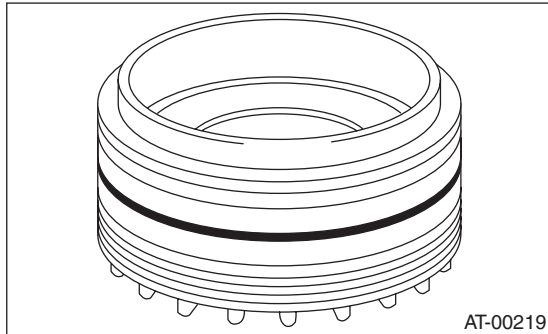
AUTOMATIC TRANSMISSION

## 2. SIDE RETAINER

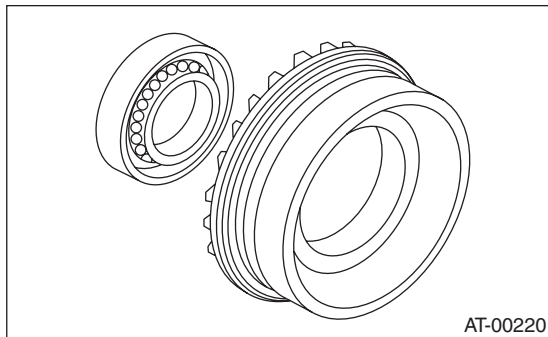
NOTE:

After adjusting the drive pinion backlash and tooth contact, remove and install the oil seal and O-ring.

1) Remove the O-ring.

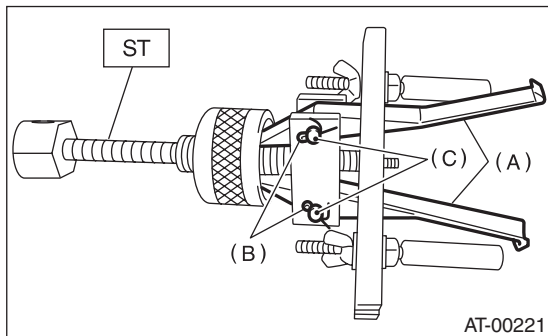


2) Remove the oil seal.



3) Remove the split pin, and then remove the claw.

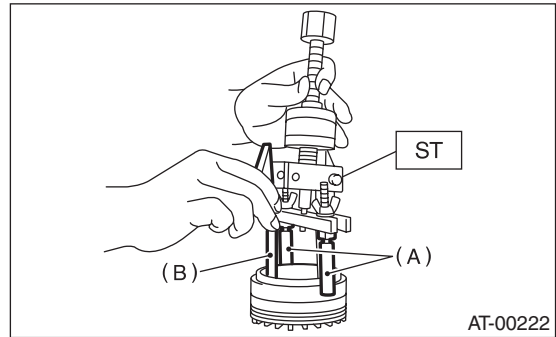
ST 398527700 PULLER ASSY



- (A) Claw
- (B) Split pin
- (C) Pin

4) Attach the two claws to the outer race, and set the ST on the differential side retainer.

ST 398527700 PULLER ASSY



- (A) Shaft
- (B) Claw

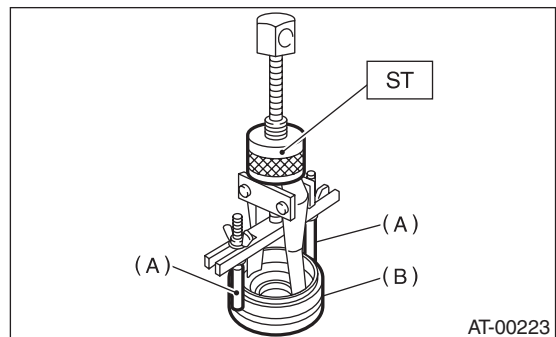
5) Restore the removed claws to original position, and install the pin and split pin.

6) Hold the shaft of ST to avoid detachment from the differential side retainer, and remove the bearing outer race.

ST 398527700 PULLER ASSY

NOTE:

Replace the bearing inner and outer races as a single unit.

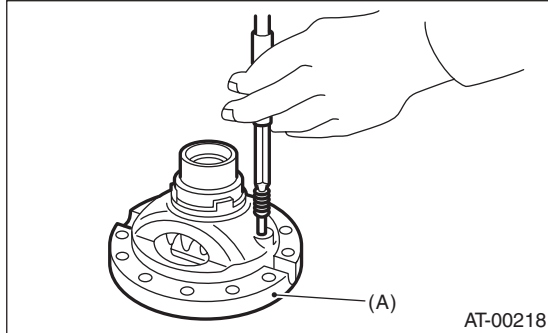


- (A) Shaft
- (B) Side retainer

## D: ASSEMBLY

### 1. DIFFERENTIAL CASE ASSEMBLY

- 1) Install the washer, differential bevel gear and differential bevel pinion in the differential case (RH). Insert the pinion shaft.
- 2) Attach the straight pin in the reverse direction.

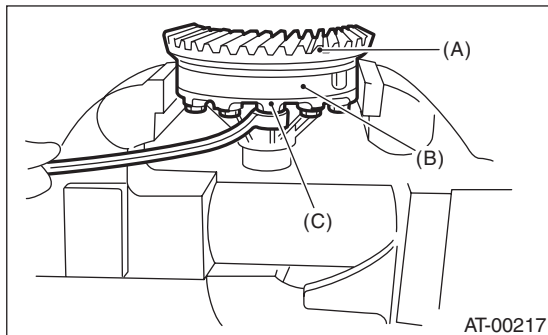


(A) Differential case (RH)

- 3) Install the washer and differential bevel gear to the differential case (LH). Put the differential case (RH) on the case, and assemble two cases.
- 4) Install the hypoid driven gear and secure by tightening the bolt.

#### Tightening torque:

**62 N·m (6.3 kgf-m, 45.7 ft-lb)**



- (A) Hypoid driven gear
- (B) Differential case (RH)
- (C) Differential case (LH)

- 5) Measurement of backlash (Selection of washer)
  - (1) Install the SUBARU genuine axle shaft to differential case.

Part No. 38415AA070 AXLE SHAFT

- (2) Measure the gear backlash using ST1 and ST2, and then insert the ST2 through the access window of case.

ST1 498247001 MAGNET BASE

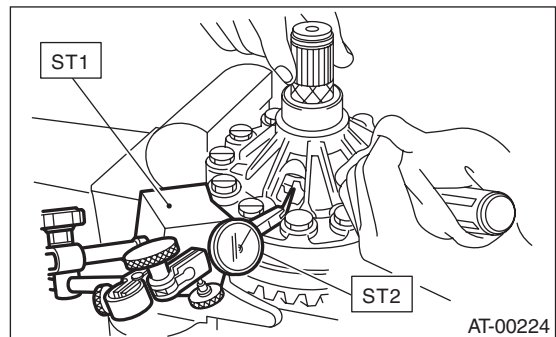
ST2 498247100 DIAL GAUGE

#### NOTE:

- Place the tooth of the differential bevel pinion against 2 teeth of the differential bevel gear, and measure the backlash.
- When measuring, fix the differential bevel pinion gear in place with a screwdriver covered with waste cloth, or a similar tool.

#### Standard:

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**

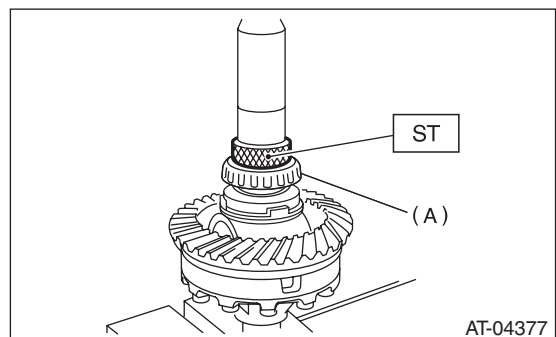


- (3) If the backlash is out of specification, select a washer from the table below.

Washer	
Part number	Thickness mm (in)
803038021	0.95 (0.037)
803038022	1.00 (0.039)
803038023	1.05 (0.041)

- 6) Using the ST, install the taper roller bearing.

ST 398487700 INSTALLER



(A) Taper roller bearing



# Front Differential Assembly

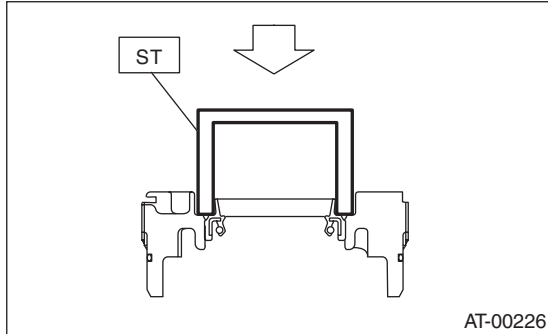
AUTOMATIC TRANSMISSION

## 2. SIDE RETAINER

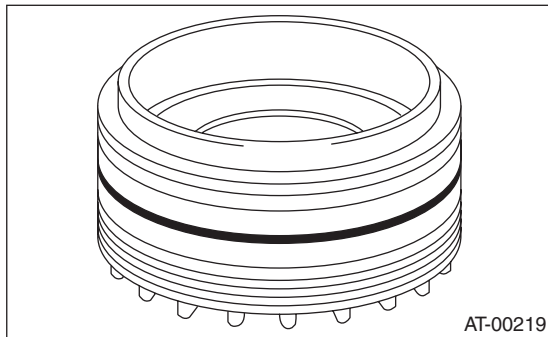
1) Install the bearing outer race to the differential side retainer.

2) Install a new oil seal using the ST and a hammer.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER



3) Apply gear oil to a new O-ring and install.



## E: INSPECTION

- Check each component for scratches, damage or other faults.
- Measure the backlash, and then adjust it to be within specification.

<Ref. to 4AT-108, ADJUSTMENT, Front Differential Assembly.>

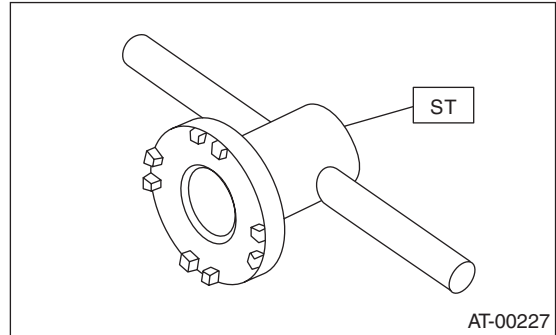
## F: ADJUSTMENT

1) Using the ST, screw-in the differential side retainer until resistance is felt.

ST 18630AA010 WRENCH COMPL RETAINER

NOTE:

- Screw-in the RH side slightly deeper than the LH side.
- ST WRENCH ASSEMBLY (499787000) can also be used.



2) Remove the oil pump housing.

3) Remove the liquid gasket from the mating surface completely.

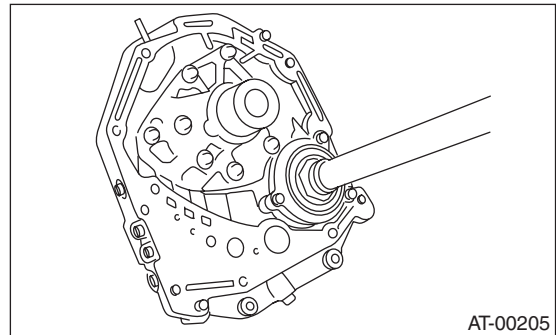
4) Install the oil pump housing assembly to the converter case, and secure them by tightening the four bolts evenly.

NOTE:

Use an old gasket or aluminum washer to prevent damaging the mating surface of the housing.

**Tightening torque:**

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

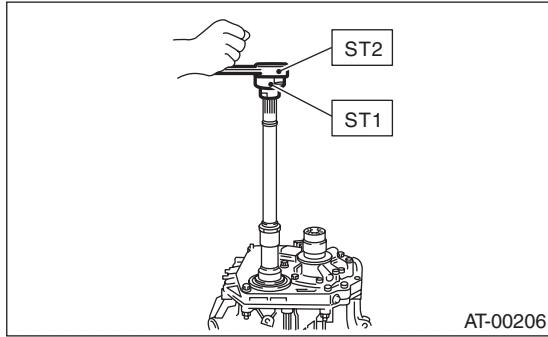


# Front Differential Assembly

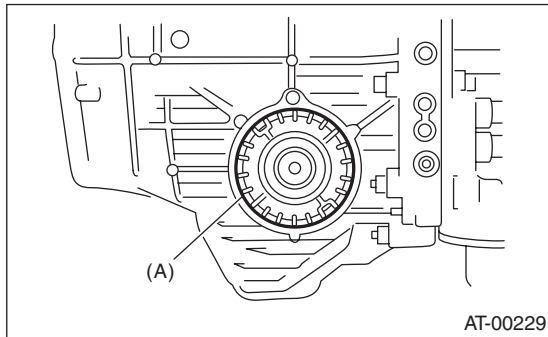
AUTOMATIC TRANSMISSION

5) Rotate the drive pinion a few times using ST1 and ST2.

ST1 498937110 HOLDER  
ST2 499787700 WRENCH

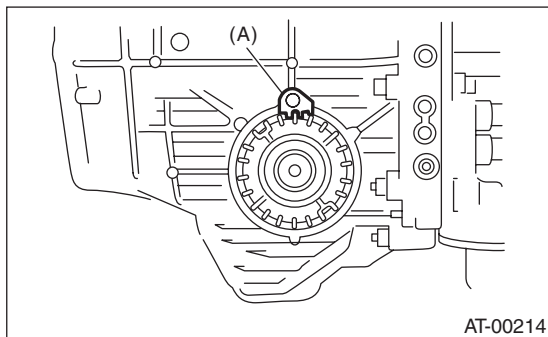


6) Tighten the LH differential side retainer by rotating the shaft until resistance is felt. Then loosen the RH side differential side retainer. Tighten the LH differential side retainer until the pinion shaft no longer turns, and continue to loosen the RH side. This is the “zero” state.



(A) Differential side retainer

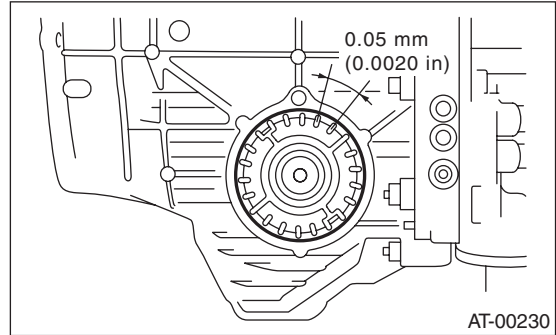
7) After reaching the “zero” state, loosen the LH differential side retainer by three notches and secure it with the lock plate. Then after returning the RH differential side retainer, retighten until it stops. Rotate the drive pinion 2 or 3 times. Tighten the RH differential side retainer further by 1-3/4 notches. This sets the preload. Finally, secure the differential side retainer with the lock plate.



(A) Lock plate

## NOTE:

Turning the differential side retainer by one notch changes the backlash approx. 0.05 mm (0.0020 in).



8) Install the Subaru genuine axle shafts to the right and left sides of the front differential.

Install the axle shaft to both sides of the front differential section.

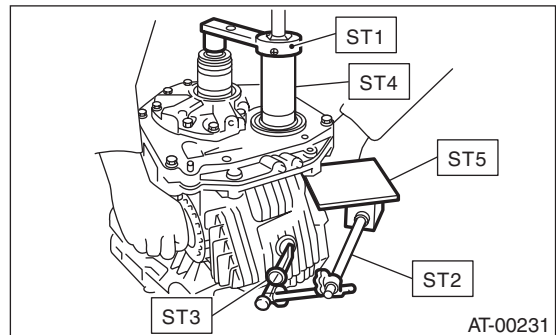
Part No. 38415AA000 AXLE SHAFT

9) Turn the drive pinion several times using ST1, and check to see if the backlash is within the specification using ST2, ST3, ST4 and ST5.

ST1 499787700 WRENCH  
ST2 498247001 MAGNET BASE  
ST3 498247100 DIAL GAUGE  
ST4 499787500 ADAPTER  
ST5 498255400 PLATE

## Backlash:

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**

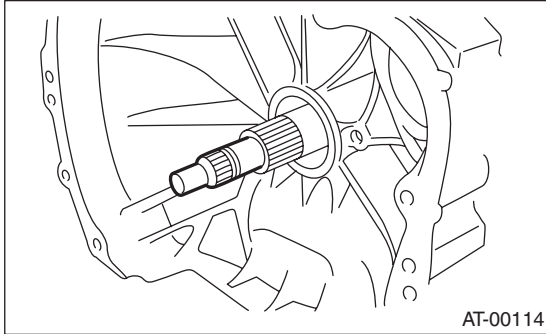


10) Adjust the teeth contact of the front differential and drive shaft. <Ref. to 4AT-101, ADJUSTMENT, Drive Pinion Shaft Assembly.>

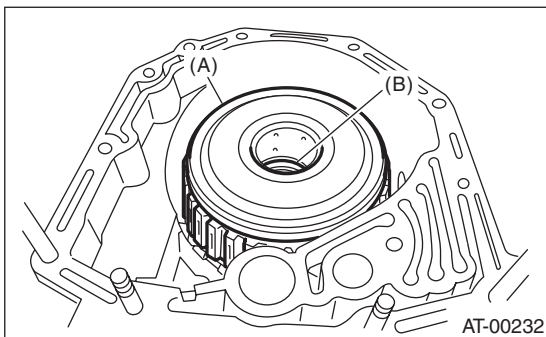
### 38.AT Main Case

#### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.

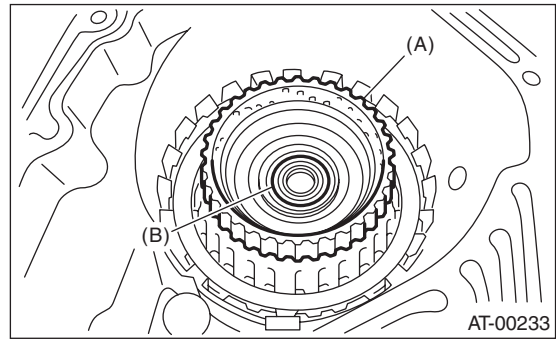


- 4) Lift up the lever on the rear side of transmission harness connector, and then disconnect it from the stay.
- 5) Disconnect the inhibitor switch connector from the stay.
- 6) Disconnect the air breather hose.
- 7) Remove the oil charge pipe. <Ref. to 4AT-69, REMOVAL, Oil Charge Pipe.>
- 8) Remove the ATF inlet and outlet pipes. <Ref. to 4AT-65, REMOVAL, ATF Cooler Pipe and Hose.>
- 9) Separate the converter case from the transmission case. <Ref. to 4AT-90, REMOVAL, Converter Case.>
- 10) Remove the oil pump housing. <Ref. to 4AT-92, REMOVAL, Oil Pump Housing.>
- 11) Take out the high clutch, thrust needle bearing and reverse clutch assembly.



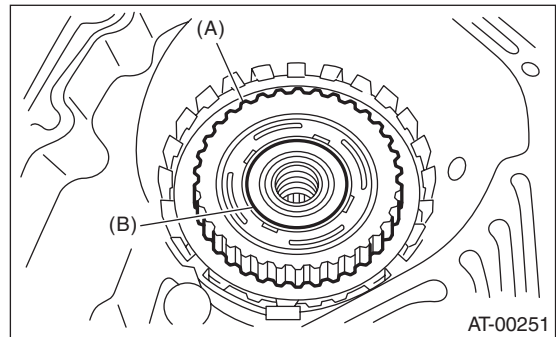
- (A) High clutch and reverse clutch ASSY
- (B) Thrust needle bearing

- 12) Take out the high clutch hub and thrust bearing.



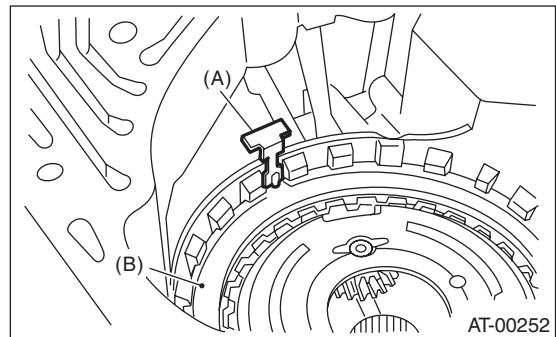
- (A) High clutch hub
- (B) Thrust needle bearing

- 13) Take out the front sun gear and thrust needle bearing.



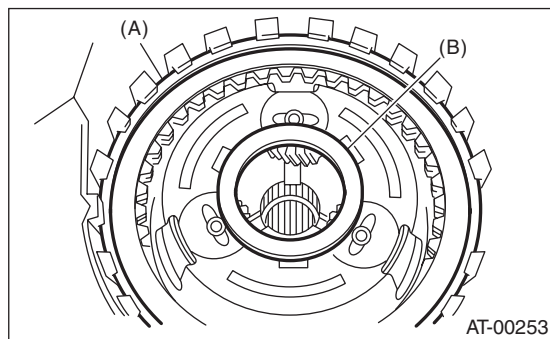
- (A) Front sun gear
- (B) Thrust needle bearing

- 14) Pull out while being careful not to break the leaf spring of the 2-4 brake.



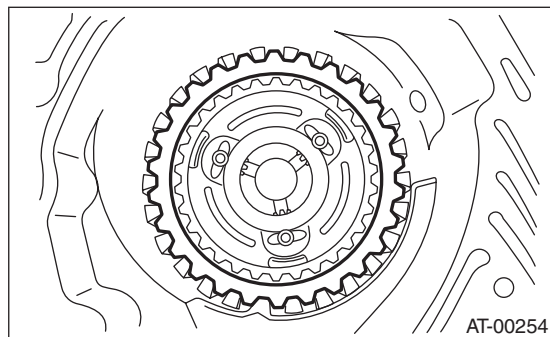
- (A) Leaf spring
- (B) Retaining plate

15) Remove the snap ring and thrust needle bearing.

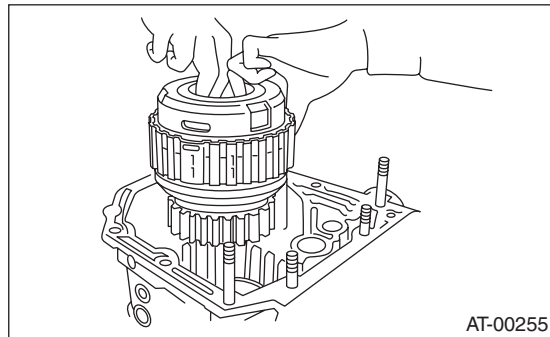


- (A) Snap ring
- (B) Thrust needle bearing

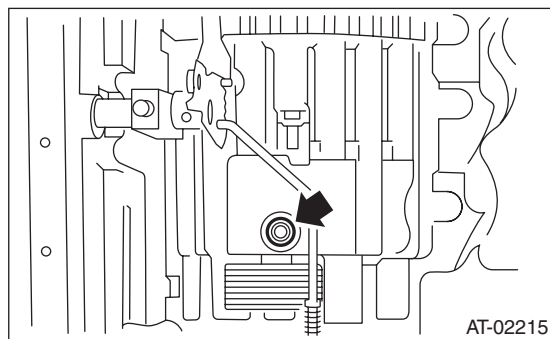
16) Take out the retaining plate, drive plate and driven plate of the 2-4 brake.



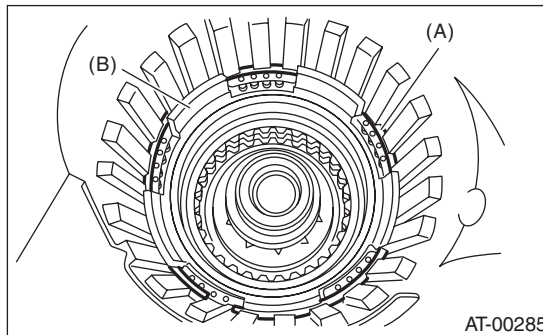
17) Take out the thrust needle bearing, planetary gear assembly and low clutch assembly.



18) Remove the 2-4 brake seal.

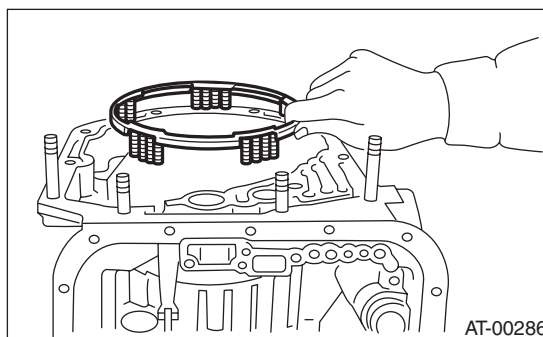


19) Remove the snap ring.

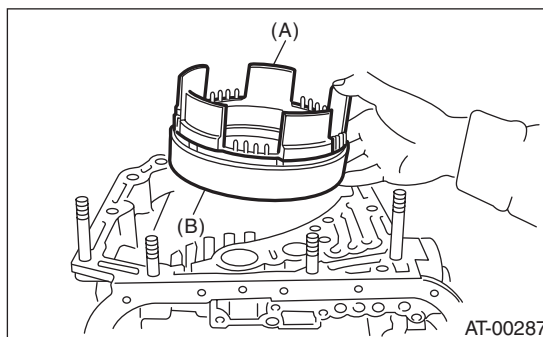


- (A) Snap ring
- (B) 2-4 brake piston

20) Take out the 2-4 brake spring retainer.



21) Remove the 2-4 brake piston and 2-4 brake piston retainer while taking care not to damage them.

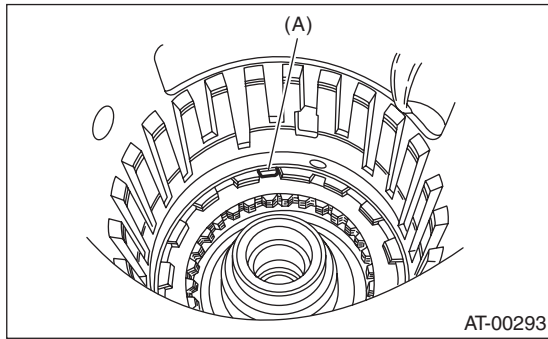


- (A) 2-4 brake piston
- (B) 2-4 brake piston retainer

# AT Main Case

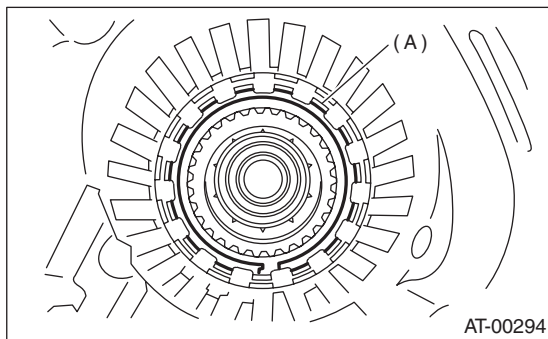
## AUTOMATIC TRANSMISSION

22) Pull out the leaf spring of the low & reverse brake while being careful not to bend it.



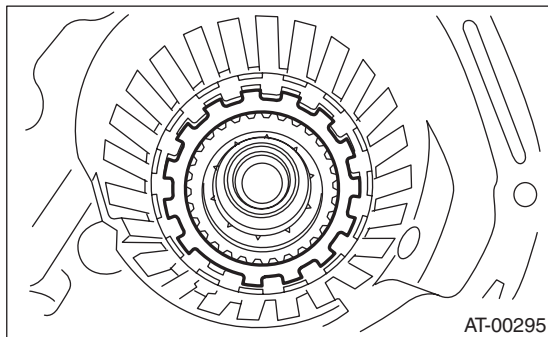
(A) Leaf spring

23) Remove the snap ring.

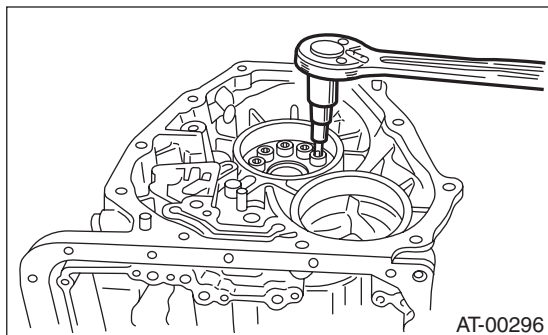


(A) Snap ring

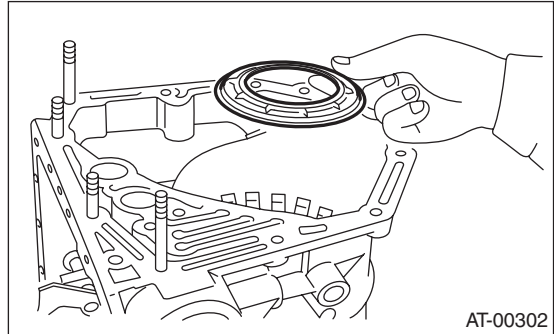
24) Take out the retaining plate, drive plate, driven plate and dish plate of the low & reverse brake.



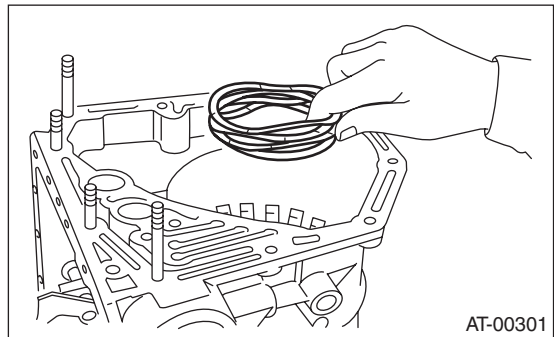
25) Turn the transmission case upside down, and then take out the socket bolts while holding the one-way clutch inner race by hand.



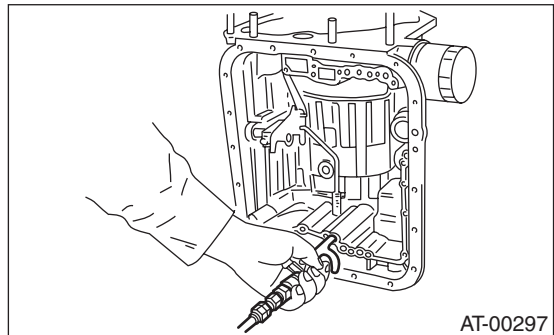
26) Remove the spring retainer.



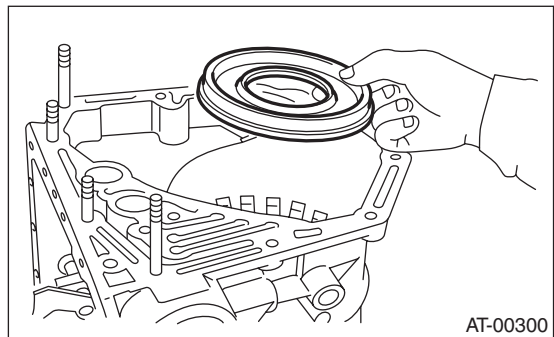
27) Take out the return spring.



28) Apply compressed air.



29) Take out the low & reverse brake piston.

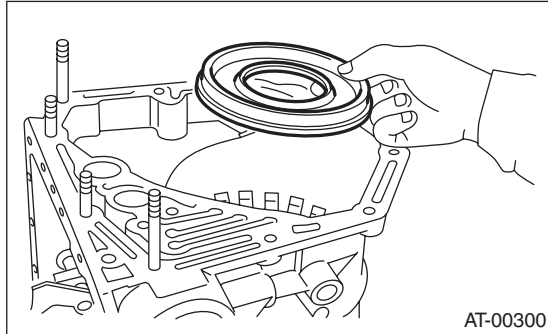


## B: INSTALLATION

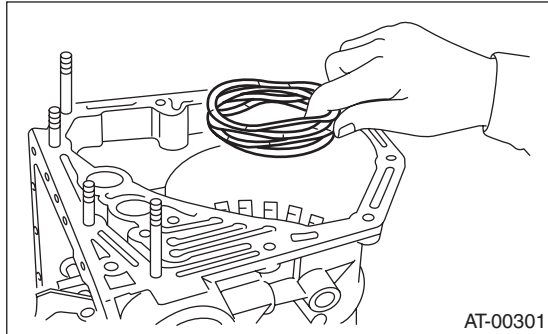
1) Install the low & reverse brake piston.

**NOTE:**

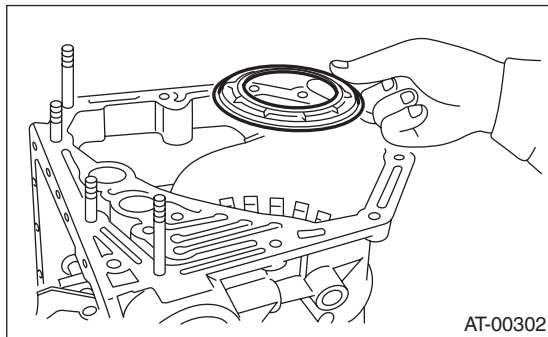
- Take care not to damage the lip seal.
- Apply ATF to the lip.



2) Install the return spring.



3) Install the spring retainer.

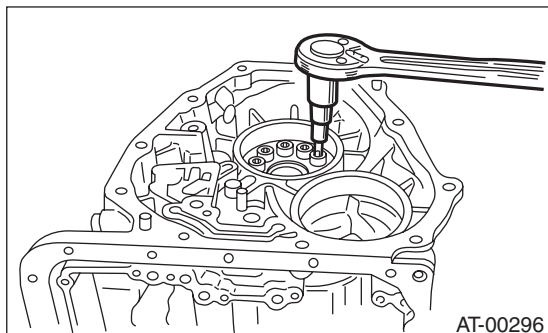


4) Install the one-way clutch inner race.

5) Tighten the socket head bolts evenly from the rear side of transmission case.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



6) Place the front side of transmission body up.

7) Install the thrust needle bearing.

8) Place the dish plate, driven plate, drive plate and retaining plate neatly in this order on surface table.

9) Set the micro gauge to retaining plate, and read its scale.

**NOTE:**

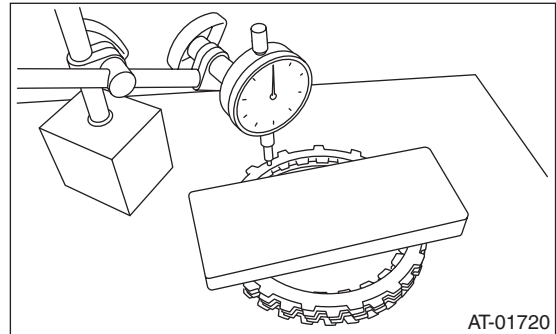
The value, which is read in the gauge at this time, is zero point.

10) Scale and record the weight "Z" of a flat board which will be put on retaining plate.

**NOTE:**

- Use a stiff board which does not bend against load as a flat board to be put on retaining plate.
- Use a flat board weighing less than 8.5 kgf (18.7 lb).

11) Put the flat board on retaining plate.



12) Using the following formula, read the push/pull gauge, and calculate "N".

$$N = 83 \text{ N (8.5 kgf, 18.7 lb)} - Z$$

N: Value indicated on push/pull gauge

83 N (8.5 kgf, 18.7 lb) : Load applied to clutch plate

Z: Flat board weight

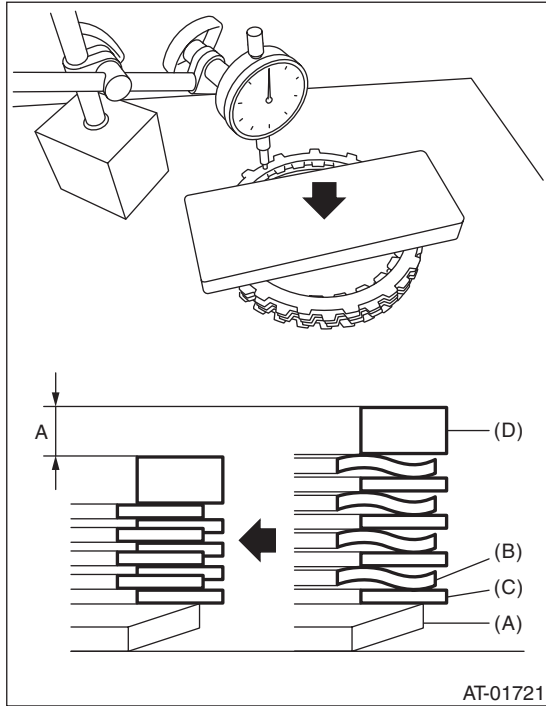
# AT Main Case

## AUTOMATIC TRANSMISSION

13) Press the center of retaining plate by applying a force of N using push/pull gauge, and then measure and record the height A. Measure at three or more locations spaced by equal distances and take the average value.

**NOTE:**

If measuring in three locations, measure every 120°. If measuring in four locations, measure every 90°.

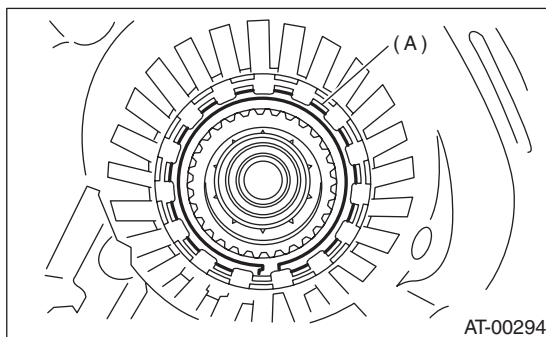


- (A) Dish plate
- (B) Driven plate
- (C) Drive plate
- (D) Retaining plate

14) Installation of the low & reverse brake:  
Install the dish plate, driven plate, drive plate and retaining plate, and then secure them with a snap ring.

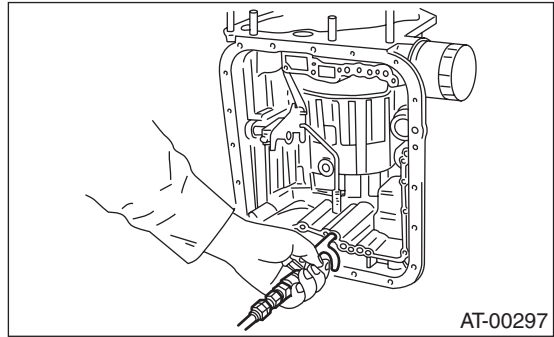
**NOTE:**

Pay attention to the orientation of the dish plate.



- (A) Snap ring

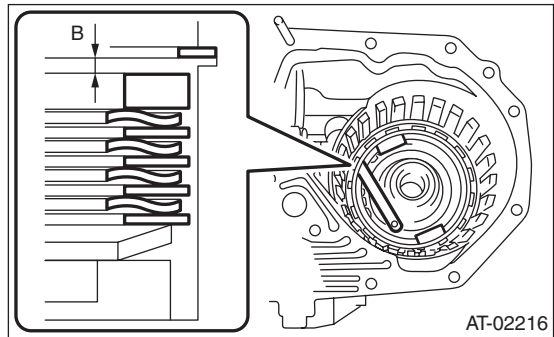
15) Apply compressed air intermittently to check for operation.



16) Place same thickness shims on both sides to prevent plate from tilting, then measure and record the clearance B.

**NOTE:**

Do not push in the shim down with force to a point where the waves on the drive plate will be crushed.



17) Piston stroke calculation

Calculate with A and B dimensions recorded before. If the calculated value exceeds the service limit, replace the drive plate with a new part and adjust it within the initial specification.

$$T = A + B$$

T: Piston stroke

A: Amount of drive plate compression

B: Clearance between retaining plate and snap ring

**Initial standard:**

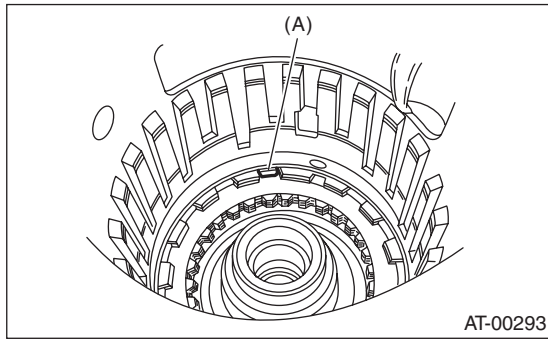
**2.15 — 2.65 mm (0.085 — 0.104 in)**

**Limit thickness:**

**2.95 mm (0.116 in)**

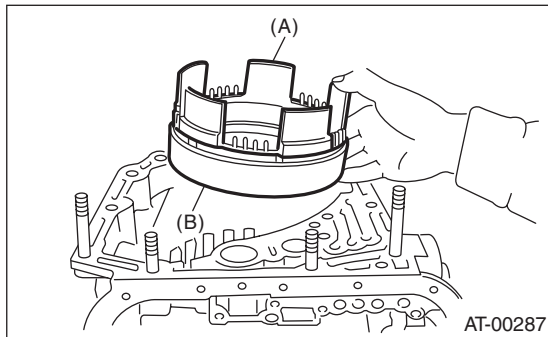
Retaining plate	
Part number	Thickness mm (in)
31667AA420	3.8 (0.150)
31667AA320	4.1 (0.161)
31667AA330	4.4 (0.173)
31667AA340	4.7 (0.185)
31667AA350	5.0 (0.197)
31667AA360	5.3 (0.209)
31667AA370	5.6 (0.220)
31667AA380	5.9 (0.232)

18) Install the leaf spring of the low & reverse brake.



(A) Leaf spring

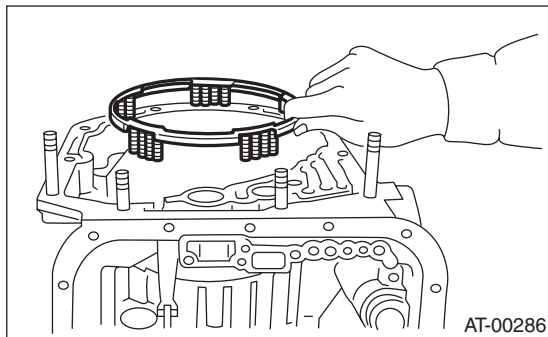
19) Install the 2-4 brake piston and 2-4 brake retainer by aligning the hole of the 2-4 brake retainer with the hole on the transmission case.



(A) 2-4 brake piston

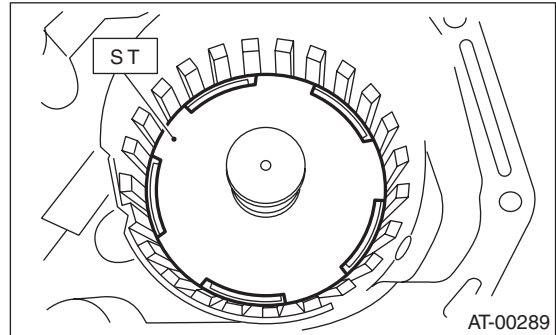
(B) 2-4 brake piston retainer

20) Install the 2-4 brake piston spring retainer to the transmission case.



21) Position the snap ring in the transmission. Using ST, press the snap ring into the specified location.

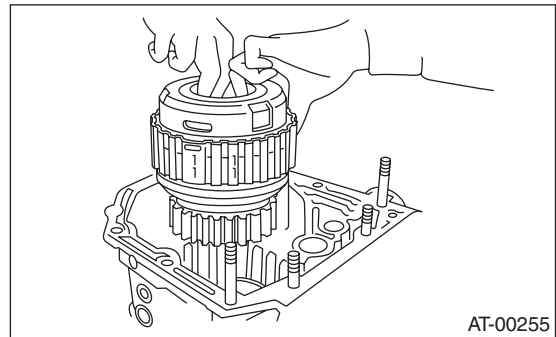
ST 498677100 COMPRESSOR



22) Install the planetary gear and low clutch assembly to the transmission case.

### CAUTION:

When installing while rotating the low clutch and planetary gear assembly, rotate slowly and be careful not to damage the seal ring.



23) Place the dish plate, driven plate, drive plate and retaining plate neatly in this order on surface table.

24) Set the micro gauge to retaining plate, and read its scale.

### NOTE:

The value, which is read in the gauge at this time, is zero point.

25) Scale and record the weight "Z" of a flat board which will be put on retaining plate.

### NOTE:

- Use a stiff board which does not bend against load as a flat board to be put on retaining plate.

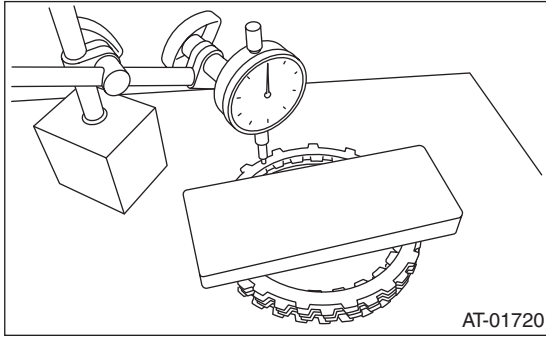
- Use a flat board weighing less than 10.2 kgf (22.5 lb).



# AT Main Case

## AUTOMATIC TRANSMISSION

26) Put the flat board on retaining plate.



27) Using the following formula, read the push/pull gauge, and calculate "N".

$$N = 100 N (10.2 \text{ kgf}, 22.5 \text{ lb}) - Z$$

N: Value indicated on push/pull gauge

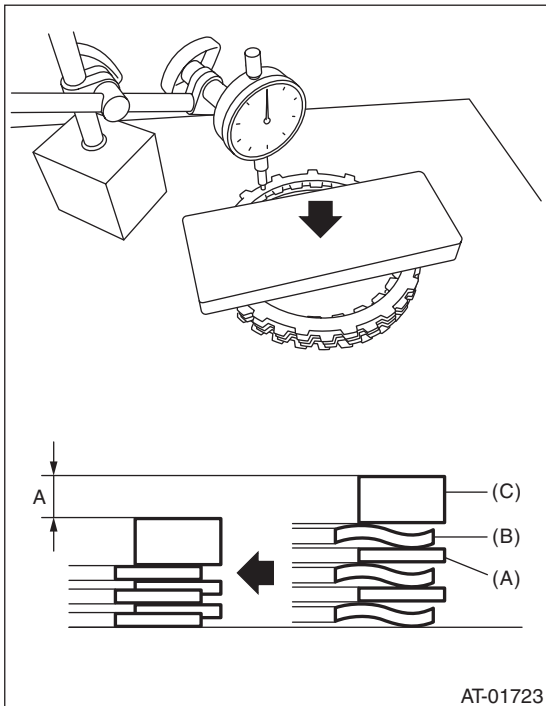
100 N (10.2 kgf, 22.5 lb) : Load applied to clutch plate

Z: Flat board weight

28) Press the center of retaining plate by applying a force of N using push/pull gauge, and then measure and record the height A. Measure at three or more locations spaced by equal distances and take the average value.

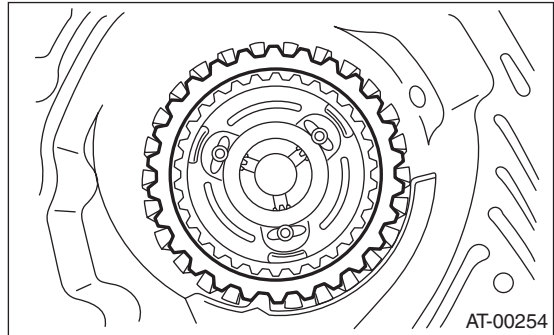
### NOTE:

If measuring in three locations, measure every 120°. If measuring in four locations, measure every 90°.

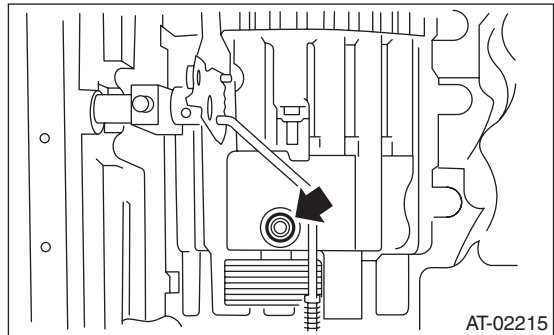


- (A) Driven plate
- (B) Drive plate
- (C) Retaining plate

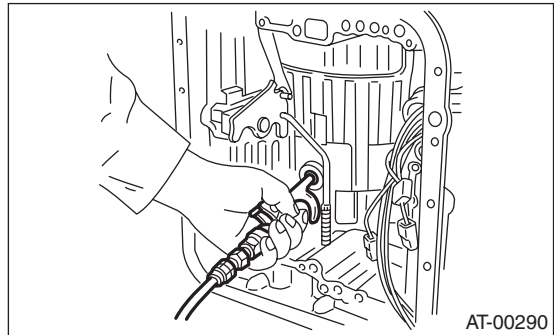
29) Install the pressure plate, drive plate, driven plate, retaining plate and snap ring.



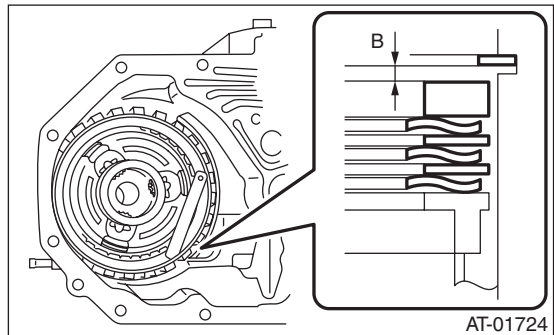
30) Install a new 2-4 brake oil seal to the transmission case.



31) After all 2-4 brake component parts have been installed, blow in air intermittently and confirm the operation of the brake.



32) Measure the clearance B between the retaining plate and snap ring.



### 33) Piston stroke calculation

Calculate with A and B dimensions recorded before. If the calculated value exceeds the service limit, replace the drive plate with a new part and adjust it within the initial specification.

$$T = A + B$$

T: Piston stroke

A: Amount of drive plate compression

B: Clearance between retaining plate and snap ring

#### Initial standard:

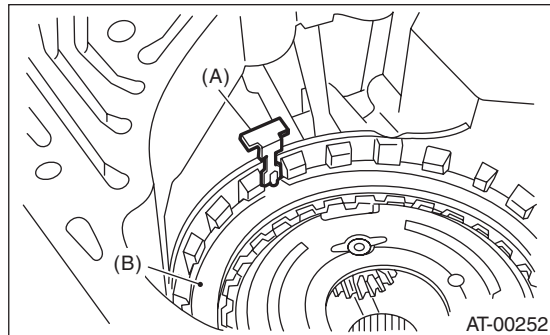
**1.7 — 2.1 mm (0.067 — 0.083 in)**

#### Limit thickness:

**2.3 mm (0.091 in)**

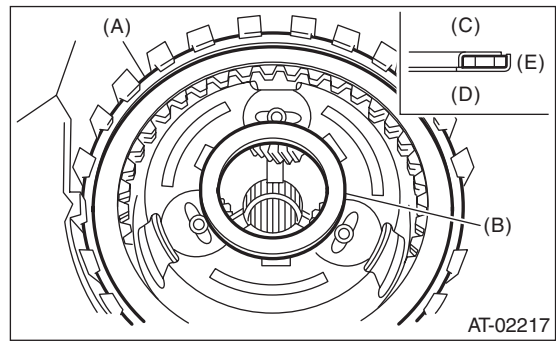
Retaining plate	
Part number	Thickness mm (in)
31567AA991	5.6 (0.220)
31567AB001	5.8 (0.228)
31567AB011	6.0 (0.236)
31567AB021	6.2 (0.244)
31567AB031	6.4 (0.252)
31567AB041	6.6 (0.260)

34) Be careful not to mistake the location of the leaf spring to be installed.



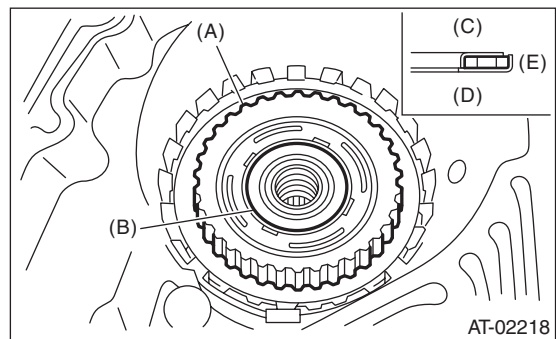
- (A) Leaf spring
- (B) Retaining plate

35) Install the thrust needle bearing in the correct direction.



- (A) Snap ring
- (B) Thrust needle bearing
- (C) Upside
- (D) Downside
- (E) Outside

36) Install the front sun gear and the thrust needle bearing.



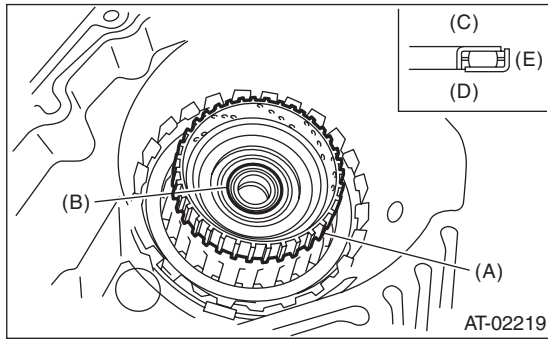
- (A) Front sun gear
- (B) Thrust needle bearing
- (C) Upside
- (D) Downside
- (E) Outside

37) Apply vaseline, and attach the thrust needle bearing to the high clutch hub, then engage the splines of the front planetary carrier correctly to install the high clutch hub.

# AT Main Case

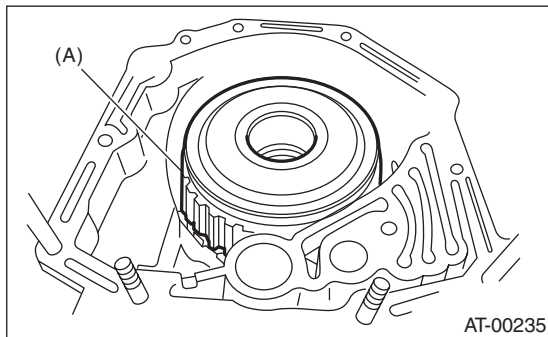
## AUTOMATIC TRANSMISSION

38) Install the thrust needle bearing in the correct direction.



- (A) High clutch hub
- (B) Thrust needle bearing
- (C) Upside
- (D) Downside
- (E) Outside

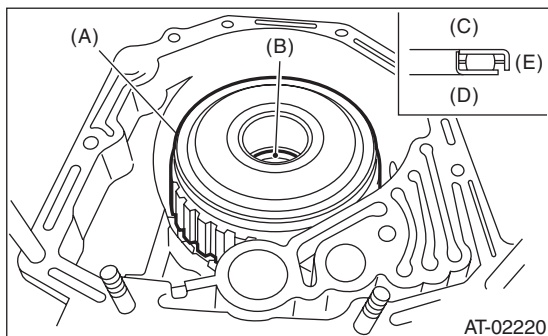
39) Install the high clutch and reverse clutch assembly.



- (A) High clutch and reverse clutch ASSY

40) Adjust the total end play. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

41) Install the thrust needle bearing in the correct direction.



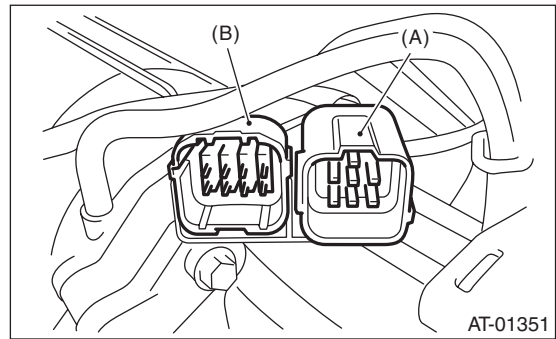
- (A) High clutch and reverse clutch ASSY
- (B) Thrust needle bearing
- (C) Upside
- (D) Downside
- (E) Outside

42) Install a new gasket along with the oil pump housing assembly. <Ref. to 4AT-92, INSTALLATION, Oil Pump Housing.>

43) Install the converter case to the transmission case assembly. <Ref. to 4AT-90, INSTALLATION, Converter Case.>

44) Insert the inhibitor switch and transmission harness connector to the stay.

45) Install the air breather hose. <Ref. to 4AT-68, INSTALLATION, Air Breather Hose.>



- (A) Transmission harness connectors
- (B) Inhibitor switch connector

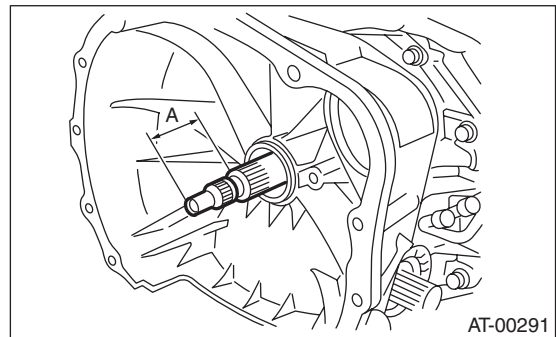
46) Install the ATF cooler pipe. <Ref. to 4AT-66, INSTALLATION, ATF Cooler Pipe and Hose.>

47) Install the oil charge pipe together with an O-ring. <Ref. to 4AT-69, INSTALLATION, Oil Charge Pipe.>

48) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

### Normal protrusion A:

**50 — 55 mm (1.97 — 2.17 in)**



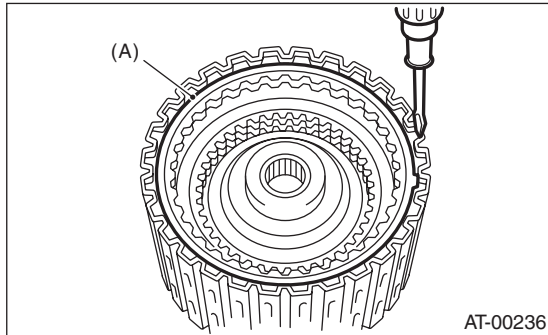
49) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>

50) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

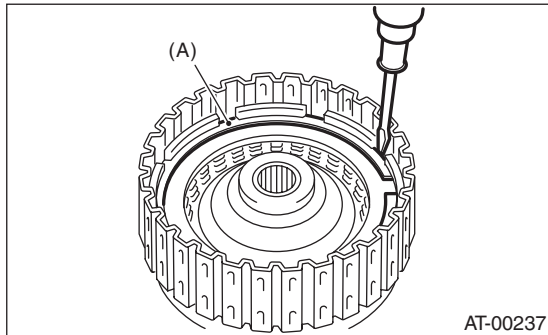
#### 1. HIGH CLUTCH AND REVERSE CLUTCH

1) Remove the snap ring, and then take out the retaining plate, drive plate and driven plate.



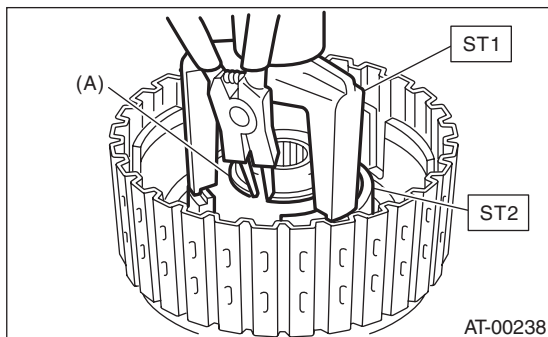
(A) Snap ring

2) Remove the snap ring, and then take out the retaining plate, drive plate and driven plate.



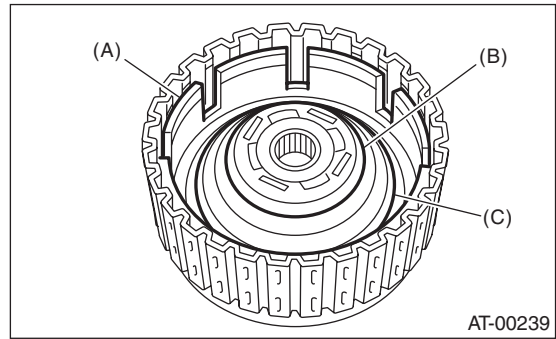
(A) Snap ring

3) Using the ST1 and ST2, remove the snap ring.  
 ST1 398673600 COMPRESSOR  
 ST2 498627100 SEAT



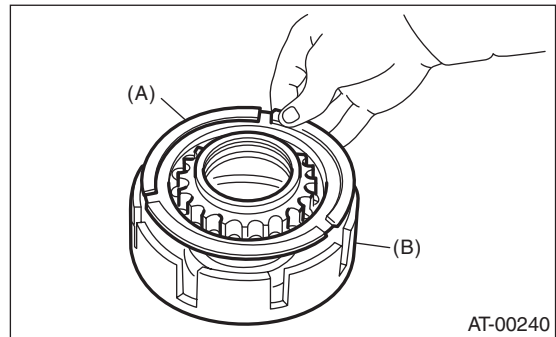
(A) Snap ring

4) Take out the clutch cover, spring retainer, high clutch piston and reverse clutch piston.



(A) Reverse clutch piston  
 (B) Clutch cover  
 (C) Return spring

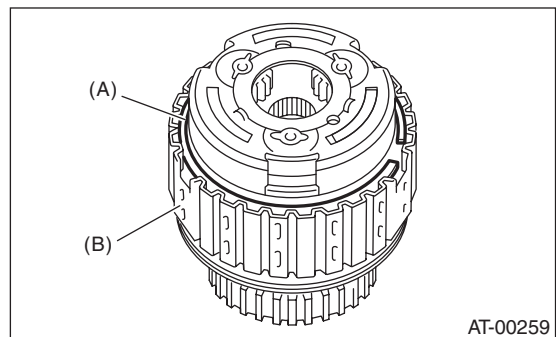
5) Remove the seal ring and lip seal from the high clutch piston and reverse clutch piston.



(A) High clutch piston  
 (B) Reverse clutch piston

#### 2. PLANETARY GEAR AND LOW CLUTCH

1) Remove the snap ring from low clutch drum.

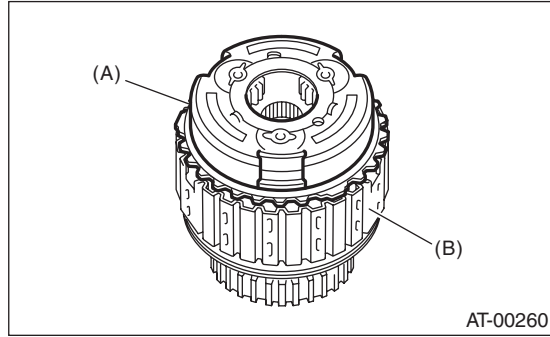


(A) Snap ring  
 (B) Low clutch drum

# AT Main Case

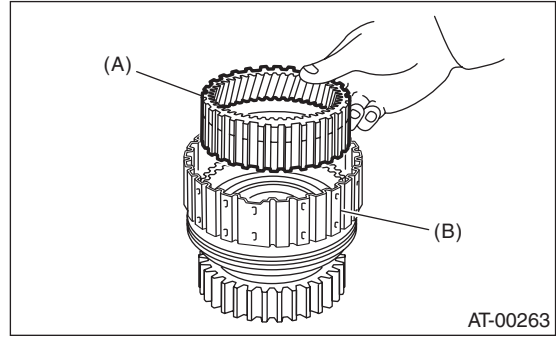
## AUTOMATIC TRANSMISSION

2) Take out the front planetary carrier.



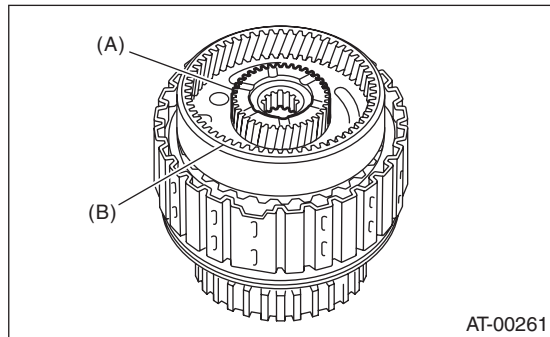
- (A) Front planetary carrier
- (B) Low clutch drum

5) Take out the rear internal gear.



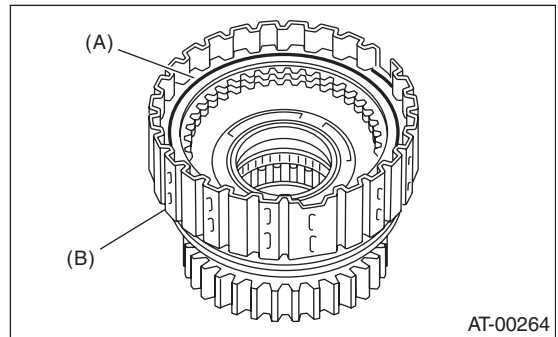
- (A) Rear internal gear
- (B) Low clutch drum

3) Take out the rear sun gear.



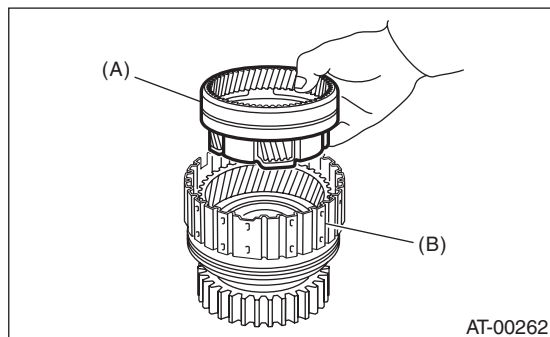
- (A) Rear sun gear
- (B) Rear planetary carrier

6) Remove the snap ring from low clutch drum.



- (A) Snap ring
- (B) Low clutch drum

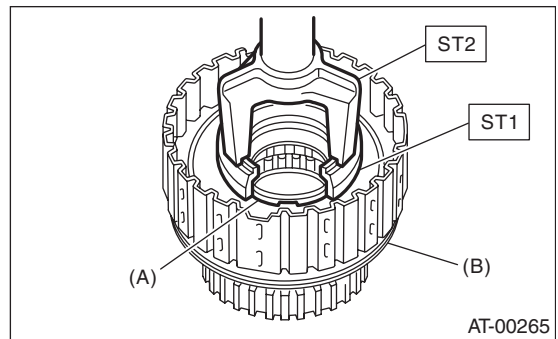
4) Take out the rear planetary carrier, washer and thrust needle bearing.



- (A) Rear planetary carrier
- (B) Low clutch drum

7) Compress the spring retainer of the low & reverse brake, and remove the snap ring from the low clutch drum using ST1 and ST2.

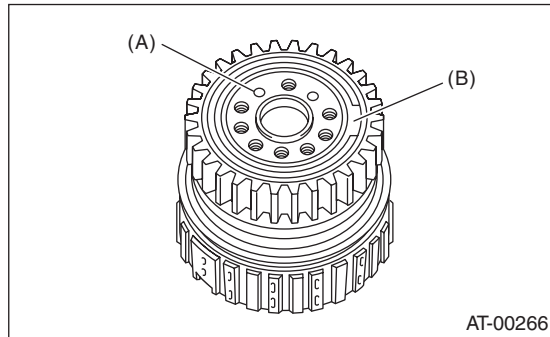
ST1 498627100 SEAT  
ST2 398673600 COMPRESSOR



- (A) Snap ring
- (B) Low clutch drum

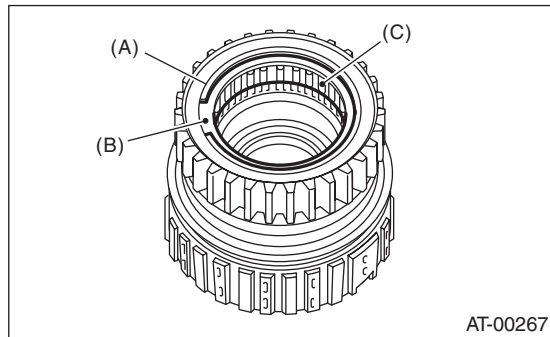
8) Remove the one-way clutch. <Ref. to 4AT-110, REMOVAL, AT Main Case.>

9) Install the one-way clutch inner race to the low clutch drum, and then apply compressed air to remove the low clutch piston.



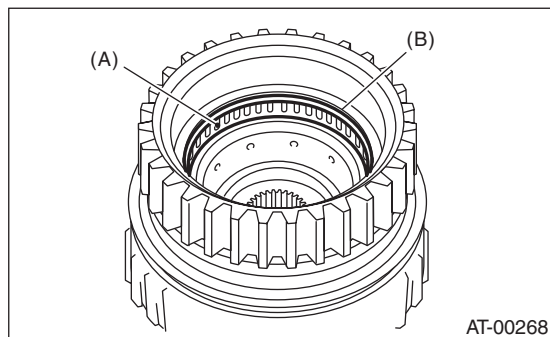
- (A) Apply compressed air.
- (B) One-way clutch inner race

10) Remove the one-way clutch inner race.  
11) Remove the one-way clutch after taking out the snap ring.



- (A) Snap ring
- (B) Plate
- (C) One-way clutch

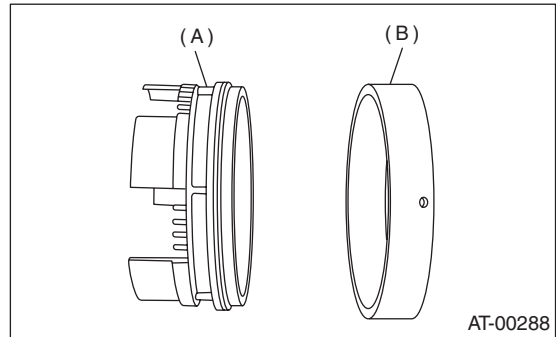
12) Remove the needle bearing after taking out the snap ring.



- (A) Needle bearing
- (B) Snap ring

### 3. 2-4 BRAKE

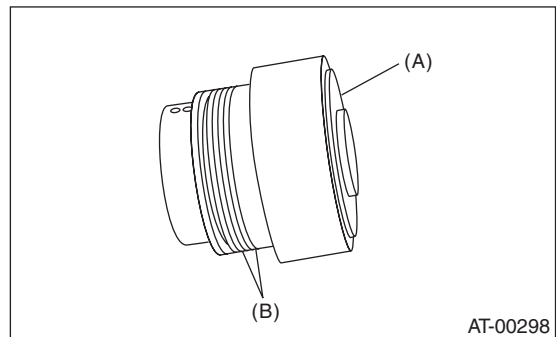
Separate the 2-4 brake piston and piston retainer.



- (A) 2-4 brake piston
- (B) 2-4 brake piston retainer

### 4. ONE-WAY CLUTCH INNER RACE

1) Remove the seal ring.

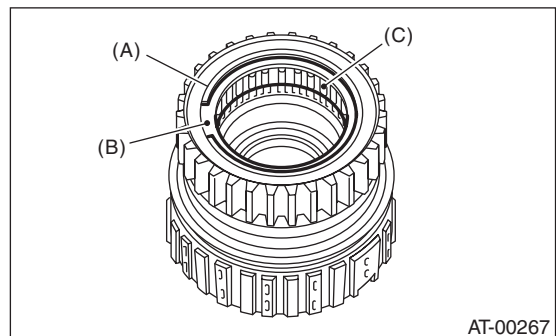


- (A) One-way clutch inner race
- (B) Seal ring

2) Remove the needle bearing using ST.  
ST 398527700 PULLER ASSY

### 5. ONE-WAY CLUTCH OUTER RACE

1) Remove the one-way clutch after taking out the snap ring.

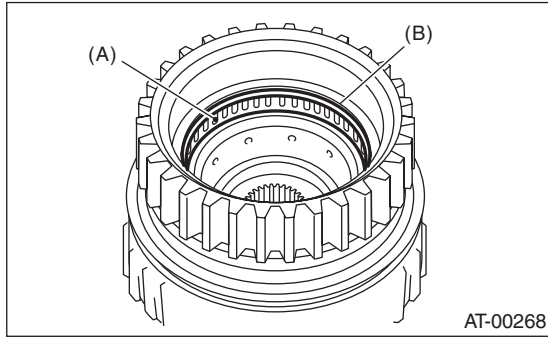


- (A) Snap ring
- (B) Plate
- (C) One-way clutch

# AT Main Case

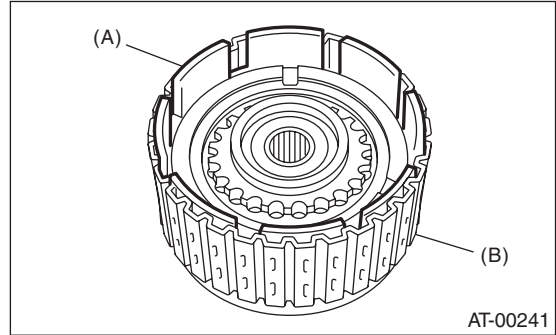
## AUTOMATIC TRANSMISSION

2) Remove the needle bearing after taking out the snap ring.



- (A) Needle bearing
- (B) Snap ring

3) Install the reverse clutch piston to the high clutch drum. Align the groove on reverse clutch piston with the groove on high clutch drum during installation.



- (A) Reverse clutch piston
- (B) High clutch drum

## D: ASSEMBLY

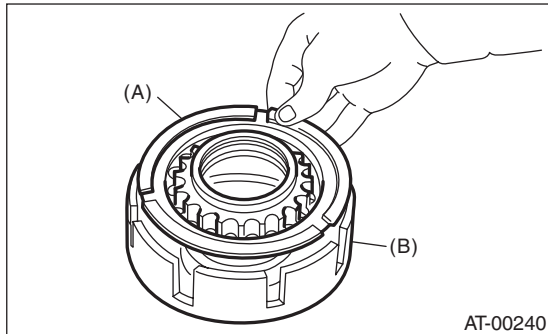
### 1. HIGH CLUTCH AND REVERSE CLUTCH

1) Install the seal ring and lip seal to the high clutch piston and reverse clutch piston.

2) Install the high clutch piston to the reverse clutch piston.

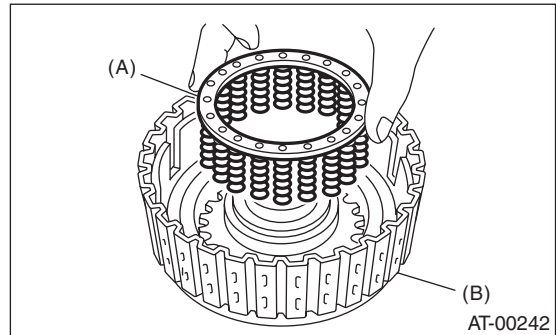
#### NOTE:

Do not damage the D-ring and lip seal.



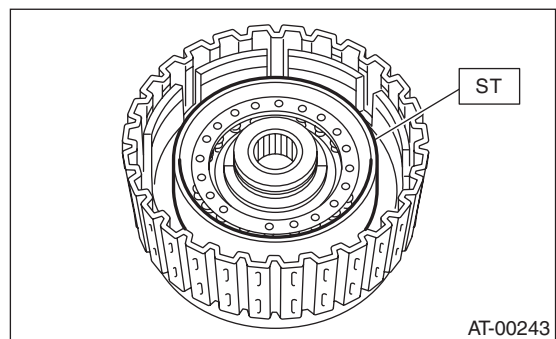
- (A) High clutch piston
- (B) Reverse clutch piston

4) Install the spring retainer to the high clutch piston.



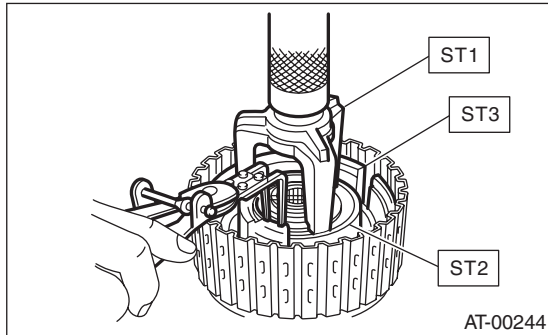
- (A) Spring retainer
- (B) High clutch drum

5) Attach the ST to the high clutch piston.  
ST 498437000 HIGH CLUTCH PISTON GUIDE



6) Install the high clutch piston cover while making sure not to bend the high clutch piston seal.

- 7) Install the snap ring using ST1 and ST2.  
 ST1 398673600 COMPRESSOR  
 ST2 498627100 SEAT  
 ST3 498437000 HIGH CLUTCH PISTON GUIDE



- 8) Place the dish plate, driven plate, drive plate and retaining plate neatly in this order on surface table.  
 9) Set the micro gauge to retaining plate, and read its scale.

**NOTE:**

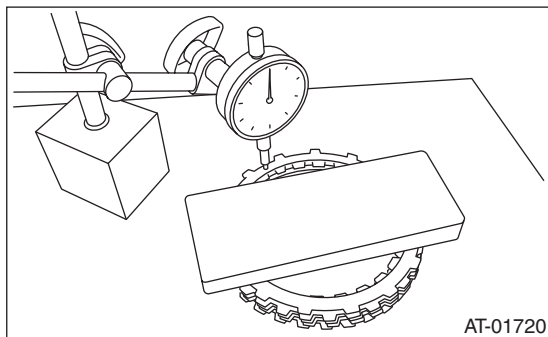
The value, which is read in the gauge at this time, is zero point.

- 10) Scale and record the weight "Z" of a flat board which will be put on retaining plate.

**NOTE:**

- Use a stiff board which does not bend against load as a flat board to be put on retaining plate.
- Use a flat board weighing less than 25.5 kgf (56.2 lb).

- 11) Put the flat board on retaining plate.



- 12) Using the following formula, read the push/pull gauge, and calculate "N".

$$N = 250 \text{ N (25.5 kgf, 56.2 lb)} - Z$$

N: Value indicated on push/pull gauge

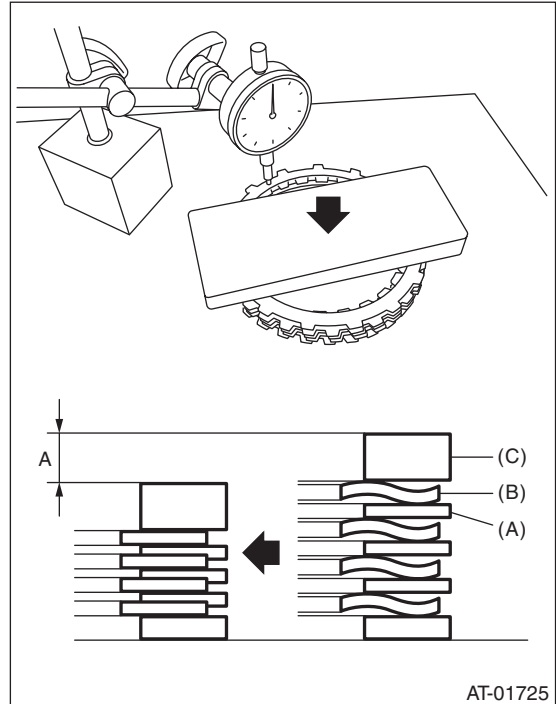
250 N (25.5 kgf, 56.2 lb) : Load applied to clutch plate

Z: Flat board weight

- 13) Press the center of retaining plate by applying a force of N using push/pull gauge, and then measure and record the height A. Measure at three or more locations spaced by equal distances and take the average value.

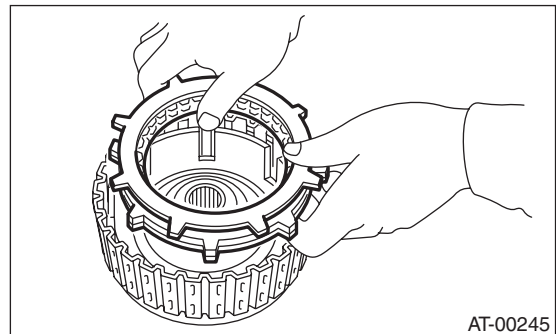
**NOTE:**

If measuring in three locations, measure every 120°. If measuring in four locations, measure every 90°.



- (A) Driven plate  
 (B) Drive plate  
 (C) Retaining plate

- 14) Install the thickest driven plate to piston side, and then install the driven plate, drive plate, retaining plate to high clutch drum.



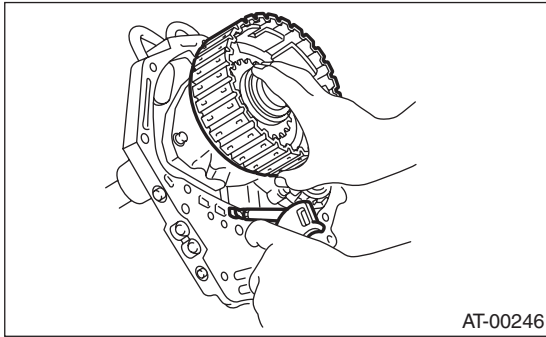
- 15) Install the snap ring to high clutch drum.



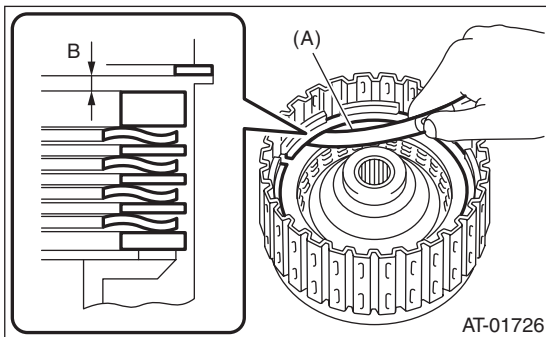
# AT Main Case

## AUTOMATIC TRANSMISSION

16) Apply compressed air intermittently to check for operation.



17) Measure and record the clearance B between the retaining plate and snap ring. (High clutch)  
At this time, do not press down the retaining plate.



(A) Thickness gauge

18) Piston stroke calculation

Calculate with A and B dimensions recorded before. If the calculated value exceeds the service limit, replace the drive plate with a new part and adjust it within the initial specification.

$$T = A + B$$

T: Piston stroke

A: Amount of drive plate compression

B: Clearance between retaining plate and snap ring

**Initial standard:**

**2.0 — 2.3 mm (0.079 — 0.091 in)**

**Limit thickness:**

**2.6 mm (0.102 in)**

High clutch retaining plate	
Part number	Thickness mm (in)
31567AA710	4.7 (0.185)
31567AA720	4.8 (0.189)
31567AA730	4.9 (0.193)
31567AA740	5.0 (0.197)
31567AA670	5.1 (0.201)
31567AA680	5.2 (0.205)
31567AA690	5.3 (0.209)
31567AA700	5.4 (0.213)

19) Place the dish plate, driven plate, drive plate and retaining plate neatly in this order on surface table.

20) Set the micro gauge to retaining plate, and read its scale.

**NOTE:**

The value, which is read in the gauge at this time, is zero point.

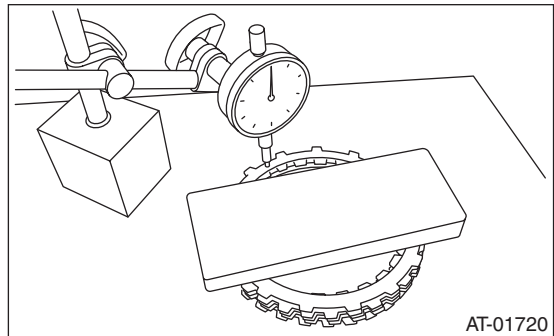
21) Scale and record the weight "Z" of a flat board which will be put on retaining plate.

**NOTE:**

- Use a stiff board which does not bend against load as a flat board to be put on retaining plate.

- Use a flat board weighing less than 15.3 kgf (33.7 lb).

22) Put the flat board on retaining plate.



23) Using the following formula, read the push/pull gauge, and calculate "N".

$$N = 150 \text{ N (15.3 kgf, 33.7 lb)} - Z$$

N: Value indicated on push/pull gauge

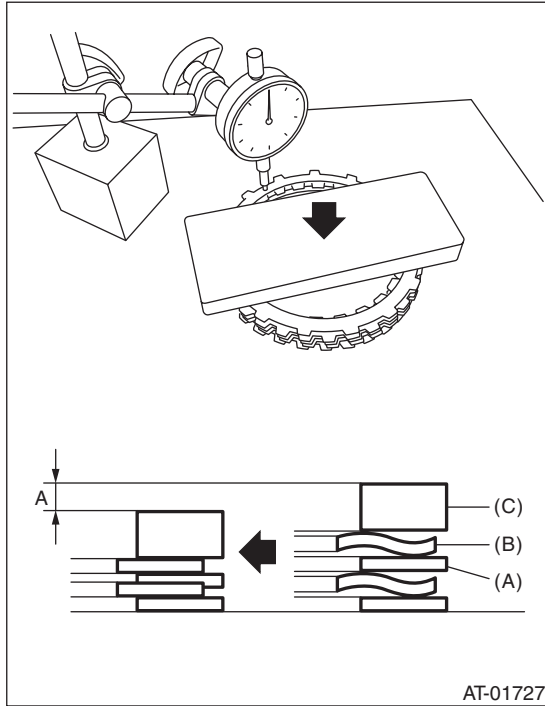
150 N (15.3 kgf, 33.7 lb) : Load applied to clutch plate

Z: Flat board weight

24) Press the center of retaining plate by applying a force of N using push/pull gauge, and then measure and record the height A. Measure at three or more locations spaced by equal distances and take the average value.

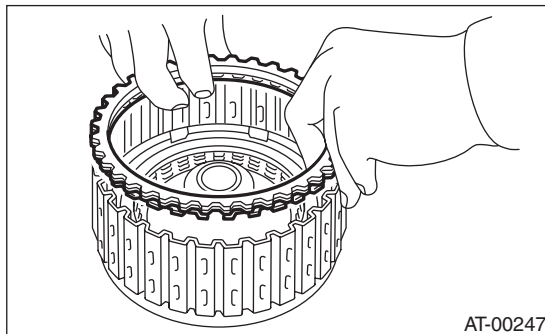
**NOTE:**

If measuring in three locations, measure every 120°. If measuring in four locations, measure every 90°.

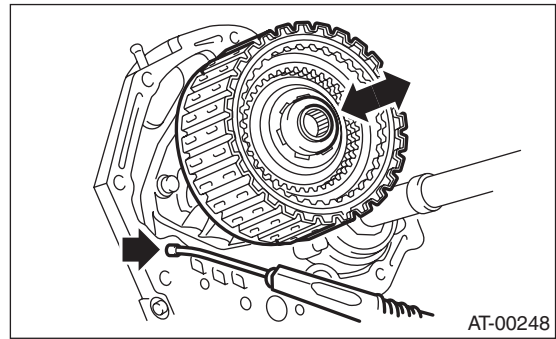


- (A) Driven plate
- (B) Drive plate
- (C) Retaining plate

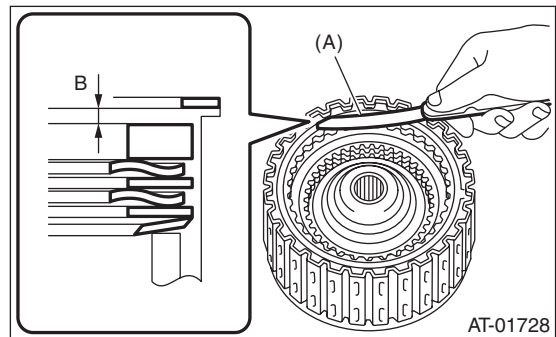
25) Install the driven plate, drive plate, retaining plate and snap ring.



26) Apply compressed air intermittently to check for operation.



27) Measure and record the clearance B between the retaining plate and snap ring. (Reverse clutch) At this time, do not press down the retaining plate.



(A) Thickness gauge

28) Piston stroke calculation

Calculate with A and B dimensions recorded before. If the calculated value exceeds the service limit, replace the drive plate with a new part and adjust it within the initial specification.

$$T = A + B$$

T: Piston stroke

A: Amount of drive plate compression

B: Clearance between retaining plate and snap ring

**Initial standard:**

**1.1 — 1.4 mm (0.043 — 0.055 in)**

**Limit thickness:**

**1.6 mm (0.063 in)**

Reverse clutch retaining plate	
Part number	Thickness mm (in)
31567AA910	4.0 (0.157)
31567AA920	4.2 (0.165)
31567AA930	4.4 (0.173)
31567AA940	4.6 (0.181)
31567AA950	4.8 (0.189)
31567AA960	5.0 (0.197)
31567AA970	5.2 (0.205)
31567AA980	5.4 (0.213)

# AT Main Case

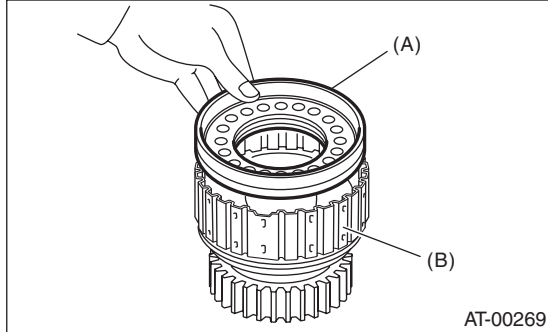
## AUTOMATIC TRANSMISSION

### 2. PLANETARY GEAR AND LOW CLUTCH

- 1) Apply ATF to a new D-ring, and install it to the low clutch piston.
- 2) Install the low clutch piston to low clutch drum.

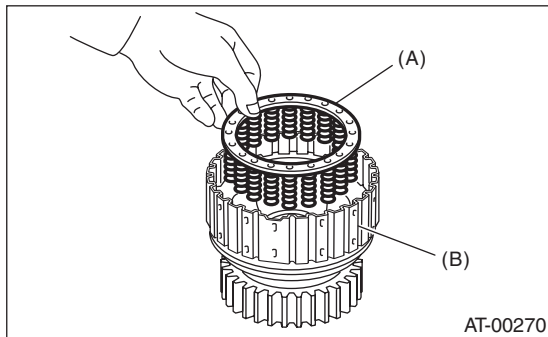
NOTE:

Do not damage the D-ring.



- (A) Low clutch piston
- (B) Low clutch drum

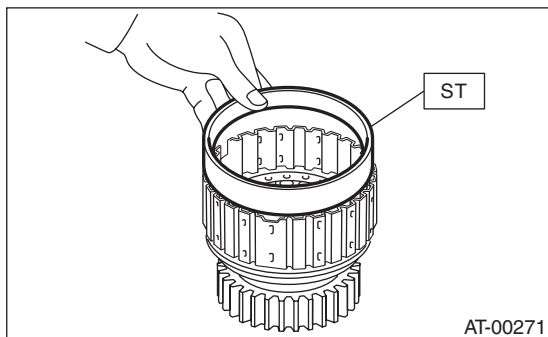
- 3) Install the spring retainer to low clutch piston.



- (A) Spring retainer
- (B) Low clutch drum

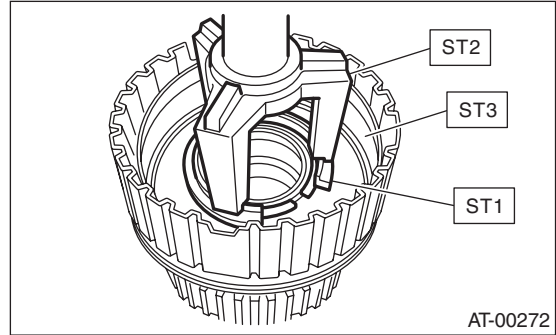
- 4) Attach the ST to the low clutch drum.

ST 498437100 LOW CLUTCH PISTON GUIDE

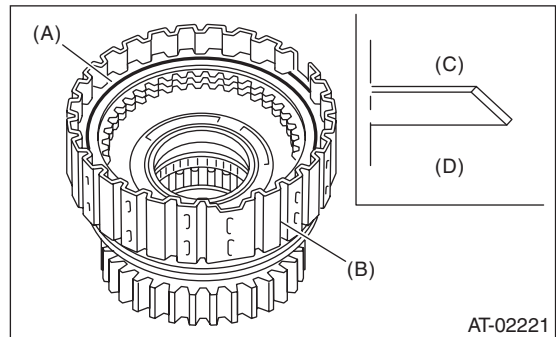


- 5) Using ST1 and ST2, set the cover on the piston and press against it, and attach the snap ring. At this time, be careful not to bend the cover seal.

ST1 498627100 SEAT  
ST2 398673600 COMPRESSOR  
ST3 498437100 LOW CLUTCH PISTON GUIDE



- 6) Install the dish plate, driven plate, drive plate and retaining plate, and then secure them with a snap ring.

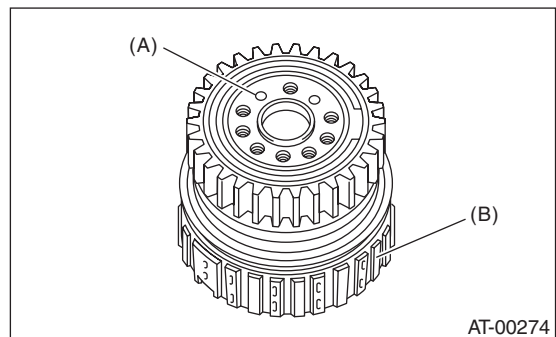


- (A) Snap ring
- (B) Low clutch drum
- (C) Dish plate
- (D) Low clutch piston side

- 7) Check the low clutch for operation.

(1) Remove the one-way clutch. <Ref. to 4AT-110, REMOVAL, AT Main Case.>

(2) Set the one-way clutch inner race, and apply compressed air for checking.



- (A) Apply compressed air.
- (B) Low clutch drum

### 8) Check the low clutch clearance.

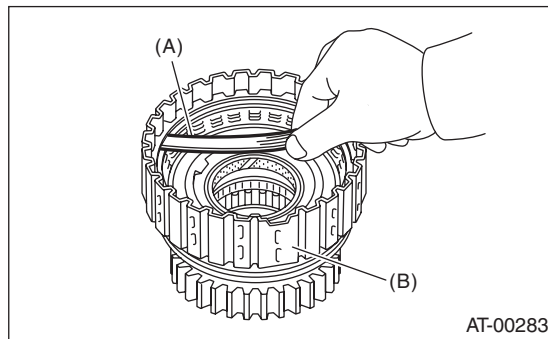
- (1) Place same thickness shims on both sides to prevent plate from tilting.
- (2) Check the clearance between retaining plate and low clutch operation.

**Initial standard:**

**0.7 — 1.1 mm (0.028 — 0.043 in)**

**Limit thickness:**

**1.6 mm (0.063 in)**

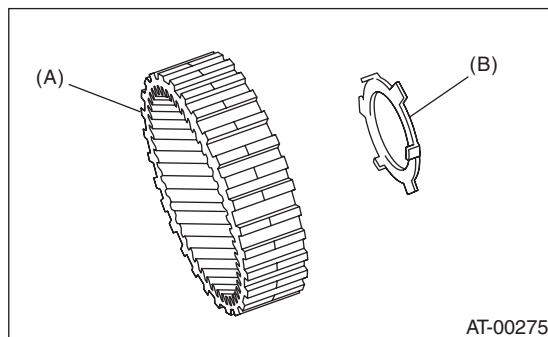


- (A) Thickness gauge
- (B) Low clutch drum

If the clearance exceeds the service limits, replace the drive plate and select and adjust the retaining plate to within default standard values.

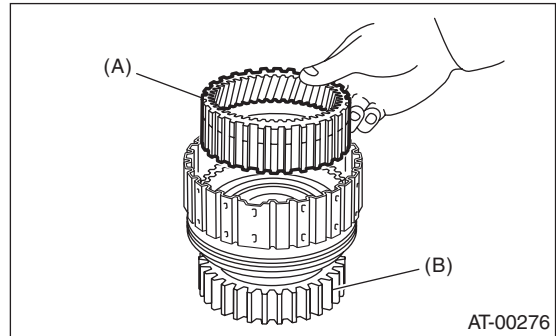
Retaining plate	
Part number	Thickness mm (in)
31567AB050	3.8 (0.150)
31567AB060	4.0 (0.157)
31567AB070	4.2 (0.165)
31567AB080	4.4 (0.173)
31567AB090	4.6 (0.181)

### 9) Install the washer to the rear internal gear.



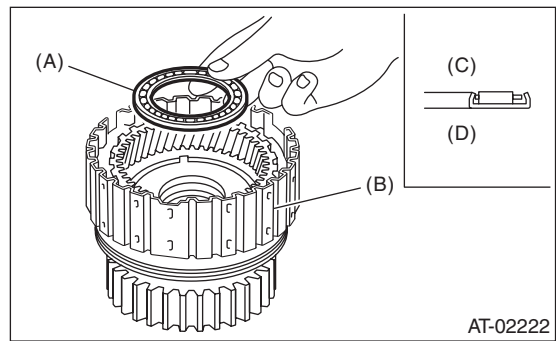
- (A) Rear internal gear
- (B) Washer

### 10) Install the rear internal gear.



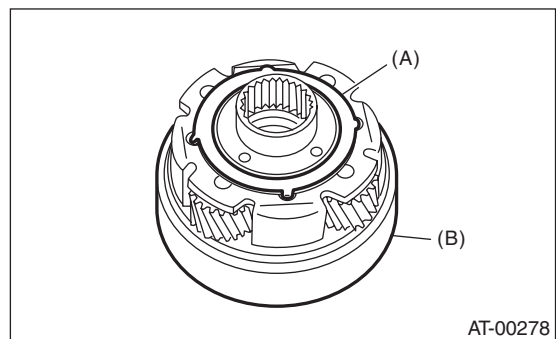
- (A) Rear internal gear
- (B) Low clutch drum

### 11) Install the thrust needle bearing in the correct direction.



- (A) Thrust needle bearing
- (B) Low clutch drum
- (C) Rear planetary, carrier side
- (D) Low clutch piston side

### 12) Install the washer by aligning the protrusion of the washer with the hole of the rear planetary carrier.

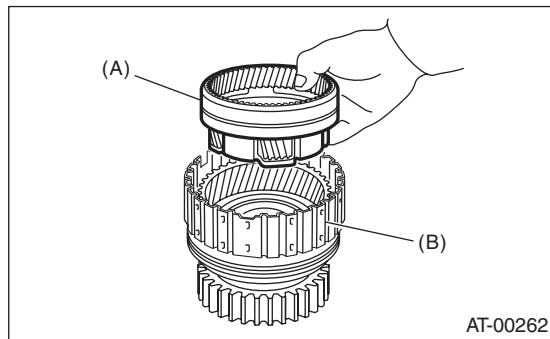


- (A) Washer
- (B) Rear planetary carrier

# AT Main Case

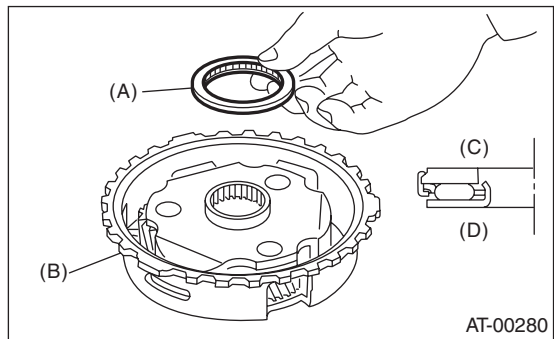
## AUTOMATIC TRANSMISSION

13) Install the rear planetary carrier to the low clutch drum.



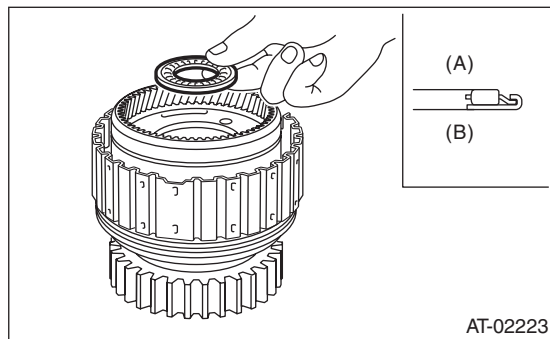
- (A) Rear planetary carrier
- (B) Low clutch drum

16) Install the thrust needle bearing in the proper direction.



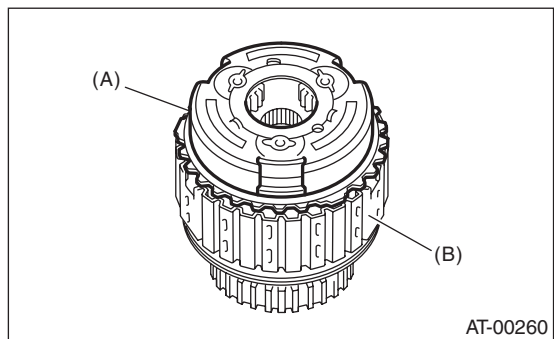
- (A) Thrust needle bearing
- (B) Front planetary carrier
- (C) Rear sun, gear side
- (D) Front planetary carrier side

14) Install the thrust needle bearing in the correct direction.



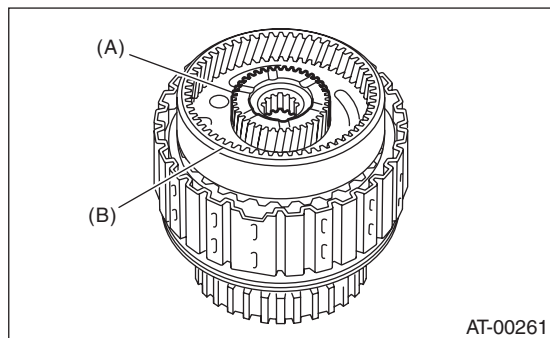
- (A) Rear sun gear side
- (B) Rear planetary carrier side

17) Install the front planetary carrier to the low clutch drum.



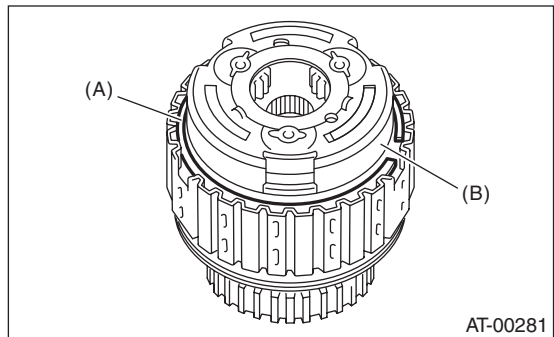
- (A) Front planetary carrier
- (B) Low clutch drum

15) Install the rear sun gear in the correct direction.



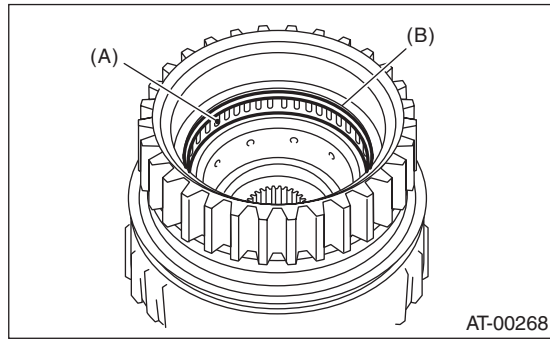
- (A) Rear sun gear
- (B) Rear planetary carrier

18) Install the snap ring to the low clutch drum.



- (A) Snap ring
- (B) Front planetary carrier

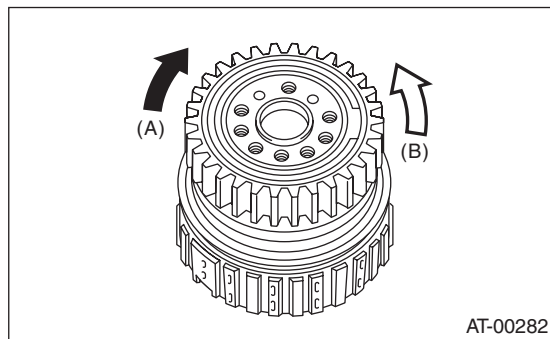
19) Install the needle bearing, and then secure with the snap ring.



- (A) Needle bearing
- (B) Snap ring

20) Install the one-way clutch and one-way clutch inner race, then secure with the snap ring.

21) Set the inner race. Make sure that the clutch locks in the clockwise direction and rotates freely in the counterclockwise direction.



- (A) Lock
- (B) Free

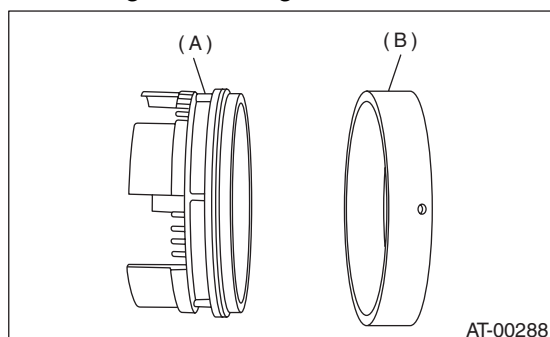
### 3. 2-4 BRAKE

1) Apply ATF to the new D-ring, then install to the 2-4 brake piston.

2) Install 2-4 brake piston to 2-4 brake piston retainer.

NOTE:

Do not damage the D-ring.

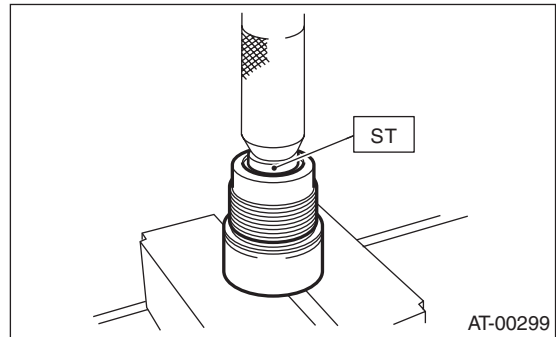


- (A) 2-4 brake piston
- (B) 2-4 brake piston retainer

### 4. ONE-WAY CLUTCH INNER RACE

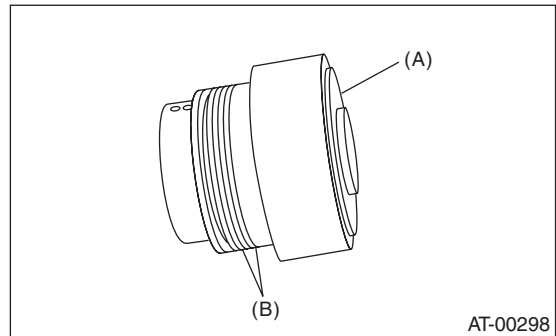
1) Install the needle bearing to inner race using ST and a press.

ST 398497701 SEAT



2) Apply vaseline to the groove of the inner race and to the new seal ring.

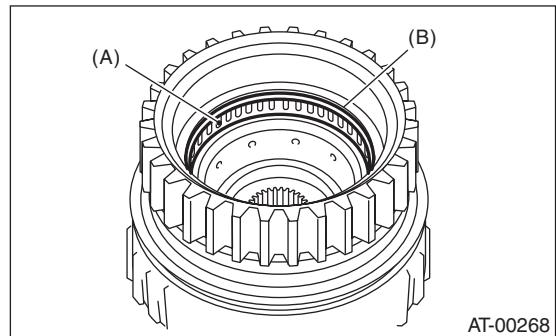
3) Install two seal rings to the one-way clutch inner race.



- (A) One-way clutch inner race
- (B) Seal ring

### 5. ONE-WAY CLUTCH OUTER RACE

1) Install the needle bearing, and then secure with the snap ring.

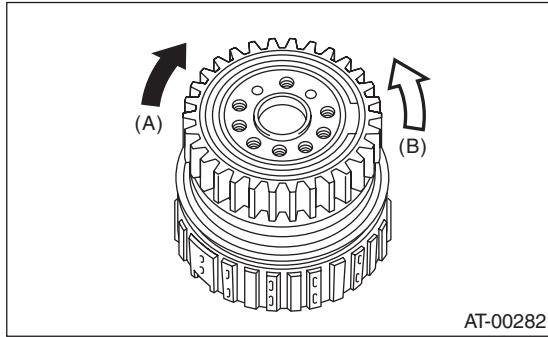


- (A) Needle bearing
- (B) Snap ring

2) Install the one-way clutch, and then secure with the snap ring.

## AUTOMATIC TRANSMISSION

3) Set the inner race. Make sure that the clutch locks in the clockwise direction and rotates freely in the counterclockwise direction.



(A) Lock

(B) Free

## 5. LOW & REVERSE BRAKE

Check the following items.

- Drive plate facing for wear or damage
- Driven plate for discoloration (burned color)
- Snap ring wear, leaf spring setting and breakage, and spring retainer deformation
- Lip seal wear and damage

## E: INSPECTION

### 1. HIGH CLUTCH AND REVERSE CLUTCH

Check the following items.

- Drive plate facing for wear or damage
- Driven plate for discoloration (burned color)
- Snap ring wear and spring retainer deformation
- Wear and damage of the lip seal and D-ring
- Piston and piston check ball operation
- Adjust the total end play. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

### 2. PLANETARY GEAR AND LOW CLUTCH

Check the following items.

- Drive plate facing for wear or damage
- Driven plate for discoloration (burned color)
- Snap ring wear and spring retainer deformation
- Wear and damage of the lip seal and D-ring
- Measure the total end play and adjust it to be within specifications. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

### 3. 2-4 BRAKE

Check the following items.

- Drive plate facing for wear or damage
- Driven plate for discoloration (burned color)
- Snap ring wear, leaf spring setting and breakage, and spring retainer deformation
- Wear and damage of the lip seal and D-ring
- Measure the total end play and adjust it to be within specifications. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

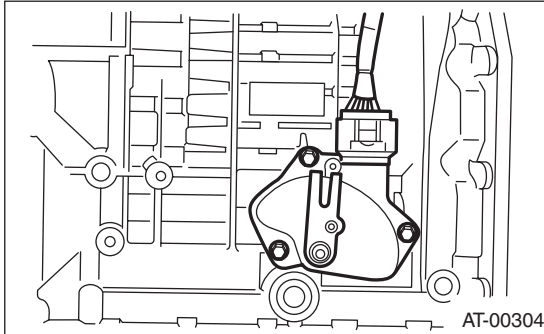
### 4. ONE-WAY CLUTCH

- Check that the snap ring is not damaged and the seal ring is not deformed.
- Measure the total end play and adjust it to be within specifications. <Ref. to 4AT-96, ADJUSTMENT, Oil Pump Housing.>

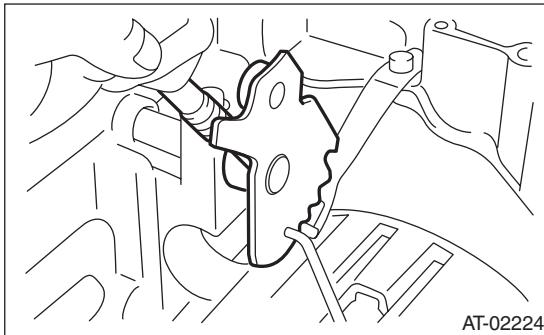
## 39. Transmission Control Device

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 4AT-36, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 4AT-70, REMOVAL, Torque Converter Assembly.>
- 3) Remove the input shaft.
- 4) Lift up the lever on the rear side of transmission harness connector, and then remove it from the stay.
- 5) Disconnect the air breather hose. <Ref. to 4AT-68, REMOVAL, Air Breather Hose.>
- 6) Remove the inhibitor switch connector from the stay.
- 7) Wrap vinyl tape around the nipple attached to the air breather hose.
- 8) Remove the pitching stopper bracket.
- 9) Remove the inhibitor switch.



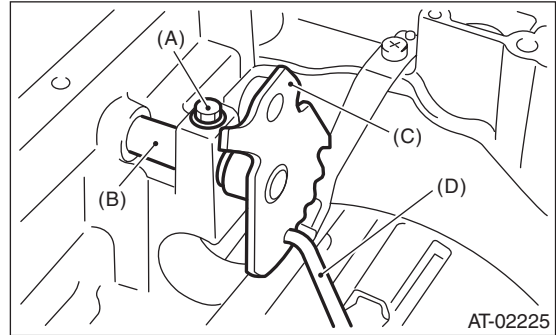
- 10) Remove the control valve body assembly. <Ref. to 4AT-58, REMOVAL, Control Valve Body.>
- 11) Pull out the straight pin of manual plate.



- 12) Remove the bolts securing select lever, and then remove the select lever, manual plate and parking rod.

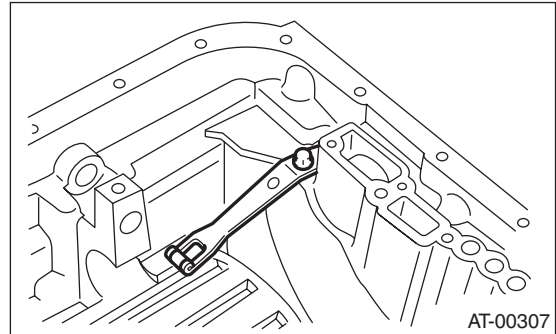
### NOTE:

Be careful not to damage the lips of press-fitted oil seal in the case.



- (A) Bolt
- (B) Range select lever
- (C) Manual plate
- (D) Parking rod

- 13) Remove the detention spring.

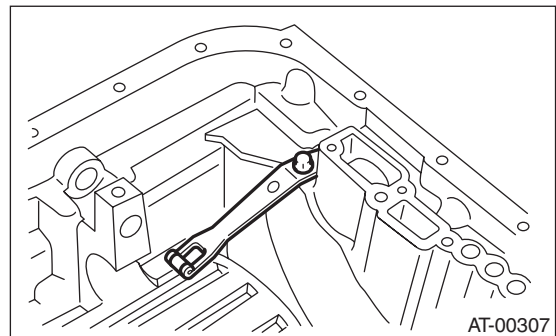


### B: INSTALLATION

- 1) Install the detention spring to the transmission case.

#### Tightening torque:

**6 N·m (0.6 kgf·m, 4.4 ft·lb)**





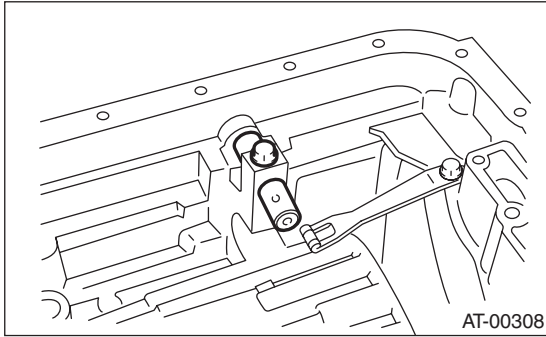
# Transmission Control Device

## AUTOMATIC TRANSMISSION

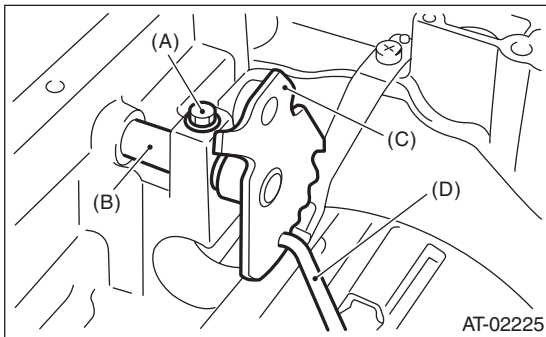
2) Insert the range select lever, then tighten the bolts.

**Tightening torque:**

**6 N·m (0.6 kgf·m, 4.4 ft·lb)**

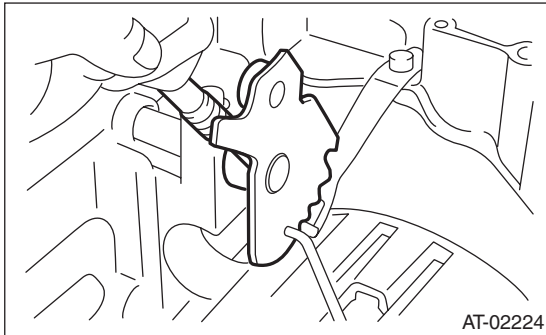


3) Insert the manual plate and parking rod.



- (A) Bolt
- (B) Range select lever
- (C) Manual plate
- (D) Parking rod

4) Insert a new straight pin to manual plate.



5) Install the oil pan and the control valve assembly. <Ref. to 4AT-59, INSTALLATION, Control Valve Body.>

6) Turn over the transmission case to its original position.

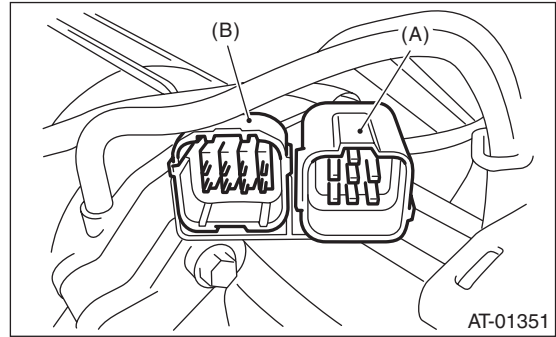
7) Install the pitching stopper bracket.

**Tightening torque:**

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

8) Install and adjust the inhibitor switch. <Ref. to 4AT-47, Inhibitor Switch.>

9) Insert the inhibitor switch and transmission harness connector to the stay.



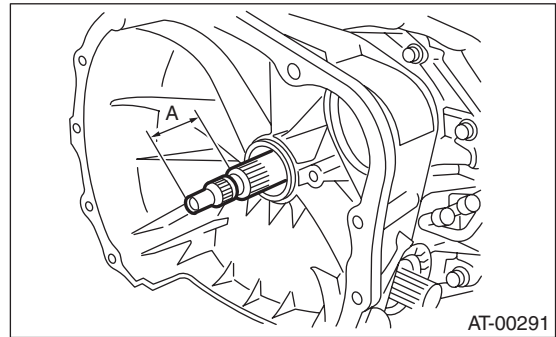
- (A) Transmission harness connectors
- (B) Inhibitor switch connector

10) Install the air breather hose. <Ref. to 4AT-68, INSTALLATION, Air Breather Hose.>

11) Insert the input shaft while rotating it lightly by hand, and then check the amount of protrusion.

**Normal protrusion A:**

**50 — 55 mm (1.97 — 2.17 in)**



12) Install the torque converter assembly. <Ref. to 4AT-70, INSTALLATION, Torque Converter Assembly.>

13) Install the transmission assembly to the vehicle. <Ref. to 4AT-39, INSTALLATION, Automatic Transmission Assembly.>

### C: INSPECTION

Make sure that the manual lever and detention spring are not worn or otherwise damaged.

# Basic Diagnostic Procedure

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

	Step	Check	Yes	No
1	<p><b>CHECK PRE-INSPECTION.</b></p> <p>1) Ask the customer when and how the trouble occurred using the interview check list. &lt;Ref. to 4AT(diag)-4, Check List for Interview.&gt;</p> <p>2) Before performing diagnosis, inspect the following items which may influence AT problems.</p> <ul style="list-style-type: none"> <li>• General Inspection &lt;Ref. to 4AT(diag)-5, INSPECTION, General Description.&gt;</li> <li>• Disconnection of harness connector</li> <li>• Visual check for harness damage</li> <li>• Oil leakage</li> <li>• Stall speed test &lt;Ref. to 4AT-32, Stall Test.&gt;</li> <li>• Line pressure test &lt;Ref. to 4AT-34, Line Pressure Test.&gt;</li> <li>• Transfer clutch pressure test &lt;Ref. to 4AT-35, Transfer Clutch Pressure Test.&gt;</li> <li>• Time lag test &lt;Ref. to 4AT-33, Time Lag Test.&gt;</li> <li>• Road test &lt;Ref. to 4AT-31, Road Test.&gt;</li> <li>• Inhibitor switch &lt;Ref. to 4AT-47, Inhibitor Switch.&gt;</li> </ul>	Is the unit that is thought to influence the AT problem working properly?	Go to step 2.	Repair or replace each item.
2	<p><b>ATF TEMPERATURE WARNING LIGHT INSPECTION.</b></p> <p>Start the engine and wait for 2 seconds or more.</p>	Is the ATF temperature warning light blinking?	Go to step 4.	Go to step 3.
3	<p><b>ATF TEMPERATURE WARNING LIGHT INSPECTION.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Check the ATF temperature warning light. &lt;Ref. to 4AT(diag)-23, INSPECTION, AT Oil Temp Warning Light Display.&gt;</p> <p>3) Turn the ignition switch to ON and wait for at least 2 seconds.</p> <p>4) Start the engine.</p>	Is the ATF temperature warning light blinking?	Go to step 4.	Go to step 5.
4	<p><b>CHECK DTC.</b></p> <p>Display DTC.</p> <p>NOTE: If the communication function of Subaru Select Monitor cannot be executed normally, check communication circuit. &lt;Ref. to 4AT(diag)-25, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, Diagnostic Procedure for Subaru Select Monitor Communication.&gt;</p>	Is DTC displayed?	Go to step 6. NOTE: Record all DTC.	Go to step 5.
5	<p><b>PERFORM GENERAL DIAGNOSTICS.</b></p> <p>1) Inspect using "Diagnostic Procedure without Diagnostic Trouble Code (DTC)". &lt;Ref. to 4AT(diag)-82, Diagnostic Procedure without Diagnostic Trouble Code (DTC).&gt;</p> <p>2) Inspect using "General Diagnostic Table". &lt;Ref. to 4AT(diag)-93, General Diagnostic Table.&gt;</p> <p>3) Perform the Inspection Mode. &lt;Ref. to 4AT(diag)-20, Inspection Mode.&gt;</p> <p>4) Display DTC.</p>	Is DTC displayed?	Go to step 6.	Finish the diagnosis.

# Basic Diagnostic Procedure

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
6	<p><b>PERFORM DIAGNOSIS.</b></p> <p>1) Inspect using the “Diagnostic Procedure with Diagnostic Trouble Code (DTC)”. &lt;Ref. to 4AT(diag)-31, Diagnostic Procedure with Diagnostic Trouble Code (DTC).&gt;</p> <p>NOTE: For DTC table, refer to “List of Diagnostic Trouble Code (DTC)”. &lt;Ref. to 4AT(diag)-29, List of Diagnostic Trouble Code (DTC).&gt;</p> <p>2) Repair the trouble cause.</p> <p>3) Perform the Clear Memory Mode.</p> <p>4) Perform the Inspection Mode. &lt;Ref. to 4AT(diag)-20, Inspection Mode.&gt;</p> <p>5) Display DTC.</p>	Is DTC displayed?	Inspect using the “Diagnostic Procedure with Diagnostic Trouble Code (DTC)”. <Ref. to 4AT(diag)-31, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Check List for Interview

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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## 2. Check List for Interview

### A: CHECK

Check the following item when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name			
Date of purchase			
Date of repair			
Transmission model	Transmission	V.I.N.	
Odometer reading	km (miles)		
Frequency	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (    times a day)		
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others (                     )		
Place	<input type="checkbox"/> Highland <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner city <input type="checkbox"/> Uphill <input type="checkbox"/> Rough road <input type="checkbox"/> Others (                     )		
Ambient air temperature	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold		
Vehicle speed	km/h (MPH)		
AT warning light (ATF temperature warning light)	<input type="checkbox"/> Blinks continuously		<input type="checkbox"/> Does not blink
Select lever position	<input type="checkbox"/> P <input type="checkbox"/> R <input type="checkbox"/> N <input type="checkbox"/> D <input type="checkbox"/> SPORT mode		
Driving condition	<input type="checkbox"/> Not affected <input type="checkbox"/> At racing <input type="checkbox"/> While decelerating	<input type="checkbox"/> At starting <input type="checkbox"/> While accelerating <input type="checkbox"/> While turning ( <input type="checkbox"/> RH/ <input type="checkbox"/> LH)	<input type="checkbox"/> While idling <input type="checkbox"/> While cruising
SPORT mode	<input type="checkbox"/> ON <input type="checkbox"/> OFF		
Symptom	<input type="checkbox"/> No up-shift		
	<input type="checkbox"/> No down-shift		
	<input type="checkbox"/> No kick down		
	<input type="checkbox"/> Vehicle does not move ( <input type="checkbox"/> Any position <input type="checkbox"/> Particular position)		
	<input type="checkbox"/> Lock-up malfunction		
	<input type="checkbox"/> Noise or vibration		
	<input type="checkbox"/> Shift shock or slip		
	<input type="checkbox"/> Select lever does not move		
<input type="checkbox"/> Others (                     )			

# General Description

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 3. General Description

#### A: CAUTION

- **Supplemental Restraint System “Airbag”**

The airbag system wiring harness is routed near the TCM.

#### CAUTION:

- All the airbag system wiring harnesses and connectors are colored yellow. Do not use an electric test equipment to check these circuits.
- Be careful not to damage the airbag system wiring harness when performing TCM diagnostics or servicing.

- **MEASUREMENT**

When measuring the voltage and resistance of the ECM, TCM or each sensor, use a tapered pin with a diameter of less than 0.64 mm (0.025 in) in order to avoid poor contact. Do not insert a pin of more than 0.65 mm (0.026 in) diameter.

#### B: INSPECTION

##### 1. BATTERY

Measure the battery voltage and specific gravity of the electrolyte.

**Standard voltage: 12 V or more**

**Specific gravity: 1.260 or more**

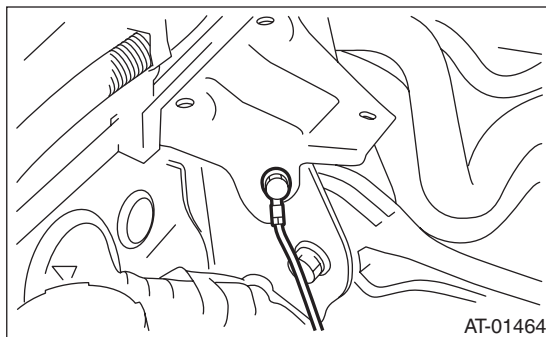
##### 2. TRANSMISSION GROUND

Make sure that the ground terminal bolt is tightened securely.

Chassis side

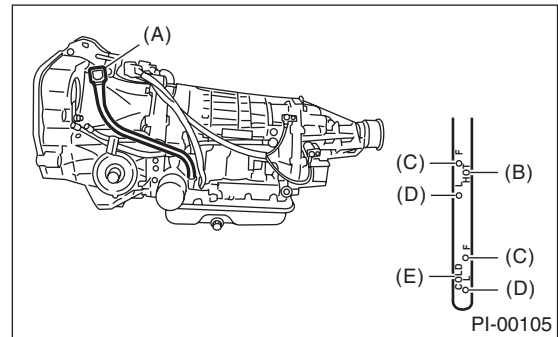
**Tightening torque:**

**13 N·m (1.3 kgf·m, 9.4 ft·lb)**



##### 3. ATF LEVEL

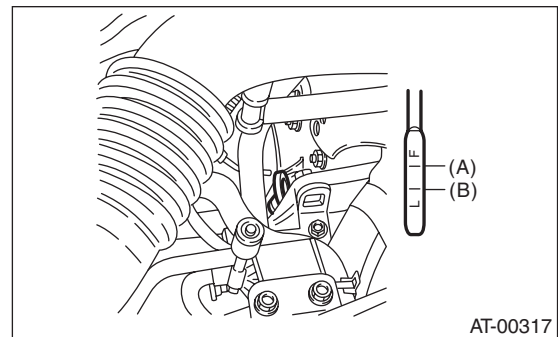
Make sure that ATF level is the specified amount. <Ref. to 4AT-28, INSPECTION, Automatic Transmission Fluid.>



- (A) Level gauge
- (B) Inspection position when “HOT”
- (C) Upper level
- (D) Lower level
- (E) Inspection position when “COLD”

##### 4. FRONT DIFFERENTIAL OIL LEVEL

Make sure the front differential oil level is the specified amount. <Ref. to 4AT-30, INSPECTION, Differential Gear Oil.>



- (A) Upper level
- (B) Lower level

# General Description

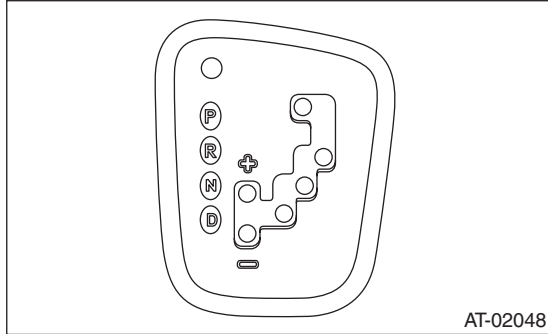
## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 5. OPERATION OF SELECT LEVER

Make sure there is no noise, dragging or contact pattern in each select lever range.

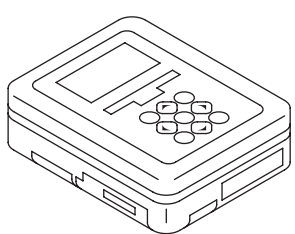
**WARNING:**

**Stop the engine while checking operation of the select lever.**



### C: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	TOOL NAME	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

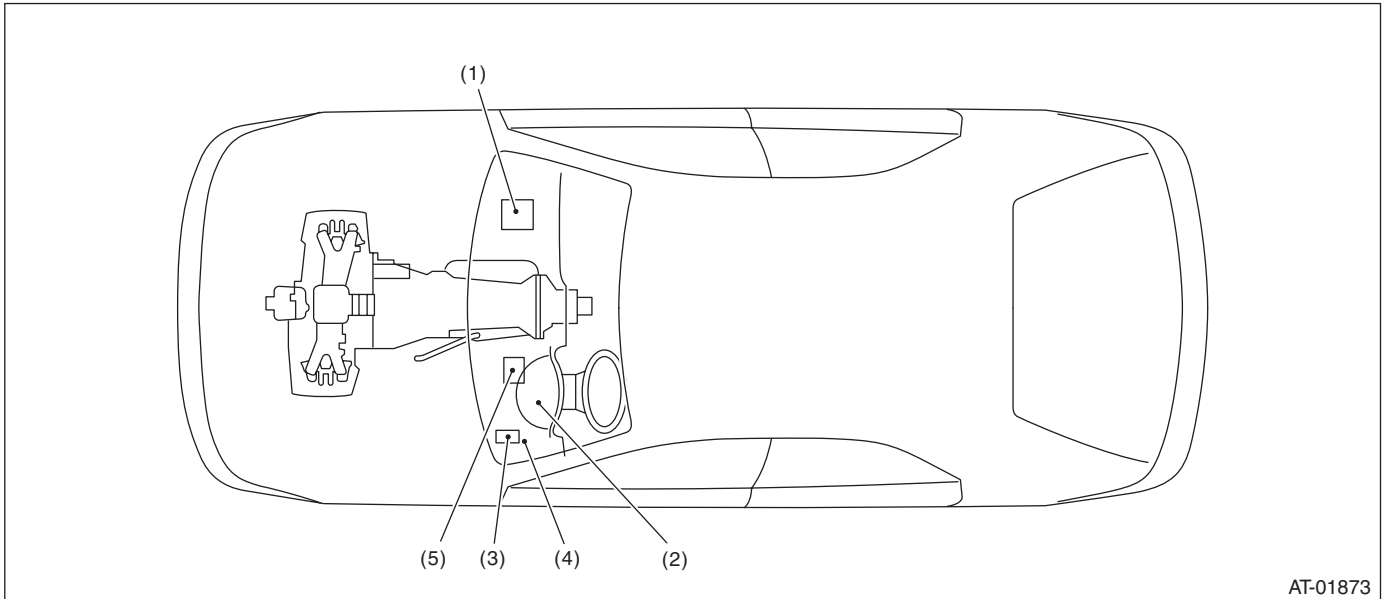
# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 4. Electrical Component Location

### A: LOCATION

#### 1. CONTROL MODULE

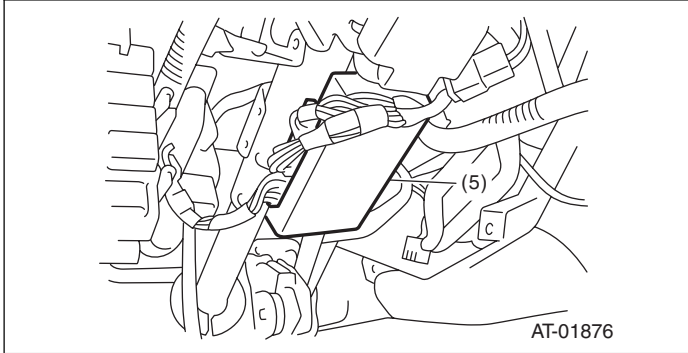
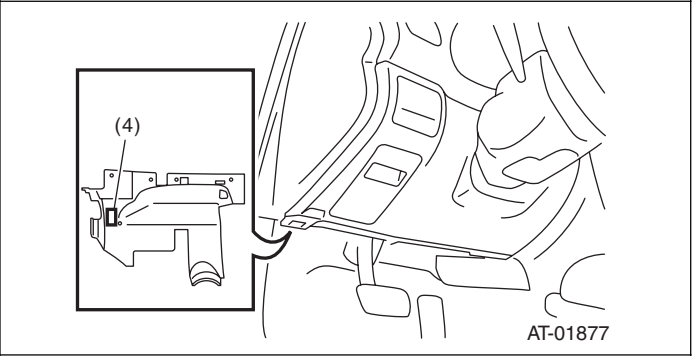
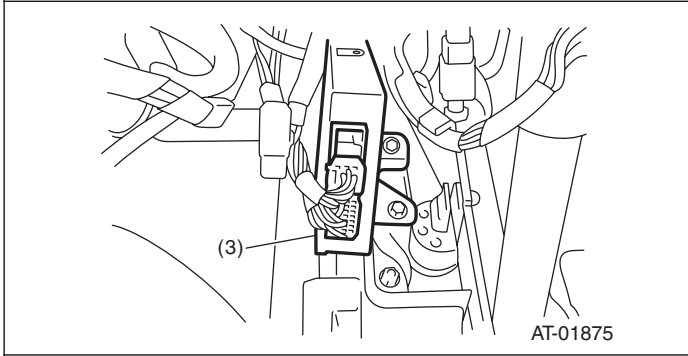
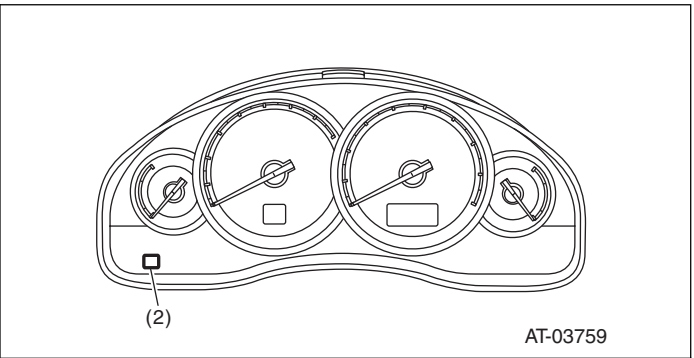
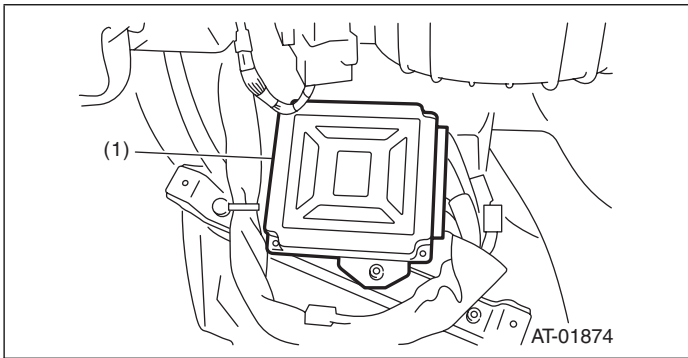


AT-01873

- |  |                                       |                          |
|--|---------------------------------------|--------------------------|
| (1) Engine control module (ECM)                                  | (3) Transmission control module (TCM) | (5) Body integrated unit |
| (2) ATF temperature warning light (AT temperature warning light) | (4) Data link connector               |                          |

# Electrical Component Location

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

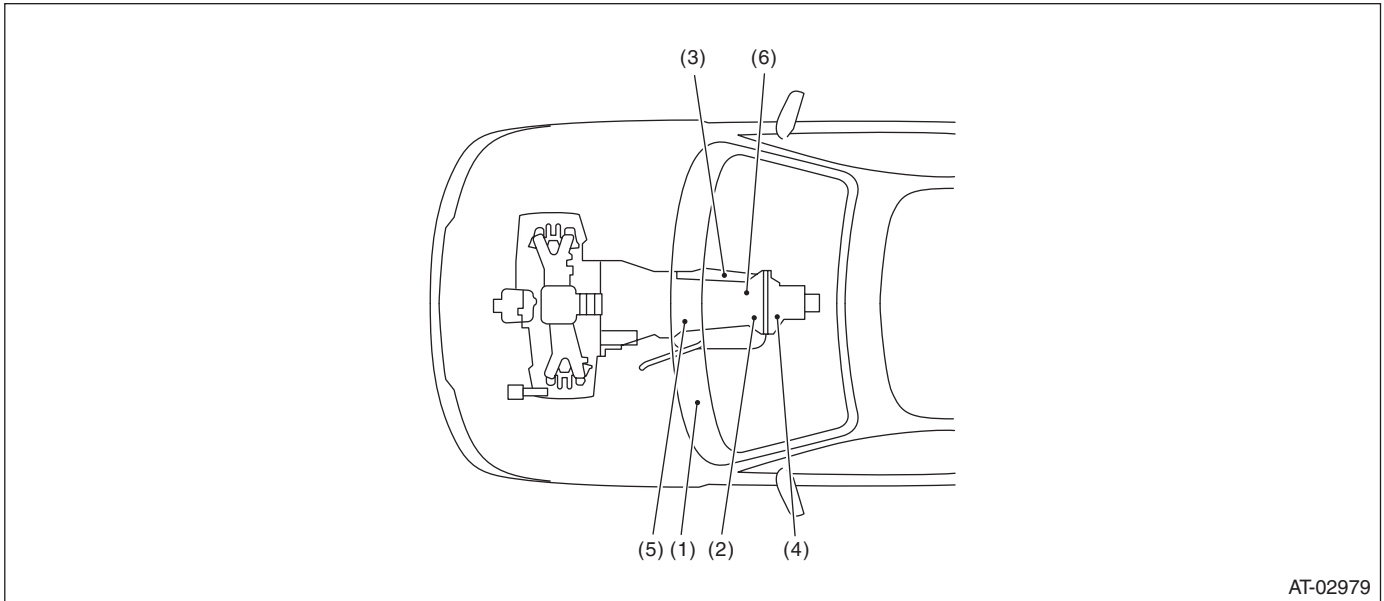




# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 2. SENSOR

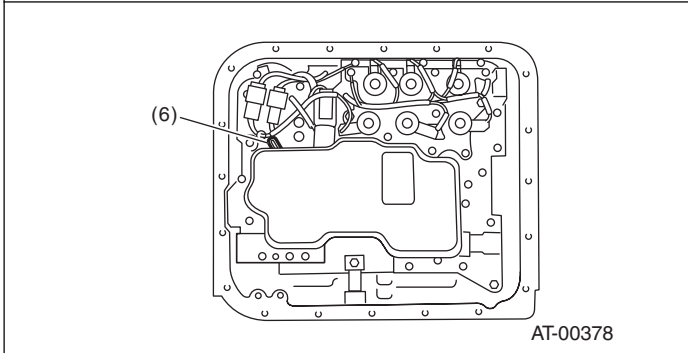
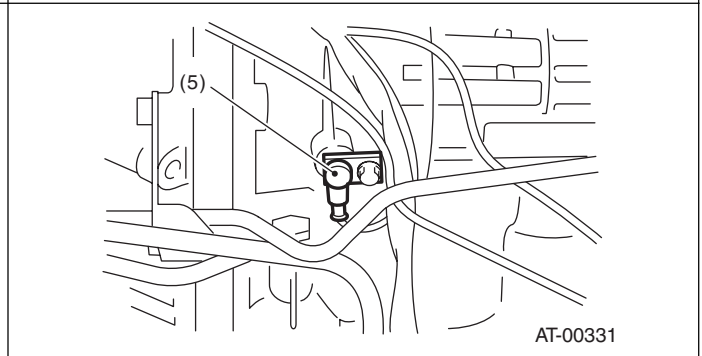
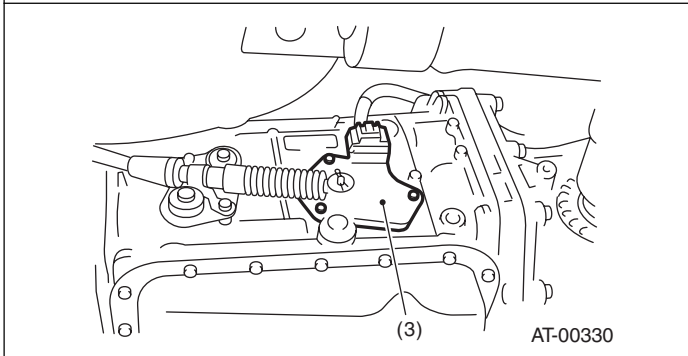
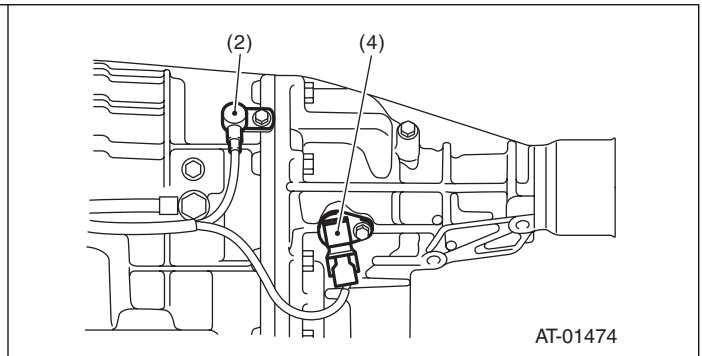
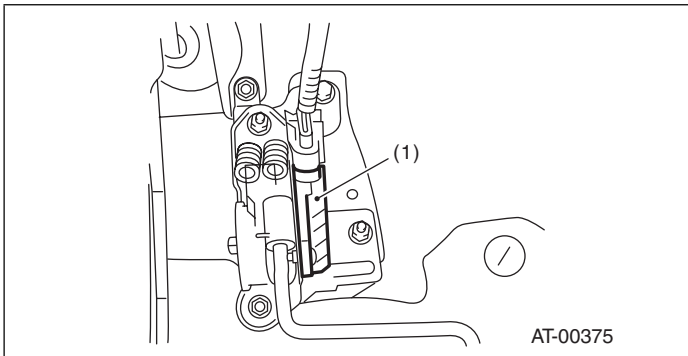


AT-02979

- |                                       |   |                            |
|---------------------------------------|---|----------------------------|
| (1) Accelerator pedal position sensor | (4) Rear vehicle speed sensor             | (6) ATF temperature sensor |
| (2) Front vehicle speed sensor        | (5) Torque converter turbine speed sensor |                            |
| (3) Inhibitor switch                  |   |                            |

# Electrical Component Location

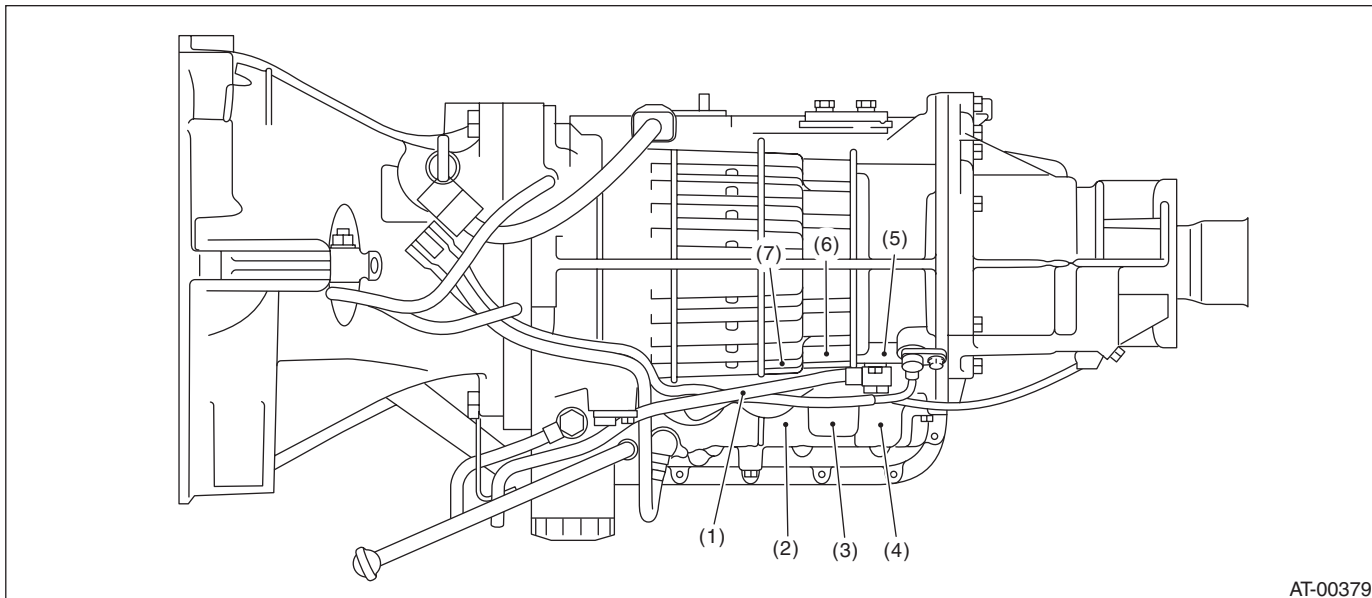
## AUTOMATIC TRANSMISSION (DIAGNOSTICS)



# Electrical Component Location

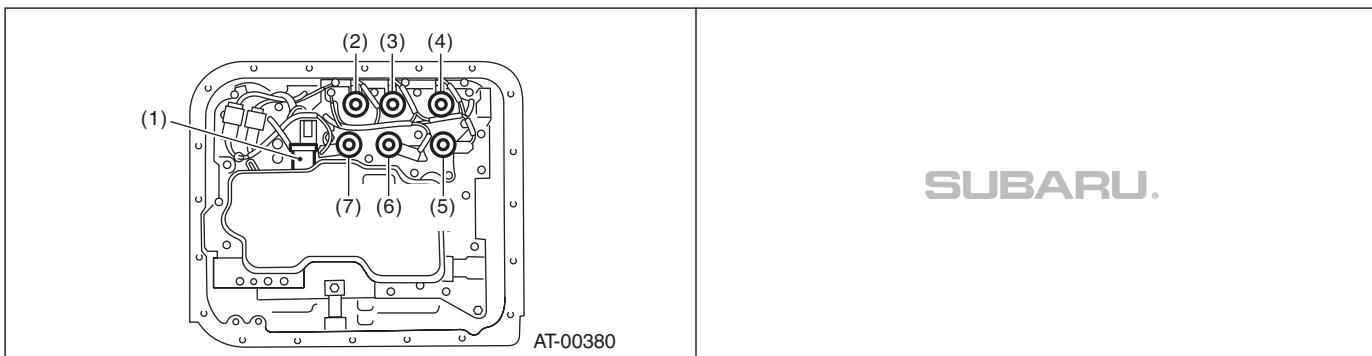
AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 3. SOLENOID



AT-00379

- |                                   |                                 |                            |
|-----------------------------------|---------------------------------|----------------------------|
| (1) Line pressure linear solenoid | (4) Low & reverse duty solenoid | (6) Transfer duty solenoid |
| (2) High clutch duty solenoid     | (5) Low clutch duty solenoid    | (7) Lock-up duty solenoid  |
| (3) 2-4 brake duty solenoid       |                                 |                            |



AT-00380

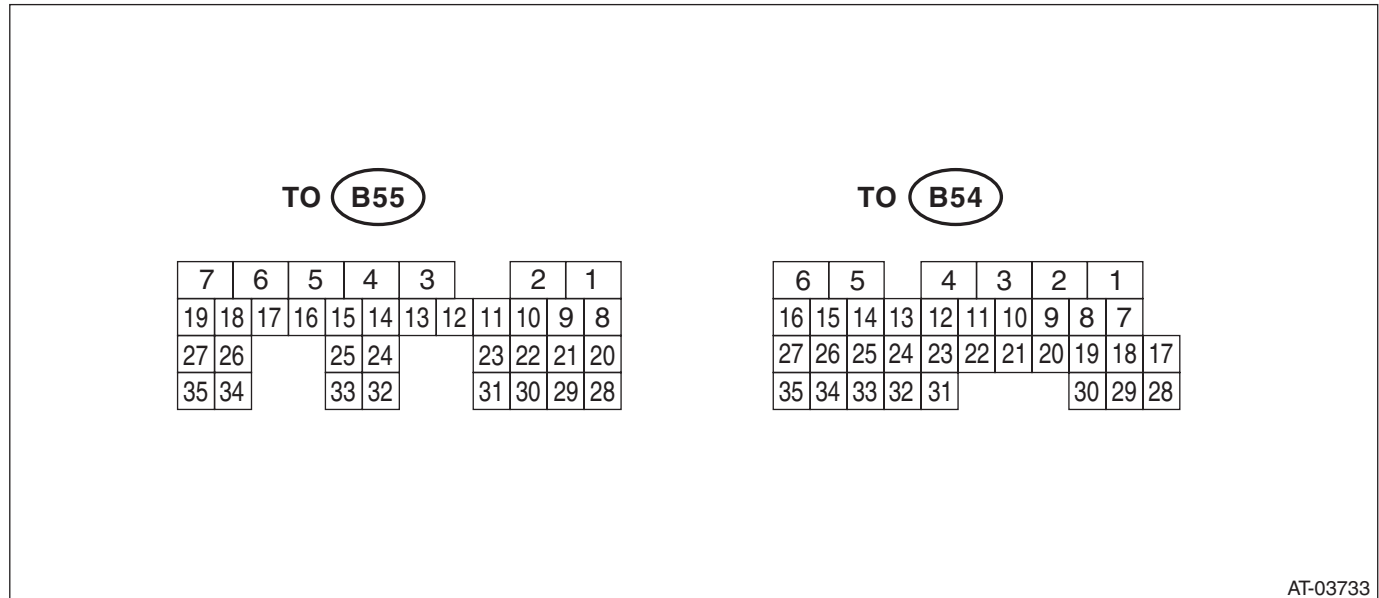
**SUBARU.**

# Transmission Control Module (TCM) I/O Signal

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 5. Transmission Control Module (TCM) I/O Signal

### A: ELECTRICAL SPECIFICATION



AT-03733

<b>Check with ignition switch ON.</b>						
Contents	Measured terminal (Connector & Terminal No.)		Measuring condition	Voltage (V)	Resistance (Ω)	
	Positive terminal	Ground terminal				
Backup power supply	(B55) No. 27	Chassis ground	—	10 — 13	—	
	(B55) No. 26	Chassis ground				
	(B55) No. 25	Chassis ground				
ACC power supply	(B55) No. 12	Chassis ground	Ignition Switch ACC	10 — 13	—	
Ignition power supply	(B55) No. 1	Chassis ground	Ignition Switch ON	10 — 13	—	
	(B55) No. 2	Chassis ground				
Inhibitor switch	“P” range switch	(B55) No. 14	Chassis ground	Select lever “P” range	Less than 1	—
				Select lever Except “P” range	8 or more	—
	“N” range switch	(B55) No. 11	Chassis ground	Select lever “N” range	Less than 1	—
				Select lever Except “N” range	8 or more	—
	“R” range switch	(B55) No. 13	Chassis ground	Select lever “R” range	Less than 1	—
				Select lever Except “R” range	8 or more	—
	“D” range switch	(B55) No. 10	Chassis ground	Select lever “D” range	Less than 1	—
				Select lever Except “D” range	8 or more	—

# Transmission Control Module (TCM) I/O Signal

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Check with ignition switch ON.					
Contents	Measured terminal (Connector & Terminal No.)		Measuring condition	Voltage (V)	Resistance ( $\Omega$ )
	Positive terminal	Ground terminal			
ATF temperature sensor	(B54) No. 23	(B54) No. 12	ATF temperature 20°C (68°F)	3.5 — 4.3	2.5k — 7.0 k
			ATF temperature 80°C (176°F)	1.0 — 2.2	300 — 800
ATF temperature sensor ground	(B54) No. 12	Chassis ground	—	0	Less than 1 (When inserting connector) $\infty$ (When disconnecting connector)
Rear vehicle speed sensor	(B54) No. 26	(B54) No. 15	20 km/h (12 MPH) Vehicle speed at least	2 or more (AC range)	—
Rear vehicle speed sensor ground	(B54) No. 15	Chassis ground	—	0	Less than 1 (When inserting connector) $\infty$ (When disconnecting connector)
Front vehicle speed sensor	(B54) No. 27	(B54) No. 16	—	—	450 — 650
Front vehicle speed sensor ground	(B54) No. 16	Chassis ground	—	—	—
Torque converter turbine speed sensor	(B54) No. 1	(B54) No. 2	Engine idling after warm-up ("D" range)	0	450 — 650
			Engine idling after warm-up ("N" range)	1 or more (AC range)	
Torque converter turbine speed sensor ground	(B54) No. 2	Chassis ground	—	—	—
Engine speed signal	(B55) No. 11	Chassis ground	Ignition switch ON (engine OFF)	Less than 1	—
			Ignition switch ON (with engine ON)	5 or more (AC range)	—
Line pressure linear solenoid	(B54) No. 4	(B54) No. 3	Ignition switch ON (with engine OFF) Throttle fully closed in "R" range after warm-up.	3.7 — 7.7	4.0 — 6.0
			Ignition switch ON (with engine OFF) Throttle fully opened in "R" range after warm-up.	1.1 — 5.1	
Line pressure linear solenoid ground	(B54) No. 3	Chassis ground	—	Less than 1	Less than 1

# Transmission Control Module (TCM) I/O Signal

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Check with ignition switch ON.					
Contents	Measured terminal (Connector & Terminal No.)		Measuring condition	Voltage (V)	Resistance ( $\Omega$ )
	Positive terminal	Ground terminal			
Lock-up duty solenoid	(B54) No. 6	Chassis ground	When lock up occurs.	10.5 or more	2.0 — 4.5
			When lock up is released.	Less than 1	
Transfer duty solenoid	(B54) No. 5	Chassis ground	With fuse installed to FWD switch	Less than 1	2.0 — 4.5
			With fuse removed from FWD switch (1st gear)	2.0 — 3.0	
2-4 brake duty solenoid	(B55) No. 4	Chassis ground	"P" or "N" range	5.0 or more	2.0 — 4.5
			2nd or 4th gear	Less than 1	
High clutch duty solenoid	(B55) No. 6	Chassis ground	3rd or 4th gear	Less than 1	2.0 — 4.5
			"P" or "N" range	5.0 or more	
Low clutch duty solenoid	(B55) No. 7	Chassis ground	1st or 2nd gear	Less than 1	2.0 — 4.5
			"P" or "N" range	5.0 or more	
Low & reverse duty solenoid	(B55) No. 5	Chassis ground	Except "1" range	5.0 or more	2.0 — 4.5
			Driving at 1st gear on manual mode (15 km/h (9.3 MPH) or more)	2.5 — 5.0	
Data link signal (Subaru Select Monitor)	(B55) No. 8	Chassis ground	—	—	—
CAN communication signal (+)	(B54) No. 18	Chassis ground	Ignition switch ON	Pulse signal	—
CAN communication signal (-)	(B54) No. 17	Chassis ground	Ignition switch ON	Pulse signal	—
FWD switch	(B55) No. 10	Chassis ground	Fuse removed	10.5 or more	—
			Fuse installed	1 or less	—
System ground circuit	(B55) No. 20	Chassis ground	—	0	Less than 1
	(B55) No. 21	Chassis ground	—	0	Less than 1
	(B55) No. 22	Chassis ground	—	0	Less than 1
	(B55) No. 23	Chassis ground	—	0	Less than 1

## 6. Subaru Select Monitor

### A: OPERATION

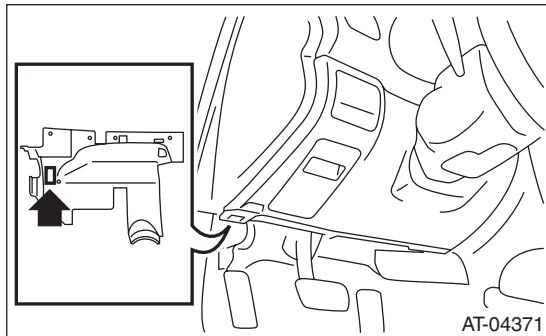
#### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

- 1) Prepare the Subaru Select Monitor kit. <Ref. to 4AT(diag)-6, PREPARATION TOOL, General Description.>
- 2) Prepare PC with Subaru Select Monitor installed.
- 3) Connect the SDI (Subaru Diagnostic Interface) to the PC USB port (exclusively for Subaru Selector Monitor) using a USB cable.

#### NOTE:

Port exclusively for Subaru Select Monitor refers to the USB port used when installing Subaru Select Monitor.

- 4) Connect the diagnosis cable to the SDI.
- 5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

- 6) Start the PC.
- 7) Turn the ignition switch to ON (engine OFF) and run the "PC application help for Subaru Select Monitor".
- 8) On the «Main Menu», select {Each System Check}.
- 9) On the «System Selection Menu», select {Transmission}.
- 10) After transmission type information pops up, select [OK].
- 11) On the «Transmission Diagnosis», select {DTC Display}.

- 12) On the «DTC Display», select {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

#### NOTE:

- For details concerning the operation procedure, refer to the "help on PC application for Subaru Select Monitor".
- For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to 4AT(diag)-29, List of Diagnostic Trouble Code (DTC).>

# Subaru Select Monitor

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 2. READ CURRENT DATA

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Transmission}.
- 3) After transmission type information pops up, select [OK].
- 4) On the «Transmission Diagnosis», select {Current Data Display & Save}.
- 5) On the «Current Data Display & Save», select {Normal sampling}.
- 6) Using the scroll key, scroll the display screen up or down until the desired data is shown.

A list of the support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Rear vehicle speed sensor signal	Rear Wheel Speed	km/h or MPH
Front vehicle speed sensor signal	Front Wheel Speed	km/h or MPH
Engine speed signal	Engine Speed	rpm
Automatic transmission fluid temperature signal	ATF Temp.	°C or °F
Accelerator pedal position sensor	Throttle voltage	V
Gear position	Gear Position	—
Line pressure control duty ratio	Line Pressure Duty Ratio	%
Lock up clutch control duty ratio	Lock up Duty Ratio	%
Transfer clutch control duty ratio	Transfer Duty Ratio	%
Accelerator pedal position sensor power supply	Throttle Voltage	V
Torque converter turbine speed signal	Turbine Revolution Speed	rpm
2 — 4 brake timing pressure control duty ratio	Brake Clutch Duty Ratio	%
Low clutch duty ratio	L/C Duty	%
High clutch duty ratio	H/C Duty	%
Low & reverse brake duty ratio	L&R/B Duty	%
Accelerator position	Acceleration Opening Angle	%
FWD switch signal	FWD SW	ON or OFF
Stop light switch signal	Stop light SW	ON or OFF
Anti lock brake system signal	ABS signal	ON or OFF
Parking range signal	P Range Signal	ON or OFF
Neutral range signal	N Range Signal	ON or OFF
Reverse range signal	R Range Signal	ON or OFF
Drive range signal	D Range Signal	ON or OFF
AT diagnosis light output signal	Diagnosis Light	ON or OFF
Cruise control signal	Cruise Control Signal	ON or OFF
ATF temperature light	ATF temperature light	ON or OFF
Up shift signal	Up SW	ON or OFF
Down shift signal	Down SW	ON or OFF
Sport mode signal	Tiptronic Mode Switch	ON or OFF

#### NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.



### 3. CLEAR MEMORY MODE

- 1) Check that the select lever is in “P” range.
- 2) On the «Main Menu», select {Each System Check}.
- 3) On the «System Selection Menu», select {Transmission}.
- 4) After transmission type information pops up, select [OK].
- 5) On the «Transmission Diagnosis», select {Clear Memory}.
- 6) When the “Done. Turn ignition switch to OFF” pops up, select [OK].
- 7) Turn Subaru Select Monitor and ignition switch to OFF. To turn the ignition switch to ON again, wait for 10 seconds or more.

#### NOTE:

- If {Clear Memories 2} is selected and performed, DTC and learned control memory are cleared. If {Clear Memories 2} is performed, perform learning control promotion. <Ref. to 4AT(diag)-17, FACILITATION OF LEARNING CONTROL, OPERATION, Subaru Select Monitor.>
- For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 4. FACILITATION OF LEARNING CONTROL

#### NOTE:

- After performing the following services, perform the transmission learning operation.  
Replacement of TCM/Replacement or disassembly of transmission assembly/Replacement of control valve body/Performing “Clear Memories 2”.
- Perform the procedures according to the message displayed on the Subaru Select Monitor.
  - 1) Warm-up or cool down until the ATF temperature displayed on the Subaru Select Monitor reaches 60 — 80°C (140 — 176° F).
  - 2) Shift the select lever to “P” range.
  - 3) Fully apply the parking brake.
  - 4) Lift up the vehicle.

#### CAUTION:

**Be sure to keep the lowest edge of the tires 30 cm or more off the ground because the vehicle vibrates during the work.**

- 5) Connect the Subaru Select Monitor to the data link connector.
- 6) Turn the ignition switch to ON.
- 7) Turn OFF all switches, which produce an electrical load, including headlight, air conditioner, seat heater, rear defogger, etc.
- 8) Turn the ECO switch to ON for model with ECO switch. Turn the SPORT mode switch to OFF for model with SPORT mode. Turn the POWER/HOLD switch to OFF for model with POWER/HOLD switch. Set to I mode for model with SI-DRIVE.

#### NOTE:

Error message is not displayed even when an incorrect mode is set. While the operation is continued, “AT learning promoting” is displayed, but it cannot end normally. If the message does not change after 2 minutes have passed, retry “AT learning mode” from the beginning.

#### CAUTION:

**Do not turn the power of the Subaru Select Monitor to OFF or disconnect the data link connector during the operation.**

- 9) Select {Learning and inspection mode related to AT} on the «Transmission Diagnosis» display screen of Subaru Select Monitor.
- 10) Select {AT learning mode} on the «Learning and inspection mode related to AT» display screen of Subaru Select Monitor.

# Subaru Select Monitor

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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11) Perform the procedures according to the message displayed on the Subaru Select Monitor.

**NOTE:**

During AT learning in progress, SPORT indicator light in the combination meter starts flashing at 2 Hz and the learning operation starts. The following message is displayed on the screen when the SPORT indicator light turns off.

12) "AT learning normally ended." is displayed, simple AT learning is completed.

**NOTE:**

- If communication error occurs during learning, retry "AT learning mode" from the beginning.
- If "Execute AT learning again after fixing troubles of the vehicle" is displayed during learning, select [OK] to display the List of Diagnostics Trouble Code. Retry "AT learning mode" from the beginning after repairing the DTC detecting portion.
- If "AT learning ended abnormally." is displayed, retry "AT learning mode" from the beginning.

Message	Primary cause of abnormal end
"AT learning ended abnormally."	<ul style="list-style-type: none"><li>• Fault is detected during AT learning.</li><li>• The accelerator pedal is depressed during AT learning.</li><li>• Operation which is not directed is performed during AT learning.</li><li>• The brake pedal is not depressed fully.</li><li>• The parking brake is not applied fully.</li><li>• Abnormal idle rise occurs. Other similar causes are probable.</li></ul>

- For details concerning the operation procedure, refer to the "PC application help for Subaru Select Monitor".

### 7. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

Refer to “Subaru Select Monitor” for information on how to display a DTC. <Ref. to 4AT(diag)-15, OPERATION, Subaru Select Monitor.>

For details concerning DTCs, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to 4AT(diag)-29, List of Diagnostic Trouble Code (DTC).>

# Inspection Mode

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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## 8. Inspection Mode

### A: PROCEDURE

#### WARNING:

**Observe the traffic law when driving on public roads.**

- 1) Shift the select lever to “D” range, and then drive the vehicle at 60 km/h (37 MPH) for at least 10 seconds.
- 2) Drive the vehicle with manual mode.

### 9. Clear Memory Mode

#### A: OPERATION

Refer to “Subaru Select Monitor” for information about how to clear a DTC.

<Ref. to 4AT(diag)-17, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

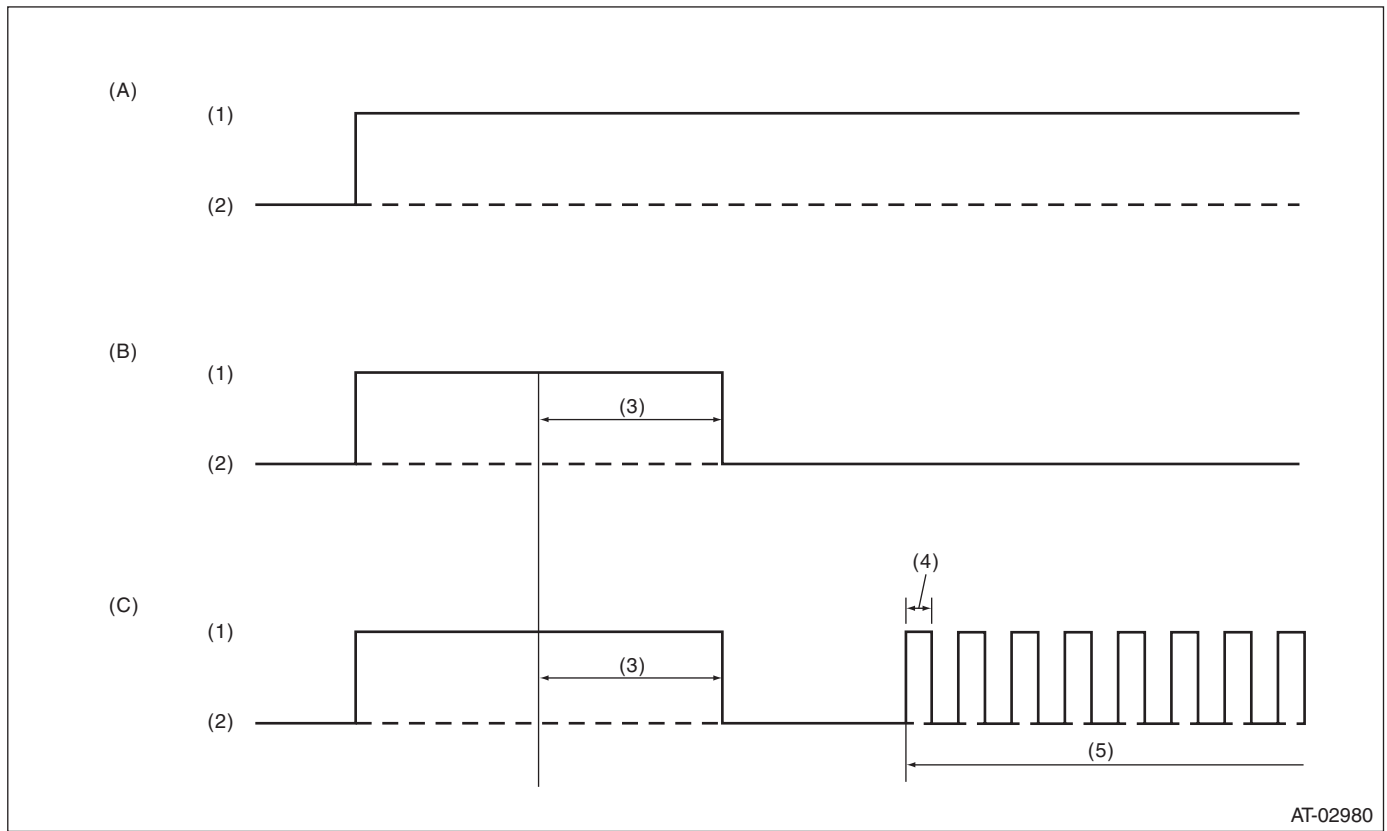
# AT Oil Temp Warning Light Display

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 10.AT Oil Temp Warning Light Display

### A: OPERATION

When any on-board diagnostics item is malfunctioning, the ATF temperature warning light blinks when a malfunction is detected after starting the engine until the ignition switch is turned OFF. The malfunctioning part or unit can be determined by a DTC during the on-board diagnostics operation. Problems which occurred previously can also be identified through the memory function. If the ATF temperature warning light does not show a problem (although a problem is occurring), the problem can be determined by checking the performance characteristics of each sensor using the Subaru Select Monitor. Warning light signal patterns are shown in the figure.



(A) Ignition switch ON (engine OFF)

(B) Normal (engine ON)

(C) Faulty (engine ON)

(1) ON

(3) 2 seconds

(5) Blink

(2) OFF

(4) 0.25 seconds

Perform the inspection when the ATF temperature warning light does not operate correctly. <Ref. to 4AT(diag)-23, INSPECTION, AT Oil Temp Warning Light Display.>

# AT Oil Temp Warning Light Display

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## B: INSPECTION

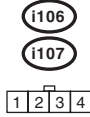
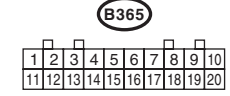
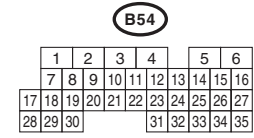
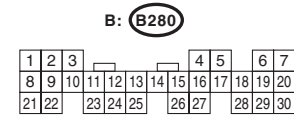
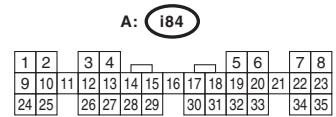
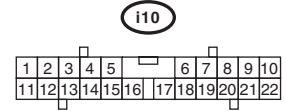
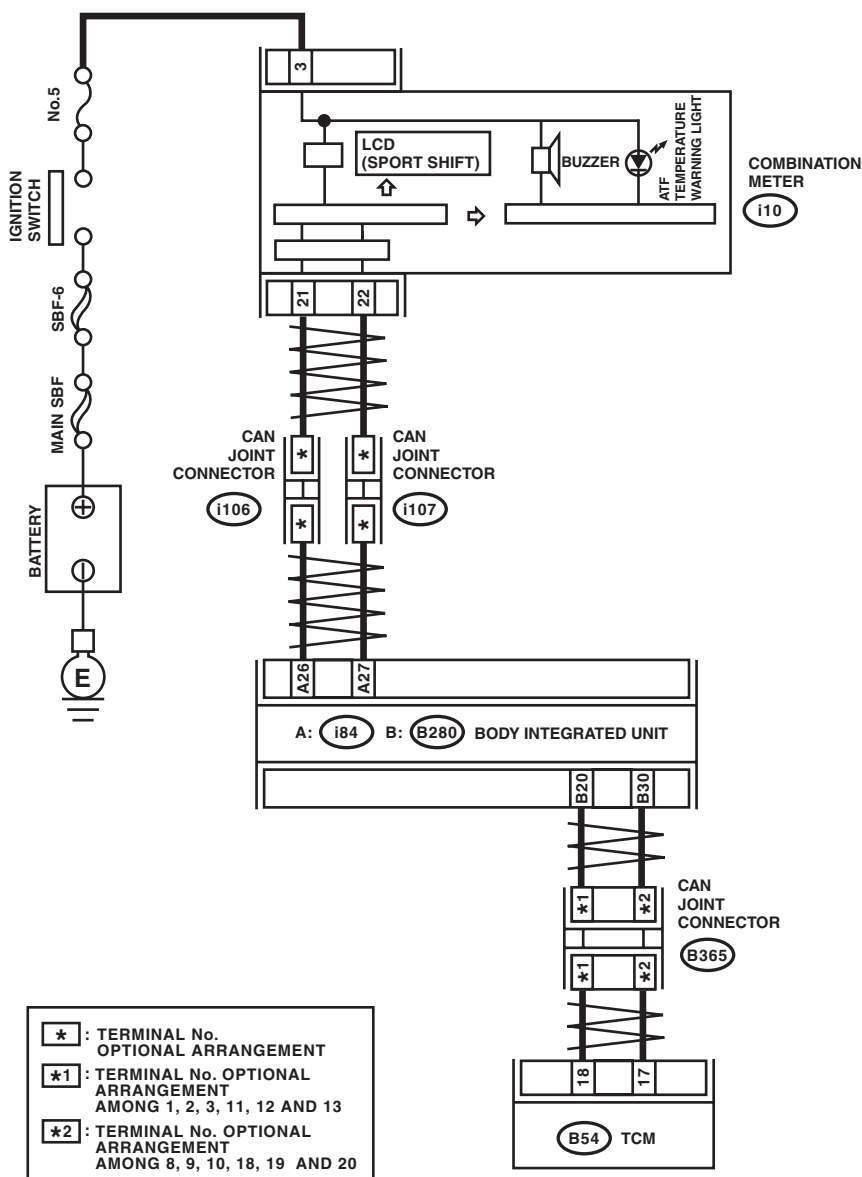
### DIAGNOSIS:

ATF temperature warning light circuit is open or shorted.

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), the ATF temperature warning light does not illuminate.

### WIRING DIAGRAM:



# AT Oil Temp Warning Light Display

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 ATF TEMPERATURE WARNING LIGHT INSPECTION.</b> Turn the ignition switch to ON.	Does the ATF temperature warning light illuminate?	Go to step 2.	Perform the self-diagnosis of combination meter.
<b>2 ATF TEMPERATURE WARNING LIGHT INSPECTION.</b> After the ignition switch is ON, wait for at least 2 seconds.	Does the ATF temperature warning light illuminate?	Go to step 3.	Go to step 4.
<b>3 ATF TEMPERATURE WARNING LIGHT INSPECTION.</b> Start the engine.	Does the ATF temperature warning light go off?	Normal. Go back to "Basic Diagnostic Procedure". <Ref. to 4AT(diag)-2, Basic Diagnostic Procedure.>	Go to step 7.
<b>4 CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> Connect the Subaru Select Monitor to the data link connector.	Is the communication between Subaru Select Monitor and TCM normal?	Go to step 5.	Check the power supply ground circuit of TCM and Subaru Select Monitor communication. <Ref. to 4AT(diag)-25, Diagnostic Procedure for Subaru Select Monitor Communication.>
<b>5 CHECK TCM.</b> Display the current data of TCM using Subaru Select Monitor.	Is the "Diagnosis Light" output signal "ON"?	Go to step 6.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>6 CHECK BODY INTEGRATED UNIT.</b> Display the current data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the "ATF oil temperature light" input signal on "Illuminate"?	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>	Check DTC of body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>
<b>7 CHECK TCM.</b> Display the current data of TCM using Subaru Select Monitor. <Ref. to 4AT(diag)-15, OPERATION, Subaru Select Monitor.>	Is the "Diagnosis Light" output signal "ON"?	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>	Go to step 8.
<b>8 CHECK BODY INTEGRATED UNIT.</b> Display the current data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the "ATF oil temperature light" input signal on "Illuminate"?	Check DTC of body integrated unit. Perform the diagnosis according to DTC. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>



# Diagnostic Procedure for Subaru Select Monitor Communication

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 11. Diagnostic Procedure for Subaru Select Monitor Communication

### A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

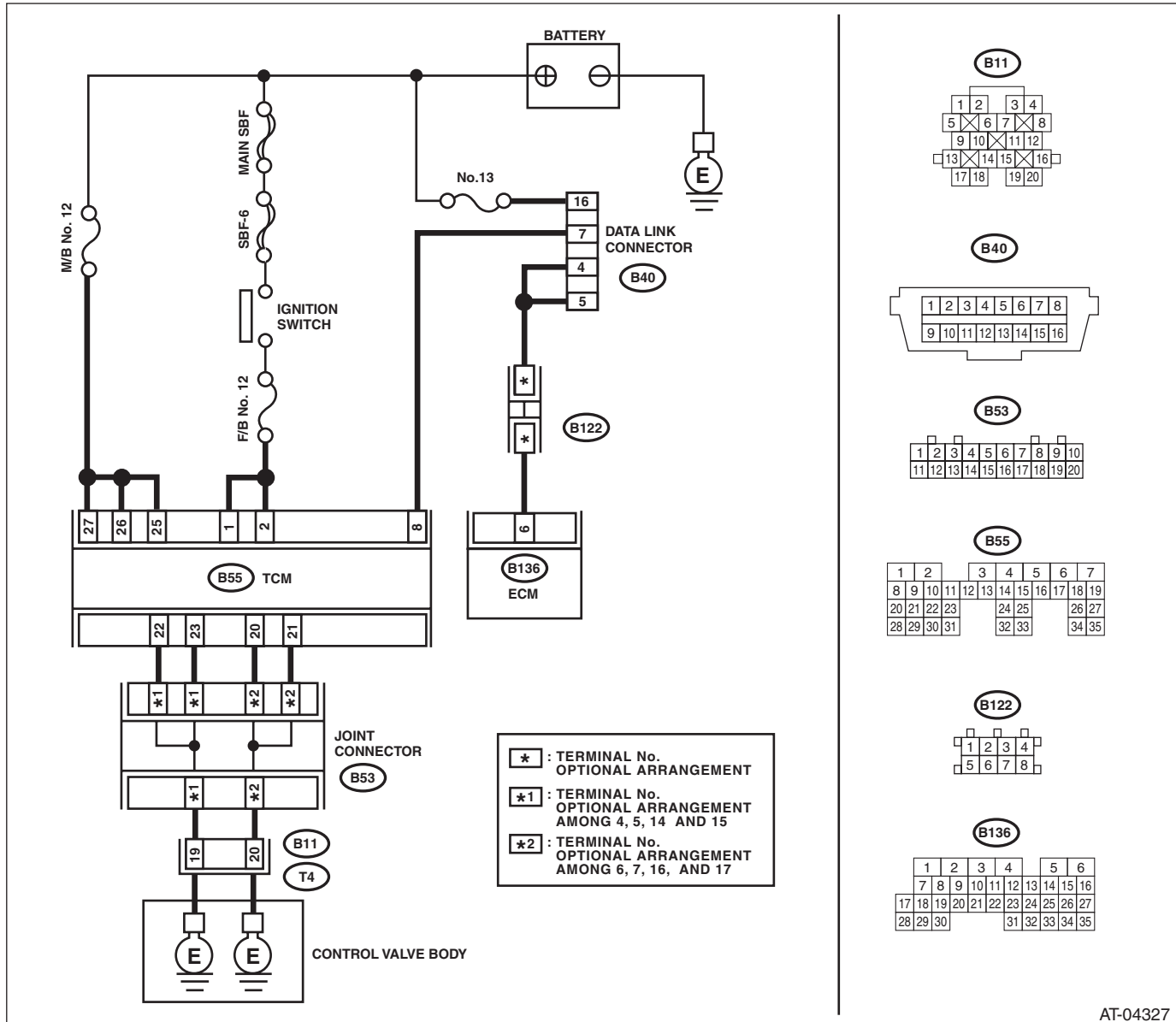
#### DIAGNOSIS:

Defective harness connector

#### TROUBLE SYMPTOM:

Subaru Select Monitor communication failure

#### WIRING DIAGRAM:



AT-04327

# Diagnostic Procedure for Subaru Select Monitor Communication

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK INSTALLATION OF TCM CONNECTOR.</b> Turn the ignition switch to OFF.	Is TCM connector connected to TCM?	Go to step 2.	Connect the TCM connector to TCM.
2	<b>CHECK SUBARU SELECT MONITOR POWER SUPPLY CIRCUIT.</b> Measure the voltage between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 16 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Repair harness connector between the battery and data link connector, and poor contact of the connector.
3	<b>CHECK SUBARU SELECT MONITOR GROUND CIRCUIT.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance of harness between data link connector and ECM. <b>Connector &amp; terminal</b> <b>(B40) No. 4 — (B136) No. 6:</b> <b>(B40) No. 5 — (B136) No. 6:</b>	Is resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between data link connector and ECM.
4	<b>CHECK SUBARU SELECT MONITOR GROUND CIRCUIT.</b> Measure the resistance of harness between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 4 — Chassis ground:</b> <b>(B40) No. 5 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between data link connector and ground terminals.
5	<b>CHECK ENGINE GROUND CIRCUIT.</b> Check the engine ground circuit.	Is the engine ground circuit normal?	Go to step 6.	Repair ground circuit of ECM.
6	<b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to transmission system can be executed normally.	Is the name of system displayed on Subaru Select Monitor?	Go to step 11.	Go to step 7.
7	<b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the TCM connector. 3) Check whether communication to engine system can be executed normally.	Is the name of system displayed on Subaru Select Monitor?	Go to step 9.	Go to step 8.
8	<b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the TCM connector. 3) Disconnect the connectors of TPM control unit, airbag control module, body integrated unit, and ABSCM&H/U. <b>CAUTION:</b> <b>When disconnecting the connector from airbag control module, always follow the precautions on AB section. &lt;Ref. to AB-4, CAUTION, General Description.&gt;</b> 4) Turn the ignition switch to ON. 5) Check whether communication to transmission system can be executed normally.	Is the name of system displayed on Subaru Select Monitor?	Check each control module.	Go to step 9.

# Diagnostic Procedure for Subaru Select Monitor Communication

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>9 CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors of TCM, ECM, TPM control unit, airbag control module, body integrated unit, and ABSCM&H/U. 3) Measure the resistance between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 10.	Check harness and connector between each control module and data link connector.
<b>10 CHECK OUTPUT SIGNAL OF TCM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between TCM and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 1 V or more?	Check harness and connector between each control module and data link connector.	Go to step 11.
<b>11 CHECK HARNESS CONNECTOR BETWEEN TCM AND DATA LINK CONNECTOR.</b> Measure the resistance between TCM connector and data link connector. <b>Connector &amp; terminal</b> <b>(B55) No. 8 — (B40) No. 7:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 12.	Repair the harness and connector between TCM and data link connector.
<b>12 CHECK INSTALLATION OF TRANSMISSION HARNESS CONNECTOR.</b>	Is the transmission harness connector connected to bulk-head harness connector?	Go to step 13.	Connect the bulk-head harness connector to transmission harness connector.
<b>13 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in control module power supply and data link connector?	Repair the poor contact.	Go to step 14.
<b>14 CHECK POWER SUPPLY OF TCM.</b> 1) Disconnect the connector from TCM. 2) Turn the ignition switch to ON. 3) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 27 (+) — Chassis ground (-):</b> <b>(B55) No. 26 (+) — Chassis ground (-):</b> <b>(B55) No. 25 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 16.	Go to step 15.
<b>15 CHECK FUSE (NO. 12).</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (M/B No. 12).	Is the fuse (No. 12) blown out?	Replace the fuse (No. 12). If the replaced fuse (No. 12) blows out easily, repair the short circuit of harness between fuse (No. 12) and TCM.	Repair the open circuit of harness between fuse (No. 12) and TCM, or fuse (No. 12) and battery, and poor contact of the connector.
<b>16 CHECK IGNITION POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Measure the ignition power supply voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 1 (+) — Chassis ground (-):</b> <b>(B55) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 18.	Go to step 17.

# Diagnostic Procedure for Subaru Select Monitor Communication

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>17 CHECK FUSE (NO. 12).</b> Remove the fuse (F/B No. 12).	Is the fuse (No. 12) blown out?	Replace the fuse (No. 12). If the replaced fuse (No. 12) blows out easily, repair the short circuit of harness between fuse (No. 12) and TCM.	Repair the open circuit of harness between fuse (No. 12) and TCM, or fuse (No. 12) and battery, and poor contact of the connector.
<b>18 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <i>Connector &amp; terminal</i> <i>(B55) No. 20 — (B11) No. 20:</i> <i>(B55) No. 21 — (B11) No. 20:</i> <i>(B55) No. 22 — (B11) No. 19:</i> <i>(B55) No. 23 — (B11) No. 19:</i>	Is resistance less than 1 Ω?	Go to step 19.	Repair the open circuit of harness between TCM and transmission harness connector, and poor contact of connector.
<b>19 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND TRANSMISSION GROUND.</b> Measure the resistance of the harness between transmission and transmission ground. <i>Connector &amp; terminal</i> <i>(T4) No. 19 — Transmission ground:</i> <i>(T4) No. 20 — Transmission ground:</i>	Is resistance less than 1 Ω?	Go to step 20.	Repair the open circuit of the harness between transmission and transmission ground.
<b>20 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in TCM power supply, ground and data link connector?	Repair the connector.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# List of Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 12.List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Contents	Diagnosis content	Reference
P0705	Transmission Range Sensor Circuit (PRNDL Input)	Inhibitor switch malfunction short circuit	<Ref. to 4AT(diag)-31, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0712	Transmission Fluid Temperature Sensor Circuit Low Input	ATF temperature sensor is faulty or input signal circuit is open.	<Ref. to 4AT(diag)-38, DTC P0712 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0713	Transmission Fluid Temperature Sensor Circuit High Input	ATF temperature sensor is faulty or input signal circuit is shorted.	<Ref. to 4AT(diag)-41, DTC P0713 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0715	Input/Turbine Speed Sensor Circuit	Torque converter turbine speed sensor malfunction, open or shorted input signal circuit	<Ref. to 4AT(diag)-43, DTC P0715 INPUT/TURBINE SPEED SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0719	Torque Converter/ Brake Switch "B" Circuit Low	Brake switch malfunction, open input signal circuit	<Ref. to 4AT(diag)-45, DTC P0719 BRAKE SWITCH CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output Speed Sensor Circuit	Front vehicle speed sensor malfunction, open or shorted input signal circuit	<Ref. to 4AT(diag)-48, DTC P0720 OUTPUT SPEED SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0724	Torque Converter/ Brake Switch "B" Circuit High	Brake switch malfunction, shorted input signal circuit	<Ref. to 4AT(diag)-50, DTC P0724 BRAKE SWITCH CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0725	Engine Speed Input Circuit	Open or shorted engine speed output signal circuit	<Ref. to 4AT(diag)-52, DTC P0725 ENGINE SPEED INPUT CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	Gear 1 Incorrect Ratio	Vehicle sensor, torque converter turbine speed sensor or control valve malfunction	<Ref. to 4AT(diag)-53, DTC P0731 GEAR 1 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0732	Gear 2 Incorrect Ratio	Vehicle sensor, torque converter turbine speed sensor or control valve malfunction	<Ref. to 4AT(diag)-53, DTC P0732 GEAR 2 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	Gear 3 Incorrect Ratio	Vehicle sensor, torque converter turbine speed sensor or control valve malfunction	<Ref. to 4AT(diag)-53, DTC P0733 GEAR 3 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0734	Gear 4 Incorrect Ratio	Vehicle sensor, torque converter turbine speed sensor or control valve malfunction	<Ref. to 4AT(diag)-53, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0736	Reverse Incorrect Ratio	Vehicle sensor, torque converter turbine speed sensor or control valve malfunction	<Ref. to 4AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Lock-up clutch is faulty or valve is stuck.	<Ref. to 4AT(diag)-55, DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque Converter Clutch Circuit Electrical	Lock-up solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-56, DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0748	Pressure Control Solenoid "A" Electrical	Line pressure linear solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-59, DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

DTC	Contents	Diagnosis content	Reference
P0753	Shift Solenoid "A" Electrical	Low clutch duty solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-61, DTC P0753 SHIFT SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift Solenoid "B" Electrical	2-4 brake duty solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-64, DTC P0758 SHIFT SOLENOID "B" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0763	Shift Solenoid "C" Electrical	High clutch duty solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-67, DTC P0763 SHIFT SOLENOID "C" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0768	Shift Solenoid "D" Electrical	Low & reverse clutch duty solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-70, DTC P0768 SHIFT SOLENOID "D" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0801	Reverse Inhibit Control Circuit	Shift lock solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-73, DTC P0801 REVERSE INHIBIT CONTROL CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1706	AT Vehicle Speed Sensor Circuit Malfunction (Rear Wheel)	Rear vehicle speed sensor is faulty or input signal circuit is open or shorted.	<Ref. to 4AT(diag)-75, DTC P1706 AT VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION (REAR WHEEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1707	AT AWD Solenoid Valve Circuit Malfunction	Transfer duty solenoid is faulty or output signal circuit is open or shorted.	<Ref. to 4AT(diag)-77, DTC P1707 AT AWD SOLENOID VALVE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1718	CAN Communication Circuit	CAN communication circuit is open or shorted.	<Ref. to 4AT(diag)-79, DTC P1718 CAN COMMUNICATION CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1817	SPORT Mode Switch Circuit	Sport shift switch is faulty or input signal circuit is open or shorted.	<Ref. to 4AT(diag)-80, DTC P1817 SPORT MODE SWITCH CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### 13. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

#### A: DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT)

##### DTC DETECTING CONDITION:

- Inhibitor switch is faulty.
- At least 2 range signal is input.

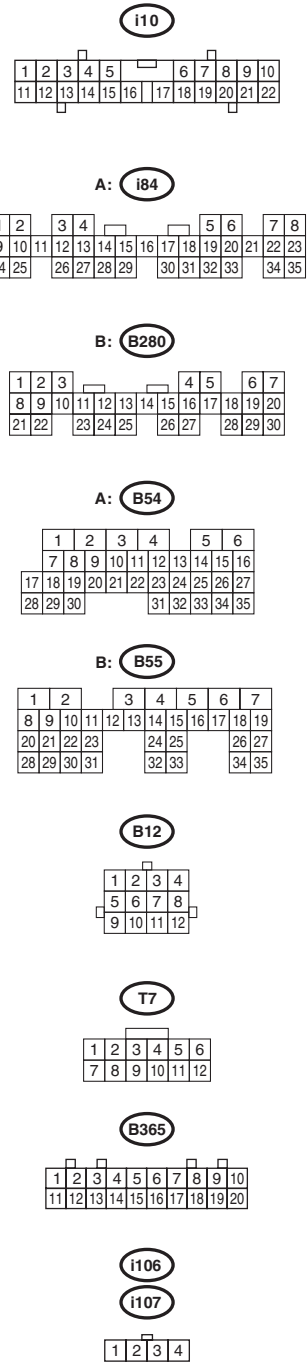
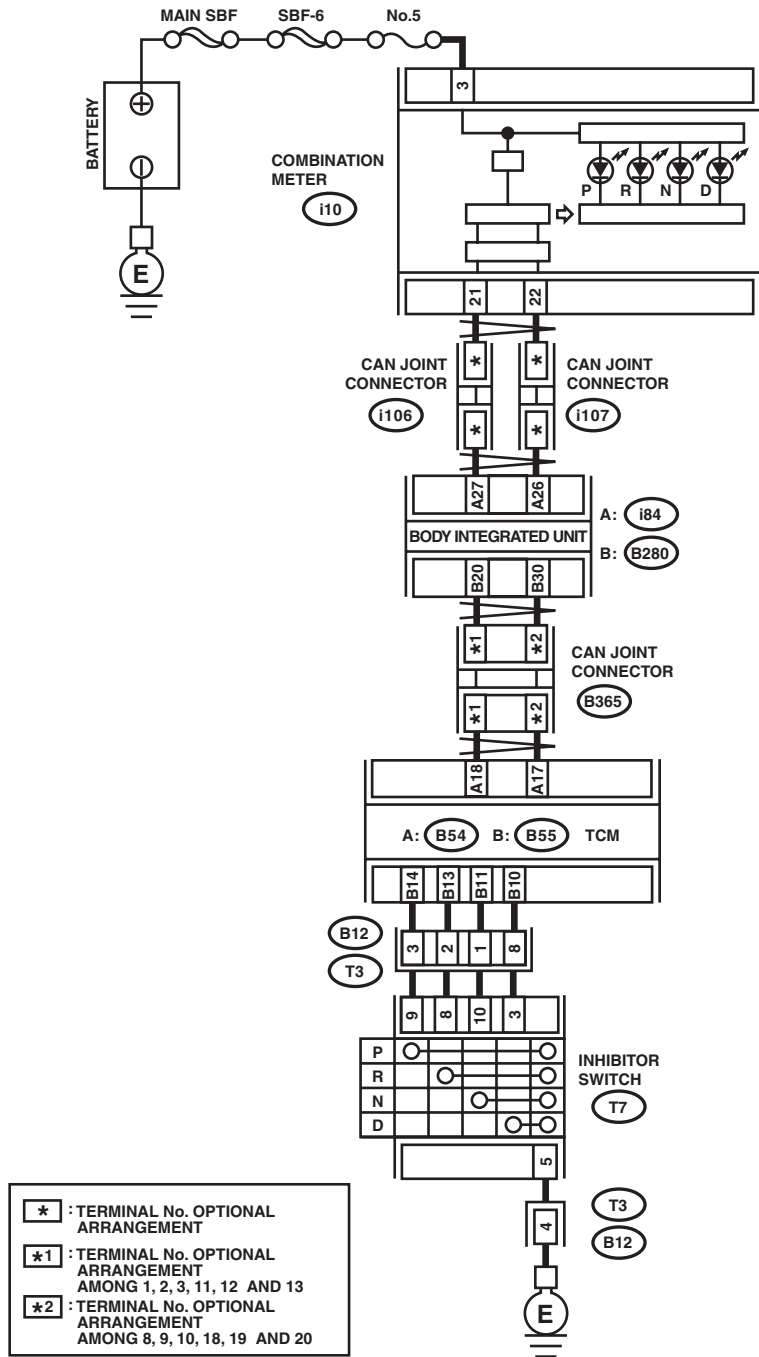
##### TROUBLE SYMPTOM:

- Shift characteristics are erroneous.
- The range position of the select lever and the AT select lever position indicator light on the combination meter do not match.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### WIRING DIAGRAM:



AT-04328

Step	Check	Yes	No
1	<b>CHECK INDICATOR LIGHT.</b> 1) Turn the ignition switch to ON. 2) Shift the select lever to "P" range.	Go to step 2.	Go to step 12.
2	<b>CHECK INDICATOR LIGHT.</b>	Go to step 26.	Go to step 3.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>3</b>	<b>CHECK INDICATOR LIGHT.</b>	Go to step <b>33</b> .	Go to step <b>4</b> .
<b>4</b>	<b>CHECK INDICATOR LIGHT.</b>	Go to step <b>40</b> .	Go to step <b>5</b> .
<b>5</b>	<b>CHECK "P" RANGE SWITCH.</b> Read the data of "P range" using Subaru Select Monitor.	Go to step <b>19</b> .	Go to step <b>6</b> .
<b>6</b>	<b>CHECK INDICATOR LIGHT.</b> Shift the select lever to "R" range.	Go to step <b>8</b> .	Go to step <b>7</b> .
<b>7</b>	<b>CHECK "R" RANGE SWITCH.</b> Read the data of "R range" using Subaru Select Monitor.	Go to step <b>23</b> .	Go to step <b>20</b> .
<b>8</b>	<b>CHECK INDICATOR LIGHT.</b> Shift the select lever to "N" range.	Go to step <b>10</b> .	Go to step <b>9</b> .
<b>9</b>	<b>CHECK "N" RANGE SWITCH.</b> Read the data of "N range" using Subaru Select Monitor.	Go to step <b>30</b> .	Go to step <b>27</b> .
<b>10</b>	<b>CHECK INDICATOR LIGHT.</b> Shift the select lever to "D" range.	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step <b>11</b> .
<b>11</b>	<b>CHECK "D" RANGE SWITCH.</b> Read the data of "D range" using Subaru Select Monitor.	Go to step <b>37</b> .	Go to step <b>34</b> .
<b>12</b>	<b>CHECK HARNESS CONNECTOR BETWEEN INHIBITOR SWITCH AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Measure the resistance of harness between inhibitor switch and chassis ground. <b>Connector &amp; terminal</b> <b>(T7) No. 5 — Chassis ground:</b>	Go to step <b>13</b> .	Repair the open circuit of harness between inhibitor switch and chassis ground, and poor contact of the connector.
<b>13</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and inhibitor switch. 3) Measure the resistance of the harness between TCM and inhibitor switch connector. <b>Connector &amp; terminal</b> <b>(B55) No. 14 — (T7) No. 9:</b>	Go to step <b>14</b> .	Repair the open circuit of harness between TCM and inhibitor switch connector, and poor contact of the connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>14 CHECK INPUT SIGNAL FOR TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to TCM and inhibitor switch. 3) Turn the ignition switch to ON. 4) Shift the select lever to "P" range. 5) Measure the voltage between TCM and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 14 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 15.	Go to step 41.
<b>15 CHECK INPUT SIGNAL FOR TCM.</b> 1) Shift the select lever to any range other than "P". 2) Measure the voltage between TCM and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 14 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Go to step 16.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>16 CHECK BODY INTEGRATED UNIT.</b> Read the data of inhibitor switch from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "7" displayed?	Go to step 17.	Check the body integrated unit.
<b>17 CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 18.
<b>18 CHECK COMBINATION METER.</b> Check the "P" range indicator light. <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the "P" range indicator light bulb OK?	Go to step 41.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>
<b>19 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM, inhibitor switch and combination meter. 3) Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 14 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 42.	Repair ground short circuit in "P" range circuit.
<b>20 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and inhibitor switch. 3) Measure the resistance of the harness between TCM and inhibitor switch connector. <b>Connector &amp; terminal</b> <b>(B55) No. 13 — (T7) No. 8:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 21.	Repair the open circuit of harness between TCM and inhibitor switch connector, and poor contact of the connector.
<b>21 CHECK INPUT SIGNAL FOR TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to TCM and inhibitor switch. 3) Turn the ignition switch to ON. 4) Shift the select lever to "R" range. 5) Measure the voltage between TCM and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 22.	Go to step 41.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>22 CHECK INPUT SIGNAL FOR TCM.</b> 1) Shift the select lever to other than "R" range. 2) Measure the voltage between TCM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 13 (+) — Chassis ground (-):</b></i>	Is the voltage 8 V or more?	Go to step 41.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>23 CHECK BODY INTEGRATED UNIT.</b> Read the data of shift position from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "6" displayed?	Go to step 24.	Check the body integrated unit.
<b>24 CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 25.
<b>25 CHECK COMBINATION METER.</b> Check the "R" range indicator light. <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the "R" range indicator light OK?	Go to step 41.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>
<b>26 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM, inhibitor switch and combination meter. 3) Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 13 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 41.	Repair ground short circuit in "R" range circuit.
<b>27 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and inhibitor switch. 3) Measure the resistance of the harness between TCM and inhibitor switch connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 11 — (T7) No. 10:</b></i>	Is resistance less than 1 Ω?	Go to step 28.	Repair the open circuit of harness between TCM and inhibitor switch connector, and poor contact of the connector.
<b>28 CHECK INPUT SIGNAL FOR TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to TCM and inhibitor switch. 3) Turn the ignition switch to ON. 4) Shift the select lever to "N" range. 5) Measure the voltage between TCM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 11 (+) — Chassis ground (-):</b></i>	Is the voltage less than 1 V?	Go to step 29.	Go to step 41.
<b>29 CHECK INPUT SIGNAL FOR TCM.</b> 1) Shift the select lever to any range other than "N" range. 2) Measure the voltage between TCM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 11 (+) — Chassis ground (-):</b></i>	Is the voltage 8 V or more?	Go to step 41.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>30 CHECK BODY INTEGRATED UNIT.</b> Read the data of shift position from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "5" displayed?	Go to step 31.	Check the body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>31 CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 32.
<b>32 CHECK COMBINATION METER.</b> Check the "N" range indicator light. <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the "N" range indicator light OK?	Go to step 41.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>
<b>33 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM, inhibitor switch and combination meter. 3) Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B55) No. 11 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 41.	Repair the ground short circuit in "N" range circuit.
<b>34 CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and inhibitor switch. 3) Measure the resistance of the harness between TCM and inhibitor switch connector. <i>Connector &amp; terminal</i> <i>(B55) No. 10 — (T7) No. 3:</i>	Is resistance less than 1 Ω?	Go to step 35.	Repair the open circuit of harness between TCM and inhibitor switch connector, and poor contact of the connector.
<b>35 CHECK INPUT SIGNAL FOR TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to TCM and inhibitor switch. 3) Turn the ignition switch to ON. 4) Shift the select lever to "D" range. 5) Measure the voltage between TCM and chassis ground. <i>Connector &amp; terminal</i> <i>(B55) No. 10 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Go to step 36.	Go to step 41.
<b>36 CHECK INPUT SIGNAL FOR TCM.</b> 1) Shift the select lever to any range other than "D" range. 2) Measure the voltage between TCM and chassis ground. <i>Connector &amp; terminal</i> <i>(B55) No. 10 (+) — Chassis ground (-):</i>	Is the voltage 8 V or more?	Go to step 41.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>37 CHECK BODY INTEGRATED UNIT.</b> Read the data of inhibitor switch from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is "4" displayed?	Go to step 38.	Check the body integrated unit.
<b>38 CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 39.
<b>39 CHECK COMBINATION METER.</b> Check the "D" range indicator light. <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the "D" range indicator light OK?	Go to step 41.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>40</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND INHIBITOR SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM, inhibitor switch and combination meter. 3) Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 10 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 41.	Repair ground short circuit in "D" range circuit.
<b>41</b> <b>CHECK POOR CONTACT.</b>	Is there poor contact in the inhibitor switch circuit?	Repair the poor contact.	Go to step 42.
<b>42</b> <b>CHECK INHIBITOR SWITCH.</b>	Is the inhibitor switch in the normal position?	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>	Adjust inhibitor switch and select cable. <Ref. to 4AT-47, Inhibitor Switch.> <Ref. to CS-27, Select Cable.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### B: DTC P0712 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT

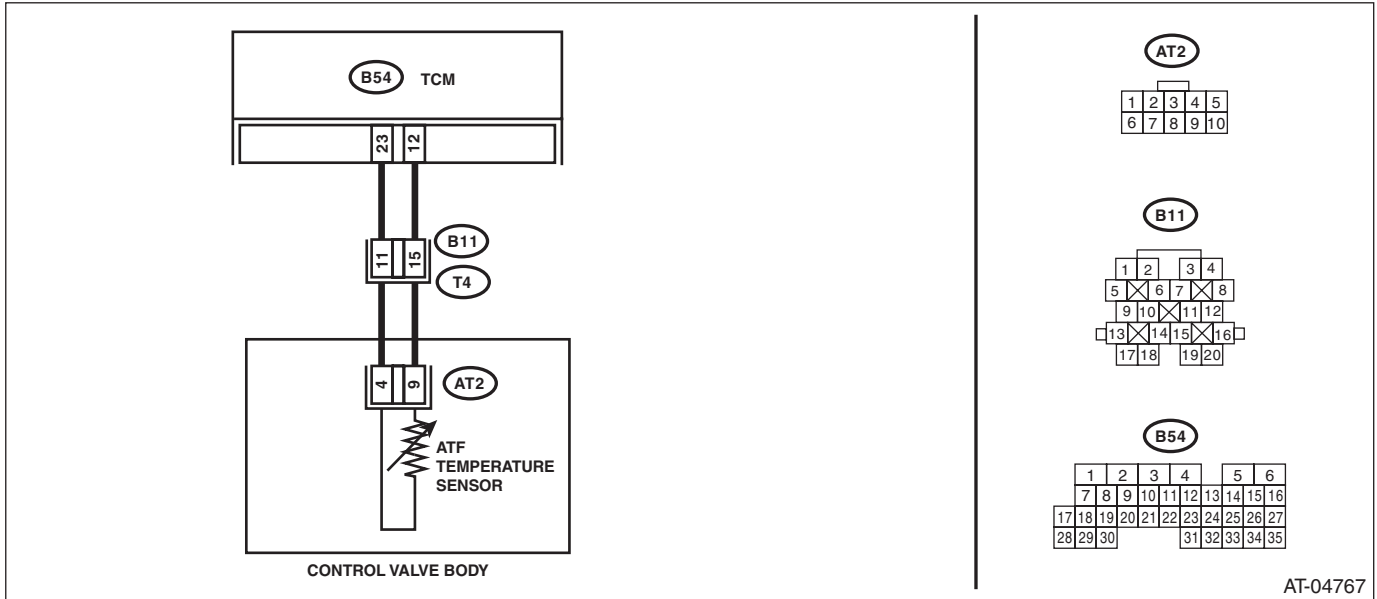
#### DTC DETECTING CONDITION:

Input signal circuit to ATF temperature sensor is open or shorted.

#### TROUBLE SYMPTOM:

Excessive shift shock

#### WIRING DIAGRAM:



AT-04767

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission and TCM. 3) Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 23 — (B11) No. 11:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 12 — (B11) No. 15:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
<b>3 CHECK ATF TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the connectors to transmission and TCM. 3) Turn the ignition switch to ON and start engine. 4) Warm-up the transmission until the ATF temperature exceeds 80°C (176°F). NOTE: If the ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Disconnect the connector from transmission. 6) Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 11 — No. 15:</b>	Is the resistance between 300 — 800 $\Omega$ ?	Go to step 4.	Go to step 7.
<b>4 CHECK ATF TEMPERATURE SENSOR.</b> Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 11 — No. 15:</b>	Does the resistance value increase while the ATF temperature decreases?	Go to step 5.	Go to step 7.
<b>5 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connector to transmission. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON (engine OFF). 4) Read the data of "ATF temperature sensor" using Subaru Select Monitor.	Does the ATF temperature gradually decrease?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness and poor contact of ATF temperature sensor and transmission connector.	Go to step 6.
<b>6 CHECK POOR CONTACT.</b>	Is there poor contact in ATF temperature sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from transmission.                      3) Remove the transmission connector from bracket.                      4) Lift up the vehicle.                      5) Drain the automatic transmission fluid.</p> <p><b>CAUTION:</b>  <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve connector.                      7) Measure the resistance of harness between ATF temperature sensor and transmission connector.</p> <p><b>Connector &amp; terminal</b>  <b>(T4) No. 11 — (AT2) No. 4:</b></p>	Is resistance less than 1 Ω?	Go to step 8.	Repair the open circuit of harness between ATF temperature sensor and transmission connector.
<p><b>8</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.</b></p> <p>Measure the resistance of harness between ATF temperature sensor and transmission connector.</p> <p><b>Connector &amp; terminal</b>  <b>(T4) No. 15 — (AT2) No. 9:</b></p>	Is resistance less than 1 Ω?	Go to step 9.	Repair the open circuit of harness between ATF temperature sensor and transmission connector.
<p><b>9</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.</b></p> <p>Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b>  <b>(T4) No. 11 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 10.	Repair the short circuit of harness between ATF temperature sensor and transmission connector.
<p><b>10</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND ATF TEMPERATURE SENSOR.</b></p> <p>Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b>  <b>(T4) No. 15 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 4AT-58, Control Valve Body.>	Repair the short circuit of harness between ATF temperature sensor and transmission connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## C: DTC P0713 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT

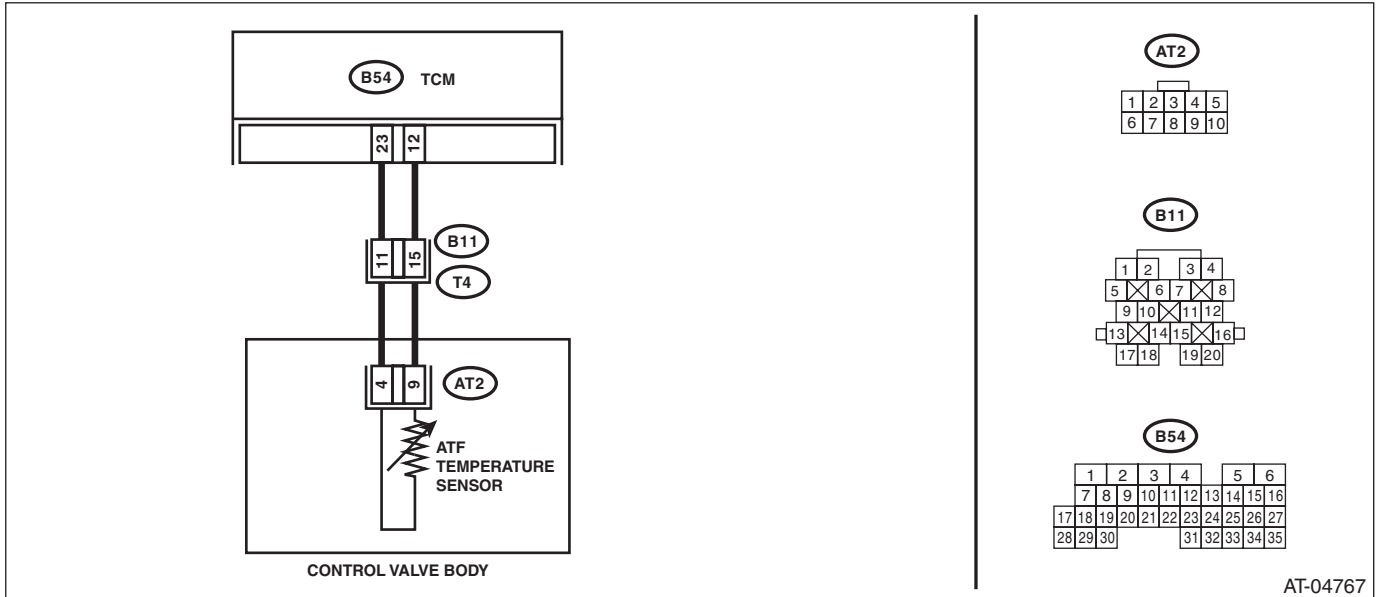
### DTC DETECTING CONDITION:

Input signal circuit to ATF temperature sensor is shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance between TCM connector terminals. <i>Connector &amp; terminal</i> <i>(B54) No. 23 — No. 12:</i>	Is the resistance 500 Ω or more?	Go to step 2.	Go to step 4.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B54) No. 23 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Go to step 4.
<b>3 CHECK HARNESS.</b> Measure the resistance between TCM connector terminals while shaking the harness. <i>Connector &amp; terminal</i> <i>(B54) No. 23 — No. 12:</i>	Does the resistance change?	Go to step 4.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>4 CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B54) No. 23 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between TCM and transmission harness.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>5</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND ATF TEMPERATURE SENSOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 12 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Repair the short circuit of harness between TCM and transmission harness.
<b>6</b> <b>CHECK ATF TEMPERATURE SENSOR.</b> Measure the resistance between transmission connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(T4) No. 11 — No. 15:</b></i>	Is the resistance 500 $\Omega$ or more?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary short circuit of connector or harness may be the cause. Repair the harness or connector.	Go to step 7.
<b>7</b> <b>CHECK TRANSMISSION HARNESS.</b> 1) Lift up the vehicle. 2) Drain the automatic transmission fluid. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 3) Remove the oil pan. 4) Disconnect the harness connector from control valve. 5) Measure the resistance between ATF temperature sensor connector terminals. 6) Measure the resistance between transmission connector and transmission ground. <i><b>Connector &amp; terminal</b></i> <i><b>(T4) No. 11 — Transmission ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 8.	Replace the transmission harness.
<b>8</b> <b>CHECK TRANSMISSION HARNESS.</b> Measure the resistance between transmission connector and transmission ground. <i><b>Connector &amp; terminal</b></i> <i><b>(T4) No. 15 — Transmission ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 9.	Replace the transmission harness.
<b>9</b> <b>CHECK ATF TEMPERATURE SENSOR.</b> Measure the resistance between control valve connector terminals. <i><b>Terminals</b></i> <i><b>No. 4 — No. 9:</b></i>	Is the resistance 500 $\Omega$ or more?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary short circuit of connector or harness may be the cause. Repair the harness or connector.	Replace the control valve body. <Ref. to 4AT-58, Control Valve Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## D: DTC P0715 INPUT/TURBINE SPEED SENSOR CIRCUIT

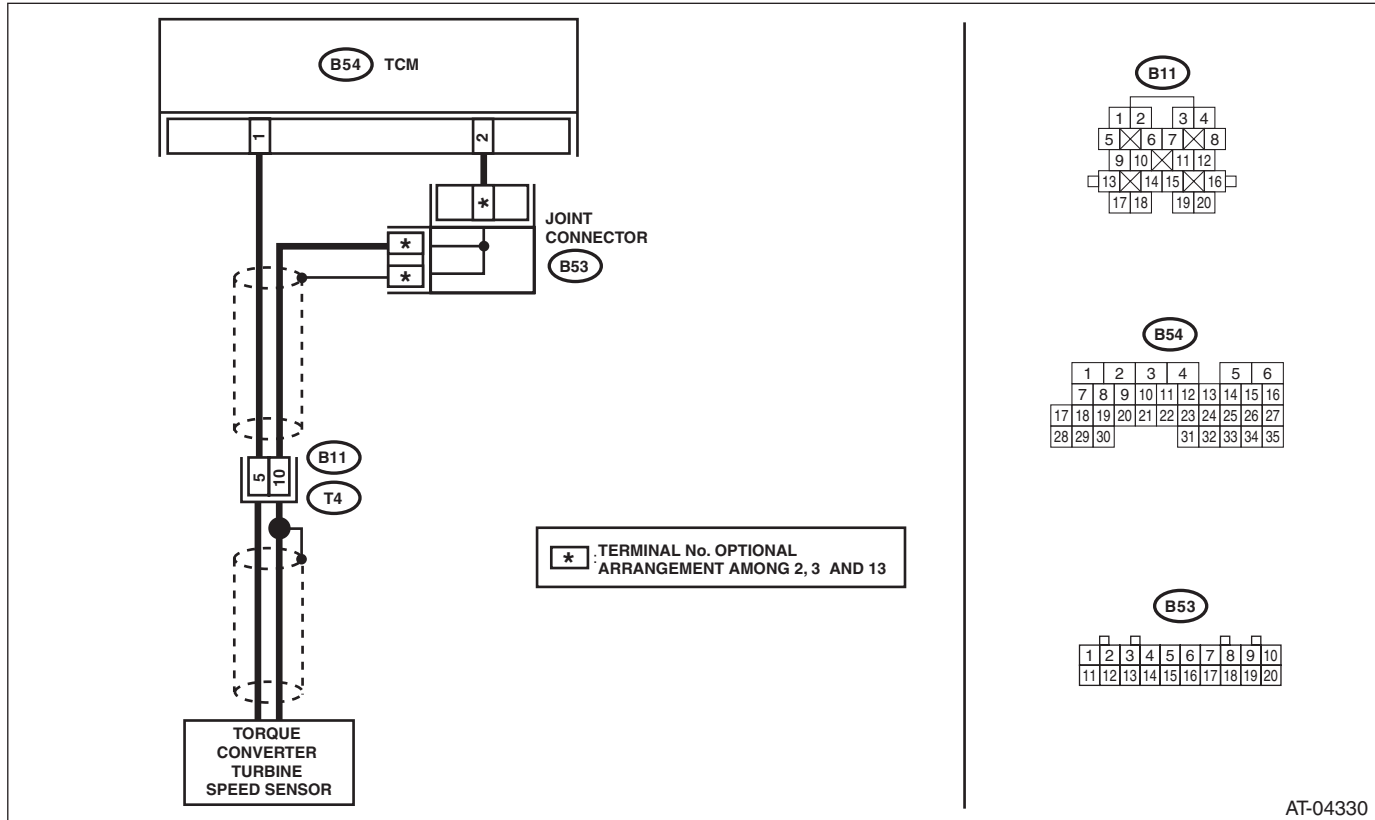
### DTC DETECTING CONDITION:

Input signal circuit of TCM is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



AT-04330

Step	Check	Yes	No
<b>1 CHECK TORQUE CONVERTER TURBINE SPEED SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Measure the resistance between transmission connector receptacle's terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 5 — No. 10:</b>	Is the resistance between 450 — 650 $\Omega$ ?	Go to step 2.	Replace the torque converter turbine speed sensor. <Ref. to 4AT-55, Torque Converter Turbine Speed Sensor.>
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Disconnect the connector from TCM. 2) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 1 — (B11) No. 5:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
<b>3 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 2 — (B11) No. 10:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between TCM and transmission connector, and poor contact of the connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 2 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between TCM and transmission connector.
<b>5 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 1 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 6.	Repair the short circuit of the harness between TCM and transmission connector, and poor contact of connector.
<b>6 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connectors to TCM and transmission. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. 4) Start the engine. 5) Shift the select lever to "P" or "N" range. 6) Read the data of "Turbine Revolution Speed" using Subaru Select Monitor. • Compare the tachometer with Subaru Select Monitor indications.	Is the revolution value same as the tachometer reading shown on the combination meter?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 7.
<b>7 CHECK POOR CONTACT.</b>	Is there poor contact in torque converter turbine speed sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## E: DTC P0719 BRAKE SWITCH CIRCUIT LOW

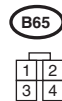
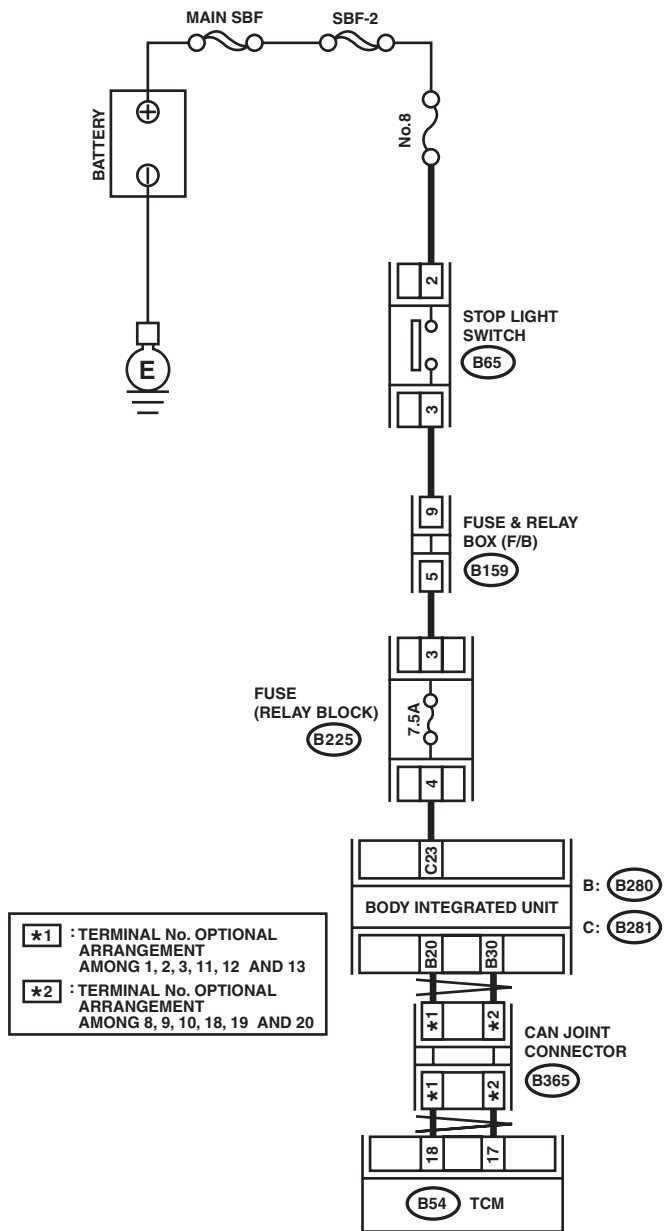
### DTC DETECTING CONDITION:

Brake switch malfunction, open input signal circuit

### TROUBLE SYMPTOM:

Gear is not shifted down when driving a down hill.

### WIRING DIAGRAM:



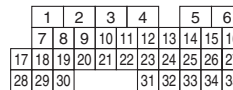
B: **B280**



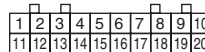
C: **B281**



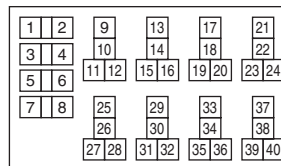
**B54**



**B365**



**B225 (BLACK)**



AT-04331

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DTC.</b>	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b> <b>CHECK FUSE (NO. 8).</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 8).	Is the fuse (No. 8) blown out?	Replace the fuse (No. 8). If the replaced fuse (No. 8) has blown out easily, repair the short circuit of harness between fuse (No. 8) and stop light switch.	Go to step 3.
<b>3</b> <b>CHECK FUSE (RELAY BLOCK) (7.5A).</b> Remove the fuse (relay block) (7.5 A).	Is the fuse (7.5A) blown out?	Replace the fuse (7.5A). If the replaced fuse (7.5A) blows out easily, repair the short circuit of harness between fuse (7.5A) and TCM.	Go to step 4.
<b>4</b> <b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Run the Subaru Select Monitor. 5) Depress the brake pedal. 6) Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 5.	Go to step 6.
<b>5</b> <b>CHECK TCM.</b> Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to 4AT(diag)-15, OPERATION, Subaru Select Monitor.>	Is ON displayed?	A temporary poor contact of connector or harness may be the cause. Check the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>6</b> <b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Disconnect the connector from body integrated unit. 2) Depress the brake pedal. 3) Measure the voltage of harness between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 9.	Go to step 7.
<b>7</b> <b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from stop light switch. 3) Measure the resistance of harness between body integrated unit and stop light switch. <b>Connector &amp; terminal</b> <b>(B281) No. 23 — (B65) No. 3:</b>	Is resistance less than 1 Ω?	Go to step 8.	Repair the open circuit of harness between body integrated unit and stop light switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>8</b> <b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> Measure the resistance of harness between body integrated unit and stop light switch. <b>Connector &amp; terminal (B281) No. 23 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 9.	Repair the short circuit of harness between body integrated unit and stop light switch.
<b>9</b> <b>CHECK POOR CONTACT.</b>	Is there poor contact in input signal of brake switch?	Repair the poor contact.	Check the body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### F: DTC P0720 OUTPUT SPEED SENSOR CIRCUIT

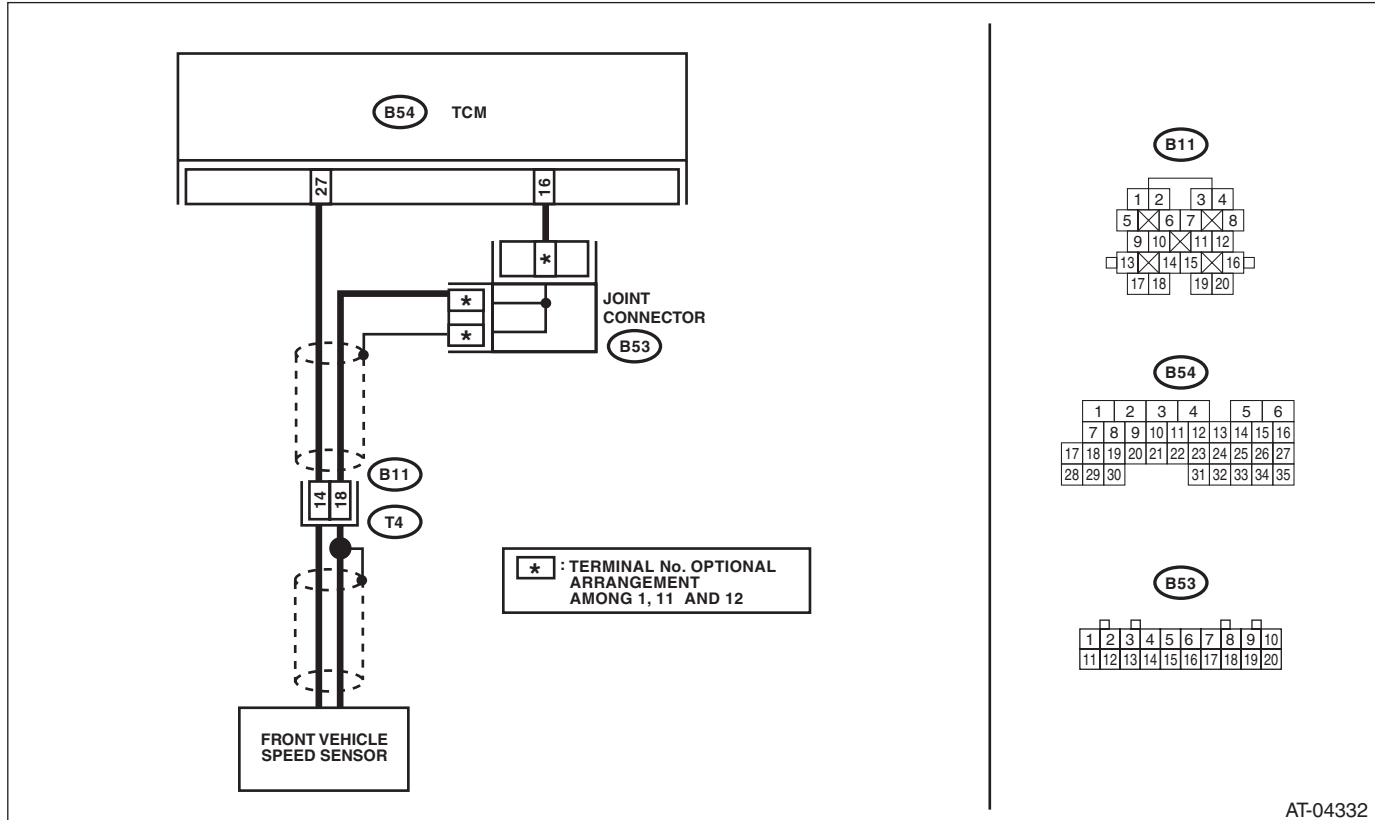
#### DTC DETECTING CONDITION:

- The vehicle speed signal is abnormal.
- The harness connector between TCM and front vehicle speed sensor is shorted or open.

#### TROUBLE SYMPTOM:

Driving performance is poor.

#### WIRING DIAGRAM:



AT-04332

Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 27 — (B11) No. 14:</b>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 16 — (B11) No. 18:</b>	Is resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector, and poor contact of the connector.
<b>3</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 27 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 16 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the short circuit of the harness between TCM and transmission connector, and poor contact of connector.
<b>5 CHECK FRONT VEHICLE SPEED SENSOR.</b> Measure the resistance between transmission connector receptacle's terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 14 — No. 18:</b>	Is the resistance between 450 — 650 $\Omega$ ?	Go to step 6.	Replace the front vehicle speed sensor. <Ref. to 4AT-51, Front Vehicle Speed Sensor.>
<b>6 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Connect the Subaru Select Monitor to the data link connector. 3) Lift up the vehicle. 4) Turn the ignition switch to ON and run the Subaru Select Monitor. 5) Start the engine. 6) Read the data of "front wheel speed" using Subaru Select Monitor. <ul style="list-style-type: none"> <li>• Compare the speedometer with Subaru Select Monitor indications.</li> <li>• Vehicle speed is indicated in "km/h" or "MPH"</li> </ul> 7) Slowly increase the vehicle speed to 60 km/h (37 MPH). NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.>	Does the speedometer indication increase as the Subaru Select Monitor front wheel speed data increases?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness in of front vehicle speed sensor circuit.	Go to step 7.
<b>7 CHECK POOR CONTACT.</b>	Is there poor contact in front vehicle speed sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### G: DTC P0724 BRAKE SWITCH CIRCUIT HIGH

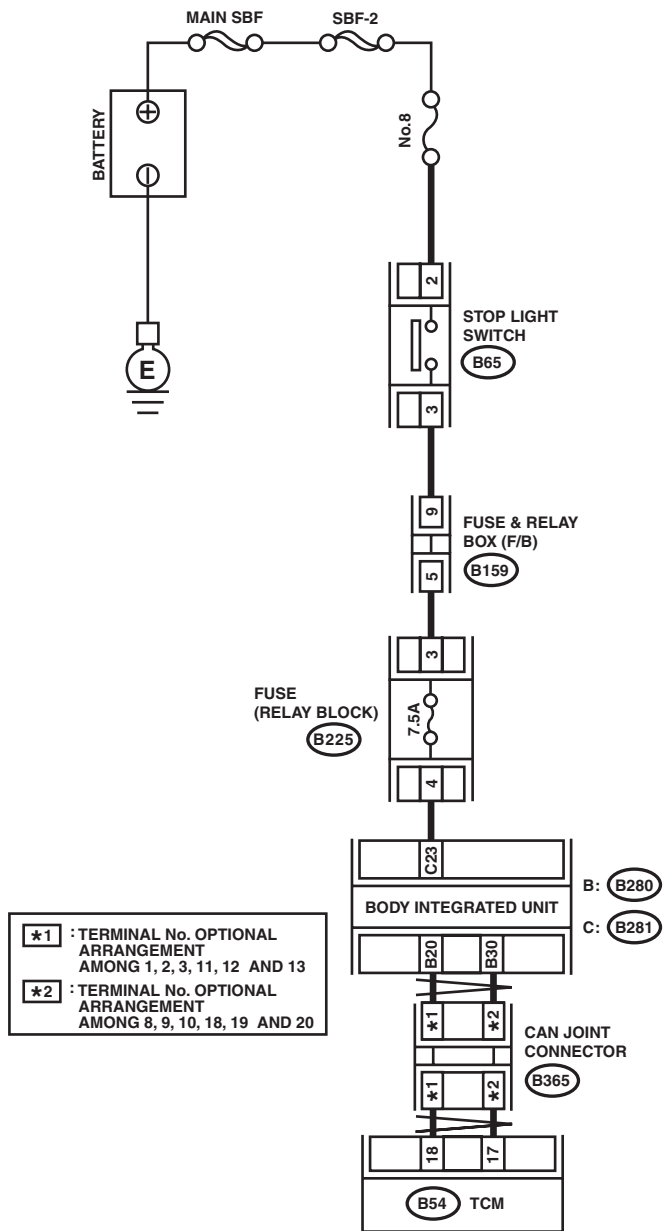
#### DTC DETECTING CONDITION:

Brake switch malfunction, open input signal circuit

#### TROUBLE SYMPTOM:

Gear is not shifted down when driving a down hill.

#### WIRING DIAGRAM:



B: **B280**



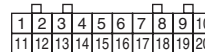
C: **B281**



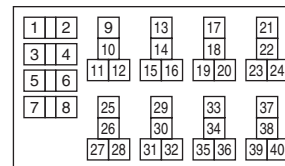
**B54**



**B365**



**B225 (BLACK)**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b>	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Run the Subaru Select Monitor. 5) Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	Go to step 3.	Go to step 4.
3	<b>CHECK TCM.</b> Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to 4AT(diag)-15, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	A temporary poor contact of connector or harness may be the cause. Check the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
4	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the voltage of harness between body integrated unit and stop light switch. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 5.	Go to step 7.
5	<b>CHECK STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from stop light switch. 3) Measure the resistance of harness between stop light switch connectors. <b>Terminals</b> <b>No. 2 — No. 3:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the stop light switch.
6	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage of harness between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 7.	Repair the short circuit of harness between TCM and stop light switch.
7	<b>CHECK POOR CONTACT.</b>	Is there poor contact in input signal of brake switch?	Repair the poor contact.	Check the body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## H: DTC P0725 ENGINE SPEED INPUT CIRCUIT

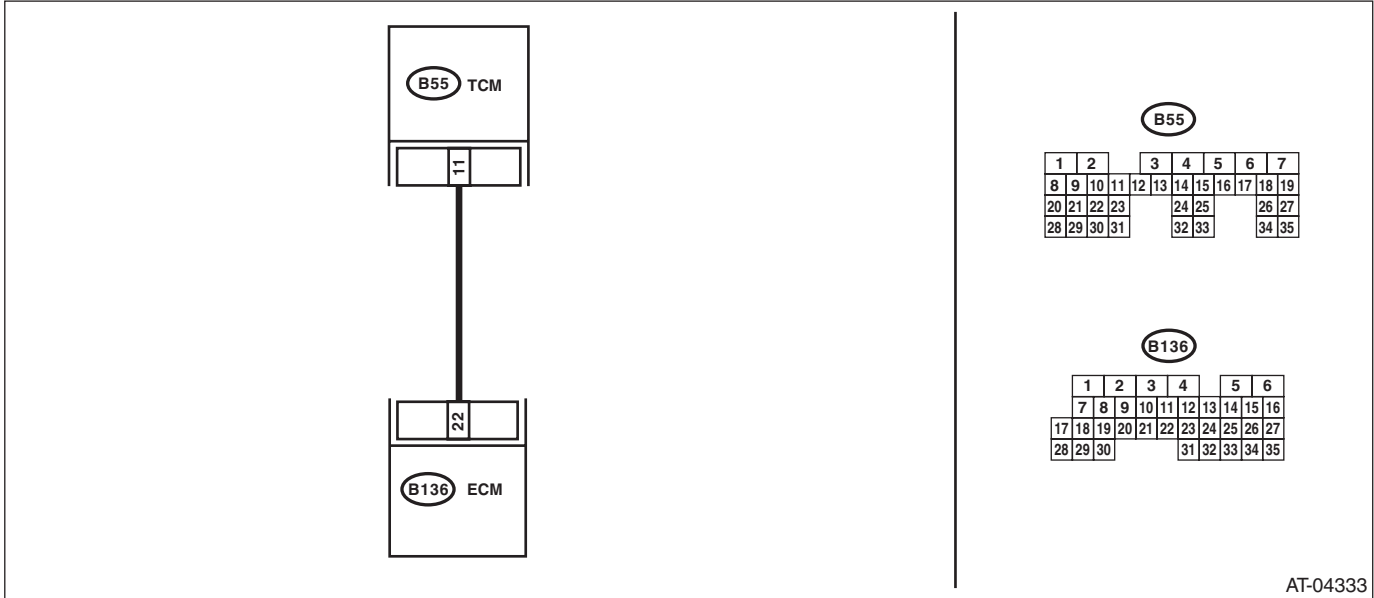
### DTC DETECTING CONDITION:

Engine speed input signal circuit is open or shorted.

### TROUBLE SYMPTOM:

- No lock-up occurs. (After engine is warmed-up)
- ATF temperature warning light remains ON when the vehicle speed is "0".

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and ECM. 3) Measure the resistance of harness between TCM and ECM. <b>Connector &amp; terminal</b> <b>(B55) No. 11 — (B136) No. 22:</b>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and ECM connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 11 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and ECM connector.
<b>3 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connectors to TCM and ECM. 2) Connect the Subaru Select Monitor to the data link connector. 3) Start the engine, and run the Subaru Select Monitor. 4) Run the engine at idle. 5) Read the data of "Engine Speed" using Subaru Select Monitor. • Display shows engine speed signal value sent from ECM.	Is the revolution value same as the tachometer reading shown on the combination meter?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in the TCM and ECM.	Go to step 4.
<b>4 CHECK POOR CONTACT.</b>	Is there poor contact in engine speed signal circuit?	Repair the poor contact.	Go to step 5.
<b>5 CONFIRM DTC P0725.</b> Replace the ECM with a new part.	Does the DTC appear again, after the memory has been cleared?	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>	Replace the ECM.

## I: DTC P0731 GEAR 1 INCORRECT RATIO

NOTE:

Refer to DTC P0736 for diagnostic procedure. <Ref. to 4AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## J: DTC P0732 GEAR 2 INCORRECT RATIO

NOTE:

Refer to DTC P0736 for diagnostic procedure. <Ref. to 4AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## K: DTC P0733 GEAR 3 INCORRECT RATIO

NOTE:

Refer to DTC P0736 for diagnostic procedure. <Ref. to 4AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## L: DTC P0734 GEAR 4 INCORRECT RATIO

NOTE:

Refer to DTC P0736 for diagnostic procedure. <Ref. to 4AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## M: DTC P0736 REVERSE INCORRECT RATIO

### DTC DETECTING CONDITION:

Vehicle sensor, torque converter turbine speed sensor or control valve malfunction

### TROUBLE SYMPTOM:

- Shift point is too high or too low.
- Excessive shift shock
- Tight corner braking phenomenon occurs.
- Gear is not shifted to reverse.
- Gear position is held by fail safe function.

	Step	Check	Yes	No
1	<b>CHECK ACCELERATOR PEDAL POSITION SENSOR.</b> 1) Connect the Subaru Select Monitor to the data link connector. 2) Turn the ignition switch to ON. 3) Read the value of "Accel. opening angle" on Subaru Select Monitor display.	Does the value of "Accel. opening angle" change from 0% to 100% smoothly when throttle is operated from fully closed to fully open?	Go to step 2.	Check the accelerator pedal position sensor circuit.
2	<b>CHECK FRONT VEHICLE SPEED SENSOR.</b> 1) Lift up the vehicle. 2) Start the engine. 3) Shift the select lever to "D" range and slowly increase vehicle speed.  NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this indicates no malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.>	Does the vehicle speed displayed by Subaru Select Monitor roughly correspond with vehicle speed indicated by the combination meter?	Go to step 3.	Check the front vehicle speed sensor circuit.
3	<b>CHECK TORQUE CONVERTER TURBINE SPEED SENSOR.</b> 1) Shift the select lever to "P" or "N" range. 2) Idle the engine.	Does the value of torque converter turbine speed sensor displayed by Subaru Select Monitor roughly correspond with the value of tachometer in combination meter?	There are malfunctions in TCM, TCM connector poor contact, or transmission assembly mechanical malfunction.	Check the torque converter turbine speed sensor circuit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## N: DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF

### DTC DETECTING CONDITION:

- Lock up clutch malfunction
- Sticky valve

### TROUBLE SYMPTOM:

No lock-up occurs.

	Step	Check	Yes	No
1	<b>CHECK LOCK-UP DUTY SOLENOID CIRCUIT.</b> Diagnose according to DTC P0743 procedure.	Is there any fault?	Repair or replace the lock up duty solenoid circuit.	Go to step 2.
2	<b>CHECK INHIBITOR SWITCH CIRCUIT.</b> Diagnose according to DTC P0705 procedure.	Is there any fault?	Repair or replace the inhibitor switch circuit.	Go to step 3.
3	<b>CHECK STOP LIGHT SWITCH CIRCUIT.</b> Diagnose according to DTC P0719 and P0724 procedures.	Is there any fault?	Repair or replace the stop light switch circuit.	Go to step 4.
4	<b>CHECK ATF TEMPERATURE SENSOR CIRCUIT.</b> Diagnose according to DTC P0712 AND P0713 procedure.	Is there any fault?	Repair or replace the ATF temperature sensor circuit.	Go to step 5.
5	<b>CHECK ACCELERATOR PEDAL POSITION SENSOR.</b> 1) Connect the Subaru Select Monitor to the data link connector. 2) Turn the ignition switch to ON. 3) Read the value of "Accel. opening angle" on Subaru Select Monitor display.	Does the value of accelerator pedal position sensor change from 0% to 100% smoothly when throttle is operated from fully closed to fully open?	Go to step 6.	Check the accelerator pedal position sensor circuit.
6	<b>CHECK TORQUE CONVERTER TURBINE SPEED SENSOR.</b> 1) Shift the select lever to "P" or "N" range. 2) Idle the engine.	Does the value of turbine speed displayed by Subaru Select Monitor almost correspond with the value of the tachometer?	Go to step 7.	Check the torque converter turbine speed sensor circuit.
7	<b>CHECK ENGINE SPEED SIGNAL.</b> Idle the engine.	Does the value of turbine speed displayed by Subaru Select Monitor almost correspond with the value of the tachometer?	There is transmission assembly mechanical malfunction.	Check the engine speed signal circuit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## O: DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL

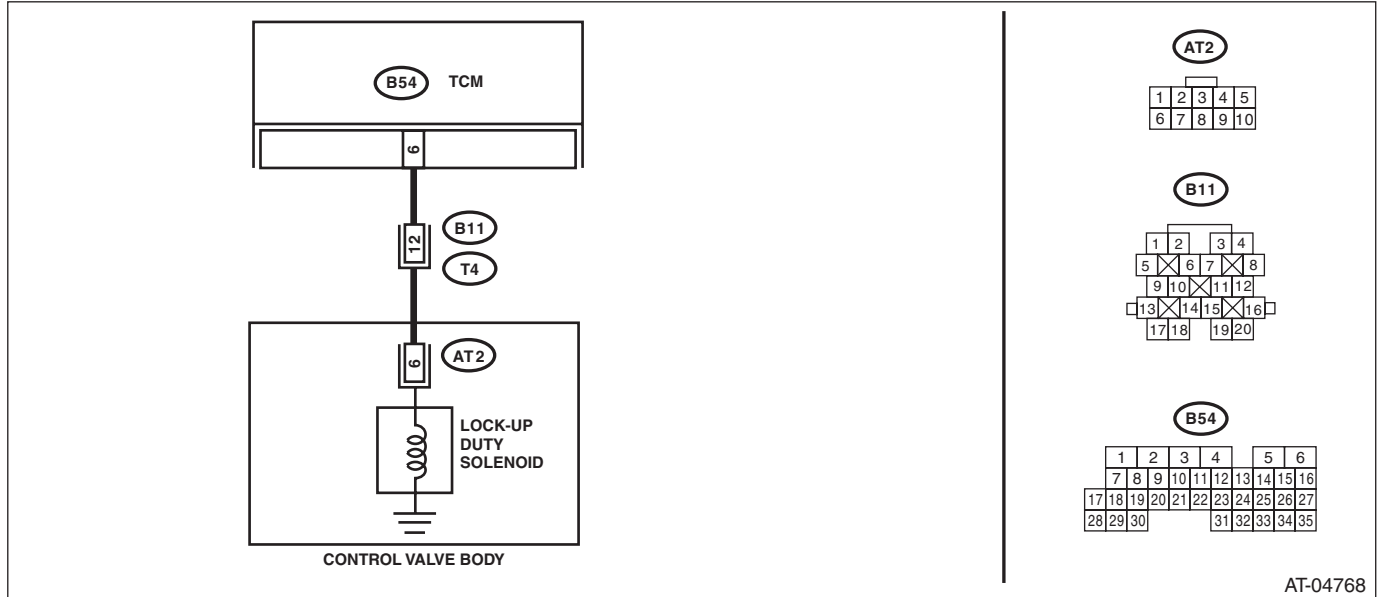
### DTC DETECTING CONDITION:

Output signal circuit of lock-up duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

No lock-up occurs. (After engine is warmed-up)

### WIRING DIAGRAM:



AT-04768



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b>	<b>CHECK DTC.</b>	Are multiple DTCs displayed?	Go to other DTC. Go to step 2.
<b>2</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 6 — (B11) No. 12:</b>	Is resistance less than 1 Ω?	Go to step 3. Repair the open circuit of harness between TCM and transmission connector.
<b>3</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of the harness connector between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B54) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4. Repair the short circuit of harness between TCM and transmission connector.
<b>4</b>	<b>CHECK LOCK-UP DUTY SOLENOID.</b> Measure the resistance between transmission connector receptacle's terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 12 — No. 20:</b>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 5. Go to step 8.
<b>5</b>	<b>CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connectors to TCM and transmission. 2) Lift up the vehicle. 3) Connect the Subaru Select Monitor to the data link connector. 4) Start the engine, and run the Subaru Select Monitor. 5) Start the engine and warm-up the engine until the ATF temperature exceeds 80°C (176°F). <b>NOTE:</b> If the ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 6) Read the data of "Lock Up Duty Ratio" using Subaru Select Monitor. • Lock-up duty solenoid is indicated in "%". 7) Shift the select lever to "D", and slowly increase vehicle speed to 60 km/h (37 MPH). <b>NOTE:</b> The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.>	Is the measured value 95%?	Go to step 6. Go to step 7.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>6 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> Return the engine to idling speed, shift the select lever to “N” range and read the data. NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. &lt;Ref. to ABS(diag)-24, Clear Memory Mode.&gt;</p>	Is the measured value 5%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 7.
<p><b>7 CHECK POOR CONTACT.</b></p>	Is there poor contact in lock-up duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<p><b>8 CHECK LOCK-UP DUTY SOLENOID (IN TRANSMISSION).</b> 1) Disconnect the transmission connector. 2) Drain the automatic transmission fluid. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 3) Remove the oil pan, and disconnect the connector from control valve body. 4) Measure the resistance between lock-up duty solenoid and transmission ground. <b>Connector &amp; terminal</b> <b>(AT2) No. 6 — Transmission ground:</b></p>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 9.	Replace the control valve body. <Ref. to 4AT-58, Control Valve Body.>
<p><b>9 CHECK HARNESS CONNECTOR BETWEEN LOCK-UP DUTY SOLENOID AND TRANSMISSION.</b> Measure the resistance of harness between lock-up duty solenoid and transmission connector. <b>Connector &amp; terminal</b> <b>(T4) No. 12 — (AT2) No. 6:</b></p>	Is resistance less than 1 Ω?	Go to step 10.	Repair the open circuit of harness between TCM and transmission connector.
<p><b>10 CHECK HARNESS CONNECTOR BETWEEN LOCK-UP DUTY SOLENOID AND TRANSMISSION.</b> Measure the resistance of harness between transmission connector and transmission ground. <b>Connector &amp; terminal</b> <b>(T4) No. 12 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in lock-up duty solenoid and transmission.	Repair the short circuit of harness between lock-up duty solenoid and transmission connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## P: DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL

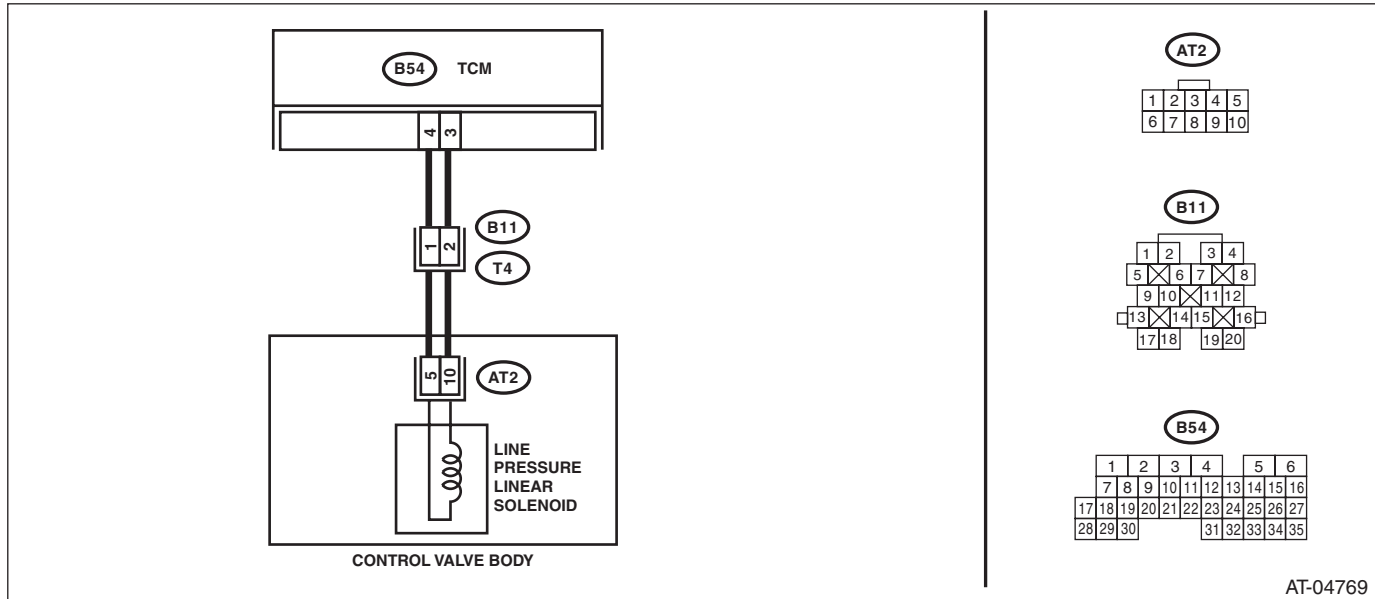
### DTC DETECTING CONDITION:

Output signal circuit of line pressure linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission and TCM. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> (B54) No. 3 — (B11) No. 2: (B54) No. 4 — (B11) No. 1:	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 3 — Chassis ground: (B54) No. 4 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK LINE PRESSURE LINEAR SOLENOID.</b> Measure the resistance between transmission connector receptacle's terminals. <b>Connector &amp; terminal</b> (T4) No. 1 — No. 2:	Is the resistance between 4 — 8 Ω?	Go to step 5.	Go to step 4.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK LINE PRESSURE LINEAR SOLENOID (IN TRANSMISSION).</b></p> <p>1) Remove the transmission connector from bracket.</p> <p>2) Drain the automatic transmission fluid.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>3) Remove the oil pan, and disconnect the connector from control valve body.</p> <p>4) Measure the resistance of line pressure linear solenoid connector terminals.</p> <p><b>Connector &amp; terminal</b> <b>(AT2) No. 5 — No. 10:</b></p>	<p>Is the resistance between 4 — 8 <math>\Omega</math>?</p>	<p>Go to step 5.</p>	<p>Replace the control valve body. &lt;Ref. to 4AT-58, Control Valve Body.&gt;</p>
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LINE PRESSURE LINEAR SOLENOID.</b></p> <p>Measure the resistance of harness between line pressure linear solenoid and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 2 — (AT2) No. 10:</b> <b>(T4) No. 1 — (AT2) No. 5:</b></p>	<p>Is resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 6.</p>	<p>Repair the open circuit of harness between line pressure linear solenoid and transmission connector.</p>
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LINE PRESSURE LINEAR SOLENOID.</b></p> <p>Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 1 — Transmission ground:</b> <b>(T4) No. 2 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in line pressure linear solenoid and transmission.</p>	<p>Repair the short circuit of harness between line pressure linear solenoid and transmission connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## Q: DTC P0753 SHIFT SOLENOID "A" ELECTRICAL

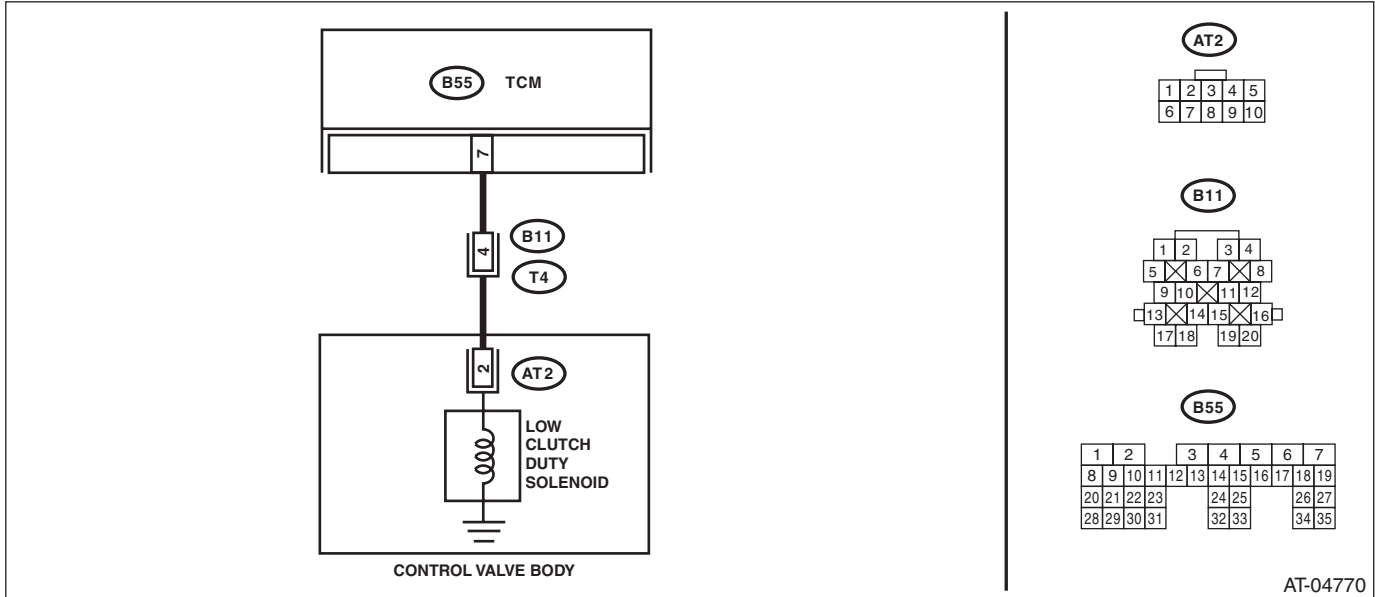
### DTC DETECTING CONDITION:

Output signal circuit of low clutch duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 7 — (B11) No. 4:</b></i>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and transmission ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B55) No. 7 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK LOW CLUTCH DUTY SOLENOID.</b> Measure the resistance between transmission connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(T4) No. 4 — No. 20:</b></i>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 4.	Go to step 7.
<b>4 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connectors to TCM and transmission. 2) Connect the Subaru Select Monitor to the data link connector. 3) Start the engine, and run the Subaru Select Monitor. 4) Warm-up the transmission until the ATF temperature exceeds approximately 80°C (176°F). NOTE: If the ambient temperature falls below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Stop the engine and turn the ignition switch to ON (with engine OFF). 6) Shift the select lever to “P” or “N” range, and depress the accelerator pedal. 7) Read the data of “Low Clutch Duty Ratio” using Subaru Select Monitor. • Low clutch duty solenoid is indicated in “%”.	Is the measured value 100%?	Go to step 5.	Go to step 6.
<b>5 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Shift the select lever to “D” range. 3) Read the data of “Low Clutch Duty Ratio”.	Is the measured value 0%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in transmission.	Go to step 6.
<b>6 CHECK POOR CONTACT.</b>	Is there poor contact in low clutch duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK LOW CLUTCH DUTY SOLENOID (IN TRANSMISSION).</b></p> <p>1) Remove the transmission connector from bracket.</p> <p>2) Drain the automatic transmission fluid.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>3) Remove the oil pan, and disconnect the connector from control valve body.</p> <p>4) Measure the resistance between low clutch duty solenoid connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(AT2) No. 2 — Transmission ground:</b></p>	<p>Is the resistance between 2.0 — 6.0 <math>\Omega</math>?</p>	<p>Go to step 8.</p>	<p>Replace the control valve body. &lt;Ref. to 4AT-58, Control Valve Body.&gt;</p>
<p><b>8</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LOW CLUTCH DUTY SOLENOID.</b></p> <p>Measure the resistance of harness between low clutch duty solenoid and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 4 — (AT2) No. 2:</b></p>	<p>Is resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 9.</p>	<p>Repair the open circuit of harness between low clutch duty solenoid and transmission connector.</p>
<p><b>9</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LOW CLUTCH DUTY SOLENOID.</b></p> <p>Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 4 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector of the low clutch duty solenoid and transmission.</p>	<p>Repair the short circuit of harness between low clutch duty solenoid and transmission connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## R: DTC P0758 SHIFT SOLENOID "B" ELECTRICAL

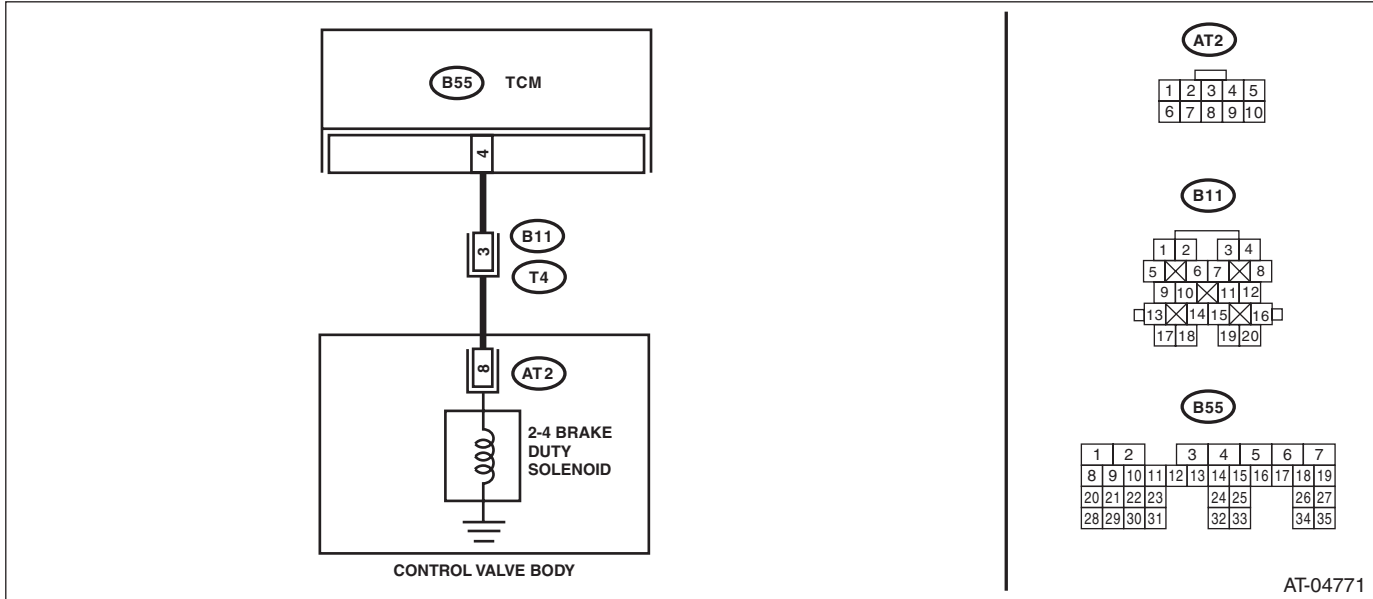
### DTC DETECTING CONDITION:

Output signal circuit of 2-4 brake duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



AT-04771



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <i>Connector &amp; terminal</i> <i>(B55) No. 4 — (B11) No. 3:</i>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B55) No. 4 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK 2-4 BRAKE DUTY SOLENOID.</b> Measure the resistance between transmission connector terminals. <i>Connector &amp; terminal</i> <i>(T4) No. 3 — No. 20:</i>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 4.	Go to step 7.
<b>4 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Connect the Subaru Select Monitor to the data link connector. 3) Start the engine, and run the Subaru Select Monitor. 4) Warm-up the transmission until the ATF temperature exceeds approximately 80°C (176°F). NOTE: If the ambient temperature falls below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Stop the engine and turn the ignition switch to ON (with engine OFF). 6) Shift the select lever to “N” range, and depress the accelerator pedal. 7) Read the data of “Brake Clutch Duty Ratio” using Subaru Select Monitor. 2-4 brake duty solenoid is indicated in “%”.	Is the measured value 100%?	Go to step 5.	Go to step 6.
<b>5 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> Shift the select lever to 2nd on manual mode.	Is the measured value 0%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 6.
<b>6 CHECK POOR CONTACT.</b>	Is there poor contact in 2-4 brake duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK 2-4 BRAKE DUTY SOLENOID (IN TRANSMISSION).</b></p> <p>1) Remove the transmission connector from bracket.</p> <p>2) Drain the automatic transmission fluid.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>3) Remove the oil pan, and disconnect the connector from 2-4 brake duty solenoid.</p> <p>4) Measure the resistance of harness between 2-4 brake duty solenoid connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(AT2) No. 8 — Transmission ground:</b></p>	<p>Is the resistance between 2.0 — 6.0 <math>\Omega</math>?</p>	<p>Go to step 8.</p>	<p>Replace the control valve body. &lt;Ref. to 4AT-58, Control Valve Body.&gt;</p>
<p><b>8</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN 2-4 BRAKE DUTY SOLENOID AND TRANSMISSION.</b></p> <p>Measure the resistance of harness between 2-4 brake duty solenoid and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 3 — (AT2) No. 8:</b></p>	<p>Is resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 9.</p>	<p>Repair the open circuit of harness between 2-4 brake duty solenoid and transmission connector.</p>
<p><b>9</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN 2-4 BRAKE DUTY SOLENOID AND TRANSMISSION.</b></p> <p>Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 3 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in 2-4 brake duty solenoid and transmission.</p>	<p>Repair the short circuit of harness between 2-4 brake duty solenoid and transmission connector.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## S: DTC P0763 SHIFT SOLENOID "C" ELECTRICAL

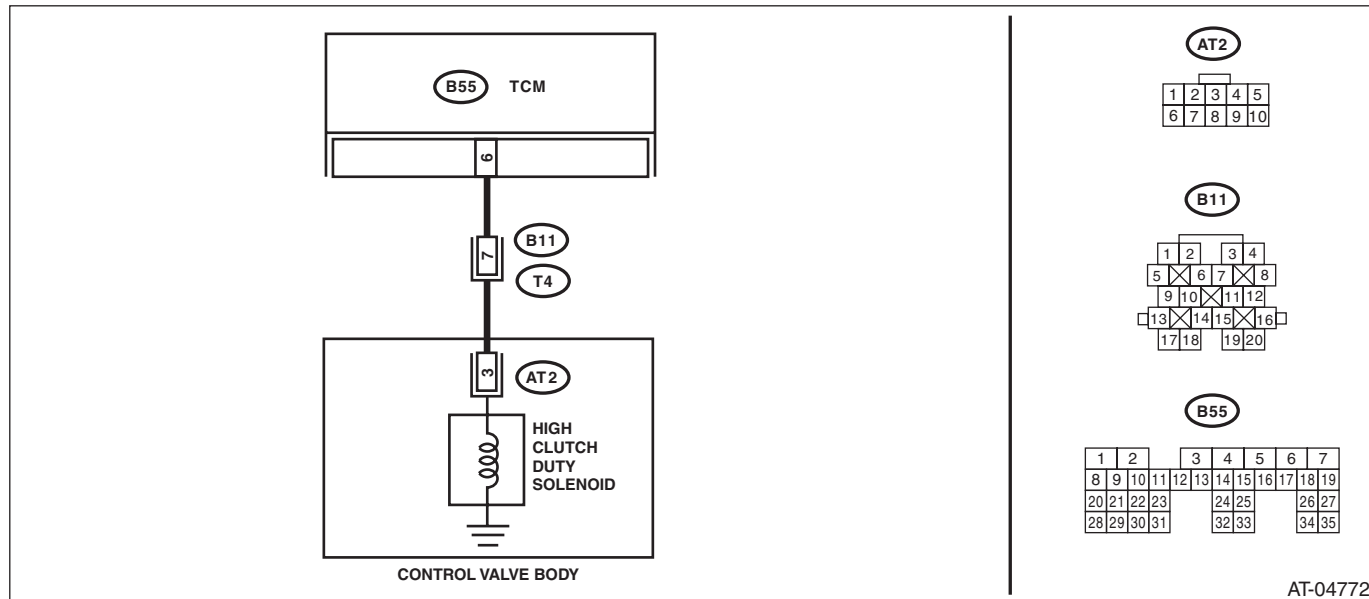
### DTC DETECTING CONDITION:

Output signal circuit of high clutch duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 6 — (B11) No. 7:</b></p>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>Measure the resistance of the harness connector between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 6 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<p><b>3 CHECK HIGH CLUTCH DUTY SOLENOID.</b></p> <p>Measure the resistance between transmission connector receptacle's terminals.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 7 — No. 20:</b></p>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 4.	Go to step 7.
<p><b>4 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b></p> <p>1) Connect the connectors to TCM and transmission. 2) Lift up the vehicle. 3) Connect the Subaru Select Monitor to the data link connector. 4) Start the engine, and run the Subaru Select Monitor. 5) Start the engine and warm-up the engine until the ATF temperature exceeds 80°C (176°F).</p> <p>NOTE: If the ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature.</p> <p>6) Read the data of "High Clutch Duty Ratio" using Subaru Select Monitor.</p> <ul style="list-style-type: none"> <li>• High clutch duty solenoid is indicated in "%".</li> </ul> <p>7) Shift the select lever to "D", and slowly increase vehicle speed to measure at 3rd or 4th.</p> <p>NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. &lt;Ref. to ABS(diag)-24, Clear Memory Mode.&gt;</p>	Is the measured value 0%?	Go to step 5.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>5 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> Return the engine to idling speed and shift the select lever to "N" range.</p> <p>NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. &lt;Ref. to ABS(diag)-24, Clear Memory Mode.&gt;</p>	Is the measured value 100%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 6.
<p><b>6 CHECK POOR CONTACT.</b></p>	Is there poor contact in high clutch duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<p><b>7 CHECK HIGH CLUTCH DUTY SOLENOID (IN TRANSMISSION).</b> 1) Remove the transmission connector from bracket. 2) Drain the automatic transmission fluid.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 3) Remove the oil pan, and disconnect the control valve body connector. 4) Measure the resistance between high clutch duty solenoid connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(AT2) No. 3 — Transmission ground:</b></p>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 8.	Replace the control valve body. <Ref. to 4AT-58, Control Valve Body.>
<p><b>8 CHECK HARNESS CONNECTOR BETWEEN HIGH CLUTCH DUTY SOLENOID AND TRANSMISSION.</b> Measure the resistance of harness between high clutch duty solenoid and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 7 — (AT2) No. 3:</b></p>	Is resistance less than 1 Ω?	Go to step 9.	Repair the open circuit of harness between TCM and transmission connector.
<p><b>9 CHECK HARNESS CONNECTOR BETWEEN HIGH CLUTCH DUTY SOLENOID AND TRANSMISSION.</b> Measure the resistance of harness between transmission connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 7 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in high clutch duty solenoid and transmission.	Repair the short circuit of harness between high clutch duty solenoid and transmission connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## T: DTC P0768 SHIFT SOLENOID "D" ELECTRICAL

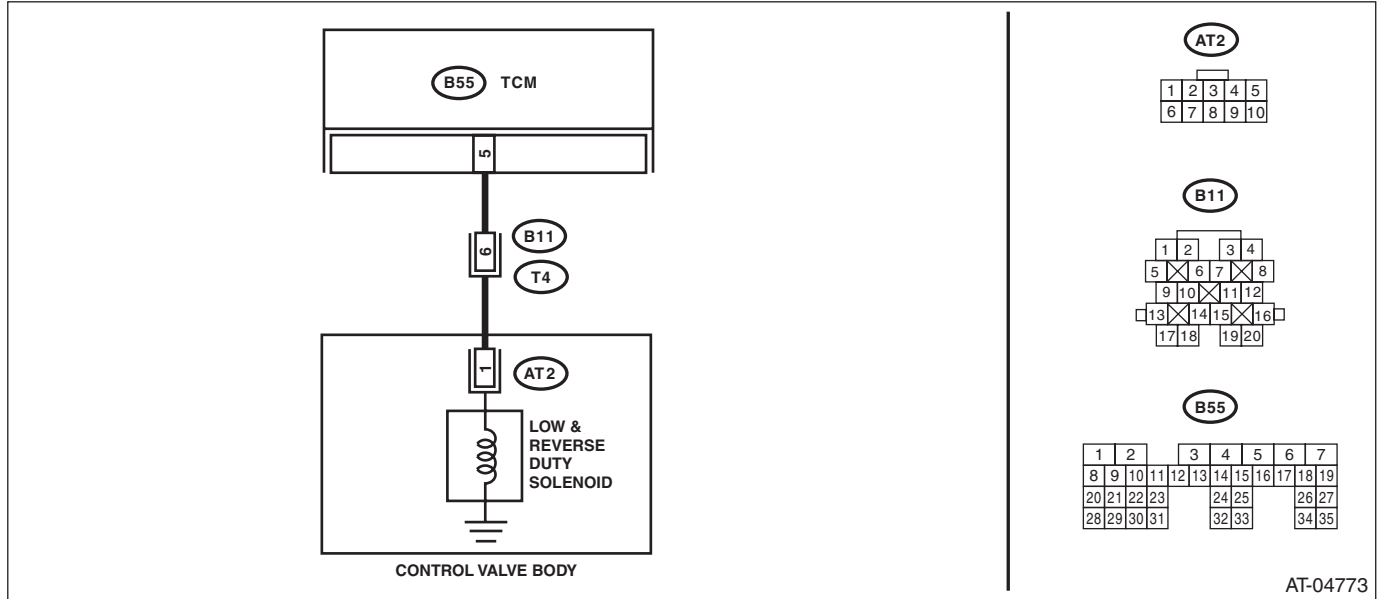
### DTC DETECTING CONDITION:

The output signal circuit of low & reverse duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

Gear is not changed.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission and TCM. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B55) No. 5 — (B11) No. 6:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 5 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK LOW &amp; REVERSE DUTY SOLENOID.</b> Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 6 — No. 20:</b>	Is the resistance between 2.0 — 6.0 $\Omega$ ?	Go to step 4.	Go to step 7.
<b>4 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Connect the Subaru Select Monitor to the data link connector. 3) Start the engine, and run the Subaru Select Monitor. 4) Warm-up the transmission until the ATF temperature exceeds approximately 80°C (176°F). NOTE: If the ambient temperature falls below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Stop the engine and turn the ignition switch to ON (with engine OFF). 6) Shift the select lever to "N" range. 7) Read the data of "L&R/B duty ratio" using Subaru Select Monitor. • Low & reverse duty solenoid is indicated in "%".	Is the measured value 100%?	Go to step 5.	Go to step 6.
<b>5 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Lift up the vehicle. 2) Shift the select lever to manual mode, and then hold it on 1st. Slowly increase the vehicle speed up to 15 km/h (9 MPH), and then return the accelerator pedal. NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.> 3) Read the data of "L&R/B duty ratio".	Is the measured value 55%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 6.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>6</b> <b>CHECK POOR CONTACT.</b>	Is there poor contact in the low & reverse duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>7</b> <b>CHECK LOW &amp; REVERSE BRAKE DUTY SOLENOID (IN TRANSMISSION).</b> 1) Remove the transmission connector from bracket. 2) Drain the automatic transmission fluid. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 3) Remove the oil pan, and disconnect the connector from control valve body. 4) Measure the resistance between low & reverse duty solenoid connector and transmission ground. <i>Connector &amp; terminal</i> <i>(AT2) No. 1 — Transmission ground:</i>	Is the resistance between 2.0 — 6.0 $\Omega$ ?	Go to step 8.	Replace the control valve body. <Ref. to 4AT-58, Control Valve Body.>
<b>8</b> <b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LOW &amp; REVERSE DUTY SOLENOID.</b> Measure the resistance of harness between low & reverse duty solenoid and transmission connector. <i>Connector &amp; terminal</i> <i>(T4) No. 6 — (AT2) No. 1:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 9.	Repair open circuit of harness between low & reverse duty solenoid and transmission connector.
<b>9</b> <b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND LOW &amp; REVERSE DUTY SOLENOID.</b> Measure the resistance of harness between transmission connector and transmission ground. <i>Connector &amp; terminal</i> <i>(T4) No. 6 — Transmission ground:</i>	Is the resistance 1 M $\Omega$ or more?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair harness or connector in low & reverse duty solenoid and transmission.	Repair the short circuit of the harness between the low & reverse duty solenoid and the transmission connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## U: DTC P0801 REVERSE INHIBIT CONTROL CIRCUIT

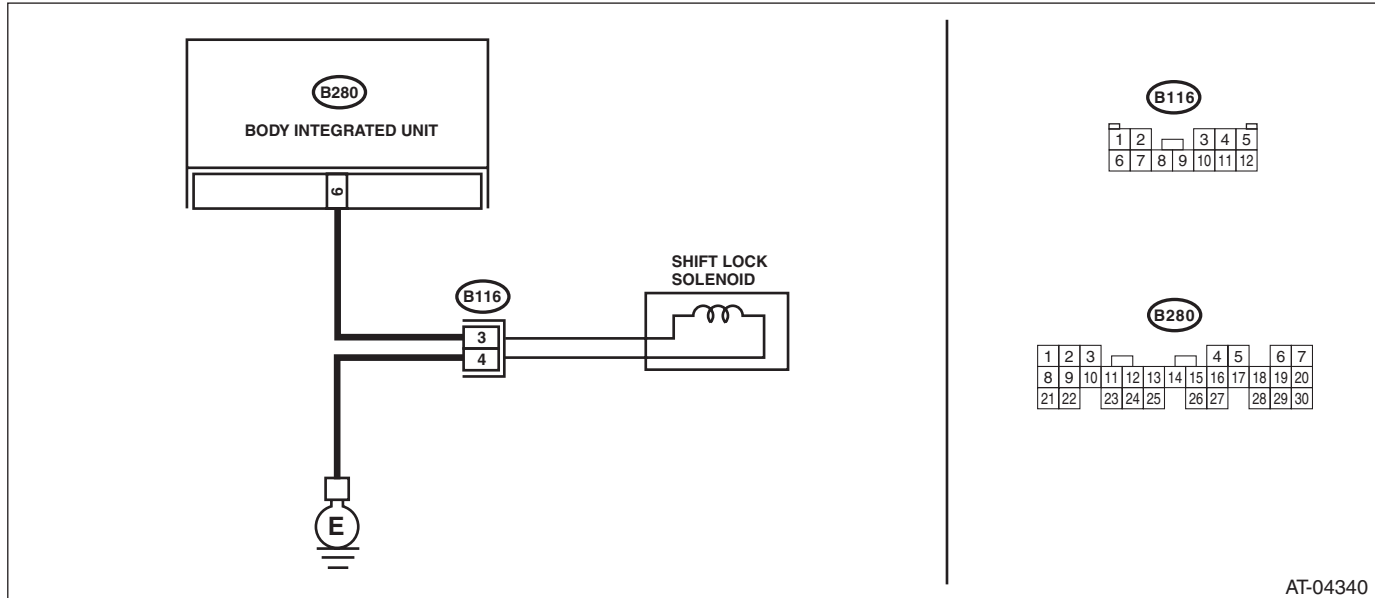
### DTC DETECTING CONDITION:

Shift lock solenoid malfunction, open or short reverse inhibitor control circuit

### TROUBLE SYMPTOM:

- Gear is shifted from “N” range to “R” range during driving at 20 km/h (12 MPH) or more.
- Gear cannot be shifted from “N” range to “R” range.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK SHIFT LOCK SOLENOID.</b> 1) Start the integrated unit by force, and check the operation of shift lock solenoid. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> 2) Operate AT select lever without depressing the brake pedal.	Does the AT select lever operate?	Go to step 2.	Go to step 3.
<b>2 CHECK OUTPUT SIGNAL OF INTEGRATED UNIT.</b> 1) Display the following items using Subaru Select Monitor. <ul style="list-style-type: none"> <li>• Key warning SW</li> <li>• Shift position</li> <li>• P SW</li> <li>• Stop light switch</li> </ul> 2) Step on the brake and shift the AT select lever to “P” range.	Do the units of measure of items displayed change?	Go to step 3.	Check the circuits of the items whose values do not change.
<b>3 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SHIFT LOCK SOLENOID.</b> Measure the harness resistance between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit of harness between body integrated unit and shift lock solenoid connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK HARNESS BETWEEN SHIFT LOCK SOLENOID AND CHASSIS GROUND TERMINAL.</b> Measure the resistance of harness between shift lock solenoid and chassis ground. <i>Connector &amp; terminal (B116) No. 4 — Chassis ground:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between chassis ground and shift lock solenoid connector.
<b>5 CHECK SHIFT LOCK SOLENOID.</b> Measure the resistance of shift lock solenoid terminals. <i>Connector &amp; terminal (B116) No. 3 — No. 4:</i>	Is the resistance between 12 — 18 $\Omega$ ?	Go to step 6.	Replace the shift lock solenoid.
<b>6 CHECK OUTPUT SIGNAL OF BODY INTEGRATED UNIT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Shift the AT select lever to "D" range. 4) Measure the voltage between body integrated unit and chassis ground. <i>Connector &amp; terminal (B280) No. 6 (+) — Chassis ground (-):</i>	Is the voltage 10.5 V or more?	Go to step 7.	Go to step 8.
<b>7 CHECK OUTPUT SIGNAL OF BODY INTEGRATED UNIT.</b> 1) Lift up the vehicle. 2) Start the engine. 3) Shift the select lever to "D" range and slowly increase vehicle speed to over 20 km/h (12 MPH). NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.> 4) Measure the voltage between body integrated unit and chassis ground. <i>Connector &amp; terminal (B280) No. 6 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in the reverse inhibitor control circuit.	Go to step 8.
<b>8 CHECK POOR CONTACT.</b>	Is there poor contact in the reverse inhibitor control circuit?	Repair the poor contact.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## V: DTC P1706 AT VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION (REAR WHEEL)

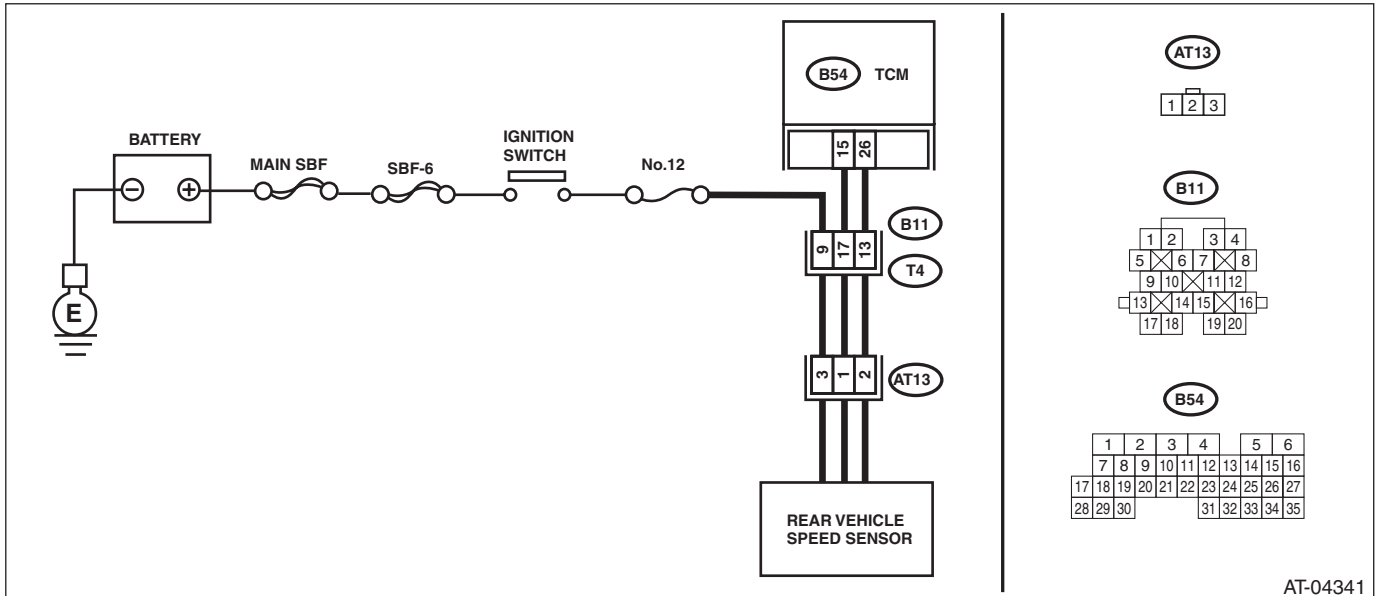
### DTC DETECTING CONDITION:

Input signal circuit of TCM is open or shorted.

### TROUBLE SYMPTOM:

No lock up or tight corner braking phenomenon is occurred.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1</b> <b>CHECK IGNITION POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear vehicle speed sensor. 3) Turn the ignition switch to ON. 4) Measure the ignition power supply voltage between rear vehicle speed sensor connector and transmission ground. <b>Connector &amp; terminal</b> <b>(AT13) No. 3 (+) — Transmission ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Check harness between rear vehicle speed sensor and battery for open circuit, short or poor contact. Repair the harness if required.
<b>2</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between TCM connector and rear vehicle speed sensor connector. <b>Connector &amp; terminal</b> <b>(B54) No. 15 — (AT13) No. 1:</b>	Is resistance less than 1 Ω?	Go to step 3.	Repair the open circuit or poor contact of the connector in harness between TCM and rear vehicle speed sensor connector.
<b>3</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and rear vehicle speed sensor connector. <b>Connector &amp; terminal</b> <b>(B54) No. 26 — (AT13) No. 2:</b>	Is resistance less than 1 Ω?	Go to step 4.	Repair the open circuit or poor contact of the connector in harness between TCM and rear vehicle speed sensor connector.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 15 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the short circuit of harness between TCM and rear vehicle speed sensor connector.
<b>5 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 26 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Repair the short circuit of harness between TCM and rear vehicle speed sensor connector.
<b>6 PREPARE OSCILLOSCOPE.</b>	Do you have an oscilloscope?	Go to step 8.	Go to step 7.
<b>7 CHECK INPUT SIGNAL FOR TCM.</b> 1) Connect the connectors to TCM and transmission. 2) Lift up the vehicle. 3) Start the engine and set vehicle in 20 km/h (12 MPH) condition.  NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.> 4) Measure the AC voltage between TCM connector terminals.  <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 26 (+) — No. 15 (-):</b></i>	Is the voltage approx. 2 V or more?	Go to step 9.	Replace the rear vehicle speed sensor.
<b>8 CHECK INPUT SIGNAL FOR TCM USING OSCILLOSCOPE.</b> 1) Connect the connectors to TCM and transmission. 2) Lift up the vehicle. 3) Set the oscilloscope to TCM connector terminals.  <i><b>Connector &amp; terminal</b></i> <i><b>Positive probe; (B54) No. 26:</b></i> <i><b>Ground lead; (B54) No. 15:</b></i> 4) Start the engine and set vehicle in 20 km/h (12 MPH) condition.  NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to ABS(diag)-24, Clear Memory Mode.> 5) Measure the signal voltage indicated on oscilloscope.	Is the pulse voltage approx. 5 V?	Go to step 9.	Replace the rear vehicle speed sensor.
<b>9 CHECK POOR CONTACT.</b>	Is there poor contact in rear vehicle speed sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## W: DTC P1707 AT AWD SOLENOID VALVE CIRCUIT MALFUNCTION

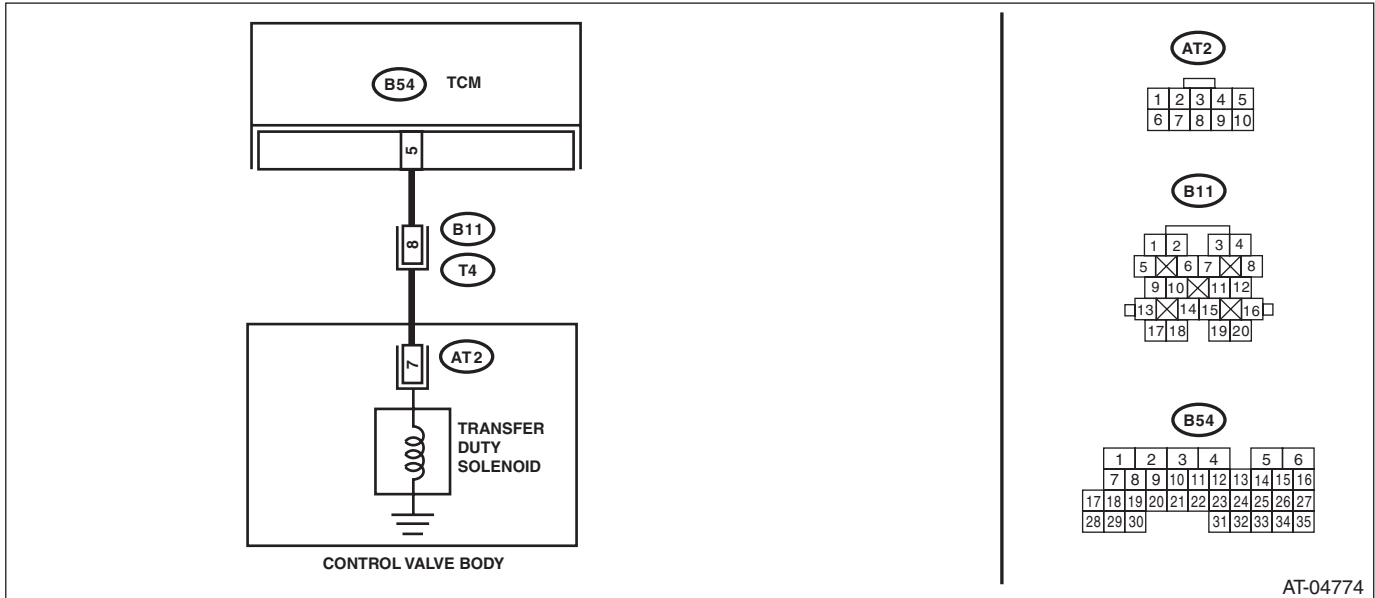
### DTC DETECTING CONDITION:

Output signal circuit of transfer duty solenoid is open or shorted.

### TROUBLE SYMPTOM:

- Tight corner braking phenomenon occurs.
- Front wheel slips on the slippery road.

### WIRING DIAGRAM:



AT-04774

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 5 — (B11) No. 8:</b></i>	Is resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness connector between TCM and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 5 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK TRANSFER DUTY SOLENOID.</b> Measure the resistance between transmission connector and transmission terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(T4) No. 8 — No. 20:</b></i>	Is the resistance between 2.0 — 6.0 Ω?	Go to step 4.	Go to step 7.
<b>4 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connectors to TCM and transmission. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor. 4) Shift the select lever to the “N” range, and fully close the throttle pedal. (Vehicle speed is 0 km/h (0 MPH)) 5) Read the data of “AWD Duty Ratio” using Subaru Select Monitor. Transfer duty solenoid is indicated in “%”.	Is the value approx. 5%?	Go to step 5.	Go to step 6.
<b>5 CHECK OUTPUT SIGNAL FROM TCM USING SUBARU SELECT MONITOR.</b> 1) Shift the select lever to “D” range. 2) Read the data of “AWD Duty Ratio” using Subaru Select Monitor. Transfer duty solenoid is indicated in “%”.	Is the measured value approx. 18 — 35%?	Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in TCM and transmission.	Go to step 6.
<b>6 CHECK POOR CONTACT.</b>	Is there poor contact in transfer duty solenoid circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK TRANSFER DUTY SOLENOID (IN TRANSMISSION).</b>                      1) Lift up the vehicle.                      2) Drain the automatic transmission fluid.  <b>CAUTION:</b>  <b>Do not drain ATF until it cools down.</b>                      3) Remove the extension case, and disconnect the connector from transfer duty solenoid.                      4) Measure the resistance between transfer duty solenoid connector and transmission ground.  <b>Connector &amp; terminal</b>  <b>(AT2) No. 7 — Transmission ground:</b></p>	<p>Is the resistance between 2.0 — 6.0 <math>\Omega</math>?</p>	<p>Go to step 8.</p>	<p>Replace the control valve body. &lt;Ref. to 4AT-58, Control Valve Body.&gt;</p>
<p><b>8</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSFER DUTY SOLENOID AND TRANSMISSION.</b>                      Measure the resistance of harness between transfer duty solenoid and transmission connector.  <b>Connector &amp; terminal</b>  <b>(T4) No. 8 — (AT2) No. 7:</b></p>	<p>Is resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 9.</p>	<p>Repair the open circuit of harness between transfer duty solenoid and transmission connector.</p>
<p><b>9</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSFER DUTY SOLENOID AND TRANSMISSION.</b>                      Measure the resistance of harness between transmission connector and transmission ground.  <b>Connector &amp; terminal</b>  <b>(T4) No. 8 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Even if the ATF temperature warning light blinks, the circuit is in normal condition at this time. A temporary poor contact of connector or harness may be the cause. Repair the harness or poor contact in the transfer duty solenoid and transmission.</p>	<p>Repair short circuit of the harness between the transfer duty solenoid and transmission connector.</p>

## X: DTC P1718 CAN COMMUNICATION CIRCUIT

NOTE:

Refer to “Body Integrated Unit” for diagnosis of P1718. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### Y: DTC P1817 SPORT MODE SWITCH CIRCUIT

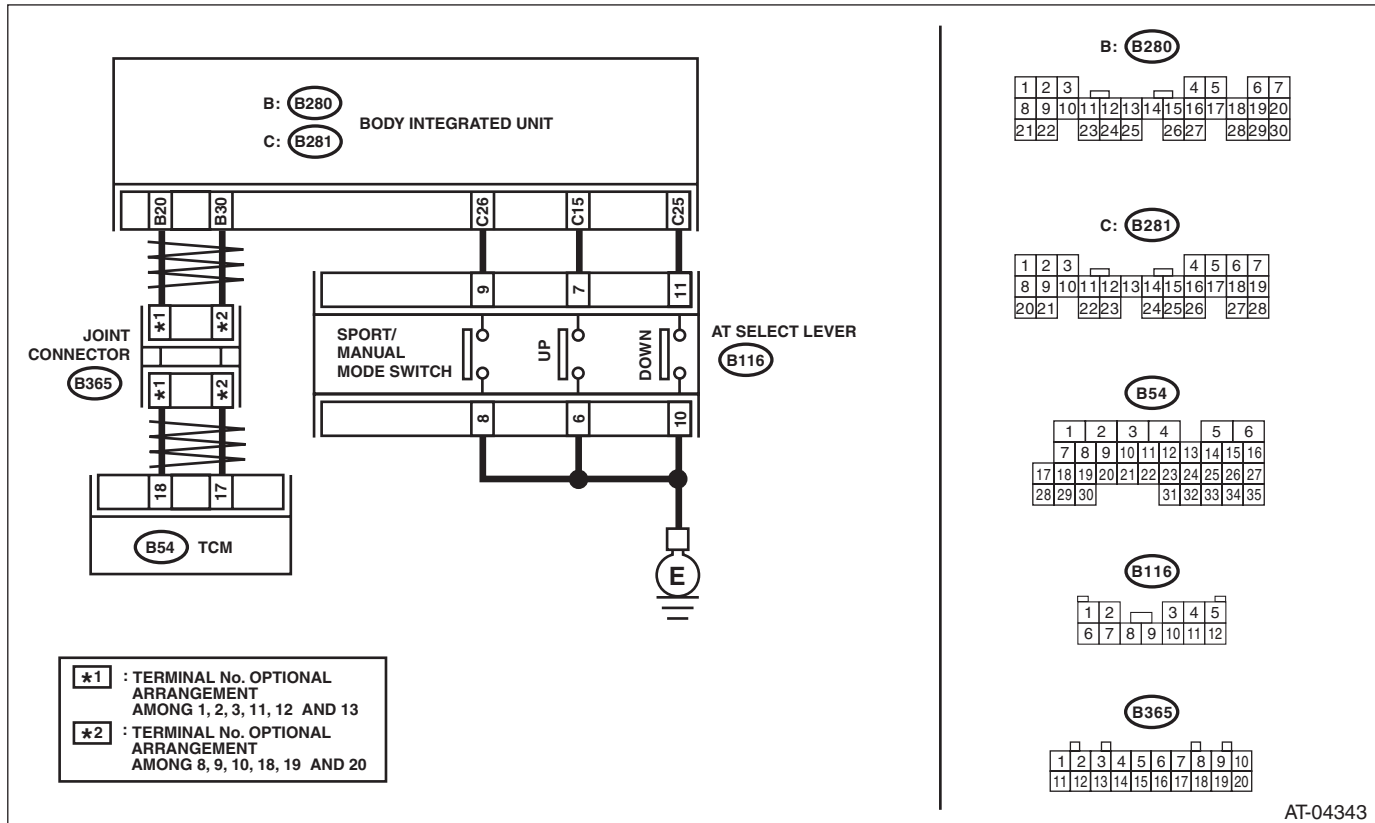
#### DTC DETECTING CONDITION:

Input signal circuit of SPORT/manual mode switch is shorted.

#### TROUBLE SYMPTOM:

- Manual mode can not be set.
- The SPORT indicator light does not illuminate.
- No SPORT mode occurs.

#### WIRING DIAGRAM:



AT-04343

Step	Check	Yes	No
<b>1</b> <b>CHECK BODY INTEGRATED UNIT.</b> 1) Connect the Subaru Select Monitor to the data link connector. 2) Turn the ignition switch to ON. (engine OFF) 3) Read the DTC of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b> <b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever to "P" range. 2) Read the "Tip mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	Go to step 3.	Go to step 7.
<b>3</b> <b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever from "P" to "D" range. 2) Read the "Tip mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the indication on each range OFF?	Go to step 4.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever to SPORT mode. 2) Read the "Tip mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 5.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>
<b>5 CHECK INHIBITOR SWITCH.</b> Shift the AT select lever from "P" to "D" range.	Is the indication of range position indicator light in combination meter synchronized with position of select lever?	Go to step 6.	Adjust the inhibitor switch and select cable. <Ref. to 4AT-47, ADJUSTMENT, Inhibitor Switch.> <Ref. to CS-31, ADJUSTMENT, Select Cable.>
<b>6 CHECK INPUT SIGNAL FROM TCM.</b> 1) Shift the AT select lever from "P" to "D" range. 2) Read the "Tip mode SW" data of TCM using Subaru Select Monitor. <Ref. to 4AT(diag)-15, OPERATION, Subaru Select Monitor.>	Is the indication on each range OFF?	Even if the ATF temperature warning light blinks, the circuit is in normal condition. A temporary short circuit of connector or harness may be the cause. Repair the harness or connector.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>7 CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector from body integrated unit and AT select lever. 3) Measure the resistance between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 26 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 8.	Repair the short circuit of harness between body integrated unit and SPORT/manual mode switch.
<b>8 CHECK SPORT SHIFT SWITCH.</b> 1) Shift the AT select lever to "P" range. 2) Measure the resistance of SPORT/manual mode switch connector terminals. <b>Terminals</b> <b>No. 9 — No. 8:</b>	Is the resistance 1 MΩ or more?	Check the body integrated unit.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

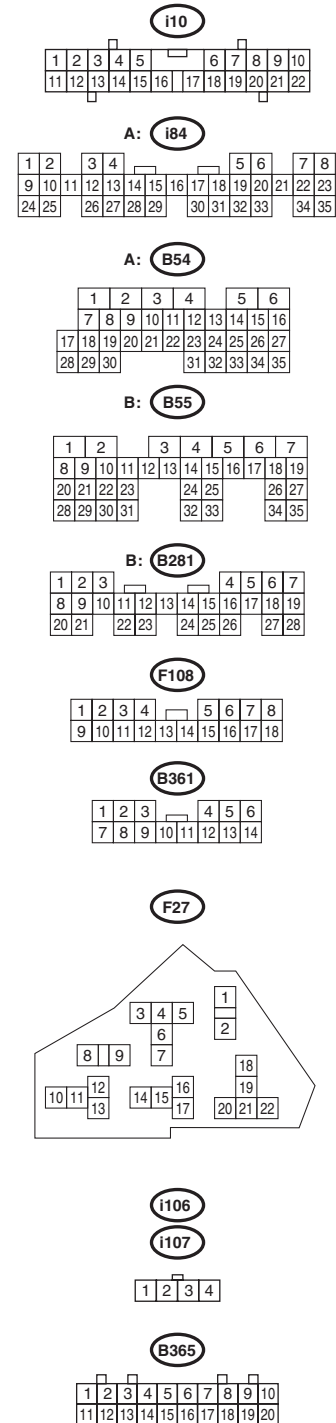
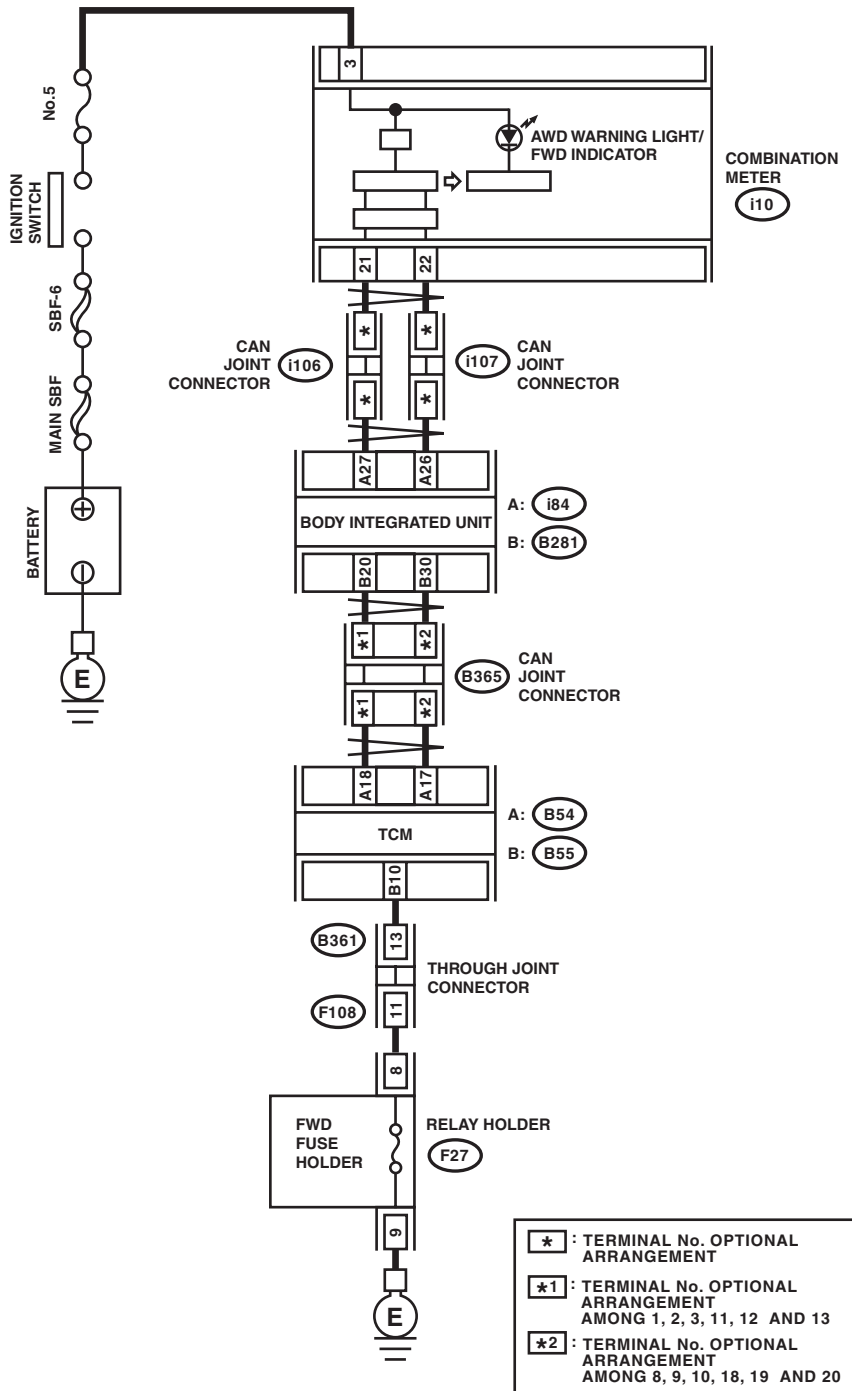
### 14. Diagnostic Procedure without Diagnostic Trouble Code (DTC)

#### A: CHECK FWD SWITCH

##### DIAGNOSIS:

- LED does not illuminate even with the fuse installed on FWD fuse holder.
- FWD signal circuit is open or shorted.

##### WIRING DIAGRAM:



AT-04344

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK SPARE FUSE.</b>	Is the spare fuse OK?	Go to step 2.	Replace the fuse.
2	<b>CHECK FWD FUSE HOLDER.</b> Connect the Subaru Select Monitor to the data link connector.	When the fuse is inserted to FWD fuse holder, does the LED illuminate?	Go to step 3.	Go to step 4.
3	<b>CHECK COMBINATION METER.</b>	Does the AWD warning light illuminate?	Go to INSPECTION FOR SPORT/MANUAL MODE SWITCH. <Ref. to 4AT(diag)-85, CHECK SPORT SHIFT SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Go to step 9.
4	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND FWD FUSE HOLDER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance of harness between TCM and FWD fuse holder. <b>Connector &amp; terminal</b> <b>(B55) No. 10 — (F27) No. 18:</b>	Is resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between TCM and FWD fuse holder.
5	<b>CHECK HARNESS CONNECTOR BETWEEN FWD FUSE HOLDER AND CHASSIS GROUND.</b> Measure the resistance of harness between FWD fuse holder and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 19 — Chassis ground:</b>	Is resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between FWD fuse holder and chassis ground.
6	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND FWD FUSE HOLDER.</b> Measure the resistance of harness connector between TCM and body to make sure that circuit does not short. <b>Connector &amp; terminal</b> <b>(B55) No. 10 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the short circuit of harness between TCM and FWD fuse holder.
7	<b>CHECK INPUT SIGNAL FOR TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector to TCM. 3) Turn the ignition switch to ON. 4) Measure the signal voltage for TCM with the fuse installed to FWD fuse holder. <b>Connector &amp; terminal</b> <b>(B55) No. 10 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 8.	Go to step 10.
8	<b>CHECK INPUT SIGNAL FOR TCM.</b> Measure the signal voltage for TCM with the fuse removed from FWD fuse holder. <b>Connector &amp; terminal</b> <b>(B55) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 10.5 V or more?	Go to step 9.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
9	<b>CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 10.
10	<b>CHECK COMBINATION METER.</b> Check the AWD warning light. <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the AWD warning light OK?	Go to step 11.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

## Diagnostic Procedure without Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
11	<b>CHECK POOR CONTACT.</b>	Is there poor contact in FWD switch circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## B: CHECK SPORT SHIFT SWITCH

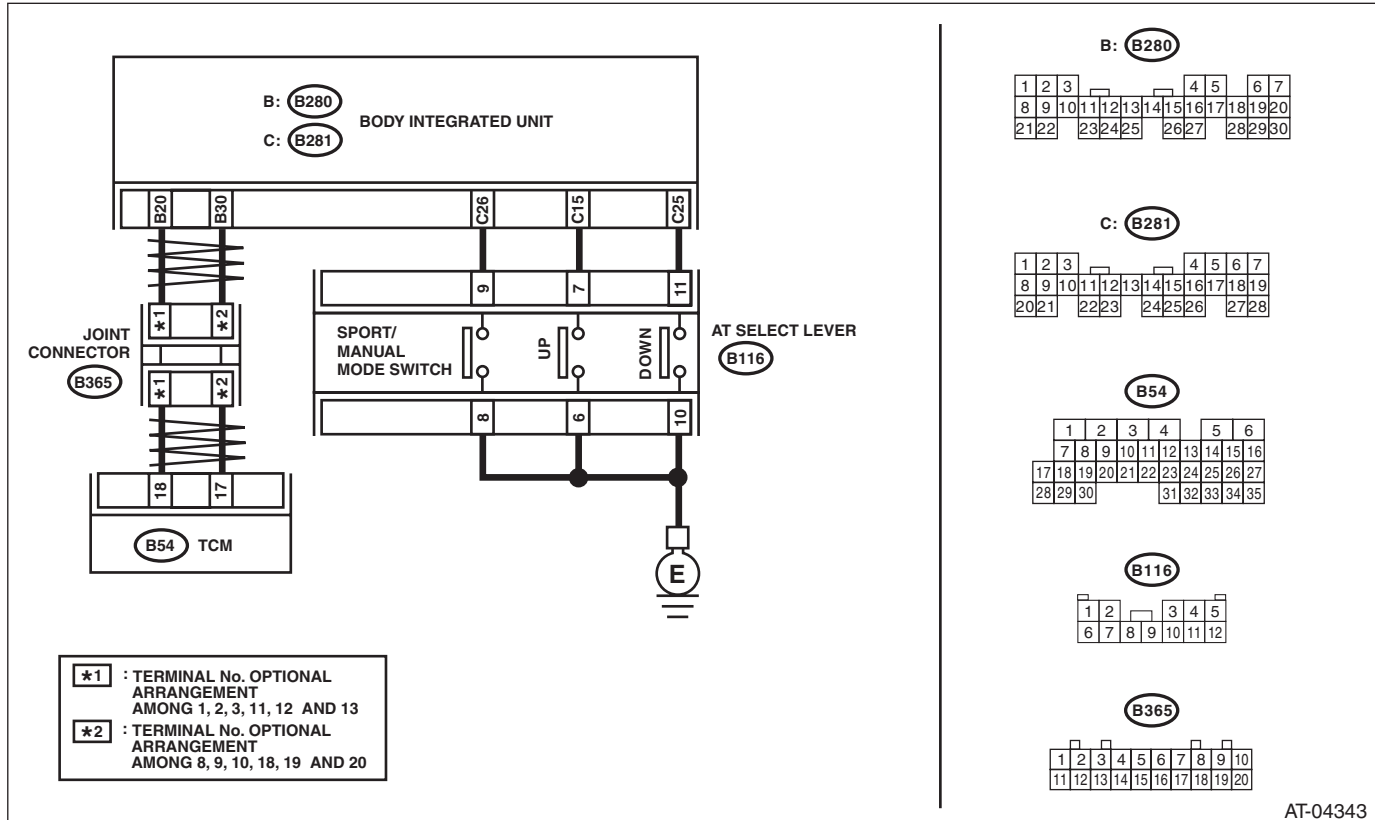
### DIAGNOSIS:

Input signal circuit of SPORT/manual mode switch is open or shorted.

### TROUBLE SYMPTOM:

Does not shift on manual mode.

### WIRING DIAGRAM:



AT-04343

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK SPORT SHIFT SWITCH.</b> 1) Move the AT select lever to SPORT mode. 2) Shift and hold the AT select lever to up side. 3) Read the "Up Switch" data of TCM using Subaru Select Monitor. <Ref. to 4AT(diag)-16, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 2.	Go to step 3.
2	<b>CHECK SPORT SHIFT SWITCH.</b> 1) Shift and hold the AT select lever to down side. 2) Read the "Down Switch" data of TCM using Subaru Select Monitor.	Is ON displayed?	Go to the procedure "INSPECTION FOR SPORT SHIFT INDICATOR LIGHT". <Ref. to 4AT(diag)-89, CHECK SPORT SHIFT INDICATOR, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Go to step 12.
3	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to ON. 2) Shift and hold the AT select lever to up side. 3) Read the "TIP UP SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 4.	Go to step 5.
4	<b>CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Check the TCM.
5	<b>CHECK GROUND CIRCUIT OF SPORT/MANUAL MODE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from SPORT/manual mode switch. 3) Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — Chassis ground:</b>	Is resistance less than 1 Ω?	Go to step 6.	Repair the open circuit of harness between SPORT/manual mode switch and chassis ground.
6	<b>CHECK SPORT/MANUAL MODE SWITCH.</b> Measure the resistance between SPORT/manual mode switch terminals. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — No. 7:</b>	Is the resistance 1 MΩ or more?	Go to step 7.	Replace the guide plate assembly.
7	<b>CHECK SPORT/MANUAL MODE SWITCH.</b> 1) Shift and hold the AT select lever to up side. 2) Measure the resistance between SPORT/manual mode switch terminals. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — No. 7:</b>	Is resistance less than 1 Ω?	Go to step 8.	Replace the guide plate assembly.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>8 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> 1) Disconnect the connector from body integrated unit. 2) Measure the resistance of harness between body integrated unit connector and SPORT/manual mode switch connector. <b>Connector &amp; terminal</b> <b>(B116) No. 7 — (B281) No. 15:</b>	Is resistance less than 1 Ω?	Go to step 9.	Repair the open circuit of harness between the SPORT/manual mode switch connector and body integrated unit connector, or poor contact of connector.
<b>9 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 7 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 10.	Repair the short circuit of harness between SPORT/manual mode switch connector and body integrated unit connector.
<b>10 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON (engine OFF). 3) Check the signal voltage for body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 1.5 — 8 V?	Go to step 11.	Replace the body integrated unit.
<b>11 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Shift and hold the AT select lever to shift up side. 2) Check the signal voltage for body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 15 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 21.	Replace the body integrated unit.
<b>12 CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to ON. 2) Shift and hold the AT select lever to down side. 3) Read the "TIP DOWN SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 13.	Go to step 14.
<b>13 CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Check the TCM.
<b>14 CHECK GROUND CIRCUIT OF SPORT/MANUAL MODE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from SPORT/manual mode switch. 3) Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 10 (+) — Chassis ground:</b>	Is resistance less than 1 Ω?	Go to step 15.	Repair the open circuit of harness between SPORT/manual mode switch and chassis ground.
<b>15 CHECK SPORT/MANUAL MODE SWITCH.</b> Measure the resistance between SPORT/manual mode switch terminals. <b>Connector &amp; terminal</b> <b>(B116) No. 10 — No. 11:</b>	Is the resistance 1 MΩ or more?	Go to step 16.	Replace the guide plate assembly.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>16 CHECK SPORT/MANUAL MODE SWITCH.</b> 1) Shift and hold the AT select lever to down side. 2) Measure the resistance between SPORT/manual mode switch terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B116) No. 10 — No. 11:</b></i>	Is resistance less than 1 Ω?	Go to step 17.	Replace the guide plate assembly.
<b>17 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> 1) Disconnect the connector from body integrated unit. 2) Measure the resistance of harness between body integrated unit connector and SPORT/manual mode switch connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B116) No. 11 — (B281) No. 25:</b></i>	Is resistance less than 1 Ω?	Go to step 18.	Repair the open circuit of harness between the SPORT/manual mode switch connector and body integrated unit connector, or poor contact of connector.
<b>18 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B116) No. 11 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 19.	Repair the short circuit of harness between SPORT/manual mode switch connector and body integrated unit connector.
<b>19 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON (engine OFF). 3) Check the signal voltage for body integrated unit. <i><b>Connector &amp; terminal</b></i> <i><b>(B281) No. 25 (+) — Chassis ground (-):</b></i>	Is the voltage 1.5 — 8 V?	Go to step 20.	Go to step 21.
<b>20 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Shift and hold the AT select lever to down side. 2) Check the signal voltage for body integrated unit. <i><b>Connector &amp; terminal</b></i> <i><b>(B281) No. 25 (+) — Chassis ground (-):</b></i>	Is the voltage less than 1 V?	Go to step 21.	Replace the body integrated unit. <Ref. to 4AT-64, Transmission Control Module (TCM).>
<b>21 CHECK POOR CONTACT.</b>	Is there poor contact in the SPORT/manual mode switch circuit?	Repair the poor contact.	Temporary poor contact of the SPORT/manual mode switch circuit connector or harness.



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## C: CHECK SPORT SHIFT INDICATOR

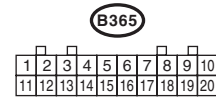
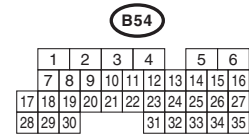
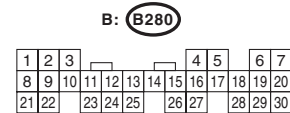
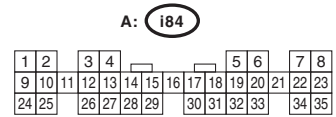
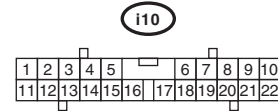
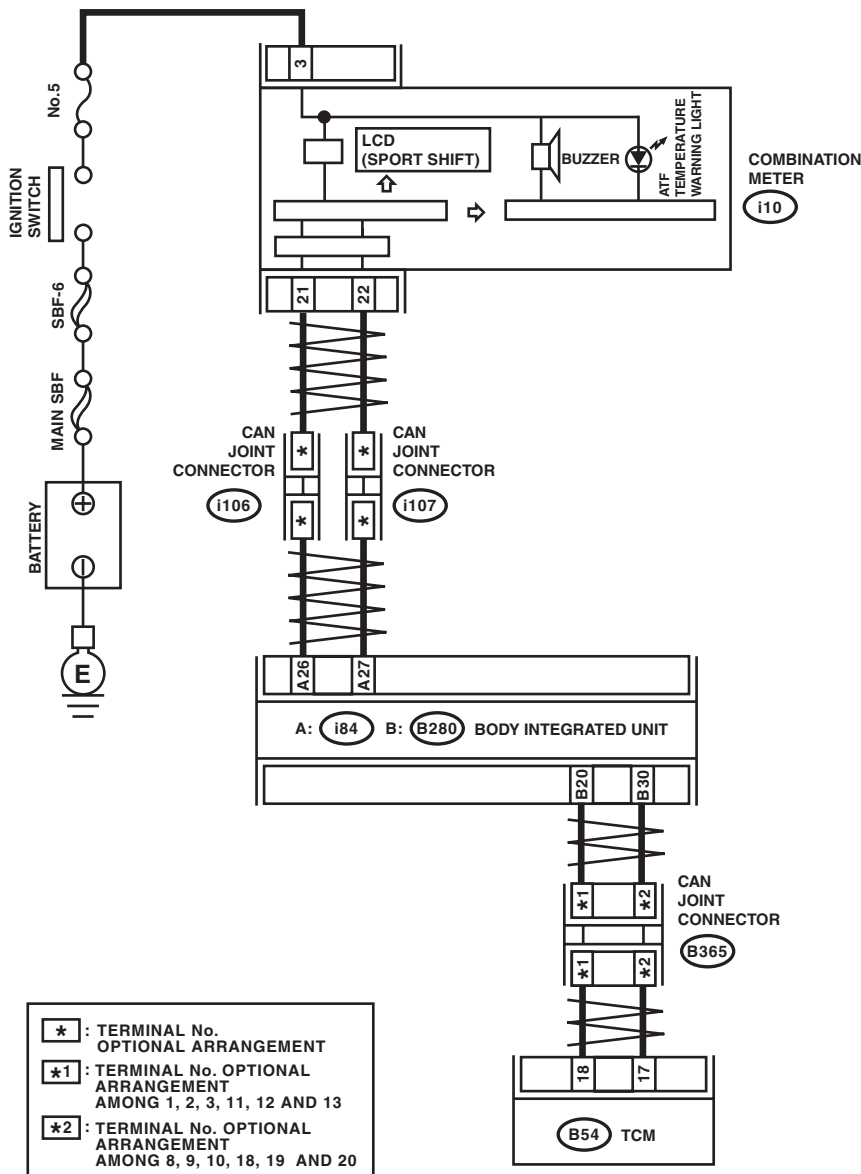
### DIAGNOSIS:

Output signal circuit of SPORT shift indicator is open or shorted.

### TROUBLE SYMPTOM:

- SPORT shift indicator does not display or remains displayed.
- SPORT shift indicator display does not change.

### WIRING DIAGRAM:



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK BODY INTEGRATED UNIT.</b> Check DTC of body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Run the Subaru Select Monitor. 5) Shift the AT select lever to SPORT mode. 6) Shift up the AT select lever. 7) Read the "Gear Position" data of TCM using Subaru Select Monitor.	Is the gear position 2?	Go to step 3.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
3	<b>CHECK TCM.</b> 1) Shift down the AT select lever. 2) Read the "Gear Position" data of TCM using Subaru Select Monitor.	Is the gear position 1?	Go to step 4.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>
4	<b>CHECK BODY INTEGRATED UNIT.</b> Read the data of SPORT shift gear position using Subaru Select Monitor.	Is the SPORT shift gear position 2?	Go to step 5.	Check the body integrated unit.
5	<b>CHECK COMBINATION METER.</b> <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the SPORT shift indicator OK?	Inspection of buzzer. <Ref. to 4AT(diag)-91, CHECK BUZZER, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## D: CHECK BUZZER

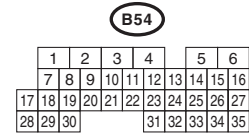
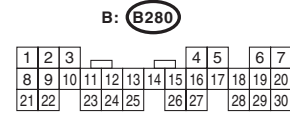
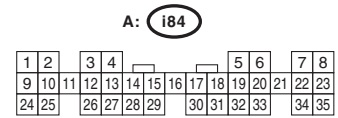
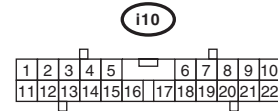
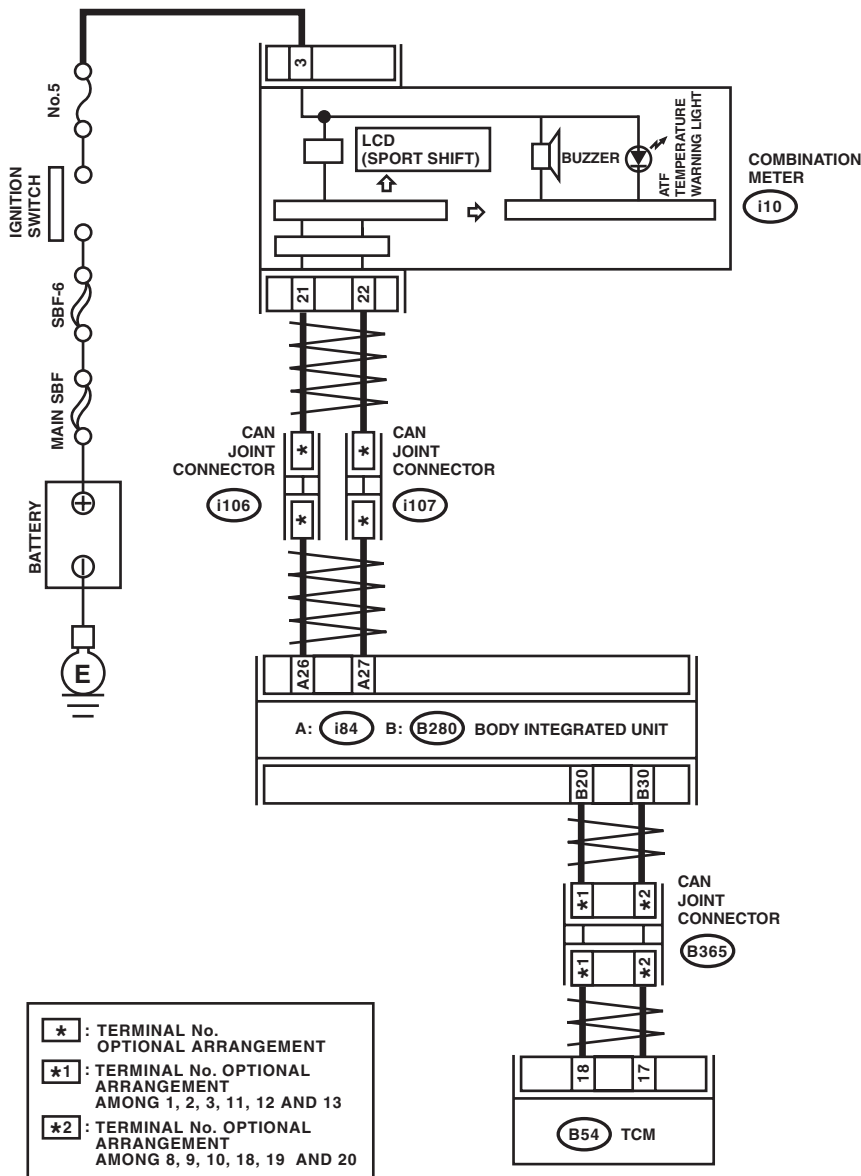
### DIAGNOSIS:

Output signal circuit of buzzer is open or shorted.

### TROUBLE SYMPTOM:

Buzzer remains beeping.

### WIRING DIAGRAM:



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Run the Subaru Select Monitor. 5) Read the data of "SPORT shift (buzzer)" of body integrated unit using Subaru Select Monitor.	Is the SPORT shift buzzer display "ON"?	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).>	Go to step 2.
<b>2</b> <b>CHECK COMBINATION METER.</b> <Ref. to IDI-4, INSPECTION, Combination Meter System.>	Is the buzzer OK?	Refer to "Symptom Related Diagnostic". <Ref. to 4AT(diag)-93, General Diagnostic Table.>	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# General Diagnostic Table

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 15. General Diagnostic Table

### A: INSPECTION

Symptom	Problem parts
Starter does not operate when select lever is in "P" or "N" range. Starter operates when select lever is in "R" or "D" range.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Select cable</li> <li>• AT select lever</li> <li>• Starter motor and harness</li> </ul>
Abnormal noise when select lever is in "P" or "N".	<ul style="list-style-type: none"> <li>• Strainer</li> <li>• Transfer duty solenoid</li> <li>• Oil pump</li> <li>• Drive plate</li> <li>• ATF level too high or too low</li> </ul>
Hissing noise occurs during standing start.	<ul style="list-style-type: none"> <li>• Strainer</li> <li>• ATF level too high or too low</li> </ul>
Noise occurs while driving in "D1".	<ul style="list-style-type: none"> <li>• Final gear</li> </ul>
Noise occurs while driving in "D2".	<ul style="list-style-type: none"> <li>• Planetary gear</li> <li>• Reduction gear</li> <li>• Differential gear oil level too high or too low</li> </ul>
Noise occurs while driving in "D3".	<ul style="list-style-type: none"> <li>• Final gear</li> <li>• Low &amp; reverse brake</li> <li>• Reduction gear</li> <li>• Differential gear oil level too high or too low</li> </ul>
Noise occurs while driving in "D4".	<ul style="list-style-type: none"> <li>• Final gear</li> <li>• Low &amp; reverse brake</li> <li>• Planetary gear</li> <li>• Reduction gear</li> <li>• Differential gear oil level too high or too low</li> </ul>
Vehicle moves when select lever is in "N" range.	<ul style="list-style-type: none"> <li>• Select cable</li> <li>• Inhibitor switch</li> <li>• TCM</li> <li>• Low clutch</li> </ul>
Shock occurs when select lever is shifted from "N" to "D" range.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Low clutch duty solenoid</li> <li>• Low clutch</li> <li>• TCM</li> <li>• Harness</li> <li>• Control valve</li> <li>• ATF deterioration</li> </ul>
Excessive time lag occurs when select lever is shifted from "N" to "D" range.	<ul style="list-style-type: none"> <li>• Control valve</li> <li>• Low clutch</li> <li>• Line pressure linear solenoid</li> <li>• Seal ring</li> <li>• Front gasket of transmission case</li> </ul>
Shock occurs when select lever is shifted from "N" to "R" range.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• TCM</li> <li>• Harness</li> <li>• Control valve</li> <li>• ATF deterioration</li> </ul>
Excessive time lag occurs when the select lever is shifted from "N" to "R" range.	<ul style="list-style-type: none"> <li>• Control valve</li> <li>• Low &amp; reverse clutch</li> <li>• Reverse clutch</li> <li>• Line pressure linear solenoid</li> <li>• Seal ring</li> <li>• Front gasket of transmission case</li> </ul>

## General Diagnostic Table

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptom	Problem parts
Vehicle does not start in any shift range. (Engine stalls)	<ul style="list-style-type: none"> <li>• Parking brake mechanism</li> <li>• Planetary gear</li> </ul>
Vehicle does not start in any shift range. (Engine operates)	<ul style="list-style-type: none"> <li>• Strainer</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• Drive pinion</li> <li>• Hypoid gear</li> <li>• Axle shaft</li> <li>• Differential gear</li> <li>• Oil pump</li> <li>• Input shaft</li> <li>• Output shaft</li> <li>• Planetary gear</li> <li>• Drive plate</li> <li>• ATF level is too low</li> <li>• Front gasket of transmission case</li> </ul>
Vehicle does not start in "R" range only. (Engine operates)	<ul style="list-style-type: none"> <li>• Select cable</li> <li>• AT select lever</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• Low &amp; reverse clutch</li> <li>• Reverse clutch</li> </ul>
Vehicle does not start in "R" range only. (Engine stalls)	<ul style="list-style-type: none"> <li>• Low clutch</li> <li>• 2-4 brake</li> <li>• Planetary gear</li> <li>• Parking brake mechanism</li> </ul>
Vehicle does not start in "D" range. (Engine operates)	<ul style="list-style-type: none"> <li>• Low clutch</li> <li>• One-way clutch</li> </ul>
Vehicle does not start in "D" range. (Engine stalls)	Reverse clutch
Vehicle does not start in "R" range only. (Engine operates)	Control valve
Acceleration during standing start is poor. (High rpm stall)	<ul style="list-style-type: none"> <li>• Control valve</li> <li>• Low clutch</li> <li>• Reverse clutch</li> <li>• ATF level is too low</li> <li>• ATF deterioration</li> <li>• Front gasket of transmission case</li> <li>• Differential gear oil level too high or too low</li> </ul>
Acceleration during standing start is poor. (Low rpm stall)	<ul style="list-style-type: none"> <li>• Oil pump</li> <li>• Torque converter one-way clutch</li> <li>• Engine performance</li> </ul>
Acceleration is poor when select lever is in "D" range. (Normal rpm stall)	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Control valve</li> <li>• High clutch</li> <li>• 2-4 brake</li> <li>• Planetary gear</li> </ul>
Acceleration is poor when select lever is in "R" range. (Normal rpm stall)	<ul style="list-style-type: none"> <li>• Control valve</li> <li>• High clutch</li> <li>• 2-4 brake</li> <li>• Planetary gear</li> </ul>
No shift occurs from 1st to 2nd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Rear vehicle speed sensor</li> <li>• Front vehicle speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• Control valve</li> <li>• 2-4 brake</li> </ul>
No shift occurs from 2nd to 3rd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Control valve</li> <li>• High clutch</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptom	Problem parts
No shift occurs from 3rd to 4th gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• ATF temperature sensor</li> <li>• Control valve</li> <li>• 2-4 brake</li> </ul>
Engine brake is not effected when select lever is shifted from 4th gear to 3rd gear.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• Control valve</li> </ul>
Engine brake is not effected when select lever is shifted from 3rd gear to 2nd gear.	Control valve
Engine brake is not effected when select lever is shifted from 2nd gear to 1st gear.	<ul style="list-style-type: none"> <li>• Control valve</li> <li>• Low &amp; reverse brake</li> </ul>
Shift characteristics are erroneous.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• TCM</li> <li>• Front vehicle speed sensor</li> <li>• Rear vehicle speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• Control valve</li> <li>• Ground</li> </ul>
No lock-up occurs.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Control valve</li> <li>• Lock-up facing</li> <li>• Engine speed signal</li> </ul>
Parking brake does not function.	<ul style="list-style-type: none"> <li>• Select cable</li> </ul>
Shift lever cannot be moved or is hard to move from "P" range.	<ul style="list-style-type: none"> <li>• AT select lever</li> <li>• Parking mechanism</li> </ul>
ATF spurts out.	ATF level too high
Differential oil spurts out.	Differential gear oil level too high
Differential oil level changes excessively.	<ul style="list-style-type: none"> <li>• Seal pipe</li> <li>• Double oil seal</li> </ul>
Odor is produced from ATF supply pipe.	<ul style="list-style-type: none"> <li>• High clutch</li> <li>• 2-4 brake</li> <li>• Low &amp; reverse clutch</li> <li>• Reverse clutch</li> <li>• Lock-up facing</li> <li>• ATF deterioration</li> </ul>
Shock occurs when shifting from 1st to 2nd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Torque converter turbine speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• 2-4 brake</li> <li>• ATF deterioration</li> <li>• Engine performance</li> <li>• Low &amp; reverse duty solenoid</li> </ul>
Slippage occurs when shifting from 1st to 2nd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• 2-4 brake</li> </ul>

## General Diagnostic Table

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptom	Problem parts
Shock occurs when shifting from 2nd to 3rd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Torque converter turbine speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Low &amp; reverse duty solenoid</li> <li>• Control valve</li> <li>• High clutch</li> <li>• 2-4 brake</li> <li>• ATF deterioration</li> <li>• Engine performance</li> <li>• High clutch duty solenoid</li> </ul>
Slippage occurs when shifting from 2nd to 3rd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• High clutch</li> <li>• 2-4 brake</li> <li>• Low &amp; reverse duty solenoid</li> </ul>
Shock occurs when shifting from 3rd to 4th gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Torque converter turbine speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• Low clutch duty solenoid</li> <li>• 2-4 brake</li> <li>• ATF deterioration</li> <li>• Engine performance</li> </ul>
Slippage occurs when shifting from 3rd to 4th gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• 2-4 brake duty solenoid</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• 2-4 brake</li> </ul>
Shock occurs when shifting from 3rd to 2nd gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Torque converter turbine speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• 2-4 brake duty solenoid</li> <li>• 2-4 brake</li> <li>• ATF deterioration</li> <li>• High clutch duty solenoid</li> </ul>
Shock occurs when shifting from 2nd to 1st gear.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Torque converter turbine speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• Low &amp; reverse clutch</li> <li>• ATF deterioration</li> <li>• 2-4 brake duty solenoid</li> <li>• Low &amp; reverse brake duty solenoid</li> </ul>



# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptom	Problem parts
Shock occurs when accelerator pedal is released from medium speed.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Line pressure linear solenoid</li> <li>• Control valve</li> <li>• Lock-up damper</li> <li>• Engine performance</li> </ul>
Vibration occurs during straight-forward operation.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Lock-up duty solenoid</li> <li>• Lock-up facing</li> <li>• Lock-up damper</li> </ul>
Vibration occurs during turns. (Tight corner braking phenomenon)	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Front vehicle speed sensor</li> <li>• Rear vehicle speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Transfer clutch</li> <li>• Transfer valve</li> <li>• Transfer duty solenoid</li> <li>• ATF deterioration</li> <li>• Harness</li> </ul>
Front wheel slippage occurs during standing starts.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Front vehicle speed sensor</li> <li>• Accelerator pedal position sensor</li> <li>• ATF temperature sensor</li> <li>• Control valve</li> <li>• Transfer clutch</li> <li>• Transfer valve</li> <li>• Transfer pipe</li> <li>• Transfer duty solenoid</li> </ul>
It is not set in FWD mode.	<ul style="list-style-type: none"> <li>• TCM</li> <li>• Transfer clutch</li> <li>• Transfer valve</li> <li>• Transfer duty solenoid</li> <li>• Fuse</li> </ul>
Select lever is hard to move.	<ul style="list-style-type: none"> <li>• Select cable</li> <li>• AT select lever</li> <li>• Detent spring</li> <li>• Manual plate</li> </ul>
Select lever is excessively hard to move. (Unreasonable resistance)	<ul style="list-style-type: none"> <li>• Detent spring</li> <li>• Manual plate</li> </ul>
Select lever slips out of selected shift position during acceleration or while driving on rough terrain.	<ul style="list-style-type: none"> <li>• Select cable</li> <li>• AT select lever</li> <li>• Detent spring</li> <li>• Manual plate</li> </ul>
Manual mode can not be set.	<ul style="list-style-type: none"> <li>• SPORT/manual mode switch</li> <li>• TCM</li> <li>• Body integrated unit</li> </ul>
Gear does not change though the select lever is operated in manual mode.	<ul style="list-style-type: none"> <li>• Up shift switch</li> <li>• Down shift switch</li> <li>• TCM</li> <li>• Body integrated unit</li> </ul>
AWD warning light remains blinking or illuminated.	<ul style="list-style-type: none"> <li>• Tire size</li> <li>• Tire pressure</li> <li>• TCM</li> <li>• FWD fuse holder</li> <li>• Harness</li> </ul>

# General Diagnostic Table

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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# General Description

## AUTOMATIC TRANSMISSION

### 1. General Description

#### A: SPECIFICATION

##### 1. TORQUE CONVERTER CLUTCH

Model	Turbo	Non-turbo
Type	Symmetric, 3 element, single stage, 2 phase torque converter	
Stall torque ratio	2.0	1.9
Nominal diameter	250 mm (9.84 in)	
Stall speed (at sea level)	2,300 — 3,200 rpm	1,900 — 2,200 rpm
One-way clutch	Sprague type one-way clutch	

##### 2. OIL PUMP

Type	Internal gear fixed displacement pump	
Driving method	Driven by engine	
Number of teeth	Inner rotor	9
	Outer rotor	10

##### 3. TRANSMISSION CONTROL ELEMENT

Type	5-forward, 1-reverse, double-row planetary gears
Multi-plate clutch	3 sets
Multi-plate brake	3 sets
One-way clutch (sprague type)	2 sets

##### 4. TRANSMISSION GEAR RATIO

1st	3.540
2nd	2.264
3rd	1.471
4th	1.000
5th	0.834
Rev.	2.370

##### 5. PLANETARY GEAR AND PLATE

Model	Turbo	Non-turbo
Number of front internal gear teeth	106	
Number of front carrier teeth	28	
Number of front sun gear teeth	50	
Number of mid internal gear teeth	78	
Number of mid carrier teeth	18	
Number of mid sun gear teeth	42	
Number of rear internal gear teeth	110	
Number of rear carrier teeth	24	
Number of rear sun gear teeth	62	
Number of front brake drive plates	2	
Number of input clutch drive plates	6	5
Number of high & low reverse clutch drive plates	4	
Number of direct clutch drive plates	5	
Number of reverse brake drive plates	5	
Number of forward brake drive plates	5	4

##### 6. SELECTOR POSITION

P (Park)	Transmission is in neutral, output member is immovable, engine start is possible
R (Reverse)	Transmission is in reverse.
N (Neutral)	Transmission is in neutral and engine start is possible
D (Drive)	Automatic gear change 1st ← → 2nd ← → 3rd ← → 4th ← → 5th
Manual mode (+)	Manual gear change 1st → 2nd → 3rd → 4th → 5th
Manual mode (-)	Manual gear change 1st ← 2nd ← 3rd ← 4th ← 5th
Control method	Wire cable type

##### 7. HYDRAULIC CONTROL AND LUBRICATION

Type	Electronic/hydraulic control [5 forward gear changes made by electronic signals of vehicle speed and accelerator (throttle) opening]
Fluid	Specified fluid: SUBARU ATF Recommended fluid: IDEMITSU ATF HP Castrol Transmax J NOTE: Use of the recommended fluid is permitted only in regions where the specified fluid is not available.
Fluid capacity ℓ (US qt, Imp qt)	9.6 — 10.0 (10.1 — 10.6, 8.4 — 8.8)
Lubrication system	Forced feed lubrication with oil pump

## 8. COOLING AND HARNESS

Cooling system	Liquid-cooler incorporated in radiator
Transmission harness	20 + 8 poles

## 9. TRANSFER

Transfer type	Variable torque distribution (VTD)
Number of transfer clutch drives and driven plates	3
Reduction gear ratio	1.000 (41/41)

## 10.FINAL REDUCTION GEAR

Model	3.0 R OBK 2.5 XT LTD OBK 3.0 R	2.5 GT LTD
Front final reduction gear ratio	3.272	3.083

## 11.RECOMMENDED GEAR OIL

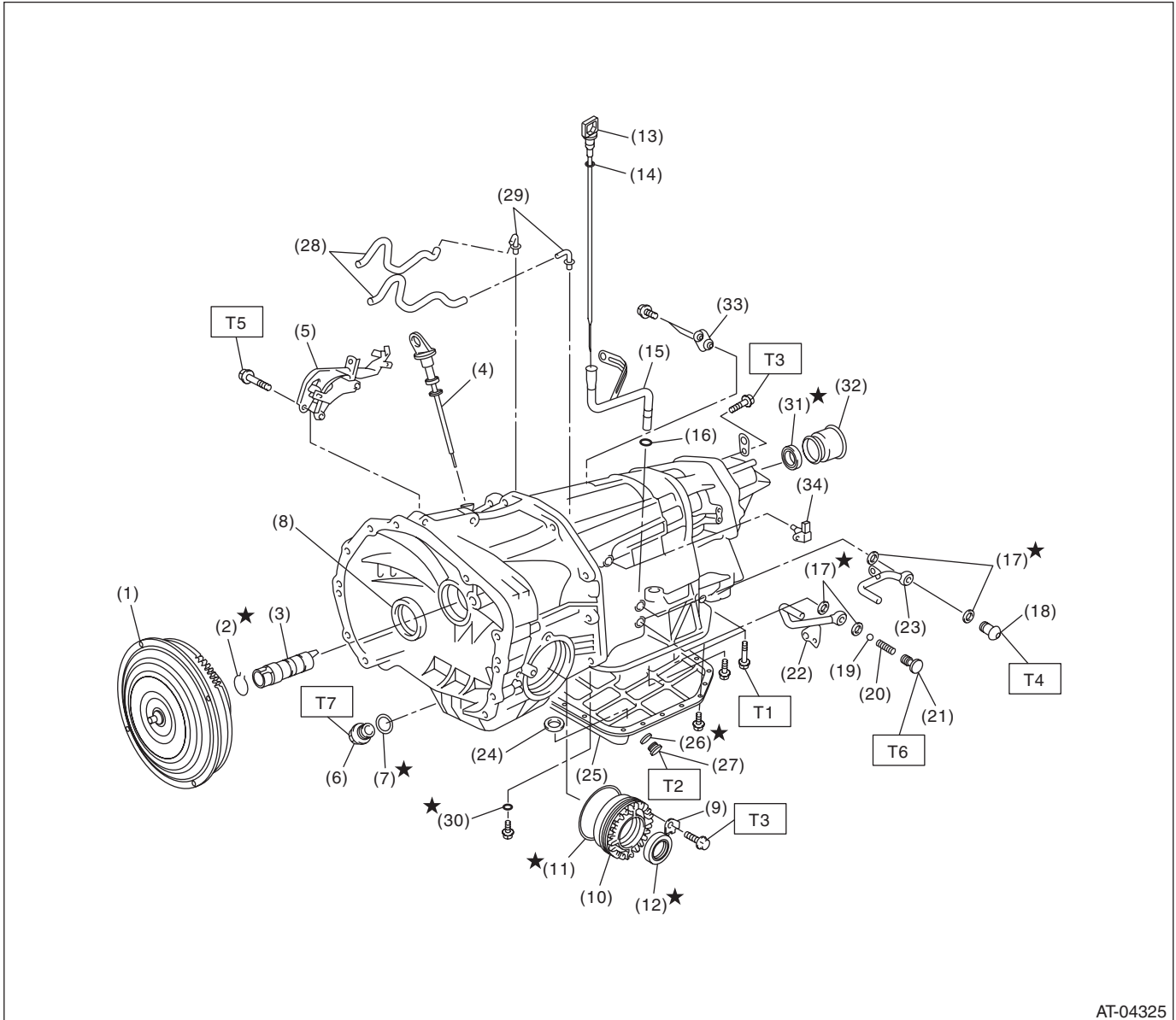
Lubrication oil	<p style="text-align: right; margin-right: 50px;">MT-00001</p>
	<p>(1) Item</p> <p>(2) Front differential gear oil</p> <p>(3) API standard</p> <p>(4) SAE viscosity No. and applicable temperature</p>
Front differential oil capacity	ℓ (US qt, Imp qt) <span style="margin-left: 100px;">1.3 — 1.5 (1.4 — 1.6, 1.1 — 1.3)</span>

# General Description

AUTOMATIC TRANSMISSION

## B: COMPONENT

### 1. TORQUE CONVERTER CLUTCH & TRANSMISSION ASSEMBLY



AT-04325

# General Description

## AUTOMATIC TRANSMISSION

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(1) Torque converter ASSY	(16) O-ring	(30) O-ring
(2) Circlip	(17) Gasket	(31) Oil seal
(3) Oil pump shaft	(18) Union screw	(32) Dust cover
(4) Differential oil level gauge	(19) Ball	(33) Floating bracket
(5) Pitching stopper bracket	(20) Spring	(34) Turbine speed sensor 1
(6) Differential oil drain plug	(21) Union screw	
(7) Gasket	(22) ATF outlet pipe	
(8) Oil seal	(23) ATF inlet pipe	
(9) Lock plate	(24) Magnet	
(10) Side retainer	(25) Oil pan	
(11) O-ring	(26) Gasket	
(12) Oil seal	(27) ATF drain plug	
(13) ATF level gauge	(28) Breather hose	
(14) O-ring	(29) Nipple	
(15) Oil charge pipe		

---

**Tightening torque:N·m (kgf-m, ft-lb)**

**T1: 5 (0.5, 3.7)**

**T2: 20 (2.0, 14.8)**

**T3: 25 (2.5, 18.4)**

**T4: 40 (4.1, 29.5)**

**T5: 41 (4.2, 30.2)**

**T6: 45 (4.6, 33.2)**

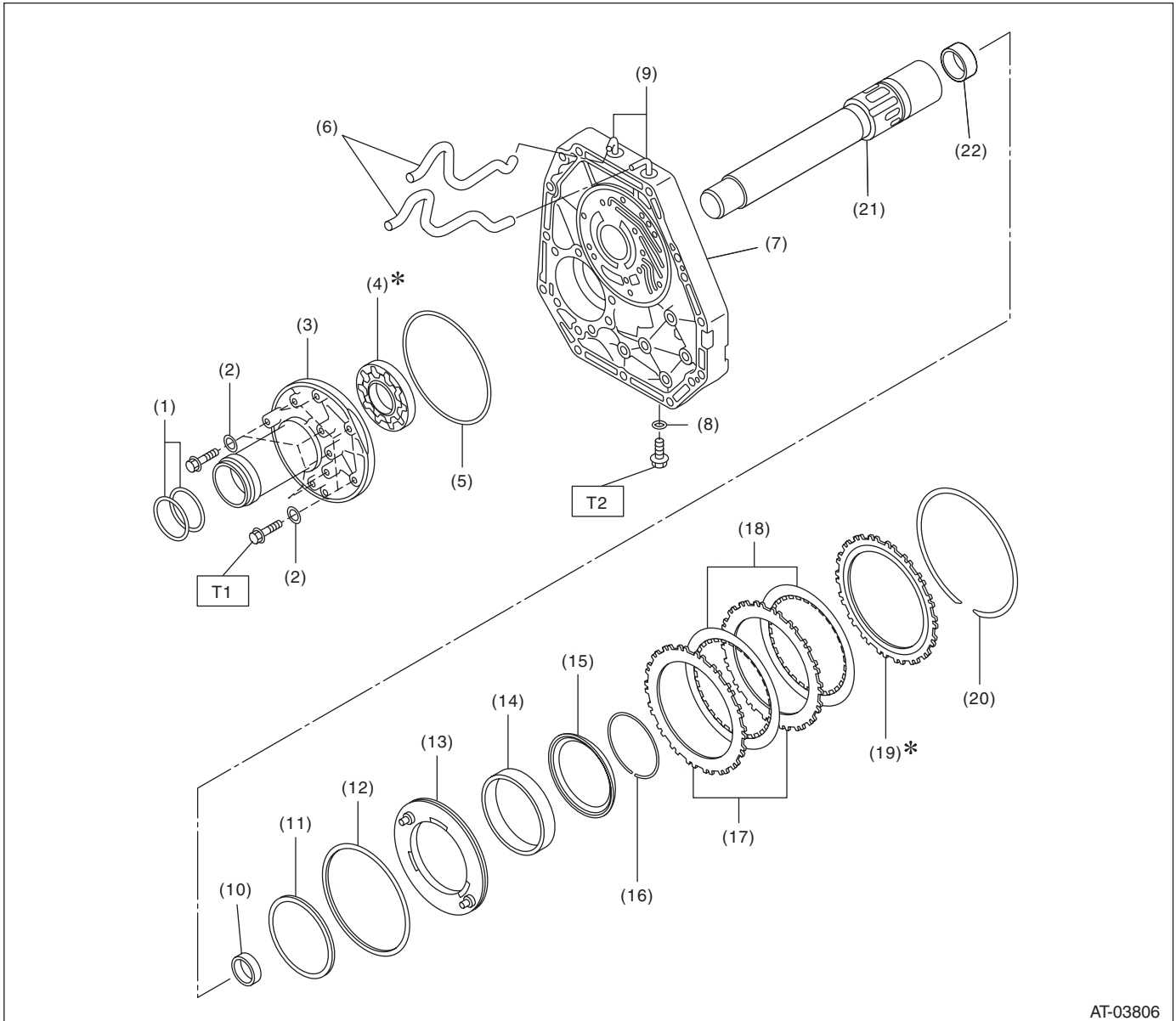
**T7: 70 (7.1, 51.6)**

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# General Description

## AUTOMATIC TRANSMISSION

### 2. OIL PUMP & FRONT BRAKE



AT-03806

- |                       |                         |                     |
|-----------------------|-------------------------|---------------------|
| (1) O-ring            | (10) Needle bearing     | (19) Retainer plate |
| (2) Washer            | (11) D-ring (Inner)     | (20) Snap ring      |
| (3) Oil pump housing  | (12) D-ring (Outer)     | (21) Stator shaft   |
| (4) Oil pump rotor    | (13) Front brake piston | (22) Needle bearing |
| (5) O-ring            | (14) Return spring      |                     |
| (6) Air breather hose | (15) Retainer           |                     |
| (7) Oil pump cover    | (16) Snap ring          |                     |
| (8) O-ring            | (17) Driven plate       |                     |
| (9) Nipple            | (18) Drive plate        |                     |

**Tightening torque: N·m (kgf·m, ft·lb)**

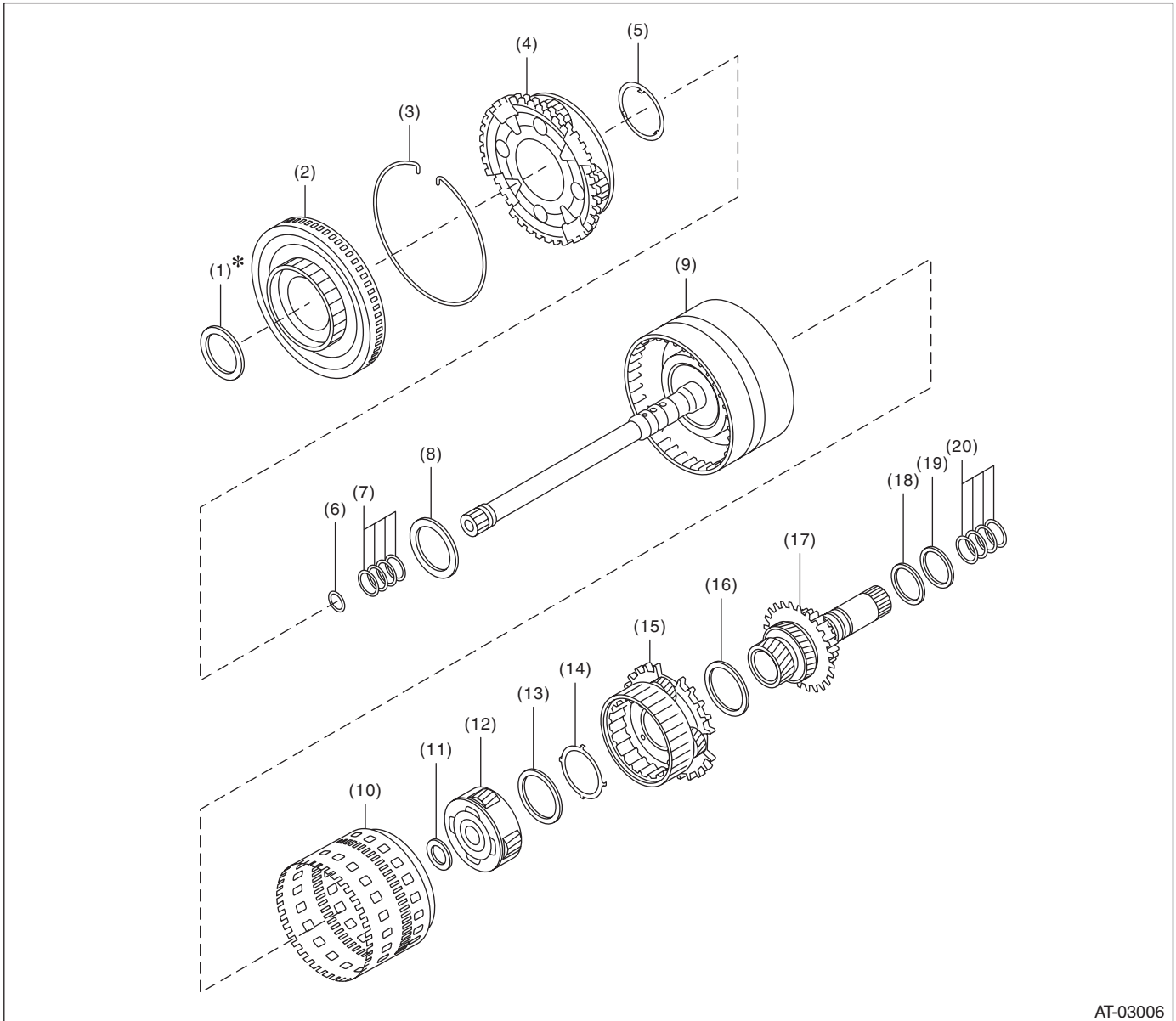
**T1: 10 (1.0, 7.4)**

**T2: 13 (1.3, 9.6)**

# General Description

AUTOMATIC TRANSMISSION

## 3. FRONT PLANETARY CARRIER AND MIDDLE & REAR PLANETARY CARRIER



AT-03006

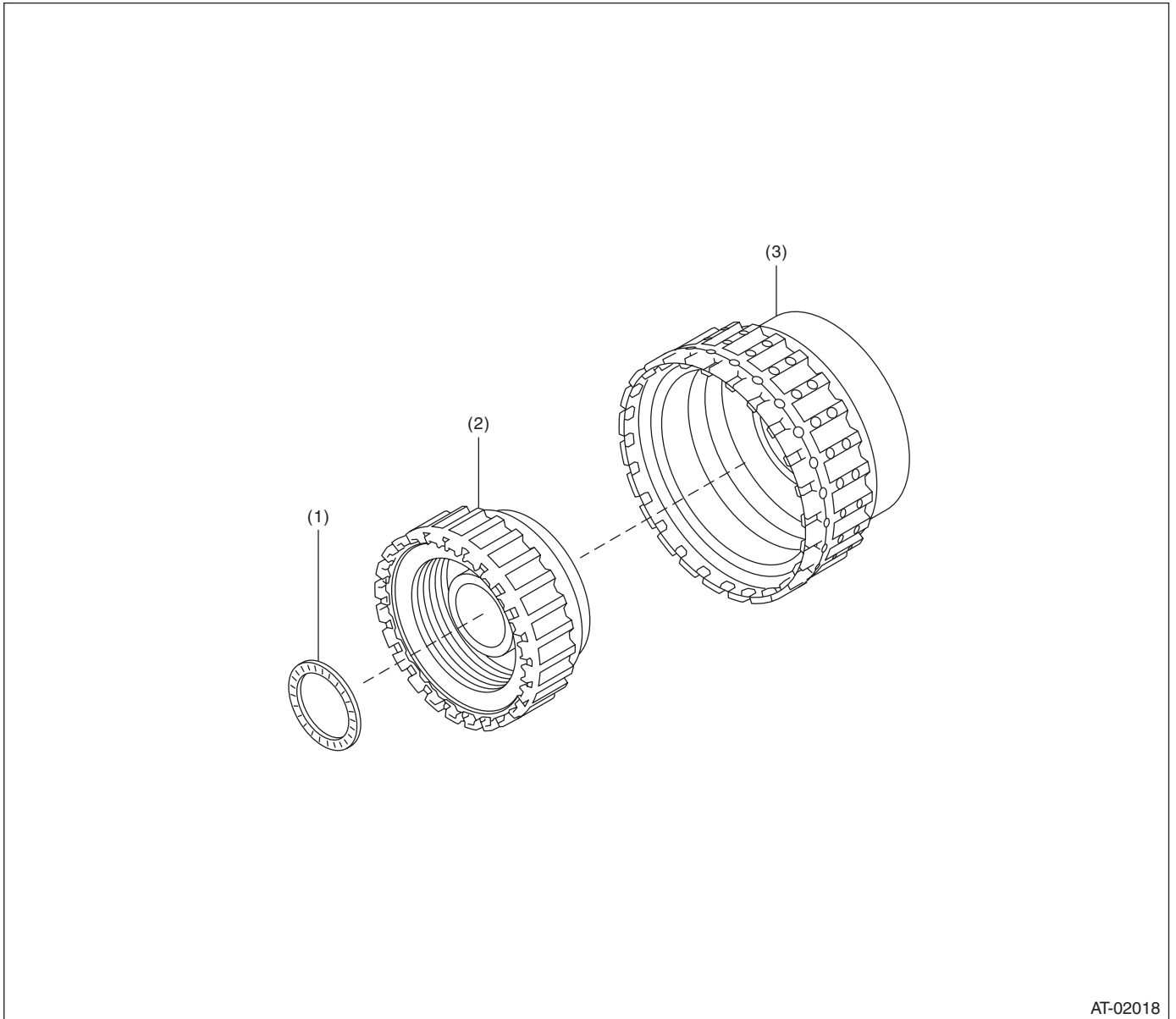
- |                         |                              |                                  |
|-------------------------|------------------------------|----------------------------------|
| (1) Thrust bearing      | (8) Thrust bearing           | (15) Rear carrier ASSY           |
| (2) Front sun gear ASSY | (9) Input clutch ASSY        | (16) Thrust bearing              |
| (3) Snap ring           | (10) Rear internal gear ASSY | (17) Middle & rear sun gear ASSY |
| (4) Front carrier ASSY  | (11) Thrust bearing          | (18) Washer                      |
| (5) Race bearing        | (12) Middle carrier ASSY     | (19) Thrust bearing              |
| (6) O-ring              | (13) Thrust bearing          | (20) Seal ring                   |
| (7) Seal ring           | (14) Race bearing            |                                  |



# General Description

AUTOMATIC TRANSMISSION

## 4. DIRECT CLUTCH AND HIGH & LOW REVERSE CLUTCH



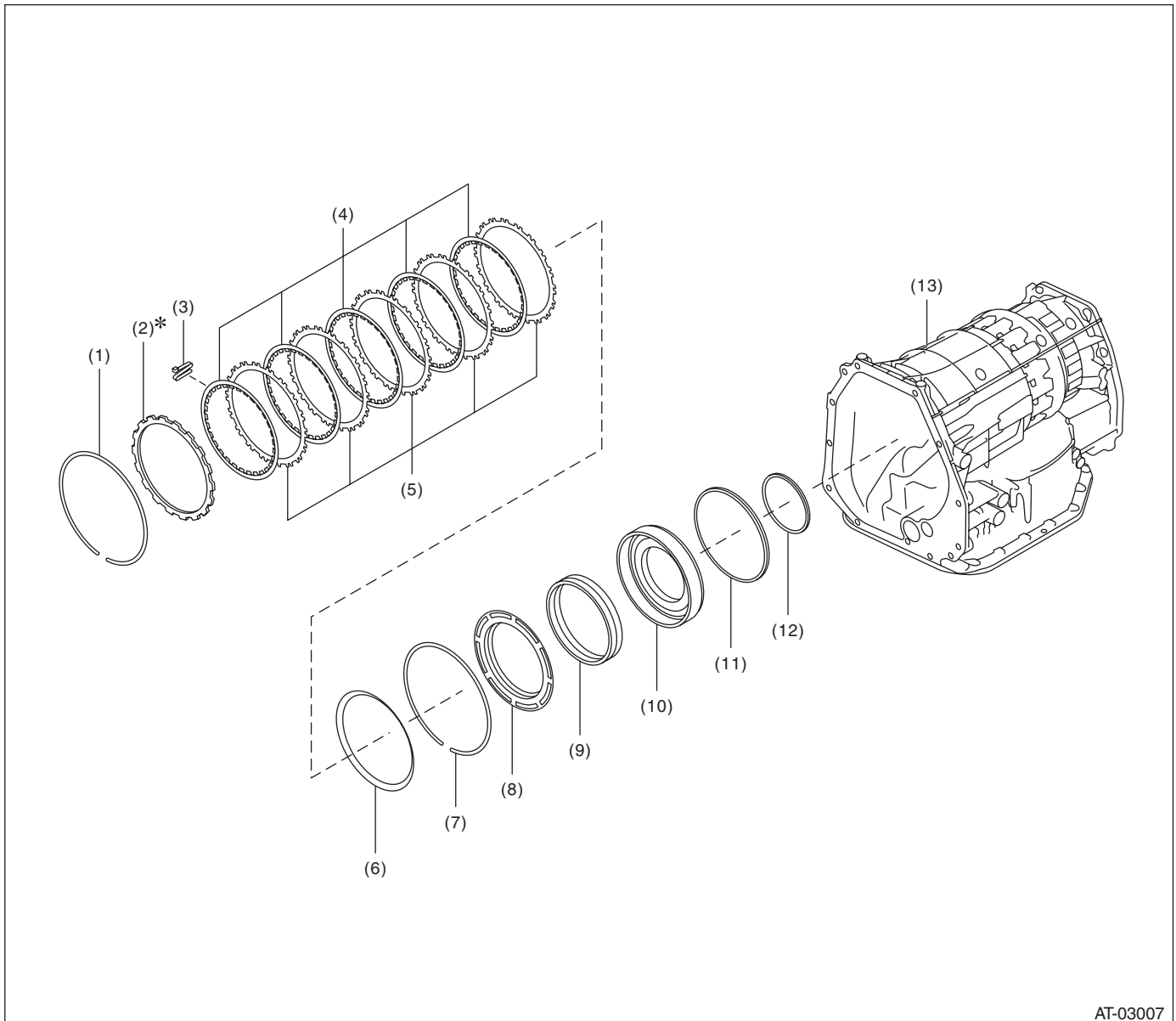
AT-02018

(1) Thrust bearing

(2) High & low reverse clutch ASSY

(3) Direct clutch ASSY

## 5. REVERSE BRAKE



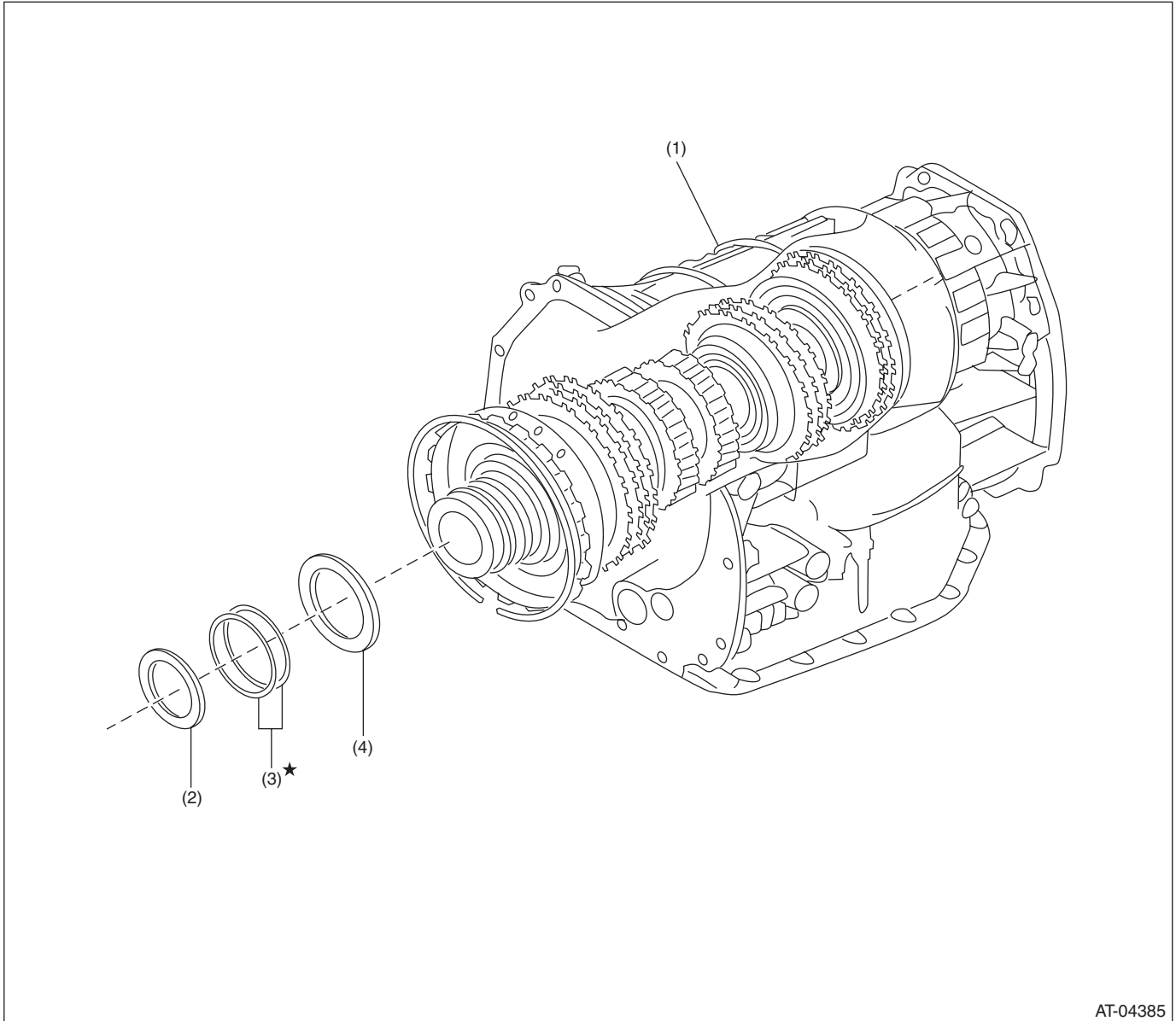
AT-03007

- |                    |                 |                           |
|--------------------|-----------------|---------------------------|
| (1) Snap ring      | (6) Dish plate  | (10) Reverse brake piston |
| (2) Retainer plate | (7) Snap ring   | (11) D-ring (Outer)       |
| (3) Leaf spring    | (8) Retainer    | (12) D-ring (Inner)       |
| (4) Drive plate    | (9) Leaf spring | (13) AT main case         |
| (5) Driven plate   |                 |                           |

# General Description

AUTOMATIC TRANSMISSION

## 6. SHORT AT ASSEMBLY



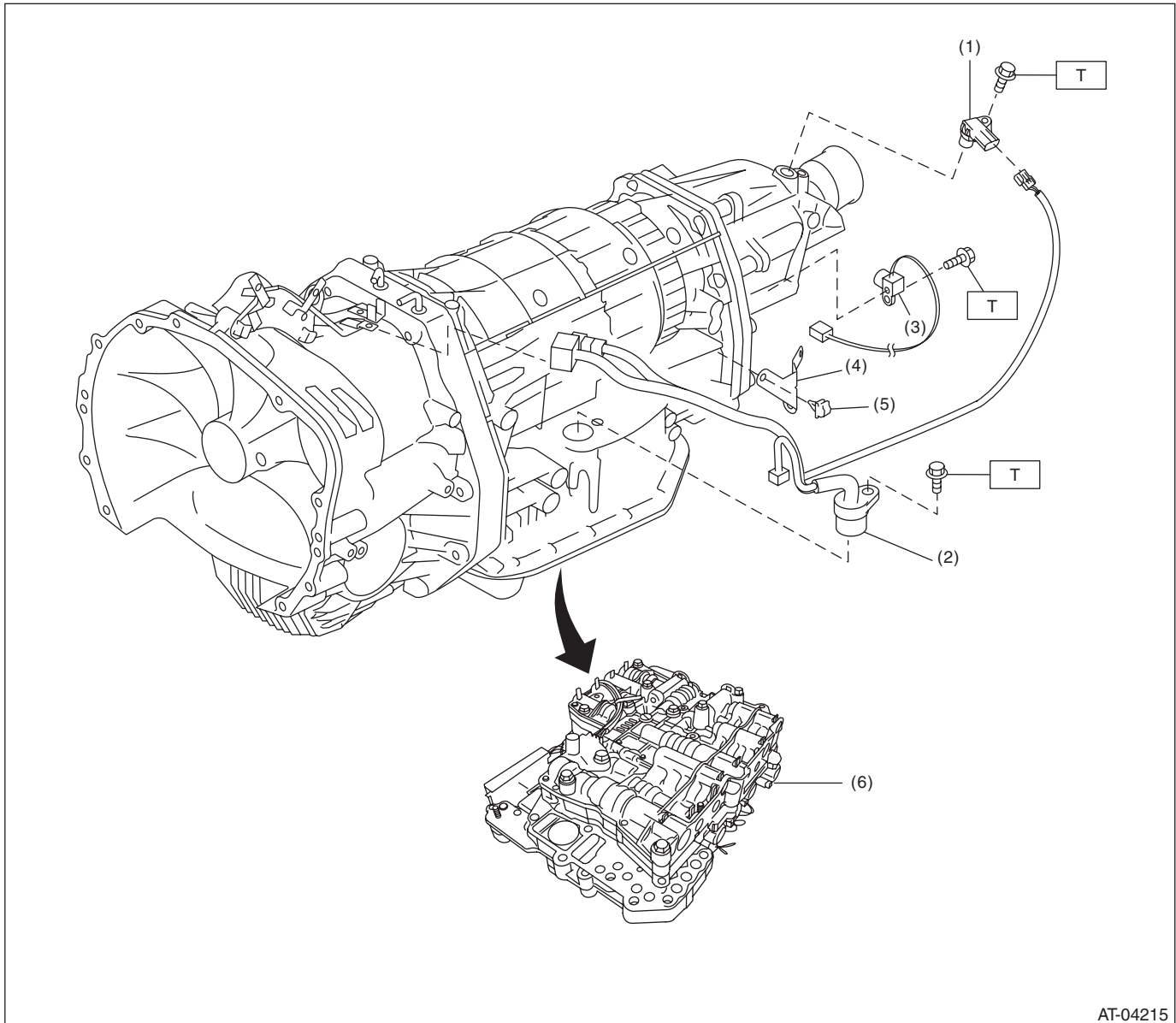
AT-04385

(1) Short AT ASSY  
(Non-disassembled)

(2) Thrust bearing  
(3) Seal ring

(4) Thrust bearing

## 7. CONTROL VALVE & TRANSMISSION HARNESS



AT-04215

- |                                |                        |
|--------------------------------|------------------------|
| (1) Rear vehicle speed sensor  | (4) Harness bracket    |
| (2) Transmission harness ASSY  | (5) Clip               |
| (3) Front vehicle speed sensor | (6) Control valve ASSY |

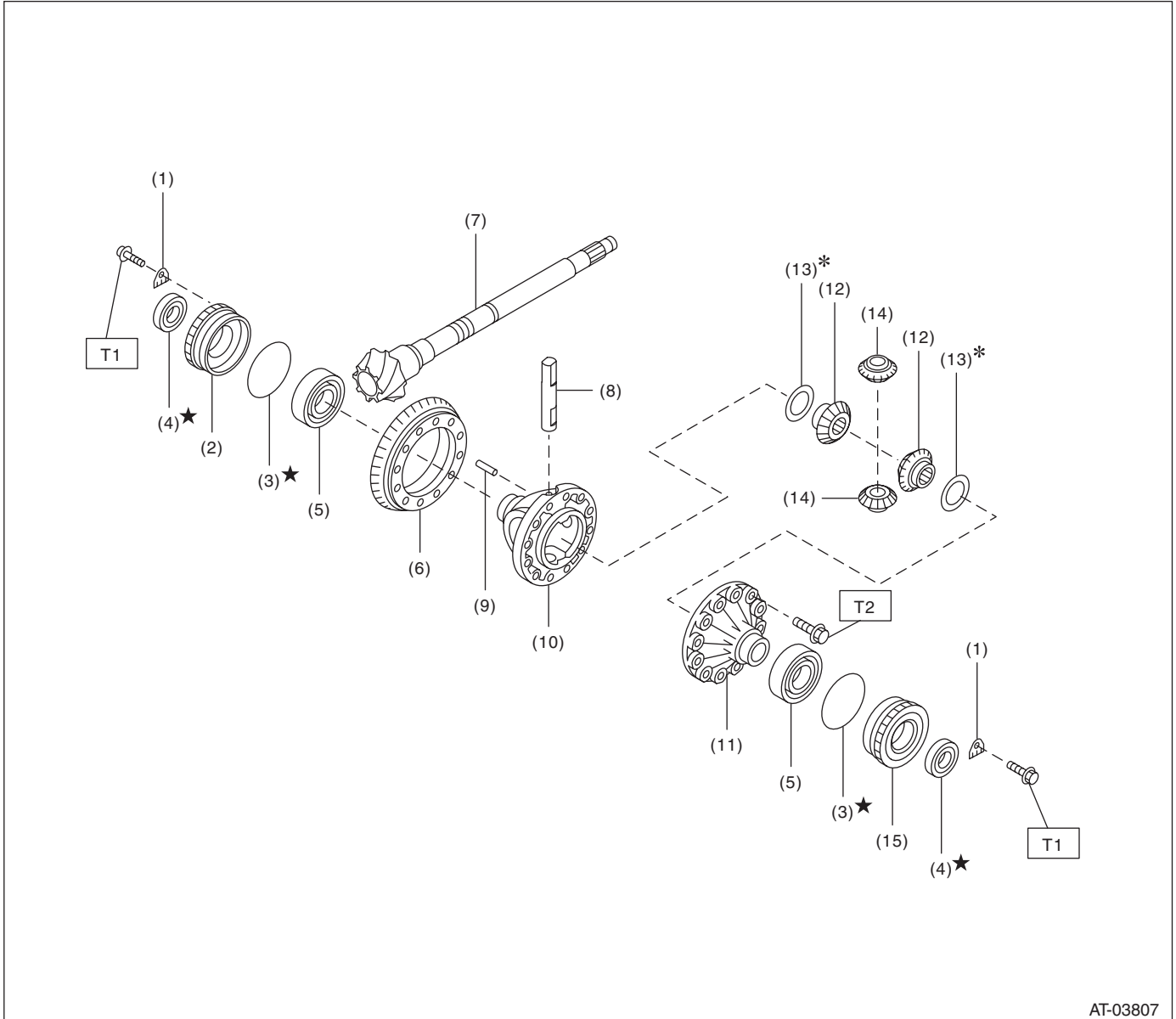
**Tightening torque: N·m (kgf-m, ft-lb)**

**T: 7 (0.7, 5.2)**

# General Description

## AUTOMATIC TRANSMISSION

### 8. DIFFERENTIAL GEAR



AT-03807

- (1) Lock plate
- (2) Differential side retainer RH
- (3) O-ring
- (4) Oil seal
- (5) Taper roller bearing
- (6) Hypoid driven gear
- (7) Drive pinion shaft

- (8) Pinion shaft
- (9) Straight pin
- (10) Differential case RH
- (11) Differential case LH
- (12) Differential bevel gear
- (13) Washer

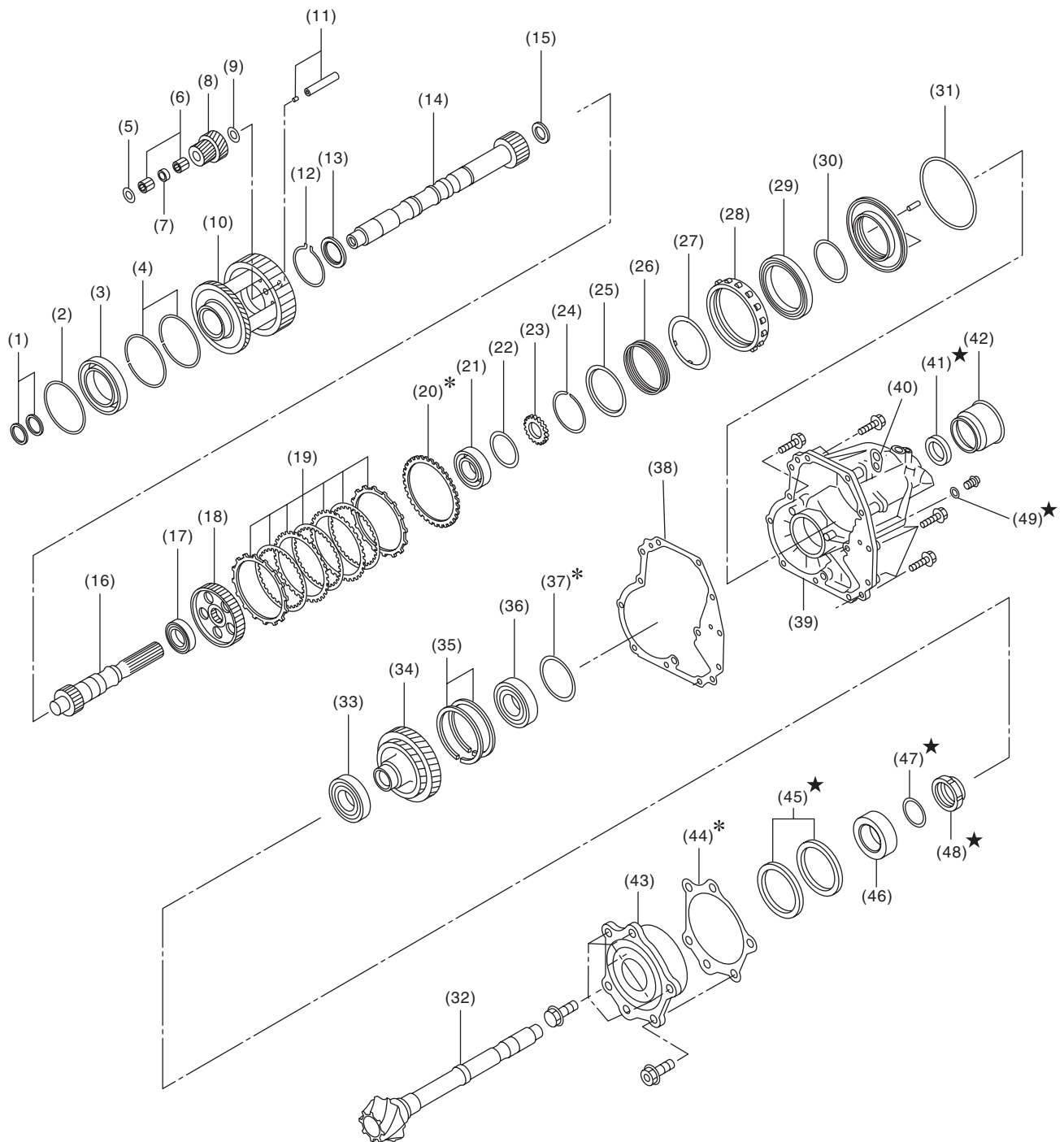
- (14) Differential bevel pinion
- (15) Differential side retainer LH

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 25 (2.5, 18.4)**

**T2: 70 (7.1, 51.6)**

### 9. TRANSFER CASE, EXTENSION CASE & REDUCTION GEAR



AT-03533

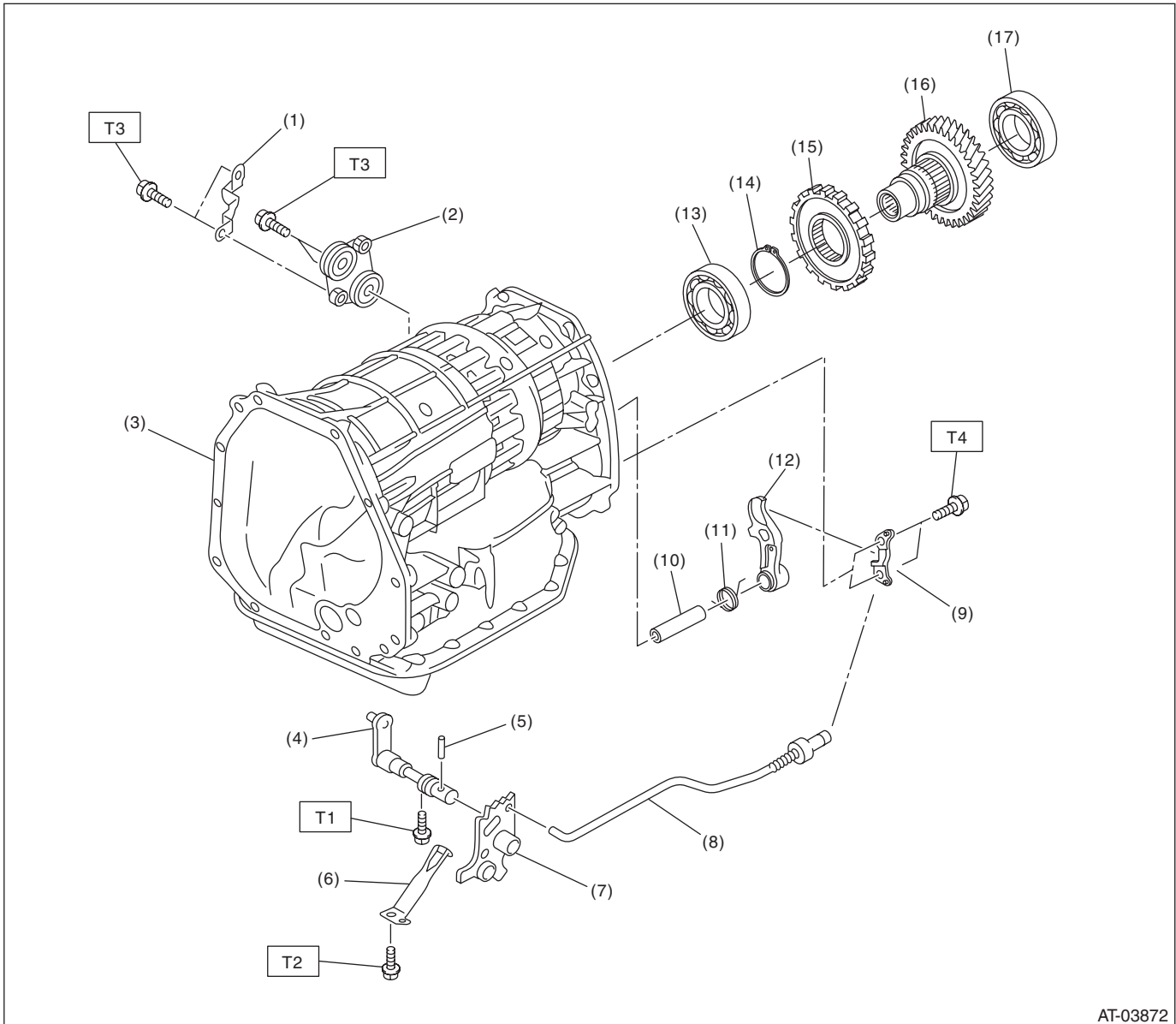
## General Description

### AUTOMATIC TRANSMISSION

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(1) Seal ring	(18) Transfer clutch hub	(34) Reduction driven gear
(2) Reduction gear shim	(19) Transfer clutch plate	(35) Snap ring
(3) Ball bearing	(20) Driven plate No. 3	(36) Ball bearing
(4) Snap ring	(21) Ball bearing	(37) Shim
(5) Planetary pinion washer	(22) Rear drive shaft shim	(38) Shim
(6) Needle bearing	(23) Revolution gear	(39) Extension case
(7) Spacer	(24) Snap ring	(40) Transmission hanger
(8) Pinion gear	(25) Clutch spring retainer	(41) Oil seal
(9) Washer	(26) Return spring	(42) Dust cover
(10) Planetary carrier ASSY	(27) Spring retainer	(43) Taper roller bearing
(11) Planetary pinion shaft ASSY	(28) Pressure plate	(44) Drive pinion shim
(12) Snap ring	(29) Ball bearing	(45) Oil seal
(13) Thrust bearing	(30) O-ring	(46) Drive pinion collar
(14) Intermediate shaft	(31) D-ring	(47) O-ring
(15) Thrust washer	(32) Drive pinion shaft	(48) Lock nut
(16) Rear drive shaft	(33) Ball bearing	(49) O-ring
(17) Ball bearing		

## 10. TRANSMISSION CONTROL DEVICE & PARKING SUPPORT



AT-03872

- |                        |                              |                   |
|------------------------|------------------------------|-------------------|
| (1) Bracket            | (9) Parking support actuator | (17) Ball bearing |
| (2) Floating bracket   | (10) Parking pawl shaft      |                   |
| (3) AT main case       | (11) Return spring           |                   |
| (4) Range select lever | (12) Parking pawl            |                   |
| (5) Straight pin       | (13) Ball bearing            |                   |
| (6) Detent spring      | (14) Snap ring               |                   |
| (7) Manual plate       | (15) Parking gear            |                   |
| (8) Parking rod        | (16) Reduction driven gear   |                   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6 (0.6, 4.4)**

**T2: 7 (0.7, 5.2)**

**T3: 25 (2.5, 18.4)**

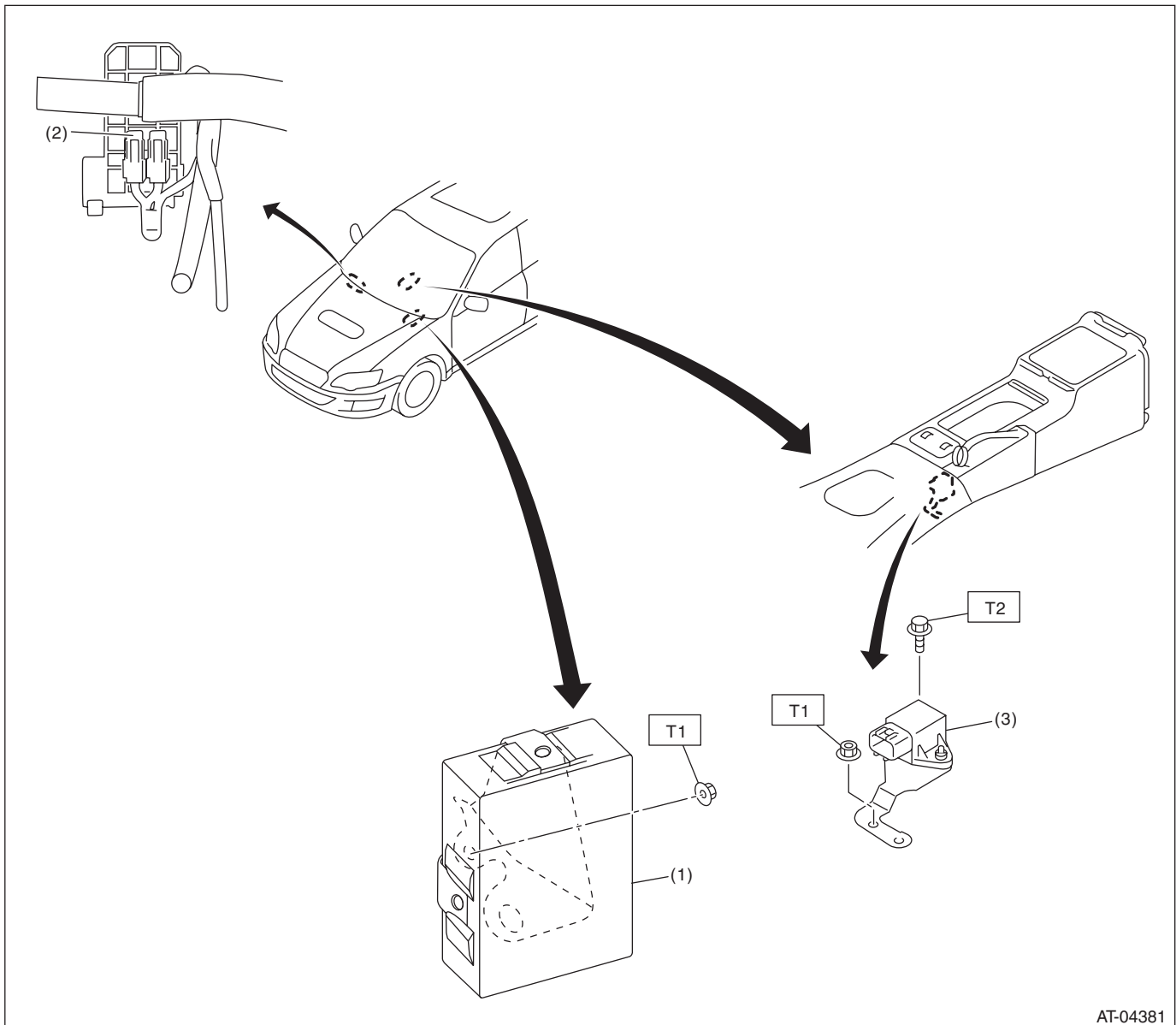
**T4: <Ref. to 5AT-78, Parking Pawl.>**



# General Description

## AUTOMATIC TRANSMISSION

### 11. TRANSMISSION CONTROL MODULE



AT-04381

(1) Transmission control module (TCM)

(3) Lateral G sensor

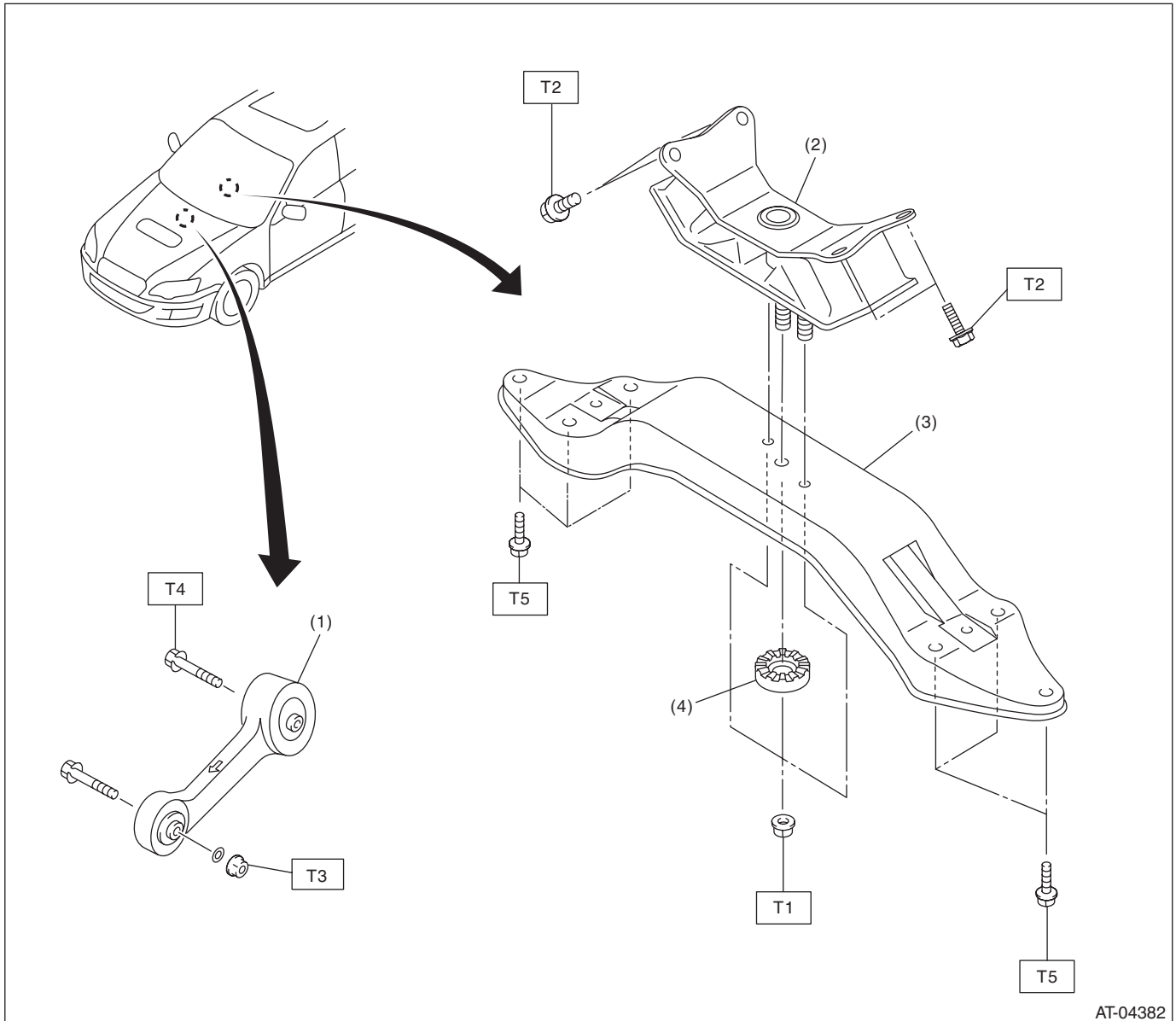
(2) Relay

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

**T2: 18 (1.8, 13.3)**

## 12. TRANSMISSION MOUNTING



AT-04382

- (1) Pitching stopper
- (2) Rear cushion rubber
- (3) Crossmember
- (4) Stopper

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 35 (3.6, 25.8)**

**T2: 40 (4.1, 29.5)**

**T3: 50 (5.1, 36.9)**

**T4: 58 (5.9, 42.8)**

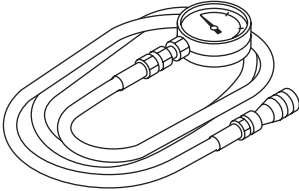
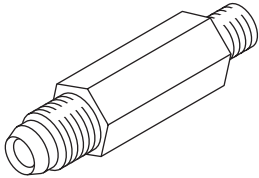
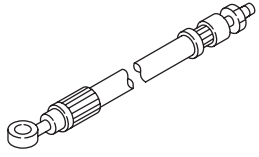
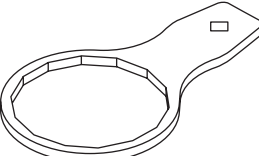
**T5: 75 (7.6, 55.3)**

#### **C: CAUTION**

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Until the oil pan is removed, do not place with the oil pan side facing up to prevent foreign matter from entering the valve body.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, disassembly and replacement.
- When disassembling the case and other light alloy parts, disassemble them by slightly tapping with a plastic hammer. Do not pry apart with screwdrivers or other tools.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine gear oil, grease or the equivalent. Do not mix them of different grades or manufacturers.
- Be sure to tighten bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply gear oil onto sliding or revolving surfaces before installation.
- Replace deformed or damaged snap rings with new parts.
- Before installing O-rings or oil seals, apply sufficient amount of ATF fluid to avoid damage and deformation.
- Be careful not to incorrectly install or fail to install O-rings, snap rings and other such parts.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Avoid damaging the mating surface of the case.
- Before applying liquid gasket, completely remove the old seal.

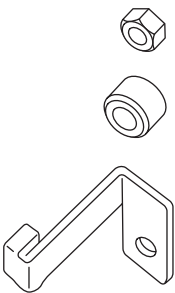
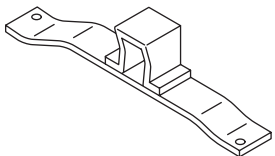
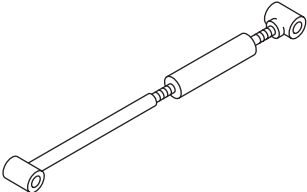
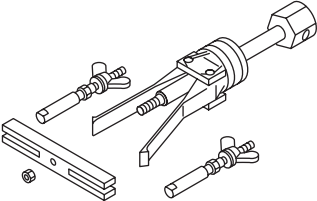
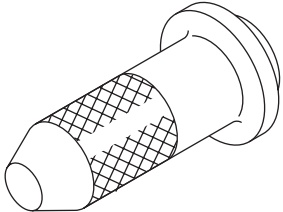
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498575400</p>	498575400	OIL PRESSURE GAUGE ASSY	Used for measuring oil pressure.
 <p style="text-align: center;">ST-498897200</p>	498897200	ADAPTER	Used together with oil pump cover installed on when measuring line pressure.
 <p style="text-align: center;">ST-498897700</p>	498897700	OIL PRESSURE ADAPTER	Used for measuring transfer clutch pressure.
 <p style="text-align: center;">ST-498545400</p>	498545400	OIL FILTER WRENCH	Used for removing and installing the ATF filter.

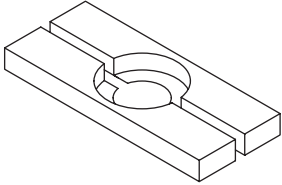
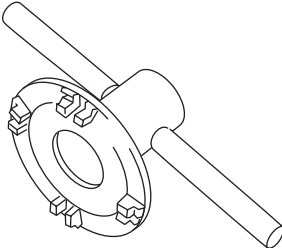
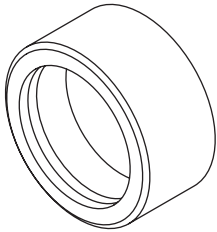
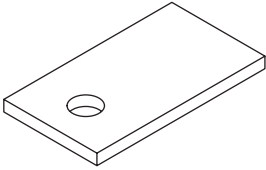
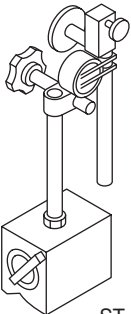
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498277200</p>	498277200	STOPPER SET	<ul style="list-style-type: none"> <li>• Used for removing and installing automatic transmission assembly to engine.</li> <li>• Used for preventing the torque converter from falling.</li> </ul>
 <p style="text-align: center;">ST41099AA010</p>	41099AA010	ENGINE SUPPORT BRACKET	Used for supporting engine.
 <p style="text-align: center;">ST41099AA020</p>	41099AA020	ENGINE SUPPORT	Used for supporting engine.
 <p style="text-align: center;">ST-398527700</p>	398527700	PULLER ASSY	<ul style="list-style-type: none"> <li>• Used for removing the extension case roller bearing.</li> <li>• Used for removing the extension oil seal.</li> <li>• Used for removing the front differential side retainer bearing outer race.</li> <li>• Used for removing the front differential side retainer oil seal.</li> </ul>
 <p style="text-align: center;">ST-498057300</p>	498057300	INSTALLER	Used for installing the extension oil seal.

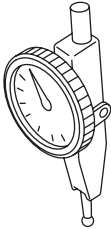
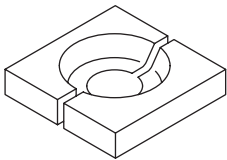
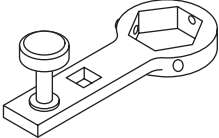
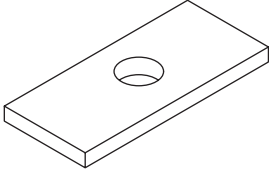
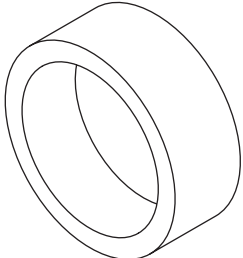
# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498077000</p>	498077000	REMOVER	Used for removing the differential taper roller bearing.
 <p>ST18630AA010</p>	18630AA010	WRENCH COMPL RETAINER	Used for removing and installing the differential side retainer.
 <p>ST-398487700</p>	398487700	DRIFT	Used for installing the front differential taper roller bearing.
 <p>ST-498255400</p>	498255400	PLATE	Used for measuring the backlash of hypoid gear.
 <p>ST-498247001</p>	498247001	MAGNET BASE	<ul style="list-style-type: none"> <li>• Used for measuring the gear backlash.</li> <li>• Used together with the DIAL GAUGE (498247100).</li> </ul>

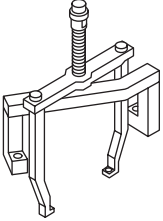
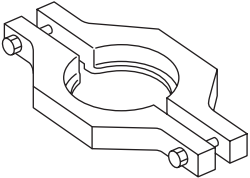
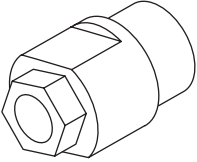
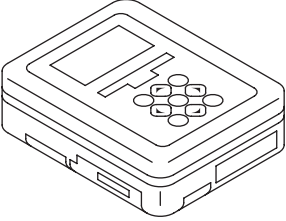
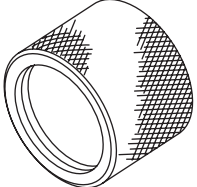
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498247100</p>	498247100	DIAL GAUGE	<ul style="list-style-type: none"> <li>• Used for measuring the gear backlash.</li> <li>• Used together with the MAGNET BASE (498247001).</li> </ul>
 <p style="text-align: center;">ST-498517000</p>	498517000	REPLACER	Used for removing the front roller bearing.
 <p style="text-align: center;">ST-499787700</p>	499787700	WRENCH	Used for removing and installing the drive pinion lock nut.
 <p style="text-align: center;">ST-398643600</p>	398643600	GAUGE	Used for measuring the total end play, extension end play and drive pinion height.
 <p style="text-align: center;">ST-398744300</p>	398744300	PISTON GUIDE	Used for measuring height from mating surface of the main case to pressure plate.

# General Description

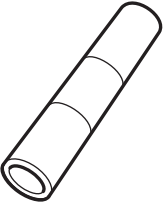
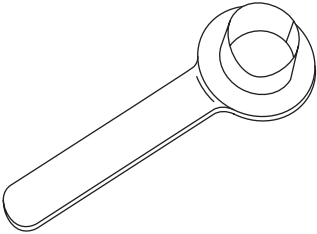
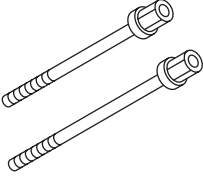
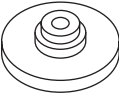
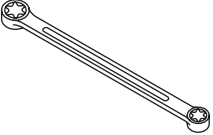
AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499737100</p>	499737100	PULLER SET	Used for removing the reduction driven gear assembly.
 <p>ST-498077600</p>	498077600	REMOVER	Used for removing the ball bearing.
 <p>ST18667AA010</p>	18667AA010	HOLDER	<ul style="list-style-type: none"> <li>• Used for removing and installing the drive pinion lock nut.</li> <li>• Used as a handle to rotate gear when checking tooth contact.</li> </ul>
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 <p>ST18675AA000</p>	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.



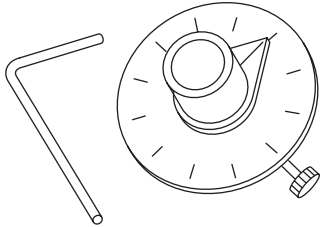
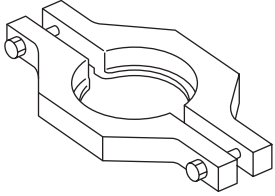
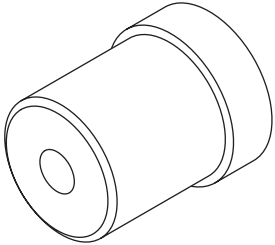
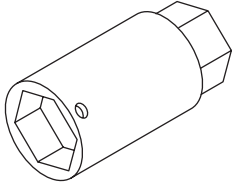
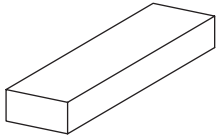
# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18654AA000</p>	18654AA000	INSTALLER	Used for removing and installing the ball bearing.
 <p style="text-align: center;">ST28399SA010</p>	28399SA010	OIL SEAL PROTECTOR	Used for protecting oil seal when installing front drive shaft.
 <p style="text-align: center;">ST18763AA000</p>	18763AA000	COMPRESSOR SHAFT	Used for disassembling multi-plate clutch for shift transmission.
 <p style="text-align: center;">ST18765AA000</p>	18765AA000	COMPRESSOR SUPPORT	Used for disassembling multi-plate clutch for shift transmission.
 <p style="text-align: center;">ST18676AA020</p>	18676AA020	TORX® WRENCH	Used for disassembling torque converter case.

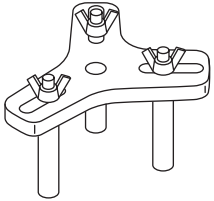
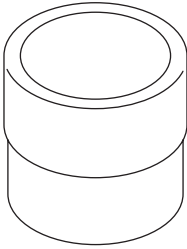
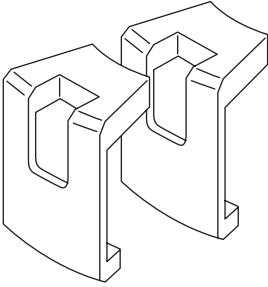
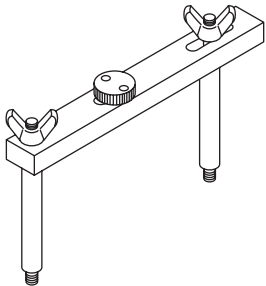
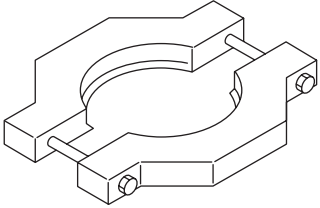
# General Description

AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18854AA000</p>	18854AA000	ANGLE GAUGE	Used for tightening parking support.
 <p>ST-498077300</p>	498077300	REMOVER	Used for removing ball bearing of reduction driven gear.
 <p>ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing the oil seal.
 <p>ST-499787500</p>	499787500	ADAPTER	Used for removing and installing drive pinion lock nut.
 <p>ST-499575400</p>	499575400	GAUGE	Used for measuring height of total end play.

# General Description

## AUTOMATIC TRANSMISSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18762AA000</p>	18762AA000	COMPRESSOR SPECIAL TOOL	Used for disassembling multi-plate clutch for shift transmission.
 <p style="text-align: center;">ST-499755602</p>	499755602	PRESS	Used for installing the parking gear.
 <p style="text-align: center;">ST18680AA010</p>	18680AA010	HOLDER GEAR	Used for removing reduction driven gear assembly. (2-piece set)
 <p style="text-align: center;">ST18766AA000</p>	18766AA000	SUPPORT PULLER	Used for removing reduction driven gear assembly.
 <p style="text-align: center;">ST18767AA000</p>	18767AA000	REMOVER	<ul style="list-style-type: none"> <li>• Used to pull out the parking gear.</li> <li>• Used to pull out the bearing from the VTD assembly.</li> </ul>

# General Description

AUTOMATIC TRANSMISSION

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Depth gauge	Used for measuring the transmission end play.
Thickness gauge	Used for measuring clearance of the clutch, brake and oil pump.
Micrometer	Used for measuring thickness of the drive pinion.
Spring scale	Used for measuring the starting torque of the drive pinion.
Circuit tester	Used for measuring resistance and voltage.
TORX® T70	Used for removing and installing differential gear oil drain plug.
Snap ring pliers	Used for removing and installing each snap ring.

# Automatic Transmission Fluid

## AUTOMATIC TRANSMISSION

### 2. Automatic Transmission Fluid

#### A: INSPECTION

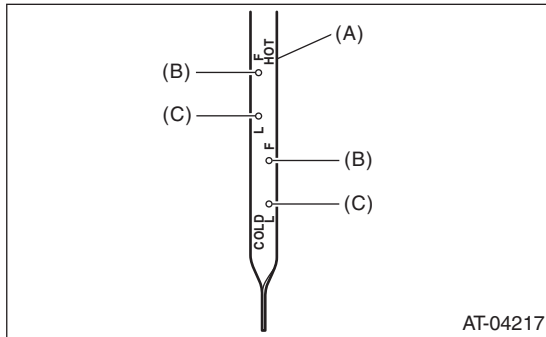
##### NOTE:

The level of ATF varies with fluid temperature. Pay attention to the ATF temperature when checking ATF level.

1) Raise the ATF temperature by driving a distance of 5 to 10 km (3 to 6 miles). Otherwise, idle the engine to raise ATF temperature to 70 — 80°C (158 — 176°F) displayed on Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

2) Park the vehicle on a level surface.

3) After selecting all positions (P, R, N, D), set the select lever in “P” range. Idle the engine for 1 or 2 minutes, and measure the ATF level.



- (A) ATF level gauge
- (B) Upper level
- (C) Lower level

4) Make sure that the ATF level is between upper and lower marks of the HOT side.

5) If the ATF level is below the lower mark, add recommended ATF until the fluid level is between upper and lower marks.

##### CAUTION:

- Be careful not to exceed the upper level.
- When the transmission is cold, be careful not to add ATF to the upper level on HOT side. Overfilling of ATF may cause oil splashing.

6) Raise the ATF temperature by driving a distance of 5 to 10 km (3 to 6 miles). Otherwise, idle the engine to raise ATF temperature to 70 — 80°C (158 — 176°F) displayed on Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

7) Check the ATF for leaks.

Visually check for leaks in the transmission. If there are leaks, replace the gasket, oil seal, plug or other parts.

#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the ATF drain plug to drain ATF.

##### CAUTION:

**Directly after the vehicle has been running or the engine has been long idle running, the ATF is hot. Be careful not to burn yourself.**

3) Check the condition of ATF.

<Ref. to 5AT-29, CONDITION CHECK, Automatic Transmission Fluid.>

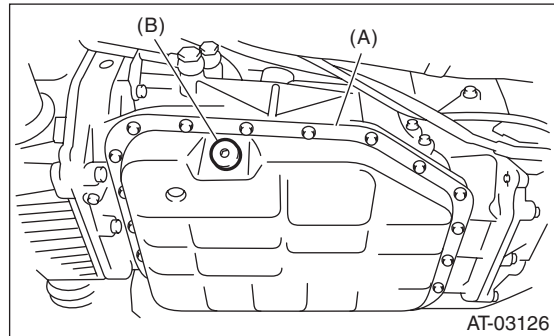
4) Tighten the ATF drain plug.

##### NOTE:

Use a new gasket.

##### Tightening torque:

**20 N·m (2.0 kgf·m, 14.8 ft·lb)**



- (A) Oil pan
- (B) ATF drain plug

5) Lower the vehicle.

6) Pour ATF from the oil charge pipe.

##### Specified fluid:

**SUBARU ATF**

##### Recommended fluid:

**IDEMITSU ATF HP**

**Castrol Transmax J**

##### NOTE:

Use of the recommended fluid is permitted only in regions where the specified fluid is not available.

##### Capacity:

**Fill with the same amount of ATF as drained.**

##### Capacity when transmission is overhauled:

**9.6 — 10.0 ℓ (10.1 — 10.6 US qt, 8.4 — 8.8 Imp qt)**

7) Check the level and leaks of ATF.

<Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

## C: CONDITION CHECK

**NOTE:**

When replacing ATF, check the inside condition of transmission body by inspecting the drained ATF.

Fluid condition	Trouble and possible cause	Corrective action
Large amount of metallic pieces are found.	Internal metal parts of transmission body are excessively worn.	Replace ATF and check if AT operates correctly.
Is thick and is a varnish-form fluid.	Clutch etc. is burned.	Replace ATF and check the AT body or vehicle for faulty.
Clouded fluid or bubbles are found in fluid.	Water is mixed.	Replace ATF and check the water entering point.

# Differential Gear Oil

## AUTOMATIC TRANSMISSION

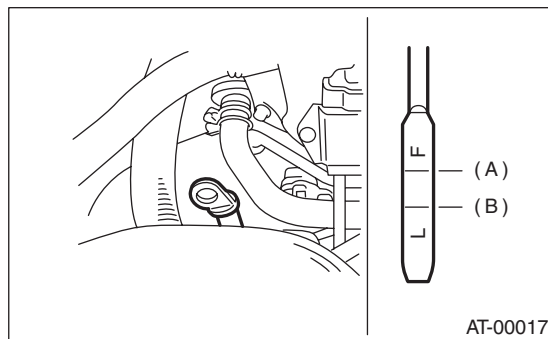
### 3. Differential Gear Oil

#### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the collector cover.
- 3) Remove the oil level gauge and wipe it clean.
- 4) Reinsert the level gauge all the way. Make sure the level gauge is inserted correctly and in the proper orientation.
- 5) Remove the oil level gauge again, and check the level of differential gear oil. If the differential gear oil level is below "L" line, add oil to bring the level up to "F" line.

#### NOTE:

To prevent overfilling the differential gear oil, do not add oil above the "F" line.



- (A) Upper level  
(B) Lower level

#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the differential gear oil drain plug using TORX® BIT T70, and then drain differential gear oil.

#### CAUTION:

• Immediately after the vehicle has been running or after idling for a long time, the differential gear oil will be hot. Be careful not to burn yourself.

• Be careful not to spill differential gear oil on the exhaust pipe to prevent it from emitting smoke or causing a fire. If differential gear oil is spilled on the exhaust pipe, wipe it off completely.

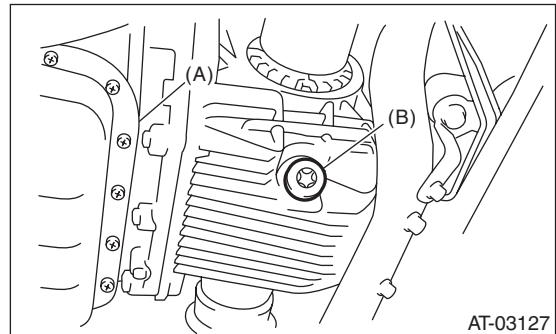
- 3) Tighten the differential gear oil drain plug using TORX® BIT T70.

#### NOTE:

Use a new gasket.

#### Tightening torque:

**70 N·m (7.1 kgf-m, 51.6 ft-lb)**



- (A) Oil pan  
(B) Differential gear oil drain plug

- 4) Lower the vehicle.
- 5) Pour gear oil into the gauge hole.

#### Recommended gear oil:

**<Ref. to 5AT-3, RECOMMENDED GEAR OIL, SPECIFICATION, General Description.>**

#### Gear oil capacity:

**1.3 — 1.5 ℓ (1.4 — 1.6 US qt, 1.1 — 1.3 Imp qt)**

- 6) Check the level of differential gear oil.  
<Ref. to 5AT-30, INSPECTION, Differential Gear Oil.>

## 4. Road Test

### A: INSPECTION

#### 1. GENERAL PRECAUTION

Road tests should be conducted to properly diagnose the condition of automatic transmission.

#### NOTE:

When performing the test, do not exceed posted speed limit.

#### 2. D RANGE SHIFT FUNCTION

Check shifting between 1st ↔ 2nd ↔ 3rd ↔ 4th ↔ 5th while driving on normal city streets.

#### 3. D RANGE SHIFT SHOCK

Check the shock level when shifting up during normal driving.

#### 4. KICK-DOWN FUNCTION

Check kick-down for each gear. Check the shock level during kick-down at the same time.

#### 5. ENGINE BRAKE OPERATION

- Check the 4th gear engine brake by shifting down from 5th to 4th range while driving in 5th gear of manual mode [50 — 60 km/h (31 — 37 MPH)].
- Check the 3rd gear engine brake by shifting down from 4th to 3rd range while driving in 4th gear of manual mode [50 — 60 km/h (31 — 37 MPH)].
- Check the 2nd gear engine brake by shifting down from 3rd to 2nd range while driving in 3rd gear of manual mode [40 — 50 km/h (25 — 31 MPH)].
- Check the 1st gear engine brake by shifting down from 2nd to 1st range while driving in 2nd gear of manual mode [20 — 30 km/h (12 — 19 MPH)].

#### 6. LOCK-UP FUNCTION

When the accelerator is lightly depressed while driving on a flat road in lock-up range, check that rpm does not change abruptly.

#### 7. P RANGE OPERATION

Stop the vehicle on an uphill grade of 5% or more and shift to the “P” range. Check that the vehicle does not move when the parking brake is released.

#### 8. NOISE AND VIBRATION

Check for noise and vibration while driving and during shifting.

#### 9. OIL LEAKAGE

After the driving test, inspect for oil leaks from the transmission body.



# Stall Test

## AUTOMATIC TRANSMISSION

### 5. Stall Test

#### A: INSPECTION

**NOTE:**

The stall test is extremely important in diagnosing the condition of an automatic transmission and engine. It should be conducted to measure the engine stall speeds in “2nd of manual mode”.

Purposes of the stall test:

- Operational check of the automatic transmission clutch
  - Operational check of the torque converter clutch
  - Engine performance check
- 1) Check that the throttle valve fully opens.
  - 2) Check that the engine oil level is correct.
  - 3) Check that the coolant level is correct.
  - 4) Check that the ATF level is correct.
  - 5) Check that the differential gear oil level is correct.
  - 6) Raise the ATF temperature to 70 to 80°C (158 to 176°F) by driving a distance of 5 to 10 km (3 to 6 miles). Confirm the ATF temperature on Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>
  - 7) Place the wheel chocks at the front and rear of all wheels and apply the parking brake.
  - 8) Move the manual linkage to ensure it operates properly, then set to “2nd gear of manual mode”.
  - 9) While stepping hard on the brake pedal, gradually step on the accelerator pedal.
  - 10) When the engine speed is stabilized, quickly record the engine speed and release accelerator pedal.

11) Shift the select lever to “N” range, and cool down the engine by idling it for one minute or more.

**NOTE:**

- Do not continue the stall test for five seconds or more at a time (from fully closed throttle to fully open throttle until stall speed reading). Doing so will make the engine oil and ATF deteriorate and the clutch and brake to be adversely affected.
  - After performing the stall test, be sure to cool down the engine for at least one minute with the select lever set in “P” or “N” range, and at an idle speed of 1,200 rpm or less.
  - If the stall speed is higher than the specified range, attempt to finish the stall test in as short a time as possible, in order to prevent the automatic transmission from sustaining damage.
  - Perform the stall test in S mode.
  - When depressing the accelerator pedal again after performing the stall test for five seconds or more, the electronic throttle control remains closed for approx. 60 seconds.
  - When the stall test is performed for 15 seconds or more continuously, the test is completed forcibly to protect the transmission unit.
- When depressing the accelerator pedal again, the electronic throttle control remains closed for approx. 60 seconds.

**Stall speed (at sea level):**

**Turbo model**

**2,300 — 3,200 rpm**

**Non-turbo model**

**1,900 — 2,200 rpm**

Stall speed (at sea level)	Range	Possible faulty parts
Over specified value	2nd gear of manual mode	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Forward brake</li> <li>• Direct clutch</li> <li>• 3rd one-way clutch</li> </ul>

## 6. Time Lag Test

### A: INSPECTION

#### NOTE:

When the select lever is shifted while the engine is idling, there will be a certain time elapse or lag before shock is felt. Using this, check the condition of forward brake, reverse brake, 1st one-way clutch and 3rd one-way clutch.

- Perform the test at normal operation fluid temperature of 70 — 80°C (158 — 176°F).
- Be sure to allow one minute or more interval between tests.
- Make three measurements and take the average value.

1) Fully apply the parking brake.

2) Start the engine.

Check the idle speed (A/C OFF).

3) Shift the select lever from “N” to “D” range. Using a stop watch, measure the time-lag from shifting the lever until the shock is felt.

#### ***Time-lag***

##### ***Specification: 1.2 seconds or less***

If “N” → “D” time-lag is longer than specification:

- Line pressure too low
- Forward brake worn
- One-way clutch not operating properly

4) In the same manner, measure the time lag of “N” → “R”.

#### ***Time-lag***

##### ***Specification: 1.5 seconds or less***

If “N” → “R” time lag is longer than specification:

- Line pressure too low
- Reverse brake worn

### 7. Line Pressure Test

#### A: MEASUREMENT

##### NOTE:

If the clutch or brake shows a sign of slippage, or shifting interval is not correct, check the line pressure.

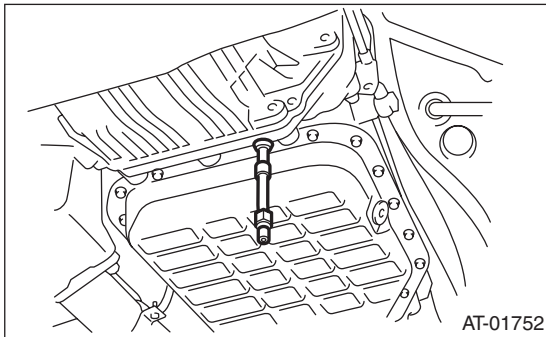
- Excessive shock during up-shift may be due to the line pressure being too high.
- Slippage or inability to operate the vehicle may, in most cases, be due to loss of oil pressure for the operation of clutch, brake or control valve.

1) Set the vehicle on a lift.

2) Remove the under cover.

3) Remove the test plug and attach the ST.

ST 498897200 OIL PRESSURE ADAPTER



4) Set the ST1 and ST2.

ST1 498897200 OIL PRESSURE ADAPTER

ST2 498575400 OIL PRESSURE GAUGE  
ASSY

5) Lower the vehicle, and pull ST1 and ST2 into the vehicle.

ST1 498897200 OIL PRESSURE ADAPTER

ST2 498575400 OIL PRESSURE GAUGE  
ASSY

6) Connect the Subaru Select Monitor to the data link connector and read the current data. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

# Line Pressure Test

AUTOMATIC TRANSMISSION

7) Perform the line pressure test.

**NOTE:**

- Do not perform the line pressure test for 5 seconds or more at a time. Doing so will make the engine oil and ATF deteriorate and the clutch and brake to be adversely affected.
- After performing the line pressure test, be sure to cool down the engine for at least one minute with the select lever set in “P” or “N” range and with the idle speed at 1,200 rpm or less.
- Fully open or fully close the throttle valve angle in order to match the “P/L Solenoid Pressure” displayed on the Subaru Select Monitor.

Range of the selector lever	Throttle valve angle	ATF temperature condition	“P/L Solenoid Pressure” displayed on the Subaru Select Monitor kPa	Standard line pressure kPa (kg/cm <sup>2</sup> , psi)
2nd gear of manual mode	Full closed	45 — 55°C (113 — 131°F)	500 — 700	Target pressure -10 — +190 (Target pressure -0.10 — +1.94, Target pressure -1.45 — +27.5)
	Full open		2,150	1,320 — 1,520 (13.46 — 15.50, 191.4 — 220.4)
R	Full closed		2,150	1,660 — 1,860 (16.93 — 18.97, 240.7 — 269.7)

8) Remove the ST and install the test plug.

**Tightening torque:**

**13 N·m (1.3 kgf·m, 9.6 ft·lb)**

# Transfer Clutch Pressure Test

AUTOMATIC TRANSMISSION

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## 8. Transfer Clutch Pressure Test

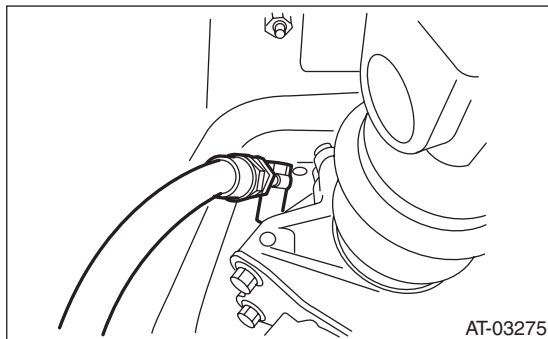
### A: INSPECTION

- 1) Lift up the vehicle.
- 2) Remove the bolts holding the heat shield cover, and move the heat shield cover to the rear.
- 3) Remove the test plug and attach the ST.

#### CAUTION:

**Be careful not to cut yourself on the heat shield cover when removing the test plugs and setting the ST.**

ST 498897700 OIL PRESSURE ADAPTER  
ST 498897800 ADAPTER SET



- 4) Set the ST.

ST 498575400 OIL PRESSURE GAUGE  
ASSY

- 5) Lower the vehicle, and pull ST3 into the vehicle.

ST1 498897700 OIL PRESSURE ADAPTER  
ST2 498897800 ADAPTER SET  
ST3 498575400 OIL PRESSURE GAUGE  
ASSY

- 6) Connect the Subaru Select Monitor to the data link connector and read the current data. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.>

# Transfer Clutch Pressure Test

AUTOMATIC TRANSMISSION

7) Perform the transfer clutch pressure test.

**NOTE:**

- Do not perform the transfer clutch pressure test for 5 seconds or more at a time. Doing so will make the engine oil and ATF deteriorate and the clutch and brake to be adversely affected.
- After performing the transfer clutch pressure test, be sure to cool down the engine for at least one minute with the select lever set in the “P” or “N” range, and at an idle speed of 1,200 rpm or less.
- Adjust the throttle valve angle in order to obtain the “T/F Solenoid Pressure” displayed on the Subaru Select Monitor.

Range of the selector lever	Throttle valve angle	ATF temperature condition	“T/F Solenoid Pressure” displayed on the Subaru Select Monitor kPa	Standard transfer clutch pressure kPa (kg/cm <sup>2</sup> , psi)
2nd gear of manual mode	Full open	45 — 55°C (113 — 131°F)	1,200	990 — 1,190 (10.09 — 12.13, 143.5 — 172.5)
	Partial throttle		500	400 — 600 (4.08 — 6.12, 58.0 — 87.0)
N	Full closed		0	0 — 50 (0 — 0.51, 0 — 7.3)

8) Remove the ST and install the test plug.

**Tightening torque:**

**13 N·m (1.3 kgf-m, 9.6 ft-lb)**

9) Install the heat shield cover.

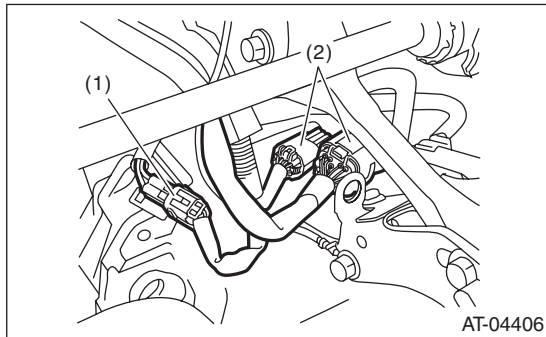
# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

### 9. Automatic Transmission Assembly

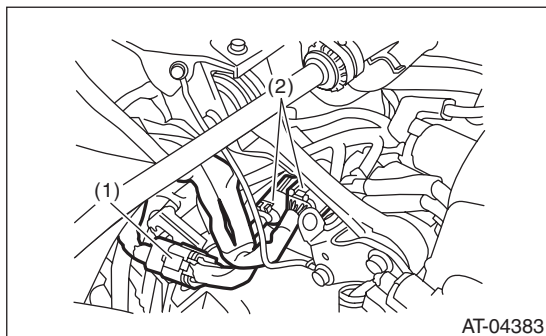
#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood and support with the hood stay.
- 3) Disconnect the ground cable from battery.
- 4) Remove the collector cover.
- 5) Remove the intercooler. (Turbo model)  
<Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 6) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 7) Remove the intake boot. (Non-turbo model)
- 8) Remove the air breather hose. <Ref. to 5AT-64, REMOVAL, Air Breather Hose.>
- 9) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
- 10) Disconnect the following connectors.
  - Turbo model



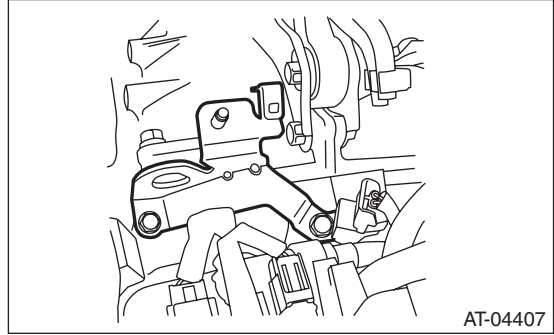
- (1) Rear oxygen sensor connector
- (2) Transmission harness connectors

- Non-turbo model

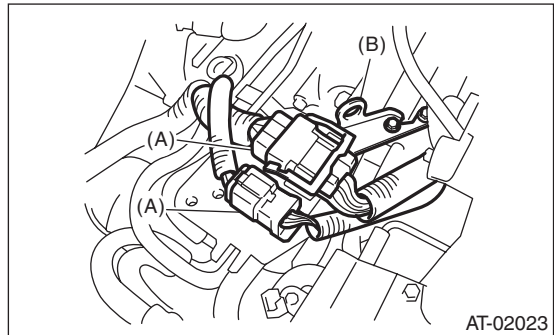


- (1) Front oxygen (A/F) and rear oxygen sensor connector
- (2) Transmission harness connectors

- 11) Remove the engine hanger. (Turbo model)

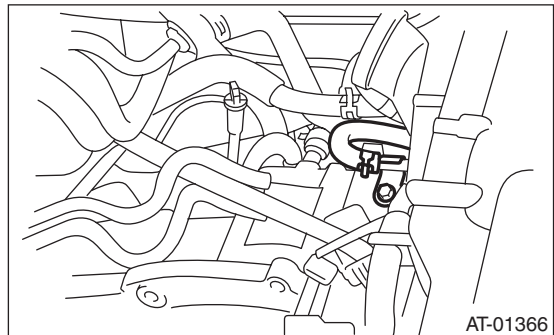


- 12) Disconnect the engine harness connectors, and then remove the engine hanger rear. (Non-turbo model)



- (A) Engine harness connectors
- (B) Engine hanger rear

- 13) Remove the water by-pass pipe. (Turbo model)



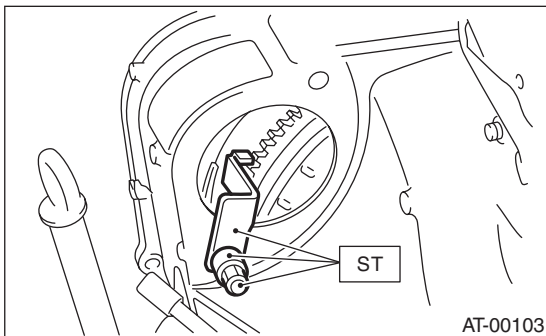
14) Separate the torque converter from drive plate.

**CAUTION:**

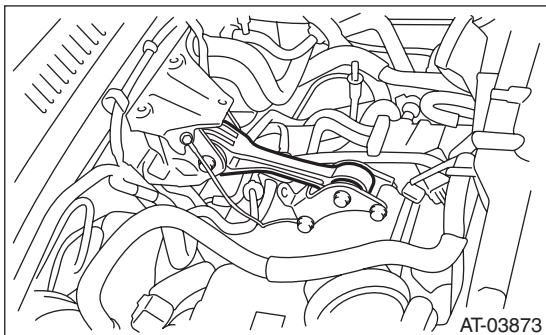
- Be careful not to drop bolts into converter housing.
- Be careful not to damage the mounting bolts.
  - (1) Remove the service hole plug.
  - (2) Remove the bolts which hold torque converter to drive plate.
  - (3) Remove the four bolts by rotating the crank pulley a little at a time.
  - (4) Make sure the torque converter moves freely by rotating with finger through the starter installation hole.



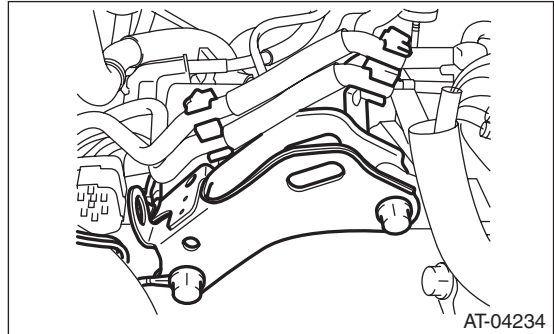
15) Attach the ST to the converter case.  
ST 498277200 STOPPER SET



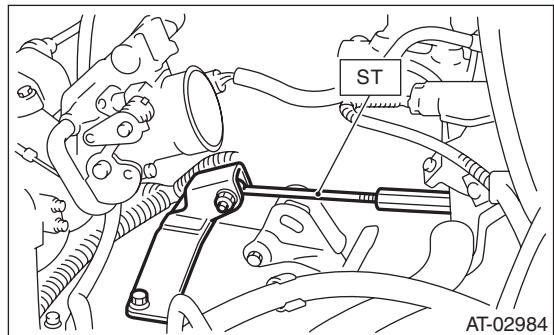
16) Remove the pitching stopper.



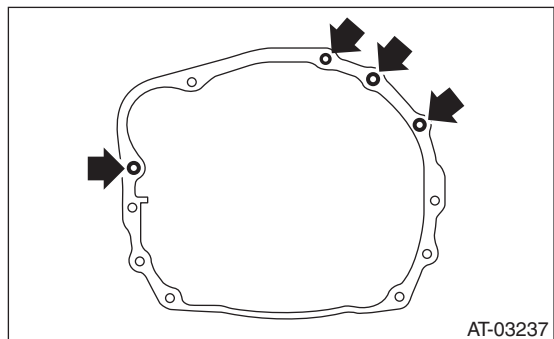
17) Remove the pitching stopper bracket.



18) Set the ST.  
ST 41099AC000 ENGINE SUPPORT ASSY



- 19) Remove the air intake duct. (Turbo model)  
<Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 20) Remove the air cleaner case. (Turbo model)  
<Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 21) Remove the transmission mounting bolt (upper side).



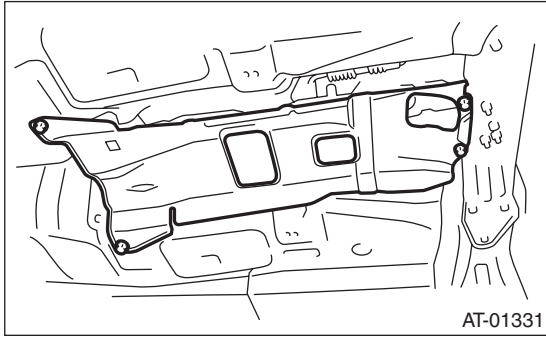
- 22) Lift up the vehicle. (Turbo model)
- 23) Remove the under cover. (Turbo model)
- 24) Remove the center and rear exhaust pipes and the muffler. (Turbo model)  
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.>  
<Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 25) Remove the front exhaust pipe, rear exhaust pipe and muffler. (Non-turbo model)  
<Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>  
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>



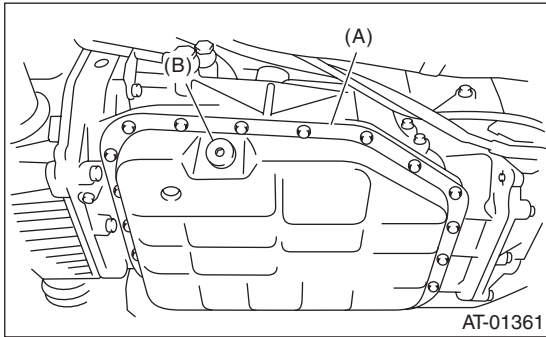
# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

26) Remove the heat shield cover.

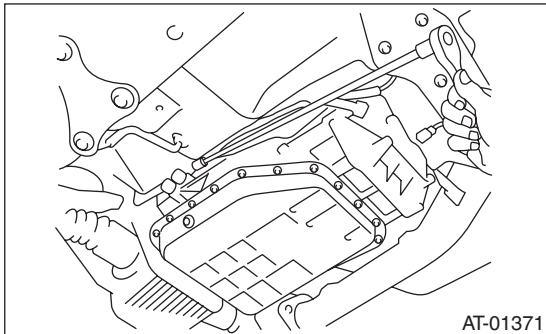


27) Remove the ATF drain plug to drain ATF.

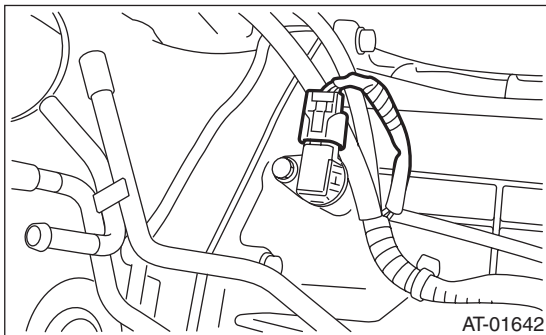


- (A) Oil pan
- (B) ATF drain plug

28) Remove the oil charge pipe.



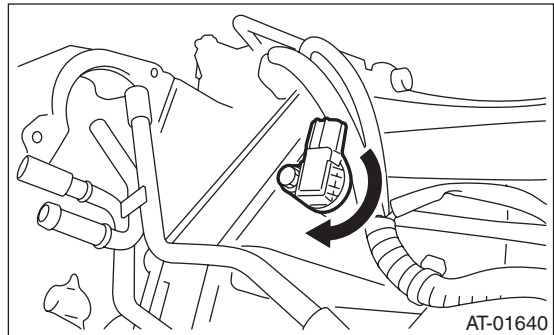
29) Disconnect the connector from turbine speed sensor 1.



30) Remove the turbine speed sensor 1 connector mounting bolt and rotate the sensor by 180°.

### CAUTION:

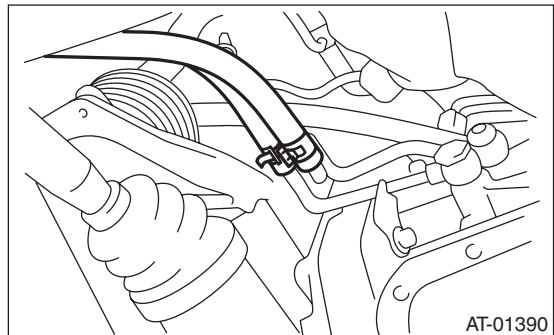
Failure to follow this procedure may cause the interference between vehicle body and sensor while removing/installing transmission, and resulting in damage.



31) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

32) Remove the shift select cable. <Ref. to CS-27, REMOVAL, Select Cable.>

33) Disconnect the hose from the ATF inlet and outlet pipes.

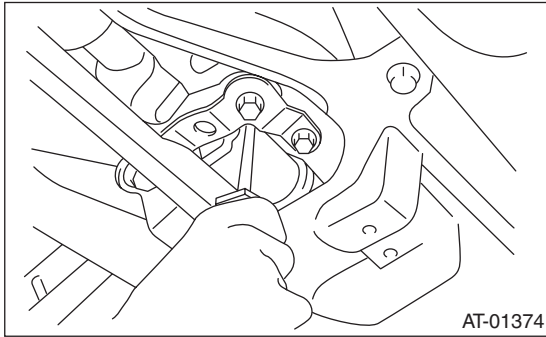
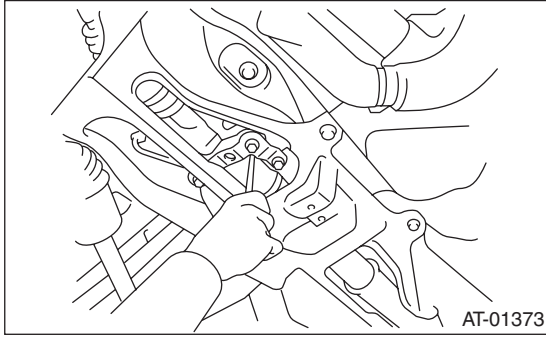


34) Remove the front crossmember support plate. <Ref. to FS-16, REMOVAL, Front Crossmember Support Plate.>

# Automatic Transmission Assembly

AUTOMATIC TRANSMISSION

35) Remove the two clutch housing cover securing bolts.

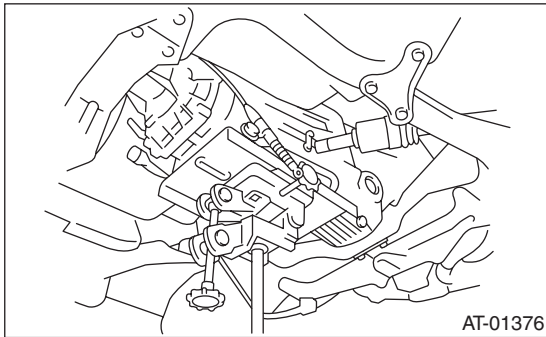


36) Remove the front stabilizer bracket. <Ref. to FS-17, REMOVAL, Front Stabilizer.>

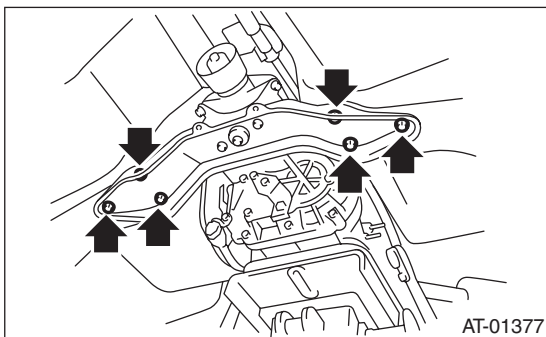
37) Remove the bolts which secure front ball joint to the housing. <Ref. to FS-18, REMOVAL, Front Ball Joint.>

38) Pull out the drive shaft from transmission.

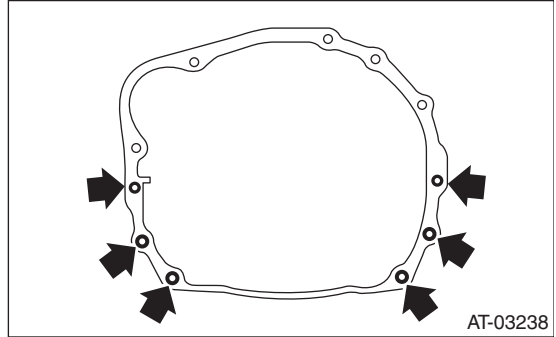
39) Set the transmission jack under the transmission.



40) Remove the rear crossmember.



41) Remove the transmission mounting bolt and nut (lower side).



42) Remove the transmission.

## NOTE:

- Turn the engine support assembly from the vehicle under body to the left (to shorten the engine support length), and lower the rear of the engine for easy disassembly.
- Be careful not to allow breather pipe and etc. to touch the vehicle body when detaching the automatic transmission assembly by pulling it backward.

# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

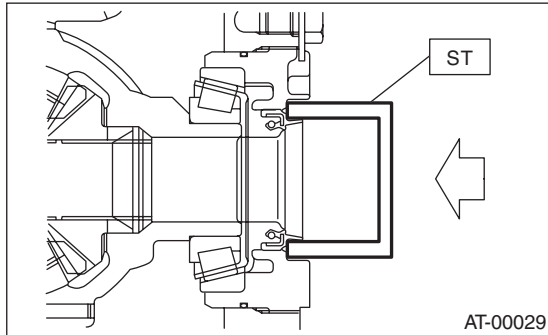
### B: INSTALLATION

- 1) Replace the front differential side retainer oil seal.
  - (1) Remove the oil seal by using flat tip screwdriver etc.
  - (2) Install a new oil seal using ST.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

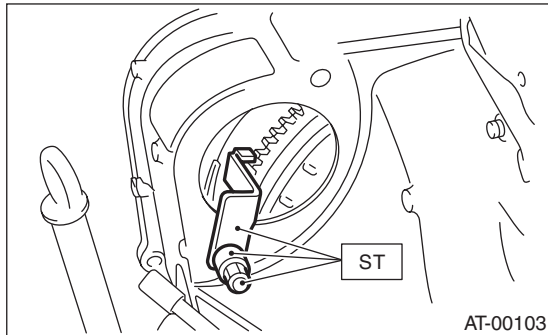
#### NOTE:

- Apply oil to the oil seal lips.
- Be sure to replace the differential side oil seal after the procedure of removing front drive shaft from transmission.



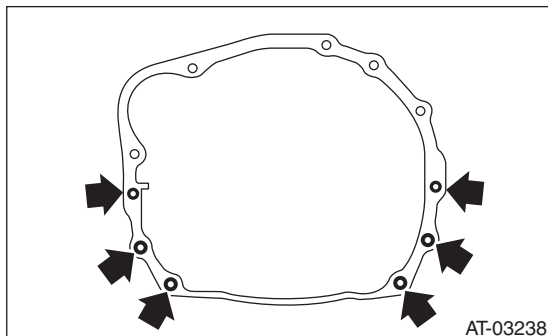
- 2) Attach the ST to converter case.

ST 498277200 STOPPER SET



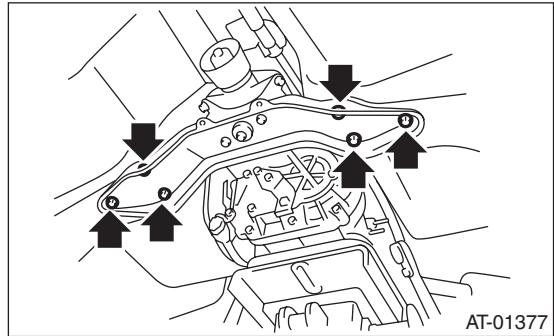
- 3) Install the transmission onto the engine.
  - (1) Lift up the transmission gradually using transmission jack.
  - (2) Engage at the spline.
- 4) Install the engine mounting bolt and nut (lower side).

**Tightening torque:**  
**50 N·m (5.1 kgf·m, 36.9 ft·lb)**



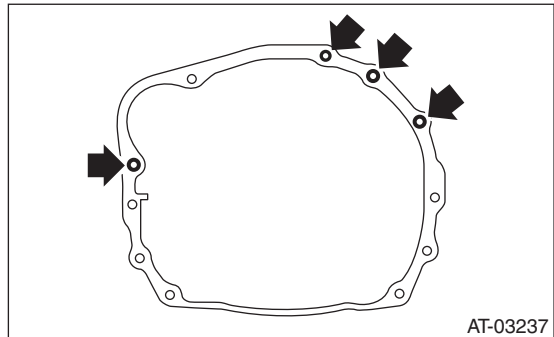
- 5) Install the transmission rear crossmember.

**Tightening torque:**  
**75 N·m (7.6 kgf·m, 55.3 ft·lb)**



- 6) Remove the transmission jack.
- 7) Lower the vehicle.
- 8) Install the engine mounting bolt (upper side).

**Tightening torque:**  
**50 N·m (5.1 kgf·m, 36.9 ft·lb)**



- 9) Remove the ST from converter case.

ST 498277200 STOPPER SET
- 10) Install the starter. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>
- 11) Install the torque converter to drive plate.

#### CAUTION:

- Be careful not to drop bolts into converter housing.
- Be careful not to damage the mounting bolts.
  - (1) Install the bolts which hold torque converter to drive plate.
  - (2) Install all four bolts by rotating the crank pulley a little at a time.
  - (3) Install the service hole.

**Tightening torque:**  
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

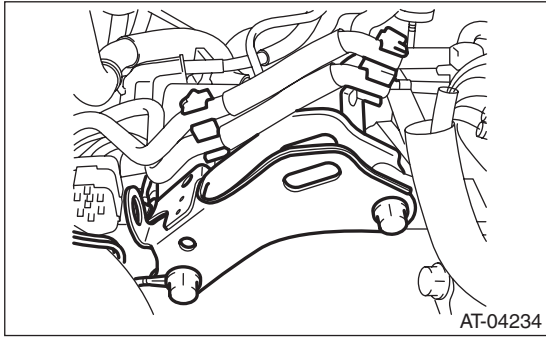
# Automatic Transmission Assembly

AUTOMATIC TRANSMISSION

12) Remove the ST and install the pitching stopper bracket.

**Tightening torque:**

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**

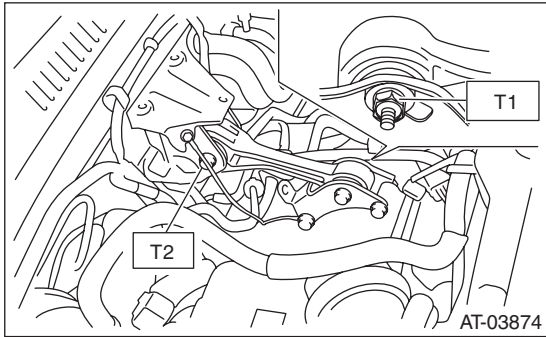


13) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

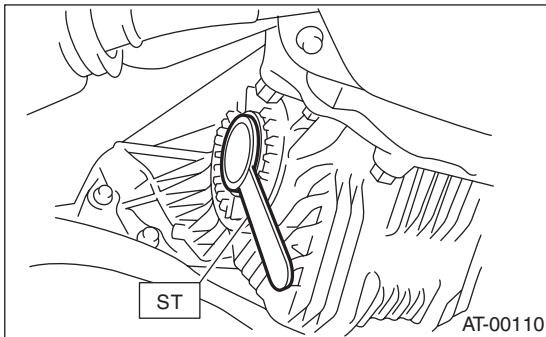
**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



14) Lift up the vehicle.

15) Set the ST to side retainer.

ST 28399SA000 OIL SEAL PROTECTOR



16) Install the front drive shaft into the transmission.

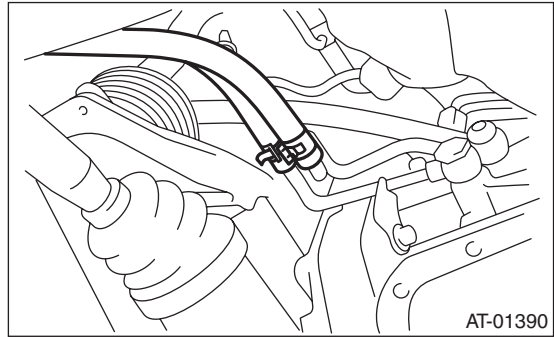
**NOTE:**

Replace the circlip of drive shaft with a new part.

17) Install the front drive shaft into transmission, remove the ST and insert the drive shaft securely.

ST 28399SA000 OIL SEAL PROTECTOR

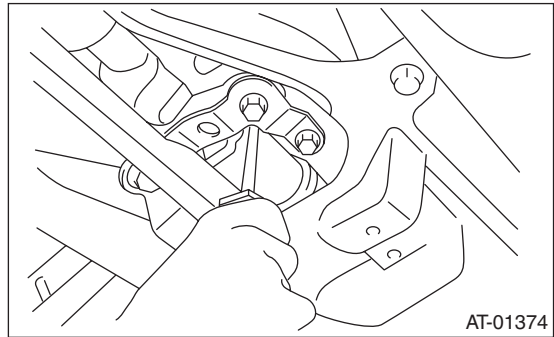
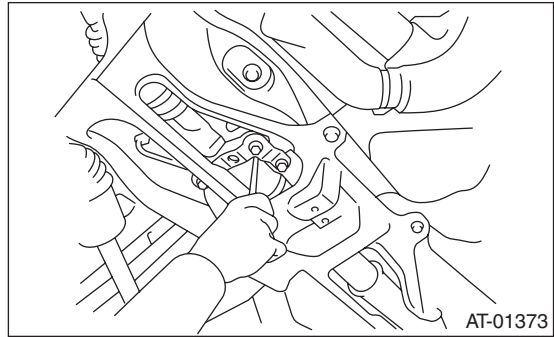
18) Install the inlet and outlet hoses to the ATF inlet and outlet pipes.



19) Insert the ball joint into housing. <Ref. to FS-18, INSTALLATION, Front Ball Joint.>

20) Install the front stabilizer bracket. <Ref. to FS-17, INSTALLATION, Front Stabilizer.>

21) Install the clutch housing cover securing bolts.



22) Install the front cross support plate. <Ref. to FS-16, INSTALLATION, Front Crossmember Support Plate.>

23) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

24) Install the shift select cable. <Ref. to CS-28, INSTALLATION, Select Cable.>

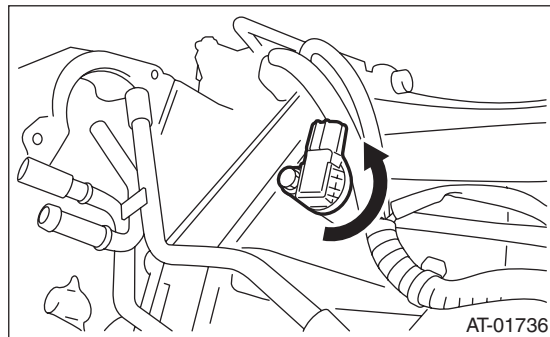
# Automatic Transmission Assembly

## AUTOMATIC TRANSMISSION

25) Install the turbine speed sensor 1 and harness, and then connect the connector.

**Tightening torque:**

**7 N·m (0.7 kgf·m, 5.2 ft-lb)**



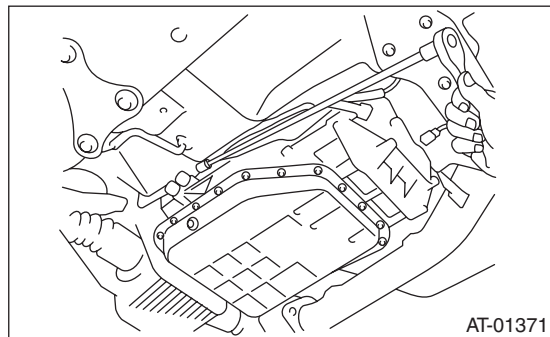
26) Install the oil charge pipe.

**NOTE:**

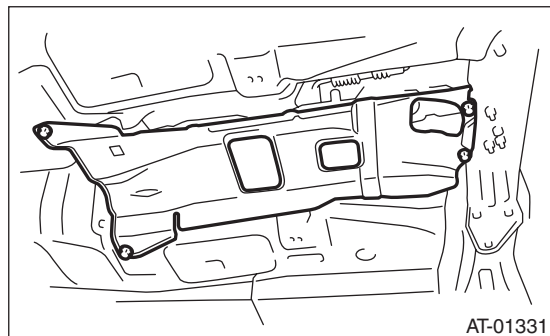
Use new bolts.

**Tightening torque:**

**38 N·m (3.9 kgf·m, 28.0 ft-lb)**



27) Install the heat shield cover.



28) Install the center, rear exhaust pipes and the muffler. (Turbo model) <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

29) Install the front exhaust pipe, rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>

30) Install the under cover.

31) Lower the vehicle.

32) Install the air cleaner case.

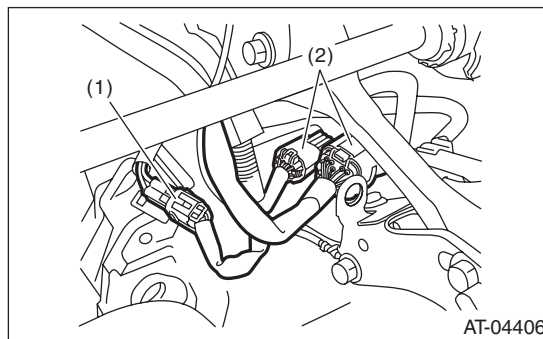
<Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.>

33) Install the air intake duct.

<Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>

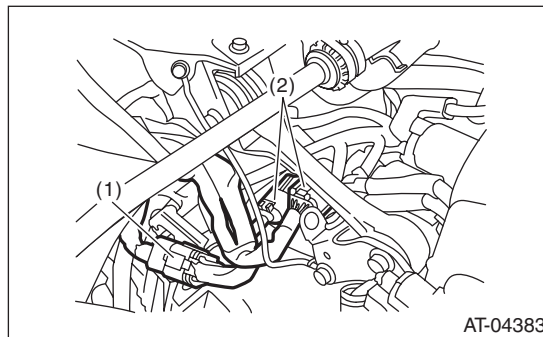
34) Connect the following connectors.

- Turbo model



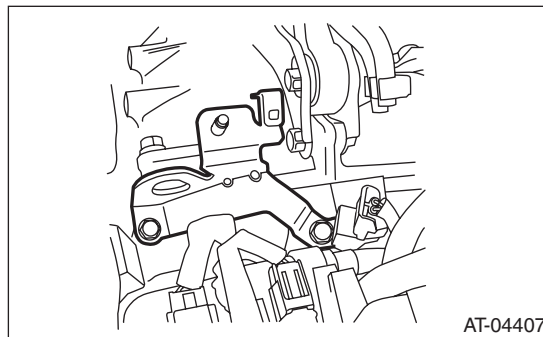
- (1) Rear oxygen sensor connector
- (2) Transmission harness connectors

- Non-turbo model

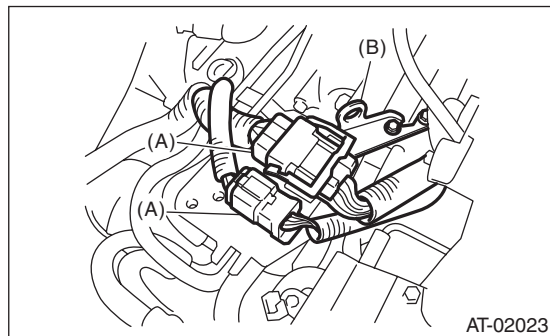


- (1) Front oxygen (A/F) and rear oxygen sensor connector
- (2) Transmission harness connectors

35) Install the engine hanger. (Turbo model)

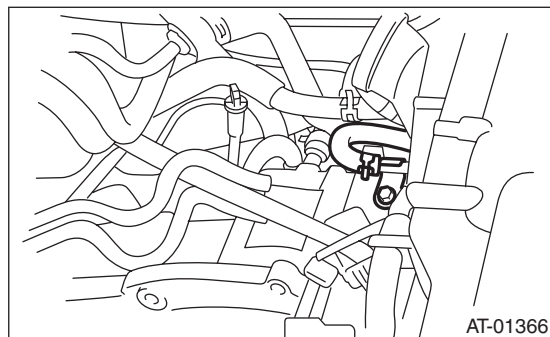


36) Install the engine hanger rear, and then connect the engine harness connector. (Non-turbo model)



- (A) Engine harness connectors
- (B) Engine hanger rear

37) Install the water by-pass pipe. (Turbo model)



38) Pour ATF from the oil charge pipe. <Ref. to 5AT-28, REPLACEMENT, Automatic Transmission Fluid.>

39) Install the air breather hose. <Ref. to 5AT-64, INSTALLATION, Air Breather Hose.>

40) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

41) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>

42) Install the intake boot. (Non-turbo model)

43) Install the collector cover.

44) Connect the battery ground cable to the battery.

45) Perform Clear Memory 2 operation. <Ref. to 5AT(diag)-19, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

46) Execute the learning control promotion. <Ref. to 5AT(diag)-23, GENERAL DESCRIPTION, Learning Control.>

47) Perform the inspection at the end of repair work, and make sure there is no faulty as below;

- Excessive shift shock
- Oil leakage from the transmission body, etc.
- Occurrence of noise caused by interference etc.

# Transmission Mounting System

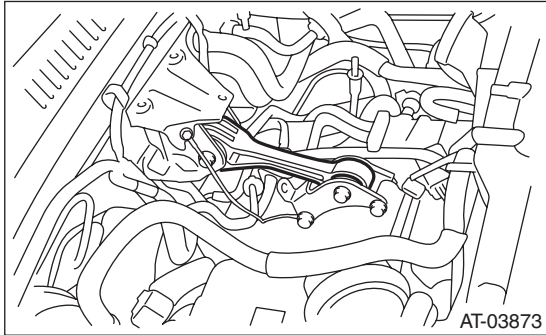
AUTOMATIC TRANSMISSION

## 10. Transmission Mounting System

### A: REMOVAL

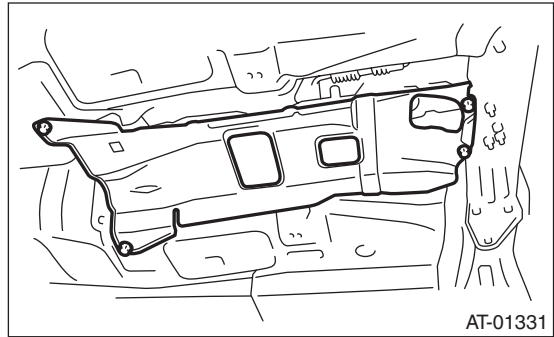
#### 1. PITCHING STOPPER

- 1) Disconnect the ground cable from battery.
- 2) Remove the intercooler. (Turbo model)  
<Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 4) Remove the pitching stopper.

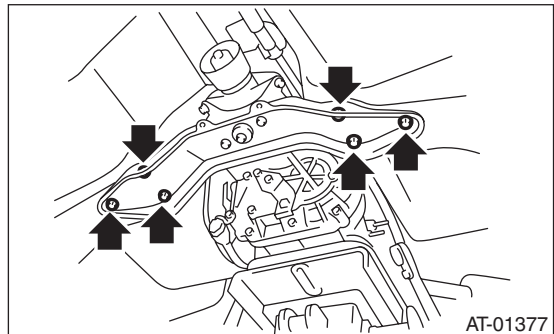


#### 2. TRANSMISSION REAR CROSSMEMBER & REAR CUSHION RUBBER

- 1) Disconnect the ground cable from battery.
- 2) Jack-up the vehicle and support it with rigid racks.
- 3) Remove the center and rear exhaust pipes and the muffler. (Turbo model)  
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 4) Remove the front exhaust pipe, rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 5) Remove the heat shield cover.



- 6) Set the transmission jack under transmission. Make sure that the support plate of transmission jack does not touch the oil pan.
- 7) Remove the transmission rear crossmember.



- 8) Remove the rear cushion rubber from transmission.

## B: INSTALLATION

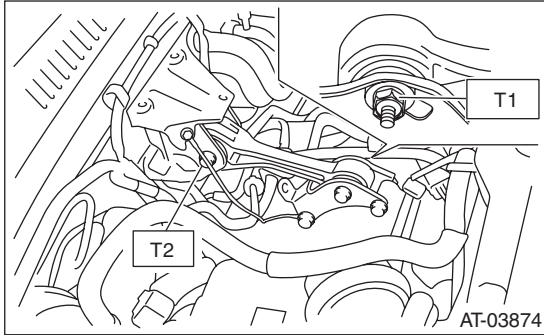
### 1. PITCHING STOPPER

1) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 2) Install the intercooler. (Turbo model)  
<Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 3) Install the air intake chamber. (Non-turbo model)  
<Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>
- 4) Connect the battery ground cable to the battery.

### 2. TRANSMISSION REAR CROSSMEMBER & REAR CUSHION RUBBER

1) Install the rear cushion rubber to the transmission.

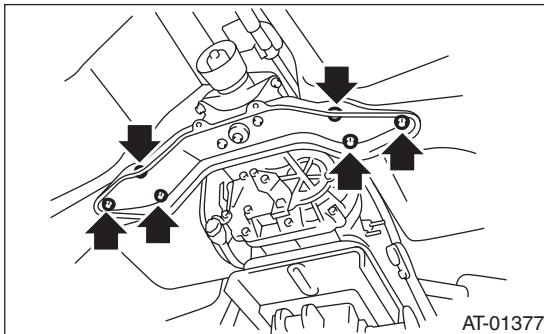
**Tightening torque:**

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

2) Install the cross member.

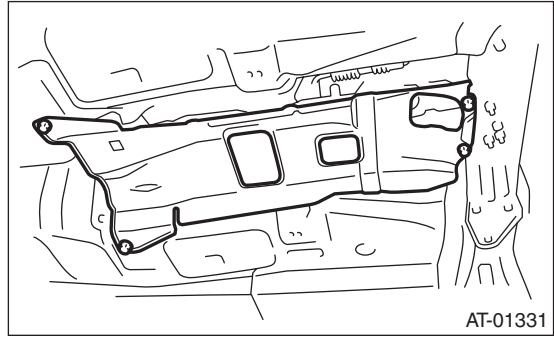
**Tightening torque:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**



3) Remove the transmission jack.

4) Install the heat shield cover.



- 5) Install the center, rear exhaust pipes and the muffler. (Turbo model)  
<Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>
- 6) Install the front exhaust pipe, rear exhaust pipe and muffler. (Non-turbo model)  
<Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>
- 7) Connect the battery ground cable to the battery.

## C: INSPECTION

Repair or replace parts if the results of the inspection below are not satisfied.

### 1. PITCHING STOPPER

Check pitching stopper for bends or damage. Check that there are no cracks, hardening or damage on rubber parts.

### 2. TRANSMISSION REAR CROSSMEMBER & REAR CUSHION RUBBER

Check crossmember for bends or damage. Check that there are no cracks, hardening, or damage on cushion rubbers.



# Extension Case Oil Seal

AUTOMATIC TRANSMISSION

## 11. Extension Case Oil Seal

### A: INSPECTION

Inspect there is no ATF leakage from the joint of transmission and propeller shaft. If a leak is found, replace the oil seal. <Ref. to 5AT-48, REPLACEMENT, Extension Case Oil Seal.>

### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Clean the transmission exterior.
- 3) Remove the ATF drain plug to drain ATF.

#### CAUTION:

**Immediately after the vehicle has been running or after idling for a long time, the ATF will be hot. Be careful not to burn yourself.**

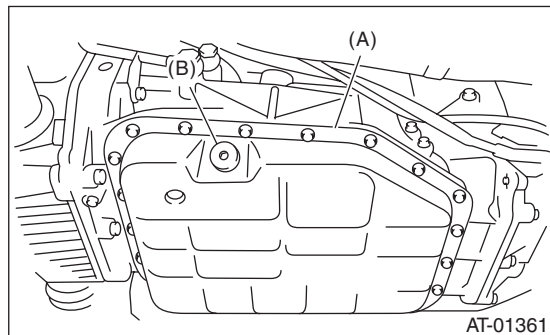
- 4) Tighten the ATF drain plug.

#### NOTE:

Use a new gasket.

#### Tightening torque:

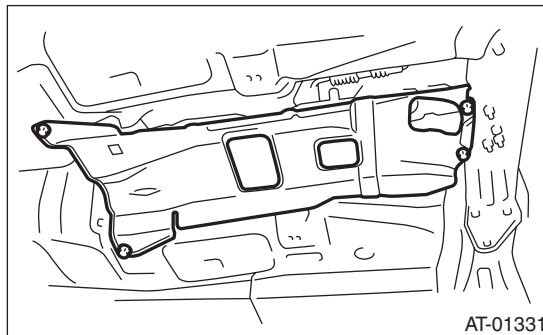
**20 N·m (2.0 kgf·m, 14.8 ft·lb)**



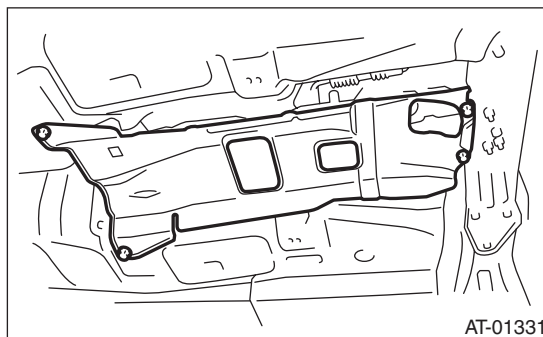
- (A) Oil pan  
(B) ATF drain plug

- 5) Remove the rear exhaust pipe and muffler. (Turbo model)  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 6) Remove the rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>

- 7) Remove the heat shield cover.



- 8) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 9) Using the ST, remove the oil seal.  
ST 398527700 PULLER ASSY
- 10) Using the ST, install the oil seal.  
ST 498057300 INSTALLER
- 11) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 12) Install the heat shield cover.



- 13) Install the rear exhaust pipe and muffler. (Turbo model)  
<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>
- 14) Install the rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>
- 15) Pour ATF from the oil charge pipe.

#### Specified fluid:

**SUBARU ATF**

#### Recommended fluid:

**IDEMITSU ATF HP**

**Castrol Transmax J**

#### NOTE:

Use of the recommended fluid is permitted only in regions where the specified fluid is not available.

#### Capacity:

**Fill with the same amount of ATF as drained.**

- 16) Check the level and leaks of the ATF. <Ref. to 5AT-28, Automatic Transmission Fluid.>

## 12. Differential Side Retainer Oil Seal

### A: INSPECTION

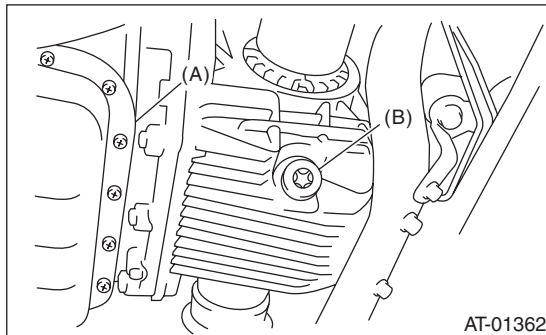
Check for leakage of gear oil from differential side retainer oil seal part. If there is an oil leak, replace the oil seal.

### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the front exhaust pipe and center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-6, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 3) Remove the front exhaust pipe. (Non-turbo model) <Ref. to EX(H6DO)-4, REMOVAL, Front Exhaust Pipe.>
- 4) Remove the differential gear oil drain plug using TORX® BIT T70, and then drain differential gear oil.

#### CAUTION:

- Immediately after the vehicle has been running or after idling for a long time, the differential gear oil will be hot. Be careful not to burn yourself.
- Be careful not to spill the differential gear oil on exhaust pipe to prevent it from emitting smoke or fire. If differential gear oil is spilled on the exhaust pipe, wipe it off completely.



- (A) Oil pan  
(B) Differential gear oil drain plug

- 5) Tighten the differential gear oil drain plug.

#### NOTE:

Use a new gasket.

#### Tightening torque:

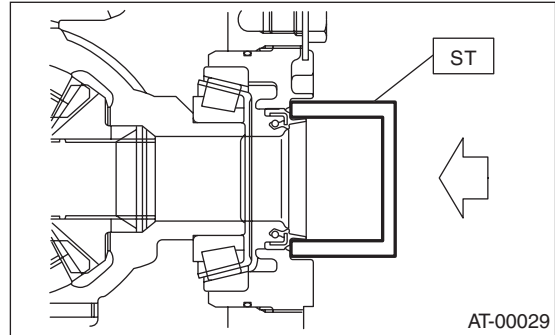
**70 N·m (7.1 kgf·m, 51.6 ft·lb)**

- 6) Separate the front drive shaft from the transmission. <Ref. to DS-23, REMOVAL, Front Drive Shaft.>

- 7) Remove the differential side retainer oil seal using driver wrapped with vinyl tape etc.

- 8) Using the ST, install the differential side retainer oil seal by lightly tapping with a hammer.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER



- 9) Apply oil to the oil seal lips.

- 10) Install the front drive shaft. <Ref. to DS-23, INSTALLATION, Front Drive Shaft.>

- 11) Install the front exhaust pipe and the center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-7, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

- 12) Install the front exhaust pipe. (Non-turbo model) <Ref. to EX(H6DO)-5, INSTALLATION, Front Exhaust Pipe.>

- 13) Lower the vehicle.

- 14) Pour gear oil into the level gauge hole.

#### Recommended gear oil:

<Ref. to 5AT-3, RECOMMENDED GEAR OIL, SPECIFICATION, General Description.>

#### Gear oil capacity:

**1.3 — 1.5 ℓ (1.4 — 1.6 US qt, 1.1 — 1.3 Imp qt)**

- 15) Check the level of differential gear oil. <Ref. to 5AT-30, INSPECTION, Differential Gear Oil.>

### 13. Inhibitor Switch

#### A: INSPECTION

Inhibitor switch cannot be checked, because the inhibitor switch is installed on control valve assembly. When a malfunction occurs, refer to 5AT (diag) section. <Ref. to 5AT(diag)-34, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

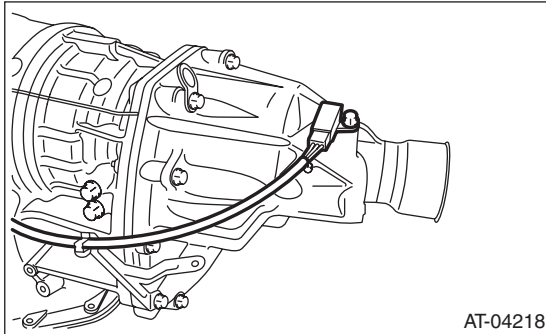
## 14. Front Vehicle Speed Sensor

### A: REMOVAL

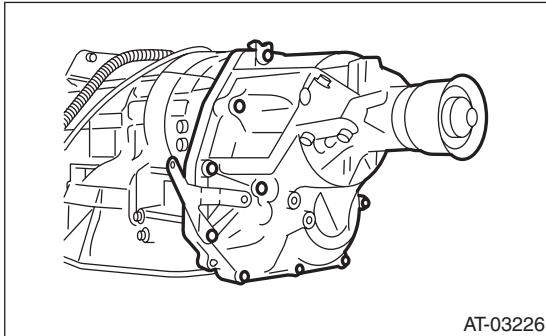
- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Disconnect the rear vehicle speed sensor connector.

#### NOTE:

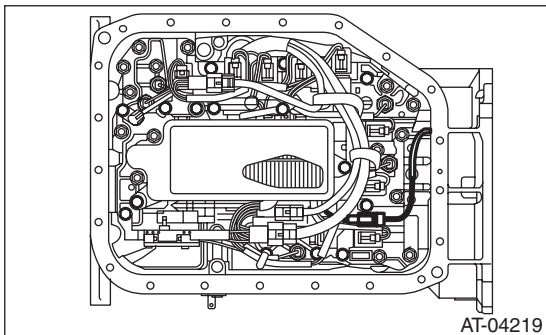
Secure the harness of the transmission harness to the transmission body using wire etc.



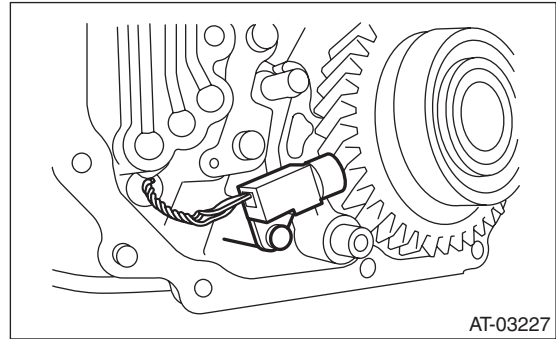
- 3) Remove the extension case.



- 4) Remove the center differential carrier. <Ref. to 5AT-76, REMOVAL, Center Differential Carrier.>
- 5) Lay along the transmission case, and then remove the oil pan.
- 6) Remove the old gasket on the oil pan and transmission case completely.
- 7) Disconnect the front vehicle speed sensor connector.



- 8) Remove the front vehicle speed sensor securing bolt.



- 9) Remove the front vehicle speed sensor through the hole of AT transmission main case.

# Front Vehicle Speed Sensor

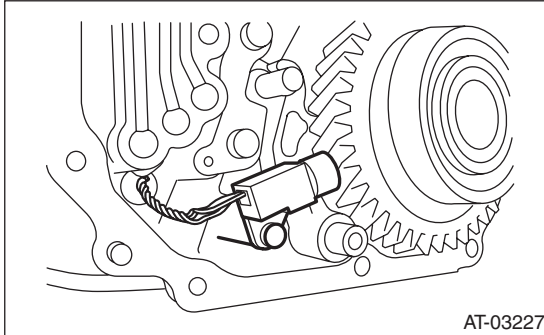
AUTOMATIC TRANSMISSION

## B: INSTALLATION

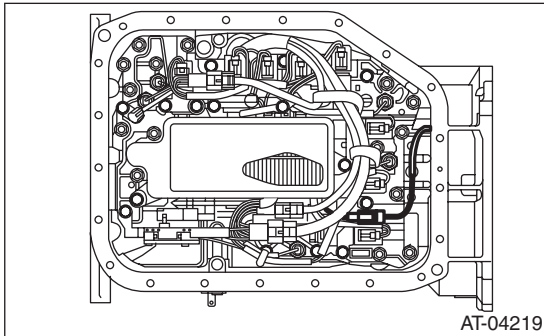
1) Install the front vehicle speed sensor.

**Tightening torque:**

**7 N·m (0.7 kgf·m, 5.2 ft·lb)**



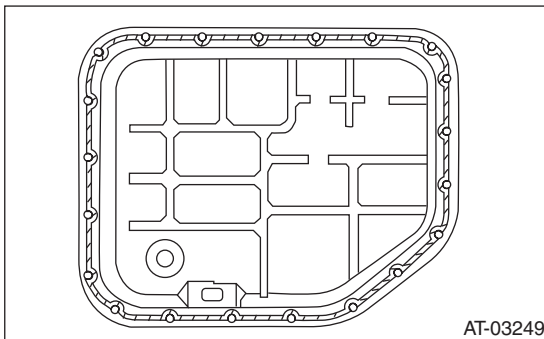
2) Connect the front vehicle speed sensor connector.



3) Apply proper amount of liquid gasket to the entire oil pan mating surface.

**Liquid gasket:**

**THREE BOND 1217B (Part No. K0877YA020)**



4) Install the oil pan by equally tightening the bolts.

**Tightening torque:**

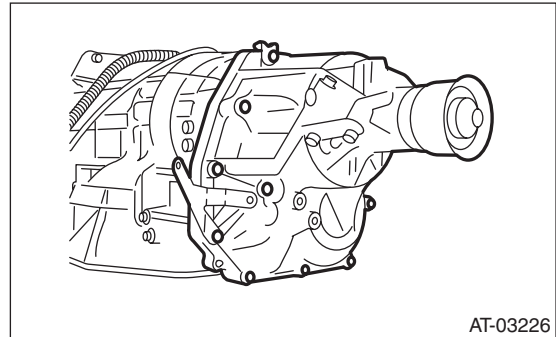
**5 N·m (0.5 kgf·m, 3.7 ft·lb)**

5) Install the center differential carrier. <Ref. to 5AT-76, INSTALLATION, Center Differential Carrier.>

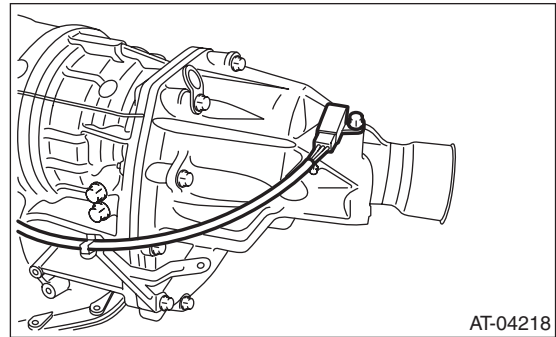
6) Install the extension case.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



7) Connect the rear vehicle speed sensor connector.



8) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

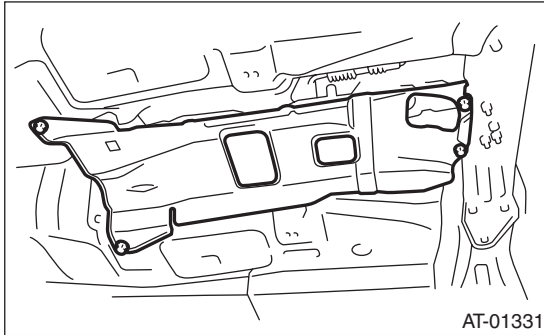
9) Pour ATF from the oil charge pipe. <Ref. to 5AT-28, REPLACEMENT, Automatic Transmission Fluid.>

10) Check the level and leaks of ATF. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

## 15. Rear Vehicle Speed Sensor

### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.
- 3) Lift up the vehicle.
- 4) Clean the transmission exterior.
- 5) Drain the ATF completely. <Ref. to 5AT-28, REPLACEMENT, Automatic Transmission Fluid.>
- 6) Remove the center and rear exhaust pipes and the muffler. (Turbo model) <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 7) Remove the rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 8) Remove the heat shield cover.

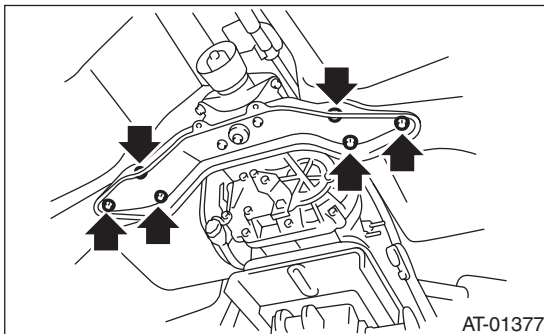


- 9) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 10) Place the transmission jack under the transmission.

#### NOTE:

Make sure that the support plate of transmission jack does not touch the cross.

- 11) Remove the transmission rear crossmember bolt.

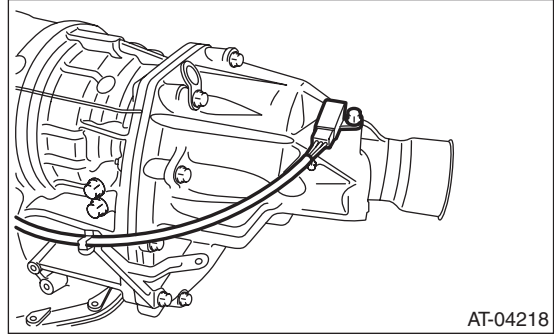


- 12) Lower the transmission jack.

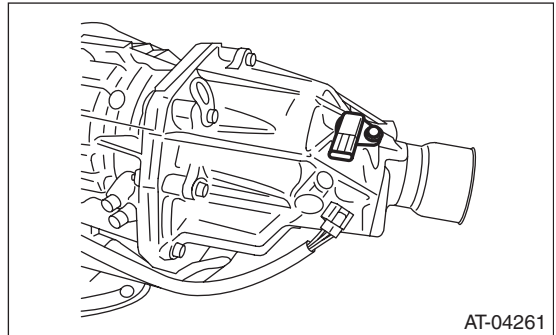
#### NOTE:

Do not separate the transmission jack and transmission.

- 13) Disconnect the rear vehicle speed sensor connector.



- 14) Remove the rear vehicle speed sensor.



# Rear Vehicle Speed Sensor

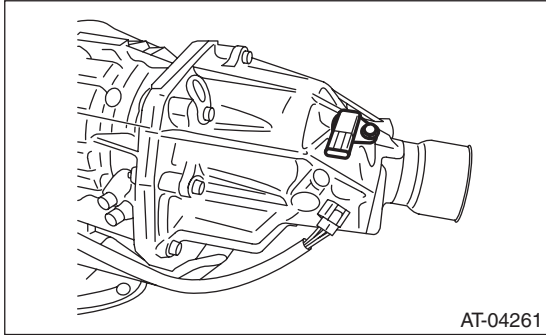
## AUTOMATIC TRANSMISSION

### B: INSTALLATION

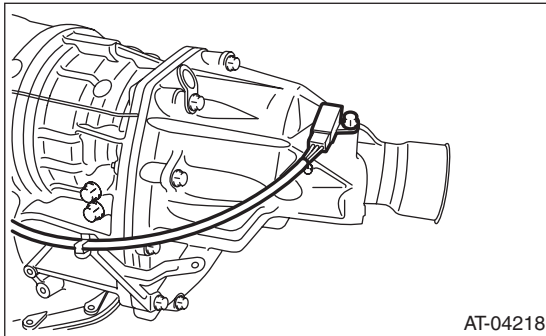
1) Install the rear vehicle speed sensor.

**Tightening torque:**

**7 N·m (0.7 kgf·m, 5.2 ft·lb)**



2) Connect the rear vehicle speed sensor connector.



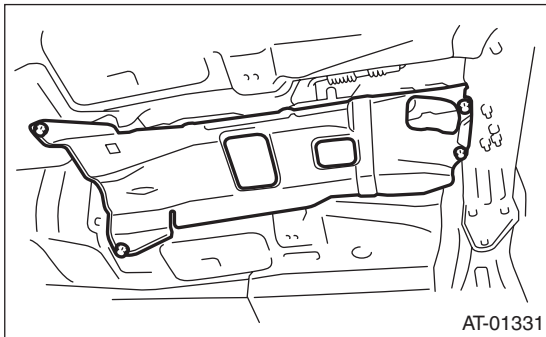
3) Install the transmission rear crossmember bolt.

**Tightening torque:**

**75 N·m (7.6 kgf·m, 55.3 ft·lb)**

4) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

5) Install the heat shield cover.



6) Install the center, rear exhaust pipes and the muffler. (Turbo model)

<Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.> <Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

7) Install the rear exhaust pipe and muffler. (Non-turbo model) <Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>

8) Lower the vehicle.

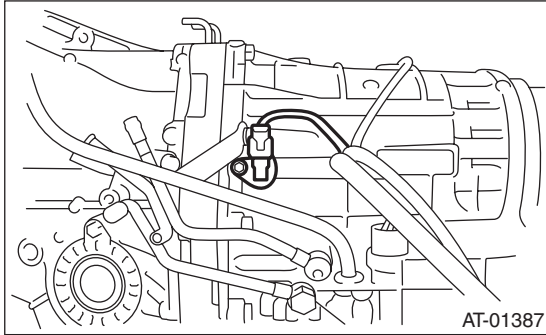
9) Pour ATF from the oil charge pipe. <Ref. to 5AT-28, REPLACEMENT, Automatic Transmission Fluid.>

10) Check the level and leaks of ATF. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>

## 16. Turbine Speed Sensor 1

### A: REMOVAL

- 1) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 3) Lift up the vehicle.
- 4) Disconnect the turbine speed sensor 1 connector.



- 5) Remove the turbine speed sensor 1.

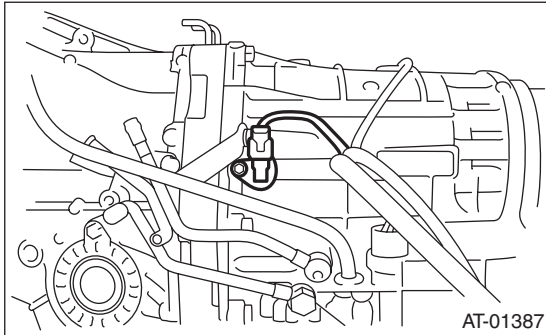
### B: INSTALLATION

- 1) Install the turbine speed sensor 1.

#### **Tightening torque:**

**7 N·m (0.7 kgf-m, 5.2 ft-lb)**

- 2) Connect the turbine speed sensor 1 connector.



- 3) Lower the vehicle.
- 4) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 5) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>



# Control Valve Body

## AUTOMATIC TRANSMISSION

### 17. Control Valve Body

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.
- 3) Lift up the vehicle.
- 4) Clean the transmission exterior.
- 5) Remove the ATF drain plug to drain ATF.

#### CAUTION:

Immediately after the vehicle has been running or after idling for a long time, the ATF will be hot. Be careful not to burn yourself.

- 6) Tighten the ATF drain plug.

#### NOTE:

Use a new gasket.

#### Tightening torque:

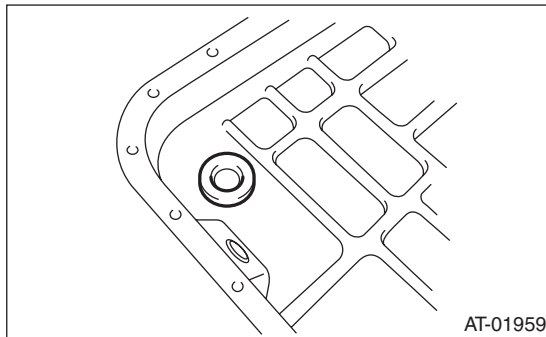
**20 N·m (2.0 kgf·m, 14.8 ft·lb)**

- 7) Remove the oil pan.

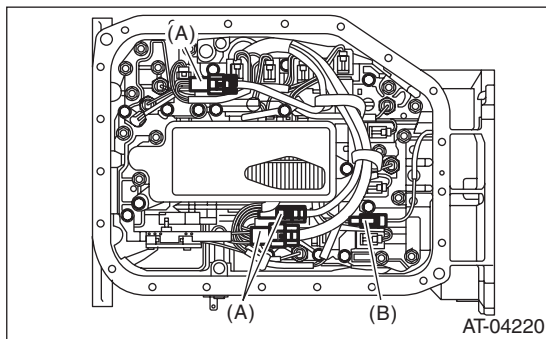
#### CAUTION:

Be sure to prevent the entering of dust and other foreign matters into oil pan.

- 8) Remove the magnet.



- 9) Clean the magnet.
- 10) Completely remove the remaining liquid gasket on the transmission case and oil pan.
- 11) Disconnect the control valve connector and front vehicle speed sensor connector.

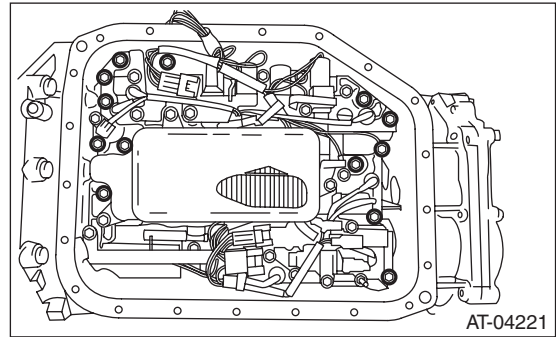


- (A) Control valve connector
- (B) Front vehicle speed sensor connector

- 12) Remove the control valve body.

#### NOTE:

The control valve body is replaced as an assembly only, because it is a non-disassembly part.

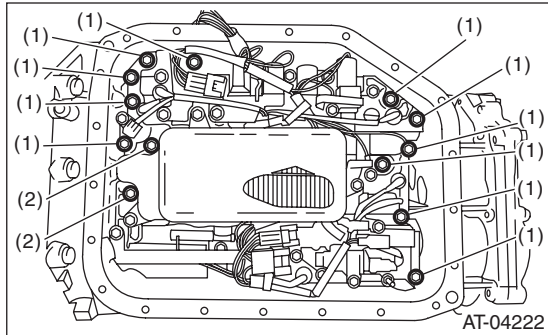


## B: INSTALLATION

- 1) Check the control valve body for dust and other foreign matter.
- 2) Install the control valve body to transmission by equally tightening the bolts.

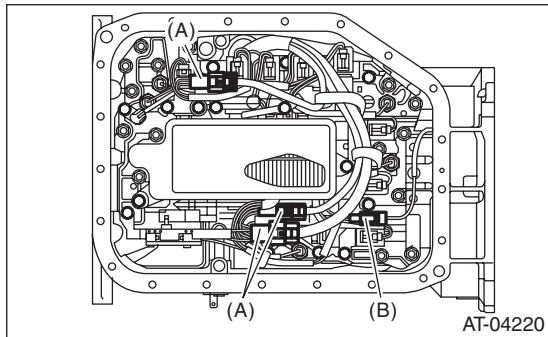
### Tightening torque:

**8 N·m (0.8 kgf-m, 5.8 ft-lb)**



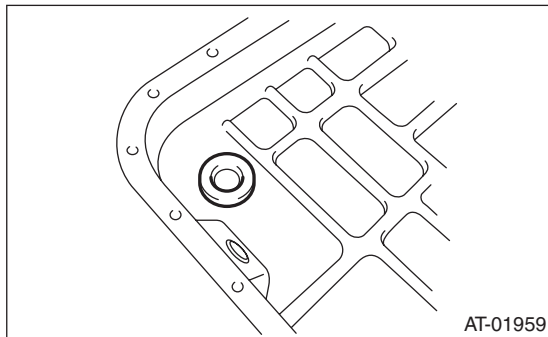
- (1) 30 mm (1.18 in)
- (2) 40 mm (1.57 in)

- 3) Connect the control valve connector.



- (A) Control valve connector
- (B) Front vehicle speed sensor connector

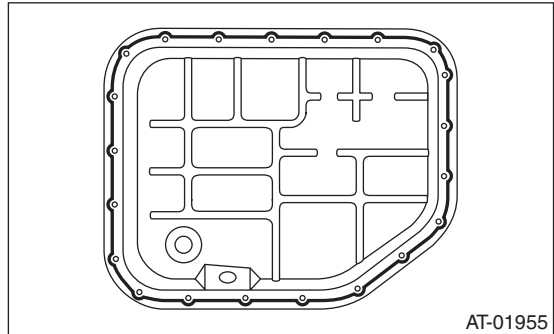
- 4) Attach the magnet at the specified position of the oil pan.



- 5) Apply liquid gasket to the oil pan.

### Liquid gasket:

**THREE BOND 1217B (Part No. K0877YA020)**



- 6) Install the oil pan by equally tightening the bolts.

### Tightening torque:

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**

- 7) Pour ATF through the oil charge pipe.

### Specified and recommended fluid:

**<Ref. to 5AT-2, SPECIFICATION, General Description.>**

### Capacity:

**Fill with the same amount of ATF as drained.**

- 8) Check the ATF level. <Ref. to 5AT-28, Automatic Transmission Fluid.>
- 9) Perform Clear Memory 2 operation. <Ref. to 5AT(diag)-19, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>
- 10) Execute the learning control promotion. <Ref. to 5AT(diag)-23, GENERAL DESCRIPTION, Learning Control.>
- 11) Perform the inspection at the end of repair work, and make sure there is no faulty as below;
  - Excessive shift shock
  - Oil leakage from the transmission body, etc.
  - Occurrence of noise caused by interference etc.

## C: INSPECTION

Check each parts for holes, damages or other foreign matters.

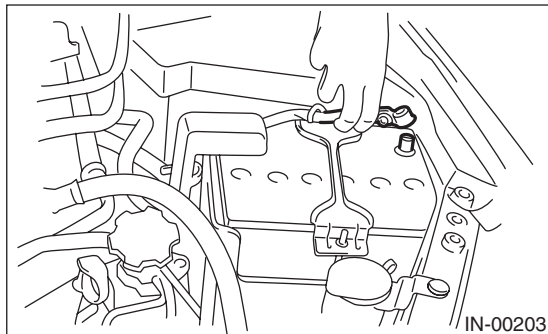
## 18.ATF Filter

### A: REMOVAL

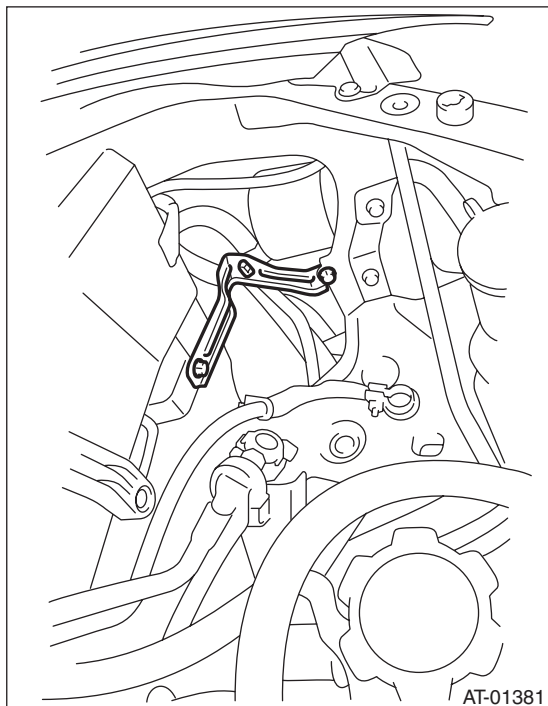
**NOTE:**

The ATF filter is maintenance free.

- 1) Disconnect the battery ground cable and remove the battery from the vehicle.



- 2) Remove the harness securing bracket.



- 3) Using the ST, remove the ATF filter.  
ST 498545400 OIL FILTER WRENCH

### B: INSTALLATION

- 1) Apply a thin coat of ATF to the oil seal part of new ATF filter.

- 2) Install the ATF filter. Turn it by hand, being careful not to damage oil seal.

- 3) Tighten the ATF filter using ST.

Calculate the ATF filter tightening torque using following formula.

$$T2 = L2 / (L1 + L2) \times T1$$

T1: 14 N·m (1.4 kgf-m, 10.1 ft-lb)

[Required torque setting]

T2: Tightening torque

L1: ST length 78 mm (3.07 in)

L2: Torque wrench length

Example:

Torque wrench length mm (in)	Tightening torque N·m (kgf-m, ft-lb)
100 (3.94)	7.7 (0.79, 5.7)
150 (5.91)	9.0 (0.92, 6.7)
200 (7.87)	10 (1.0, 7.4)

**NOTE:**

Align the ST with the torque wrench while tightening the ATF filter.

ST 498545400 OIL FILTER WRENCH

- 4) Fill ATF.

- 5) Inspect the level of ATF. <Ref. to 5AT-28, Automatic Transmission Fluid.>

- 6) Install the harness securing bracket.

- 7) Install the battery.

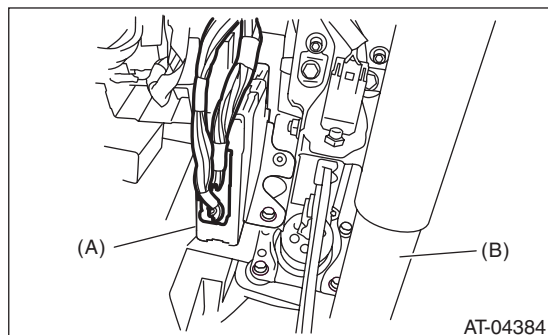
### C: INSPECTION

Check for rust, hole, ATF leaks or other damage. Replace the part if any damage is found in the inspection.

## 19. Transmission Control Module (TCM)

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the lower cover and then disconnect the connector.
- 3) Disconnect the connector from TCM.



- (A) Transmission control module (TCM)  
 (B) Steering column

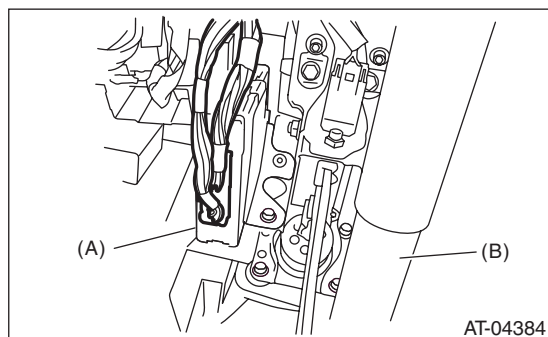
- 4) Remove the TCM.

### B: INSTALLATION

- 1) Install the TCM.

#### **Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



- (A) Transmission control module (TCM)  
 (B) Steering column

- 2) Connect the connector to the TCM.
- 3) Install in the reverse order of removal.
- 4) Perform Clear Memory 2 operation. <Ref. to 5AT(diag)-19, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>
- 5) Execute the learning control promotion. <Ref. to 5AT(diag)-23, GENERAL DESCRIPTION, Learning Control.>
- 6) Perform the inspection at the end of repair work, and make sure there is no faulty as below;
  - Excessive shift shock
  - Oil leakage from the transmission body, etc.
  - Occurrence of noise caused by interference etc.

# Lateral G Sensor

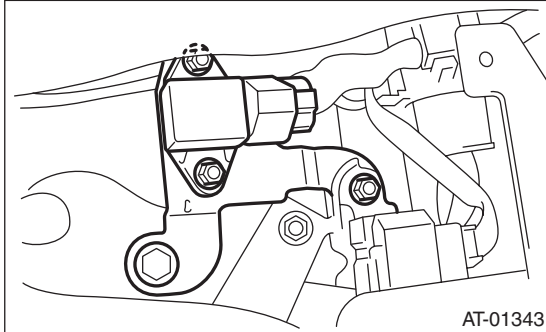
AUTOMATIC TRANSMISSION

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## 20.Lateral G Sensor

### A: REMOVAL

- 1) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 2) Disconnect the connector from the lateral G sensor.



- 3) Remove the lateral G sensor.

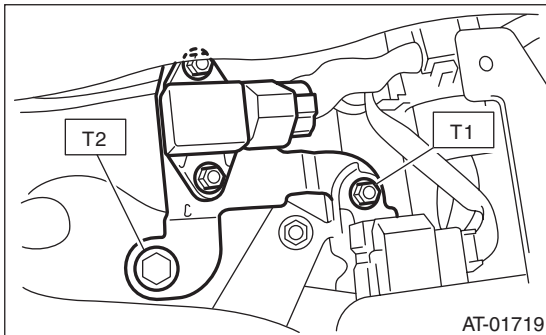
### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

**T1: 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

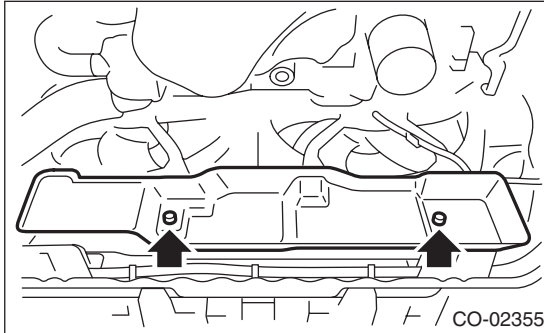
**T2: 18 N·m (1.8 kgf-m, 13.3 ft-lb)**



## 21. ATF Cooler Pipe and Hose

### A: REMOVAL

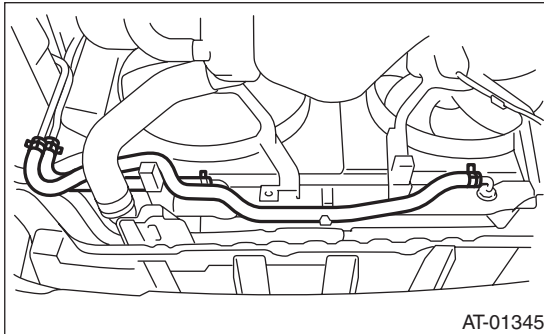
- 1) Set the vehicle on a lift.
- 2) Remove the battery.
- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the radiator under cover.



- 6) Disconnect the ATF cooler hose from the radiator.

**NOTE:**

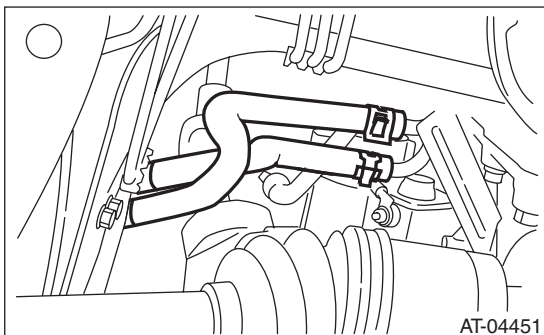
- Do not use a screwdriver or other pointed tools.
- If it is hard to remove the hose, wrap the hose with cloth to prevent from damaging it, and while turning with pliers, pull straight out by hand.



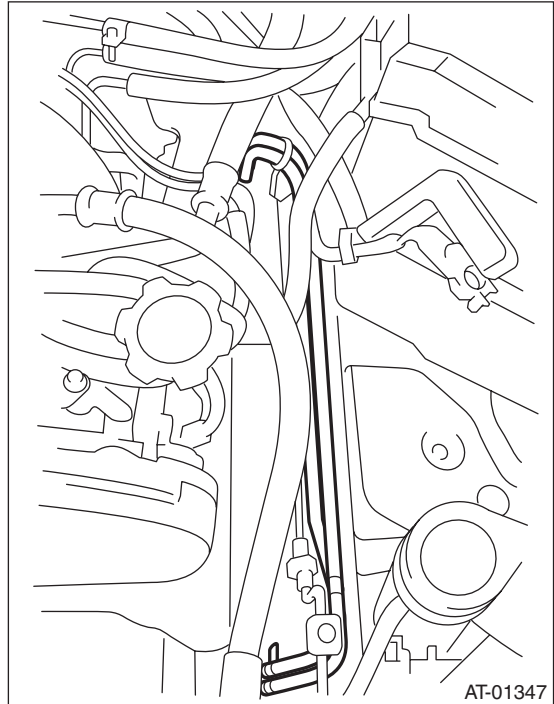
- 7) Disconnect the ATF cooler hoses from the pipes.

**NOTE:**

- Do not use a screwdriver or other pointed tools.
- If it is hard to remove the hose, wrap the hose with cloth to prevent from damaging it, and while turning with pliers, pull straight out by hand.



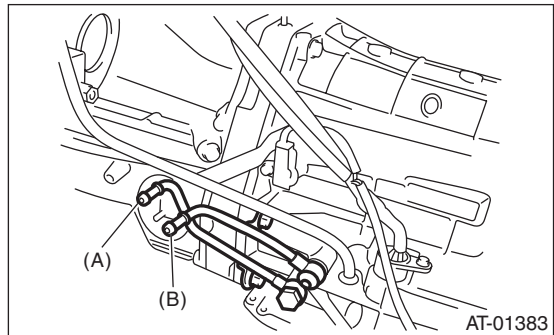
- 8) Disconnect the ATF cooler pipe from frame.



- 9) Remove the ATF inlet pipe and outlet pipe.

**NOTE:**

When disconnecting the outlet pipe, be careful not to lose the ball and spring used together with retaining screw.



- (A) ATF outlet pipe
- (B) ATF inlet pipe

# ATF Cooler Pipe and Hose

## AUTOMATIC TRANSMISSION

### B: INSTALLATION

1) Install the ATF inlet pipe and outlet pipe with new washers.

**NOTE:**

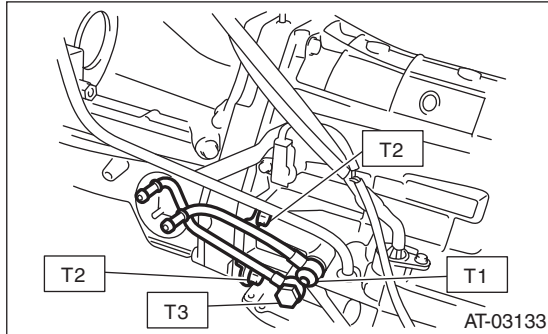
Use new bolts for the contact area of the converter case.

**Tightening torque:**

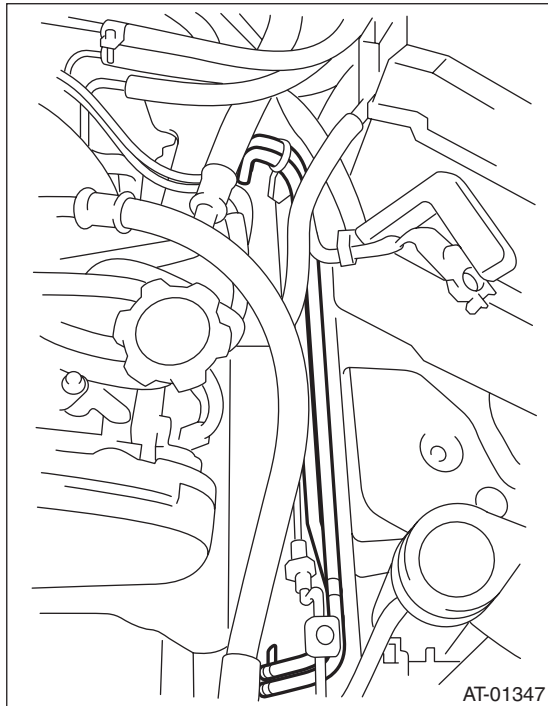
**T1: 40 N·m (4.1 kgf·m, 29.5 ft·lb)**

**T2: 38 N·m (5.9 kgf·m, 28.0 ft·lb)**

**T3: 45 N·m (4.6 kgf·m, 33.2 ft·lb)**



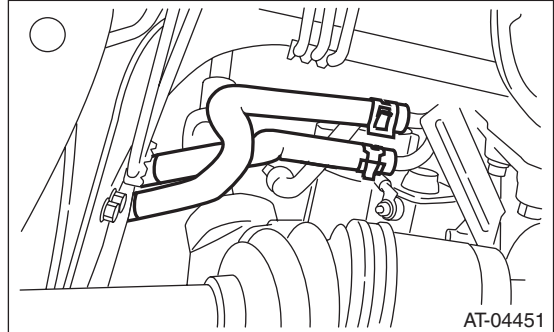
2) Install the ATF cooler pipe to frame.



3) Connect the ATF cooler hose to the pipe on the transmission side.

**NOTE:**

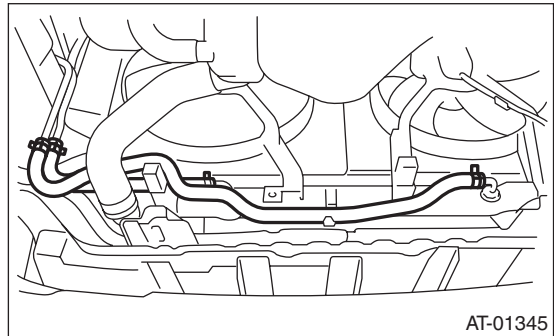
- Install so that the hose is not folded over, excessively bent or twisted.
- Insert the hose to the specified position.



4) Connect the ATF cooler hose to the pipe on the radiator side.

**NOTE:**

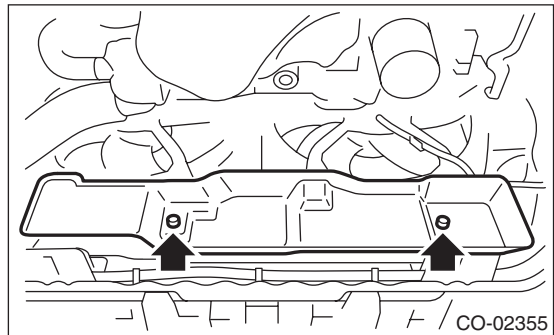
- Install so that the hose is not folded over, excessively bent or twisted.
- Insert the hose to the specified position.



5) Install the radiator under cover.

**Tightening torque:**

**4.9 N·m (0.5 kgf·m, 3.6 ft·lb)**



6) Install the under cover.

7) Install the battery.

8) Fill ATF. <Ref. to 5AT-28, Automatic Transmission Fluid.>

**NOTE:**

Make sure there are no ATF leaks in joints between the transmission, radiator, pipes, and hoses.

## **C: INSPECTION**

Repair or replace any faulty hoses, pipes, clamps, and washers found in the inspection below.

- 1) Check for ATF leaks in joints between the transmission, radiator, pipes, and hoses.
- 2) Check the clamp for deformation.
- 3) Lightly bend the hose and check for cracks in the surface or other damages.
- 4) Pinch the hose with your fingers and check for poor elasticity. Also check for poor elasticity in the parts where the clamp was installed by pressing with your fingernail.
- 5) Check for peeling, cracks, and deformation at the tip of the hose.



# Air Breather Hose

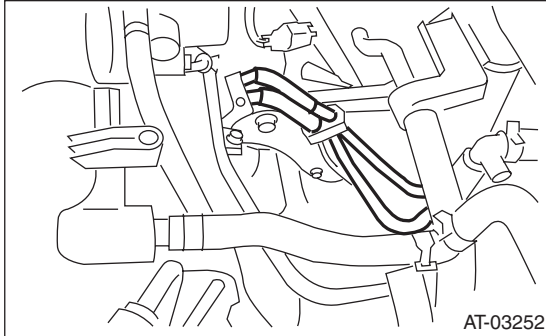
AUTOMATIC TRANSMISSION

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## 22. Air Breather Hose

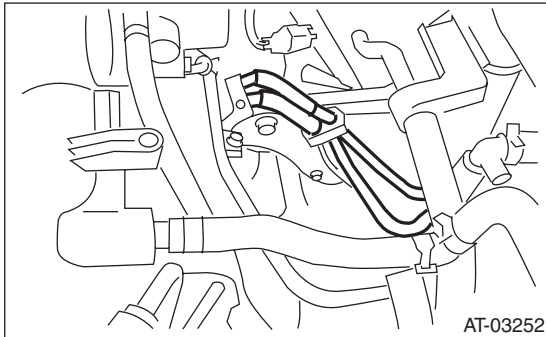
### A: REMOVAL

- 1) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 3) Disconnect the air breather hose.



### B: INSTALLATION

- 1) Connect the air breather hose.



- 2) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 3) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>

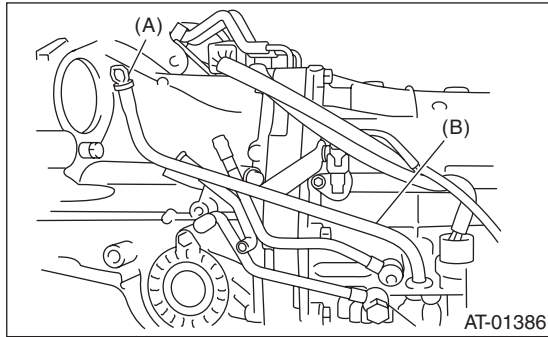
### C: INSPECTION

Make sure the hose is not cracked or clogged.

## 23.Oil Charge Pipe

### A: REMOVAL

- 1) Remove the intercooler. (Turbo model)  
<Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, REMOVAL, Air Intake Chamber.>
- 3) Remove the oil charge pipe, and then remove the O-ring from flange side.



- (A) ATF level gauge  
(B) Oil charge pipe

### B: INSTALLATION

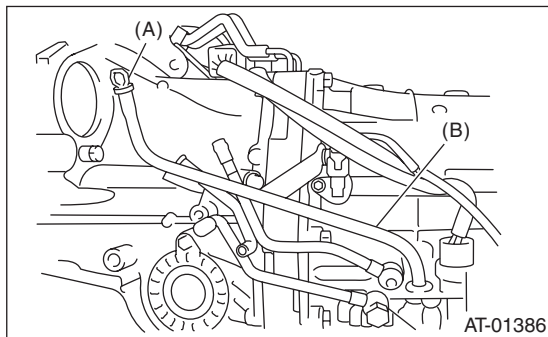
- 1) Install the oil charge pipe with a new O-ring.

#### NOTE:

Use new bolts.

#### **Tightening torque:**

**38 N·m (3.9 kgf·m, 28.0 ft·lb)**



- (A) ATF level gauge  
(B) Oil charge pipe

- 2) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 3) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H6DO)-7, INSTALLATION, Air Intake Chamber.>

### C: INSPECTION

Make sure the oil charge pipe is not deformed or damaged.

# Torque Converter Assembly

AUTOMATIC TRANSMISSION

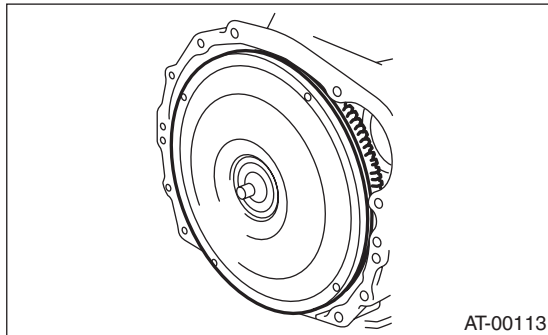
## 24. Torque Converter Assembly

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter and oil pump shaft horizontally.

#### NOTE:

- Be sure not to scratch the inside of bushing in oil pump shaft.
- Be careful that the oil pump shaft may drawn out simultaneously.



- 3) Remove the oil pump shaft from torque converter as necessary.

### B: INSTALLATION

- 1) When the oil pump shaft is removed, install the shaft to torque converter.

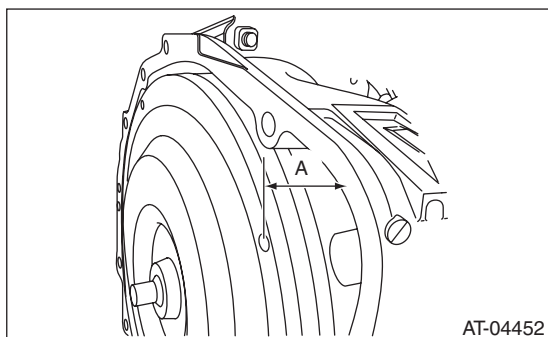
#### NOTE:

Make sure the clip is firmly inserted.

- 2) Install the oil pump shaft to torque converter, and then make sure that the clip is secured on groove.
- 3) Apply ATF to the revolving and sliding surface of the oil pump shaft.
- 4) Holding the torque converter assembly by hand, lightly rotate it to engage with the oil pump rotor.
- 5) Check the protruding dimension of the torque converter assembly.

#### **Dimension A:**

**8 mm (0.31 in) or less**



- 6) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

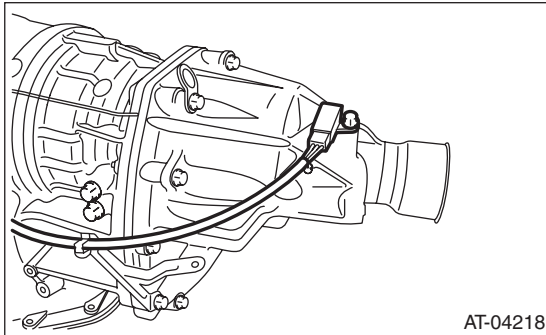
### C: INSPECTION

Make sure the ring gear and protrusion of torque converter end are not deformed or damaged.

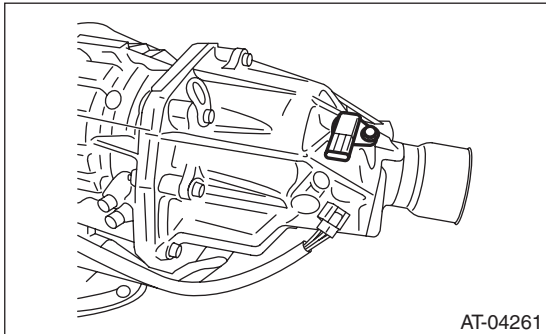
## 25.Extension Case

### A: REMOVAL

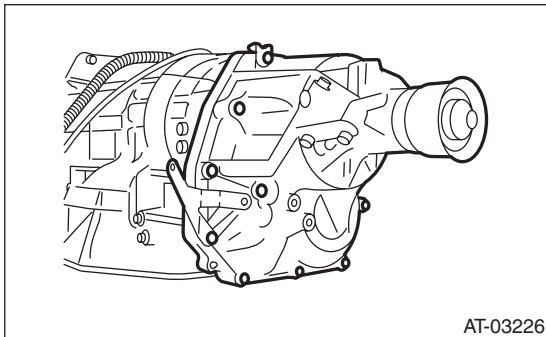
- 1) Remove the transmission assembly.  
<Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Disconnect the rear vehicle speed sensor connector.



- 3) Remove the rear vehicle speed sensor.



- 4) Remove the extension case.

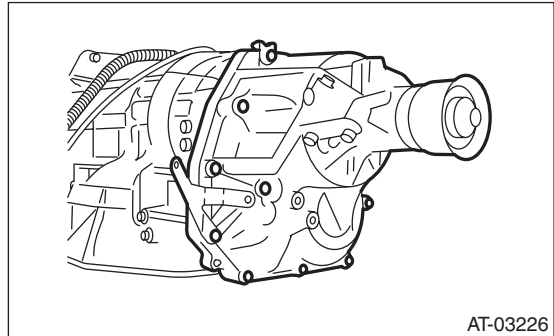


### B: INSTALLATION

- 1) Attach the selected reduction driven gear shim to end surface of reduction driven gear with vaseline. <Ref. to 5AT-75, ADJUSTMENT, Reduction Driven Gear.>
- 2) Install the extension case.

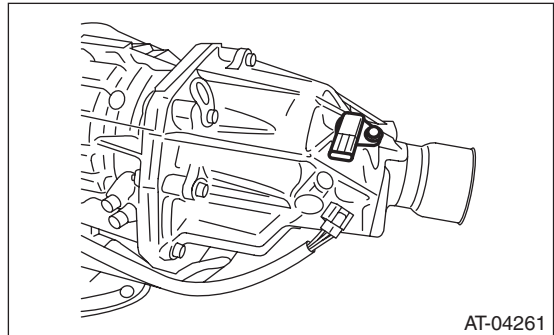
NOTE:  
Use a new gasket.

**Tightening torque:**  
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

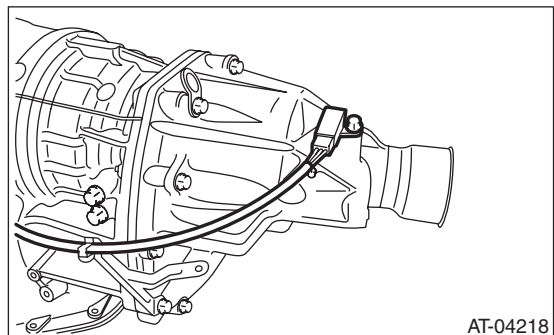


- 3) Install the rear vehicle speed sensor.

**Tightening torque:**  
**7 N·m (0.7 kgf·m, 5.2 ft·lb)**



- 4) Connect the rear vehicle speed sensor connector.



- 5) Install the transmission assembly.  
<Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

# Extension Case

## AUTOMATIC TRANSMISSION

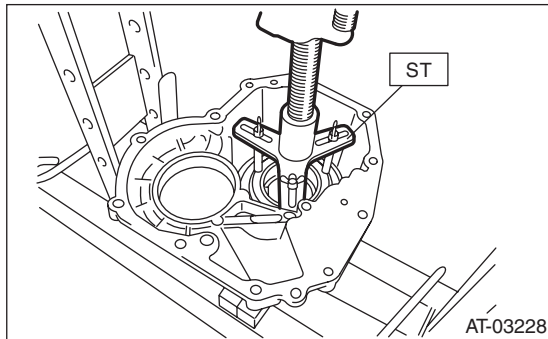
### C: DISASSEMBLY

1) Take out the transfer clutch and multi-plate clutch hub assembly by lightly tapping the end of rear drive shaft.

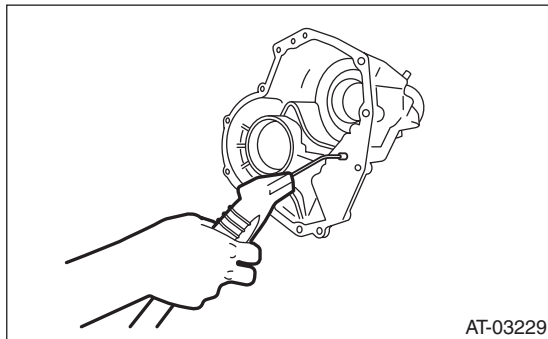
#### NOTE:

Be careful not to damage the oil seal of the extension.

2) Remove the snap ring using the ST and press.  
ST 18762AA000 COMPRESSOR SPECIAL TOOL



3) Remove the clutch piston by applying compressed air.



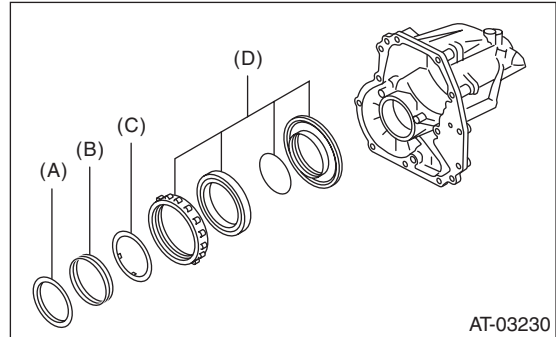
4) Remove the dust cover from extension case.  
5) Remove the oil seal from the extension case.

### D: ASSEMBLY

1) Press-fit the new oil seal using ST and the press.  
ST 498057300 INSTALLER

2) Press-fit the dust cover.

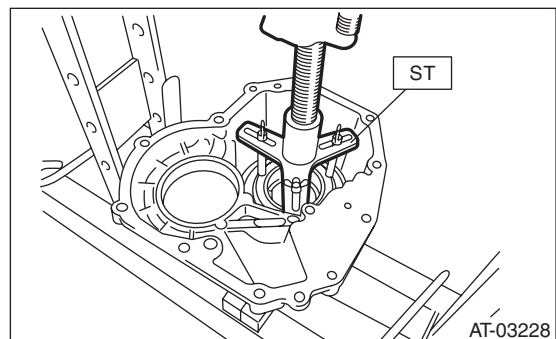
3) Insert the transfer clutch assembly, spring retainer, return spring and clutch spring retainer.



- (A) Clutch spring retainer
- (B) Return spring
- (C) Spring retainer
- (D) Transfer clutch piston ASSY

4) Using the ST and compressor, install the snap ring.

ST 18762AA000 COMPRESSOR SPECIAL TOOL



5) Install the transfer clutch. <Ref. to 5AT-69, INSTALLATION, Transfer Clutch.>

6) Install the multi-plate hub assembly.

### E: INSPECTION

- Use compressed air to make sure the extension case routes are not clogged or leaking.
- Inspect the extension end play, and adjust it to within the standard value.

<Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>

## 26. Transfer Clutch

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the extension case, and then remove the transfer clutch. <Ref. to 5AT-67, REMOVAL, Extension Case.>, <Ref. to 5AT-68, DISASSEMBLY, Extension Case.>

### B: INSTALLATION

- 1) Select the rear drive shaft shim. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>
- 2) Select driven plate No. 3. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>
- 3) Install the extension case. <Ref. to 5AT-67, INSTALLATION, Extension Case.>
- 4) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

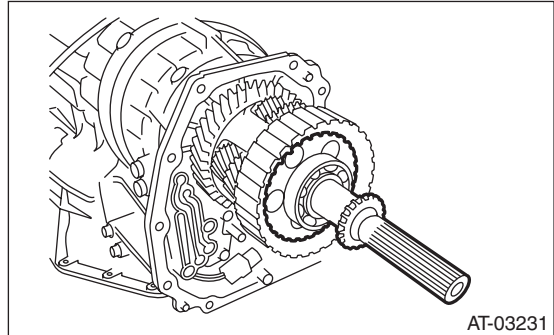
### C: INSPECTION

- Inspect the drive plate facing for wear and damage.
- Make sure the snap ring is not worn and the return spring has no permanent distortion, damage, or deformation.
- Check that the D-ring is not damaged.
- Inspect the extension end play, and adjust it to within the standard value. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>

## D: ADJUSTMENT

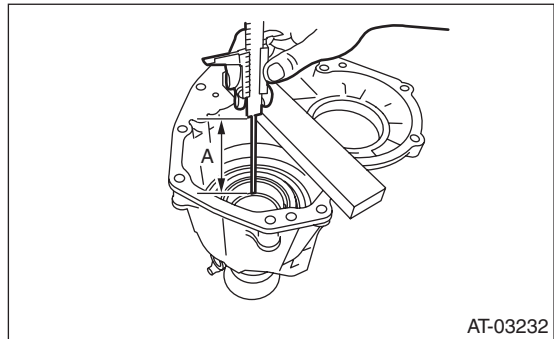
### 1. REAR DRIVE SHAFT SHIM SELECTION

- 1) Insert the rear drive shaft into the reduction drive gear and center differential assembly.



- 2) Using the ST, measure the depth "A", which is from mating surface of extension case to ball bearing outer ring contact surface.

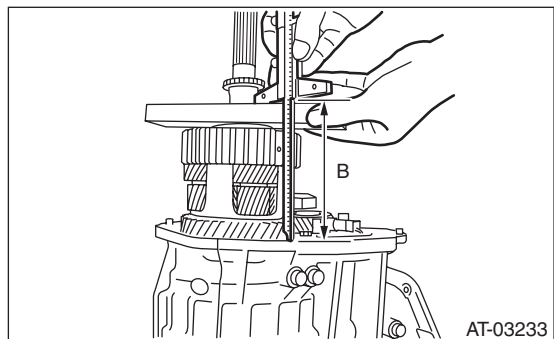
ST 398643600 GAUGE



A Measured value

- 3) Using the ST, measure the height "B" from the AT main case mating surface to ball bearing outer ring contact surface.

ST 398643600 GAUGE



B Measured value

# Transfer Clutch

## AUTOMATIC TRANSMISSION

### 4) Calculation formula:

When clearances are 0.05 mm (0.0020 in):

$$T \text{ (mm)} = A - B + 0.23$$

$$[T \text{ (in)} = A - B + 0.009]$$

When clearances are 0.25 mm (0.0098 in):

$$T \text{ (mm)} = A - B + 0.03$$

$$[T \text{ (in)} = A - B + 0.001]$$

A: Depth from end of extension case to ball bearing outer ring contact surface

B: Height from end of AT main case contact surface to the ball bearing outer ring contact surface

T: Shim thickness

### Standard:

**0.05 — 0.25 mm (0.0020 — 0.0098 in)**

### NOTE:

Calculation formula for “T” above is applied when measuring with the ST (398643600 GAUGE).

When not using the ST,

When clearances are 0.05 mm (0.0020 in):

$$T \text{ (mm)} = (A - \alpha) - ((B - \beta) - 0.28) - 0.05$$

$$[T \text{ (in)} = (A - \alpha) - ((B - \beta) - 0.011) - 0.0020]$$

When clearances are 0.25 mm (0.0098 in):

$$T \text{ (mm)} = (A - \alpha) - ((B - \beta) - 0.28) - 0.25$$

$$[T \text{ (in)} = (A - \alpha) - ((B - \beta) - 0.011) - 0.0098]$$

is applied.

T: Shim thickness

A: Depth from end of extension case to ball bearing outer ring contact surface

B: Height from end of AT main case contact surface to the ball bearing outer ring contact surface

$\alpha$ : Thickness of collar used when measuring “A”

$\beta$ : Thickness of collar used when measuring “B”

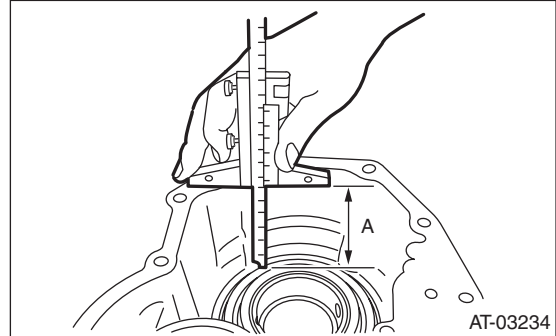
0.28 (0.011): Gasket thickness (Unit mm (in))

Adjustment shim	
Part number	Thickness mm (in)
33281AA040	0.2 (0.008)
33281AA050	0.5 (0.020)
33281AA060	0.3 (0.012)

## 2. SELECTION OF DRIVEN PLATE NO. 3

1) Install the drive plate and driven plate to the center differential carrier.

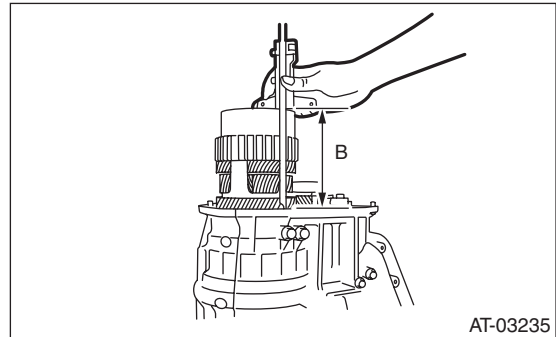
2) Measure the depth “A” from the mating surface of the extension case to the multi-plate clutch (LSD) piston.



A Measured value

3) Using the ST, measure the height “B” from the AT main case mating surface to end of ST, and then subtract the thickness of ST (piston guide) (50 mm (1.97 in)) from measured value.

ST 398744300 PISTON GUIDE



B Measured value

4) Calculation formula:

When clearances are 0.2 mm (0.008 in):

$$T \text{ (mm)} = A - B + 0.08$$

$$[T \text{ (in)} = A - B + 0.0031]$$

When clearances are 0.6 mm (0.024 in):

$$T \text{ (mm)} = A - B - 0.32$$

$$[T \text{ (in)} = A - B - 0.0126]$$

T: Thickness of driven plate No. 3

A: Depth from mating surface of extension case to multi-plate clutch (LSD) piston

B: Height from AT main case mating surface to end of ST

**Standard:**

**0.2 — 0.6 mm (0.008 — 0.024 in)**

**NOTE:**

Calculation formula for “T” is applied when measuring using ST (398643600 GAUGE, 398744300 PISTON GUIDE). When not using the ST,

When clearances are 0.2 mm (0.008 in):

$$T \text{ (mm)} = A - (B - \alpha - 0.28) - 0.2$$

$$[T \text{ (in)} = A - (B - \alpha - 0.011) - 0.008]$$

When clearances are 0.6 mm (0.024 in):

$$T \text{ (mm)} = A - (B - \alpha - 0.28) - 0.6$$

$$[T \text{ (in)} = A - (B - \alpha - 0.011) - 0.024]$$

is applied.

T: Thickness of driven plate No. 3

A: Depth from mating surface of extension case to multi-plate clutch (LSD) piston

B: Height from the AT main case mating surface to the contact face of the tool that was used as the substitute of the ST.

$\alpha$ : Thickness of tool used when measuring “B”

0.28 (0.011): Gasket thickness (Unit mm (in))

If it is out of specification, select the driven plate No. 3 to adjust within the specification.

Driven plate No. 3	
Part number	Thickness mm (in)
31589AA041	1.6 (0.063)
31589AA050	2.0 (0.079)
31589AA060	2.4 (0.094)
31589AA070	2.8 (0.110)



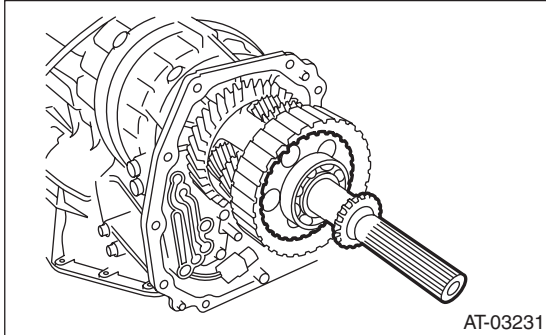
# Rear Drive Shaft

## AUTOMATIC TRANSMISSION

### 27.Rear Drive Shaft

#### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear vehicle speed sensor, and then remove the extension case. <Ref. to 5AT-67, REMOVAL, Extension Case.>
- 3) Pull out the rear driveshaft from center differential assembly.



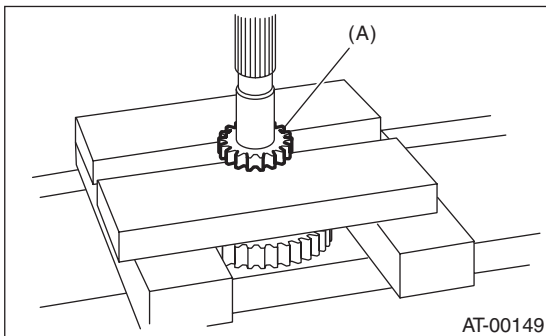
- 4) Remove the drive plate and driven plate.

#### B: INSTALLATION

- 1) Select the shim. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>
- 2) Install drive plate and driven plate.
- 3) Insert the rear driveshaft into the center differential assembly.
- 4) Combine the extension case, and then install the rear vehicle speed sensor. <Ref. to 5AT-67, INSTALLATION, Extension Case.>
- 5) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

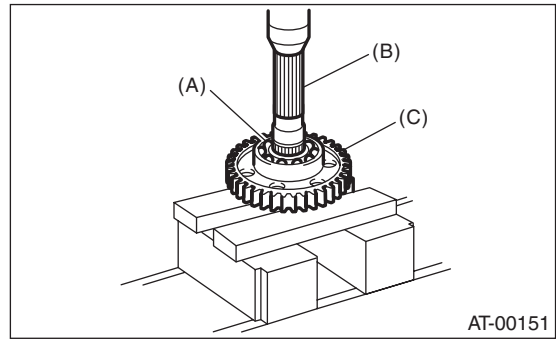
#### C: DISASSEMBLY

- 1) Using a press, remove the revolution gear.



(A) Revolution gear

- 2) Using a press, remove the front and rear side ball bearings and clutch hub.



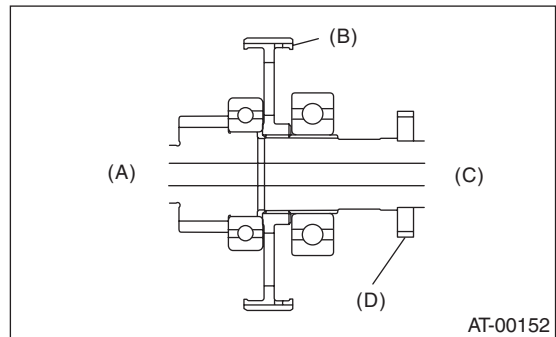
(A) Rear ball bearing  
(B) Rear drive shaft  
(C) Clutch hub

#### D: ASSEMBLY

Assemble in the reverse order of disassembly.

#### NOTE:

- Use new ball bearings and revolution gear.
- Make sure the clutch hub is facing the correct direction.



(A) Front side  
(B) Clutch hub  
(C) Rear side  
(D) Revolution gear

#### E: INSPECTION

- Check each parts for holes, damages or other foreign matters.
- Inspect the extension end play, and adjust it to within the standard value. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>

## 28.Reduction Driven Gear

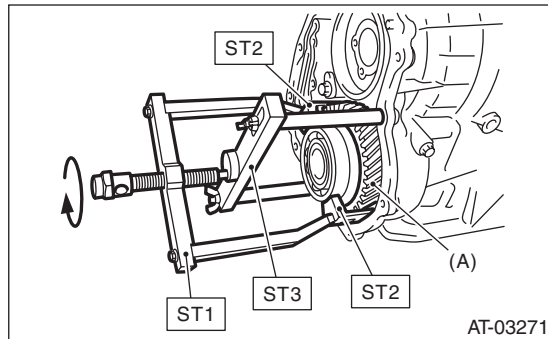
### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 5AT-67, REMOVAL, Extension Case.>
- 3) Remove the center differential carrier. <Ref. to 5AT-76, REMOVAL, Center Differential Carrier.>
- 4) Set the range select lever to the "P" range.
- 5) Using ST1, ST2 and ST3, pull out the reduction driven gear.

ST1 499737100 PULLER SET

ST2 18680AA010 GEAR HOLDER

ST3 18766AA000 SUPPORT PULLER



(A) Reduction driven gear

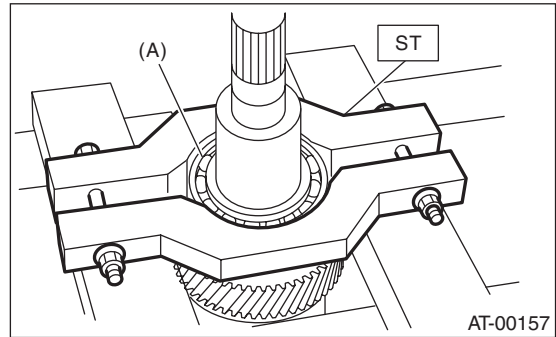
### B: INSTALLATION

- 1) Set the range select lever to the "P" range.
- 2) Use a plastic hammer to install reduction driven gear assembly.
- 3) Select the reduction gear shims. <Ref. to 5AT-75, ADJUSTMENT, Reduction Driven Gear.>
- 4) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 5AT-67, INSTALLATION, Extension Case.>
- 5) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

### C: DISASSEMBLY

- 1) Remove the ball bearing from reduction driven gear using ST.

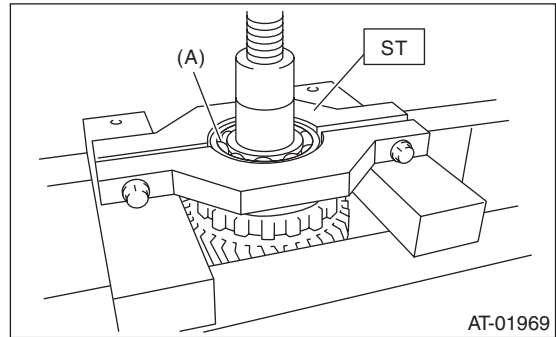
ST 498077300 REMOVER



(A) Ball bearing

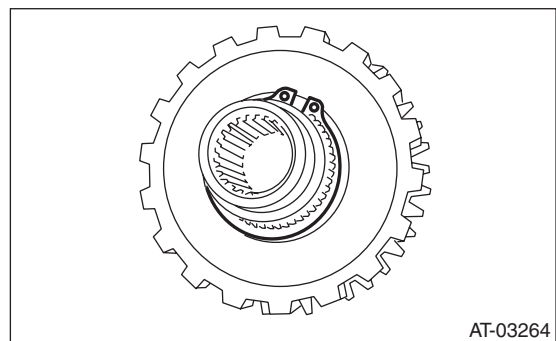
- 2) Remove the ball bearing on the reverse side with the same procedure as step 1).

ST 498077300 REMOVER



(A) Ball bearing

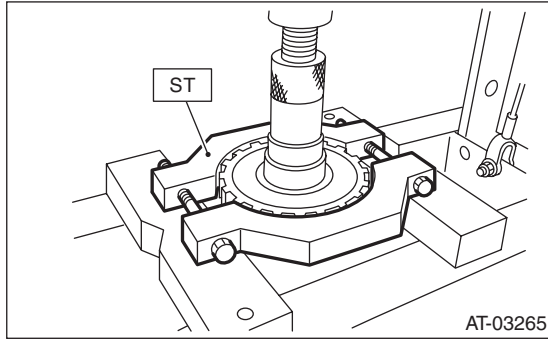
- 3) Remove the snap ring of the parking gear.



# Reduction Driven Gear

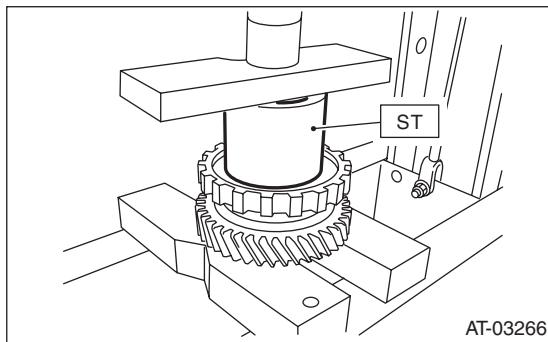
## AUTOMATIC TRANSMISSION

- 4) Using the ST, remove the parking gear.  
ST 18767AA000 REMOVER

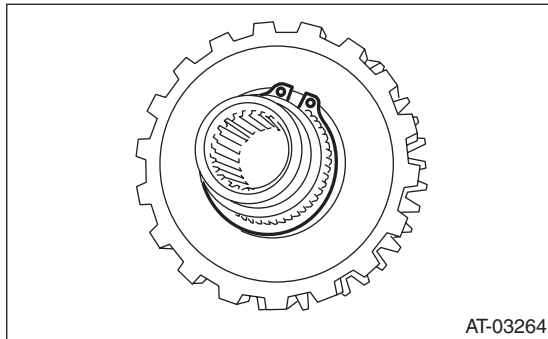


### D: ASSEMBLY

- 1) Using the ST, install the parking gear.  
ST 499755602 PRESS

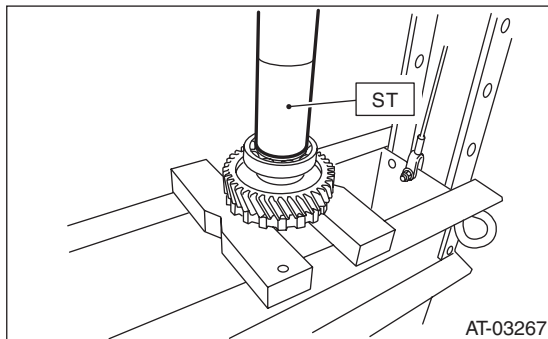


- 2) Install the snap ring.



- 3) Install the new ball bearing to reduction driven gear using press.

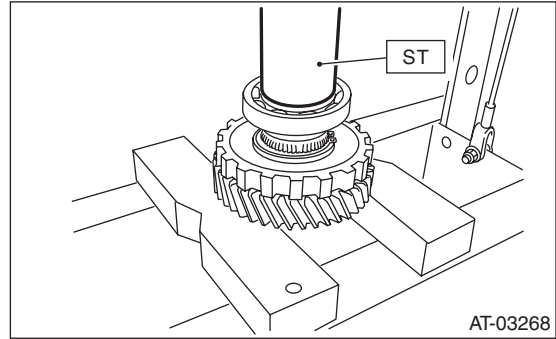
ST 18654AA000 INSTALLER



(A) Ball bearing 1

- 4) Install the ball bearing on the reverse side with the same procedure as step 3).

ST 18654AA000 INSTALLER



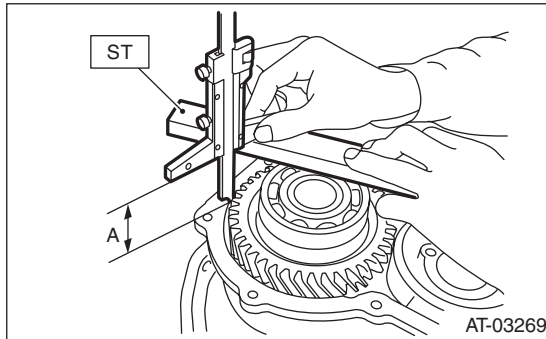
### E: INSPECTION

Make sure the ball bearing and gear is not deformed or damaged.

## F: ADJUSTMENT

1) Using the ST, measure the height “A” from the AT main case mating surface to ball bearing outer ring contact surface.

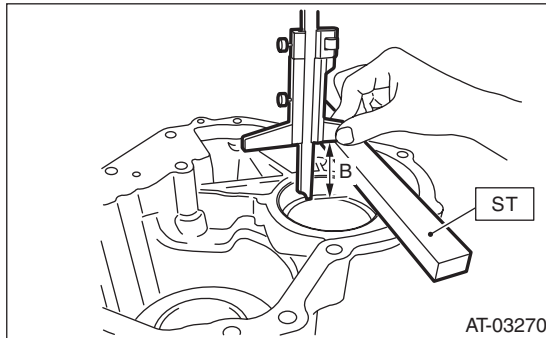
ST 499575400 GAUGE



A Measured value

2) Using the ST, measure the depth “B”, which is from mating surface of extension case to ball bearing outer ring contact surface.

ST 499575400 GAUGE



B Measured value

3) Calculation formula:

Select the ball bearing shim from the table to adjust clearances within 0.05 — 0.25 mm (0.0020 — 0.0098 in).

When clearances are 0.05 mm (0.0020 in):

$$T \text{ (mm)} = B - A + 0.23$$

$$[T \text{ (in)} = B - A + 0.0091]$$

When clearances are 0.25 mm (0.0098 in):

$$T \text{ (mm)} = B - A + 0.03$$

$$[T \text{ (in)} = B - A + 0.0011]$$

T: Shim clearance

A: Height from the mating surface of the AT main case to the ball bearing outer ring end surface

B: Depth from mating surface of extension case to ball bearing outer ring contact surface

Reduction gear shim	
Part number	Thickness mm (in)
31288AA030	0.2 (0.008)
31288AA050	0.5 (0.020)
31288AA060	0.3 (0.012)

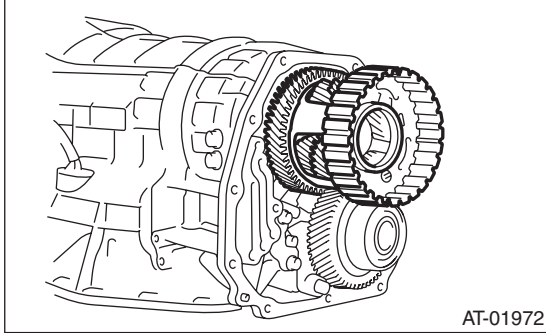
# Center Differential Carrier

AUTOMATIC TRANSMISSION

## 29.Center Differential Carrier

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the rear wheel speed sensor, and separate the extension case from transmission case. <Ref. to 5AT-67, REMOVAL, Extension Case.>
- 3) Extract the rear drive shaft. <Ref. to 5AT-72, REMOVAL, Rear Drive Shaft.>
- 4) Pull out the center differential carrier assembly.



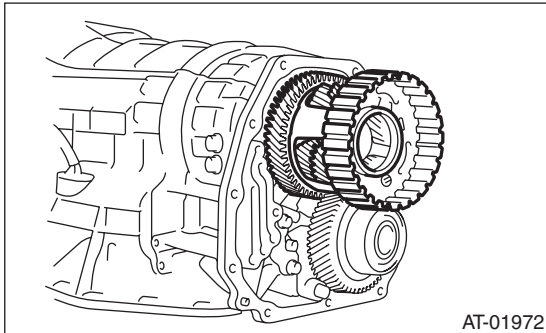
- 5) Pull out the shim(s) from transmission case.

### B: INSTALLATION

- 1) Install the center differential assembly with the shim(s).

#### NOTE:

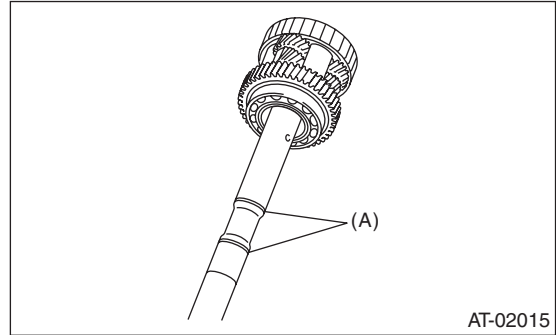
Press-fit it to the bottom of bearing shoulder completely.



- 2) Insert the rear drive shaft. <Ref. to 5AT-72, INSTALLATION, Rear Drive Shaft.>
- 3) Join the transmission case and the extension case, and then install the rear vehicle speed sensor. <Ref. to 5AT-67, INSTALLATION, Extension Case.>
- 4) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

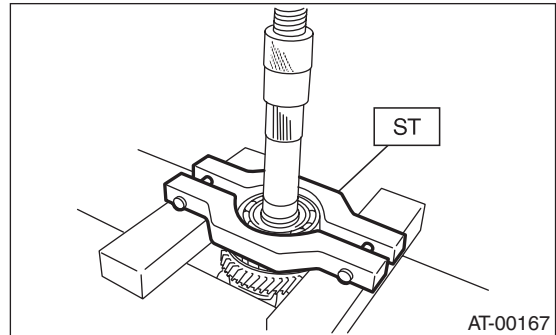
### C: DISASSEMBLY

- 1) Remove the seal ring.

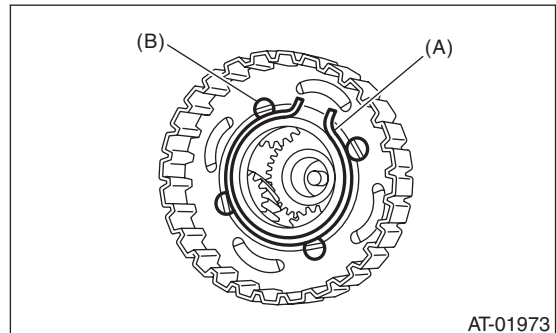


(A) Seal ring

- 2) Using a press and ST, remove the ball bearing.  
ST 498077600 REMOVER

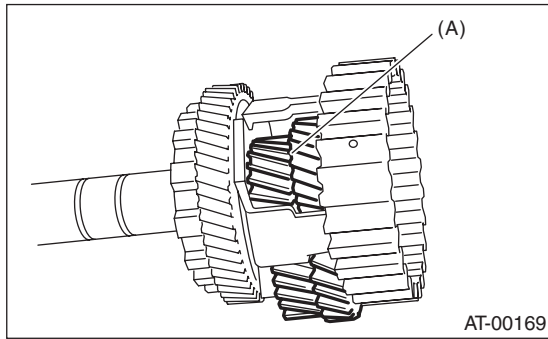


- 3) Remove the snap ring, and pull out the shaft from center differential assembly.



(A) Snap ring  
(B) Shaft

- 4) Remove the thrust washers, pinion gears and washers from center differential assembly.



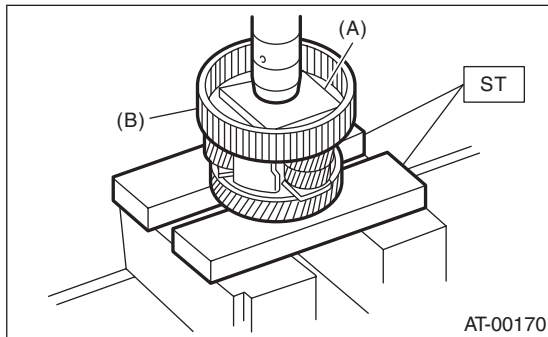
(A) Pinion gear

- 5) Pull out the intermediate shaft and thrust bearing.

## D: ASSEMBLY

- 1) Install the thrust washer onto intermediate shaft.
- 2) Install the thrust bearing onto intermediate shaft.
- 3) Install the pinion gears and washers.
- 4) Insert the shaft into the center differential assembly.
- 5) Install the snap ring.
- 6) Using a press, install a new ball bearing into the center differential assembly.

ST 498077000 REMOVER



(A) Plate

(B) Center differential carrier

- 7) Apply vaseline onto the seal ring outer surface and shaft grooves.
- 8) Install a new seal ring.

## E: INSPECTION

- Check each parts for holes, damages or other foreign matters.
- Inspect the extension end play, and adjust it to within the standard value. <Ref. to 5AT-69, ADJUSTMENT, Transfer Clutch.>

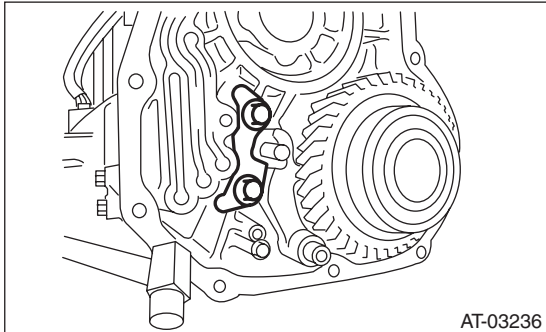
# Parking Pawl

AUTOMATIC TRANSMISSION

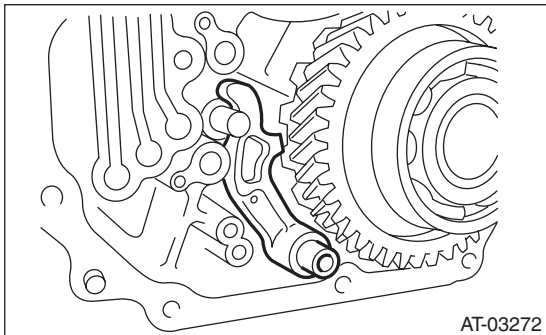
## 30. Parking Pawl

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the extension case. <Ref. to 5AT-67, REMOVAL, Extension Case.>
- 3) Remove the center differential carrier. <Ref. to 5AT-76, REMOVAL, Center Differential Carrier.>
- 4) Remove the front vehicle speed sensor. <Ref. to 5AT-51, REMOVAL, Front Vehicle Speed Sensor.>
- 5) Remove the parking support actuator.

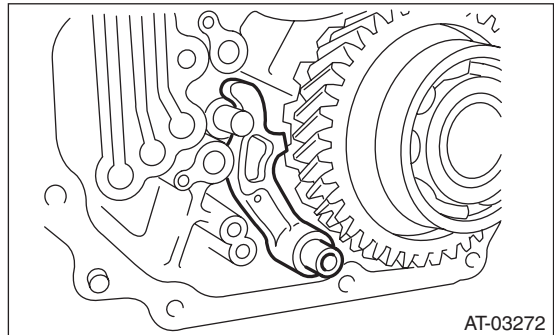


- 6) Remove the parking pawl, parking pawl shaft and return spring.



### B: INSTALLATION

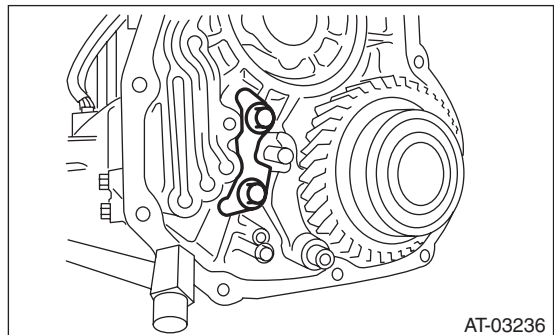
- 1) Set the transmission to the "N" range.
- 2) Install the parking pawl, parking pawl shaft and return spring.



- 3) Install the parking support actuator.

#### **Tightening torque:**

**$10 \pm 2$  N·m ( $1.0 \pm 0.2$  kgf·m,  $7.4 \pm 1.5$  ft·lb)**



4) Using the ST, tighten the bolts which tightened in step 3) with specified angle.

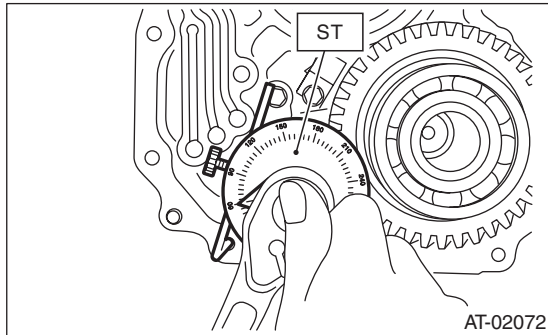
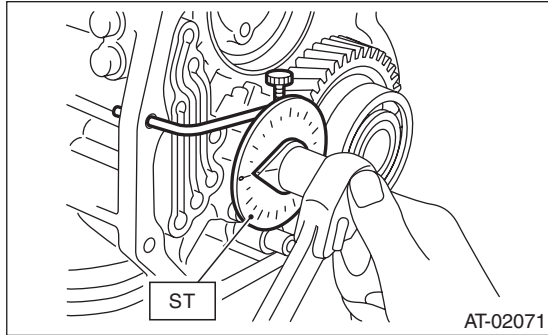
**Tightening angle:**

$17^{\circ} \pm 2^{\circ}$

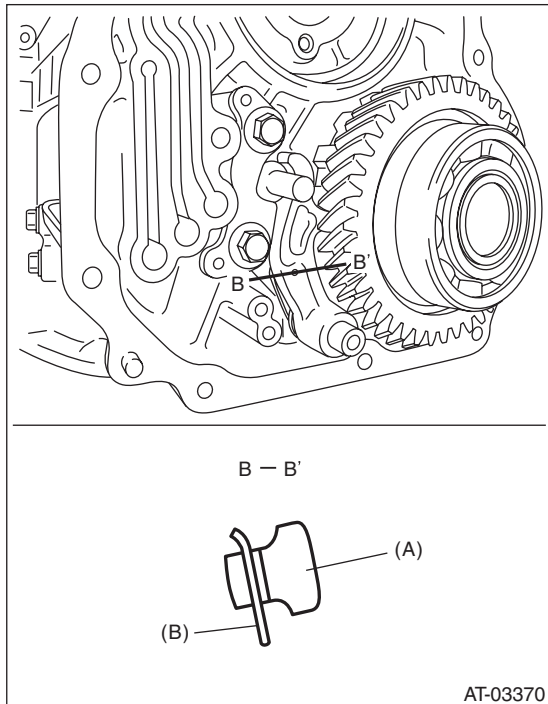
ST 18854AA000 ANGLE GAUGE

**NOTE:**

Do not use extension as much as possible.



5) Make sure that the return spring is sticking out of the parking pole hole.



- (A) Parking pawl
- (B) Return spring

6) Install the front vehicle speed sensor. <Ref. to 5AT-52, INSTALLATION, Front Vehicle Speed Sensor.>

7) Install the center differential carrier. <Ref. to 5AT-76, INSTALLATION, Center Differential Carrier.>

8) Install the extension case. <Ref. to 5AT-67, INSTALLATION, Extension Case.>

9) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

**C: INSPECTION**

Make sure that the tab of parking pawl on reduction driven gear is not worn or otherwise damaged.



# Converter Case

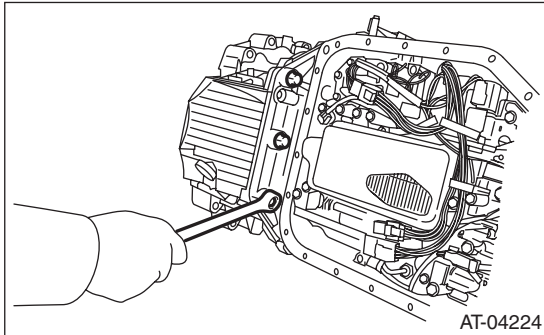
AUTOMATIC TRANSMISSION

## 31. Converter Case

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Remove the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Remove the transmission harness connector from stay.
- 4) Remove the turbine speed sensor 1. <Ref. to 5AT-55, REMOVAL, Turbine Speed Sensor 1.>
- 5) Remove the oil charge pipe. <Ref. to 5AT-65, REMOVAL, Oil Charge Pipe.>
- 6) Remove the ATF inlet and outlet pipes. <Ref. to 5AT-61, REMOVAL, ATF Cooler Pipe and Hose.>
- 7) Remove the converter case attachment bolts.
- 8) Lay along the transmission body, and then remove the oil pan.
- 9) Remove the three converter case mounting bolts (TORX®).

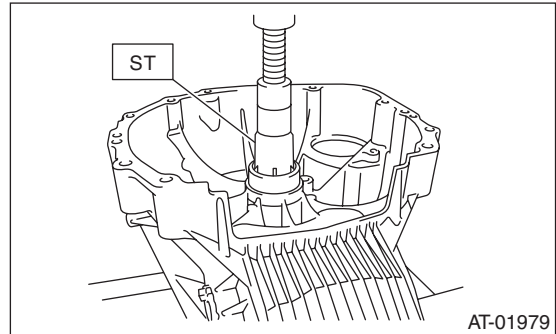
ST 18676AA020 TORX® WRENCH



- 10) Separate the converter case by lightly tapping with plastic hammer.
- 11) Remove the front differential assembly. <Ref. to 5AT-92, REMOVAL, Front Differential Assembly.>
- 12) Remove the oil seal from converter case.

### B: INSTALLATION

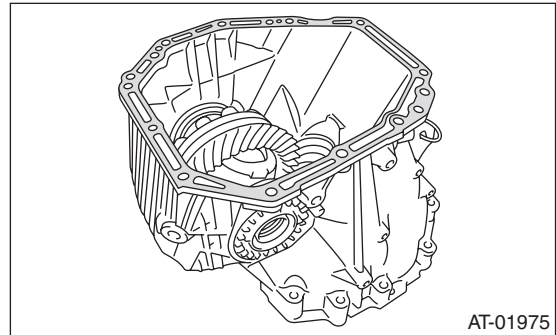
- 1) Check the appearance of each component and clean them.
- 2) Press-fit the oil seal to converter case using ST. ST 499587100 OIL SEAL INSTALLER



- 3) Install the front differential assembly to the case. <Ref. to 5AT-92, INSTALLATION, Front Differential Assembly.>
- 4) Install the right and left side retainers. <Ref. to 5AT-96, ADJUSTMENT, Front Differential Assembly.>
- 5) Apply proper amount of liquid gasket to the entire matching surface of converter case.

#### Liquid gasket:

**THREE BOND 1215 (Part No. 004403007)**



- 6) Install the converter case assembly without damaging bushing and oil seal.

#### NOTE:

Use new bolts for the oil charge pipe and ATF cooler pipe.

#### Tightening torque:

**Oil charge pipe and ATF cooler pipe**  
**38 N·m (3.9 kgf·m, 28.0 ft·lb)**

#### Other than above

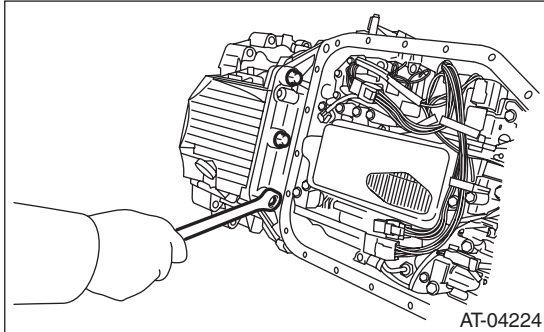
**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

7) Install the three converter case mounting bolts (TORX®).

ST 18676AA020 TORX® WRENCH

**Tightening torque:**

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**



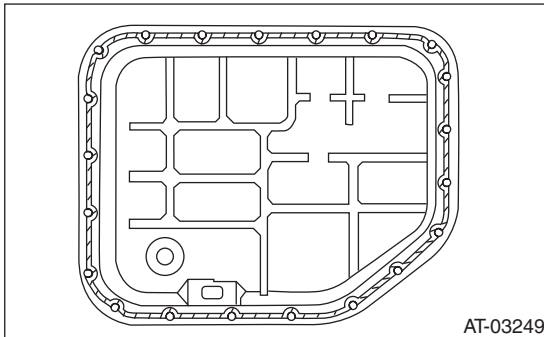
8) Apply proper amount of liquid gasket to the entire oil pan mating surface, and then install it.

**Liquid gasket:**

**THREE BOND 1217B (Part No. K0877YA020)**

**Tightening torque:**

**5 N·m (0.5 kgf-m, 3.7 ft-lb)**



9) Install the transmission harness connector to the stay.

10) Install the air breather hose. <Ref. to 5AT-64, INSTALLATION, Air Breather Hose.>

11) Install the ATF cooler pipe. <Ref. to 5AT-62, INSTALLATION, ATF Cooler Pipe and Hose.>

12) Install the oil charge pipe with O-ring. <Ref. to 5AT-65, INSTALLATION, Oil Charge Pipe.>

13) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>

14) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

## C: INSPECTION

Measure the backlash, and then adjust it to be within standard values. <Ref. to 5AT-89, ADJUSTMENT, Drive Pinion Shaft Assembly.>

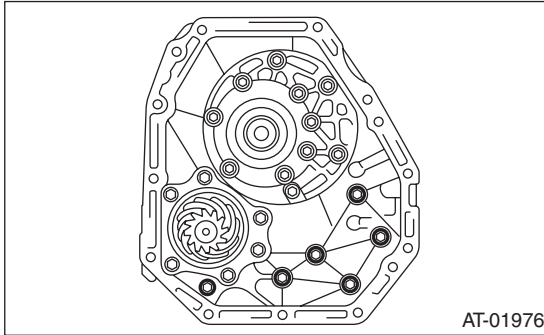
# Oil Pump Cover

AUTOMATIC TRANSMISSION

## 32.Oil Pump Cover

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Remove the transmission harness connector from stay.
- 4) Remove the oil charge pipe. <Ref. to 5AT-65, REMOVAL, Oil Charge Pipe.>
- 5) Remove the ATF inlet and outlet pipes. <Ref. to 5AT-61, REMOVAL, ATF Cooler Pipe and Hose.>
- 6) Separate the converter case and transmission case. <Ref. to 5AT-80, REMOVAL, Converter Case.>
- 7) Remove the oil pump cover mounting bolt, and then separate the oil pump cover from the AT main case by lightly tapping with plastic hammer.

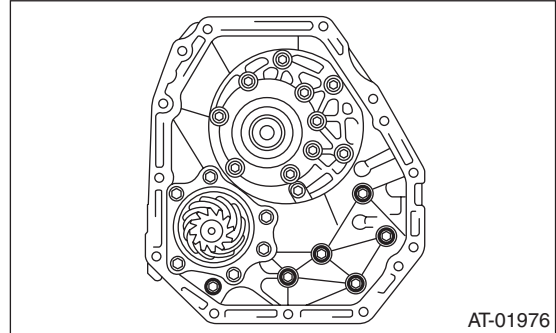


### B: INSTALLATION

- 1) Secure the oil pump cover.

#### **Tightening torque:**

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**

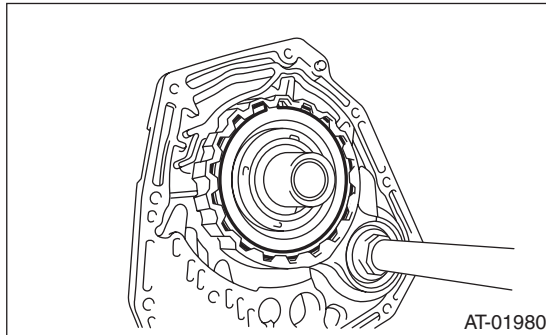


- 2) Install the converter case assembly to the transmission case assembly. <Ref. to 5AT-80, INSTALLATION, Converter Case.>
- 3) Install the transmission harness connector to the stay.
- 4) Install the ATF cooler pipe. <Ref. to 5AT-62, INSTALLATION, ATF Cooler Pipe and Hose.>
- 5) Install the oil charge pipe together with an O-ring. <Ref. to 5AT-65, INSTALLATION, Oil Charge Pipe.>
- 6) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>
- 7) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

## C: DISASSEMBLY

### 1. FRONT BRAKE

- 1) Remove the snap ring.



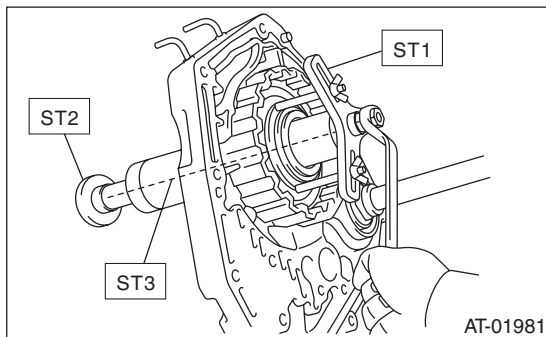
- 2) Remove the retainer plate, drive plate and driven plate.

- 3) Using the ST1, ST2 and ST3, remove the snap ring.

ST1 18762AA000 COMPRESSOR SPECIAL TOOL

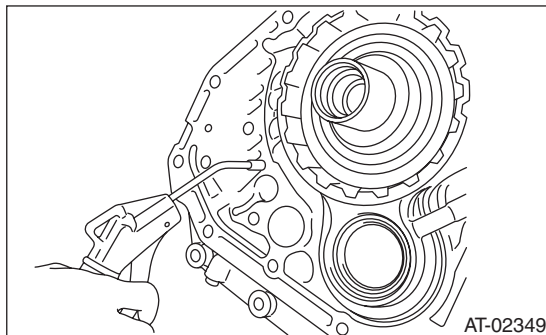
ST2 18765AA000 COMPRESSOR SUPPORT

ST3 18763AA000 COMPRESSOR SHAFT



- 4) Remove the retainer and return spring.

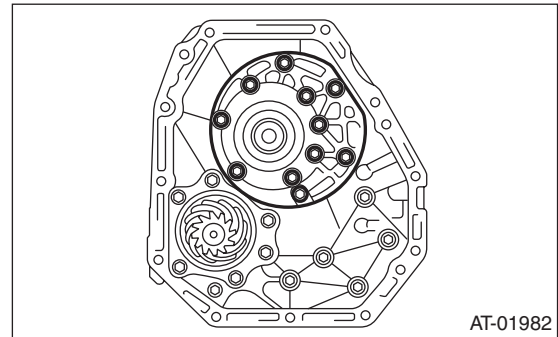
- 5) Remove the front brake piston using compressed air.



- 6) Remove the D-ring from front brake piston.

### 2. OIL PUMP

- 1) Take out the oil pump housing.



- 2) Take out the oil pump body.

# Oil Pump Cover

AUTOMATIC TRANSMISSION

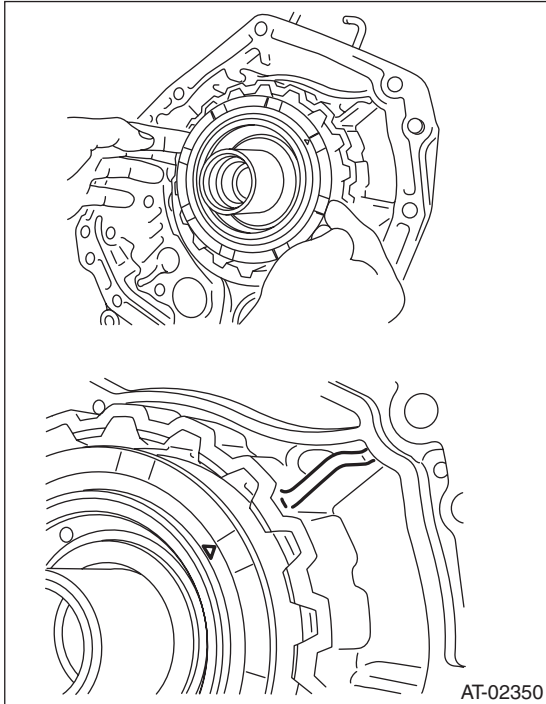
## D: ASSEMBLY

### 1. FRONT BRAKE

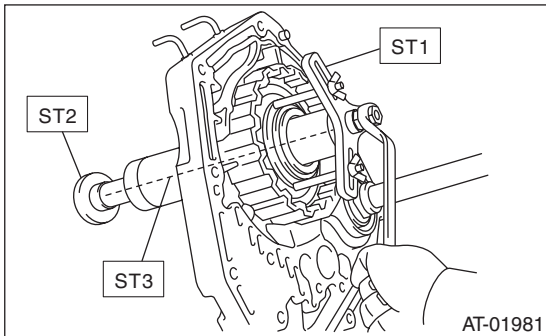
- 1) Apply ATF to D-ring, and then install it to the front brake piston.
- 2) Install the front brake piston to oil pump cover.

**NOTE:**

Install by aligning the “▲” mark on front brake piston surface with the oil pump cover rib.



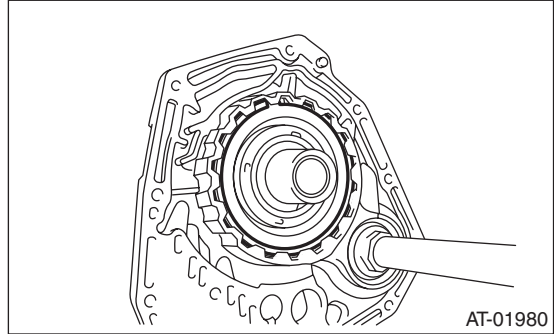
- 3) Install the retainer and return spring.
  - 4) Install the front brake piston assembly using ST1, ST2 and ST3.
- ST1 18762AA000 COMPRESSOR SPECIAL TOOL  
 ST2 18765AA000 COMPRESSOR SUPPORT  
 ST3 18763AA000 COMPRESSOR SHAFT



- 5) Install the genuine driven plate instead of retainer plate, and temporarily assemble the drive plate and driven plate.

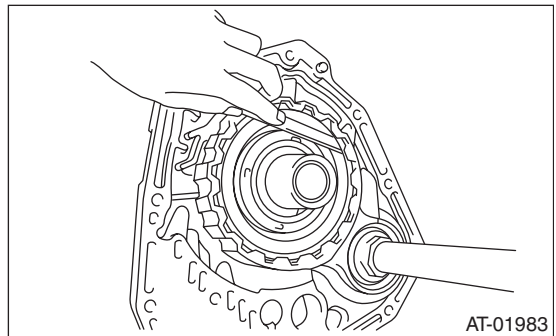
Part No. 31536AA290 DRIVEN PLATE

- 6) Install the snap ring.



- 7) Measure the clearance between retainer plate and snap ring, and then select the suitable retainer plate from table.

**Front brake clearance specification:**  
**0.7 — 1.1 mm (0.028 — 0.043 in)**



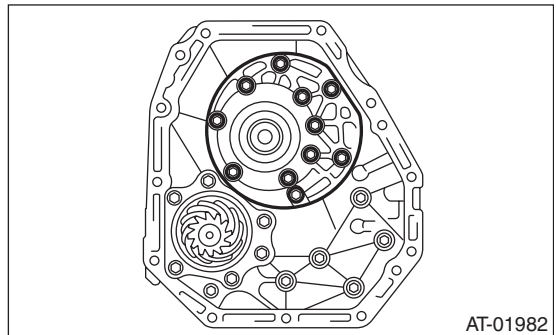
Front brake retainer plate	
Part number	Thickness mm (in)
31567AB130	3.4 (0.134)
31567AB140	3.6 (0.142)
31567AB150	3.8 (0.150)
31567AB160	4.0 (0.157)

- 8) Remove the snap ring, replace the drive plate used in measurement of clearance with the retainer plate, and then reassemble.

### 2. OIL PUMP

- 1) Apply ATF to oil pump assembly, and then install it to oil pump housing.
- 2) Install the O-ring to oil pump cover.
- 3) Install the oil pump housing to the oil pump cover.

**Tightening torque:**  
**10 N·m (1.0 kgf-m, 7.4 ft-lb)**



## E: INSPECTION

### 1. FRONT BRAKE

Check the following items.

- Drive plate facing for wear and damage
- Snap ring for wear, return spring for damage, and retainer for damage
- Piston for damage
- D-ring for damage

### 2. OIL PUMP

Check the following items.

- Oil pump cover and oil seal for breakage or damage
- Oil pump body for scratch or damage

1) Check the seal ring and oil seal for breaks and damage.

2) Check other parts for dents or faults.

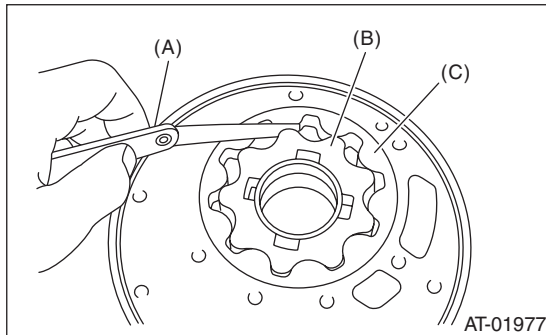
3) Oil pump rotor assembly selection

(1) Tip clearance

Install the inner rotor and outer rotor to oil pump housing. With rotor gears facing each other, measure the crest-to-crest clearance.

**Tip clearance:**

**0.02 — 0.15 mm (0.0008 — 0.0059 in)**



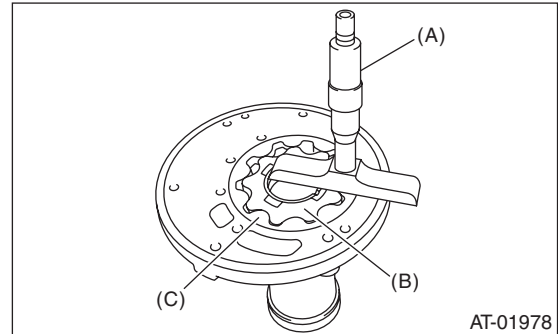
- (A) Thickness gauge
- (B) Inner rotor
- (C) Outer rotor

(2) Side clearance

Set a depth gauge to oil pump housing, then measure the oil pump housing-to-rotor clearance.

**Side clearance:**

**0.02 — 0.045 mm (0.0008 — 0.0018 in)**



- (A) Depth gauge
- (B) Inner rotor
- (C) Outer rotor

(3) If the depth and/or side clearance are not within the specification, replace the rotor assembly.

Oil pump rotor assembly	
Part number	Thickness mm (in)
15008AA130	11.37 — 11.38 (0.4476 — 0.4480)
15008AA140	11.38 — 11.39 (0.4480 — 0.4484)
15008AA150	11.39 — 11.40 (0.4484 — 0.4488)

Measure the total end play and adjust it to be within specifications. <Ref. to 5AT-107, ADJUSTMENT, AT Main Case.>

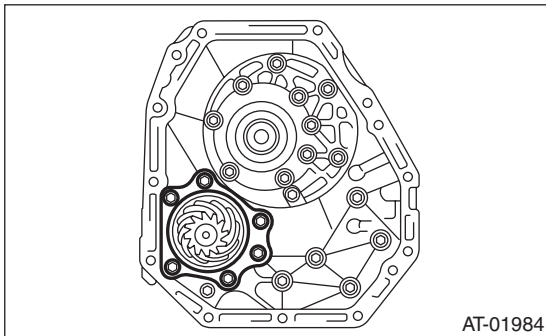
# Drive Pinion Shaft Assembly

AUTOMATIC TRANSMISSION

## 33. Drive Pinion Shaft Assembly

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Remove the transmission harness connector from stay.
- 4) Disconnect the air breather hose. <Ref. to 5AT-64, REMOVAL, Air Breather Hose.>
- 5) Remove the oil charge pipe. <Ref. to 5AT-65, REMOVAL, Oil Charge Pipe.>
- 6) Remove the ATF inlet and outlet pipes. <Ref. to 5AT-61, REMOVAL, ATF Cooler Pipe and Hose.>
- 7) Separate the converter case and transmission case. <Ref. to 5AT-80, REMOVAL, Converter Case.>
- 8) Remove the drive pinion shaft mounting bolts, and then remove the drive pinion shaft assembly from oil pump cover.



- 9) Remove the oil pump cover from AT main case. <Ref. to 5AT-82, Oil Pump Cover.>

### B: INSTALLATION

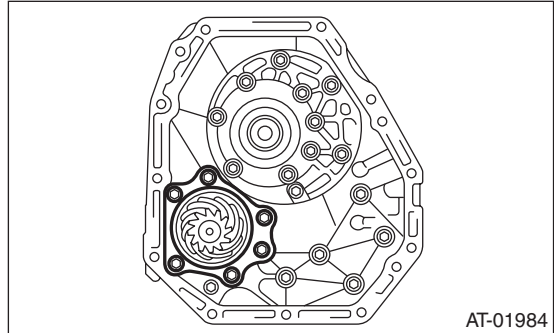
- 1) Assemble the drive pinion assembly to oil pump cover.

NOTE:

Be careful not to bend the shim.

**Tightening torque:**

**70 N·m (7.1 kgf·m, 51.6 ft·lb)**

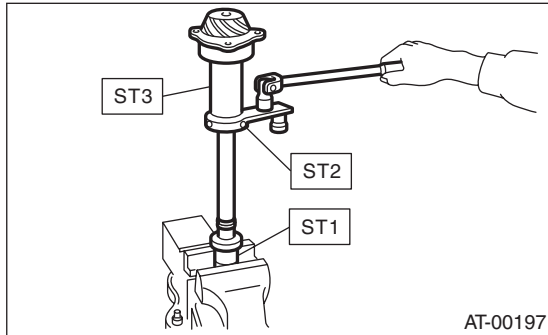


- 2) Adjust the tooth contact between drive pinion shaft assembly and the front differential side gear. <Ref. to 5AT-89, ADJUSTMENT, Drive Pinion Shaft Assembly.>
- 3) Join the converter case with the transmission case. <Ref. to 5AT-80, INSTALLATION, Converter Case.>
- 4) Install the transmission harness connector to the stay.
- 5) Install the ATF cooler pipe. <Ref. to 5AT-62, INSTALLATION, ATF Cooler Pipe and Hose.>
- 6) Install the oil charge pipe with O-ring.
- 7) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>
- 8) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

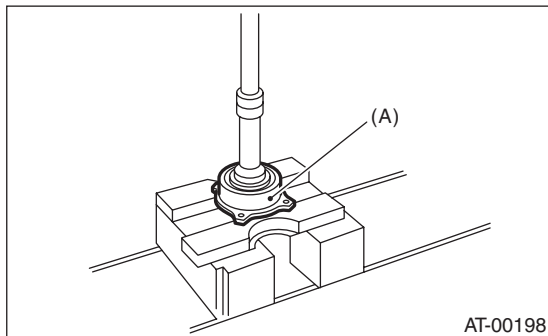
## C: DISASSEMBLY

1) Flatten the lock nut tab, and then remove the lock nut while holding the rear spline part of the shaft using ST1 and ST2. Pull out the drive pinion collar.

- ST1 18667AA010 HOLDER
- ST2 499787700 WRENCH
- ST3 499787500 ADAPTER



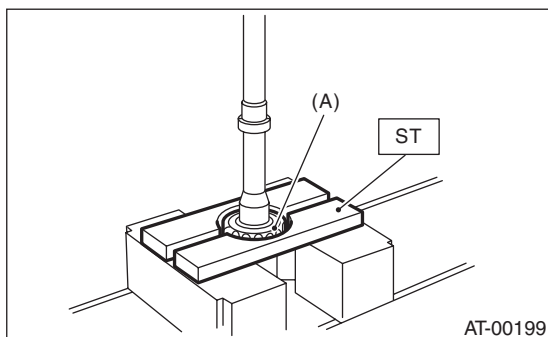
- 2) Remove the O-ring.
- 3) Separate the roller bearing and outer race from shaft using a press.



(A) Outer race

- 4) Separate the front roller bearing from shaft using a press and ST.

- ST 498517000 REPLACER

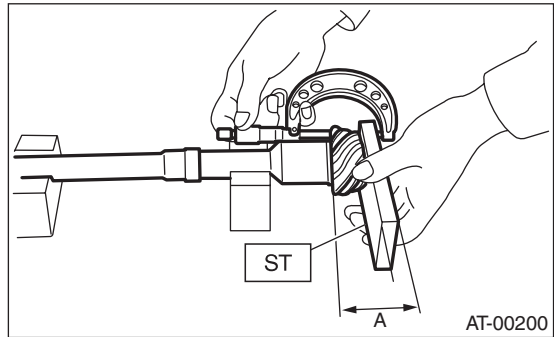


(A) Front roller bearing

## D: ASSEMBLY

- 1) Measure the dimension "A" of the drive pinion shaft.

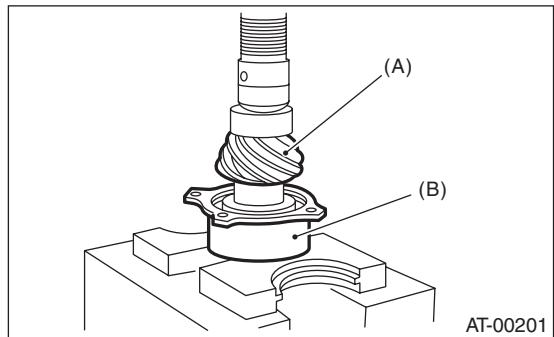
- ST 398643600 GAUGE



- 2) Using a press, press-fit the new roller bearing into the specified position.

### NOTE:

If excessive force is applied to roller bearing, the roller bearing will not turn easily.



- (A) Drive pinion shaft
- (B) Roller bearing

- 3) After fitting a new O-ring to the shaft, attach the drive pinion collar to the shaft.



# Drive Pinion Shaft Assembly

## AUTOMATIC TRANSMISSION

4) Tighten the new lock nuts using ST1, ST2 and ST3.

Use the calculation below to calculate the tightening torque.

$$T2 = L2 / (L1 + L2) \times T1$$

T1: 116 N·m (11.8 kgf·m, 85.3 ft·lb)

[Required torque setting]

T2: Tightening torque

L1: ST2 length 0.072 m (2.83 in)

L2: Torque wrench length

Example:

Torque wrench length m (in)	Tightening torque N·m (kgf·m, ft·lb)
0.4 (15.75)	98 (10.0, 72)
0.45 (17.72)	100 (10.2, 73.8)
0.5 (19.69)	101 (10.3, 74.5)
0.55 (21.65)	102 (10.4, 75)

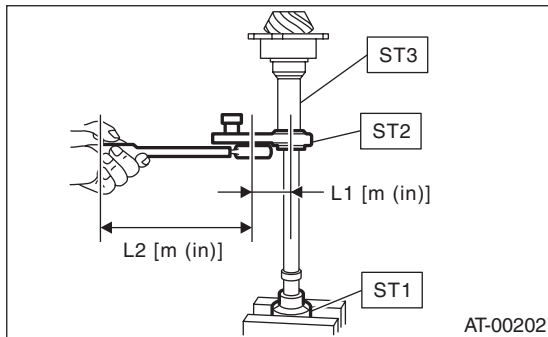
ST1 18667AA010 HOLDER

ST2 499787700 WRENCH

ST3 499787500 ADAPTER

NOTE:

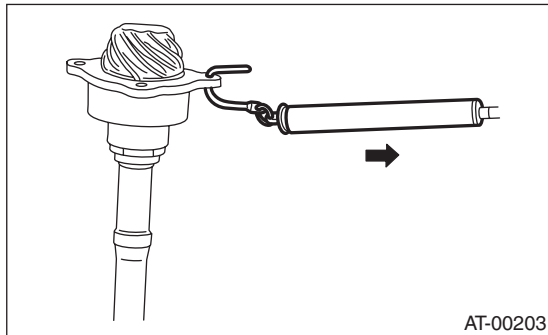
Attach ST2 to torque wrench as straight as possible.



5) Measure the starting torque of the bearing. Make sure the starting torque is within the specified range. If the torque is not within specified range, replace the roller bearing.

**Starting torque:**

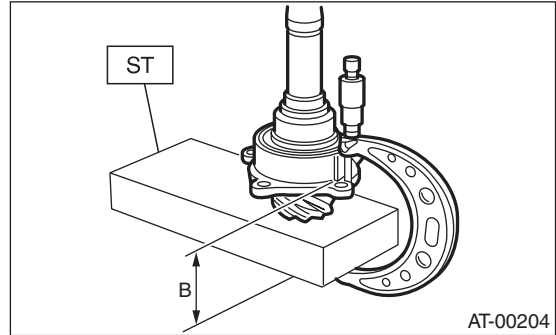
**7.6 — 38.1 N (0.776 — 3.88 kgf, 1.7 — 8.6 lb)**



6) Crimp the locknut in 2 locations.

7) Measure the dimension “B” of the drive pinion shaft.

ST 398643600 GAUGE



8) Calculate the thickness “t” (mm) of the drive pinion shim.

$$t = 6.5 \pm 0.0625 - (B - A)$$

9) Select three or less shims from following table.

Drive pinion shim	
Part number	Thickness mm (in)
31451AA180	0.150 (0.0059)
31451AA190	0.175 (0.0069)
31451AA200	0.200 (0.0079)
31451AA210	0.225 (0.0089)
31451AA220	0.250 (0.0098)
31451AA230	0.275 (0.0108)

## E: INSPECTION

- Make sure that all component parts are free of scratches, holes and other faults.
- Adjust the tooth alignment. <Ref. to 5AT-89, ADJUSTMENT, Drive Pinion Shaft Assembly.>

## F: ADJUSTMENT

- 1) Remove the liquid gasket from the mating surface completely.
- 2) Install the converter case to oil pump cover, and secure them with tightening four bolts evenly.

**NOTE:**

Use an old gasket or aluminum washer to prevent damaging the mating surface of the housing.

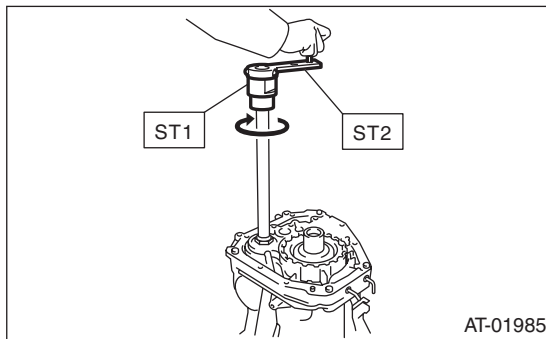
**Tightening torque:**

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

- 3) Rotate the drive pinion a few times using ST1 and ST2.

ST1 18667AA010 HOLDER

ST2 499787700 WRENCH



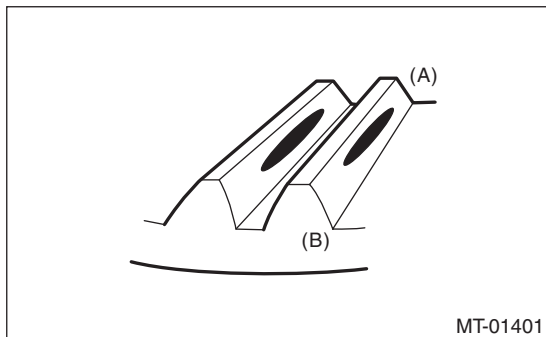
- 4) Adjust the drive pinion and hypoid driven gear backlash. <Ref. to 5AT-96, ADJUSTMENT, Front Differential Assembly.>

- 5) Apply lead-free red dye evenly to the surfaces of three or four teeth on hypoid driven gear. Rotate the drive pinion in the leftward and rightward for several times. Remove the oil pump cover, and check the tooth contact pattern.

If the teeth contact is inappropriate, adjust the backlash or shim thickness. <Ref. to 5AT-96, ADJUSTMENT, Front Differential Assembly.>

- Correct tooth contact

**Check item: Tooth contact surface is slightly shifted toward the toe side under a no-load condition. (When driving, it moves towards the heel side.)**

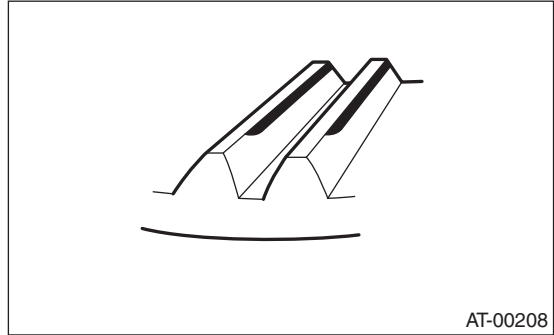


- (A) Toe side
- (B) Heel side

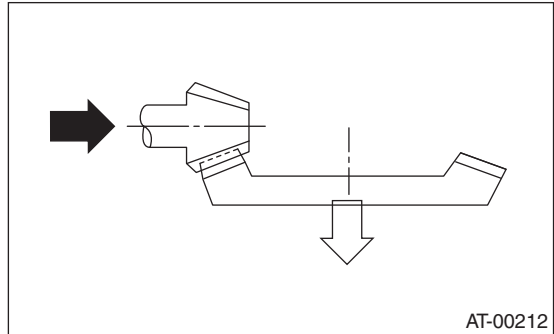
- Face contact

**Check item: Backlash is too large.**

Contact pattern



Corrective action: Increase thickness of pinion height adjusting washer according to the procedures for moving the drive pinion closer to the driven gear.



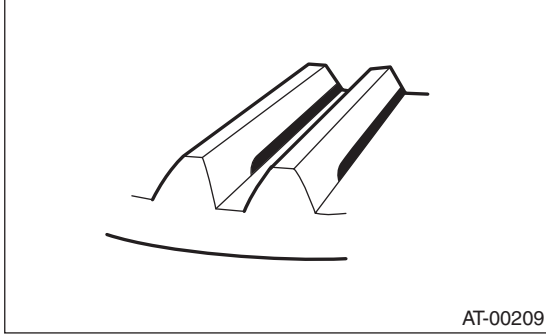
# Drive Pinion Shaft Assembly

## AUTOMATIC TRANSMISSION

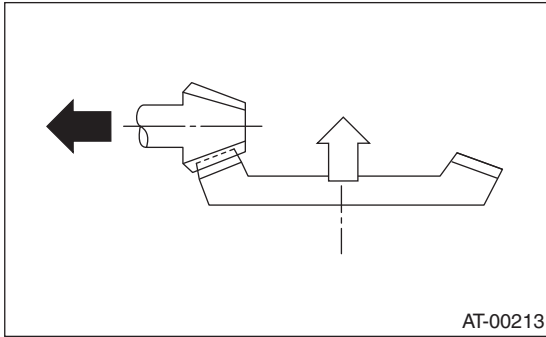
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



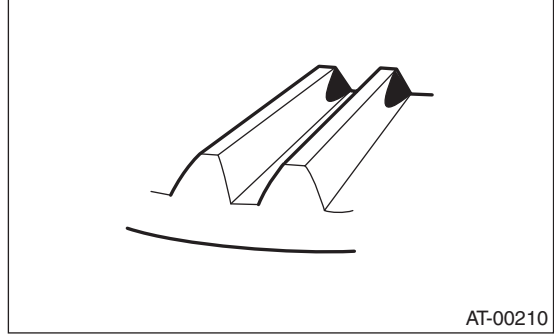
Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the driven gear.



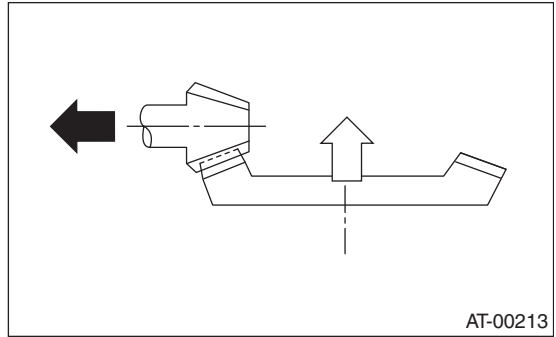
- Toe contact (inside contact)

**Check item: Teeth contact area is too small.**

Contact pattern



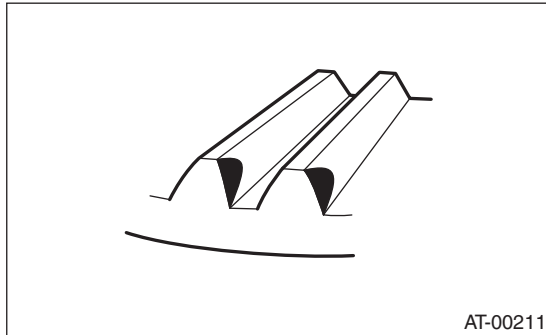
Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the driven gear side.



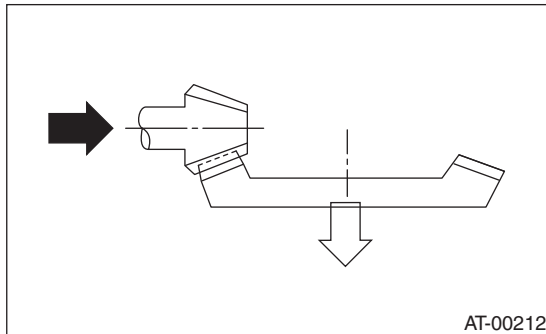
- Heel contact (outside end contact)

**Check item: Teeth contact area is too small.**

Contact pattern



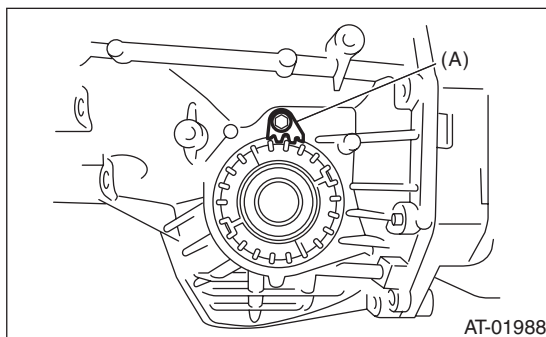
Corrective action: Increase thickness of pinion height adjusting washer according to the procedures for moving the drive pinion closer to the driven gear.



6) If tooth contact is correct, mark the retainer position and loosen it. After fitting a new O-ring and oil seal, screw in the retainer to the marked position. Tighten the lock plate with specified torque.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



(A) Lock plate

# Front Differential Assembly

AUTOMATIC TRANSMISSION

## 34. Front Differential Assembly

### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Remove the transmission harness connector from stay.
- 4) Remove the oil charge pipe. <Ref. to 5AT-65, REMOVAL, Oil Charge Pipe.>
- 5) Remove the ATF inlet and outlet pipes. <Ref. to 5AT-61, REMOVAL, ATF Cooler Pipe and Hose.>
- 6) Separate the converter case from the transmission case. <Ref. to 5AT-80, REMOVAL, Converter Case.>
- 7) Remove the differential side retainers using ST. ST 18630AA010 WRENCH COMPL RETAINER

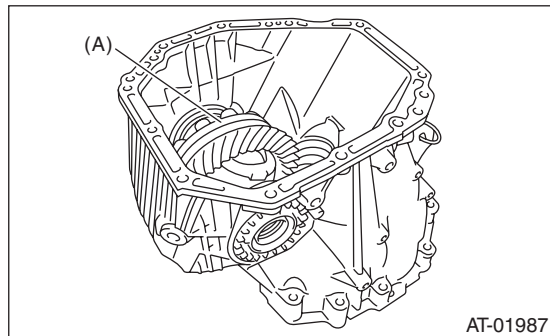
#### NOTE:

Hold the differential case assembly by hand to avoid damaging the retainer mounting hole of the converter case.

- 8) Remove the differential assembly while being careful not to damage the attachment part of retainer.

### B: INSTALLATION

- 1) When installing the front differential assembly to case, be careful not to damage the inside of case (particularly, the differential side retainer mating surface).



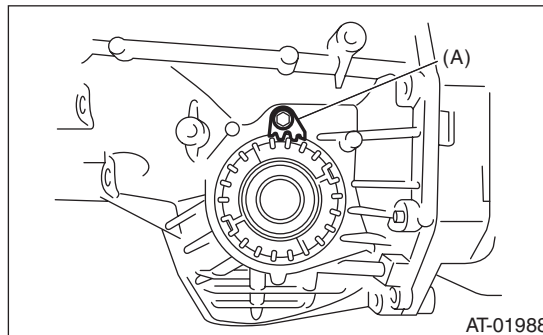
(A) Front differential ASSY

- 2) Install the O-ring to left and right side retainer.
- 3) Using the ST, install the side retainer. <Ref. to 5AT-92, INSTALLATION, Front Differential Assembly.>  
ST 18630AA010 WRENCH COMPL RETAINER
- 4) Adjust the backlash of the front differential. <Ref. to 5AT-96, ADJUSTMENT, Front Differential Assembly.>

- 5) Install the lock plate.

#### Tightening torque:

25 N·m (2.5 kgf·m, 18.4 ft·lb)



(A) Lock plate

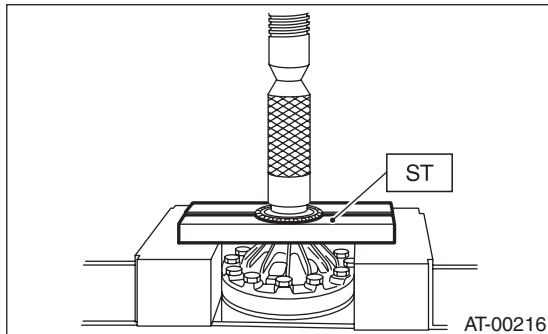
- 6) Install the converter case to the transmission case. <Ref. to 5AT-80, INSTALLATION, Converter Case.>
- 7) Install the transmission harness connector to the stay.
- 8) Install the ATF cooler pipe. <Ref. to 5AT-62, INSTALLATION, ATF Cooler Pipe and Hose.>
- 9) Install the oil charge pipe together with an O-ring. <Ref. to 5AT-65, INSTALLATION, Oil Charge Pipe.>
- 10) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>
- 11) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

## C: DISASSEMBLY

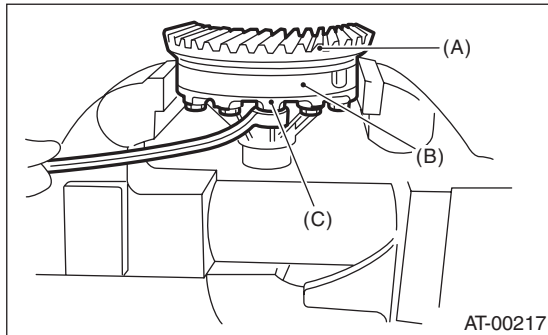
### 1. DIFFERENTIAL CASE ASSEMBLY

1) Remove the taper roller bearing using the ST and a press.

ST 498077000 REMOVER

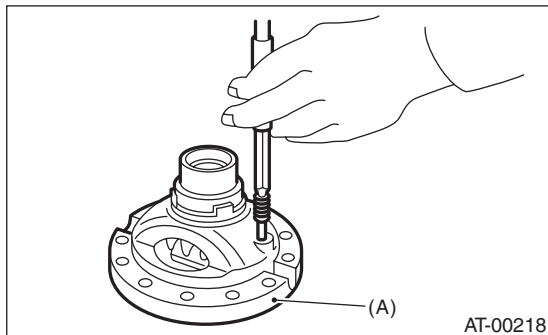


2) Secure the case in a vise, remove the hypoid driven gear tightening bolts, and then separate the hypoid driven gear into case (RH) and case (LH).



- (A) Hypoid driven gear
- (B) Differential case (RH)
- (C) Differential case (LH)

3) Pull out the straight pin and shaft, and then remove the differential bevel gear, washer and differential bevel pinion.



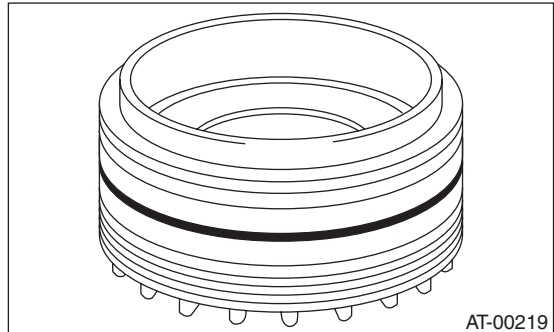
- (A) Differential case (RH)

### 2. SIDE RETAINER

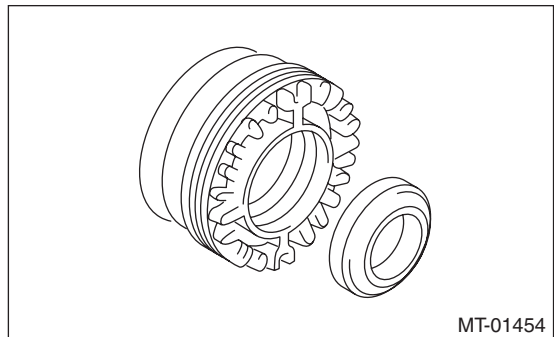
NOTE:

After adjusting the drive pinion backlash and tooth contact, remove and install the oil seal and O-ring.

1) Remove the O-ring.

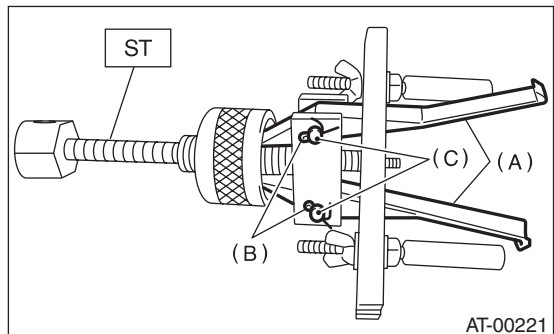


2) Remove the oil seal.



3) Remove the split pin, and then remove the claw.

ST 398527700 PULLER ASSY



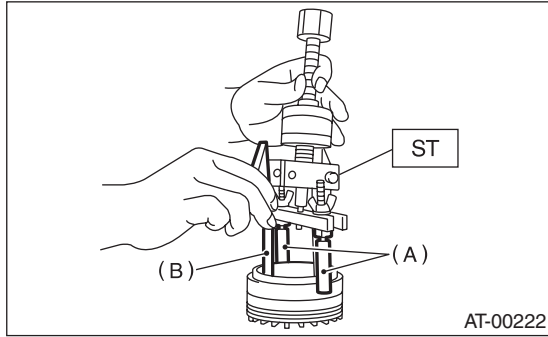
- (A) Claw
- (B) Split pin
- (C) Pin

# Front Differential Assembly

## AUTOMATIC TRANSMISSION

4) Attach two claws to the outer race, and set the ST to side retainer.

ST 398527700 PULLER ASSY



- (A) Shaft
- (B) Claw

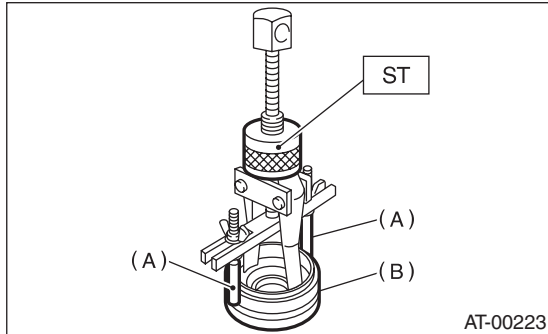
5) Restore the removed claws to original position, and install the pin and split pin.

6) Hold the shaft of ST to avoid removing from side retainer, and then remove the bearing outer race.

ST 398527700 PULLER ASSY

### NOTE:

Replace the bearing inner and outer races as a single unit.



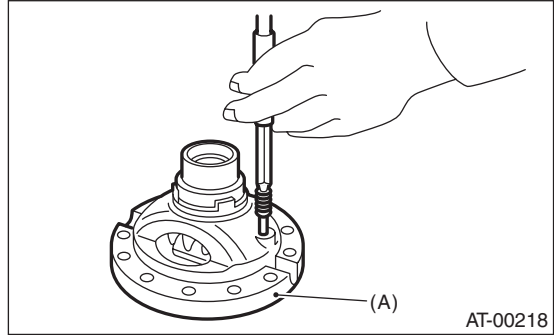
- (A) Shaft
- (B) Side retainer

## D: ASSEMBLY

### 1. DIFFERENTIAL CASE ASSEMBLY

1) Install the washer, differential bevel gear and differential bevel pinion in the differential case (RH). Insert the pinion shaft.

2) Attach the straight pin in the reverse direction.



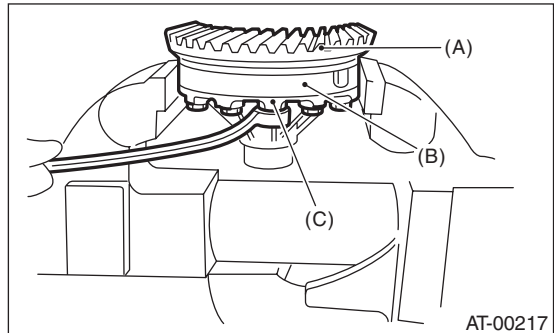
- (A) Differential case (RH)

3) Install the washer and differential bevel gear to the differential case (LH). Put the differential case (RH) on the case, and assemble two cases.

4) Install the hypoid driven gear and secure by tightening the bolt.

### **Tightening torque:**

**70 N·m (7.1 kgf·m, 51.6 ft·lb)**



- (A) Hypoid driven gear
- (B) Differential case (RH)
- (C) Differential case (LH)

- 5) Measurement of backlash (Selection of washer)  
 (1) Install the SUBARU genuine axle shaft to differential case.

Part No. 38415AA070 AXLE SHAFT

- (2) Measure the gear backlash using ST1 and ST2, and then insert the ST2 though the access window of case.

ST1 498247001 MAGNET BASE

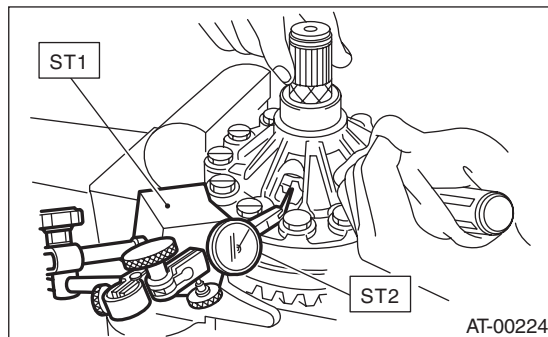
ST2 498247100 DIAL GAUGE

**NOTE:**

- Measure the backlash by applying a differential bevel pinion tooth between two differential bevel gear teeth.
- Fix the differential bevel pinion gear in place with a screwdriver covered with cloth or similar tool when measuring.

**Standard:**

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



- (3) If the backlash is not within specification, select a washer from the table below.

Washer	
Part number	Thickness mm (in)
803038021	0.95 (0.037)
803038022	1.00 (0.039)
803038023	1.05 (0.041)

- 6) Using the ST, install the taper roller bearing.  
 ST 398487700 DRIFT

## 2. SIDE RETAINER

**NOTE:**

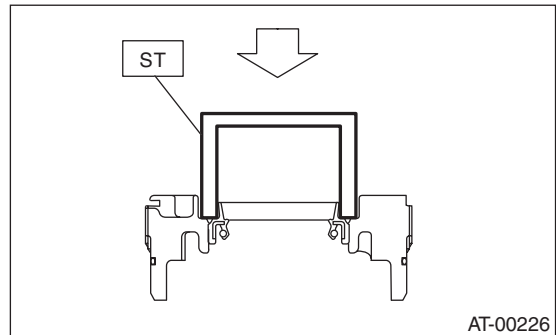
Install the oil seal and O-ring of side retainer after the adjustment of backlash and tooth contact.

- 1) Install the bearing outer race to side retainer.
- 2) Install a new oil seal using ST.

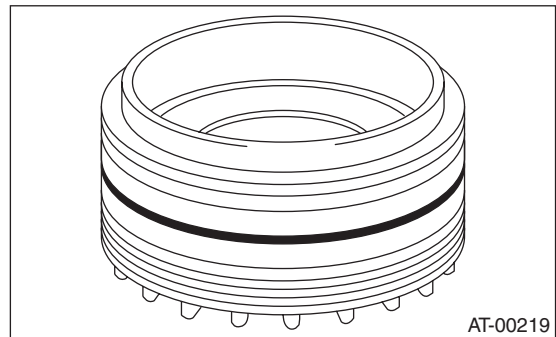
ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

**NOTE:**

Apply oil to the oil seal lips.



- 3) Install a new O-ring.



## E: INSPECTION

- Check each component for scratches, damage or other faults.
- Measure the backlash, and then adjust it to be within specification.

<Ref. to 5AT-96, ADJUSTMENT, Front Differential Assembly.>



# Front Differential Assembly

AUTOMATIC TRANSMISSION

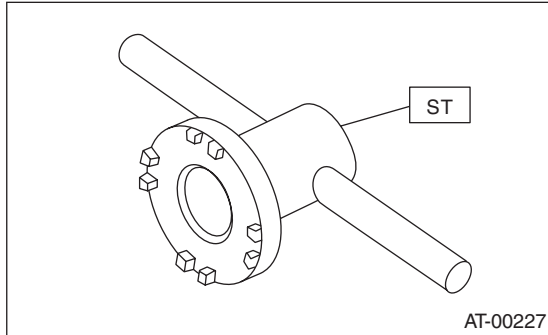
## F: ADJUSTMENT

1) Using the ST, screw-in the retainer until resistance is felt.

### NOTE:

Screw in the RH side slightly deeper than the LH side.

ST 18630AA010 WRENCH COMPL RETAINER



- 2) Remove the oil pump cover.
- 3) Remove the liquid gasket from the mating surface completely.
- 4) Install the oil pump cover to converter case, and secure them with tightening four bolts evenly.

### NOTE:

Use an old gasket or aluminum washer to prevent damaging the mating surface of the housing.

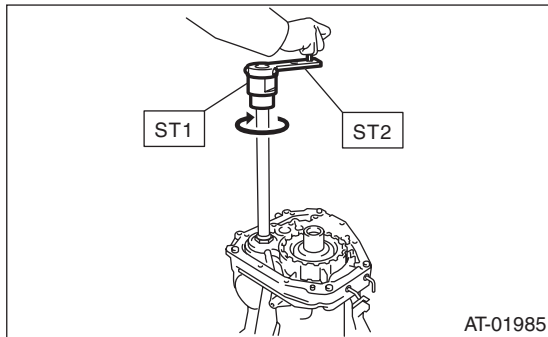
### Tightening torque:

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

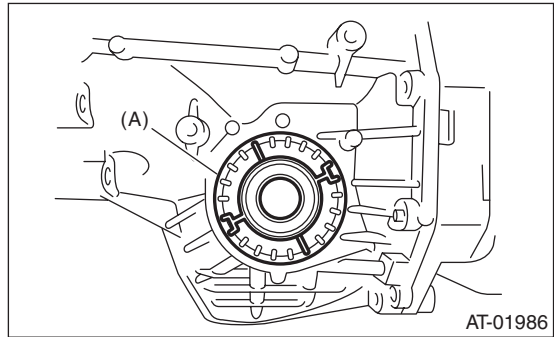
5) Rotate the drive pinion ten times or more using ST1 and ST2.

ST1 18667AA010 HOLDER

ST2 499787700 WRENCH

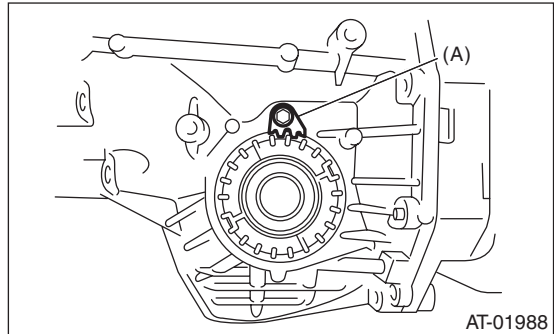


6) Tighten the LH retainer by rotating the shaft until resistance is felt. Then loosen the retainer RH. Keep tightening the retainer LH, and loosening the retainer RH until the pinion shaft no longer be turned. This is the "zero" state.



(A) Retainer

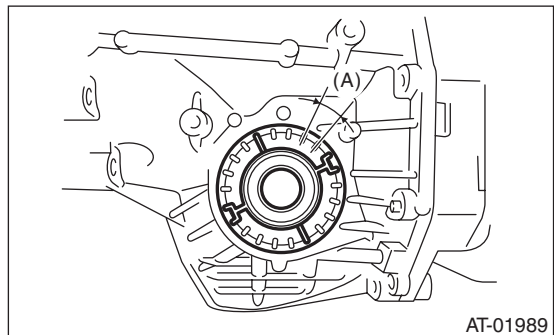
7) After the "zero" state is established, loosen the retainer LH by 3 notches and secure it with the lock plate. Then loosen the retainer RH and retighten until it stops. Rotate the drive pinion 2 or 3 times. Tighten the retainer RH further 1-3/4 notches. This sets the preload. Finally, secure the retainer with its lock plate.



(A) Lock plate

### NOTE:

Turning the retainer by one tooth changes the backlash approx. 0.05 mm (0.0020 in).



(A) 0.05 mm (0.0020 in)

8) Turn the drive pinion several times using ST1, and check to see if the backlash is within the specification using ST2, ST3, ST4 and ST5.

ST1 499787700 WRENCH  
ST2 498247001 MAGNET BASE  
ST3 498247100 DIAL GAUGE  
ST4 499787500 ADAPTER  
ST5 498255400 PLATE

**Backlash:**

***0.13 — 0.18 mm (0.0051 — 0.0071 in)***

9) Adjust the teeth contact of the front differential and drive shaft. <Ref. to 5AT-89, ADJUSTMENT, Drive Pinion Shaft Assembly.>

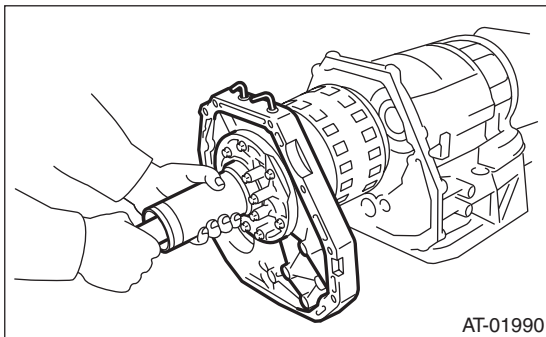
## 35.AT Main Case

### A: REMOVAL

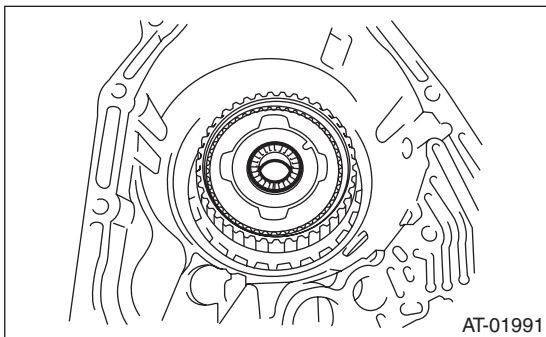
- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Remove the transmission harness connector from stay.
- 4) Disconnect the air breather hose.
- 5) Remove the oil charge pipe. <Ref. to 5AT-65, REMOVAL, Oil Charge Pipe.>
- 6) Remove the ATF inlet and outlet pipes. <Ref. to 5AT-61, REMOVAL, ATF Cooler Pipe and Hose.>
- 7) Remove the extension case. <Ref. to 5AT-67, REMOVAL, Extension Case.>
- 8) Remove the center differential carrier. <Ref. to 5AT-76, REMOVAL, Center Differential Carrier.>
- 9) Remove the reduction driven gear. <Ref. to 5AT-73, REMOVAL, Reduction Driven Gear.>
- 10) Separate the converter case from the transmission case. <Ref. to 5AT-80, REMOVAL, Converter Case.>
- 11) Remove the control valve body. <Ref. to 5AT-56, REMOVAL, Control Valve Body.>
- 12) Remove the oil pump cover. <Ref. to 5AT-82, REMOVAL, Oil Pump Cover.>

#### NOTE:

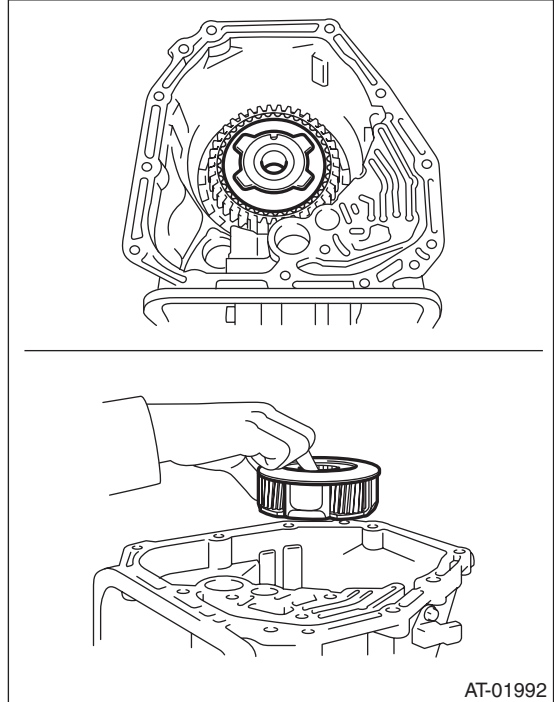
The input clutch pack assembly and front sun gear assembly are also removed together.



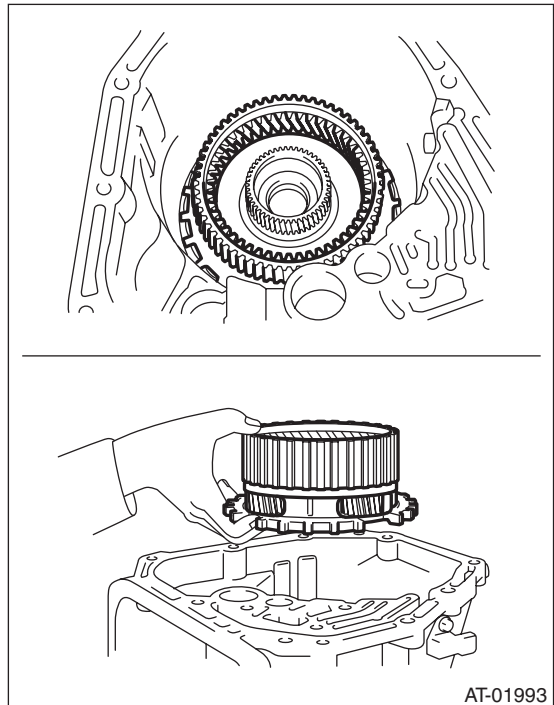
- 13) Remove the needle bearing of the middle carrier assembly.



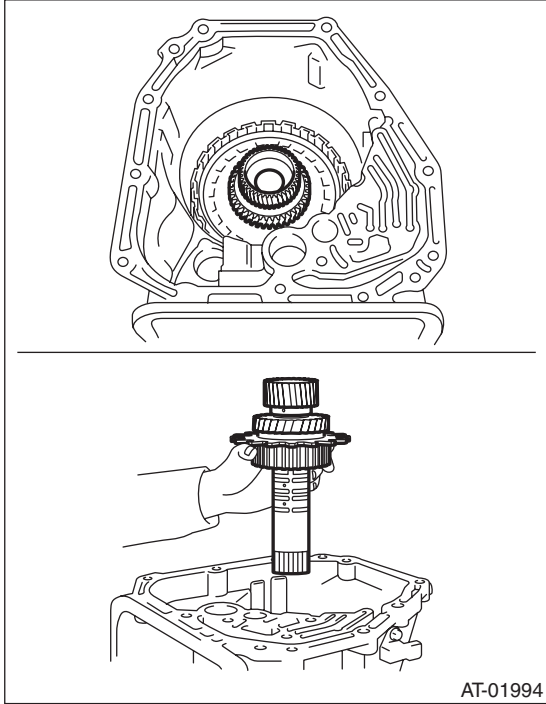
- 14) Remove the middle carrier assembly.



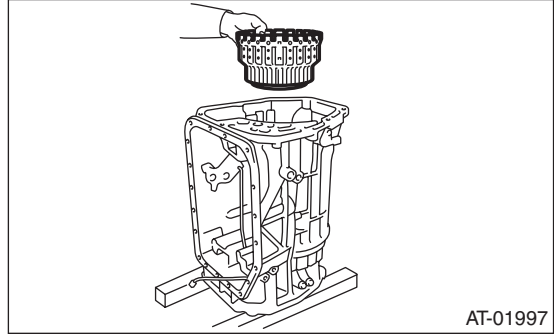
- 15) Remove the rear carrier assembly.



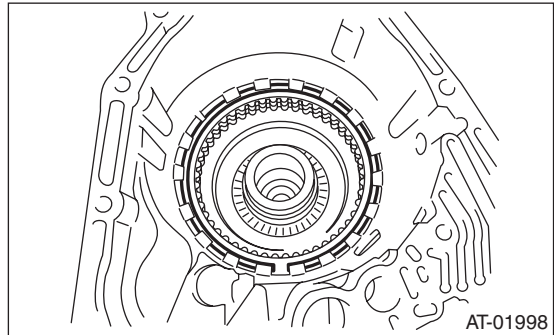
16) Remove the middle & rear sun gear assembly.



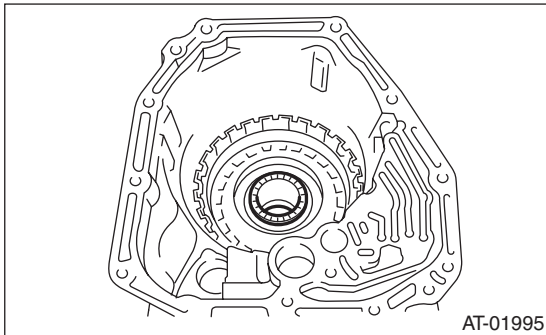
19) Remove the direct clutch assembly.



20) Remove the snap ring of reverse brake.

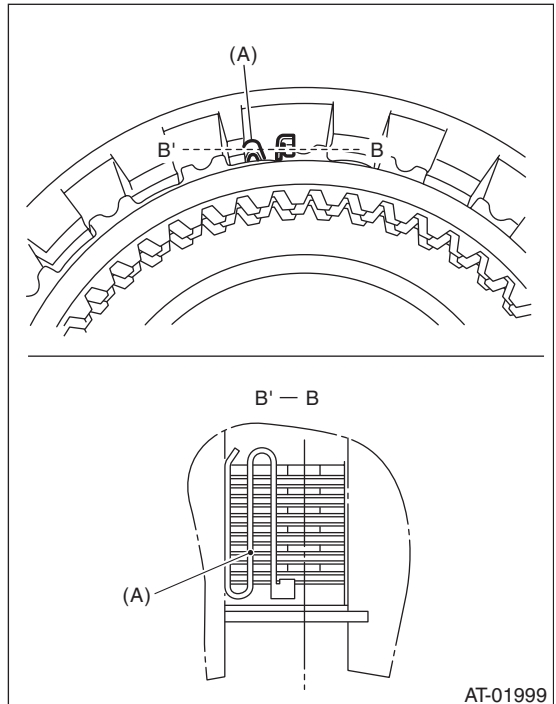


17) Remove the thrust needle bearing of high & low reverse clutch.

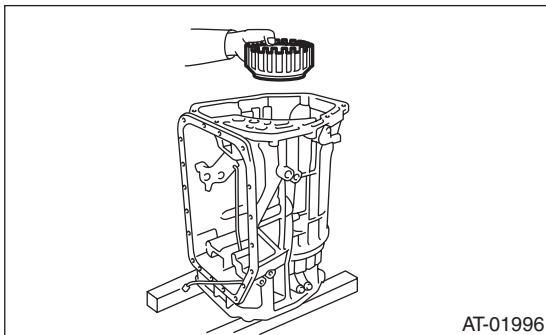


21) Remove the retaining plate.

22) Remove the leaf spring.



18) Remove the high & low reverse clutch assembly.



(A) Leaf spring

23) Take out the drive plate, driven plate and dish plate.

# AT Main Case

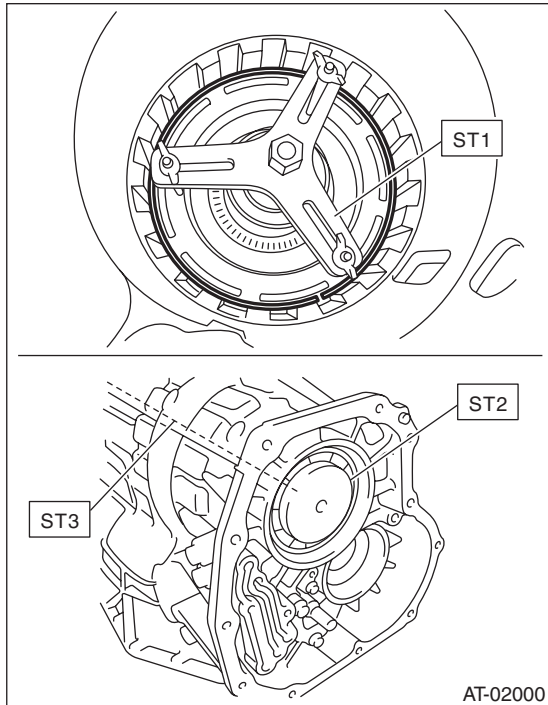
## AUTOMATIC TRANSMISSION

24) Remove the snap ring of the reverse brake spring retainer.

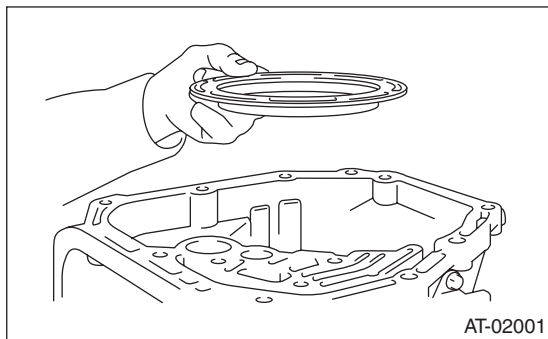
ST1 18762AA000 COMPRESSOR SPECIAL TOOL

ST2 18765AA000 COMPRESSOR SUPPORT

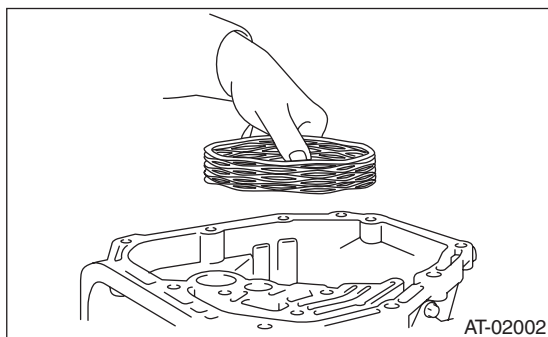
ST3 18763AA000 COMPRESSOR SHAFT



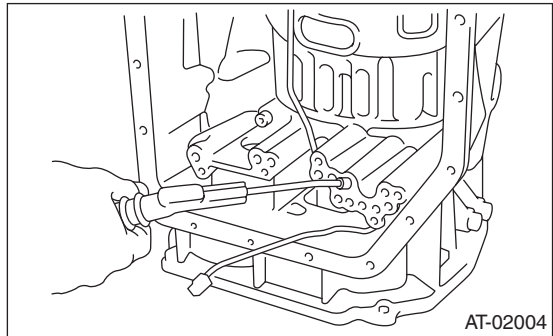
25) Remove the spring retainer.



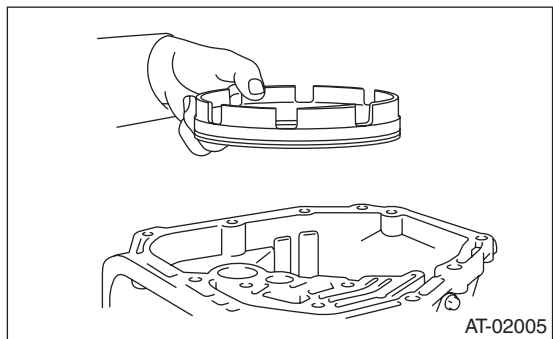
26) Remove the return spring.



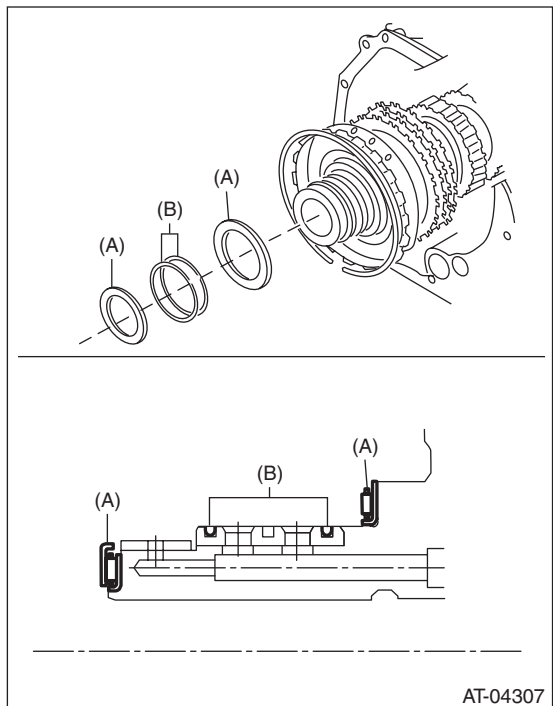
27) Apply compressed air.



28) Remove the reverse brake piston.



29) Remove the thrust bearing and the seal ring.

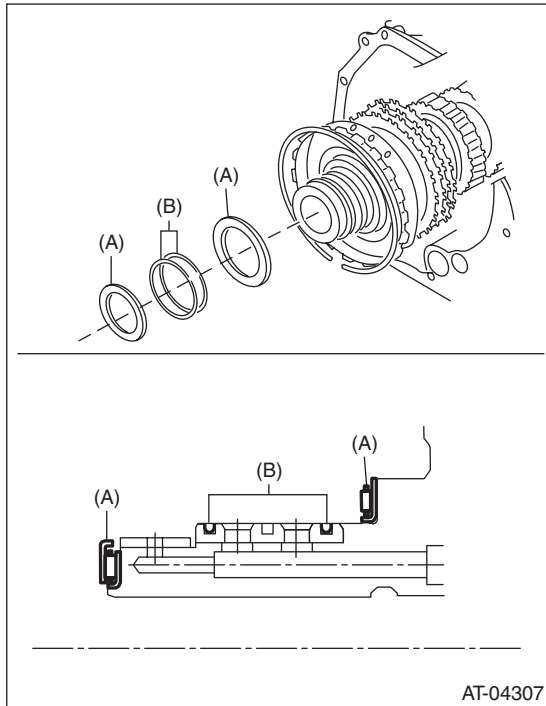


(A) Thrust bearing

(B) Seal ring

## B: INSTALLATION

- 1) Apply ATF to a new seal ring.
- 2) Install the thrust bearing and a new seal ring to the drum support.



- (A) Thrust bearing
- (B) Seal ring

- 3) Install the reverse brake piston.

**NOTE:**

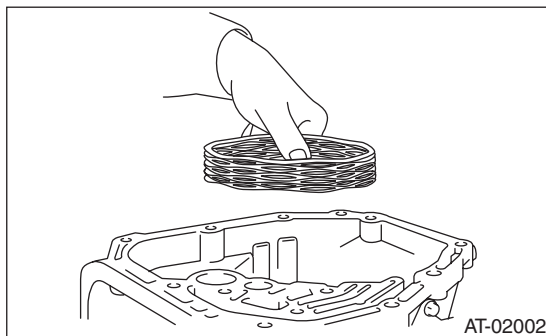
Apply ATF onto the piston sliding surface.

ST1 18762AA000 COMPRESSOR SPECIAL TOOL

ST2 18765AA000 COMPRESSOR SUPPORT

ST3 18763AA000 COMPRESSOR SHAFT

- 4) Install the return spring.

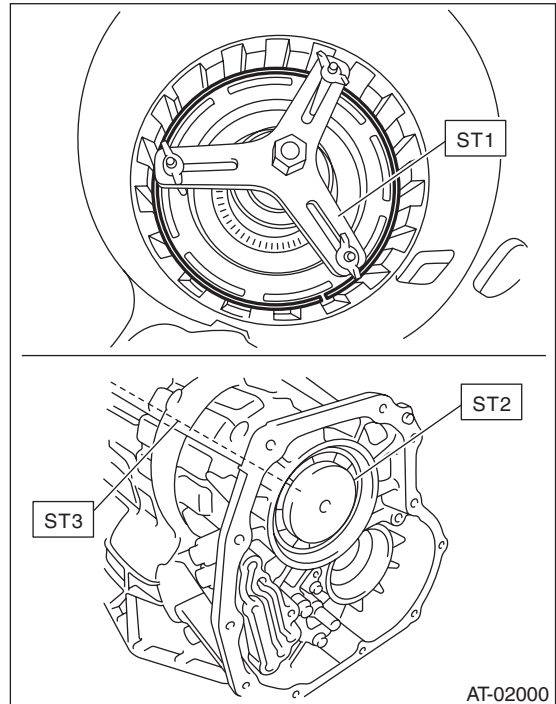


- 5) Install the spring retainer and snap ring.

ST1 18762AA000 COMPRESSOR SPECIAL TOOL

ST2 18765AA000 COMPRESSOR SUPPORT

ST3 18763AA000 COMPRESSOR SHAFT



- 6) Install the dish plate.

**NOTE:**

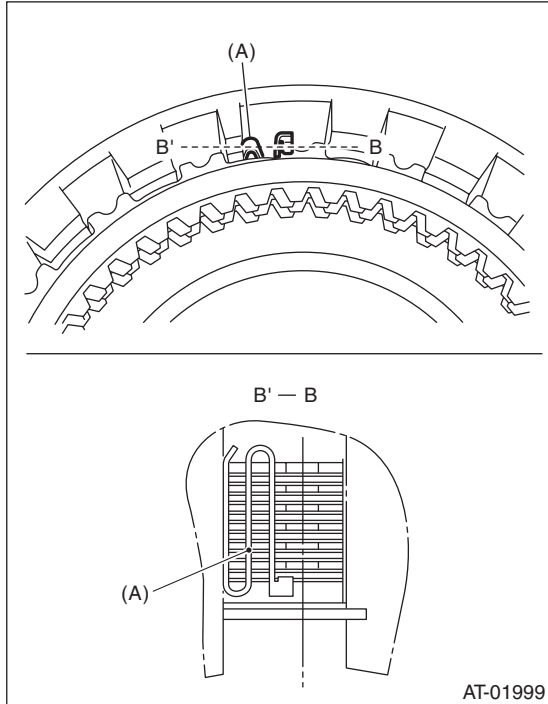
When installing, make sure that the identification mark is facing the front side of transmission.

- 7) Install the drive plate and driven plate.

# AT Main Case

## AUTOMATIC TRANSMISSION

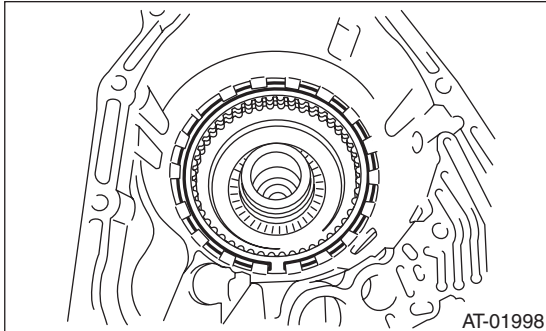
8) Install the leaf spring.



(A) Leaf spring

9) Install the retaining plate.

10) Install the snap ring of the reverse brake.

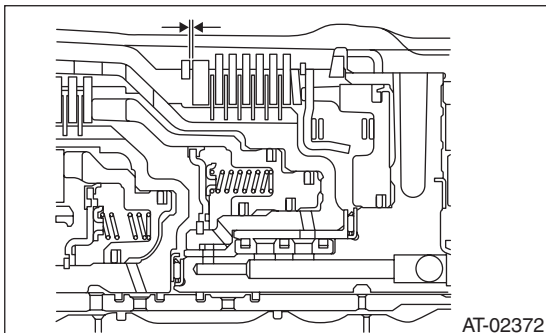


11) Perform the clearance check of reverse brake.

(1) Measure the clearance between retainer plate and snap ring using thickness gauge.

**Standard:**

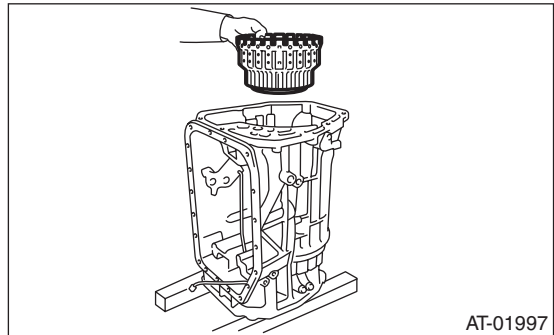
**0.7 — 1.1 mm (0.028 — 0.043 in)**



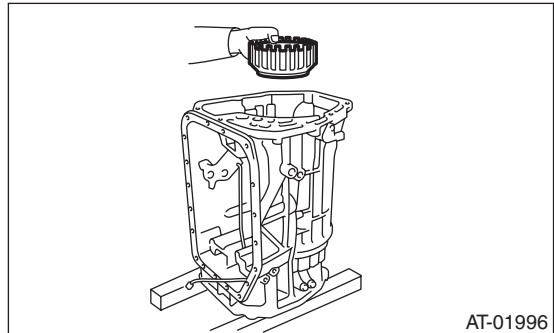
(2) If it is out of specification, select a suitable retainer plate from the following table and assemble it.

Retainer plate	
Part number	Thickness mm (in)
31567AB100	4.2 (0.165)
31567AB170	4.4 (0.173)
31567AB180	4.6 (0.181)
31567AB190	4.8 (0.189)
31567AB200	5.0 (0.197)

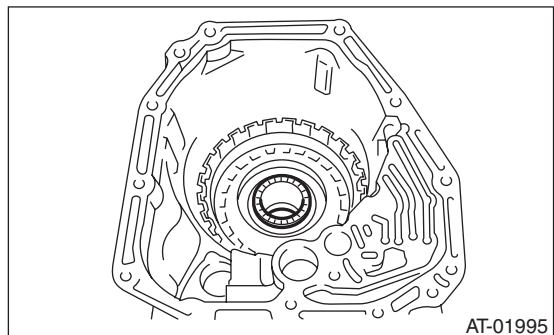
12) Install the direct clutch assembly.



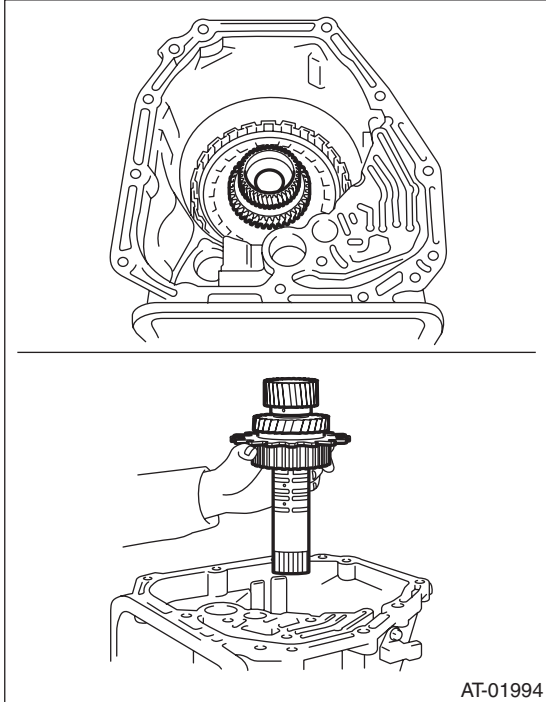
13) Install the high & low reverse clutch assembly.



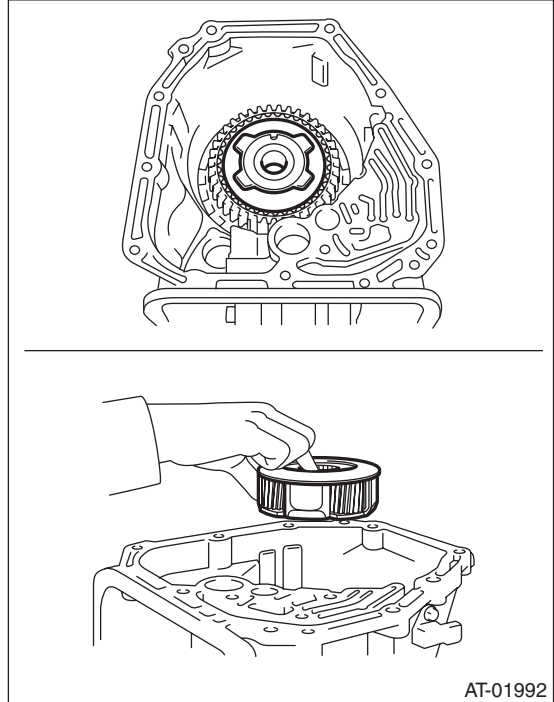
14) Install the thrust needle bearing of the high & low reverse clutch.



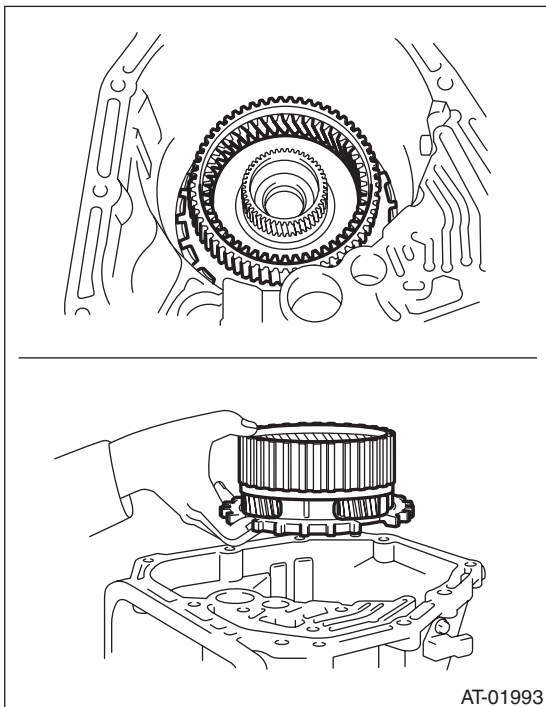
15) Install the middle & rear sun gear assembly.



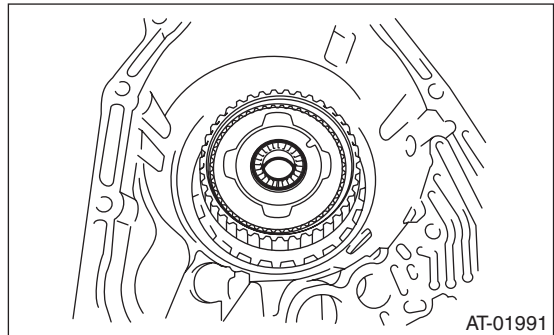
17) Install the middle carrier assembly.



16) Install the rear carrier assembly.

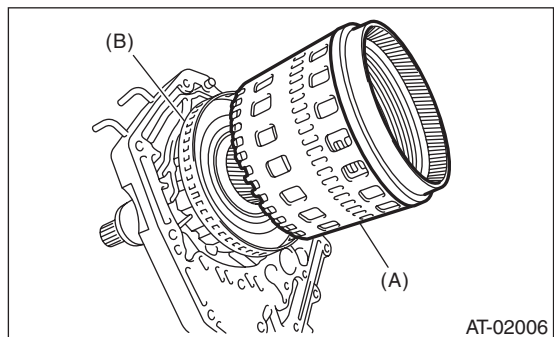


18) Install the thrust needle bearing of middle carrier assembly.



19) Measure the total end play, and select the bearing. <Ref. to 5AT-107, ADJUSTMENT, AT Main Case.>

20) Install the impact clutch pack assembly to oil pump cover.



- (A) Impact clutch pack ASSY
- (B) Front sun gear ASSY

21) Turn the transmission sideways.

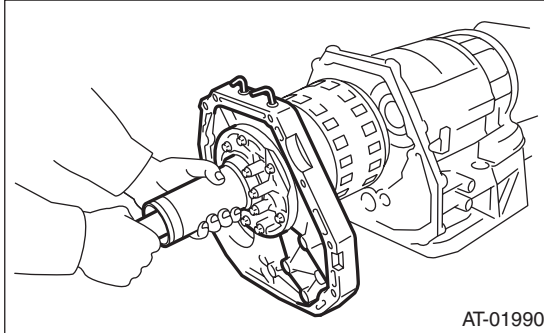


# AT Main Case

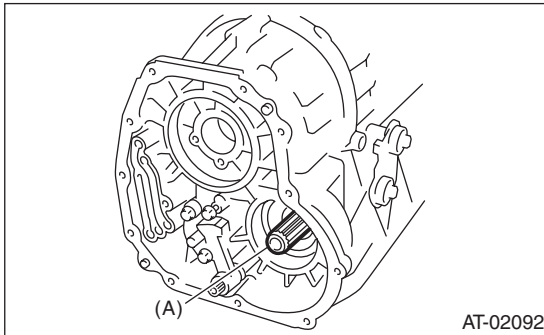
## AUTOMATIC TRANSMISSION

22) Install the oil pump cover.

- (1) Apply ATF to the O-ring of input clutch shaft.
- (2) Install the oil pump cover to AT main case while supporting the input clutch shaft and oil pump housing with your hand.



(3) Make sure the rear end of drive pinion shaft is engaged to the spline of reduction driven gear.

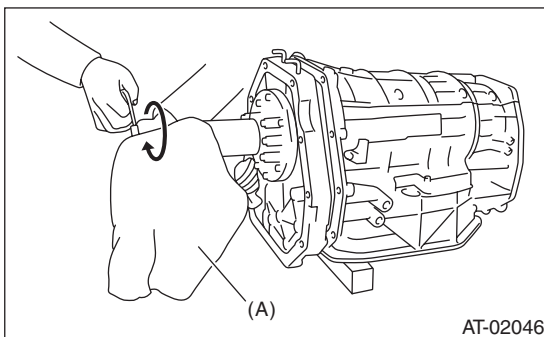


(A) Drive pinion shaft

(4) Protect the input clutch shaft with a cloth, and rotate to engage the spline of the input clutch and rear carrier using pliers.

### NOTE:

Work with pressing the oil pump cover.

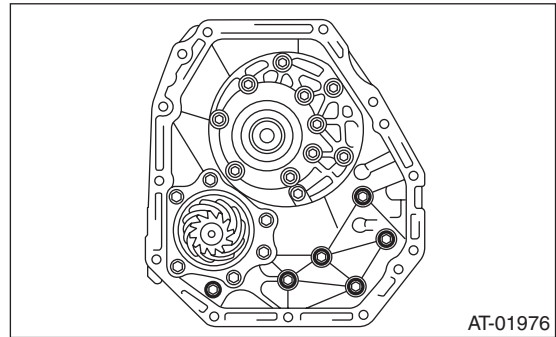


(A) Cloth

(5) Combine the oil pump cover with transmission main case.

### Tightening torque:

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**



23) Install the center differential carrier. <Ref. to 5AT-76, INSTALLATION, Center Differential Carrier.>

24) Install the reduction driven gear. <Ref. to 5AT-73, INSTALLATION, Reduction Driven Gear.>

25) Install the extension case. <Ref. to 5AT-67, INSTALLATION, Extension Case.>

26) Install the control valve body. <Ref. to 5AT-57, INSTALLATION, Control Valve Body.>

27) Install the converter case assembly to the transmission case assembly. <Ref. to 5AT-80, INSTALLATION, Converter Case.>

28) Install the air breather hose. <Ref. to 5AT-64, INSTALLATION, Air Breather Hose.>

29) Install the ATF cooler pipe. <Ref. to 5AT-62, INSTALLATION, ATF Cooler Pipe and Hose.>

30) Install the oil charge pipe together with an O-ring. <Ref. to 5AT-65, INSTALLATION, Oil Charge Pipe.>

31) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>

32) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

33) Perform Clear Memory 2 operation. <Ref. to 5AT(diag)-19, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

34) Execute the learning control promotion. <Ref. to 5AT(diag)-23, GENERAL DESCRIPTION, Learning Control.>

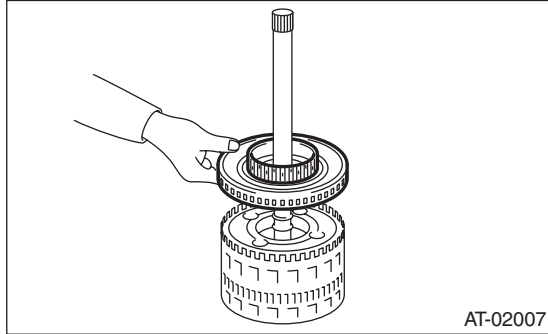
35) Perform the inspection at the end of repair work, and make sure there is no faulty as below;

- Excessive shift shock
- Oil leakage from the transmission body, etc.
- Occurrence of noise caused by interference etc.

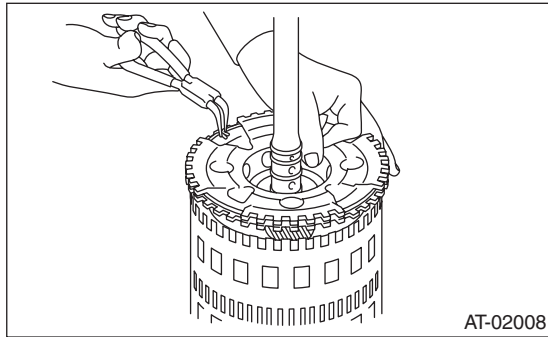
### C: DISASSEMBLY

#### 1. INPUT CLUTCH PACK ASSEMBLY

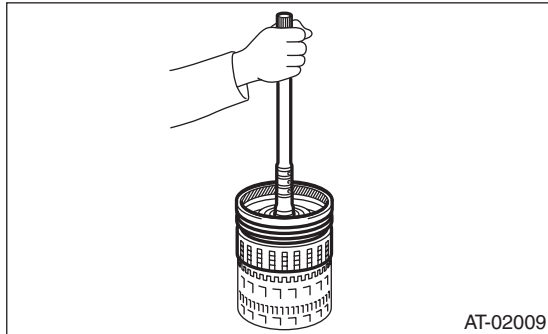
- 1) Remove the front sun gear.



- 2) Remove the thrust bearing.
- 3) Remove the snap ring, and then remove the front carrier.



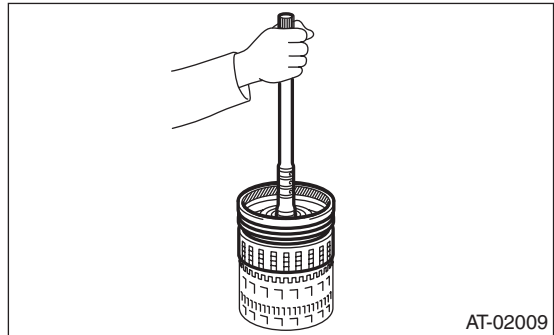
- 4) Remove the input clutch assembly from rear internal gear.



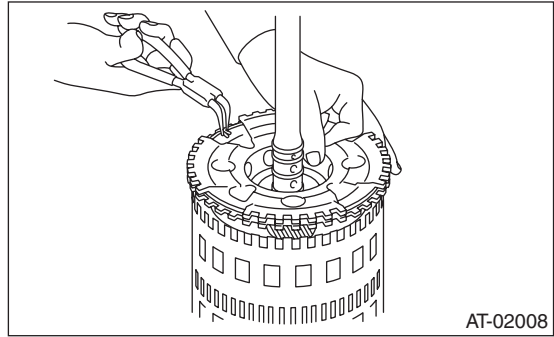
### D: ASSEMBLY

#### 1. INPUT CLUTCH PACK ASSEMBLY

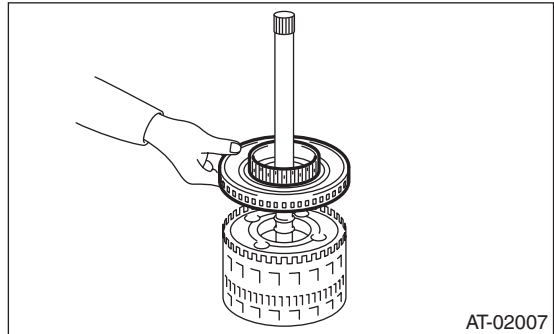
- 1) Assemble the input clutch assembly to rear internal gear.



- 2) Install the front carrier, and then install the snap ring.



- 3) Install the thrust bearing.
- 4) Install the front sun gear.



# AT Main Case

## AUTOMATIC TRANSMISSION

### E: INSPECTION

#### 1. FRONT, MIDDLE & REAR PLANETARY CARRIER ASSEMBLY

Check the following items.

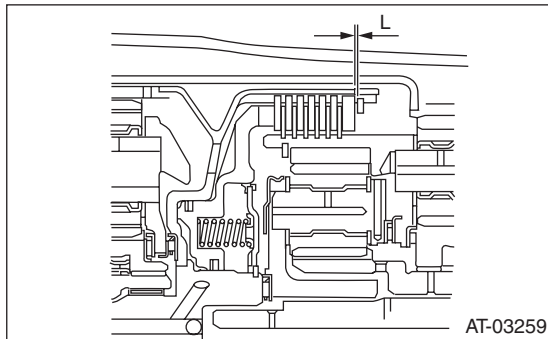
- Visually inspect the tooth surface of planetary gear, and replace with new part if damaged, broken or excessively worn.
- Inspect the planetary carrier body for damage or breakage.

#### 2. INPUT CLUTCH

- Check the clearance of the input clutch. Measure the clearance "L" between snap ring and retaining plate using a thickness gauge. If it is out of specification, replace the entire direct clutch assembly.
- Check for damage on the drive plate, driven plate and snap ring, and replace the entire input clutch assembly if damaged.

**Standard:**

**0.7 — 1.1 mm (0.028 — 0.043 in)**

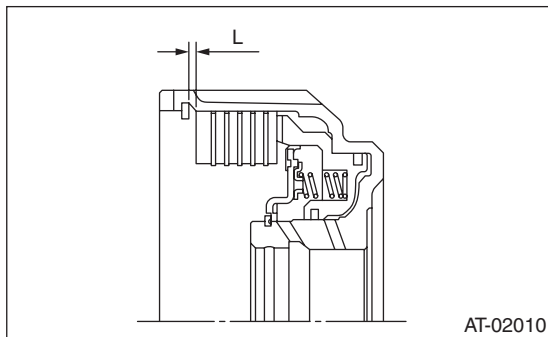


#### 3. HIGH & LOW REVERSE CLUTCH ASSY

- Check the clearance of the high & low reverse clutch.
- Measure the clearance "L" between snap ring and retaining plate using a thickness gauge. If it is out of specification, replace the entire high & low reverse clutch assembly.
- Check for damage on the drive plate, driven plate and snap ring, and replace the entire high & low reverse clutch assembly if damaged.

**Standard:**

**1.8 — 2.2 mm (0.070 — 0.087 in)**

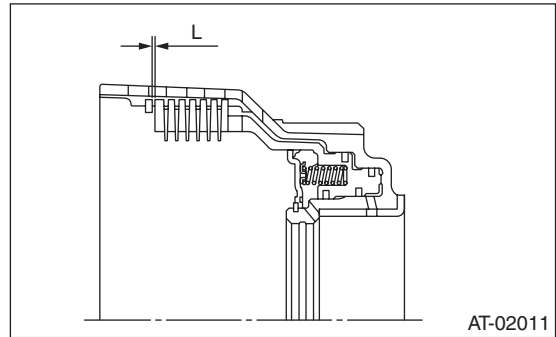


#### 4. DIRECT CLUTCH ASSEMBLY

- Check the clearance of direct clutch. Measure the clearance "L" between snap ring and retaining plate using a thickness gauge. If it is out of specification, replace them as direct clutch assembly.
- Check for damage on the drive plate, driven plate and snap ring, and replace the entire direct clutch assembly if damaged.

**Standard:**

**0.6 — 1.0 mm (0.024 — 0.039 in)**



#### 5. REVERSE BRAKE

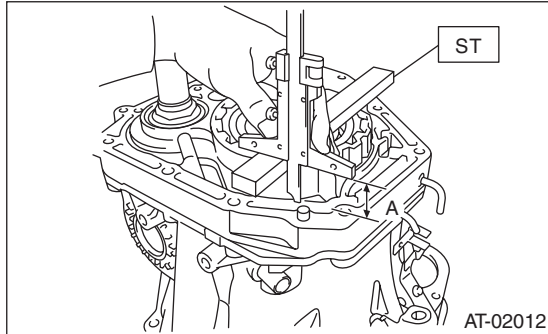
Check the following items.

- Drive plate facing for wear or damage
- Snap ring for wear, return spring for breakage, and spring retainer for deformation
- Lip seal and D-ring for damage
- Piston operation

### F: ADJUSTMENT

1) Using the ST, measure the height “A” from the AT main case mating surface to convex surface of oil pump cover.

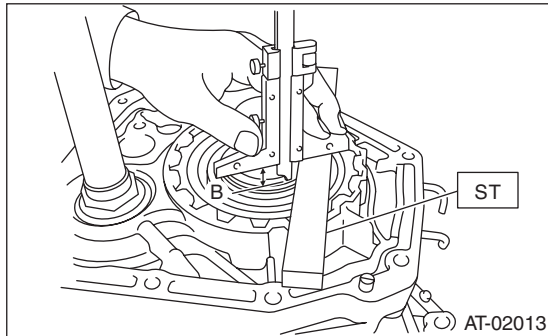
ST 499575400 GAUGE



A Measured value

2) Using the ST, measure the depth “B” from the convex surface of oil pump cover to thrust bearing transferring surface.

ST 499575400 GAUGE



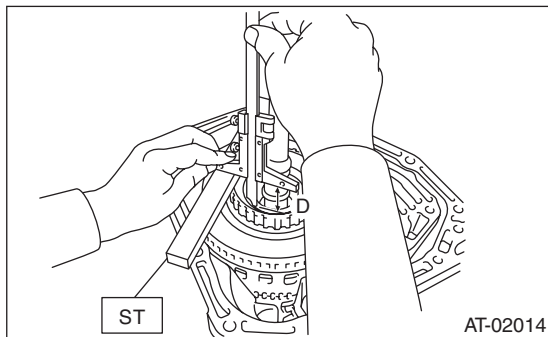
B Measured value

3) Calculate the measured value from step 1) and 2), and then set the calculated value as “C”

Calculation formula:  $C = A - B$

4) Using the ST, measure the depth “D” from the AT main case mating surface to thrust bearing transferring surface of front sun gear.

ST 499575400 GAUGE



D Measured value

5) Set the value as “E” which subtract the thickness of ST (GAUGE) from the measured value on step 4).

Calculation:  $E \text{ (mm)} = D - 15$

$[E \text{ (in)} = D - 0.59]$

6) Calculation formula:

Select one thrust bearing from the table to adjust clearance within 0.25 — 0.55 mm (0.0098 — 0.022 in).

When clearances are 0.25 mm (0.0098 in):

$T \text{ (mm)} = E - C + 0.03$

$[T \text{ (in)} = E - C + 0.0012]$

When clearances are 0.55 mm (0.022 in):

$T \text{ (mm)} = E - C + 0.27$

$[T \text{ (in)} = E - C + 0.012]$

T: Thrust bearing thickness

C: Distance from oil pump cover mating surface to rear end of oil pump cover

E: Depth from mating surface of AT main case to bearing surface of front sun gear

NOTE:

Calculation formula for “T” above is applied when measuring with the ST (499575400 GAUGE). In the calculation without using ST, substitute the thickness of collar used to calculate the value “E” on step 5).

Thrust bearing	
Part number	Thickness mm (in)
806548020	3.2 (0.126)
606548030	3.4 (0.134)
806548040	3.6 (0.142)
806548050	3.8 (0.150)
806548060	4.0 (0.157)
806548070	4.2 (0.165)

# Transmission Control Device

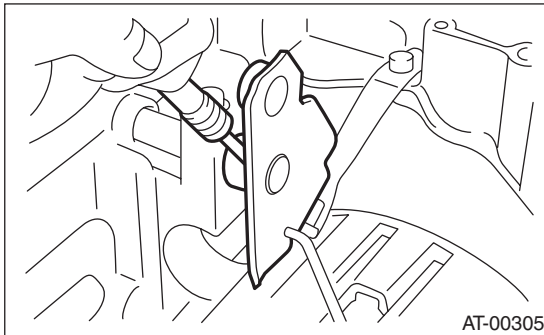
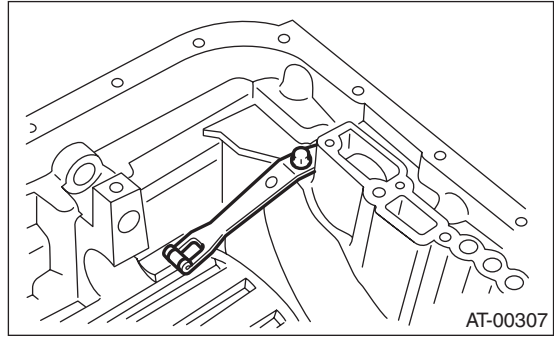
## AUTOMATIC TRANSMISSION

### 36. Transmission Control Device

#### A: REMOVAL

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5AT-38, REMOVAL, Automatic Transmission Assembly.>
- 2) Pull out the torque converter assembly. <Ref. to 5AT-66, REMOVAL, Torque Converter Assembly.>
- 3) Lift up the lever on the rear side of transmission harness connector, and then disconnect it from the stay.
- 4) Disconnect the air breather hose. <Ref. to 5AT-64, REMOVAL, Air Breather Hose.>
- 5) Wrap vinyl tape around the nipple attached to the air breather hose.
- 6) Remove the pitching stopper bracket.
- 7) Remove the control valve body assembly. <Ref. to 5AT-56, REMOVAL, Control Valve Body.>
- 8) Pull out the straight pin of manual plate.

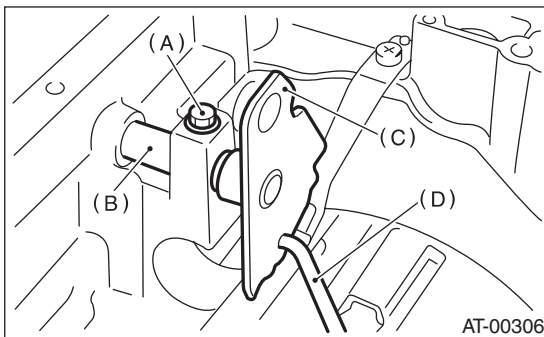
- 10) Remove the detent spring.



- 9) Remove the bolts securing select lever, and then remove the select lever, manual plate and parking rod.

#### NOTE:

Be careful not to damage the lips of press-fitted oil seal in the case.



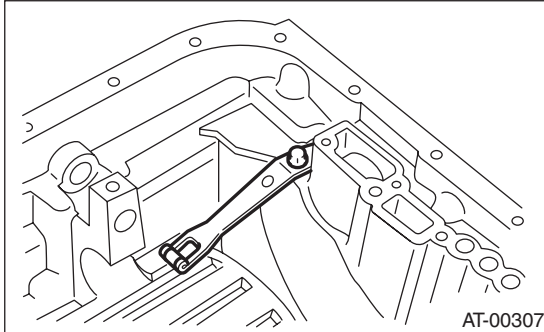
- (A) Bolt
- (B) Range select lever
- (C) Manual plate
- (D) Parking rod

## B: INSTALLATION

1) Install the detent spring to the transmission case.

**Tightening torque:**

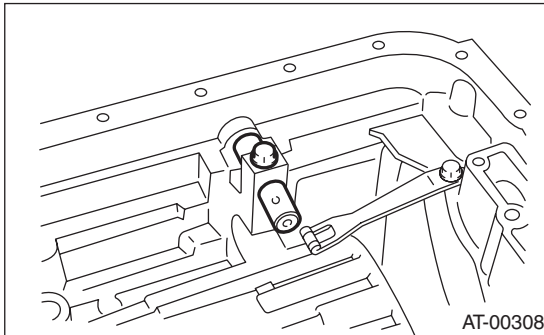
**7 N·m (0.7 kgf·m, 5.2 ft-lb)**



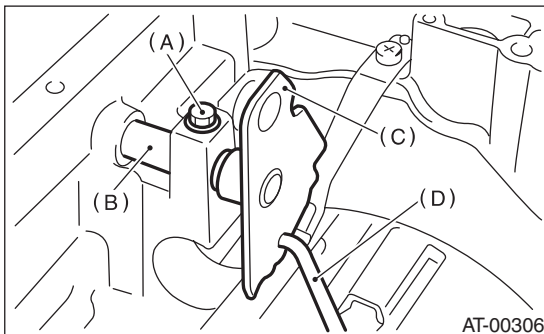
2) Insert the select lever, and then tighten the bolt.

**Tightening torque:**

**6 N·m (0.6 kgf·m, 4.4 ft-lb)**

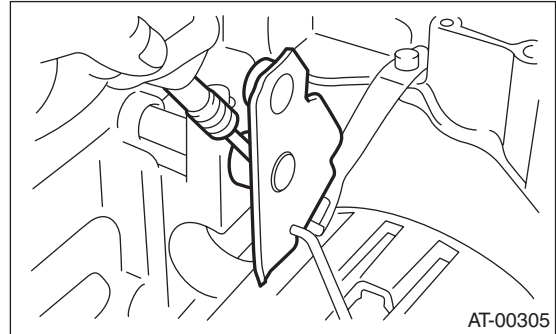


3) Insert the manual plate and parking rod.



- (A) Bolt
- (B) Range select lever
- (C) Manual plate
- (D) Parking rod

4) Insert the spring pin to the manual plate.



5) Install the oil pan and the control valve body assembly. <Ref. to 5AT-57, INSTALLATION, Control Valve Body.>

6) Install the pitching stopper bracket.

**Tightening torque:**

**41 N·m (4.2 kgf·m, 30.2 ft-lb)**

7) Insert the transmission connector to the stay.

8) Install the air breather hose. <Ref. to 5AT-64, INSTALLATION, Air Breather Hose.>

9) Install the torque converter assembly. <Ref. to 5AT-66, INSTALLATION, Torque Converter Assembly.>

10) Install the transmission assembly to the vehicle. <Ref. to 5AT-42, INSTALLATION, Automatic Transmission Assembly.>

## C: INSPECTION

Make sure the manual lever and detent spring are not worn or otherwise damaged.

# Transmission Control Device

AUTOMATIC TRANSMISSION

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# Basic Diagnostic Procedure

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

Step	Check	Yes	No
<b>1 CHECK PRE-INSPECTION.</b> 1) Ask the customer when and how the trouble occurred using the interview checklist. <Ref. to 5AT(diag)-4, Check List for Interview.> 2) Before performing diagnosis, inspect the following items which may influence AT problems. <ul style="list-style-type: none"> <li>• General Inspection &lt;Ref. to 5AT(diag)-5, INSPECTION, General Description.&gt;</li> <li>• Oil leakage</li> <li>• Stall speed test &lt;Ref. to 5AT-32, Stall Test.&gt;</li> <li>• Line pressure test &lt;Ref. to 5AT-34, Line Pressure Test.&gt;</li> <li>• Transfer Clutch Pressure Test &lt;Ref. to 5AT-36, Transfer Clutch Pressure Test.&gt;</li> <li>• Time Lag Test &lt;Ref. to 5AT-33, Time Lag Test.&gt;</li> <li>• Road Test &lt;Ref. to 5AT-31, Road Test.&gt;</li> <li>• Inhibitor Switch &lt;Ref. to 5AT-50, Inhibitor Switch.&gt;</li> </ul>	Is the unit that is thought to influence the AT problem working properly?	Go to step 2.	Repair or replace each item.
<b>2 CHECK AT OIL TEMP LIGHT.</b> After the ignition switch is turned to ON, wait for at least 2 seconds.	Does the AT OIL TEMP light illuminate?	Go to step 4.	Go to step 3.
<b>3 CHECK AT OIL TEMP LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Check the AT OIL TEMP light. <Ref. to 5AT(diag)-26, INSPECTION, AT Oil Temp Warning Light Display.> 3) After the ignition switch is turned to ON, wait for at least 2 seconds.	Does the AT OIL TEMP light blink?	Go to step 4.	Go to step 5.
<b>4 CHECK DTC.</b> Read the DTC. <Ref. to 5AT(diag)-20, OPERATION, Read Diagnostic Trouble Code (DTC).> NOTE: If the communication function of Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to 5AT(diag)-28, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, Diagnostic Procedure for Subaru Select Monitor Communication.>	Is DTC displayed?	Go to step 6. NOTE: Record all DTC.	Go to step 5.
<b>5 PERFORM GENERAL DIAGNOSTICS.</b> 1) Inspect using "Diagnostic Procedure without Diagnostic Trouble Code (DTC)". <Ref. to 5AT(diag)-105, Diagnostic Procedure without Diagnostic Trouble Code (DTC).> 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. <Ref. to 5AT(diag)-21, Inspection Mode.> 4) Display DTC.	Is DTC displayed?	Go to step 6.	Inspect using "General Diagnostic Table". <Ref. to 5AT(diag)-112, General Diagnostic Table.>



# Basic Diagnostic Procedure

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
6	<p><b>PERFORM DIAGNOSIS.</b></p> <p>1) Inspect using the “Diagnostic Procedure with Diagnostic Trouble Code (DTC)”. &lt;Ref. to 5AT(diag)-34, Diagnostic Procedure with Diagnostic Trouble Code (DTC).&gt;</p> <p>NOTE: For DTC table, refer to “List of Diagnostic Trouble Code (DTC)”. &lt;Ref. to 5AT(diag)-31, List of Diagnostic Trouble Code (DTC).&gt;</p> <p>2) Repair the trouble cause.</p> <p>3) Perform the Clear Memory Mode.</p> <p>4) Perform the Inspection Mode. &lt;Ref. to 5AT(diag)-21, Inspection Mode.&gt;</p> <p>5) Display DTC.</p>	Is DTC displayed?	Inspect using the “Diagnostic Procedure with Diagnostic Trouble Code (DTC)”. <Ref. to 5AT(diag)-34, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Inspect using “General Diagnostic Table”. <Ref. to 5AT(diag)-112, General Diagnostic Table.>

## Check List for Interview

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 2. Check List for Interview

#### A: CHECK

Check the following items when a problem has occurred.

#### NOTE:

Use copies of this page for interviewing customers.

Customer's name			
Date of purchase			
Date of repair			
Transmission model	Transmission	V.I.N.	
Odometer reading	km (miles)		
Symptom	<input type="checkbox"/> No up-shift		
	<input type="checkbox"/> No down-shift		
	<input type="checkbox"/> No kick down		
	<input type="checkbox"/> Vehicle does not move ( <input type="checkbox"/> Any position <input type="checkbox"/> Particular position)		
	<input type="checkbox"/> Lock-up malfunction		
	<input type="checkbox"/> Noise or vibration		
	<input type="checkbox"/> Shift shock or slip		
	<input type="checkbox"/> Select lever does not move		
	<input type="checkbox"/> Others (                                    )		
Frequency	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (     times a day)		
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others (                                    )		
Place	<input type="checkbox"/> Highland <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner city <input type="checkbox"/> Uphill <input type="checkbox"/> Rough road <input type="checkbox"/> Others (                                    )		
Ambient air temperature	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold		
Vehicle speed	km/h (MPH)		
AT warning light (AT OIL TEMP light)	<input type="checkbox"/> Blinks continuously	<input type="checkbox"/> Not blink	
Select lever position	<input type="checkbox"/> P <input type="checkbox"/> R <input type="checkbox"/> N <input type="checkbox"/> D <input type="checkbox"/> Manual mode		
Driving condition	<input type="checkbox"/> Not affected	<input type="checkbox"/> At starting	<input type="checkbox"/> While idling
	<input type="checkbox"/> At racing	<input type="checkbox"/> While accelerating	<input type="checkbox"/> While cruising
	<input type="checkbox"/> While decelerating	<input type="checkbox"/> While turning ( <input type="checkbox"/> RH/ <input type="checkbox"/> LH)	
Manual mode	<input type="checkbox"/> ON <input type="checkbox"/> OFF		

# General Description

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 3. General Description

#### A: CAUTION

- **Supplemental Restraint System “Airbag”**

The airbag system wiring harness is routed near the TCM.

#### CAUTION:

- All the airbag system wiring harnesses and connectors are colored yellow. Do not use an electric test equipment to check these circuits.
- Be careful not to damage the airbag system wiring harness when performing diagnostics or servicing the TCM.

- **Measurement**

When measuring the voltage and resistance of the ECM, TCM or each sensor, use a tapered pin with a diameter of less than 0.64 mm (0.025 in) in order to avoid poor contact. Do not insert a pin of more than 0.65 mm (0.026 in) diameter.

#### B: INSPECTION

##### 1. BATTERY

Measure the battery voltage and specific gravity of the electrolyte.

**Standard voltage:**

**12 V or more**

**Specific gravity:**

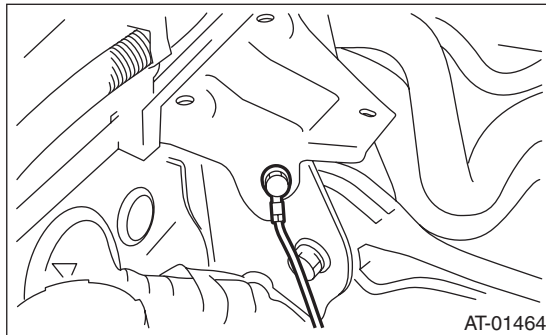
**1.260 or more**

##### 2. TRANSMISSION GROUND

Make sure that the ground terminal bolt is tightened securely.

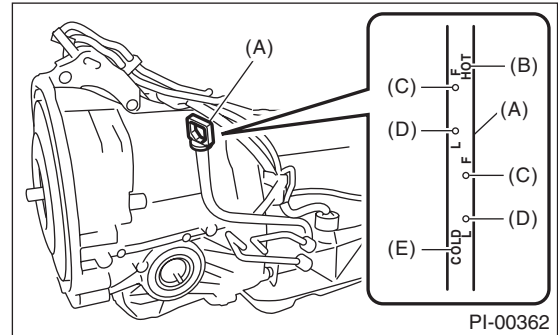
**Tightening torque:**

**13 N·m (1.3 kgf·m, 9.4 ft·lb)**



##### 3. ATF LEVEL

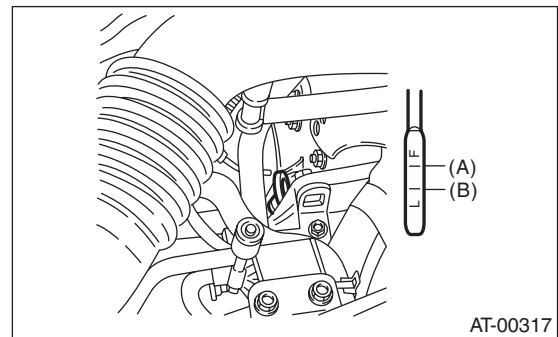
Make sure that ATF level is the specified amount. <Ref. to 5AT-28, INSPECTION, Automatic Transmission Fluid.>



- (A) Level gauge
- (B) Inspection position when “HOT”
- (C) Upper level
- (D) Lower level
- (E) Inspection position when “COLD”

##### 4. FRONT DIFFERENTIAL OIL LEVEL

Make sure the front differential oil level is the specified amount. <Ref. to 5AT-30, INSPECTION, Differential Gear Oil.>



- (A) Upper level
- (B) Lower level

# General Description

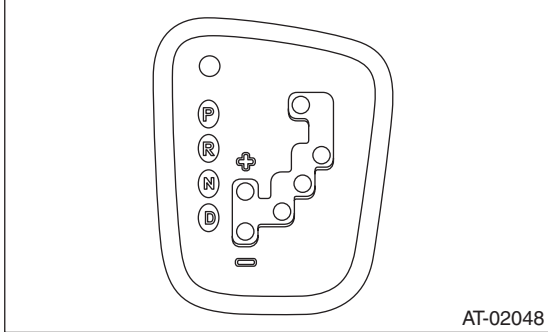
## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### 5. OPERATION OF SHIFT SELECT LEVER

Make sure there is no noise, dragging or contact pattern in each select lever range.

**WARNING:**

**Stop the engine while checking operation of the select lever.**



### C: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
<p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

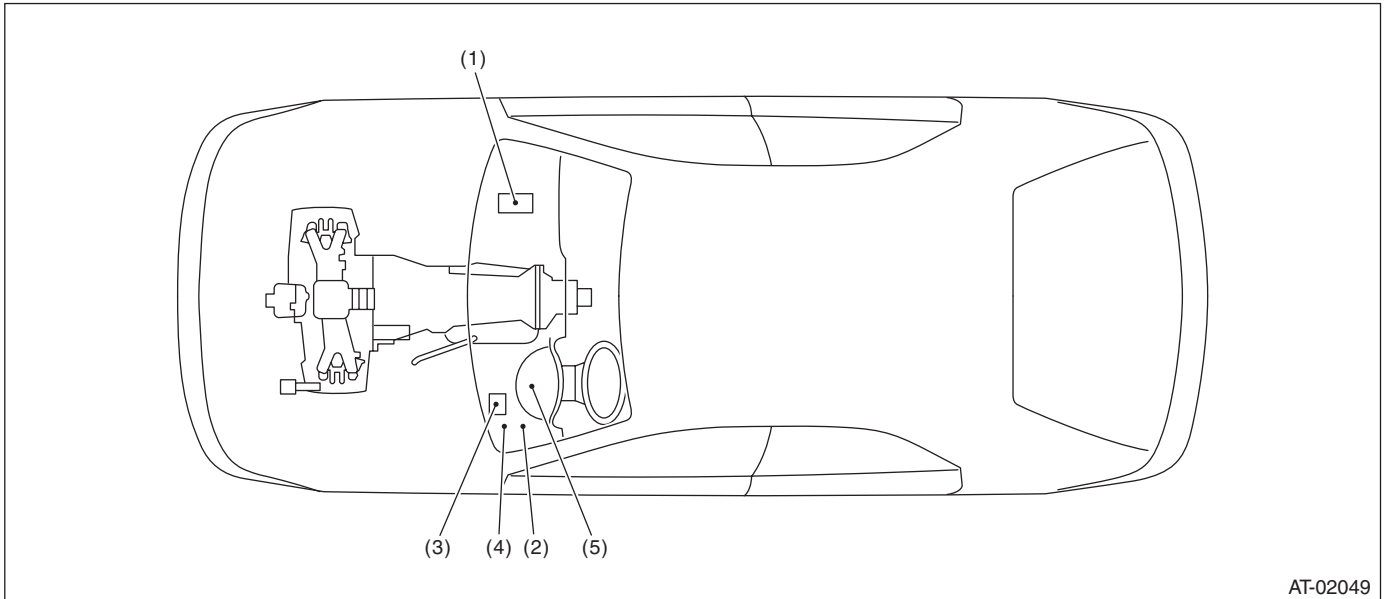
# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 4. Electrical Component Location

### A: LOCATION

#### 1. CONTROL MODULE



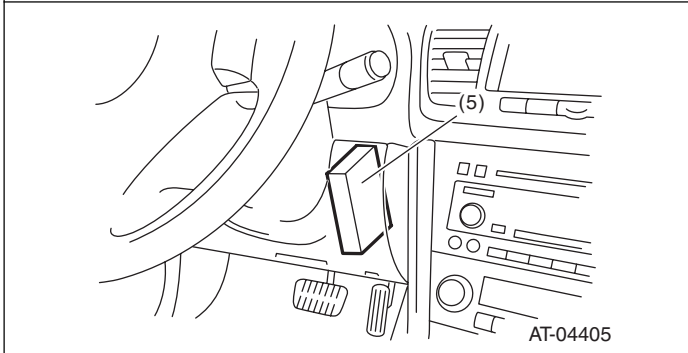
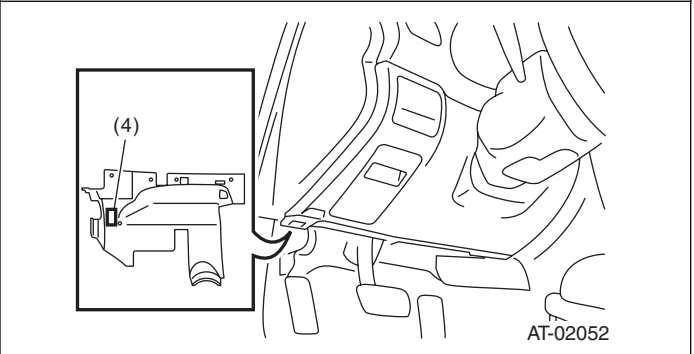
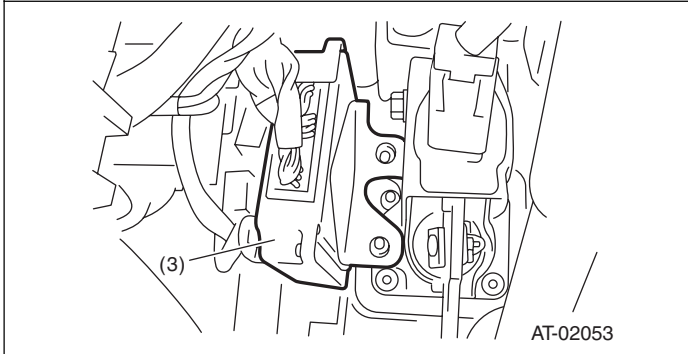
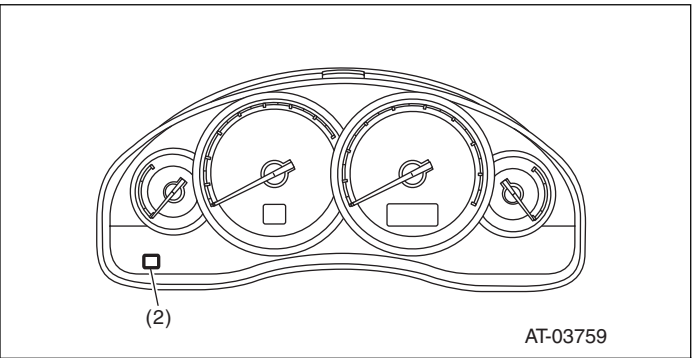
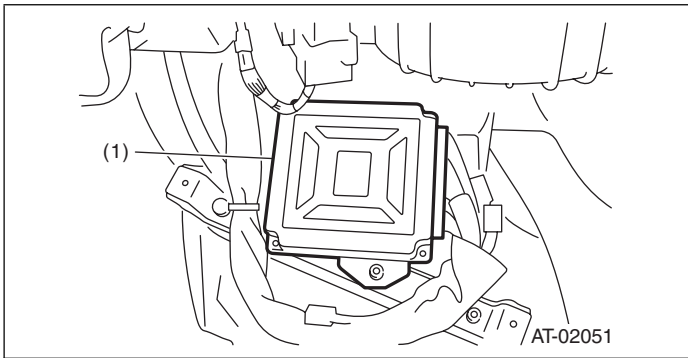
(1) Engine control module (ECM)  
(2) AT OIL TEMP light (AT warning light)

(3) Transmission control module (TCM)

(4) Data link connector  
(5) Body integrated unit

# Electrical Component Location

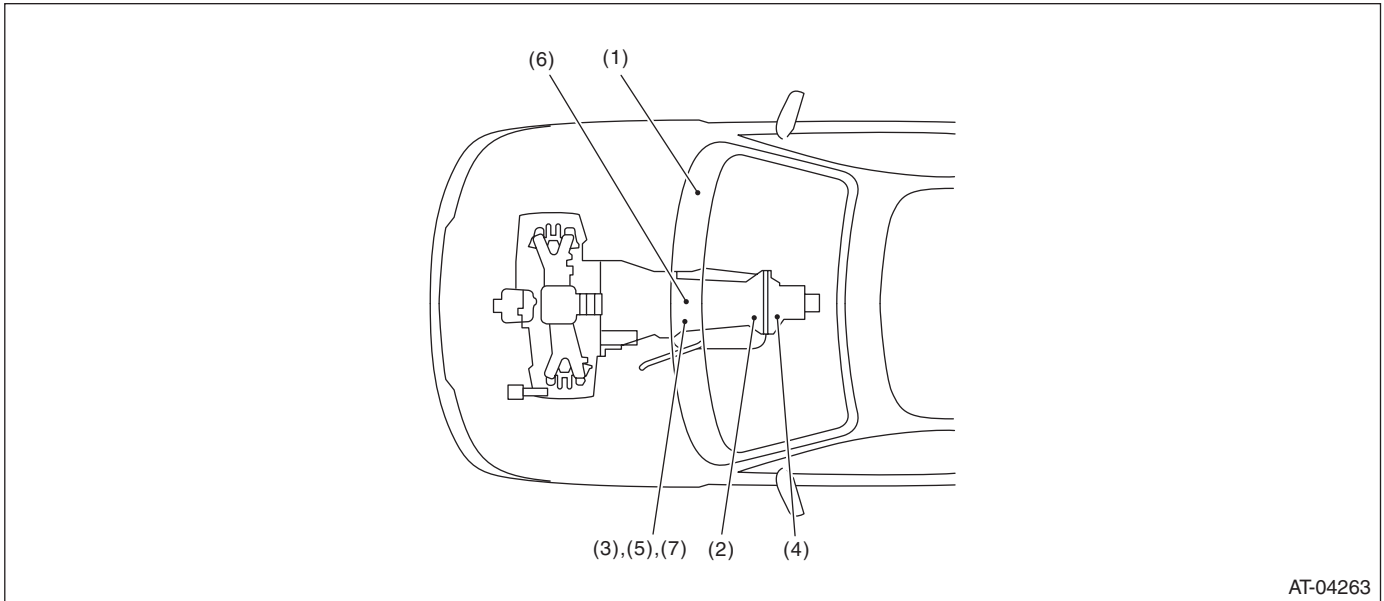
## AUTOMATIC TRANSMISSION (DIAGNOSTICS)



# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 2. SENSOR

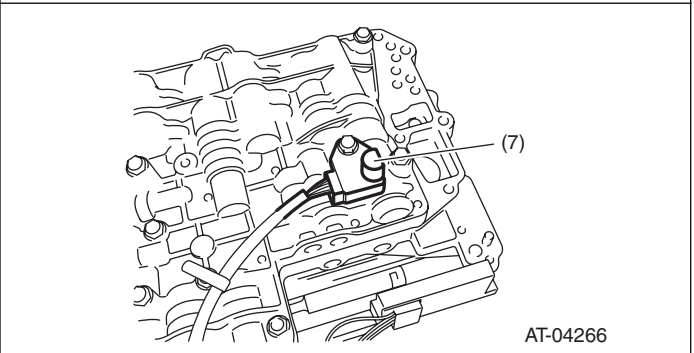
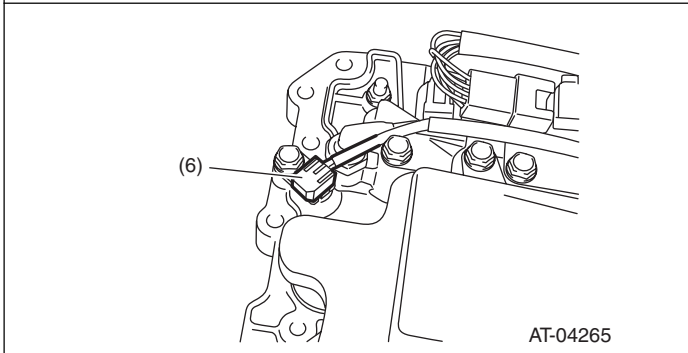
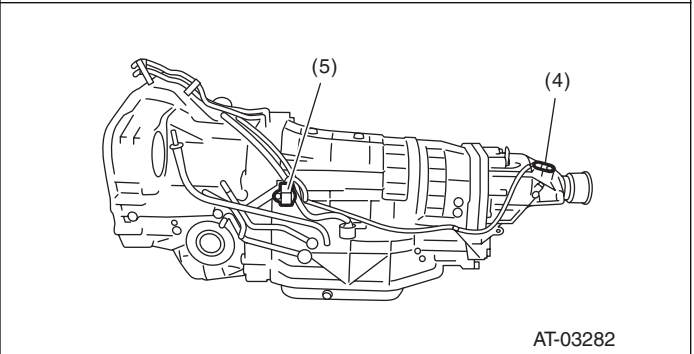
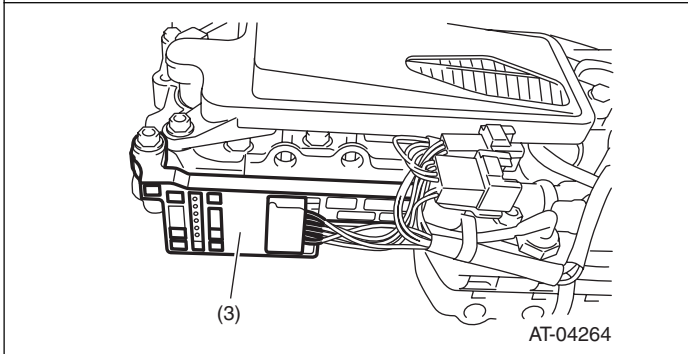
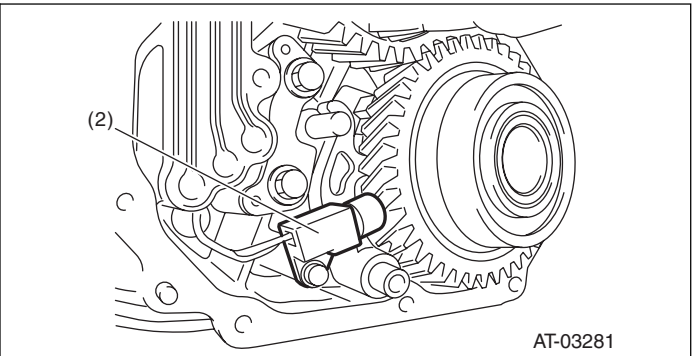
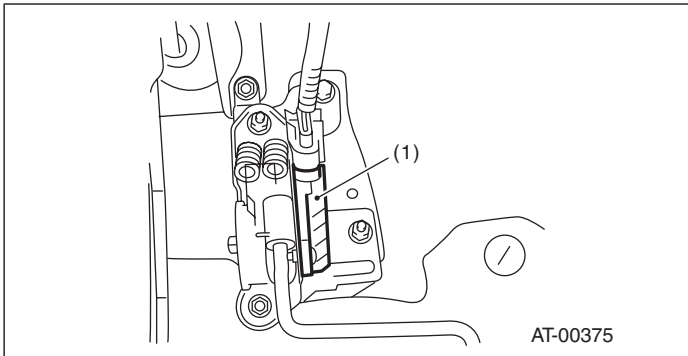


AT-04263

- |                                       |                               |                            |
|---------------------------------------|-------------------------------|----------------------------|
| (1) Accelerator pedal position sensor | (4) Rear vehicle speed sensor | (6) ATF temperature sensor |
| (2) Front vehicle speed sensor        | (5) Turbine speed sensor 1    | (7) Turbine speed sensor 2 |
| (3) Inhibitor switch                  |                               |                            |

# Electrical Component Location

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

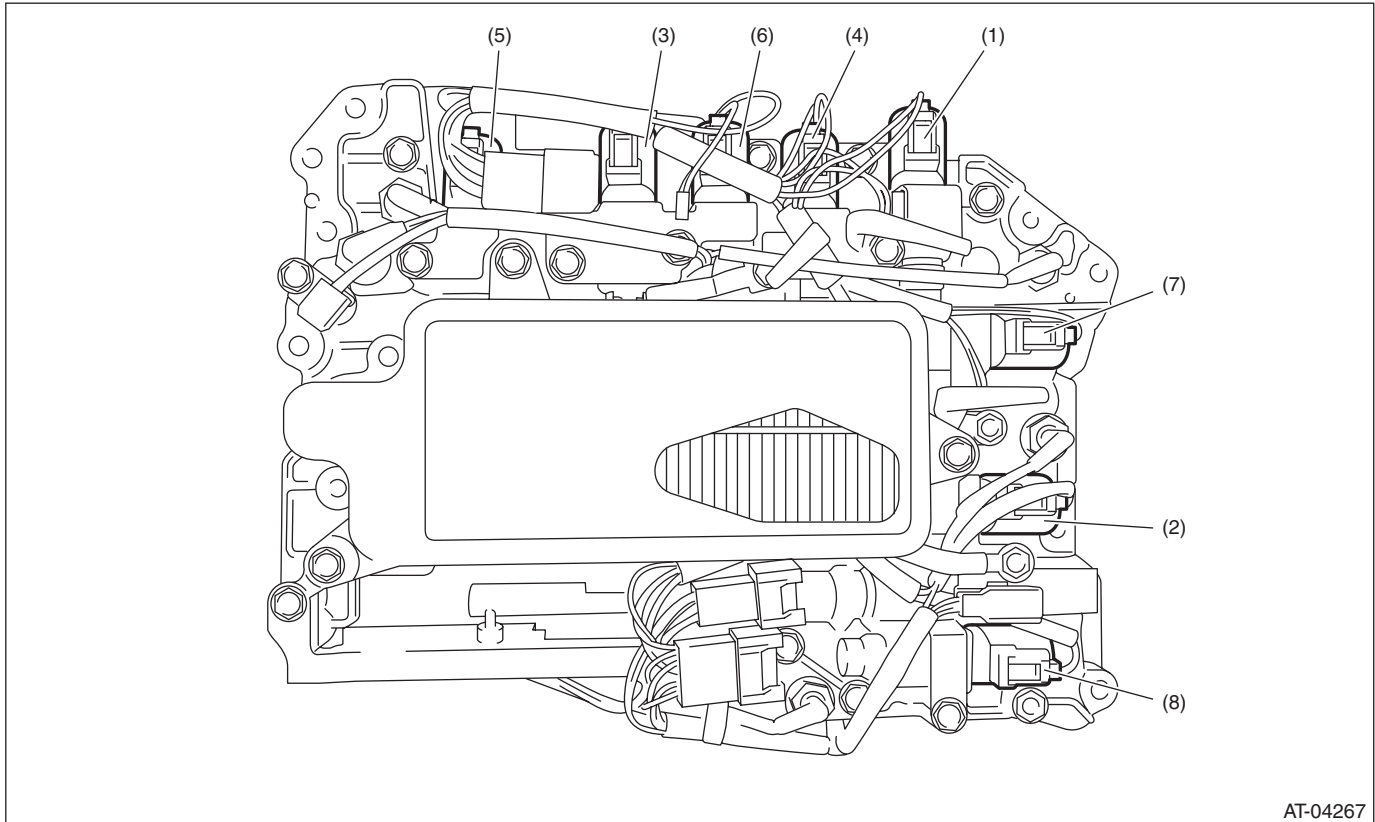




# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 3. SOLENOID



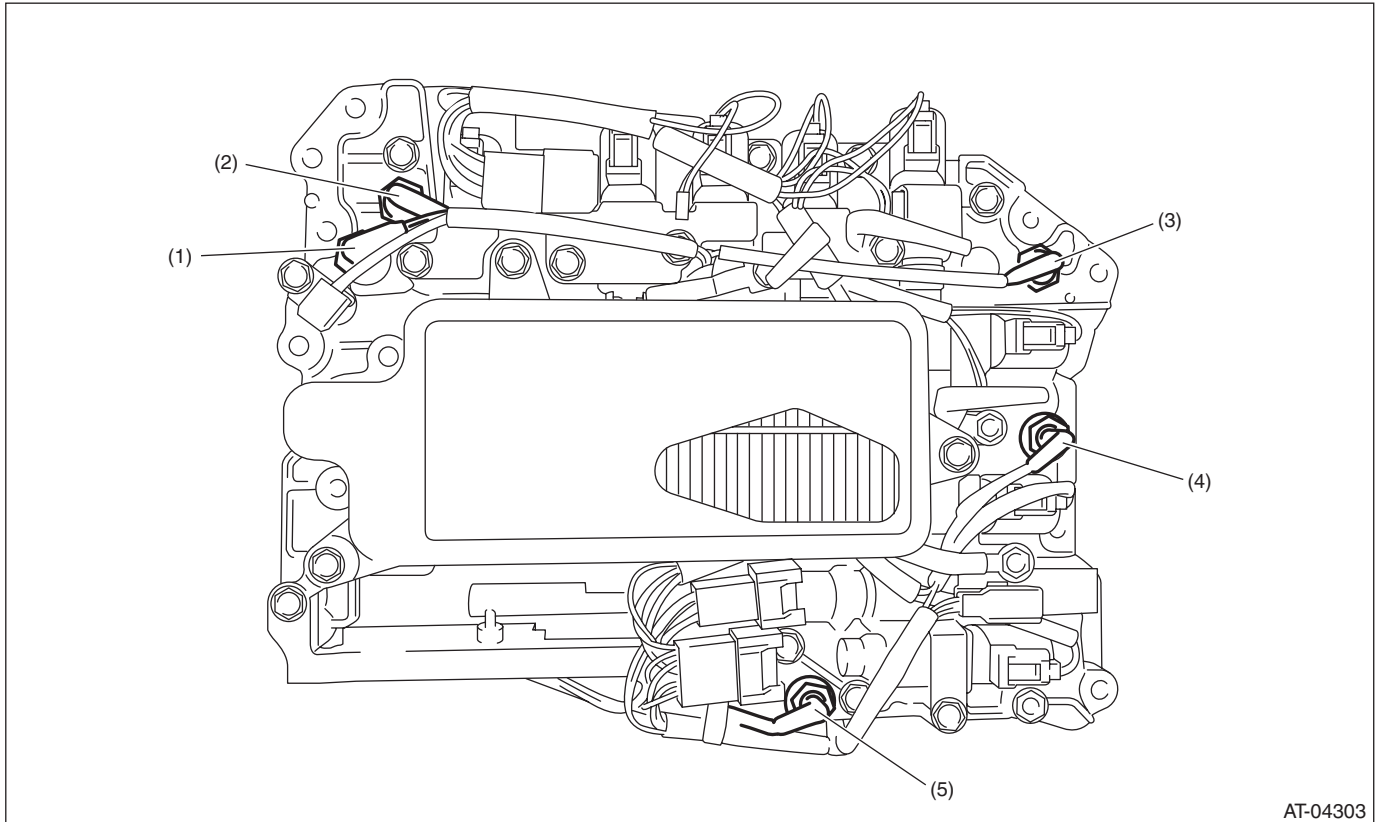
AT-04267

- |   |                                   |                                      |
|---|-----------------------------------|--------------------------------------|
| (1) High & low reverse clutch linear solenoid | (3) Front brake linear solenoid   | (6) Lock-up pressure linear solenoid |
| (2) Direct clutch linear solenoid             | (4) Input clutch linear solenoid  | (7) Transfer linear solenoid         |
| (5) Line pressure linear solenoid             | (8) Forward brake linear solenoid |                                      |

# Electrical Component Location

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 4. OIL PRESSURE SWITCH



AT-04303

(1) Front brake oil pressure switch  
(2) Input clutch oil pressure switch

(3) High & low reverse clutch oil pressure switch

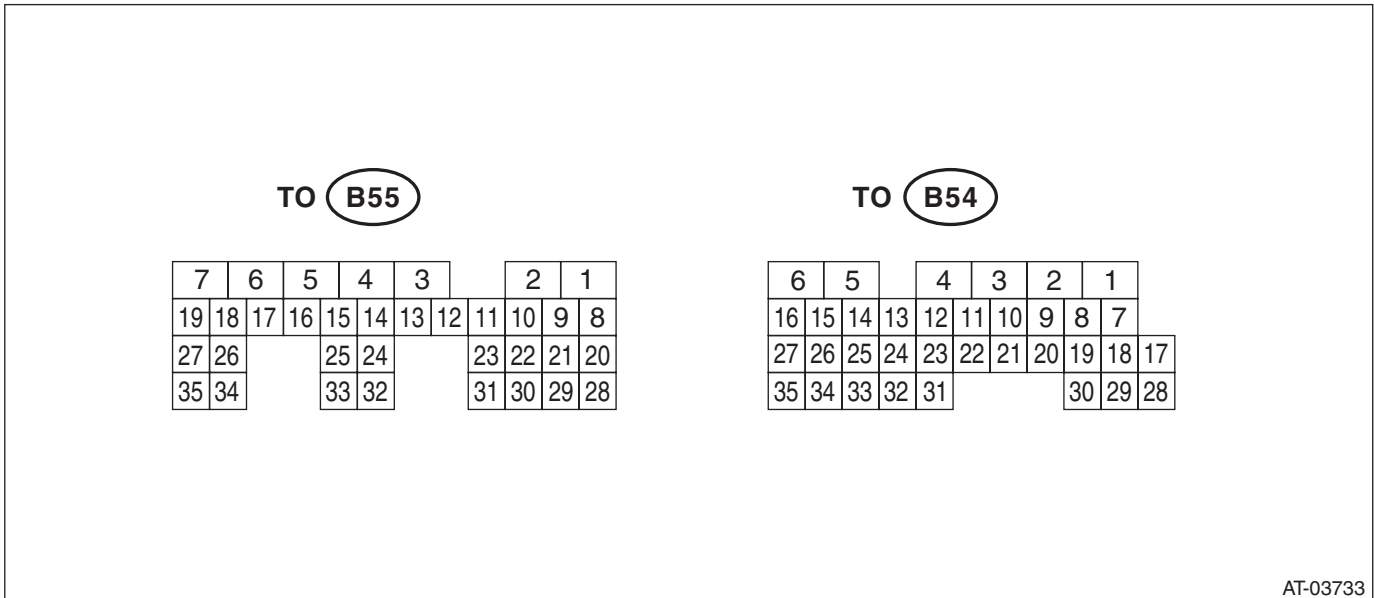
(4) Direct clutch oil pressure switch  
(5) Forward brake oil pressure switch

# Transmission Control Module (TCM) I/O Signal

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 5. Transmission Control Module (TCM) I/O Signal

### A: ELECTRICAL SPECIFICATION



AT-03733

#### NOTE:

The measurement should be performed after warming up.

# Transmission Control Module (TCM) I/O Signal

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Item	Connector No.	Terminal No.	Measuring condition	Measured value	Resistance between terminal and chassis ground	Remarks
P/L solenoid output	B54	6	Engine ON, "P" range, accelerator OFF, brake ON	3.5 — 7.5 V	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
I/C oil pressure switch input	B54	20	While driving at 1st-3rd of manual mode	6 V or more		
			While driving at 4th or 5th of manual mode	Less than 1.5 V		
Power GND	B54	12	Always	Approx. 0 V	—	
CAN communication line (+)	B55	21	—	—	—	
CAN communication line (-)	B55	20	—	—	—	
ATF temperature sensor 1 input	B54	17	Ignition switch ON ATF oil temperature 20°C (68°F)	3.5 — 4.3 V	2.5 — 7.0 kΩ	When measuring the resistance, be sure to disconnect the connector and perform the measurement with TCM alone.
			Ignition switch ON ATF oil temperature 80°C (176°F)	1 — 2.2 V	0.3 — 0.8 kΩ	
Backup power supply	B55	24	Ignition switch ON	8 V or more	—	
			Ignition switch OFF			
I/C solenoid output	B54	3	While driving at 1st-3rd of manual mode	5 V or more	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			While driving at 4th or 5th of manual mode	Less than 1.5 V		
H & LR/C solenoid output	B54	5	While driving at 2nd of manual mode	5 V or more	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			While driving at 1st, 3rd-5th of manual mode	Less than 1.5 V		
Power GND	B54	13	Always	Approx. 0 V	—	
Analog GND	B54	18	Always	Approx. 0 V	—	
Fr/B solenoid output	B54	4	While driving at other than 4th of manual mode	5 V or more	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			While driving at 4th of manual mode	Less than 1.5 V		
L/U solenoid output	B54	7	When lock-up	3 V or more	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			When not lock-up	Less than 1 V		
D/C solenoid output	B54	1	While driving at 1st or 5th of manual mode	5 V or more	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			While driving at 2nd-4th of manual mode	Less than 1.5 V		
D/C oil pressure switch input	B54	22	While driving at 1st or 5th of manual mode	6 V or more		
			While driving at 2nd-4th of manual mode	Less than 1.5 V		
Subaru Select Monitor communication line	B55	8	Ignition switch ON	8 V or more	—	
			Ignition switch OFF	Less than 1 V		

# Transmission Control Module (TCM) I/O Signal

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Item	Connector No.	Terminal No.	Measuring condition	Measured value	Resistance between terminal and chassis ground	Remarks
Sensor GND (analog)	B54	16	Always	Approx. 0 V	—	
H&LR/C oil pressure switch input	B54	14	While driving at 2nd of manual mode	6 V or more	—	
			While driving at 3rd-5th of manual mode	Less than 1.5 V		
Fwd/B solenoid output	B54	19	While driving at 1st or 2nd of manual mode	5 V or more		Drive frequency: 300 Hz
			While driving at 3rd-5th of manual mode	Less than 1.5 V		
Fwd/B oil pressure switch input	B54	21	While driving at 1st or 2nd of manual mode	Less than 1.5 V		
			While driving at 3rd-5th of manual mode	6 V or more		
Front vehicle speed sensor input	B54	24	While driving at 2nd and 20 km/h (12 MPH) of manual mode	Approx. 500 — 700 rpm	—	Use the Subaru Select Monitor.
			While driving at 4th and 80 km/h (50 MPH) of manual mode	Approx. 2,000 — 2,500 rpm		Use the Subaru Select Monitor.
Inhibitor switch 1 input	B54	8	Ignition switch ON, "P" range	Less than 0.5 V	—	
			Ignition switch ON, "N" range	5 V or more		
Inhibitor switch 2 input	B54	9	Ignition switch ON, "P" range	5 V or more	—	
			Ignition switch ON, "D" range	Less than 0.5 V		
Lateral G sensor signal	B55	9	Ignition switch ON	2.0 — 3.0	—	
Ignition power supply	B54	27	Ignition switch ON	8 V or more	—	
			Ignition switch OFF	Less than 1 V		
Rear vehicle speed sensor input	B54	23	While driving at 2nd and 20 km/h (12 MPH) of manual mode	Approx. 500 — 700 rpm	—	Use the Subaru Select Monitor.
			While driving at 4th and 80 km/h (50 MPH) of manual mode	Approx. 2,000 — 2,500 rpm		Use the Subaru Select Monitor.
Fr/B oil pressure switch input	B54	15	While driving at other than 4th of manual mode	Less than 1.5 V	—	
			While driving at 4th of manual mode	6 V or more		
Turbine speed sensor 1 input	B54	26	2nd of manual mode, turbine speed sensor is 2,000 rpm (Read from Subaru Select Monitor)	Approx. 0 rpm	—	Use the Subaru Select Monitor.
			4th of manual mode, turbine speed sensor is 2,000 rpm (Read from Subaru Select Monitor)	Approx. 1,900 — 2,100 rpm		Use the Subaru Select Monitor.

# Transmission Control Module (TCM) I/O Signal

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Item	Connector No.	Terminal No.	Measuring condition	Measured value	Resistance between terminal and chassis ground	Remarks
Lateral G sensor power supply output	B55	7	Ignition switch ON (when lateral G sensor is in horizontal position)	4.75 — 5.25	—	
Inhibitor switch 3 input	B54	10	Ignition switch ON, "R" range	5 V or more	—	
			Ignition switch ON, "D" range	Less than 0.5 V		
Control GND1	B55	23	Ignition switch ON	Approx. 0 V		
			Ignition switch OFF			
Control GND2	B55	22	Ignition switch ON	Approx. 0 V		
			Ignition switch OFF			
Inhibitor switch 4 input	B54	11	Ignition switch ON, "P" range	Less than 0.5 V	—	
			Ignition switch ON, "D" range	5 V or more		
Back-up light relay output	B55	13	Ignition switch ON, "R" range	Less than 1 V	90 — 110 Ω (ATF temperature 25°C (77°F))	
			Ignition switch ON, other than "R" range	8 V or more		
AWD solenoid output	B54	2	Engine ON, "P" range or "N" range, accelerator OFF	Less than 1 V	3 — 9 Ω (ATF temperature 20°C (68°F))	Drive frequency: 300 Hz
			Engine ON, "D" range, accelerator OFF, brake ON	2 V or more		
Turbine speed sensor 2 input	B54	25	2nd of manual mode, turbine speed sensor is 2,000 rpm (Read from Subaru Select Monitor)	Approx. 1,200 — 1,500 rpm	—	Use the Subaru Select Monitor.
			4th of manual mode, turbine speed sensor is 2,000 rpm (Read from Subaru Select Monitor)	Approx. 1,900 — 2,100 rpm	—	Use the Subaru Select Monitor.
PN signal output	B55	11	Ignition switch ON, Other than "P" range or "N" range	8 V or more	—	
			Ignition switch ON, "P" range or "N" range	Less than 1 V	—	
Ignition power supply 1	B55	26	Ignition switch ON	8 V or more		
			Ignition switch OFF			
Ignition power supply 2	B55	19	Ignition switch ON	8 V or more		
			Ignition switch OFF	Less than 1 V		
Ignition power supply 3	B55	18	Ignition switch ON	8 V or more		
			Ignition switch OFF	Less than 1 V		
Ignition power supply 4	B55	25	Ignition switch ON	8 V or more		
			Ignition switch OFF			

## 6. Subaru Select Monitor

### A: OPERATION

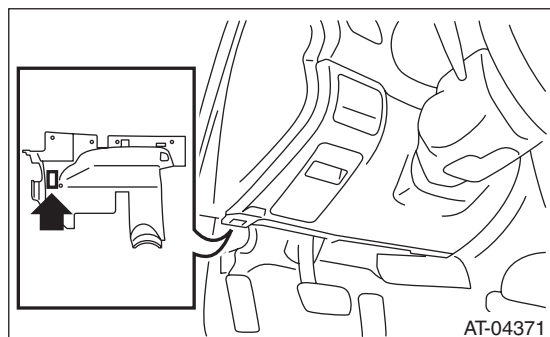
#### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

- 1) Prepare the Subaru Select Monitor kit. <Ref. to 5AT(diag)-6, PREPARATION TOOL, General Description.>
- 2) Prepare PC with Subaru Select Monitor installed.
- 3) Connect the SDI (Subaru Diagnostic Interface) to the PC USB port (exclusively for Subaru Selector Monitor) using a USB cable.

#### NOTE:

Port exclusively for Subaru Select Monitor refers to the USB port used when installing Subaru Select Monitor.

- 4) Connect the diagnosis cable to the SDI.
- 5) Connect the SDI to the data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

- 6) Start the PC.
- 7) Turn the ignition switch to ON (engine OFF) and run the "PC application help for Subaru Select Monitor".
- 8) On the «Main Menu», select {Each System Check}.
- 9) On the «System Selection Menu», select {Transmission}.
- 10) After transmission type information pops up, select [OK].
- 11) On the «Transmission Diagnosis», select {DTC Display}.
- 12) On the «Diagnostic Trouble Code» screen, select {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

#### 2. READ CURRENT DATA

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Transmission}.
- 3) After transmission type information pops up, select [OK].
- 4) On the «Transmission Diagnosis» screen, select {Current Data Display & Save}.
- 5) Select {Normal sampling} on the «Current Data Display & Save» screen.

## Subaru Select Monitor

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

6) Using the scroll key, scroll the display screen up or down until the desired data is shown.

- A list of the support data is shown in the following table.

Item	Display	Unit of measure
Engine speed signal	Engine Speed	rpm
Battery voltage	Battery Voltage	V
Accelerator pedal position sensor	Acceleration Opening Angle	%
Front vehicle speed sensor signal	Front Wheel Speed	km/h
Gear position	Gear Position	—
Turbine speed sensor signal	Turbine Revolution Speed	rpm
Rear vehicle speed sensor signal	Rear Wheel Speed	km/h
Lateral G sensor	Lateral G Sensor	V
ATF temperature sensor signal	ATF Temp.	°C
Turbine speed sensor 1 signal	Turbine Revolution Speed 1	rpm
Turbine speed sensor 2 signal	Turbine Revolution Speed 2	rpm
High & low reverse clutch solenoid indicator current	H&LR/C Solenoid Current	A
Direct clutch solenoid indicator current	D/C Solenoid Current	A
Front brake solenoid indicator current	F/B Solenoid Current	A
Input clutch solenoid indicator current	I/C Solenoid Current	A
Line pressure solenoid indicator current	P/L Solenoid Current	A
Lock-up solenoid indicator current	L/U Solenoid Current	A
Transfer solenoid indicator current	AWD Solenoid Current	A
High & low reverse clutch solenoid target oil pressure	H&LR/C Solenoid Target Pressure	kPa
Direct clutch solenoid target oil pressure	D/C Solenoid Target Pressure	kPa
Front brake solenoid target oil pressure	F/B Solenoid Target Pressure	kPa
Input clutch solenoid target oil pressure	I/C Solenoid Target Pressure	kPa
Line pressure solenoid target oil pressure	P/L Solenoid Target Pressure	kPa
Lock-up solenoid target oil pressure	L/U Solenoid Target Pressure	kPa
Transfer solenoid target oil pressure	AWD Solenoid Target Pressure	kPa
Ignition switch	Ignition Switch	ON Input or OFF Input
Tip signal	Tiptronic Mode Switch	ON or OFF
Cruise control ON signal	Cruise Control Signal	ON or OFF
Tip down shift signal	Down SW	ON or OFF
Stop light switch signal	Stop Light SW	ON or OFF
Tip up shift signal	Up SW	ON or OFF
Drive range signal	D Range Signal	ON or OFF
Reverse range signal	R Range Signal	ON or OFF
Diagnosis light output signal	Diagnosis Light	ON or OFF
ATF oil temperature light signal	ATF Temperature Lamp	ON or OFF
Parking range signal	P Range Signal	ON or OFF
P/N range output signal	P/N Signal	ON or OFF
Neutral range signal	N Range Signal	ON or OFF
Inhibitor switch 1 input signal	Inhibitor SW1	High or Low
Inhibitor switch 2 input signal	Inhibitor SW2	High or Low
Inhibitor switch 3 input signal	Inhibitor SW3	High or Low
Inhibitor switch 4 input signal	Inhibitor SW4	High or Low
Backup light relay output signal	Back-up light relay	ON or OFF
High & low reverse clutch oil pressure switch input signal	H&LR/C Oil Pressure SW	ON or OFF
Direct clutch oil pressure switch input signal	D/C Oil Pressure SW	ON or OFF
Front brake oil pressure switch input signal	Fr/B Oil Pressure SW	ON or OFF
Input clutch oil pressure switch input signal	I/C Oil Pressure SW	ON or OFF
Forward brake indicator current	Fwd/B Solenoid Current	A



# Subaru Select Monitor

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Item	Display	Unit of measure
Forward brake solenoid input signal	Fwd/B Solenoid Pressure	Kpa
Forward brake oil pressure switch input signal	Fwd/B Fluid Pressure	ON or OFF

### NOTE:

For details concerning the operation procedure, refer to the «help on PC application for Subaru Select Monitor».

### 3. CLEAR MEMORY MODE

- 1) Check that the select lever is in “P” range.
- 2) On the «Main Menu», select {Each System Check}.
- 3) On the «System Selection Menu», select {Transmission}.
- 4) After transmission type information pops up, select [OK].
- 5) On the «Transmission Diagnosis», select {Clear Memory}.
- 6) When the “Done. Turn ignition switch to OFF” pops up, select [OK].
- 7) Turn Subaru Select Monitor and ignition switch to OFF. To turn the ignition switch to ON again, wait for 10 seconds or more.

### NOTE:

- To clear the previous DTC, use {Clear Memory}, and to clear the learned value, use {Clear Memory 2}.
- For details concerning the operation procedure, refer to the «help on PC application for Subaru Select Monitor».

## Read Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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### 7. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

Refer to “Subaru Select Monitor” for information about how to obtain and understand DTC. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>

## 8. Inspection Mode

### A: PROCEDURE

#### WARNING:

**Observe the traffic law when driving on public roads.**

- 1) Shift the select lever to “D” range, and then drive the vehicle with changing the gear from 1st to 5th.
- 2) When driving the vehicle at 5th speed of “D” range, set the gear to manual mode and drive the vehicle by downshifting using “-” of the select lever from 5th → 4th, 4th → 3rd, 3rd → 2nd, and 2nd → 1st.

#### NOTE:

At shifting down, drive the vehicle at least 10 seconds in each speed.

- 3) Shift the select lever to “R” range and drive the vehicle for 2 seconds or more.

## Clear Memory Mode

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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### 9. Clear Memory Mode

#### A: OPERATION

Use "Subaru Select Monitor" to clear DTC. <Ref. to 5AT(diag)-19, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

#### NOTE:

DTC cannot be cleared without using Subaru Select Monitor.

## 10. Learning Control

### A: GENERAL DESCRIPTION

- After performing the following services, perform the transmission learning operation.  
Replacement of TCM/Replacement or disassembly of transmission assembly/Replacement of control valve body/Performing "Clear Memories 2".
- Perform the procedures according to the message displayed on the Subaru Select Monitor.

### B: PROCEDURE

#### 1. PREPARATION FOR LEARNING CONTROL

- 1) Warm-up or cool down until the ATF temperature displayed on the Subaru Select Monitor reaches 60 — 80°C (140 — 176° F).
- 2) Shift the select lever to "P" range.
- 3) Fully apply the parking brake.
- 4) Lift up the vehicle.

#### CAUTION:

**Be sure to keep the lowest edge of the tires 30 cm or more off the ground because the vehicle vibrates during the work.**

- 5) Connect the Subaru Select Monitor to the data link connector.
- 6) Turn the ignition switch to ON. (Press push button ignition switch twice without depressing brake pedal for push button start.)
- 7) Select {Learning and inspection mode related to AT} on the «Transmission Diagnosis» display screen of Subaru Select Monitor.
- 8) Select {AT learning mode} on the «Learning and inspection mode related to AT» display screen of Subaru Select Monitor.
- 9) Perform the procedures according to the message displayed on the Subaru Select Monitor.

#### 2. SIMPLE LEARNING

##### NOTE:

The simple learning is performed with the vehicle lifted up, not by driving actually.

##### CAUTION:

**Do not turn the power of the Subaru Select Monitor to OFF or disconnect the data link connector during the operation.**

- 1) Perform the procedures according to the message displayed on the Subaru Select Monitor.

##### NOTE:

During "SHIFT control system learning in progress" and "AWD control system learning in progress", AT OIL TEMP light in the combination meter starts flashing at 2 Hz and the learning operation starts. The following message is displayed on the screen when the AT OIL TEMP light turns off. If operation ended abnormally during learning, AT OIL TEMP light flashes at 4 Hz.

# Learning Control

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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2) "AT learning normally ended." is displayed, simple AT learning is completed.

### NOTE:

- If communication error occurs during learning, retry "AT learning mode" from the beginning.
- If "Execute AT learning again after fixing troubles of the vehicle" is displayed during learning, select [OK] to display the List of Diagnostics Trouble Code. Retry "AT learning mode" from the beginning after repairing the DTC detecting portion.
- If "AT learning ended abnormally." is displayed, retry "AT learning mode" from the beginning.

Message	Primary cause of abnormal end
"AT learning ended abnormally."	<ul style="list-style-type: none"><li>• Fault is detected during AT learning.</li><li>• The accelerator pedal is depressed during AT learning.</li><li>• Operation which is not directed is performed during AT learning.</li><li>• The brake pedal is not depressed fully.</li><li>• The parking brake is not applied fully.</li><li>• Abnormal idle rise occurs. Other similar causes are probable.</li></ul>

- For details concerning the operation procedure, refer to the "PC application help for Subaru Select Monitor".

### 3. DRIVING CHECK

Drive actually and check for shifting shock or faults. If shifting shock is felt, perform the learning operation again.

If reducing of shifting shock is not felt, recheck that other parts are normal.

# AT Oil Temp Warning Light Display

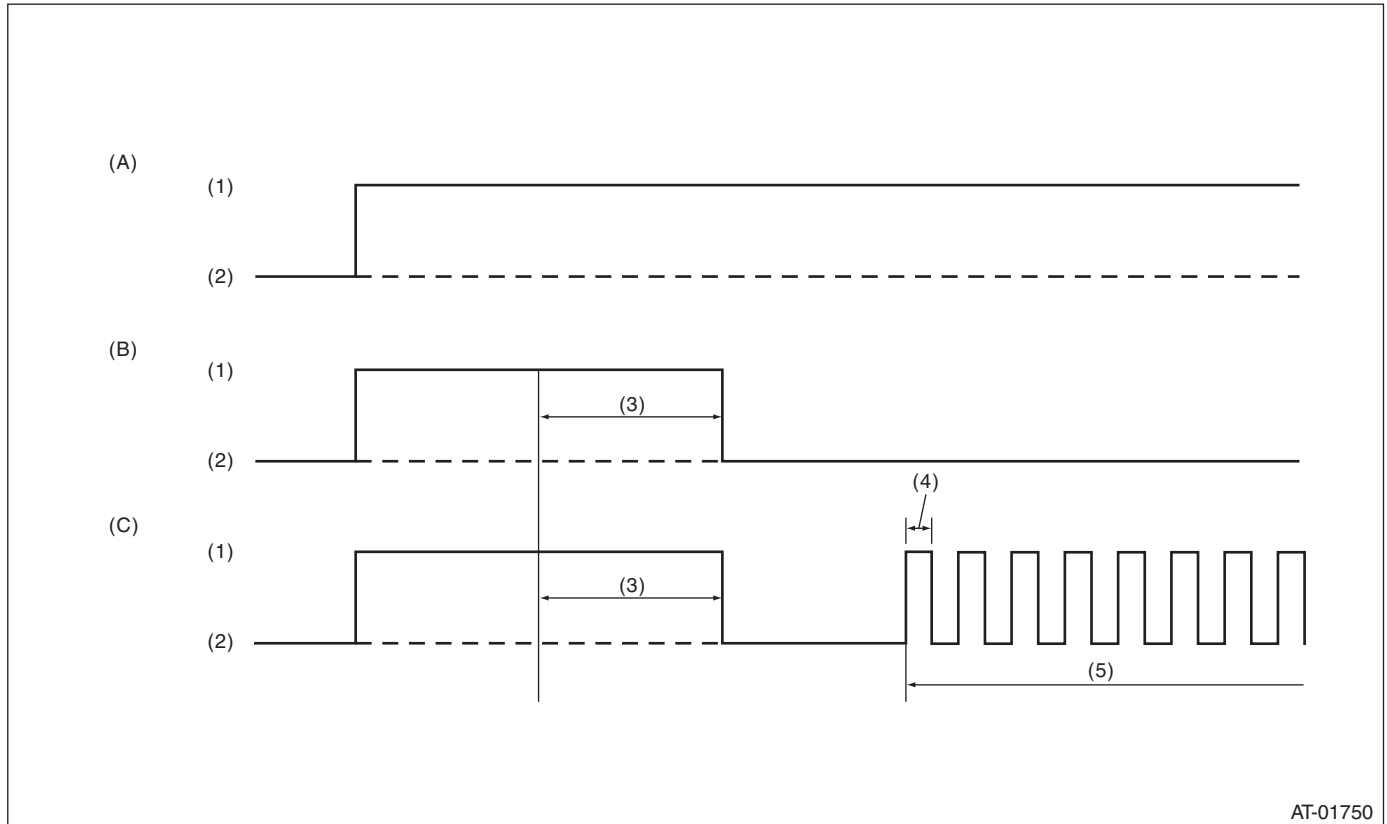
AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 11.AT Oil Temp Warning Light Display

### A: OPERATION

When any on-board diagnostics item is malfunctioning, the AT OIL TEMP light blinks from the time the malfunction is detected after starting the engine until the ignition switch is turned OFF. The malfunctioning part or unit can be determined by a DTC during the on-board diagnostics operation. Problems which occurred previously can also be identified through the memory function. If the AT OIL TEMP light does not show a problem (although a problem is occurring), the problem can be determined by checking the performance characteristics of each sensor using Subaru Select Monitor. Indicator light signal patterns are as shown in the figure.

When the AT OIL TEMP light does not operate normally but no DTC is stored, perform the AT OIL TEMP light inspection. <Ref. to 5AT(diag)-26, INSPECTION, AT Oil Temp Warning Light Display.>



(A) Ignition switch (engine OFF)

(B) Normal (engine ON)

(C) Faulty (engine ON)

(1) ON

(3) 2 sec.

(5) Blink

(2) OFF

(4) 0.25 sec.

# AT Oil Temp Warning Light Display

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## B: INSPECTION

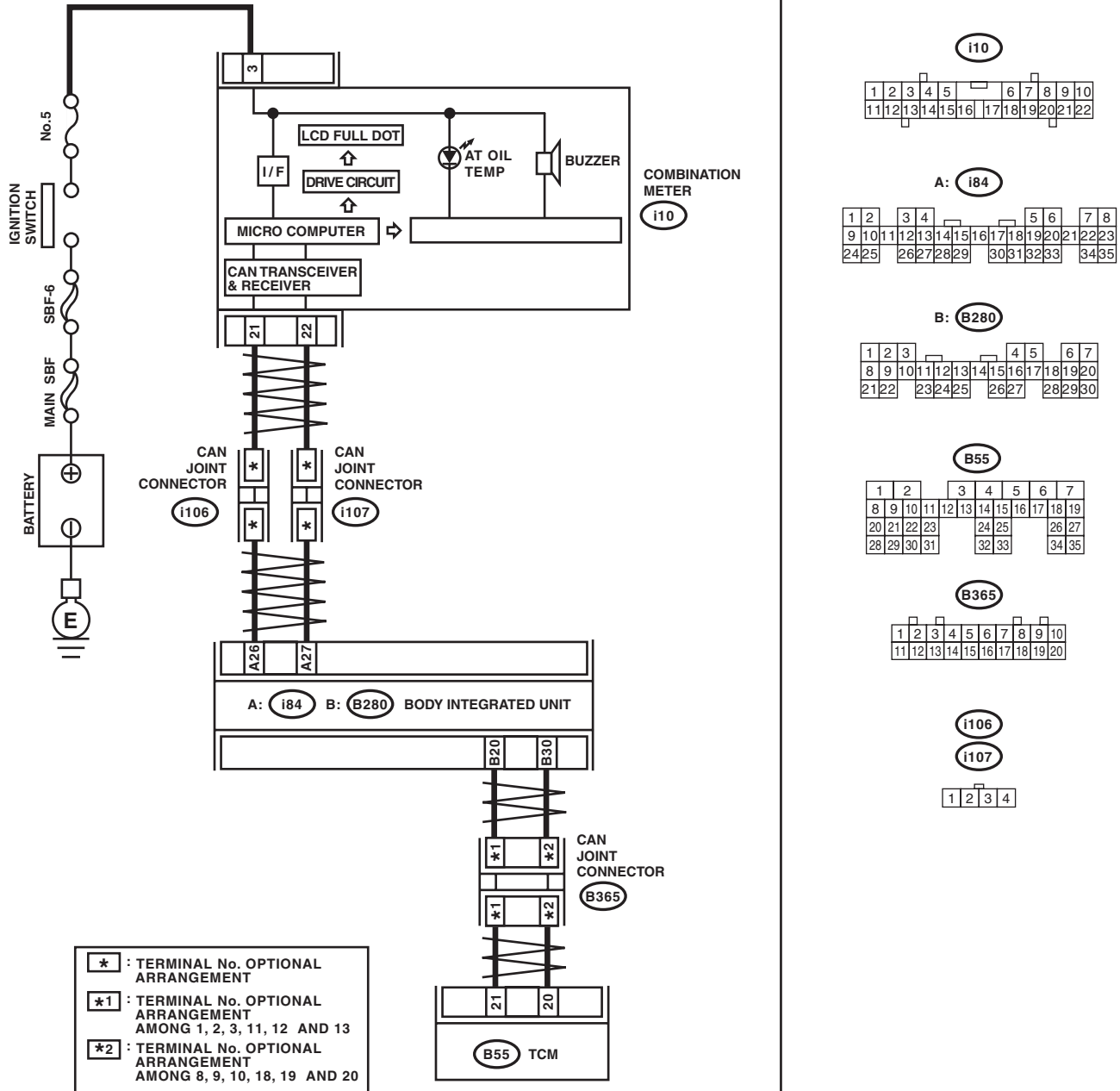
### DIAGNOSIS:

AT OIL TEMP light circuit is open or shorted.

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), AT OIL TEMP light does not illuminate.

### WIRING DIAGRAM:



AT-04345



# AT Oil Temp Warning Light Display

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK AT OIL TEMP LIGHT.</b> Turn the ignition switch to ON.	Does the AT OIL TEMP light illuminate?	Go to step 2.	Perform the self-diagnosis of combination meter.
2	<b>CHECK AT OIL TEMP LIGHT.</b> After the ignition switch is ON, wait for at least 2 seconds.	Does the AT OIL TEMP light illuminate?	Go to step 3.	Go to step 4.
3	<b>CHECK AT OIL TEMP LIGHT.</b> Start the engine.	Does the AT OIL TEMP light go off?	Normal. Go back to "Basic Diagnostic Procedure". <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>	Go to step 7.
4	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> Connect the Subaru Select Monitor to the data link connector.	Is the communication between Subaru Select Monitor and TCM normal?	Go to step 5.	Check the power supply ground circuit of TCM and Subaru Select Monitor communication. <Ref. to 5AT(diag)-28, Diagnostic Procedure for Subaru Select Monitor Communication.>
5	<b>CHECK TCM.</b> Display the current data of TCM using Subaru Select Monitor.	Is the "Diagnosis Light" output signal "ON"?	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
6	<b>CHECK BODY INTEGRATED UNIT.</b> Display the current data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Does the "AT OIL TEMP light" input signal "Illuminate"?	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>	Check DTC of body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>
7	<b>CHECK TCM.</b> 1) Start the engine. 2) Display the current data of TCM using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is the "Diagnosis Light" output signal "ON"?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 8.
8	<b>CHECK BODY INTEGRATED UNIT.</b> Display the current data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Does the "AT OIL TEMP light" input signal "Illuminate"?	Check DTC of body integrated unit. Perform the diagnosis according to DTC. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Perform the self-diagnosis of combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>

# Diagnostic Procedure for Subaru Select Monitor Communication

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 12. Diagnostic Procedure for Subaru Select Monitor Communication

### A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

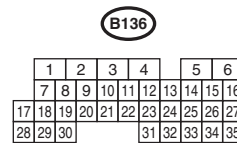
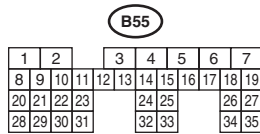
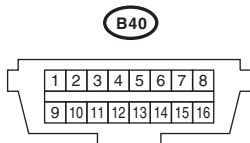
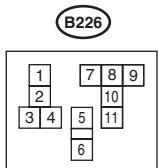
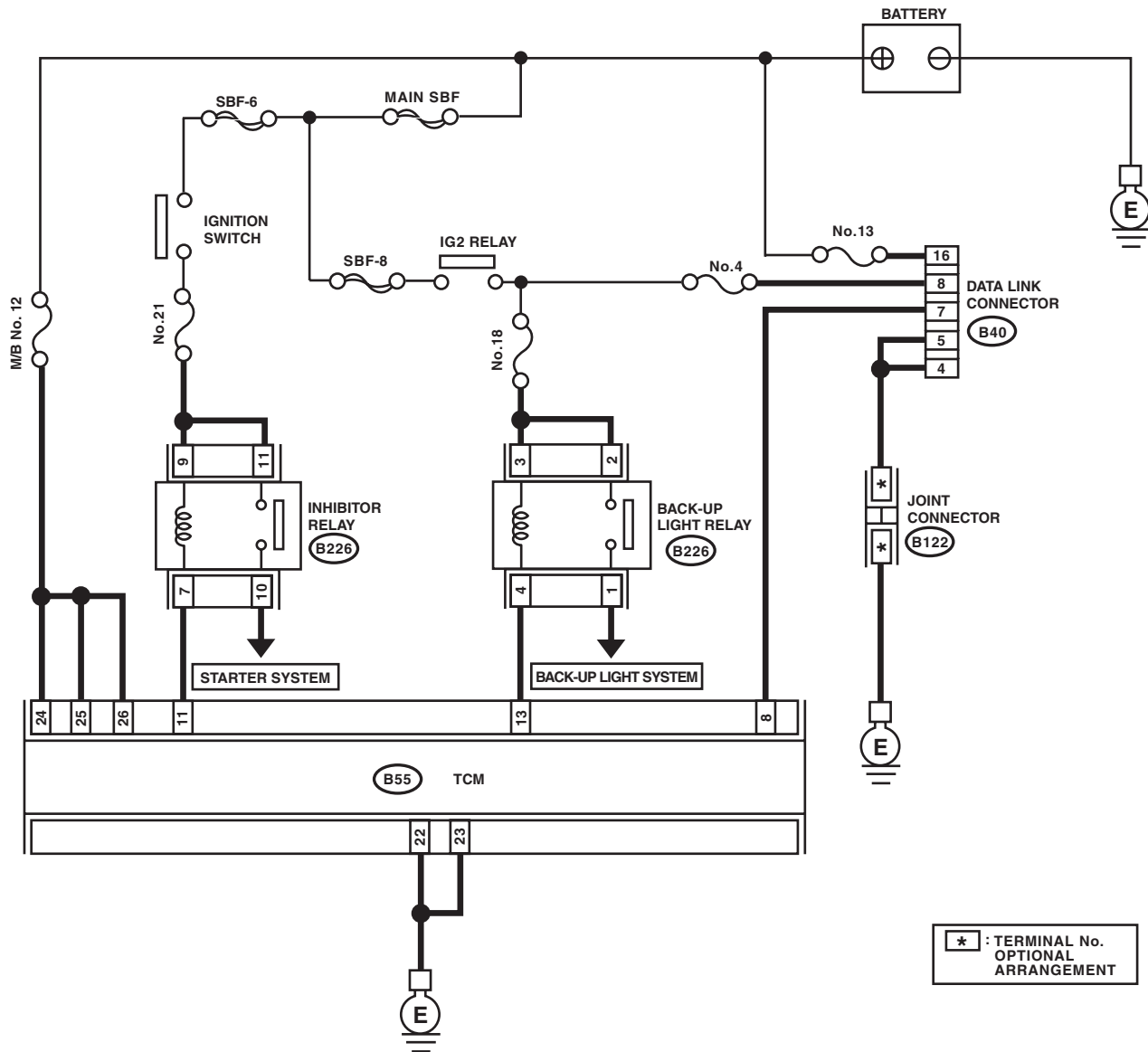
#### DIAGNOSIS:

Defective harness connector

#### TROUBLE SYMPTOM:

Subaru Select Monitor communication failure

#### WIRING DIAGRAM:



AT-04346

# Diagnostic Procedure for Subaru Select Monitor Communication

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
1	<p><b>CHECK SUBARU SELECT MONITOR POWER SUPPLY CIRCUIT.</b> Measure the voltage between data link connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B40) No. 16 (+) — Chassis ground (-):</i></p>	Is the voltage 10 V or more?	Go to step 2.	Repair harness connector between the battery and data link connector, and poor contact of the connector.
2	<p><b>CHECK SUBARU SELECT MONITOR GROUND CIRCUIT.</b> Measure the resistance of harness between data link connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B40) No. 4 — Chassis ground:</i> <i>(B40) No. 5 — Chassis ground:</i></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between data link connector and ground terminal, and poor contact of connector.
3	<p><b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to the transmission system can be executed normally.</p>	Is the name of system displayed on Subaru Select Monitor?	Go to step 8.	Go to step 4.
4	<p><b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the TCM connector. 3) Turn the ignition switch to ON. 4) Check whether communication to engine system can be executed normally.</p>	Is the name of system displayed on Subaru Select Monitor?	Go to step 6.	Go to step 5.
5	<p><b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the TCM connector. 3) Disconnect the connector from ECM. 4) Turn the ignition switch to ON. 5) Check whether communication to transmission system can be executed normally.</p>	Is the name of system displayed on Subaru Select Monitor?	Inspect the ECM.	Go to step 6.
6	<p><b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the TCM and ECM connector. 3) Measure the resistance between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B40) No. 7 — Chassis ground:</i></p>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Check harness and connector between each control module and data link connector.
7	<p><b>CHECK OUTPUT SIGNAL OF TCM.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between TCM and chassis ground. <i>Connector &amp; terminal</i> <i>(B40) No. 7 (+) — Chassis ground (-):</i></p>	Is the voltage 1 V or more?	Check harness and connector between each control module and data link connector.	Go to step 8.
8	<p><b>CHECK HARNESS CONNECTOR BETWEEN TCM AND DATA LINK CONNECTOR.</b> Measure the resistance between TCM connector and data link connector. <i>Connector &amp; terminal</i> <i>(B55) No. 8 — (B40) No. 7:</i></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the harness and connector between TCM and data link connector.
9	<p><b>CHECK INSTALLATION OF TCM CONNECTOR.</b> Turn the ignition switch to OFF.</p>	Is TCM connector connected to TCM?	Go to step 10.	Connect the TCM connector to TCM.

# Diagnostic Procedure for Subaru Select Monitor Communication

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>10</b> <b>CHECK INSTALLATION OF TRANSMISSION HARNESS CONNECTOR.</b>	Is the transmission harness connector connected to bulk-head harness connector?	Go to step 11.	Connect the bulk-head harness connector to transmission harness connector.
<b>11</b> <b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in control module power supply and data link connector?	Repair the poor contact.	Go to step 12.
<b>12</b> <b>CHECK POWER SUPPLY OF TCM.</b> 1) Disconnect the connector from TCM. 2) Turn the ignition switch to ON. 3) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 24 (+) — Chassis ground (-):</b> <b>(B55) No. 25 (+) — Chassis ground (-):</b> <b>(B55) No. 26 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 15.	Go to step 13.
<b>13</b> <b>CHECK FUSE (NO. 12).</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 12).	Is the fuse (No. 12) blown out?	Replace the fuse (No. 12).	Go to step 14.
<b>14</b> <b>CHECK HARNESS.</b> Measure the resistance between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 24 — Chassis ground:</b> <b>(B55) No. 25 — Chassis ground:</b> <b>(B55) No. 26 — Chassis ground:</b>	Is the resistance 10 Ω or less?	Replace the fuse (No. 12). If the replaced fuse (No. 12) blows out easily, repair the short circuit of harness between fuse (No. 12) and TCM.	Go to step 15.
<b>15</b> <b>CHECK IGNITION POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Measure the ignition power supply voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 17 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 17.	Go to step 16.
<b>16</b> <b>CHECK FUSE (NO. 21).</b> Remove the fuse (No. 21).	Is the fuse (No. 21) blown out?	Replace the fuse (No. 21). If the replaced fuse (No. 21) blows out easily, repair the short circuit of harness between fuse (No. 21) and TCM.	Go to step 17.
<b>17</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance of the harness between TCM and transmission ground. <b>Connector &amp; terminal</b> <b>(B54) No. 22 — Transmission ground:</b> <b>(B54) No. 23 — Transmission ground:</b>	Is the resistance 1 MΩ or more?	Repair the short circuit of harness between TCM and transmission harness connector, and poor contact of connector.	Go to step 18.
<b>18</b> <b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in TCM power supply, ground and data link connector?	Repair the connector.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>

# List of Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 13. List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Item	Content of diagnosis	Reference target
P0705	Transmission Range Sensor Circuit (PRNDL Input)	Inhibitor switch malfunction, open or short circuit	<Ref. to 5AT(diag)-34, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0712	Transmission Fluid Temperature Sensor Circuit Low Input	ATF temperature sensor 1 malfunction, or open input signal circuit	<Ref. to 5AT(diag)-38, DTC P0712 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0713	Transmission Fluid Temperature Sensor Circuit High Input	ATF temperature sensor 1 malfunction, short input signal circuit	<Ref. to 5AT(diag)-40, DTC P0713 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0715	Input/Turbine Speed Sensor Circuit	Turbine speed sensor 1 malfunction, short input signal circuit	<Ref. to 5AT(diag)-42, DTC P0715 INPUT/TURBINE SPEED SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0719	Torque Converter/Brake Switch "B" Circuit Low	Brake switch malfunction, open input signal circuit, body integrated unit malfunction, CAN communication failure	<Ref. to 5AT(diag)-45, DTC P0719 BRAKE SWITCH CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output Speed Sensor Circuit	Front wheel speed sensor is faulty or input signal circuit, ground, power supply is open or shorted.	<Ref. to 5AT(diag)-48, DTC P0720 OUTPUT SPEED SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0724	Torque Converter/Brake Switch "B" Circuit High	Brake switch malfunction, short circuit of input signal, body integrated unit, CAN communication failure	<Ref. to 5AT(diag)-51, DTC P0724 BRAKE SWITCH CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	Gear 1 Incorrect Ratio	Vehicle sensor, turbine speed sensor, control valve malfunction or shift clutch malfunction	<Ref. to 5AT(diag)-53, DTC P0731 GEAR 1 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0732	Gear 2 Incorrect Ratio	Vehicle sensor, turbine speed sensor, control valve malfunction or shift clutch malfunction	<Ref. to 5AT(diag)-53, DTC P0732 GEAR 2 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	Gear 3 Incorrect Ratio	Vehicle sensor, turbine speed sensor or shift clutch malfunction	<Ref. to 5AT(diag)-53, DTC P0733 GEAR 3 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0734	Gear 4 Incorrect Ratio	Vehicle sensor, turbine speed sensor or shift clutch malfunction	<Ref. to 5AT(diag)-53, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0735	Gear 5 Incorrect Ratio	Vehicle sensor, turbine speed sensor or shift clutch malfunction	<Ref. to 5AT(diag)-53, DTC P0735 GEAR 5 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0736	Reverse Incorrect Ratio	Vehicle sensor, turbine speed sensor or shift clutch malfunction	<Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Lock-up clutch is faulty or valve is stuck.	<Ref. to 5AT(diag)-55, DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque Converter Clutch Circuit Electrical	L/U solenoid circuit malfunction or L/U solenoid body malfunction	<Ref. to 5AT(diag)-57, DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

DTC	Item	Content of diagnosis	Reference target
P0748	Pressure Control Solenoid "A" Electrical	Line pressure solenoid circuit malfunction or line pressure solenoid body malfunction	<Ref. to 5AT(diag)-59, DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0751	Shift Solenoid "A" Performance or Stuck Off	Fr/B Solenoid Function Malfunction	<Ref. to 5AT(diag)-61, DTC P0751 SHIFT SOLENOID "A" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0753	Shift Solenoid "A" Electrical	Fr/B solenoid circuit malfunction or Fr/B solenoid body malfunction	<Ref. to 5AT(diag)-63, DTC P0753 SHIFT SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0756	Shift Solenoid "B" Performance or Stuck Off	Shift Solenoid "B" Performance malfunction	<Ref. to 5AT(diag)-65, DTC P0756 SHIFT SOLENOID "B" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift Solenoid "B" Electrical	I/C solenoid circuit malfunction or I/C solenoid body malfunction	<Ref. to 5AT(diag)-67, DTC P0758 SHIFT SOLENOID "B" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0761	Shift Solenoid "C" Performance or Stuck Off	H&LR/C solenoid malfunction	<Ref. to 5AT(diag)-69, DTC P0761 SHIFT SOLENOID "C" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0763	Shift Solenoid "C" Electrical	H&LR/C solenoid circuit malfunction or H&LR/C solenoid body malfunction	<Ref. to 5AT(diag)-71, DTC P0763 SHIFT SOLENOID "C" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0766	Shift Solenoid "D" Performance or Stuck Off	D/C solenoid malfunction	<Ref. to 5AT(diag)-73, DTC P0766 SHIFT SOLENOID "D" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0768	Shift Solenoid "D" Electrical	D/C solenoid circuit malfunction or D/C solenoid body malfunction	<Ref. to 5AT(diag)-75, DTC P0768 SHIFT SOLENOID "D" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0771	Shift Solenoid "E" Performance or Stuck Off	Fwd/B solenoid malfunction	<Ref. to 5AT(diag)-77, DTC P0771 SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0773	Shift Solenoid "E" Electrical	Fwd/B solenoid circuit malfunction or Fwd/B solenoid body malfunction	<Ref. to 5AT(diag)-79, DTC P0773 SHIFT SOLENOID "E" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0801	Reverse Inhibit Control Circuit	<ul style="list-style-type: none"> <li>• Shift lock solenoid is faulty or output signal circuit is open or shorted.</li> <li>• Blown out of TCM+B fuse</li> </ul>	<Ref. to 5AT(diag)-81, DTC P0801 REVERSE INHIBIT CONTROL CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0817	Starter Disable Circuit	<ul style="list-style-type: none"> <li>• PN signal output circuit is open or shorted.</li> <li>• ECM Source Voltage Is Abnormal</li> <li>• Blown out of TCM+B fuse</li> </ul>	<Ref. to 5AT(diag)-83, DTC P0817 STARTER DISABLE CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0957	Backup Light Relay Circuit Low	Back-up relay output circuit is open, shorted or relay OFF malfunction	<Ref. to 5AT(diag)-85, DTC P0957 BACKUP LIGHT RELAY CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0958	Backup Light Relay Circuit High	Back-up relay output circuit is open, shorted or relay ON malfunction	<Ref. to 5AT(diag)-87, DTC P0958 BACKUP LIGHT RELAY CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1706	AT Vehicle Speed Sensor Circuit Malfunction (Rear Wheel)	Rear wheel speed sensor is faulty or input circuit, ground, power supply is open or shorted.	<Ref. to 5AT(diag)-89, DTC P1706 AT VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION (REAR WHEEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

DTC	Item	Content of diagnosis	Reference target
P1707	AT AWD Solenoid Valve Circuit Malfunction	AWD solenoid circuit malfunction or AWD solenoid body malfunction	<Ref. to 5AT(diag)-91, DTC P1707 AT AWD SOLENOID VALVE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1710	Torque Converter Turbine 2 Speed Signal Circuit 2 Malfunction	Torque converter sensor 2 malfunction, input circuit, ground, power open, short circuit	<Ref. to 5AT(diag)-93, DTC P1710 TORQUE CONVERTER TURBINE 2 SPEED SIGNAL CIRCUIT 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1718	AT Can Communication Circuit	CAN communication line bus-off open circuit, ECM short circuit, ABS/VDCCM or integrated CU malfunction	<Ref. to 5AT(diag)-94, DTC P1718 AT CAN COMMUNICATION CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1760	Lateral Acceleration Sensor Performance Problem	Faulty lateral G sensor	<Ref. to 5AT(diag)-95, DTC P1760 LATERAL ACCELERATION SENSOR PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1761	Lateral Acceleration Sensor Circuit Low	Lateral G sensor is faulty, input signal circuit is open, or CAN communication failure occurs	<Ref. to 5AT(diag)-97, DTC P1761 LATERAL ACCELERATION SENSOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1762	Lateral Acceleration Sensor Circuit High	Lateral G sensor is faulty or input signal circuit is shorted.	<Ref. to 5AT(diag)-99, DTC P1762 LATERAL ACCELERATION SENSOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1817	SPORT Mode Switch Circuit (Manual Switch)	Manual mode switch is open, shorted, or switch malfunction	<Ref. to 5AT(diag)-102, DTC P1817 SPORT MODE SWITCH CIRCUIT (MANUAL SWITCH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1840	Transmission Fluid Pressure Sensor/Switch A Circuit	Fr/B oil pressure switch is open or shorted, or switch malfunction	<Ref. to 5AT(diag)-104, DTC P1840 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1841	Transmission Fluid Pressure Sensor/Switch B Circuit	Fwd/B oil pressure switch is open or shorted, or switch malfunction	<Ref. to 5AT(diag)-104, DTC P1841 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH B CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1842	Transmission Fluid Pressure Sensor/Switch C Circuit	I/C oil pressure switch is open or shorted, or switch malfunction.	<Ref. to 5AT(diag)-104, DTC P1842 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH C CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1843	Transmission Fluid Pressure Sensor/Switch D Circuit	D/C oil pressure switch is open or shorted, or switch malfunction.	<Ref. to 5AT(diag)-104, DTC P1843 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH D CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1844	Transmission Fluid Pressure Sensor/Switch E Circuit	H&LR/C oil pressure switch is open or shorted, or switch malfunction.	<Ref. to 5AT(diag)-104, DTC P1844 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH E CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **Diagnostic Procedure with Diagnostic Trouble Code (DTC)**

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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### **14. Diagnostic Procedure with Diagnostic Trouble Code (DTC)**

#### **A: DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT)**

##### **DTC DETECTING CONDITION:**

The inhibitor switch is open or short.

##### **TROUBLE SYMPTOM:**

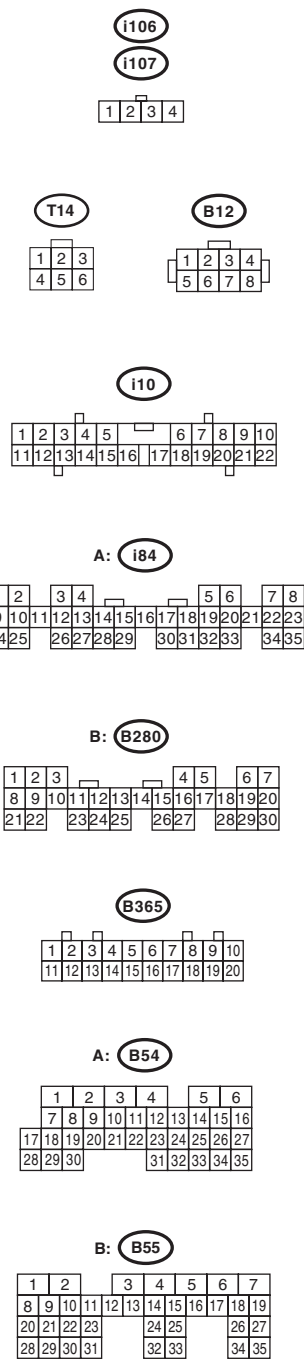
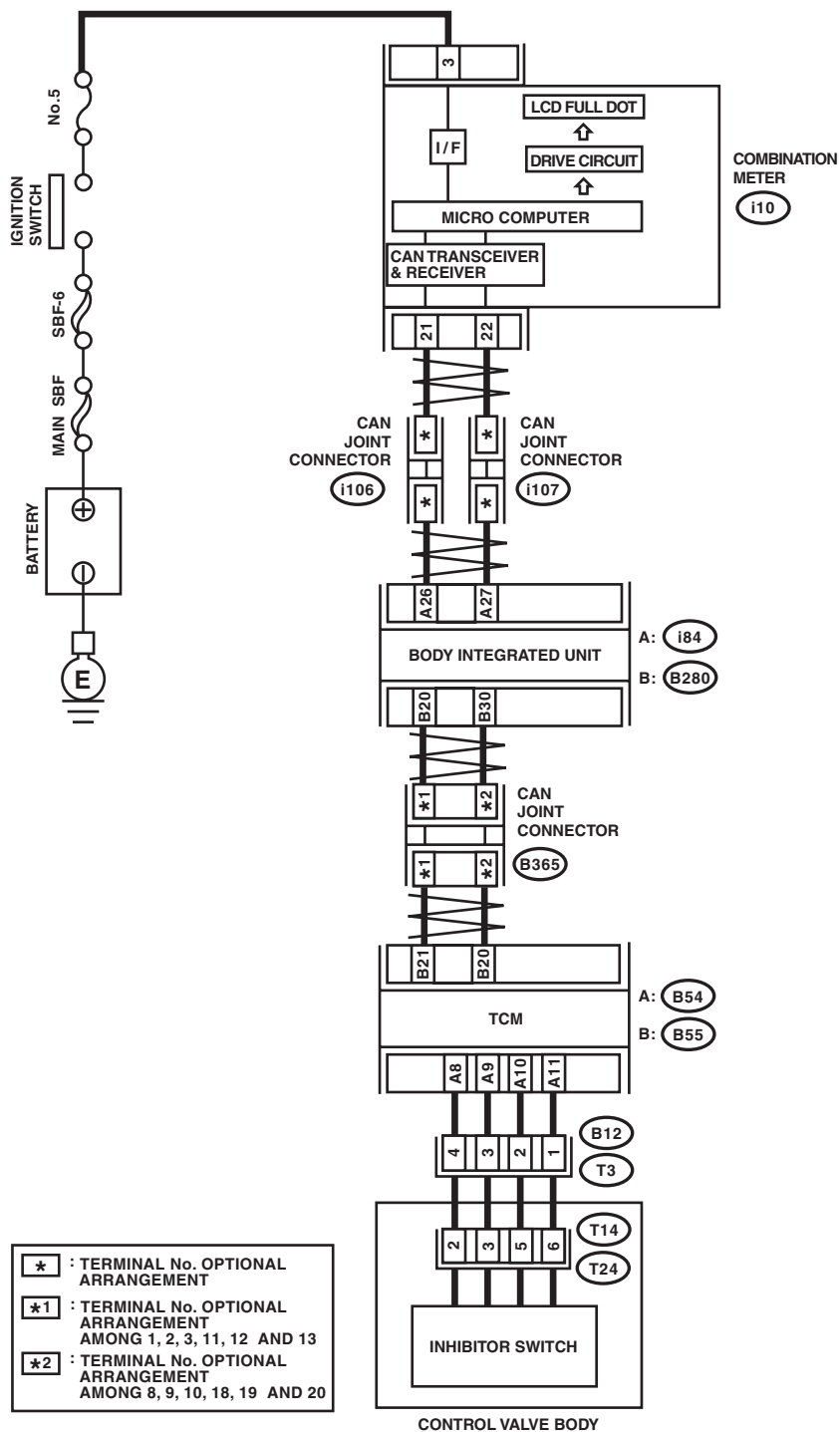
- Shift characteristics are erroneous.
- Shift indicator light does not match with select lever.
- Shift indicator light does not illuminate.
- N-D, N-R shock occur.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### WIRING DIAGRAM:



AT-04347

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK DTC OF TCM.</b>	Is DTC of AT CAN communication circuit displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK INHIBITOR SWITCH.</b> 1) Shift the select lever to "P" range. 2) Check input signal of inhibitor SW 1 — 4 monitor using Subaru Select Monitor.	Is all displayed "High"?	Go to step 4.	Go to step 3.
3	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance between TCM connector and chassis ground about the item which indicated Low on step 2. <b>Connector &amp; terminal</b> <b>(B54) No. 8 — Chassis ground:</b> <b>(B54) No. 9 — Chassis ground:</b> <b>(B54) No. 10 — Chassis ground:</b> <b>(B54) No. 11 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Repair the short circuit of harness between TCM connector and chassis ground.
4	<b>CHECK INHIBITOR SWITCH.</b> 1) Shift the select lever to "D" range. 2) Check input signal of inhibitor SW 1 — 4 monitor using Subaru Select Monitor.	Is all displayed Low?	Go to step 6.	Go to step 5.
5	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector about the item which indicated High on step 4. <b>Connector &amp; terminal</b> <b>(B54) No. 8 — (B12) No. 4:</b> <b>(B54) No. 9 — (B12) No. 3:</b> <b>(B54) No. 10 — (B12) No. 2:</b> <b>(B54) No. 11 — (B12) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between TCM connector and transmission connector.
6	<b>CHECK INPUT SIGNAL FOR TCM USING CIRCUIT TESTER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the transmission connector (B12). 3) Connect the TCM connector. 4) Turn the ignition switch to ON. 5) Measure the voltage between TCM terminals. <b>Connector &amp; terminal</b> <b>(B54) No. 8 (+) — (B55) No. 23 (-):</b> <b>(B54) No. 9 (+) — (B55) No. 23 (-):</b> <b>(B54) No. 10 (+) — (B55) No. 23 (-):</b> <b>(B54) No. 11 (+) — (B55) No. 23 (-):</b>	Is the voltage of inhibitor SW 1 — 4 between 4 — 6 V?	Go to step 8.	Go to step 7.
7	<b>CHECK TCM I/O SIGNAL.</b> Check the power supply and ground I/O signals. <Ref. to 5AT(diag)-13, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.>	Is TCM I/O signal OK?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Repair the open or short circuit for power supply and ground.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>8</b>      <b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF.                  2) Disconnect the connector from transmission.                  3) Remove the transmission connector from bracket.                  4) Lift up the vehicle.</p> <p>NOTE:                  Raise all wheels off the floor.                  5) Drain the ATF.</p> <p><b>CAUTION:</b>  <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the connector from control valve body connector.                  7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b>  <i>(T3) No. 4 — (T14) No. 2:</i>  <i>(T3) No. 3 — (T14) No. 3:</i>  <i>(T3) No. 2 — (T14) No. 5:</i>  <i>(T3) No. 1 — (T14) No. 6:</i></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 9.</p>	<p>Repair the open circuit of harness between control valve body connector and transmission connector.</p>
<p><b>9</b>      <b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b>  <i>(T14) No. 2 — Transmission ground:</i>  <i>(T14) No. 3 — Transmission ground:</i>  <i>(T14) No. 5 — Transmission ground:</i>  <i>(T14) No. 6 — Transmission ground:</i></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 10.</p>	<p>Repair the short circuit of harness between control valve body connector and transmission connector.</p>
<p><b>10</b>      <b>CHECK POOR CONTACT.</b></p>	<p>Is there any poor contact in inhibitor SW 1 — 4 monitor circuit?</p>	<p>Repair the poor contact.</p>	<p>Replace the control valve body.                  &lt;Ref. to 5AT-56, Control Valve Body.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## B: DTC P0712 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT

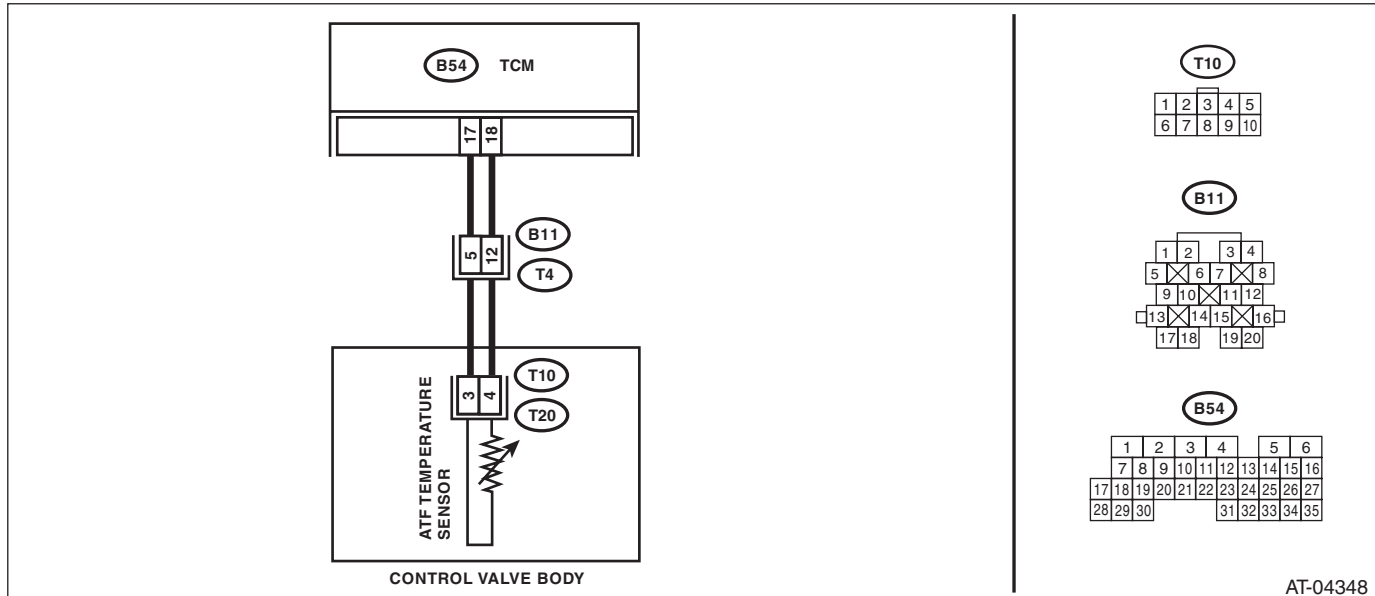
### DTC DETECTING CONDITION:

Input signal circuit to ATF temperature sensor is open.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 17 — (B11) No. 5:</b> <b>(B54) No. 18 — (B11) No. 12:</b>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2</b> <b>CHECK ATF OIL TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the connectors to transmission and TCM. 3) Turn the ignition switch to ON and start engine. 4) Warm-up the transmission until the ATF temperature exceeds 80°C (176°F). NOTE: If the ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Disconnect the connector from transmission. 6) Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 5 — (T4) No. 12:</b>	Is the resistance between 300 — 800 Ω?	Go to step 3.	Go to step 5.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>3</b> <b>CHECK ATF OIL TEMPERATURE SENSOR.</b> Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 5 — (T4) No. 12:</b>	Does the resistance value increase while the ATF temperature decreases?	Go to step 4.	Go to step 5.
<b>4</b> <b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connector. 2) Turn the ignition switch to ON. (engine OFF) 3) Read the ATF temperature using Subaru Select Monitor.	Does the ATF temperature gradually decrease?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness between ATF oil temperature sensor and transmission connector.	Go to step 6.
<b>5</b> <b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 6) Remove the oil pan, and disconnect the connector from control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector. <b>Connector &amp; terminal</b> <b>(T4) No. 12 — (T10) No. 4:</b> <b>(T4) No. 5 — (T10) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Repair the open circuit of harness between transmission connector and control valve body connector.
<b>6</b> <b>CHECK POOR CONTACT.</b>	Is there poor contact in ATF oil temperature sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## C: DTC P0713 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT

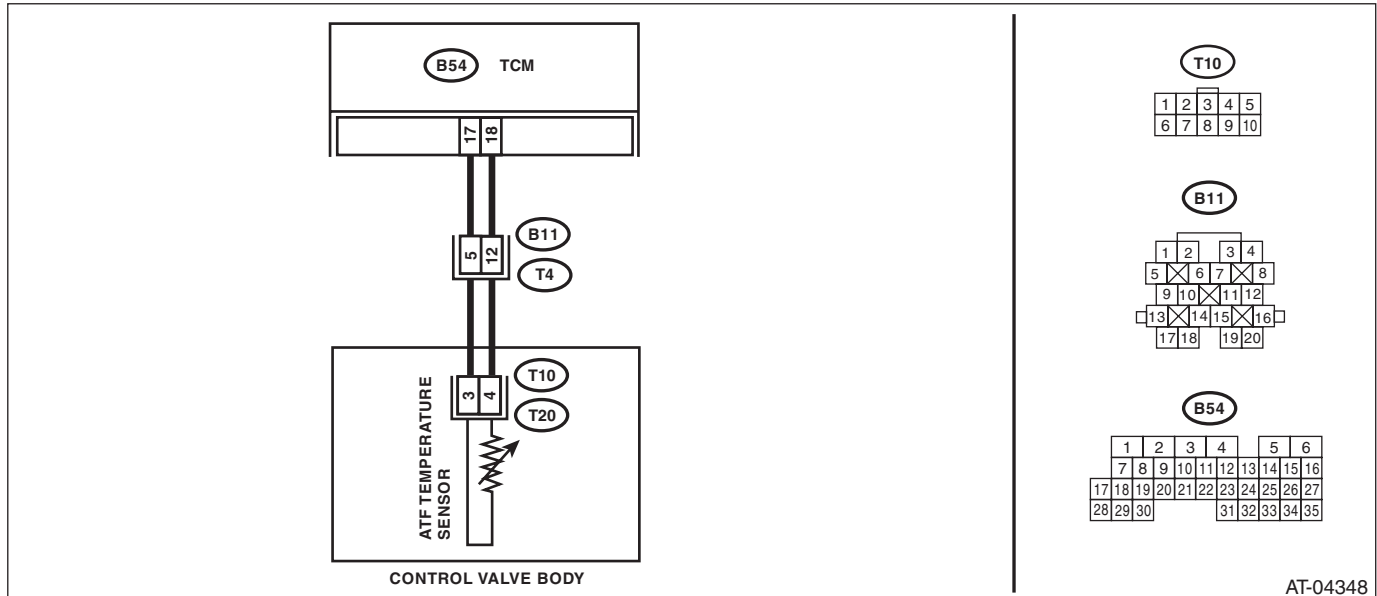
### DTC DETECTING CONDITION:

Input signal circuit to ATF oil temperature sensor is shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1</b> <b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B54) No. 17 — Chassis ground:</b> <b>(B54) No. 18 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 2.	Repair the short circuit of harness between TCM and transmission connector.
<b>2</b> <b>CHECK ATF OIL TEMPERATURE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the connectors to transmission and TCM. 3) Turn the ignition switch to ON and start engine. 4) Warm-up the transmission until the ATF temperature exceeds 80°C (176°F). <b>NOTE:</b> If the ambient temperature is below 0°C (32°F), drive the vehicle until the ATF reaches its operating temperature. 5) Disconnect the connector from transmission. 6) Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 5 — (T4) No. 12:</b>	Is the resistance between 300 — 800 $\Omega$ ?	Go to step 3.	Go to step 5.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>3 CHECK ATF OIL TEMPERATURE SENSOR.</b> Measure the resistance between transmission connector terminals. <b>Connector &amp; terminal</b> <b>(T4) No. 5 — (T4) No. 12:</b>	Does the resistance value increase while the ATF temperature decreases?	Go to step 4.	Go to step 5.
<b>4 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect the connector. 2) Turn the ignition switch to ON. (engine OFF) 3) Read the ATF temperature using Subaru Select Monitor.	Does the ATF temperature gradually decrease?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness between ATF oil temperature sensor and transmission connector.	Go to step 6.
<b>5 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 6) Remove the oil pan, and disconnect the connector from control valve body connector. 7) Measure the resistance between chassis ground and control valve body connector. <b>Connector &amp; terminal</b> <b>(T10) No. 3 — Chassis ground:</b> <b>(T10) No. 4 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Repair the short circuit of harness between transmission connector and control valve body connector.
<b>6 CHECK POOR CONTACT.</b>	Is there poor contact in ATF oil temperature sensor circuit?	Repair the poor contact.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## D: DTC P0715 INPUT/TURBINE SPEED SENSOR CIRCUIT

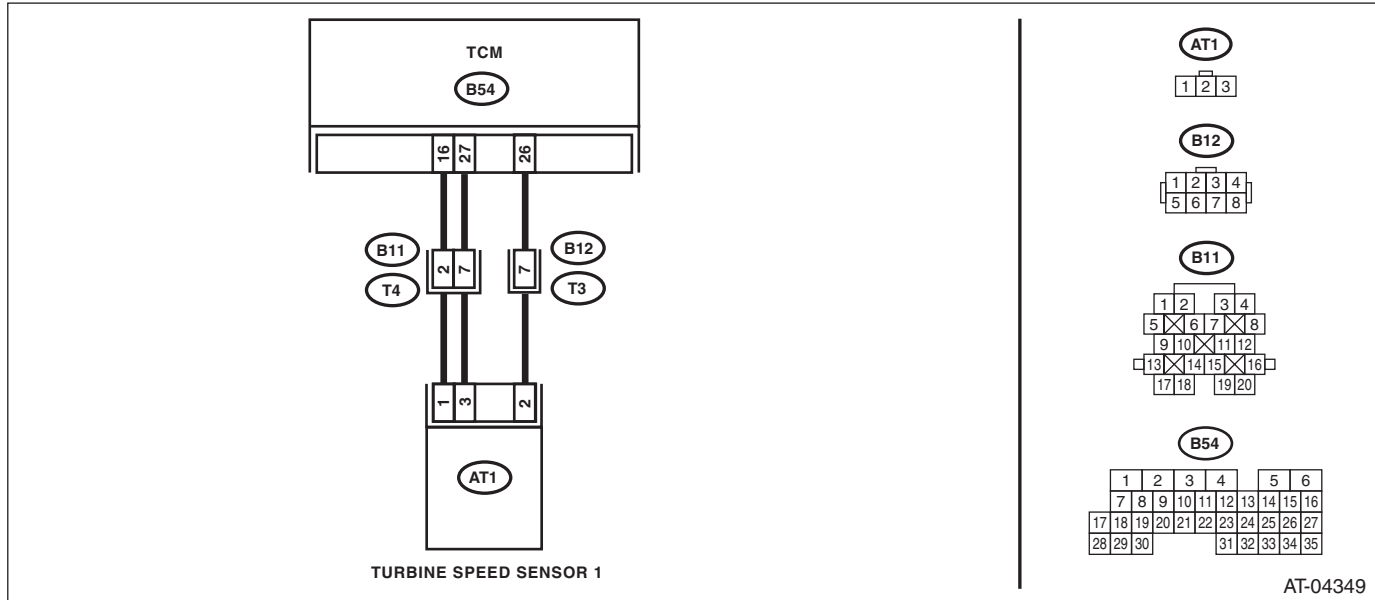
### DTC DETECTING CONDITION:

Input signal circuit of TCM is open or shorted.

### TROUBLE SYMPTOM:

- Excessive shift shock
- Does not shift to 5th

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<p><b>CHECK TCM I/O SIGNAL.</b> Check the power supply and ground I/O signals. &lt;Ref. to 5AT(diag)-13, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.&gt;</p>	Is TCM I/O signal OK?	Go to step 2.	Repair the open or short circuit for power supply and ground.
2	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> 1) Disconnect the connectors from TCM and transmission. 2) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> (B54) No. 16 — (B11) No. 2: (B54) No. 26 — (B12) No. 7: (B54) No. 27 — (B11) No. 7:</p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
3	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 16 — Chassis ground: (B54) No. 26 — Chassis ground: (B54) No. 27 — Chassis ground:</p>	Is the resistance less than 1 MΩ?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
4	<b>CHECK TCM POWER SUPPLY OUTPUT.</b> 1) Connect the connector to the TCM. (Transmission connector is disconnected) 2) Turn the ignition switch to ON. (engine OFF) 3) Measure the voltage between transmission connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B11) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
5	<b>CHECK INPUT CIRCUIT OF TCM TURBINE SPEED SENSOR.</b> Measure the voltage between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B12) No. 7 (+) — (B11) No. 2 (-):</b>	Is the voltage 4 — 6 V?	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
6	<b>CHECK HARNESS ASSEMBLY (TURBINE SPEED SENSOR GROUND).</b> Check the installing condition of ground connecting harness of harness assembly (used for both of turbine speed sensor 1, rear vehicle speed sensor).	Is the ground connecting harness installed securely to the transmission body? Is there any serious damage in the harness and terminal?	Go to step 7.	When poor installation of ground occurs, install it securely. Replace the transmission assembly if the harness or terminal is damaged. <Ref. to 5AT-38, Automatic Transmission Assembly.>
7	<b>CHECK HARNESS ASSEMBLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Disconnect the connector from turbine speed sensor 1. 4) Measure the resistance between transmission connector and turbine speed sensor 1 connector. <b>Connector &amp; terminal</b> <b>(T3) No. 7 — (AT1) No. 2:</b> <b>(T4) No. 7 — (AT1) No. 3:</b> <b>(T4) No. 2 — (AT1) No. 1:</b> <b>(AT1) No. 1 — Chassis ground:</b>	Is the resistance less than 1 Ω?	Go to step 8.	Repair the open circuit of harness between TCM and transmission connector, or poor contact of connector.
8	<b>CHECK HARNESS ASSEMBLY.</b> Measure the resistance between transmission connector and chassis ground. <b>Connector &amp; terminal</b> <b>(T3) No. 7 — Chassis ground:</b> <b>(T4) No. 7 — Chassis ground:</b> <b>(T4) No. 2 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 9.	Repair the short circuit of harness between TCM and transmission connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
9	<p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <p>1) Connect all connectors. 2) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor.</p> <p>3) Start the engine, and set the vehicle in 4th speed driving condition of manual mode.</p> <p>NOTE: Turbine speed sensor 1 signal can be measured only on 4th speed.</p> <p>4) Read the current data of turbine speed sensor 1 using the Subaru Select Monitor. &lt;Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.&gt;</p> <p>NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the VDC memory clearance procedure of on-board diagnostics system. &lt;Ref. to VDC(diag)-23, Clear Memory Mode.&gt;</p>	<p>Does the value of the turbine speed sensor 1 change depending on the acceleration, deceleration and shifting range of the vehicle?</p>	<p>Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness between ATF temperature sensor and transmission connector.</p>	<p>Replace the turbine speed sensor 1. &lt;Ref. to 5AT-55, Turbine Speed Sensor 1.&gt;</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## E: DTC P0719 BRAKE SWITCH CIRCUIT LOW

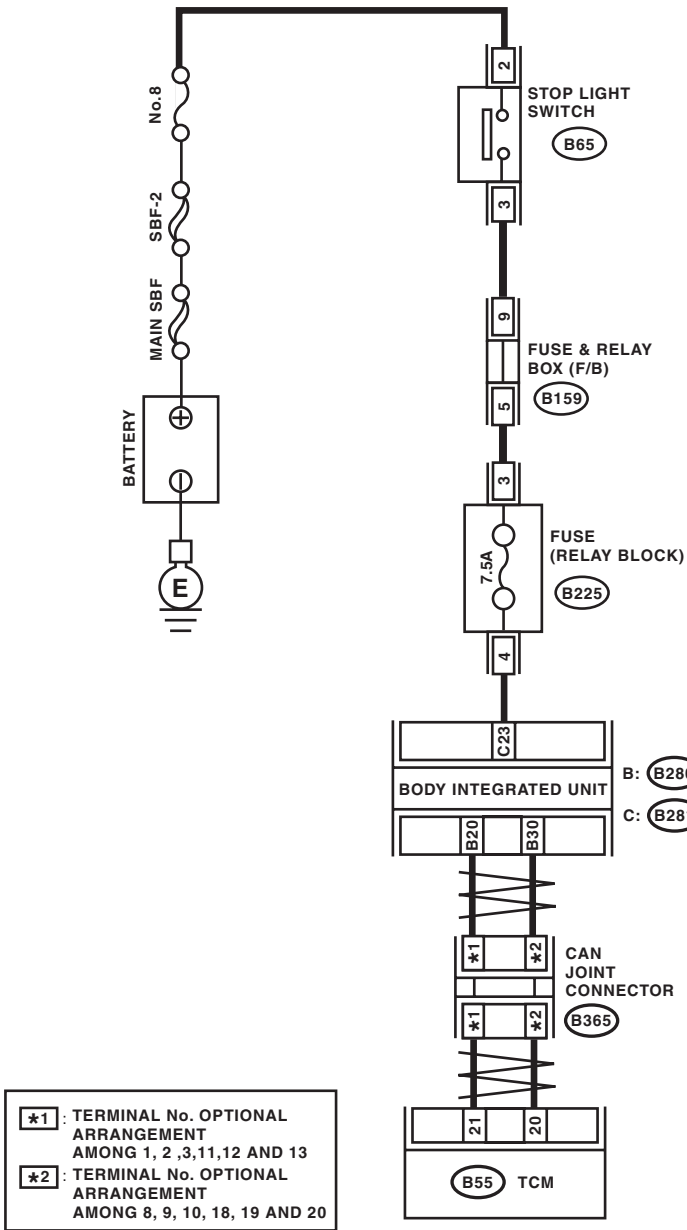
### DTC DETECTING CONDITION:

Stop light switch malfunction, open input signal circuit

### TROUBLE SYMPTOM:

Brake down control does not operate at S# mode.

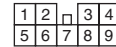
### WIRING DIAGRAM:



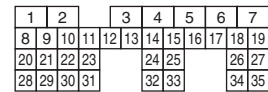
**B65**



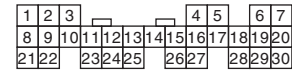
**B159**



**B55**



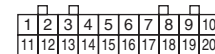
**B: B280**



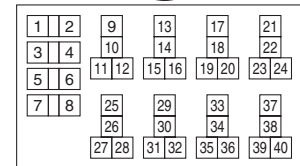
**C: B281**



**B365**



**B225**



RELAY BLOCK

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
<b>1</b>	<b>CHECK DTC.</b>	Is any of following DTC displayed? / AT CAN Communication Circuit / Output Speed Sensor Circuit / AT Vehicle Speed Sensor Circuit Malfunction (Rear Wheel)	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b>	<b>CHECK FUSE (RELAY BLOCK).</b> Remove the fuse (7.5A) in the relay block.	Is the fuse (7.5A) blown out?	Replace the fuse (7.5A). If the replaced fuse (7.5A) has blown out easily, repair short circuit of harness between fuse (7.5A) and body integrated unit.	Go to step 3.
<b>3</b>	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Turn the Subaru Select Monitor switch to ON. 5) Depress the brake pedal. 6) Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is ON displayed?	Go to step 4.	Go to step 5.
<b>4</b>	<b>CHECK TCM.</b> Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is ON displayed?	A temporary poor contact of connector or harness may be the cause. Check the poor contact.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>5</b>	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Disconnect the connector from body integrated unit. 2) Depress the brake pedal. 3) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 8.	Go to step 6.
<b>6</b>	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from stop light switch. 3) Measure the resistance of harness between body integrated unit and stop light switch. <b>Connector &amp; terminal</b> <b>(B281) No. 23 — (B65) No. 3:</b>	Is the resistance less than 1 Ω?	Go to step 7.	Repair the open circuit of harness between body integrated unit and stop light switch.
<b>7</b>	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> Measure the resistance of harness between body integrated unit connector and stop light switch. <b>Connector &amp; terminal</b> <b>(B281) No. 23 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 8.	Repair the short circuit of harness between body integrated unit and stop light switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
8	CHECK POOR CONTACT.	Is there poor contact in input signal of brake switch?	Repair the poor contact.	Check the body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### F: DTC P0720 OUTPUT SPEED SENSOR CIRCUIT

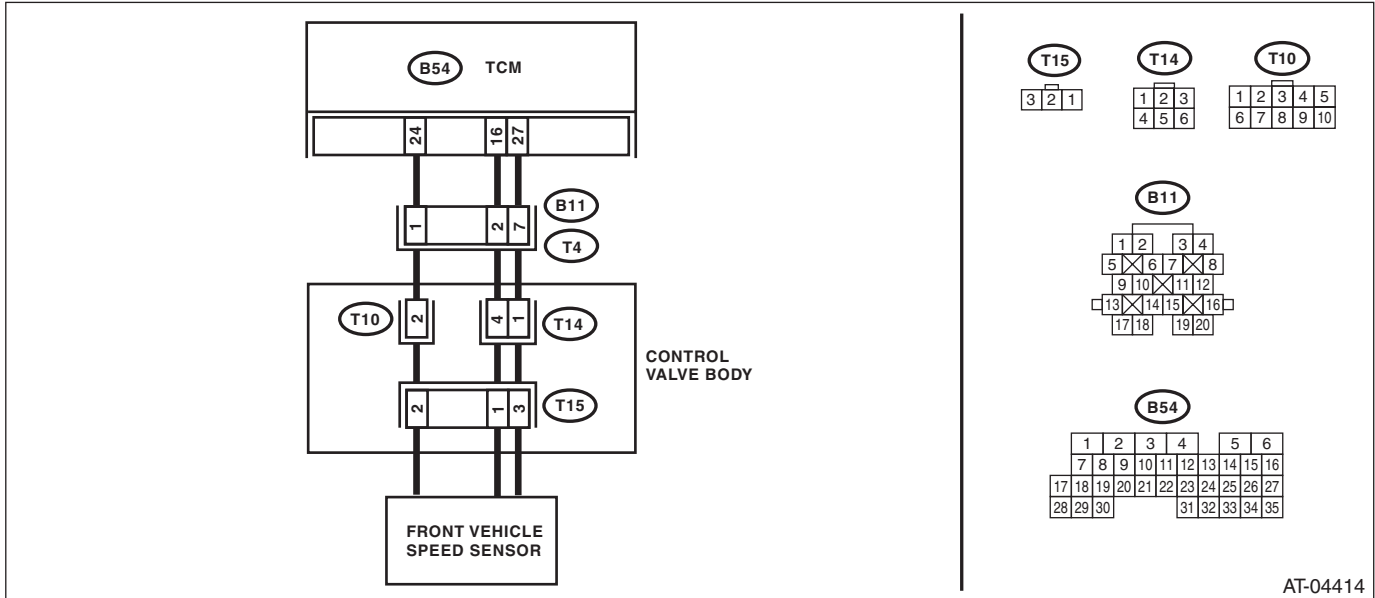
#### DTC DETECTING CONDITION:

- AT vehicle speed signal is abnormal.
- The harness connector between TCM and front vehicle speed sensor is shorted or open.

#### TROUBLE SYMPTOM:

- Shifting quality malfunction
- Driving performance is poor.

#### WIRING DIAGRAM:



AT-04414

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK TCM I/O SIGNAL.</b> Check the power supply and ground I/O signals. <Ref. to 5AT(diag)-13, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.>	Is TCM I/O signal OK?	Go to step 2.	Repair the open or short circuit for power supply and ground.
<b>2 CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> 1) Disconnect the connectors from TCM and transmission. 2) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B54) No. 24 — (B11) No. 1:</b> <b>(B54) No. 16 — (B11) No. 2:</b> <b>(B54) No. 27 — (B11) No. 7:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
<b>3 CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B54) No. 24 — Chassis ground:</b>	Is the resistance less than 1 M $\Omega$ ?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.
<b>4 CHECK TCM POWER SUPPLY OUTPUT.</b> 1) Connect the connector to the TCM. (Transmission connector is disconnected) 2) Turn the ignition switch to ON. (engine OFF) 3) Measure the voltage between transmission connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B11) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>5 CHECK INPUT CIRCUIT OF TCM TURBINE SPEED SENSOR.</b> Measure the voltage variation between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B11) No. 1 (+) — (B11) No. 2 (-):</b>	Is the voltage 4 — 6 V?	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>6 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Lift up the vehicle. NOTE: Raise all wheels off the floor. 3) Start the engine, and drive it. 4) Read the current data of front wheel speed using Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to VDC(diag)-15, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>	Does the value of the front wheel speed change depending on the acceleration and deceleration of the vehicle?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness between ATF temperature sensor and transmission connector.	Go to step 7.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>7</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the connector from transmission.                      3) Remove the transmission connector from bracket.                      4) Lift up the vehicle.</p> <p>NOTE:                      Raise all wheels off the floor.                      5) Drain the ATF.</p> <p><b>CAUTION:</b>  <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the connector from control valve body connector.                      7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b>  <b>(T4) No. 1 — (T10) No. 2:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 8.</p>	<p>Repair the open circuit of harness between control valve body connector and transmission connector.</p>
<p><b>8</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b>  <b>(T10) No. 2 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Go to step 9.</p>	<p>Repair the short circuit of harness between transmission connector and transmission ground.</p>
<p><b>9</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN CONTROL VALVE BODY AND FRONT VEHICLE SPEED SENSOR.</b></p> <p>1) Disconnect the connector from front vehicle speed sensor.                      2) Measure the resistance of harness between control valve body connector and vehicle speed sensor connector.</p> <p><b>Connector &amp; terminal</b>  <b>(T14) No. 4 — (T15) No. 1:</b>  <b>(T10) No. 2 — (T15) No. 2:</b>  <b>(T14) No. 1 — (T15) No. 3:</b></p>	<p>Is the resistance less than 1 <math>\Omega</math>?</p>	<p>Go to step 10.</p>	<p>Replace the control valve body.                      &lt;Ref. to 5AT-56, Control Valve Body.&gt;</p>
<p><b>10</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN CONTROL VALVE BODY AND FRONT VEHICLE SPEED SENSOR.</b></p> <p>Measure the resistance of harness between control valve body connector and transmission ground.</p> <p><b>Connector &amp; terminal</b>  <b>(T10) No. 2 — Transmission ground:</b></p>	<p>Is the resistance 1 M<math>\Omega</math> or more?</p>	<p>Replace the front vehicle speed sensor.</p>	<p>Replace the control valve body.                      &lt;Ref. to 5AT-56, Control Valve Body.&gt;</p>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## G: DTC P0724 BRAKE SWITCH CIRCUIT HIGH

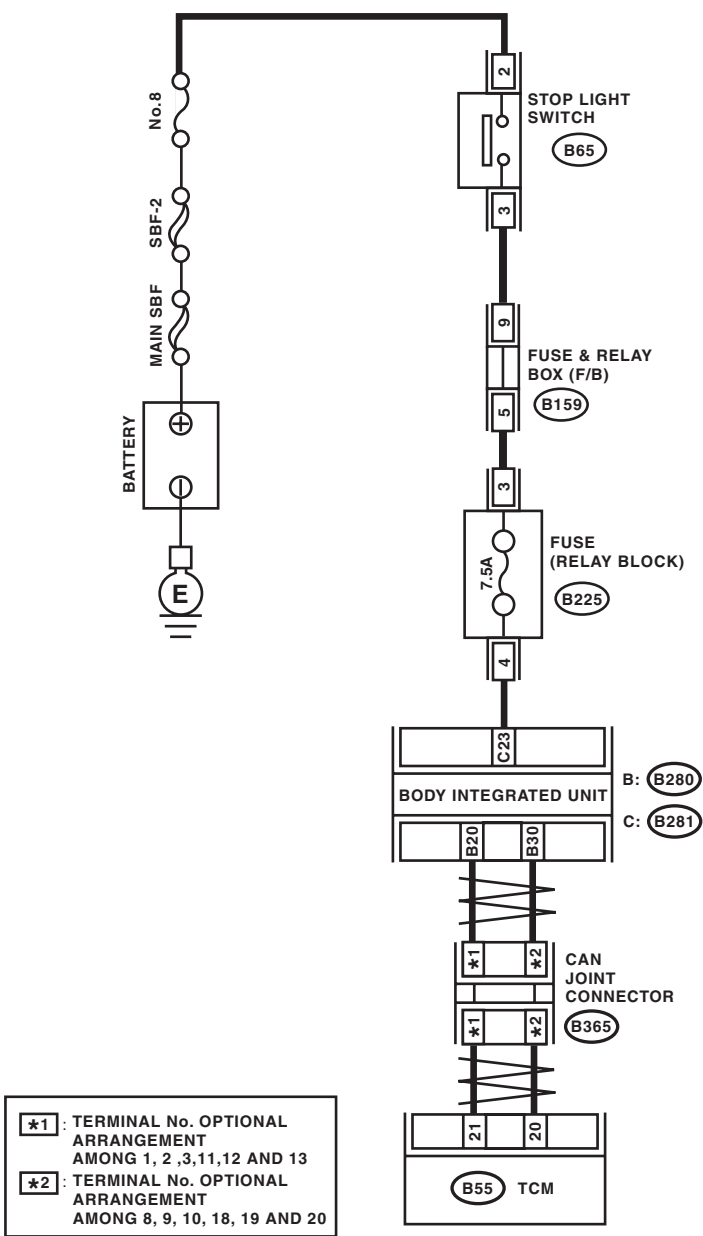
### DTC DETECTING CONDITION:

Stop light switch malfunction, open input signal circuit

### TROUBLE SYMPTOM:

Gear is not shifted down when climbing a hill.

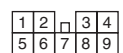
### WIRING DIAGRAM:



**B65**



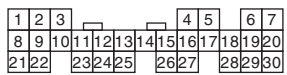
**B159**



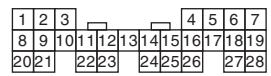
**B55**



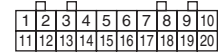
**B: B280**



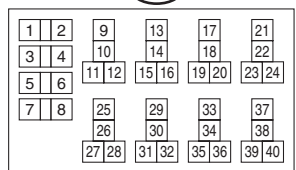
**C: B281**



**B365**



**B225**



RELAY BLOCK

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
<b>1</b>	<b>CHECK DTC.</b>	Is any of following DTC detected? / AT CAN Communication Circuit / Output Speed Sensor Circuit / AT Vehicle Speed Sensor Circuit Malfunction (Rear Wheel)	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b>	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Turn the Subaru Select Monitor switch to ON. 5) Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	Go to step 3.	Go to step 4.
<b>3</b>	<b>CHECK TCM.</b> Read the data of "Stop Light Switch" using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	A temporary poor contact of connector or harness may be the cause. Check the poor contact.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>4</b>	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Disconnect the connector from body integrated unit. 2) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 5.	Go to step 7.
<b>5</b>	<b>CHECK STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from stop light switch. 3) Measure the resistance of harness between stop light switch connectors. <b>Connector &amp; terminal</b> <b>(B65) No. 3 — (B65) No. 2:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the stop light switch.
<b>6</b>	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage of harness between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 23 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 7.	Repair the short circuit of harness between TCM and stop light switch.
<b>7</b>	<b>CHECK POOR CONTACT.</b>	Is there poor contact in input signal of brake switch?	Repair the poor contact.	Check the body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

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## **H: DTC P0731 GEAR 1 INCORRECT RATIO**

**NOTE:**

Refer to DTC P0736 for diagnostic procedure. <Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **I: DTC P0732 GEAR 2 INCORRECT RATIO**

**NOTE:**

Refer to DTC P0736 for diagnostic procedure. <Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **J: DTC P0733 GEAR 3 INCORRECT RATIO**

**NOTE:**

Refer to DTC P0736 for diagnostic procedure. <Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **K: DTC P0734 GEAR 4 INCORRECT RATIO**

**NOTE:**

Refer to DTC P0736 for diagnostic procedure. <Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **L: DTC P0735 GEAR 5 INCORRECT RATIO**

**NOTE:**

Refer to DTC P0736 for diagnostic procedure. <Ref. to 5AT(diag)-54, DTC P0736 REVERSE INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## M: DTC P0736 REVERSE INCORRECT RATIO

### DTC DETECTING CONDITION:

Target gear ratio and actual gear ratio do not match.

### TROUBLE SYMPTOM:

- Shift point is too high or too low.
- Excessive shift shock
- Gear is not changed.
- The vehicle does not move in D or R range with the engine running at high speed.

Step	Check	Yes	No	
<b>1</b>	<b>CHECK DTC OF TCM.</b>	Is any DTC of the followings detected? P0715, P0720, P0753, P0758, P0763, P0768, P0773, P0751, P0756, P0761, P0766, P0771, P1706, P1710, P1718	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b>	<b>CHECK TURBINE SPEED SENSOR USING SUBARU SELECT MONITOR.</b> 1) Lift up the vehicle. NOTE: Raise all wheels off the floor. 2) Start the engine, and drive it. 3) Read the current data of torque converter turbine speed using Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the VDC memory clearance procedure of on-board diagnostics system. <Ref. to VDC(diag)-15, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>	Does the displayed value of the Subaru Select Monitor change according to engine speed and shifting?	Go to step 3.	Perform the diagnosis according to DTC P0715, P1710.
<b>3</b>	<b>CHECK FRONT AND REAR VEHICLE SPEED SENSORS.</b>	Do the values displayed for each of the Subaru Select Monitor and the speedometer substantially match?	Go to step 4.	Perform the diagnosis according to DTC P0720, P1706.
<b>4</b>	<b>CHECK INHIBITOR SWITCH.</b>	Do the values displayed for the Subaru Select Monitor and the meter indicator match?	Go to step 5.	Perform the diagnosis according to DTC P0705.
<b>5</b>	<b>DRIVING CHECK.</b> 1) Turn the ignition switch to OFF. 2) After restarting the engine, check that the AT OIL TEMP light is not blinking, and perform a drive check based on the Inspection Mode. <Ref. to 5AT(diag)-21, PROCEDURE, Inspection Mode.>	Is DTC displayed again?	Check the DTC. Then, when proceeded again to step 5, go to step 6.	Go to step 6.
<b>6</b>	<b>CHECK AFTER REPAIR.</b>	Is the trouble symptom unrepeatable (malfunction in shifting such as excessive shift shock, engine speed increases excessively when shifting)?	Replace the transmission assembly.	Temporary poor contact occurs. Check that the harness connector is not faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## N: DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF

### DTC DETECTING CONDITION:

- Defective lock-up clutch or torque converter assembly
- Defective control valve
- Defective turbine speed sensor 1 or 2

### TROUBLE SYMPTOM:

No lock-up occurs. (After engine is warmed-up)

	Step	Check	Yes	No
1	<b>CHECK DTC OF TCM.</b>	Is any DTC of the followings detected? P0715, P0720, P0753, P0758, P0763, P0768, P0773, P0751, P0756, P0761, P0766, P0771, P1710, P1718	Perform the diagnosis according to each DTC.	Go to step 2.
2	<b>DRIVING CHECK FOR LOCK-UP CONDITION.</b> 1) Perform a drive check based on the Inspection Mode with the following conditions. <Ref. to 5AT(diag)-21, PROCEDURE, Inspection Mode.> (1) Read the current data of throttle opening angle using Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> (2) Keep the same vehicle speed at 60 km/h with 10% or less throttle opening angle which is read currently on Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> (3) Read the current data of L/U solenoid target pressure using Subaru Select Monitor. <Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.> (4) Check the engine speed and turbine speed when the L/U solenoid target value displayed on Subaru Select Monitor is 500 kPa or more.	Are the engine speed and turbine speed almost the same?	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.	Go to step 3.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
<p><b>3</b></p> <p><b>DRIVING CHECK FOR LOCK-UP CONDITION.</b></p> <p>1) Clear the memory. &lt;Ref. to 5AT(diag)-19, OPERATION, Subaru Select Monitor.&gt;</p> <p>2) Perform a drive check based on the Inspection Mode with the following conditions. &lt;Ref. to 5AT(diag)-21, PROCEDURE, Inspection Mode.&gt;</p> <p>(1) Read the current data of throttle opening angle using Subaru Select Monitor. &lt;Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.&gt;</p> <p>(2) Keep the same vehicle speed at 60 km/h with 10% or less throttle opening angle which is read currently on Subaru Select Monitor. &lt;Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.&gt;</p> <p>(3) Read the current data of L/U solenoid target pressure using Subaru Select Monitor. &lt;Ref. to 5AT(diag)-17, READ CURRENT DATA, OPERATION, Subaru Select Monitor.&gt;</p> <p>(4) Drive the vehicle continuously for one minutes or more with the L/U solenoid target value displayed on Subaru Select Monitor at 500 kPa or more.</p> <p>3) Turn the ignition switch to OFF.</p> <p>4) Turn the ignition switch to ON. (engine ON)</p> <p>5) Perform the step 2) again.</p>	<p>Does the AT OIL TEMP light blink and is DTC P0741 displayed?</p>	<p>Replace the transmission assembly when DTC P0741 is displayed.</p> <p>When DTC other than P0741 is displayed, perform the diagnosis corresponding to the DTC.</p>	<p>Temporary poor contact or open circuit occurs.</p> <p>Recheck that the harness connector has no faulty.</p>	

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## O: DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL

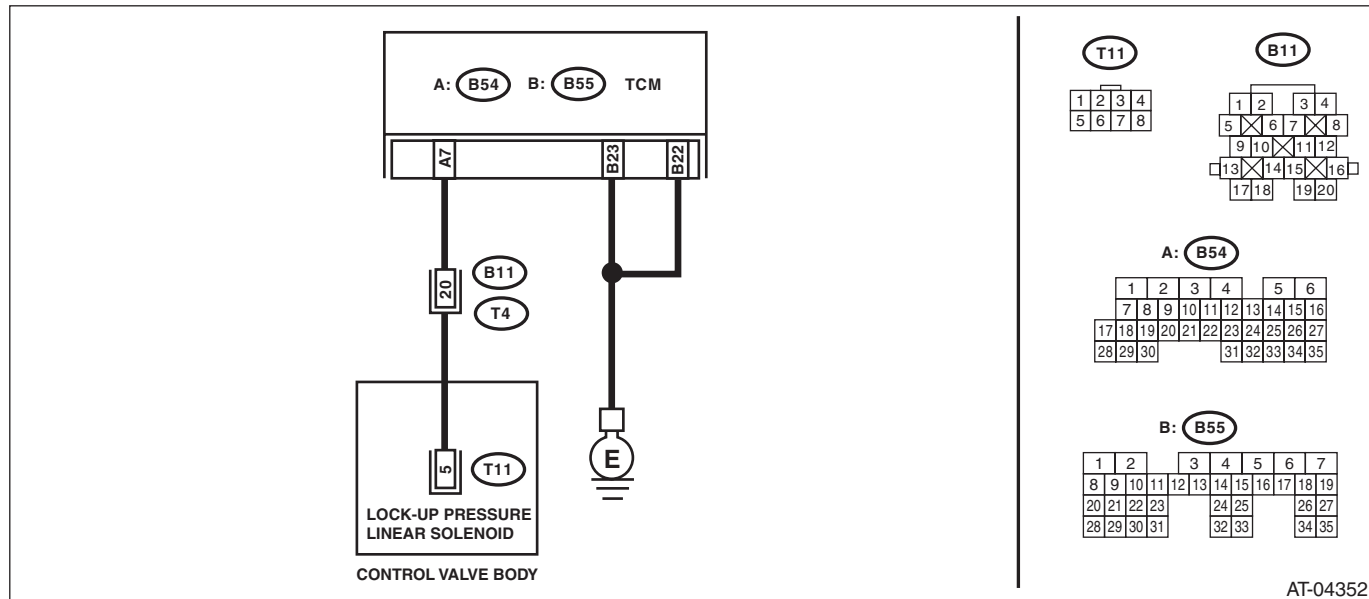
### DTC DETECTING CONDITION:

Output signal circuit of lock-up pressure linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

No lock-up occurs. (After engine is warmed-up)

### WIRING DIAGRAM:



AT-04352

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <i>Connector &amp; terminal</i> <i>(B55) No. 22 — Chassis ground:</i> <i>(B55) No. 23 — Chassis ground:</i> <i>(B54) No. 7 — (B11) No. 20:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B54) No. 7 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. NOTE: Do not drain ATF until it cools down. 6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector. <i>Connector &amp; terminal</i> <i>(T4) No. 20 — (T11) No. 5:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> Measure the resistance between chassis ground and control valve body connector. <i>Connector &amp; terminal</i> <i>(T11) No. 5 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body connector and transmission ground.
<b>5 CHECK LOCK-UP PRESSURE LINEAR SOLENOID.</b> Measure the resistance between transmission ground and control valve body connector. <i>Connector &amp; terminal</i> <i>(T21) No. 5 — Transmission ground:</i>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<b>6 CHECK POOR CONTACT.</b> Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<b>7 CHECK AFTER REPAIR.</b> 1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## P: DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL

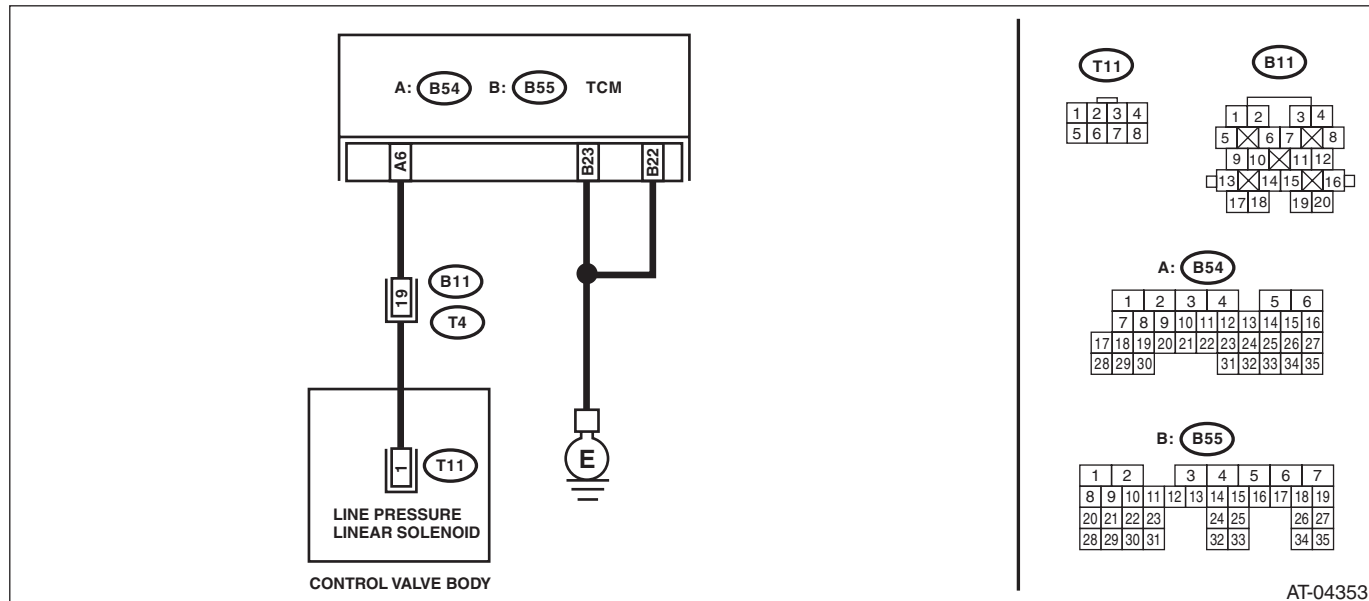
### DTC DETECTING CONDITION:

Output signal circuit of line pressure linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Excessive shift shock

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b> <b>(B54) No. 6 — (B11) No. 19:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b></p> <p>Measure the resistance between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B54) No. 6 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<p><b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor. 5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 19 — (T11) No. 1:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<p><b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T11) No. 1 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body connector and transmission ground.
<p><b>5 CHECK LINE PRESSURE LINEAR SOLENOID.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T21) No. 1 — Transmission ground:</b></p>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.</p>	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<p><b>7 CHECK AFTER REPAIR.</b></p> <p>1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.</p>	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## Q: DTC P0751 SHIFT SOLENOID "A" PERFORMANCE OR STUCK OFF

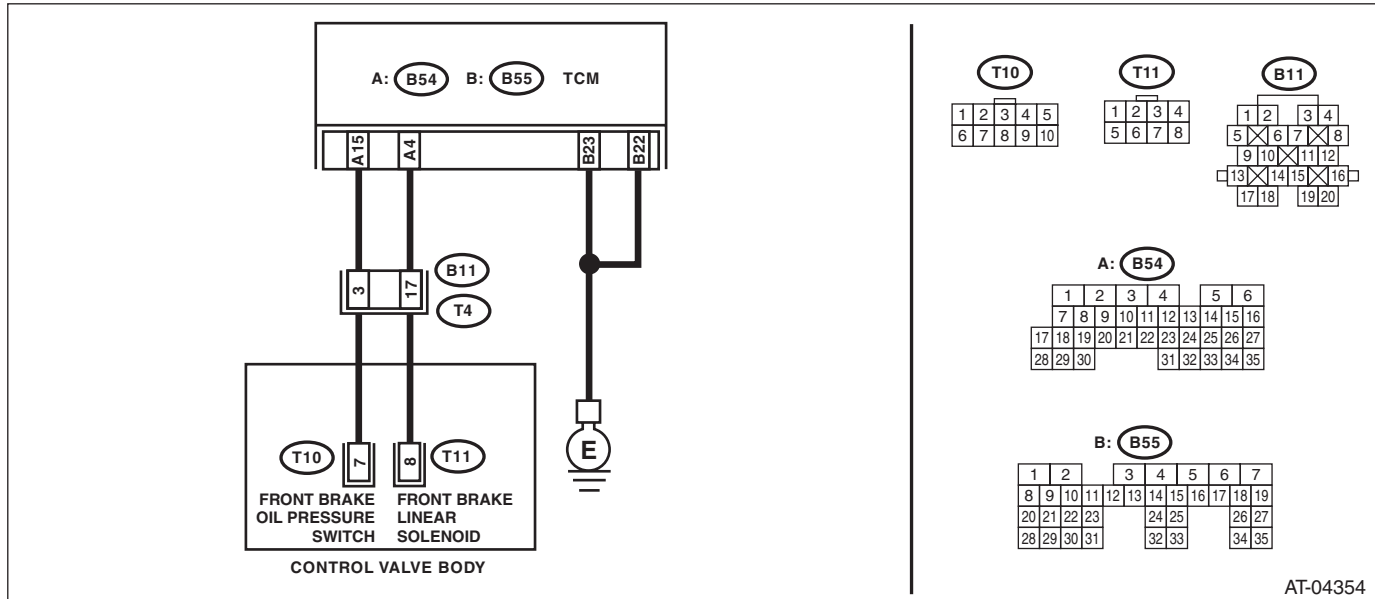
### DTC DETECTING CONDITION:

Output signal value of front brake linear solenoid does not match the oil pressure.

### TROUBLE SYMPTOM:

Locked to 1st gear.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> (B55) No. 22 — Chassis ground: (B55) No. 23 — Chassis ground: (B54) No. 15 — (B11) No. 3: (B54) No. 4 — (B11) No. 17:	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 4 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. (engine OFF) 3) Check input signal of "Fr/B oil pressure SW".	Is OFF displayed?	Go to step 4.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Turn the ignition switch to ON. (engine ON)</li> <li>3) Shift to 1st speed while checking the current gear position using Subaru Select Monitor.</li> <li>4) Check input signal of "Fr/B oil pressure SW".</li> </ol>	Is ON displayed?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness in the solenoid output and oil pressure SW input.	Go to step 5.
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission connector and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(B11) No. 17 — (T11) No. 8:</b> <b>(B11) No. 3 — (T10) No. 7:</b></p>	Is the resistance less than 1 Ω?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission ground and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T10) No. 7 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## R: DTC P0753 SHIFT SOLENOID "A" ELECTRICAL

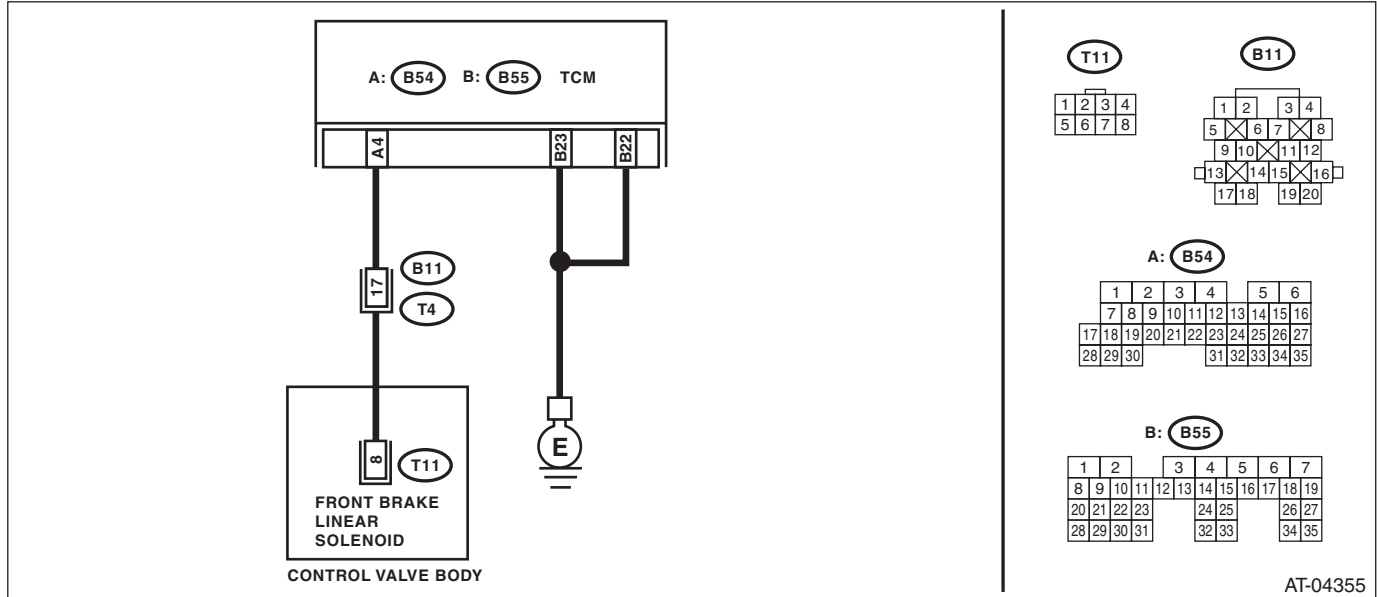
### DTC DETECTING CONDITION:

Output signal circuit of front brake linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Locked to 1st gear.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b> <b>(B54) No. 4 — (B11) No. 17:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b></p> <p>Measure the resistance of harness between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B54) No. 4 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<p><b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor. 5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 17 — (T11) No. 8:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<p><b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T11) No. 8 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body and transmission connector.
<p><b>5 CHECK FRONT BRAKE LINEAR SOLENOID.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T21) No. 8 — Transmission ground:</b></p>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.</p>	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<p><b>7 CHECK AFTER REPAIR.</b></p> <p>1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.</p>	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## S: DTC P0756 SHIFT SOLENOID "B" PERFORMANCE OR STUCK OFF

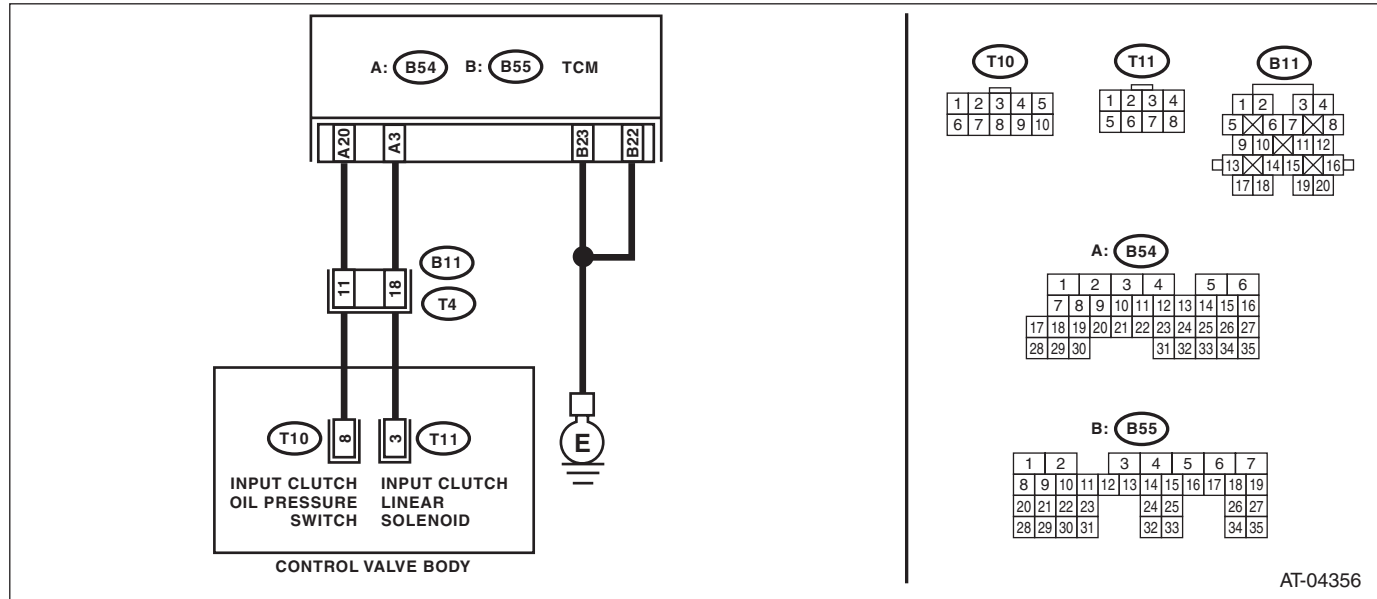
### DTC DETECTING CONDITION:

Output signal value of input clutch linear solenoid does not match the oil pressure.

### TROUBLE SYMPTOM:

Locked to 1st or 4th gear.

### WIRING DIAGRAM:



AT-04356

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> (B55) No. 22 — Chassis ground: (B55) No. 23 — Chassis ground: (B54) No. 3 — (B11) No. 18: (B54) No. 20 — (B11) No. 11:	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 20 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. (engine OFF) 3) Check input signal of "I/C oil pressure SW".	Is OFF displayed?	Go to step 4.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Turn the ignition switch to ON. (engine ON)</li> <li>3) Drive the vehicle on 4th speed of "D" range with checking current gear position using Subaru Select Monitor.</li> <li>4) Check input signal of "I/C oil pressure SW".</li> </ol>	Is ON displayed?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness in the solenoid output and oil pressure SW input.	Go to step 5.
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission connector and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T4) No. 18 — (T11) No. 3:</b> <b>(T4) No. 11 — (T10) No. 8:</b></p>	Is the resistance less than 1 Ω?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Check the insulation of transmission harness assembly.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T10) No. 8 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## T: DTC P0758 SHIFT SOLENOID "B" ELECTRICAL

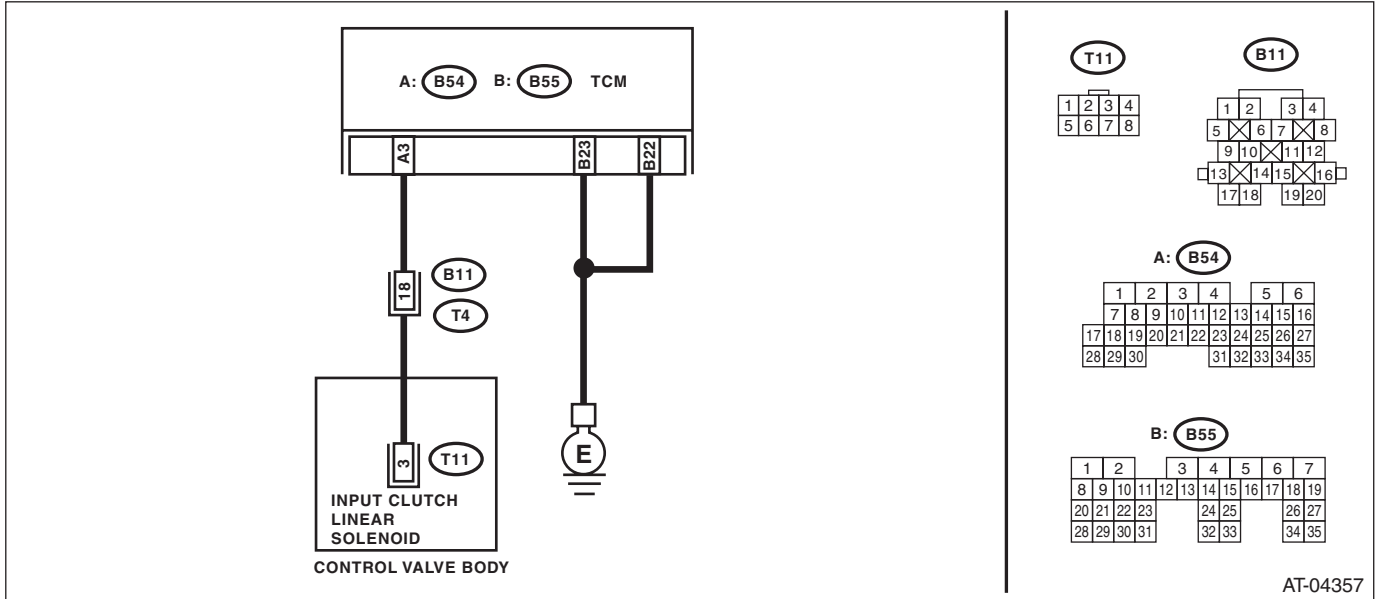
### DTC DETECTING CONDITION:

Output signal circuit of input clutch linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Locked to 1st or 4th gear.

### WIRING DIAGRAM:



AT-04357

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b> <b>(B54) No. 3 — (B11) No. 18:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND BODY HARNESS.</b> Measure the resistance of harness between TCM connector and body harness. <b>Connector &amp; terminal</b> <b>(B54) No. 3 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector. <b>Connector &amp; terminal</b> <b>(T4) No. 18 — (T11) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> Measure the resistance between chassis ground and control valve body connector. <b>Connector &amp; terminal</b> <b>(T11) No. 3 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Repair the short circuit of harness between transmission connector and control valve body connector.
<b>5 CHECK INPUT CLUTCH LINEAR SOLENOID.</b> Measure the resistance between transmission ground and control valve body connector. <b>Connector &amp; terminal</b> <b>(T21) No. 3 — Transmission ground:</b>	Is the resistance between 3—9 $\Omega$ ?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<b>6 CHECK POOR CONTACT.</b> Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<b>7 CHECK AFTER REPAIR.</b> 1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## U: DTC P0761 SHIFT SOLENOID "C" PERFORMANCE OR STUCK OFF

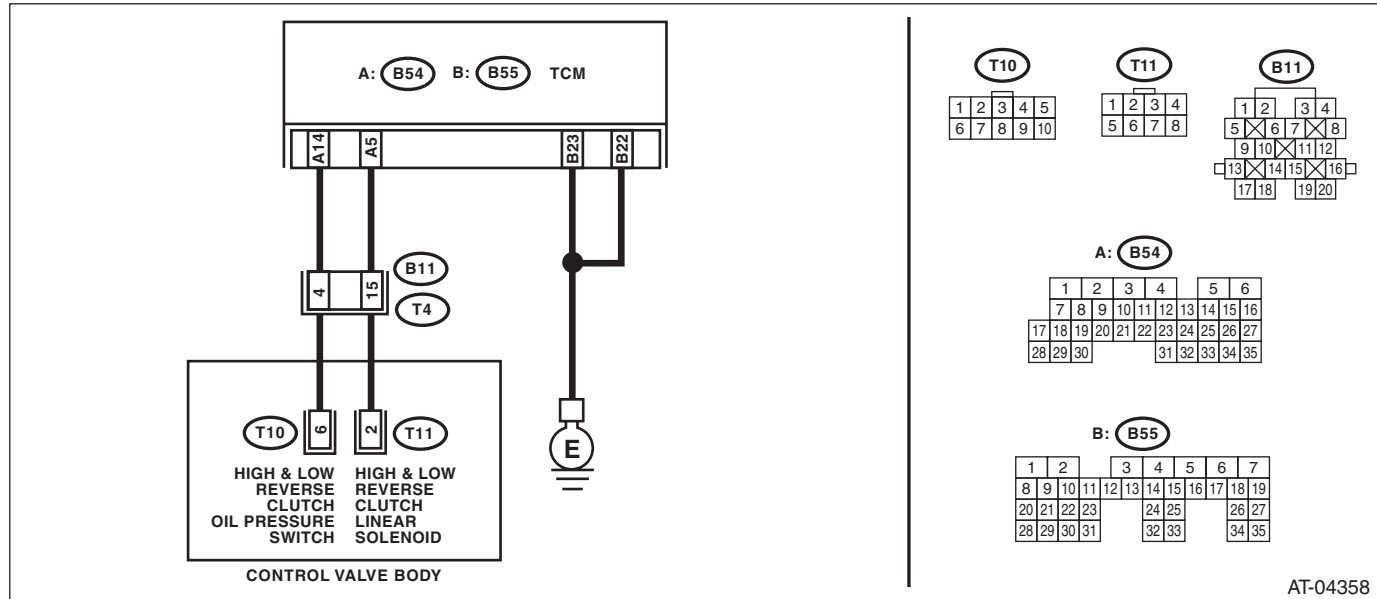
### DTC DETECTING CONDITION:

Output signal value of high & low reverse clutch linear solenoid does not match the oil pressure.

### TROUBLE SYMPTOM:

Locked to 1st gear.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <b>Connector &amp; terminal</b> (B55) No. 22 — Chassis ground: (B55) No. 23 — Chassis ground: (B54) No. 5 — (B11) No. 15: (B54) No. 14 — (B11) No. 4:	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 14 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. (engine OFF) 3) Check the input signal of the "H&LR/C oil pressure SW".	Is OFF displayed?	Go to step 4.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Turn the ignition switch to ON. (engine ON)</li> <li>3) Shift to "D" range and brake ON (1st) with checking current gear position using Subaru Select Monitor.</li> <li>4) Check the input signal of the "H&amp;LR/C oil pressure SW".</li> </ol>	Is ON displayed?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness in the solenoid output and oil pressure SW input.	Go to step 5.
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission connector and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T4) No. 15 — (T11) No. 2:</b> <b>(T4) No. 4 — (T10) No. 6:</b></p>	Is the resistance less than 1 Ω?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Check the insulation of transmission harness assembly.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T10) No. 6 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## V: DTC P0763 SHIFT SOLENOID "C" ELECTRICAL

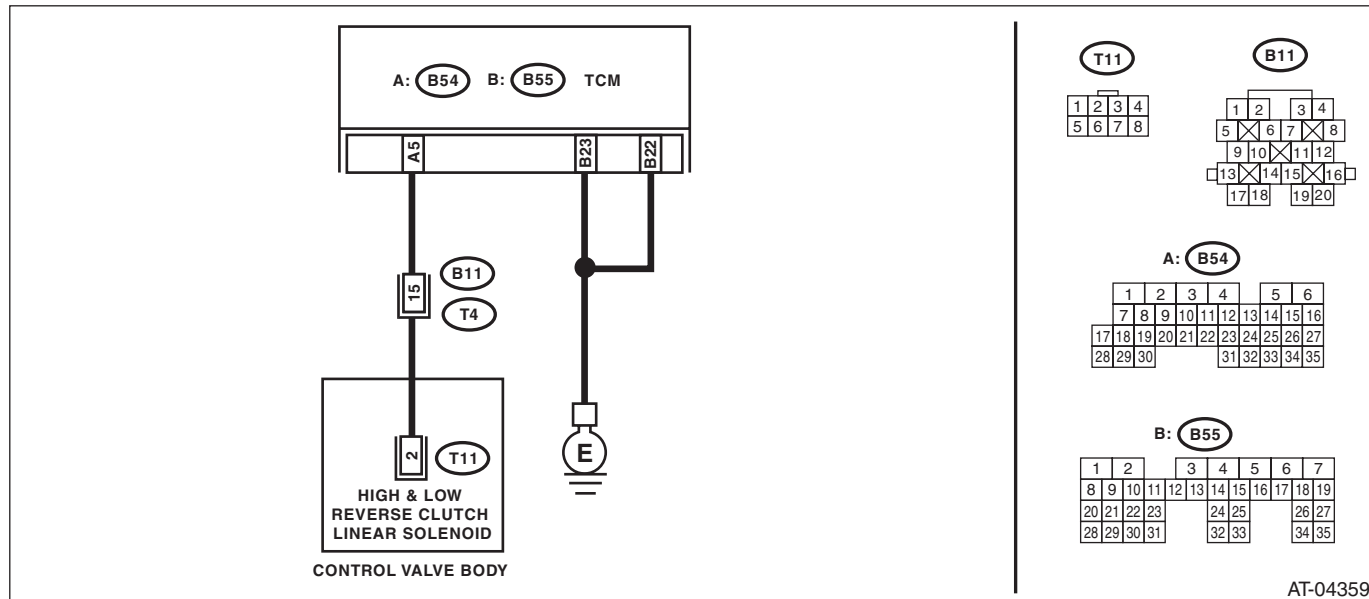
### DTC DETECTING CONDITION:

Output signal circuit of high & low reverse clutch linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Locked to 1st gear.

### WIRING DIAGRAM:



AT-04359

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <i>Connector &amp; terminal</i> <i>(B55) No. 22 — Chassis ground:</i> <i>(B55) No. 23 — Chassis ground:</i> <i>(B54) No. 5 — (B11) No. 15:</i>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b> Measure the resistance of harness between TCM connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B54) No. 5 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector. <i>Connector &amp; terminal</i> <i>(T4) No. 15 — (T11) No. 2:</i>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> Measure the resistance of harness connector between control valve body connector and chassis ground. <i>Connector &amp; terminal</i> <i>(T11) No. 2 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the open circuit of harness between control valve body connector and transmission ground.
<b>5 CHECK HIGH &amp; LOW REVERSE CLUTCH LINEAR SOLENOID.</b> Measure the resistance between transmission ground and control valve body connector. <i>Connector &amp; terminal</i> <i>(T21) No. 2 — Transmission ground:</i>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<b>6 CHECK POOR CONTACT.</b> Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.	Is there any losing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<b>7 CHECK AFTER REPAIR.</b> 1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## W: DTC P0766 SHIFT SOLENOID "D" PERFORMANCE OR STUCK OFF

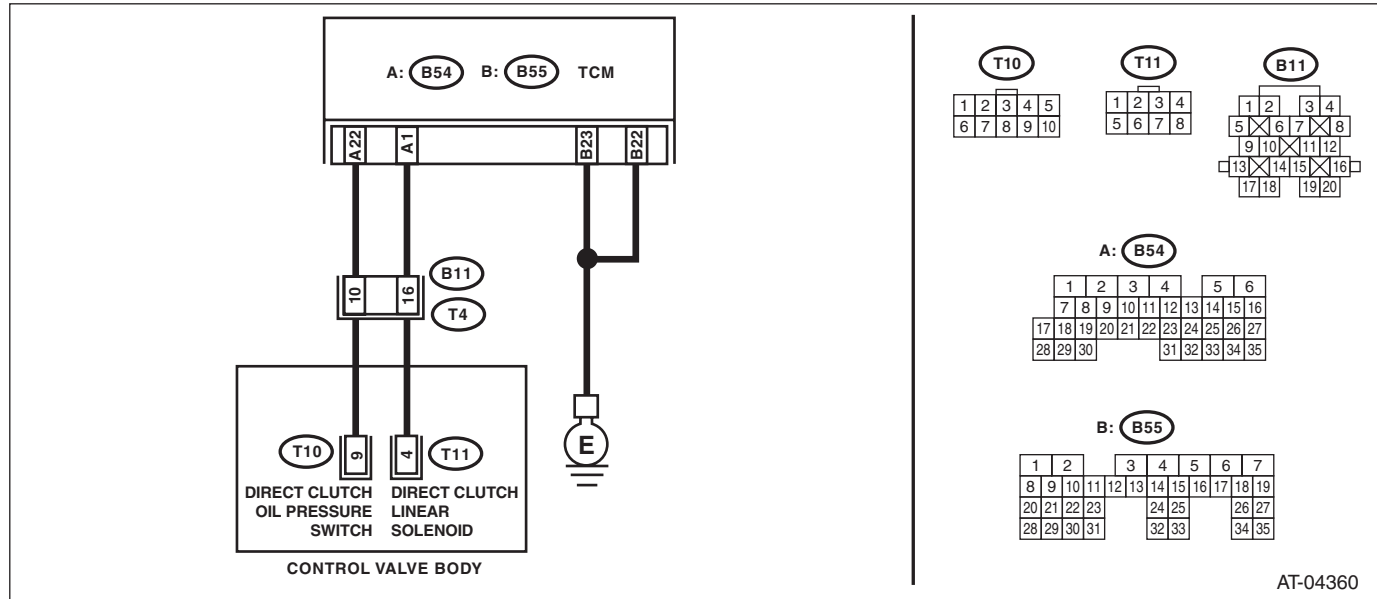
### DTC DETECTING CONDITION:

Output signal value of direct clutch linear solenoid does not match the oil pressure.

### TROUBLE SYMPTOM:

Locked to 1st or 4th gear.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector. <i>Connector &amp; terminal</i> (B55) No. 22 — Chassis ground: (B55) No. 23 — Chassis ground: (B54) No. 1 — (B11) No. 16: (B54) No. 22 — (B11) No. 10:	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
<b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND BODY HARNESS.</b> Measure the resistance of harness between TCM connector and body harness. <i>Connector &amp; terminal</i> (B54) No. 22 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
<b>3 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. (engine OFF) 3) Check input signal of "D/C oil pressure SW".	Is OFF displayed?	Go to step 4.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Turn the ignition switch to ON. (engine ON)</li> <li>3) Shift to 2nd speed of manual mode and brake ON with checking current gear position using Subaru Select Monitor.</li> <li>4) Check input signal of "D/C oil pressure SW".</li> </ol>	Is ON displayed?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness in the solenoid output and oil pressure SW input.	Go to step 5.
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission connector and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T4) No. 16 — (T11) No. 4:</b> <b>(T4) No. 10 — (T10) No. 9:</b></p>	Is the resistance less than 1 Ω?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Check the insulation of transmission harness assembly.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T10) No. 9 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## X: DTC P0768 SHIFT SOLENOID "D" ELECTRICAL

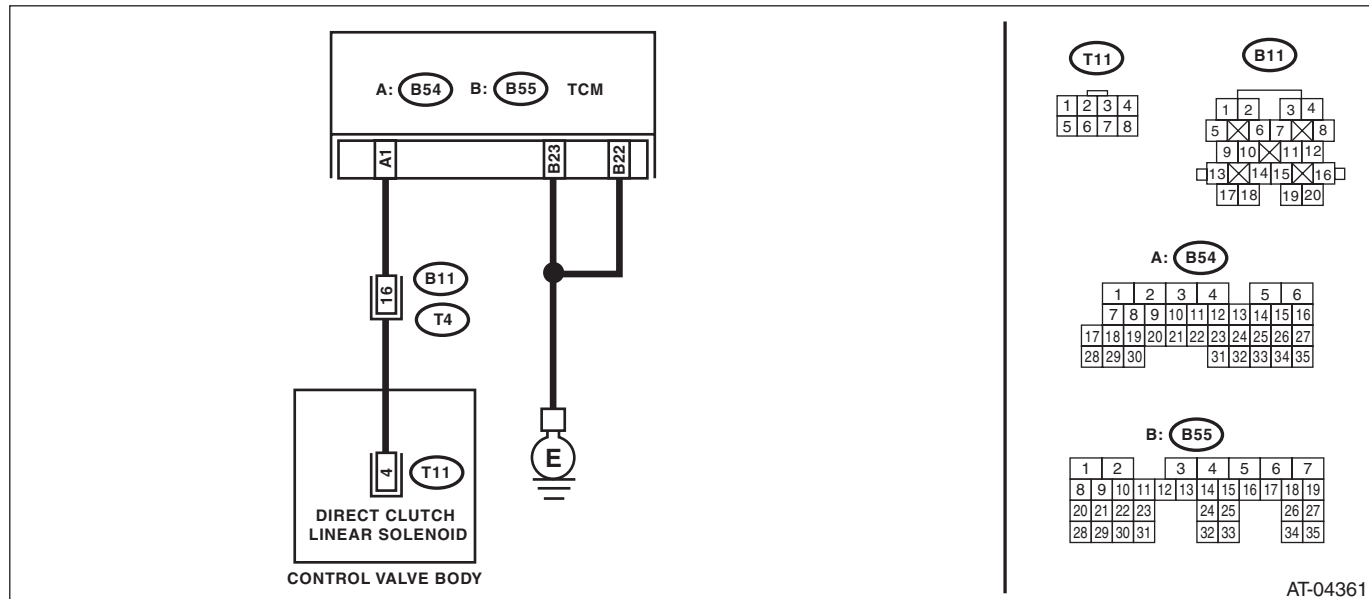
### DTC DETECTING CONDITION:

The output signal circuit of direct clutch linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Locked to 1st or 4th gear.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b> <b>(B54) No. 1 — (B11) No. 16:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b></p> <p>Measure the resistance of harness between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B54) No. 1 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<p><b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor. 5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 16 — (T11) No. 4:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<p><b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between chassis ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T11) No. 4 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body connector and transmission ground.
<p><b>5 CHECK DIRECT CLUTCH LINEAR SOLENOID.</b></p> <p>Measure the resistance of harness connector between control valve body connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T21) No. 4 — Transmission ground:</b></p>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.</p>	Is there any losing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<p><b>7 CHECK AFTER REPAIR.</b></p> <p>1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.</p>	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## Y: DTC P0771 SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF

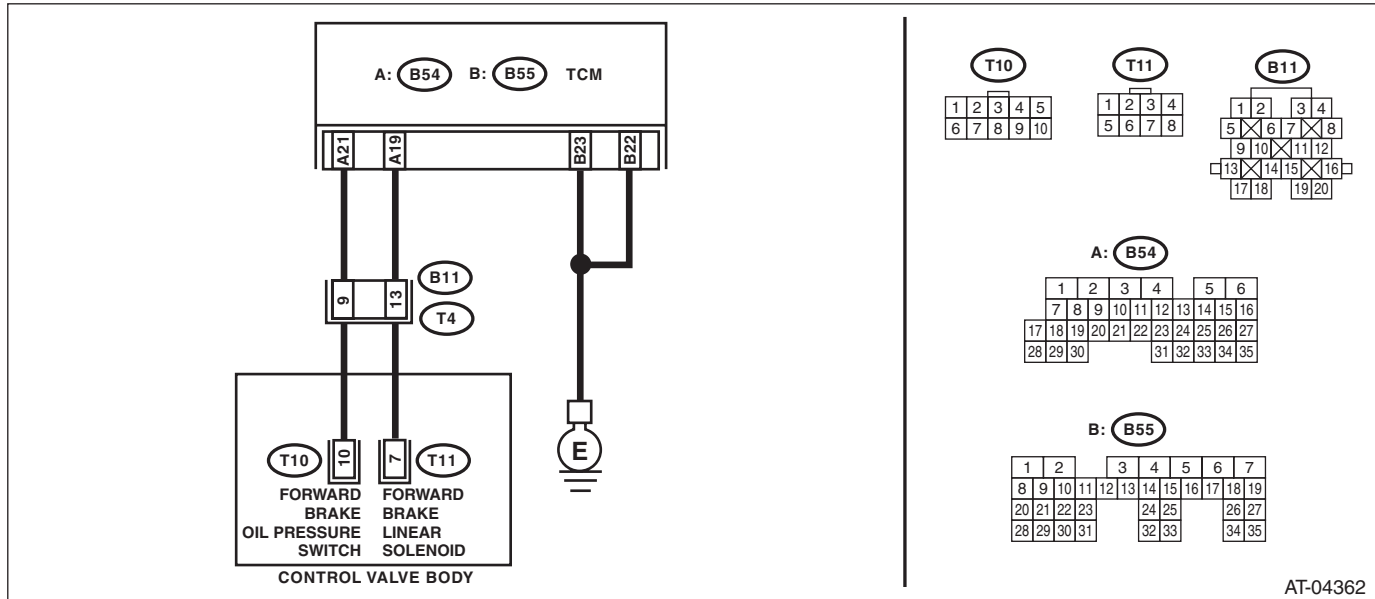
### DTC DETECTING CONDITION:

Output signal of forward brake linear solenoid does not match the oil pressure.

### TROUBLE SYMPTOM:

Locked to 2nd, 3rd, 4th gear.

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<p><b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connectors from TCM and transmission.</p> <p>3) Measure the resistance of harness between TCM and transmission connector.</p> <p><b>Connector &amp; terminal</b>                      (B55) No. 22 — Chassis ground:                      (B55) No. 23 — Chassis ground:                      (B54) No. 19 — (B11) No. 13:                      (B54) No. 21 — (B11) No. 9:</p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM and transmission connector.
2	<p><b>CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b></p> <p>Measure the resistance between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>                      (B54) No. 21 — Chassis ground:</p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM and transmission connector.
3	<p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <p>1) Connect all connectors.</p> <p>2) Turn the ignition switch to ON. (engine OFF)</p> <p>3) Check input signal of "Fwd/B oil pressure SW".</p>	Is OFF displayed?	Go to step 4.	Go to step 6.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4</b></p> <p><b>CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Turn the ignition switch to ON. (engine ON)</li> <li>3) Drive the vehicle on 2nd speed of manual mode 15 km/h (9 MPH) with checking current gear position using Subaru Select Monitor.</li> <li>4) Check input signal of "Fwd/B oil pressure SW".</li> </ol>	Is ON displayed?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness in the solenoid output and oil pressure SW input.	Go to step 5.
<p><b>5</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Measure the resistance between transmission connector and control valve body connector.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T4) No. 13 — (T11) No. 7:</b> <b>(T4) No. 9 — (T10) No. 10:</b></p>	Is the resistance less than 1 Ω?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Replace the transmission harness assembly.
<p><b>6</b></p> <p><b>CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from transmission.</li> <li>3) Remove the transmission connector from bracket.</li> <li>4) Lift up the vehicle.</li> </ol> <p>NOTE: Raise all wheels off the floor.</p> <p>5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <ol style="list-style-type: none"> <li>6) Remove the oil pan, and disconnect the control valve body connector.</li> <li>7) Check the insulation of transmission harness assembly.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(T10) No. 10 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Repair the short circuit of harness between transmission connector and control valve body connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## Z: DTC P0773 SHIFT SOLENOID "E" ELECTRICAL

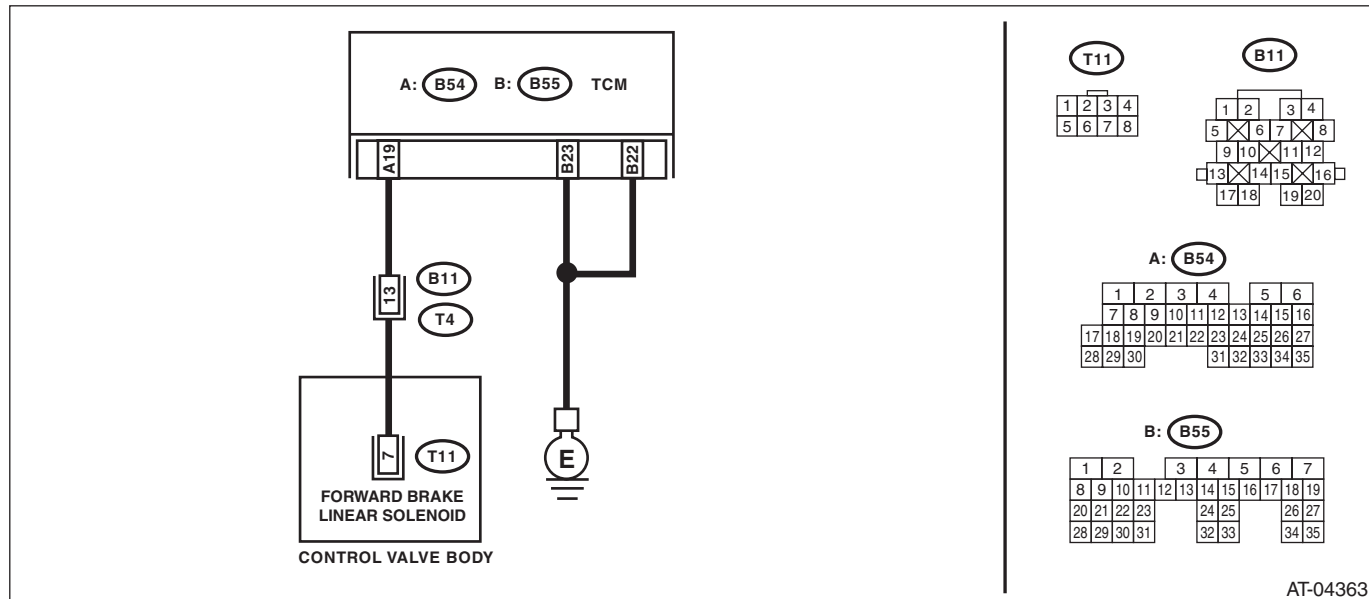
### DTC DETECTING CONDITION:

Output signal circuit of forward brake linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

Locked to 2nd, 3rd, 4th gear.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b> <b>(B54) No. 19 — (B11) No. 13:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND BODY HARNESS.</b></p> <p>Measure the resistance of harness between TCM connector and body harness.</p> <p><b>Connector &amp; terminal</b> <b>(B54) No. 19 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<p><b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor. 5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 13 — (T11) No. 7:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<p><b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between chassis ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T11) No. 7 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body connector and transmission ground.
<p><b>5 CHECK FORWARD BRAKE LINEAR SOLENOID.</b></p> <p>Measure the resistance of harness connector between control valve body connector and transmission ground.</p> <p><b>Connector &amp; terminal</b> <b>(T21) No. 7 — Transmission ground:</b></p>	Is the resistance between 5 — 17 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.</p>	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<p><b>7 CHECK AFTER REPAIR.</b></p> <p>1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.</p>	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AA:DTC P0801 REVERSE INHIBIT CONTROL CIRCUIT

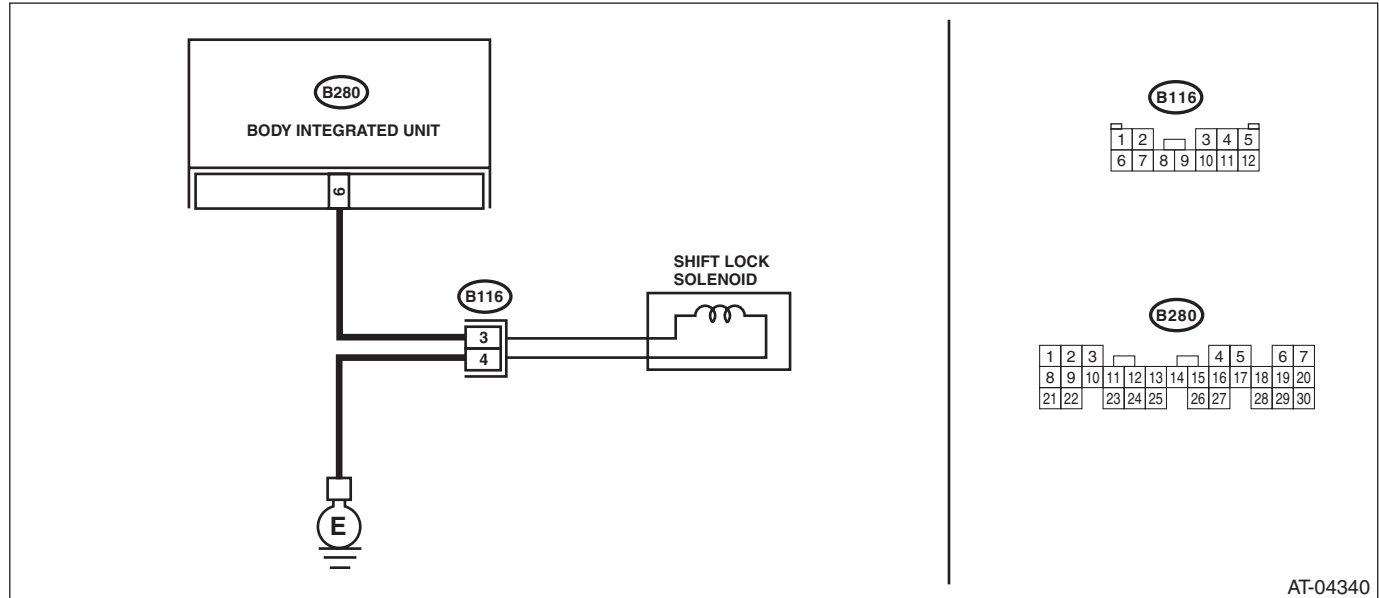
### DTC DETECTING CONDITION:

Shift lock solenoid malfunction, open or short reverse inhibitor control circuit

### TROUBLE SYMPTOM:

- Gear is shifted from “N” range to “R” range during driving at 20 km/h (12 MPH) or more.
- Gear can not be shifted from “N” range to “R” range though the vehicle is parked.

### WIRING DIAGRAM:



Step	Check	Yes	No
<b>1 CHECK SHIFT LOCK SOLENOID.</b> 1) Start the integrated unit by force, and check the operation of shift lock solenoid. (<Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>) 2) Operate AT select lever without depressing the brake pedal.	Does the AT select lever operate?	Go to step 2.	Go to step 3.
<b>2 CHECK OUTPUT SIGNAL OF INTEGRATED UNIT.</b> 1) Display the following items using Subaru Select Monitor. <ul style="list-style-type: none"> <li>• Key warning SW</li> <li>• Shift position</li> <li>• P SW</li> <li>• Stop light switch</li> </ul> 2) Step on the brake and shift the AT select lever to “P” range.	Do the units of measure of items displayed change?	Go to step 3.	Check the circuits of the items whose values do not change.
<b>3 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SHIFT LOCK SOLENOID.</b> Measure the harness resistance between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit of harness between body integrated unit and shift lock solenoid connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK HARNESS BETWEEN SHIFT LOCK SOLENOID AND CHASSIS GROUND TERMINAL.</b> Measure the resistance of harness between shift lock solenoid and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B116) No. 4 — Chassis ground:</b></i>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between chassis ground and shift lock solenoid connector.
<b>5 CHECK SHIFT LOCK SOLENOID.</b> Measure the resistance of shift lock solenoid terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B116) No. 3 — No. 4:</b></i>	Is the resistance between 7 — 21 $\Omega$ ?	Go to step 6.	Replace the shift lock solenoid.
<b>6 CHECK OUTPUT SIGNAL OF BODY INTEGRATED UNIT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) With the brake pedal depressed, shift the AT select lever to "D" range. 4) Measure the voltage between body integrated unit and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B280) No. 6 (+) — Chassis ground (-):</b></i>	Is the voltage 10.5 V or more?	Go to step 7.	Go to step 8.
<b>7 CHECK OUTPUT SIGNAL OF BODY INTEGRATED UNIT.</b> 1) Lift up the vehicle. NOTE: Raise all wheels off the floor. 2) Start the engine. 3) Shift the AT select lever to "D" range and slowly increase vehicle speed to exceed 20 km/h (12 MPH). NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the VDC memory clearance procedure of on-board diagnostics system. <Ref. to VDC(diag)-15, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Measure the voltage between body integrated unit and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B280) No. 6 (+) — Chassis ground (-):</b></i>	Is the voltage less than 1 V?	Even if the AT OIL TEMP light illuminates, the circuit is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the harness or connector in the reverse inhibitor control circuit.	Go to step 8.
<b>8 CHECK POOR CONTACT.</b>	Is there poor contact in the reverse inhibitor control circuit?	Repair the poor contact.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AB:DTC P0817 STARTER DISABLE CIRCUIT

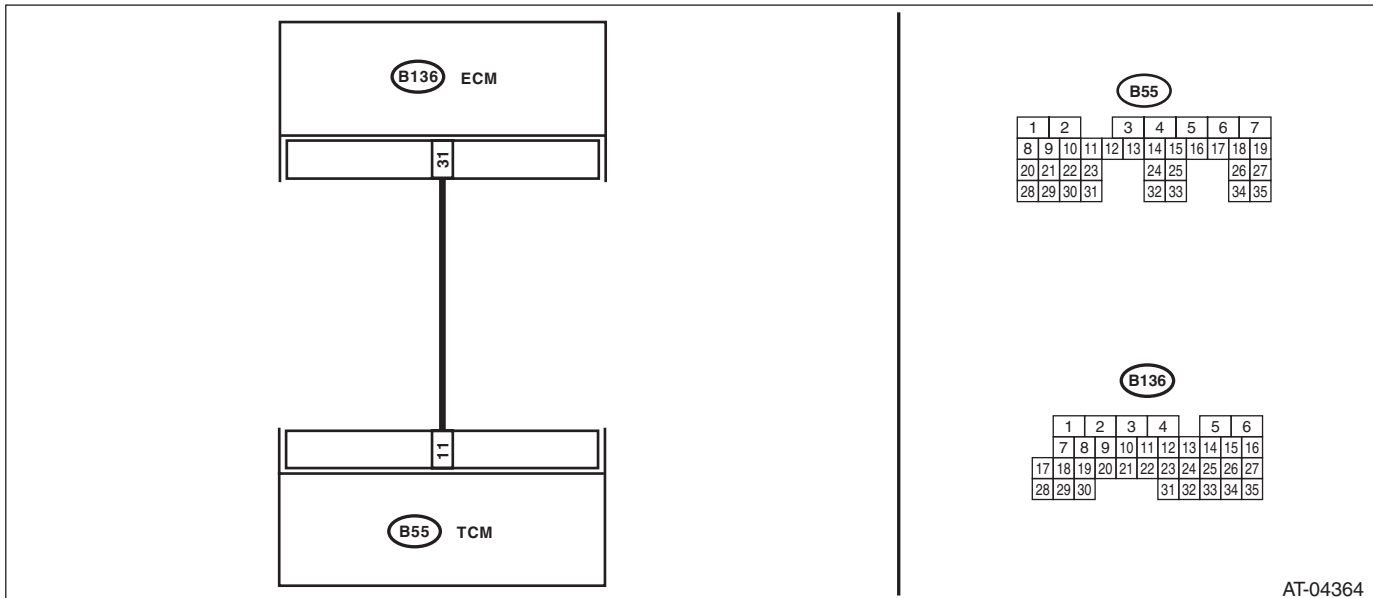
### DTC DETECTING CONDITION:

Open or short in P/N signal output circuit

### TROUBLE SYMPTOM:

- Engine can be started on other than “P” or “N” range
- Engine can not be started on “P” or “N” range.

### WIRING DIAGRAM:



AT-04364

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC OF TCM.</b>	Is DTC of Transmission Range Sensor Circuit (PRNDL Input) detected?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK ECM.</b>	Is the communication between Subaru Select Monitor and ECM normal?	Go to step 3.	Perform the diagnosis according to DTC concerning ECM.
3	<b>CHECK FUSE (NO. 32).</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse.	Is the fuse (No. 32) blown out?	Replace the fuse (No. 32). If the replaced fuse (No. 32) blows out easily, repair the short circuit of harness between fuse (No. 32) and TCM.	Go to step 4.
4	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and transmission. 3) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> <b>(B55) No. 11 — (B136) No. 31</b>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit of harness between TCM and transmission connector, or poor contact of connector.
5	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND ECM.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 11 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Repair the short circuit of harness between transmission connector and chassis ground.
6	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Connect the TCM and ECM connector. 2) Turn the ignition switch to ON. (engine OFF) 3) Shift the select lever to "P" range. 4) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 1 V or less?	Go to step 7.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
7	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Shift the select lever to "D" range. 2) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Go to step 8.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
8	<b>CHECK POOR CONTACT.</b>	Is there any open or poor contact of connector (loosing terminal, entering foreign matter, damaging connector body)?	Repair the poor contact.	Check the neutral switch of ECM.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AC:DTC P0957 BACKUP LIGHT RELAY CIRCUIT LOW

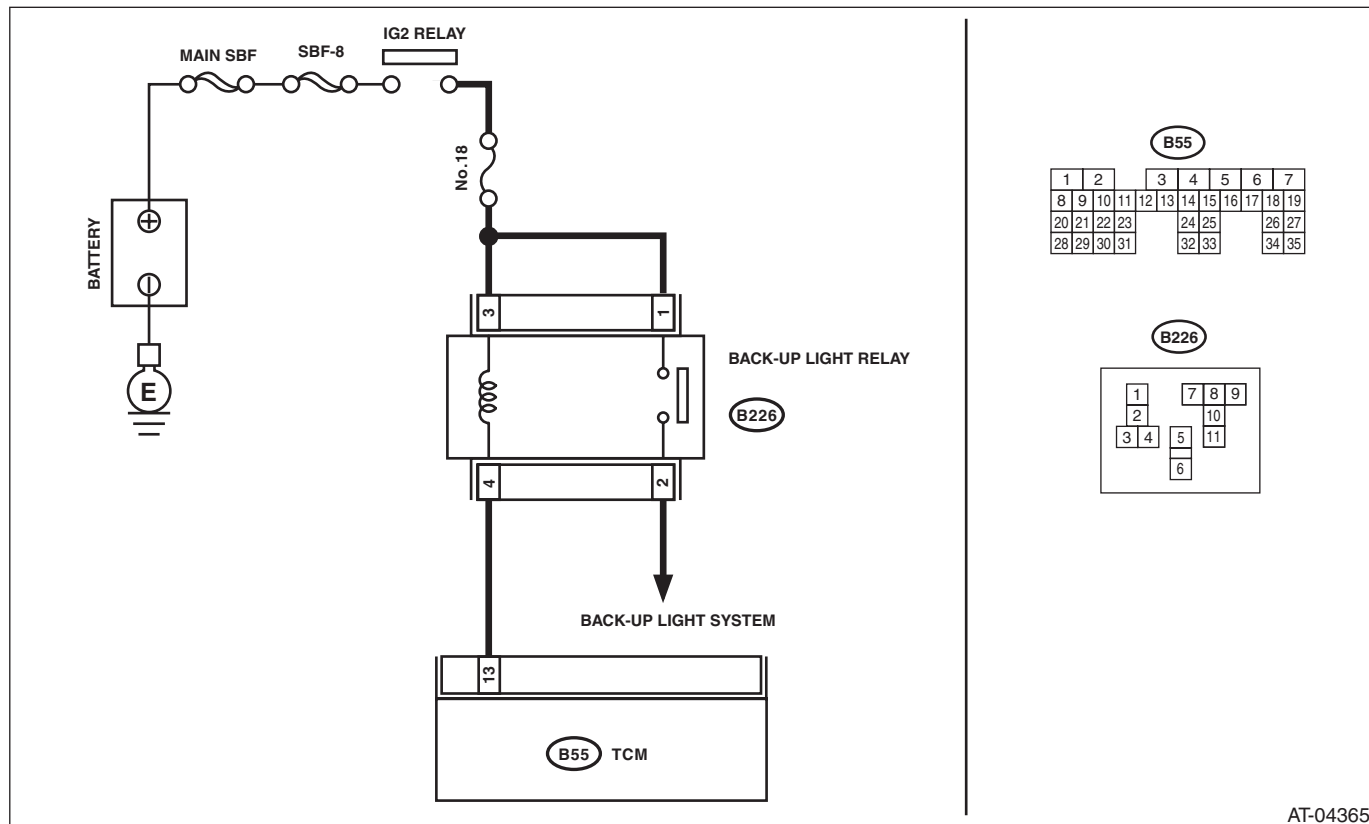
### DTC DETECTING CONDITION:

Output circuit of the back-up light relay is open or shorted

### TROUBLE SYMPTOM:

Back-up light does not illuminate in "R" range.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b>	<b>CHECK DTC OF TCM.</b>	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND BACK-UP LIGHT RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and back-up light relay. 3) Measure the resistance of harness between TCM connector and back-up light relay connector. <b>Connector &amp; terminal</b> <b>(B55) No. 13 — (B226) No. 4:</b>	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector, or poor contact of connector.
<b>3</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 — Chassis ground:</b>	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.
<b>4</b>	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Move the select lever to "P" range. 3) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 (+) — Chassis ground (-):</b>	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>5</b>	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Set the select lever to "R" range. 2) Is the voltage 1 V or less? 3) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 (+) — Chassis ground (-):</b>	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>6</b>	<b>CHECK INPUT VOLTAGE FOR BACK-UP LIGHT RELAY.</b> Measure the voltage between back-up light relay and chassis ground.	Replace the back-up light relay.	Check open or short circuit of harness between fuse (No. 18) and back-up light relay.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AD:DTC P0958 BACKUP LIGHT RELAY CIRCUIT HIGH

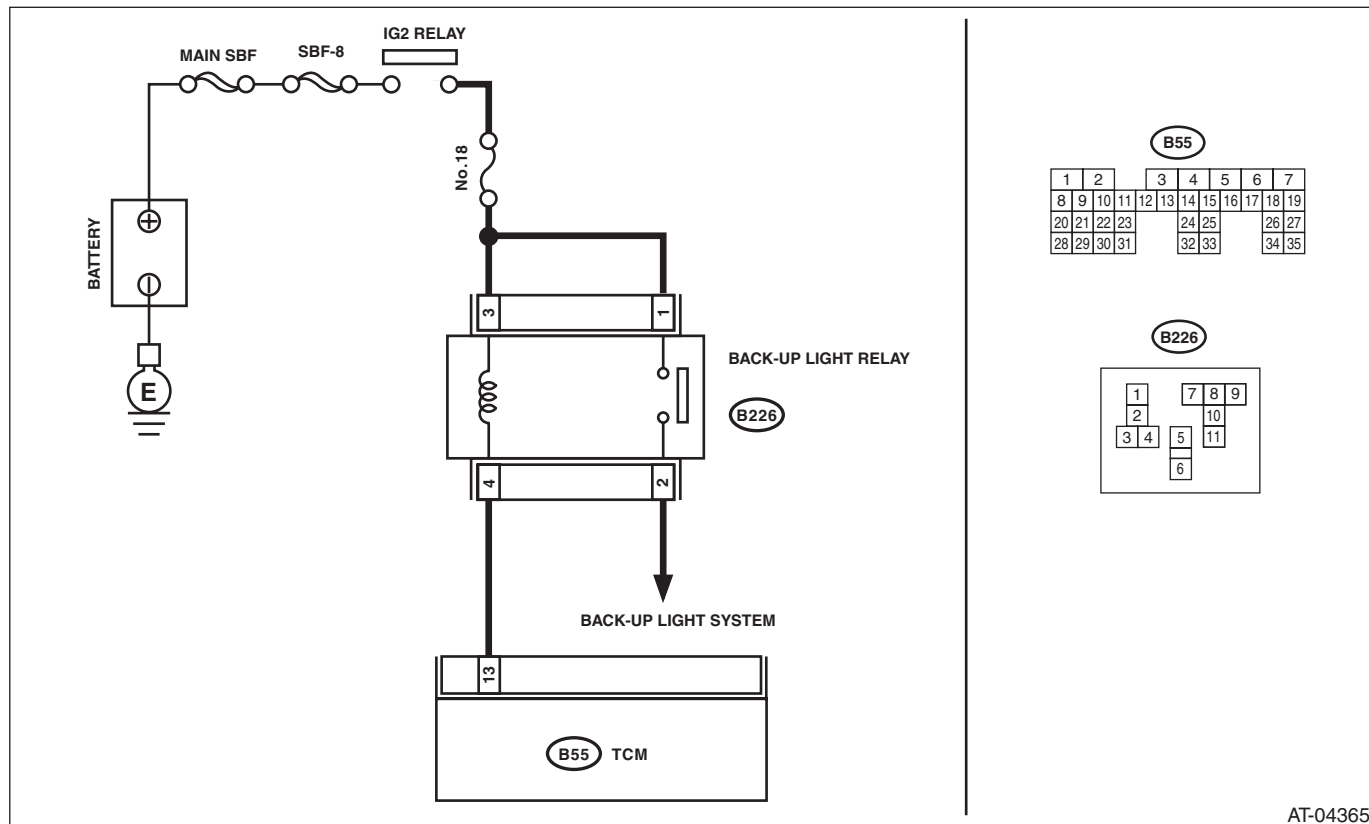
### DTC DETECTING CONDITION:

Output circuit of the back-up light relay is open or shorted

### TROUBLE SYMPTOM:

Back-up light does not illuminate in "R" range.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
<b>1</b>	<b>CHECK DTC OF TCM.</b>	Is DTC of Transmission Range Sensor Circuit (PRNDL Input) detected?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND BACK-UP LIGHT RELAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM and back-up light relay. 3) Measure the resistance of harness between TCM connector and back-up light relay connector. <b>Connector &amp; terminal</b> <b>(B55) No. 13 — (B226) No. 4:</b>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector, or poor contact of connector.
<b>3</b>	<b>CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.
<b>4</b>	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Move the select lever to "P" range. 3) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 (+) — Chassis ground (-):</b>	Is the voltage 8 V or more?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>5</b>	<b>CHECK TCM OUTPUT SIGNAL.</b> 1) Set the select lever to "R" range. 2) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 13 (+) — Chassis ground (-):</b>	Is the voltage 1 V or less?	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>6</b>	<b>CHECK INPUT VOLTAGE FOR BACK-UP LIGHT RELAY.</b> Measure the voltage between back-up light relay and chassis ground.	Is the voltage 10 — 13 V?	Replace the back-up light relay.	Check open or short circuit of harness between fuse (No. 18) and back-up light relay.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AE:DTC P1706 AT VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION (REAR WHEEL)

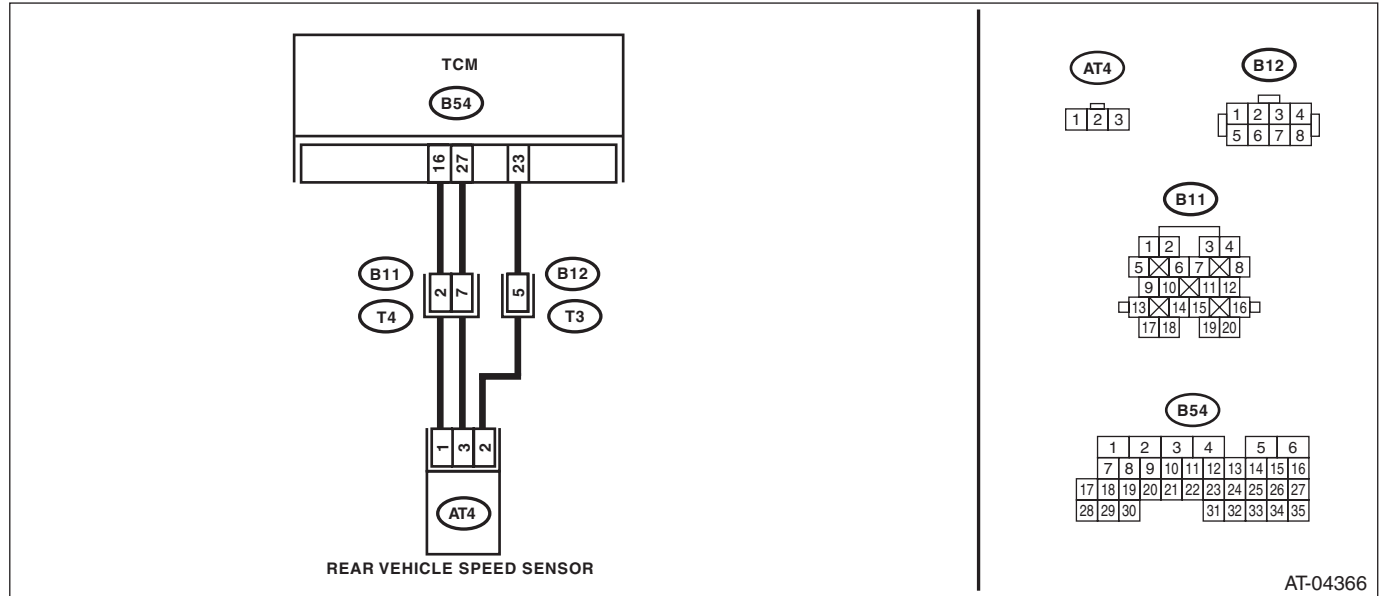
### DTC DETECTING CONDITION:

Input signal circuit of TCM is open or shorted.

### TROUBLE SYMPTOM:

- Shifting quality malfunction
- Tight corner braking phenomenon occurs.

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<p><b>CHECK TCM I/O SIGNAL.</b> Check the power supply and ground I/O signal. &lt;Ref. to 5AT(diag)-13, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.&gt;</p>	Is TCM I/O signal OK?	Go to step 2.	Repair the open or short circuit for power supply and ground.
2	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> 1) Disconnect the connectors from TCM and transmission. 2) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> (B54) No. 23 — (B12) No. 5: (B54) No. 27 — (B11) No. 7: (B54) No. 16 — (B11) No. 2:</p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
3	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 23 — Chassis ground: (B54) No. 27 — Chassis ground: (B54) No. 16 — Chassis ground:</p>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK TCM POWER SUPPLY OUTPUT.</b> 1) Connect the connector to the TCM. (Transmission connector is disconnected) 2) Turn the ignition switch to ON. (engine OFF) 3) Measure the voltage between transmission connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B11) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 10 — 13 V?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>5 CHECK INPUT CIRCUIT OF TCM TURBINE SPEED SENSOR.</b> Measure the voltage variation between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B12) No. 5 (+) — (B11) No. 2 (-):</b>	Is the voltage 4 — 6 V?	Go to step 7.	Go to step 6.
<b>6 CHECK HARNESS ASSEMBLY (TURBINE SPEED SENSOR GROUND).</b> Check the installing condition of ground connecting harness (used for both of turbine speed sensor 1, rear vehicle speed sensor).	Is the ground connecting harness installed to transmission body correctly, or the harness and connector terminals not damaged?	Go to step 7.	When the poor installation of ground connecting harness, install it securely. Replace the transmission assembly when the harness is damaged. <Ref. to 5AT-38, Automatic Transmission Assembly.>
<b>7 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Lift up the vehicle. NOTE: Raise all wheels off the floor. 3) Start the engine, and drive the vehicle. 4) Read the current data of rear wheel speed using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.> NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to VDC(diag)-15, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>	Does the value of the rear wheel speed depending on the acceleration and deceleration of the vehicle?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair poor contact of harness in ATF temperature sensor and transmission connector.	Replace the transmission harness.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AF:DTC P1707 AT AWD SOLENOID VALVE CIRCUIT MALFUNCTION

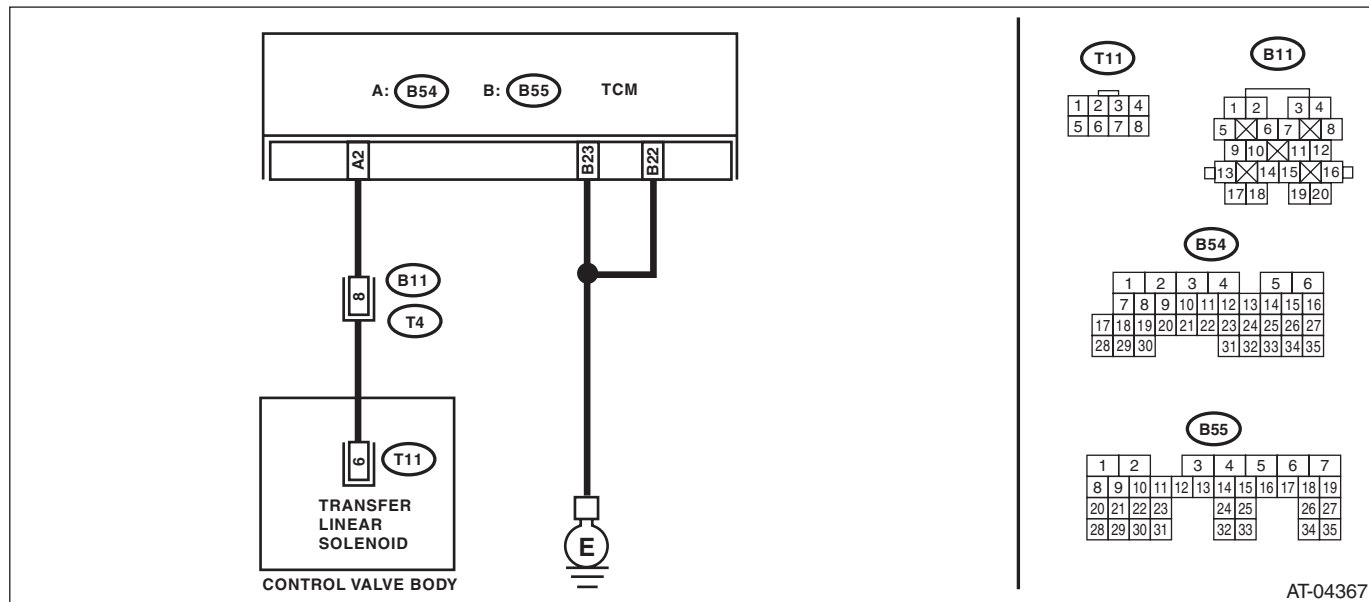
### DTC DETECTING CONDITION:

Output signal circuit of transfer linear solenoid is open or shorted.

### TROUBLE SYMPTOM:

- Tight corner braking phenomenon occurs.
- Drivability getting worse.

### WIRING DIAGRAM:



AT-04367

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK HARNESS CONNECTOR BETWEEN TCM AND TRANSMISSION.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and transmission. 3) Measure the resistance of harness between TCM and transmission connector.</p> <p><b>Connector &amp; terminal</b> <b>(B54) No. 2 — (B11) No. 8:</b> <b>(B55) No. 22 — Chassis ground:</b> <b>(B55) No. 23 — Chassis ground:</b></p>	Is the resistance less than 1 Ω?	Go to step 2.	Repair the open circuit of harness between TCM connector and transmission connector.
<p><b>2 CHECK HARNESS CONNECTOR BETWEEN TCM AND CHASSIS GROUND.</b></p> <p>Measure the resistance of harness between TCM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B55) No. 23 — Chassis ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 3.	Repair the short circuit of harness between TCM connector and transmission connector.
<p><b>3 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle.</p> <p>NOTE: Raise all wheels off the floor. 5) Drain the ATF.</p> <p><b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b></p> <p>6) Remove the oil pan, and disconnect the control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T4) No. 8 — (T11) No. 6:</b></p>	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit of harness between transmission connector and control valve body connector.
<p><b>4 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T11) No. 6 — Transmission ground:</b></p>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the short circuit of harness between control valve body connector and transmission ground.
<p><b>5 CHECK TRANSFER LINEAR SOLENOID.</b></p> <p>Measure the resistance between transmission ground and control valve body connector.</p> <p><b>Connector &amp; terminal</b> <b>(T21) No. 6 — Transmission ground:</b></p>	Is the resistance between 3—9 Ω?	Go to step 6.	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check that there are no poor contact in TCM connector, transmission connector and control valve body connector.</p>	Is there any loosing terminal, entering foreign matter, damaging connector body?	Repair the poor contact.	Go to step 7.
<p><b>7 CHECK AFTER REPAIR.</b></p> <p>1) Perform the Clear Memory Mode. 2) Drive for a while, read the DTC, and check that there is no faulty.</p>	Is DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Temporary poor contact or open circuit occurs. Recheck that the harness connector has no faulty.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AG:DTC P1710 TORQUE CONVERTER TURBINE 2 SPEED SIGNAL CIRCUIT 2 MALFUNCTION

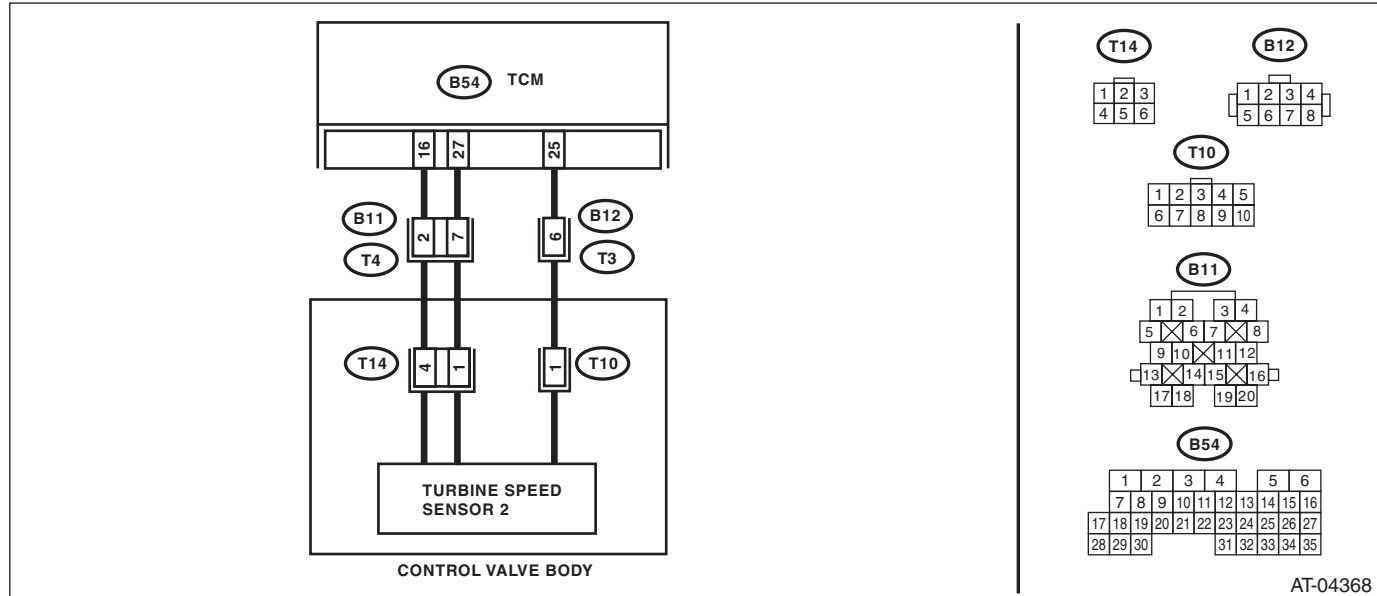
### DTC DETECTING CONDITION:

Input signal circuit of TCM is open or shorted.

### TROUBLE SYMPTOM:

- Excessive shift shock
- Does not shift to 5th

### WIRING DIAGRAM:



AT-04368

Step	Check	Yes	No	
1	<p><b>CHECK TCM I/O SIGNAL.</b> Check the power supply and ground I/O signal. &lt;Ref. to 5AT(diag)-13, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.&gt;</p>	Is TCM I/O signal OK?	Go to step 2.	Repair the open or short circuit for power supply and ground.
2	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> 1) Disconnect the connectors from TCM and transmission. 2) Measure the resistance of harness between TCM connector and transmission connector. <b>Connector &amp; terminal</b> (B54) No. 25 — (B12) No. 6: (B54) No. 16 — (B11) No. 2: (B54) No. 27 — (B11) No. 7:</p>	Is the resistance less than 1 Ω?	Go to step 3.	Repair the open circuit of harness between TCM and transmission connector.
3	<p><b>CHECK TCM AND TRANSMISSION HARNESS CONNECTOR.</b> Measure the resistance of harness between TCM connector and chassis ground. <b>Connector &amp; terminal</b> (B54) No. 25 — Chassis ground:</p>	Is the resistance less than 1 MΩ?	Go to step 4.	Repair the short circuit of harness between TCM and transmission connector.
4	<p><b>CHECK TCM POWER SUPPLY OUTPUT.</b> 1) Connect the connector to the TCM. (Transmission connector is disconnected) 2) Turn the ignition switch to ON. (engine OFF) 3) Measure the voltage between transmission connector and chassis ground. <b>Connector &amp; terminal</b> (B11) No. 7 (+) — Chassis ground (-):</p>	Is the voltage 10 — 13 V?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK INPUT CIRCUIT OF TCM TURBINE SPEED SENSOR 2.</b> Measure the voltage between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B12) No. 6 (+) — (B11) No. 2 (-):</b>	Is the voltage 4 — 6 V?	Go to step 6.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>6 CHECK INPUT SIGNAL FOR TCM USING SUBARU SELECT MONITOR.</b> 1) Connect all connectors. 2) Lift up the vehicle. NOTE: Raise all wheels off the floor. 3) Start the engine, and set the vehicle in 1st speed driving condition of manual mode. 4) Read the current data of torque converter turbine speed 2 using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.> NOTE: The speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When AT control diagnosis is finished, perform the ABS memory clearance procedure of on-board diagnostics system. <Ref. to VDC(diag)-15, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>	Does the value of the turbine speed sensor 2 change depending on the acceleration, deceleration and shifting gear of the vehicle?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause. Repair the poor contact of harness of turbine speed sensor 2 and transmission connector.	Go to step 7.
<b>7 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission. 3) Remove the transmission connector from bracket. 4) Lift up the vehicle. NOTE: Raise all wheels off the floor. 5) Drain the ATF. <b>CAUTION:</b> <b>Do not drain ATF until it cools down.</b> 6) Remove the oil pan, and disconnect the connector from control valve body connector. 7) Measure the resistance between transmission connector and control valve body connector. <b>Connector &amp; terminal</b> <b>(T3) No. 6 — (T10) No. 1:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 8.	Repair the open circuit of harness between transmission connector and control valve body connector.
<b>8 CHECK HARNESS CONNECTOR BETWEEN TRANSMISSION AND CONTROL VALVE BODY.</b> Measure the resistance between transmission ground and control valve body connector. <b>Connector &amp; terminal</b> <b>(T10) No. 1 — Transmission ground:</b>	Is the resistance 1 M $\Omega$ or more?	Replace the control valve body. <Ref. to 5AT-56, Control Valve Body.>	Repair the short circuit of harness between transmission connector and transmission ground.

### AH:DTC P1718 AT CAN COMMUNICATION CIRCUIT

#### NOTE:

DTC P1718 AT CAN communication circuit, refer to “LAN System”. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

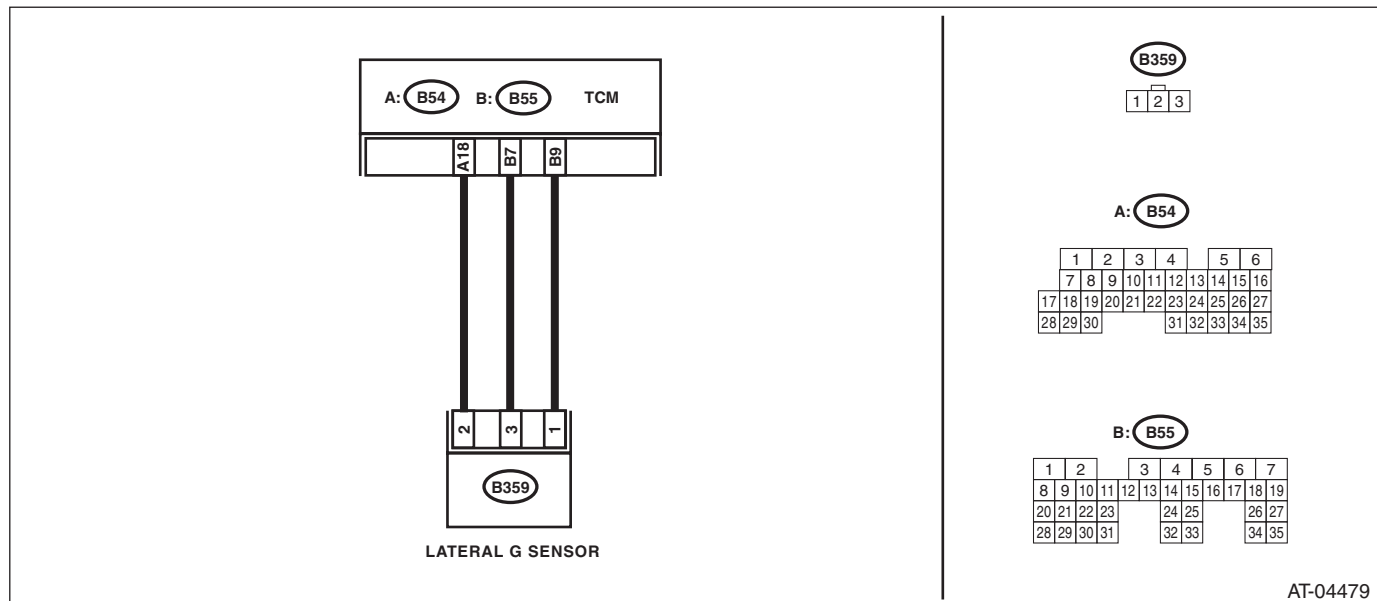
AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AI: DTC P1760 LATERAL ACCELERATION SENSOR PERFORMANCE PROBLEM

### DTC DETECTING CONDITION:

Lateral G sensor output voltage fault

### WIRING DIAGRAM:



AT-04479

Step	Check	Yes	No
1	<b>CHECK VEHICLE CONDITION.</b>	Go to step 2.	Go to step 4.
2	<b>CHECK DTC OF TCM.</b>	Is the vehicle a model with VDC, which has the VDC OFF switch on the instrument panel?	Perform the diagnosis according to DTC.
3	<b>CHECK DTC OF ABS.</b>	Is DTC of AT CAN communication detected?	Go to step 3.
4	<b>CHECK DTC OF ABS.</b>	Is DTC of ABS detected?	Perform the diagnosis according to DTC of ABS.
5	<b>CHECK OUTPUT OF LATERAL G SENSOR USING SUBARU SELECT MONITOR.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the reading indicated on monitor display 2.3 — 2.7 V?	Go to step 5.
6	<b>CHECK OUTPUT OF LATERAL G SENSOR USING SUBARU SELECT MONITOR.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the value on the display 3.3 — 4.3 V with the lateral G sensor inclined 90° to right?	Go to step 6.
7	<b>CHECK OUTPUT OF LATERAL G SENSOR USING SUBARU SELECT MONITOR.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the value on the display 0.7 — 1.7 V with the lateral G sensor inclined 90° to left?	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
8	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between TCM and lateral G sensor?	Go to step 7.
9		Repair the connector.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
10		Go to step 8.	

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>8 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 9.
<b>9 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
<b>10 CHECK OPEN CIRCUIT IN LATERAL G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance between TCM connector terminals. <i>Connector &amp; terminal (B54) No. 18 — (B55) No. 7:</i>	Is the resistance 5.0 — 6.0 kΩ?	Go to step 11.	Repair the harness between lateral G sensor and TCM.
<b>11 CHECK LATERAL G SENSOR.</b> 1) Remove the console box. 2) Remove the lateral G sensor from vehicle. 3) Connect the connector to lateral G sensor. 4) Connect the connector to ABSCM&H/U. 5) Turn the ignition switch to ON. 6) Measure the voltage between lateral G sensor connector terminals. <i>Connector &amp; terminal (B359) No. 3 (+) — No. 2 (-):</i>	Is the voltage 2.3 — 2.7 V when lateral G sensor is in horizontal position?	Go to step 12.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>12 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <i>Connector &amp; terminal (B359) No. 3 (+) — No. 2 (-):</i>	Is the voltage 3.3 — 4.3 V when lateral G sensor is inclined 90° to right?	Go to step 13.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>13 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <i>Connector &amp; terminal (B359) No. 3 (+) — No. 2 (-):</i>	Is the voltage 0.7 — 1.7 V when lateral G sensor is inclined 90° to left?	Go to step 14.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>14 CHECK ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Perform the Clear Memory Mode. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 15.
<b>15 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

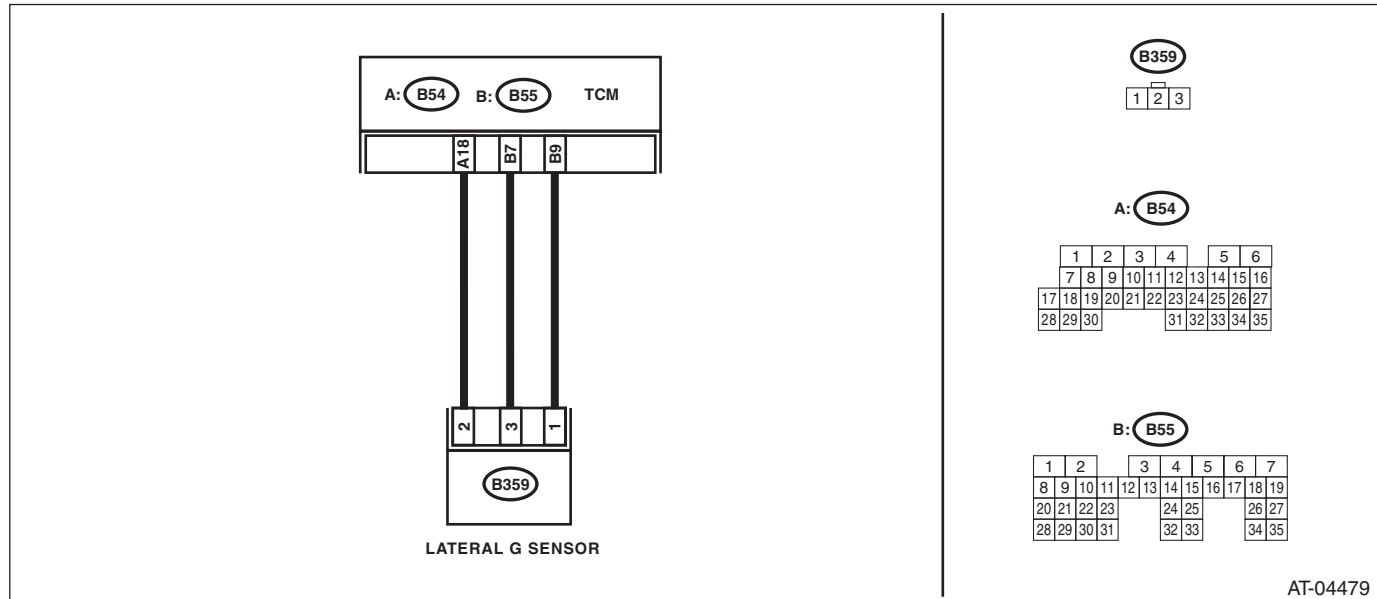
AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AJ:DTC P1761 LATERAL ACCELERATION SENSOR CIRCUIT LOW

### DTC DETECTING CONDITION:

- Lateral G sensor open circuit or output voltage fault (Model without VDC)
- CAN communication malfunction (Model with VDC)

### WIRING DIAGRAM:



Step	Check	Yes	No
1	<b>CHECK VEHICLE CONDITION.</b>	Go to step 2.	Go to step 4.
2	<b>CHECK DTC OF TCM.</b>	Is the vehicle a model with VDC, which has the VDC OFF switch on the instrument panel?	Perform the diagnosis according to DTC.
3	<b>CHECK DTC OF ABS.</b>	Is DTC of AT CAN communication detected?	Go to step 3.
4	<b>CHECK DTC OF ABS.</b>	Is DTC of ABS detected?	Perform the diagnosis according to DTC of ABS.
5	<b>CHECK OUTPUT OF LATERAL G SENSOR USING SUBARU SELECT MONITOR.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the reading indicated on monitor display 2.3 — 2.7 V when lateral G sensor is level?	Temporary poor contact occurs. Recheck for defective parts in harness and connectors.
6	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between TCM and lateral G sensor?	Go to step 8.
7	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Repair the connector.
8	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
		Perform the diagnosis according to DTC.	Go to step 7.
			Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>8 CHECK OPEN CIRCUIT IN LATERAL G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance between TCM connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 18 — (B55) No. 7:</b></i>	Is the resistance 5.0 — 6.0 k $\Omega$ ?	Go to step 9.	Repair the harness between lateral G sensor and TCM.
<b>9 CHECK GROUND SHORT OF HARNESS.</b> Measure the resistance between TCM connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B54) No. 18 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Go to step 10.	Repair the harness between lateral G sensor and TCM. Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>10 CHECK LATERAL G SENSOR.</b> 1) Remove the console box. 2) Remove the lateral G sensor from vehicle. 3) Connect the connector to lateral G sensor. 4) Connect the TCM connector. 5) Turn the ignition switch to ON. 6) Measure the voltage between lateral G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B359) No. 3 (+) — No. 2 (-):</b></i>	Is the voltage 2.3 — 2.7 V when lateral G sensor is in horizontal position?	Go to step 11.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>11 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B359) No. 3 (+) — No. 2 (-):</b></i>	Is the voltage 3.3 — 4.3 V when lateral G sensor is inclined 90° to right?	Go to step 12.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>12 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B359) No. 3 (+) — No. 2 (-):</b></i>	Is the voltage 0.7 — 1.7 V when lateral G sensor is inclined 90° to left?	Go to step 13.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>13 CHECK TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Perform the Clear Memory Mode. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 14.
<b>14 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

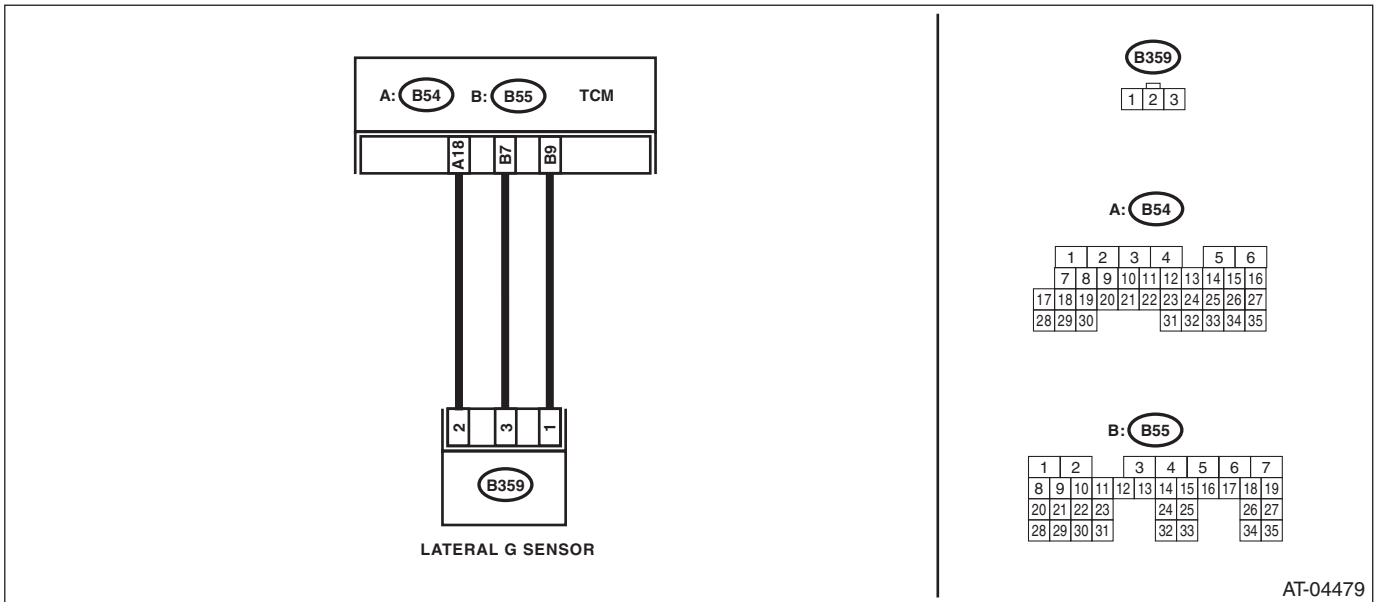
AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## AK:DTC P1762 LATERAL ACCELERATION SENSOR CIRCUIT HIGH

### DTC DETECTING CONDITION:

Lateral G sensor output voltage fault

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK VEHICLE CONDITION.</b>	Is the vehicle a model with VDC, which has the VDC OFF switch on the instrument panel?	Go to step 2.	Go to step 4.
2	<b>CHECK DTC OF TCM.</b>	Is DTC of AT CAN communication detected?	Perform the diagnosis according to DTC.	Go to step 3.
3	<b>CHECK DTC OF ABS.</b>	Is DTC of ABS detected?	Perform the diagnosis according to DTC of ABS.	Temporary poor contact occurs. Recheck for defective parts in harness and connectors.
4	<b>CHECK OUTPUT OF LATERAL G SENSOR USING SUBARU SELECT MONITOR.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the reading indicated on monitor display 2.3 — 2.7 V when lateral G sensor is level?	Go to step 5.	Go to step 8.
5	<b>CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between TCM and lateral G sensor?	Repair the connector.	Go to step 6.
6	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 7.
7	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
8	<b>CHECK INFORMATION STORED IN FREEZE FRAME DATA.</b> Read the value of "Lateral G Sensor" using Subaru Select Monitor.	Is the reading on monitor 4.65 V or more?	Go to step 9.	Go to step 15.
9	<b>CHECK OPEN CIRCUIT IN LATERAL G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B55) No. 9 — (B54) No. 18:</b>	Is the resistance 4.3 — 4.9 kΩ?	Go to step 10.	Repair the harness connector between the lateral G sensor and ABSCM&H/U.
10	<b>CHECK BATTERY SHORT OF HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Remove the console box. 3) Disconnect the connector from the lateral G sensor. 4) Disconnect the connector from TCM. 5) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 11.	Repair the harness between lateral G sensor and TCM.
11	<b>CHECK BATTERY SHORT OF HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between TCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B55) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 12.	Repair the harness between lateral G sensor and TCM.
12	<b>CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between TCM and lateral G sensor?	Repair the connector.	Go to step 13.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>13 CHECK TCM.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 14.
<b>14 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
<b>15 CHECK LATERAL G SENSOR INPUT VOLTAGE.</b> 1) Turn the ignition switch to OFF. 2) Remove the console box. 3) Remove the lateral G sensor from vehicle. (Do not disconnect the connector.) 4) Turn the ignition switch to ON. 5) Measure the voltage between lateral G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B359) No. 1 (+) — No. 2 (-):</b>	Is the voltage 4.75 — 5.25 V?	Go to step 16.	Repair the harness between lateral G sensor and TCM.
<b>16 CHECK OPEN CIRCUIT IN LATERAL G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from TCM. 3) Measure the resistance between TCM connector terminals. <b>Connector &amp; terminal</b> <b>(B55) No. 9 — No. 7:</b>	Is the resistance 5.0 — 5.6 k $\Omega$ ?	Go to step 17.	Repair the harness between lateral G sensor and TCM.
<b>17 CHECK LATERAL G SENSOR.</b> 1) Connect the connector to lateral G sensor. 2) Connect the TCM connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between lateral G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B359) No. 3 (+) — No. 2 (-):</b>	Is the voltage 2.3 — 2.7 V when lateral G sensor is in horizontal position?	Go to step 18.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>18 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B359) No. 3 (+) — No. 2 (-):</b>	Is the voltage 3.3 — 4.3 V when lateral G sensor is inclined 90° to right?	Go to step 19.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>19 CHECK LATERAL G SENSOR.</b> Measure the voltage between lateral G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B359) No. 3 (+) — No. 2 (-):</b>	Is the voltage 0.7 — 1.7 V when lateral G sensor is inclined 90° to left?	Go to step 20.	Replace the lateral G sensor. <Ref. to 5AT-60, Lateral G Sensor.>
<b>20 CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between TCM and lateral G sensor?	Repair the connector.	Go to step 21.
<b>21 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 22.
<b>22 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### AL:DTC P1817 SPORT MODE SWITCH CIRCUIT (MANUAL SWITCH)

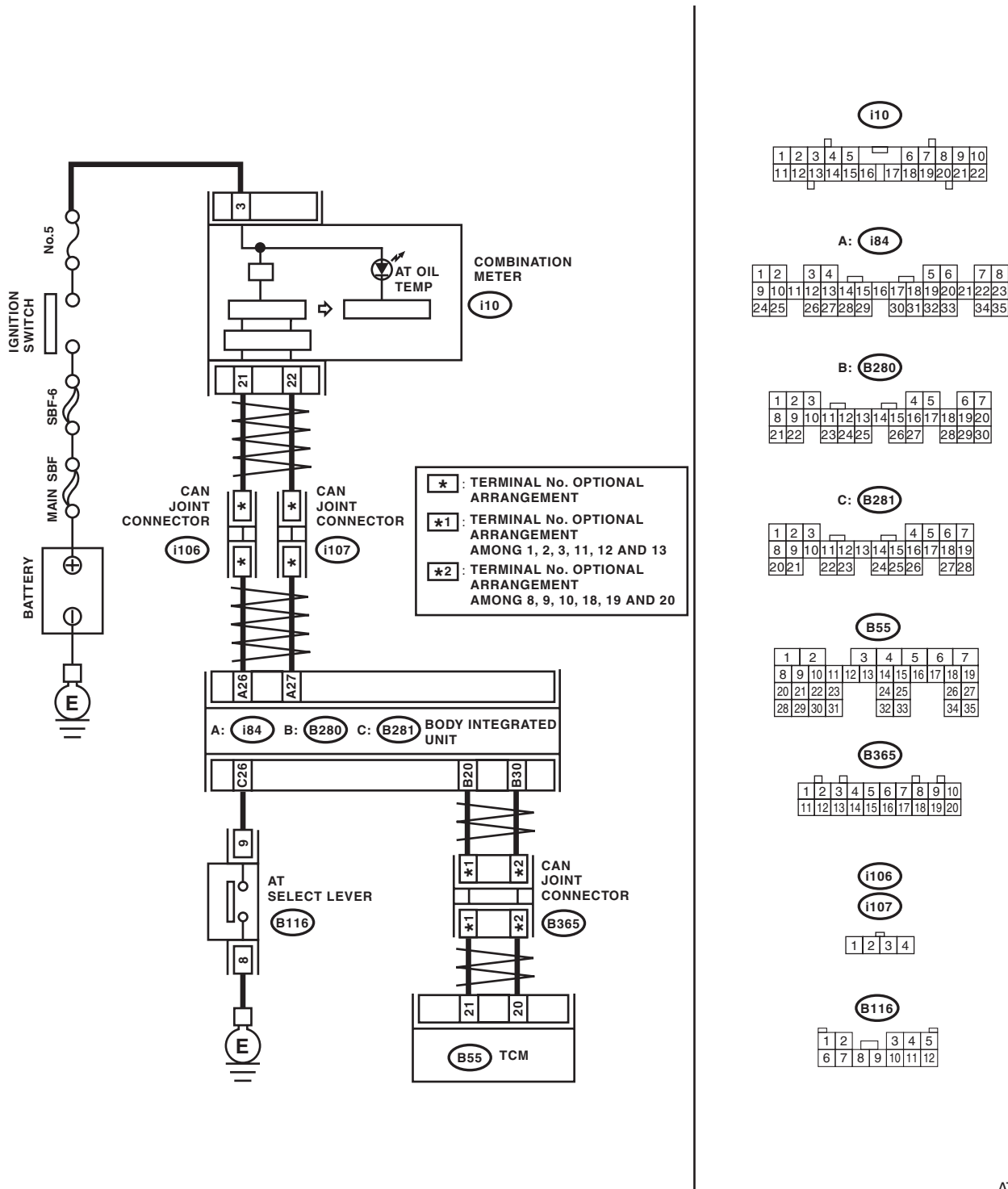
#### DTC DETECTING CONDITION:

Input signal circuit of SPORT/manual mode switch is open or shorted.

#### TROUBLE SYMPTOM:

- Manual mode can not be set.
- When shifting to "N" → "D", the SPORT shift indicator light illuminates.

#### WIRING DIAGRAM:



AT-04369

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Connect the Subaru Select Monitor to the data link connector. 2) Turn the ignition switch to ON. (engine OFF) 3) Read the DTC of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever to "P" range. 2) Read the "TIP mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	Go to step 3.	Go to step 7.
3	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever from "P" to "D" range. 2) Read the "TIP mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the indication on each range OFF?	Go to step 4.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>
4	<b>CHECK BODY INTEGRATED UNIT INPUT SIGNAL.</b> 1) Shift the AT select lever to manual mode. 2) Shift the AT select lever to other than "D" range. 3) Read the "TIP mode SW" data of body integrated unit using Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is OFF displayed?	Go to step 5.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>
5	<b>CHECK DTC OF TCM.</b>	Is DTC of Transmission Range Sensor Circuit (PRNDL Input) and AT CAN communication circuit displayed?	Perform the diagnosis according to each DTC.	Go to step 6.
6	<b>CHECK INPUT SIGNAL FROM TCM.</b> 1) Shift the AT select lever from "P" to "D" range. 2) Read the "TIP mode SW" data of TCM using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is the indication on each range OFF?	Even if the AT OIL TEMP light blinks, the system is in normal condition. A temporary poor contact of connector or harness may be the cause.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
7	<b>CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND MANUAL MODE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect harness connector from body integrated unit and select lever. 3) Measure the harness resistance between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 27 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 8.	Repair the short circuit of harness between body integrated unit and manual mode.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>8</b> <b>CHECK MANUAL MODE SWITCH.</b> 1) Shift the select lever to "P" range. 2) Measure the resistance between harness connector terminals of SPORT/manual mode switch. <i>Terminals</i> <i>(B116) No. 9 — No. 8</i>	Is the resistance 1 M $\Omega$ or more?	Check the body integrated unit.	Replace the select lever assembly. <Ref. to CS-23, Select Lever.>

### **AM:DTC P1840 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT**

#### **DTC DETECTING CONDITION:**

Front brake oil pressure switch malfunction

#### **TROUBLE SYMPTOM:**

Excessive shift shock

#### **NOTE:**

Refer to DTC P0751 for diagnostic procedure. <Ref. to 5AT(diag)-61, DTC P0751 SHIFT SOLENOID "A" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **AN:DTC P1841 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH B CIRCUIT**

#### **DTC DETECTING CONDITION:**

Forward brake oil pressure switch malfunction

#### **TROUBLE SYMPTOM:**

Excessive shift shock

#### **NOTE:**

Refer to DTC P0771 for diagnostic procedure. <Ref. to 5AT(diag)-77, DTC P0771 SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **AO:DTC P1842 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH C CIRCUIT**

#### **DTC DETECTING CONDITION:**

Input clutch oil pressure switch is malfunction.

#### **TROUBLE SYMPTOM:**

Excessive shift shock

#### **NOTE:**

Refer to DTC P0756 for diagnostic procedure. <Ref. to 5AT(diag)-65, DTC P0756 SHIFT SOLENOID "B" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **AP:DTC P1843 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH D CIRCUIT**

#### **DTC DETECTING CONDITION:**

Direct clutch oil pressure switch malfunction.

#### **TROUBLE SYMPTOM:**

Excessive shift shock

#### **NOTE:**

Refer to DTC P0766 for diagnostic procedure. <Ref. to 5AT(diag)-73, DTC P0766 SHIFT SOLENOID "D" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **AQ:DTC P1844 TRANSMISSION FLUID PRESSURE SENSOR/SWITCH E CIRCUIT**

#### **DTC DETECTING CONDITION:**

High & low reverse clutch oil pressure switch malfunction.

#### **TROUBLE SYMPTOM:**

Excessive shift shock

#### **NOTE:**

Refer to DTC P0761 for diagnostic procedure. <Ref. to 5AT(diag)-69, DTC P0761 SHIFT SOLENOID "C" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 15. Diagnostic Procedure without Diagnostic Trouble Code (DTC)

### A: CHECK MANUAL MODE SWITCH

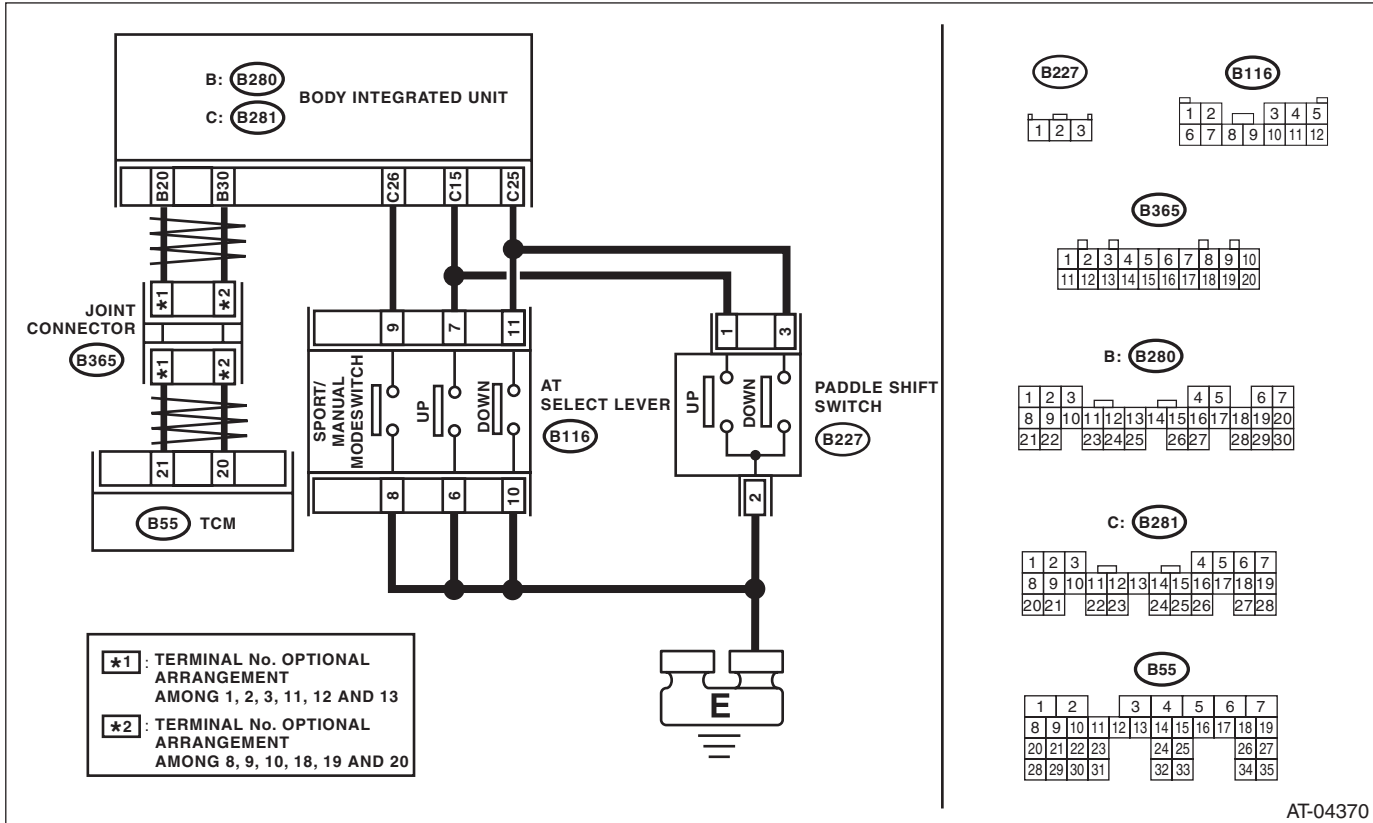
#### DIAGNOSIS:

Input signal circuit of SPORT/manual mode switch is open or shorted.

#### TROUBLE SYMPTOM:

Does not shift on manual mode.

#### WIRING DIAGRAM:



AT-04370

Step	Check	Yes	No	
1	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Perform ON/OFF operation on the SPORT/manual mode switch. 2) Read the data of "TIP mode SW" using Subaru Select Monitor.	Is the ON/OFF normally detected?	Go to step 2.	Go to step 7.
2	<b>CHECK DTC OF BODY INTEGRATED UNIT.</b>	Is DTC of CAN detected?	Perform the diagnosis according to DTC.	Go to step 3.
3	<b>CHECK TCM.</b> 1) Perform ON/OFF operation on the SPORT/manual mode switch. 2) Read the data of "TIP mode SW" using Subaru Select Monitor.	Is the ON/OFF normally detected?	Go to step 4.	Go to step 5.
4	<b>CHECK SPORT SHIFT INDICATOR OF COMBINATION METER.</b>	Is the SPORT shift indicator light OK?	Go to step 6.	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
5	<b>CHECK DTC OF TCM.</b>	Is DTC of CAN detected?	Perform the diagnosis according to DTC.  Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
6	<b>CHECK DTC OF METER.</b>	Is DTC of CAN detected?	Perform the diagnosis according to DTC.  Replace the meter.
7	<b>CHECK GROUND CIRCUIT OF SPORT/MANUAL MODE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from SPORT/manual mode switch. 3) Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — Chassis ground:</b> <b>(B116) No. 10 — Chassis ground:</b>	Is the resistance less than 1 Ω?	Go to step 8.  Repair the open circuit of harness between SPORT/manual mode switch and chassis ground.
8	<b>CHECK SPORT/MANUAL MODE SWITCH.</b> Measure the resistance between SPORT/manual mode switch terminals. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — No. 7:</b> <b>(B116) No. 10 — No. 11:</b>	Is the resistance 1 MΩ or more?	Go to step 9.  Replace the guide plate assembly.
9	<b>CHECK SPORT/MANUAL MODE SWITCH.</b> 1) Move the select lever to manual mode. 2) Measure the resistance between SPORT/manual mode switch terminals. <b>Connector &amp; terminal</b> <b>(B116) No. 6 — No. 7:</b> <b>(B116) No. 10 — No. 11:</b>	Is the resistance less than 1 Ω?	Go to step 10.  Replace the guide plate assembly.
10	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> 1) Disconnect the connector from body integrated unit. 2) Measure the resistance of harness between body integrated unit connector and SPORT/manual mode switch connector. <b>Connector &amp; terminal</b> <b>(B116) No. 7 — (B281) No. 15:</b> <b>(B116) No. 11 — (B281) No. 25:</b>	Is the resistance less than 1 Ω?	Go to step 11.  Repair the open circuit of harness between the SPORT/manual mode switch connector and body integrated unit connector, or poor contact of connector.
11	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND SPORT/MANUAL MODE SWITCH.</b> 1) Disconnect the connector from body integrated unit. 2) Measure the resistance of harness between SPORT/manual mode switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 7 — Chassis ground:</b> <b>(B116) No. 9 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 12.  Repair the short circuit of harness between SPORT/manual mode switch connector and body integrated unit connector.



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Step	Check	Yes	No
<b>12 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Connect all connectors. 2) Turn the ignition switch to ON. (engine OFF) 3) Check the signal voltage for body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 15 (+) — Chassis ground (-):</b> <b>(B281) No. 25 (+) — Chassis ground (-):</b>	Is the voltage 9 V or more?	Go to step 13.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>13 CHECK INPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Shift and hold the AT select lever to shift up side. 2) Check the signal voltage for body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 15 (+) — Chassis ground (-):</b> <b>(B281) No. 25 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 14.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>14 CHECK PADDLE SHIFT SWITCH GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from paddle shift switch. 3) Measure the resistance of harness between paddle shift switch connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B227) No. 3 — Chassis ground:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 15.	Repair the open circuit of harness between paddle shift switch and chassis ground.
<b>15 CHECK PADDLE SHIFT SWITCH.</b> Measure the resistance between paddle shift switch connector terminals. <b>Connector &amp; terminal</b> <b>(B227) No. 2 — (B227) No. 3:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 16.	Replace the paddle shift switch connector or paddle shift switch. Or repair the poor contact of connector.
<b>16 CHECK PADDLE SHIFT SWITCH.</b> 1) Press and hold the + side of paddle shift switch. 2) Measure the resistance between paddle shift switch connector terminals. <b>Connector &amp; terminal</b> <b>(B227) No. 2 — (B227) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 17.	Replace the paddle shift switch connector or paddle shift switch. Or repair the poor contact of connector.
<b>17 CHECK POOR CONTACT.</b>	Is there poor contact in the SPORT/manual mode switch circuit?	Repair the poor contact.	Temporary poor contact of the SPORT/manual mode switch circuit connector or harness.

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### B: CHECK SPORT SHIFT INDICATOR LIGHT

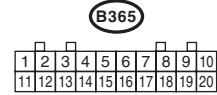
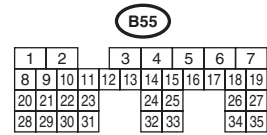
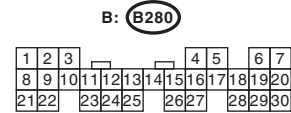
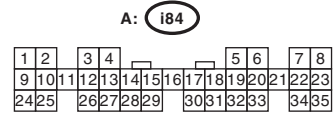
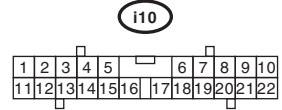
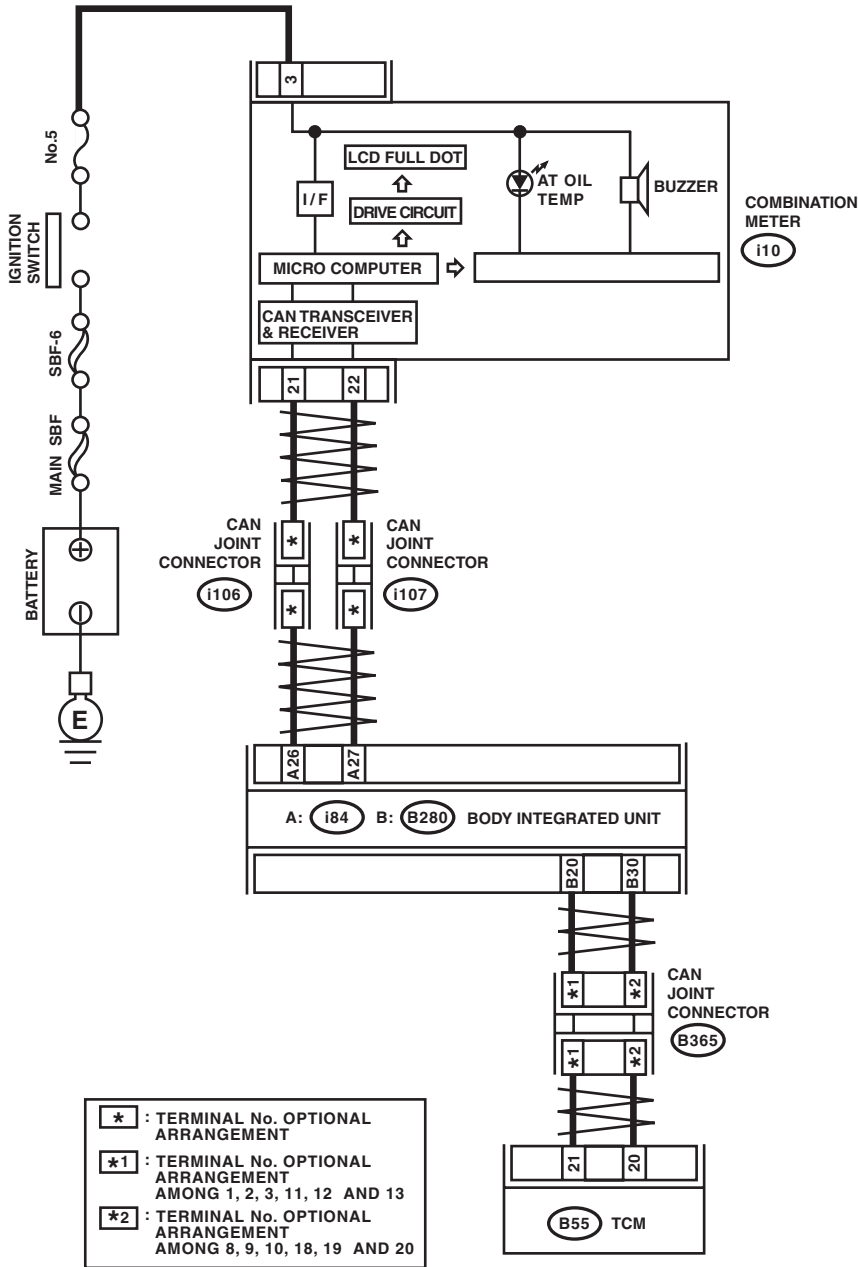
#### DIAGNOSIS:

Output signal circuit of SPORT shift indicator light is open or shorted.

#### TROUBLE SYMPTOM:

- SPORT shift indicator light does not illuminate or remains illuminated.
- SPORT shift indicator light display does not change.

#### WIRING DIAGRAM:



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK BODY INTEGRATED UNIT.</b> Check DTC of the body integrated unit.	Is DTC of AT CAN communication circuit displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK TCM.</b> Check DTC of TCM.	Is DTC of AT CAN communication circuit displayed?	Perform the diagnosis according to DTC.	Go to step 3.
3	<b>CHECK TCM.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Turn the Subaru Select Monitor switch to ON. 5) Shift the AT select lever to manual mode side, and shift down the AT select lever. 6) Read the indicator.	Is the gear position at 1 and "▲" displayed?	Go to step 4.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
4	<b>CHECK TCM.</b> 1) Shift up the AT select lever. 2) Read the indicator.	Is the gear position at 2 and "▼" displayed?	Go to step 5.	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>
5	<b>CHECK BODY INTEGRATED UNIT.</b> Read the gear position data using Subaru Select Monitor.	Is the SPORT shift gear position 2?	Go to step 6.	Check the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
6	<b>CHECK COMBINATION METER.</b>	Is the SPORT shift indicator OK?	Refer to "Symptom Related Diagnostic". <Ref. to 5AT(diag)-112, General Diagnostic Table.>	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

### C: CHECK BUZZER

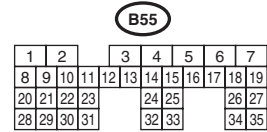
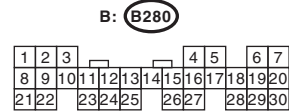
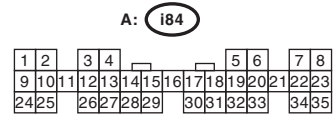
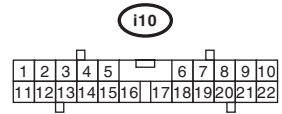
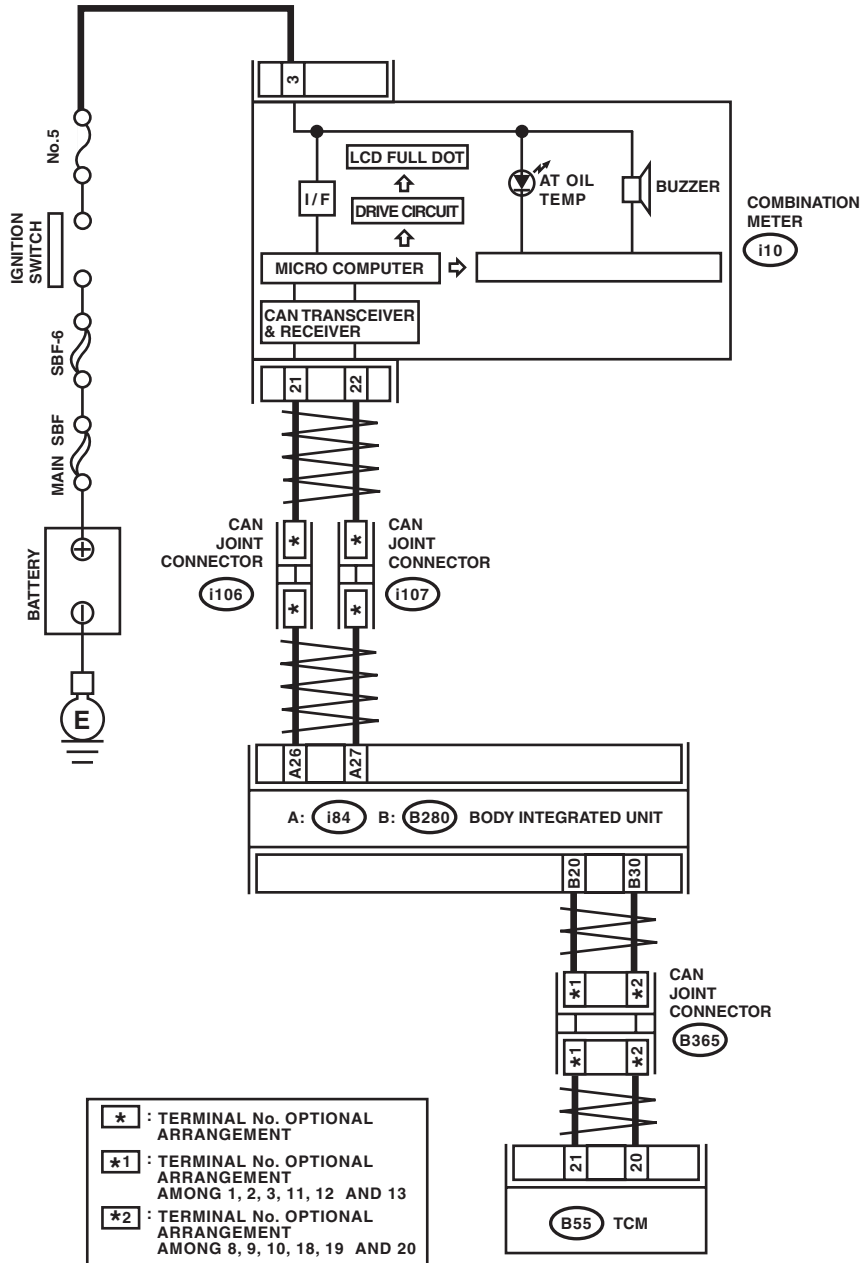
#### DIAGNOSIS:

Output signal circuit of buzzer is open or shorted.

#### TROUBLE SYMPTOM:

Buzzer remains beeping.

#### WIRING DIAGRAM:



# Diagnostic Procedure without Diagnostic Trouble Code (DTC)

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK BODY INTEGRATED UNIT.</b> Check DTC of the body integrated unit.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK TCM.</b> Check DTC of TCM.	Is DTC of CAN communication displayed?	Perform the diagnosis according to DTC.	Go to step 3.
3	<b>CHECK BUZZER STOP.</b> Disconnect the connector (B55).	Does the buzzer stop?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 4.
4	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON. (engine OFF) 4) Turn the Subaru Select Monitor switch to ON. 5) Read the data of SPORT shift buzzer using Subaru Select Monitor.	Is the SPORT shift buzzer display "ON"?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Go to step 5.
5	<b>CHECK COMBINATION METER. &lt;Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.&gt;</b>	Is the buzzer OK?	Refer to "Symptom Related Diagnostic". <Ref. to 5AT(diag)-112, General Diagnostic Table.>	Replace the combination meter assembly. <Ref. to IDI-19, Combination Meter.>

# General Diagnostic Table

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

## 16. General Diagnostic Table

### A: INSPECTION

Symptoms	Problem parts
Shifting vehicle speed is low on "D" range.	<ul style="list-style-type: none"> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• ATF temperature sensor</li> <li>• CAN communication signal</li> </ul>
Shifting vehicle speed is high on "D" range.	<ul style="list-style-type: none"> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Brake switch signal</li> <li>• Lateral G sensor</li> <li>• ATF temperature sensor</li> </ul>
Excessive shift shock ("N" → "D" range)	<ul style="list-style-type: none"> <li>• Engine idle speed</li> <li>• Engine speed signal</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• ATF temperature sensor</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• CAN communication signal</li> <li>• Fluid level and condition</li> <li>• TCM power supply</li> </ul>
Excessive shift shock on 1st of "D" range → 2nd of "D" range or "1st of manual mode" → "2nd of manual mode".	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• CAN communication signal</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shift shock on 2nd of "D" range → 3rd of "D" range or "2nd of manual mode" → "3rd of manual mode".	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• CAN communication signal</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shift shock on 3rd of "D" range → 4th of "D" range or "3rd of manual mode" → "4th of manual mode".	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• CAN communication signal</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Excessive shift shock on 4th of "D" range → 5th of "D" range or "4th of manual mode" → "5th of manual mode".	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• CAN communication signal</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shock at kick down.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• CAN communication signal</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shock at shift up.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Engine speed signal</li> <li>• CAN communication signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shock at lock up.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• Engine speed signal</li> <li>• CAN communication signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Lock up solenoid valve</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Fluid level and condition</li> </ul>
Excessive shock at engine brake.	<ul style="list-style-type: none"> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Control cable adjustment</li> <li>• CAN communication signal</li> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Forward brake solenoid valve</li> </ul>
Judder is occurred at lock up.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Lock up solenoid valve</li> <li>• ATF temperature sensor</li> </ul>
Noise at "R", "N" and "D" range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Engine speed signal</li> <li>• ATF temperature sensor</li> </ul>
Hold at "D" range or 1st on manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Hold at "D" range or 2nd on manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Forward brake solenoid valve</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Hold at "D" range or 3rd on manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Hold at "D" range or 4th on manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• Forward brake solenoid valve</li> <li>• Front brake solenoid valve</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> <li>• TCM power supply</li> </ul>
Hold at "D" range or 5th on manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Line pressure</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift 1st of "D" range → 2nd of "D" range or "1st of manual mode" → "2nd of manual mode".	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Up switch</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift 2nd of "D" range → 3rd of "D" range or "2nd of manual mode" → "3rd of manual mode".	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift 3rd of "D" range → 4th of "D" range or "3rd of manual mode" → "4th of manual mode".	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>



# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Gear does not shift 4th of "D" range → 5th of "D" range or "4th of manual mode" → "5th of manual mode".	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• ATF temperature sensor</li> <li>• Line pressure</li> <li>• Up switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift down to 4th on "D" range or manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift down to 3rd on "D" range or manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Line pressure</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> <li>• TCM power supply</li> </ul>
Gear does not shift down to 2nd on "D" range or manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid</li> <li>• Line pressure</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
Gear does not shift down to 1st on "D" range or manual mode.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Down switch signal</li> <li>• CAN communication signal</li> <li>• Accelerator pedal position sensor</li> </ul>
No lock-up occurs.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Lock up solenoid valve</li> <li>• CAN communication signal</li> <li>• ATF temperature sensor</li> <li>• Accelerator pedal position sensor</li> <li>• Brake switch signal</li> <li>• Range signal</li> </ul>
No shift shock occurred when shifting 1st of "D" range → 2nd of "D" range or "1st of manual mode" → "2nd of manual mode". Or clutch slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• CAN communication signal</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
No shift shock occurred when shifting 2nd of "D" range → 3rd of "D" range or "2nd of manual mode" → 3rd of manual mode". Or clutch slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• Line pressure</li> <li>• CAN communication signal</li> </ul>
No shift shock occurred when shifting 3rd of "D" range → 4th of "D" range or "3rd of manual mode" → "4th of manual mode". Or clutch slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Line pressure</li> <li>• CAN communication signal</li> </ul>
No shift shock occurred when shifting 4th of "D" range → 5th of "D" range or "4th of manual mode" → "5th of manual mode". Or clutch slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> </ul>
Engine skids when shifting 5th of "D" range → 4th of "D" range or "5th of manual mode" → "4th of manual mode". Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> </ul>
Engine skids when shifting 4th of "D" range → 3rd of "D" range or "4th of manual mode" → "3rd of manual mode". Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> </ul>
Engine skids when shifting 3rd of "D" range → 2nd of "D" range or "3rd of manual mode" → "2nd of manual mode". Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> </ul>
Engine skids when shifting 2nd of "D" range → 1st of "D" range or "2nd of manual mode" → "1st of manual mode". Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Vehicle speed sensor 1 and vehicle speed sensor 2</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> </ul>
Engine brake does not function at 5th → 4th of manual mode.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Manual mode switch</li> <li>• Oil pressure switch 1</li> <li>• Down switch signal</li> </ul>
Engine brake does not function at 4th → 3rd of manual mode.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Manual mode switch</li> <li>• Oil pressure switch 1 and oil pressure switch 3</li> <li>• Down switch signal</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Engine brake does not function at 3rd → 2nd of manual mode.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Manual mode switch</li> <li>• Oil pressure switch 5</li> <li>• Forward brake solenoid valve</li> </ul>
Engine brake does not function at 2nd → 1st of manual mode.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Manual mode switch</li> <li>• Oil pressure switch 4</li> <li>• Forward brake solenoid valve</li> </ul>
Excessive acceleration failure on “D” range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> <li>• Vehicle speed sensor 1, 2</li> </ul>
Excessive acceleration failure in “R” range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> <li>• CAN communication signal</li> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> <li>• Vehicle speed sensor 1, 2</li> </ul>
Engine skids when start driving (1st) the vehicle. Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> </ul>
Engine skids when driving at 2nd. Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> </ul>
Engine skids when driving at 3rd. Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 5 and high &amp; low reverse clutch solenoid valve</li> </ul>
Engine skids when driving at 4th. Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 3 and input clutch solenoid valve</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Engine skids when driving at 5th. Or slipping occurred.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 1 and front brake solenoid valve</li> </ul>
Slip at lock up.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Engine speed signal</li> <li>• Turbine speed sensor 1 and turbine speed sensor 2</li> <li>• Lock up solenoid valve</li> <li>• CAN communication signal</li> </ul>
Maximum vehicle speed is low.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Accelerator pedal position sensor</li> <li>• Throttle position sensor</li> <li>• CAN communication signal</li> <li>• Direct clutch solenoid valve</li> <li>• Vehicle speed sensor 1 and 2</li> </ul>
There is completely no creep.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Engine speed signal</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 4 and direct clutch solenoid valve</li> <li>• Line pressure</li> </ul>
Excessive large creep.	<ul style="list-style-type: none"> <li>• Engine speed signal</li> <li>• CAN communication signal</li> <li>• Oil pressure switch 4</li> </ul>
Vehicle cannot be parking condition on "P" range. Parking condition is not released though shifting to other ranges.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> </ul>
Vehicle can drive on "P" range.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Line pressure</li> </ul>
Vehicle can drive on "N" range.	<ul style="list-style-type: none"> <li>• Inhibitor switch</li> <li>• Fluid level and condition</li> <li>• Control cable adjustment</li> <li>• Line pressure</li> </ul>
Vehicle cannot drive at any range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> <li>• Loosing or damaging of propeller shaft.</li> <li>• Loosing or damaging of drive shaft.</li> </ul>
Vehicle cannot drive on "D" range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> <li>• Loosing or damaging of propeller shaft.</li> <li>• Loosing or damaging of drive shaft.</li> </ul>
Vehicle cannot drive on "R" range.	<ul style="list-style-type: none"> <li>• Fluid level and condition</li> <li>• Line pressure</li> <li>• Inhibitor switch</li> <li>• Control cable adjustment</li> <li>• Loosing or damaging of propeller shaft.</li> <li>• Loosing or damaging of drive shaft.</li> </ul>

# General Diagnostic Table

## AUTOMATIC TRANSMISSION (DIAGNOSTICS)

Symptoms	Problem parts
Engine cannot start on "N" or "P" range	<ul style="list-style-type: none"><li>• Push engine switch and starter</li><li>• Control cable adjustment</li><li>• Inhibitor switch</li><li>• CAN communication line</li><li>• TCM</li></ul>
Engine start other than "N" or "P" range	<ul style="list-style-type: none"><li>• Push engine switch and starter</li><li>• Control cable adjustment</li><li>• Inhibitor switch</li><li>• TCM</li></ul>
Engine stalls.	<ul style="list-style-type: none"><li>• Fluid level and condition</li><li>• Engine speed signal</li><li>• Turbine speed sensor 1 and turbine speed sensor 2</li><li>• Lock up solenoid valve</li><li>• Line pressure</li></ul>
Engine stalls when shifting to "N" → "D" and "R" range.	<ul style="list-style-type: none"><li>• Fluid level and condition</li><li>• Engine speed signal</li><li>• Turbine speed sensor 1 and turbine speed sensor 2</li><li>• Lock up solenoid valve</li><li>• Line pressure</li></ul>

# General Diagnostic Table

AUTOMATIC TRANSMISSION (DIAGNOSTICS)

---

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 1. General Description

#### A: SPECIFICATION

##### 1. MANUAL TRANSMISSION AND DIFFERENTIAL

Model		2.5 L non-turbo model		2.5 L turbo model		
		Except for OUTBACK	OUTBACK	Except for OUTBACK	OUTBACK	
Type		5-forward speeds and 1-reverse				
Transmission gear ratio		1st	3.454		3.166	
		2nd	2.062		1.882	
		3rd	1.448		1.296	
		4th	1.088		0.972	
		5th	0.780	0.825	0.738	
		Reverse	3.333			
Front reduction gear	Final	Type of gear	Hypoid			
		Gear ratio	3.900	4.111	3.900	4.444
Rear reduction gear	Transfer	Type of gear	Helical			
		Gear ratio	1.000			
	Final	Type of gear	Hypoid			
		Gear ratio	3.900	4.111	3.900	4.444
Front differential	Type and number of gear	Straight bevel gear (Bevel pinion: 2, Bevel gear: 2)				
Center differential	Type and number of gear	Straight bevel gear (Bevel pinion: 2, bevel gear: 2 and viscous coupling)				
Transmission gear oil		GL-5				
Transmission gear oil capacity	Single-range model	3.5 ℓ (3.7 US qt, 3.1 Imp qt)				

# General Description

MANUAL TRANSMISSION AND DIFFERENTIAL

## 2. TRANSMISSION GEAR OIL

**Recommended oil:**

**GL-5 (75W-90) or equivalent**

## 3. TRANSMISSION CASE ASSEMBLY

Drive pinion shim adjustment

**Hypoid gear backlash:**

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**

Drive pinion shim			
Part number	Thickness mm (in)	Part number	Thickness mm (in)
32295AA031	0.150 (0.0059)	32295AA071	0.250 (0.0098)
32295AA041	0.175 (0.0069)	32295AA081	0.275 (0.0108)
32295AA051	0.200 (0.0079)	32295AA091	0.300 (0.0118)
32295AA061	0.225 (0.0089)	32295AA101	0.500 (0.0197)

Selection of main shaft rear plate

Main shaft rear plate		
Dimension "A" mm (in)	Part number	Mark
4.00 — 4.13 (0.1575 — 0.1626)	32294AA041	1
3.87 — 4.00 (0.1524 — 0.1575)	32294AA051	2

## 4. DRIVE PINION ASSEMBLY

Preload adjustment of thrust bearing

**Starting torque:**

**0.3 — 0.8 N·m (0.03 — 0.08 kgf·m, 0.2 — 0.6 ft·lb)**

Adjusting washer No. 1	
Part number	Thickness mm (in)
803025051	3.925 (0.1545)
803025052	3.950 (0.1555)
803025053	3.975 (0.1565)
803025054	4.000 (0.1575)
803025055	4.025 (0.1585)
803025056	4.050 (0.1594)
803025057	4.075 (0.1604)

Adjusting washer No. 2	
Part number	Thickness mm (in)
803025059	3.850 (0.1516)
803025054	4.000 (0.1575)
803025058	4.150 (0.1634)

## 5. REVERSE IDLER GEAR

Adjustment of reverse idler gear position

**Reverse idler gear to transmission case (LH) wall clearance:**

**6.0 — 7.5 mm (0.236 — 0.295 in)**

Reverse shifter lever		
Part number	Mark	Remarks
32820AA070	7	Further from case wall
32820AA080	8	Standard
32820AA090	9	Closer to the case wall

After installing a suitable reverse shifter lever, adjust the clearance using washers.

**Reverse idler gear to transmission case wall clearance:**

**0 — 0.5 mm (0 — 0.020 in)**

Washer (20.5 × 26 × t)			
Part number	Thickness mm (in)	Part number	Thickness mm (in)
803020151	0.4 (0.016)	803020154	1.9 (0.075)
803020152	1.1 (0.043)	803020155	2.3 (0.091)
803020153	1.5 (0.059)	—	—



# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 6. SHIFTER FORK AND ROD

Select a suitable shifter fork so that both the coupling sleeve and reverse driven gear are positioned in the center of their synchromesh mechanisms.

#### Rod end clearance:

##### A: 3rd-4th — 5th

0.5 — 1.3 mm (0.020 — 0.051 in)

##### B: 1st-2nd — 3rd-4th

0.4 — 1.4 mm (0.016 — 0.055 in)

1st-2nd shifter fork		
Part number	Mark	Remarks
32804AA060	1	Approaches 1st gear by 0.2 mm (0.008 in).
32804AA070	No mark	Standard
32804AA080	3	Approaches 2nd gear by 0.2 mm (0.008 in).

3rd-4th shifter fork		
Part number	Mark	Remarks
32810AA061	1	Approaches 4th gear by 0.2 mm (0.008 in).
32810AA071	No mark	Standard
32810AA101	3	Approaches 3rd gear by 0.2 mm (0.008 in).

5th shifter fork (Non-turbo model), Identification paint (pink)		
Part number	Mark	Remarks
32812AA201	7	Approaches 5th gear by 0.2 mm (0.008 in).
32812AA211	No mark	Standard
32812AA221	9	Moves away from 5th gear by 0.2 mm (0.008 in).

5th shifter fork (Turbo model), Identification paint (blue)		
Part number	Mark	Remarks
32812AA231	7	Approaches 5th gear by 0.2 mm (0.008 in).
32812AA241	No mark	Standard
32812AA251	9	Moves away from 5th gear by 0.2 mm (0.008 in).

### 7. TRANSFER CASE

#### Neutral position adjustment

Adjusting shim	
Part number	Thickness mm (in)
32190AA000	0.15 (0.0059)
32190AA010	0.30 (0.0118)

Reverse accent shaft		
Part number	Mark	Remarks
32188AA130	S	Neutral position is closer to 1st.
32188AA140	T	Standard
32188AA150	U	Neutral position is closer to reverse gear.

#### Reverse check plate adjustment

Reverse check plate			
Part number	Mark	Angle $\theta$	Remarks
32189AA001	0	28°	Arm stops closer to 5th gear.
32189AA011	1	31°	Arm stops closer to 5th gear.
33189AA021	2	34°	Arm stops in the center.
32189AA031	3	37°	Arm stops closer to reverse gear.
32189AA041	4	40°	Arm stops closer to reverse gear.

# General Description

MANUAL TRANSMISSION AND DIFFERENTIAL

## 8. EXTENSION ASSEMBLY

**Preload of the taper roller bearing  
(amount of standard protrusion):**

**0.15 — 0.25 mm (0.006 — 0.010 in)**

NOTE:

Be sure that the amount of preload is within the standard value.

Thrust washer (50 × 61 × t)	
Part number	Thickness mm (in)
803050060	0.50 (0.0197)
803050061	0.55 (0.0217)
803050062	0.60 (0.0236)
803050063	0.65 (0.0256)
803050064	0.70 (0.0276)
803050065	0.75 (0.0295)
803050066	0.80 (0.0315)
803050067	0.85 (0.0335)
803050068	0.90 (0.0354)
803050069	0.95 (0.0374)
803050070	1.00 (0.0394)
803050071	1.05 (0.0413)
803050072	1.10 (0.0433)
803050073	1.15 (0.0453)
803050074	1.20 (0.0472)
803050075	1.25 (0.0492)
803050076	1.30 (0.0512)
803050077	1.35 (0.0531)
803050078	1.40 (0.0551)
803050079	1.45 (0.0571)

**Thrust washer to center differential side  
clearance:**

**0.15 — 0.35 mm (0.0059 — 0.0138 in)**

Thrust washer	
Part number	Thickness mm (in)
803036050	0.9 (0.035)
803036054	1.0 (0.039)
803036051	1.1 (0.043)
803036055	1.2 (0.047)
803036052	1.3 (0.051)
803036056	1.4 (0.055)
803036053	1.5 (0.059)
803036057	1.6 (0.063)
803036058	1.7 (0.067)

## 9. FRONT DIFFERENTIAL

**Bevel gear to pinion backlash:  
0.13 — 0.18 mm (0.0051 — 0.0071 in)**

Washer (38.1 × 50 × t)			
Part number	Thickness mm (in)	Part number	Thickness mm (in)
803038021	0.925 — 0.950 (0.0364 — 0.0374)	803038023	1.025 — 1.050 (0.0404 — 0.0413)
803038022	0.975 — 1.000 (0.0384 — 0.0394)	—	—

## 10. TRANSFER DRIVE GEAR

**Snap ring (Outer-30) to ball bearing clearance:  
0.01 — 0.15 mm (0.0004 — 0.0059 in)**

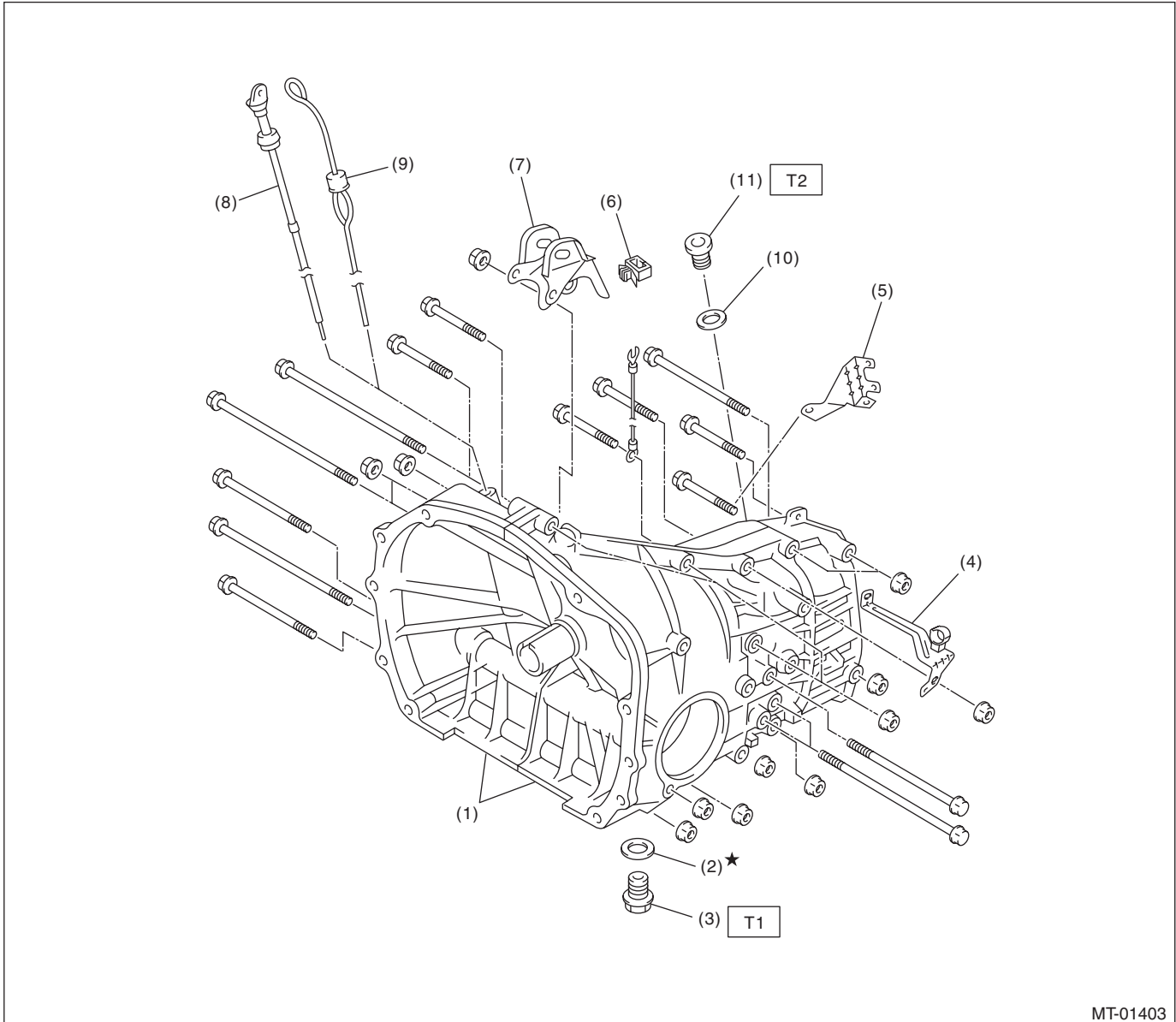
Snap ring (Outer-30)	
Part number	Thickness mm (in)
805030041	1.53 (0.0602)
805030042	1.65 (0.0650)
805030043	1.77 (0.0697)

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: COMPONENT

#### 1. TRANSMISSION CASE



MT-01403

- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| (1) Transmission case ASSY            | (6) Clamp                             |
| (2) Gasket                            | (7) Pitching stopper bracket          |
| (3) Drain plug                        | (8) Oil level gauge (Non-turbo model) |
| (4) Harness bracket (Non-turbo model) | (9) Oil level gauge (Turbo model)     |
| (5) Harness bracket (Turbo model)     | (10) Gasket                           |
|                                       | (11) Plug                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

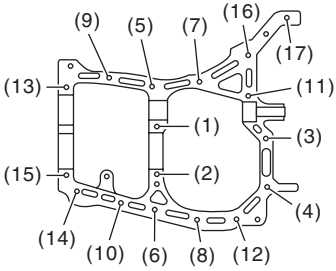
**T1: 44 (4.5, 32.5) (Aluminum gasket)**

**70 (7.1, 51.6) (Copper gasket)**

**T2: 60 (6.1, 43.7)**

# General Description

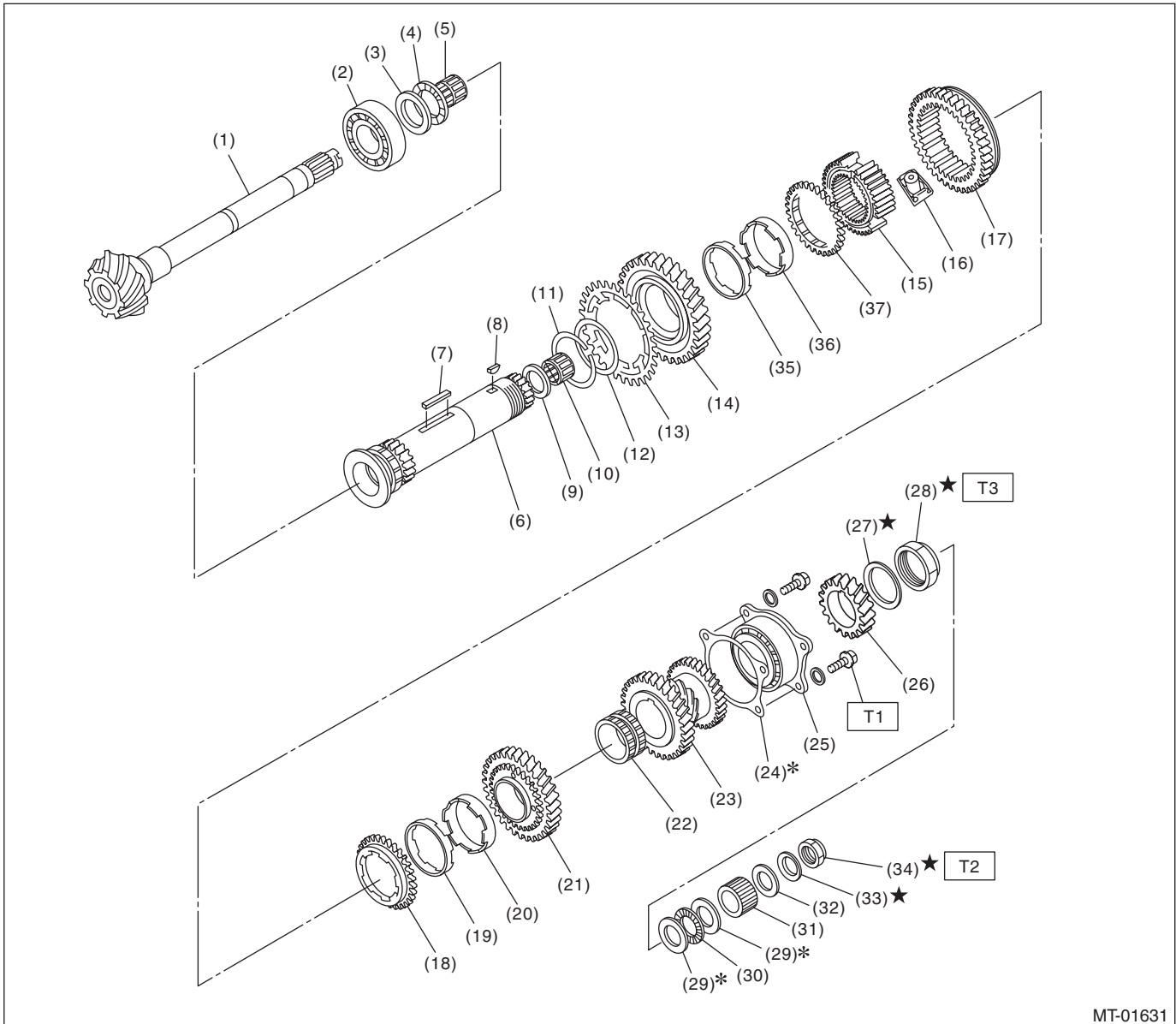
## Transmission case tightening torque

 <p>MT-00003</p>	Bolt No.	Bolt size mm	Tightening torque: N·m (kgf·m, ft·lb)
	(5) — (15)	8	25 (2.5, 18.4)
	(1) — (4) (16) — (17)	10	39 (4.0, 28.9)

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. DRIVE PINION ASSEMBLY



MT-01631

(1) Drive pinion shaft	(15) 1st-2nd synchronizer hub	(30) Thrust bearing
(2) Roller bearing	(16) Ball detent	(31) Differential bevel gear sleeve
(3) Washer	(17) Reverse driven gear	(32) Washer
(4) Thrust bearing	(18) Outer baulk ring	(33) Lock washer
(5) Needle bearing	(19) Synchro cone	(34) Lock nut
(6) Driven shaft	(20) Inner baulk ring	(35) Inner baulk ring
(7) Key	(21) 2nd driven gear	(36) Synchro cone
(8) Woodruff key	(22) 2nd driven gear bushing	(37) Outer baulk ring
(9) Drive pinion collar	(23) 3rd-4th driven gear	
(10) Needle bearing	(24) Driven pinion shim	
(11) Snap ring (outer) (2.5 L non-turbo model)	(25) Roller bearing	
(12) Washer (2.5 L non-turbo model)	(26) 5th driven gear	
(13) Sub gear (2.5 L non-turbo model)	(27) Lock washer	
(14) 1st driven gear	(28) Lock nut	
	(29) Washer	

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**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 30 (3.1, 22.1)**

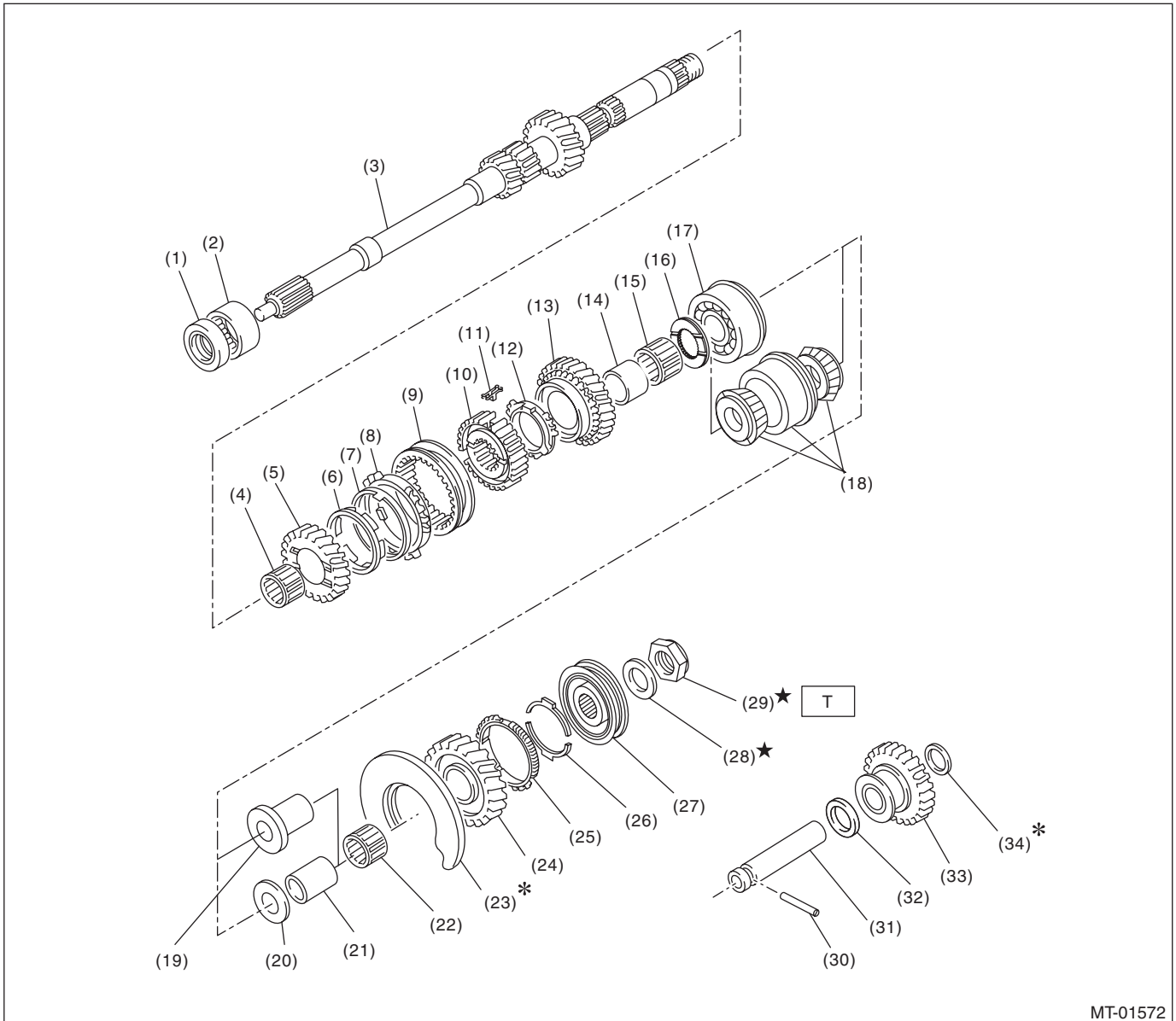
**T2: 120 (12.2, 88.5)**

**T3: 260 (26.5, 191.8)**

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# General Description

## 3. MAIN SHAFT FOR SINGLE-RANGE



MT-01572

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

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(1) Oil seal	(15) Needle bearing	(25) 5th baulk ring
(2) Needle bearing	(16) 4th gear thrust washer	(26) Baulk lever
(3) Transmission main shaft	(17) Ball bearing (Non-turbo model)	(27) 5th hub & sleeve No. 2
(4) Needle bearing	(18) Taper roller bearing (Turbo model)	(28) Lock washer
(5) 3rd drive gear	(19) 5th needle bearing race (Turbo model)	(29) Lock nut
(6) Inner baulk ring	(20) 5th gear thrust washer (Non-turbo model)	(30) Straight pin
(7) 3rd synchro cone	(21) 5th needle bearing race (Non-turbo model)	(31) Reverse idler gear shaft
(8) Outer baulk ring	(22) Needle bearing	(32) Washer
(9) 3rd-4th coupling sleeve	(23) Main shaft rear plate	(33) Reverse idler gear
(10) 3rd-4th synchronizer hub	(24) 5th drive gear	(34) Washer
(11) 3rd-4th shifting insert key		
(12) 4th baulk ring		
(13) 4th drive gear		
(14) 4th needle bearing race		

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***Tightening torque:N·m (kgf·m, ft·lb)***

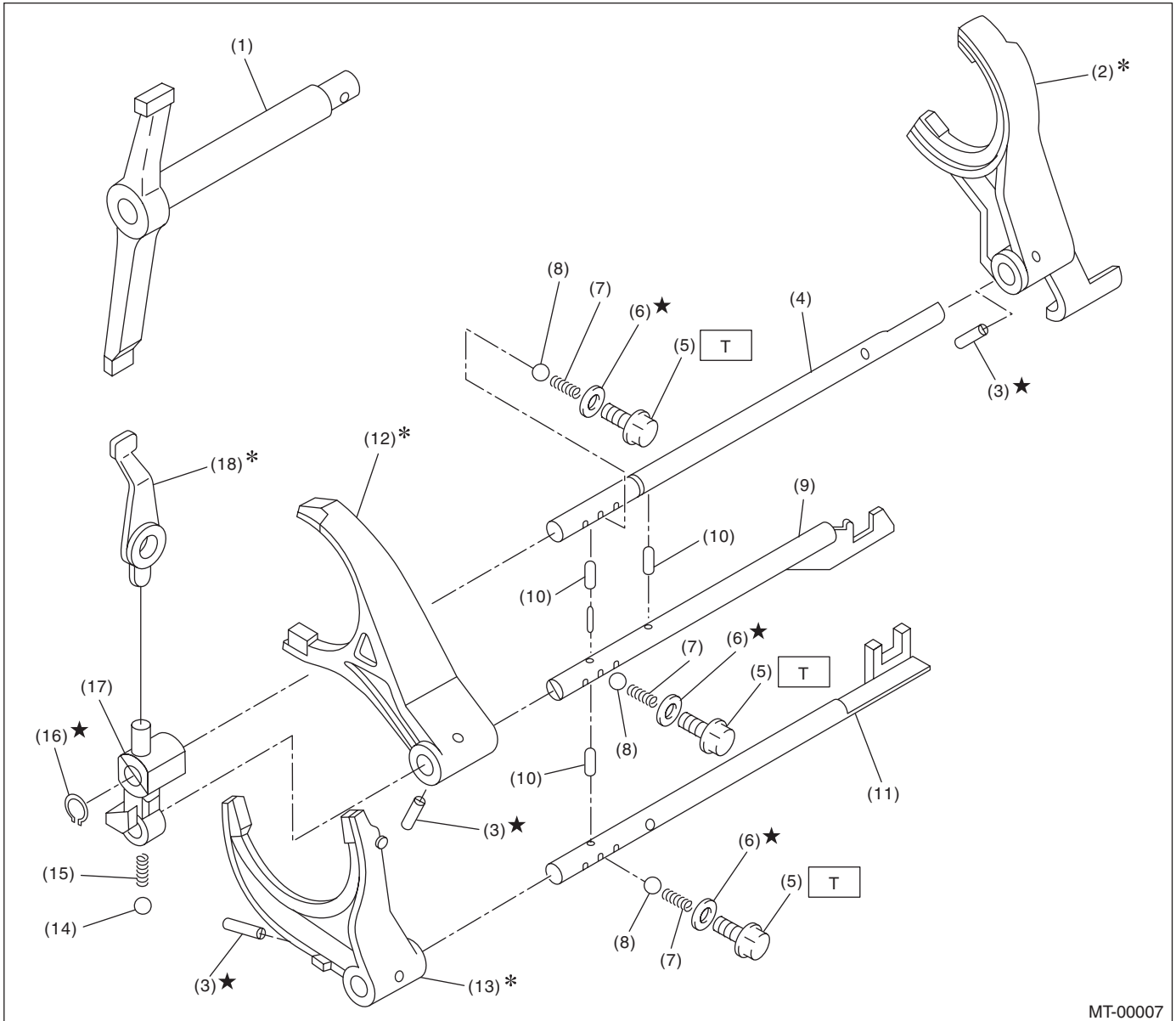
***T: 120 (12.2, 88.5)***

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# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 4. SHIFTER FORK AND SHIFTER ROD



MT-00007

- |                          |                           |                            |
|--------------------------|---------------------------|----------------------------|
| (1) Shifter arm          | (8) Ball                  | (15) Spring                |
| (2) 5th shifter fork     | (9) 3rd-4th fork rod      | (16) Snap ring (Outer)     |
| (3) Straight pin         | (10) Interlock plunger    | (17) Reverse fork rod arm  |
| (4) Reverse fork rod     | (11) 1st-2nd fork rod     | (18) Reverse shifter lever |
| (5) Checking ball plug   | (12) 3rd-4th shifter fork |                            |
| (6) Gasket               | (13) 1st-2nd shifter fork |                            |
| (7) Checking ball spring | (14) Ball                 |                            |

**Tightening torque: N·m (kgf·m, ft·lb)**

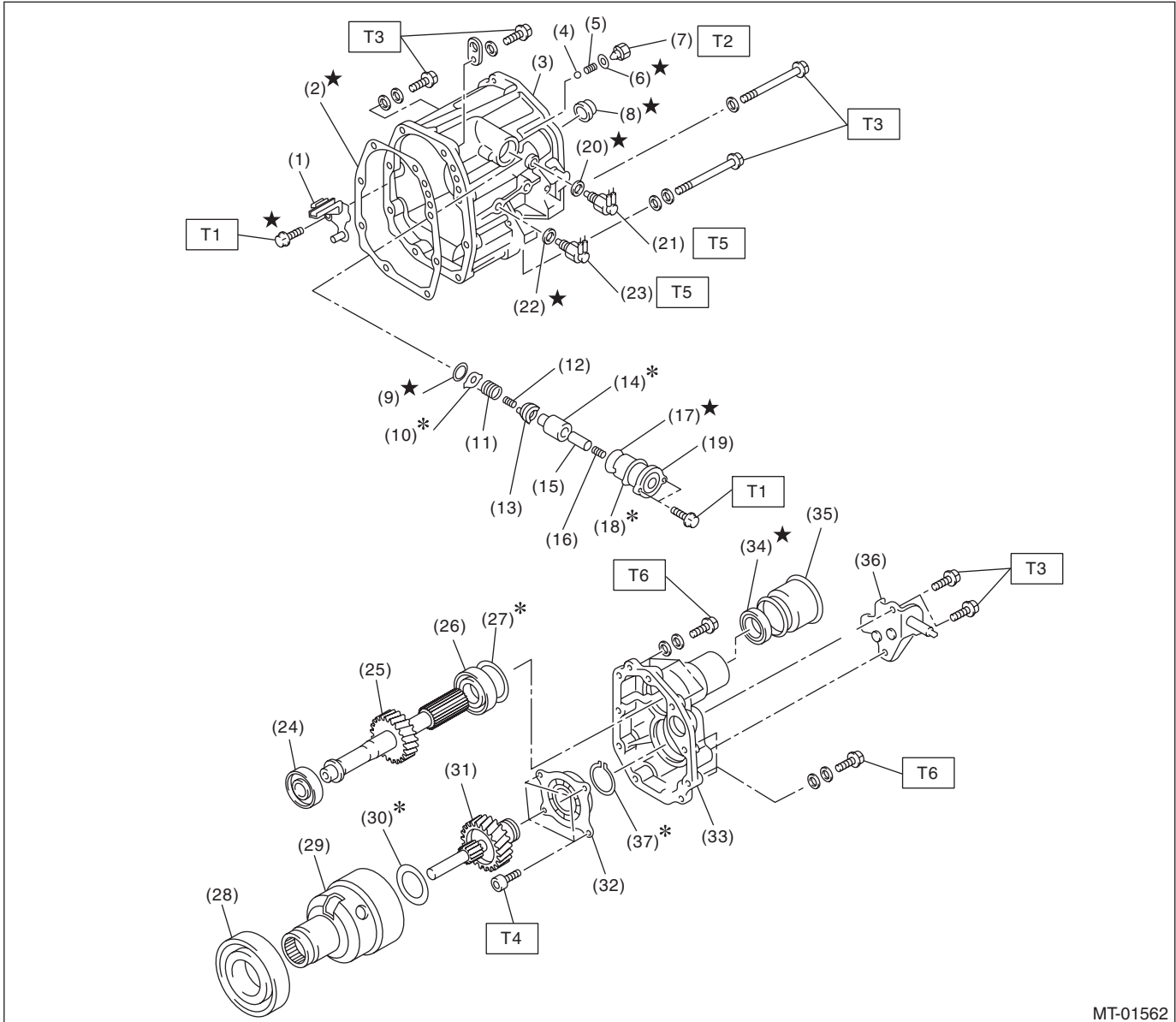
**T: 20 (2.0, 14.8)**



# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 5. TRANSFER CASE AND EXTENSION



MT-01562

- |                            |                              |                          |
|----------------------------|------------------------------|--------------------------|
| (1) Oil guide              | (16) Return spring           | (31) Transfer drive gear |
| (2) Gasket                 | (17) O-ring                  | (32) Ball bearing        |
| (3) Transfer case          | (18) Adjusting select shim   | (33) Extension case      |
| (4) Ball                   | (19) Reverse check sleeve    | (34) Oil seal            |
| (5) Reverse accent spring  | (20) Gasket                  | (35) Dust cover          |
| (6) Gasket                 | (21) Neutral position switch | (36) Shift bracket       |
| (7) Plug                   | (22) Gasket                  | (37) Snap ring           |
| (8) Oil seal               | (23) Back-up light switch    |                          |
| (9) Snap ring (Inner)      | (24) Roller bearing          |                          |
| (10) Reverse check plate   | (25) Transfer driven gear    |                          |
| (11) Reverse check spring  | (26) Roller bearing          |                          |
| (12) Reverse return spring | (27) Adjusting washer        |                          |
| (13) Reverse check cam     | (28) Ball bearing            |                          |
| (14) Reverse accent shaft  | (29) Center differential     |                          |
| (15) Return spring cap     | (30) Adjusting washer        |                          |

#### Tightening torque: N·m (kgf·m, ft·lb)

**T1: 6.4 (0.65, 4.7)**

**T2: 9.75 (1.0, 7.2)**

**T3: 24.5 (2.5, 18.1)**

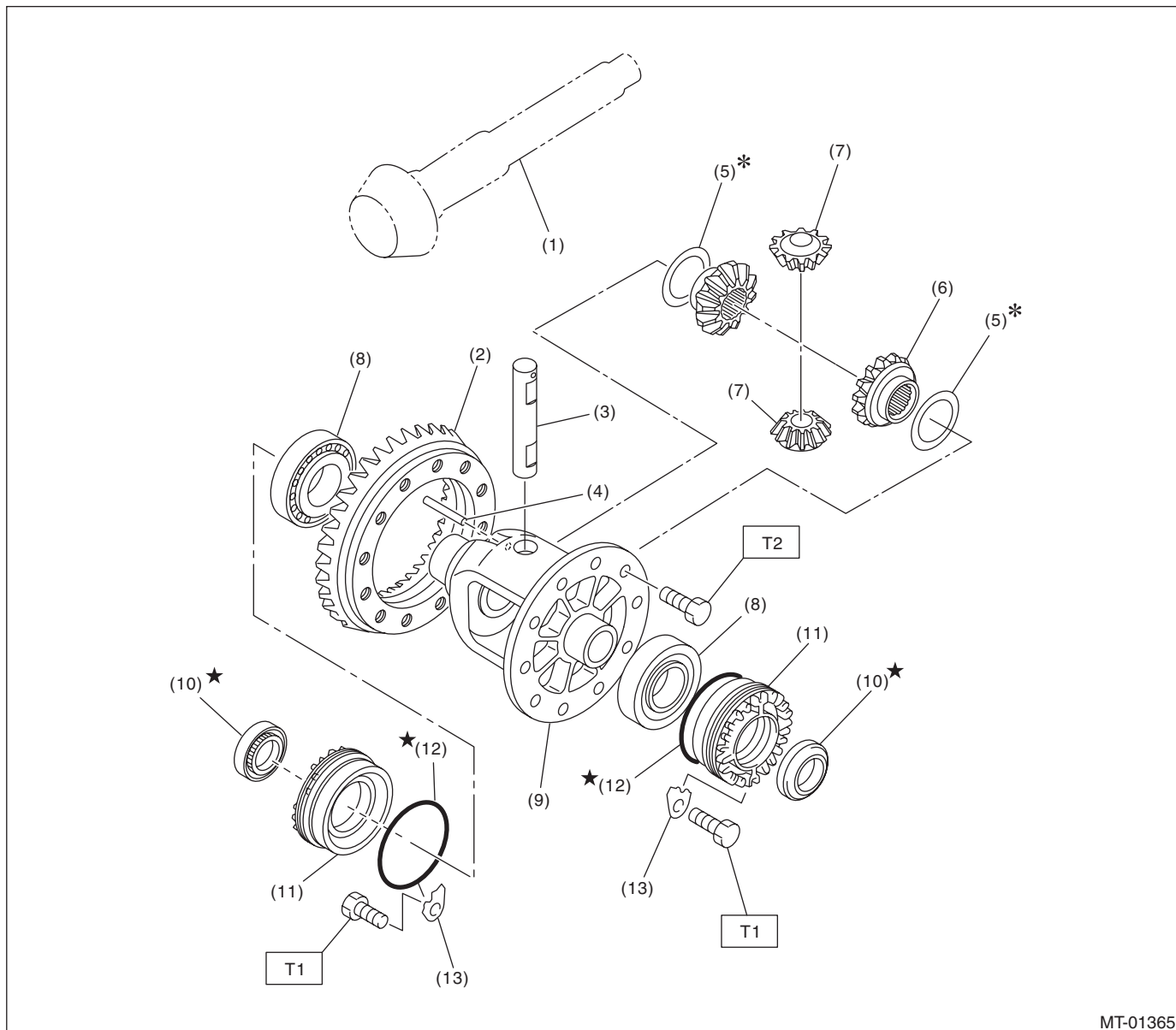
**T4: 26 (2.7, 19.2)**

**T5: 32.3 (3.3, 23.8)**

**T6: 40 (4.1, 29.5)**

# General Description

## 6. FRONT DIFFERENTIAL



- |                             |                                 |                          |
|-----------------------------|---------------------------------|--------------------------|
| (1) Drive pinion shaft      | (7) Differential bevel pinion   | (13) Retainer lock plate |
| (2) Hypoid driven gear      | (8) Roller bearing              |                          |
| (3) Pinion shaft            | (9) Differential case           |                          |
| (4) Straight pin            | (10) Oil seal                   |                          |
| (5) Washer                  | (11) Differential side retainer |                          |
| (6) Differential bevel gear | (12) O-ring                     |                          |

**Tightening torque: N·m (kgf·m, ft·lb)**

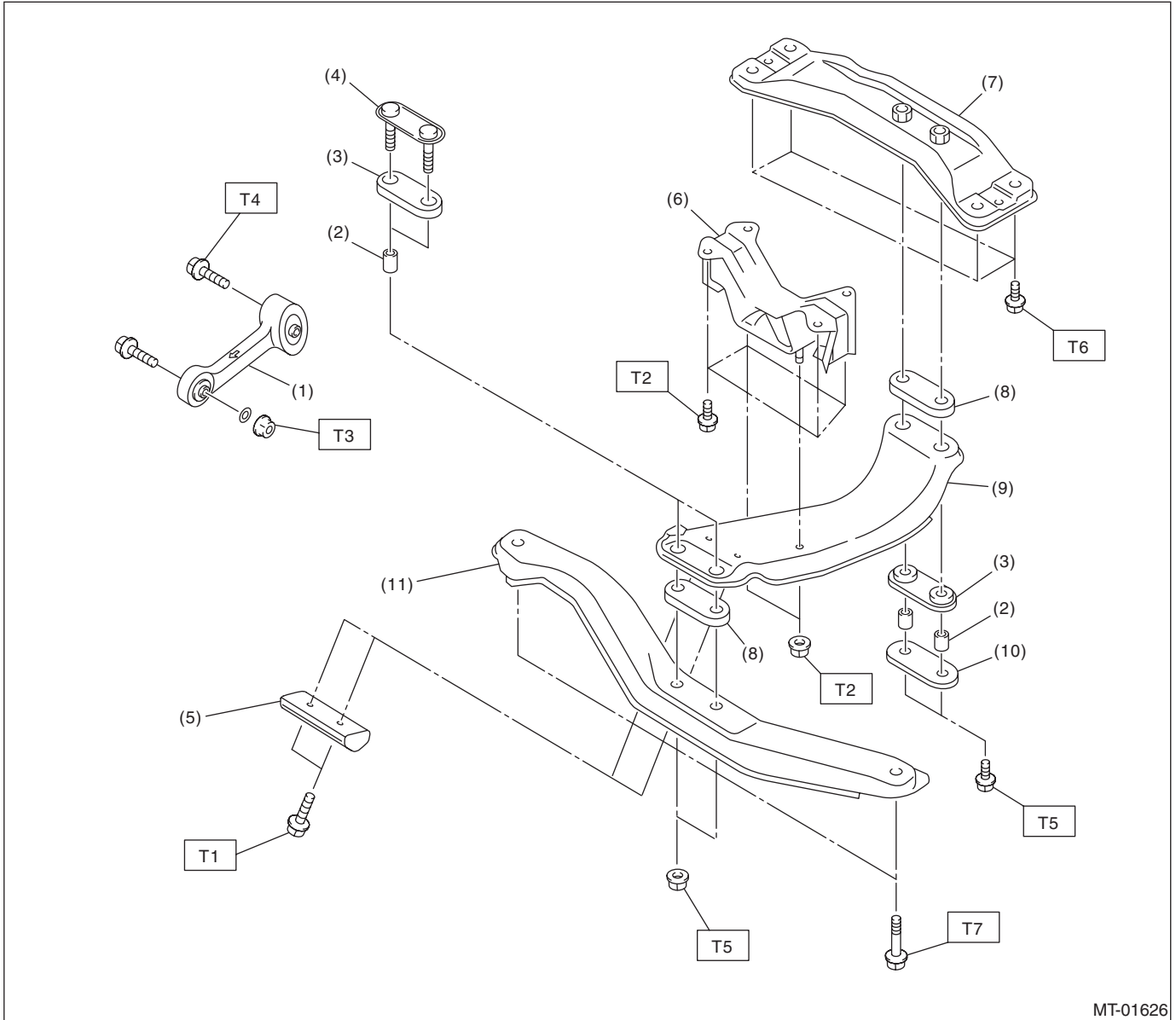
**T1: 25 (2.5, 18.4)**

**T2: 62 (6.3, 45.6)**

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 7. TRANSMISSION MOUNTING



MT-01626

- |                                 |                          |
|---------------------------------|--------------------------|
| (1) Pitching stopper            | (7) Rear crossmember     |
| (2) Spacer                      | (8) Upper cushion rubber |
| (3) Lower cushion rubber        | (9) Center crossmember   |
| (4) Front plate                 | (10) Rear plate          |
| (5) Dynamic damper              | (11) Front crossmember   |
| (6) Transmission cushion rubber |                          |

**Tightening torque: N·m (kgf·m, ft·lb)**

- T1: 7.5 (0.76, 5.5)**  
**T2: 35 (3.6, 25.8)**  
**T3: 50 (5.1, 36.9)**  
**T4: 58 (5.9, 42.8)**  
**T5: 70 (7.1, 51.6)**  
**T6: 75 (7.6, 55.3)**  
**T7: 140 (14.3, 103.3)**

### **C: CAUTION**

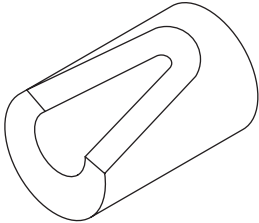
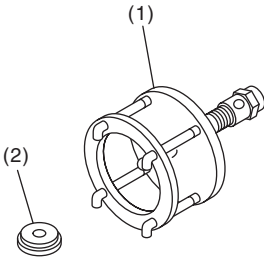
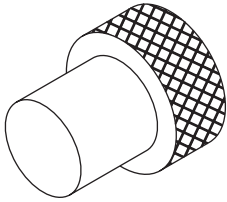
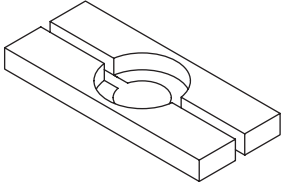
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- When disassembling the case and other light alloy parts, use a plastic hammer to force it apart. Do not pry apart with screwdrivers or other tools.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine gear oil, grease or the equivalent. Do not mix gear oil, grease, etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply gear oil onto sliding or revolving surfaces before installation.
- Replace deformed or damaged snap rings with new parts.
- Before installing O-rings or oil seals, apply sufficient amount of gear oil to avoid damage and deformation.
- Be careful not to incorrectly install or fail to install O-rings, snap rings and other such parts.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Avoid damaging the mating surface of the case.
- Before applying liquid gasket, completely remove the liquid gasket.

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

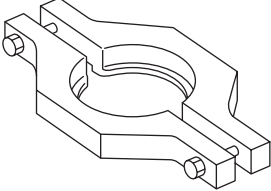
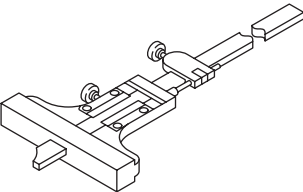
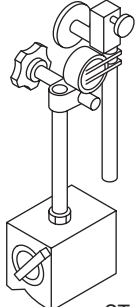
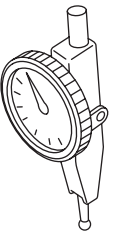
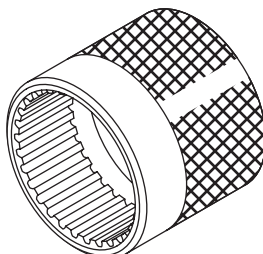
### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-399411700</p>	399411700	ACCENT BALL INSTALLER	Used for installing reverse shifter rail arm.
 <p style="text-align: center;">ST-899524100</p>	899524100	PULLER SET	Used for removing and installing the roller bearing (Differential). (1) Puller (2) Cap
 <p style="text-align: center;">ST-399780104</p>	399780104	WEIGHT	Used for measuring preload on the roller bearing.
 <p style="text-align: center;">ST-498077000</p>	498077000	REMOVER	Used for removing the roller bearing of the drive pinion shaft.

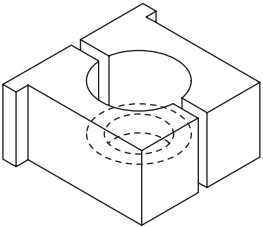
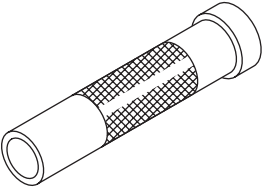
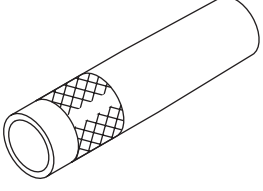
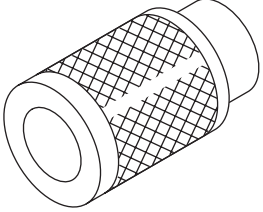
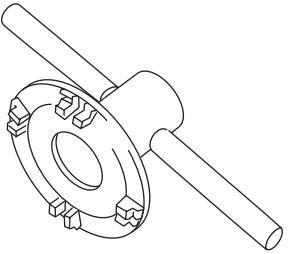
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498077300</p>	498077300	CENTER DIFFERENTIAL BEARING REMOVER	Used for removing the center differential cover ball bearing.
 <p>ST-498147001</p>	498147001	DEPTH GAUGE	Used for adjusting the main shaft axial end play.
 <p>ST-498247001</p>	498247001	MAGNET BASE	<ul style="list-style-type: none"> <li>• Used for measuring backlash between the side gear and pinion, and the hypoid gear.</li> <li>• Used together with the DIAL GAUGE (498247100).</li> </ul>
 <p>ST-498247100</p>	498247100	DIAL GAUGE	<ul style="list-style-type: none"> <li>• Used for measuring backlash between the side gear and pinion, and the hypoid gear.</li> <li>• Used together with the MAGNET BASE (498247001).</li> </ul>
 <p>ST-498427100</p>	498427100	STOPPER	Used for securing the drive pinion shaft assembly and the driven gear assembly when removing the drive pinion shaft assembly lock nut.

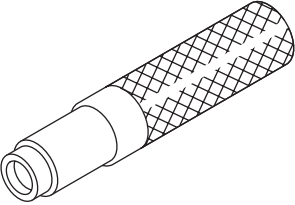
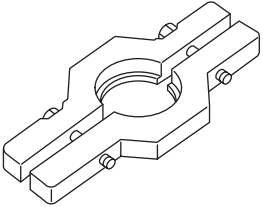
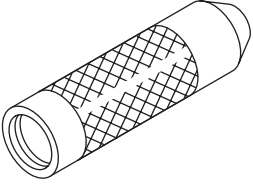
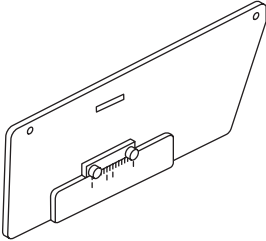
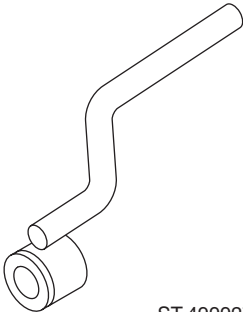
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498937000</p>	498937000	TRANSMISSION HOLDER	Used for removing and installing the lock nut of the transmission main shaft.
 <p>ST-499277100</p>	499277100	BUSHING 1-2 INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the 1st driven gear thrust plate and the 1st-2nd driven gear bushing.</li> <li>• Used for installing the roller bearing outer race to the differential case.</li> </ul>
 <p>ST-499277200</p>	499277200	INSTALLER	Used for press-fitting the 2nd driven gear, roller bearings and the 5th driven gear onto the driven shaft.
 <p>ST-499757002</p>	499757002	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the snap ring (OUT 25), and ball bearing (25 × 26 × 17).</li> <li>• Used for installing the bearing cone of the transfer driven gear (extension core side).</li> </ul>
 <p>ST18630AA010</p>	18630AA010	WRENCH COMPL RETAINER	<ul style="list-style-type: none"> <li>• Used for removing and installing the differential side retainer.</li> <li>• WRENCH ASSEMBLY (499787000) can also be used.</li> </ul>

# General Description

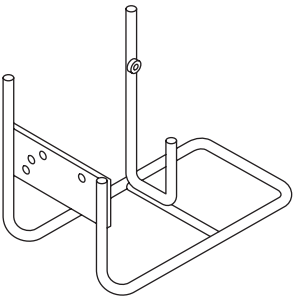
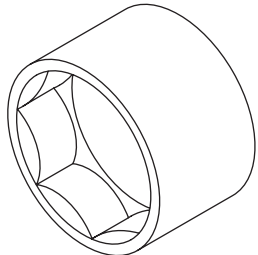
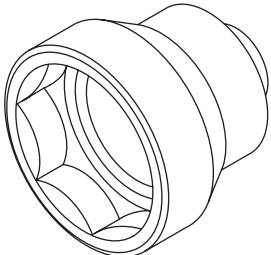
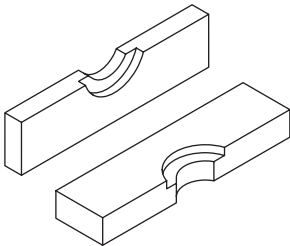
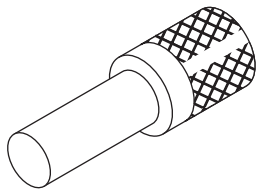
## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499827000</p>	499827000	PRESS	Used for installing the speedometer oil seal when attaching the speedometer cable to the transmission.
 <p>ST-499857000</p>	499857000	5TH DRIVEN GEAR REMOVER	Used for removing the 5th driven gear.
 <p>ST-499877000</p>	499877000	RACE 4-5 INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the 4th needle bearing race and ball bearing onto the transmission main shaft.</li> <li>• Used together with the REMOVER (899714110).</li> </ul>
 <p>ST-499917500</p>	499917500	DRIVE PINION GAUGE ASSY	Used for adjusting the drive pinion shim.
 <p>ST-499927100</p>	499927100	HANDLE	Used for fitting the transmission main shaft.



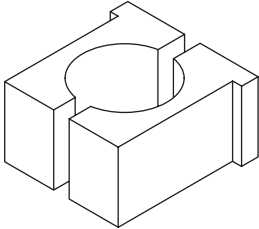
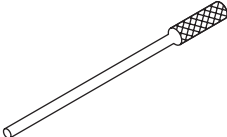
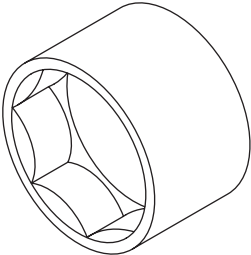
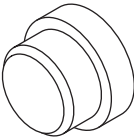
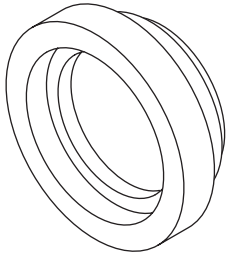
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-499937100</p>	499937100	TRANSMISSION STAND SET	Used for disassembling and assembling the transmission.
 <p style="text-align: center;">ST-499987003</p>	499987003	SOCKET WRENCH (35)	Used for removing and installing the driven pinion lock nut and main shaft lock nut.
 <p style="text-align: center;">ST-499987300</p>	499987300	SOCKET WRENCH (50)	Used for removing and installing the driven gear assembly lock nut.
 <p style="text-align: center;">ST-899714110</p>	899714110	REMOVER	Used for fixing the transmission main shaft, drive pinion and rear drive shaft.
 <p style="text-align: center;">ST-899864100</p>	899864100	REMOVER	Used for removing transmission main shaft and drive pinion parts.

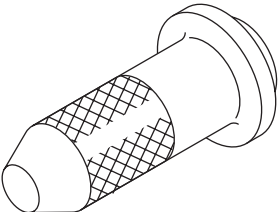
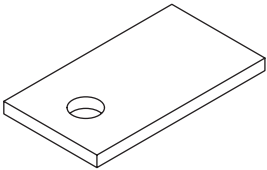
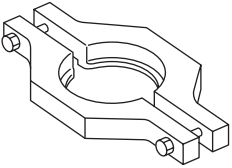
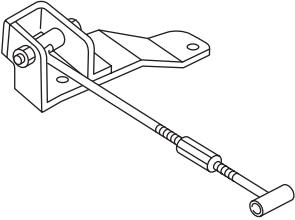
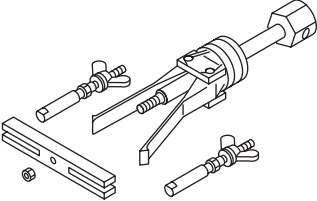
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-899884100</p>	899884100	HOLDER	Used for tightening the lock nut on the sleeve.
 <p>ST-899904100</p>	899904100	REMOVER	Used for removing and installing the straight pin.
 <p>ST-899988608</p>	899988608	SOCKET WRENCH (27)	Used for removing and installing the drive pinion lock nut.
 <p>ST-398497701</p>	398497701	ADAPTER	<ul style="list-style-type: none"> <li>• Used for installing roller bearing onto the differential case.</li> <li>• Used together with the INSTALLER (499277100).</li> </ul>
 <p>ST-499587000</p>	499587000	INSTALLER	Used for installing the driven gears to the driven shaft.

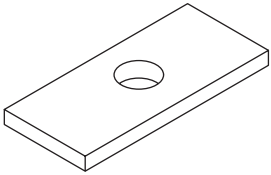
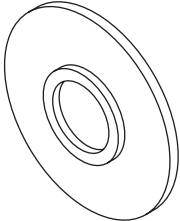
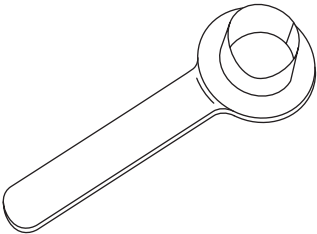
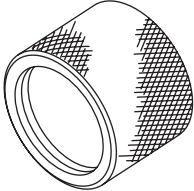
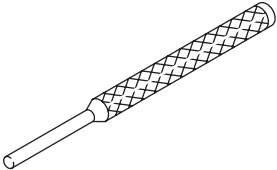
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498057300</p>	498057300	INSTALLER	Used for installing the extension oil seal.
 <p style="text-align: center;">ST-498255400</p>	498255400	PLATE	Used for measuring backlash.
 <p style="text-align: center;">ST-498077400</p>	498077400	SYNCHRONIZER CONE REMOVER	<ul style="list-style-type: none"> <li>• Used for removing the synchronizer cone of the main shaft.</li> <li>• Used for removing 5th driven gear of the drive pinion shaft.</li> </ul>
 <p style="text-align: center;">ST41099AC000</p>	41099AC000	ENGINE SUPPORT ASSY	Used for supporting the engine.
 <p style="text-align: center;">ST-398527700</p>	398527700	PULLER ASSY	Used for removing the extension case roller bearing.

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-398643600</p>	398643600	GAUGE	Used for measuring the total end play, extension end play and drive pinion height.
 <p>ST-398177700</p>	398177700	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the bearing cone of transfer driven gear (transfer case side).</li> <li>• Used for installing the ball bearing of the transfer drive gear.</li> </ul>
 <p>ST28399SA010</p>	28399SA010	FRONT DRIVE SHAFT OIL SEAL PROTECTOR	Used for protecting the oil seal from damage when inserting the front drive shaft.
 <p>ST18675AA000</p>	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.
 <p>ST-398791700</p>	398791700	STRAIGHT PIN REMOVER	Used for installing and removing the straight pin.

# General Description

MANUAL TRANSMISSION AND DIFFERENTIAL

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## 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
TORX® BIT T70	Used for installing and removing the differential gear oil drain plug.

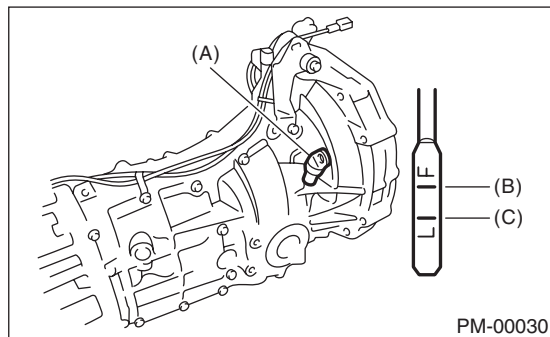
# Transmission Gear Oil

MANUAL TRANSMISSION AND DIFFERENTIAL

## 2. Transmission Gear Oil

### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Turn the ignition switch to OFF, and wait until the engine cools.
- 3) Remove the oil level gauge and wipe it clean.
- 4) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted in the proper direction.
- 5) Pull out the oil level gauge again, and check the oil level. If it is at the lower level or less, add oil through the oil level gauge hole to bring the level up to the upper level.



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

### B: REPLACEMENT

- 1) Pull out the oil level gauge.
- 2) Lift up the vehicle.
- 3) Using the TORX<sup>®</sup> BIT T70, remove the drain plug, and drain the transmission gear oil completely.

#### CAUTION:

- Immediately after the engine has been running, the transmission gear oil is hot. Be careful not to burn yourself.

- Be careful not to spill the transmission gear oil on the exhaust pipe, to prevent emission of smoke or causing a fire. If differential gear oil is spilled on the exhaust pipe, wipe it off completely.

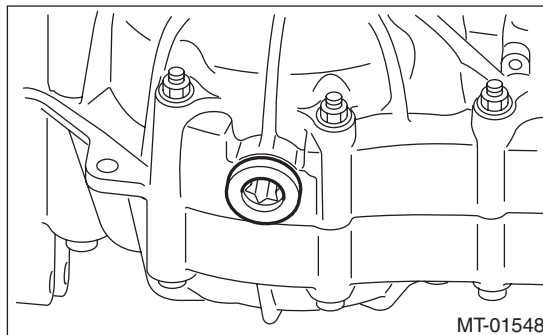
- 4) Using the TORX<sup>®</sup> BIT T70, tighten the transmission gear oil drain plug.

#### NOTE:

- Tighten the drain plug of the transmission gear oil after draining the transmission gear oil.
- Use a new gasket.

#### Tightening torque:

**44 N·m (4.5 kgf·m, 32.5 ft·lb) (Aluminum gasket)**  
**70 N·m (7.1 kgf·m, 51.6 ft·lb) (Copper gasket)**



- 5) Lower the vehicle.
- 6) Pour gear oil through the oil level gauge hole.

#### Recommended gear oil:

**GL-5 (75W-90) or equivalent**

#### Gear oil capacity:

**3.5 ℓ (3.7 US qt, 3.1 Imp qt)**

- 7) Measure the transmission gear oil level to check that it is within specifications.

#### CAUTION:

When inserting the oil level gauge into transmission, align the protrusion on the top part of the oil level gauge with the notch in the oil level gauge hole.

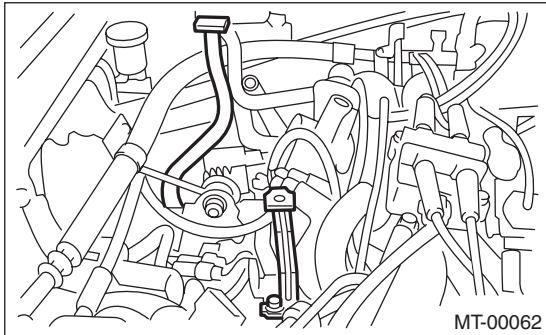
# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

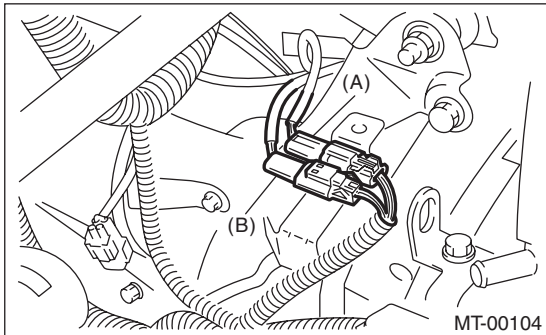
### 3. Manual Transmission Assembly

#### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully, and support with stay.
- 3) Disconnect the ground cable from battery.
- 4) Drain transmission gear oil completely. <Ref. to 5MT-25, REPLACEMENT, Transmission Gear Oil.>
- 5) Remove the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 6) Remove the air intake chamber stay. (Non-turbo model)

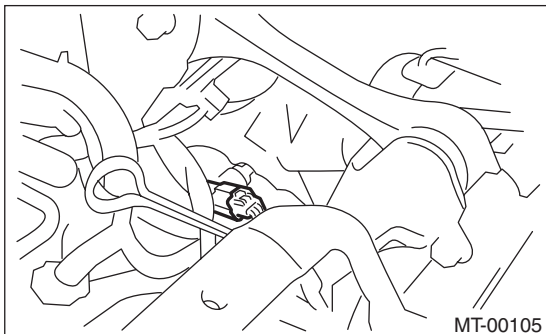


- 7) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
  - 8) Disconnect the connector back-up light switch & neutral position switch.
- Non-turbo model

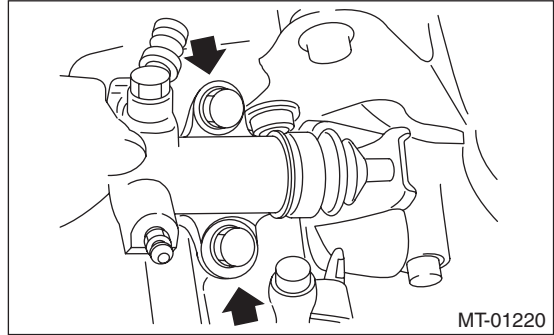


- (A) Neutral position switch connector (Brown)
- (B) Back-up light switch connector (Gray)

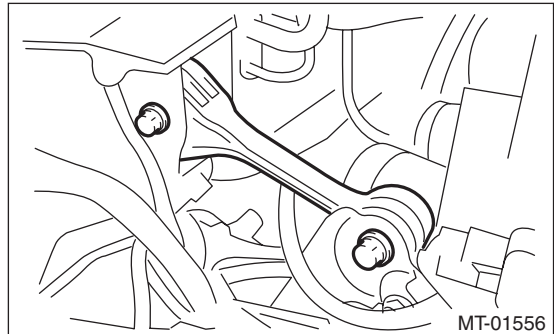
- Turbo model



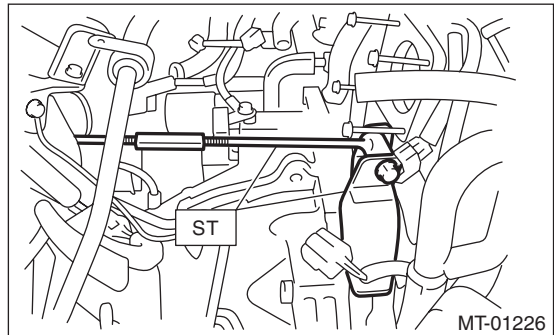
- 9) Remove the starter. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>
- 10) Remove the operating cylinder from the transmission, and suspend on a wire.



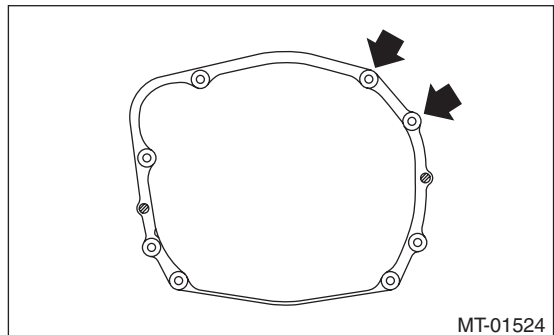
- 11) Remove the pitching stopper.



- 12) Set the ST.  
ST 41099AC000 ENGINE SUPPORT ASSY



- 13) Remove the bolts which hold upper side of transmission to engine.



- 14) Lift up the vehicle.
- 15) Remove the front and center exhaust pipes. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

16) Remove the center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>

17) Remove the rear exhaust pipe and muffler.

- Non-turbo model

<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>

- Turbo model

<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

### CAUTION:

**When removing the exhaust pipes, be careful each exhaust pipe does not drop out.**

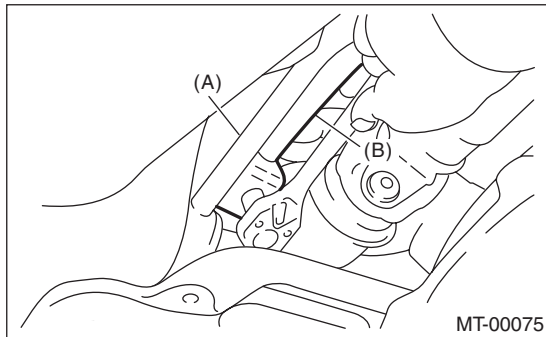
18) Remove the heat shield cover. (If equipped)

19) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

20) Remove the gear shift rod and the stay from the transmission.

(1) Disconnect the stay from the transmission.

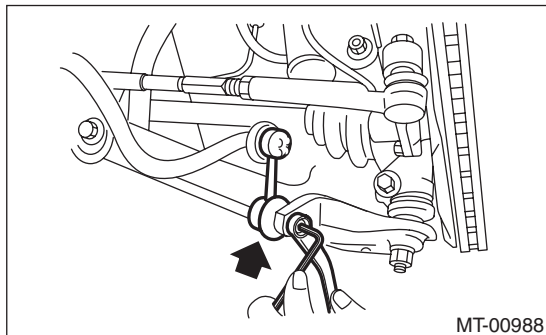
(2) Remove the gear shift rod from the transmission.



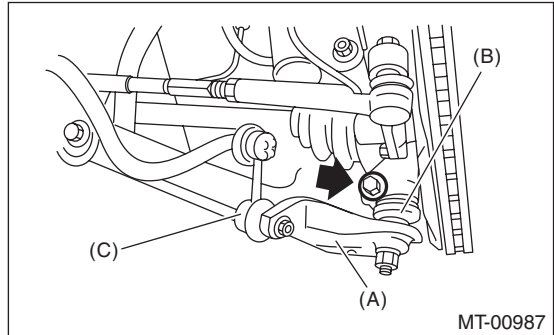
(A) Stay

(B) Gear shift rod

21) Disconnect the stabilizer link from the front arm.



22) Remove the bolt securing the ball joint of the front arm to the housing, then separate the front arms and the housing.

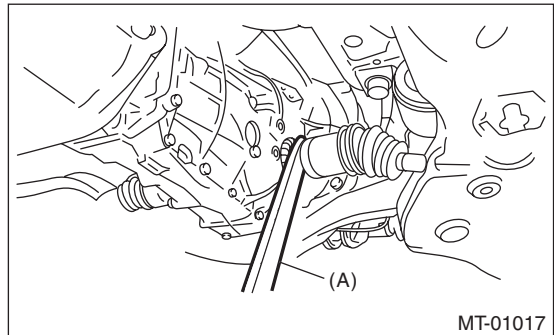


(A) Front arm

(B) Ball joint

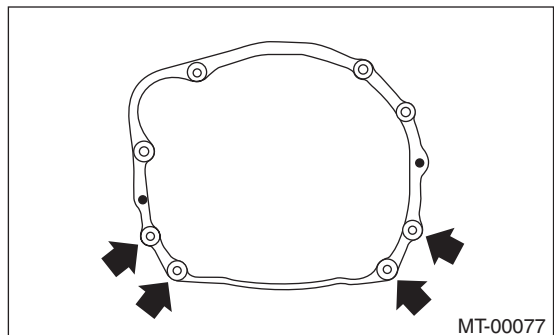
(C) Stabilizer link

23) Using a crowbar, remove the left and right front drive shaft from the transmission.



(A) Bar

24) Remove the bolts and nuts which hold lower side of transmission to engine.





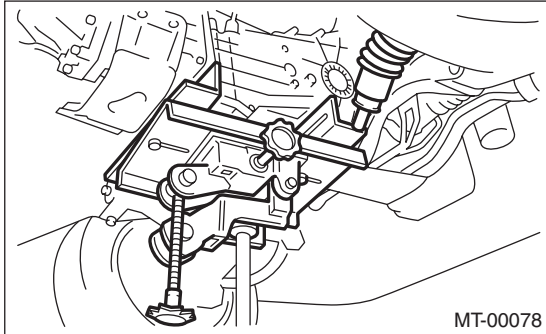
# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

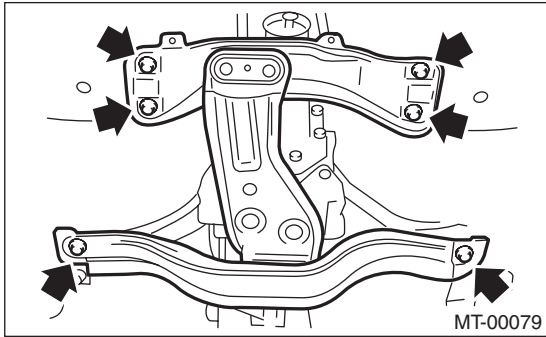
25) Place the transmission jack under the transmission.

### CAUTION:

**Always support the transmission case with a transmission jack.**



26) Remove the front crossmember and rear crossmember from the vehicle.



27) Tighten the turnbuckle of the ST while lowering the transmission jack to tilt the engine assembly towards the back.

28) Remove the transmission.

### NOTE:

Move the transmission jack towards the rear until the main shaft is withdrawn from the clutch disc.

29) Separate the transmission assembly from the transmission cushion rubber.

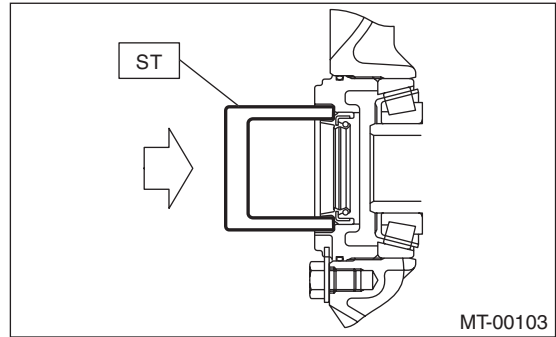
## B: INSTALLATION

1) Replace the differential side retainer oil seal. <Ref. to 5MT-34, REPLACEMENT, Differential Side Retainer Oil Seal.>

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

### NOTE:

Be sure to replace the differential side retainer oil seal after the removing the front drive shaft.



2) Install the transmission cushion rubber to the transmission assembly.

### Tightening torque:

**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

3) Install the transmission onto the engine.

(1) Lift up the transmission gradually using a transmission jack.

(2) Engage at the spline section.

### NOTE:

Be careful not to hit the main shaft against the clutch housing cover.

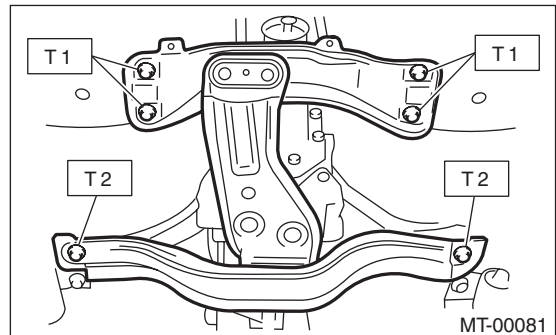
4) Loosen the turnbuckle of the ST while raising the transmission jack to return the engine to its original position.

5) Install the front crossmember and rear crossmember.

### Tightening torque:

**T1: 75 N·m (7.6 kgf-m, 55.3 ft-lb)**

**T2: 140 N·m (14.3 kgf-m, 103.3 ft-lb)**



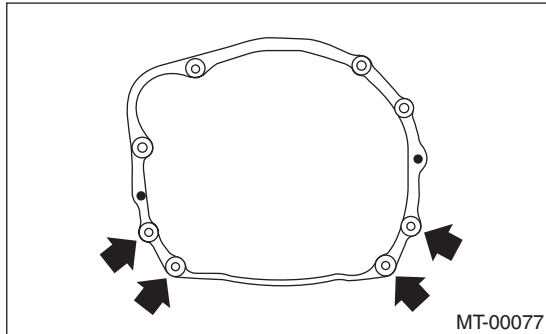
# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

- 6) Take out the transmission jack.
- 7) Tighten the bolts and nuts which hold the lower side of transmission to the engine.

### Tightening torque:

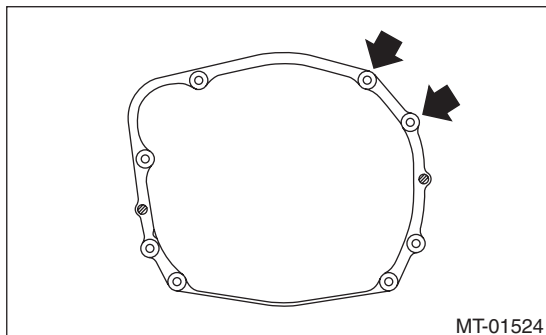
**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



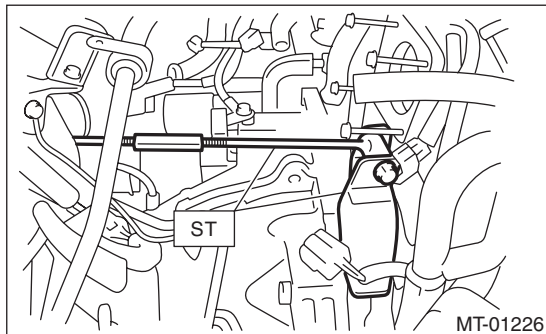
- 8) Connect the transmission to the engine.
  - (1) Install the starter.  
<Ref. to SC(H4SO)-6, INSTALLATION, Starter.>
  - (2) Tighten the bolts which hold the upper side of the transmission to the engine.

### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



- 9) Remove the ST.

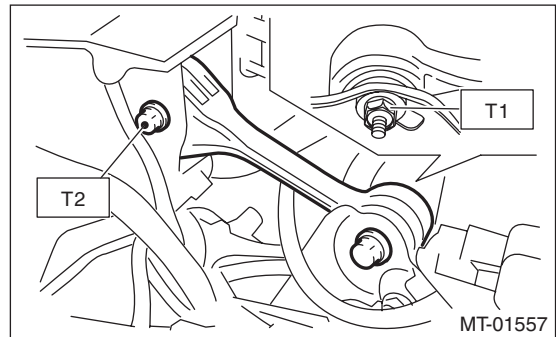


- 10) Install the pitching stopper.

### Tightening torque:

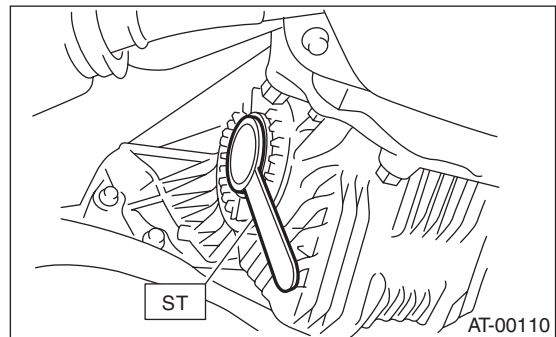
**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 11) Lift up the vehicle.
- 12) Install the front drive shaft into the transmission.

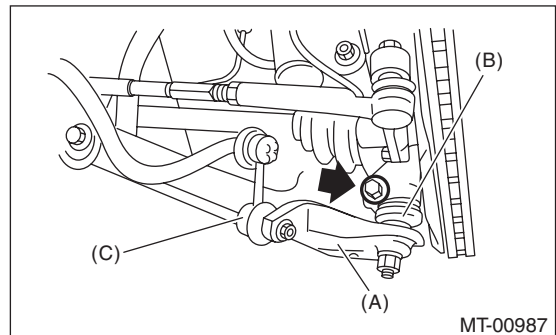
ST 28399SA010 FRONT DRIVE SHAFT OIL SEAL PROTECTOR



- 13) Insert the ball joints of the front arm into the housing, then tighten the installing bolts.

### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**



- (A) Front arm
- (B) Ball joint
- (C) Stabilizer link

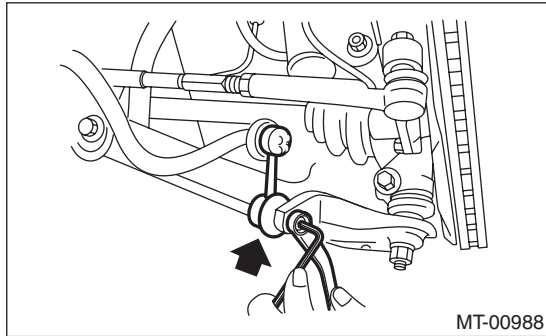
# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

14) Attach the stabilizer link to the front arm.

**Tightening torque:**

**45 N·m (4.6 kgf·m, 33.2 ft·lb)**

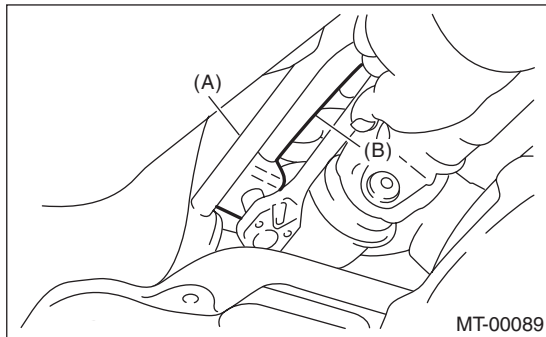


15) Attach the gear shift rod and stay.

(1) Attach the gear shift rod to the transmission.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



(A) Stay

(B) Gear shift rod

(2) Attach the stay to the transmission.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**

16) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

17) Install the heat shield cover. (If equipped)

18) Install the rear exhaust pipe and muffler.

• Non-turbo model

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

• Turbo model

<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

19) Install the front and center exhaust pipe. (Non-turbo model)

<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

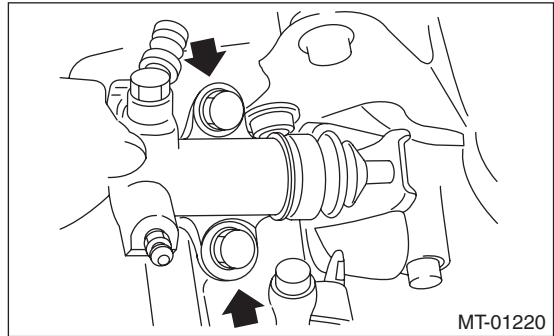
20) Install the center exhaust pipe. (Turbo model)

<Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

21) Install the operating cylinder.

**Tightening torque:**

**37 N·m (3.8 kgf·m, 27.5 ft·lb)**



22) Connect the following connectors.

(1) Transmission ground cable

**Tightening torque:**

**13 N·m (1.3 kgf·m, 9.4 ft·lb)**

(2) Neutral position switch connector

(3) Back-up light switch connector

23) Fill transmission gear oil through the transmission oil level gauge hole.

24) Install the air intake chamber stay.

(Non-turbo model)

**Tightening torque:**

**16 N·m (1.6 kgf·m, 11.6 ft·lb)**

25) Install the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

26) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

27) Connect the battery ground cable to the battery.

28) Take off the vehicle from lift arms.

# Transmission Mounting System

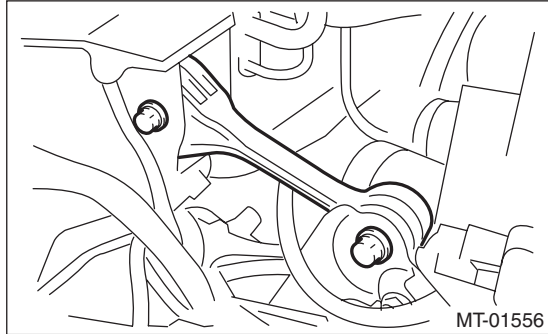
MANUAL TRANSMISSION AND DIFFERENTIAL

## 4. Transmission Mounting System

### A: REMOVAL

#### 1. PITCHING STOPPER

- 1) Disconnect the ground cable from battery.
- 2) Remove the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 3) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Remove the pitching stopper.



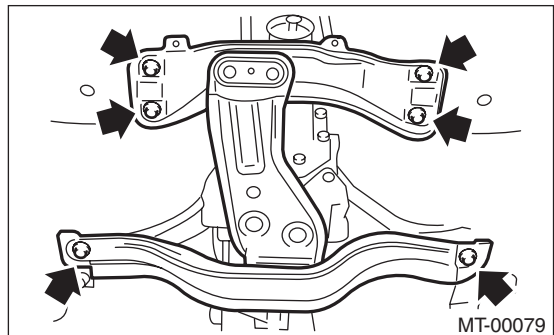
#### 2. CROSSMEMBER AND CUSHION RUBBER

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle.
- 3) Remove the front and center exhaust pipes. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 4) Remove the center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 5) Remove the rear exhaust pipe and muffler.
  - Non-turbo model <Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - Turbo model <Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 6) Remove the heat shield cover. (If equipped)
- 7) Set the transmission jack under the transmission body.

#### CAUTION:

**Always support the transmission case with a transmission jack.**

- 8) Remove the front crossmember and the rear crossmember.



- 9) Remove the transmission cushion rubber.

# Transmission Mounting System

MANUAL TRANSMISSION AND DIFFERENTIAL

## B: INSTALLATION

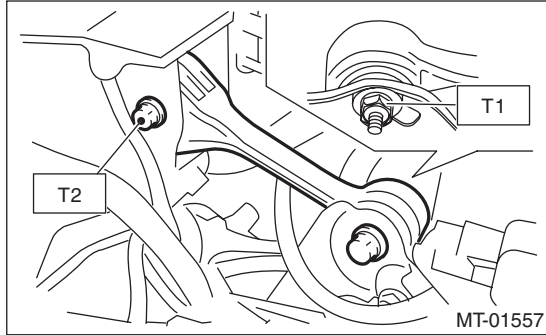
### 1. PITCHING STOPPER

1) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



2) Install the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

3) Install the intercooler. (Turbo model)

<Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

4) Connect the battery ground cable to the battery.

### 2. CROSSMEMBER AND CUSHION RUBBER

1) Install the transmission cushion rubber.

**Tightening torque:**

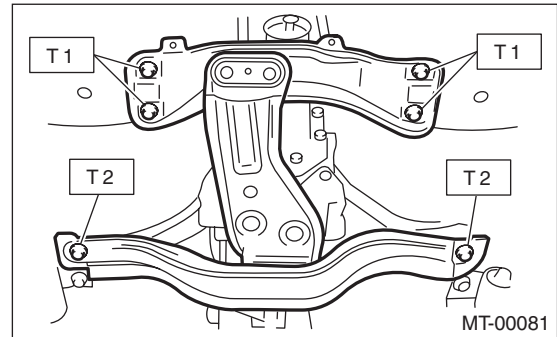
**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

2) Install the front crossmember and rear crossmember.

**Tightening torque:**

**T1: 75 N·m (7.6 kgf-m, 55.3 ft-lb)**

**T2: 140 N·m (14.3 kgf-m, 103.3 ft-lb)**



3) Remove the transmission jack.

4) Install the heat shield cover. (If equipped)

5) Install the front and center exhaust pipe. (Non-turbo model)

<Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

6) Install the center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

7) Install the rear exhaust pipe and muffler.

- Non-turbo model

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- Turbo model

<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

8) Lower the vehicle.

9) Connect the battery ground cable to the battery.

## C: INSPECTION

Perform the following inspection procedures and repair or replace faulty parts.

### 1. PITCHING STOPPER

Check the pitching stopper for bends or damage. Check that the rubber is not stiff, cracked or otherwise damaged.

### 2. CROSSMEMBER AND CUSHION RUBBER

Check crossmember for bends or damage. Check that the cushion rubber is not stiff, cracked, or otherwise damaged.

## 5. Oil Seal

### A: INSPECTION

Check for leakage of gear oil from the oil seal. If there is oil leakage, replace the oil seal with the new part and check the propeller shaft.

### B: REPLACEMENT

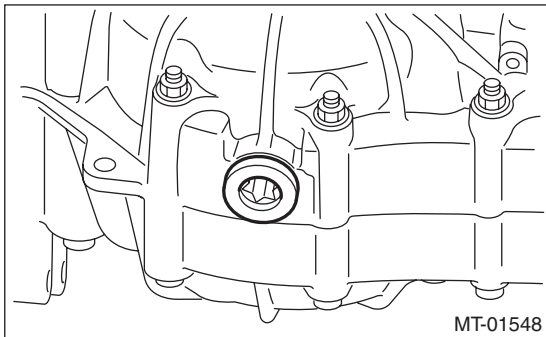
- 1) Clean the transmission exterior.
- 2) Using the TORX<sup>®</sup> BIT T70, remove the drain plug, and drain the transmission gear oil completely.
- 3) Using the TORX<sup>®</sup> BIT T70, tighten the transmission gear oil drain plug.

**NOTE:**

Use a new gasket.

**Tightening torque:**

- 44 N·m (4.5 kgf-m, 32.5 ft-lb) (Aluminum gasket)**
- 70 N·m (7.1 kgf-m, 51.6 ft-lb) (Copper gasket)**



- 4) Remove the rear exhaust pipe and muffler.

- Non-turbo model

<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>

- Turbo model

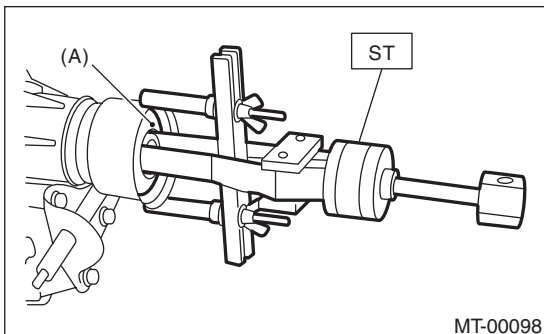
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

- 5) Remove the heat shield cover. (If equipped)

- 6) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

- 7) Using the ST, remove the oil seal.

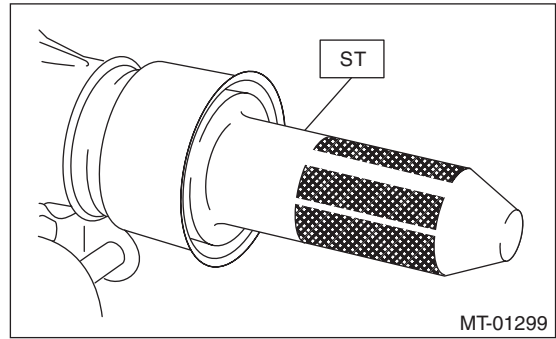
ST 398527700 PULLER ASSY



(A) Oil seal

- 8) Using the ST, install the oil seal.

ST 498057300 INSTALLER



- 9) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

- 10) Install the heat shield cover. (If equipped)

- 11) Install the rear exhaust pipe and muffler.

- Non-turbo model

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- Turbo model

<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

- 12) Pour in the transmission gear oil and check the oil level. <Ref. to 5MT-25, Transmission Gear Oil.>

# Differential Side Retainer Oil Seal

## MANUAL TRANSMISSION AND DIFFERENTIAL

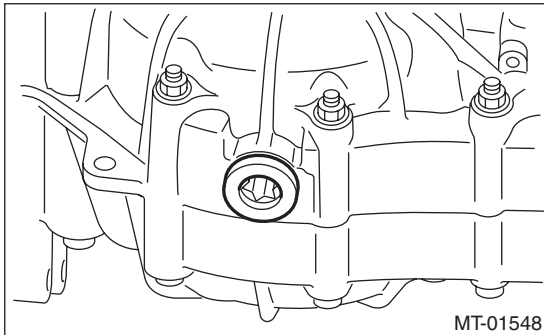
### 6. Differential Side Retainer Oil Seal

#### A: INSPECTION

Check for leakage of gear oil from the differential side retainer oil seal. If there is oil leakage, replace the oil seal with the new part and check the drive shaft.

#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the differential gear oil drain plug using TORX<sup>®</sup> bit T70, and drain the differential gear oil completely.

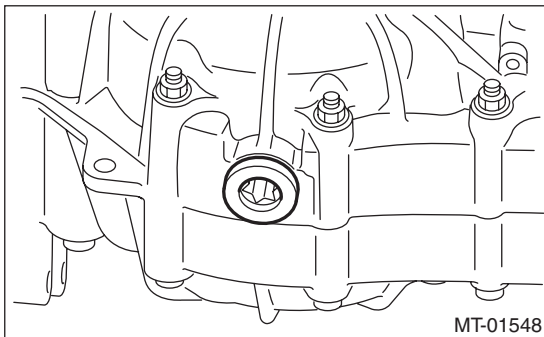


- 3) Replace the gasket with a new part and tighten the differential gear oil drain plug using the TORX<sup>®</sup> bit T70.

#### Tightening torque:

**44 N·m (4.5 kgf-m, 32.5 ft-lb) (Aluminum gasket)**

**70 N·m (7.1 kgf-m, 51.6 ft-lb) (Copper gasket)**



- 4) Remove the front and center exhaust pipes. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>
- 5) Remove the center exhaust pipe. (Turbo model) <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 6) Separate the front drive shaft from the transmission. <Ref. to DS-23, REMOVAL, Front Drive Shaft.>

- 7) Remove the differential side retainer oil seal.

#### NOTE:

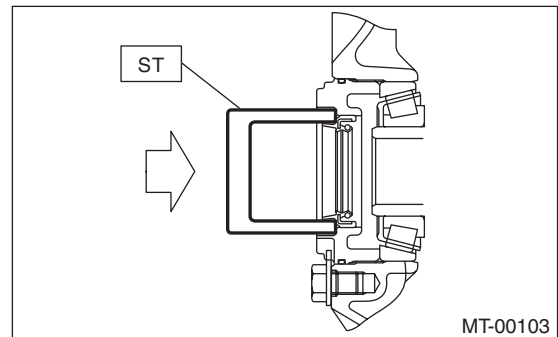
- Be sure to replace the differential side retainer oil seal after the procedure of removing front drive shaft from transmission.
- To remove the oil seal, use ST 398527700 PULLER ASSY. When removing the part by using a flat tip screwdriver, be careful not to scratch the differential side retainer.

- 8) Using the ST, install the differential side retainer oil seal by lightly tapping with a plastic hammer.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

#### NOTE:

Apply oil to the oil seal lips.



- 9) Install the front drive shaft. <Ref. to DS-23, INSTALLATION, Front Drive Shaft.>

- 10) Install the front and center exhaust pipe. (Non-turbo model) <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

- 11) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

- 12) Lower the vehicle.

- 13) Fill the transmission gear oil through the oil level gauge hole. <Ref. to 5MT-25, REPLACEMENT, Transmission Gear Oil.>

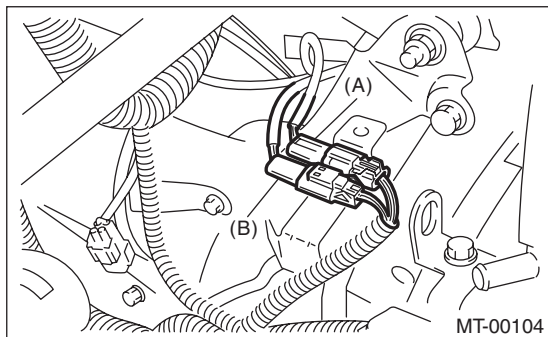
## 7. Switches and Harness

### A: REMOVAL

#### 1. BACK-UP LIGHT SWITCH & NEUTRAL POSITION SWITCH

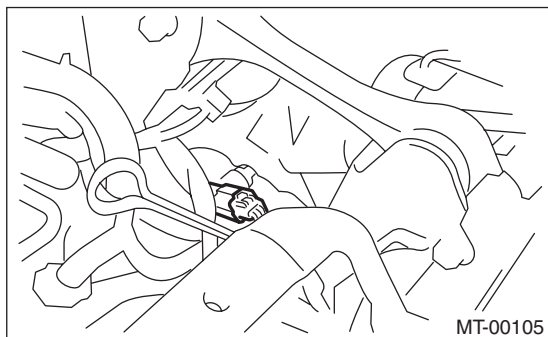
- 1) Disconnect the ground cable from battery.
- 2) Remove the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 3) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Disconnect the connector back-up light switch & neutral position switch.

- Non-turbo model



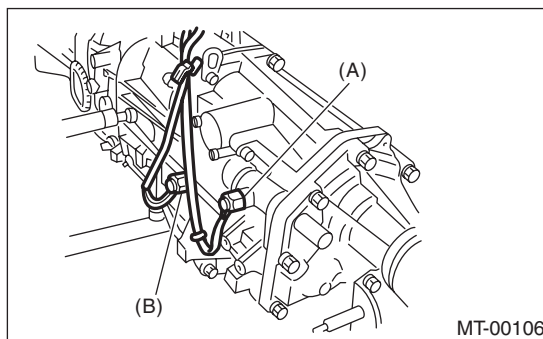
- (A) Neutral position switch connector (Brown)
- (B) Back-up light switch connector (Gray)

- Turbo model



- 5) Lift up the vehicle.

- 6) Remove the back-up light switch & neutral position switch with the harness.



- (A) Neutral position switch
- (B) Back-up light switch



# Switches and Harness

## MANUAL TRANSMISSION AND DIFFERENTIAL

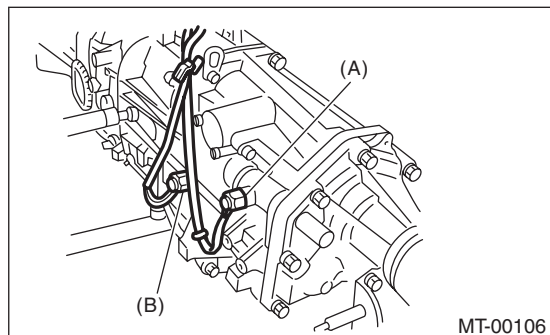
### B: INSTALLATION

#### 1. BACK-UP LIGHT SWITCH & NEUTRAL POSITION SWITCH

1) Install the back-up light switch & neutral position switch with the harness.

**Tightening torque:**

**32.3 N·m (3.3 kgf-m, 23.8 ft-lb)**



- (A) Neutral position switch
- (B) Back-up light switch

- 2) Connect the connectors of back-up light switch & neutral position switch.
- 3) Install the air intake chamber and intake boot. (Non-turbo model) <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
- 4) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 5) Connect the battery ground cable to the battery.

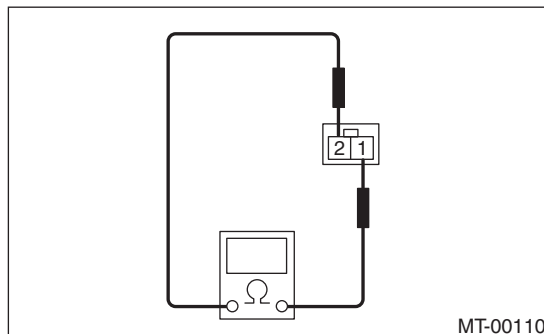
### C: INSPECTION

#### 1. BACK-UP LIGHT SWITCH

Check the back-up light switch. <Ref. to LI-8, INSPECTION, Back-up Light System.>

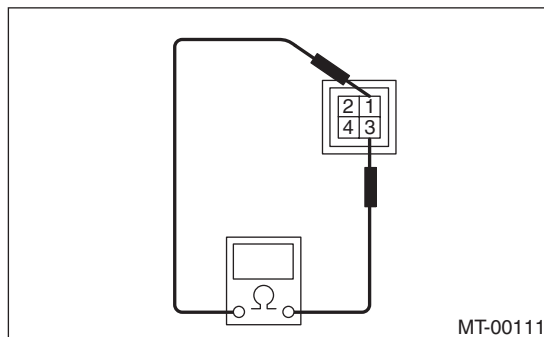
#### 2. NEUTRAL POSITION SWITCH

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the connector of neutral position switch.
- 3) Measure the resistance between neutral position switch terminals.
  - Non-turbo model



Gear shift position	Terminal No.	Specified resistance
Neutral position	1 and 2	Less than 1 Ω
Other positions		1 MΩ or more

- Turbo model



Gear shift position	Terminal No.	Specified resistance
Neutral position	1 and 3	Less than 1 Ω
Other positions		1 MΩ or more

- 4) Replace faulty parts.

## 8. Preparation for Overhaul

### A: PROCEDURE

- 1) Clean oil, grease, dirt and dust from the transmission.
- 2) Using the TORX<sup>®</sup> BIT T70, remove the transmission gear oil drain plug, and drain the transmission gear oil completely.
- 3) Using the TORX<sup>®</sup> BIT T70, tighten the transmission gear oil drain plug.

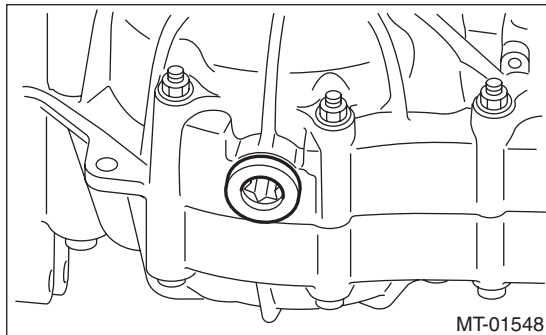
#### NOTE:

Use a new gasket.

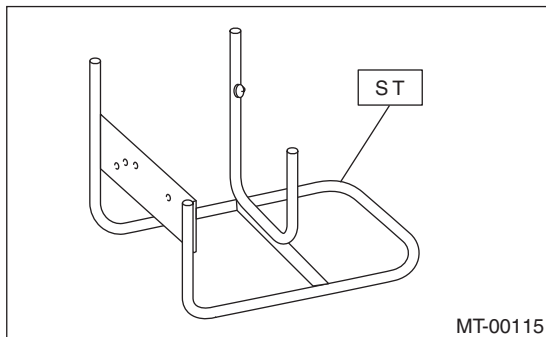
#### **Tightening torque:**

**44 N·m (4.5 kgf-m, 32.5 ft-lb) (Aluminum gasket)**

**70 N·m (7.1 kgf-m, 51.6 ft-lb) (Copper gasket)**



- 4) Attach the transmission to the ST.  
ST 499937100 TRANSMISSION STAND



- 5) Apply oil to rotating parts before assembly.
- 6) All disassembled parts, if to be reused, should be reinstalled in the original positions and directions.
- 7) Gaskets, lock washers and lock nuts must be replaced with new parts.
- 8) Apply liquid gasket to the specified areas to prevent leakage.

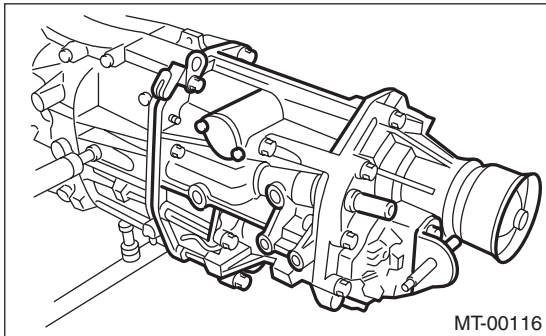
# Transfer Case and Extension Case Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

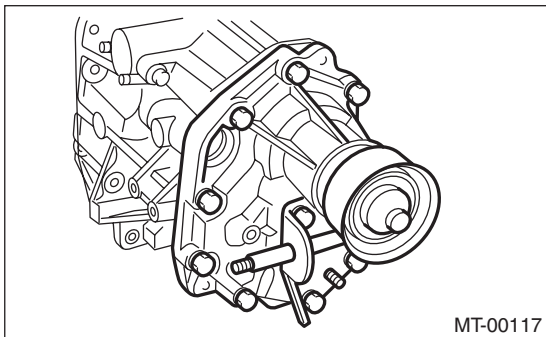
### 9. Transfer Case and Extension Case Assembly

#### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the back-up light switch & neutral position switch. <Ref. to 5MT-35, REMOVAL, Switches and Harness.>
- 3) Remove the transfer case together with the extension case assembly.

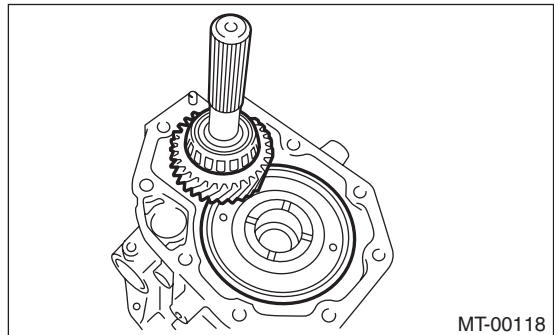


- 4) Remove the shifter arm.
- 5) Remove the extension case assembly.

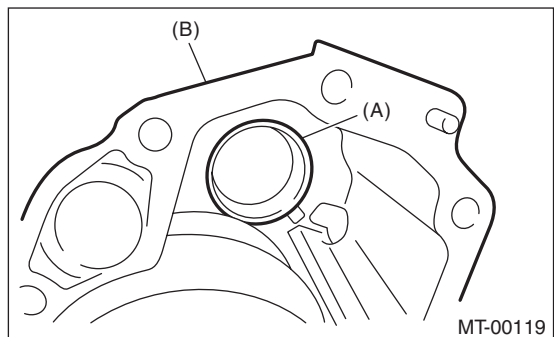


#### B: INSTALLATION

- 1) Install the center differential and transfer driven gear into the transfer case.

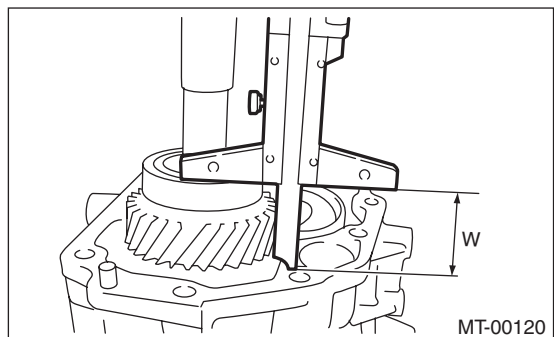


- 2) Remove the bearing outer race from the extension case.



- (A) Bearing outer race  
(B) Extension case

- 3) While holding the bearing outer race horizontally, rotate the driven shaft for ten turns.
- 4) Measure the height "W" between transfer case and taper roller bearing on the transfer driven gear.



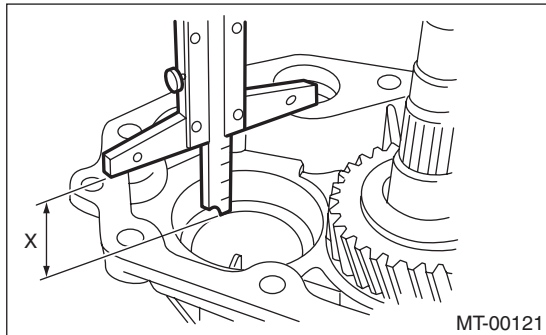
# Transfer Case and Extension Case Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

5) Measure depth “X” on bearing insertion part of the extension case.

**NOTE:**

Measure with bearing outer race and thrust washer removed.



6) Calculate the thickness “t” of the thrust washer using following calculation.

$$t = X - W + (0.2 - 0.3 \text{ mm (0.008 - 0.012 in)})$$

7) Select the washer with the nearest value in the following table.

**Preload of the taper roller bearing (amount of standard protrusion):**

**0.15 — 0.25 mm (0.006 — 0.010 in)**

**NOTE:**

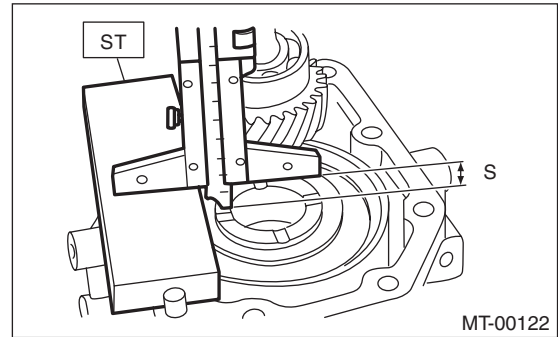
Be sure that the amount of preload is within the standard value.

Thrust washer (50 × 61 × t)	
Part number	Thickness mm (in)
803050060	0.50 (0.0197)
803050061	0.55 (0.0217)
803050062	0.60 (0.0236)
803050063	0.65 (0.0256)
803050064	0.70 (0.0276)
803050065	0.75 (0.0295)
803050066	0.80 (0.0315)
803050067	0.85 (0.0335)
803050068	0.90 (0.0354)
803050069	0.95 (0.0374)
803050070	1.00 (0.0394)
803050071	1.05 (0.0413)
803050072	1.10 (0.0433)
803050073	1.15 (0.0453)
803050074	1.20 (0.0472)
803050075	1.25 (0.0492)
803050076	1.30 (0.0512)
803050077	1.35 (0.0531)
803050078	1.40 (0.0551)
803050079	1.45 (0.0571)

8) Fit the thrust washers on the transfer drive shaft.  
9) Install the bearing outer race into the extension case.

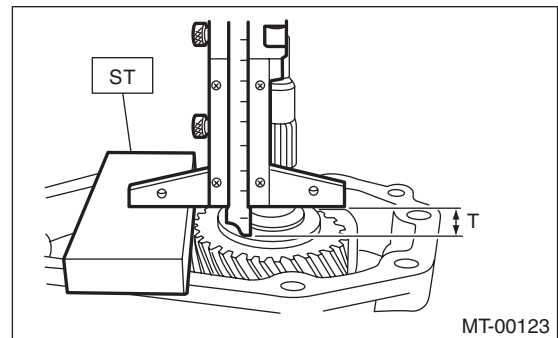
10) Measure the depth “S” between transfer case and center differential.

ST 398643600 GAUGE



11) Measure the height “T” between the extension case and transfer drive gear.

ST 398643600 GAUGE



**NOTE:**

ST thickness [15 mm (0.59 in)]

12) Calculate the thickness “U” of the thrust washer using following calculation.

$$U = S + T - 30 \text{ mm (1.18 in) [Thickness of ST]}$$

13) Select a suitable washer in the following table.

**Standard clearance:**

**0.15 — 0.35 mm (0.0059 — 0.0138 in)**

Thrust washer	
Part number	Thickness mm (in)
803036050	0.9 (0.035)
803036054	1.0 (0.039)
803036051	1.1 (0.043)
803036055	1.2 (0.047)
803036052	1.3 (0.051)
803036056	1.4 (0.055)
803036053	1.5 (0.059)
803036057	1.6 (0.063)
803036058	1.7 (0.067)

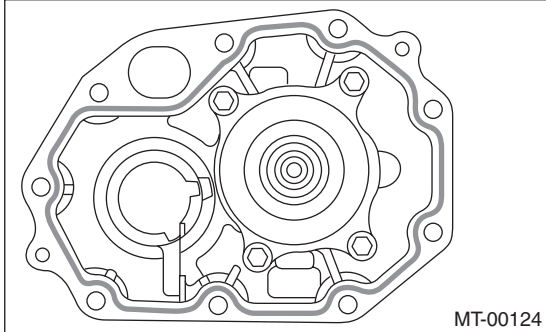
14) Fit the thrust washer onto the center differential.

# Transfer Case and Extension Case Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

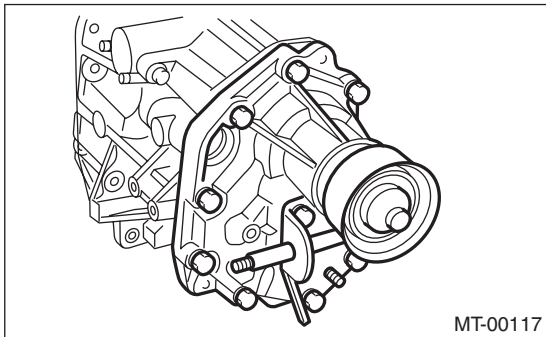
15) Apply a proper amount of liquid gasket to the transfer case mating surface.

**Liquid gasket:**  
**THREE BOND 1215 (Part No. 004403007) or equivalent**

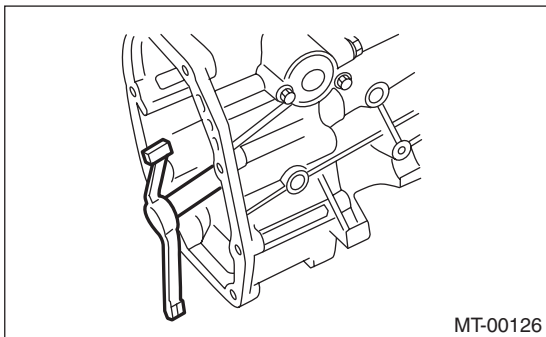


16) Install the extension assembly into the transfer case.

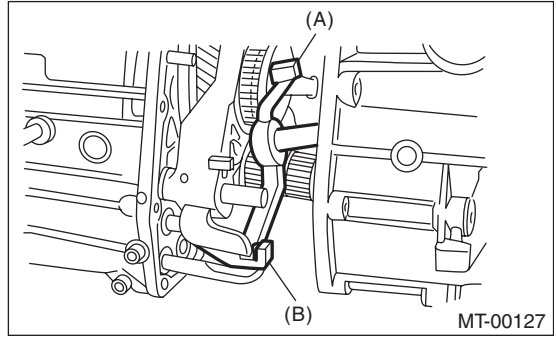
**Tightening torque:**  
**40 N·m (4.1 kgf-m, 29.5 ft-lb)**



17) Attach the shifter arm to transfer case.



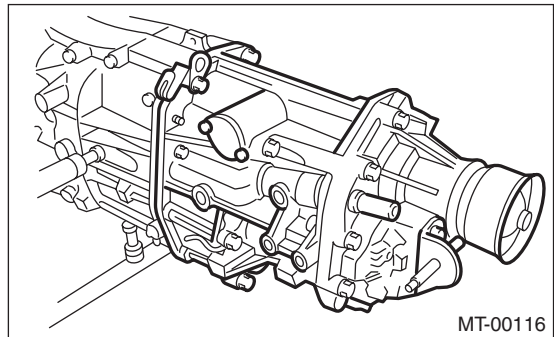
18) Hang the shifter arm on 3rd-4th fork rod.



(A) Shifter arm  
(B) 3rd-4th fork rod

19) Install the extension case assembly along with the transfer case to the transmission case.

**Tightening torque:**  
**24.5 N·m (2.5 kgf-m, 18.1 ft-lb)**



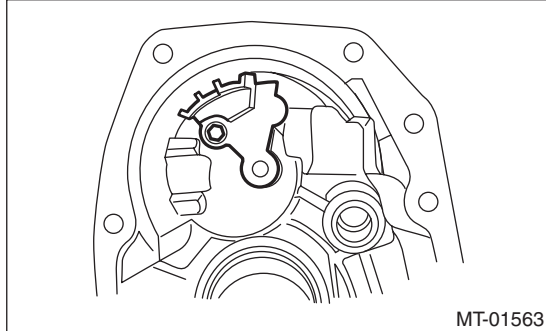
# Transfer Case and Extension Case Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## C: DISASSEMBLY

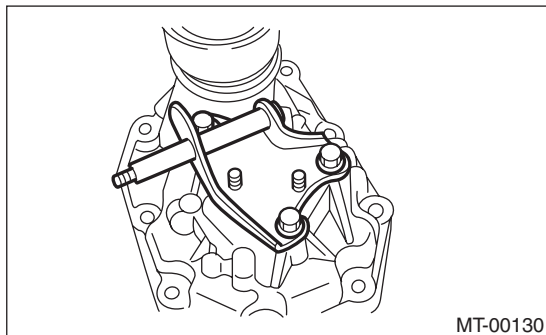
### 1. TRANSFER CASE

- 1) Remove the reverse check assembly. <Ref. to 5MT-47, REMOVAL, Reverse Check Sleeve.>
- 2) Remove the oil guide.



### 2. EXTENSION CASE

- 1) Remove the transfer drive gear assembly. <Ref. to 5MT-42, REMOVAL, Transfer Drive Gear.>
- 2) Remove the shift bracket.



- 3) Remove the oil seal from the extension case. <Ref. to 5MT-33, Oil Seal.>

## D: ASSEMBLY

### 1. EXTENSION CASE

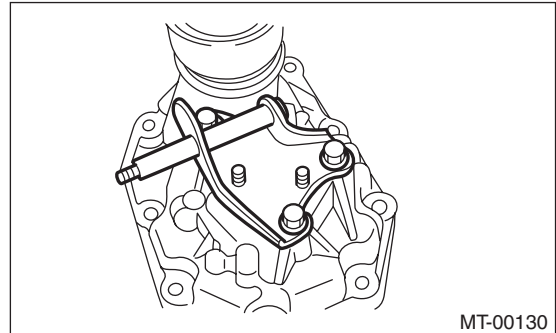
- 1) Using the ST, install the oil seal to the extension case. <Ref. to 5MT-33, Oil Seal.>

#### NOTE:

- Use a new oil seal.
- 2) Install the shift bracket to extension case.

#### Tightening torque:

**24.5 N·m (2.5 kgf·m, 18.1 ft·lb)**



- 3) Install the transfer drive gear to the extension case. <Ref. to 5MT-42, INSTALLATION, Transfer Drive Gear.>

### 2. TRANSFER CASE

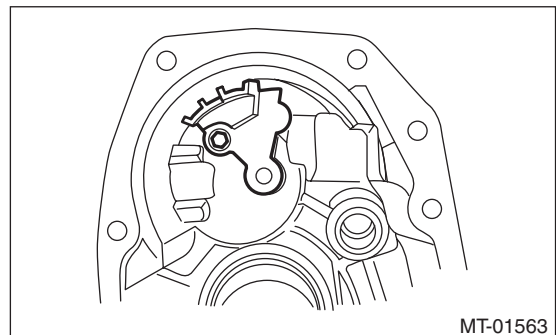
- 1) Install the oil guide to the transfer case.

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**

#### NOTE:

- Use a new installing bolt.



- 2) Install the reverse check sleeve assembly to the transfer case. <Ref. to 5MT-47, INSTALLATION, Reverse Check Sleeve.>

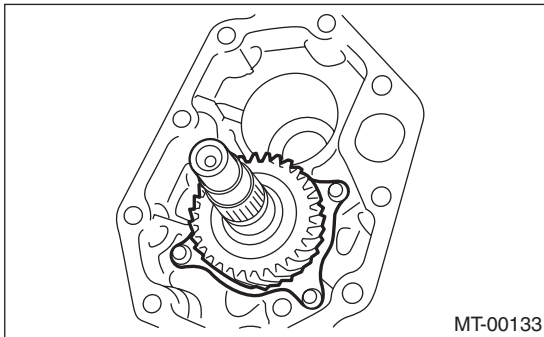
# Transfer Drive Gear

MANUAL TRANSMISSION AND DIFFERENTIAL

## 10. Transfer Drive Gear

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the back-up light switch & neutral position switch. <Ref. to 5MT-35, REMOVAL, Switches and Harness.>
- 3) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the extension case assembly.
- 5) Remove the transfer driven gear.
- 6) Remove the transfer drive gear.

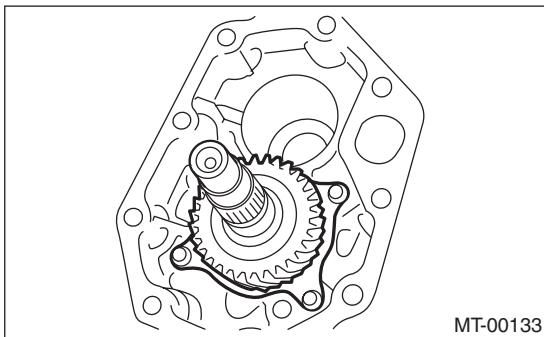


### B: INSTALLATION

- 1) Install the transfer drive gear.

#### *Tightening torque:*

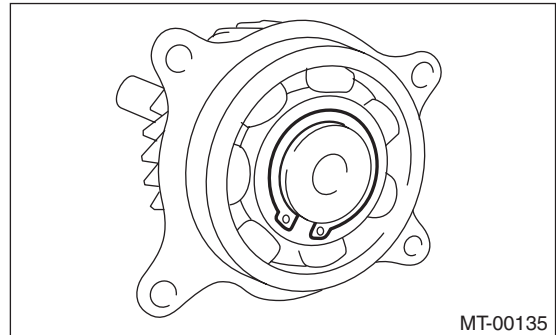
**26 N·m (2.7 kgf·m, 19.2 ft·lb)**



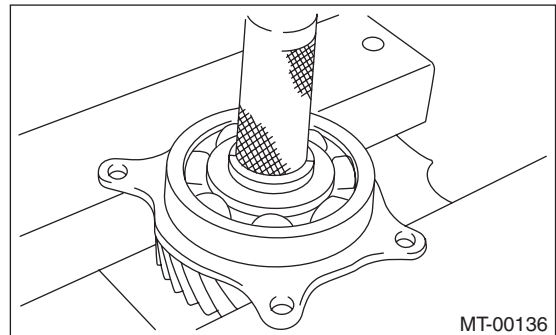
- 2) Install the transfer driven gear.
- 3) Install the extension case assembly.
- 4) Install the transfer case and the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 5) Install the back-up light switch and the neutral position switch. <Ref. to 5MT-36, INSTALLATION, Switches and Harness.>
- 6) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

- 1) Remove the snap ring.



- 2) Remove the ball bearing.



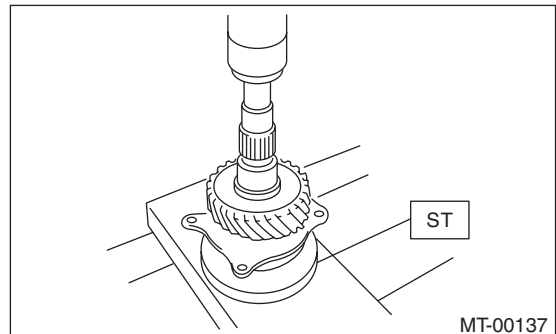
### D: ASSEMBLY

- 1) Set the ST against the inner race of the bearing, and install the drive shaft.

ST 398177700 INSTALLER

#### **CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**



- 2) Install the snap ring on the transfer drive shaft.
- 3) Inspect the clearance between the snap ring and the ball bearing. <Ref. to 5MT-43, INSPECTION, Transfer Drive Gear.>

## E: INSPECTION

### 1) Bearing

Replace the bearings in the following cases.

- In case of broken or rusty bearings
- In case of worn or damaged bearings
- When the bearings fail to turn smoothly or emit noise in rotation after gear oil lubrication.

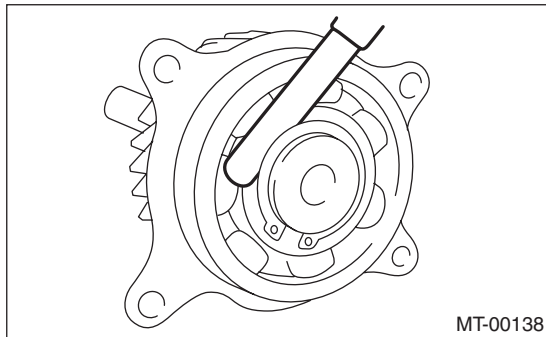
### 2) Drive gear

If the drive gear tooth surface and shaft are excessively broken or damaged, replace the drive gear.

3) Measure the clearance between snap ring and inner race of ball bearing with a thickness gauge.

### **Clearance:**

**0.01 — 0.15 mm (0.0004 — 0.0059 in)**



If the measurement is not within specification, select a suitable snap ring and replace it.

Snap ring (Outer-30)	
Part number	Thickness mm (in)
805030041	1.53 (0.0602)
805030042	1.65 (0.0650)
805030043	1.77 (0.0697)



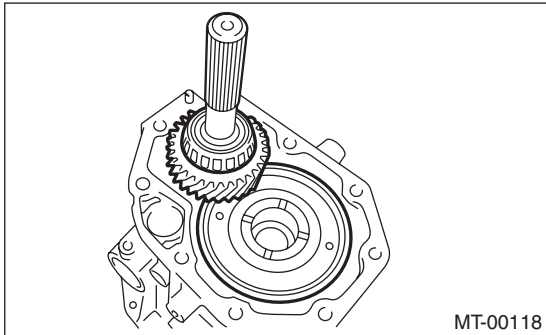
# Transfer Driven Gear

## MANUAL TRANSMISSION AND DIFFERENTIAL

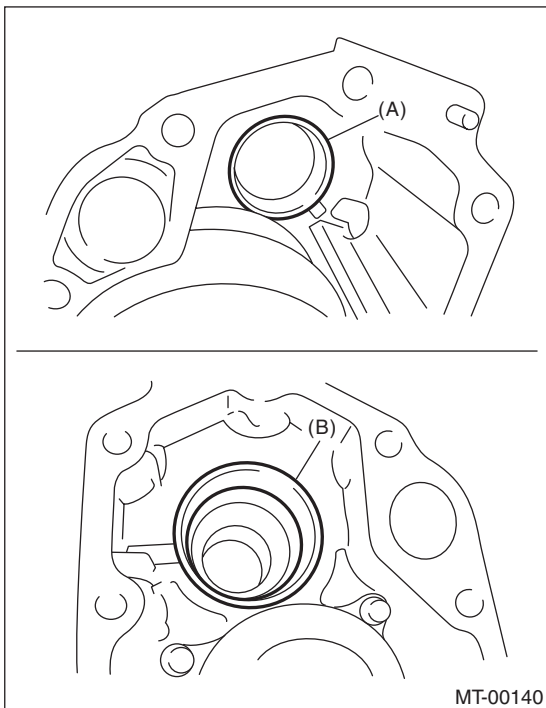
### 11. Transfer Driven Gear

#### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the back-up light switch & neutral position switch. <Ref. to 5MT-35, REMOVAL, Switches and Harness.>
- 3) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the extension case assembly.
- 5) Remove the transfer driven gear.



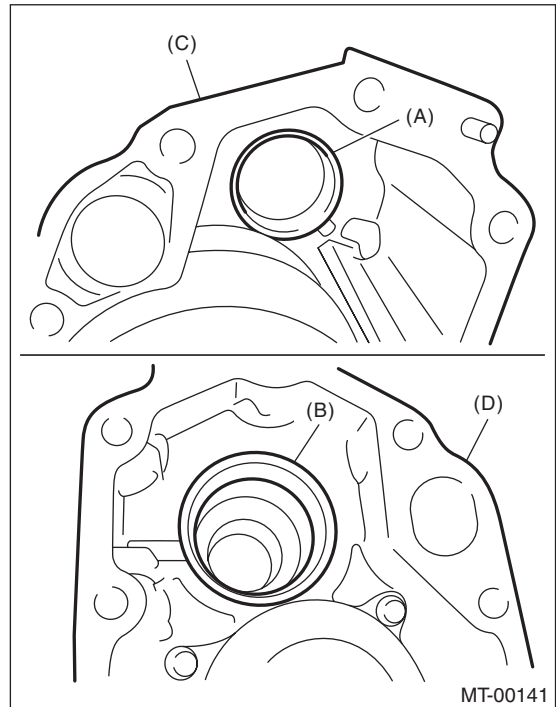
- 6) Remove bearing outer races from the extension case and transfer case.



- (A) Bearing outer race (Transfer case side)
- (B) Bearing outer race (Extension case side)

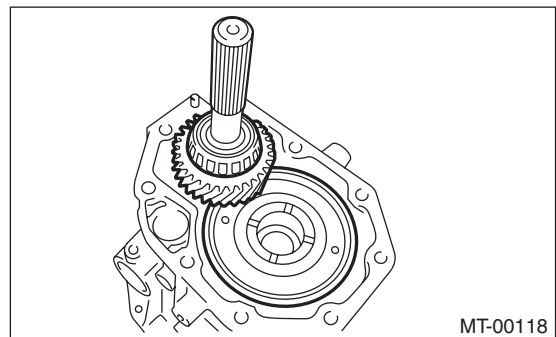
#### B: INSTALLATION

- 1) Install the bearing outer races to extension case and transfer case.



- (A) Bearing outer race
- (B) Bearing outer race
- (C) Transfer case
- (D) Extension case

- 2) Install the transfer driven gear.



- 3) Install the transfer case and the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 4) Install the back-up light switch and the neutral position switch. <Ref. to 5MT-36, INSTALLATION, Switches and Harness.>
- 5) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

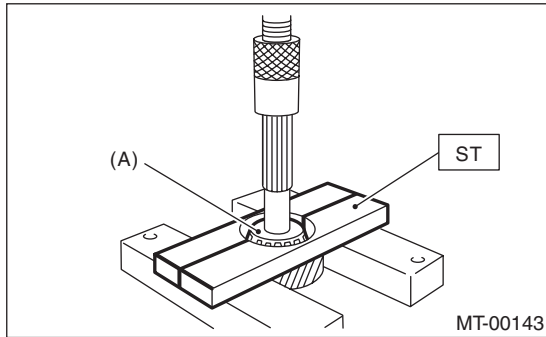
# Transfer Driven Gear

MANUAL TRANSMISSION AND DIFFERENTIAL

## C: DISASSEMBLY

1) Using the ST, remove the roller bearing (extension case side).

ST 498077000 REMOVER

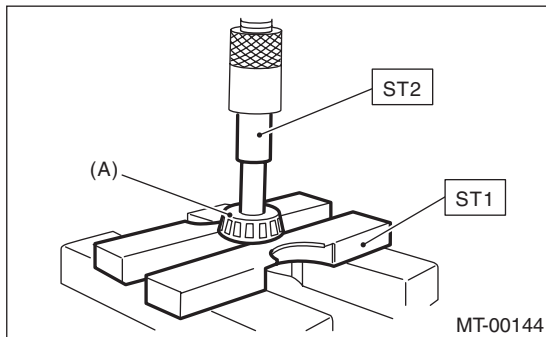


(A) Roller bearing

2) Using ST1 and ST2, remove the roller bearing (transfer case side).

ST1 498077000 REMOVER

ST2 899864100 REMOVER



(A) Roller bearing

## D: ASSEMBLY

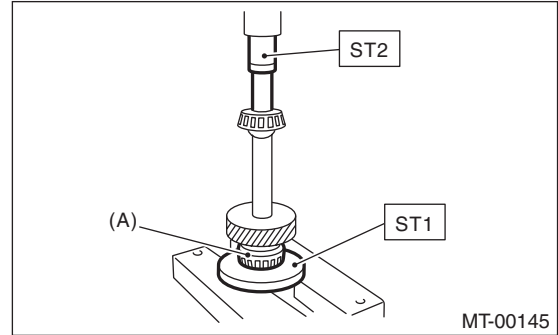
1) Using the ST, install the roller bearing (extension case side).

ST1 398177700 INSTALLER

ST2 899864100 REMOVER

### CAUTION:

Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).



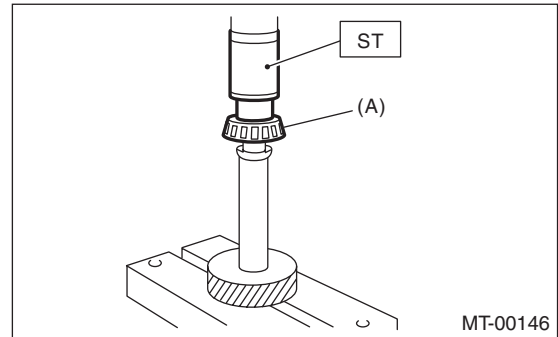
(A) Roller bearing

2) Using ST, install the roller bearing (transfer case side).

ST 499757002 INSTALLER

### CAUTION:

Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).



(A) Roller bearing

## E: INSPECTION

1) Bearing

Replace the bearings in the following cases.

- In case of broken or rusty bearings
- In case of worn or damaged bearings
- When the bearings fail to turn smoothly or emit noise in rotation after gear oil lubrication.

2) Driven gear

If the driven gear tooth surface and shaft are excessively broken or damaged, replace the driven gear.

# Center Differential

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 12.Center Differential

#### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 3) Remove the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the transfer driven gear. <Ref. to 5MT-44, REMOVAL, Transfer Driven Gear.>
- 5) Remove the center differential.

#### B: INSTALLATION

- 1) Install the center differential into transfer case.
- 2) Install the transfer driven gear. <Ref. to 5MT-44, INSTALLATION, Transfer Driven Gear.>
- 3) Install the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 4) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 5) Install the back-up light switch and the neutral position switch. <Ref. to 5MT-36, INSTALLATION, Switches and Harness.>
- 6) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

#### C: DISASSEMBLY

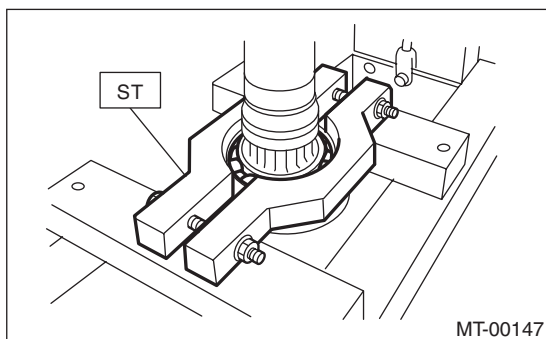
##### NOTE:

Center differential is a non-disassembled part which should not be disassembled.  
Remove the ball bearing using ST.

##### NOTE:

Do not reuse the ball bearing.

ST 498077300 CENTER DIFFERENTIAL  
BEARING REMOVER

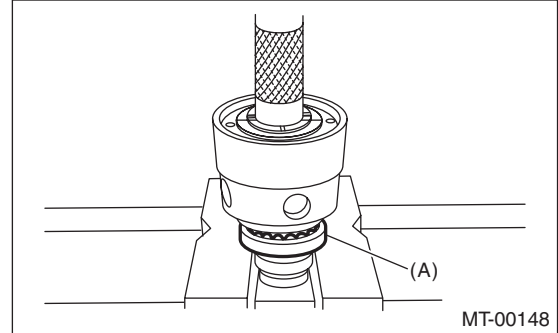


#### D: ASSEMBLY

Install the ball bearing into the center differential assembly.

##### CAUTION:

Do not apply a load in excess of 10 kN  
(1 ton, 1.1 US ton, 1.0 Imp ton).



(A) Ball bearing

#### E: INSPECTION

##### 1) Bearing

Replace the bearings in the following cases.

- In case of broken or rusty bearings
- In case of worn or damaged bearings
- When the bearings fail to turn smoothly or emit noise in rotation after gear oil lubrication.
- When bearing has other defects.

##### 2) Center differential

Replace the center differential case assembly if worn or damaged.

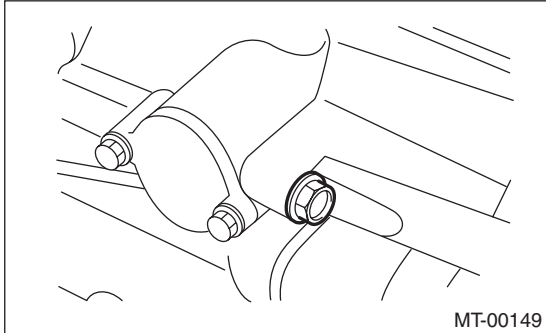
# Reverse Check Sleeve

MANUAL TRANSMISSION AND DIFFERENTIAL

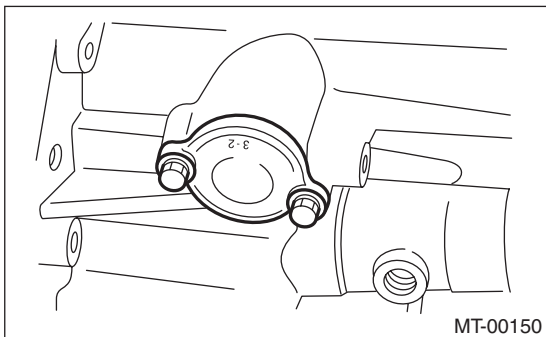
## 13. Reverse Check Sleeve

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 3) Remove the shifter arm.
- 4) Remove the plug, gasket, reverse accent spring, and reverse check ball.



- 5) Remove the reverse check sleeve.

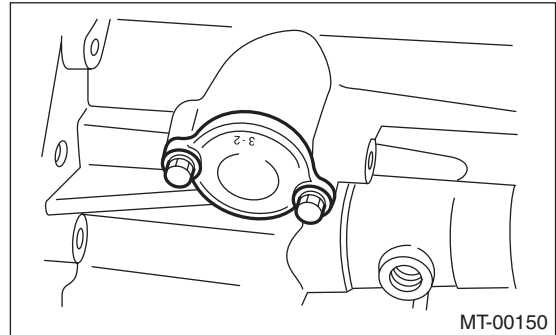


### B: INSTALLATION

- 1) Install the reverse check sleeve.

#### **Tightening torque:**

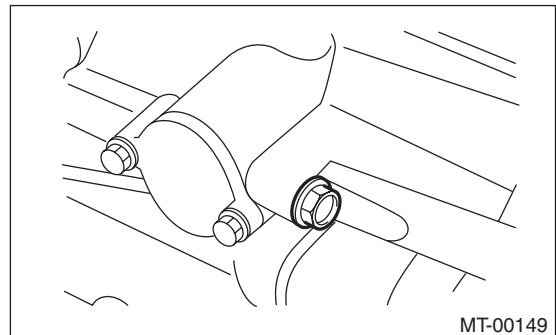
**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)**



- 2) Reverse check ball, reverse accent spring, gasket and plug to the transfer case.

#### **Tightening torque:**

**9.75 N·m (1.0 kgf-m, 7.2 ft-lb)**



- 3) Attach the shifter arm to the transfer case assembly.
- 4) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 5) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

# Reverse Check Sleeve

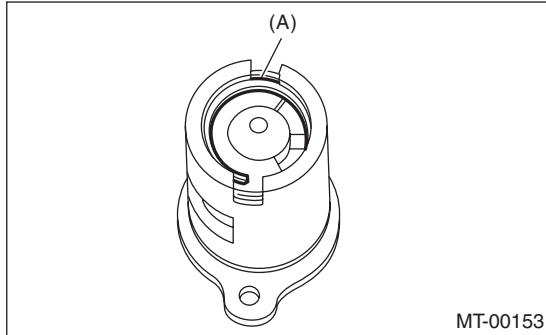
## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: DISASSEMBLY

1) Cover the reverse check sleeve with a rag, and remove the snap ring using a screwdriver.

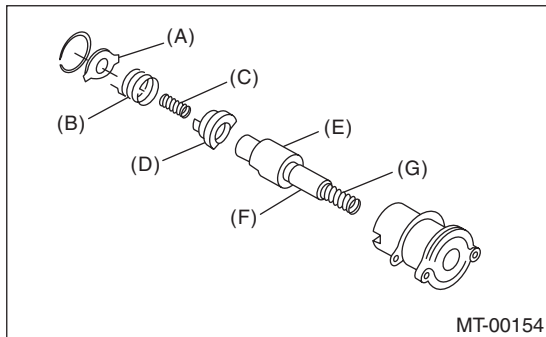
#### NOTE:

Replace the snap ring with a new part if it is deformed or spring force is weakened.



(A) Snap ring

2) Remove the reverse check plate, reverse check spring, reverse check cam, return spring (5th-Rev), reverse accent shaft, return spring cap and return spring (1st-2nd).



- (A) Reverse check plate
- (B) Reverse check spring
- (C) Return spring (5th-Rev)
- (D) Reverse check cam
- (E) Reverse accent shaft
- (F) Return spring cap
- (G) Return spring (1st-2nd)

3) Remove the O-ring.

#### NOTE:

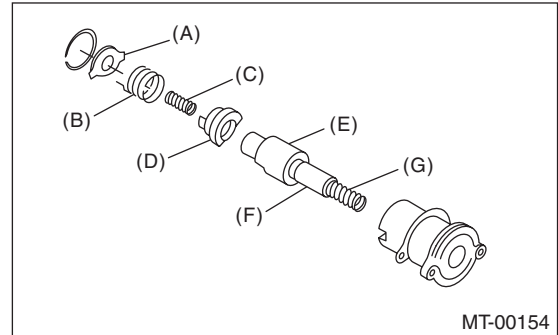
- Visually check the O-ring. Replace if faulty.
- Be careful not to damage the adjusting shim between reverse check sleeve assembly and the case.

### D: ASSEMBLY

1) Install the return spring (1st-2nd), return spring cap, reverse accent shaft, reverse check cam, return spring (5th-Rev) and reverse check spring to the reverse check sleeve.

#### NOTE:

Be sure to position the bent section of reverse check spring to fit in the groove of the check cam.



- (A) Reverse check plate
- (B) Reverse check spring
- (C) Return spring (5th-Rev)
- (D) Reverse check cam
- (E) Reverse accent shaft
- (F) Return spring cap
- (G) Return spring (1st-2nd)

2) Hook the curved section of the reverse check spring over the reverse check plate.

3) Rotate the cam so that the protrusion of the reverse check cam comes to the opening of the plate.

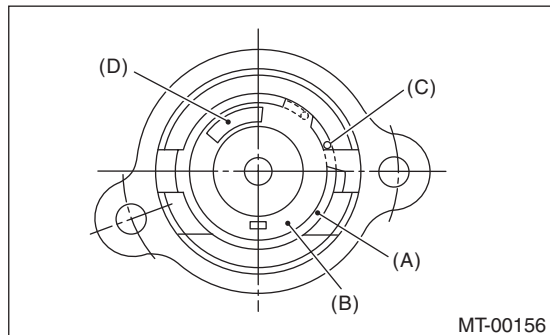
4) With cam held in that position, install the reverse check plate onto the reverse check sleeve and hold in place with the snap ring.

5) Position the new O-ring in the groove of sleeve.

# Reverse Check Sleeve

## E: INSPECTION

- Make sure the cutout of the reverse accent shaft is aligned with the opening in the reverse check sleeve.
  - Turn the cam by hand to check for smooth rotation.
  - Move the cam and shaft all the way toward the plate, and make sure it releases.
- If the cam does not return properly, replace the reverse check spring. If the shaft does not return, check for scratches on the inner surface of sleeve. If the sleeve is in good order, replace the spring.



- (A) Snap ring
- (B) Reverse check plate
- (C) Reverse check spring
- (D) Reverse check cam

- Select a suitable reverse accent shaft and reverse check plate. <Ref. to 5MT-49, ADJUSTMENT, Reverse Check Sleeve.>

## F: ADJUSTMENT

### 1. NEUTRAL POSITION ADJUSTMENT

- 1) Shift the gear into 3rd gear position.
- 2) Because of the return spring, until the arm contacts the stopper the shifter arm will feel lighter moving towards 1st/2nd gear and heavier towards the reverse gear.
- 3) Make adjustment so that the heavy stroke (reverse side) is a little heavier than the lighter stroke (1st/2nd side).
- 4) To adjust, remove the bolts holding the reverse check sleeve assembly to the case, and move the sleeve assembly outward, then place an adjustment shim between the sleeve assembly and the case to adjust the clearance.

#### CAUTION:

**Be careful not to damage the O-ring when placing shims.**

#### NOTE:

- When the shim is removed, the neutral position will move closer to reverse, when the shim is added, the neutral position will move closer to 1st gear.
- If it is not possible to adjust the clearance with only shims, replace the reverse accent shaft and re-adjust.

Adjusting shim	
Part number	Thickness mm (in)
32190AA000	0.15 (0.0059)
32190AA010	0.30 (0.0118)

Reverse accent shaft		
Part number	Mark	Remarks
32188AA130	S	Neutral position is closer to 1st.
32188AA140	T	Standard
32188AA150	U	Neutral position is closer to reverse gear.

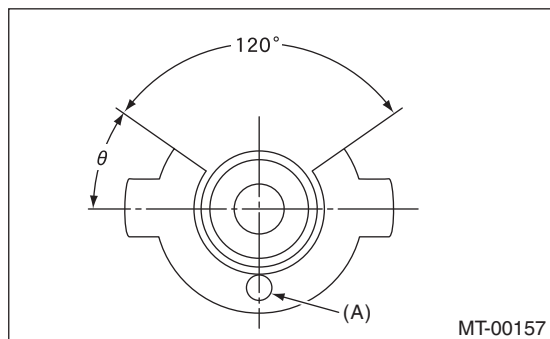
# Reverse Check Sleeve

## 2. REVERSE CHECK PLATE ADJUSTMENT

1) Shift the shifter arm to “5th” and then to reverse to see if the reverse check mechanism operates properly.

2) Also check to see if the arm returns to neutral when released from the reverse position. If the arm does not return properly, replace the reverse check plate.

Reverse check plate			
Part number	(A): No.	Angle $\theta$	Remarks
32189AA001	0	28°	Arm stops closer to 5th gear.
32189AA011	1	31°	Arm stops closer to 5th gear.
32189AA021	2	34°	Arm stops in the center.
32189AA031	3	37°	Arm stops closer to reverse gear.
32189AA041	4	40°	Arm stops closer to reverse gear.



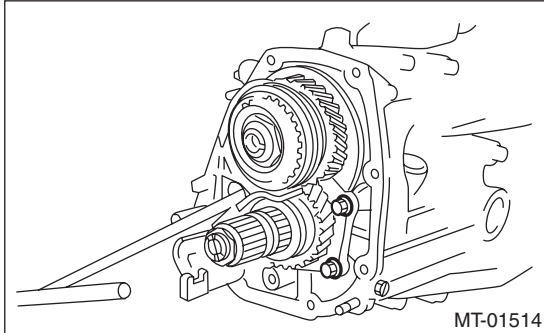
# Transmission Case

MANUAL TRANSMISSION AND DIFFERENTIAL

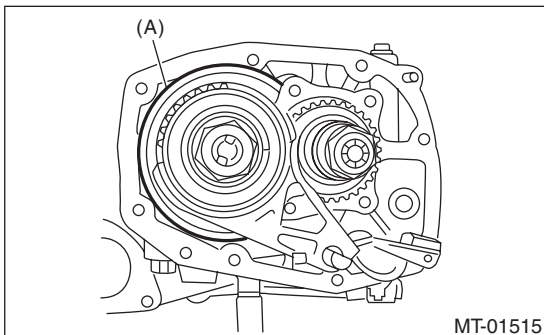
## 14. Transmission Case

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the clutch release lever. <Ref. to CL-18, REMOVAL, Release Bearing and Lever.>
- 3) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the bearing mounting bolt.

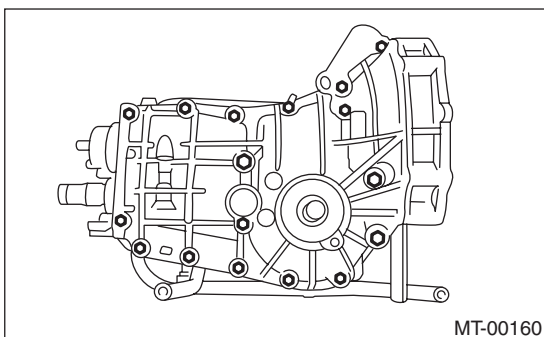


- 5) Remove the main shaft rear plate.



(A) Main shaft rear plate

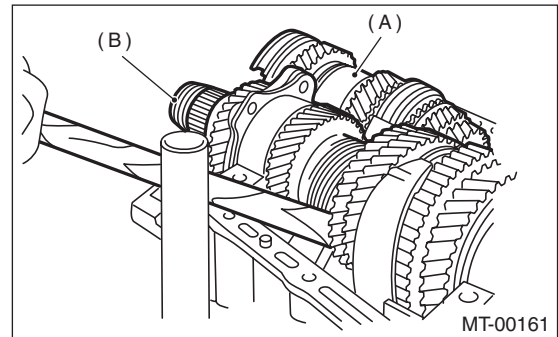
- 6) Separate the transmission case into the right and left cases by loosening the coupling bolts and nuts.



- 7) Remove the drive pinion shaft assembly from the left side of the transmission case.

#### NOTE:

Use a hammer handle, etc. to remove if too tight.

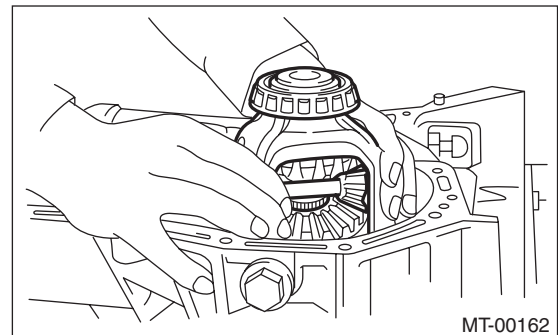


(A) Main shaft ASSY for single-range  
(B) Drive pinion shaft ASSY

- 8) Remove the main shaft assembly for single-range.
- 9) Remove the front differential assembly.

#### NOTE:

- Do not confuse the right and left roller bearing outer races.
- Be careful not to damage the oil seal of retainer.





# Transmission Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: INSTALLATION

- 1) Wipe off grease, oil and dust on the mating surfaces of transmission cases with cleaning solvent.
- 2) Install the front differential assembly.
- 3) Install the main shaft assembly for single-range. Install the transmission case knock pin into the knock pin hole of needle bearing.
- 4) Install the drive pinion shaft assembly. Install the transmission case knock pin into the roller bearing knock pin hole.
- 5) Apply liquid gasket, then join the right side and left side of the case together.

#### Liquid gasket:

**THREE BOND 1215 (Part No. 004403007) or equivalent**

- 6) With brackets and clips as shown in the figure, tighten the seventeen bolts.

#### NOTE:

- Insert the bolts from the bottom and tighten the nuts at the top.
- Put the cases together so that the drive pinion shim and input shaft holder shims are not caught between cases.

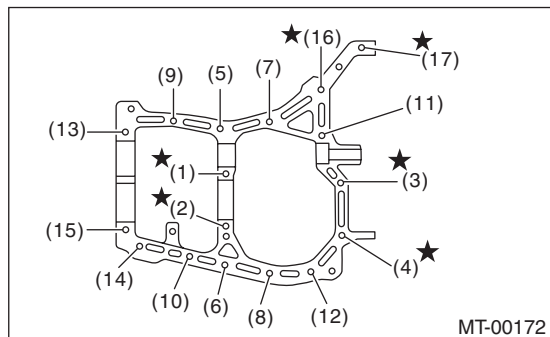
#### Tightening torque:

**8 mm bolt**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

★ **10 mm bolt**

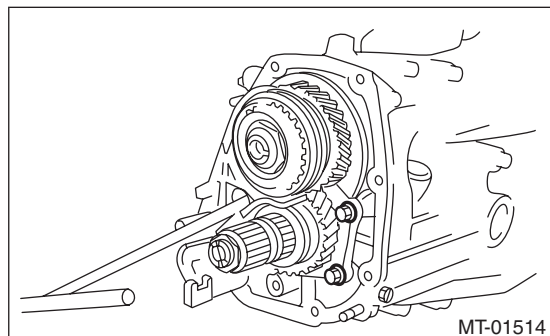
**39 N·m (4.0 kgf·m, 28.9 ft·lb)**



- 7) Tighten the ball bearing mounting bolts.

#### Tightening torque:

**30 N·m (3.1 kgf·m, 22.1 ft·lb)**

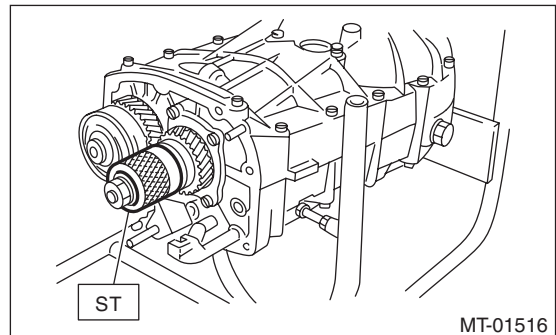


- 8) Perform backlash adjustment of the hypoid gear and preload measurement of the roller bearing:

#### NOTE:

Attach the ST on drive pinion assembly.

ST 498427100 STOPPER



- 9) Place the transmission with the left side of case facing downward, and put ST1 on bearing cup.

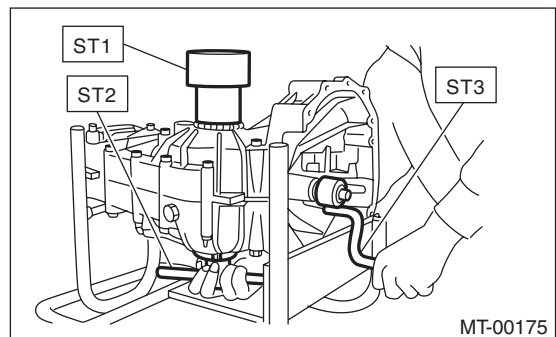
- 10) Screw the retainer assembly from the bottom into left case using ST2. Fit the ST3 on transmission main shaft. Shift the gear into 4th or 5th, and turn the shaft several times. Screw in the retainer while rotating the ST3 until a slight resistance is felt on ST2.

This is the contact point of the hypoid gear and the drive pinion shaft. Repeat the above sequence several times to ensure the contact point.

ST1 399780104 WEIGHT

ST2 18630AA010 WRENCH COMPL RETAINER

ST3 499927100 HANDLE



# Transmission Case

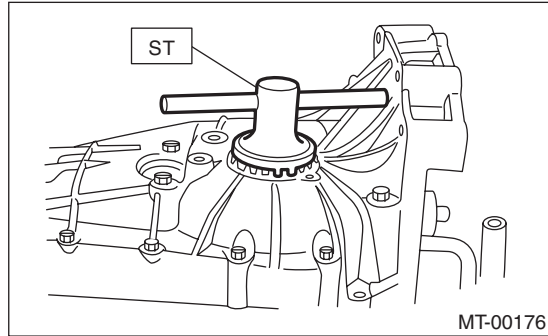
## MANUAL TRANSMISSION AND DIFFERENTIAL

11) Remove the weight, and screw in the retainer without the O-ring on the upper side, and stop at the point where a slight resistance is felt.

### NOTE:

In this condition, the backlash between hypoid gear and drive pinion shaft is zero.

ST 18630AA010 WRENCH COMPL RETAINER



12) Loosen the retainer on the lower side by 3 notches and turn the retainer on the upper side by the same amount in order to apply backlash.

13) Rotate the retainer of the upper side additionally by 1 notch in order to apply preload on taper roller bearing.

14) Tighten temporarily both the upper and lower lock plates, and put marks both the holder and lock plate for later readjustment.

### NOTE:

If it is hard to install the lock plates, reverse the sides and install them.

15) Turn the transmission main shaft several times while tapping around the retainer lightly with plastic hammer.

16) Inspect and adjust backlash and tooth contact of the hypoid gear. <Ref. to 5MT-72, INSPECTION, Front Differential Assembly.>

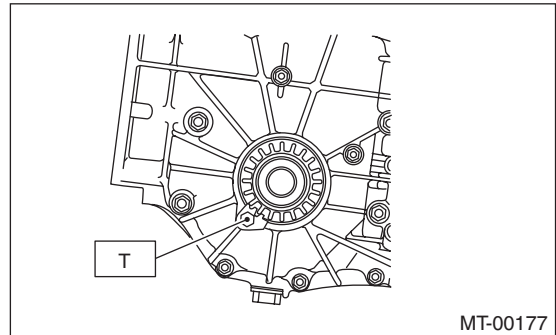
17) After checking the tooth contact of the hypoid gears, remove the lock plate. Then loosen the retainer until the O-ring groove appears. Fit the O-ring into the groove and tighten the retainer into the position where retainer was tightened previously. Install the lock plate.

### NOTE:

- Count number of turns while loosening retainer and record it.
- Perform this for both upper and lower retainers.

### Tightening torque:

**T: 25 N·m (2.5 kgf·m, 18.4 ft·lb)**



18) Select the main shaft rear plate. <Ref. to 5MT-58, ADJUSTMENT, Main Shaft Assembly for Single-range.>

19) Install the clutch release lever and bearing. <Ref. to CL-18, INSTALLATION, Release Bearing and Lever.>

20) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>

21) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

## C: INSPECTION

Check the transmission case for cracks, damage, or oil leaks.

# Main Shaft Assembly for Single-range

MANUAL TRANSMISSION AND DIFFERENTIAL

## 15. Main Shaft Assembly for Single-range

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 3) Remove the transmission case. <Ref. to 5MT-51, REMOVAL, Transmission Case.>
- 4) Remove the drive pinion shaft assembly. <Ref. to 5MT-59, REMOVAL, Drive Pinion Shaft Assembly.>
- 5) Remove the main shaft assembly for single-range.

### B: INSTALLATION

- 1) Install the needle bearing and oil seal to the front of the transmission single-range main shaft assembly.

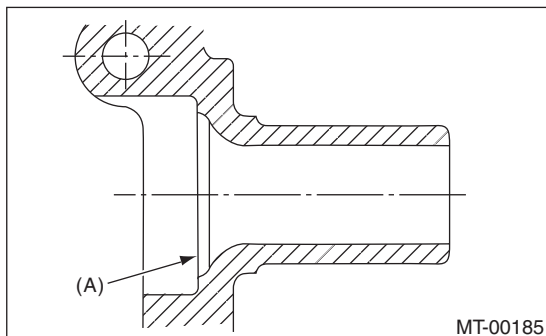
#### NOTE:

- Wrap the clutch splined section with vinyl tape to prevent damage to the oil seal.
- Apply UNILUBE #2 (or equivalent) to the sealing lip of the oil seal.
- Use a new oil seal.

- 2) Install the transmission case knock pin into the knock pin hole of the needle bearing outer race.

#### NOTE:

Align the end face of the seal with surface (A) when installing the oil seal.



- 3) Install the drive pinion shaft assembly. <Ref. to 5MT-59, INSTALLATION, Drive Pinion Shaft Assembly.>
- 4) Install the transmission case. <Ref. to 5MT-52, INSTALLATION, Transmission Case.>
- 5) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 6) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

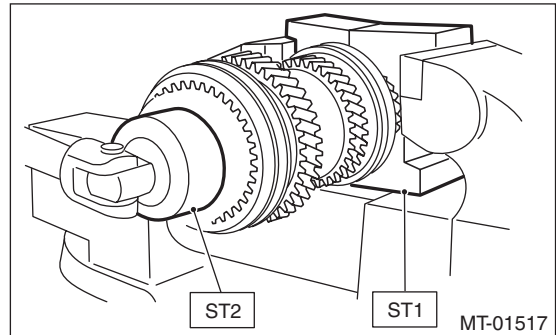
- 1) Put vinyl tape around main shaft spline to protect the oil seal from damage. Then pull out the oil seal and needle bearing by hand.
- 2) Remove the lock nut from transmission main shaft assembly for single range.

#### NOTE:

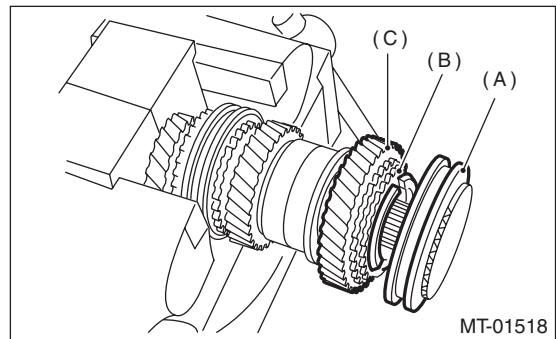
Flatten the lock nut tab before removing the lock nut.

ST1 498937000 TRANSMISSION HOLDER

ST2 499987003 SOCKET WRENCH (35)



- 3) Remove the 5th hub & sleeve No. 2, baulk lever, baulk ring, 5th drive gear & needle bearing.



- (A) 5th hub & sleeve No. 2
- (B) Baulk ring
- (C) 5th drive gear

# Main Shaft Assembly for Single-range

MANUAL TRANSMISSION AND DIFFERENTIAL

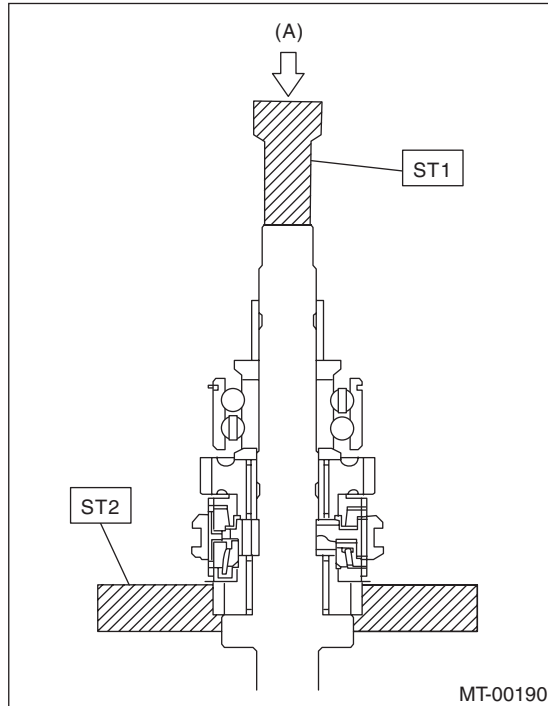
4) Using ST1 and ST2, remove the rest of the parts.

NOTE:

- When replacing the sleeve & hub, replace them as a set.
- Do not disassemble the sleeve & hub; the aligning position is pre-matched.
- If it is necessary to disassemble, mark the engaging points on the splines beforehand.

ST1 899864100 REMOVER

ST2 899714110 REMOVER



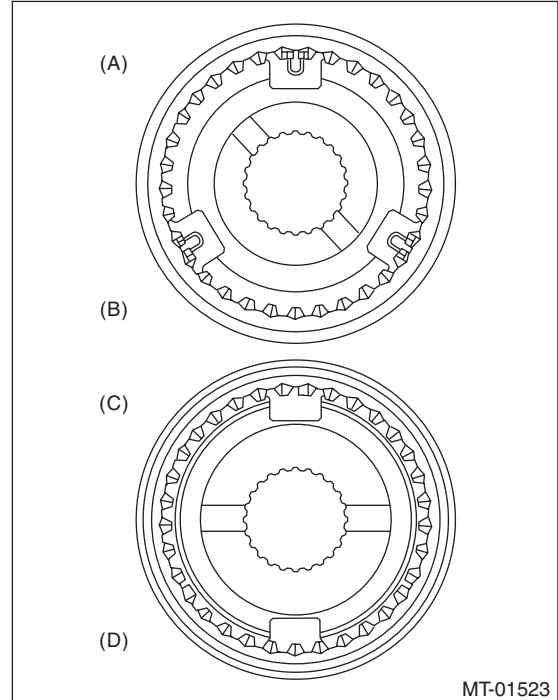
(A) Press

## D: ASSEMBLY

1) When the sleeve & hub assemblies have been disassembled, reassemble by aligning the alignment marks.

NOTE:

Position the open ends of the spring 120° apart.



- (A) 3rd-4th hub ASSY
- (B) 3rd gear side
- (C) 5th hub & sleeve No. 2
- (D) 5th gear side

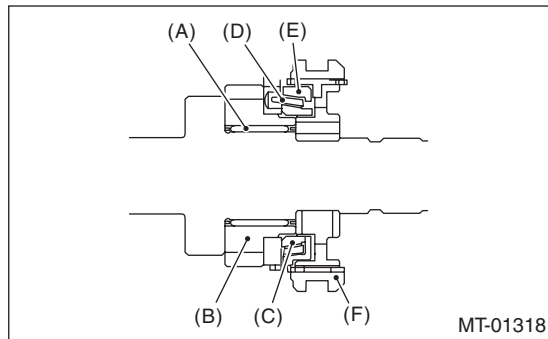
# Main Shaft Assembly for Single-range

## MANUAL TRANSMISSION AND DIFFERENTIAL

2) Install the 3rd drive gear, outer baulk ring, synchro cone, inner baulk ring, sleeve & hub assembly for the 3rd needle bearing, on the transmission main shaft.

**NOTE:**

Align the groove in baulk ring with the shifting insert.



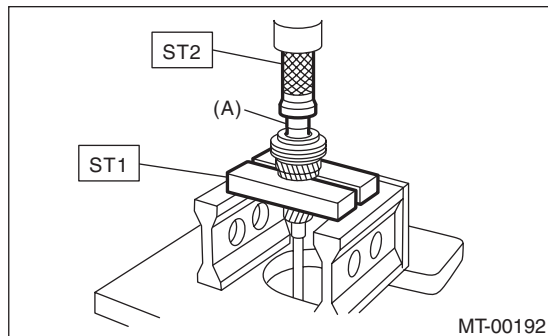
- (A) 3rd needle bearing
- (B) 3rd drive gear
- (C) Inner baulk ring
- (D) Synchro cone
- (E) Outer baulk ring
- (F) Sleeve & hub ASSY

3) Install the 4th needle bearing race onto transmission main shaft using ST1, ST2 and press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

- ST1 899714110 REMOVER
- ST2 499877000 RACE 4-5 INSTALLER

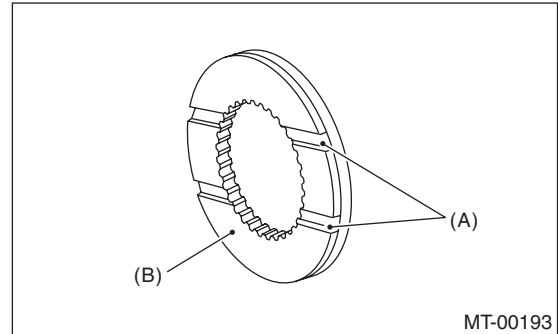


- (A) 4th needle bearing race

4) Install the baulk ring, needle bearing, 4th drive gear and 4th gear thrust washer to the transmission main shaft.

**NOTE:**

Align the baulk ring and gear & hub assembly with the key groove.



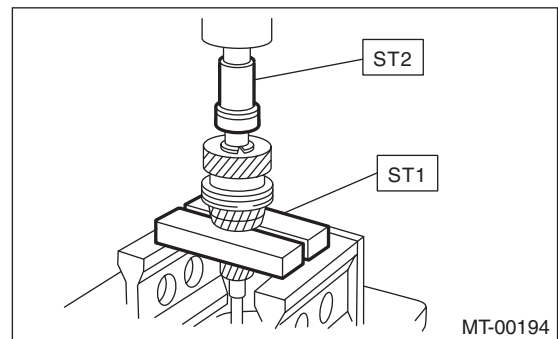
- (A) Groove
- (B) Face this surface to the 4th gear side.

5) Press-fit the ball bearing into the rear section of transmission main shaft using ST1, ST2 and a press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

- ST1 899714110 REMOVER
- ST2 499877000 RACE 4-5 INSTALLER



# Main Shaft Assembly for Single-range

MANUAL TRANSMISSION AND DIFFERENTIAL

6) Using the ST1 and ST2, install the 5th gear thrust washer and 5th needle bearing race onto the rear section of transmission main shaft.

**CAUTION:**

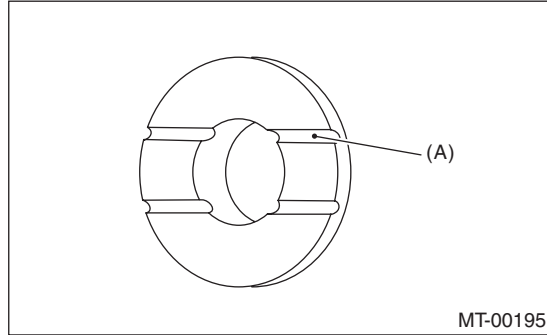
**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

**NOTE:**

Make sure the thrust washer is oriented in the correct direction.

ST1 899714110 REMOVER

ST2 499877000 RACE 4-5 INSTALLER

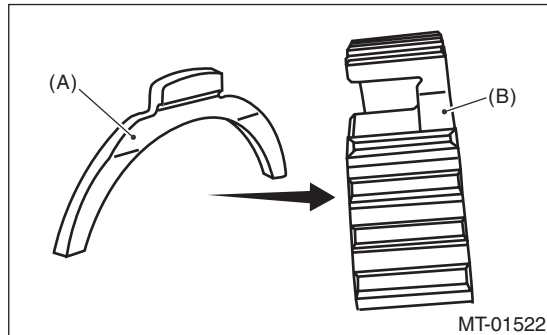


(A) Face this surface to the 5th gear side.

7) Install rest of the parts to the rear section of the transmission main shaft.

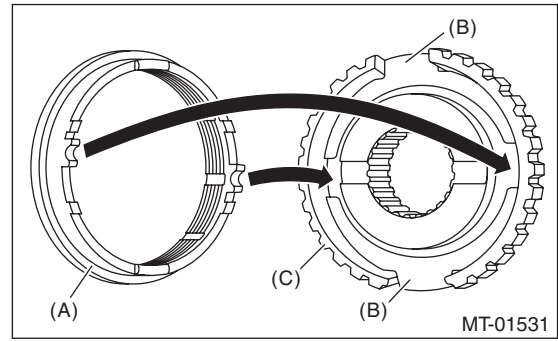
**CAUTION:**

• **Install the baulk lever so that the concave side faces toward the 5th hub.**

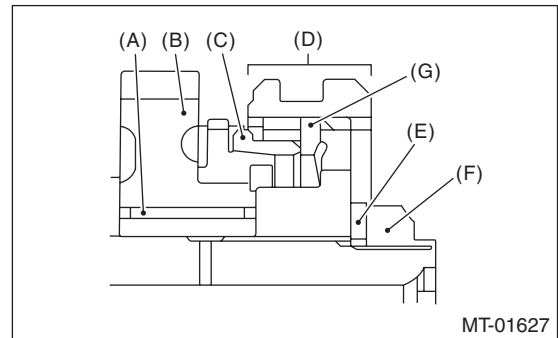


(A) Baulk lever  
(B) 5th hub

• **Fit the convex portions of baulk ring with the gaps between baulk levers.**



(A) Baulk ring  
(B) Baulk lever  
(C) 5th hub



(A) Needle bearing  
(B) 5th drive gear  
(C) Baulk ring  
(D) 5th hub & sleeve No. 2  
(E) Lock washer  
(F) Lock nut  
(G) Baulk lever

8) Tighten the lock nuts to the specified torque using ST1 and ST2.

9) Crimp lock nuts in two locations after tightening.

ST1 499987003 SOCKET WRENCH (35)

ST2 498937000 TRANSMISSION HOLDER

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

# Main Shaft Assembly for Single-range

## MANUAL TRANSMISSION AND DIFFERENTIAL

### E: INSPECTION

Disassembled parts should be washed clean first with cleaning solvent and then inspected carefully.

#### 1) Bearing

Replace the bearings in the following cases.

- When the bearing balls, outer races and inner races are broken or rusty.
- When the bearing is worn.
- When the bearings fail to turn smoothly or emit noise in rotation after gear oil lubrication.
- When bearing has other defects.

#### 2) Bushing (each gear)

Replace the bushing in following cases.

- When the sliding surface is damaged or abnormally worn.
- When the inner wall is abnormally worn.

#### 3) Gear

Replace gears in the following cases.

- Replace gear with new part if its tooth surfaces are broken, damaged or excessively worn.
- Correct or replace if the cone that contacts the baulk ring is rough or damaged.
- Correct or replace if the inner surface or end face is damaged.

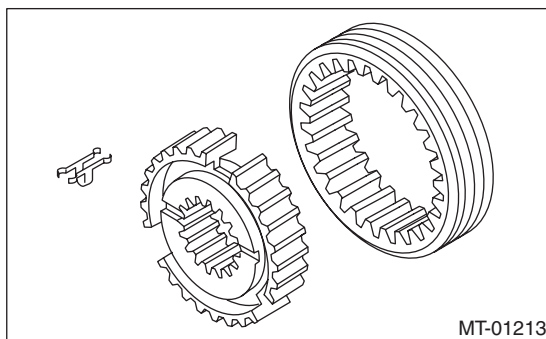
#### 4) Baulk ring

Replace the baulk rings in the following cases.

- When the inner surface and end face are damaged.
- When the ring inner surface is abnormally or partially worn down.
- When the contact surface of synchronizer ring insert is cracked or abnormally worn.

#### 5) Shifting insert key

Replace the insert key if deformed, excessively worn or defective in any way.



#### 6) Oil seal

Replace the oil seal if the lip is deformed, hardened, worn or defective in any way.

#### 7) O-ring

Replace the O-ring if the sealing face is deformed, hardened, damaged, worn or defective in any way.

#### 8) Gearshift mechanism

Repair or replace the gearshift mechanism if excessively worn, bent or defective in any way.

### F: ADJUSTMENT

Selection of main shaft rear plate:

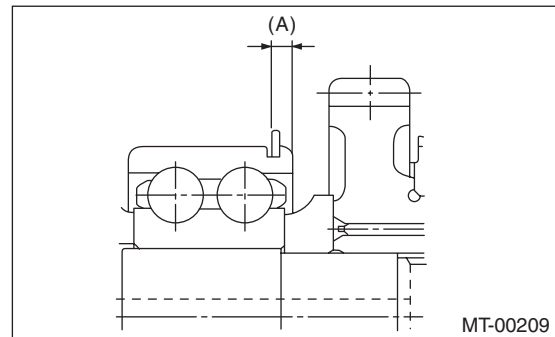
Using the ST, measure the protrusion amount (A) of ball bearing from transmission main case surface, and select a suitable plate in the following table.

NOTE:

Before measuring, tap the end of main shaft with a plastic hammer lightly in order to make the clearance zero between the main case surface and moving flange of bearing.

ST 498147001 DEPTH GAUGE

Dimension (A) mm (in)	Part number	Mark
4.00 — 4.13 (0.1575 — 0.1626)	32294AA041	1
3.87 — 4.00 (0.1524 — 0.1575)	32294AA051	2



# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

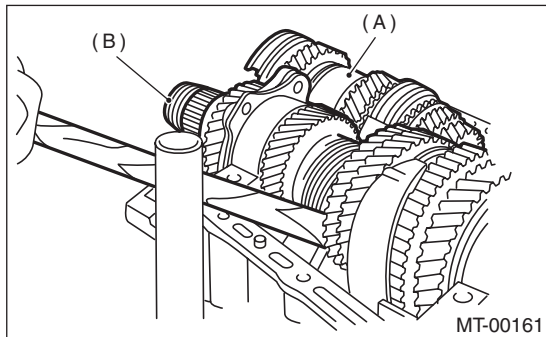
## 16. Drive Pinion Shaft Assembly

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 3) Remove the transmission case. <Ref. to 5MT-51, REMOVAL, Transmission Case.>
- 4) Remove the drive pinion shaft assembly.

#### NOTE:

Use a hammer handle, etc. to remove if too tight.

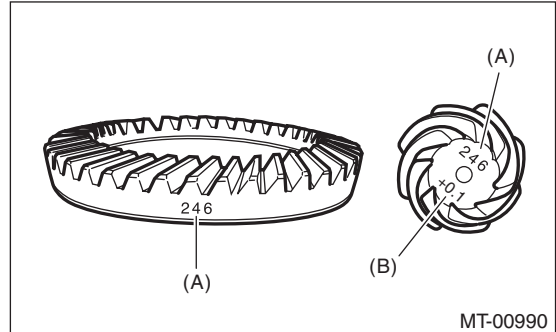


- (A) Main shaft ASSY for single-range
- (B) Drive pinion shaft ASSY

### B: INSTALLATION

- 1) Remove the front differential assembly.
- 2) Alignment marks/numbers on hypoid gear set: The number (A) on top of the drive pinion, and the number on the hypoid driven gear are set numbers for the two gears. Use a pair having the same numbers.

The figure (B) below shows a number for shim adjustment. If no number is shown, the value is zero.



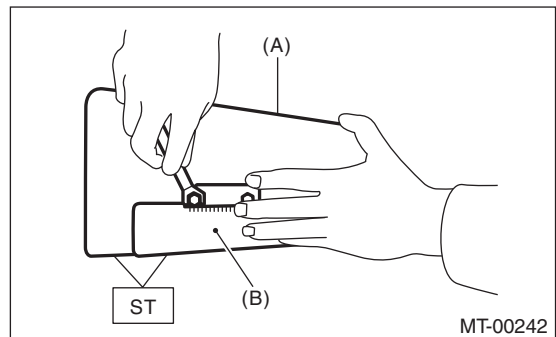
- (A) Set number
- (B) Number for shim adjustment

- 3) Place the drive pinion shaft assembly on transmission main case RH without shim and tighten the bearing mounting bolts.
- 4) Perform inspection and adjustment of ST.

#### NOTE:

- Loosen the two bolts and adjust so that the scale indicates 0.5 correctly when the plate end and the scale end are on the same level.
- Tighten the two bolts.

ST 499917500 DRIVE PINION GAUGE ASSY



- (A) Plate
- (B) Scale

- 5) Position the ST by inserting the knock pin of ST into the knock hole of transmission case.

ST 499917500 DRIVE PINION GAUGE ASSY

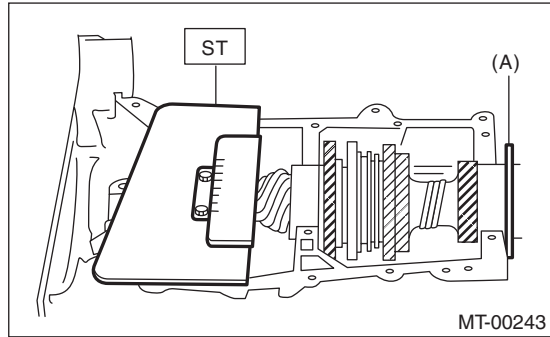


# Drive Pinion Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

6) Slide the drive pinion gauge scale with finger tip and read the value at the point where it matches with the end face of drive pinion.

ST 499917500 DRIVE PINION GAUGE ASSY



(A) Adjust the clearance to zero without shim.

7) The thickness of shim shall be determined by adding the value indicated on drive pinion to the value indicated on the ST. (Add if the number on drive pinion is prefixed by +, and subtract if the number is prefixed by -.)

ST 499917500 DRIVE PINION GAUGE ASSY

8) Select one to three shims in the following table for the value determined as described above, and take the shim(s) which thickness is closest to the said value.

Drive pinion shim	
Part number	Thickness mm (in)
32295AA031	0.150 (0.0059)
32295AA041	0.175 (0.0069)
32295AA051	0.200 (0.0079)
32295AA061	0.225 (0.0089)
32295AA071	0.250 (0.0098)
32295AA081	0.275 (0.0108)
32295AA091	0.300 (0.0118)
32295AA101	0.500 (0.0197)

9) Install the front differential assembly. <Ref. to 5MT-68, INSTALLATION, Front Differential Assembly.>

10) Set the transmission main shaft assembly for single range and drive pinion shaft assembly in the install location. (When doing so, there will be no clearance between the two when moved all the way to the front). Inspect a suitable 1st-2nd, 3rd-4th and 5th shifter fork so that the coupling sleeve and reverse driven gear are positioned in the center of the synchronizing mechanism. <Ref. to 5MT-65, INSPECTION, Drive Pinion Shaft Assembly.>

11) Install the transmission case. <Ref. to 5MT-52, INSTALLATION, Transmission Case.>

12) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>

13) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

## C: DISASSEMBLY

NOTE:

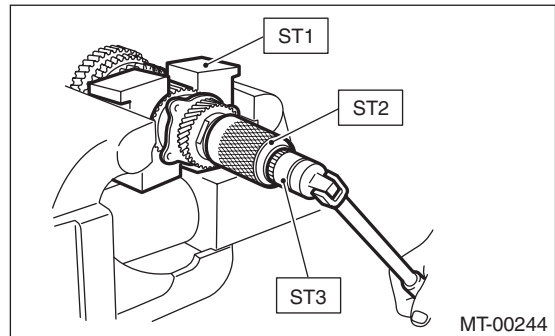
Attach a cloth to the end of driven shaft (on the frictional side of the thrust needle bearing) to prevent damage during disassembly or reassembly.

1) Flatten the tab of the axle nut. Remove the lock nut with ST1, ST2 and ST3.

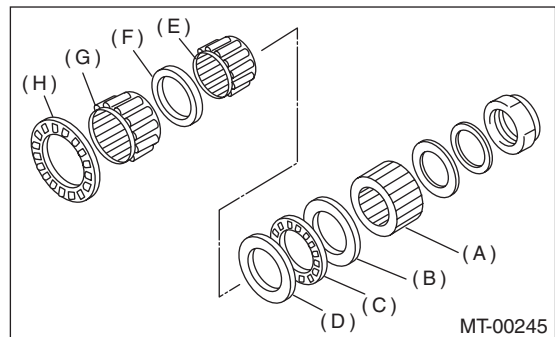
ST1 899884100 HOLDER

ST2 498427100 STOPPER

ST3 899988608 SOCKET WRENCH (27)



2) Draw out the drive pinion from driven shaft. Remove the differential bevel gear sleeve, adjusting washer No. 1, adjusting washer No. 2, thrust bearing, needle bearing and drive pinion collar.



- (A) Differential bevel gear sleeve
- (B) Adjusting washer No. 1 (25 × 37.5 × t)
- (C) Thrust bearing (25 × 37.5 × 3)
- (D) Adjusting washer No. 2 (25 × 37.5 × 4)
- (E) Needle bearing (25 × 30 × 20)
- (F) Drive pinion collar
- (G) Needle bearing (30 × 37 × 23)
- (H) Thrust bearing (33 × 50 × 3)

# Drive Pinion Shaft Assembly

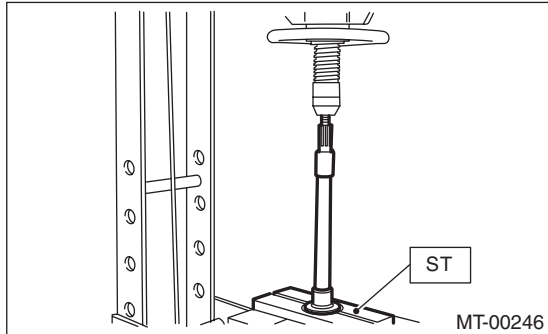
MANUAL TRANSMISSION AND DIFFERENTIAL

3) Remove the roller bearing and washer using ST and a press.

NOTE:

Do not reuse the roller bearing.

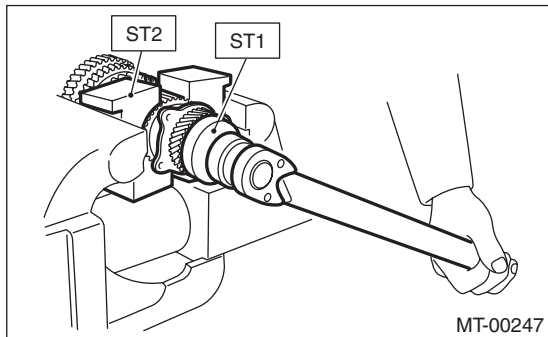
ST 498077000 REMOVER



4) Flatten the tab of the axle nut. Remove the lock nut using ST1 and ST2.

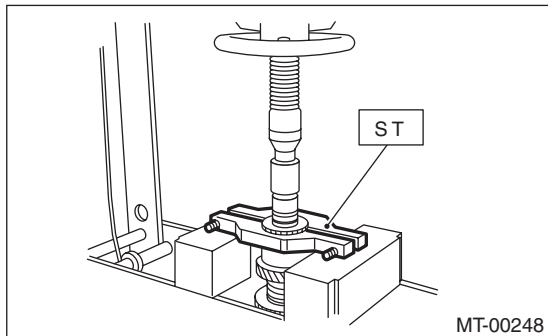
ST1 499987300 SOCKET WRENCH (50)

ST2 899884100 HOLDER



5) Remove the 5th driven gear using ST.

ST 499857000 5TH DRIVEN GEAR REMOVER

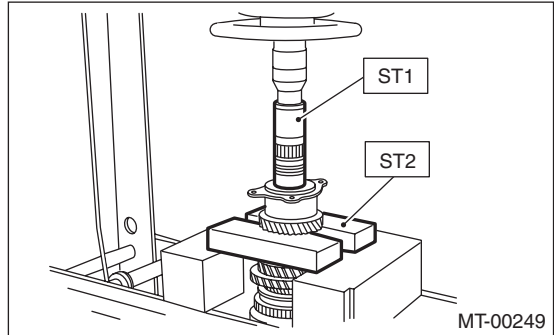


6) Remove the woodruff key.

7) Remove the roller bearing and 3rd-4th driven gear using ST1 and ST2.

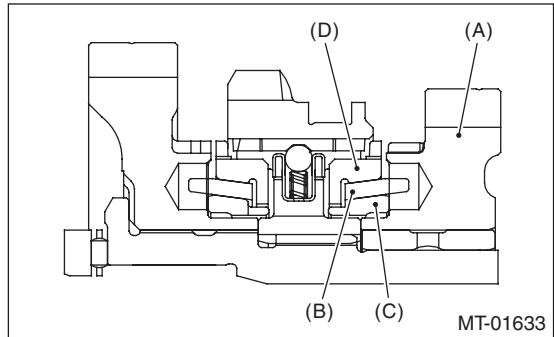
ST1 499757002 INSTALLER

ST2 899714110 REMOVER



8) Remove the key.

9) Remove the 2nd driven gear, inner baulk ring, synchro cone and outer baulk ring.



(A) 2nd driven gear

(B) Inner baulk ring

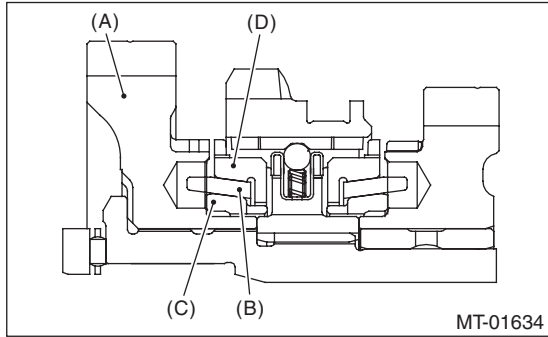
(C) Synchro cone

(D) Outer baulk ring

# Drive Pinion Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

10) Remove the 1st driven gear, inner baulk ring, synchro cone, outer baulk ring, 2nd gear bushing, gear and hub using ST1 and ST2.

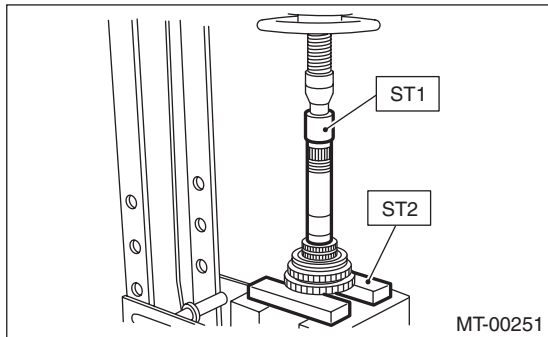


- (A) 1st driven gear
- (B) Inner baulk ring
- (C) Synchro cone
- (D) Outer baulk ring

### NOTE:

If necessary, use the new gear & hub assembly, when replacing the gear or hub assembly. Because these must engage at the specified point, avoid disassembly as much as possible. If it must be disassembled, mark the engaging point on the spline beforehand.

ST1 499757002 INSTALLER  
ST2 899714110 REMOVER



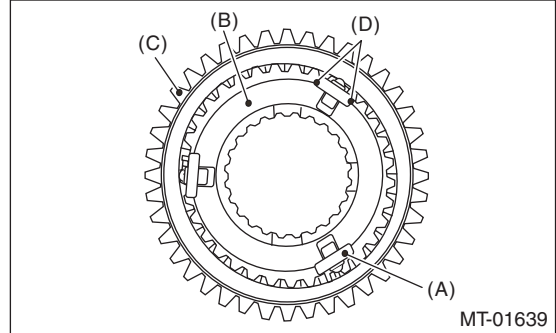
11) Remove the sub gear, washer, and snap ring (outer) for the 1st driven gear. (2.5 L non-turbo model)

## D: ASSEMBLY

1) Install the sleeve and gear & hub assembly by matching alignment marks.

### NOTE:

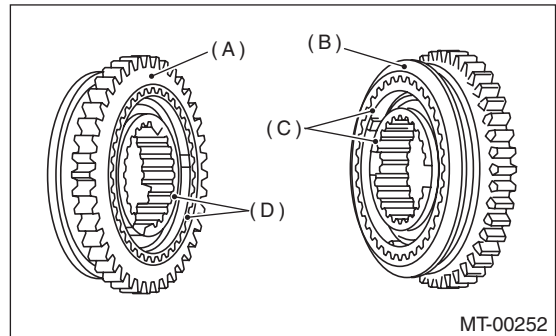
After installation, make sure there is no significant gap at both sides of the ball detent.



- (A) Ball detent
- (B) 1st-2nd synchronizer hub
- (C) Reverse driven gear
- (D) There is no significant gap at these points.

### NOTE:

Use the new gear & hub assembly, if replacing the gear or hub.



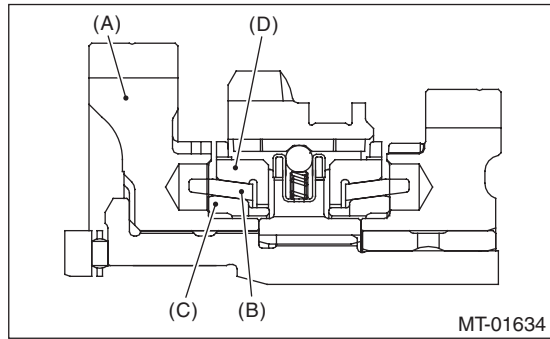
- (A) 1st gear side
- (B) 2nd gear side
- (C) Flush surface
- (D) Stepped surface

2) Install the washer, snap ring (outer) and sub gear onto the 1st driven gear. (2.5 L non-turbo model)

# Drive Pinion Shaft Assembly

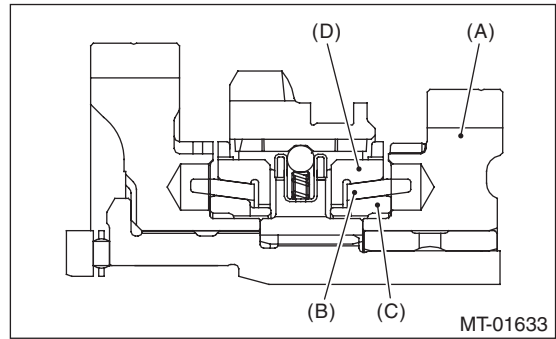
MANUAL TRANSMISSION AND DIFFERENTIAL

3) Install the 1st driven gear, inner baulk ring, synchro cone, outer baulk ring onto driven shaft.



- (A) 1st driven gear
- (B) Inner baulk ring
- (C) Synchro cone
- (D) Outer baulk ring

5) Install the 2nd driven gear, inner baulk ring, synchro cone and outer baulk ring, and insert them onto driven shaft.



- (A) 2nd driven gear
- (B) Inner baulk ring
- (C) Synchro cone
- (D) Outer baulk ring

**NOTE:**

- Take care to install the gear & hub assembly in proper direction.
- Align the baulk ring and gear & hub assembly with the key groove.

4) Install the 2nd driven gear bushing onto the driven shaft using ST1, ST2 and a press.

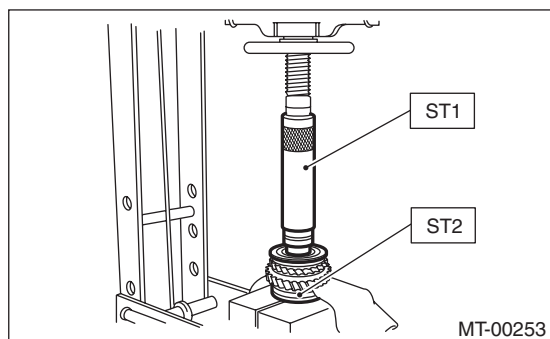
**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

**NOTE:**

- Attach a cloth to the end of the driven shaft to prevent damage.
- When press fitting, align the oil holes of the shaft and bushing

ST1 499277200 INSTALLER  
ST2 499587000 INSTALLER



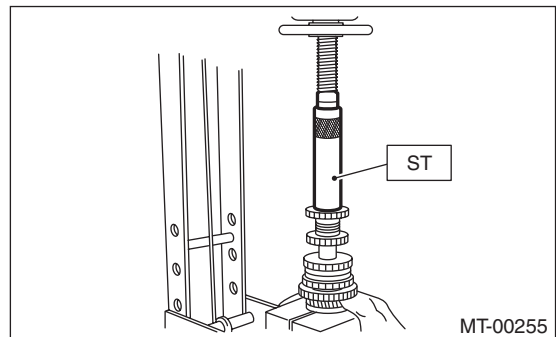
6) After installing key on driven shaft, install the 3rd-4th driven gear using an ST and a press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

**NOTE:**

Align the groove in baulk ring with the insert.  
ST 499277200 INSTALLER

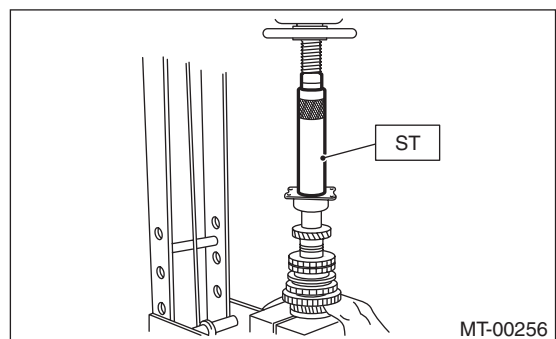


7) Install a set of roller bearings onto the driven shaft using the ST and a press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

ST 499277200 INSTALLER



# Drive Pinion Shaft Assembly

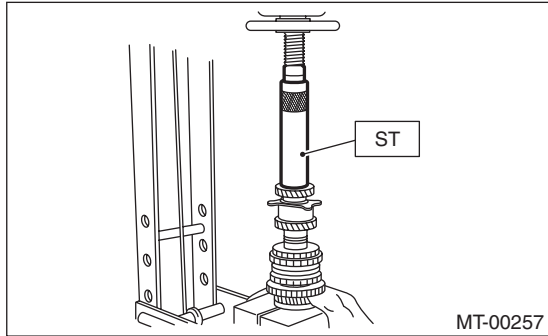
## MANUAL TRANSMISSION AND DIFFERENTIAL

8) Position the woodruff key in groove of the rear of driven shaft. Install the 5th driven gear onto driven shaft using ST and a press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

ST 499277200 INSTALLER

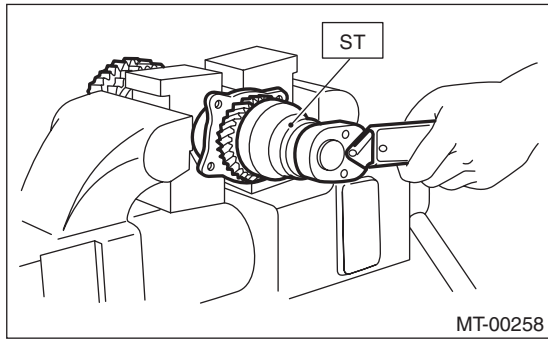


9) Install the lock washer. Install the lock nut and tighten to the specified torque using the ST.

ST 499987300 SOCKET WRENCH (50)

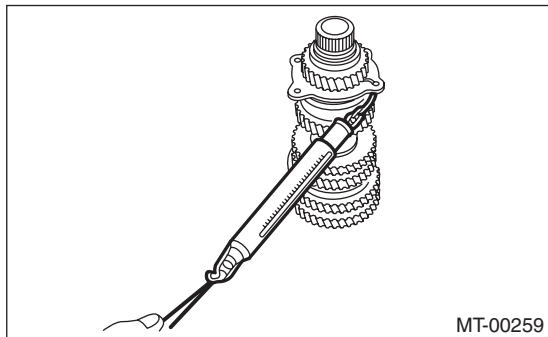
**Tightening torque:**

**260 N·m (26.5 kgf·m, 191.8 ft·lb)**



**NOTE:**

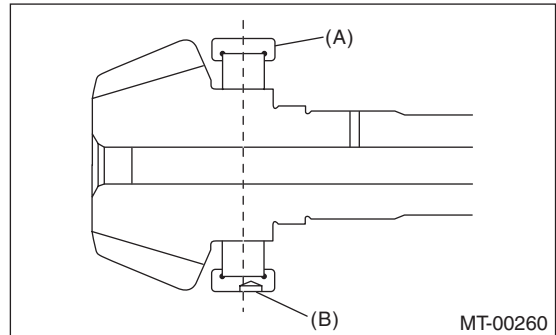
- Crimp the locknut in 2 locations.
- Using a spring scale, check that starting torque of the roller bearing is 0.1 to 1.5 N (0.01 to 0.15 kgf, 0.02 to 0.33 lbf).



10) Install the roller bearing onto drive pinion.

**NOTE:**

When installing the roller bearing, note its directions (front and rear) because the knock pin hole of outer race is offset.



(A) Roller bearing

(B) Knock pin hole

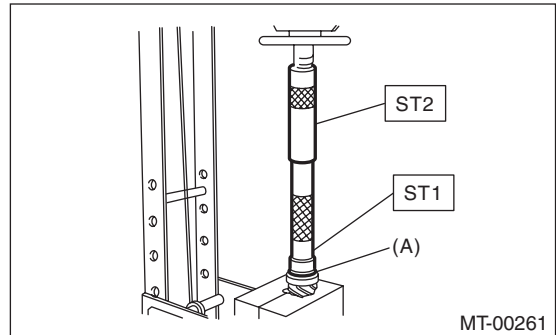
11) Install the washer using ST1, ST2 and a press.

**CAUTION:**

**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

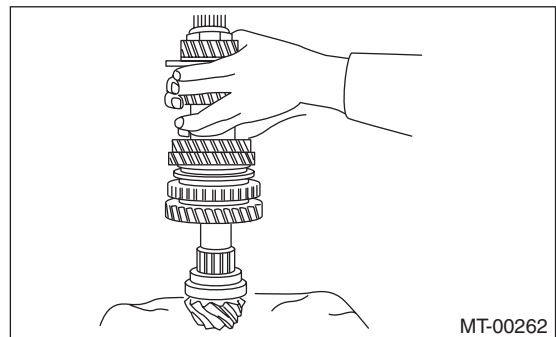
ST1 499277100 BUSHING 1-2 INSTALLER

ST2 499277200 INSTALLER



(A) Washer

12) Install the thrust bearing and needle bearing. Install the driven shaft assembly.



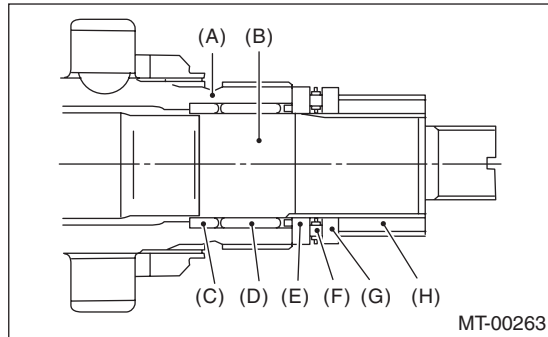
# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

13) Install the drive pinion collar, needle bearing, adjusting washer No. 2, thrust bearing, adjusting washer No. 1 and differential bevel gear sleeve in this order.

## NOTE:

Be careful to install the spacer in the proper direction.



- (A) Driven shaft
- (B) Drive shaft
- (C) Drive pinion collar
- (D) Needle bearing (25 × 30 × 20)
- (E) Adjusting washer No. 2 (25 × 36 × 4)
- (F) Thrust bearing (25 × 37.5 × 3)
- (G) Adjusting washer No. 1 (25 × 36 × t)
- (H) Differential bevel gear sleeve

14) Adjust the thrust bearing preload. <Ref. to 5MT-66, THRUST BEARING PRELOAD, ADJUSTMENT, Drive Pinion Shaft Assembly.>

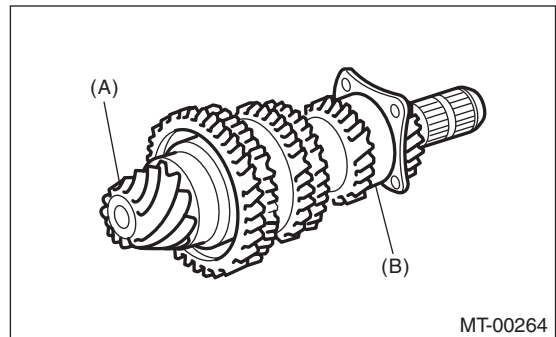
## E: INSPECTION

Disassembled parts should be washed clean first with cleaning solvent and then inspected carefully.

### 1) Bearing

Replace the bearings in the following cases.

- When the bearing balls, outer races and inner races are broken or rusty.
- When the bearing is worn.
- When the bearings fail to turn smoothly or emit noise in rotation after gear oil lubrication.
- The ball bearing on the rear side of the drive pinion shaft should be checked for smooth rotation before the drive pinion assembly is disassembled. In this case, because a preload is working on the bearing, its rotation feels like it is slightly dragging unlike other bearings.



- (A) Drive pinion shaft
- (B) Ball bearing

- When bearing has other defects.

### 2) Bushing (each gear)

Replace the bushing in following cases.

- When the sliding surface is damaged or abnormally worn.
- When the inner wall is abnormally worn.

### 3) Gear

Replace the bearings in the following cases.

- Replace gear with new part if its tooth surfaces are broken, damaged or excessively worn.
- Correct or replace if the cone that contacts the baulk ring is rough or damaged.
- Correct or replace if the inner surface or end face is damaged.

# Drive Pinion Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

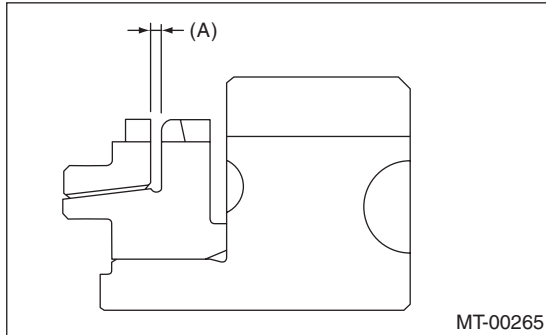
### 4) Baulk ring

Replace the ring in following cases:

- When the inner surface and end face are damaged.
- When the ring inner surface is abnormally or partially worn down.
- If the gap between the end faces of the ring and the gear splined part is excessively small, check the clearance (A) while pressing the ring against the cone.

#### Clearance (A):

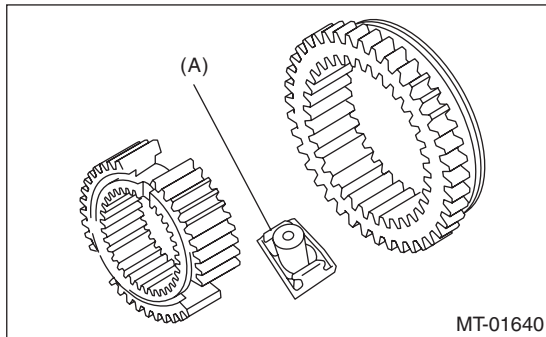
**0.5 — 1.0 mm (0.020 — 0.040 in)**



- When the contact surface of synchronizer ring insert is scratched or abnormally worn.

### 5) Ball detent

Replace the ball detent if deformed, excessively worn or defective in any way.



(A) Ball detent

### 6) Oil seal

Replace the oil seal if the lip is deformed, hardened, worn or defective in any way.

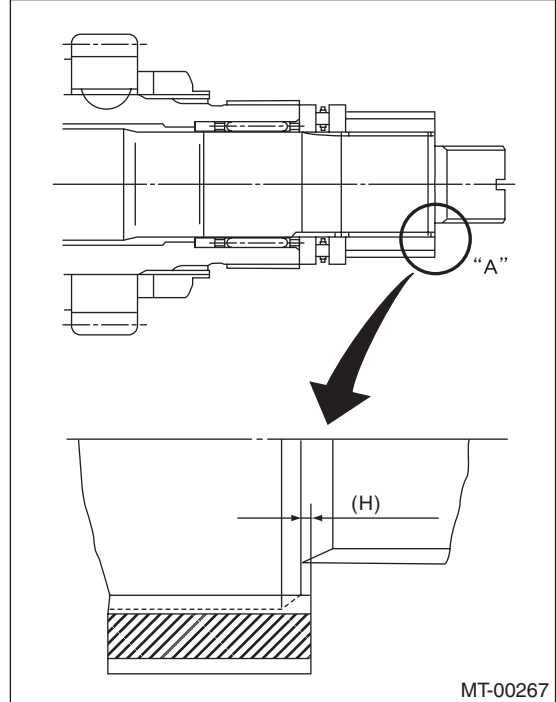
### 7) O-ring

Replace the O-ring if the sealing face is deformed, hardened, damaged, worn or defective in any way.

## F: ADJUSTMENT

### 1. THRUST BEARING PRELOAD

1) Select a suitable adjusting washer No. 1 to so that dimension (H) will be zero in a visual check. Position the washer (18.3 × 30 × 4) and lock washer (18 × 30 × 2) and install lock nut.(18 × 13.5)

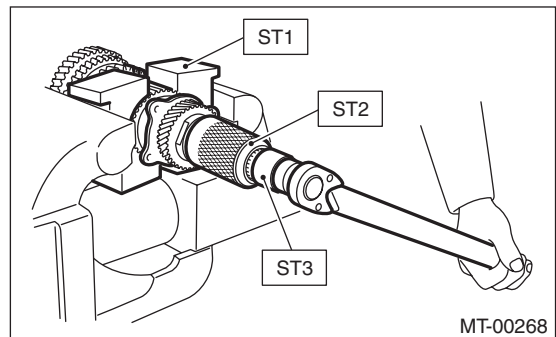


2) Using the ST1, ST2 and ST3, tighten the new lock nut to the specified torque.

- |     |           |                    |
|-----|-----------|--------------------|
| ST1 | 899884100 | HOLDER             |
| ST2 | 498427100 | STOPPER            |
| ST3 | 899988608 | SOCKET WRENCH (27) |

#### Tightening torque:

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**



# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

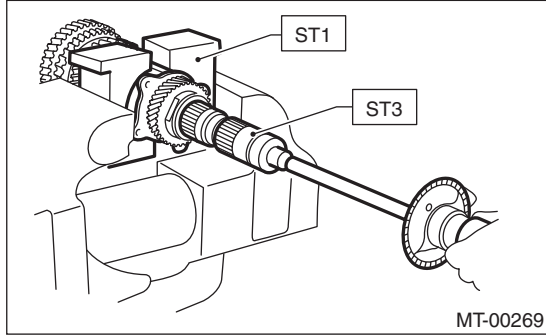
3) After removing the ST2, measure the starting torque using torque driver.

ST1 899884100 HOLDER

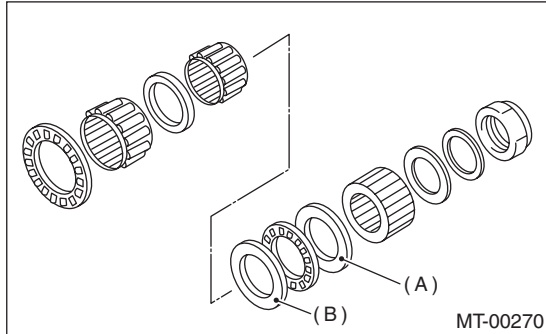
ST3 899988608 SOCKET WRENCH (27)

**Starting torque:**

**0.3 — 0.8 N·m (0.03 — 0.08 kgf·m, 0.2 — 0.6 ft·lb)**



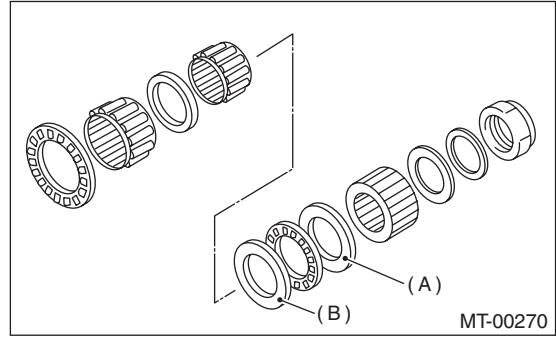
4) If the starting torque is not within the specified limit, select new adjusting washer No. 1 and recheck starting torque.



(A) Adjusting washer No. 1

(B) Adjusting washer No. 2

5) When the specified starting torque cannot be obtained by adjusting washer No. 1, select adjusting washer No. 2 from the following table. Repeat procedures 1) through 4) to adjust starting torque.



(A) Adjusting washer No. 1

(B) Adjusting washer No. 2

Starting torque	Dimension H	Adjusting washer No. 2
Low	Small	Select thicker one.
High	Large	Select thinner one.

Adjusting washer No. 2	
Part number	Thickness mm (in)
803025059	3.850 (0.1516)
803025054	4.000 (0.1575)
803025058	4.150 (0.1634)

6) Recheck that the starting torque is within the specified range, then crimp the lock nut at four positions.

Adjusting washer No. 1	
Part number	Thickness mm (in)
803025051	3.925 (0.1545)
803025052	3.950 (0.1555)
803025053	3.975 (0.1565)
803025054	4.000 (0.1575)
803025055	4.025 (0.1585)
803025056	4.050 (0.1594)
803025057	4.075 (0.1604)



# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

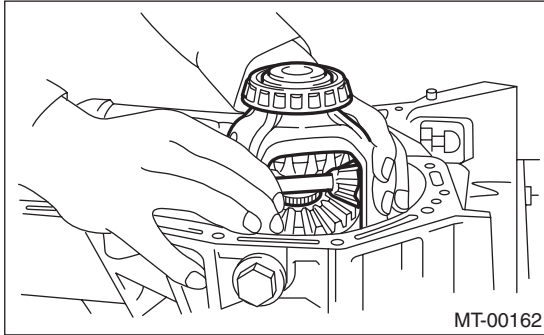
### 17. Front Differential Assembly

#### A: REMOVAL

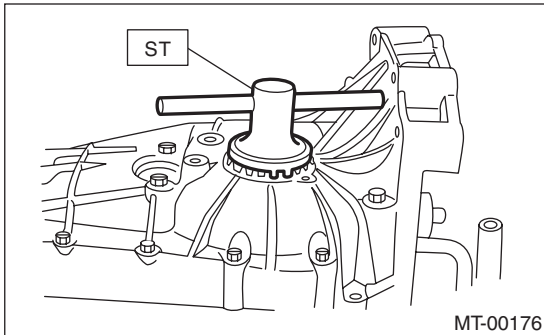
- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 3) Remove the transmission case. <Ref. to 5MT-51, REMOVAL, Transmission Case.>
- 4) Remove the drive pinion shaft assembly. <Ref. to 5MT-59, REMOVAL, Drive Pinion Shaft Assembly.>
- 5) Remove the main shaft assembly for single-range. <Ref. to 5MT-54, REMOVAL, Main Shaft Assembly for Single-range.>
- 6) Remove the front differential assembly.

#### NOTE:

- Do not confuse the right and left roller bearing outer races.
- Be careful not to damage the oil seal of retainer.



- 7) Remove the differential side retainers using ST. 18630AA010 WRENCH COMPL RETAINER



- 8) Remove the bearing outer race from the transmission case.

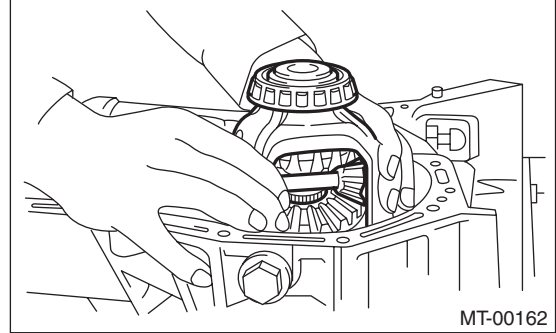
ST 398527700 PULLER ASSY

#### B: INSTALLATION

- 1) Install the differential side retainers using ST. 18630AA010 WRENCH COMPL RETAINER
- 2) Install the bearing outer race to the transmission case.
- 3) Install the front differential assembly.

#### NOTE:

Be careful not to fold the sealing lip of oil seal.



- 4) Install the main shaft assembly for single-range. <Ref. to 5MT-54, INSTALLATION, Main Shaft Assembly for Single-range.>
- 5) Install the drive pinion shaft assembly. <Ref. to 5MT-59, INSTALLATION, Drive Pinion Shaft Assembly.>
- 6) Install the transmission case. <Ref. to 5MT-52, INSTALLATION, Transmission Case.>
- 7) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 8) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

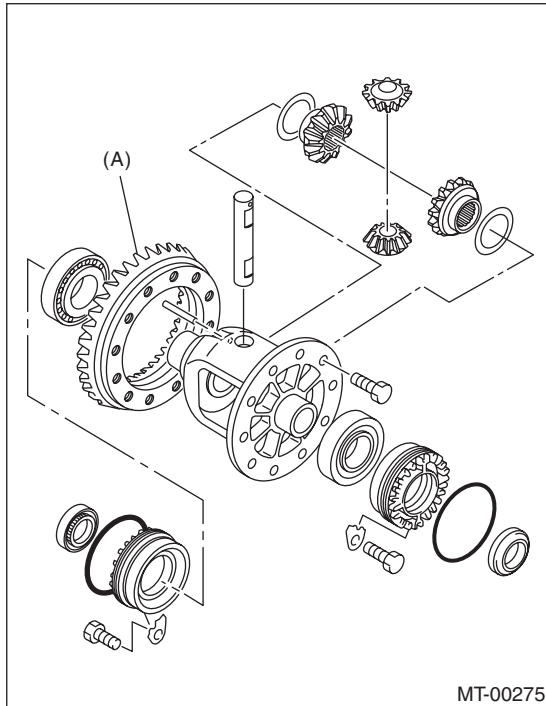
# Front Differential Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## C: DISASSEMBLY

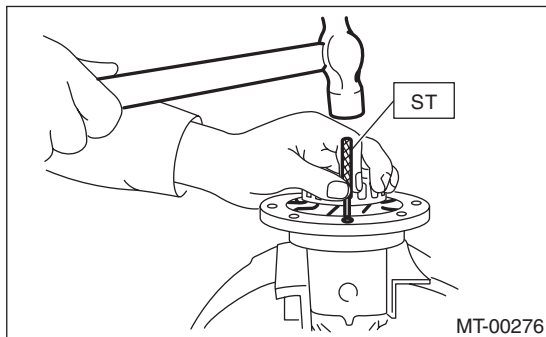
### 1. DIFFERENTIAL CASE ASSEMBLY

1) Loosen the twelve bolts and remove hypoid driven gear.

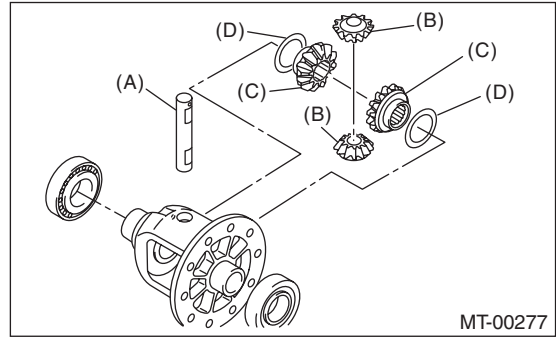


(A) Hypoid driven gear

2) Drive out the straight pin from differential assembly toward hypoid driven gear side.  
ST 899904100 REMOVER

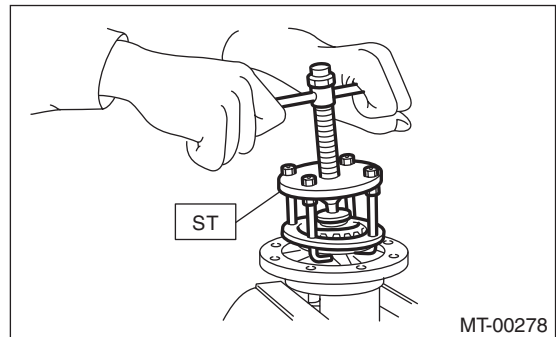


3) Pull out the pinion shaft, and remove the differential bevel pinion, differential bevel gear and washer.



- (A) Pinion shaft
- (B) Differential bevel pinion
- (C) Differential bevel gear
- (D) Washer

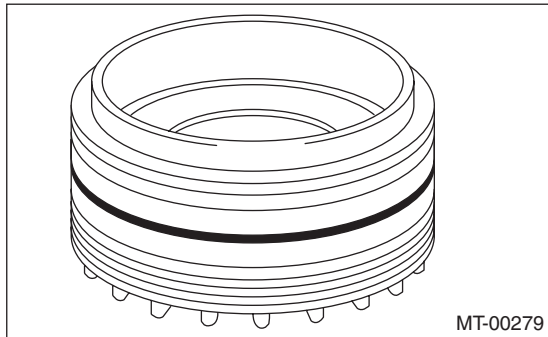
4) Using the ST, remove the roller bearing.  
ST 899524100 PULLER SET



# Front Differential Assembly

## 2. SIDE RETAINER

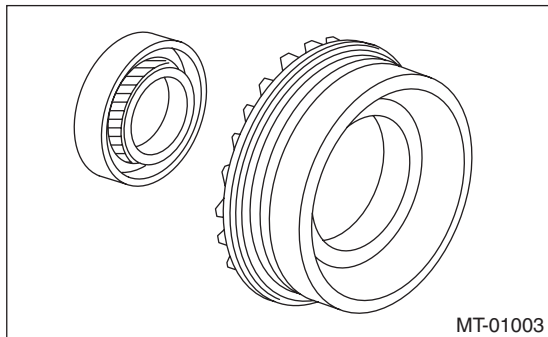
1) Remove the O-ring.



2) Remove the oil seal.

### NOTE:

- Remove using the flat tip screwdriver.
- Do not reuse the oil seal. Replace the oil seal with a new part.



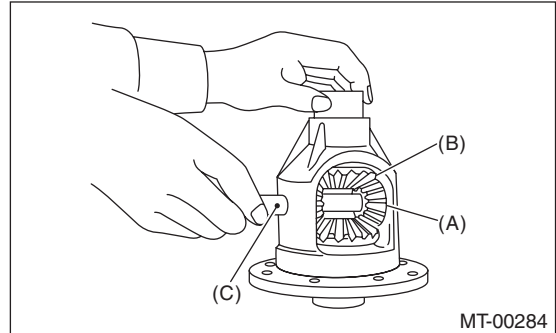
## D: ASSEMBLY

### 1. DIFFERENTIAL CASE ASSEMBLY

1) Install the differential bevel gear and differential bevel pinion together with washers, and insert the pinion shaft.

### NOTE:

Face the chamfered side of washer toward gear.



- (A) Differential bevel pinion
- (B) Differential bevel gear
- (C) Pinion shaft

2) Measure the backlash between differential bevel gear and differential pinion. If backlash is not within specified value, install a suitable washer to adjust. <Ref. to 5MT-72, BEVEL PINION GEAR BACKLASH, INSPECTION, Front Differential Assembly.>

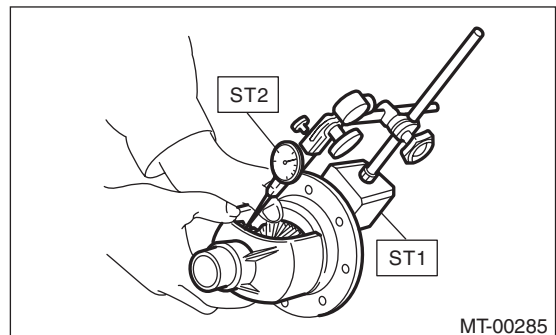
### NOTE:

Be sure the pinion gear teeth contacts adjacent gear teeth during measurement.

- ST1 498247001 MAGNET BASE
- ST2 498247100 DIAL GAUGE

### Standard backlash

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



# Front Differential Assembly

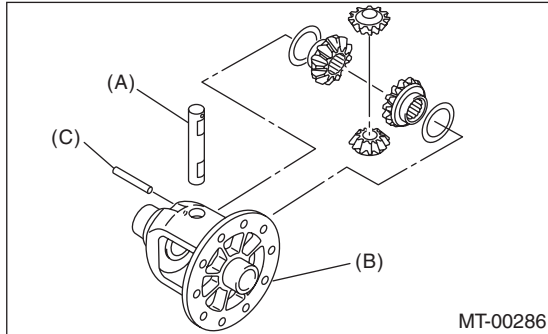
MANUAL TRANSMISSION AND DIFFERENTIAL

3) Align the pinion shaft and differential case with each hole, and drive the straight pin into the holes from the hypoid driven gear using the ST.

NOTE:

Lock the straight pin after installing.

ST 899904100 REMOVER



- (A) Pinion shaft
- (B) Differential case
- (C) Straight pin

4) Install the roller bearing to differential case.

**CAUTION:**

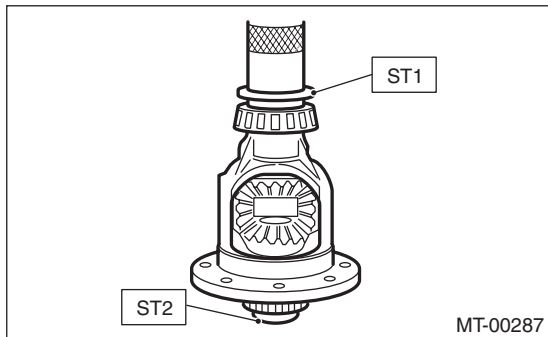
**Do not apply a load in excess of 10 kN (1 ton, 1.1 US ton, 1.0 Imp ton).**

NOTE:

Be careful because the roller bearing outer races are used as a set.

ST1 499277100 BUSHING 1-2 INSTALLER

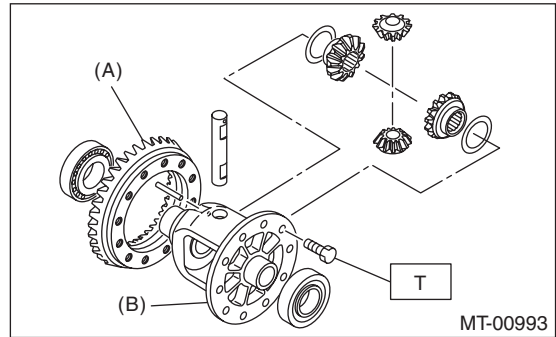
ST2 398497701 ADAPTER



5) Install the hypoid driven gear to the differential case using twelve bolts.

**Tightening torque:**

**T: 62 N·m (6.3 kgf·m, 45.6 ft·lb)**

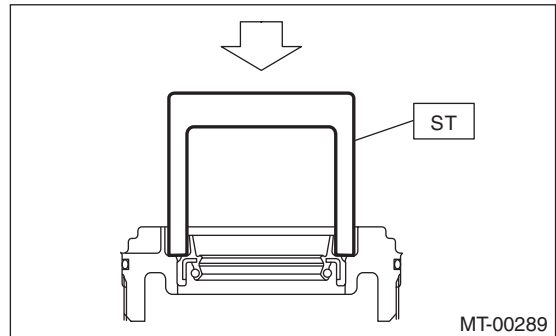


- (A) Hypoid driven gear
- (B) Differential case

## 2. SIDE RETAINER

1) Install a new oil seal.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER



**CAUTION:**

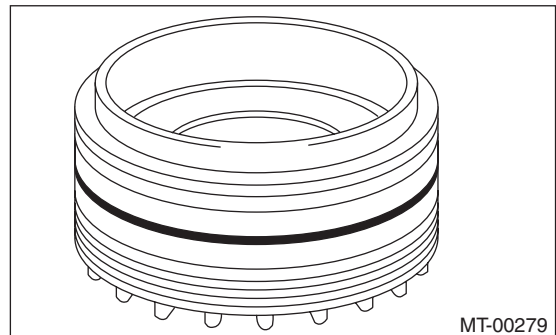
- When press-fitting the oil seal to the side retainer, tap with a plastic hammer etc. to press in.

- Never use a press.

2) Install a new O-ring.

NOTE:

Do not stretch or damage the O-ring.



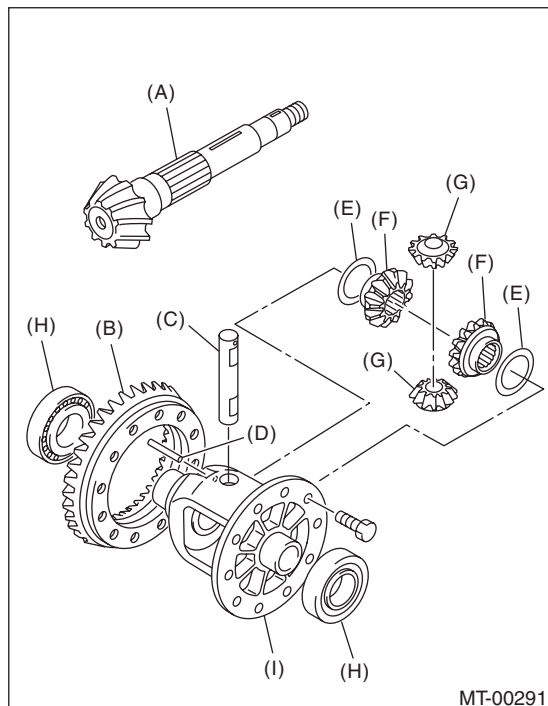
# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### E: INSPECTION

Repair or replace the differential gear in the following cases:

- When the hypoid drive gear and drive pinion shaft tooth surfaces are damaged, excessively worn, or seized.
- When the roller bearing on the drive pinion shaft has a worn or damaged roller path.
- When there is damage, wear or seizure of the differential bevel pinion, differential bevel gear, washer, pinion shaft or straight pin.
- When the differential case has worn or damaged sliding surfaces.



- (A) Drive pinion shaft
- (B) Hypoid driven gear
- (C) Pinion shaft
- (D) Straight pin
- (E) Washer
- (F) Differential bevel gear
- (G) Differential bevel pinion
- (H) Roller bearing
- (I) Differential case

### 1. BEVEL PINION GEAR BACKLASH

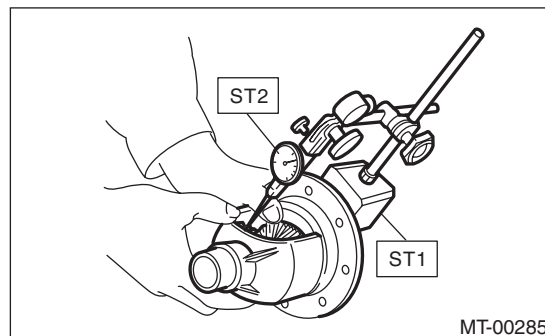
Measure the backlash between differential bevel gear and differential bevel pinion. If backlash is not within specified value, install a suitable washer to adjust. <Ref. to 5MT-73, ADJUSTMENT, Front Differential Assembly.>

ST1 498247001 MAGNET BASE

ST2 498247100 DIAL GAUGE

#### Standard backlash

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



### 2. HYPOID GEAR BACKLASH

1) Set the ST1, ST2 and ST3. Insert the needle through transmission oil drain plug hole so that the needle comes in contact with the tooth surface on the right corner, and check the backlash.

ST1 498247001 MAGNET BASE

ST2 498247100 DIAL GAUGE

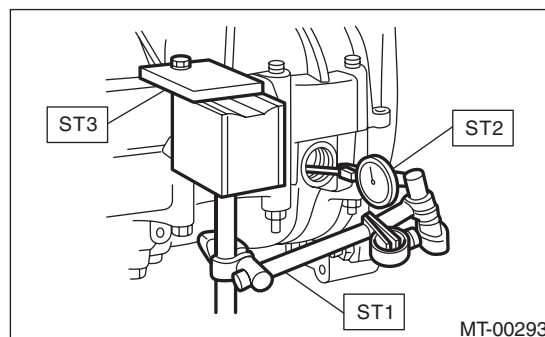
ST3 498255400 PLATE

2) Install SUBARU genuine axle shafts to both sides, rotate in the inversion direction so that the gauge contacts the tooth surface, and read the dial gauge

Part No. 38415AA100 AXLE SHAFT

#### Backlash

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



#### NOTE:

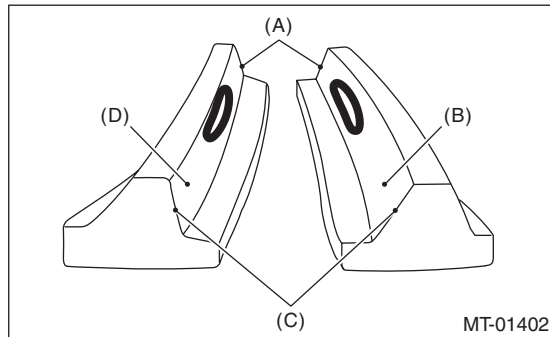
If the backlash is outside the specified range, adjust it by turning the side retainer in the right side case.

# Front Differential Assembly

## 3. TOOTH CONTACT OF HYPOID GEAR

Check tooth contact of hypoid gear as follows: Apply a thin uniform coat of lead-free red dye on both teeth surfaces on 3 or 4 teeth of the hypoid gear. Move the hypoid gear back and forth by turning the transmission main shaft until a definite contact pattern is developed on the hypoid gear, and judge whether face contact is correct. If it is improper, make adjustment. <Ref. to 5MT-73, ADJUSTMENT, Front Differential Assembly.>

- Tooth contact is correct.



- (A) Toe
- (B) Coast side
- (C) Heel
- (D) Drive side

## F: ADJUSTMENT

### 1. BEVEL PINION GEAR BACKLASH

1) Disassemble the front differential assembly. <Ref. to 5MT-69, DISASSEMBLY, Front Differential Assembly.>

2) Select a different washer from the table and install.

Washer	
Part number	Thickness mm (in)
803038021	0.925 — 0.950 (0.0364 — 0.0374)
803038022	0.975 — 1.000 (0.0384 — 0.0394)
803038023	1.025 — 1.050 (0.0404 — 0.0413)

3) Adjust until the standard value is obtained.

#### Backlash:

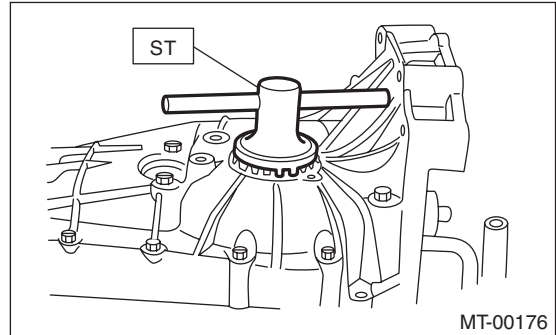
##### Standard

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**

## 2. HYPOID GEAR BACKLASH

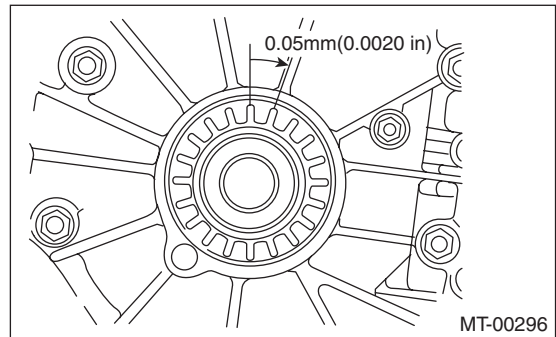
Adjust the backlash by turning the holder in the RH side case.

ST 18630AA010 WRENCH COMPL RETAINER



#### NOTE:

Each time side retainer rotates one tooth, backlash changes by 0.05 mm (0.020 in).

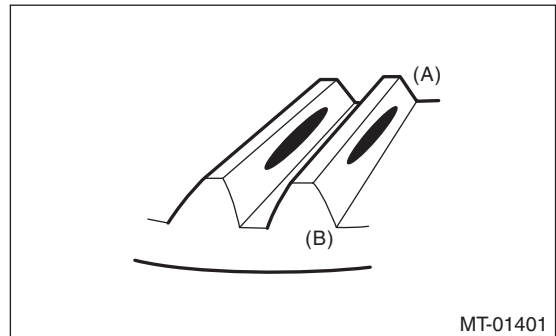


## 3. TOOTH CONTACT OF HYPOID GEAR

1) Adjust until correct teeth contact is obtained.  
2) Check tooth contact, and perform the adjustment as follows.

- Tooth contact

**Check item: Tooth contact surface is slightly shifted toward the toe side under a no-load condition. (When driving, it moves towards the heel side.)**



- (A) Toe side
- (B) Heel side

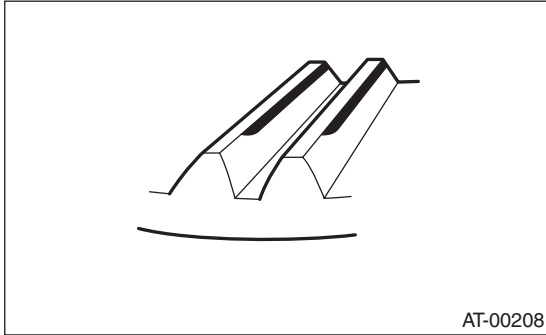
# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

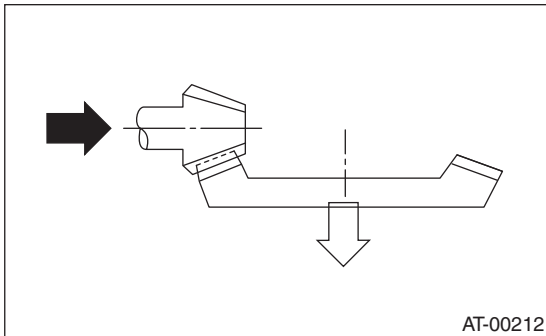
- Face contact

**Check item: Backlash is too large.**

Contact pattern



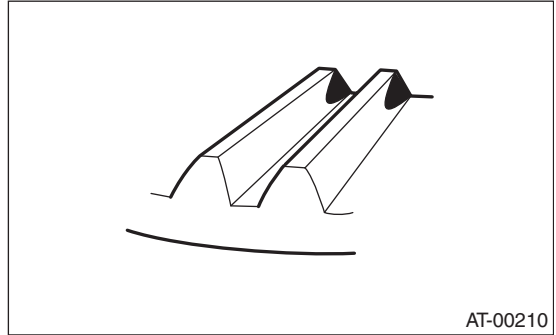
Corrective action: Reduce thickness of pinion height adjusting washer in order to bring the drive pinion closer to driven gear side.



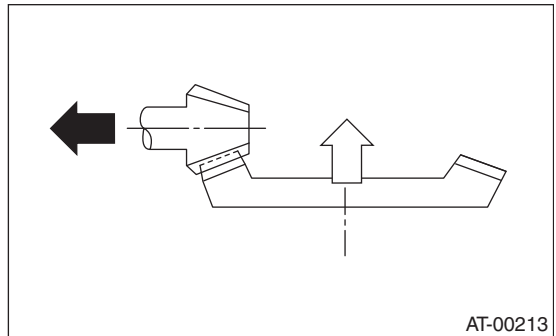
- Toe contact (inside contact)

**Check item: Teeth contact area is too small.**

Contact pattern



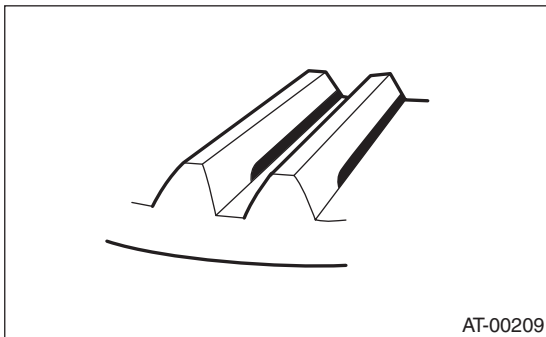
Corrective action: Increase thickness of pinion height adjusting washer according to the procedures for moving the drive pinion closer to the driven gear.



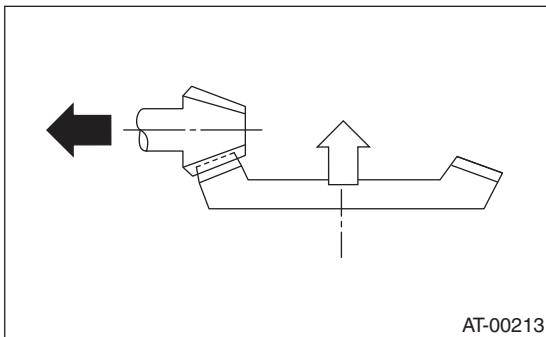
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



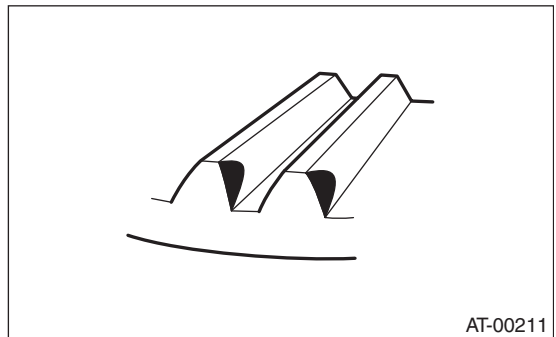
Corrective action: Increase the thickness of the pinion height adjusting washer in order to place the drive pinion away from the driven gear.



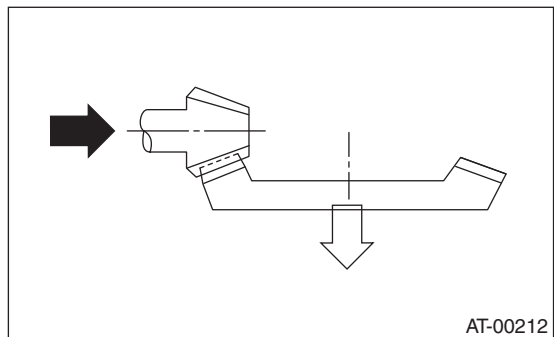
- Heel contact (outside end contact)

**Check item: Teeth contact area is too small.**

Contact pattern



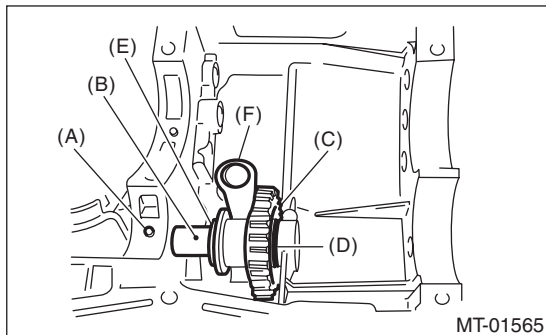
Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the driven gear.



## 18. Reverse Idler Gear

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the back-up light switch and the neutral position switch. <Ref. to 5MT-35, REMOVAL, Switches and Harness.>
- 3) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the transmission case. <Ref. to 5MT-51, REMOVAL, Transmission Case.>
- 5) Remove the drive pinion shaft assembly. <Ref. to 5MT-59, REMOVAL, Drive Pinion Shaft Assembly.>
- 6) Remove the main shaft assembly for single-range. <Ref. to 5MT-54, REMOVAL, Main Shaft Assembly for Single-range.>
- 7) Remove the front differential assembly. <Ref. to 5MT-68, REMOVAL, Front Differential Assembly.>
- 8) Remove the shifter forks and rods. <Ref. to 5MT-77, REMOVAL, Shifter Fork and Rod.>
- 9) Pull out the straight pin, and remove the reverse idler gear shaft, washer, reverse idler gear and washer.



- (A) Straight pin
- (B) Reverse idler gear shaft
- (C) Reverse idler gear
- (D) Washer
- (E) Washer
- (F) Reverse shifter lever

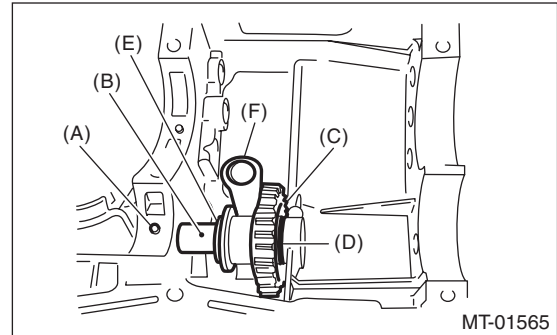
- 10) Remove the reverse shifter lever.

### B: INSTALLATION

- 1) Install the reverse shifter lever, washer, reverse idler gear, washer and reverse idler gear shaft, and secure them with the straight pin.

#### NOTE:

Be sure to install the reverse idler gear shaft from rear side.



- (A) Straight pin
- (B) Reverse idler gear shaft
- (C) Reverse idler gear
- (D) Washer
- (E) Washer
- (F) Reverse shifter lever

- 2) Check and adjust clearance between the reverse idler gear and the timing case wall surface. <Ref. to 5MT-75, INSTALLATION, Reverse Idler Gear.> <Ref. to 5MT-76, ADJUSTMENT, Reverse Idler Gear.>
- 3) Install the shifter forks and rods. <Ref. to 5MT-78, INSTALLATION, Shifter Fork and Rod.>
- 4) Install the front differential assembly. <Ref. to 5MT-68, INSTALLATION, Front Differential Assembly.>
- 5) Install the main shaft assembly for single-range. <Ref. to 5MT-54, INSTALLATION, Main Shaft Assembly for Single-range.>
- 6) Install the drive pinion shaft assembly. <Ref. to 5MT-59, INSTALLATION, Drive Pinion Shaft Assembly.>
- 7) Install the transmission case. <Ref. to 5MT-52, INSTALLATION, Transmission Case.>
- 8) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>
- 9) Install the back-up light switch & neutral position switch. <Ref. to 5MT-36, INSTALLATION, Switches and Harness.>
- 10) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>



# Reverse Idler Gear

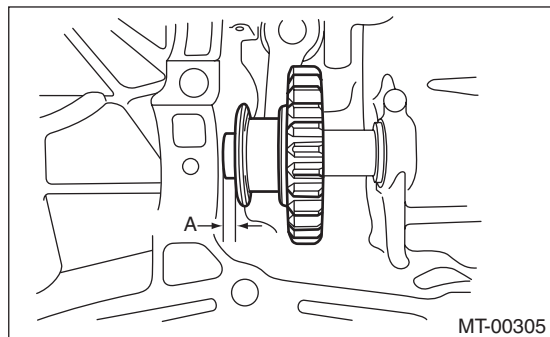
## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: INSPECTION

1) Move the reverse shifter rod toward the reverse side. Check the clearance between the reverse idler gear and the timing case wall surface. If out of specification, select an appropriate reverse shifter lever and adjust.

**Clearance A:**

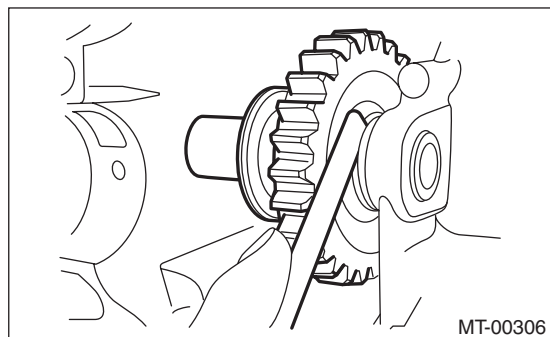
**6.0 — 7.5 mm (0.236 — 0.295 in)**



2) After installing a suitable reverse shifter lever, shift into neutral. Check the clearance between the reverse idler gear and the timing case wall surface. If out of specification, select the appropriate washer and adjust.

**Clearance:**

**0 — 0.5 mm (0 — 0.020 in)**



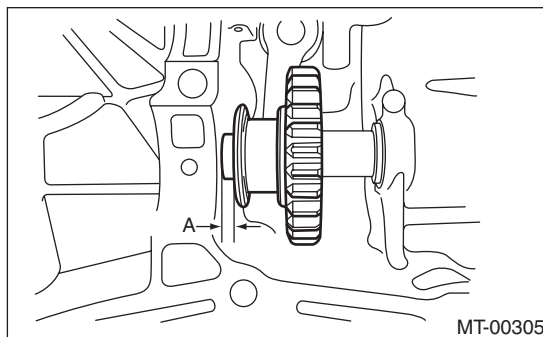
3) Check the reverse idler gear and shaft for damage. Replace if it is damaged.

### D: ADJUSTMENT

1) Select the appropriate reverse shifter lever from the table below, and adjust until the clearance between the reverse idler gear and transmission case wall is within specification.

**Clearance A:**

**6.0 — 7.5 mm (0.236 — 0.295 in)**

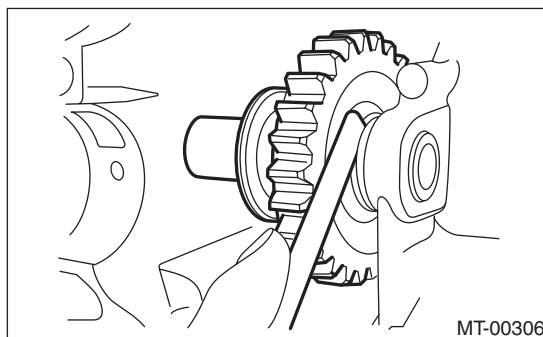


Reverse shifter lever		
Part number	Mark	Remarks
32820AA070	7	Far from case wall
32820AA080	8	Standard
32820AA090	9	Closer to case wall

2) Select the appropriate washer from the table below, and adjust until the clearance between the reverse idler gear and transmission case wall is within specification.

**Clearance:**

**0 — 0.5 mm (0 — 0.020 in)**



Washer	
Part number	Thickness mm (in)
803020151	0.4 (0.016)
803020152	1.1 (0.043)
803020153	1.5 (0.059)
803020154	1.9 (0.075)
803020155	2.3 (0.091)

# Shifter Fork and Rod

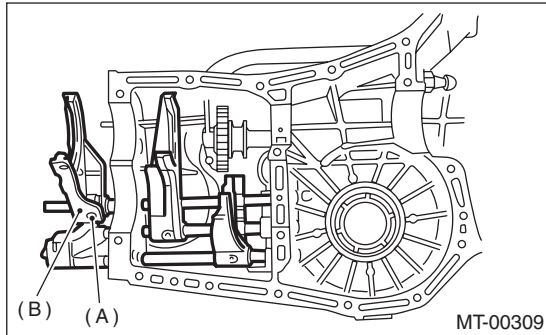
MANUAL TRANSMISSION AND DIFFERENTIAL

## 19. Shifter Fork and Rod

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>
- 2) Remove the back-up light switch and the neutral position switch. <Ref. to 5MT-35, REMOVAL, Switches and Harness.>
- 3) Remove the transfer case together with the extension case assembly. <Ref. to 5MT-38, REMOVAL, Transfer Case and Extension Case Assembly.>
- 4) Remove the transmission case. <Ref. to 5MT-51, REMOVAL, Transmission Case.>
- 5) Remove the drive pinion shaft assembly. <Ref. to 5MT-59, REMOVAL, Drive Pinion Shaft Assembly.>
- 6) Remove the main shaft assembly for single-range. <Ref. to 5MT-54, REMOVAL, Main Shaft Assembly for Single-range.>
- 7) Remove the front differential assembly. <Ref. to 5MT-68, REMOVAL, Front Differential Assembly.>
- 8) Drive out the straight pin by tapping with the ST, and pull out the 5th shifter fork.

ST 398791700 STRAIGHT PIN REMOVER



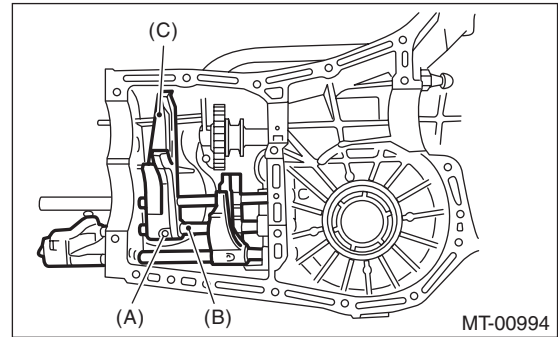
- (A) Straight pin
- (B) 5th shifter fork

- 9) Remove the plugs, springs and check balls.
- 10) Drive out the straight pin by tapping with the ST, and pull out the 3rd – 4th fork rod and shifter fork.

#### NOTE:

When removing the rod, keep other rods in neutral. Also, when pulling out the straight pin, remove it toward the inside of case so that it does not hit against the case.

ST 398791700 STRAIGHT PIN REMOVER



- (A) Straight pin
- (B) 3rd-4th fork rod
- (C) Shifter fork

- 11) Drive out the straight pin by tapping with the ST, and pull out the 1st – 2nd fork rod and shifter fork.

ST 398791700 STRAIGHT PIN REMOVER

- 12) Remove the snap ring (outer), and pull out the reverse fork rod from reverse fork rod arm. Then take out the ball, spring and interlock plunger from the rod.

And then remove the rod.

#### NOTE:

When pulling out the reverse fork rod arm, be careful not to let the ball pop out of arm.

- 13) Remove the reverse shifter lever.

# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: INSTALLATION

1) Install the reverse arm fork spring, ball and interlock plunger to the reverse fork rod arm. Insert the reverse fork rod into the hole of the reverse fork rod arm, and hold it with snap ring (outer) using ST.

#### NOTE:

Apply grease to plunger to prevent it from falling.

ST 399411700 ACCENT BALL INSTALLER

2) Position the ball, spring and new gasket in the reverse fork rod hole on the left side of transmission case, and tighten the checking ball plug.

3) Install the 1st-2nd fork rod into 1st-2nd shifter fork through the hole on the rear of transmission case.

4) Align the holes in the rod and the fork, and drive the new straight pin into these holes using the ST.

#### NOTE:

- Set other rods to neutral.
- Make sure the interlock plunger is on the 3rd-4th fork rod side.

ST 398791700 STRAIGHT PIN REMOVER

5) Attach the interlock plunger on 3rd-4th fork rod.

#### NOTE:

Apply grease to plunger to prevent it from falling.

6) Attach the 3rd-4th fork rod into 3rd-4th shifter fork through the hole on the rear of transmission case.

7) Align the holes in the rod and the fork, and drive the new straight pin into these holes.

#### NOTE:

- Set the reverse fork rod to neutral.
- Make sure the interlock plunger (before installation) is on the reverse fork rod side.

ST 398791700 STRAIGHT PIN REMOVER

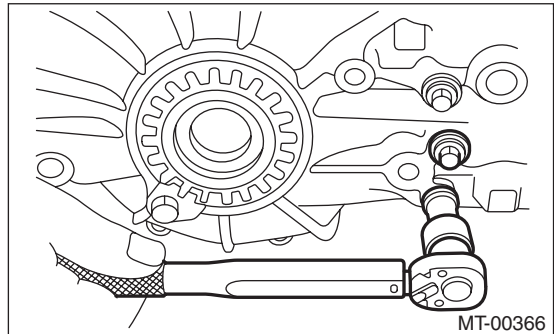
8) Install the 5th shifter fork onto the rear of reverse fork rod. Align the holes in the two parts and drive new straight pin into the specified place.

ST 398791700 STRAIGHT PIN REMOVER

9) Position the balls, check ball springs and new gaskets into holes of the 3rd-4th fork rods and 1st-2nd fork rods, and install the plugs.

#### Tightening torque:

**20 N·m (2.0 kgf·m, 14.8 ft·lb)**



10) Install the front differential assembly. <Ref. to 5MT-68, INSTALLATION, Front Differential Assembly.>

11) Install the main shaft assembly for single-range. <Ref. to 5MT-54, INSTALLATION, Main Shaft Assembly for Single-range.>

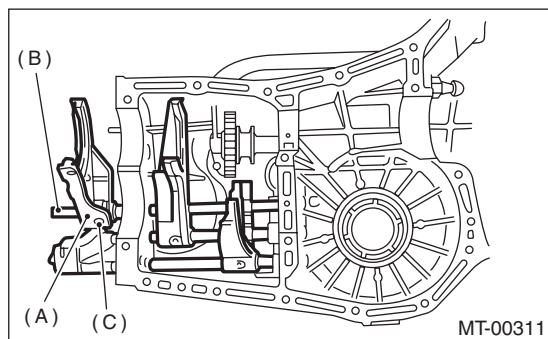
12) Install the drive pinion shaft assembly. <Ref. to 5MT-59, INSTALLATION, Drive Pinion Shaft Assembly.>

13) Install the transmission case. <Ref. to 5MT-52, INSTALLATION, Transmission Case.>

14) Install the transfer case together with the extension case assembly. <Ref. to 5MT-38, INSTALLATION, Transfer Case and Extension Case Assembly.>

15) Install the back-up light switch & neutral position switch. <Ref. to 5MT-36, INSTALLATION, Switches and Harness.>

16) Install the manual transmission assembly to the vehicle. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>



- (A) 5th shifter fork
- (B) Reverse fork rod
- (C) Straight pin

# Shifter Fork and Rod

## C: INSPECTION

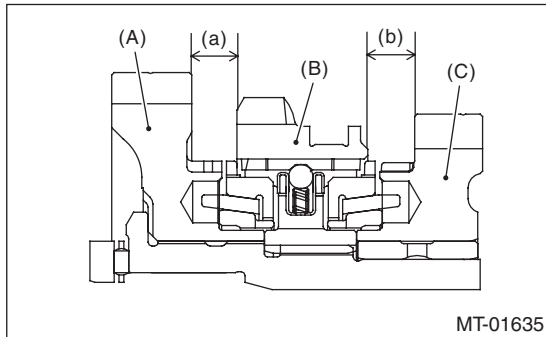
1) Check the fork and rod for damage. Replace if it is damaged.

2) Gearshift mechanism

Repair or replace the gearshift mechanism if excessively worn, bent or defective in any way.

3) Inspect the clearance between 1st, 2nd driven gear and reverse driven gear. If any clearance is not within specifications, replace the shifter fork as required.

**Clearance (a) and (b):**  
**9.5 mm (0.374 in)**

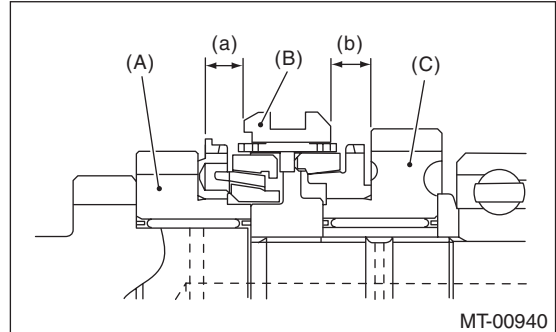


- (A) 1st driven gear
- (B) Reverse driven gear
- (C) 2nd driven gear

1st-2nd shifter fork		
Part number	Mark	Remarks
32804AA060	1	Approaches 1st gear by 0.2 mm (0.008 in).
32804AA070	—	Standard
32804AA080	3	Approaches 2nd gear by 0.2 mm (0.008 in).

4) Inspect the clearance between the 3rd, 4th drive gear and the coupling sleeve. If any clearance is not within specifications, replace the shifter fork as required.

**Clearance (a) and (b):**  
**7.3 mm (0.287 in)**



- (A) 3rd drive gear
- (B) Coupling sleeve
- (C) 4th drive gear

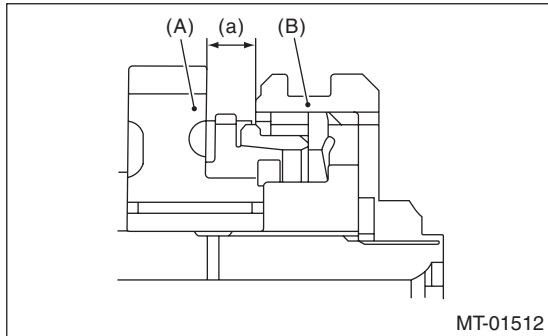
3rd-4th shifter fork		
Part number	Mark	Remarks
32810AA061	1	Approaches 4th gear by 0.2 mm (0.008 in).
32810AA071	—	Standard
32810AA101	3	Approaches 3rd gear by 0.2 mm (0.008 in).

# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

5) Inspect the clearance between 5th drive gear and coupling sleeve. If any clearance is not within specifications, replace the shifter fork as required.

**Clearance (a):**  
**9.3 mm (0.366 in)**



- (A) 5th drive gear
- (B) Coupling sleeve

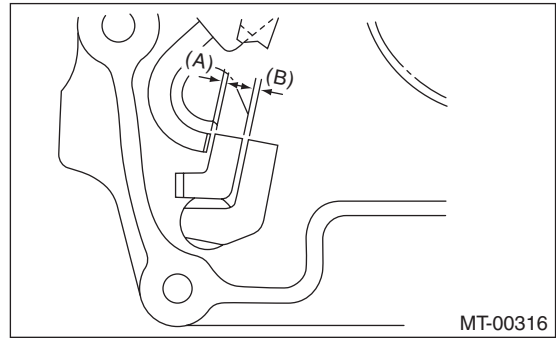
5th shifter fork (Non-turbo model), Identification paint (pink)		
Part number	Mark	Remarks
32812AA201	7	Approaches 5th gear by 0.2 mm (0.008 in).
32812AA211	No mark	Standard
32812AA221	9	Moves away from 5th gear by 0.2 mm (0.008 in).

5th shifter fork (Turbo model), Identification paint (blue)		
Part number	Mark	Remarks
32812AA231	7	Approaches 5th gear by 0.2 mm (0.008 in).
32812AA241	No mark	Standard
32812AA251	9	Moves away from 5th gear by 0.2 mm (0.008 in).

6) Inspect the rod end clearances (A) and (B). If any clearance is not within specifications, replace the rod or fork as required.

**Clearance (A):**  
**3rd-4th — 5th**  
**0.5 — 1.3 mm (0.020 — 0.051 in)**

**Clearance (B):**  
**1st-2nd — 3rd-4th**  
**0.4 — 1.4 mm (0.016 — 0.055 in)**



# General Diagnostic Table

MANUAL TRANSMISSION AND DIFFERENTIAL

## 20. General Diagnostic Table

### A: INSPECTION

#### 1. MANUAL TRANSMISSION

Symptom	Possible cause	Corrective action
1. Gears are difficult to intermesh. <b>NOTE:</b> The cause for difficulty in shifting gears can be classified into two kinds: One is a defective gear shift system and the other is defective transmission. However, if the operation is heavy and engagement of the gears is difficult, a defective clutch disengagement may also be responsible. Check whether the clutch is correctly functioning, before checking the gear shift system and transmission.	(a) Worn, damaged or burred chamfer at internal spline of the sleeve and reverse driven gear	Replace.
	(b) Worn, damaged or burred chamfer of gear spline	Replace.
	(c) Worn or scratched bushings	Replace.
	(d) Incorrect contact or wear between synchronizer ring and gear cone	Correct or replace.
2. Gear slip-out <ul style="list-style-type: none"> <li>• Gear slips out when coasting on rough road.</li> <li>• Gear slips out during acceleration.</li> </ul>	(a) Defective pitching stopper adjustment	Adjust.
	(b) Loose engine mounting bolts	Tighten or replace.
	(c) Worn fork shifter, broken shifter fork rail spring	Replace.
	(d) Worn or damaged ball bearing	Replace.
	(e) Excessive clearance between splines of synchronizer hub and synchronizer sleeve	Replace.
	(f) Worn tooth step of synchronizer hub (caused by slip-out of 3rd gear)	Replace.
	(g) Worn 1st driven gear and driven shaft	Replace.
	(h) Worn 2nd driven gear and bushing	Replace.
	(i) Worn 3rd drive gear and needle bearing	Replace.
	(j) Worn 4th drive gear and needle bearing	Replace.
	(k) Worn reverse idler gear and bushing	Replace.
3. Noise emitted from transmission <b>NOTE:</b> If a noise is heard when the vehicle is parked with its engine idling and if a noise ceases when the clutch is disengaged, it may be considered that the noise is coming from the transmission.	(a) Insufficient or improper lubrication	Lubricate with specified oil or replace.
	(b) Worn or damaged gears and bearings <b>NOTE:</b> If the trouble is only wear of the tooth surfaces, merely a high roaring noise will occur at high speeds, but if any part is broken, rhythmical knocking sound will be heard even at low speeds.	Replace.

# General Diagnostic Table

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. DIFFERENTIAL

Symptoms	Possible cause	Corrective action
<p>1. Broken differential (case, gear, bearing, etc.)</p> <p>NOTE: Noise will occur, and eventually the differential will not be able to operate due to broken pieces obstructing the gear revolution.</p>	(a) Insufficient or improper oil	Disassemble the differential and replace broken components. At the same time check other components for any trouble, and replace if necessary.
	(b) Use of vehicle under severe conditions such as excessive load and improper use of the clutch	Readjust the preload and backlash of the bearing, and the contact surface of gear.
	(c) Improper adjustment of taper roller bearing	Adjust.
	(d) Improper adjustment of the drive pinion and the hypoid driven gear	Adjust.
	(e) Excessive backlash of a vehicle under severe operating conditions due to worn differential side gear, washer or differential pinion.	Add recommended oil to the specified level. Do not use vehicle under severe operating conditions.
	(f) Loose hypoid driven gear tightening bolts	Tighten.
<p>2. Differential and hypoid gear noises</p> <p>Troubles of the differential and hypoid gear always appear as noise problems. Therefore noise is the first indication of trouble. However, noises from the engine, muffler, tire, exhaust gas, bearing, body, etc. are easily mistaken for the differential noise. Pay special attention to the hypoid gear noise because it is easily confused with other gear noises. There are the following four kinds of noises.</p> <ul style="list-style-type: none"> <li>• Gear noise when driving: If noise increases as the vehicle speed increases, it may be due to insufficient gear oil, incorrect gear engagement, damaged gears, etc.</li> <li>• Gear noise when coasting: Damaged gears due to misadjusted bearings and incorrect shim adjustment.</li> <li>• Bearing noise when driving or coasting: Cracked, broken or damaged bearings</li> <li>• Noise mainly when turning: Noise from differential side gear, differential pinion or differential pinion shaft, etc.</li> </ul>	(a) Insufficient oil	Lubricate.
	(b) Improper adjustment of hypoid driven gear and drive pinion	Check the tooth contact.
	(c) Worn teeth of hypoid driven gear and drive pinion	Replace as a set. Readjust the bearing preload.
	(d) Loose roller bearing	Readjust the backlash of the hypoid driven gear to drive pinion, and check the tooth contact.
	(e) Distorted hypoid driven gear or differential case	Replace.
	(f) Worn washer and differential pinion shaft	Replace.

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 1. General Description

#### A: SPECIFICATION

##### 1. MANUAL TRANSMISSION AND FRONT DIFFERENTIAL

Type		6-forward speeds and 1-reverse	
Transmission gear ratio	1st		3.636
	2nd		2.235
	3rd		1.521
	4th		1.137
	5th		0.891
	6th		0.707
	Rev.		3.545
Front reduction gear	Final	Type of gear	Hypoid
		Gear ratio	3.900
Rear reduction gear	Transfer	Type of gear	Helical
		Gear ratio	1.100
	Final	Type of gear	Hypoid
		Gear ratio	3.545
Front differential	Type and number of gear	Straight bevel gear (Bevel pinion: 4, Bevel gear: 2)	
Center differential	Type and number of gear	Straight bevel gear (Bevel pinion: 2, bevel gear: 2 and viscous coupling)	
Transmission gear oil		GL-5	
Transmission gear oil capacity		4.1 ℓ (4.3 US qt, 3.6 Imp qt)	

##### 2. TRANSMISSION GEAR OIL

**Recommended oil:**

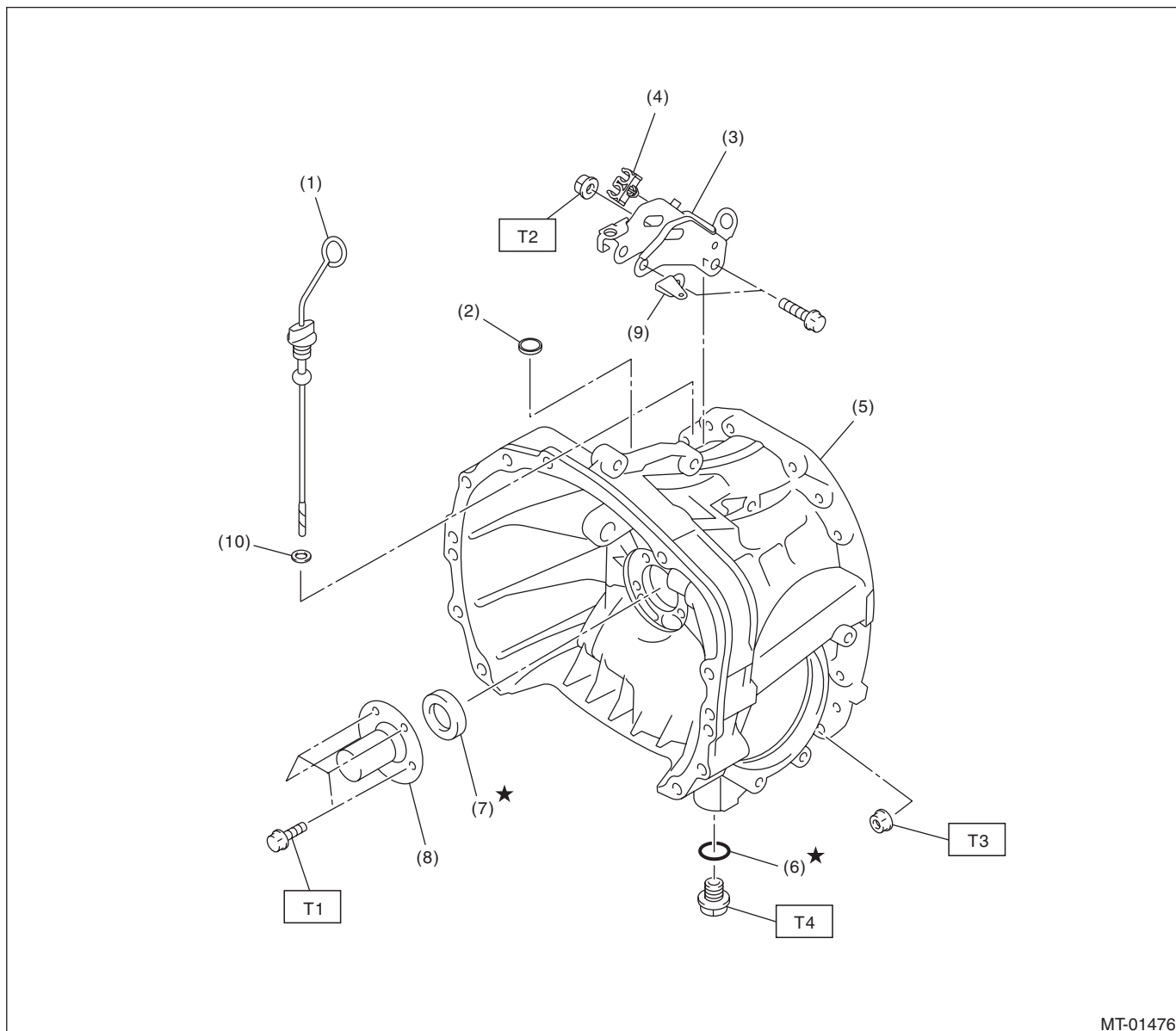
***GL-5 (75W-90) or equivalent***



# General Description

## B: COMPONENT

### 1. CLUTCH HOUSING



- |                              |                                  |
|------------------------------|----------------------------------|
| (1) Oil level gauge          | (6) Gasket                       |
| (2) Plug                     | (7) Oil seal                     |
| (3) Pitching stopper bracket | (8) Clutch release bearing guide |
| (4) Clip                     | (9) Return spring bracket        |
| (5) Clutch housing           | (10) O-ring                      |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 6.4 (0.65, 4.7)**

**T2: 41 (4.2, 30.2)**

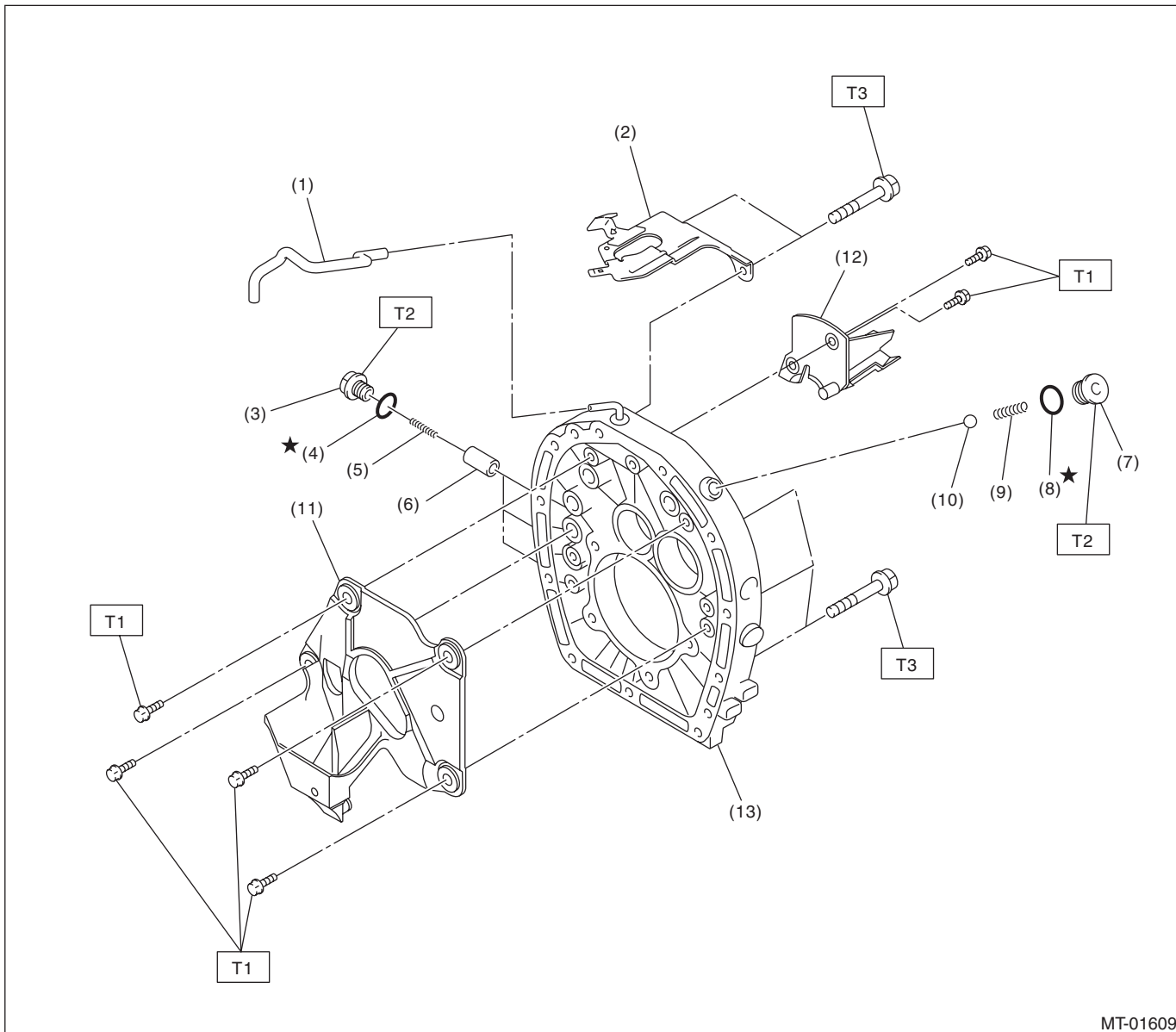
**T3: 50 (5.1, 36.9)**

**T4: 70 (7.1, 51.6)**

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. ADAPTER PLATE



MT-01609

- (1) Breather hose
- (2) Transmission harness stay
- (3) Check plug
- (4) O-ring
- (5) Check spring
- (6) Plunger

- (7) Check plug
- (8) O-ring
- (9) Check spring
- (10) Check ball
- (11) Oil guide A
- (12) Oil guide B

- (13) Adapter plate

**Tightening torque: N·m (kgf·m, ft·lb)**

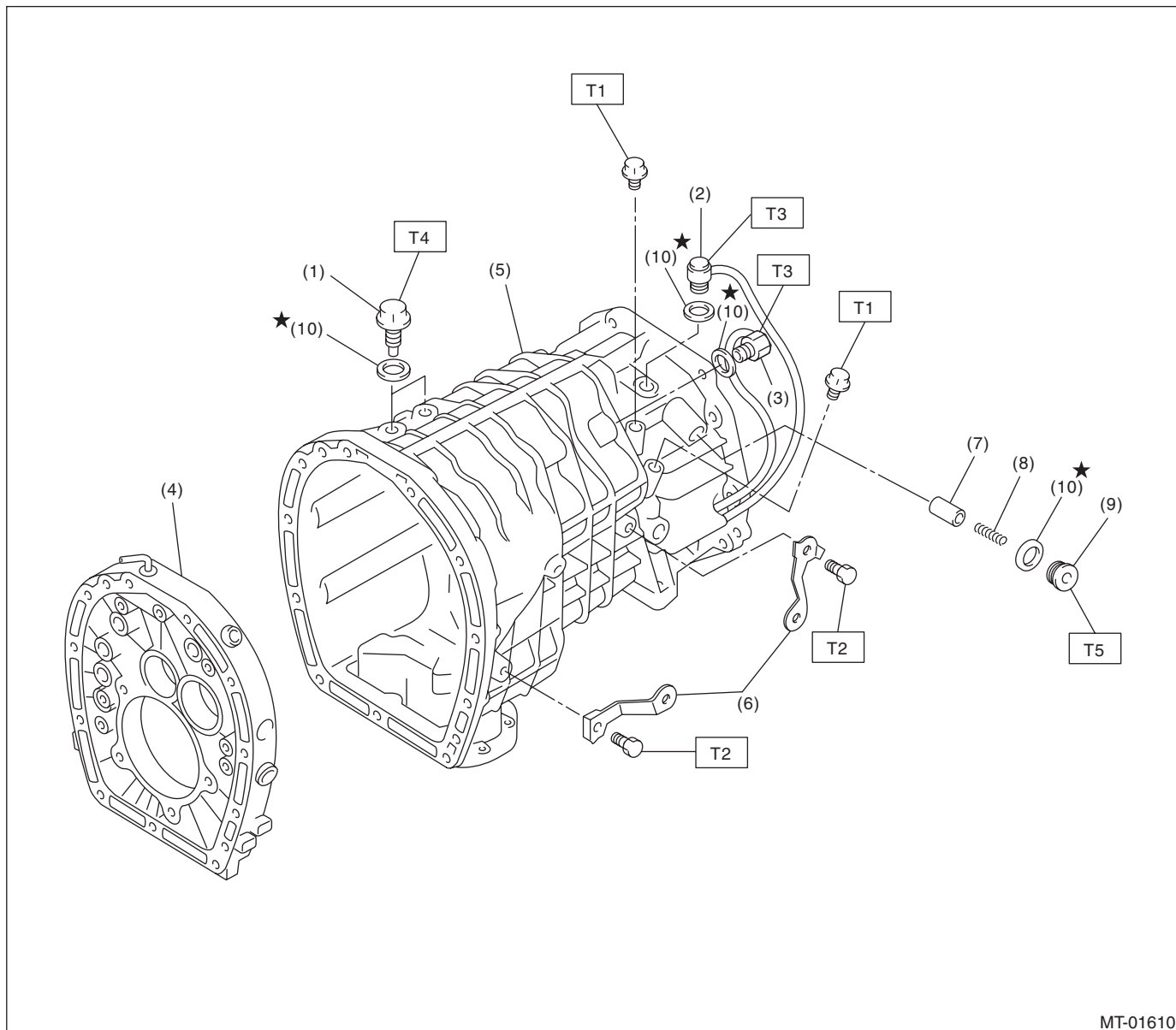
**T1: 18 (1.8, 13.3)**

**T2: 37 (3.8, 27.3)**

**T3: 50 (5.1, 36.9)**

# General Description

## 3. TRANSMISSION CASE



MT-01610

- |                          |                     |
|--------------------------|---------------------|
| (1) Pilot bolt           | (6) Harness bracket |
| (2) Neutral switch       | (7) Plunger         |
| (3) Back-up light switch | (8) Spring          |
| (4) Adapter plate        | (9) Plug            |
| (5) Transmission case    | (10) Gasket         |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 13 (1.3, 9.6)**

**T2: 16 (1.6, 11.8)**

**T3: 32 (3.3, 23.6)**

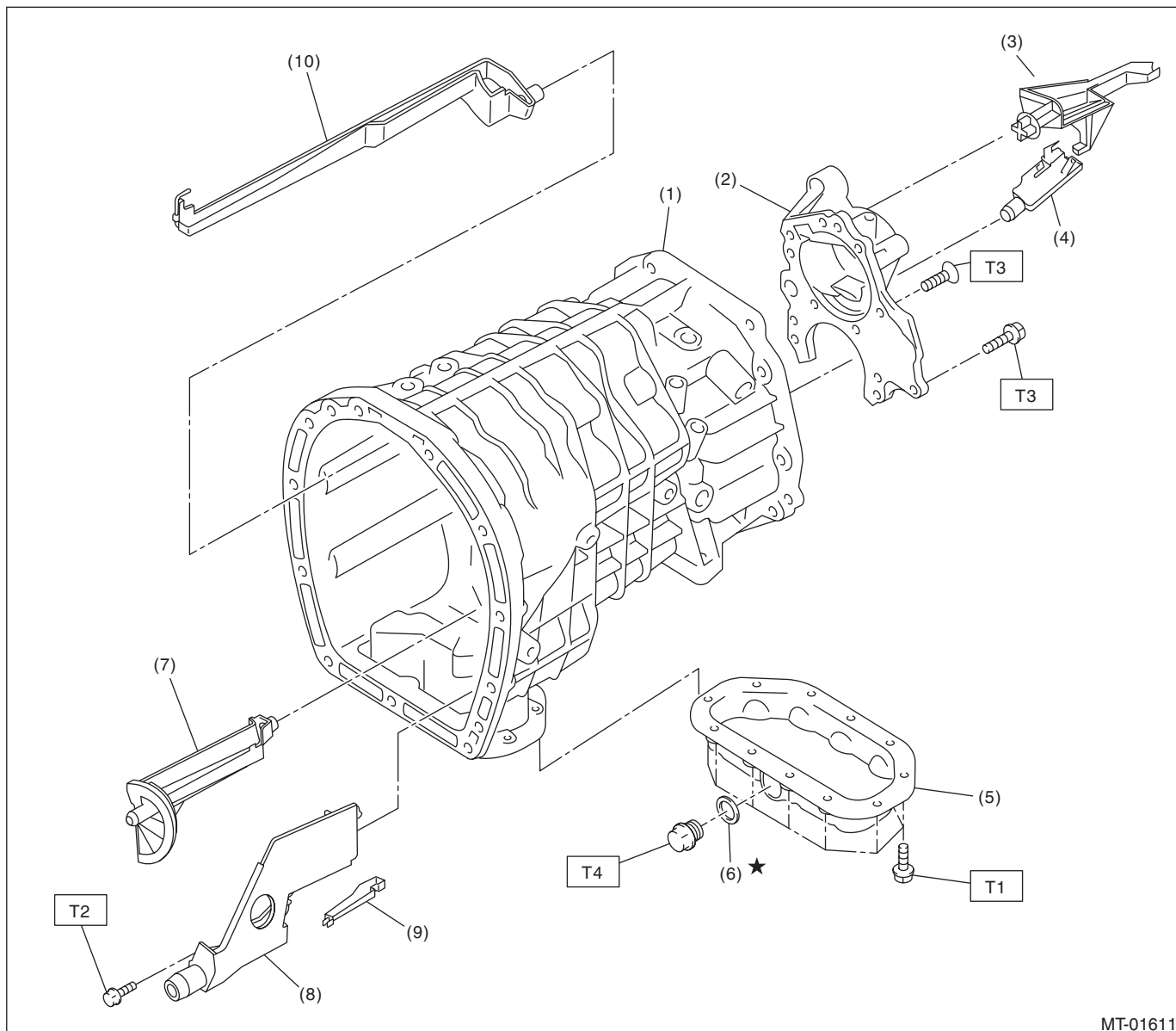
**T4: 34 (3.5, 25.1)**

**T5: 41 (4.2, 30.2)**

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 4. OIL PAN & OIL GUIDE



MT-01611

- |                             |                  |
|-----------------------------|------------------|
| (1) Transmission case       | (6) Gasket       |
| (2) Transfer bearing holder | (7) Oil guide F  |
| (3) Oil guide G             | (8) Oil guide D  |
| (4) Oil guide H             | (9) Oil guide E  |
| (5) Oil pan                 | (10) Oil guide C |

#### **Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 6.4 (0.65, 4.7)**

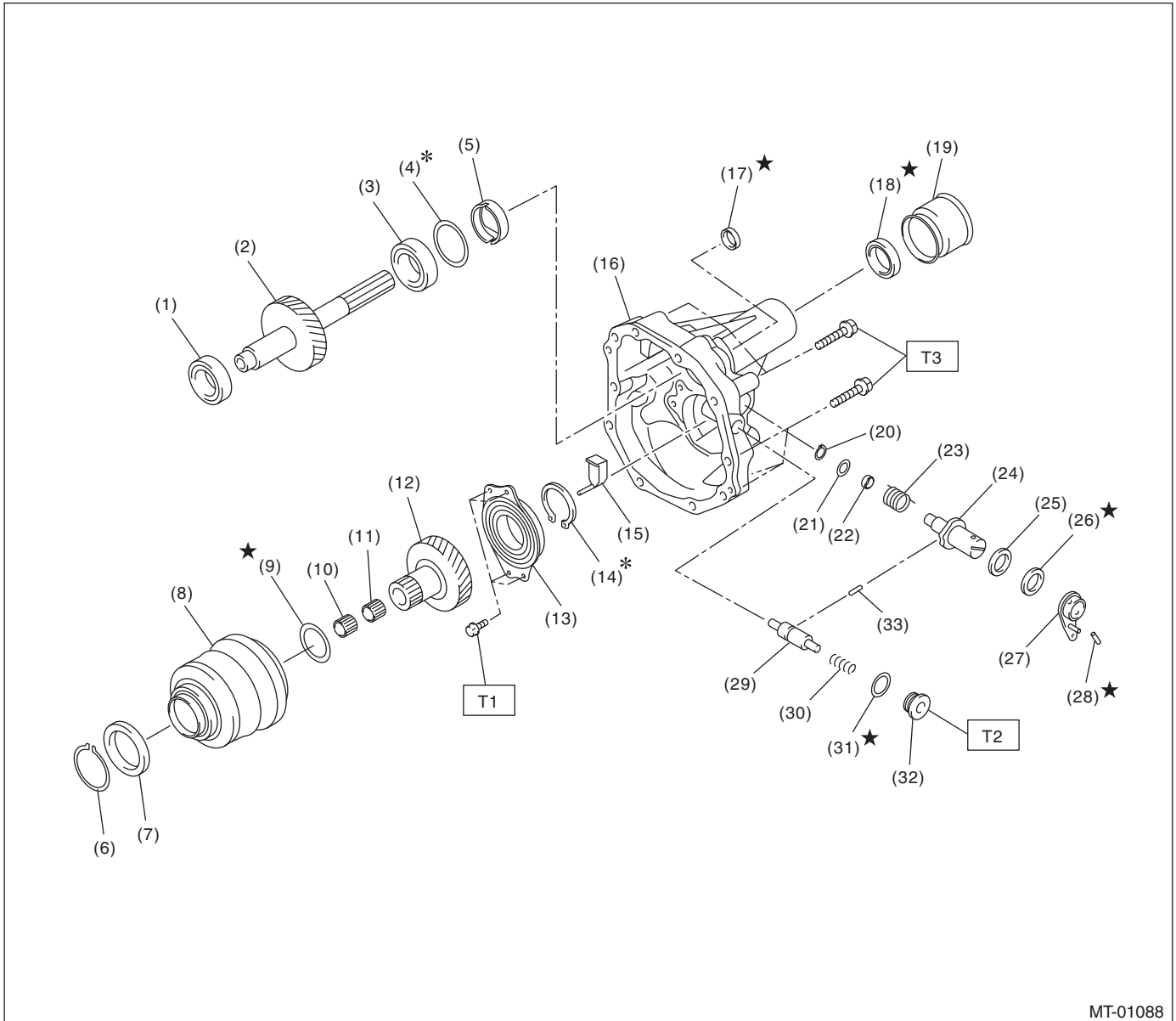
**T2: 18 (1.8, 13.3)**

**T3: 25 (2.5, 18.1)**

**T4: 44 (4.5, 32.5)**

# General Description

## 5. EXTENSION CASE AND CENTER DIFFERENTIAL



MT-01088

- |                                 |                          |                                |
|---------------------------------|--------------------------|--------------------------------|
| (1) Taper roller bearing        | (14) Snap ring           | (27) Reverse check lever COMPL |
| (2) Transfer driven gear        | (15) Oil guide           | (28) Straight pin              |
| (3) Taper roller bearing        | (16) Extension case      | (29) Reverse check plug        |
| (4) Shim                        | (17) Oil seal            | (30) Spring                    |
| (5) Oil plate                   | (18) Oil seal            | (31) Gasket                    |
| (6) Snap ring                   | (19) Dust cover          | (32) Plug                      |
| (7) Collar                      | (20) Snap ring           | (33) Plunger                   |
| (8) Center differential         | (21) Washer              |                                |
| (9) Shim                        | (22) Bushing             |                                |
| (10) Needle bearing             | (23) Spring              |                                |
| (11) Needle bearing             | (24) Reverse check shaft |                                |
| (12) Transfer drive gear        | (25) Ball bearing        |                                |
| (13) Ball bearing (with flange) | (26) Oil seal            |                                |

---

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 25 (2.5, 18.4)**

**T2: 41 (4.2, 30.2)**

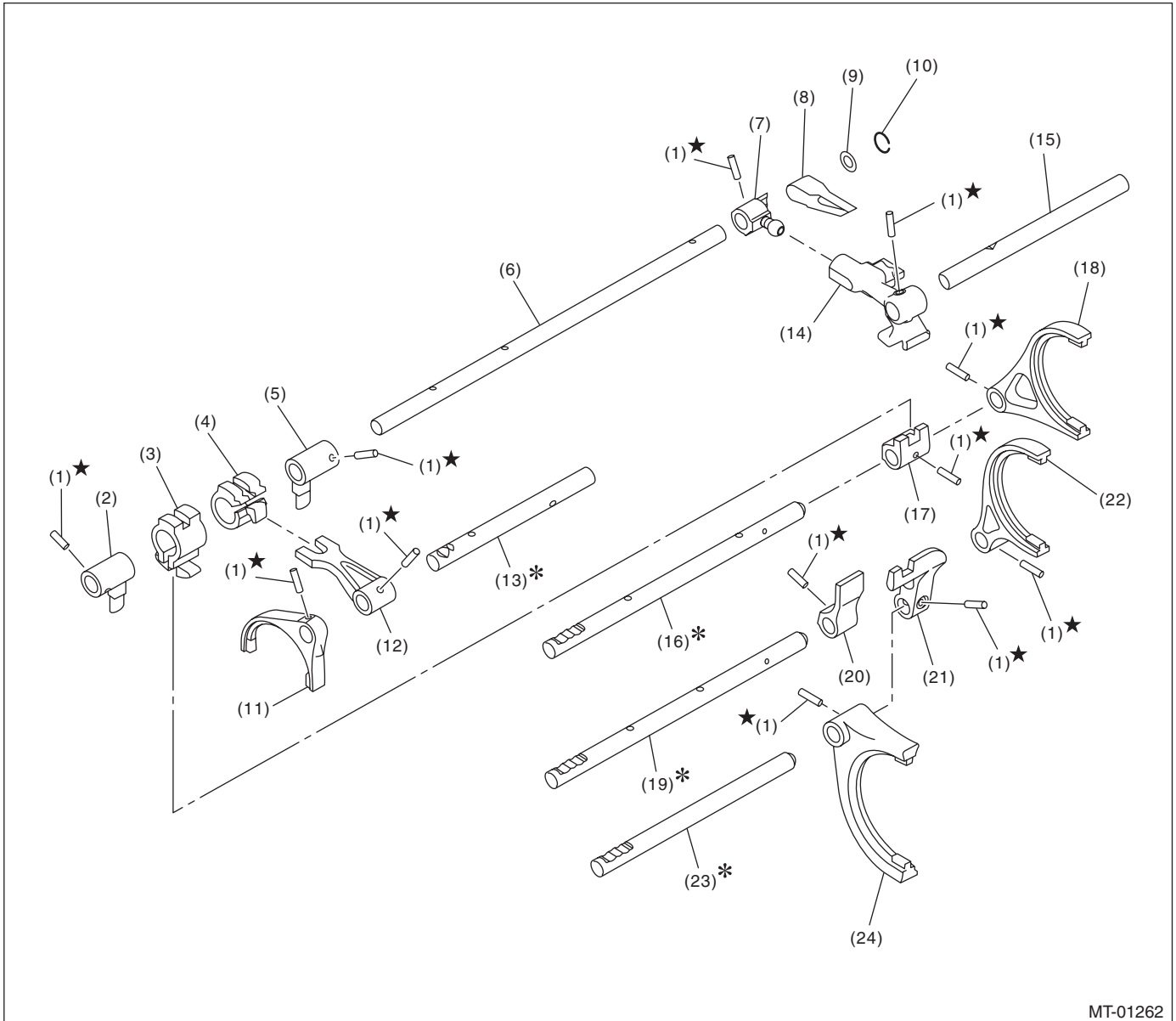
**T3: 48 (4.9, 35.4)**

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# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 6. SHIFTER FORK AND FORK ROD

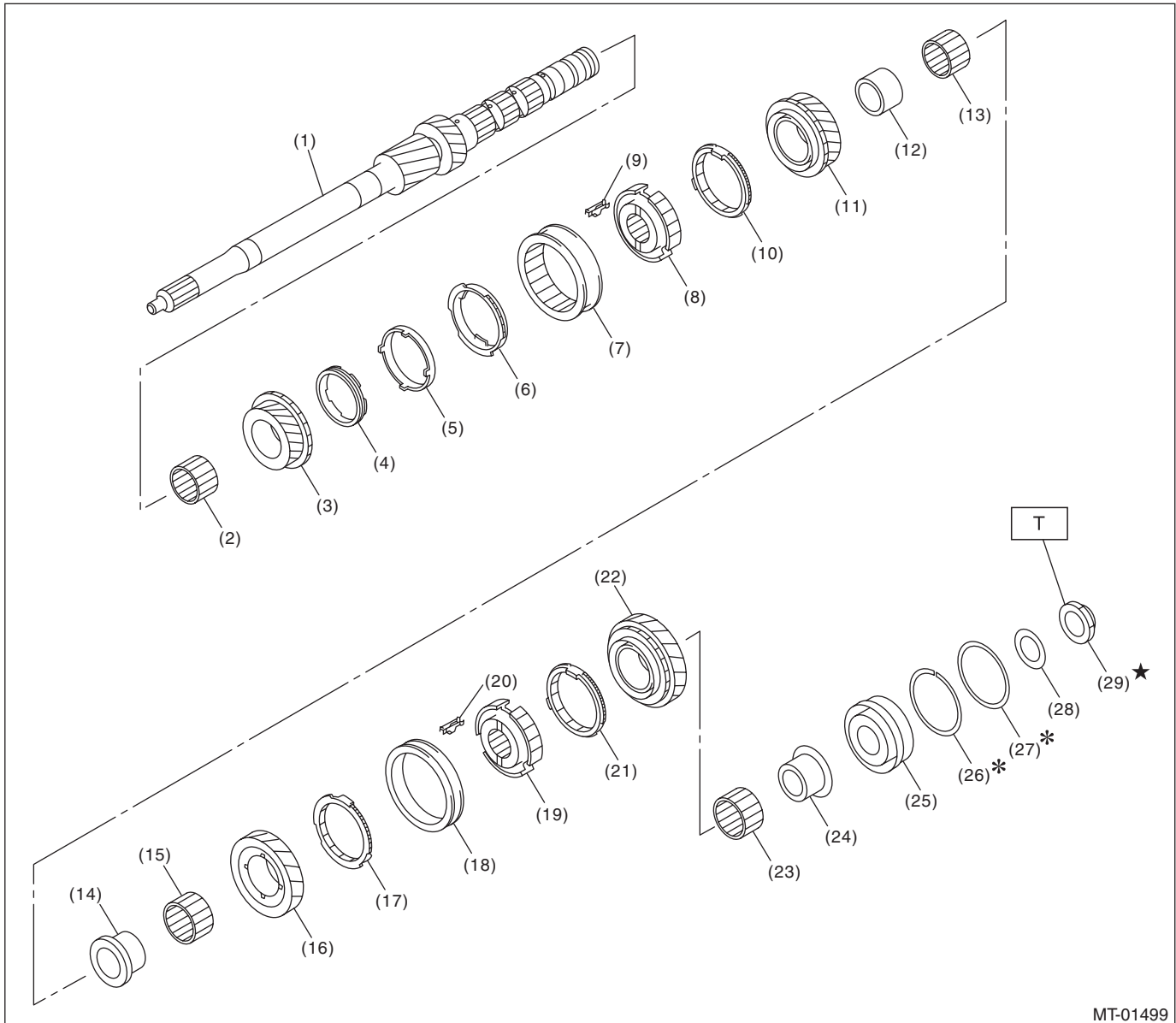


MT-01262

- |                             |                          |                          |
|-----------------------------|--------------------------|--------------------------|
| (1) Spring pin              | (9) Washer               | (17) 5th-6th shifter arm |
| (2) Interlock arm           | (10) Snap ring           | (18) 5th-6th fork COMPL  |
| (3) Interlock block         | (11) Reverse fork COMPL  | (19) 3rd-4th fork rod    |
| (4) Reverse interlock block | (12) Reverse shifter arm | (20) 3rd-4th shifter arm |
| (5) Interlock arm           | (13) Reverse fork rod    | (21) 1st-2nd shifter arm |
| (6) Striking rod            | (14) Selector arm        | (22) 3rd-4th fork COMPL  |
| (7) Selector arm No. 2      | (15) Shifter arm shaft   | (23) 1st-2nd fork rod    |
| (8) Neutral set spring      | (16) 5th-6th fork rod    | (24) 1st-2nd fork COMPL  |

# General Description

## 7. MAIN SHAFT ASSEMBLY



MT-01499

- |                      |                      |                           |
|----------------------|----------------------|---------------------------|
| (1) Main shaft       | (12) 4th bushing     | (23) Needle bearing       |
| (2) Needle bearing   | (13) Needle bearing  | (24) 6th bushing          |
| (3) 3rd drive gear   | (14) 5th bushing     | (25) Taper roller bearing |
| (4) Inner baulk ring | (15) Needle bearing  | (26) Snap ring            |
| (5) Synchro cone     | (16) 5th drive gear  | (27) Washer               |
| (6) Outer baulk ring | (17) 5th baulk ring  | (28) Washer               |
| (7) 3rd-4th sleeve   | (18) 5th-6th sleeve  | (29) Lock nut             |
| (8) 3rd-4th hub      | (19) 5th-6th hub     |                           |
| (9) Shifting insert  | (20) Shifting insert |                           |
| (10) 4th baulk ring  | (21) 6th baulk ring  |                           |
| (11) 4th gear        | (22) 6th drive gear  |                           |

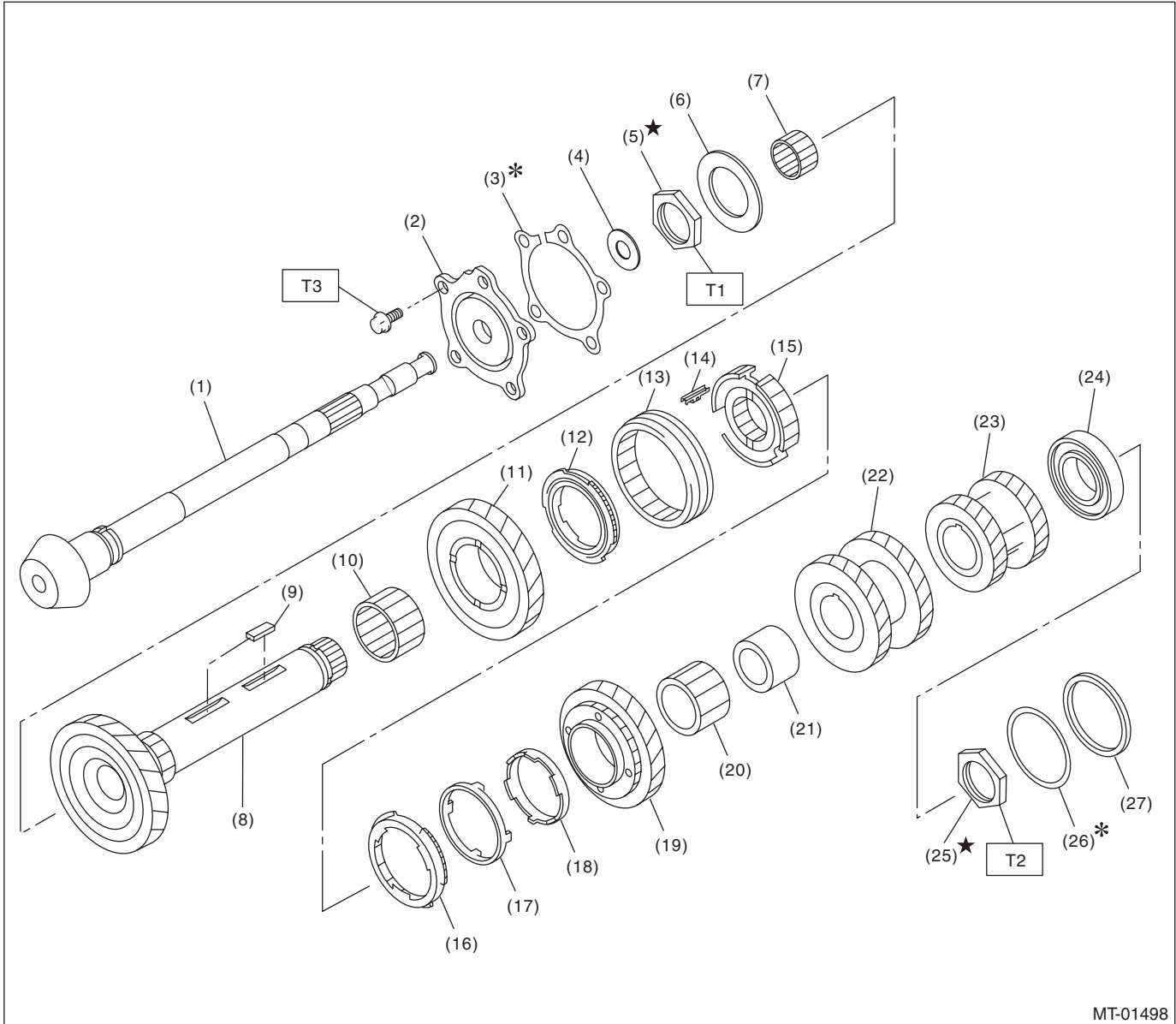
**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 392 (40.0, 289)**

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 8. DRIVE PINION AND DRIVE SHAFT ASSEMBLY



MT-01498

- |                            |                          |               |
|----------------------------|--------------------------|---------------|
| (1) Drive pinion shaft     | (13) 1st-2nd sleeve      | (25) Lock nut |
| (2) Taper roller bearing   | (14) Shifting insert     | (26) Shim     |
| (3) Shim                   | (15) 1st-2nd hub         | (27) Collar   |
| (4) Washer                 | (16) Outer baulk ring    |               |
| (5) Lock nut               | (17) Synchro cone        |               |
| (6) Thrust bearing         | (18) Inner baulk ring    |               |
| (7) Needle bearing         | (19) 2nd driven gear     |               |
| (8) Driven shaft           | (20) Needle bearing      |               |
| (9) Key                    | (21) 2nd bushing         |               |
| (10) Needle bearing        | (22) 3rd-4th driven gear |               |
| (11) 1st driven gear       | (23) 5th-6th driven gear |               |
| (12) 1st synchro ring ASSY | (24) Ball bearing        |               |

#### **Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 285 (29.1, 210)**

**\* 265 (27.0, 195)**

**T2: 570 (58.1, 420)**

**\* 530 (54.0, 391)**

**T3: 54 (5.5, 40)**

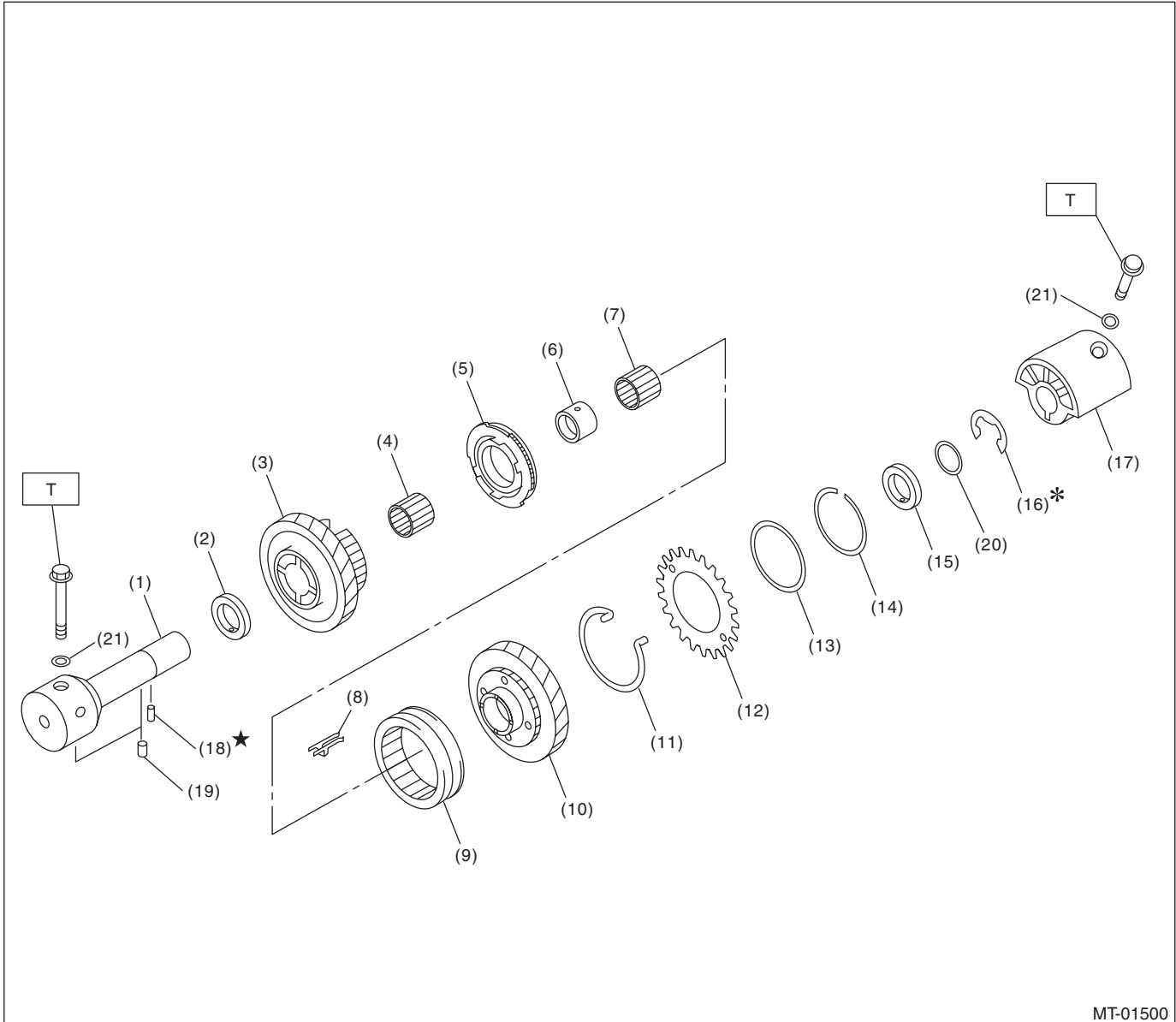
\* Tightening torque when using the ST



# General Description

MANUAL TRANSMISSION AND DIFFERENTIAL

## 9. REVERSE IDLER GEAR ASSEMBLY



MT-01500

- |                                 |                                  |                           |
|---------------------------------|----------------------------------|---------------------------|
| (1) Base COMPL                  | (9) Reverse coupling sleeve      | (17) Reverse idler holder |
| (2) Counter high and low washer | (10) Reverse idler gear          | (18) Spring pin           |
| (3) Reverse idler gear No. 2    | (11) Spring                      | (19) Knock pin            |
| (4) Needle bearing              | (12) Sub gear                    | (20) Washer               |
| (5) Reverse idler synchro set   | (13) Friction plate              | (21) Gasket               |
| (6) Reverse idler gear bushing  | (14) Snap ring                   |                           |
| (7) Needle bearing              | (15) Counter high and low washer |                           |
| (8) Shifting insert             | (16) Snap ring                   |                           |

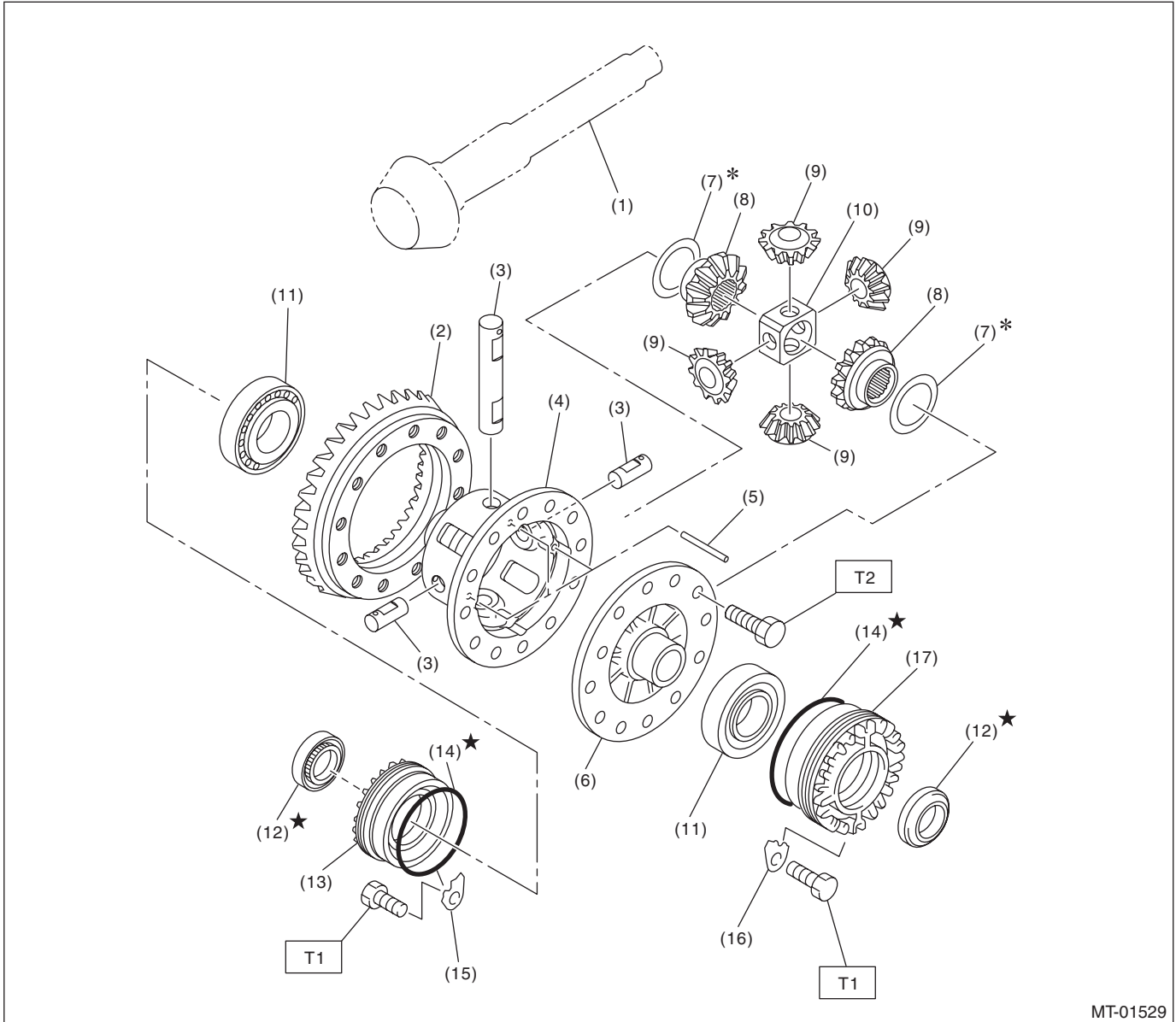
**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 25 (2.5, 18.1)**

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 10.FRONT DIFFERENTIAL



MT-01529

- |                          |                                    |                                    |
|--------------------------|------------------------------------|------------------------------------|
| (1) Drive pinion shaft   | (8) Differential bevel gear        | (15) Retainer lock plate RH        |
| (2) Hypoid driven gear   | (9) Differential bevel pinion      | (16) Retainer lock plate LH        |
| (3) Pinion shaft         | (10) Pinion shaft joint            | (17) Differential side retainer LH |
| (4) Differential case RH | (11) Roller bearing                |                                    |
| (5) Straight pin         | (12) Oil seal                      |                                    |
| (6) Differential case LH | (13) Differential side retainer RH |                                    |
| (7) Washer               | (14) O-ring                        |                                    |

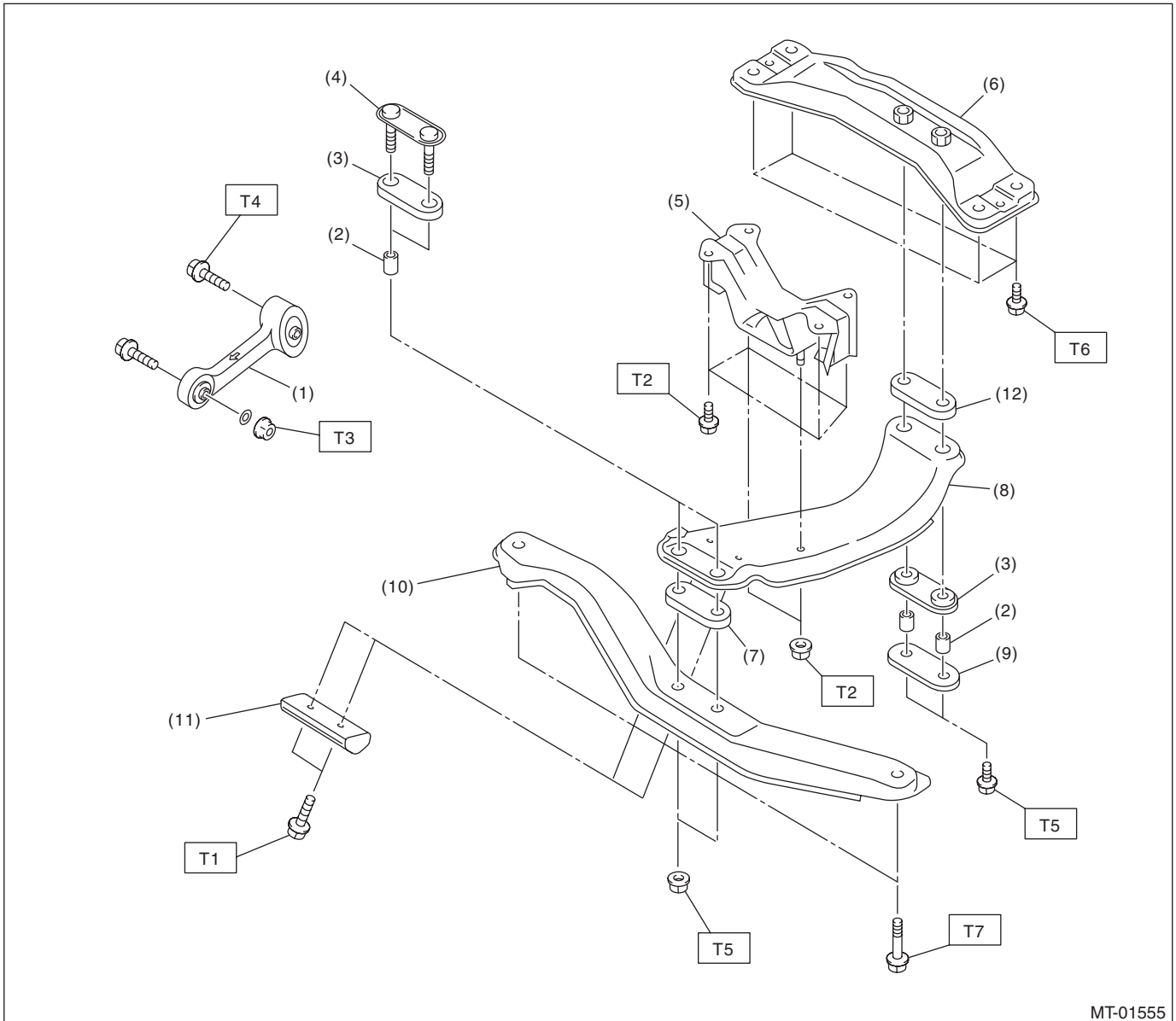
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 25 (2.5, 18.1)**

**T2: 69 (7.0, 50.9)**

# General Description

## 11. TRANSMISSION MOUNTING



MT-01555

- |                                 |                           |
|---------------------------------|---------------------------|
| (1) Pitching stopper            | (7) Upper cushion rubber  |
| (2) Spacer                      | (8) Center crossmember    |
| (3) Lower cushion rubber        | (9) Rear plate            |
| (4) Front plate                 | (10) Front crossmember    |
| (5) Transmission cushion rubber | (11) Dynamic damper       |
| (6) Rear crossmember            | (12) Upper cushion rubber |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.8, 5.5)**

**T2: 35 (3.6, 25.8)**

**T3: 50 (5.1, 36.9)**

**T4: 58 (5.9, 42.8)**

**T5: 70 (7.1, 51.6)**

**T6: 75 (7.5, 55.3)**

**T7: 140 (14.3, 103)**

## General Description

### MANUAL TRANSMISSION AND DIFFERENTIAL

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#### **C: CAUTION**

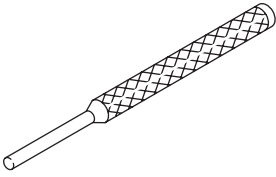
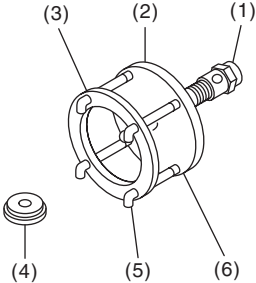
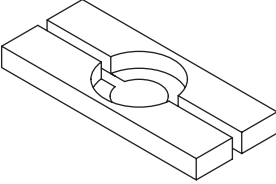
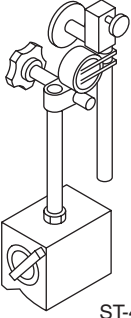
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- When disassembling the case and other light alloy parts, disassemble by using a plastic hammer. Do not pry apart with screwdrivers or other tools.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine transmission gear oil, grease or the equivalent. Do not mix transmission gear oil, grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply transmission gear oil onto sliding or revolving surfaces before installation.
- Replace deformed or damaged snap rings with new parts.
- Before installing O-rings or oil seals, apply sufficient amount of transmission gear oil to avoid damage and deformation.
- Be careful not to incorrectly install or fail to install O-rings, snap rings and other parts.
- Before securing a part on a vise, place cushioning materials such as wood blocks, aluminum plates, or waste cloth between the part and the vise.
- Avoid damaging the mating surface of the case.
- Before applying liquid gasket, completely remove the old liquid gasket.

# General Description

MANUAL TRANSMISSION AND DIFFERENTIAL

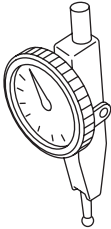
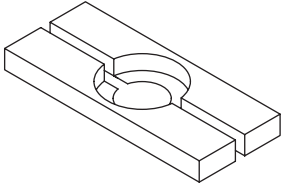
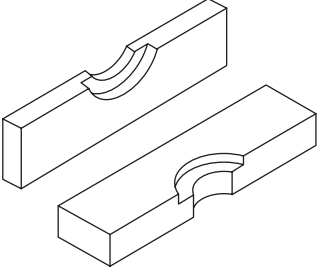
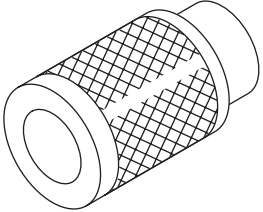
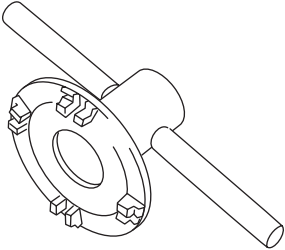
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-398791700</p>	398791700	REMOVER	Used for removing and installing the spring pin (6 mm).
 <p>ST-399527700</p>	399527700	PULLER SET	Used for removing and installing the roller bearing (Differential). (1) BOLT (899521412) (2) PULLER (399527702) (3) HOLDER (399527703) (4) ADAPTER (398497701) (5) BOLT (899520107) (6) NUT (021008000)
 <p>ST-498515700</p>	498515700	REMOVER	Used for removing the roller bearing of the drive pinion shaft.
 <p>ST-498247001</p>	498247001	MAGNET BASE	<ul style="list-style-type: none"> <li>Used for measuring backlash between the side gear, pinion, and hypoid gear.</li> <li>Used together with the DIAL GAUGE (498247100).</li> </ul>

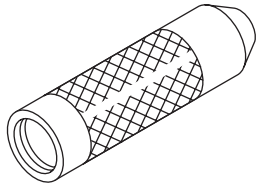
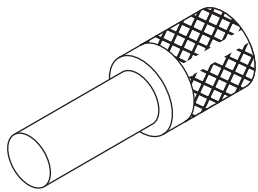
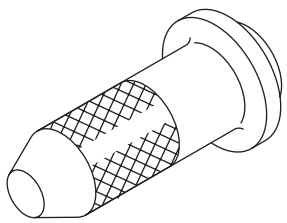
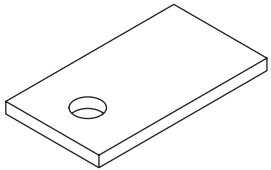
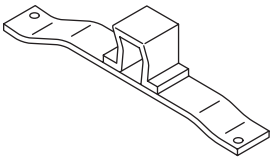
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498247100</p>	498247100	DIAL GAUGE	<ul style="list-style-type: none"> <li>• Used for measuring backlash between the side gear, pinion, and hypoid gear.</li> <li>• Used together with the MAGNET BASE (498247001).</li> </ul>
 <p style="text-align: center;">ST-498077000</p>	498077000	REMOVER	Used for removing the differential taper roller bearing.
 <p style="text-align: center;">ST-899858600</p>	899858600	REMOVER	Used for removing the roller bearing.
 <p style="text-align: center;">ST-499757002</p>	499757002	INSTALLER	Used for installing the bearing cone of the transfer driven gear (extension core side).
 <p style="text-align: center;">ST18630AA010</p>	18630AA010	WRENCH COMPL RETAINER	<ul style="list-style-type: none"> <li>• Used for removing and installing the differential side retainer RH.</li> <li>• WRENCH ASSEMBLY (499787000) can also be used.</li> </ul>

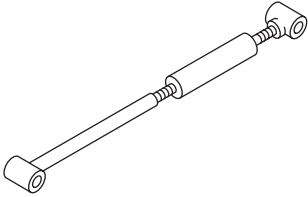
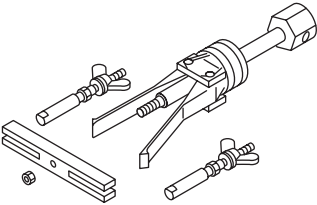
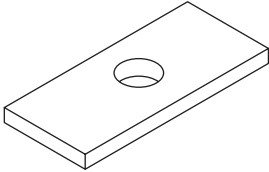
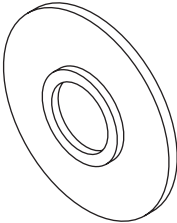
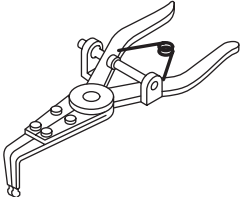
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499877000</p>	499877000	RACE 4-5 INSTALLER	Used for disassembling the driven shaft and transfer driven gear.
 <p>ST-899864100</p>	899864100	REMOVER	Used for removing the transmission main shaft and drive pinion parts.
 <p>ST-498057300</p>	498057300	INSTALLER	Used for installing the extension oil seal.
 <p>ST-498255400</p>	498255400	PLATE	Used for measuring backlash.
 <p>ST41099AA010</p>	41099AA010	ENGINE SUPPORT BRACKET	Used for supporting engine.

# General Description

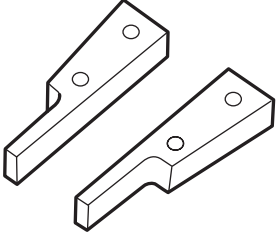
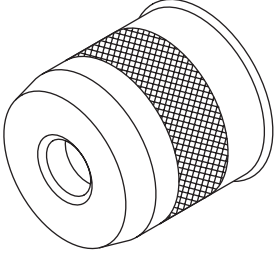
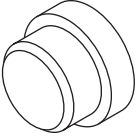
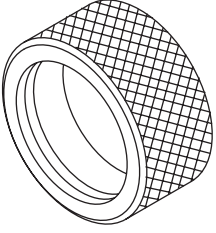
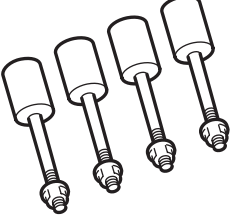
## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST41099AA020</p>	41099AA020	ENGINE SUPPORT	Used for supporting engine.
 <p style="text-align: center;">ST-398527700</p>	398527700	PULLER ASSY	Used for removing the extension case oil seal and the front side retainer bearing outer race.
 <p style="text-align: center;">ST-398643600</p>	398643600	GAUGE	Used for measuring the total end play, extension end play and drive pinion height.
 <p style="text-align: center;">ST-398177700</p>	398177700	INSTALLER	Used for assembling the main shaft.
 <p style="text-align: center;">ST-399893600</p>	399893600	PLIER	<ul style="list-style-type: none"> <li>• Used for removing and installing the neutral set spring.</li> <li>• Used together with the CLAW (18756AA000).</li> </ul>




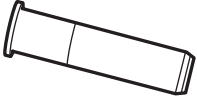
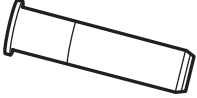
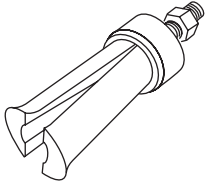
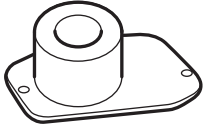
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18756AA000</p>	18756AA000	CLAW	<ul style="list-style-type: none"> <li>Used for removing and installing the neutral set spring.</li> <li>Used together with the PLIER (399893600).</li> </ul>
 <p>ST-499247400</p>	499247400	INSTALLER	Used for installing the ball bearing of the transfer drive gear.
 <p>ST-398497701</p>	398497701	SEATS	Used for installing the ball bearing of the transfer drive gear.
 <p>ST-398437700</p>	398437700	INSTALLER	Used for installing the front differential side bearing.
 <p>ST18632AA000</p>	18632AA000	STAND ASSY	Used for disassembling and assembling the transmission.

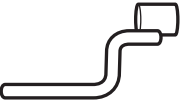


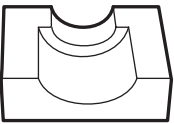
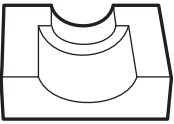
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18671AA000</p>	18671AA000	OIL SEAL GUIDE	<ul style="list-style-type: none"> <li>• Used for installing the oil seal to the reverse check.</li> <li>• Used together with the INSTALLER (18657AA010).</li> </ul>
 <p style="text-align: center;">ST18657AA010</p>	18657AA010	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the oil seal to the reverse check.</li> <li>• Used together with the OIL SEAL GUIDE (18671AA000).</li> </ul>
 <p style="text-align: center;">ST18657AA000</p>	18657AA000	INSTALLER	Used for installing the oil seal to the shift rod.
 <p style="text-align: center;">ST18758AA000</p>	18758AA000	PULLER	Used for removing the extension taper roller bearing outer race.
 <p style="text-align: center;">ST18831AA000</p>	18831AA000	GAUGE	Used for measuring the extension taper roller bearing.

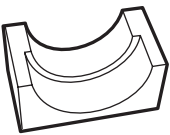
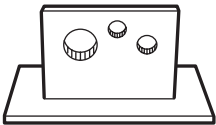

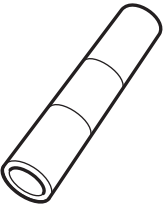
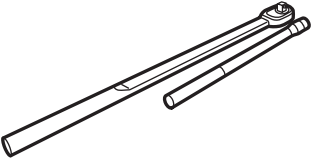
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18631AA000</p>	18631AA000	HANDLE	Used for measuring the front differential backlash.
 <p>ST18754AA000</p>	18754AA000	REMOVER	Used to remove parts of the driven gear.
 <p>ST18757AA000</p>	18757AA000	STRAIGHT PIN REMOVER	Used for installing the reverse idler gear.
 <p>ST18665AA000</p>	18665AA000	HOLDER	<ul style="list-style-type: none"> <li>Used for removing and installing the main shaft lock nut.</li> <li>Used together with the BASE (18664AA000).</li> </ul>
 <p>ST18666AA000</p>	18666AA000	HOLDER	<ul style="list-style-type: none"> <li>Used for removing and installing the driven shaft lock nut.</li> <li>Used together with the BASE (18664AA000).</li> </ul>




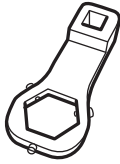
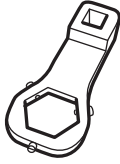
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18667AA000</p>	18667AA000	HOLDER	<ul style="list-style-type: none"> <li>• Used for removing and installing the drive pinion shaft lock nut.</li> <li>• Used together with the BASE (18664AA000).</li> </ul>
 <p style="text-align: center;">ST18664AA000</p>	18664AA000	BASE	<ul style="list-style-type: none"> <li>• Used for removing and installing the main shaft lock nut.</li> <li>• Used for removing and installing the drive pinion shaft lock nut.</li> <li>• Used for removing and installing the driven shaft lock nut.</li> </ul>
 <p style="text-align: center;">ST18722AA010</p>	18722AA010	REMOVER	Used for disassembling the main shaft.
 <p style="text-align: center;">ST18651AA000</p>	18651AA000	INSTALLER	Used for assembling the main shaft.
 <p style="text-align: center;">ST18852AA000</p>	18852AA000	TORQUE WRENCH	<ul style="list-style-type: none"> <li>• Used to tighten the main shaft lock nut.</li> <li>• Used to tighten the drive pinion shaft lock nut.</li> <li>• Used to tighten the driven shaft lock nut.</li> </ul>

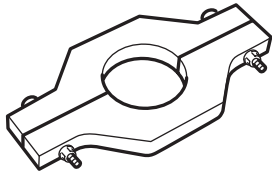
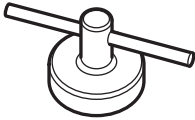
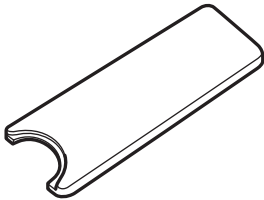
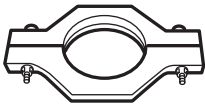
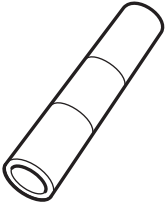
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18668AA000</p>	18668AA000	PUNCH	Used to crimp the main shaft lock nut.
 <p style="text-align: center;">ST18669AA000</p>	18669AA000	PUNCH	Used to crimp the driven shaft lock nut.
 <p style="text-align: center;">ST18670AA000</p>	18670AA000	PUNCH	Used to crimp the drive pinion shaft lock nut.
 <p style="text-align: center;">ST18620AA000</p>	18620AA000	ADAPTER WRENCH	Used for removing and installing the driven gear shaft lock nut.
 <p style="text-align: center;">ST18621AA000</p>	18621AA000	ADAPTER WRENCH	Used for removing and installing the drive pinion shaft lock nut.

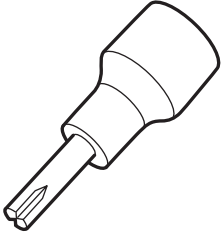
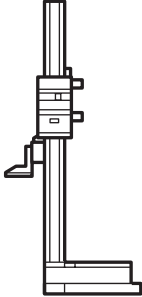
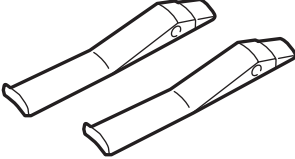
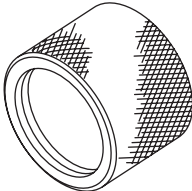
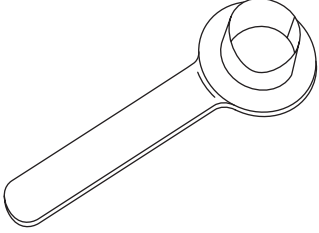
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18723AA000</p>	18723AA000	REMOVER	Used for disassembling the driven shaft.
 <p style="text-align: center;">ST18630AA000</p>	18630AA000	WRENCH ASSY	Used for removing and installing the differential side retainer LH.
 <p style="text-align: center;">ST18672AA000</p>	18672AA000	GUIDE CLIP	Used for installing the reverse idler snap ring.
 <p style="text-align: center;">ST18720AA000</p>	18720AA000	REMOVER	Used for disassembling the main shaft.
 <p style="text-align: center;">ST18654AA000</p>	18654AA000	INSTALLER	Used for assembling the driven shaft.

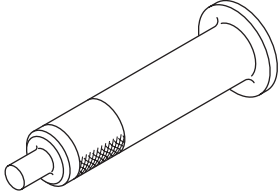
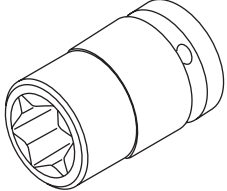
# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST18663AA000</p>	18663AA000	SOCKET	Used for removing and installing the transfer bearing holder.
 <p>ST18853AA000</p>	18853AA000	HEIGHT GAUGE	Used for selecting the shift rod.
 <p>ST18760AA000</p>	18760AA000	CLAW	<ul style="list-style-type: none"> <li>• Used for removing the front side retainer bearing outer race.</li> <li>• Used together with PULLER ASSY (398527700).</li> </ul>
 <p>ST18675AA000</p>	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.
 <p>ST28399SA010</p>	28399SA010	OIL SEAL PROTECTOR	Used for protecting oil seal when installing front drive shaft.

# General Description

## MANUAL TRANSMISSION AND DIFFERENTIAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18657AA020</p>	18657AA020	OIL SEAL INSTALLER	Used for installing the oil seal.
 <p style="text-align: center;">ST18270KA020</p>	18270KA020	SOCKET (E20)	Used for removing and installing the hypoid driven gear.

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
TORX® bit T70	Used for removing and installing transmission gear oil drain plug.
Depth gauge	Used for measuring the transmission end play.



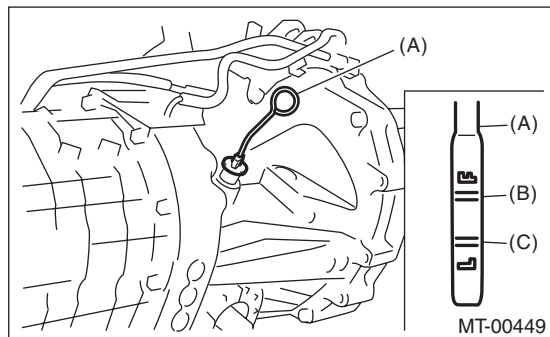
# Transmission Gear Oil

MANUAL TRANSMISSION AND DIFFERENTIAL

## 2. Transmission Gear Oil

### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Turn the ignition switch to OFF, and wait until the engine cools.
- 3) Remove the oil level gauge and wipe it clean.
- 4) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted in the proper direction.
- 5) Pull out the oil level gauge again, and check the oil level. If it is at the lower level or less, add oil through the oil level gauge hole to bring the level up to the upper level.



- (A) Oil level gauge
- (B) Upper level
- (C) Lower level

### B: REPLACEMENT

- 1) Pull out the oil level gauge.
- 2) Lift up the vehicle.
- 3) Drain transmission gear oil completely.

#### CAUTION:

**Immediately after the engine has been running, the transmission gear oil is hot. Be careful not to burn yourself.**

#### NOTE:

- Tighten the drain plug of the transmission gear oil after draining the transmission gear oil.
- Be sure to use a new gasket.
- Use TORX® bit T70 to remove and install the drain plug on clutch housing side.

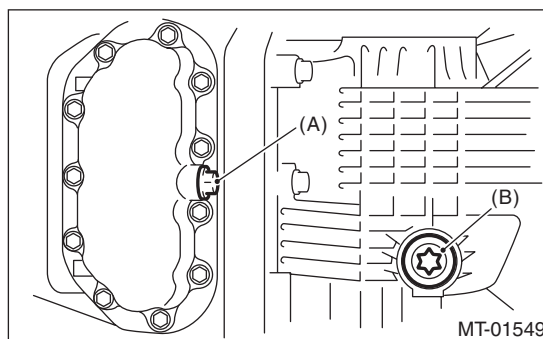
#### Tightening torque:

##### Oil pan side

**44 N·m (4.5 kgf-m, 32.5 ft-lb)**

##### Clutch housing side

**70 N·m (7.1 kgf-m, 51.6 ft-lb)**



- (A) Drain plug (Oil pan side)
- (B) Drain plug (Clutch housing side)

- 4) Lower the vehicle.
- 5) Pour transmission gear oil through the gauge hole.

#### Recommended gear oil

**GL-5 (75W-90) or equivalent**

#### Transmission gear oil capacity

**4.1 ℓ (4.3 US qt, 3.6 Imp qt)**

- 6) Check the level of the transmission gear oil.

#### NOTE:

- When inserting the level gauge into the transmission gear, align the protrusion on the top of the level gauge with the notch in the gauge hole.
- Keep the transmission gear oil level to be between the range marked on the level gauge.

### 3. Oil Seal

#### A: INSPECTION

Inspect for oil leakage from the oil seal. If there is any deformation, hardening, wear or other malfunctions of the oil seal, perform the following:

- Replace the oil seal.
- Inspect the propeller shaft.

#### B: REPLACEMENT

- 1) Clean the transmission exterior.
- 2) Drain transmission gear oil completely.

#### NOTE:

- Tighten the drain plug after draining the transmission gear oil.
- Be sure to use a new gasket.
- Use TORX® bit T70 to remove and install the drain plug on clutch housing side.

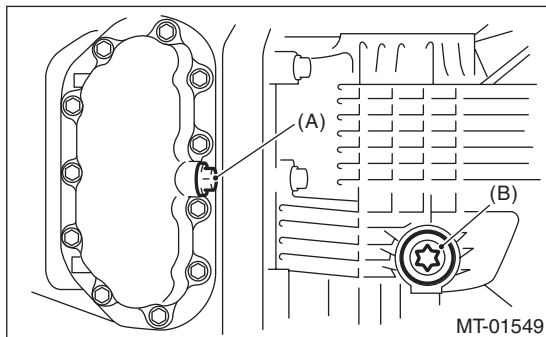
#### Tightening torque:

##### Oil pan side

**44 N·m (4.5 kgf-m, 32.5 ft-lb)**

##### Clutch housing side

**70 N·m (7.1 kgf-m, 51.6 ft-lb)**

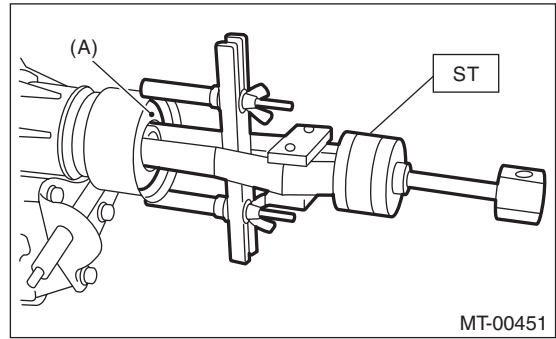


(A) Drain plug (Oil pan side)

(B) Drain plug (Clutch housing side)

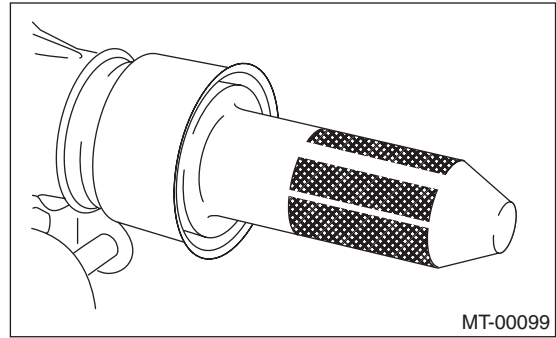
- 3) Remove the rear exhaust pipe and muffler.
- 4) Remove the heat shield cover. (If equipped)
- 5) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

- 6) Using the ST, remove the oil seal.  
ST 398527700 PULLER ASSY



(A) Oil seal

- 7) Using the ST, install the oil seal.  
ST 498057300 INSTALLER



- 8) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 9) Install the heat shield cover. (If equipped)
- 10) Install the rear exhaust pipe and muffler.
- 11) Pour in transmission gear oil and check the oil level. <Ref. to 6MT-27, REPLACEMENT, Transmission Gear Oil.>

## 4. Differential Side Retainer Oil Seal

### A: INSPECTION

Check that there is no oil leaking from the differential side retainer oil seal. If there is oil leakage, perform the following procedures.

- Replace the oil seal.
- Check the front drive shaft.

### B: REPLACEMENT

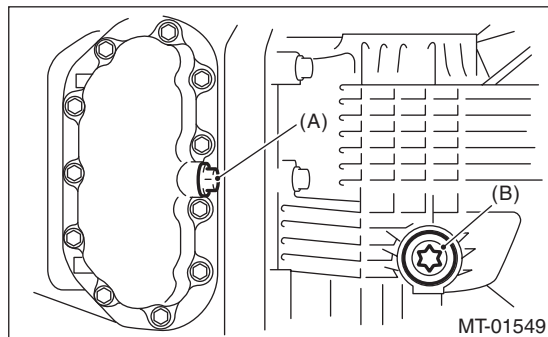
- 1) Lift up the vehicle.
- 2) Remove the front exhaust pipe and center exhaust pipe. <Ref. to EX(H4DOTC)-6, REMOVAL, Front Exhaust Pipe.>
- 3) Remove the drain plug and completely drain the transmission gear oil.

#### CAUTION:

- **Immediately after the vehicle has been running or after idling for a long time, the transmission gear oil will be hot. Be careful not to burn yourself.**
- **Be careful not to spill the transmission gear oil on exhaust pipe to prevent it from emitting smoke or causing fires. If transmission gear oil is spilled on the exhaust pipe, wipe it off completely.**

#### NOTE:

Use TORX® bit T70 to remove the drain plug on clutch housing side.



- (A) Drain plug (Oil pan side)  
 (B) Drain plug (Clutch housing side)

- 4) Tighten the drain plug.

#### NOTE:

- Use a new gasket.
- Use TORX® bit T70 to install the drain plug on clutch housing side.

#### Tightening torque:

##### Oil pan side

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**

##### Clutch housing side

**70 N·m (7.1 kgf·m, 51.6 ft·lb)**

- 5) Separate the front drive shaft from the transmission. <Ref. to DS-23, REMOVAL, Front Drive Shaft.>

- 6) Remove the differential side retainer oil seal by using a flat tip screwdriver or similar tools.

- 7) Using the ST, install the differential side retainer oil seal by lightly tapping with a hammer.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

- 8) Apply transmission gear oil to the oil seal lips.

- 9) Set the ST to the side retainer.

ST 28399SA010 OIL SEAL PROTECTOR

- 10) Install the front drive shaft into the transmission.

#### NOTE:

Replace the circlip of drive shaft with a new part.

- 11) Install the front drive shaft into transmission, remove the ST and insert the drive shaft securely.

ST 28399SA010 OIL SEAL PROTECTOR

- 12) Install the front exhaust pipe and the center exhaust pipe. <Ref. to EX(H4DOTC)-7, INSTALLATION, Front Exhaust Pipe.>

- 13) Lower the vehicle.

- 14) Fill with transmission gear oil through the oil level gauge hole.

#### Recommended gear oil:

**GL-5 (75W-90) or equivalent**

#### Transmission gear oil capacity:

**4.1 ℓ (4.3 US qt, 3.6 Imp qt)**

- 15) Check the level of the transmission gear oil. <Ref. to 6MT-27, INSPECTION, Transmission Gear Oil.>

# Transmission Mounting System

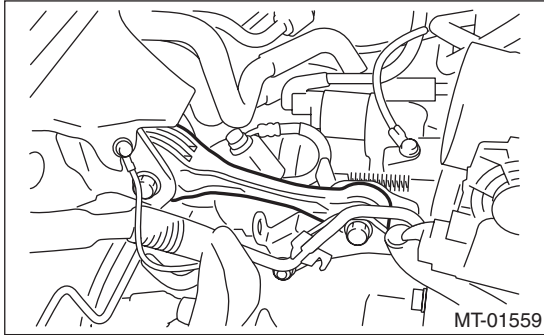
MANUAL TRANSMISSION AND DIFFERENTIAL

## 5. Transmission Mounting System

### A: REMOVAL

#### 1. PITCHING STOPPER

- 1) Disconnect the ground cable from battery.
- 2) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Remove the pitching stopper.



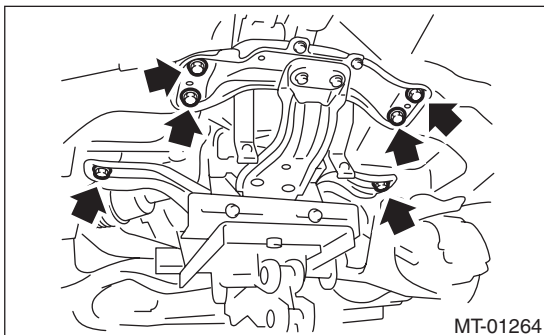
#### 2. CROSSMEMBER AND CUSHION RUBBER

- 1) Disconnect the ground cable from battery.
- 2) Lift up the vehicle.
- 3) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 4) Remove the rear exhaust pipe and muffler.
- 5) Remove the heat shield cover. (If equipped)
- 6) Set the transmission jack under the transmission body.

#### CAUTION:

Always support the transmission case with a transmission jack.

- 7) Remove the front and rear crossmembers.



- 8) Remove the transmission cushion rubber.

### B: INSTALLATION

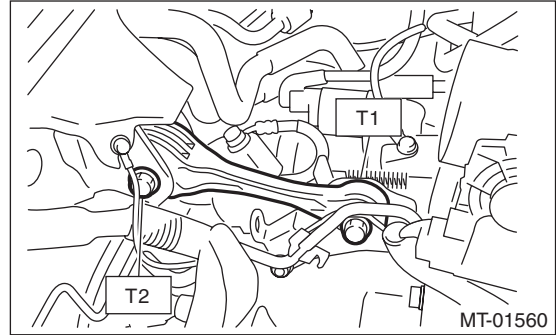
#### 1. PITCHING STOPPER

- 1) Install the pitching stopper.

#### Tightening torque:

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)**



- 2) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 3) Connect the battery ground cable to the battery.

#### 2. CROSSMEMBER AND CUSHION RUBBER

- 1) Install the transmission cushion rubber.

#### Tightening torque:

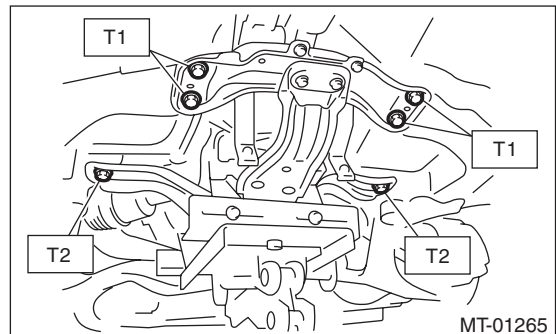
**35 N·m (3.6 kgf-m, 25.8 ft-lb)**

- 2) Install the front crossmember and rear crossmember.

#### Tightening torque:

**T1: 75 N·m (7.6 kgf-m, 55.3 ft-lb)**

**T2: 140 N·m (14.3 kgf-m, 103 ft-lb)**



- 3) Remove the transmission jack.
- 4) Install the heat shield cover. (If equipped)
- 5) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>
- 6) Install the rear exhaust pipe and muffler.

## **C: INSPECTION**

Perform the following inspection procedures and repair or replace faulty parts.

### **1. PITCHING STOPPER**

Check the pitching stopper for bends or damage. Check that the rubber is not stiff, cracked or otherwise damaged.

### **2. CROSSMEMBER AND CUSHION RUBBER**

Check crossmember for bends or damage. Check that the cushion rubber is not stiff, cracked, or otherwise damaged.

# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 6. Manual Transmission Assembly

#### A: REMOVAL

1) Set the vehicle on a lift. Open the front hood, and support it with the stay.

##### NOTE:

Set the hood stay into the specified hole.

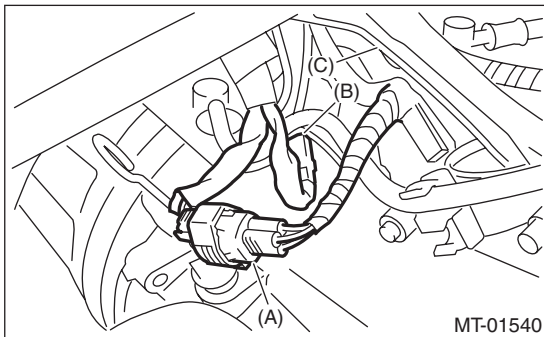
2) Disconnect the ground cable from battery.

3) Remove the collector cover.

4) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>

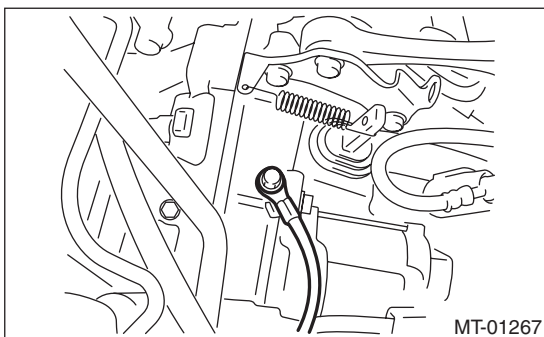
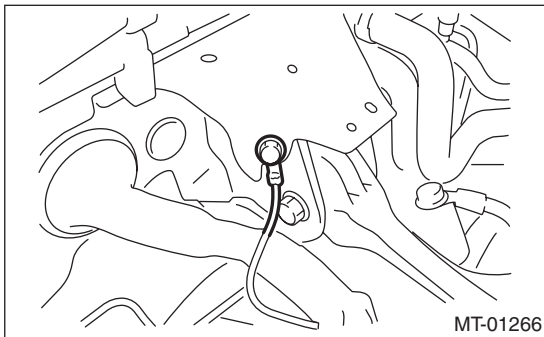
5) Remove the front wheels.

6) Disconnect the following harness connectors, and then remove the engine hanger rear.



- (A) Neutral position switch backup light switch connector
- (B) Rear oxygen sensor connector
- (C) Pitching stopper

7) Disconnect the ground cable on the upper side of the transmission case and body.

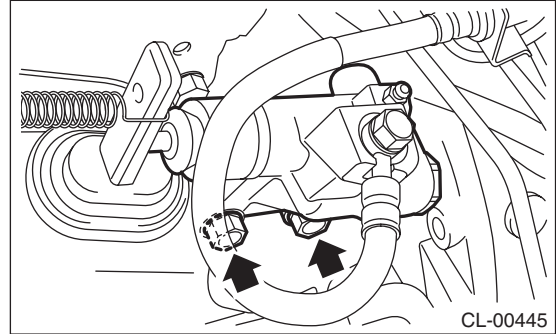


8) Remove the starter assembly. <Ref. to SC(H4SO)-6, REMOVAL, Starter.>

9) Remove the operating cylinder from the transmission.

##### NOTE:

Hang the removed operating cylinder with a piece of wire.

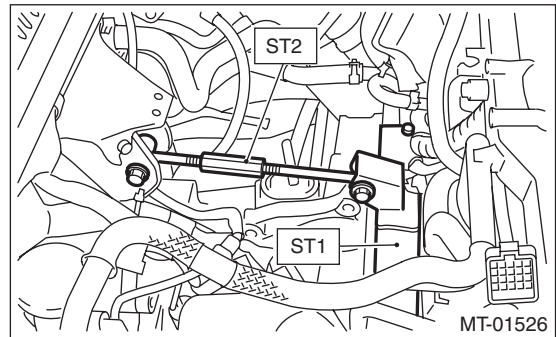


10) Remove the pitching stopper and pitching stopper bracket.

11) Set the ST.

ST1 41099AA010 ENGINE SUPPORT BRACKET

ST2 41099AA020 ENGINE SUPPORT



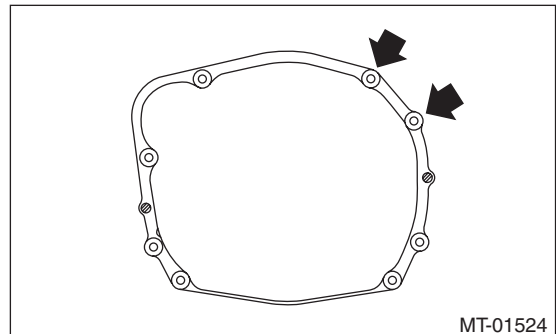
12) Remove the clutch release shaft.

(1) Remove the plug using a hexagon wrench.

(2) Attach a 6 mm (0.24 in) bolt to the release shaft, and pull out the release shaft.

(3) Lift the release fork, and remove from the claw of the release bearing. Pull the release fork to the engine side, and make it so that it moves freely.

13) Remove the bolts which hold upper side of transmission to engine.



# Manual Transmission Assembly

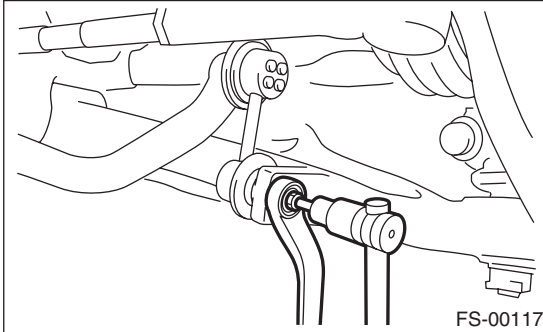
## MANUAL TRANSMISSION AND DIFFERENTIAL

- 14) Lift up the vehicle.
- 15) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
- 16) Remove the rear exhaust pipe and muffler.

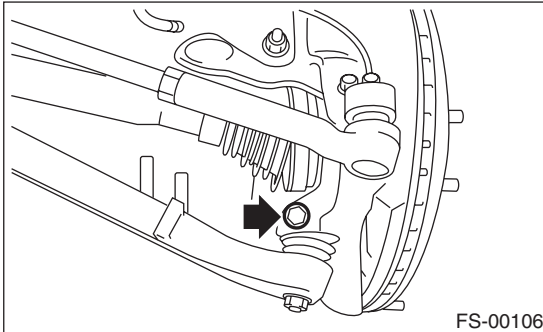
### CAUTION:

**When removing the exhaust pipes, be careful each exhaust pipe does not drop out.**

- 17) Remove the heat shield cover. (If equipped)
- 18) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 19) Remove the front stabilizer link.

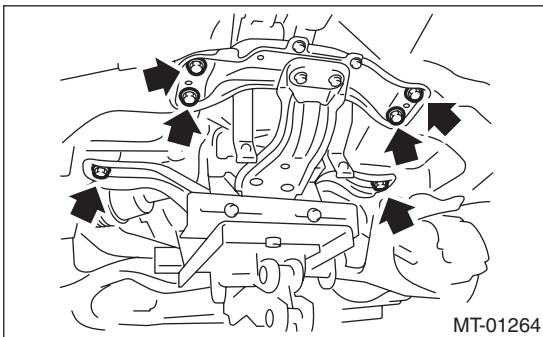


- 20) Remove the ball joint of front arm from the housing.



- 21) Remove the front drive shaft. <Ref. to DS-23, REMOVAL, Front Drive Shaft.>

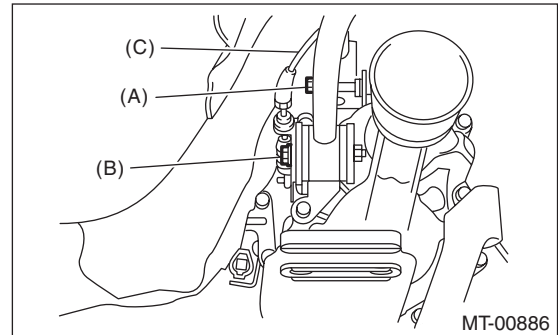
- 22) Set the transmission jack under the transmission, and remove the front crossmember and rear crossmember.



- 23) Move the transmission to the right side of the vehicle, and remove the joint COMPL, stay bolts and reverse check cable.

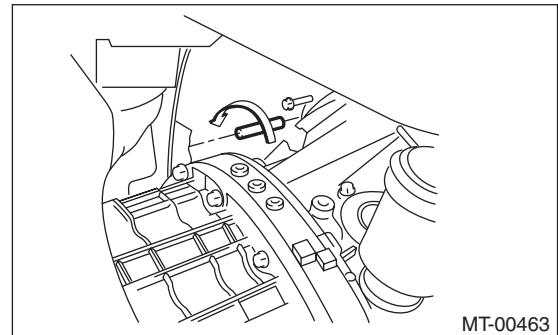
### NOTE:

If the transmission is not moved aside, the joint COMPL and stay bolts may contact the body and cause damage.



- (A) Joint COMPL bolt
- (B) Stay bolt
- (C) Reverse check cable

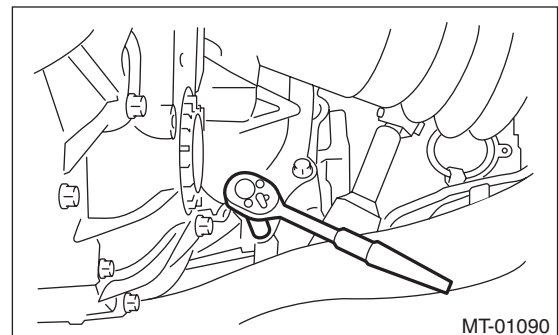
- 24) Tighten the turnbuckle of the ST to tilt the engine assembly towards the back.



- 25) Remove the bolts holding the bottom of transmission to the engine, and remove the transmission from the vehicle.

### NOTE:

- During removal, be careful not to hit the transmission against the body when pulling towards the rear.
- The clutch pipe and breather pipe may interfere with each other. Remove carefully.



# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: INSTALLATION

1) Set the release fork, release bearing and release shaft to the transmission. <Ref. to CL-18, INSTALLATION, Release Bearing and Lever.>

2) Replace the front differential side retainer oil seal.

(1) Remove the oil seal by using flat tip screwdriver etc.

(2) Apply gear oil to the lip of new oil seals.

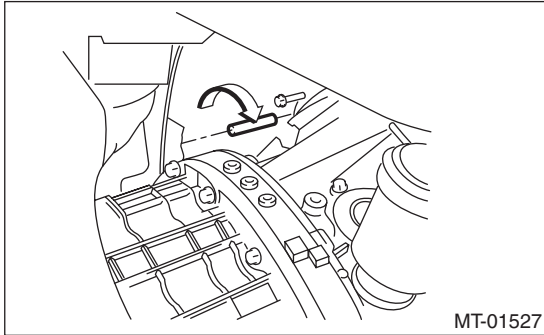
(3) Install a new oil seal using ST.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

#### NOTE:

Be sure to replace the differential side oil seal after the procedure of removing front drive shaft from transmission.

3) Loosen the turnbuckle of ST to return the engine to its original position.



4) Install the transmission.

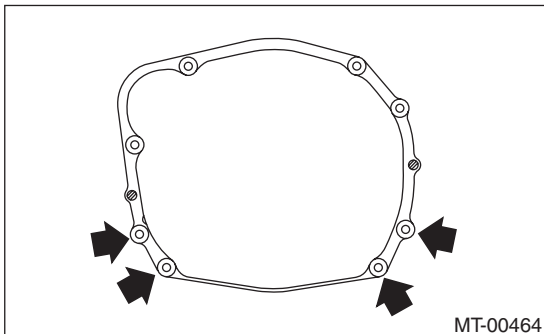
5) Tighten the bolts and nuts which hold the lower side of transmission to the engine.

#### NOTE:

- Make sure that the main shaft spline is completely inserted.
- Make sure that the rear end of the engine is set low.

#### Tightening torque:

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**

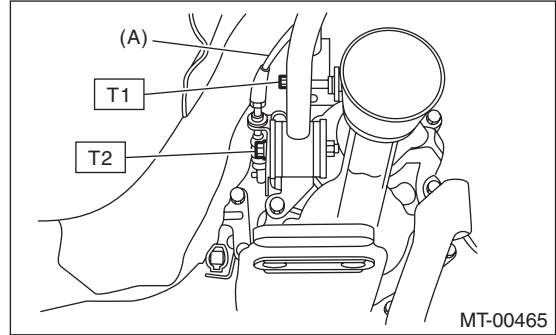


6) Move the transmission to the right side of the vehicle, and attach the joint COMPL, stay bolts and reverse check cable.

#### Tightening torque:

**T1: 11.8 N·m (1.2 kgf·m, 8.7 ft·lb)**

**T2: 32 N·m (3.3 kgf·m, 23.6 ft·lb)**



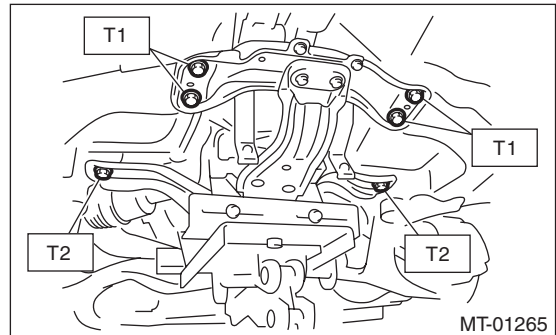
(A) Reverse check cable

7) Install the front crossmember and rear crossmember.

#### Tightening torque:

**T1: 75 N·m (7.6 kgf·m, 55.3 ft·lb)**

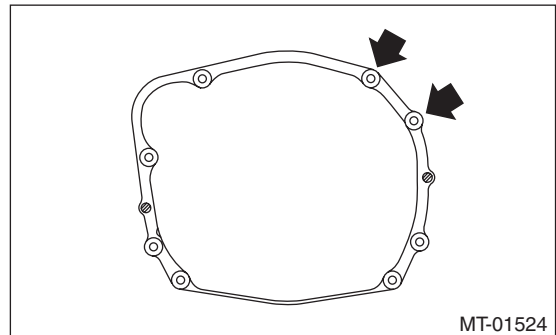
**T2: 140 N·m (14.3 kgf·m, 103 ft·lb)**



8) Tighten the bolts which hold the upper side of the transmission to the engine.

#### Tightening torque:

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**





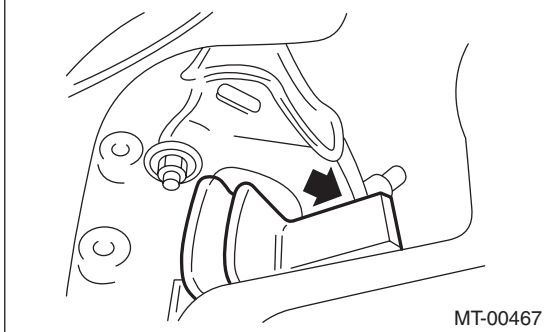
# Manual Transmission Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

9) Make sure that the release bearing is completely inserted.

**NOTE:**

- Push the release fork towards the operating cylinder side until a clicking sound is heard. Pull the release fork towards the engine side. If the release fork is not in contact with the case, the setting is complete.
- Confirm that the boot cover is set securely.



10) Install the pitching stopper bracket.

**Tightening torque:**

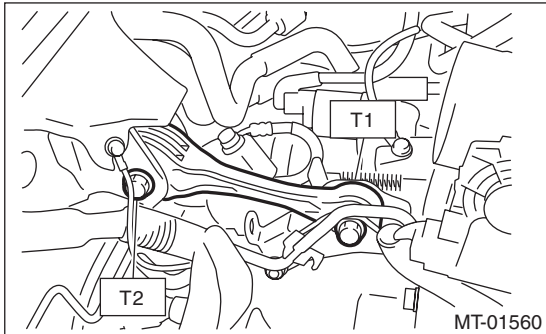
**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

11) Install the pitching stopper.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf·m, 36.9 ft·lb)**

**T2: 58 N·m (5.9 kgf·m, 42.8 ft·lb)**



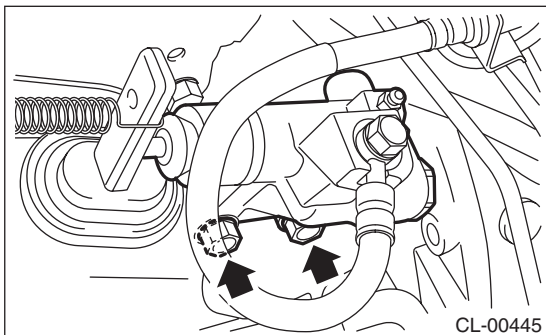
12) Install the clutch operating cylinder.

**Tightening torque:**

**41 N·m (4.2 kgf·m, 30.2 ft·lb)**

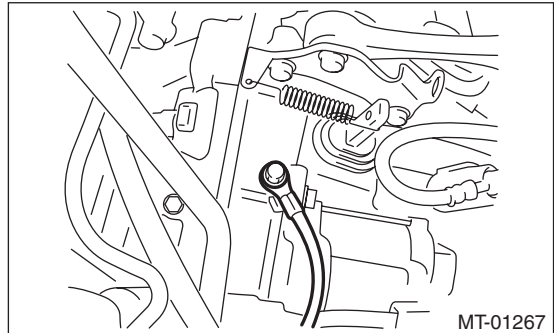
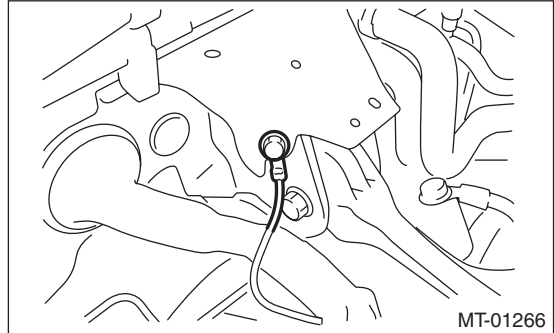
**NOTE:**

Check that the clutch hose is routed properly.

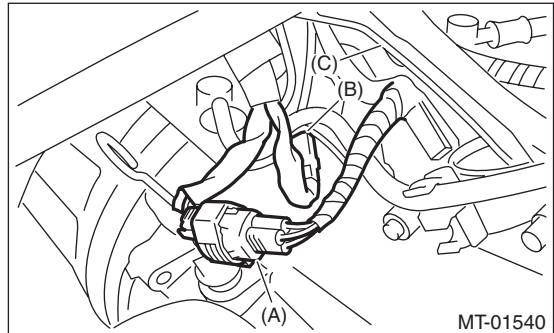


13) Install the starter assembly. <Ref. to SC(H4SO)-6, INSTALLATION, Starter.>

14) Attach the ground cable to the transmission and body.



15) Connect the following harness connectors, then attach the engine hanger rear.



- (A) Neutral position switch backup light switch connector
- (B) Rear oxygen sensor connector
- (C) Pitching stopper

16) Set the ST to side retainer.

ST 28399SA010 OIL SEAL PROTECTOR

17) Install the front drive shaft into the transmission.

**NOTE:**

Replace the circlip of drive shaft with a new part.

18) Install the front drive shaft into transmission, remove the ST and insert the drive shaft securely.

ST 28399SA010 OIL SEAL PROTECTOR

# Manual Transmission Assembly

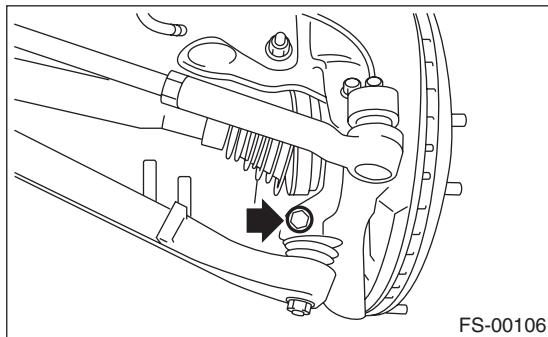
## MANUAL TRANSMISSION AND DIFFERENTIAL

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19) Install the ball joint of the front arm.

**Tightening torque:**

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**



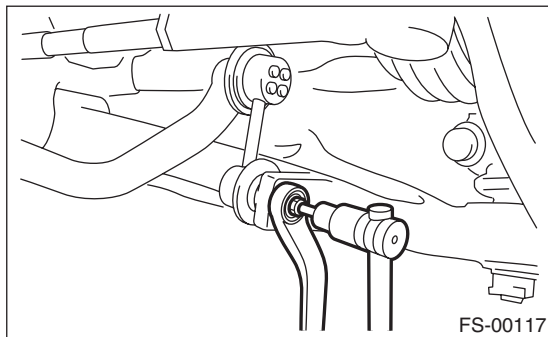
20) Install the front stabilizer link.

**Tightening torque:**

**45 N·m (4.6 kgf·m, 33.2 ft·lb)**

**NOTE:**

Use a new self-locking nut.



21) Install the heat shield cover. (If equipped)

22) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

23) Install the rear exhaust pipe and muffler.

24) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

25) Fill the transmission gear oil.

<Ref. to 6MT-27, REPLACEMENT, Transmission Gear Oil.>

26) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

27) Install the collector cover.

28) Connect the battery ground cable to the battery.

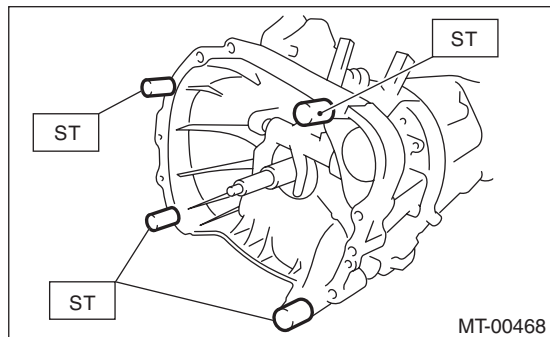
## 7. Preparation for Overhaul

### A: PROCEDURE

1) Clean oil, grease, dirt and dust from the transmission.

2) Attach the transmission to the ST.

ST 18632AA000 STAND ASSY



3) Apply oil to rotating parts before assembly.

4) When reusing disassembled parts, reinstall in the original positions and directions.

5) Gaskets, lock washers and lock nuts must be replaced with new parts.

6) Apply liquid gasket to the specified areas to prevent leakage.

## Air Breather Hose

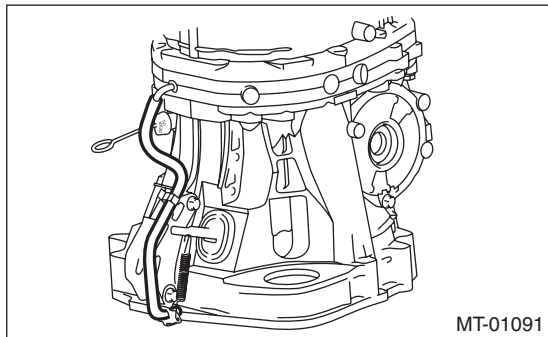
MANUAL TRANSMISSION AND DIFFERENTIAL

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### 8. Air Breather Hose

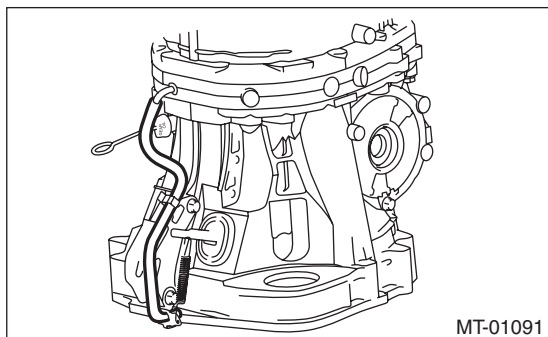
#### A: REMOVAL

Disconnect the air breather hose.



#### B: INSTALLATION

Connect the air breather hose.



#### C: INSPECTION

Make sure the hose is not cracked or clogged.

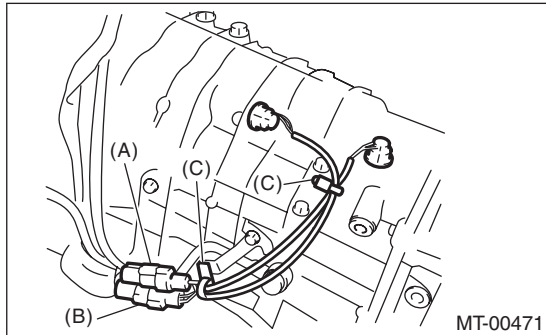
# Back-up Light Switch

MANUAL TRANSMISSION AND DIFFERENTIAL

## 9. Back-up Light Switch

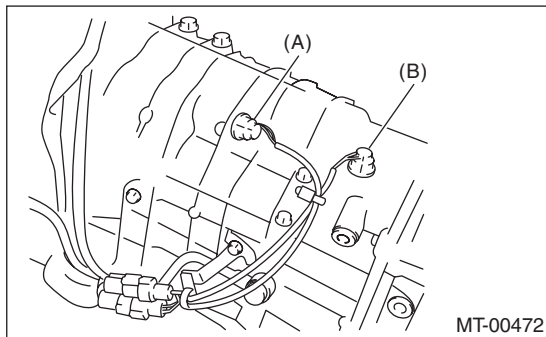
### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Disconnect the back-up light switch connector.



- (A) Back-up light switch connector (White)
- (B) Neutral position switch connector (Black)
- (C) Clip

- 3) Disconnect the back-up light switch.



- (A) Back-up light switch
- (B) Neutral position switch

### B: INSTALLATION

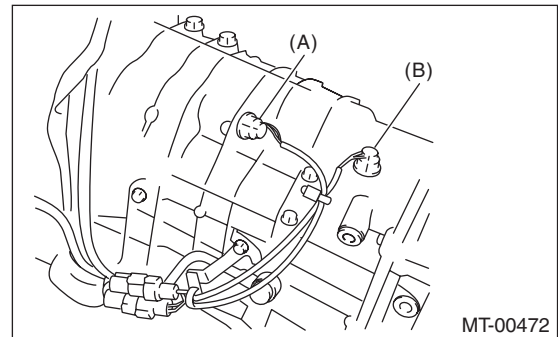
- 1) Install the back-up light switch.

NOTE:

Use a new gasket.

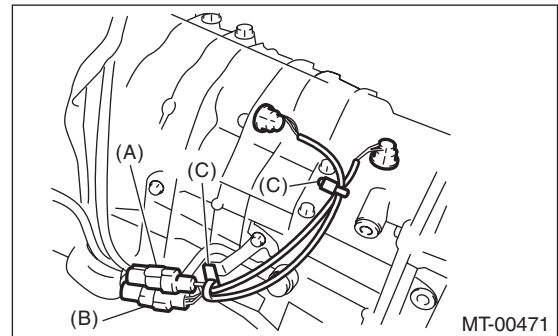
**Tightening torque:**

**32 N·m (3.3 kgf·m, 23.6 ft·lb)**



- (A) Back-up light switch
- (B) Neutral position switch

- 2) Connect the back-up light switch connector.



- (A) Back-up light switch connector (White)
- (B) Neutral position switch connector (Black)
- (C) Clip

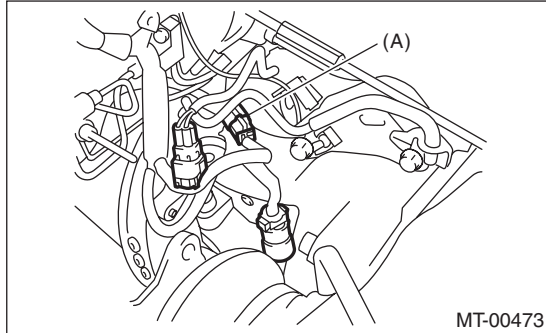
- 3) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

# Back-up Light Switch

## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: INSPECTION

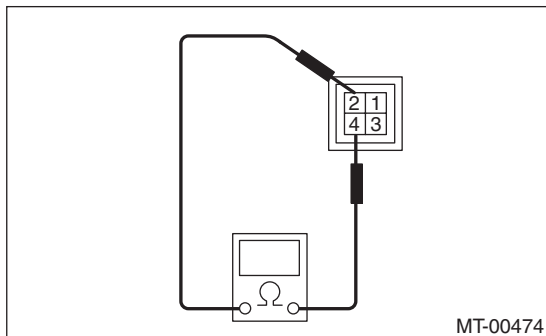
- 1) Disconnect the ground cable from the battery.
- 2) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Disconnect the transmission harness and chassis harness.



(A) Transmission connector

- 4) Measure the resistance between the back-up light switch terminals. If it is not within the specification, replace the back-up light switch.

Gear shift position	Terminal No.	Standard
Back position	2 and 4	Less than 1 $\Omega$
Other positions		1 M $\Omega$ or more



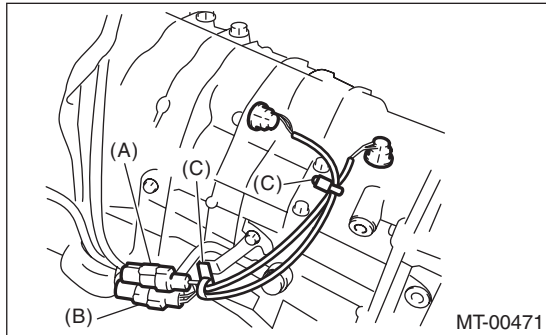
# Neutral Position Switch

MANUAL TRANSMISSION AND DIFFERENTIAL

## 10. Neutral Position Switch

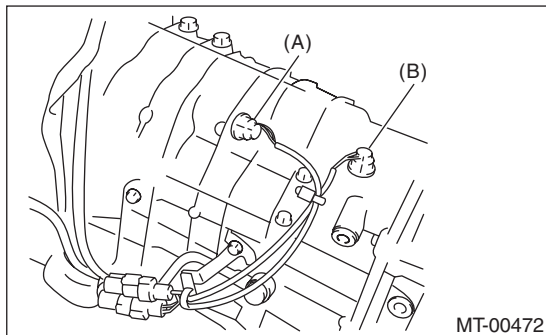
### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Disconnect the connector and clip of the neutral position switch.



- (A) Back-up light switch connector (White)
- (B) Neutral position switch connector (Black)
- (C) Clip

- 3) Remove the neutral position switch.



- (A) Back-up light switch
- (B) Neutral position switch

### B: INSTALLATION

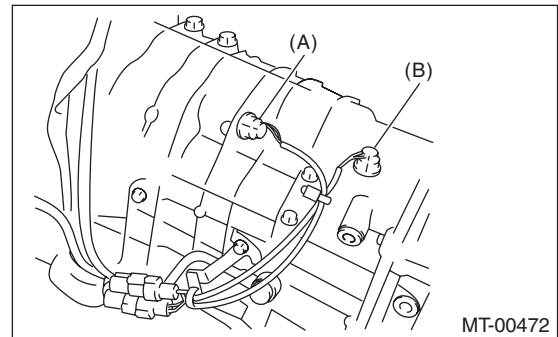
- 1) Install the neutral position switch.

NOTE:

Use a new gasket.

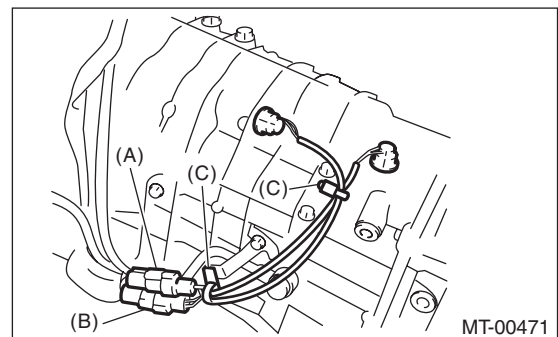
**Tightening torque:**

**32 N·m (3.3 kgf-m, 23.6 ft-lb)**



- (A) Back-up light switch
- (B) Neutral position switch

- 2) Connect the connector and clip of the neutral position switch.



- (A) Back-up light switch connector (White)
- (B) Neutral position switch connector (Black)
- (C) Clip

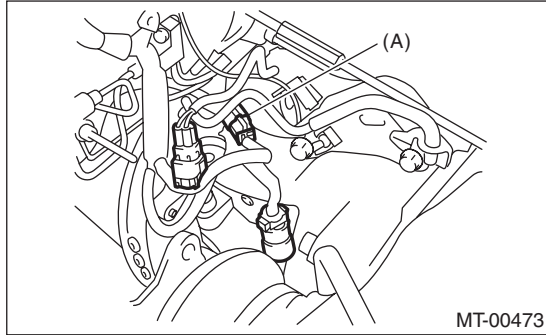
- 3) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

# Neutral Position Switch

## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: INSPECTION

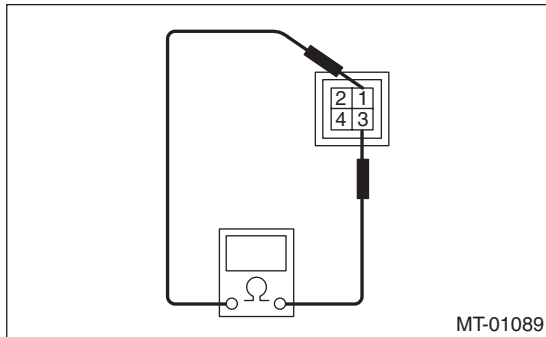
- 1) Disconnect the ground cable from the battery.
- 2) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Disconnect the transmission harness and chassis harness.



(A) Transmission connector

- 4) Measure the resistance between neutral position switch terminals. If not within the standard values, replace the neutral position switch.

Gear shift position	Terminal No.	Standard
Neutral position	1 and 3	1 M $\Omega$ or more
Other positions		Less than 1 $\Omega$

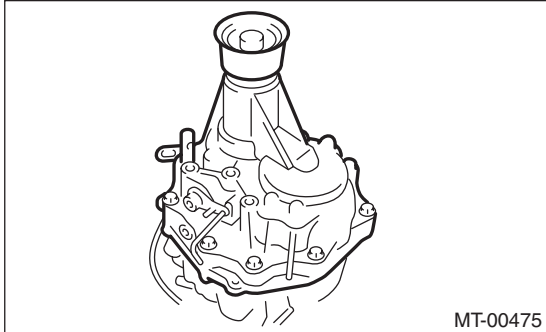




## 11.Extension Case

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the extension case.



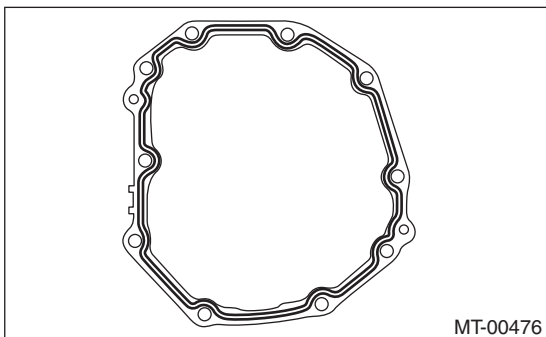
- 4) Remove any remaining liquid gasket from the extension case and transmission case.

### B: INSTALLATION

- 1) Select the thrust washer of the transfer driven gear, and attach to the extension case. <Ref. to 6MT-45, ADJUSTMENT, Extension Case.>
- 2) Apply a thin coat of oil to the outer surface of the bearing cone, and attach to the extension case.
- 3) Select the thrust washer of the transfer drive gear, and attach to the center differential.
- 4) Apply liquid gasket to the transmission case.

#### Liquid gasket:

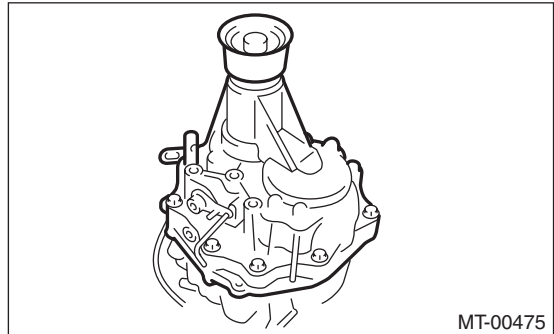
**THREE BOND 1215 (Part No. 004403007)**



- 5) Install the extension case.

#### Tightening torque:

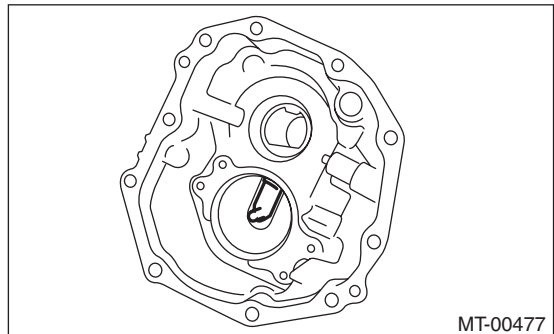
**48 N·m (4.9 kgf·m, 35.4 ft·lb)**



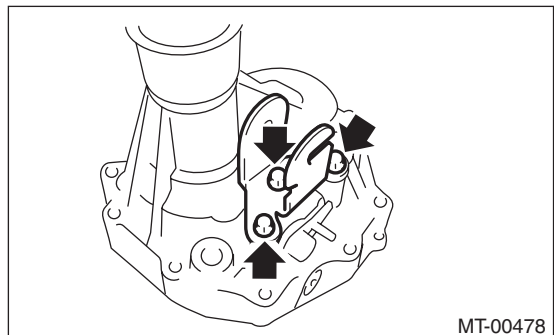
- 6) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

- 1) Remove the transfer drive gear. <Ref. to 6MT-53, REMOVAL, Transfer Drive Gear.>
- 2) Remove the oil guide.



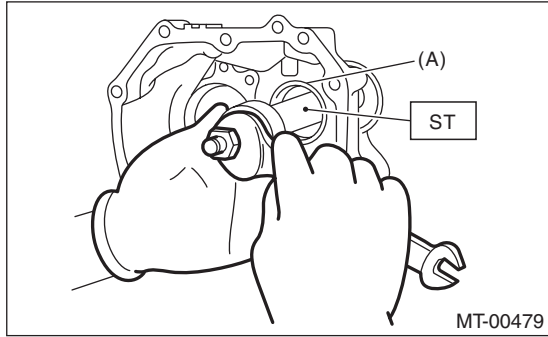
- 3) Remove the shift bracket.



# Extension Case

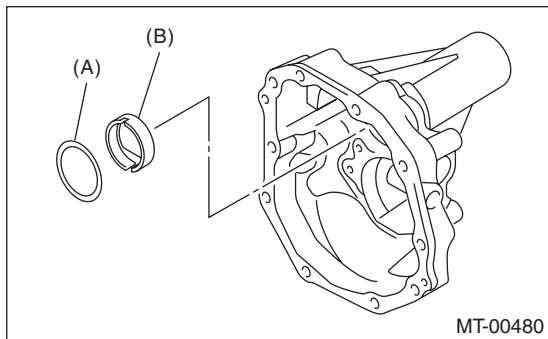
## MANUAL TRANSMISSION AND DIFFERENTIAL

- 4) Remove the bearing cone using the ST.  
ST 18758AA000 PULLER



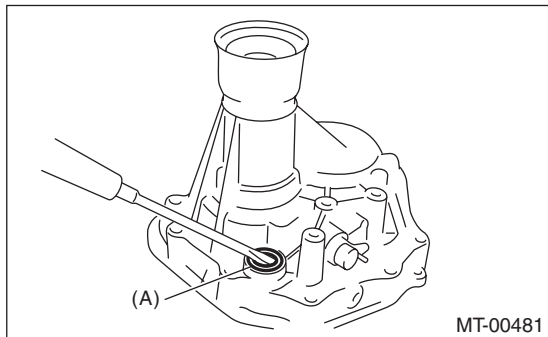
(A) Bearing cone

- 5) Remove the thrust washer and oil plate.



(A) Thrust washer  
(B) Oil plate

- 6) Remove the shifter arm oil seal.

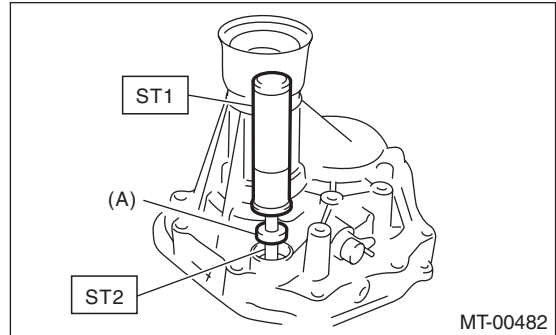


(A) Oil seal

- 7) Remove the reverse check system. <Ref. to 6MT-50, REMOVAL, Reverse Check System.>  
8) Remove the extension oil seal. <Ref. to 6MT-28, REPLACEMENT, Oil Seal.>

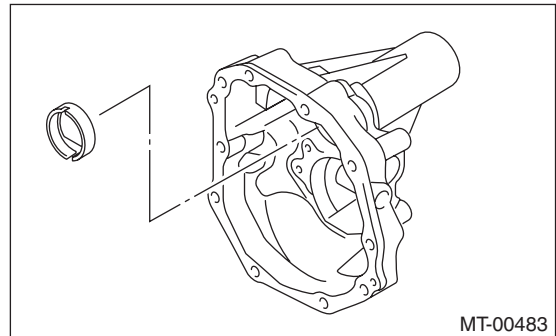
## D: ASSEMBLY

- 1) Install the reverse check system. <Ref. to 6MT-51, INSTALLATION, Reverse Check System.>  
2) Install the extension case oil seal. <Ref. to 6MT-28, REPLACEMENT, Oil Seal.>  
3) Install a shifter arm oil seal using the ST.  
ST1 18657AA000 INSTALLER  
ST2 18671AA000 OIL SEAL GUIDE



(A) Oil seal

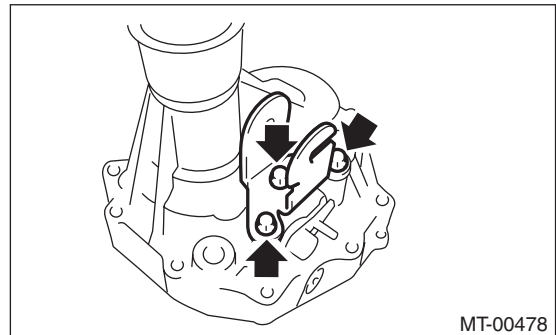
- 4) Install the oil plate.



- 5) Select the thrust washer of the bearing, and attach to the extension case. <Ref. to 6MT-45, ADJUSTMENT, Extension Case.>  
6) Apply a thin coat of oil to the outer surface of the bearing cone, and attach to the extension case.  
7) Install the shift bracket.

### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- 8) Attach the oil guide and the transfer driven gear. <Ref. to 6MT-53, INSTALLATION, Transfer Drive Gear.>

# Extension Case

MANUAL TRANSMISSION AND DIFFERENTIAL

## E: INSPECTION

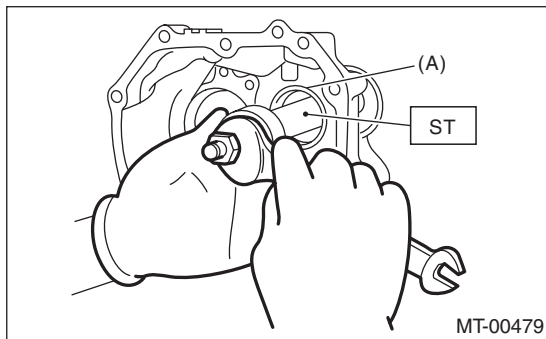
- 1) Check to make sure there is no damage or cracks on the extension case. If damage or cracking is found, replace the extension case.
- 2) Inspect for oil leaks at the extension case and transmission case oil seals and mating surfaces. If there are oil leaks, replace the oil seal and liquid gasket.

## F: ADJUSTMENT

### 1. TRANSFER DRIVEN GEAR BEARING THRUST WASHER ADJUSTMENT

- 1) Remove the bearing cone from the extension case using the ST.

ST 18758AA000 PULLER



(A) Bearing cone

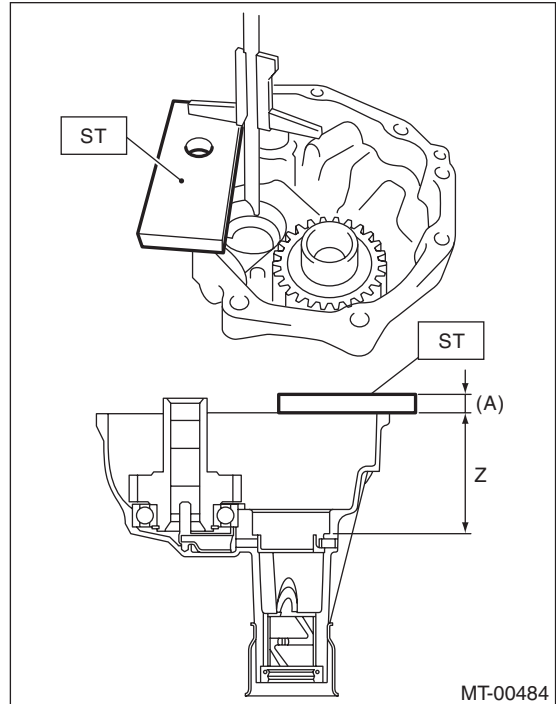
- 2) Remove the thrust washer.

- 3) Measure depth "Z" between the extension case end area and bearing cone contact area.

ST 398643600 GAUGE

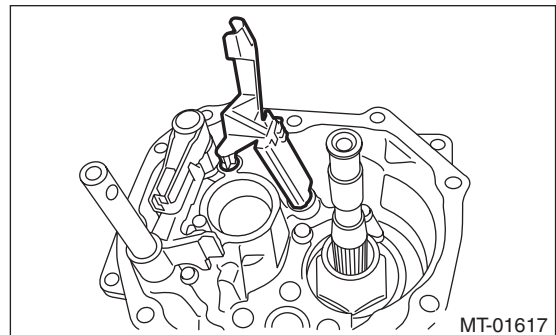
#### NOTE:

When measuring depth "Z", subtract the thickness of the ST [15 mm (0.59 in)] from the measured value.



(A) 15 mm (0.59 in)

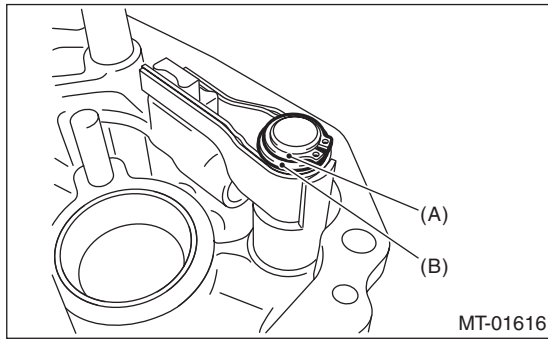
- 4) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 5) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 6) Remove the oil guides G and H.



# Extension Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

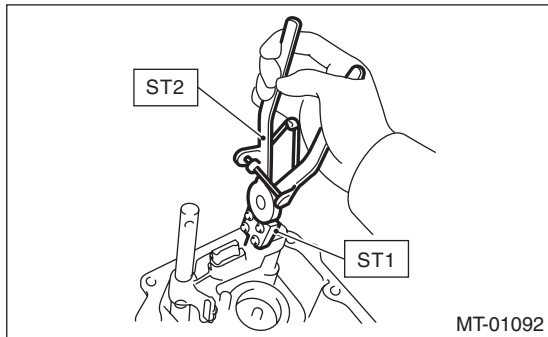
7) Remove the snap ring and flat washer from the selector arm area.



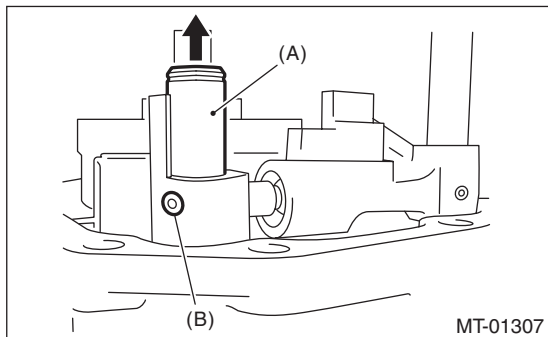
- (A) Snap ring
- (B) Flat washer

8) Using an ST, remove the neutral set spring and support.

ST1 18756AA000 CLAW  
ST2 399893600 PLIER

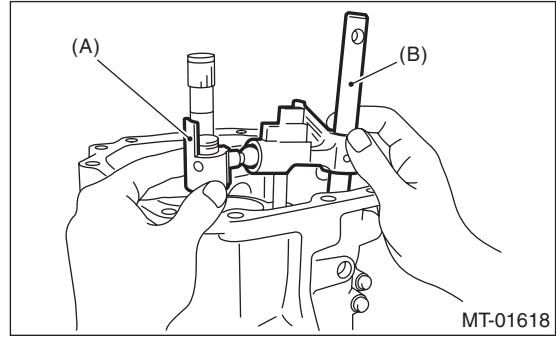


9) Lift the striking rod, and remove the spring pin.



- (A) Striking rod
- (B) Spring pin

10) Remove the selector arm No. 2 and the shifter arm.

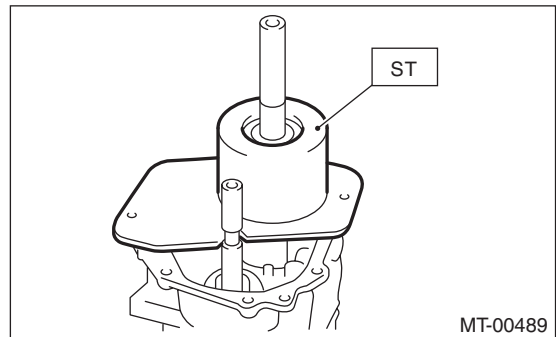


- (A) Selector arm No. 2
- (B) Shifter arm

11) Attach the bearing cone to the transfer driven gear.

12) Set the ST.

ST 18831AA000 GAUGE



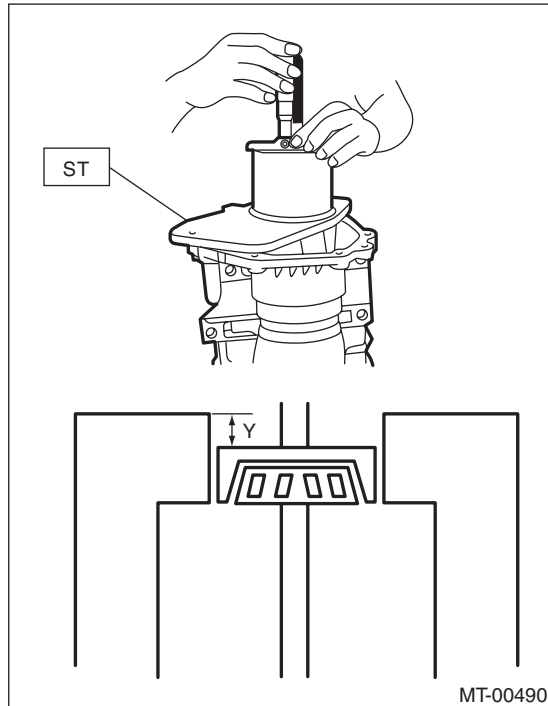
13) Turn the transfer driven gear 10 or more times to seat the bearing properly.

# Extension Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

14) Measure depth "Y" between the end of the ST and the bearing cone.

ST 18831AA000 GAUGE



15) Using the following calculation, calculate the transfer driven gear bearing thrust washer value "t".  
 $t = Z - (100 - Y) - \{0.04 - 0.11 \text{ mm (0.0016 - 0.0043 in)}\}$

t mm (in)	Transfer driven gear bearing thrust washer thickness
Y mm (in)	Depth between the end of the ST and the bearing cone.
Z mm (in)	Depth between the end of the extension case and the bearing cone contact area.
0.04 — 0.11 mm (0.0016 — 0.0043 in)	Standard clearance between the thrust washer and taper roller bearing
100 mm (3.94 in)	Height of ST

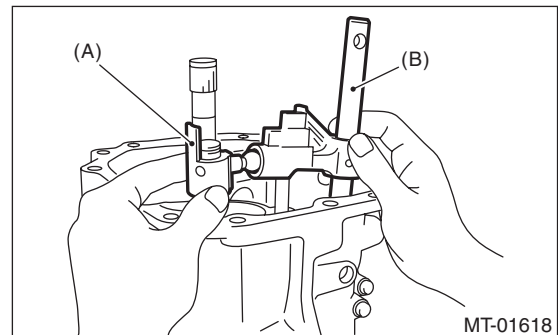
16) Refer to the calculated value "t" to select the closest thrust washer from the following table.

**Standard clearance between the thrust washer and taper roller bearing**

**0.04 — 0.11 mm (0.0016 — 0.0043 in)**

Thrust washer (50 × 61 × t)	
Part No.	Thickness t mm (in)
803050060	0.50 (0.0197)
803050061	0.55 (0.0217)
803050062	0.60 (0.0236)
803050063	0.65 (0.0256)
803050064	0.70 (0.0276)
803050065	0.75 (0.0295)
803050066	0.80 (0.0315)
803050067	0.85 (0.0335)
803050068	0.90 (0.0354)
803050069	0.95 (0.0374)
803050070	1.00 (0.0394)
803050071	1.05 (0.0413)
803050072	1.10 (0.0433)
803050073	1.15 (0.0453)
803050074	1.20 (0.0472)
803050075	1.25 (0.0492)
803050076	1.30 (0.0512)
803050077	1.35 (0.0531)
803050078	1.40 (0.0551)
803050079	1.45 (0.0570)

17) Install the selector arm No. 2 and the shifter arm.



- (A) Selector arm No. 2
- (B) Shifter arm

18) Install a new spring pin.

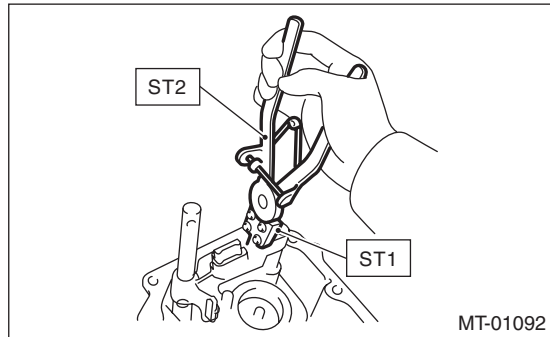
# Extension Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

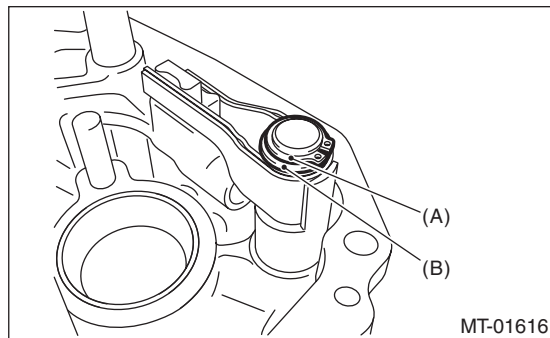
19) Using the ST, install the neutral set spring and support.

ST1 18756AA000 CLAW

ST2 399893600 PLIER



20) Install the flat washer and snap ring to the selector arm area.



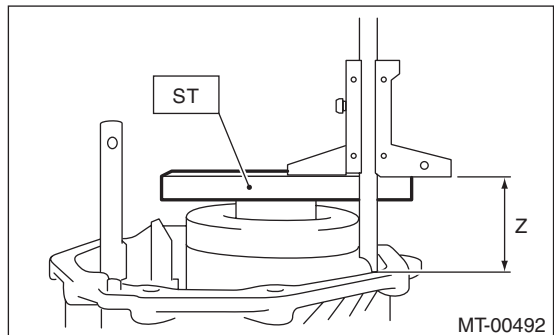
- (A) Snap ring
- (B) Flat washer

21) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>

## 2. TRANSFER DRIVE GEAR THRUST WASHER SELECTION

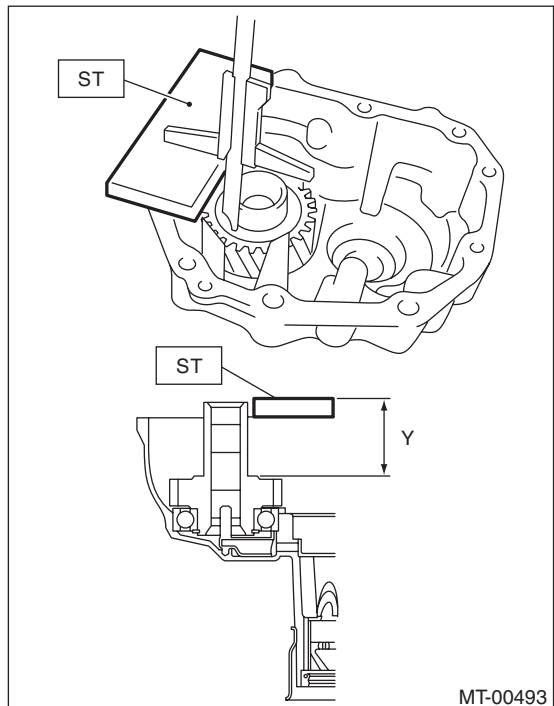
1) Measure height "Z" between the transmission case end area and ST.

ST 398643600 GAUGE



2) Measure depth "Y" between the end of the ST and the transfer drive gear.

ST 398643600 GAUGE



3) Using the following calculation, calculate the transfer drive gear thrust washer value “t”.

$$t = \{Y - 15 \text{ mm (0.59 in)}\} - \{Z - 15 \text{ mm (0.59 in)}\} - 0.45 - 0.65 \text{ mm (0.018 - 0.026 in)}$$

t mm (in)	Transfer drive gear thrust washer thickness
Y mm (in)	Depth between the end of the ST and the transfer drive gear
Z mm (in)	Height from the end of the transmission case to the end of the ST.
0.45 — 0.65 mm (0.018 — 0.026 in)	Standard clearance between the thrust washer and transfer drive gear
15 mm (0.591 in)	Thickness of ST

4) Refer to the calculated value “t” to select the closest thrust washer from the following table.

***Standard clearance between the thrust washer and transfer drive gear***

***0.45 — 0.65 mm (0.018 — 0.026 in)***

Thrust washer (36.3 × 52 × t)	
Part No.	Thickness mm (in)
803036070	0.80 (0.0315)
803036071	0.95 (0.0374)
803036072	1.10 (0.0433)
803036073	1.25 (0.0492)
803036074	1.40 (0.0551)
803036075	0.65 (0.0256)

5) Install the selected thrust washer.

# Reverse Check System

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 12.Reverse Check System

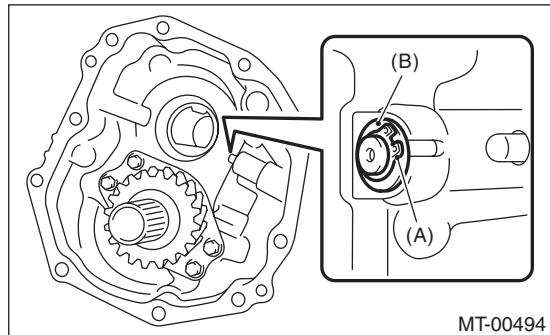
#### A: REMOVAL

1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>

2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>

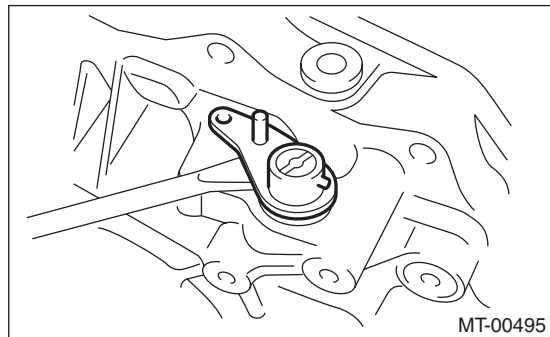
3) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>

4) Remove the snap ring and washer from the reverse check shaft.



- (A) Snap ring
- (B) Washer

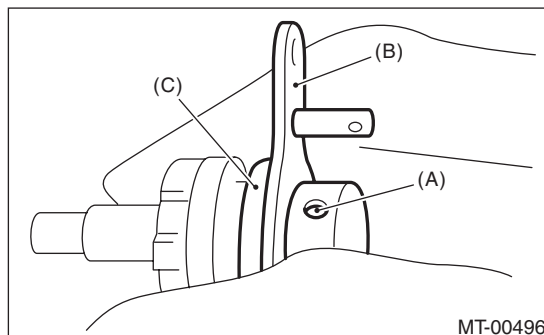
5) Remove the reverse check shaft and spring from the extension case.



6) Remove the spring pin, and remove the reverse check lever and oil seal from the reverse check shaft.

NOTE:

Do not reuse the oil seal.

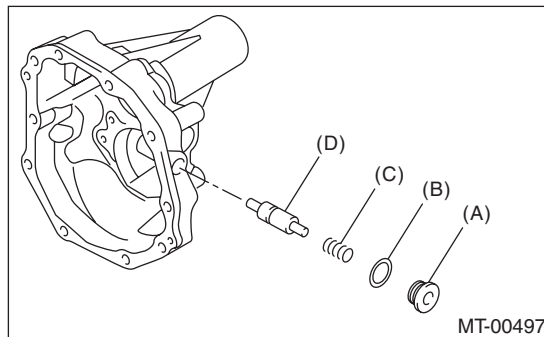


- (A) Spring pin
- (B) Reverse check lever
- (C) Oil seal

7) Remove the plug from the extension case, and remove the gasket, spring and plunger.

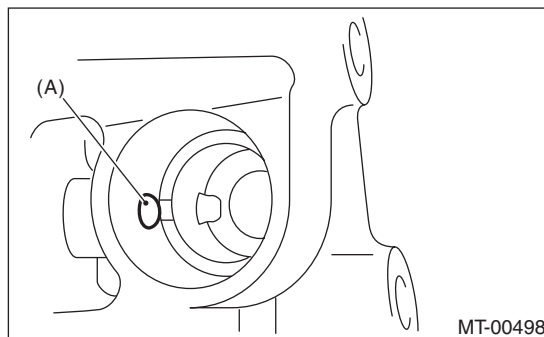
NOTE:

Do not reuse the gasket.



- (A) Plug
- (B) Gasket
- (C) Spring
- (D) Plunger

8) Remove the reverse lock plunger.



- (A) Reverse lock plunger



# Reverse Check System

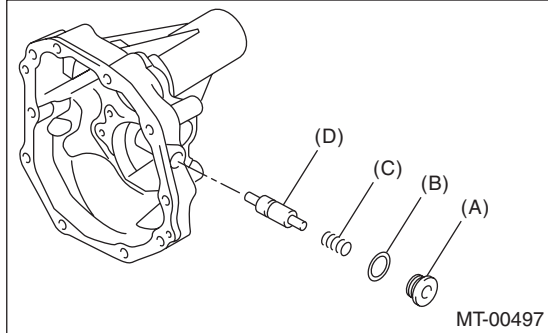
MANUAL TRANSMISSION AND DIFFERENTIAL

## B: INSTALLATION

- 1) Insert the reverse lock plunger.
- 2) Install the reverse check plug, spring, gasket, and plug in order.

### Tightening torque:

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**

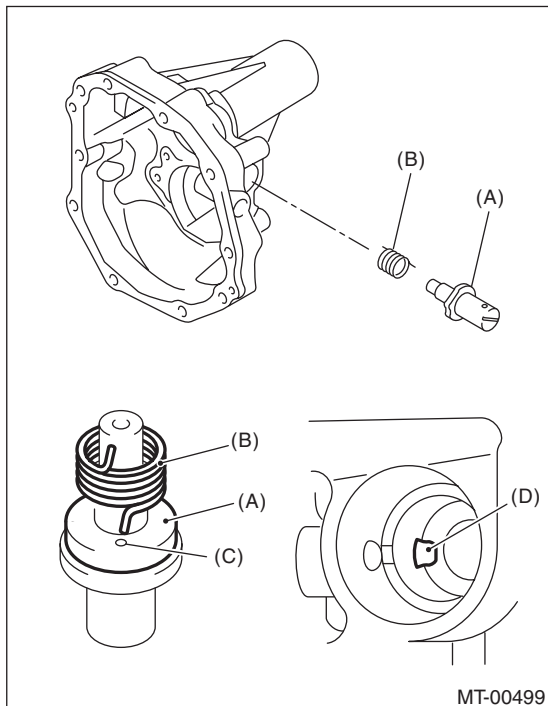


- (A) Plug
- (B) Gasket
- (C) Spring
- (D) Reverse check plug

- 3) Install the spring and reverse check shaft to the extension case.

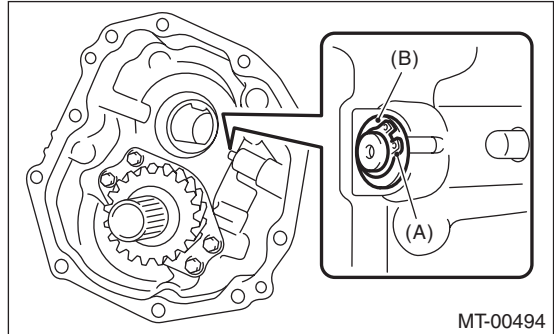
### NOTE:

Confirm that the end of the spring matches the hole of the reverse check shaft and the cut out of the extension case.



- (A) Reverse check shaft
- (B) Spring
- (C) Hole
- (D) Cut out

- 4) Install the washer and snap ring.

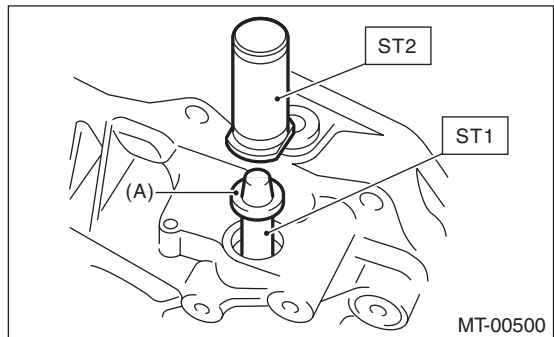


- (A) Snap ring
- (B) Washer

- 5) Attach ST1 to the reverse check shaft. Install the new oil seal, and push it in using ST2.

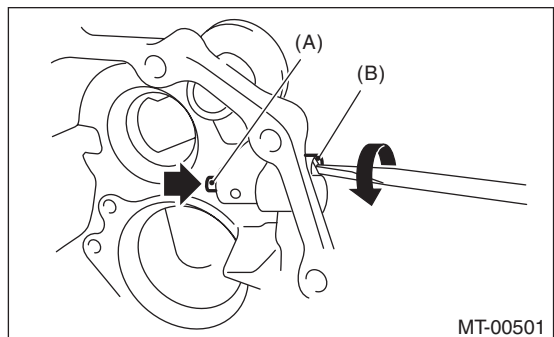
ST1 18671AA000 OIL SEAL GUIDE

ST2 18657AA010 INSTALLER



- (A) Oil seal

- 6) Insert the reverse check lever, and turn the reverse check shaft until the plunger is pushed in first.

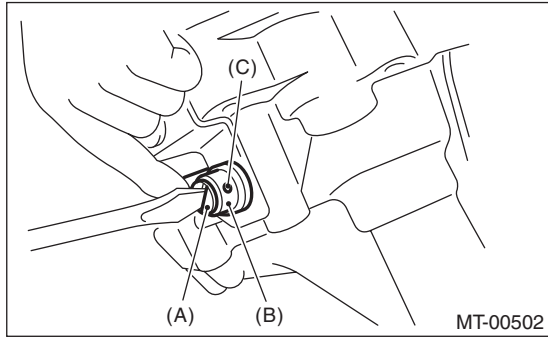


- (A) Plunger
- (B) Reverse check shaft

# Reverse Check System

## MANUAL TRANSMISSION AND DIFFERENTIAL

7) Match the hole of the reverse check lever and the reverse check shaft, and attach the spring pin.



- (A) Reverse check shaft
- (B) Reverse check lever
- (C) Hole

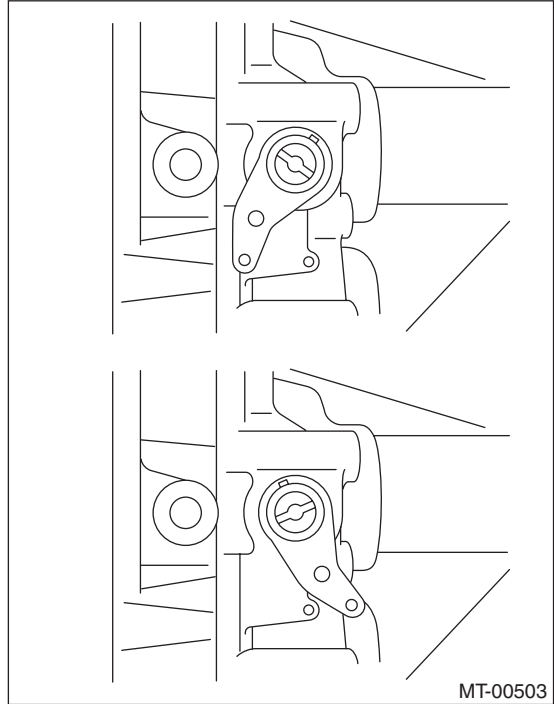
8) Check that the reverse check is operating correctly. <Ref. to 6MT-52, INSPECTION, Reverse Check System.>

9) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>

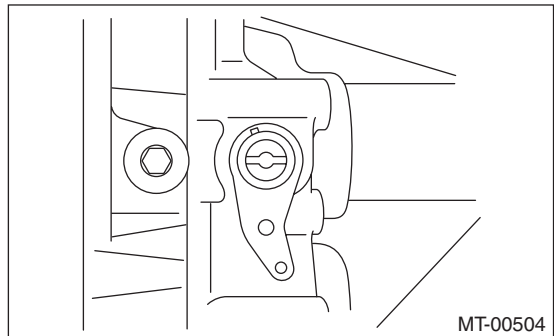
10) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

## C: INSPECTION

- 1) Check that there is no damage on any parts.
- 2) Check that the reverse check lever is operating smoothly.
- 3) Inspect that there is no oil leak at the oil seal section of the reverse check shaft. If there is oil leakage, replace the oil seal.
- 4) Check the operation of the reverse check.
  - (1) When the reverse check lever is in the following position, the plunger is pressed, or the gear can shift into reverse.



- (2) When the reverse check lever is in the following position, the plunger is not pressed, or the gear cannot shift into reverse.



- 5) If it is not as specified, reassemble the reverse check system.

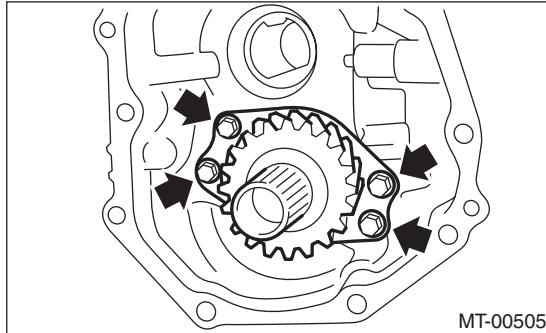
# Transfer Drive Gear

MANUAL TRANSMISSION AND DIFFERENTIAL

## 13. Transfer Drive Gear

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 4) Remove the transfer drive gear.

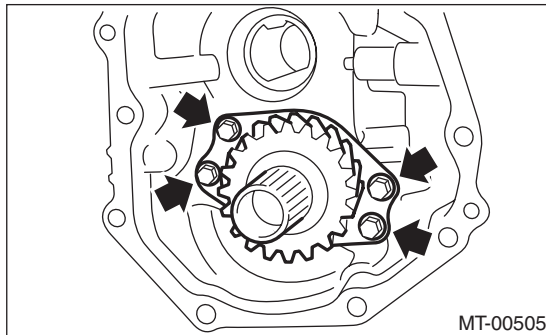


### B: INSTALLATION

- 1) Install the transfer drive gear.

#### *Tightening torque:*

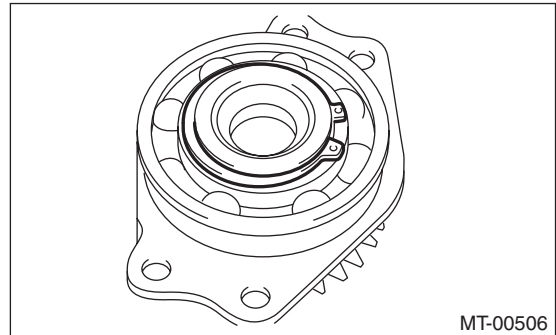
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



- 2) When the ball bearing, transfer drive gear or snap ring are replaced, select an appropriate thrust washer for the transfer drive gear. <Ref. to 6MT-44, ASSEMBLY, Extension Case.>
- 3) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 4) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

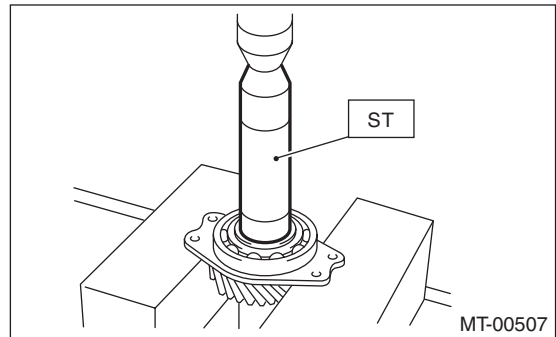
- 1) Remove the snap ring.



- 2) Remove the bearing using the ST.  
ST 499877000 RACE 4-5 INSTALLER

#### NOTE:

Do not reuse the ball bearing.

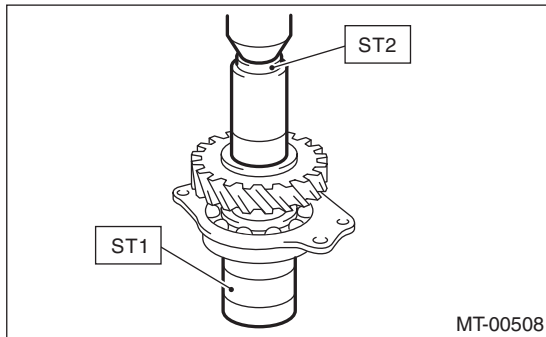


# Transfer Drive Gear

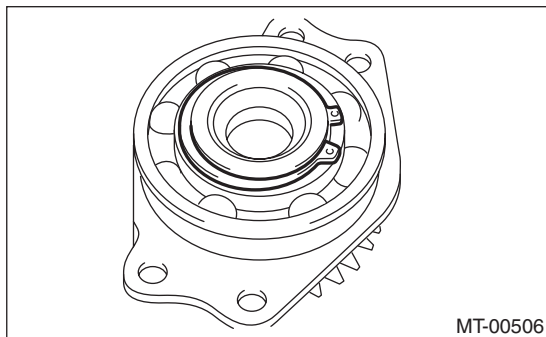
## MANUAL TRANSMISSION AND DIFFERENTIAL

### D: ASSEMBLY

- 1) Using the ST, install the ball bearing.  
ST1 499247400 INSTALLER  
ST2 398497701 SEATS



- 2) Install the snap ring.



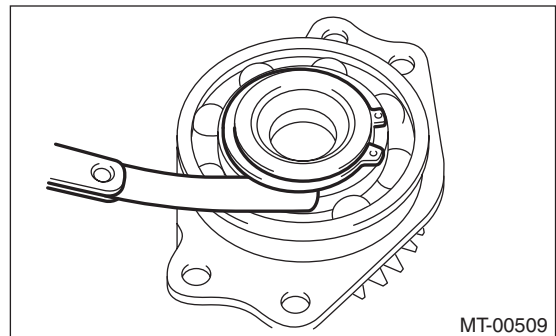
- 3) Inspect the clearance between the snap ring and the ball bearing. <Ref. to 6MT-54, INSPECTION, Transfer Drive Gear.>

### E: INSPECTION

- 1) Bearing  
Replace the bearings in the following cases.
  - Breakage or rusting of the bearing
  - Wear and damage
  - The bearing does not rotate smoothly or an abnormal noise is emitted.
- 2) Drive gear  
Replace the drive gear in the following cases.
  - The drive gear tooth surface and shaft are excessively broken or damaged.
- 3) Measure the clearance between the snap ring and ball bearing inner race with a thickness gauge.

#### **Standard clearance between the snap ring and inner race:**

**0 — 0.15 mm (0 — 0.0059 in)**



- 4) If the measurement is not within specification, select a suitable snap ring.

Thrust washer	
Part No.	Thickness mm (in)
805045050	1.76 (0.069)
805045060	1.88 (0.074)
805045070	2.00 (0.079)

After replacing the snap ring, reinspect the clearance.

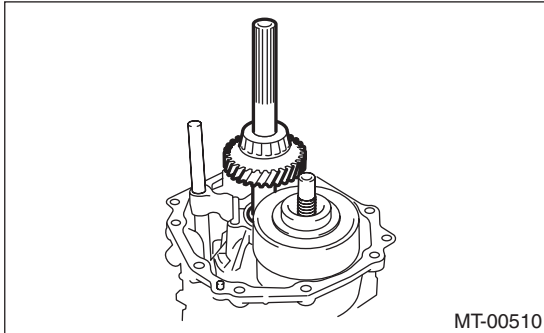
# Transfer Driven Gear

MANUAL TRANSMISSION AND DIFFERENTIAL

## 14. Transfer Driven Gear

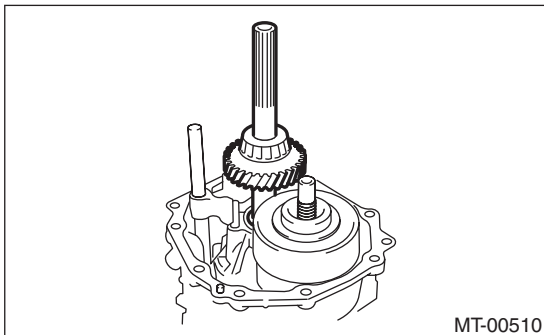
### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 4) Remove the transfer driven gear.



### B: INSTALLATION

- 1) Install the transfer driven gear.

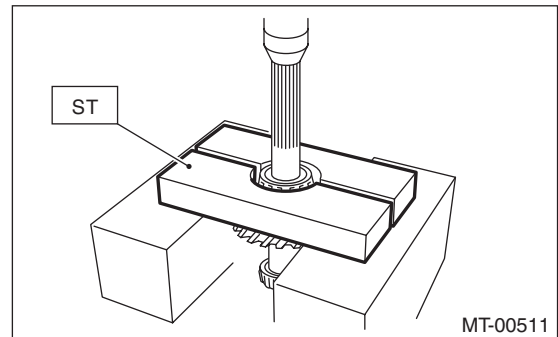


- 2) When the bearing or the transfer driven gear is replaced, select an appropriate thrust washer for the transfer driven gear. <Ref. to 6MT-45, ADJUSTMENT, Extension Case.>
- 3) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 4) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

- 1) Using the ST, remove the roller bearing (extension case side).

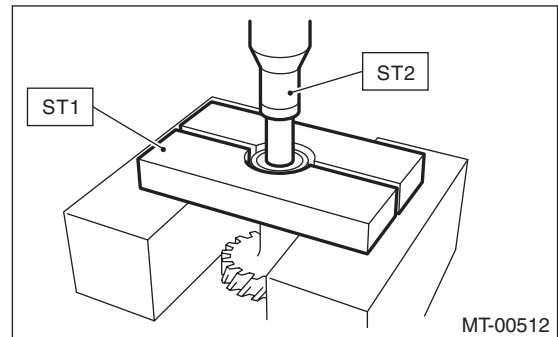
ST 498515700 REMOVER



- 2) Using the ST, remove the roller bearing (transmission case side).

ST1 899858600 REMOVER

ST2 899864100 REMOVER



# Transfer Driven Gear

## MANUAL TRANSMISSION AND DIFFERENTIAL

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### D: ASSEMBLY

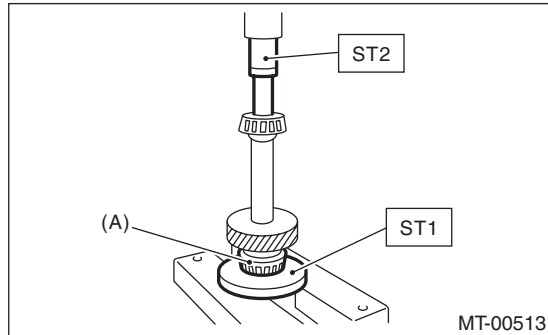
1) Using the ST, install the roller bearing  
(extension case side).

ST1 398177700 INSTALLER

ST2 899864100 REMOVER

#### CAUTION:

**Do not apply pressure in excess of 10 kN  
(1 ton, 1.1 US ton, 1.0 Imp ton).**



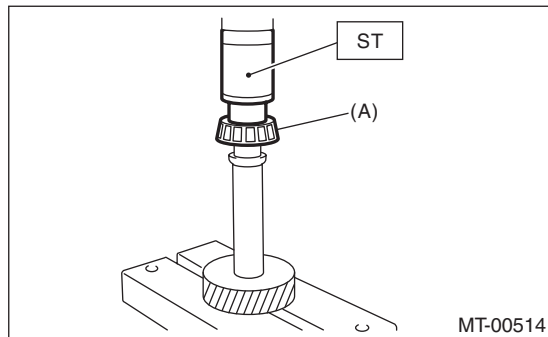
(A) Roller bearing

2) Using the ST, install the roller bearing  
(transmission case side).

ST 499757002 INSTALLER

#### CAUTION:

**Do not apply pressure in excess of 10 kN  
(1 ton, 1.1 US ton, 1.0 Imp ton).**



(A) Roller bearing

### E: INSPECTION

1) Bearing

Replace the bearings in the following cases.

- Breakage or rusting of the bearing
- Wear and damage
- After applying transmission gear oil, bearing does not rotate smoothly or an abnormal noise is emitted.

2) Driven gear

Replace the driven gear in the following cases.

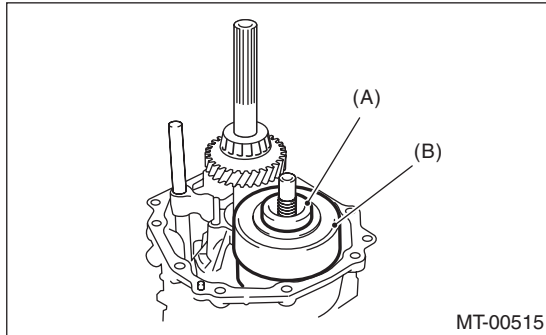
- The driven gear tooth surface and shaft are excessively broken or damaged.

# Center Differential

## 15.Center Differential

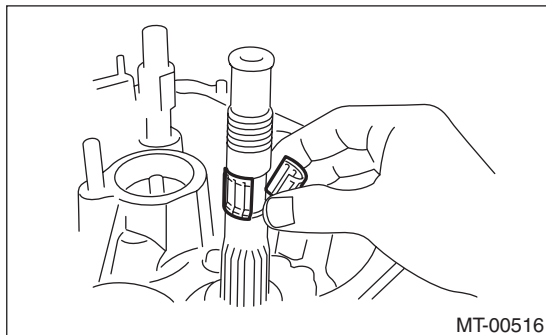
### A: REMOVAL

- 1) Remove the manual transmission case from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 4) Remove the thrust washer and center differential.



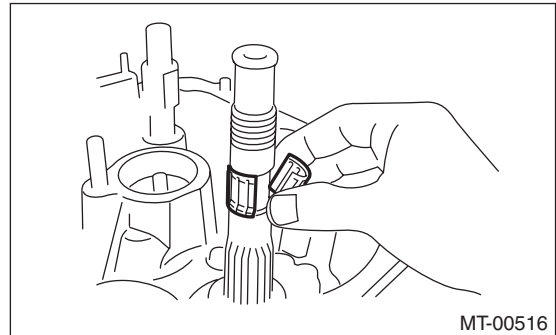
- (A) Thrust washer
- (B) Center differential

- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the needle bearing.

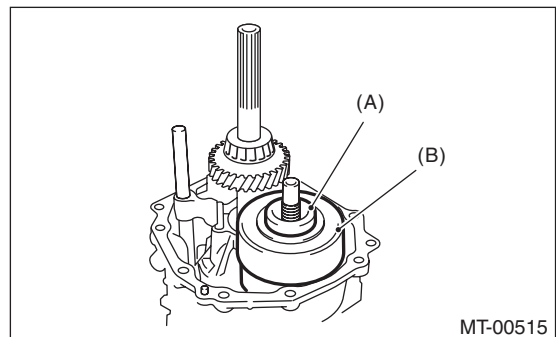


### B: INSTALLATION

- 1) Install the needle bearing.



- 2) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 3) Install the thrust washer and center differential.



- (A) Thrust washer
- (B) Center differential

- 4) When replacing the center differential, select and install the appropriate transfer drive gear and thrust washer. <Ref. to 6MT-45, ADJUSTMENT, Extension Case.>
- 5) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 6) Install the manual transmission case assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: INSPECTION

Check that there is no damage on the center differential. Replace if damaged.

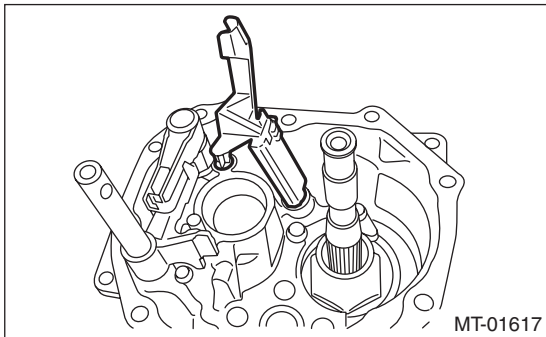
# Transmission Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

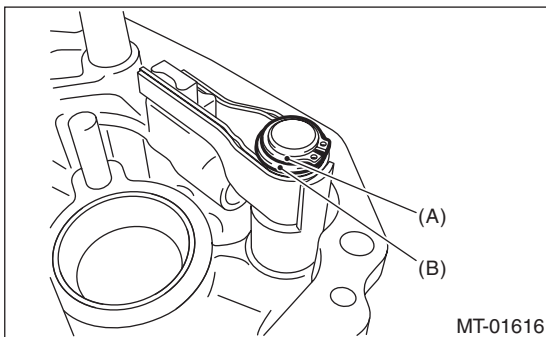
### 16. Transmission Case

#### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.> <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the oil guides G and H.



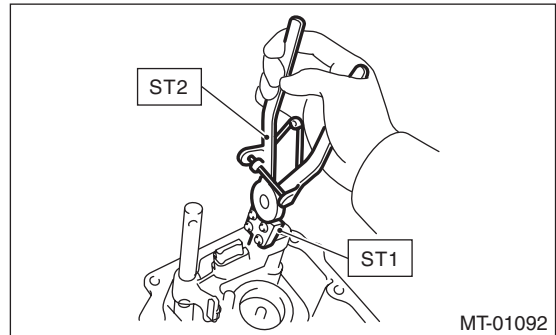
- 8) Remove the snap ring and flat washer from the selector arm area.



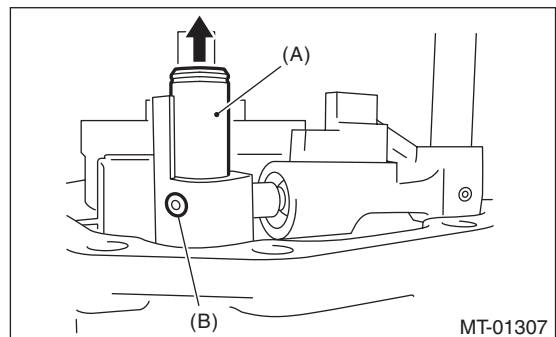
- (A) Snap ring
- (B) Flat washer

- 9) Using an ST, remove the neutral set spring and support.

ST1 18756AA000 CLAW  
ST2 399893600 PLIER

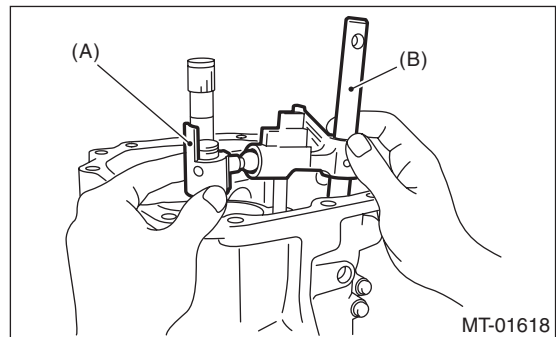


- 10) Lift the striking rod, and remove the spring pin.



- (A) Striking rod
- (B) Spring pin

- 11) Remove the selector arm No. 2 and the shifter arm.



- (A) Selector arm No. 2
- (B) Shifter arm



# Transmission Case

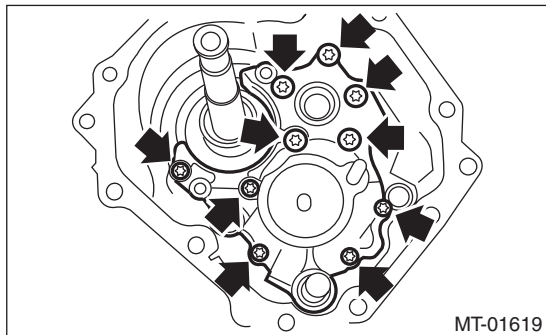
MANUAL TRANSMISSION AND DIFFERENTIAL

12) Remove the transfer bearing holder.

**NOTE:**

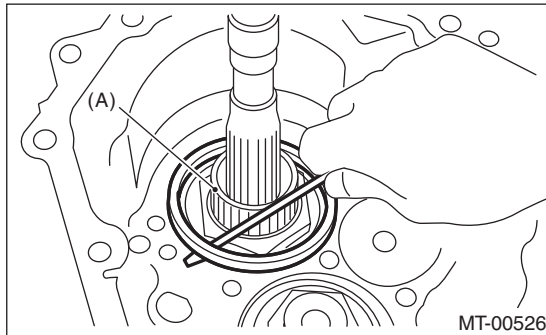
Using a general tool may cause damage. Remove the bolt using the ST.

ST 18663AA000 SOCKET



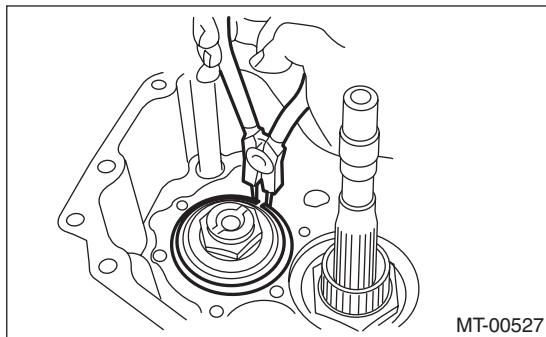
13) Remove the thrust washer on the main shaft section.

14) Remove the driven gear assembly shim and spacer.

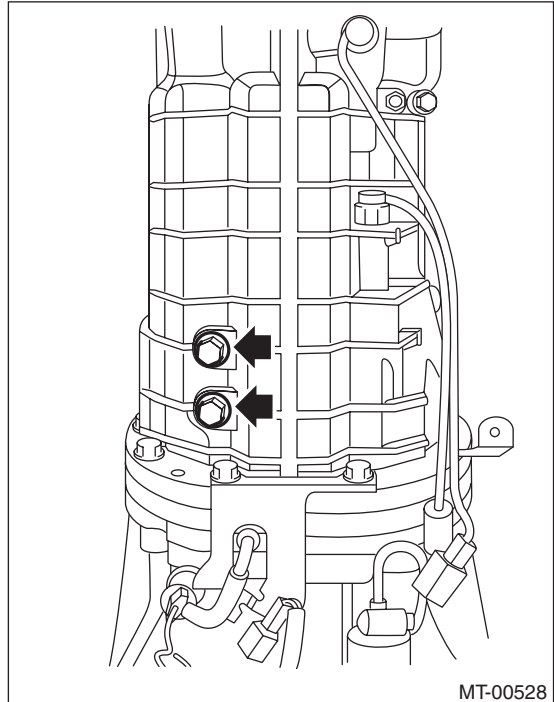


(A) Driven gear ASSY

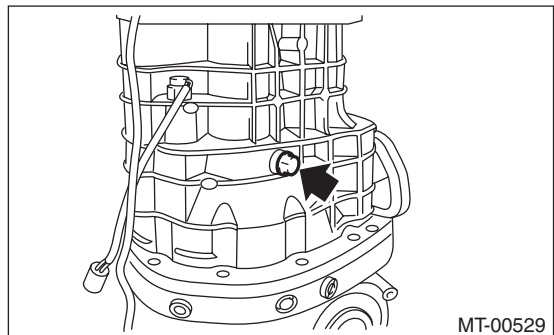
15) Remove the snap ring.



16) Remove the pilot bolt.



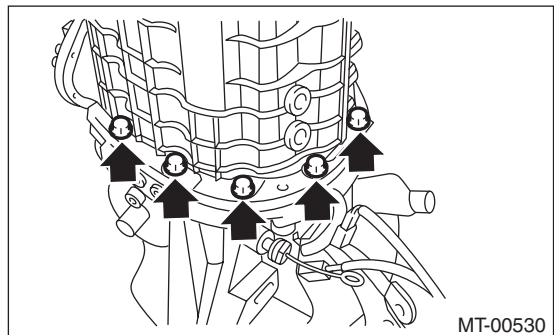
17) Remove the holder reverse bolt.



18) Remove the transmission case.

**NOTE:**

If the oil guide is caught between the shift fork, it may be difficult to remove the transmission case. Move the oil guide, then remove. Do not pull on the transmission case with excessive force.



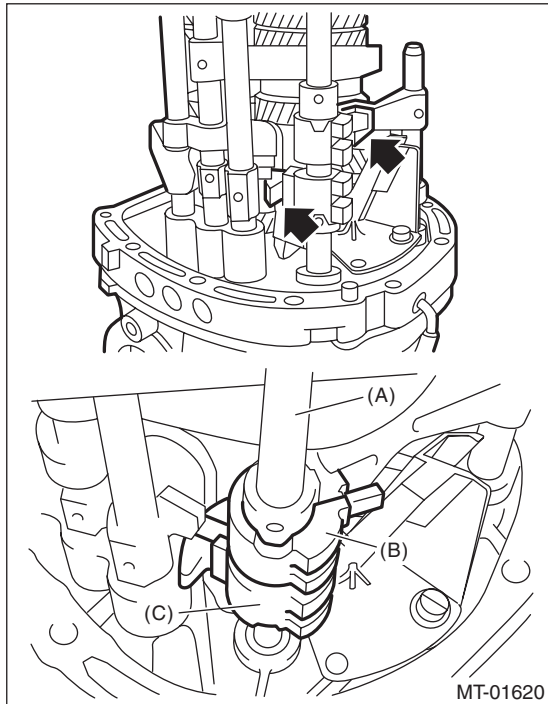
19) Remove any remaining liquid gasket from the transmission case and adapter plate.

# Transmission Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: INSTALLATION

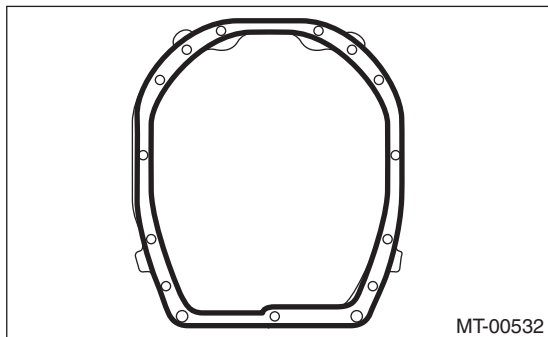
1) Check that the shifter fork and the interlock block are both shifted into the neutral position. If they are not, shift into the neutral position.



- (A) Striking rod
- (B) Reverse interlock block
- (C) Interlock block

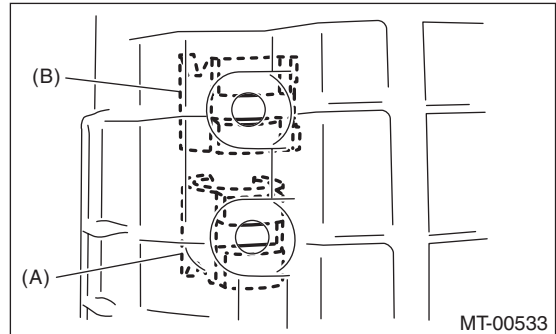
2) Apply liquid gasket to the adapter plate.

**Liquid gasket:**  
**THREE BOND 1215 (Part No. 004403007)**



3) Install the transmission case.

4) By inspecting from the pilot bolt attachment hole, check that the interlock block and the reverse interlock block are aligned to the neutral position. If not aligned, remove the transmission case, and shift the shifter fork and interlock block to the neutral position.



- (A) Interlock block
- (B) Reverse interlock block

5) Use a new gasket to temporarily attach the pilot bolt.

6) Affix the transmission case with the bolts and nuts.

**Tightening torque:**  
**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

7) Tighten the pilot bolt.

**Tightening torque:**  
**34 N·m (3.5 kgf-m, 25.1 ft-lb)**

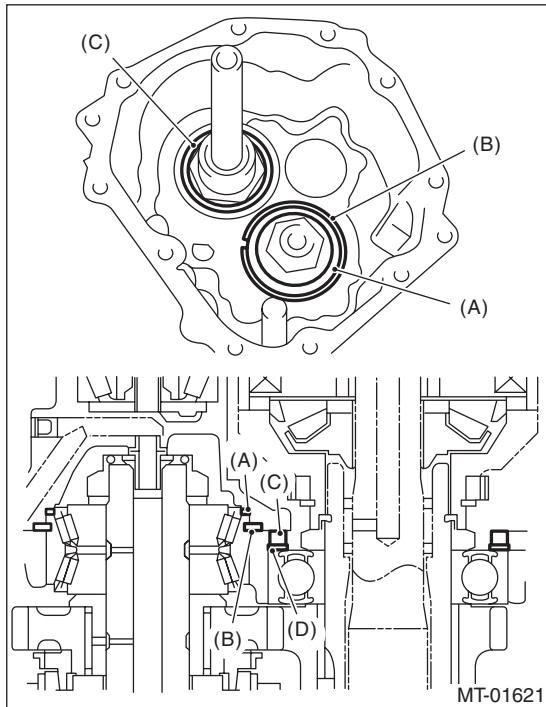
8) Tighten the holder reverse bolt.

**Tightening torque:**  
**25 N·m (2.5 kgf-m, 18.4 ft-lb)**

# Transmission Case

## MANUAL TRANSMISSION AND DIFFERENTIAL

9) Install the snap ring, washer and collar of the driven gear assembly.



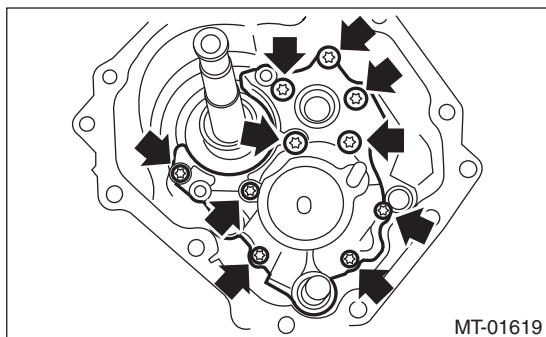
- (A) Washer
- (B) Snap ring
- (C) Collar
- (D) Washer

10) Attach the thrust washer to the main shaft.  
11) Install the transfer bearing holder.

### **Tightening torque:**

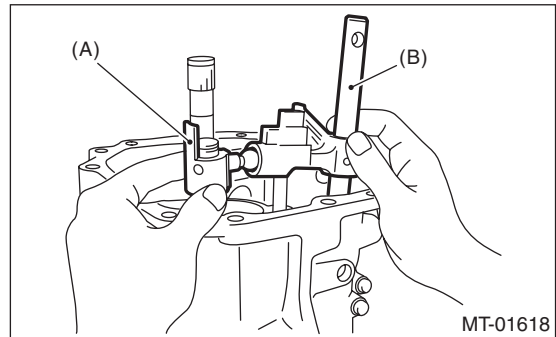
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

ST 18663AA000 SOCKET



12) When replacing the transfer bearing holder, select the appropriate transfer driven gear and thrust washer, and install to the extension case. <Ref. to 6MT-45, ADJUSTMENT, Extension Case.>

13) Install the selector arm No. 2 and the shifter arm.



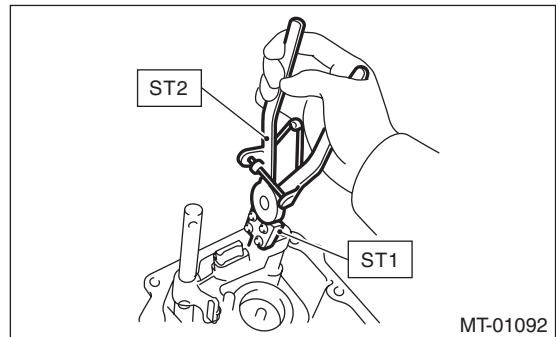
- (A) Selector arm No. 2
- (B) Shifter arm

14) Install a new spring pin.

15) Using the ST, install the neutral set spring.

ST1 18756AA000 CLAW

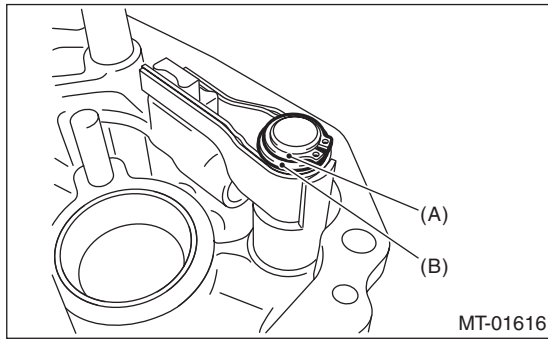
ST2 399893600 PLIER



# Transmission Case

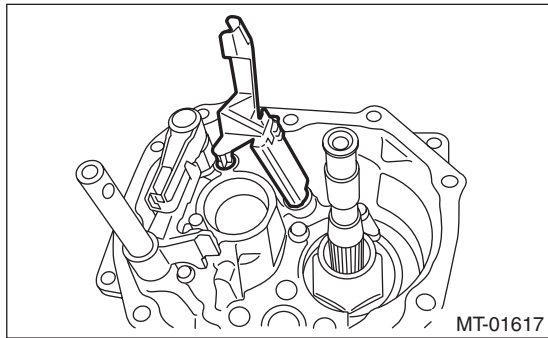
## MANUAL TRANSMISSION AND DIFFERENTIAL

16) Install the snap ring and flat washer to the selector arm area.



- (A) Snap ring
- (B) Flat washer

17) Install the oil guides G and H.



18) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>

19) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>

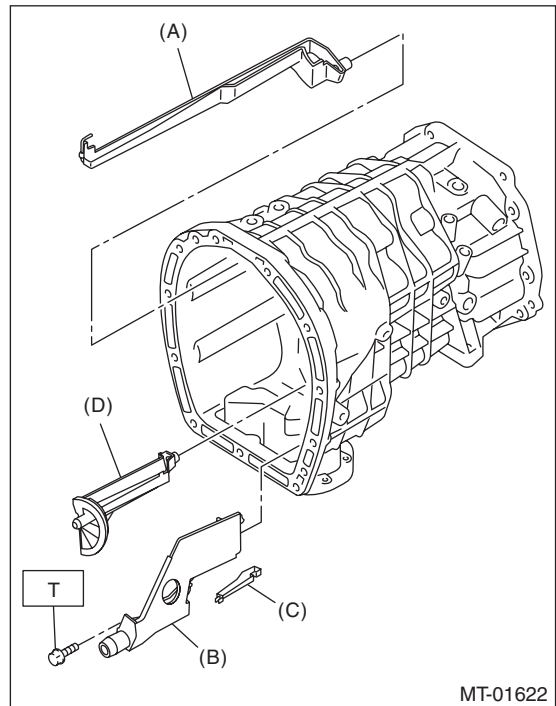
20) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>

21) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.> <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>

22) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

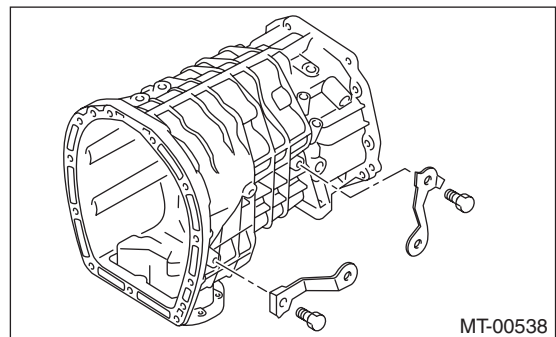
## C: DISASSEMBLY

1) Remove the oil guides C, D, E and F.

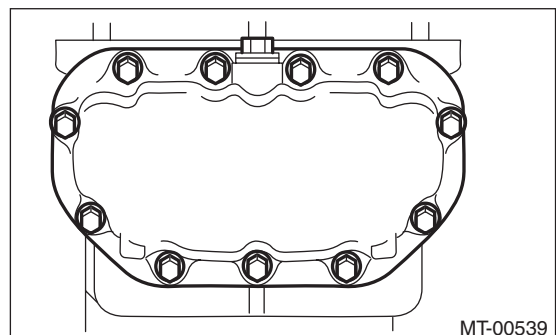


- (A) Oil guide C
- (B) Oil guide D
- (C) Oil guide E
- (D) Oil guide F

2) Remove the harness bracket.



3) Remove the oil pan.



4) Remove any remaining liquid gasket from the transmission case and oil pan.

# Transmission Case

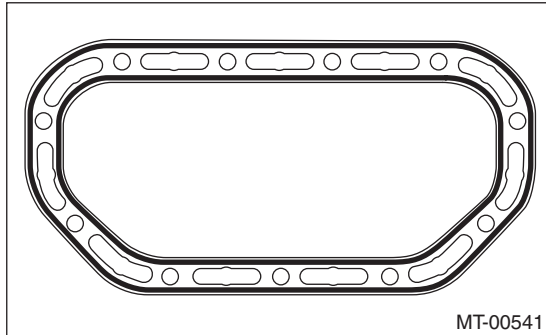
MANUAL TRANSMISSION AND DIFFERENTIAL

## D: ASSEMBLY

1) Apply liquid gasket to the oil pan.

**Liquid gasket:**

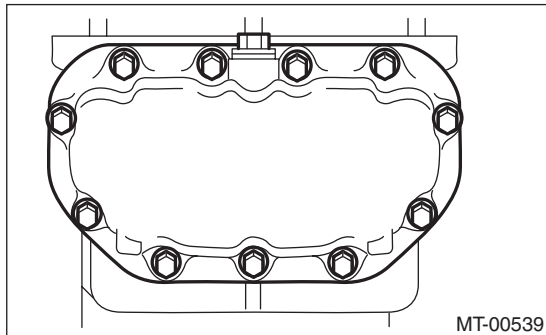
**THREE BOND 1215 (Part No. 004403007)**



2) Install the oil pan.

**Tightening torque:**

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



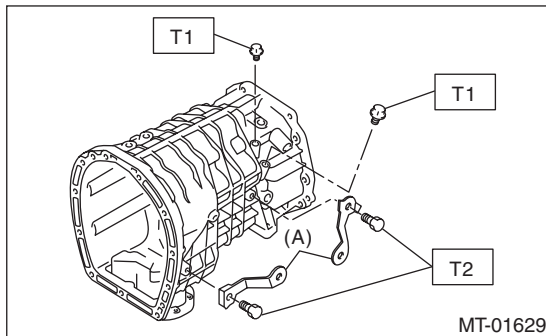
3) Install the relief valve, relief valve spring and a new O-ring.

4) Install the ball, valve spring and a new O-ring.

**Tightening torque:**

**T1: 13 N·m (1.3 kgf·m, 9.6 ft·lb)**

**T2: 16 N·m (1.6 kgf·m, 11.8 ft·lb)**

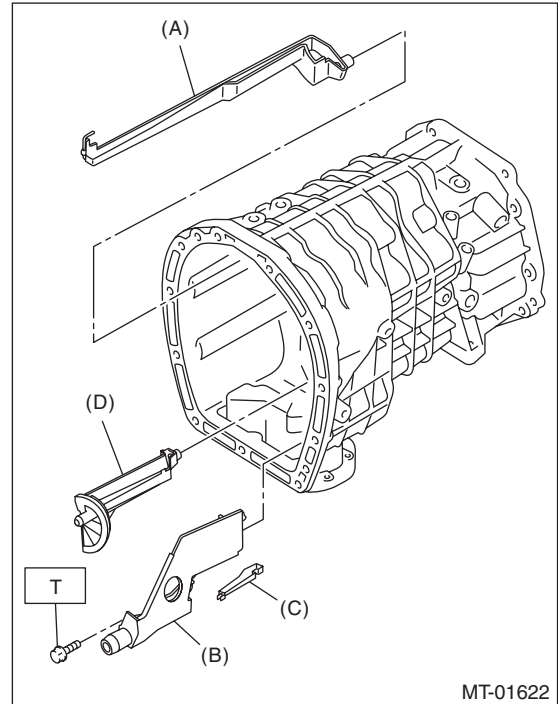


(A) Harness bracket

5) Install the oil guides C, D, E and F.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



(A) Oil guide C

(B) Oil guide D

(C) Oil guide E

(D) Oil guide F

## E: INSPECTION

1) If the sludge is accumulated in the oil pan, use a waste cloth to wipe it off completely.

2) Check that there is no damage on any parts. Replace damaged parts with new parts.

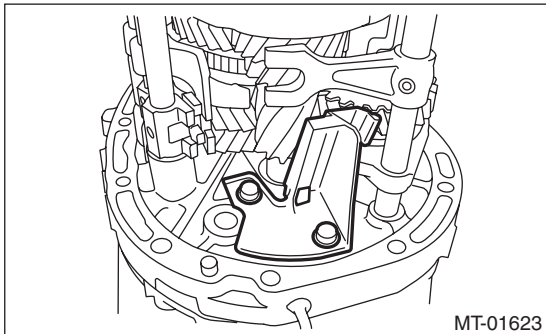
# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

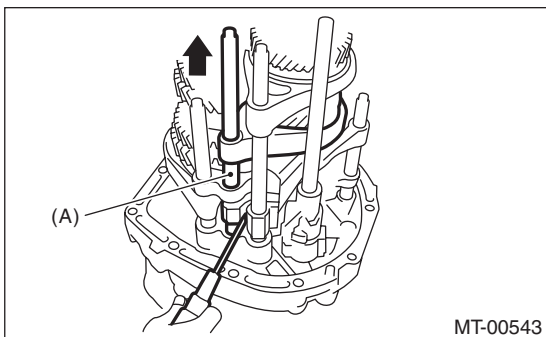
### 17. Main Shaft Assembly

#### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.>, <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the striking rod.
- 9) Remove the oil guide B.

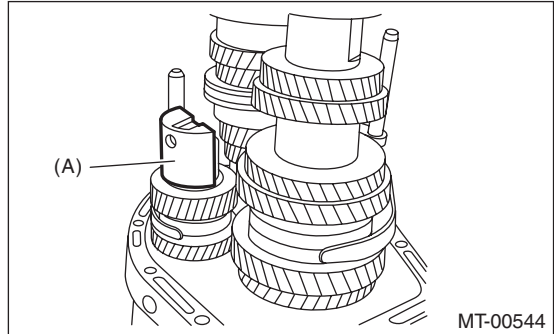


- 10) Use a screw driver to shift to the 4th gear position.



(A) 3rd-4th shift rod

- 11) Remove the reverse idler holder.

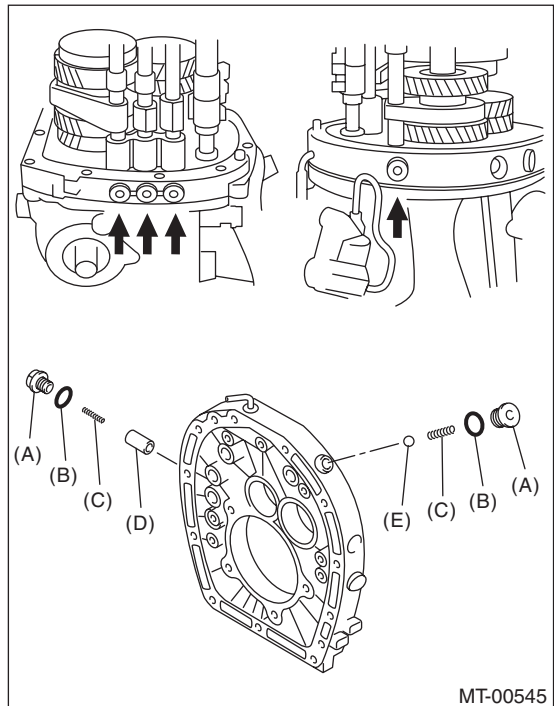


(A) Reverse idler holder

- 12) Remove the check plug, O-ring, check spring, plunger and check ball from the adapter plate.

#### NOTE:

Do not reuse the O-ring.

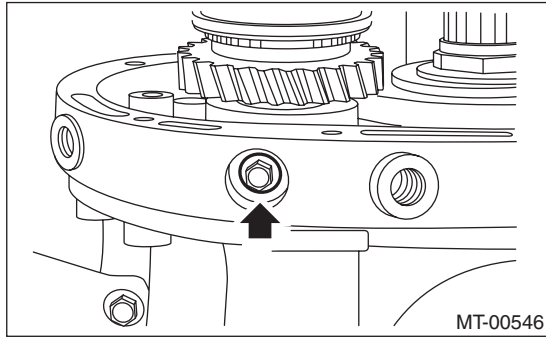


- (A) Check plug
- (B) O-ring
- (C) Check spring
- (D) Plunger
- (E) Check ball

# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

13) Remove the bolt and gasket holding the reverse idler shaft.



14) Push the main shaft assembly, driven gear assembly, reverse idler gear and shifter forks to remove from the adapter plate all at once.

### NOTE:

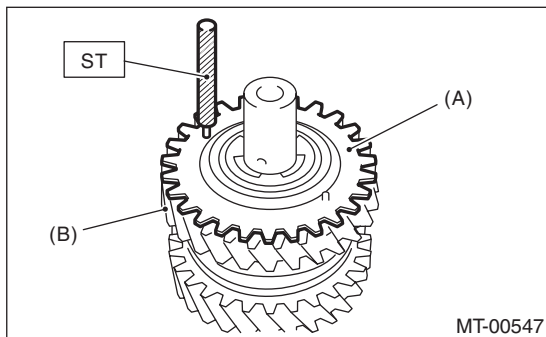
A helper is required to perform this work.

## B: INSTALLATION

1) Adjust the 3rd-4th and 5th-6th shifter fork rods. <Ref. to 6MT-112, ADJUSTMENT, Shifter Fork and Rod.>

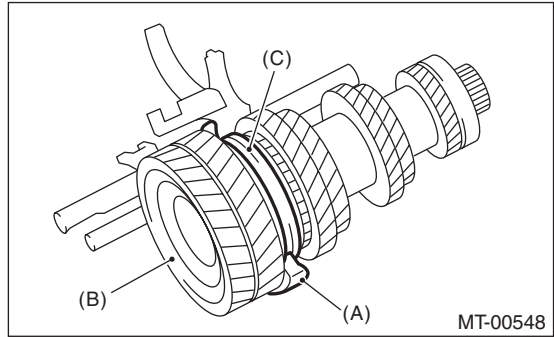
2) Turn the sub gear counterclockwise for approximately 3 teeth. Match the sub gear and reverse idler gear holes, and insert the ST.

ST 18757AA000 STRAIGHT PIN



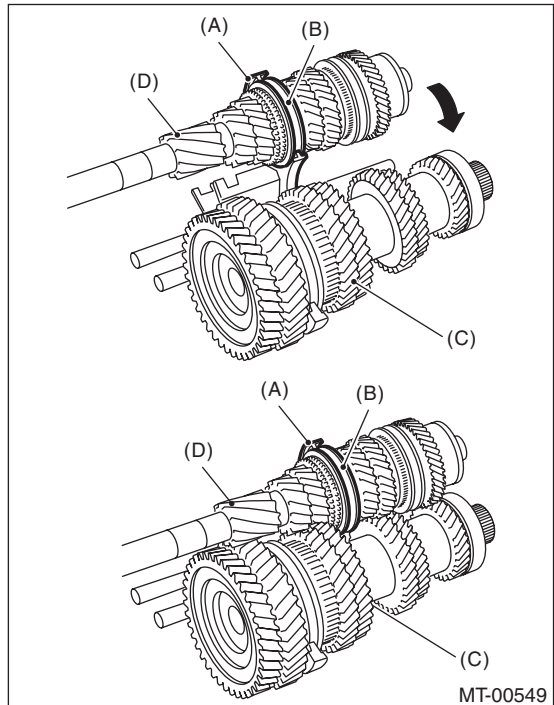
- (A) Sub gear
- (B) Reverse idler gear

3) Attach the driven gear assembly to the 1st-2nd shifter fork assembly.



- (A) 1st-2nd shifter fork
- (B) Driven gear ASSY
- (C) 1st-2nd sleeve

4) Attach the main shaft assembly to the 3rd-4th shifter fork, and assemble to the driven gear assembly.

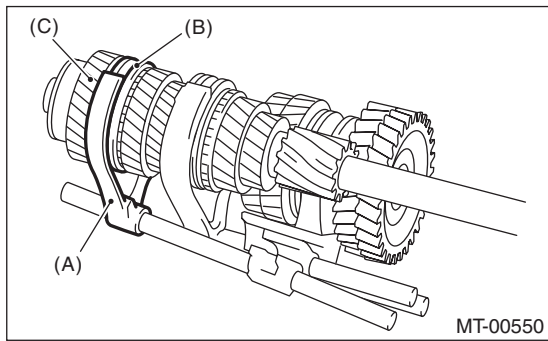


- (A) 3rd-4th shifter fork
- (B) 3rd-4th sleeve
- (C) Driven gear ASSY
- (D) Main shaft ASSY

# Main Shaft Assembly

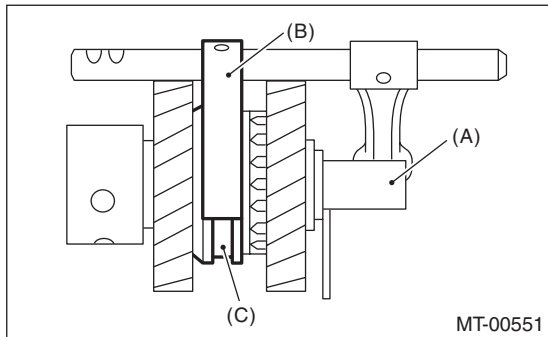
## MANUAL TRANSMISSION AND DIFFERENTIAL

5) Attach the 5th-6th shifter fork assembly to the main shaft assembly.



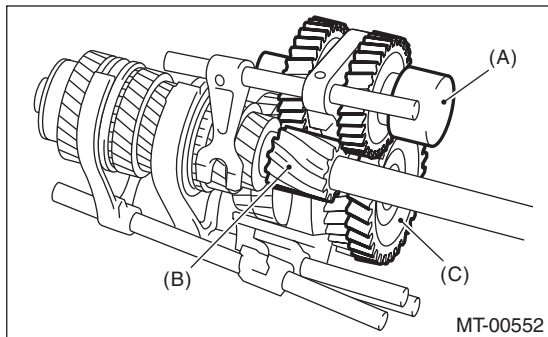
- (A) 5th-6th shifter fork
- (B) 5th-6th sleeve
- (C) Main shaft ASSY

6) Attach the reverse shifter fork assembly to the reverse idler gear assembly.



- (A) Reverse idler gear ASSY
- (B) Reverse shifter fork
- (C) Reverse sleeve

7) Install the reverse idler gear assembly.



- (A) Reverse idler gear ASSY
- (B) 1st drive gear
- (C) Reverse gear

8) Install the thrust bearing of the driven gear assembly.

9) Push on the shifter forks, main shaft assembly, driven gear assembly and reverse idler gear assemblies, to attach to the adapter plate all at once.

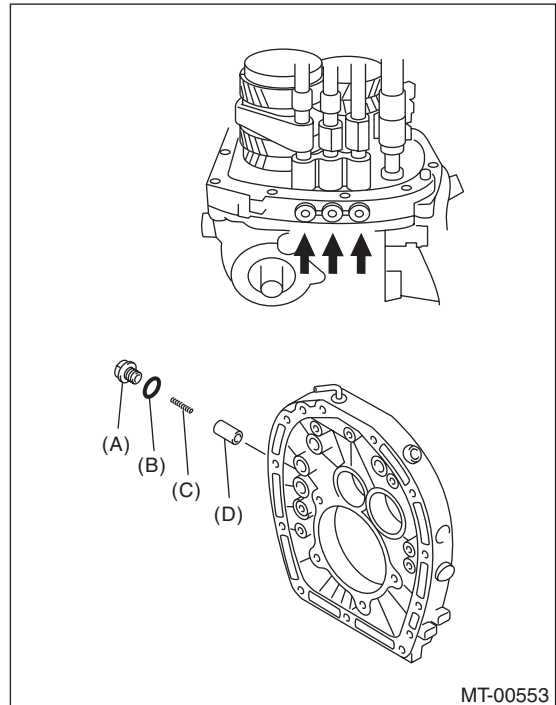
### NOTE:

A helper is required to perform this work.

10) Install the plunger, check spring, new O-ring and check plug.

### Tightening torque:

**37 N·m (3.8 kgf·m, 27.3 ft·lb)**



- (A) Check plug
- (B) O-ring
- (C) Check spring
- (D) Plunger



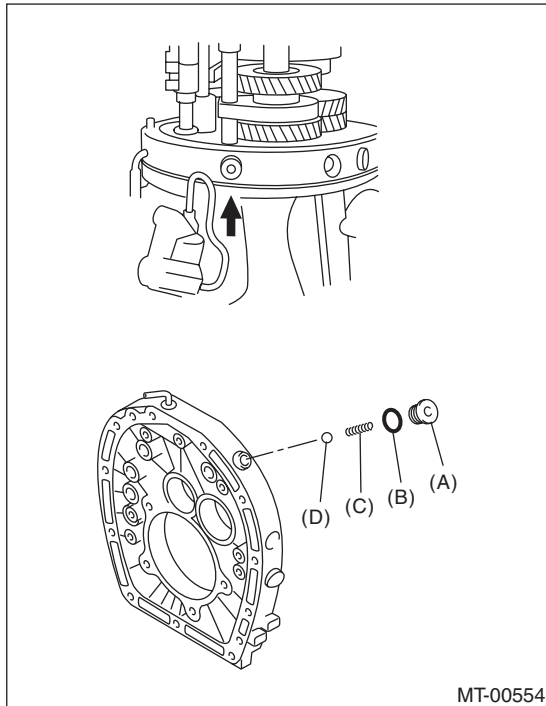
# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

11) Install the check ball, check spring, new O-ring and check plug.

**Tightening torque:**

**37 N·m (3.8 kgf·m, 27.3 ft·lb)**

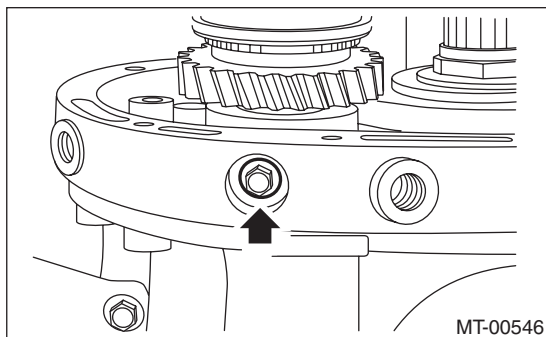


- (A) Check plug
- (B) O-ring
- (C) Check spring
- (D) Check ball

12) Install a bolt and a new gasket.

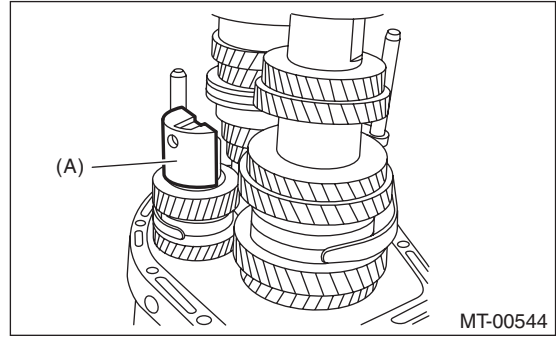
**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



13) Use a screw driver to shift to the 4th gear position.

14) Install the reverse idler holder.

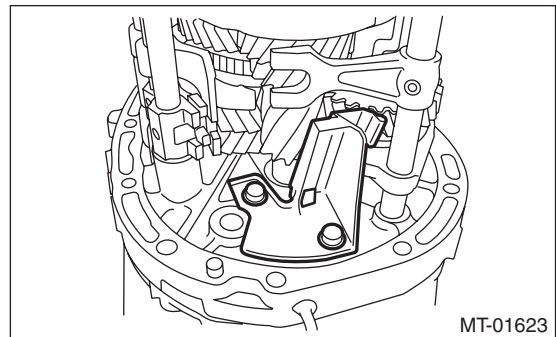


(A) Reverse idler holder

15) Install the oil guide B.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



16) Install the striking rod.

17) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>

18) Install the selected main shaft snap ring and washers.

19) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>

20) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>

21) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>

22) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.>, <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>

23) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: DISASSEMBLY

#### NOTE:

Individual sleeves and hubs meet at a specified position. Before disassembly, mark the meeting position of the sleeve and hub.

1) Affix the ST to the work table.

ST 18664AA000 BASE

2) Flatten the tab of the axle nut.

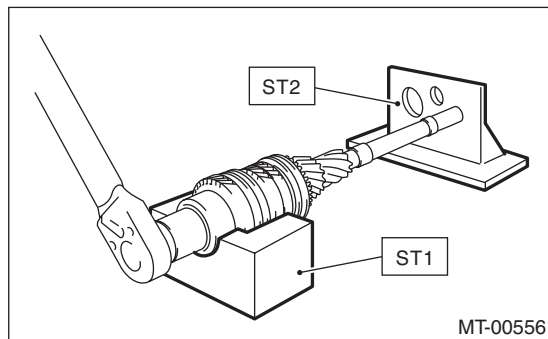
3) Set the main shaft assembly to the ST, and remove the lock nut and washer.

ST1 18665AA000 HOLDER

ST2 18664AA000 BASE

#### NOTE:

Use a 38 mm socket wrench.

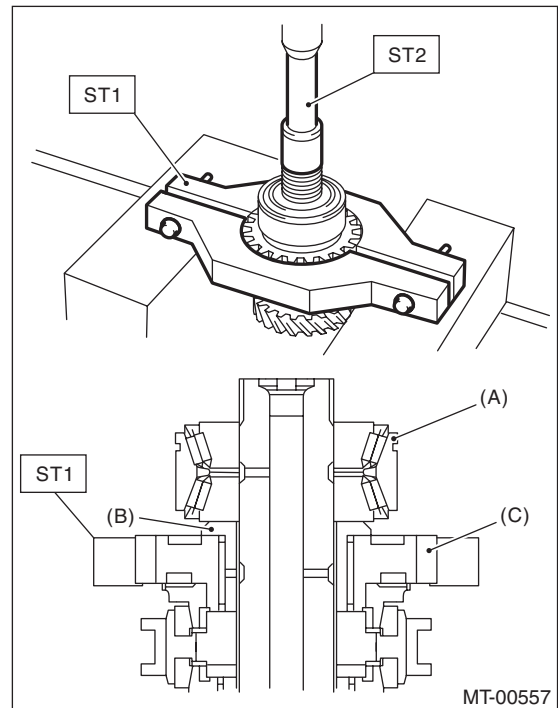


4) Remove the main shaft assembly from the ST.

5) Set the ST1 to the 6th drive gear, and use a press to remove the taper roller bearing, bushing and 6th drive gear.

ST1 18722AA010 REMOVER

ST2 899864100 REMOVER

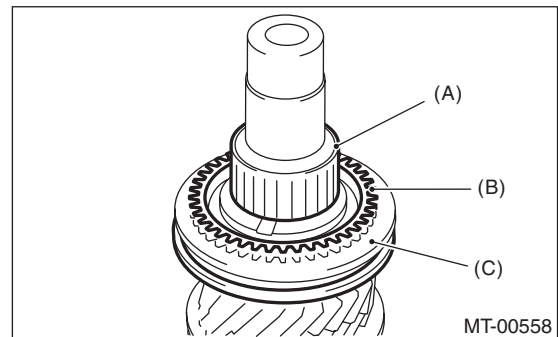


(A) Taper roller bearing

(B) Bushing

(C) 6th drive gear

6) Remove the 5th-6th sleeve, 6th needle bearing and 6th baulk ring.



(A) Needle bearing

(B) 6th baulk ring

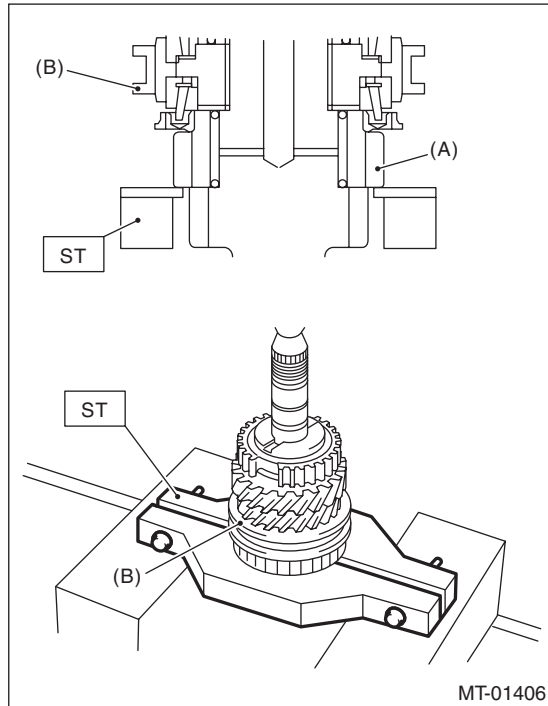
(C) 5th-6th sleeve

# Main Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

7) Set the ST to the 3rd drive gear, and use a press to remove individual parts.

ST 18720AA000 REMOVER



(A) 3rd drive gear

(B) 3rd-4th sleeve

## D: ASSEMBLY

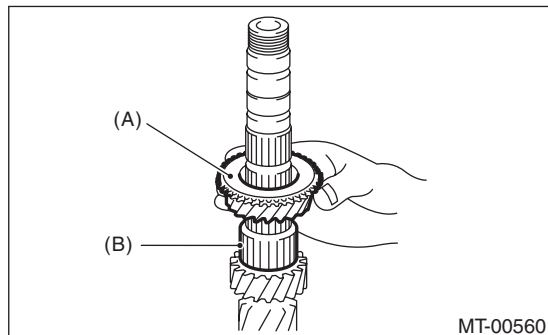
NOTE:

When replacing the following parts, replace as a set.

- Sleeve and hub
- Outer baulk ring, 3rd synchro cone and inner baulk ring
- Taper roller bearing

1) Apply adequate transmission gear oil to the main shaft, 3rd needle bearing and 3rd drive gear inner surface.

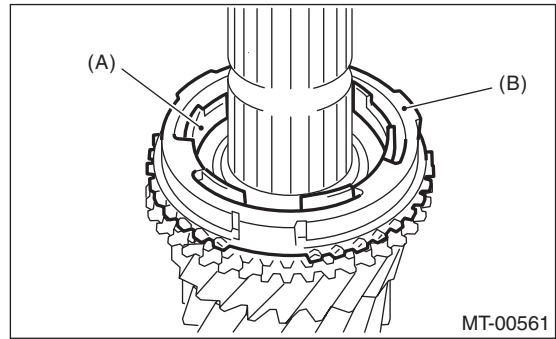
2) Install the 3rd needle bearing and 3rd drive gear to the main shaft.



(A) 3rd needle bearing

(B) 3rd drive gear

3) Install the inner baulk ring, 3rd synchro cone and outer baulk ring.

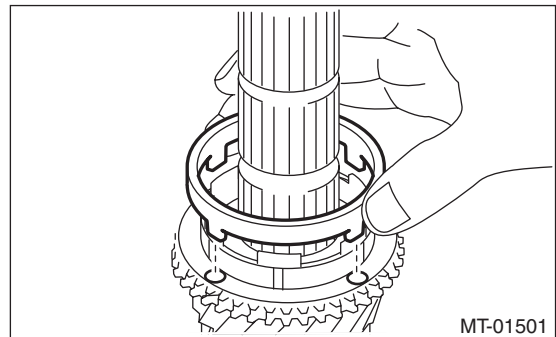


(A) Inner baulk ring

(B) Outer baulk ring

NOTE:

Install the 3rd synchro cone by aligning the protrusion of the 3rd synchro cone with the hole on the 3rd drive gear.

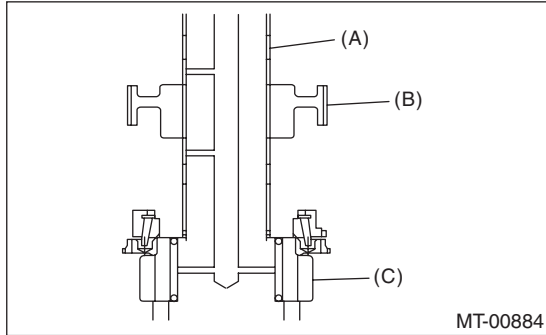


# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

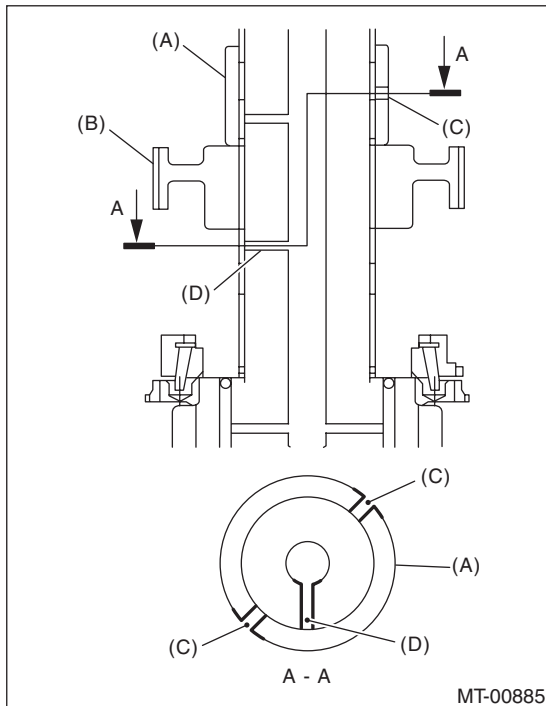
### 4) Install the 3rd-4th hub and 4th bushing.

(1) Being careful of the install direction of the 3rd-4th hub, set to the main shaft.



- (A) Main shaft
- (B) 3rd-4th hub
- (C) 3rd drive gear

(2) Being careful not to cover the oil holes of the main shaft and 4th bushing, attach to the main shaft.



- (A) 4th bushing
- (B) 3rd-4th hub
- (C) 4th bushing oil hole
- (D) Main shaft oil hole

(3) Using the ST, push in to the 3rd-4th hub and 4th bushing all at once.

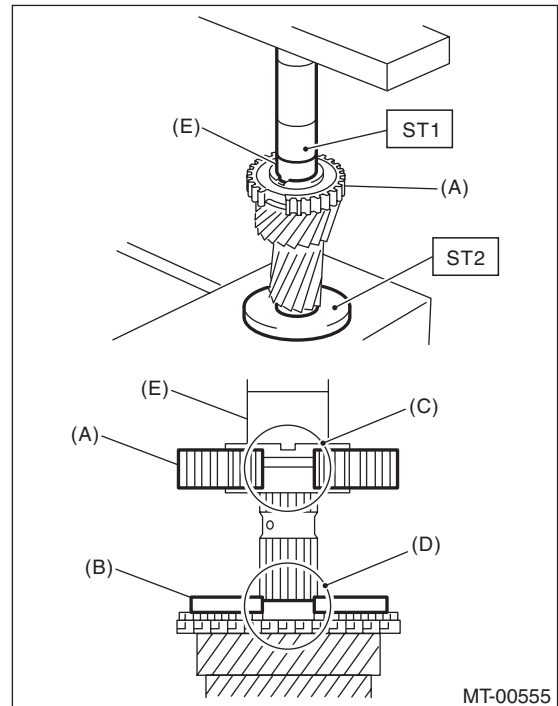
ST1 18651AA000 INSTALLER  
ST2 398177700 INSTALLER

### CAUTION:

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**

### NOTE:

When pushing into the 3rd-4th hub and 4th bushing, move the outer baulk ring to match the protrusion of the outer baulk ring and the cut out on the 3rd-4th bushing.



- (A) 3rd-4th hub
- (B) Outer baulk ring
- (C) Cut out on the 3rd-4th hub
- (D) Protrusion of the outer baulk ring
- (E) 4th bushing

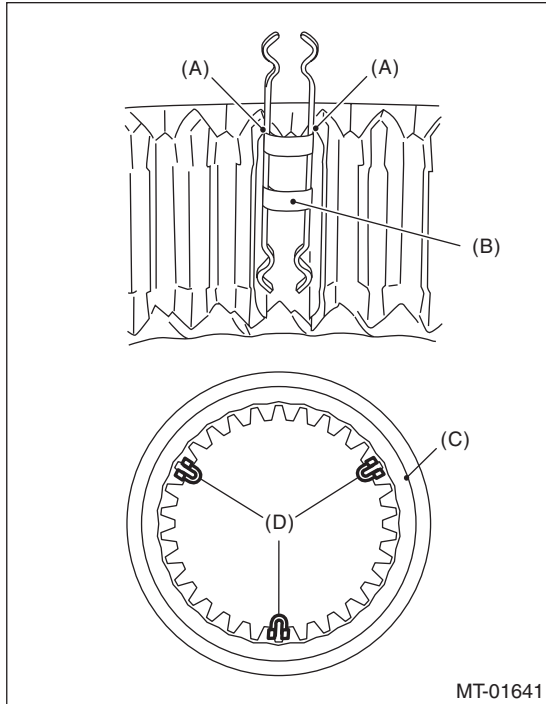
5) Make sure that the 3rd drive gear can be turned smoothly by hand. If it does not turn smoothly, re-assemble.

# Main Shaft Assembly

6) Attach the 3rd-4th shifting insert key at the appropriate position of the 3rd-4th sleeve.

**NOTE:**

- The angle of each shifting insert key is 120°.
- Refer to the following figure to install the shifting insert key.

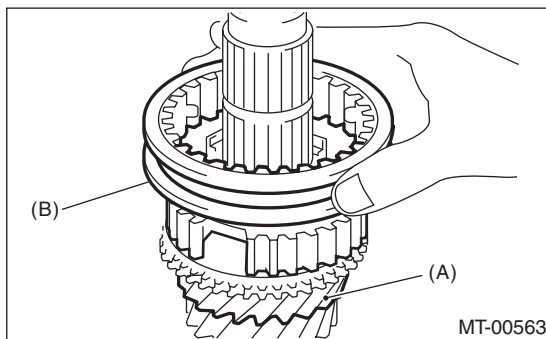


- (A) Attach the straight part of the shifting insert key to the sleeve convex portion.
- (B) Shifting insert key
- (C) 3rd-4th sleeve
- (D) 3rd-4th shifting insert key

7) Attach the 3rd-4th sleeve to the 3rd-4th hub.

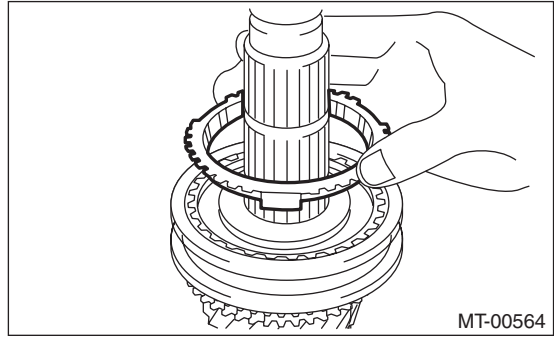
**NOTE:**

- There is an identification groove on the 3rd-4th sleeve.
- Place the groove towards the 3rd drive gear, and attach the 3rd-4th sleeve.



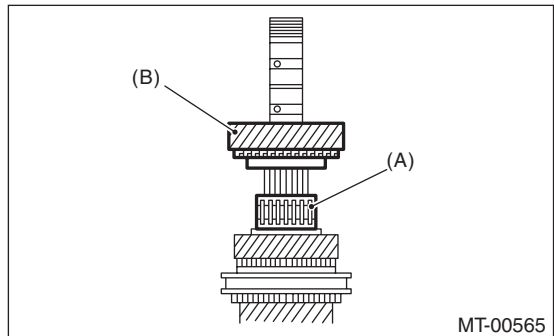
- (A) 3rd drive gear
- (B) 3rd-4th sleeve identification groove (1)

8) Install the 4th baulk ring.



9) Apply adequate transmission gear oil to the main shaft, 4th needle bearing and 4th drive gear inner surface.

10) Install the 4th needle bearing and 4th drive gear.



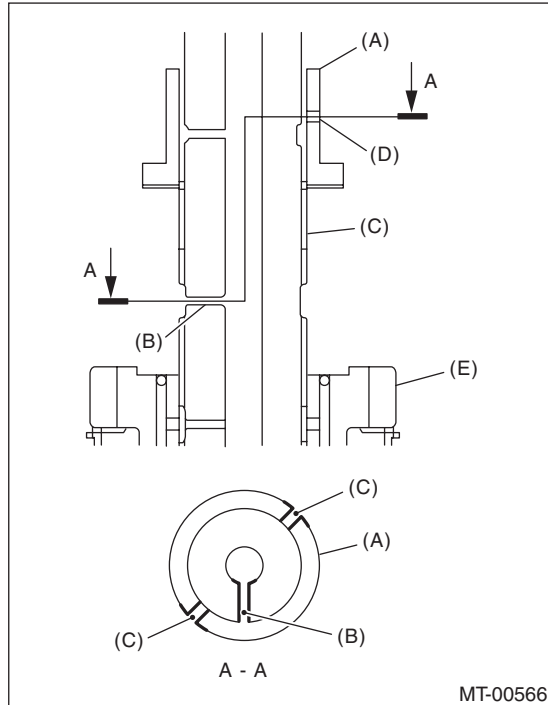
- (A) 4th needle bearing
- (B) 4th drive gear

# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 11) Install the 5th bushing.

(1) Being careful not to cover the oil holes of the main shaft and 5th bushing, attach to the main shaft.



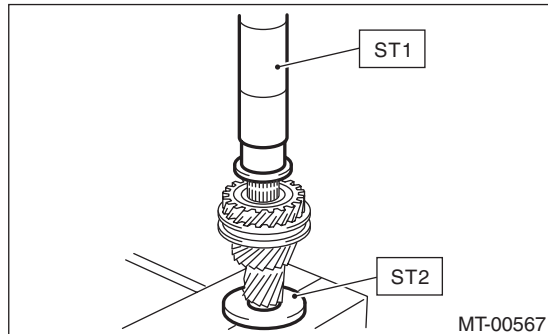
- (A) 5th bushing
- (B) Main shaft oil hole
- (C) Main shaft
- (D) 5th bushing oil hole
- (E) 4th drive gear

(2) Using the ST, push into the 5th bushing.

ST1 18651AA000 INSTALLER  
ST2 398177700 INSTALLER

### CAUTION:

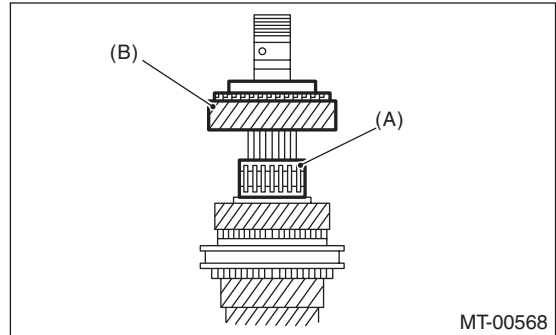
**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**



12) Make sure that the 4th drive gear can be turned smoothly by hand. If it does not turn smoothly, re-assemble.

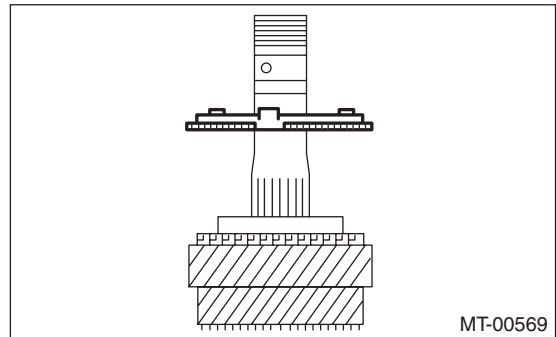
13) Apply adequate transmission gear oil to the main shaft, 5th needle bearing and 5th drive gear inner surface.

14) Install the 5th needle bearing and 5th drive gear.



- (A) 5th needle bearing
- (B) 5th drive gear

15) Install the 5th baulk ring.

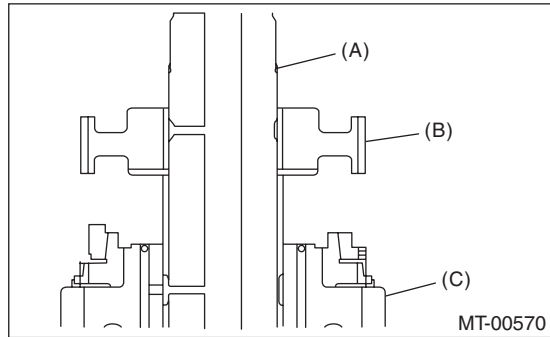


# Main Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

16) Install the 5th-6th hub.

(1) Being careful of the install direction of the 5th-6th hub, set to the main shaft.



- (A) Main shaft
- (B) 5th-6th hub
- (C) 5th drive gear

(2) Using the ST, push into the 5th-6th hub.

ST1 18651AA000 INSTALLER

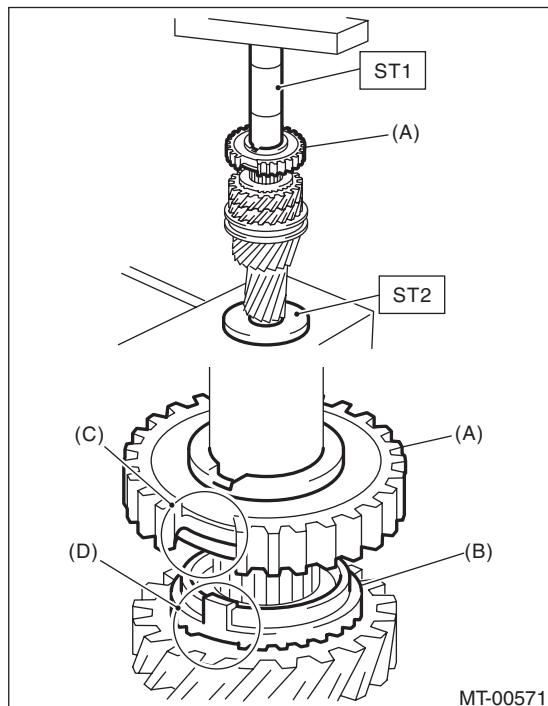
ST2 398177700 INSTALLER

### CAUTION:

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**

### NOTE:

When pushing into the 5th-6th hub, move the outer baulk ring to match the protrusion of the outer baulk ring and the cut out on the 5th-6th bushing.



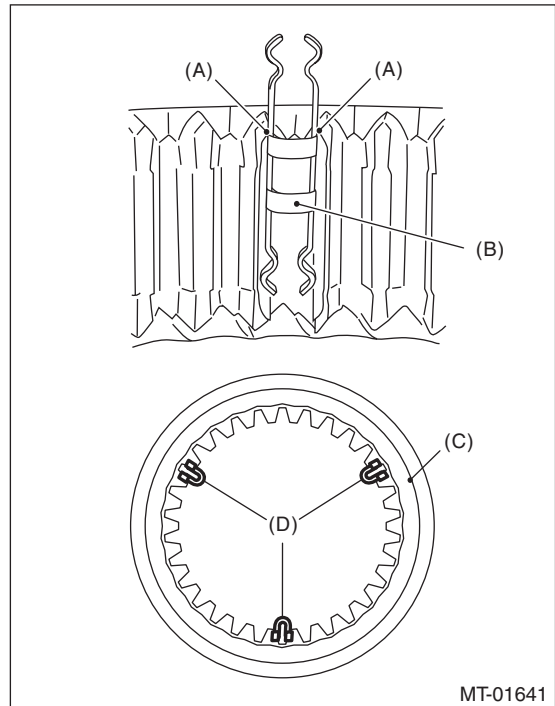
- (A) 5th-6th hub
- (B) Outer baulk ring
- (C) Cut out on the 5th-6th hub
- (D) Protrusion of the outer baulk ring

17) Make sure that the 5th drive gear can be turned smoothly by hand. If it does not turn smoothly, re-assemble.

18) Attach the 5th-6th shifting insert key at the appropriate position of the 5th-6th sleeve.

### NOTE:

- The angle of each shifting insert key is 120°.
- Refer to the following figure to install the shifting insert key.



- (A) Attach the straight part of the shifting insert key to the sleeve convex portion.
- (B) Shifting insert key
- (C) 5th-6th sleeve
- (D) Shifting insert key

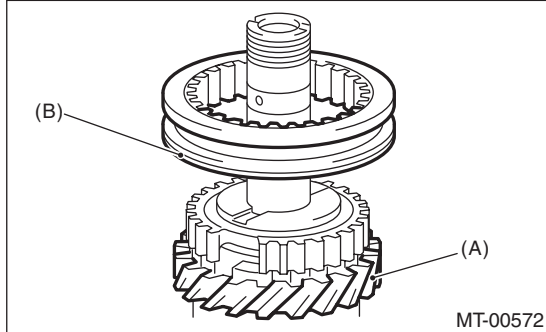
# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

19) Attach the 5th-6th sleeve to the 5th-6th hub.

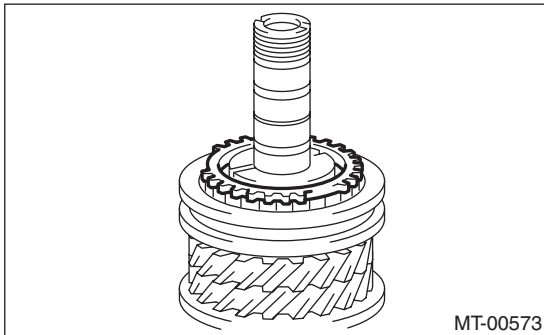
**NOTE:**

- There are 2 identification grooves on the 5th-6th sleeve.
- Place the grooves towards the 5th drive gear, and attach the 5th-6th sleeve.



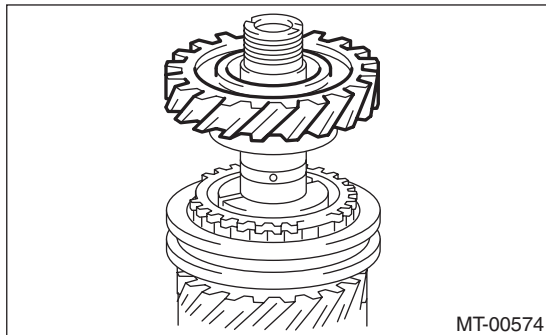
- (A) 5th drive gear  
(B) 5th-6th sleeve identification groove (2)

20) Install the 6th baulk ring.

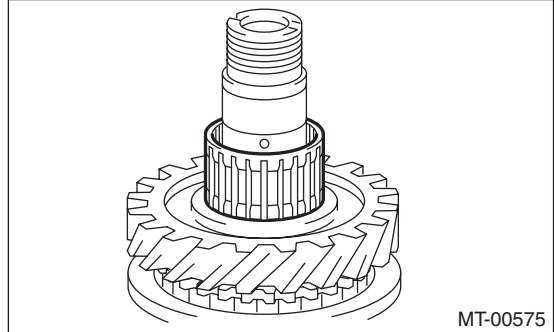


21) Apply adequate transmission gear oil to the main shaft, 6th needle bearing and 6th drive gear inner surface.

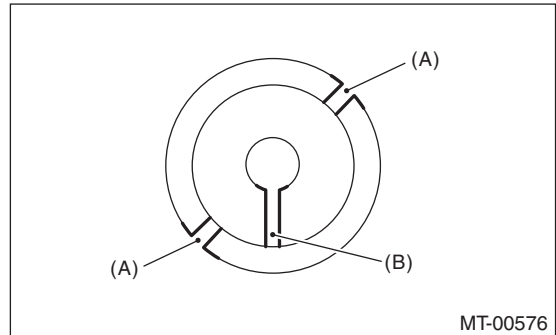
22) Install the 6th drive gear.



23) Install the 6th needle bearing.



24) Being careful not to cover the oil holes of the 6th bushing and the main shaft, set the 6th bushing to the main shaft.



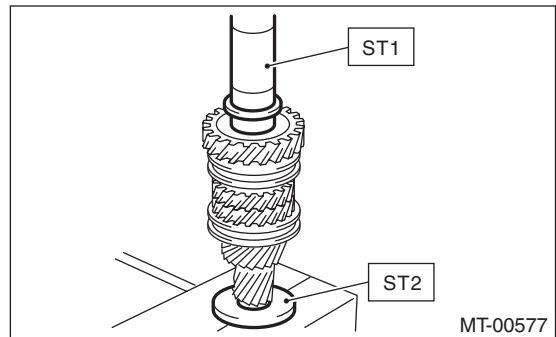
- (A) 6th bushing oil hole  
(B) Main shaft oil hole

25) Using the ST, install the 6th bushing.

- ST1 18651AA000 INSTALLER  
ST2 398177700 INSTALLER

**CAUTION:**

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**



26) Make sure that the 6th drive gear can be turned smoothly by hand. If it does not turn smoothly, re-assemble.



# Main Shaft Assembly

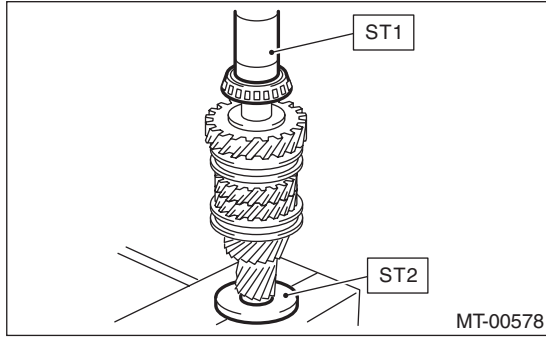
MANUAL TRANSMISSION AND DIFFERENTIAL

27) Using the ST, install the inner bearing of the taper roller bearing.

ST1 18651AA000 INSTALLER  
ST2 398177700 INSTALLER

**CAUTION:**

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**



28) Using the ST, install the outer race and the outer bearing of the taper roller bearing.

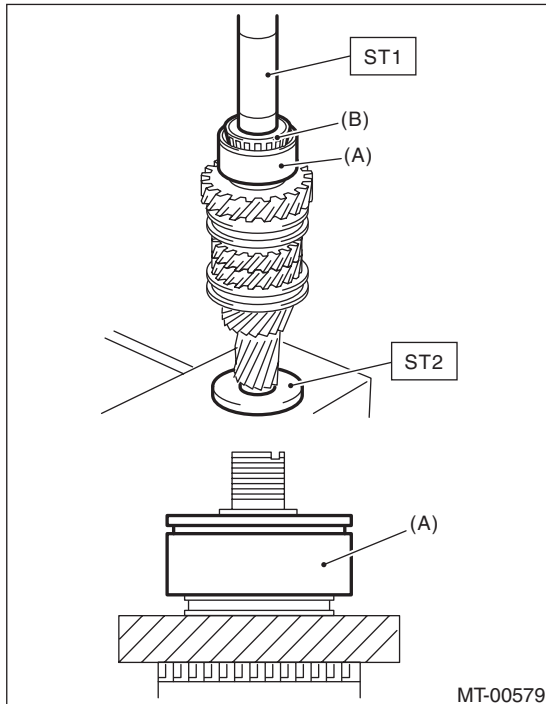
ST1 18651AA000 INSTALLER  
ST2 398177700 INSTALLER

**CAUTION:**

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**

**NOTE:**

- Confirm that the outer race is installed in the proper direction.
- Push in until there is no backlash on the outer race and the bearing turns smoothly by hand.



- (A) Outer race
- (B) Outer bearing of the taper roller bearing

29) Make sure that the taper roller bearing turns smoothly by hand. If it does not rotate smoothly, replace the taper roller bearing as a set, and reassemble.

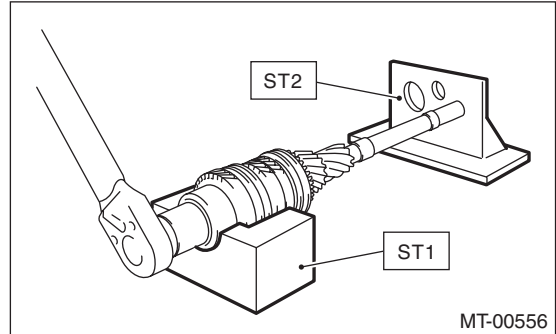
30) Attach the lock washer and a new lock nut.

31) Set the main shaft assembly to the ST, and tighten the lock nut.

ST1 18665AA000 HOLDER  
ST2 18664AA000 BASE

**Tightening torque:**

**392 N·m (40.0 kgf·m, 289 ft·lb)**

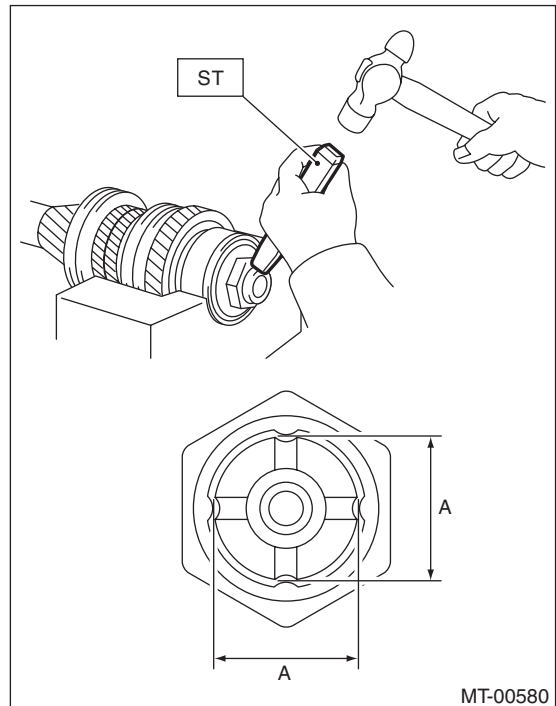


32) Using the ST, crimp the lock nut in 4 locations, with dimensions within A  $27 \pm 0.3$  mm ( $1.06 \pm 0.01$  in).

ST 18668AA000 PUNCH

**NOTE:**

Do not damage the crimp area of the lock nut.



# Main Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### E: INSPECTION

Disassembled parts should be washed clean first with cleaning solvent and then inspected carefully.

#### 1) Bearing

Replace the bearings in the following cases.

- Wear, rusting or damage of the bearings
- The bearing does not rotate smoothly or an abnormal noise is emitted when turning.
- The bearing has other defects.

#### 2) Bushing (each gear)

Replace the bushing in following cases.

- The sliding surface is damaged or abnormally worn.

#### 3) Gear

Replace gears in the following cases.

- The gear teeth surface is damaged or excessively worn.
- The contact area of the baulk ring is damaged.
- The inner face of the gear is worn.

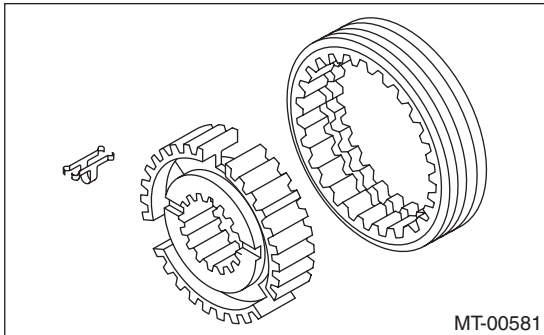
#### 4) Baulk ring, synchro cone

Replace the baulk ring and synchro cone in the following cases.

- Wear, rusting or damage of the baulk ring

#### 5) Shifting insert key

Replace the shifting insert key if deformed, excessively worn or defective in any way.



### F: ADJUSTMENT

#### 1. MAIN SHAFT SNAP RING & WASHER SELECTION

##### NOTE:

In the following conditions, perform the procedures below.

- Replacing driven gears 1st through 6th
- Replacing the 1st and 2nd synchro ring assembly
- Replacing the ball bearing
- Replacing the adapter plate
- Replacing the driven shaft

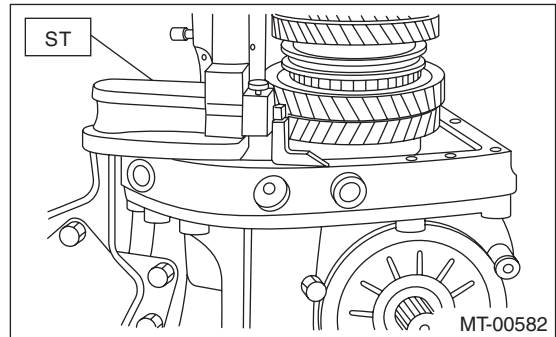
1) Insert the drive pinion assembly into the adapter plate.

##### NOTE:

Confirm that the thrust bearing outer race has not been removed and the drive pinion is not lifted.

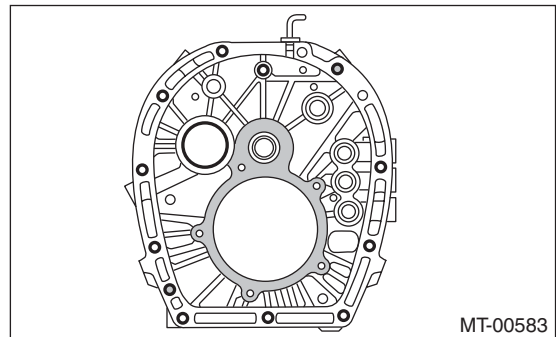
2) Set the height gauge to the adapter plate. Lower the height gauge indicator to the mating surface of the adapter plate and case, and set to 0 points.

ST 18853AA000 HEIGHT GAUGE



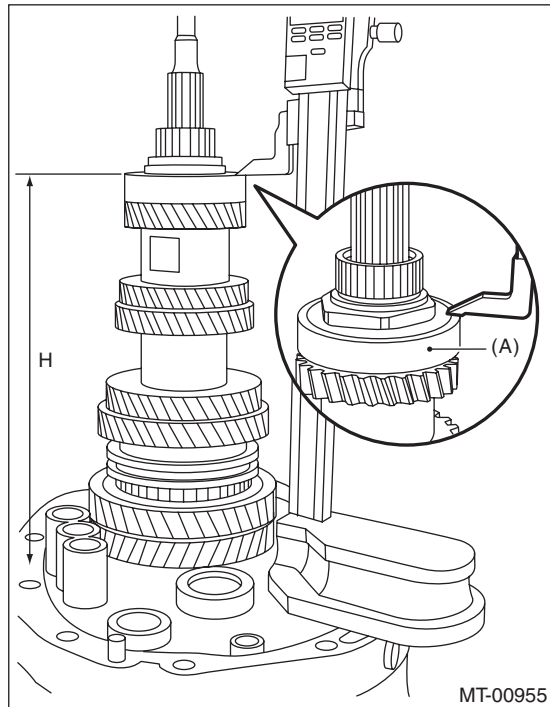
##### NOTE:

- The adapter plate will be the base point for the measurement. Use a scraper to remove any gasket material remaining on the end face.
- During measurement, do not place the height gauge in the shaded area shown in the figure.



# Main Shaft Assembly

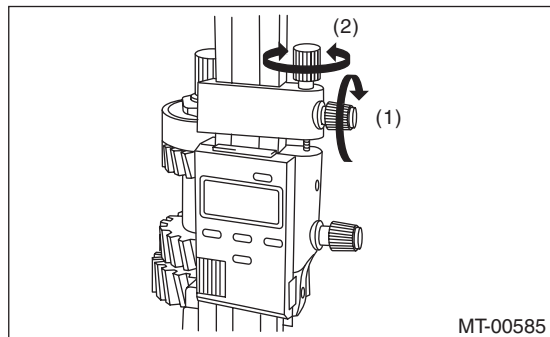
3) Measure the height to the ball bearing end face (height H).



(A) Ball bearing

**NOTE:**

Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the end face of the bearing.



Turn approximately 120° at a time, and measure the ball bearing in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.

4) According to the measurement value, select the snap ring and washer from the following table.

**Snap ring**

H: mm (in)	Part No.	Thickness: mm (in)
270.83 — 271.40 (10.66 — 10.69)	805072010	1.65 (0.065)
271.41 — 271.98 (10.69 — 10.71)	805072011	1.95 (0.077)
271.99 — 272.56 (10.71 — 10.73)	805072012	2.25 (0.089)

**Washer**

H: mm (in)	Part No.	Thickness: mm (in)
270.83 — 271.40 (10.66 — 10.69)	803067012	1.6 (0.063)
271.41 — 271.98 (10.69 — 10.71)	803067011	1.3 (0.051)
271.99 — 272.56 (10.71 — 10.73)	803067010	1.0 (0.039)

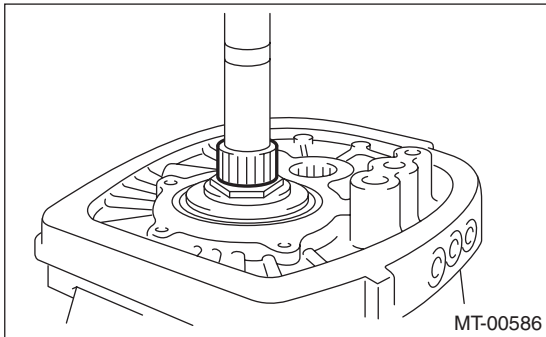
# Driven Gear Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## 18. Driven Gear Assembly

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.>, <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the driven gear assembly. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>
- 9) Remove the 1st needle bearing.



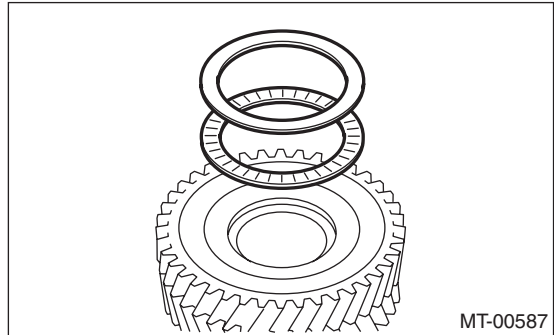
- 10) Remove the thrust needle bearing.

### B: INSTALLATION

- 1) Adjust the main shaft snap ring. <Ref. to 6MT-76, ADJUSTMENT, Main Shaft Assembly.>
- 2) Adjust the 1st-2nd shifter rod. <Ref. to 6MT-112, ADJUSTMENT, Shifter Fork and Rod.>
- 3) Install the thrust needle bearing.

#### NOTE:

Confirm that the thrust needle bearing is installed in the proper direction.



- 4) Install the 1st needle bearing.
- 5) Install the driven gear assembly. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>
- 6) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>
- 7) Adjust the backlash of the driven gear assembly in the axial direction. <Ref. to 6MT-86, ADJUSTMENT, Driven Gear Assembly.>
- 8) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>
- 9) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 10) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 11) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.>, <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>
- 12) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

# Driven Gear Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## C: DISASSEMBLY

### NOTE:

Individual sleeves and hubs meet at a specified position. Before disassembly, mark the meeting position of the sleeve and hub.

1) Affix the ST to the work table.

ST 18664AA000 BASE

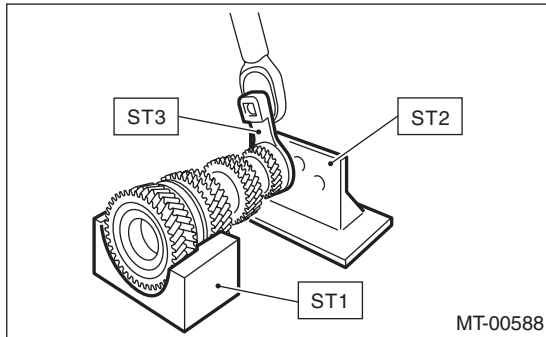
2) Flatten the tab of the axle nut.

3) Attach ST3 to the lock nut, set the driven gear assembly to the ST, and remove the lock nut and washer.

ST1 18666AA000 HOLDER

ST2 18664AA000 BASE

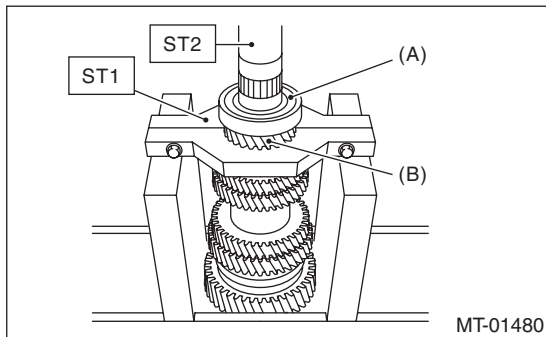
ST3 18620AA000 ADAPTER WRENCH



4) Attach ST1 to the 6th gear, then remove the ball bearing and 5th-6th driven gear.

ST1 18723AA000 REMOVER

ST2 499877000 RACE 4-5 INSTALLER



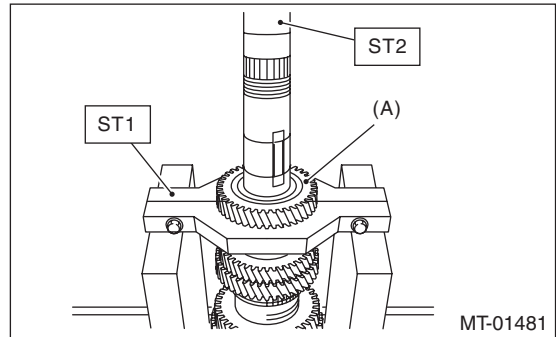
(A) Ball bearing

(B) 5th-6th driven gear

5) Attach ST1 to the 4th gear, then remove the 3rd-4th driven gear.

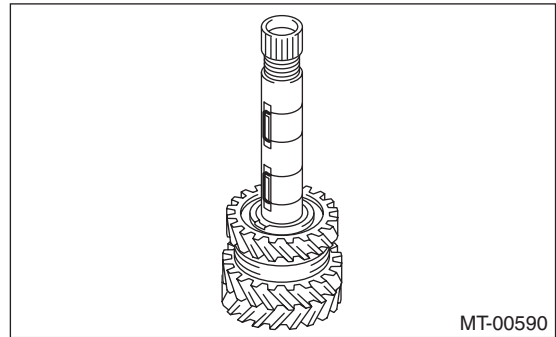
ST1 18723AA000 REMOVER

ST2 499877000 RACE 4-5 INSTALLER

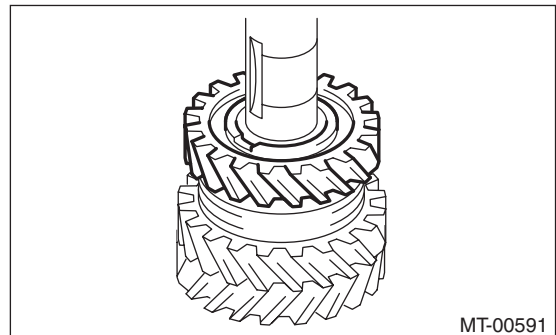


(A) 3rd-4th driven gear

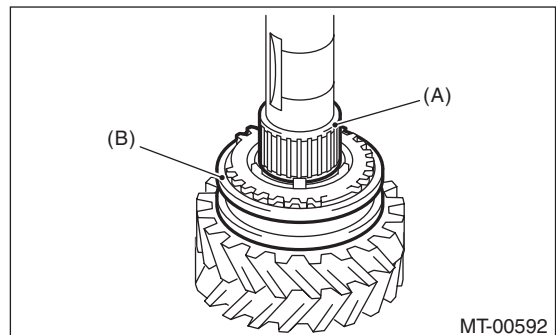
6) Remove the driven gear key.



7) Remove the 2nd gear.



8) Remove the needle bearing and 1st-2nd sleeve.



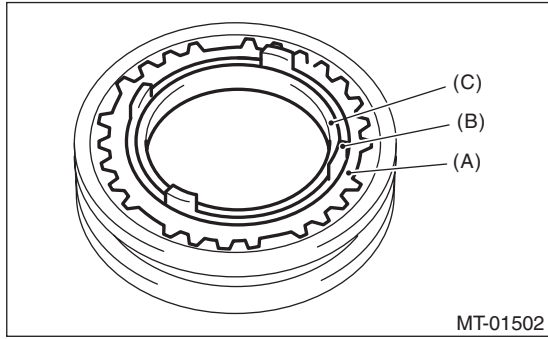
(A) Needle bearing

(B) 1st-2nd sleeve

# Driven Gear Assembly

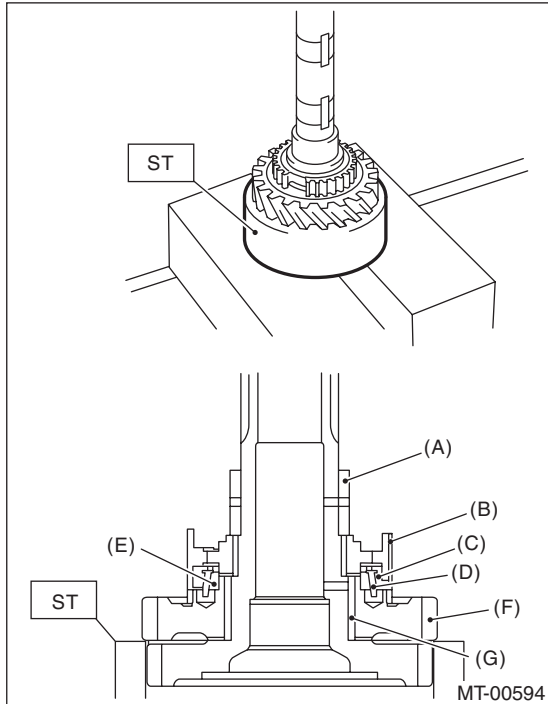
## MANUAL TRANSMISSION AND DIFFERENTIAL

9) Remove the outer baulk ring, 2nd synchro cone and inner baulk ring.



- (A) Outer baulk ring
- (B) 2nd synchro cone
- (C) Inner baulk ring

10) Using the ST, remove individual parts.  
ST 18754AA000 REMOVER



- (A) 2nd bushing
- (B) 1st-2nd hub
- (C) Outer baulk ring
- (D) 1st synchro cone
- (E) Inner baulk ring
- (F) 1st driven gear
- (G) 1st needle bearing

## D: ASSEMBLY

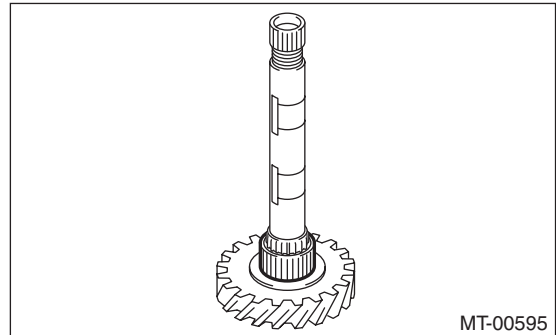
### NOTE:

When replacing the following parts, replace as a set.

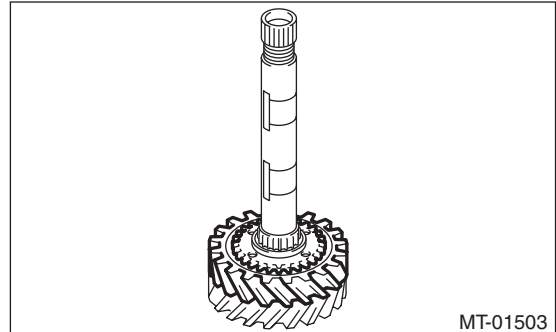
- Sleeve and hub
- Outer baulk ring, 1st synchro cone and inner baulk ring
- Outer baulk ring, 2nd synchro cone and inner baulk ring

1) Apply adequate transmission gear oil to the main shaft, 1st needle bearing and 1st drive gear inner surface.

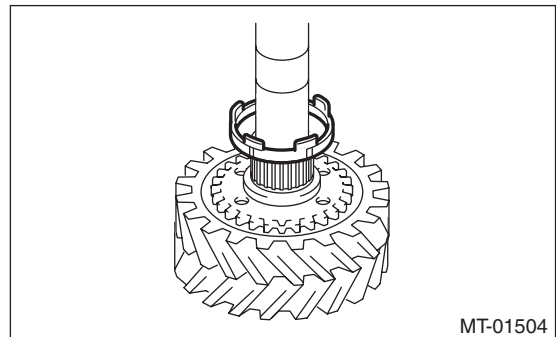
2) Install the 1st needle bearing.



3) Attach the 1st driven gear to the driven shaft.



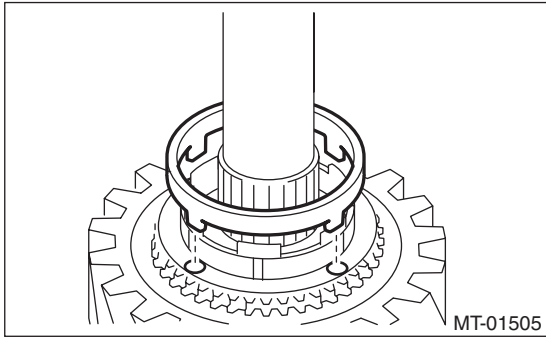
4) Install the inner baulk ring.



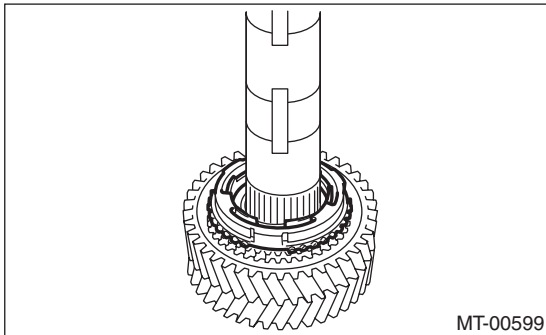
# Driven Gear Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

5) Match the protrusion of the 1st synchro cone to the hole of the 1st drive gear, then install.



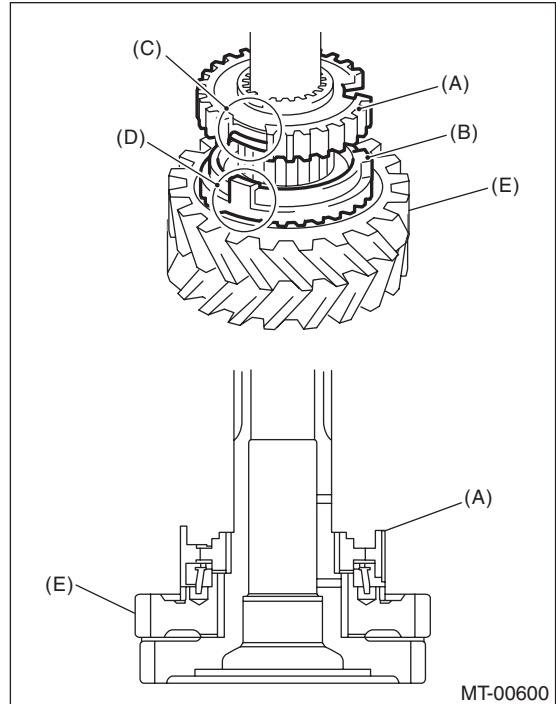
6) Install the outer baulk ring.



7) Install the 1st-2nd hub.

NOTE:

- Match the cut out of the 1st-2nd hub with the protrusion on the outer baulk ring, then install.
- Make sure that the 1st-2nd hub is installed in the correct direction.

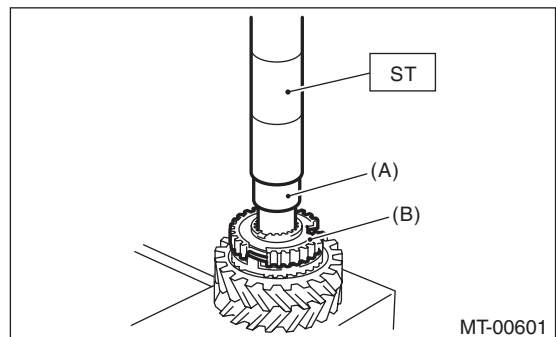


- (A) 1st-2nd hub
- (B) Outer baulk ring
- (C) 1st-2nd hub cut out section
- (D) Protrusion of the outer baulk ring
- (E) 1st driven gear

8) Using the ST, install the 2nd hub.  
ST 18654AA000 INSTALLER

CAUTION:

Do not apply pressure in excess of 40 kN  
(4.0 ton, 4.4 US ton, 3.9 Imp ton).



- (A) 2nd bushing
- (B) 1st-2nd hub

# Driven Gear Assembly

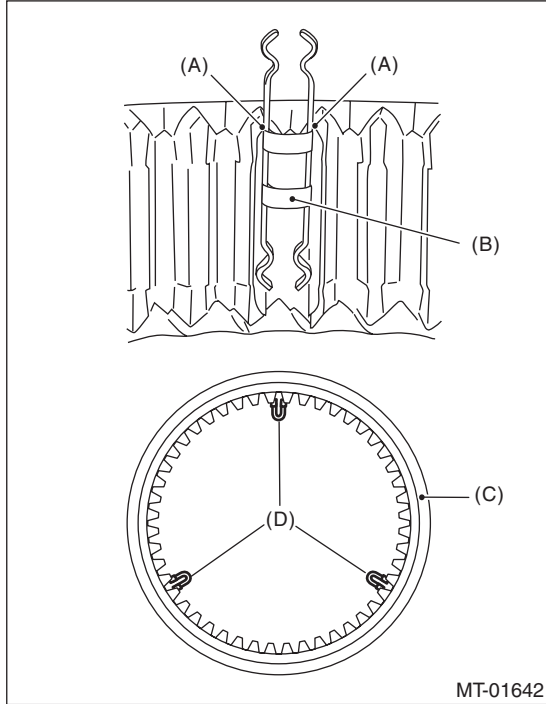
## MANUAL TRANSMISSION AND DIFFERENTIAL

9) Make sure that the 1st drive gear can be turned smoothly by hand. If it does not turn smoothly, re-assemble.

10) Attach the shifting insert key to the appropriate position of the 1st-2nd sleeve.

**NOTE:**

- The angle of each shifting insert key is 120°.
- Refer to the following figure to install the shifting insert key.

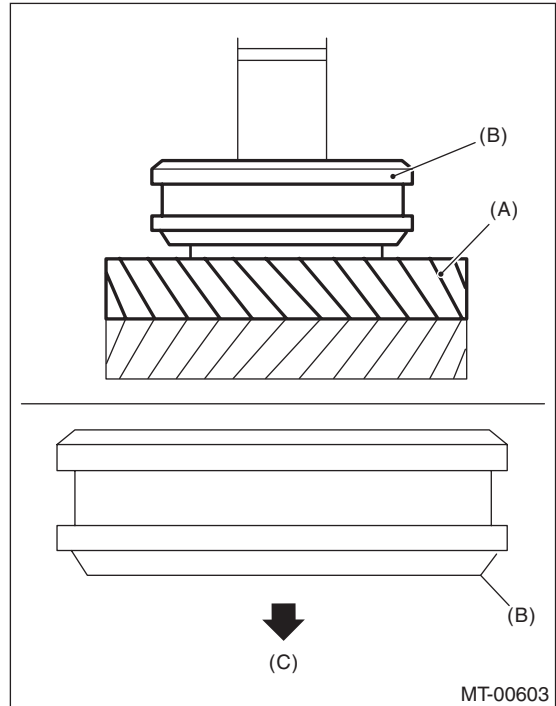


- (A) Attach the straight part of the shifting insert key to the sleeve convex portion.
- (B) Shifting insert key
- (C) 1st-2nd sleeve
- (D) Shifting insert key

11) Attach the 1st-2nd sleeve to the 1st-2nd hub.

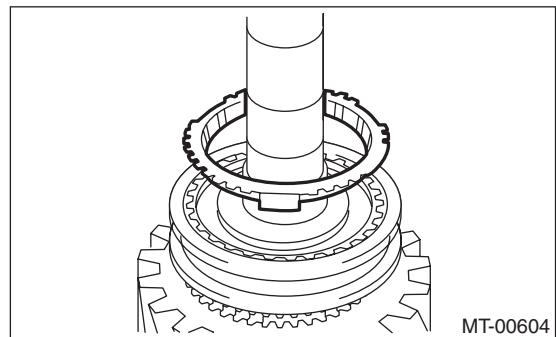
**NOTE:**

Make sure that the 1st-2nd sleeve is installed in the correct direction.

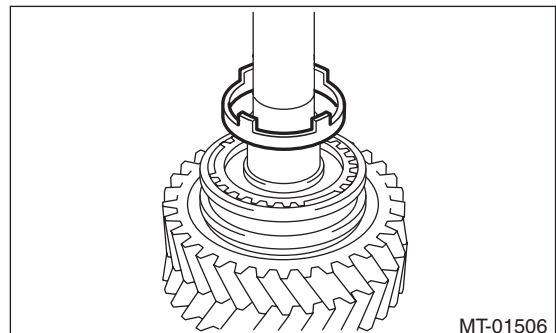


- (A) 1st driven gear
- (B) 1st-2nd sleeve
- (C) 1st driven gear side

12) Install the outer baulk ring.



13) Install the 2nd synchro cone.

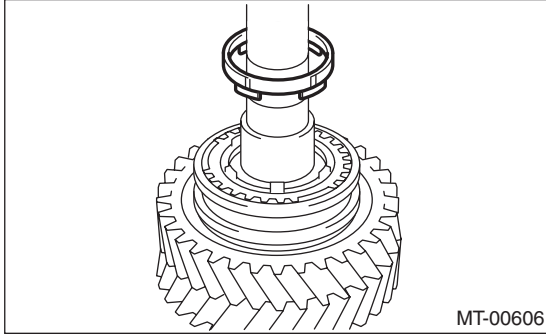




# Driven Gear Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

14) Install the inner baulk ring.

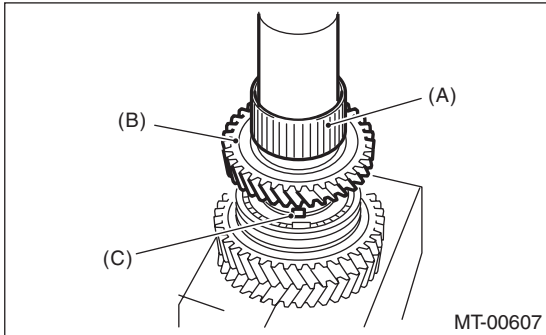


15) Apply adequate transmission gear oil to the bushing, 2nd needle bearing and 2nd drive gear inner surface.

16) Install the 2nd needle bearing and 2nd driven gear.

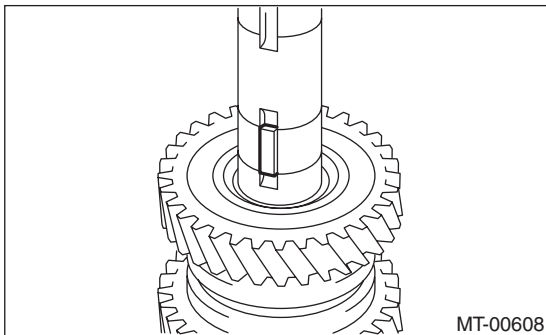
**NOTE:**

Match the protrusion of the 2nd synchro cone to the hole of the 2nd driven gear, then install.



- (A) 2nd needle bearing
- (B) 2nd driven gear
- (C) Protrusion of the 2nd synchro cone

17) Attach the key.



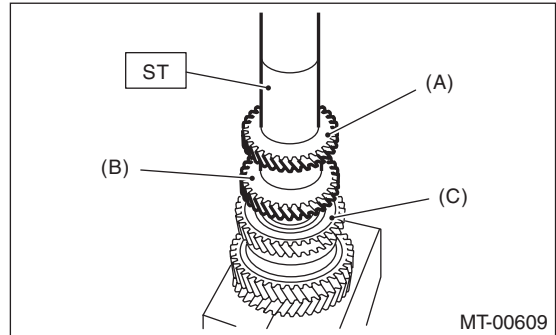
18) Using the ST, install the 3rd-4th driven gear.  
ST 18654AA000 INSTALLER

**CAUTION:**

Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).

**NOTE:**

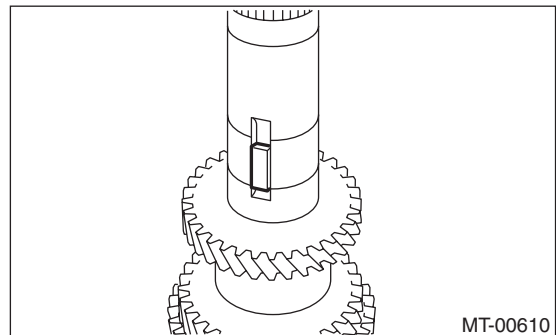
- Make sure that the 3rd-4th driven gear is installed in the correct direction.
- Match the groove on the 3rd-4th driven gear to the key.



- (A) 4th gear
- (B) 3rd gear
- (C) 2nd gear

19) Make sure that the 2nd driven gear can be turned smoothly by hand. If it does not turn smoothly, reassemble.

20) Attach the key.



# Driven Gear Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

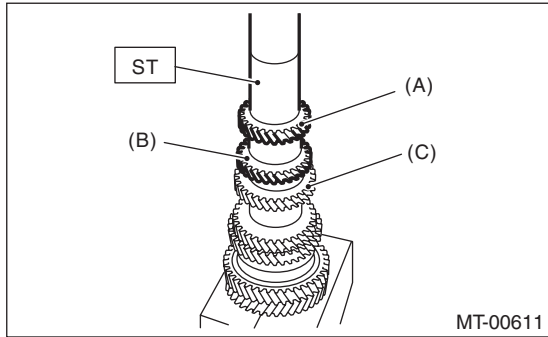
21) Using the ST, install the 5th-6th driven gear.  
ST 18654AA000 INSTALLER

**CAUTION:**

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**

**NOTE:**

- Make sure that the 5th-6th driven gear is installed in the correct direction.
- Match the groove on the 5th-6th driven gear to the key.



- (A) 6th gear
- (B) 5th gear
- (C) 4th gear

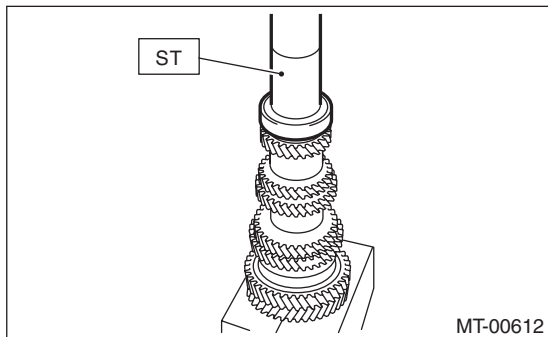
22) Using the ST, install the ball bearing.  
ST 18654AA000 INSTALLER

**CAUTION:**

**Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).**

**NOTE:**

Confirm that the ball bearing is installed in the proper direction.



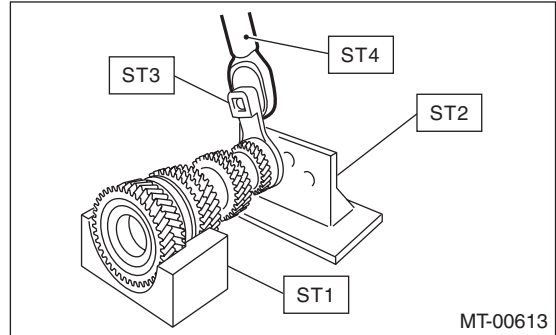
23) Make sure that the ball bearing turns smoothly by hand. If it does not turn smoothly, reassemble.  
24) Install a new lock nut.

25) Attach ST3 to the lock nut, attach ST to the driven gear assembly, and tighten the lock nut.

- ST1 18666AA000 HOLDER
- ST2 18664AA000 BASE
- ST3 18620AA000 ADAPTER WRENCH
- ST4 18852AA000 TORQUE WRENCH

**Tightening torque:**

**530 N·m (54.0 kgf·m, 391 ft·lb)**

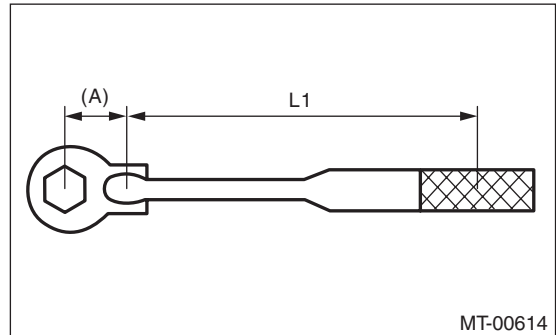


**NOTE:**

When using a torque wrench other than ST4, use the calculation below to calculate and tighten the lock nut.

$$T = L1 / (0.1 + L1) \times 570$$

T	N·m (kgf·m, ft·lb)	Torque wrench setting
L1	m (in)	Torque wrench length
0.1 m (3.94 in)		Length of ST
570 N·m (58.1 kgf·m, 420 ft·lb)		Tightening torque (lock nut):



(A) 0.1 m (3.94 in)

# Driven Gear Assembly

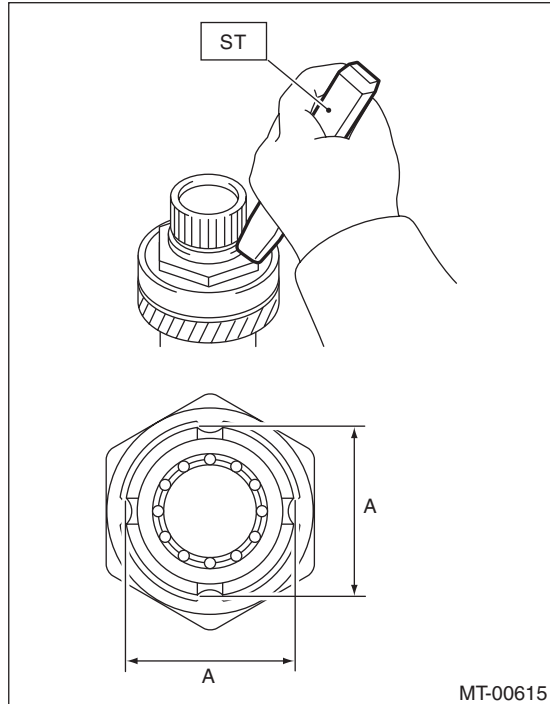
MANUAL TRANSMISSION AND DIFFERENTIAL

26) Using the ST, crimp the lock nut in 4 locations, with dimensions within  $A 44 \pm 0.5$  mm ( $1.73 \pm 0.02$  in).

ST 18669AA000 PUNCH DRIVEN SHAFT

NOTE:

Do not damage the crimp area of the lock nut.



## E: INSPECTION

Disassembled parts should be washed clean first with cleaning solvent and then inspected carefully.

### 1) Bearing

Replace the bearings in the following cases.

- Wear, rusting or damage of the bearings
- The bearing does not rotate smoothly or an abnormal noise is emitted when turning.
- The bearing has other defects.

### 2) Bushing (each gear)

Replace the bushing in following cases.

- The sliding surface is damaged or abnormally worn.

### 3) Gear

Replace gears in the following cases.

- The gear teeth surface is damaged or excessively worn.
- The contact area of the baulk ring is damaged.
- The inner face of the gear is worn.

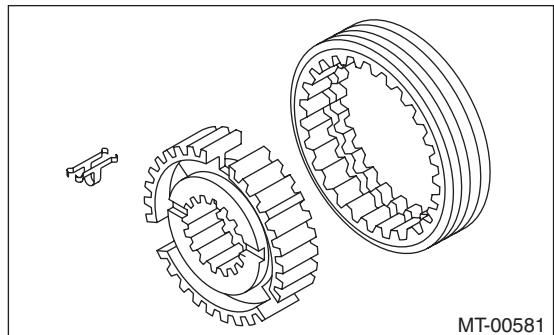
### 4) Baulk ring, synchro cone

Replace the baulk ring and synchro cone in the following cases.

- Wear, rusting or damage of the baulk ring

### 5) Shifting insert key

Replace the shifting insert key if deformed, excessively worn or defective in any way.

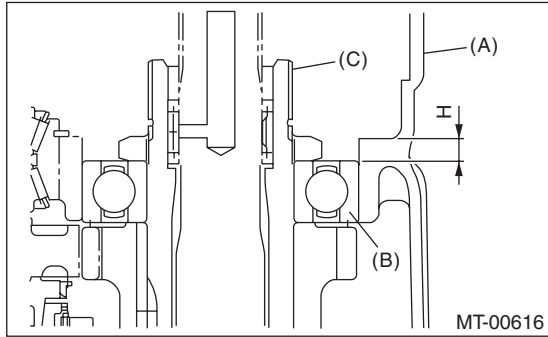


# Driven Gear Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### F: ADJUSTMENT

1) Measure the length “H” from the transmission case and transfer bearing holder mating surface, to the end face of the ball bearing.



- (A) Transmission case
- (B) Ball bearing
- (C) Driven gear ASSY

2) Using the following calculation, calculate the thickness of the driven gear assembly washer.

$$T = H - \{5.8 \pm 0.05 \text{ mm (0.23} \pm 0.002 \text{ in)}\} - \{0.1 \text{ — } 0.3 \text{ mm (0.0039 — 0.0118 in)}\}$$

t	Washer thickness
H	Length from the transmission case and transfer bearing holder mating surface to the end face of the ball bearing
5.8±0.05 mm (0.23±0.002 in)	Collar thickness
0.1 — 0.3 mm (0.0039 — 0.0118 in)	Driven gear assembly axial direction backlash standard

3) Select 0 to 3 washers from the following table, and adjust the backlash that is closest to the standard value.

**Driven gear assembly axial direction backlash standard:**

**0.1 — 0.3 mm (0.0039 — 0.0118 in)**

Washer	
Part No.	Thickness t mm (in)
803072030	0.15 (0.0059)
803072031	0.30 (0.0118)
803072032	0.45 (0.0177)
803072033	0.60 (0.0236)

# Reverse Idler Gear Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## 19. Reverse Idler Gear Assembly

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.>, <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the reverse idler gear assembly. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>

### B: INSTALLATION

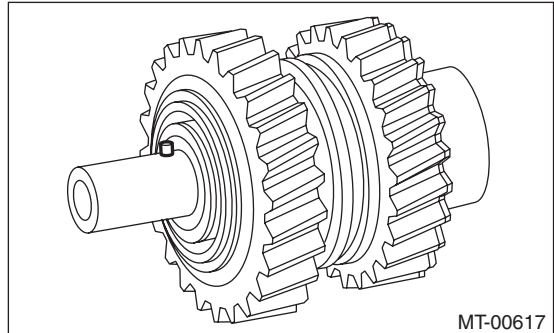
- 1) Select the reverse fork rod. <Ref. to 6MT-112, ADJUSTMENT, Shifter Fork and Rod.>
- 2) Install the reverse idler gear assembly. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>
- 3) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>
- 4) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>
- 5) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 6) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 7) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.>, <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>
- 8) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

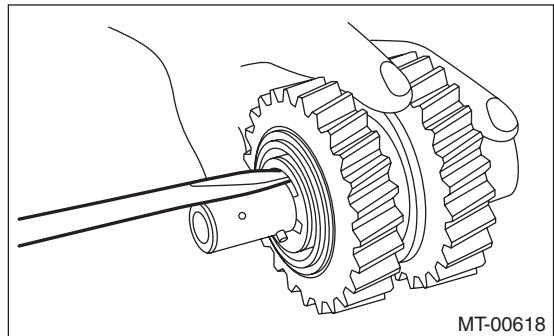
#### NOTE:

Sleeves and reverse gears meet at a specified position. Before disassembly, mark the meeting position of the sleeve and hub.

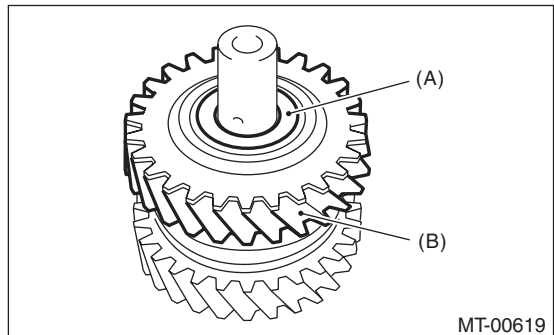
- 1) Remove the spring pin.



- 2) Remove the snap ring and washer.



- 3) Remove the counter high & low washer and reverse idler gear.

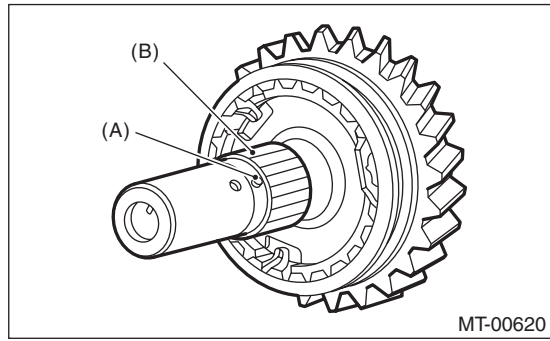


- (A) Counter high and low washer  
(B) Reverse idler gear

# Reverse Idler Gear Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

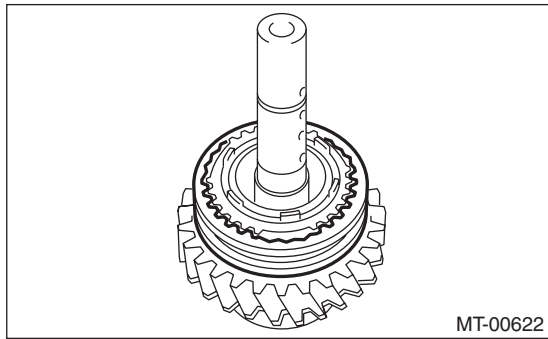
4) Remove the knock pin and reverse idler gear needle bearing.



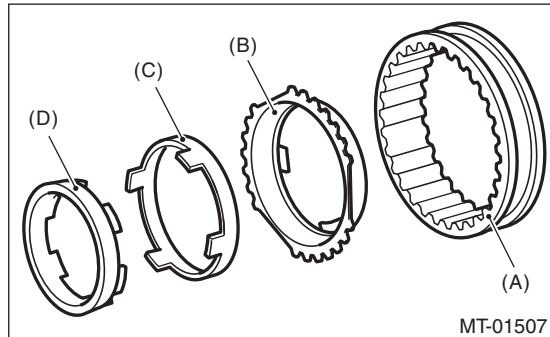
- (A) Knock pin
- (B) Reverse idler gear needle bearing

5) Remove the collar.

6) Remove the reverse sleeve.

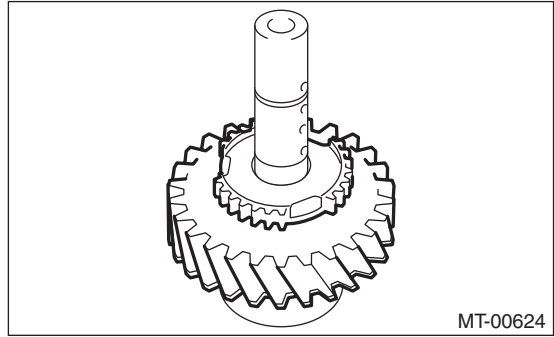


7) Remove the outer baulk ring, reverse synchro cone and inner baulk ring from the reverse sleeve.

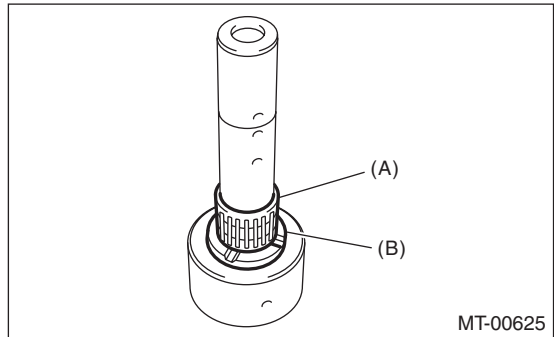


- (A) Reverse sleeve
- (B) Outer baulk ring
- (C) Reverse synchro cone
- (D) Inner baulk ring

8) Remove reverse idler gear No. 2.

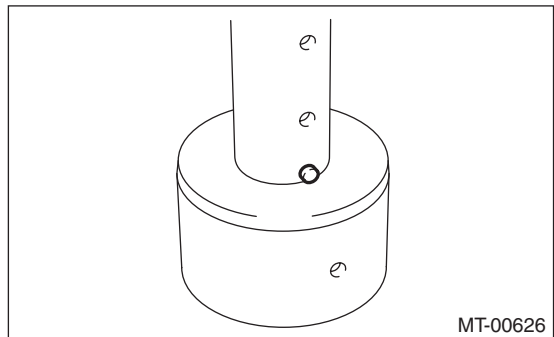


9) Remove the counter high & low washer and needle bearing.

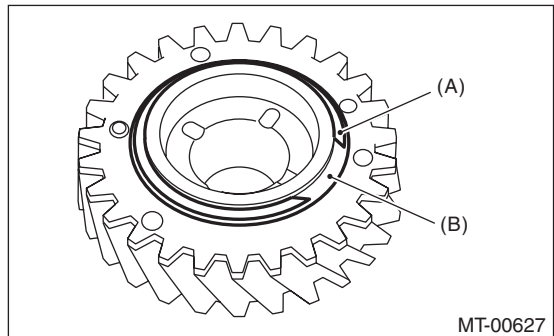


- (A) Needle bearing
- (B) Counter high and low washer

10) Remove the knock pin.



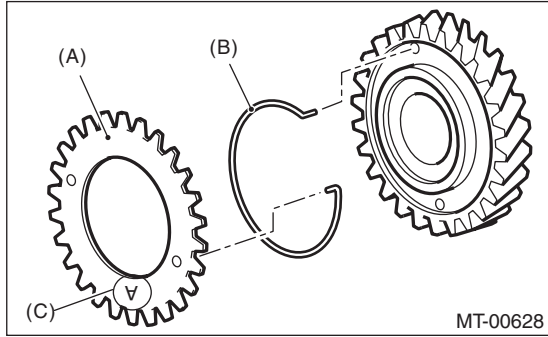
11) Remove the snap ring and friction plate from reverse gear.



- (A) Snap ring
- (B) Friction plate

# Reverse Idler Gear Assembly

12) Remove the sub gear and spring.



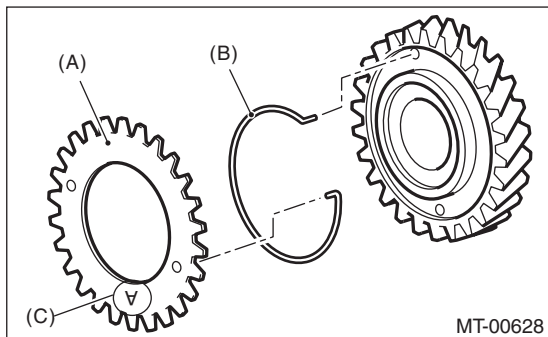
- (A) Sub gear
- (B) Spring
- (C) Stamp (Marking A)

## D: ASSEMBLY

1) Attach the sub gear and spring.

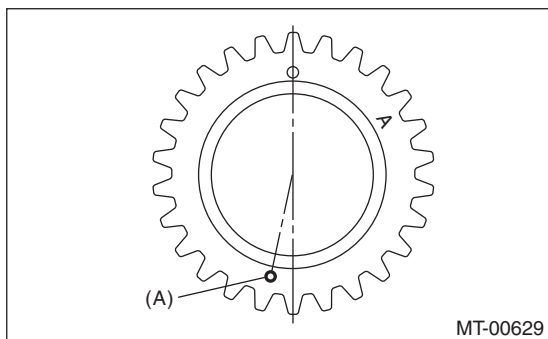
NOTE:

- Turn the white marking on the hook section towards the sub gear side, and attach the spring.
- Point the stamp (marking A) towards the outside, and install the sub gear.



- (A) Sub gear
- (B) Spring
- (C) Stamp (Marking A)

- While paying attention to the direction of the sub gear attachment hole, attach the spring and sub gear.

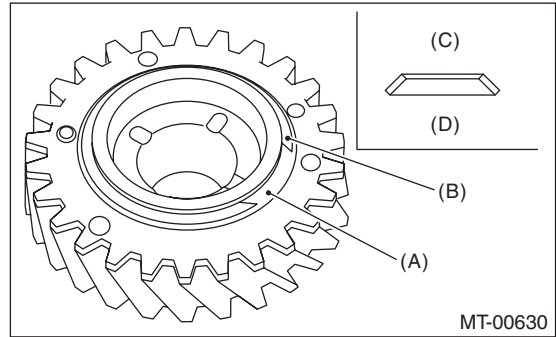


- (A) Attachment hole

2) Install the friction plate and snap ring.

NOTE:

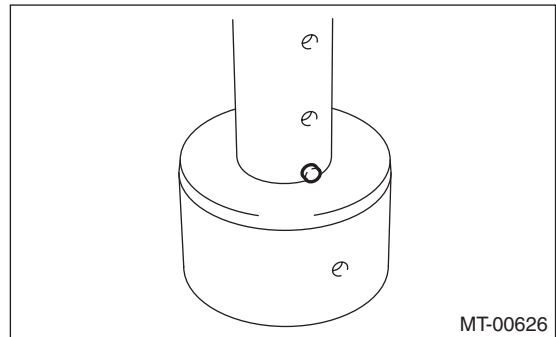
Confirm that the friction plate is installed in the proper direction.



- (A) Friction plate
- (B) Snap ring
- (C) Snap ring side
- (D) Sub gear side

3) Apply adequate transmission gear oil to the shaft, needle bearing and reverse drive gear inner surface.

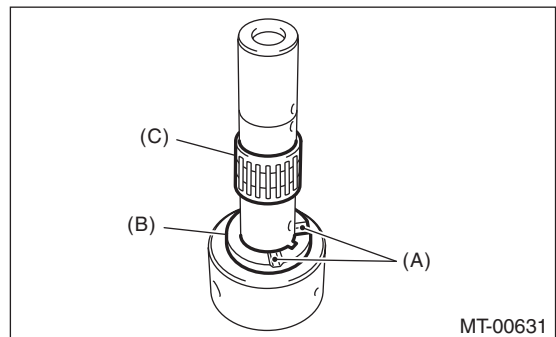
4) Install the knock pin.



5) Install the counter high & low washer and needle bearing.

NOTE:

Point the groove towards the reverse idler gear, and attach the washer.

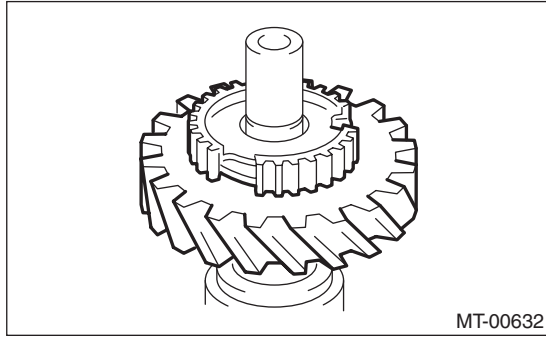


- (A) Groove
- (B) Counter high and low washer
- (C) Needle bearing

# Reverse Idler Gear Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

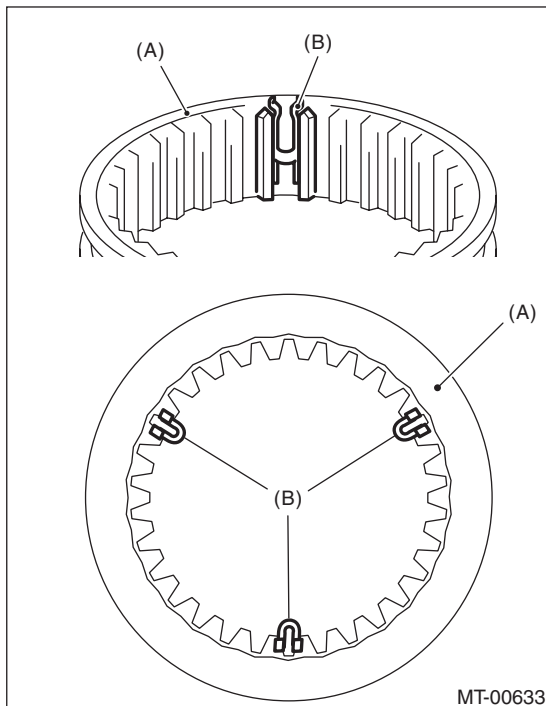
6) Install the reverse idler gear No. 2.



7) Attach the shifting insert key to the appropriate location of the reverse sleeve.

NOTE:

The angle of each shifting insert key is 120°.

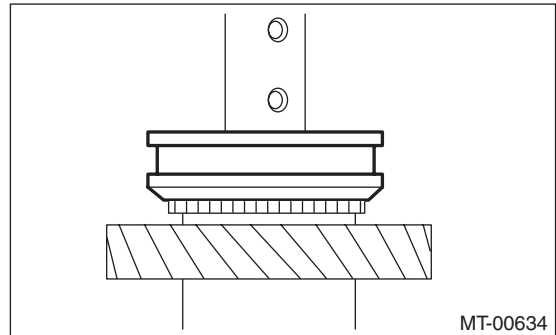


- (A) Reverse sleeve
- (B) Shifting insert key

8) Attach the reverse sleeve to the reverse idler gear No. 2.

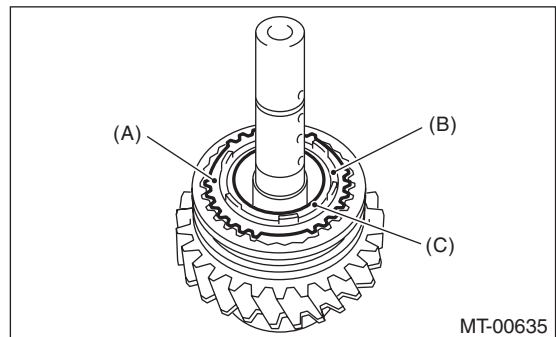
NOTE:

Confirm that the reverse sleeve is installed in the proper direction.



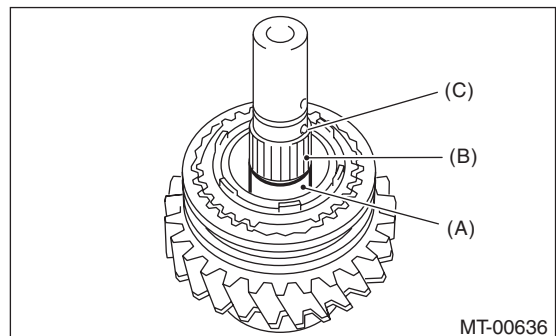
9) Apply adequate transmission gear oil to the collar, needle bearing and reverse drive gear inner surface.

10) Install the outer baulk ring, reverse synchro cone and inner baulk ring.



- (A) Outer baulk ring
- (B) Reverse synchro cone
- (C) Inner baulk ring

11) Install the collar and needle bearing, then the knock pin.

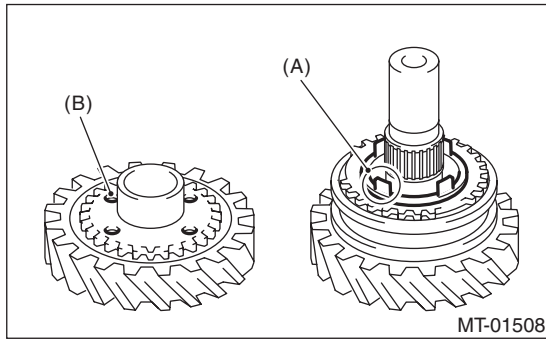


- (A) Collar
- (B) Needle bearing
- (C) Knock pin



# Reverse Idler Gear Assembly

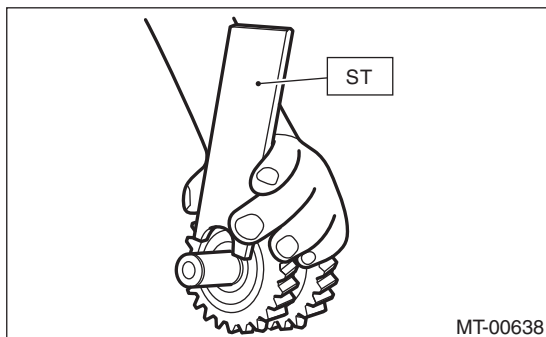
12) Match the protrusion of the reverse synchro cone to the hole on the reverse idler gear, and install the reverse idler gear.



(A) Protrusion on the reverse synchro cone  
(B) Hole of the reverse idler gear

13) Point the groove towards the reverse idler gear, and attach the counter high & low washer and the washer.

14) Using the ST, install the snap ring.  
ST 18672AA000 GUIDE CLIP



MT-00638

15) Inspect and adjust the clearance between the snap ring and the washer. <Ref. to 6MT-91, INSPECTION, Reverse Idler Gear Assembly.>

16) Install a new spring pin.

## E: INSPECTION

Disassembled parts should be washed clean first with cleaning solvent and then inspected carefully.

1) Bearing

Replace the bearings in the following cases.

- Wear, rusting or damage of the bearings
- The bearing does not rotate smoothly or an abnormal noise is emitted when turning.
- The bearing has other defects.

2) Bushing (each gear)

Replace the bushing in following cases.

- The sliding surface is damaged or abnormally worn.

3) Gear

Replace gears in the following cases.

- The gear teeth surface is damaged or excessively worn.
- The contact area of the baulk ring is damaged.
- The inner face of the gear is worn.

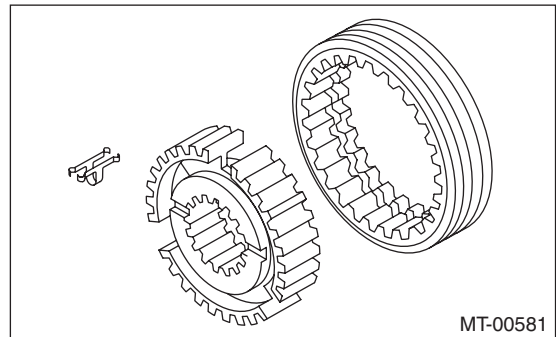
4) Baulk ring, synchro cone

Replace the baulk ring and synchro cone in the following cases.

- Wear, rusting or damage of the baulk ring

5) Shifting insert key

Replace the shifting insert key if deformed, excessively worn or defective in any way.

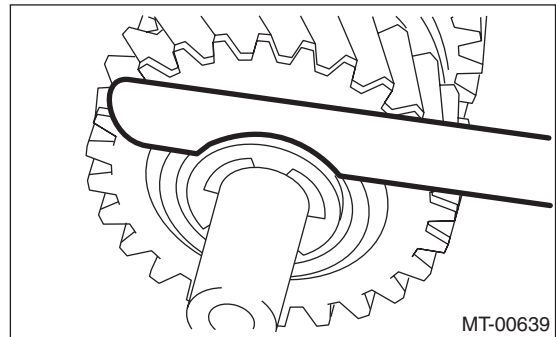


MT-00581

6) Check clearance between the snap ring and washer.

**Clearance specification:**

**0.1 — 0.3 mm (0.0039 — 0.0118 in)**



MT-00639

If the clearance is out of the specification, select a snap ring from the following table and replace it.

Snap ring	
Part No.	Thickness mm (in)
031319000	1.50 (0.059)
805019030	1.60 (0.062)
805019010	1.72 (0.068)

After replacing the snap ring, inspect the clearance.

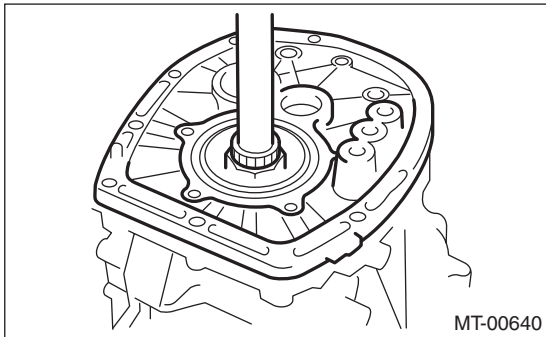
# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

## 20. Drive Pinion Shaft Assembly

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.>, <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the individual gear assemblies. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>
- 9) Remove the drive pinion shaft assembly.

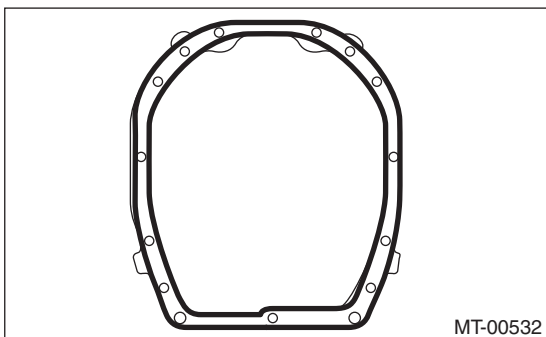


### B: INSTALLATION

- 1) Remove any remaining gasket material from the drive plate and clutch housing.
- 2) Apply liquid gasket to the clutch housing.

#### Liquid gasket:

**THREE BOND 1215 (Part No. 004403007)**



- 3) Install the individual gear assemblies. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>
- 4) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>

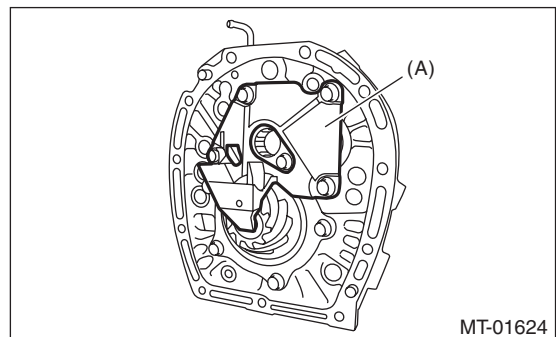
- 5) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>
- 6) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 7) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 8) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.>, <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>
- 9) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

### C: DISASSEMBLY

#### NOTE:

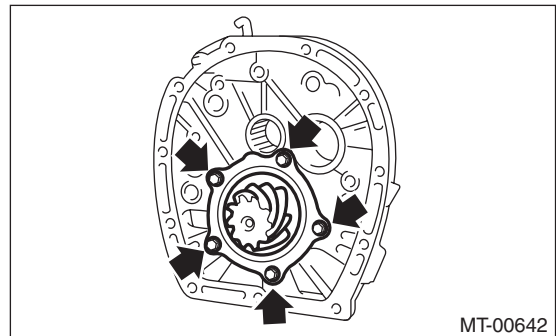
Replace the drive pinion shaft and hypoid driven gear as a set.

- 1) Remove the oil guide A.



(A) Oil guide A

- 2) Remove the drive pinion shaft and shim from the adapter plate.



- 3) Affix the ST to the work table.  
ST 18664AA000 BASE
- 4) Flatten the tab of the axle nut.

# Drive Pinion Shaft Assembly

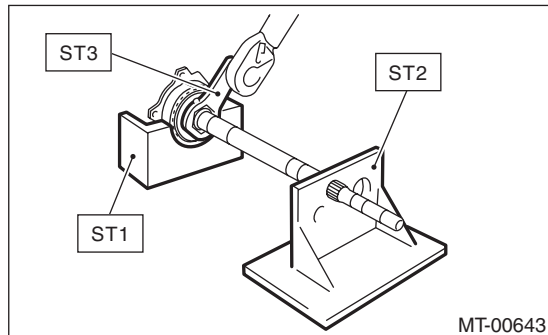
MANUAL TRANSMISSION AND DIFFERENTIAL

5) Attach ST3 to the lock nut, and set the drive pinion shaft to ST. Remove the lock nut and washer.

ST1 18667AA000 HOLDER

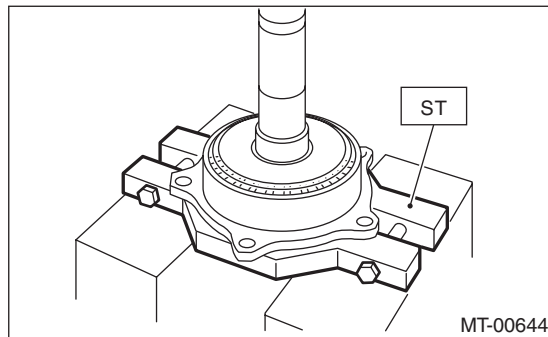
ST2 18664AA000 BASE

ST3 18621AA000 ADAPTER WRENCH



6) Using the ST, remove the taper roller bearing assembly.

ST 18723AA000 REMOVER



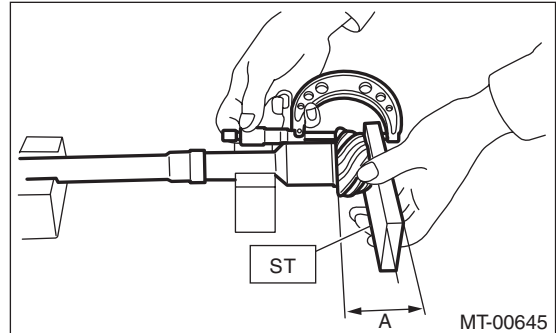
## D: ASSEMBLY

1) Using the ST, measure drive pinion measurement A.

NOTE:

When selecting the drive pinion shim, refer to measurement A.

ST 398643600 GAUGE

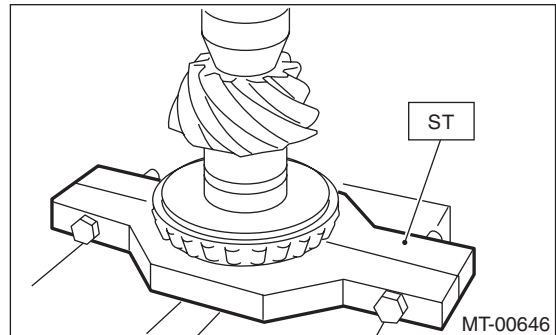


2) Using the ST and a press, attach the inner bearing of the taper roller bearing to the drive pinion shaft.

ST 18723AA000 REMOVER

CAUTION:

Do not apply pressure in excess of 40 kN (4.0 ton, 4.4 US ton, 3.9 Imp ton).

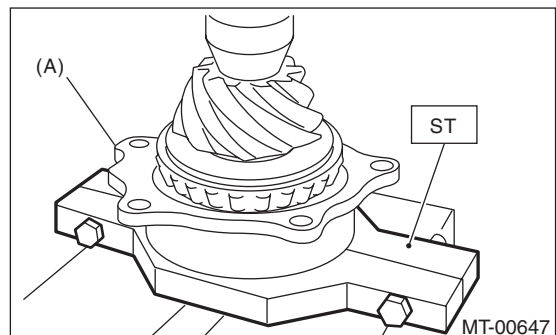


3) Using the ST and a press, attach the outer race and the taper roller bearing to the drive pinion shaft.

ST 18723AA000 REMOVER

NOTE:

Push in to a position where the bearing rotates smoothly.



(A) Outer race

# Drive Pinion Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

- 4) Attach the washer and a new lock nut.
- 5) Set the ST to the drive pinion, and tighten the lock nut.

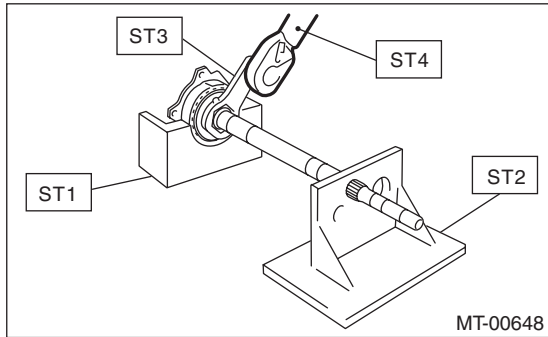
ST1 18667AA000 HOLDER  
 ST2 18664AA000 BASE  
 ST3 18621AA000 ADAPTER WRENCH  
 ST4 18852AA000 TORQUE WRENCH

**NOTE:**

Tighten using the ST and the straight line torque wrench.

**Tightening torque:**

**265 N·m (27.0 kgf·m, 195 ft·lb)**



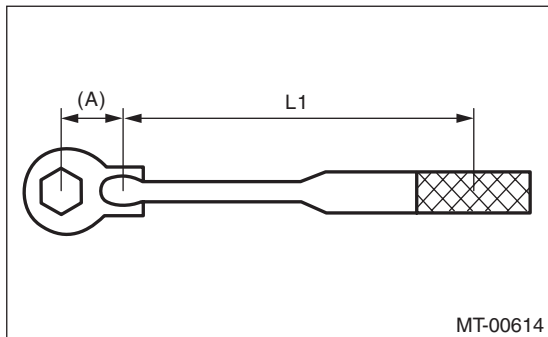
**NOTE:**

When using a torque wrench other than ST4, use the calculation below to calculate and tighten the lock nut.

Tighten using the ST and the straight line torque wrench.

$$T = L1 / (0.1 + L1) \times 285$$

T	N·m (kgf·m, ft·lb)	Torque wrench setting
L1	m (in)	Torque wrench length
0.1 m (3.94 in)		Length of ST
285 N·m (29.0 kgf·m, 210 ft·lb)		Tightening torque (lock nut)



(A) 0.1 m (3.94 in)

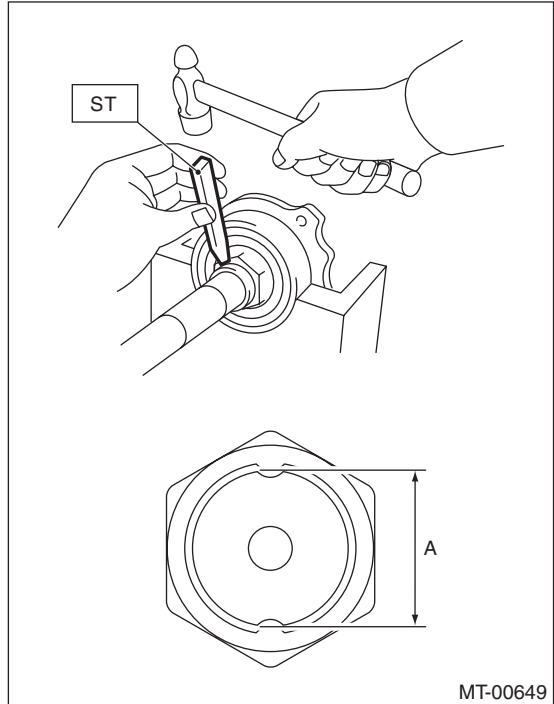
- 6) Measure the starting torque. <Ref. to 6MT-95, INSPECTION, Drive Pinion Shaft Assembly.>

- 7) Using the ST, crimp the lock nut in 2 locations, with dimensions within A 37±0.5 mm (1.46±0.02 in).

ST 18670AA000 PUNCH

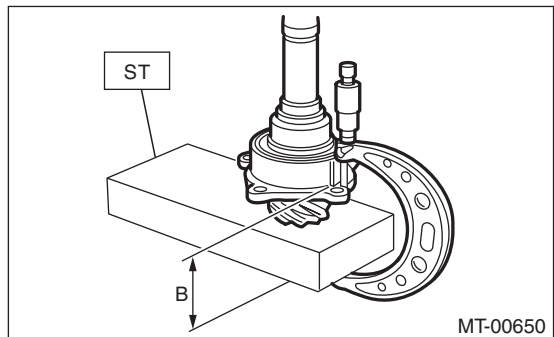
**NOTE:**

Do not damage the crimp area of the lock nut.



- 8) Using the ST, measure drive pinion measurement B.

ST 398643600 GAUGE



# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

9) Calculate from the calculation below to select 1 or 2 drive pinion shims from the following table.  
 $6.5 \pm 0.0625 \text{ mm} - (B - A)$  [ $0.26 \pm 0.0025 \text{ in} - (B - A)$ ]

NOTE:

A: Measurement value in step 1)

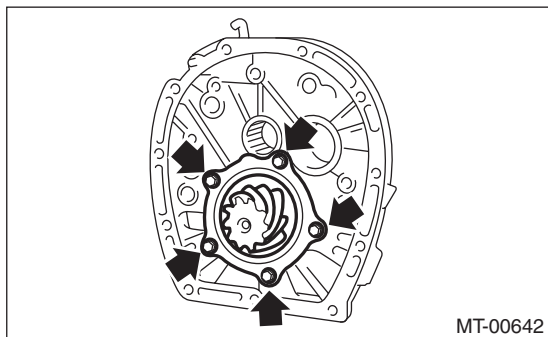
B: Measurement value in step 8)

Drive pinion shim	
Part No.	Thickness mm (in)
32295AA270	0.15 (0.0059)
32295AA280	0.175 (0.0069)
32295AA290	0.20 (0.0079)
32295AA300	0.225 (0.0089)
32295AA310	0.25 (0.0098)
32295AA320	0.275 (0.0108)

10) Apply transmission gear oil to the side face of the taper roller bearing, and attach the drive pinion shaft and the selected shims to the adapter plate.

**Tightening torque:**

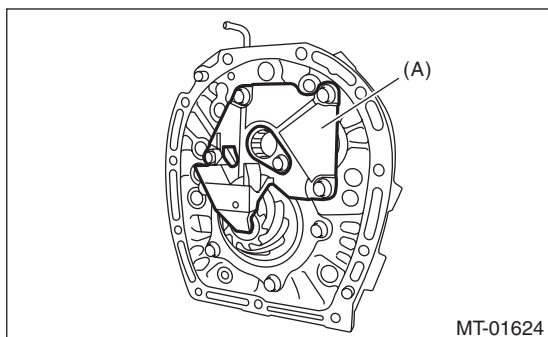
**54 N·m (5.5 kgf·m, 40 ft·lb)**



11) Install the oil guide A.

**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.3 ft·lb)**



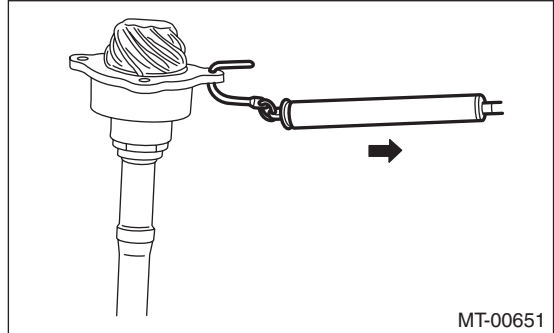
(A) Oil guide A

## E: INSPECTION

1) Using a spring scale, measure the starting torque. If the starting torque is outside the specification range, replace the taper roller bearing.

**Starting torque:**

**0 — 0.95 N (0 — 0.097 kgf, 0 — 0.21 lb)**



2) Gear

Replace gears in the following cases.

- The gear teeth surface is damaged or excessively worn.

3) Bearing

Replace the bearings in the following cases.

- Wear, rusting or damage of the bearings
- The bearing does not rotate smoothly or an abnormal noise is emitted when turning.

4) Adapter plate

Replace the adapter plate in the following cases:

- Wear, rusting or damage of the bearings
- Damage of the adapter plate

5) Check that the pipes and pipe chambers are not damaged or clogged. Repair or replace if damaged or clogged.

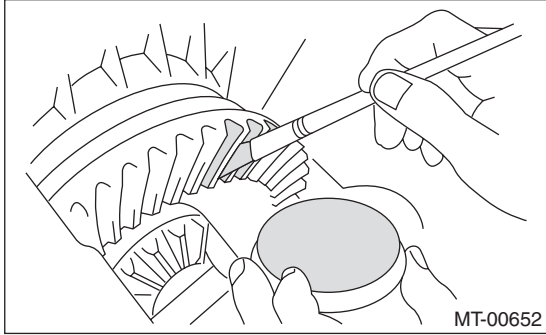
# Drive Pinion Shaft Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### F: ADJUSTMENT

1) Inspect and adjust the hypoid driven gear-to-drive pinion backlash. <Ref. to 6MT-105, HYPOID GEAR BACKLASH, ADJUSTMENT, Front Differential Assembly.>

2) Apply a thin uniform coat of lead-free red dye on the surfaces of 3 or 4 hypoid driven gear teeth.



3) Install the drive pinion shaft assembly to the clutch housing, and tighten at least 4 bolts.

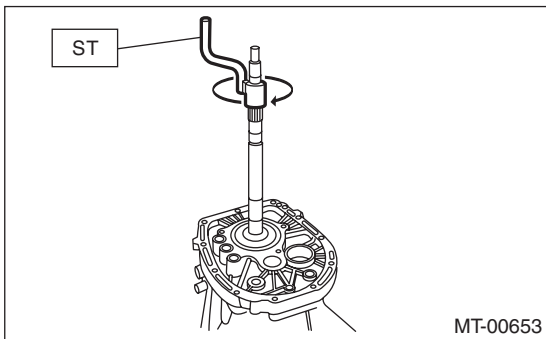
#### NOTE:

Install with the remaining liquid gasket, so that the clutch housing and the adapter plate will not be damaged.

#### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

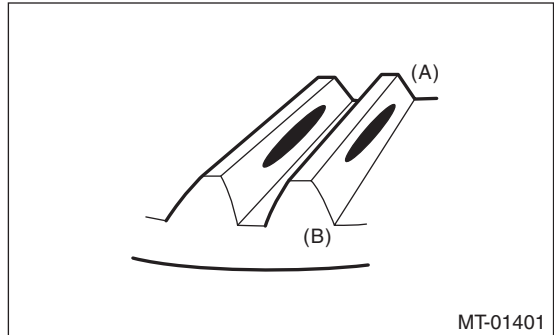
4) Turn a few times using the ST.  
ST 18631AA000 HANDLE



5) Remove the drive pinion shaft assembly, and inspect the mating condition of the teeth. If the mating is not correct, change shim thickness to adjust backlash.

- Correct tooth contact

**Check item: Tooth contact surface is slightly shifted toward the toe side under a no-load condition. (When driving, it moves towards the heel side.)**



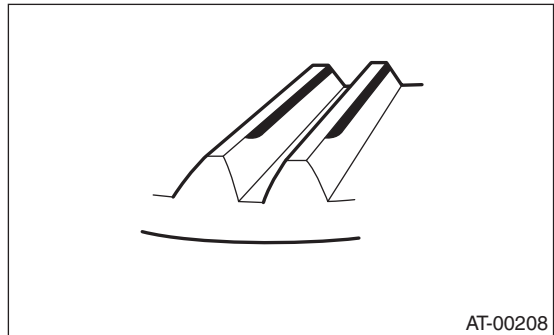
(A) Toe side

(B) Heel side

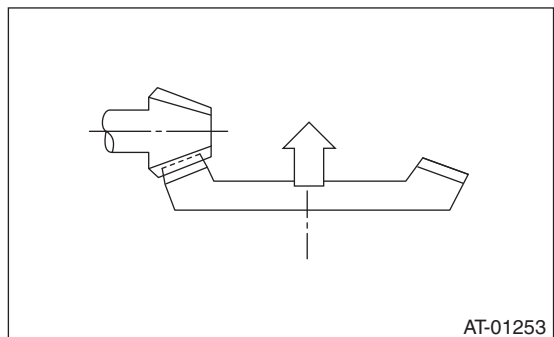
- Face contact

**Check item: Backlash is too large.**

Contact pattern



Adjustment: Reconfirm and adjust backlash.



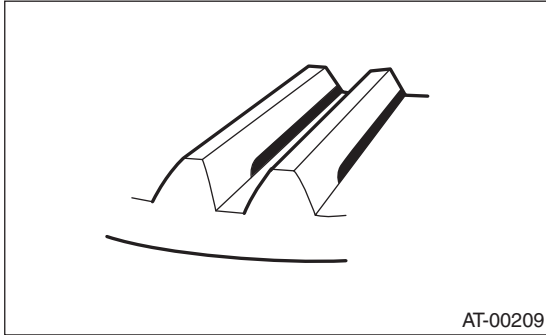
# Drive Pinion Shaft Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

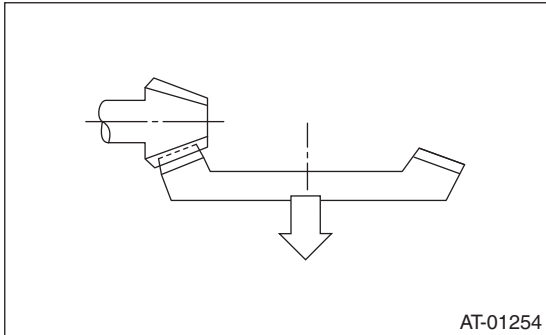
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



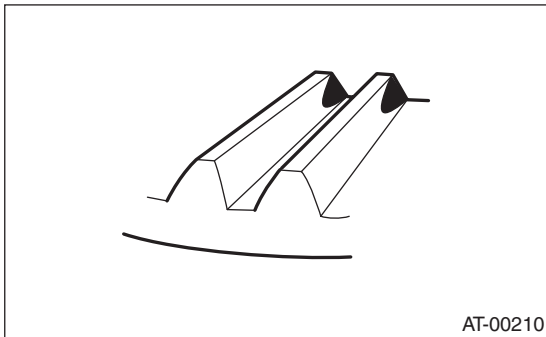
Adjustment: Reconfirm and adjust backlash.



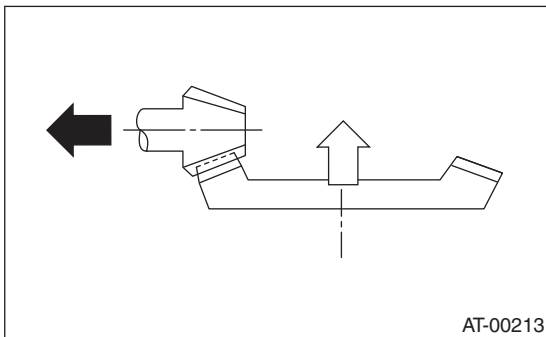
- Toe contact (inside contact)

**Check item: Teeth contact area is too small.**

Contact pattern



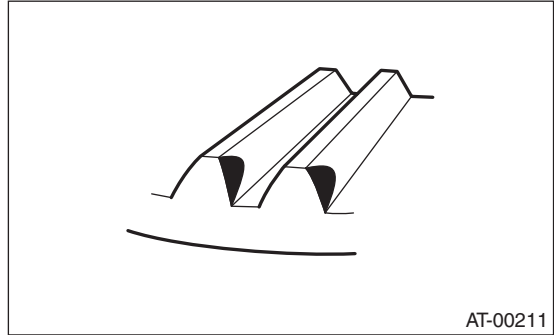
Adjustment: Reduce the thickness of the drive pinion shim according to the procedure for moving the drive pinion away from the driven gear.



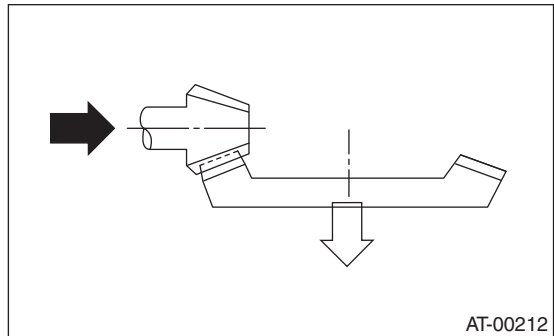
- Heel contact (outside end contact)

**Check item: Teeth contact area is too small.**

Contact pattern



Adjustment: Increase thickness of the drive pinion shim according to the procedures for moving the drive pinion closer to the driven gear.



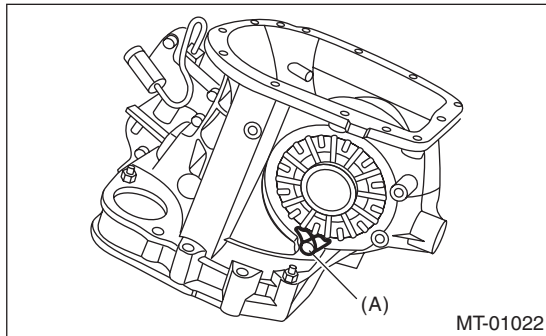
# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 21. Front Differential Assembly

#### A: REMOVAL

- 1) Remove the manual transmission assembly. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.> <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the individual gear assemblies. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>
- 9) Remove the drive pinion shaft assembly. <Ref. to 6MT-92, REMOVAL, Drive Pinion Shaft Assembly.>
- 10) Remove the lock plates on both sides.



(A) Lock plate

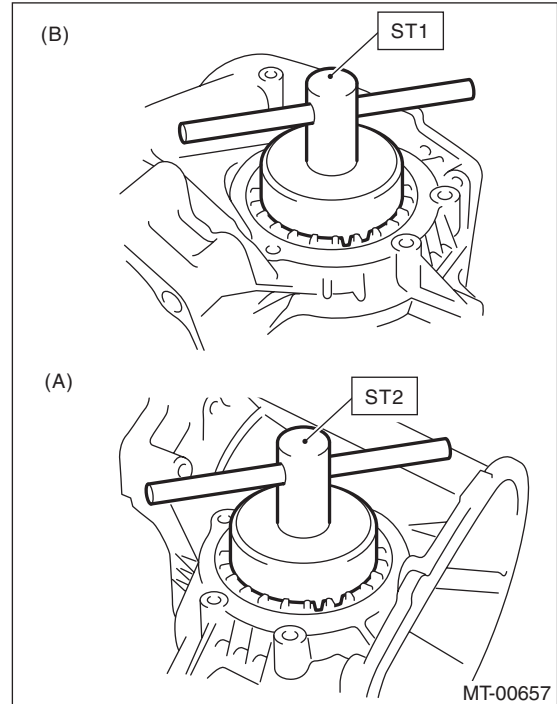
- 11) Remove the differential side retainers on both sides using the ST.

ST1 18630AA010 WRENCH COMPL RETAINER  
(RH side)

ST2 18630AA000 WRENCH ASSEMBLY  
(LH side)

#### NOTE:

Be careful not to damage the section where the clutch case retainer will be attached.



(A) LH side

(B) RH side

- 12) Remove the front differential.



# Front Differential Assembly

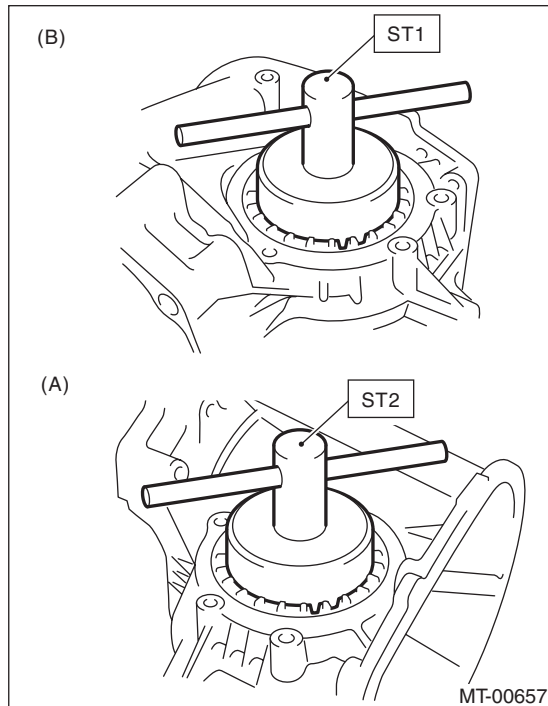
## B: INSTALLATION

- 1) Install the differential assembly to the clutch housing.
- 2) Apply oil to the screw threads of the side retainer.
- 3) Remove the O-rings on both sides of the side retainer.
- 4) Install the differential side retainers to both sides, using the ST.

ST1 18630AA010 WRENCH COMPL RETAINER (RH side)  
ST2 18630AA000 WRENCH ASSY (LH side)

### NOTE:

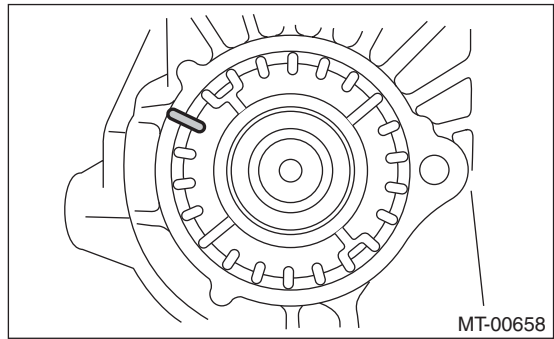
Be careful not to damage the oil seal.



- (A) LH side  
(B) RH side

- 5) Inspect and adjust the hypoid gear backlash. <Ref. to 6MT-104, HYPOID GEAR BACKLASH, INSPECTION, Front Differential Assembly.>
- 6) Inspect and adjust the tooth contact. <Ref. to 6MT-96, ADJUSTMENT, Drive Pinion Shaft Assembly.>

- 7) Mark the mating positions of the left and right side retainers and the clutch housing.



- 8) Remove the differential side retainers from both sides.

### NOTE:

When removing the side retainer, record how many times it was turned to remove.

- 9) Install new O-rings to the side retainers on both sides.
- 10) Attach the differential side retainers to both sides.

### NOTE:

When attaching, turn the side retainer the same number of turns it took to remove, and align the marks.

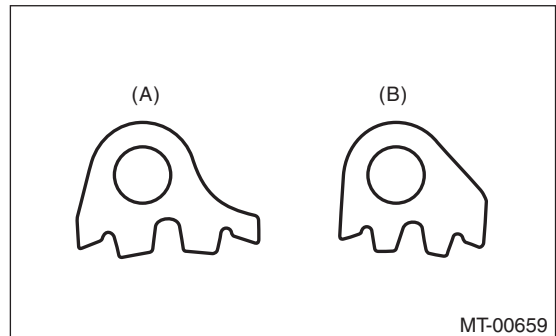
- 11) Install the lock plate.

### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

### NOTE:

Be careful not to confuse the left and right side lock plates.



- (A) LH  
(B) RH

# Front Differential Assembly

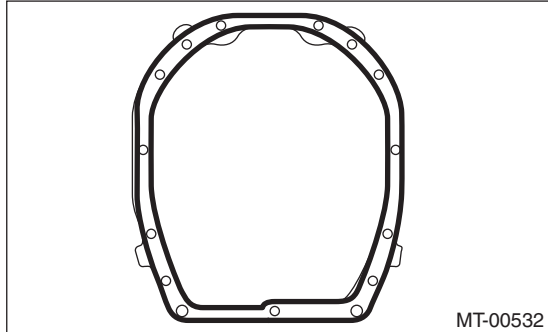
## MANUAL TRANSMISSION AND DIFFERENTIAL

12) Remove any remaining liquid gasket from the clutch housing and adapter plate.

13) Apply liquid gasket to the clutch housing.

### Liquid gasket:

**THREE BOND 1215 (Part No. 004403007)**



MT-00532

14) Install the drive pinion shaft assembly. <Ref. to 6MT-92, INSTALLATION, Drive Pinion Shaft Assembly.>

15) Install the individual gear assemblies all at once. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>

16) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>

17) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>

18) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>

19) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>

20) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.> <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>

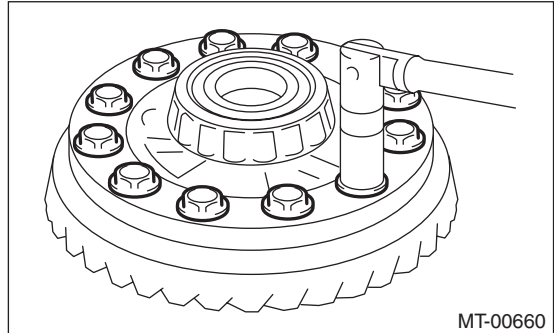
21) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

## C: DISASSEMBLY

### 1. DIFFERENTIAL CASE

1) Fix the differential assembly on a vice, and remove the hypoid driven gear.

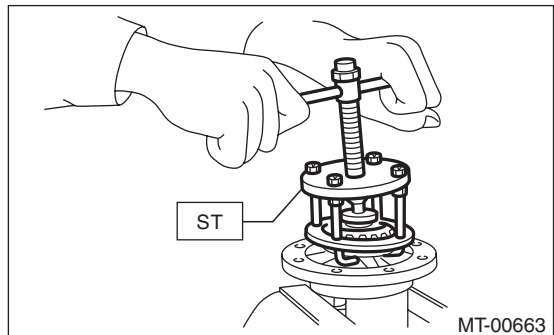
ST 18270KA020 SOCKET (E20)



MT-00660

2) Using the ST, remove the roller bearing.

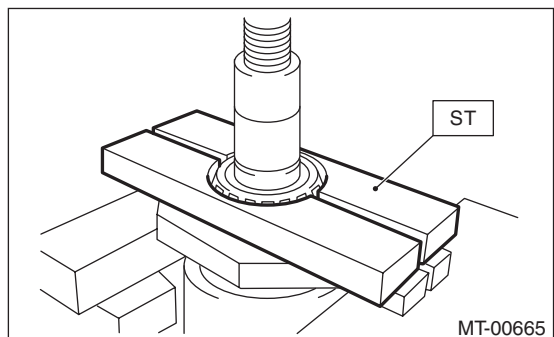
ST 399527700 PULLER SET



MT-00663

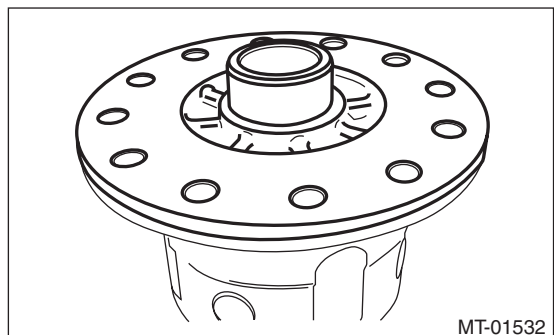
3) Using the ST, remove the roller bearing.

ST 498077000 REMOVER



MT-00665

4) Remove the differential case LH.

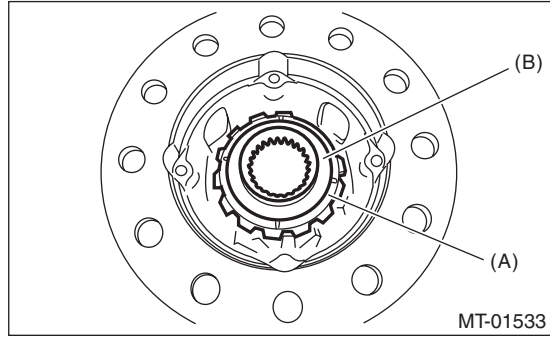


MT-01532

# Front Differential Assembly

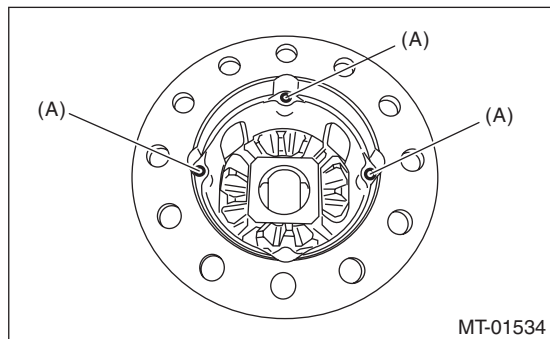
MANUAL TRANSMISSION AND DIFFERENTIAL

5) Remove the differential bevel gear and washer.



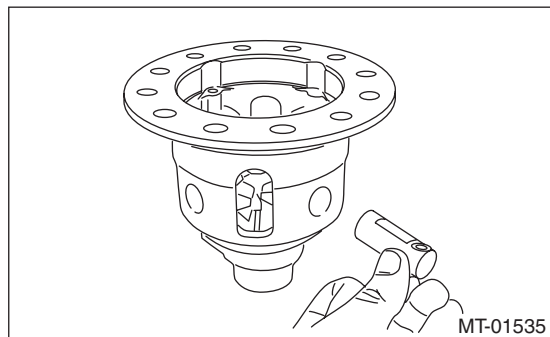
- (A) Differential bevel gear
- (B) Washer

6) Using a manet tool, etc., remove 3 straight pins.

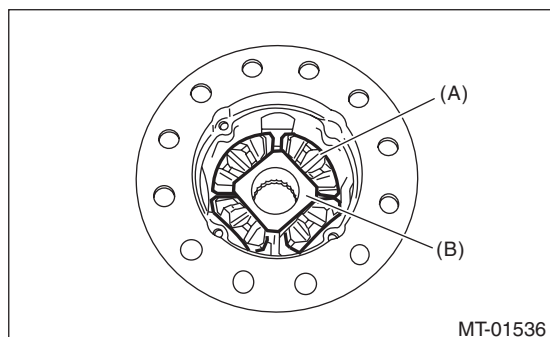


- (A) Straight pin

7) Remove 3 pinion shafts.



8) Remove differential bevel pinion and pinion shaft joint.

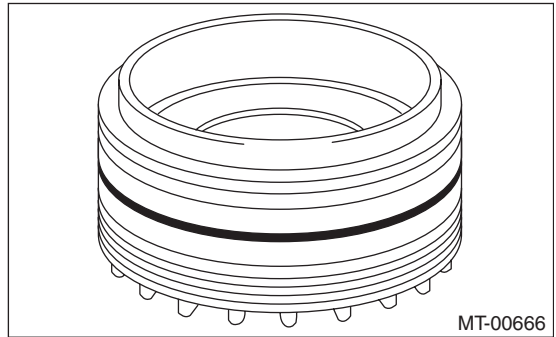


- (A) Differential bevel pinion
- (B) Pinion shaft joint

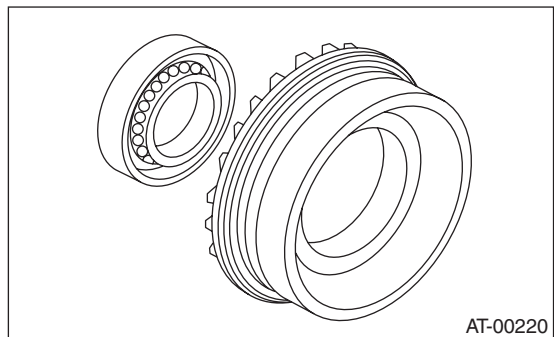
9) Remove the differential bevel gear and washer.

## 2. SIDE RETAINER

1) Remove the O-ring.

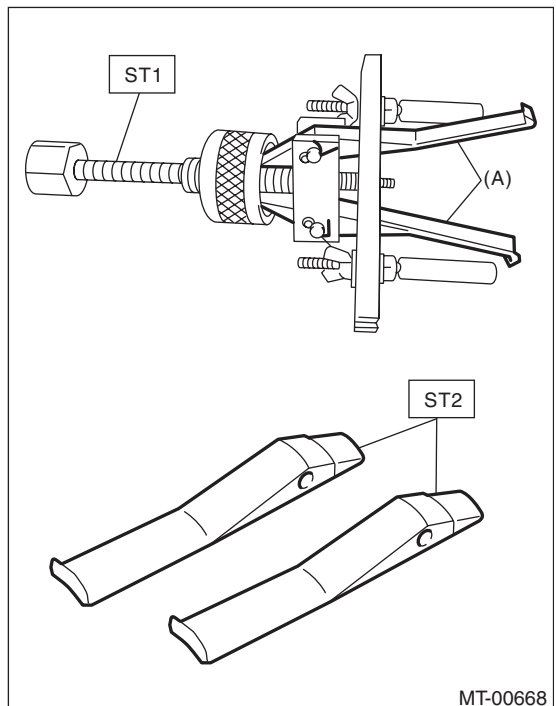


2) Remove the oil seal.



3) Remove the claw of ST1, and attach the claw of ST2.

- ST1 398527700 PULLER ASSY
- ST2 18760AA000 CLAW



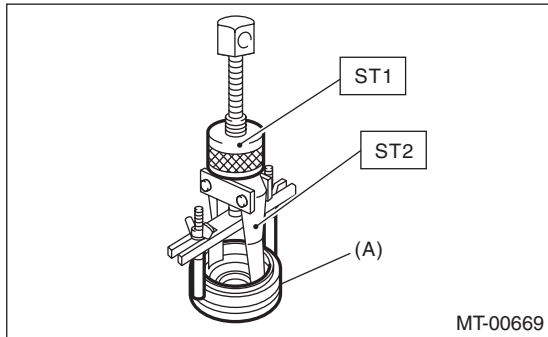
- (A) CLAW

# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

4) Remove the bearing outer race from the side retainer, using the ST.

ST1 398527700 PULLER ASSY  
ST2 18760AA000 CLAW



(A) Side retainer

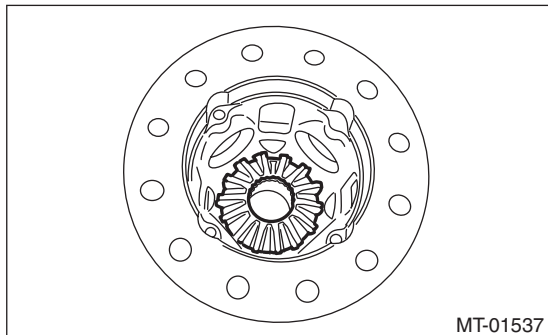
## D: ASSEMBLY

### 1. DIFFERENTIAL CASE

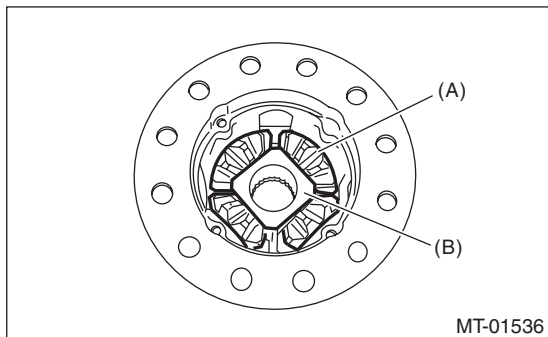
1) Install differential bevel gear and washer to the differential case RH.

NOTE:

Face the chamfered side of washer toward gear.

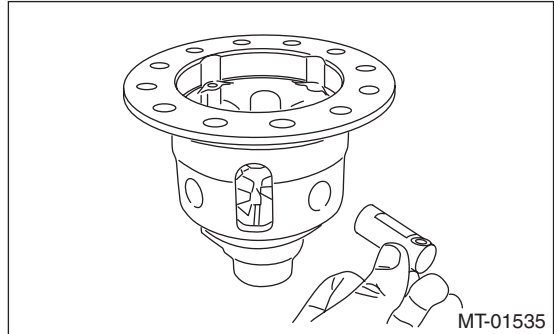


2) Install differential bevel pinion and pinion shaft joint.



(A) Differential bevel pinion  
(B) Pinion shaft joint

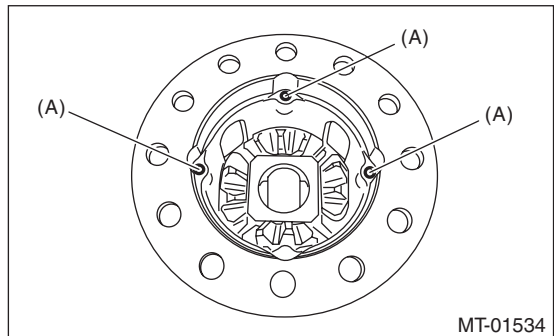
3) Install 3 pinion shafts.



4) Install 3 straight pins.

NOTE:

Make sure the straight pins are inserted completely.

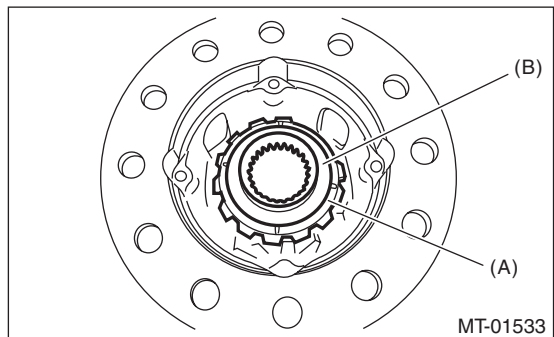


(A) Straight pin

5) Attach the differential bevel gear and washer.

NOTE:

Face the chamfered side of washer toward gear.

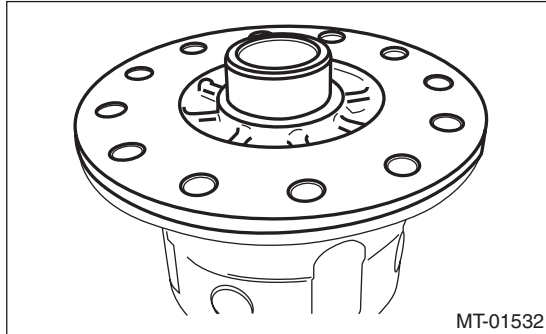


(A) Differential bevel gear  
(B) Washer

# Front Differential Assembly

MANUAL TRANSMISSION AND DIFFERENTIAL

6) Install the differential case LH.



7) Use the ST to attach bearings of differential cases RH and LH.

ST1 398437700 INSTALLER

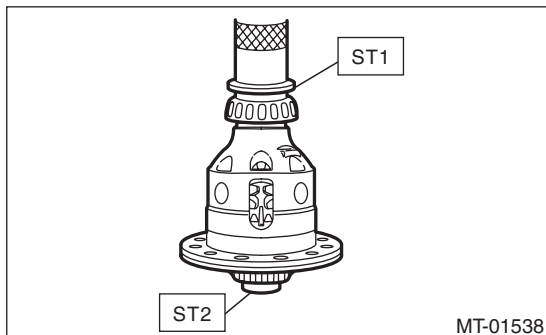
ST2 398497701 SEATS

### CAUTION:

Do not apply pressure in excess of 20 kN (2.0 ton, 2.2 US ton, 2.0 Imp ton).

### NOTE:

Always replace bearings and outer races as a set.

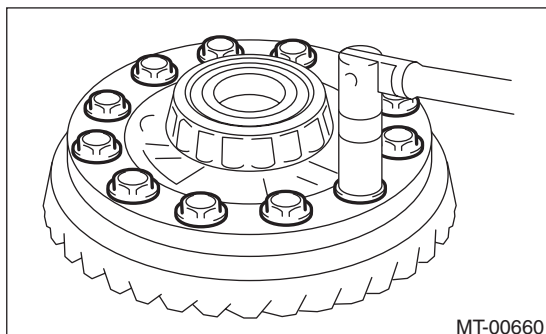


8) Attach the hypoid driven gear to the differential case.

ST 18270KA020 SOCKET (E20)

### Tightening torque:

**69 N·m (7.0 kgf·m, 50.9 ft·lb)**



9) Inspect the backlash of the bevel pinion gear.  
<Ref. to 6MT-104, BEVEL PINION GEAR BACKLASH, INSPECTION, Front Differential Assembly.>

## 2. SIDE RETAINER

### NOTE:

Install the oil seal and O-ring of side retainer after the adjustment of backlash and tooth contact.

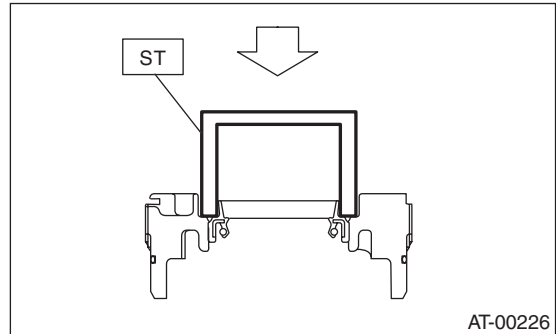
1) Install the bearing outer race to side retainer.

2) Using the ST, install the oil seal.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

### NOTE:

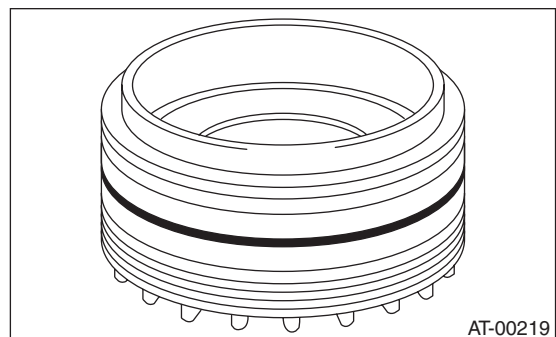
- Use a new oil seal.
- Apply oil to the oil seal lips.



3) Install the O-ring.

### NOTE:

Use new O-rings.



# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

### E: INSPECTION

Repair or replace the differential in the following cases:

- If gears are damaged, seized, or are excessively worn.
- If differential case sliding surfaces are damaged, seized, or are excessively worn.
- If there is damage, rust or wear in the bearings or bearing locations.
- If the bearing does not rotate smoothly or an abnormal noise is emitted when turning.

### 1. BEVEL PINION GEAR BACKLASH

Measure the backlash of the differential bevel pinion. If backlash is not within standard value, install a suitable washer to adjust. <Ref. to 6MT-105, ADJUSTMENT, Front Differential Assembly.>

#### CAUTION:

**When measuring the backlash, hold the differential assembly in upright position.**

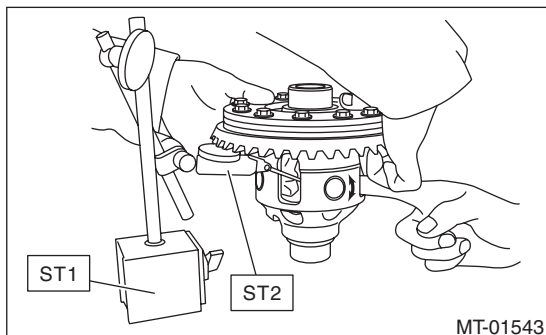
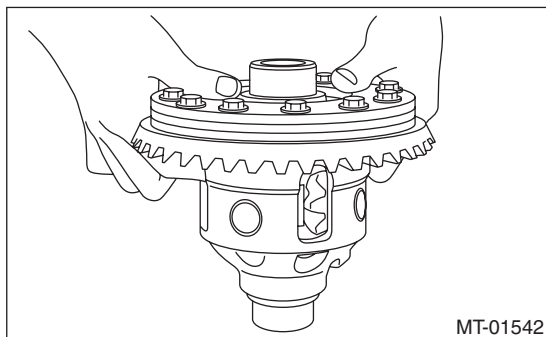
#### NOTE:

- It is recommended that backlash be measured by 2 people. One person should push the differential bevel gear upward (differential case LH side), and the other person measure the backlash.
- Before measuring backlash, turn so that the gears will settle in their individual locations.

ST1 498247001 MAGNET BASE  
ST2 498247100 DIAL GAUGE

#### Standard backlash

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



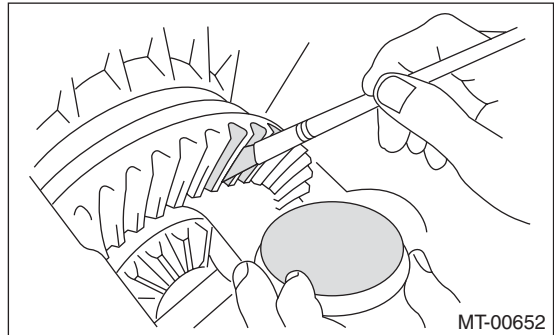
### 2. HYPOID GEAR BACKLASH

Inspect the hypoid gear backlash. Adjust if out of standard. <Ref. to 6MT-105, HYPOID GEAR BACKLASH, ADJUSTMENT, Front Differential Assembly.>

### 3. TOOTH CONTACT OF HYPOID GEAR

1) Check that the hypoid gear backlash is within the standard value. Adjust if out of standard. <Ref. to 6MT-105, HYPOID GEAR BACKLASH, ADJUSTMENT, Front Differential Assembly.>

2) Apply a thin uniform coat of lead-free red dye on the surfaces of 3 or 4 hypoid driven gear teeth.



3) Attach the drive pinion shaft assembly, and affix with 4 bolts.

#### NOTE:

Use old gaskets and washers to prevent the mating surfaces of the housing from becoming damaged.

#### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

4) Turn the drive pinion shaft to the left and right for several turns.

# Front Differential Assembly

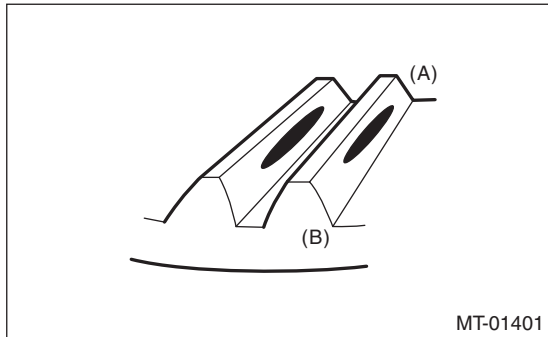
MANUAL TRANSMISSION AND DIFFERENTIAL

5) Remove the drive pinion shaft assembly, and inspect the mating condition of the teeth. If tooth contact is not correct, perform adjustment. <Ref. to 6MT-96, ADJUSTMENT, Drive Pinion Shaft Assembly.>

- Correct tooth contact

**NOTE:**

In a no load condition, the tooth contact from the center to the toe side is 50 — 60% (While driving, the tooth contact will shift towards the heel side.).



- (A) Toe side
- (B) Heel side

## F: ADJUSTMENT

### 1. BEVEL PINION GEAR BACKLASH

1) Measure the backlash of the bevel pinion gear. <Ref. to 6MT-104, BEVEL PINION GEAR BACKLASH, INSPECTION, Front Differential Assembly.>

2) Disassemble the differential case. <Ref. to 6MT-100, DIFFERENTIAL CASE, DISASSEMBLY, Front Differential Assembly.>

3) Select a washer from the following table, and assemble the differential case. <Ref. to 6MT-102, DIFFERENTIAL CASE, ASSEMBLY, Front Differential Assembly.>

**NOTE:**

If the backlash is excessive, select a thicker washer. If the backlash is too small, select a thinner washer.

Washer	
Part No.	Thickness mm (in)
803038021	0.950 (0.0374)
803038022	1.000 (0.0394)
803038023	1.050 (0.0413)
803038024	0.900 (0.0354)
803038025	1.100 (0.0433)

### 2. HYPOID GEAR BACKLASH

1) Attach the RH and LH side retainers.

ST1 18630AA010 WRENCH COMPL RETAINER  
(RH side)

ST2 18630AA000 WRENCH ASSEMBLY  
(LH side)

**NOTE:**

- Twist in the RH side side retainer a little further than the LH side.
- WRENCH ASSEMBLY (499787000) can also be used.

2) Attach the drive pinion shaft assembly, and affix with 4 bolts.

**NOTE:**

Use old gaskets and washers to prevent the mating surfaces of the housing from becoming damaged.

**Tightening torque:**

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**

3) Using the ST, twist in the side retainer LH until it just contacts the drive pinion and hypoid driven gear. Loosen side retainer RH.

ST1 18630AA010 WRENCH COMPL RETAINER  
(RH side)

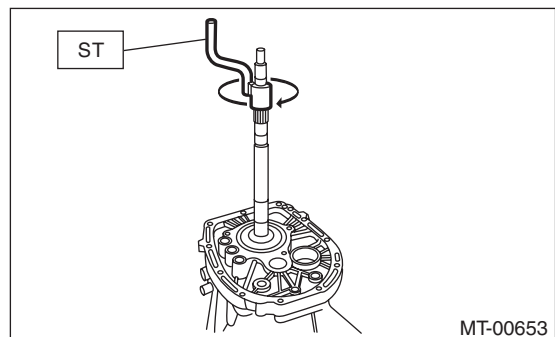
ST2 18630AA000 WRENCH ASSEMBLY  
(LH side)

**NOTE:**

WRENCH ASSEMBLY (499787000) can also be used.

4) Use the ST to turn the drive pinion shaft a few times.

ST 18631AA000 HANDLE

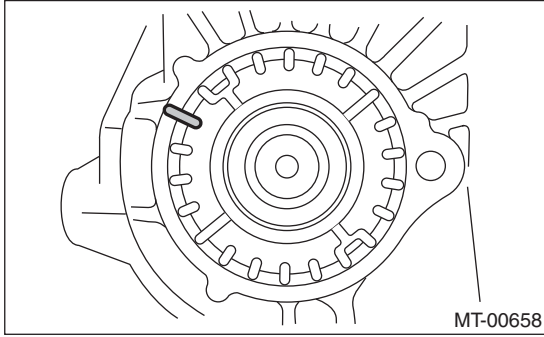


5) Repeat steps 3) and 4) until side retainer LH does not turn anymore. For side retainer RH, twist in until the inner race and outer race just comes into contact. This is the “zero” backlash state.

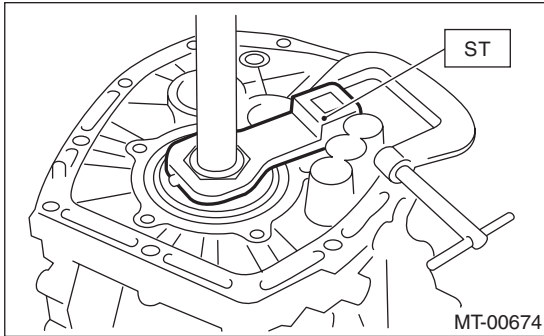
# Front Differential Assembly

## MANUAL TRANSMISSION AND DIFFERENTIAL

- 6) Mark the mating positions of the left and right side retainers and the clutch housing.



- 7) Turn the back side retainer LH by 3 notches, and screw in the side retainer RH by 3 notches.  
8) Use the ST to fix the drive pinion shaft in place.  
ST 18621AA000 ADAPTER WRENCH



- 9) Install the SUBARU genuine axle shaft to the front differential left and right sides.

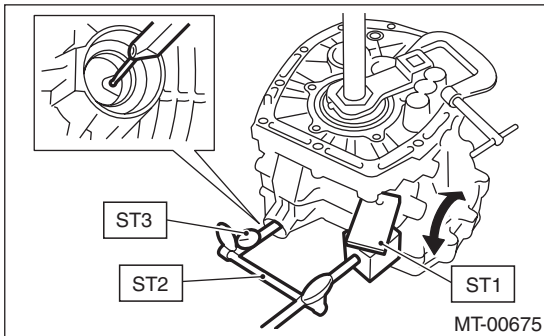
Part No. 38415AA000 AXLE SHAFT

- 10) After turning the drive pinion shaft several turns, use the ST to measure the hypoid gear backlash.

ST1 498255400 PLATE  
ST2 498247001 MAGNET BASE  
ST3 498247100 DIAL GAUGE

### **Hypoid gear backlash:**

**0.13 — 0.18 mm (0.0051 — 0.0071 in)**



- 11) If the backlash is out of specified range, turn the right and left side retainers to adjust.  
12) Turn the RH side retainer by 1.75 notches or more.

### **3. TOOTH CONTACT OF HYPOID GEAR**

Regarding teeth contact conditions, refer to the drive pinion section. <Ref. to 6MT-104, TOOTH CONTACT OF HYPOID GEAR, INSPECTION, Front Differential Assembly.>



## 22. Shifter Fork and Rod

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.> <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the individual gear assemblies. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>

### B: INSTALLATION

- 1) Install the individual gear assemblies all at once. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>
- 2) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>
- 3) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>
- 4) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 5) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 6) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.> <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>
- 7) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

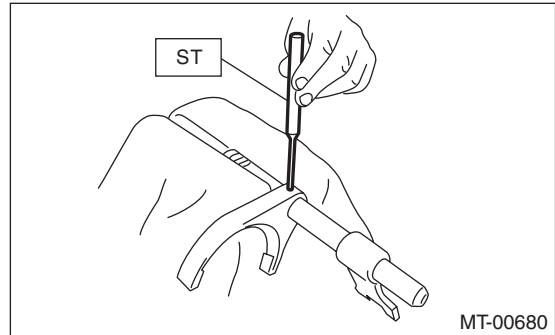
### C: DISASSEMBLY

#### NOTE:

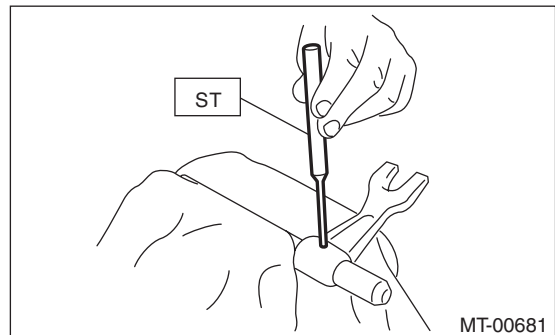
Discard the removed spring pin, and replace with a new part.

#### 1. REVERSE SHIFTER FORK

- 1) Remove the reverse fork using the ST.  
ST 398791700 REMOVER



- 2) Remove the reverse shifter arm using the ST.  
ST 398791700 REMOVER

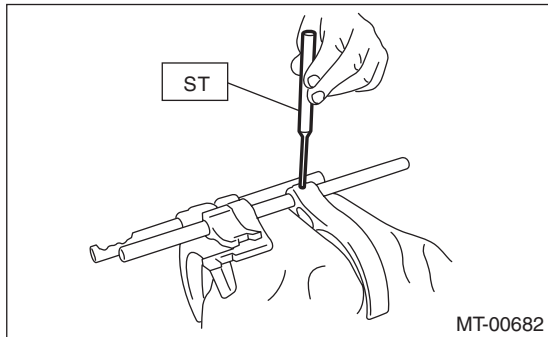


# Shifter Fork and Rod

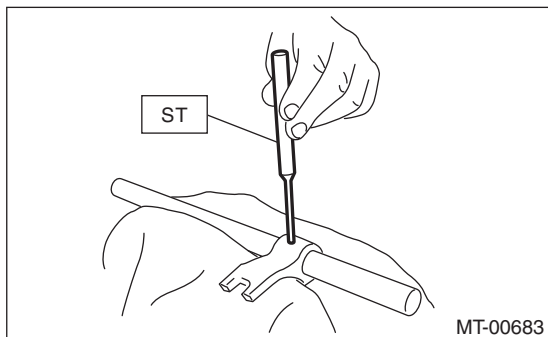
## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. 1ST-2ND, 3RD-4TH SHIFTER FORK

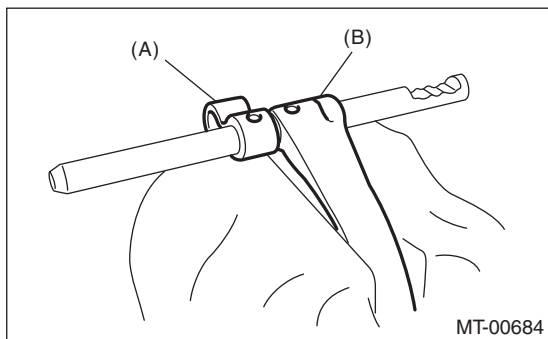
1) Using the ST, remove the 3rd-4th shifter fork.  
ST 398791700 REMOVER



2) Using the ST, remove the 3rd-4th shifter arm.  
ST 398791700 REMOVER



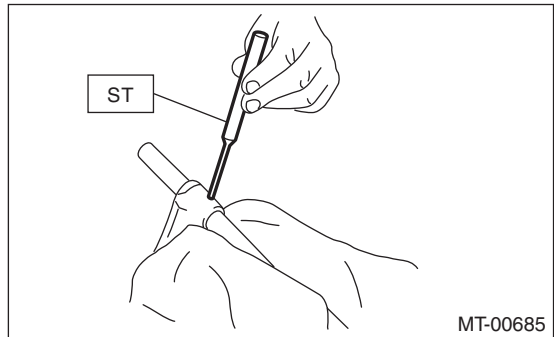
3) Using the ST, remove the 1st-2nd shifter arm and 1st-2nd shifter fork.  
ST 398791700 REMOVER



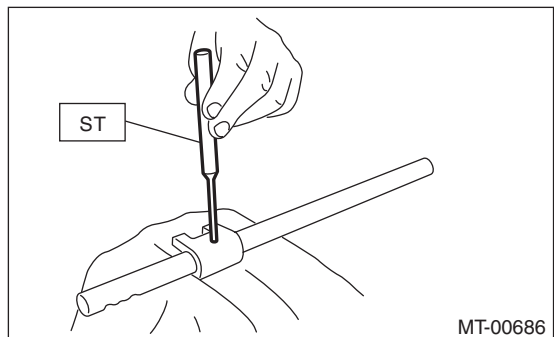
- (A) 1st-2nd shifter arm
- (B) 1st-2nd shifter fork

### 3. 5TH-6TH SHIFTER FORK

1) Using the ST, remove the 5th-6th shifter fork.  
ST 398791700 REMOVER

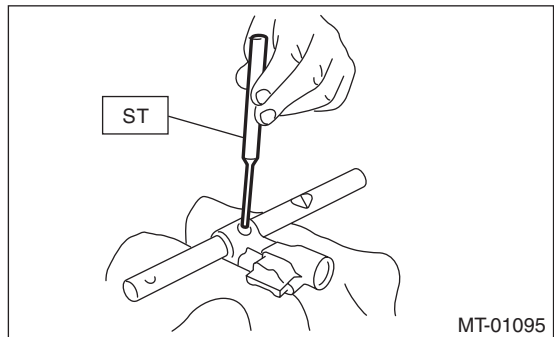


2) Using the ST, remove the 5th-6th shifter arm.  
ST 398791700 REMOVER



### 4. SHIFTER ARM SHAFT

Remove the selector arm using the ST.  
ST 398791700 REMOVER

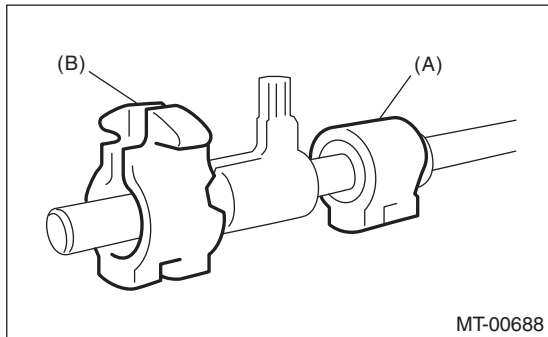


# Shifter Fork and Rod

MANUAL TRANSMISSION AND DIFFERENTIAL

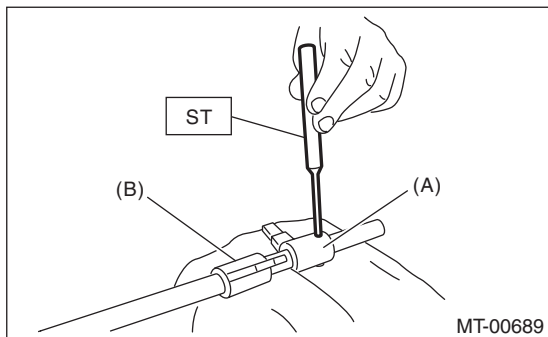
## 5. STRIKING ROD

1) Remove the reverse interlock block and the interlock block from the striking rod.



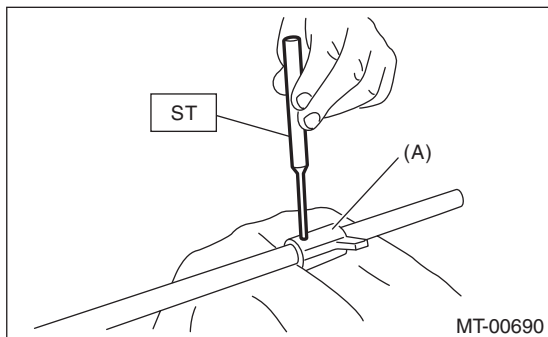
- (A) Reverse interlock block
- (B) Interlock block

2) Remove the reverse interlock arm using the ST.  
ST 398791700 REMOVER



- (A) Reverse interlock arm
- (B) Interlock arm

3) Remove the interlock arm using the ST.  
ST 398791700 REMOVER



- (A) Interlock arm

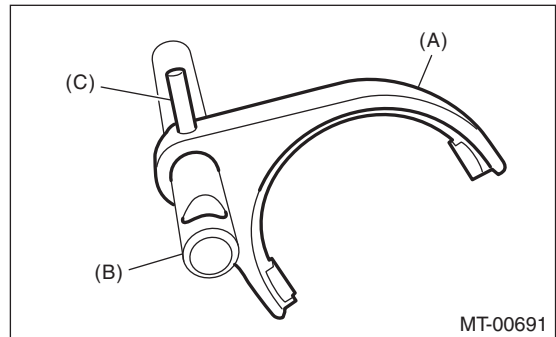
## D: ASSEMBLY

### 1. REVERSE SHIFTER FORK

1) Using the ST, install the reverse fork.  
ST 398791700 REMOVER

NOTE:

Confirm that the reverse fork and rod are installed in the proper direction.

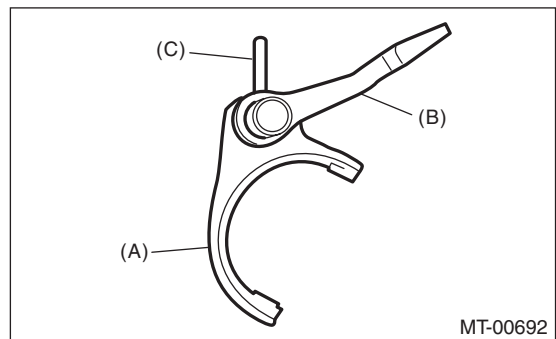


- (A) Reverse fork
- (B) Reverse rod
- (C) Spring pin

2) Using the ST, install the reverse arm.  
ST 398791700 REMOVER

NOTE:

Confirm that the reverse arm and rod are installed in the proper direction.



- (A) Reverse arm
- (B) Reverse rod
- (C) Spring pin

# Shifter Fork and Rod

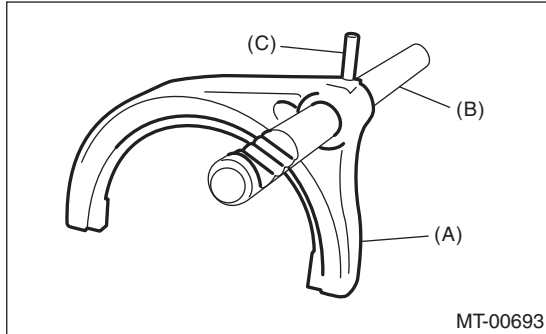
## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. 1ST-2ND, 3RD-4TH SHIFTER FORK

1) Using the ST, install the 1st-2nd shifter fork.  
ST 398791700 REMOVER

**NOTE:**

Make sure that the 1st-2nd shifter fork and rod are installed in the correct direction.

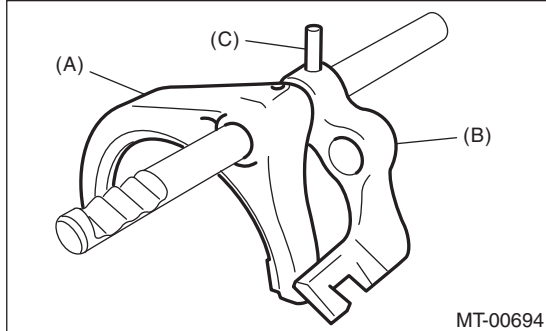


- (A) 1st-2nd shifter fork
- (B) 1st-2nd shifter rod
- (C) Spring pin

2) Using the ST, install the 1st-2nd shifter arm.  
ST 398791700 REMOVER

**NOTE:**

Make sure that the 1st-2nd shifter arm and fork are installed in the correct direction.

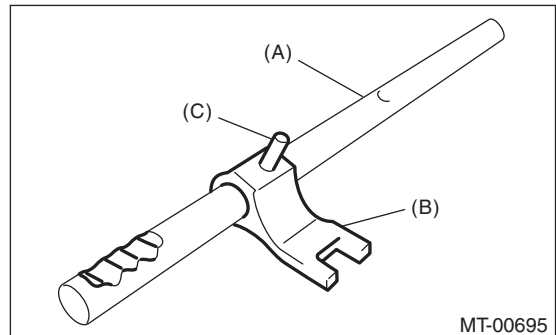


- (A) 1st-2nd shifter fork
- (B) 1st-2nd shifter arm
- (C) Spring pin

3) Using the ST, install the 3rd-4th shifter arm.  
ST 398791700 REMOVER

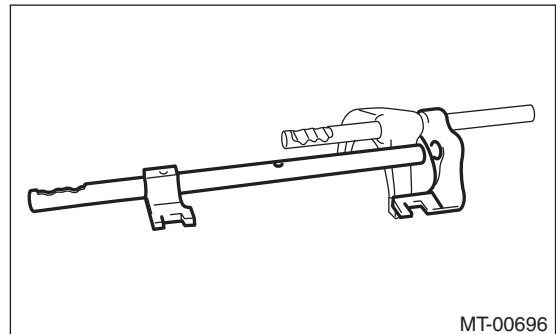
**NOTE:**

Make sure that the 3rd-4th shifter arm and rod are installed in the correct direction.



- (A) 3rd-4th shifter rod
- (B) 3rd-4th shifter arm
- (C) Spring pin

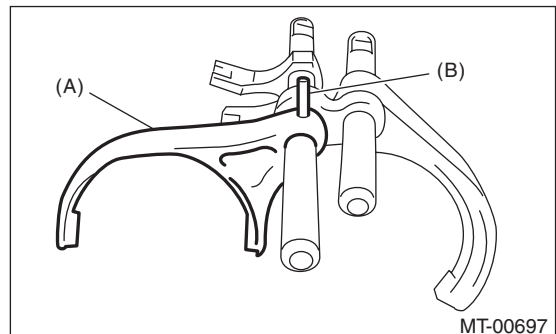
4) Attach the 3rd-4th fork rod to the 1st-2nd shifter arm.



5) Using the ST, install the 3rd-4th shifter fork.  
ST 398791700 REMOVER

**NOTE:**

Make sure that the 3rd-4th shifter fork is installed in the correct direction.



- (A) 3rd-4th shifter fork
- (B) Spring pin

# Shifter Fork and Rod

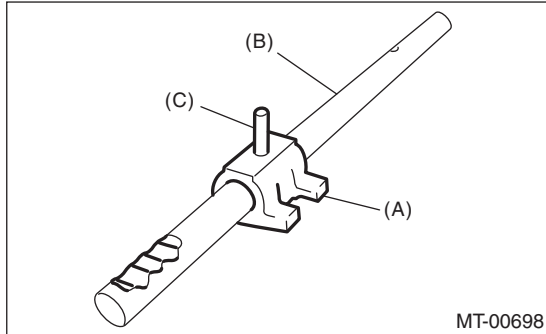
MANUAL TRANSMISSION AND DIFFERENTIAL

## 3. 5TH-6TH SHIFTER FORK

1) Using the ST, install the 5th-6th shifter arm.  
ST 398791700 REMOVER

**NOTE:**

Make sure that the 5th-6th shifter arm and rod are installed in the correct direction.

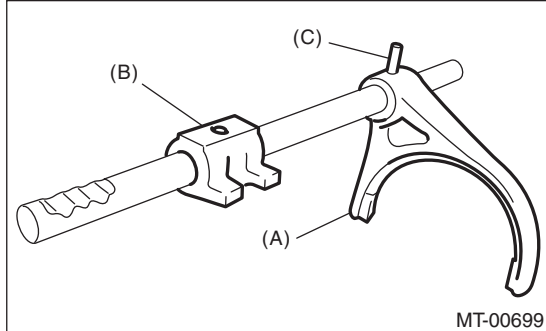


- (A) 5th-6th shifter arm
- (B) 5th-6th shifter rod
- (C) Spring pin

2) Using the ST, install the 5th-6th shifter fork.  
ST 398791700 REMOVER

**NOTE:**

Check that the 5th-6th shifter fork and arm are installed.



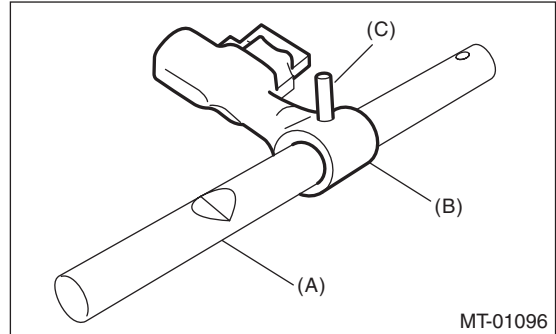
- (A) 5th-6th shifter fork
- (B) 5th-6th shifter arm
- (C) Spring pin

## 4. SHIFTER ARM SHAFT

Using the ST, install the selector arm.  
ST 398791700 REMOVER

**NOTE:**

Confirm that the selector arm and rod are installed in the proper direction.



- (A) Selector rod
- (B) Selector arm
- (C) Spring pin

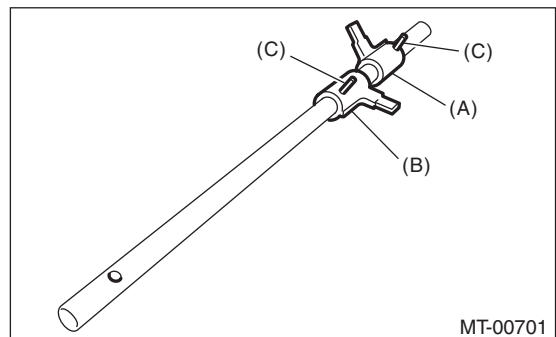
## 5. STRIKING ROD

1) Using the ST, install the reverse interlock arm and interlock arm.  
ST 398791700 REMOVER

ST 398791700 REMOVER

**NOTE:**

- Confirm that the reverse interlock arm and rod are installed in the proper direction.
- Confirm that the interlock arm and rod are installed in the proper direction.



- (A) Reverse interlock arm
- (B) Interlock arm
- (C) Spring pin

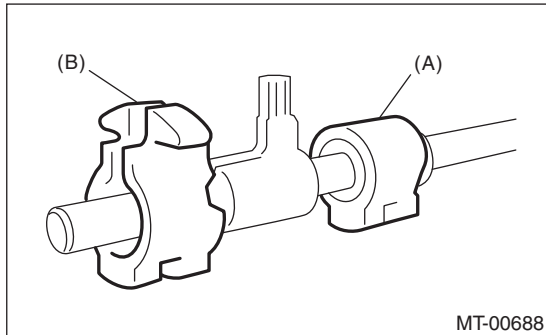
# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

2) Attach the reverse interlock block and interlock block to the striking rod.

### NOTE:

Confirm that the reverse interlock block and interlock block are installed in the proper direction.



- (A) Reverse interlock block
- (B) Interlock block

## E: INSPECTION

- 1) Check the shift shaft and shift rod for damage. Replace if damaged.
- 2) Repair or replace the gearshift mechanism if excessively worn, bent or defective in any way.

## F: ADJUSTMENT

### 1. 1ST-2ND FORK ROD SELECTION

#### NOTE:

In the following conditions, perform the procedures below.

- Replacing the 1st and 2nd driven gear
- Replacing the 1st and 2nd synchro ring assembly
- Replacing the adapter plate
- Replacing the driven shaft
- Replacing the 1st-2nd hub and sleeve assemblies

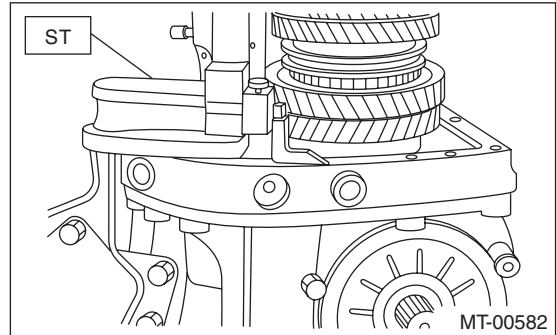
1) Insert the drive pinion assembly into the adapter plate.

#### NOTE:

Confirm that the thrust bearing outer race has not been removed and the drive pinion is not lifted.

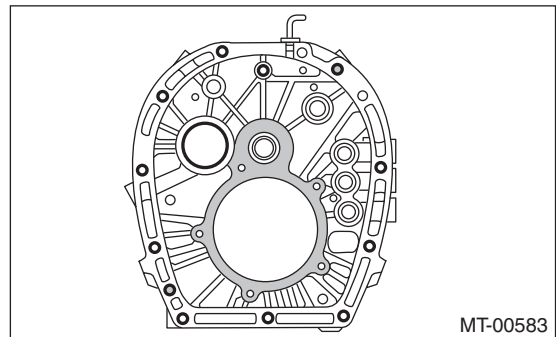
2) Set the height gauge to the adapter plate. Lower the height gauge indicator to the mating surface of the adapter plate and case, and set to 0 points.

ST 18853AA000 HEIGHT GAUGE



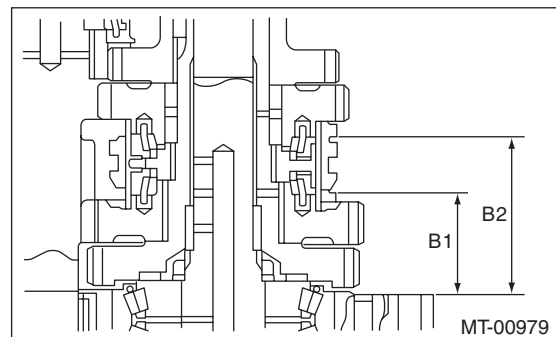
#### NOTE:

- The adapter plate will be the base point for the measurement. Use a scraper to remove any gasket material remaining on the end face.
- During measurement, do not place the height gauge in the shaded area shown in the figure.



3) Select the main shaft snap ring. <Ref. to 6MT-76, ADJUSTMENT, Main Shaft Assembly.>

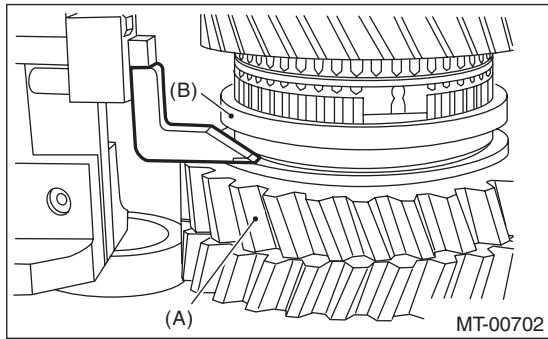
4) Measure "B1" and "B2" as shown in the figure.



# Shifter Fork and Rod

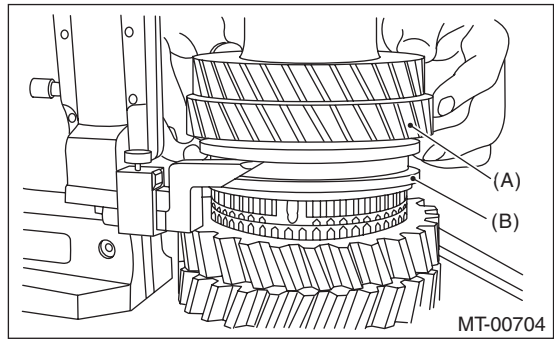
## MANUAL TRANSMISSION AND DIFFERENTIAL

5) Shift the 1st-2nd sleeve to the 1st driven gear side, push down to the stopper, and measure "B1".



- (A) 1st driven gear
- (B) 1st-2nd sleeve

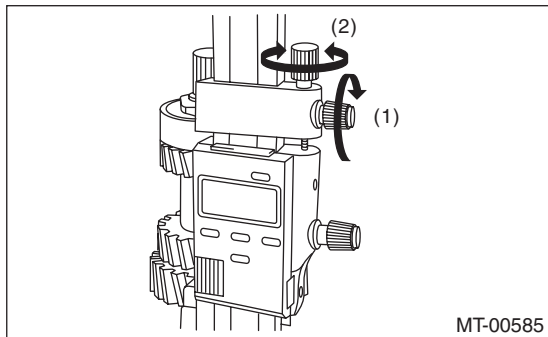
7) Shift the 1st-2nd sleeve to the 2nd driven gear side, push up on the stopper, and measure "B2".



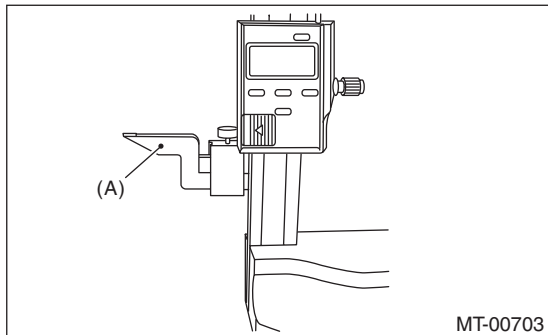
- (A) 2nd driven gear
- (B) 1st-2nd sleeve

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the 1st side end surface of the sleeve.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



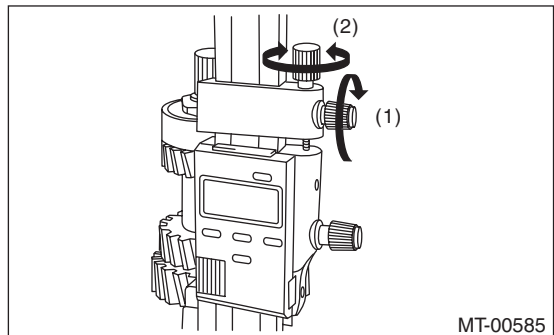
6) Set the height gauge indicator upside down.



- (A) Indicator

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the 2nd side end surface of the sleeve.
- The measurement is to be performed with 2 persons, while holding the sleeve straight.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

8) According to both of the measurements, calculate the neutral position of the 1st-2nd sleeve. From the following calculation, select a fork rod which matches the calculated value.

Calculation:  $T = (B1 + B2) / 2$

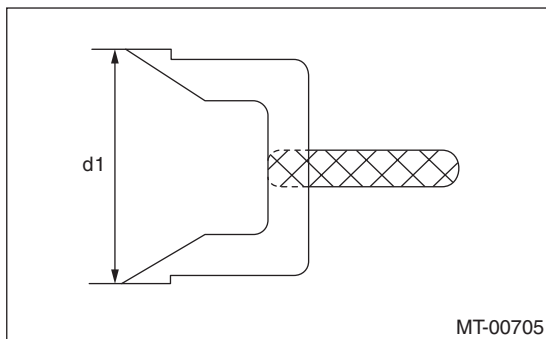
T: 1st-2nd sleeve center position

B1: Height from the adapter plate end to the sleeve end, when shifted to 1st gear

B2: Measured height from the adapter plate end to the sleeve end, when shifted to 2nd gear: +55 mm (2.17 in)

### NOTE:

Attach the indicator upside down in comparison to the setting procedures for the 0 point. Add d1 [Numerical value: 55 mm (2.17 in)] from the figure below to "B2", and measure "B2".



T	mm (in)	Lot No. (marking)
62.93 — 63.23 (2.4776 — 2.4894)		32801AA111 (1)
63.23 — 63.53 (2.4894 — 2.5012)		32801AA131 (none)
63.53 — 63.83 (2.5012 — 2.5130)		32801AA141 (2)

## 2. 3RD-4TH FORK ROD SELECTION

### NOTE:

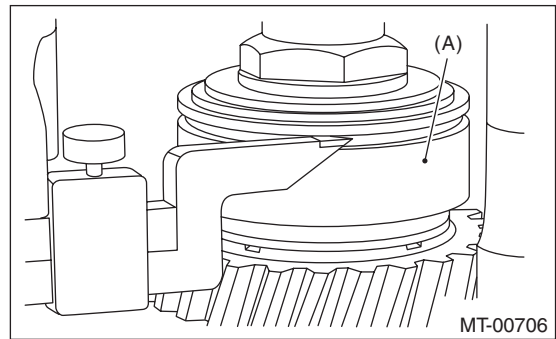
In the following conditions, perform the procedures below.

- Replacing the main shaft
- Replacing the 3rd, and 3rd to 6th drive gear and bushing
- Replacing the 3rd, and 3rd to 6th synchro assemblies
- Replacing the 3rd-4th hub and sleeve assemblies

1) Insert the main shaft assembly into the adapter plate.

2) Set the height gauge to the adapter plate. Lower the height gauge indicator to the top surface of the snap ring groove, and set to the 0 point on the upper side of the main rear bearing.

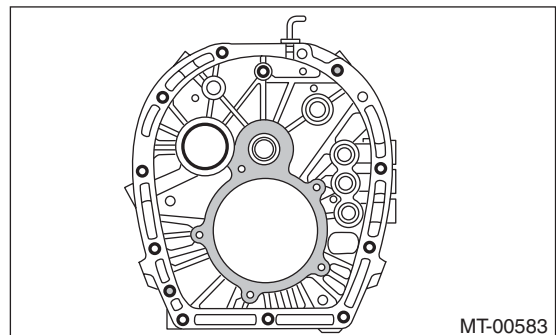
ST 18853AA000 HEIGHT GAUGE



(A) Ball bearing

### NOTE:

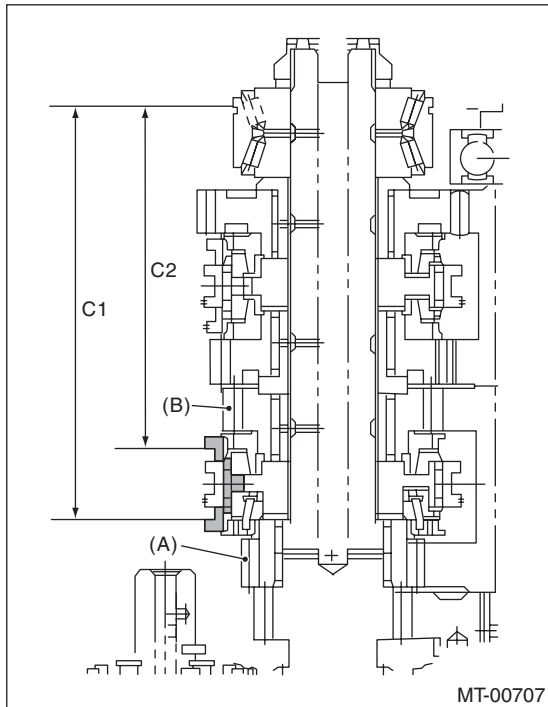
- The height gauge will be set on the adapter plate during the measurement. Use a scraper to remove any gasket material remaining on the end face.
- During measurement, do not place the height gauge in the shaded area shown in the figure.





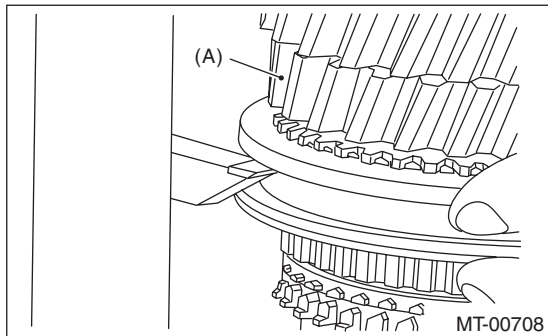
# Shifter Fork and Rod

3) Use a height gauge to measure “C1” and “C2” as shown in the figure.



- (A) 3rd drive gear
- (B) 4th drive gear

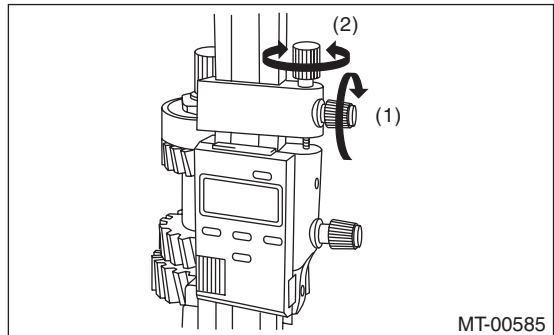
(1) Shift the 3rd-4th sleeve to the 4th gear side, push up on the stopper, and measure “C2”.



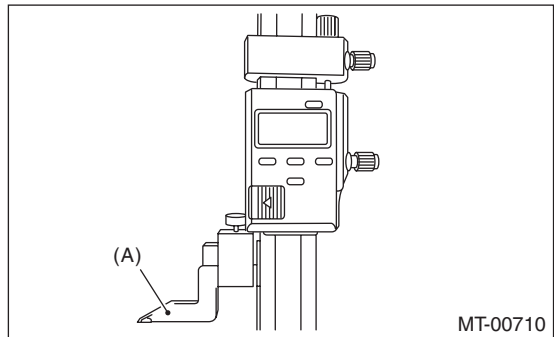
- (A) 4th drive gear

## NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure.
- Turn dial (2), and set the indicator to the 4th side end surface of the sleeve.
- The measurement is to be performed with 2 persons, while holding the sleeve straight.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



(2) Set the height gauge indicator upside down.

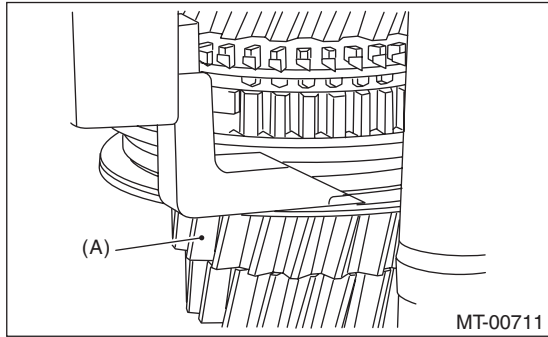


- (A) Indicator

# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

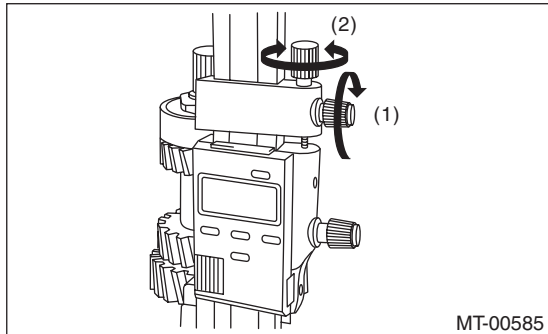
(3) Shift the 3rd-4th sleeve to the 3rd drive gear side, push down to the stopper, and measure "C1".



(A) 3rd drive gear

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the 3rd side end surface of the sleeve.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



4) According to both of the measurements, calculate the neutral position of the 3rd-4th sleeve. From the following calculation, select a fork rod which matches the calculated value.

$$\text{Calculation: } T = (C1 + C2) / 2$$

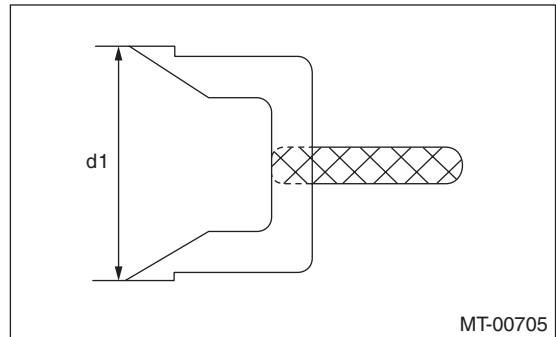
T: 3rd-4th sleeve center position

C1: Measured depth from the main shaft rear bearing snap ring groove to the sleeve end, when shifted to 3rd gear: +55 mm (2.17 in)

C2: Measured depth from the main shaft rear bearing snap ring groove to the sleeve end, when shifted to 4th gear

### NOTE:

Attach the indicator upside down in comparison to the setting procedures for the 0 point. Add d1 [Numerical value: 55 mm (2.17 in)] from the figure below to "C1", and measure "C1".



T	mm (in)	Lot No. (marking)		
		M.SFT Snap ring 805072010 [t = 1.65 mm (0.065 in)]	M.SFT Snap ring 805072011 [t = 1.95 mm (0.077 in)]	M.SFT Snap ring 805072012 [t = 2.25 mm (0.089 in)]
137.22 — 137.52 (5.4024 — 5.4142)	32809AA17 1 (none)	32809AA18 1 (2)	32809AA19 1 (4)	
137.52 — 137.82 (5.4142 — 5.4260)	32809AA16 1 (1)	32809AA17 1 (none)	32809AA18 1 (2)	
137.82 — 138.12 (5.4260 — 5.4379)	32809AA14 1 (3)	32809AA16 1 (1)	32809AA17 1 (none)	

T = Thickness

# Shifter Fork and Rod

## 3. 5TH-6TH FORK ROD SELECTION

**NOTE:**

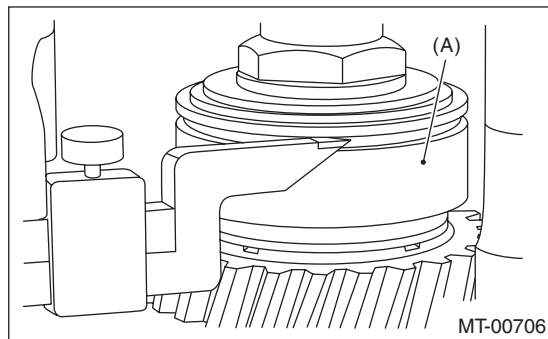
In the following conditions, perform the procedures below.

- Replacing the main shaft
- Replacing the 3rd to 6th drive gear and bushing
- Replacing the 3rd to 6th synchro ring assemblies
- Replacing the 3rd-4th hub and sleeve assemblies
- Replacing the 5th-6th hub and sleeve assemblies

1) Insert the main shaft assembly into the adapter plate.

2) Set the height gauge to the adapter plate. Lower the height gauge indicator to the upper face of the snap ring groove or the upper side of the main rear bearing. Set to 0 point.

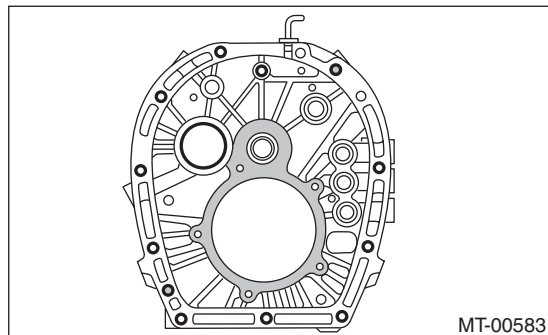
ST 18853AA000 HEIGHT GAUGE



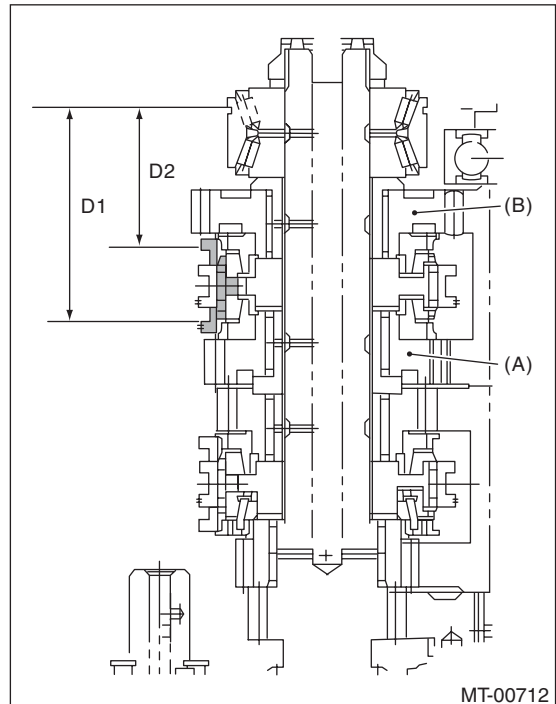
(A) Ball bearing

**NOTE:**

- The height gauge will be set on the adapter plate during the measurement. Use a scraper to remove any gasket material remaining on the end face.
- During measurement, do not place the height gauge in the shaded area shown in the figure.



3) Use a height gauge to measure “D1” and “D2” as shown in the figure.

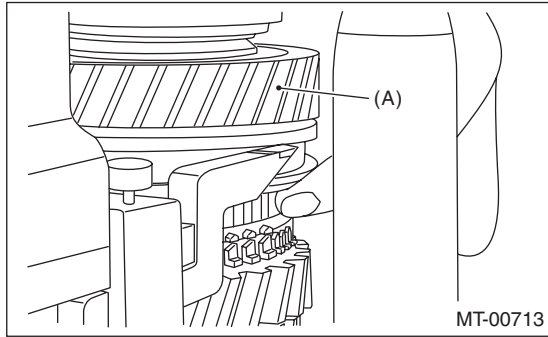


- (A) 5th main gear
- (B) 6th main gear

# Shifter Fork and Rod

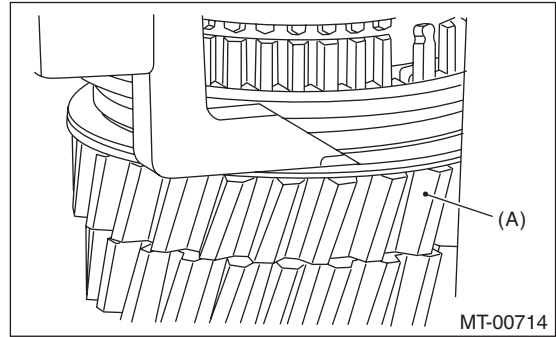
## MANUAL TRANSMISSION AND DIFFERENTIAL

(1) Shift the 5th-6th sleeve to the 6th main gear side, push up on the stopper, and measure "D2".



(A) 6th main gear

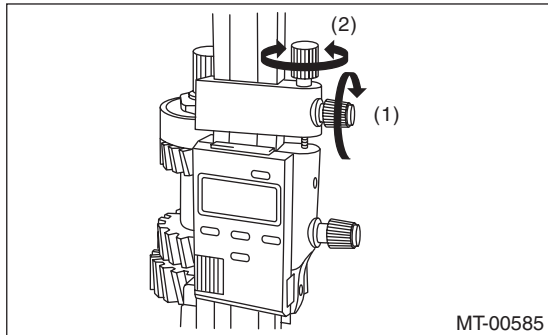
(3) Shift the 5th-6th sleeve to the 5th main gear side, push down to the stopper, and measure "D1".



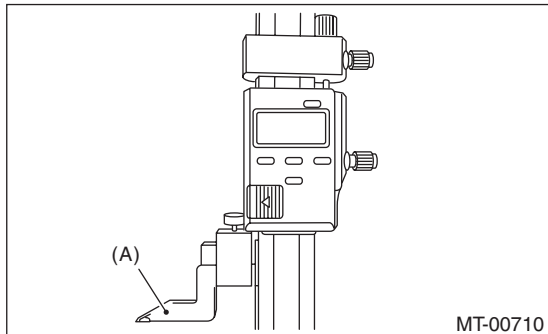
(A) 5th main gear

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the 6th side end surface of the sleeve.
- The measurement is to be performed with 2 persons, while holding the sleeve straight.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



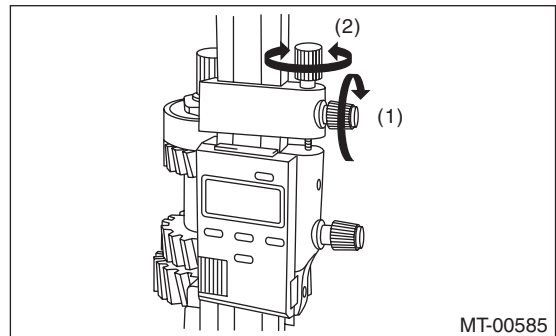
(2) Set the height gauge indicator upside down.



(A) Indicator

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the 5th side end surface of the sleeve.
- Turn approximately 72° at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



# Shifter Fork and Rod

4) According to both of the measurements, calculate the neutral position of the 5th-6th sleeve. From the following calculation, select a fork rod which matches the calculated value.

Calculation:  $T = (D1 + D2) / 2$

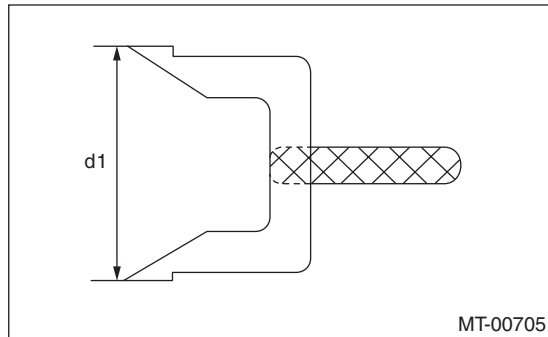
T: 5th-6th sleeve center position

D1: Measured length from the shaft rear bearing snap ring groove to the sleeve groove end, when shifted to 5th gear [Measured value +55 mm (2.17 in)]

D2: Measured length from the main shaft rear bearing snap ring groove to the sleeve groove end, when shifted to 6th gear

**NOTE:**

Attach the indicator upside down in comparison to the setting procedures for the 0 point. Add d1 [Numerical value: 55 mm (2.17 in) from the figure below to "D1", and measure "D1".



MT-00705

T	mm (in)	Lot No. (marking)		
		M.SFT Snap ring 805072010 [t = 1.65 mm (0.065 in)]	M.SFT Snap ring 805072011 [t = 1.95 mm (0.077 in)]	M.SFT Snap ring 805072012 [t = 2.25 mm (0.089 in)]
64.12 — 64.42 (2.5244 — 2.5362)		32945AA02 1 (none)	32945AA03 1 (2)	32945AA04 1 (4)
64.42 — 64.72 (2.5362 — 2.5480)		32945AA01 1 (1)	32945AA02 1 (none)	32945AA03 1 (2)
64.72 — 65.02 (2.5480 — 2.5598)		32945AA00 1 (3)	32945AA01 1 (1)	32945AA02 1 (none)

T = Thickness

## 4. REVERSE FORK ROD SELECTION

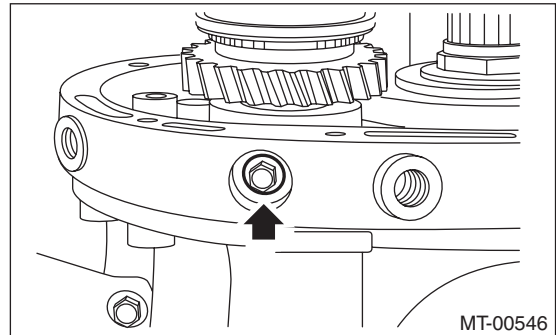
**NOTE:**

In the following conditions, perform the procedures below.

- Replacing the reverse idler gear
  - Replacing the reverse idler gear No. 2
  - Replacing the adapter plate
  - Replacing the base
- 1) Insert the reverse idler gear assembly into the adapter plate.
  - 2) Tighten the base COMPL attachment bolts.

**Tightening torque:**

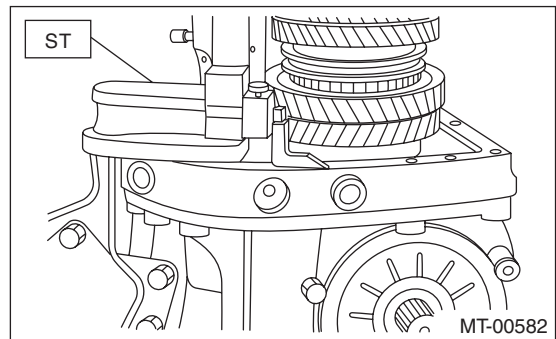
**25 N·m (2.5 kgf·m, 18.4 ft·lb)**



MT-00546

- 3) Set the height gauge to the adapter plate. Lower the height gauge indicator to the mating surface of the adapter plate and case, and set to 0 points.

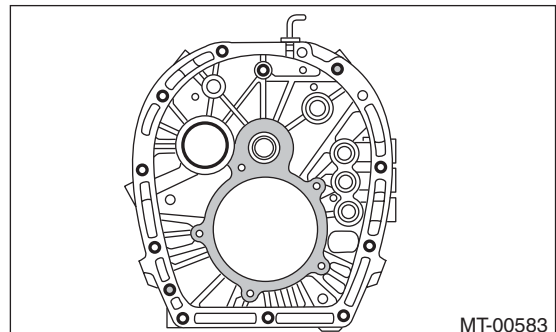
ST 18853AA000 HEIGHT GAUGE



MT-00582

**NOTE:**

- The adapter plate will be the base point for the measurement. Use a scraper to remove any gasket material remaining on the end face.
- During measurement, do not place the height gauge in the shaded area shown in the figure.

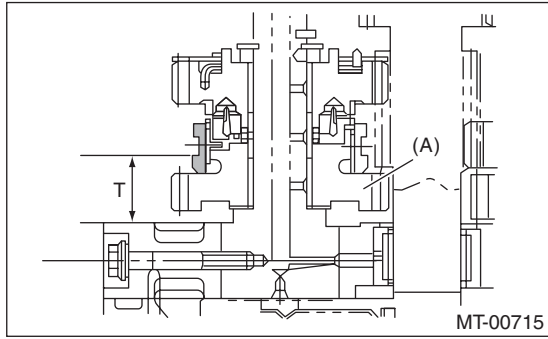


MT-00583

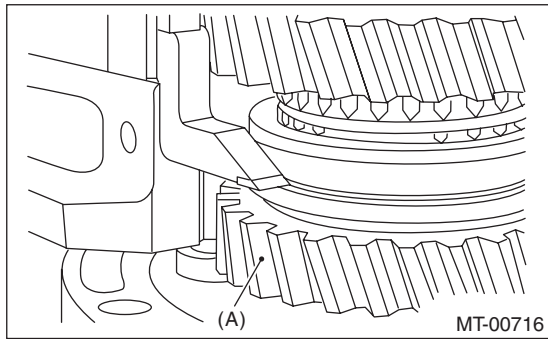
# Shifter Fork and Rod

## MANUAL TRANSMISSION AND DIFFERENTIAL

4) Press fit the reverse sleeve to the reverse idler gear No. 2, and measure "T".



(A) Reverse idler gear No. 2



(A) Reverse idler gear No. 2

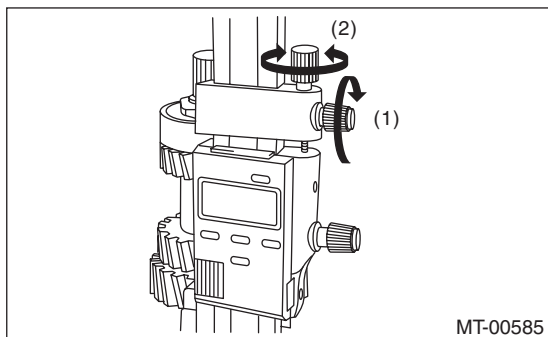
5) Calculate the neutral position of the reverse sleeve according to the measurement. From the following calculation, select a fork rod which matches the calculated value.

Calculation:  $T + 4.8 \text{ mm (0.189 in)}$

$T + 4.8 \text{ mm (0.189 in)}$ mm (in)	Lot No. (marking)
33.50 — 33.80 (1.3189 — 1.3307)	32816AA110 (1)
33.80 — 34.10 (1.3307 — 1.3425)	32816AA130 (none)
34.10 — 34.40 (1.3425 — 1.3543)	32816AA140 (2)
T = Thickness	

### NOTE:

- Set the height gauge indicator near the measurement target, and lock dial (1) as shown in the figure. Turn dial (2), and set the indicator to the end face of the reverse sleeve side.
- Turn approximately  $72^\circ$  at a time, and measure the sleeve in 5 locations. Round off the 2 highest and 2 lowest measurement values. The remaining center value is used as the measurement value.



## 23. Clutch Housing

### A: REMOVAL

- 1) Remove the manual transmission assembly from the vehicle. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Prepare the transmission for overhaul. <Ref. to 6MT-37, Preparation for Overhaul.>
- 3) Remove the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, REMOVAL, Neutral Position Switch.> <Ref. to 6MT-39, REMOVAL, Back-up Light Switch.>
- 4) Remove the extension case. <Ref. to 6MT-43, REMOVAL, Extension Case.>
- 5) Remove the transfer driven gear. <Ref. to 6MT-55, REMOVAL, Transfer Driven Gear.>
- 6) Remove the center differential. <Ref. to 6MT-57, REMOVAL, Center Differential.>
- 7) Remove the transmission case. <Ref. to 6MT-58, REMOVAL, Transmission Case.>
- 8) Remove the individual gear assemblies. <Ref. to 6MT-64, REMOVAL, Main Shaft Assembly.>
- 9) Remove the drive pinion shaft assembly. <Ref. to 6MT-92, REMOVAL, Drive Pinion Shaft Assembly.>
- 10) Remove the front differential assembly. <Ref. to 6MT-98, REMOVAL, Front Differential Assembly.>

### B: INSTALLATION

- 1) Install the pitching stopper bracket.

#### **Tightening torque:**

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**

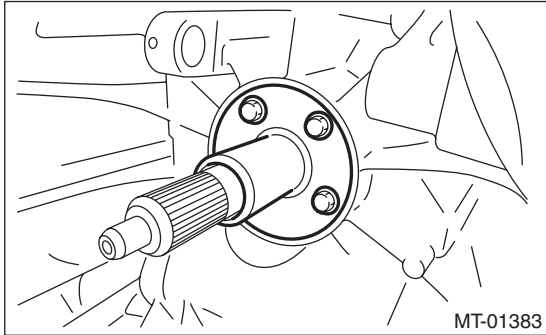
- 2) Install the front differential assembly. <Ref. to 6MT-99, INSTALLATION, Front Differential Assembly.>
- 3) Install the drive pinion shaft assembly. <Ref. to 6MT-92, INSTALLATION, Drive Pinion Shaft Assembly.>
- 4) Install the individual gear assemblies all at once. <Ref. to 6MT-65, INSTALLATION, Main Shaft Assembly.>
- 5) Install the transmission case. <Ref. to 6MT-60, INSTALLATION, Transmission Case.>
- 6) Install the center differential. <Ref. to 6MT-57, INSTALLATION, Center Differential.>
- 7) Install the transfer driven gear. <Ref. to 6MT-55, INSTALLATION, Transfer Driven Gear.>
- 8) Install the extension case. <Ref. to 6MT-43, INSTALLATION, Extension Case.>
- 9) Install the neutral position switch, back-up light switch and harness. <Ref. to 6MT-41, INSTALLATION, Neutral Position Switch.> <Ref. to 6MT-39, INSTALLATION, Back-up Light Switch.>
- 10) Install the manual transmission assembly to the vehicle. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

# Clutch Housing

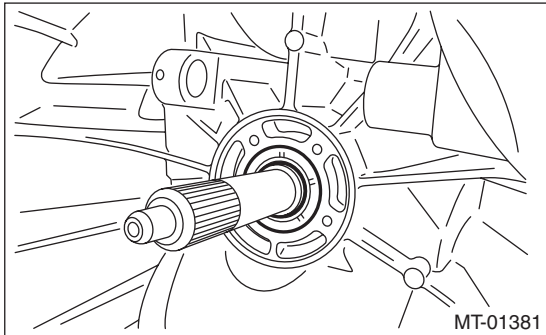
## MANUAL TRANSMISSION AND DIFFERENTIAL

### C: DISASSEMBLY

- 1) Remove the clutch release bearing guide.



- 2) Remove the oil seal.



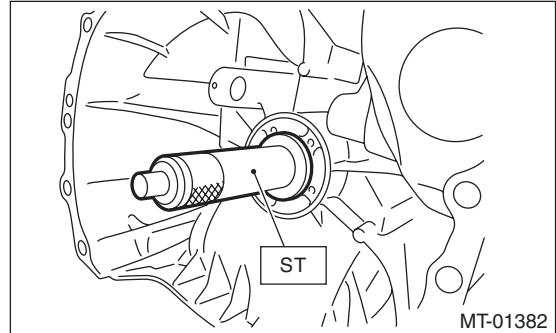
### D: ASSEMBLY

- 1) Attach the oil seal to the clutch housing, being careful not to damage the seal.

#### NOTE:

Use a new oil seal.

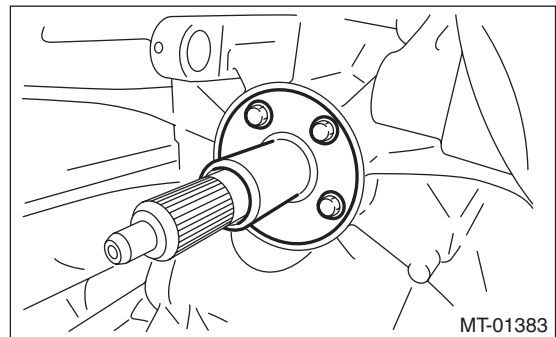
ST 18657AA020 OIL SEAL INSTALLER



- 2) Install the clutch release bearing guide.

#### Tightening torque:

**6.4 N·m (0.65 kgf·m, 4.7 ft·lb)**



### E: INSPECTION

- 1) Check to make sure there is no damage or cracks on the clutch housing. If there is excessive damage, replace the clutch housing.
- 2) Inspect the clutch housing for transmission gear oil leakage. If any oil leaks are found, repair or replace the applicable part.



# General Diagnostic Table

MANUAL TRANSMISSION AND DIFFERENTIAL

## 24. General Diagnostic Table

### A: INSPECTION

#### 1. MANUAL TRANSMISSION

Symptom	Possible cause	Corrective action
1. Gears are difficult to engage <b>NOTE:</b> The cause for difficulty in shifting gears can be classified into two types: One is a defective gear shift system and the other is defective transmission. However, if the operation is heavy and engagement of the gears is difficult, a defective clutch function may also be responsible. Check whether the clutch is correctly functioning, before checking the gear shift system and transmission.	(a) Worn, damaged or burred chamfer at internal spline of the sleeve	Replace.
	(b) Gear spline wear, damage, dents	Replace.
	(c) Worn or scratched bushings	Replace.
	(d) Incorrect contact or wear between synchronizer ring and gear cone	Correct or replace.
2. Gear slip-out <ul style="list-style-type: none"> <li>• Gear slips out when coasting on rough road.</li> <li>• Gear slips out during acceleration.</li> </ul>	(a) Defective pitching stopper	Adjust.
	(b) Loose engine mounting bolts	Tighten or replace.
	(c) Worn fork shifter, broken shifter fork rail spring	Replace.
	(d) Worn or damaged ball bearing	Replace.
	(e) Large clearance between splines of synchronizer hub and synchronizer sleeve	Replace.
	(f) Worn in the synchronizer hub chamfer angle	Replace.
	(g) Worn 1st driven gear, needle bearing and race	Replace.
	(h) Worn 2nd driven gear, needle bearing and race	Replace.
	(i) Worn 3rd drive gear and bushing	Replace.
	(j) Worn 4th drive gear and bushing	Replace.
	(k) Worn 5th drive gear and bushing	Replace.
	(l) Worn 6th drive gear and bushing	Replace.
	(m) Worn reverse idler gear and bushing	Replace.
3. Noise emitted from transmission <b>NOTE:</b> If a noise is heard when the vehicle is parked with its engine idling and ceases when the clutch is disengaged, it may be considered that the noise is coming from the transmission.	(a) Insufficient or improper lubrication	Replenish or replace with the specified amount of recommended oil.
	(b) Worn or damaged gears and bearings <b>NOTE:</b> If the trouble is only wear of the gear teeth surfaces, only a high whirring noise will occur at high speeds, but if any part is broken, rhythmical clicking sounds will be heard even at low speeds.	Replace.

# General Diagnostic Table

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. DIFFERENTIAL

Symptom	Possible cause	Corrective action
1. Broken differential (case, gear, bearing, etc.) <b>NOTE:</b> Noise will occur, and eventually the differential will not be able to operate due to broken pieces obstructing the gear revolution.	(a) Insufficient or improper oil	Disassemble the differential and replace broken components. At the same time check other components for any trouble, and replace if necessary.
	(b) Use of vehicle under severe conditions such as excessive load and improper use of the clutch	Readjust the preload and backlash of the bearing, and the contact surface of gear.
	(c) Improper adjustment of taper roller bearing	Adjust.
	(d) Improper adjustment of the drive pinion and the hypoid driven gear	Adjust.
	(e) Loose hypoid driven gear clump bolts	Tighten.
2. Differential and hypoid gear noises Troubles of the differential and hypoid gear always appear as noise problems. Therefore noise is the first indication of trouble. However, noises from the engine, muffler, tire, exhaust gas, bearing, body, etc. are easily mistaken for the differential noise. Pay special attention to the hypoid gear noise because it is easily confused with other gear noises. There are the following four kinds of noises. <ul style="list-style-type: none"> <li>• Gear noise when driving: If noise increases as the vehicle speed increases, it may be due to insufficient gear oil, incorrect gear engagement, damaged gears, etc.</li> <li>• Gear noise when coasting: Damaged gears due to misadjusted bearings and incorrect shim adjustment.</li> <li>• Bearing noise when driving or coasting: Cracked, broken or damaged bearings.</li> </ul>	(a) Insufficient oil	Replenish or replace with the specified amount of recommended oil.
	(b) Improper adjustment of hypoid driven gear and drive pinion	Check the tooth contact.
	(c) Worn teeth of hypoid driven gear and drive pinion	Replace as a set. Readjust the bearing preload.
	(d) Loose roller bearing	Readjust the backlash of the hypoid driven gear to drive pinion, and check the tooth contact.
	(e) Distorted hypoid driven gear or differential case	Replace.

# General Description

## CLUTCH SYSTEM

### 1. General Description

#### A: SPECIFICATION

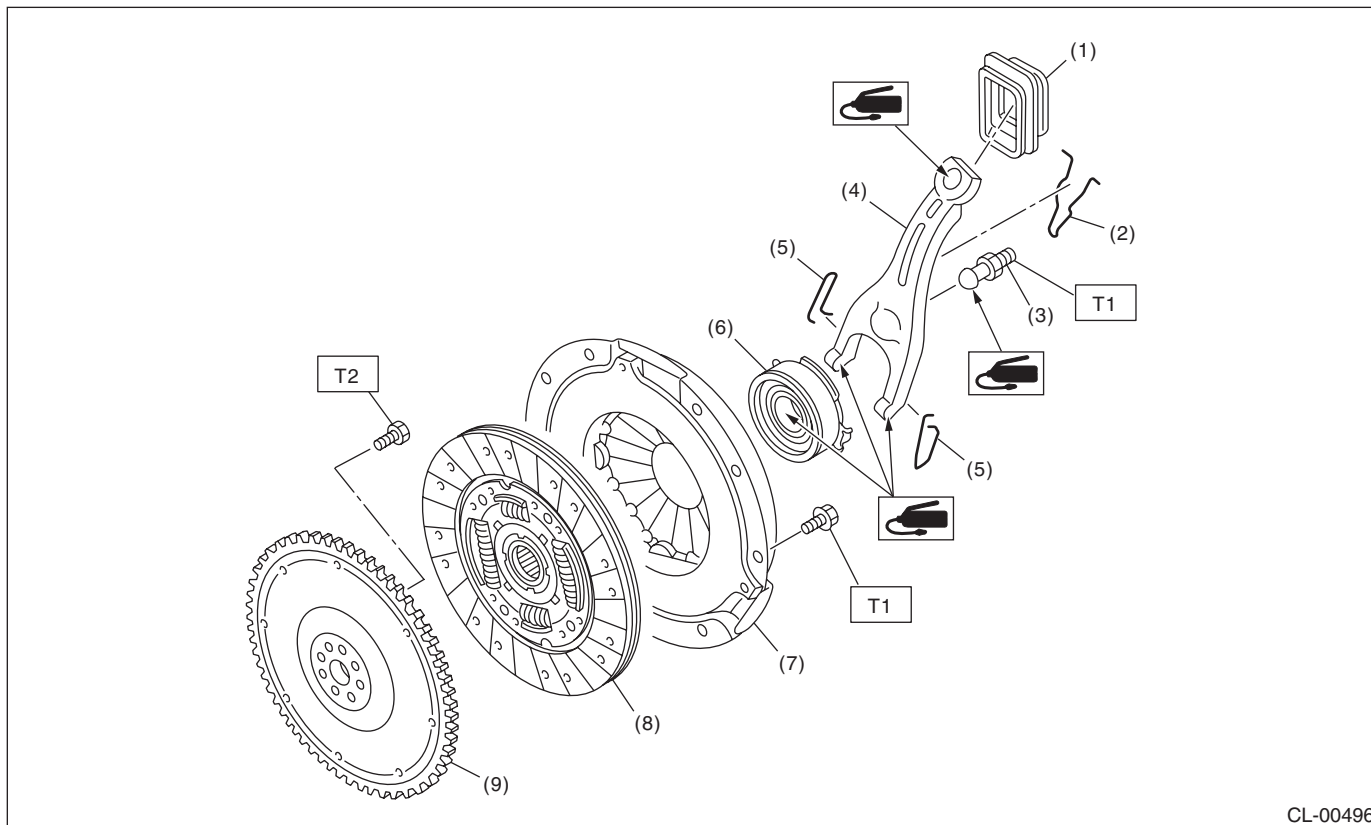
Model		2.5 L non-turbo	2.5 L turbo	
Transmission type		5MT		
Clutch cover	Type	Push type		
	Diaphragm set load N (kgf, lbf)	5,688 (580, 1,279)	7,850 (800, 1,764)	
Clutch disc	Facing material		Woven	
	O.D. × I.D. × thickness mm (in)	225 × 150 × 3.5 (8.86 × 5.91 × 0.138)	230 × 155 × 3.2 (9.06 × 6.10 × 0.126)	
	Spline outer diameter mm (in)		25.2 (0.992)	
	Depth of rivet head mm (in)	Standard value	1.3 — 1.9 (0.051 — 0.075)	
		Limit of sinking	0.3 (0.012)	
Deflection limit mm (in)		0.7 (0.027) at R = 110 (4.33)	1.0 (0.039) at R = 110 (4.33)	
Clutch release lever ratio		1.6		
Release bearing		Grease-packed self-aligning		
Clutch pedal	Full stroke mm (in)	130 — 135 (5.12 — 5.31)	135 — 140 (5.31 — 5.51)	
	Free play mm (in)	4 — 13 (0.16 — 0.51)		
Flywheel	Type	Flexible		

Model		2.5 L turbo		
Transmission type		6MT		
Clutch cover	Type	Pull type		
	Diaphragm set load N (kgf, lbf)	7,160 (730, 1,610)		
Clutch disc	Facing material		Woven	
	O.D. × I.D. × thickness mm (in)	Flywheel side	240 × 160 × 3.2 (9.45 × 6.30 × 0.126)	
		Clutch cover side	240 × 160 × 3.5 (9.45 × 6.30 × 0.138)	
	Spline outer diameter mm (in)		25.2 (0.992)	
	Depth of rivet head mm (in)	Flywheel side	1.35 — 1.95 (0.053 — 0.077)	
		Clutch cover side	1.65 — 2.25 (0.065 — 0.089)	
Limit of sinking		0.3 (0.012)		
Deflection limit mm (in)		1.0 (0.039) at R = 110 (4.33)		
Clutch release lever ratio		1.7		
Release bearing		Grease-packed self-aligning		
Clutch pedal	Full stroke mm (in)	130 — 135 (5.12 — 5.31)		
	Free play mm (in)	4 — 13 (0.16 — 0.51)		
Flywheel	Type	Conventional		

## B: COMPONENT

### 1. CLUTCH ASSEMBLY

- 5MT non-turbo model



CL-00496

- |                   |                       |
|-------------------|-----------------------|
| (1) Dust cover    | (6) Release bearing   |
| (2) Lever spring  | (7) Clutch cover      |
| (3) Pivot         | (8) Clutch disc       |
| (4) Release lever | (9) Flexible flywheel |
| (5) Clip          |                       |

**Tightening torque: N·m (kgf·m, ft·lb)**

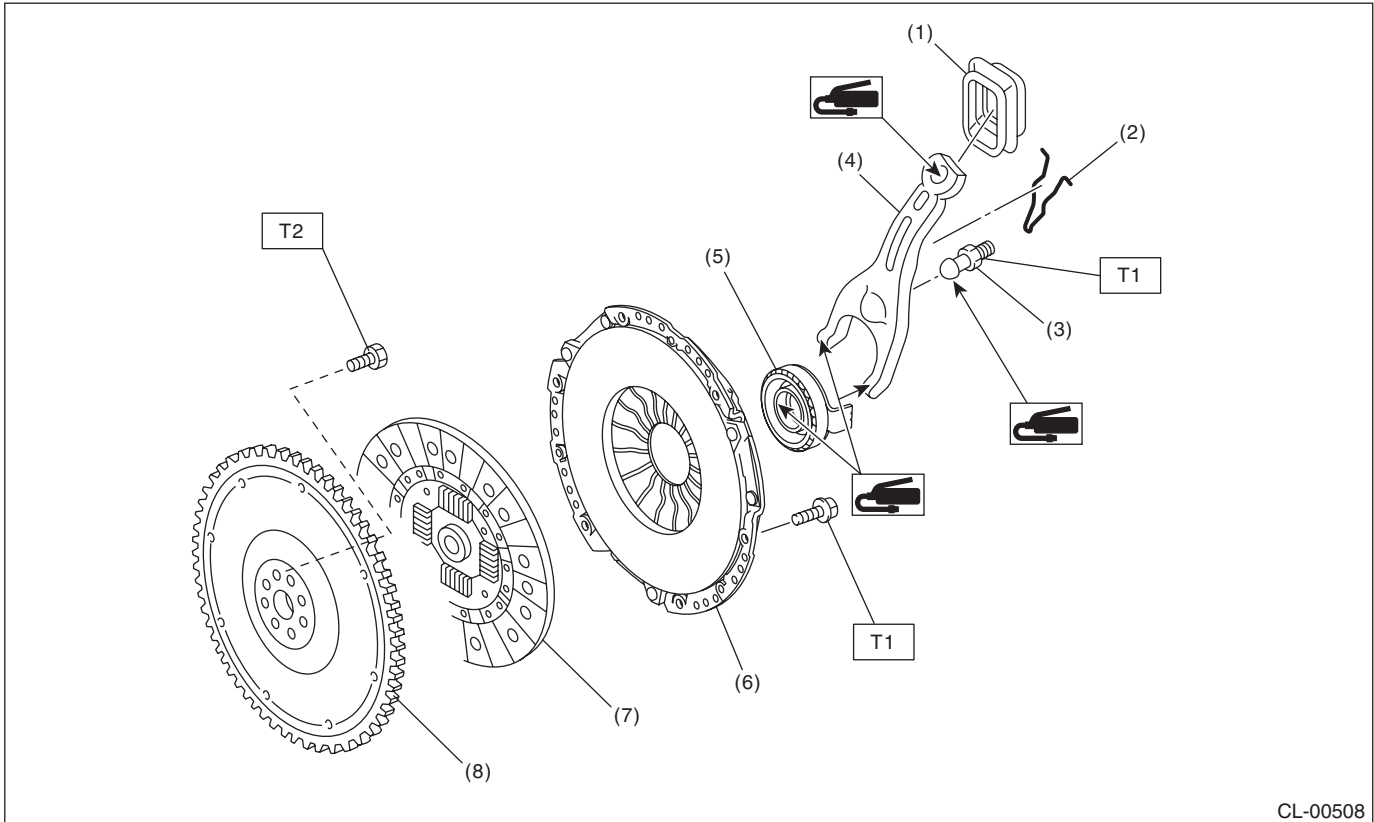
**T1: 16 (1.6, 11.8)**

**T2: 72 (7.3, 52.8)**

# General Description

## CLUTCH SYSTEM

- 5MT turbo model



CL-00508

- |                   |                       |
|-------------------|-----------------------|
| (1) Dust cover    | (5) Release bearing   |
| (2) Lever spring  | (6) Clutch cover      |
| (3) Pivot         | (7) Clutch disc       |
| (4) Release lever | (8) Flexible flywheel |

**Tightening torque: N·m (kgf·m, ft·lb)**

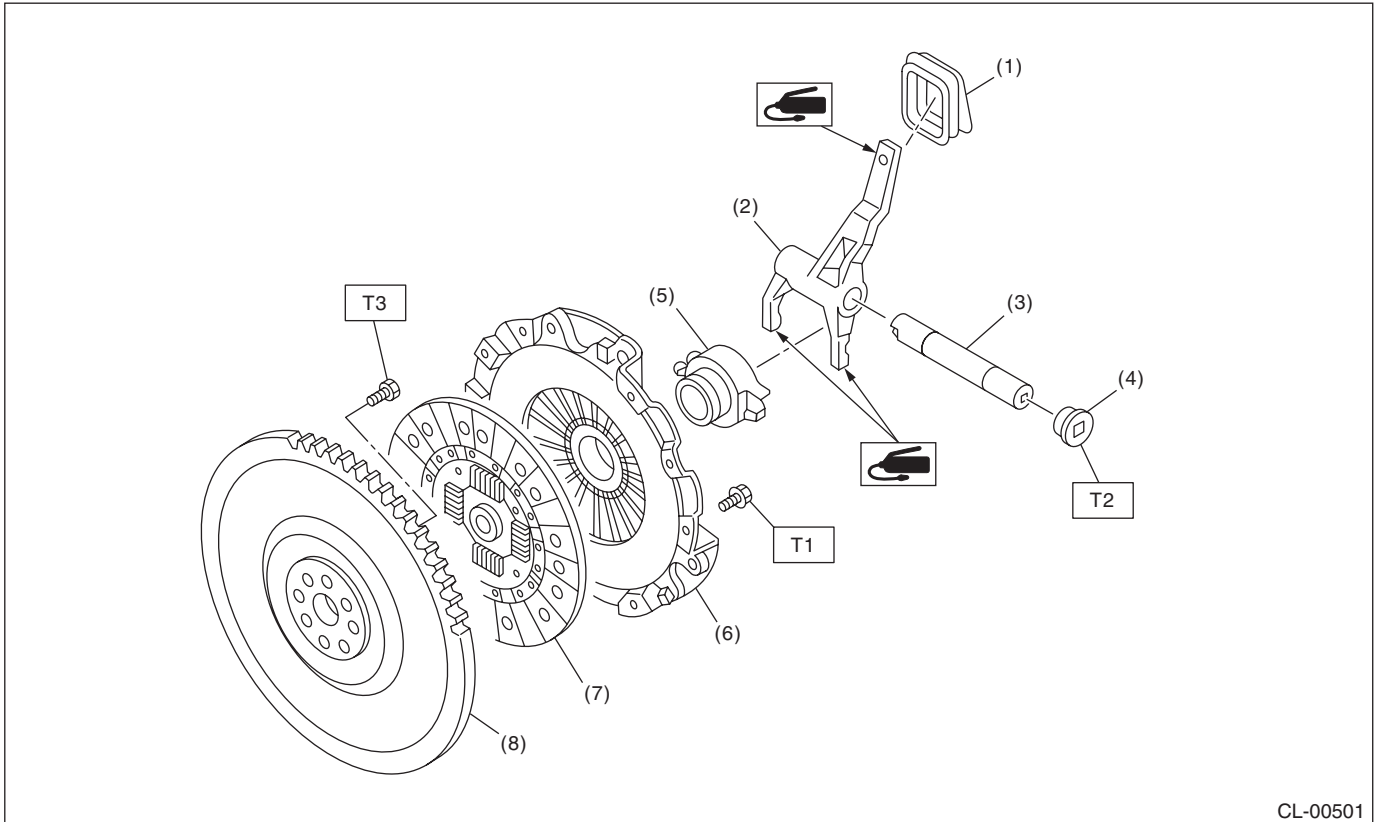
**T1: 16 (1.6, 11.8)**

**T2: 72 (7.3, 52.8)**

# General Description

## CLUTCH SYSTEM

- 6MT model



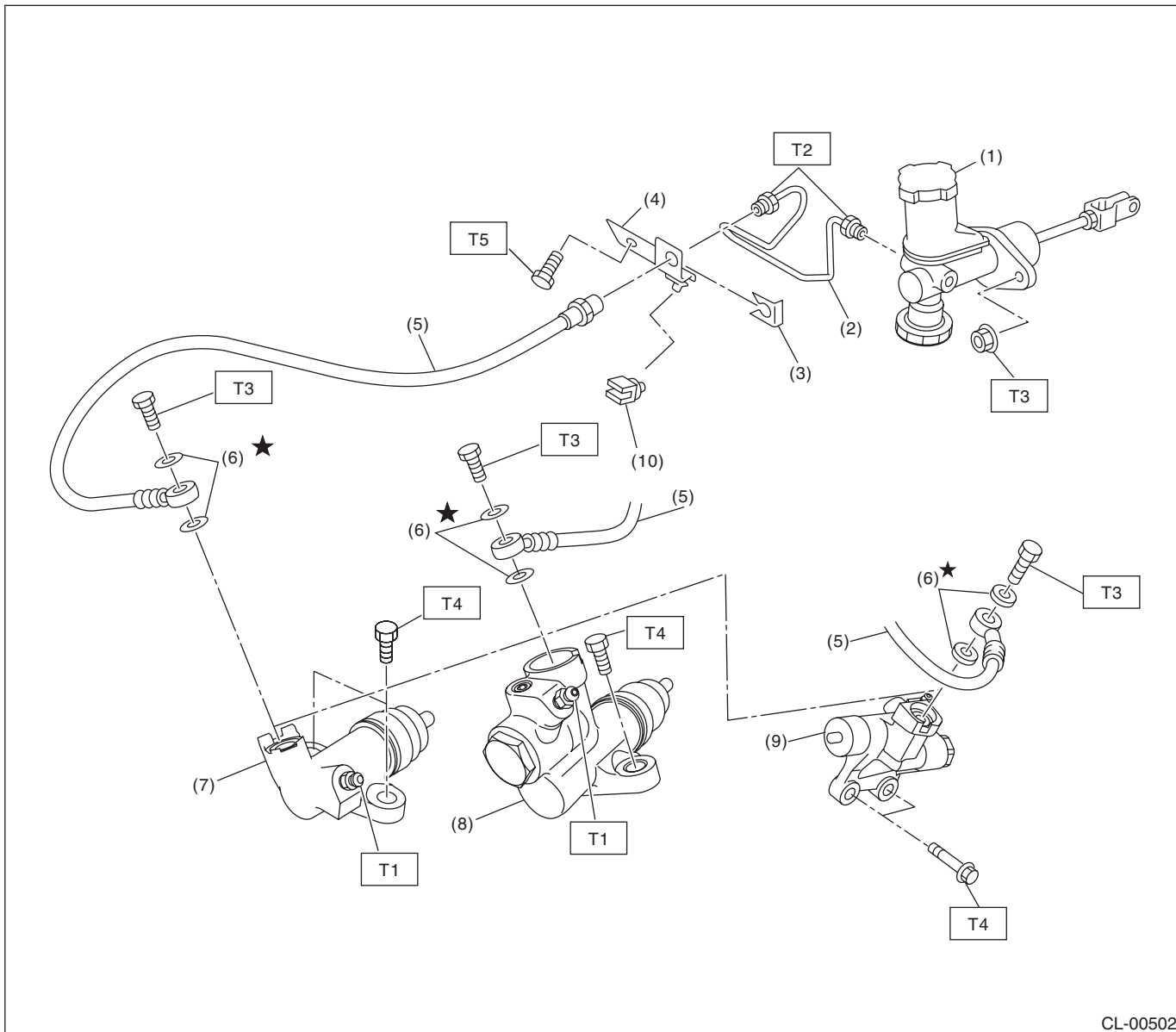
- |                   |                           |
|-------------------|---------------------------|
| (1) Dust cover    | (5) Release bearing       |
| (2) Release lever | (6) Clutch cover          |
| (3) Release shaft | (7) Clutch disc           |
| (4) Plug          | (8) Conventional flywheel |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T1: 16 (1.6, 11.8)**  
**T2: 44 (4.5, 32.5)**  
**T3: 81 (8.2, 59.4)**

# General Description

## CLUTCH SYSTEM

### 2. CLUTCH PIPE AND HOSE



CL-00502

- |   |   |
|---|---|
| (1) Master cylinder ASSY                        | (8) Operating cylinder<br>(5MT turbo model) |
| (2) Clutch pipe                                 | (9) Operating cylinder<br>(6MT turbo model) |
| (3) Clamp                                       | (10) Clip                                   |
| (4) Bracket                                     |   |
| (5) Clutch hose                                 |   |
| (6) Washer                                      |   |
| (7) Operating cylinder<br>(5MT non-turbo model) |   |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

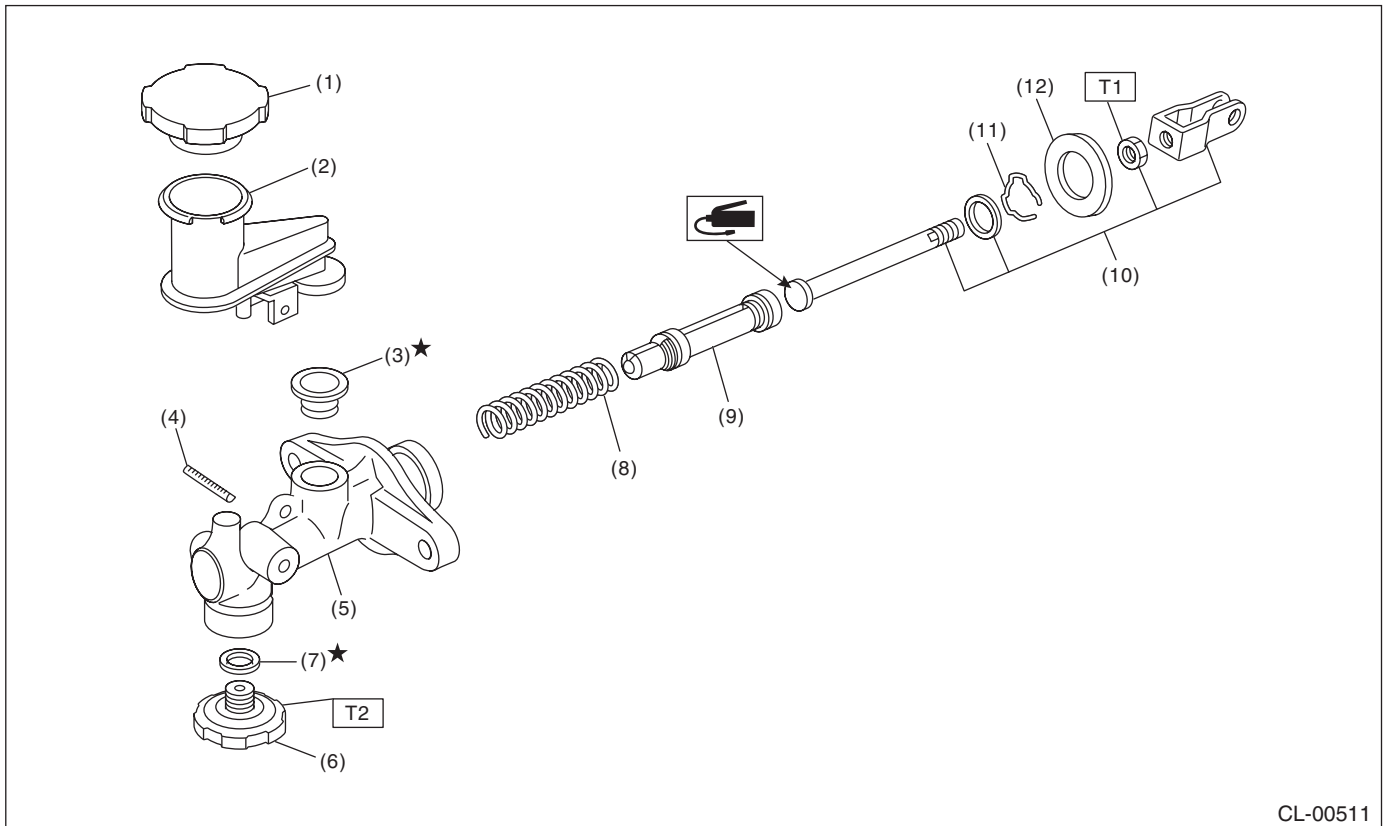
**T2: 15 (1.5, 10.8)**

**T3: 18 (1.8, 13.0)**

**T4: 37 (3.8, 27.5)**

**T5: 25 (2.5, 18.4)**

## 3. MASTER CYLINDER



CL-00511

- |                     |                       |
|---------------------|-----------------------|
| (1) Reservoir cap   | (7) Gasket            |
| (2) Reservoir tank  | (8) Return spring     |
| (3) Oil seal        | (9) Piston            |
| (4) Straight pin    | (10) Push rod ASSY    |
| (5) Master cylinder | (11) Piston stop ring |
| (6) Clutch damper   | (12) Seat             |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 10 (1.0, 7)**

**T2: 46.6 (4.75, 34.4)**

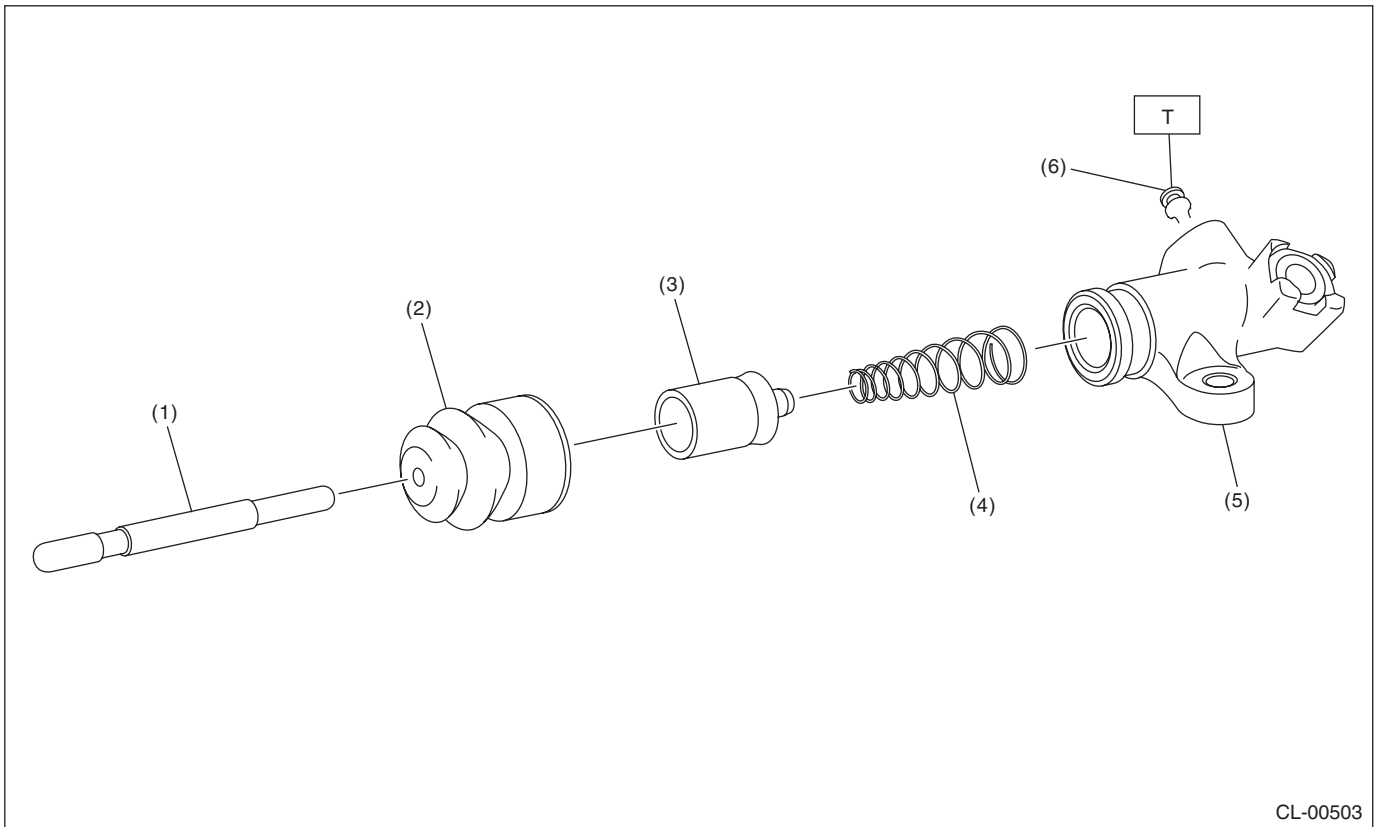


# General Description

## CLUTCH SYSTEM

### 4. OPERATING CYLINDER

- 5MT non-turbo model

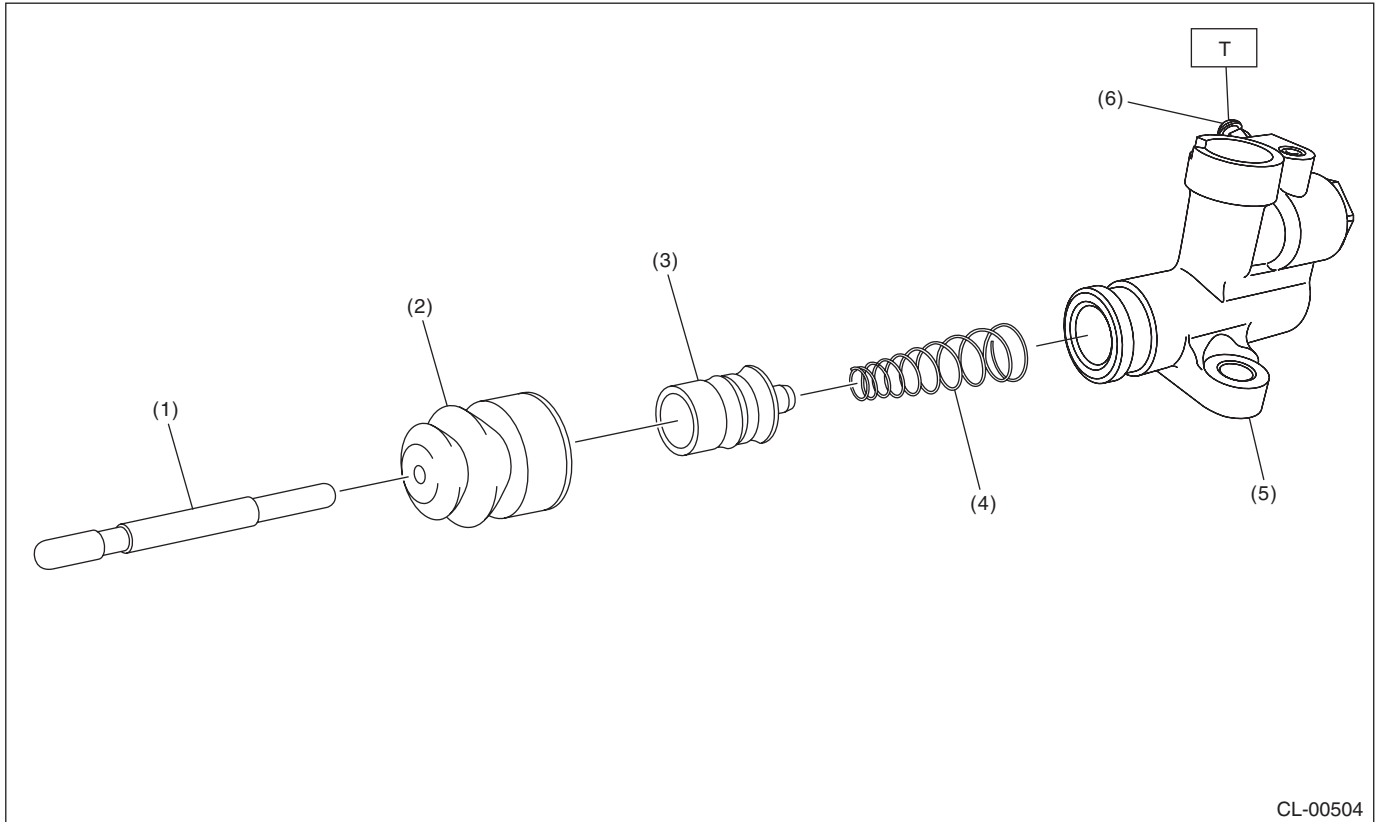


CL-00503

- |              |                        |
|--------------|------------------------|
| (1) Push rod | (4) Piston spring      |
| (2) Boot     | (5) Operating cylinder |
| (3) Piston   | (6) Bleeder screw      |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 8 (0.8, 5.8)**

- 5MT turbo model



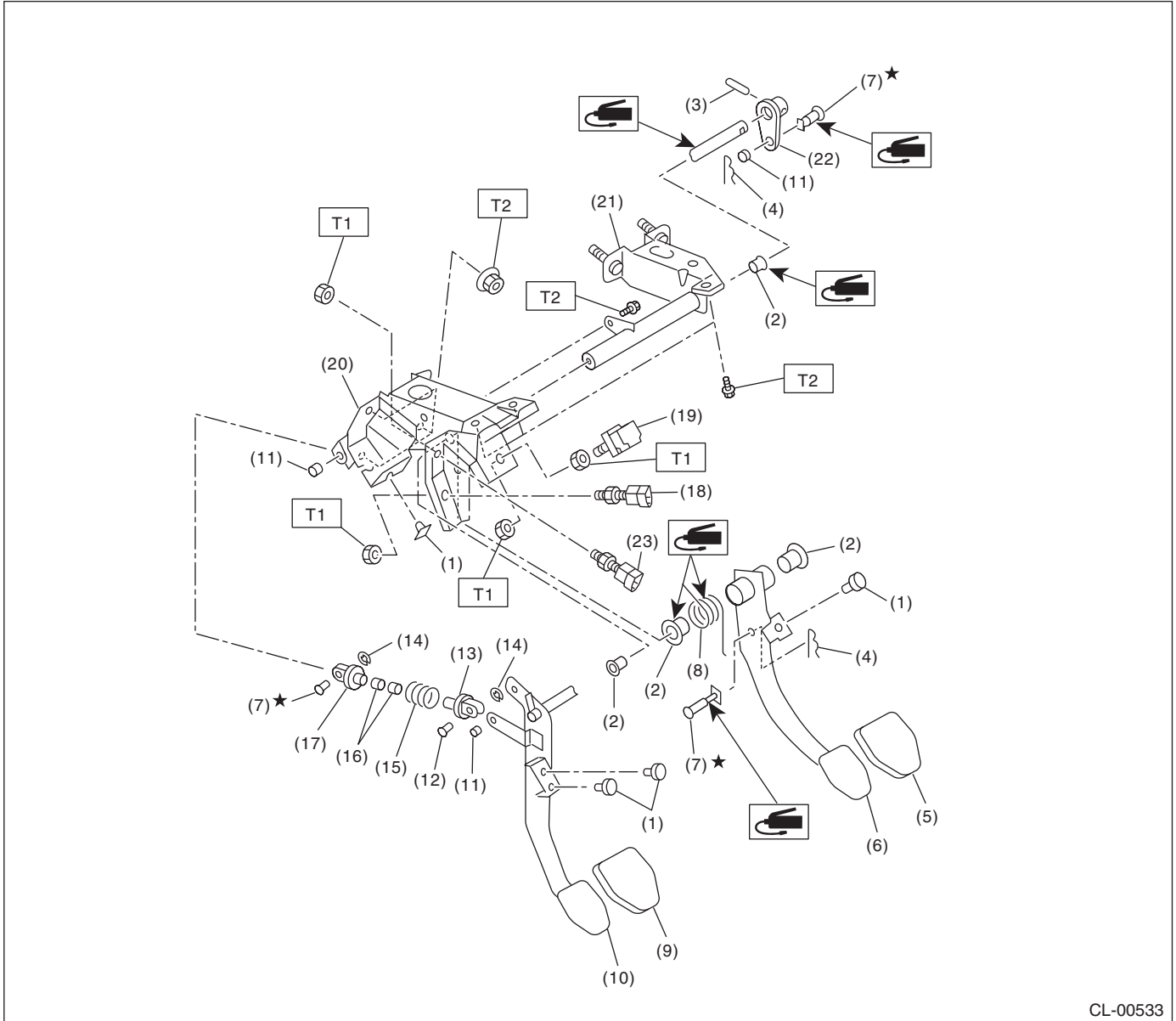
- |              |                        |
|--------------|------------------------|
| (1) Push rod | (4) Piston spring      |
| (2) Boot     | (5) Operating cylinder |
| (3) Piston   | (6) Bleeder screw      |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 8 (0.8, 5.8)**

# General Description

## CLUTCH SYSTEM

### 5. CLUTCH PEDAL



CL-00533

- |                        |                                     |                                     |
|------------------------|-------------------------------------|-------------------------------------|
| (1) Stopper            | (10) Clutch pedal                   | (19) Stop light switch              |
| (2) Bushing            | (11) Bushing C                      | (20) Pedal bracket                  |
| (3) Spring pin         | (12) Clutch clevis pin              | (21) Clutch master cylinder bracket |
| (4) Snap pin           | (13) Assist rod A                   | (22) Lever                          |
| (5) Brake pedal pad    | (14) Clip                           | (23) Clutch switch (Clutch start)   |
| (6) Brake pedal        | (15) Assist spring                  |                                     |
| (7) Clevis pin         | (16) Assist bushing                 |                                     |
| (8) Brake pedal spring | (17) Assist rod B                   |                                     |
| (9) Clutch pedal pad   | (18) Clutch switch (Cruise control) |                                     |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 18 (1.8, 13.0)**

### **C: CAUTION**

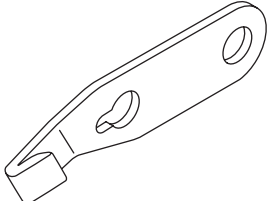
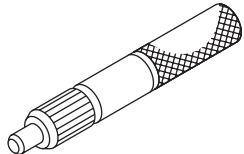
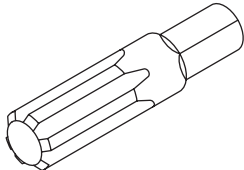
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine fluid, grease etc. or equivalent. Do not mix fluid, grease, etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply grease onto sliding or revolving surfaces before installation.
- Before installing O-rings or snap rings, apply sufficient amount of fluid to avoid damage and deformation.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Keep fluids away from the vehicle body. If any fluid contacts the vehicle body, immediately flush the area with water.

# General Description

CLUTCH SYSTEM

## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of the flywheel.
 <p style="text-align: center;">ST-499747100</p>	499747100	CLUTCH DISC GUIDE	Used when installing the clutch disc to the flywheel.
 <p style="text-align: center;">ST-499057000</p>	499057000	TORX® PLUS	Used for removing and installing the flywheel. (5MT turbo model)

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and ampere.
Dial gauge	Used for measuring clutch disc run-out.
Depth gauge	Used for measuring clutch disc wear.

## 2. Clutch Disc and Cover

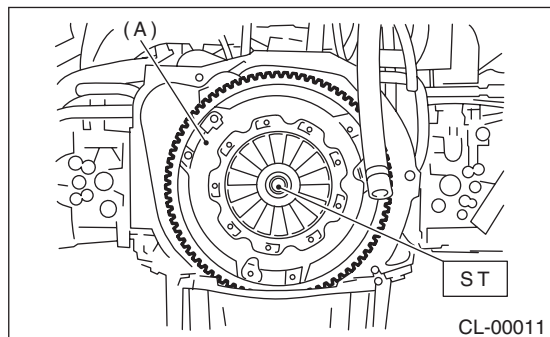
### A: REMOVAL

**NOTE:**

The illustration below is for a 5MT non-turbo model. However, perform the same procedures for models other than 5MT non-turbo model as well.

- 1) Remove the transmission assembly from vehicle body. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.> <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>
- 2) Insert the ST on the flywheel.

ST 499747100 CLUTCH DISC GUIDE



(A) Clutch cover

- 3) Remove the clutch cover and clutch disc.

**NOTE:**

- Take care not to allow oil to touch the clutch disc face.
- Do not disassemble the clutch cover or clutch disc.

### B: INSTALLATION

**NOTE:**

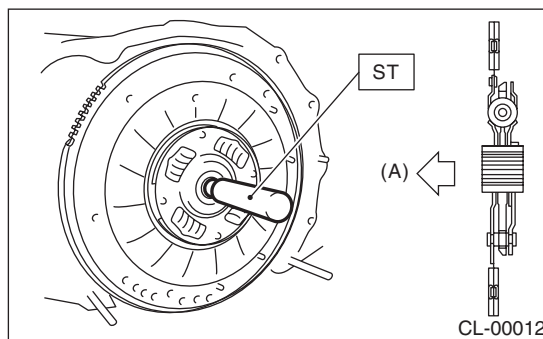
The illustration below is for a 5MT non-turbo model. However, perform the same procedures for models other than 5MT non-turbo model as well.

- 1) Insert the ST into the clutch disc and attach to the flywheel by inserting the ST end into pilot bearing.

**NOTE:**

When installing the clutch disc, be careful to attach in the correct direction.

ST 499747100 CLUTCH DISC GUIDE



(A) Flywheel side

# Clutch Disc and Cover

## CLUTCH SYSTEM

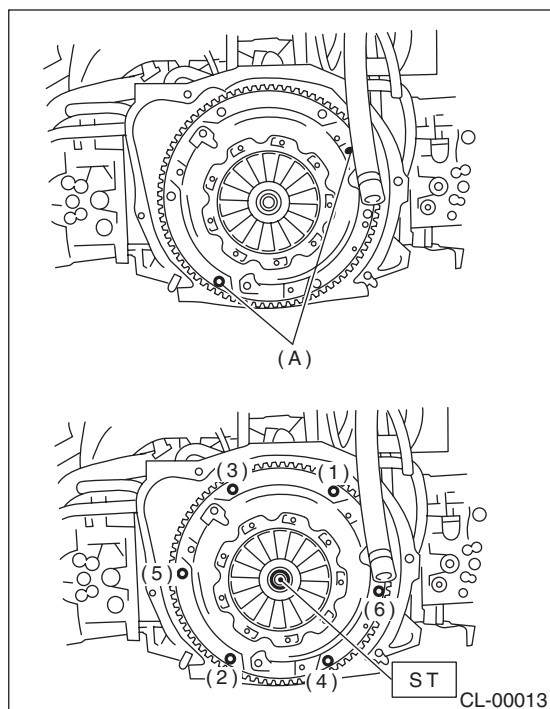
2) Install the clutch cover to the flywheel and tighten the bolts to the specified torque.

### NOTE:

- When installing the clutch cover to the flywheel, position the clutch cover so that the distance between unbalance marks (● paint marks) is at least 120°. (The unbalance marks ● indicate the directions of residual unbalance.)
- Note the front and rear of the clutch disc when installing.
- Tighten the clutch cover installing bolts gradually. Each bolt should be tightened to the specified torque in a crisscross order.

### Tightening torque:

**16 N·m (1.6 kgf-m, 11.8 ft-lb)**



(A) Unbalance mark (paint)

3) Remove the ST.

ST 499747100 CLUTCH DISC GUIDE

4) Install the transmission assembly. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.> <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

## C: INSPECTION

### NOTE:

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.

### 1. CLUTCH DISC

1) Facing wear:

Measure the depth from the facing surface to the rivet head. Replace if the face is worn locally or worn down to less than the specified value.

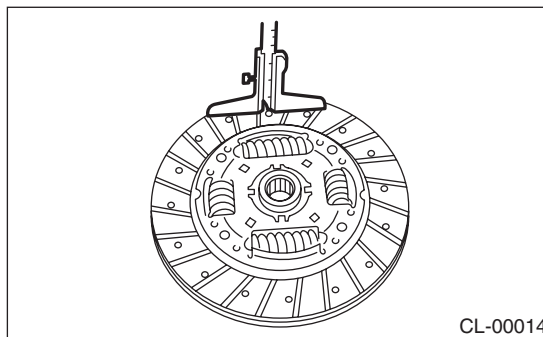
#### Depth to rivet head:

**Limit of sinking**

**0.3 mm (0.012 in)**

### NOTE:

Do not wash the clutch disc with any type of cleaning fluid.

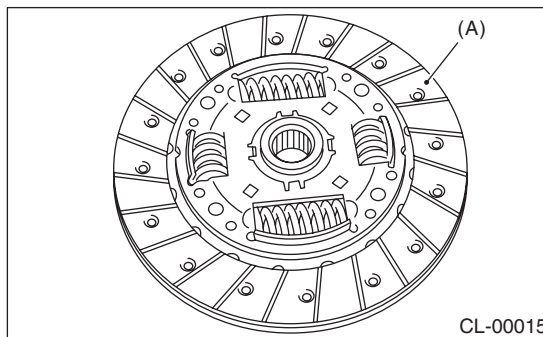


2) Hardened facing

Replace the clutch disc.

3) Oil soakage on facing

Replace the clutch disc and inspect the transmission front oil seal, transmission case mating surface, engine rear oil seal and other locations for oil leakage.



(A) Clutch facing

## 4) Deflection on facing:

If deflection exceeds the specified value at the outer circumference of the facing, replace the clutch disc.

ST 499747100 CLUTCH DISC GUIDE

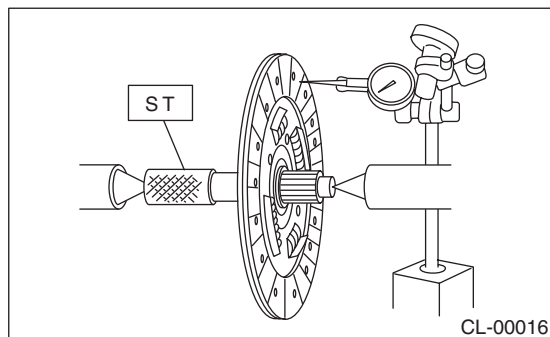
### Limit for deflection:

#### Turbo model

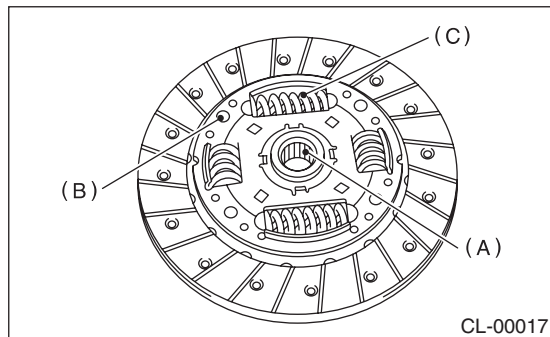
1.0 mm (0.039 in) at R = 110 mm (4.33 in)

#### Non-turbo model

0.7 mm (0.027 in) at R = 110 mm (4.33 in)



5) If there is spline wear, loose rivets, failed damper springs, etc., replace the clutch disc.



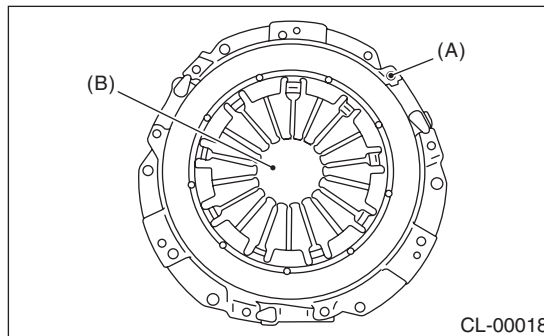
- (A) Spline
- (B) Rivet
- (C) Damper spring

## 2. CLUTCH COVER

### NOTE:

Visually check the following items without disassembling, and replace or repair if defective.

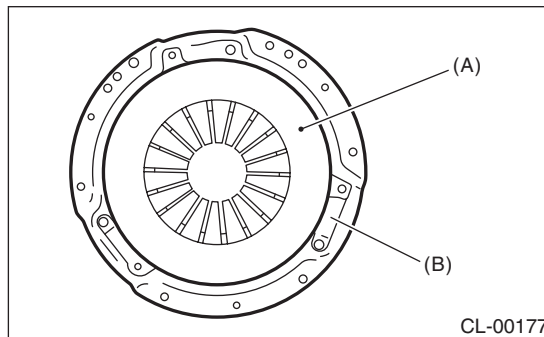
- 1) Loose thrust rivet
- 2) Damaged or worn bearing contact area at the center of diaphragm spring



- (A) Thrust rivet
- (B) Diaphragm spring

3) Damaged or worn disc contact surface of the pressure plate

- 4) Loose strap plate installation area
- 5) Worn diaphragm sliding area



- (A) Pressure plate
- (B) Strap plate



# Flywheel

## CLUTCH SYSTEM

### 3. Flywheel

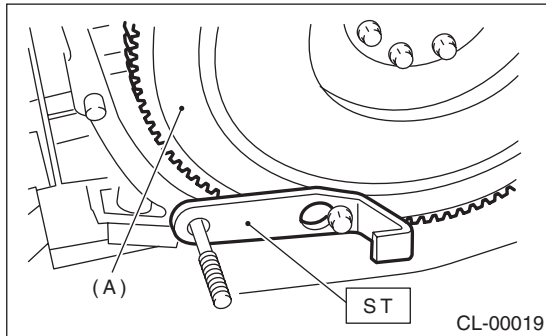
#### A: REMOVAL

1) Remove the transmission assembly. <Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.> <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>

2) Remove the clutch cover and clutch disc. <Ref. to CL-13, REMOVAL, Clutch Disc and Cover.>

3) Using the ST, remove the flywheel.

ST 498497100 CRANKSHAFT STOPPER  
ST 499057000 TORX® PLUS  
(Used for 5MT turbo model)

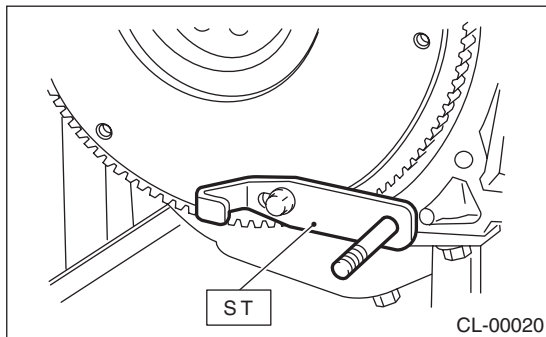


(A) Flywheel

#### B: INSTALLATION

1) Install the flywheel and ST.

ST 498497100 CRANKSHAFT STOPPER

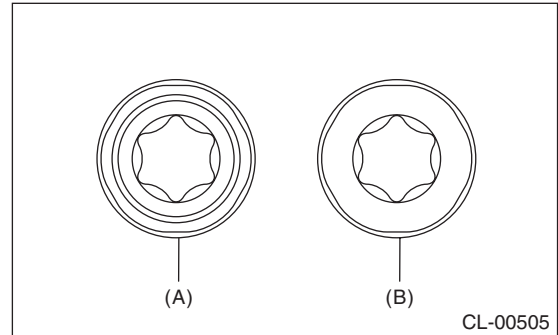


2) Tighten the flywheel mounting bolts to the specified torque.

ST 499057000 TORX® PLUS  
(Used for 5MT turbo model)

#### CAUTION:

The bolts without identification groove as shown in the figure must be used as flywheel attaching bolts for 5MT turbo model.



(A) Bolt with identification groove

(B) Bolt without identification groove

#### NOTE:

Tighten the flywheel attachment bolts gradually. Each bolt should be tightened to the specified torque in crisscross order.

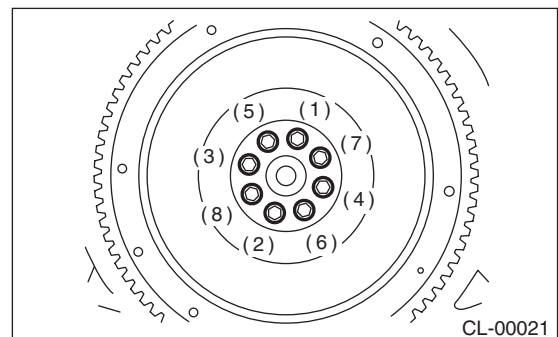
#### Tightening torque:

##### 5MT model

72 N·m (7.3 kgf·m, 52.8 ft·lb)

##### 6MT model

81 N·m (8.2 kgf·m, 59.4 ft·lb)



3) Install the clutch disc and cover. <Ref. to CL-13, INSTALLATION, Clutch Disc and Cover.>

4) Install the transmission assembly. <Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.> <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

**C: INSPECTION****NOTE:**

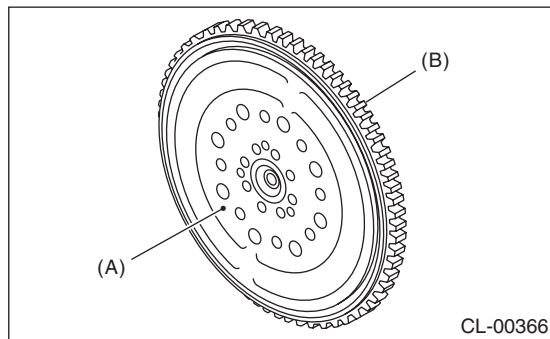
The illustration below is for a Turbo model. However, perform the same procedures for the Non-turbo model.

**CAUTION:**

**Since this bearing is grease-sealed and is a non-lubrication type, do not wash with gasoline or any solvents.**

1) Damage on sliding surface of facing and the ring gear

If defective, replace the flywheel.



(A) Flywheel

(B) Ring gear

2) Smoothness of rotation

Rotate the ball bearing while applying pressure in the thrust direction.

3) If noise or excessive play is noted, replace the flywheel.

# Release Bearing and Lever

## CLUTCH SYSTEM

### 4. Release Bearing and Lever

#### A: REMOVAL

##### 1. 5MT MODEL

1) Remove the transmission assembly from vehicle body.

<Ref. to 5MT-26, REMOVAL, Manual Transmission Assembly.>

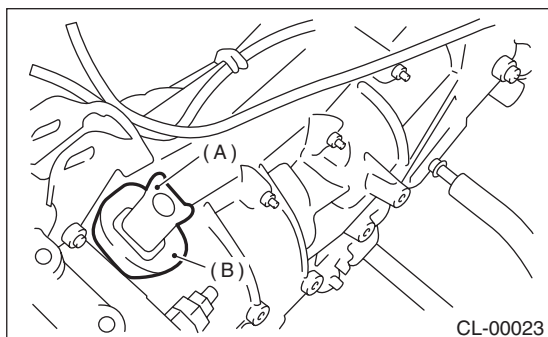
2) Remove the two clips from the release lever and remove the release bearing. (Non-turbo model)

#### CAUTION:

**Be careful not to deform the clips.**

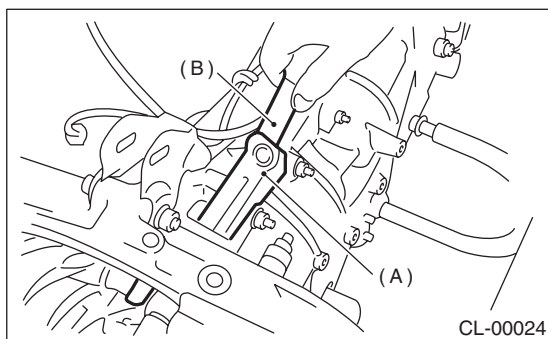
3) Remove the release bearing from the clutch release lever. (Turbo model)

4) Remove the dust cover.



- (A) Release lever
- (B) Dust cover

5) Remove the lever spring from the pivot with a screwdriver by accessing it through the clutch housing release lever hole. Then remove the release lever.



- (A) Release lever
- (B) Screwdriver

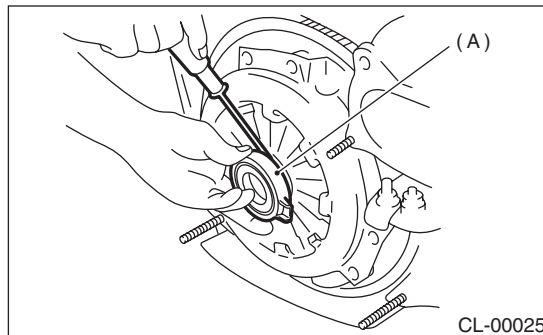
##### 2. 6MT MODEL

1) Remove the transmission assembly from vehicle body. <Ref. to 6MT-32, REMOVAL, Manual Transmission Assembly.>

2) Remove the release lever from the transmission.

3) Install the release bearing to the engine side.

4) Using a flat tip screwdriver, remove the release bearing from the clutch cover.



- (A) Release bearing

#### B: INSTALLATION

##### 1. 5MT MODEL

#### NOTE:

Apply the specified grease to lubricate the following points before installation.

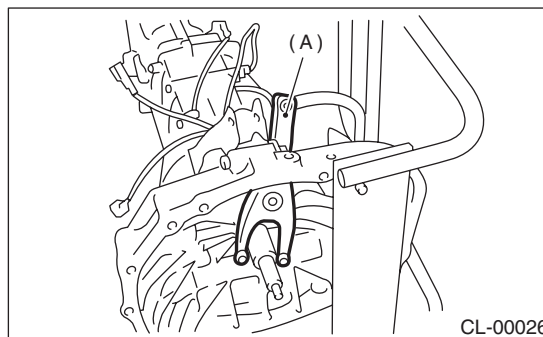
- Contact surface of lever and pivot
- Contact surface of lever and bearing
- Transmission main shaft spline (Use grease containing molybdenum disulphide.)

1) While pushing the release lever to the pivot and twisting it to both sides, fit the lever spring onto the raised portion of the pivot.

#### NOTE:

• Apply grease (KOPR-KOTE: Part No. 003603001) to the contact point of the release lever and operating cylinder.

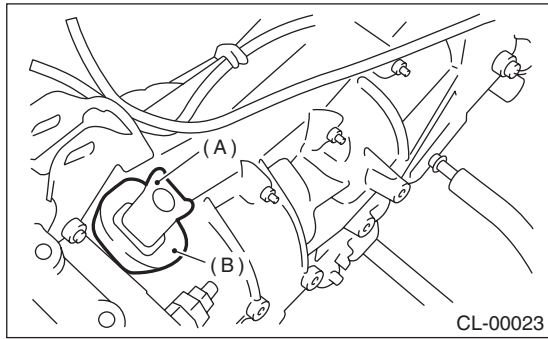
• Observing from the main case hole, check that the lever spring is installed securely.



- (A) Release lever

2) Install the release bearing and fasten it with two clips. (Non-turbo model)

- 3) Install the release bearing. (Turbo model)
- 4) Install the dust cover.

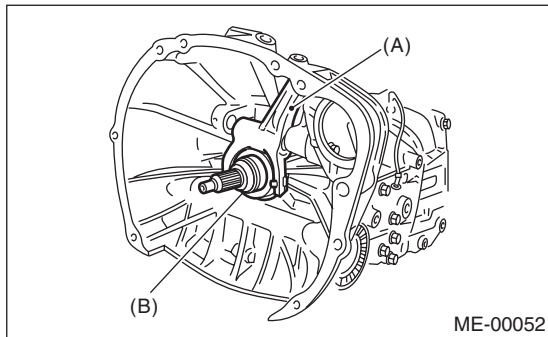


- (A) Release lever
- (B) Dust cover

- 5) Check the bearing for smooth movement by operating the release lever.
- 6) Install the transmission assembly.  
<Ref. to 5MT-28, INSTALLATION, Manual Transmission Assembly.>

## 2. 6MT MODEL

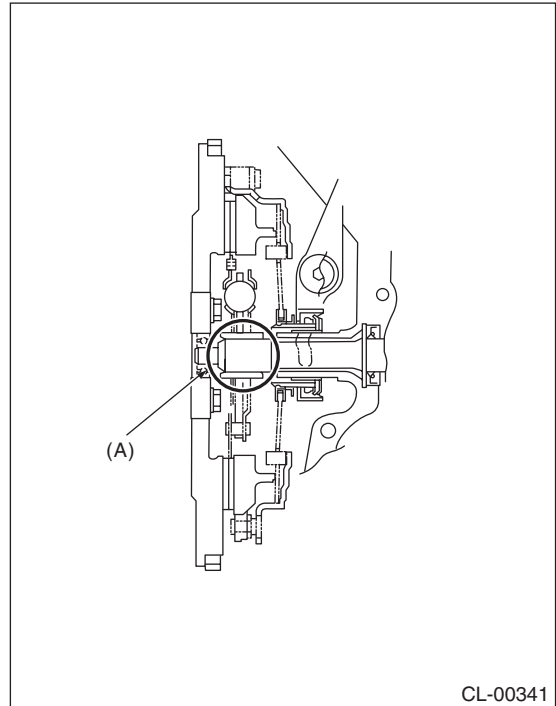
- 1) Attach the release bearing to the transmission.
- 2) Insert the release lever into the release bearing tab.



- (A) Release lever
- (B) Release bearing

- 3) Apply grease to splines.

**Grease:**  
**NICHIMOLY N-130**

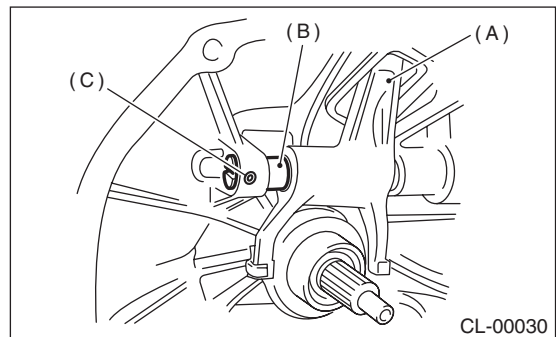


- (A) Spline

- 4) Insert the release shaft into the release lever.

**NOTE:**

Make sure the cut portion of the release shaft comes into contact with the spring pin.



- (A) Release lever
- (B) Release shaft
- (C) Spring pin

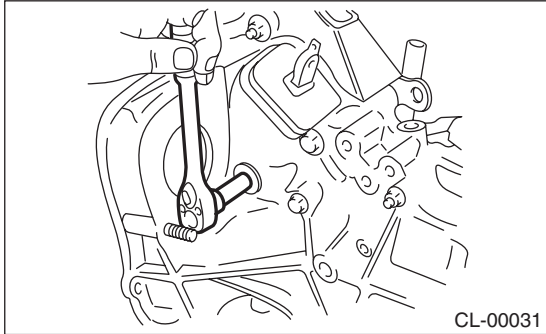
# Release Bearing and Lever

## CLUTCH SYSTEM

5) Tighten the plugs.

### **Tightening torque:**

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**



6) Check the release bearing and release lever for smooth movement by operating the release lever.

7) Install the transmission assembly. <Ref. to 6MT-34, INSTALLATION, Manual Transmission Assembly.>

## C: INSPECTION

### 1. RELEASE BEARING

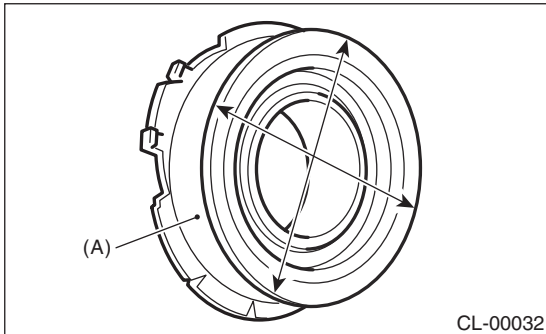
#### NOTE:

Since this bearing is grease-sealed and is a non-lubrication type, do not wash with gasoline or any other solvent when servicing the clutch.

1) Check the bearing for smooth movement by applying force to the bearing in the radial direction.

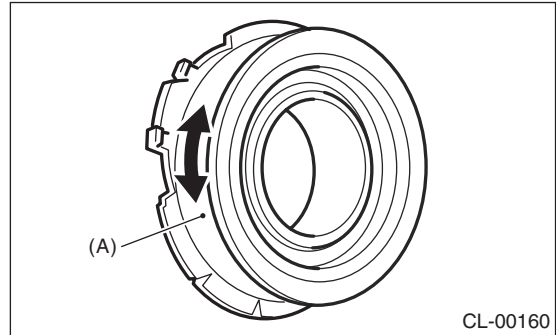
#### **Radial direction stroke:**

**1.6 mm (0.063 in)**



(A) Bearing case

2) While applying force to the bearing in the rotational direction, check the bearing for smooth rotation.

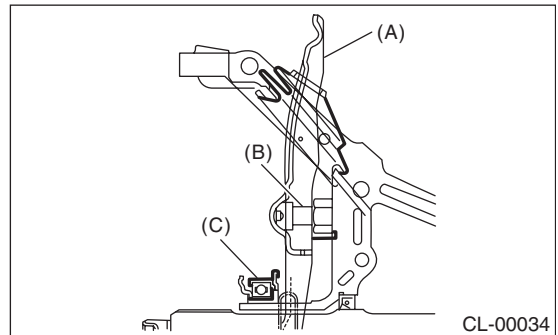


(A) Bearing case

3) Check for wear and damage at the bearing case surface in contact with the lever.

### 2. RELEASE LEVER

Check the pivot portion of the lever and the contact area with the release bearing case for wear.



(A) Clutch release lever

(B) Pivot

(C) Clutch release bearing

## 5. Operating Cylinder

### A: REMOVAL

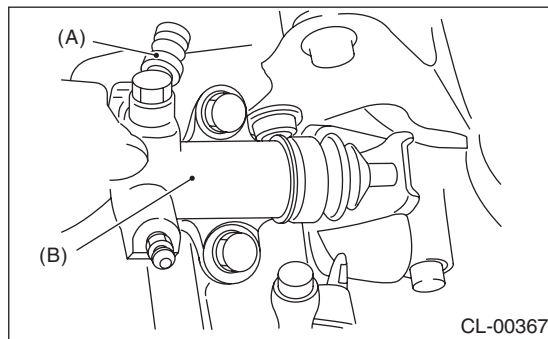
- 1) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 2) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Disconnect the clutch hose from the operating cylinder.

#### CAUTION:

- Cover the hose joint to prevent the clutch fluid from flowing out.
- Do not loosen or remove the cap bolts. (5MT turbo model)
- 5MT model

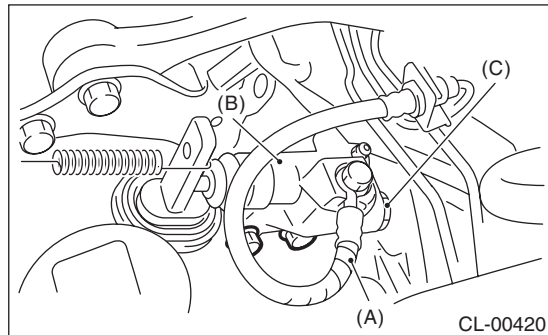
#### NOTE:

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



- (A) Clutch hose
- (B) Operating cylinder

- 6MT model



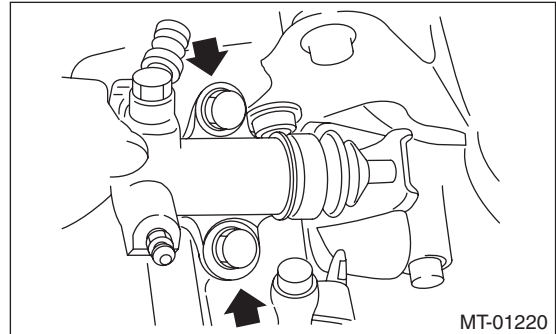
- (A) Clutch hose
- (B) Operating cylinder
- (C) Cap bolt

- 4) Remove the operating cylinder from the transmission.

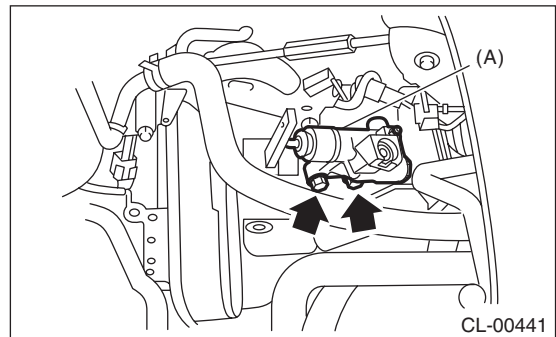
- 5MT model

#### NOTE:

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



- 6MT model



- (A) Operating cylinder

# Operating Cylinder

## CLUTCH SYSTEM

### B: INSTALLATION

#### 1. 5MT MODEL

1) Install in the reverse order of removal.

#### NOTE:

Before installing the operating cylinder, apply grease (KOPR-KOTE: Part No. 003603001) to the contact point of the release lever and operating cylinder.

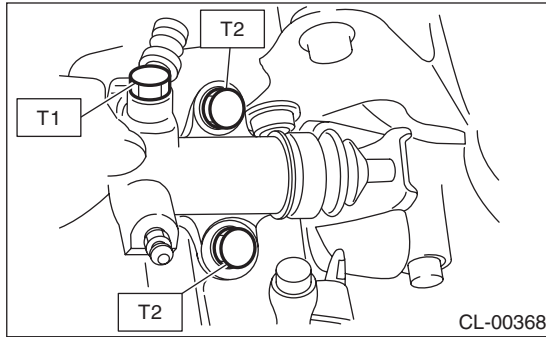
#### Tightening torque:

**T1: 18 N·m (1.8 kgf-m, 13.0 ft-lb)**

**T2: 37 N·m (3.8 kgf-m, 27.5 ft-lb)**

#### NOTE:

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



2) After bleeding air from the operating cylinder, ensure that the clutch operates properly.  
<Ref. to CL-29, Clutch Fluid Air Bleeding.>

#### 2. 6MT MODEL

1) Install in the reverse order of removal.

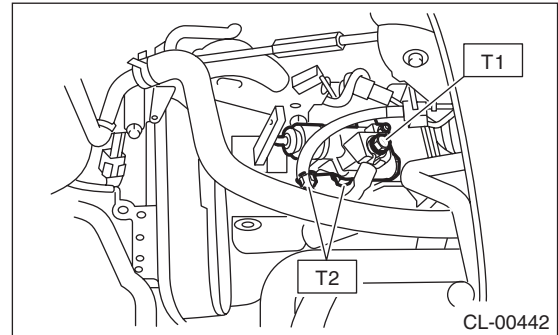
#### NOTE:

Before installing the operating cylinder, apply grease (KOPR-KOTE: Part No. 003603001) to the contact point of the release lever and operating cylinder.

#### Tightening torque:

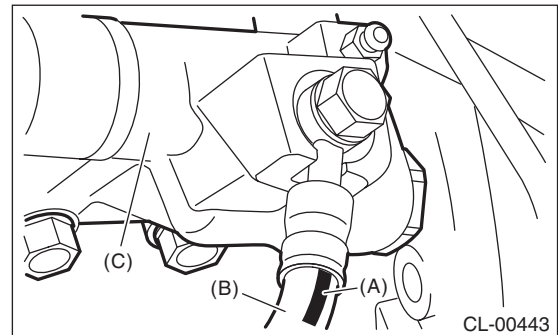
**T1: 18 N·m (1.8 kgf-m, 13.0 ft-lb)**

**T2: 41 N·m (4.2 kgf-m, 30.2 ft-lb)**



#### NOTE:

- Be sure to install the clutch hose with the mark side facing upward.
- Be careful not to twist the clutch hose during installation.



- (A) Mark
- (B) Clutch hose
- (C) Operating cylinder

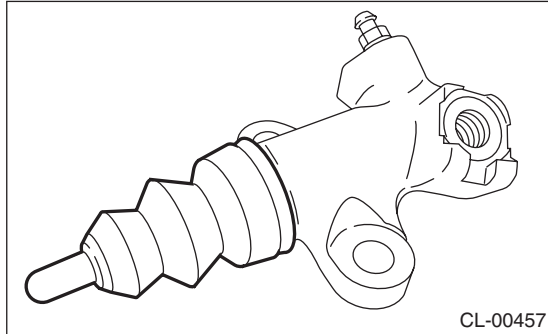
2) After bleeding air from the operating cylinder, ensure that the clutch operates properly.  
<Ref. to CL-29, Clutch Fluid Air Bleeding.>

## C: DISASSEMBLY

1) Remove the boots and push rod assembly.

NOTE:

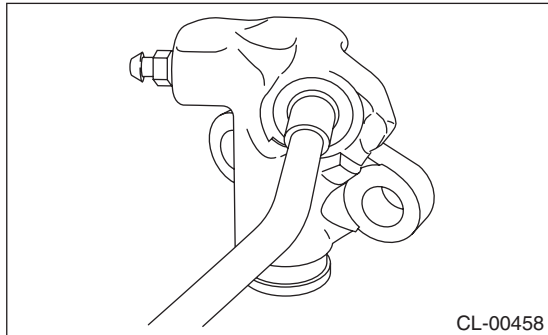
- Only 5MT model can be disassembled.
- The illustration below is for a Non-turbo model.



2) Apply compressed air through clutch hose attaching port.

NOTE:

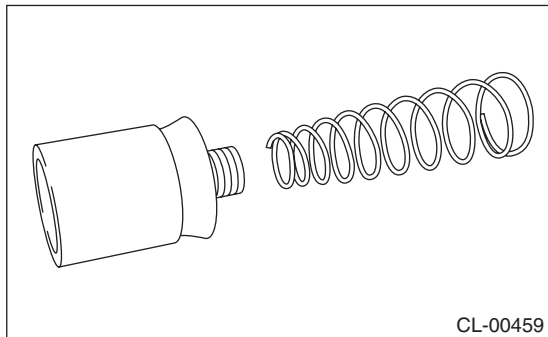
Face the piston port down and place a piece of wood underneath to prevent the piston from popping out.



3) Separate the piston and piston spring.

NOTE:

The illustration below is for a Non-turbo model.



## D: ASSEMBLY

NOTE:

During assembly, apply hydraulic oil to all parts.

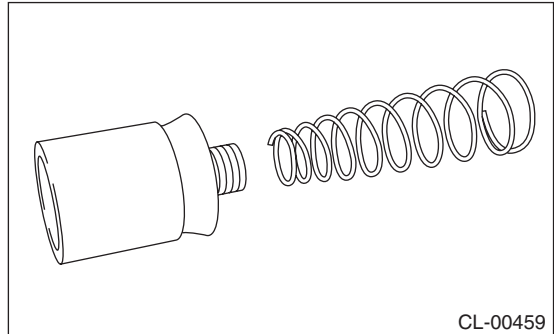
**Recommended brake fluid**

**FMVSS No. 116, fresh DOT3 or 4 brake fluid**

1) Install the piston spring to the piston.

NOTE:

- Only 5MT model can be assembled.
- The illustration below is for a Non-turbo model.



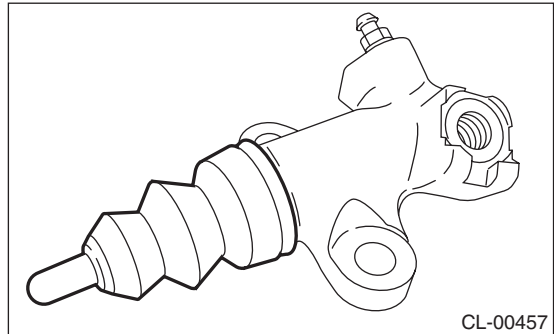
2) Insert piston to the operating cylinder.

3) Install push rod to the boot.

4) Install boot and push rod to the operating cylinder.

NOTE:

The illustration below is for a Non-turbo model.



## E: INSPECTION

1) Check the operating cylinder for damage. If operating cylinder is damaged, replace it.

2) Check the operating cylinder for fluid leakage or damage on the boot. If any leakage or damage is found, replace the operating cylinder.



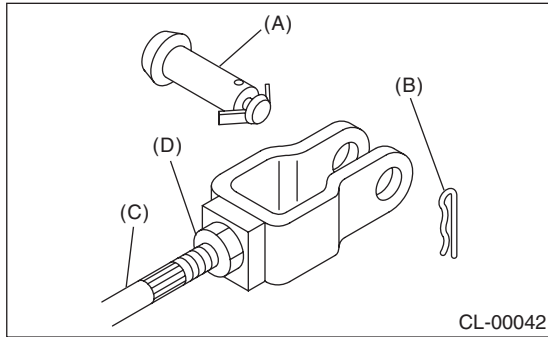
# Master Cylinder

## CLUTCH SYSTEM

### 6. Master Cylinder

#### A: REMOVAL

- 1) Thoroughly drain the brake fluid from the reservoir tank.
- 2) Remove the snap pin and clevis pin, and then separate the push rod of the master cylinder from clutch pedal.

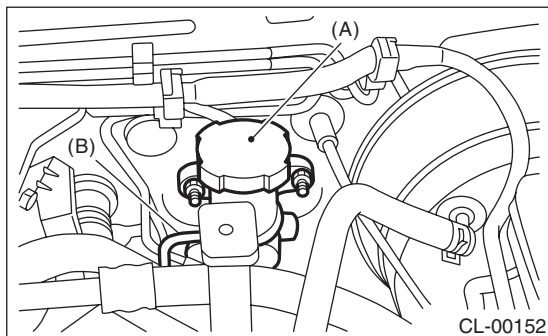


- (A) Clevis pin
- (B) Snap pin
- (C) Push rod
- (D) Lock nut

- 3) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 4) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 5) Remove the clutch pipe from the master cylinder.
- 6) Remove the master cylinder and reservoir tank as a unit.

#### CAUTION:

**Be careful not to spill the brake fluid. Brake fluid spilled on the vehicle body will harm the paint surface; wipe off quickly if spilled.**



- (A) Master cylinder ASSY
- (B) Clutch pipe

#### B: INSTALLATION

- 1) Install the master cylinder to the vehicle body, and connect the clutch pipe to the master cylinder.

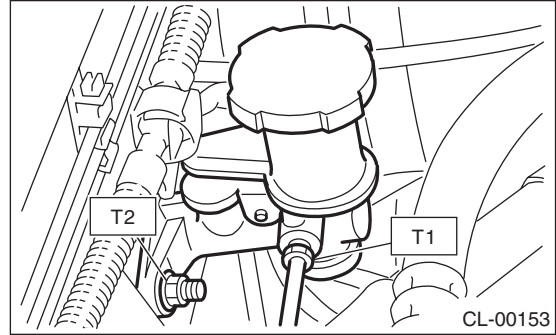
#### NOTE:

Check that the pipe is routed properly.

#### Tightening torque:

**T1: 15 N·m (1.5 kgf·m, 10.8 ft·lb)**

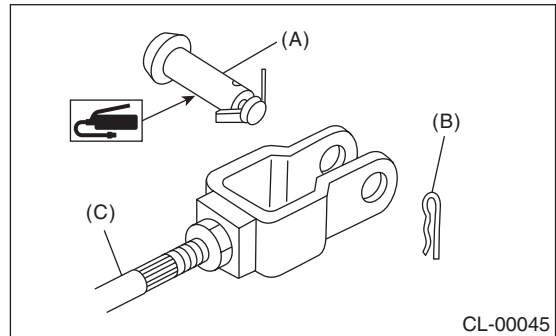
**T2: 18 N·m (1.8 kgf·m, 13.0 ft·lb)**



- 2) Connect the push rod of the master cylinder to the clutch pedal, and install the clevis pin and snap pin.

#### NOTE:

Apply grease to the clevis pin.



- (A) Clevis pin
- (B) Snap pin
- (C) Push rod

- 3) After bleeding air from the clutch system, ensure that the clutch operates properly.

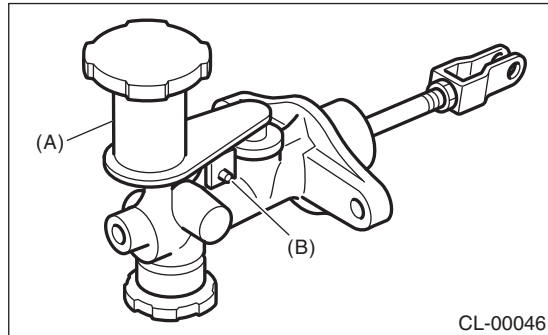
<Ref. to CL-29, Clutch Fluid Air Bleeding.>

- 4) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

- 5) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

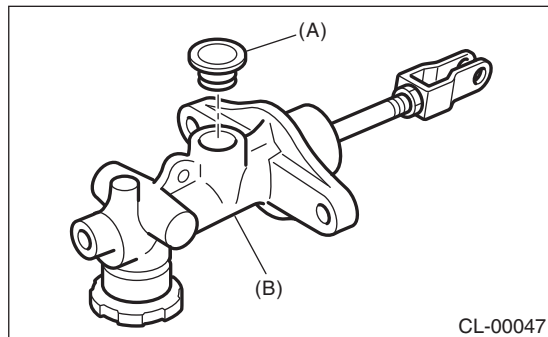
## C: DISASSEMBLY

1) Remove the straight pin and reservoir tank.



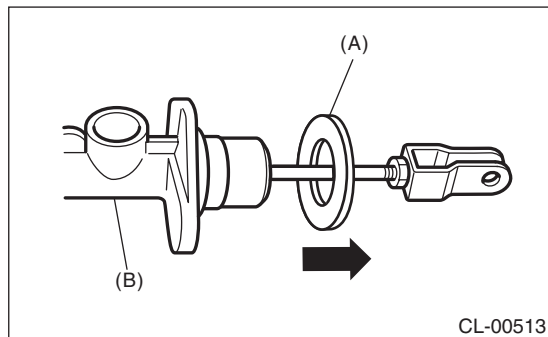
- (A) Reservoir tank
- (B) Straight pin

2) Remove the oil seal.



- (A) Oil seal
- (B) Master cylinder

3) Move the seat towards the rear.



- (A) Seat
- (B) Master cylinder

4) Remove the snap ring.

### CAUTION:

**Be careful when removing the snap ring, to prevent the rod, washer, piston and return spring from flying out.**

5) Remove the clutch damper.

## D: ASSEMBLY

1) Install the clutch damper.

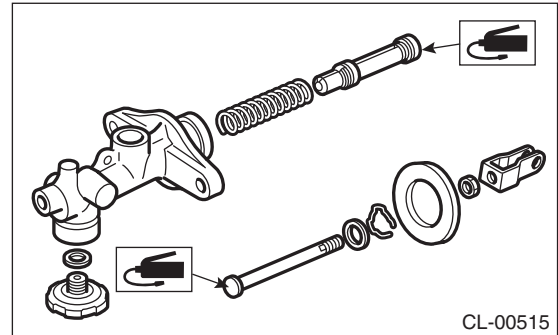
### Tightening torque:

**46.6 N·m (4.75 kgf-m, 34.4 ft-lb)**

2) Apply a coat of grease to the contact surfaces of the push rod and piston before installation.

### Grease:

**SILICONE GREASE G40M (Part No. 004404003)**



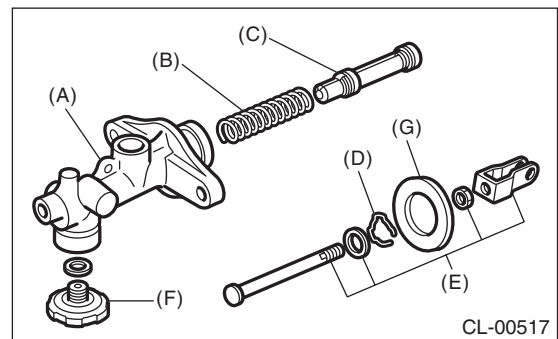
3) Assemble in the reverse order of disassembly.

### Tightening torque:

**10 N·m (1.0 kgf-m, 7 ft-lb)**

## E: INSPECTION

If any damage, deformation, wear, swelling, rust or other faults are found on the cylinder, piston, push rod, fluid reservoir, return spring, gasket, clutch damper, seat or hose, replace the faulty part.



- (A) Master cylinder body
- (B) Return spring
- (C) Piston
- (D) Stop ring
- (E) Push rod ASSY
- (F) Clutch damper
- (G) Seat

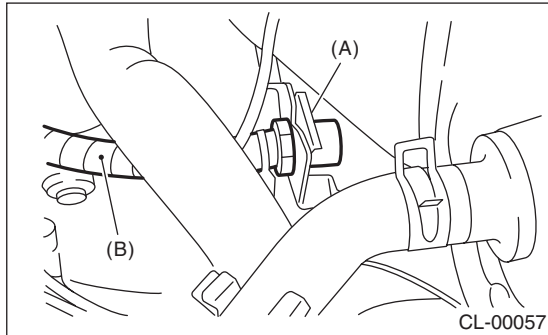
# Clutch Pipe and Hose

## CLUTCH SYSTEM

### 7. Clutch Pipe and Hose

#### A: REMOVAL

- 1) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
- 2) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 3) Drain the clutch fluid. <Ref. to CL-28, Clutch Fluid.>
- 4) Disconnect the clutch pipe from the clutch hose and master cylinder.
- 5) Pull out the clamp, then remove the clutch hose from the bracket.



- (A) Clamp  
(B) Clutch hose

- 6) Disconnect the hose from the operating cylinder.
- 7) Remove the bracket.

#### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Bleed air from the clutch fluid. <Ref. to CL-29, Clutch Fluid Air Bleeding.>

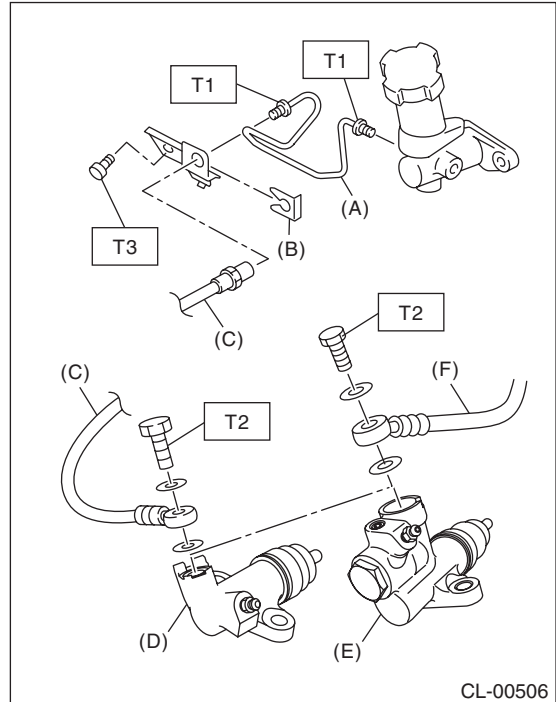
- 5MT model

#### Tightening torque:

**T1: 15 N·m (1.5 kgf-m, 10.8 ft-lb)**

**T2: 18 N·m (1.8 kgf-m, 13.0 ft-lb)**

**T3: 25 N·m (2.5 kgf-m, 18.4 ft-lb)**



- (A) Clutch pipe  
(B) Clip  
(C) Clutch hose (Non-turbo model)  
(D) Operating cylinder (Non-turbo model)  
(E) Operating cylinder (Turbo model)  
(F) Clutch hose (Turbo model)

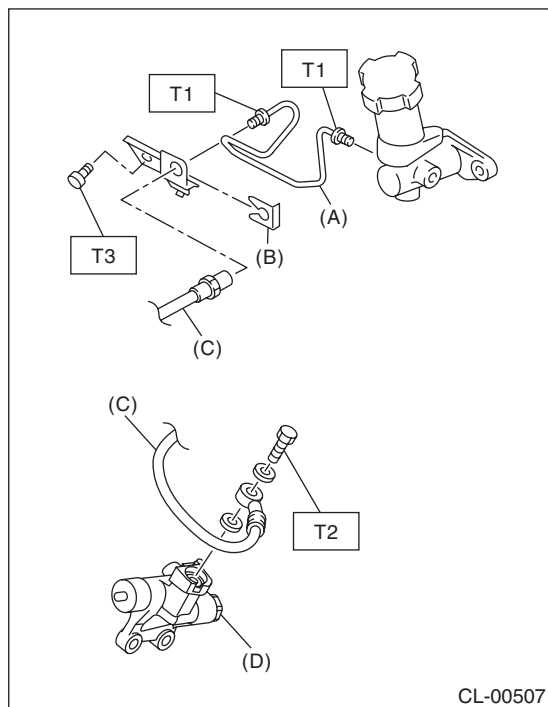
- 6MT model

**Tightening torque:**

**T1: 15 N·m (1.5 kgf-m, 10.8 ft-lb)**

**T2: 18 N·m (1.8 kgf-m, 13.0 ft-lb)**

**T3: 25 N·m (2.5 kgf-m, 18.4 ft-lb)**



- (A) Clutch pipe
- (B) Clip
- (C) Clutch hose
- (D) Operating cylinder (6MT turbo model)

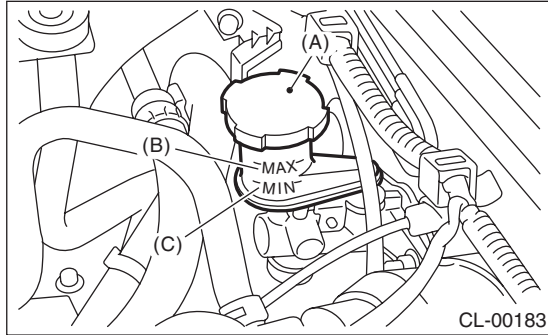
## C: INSPECTION

Check pipes and hoses for cracks, breakage or damage. Check joints for fluid leakage. If any cracks, breakage, damage or leakage is found, repair or replace the defective pipe or hose.

### 8. Clutch Fluid

#### A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Inspect the fluid level using the scale on the outside of the reservoir tank. If the level is below "MIN", add fluid to bring it up to "MAX", and also inspect for leakage.



- (A) Reservoir tank
- (B) MAX. level
- (C) MIN. level

#### B: REPLACEMENT

##### CAUTION:

- Use new FMVSS No. 116, DOT3 or 4 brake fluid.
- Cover the bleeder with cloth to prevent brake fluid from being splashed on surrounding parts when loosening the bleeder.
- Avoid mixing different brands of brake fluid to prevent the quality of fluid from degrading.
- Be careful not to allow dirt or dust to enter the reservoir tank.

##### NOTE:

- During bleeding operation, keep the clutch reservoir tank filled with brake fluid to prevent entry of air.
  - Clutch pedal must be operated very slowly.
  - For convenience and safety, it is advisable to have two people working.
  - The amount of brake fluid required is approximately 70 mℓ (2.4 US fl oz, 2.5 Imp fl oz) for total clutch system.
- 1) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
  - 2) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
  - 3) Drain the brake fluid from the reservoir tank.
  - 4) Refill the reservoir tank with recommended brake fluid.

##### **Recommended brake fluid:**

**FMVSS No. 116, fresh DOT3 or 4 brake fluid**

- 5) If necessary, bleed air from the clutch fluid. <Ref. to CL-29, Clutch Fluid Air Bleeding.>

## 9. Clutch Fluid Air Bleeding

### A: PROCEDURE

#### 1. 5MT MODEL

**NOTE:**

Bleed air from the oil line with help of a co-worker.

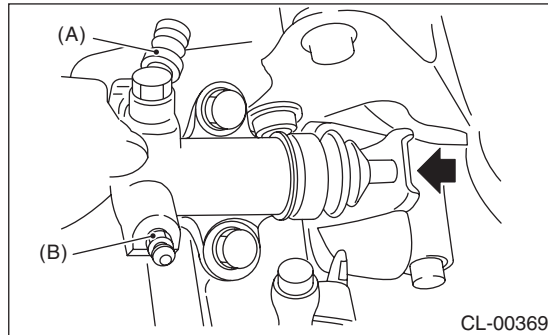
1) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>

2) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>

3) Fit one end of a vinyl tube into the air bleeder of the operating cylinder, and put the other end into a brake fluid container.

**NOTE:**

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



(A) Clutch hose  
(B) Air bleeder

4) Slowly depress the clutch pedal and keep it depressed. Then open the air bleeder to discharge air together with the fluid.

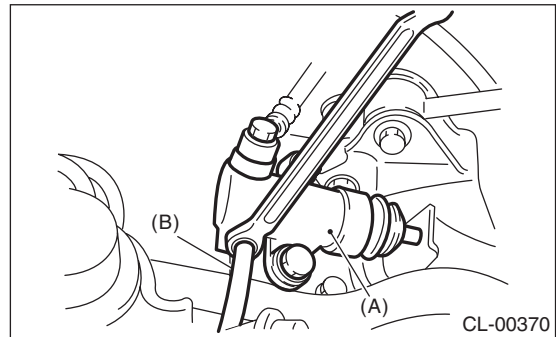
Release the air bleeder for 1 or 2 seconds. Next, with the bleeder closed, slowly release the clutch pedal.

**CAUTION:**

**Cover the bleeder with cloth to prevent brake fluid from being splashed on surrounding parts when loosening the bleeder.**

**NOTE:**

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



(A) Operating cylinder  
(B) Vinyl tube

5) Repeat procedure 4), until there are no more air bubbles in the vinyl tube.

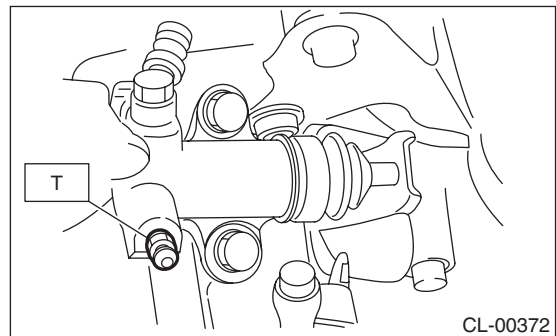
6) Tighten the air bleeder.

**Tightening torque:**

**T: 8 N·m (0.8 kgf·m, 5.8 ft-lb)**

**NOTE:**

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



7) After stepping on the clutch pedal, make sure that there are no leaks evident in the entire clutch system.

8) After bleeding the air from clutch system, ensure that the clutch operates properly.

# Clutch Fluid Air Bleeding

## CLUTCH SYSTEM

### 2. 6MT MODEL

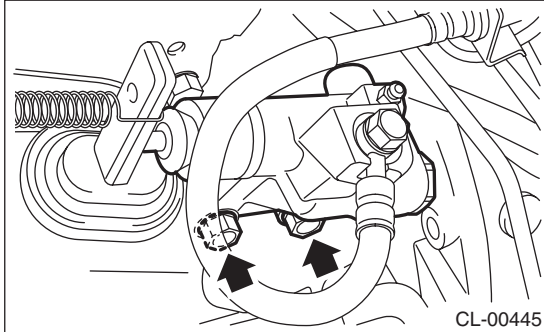
#### NOTE:

Bleed air from the oil line with help of a co-worker.

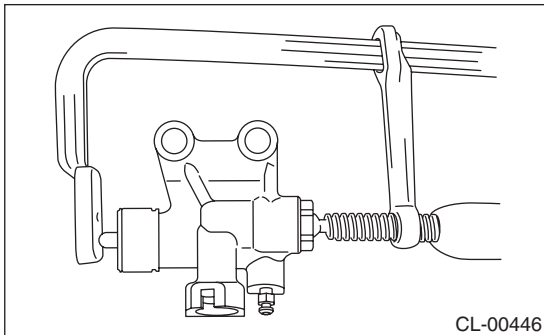
- 1) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 2) Fit one end of a vinyl tube to the air bleeder of the master cylinder, and put the other end into a brake fluid container.
- 3) Remove the operating cylinder.

#### NOTE:

Do not remove the clutch hose.



- 4) Hold the piston with a clamp to prevent piston from popping out.



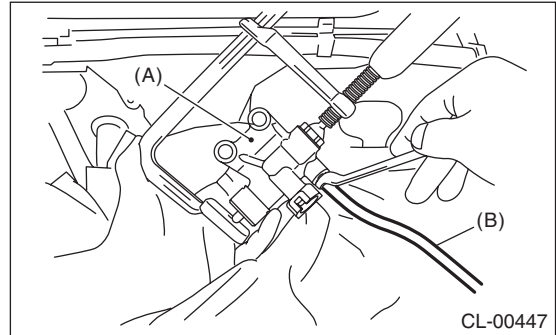
- 5) Fit one end of a vinyl tube into the air bleeder of the operating cylinder, and put the other end into a brake fluid container.

- 6) Slowly depress the clutch pedal and keep it depressed. Then open the air bleeder to discharge air together with the fluid.

Release the air bleeder for 1 or 2 seconds. Next, with the bleeder closed, slowly release the clutch pedal.

#### NOTE:

When performing this procedure, place the screw portion of the air bleeder higher than the end of operating cylinder.



- (A) Operating cylinder  
(B) Vinyl tube

- 7) Repeat these steps until there are no more air bubbles in the vinyl tube.

#### CAUTION:

Cover the bleeder with cloth to prevent brake fluid from being splashed on surrounding parts when loosening the bleeder.

- 8) Tighten the air bleeder.

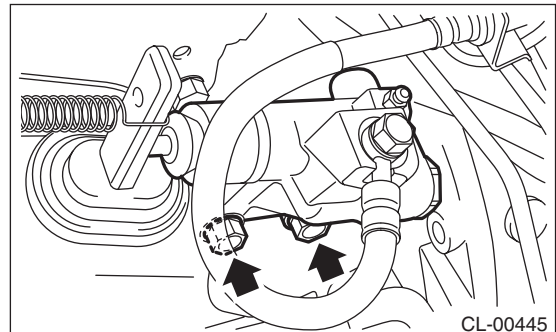
#### Tightening torque:

**8 N·m (0.8 kgf-m, 5.8 ft-lb)**

- 9) Install the operating cylinder.

#### Tightening torque:

**41 N·m (4.2 kgf-m, 30.2 ft-lb)**



- 10) After depressing the clutch pedal, make sure that there are no leaks evident in the entire system.

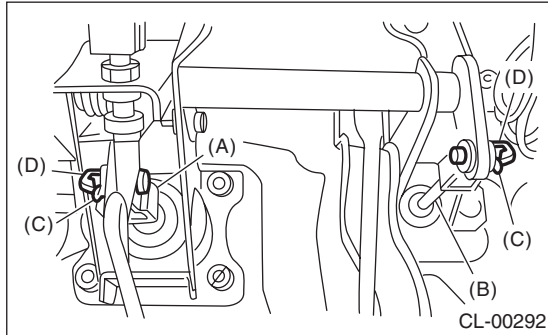
11) After bleeding air from system, ensure that the clutch operates properly.

- 12) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

## 10. Clutch Pedal

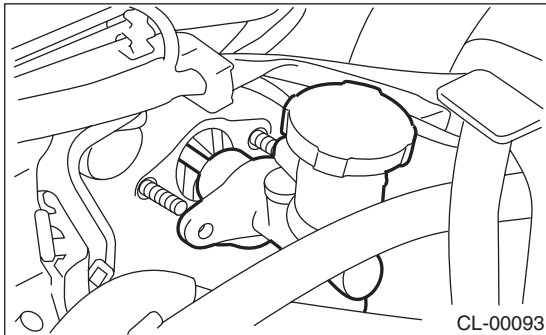
### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the steering column. <Ref. to PS-17, REMOVAL, Tilt Steering Column.>
- 3) Disconnect the connectors of the stop light switch and clutch switch.
- 4) Remove the snap pins from clevis pins which secure the lever to the push rod and operating rod.
- 5) Pull out the clevis pins which secures the lever to the push rod and operating rod.



- (A) Operating rod
- (B) Push rod
- (C) Snap pin
- (D) Clevis pin

- 6) Remove the nut which secures the clutch master cylinder.



- 7) Remove the bolt which secures the brake pedal and clutch pedal, and remove the pedal assembly.

### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### Tightening torque:

**T: 18 N·m (1.8 kgf-m, 13.0 ft-lb)**

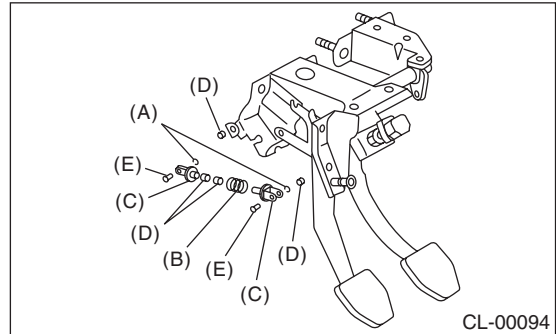
#### CAUTION:

**Always use a new clevis pin.**

- 2) Adjust the clutch pedal after installation. <Ref. to CL-32, ADJUSTMENT, Clutch Pedal.>

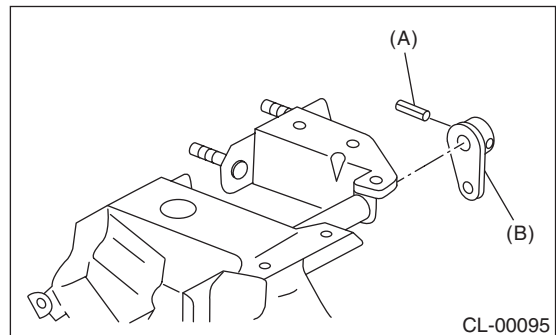
### C: DISASSEMBLY

- 1) Remove the clutch switches.
- 2) Remove the clip, assist spring, rod and bushing.



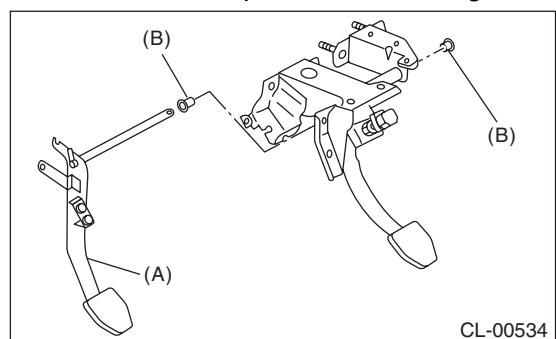
- (A) Clip
- (B) Assist spring
- (C) Assist rod
- (D) Bushing
- (E) Clevis pin

- 3) Extract the spring pin and remove the lever.



- (A) Pin
- (B) Lever

- 4) Remove the clutch pedal and bushing.



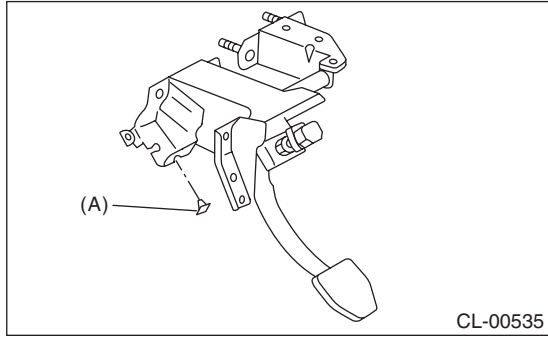
- (A) Clutch pedal
- (B) Bushing



# Clutch Pedal

## CLUTCH SYSTEM

5) Remove the stopper.



(A) Stopper

6) Remove the stopper from the clutch pedal.

7) Remove the clutch pedal pad.

## D: ASSEMBLY

1) Temporarily assemble the clutch switch, etc. to pedal bracket.

2) Clean the clutch pedal and brake pedal bushing holes, apply a thin coat of grease, and install the bushings.

3) Align the holes of the pedal bracket, clutch pedal and brake pedal, and install the brake pedal return spring, assist rod, spring and bushing.

### NOTE:

Clean the inside of bushings and apply a thin coat of grease before installing the spacer.

## E: INSPECTION

### 1. CLUTCH PEDAL

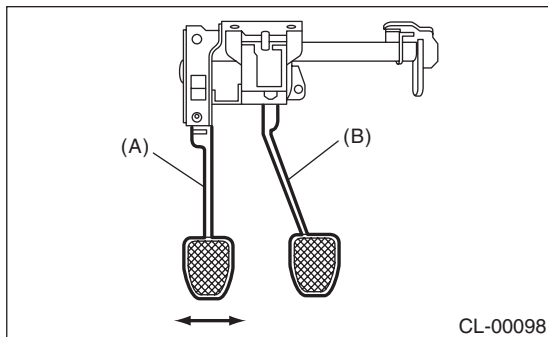
Move the clutch pedal pads in the lateral direction with a force of approximately 10 N (1 kgf, 2 lbf) to check that the clutch pedal deflection is within the service limit.

If it exceeds the service limit, replace with new bushings.

### **Deflection of the clutch pedal:**

#### **Service limit**

**5.0 mm (0.197 in) or less**



(A) Clutch pedal

(B) Brake pedal

## F: ADJUSTMENT

1) Measure the full stroke of the clutch pedal.

### NOTE:

- Measure the leading end of the seat cushion and center of the pedal.
- Align the seat with the seventh notch position from the position at the very front.

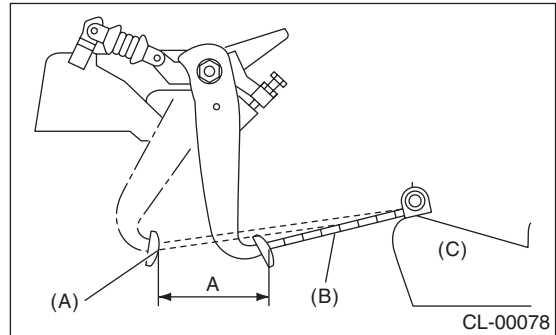
### **Specified clutch pedal full stroke A:**

**5MT non-turbo model and 6MT model:**

**130 — 135 mm (5.12 — 5.31 in)**

**5MT turbo model:**

**135 — 140 mm (5.31 — 5.51 in)**



(A) Clutch pedal (Full stroke condition)

(B) Scale

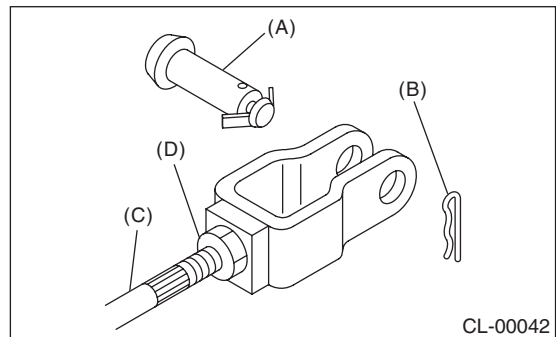
(C) Seats

2) If the full stroke is not within the specified value, loosen the clutch switch lock nut to adjust.

### **Tightening torque:**

**8 N·m (0.8 kgf-m, 5.8 ft-lb)**

3) Loosen the push rod lock nuts.



(A) Clevis pin

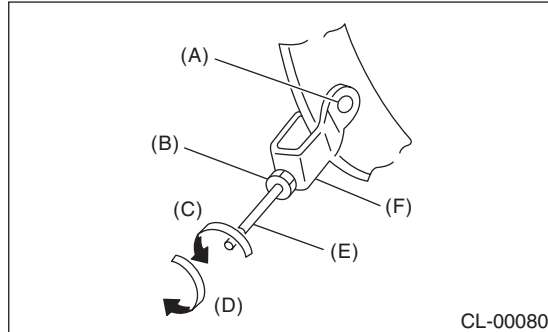
(B) Snap pin

(C) Push rod

(D) Push rod lock nut

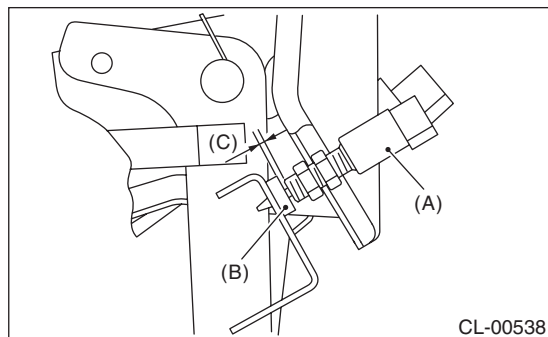
4) Rotate the push rod to adjust.

- (1) Make sure that the clutch pedal contacts the clutch switch side when the pedal is released.
- (2) Make sure that the clutch pedal contacts the clutch pedal bracket stopper when the clutch pedal is at the maximum stroke position.



- (A) Clevis hole
- (B) Push rod lock nut
- (C) In the shorter direction
- (D) In the longer direction
- (E) Push rod
- (F) U shaped hardware

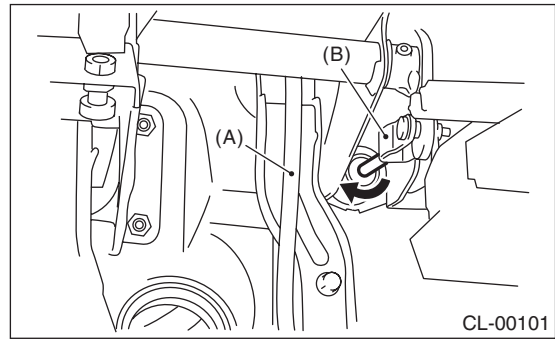
5) Turn the push rod to shorten until a clearance is gained on the clutch switch side.



- (A) Clutch switch
- (B) Stopper
- (C) Clearance

6) Turn the push rod to lengthen until clutch pedal contacts the clutch switch.

7) Turn further in the direction that will shorten the push rod (arrow direction shown in figure) by 270°.



- (A) Accelerator pedal
- (B) Clevis

- 8) Check that the clevis pin moves smoothly by moving it in the left and right directions.
- 9) Tighten the push rod lock nut.

**Tightening torque:**

**10 N·m (1.0 kgf·m, 7.2 ft·lb)**

- 10) Depress and release the clutch pedal two or three times to ensure that the clutch pedal and release fork operate smoothly. If the clutch pedal and release fork do not operate smoothly, bleed air from the clutch hydraulic system. <Ref. to CL-29, Clutch Fluid Air Bleeding.>

- 11) Measure the clutch pedal full stroke length again to ensure that it is within specifications. If it is not within specifications, repeat adjustment procedures again from the beginning.

**Specified clutch pedal full stroke:**

**5MT non-turbo model and 6MT model:**

**130 — 135 mm (5.12 — 5.31 in)**

**5MT turbo model:**

**135 — 140 mm (5.31 — 5.51 in)**

- 12) Move the clevis pin to left, then to right. The clevis pin should move without resistance even if it is rattling. If resistance is felt, repeat adjustment procedures again from the beginning.

# Clutch Pedal

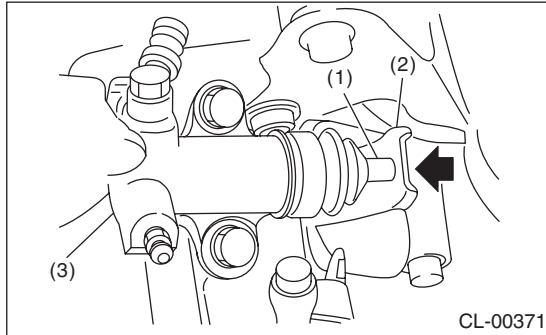
## CLUTCH SYSTEM

13) Push the release lever until the operating cylinder push rod retracts. Make sure that the clutch fluid level in the reservoir tank increases. If the clutch fluid level increases, the hydraulic clutch is properly adjusted; if the fluid level does not increase or the push rod does not retract, replace the master cylinder. <Ref. to CL-24, Master Cylinder.>

- 5MT model

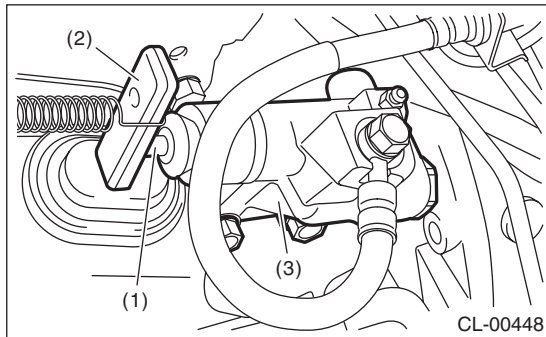
### NOTE:

The illustration below is for a Non-turbo model. However, perform the same procedures for the Turbo model.



- (1) Push rod
- (2) Release lever
- (3) Operating cylinder

- 6MT model

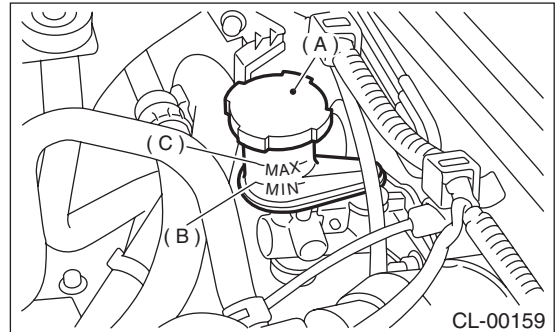


- (1) Push rod
- (2) Release lever
- (3) Operating cylinder

14) Check the fluid level using the scale on the outside of the reservoir tank. If the level is below "MIN", fill fluid up to "MAX" level.

### Recommended clutch fluid:

**FMVSS No. 116, fresh DOT3 or 4 brake fluid**



- (A) Reservoir tank
- (B) MIN. level
- (C) MAX. level

## 11. Clutch Switch

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the instrument panel lower cover.
- 3) Disconnect the connector from clutch switch.
- 4) Remove the clutch switches.

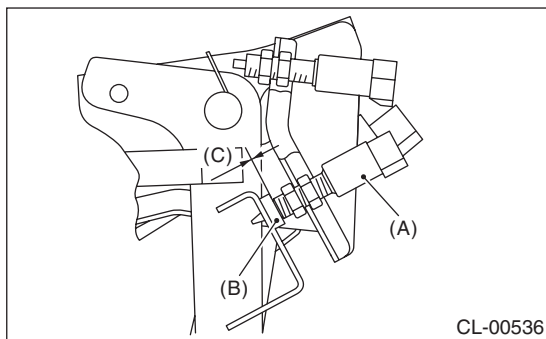
### B: INSTALLATION

#### 1. CLUTCH SWITCH (WITH CRUISE CONTROL)

- 1) Install so that there is a gap of 0 mm (0 in) of the clutch switch and clutch pedal stopper.

**Tightening torque:**

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**



- (A) Clutch switch
- (B) Stopper
- (C) 0 mm (0 in)

- 2) Measure the stroke of the clutch pedal.

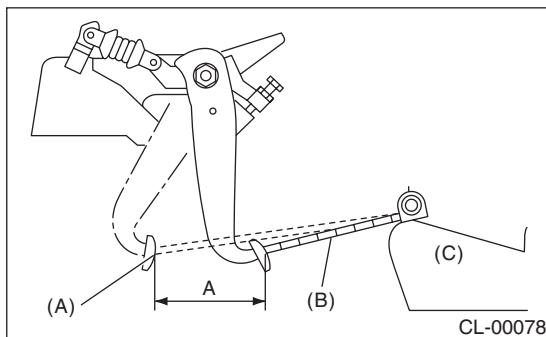
**Clutch pedal standard full stroke: A**

**5MT non-turbo model and 6MT model**

**130 — 135 mm (5.12 — 5.31 in)**

**5MT turbo model**

**135 — 140 mm (5.31 — 5.51 in)**



- (A) Clutch pedal (Full stroke condition)
- (B) Scale
- (C) Seats

- 3) If the clutch pedal stroke is out of specification, adjust the stroke. <Ref. to CL-32, ADJUSTMENT, Clutch Pedal.>

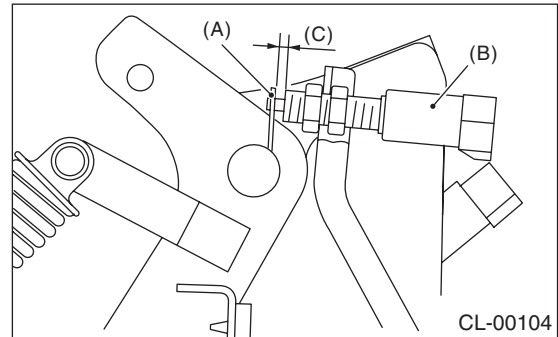
- 4) Connect the clutch switch connector.

#### 2. CLUTCH SWITCH (CLUTCH START)

- 1) Fully depress the clutch and hold it.
- 2) Install the clutch pedal plate and clutch pedal so that the gap between them is 2 — 2.5 mm (0.08 — 0.10 in), and then tighten the lock nut.

**Tightening torque:**

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**



- (A) Plate
- (B) Clutch pedal
- (C) 2 — 2.5 mm (0.08 — 0.10 in)

- 3) Connect the clutch switch connector.

- 4) Make sure that engine does not start with clutch pedal not depressed.

- 5) Make sure that engine starts with clutch pedal fully depressed.

# Clutch Switch

## CLUTCH SYSTEM

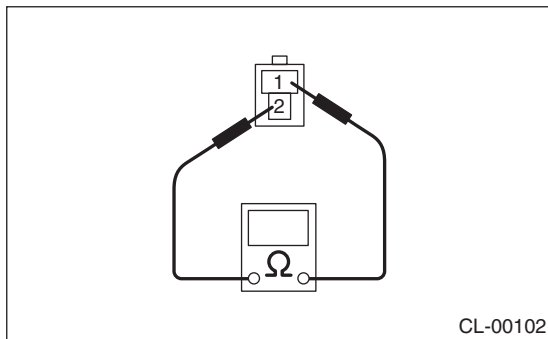
### C: INSPECTION

- 1) Make sure that engine does not start with clutch pedal not depressed. If the engine starts, adjust the clutch switch and inspect the starter interlock circuit.
- 2) Make sure that engine starts with clutch pedal fully depressed. If the engine does not start, adjust the clutch switch and inspect the starter interlock circuit.
- 3) Check the clutch switch for continuity. If the resistance is not at the standard value, replace the switch.

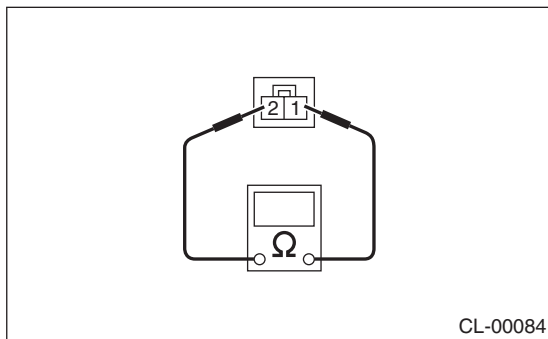
- (1) Disconnect the clutch switch connector.
- (2) Measure the resistance between terminal 1 and 2 of the switch.

Condition	Terminal No.	Specified resistance
When clutch pedal is depressed	1 and 2	Less than 1 $\Omega$
When the clutch pedal is not depressed.	1 and 2	1 M $\Omega$ or more

#### Clutch switch (Clutch start)

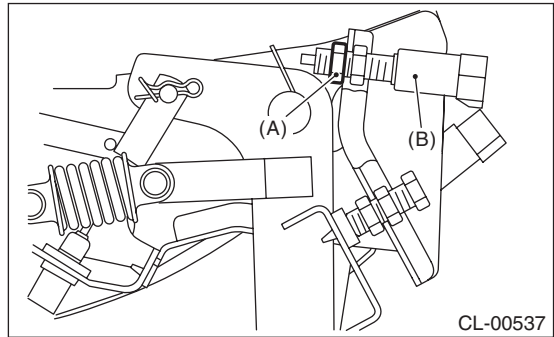


#### Clutch switch (Cruise control)



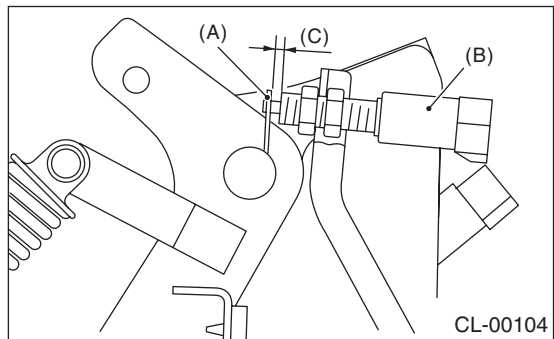
### D: ADJUSTMENT

- 1) Loosen the lock nut of clutch switch (clutch start).



- (A) Lock nut  
(B) Clutch switch (Clutch start)

- 2) Fully depress the clutch and hold it.
- 3) Adjust the gap of the clutch pedal plate and the clutch switch to be 2 — 2.5 mm (0.08 — 0.10 in).



- (A) Plate  
(B) Clutch switch (Clutch start)  
(C) 2 — 2.5 mm (0.08 — 0.10 in)

- 4) Tighten the lock nut.

**Tightening torque:**  
**8 N·m (0.8 kgf·m, 5.8 ft·lb)**

## 12. General Diagnostic Table

### A: INSPECTION

#### 1. CLUTCH

Symptom	Possible cause	Corrective action
<p>1. Clutch slippage. It is hard to perceive clutch slippage in the early stage, but pay attention to the following symptoms.</p> <ul style="list-style-type: none"> <li>• Engine speeds up when shifting.</li> <li>• High-speed driving is not possible; especially rapid acceleration is not possible and vehicle speed does not increase in proportion to the increase in engine speed.</li> <li>• Power drops particularly when ascending a slope, and there is a burning smell of the clutch plate.</li> <li>• Method of testing: Park the vehicle and fully apply the parking brake. Disengage the clutch and shift the transmission gear into the 1st. Gradually increase the engine speed while gradually allowing the clutch to engage. The clutch function is satisfactory if the engine stalls. However, the clutch is slipping if the vehicle does not move forward and the engine does not stall.</li> </ul>	(a) Oil on the clutch face	Replace.
	(b) Worn clutch face	Replace.
	(c) Deteriorated diaphragm spring	Replace.
	(d) Warped pressure plate or flywheel	Correct or replace.
	(e) Defective release bearing holder	Correct or replace.
<p>2. Clutch drags. As a symptom of this trouble, a harsh scratching noise occurs and control becomes difficult when shifting gears. The symptom becomes more apparent when shifting into the 1st gear. However, because most trouble of this sort is due to a defective synchronization mechanism, perform the following tests. Method of testing: &lt;Ref. to CL-38, DIAGNOSTIC DIAGRAM OF CLUTCH DRAG, INSPECTION, General Diagnostic Table.&gt; The problem is caused by insufficient disengagement of the clutch if an abnormal noise occurs during this test.</p>	(a) Worn or rusty clutch disc hub spline	Replace the clutch disc.
	(b) Excessive deflection of clutch disc face	Correct or replace.
	(c) Crankshaft pilot needle bearing sticking	Replace.
	(d) Cracked clutch disc face	Replace.
	(e) Stuck clutch disc (smeared by oil or water)	Replace.
<p>3. Clutch chatters. Clutch chattering is an unpleasant vibration to the whole vehicle when the vehicle is just started with clutch partially engaged.</p>	(a) Adhesion of oil on the clutch face	Replace the clutch disc.
	(b) Weak or broken damper spring	Replace the clutch disc.
	(c) Poor contact of the disc surface or excessively worn disc	Replace the faulty clutch disc.
	(d) Warped pressure plate or flywheel	Correct or replace.
	(e) Loose disc rivets	Replace the clutch disc.
	(f) Loose engine mounting	Retighten or replace mounting.
	(g) Improper adjustment of the pitching stopper	Adjust.

# General Diagnostic Table

## CLUTCH SYSTEM

Symptom	Possible cause	Corrective action
4. Noisy clutch Examine whether the noise is generated when the clutch is disengaged, engaged, or partially engaged.	(a) Broken, worn or insufficiently lubricated release bearing	Replace the release bearing.
	(b) Insufficient lubrication of the pilot bearing	Replace the pilot bearing.
	(c) Loose clutch disc hub	Replace the clutch disc.
	(d) Loose damper spring retainer	Replace the clutch disc.
	(e) Deteriorated or broken damper spring	Replace the clutch disc.
5. Clutch grabs suddenly. When starting the vehicle with the clutch partially engaged, the clutch engages suddenly and the vehicle jumps instead of making a smooth start.	(a) Grease or oil on facing	Replace the clutch disc.
	(b) Deteriorated cushioning spring	Replace the clutch disc.
	(c) Worn or rusted spline of clutch disc or main shaft	Take off rust, apply grease or replace clutch disc or main shaft.
	(d) Deteriorated or broken damper spring	Replace the clutch disc.
	(e) Loose engine mounting	Retighten or replace mounting.
	(f) Deteriorated diaphragm spring	Replace.

## 2. CLUTCH PEDAL

Symptom	Corrective action
Insufficient pedal play	Adjust the free play of the pedal.
Insufficient clutch pedal free play	Adjust the free play of the pedal.
Excessively worn and damaged pedal shaft and/or bushing	Replace the bushing or shaft with a new part.

## 3. DIAGNOSTIC DIAGRAM OF CLUTCH DRAG

Step	Check	Yes	No
<b>1</b> <b>CHECK GEAR NOISE.</b> 1) Start the engine. 2) Disengage the clutch and shift quickly from neutral to reverse in idling condition.	Is there any abnormal noise from the transmission gear?	Go to step 2.	Clutch is normal.
<b>2</b> <b>CHECK GEAR NOISE.</b> Disengage the clutch at idle and shift from neutral to reverse within 0.5 — 1.0 seconds.	Is there any abnormal noise from the transmission gear?	Go to step 3.	Defective transmission or excessive clutch drag torque. Inspect Pilot bearing, clutch disc, transmission and clutch disc hub spline.
<b>3</b> <b>CHECK GEAR NOISE.</b> 1) Disengage the clutch at idle and shift from neutral to reverse within 0.5 — 1.0 seconds. 2) With the clutch disengaged, shift from neutral to reverse, reverse to neutral several times.	Is there any abnormal noise from the transmission gear?	Inadequate clutch disengage. Inspect the clutch disc, clutch cover, clutch release, and clutch pedal free play.	Clutch and fly-wheel seizure. Inspect the clutch disc and the spline of the clutch disc hub.

# General Description

## FRONT SUSPENSION

### 1. General Description

#### A: SPECIFICATION

	Model		Sedan			Wagon		
			2.5 i	2.5 GT	2.5 GT spec.B, 3.0 R	2.5 i	2.5 GT	OUTBACK
Front	Wheel arch height (Tolerance: $+12\text{ mm}$ $-24\text{ mm}$ ( $+0.47\text{ in}$ $-0.94\text{ in}$ ))	mm (in)	381 (15.0)			381 (15.0)		439 (17.3)
	Camber (Tolerance: $\pm 0^{\circ}45'$ Differences between RH and LH: 45' or less)		$-0^{\circ}15'$			$-0^{\circ}15'$		$0^{\circ}40'$
	Caster (Referential Value)		$5^{\circ}55'$			$5^{\circ}40'$		$4^{\circ}55'$
	Steering angle (Tolerance: $\pm 1.5^{\circ}$ )	Inner wheel	$37.6^{\circ}$	$33.8^{\circ}$		$37.6^{\circ}$		
		Outer wheel	$33.0^{\circ}$	$30.2^{\circ}$		$33.0^{\circ}$		
	Toe-in	mm (in)	$0\pm 3$ ( $0\pm 0.12$ ) Toe angle (sum of both wheels): $0^{\circ}\pm 0^{\circ}15'$					
Kingpin angle (Referential Value)		$13^{\circ}45'$			$13^{\circ}45'$		$12^{\circ}05'$	
Rear	Wheel arch height (Tolerance: $+12\text{ mm}$ $-24\text{ mm}$ ( $+0.47\text{ in}$ $-0.94\text{ in}$ ))	mm (in)	365 (14.4)			375 (14.8)		438 (17.2)
	Camber (Tolerance: $\pm 0^{\circ}45'$ Differences between RH and LH: 45' or less)		$-0^{\circ}40'$			$-0^{\circ}30'$		$-0^{\circ}10'$
	Toe-in	mm (in)	<sup>*2</sup>					<sup>*1</sup>
	Thrust angle (Tolerance: $\pm 0^{\circ}30'$ )		$0^{\circ}$					

<sup>\*1</sup>: OUTBACK model

$-3 - 0\text{ mm}$  ( $-0.12 - 0\text{ in}$ ) Toe angle (sum of both wheels):  $-0^{\circ}15' - 0^{\circ}$

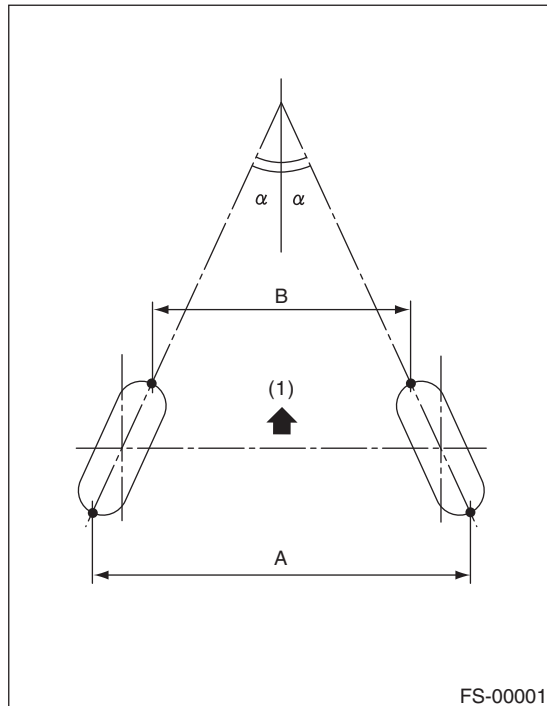
<sup>\*2</sup>: Except for OUTBACK model

$0\pm 3\text{ mm}$  ( $0\pm 0.12\text{ in}$ ) Toe angle (sum of both wheels):  $0^{\circ}\pm 0^{\circ}15'$



**NOTE:**

- Front and rear toe-in and front camber can be adjusted. Adjust if the toe-in or camber tolerance exceeds specifications.
- Other items indicated in the specifications table cannot be adjusted. If other items exceed specifications, check the suspension parts and connections for deformation, and replace with new parts as required.



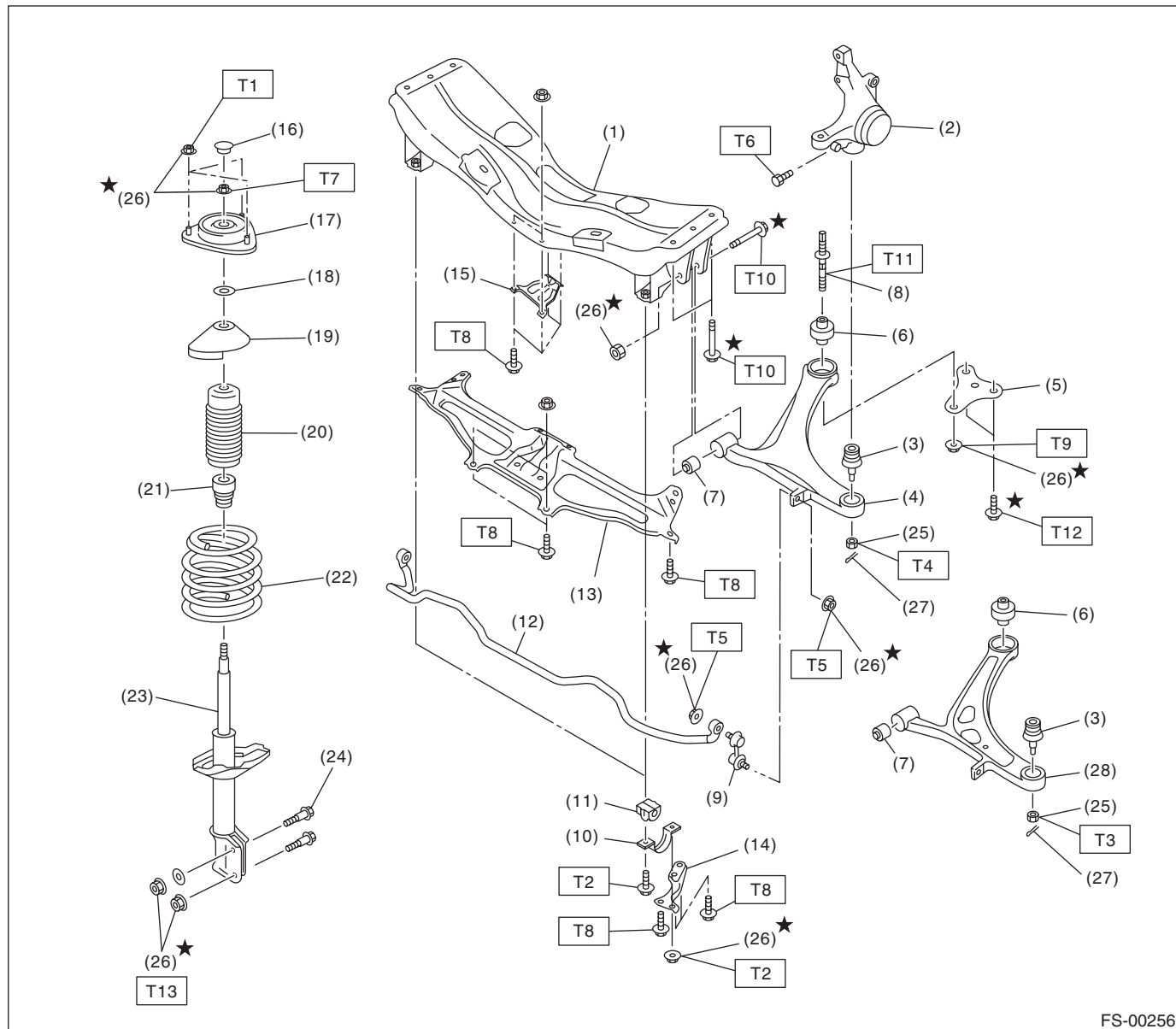
(1) Front

$A - B =$  Positive: Toe-in, Negative: Toe-out  
 $\alpha =$  Individual toe angles

# General Description

## FRONT SUSPENSION

### B: COMPONENT



FS-00256

# General Description

## FRONT SUSPENSION

---

(1) Front crossmember	(15) Jack-up plate	<b>Tightening torque:N-m (kgf-m, ft-lb)</b>
(2) Housing	(16) Dust seal	<b>T1: 20 (2.0, 14.5)</b>
(3) Ball joint	(17) Strut mount	<b>T2: 25 (2.5, 18.1)</b>
(4) Front arm (steel type)	(18) Spacer	<b>T3: 30 (3.1, 22)</b>
(5) Support plate	(19) Upper spring seat	<b>T4: 39 (4.0, 28.8)</b>
(6) Rear bushing	(20) Dust cover	<b>T5: 45 (4.6, 33.2)</b>
(7) Front bushing	(21) Helper	<b>T6: 50 (5.1, 36.9)</b>
(8) Stud bolt	(22) Coil spring	<b>T7: 55 (5.6, 41)</b>
(9) Stabilizer link	(23) Damper strut	<b>T8: 60 (6.1, 44.3)</b>
(10) Bracket	(24) Adjusting bolt	<b>T9: 88 (9.0, 64.9)</b>
(11) Bushing	(25) Castle nut	<b>T10: 95 (9.7, 70.1)</b>
(12) Stabilizer	(26) Self-locking nut	<b>T11: 110 (11.2, 81.1)</b>
(13) Crossmember support plate (Large type)	(27) Cotter pin	<b>T12: 150 (15.3, 110.6)</b>
(14) Crossmember support plate (Small type)	(28) Front arm (aluminium type)	<b>T13: 152 (15.5, 112.1)</b>

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### C: CAUTION

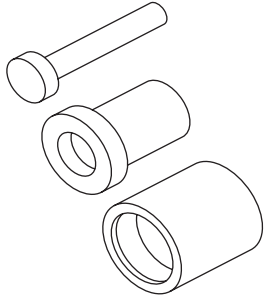
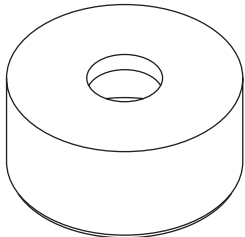
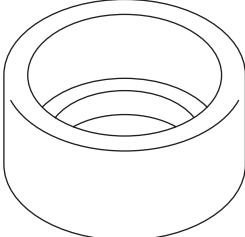
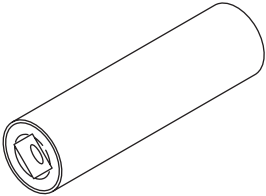
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

# General Description

## FRONT SUSPENSION

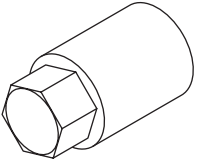
### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-927680000</p>	927680000	INSTALLER & REMOVER SET	Used for replacing front arm front bushing.
 <p style="text-align: center;">ST20299AG000</p>	20299AG000	REMOVER	Used for replacing front arm rear bushing. Used together with BASE (20999AG010).
 <p style="text-align: center;">ST20299AG010</p>	20299AG010	BASE	Used for replacing front arm rear bushing. Used together with REMOVER (20999AG000).
 <p style="text-align: center;">ST20299AG020</p>	20299AG020	STUD BOLT SOCKET	Used for removing and installing the stud bolt for front arm installing portion.

# General Description

FRONT SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST20399AG000	20399AG000	STRUT MOUNT SOCKET	Used for disassembling and assembling strut mount.

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Alignment gauge	Used for measuring wheel alignment.
Alignment gauge adapter	Used for measuring wheel alignment.
Turning radius gauge	Used for measuring wheel alignment.
Toe-in gauge	Used for toe-in measurement.
Dial gauge	Used for damper strut measurement.
Coil spring compressor	Used for strut assembly/disassembly.

# Wheel Alignment

## FRONT SUSPENSION

## 2. Wheel Alignment

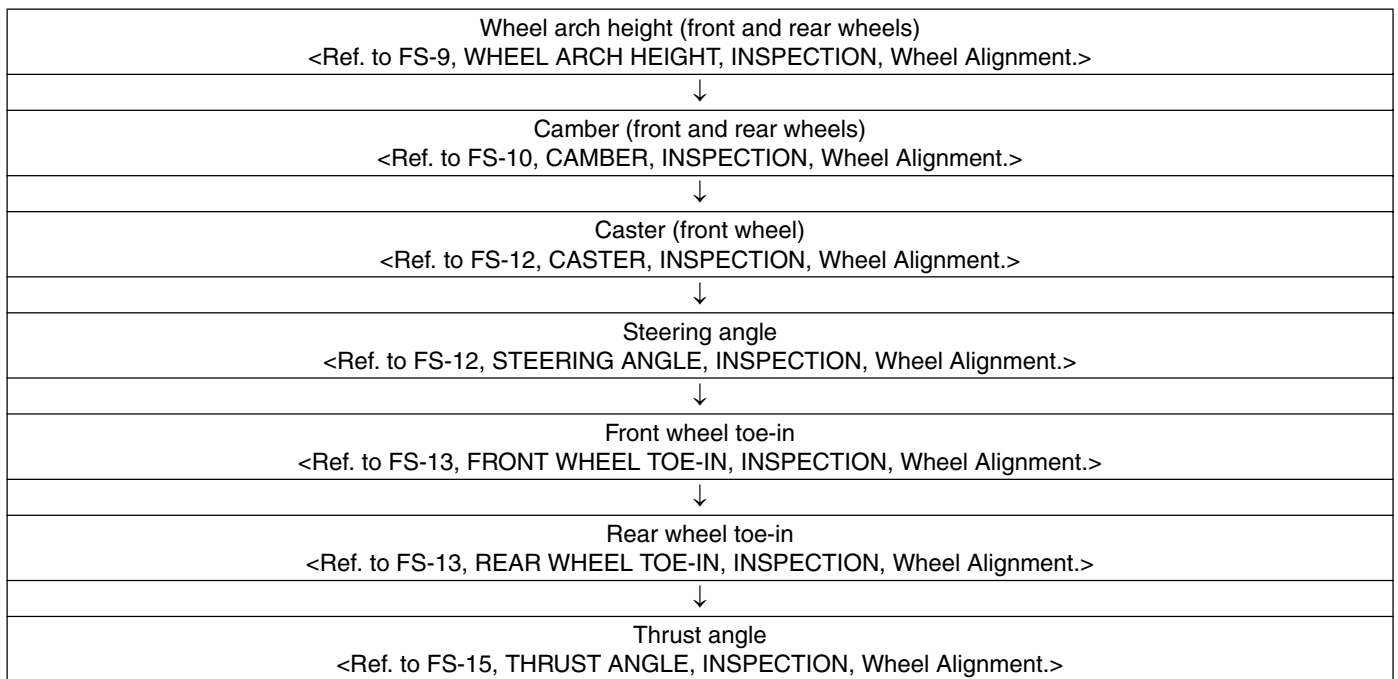
### A: INSPECTION

Check the following items before performing the wheel alignment measurement.

Check items before measuring wheel alignment:

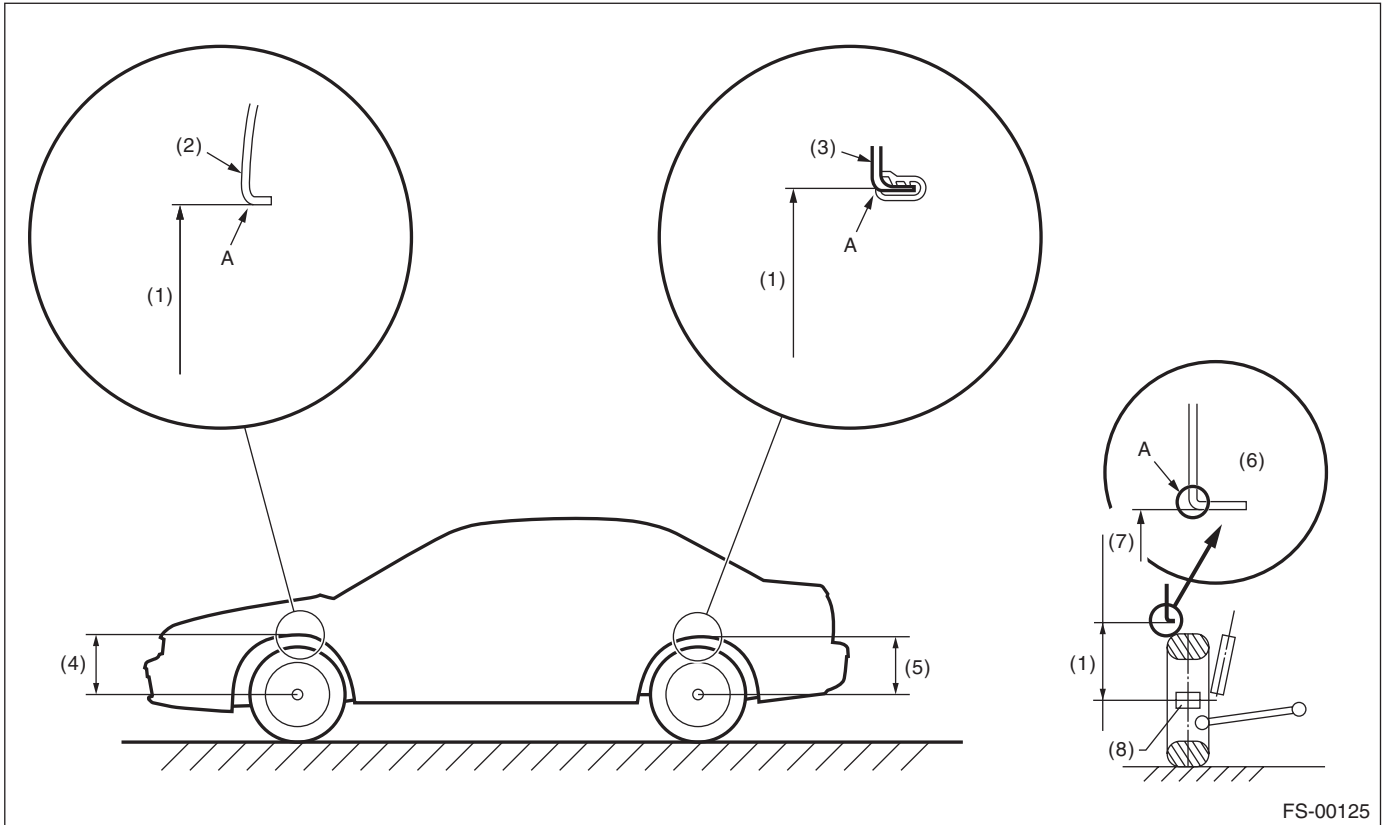
- Tire inflation pressure
- Uneven wear of RH and LH tires, or difference of sizes
- Tire runout
- Excessive play and wear of ball joint
- Excessive play and wear of tie rod end
- Excessive play of wheel bearing
- Right and left wheel base imbalance
- Deformation and excessive play of steering link
- Deformation and excessive play of suspension parts

Check, adjust and measure the wheel alignment in accordance with the procedures indicated in the figure.



## 1. WHEEL ARCH HEIGHT

- 1) Park the vehicle on a level surface.
- 2) Empty the vehicle so that it is at “curb weight”. (Empty the luggage compartment, load the spare tire, jack and service tools, and fill up the fuel tank.)
- 3) Set the steering wheel in a straight-ahead position, and stabilize the suspensions by moving the vehicle in a straight line for 5 m (16 ft) or more.
- 4) Suspend a thread from the wheel arch (point “A” in the figure below) and affix at a position directly above the center of wheel.
- 5) Measure the distance between the point “A” and the center of wheel.



- |                       |                             |                          |
|-----------------------|-----------------------------|--------------------------|
| (1) Wheel arch height | (4) Front wheel arch height | (7) Point of measurement |
| (2) Front fender      | (5) Rear wheel arch height  | (8) End of spindle       |
| (3) Rear quarter      | (6) Flange bend line        |                          |

Wheel arch height specification mm (in) (Tolerance: +12 mm -24 mm (+0.47 in -0.94 in))			
Model	Sedan	Wagon	
	All models	Except for OUTBACK	OUTBACK
Front	381 (15.0)	381 (15.0)	439 (17.3)
Rear	365 (14.4)	375 (14.8)	438 (17.2)

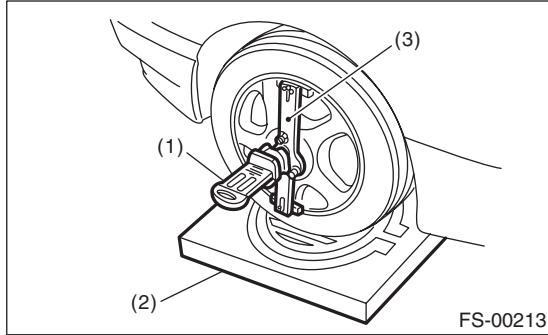
# Wheel Alignment

## FRONT SUSPENSION

### 2. CAMBER

#### • INSPECTION

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of the front and rear wheels are at the same height.
- 2) Set the adapter into the center of wheel, and then set the wheel alignment gauge.



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Adapter

- 3) Measure the camber angle in accordance with the operation manual for wheel alignment gauge.

Model	Camber (Difference between RH and LH 45' or less)
Except for OUTBACK	$-0^{\circ}15' \pm 0^{\circ}45'$
OUTBACK	$0^{\circ}40' \pm 0^{\circ}45'$

#### • FRONT CAMBER ADJUSTMENT

- 1) When adjusting the camber, adjust it to the following value.

Model	Camber (Difference between RH and LH 45' or less)
Except for OUTBACK	$-0^{\circ}15' \pm 0^{\circ}30'$
OUTBACK	$0^{\circ}40' \pm 0^{\circ}30'$

- 2) Loosen the two self-locking nuts located at the front lower section of the strut.

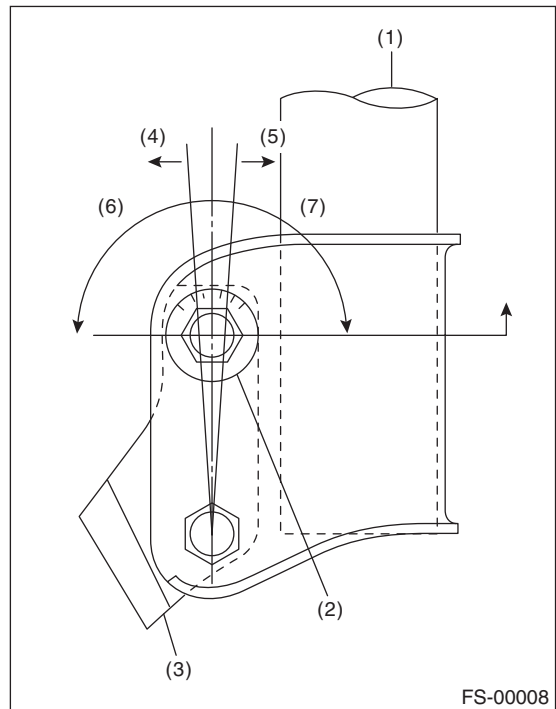
#### NOTE:

When the adjusting bolt needs to be loosened or tightened, hold its head with a wrench and turn the self-locking nut.

- 3) Turn the camber adjusting bolt so that the camber is set at specification.

#### NOTE:

Moving the adjusting bolt by one scale changes the camber by approximately  $0^{\circ}15'$ .

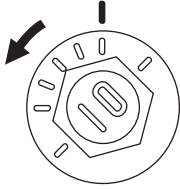
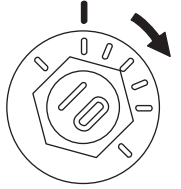


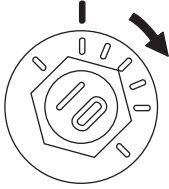
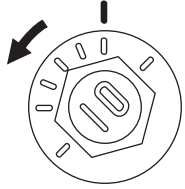
- (1) Strut
- (2) Adjusting bolt
- (3) Housing
- (4) Outer
- (5) Inner
- (6) Camber is increased.
- (7) Camber is decreased.



# Wheel Alignment

FRONT SUSPENSION

To increase camber:	
Rotate the left side counterclockwise.	Rotate the right side clockwise.
 <p>FS-00009</p>	 <p>FS-00010</p>

To decrease camber:	
Rotate the left side clockwise.	Rotate the right side counterclockwise.
 <p>FS-00010</p>	 <p>FS-00009</p>

4) Tighten two new self-locking nuts.

**Tightening torque:**

**152 N·m (15.5 kgf-m, 112.1 ft-lb)**

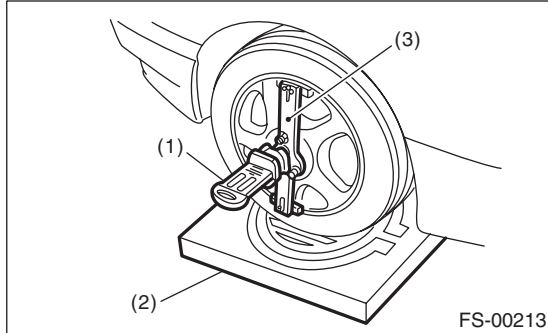
# Wheel Alignment

## FRONT SUSPENSION

### 3. CASTER

#### INSPECTION

- 1) Place the front wheel on the turning radius gauge. Make sure the ground contact surfaces of the front and rear wheels are at the same height.
- 2) Set the adapter into the center of wheel, and then set the wheel alignment gauge.



- (1) Alignment gauge
- (2) Turning radius gauge
- (3) Adapter

- 3) Measure the caster angle in accordance with the operation manual for wheel alignment gauge.

Model	Caster (Reference)
Sedan	5°55'
Wagon	5°40'
OUTBACK	4°55'

### 4. STEERING ANGLE

#### • INSPECTION

- 1) Place the vehicle on turning radius gauge.
- 2) While depressing the brake pedal, turn the steering wheel fully to the left and right. With the steering wheel held at each fully turned position, measure both the inner and outer wheel steering angles.

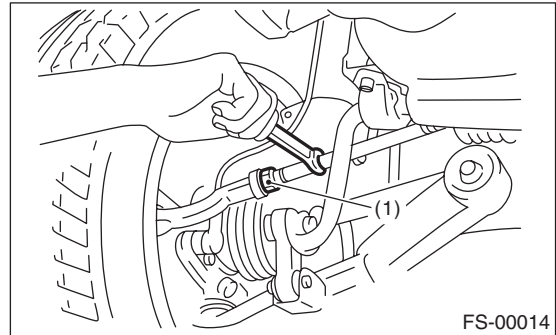
Model	Inner wheel	Outer wheel
2.5 GT spec.B, 3.0 R	33.8°±1.5°	30.2°±1.5°
Other than above	37.6°±1.5°	33.0°±1.5°

#### • ADJUSTMENT

- 1) Turn the tie-rod to adjust the steering angle of both inner and outer wheels.
- 2) Check the toe-in.

#### NOTE:

Correct the boot if it is twisted.



- (1) Lock nut

## 5. FRONT WHEEL TOE-IN

### • INSPECTION

#### Toe-in:

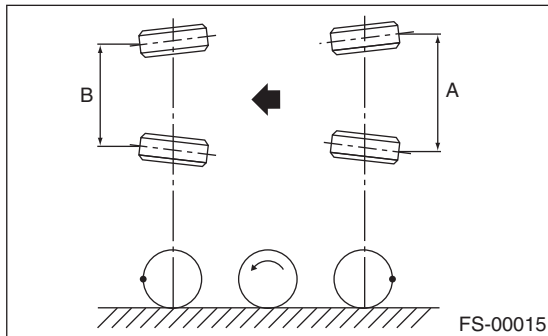
**$0 \pm 3 \text{ mm } (0 \pm 0.12 \text{ in})$**

- 1) Set the toe-in gauge in the position at wheel axis center height behind the right and left front tires.
- 2) Place a mark at the center of both left and right tires, and measure distance "A" between the marks.
- 3) Move the vehicle forward to rotate the tires  $180^\circ$ .

#### NOTE:

Be sure to rotate the tires in the forward direction.  
4) Measure the distance "B" between the left and right marks. Find toe-in using the following equation:

$$A - B = \text{Toe-in}$$



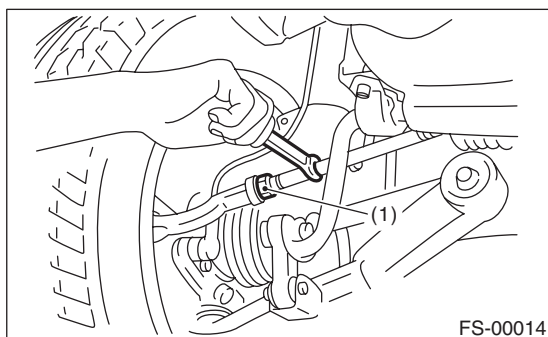
### • ADJUSTMENT

When adjusting the toe-in, adjust it to the following value.

#### Toe-in:

**$0 \pm 2 \text{ mm } (0 \pm 0.08 \text{ in})$**

- 1) Check that the left and right wheel steering angles are within specification.
  - 2) Loosen the left and right side steering tie-rod lock nuts.
  - 3) Turn the left and right tie-rods by equal amounts until the toe-in is at the specification.
- Both the left and right tie-rods are right-hand threaded. To increase toe-in, turn both tie-rods clockwise by equal amount (viewing from the inside of vehicle).



(1) Lock nut

- 4) Tighten the tie-rod lock nut.

#### Tightening torque:

**$85 \text{ N}\cdot\text{m } (8.7 \text{ kgf}\cdot\text{m}, 62.7 \text{ ft}\cdot\text{lb})$**

#### NOTE:

Check and correct the tie rod boot if twisted.

## 6. REAR WHEEL TOE-IN

### • INSPECTION

#### Toe-in:

***OUTBACK model***

**$-3 - 0 \text{ mm } (-0.12 - 0 \text{ in})$**

***Except for OUTBACK model***

**$0 \pm 3 \text{ mm } (0 \pm 0.12 \text{ in})$**

Refer to FRONT WHEEL TOE-IN for rear toe-in inspection procedures.

<Ref. to FS-13, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

### • ADJUSTMENT

When adjusting, adjust it to the following value.

#### Toe-in:

***OUTBACK model***

**$-3 - 0 \text{ mm } (-0.12 - 0 \text{ in})$**

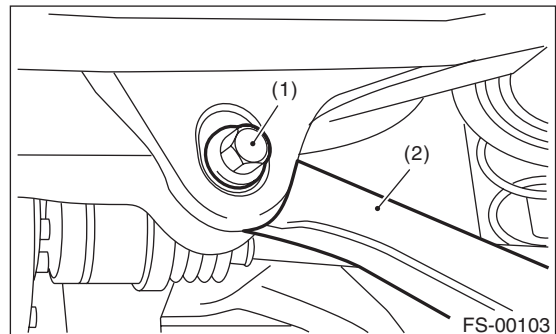
***Except for OUTBACK model***

**$0 \pm 2 \text{ mm } (0 \pm 0.08 \text{ in})$**

- 1) Loosen the self-locking nut on the inner side of rear link.

#### NOTE:

When loosening or tightening the adjusting bolt, hold the bolt head and turn the self-locking nut.



(1) Adjusting bolt

(2) Rear link

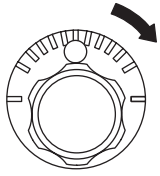
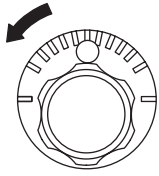
# Wheel Alignment

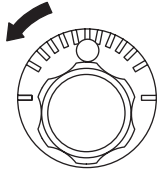
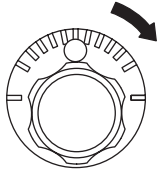
## FRONT SUSPENSION

2) Turn the adjusting bolt until toe-in is within the specification.

### NOTE:

When the left and right wheels are adjusted for toe-in at the same time, the movement of one scale graduation changes toe-in by approx. 0.6 mm (0.02 in).

To increase toe-in:	
Rotate the left side clockwise.	Rotate the right side counterclockwise.
 FS-00018	 FS-00019

To decrease toe-in:	
Rotate the left side counterclockwise.	Rotate the right side clockwise.
 FS-00019	 FS-00018

3) Attach and tighten a new self-locking nut.

### **Tightening torque:**

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

## 7. THRUST ANGLE

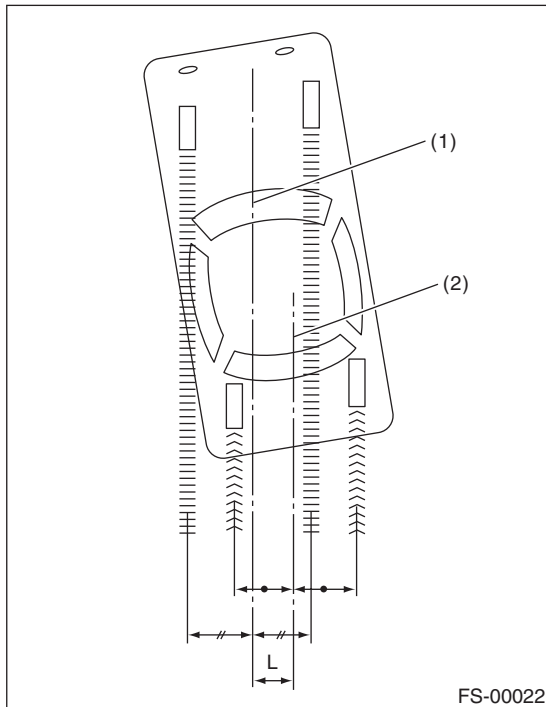
### • INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Move the vehicle 3 to 4 meters (10 to 13 feet) straight forward.
- 3) Draw the center of loci for both the front and rear axles.
- 4) Measure distance "L" between the center lines of the axle loci.

### Thrust angle

$0^{\circ} \pm 30'$

**Less than 30' when "L" is 23 mm (0.9 in) or less.**



- (1) Center line of loci (front axle)
- (2) Center line of loci (rear axle)

### • ADJUSTMENT

When adjusting, adjust it to the following value.

### Thrust angle

$0^{\circ} \pm 20'$

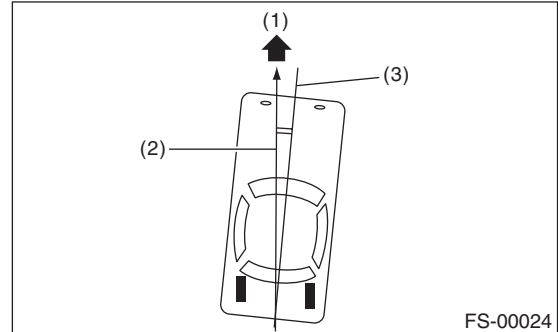
**Less than 20' when "L" is 15 mm (0.6 in) or less.**

- 1) Make thrust angle adjustments by turning the toe-in adjusting bolts of the rear suspension equally in the same direction.
- 2) When one rear wheel is adjusted in a toe-in direction, adjust the other rear wheel equally in toe-out direction, in order to make the thrust angle adjustment.

- 3) When the left and right adjusting bolts are turned by one graduation, the thrust angle will change approx. 17' ("L" is approx. 13 mm (0.51 in)).

### NOTE:

Thrust angle is a mean value of left and right wheel toe angles in relation to the vehicle body center line. Vehicle is driven straight in the thrust angle direction while slanting in the oblique direction depending on the degree of the mean thrust angle.



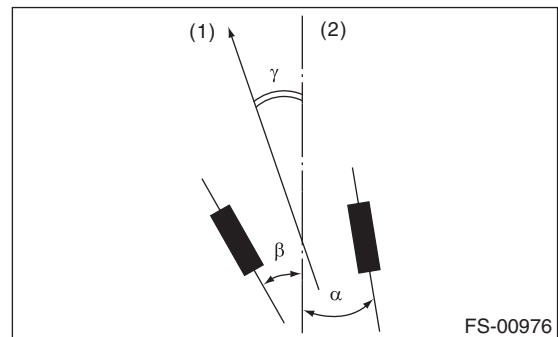
- (1) Front
- (2) Thrust angle
- (3) Body center line

### Thrust angle: $r = (\alpha - \beta)/2$

$\alpha$ : Rear RH wheel toe-in angle

$\beta$ : Rear LH wheel toe-in angle

Substitute only the positive toe-in values from each wheel into  $\alpha$  and  $\beta$  in the equation.



- (1) Front
- (2) Body center line

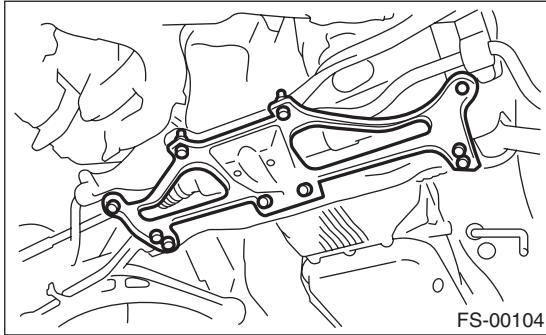
# Front Crossmember Support Plate

## FRONT SUSPENSION

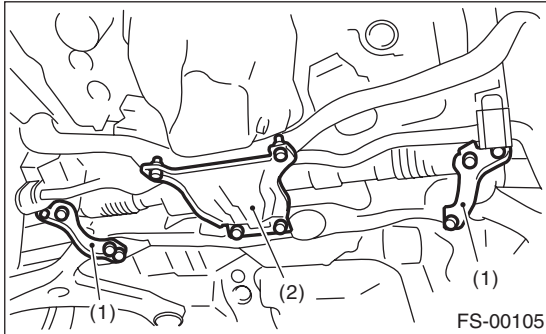
### 3. Front Crossmember Support Plate

#### A: REMOVAL

- 1) Lift up the vehicle.
  - 2) Remove the front under cover. <Ref. to EI-26, REMOVAL, Front Under Cover.>
  - 3) Remove the bolt and remove front crossmember support plate.
- Large type



- Small type



- (1) Crossmember support plate
- (2) Jack-up plate

#### B: INSTALLATION

Install in the reverse order of removal.

##### NOTE:

Tighten the small type crossmember support plate together with stabilizer bracket.

After installing the stabilizer bracket to the crossmember, tighten the crossmember support plate together.

##### *Tightening torque:*

***Crossmember support plate:***

***60 N·m (6.1 kgf·m, 44.3 ft·lb)***

***Crossmember support plate (Tightened together with the stabilizer bracket):***

***25 N·m (2.5 kgf·m, 18.1 ft·lb)***

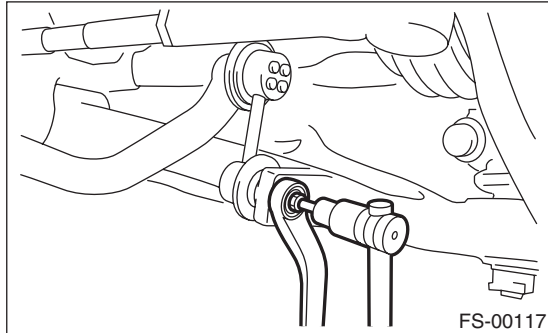
***Jack-up plate:***

***60 N·m (6.1 kgf·m, 44.3 ft·lb)***

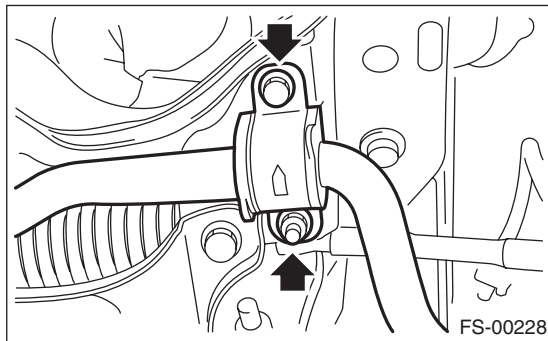
## 4. Front Stabilizer

### A: REMOVAL

- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front under cover. <Ref. to EI-26, REMOVAL, Front Under Cover.>
- 3) Remove the front crossmember support plate. <Ref. to FS-16, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the stabilizer link.



- 5) Remove the stabilizer bracket.

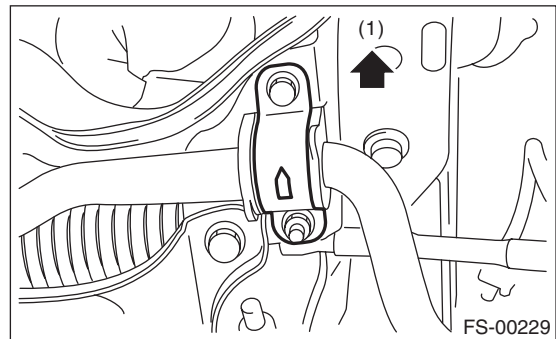


### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

- Use a new self-locking nut.
- Ensure the stabilizer bushing and stabilizer have the same identification colors.
- Install the stabilizer bushing (front crossmember side) while aligning it with the paint mark on stabilizer.
- The stabilizer bracket has a set orientation. Install it with the arrow mark facing the upper side of the vehicle.



(1) Front side of vehicle

#### Tightening torque:

##### Stabilizer link:

45 N·m (4.6 kgf·m, 33.2 ft·lb)

##### Stabilizer bracket:

25 N·m (2.5 kgf·m, 18.1 ft·lb)

### C: INSPECTION

- 1) Check the bushing for abnormal fatigue or damage.
- 2) Check the stabilizer link for damage.

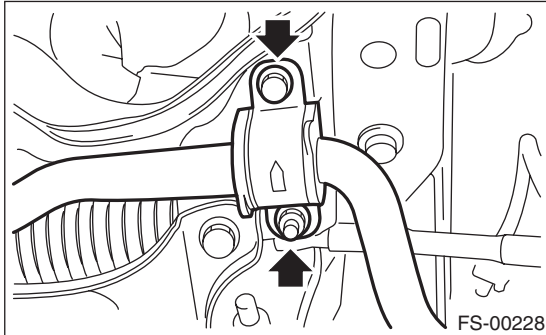
# Front Ball Joint

## FRONT SUSPENSION

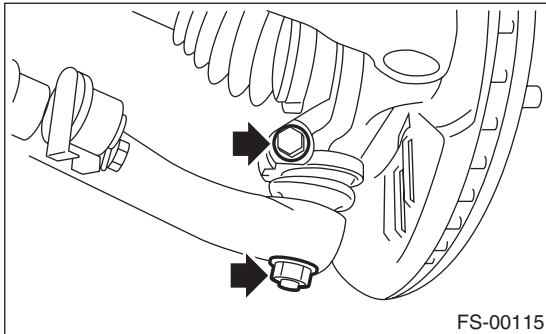
### 5. Front Ball Joint

#### A: REMOVAL

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the both sides of stabilizer bracket.



- 3) Pull out the pin from ball stud, remove the castle nut, and extract the ball stud from front arm.
- 4) Remove the bolt installing ball joint to housing.



- 5) Extract the ball joint from housing.

#### B: INSTALLATION

- 1) Insert the ball joint into housing.

**Tightening torque (Bolt):**  
**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

#### CAUTION:

Do not apply grease to the tapered portion of ball stud.

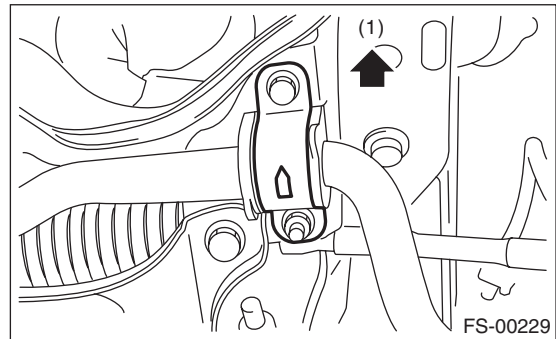
- 2) Install the ball joint into front arm.

**Tightening torque (castle nut):**  
**Front arm (aluminium type):**  
**30 N·m (3.1 kgf-m, 22 ft-lb)**  
**Front arm (steel type):**  
**39 N·m (4.0 kgf-m, 28.8 ft-lb)**

- 3) Retighten the castle nut further up to 60° until the hole in the ball stud is aligned with a slot in castle nut. Then, insert a new cotter pin and bend it around the castle nut.
- 4) Install the stabilizer bracket.

#### NOTE:

The stabilizer bracket has a set orientation. Install it with the arrow mark facing the upper side of the vehicle.



(1) Front side of vehicle

**Tightening torque:**  
**25 N·m (2.5 kgf-m, 18.1 ft-lb)**

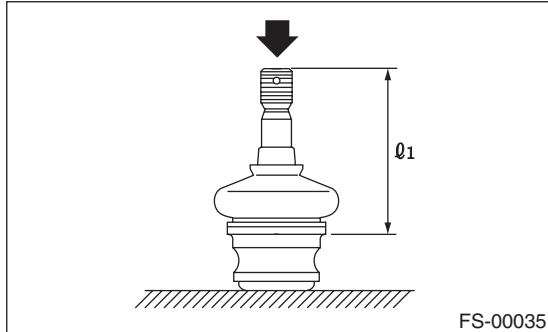
- 5) Install the front wheels.



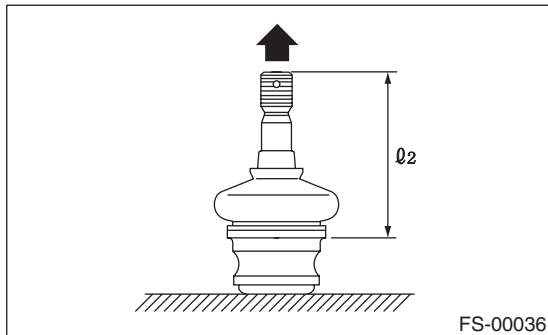
## C: INSPECTION

1) Measure the play of the ball joint using the following procedures. Replace with a new part if the play exceeds specification.

(1) With 686 N (70 kgf, 154 lb) loaded in direction shown in the figure, measure the length  $Q_1$ .



(2) With 686 N (70 kgf, 154 lb) loaded in direction shown in the figure, measure the length  $Q_2$ .



(3) Determine free play using the following formula.

$$S = Q_2 - Q_1$$

(4) Replace with a new part if the play exceeds specification.

### **Front ball joint**

#### **Specification for replacement S:**

**Less than 0.3 mm (0.012 in)**

2) If the play is within specification, visually check the dust cover.

3) Remove the ball joint and cover, and check for wear, damage or cracks. If any damage is found, replace the corresponding part.

4) If the dust cover is damaged, replace with a new ball joint.

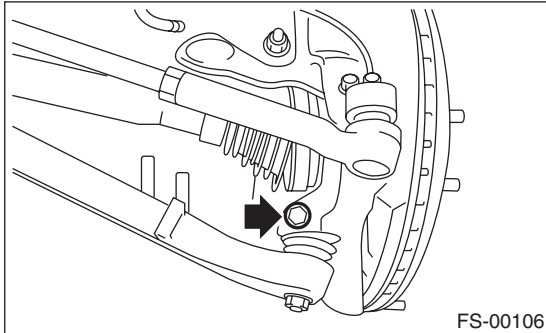
# Front Arm

## FRONT SUSPENSION

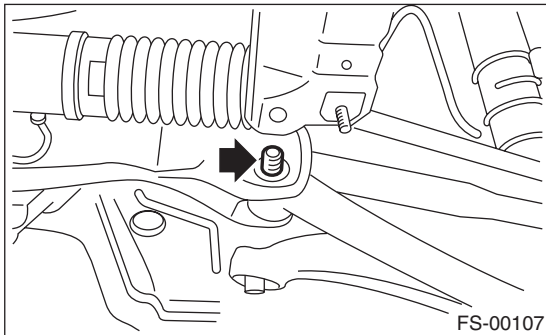
### 6. Front Arm

#### A: REMOVAL

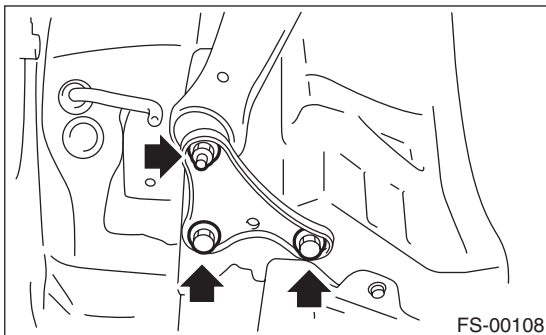
- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front crossmember support plate. <Ref. to FS-16, REMOVAL, Front Crossmember Support Plate.>
- 3) Remove the front stabilizer. <Ref. to FS-17, REMOVAL, Front Stabilizer.>
- 4) Remove the ball joint of front arm.



- 5) Remove the nut securing the front arm to crossmember. (Do not remove the bolt.)



- 6) Remove the front arm support plate.

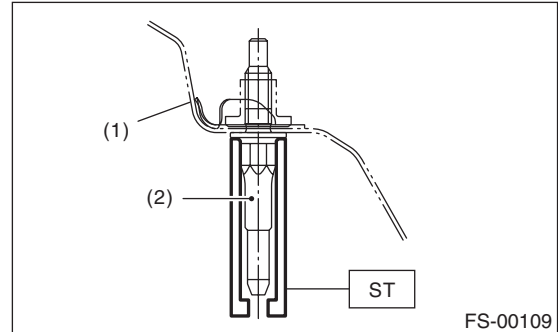


- 7) Remove the bolt securing front arm to crossmember and pull the front arm out of the crossmember.

- 8) To remove the stud bolt, use the ST.  
ST 20299AG020 STUD BOLT SOCKET

#### CAUTION:

**Do not remove the stud bolt without necessity. Always replace the parts with new parts when removed.**



- (1) Vehicle body
- (2) Stud bolt

#### B: INSTALLATION

- 1) Using the ST, install the stud bolt.  
ST 20299AG020 STUD BOLT SOCKET

#### Tightening torque:

**110 N·m (11.2 kgf-m, 81.1 ft-lb)**

- 2) Using new bolts and self-locking nuts, temporarily tighten the front arm to crossmember.
- 3) Secure the front arm to body, and then install the support plate with new bolts and self-locking nuts.

#### Tightening torque:

**Support plate to Front arm:**

**88 N·m (9.0 kgf-m, 64.9 ft-lb)**

**Support plate to Body:**

**150 N·m (15.3 kgf-m, 110.6 ft-lb)**

- 4) Install the ball joint into housing.

#### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

- 5) Install the stabilizer. <Ref. to FS-17, INSTALLATION, Front Stabilizer.>

- 6) Lower the vehicle from lift, and tighten the bolt which secures the front arm to crossmember with wheels in full contact with the ground and the vehicle at curb weight.

#### Tightening torque:

**95 N·m (9.7 kgf-m, 70.1 ft-lb)**

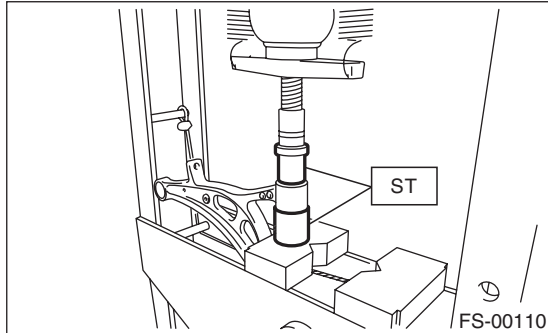
- 7) Inspect the wheel alignment and adjust if necessary.

## C: DISASSEMBLY

### 1. FRONT BUSHING

Using the ST and a press, remove the front bushing.

ST 927680000 INSTALLER & REMOVER SET

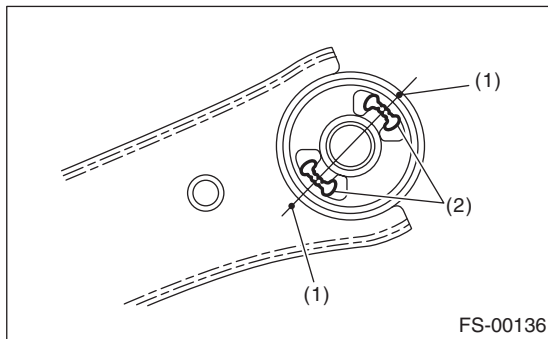


### 2. REAR BUSHING

1) Put an alignment mark on the front arm based on the center of rear bushing recess portion.

#### CAUTION:

**Always put an alignment mark for aligning the position on bushing installation.**

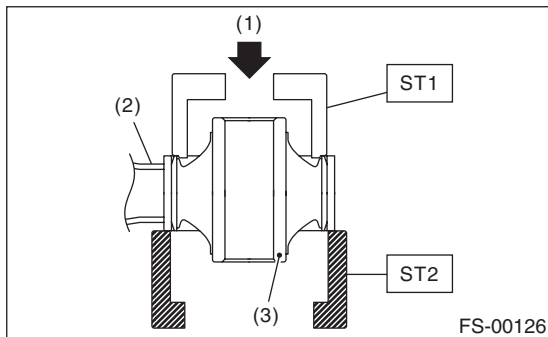


- (1) Put an alignment mark.
- (2) Recess section

2) Using the ST and a press, remove the rear bushing.

ST1 20299AG000 REMOVER

ST2 20299AG010 BASE



- (1) Press
- (2) Front arm
- (3) Rear bushing

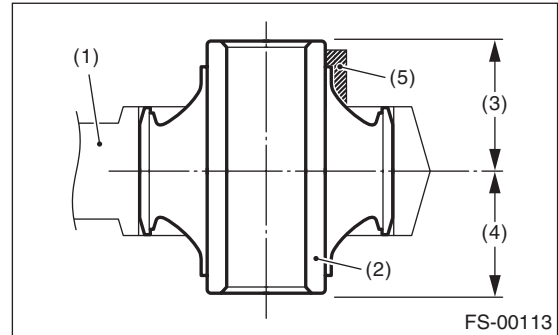
## D: ASSEMBLY

### 1. FRONT BUSHING

Assemble in the reverse order of disassembly.

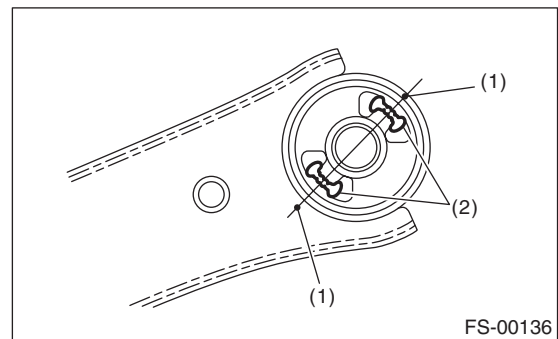
### 2. REAR BUSHING

1) Install the rear bushing with its longer inner cylinder facing upward and the shorter facing downward and protruding part rearward as shown in the figure.



- (1) Front arm
- (2) Bushing inner cylinder
- (3) Longer
- (4) Shorter
- (5) Protrusion portion

2) Align the center of rear bushing recess portion with the alignment mark on the front arm.



- (1) Alignment mark
- (2) Recess section

# Front Arm

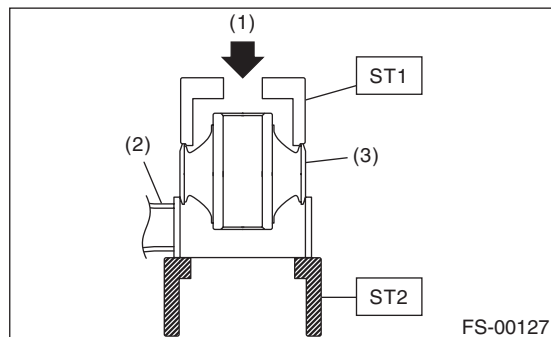
## FRONT SUSPENSION

---

3) Using the ST and a press, install the rear bushing.

ST1 20299AG000 REMOVER

ST2 20299AG010 BASE



- (1) Press
- (2) Front arm
- (3) Rear bushing

## E: INSPECTION

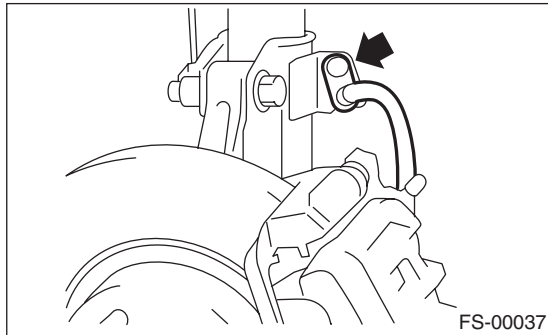
1) Check the front arm for damage or cracks, and correct or replace if defective.

2) Check the bushing for abnormal fatigue or damage.

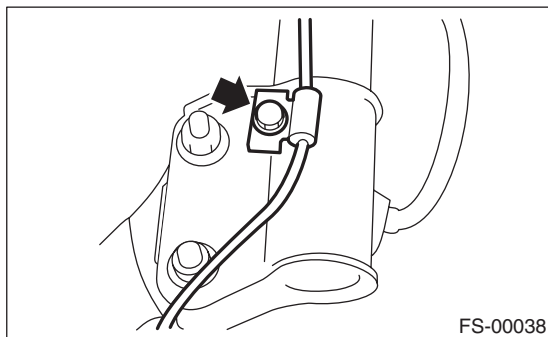
## 7. Front Strut

### A: REMOVAL

- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Place an alignment mark on the camber adjusting bolt and strut.
- 3) Remove the bolt securing the brake hose from the strut.



- 4) Remove the bolt securing the ABS wheel speed sensor harness.

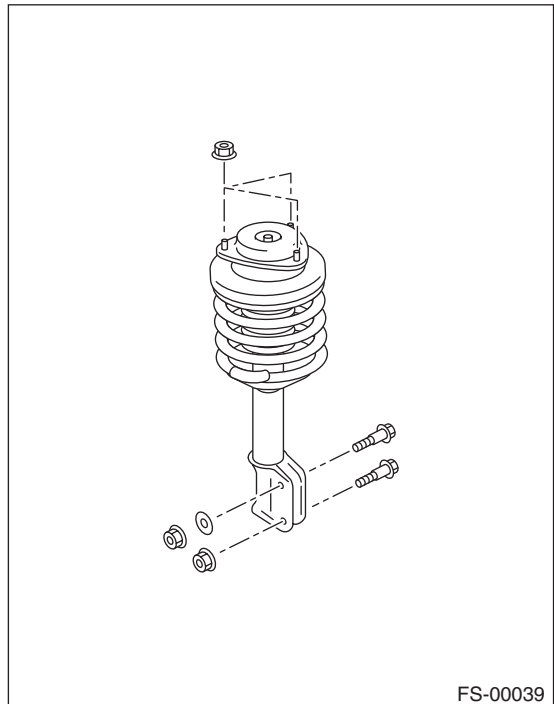


- 5) Remove the two bolts securing the housing to the strut.

**NOTE:**

While holding the head of the adjusting bolt, loosen the self-locking nut.

- 6) Remove the three nuts securing strut mount to body.



### B: INSTALLATION

- 1) Install the strut mount at the upper side of strut to body, and tighten it with new self-locking nuts.

**Tightening torque:**

**20 N·m (2.0 kgf-m, 14.5 ft-lb)**

- 2) Align alignment marks on the camber adjusting bolt and strut.

Using new self-locking nuts, install the strut to the housing.

**NOTE:**

While holding the head of adjusting bolt, tighten the self-locking nut.

**Tightening torque:**

**152 N·m (15.5 kgf-m, 112.1 ft-lb)**

- 3) Secure the ABS wheel speed sensor harness to the strut.

**Tightening torque:**

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**

- 4) Install the bolts which secure the brake hose to the strut.

**Tightening torque:**

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**

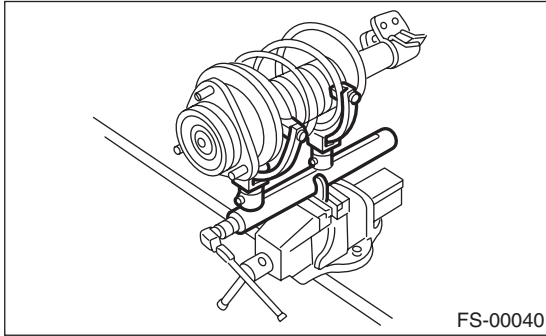
- 5) Install the front wheels.
- 6) Inspect the wheel alignment and adjust if necessary.

# Front Strut

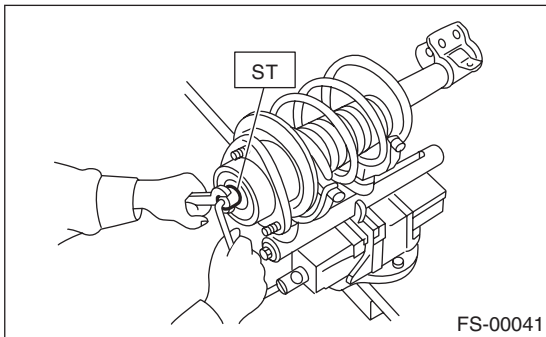
## FRONT SUSPENSION

### C: DISASSEMBLY

1) Using a coil spring compressor, compress the coil spring.



2) Using the ST, remove the self-locking nut.  
ST 20399AG000 STRUT MOUNT SOCKET



3) Remove the strut mount, spacer and upper spring seat from strut.

4) Gradually decrease the compression force of compressor, and remove the coil spring.

5) Remove the dust cover and helper spring.

### D: ASSEMBLY

1) Before installing the coil spring, strut mount, etc. on strut, check for the presence of air in the dampening force generating mechanism of the strut since air prevents proper dampening force production.

2) Checking for presence of air

(1) Place the strut vertically with the piston rod facing up.

(2) Move the piston rod to the center of its entire stroke.

(3) While holding the piston rod end with fingers, move the rod up and down.

(4) If the piston rod moves 10 mm (0.39 in) or more in the former step, purge air from the strut.

3) Air purging procedure

(1) Place the strut vertically with the piston rod facing up.

(2) Fully extend the piston rod.

(3) With the piston rod fully extended, place the piston rod side down. The strut must stand vertically.

(4) Fully retract the piston rod.

(5) Repeat 3 or 4 times from the step (1).

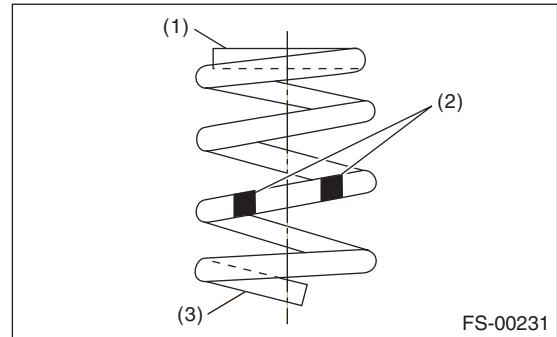
NOTE:

After purging air from the strut, be sure to place the strut with the piston rod facing up. If the strut is laid down for any reason, check for the entry of air in accordance with "Checking for presence of air"

4) Using a coil spring compressor, compress the coil spring.

NOTE:

Make sure that the vertical install direction of the coil spring is as shown in the figure.

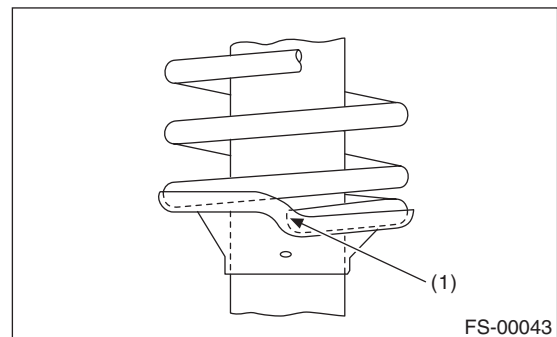


(1) Diameter is small (Upper part)

(2) Identification paint

(3) Diameter is large (Bottom part)

5) Set the coil spring correctly so that its end face seats well in the spring seat as shown in the figure.



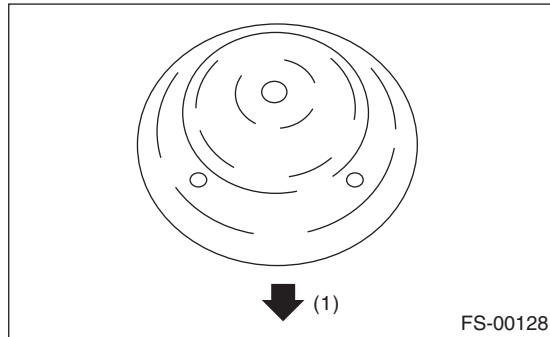
(1) Coil spring end face

6) Install the helper and dust cover to the piston rod.

7) Pull the piston rod fully upward, and install the spring seat.

**NOTE:**

Position the upper spring seat as shown in the figure.



(1) Outside of body

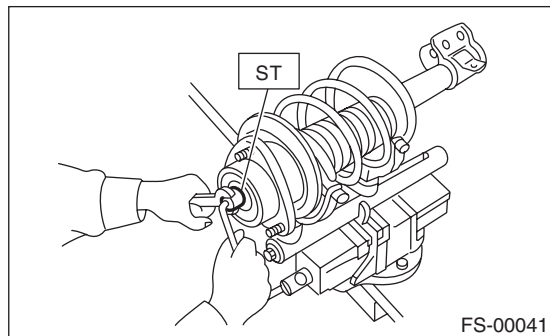
8) Install spacer and the strut mount to piston rod, and tighten a new self-locking nut temporarily.

9) Using a hexagon wrench to prevent strut rod from turning, tighten the new self-locking nut with ST.

ST 20399AG000 STRUT MOUNT SOCKET

**Tightening torque:**

**55 N·m (5.6 kgf·m, 41 ft·lb)**



10) Loosen the coil spring compressor carefully.

**E: INSPECTION**

Check the removed part for wear, damage and cracks, and then repair or replace it if defective.

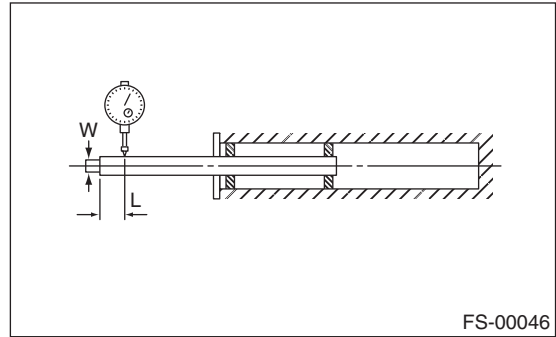
**1. DAMPER STRUT**

- 1) Check for oil leaks.
- 2) Move the piston rod up and down to check that it operates smoothly without any hitch.

**3) Piston rod play**

Measure the play as follows:

Fix the outer shell in place and fully extend the rod. Set a dial gauge at the end of rod L [10 mm (0.39 in)], and then read the dial gauge indication  $P_1$  while applying a force of W [20 N (2 kgf, 4 lb)] to the threaded portion. Apply a force of 20 N (2 kgf, 4 lb) from the opposite direction of "W", and then read the dial gauge indication  $P_2$ .



**Play limit ( $P_1 + P_2$ ):**  
**0.8 mm (0.031 in)**

If the play exceeds limit, replace the strut.

**2. STRUT MOUNT**

Check the rubber part for deformation, cracks or deterioration, and then replace it with a new part if defective.

**3. DUST COVER**

If major cracks or damage are found, replace it with a new part.

**4. COIL SPRING**

If a permanent strain is found, replaced it with a new part.

**5. HELPER**

If major cracks or damage are found, replace it with a new part.

# Front Strut

## FRONT SUSPENSION

### F: DISPOSAL

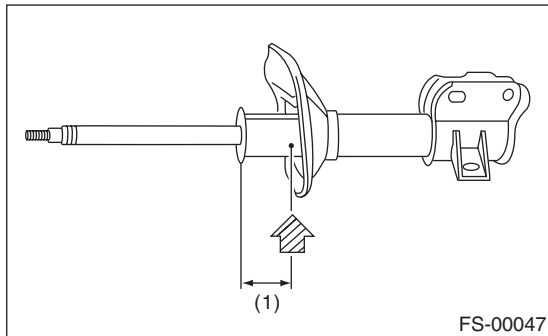
#### 1. EXCEPT FOR BILSTEIN STRUT

##### CAUTION:

- Before handling struts, be sure to wear goggles to protect eyes from gas, oil and cutting powder.
- Do not disassemble the strut damper or throw into flames.
- When discarding gas filled struts, drill holes in them to purge the gas.

1) Place the strut on a level surface with the piston rod fully expanded.

2) Using a 2 — 3 mm (0.08 — 0.12 in) dia. drill, make holes in areas shown in the figure.



(1) 40 mm (1.57 in)

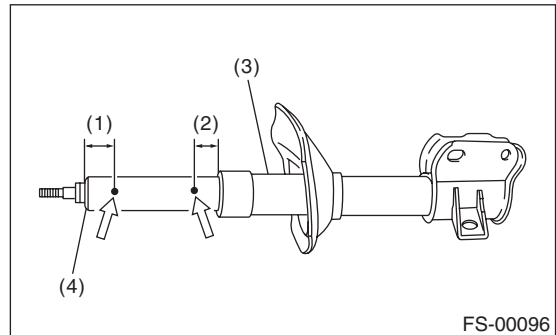
#### 2. BILSTEIN STRUT

##### CAUTION:

- Before handling struts filled with gas, be sure to wear goggles to protect eyes from gas, oil and metal shavings.
- Do not disassemble the strut damper or throw into flames.
- When discarding gas filled struts, drill holes in them to purge the gas.

1) Place the gas-filled strut on a level surface with the damping tube fully extended.

2) Using a 2 — 3 mm (0.08 — 0.12 in) dia. drill, make the holes at (1) first, and then (2).



(1) 20 mm (0.78 in)

(2) 10 mm (0.39 in)

(3) Strut

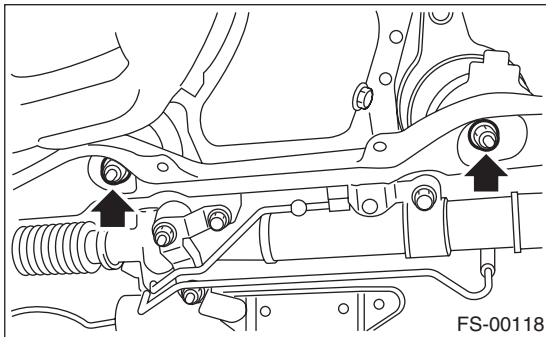
(4) Damping tube



## 8. Front Crossmember

### A: REMOVAL

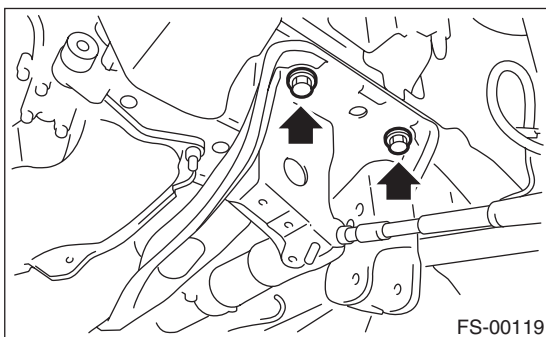
- 1) Lift up the vehicle, and then remove the front wheels.
- 2) Remove the front exhaust pipe.
- 3) Remove the front crossmember support plate. <Ref. to FS-16, REMOVAL, Front Crossmember Support Plate.>
- 4) Remove the front stabilizer. <Ref. to FS-17, REMOVAL, Front Stabilizer.>
- 5) Disconnect the tie-rod end from housing.
- 6) Remove the front arm. <Ref. to FS-20, REMOVAL, Front Arm.>
- 7) Remove the nuts attaching the engine mount cushion rubber to crossmember.



- 8) Remove the steering universal joint.
- 9) Disconnect the power steering hose from steering gearbox.
- 10) Lift the engine approx. 10 mm (0.39 in) using a chain block.
- 11) Support the crossmember with a jack, remove the bolts securing crossmember to body, and then gradually lower the crossmember with steering gearbox as a unit.

### CAUTION:

**When removing the crossmember downward, be careful that the tie-rod end does not interfere with drive shaft boot.**



### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### NOTE:

- Use a new bolt and self-locking nut. For parts which are not reusable, refer to "COMPONENT". <Ref. to FS-4, COMPONENT, General Description.>
- Always tighten the stabilizer bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

#### Tightening torque:

##### **Crossmember to body:**

**95 N·m (9.7 kgf-m, 70.1 ft-lb)**

##### **Engine mounting to Crossmember:**

**75 N·m (7.6 kgf-m, 55.3 ft-lb)**

##### **Front arm to Crossmember:**

**95 N·m (9.7 kgf-m, 70.1 ft-lb)**

##### **Front arm to Support plate:**

**88 N·m (9.0 kgf-m, 64.9 ft-lb)**

##### **Support plate to Body:**

**150 N·m (15.3 kgf-m, 110.6 ft-lb)**

##### **Tie-rod end to Housing:**

**27.0 N·m (2.75 kgf-m, 19.9 ft-lb)**

After tightening to the specified torque, tighten the castle nut further but within 60° until the hole in the ball stud is aligned with a slot in castle nut

##### **Universal joint:**

**24 N·m (2.4 kgf-m, 17.7 ft-lb)**

##### **Stabilizer bracket:**

**25 N·m (2.5 kgf-m, 18.1 ft-lb)**

##### **Stabilizer link:**

**45 N·m (4.6 kgf-m, 33.2 ft-lb)**

##### **Power steering hose to Steering gearbox:**

**15 N·m (1.5 kgf-m, 11 ft-lb)**

- 2) Purge air from the power steering system.
- 3) Inspect the wheel alignment and adjust if necessary.

### C: INSPECTION

Check the crossmember for wear, damage or cracks, and then repair or replace if faulty.

# General Diagnostic Table

## FRONT SUSPENSION

### 9. General Diagnostic Table

#### A: INSPECTION

##### 1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible cause	Corrective action
(1) Permanent distortion or damage of the coil spring	Replace.
(2) Rough operation of damper strut or shock absorber	Replace.
(3) Improper installation of strut or shock absorber	Replace with appropriate parts.
(4) Installation of the wrong coil spring	Replace with appropriate parts.

##### 2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of the vehicle continues too long after running over bump and hump.
- 3) Excessive shock in bumping

Possible cause	Corrective action
(1) Damaged coil spring	Replace.
(2) Overinflation of tires	Adjust.
(3) Improper wheel arch height	Adjust or replace the coil springs with new parts.
(4) Fault in operation of damper strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of damper strut or shock absorber	Replace with appropriate parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly or shock absorber	Replace.
(9) Oil leakage from the damper strut or shock absorber	Replace.

##### 3. NOISE

Possible cause	Corrective action
(1) Wear or damage of damper strut or shock absorber component parts	Replace.
(2) Loosening of the suspension link installing bolt	Tighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitable length (maximum or minimum) of damper strut or shock absorber	Replace with appropriate parts.
(5) Damaged coil spring	Replace.
(6) Wear or damage of the ball joint	Replace.
(7) Deformation of the stabilizer clamp	Replace.

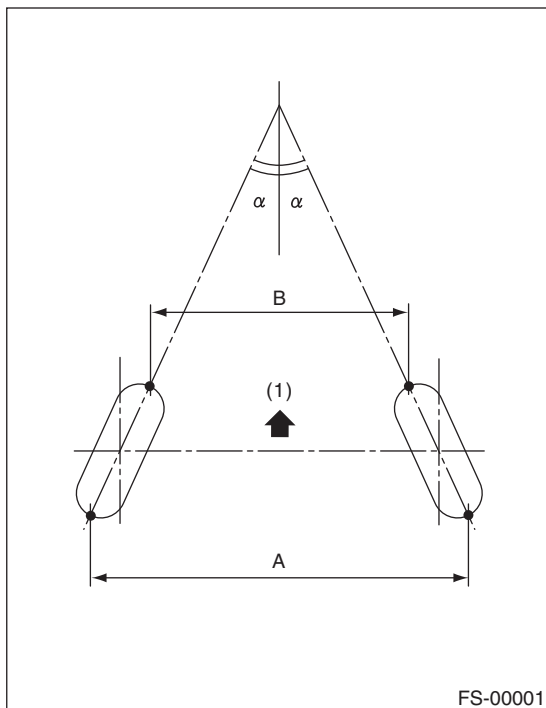
### 1. General Description

#### A: SPECIFICATION

Refer to "FS" section for rear suspension specifications. <Ref. to FS-2, SPECIFICATION, General Description.>

**NOTE:**

- Front and rear toe-in and front camber can be adjusted. Adjust if the toe-in or camber tolerance exceeds specifications.
- Other items indicated in the specifications table cannot be adjusted. If other items exceed specifications, check the suspension parts and connections for deformation, and replace with new parts as required.



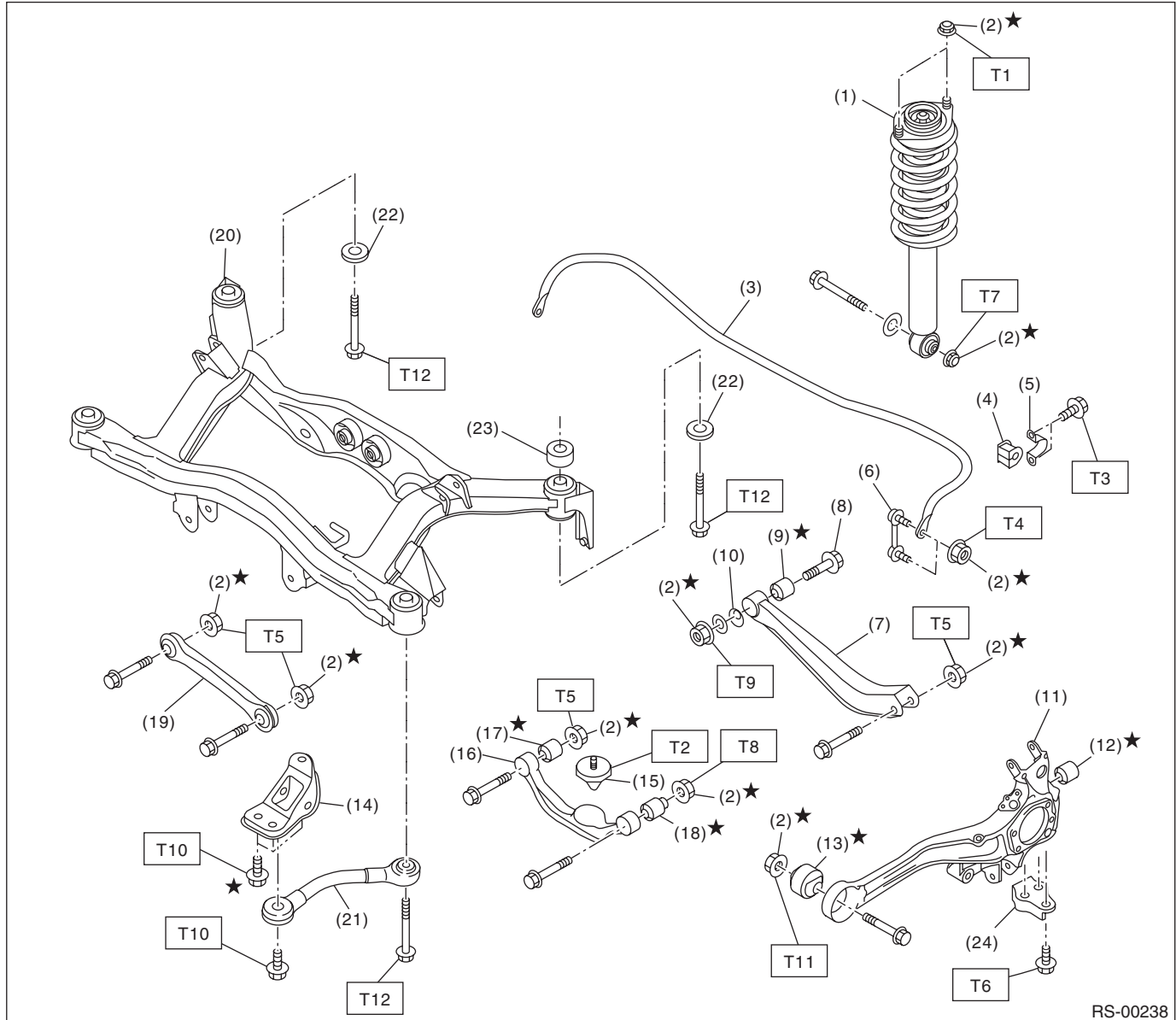
(1) Front

A – B = Positive: Toe-in, Negative: Toe-out

$\alpha$  = Individual toe angles

### B: COMPONENT

#### 1. REAR SUSPENSION



RS-00238

- |                             |                                      |
|-----------------------------|--------------------------------------|
| (1) Shock absorber          | (14) Rear arm bracket                |
| (2) Self-locking nut        | (15) Helper                          |
| (3) Stabilizer              | (16) Upper link                      |
| (4) Stabilizer bushing      | (17) Upper link bushing (inner side) |
| (5) Bracket                 | (18) Upper link bushing (outer side) |
| (6) Stabilizer link         | (19) Front link                      |
| (7) Rear link               | (20) Rear sub frame                  |
| (8) Adjusting bolt          | (21) Sub frame support arm           |
| (9) Rear link bushing       | (22) Sub frame lower stopper         |
| (10) Adjusting washer       | (23) Spacer                          |
| (11) Rear arm               | (24) Stabilizer link bracket         |
| (12) Rear arm rear bushing  | (model with aluminum rear arm)       |
| (13) Rear arm front bushing |                                      |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 30 (3.1, 22.4)**

**T2: 32 (3.3, 24)**

**T3: 38 (3.9, 28)**

**T4: 44 (4.5, 32.5)**

**T5: 57 (5.8, 42)**

**T6: 60 (6.1, 44)**

**T7: 62 (6.3, 46)**

**T8: 65 (6.6, 48)**

**T9: 120 (12.2, 89)**

**T10: 125 (12.7, 92)**

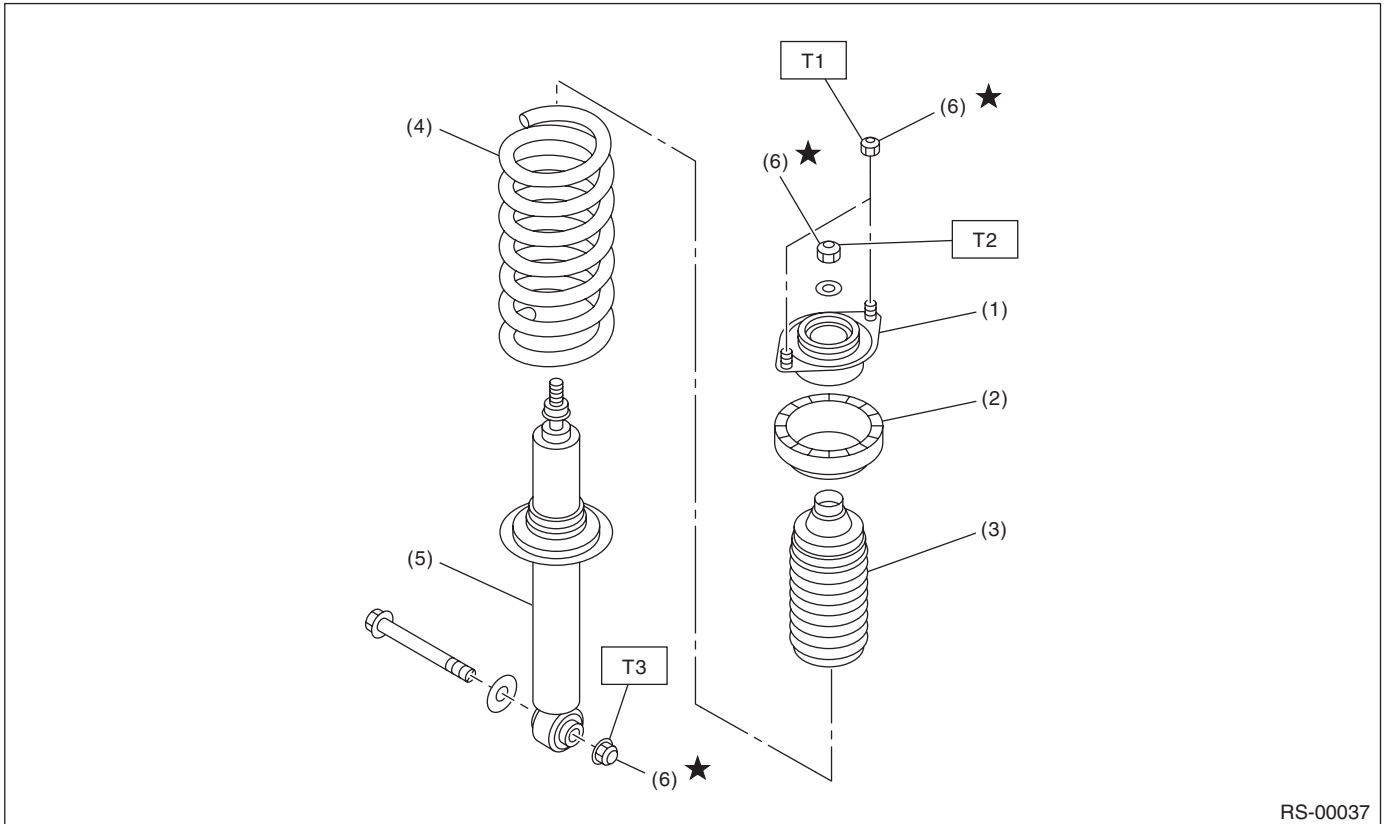
**T11: 150 (15.3, 111)**

**T12: 175 (17.8, 129)**

# General Description

## REAR SUSPENSION

### 2. SHOCK ABSORBER



- |                        |                      |
|------------------------|----------------------|
| (1) Mount              | (4) Coil spring      |
| (2) Upper rubber sheet | (5) Shock absorber   |
| (3) Dust cover         | (6) Self-locking nut |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 30 (3.1, 22.4)**

**T2: 35 (3.6, 26)**

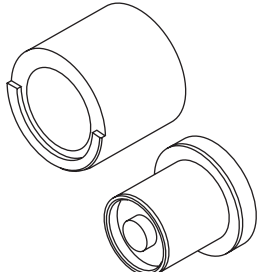
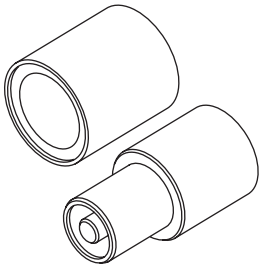
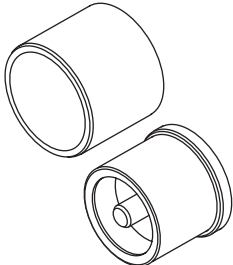
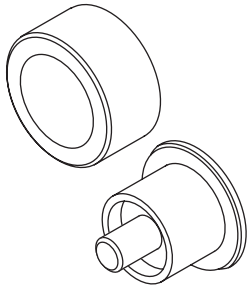
**T3: 62 (6.3, 46)**

### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before disposing of shock absorbers, be sure to bleed the gas out completely. Also, do not expose to flames or fire.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

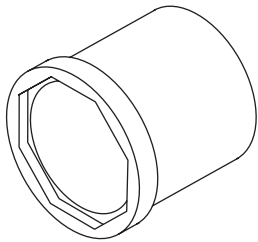
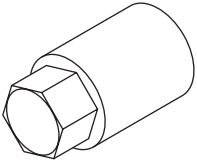
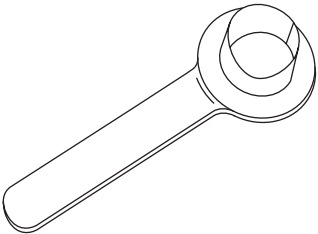
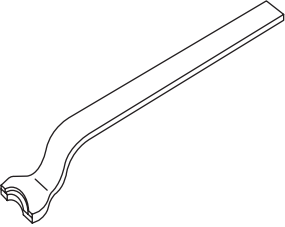
## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST20099AE000</p>	20099AE000	INSTALLER & REMOVER	Used for replacing the rear link bushing.
 <p style="text-align: center;">ST20099AE010</p>	20099AE010	INSTALLER & REMOVER	Used for replacing the upper link bushing.
 <p style="text-align: center;">ST20099AE020</p>	20099AE020	INSTALLER & REMOVER SET	Used for replacing the rear arm front bushing.
 <p style="text-align: center;">ST20099AE040</p>	20099AE040	INSTALLER & REMOVER SET	Used for replacing the rear arm rear bushing.

# General Description

## REAR SUSPENSION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST20099AE030</p>	20099AE030	HELPER SOCKET WRENCH	Used for replacing helper.
 <p style="text-align: center;">ST20399AG000</p>	20399AG000	STRUT MOUNT SOCKET	Used for removing and installing shock mount.
 <p style="text-align: center;">ST28099PA090</p>	28099PA090	OIL SEAL PROTECTOR	<ul style="list-style-type: none"> <li>• Used for installing the rear drive shaft to the rear differential.</li> <li>• For oil seal protection</li> </ul>
 <p style="text-align: center;">ST28099PA100</p>	28099PA100	REMOVER	Used for removal of DOJ.

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Alignment gauge	Used for measuring wheel alignment.
Alignment gauge adapter	Used for measuring wheel alignment.
Turning radius gauge	Used for measuring wheel alignment.
Toe-in gauge	Used for toe-in measurement.
Transmission jack	Used for removing and installing suspension.
Bearing puller	Used for removing bushings.
Coil spring compressor	Used for disassembling and assembling shock absorber.

## 2. Wheel Alignment

### A: INSPECTION

**NOTE:**

Measure and adjust the front and rear wheel alignment at a time. Refer to "FS" section for measurement and adjustment of wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>



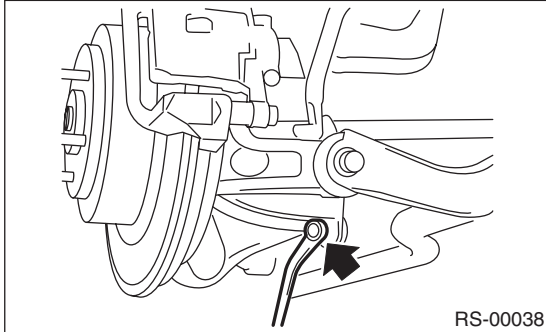
# Rear Stabilizer

## REAR SUSPENSION

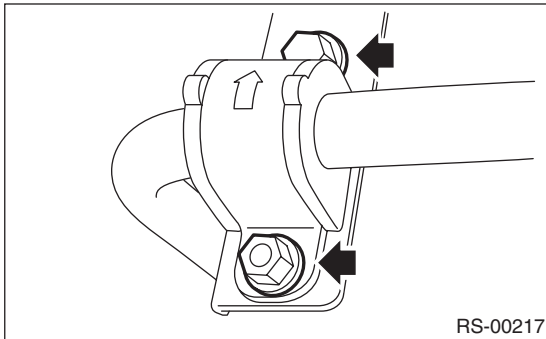
### 3. Rear Stabilizer

#### A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the stabilizer link.



- 3) Remove the stabilizer bracket.

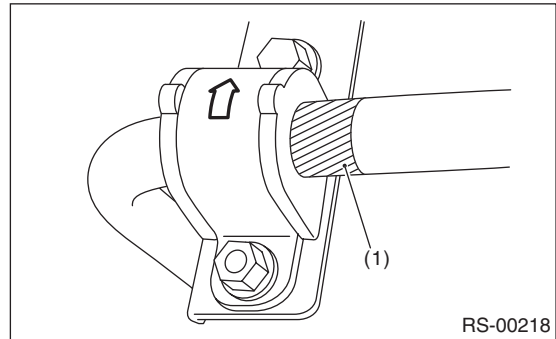


#### B: INSTALLATION

- 1) Install in the reverse order of removal.

##### NOTE:

- Use a new self-locking nut.
- Ensure the stabilizer bushing and stabilizer have the same identification colors.
- To install the stabilizer bushing, align the paint mark end of stabilizer to the end of stabilizer bushing.
- The stabilizer bracket has a set orientation. Install it with the arrow mark facing the upper side of the vehicle.



(1) Paint mark

- 2) Always tighten the stabilizer bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.

##### **Tightening torque:**

###### **Stabilizer link**

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**

###### **Stabilizer bracket**

**38 N·m (3.9 kgf·m, 28 ft·lb)**

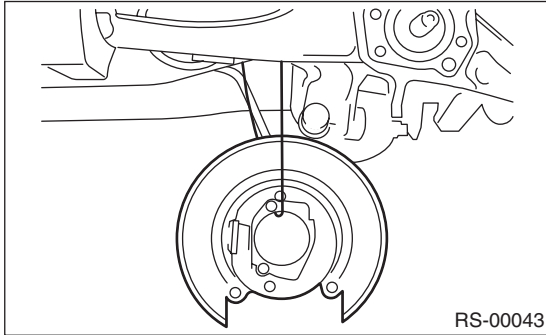
#### C: INSPECTION

- 1) Check the bushing for abnormal fatigue or damage.
- 2) Check the stabilizer link for damage.

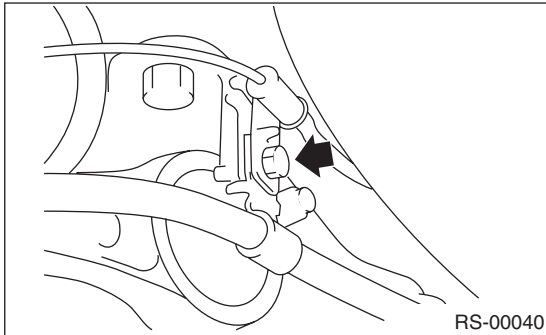
## 4. Rear Arm

### A: REMOVAL

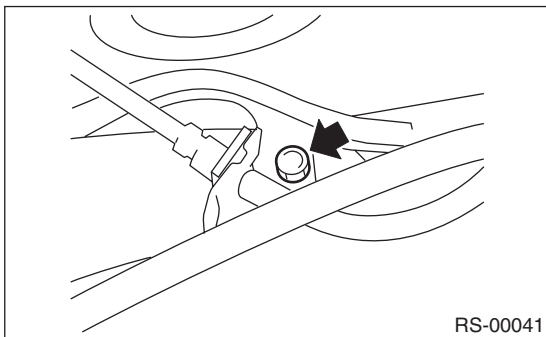
- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the sub frame support arm.  
<Ref. to RS-20, REMOVAL, Sub Frame Support Arm.>
- 3) Remove the bearing unit.  
<Ref. to DS-19, REMOVAL, Rear Hub Unit Bearing.>
- 4) Hang the back plate from sub frame.



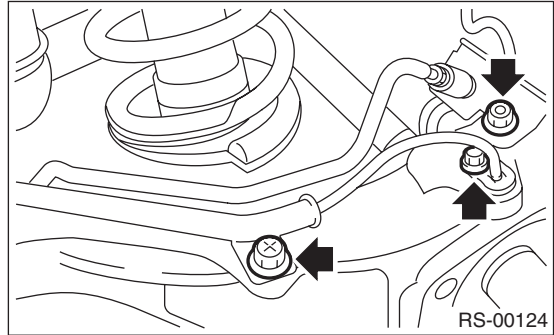
- 5) Remove the bolt which secures the parking brake cable clamp to the rear arm bracket.



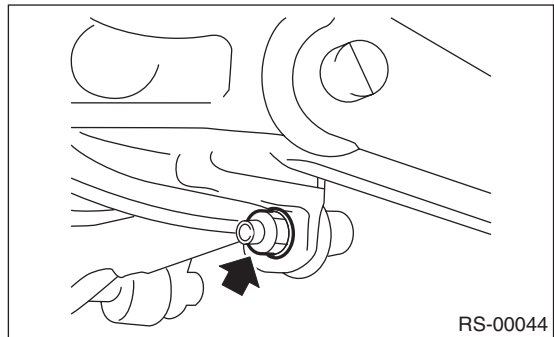
- 6) Remove the bolt which holds the brake hose bracket and ABS wheel speed sensor bracket to the rear arm.



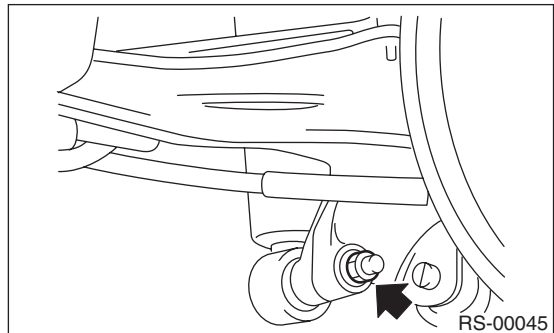
- 7) Remove the bolts which secure the brake hose bracket to the rear arm. Remove the bolts which secure the ABS wheel speed sensor to the rear arm.



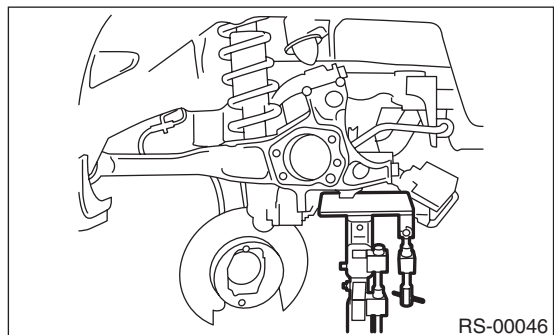
- 8) Remove the stabilizer link from the rear arm.



- 9) Remove the shock absorber from the rear arm.



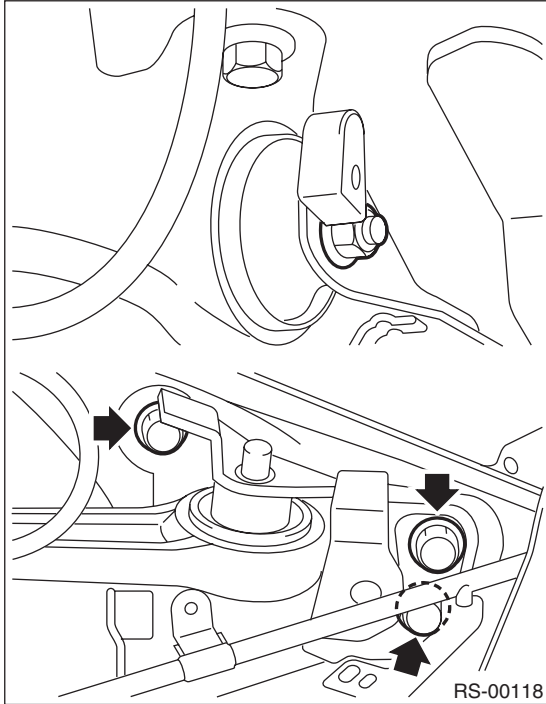
- 10) Support the rear arm horizontally using a transmission jack.



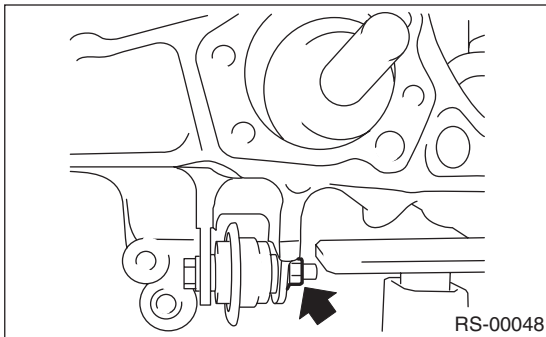
# Rear Arm

## REAR SUSPENSION

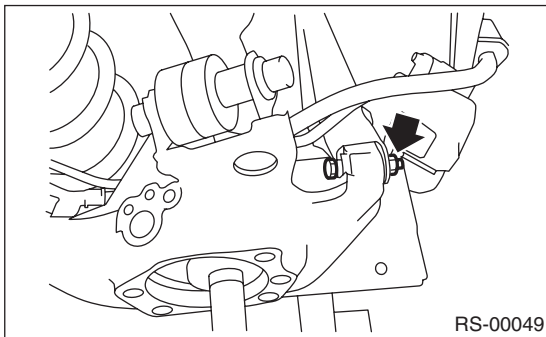
11) Remove the nuts which hold the rear arm to bracket. Remove the bolts and then remove the rear frame bracket.



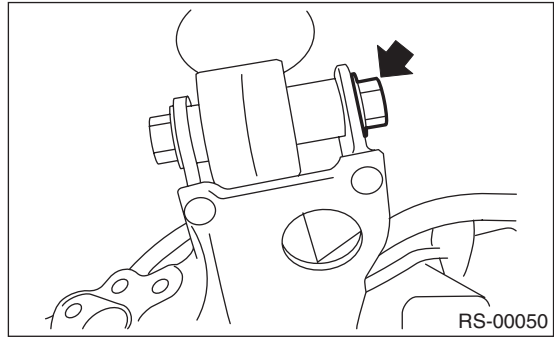
12) Loosen the nut which holds the front link to the rear arm.



13) Loosen the nut which holds the rear link to the rear arm.



14) Loosen the nut which holds the upper link to the rear arm.



15) Remove the bolt which secures the rear arm to the link, and then remove the rear arm.

## B: INSTALLATION

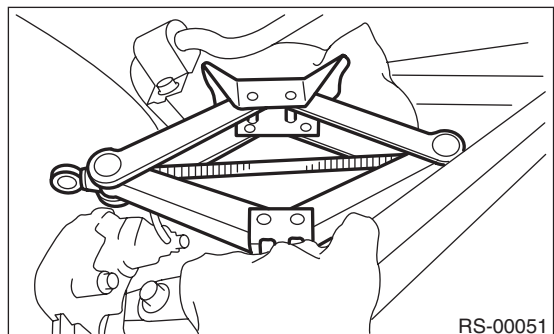
### NOTE:

Use a new bolt and self-locking nut. For parts which are not reusable, refer to "COMPONENT". <Ref. to RS-3, REAR SUSPENSION, COMPONENT, General Description.>

- 1) Support the rear arm using a transmission jack.
- 2) Install the rear arm and temporarily tighten the bolts which hold the rear arm to the link.
- 3) Install the bearing unit.  
<Ref. to DS-20, INSTALLATION, Rear Hub Unit Bearing.>
- 4) Install the bolts which secure the ABS wheel speed sensor to rear arm.
- 5) Install the bolts which secure the brake hose to the rear arm.
- 6) Install bolts which secure the parking brake cable clamp to the rear arm bracket.
- 7) Set the vehicle equipped jack upside down, between the rear link and sub frame. Align the location of the jack, and with the rear shock absorber and rear arm attachment locations matched, temporarily tighten the bolt and nut.

### CAUTION:

Protect the rear link and sub frame from being damaged by putting a waste cloth between the contact surface with the jack.

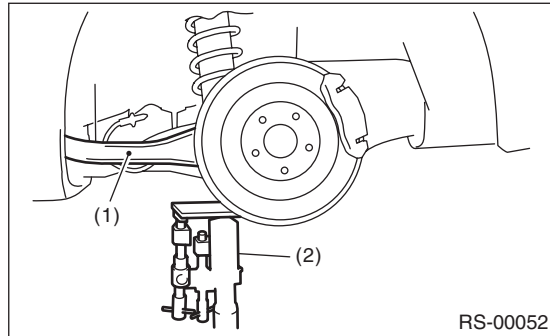


8) Support the rear arm horizontally using a transmission jack.

9) Tighten the nuts and bolts which hold the rear arm, front link, rear link, upper link and shock absorber.

**NOTE:**

Always tighten the stabilizer bushing in the state where the vehicle is at curb weight and the wheels are in full contact with the ground.



- (1) Rear arm
- (2) Transmission jack

10) Install the sub frame support arm.

**Tightening torque:**

**Refer to "COMPONENT" of "General Description" for the tightening torque. <Ref. to RS-3, REAR SUSPENSION, COMPONENT, General Description.>**

11) Inspect the wheel alignment and adjust if necessary.

## C: DISASSEMBLY

### 1. FRONT BUSHING

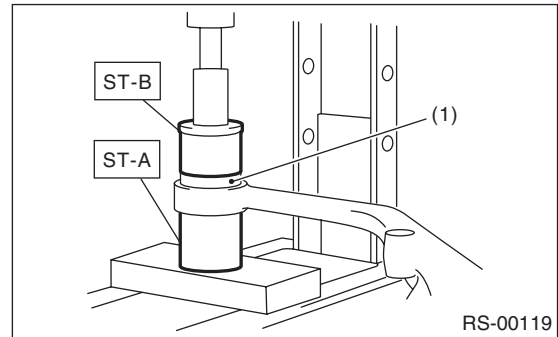
1) Set the ST A with the larger side of its inner diameter turned upward.

2) Set the rear arm with the protruding side of bushing turned upward.

3) Place the ST B on bushing, and push the bushing out.

ST A 20099AE020INSTALLER & REMOVER SET

ST B 20099AE020INSTALLER & REMOVER SET

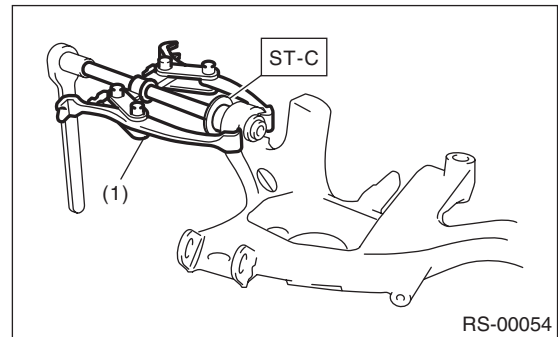


- (1) Bushing

### 2. REAR BUSHING

Using the ST C and bearing puller, press the rear bushing out.

ST C 20099AE040INSTALLER & REMOVER SET



- (1) Bearing puller

# Rear Arm

## REAR SUSPENSION

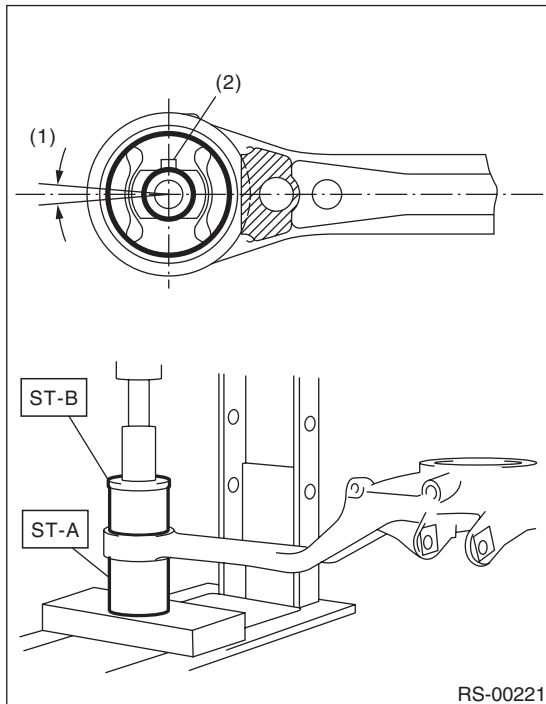
### D: ASSEMBLY

#### 1. FRONT BUSHING

- 1) Set the ST A with the larger side of its inner diameter turned upward.
- 2) Set the rear arm with the vehicle inner side of arm turned downward.
- 3) Place the bushing on rear arm as shown in the figure.
- 4) Place the ST B on the bushing, and press-fit until each edge surface of bushing and rear arm is aligned.

ST A 20099AE020INSTALLER & REMOVER SET

ST B 20099AE020INSTALLER & REMOVER SET



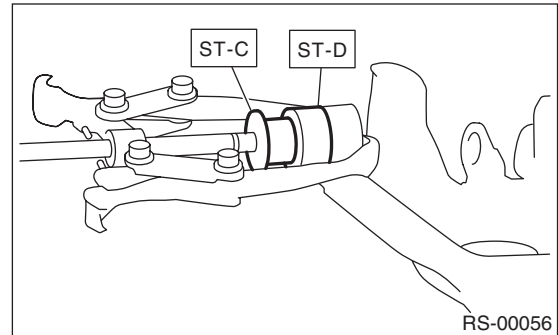
- (1)  $0 \pm 5^\circ$
- (2) Rubber protrusion: Assemble with the rubber protrusion side facing the arm inner side.

#### 2. REAR BUSHING

- 1) Insert the bushing into the bore of ST D.
- 2) Set the ST C, ST D and bearing puller in the specified positions as shown in the figure, and then press-fit the bushing until the outer end of bushing and rear end of rear arm is flat.

ST C 20099AE040INSTALLER & REMOVER SET

ST D 20099AE040INSTALLER & REMOVER SET



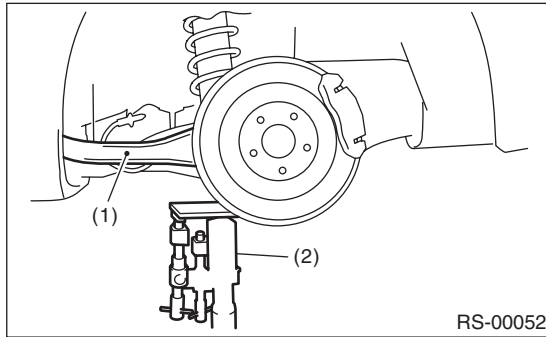
### E: INSPECTION

Check the rear arm for bending, corrosion or damage.

## 5. Upper Link

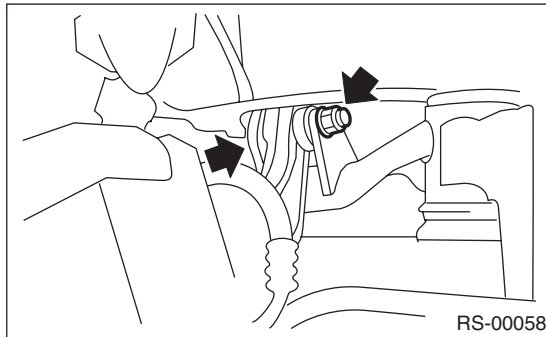
### A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Support the rear arm horizontally using a transmission jack.

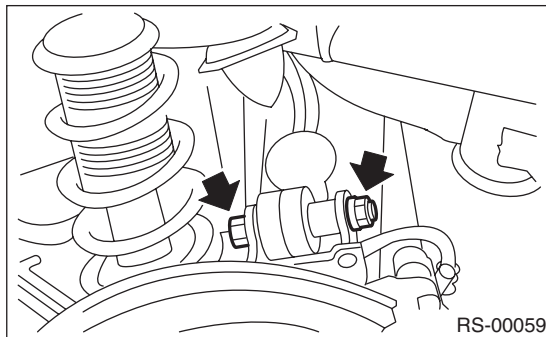


- (1) Rear arm
- (2) Transmission jack

- 3) Remove the bolt which secures the upper link to sub frame.

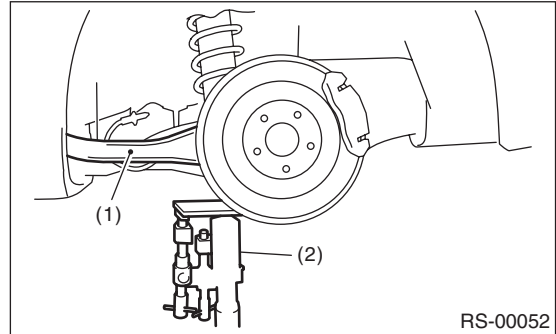


- 4) Remove the bolts which secure the upper link to the rear arm, and then remove the upper link.



### B: INSTALLATION

- 1) Support the rear arm horizontally using a transmission jack.
- 2) Using new self-locking nuts, install the upper link.



- (1) Rear arm
- (2) Transmission jack

#### NOTE:

Inspect the wheel alignment and adjust if necessary.

#### Tightening torque:

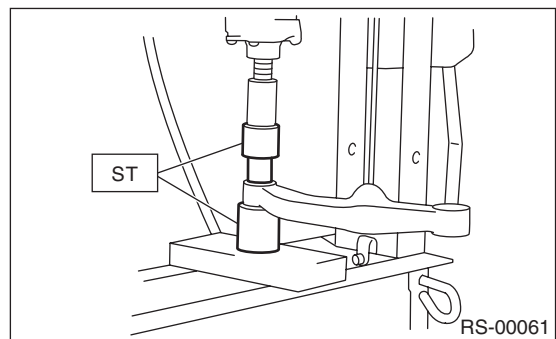
**Upper link-to-Sub frame**  
57 N·m (5.8 kgf-m, 42 ft-lb)

**Upper link-to-Rear arm**  
65 N·m (6.6 kgf-m, 48 ft-lb)

### C: DISASSEMBLY

Using the ST, press the bushing out.

ST 20099AE010 INSTALLER & REMOVER



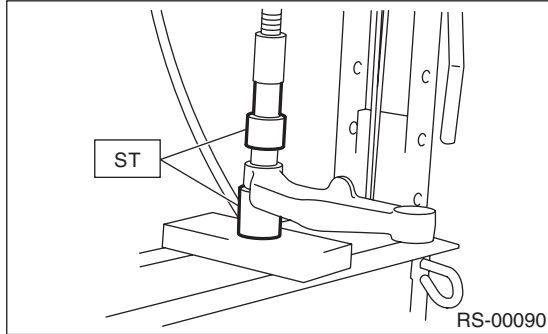
# Upper Link

## REAR SUSPENSION

### D: ASSEMBLY

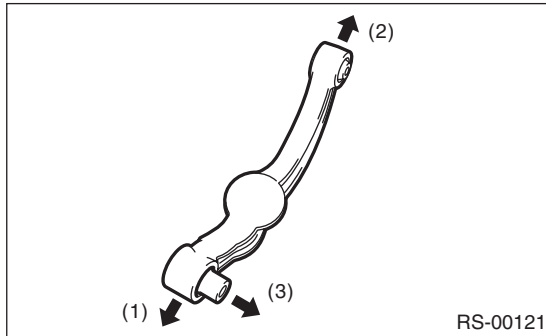
Using the ST, press the bushing into place.

ST 20099AE010 INSTALLER & REMOVER



#### CAUTION:

**Outer side bushing has an orientation. Assemble it with the longer protrusion faced to the rear side of vehicle.**



- (1) Rear arm
- (2) Rear sub frame
- (3) Rear side of vehicle

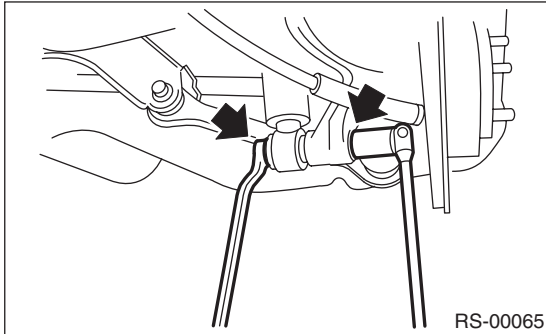
### E: INSPECTION

- 1) Visually check the upper link for abnormal fatigue or damage.
- 2) Visually check the bushing for abnormal fatigue or damage.

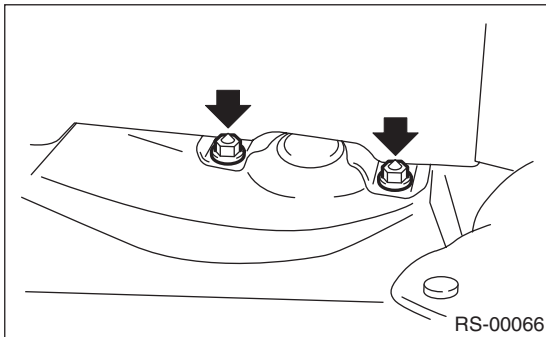
## 6. Rear Shock Absorber

### A: REMOVAL

- 1) Remove the luggage floor mat. (Wagon model)
- 2) Roll up the trunk side trim. (Sedan model)
- 3) Lift up the vehicle, and then remove the rear wheels.
- 4) Remove the bolts which secure the shock absorber to rear arm.



- 5) Support the shock absorber using a jack.
- 6) Remove the nuts which secure the shock absorber mount to vehicle.



- 7) Remove the shock absorber.

### B: INSTALLATION

- 1) Support the shock absorber using a jack.
- 2) Using new self-locking nuts, secure the shock absorber to vehicle.

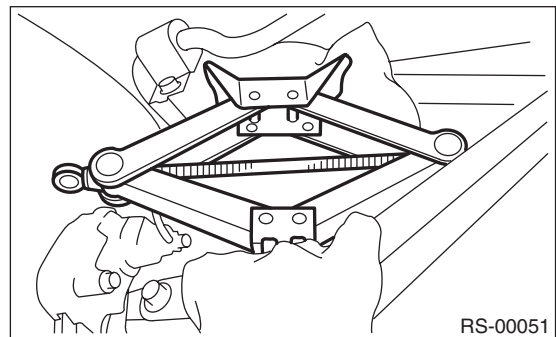
#### **Tightening torque:**

**30 N·m (3.1 kgf-m, 22.4 ft-lb)**

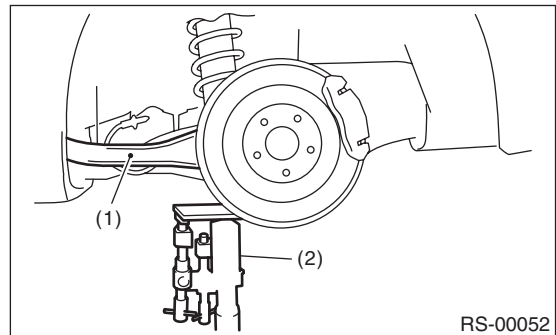
- 3) Set the vehicle equipped jack upside down, between the rear link and sub frame. Adjust the position of the jack, and align the attachment position of the rear shock absorber and rear arm. Using new self-locking nuts, temporarily tighten the bolt.

#### **CAUTION:**

**Protect the rear link and sub frame from being damaged by putting a waste cloth between the contact surface with the jack.**



- 4) Support the rear arm horizontally using a transmission jack.
- 5) Using new self-locking nuts, tighten the bolt and nut which secures the shock absorber.



- (1) Rear arm
- (2) Transmission jack

#### **Tightening torque:**

**62 N·m (6.3 kgf-m, 46 ft-lb)**

- 6) Install the luggage floor mat. (Wagon model)
- 7) Set the trunk side trim. (Sedan model)
- 8) Check the wheel alignment and adjust it if necessary.



# Rear Shock Absorber

## REAR SUSPENSION

---

### C: DISASSEMBLY

Refer to “Front Strut” for disassembly procedure.  
<Ref. to FS-24, DISASSEMBLY, Front Strut.>

### D: ASSEMBLY

Refer to “Front Strut” for installation procedures.  
<Ref. to FS-24, ASSEMBLY, Front Strut.>

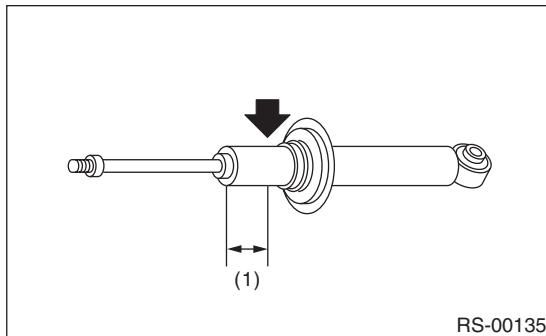
### E: INSPECTION

Refer to “Front Strut” for inspection procedures.  
<Ref. to FS-25, INSPECTION, Front Strut.>

### F: DISPOSAL

#### CAUTION:

- Before handling the shock absorber, be sure to wear goggles to protect eyes from gas, oil and cutting powder.
- Do not disassemble the shock absorber or place it into a fire.
- Drill a hole into shock absorbers in case of discarding shock absorbers filled with gas.
  - 1) Place the shock absorber on a level surface with the piston rod fully expanded.
  - 2) Make a hole into the specified position 30 mm (1.18 in) deep using a drill with 2 — 3 mm (0.08 — 0.12 in) diameter.

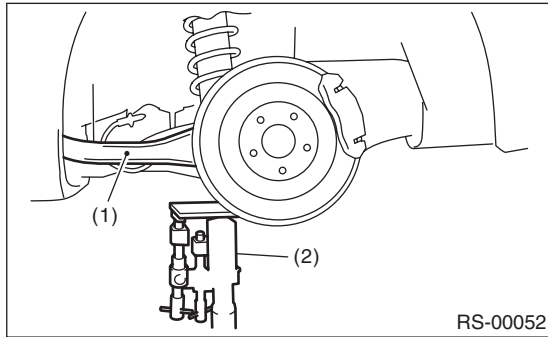


(1) 40 mm (1.57 in)

## 7. Front Link

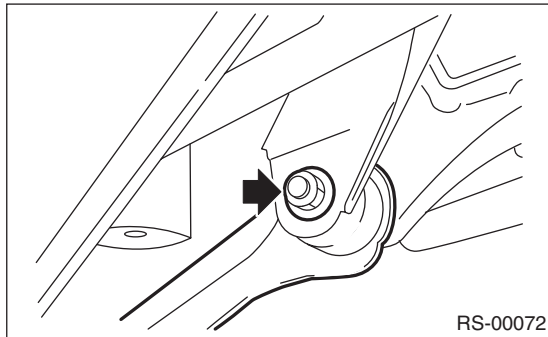
### A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Support the rear arm horizontally using a transmission jack.

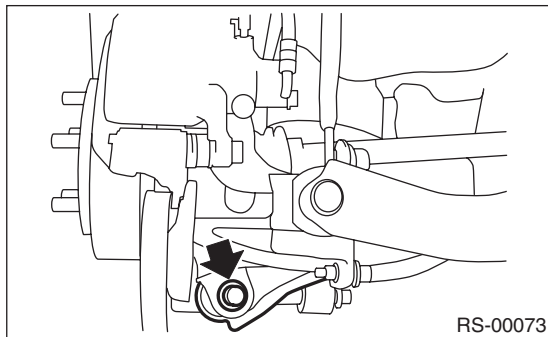


- (1) Rear arm
- (2) Transmission jack

- 3) Remove the bolt which secures the front link to the sub frame.

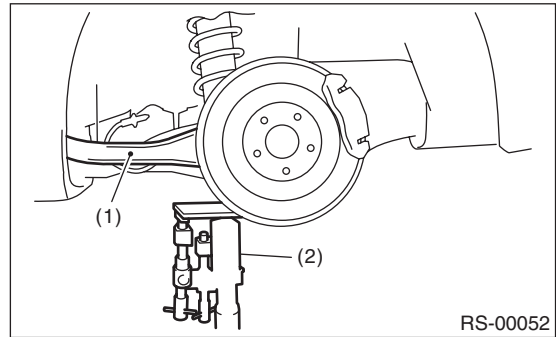


- 4) Remove the bolt which secures the front link to rear arm, then remove the front link.



### B: INSTALLATION

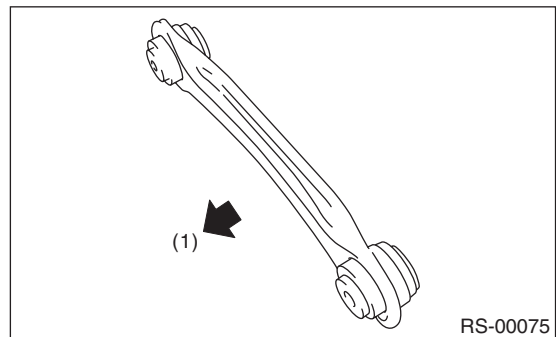
- 1) Support the rear arm horizontally using a transmission jack.
- 2) Using new self-locking nuts, install the front link.



- (1) Rear arm
- (2) Transmission jack

### CAUTION:

**Install the front link with the protruding side facing the front side of the vehicle.**



- (1) Front

### NOTE:

Inspect the wheel alignment and adjust if necessary.

### Tightening torque:

**57 N·m (5.8 kgf-m, 42 ft-lb)**

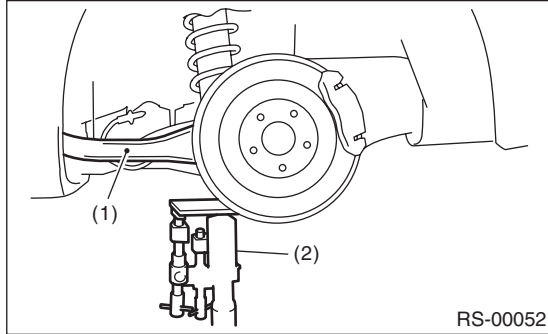
### C: INSPECTION

Visually check the front link for damage and deformation.

## 8. Rear Link

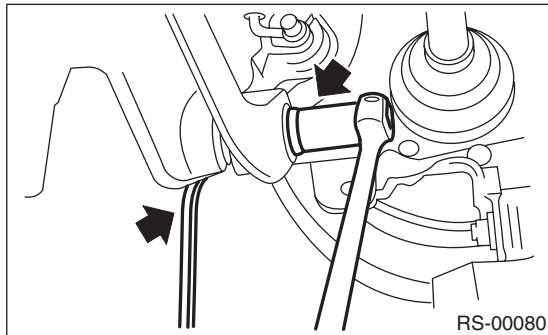
### A: REMOVAL

- 1) Lift up the vehicle, and then remove the rear wheels.
- 2) Remove the rear stabilizer. <Ref. to RS-8, REMOVAL, Rear Stabilizer.>
- 3) Support the rear arm horizontally using a transmission jack.



- (1) Rear arm
- (2) Transmission jack

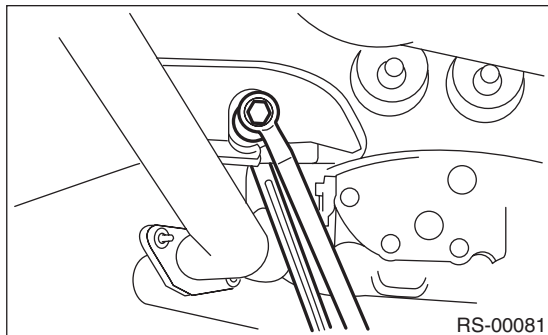
- 4) Remove the bolts which secures the rear link to the rear arm.



- 5) Place alignment marks on the rear link adjusting bolt and sub frame.
- 6) Remove the bolt which secures the rear link to the sub frame, then remove the rear link.

### CAUTION:

When loosening the adjusting bolt, make sure to fix the bolt head in place when loosening the nut.

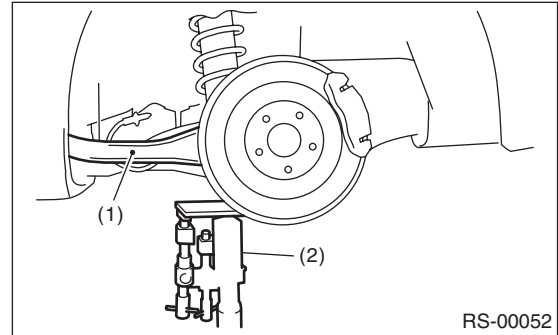


### B: INSTALLATION

- 1) Support the rear arm horizontally using a transmission jack.
- 2) Using new self-locking nuts, install the rear link.

### NOTE:

Tighten the self-locking nut with the bolt head fixed in place when installing the adjusting bolt.



- (1) Rear arm
- (2) Transmission jack

### Tightening torque:

**Rear link-to-Sub frame**

**120 N·m (12.2 kgf-m, 89 ft-lb)**

**Rear link-to-Rear arm**

**57 N·m (5.8 kgf-m, 42 ft-lb)**

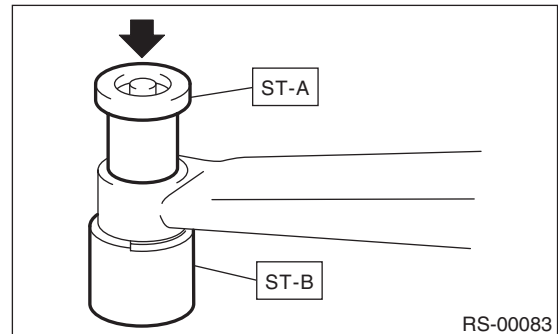
- 3) Inspect the wheel alignment and adjust if necessary.

### C: DISASSEMBLY

Using the ST A and ST B, press the bushing out.

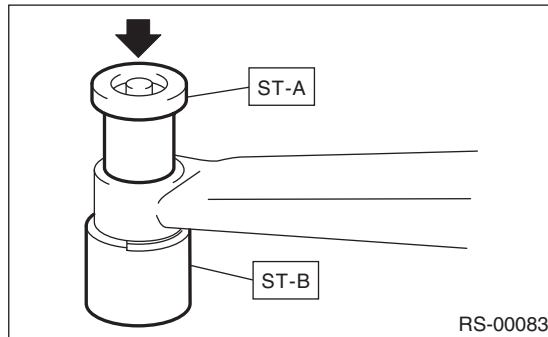
STA 20099AE000 INSTALLER & REMOVER

STB 20099AE000 INSTALLER & REMOVER



**D: ASSEMBLY**

Using the ST A and ST B, press-fit the bushing.  
STA 20099AE000 INSTALLER & REMOVER  
STB 20099AE000 INSTALLER & REMOVER

**E: INSPECTION**

- 1) Visually check the rear link for abnormal fatigue or damage.
- 2) Visually check the bushing for abnormal fatigue or damage.

# Sub Frame Support Arm

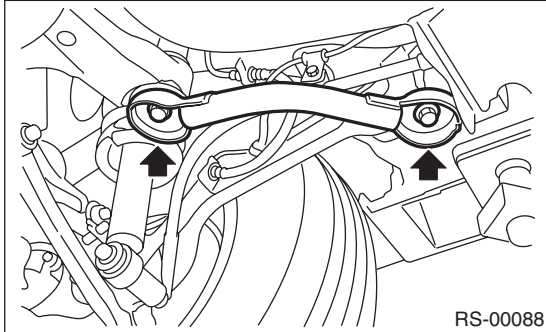
REAR SUSPENSION

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## 9. Sub Frame Support Arm

### A: REMOVAL

- 1) Lift up the vehicle and support the rear sub frame with a support stand.
- 2) Remove the sub frame support arm.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

*Sub frame support arm-to-Rear arm bracket*  
*125 N·m (12.7 kgf·m, 92 ft·lb)*

*Sub frame support arm-to-Rear sub frame*  
*175 N·m (17.8 kgf·m, 129 ft·lb)*

### C: INSPECTION

Visually check the sub frame support arm for damage and deformation.

## 10. Rear Sub Frame

### A: REMOVAL

1) Separate the front exhaust pipe and rear exhaust pipe.

2) Remove the rear exhaust pipe and muffler.

3) Remove the rear differential.

T-type

<Ref. to DI-31, REMOVAL, Rear Differential (T-type).>

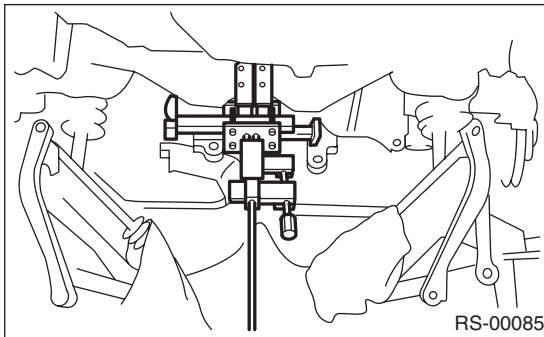
VA-type

<Ref. to DI-60, REMOVAL, Rear Differential (VA-type).>

4) Remove the rear stabilizer. <Ref. to RS-8, REMOVAL, Rear Stabilizer.>

5) Remove the bolts which secure the rear shock absorber to the rear arm.

6) Support the sub frame using a transmission jack.



7) Remove the front link from sub frame.

<Ref. to RS-17, REMOVAL, Front Link.>

8) Remove the rear link from the sub frame.

<Ref. to RS-18, REMOVAL, Rear Link.>

9) Remove the upper link from the sub frame.

<Ref. to RS-13, REMOVAL, Upper Link.>

10) Remove the sub frame support arm.

11) Remove the sub frame.

### B: INSTALLATION

1) Install in the reverse order of removal.

2) Follow the procedure below for the rear differential installation and tightening torque.

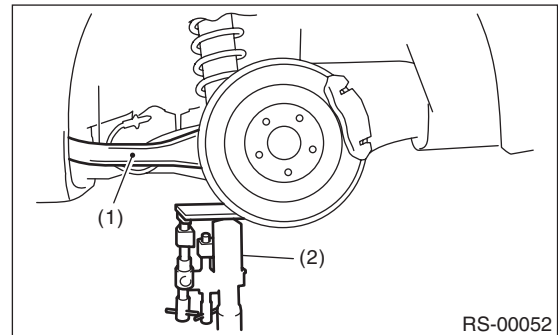
T-type

<Ref. to DI-32, INSTALLATION, Rear Differential (T-type).>

VA-type

<Ref. to DI-61, INSTALLATION, Rear Differential (VA-type).>

3) Support the rear arm horizontally using a transmission jack. Tighten the nuts and bolts which hold the rear arm, front link, rear link, upper link and shock absorber.



(1) Rear arm

(2) Transmission jack

#### **Tightening torque:**

**Refer to "COMPONENT" of "General Description" for tightening torque. <Ref. to RS-3, REAR SUSPENSION, COMPONENT, General Description.>**

4) Check the wheel alignment and adjust it if necessary.

### C: INSPECTION

Check the removed parts for wear, damage and crack, and repair or replace them if faulty.

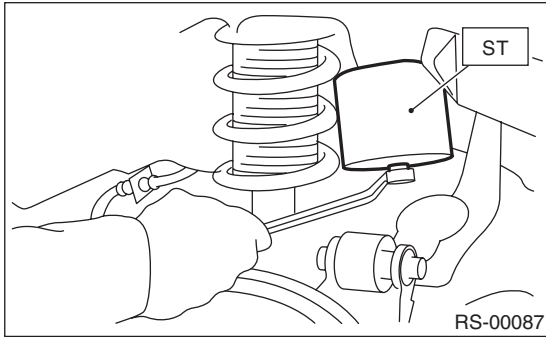
### 11.Helper

#### A: REMOVAL

1) Lift up the vehicle, and then remove the rear wheels.

2) Remove the helper using the ST.

ST 20099AE030 HELPER SOCKET WRENCH



#### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**32 N·m (3.3 kgf-m, 24 ft-lb)**

#### C: INSPECTION

Check the helper for major cracks or damages.

## 12. General Diagnostic Table

### A: INSPECTION

#### 1. IMPROPER VEHICLE POSTURE OR IMPROPER WHEEL ARCH HEIGHT

Possible cause	Corrective action
(1) Permanent distortion or damaged coil spring	Replace.
(2) Rough operation of damper strut or shock absorber	Replace.
(3) Improper installation of strut or shock absorber	Replace with proper parts.
(4) Installation of the wrong coil spring	Replace with proper parts.

#### 2. POOR RIDE COMFORT

- 1) Large rebound shock
- 2) Rocking of the vehicle continues too long after running over bump and hump.
- 3) Excessive shock in bumping

Possible cause	Corrective action
(1) Damaged coil spring	Replace.
(2) Overinflation of tires	Adjust.
(3) Improper wheel arch height	Adjust or replace the coil springs with new parts.
(4) Fault in operation of damper strut or shock absorber	Replace.
(5) Damage or deformation of strut mount or shock absorber mount	Replace.
(6) Unsuitable length (maximum or minimum) of damper strut or shock absorber	Replace with appropriate parts.
(7) Deformation or loss of bushing	Replace.
(8) Deformation or damage of helper in strut assembly or shock absorber	Replace.
(9) Oil leakage from the damper strut or shock absorber	Replace.

#### 3. NOISE

Possible cause	Corrective action
(1) Wear or damage of damper strut or shock absorber component parts	Replace.
(2) Loosening of the suspension link installing bolt	Tighten to the specified torque.
(3) Deformation or loss of bushing	Replace.
(4) Unsuitable length (maximum or minimum) of damper strut or shock absorber	Replace with appropriate parts.
(5) Damaged coil spring	Replace.
(6) Wear or damage of the ball joint	Replace.
(7) Deformation of the stabilizer clamp	Replace.



# General Diagnostic Table

REAR SUSPENSION

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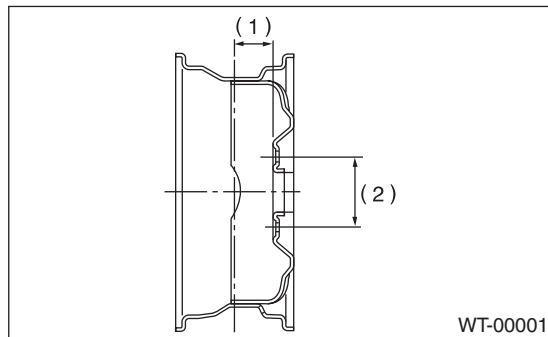
# General Description

## WHEEL AND TIRE SYSTEM

### 1. General Description

#### A: SPECIFICATION

##### 1. WHEEL AND TIRE SIZE



- (1) Offset  
(2) P.C.D.

Specification		Tire size	Wheel size	Offset mm (in)	P.C.D. mm (in)	Tire inflation pressure kPa (kgf/cm <sup>2</sup> , psi)	
						Front wheel	Rear wheel
Sedan	2.5 i, — LTD	P205/55 R16 89H	16 × 6 <sup>1</sup> / <sub>2</sub> JJ	55 (2.17)	100 (3.94)	220 (2.2, 32)	210 (2.1, 30)
		P205/50 R17 88V	17 × 7JJ			230 (2.3, 33)	220 (2.2, 32)
	2.5 GT LTD	215/45 R17 91W	18 × 7JJ			240 (2.4, 35)	230 (2.3, 33)
	2.5 GT spec. B	215/45 R18 89Y	18 × 7JJ			230 (2.3, 33)	220 (2.2, 32)
	3.0 R LTD	P215/45 R18 89W	18 × 7JJ				
Wagon	2.5 i, — LTD	P205/55 R16 89H	16 × 6 <sup>1</sup> / <sub>2</sub> JJ	48 (1.89)	100 (3.94)	220 (2.2, 32)	210 (2.1, 30)
		P205/50 R17 88V	17 × 7JJ			240 (2.4, 35)	230 (2.3, 33)
	2.5 GT LTD	215/45 R17 91W					
	OUTBACK 2.5 i Base	P225/60 R16 97H	16 × 6 <sup>1</sup> / <sub>2</sub> JJ			220 (2.2, 32)	210 (2.1, 30)
	OUTBACK 2.5 i, — LTD, OUTBACK 2.5 XT LTD	P225/55 R17 95V	17 × 7JJ				
OUTBACK 3.0 R, — LTD, — LLB							
"T-type" Tire	2.5 i, — LTD	T135/80R16 101M	16 × 4T	50 (1.97)	420 (4.2, 60)		
	2.5 GT LTD	T135/70D17 102M	17 × 4T	40 (1.57)			
	OUTBACK, 2.5 GT spec.B, 3.0 R LTD	T155/70D17 110M	17 × 4T	40 (1.57)			

##### 2. SERVICE DATA

Part	Axial runout	Radial runout
Steel wheel	1.5 mm (0.059 in)	
Aluminum wheel	1.0 mm (0.039 in)	

# General Description

## WHEEL AND TIRE SYSTEM

### 3. ADJUSTING PARTS

Wheel balancing	Standard:	Service limit
Dynamic unbalance	10 g (0.35 oz) or less	

Balance weight part number (Knock-on type weight for steel wheels)	Weight
28101AA001	5 g (0.18 oz)
28101AA011	10 g (0.35 oz)
28101AA021	15 g (0.53 oz)
28101AA031	20 g (0.71 oz)
28101AA041	25 g (0.88 oz)
28101AA051	30 g (1.06 oz)
28101AA061	35 g (1.23 oz)
28101AA071	40 g (1.41 oz)
28101AA081	45 g (1.59 oz)
28101AA091	50 g (1.76 oz)
28101AA101	55 g (1.94 oz)
28101AA111	60 g (2.12 oz)

Balance weight part number (Knock-on type weight for aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
23141GA562	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

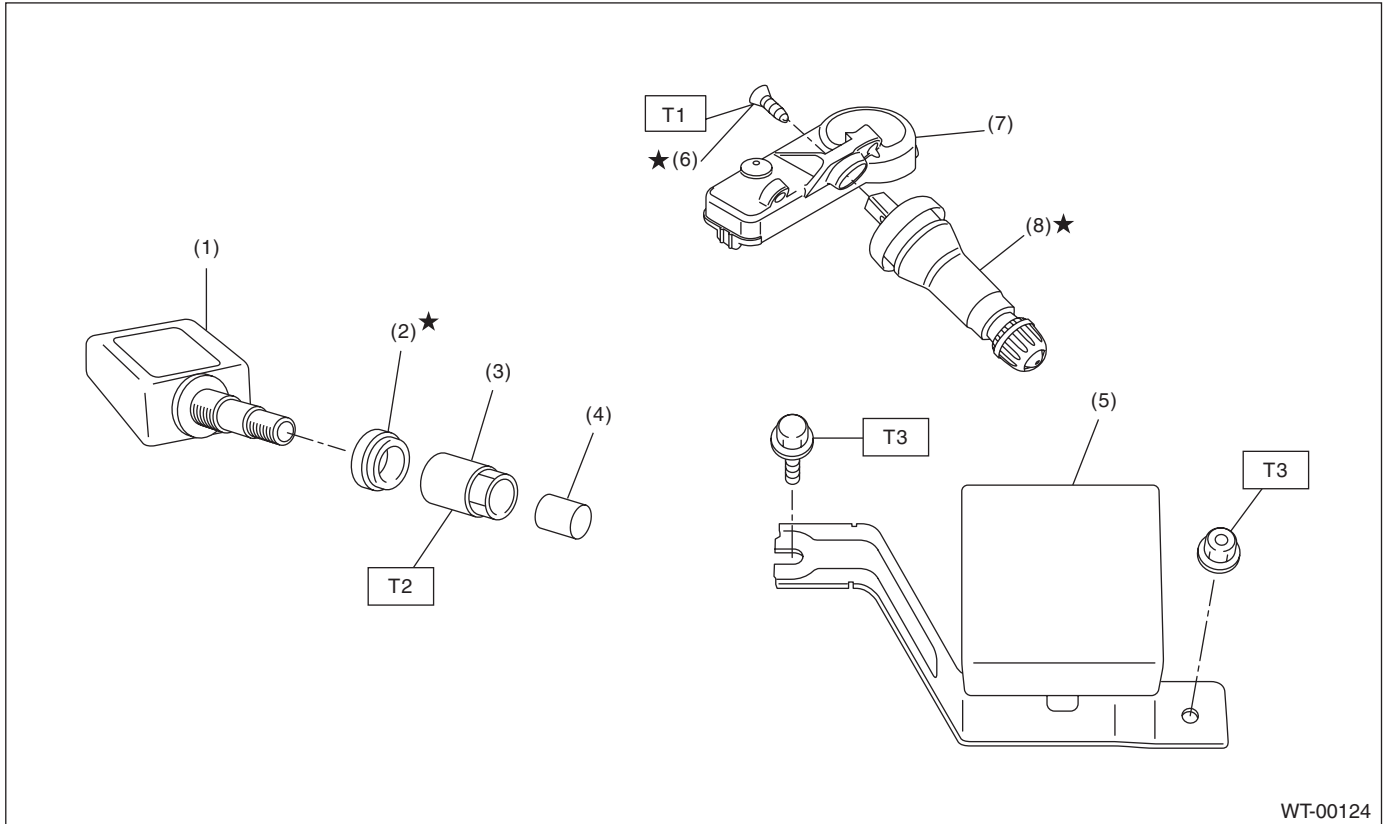
Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE00B	5 g (0.18 oz)
28101AE01B	7.5 g (0.26 oz)
28101AE02B	10 g (0.35 oz)
28101AE03B	12.5 g (0.44 oz)
28101AE04B	15 g (0.53 oz)
28101AE05B	17.5 g (0.62 oz)
28101AE06B	20 g (0.71 oz)
28101AE07B	22.5 g (0.79 oz)
28101AE08B	25 g (0.88 oz)
28101AE09B	27.5 g (0.97 oz)
28101AE10B	30 g (1.06 oz)
28101AE11B	32.5 g (1.15 oz)

Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE12B	35 g (1.23 oz)
28101AE13B	37.5 g (1.32 oz)
28101AE14B	40 g (1.41 oz)
28101AE15B	42.5 g (1.50 oz)
28101AE16B	45 g (1.59 oz)
28101AE17B	47.5 g (1.68 oz)
28101AE18B	50 g (1.76 oz)
28101AE19B	52.5 g (1.85 oz)
28101AE20B	55 g (1.94 oz)
28101AE21B	57.5 g (2.03 oz)
28101AE22B	60 g (2.12 oz)
28101AE23B	62.5 g (2.20 oz)
28101AE24B	65 g (2.29 oz)
28101AE25B	67.5 g (2.38 oz)
28101AE26B	70 g (2.47 oz)
28101AE27B	72.5 g (2.56 oz)
28101AE28B	75 g (2.65 oz)
28101AE29B	77.5 g (2.73 oz)
28101AE30B	80 g (2.82 oz)
28101AE31B	82.5 g (2.91 oz)
28101AE32B	85 g (3.00 oz)
28101AE33B	87.5 g (3.09 oz)
28101AE34B	90 g (3.17 oz)
28101AE35B	92.5 g (3.26 oz)
28101AE36B	95 g (3.35 oz)
28101AE37B	97.5 g (3.44 oz)
28101AE38B	100 g (3.53 oz)
28101AG50B	102.5 g (3.62 oz)
28101AG51B	105 g (3.70 oz)
28101AG52B	107.5 g (3.79 oz)
28101AG53B	110 g (3.88 oz)
28101AG54B	112.5 g (3.97 oz)
28101AG55B	115 g (4.06 oz)
28101AG56B	117.5 g (4.14 oz)
28101AG57B	120 g (4.23 oz)

# General Description

## WHEEL AND TIRE SYSTEM

### B: COMPONENT



- |   |                                |
|---|--------------------------------|
| (1) Transmitter (Clamp in type)             | (6) Screw                      |
| (2) Grommet                                 | (7) Transmitter (Snap in type) |
| (3) Nut                                     | (8) Valve                      |
| (4) Cap                                     |                                |
| (5) Tire pressure monitoring control module |                                |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 1.4 (0.1, 1)**

**T2: 7.5 (0.76, 5.53)**

**T3: 8 (0.8, 5.8)**

### C: PREPARATION TOOL

#### 1. GENERAL TOOL

TOOL NAME	REMARKS
Air pressure gauge	Used for measuring tire air pressure.
Dial gauge with magnet stand	Used for measuring wheel runout.
Wheel balancer	Used for adjusting wheel balance.

## 2. Tire

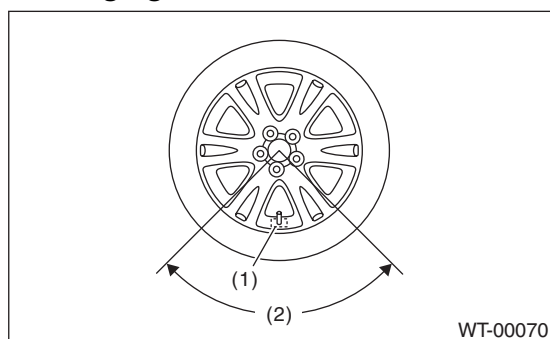
### A: INSPECTION

1) Take stones, glass, nails etc. out of the tread groove.

2) Replace tires in the following cases.

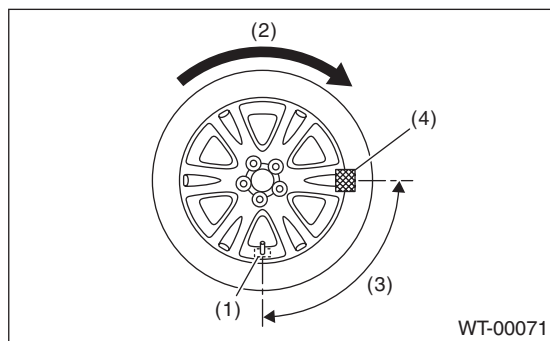
#### CAUTION:

- When replacing a tire, make sure to use only tires of the same size, construction and load range as originally installed.
- Use a tire changer when removing the tire from the wheel.
- On models equipped with tire pressure monitoring systems, do not use the bead breaker in a 90° area centered on the transmitter to prevent damaging the transmitter.



- (1) Transmitter  
 (2) 90°  
 (use of a bead breaker is prohibited in this area.)

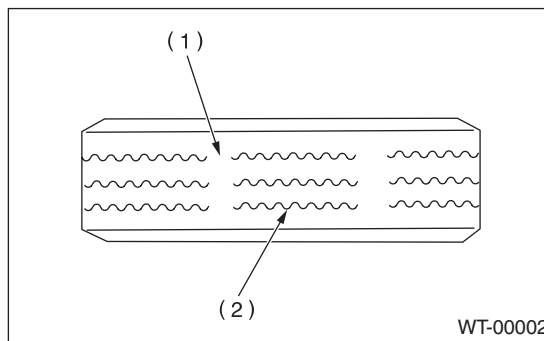
- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (1) Transmitter  
 (2) Direction of turn table rotation  
 (3) 90°  
 (4) Tire changer boom

(1) If large cracks on side wall, damage or cracks on the tread is found.

(2) When the “tread wear indicator” appears as a solid band across the tread.



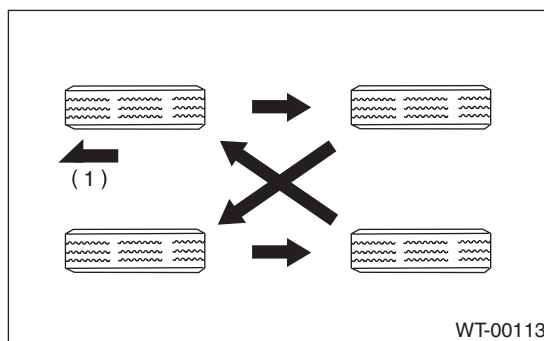
- (1) Tread wear indicator  
 (2) Tire tread

3) When a crack on tire valve is found, replace the tire valve.

### 1. TIRE ROTATION

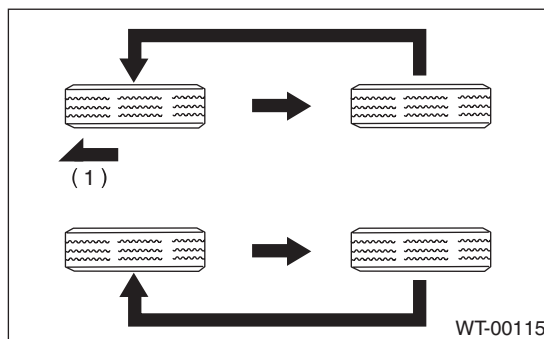
Rotate tires periodically (12,500 km/7,500 miles) as shown in the figure, in order to prevent them from uneven wear and to prolong their life.

- Without instruction for the direction of tire rotation.



- (1) Front

- With instruction for the direction of tire rotation



- (1) Front

## Tire

### WHEEL AND TIRE SYSTEM

---

**NOTE:**

Vehicles equipped with tire pressure monitoring systems will require re-registration of transmitter ID. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

## 3. Steel Wheel

### A: REMOVAL

- 1) Apply the parking brake, and position select lever to "P".
- 2) Set the shop jacks or a lift to the specified points, and support the vehicle with its wheels slightly contacting the floor.
- 3) Loosen the wheel nuts.
- 4) Raise the vehicle until its wheels are off the ground using the jack or a lift.
- 5) Remove the wheel nuts and wheels.

#### NOTE:

- When removing the wheels, be careful not to damage the hub bolts.
- Place the wheels with their outer sides facing upward to prevent wheels from being damaged.

### B: INSTALLATION

- 1) Remove dirt from the mating surface of the wheel and brake rotor.
- 2) Attach the wheel to the hub by aligning the wheel bolt holes with the hub bolts.
- 3) Temporarily attach the wheel nuts to the hub bolts. (In the case of aluminum wheels, use SUBARU genuine wheel nuts for aluminum wheels.)
- 4) Tighten the nuts by hand, making sure the wheel hub hole is aligned correctly to the guide portion of hub.
- 5) Tighten the wheel nuts in a diagonal selection to the specified torque. Use a wheel nut wrench.

#### Wheel nut tightening torque:

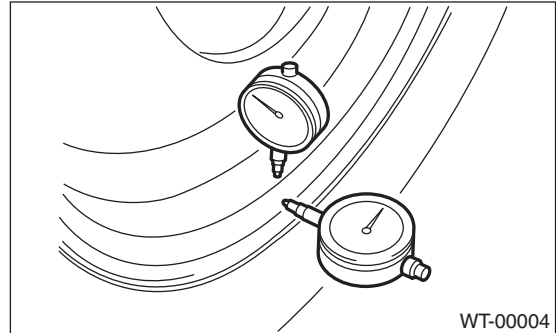
**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

#### CAUTION:

- Tighten the wheel nuts in two or three steps by gradually increasing the torque on opposing nuts, until they reach the specified torque.
  - Do not push the wrench by foot. Always use both hands when tightening the nuts.
  - Make sure the bolt, nut and the nut seating surface of the wheel are free from oil.
- 6) If a wheel is removed for replacement or for repair of a puncture, retighten the wheel nuts to the specified torque after driving 1,000 km (600 miles).

### C: INSPECTION

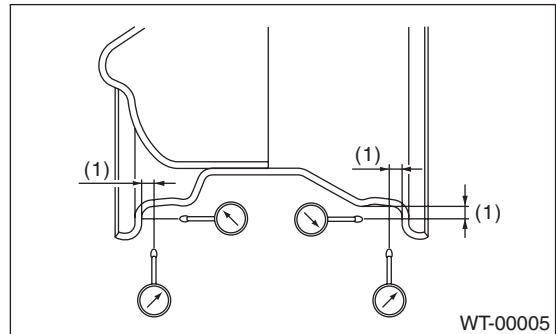
- 1) Deformation or damage to the rim may cause air leakage. Check the rim flange for deformation, cracks or damage, and repair or replace as necessary.
- 2) Jack-up the vehicle until wheels clear the floor.
- 3) Slowly rotate the wheel to check rim "runout" using a dial gauge.



#### Rim runout:

Axial runout limit	Vertical run out limit
1.5 mm (0.059 in)	

- 4) If the rim runout exceeds specifications, remove the tire from the wheel and check runout with the dial gauge attached to positions shown in the figure.



(1) Approx. 7 mm (0.28 in)

- 5) If the measured runout still exceeds specifications, replace the wheel.

### 4. Aluminum Wheel

#### A: REMOVAL

Refer to “Steel Wheels” for removal procedure of aluminum wheels. <Ref. to WT-7, REMOVAL, Steel Wheel.>

#### B: INSTALLATION

Refer to “Steel Wheels” for installation procedure of aluminum wheels. <Ref. to WT-7, INSTALLATION, Steel Wheel.>

#### C: INSPECTION

Refer to “Steel Wheels” for inspection procedure of aluminum wheels. <Ref. to WT-7, INSPECTION, Steel Wheel.>

##### ***Rim runout:***

Axial runout limit	Vertical run out limit
1.0 mm (0.039 in)	

#### D: CAUTION

Aluminum wheels are easily scratched. To maintain their appearance and safety, be careful of the following:

- 1) Do not damage the aluminum wheels during removal, installation, wheel balancing, etc. After removing aluminum wheels, place them on a rubber mat etc.
- 2) When washing the aluminum wheel, use neutral synthetic detergent and water. Avoid using cleansers containing abrasives, hard brushes or an automatic car washer.



## 5. Wheel Balancing

### A: ADJUSTMENT

**NOTE:**

Because an adhesive type weight is adopted for the outside balance weight of 17-inch and 18-inch wheels, change the setting of the wheel balancer to adhesive type weight.

1) Remove the balance weights.

**CAUTION:**

- Be careful not to damage the wheel.
- Completely remove the double-sided tape of the adhesive weight from the wheel.

2) Using the wheel balancer, measure wheel balance.

3) Select a weight close to the value measured by wheel balancer.

**CAUTION:**

**Use SUBARU genuine balance weights.**

Balance weight part number (Knock-on type weight for steel wheels)	Weight
28101AA001	5 g (0.18 oz)
28101AA011	10 g (0.35 oz)
28101AA021	15 g (0.53 oz)
28101AA031	20 g (0.71 oz)
28101AA041	25 g (0.88 oz)
28101AA051	30 g (1.06 oz)
28101AA061	35 g (1.23 oz)
28101AA071	40 g (1.41 oz)
28101AA081	45 g (1.59 oz)
28101AA091	50 g (1.76 oz)
28101AA101	55 g (1.94 oz)
28101AA111	60 g (2.12 oz)

Balance weight part number (Knock-on type weight for aluminum wheel)	Weight
23141GA462	5 g (0.18 oz)
23141GA472	10 g (0.35 oz)
23141GA482	15 g (0.53 oz)
23141GA492	20 g (0.71 oz)
23141GA502	25 g (0.88 oz)
23141GA512	30 g (1.06 oz)
23141GA522	35 g (1.23 oz)
23141GA532	40 g (1.41 oz)
23141GA542	45 g (1.59 oz)
23141GA552	50 g (1.76 oz)
23141GA562	55 g (1.94 oz)
23141GA572	60 g (2.12 oz)

Balance weight part number (Adhesive type weight for aluminum wheel)	Weight
28101AE00B	5 g (0.18 oz)
28101AE01B	7.5 g (0.26 oz)
28101AE02B	10 g (0.35 oz)
28101AE03B	12.5 g (0.44 oz)
28101AE04B	15 g (0.53 oz)
28101AE05B	17.5 g (0.62 oz)
28101AE06B	20 g (0.71 oz)
28101AE07B	22.5 g (0.79 oz)
28101AE08B	25 g (0.88 oz)
28101AE09B	27.5 g (0.97 oz)
28101AE10B	30 g (1.06 oz)
28101AE11B	32.5 g (1.15 oz)
28101AE12B	35 g (1.23 oz)
28101AE13B	37.5 g (1.32 oz)
28101AE14B	40 g (1.41 oz)
28101AE15B	42.5 g (1.50 oz)
28101AE16B	45 g (1.59 oz)
28101AE17B	47.5 g (1.68 oz)
28101AE18B	50 g (1.76 oz)
28101AE19B	52.5 g (1.85 oz)
28101AE20B	55 g (1.94 oz)
28101AE21B	57.5 g (2.03 oz)
28101AE22B	60 g (2.12 oz)
28101AE23B	62.5 g (2.20 oz)
28101AE24B	65 g (2.29 oz)
28101AE25B	67.5 g (2.38 oz)
28101AE26B	70 g (2.47 oz)
28101AE27B	72.5 g (2.56 oz)
28101AE28B	75 g (2.65 oz)
28101AE29B	77.5 g (2.73 oz)
28101AE30B	80 g (2.82 oz)
28101AE31B	82.5 g (2.91 oz)
28101AE32B	85 g (3.00 oz)
28101AE33B	87.5 g (3.09 oz)
28101AE34B	90 g (3.17 oz)
28101AE35B	92.5 g (3.26 oz)
28101AE36B	95 g (3.35 oz)
28101AE37B	97.5 g (3.44 oz)
28101AE38B	100 g (3.53 oz)
28101AG50B	102.5 g (3.62 oz)
28101AG51B	105 g (3.70 oz)
28101AG52B	107.5 g (3.79 oz)
28101AG53B	110 g (3.88 oz)
28101AG54B	112.5 g (3.97 oz)
28101AG55B	115 g (4.06 oz)
28101AG56B	117.5 g (4.14 oz)
28101AG57B	120 g (4.23 oz)

# Wheel Balancing

## WHEEL AND TIRE SYSTEM

4) Install the selected weight to the point designated by the wheel balancer.

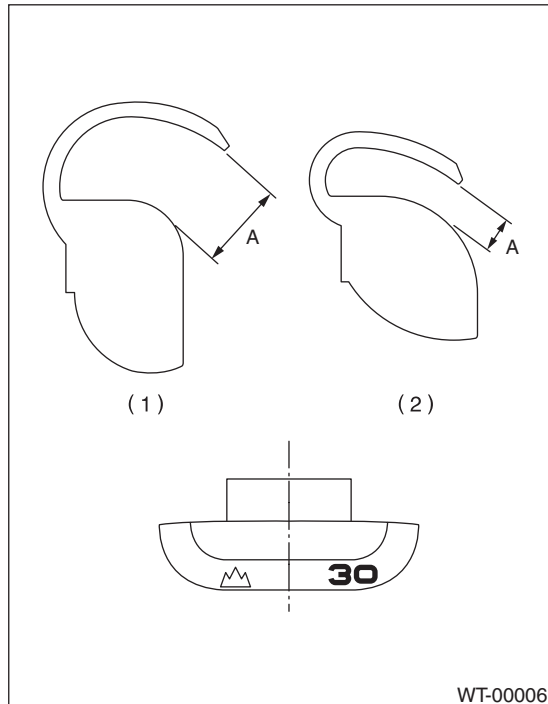
### CAUTION:

- Decrease the wheel surface where the adhesive type weight will be applied.
- Press the adhesive type weight by 25 N (2.5 kgf, 5.6 lb) or more per 5 g (0.18 oz) for 2 seconds or more and attain full adhesion.
- Total application of the adhesive type weight should be 100 g (3.53 oz) or less.
- The total weight of all adhesive weight on models with transmitters (tire pressure sensor) is to be 120 g (4.23 oz) or less.

5) Using the wheel balancer, measure the wheel balance again. Check that wheel balance is correctly adjusted.

### NOTE:

Knock-on type balance weights for aluminum wheels can be used on any 15 to 18 inch aluminum wheels.



- (1) Knock-on type weight for aluminum wheel  
(2) Knock-on type weight for steel wheel

### Service limit A:

#### **Knock-on type weight for steel wheel:**

5 — 25 g (0.18 — 0.88 oz) 2.0 mm (0.08 in)

30 g (1.06 oz) or more 1.8 mm (0.07 in)

#### **Knock-on type weight for aluminum wheel:**

5 — 25 g (0.18 — 0.88 oz) 5.0 mm (0.20 in)

30 g (1.06 oz) or more 4.5 mm (0.177 in)

## 6. “T-type” Tire

### A: NOTE

“T-type” tire for temporary use is equipped as a spare tire.

#### CAUTION:

- Do not drive at a speed greater than 80 km/h (50 MPH).
- For the model with tire pressure monitoring system, the indicator light may blink when running with the “T-type” tire.

### B: REPLACEMENT

Refer to “Steel Wheels” for removal and installation procedures of the “T-type” tire. <Ref. to WT-7, REMOVAL, Steel Wheel.>

#### CAUTION:

**The “T-type” tire is only for temporary use. Replace with a conventional tire as soon as possible.**

### C: INSPECTION

- 1) Check the tire air pressure.

#### **Specifications:**

**420 kPa (4.2 kg/cm<sup>2</sup>, 60 psi)**

- 2) Take stones, glass, nails, etc. out of the tread groove.
- 3) Check the tires for deformation, cracks, partial wear, or wear.

#### CAUTION:

**Replace the tire with a new part if defective.**

# Tire Pressure Monitoring System

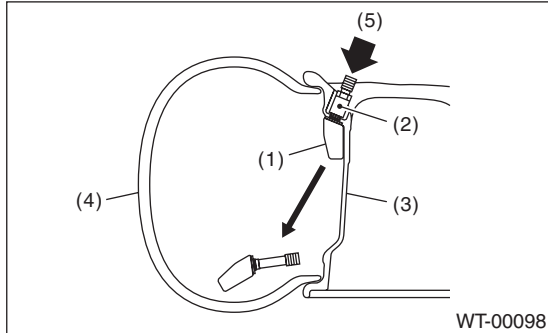
## WHEEL AND TIRE SYSTEM

### 7. Tire Pressure Monitoring System

#### A: REMOVAL

##### 1. TRANSMITTER (CLAMP IN TYPE)

- 1) Remove the wheels from the vehicle. <Ref. to WT-7, REMOVAL, Steel Wheel.>
- 2) Bleed air from tire valve.
- 3) Remove the nut, and drop the transmitter in the tire.



- (1) Transmitter
- (2) Nut
- (3) Wheel
- (4) Tire
- (5) Push

- 4) Remove the tires from wheels.

#### CAUTION:

Use a tire changer when removing the tire from the wheel.

- 5) Remove the nut to take out transmitter.

#### NOTE:

Replace the grommet with a new part when reusing transmitter.

##### 2. TRANSMITTER (SNAP IN TYPE)

- 1) Remove the wheels from the vehicle. <Ref. to WT-7, REMOVAL, Steel Wheel.>
- 2) Remove the tires from wheels.

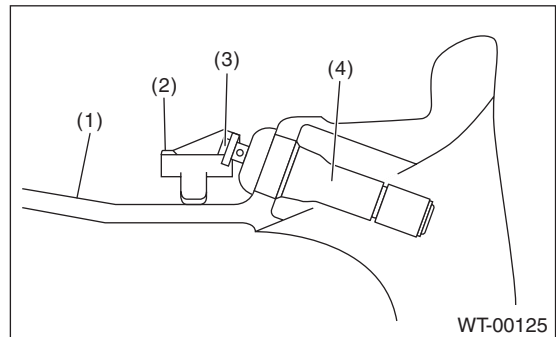
#### CAUTION:

Use a tire changer when removing the tire from the wheel.

- 3) Loosen the screw to remove the transmitter from the valve.

#### NOTE:

Replace the valve and screw with a new part when reusing transmitter.

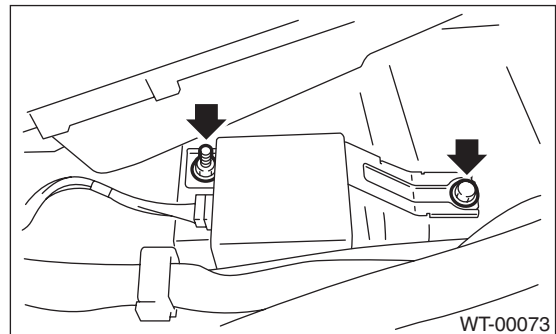


- (1) Wheel
- (2) Transmitter
- (3) Screw
- (4) Valve

- 4) Remove the valve stems from the wheel.

##### 3. TIRE PRESSURE MONITORING CONTROL MODULE

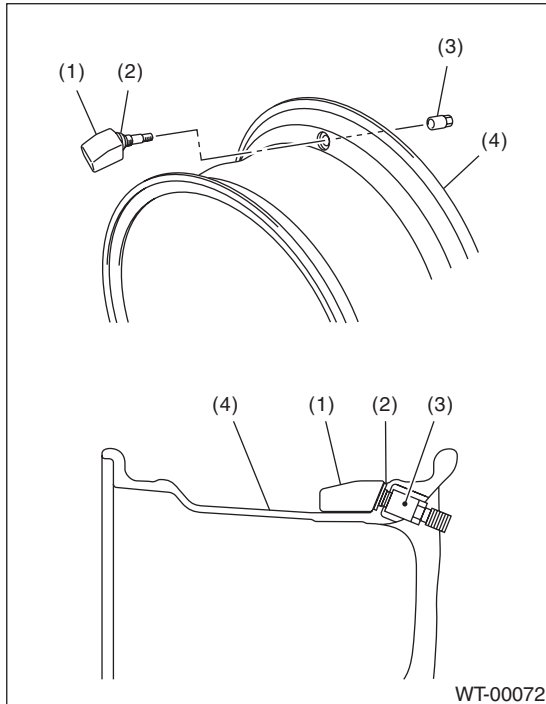
- 1) Remove the driver's seat. <Ref. to SE-9, REMOVAL, Front Seat.>
- 2) Turn up the floor mat in the driver's seat area.
- 3) Remove the connector to remove tire pressure monitoring control module.



## B: INSTALLATION

### 1. TRANSMITTER (CLAMP IN TYPE)

1) Install the transmitter to the wheel by aligning it with valve hole, and then tighten with nuts.



- (1) Transmitter
- (2) Grommet
- (3) Nut
- (4) Wheel

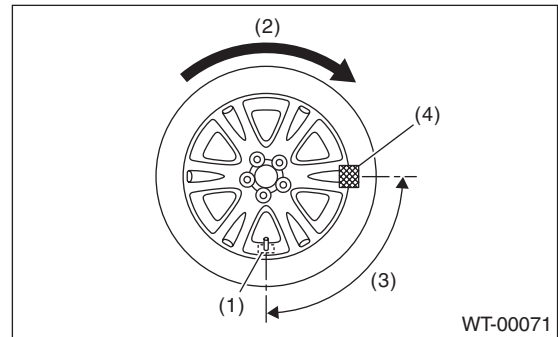
#### **Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.53 ft-lb)**

2) Install the tires to wheels.

#### **CAUTION:**

- Use a tire changer when installing tire to wheel.
- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (1) Transmitter
- (2) Direction of turn table rotation
- (3) 90°
- (4) Tire changer boom

3) Install the wheels to vehicle. <Ref. to WT-7, INSTALLATION, Steel Wheel.>

4) Register the transmitter ID to the tire pressure monitoring control module. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

# Tire Pressure Monitoring System

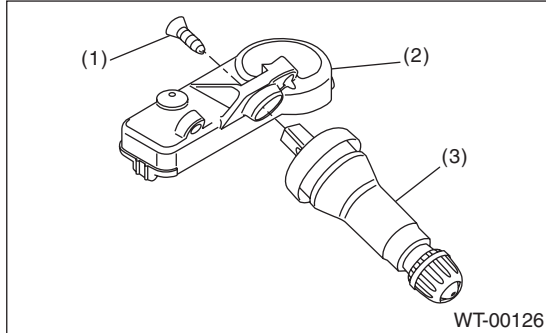
## WHEEL AND TIRE SYSTEM

### 2. TRANSMITTER (SNAP IN TYPE)

#### CAUTION:

Use the new transmitter assembly or replace the new valve and screw, when installing.

1) Replace the valve and screw with a new part when reusing transmitter.



- (1) Screw
- (2) Transmitter
- (3) Valve

#### Tightening torque:

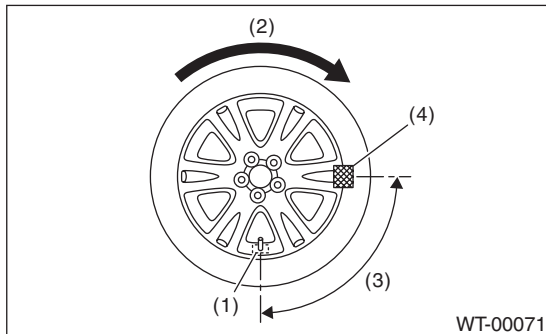
**1.4 N·m (0.1 kgf·m, 1 ft·lb)**

2) Install the transmitter to the wheel by aligning it with valve hole.

3) Install the tires to wheels.

#### CAUTION:

- Use a tire changer when installing tire to wheel.
- To prevent damaging the transmitter, set the tire changer boom in the position as shown in the figure.



- (1) Transmitter
- (2) Direction of turn table rotation
- (3) 90°
- (4) Tire changer boom

4) Install the wheels to vehicle. <Ref. to WT-7, INSTALLATION, Steel Wheel.>

5) Register the transmitter ID to the tire pressure monitoring control module. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

### 3. TIRE PRESSURE MONITORING CONTROL MODULE

Install in the reverse order of removal.

#### Tightening torque:

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**

### C: ADJUSTMENT

Re-register the transmitter ID when transmitter has been replaced or tires have been rotated. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>

## 8. General Diagnostic Table

### A: INSPECTION

Symptoms	Possible cause	Corrective action
Wheel is out of balance.	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to Abnormal tire wear in this table, carry out the procedure and replace the tire.
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-7, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-25, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-16, INSPECTION, Rear Shock Absorber.>
	Front axle	Check the front axle. <Ref. to DS-16, INSPECTION, Front Axle.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-18, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-22, INSPECTION, Rear Hub Unit Bearing.>
Vehicle is abnormally out of balance.	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to Abnormal tire wear in this table, carry out the procedure and replace the tire.
	Front stabilizer	Inspect the front stabilizer. <Ref. to FS-17, INSPECTION, Front Stabilizer.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-7, INSPECTION, Wheel Alignment.>
Abnormal wheel vibration	Improperly inflated tire.	Adjust the tire pressure.
	Uneven wear	Check the tire referring to Abnormal tire wear in this table, carry out the procedure and replace the tire.
	Improper wheel balancing	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front axle	Check the front axle. <Ref. to DS-16, INSPECTION, Front Axle.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-18, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-22, INSPECTION, Rear Hub Unit Bearing.>

# General Diagnostic Table

## WHEEL AND TIRE SYSTEM

Symptoms	Possible cause	Corrective action
Abnormal tire wear	Improperly inflated tire.	Adjust the tire pressure.
	Improper wheel balancing	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-7, INSPECTION, Wheel Alignment.>



# Basic Diagnostic Procedure

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

##### CAUTION:

Remove foreign matter (dust, water, oil etc.) from the tire pressure monitoring control module connector when removing or installing.

##### NOTE:

To check harness for broken wires or short circuits, shake the suspected trouble spot or connector.

Step	Check	Yes	No
<b>1</b> <b>CHECK PRE-INSPECTION.</b> 1) Check with the user regarding when the warning light lit or started blinking. 2) Before performing diagnostics, check all components which may adversely affect the tire pressure monitor system. <Ref. to TPM(diag)-3, INSPECTION, General Description.>	Is the component that might affect the tire pressure monitor system normal?	Go to step 2.	Repair or replace each component.
<b>2</b> <b>CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. <b>NOTE:</b> If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to TPM(diag)-11, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 4) Read the DTC. <Ref. to TPM(diag)-16, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Go to step 4.	Go to step 3.
<b>3</b> <b>PERFORM GENERAL DIAGNOSTICS.</b> 1) Perform the inspection by referring to "General Diagnostic Table". <Ref. to TPM(diag)-38, General Diagnostic Table.> 2) Perform Clear Memory Mode. <Ref. to TPM(diag)-10, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 3) Perform Inspection Mode. <Ref. to TPM(diag)-17, Inspection Mode.> 4) Read the DTC. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> Check that there is no DTC displayed.	Does the tire pressure warning light illuminates for about 2 seconds and then goes off after turning on the ignition switch, and then go out?	Finish the diagnosis.	Check by referring to "Diagnostic Procedure for TPM". <Ref. to TPM(diag)-14, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>
<b>4</b> <b>PERFORM DIAGNOSIS.</b> 1) Refer to "List of Diagnostic Trouble Code (DTC)". 2) Correct the cause of trouble. 3) Perform Clear Memory Mode. <Ref. to TPM(diag)-10, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 4) Perform the drive test. Drive the vehicle at 40 km/h (25 MPH) or faster for at least 10 minutes. 5) Read the DTC. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Repeat steps 1 to 4 until DTC is not shown.	Finish the diagnosis.

# General Description

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 2. General Description

#### A: CAUTION

##### 1. SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

Airbag system wiring harness is routed near the TPM control module.

##### CAUTION:

- All airbag system wiring harnesses are yellow. Do not use the electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the tire pressure monitoring control module.

##### 2. TIRE PRESSURE MONITORING CONTROL MODULE

- If the transmitter is replaced, ID registration for the transmitter is required. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>
- When adjusting tire pressure indoors in winter, there is a big temperature difference between the indoor facilities and outside. Once the car is outside where the temperature is lower, the air pressure in the tires will drop, causing the tire pressure warning light to illuminate, even if the pressure in the tires was adjusted to standard values indoors. To avoid this, it is necessary to adjust the tire pressure to the high side in consideration of the difference in temperature between inside and outside according to the following table.

a. 215/45ZR17

Temperature °C (°F)	Indoor temperature	15.5 (60)		
	Ambient temperature	-1 (30)	-12 (10)	-23 (-10)
Air pressure kPa (psi)	Front	265 (38)	280 (40)	295 (42)
	Rear	250 (36)	265 (38)	280 (40)

b. 215/45R18 and P215/45R18, P205/50R17

Temperature °C (°F)	Indoor temperature	15.5 (60)		
	Ambient temperature	-1 (30)	-12 (10)	-23 (-10)
Air pressure kPa (psi)	Front	250 (36)	265 (38)	280 (40)
	Rear	240 (35)	255 (37)	270 (39)

c. P225/60R16 and P225/55R17

Temperature °C (°F)	Indoor temperature	15.5 (60)		
	Ambient temperature	-1 (30)	-12 (10)	-23 (-10)
Air pressure kPa (psi)	Front	240 (35)	255 (37)	270 (39)
	Rear	230 (33)	245 (35)	260 (37)

#### B: INSPECTION

Before performing diagnosis, check the following item which might affect the quality of the tire pressure monitoring system.

##### 1. TIRE

- Inspect that the tire pressure is within the specification while the tire is cool. (Refer to Tire Caution Label.)
- Check the tires for damage or the insertion of foreign matters.

##### 2. BATTERY

Check that amount of battery fluid, gravity and voltage are within the specifications.

**Standard voltage: 12 V or more**

**Specific gravity: 1.260 or more**

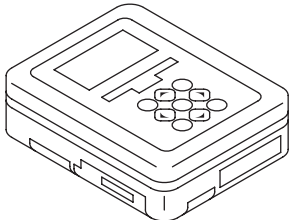
## General Description

### TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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## C: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

### 2. GENERAL TOOL

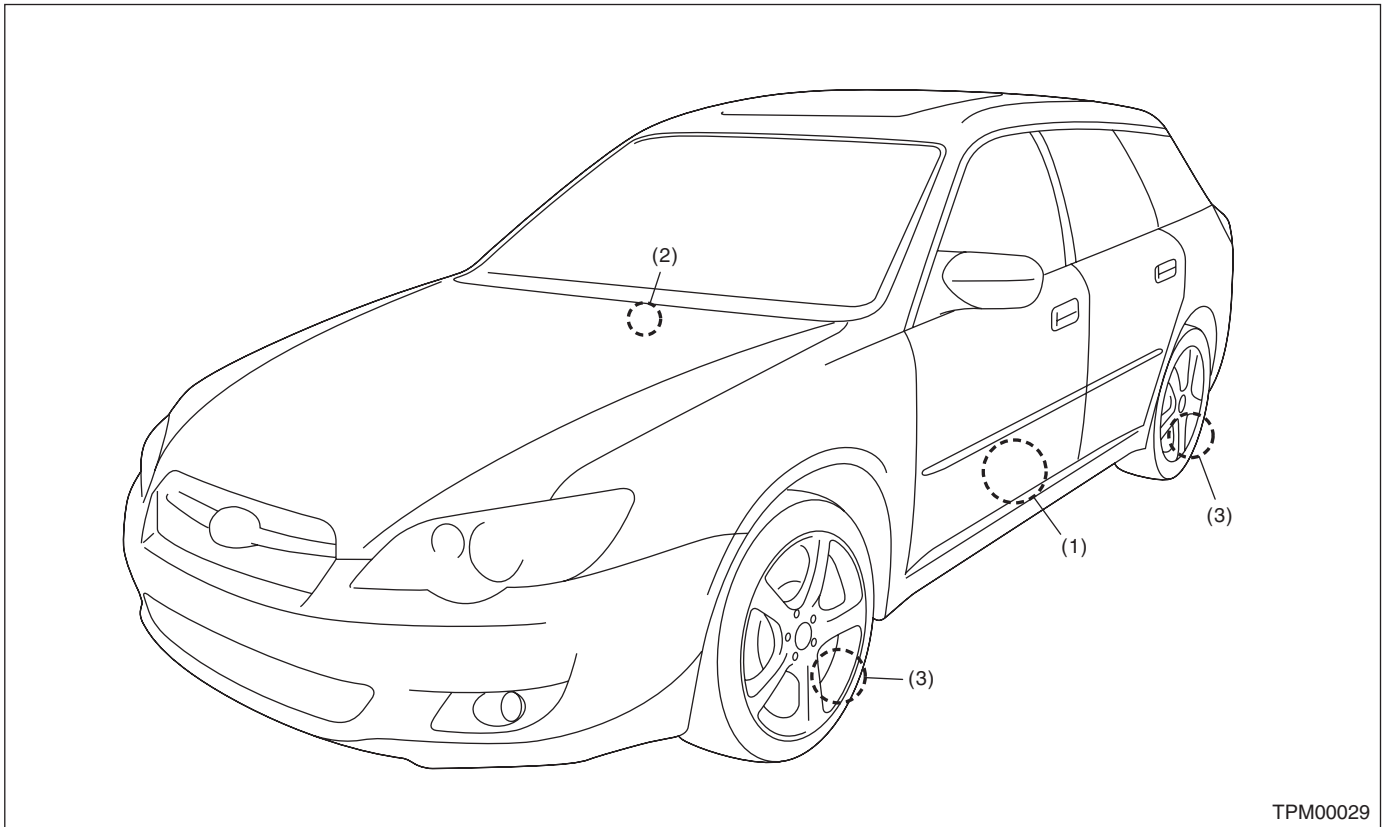
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Transmitter registration tool	Used to register the transmitter ID. Manufacturer: Kent-Moore Item number: J45295

# Electrical Component Location

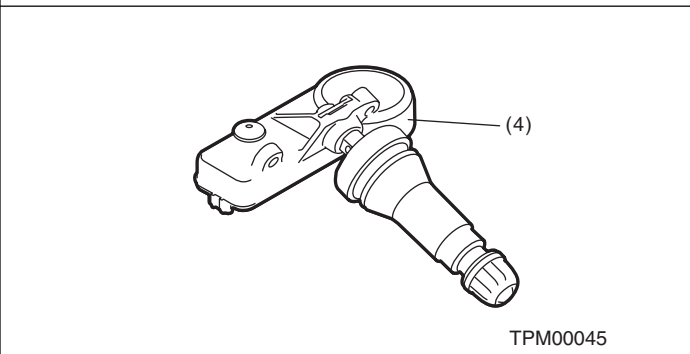
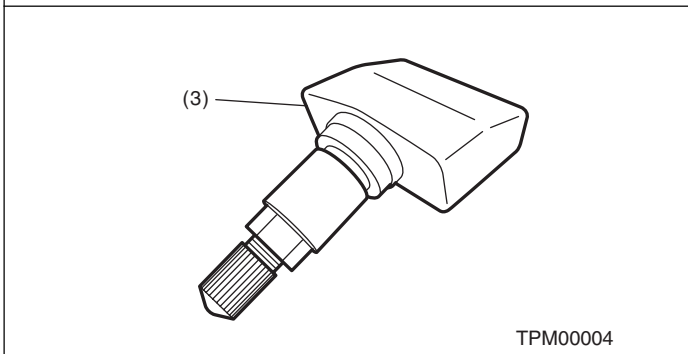
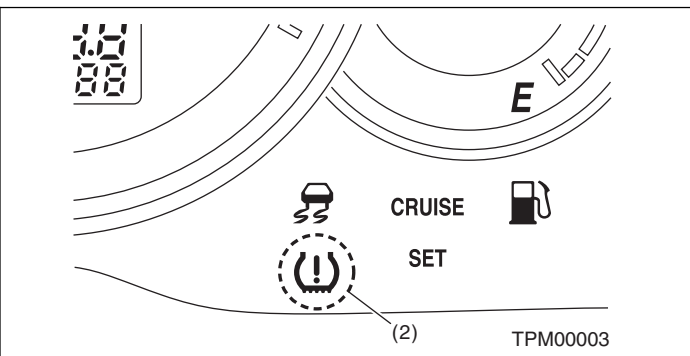
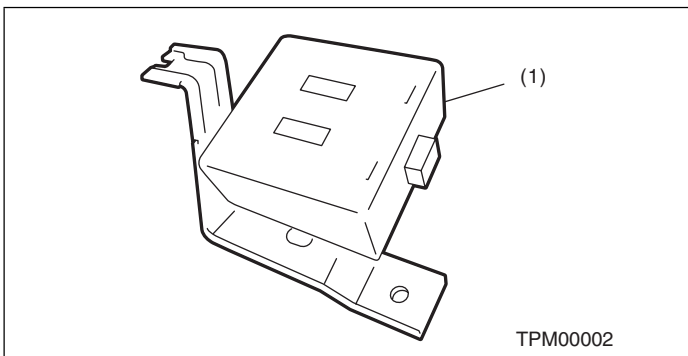
## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 3. Electrical Component Location

#### A: LOCATION



- (1) Tire pressure monitoring control module
- (2) Tire pressure warning light
- (3) Clamp-in type transmitter
- (4) Snap-in type transmitter



## Control Module I/O Signal

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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### 4. Control Module I/O Signal

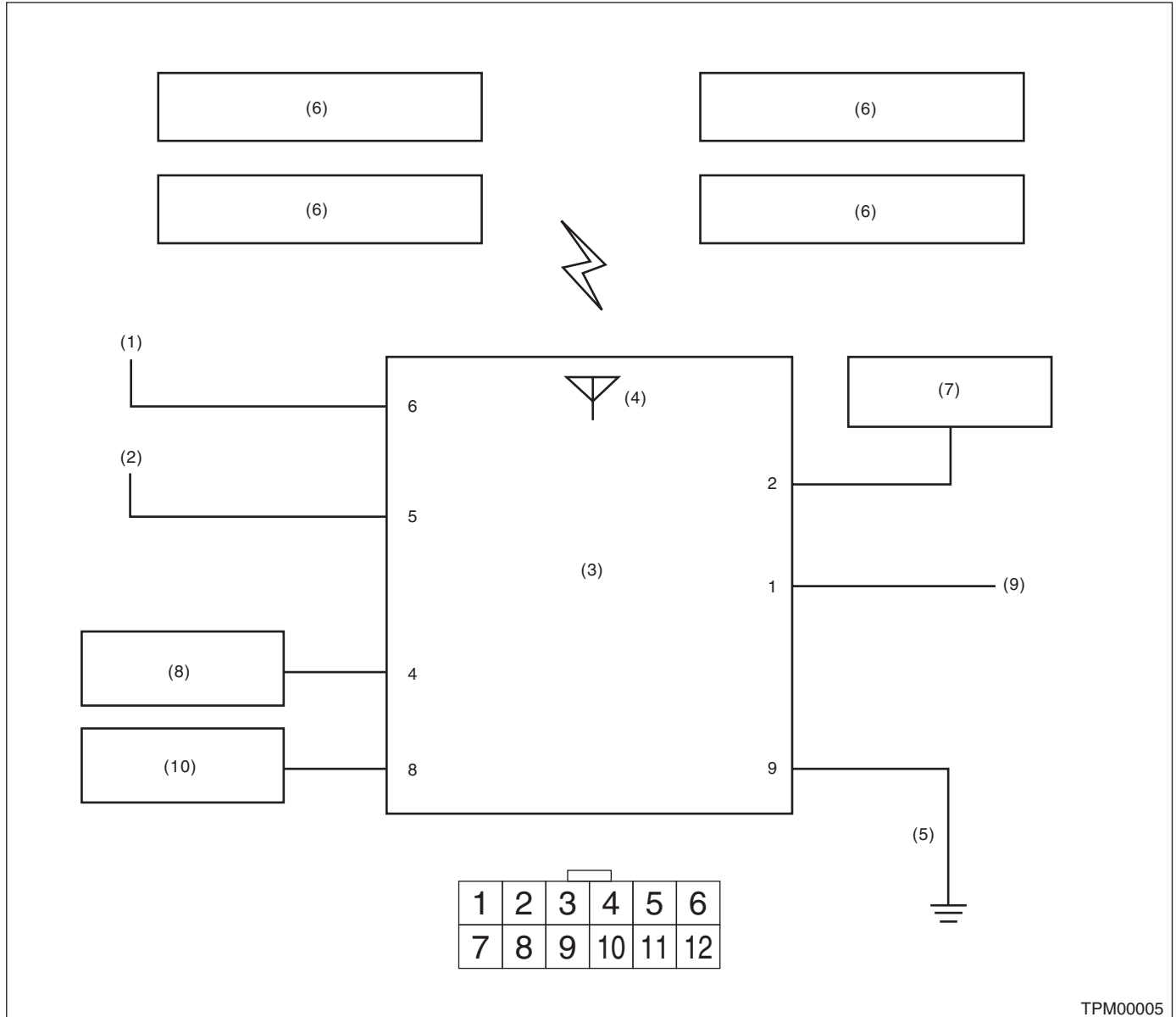
#### A: ELECTRICAL SPECIFICATION

Terminal No.	Measured value	Measuring condition	Remarks
1	Select monitor communication	Serial communication	—
2	Tire pressure warning light output	Illuminate when malfunction occurs, or tire pressure decreases	System failure: blinks 25 times → illuminates Tire pressure decreases: turns on
4	Speed sensor signal	While driving (Pulse signal)	Change according to vehicle speed
5	Ignition power supply	IG switch ON (Battery voltage)	—
6	Battery power supply	Battery voltage	Always
8	Body integrated unit (Hazard output signal)	—	When hazard turns on.
9	GND	0 V (Always)	Always

# Control Module I/O Signal

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## B: WIRING DIAGRAM



- |   |                       |                           |
|---|-----------------------|---------------------------|
| (1) Battery power supply                    | (4) Antenna           | (8) Vehicle speed signal  |
| (2) Ignition power supply                   | (5) GND               | (9) Subaru Select Monitor |
| (3) Tire pressure monitoring control module | (6) Transmitter       | (10) Body integrated unit |
|   | (7) Combination meter |                           |

# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 5. Subaru Select Monitor

#### A: OPERATION

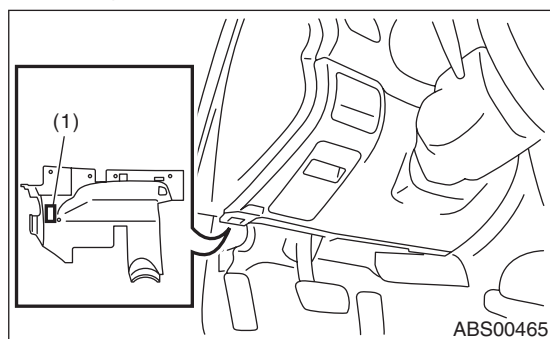
##### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to TPM(diag)-4, SPECIAL TOOL, PREPARATION TOOL, General Description.>

2) Connect the diagnosis cable to the Subaru Select Monitor.

3) Connect the Subaru Select Monitor to the data link connector.

(1) The data link connector is located in the lower portion of the instrument panel (on the driver's side).



(1) Data link connector

(2) Connect the diagnosis cable to the data link connector.

#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.

5) On the «Main Menu», select {Each System Check}.

6) On the «System Selection Menu», select {Tire Pressure Monitor}.

7) After {Model Year} is displayed, select [OK].

8) On the «Tire Pressure Monitor Diagnosis», select {DTC Display}.

#### NOTE:

- For details concerning the operation procedure, refer to the “help file for Subaru Select Monitor”.

- For details concerning DTCs, refer to List of Diagnostic Trouble Codes (DTC). <Ref. to TPM(diag)-26, List of Diagnostic Trouble Code (DTC).>

- All DTCs detected will be displayed.

- If a particular DTC is not properly stored in memory (due to a voltage drop of the tire air pressure monitor control module power supply, etc.) when a problem occurs, a DTC suffixed with a question mark will appear on the Subaru Select Monitor display. This shows it may be an unreliable reading.

9) If communication is not possible between the tire pressure monitoring control module and the Subaru Select Monitor, check the communication circuit. <Ref. to TPM(diag)-11, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

10) When DTC is not displayed, check the indicator circuit and communication circuit. <Ref. to TPM(diag)-14, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>

# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 2. DATA DISPLAY

- 1) On the «Main Menu», select {Each System Check}.
  - 2) On the «System Selection Menu», select {Tire Pressure Monitor}.
  - 3) After the {Tire Pressure Monitor} is displayed, select [OK].
  - 4) On the «Tire Pressure Monitor Diagnosis», select the {Data Display}, and then necessary data will be displayed.
- A list of the support data is shown in the following table.

#### 1. Data monitor (Analog)

Display	Contents to be monitored	Unit of measure
FR FN Code	LEARN, LOW BAT, OFF, WAKE, RE ME, NORMAL	LEARN: Transmitted transmitter ID using the transmitter registration tool LOW BAT: Transmitter battery voltage running low OFF: Transmitter function stops (no data transmission) RE ME: Tire air changes $\pm 8.4$ kPa WAKE: When data transmission is started from a stopped state. NORMAL: Conditions other than above
FL FN Code		
RR FN Code		
RL FN Code		
FR tire pressure	Value converted to tire pressure from data delivered from transmitter is displayed. (The figure may differ from the actual measured values.)	kPa, psig, mmHg, inHg
FL tire pressure		kPa, psig, mmHg, inHg
RR tire pressure		kPa, psig, mmHg, inHg
RL tire pressure		kPa, psig, mmHg, inHg
Vehicle Speed	Vehicle speed signal which is input in control module.	km/h, MPH
Pressure warning	Threshold where tire pressure warning light illuminates	kPa, psig, mmHg, inHg
Return pressure	Threshold where tire pressure warning light goes out	kPa, psig, mmHg, inHg



# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 3. CLEAR MEMORY

- 1) On the «Main Menu», select {2. Each System Check}.
- 2) On the «System Selection Menu», select {Tire Pressure Monitor}.
- 3) After the {Tire Pressure Monitor} is displayed, select [OK].
- 4) On the «Tire Pressure Monitor Diagnosis», select {Clear Memory}.
- 5) When “Done” and “Turn ignition switch to OFF” are shown on the display screen, end the Subaru Select Monitor and turn the ignition switch to OFF.

#### NOTE:

For details concerning the operation procedure, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

### 4. REGISTER TRANSMITTER ID

Perform the procedures below to register the transmitter.

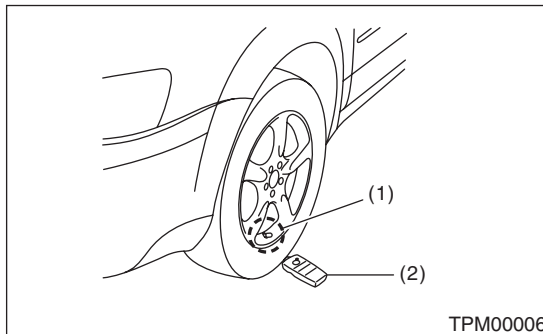
- Transmitter replaced.
- Replaced the tire pressure monitoring control module.

#### NOTE:

- If registration of the transmitter ID is not possible after 2 attempts, replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.> <Ref. to WT-14, TIRE PRESSURE MONITORING CONTROL MODULE, INSTALLATION, Tire Pressure Monitoring System.>
- During the registration, turn the ignition switch to OFF and end the Subaru Select Monitor. Or if the registration is not performed for 5 minutes or more, the registration mode is cancelled.
- When rotating tires, there is no affect on the performance or functions of the tire pressure monitoring control module even if the transmitter (ID) is not registered, however, the tire position displayed on the Subaru Select Monitor will be incorrect.

- 1) Adjust all tire pressures to the specifications.
- 2) Connect Subaru Select Monitor and select {2. Each System Check} on the «Main Menu».
- 3) On the «System Selection Menu», select {Tire Pressure Monitor}.
- 4) After the {Tire Pressure Monitor} is displayed, select [OK].
- 5) On the «Tire Pressure Monitor Diagnosis», select {Transmitter ID regist confirm}.
- 6) {When ID registration mode execute, Registered ID is deleted Proceed?} is displayed, select [OK].

- 7) Touch the transmitter registration tool to the side wall area near the air valve on the front left tire, and press the switch. The transmitter ID is sent to the tire pressure monitoring control module. (At that time, the tire pressure warning light blinks to confirm that the registration has started.)



- (1) Air valve (transmitter)
- (2) Transmitter registration tool

#### NOTE:

- The registration order of transmitter ID is not specified.
  - The transmitter registration tool is used by touching the side wall area near the transmitter.
  - When registration of each tire is completed, the hazard light will blink and {ID registration completed} is displayed on the Select Monitor screen.
  - If registration procedure stop in the halfway (turning ignition switch to OFF, wrong registration order, etc), proceed from step 5)
- 8) When ID registration is completed, the tire pressure warning light remains lit for approximately 2 seconds, to end the registration. Switch to the screen displaying the transmitter ID on the Subaru Select Monitor display. <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID)., OPERATION, Subaru Select Monitor.>
  - 9) Check the transmitter ID that was registered, then perform a driving test. <Ref. to TPM(diag)-17, PROCEDURE, Inspection Mode.>

### 5. DISPLAY TRANSMITTER (ID).

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Tire Pressure Monitor}.
- 3) After the {Tire Pressure Monitor} is displayed, select [OK].
- 4) On the «Tire Pressure Monitor Diagnosis», select {Transmitter ID regist confirm}.
- 5) Select the {Transmitter ID Data Monitor} and then select [OK] to display the transmitter ID.

# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### B: INSPECTION

#### 1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

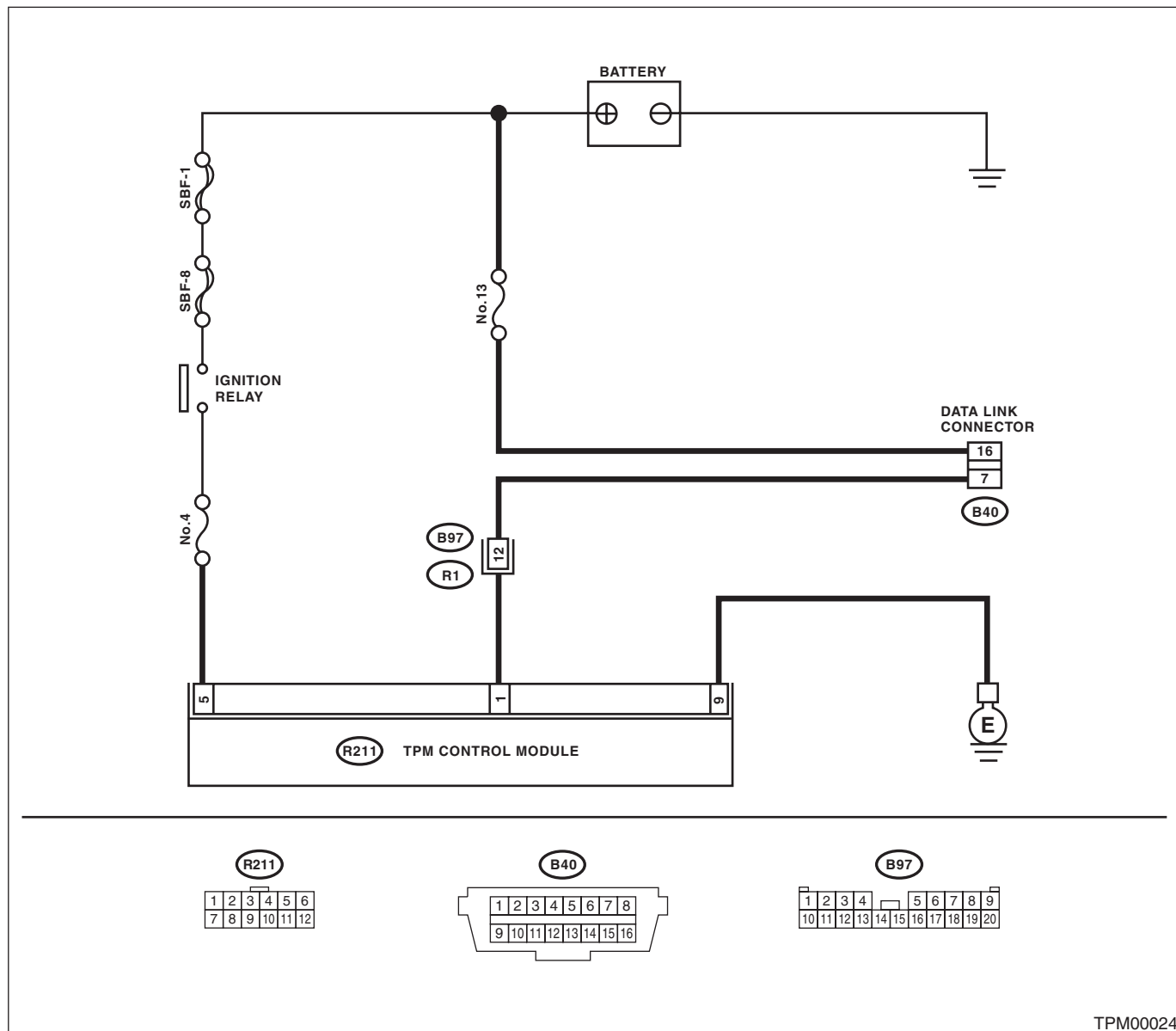
##### DETECTING CONDITION:

Defective harness connector

##### TROUBLE SYMPTOM:

Communication is impossible between the tire pressure monitoring control module and the Subaru Select Monitor.

##### WIRING DIAGRAM:



# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK IGNITION SWITCH.</b>	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select TPM mode using Subaru Select Monitor.
2	<b>CHECK BATTERY.</b>	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
3	<b>CHECK BATTERY TERMINAL.</b>	Is there poor contact at battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
4	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be performed normally.	Is the system name displayed on Subaru Select Monitor?	Go to step 8.	Go to step 5.
5	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the tire pressure monitoring control module connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Is the system name displayed on Subaru Select Monitor?	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Go to step 6.
6	<b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the tire pressure monitoring control module. 3) Measure the resistance between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7	<b>CHECK THE TIRE PRESSURE MONITORING CONTROL MODULE OUTPUT SIGNAL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between tire pressure monitoring control module and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control module and data link connector.
8	<b>CHECK HARNESS CONNECTOR BETWEEN TIRE PRESSURE MONITORING CONTROL MODULE AND DATA LINK CONNECTOR.</b> Measure the resistance between tire pressure monitoring control module and data link connector. <b>Connector &amp; terminal</b> <b>(R211) No. 1 — (B40) No. 7:</b>	Is resistance less than 0.5 $\Omega$ ?	Go to step 9.	Repair the harness and connector between tire pressure monitoring control module and data link connector.
9	<b>CHECK TIRE PRESSURE MONITORING CONTROL MODULE CONNECTOR.</b> Turn the ignition switch to OFF.	Is the tire pressure monitoring control module connector inserted in the tire pressure monitoring control module until it locks?	Go to step 10.	Insert the tire pressure monitoring control module connector into the tire pressure monitoring control module.

# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the ignition power voltage between tire pressure monitoring control module connector and chassis ground. <b>Connector &amp; terminal</b> <b>(R211) No. 5 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit of the harness between the tire pressure monitoring control module and battery.
<b>11 CHECK HARNESS CONNECTOR BETWEEN TIRE PRESSURE MONITORING CONTROL MODULE AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the tire pressure monitoring control module. 3) Measure the resistance of harness between tire pressure monitoring control module and chassis ground. <b>Connector &amp; terminal</b> <b>(R211) No. 9 — Chassis ground:</b>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 12.	Repair open circuit of the harness of the tire pressure monitoring control module.
<b>12 CHECK POOR CONTACT OF CONNECTOR.</b>	Is there poor contact in tire pressure monitoring control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>

# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 2. WITHOUT DTC

#### DETECTING CONDITION:

- Defective combination meter
- Defective harness

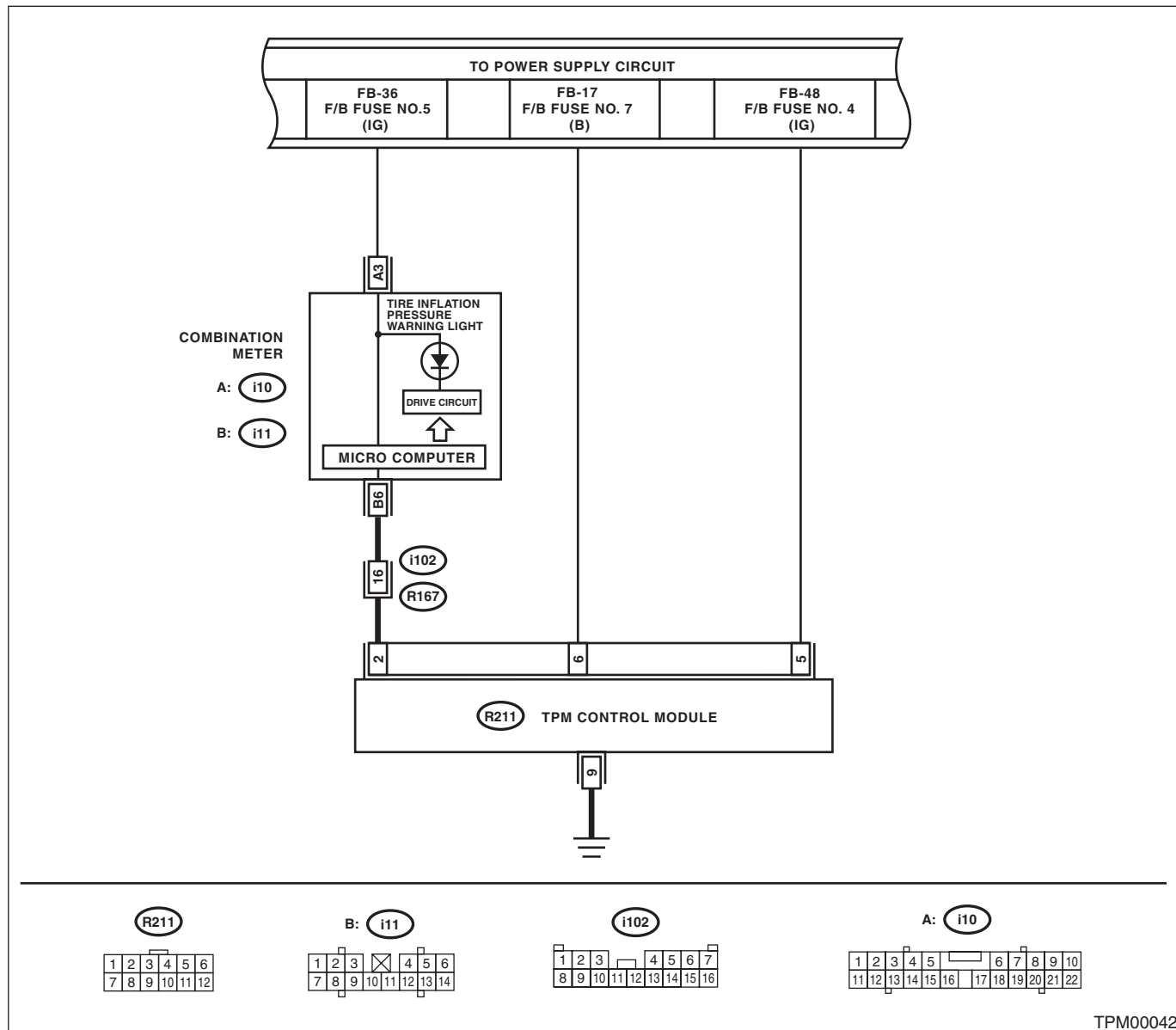
#### TROUBLE SYMPTOM:

- TIRE PRESSURE WARNING LIGHT DOES NOT GO OFF
- "NO TROUBLE CODE" will be displayed on the Subaru Select Monitor.

#### NOTE:

When the tire pressure warning light is OFF and "NO TROUBLE CODE" is displayed on Subaru Select Monitor, the system is in a normal condition.

#### WIRING DIAGRAM:



# Subaru Select Monitor

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK SUBARU SELECT MONITOR DATA.</b> 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Read the data of the "Tire pressure warning light".	Is "ON" indicated?	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Go to step 2.
<b>2 CHECK WIRING HARNESS.</b> Measure the resistance between tire pressure monitoring control module and combination meter connector. <b>Connector &amp; terminal</b> <i>(i11) No. 6 — (R211) No. 2:</i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the harness and connector between tire pressure monitoring control module and combination meter.
<b>3 CHECK POOR CONTACT OF CONNECTOR.</b>	Is there poor contact in the tire pressure monitoring control module connector and combination meter connector?	Repair the connector.	Check the combination meter.

## Read Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

---

### 6. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

For details regarding reading of DTCs, refer to "Subaru Select Monitor". <Ref. to TPM(diag)-8, Subaru Select Monitor.>

### 7. Inspection Mode

#### A: PROCEDURE

Reproduce the malfunction occurrence condition as much as possible. Drive the vehicle at 40 km/h (25 MPH) or faster for at least ten minutes.



## Clear Memory Mode

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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### 8. Clear Memory Mode

#### A: OPERATION

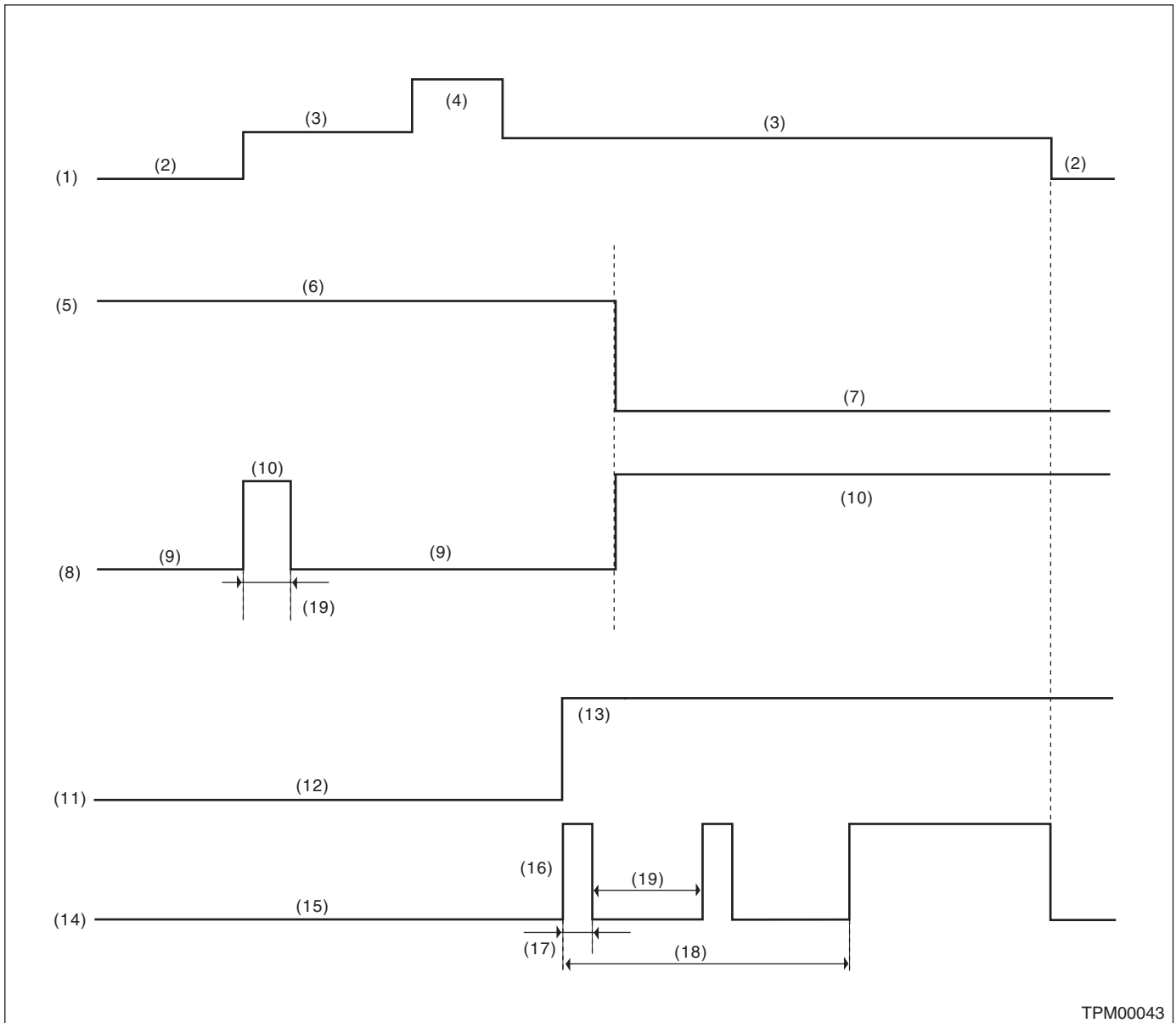
For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to TPM(diag)-8, Subaru Select Monitor.>

# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## 9. Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

### A: INSPECTION



TPM00043

- |   |                                 |                                  |
|---|---------------------------------|----------------------------------|
| (1) Ignition switch                                     | (8) Tire pressure warning light | (14) Tire pressure warning light |
| (2) OFF   | (9) Light OFF                   | (15) Light OFF                   |
| (3) ON  | (10) Light ON                   | (16) Blink                       |
| (4) Start   | (11) System status              | (17) 1 second                    |
| (5) Tire pressure                                       | (12) Normal                     | (18) Blinks 25 times             |
| (6) Meet the specification                              | (13) Malfunction                | (19) 2 seconds                   |
| (7) 180 kPa (1.8 kgf/cm <sup>2</sup> , 26 psi), or less |                                 |                                  |

# **Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern**

## **TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)**

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1) When the tire pressure warning light does not illuminate in accordance with this illumination pattern, there must be an electrical malfunction.

2) If the tire pressure warning light does not go off, check the tire pressure monitoring control module/warning light circuit and the combination meter circuit. <Ref. to TPM(diag)-22, TIRE PRESSURE WARNING LIGHT DOES NOT COME OFF, Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern.>

### **NOTE:**

If the problem is fixed while driving at approximately 40 km/h (25 MPH) after the tire pressure warning light blinks/lights, the warning light goes out and the tire pressure monitor system operates normally. (If there is a decrease in tire pressure, or a malfunction of the system, the malfunction history is displayed.)

# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## B: TIRE PRESSURE WARNING LIGHT DOES NOT COME ON

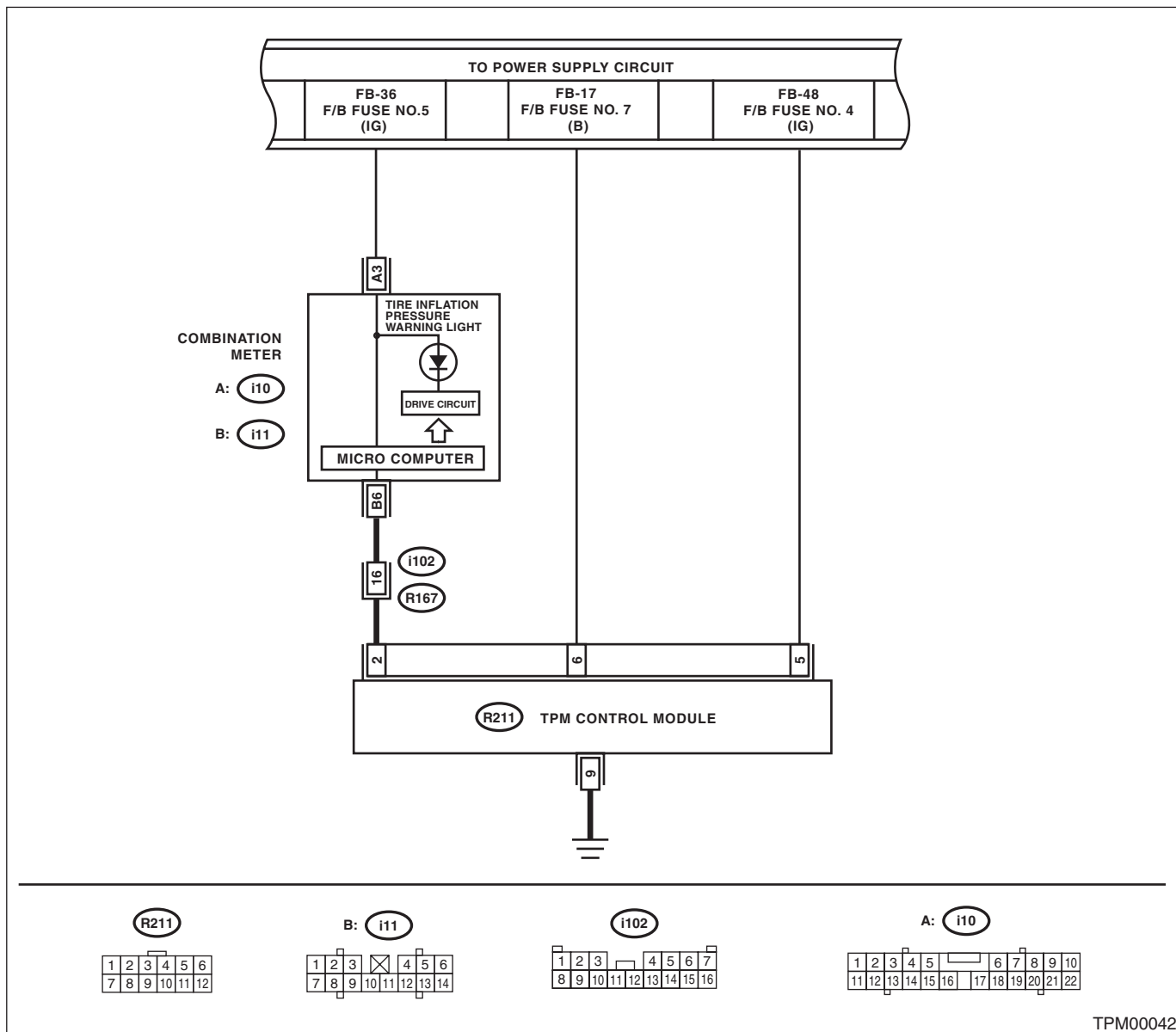
### DETECTING CONDITION:

Defective combination meter

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), the tire pressure warning light does not come on (for approximately 2 seconds).

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<p><b>CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. &lt;Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.&gt;</p>	<p>Is diagnostics code (DTC) displayed?</p>	<p>Perform the diagnosis according to the DTC. &lt;Ref. to TPM(diag)-26, List of Diagnostic Trouble Code (DTC).&gt;</p>	<p>Replace the combination meter. &lt;Ref. to IDI-19, REMOVAL, Combination Meter.&gt;</p>

# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## C: TIRE PRESSURE WARNING LIGHT DOES NOT COME OFF

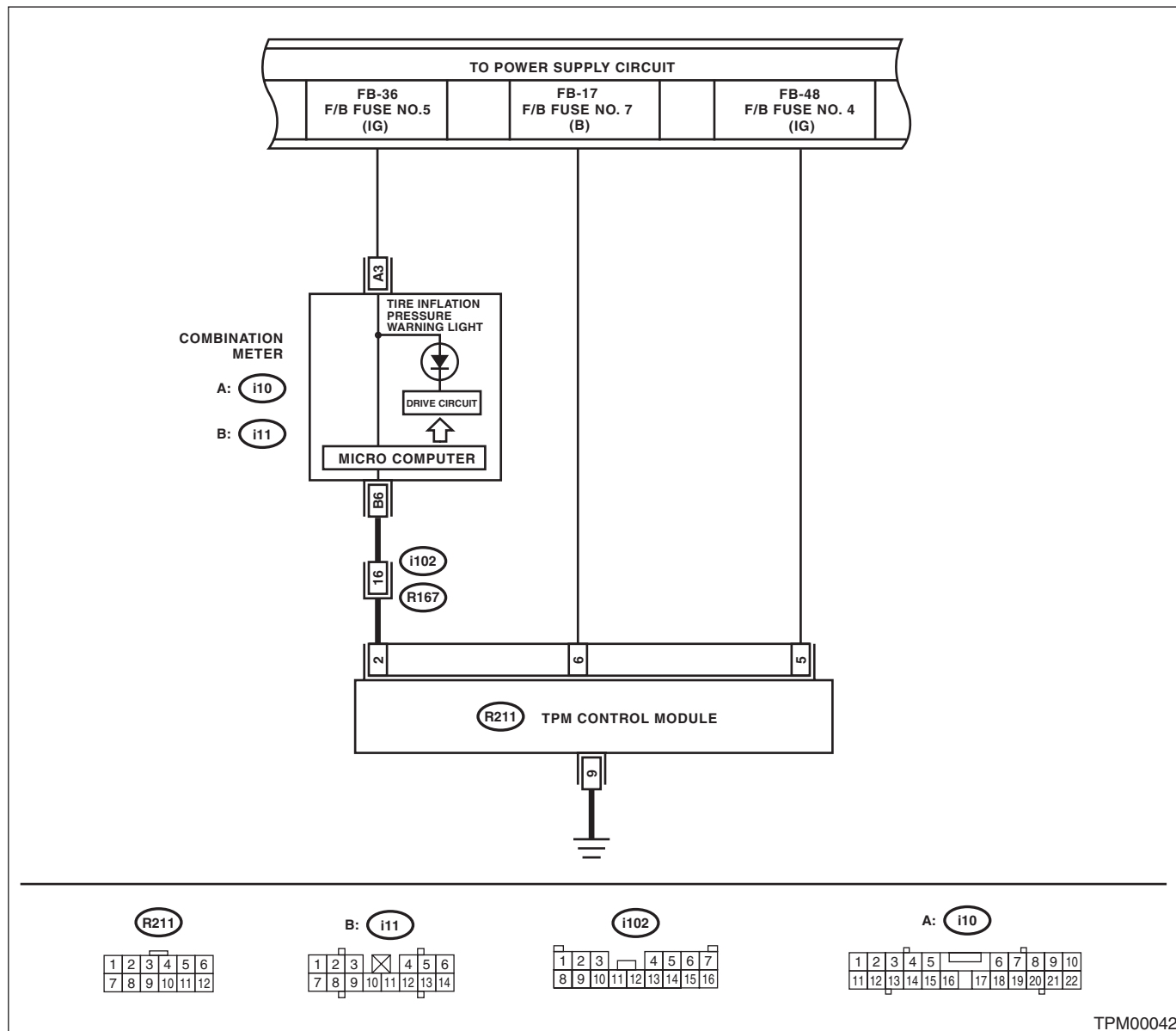
### DETECTING CONDITION:

- Defective combination meter
- Tires pressure drop
- Transmitter ID not registered

### TROUBLE SYMPTOM:

Tire pressure warning light remains illuminating after engine starts.

### WIRING DIAGRAM:



# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to the DTC. <Ref. to TPM(diag)-26, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK TRANSMITTER (ID).</b> Display the transmitter ID of the tire pressure monitor system.	Is the transmitter ID registered?	Go to step 3.	Register the transmitter ID. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.>
3	<b>CHECK TRANSMITTER DATA OUTPUT.</b> 1) Select data display of the tire pressure monitoring. 2) Start the engine and check the tire pressure warning light output.	Is the warning light output ON?	Replace the tire pressure monitoring control module. <Ref. to WT-12, TIRE PRESSURE MONITORING CONTROL MODULE, REMOVAL, Tire Pressure Monitoring System.>	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>

# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

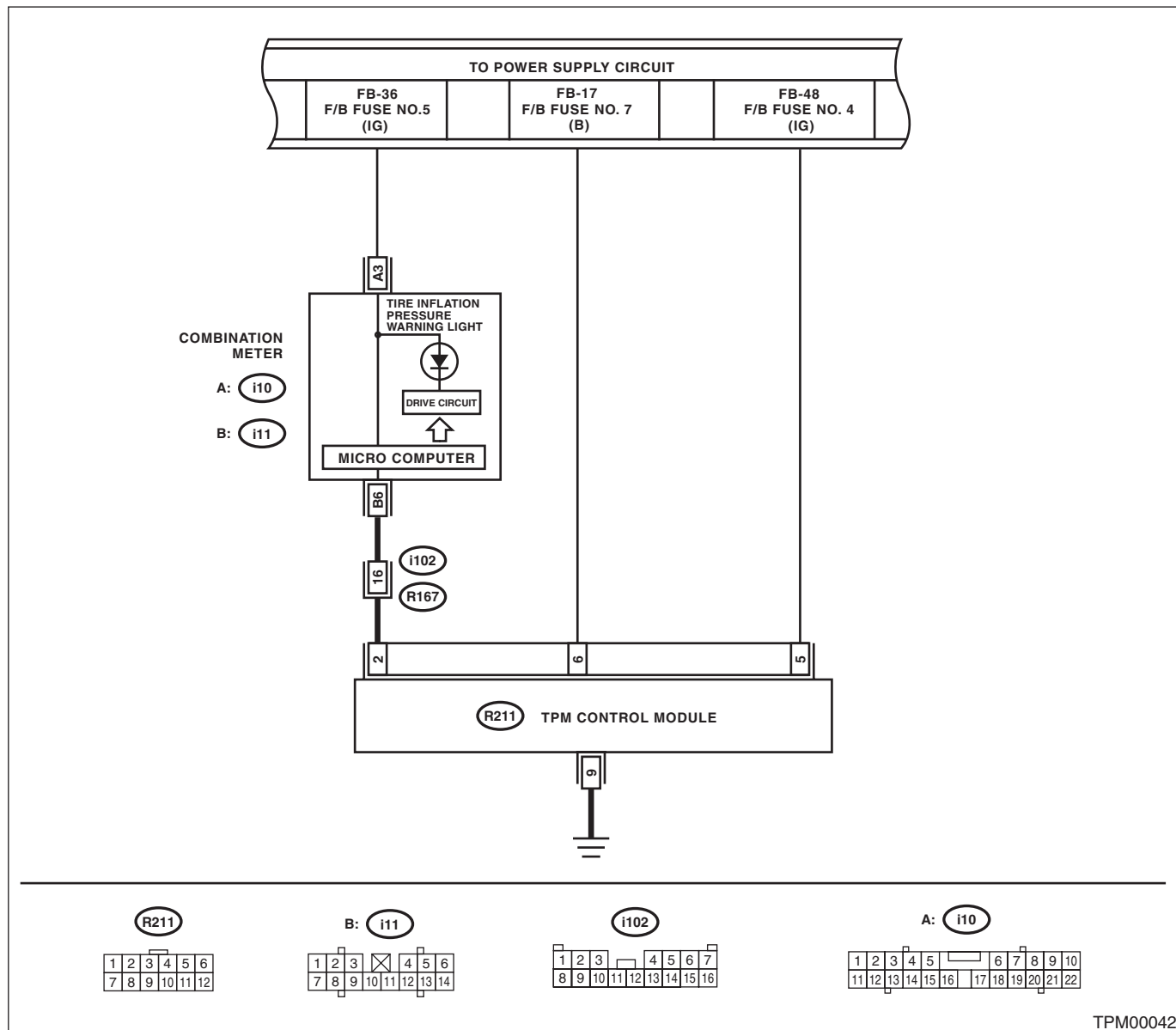
## D: TIRE PRESSURE WARNING LIGHT IS 25 TIMES BLINKING AND TURN ON DETECTING CONDITION:

- Tire pressure monitoring control module is faulty.
- Defective harness
- Transmitter is faulty.

### TROUBLE SYMPTOM:

Every time the engine starts, tire pressure warning light blinks 25 times and then illuminates.

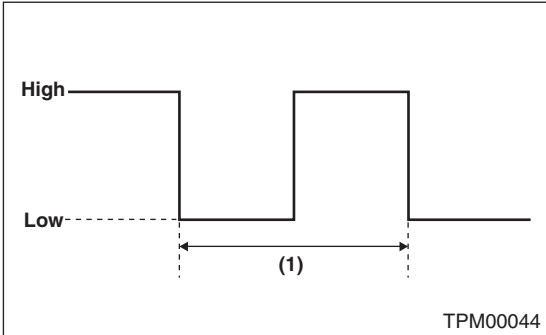
### WIRING DIAGRAM:



TPM00042

# Tire Pressure Warning Light / Trouble Indicator Light Illumination Pattern

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> Connect the Subaru Select Monitor, and read the Diagnostic Trouble Code. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is diagnostics code (DTC) displayed?	Perform the diagnosis according to the DTC. <Ref. to TPM(diag)-26, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	<b>CHECK HARNESS.</b> 1) Connect the Subaru Select Monitor to the terminal No. 2 of the tire pressure monitoring control module connector (R211). <b>Connector &amp; terminal</b> <b>(R211) No. 2 (+) — Chassis ground (-):</b> 2) Turn the ignition switch to ON, and select "Oscilloscope" from the Main Menu of Subaru Select Monitor. 3) Check the voltage displayed.	Is the voltage 10 V or more?	Go to step 3.	Go to step 4.
3	<b>CHECK HARNESS.</b> 1) Check the output waveform displayed in the oscilloscope of Subaru Select Monitor. 	Is the pattern the same output waveform as shown in the figure? (1) 400±20 ms Duty 50 % High: Battery voltage Low: 1.5 V or less	Check the combination meter.	Replace the tire pressure monitoring control module. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>
4	<b>CHECK HARNESS.</b> 1) Disconnect the tire pressure monitoring control module connector. 2) Connect the Subaru Select Monitor to the terminal No. 2 of the tire pressure monitoring control module connector (R211). <b>Connector &amp; terminal</b> <b>(R211) No. 2 (+) — Chassis ground (-):</b> 3) Turn the ignition switch to ON, and select "Oscilloscope" from the Main Menu of Subaru Select Monitor. 4) Check the voltage displayed.	Is the voltage 10 V or more?	Replace the tire pressure monitoring control module. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>	The harness between the combination meter connector and the tire pressure monitoring control module connector is shorted or open. Repair or replace the harness.



## List of Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### 10. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Contents of diagnosis	Remarks
11	Tire 1 Air Pressure Decrease	Tire pressure of tire 1 is reduced.	<Ref. to TPM(diag)-28, DTC 11 TIRE 1 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	Tire 2 Air Pressure Decrease	Tire pressure of tire 2 is reduced.	<Ref. to TPM(diag)-28, DTC 12 TIRE 2 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	Tire 3 Air Pressure Decrease	Tire pressure of tire 3 is reduced.	<Ref. to TPM(diag)-28, DTC 13 TIRE 3 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
14	Tire 4 Air Pressure Decrease	Tire pressure of tire 4 is reduced.	<Ref. to TPM(diag)-28, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Transmitter 1 No Data	Data cannot be received from transmitter 1.	<Ref. to TPM(diag)-29, DTC 21 TRANSMITTER 1 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Transmitter 2 No Data	Data cannot be received from transmitter 2.	<Ref. to TPM(diag)-29, DTC 22 TRANSMITTER 2 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	Transmitter 3 No Data	Data cannot be received from transmitter 3.	<Ref. to TPM(diag)-29, DTC 23 TRANSMITTER 3 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	Transmitter 4 No Data	Data cannot be received from transmitter 4.	<Ref. to TPM(diag)-30, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
31	Transmitter 1 Pressure Data Abnormal	Transmitter 1 data contents are abnormal.	<Ref. to TPM(diag)-31, DTC 31 TRANSMITTER 1 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
32	Transmitter 2 Pressure Data Abnormal	Transmitter 2 data contents are abnormal.	<Ref. to TPM(diag)-31, DTC 32 TRANSMITTER 2 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
33	Transmitter 3 Pressure Data Abnormal	Transmitter 3 data contents are abnormal.	<Ref. to TPM(diag)-31, DTC 33 TRANSMITTER 3 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
34	Transmitter 4 Pressure Data Abnormal	Transmitter 4 data contents are abnormal.	<Ref. to TPM(diag)-32, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
41	Transmitter 1 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-33, DTC 41 TRANSMITTER 1 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

DTC	Item	Contents of diagnosis	Remarks
42	Transmitter 2 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-33, DTC 42 TRANSMITTER 2 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
43	Transmitter 3 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-33, DTC 43 TRANSMITTER 3 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	Transmitter 4 Function Code Abnormal	Function code has error.	<Ref. to TPM(diag)-34, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
51	Transmitter 1 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-35, DTC 51 TRANSMITTER 1 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
52	Transmitter 2 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-35, DTC 52 TRANSMITTER 2 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
53	Transmitter 3 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-35, DTC 53 TRANSMITTER 3 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
54	Transmitter 4 Battery Voltage Decrease	Transmitter battery voltage is low.	<Ref. to TPM(diag)-35, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
61	Vehicle Speed Is Abnormal	Vehicle speed signal is not input to the control module when the vehicle speed is 6 km/h (3.7 MPH) or more.	<Ref. to TPM(diag)-36, DTC 61 VEHICLE SPEED IS ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## 11. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC 11 TIRE 1 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for the diagnostic procedure. <Ref. to TPM(diag)-28, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### B: DTC 12 TIRE 2 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for the diagnostic procedure. <Ref. to TPM(diag)-28, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### C: DTC 13 TIRE 3 AIR PRESSURE DECREASE

NOTE:

Refer to DTC 14 for the diagnostic procedure. <Ref. to TPM(diag)-28, DTC 14 TIRE 4 AIR PRESSURE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### D: DTC 14 TIRE 4 AIR PRESSURE DECREASE

#### DTC DETECTING CONDITION:

Inflation pressure of tires dropped under specifications (180 kPs (1.8 kgf/cm<sup>2</sup>, 26.1 psi) or less).

#### TROUBLE SYMPTOM:

Tire pressure warning light illuminates.

	Step	Check	Yes	No
1	<b>CHECK THE TIRES.</b> Lift up the vehicle and check for damage in the tires.	Are there cracks or damage?	Replace the tire. <Ref. to WT-5, Tire.>	Go to step 2.
2	<b>CHECK THE TIRES.</b> Check the tire air pressure.	Is the tire pressure in the specifications?	Go to step 3.	Adjust the air pressure.
3	<b>CHECK TRANSMITTER.</b> Drive the vehicle at 40 km/h (25 MPH) or faster and compare the data from the transmitter on the four wheels.	Is there a transmitter with different data?	Replace the transmitter (tire pressure sensor). <Ref. to WT-12, Tire Pressure Monitoring System.>	Go to step 4.
4	<b>PERFORM DRIVING TEST.</b> 1) Perform Clear Memory Mode. <Ref. to TPM(diag)-10, CLEAR MEMORY, OPERATION, Subaru Select Monitor.> 2) Perform a driving test. <Ref. to TPM(diag)-17, PROCEDURE, Inspection Mode.> 3) Read the DTC. <Ref. to TPM(diag)-8, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Inspect by referring to "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to TPM(diag)-28, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

#### CAUTION:

When driving vehicle to perform driving test, there should be always 2 persons (driver and checker) to check.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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### **E: DTC 21 TRANSMITTER 1 NO DATA**

**NOTE:**

Refer to DTC 24 for the diagnostic procedure. <Ref. to TPM(diag)-30, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **F: DTC 22 TRANSMITTER 2 NO DATA**

**NOTE:**

Refer to DTC 24 for the diagnostic procedure. <Ref. to TPM(diag)-30, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **G: DTC 23 TRANSMITTER 3 NO DATA**

**NOTE:**

Refer to DTC 24 for the diagnostic procedure. <Ref. to TPM(diag)-30, DTC 24 TRANSMITTER 4 NO DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### H: DTC 24 TRANSMITTER 4 NO DATA

#### DTC DETECTING CONDITION:

Data from each transmitter is not received for 8 minutes.

#### TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

	Step	Check	Yes	No
1	<b>START FL TRANSMITTER.</b> 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmitter ID". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID)., OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace front left transmitter.
2	<b>CHECK FL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
3	<b>START FR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the front right transmitter.
4	<b>CHECK FR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
5	<b>START RR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter.
6	<b>CHECK RR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
7	<b>START RL TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter.
8	<b>CHECK RL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
9	<b>CHECK MALFUNCTION TRANSMITTER.</b>	Is ID recorded by this procedure?	Go to step 10.	Go to step 1.
10	<b>CHECK MALFUNCTION TRANSMITTER.</b> Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position.	Replace the transmitter showing the latest ID that is not included in the registered IDs.

#### CAUTION:

When driving vehicle to perform driving test, there should be always 2 persons (driver and checker) to check.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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## **I: DTC 31 TRANSMITTER 1 PRESSURE DATA ABNORMAL**

NOTE:

Refer to DTC 34 for the diagnostic procedure. <Ref. to TPM(diag)-32, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **J: DTC 32 TRANSMITTER 2 PRESSURE DATA ABNORMAL**

NOTE:

Refer to DTC 34 for the diagnostic procedure. <Ref. to TPM(diag)-32, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **K: DTC 33 TRANSMITTER 3 PRESSURE DATA ABNORMAL**

NOTE:

Refer to DTC 34 for the diagnostic procedure. <Ref. to TPM(diag)-32, DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### L: DTC 34 TRANSMITTER 4 PRESSURE DATA ABNORMAL

#### DTC DETECTING CONDITION:

- When comparing the data from each transmitter to the previous data, the change is large.
- The pressure exceeds what the transmitter can measure. (Excessive pressure)

#### TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

	Step	Check	Yes	No
1	<b>START FL TRANSMITTER.</b> 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmitter ID". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID)., OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace front left transmitter.
2	<b>CHECK FL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
3	<b>START FR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the front right transmitter.
4	<b>CHECK FR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
5	<b>START RR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter.
6	<b>CHECK RR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
7	<b>START RL TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter.
8	<b>CHECK RL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
9	<b>CHECK MALFUNCTION TRANSMITTER.</b>	Is ID recorded by this procedure?	Go to step 10.	Go to step 1.
10	<b>CHECK MALFUNCTION TRANSMITTER.</b> Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position.	Replace the transmitter showing the latest ID that is not included in the registered IDs.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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### **M: DTC 41 TRANSMITTER 1 FUNCTION CODE ABNORMAL**

**NOTE:**

Refer to DTC 44 for the diagnostic procedure. <Ref. to TPM(diag)-34, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **N: DTC 42 TRANSMITTER 2 FUNCTION CODE ABNORMAL**

**NOTE:**

Refer to DTC 44 for the diagnostic procedure. <Ref. to TPM(diag)-34, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **O: DTC 43 TRANSMITTER 3 FUNCTION CODE ABNORMAL**

**NOTE:**

Refer to DTC 44 for the diagnostic procedure. <Ref. to TPM(diag)-34, DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

#### **P: DTC 44 TRANSMITTER 4 FUNCTION CODE ABNORMAL**

##### **DTC DETECTING CONDITION:**

Unexpected function codes received from each transmitter.

##### **TROUBLE SYMPTOM:**

Tire pressure warning light blinks 25 times and then illuminates.

Step	Check	Yes	No
<b>1 START FL TRANSMITTER.</b> 1) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 2) Select "Transmitter ID". <Ref. to TPM(diag)-10, DISPLAY TRANSMITTER (ID)., OPERATION, Subaru Select Monitor.> 3) Use the transmitter registration tool and transmit the ID from the FL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 2.	Replace front left transmitter.
<b>2 CHECK FL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 1 registered ID.	Are the two IDs same?	Go to step 3.	Record the received ID update as the FL transmitter. Go to step 3.
<b>3 START FR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the FR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 4.	Replace the front right transmitter.
<b>4 CHECK FR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 2 registered ID.	Are the two IDs same?	Go to step 5.	Record the received ID update as the FR transmitter. Go to step 5.
<b>5 START RR TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RR transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 6.	Replace the RR transmitter.
<b>6 CHECK RR TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 3 registered ID.	Are the two IDs same?	Go to step 7.	Record the received ID update as the RR transmitter. Go to step 7.
<b>7 START RL TRANSMITTER.</b> Use the transmitter registration tool and transmit the ID from the RL transmitter to check "Latest Received ID".	Is "Latest Received ID" updated?	Go to step 8.	Replace the RL transmitter.
<b>8 CHECK RL TRANSMITTER ID.</b> Check the ID displayed in the updated ID display and the tire 4 registered ID.	Are the two IDs same?	Go to step 9.	Record the received ID update as the RL transmitter. Go to step 9.
<b>9 CHECK MALFUNCTION TRANSMITTER.</b>	Is ID recorded by this procedure?	Go to step 10.	Replace the transmitter indicated by DTC.
<b>10 CHECK MALFUNCTION TRANSMITTER.</b> Check the registered ID of the transmitter indicated by DTC.	Is there checked ID in the record?	Replace the transmitter of the recorded position.	Replace the transmitter indicated by DTC.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

## Q: DTC 51 TRANSMITTER 1 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for the diagnostic procedure. <Ref. to TPM(diag)-35, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## R: DTC 52 TRANSMITTER 2 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for the diagnostic procedure. <Ref. to TPM(diag)-35, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## S: DTC 53 TRANSMITTER 3 BATTERY VOLTAGE DECREASE

NOTE:

Refer to DTC 54 for the diagnostic procedure. <Ref. to TPM(diag)-35, DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## T: DTC 54 TRANSMITTER 4 BATTERY VOLTAGE DECREASE

### DTC DETECTING CONDITION:

Low battery signals received 20 times from each transmitter.

### TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

	Step	Check	Yes	No
1	<b>CHECK TRANSMITTER.</b> 1) Replace all transmitters and register their IDs. <Ref. to TPM(diag)-10, REGISTER TRANSMITTER ID, OPERATION, Subaru Select Monitor.> 2) Perform the Clear Memory Mode, and perform driving test.	Is the fault eliminated?	Internal battery of the transmitter had worn out.	Replace the tire pressure monitoring control module. <Ref. to WT-12, REMOVAL, Tire Pressure Monitoring System.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

### U: DTC 61 VEHICLE SPEED IS ABNORMAL

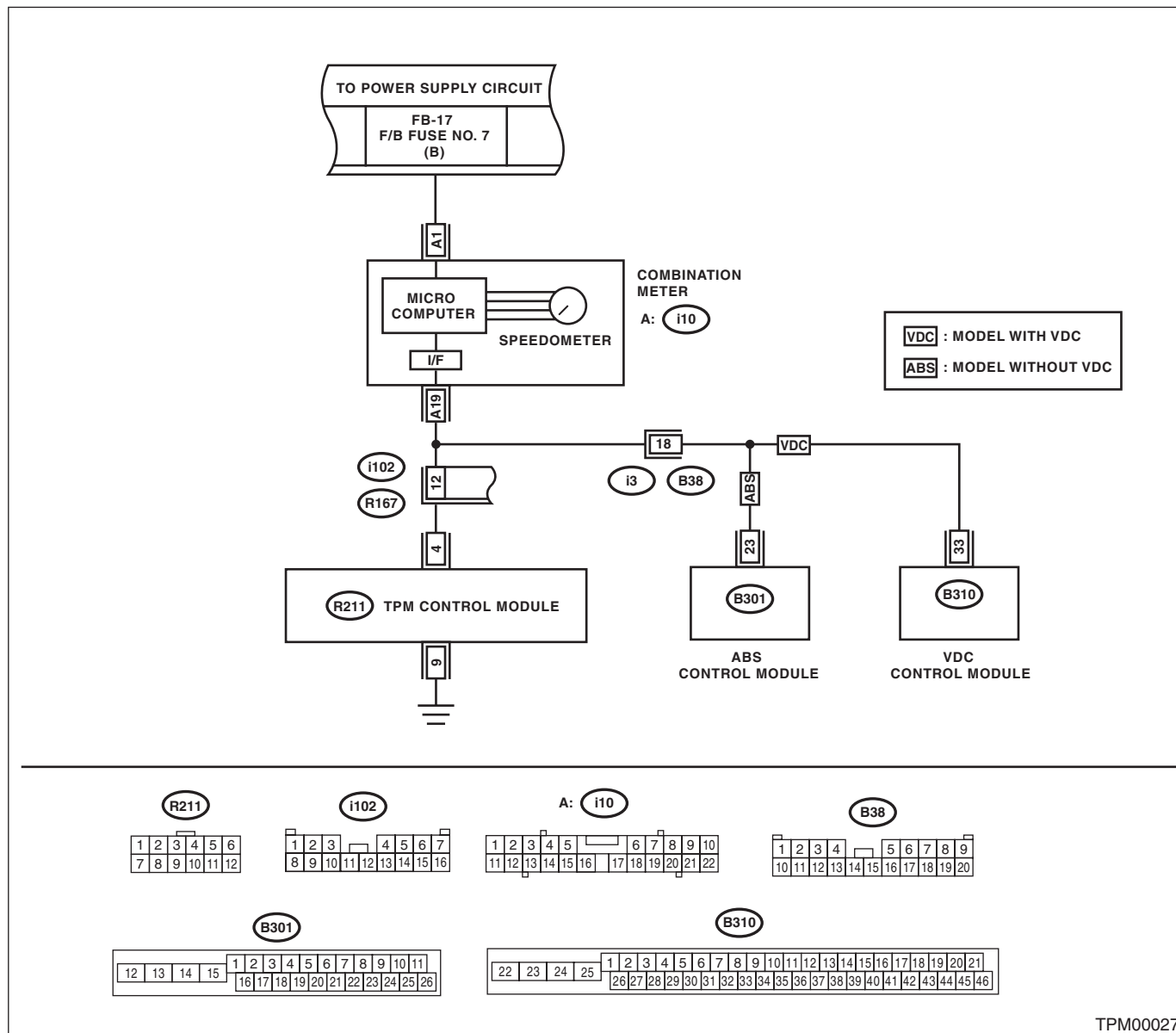
#### DTC DETECTING CONDITION:

Vehicle speed function codes were received from the transmitter, but the vehicle speed signal was not input to the module.

#### TROUBLE SYMPTOM:

Tire pressure warning light blinks 25 times and then illuminates.

#### WIRING DIAGRAM:



TPM00027

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK TIRE PRESSURE MONITORING CONTROL MODULE.</b> 1) Connect an oscilloscope to the terminal No. 4 of the tire pressure monitoring control module connector (R211). 2) Drive the vehicle at 40 km/h (25 MPH) and check the vehicle speed signal at that time.	Is the vehicle speed being input?	Replace the tire pressure monitoring control module. <Ref. to WT-12, Tire Pressure Monitoring System.>	Go to step 2.
<b>2</b>	<b>CHECK HARNESS.</b> 1) Disconnect the combination meter connector (i10). 2) Connect the tire pressure monitoring control module connector (R211) and combination meter connector (i10) and measure the resistance.	Is the resistance less than 0.5 $\Omega$ ?	Check the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>	Repair or replace the open circuit of the harness.

# General Diagnostic Table

TIRE PRESSURE MONITORING SYSTEM (DIAGNOSTICS)

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## 12.General Diagnostic Table

### A: INSPECTION

Symptoms		Problem parts
Tire pressure warning light illuminates.	Tire pressure is reduced.	<ul style="list-style-type: none"><li>• Improper tire pressure adjustment.</li><li>• Punctured tire</li></ul>
Tire pressure warning light blinks 25 times and then illuminates.	Tire pressure monitoring system has malfunction.	<ul style="list-style-type: none"><li>• Air pressure sensor malfunction</li><li>• Air pressure sensor is out of battery.</li><li>• Tire pressure monitoring control module is faulty.</li><li>• Defective vehicle harness</li><li>• Defective combination meter</li></ul>
Tire pressure is dropping but the warning light does not illuminate.	Tire pressure warning light does not illuminate.	<ul style="list-style-type: none"><li>• Air pressure sensor is faulty.</li><li>• Tire pressure monitoring control module is faulty.</li><li>• Defective combination meter</li></ul>

# General Description

## DIFFERENTIALS

### 1. General Description

#### A: SPECIFICATION

##### 1. REAR DIFFERENTIAL

When replacing a rear differential assembly, select the correct one according to the following table.

NOTE:

- Using a different rear differential assembly will cause the drive train and tires to drag or emit abnormal noise.
- For option code, refer to “ID” section. <Ref. to ID-2, IDENTIFICATION, Identification.>

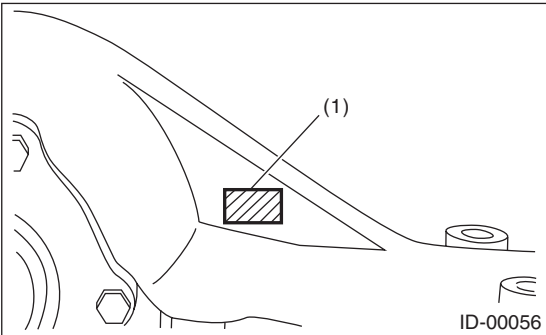
Model	Sedan, Wagon					
	2.5 L Non-turbo			2.5 L Turbo		
	5MT	AT		6MT	5MT	AT
Rear differential type	T-type	VA1-type	T-type	T-type		VA2-type
Identification	T1	XJ	T2	HY	EW	XZ
LSD type	—			Torsen	Viscous coupling	
Type of gear	Hypoid gear					
Gear ratio (Number of gear teeth)	3.900 (39/10)	4.111 (37/9)		3.545 (39/11)	3.900 (39/10)	3.083 (37/12)
Oil capacity	0.8 ℓ (0.8 US qt, 0.7 Imp qt)			1.0 ℓ (1.1 US qt, 0.9 Imp qt)	0.8 ℓ (0.8 US qt, 0.7 Imp qt)	
Rear differential gear oil	GL-5					

Model	OUTBACK						
	2.5 L Non-turbo				2.5 L Turbo		3.0 L
	5MT		AT		5MT	AT	
Rear differential type	T-type					VA2-type	
Identification	JE	T2	CD	TP	CF	XU	
LSD type	Viscous Coupling	—	Viscous Coupling	—	Viscous coupling		
Type of gear	Hypoid gear						
Gear ratio (Number of gear teeth)	4.111 (37/9)		4.444 (40/9)			3.272 (36/11)	
Oil capacity	0.8 ℓ (0.8 US qt, 0.7 Imp qt)						
Rear differential gear oil	GL-5						

## 2. IDENTIFICATION

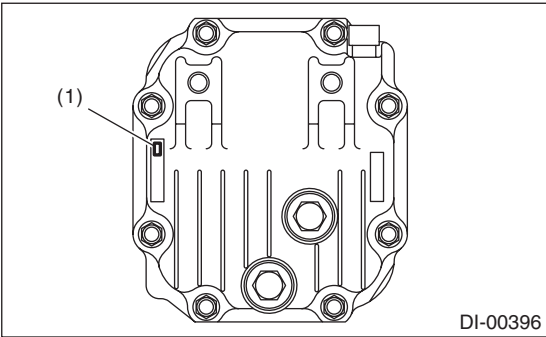
Identification label positions are shown in the following figures. For details concerning identification, refer to the “ID” section.

- T-type



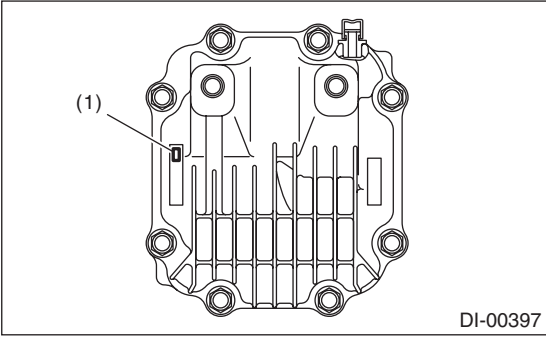
(1) Identification

- VA1-type



(1) Identification

- VA2-type

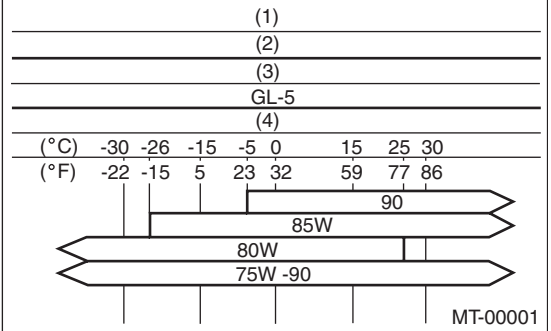


(1) Identification

## 3. REAR DIFFERENTIAL GEAR OIL

*Recommended gear oil:*  
**GL-5 (75W-90)**

**CAUTION:**  
Each oil manufacturer has its base oil and additives. Thus, do not mix two or more brands.



- (1) Item
- (2) Rear differential gear oil
- (3) API classification
- (4) SAE viscosity No. and applicable temperature

# General Description

## DIFFERENTIALS

### 4. SERVICE DATA

Drive pinion bearing preload (For new bearing)	Measure with spring measurement. (Measured from the companion flange bolt) N (kgf, lbf)	T-type (Except for GT spec. B 6MT model)	17.7 — 38.8 (1.8 — 4.0, 4.0 — 8.7)
		T-type (GT spec. B 6MT model)	24.1 — 38.6 (2.5 — 3.9, 5.4 — 8.7)
		VA-type	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measure with torque wrench N·m (kgf-m, ft-lb)	T-type (Except for GT spec. B 6MT model)	0.67 — 1.47 (0.07 — 0.15, 0.49 — 1.08)
		T-type (GT spec. B 6MT model)	0.91 — 1.46 (0.09 — 0.15, 0.67 — 1.08)
		VA-type	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Side gear backlash	mm (in)	T-type	0.10 — 0.20 (0.004 — 0.008)
		VA-type	0.05 — 0.15 (0.002 — 0.006)
Side bearing standard width	mm (in)		20.00 (0.7874)
Hypoid driven gear to drive pinion backlash	mm (in)	T-type	0.10 — 0.20 (0.004 — 0.008)
		VA-type	0.10 — 0.15 (0.004 — 0.006)
Hypoid driven gear runout on its back surface	mm (in)		0.05 (0.002)



# General Description

DIFFERENTIALS

## 5. ADJUSTING PARTS

- T-type (except for GT spec. B 6MT model)

	Part No.	Length mm (in)
Preload adjusting collar	383695201	56.2 (2.213)
	383695202	56.4 (2.220)
	383695203	56.6 (2.228)
	383695204	56.8 (2.236)
	383695205	57.0 (2.244)
	383695206	57.2 (2.252)
Preload adjusting washer	383705200	2.59 (0.1020)
	383715200	2.57 (0.1012)
	383725200	2.55 (0.1004)
	383735200	2.53 (0.0996)
	383745200	2.51 (0.0988)
	383755200	2.49 (0.0980)
	383765200	2.47 (0.0972)
	383775200	2.45 (0.0965)
	383785200	2.43 (0.0957)
	383795200	2.41 (0.0949)
	383805200	2.39 (0.0941)
	383815200	2.37 (0.0933)
	383825200	2.35 (0.0925)
	383835200	2.33 (0.0917)
383845200	2.31 (0.0909)	

	Part No.	Thickness mm (in)
Pinion height adjusting washer	383495200	3.09 (0.1217)
	383505200	3.12 (0.1228)
	383515200	3.15 (0.1240)
	383525200	3.18 (0.1252)
	383535200	3.21 (0.1264)
	383545200	3.24 (0.1276)
	383555200	3.27 (0.1287)
	383565200	3.30 (0.1299)
	383575200	3.33 (0.1311)
	383585200	3.36 (0.1323)
	383595200	3.39 (0.1335)
	383605200	3.42 (0.1346)
	383615200	3.45 (0.1358)
	383625200	3.48 (0.1370)
	383635200	3.51 (0.1382)
	383645200	3.54 (0.1394)
	383655200	3.57 (0.1406)
	383665200	3.60 (0.1417)
	383675200	3.63 (0.1429)
383685200	3.66 (0.1441)	
Side gear thrust washer (Model without LSD)	383445201	0.75 — 0.80 (0.0295 — 0.0315)
	383445202	0.80 — 0.85 (0.0315 — 0.0335)
	383445203	0.85 — 0.90 (0.0335 — 0.0354)

## General Description

### DIFFERENTIALS

	Part No.	Thickness mm (in)
Side bearing retainer shim	383475201	0.20 (0.0079)
	383475202	0.25 (0.0098)
	383475203	0.30 (0.0118)
	383475204	0.40 (0.0157)
	383475205	0.50 (0.0197)

Drive pinion bearing preload	Measure with spring measurement. (Measured from the companion flange bolt)	N (kgf, lb)	17.7 — 38.8 (1.8 — 4.0, 4.0 — 8.7)
	Measure with torque wrench	N·m (kgf-m, ft-lb)	0.67 — 1.47 (0.07 — 0.15, 0.49 — 1.08)
Side gear backlash		mm (in)	0.10 — 0.20 (0.004 — 0.008)
Hypoid driven gear to drive pinion backlash limit		mm (in)	0.10 — 0.20 (0.004 — 0.008)
Hypoid driven gear runout limit on its back surface		mm (in)	0.05 (0.002)

# General Description

DIFFERENTIALS

- T-type (GT spec. B 6MT model)

Drive pinion bearing preload (For new bearing)	Measure with spring measurement. (Measured from the companion flange bolt) N (kgf, lbf)	24.1 — 38.6 (2.5 — 3.9, 5.4 — 8.7)
	Measure with torque wrench N·m (kgf·m, ft·lb)	0.91 — 1.46 (0.09 — 0.15, 0.67 — 1.08)
Preload adjusting spacer	Part No.	Length mm (in)
	31454AA130	52.2 (2.055)
	31454AA140	52.4 (2.063)
	31454AA150	52.6 (2.071)
	31454AA160	52.8 (2.079)
	31454AA170	53.0 (2.087)
Preload adjusting washer	31454AA180	53.2 (2.094)
	Part No.	Length mm (in)
	383705200	2.59 (0.1020)
	383715200	2.57 (0.1012)
	383725200	2.55 (0.1004)
	383735200	2.53 (0.0996)
	383745200	2.51 (0.0988)
	383755200	2.49 (0.0980)
	383765200	2.47 (0.0972)
	383775200	2.45 (0.0965)
	383785200	2.43 (0.0957)
	383795200	2.41 (0.0949)
	383805200	2.39 (0.0941)
	383815200	2.37 (0.0933)
	383825200	2.35 (0.0925)
Pinion height adjusting washer	383835200	2.33 (0.0917)
	383845200	2.31 (0.0909)
	Part No.	Length mm (in)
	38336AA230	3.09 (0.1217)
	38336AA240	3.12 (0.1228)
	38336AA250	3.15 (0.1240)
	38336AA260	3.18 (0.1252)
	38336AA270	3.21 (0.1264)
	38336AA280	3.24 (0.1276)
	38336AA290	3.27 (0.1287)
	38336AA300	3.30 (0.1299)
	38336AA310	3.33 (0.1311)
	38336AA320	3.36 (0.1323)
	38336AA330	3.39 (0.1335)
	38336AA340	3.42 (0.1346)
	38336AA350	3.45 (0.1358)
	38336AA360	3.48 (0.1370)
38336AA370	3.51 (0.1382)	
38336AA380	3.54 (0.1394)	
38336AA390	3.57 (0.1406)	
38336AA400	3.60 (0.1417)	
38336AA410	3.63 (0.1429)	
38336AA420	3.66 (0.1441)	
Side bearing standard width mm (in)		20.00 (0.7874)

## General Description

### DIFFERENTIALS

	Part No.	Thickness mm (in)
Side bearing retainer shim	383475201	0.20 (0.0079)
	383475202	0.25 (0.0098)
	383475203	0.30 (0.0118)
	383475204	0.40 (0.0157)
	383475205	0.50 (0.0197)
Hypoid driven gear to drive pinion backlash	Limit mm (in)	0.10 — 0.20 (0.004 — 0.008)
Driven gear rear face runout limit		0.05 (0.002)

# General Description

DIFFERENTIALS

- VA1-type

	Part No.	Length mm (in)
Preload adjusting collar	32288AA040	52.3 (2.059)
	32288AA050	52.5 (2.067)
	31454AA100	52.6 (2.071)
	32288AA060	52.7 (2.075)
	31454AA110	52.8 (2.079)
	32288AA070	52.9 (2.083)
	31454AA120	53.0 (2.087)
	32288AA080	53.1 (2.091)
	32288AA090	53.3 (2.098)

	Part No.	Thickness mm (in)
Preload adjusting washer	38336AA000	1.500 (0.0591)
	38336AA120	1.513 (0.0596)
	38336AA010	1.525 (0.0600)
	38336AA130	1.538 (0.0606)
	38336AA020	1.550 (0.0610)
	38336AA140	1.563 (0.0615)
	38336AA030	1.575 (0.0620)
	38336AA150	1.588 (0.0625)
	38336AA040	1.600 (0.0630)
	38336AA160	1.613 (0.0635)
	38336AA050	1.625 (0.0640)
	38336AA170	1.638 (0.0645)
	38336AA060	1.650 (0.0650)
	38336AA180	1.663 (0.0655)
	38336AA070	1.675 (0.0659)
	38336AA190	1.688 (0.0665)
	38336AA080	1.700 (0.0669)
	38336AA200	1.713 (0.0674)
	38336AA090	1.725 (0.0679)
	38336AA210	1.738 (0.0684)
38336AA100	1.750 (0.0689)	
38336AA220	1.763 (0.0694)	
38336AA110	1.775 (0.0699)	
Pinion height adjusting washer	32295AA200	0.150 (0.0059)
	32295AA210	0.175 (0.0069)
	32295AA220	0.200 (0.0079)
	32295AA230	0.225 (0.0089)
	32295AA240	0.250 (0.0098)
32295AA250	0.275 (0.0108)	
Side gear thrust washer	803135011	0.925 — 0.950 (0.0364 — 0.0374)
	803135012	0.950 — 0.975 (0.0374 — 0.0384)
	803135013	0.975 — 1.000 (0.0384 — 0.0394)
	803135014	1.000 — 1.025 (0.0394 — 0.0404)
	803135015	1.025 — 1.050 (0.0404 — 0.0413)

## General Description

### DIFFERENTIALS

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Drive pinion bearing preload	Measure with spring measurement. (Measured from the companion flange bolt)	N (kgf, lb)	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measure with torque wrench	N·m (kgf·m, ft·lb)	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Side gear backlash		mm (in)	0.05 — 0.15 (0.002 — 0.006)
Hypoid driven gear to drive pinion backlash limit		mm (in)	0.10 — 0.15 (0.004 — 0.006)

# General Description

DIFFERENTIALS

- VA2-type

	Part No.	Length mm (in)
Preload adjusting collar	31454AA250	51.05 (2.010)
	31454AA260	51.25 (2.018)
	31454AA270	51.35 (2.022)
	31454AA280	51.45 (2.026)
	31454AA290	51.55 (2.030)
	31454AA300	51.65 (2.033)
	31454AA310	51.75 (2.037)
	31454AA320	51.85 (2.041)
	31454AA330	52.05 (2.049)

	Part No.	Thickness mm (in)
Preload adjusting washer	38336AA430	1.500 (0.0591)
	38336AA440	1.513 (0.0596)
	38336AA450	1.525 (0.0600)
	38336AA460	1.538 (0.0606)
	38336AA470	1.550 (0.0610)
	38336AA480	1.563 (0.0615)
	38336AA490	1.575 (0.0620)
	38336AA500	1.588 (0.0625)
	38336AA510	1.600 (0.0630)
	38336AA520	1.613 (0.0635)
	38336AA530	1.625 (0.0640)
	38336AA540	1.638 (0.0645)
	38336AA550	1.650 (0.0650)
	38336AA560	1.663 (0.0655)
	38336AA570	1.675 (0.0659)
	38336AA580	1.688 (0.0665)
	38336AA590	1.700 (0.0669)
	38336AA600	1.713 (0.0674)
	38336AA610	1.725 (0.0679)
38336AA620	1.738 (0.0684)	
38336AA630	1.750 (0.0689)	
38336AA640	1.763 (0.0694)	
38336AA650	1.775 (0.0699)	
Pinion height adjusting washer	32295AA350	0.150 (0.0059)
	32295AA360	0.175 (0.0069)
	32295AA370	0.200 (0.0079)
	32295AA380	0.225 (0.0089)
	32295AA390	0.250 (0.0098)
	32295AA400	0.275 (0.0108)

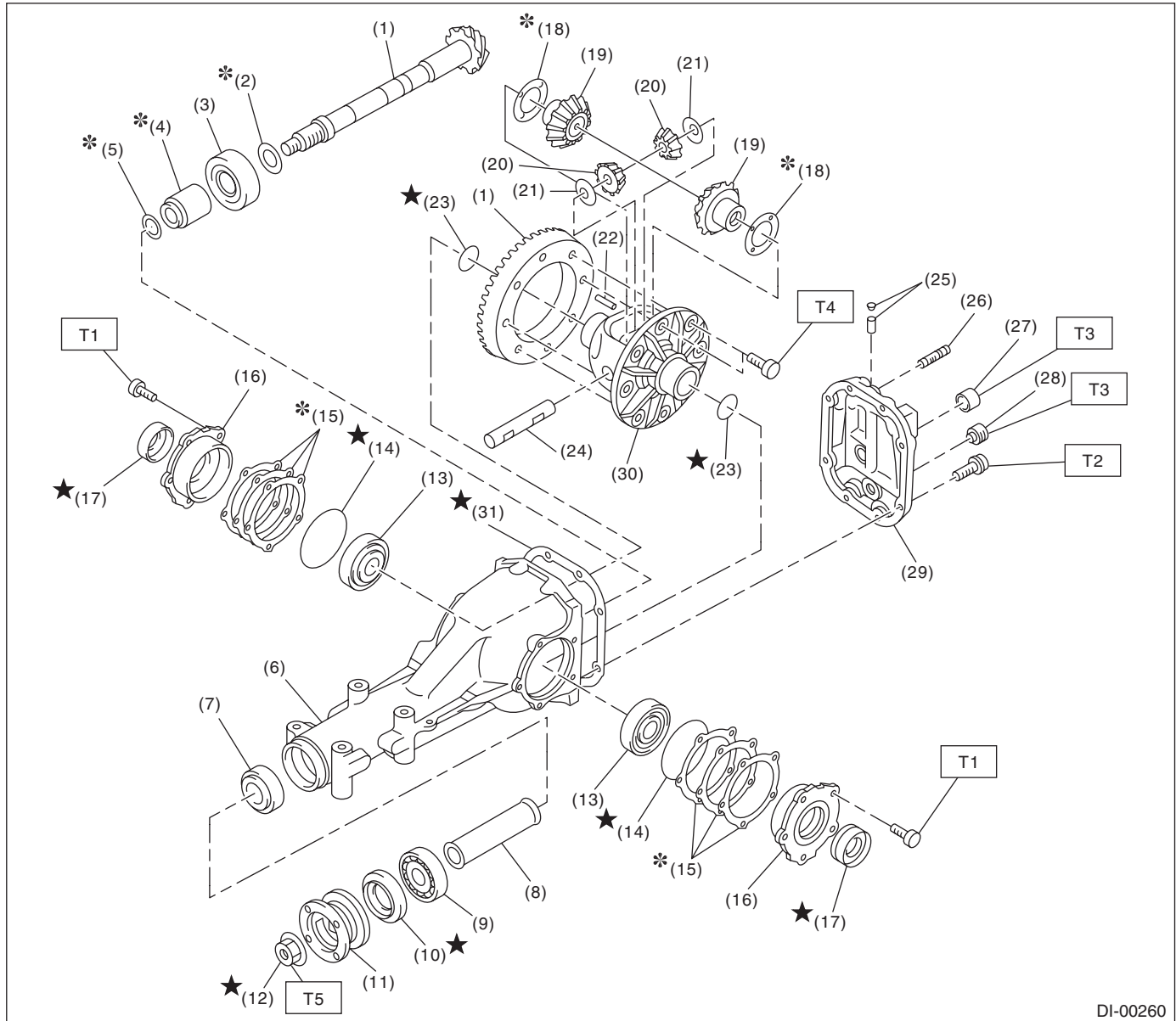
Drive pinion bearing preload	Measure with spring measurement. (Measured from the companion flange bolt)	N (kgf, lb)	12.7 — 32.2 (1.3 — 3.3, 2.9 — 7.2)
	Measure with torque wrench	N·m (kgf·m, ft·lb)	0.48 — 1.22 (0.05 — 0.12, 0.35 — 0.90)
Hypoid driven gear to drive pinion backlash limit		mm (in)	0.10 — 0.15 (0.004 — 0.006)

# General Description

## DIFFERENTIALS

### B: COMPONENT

#### 1. REAR DIFFERENTIAL WITHOUT LSD (T-TYPE)



DI-00260

- |   |                                 |                        |
|---|---------------------------------|------------------------|
| (1) Hypoid driven gear and drive pinion set | (14) O-ring                     | (27) Oil filler plug   |
| (2) Pinion height adjusting washer          | (15) Side bearing retainer shim | (28) Oil drain plug    |
| (3) Rear bearing                            | (16) Side bearing retainer      | (29) Rear cover        |
| (4) Bearing preload adjusting collar        | (17) Side oil seal              | (30) Differential case |
| (5) Bearing preload adjusting washer        | (18) Side gear thrust washer    | (31) Gasket            |
| (6) Differential carrier                    | (19) Side gear                  |                        |
| (7) Front bearing                           | (20) Pinion mate gear           |                        |
| (8) Collar                                  | (21) Pinion mate gear washer    |                        |
| (9) Pilot bearing                           | (22) Pinion shaft lock pin      |                        |
| (10) Front oil seal                         | (23) Snap ring                  |                        |
| (11) Companion flange                       | (24) Pinion mate shaft          |                        |
| (12) Self-locking nut                       | (25) Air breather cap           |                        |
| (13) Side bearing                           | (26) Stud bolt                  |                        |

#### **Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 10.5 (1.1, 7.7)**

**T2: 29.5 (3.0, 21.8)**

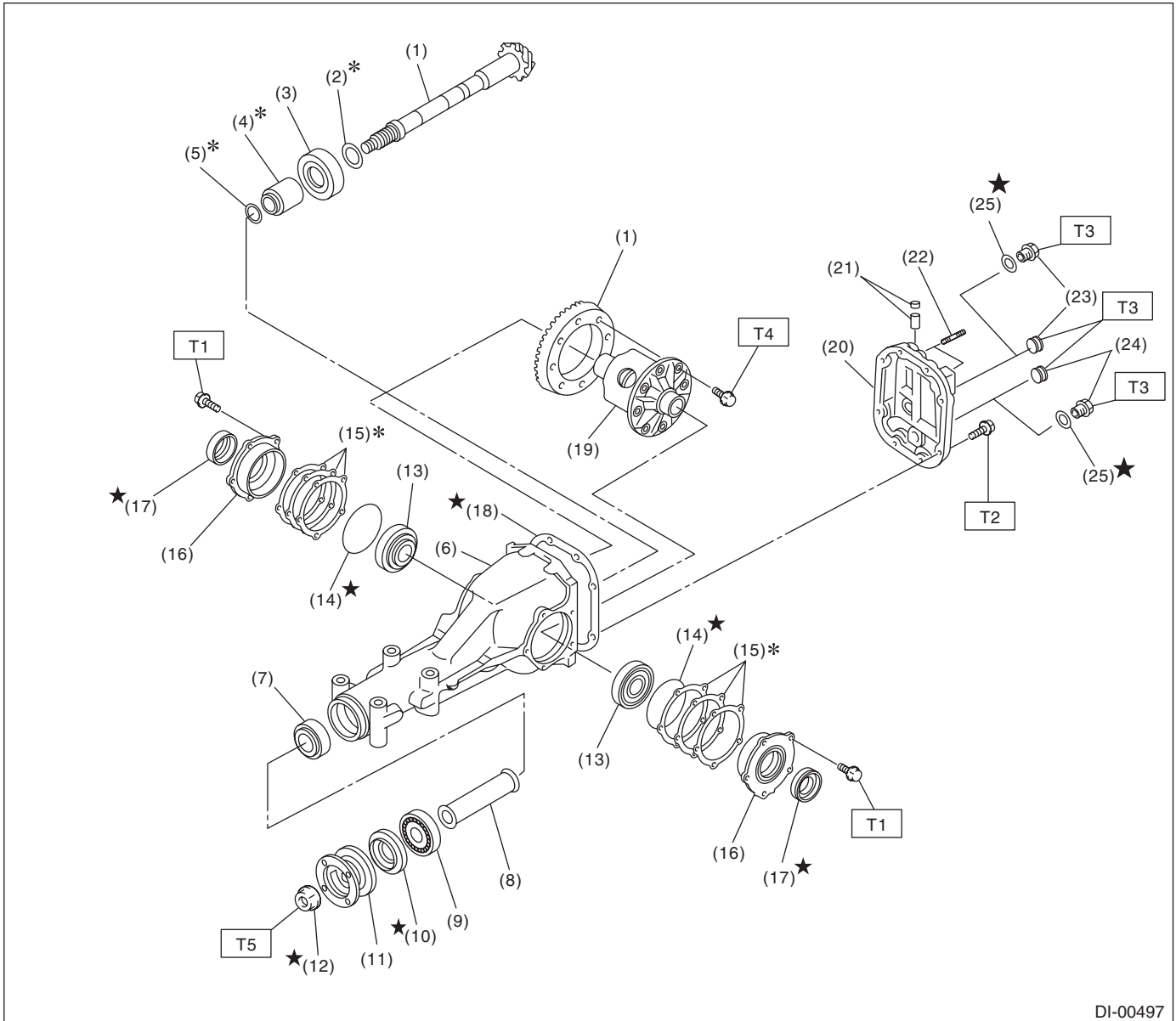
**T3: 49 (5.0, 36.2)**

**T4: 103 (10.5, 76.0)**

**T5: 181.5 (18.5, 134.0)**



## 2. REAR DIFFERENTIAL WITH LSD (T-TYPE)



DI-00497

- |   |                                    |
|---|------------------------------------|
| (1) Hypoid driven gear and drive pinion set | (13) Side bearing                  |
| (2) Pinion height adjusting washer          | (14) O-ring                        |
| (3) Rear bearing                            | (15) Side bearing retainer shim    |
| (4) Bearing preload adjusting collar        | (16) Side bearing retainer         |
| (5) Bearing preload adjusting washer        | (17) Side oil seal                 |
| (6) Differential carrier                    | (18) Gasket                        |
| (7) Front bearing                           | (19) Differential case ASSY        |
| (8) Collar                                  | (20) Rear cover                    |
| (9) Pilot bearing                           | (21) Air breather cap              |
| (10) Front oil seal                         | (22) Stud bolt                     |
| (11) Companion flange                       | (23) Oil filler plug               |
| (12) Self-locking nut                       | (24) Oil drain plug                |
|   | (25) Gasket (GT spec. B 6MT model) |

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 10.5 (1.1, 7.7)**

**T2: 29.5 (3.0, 21.8) (Except for GT spec. B 6MT model)  
44 (4.5, 32.5) (GT spec. B 6MT model)**

**T3: 49 (5.0, 36.2) (Except for GT spec. B 6MT model)  
60 (6.1, 44.3) (GT spec. B 6MT model)**

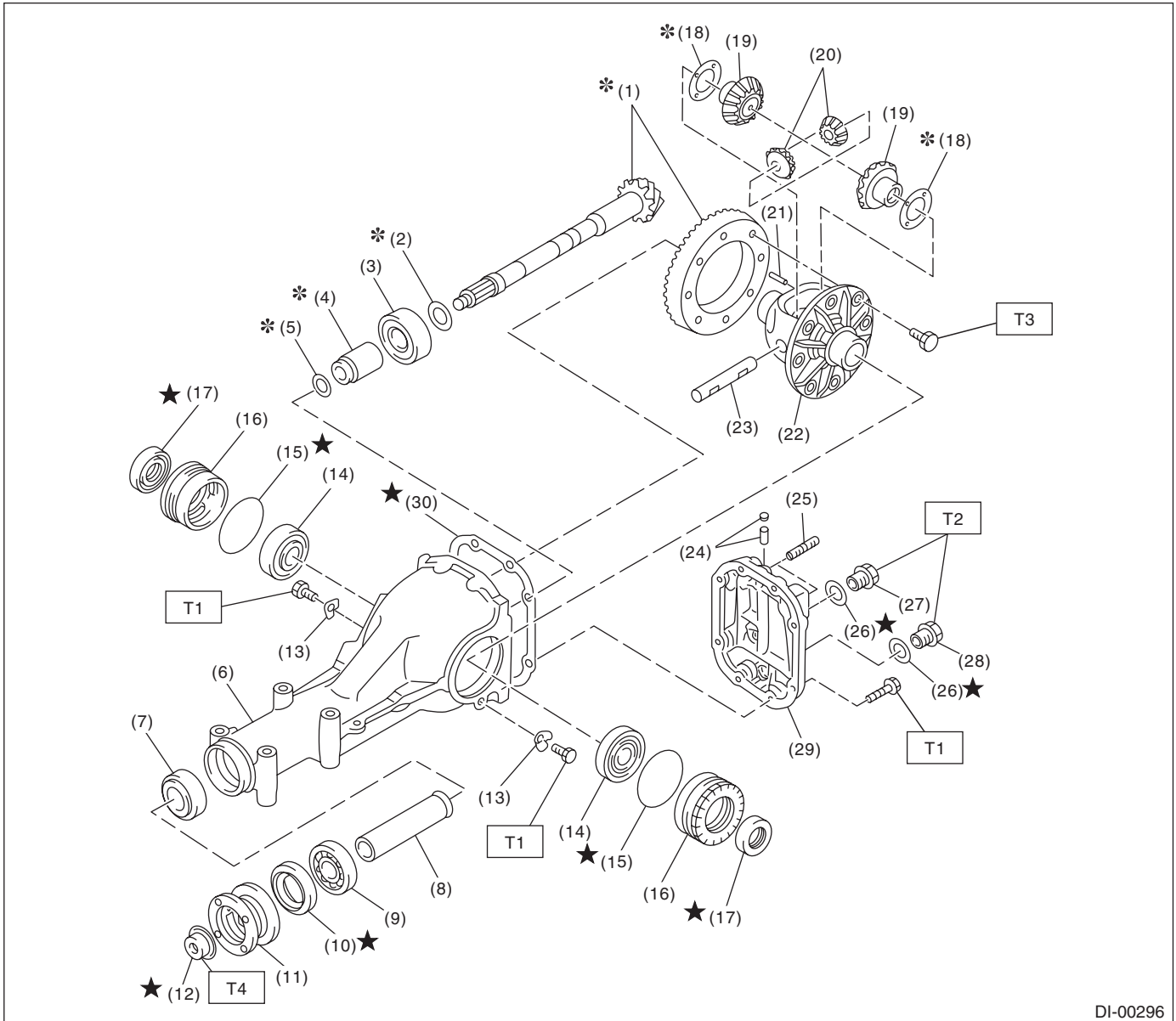
**T4: 103 (10.5, 76.0)**

**T5: 181.5 (18.5, 134.0)**

# General Description

## DIFFERENTIALS

### 3. REAR DIFFERENTIAL (VA1-TYPE)



DI-00296

- |   |                              |                      |
|---|------------------------------|----------------------|
| (1) Hypoid driven gear and drive pinion set | (13) Lock plate              | (25) Stud bolt       |
| (2) Pinion height adjusting washer          | (14) Side bearing            | (26) Gasket          |
| (3) Rear bearing                            | (15) O-ring                  | (27) Oil filler plug |
| (4) Bearing preload adjusting collar        | (16) Axle shaft holder       | (28) Oil drain plug  |
| (5) Bearing preload adjusting washer        | (17) Side oil seal           | (29) Rear cover      |
| (6) Differential carrier                    | (18) Side gear thrust washer | (30) Gasket          |
| (7) Front bearing                           | (19) Side gear               |                      |
| (8) Collar                                  | (20) Pinion mate gear        |                      |
| (9) Pilot bearing                           | (21) Pinion shaft lock pin   |                      |
| (10) Front oil seal                         | (22) Differential case       |                      |
| (11) Companion flange                       | (23) Pinion mate shaft       |                      |
| (12) Self-locking nut                       | (24) Air breather cap        |                      |

#### Tightening torque: N·m (kgf·m, ft·lb)

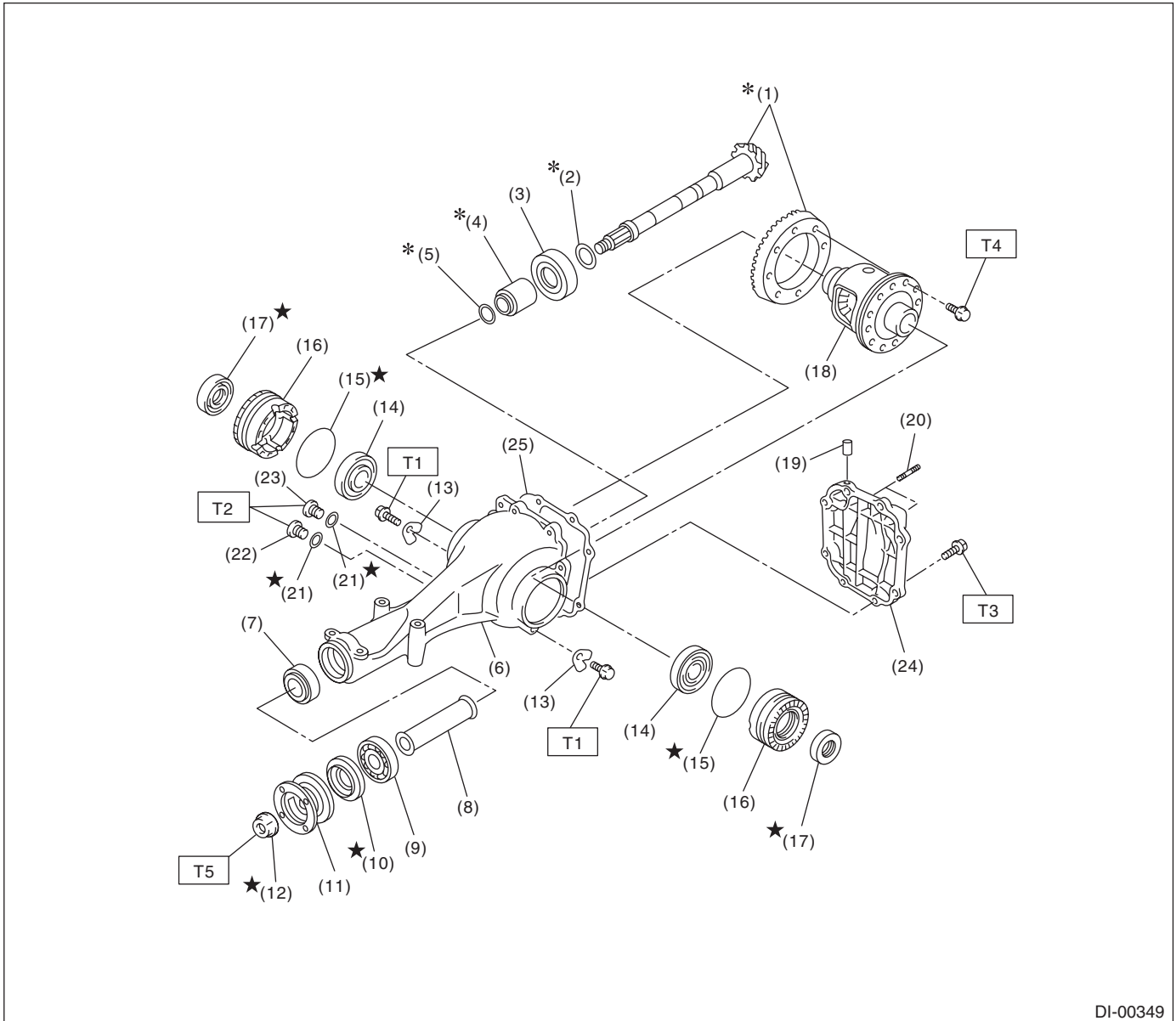
**T1: 25 (2.5, 18.5)**

**T2: 34 (3.5, 25.1)**

**T3: 62 (6.3, 45.8)**

**T4: 191 (19.5, 141.0)**

## 4. REAR DIFFERENTIAL (VA2-TYPE)



DI-00349

- |   |                             |
|---|-----------------------------|
| (1) Hypoid driven gear and drive pinion set | (12) Self-locking nut       |
| (2) Pinion height adjusting washer          | (13) Lock plate             |
| (3) Rear bearing                            | (14) Side bearing           |
| (4) Bearing preload adjusting collar        | (15) O-ring                 |
| (5) Bearing preload adjusting washer        | (16) Axle shaft holder      |
| (6) Differential carrier                    | (17) Side oil seal          |
| (7) Front bearing                           | (18) Differential case ASSY |
| (8) Collar                                  | (19) Air breather cap       |
| (9) Pilot bearing                           | (20) Stud bolt              |
| (10) Front oil seal                         | (21) Gasket                 |
| (11) Companion flange                       | (22) Oil filler plug        |

- |                     |
|---------------------|
| (23) Oil drain plug |
| (24) Rear cover     |
| (25) Gasket         |

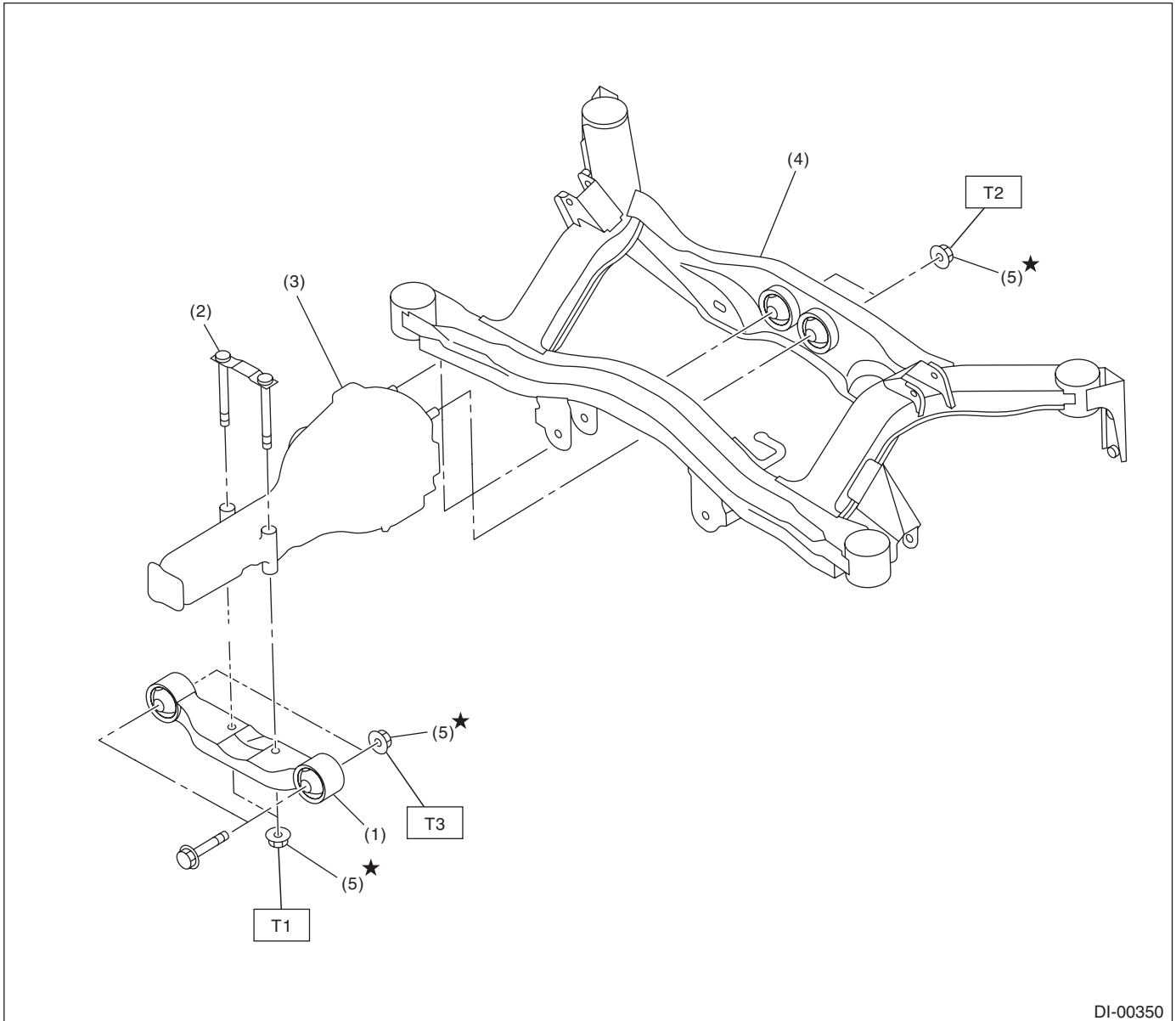
**Tightening torque: N·m (kgf·m, ft·lb)**

- |                              |
|------------------------------|
| <b>T1: 25 (2.5, 18.5)</b>    |
| <b>T2: 29 (3.0, 21.4)</b>    |
| <b>T3: 34 (3.5, 25.1)</b>    |
| <b>T4: 62 (6.3, 45.8)</b>    |
| <b>T5: 191 (19.5, 141.0)</b> |

# General Description

## DIFFERENTIALS

### 5. REAR DIFFERENTIAL MOUNTING SYSTEM



DI-00350

- |                                    |                      |
|------------------------------------|----------------------|
| (1) Rear differential front member | (5) Self-locking nut |
| (2) Rear differential member plate |                      |
| (3) Rear differential ASSY         |                      |
| (4) Sub frame                      |                      |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 50 (5.1, 36.9)**

**T2: 70 (7.1, 51.6)**

**T3: 110 (11.2, 81)**

### **C: CAUTION**

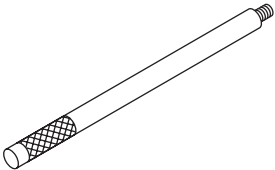
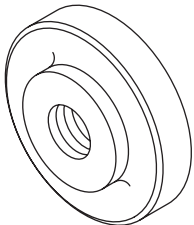
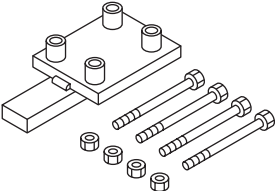
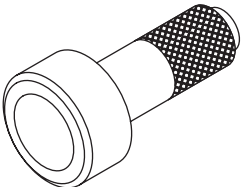
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine gear oil, grease or the equivalent. Do not mix gear oil, grease, etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply gear oil onto sliding or revolving surfaces before installation.
- Before installing the O-ring or snap ring, apply a sufficient amount of gear oil to avoid damage and deformation.
- Before securing a part on a vise, place cushioning material such as wood blocks, aluminum plate, or cloth between the part and the vise.
- Avoid damaging the mating surface of the case.

# General Description

## DIFFERENTIALS

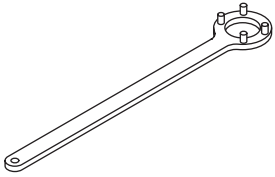
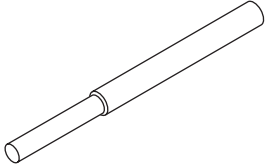
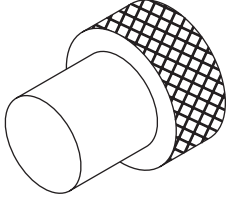
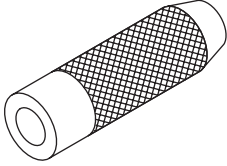
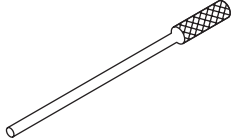
### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-398477701</p>	398477701	HANDLE	Used for installing the front and rear bearing cones.
 <p style="text-align: center;">ST-398477702</p>	398477702	DRIFT	<ul style="list-style-type: none"> <li>• Used for press-fitting the bearing cone of differential carrier (front).</li> <li>• For T-type</li> </ul>
 <p style="text-align: center;">ST-398217700</p>	398217700	ATTACHMENT SET	Stand for rear differential carrier disassembly and assembly.
 <p style="text-align: center;">ST-498447120</p>	498447120	INSTALLER	Used for installing the front oil seal.

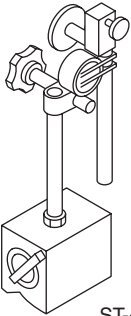
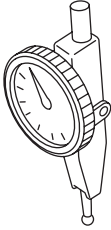
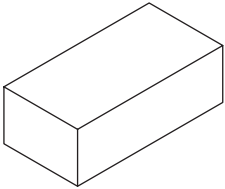
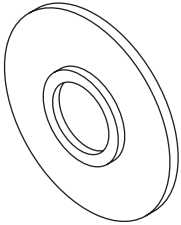
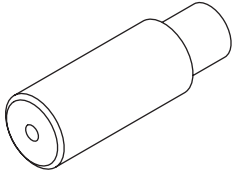
# General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498427200</p>	498427200	FLANGE WRENCH	Used for stopping rotation of companion flange when removing and tightening self-lock nut.
 <p style="text-align: center;">ST-398467700</p>	398467700	DRIFT	<ul style="list-style-type: none"> <li>• Used for removing pinion, pilot bearing and front bearing cone.</li> <li>• For T-type and VA1-type</li> </ul>
 <p style="text-align: center;">ST-399780104</p>	399780104	WEIGHT	Used for installing the front bearing cone and the pilot bearing companion flange.
 <p style="text-align: center;">ST-899580100</p>	899580100	INSTALLER	Used for press-fitting the front bearing cone and pilot bearing.
 <p style="text-align: center;">ST-899904100</p>	899904100	STRAIGHT PIN REMOVER	Used for driving out differential pinion shaft lock pin.

# General Description

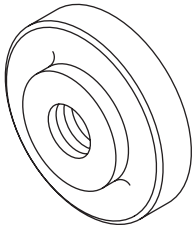
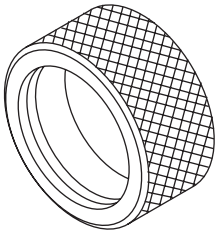
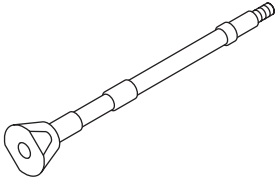
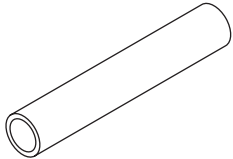
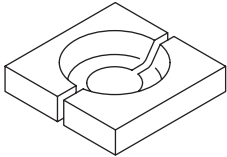
## DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498247001</p>	498247001	MAGNET BASE	<ul style="list-style-type: none"> <li>• Used for measuring backlash between side gear and pinion, and hypoid gear.</li> <li>• Used together with the DIAL GAUGE (498247100).</li> </ul>
 <p style="text-align: center;">ST-498247100</p>	498247100	DIAL GAUGE	<ul style="list-style-type: none"> <li>• Used for measuring backlash between side gear and pinion, and hypoid gear.</li> <li>• Used together with the MAGNET BASE (498247001).</li> </ul>
 <p style="text-align: center;">ST-398507704</p>	398507704	BLOCK	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For T-type and VA1-type</li> </ul>
 <p style="text-align: center;">ST-398177700</p>	398177700	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the rear bearing cone.</li> <li>• For T-type and VA2-type</li> </ul>
 <p style="text-align: center;">ST-398457700</p>	398457700	ATTACHMENT	<ul style="list-style-type: none"> <li>• Used for removing the side bearing retainer.</li> <li>• For T-type</li> </ul>



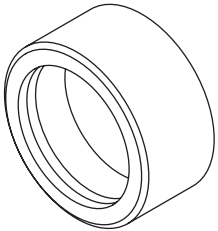
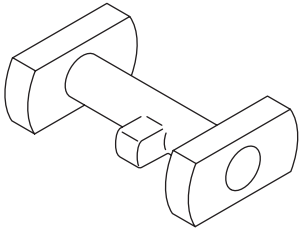
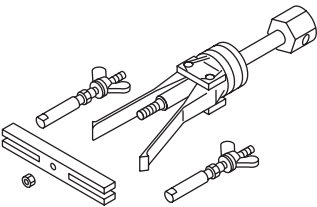
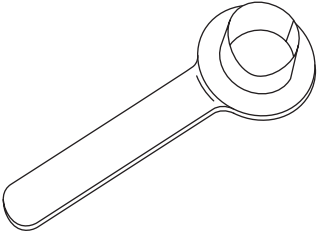
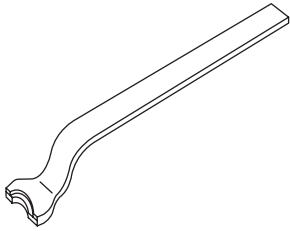
# General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-398477703</p>	398477703	DRIFT 2	<ul style="list-style-type: none"> <li>• Used for press-fitting bearing race (rear) of differential carrier.</li> <li>• For T-type and VA2-type</li> </ul>
 <p style="text-align: center;">ST-398437700</p>	398437700	DRIFT	<ul style="list-style-type: none"> <li>• Used for installing the side oil seal.</li> <li>• For T-type and VA2-type</li> </ul>
 <p style="text-align: center;">ST-398507702</p>	398507702	DUMMY SHAFT	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For T-type</li> </ul>
 <p style="text-align: center;">ST-398507703</p>	398507703	DUMMY COLLAR	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For T-type</li> </ul>
 <p style="text-align: center;">ST-398517700</p>	398517700	REPLACER	<ul style="list-style-type: none"> <li>• Used for removing rear bearing cone.</li> <li>• For T-type and VA2-type</li> </ul>

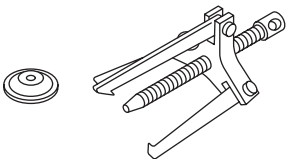
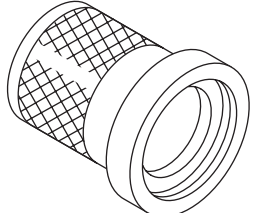
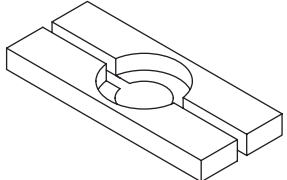
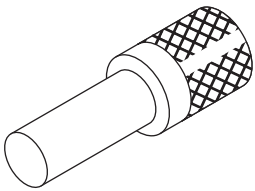
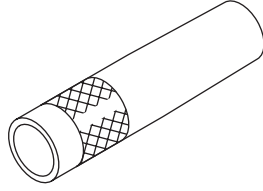
# General Description

## DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-398487700</p>	398487700	DRIFT	<ul style="list-style-type: none"> <li>• Used for press-fitting side bearing cone.</li> <li>• For T-type and VA2-type</li> </ul>
 <p style="text-align: center;">ST-398507701</p>	398507701	DIFFERENTIAL CARRIER GAUGE	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height.</li> <li>• For T-type</li> </ul>
 <p style="text-align: center;">ST-398527700</p>	398527700	PULLER ASSY	<ul style="list-style-type: none"> <li>• Used for removing front oil seal.</li> <li>• Used for removing side bearing cup. (T-type)</li> </ul>
 <p style="text-align: center;">ST28099PA090</p>	28099PA090	OIL SEAL PROTECTOR	<ul style="list-style-type: none"> <li>• Used for installing the rear drive shaft to the rear differential.</li> <li>• For oil seal protection</li> </ul>
 <p style="text-align: center;">ST28099PA100</p>	28099PA100	DRIVE SHAFT REMOVER	<ul style="list-style-type: none"> <li>• Used for removing the rear drive shaft from rear differential.</li> <li>• For T-type</li> </ul>

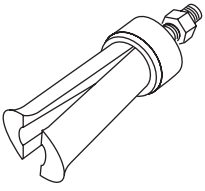
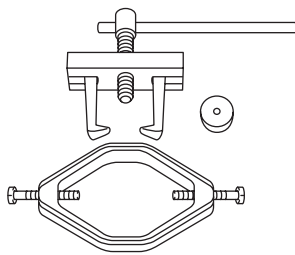
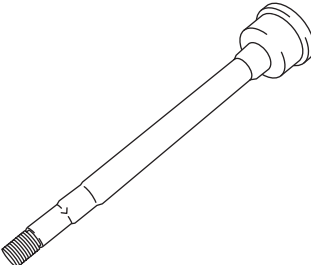
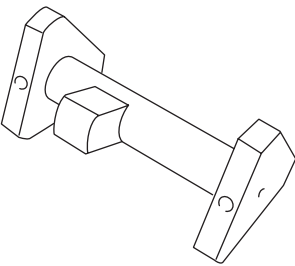
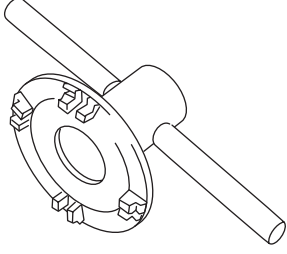
# General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-399703600</p>	399703600	PULLER ASSY	Used for removing companion flange.
 <p>ST-899874100</p>	899874100	INSTALLER	Used for installing the companion flange.
 <p>ST-498077000</p>	498077000	REMOVER	<ul style="list-style-type: none"> <li>• Used for removing the differential side bearing cone.</li> <li>• For VA2-type</li> </ul>
 <p>ST-899864100</p>	899864100	REMOVER	Used for removing the differential side bearing.
 <p>ST-499277200</p>	499277200	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the front bearing cone.</li> <li>• For VA2-type</li> </ul>

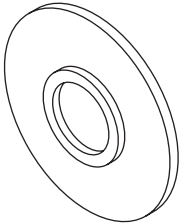
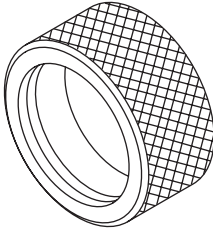
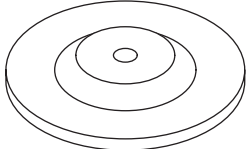
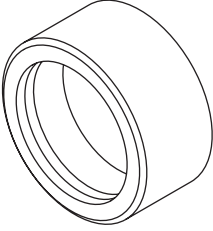
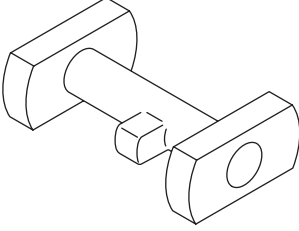
# General Description

## DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST18758AA000</p>	18758AA000	PULLER	<ul style="list-style-type: none"> <li>• Used for removing side bearing cup.</li> <li>• For VA2-type</li> </ul>
 <p style="text-align: center;">ST18759AA000</p>	18759AA000	PULLER ASSY	<ul style="list-style-type: none"> <li>• Used for removing the differential side bearing cone.</li> <li>• For T-type</li> </ul>
 <p style="text-align: center;">ST18678AA000</p>	18678AA000	DUMMY SHAFT	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For VA2-type</li> </ul>
 <p style="text-align: center;">ST18831AA010</p>	18831AA010	DIFFERENTIAL CARRIER GAUGE	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height.</li> <li>• For VA2-type</li> </ul>
 <p style="text-align: center;">ST18630AA010</p>	18630AA010	WRENCH COMPL RETAINER	<ul style="list-style-type: none"> <li>• Used for removing and installing the side oil seal holder.</li> <li>• For VA-type</li> <li>• WRENCH ASSEMBLY (499787000) can also be used.</li> </ul>

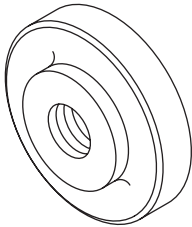
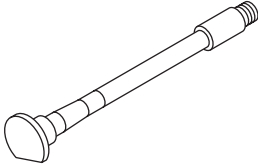
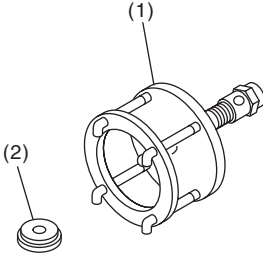
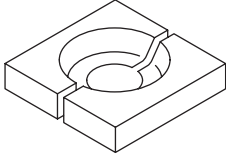
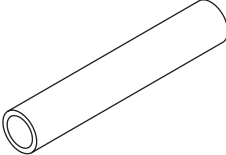
# General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498175500</p>	498175500	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the rear bearing cone.</li> <li>• For VA1-type</li> </ul>
 <p style="text-align: center;">ST-498447100</p>	498447100	INSTALLER	<ul style="list-style-type: none"> <li>• Used for installing the oil seal.</li> <li>• For VA1-type and T-type</li> </ul>
 <p style="text-align: center;">ST-399520105</p>	399520105	SEAT	<ul style="list-style-type: none"> <li>• Used for removing the side bearing cone.</li> <li>• Used together with the PULLER SET (899524100).</li> <li>• For VA-type</li> </ul>
 <p style="text-align: center;">ST-498485400</p>	498485400	DRIFT	<ul style="list-style-type: none"> <li>• Used for installing side bearing cone.</li> <li>• For VA1-type</li> </ul>
 <p style="text-align: center;">ST-498505501</p>	498505501	DIFFERENTIAL CARRIER GAUGE	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height.</li> <li>• For VA1-type</li> </ul>

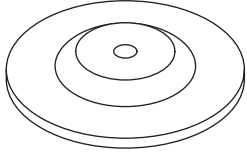
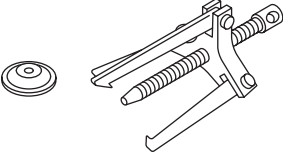
# General Description

## DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498447110</p>	498447110	DRIFT	<ul style="list-style-type: none"> <li>• Used for press-fitting the bearing race (front) of the differential carrier.</li> <li>• For VA1-type</li> </ul>
 <p style="text-align: center;">ST-498447150</p>	498447150	DUMMY SHAFT	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For VA1-type</li> </ul>
 <p style="text-align: center;">ST-899524100</p>	899524100	PULLER SET	<p>Used for removing the differential side bearing cone.</p> <p>(1) Puller (2) Cap</p>
 <p style="text-align: center;">ST-498515500</p>	498515500	REPLACER	<ul style="list-style-type: none"> <li>• Used for removing rear bearing cone.</li> <li>• For VA1-type</li> </ul>
 <p style="text-align: center;">ST32285AA000</p>	32285AA000	DUMMY COLLAR	<ul style="list-style-type: none"> <li>• Used for adjusting pinion height and preload.</li> <li>• For VA1-type</li> </ul>

# General Description

DIFFERENTIALS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499705404	499705404	SEAT	<ul style="list-style-type: none"> <li>• Used for removing the side bearing race.</li> <li>• Used together with PULLER ASSY (499705401).</li> <li>• For VA1-type</li> </ul>
 ST-499705401	499705401	PULLER ASSY	<ul style="list-style-type: none"> <li>• Used for removing the side bearing race.</li> <li>• Used together with SEAT (499705404).</li> <li>• For VA-type</li> </ul>

## 2. GENERAL TOOL

TOOL NAME	REMARKS
Transmission jack	Used for assembly/disassembly of the rear differential.
Puller	Used for removing the side bearing retainer.
Thickness gauge	Used for measuring clearance.
Hexagon wrench	Used for installing and removing the filler and drain plug.
Tire lever	Used for removing the front drive shaft. (VA-type)

# Differential Gear Oil

## DIFFERENTIALS

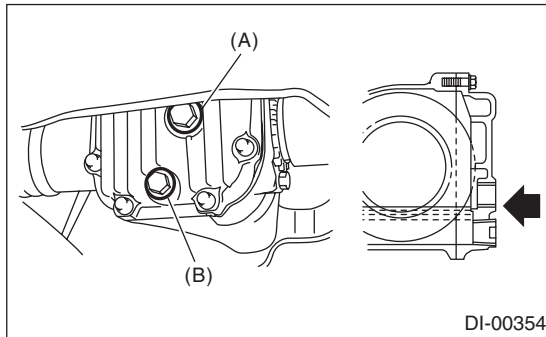
### 2. Differential Gear Oil

#### A: INSPECTION

1) Remove the filler plug, and then check the gear oil. Replace the gear oil if it is contaminated or deteriorated. <Ref. to DI-28, REPLACEMENT, Differential Gear Oil.>

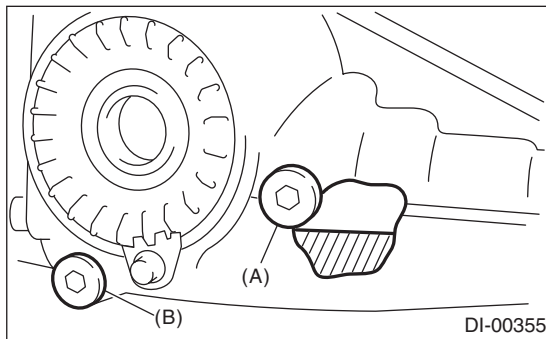
2) Check that the gear oil level is up to the bottom of the filler plug hole. If the level is low, refill up to the bottom of filler plug.

- Except for VA2-type



- (A) Filler plug
- (B) Drain plug

- VA2-type



- (A) Filler plug
- (B) Drain plug

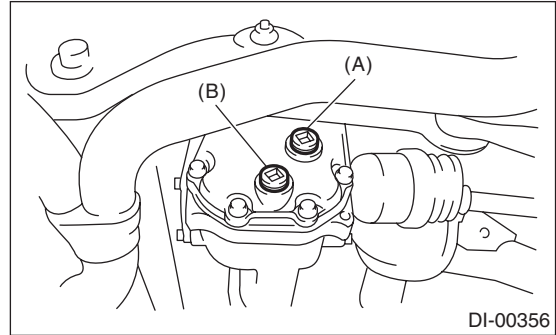
#### B: REPLACEMENT

- 1) Lift up the vehicle.
- 2) Remove the oil drain plug and filler plug, and drain the gear oil.

#### CAUTION:

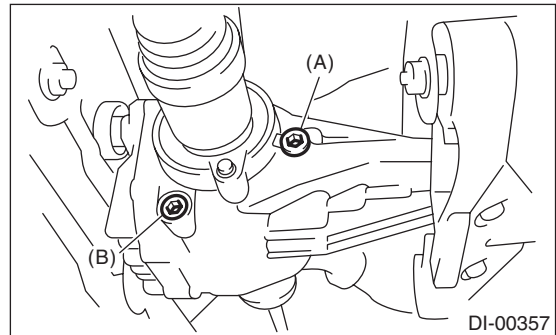
**Be careful not to burn your hands, because gear oil becomes extremely hot after running.**

- Except for VA2-type



- (A) Filler plug
- (B) Drain plug

- VA2-type



- (A) Filler plug
- (B) Drain plug



3) Tighten the oil drain plug.

NOTE:

- Apply liquid gasket to the drain plug for the T-type (except for GT spec. B 6MT model).

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**

- Use a new copper gasket for the VA1-type and T-type (GT spec. B 6MT model).
- Use a new metal gasket for the VA2-type.

**Tightening torque:**

**T-type (except for GT spec. B 6MT model):**

**49 N·m (5.0 kgf-m, 36.2 ft-lb)**

**T-type (GT spec. B 6MT model):**

**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

**VA1-type:**

**34 N·m (3.5 kgf-m, 25.1 ft-lb)**

**VA2-type:**

**29 N·m (3.0 kgf-m, 21.4 ft-lb)**

4) Fill the differential carrier with gear oil to the bottom of filler plug.

NOTE:

- Carefully refill oil while watching the level. Excessive or insufficient oil must be avoided.

**Recommended gear oil:**

**<Ref. to DI-2, SPECIFICATION, General Description.>**

**Oil capacity:**

**Except for GT spec. B 6MT model:**

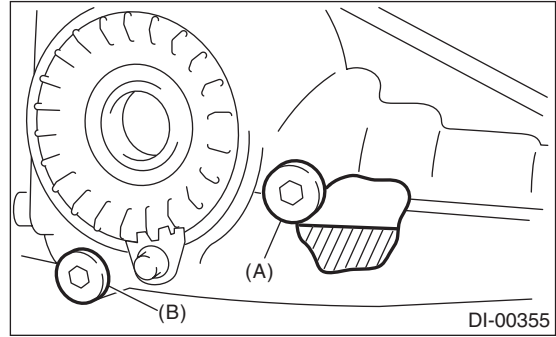
**0.8 ℓ (0.8 US qt, 0.7 Imp qt)**

**GT spec. B 6MT model:**

**1.0 ℓ (1.1 US qt, 0.9 Imp qt)**

- Except for VA2-type

- VA2-type



(A) Filler plug

(B) Drain plug

5) Install the filler plug.

NOTE:

- Apply liquid gasket to the filler plug for the T-type (except for GT spec. B 6MT model).

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**

- Use a new copper gasket for the VA1-type and T-type (GT spec. B 6MT model).
- Use a new metal gasket for the VA2-type.

**Tightening torque:**

**T-type (except for GT spec. B 6MT model):**

**49 N·m (5.0 kgf-m, 36.2 ft-lb)**

**T-type (GT spec. B 6MT model):**

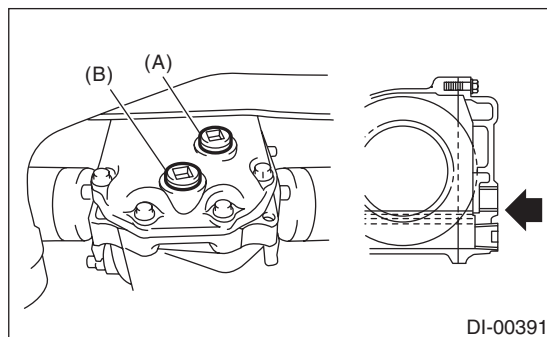
**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

**VA1-type:**

**34 N·m (3.5 kgf-m, 25.1 ft-lb)**

**VA2-type:**

**29 N·m (3.0 kgf-m, 21.4 ft-lb)**



(A) Filler plug

(B) Drain plug

### 3. Front Differential Assembly

#### A: NOTE

##### 1. AT MODEL

- 4AT

For front differential of 4AT model, refer to “4AT” section. <Ref. to 4AT-104, Front Differential Assembly.>

- 5AT

For front differential of 5AT model, refer to “5AT” section. <Ref. to 5AT-92, Front Differential Assembly.>

##### 2. MT MODEL

- 5MT

For front differential of the 5MT model, refer to “5MT” section. <Ref. to 5MT-68, Front Differential Assembly.>

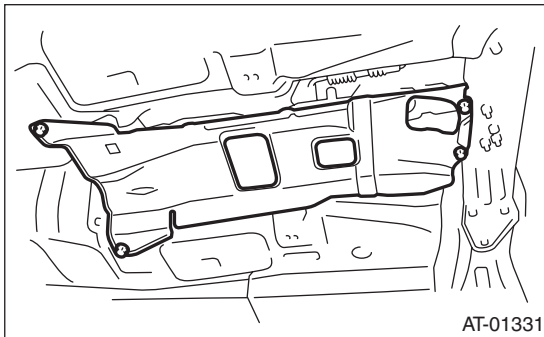
- 6MT

For front differential of the 6MT model, refer to “6MT” section. <Ref. to 6MT-98, Front Differential Assembly.>

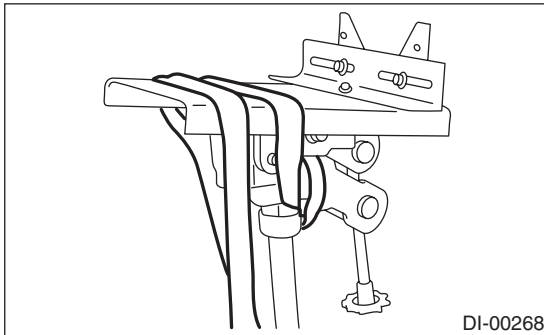
## 4. Rear Differential (T-type)

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Shift the select lever or gear shift lever to neutral.
- 3) Release the parking brake.
- 4) Lift up the vehicle.
- 5) Remove the rear exhaust pipe and muffler.
  - 2.5 L SOHC Non-turbo  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - 2.5 L DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
- 6) Remove the heat shield cover.



- 7) Remove the propeller shaft.  
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 8) Prepare the transmission jack and band.

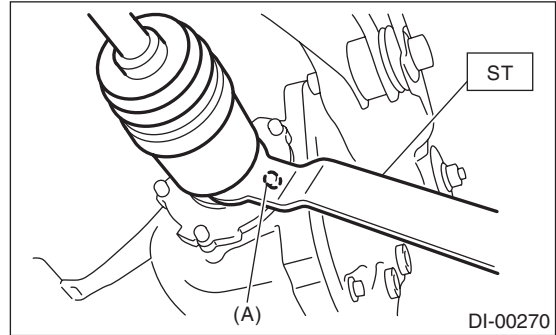


- 9) Loosen the self-lock nuts which hold the rear differential to rear crossmember.



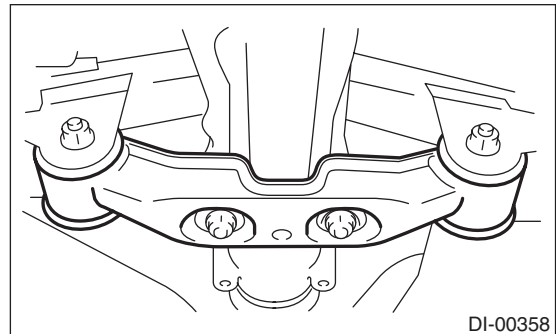
- 10) Remove the DOJ of rear drive shaft from rear differential using ST.

ST 28099PA100 DRIVE SHAFT REMOVER

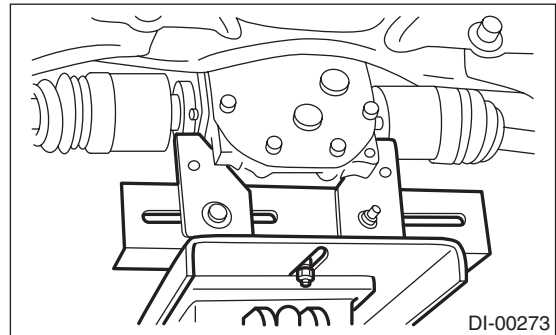


(A) Bolt

- 11) Remove the rear differential front member.



- 12) Support the rear differential with the transmission jack.



- 13) Secure the rear differential using band.
- 14) Remove the self-lock nuts which hold the rear differential to the crossmember.

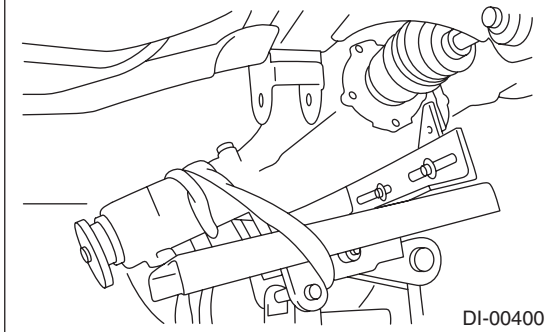
# Rear Differential (T-type)

## DIFFERENTIALS

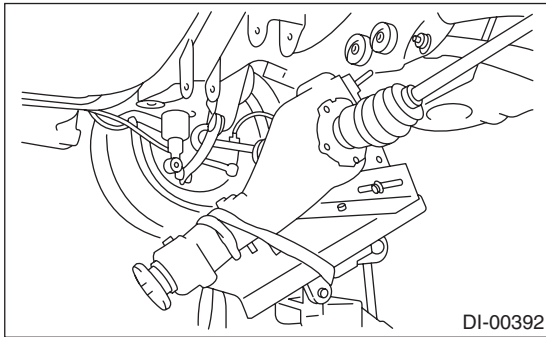
15) Remove the rear differential stud bolt from rear crossmember bushing.

**NOTE:**

When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary



16) Lower the transmission jack stand after removing the rear differential stud bolt from the rear crossmember. Rear drive shaft should not come into contact with the lateral link bolt.

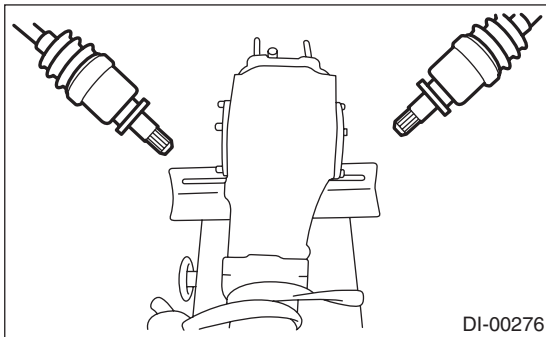


17) Pull out the axle shaft from rear differential.

**NOTE:**

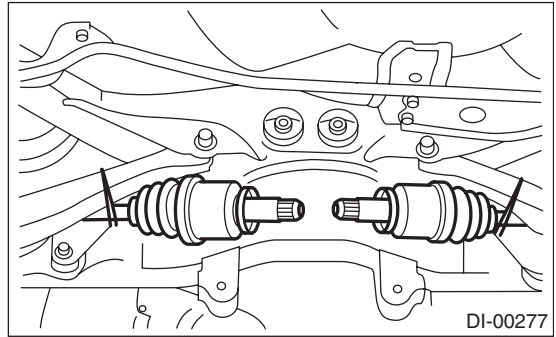
If it is difficult to remove the axle shaft from the rear differential, remove it using a ST.

ST 28099PA100 DRIVE SHAFT REMOVER

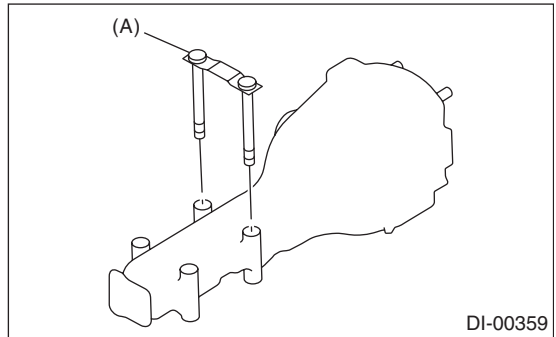


18) Lower the transmission jack.

19) Secure the rear drive shaft to lateral link using wire.



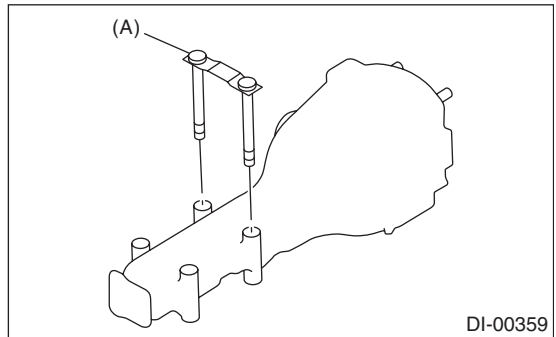
20) Remove the rear differential member plate from rear differential.



(A) Rear differential member plate

## B: INSTALLATION

1) Install the rear differential member plate to the rear differential.



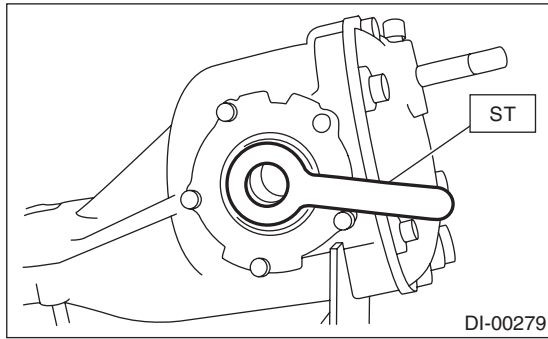
(A) Rear differential member plate

2) Set the rear differential to transmission jack.

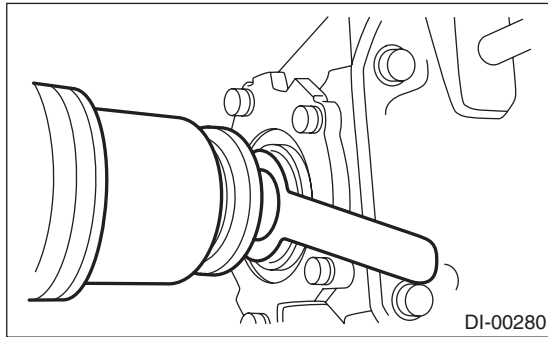
**NOTE:**

Secure the rear differential to transmission jack using band.

3) Attach the ST to rear differential.  
ST 28099PA090 OIL SEAL PROTECTOR

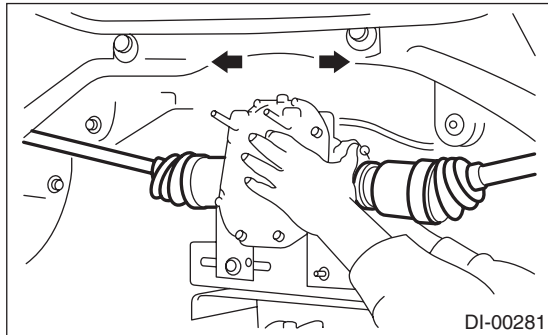


4) Insert the spline shaft until the spline portion comes inside the side oil seal.

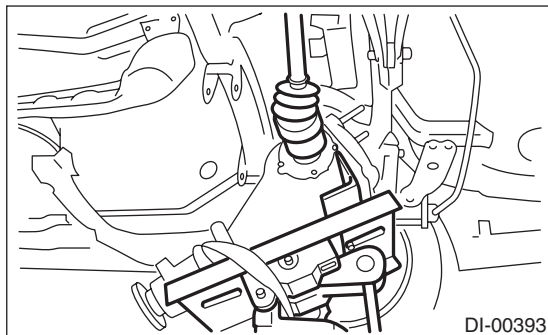


5) Remove ST from rear differential.  
ST 28099PA090 OIL SEAL PROTECTOR

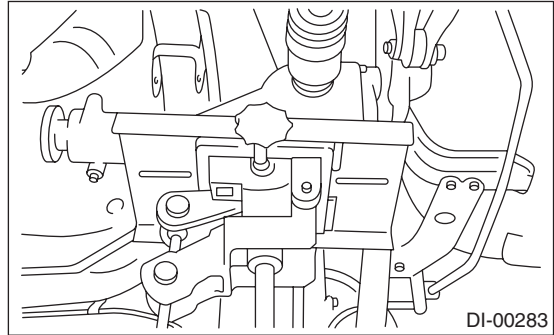
6) Push the rear differential to insert the axle shaft into rear differential.



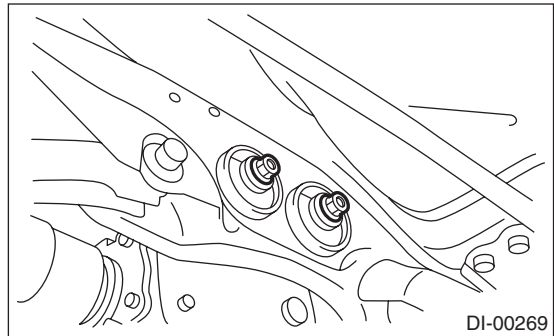
7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into rear cross-member bushing properly.



8) After inserting the rear differential stud bolt into the rear crossmember bushing, lift up the transmission jack and align the rear differential to its attachment position.



9) Tighten a new self-locking nut temporarily to rear crossmember.



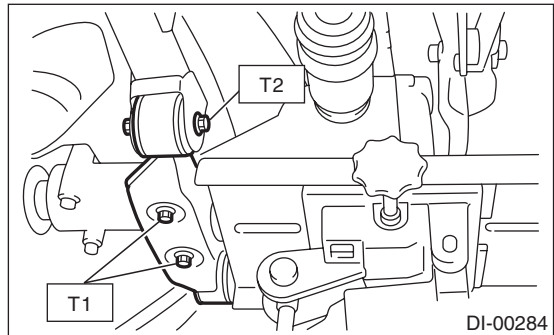
10) Remove the band from rear differential. Lift up the rear differential until the rear differential is separated from the transmission jack.

11) Install the rear differential front member with a new self-locking nut.

**Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 110 N·m (11.2 kgf-m, 81 ft-lb)**



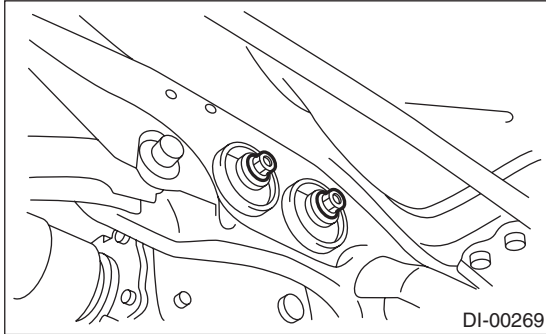
## Rear Differential (T-type)

### DIFFERENTIALS

12) Tighten the self-locking nut.

#### **Tightening torque:**

**70 N·m (7.1 kgf-m, 51 ft-lb)**



13) Lower the transmission jack.

14) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

15) Install the heat shield cover.

16) Install the rear exhaust pipe and muffler.

- 2.5 L SOHC Non-turbo

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- 2.5 L DOHC turbo model

<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

17) After installing the rear differential carrier to the vehicle, remove the filler plug, and refill with gear oil up to the lower lip of the plug hole.

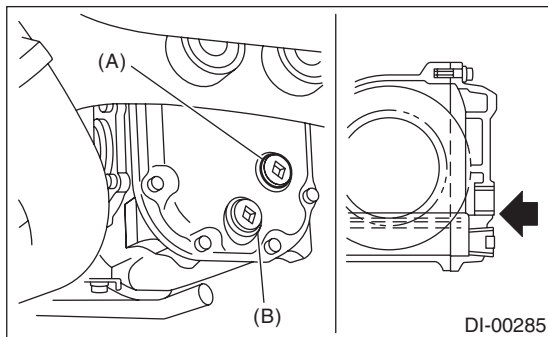
#### **Oil capacity:**

**Except for GT spec. B 6MT model:**

**0.8 ℓ (0.8 US qt, 0.7 Imp qt)**

**GT spec. B 6MT model:**

**1.0 ℓ (1.1 US qt, 0.9 Imp qt)**



(A) Filler plug

(B) Drain plug

18) Tighten the filler plug.

#### **NOTE:**

- Apply liquid gasket to the filler plug. (Except for GT spec. B 6MT model)

#### **Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**

- Use a new copper gasket. (GT spec. B 6MT model)

#### **Tightening torque:**

**Except for GT spec. B 6MT model:**

**49 N·m (5.0 kgf-m, 36.2 ft-lb)**

**GT spec. B 6MT model:**

**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

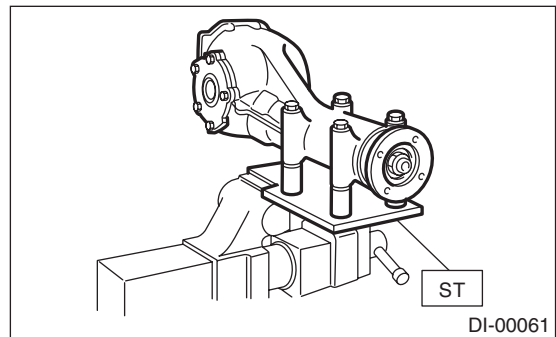
## **C: DISASSEMBLY**

To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash of hypoid driven gear and drive pinion.
- Hypoid driven gear runout on its back surface
- Total preload of drive pinion

1) Set the ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT SET

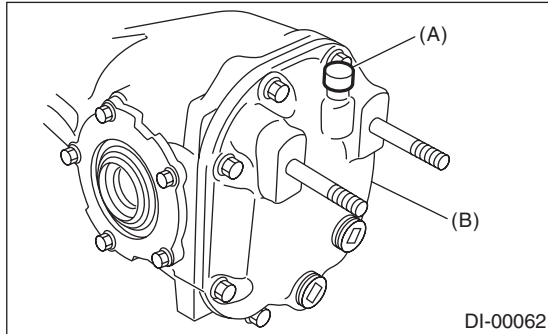


2) Remove the oil drain plug and filler plug, and drain the gear oil.

3) Remove the air breather cap.

**NOTE:**

- Do not attempt to replace the air breather cap unless necessary.
- Whenever the air breather cap is removed, replace it with a new part.

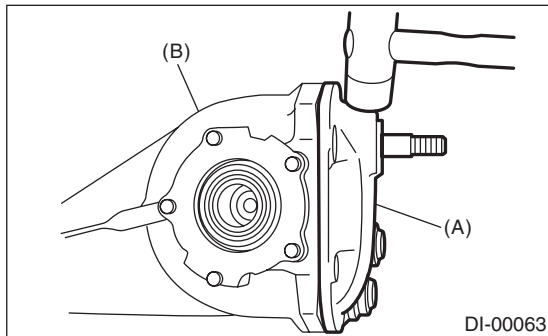


- (A) Air breather cap
- (B) Rear cover

4) Remove the bolts, and then remove the rear cover.

**NOTE:**

Remove it by tapping with a plastic hammer.



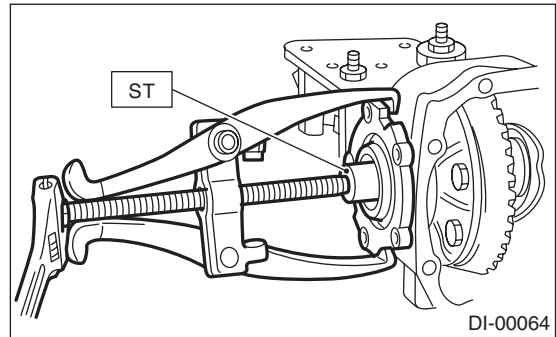
- (A) Rear cover
- (B) Differential carrier

5) Keep the side bearing retainers separate to make it possible to identify RH and LH sides. Remove the side bearing retainer attaching bolts, set the ST to differential case, and extract the side bearing retainers RH and LH with a puller.

**NOTE:**

Each shim, which is installed to adjusted the side bearing preload, should be kept together with its mating retainer.

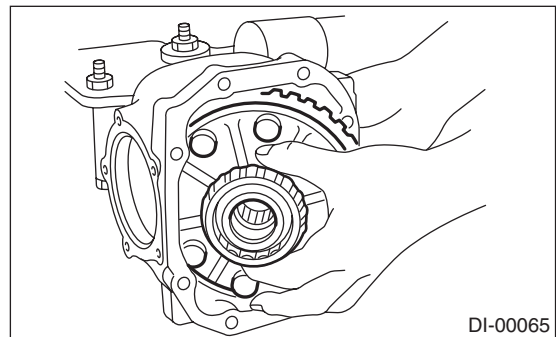
ST 398457700 ATTACHMENT



6) Pull out the differential case assembly from differential carrier.

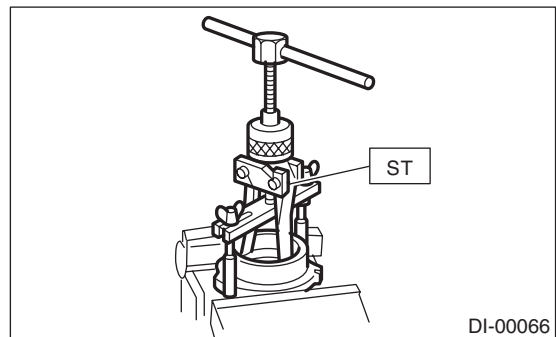
**NOTE:**

Be careful so that the teeth do not hit against the case.



7) When replacing the side bearing, remove the bearing cup from the side bearing retainer using ST.

ST 398527700 PULLER ASSY



# Rear Differential (T-type)

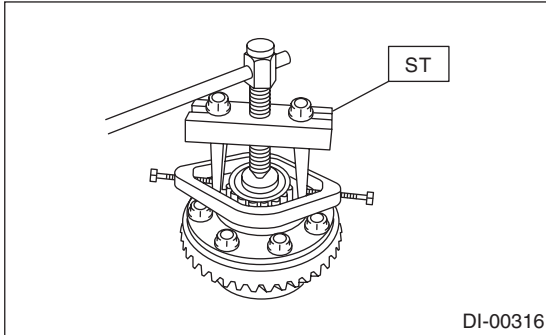
## DIFFERENTIALS

8) Remove the bearing cone with ST.

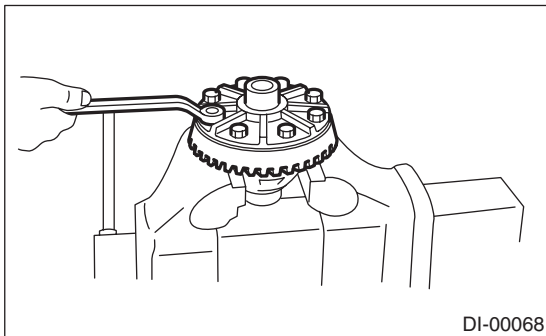
**NOTE:**

- Do not attempt to disassemble the parts unless necessary.
- Set the puller so that its claws catch the edge of the bearing cone.
- Store so that the right and left side bearing races and cones are not mixed together.

ST 18759AA000 PULLER ASSY



9) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

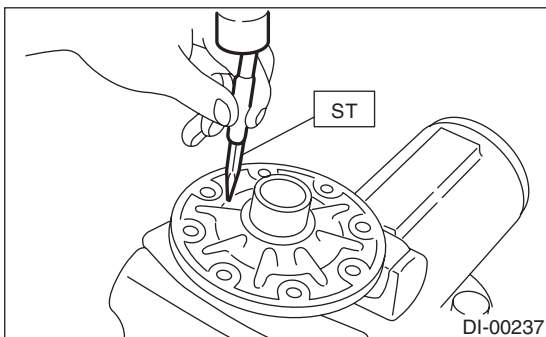


10) Drive out the pinion shaft lock pin from the hypoid driven gear side. (Model without LSD)

**NOTE:**

The lock pin is staked at the pin hole end on the differential carrier. Do not drive it out forcibly before removing the stake.

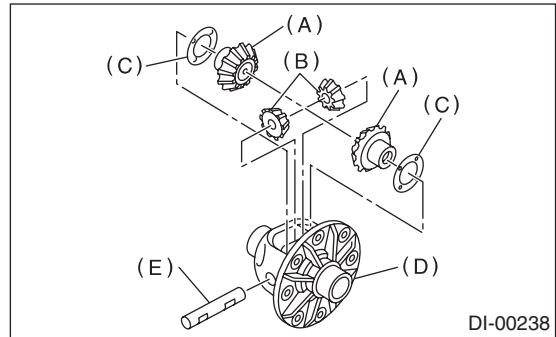
ST 899904100 STRAIGHT PIN REMOVER



11) Draw out the pinion mate shaft and remove pinion mate gears, side gears and thrust washers. (Model without LSD)

**NOTE:**

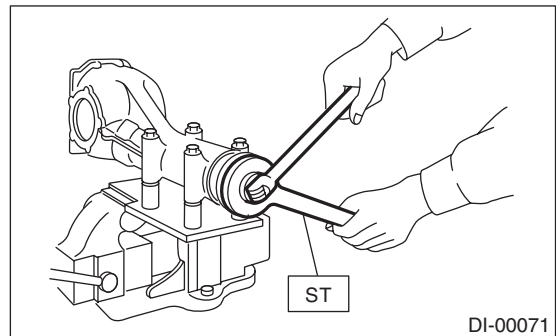
The gears should be marked or kept separated right and left, and front and rear as well as thrust washers.



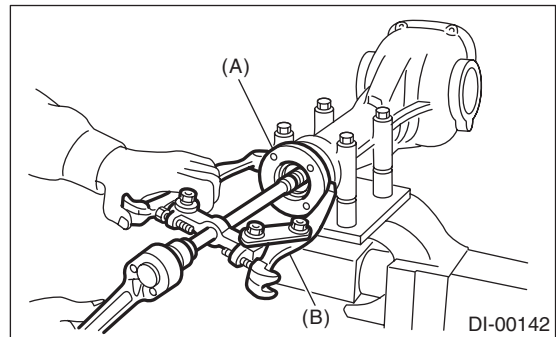
- (A) Side gear
- (B) Pinion mate gear
- (C) Thrust washer
- (D) Differential case
- (E) Pinion mate shaft

12) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



13) Extract the companion flange with a puller.



- (A) Companion flange
- (B) Puller



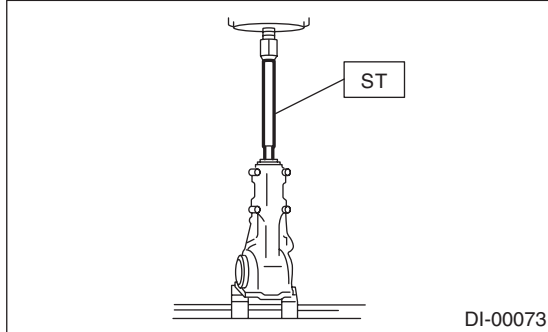
# Rear Differential (T-type)

14) Press the end of drive pinion shaft and extract it together with rear bearing cone, pinion height adjusting washer and washer.

**NOTE:**

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

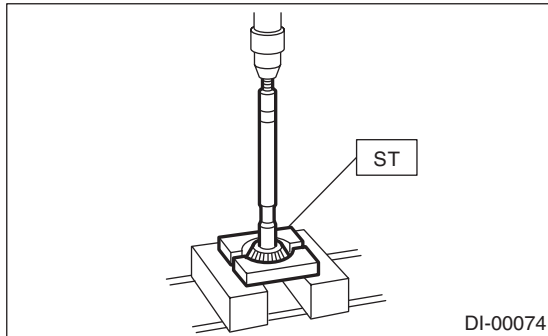


15) Remove the rear bearing cone from drive pinion by supporting the cone with ST.

**NOTE:**

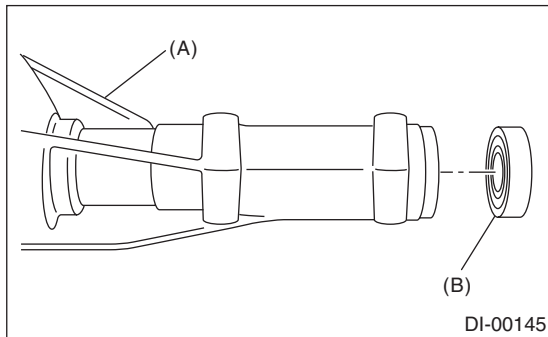
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



16) Remove the front oil seal from differential carrier using ST.

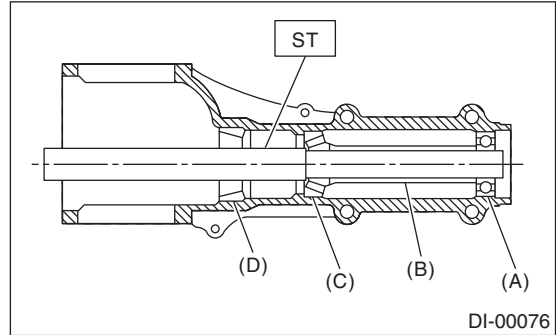
ST 398527700 PULLER ASSY



- (A) Differential carrier
- (B) Front oil seal

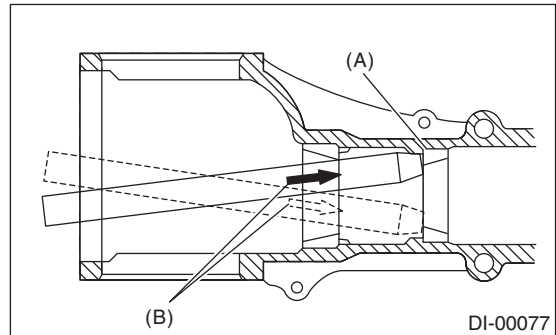
17) Remove the pilot bearing together with the front bearing cone and collar using the ST.

ST 398467700 DRIFT



- (A) Pilot bearing
- (B) Collar
- (C) Front bearing
- (D) Rear bearing cup

18) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order using a brass bar.



- (A) 2 cutout portions along diagonal lines
- (B) Tap alternately with brass bar.

# Rear Differential (T-type)

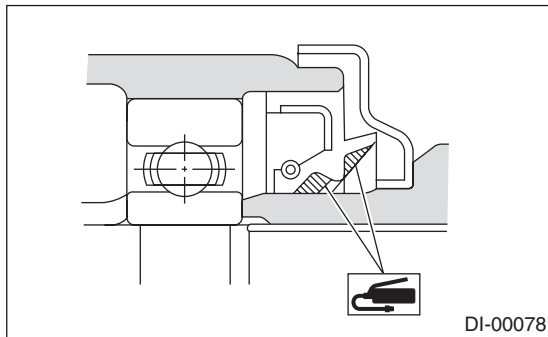
## DIFFERENTIALS

### D: ASSEMBLY

#### 1. EXCEPT FOR GT SPEC. B 6MT MODEL

##### NOTE:

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the RH and LH bearing races.
- Use a new O-ring and gasket.
- Replace the oil seal with a new part at every disassembly.
- Apply grease to the oil seal lip.
- Be careful not to mix up the differential oil seal RH and LH.



#### 1) Adjusting preload for front and rear bearings

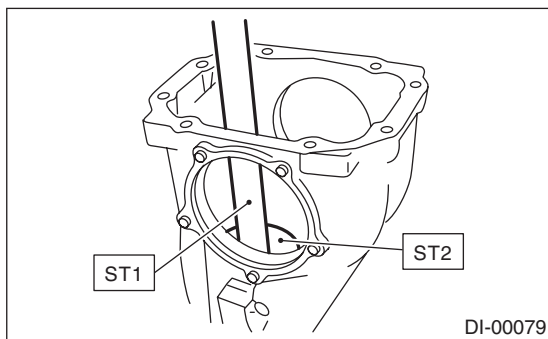
##### NOTE:

Adjust the bearing preload between front and rear bearings with collar and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

(1) Install the rear bearing race (rear) into the differential carrier using ST1 and ST2.

ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



(2) Install the rear bearing race (front) into the differential carrier using ST1 and ST2.

ST1 398477701 HANDLE

ST2 398477702 DRIFT

(3) Insert the ST1 into carrier with the pinion height adjusting washer and rear bearing cone fitted onto it.

##### NOTE:

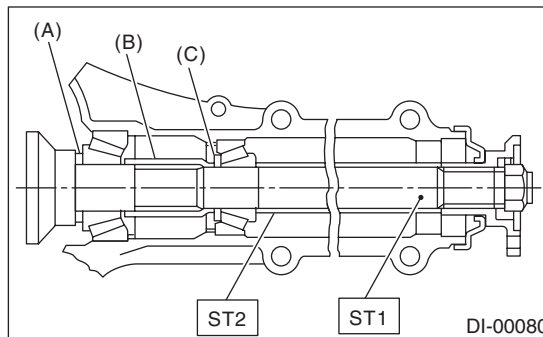
- If tooth contact is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

- Use new rear bearing cone.

(4) Install the preload adjusting collar & washer, front bearing cone, ST2, companion flange, and washer & self-locking nut.

ST1 398507702 DUMMY SHAFT

ST2 398507703 DUMMY COLLAR



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer

(5) Turn the ST1 by hand to smooth the bearing, and tighten the self-locking nut while measuring the initial load or initial torque with a spring scale or torque wrench. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.

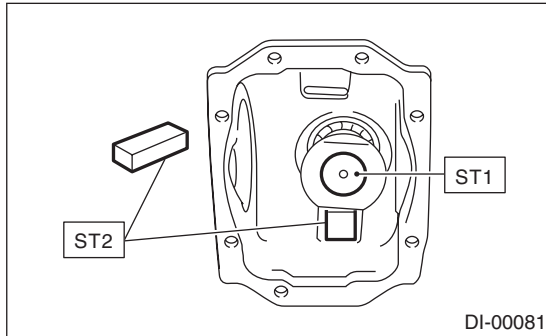
**NOTE:**

- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock ST1 with ST2 as shown in the figure.

ST1 398507704 BLOCK  
 ST2 398507702 DUMMY SHAFT

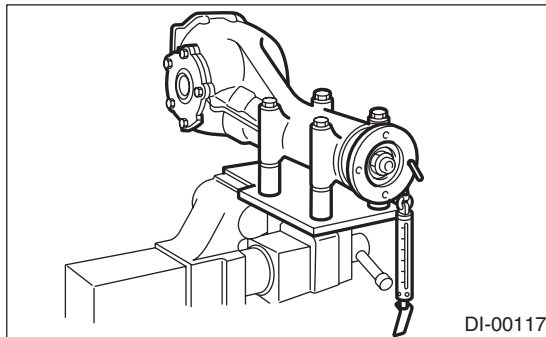
**Tightening torque:**

**181.5 N·m (18.5 kgf·m, 134.0 ft·lb)**



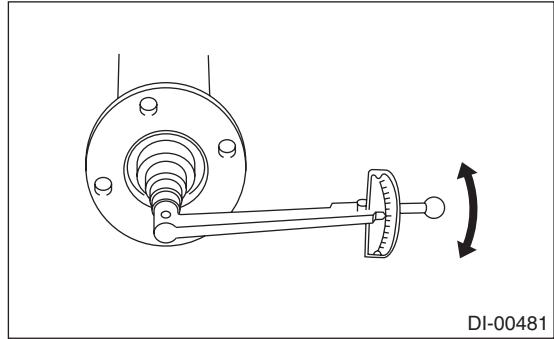
**Initial load:**

**17.7 — 38.8 N (1.8 — 4.0 kgf, 4.0 — 8.7 lb)**



**Initial torque:**

**0.67 — 1.47 N·m (0.07 — 0.15 kgf·m,  
 0.49 — 1.08 ft·lb)**



Preload adjusting washer	
Part No.	Thickness mm (in)
383705200	2.59 (0.1020)
383715200	2.57 (0.1012)
383725200	2.55 (0.1004)
383735200	2.53 (0.0996)
383745200	2.51 (0.0988)
383755200	2.49 (0.0980)
383765200	2.47 (0.0972)
383775200	2.45 (0.0965)
383785200	2.43 (0.0957)
383795200	2.41 (0.0949)
383805200	2.39 (0.0941)
383815200	2.37 (0.0933)
383825200	2.35 (0.0925)
383835200	2.33 (0.0917)
383845200	2.31 (0.0909)

Preload adjusting collar	
Part No.	Thickness mm (in)
383695201	56.2 (2.213)
383695202	56.4 (2.220)
383695203	56.6 (2.228)
383695204	56.8 (2.236)
383695205	57.0 (2.244)
383695206	57.2 (2.252)

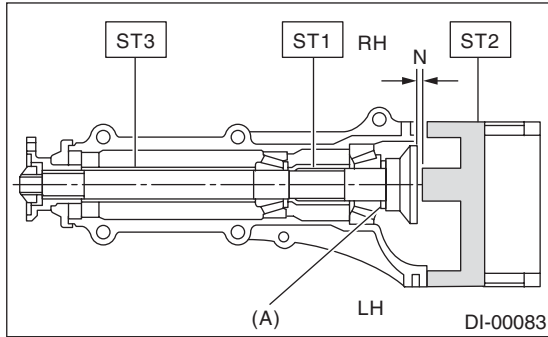
# Rear Differential (T-type)

## DIFFERENTIALS

2) Adjusting drive pinion height:  
Adjust the drive pinion height with washer installed between the rear bearing cone and the back of pinion gear.

(1) Attach the ST2.

- ST1 398507702 DUMMY SHAFT
- ST2 398507701 DIFFERENTIAL CARRIER GAUGE
- ST3 398507703 DUMMY COLLAR



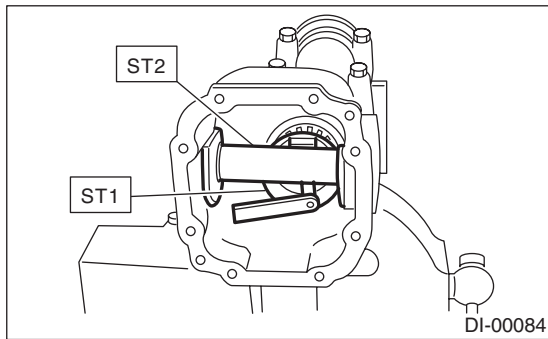
(A) Pinion height adjusting washer

(2) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

### NOTE:

Make sure there is no clearance between the case and ST2.

- ST1 398507702 DUMMY SHAFT
- ST2 398507701 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

$$T = To + N - (H \times 0.01) - 0.20 \text{ mm (0.008 in)}$$

### NOTE:

Use copies of this page.

T	Thickness of pinion height adjusting washer mm (in)	
To	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
H	Figure marked on drive pinion head	
Memo:		

(Example of calculation)

$$To = 2.20 + 1.20 = 3.40 \text{ mm}$$

$$N = 0.23 \text{ mm}$$

$$H = +1$$

$$T = 3.40 + 0.23 - 0.01 - 0.20 = 3.42$$

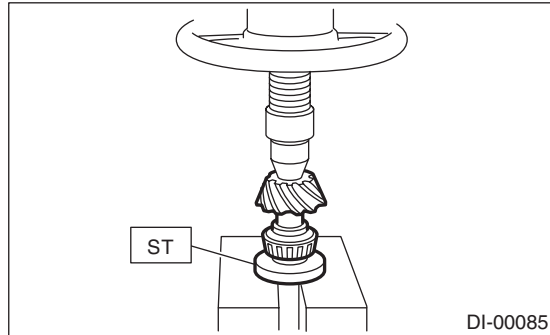
Result: Thickness = 3.42 mm

Therefore, use WASHER 383605200.

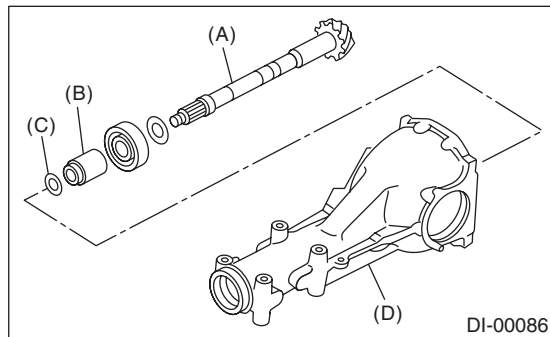
Pinion height adjusting washer	
Part No.	Thickness mm (in)
383495200	3.09 (0.1217)
383505200	3.12 (0.1228)
383515200	3.15 (0.1240)
383525200	3.18 (0.1252)
383535200	3.21 (0.1264)
383545200	3.24 (0.1276)
383555200	3.27 (0.1287)
383565200	3.30 (0.1299)
383575200	3.33 (0.1311)
383585200	3.36 (0.1323)
383595200	3.39 (0.1335)
383605200	3.42 (0.1346)
383615200	3.45 (0.1358)
383625200	3.48 (0.1370)
383635200	3.51 (0.1382)
383645200	3.54 (0.1394)
383655200	3.57 (0.1406)
383665200	3.60 (0.1417)
383675200	3.63 (0.1429)
383685200	3.66 (0.1441)

3) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

ST 398177700 INSTALLER



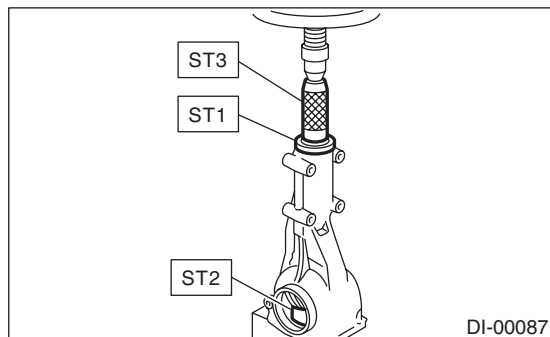
4) Insert the drive pinion into the differential carrier, and install the preselected bearing preload adjusting collar and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting collar
- (C) Bearing preload adjusting washer
- (D) Differential carrier

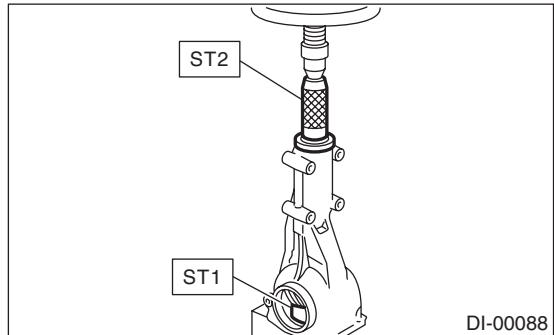
5) Press-fit the front bearing cone into case with ST1, ST2 and ST3.

ST1 398507703 DUMMY COLLAR  
 ST2 399780104 WEIGHT  
 ST3 899580100 INSTALLER



6) Insert the collar, then press-fit the pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT  
 ST2 899580100 INSTALLER

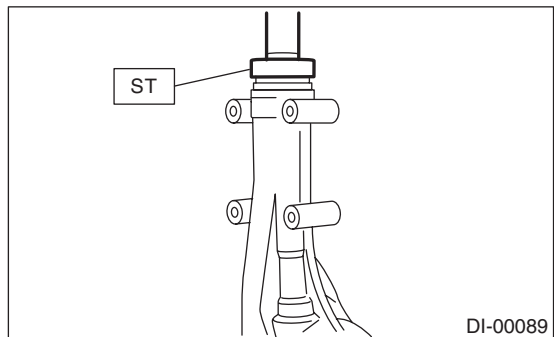


7) Fit a new oil seal with ST.

NOTE:

- Press-fit until the oil seal end comes 1 mm (0.04 in) inward from end of carrier.
- Apply grease to the oil seal lips.

ST 498447120 INSTALLER

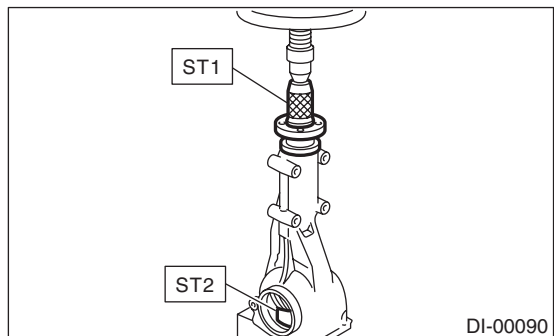


8) Press-fit the companion flange with ST1 and ST2.

NOTE:

Be careful not to damage the bearing.

ST1 899874100 INSTALLER  
 ST2 399780104 WEIGHT



# Rear Differential (T-type)

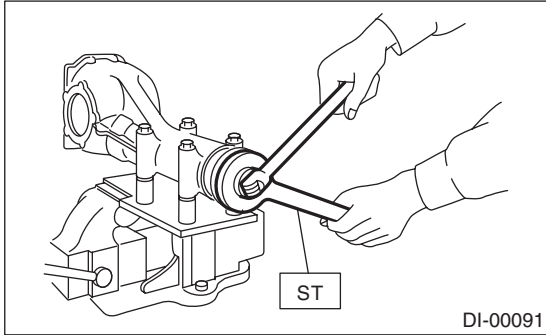
## DIFFERENTIALS

9) Attach a new self-locking nut and tighten using the ST.

ST 498427200 FLANGE WRENCH

**Tightening torque:**

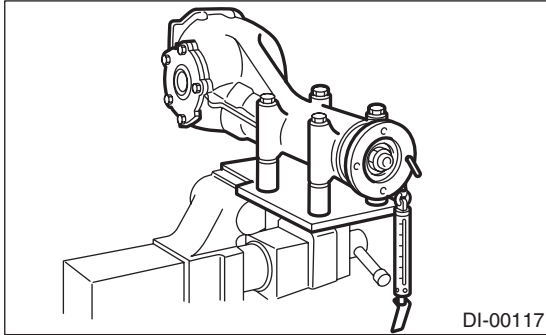
**181.5 N·m (18.5 kgf·m, 134.0 ft·lb)**



10) Check the initial torque and initial load.

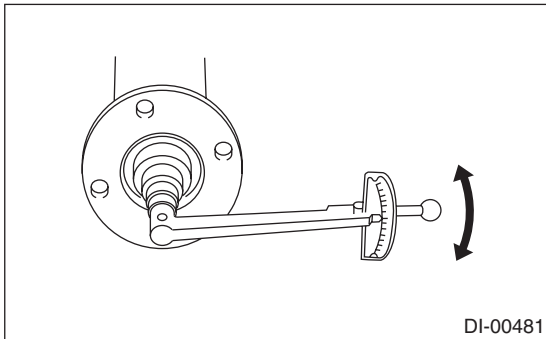
**Initial load:**

**17.7 — 38.8 N (1.8 — 4.0 kgf, 4.0 — 8.7 lb)**



**Initial torque:**

**0.67 — 1.47 N·m (0.07 — 0.15 kgf·m,  
0.49 — 1.08 ft·lb)**



11) Install the driven gear to the differential case.

**NOTE:**

Before installing bolts, apply seal material to bolt threads.

**SEAL MATERIAL**

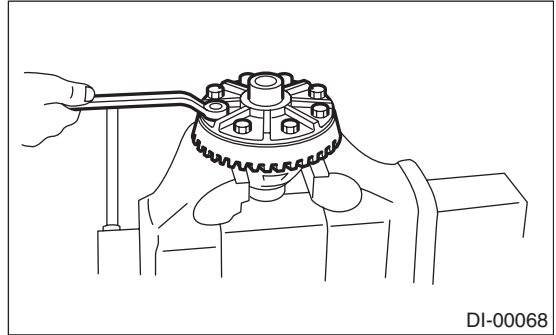
**THREE BOND 1324 (Part No. 004403042) or equivalent**

**NOTE:**

Tighten diagonally while tapping the bolt heads.

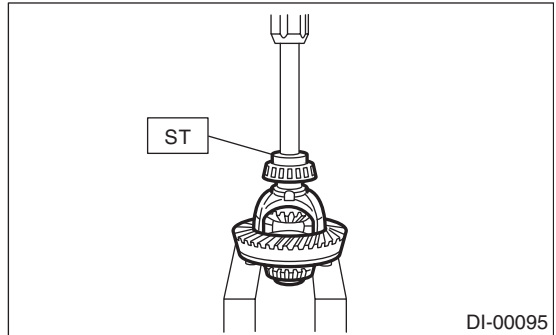
**Tightening torque:**

**103 N·m (10.5 kgf·m, 76.0 ft·lb)**



12) Press the side bearing into differential case using ST.

ST 398487700 DRIFT



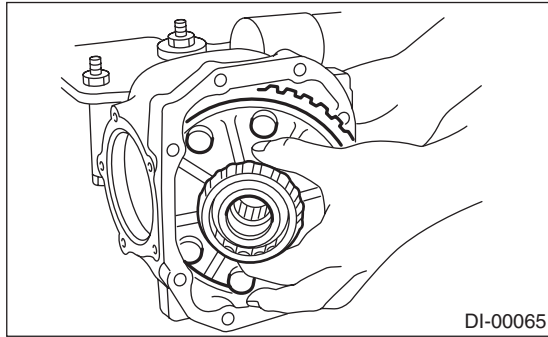
13) Press the side bearing race into side bearing retainer using the ST.

ST 398417700 DRIFT PUNCH

14) Adjusting the side bearing retainer shims

(1) The driven gear backlash and side bearing preload can be adjusted by the side bearing retainer shim thickness.

(2) Install the differential case assembly into differential carrier in the reverse order of disassembly.



(3) Install the side bearing retainer shims to retainers RH and LH from which they were installed.

**NOTE:**

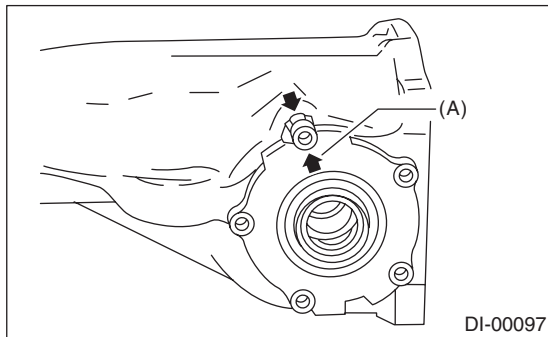
Replace broken or corroded side retainer shims and O-rings with a new part of the same thickness.

Side bearing retainer shim	
Part No.	Thickness mm (in)
383475201	0.20 (0.0079)
383475202	0.25 (0.0098)
383475203	0.30 (0.0118)
383475204	0.40 (0.0157)
383475205	0.50 (0.0197)

(4) Align the arrow mark on differential carrier with the mark on side retainer during installation.

**NOTE:**

- Replace the broken or cracked O-ring with a new part.
- Be careful that side bearing race is not damaged by the bearing roller.

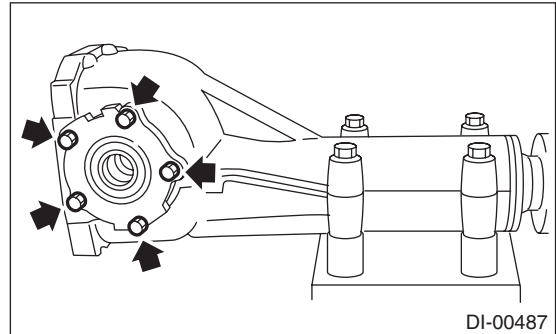


(A) Arrow mark

(5) Tighten the side bearing retainer bolts.

**Tightening torque:**

**10.5 N·m (1.1 kgf-m, 7.7 ft-lb)**



(6) Measure the driven gear to drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with the tooth surface of hypoid driven gear, and move the hypoid driven gear while securing the drive pinion. Read the value indicated on dial gauge. If the backlash is not within the range of specifications, adjust the side bearing retainer shim using the following procedures.

**•When backlash exceeds 0.2 mm (0.008 in):**

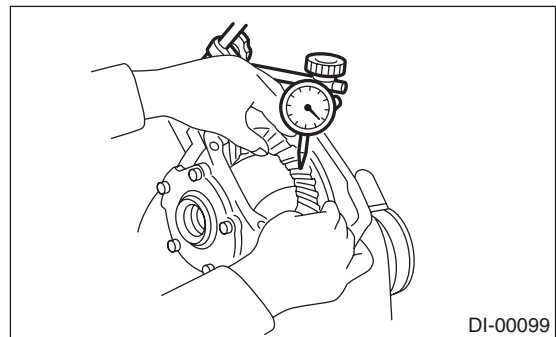
Reduce the hypoid driven gear rear face shim thickness and increase the hypoid driven gear tooth surface side shim thickness.

**•When backlash is less than 0.1 mm (0.004 in):**

Increase the hypoid driven gear rear face shim thickness and reduce the tooth surface side shim thickness.

**Backlash:**

**0.10 — 0.20 mm (0.004 — 0.008 in)**



(7) At the same time, measure the preload increase amount of the drive pinion. Compared with the resistance when differential case is not installed, if the total preload is not within specification, adjust the thickness of side bearing retainer shims, increasing/reducing both shims by an even amount at a time.

**Total preload:**

**20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)**

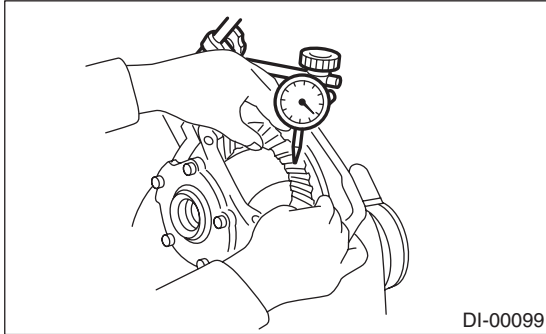
## Rear Differential (T-type)

### DIFFERENTIALS

15) Recheck the driven gear to pinion backlash.

**Backlash:**

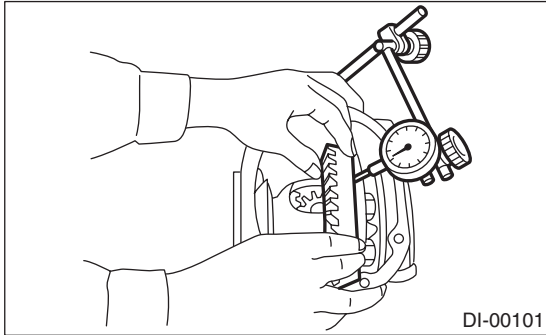
**0.10 — 0.20 mm (0.004 — 0.008 in)**



16) Check the driven gear runout on its back surface, and make sure that the pinion and driven gear rotate smoothly.

**Driven gear rear face runout limit:**

**0.05 mm (0.002 in)**



17) Checking and adjusting the tooth contact of driven gear

(1) Apply lead-free red dye evenly to the surfaces of three or four teeth on the driven gear. Check the contact pattern after rotating the driven gear several revolutions back and forth until a definite contact pattern appears on the driven gear.

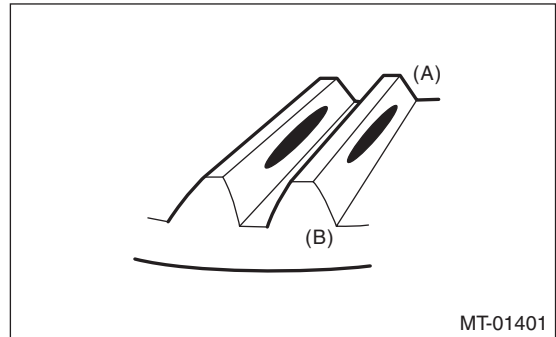
(2) When the contact pattern is not correct, re-adjust.

**NOTE:**

Be sure to wipe off the lead-free red dye after the adjustment is completed.

- Correct tooth contact

**Check item: Tooth contact pattern is slightly shifted towards the toe side under no-load rotation. (When driving, it moves towards the heel side.)**



(A) Toe side

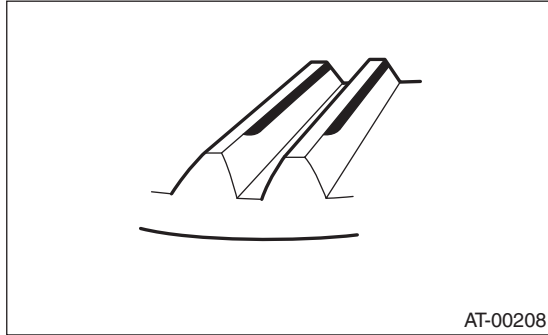
(B) Heel side



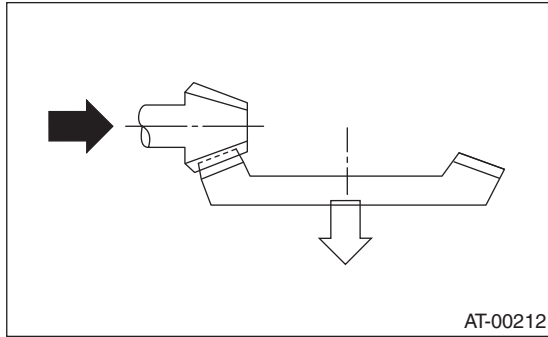
- Face contact

**Check item: Backlash is too large.**

Contact pattern



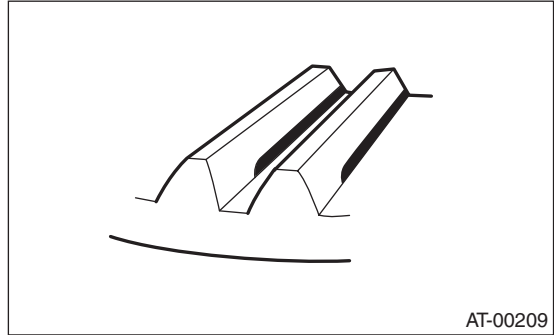
Corrective action: Increase the thickness of pinion height adjusting washer according to the procedure for bringing the drive pinion close to the driven gear.



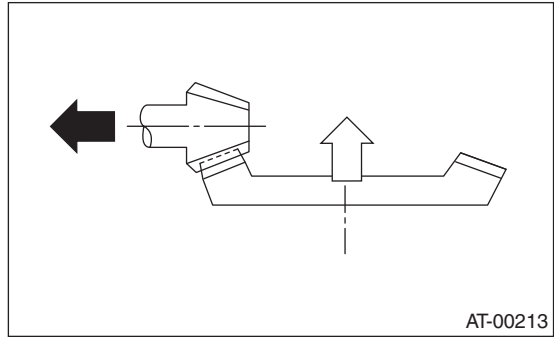
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



Adjustment: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive the pinion away from driven gear.



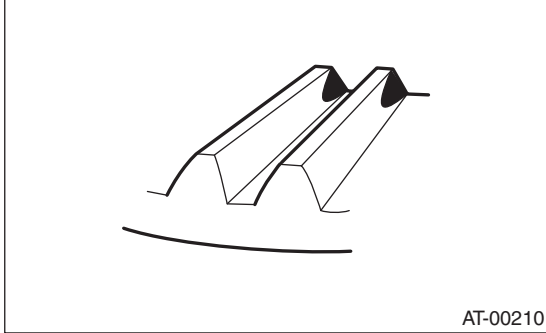
# Rear Differential (T-type)

## DIFFERENTIALS

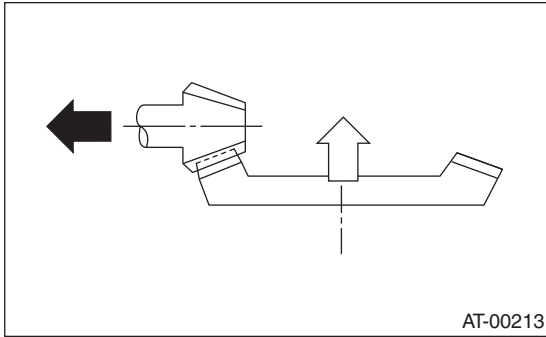
- Toe contact (inner side contact)

**Check item: Contact area is too small.**

Contact pattern



Adjustment: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive the pinion away from driven gear.



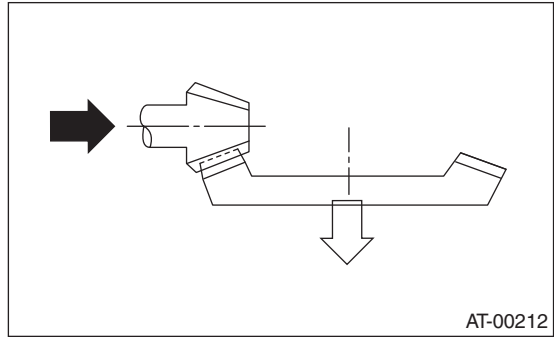
- Heel contact (outside end contact)

**Check item: Contact area is too small.**

Contact pattern



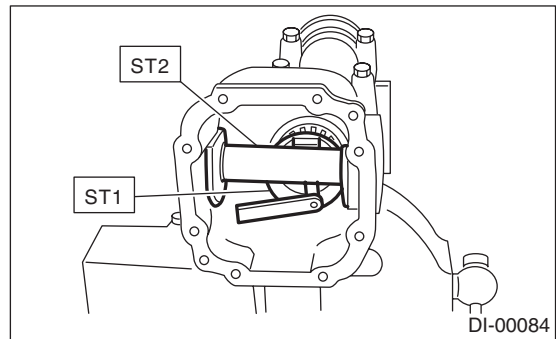
Corrective action: Increase thickness of pinion height adjusting washer according to the procedures for moving the drive pinion closer to the driven gear.



18) If proper tooth contact is not obtained, once again adjust the drive pinion height by changing the RH and LH side bearing retainer shims and the hypoid gear backlash.

(1) Drive pinion height

ST1 398507702 DUMMY SHAFT  
ST2 398507701 DIFFERENTIAL CARRIER GAUGE



$$T = To + N - (H \times 0.01) - 0.20 \text{ (mm)}$$

Place:

T = Thickness of pinion height adjusting washer (mm)

To = Thickness of washer temporarily inserted (mm)

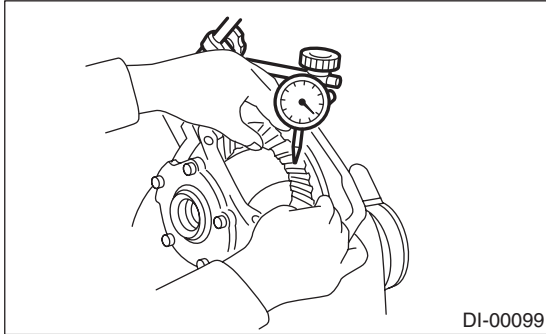
N = Clearance of thickness gauge (mm)

H = Figure marked on drive pinion head

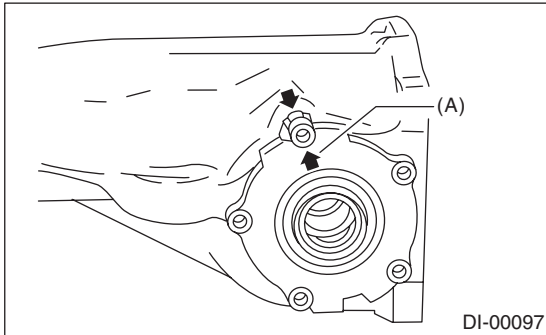
(2) Hypoid gear backlash

**Backlash:**

**0.10 — 0.20 mm (0.004 — 0.008 in)**



- 19) Remove the RH and LH side bearing retainer.
- 20) Install O-rings and side bearing retainer shims to side bearing retainers of both sides.
- 21) Install oil seals to side bearing retainers of both sides. <Ref. to DI-92, REPLACEMENT, Rear Differential Side Oil Seal.>
- 22) Align the arrow mark on differential carrier with the mark on side retainer during installation.



(A) Arrow mark

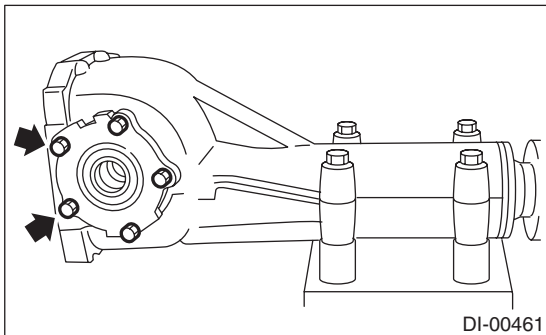
23) Apply liquid gasket to the bolts indicated by the arrows, and tighten the side bearing retainer bolts.

**Liquid gasket:**

**THREE BOND 1105 (Part No. 004403010) or equivalent**

**Tightening torque:**

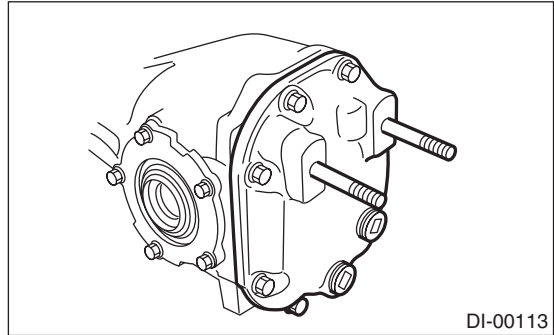
**10.5 N·m (1.1 kgf-m, 7.7 ft-lb)**



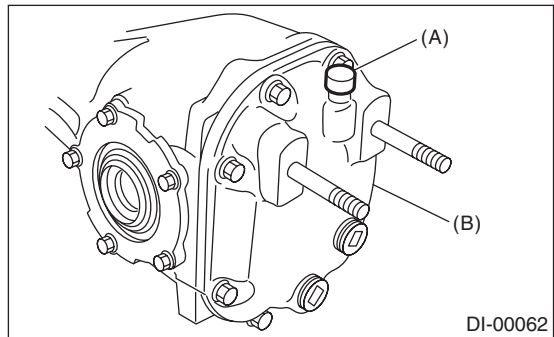
24) Install the new gasket and rear cover, and tighten the bolts to the specified torque.

**Tightening torque:**

**29.5 N·m (3.0 kgf-m, 21.8 ft-lb)**



25) Install the air breather cap.



- (A) Air breather cap
- (B) Rear cover

26) Install the oil drain plug and filler plug.

**Tightening torque:**

**49 N·m (5.0 kgf-m, 36.2 ft-lb)**

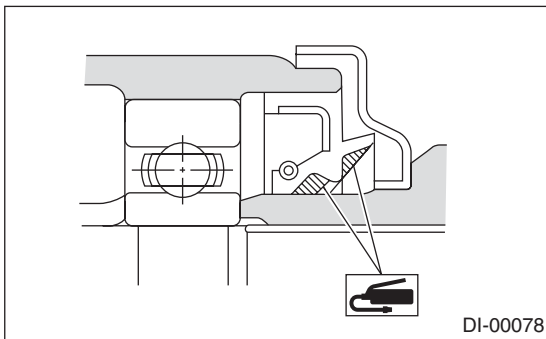
# Rear Differential (T-type)

## DIFFERENTIALS

### 2. GT SPEC. B 6MT MODEL

#### 1) Assembling instructions:

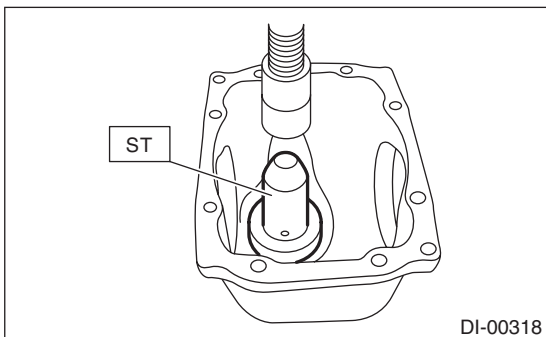
- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the RH and LH bearing races.
- Replace the oil seal with a new part at every disassembly.
- Apply chassis grease between the lips.



- Adjust the bearing preload between front and rear bearings with spacer and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

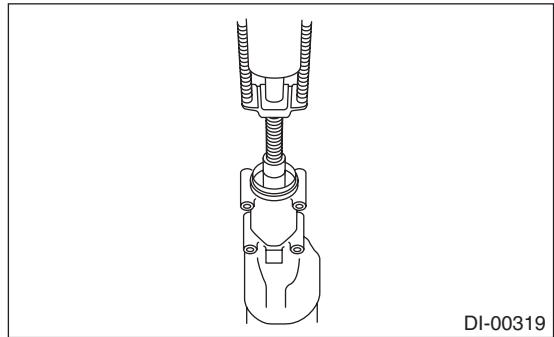
#### 2) Using the ST, press-fit the rear bearing race to the differential carrier.

ST 398417700 DRIFT PUNCH



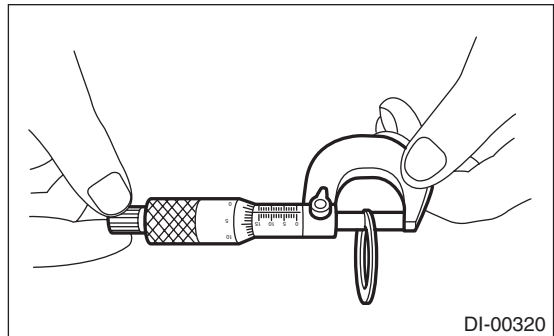
#### 3) Using the ST, press-fit the front bearing race to the differential carrier.

ST 398477702 DRIFT



#### 4) Selection of pinion height adjusting washer

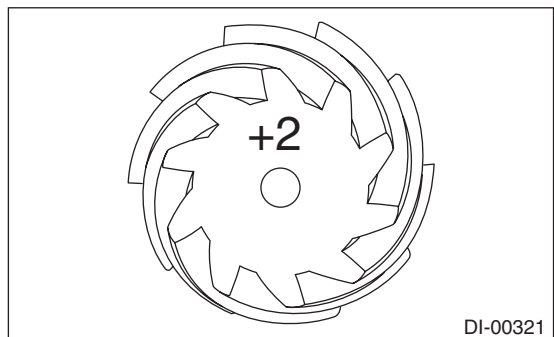
(1) Measure the thickness of the inserted pinion height adjusting washer.



(2) Read the stamps of the attached drive pinion gear and a new part.

#### NOTE:

When there is no stamp, it indicates 0 (zero).



(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the installed washer with this one.

$$T = T1 + (T2 \times 0.01 - T3 \times 0.01)$$

T mm	Thickness of the selected pinion height adjusting washer
T1 mm	Thickness of the inserted pinion height adjusting washer
T2 mm	Numbers stamped on the attached drive pinion gear
T3 mm	Numbers stamped on a new drive pinion gear

(Example of calculation)

T1 = 3.30, T2 = +2, T3 = -1

$$T = 3.30 + \{(2 \times 0.01) - (-1 \times 0.01)\} = 3.33$$

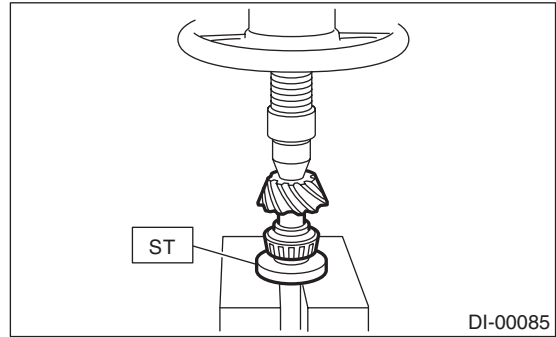
Result: Thickness = 3.33 mm

A washer to be used is 38336AA310.

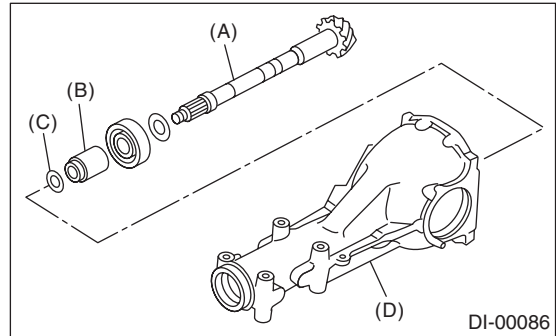
Pinion height adjusting washer	
Part No.	Thickness mm (in)
38336AA230	3.09 (0.1217)
38336AA240	3.12 (0.1228)
38336AA250	3.15 (0.1240)
38336AA260	3.18 (0.1252)
38336AA270	3.21 (0.1264)
38336AA280	3.24 (0.1276)
38336AA290	3.27 (0.1287)
38336AA300	3.30 (0.1299)
38336AA310	3.33 (0.1311)
38336AA320	3.36 (0.1323)
38336AA330	3.39 (0.1335)
38336AA340	3.42 (0.1346)
38336AA350	3.45 (0.1358)
38336AA360	3.48 (0.1370)
38336AA370	3.51 (0.1382)
38336AA380	3.54 (0.1394)
38336AA390	3.57 (0.1406)
38336AA400	3.60 (0.1417)
38336AA410	3.63 (0.1429)
38336AA420	3.66 (0.1441)

5) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

ST 18674AA000 INSTALLER



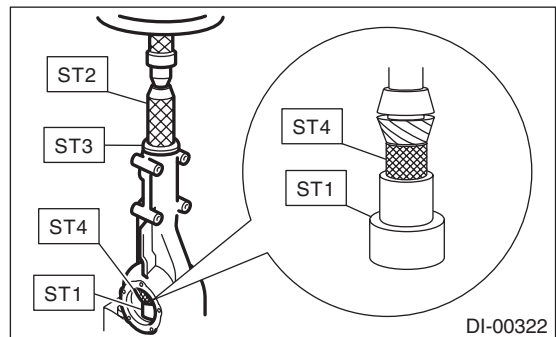
6) Insert the drive pinion into the differential carrier, and install the originally attached bearing preload adjusting spacer and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting spacer
- (C) Bearing preload adjusting washer
- (D) Differential carrier

7) Insert the spacer, then press-fit the pilot bearing with the ST.

ST1 399780104 WEIGHT  
 ST2 899580100 INSTALLER  
 ST3 398507703 DUMMY COLLAR  
 ST4 498937110 HOLDER DRIVE PINION



# Rear Differential (T-type)

## DIFFERENTIALS

8) Press-fit the companion flange with ST1, ST2 and ST3.

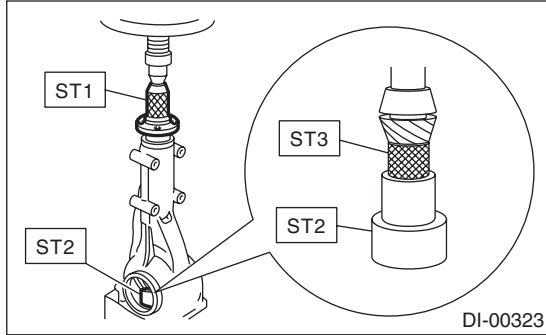
**NOTE:**

Be careful not to damage the bearing.

ST1 899874100 INSTALLER

ST2 399780104 WEIGHT

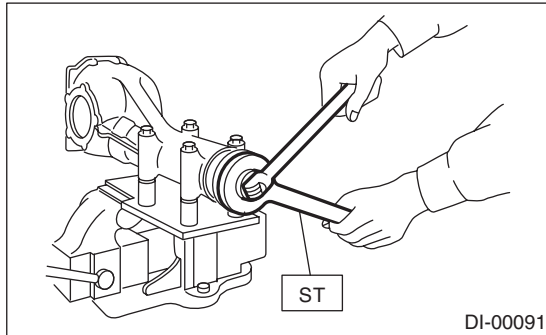
ST3 498937110 HOLDER DRIVE PINION



9) Install the self-locking nut. Tighten using the ST.  
ST 498427200 FLANGE WRENCH

**Tightening torque:**

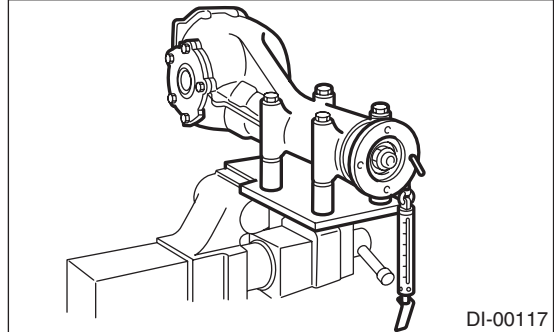
**181.5 N·m (18.5 kgf·m, 134.0 ft·lb)**



10) Turn the drive pinion shaft 10 or more times to make it fit in each taper roller bearing, and measure the initial load or initial torque.

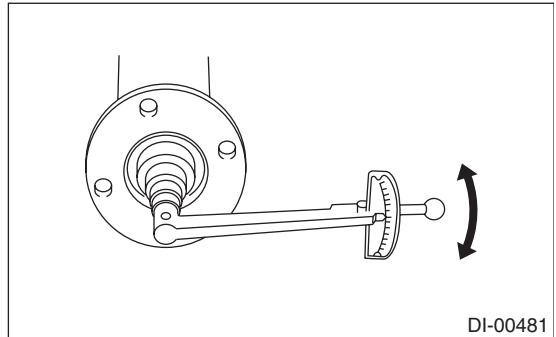
**Initial load:**

**24.1 — 38.6 N (2.5 — 3.9 kgf, 5.4 — 8.7 lb)**



**Initial torque:**

**0.91 — 1.46 N·m (0.09 — 0.15 kgf·m,  
0.67 — 1.08 ft·lb)**

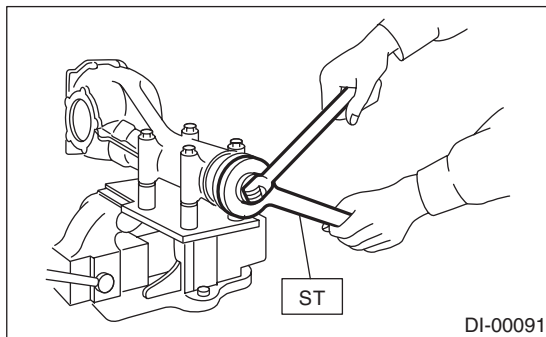


11) If the bearing preload is outside the specification range, select a preload adjusting washer and spacer from the table below to fit within the specification range.

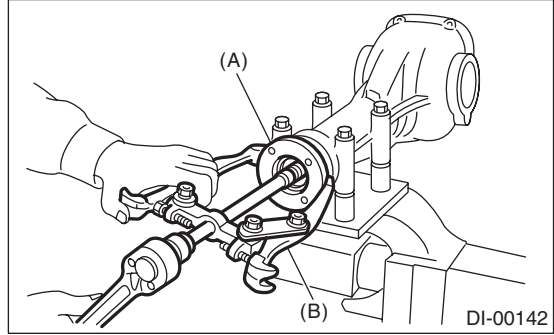
Preload adjusting washer	
Part No.	Thickness mm (in)
383705200	2.59 (0.1020)
383715200	2.57 (0.1012)
383725200	2.55 (0.1004)
383735200	2.53 (0.0996)
383745200	2.51 (0.0988)
383755200	2.49 (0.0980)
383765200	2.47 (0.0972)
383775200	2.45 (0.0965)
383785200	2.43 (0.0957)
383795200	2.41 (0.0949)
383805200	2.39 (0.0941)
383815200	2.37 (0.0933)
383825200	2.35 (0.0925)
383835200	2.33 (0.0917)
383845200	2.31 (0.0909)

Preload adjusting collar	
Part No.	Thickness mm (in)
31454AA130	52.2 (2.055)
31454AA140	52.4 (2.063)
31454AA150	52.6 (2.071)
31454AA160	52.8 (2.079)
31454AA170	53.0 (2.087)
31454AA180	53.2 (2.094)

12) Remove the self-locking nut while holding the companion flange with ST.  
 ST 498427200 FLANGE WRENCH



13) Draw out the companion flange with a puller.



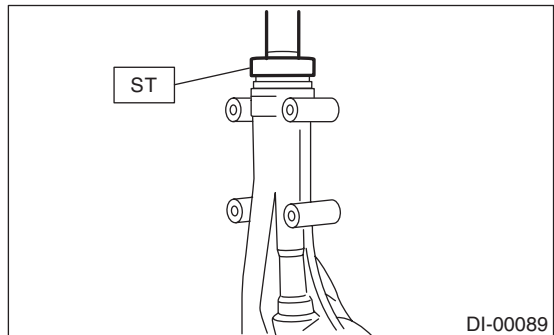
(A) Companion flange  
 (B) Puller

14) Install a new oil seal using ST.

**NOTE:**

- Press-fit until the oil seal end comes 1 mm (0.04 in) inward from end of carrier.
- Apply grease between the oil seal lips.

ST 498447120 INSTALLER



15) Press-fit the companion flange with ST1, ST2 and ST3.

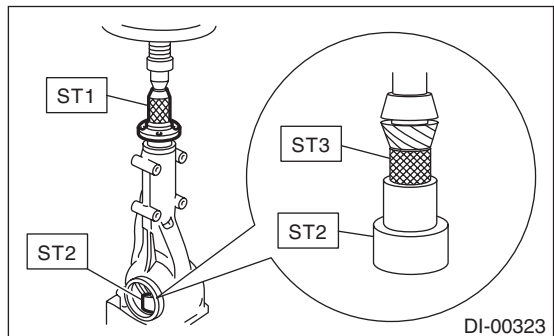
ST1 899874100 INSTALLER

ST2 399780104 WEIGHT

ST3 498937110 HOLDER DRIVE PINION

**NOTE:**

Be careful not to damage the bearing.

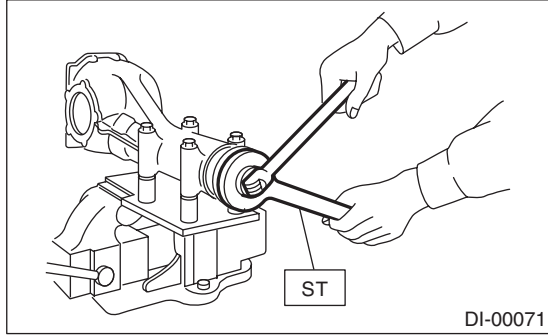


# Rear Differential (T-type)

## DIFFERENTIALS

16) Install the self-locking nut. Tighten using the ST.

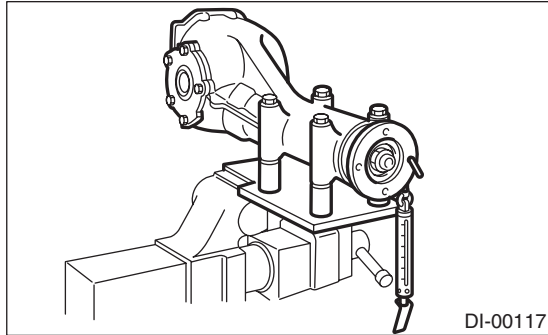
ST 498427200 FLANGE WRENCH



17) Check the initial torque and initial load.

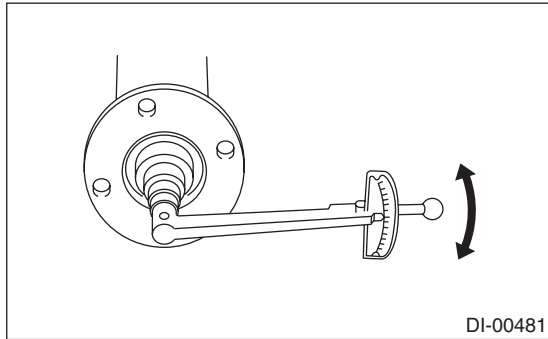
**Initial load:**

**24.1 — 38.6 N (2.5 — 3.9 kgf, 5.4 — 8.7 lb)**



**Initial torque:**

**0.91 — 1.46 N·m (0.09 — 0.15 kgf·m,  
0.67 — 1.08 ft·lb)**



18) Install the driven gear to the differential case.

**NOTE:**

Before installing bolts, apply seal material to bolt threads.

**SEAL MATERIAL**

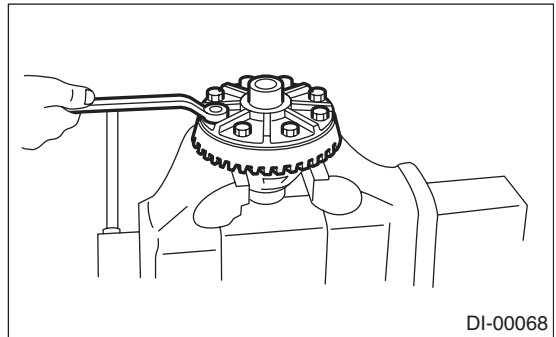
**THREE BOND 1324 (Part No. 004403042) or equivalent**

**NOTE:**

Tighten diagonally while gently tapping the bolt heads.

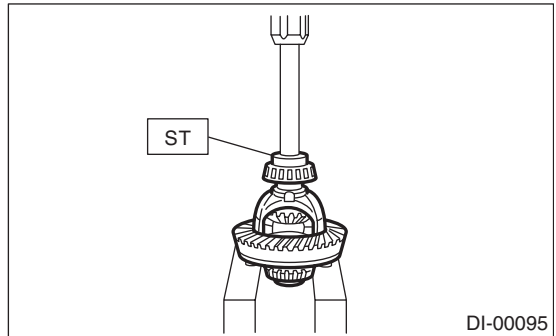
**Tightening torque:**

**103 N·m (10.5 kgf·m, 76.0 ft·lb)**



19) Press the side bearing into differential case using ST.

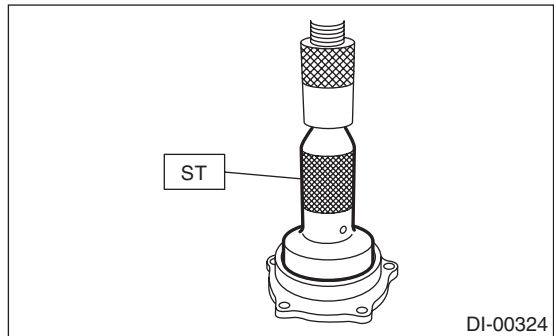
ST 398487700 DRIFT



20) Assembling the side retainer

(1) Using the ST and a press, press-fit the side bearing outer race.

ST 398417700 DRIFT



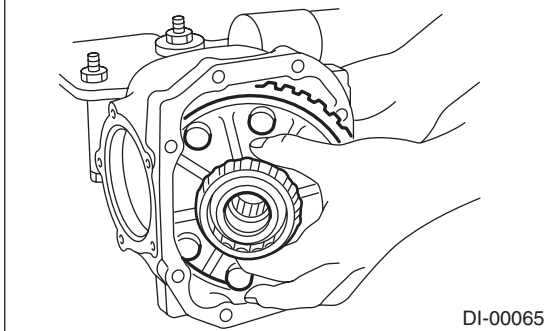
(2) Install the oil seal. <Ref. to DI-92, REPLACEMENT, Rear Differential Side Oil Seal.>



21) Adjusting the side bearing retainer shims

(1) The driven gear backlash and side bearing preload can be adjusted by the side bearing retainer shim thickness.

(2) Install the differential case assembly into differential carrier in the reverse order of disassembly.



(3) Install the side retainer shims and O-rings to retainers RH and LH from which they were removed.

**NOTE:**

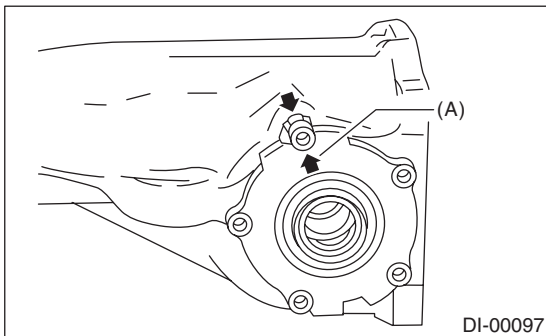
- Replace the broken or cracked O-ring with a new part.
- Replace broken or corroded side retainer shims with a new part of the same thickness.

Side bearing retainer shim	
Part No.	Thickness mm (in)
383475201	0.20 (0.0079)
383475202	0.25 (0.0098)
383475203	0.30 (0.0118)
383475204	0.40 (0.0157)
383475205	0.50 (0.0197)

(4) Align the arrow mark on differential carrier with the mark on side retainer during installation.

**NOTE:**

Be careful that side bearing outer race is not damaged by the bearing roller.

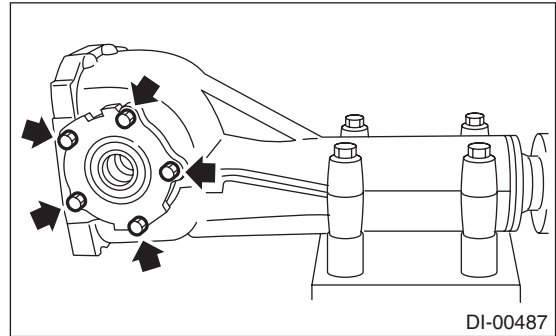


(A) Arrow mark

(5) Tighten the side bearing retainer bolts.

**Tightening torque:**

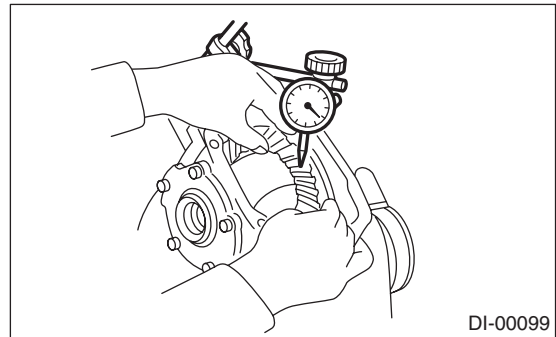
**10.5 N·m (1.1 kgf-m, 7.7 ft-lb)**



(6) Measure the driven gear to drive pinion backlash. Set the magnet base on the differential carrier. Align the contact point of dial gauge with the tooth surface of hypoid driven gear, and move the hypoid driven gear while securing the drive pinion. Read the value indicated on dial gauge.

**Backlash:**

**0.10 — 0.20 mm (0.004 — 0.008 in)**



(7) At the same time, measure the total preload of the drive pinion. Compared with the time when differential case is not installed, if the total preload is not within specification, adjust the thickness of side bearing retainer shims, increasing/reducing both shims by an even amount at a time.

**Total preload:**

**27.0 — 54.0 N (2.8 — 5.5 kgf, 6.1 — 12.2 lb)**

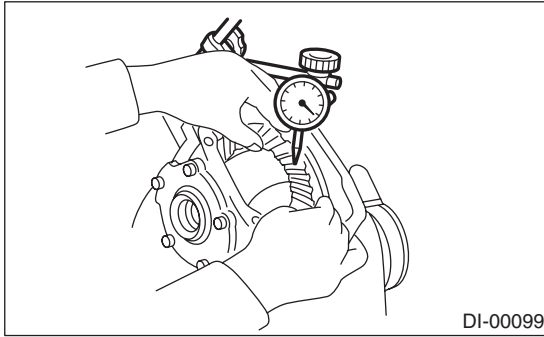
# Rear Differential (T-type)

## DIFFERENTIALS

22) Measure the driven gear to drive pinion backlash again.

**Backlash:**

**0.10 — 0.20 mm (0.004 — 0.008 in)**

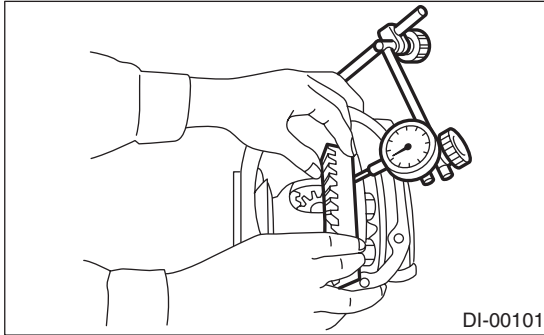


23) Check the driven gear runout on its back surface, and make sure that the pinion and driven gear rotate smoothly.

If the driven gear runout on its back surface exceeds the specification, check for any foreign objects between the hypoid driven gear and differential case, and for any deformation of the case or gear.

**Driven gear rear face runout limit:**

**0.05 mm (0.002 in)**



24) Checking and adjusting the tooth contact of driven gear

(1) Apply lead-free red dye evenly to the both side of three or four teeth on the driven gear. Check the contact pattern after rotating the driven gear several revolutions back and forth until a definite contact pattern appears on the driven gear.

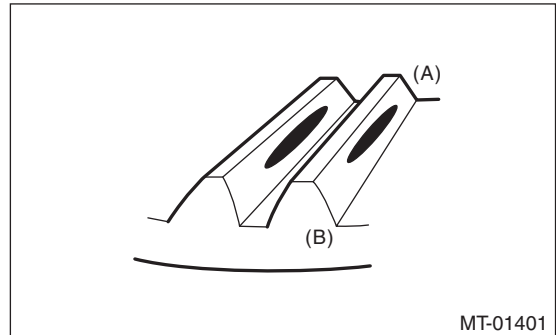
(2) If the contact pattern is improper, readjust it in accordance with the instruction in "Contact pattern".

**NOTE:**

Be sure to wipe off the lead-free red dye after the adjustment is completed.

- Correct tooth contact

**Check item: Tooth contact pattern is slightly shifted towards the toe side under no-load rotation. (When driving, it moves towards the heel side.)**



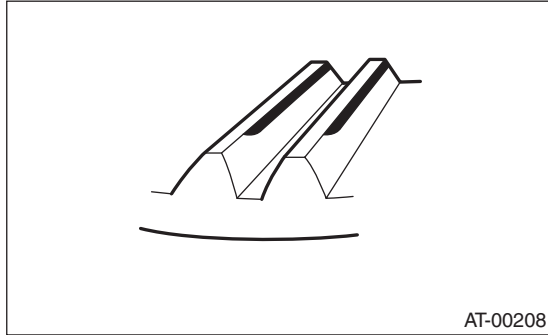
(A) Toe side

(B) Heel side

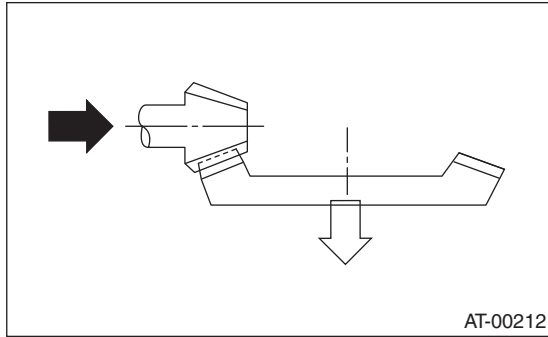
- Face contact

**Check item: Backlash is too large.**

Contact pattern



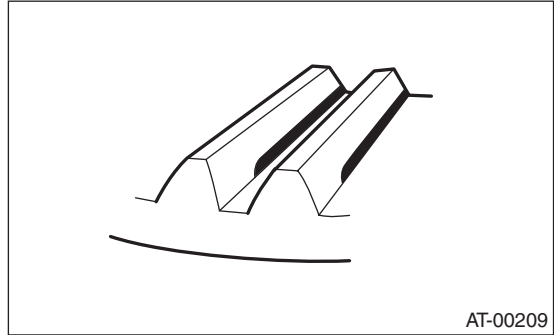
Corrective action: Increase the thickness of pinion height adjusting washer according to the procedure for bringing the drive pinion close to the driven gear.



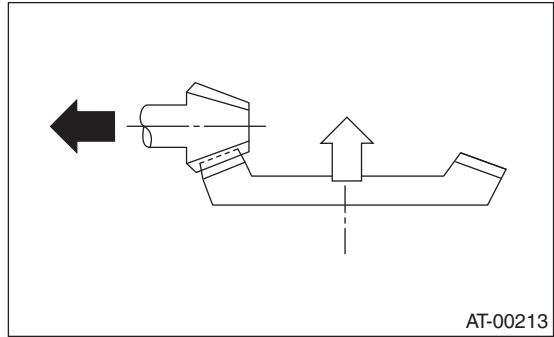
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



Adjustment: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive the pinion away from driven gear.



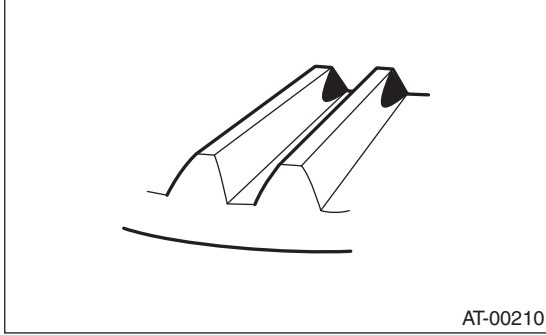
# Rear Differential (T-type)

## DIFFERENTIALS

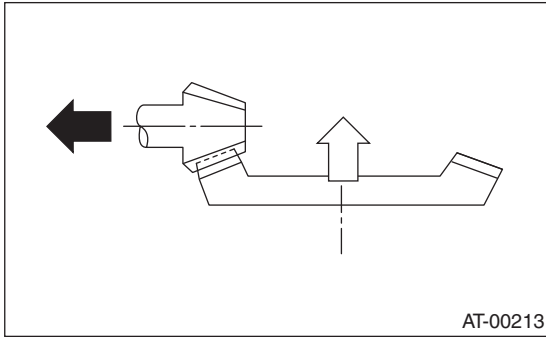
- Toe contact (inner side contact)

**Check item: Contact area is too small.**

Contact pattern



Adjustment: Reduce the thickness of pinion height adjusting washer according to the procedure for bringing drive the pinion away from driven gear.



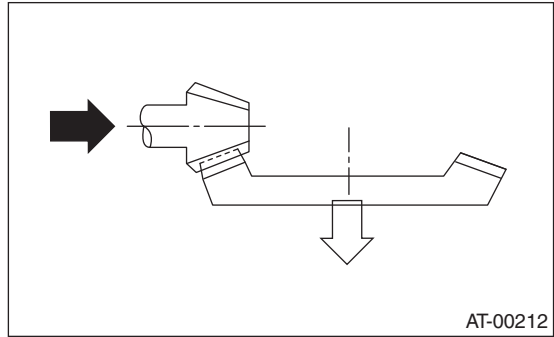
- Heel contact (outside end contact)

**Check item: Contact area is too small.**

Contact pattern



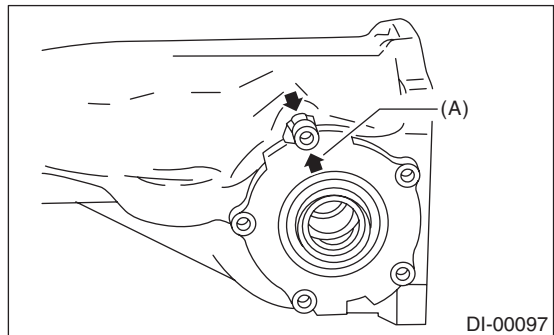
Corrective action: Increase thickness of pinion height adjusting washer according to the procedures for moving the drive pinion closer to the driven gear.



25) If proper tooth contact is not obtained, once again adjust the drive pinion height by changing the RH and LH side bearing retainer shims and the hypoid gear backlash.

26) Install oil seals to side bearing retainers of both sides. <Ref. to DI-92, REPLACEMENT, Rear Differential Side Oil Seal.>

27) Align the arrow mark on differential carrier with the mark on side retainer during installation.

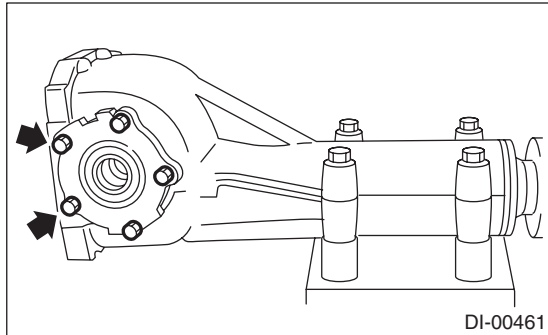


(A) Arrow mark

28) Apply liquid gasket to the bolts indicated by the arrows, and tighten the side bearing retainer bolts.

**Liquid gasket:**  
**THREE BOND 1105 (Part No. 004403010) or equivalent**

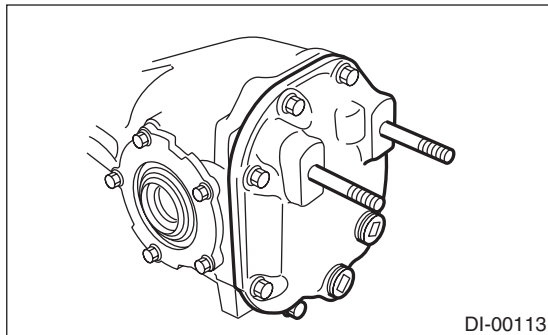
**Tightening torque:**  
**10.5 N-m (1.1 kgf-m, 7.7 ft-lb)**



(A) Side bearing retainer bolt

29) Install the new gasket and rear cover, and tighten the bolts to the specified torque.

**Tightening torque:**  
**44 N-m (4.5 kgf-m, 32.5 ft-lb)**



30) Install the breather cap.

## E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage and other defects. Repair or replace the defective parts as necessary.

- 1) Hypoid driven gear and drive pinion
  - If there is evidently an abnormal tooth contact, find out the cause and adjust until the teeth contact correctly. Replace the gear if there is an excessive worn or an incapable adjustment.
  - If crack, cutout or seizure is found, replace the parts as a set. Slight damage of some teeth can be corrected by oil stone or the like.
- 2) Side gear and pinion mate gear
  - Replace if cracks, scoring or other defects are evident on the tooth surface.
  - Replace if thrust washer contact surface is worn or seized. Slight damages of the surface can be corrected by oil stones or equivalent.

3) Bearing  
 Replace if seizure, peeling, wear, rust, dragging during rotation, noise or other defect is evident.

4) Thrust washer of the side gear and pinion mate gear:

Replace if seized, flawed, abnormally worn or having other defects.

5) Oil seal  
 Replace if deformed or damaged, and at every disassembling.

6) Differential carrier  
 Replace if the bearing bores are worn or damaged.

7) Differential case  
 Replace if its sliding surfaces are worn or cracked.

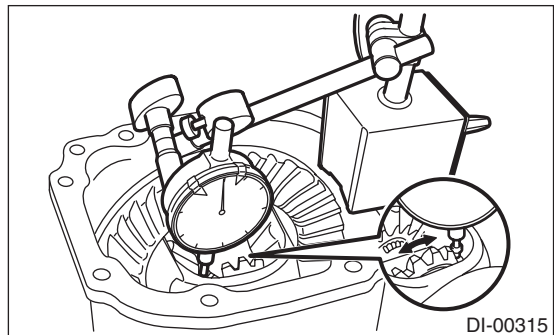
8) Companion flange  
 Replace if the oil seal lip contact surface shows cracking.

### 1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of side gear. (Model without LSD)

**Side gear backlash:**  
**0.1 — 0.2 mm (0.004 — 0.008 in)**

If the side gear backlash is not within the specification, select the side gear thrust washer and adjust the side gear backlash as specified.



# Rear Differential (T-type)

## DIFFERENTIALS

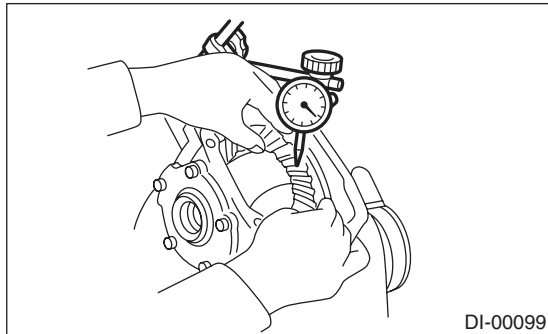
### 2. HYPOID DRIVEN GEAR BACKLASH

Using a dial gauge, check the backlash of hypoid driven gear.

**Hypoid driven gear backlash:**

**0.1 — 0.2 mm (0.004 — 0.008 in)**

If the hypoid driven gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



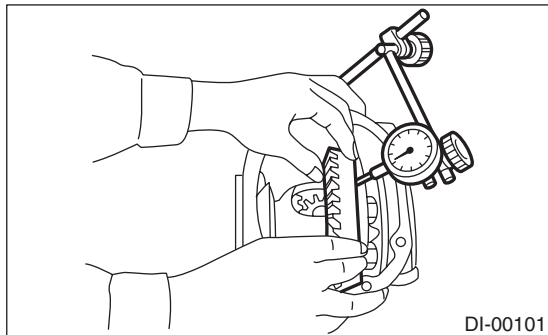
### 3. HYPOID DRIVEN GEAR RUNOUT ON ITS BACK SURFACE

Using a dial gauge, check the hypoid driven gear back surface runout.

**Hypoid driven gear back surface runout:**

**0.05 mm (0.002 in)**

If the hypoid driven gear runout exceeds 0.05 mm (0.002 in), replace the hypoid driven gear.



### 4. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Inspect the tooth contact between the hypoid driven gear and drive pinion. <Ref. to DI-38, ASSEMBLY, Rear Differential (T-type).>

### 5. TOTAL PRELOAD

Using a spring scale, check the total preload.

**Total preload:**

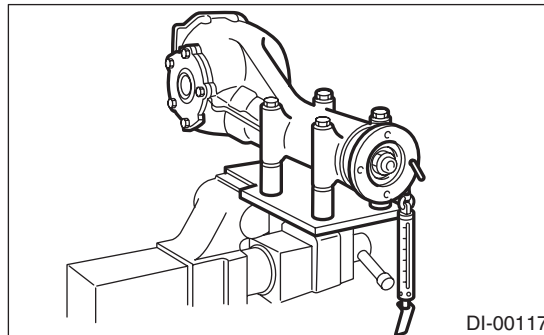
**Except for GT spec. B 6MT model:**

**20.7 — 54.4 N (2.1 — 5.5 kgf, 4.7 — 12.2 lb)**

**GT spec. B 6MT model**

**27.0 — 54.0 N (2.8 — 5.5 kgf, 6.1 — 12.1 lb)**

If the total preload is not within the specification, adjust the side bearing retainer shims.



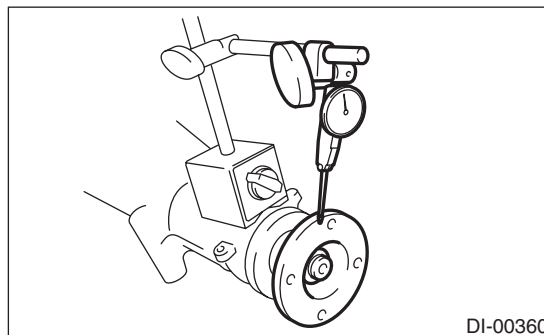
### 6. COMPANION FLANGE

1) If rust or dirt is attached to the companion flange, remove them.

2) Set a dial gauge at a companion flange surface (mating surface of propeller shaft and companion flange), and then measure the companion flange runout.

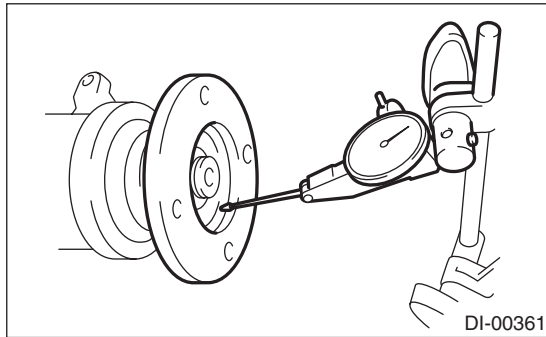
**Limit of runout:**

**0.08 mm (0.003 in)**



3) Set the gauge inside of the companion flange, and measure the runout.

**Limit of runout:**  
**0.08 mm (0.003 in)**



4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point where the runout is within the limit.

5) If the runout exceeds the limit even after changing the phase, replace the companion flange and recheck the runout.

6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

## F: ADJUSTMENT

### 1. SIDE GEAR BACKLASH

Adjust the side gear backlash.

<Ref. to DI-38, ASSEMBLY, Rear Differential (T-type).>

### 2. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash.

<Ref. to DI-38, ASSEMBLY, Rear Differential (T-type).>

### 3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear.

<Ref. to DI-38, ASSEMBLY, Rear Differential (T-type).>

### 4. TOTAL PRELOAD

Adjust the side bearing shim.

<Ref. to DI-38, ASSEMBLY, Rear Differential (T-type).>

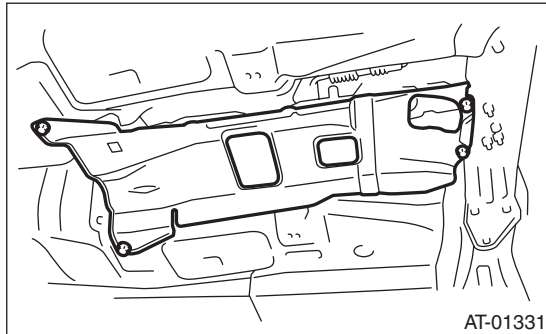
# Rear Differential (VA-type)

## DIFFERENTIALS

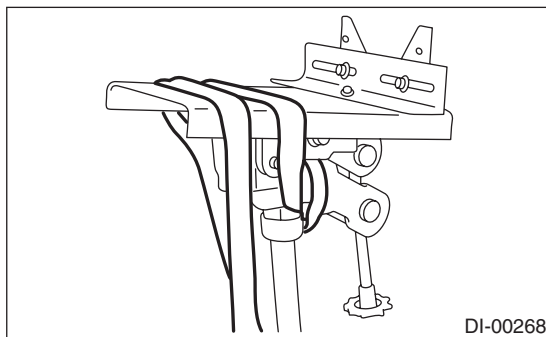
### 5. Rear Differential (VA-type)

#### A: REMOVAL

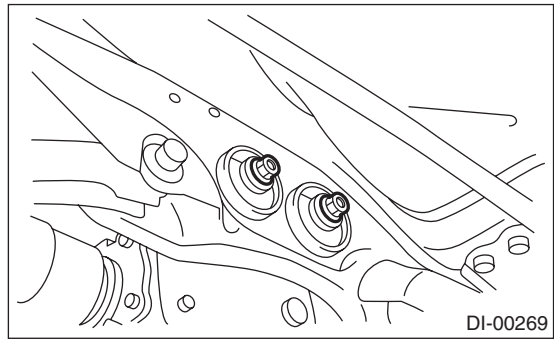
- 1) Disconnect the ground cable from the battery.
- 2) Shift the select lever or gear shift lever to neutral.
- 3) Release the parking brake.
- 4) Lift up the vehicle.
- 5) Remove the rear exhaust pipe and muffler.
  - 2.5 L SOHC Non-turbo model  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - 2.5 L DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
  - 3.0 L DOHC non-turbo model  
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 6) Remove the heat shield cover.



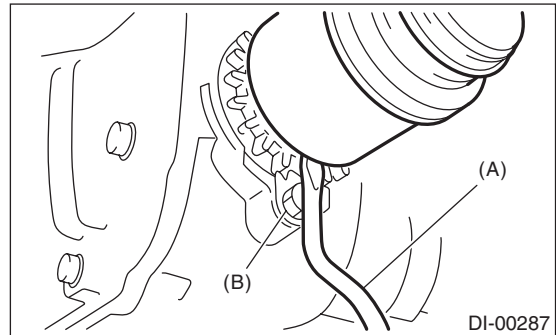
- 7) Remove the propeller shaft.  
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 8) Prepare the transmission jack and band.



- 9) Loosen the self-lock nuts which hold the rear differential to rear crossmember.

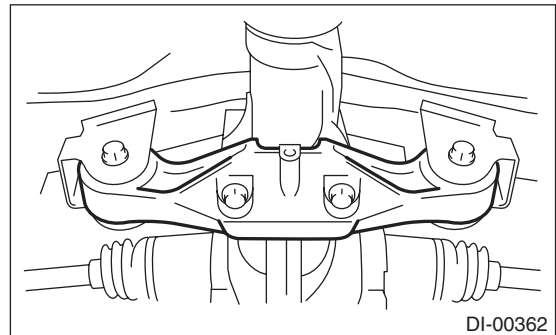


- 10) Remove the DOJ of rear drive shaft from rear differential.

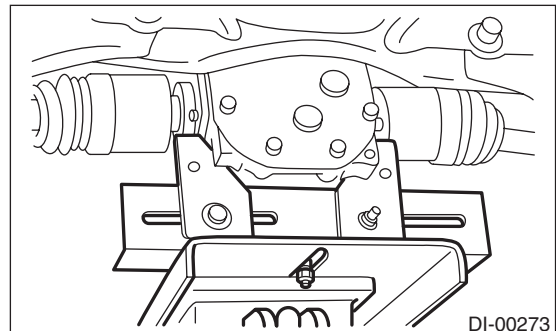


- (A) Tire lever  
(B) Bolt

- 11) Remove the nuts which hold the rear differential front member.



- 12) Support the rear differential with the transmission jack.

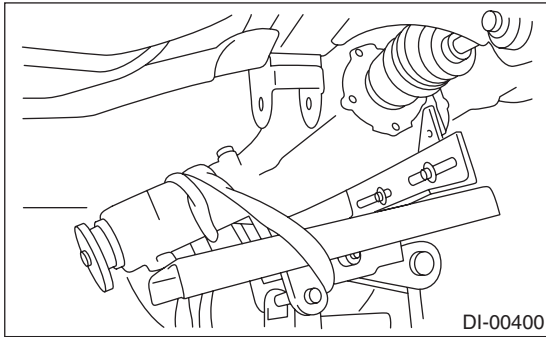




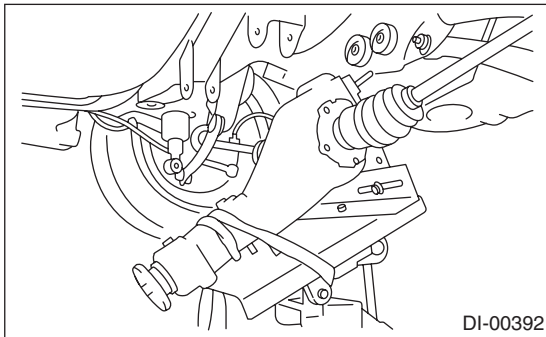
- 13) Remove the rear differential front member.
- 14) Secure the rear differential using band.
- 15) Remove the self-lock nuts which hold the rear differential to rear crossmember.
- 16) Remove the rear differential stud bolt from rear crossmember bushing.

**NOTE:**

When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary



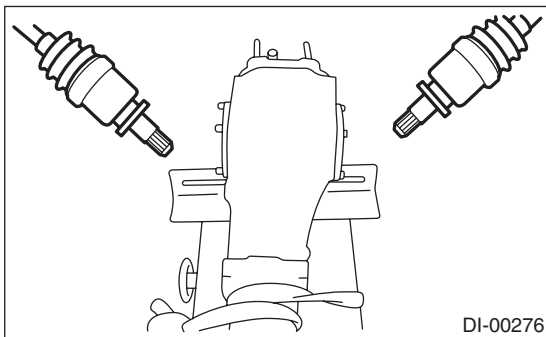
- 17) Lower the transmission jack stand after removing the rear differential stud bolt from the rear crossmember. Rear drive shaft should not come into contact with the lateral link bolt.



- 18) Pull out the axle shaft from rear differential.

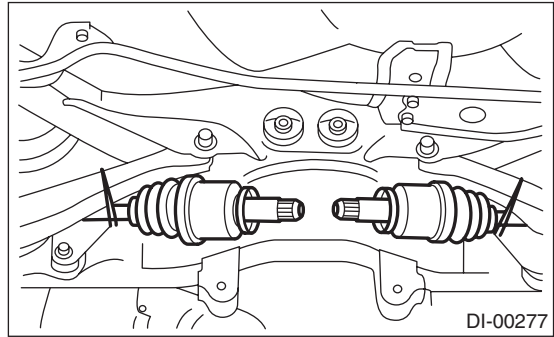
**NOTE:**

If it is difficult to remove the axle shaft from rear differential, remove it using tire lever.

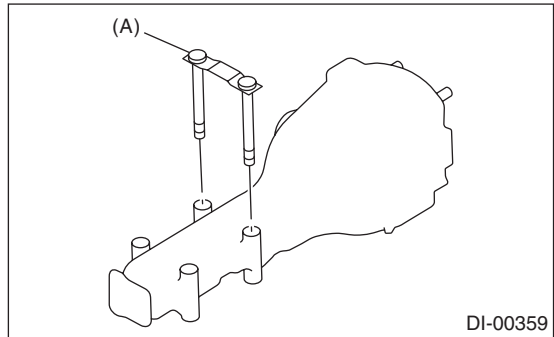


- 19) Lower the transmission jack.

- 20) Secure the rear drive shaft to lateral link using wire.



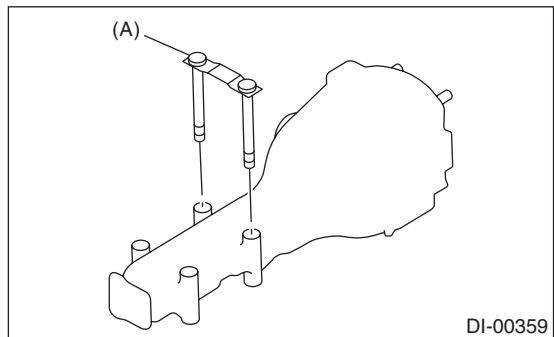
- 21) Remove the rear differential member plate from rear differential.



(A) Rear differential member plate

## B: INSTALLATION

- 1) Insert the rear differential member plate into rear differential.



(A) Rear differential member plate

- 2) Set the rear differential to transmission jack.

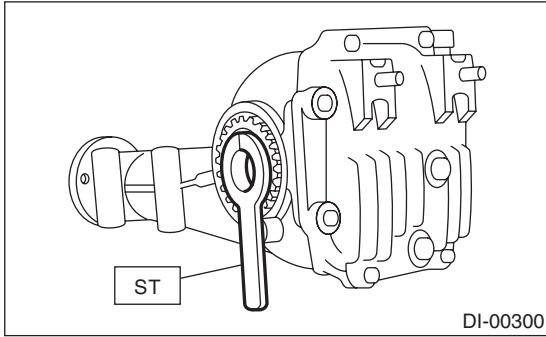
**NOTE:**

Secure the rear differential to transmission jack using band.

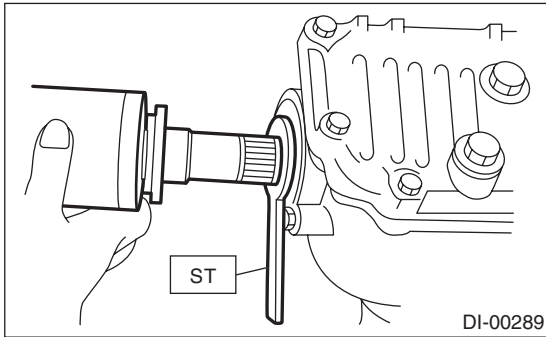
## Rear Differential (VA-type)

### DIFFERENTIALS

- 3) Attach the ST to rear differential.  
ST 28099PA090 OIL SEAL PROTECTOR

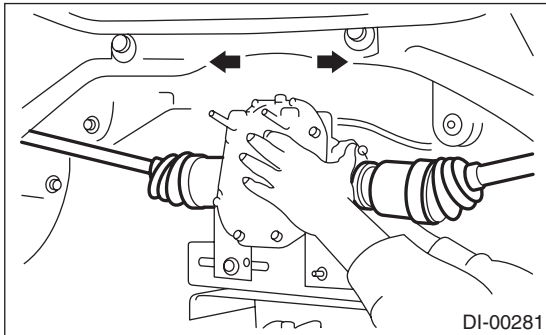


- 4) Insert the spline shaft until the spline portion comes inside the side oil seal.

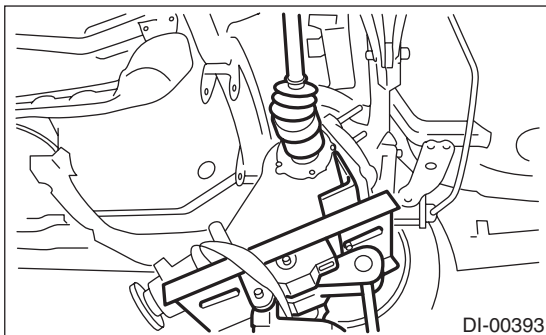


- 5) Remove ST from rear differential.  
ST 28099PA090 OIL SEAL PROTECTOR

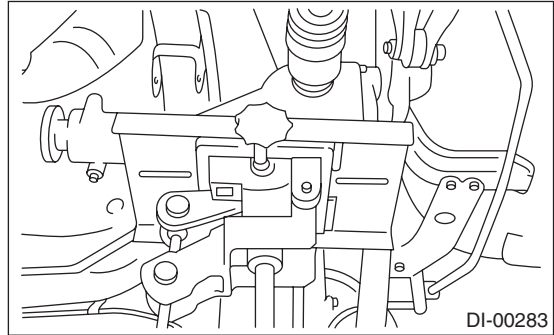
- 6) Push the rear differential to insert the axle shaft into rear differential.



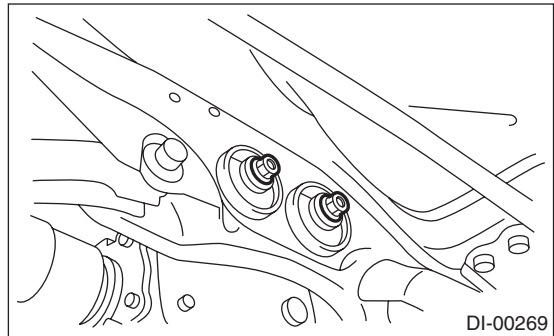
- 7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into rear cross-member bushing properly.



- 8) After inserting the rear differential stud bolt into the rear crossmember bushing, lift up the transmission jack and align the rear differential to its attachment position.



- 9) Tighten a new self-locking nut temporarily to rear crossmember.



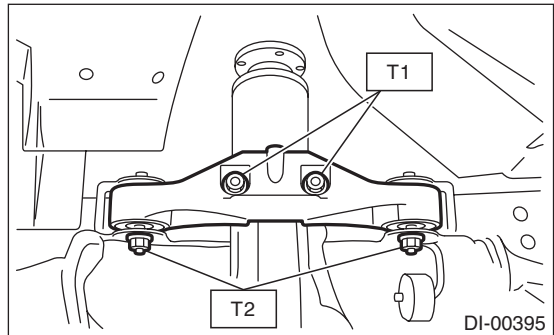
- 10) Remove the band from rear differential. Lift up the rear differential until the rear differential is separated from the transmission jack.

- 11) Install the rear differential front member with a new self-locking nut.

#### **Tightening torque:**

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

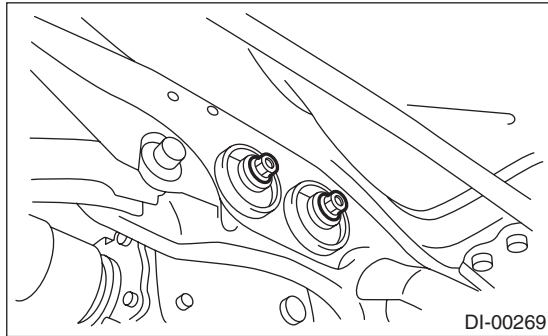
**T2: 110 N·m (11.2 kgf-m, 81 ft-lb)**



12) Tighten the self-locking nut.

**Tightening torque:**

**70 N·m (7.1 kgf·m, 51 ft·lb)**



13) Lower the transmission jack.

14) Install the propeller shaft.

<Ref. to DS-11, INSTALLATION, Propeller Shaft.>

15) Install the heat shield cover.

16) Install the rear exhaust pipe and muffler.

- 2.5 L SOHC Non-turbo model

<Ref. to EX(H4SO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, INSTALLATION, Muffler.>

- 2.5 L DOHC turbo model

<Ref. to EX(H4DOTC)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, INSTALLATION, Muffler.>

- 3.0 L DOHC non-turbo model

<Ref. to EX(H6DO)-8, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-10, INSTALLATION, Muffler.>

## C: DISASSEMBLY

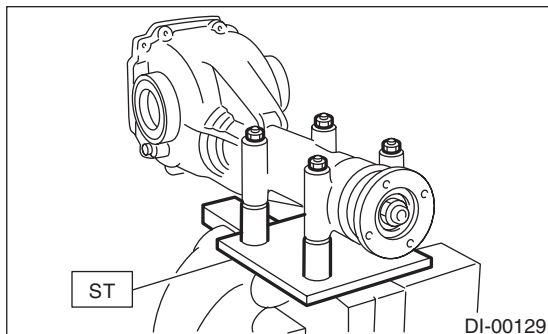
### 1. VA1-TYPE

To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash between hypoid driven gear and drive pinion
- Hypoid driven gear runout on its back surface
- Total preload of drive pinion

1) Set the ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT SET

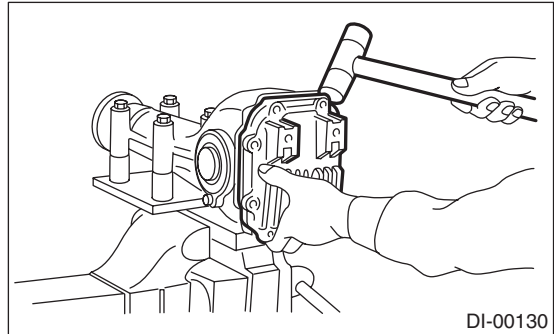


2) Remove the oil drain plug and filler plug, and drain the gear oil.

3) Remove the mounting bolts, and remove the rear cover.

**NOTE:**

Remove it by tapping with a plastic hammer.

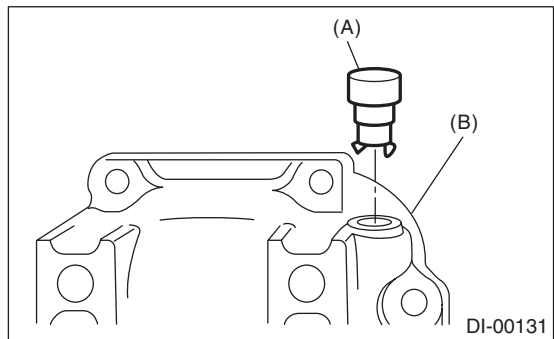


4) Remove the air breather cap.

**NOTE:**

- Do not attempt to replace the air breather cap unless necessary.

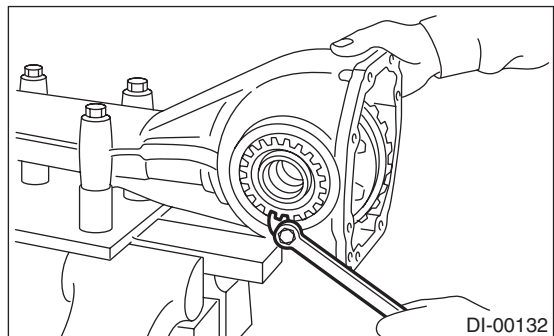
- Whenever the air breather cap is removed, replace it with a new part.



(A) Air breather cap

(B) Rear cover

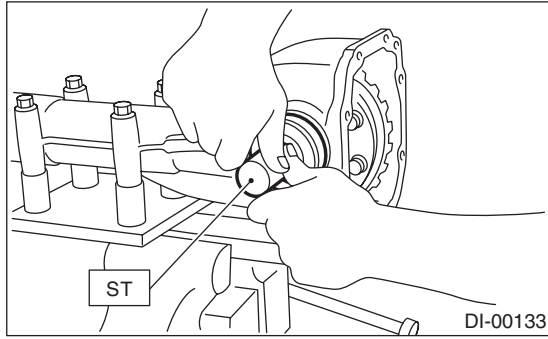
5) Remove the lock plate RH and LH.



# Rear Differential (VA-type)

## DIFFERENTIALS

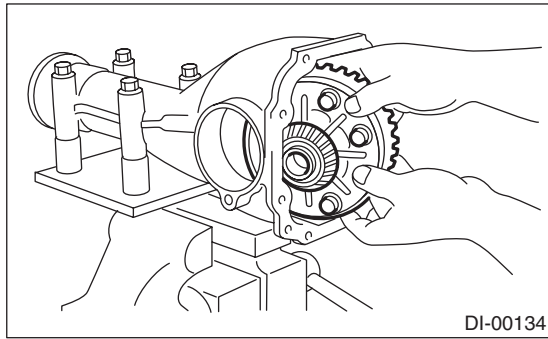
6) Remove the holder RH and LH with ST.  
ST 18630AA010 WRENCH COMPL RETAINER



7) Pull out the differential case assembly from differential carrier.

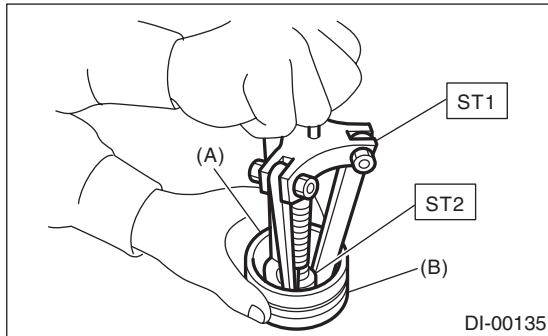
NOTE:

Be careful so that the teeth do not hit against the case.



8) Remove the bearing race from holder RH and LH with ST1 and ST2.

ST1 499705401 PULLER ASSY  
ST2 499705404 SEAT

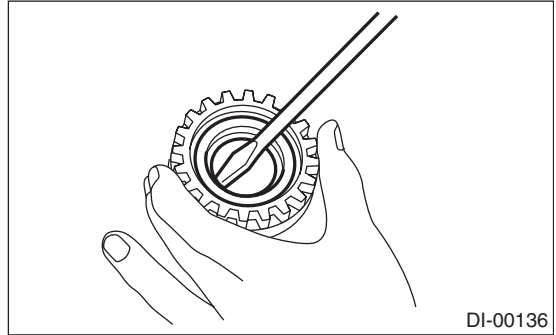


- (A) Bearing race
- (B) Holder

9) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:

Perform this operation only when changing oil seal.

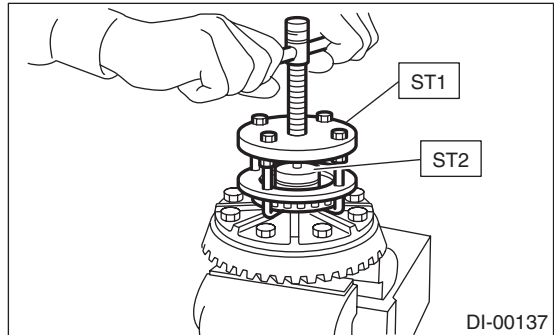


10) Extract the bearing cone with ST1 and ST2.

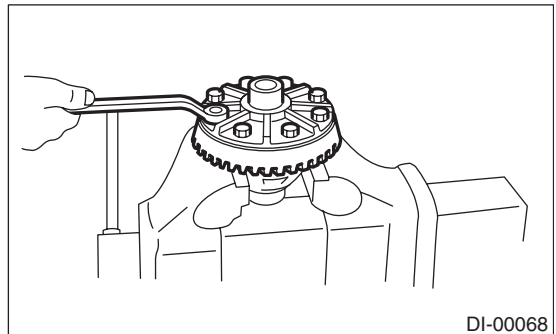
NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Set the puller so that its claws catch the edge of the bearing cone.
- Store so that the right and left side bearing races and cones are not mixed together.

ST1 899524100 PULLER SET  
ST2 399520105 SEAT



11) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

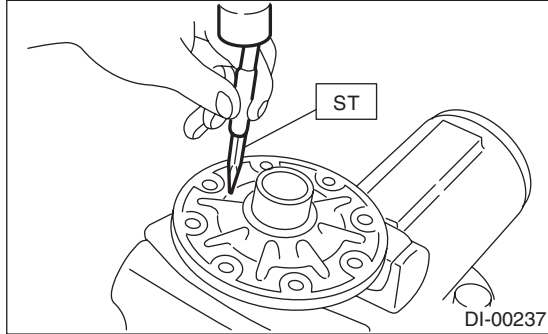


12) Drive out the pinion shaft lock pin from the hypoid driven gear side.

**NOTE:**

The lock pin is staked at the pin hole end on the differential case. Do not drive it out forcibly before removing the stake.

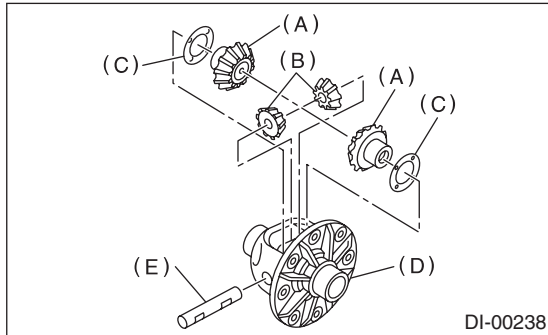
ST 899904100 STRAIGHT PIN REMOVER



13) Draw out the pinion mate shaft and remove pinion mate gears, side gears and thrust washers.

**NOTE:**

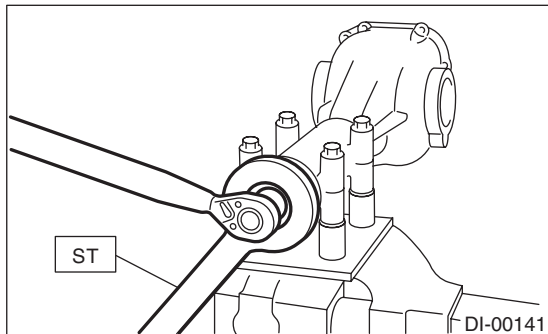
The gears should be marked or kept separated right and left, and front and rear as well as thrust washers.



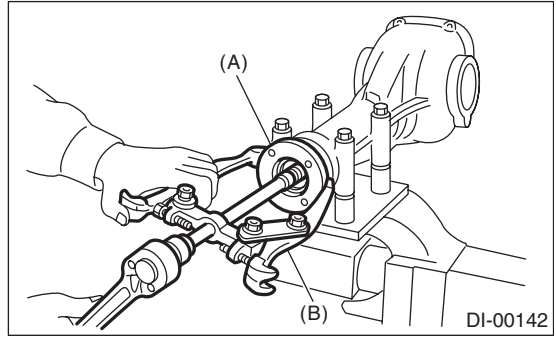
- (A) Side gear
- (B) Pinion mate gear
- (C) Thrust washer
- (D) Differential case
- (E) Pinion mate shaft

14) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



15) Extract the companion flange with a puller.



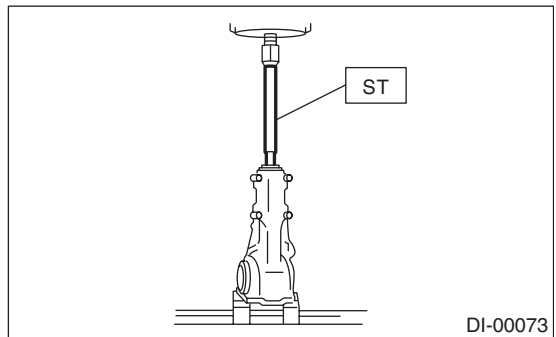
- (A) Companion flange
- (B) Puller

16) Press the end of drive pinion shaft and extract it together with rear bearing cone, pinion height adjusting washer and washer.

**NOTE:**

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

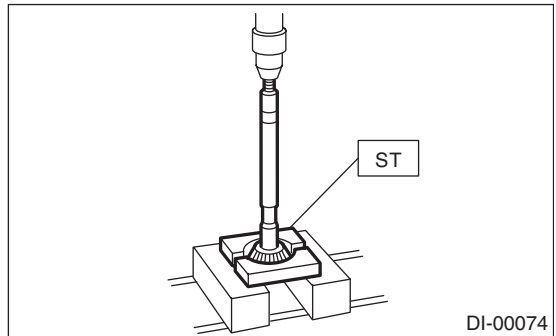


17) Remove the rear bearing cone from drive pinion by supporting the cone with ST.

**NOTE:**

Place the replacer so that its center-recessed side faces the pinion gear.

ST 498515500 REPLACER

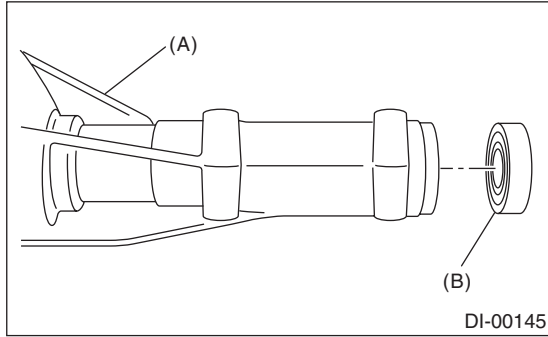


# Rear Differential (VA-type)

## DIFFERENTIALS

18) Remove the front oil seal from differential carrier using ST.

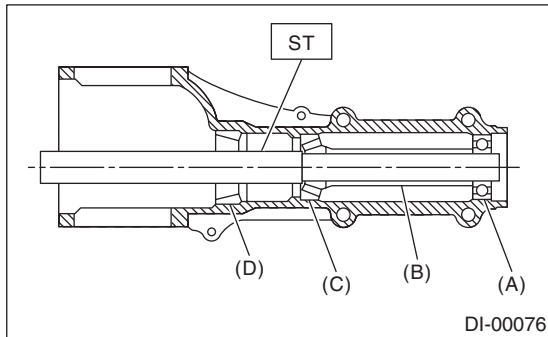
ST 398527700 PULLER ASSY



- (A) Differential carrier
- (B) Front oil seal

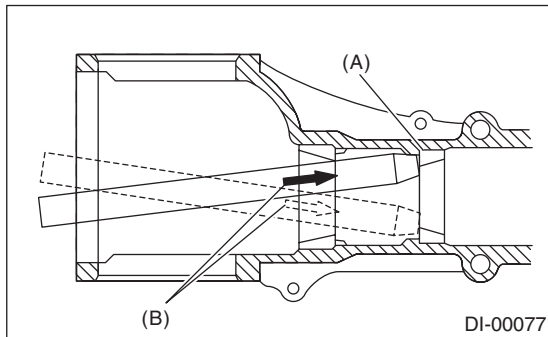
19) Remove the pilot bearing together with the front bearing cone and collar using the ST.

ST 398467700 DRIFT



- (A) Pilot bearing
- (B) Collar
- (C) Front bearing
- (D) Rear bearing cup

20) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order using a brass bar.



- (A) 2 cutout portions along diagonal lines
- (B) Tap alternately with brass bar.

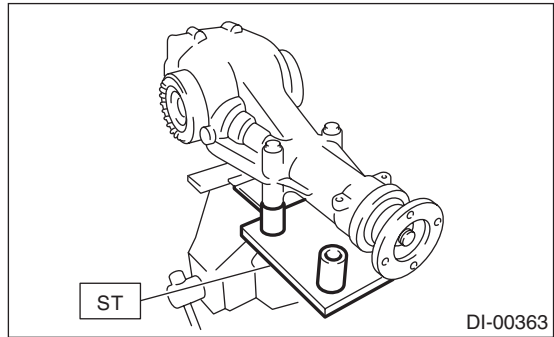
## 2. VA2-TYPE

To detect the real cause of trouble, inspect the following items before disassembling.

- Tooth contact and backlash between hypoid driven gear and drive pinion
- Hypoid driven gear runout on its back surface
- Total preload of drive pinion

1) Set the ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT

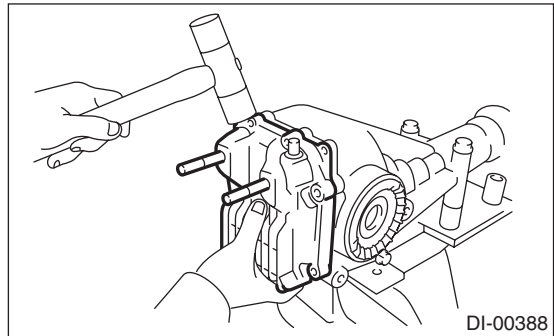


2) Remove the oil drain plug and filler plug, and drain the gear oil.

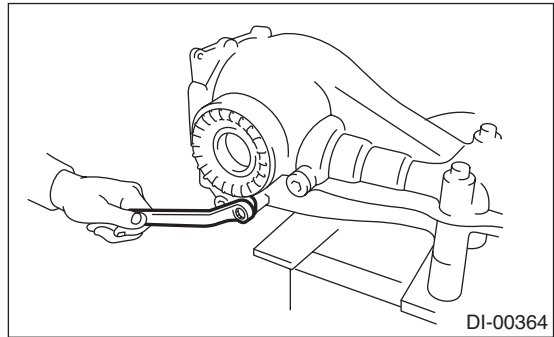
3) Remove the mounting bolts, and remove the rear cover.

### NOTE:

Remove it by tapping with a plastic hammer.

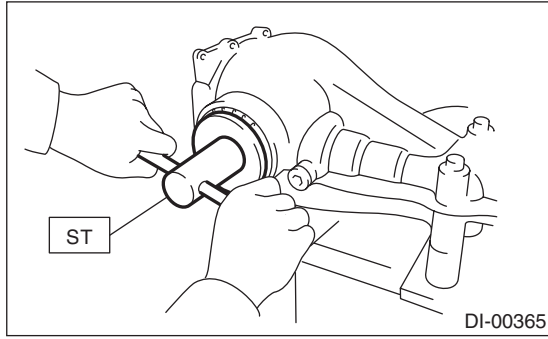


4) Remove the lock plate RH and LH.



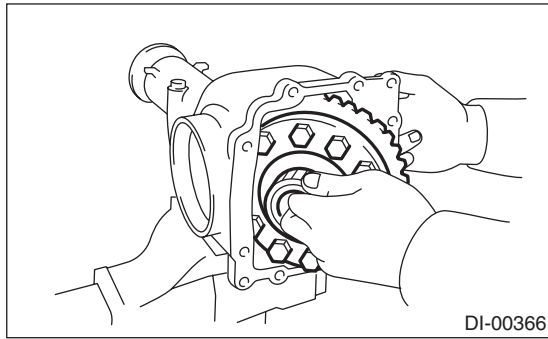
# Rear Differential (VA-type)

5) Remove the holder RH and LH with ST.  
ST 18630AA010 WRENCH COMPL RETAINER



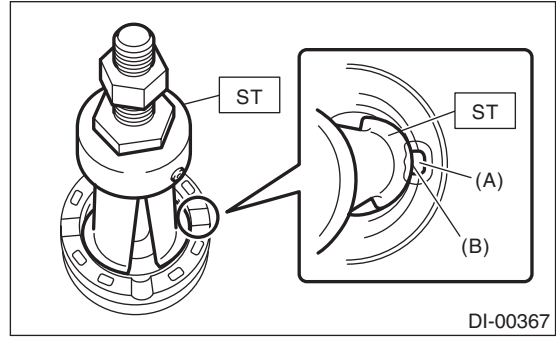
6) Pull out the differential case assembly from differential carrier.

NOTE:  
Be careful so that the teeth do not hit against the case.

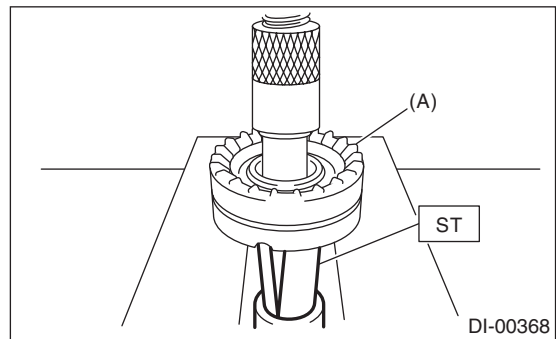


7) Remove the bearing race from holder RH and LH with ST and press.  
ST 18758AA000 PULLER

NOTE:  
• Make sure the bolt of puller turn manually.  
• Set the puller so that its claws catch the groove of holder.



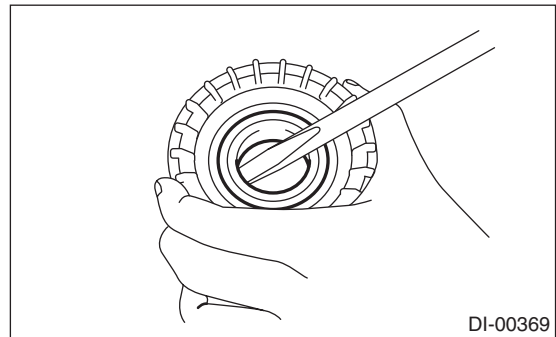
(A) Groove  
(B) Claw



(A) Holder

8) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:  
Perform this operation only when changing oil seal.



# Rear Differential (VA-type)

## DIFFERENTIALS

9) Extract the bearing cone with ST1, ST2 and ST3

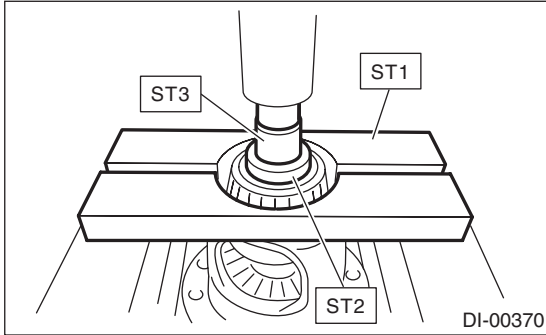
### NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Never mix up the RH and LH bearing races and cones.

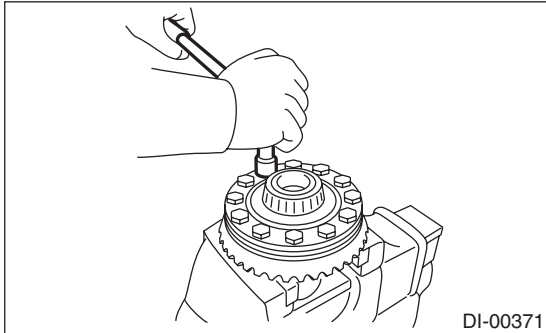
ST1 498077000 REMOVER

ST2 399520105 SEAT

ST3 899864100 REMOVER

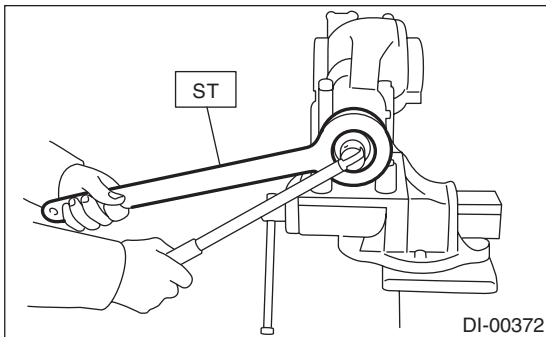


10) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

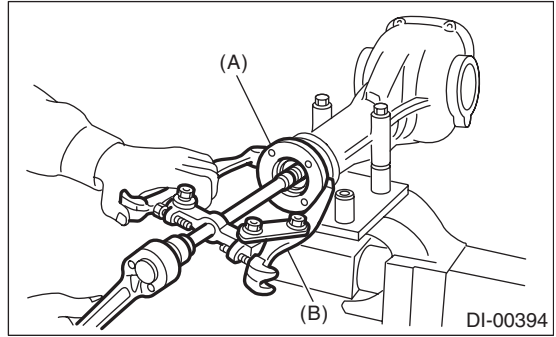


11) Remove the self-locking nut while holding the companion flange with ST.

ST 498427200 FLANGE WRENCH



12) Extract the companion flange with a puller.



(A) Companion flange

(B) Puller

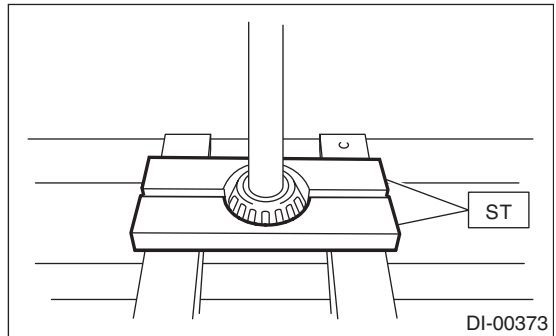
13) Removes the drive pinion shaft.

14) Remove the rear bearing cone from drive pinion by supporting the cone with ST.

### NOTE:

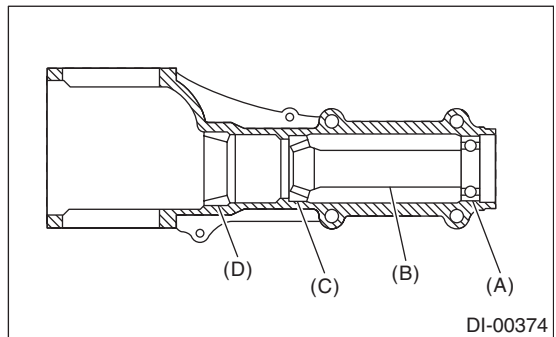
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



15) Remove the front oil seal from differential carrier using screwdriver.

16) Remove the pilot bearing, front bearing cone and collar.



(A) Pilot bearing

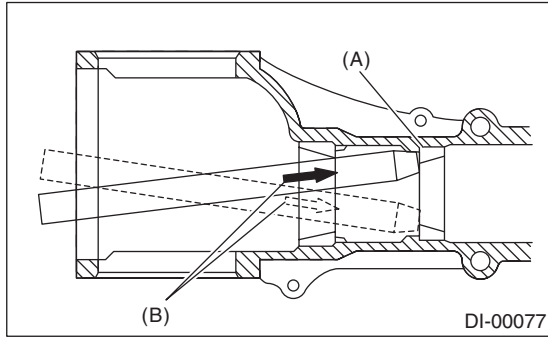
(B) Collar

(C) Front bearing

(D) Rear bearing cup



17) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order using a brass bar.



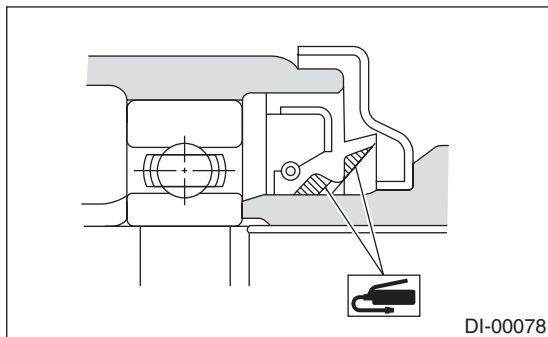
- (A) 2 cutout portions along diagonal lines
- (B) Tap alternately with brass bar.

## D: ASSEMBLY

### 1. VA1-TYPE

**NOTE:**

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the RH and LH bearing races.
- Replace the oil seal with a new part at every disassembly. Apply grease to the lips when installing the oil seal.
- Be careful not to mix up the differential oil seal RH and LH.



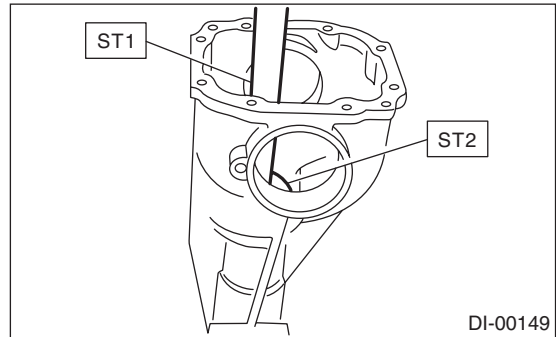
#### 1) Adjusting preload for front and rear bearings

**NOTE:**

Adjust the bearing preload between front and rear bearings with collar and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

(1) Install the rear bearing race into the differential carrier using ST1 and ST2.

- ST1 398477701 HANDLE
- ST2 398477702 DRIFT



(2) Install the front bearing race to the differential carrier using ST1 and ST2.

- ST1 398477701 HANDLE
- ST2 498447110 DRIFT

(3) Insert the front bearing cone.

**NOTE:**

Use new front bearing cone.

(4) Measure and record the thickness of the pinion height adjusting washer.

**NOTE:**

If tooth contact (drive pinion, hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

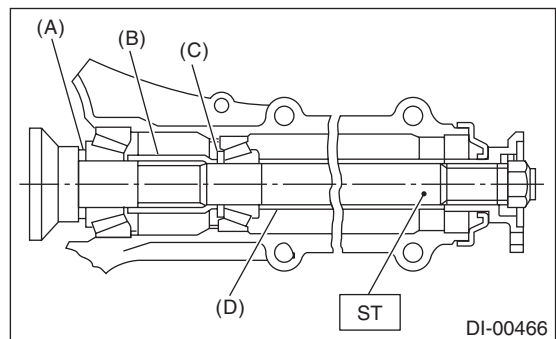
(5) Insert ST1 into the case with the pinion height adjusting washer and rear bearing cone fitted onto it.

**NOTE:**

Use new rear bearing cone.

(6) Install the preload adjusting collar & washer, front bearing cone, ST2, companion flange, and washer & self-locking nut.

- ST 498447150 DUMMY SHAFT
- Part No. 32285AA000Collar



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer
- (D) Collar (SUBARU genuine part)

## Rear Differential (VA-type)

### DIFFERENTIALS

(7) Turn the ST1 by hand to smooth the bearing, and tighten the self-locking nut while measuring the initial load or initial torque with a spring scale or torque wrench. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.

#### NOTE:

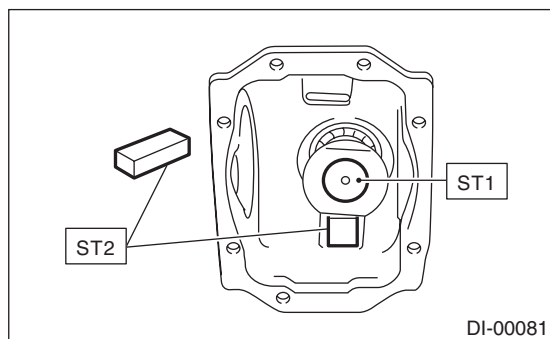
- Use a new self-locking nut.
- Measure the preload in direction of tangent to the flange.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock ST1 with ST2 as shown in the figure.

ST1 398507704 BLOCK

ST2 498447150 DUMMY SHAFT

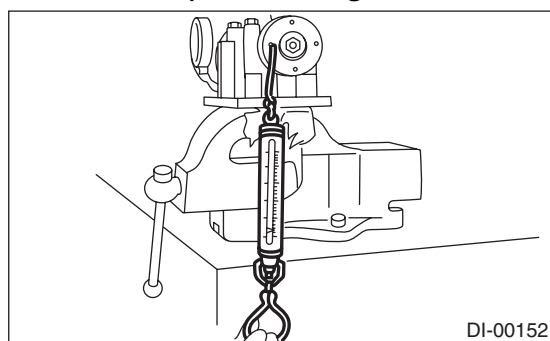
#### Tightening torque:

**191 N·m (19.5 kgf·m, 141.0 ft·lb)**



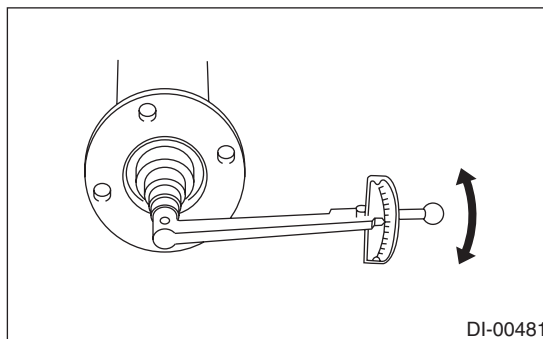
#### Initial load:

**12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lb)**



#### Initial torque:

**0.48 — 1.22 N·m (0.05 — 0.12 kgf·m,  
0.35 — 0.9 ft·lb)**



#### Preload adjusting washer

Part No.	Thickness mm (in)
38336AA000	1.500 (0.0591)
38336AA120	1.513 (0.0596)
38336AA010	1.525 (0.0600)
38336AA130	1.538 (0.0606)
38336AA020	1.550 (0.0610)
38336AA140	1.563 (0.0615)
38336AA030	1.575 (0.0620)
38336AA150	1.588 (0.0625)
38336AA040	1.600 (0.0630)
38336AA160	1.613 (0.0635)
38336AA050	1.625 (0.0640)
38336AA170	1.638 (0.0645)
38336AA060	1.650 (0.0650)
38336AA180	1.663 (0.0655)
38336AA070	1.675 (0.0659)
38336AA190	1.688 (0.0665)
38336AA080	1.700 (0.0669)
38336AA200	1.713 (0.0674)
38336AA090	1.725 (0.0679)
38336AA210	1.738 (0.0684)
38336AA100	1.750 (0.0689)
38336AA220	1.763 (0.0694)
38336AA110	1.775 (0.0699)

#### Preload adjusting collar

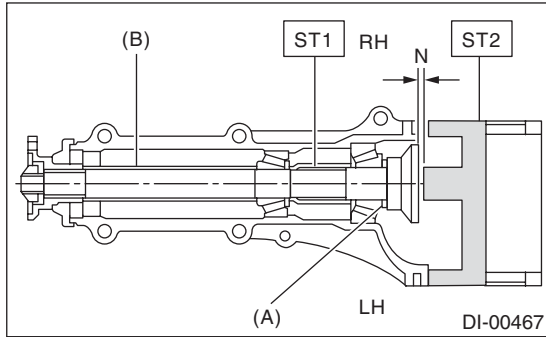
Part No.	Length mm (in)
32288AA040	52.3 (2.059)
32288AA050	52.5 (2.067)
31454AA100	52.6 (2.071)
32288AA060	52.7 (2.075)
31454AA110	52.8 (2.079)
32288AA070	52.9 (2.083)
31454AA120	53.0 (2.087)
32288AA080	53.1 (2.091)
32288AA090	53.3 (2.098)

2) Adjusting drive pinion height:  
Adjust the drive pinion height with washer installed between the rear bearing cone and the back of pinion gear.

(1) Attach the ST2.

ST1 498447150 DUMMY SHAFT  
ST2 498505501 DIFFERENTIAL CARRIER GAUGE

Part No. 32285AA000 Collar



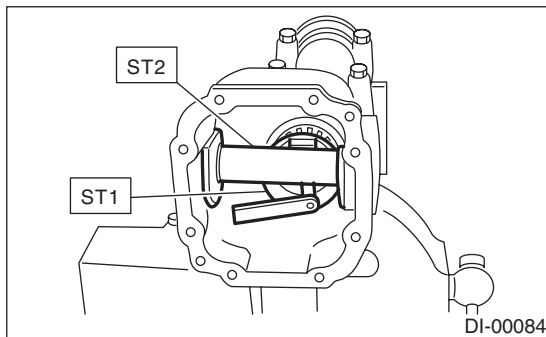
- (A) Pinion height adjusting washer
- (B) Collar (SUBARU genuine part)

(2) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

**NOTE:**

Make sure there is no clearance between the case and ST2.

ST1 498447150 DUMMY SHAFT  
ST2 498505501 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

**NOTE:**

Adjust it using 1 — 3 washers.

$$T = To + N - 0.05 \text{ (mm)}$$

T	Thickness of pinion height adjusting washer mm (in)	
To	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

$$To = 0.15 \text{ mm}$$

$$N = 0.1 \text{ mm}$$

$$T = 0.15 + 0.1 - 0.05 = 0.2 \text{ mm}$$

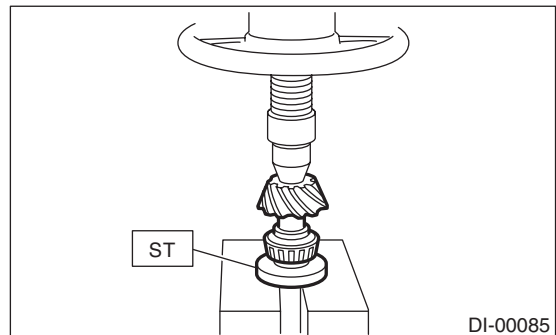
Result: Thickness = 0.2 mm

Therefore use part number 32295AA220.

Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA200	0.150 (0.0059)
32295AA210	0.175 (0.0069)
32295AA220	0.200 (0.0079)
32295AA230	0.225 (0.0089)
32295AA240	0.250 (0.0098)
32295AA250	0.275 (0.0108)

3) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

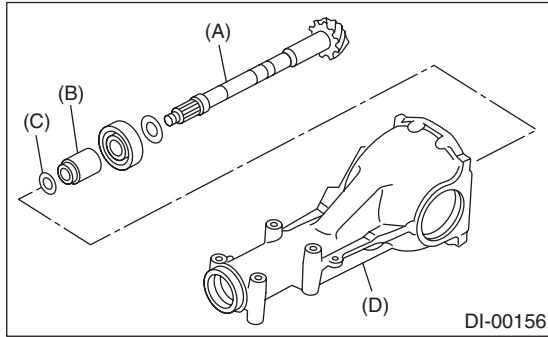
ST 498175500 INSTALLER



# Rear Differential (VA-type)

## DIFFERENTIALS

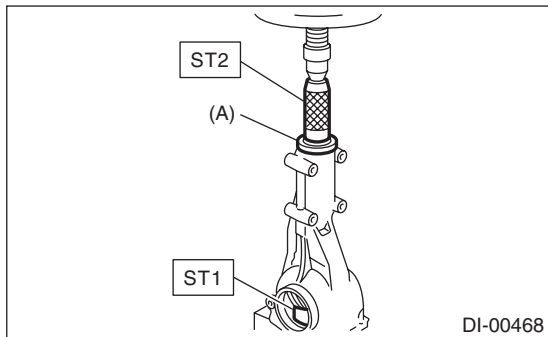
4) Insert the drive pinion into the differential carrier, and install the preselected bearing preload adjusting collar and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting collar
- (C) Bearing preload adjusting washer
- (D) Differential carrier

5) Press-fit the front bearing cone into the carrier with ST1, ST2 and collar.

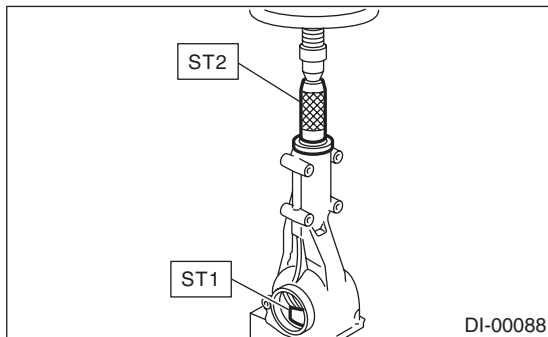
ST1 399780104 WEIGHT  
ST2 899580100 INSTALLER  
Part No. 32285AA000 Collar



- (A) Collar (SUBARU genuine part)

6) Insert the collar, then press-fit the pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT  
ST2 899580100 INSTALLER

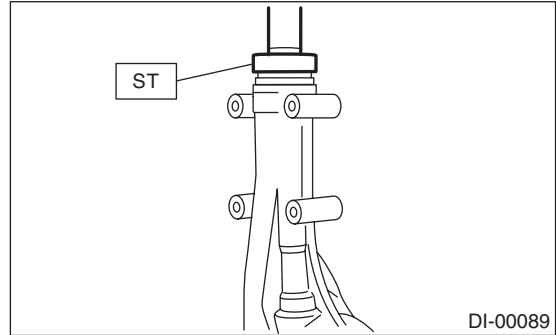


7) Fit a new oil seal with ST.

NOTE:

- Press-fit until the oil seal end comes 1 mm (0.04 in) inward from end of carrier.
- Apply grease to the oil seal lips.

ST 498447120 INSTALLER

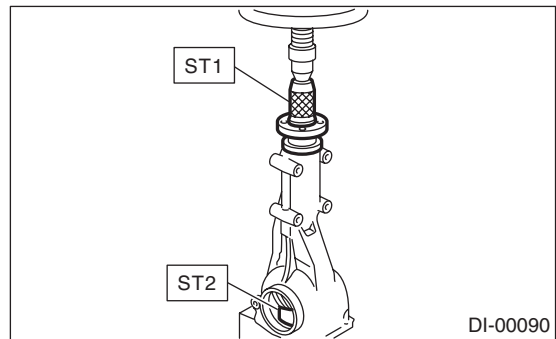


8) Press-fit the companion flange with ST1 and ST2.

NOTE:

Be careful not to damage the bearing.

ST1 899874100 INSTALLER  
ST2 399780104 WEIGHT



9) Attach a new self-locking nut and secure the companion flange using ST, then tighten the nut.

**NOTE:**

Before installing lock nuts, apply seal material to lock nut threads.

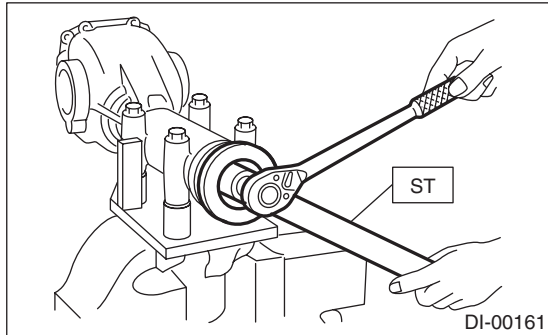
**SEAL MATERIAL**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

ST 498427200 FLANGE WRENCH

**Tightening torque:**

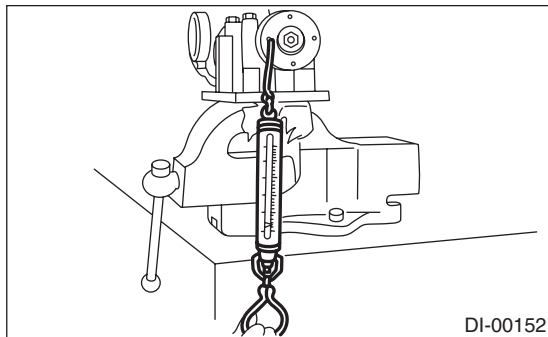
**191 N·m (19.5 kgf·m, 141.0 ft·lb)**



10) Check the initial torque and initial load.

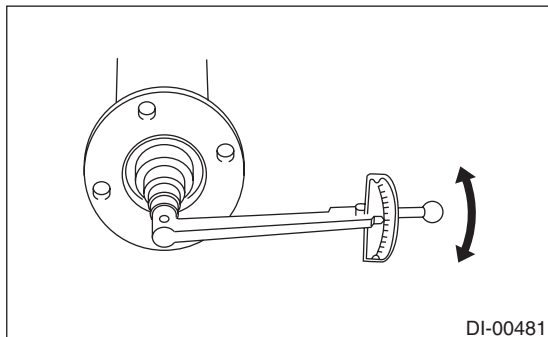
**Initial load:**

**12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lb)**



**Initial torque:**

**0.48 — 1.22 N·m (0.05 — 0.12 kgf·m, 0.35 — 0.90 ft·lb)**

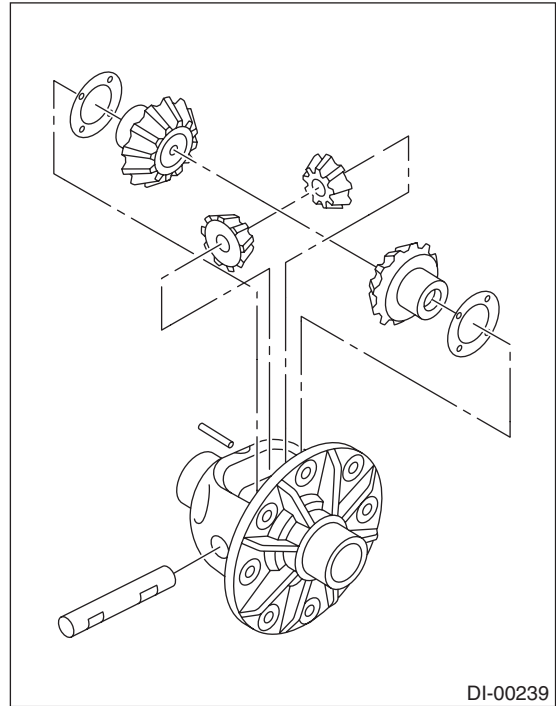


11) Assembling differential case

Install the side gears and pinion mate gears, with their thrust washers and pinion mate shaft, into the differential case.

**NOTE:**

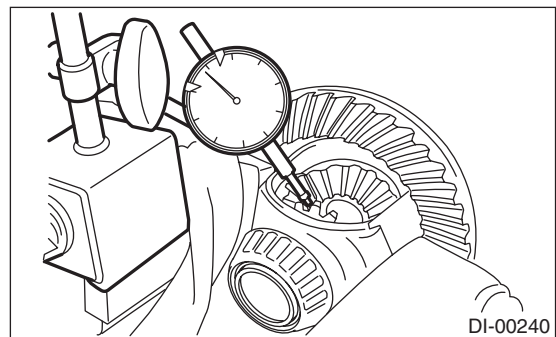
- Apply gear oil on both sides of the washer and on the side gear shaft before installing.
- Insert the pinion mate shaft into the differential case by aligning the lock pin holes.



(1) Measure the side gear backlash.

**Side gear backlash:**

**0.05 — 0.15 mm (0.002 — 0.006 in)**



(2) Adjust the side gear backlash as specified by selecting side gear thrust washer.

Side gear thrust washer	
Part No.	Thickness mm (in)
803135011	0.925 — 0.950 (0.0364 — 0.0374)
803135012	0.950 — 0.975 (0.0374 — 0.0384)
803135013	0.975 — 1.000 (0.0384 — 0.0394)
803135014	1.000 — 1.025 (0.0394 — 0.0404)
803135015	1.025 — 1.050 (0.0404 — 0.0413)

## Rear Differential (VA-type)

### DIFFERENTIALS

(3) Check the condition of rotation after applying oil to the gear tooth surfaces and thrust surfaces.

(4) After inserting the pinion shaft lock pin into differential case, stake the both sides of the hole to prevent pin from falling off.

12) Install the hypoid driven gear to differential case.

#### NOTE:

- Before installing bolts, apply seal material to bolt threads.

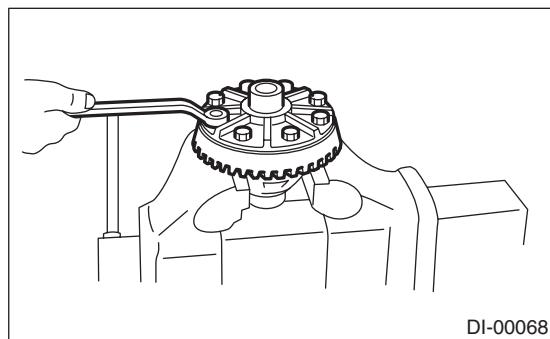
#### SEAL MATERIAL

**THREE BOND 1324 (Part No. 004403042) or equivalent**

- Tighten diagonally while tapping the bolt heads.

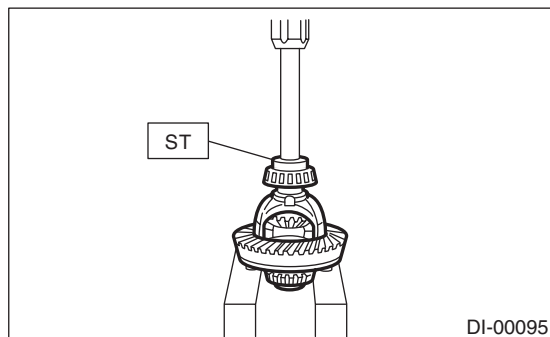
#### Tightening torque:

**62 N·m (6.3 kgf·m, 45.8 ft·lb)**



13) Press the side bearing into differential case using ST.

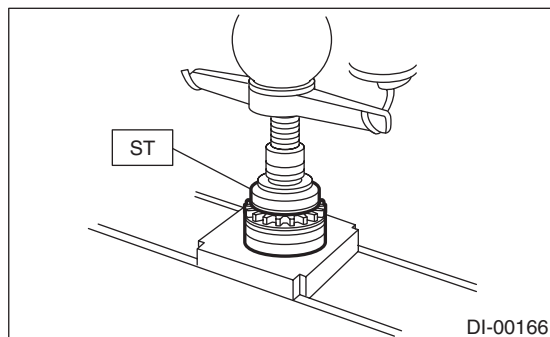
ST 498485400 DRIFT



14) Assemble holders.

(1) Install the oil seal into holder RH and LH.

ST 498447100 INSTALLER

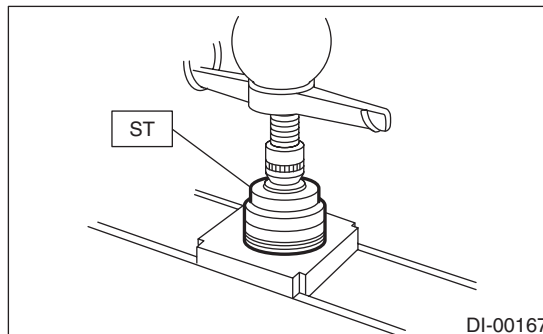


(2) Install the bearing race into holder RH and LH.

ST 398477702 DRIFT

#### CAUTION:

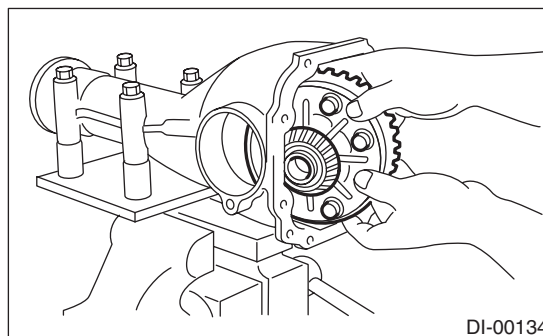
**Make sure that the RH and LH oil seals, bearing outer races and cones are properly assembled.**



(3) Install the differential assembly into differential carrier in the reverse order of disassembly.

#### NOTE:

Be careful so that the teeth do not hit against the case.

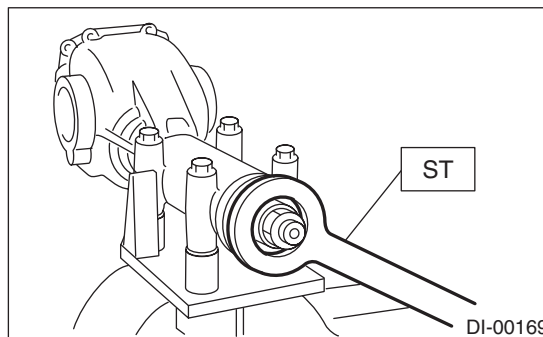


(4) Temporarily tighten the side holders RH and LH in differential carrier to install.

15) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and preload adjustment of differential side bearing.

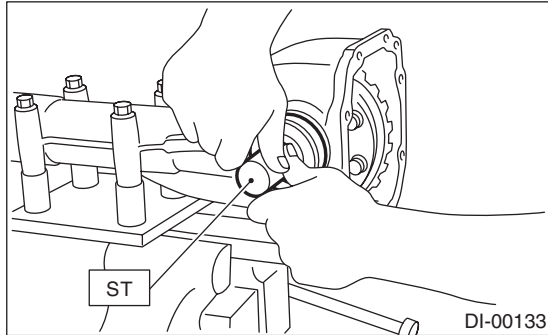
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in the side holder LH until light contact is made with ST.

ST 18630AA010 WRENCH COMPL RETAINER



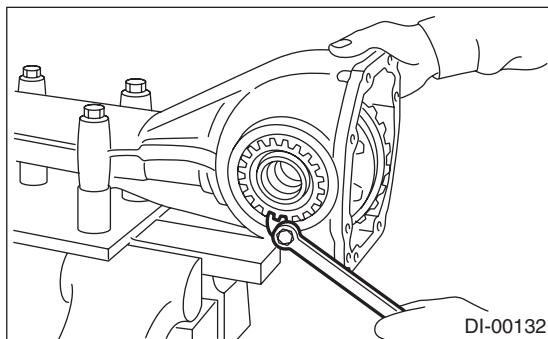
(3) Back off the holder on the hypoid driven gear side by approx. 1 and 1/2 teeth, and tighten the other side holder by approx. 2 teeth [amount that the holder on hypoid driven gear side is turned back (1 and 1/2) + 1/2 teeth].

[Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.] This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

**NOTE:**

Turn over the lock plate to shift the holder by 1/2 tooth.



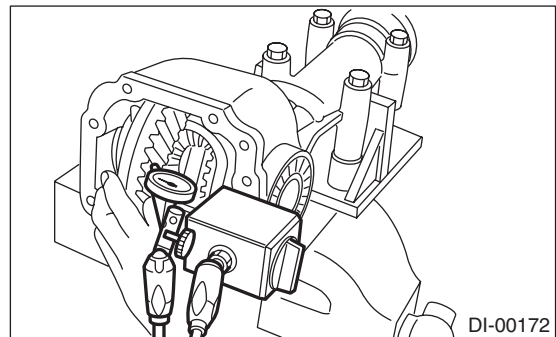
(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

**NOTE:**

If measured value of backlash is not within the specified range, repeat the procedures for pinion driven gear set backlash adjustment and the differential side bearing preload adjustment.

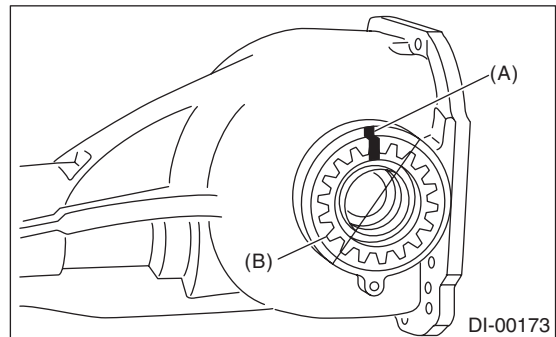
**Backlash:**

**0.10 — 0.15 mm (0.004 — 0.006 in)**



16) Put alignment marks on both the differential carrier and holder. Remove the holder side at a time.

Replace them in the original position after inserting an O-ring and applying grease to the threaded portion.



(A) Alignment mark

(B) Holder

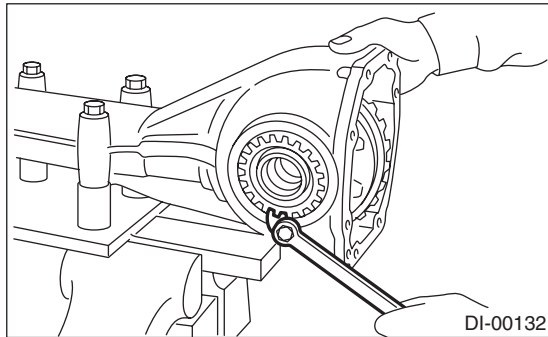
## Rear Differential (VA-type)

### DIFFERENTIALS

17) Tighten the bolt of lock plate to specified torque.

**Tightening torque:**

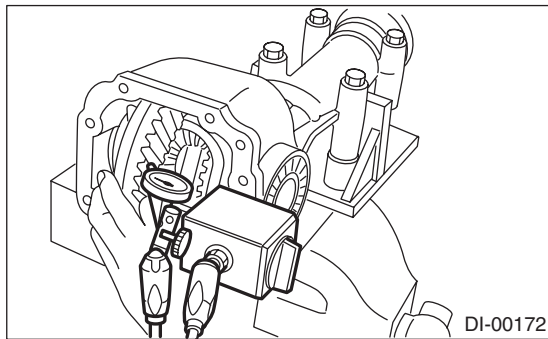
**25 N·m (2.5 kgf·m, 18.5 ft·lb)**



18) Recheck the hypoid driven gear to pinion backlash.

**Backlash:**

**0.10 — 0.15 mm (0.004 — 0.006 in)**



19) Checking and adjusting the tooth contact of hypoid driven gear

(1) Apply lead-free red dye evenly to the both side of three or four teeth on hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.

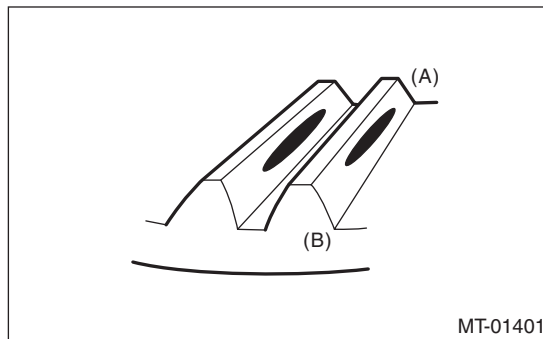
(2) When the contact pattern is not correct, readjust.

**NOTE:**

Be sure to wipe off the lead-free red dye after the adjustment is completed.

- Correct tooth contact

**Check item: Tooth contact pattern is slightly shifted towards the toe side under no-load rotation. (When driving, it moves towards the heel side.)**



(A) Toe side

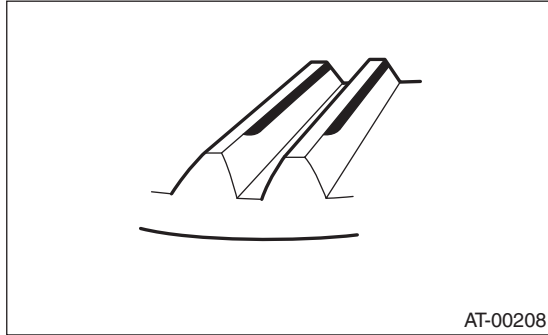
(B) Heel side



- Face contact

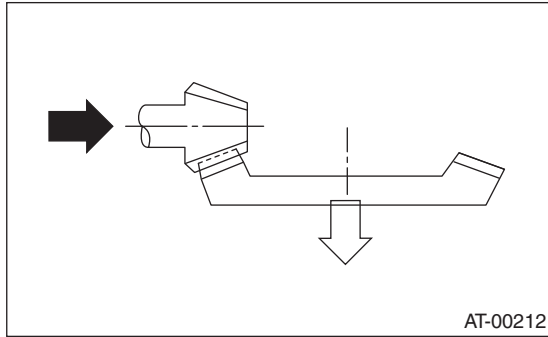
**Check item: Backlash is too large.**

Contact pattern



AT-00208

Corrective action: Increase thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion closer to the hypoid driven gear.

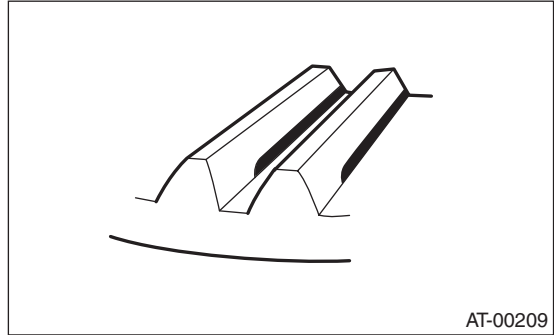


AT-00212

- Flank contact

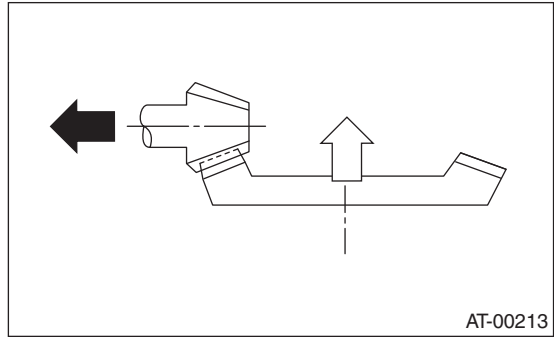
**Check item: Backlash is too small.**

Contact pattern



AT-00209

Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the hypoid driven gear.



AT-00213

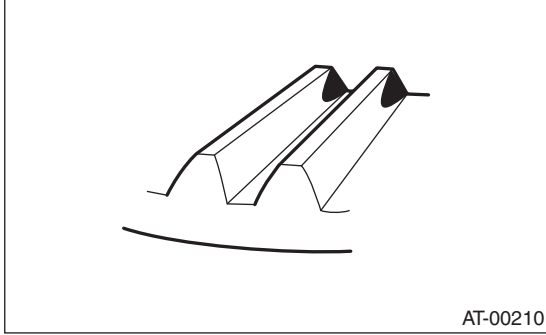
# Rear Differential (VA-type)

## DIFFERENTIALS

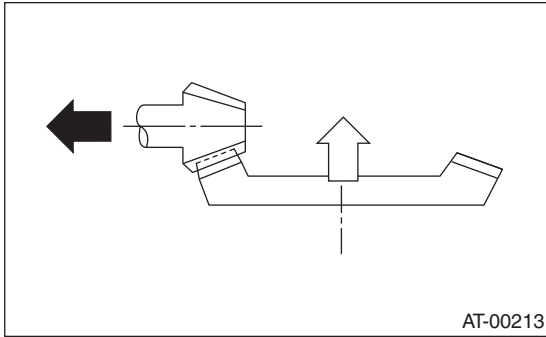
- Toe contact (inner side contact)

**Check item: Contact area is too small.**

Contact pattern



Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the hypoid driven gear.



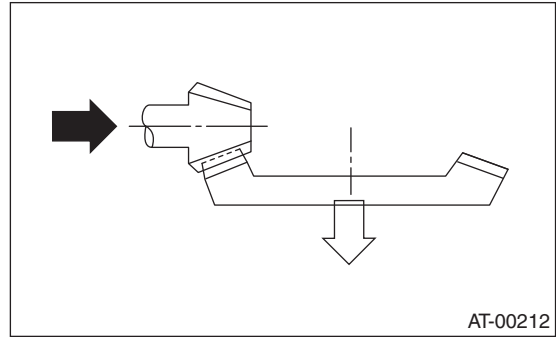
- Heel contact (outside end contact)

**Check item: Contact area is too small.**

Contact pattern



Corrective action: Increase thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion closer to the hypoid driven gear.

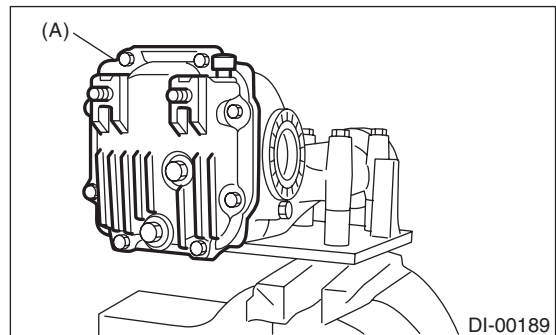


20) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

21) Install the new gasket and rear cover to the differential carrier, and tighten the bolts to specified torque.

**Tightening torque:**

**25 N·m (2.5 kgf-m, 18.5 ft-lb)**

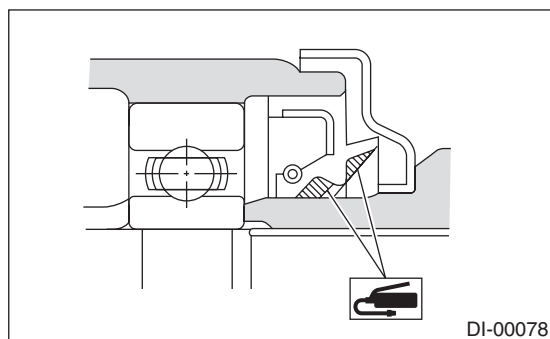


(A) Rear cover

## 2. VA2-TYPE

### NOTE:

- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the RH and LH bearing races.
- Replace the oil seal with a new part at every disassembly. Apply grease to the lips when installing the oil seal.
- Be careful not to mix up the differential oil seal RH and LH.



### 1) Adjusting preload for front and rear bearings

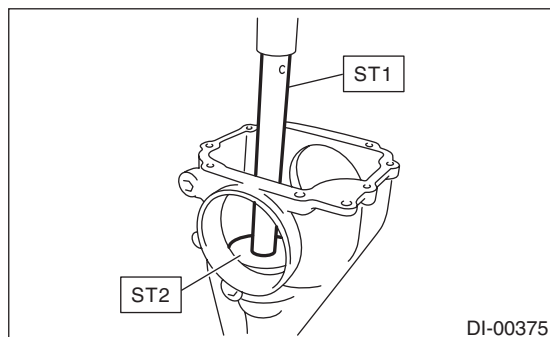
### NOTE:

Adjust the bearing preload between front and rear bearings with collar and washer. Pinion height adjusting washer is not affected by this adjustment. The adjustment must not be carried out with oil seal inserted.

(1) Install the rear bearing race into the differential carrier using ST1 and ST2.

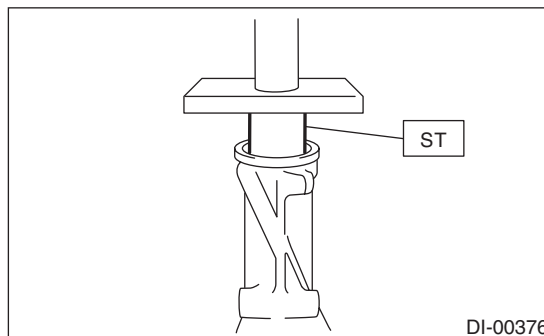
ST1 398477701 HANDLE

ST2 398477703 DRIFT 2



(2) Using the ST, install the front bearing race to the differential carrier.

ST 499277200 INSTALLER



(3) Insert the front bearing cone.

### NOTE:

Use new front bearing cone.

(4) Measure and record the thickness of the pinion height adjusting washer.

### NOTE:

If tooth contact (drive pinion, hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

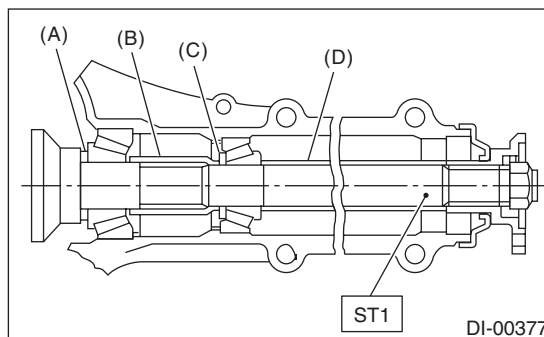
(5) Insert the ST1 into carrier with the pinion height adjusting washer and rear bearing cone fitted onto it.

### NOTE:

Use new rear bearing cone.

(6) Install the preload adjusting collar & washer, front bearing cone, collar, companion flange, and washer & self-locking nut.

ST1 18678AA000 DUMMY SHAFT



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer
- (D) Collar

## Rear Differential (VA-type)

### DIFFERENTIALS

(7) Turn ST1 by hand to seat the bearing, and measure the initial load and initial torque with a spring scale or a torque wrench while tightening the selflocking nut. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.

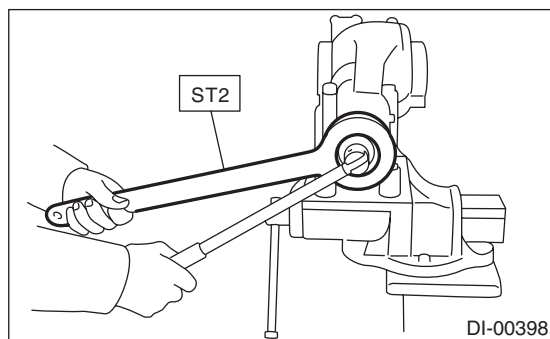
#### NOTE:

- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock companion flange with ST2 as shown in the figure.
- Measure the preload in direction of tangent to the flange.

ST1 18678AA000 DUMMY SHAFT  
ST2 498427200 FLANGE WRENCH

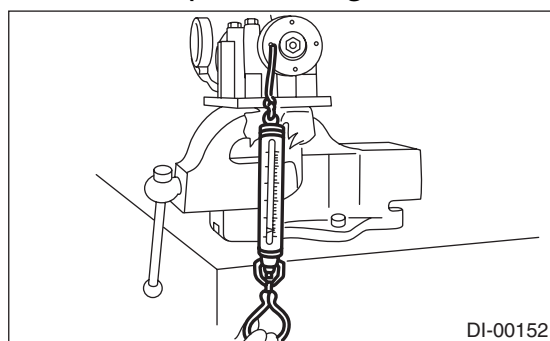
#### Tightening torque:

**191 N·m (19.5 kgf·m, 141.0 ft·lb)**



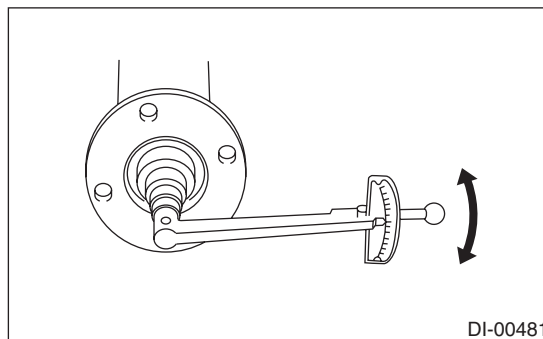
#### Initial load:

**12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lb)**



#### Initial torque:

**0.48 — 1.22 N·m (0.05 — 0.12 kgf·m,  
0.35 — 0.90 ft·lb)**



#### Preload adjusting washer

Part No.	Thickness mm (in)
38336AA430	1.500 (0.0591)
38336AA440	1.513 (0.0596)
38336AA450	1.525 (0.0600)
38336AA460	1.538 (0.0606)
38336AA470	1.550 (0.0610)
38336AA480	1.563 (0.0615)
38336AA490	1.575 (0.0620)
38336AA500	1.588 (0.0625)
38336AA510	1.600 (0.0630)
38336AA520	1.613 (0.0635)
38336AA530	1.625 (0.0640)
38336AA540	1.638 (0.0645)
38336AA550	1.650 (0.0650)
38336AA560	1.663 (0.0655)
38336AA570	1.675 (0.0659)
38336AA580	1.688 (0.0665)
38336AA590	1.700 (0.0669)
38336AA600	1.713 (0.0674)
38336AA610	1.725 (0.0679)
38336AA620	1.738 (0.0684)
38336AA630	1.750 (0.0689)
38336AA640	1.763 (0.0694)
38336AA650	1.775 (0.0699)

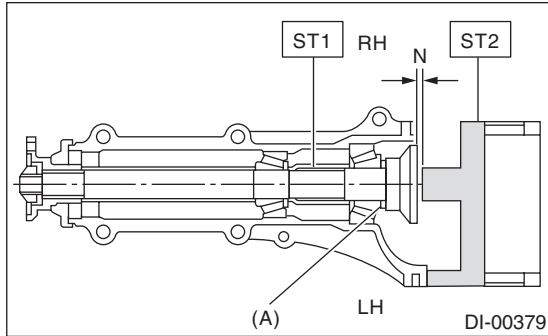
#### Preload adjusting collar

Part No.	Length mm (in)
31454AA250	51.05 (2.010)
31454AA260	51.25 (2.018)
31454AA270	51.35 (2.022)
31454AA280	51.45 (2.026)
31454AA290	51.55 (2.030)
31454AA300	51.65 (2.033)
31454AA310	51.75 (2.037)
31454AA320	51.85 (2.041)
31454AA330	52.05 (2.049)

2) Adjusting drive pinion height:  
Adjust the drive pinion height with washer installed between the rear bearing cone and the back of pinion gear.

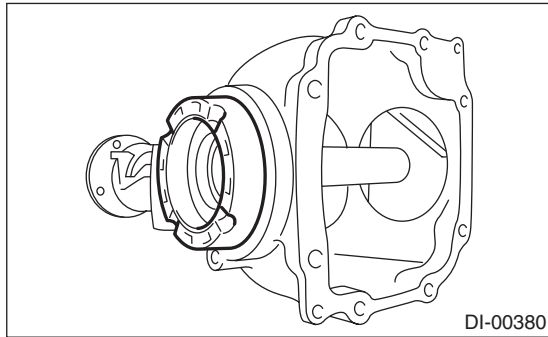
(1) Attach the ST2.

ST1 18678AA000 DUMMY SHAFT  
ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(A) Pinion height adjusting washer

(2) Install the side holder LH to the left side of the differential carrier in reverse direction.

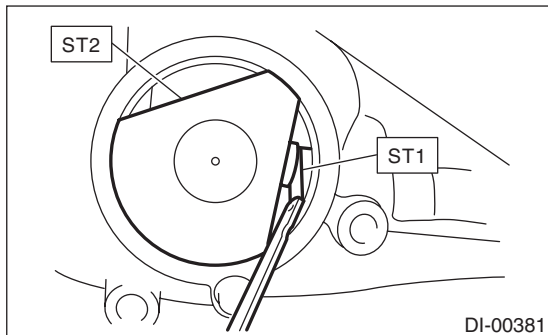


(3) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

**NOTE:**

Make sure there is no clearance between the case and ST2.

ST1 18678AA000 DUMMY SHAFT  
ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(4) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

**NOTE:**

Adjust it using 1 — 3 washers.

$$T = To + N - 0.05 \text{ (mm)}$$

T	Thickness of pinion height adjusting washer mm (in)	
To	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

$$To = 0.15 \text{ mm}$$

$$N = 0.1 \text{ mm}$$

$$T = 0.15 + 0.1 - 0.05 = 0.2 \text{ mm}$$

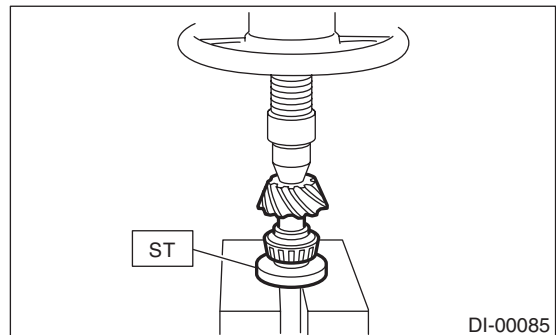
Result: Thickness = 0.2 mm

Therefore use part number 32295AA370.

Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA350	0.150 (0.0059)
32295AA360	0.175 (0.0069)
32295AA370	0.200 (0.0079)
32295AA380	0.225 (0.0089)
32295AA390	0.250 (0.0098)
32295AA400	0.275 (0.0108)

3) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

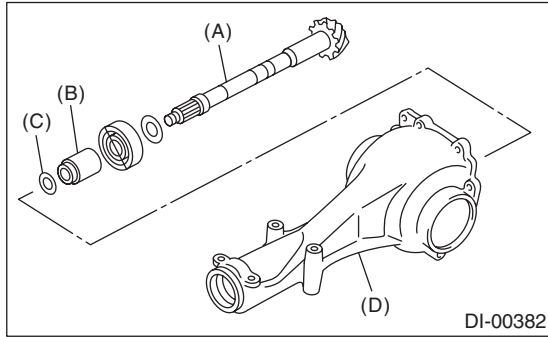
ST 398177700 INSTALLER



# Rear Differential (VA-type)

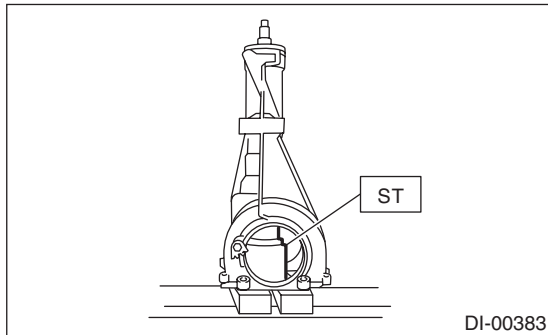
## DIFFERENTIALS

4) Insert the drive pinion into the differential carrier, and install the preselected bearing preload adjusting collar and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting collar
- (C) Bearing preload adjusting washer
- (D) Differential carrier

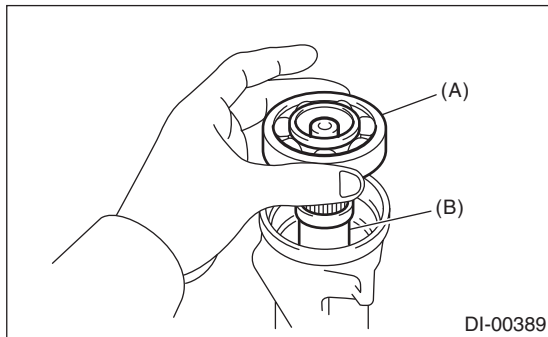
5) Set ST and differential carrier to the press and install the front bearing cone.  
ST 399780104 WEIGHT



### NOTE:

Set the carrier to the press until the companion flange is installed.

6) Insert the collar, then install the pilot bearing.



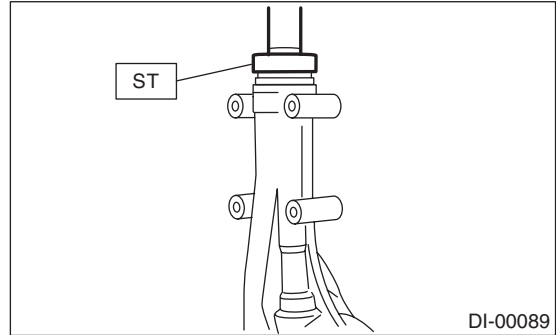
- (A) Pilot bearing
- (B) Collar

7) Fit a new oil seal with ST.

### NOTE:

- Press-fit until the oil seal end comes 1 mm (0.04 in) inward from end of carrier.
- Apply grease to the oil seal lips.

ST 499277200 INSTALLER

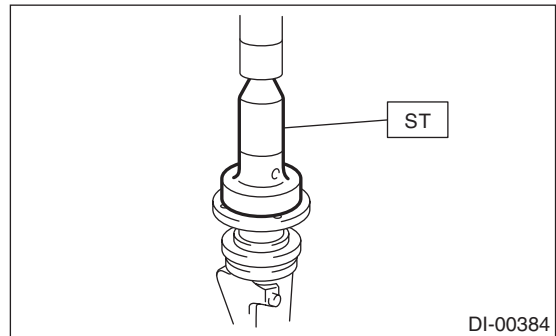


8) Press-fit the companion flange with ST.

### NOTE:

Be careful not to damage the bearing.

ST 899874100 INSTALLER



9) Attach a new self-locking nut and secure the companion flange using ST, then tighten the nut.

### NOTE:

Before installing lock nuts, apply seal material to lock nut threads.

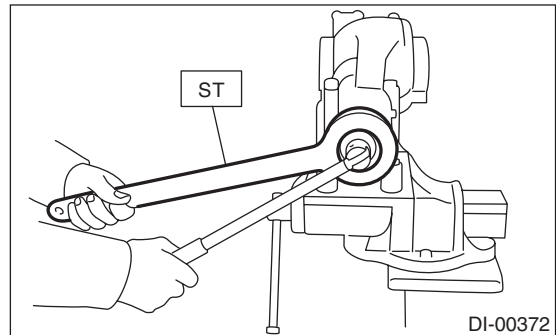
### SEAL MATERIAL

**THREE BOND 1324 (Part No. 004403042) or equivalent**

ST 498427200 FLANGE WRENCH

### Tightening torque:

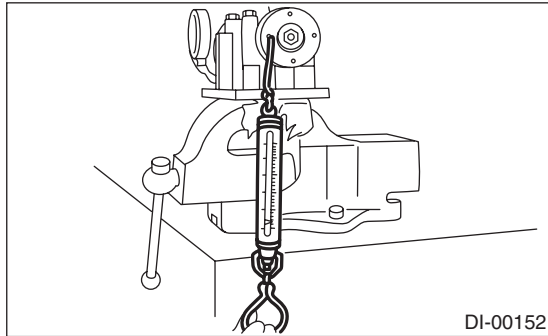
**191 N·m (19.5 kgf·m, 141.0 ft·lb)**



10) Measure the initial torque and initial load.

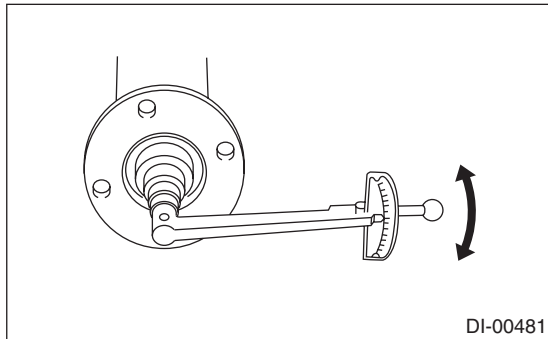
**Initial load:**

**12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.2 lb)**



**Initial torque:**

**0.48 — 1.22 N·m (0.05 — 0.12 kgf·m,  
0.35 — 0.90 ft·lb)**



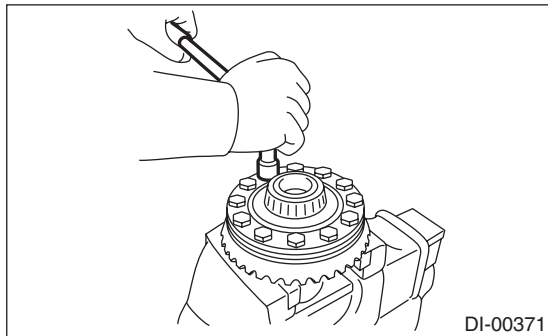
11) Install the hypoid driven gear to differential case.

**NOTE:**

- Tighten diagonally while tapping the bolt heads.
- Set a cushioning such as wooden block, aluminum plate or shop cloth between vise and differential case if the side gear comes into contact with vise.

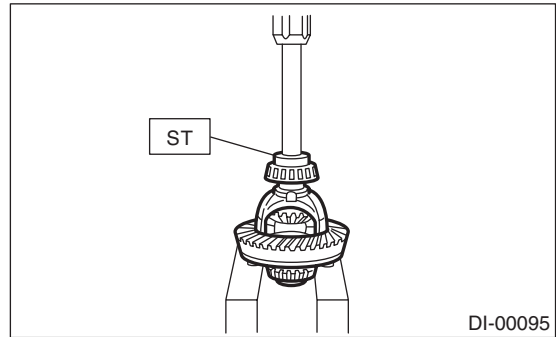
**Tightening torque:**

**62 N·m (6.3 kgf·m, 45.8 ft·lb)**



12) Press the side bearing into differential case using ST.

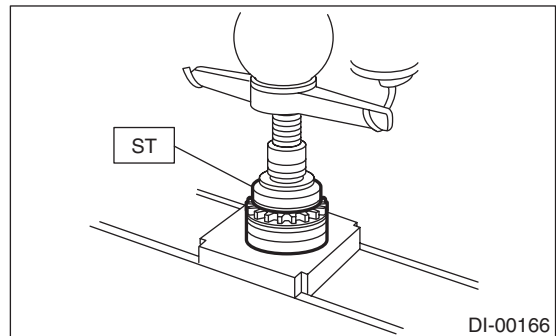
ST 398487700 DRIFT



13) Assemble holders.

(1) Install the new oil seal into holder RH and LH.

ST 498447100 INSTALLER



(2) Install the bearing race into holder RH and LH.

ST 398417700 DRIFT PUNCH

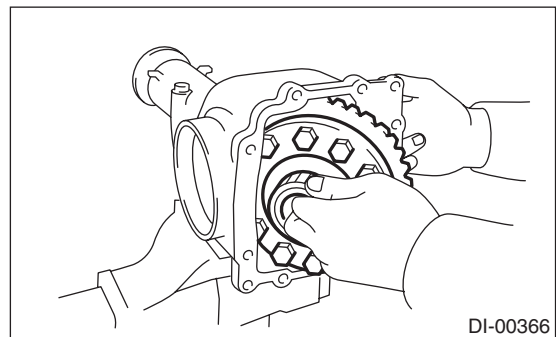
**CAUTION:**

**Make sure that the RH and LH oil seals, bearing outer races and cones are properly assembled.**

(3) Install the differential assembly into differential carrier in the reverse order of disassembly.

**NOTE:**

Be careful so that the teeth do not hit against the case.



(4) Temporarily tighten the side holders RH and LH in differential carrier to install.

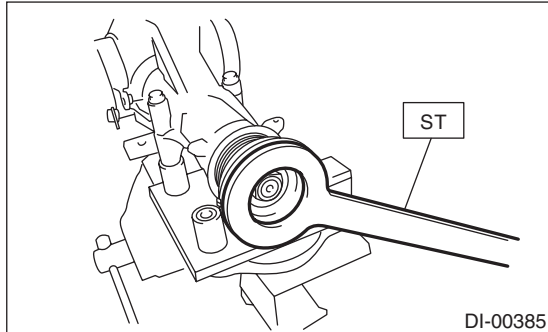
# Rear Differential (VA-type)

## DIFFERENTIALS

14) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and preload adjustment of differential side bearing.

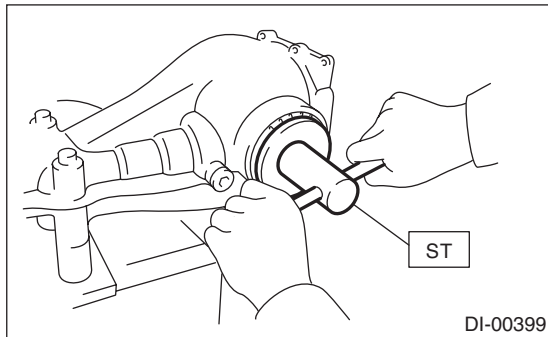
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in the side holder LH until light contact is made with ST.

ST 18630AA010 WRENCH COMPL RETAINER



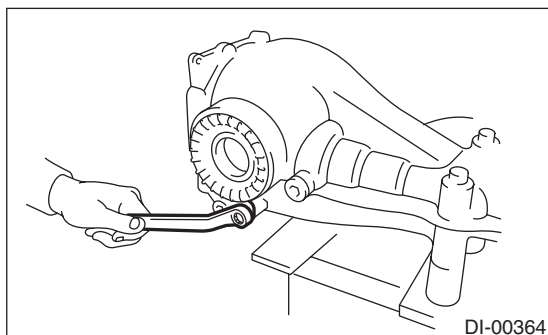
(3) Back off the holder on the hypoid driven gear side by approx. 1 and 1/2 teeth, and tighten the other side holder by approx. 2 teeth [amount that the holder on hypoid driven gear side is turned back (1 and 1/2) + 1/2 teeth].

[Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.] This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

### NOTE:

Turn over the lock plate to shift the holder by 1/2 tooth.



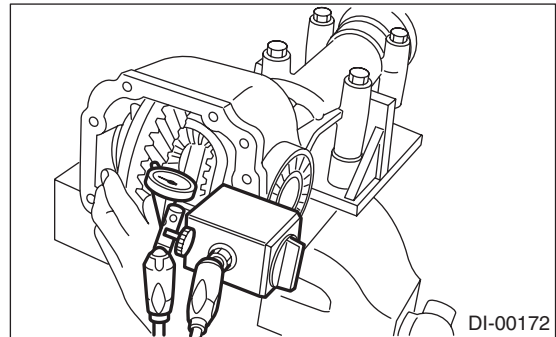
(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

### NOTE:

If measured value of backlash is not within the specified range, repeat the procedures for pinion driven gear set backlash adjustment and the differential side bearing preload adjustment.

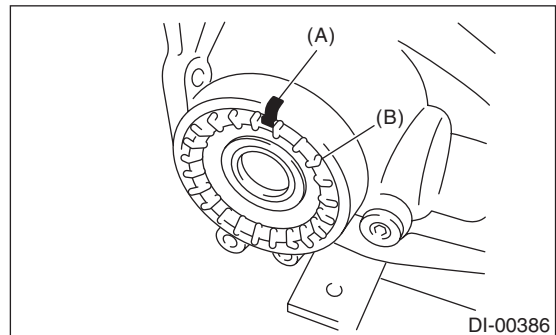
### Backlash:

**0.10 — 0.15 mm (0.004 — 0.006 in)**



15) Put alignment marks on both the differential carrier and holder. Remove the holder side at a time.

Replace them in the original position after inserting an O-ring and applying grease to the threaded portion.



(A) Alignment mark

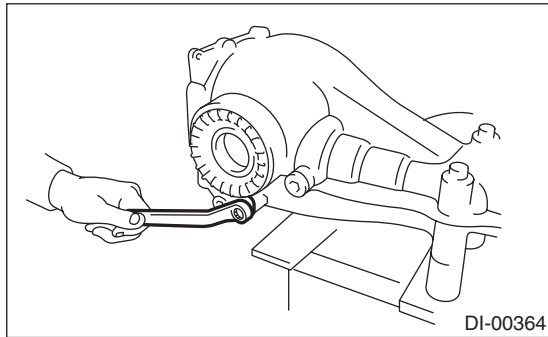
(B) Holder



16) Tighten the bolt of lock plate to specified torque.

**Tightening torque:**

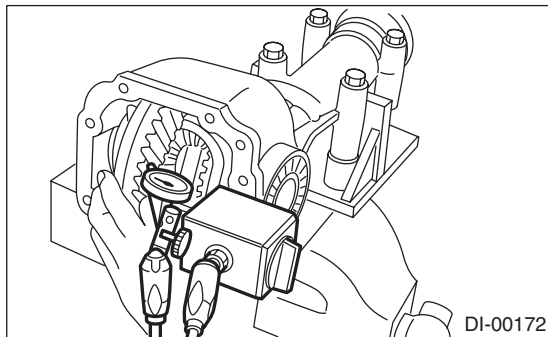
**25 N·m (2.5 kgf·m, 18.5 ft·lb)**



17) Recheck the hypoid driven gear to pinion backlash.

**Backlash:**

**0.10 — 0.15 mm (0.004 — 0.006 in)**



18) Checking and adjusting the tooth contact of hypoid driven gear

(1) Apply lead-free red dye evenly to the both side of three or four teeth on hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.

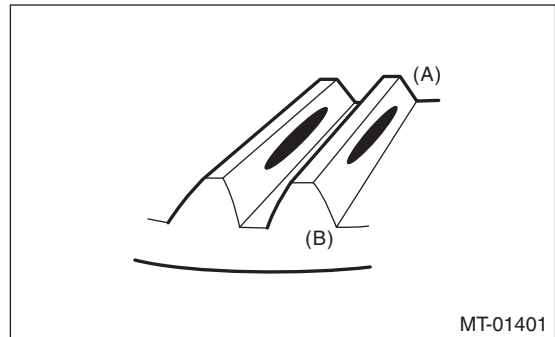
(2) When the contact pattern is not correct, readjust.

**NOTE:**

Be sure to wipe off the lead-free red dye after the adjustment is completed.

- Correct tooth contact

**Check item: Tooth contact pattern is slightly shifted towards the toe side under no-load rotation. (When driving, it moves towards the heel side.)**



(A) Toe side

(B) Heel side

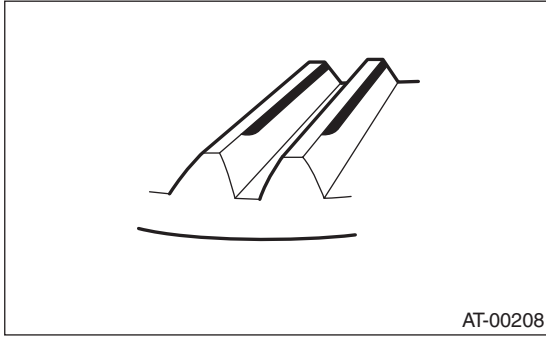
# Rear Differential (VA-type)

## DIFFERENTIALS

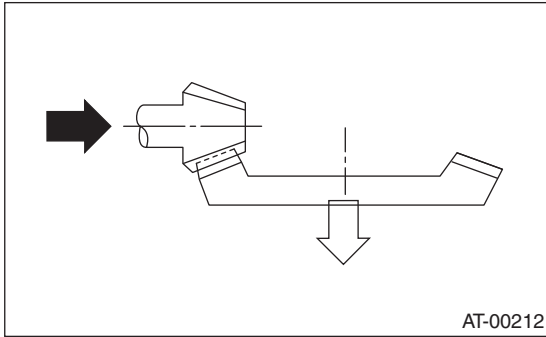
- Face contact

**Check item: Backlash is too large.**

Contact pattern



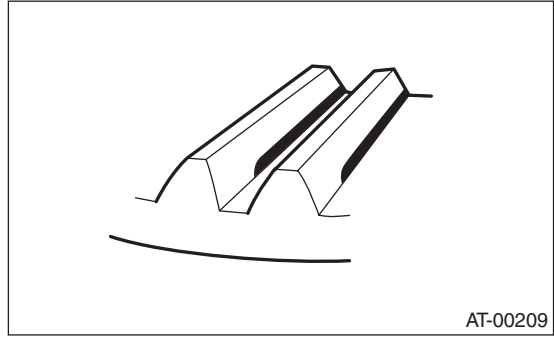
Corrective action: Increase thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion closer to the hypoid driven gear.



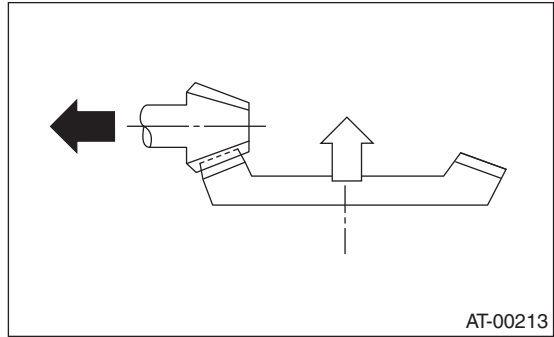
- Flank contact

**Check item: Backlash is too small.**

Contact pattern



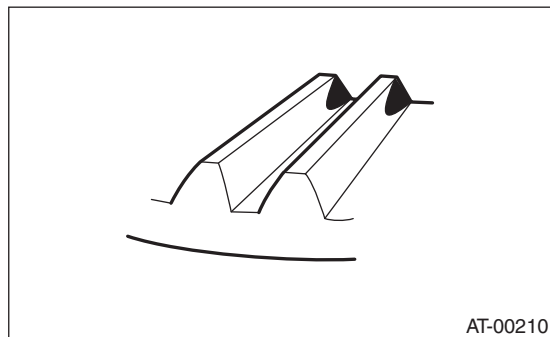
Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the hypoid driven gear.



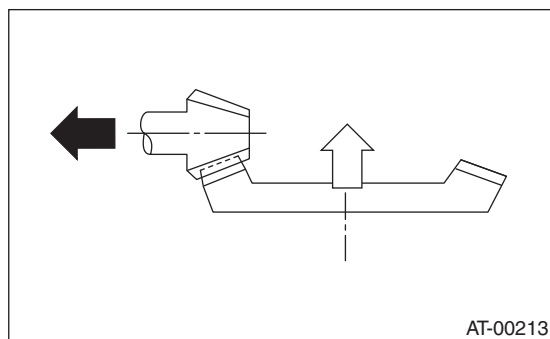
- Toe contact (inner side contact)

**Check item: Contact area is too small.**

Contact pattern



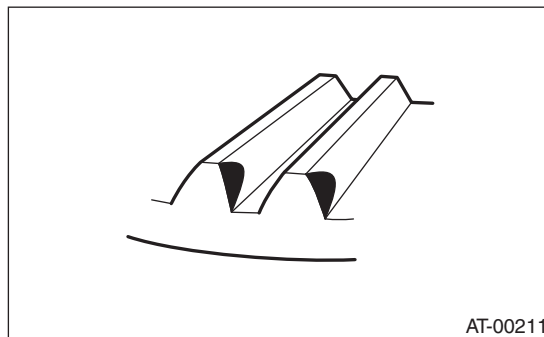
Corrective action: Reduce thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion away from the hypoid driven gear.



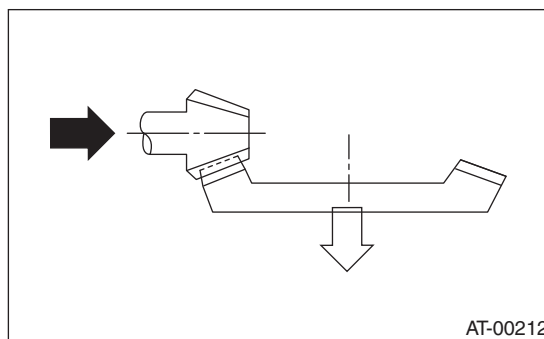
- Heel contact (outside end contact)

**Check item: Contact area is too small.**

Contact pattern



Corrective action: Increase thickness of the pinion height adjusting washer according to the procedures for moving the drive pinion closer to the hypoid driven gear.

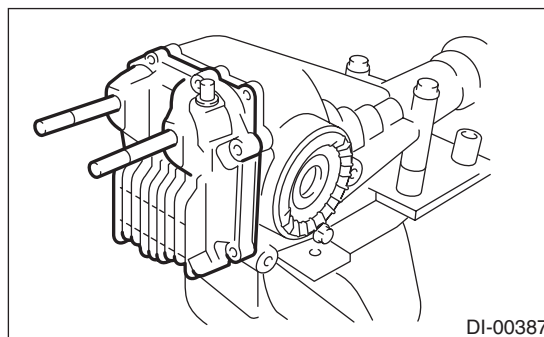


19) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

20) Install the new gasket and rear cover to the differential carrier, and tighten the bolts to specified torque.

**Tightening torque:**

**34 N·m (3.5 kgf-m, 25.1 ft-lb)**



# Rear Differential (VA-type)

## DIFFERENTIALS

### E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage or other defects. Repair or replace the defective parts as necessary.

#### 1) Hypoid driven gear and drive pinion

- If there is evidently an abnormal tooth contact, find out the cause and adjust until the teeth contact correctly. Replace the gear if there is an excessive worn or an incapable adjustment.

- If crack, cutout or seizure is found, replace the parts as a set. Slight damage of some teeth can be corrected by oil stone or the like.

#### 2) Side gear and pinion mate gear

- Replace if cracks, scoring or other defects are evident on the tooth surface.

- Replace if thrust washer contact surface is worn or seized. Slight damages of the surface can be corrected by oil stones or equivalent.

#### 3) Bearing

Replace if seizure, peeling, wear, rust, dragging during rotation, noise or other defect is evident.

#### 4) Thrust washer of the side gear and pinion mate gear:

Replace if seized, flawed, abnormally worn or having other defects.

#### 5) Oil seal

Replace if deformed or damaged, and at every disassembling.

#### 6) Differential carrier

Replace if the bearing bores are worn or damaged.

#### 7) Differential case

Replace if its sliding surfaces are worn or cracked.

#### 8) Companion flange

Replace if the oil seal lip contact surface shows cracking.

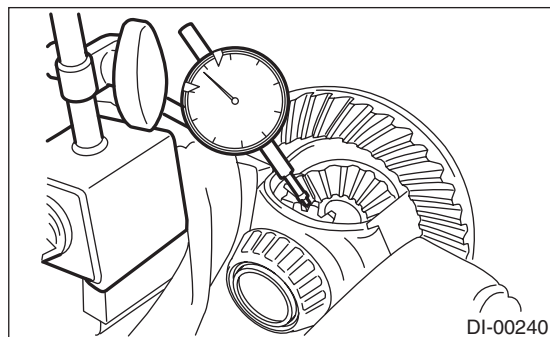
### 1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of side gear. (VA1-type only)

#### *Side gear backlash:*

**0.05 — 0.15 mm (0.002 — 0.006 in)**

If the side gear backlash is not within the specification, select the side gear thrust washer and adjust the side gear backlash as specified.



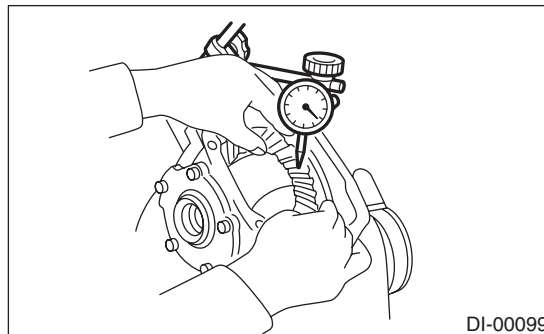
### 2. HYPOID DRIVEN GEAR BACKLASH

Using a dial gauge, check the backlash of hypoid driven gear.

#### *Hypoid driven gear backlash:*

**0.10 — 0.15 mm (0.004 — 0.006 in)**

If the hypoid driven gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



### 3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

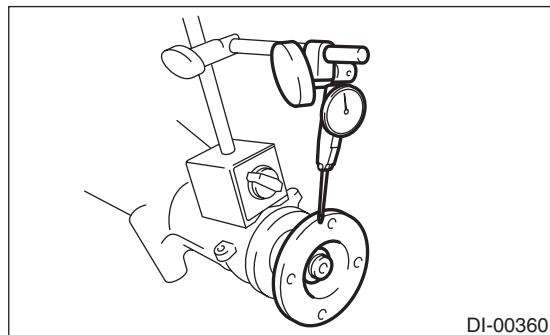
Inspect the tooth contact between the hypoid driven gear and drive pinion. <Ref. to DI-69, ASSEMBLY, Rear Differential (VA-type).>

#### 4. COMPANION FLANGE

- 1) If rust or dirt is attached to the companion flange, remove them.
- 2) Set a dial gauge at a companion flange surface (mating surface of propeller shaft and companion flange), and then measure the companion flange runout.

**Limit of runout:**

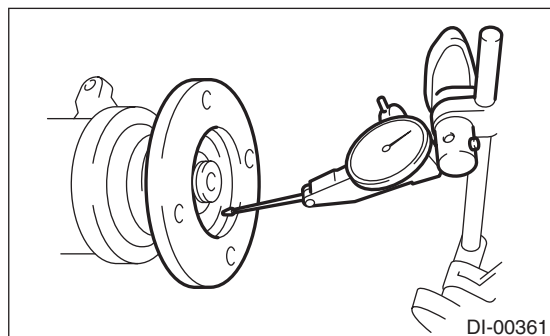
**0.08 mm (0.003 in)**



- 3) Set the gauge inside of the companion flange, and measure the runout.

**Limit of runout:**

**0.08 mm (0.003 in)**



- 4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point where the runout is within the limit.
- 5) If the runout exceeds the limit even after changing the phase, replace the companion flange and recheck the runout.
- 6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

#### F: ADJUSTMENT

##### 1. SIDE GEAR BACKLASH

Adjust the side gear backlash. (VA1-type)  
 <Ref. to DI-69, ASSEMBLY, Rear Differential (VA-type).>

##### 2. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash.  
 <Ref. to DI-69, ASSEMBLY, Rear Differential (VA-type).>

##### 3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear.  
 <Ref. to DI-69, ASSEMBLY, Rear Differential (VA-type).>

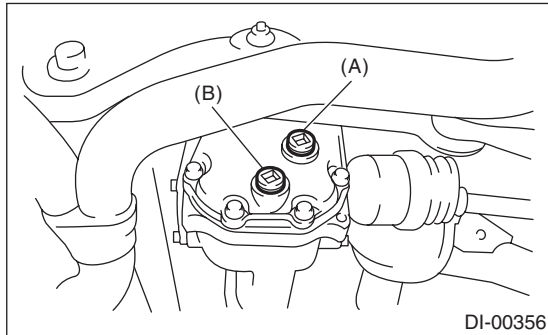
## 6. Rear Differential Front Oil Seal

### A: INSPECTION

Make sure that there is no leakage from front oil seal portion. If there is any leakage replace the oil seal and inspect the propeller shaft.

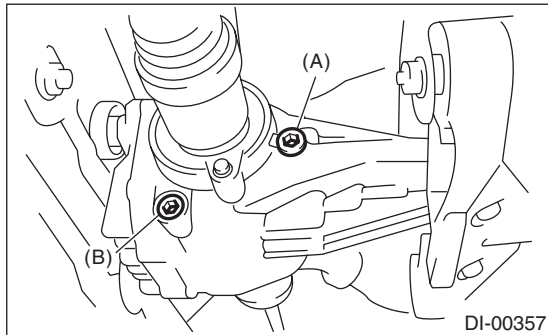
### B: REPLACEMENT

- 1) Shift the select lever or gear shift lever to neutral.
- 2) Release the parking brake.
- 3) Remove the oil drain plug, and drain gear oil.
  - Except for VA2-type



- (A) Filler plug
- (B) Drain plug

- VA2-type



- (A) Filler plug
- (B) Drain plug

- 4) Install the oil drain plug.

#### NOTE:

- Apply liquid gasket to the drain plug for the T-type (except for GT spec. B 6MT model).

#### Liquid gasket:

**THREE BOND 1105 (Part No. 004403010) or equivalent**

- Use a new copper gasket for the VA1-type and T-type (GT spec. B 6MT model).
- Use a new metal gasket for the VA2-type.

#### Tightening torque:

**T-type (except for GT spec. B 6MT model):**

**49 N·m (5.0 kgf-m, 36.2 ft-lb)**

**T-type (GT spec. B 6MT model):**

**60 N·m (6.1 kgf-m, 44.3 ft-lb)**

**VA1-type:**

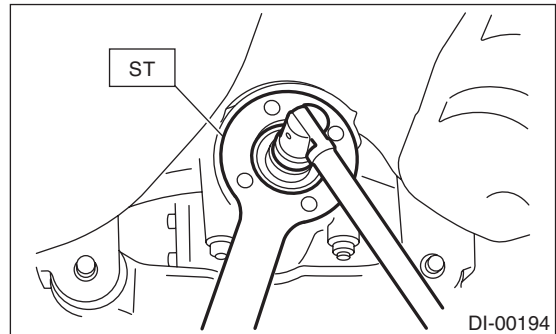
**34 N·m (3.5 kgf-m, 25.1 ft-lb)**

**VA2-type:**

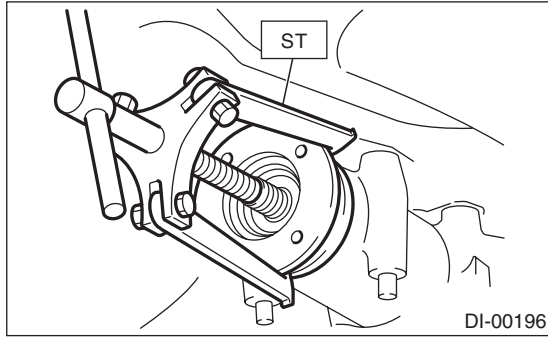
**29 N·m (3.0 kgf-m, 21.4 ft-lb)**

- 5) Lift up the vehicle.
- 6) Remove the rear exhaust pipe and muffler.
  - 2.5 L SOHC Non-turbo model  
<Ref. to EX(H4SO)-8, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-10, REMOVAL, Muffler.>
  - 2.5 L DOHC turbo model  
<Ref. to EX(H4DOTC)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>
  - 3.0 L DOHC non-turbo model  
<Ref. to EX(H6DO)-7, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H6DO)-9, REMOVAL, Muffler.>
- 7) Remove the heat shield cover. (When equipped)
- 8) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 9) Remove the self-locking nut while holding the companion flange with ST.

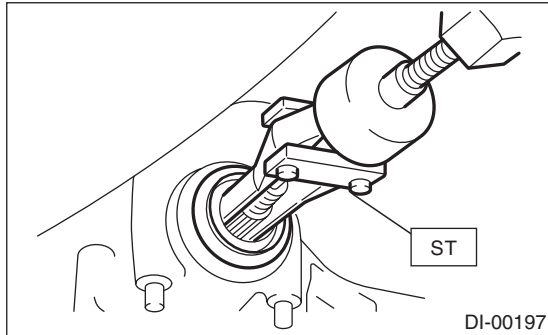
ST 498427200 FLANGE WRENCH



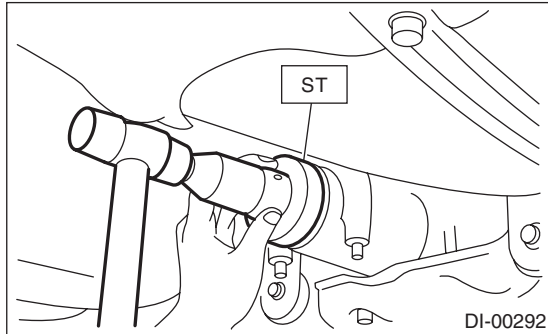
- 10) Extract the companion flange using ST.  
ST 399703600 PULLER ASSY



- 11) Remove the oil seal using ST or screwdriver.  
ST 398527700 PULLER ASSY



- 12) Install a new oil seal using ST.  
ST 498447120 INSTALLER



- 13) Install the companion flange.

NOTE:

Use a plastic hammer to install companion flange.

- 14) Apply seal material on the drive pinion shaft thread and new self-locking nut seat.

**SEAL MATERIAL**

**THREE BOND 1324 (Part No. 004403042) or equivalent**

- 15) Tighten the self-locking nut within the specified torque range so that the rotating resistance of companion flange becomes the same as that of before oil seal replacement.

ST 498427200 FLANGE WRENCH

NOTE:

Use a new self-locking nut.

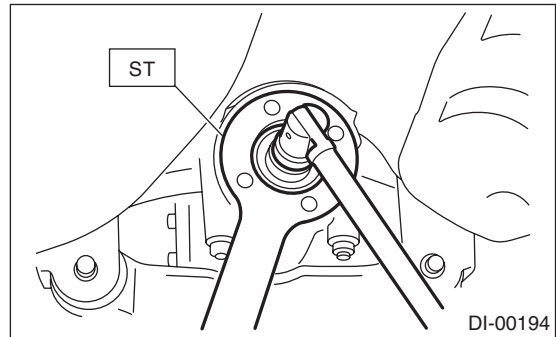
**Tightening torque:**

**T-type:**

**181.5 N·m (18.5 kgf·m, 134.0 ft·lb)**

**VA-type:**

**191 N·m (19.5 kgf·m, 141.0 ft·lb)**



- 16) Hereafter, reassemble in the reverse order of disassembly.

### 7. Rear Differential Side Oil Seal

#### A: INSPECTION

Make sure that there is no leakage from side oil seal. If there is any leakage, replace the oil seal.

#### B: REPLACEMENT

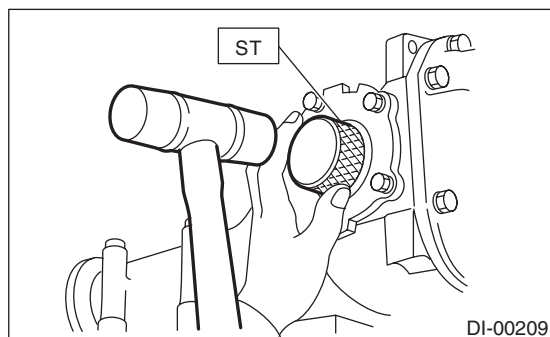
1) Remove the rear differential. <Ref. to DI-31, REMOVAL, Rear Differential (T-type).> <Ref. to DI-60, REMOVAL, Rear Differential (VA-type).>

2) Remove the rear differential side oil seal using a screwdriver wrapped with vinyl tape to prevent the side retainer from scratches.

3) Using the ST, install the oil seal to the side retainer.

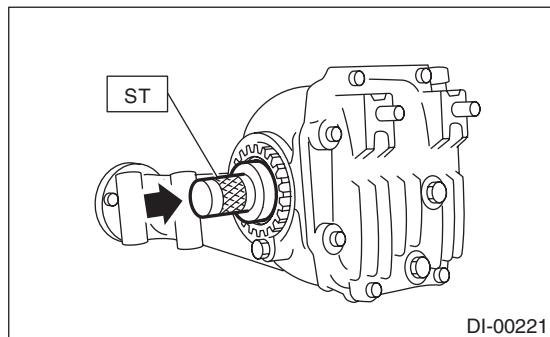
- T-type and VA2-type

ST 398437700 DRIFT



- VA1-type

ST 498447100 INSTALLER



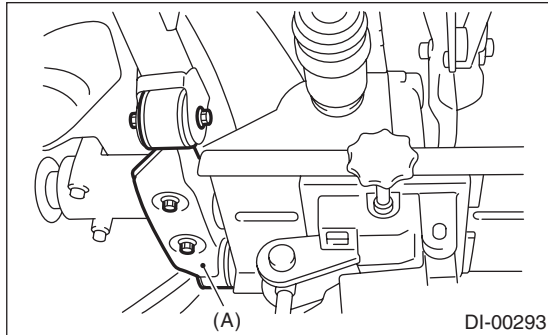
4) Install the rear differential. <Ref. to DI-32, INSTALLATION, Rear Differential (T-type).> <Ref. to DI-61, INSTALLATION, Rear Differential (VA-type).>



## 8. Rear Differential Front Member

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle.
- 3) Support the rear differential using transmission jack, and then remove the rear differential front member.



(A) Rear differential front member

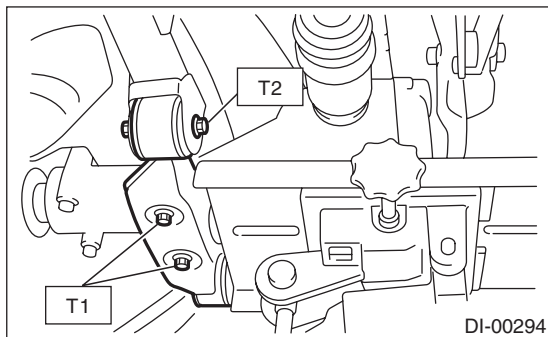
### B: INSTALLATION

Using new self-locking nuts, install the rear differential front member.

#### *Tightening torque:*

**T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)**

**T2: 110 N·m (11.2 kgf-m, 81 ft-lb)**



### C: INSPECTION

- 1) Check the rear differential front member for damage, bend and corrosion.  
If damage, bend or corrosion is excessive, replace the rear differential front member.
- 2) Check the bushings of rear differential member for cracking, hardening and damage.  
If cracking, hardening or damage is excessive, replace rear differential front member.

# General Diagnostic Table

## DIFFERENTIALS

### 9. General Diagnostic Table

#### A: INSPECTION

Symptom or trouble	Possible cause	Remedy
<b>1. Oil leakage</b>	(1) Worn, scratched, or incorrectly seated front or side oil seal. Scored, battered or excessively worn sliding surface of companion flange.	Correct or replace.
	(2) Clogged or damaged air breather.	Clean, repair or replace.
	(3) Loose bolts on side retainer, or incorrectly fitted O-ring.	Tighten the bolts to specified torque. Replace the O-ring.
	(4) Loose rear cover attaching bolts or damaged gasket.	Tighten the bolts to specified torque. Replace gasket and apply liquid gasket.
	(5) Loose oil filler or drain plug.	Retighten and apply liquid gasket.
	(6) Wear, damage or incorrect fitting of side retainer or oil seal.	Correct or replace.
<b>2. Seizure</b> NOTE: Seized or damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	(1) Insufficient backlash for hypoid gear.	Readjust or replace.
	(2) Excessive preload for side, rear or front bearing.	Readjust or replace.
	(3) Insufficient or improper oil used.	Replace seized part and fill with specified oil to specified level.
<b>3. Damage</b> NOTE: Damaged parts should be replaced, and also other parts should be thoroughly checked for any defect and should be repaired or replaced as required.	(1) Improper backlash for hypoid gear.	Replace.
	(2) Insufficient or excessive preload for side, rear or front bearing.	Readjust or replace.
	(3) Excessive backlash for differential gear.	Replace gear or thrust washer.
	(4) Loose bolts and nuts such as hypoid driven gear bolt	Retighten.
	(5) Damage due to overloading.	Replace.
<b>4. Noises when starting or shifting gears</b> NOTE: Noises may be caused by differential assembly, universal joint, wheel bearing, etc. Find out what is actually making noise before disassembling.	(1) Excessive backlash for hypoid gear.	Readjust.
	(2) Excessive backlash for differential gear.	Replace gear or thrust washer.
	(3) Insufficient preload for front or rear bearing.	Readjust.
	(4) Loose drive pinion nut.	Tighten to the specified torque.
	(5) Loose bolts and nuts such as side bearing retainer attaching bolt.	Tighten to the specified torque.
<b>5. Noises when cornering</b>	(1) Damaged differential gear.	Replace.
	(2) Excessive wear or damage of thrust washer.	Replace.
	(3) Broken pinion mate shaft.	Replace.
	(4) Seized or damaged side bearing.	Replace.

# General Diagnostic Table

DIFFERENTIALS

Symptom or trouble	Possible cause	Remedy
<b>6. Gear Noise</b> NOTE: Since noises from engine, muffler, transmission, propeller shaft, wheel bearings, tires, and body are sometimes mistaken for noises from differential assembly, be careful in checking them. Inspection methods to locate noises include coasting, accelerating, cruising, and jacking-up all four wheels. Perform these inspections according to the condition of trouble. When listening to noises, shift gears into four wheel drive and fourth speed position, trying to pick up only differential noise.	(1) Improper tooth contact of hypoid gear.	Readjust or replace hypoid gear set.
	(2) Improper backlash of the hypoid gear.	Readjust.
	(3) Scored or chipped teeth of hypoid gear.	Replace hypoid gear set.
	(4) Seized hypoid gear.	Replace hypoid gear set.
	(5) Improper preload for front or rear bearings.	Readjust.
	(6) Seized, cut-away or chipped front or rear bearing.	Replace.
	(7) Seized, cut-away or chipped side bearing.	Replace.
	(8) Vibrating differential gear.	Replace.

# General Diagnostic Table

DIFFERENTIALS

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## 1. General Description

### A: NOTE

For general description, refer to the “4AT”, “5AT”, “5MT” or “6MT” section.

4AT model:

<Ref. to 4AT-2, General Description.>

5AT model:

<Ref. to 5AT-2, General Description.>

5MT model:

<Ref. to 5MT-2, General Description.>

6MT model:

<Ref. to 6MT-2, General Description.>

## 2. Transfer Case and Extension Case Assembly

### A: NOTE

For removal, installation and inspection, refer to the "5MT" section. <Ref. to 5MT-38, Transfer Case and Extension Case Assembly.>

## 3. Transfer Clutch

### A: NOTE

For removal, installation and inspection, refer to the "4AT" or "5AT" section.

4AT model:

<Ref. to 4AT-75, Transfer Clutch.>

5AT model:

<Ref. to 5AT-69, Transfer Clutch.>

## 4. Extension Case

### A: NOTE

For removal, installation and inspection, refer to the "4AT", "5AT" or "6MT" section.

4AT model:

<Ref. to 4AT-71, Extension Case.>

5AT model:

<Ref. to 5AT-67, Extension Case.>

6MT model:

<Ref. to 6MT-43, Extension Case.>



## 5. Oil Seal

### A: NOTE

For replacement and inspection, refer to the “4AT”, “5AT”, “5MT” or “6MT” section.

4AT model:

<Ref. to 4AT-45, Extension Case Oil Seal.> <Ref. to 4AT-46, Differential Side Retainer Oil Seal.>

5AT model:

<Ref. to 5AT-48, Extension Case Oil Seal.> <Ref. to 5AT-49, Differential Side Retainer Oil Seal.>

5MT model:

<Ref. to 5MT-33, Oil Seal.> <Ref. to 5MT-34, Differential Side Retainer Oil Seal.>

6MT model:

<Ref. to 6MT-28, Oil Seal.> <Ref. to 6MT-29, Differential Side Retainer Oil Seal.>

## 6. Transfer Drive Gear

### A: NOTE

For removal, installation and inspection, refer to the "5MT" or "6MT" section.

5MT model:

<Ref. to 5MT-42, Transfer Drive Gear.>

6MT model:

<Ref. to 6MT-53, Transfer Drive Gear.>

## 7. Transfer Driven Gear

### A: NOTE

For removal, installation and inspection, refer to the "5MT" or "6MT" section.

5MT model:

<Ref. to 5MT-44, Transfer Driven Gear.>

6MT model:

<Ref. to 6MT-55, Transfer Driven Gear.>

## 8. Reduction Drive Gear

### A: NOTE

For removal, installation and inspection, refer to the "4AT" section. <Ref. to 4AT-85, Reduction Drive Gear.>

## 9. Center Differential Carrier

### A: NOTE

For removal, installation and inspection, refer to the "4AT" or "5AT" section.

4AT model:

<Ref. to 4AT-87, Center Differential Carrier.>

5AT model:

<Ref. to 5AT-76, Center Differential Carrier.>

## 10.Reduction Driven Gear

### A: NOTE

For removal, installation and inspection, refer to the "4AT" or "5AT" section.

4AT model:

<Ref. to 4AT-83, Reduction Driven Gear.>

5AT model:

<Ref. to 5AT-73, Reduction Driven Gear.>

## 11.Center Differential

### A: NOTE

For removal, installation and inspection, refer to the "5MT" or "6MT" section.

5MT model:

<Ref. to 5MT-46, Center Differential.>

6MT model:

<Ref. to 6MT-57, Center Differential.>

## 12. Transfer Clutch Pressure Test

### A: NOTE

For inspection, refer to "4AT" or "5AT" section.

4AT model:

<Ref. to 4AT-35, Transfer Clutch Pressure Test.>

5AT model:

<Ref. to 5AT-36, Transfer Clutch Pressure Test.>



# Transfer Clutch Pressure Test

TRANSFER CASE

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# General Description

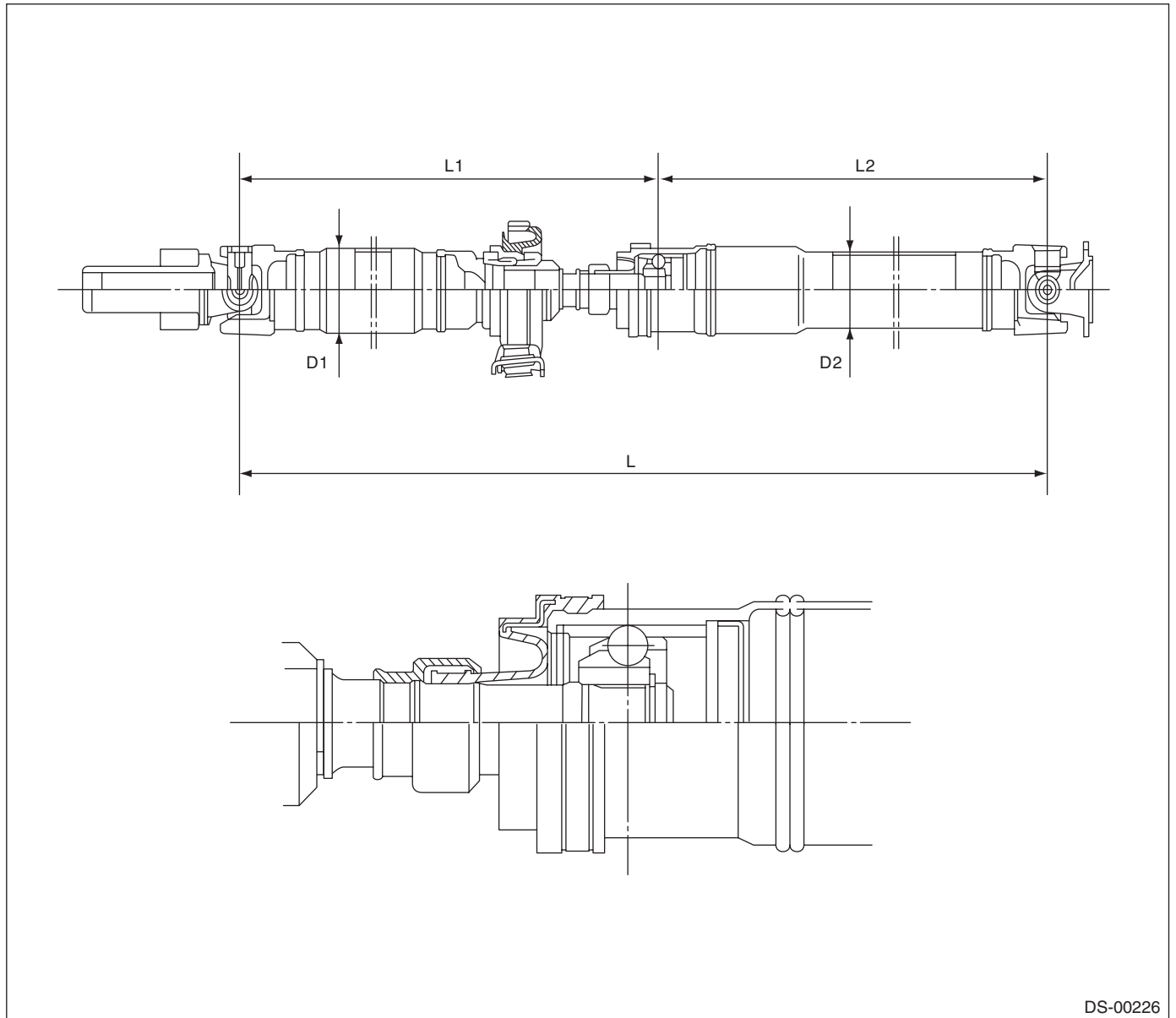
## DRIVE SHAFT SYSTEM

### 1. General Description

#### A: SPECIFICATION

##### 1. PROPELLER SHAFT

Model		5MT	6MT	4AT	5AT
Propeller shaft type		EDJ			
Propeller shaft length: L	mm (in)	1,483 (58.39)	1,423 (56.02)	1,423 (56.02)	1,310 (51.57)
Front propeller shaft Joint-to-joint length: L <sub>1</sub>	mm (in)	735 (28.9)	675 (26.6)	675 (26.6)	562 (22.1)
Rear propeller shaft Joint-to-Joint length: L <sub>2</sub>	mm (in)	748 (29.4)			
Outer diameter of tube:	mm (in)	D <sub>1</sub>			
		D <sub>2</sub>			

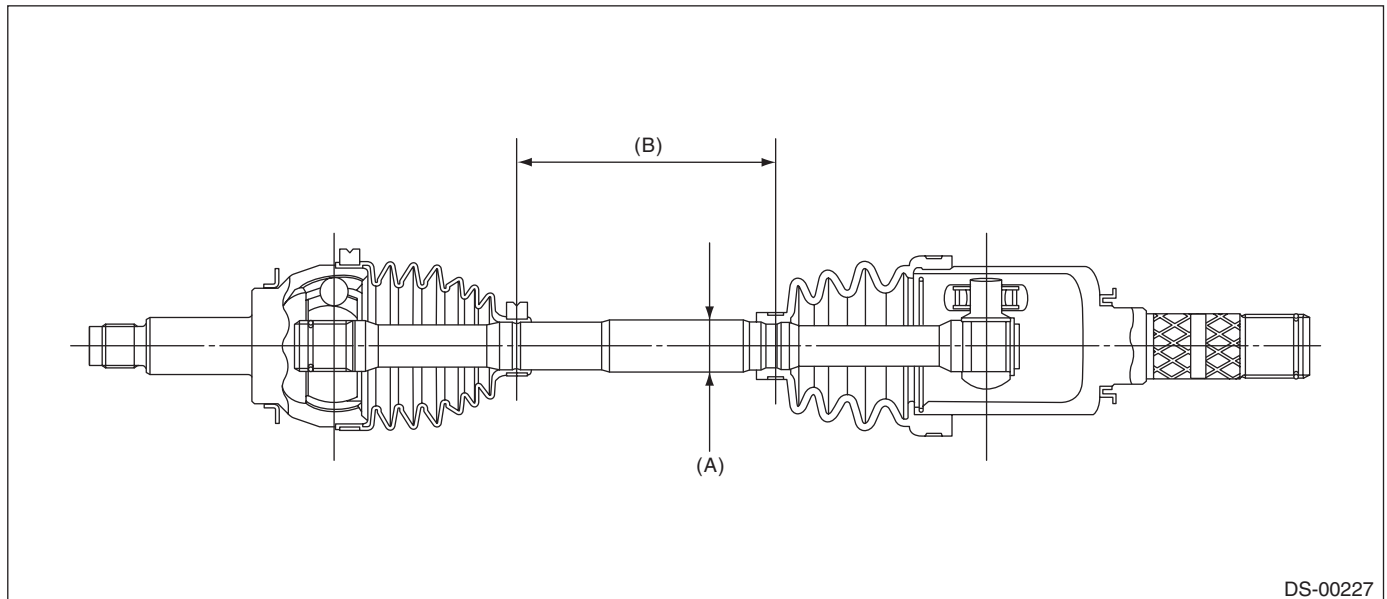


DS-00226

# General Description

## 2. FRONT DRIVE SHAFT ASSEMBLY

Model	Type of drive shaft	Axle diameter $\phi$ D mm (in)	Axle length L mm (in)
Turbo 5MT, 6MT	EBJ + PTJ	26 (1.0)	332.5 (13.09)
Other than above	EBJ + PTJ	26 (1.0)	349.6 (13.76)



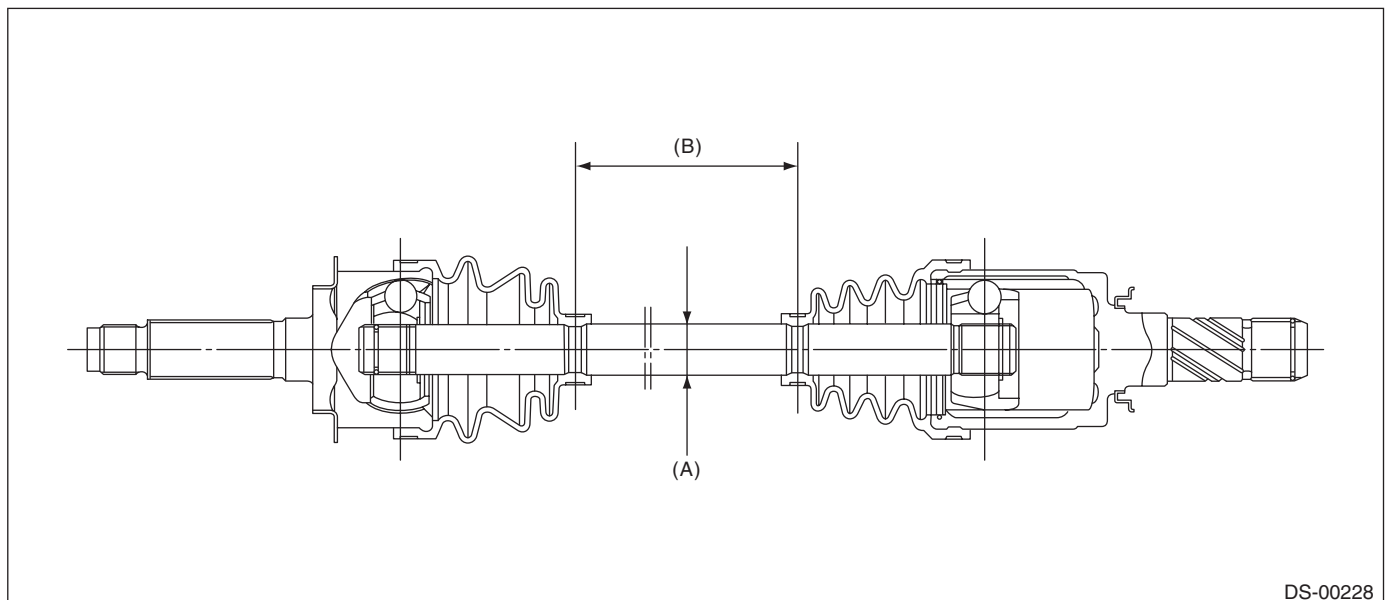
DS-00227

(A) Axle diameter

(B) Axle length

## 3. REAR DRIVE SHAFT ASSEMBLY

Model	Type of drive shaft	Axle diameter $\phi$ D mm (in)	Axle length L mm (in)
2.5 i AT	BJ + DOJ	22 (0.87)	382 (15.04)
6MT	EBJ + DOJ	22 (0.87)	331.8 (13.06)
Other than above	EBJ + DOJ	22 (0.87)	375.1 (14.77)



DS-00228

(A) Axle diameter

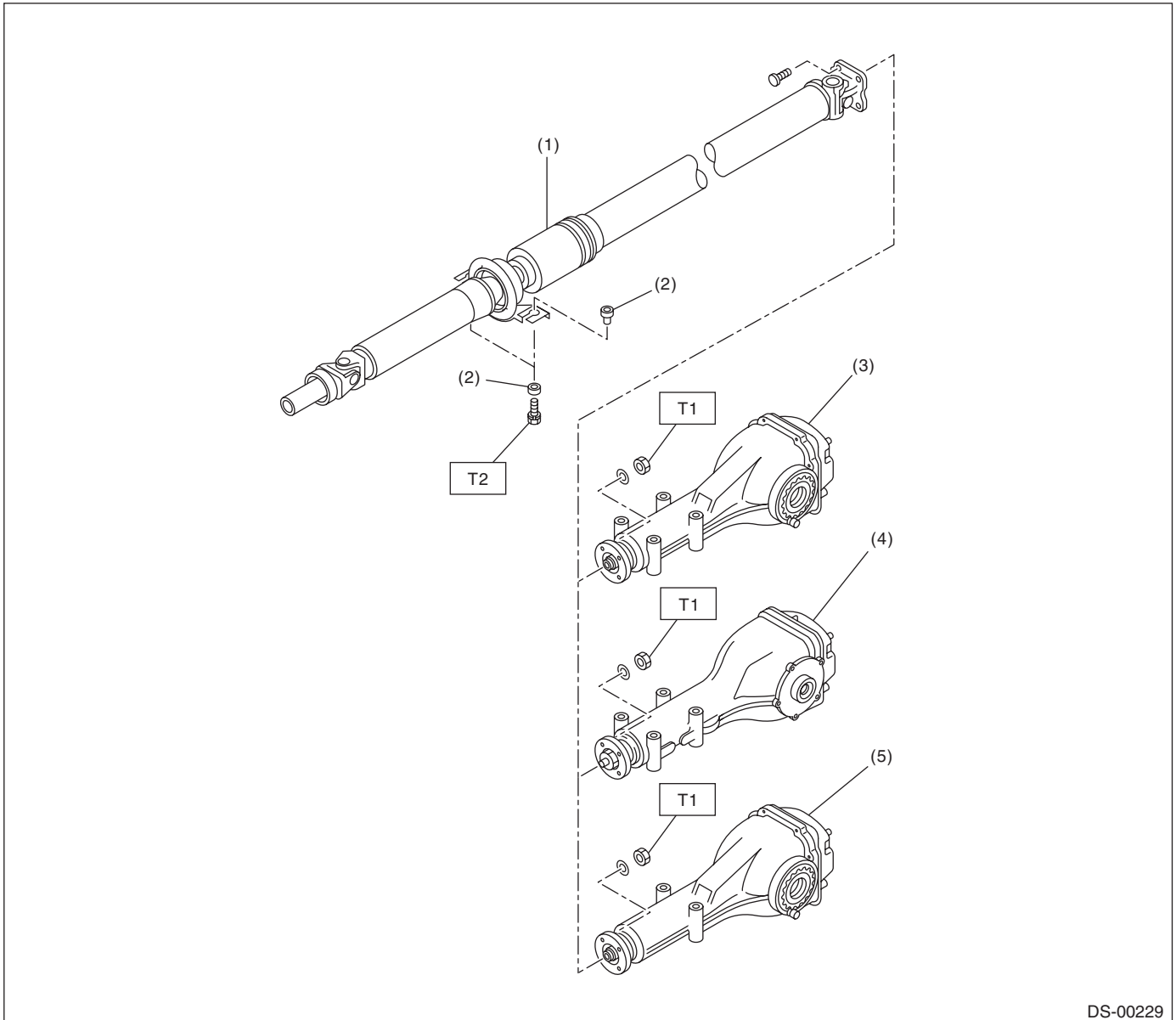
(B) Axle length

# General Description

## DRIVE SHAFT SYSTEM

### B: COMPONENT

#### 1. PROPELLER SHAFT



DS-00229

- (1) Propeller shaft
- (2) Bushing
- (3) Rear differential (VA1-type)

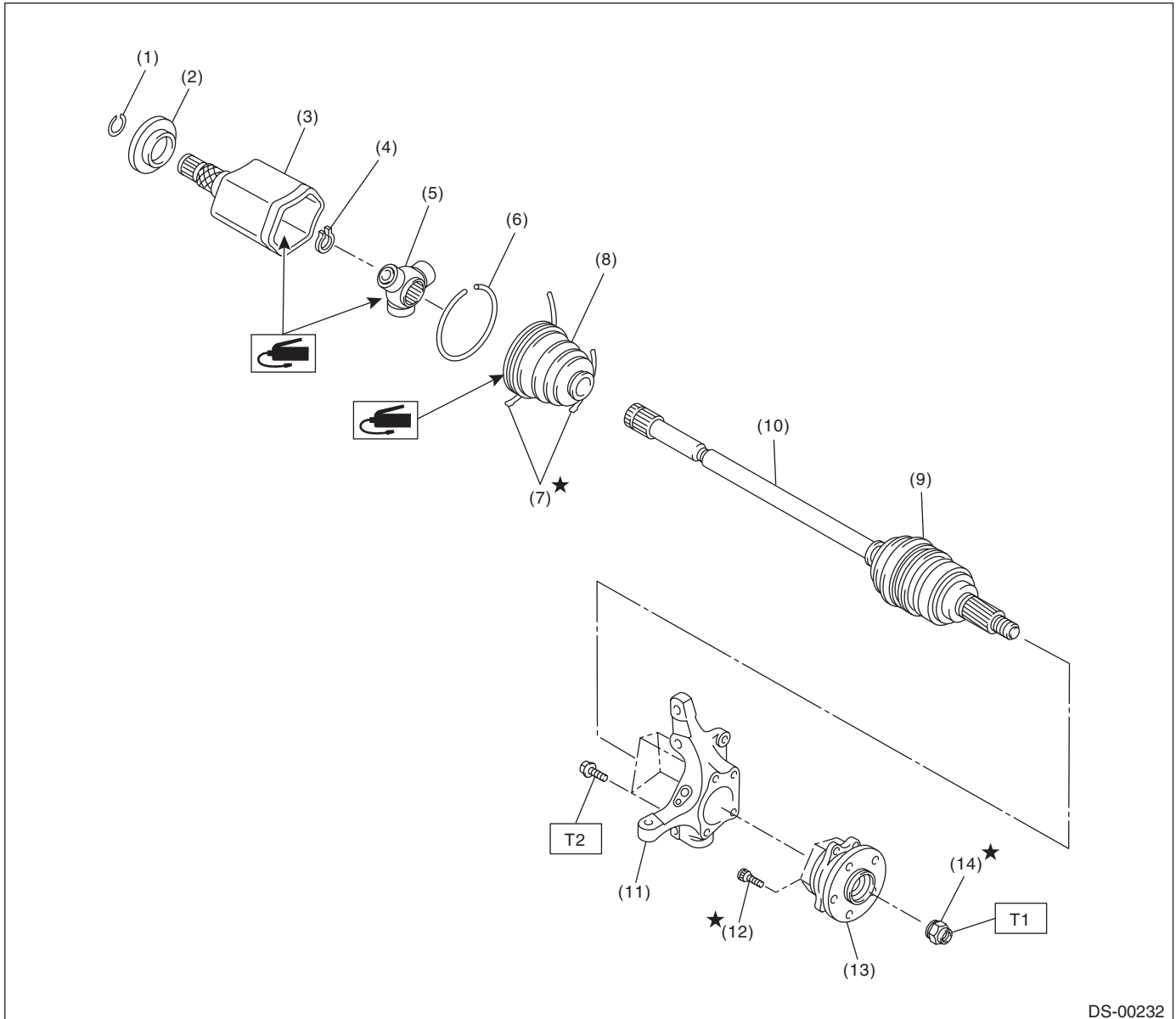
- (4) Rear differential (T-type)
- (5) Rear differential (VA2-type)

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 31 (3.2, 23.1)**

**T2: 52 (5.3, 38.3)**

### 2. FRONT AXLE



DS-00232

- |                      |                     |                             |
|----------------------|---------------------|-----------------------------|
| (1) Circlip          | (7) Boot band       | (13) Front hub unit bearing |
| (2) Baffle plate     | (8) Boot (PTJ)      | (14) Axle nut               |
| (3) Outer race (PTJ) | (9) Boot (EBJ)      |                             |
| (4) Snap ring        | (10) EBJ shaft ASSY |                             |
| (5) Trunnion         | (11) Housing        |                             |
| (6) Snap ring        | (12) Hub bolt       |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

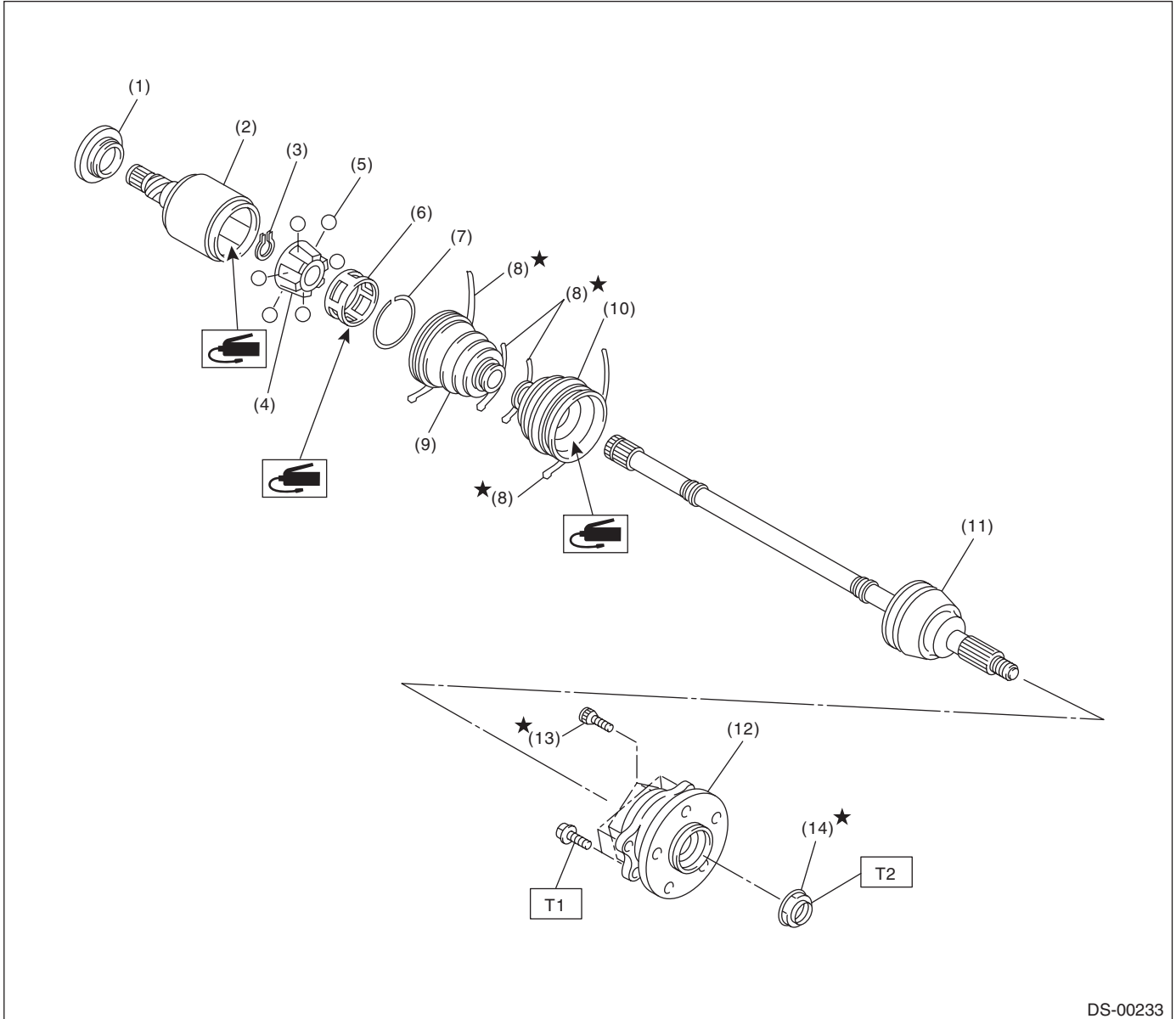
**T1: 220 (22.4, 162)**

**T2: 65 (6.6, 47.9)**

# General Description

## DRIVE SHAFT SYSTEM

### 3. REAR AXLE



DS-00233

- |                        |   |               |
|------------------------|---|---------------|
| (1) Baffle plate (DOJ) | (8) Boot band   | (13) Hub bolt |
| (2) Outer race (DOJ)   | (9) Boot (DOJ)  | (14) Axle nut |
| (3) Snap ring          | (10) Boot (BJ)  |               |
| (4) Inner race         | (11) BJ shaft ASSY (2.5 i AT model)<br>EBJ shaft ASSY (Except for 2.5 i AT model) |               |
| (5) Ball               | (12) Rear hub unit bearing  |               |
| (6) Cage               |   |               |
| (7) Snap ring          |   |               |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 65 (6.6, 47.9)**

**T2: 240 (24.5, 177)**

### **C: CAUTION**

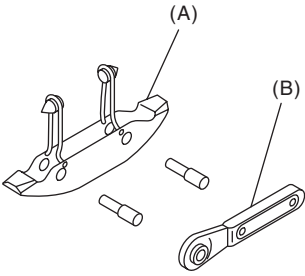
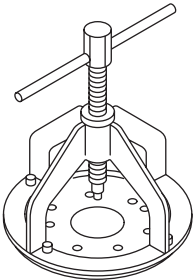
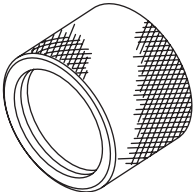
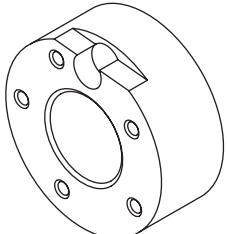
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Apply grease onto sliding or revolving surfaces before installation.
- Before installing snap rings, apply sufficient amount of grease to avoid damage and deformation.
- Before securing a part on a vise, place cushioning materials such as wood blocks, aluminum plates, or waste cloth between the part and the vise.

# General Description

## DRIVE SHAFT SYSTEM

### D: PREPARATION TOOL

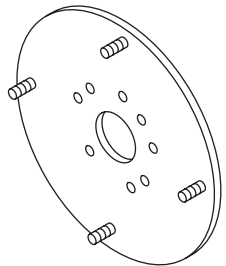
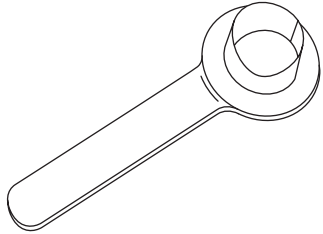
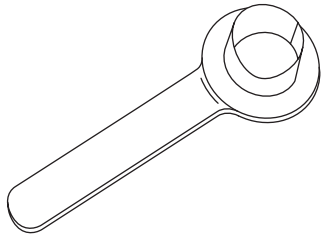
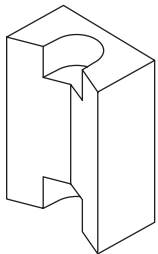
#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-925091000</p>	925091000	BAND TIGHTENING TOOL	Used for tightening the boot band. (A) Jig for the band (B) Ratchet wrench
 <p>ST-926470000</p>	926470000	AXLE SHAFT PULLER	<ul style="list-style-type: none"> <li>Used for removing the axle shaft.</li> <li>Used together with the AXLE SHAFT PULLER PLATE (28099PA110).</li> </ul>
 <p>ST18675AA000</p>	18675AA000	DIFFERENTIAL SIDE OIL SEAL INSTALLER	Used for installing the differential side retainer oil seal.
 <p>ST-927080000</p>	927080000	HUB STAND	Used for assembling hub bolt in hub.



# General Description

DRIVE SHAFT SYSTEM

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST28099PA110</p>	28099PA110	AXLE SHAFT PULLER PLATE	Exchange with the plate of the AXLE SHAFT PULLER (926470000) to use.
 <p>ST28099PA090</p>	28099PA090	OIL SEAL PROTECTOR	<ul style="list-style-type: none"> <li>Used for installing the rear drive shaft to the rear differential.</li> <li>For protecting the oil seal.</li> </ul>
 <p>ST28399SA010</p>	28399SA010	OIL SEAL PROTECTOR	<ul style="list-style-type: none"> <li>Used for installing front drive shaft into front differential.</li> <li>For protecting the oil seal.</li> </ul>
 <p>ST28399AG000</p>	28399AG000	HUB STAND	Used for extracting hub bolt.

## 2. GENERAL TOOL

DESCRIPTION	REMARKS
Puller	Used for removing the ball joint from knuckle arm.
Dial gauge	Used for inspecting the propeller shaft run-out.
Extension cap	Used for preventing leakage of gear oil or ATF.
Bar	Used for extracting drive shaft.

# Propeller Shaft

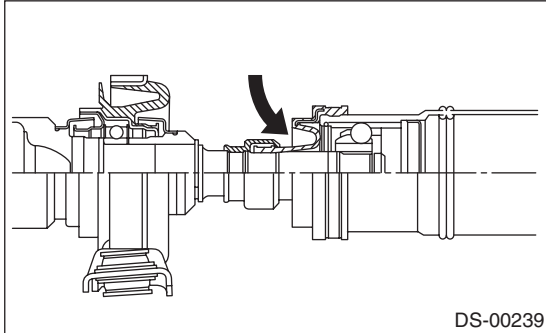
## DRIVE SHAFT SYSTEM

### 2. Propeller Shaft

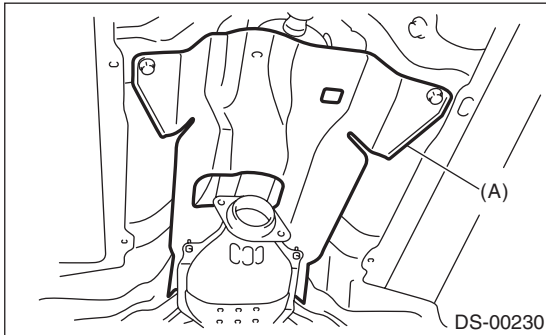
#### A: REMOVAL

##### NOTE:

- Before removing propeller shaft, wrap metal parts with a cloth or rubber material.
- In case of a EDJ type, wrap the metal parts at the rubber boot of EDJ with a cloth or rubber material before removing propeller shaft, as shown in the figure. The rubber boot may be damaged due to interference with adjacent metal parts while bending the EDJ during removal.

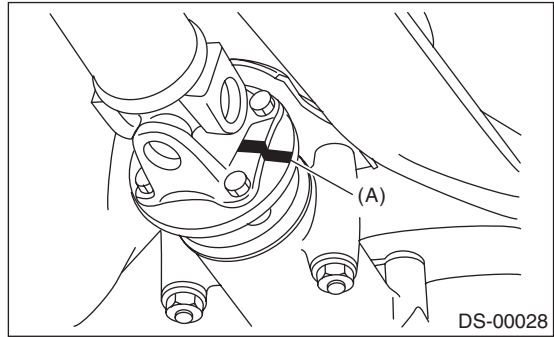


- 1) Disconnect the ground cable from the battery.
- 2) Shift the select lever or gear shift lever to neutral.
- 3) Release the parking brake.
- 4) Lift up the vehicle.
- 5) Remove the center exhaust pipe.
- 6) Remove the rear exhaust pipe and muffler.
- 7) Remove the heat shield cover.



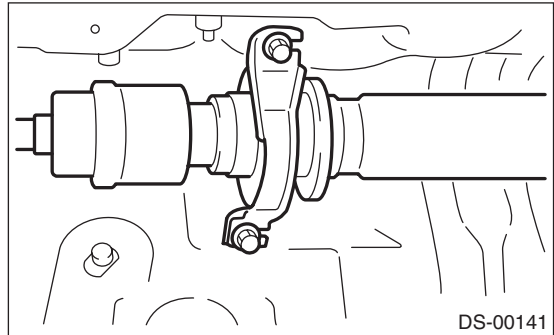
(A) Heat shield cover

- 8) Make alignment marks on the flange yoke and rear differential before removal.



(A) Alignment mark

- 9) Remove the three bolts holding the propeller shaft to the rear differential.
- 10) Remove the remaining bolt.
- 11) Remove the two bolts which hold center bearing to vehicle body.



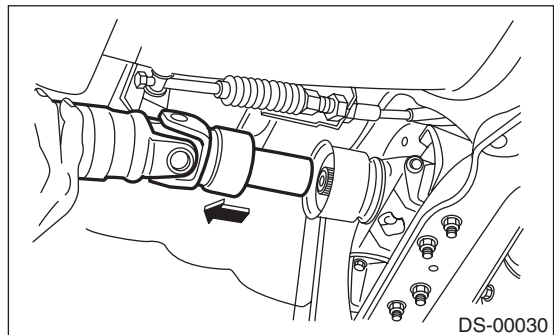
- 12) Remove the propeller shaft from transmission.

##### CAUTION:

- Be careful not to damage oil seals and frictional surface of the sleeve yoke.
- Cover the center exhaust pipe with a cloth to keep off any ATF or oil spilled from transmission when removing propeller shaft.

##### NOTE:

Use a container to catch ATF or oil flowing from propeller shaft.



13) Install an extension cap to the transmission.

**NOTE:**

If extension cap is not available, place vinyl bag over opening and fasten with string to prevent gear oil or ATF from leaking.

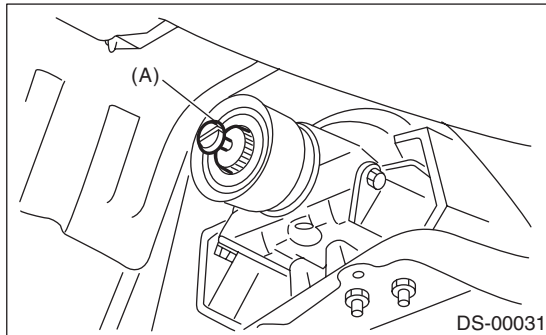
3) Install the heat shield cover.

4) Install the center exhaust pipe.

5) Install the rear exhaust pipe and muffler.

6) Lower the vehicle.

7) Connect the ground cable to the battery.



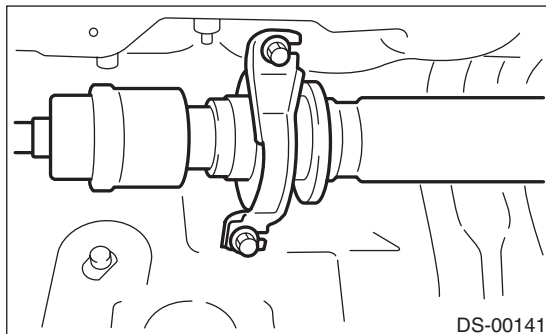
(A) Extension cap

## B: INSTALLATION

1) Insert the sleeve yoke into the transmission and attach center bearing to body.

**Tightening torque:**

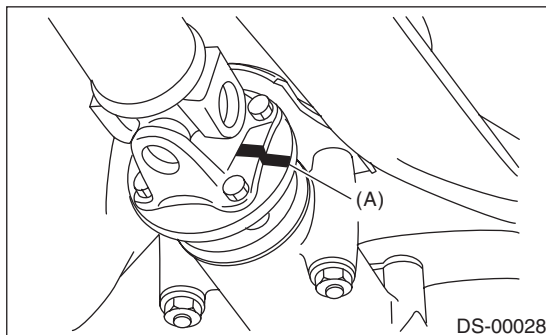
**52 N·m (5.3 kgf·m, 38.3 ft·lb)**



2) Align the alignment marks and connect the flange yoke and rear differential.

**Tightening torque:**

**31 N·m (3.2 kgf·m, 23.1 ft·lb)**



(A) Alignment mark

# Propeller Shaft

## DRIVE SHAFT SYSTEM

### C: INSPECTION

#### NOTE:

Do not disassemble propeller shaft. Check the following and replace if necessary.

- Tube surface for dents or cracks
- Splines for deformation or abnormal wear
- Unsmooth joint operation or abnormal noise
- Center bearing for free play, noise or non-smooth operation.
- Oil seals for abnormal wear or damage
- Damaged center bearing

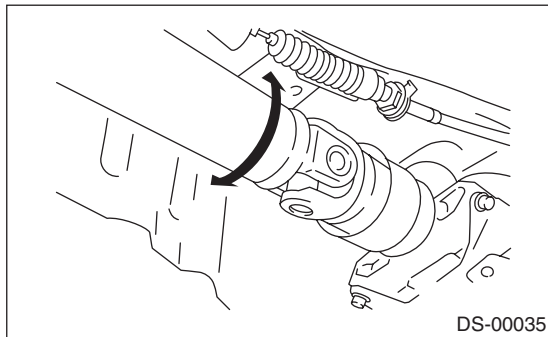
Check the following points with propeller shaft installed in vehicle.

#### 1. JOINTS AND CONNECTIONS

- 1) Remove the center exhaust pipe.
- 2) Remove the heat shield cover.
- 3) Check for any looseness of the yoke flange mounting bolts which connect to the rear differential and center bearing bracket mounting bolts.

#### 2. SPLINES AND BEARING

- 1) Remove the center exhaust pipe.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Turn the propeller shaft by hand to see if abnormal free play exists at splines. Also move yokes to see if abnormal free play exists at spiders and bearings.

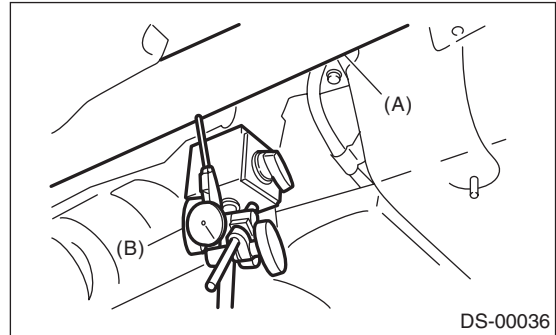


#### 3. RUNOUT OF PROPELLER SHAFT

- 1) Remove the center exhaust pipe.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Set the dial gauge with its indicator stem at the center of the propeller shaft tube.
- 5) Turn the propeller shaft slowly by hands to check for runout of the propeller shaft.

#### Runout:

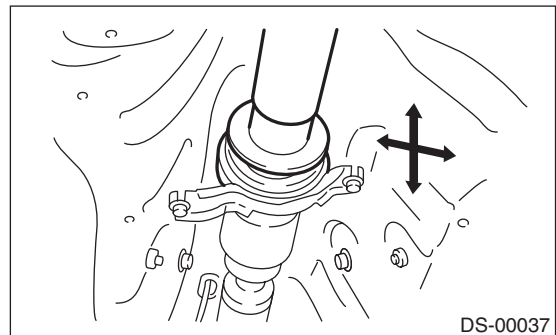
**Service limit 0.6 mm (0.024 in)**



- (A) Propeller shaft  
(B) Dial gauge

#### 4. CENTER BEARING FREE PLAY

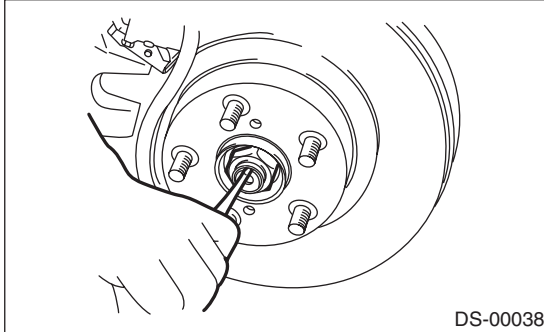
- 1) Remove the front and center exhaust pipes.
- 2) Remove the rear exhaust pipe and muffler.
- 3) Remove the heat shield cover.
- 4) Move the propeller shaft near the center bearing up, down, left, right by hand, to check for any abnormal free play of the bearings.



## 3. Front Axle

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Lift the crimped section of axle nut.

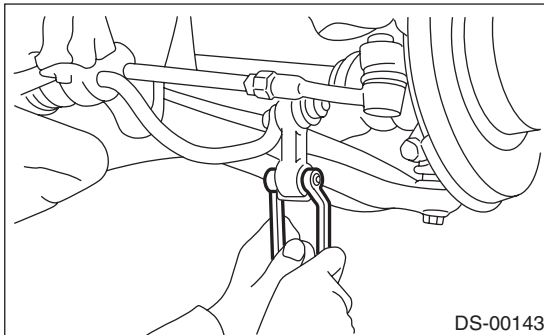


- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

**CAUTION:**

Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.

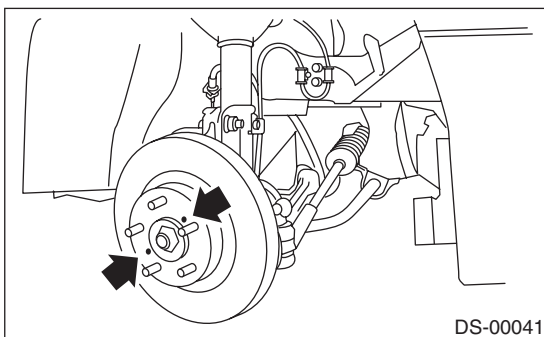
- 5) Remove the stabilizer link.



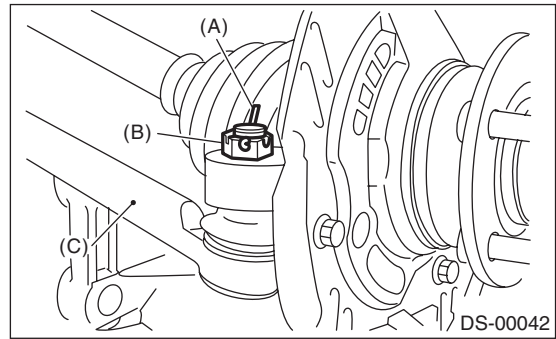
- 6) Remove the disc brake caliper from the housing, and suspend it from strut using a wire.
- 7) Remove the disc rotor from the hub.

**NOTE:**

If it is difficult to remove the disc rotor from the hub, drive the 8 mm bolt into the threaded end of rotor, and then remove the rotor.

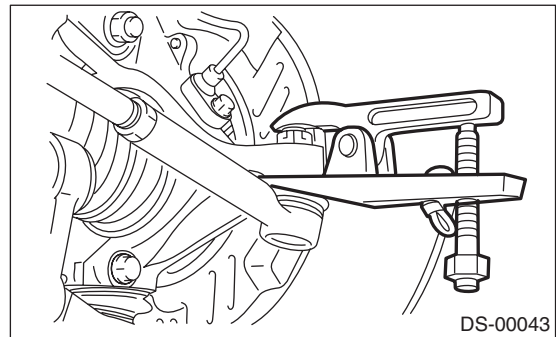


- 8) Remove the cotter pin and castle nut securing the tie-rod end to the housing knuckle arm.



- (A) Cotter pin
- (B) Castle nut
- (C) Tie-rod

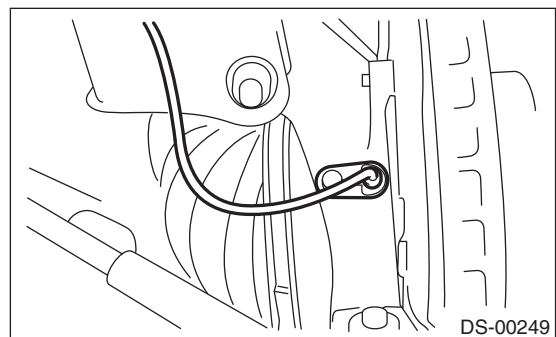
- 9) Using a puller, remove the tie-rod ball joint from knuckle arm.



**CAUTION:**

When removing tie-rod, do not hit the tie-rod end with hammer.

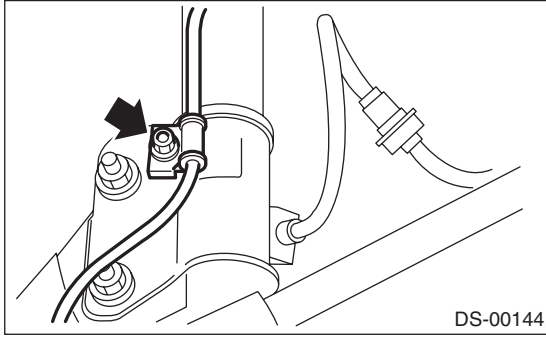
- 10) Remove the ABS wheel speed sensor assembly and harness.



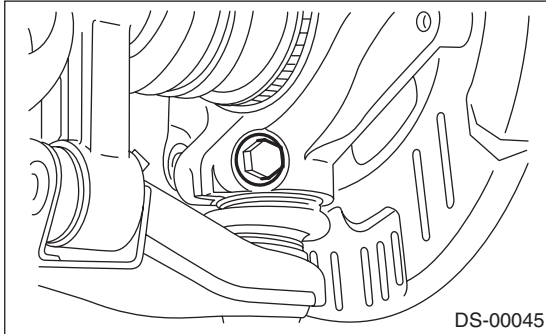
# Front Axle

## DRIVE SHAFT SYSTEM

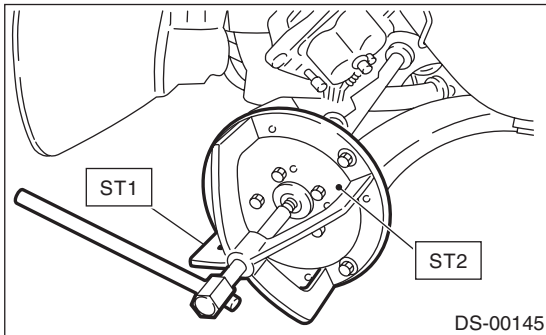
- 11) Remove the bolts which secure the sensor harness to the strut.



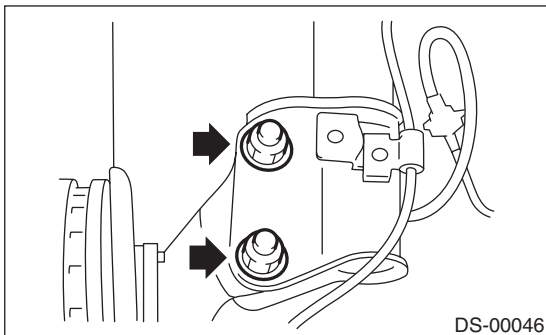
- 12) Remove the front arm ball joint from the housing.



- 13) Remove the PTJ from transmission.  
14) Remove the front drive shaft assembly from the hub. If it is hard to remove, use the ST.  
ST1 926470000 AXLE SHAFT PULLER  
ST2 28099PA110 AXLE SHAFT PULLER PLATE



- 15) After scribing an alignment mark on camber adjusting bolt head, remove the bolts which connect the housing and strut, and disconnect the housing from strut.



## B: INSTALLATION

- 1) Align the alignment mark on the camber adjusting bolt head, and tighten the housing and strut using a new self-locking nut.

### Tightening torque:

**175 N·m (17.8 kgf-m, 129.1 ft-lb)**

- 2) Install the front drive shaft. <Ref. to DS-23, INSTALLATION, Front Drive Shaft.>  
3) Install the front arm ball joint to the housing.

### Tightening torque:

**50 N·m (5.1 kgf-m, 36.9 ft-lb)**

- 4) Install the ABS sensor harness to the strut.  
5) Install the ABS wheel speed sensor on the housing.

### Tightening torque:

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

- 6) Install the disc rotor to hub.  
7) Install the disc brake caliper on the housing.

### Tightening torque:

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

- 8) Install the stabilizer link.  
9) Connect the tie-rod end ball joint to the knuckle arm with a castle nut.

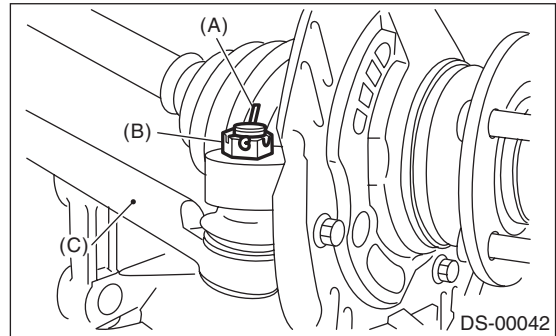
### Tightening torque:

**27.0 N·m (2.75 kgf-m, 19.9 ft-lb)**

## CAUTION:

**When connecting the tie-rod, do not hit the cap at bottom of tie-rod end with a hammer.**

- 10) Tighten the castle nut to specified torque and tighten further within 60° until the pin hole is aligned with the slot in nut. Bend the cotter pin to lock.



- (A) Cotter pin  
(B) Castle nut  
(C) Tie-rod

11) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

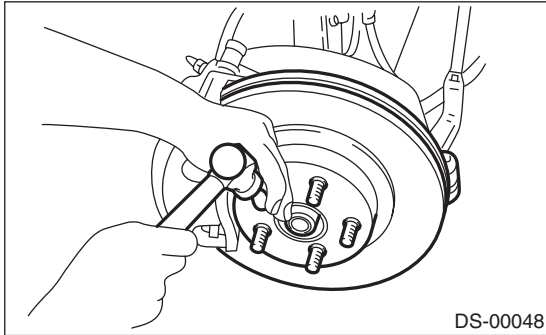
**Tightening torque:**

**220 N·m (22.4 kgf-m, 162 ft-lb)**

**CAUTION:**

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

12) After tightening the axle nut, lock it securely.



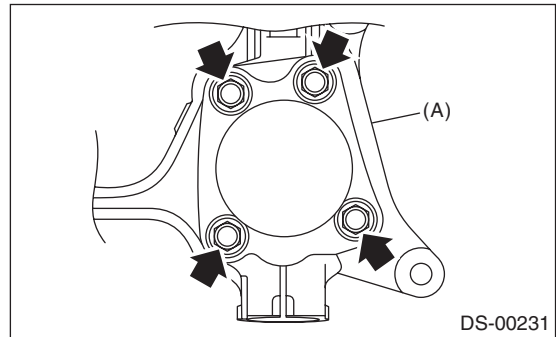
13) Install the wheel and tighten the wheel nuts to specified torque.

**Tightening torque:**

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

## C: DISASSEMBLY

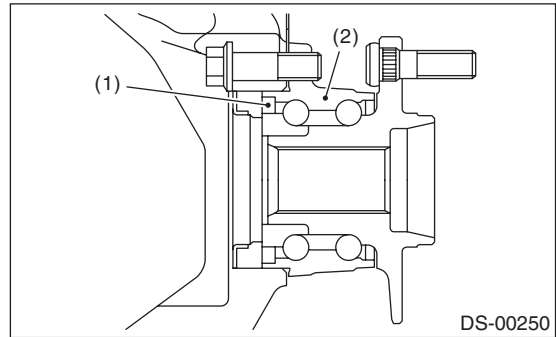
1) Remove the four bolts from the housing, and remove the front hub unit bearing and disc cover.



(A) Housing

**CAUTION:**

- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



(1) Magnetic encoder  
(2) Front hub unit bearing

2) Disassemble the front hub unit bearing. <Ref. to DS-18, DISASSEMBLY, Front Hub Unit Bearing.>

# Front Axle

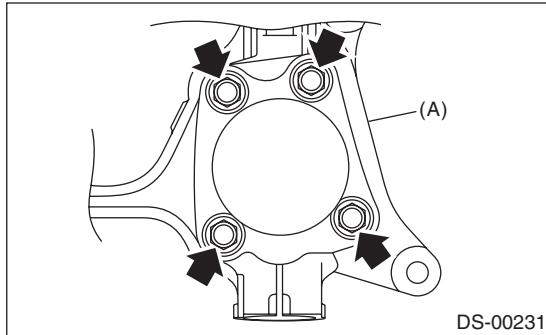
## DRIVE SHAFT SYSTEM

### D: ASSEMBLY

- 1) Assemble the front hub unit bearing. <Ref. to DS-18, ASSEMBLY, Front Hub Unit Bearing.>
- 2) Place the disc cover between housing and front hub unit, and tighten the four bolts.

#### Tightening torque:

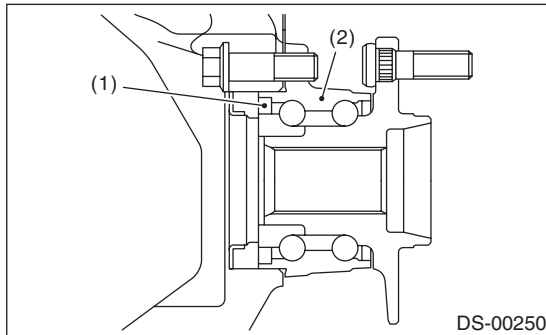
**65 N·m (6.6 kgf-m, 47.9 ft-lb)**



(A) Housing

#### CAUTION:

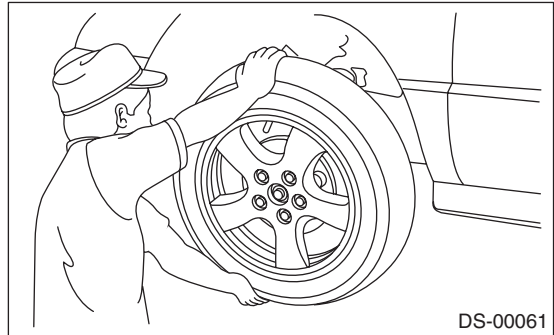
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



- (1) Magnetic encoder
- (2) Front hub unit bearing

### E: INSPECTION

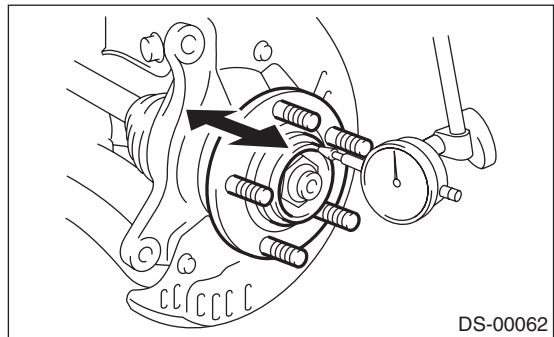
- 1) Moving the front tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



- 2) Inspect the lean of axis direction using a dial gauge. Replace the bearing if the load range exceeds the limitation.

#### Service limit:

**Maximum: 0.05 mm (0.0020 in)**

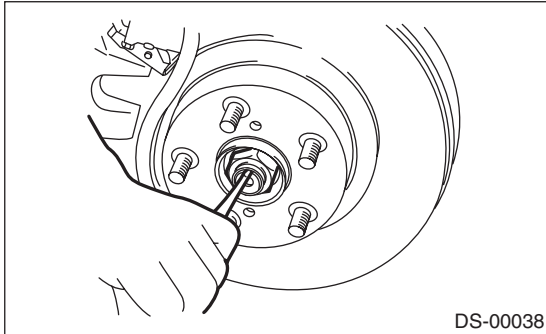




## 4. Front Hub Unit Bearing

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Lift the crimped section of axle nut.



- 4) Remove the axle nut using a socket wrench while depressing the brake pedal.

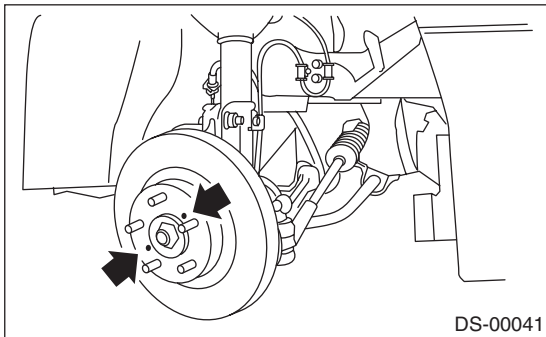
#### CAUTION:

**Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.**

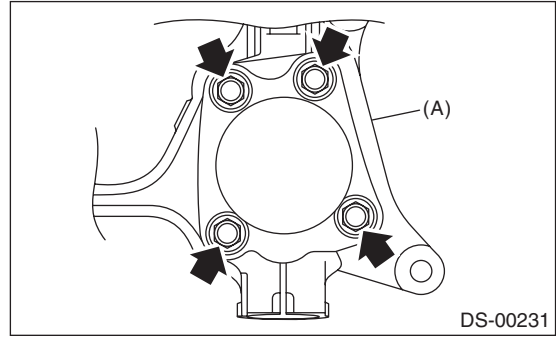
- 5) Remove the disc brake caliper from the housing, and suspend it from strut using a wire.
- 6) Remove the disc rotor from the hub.

#### NOTE:

If it is difficult to remove the disc rotor from the hub, drive the 8 mm bolt into the threaded end of rotor, and then remove the rotor.



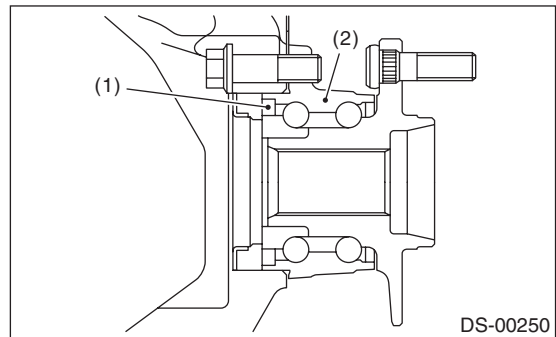
- 7) Remove the four bolts from the housing.



(A) Housing

#### CAUTION:

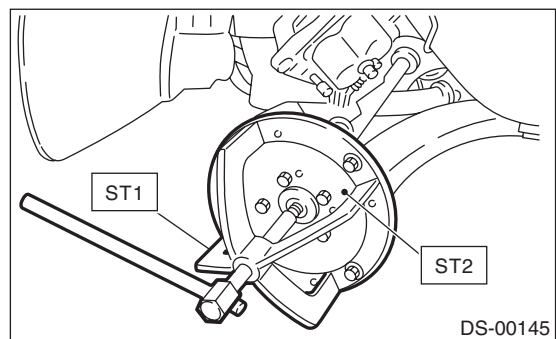
- Do not get closer the tool which charged magnetism to magnetic encoder.
- Be careful not to damage the magnetic encoder.



(1) Magnetic encoder  
(2) Front hub unit bearing

- 8) Remove the front hub unit bearing. If it is hard to remove, use the ST.

ST1 926470000 AXLE SHAFT PULLER  
ST2 28099PA110 AXLE SHAFT PULLER PLATE



# Front Hub Unit Bearing

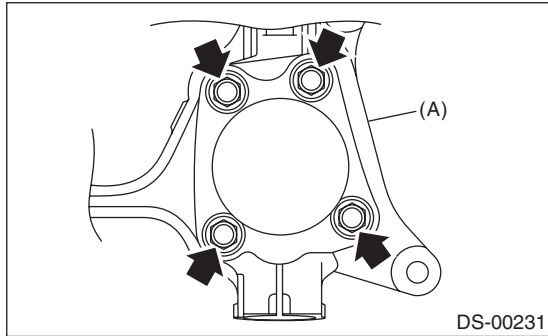
## DRIVE SHAFT SYSTEM

### B: INSTALLATION

1) Place the disc cover between housing and front hub unit, and tighten the four bolts.

**Tightening torque:**

**65 N·m (6.6 kgf·m, 47.9 ft-lb)**



(A) Housing

2) Install the front drive shaft. <Ref. to DS-23, INSTALLATION, Front Drive Shaft.>

3) Tighten the axle nut temporarily.

4) Install the disc rotor to hub.

5) Install the disc brake caliper on the housing.

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft-lb)**

6) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

**Tightening torque:**

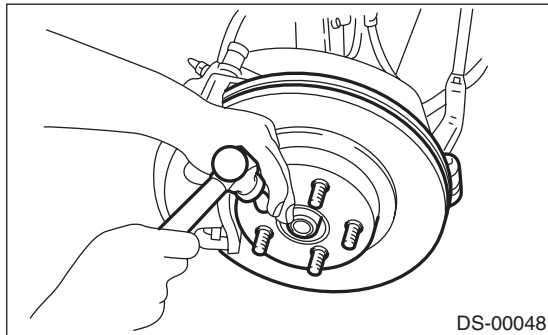
**220 N·m (22.4 kgf·m, 162 ft-lb)**

**CAUTION:**

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.

- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

7) After tightening the axle nut, lock it securely.



8) Install the wheel and tighten the wheel nuts to specified torque.

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft-lb)**

### C: DISASSEMBLY

Using the ST and a hydraulic press, push out the hub bolts.

ST 28399AG000 HUB STAND

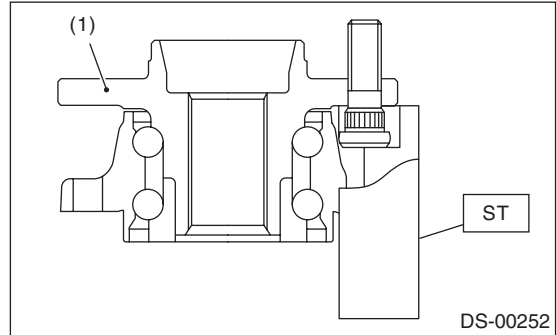
**CAUTION:**

- Be careful not to hammer the hub bolts. This may deform the hub.

- Do not reuse the hub bolt.

**NOTE:**

Since the hub unit bearing can not be disassembled, only hub bolts can be removed.

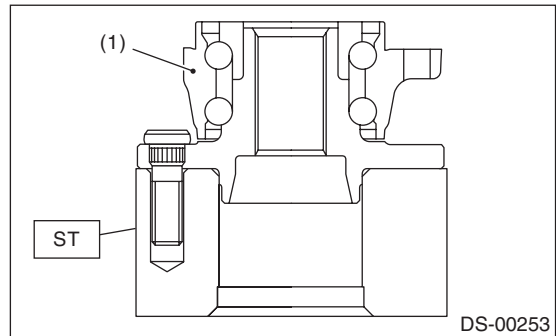


(1) Front hub unit bearing

### D: ASSEMBLY

1) Attach the hub to the ST securely.

ST 927080000 HUB STAND



(1) Front hub unit bearing

2) Using a press, press the new hub bolts until their seating surfaces contact the hub.

**NOTE:**

Use the 12 mm (0.47 in) dia. holes in the HUB STAND to prevent bolts from tilting.

### E: INSPECTION

Refer to "Front Axle" for inspection procedures. <Ref. to DS-16, INSPECTION, Front Axle.>

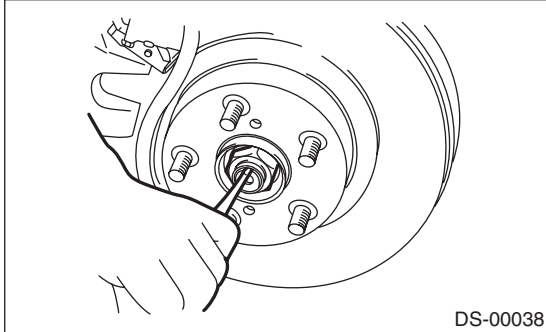
**CAUTION:**

If there is any fault in the bearing, replace hub unit bearing.

## 5. Rear Hub Unit Bearing

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, then remove the rear wheels.
- 3) Lift the crimped section of axle nut.

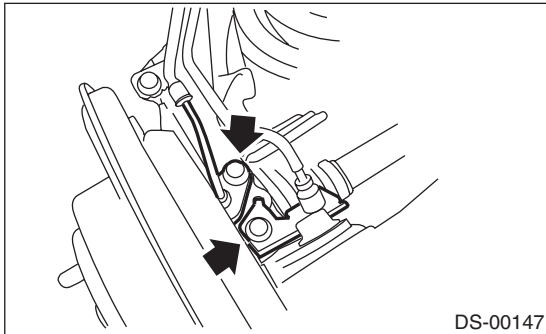


- 4) While applying the parking brake, remove the axle nut using a socket wrench.

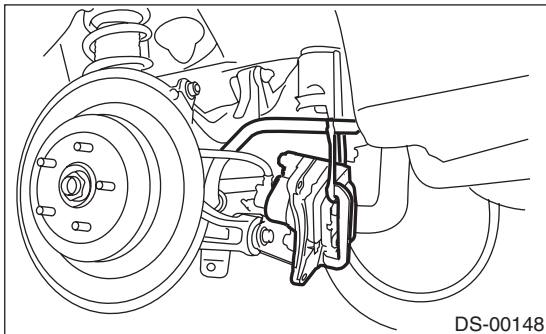
#### CAUTION:

**Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.**

- 5) Release the parking brake.
- 6) Remove the rear ABS wheel speed sensor.



- 7) Remove the disc brake caliper from back plate, and suspend it from the stabilizer using a wire.

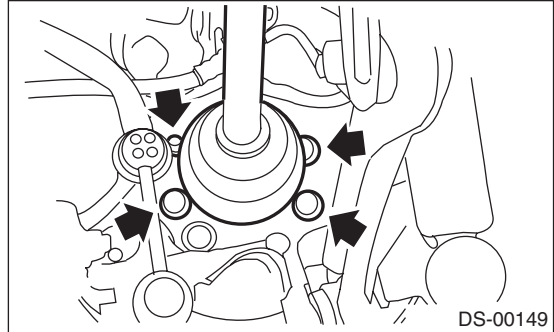


- 8) Remove the disc rotor from the hub.

#### NOTE:

- Mark the mating surface of hub and disc rotor before removing the disc rotor to avoid confusing when installing.
- If it is difficult to remove the disc rotor from the hub, drive the 8 mm bolt into the threaded end of rotor, and then remove the rotor.

- 9) Remove the four bolts from rear arm.



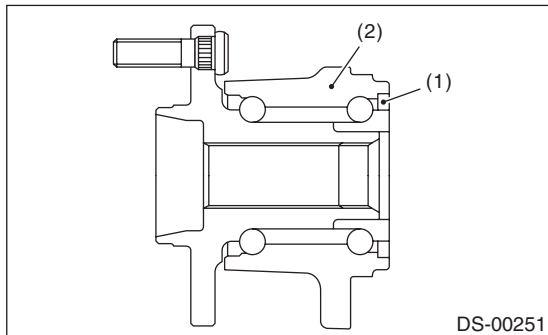
# Rear Hub Unit Bearing

## DRIVE SHAFT SYSTEM

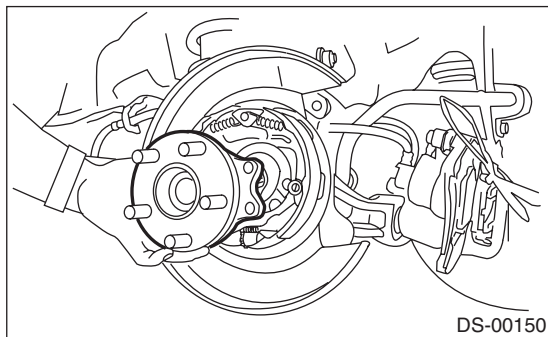
10) Remove the hub unit bearing.

### CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.



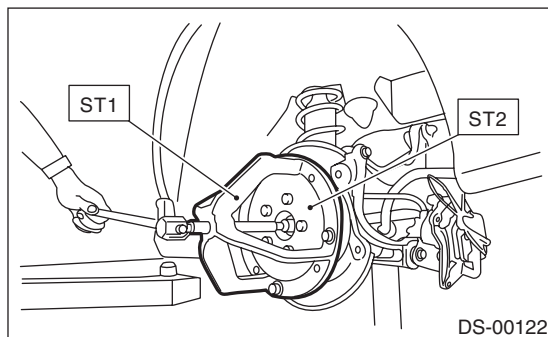
- (1) Magnetic encoder
- (2) Rear hub unit bearing



### NOTE:

If it is hard to remove, use the ST.

- ST1 926470000 AXLE SHAFT PULLER
- ST2 28099PA110 AXLE SHAFT PULLER PLATE

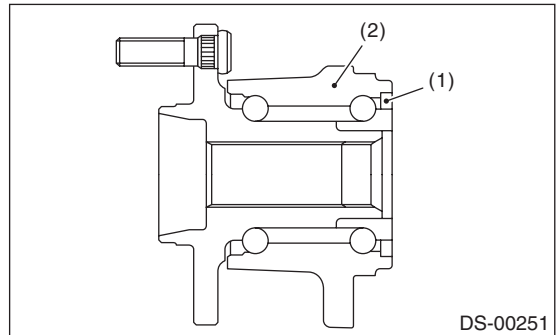


## B: INSTALLATION

1) Aligning the hub unit bearing to the mounting hole of the back plate, install the hub unit assembly and back plate. Tighten the axle nut temporarily.

### CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.

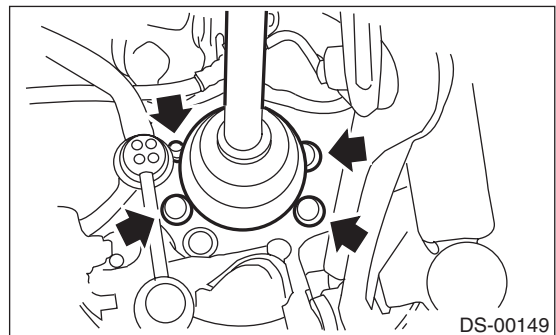


- (1) Magnetic encoder
- (2) Rear hub unit bearing

2) Tighten the four bolts.

### Tightening torque:

**65 N·m (6.6 kgf·m, 47.9 ft·lb)**



3) Remove the axle nut.

4) Draw the rear drive shaft into specified position.

5) Tighten the new axle nut temporarily.

### CAUTION:

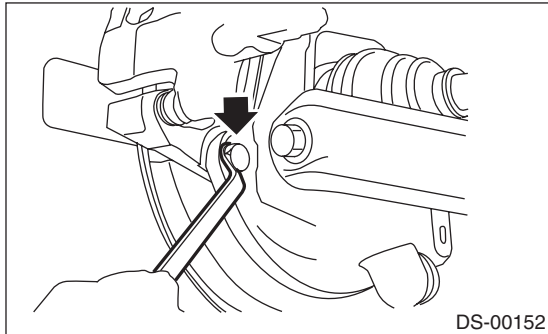
**Use a new axle nut (olive color).**

6) Install the disc rotor to hub.

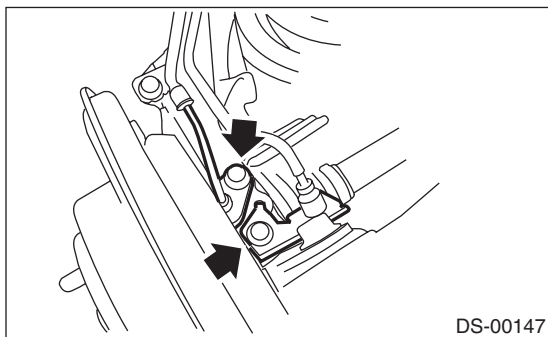
7) Install the disc brake caliper on the back plate.

**Tightening torque:**

**66 N·m (6.7 kgf·m, 48.7 ft·lb)**



8) Install the rear ABS wheel speed sensor and brake cable bracket.



9) Adjust the parking brake lever stroke by turning the adjuster. <Ref. to PB-4, ADJUSTMENT, Parking Brake Lever.>

10) While applying the parking brake and depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

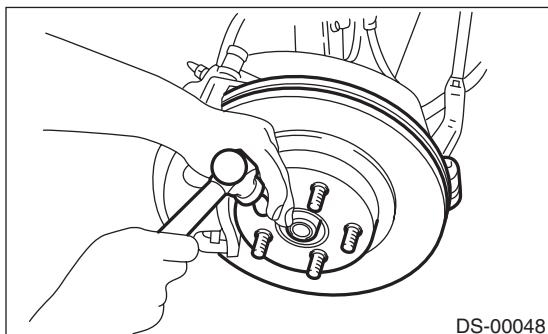
**Tightening torque:**

**240 N·m (24.5 kgf·m, 177 ft·lb)**

**CAUTION:**

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

11) After tightening the axle nut, lock it securely.



12) Install the wheel and tighten the wheel nuts to specified torque.

**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

**C: DISASSEMBLY**

Using the ST and a hydraulic press, push out the hub bolts.

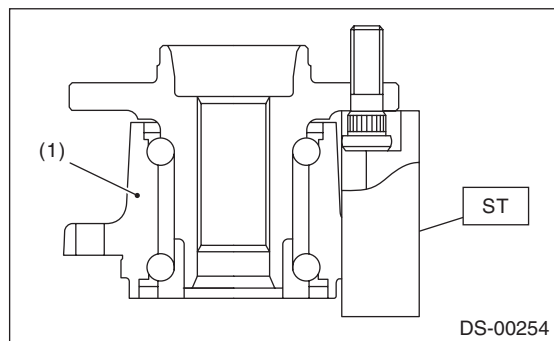
ST 28399AG000 HUB STAND

**CAUTION:**

- Be careful not to hammer the hub bolts. This may deform the hub.
- Do not reuse the hub bolt.

**NOTE:**

Since the hub unit bearing can not be disassembled, only hub bolts can be removed.

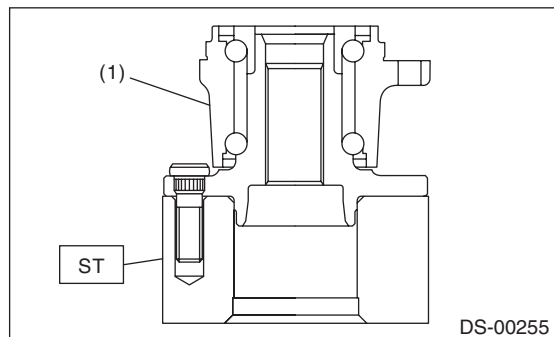


(1) Rear hub unit bearing

**D: ASSEMBLY**

1) Attach the hub to the ST securely.

ST 927080000 HUB STAND



(1) Rear hub unit bearing

2) Using a press, press the new hub bolts until their seating surfaces contact the hub.

**NOTE:**

Use the 12 mm (0.47 in) dia. holes in the HUB STAND to prevent bolts from tilting.

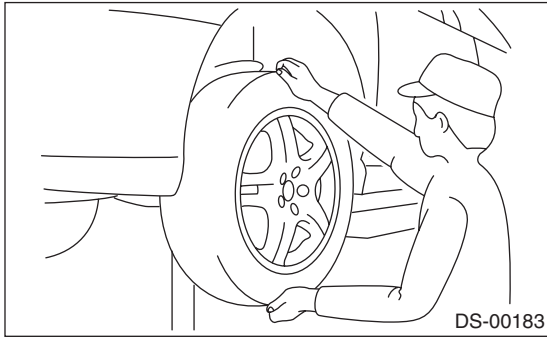
# Rear Hub Unit Bearing

## DRIVE SHAFT SYSTEM

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### E: INSPECTION

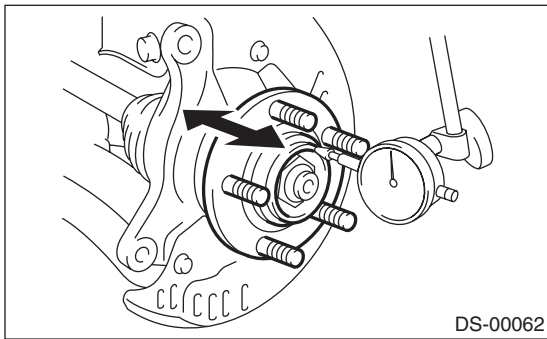
1) Moving the rear tire up and down by hand, check there is no backlash in bearing, and check the wheel rotates smoothly.



2) Inspect the lean of axis direction using a dial gauge. Replace the hub bearing if the play exceeds the limit value.

**Service limit:**

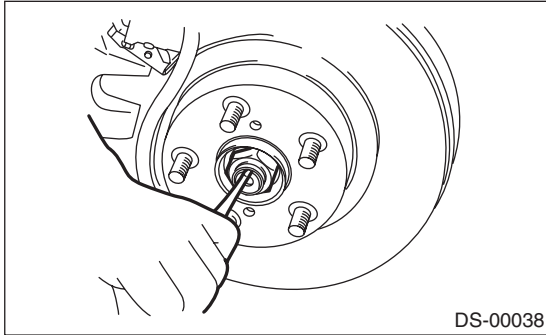
**Maximum: 0.05 mm (0.0020 in)**



## 6. Front Drive Shaft

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, and remove the front wheels.
- 3) Drain the transmission gear oil. (MT model)
- 4) Drain the differential gear oil. (AT model)
- 5) Lift the crimped section of axle nut.

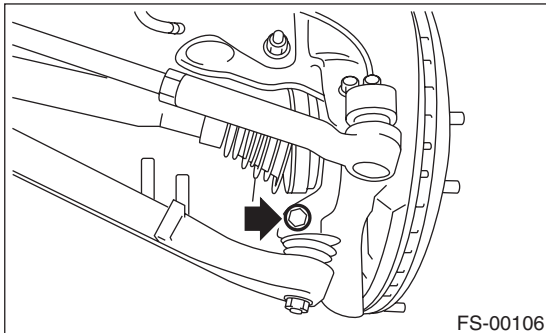


- 6) Remove the axle nut using a socket wrench while depressing the brake pedal.

#### CAUTION:

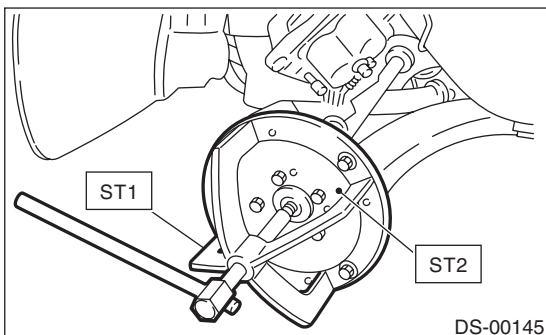
**Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.**

- 7) Remove the stabilizer link from front arm.
- 8) Disconnect the front arm ball joint from the housing.



- 9) Remove the front drive shaft assembly. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER  
ST2 28099PA110 AXLE SHAFT PULLER PLATE



- 10) Using a bar, remove the front drive shaft from transmission.

#### CAUTION:

**Be careful not to allow the bar to damage holder area.**

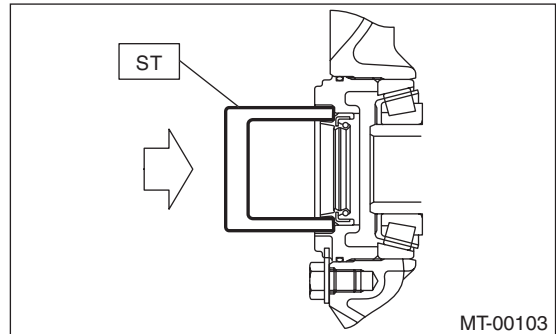
### B: INSTALLATION

- 1) Using the ST, replace the differential side retainer oil seal with a new seal.

ST 18675AA000 DIFFERENTIAL SIDE OIL SEAL INSTALLER

#### NOTE:

After pulling out the drive shaft, be sure to replace with a new oil seal.



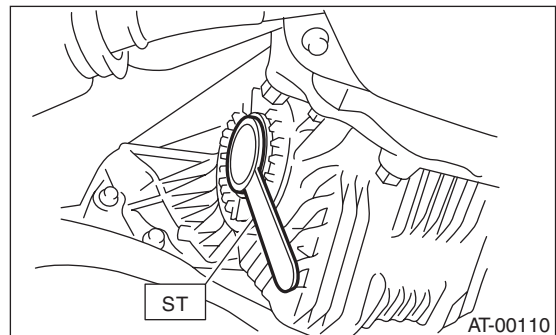
- 2) Insert the EBJ into hub splines.
- 3) Draw the drive shaft into specified position.

#### CAUTION:

**Do not hammer drive shaft when installing it.**

- 4) Tighten the axle nut temporarily.
- 5) Using the ST, install the front drive shaft to transmission.

ST 28399SA010 OIL SEAL PROTECTOR



- 6) Connect the front arm ball joint to the housing.

#### Tightening torque:

**50 N·m (5.1 kgf·m, 36.9 ft·lb)**

# Front Drive Shaft

## DRIVE SHAFT SYSTEM

7) Install the stabilizer link.

### Tightening torque:

**45 N·m (4.6 kgf·m, 33.2 ft·lb)**

### CAUTION:

**Be sure to use a new self-locking nut.**

8) While depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

### Tightening torque:

**220 N·m (22.4 kgf·m, 162 ft·lb)**

### CAUTION:

• **Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.**

• **Be sure to tighten axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.**

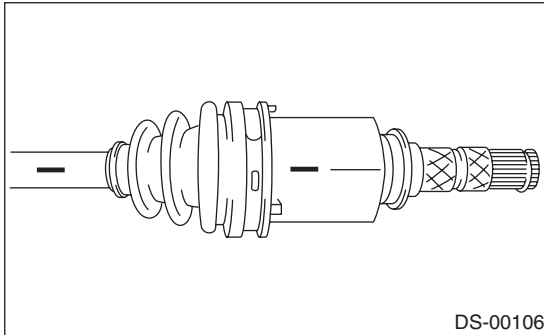
9) After tightening axle nut, lock it securely.

10) Fill the transmission gear oil. (MT model)

11) Fill the differential gear oil. (AT model)

## C: DISASSEMBLY

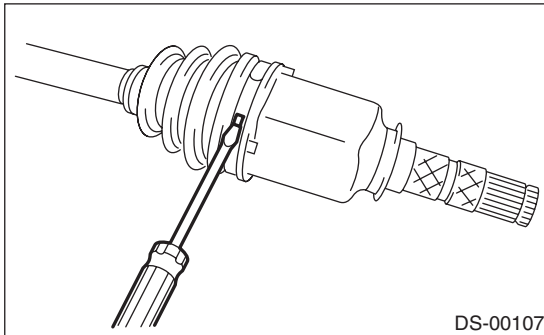
1) Place alignment marks on the shaft and outer race.



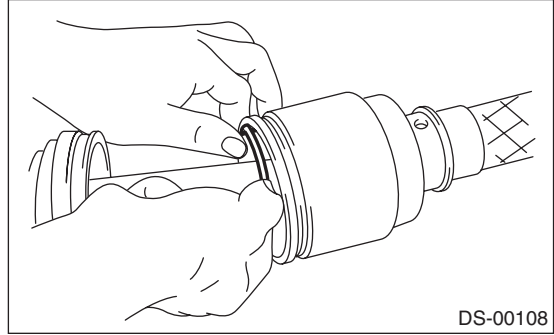
2) Remove the PTJ boot band and boot.

### CAUTION:

**Be careful not to damage the boot.**



3) Remove the snap ring from PTJ outer race.



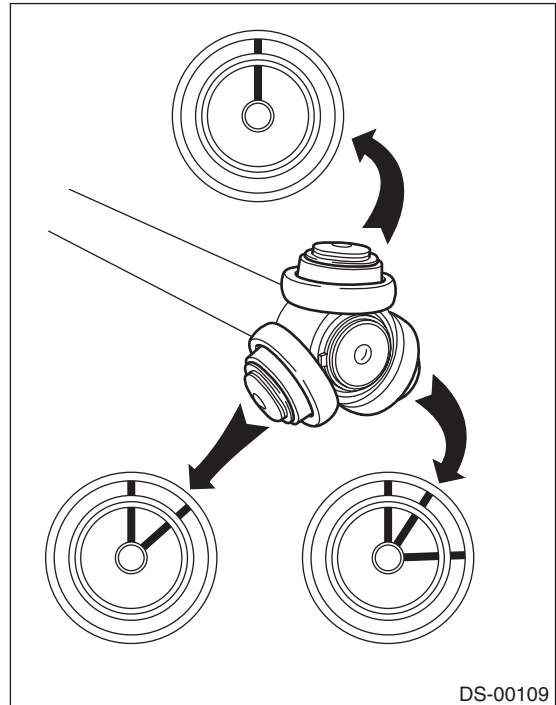
4) Remove the PTJ outer race from shaft assembly.

5) Wipe off grease.

### CAUTION:

**The grease is a special type of grease. Do not mix with other grease.**

6) Place alignment marks on the roller kit and trunnion.

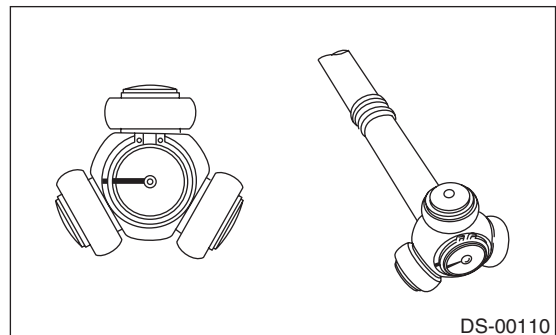


7) Remove the roller kit from trunnion.

### CAUTION:

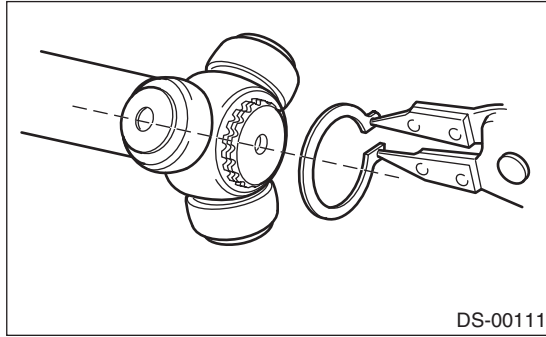
**Be careful with the roller kit position.**

8) Place alignment marks on the trunnion and shaft.





9) Remove the snap ring and trunnion.



**CAUTION:**  
Be sure to wrap shaft splines with vinyl tape to protect the boot from scratches.

10) Remove the PTJ boot.

**NOTE:**

The BJ is a non-disassembly part, so the axle disassembly stops here.

## D: ASSEMBLY

**NOTE:**

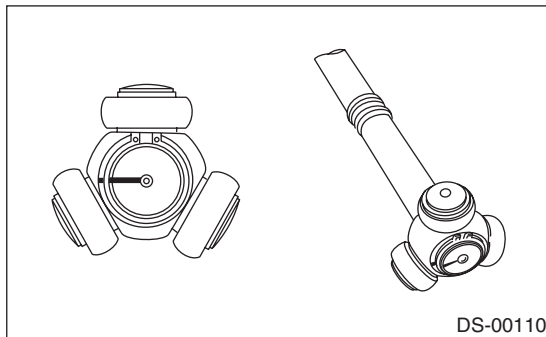
Use specified grease.

**PTJ side:**

**NKG302 (Part No. 28395AG02A)**

1) Place the PTJ boot at the center of shaft.

2) Align alignment marks and install the trunnion on the shaft.



3) Install the snap ring to shaft.

**CAUTION:**

Confirm that the snap ring is completely fitted in shaft groove.

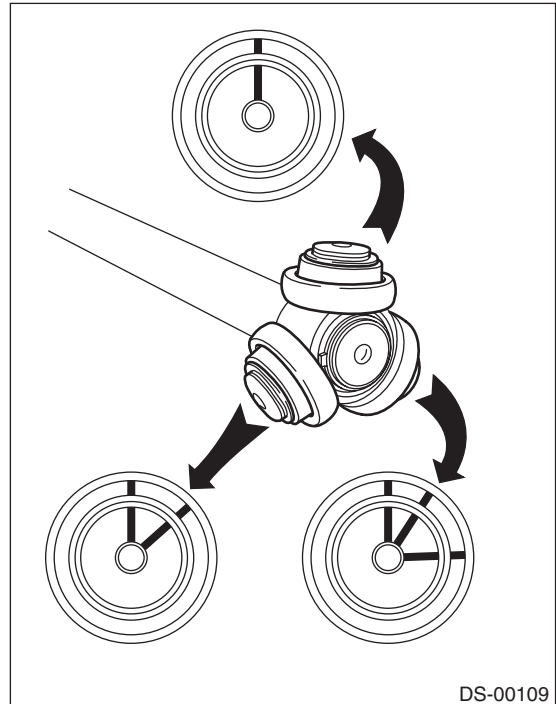
4) Fill 100 to 110 g (3.53 to 3.88 oz) of specified grease into the interior of PTJ outer race.

5) Apply a thin coat of specified grease to the roller kit and trunnion.

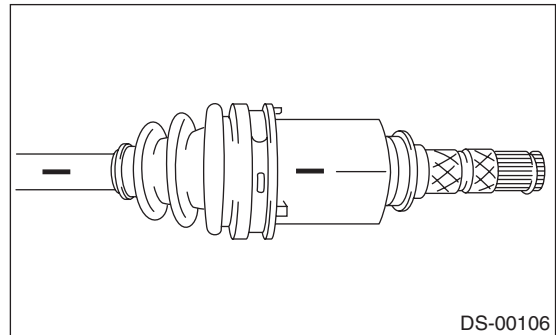
6) Align alignment marks on roller kit and trunnion and install the roller kit.

**CAUTION:**

Be careful with the roller kit position.



7) Align the alignment marks of the shaft and outer race, and install the outer race.



8) Install the snap ring in the groove on PTJ outer race.

**CAUTION:**

Pull the shaft lightly and assure that the snap ring is completely fitted in the groove.

9) Apply an even coat of the specified grease 30 to 40 g (1.06 to 1.41 oz) to the entire inner surface of boot.

10) Install the PTJ boot taking care not to twist it.

**CAUTION:**

- The large end of PTJ boot and the boot groove shall be cleaned completely so as to be free from grease and other substances.

- When installing PTJ boot, position outer race of PTJ at center of its travel.

# Front Drive Shaft

## DRIVE SHAFT SYSTEM

11) Put a new band through the clip and wind twice in the band groove of the boot.

12) Pinch the end of band with pliers. Hold the clip and tighten securely.

### NOTE:

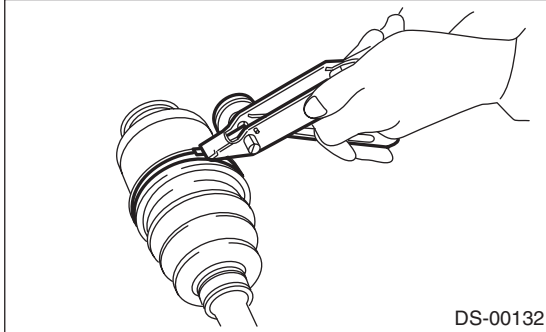
When tightening boot, use care so that the air within the boot is appropriate.

13) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

### NOTE:

Tighten the band until it cannot be moved by hand.

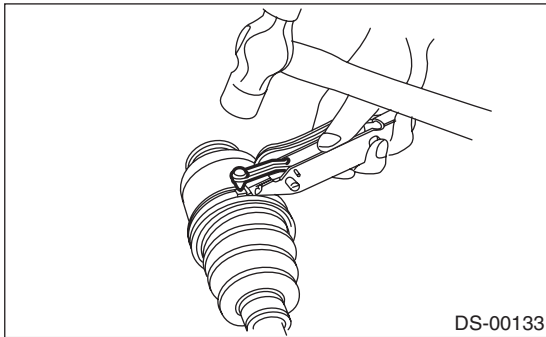


14) Tap the clip with the punch provided at the end of the ST.

ST 925091000 BAND TIGHTENING TOOL

### CAUTION:

Tap to an extent that the boot underneath is not damaged.



15) Cut off the band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

### CAUTION:

Make sure that the end of the band is in close contact with clip.

16) Extend and retract the PTJ to provide equal grease coating.

## E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. If faulty, repair or replace.

- PTJ (pillow tripod joint)

Check for seizure, corrosion, damage, wear and excessive play.

- EBJ (high-efficiency compact ball fixed joint)

Check for seizure, corrosion, damage and excessive play.

- Shaft

Check for excessive bending, twisting, damage and wear.

- Boot

Check for wear, warping, breakage and scratches.

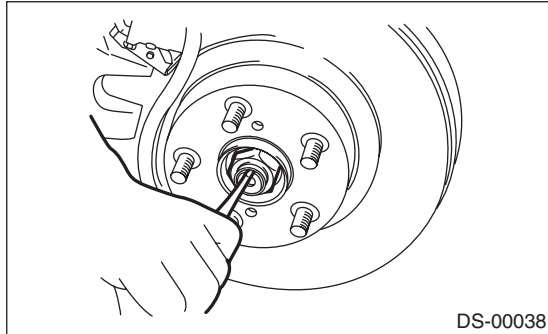
- Grease

Check for discoloration and fluidity.

## 7. Rear Drive Shaft

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, then remove the rear wheels.
- 3) Lift the crimped section of axle nut.



- 4) While applying the parking brake, remove the axle nut using a socket wrench.

#### CAUTION:

**Remove the wheel before loosening the axle nut. Failure to follow this rule may damage the wheel bearings.**

- 5) Remove the rear differential assembly.

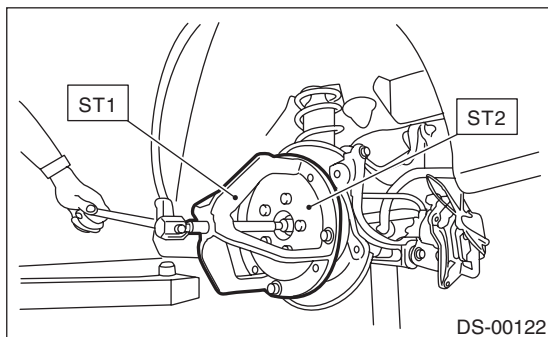
- T-type  
<Ref. to DI-31, REMOVAL, Rear Differential (T-type).>
- VA-type  
<Ref. to DI-60, REMOVAL, Rear Differential (VA-type).>

- 6) Remove the axle nut and rear drive shaft. If it is hard to remove, use ST1 and ST2.

ST1 926470000 AXLE SHAFT PULLER  
ST2 927140000 AXLE SHAFT PULLER  
PLATE

#### CAUTION:

- Do not hammer drive shaft when removing.
- Do not damage the oil seal and magnetic encoder.

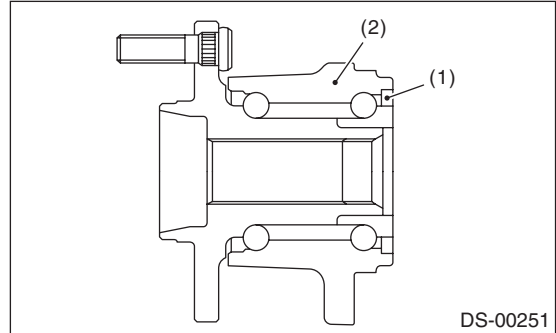


### B: INSTALLATION

- 1) Insert the BJ or EBJ into the rear hub splines.

#### CAUTION:

- Be careful not to damage the magnetic encoder.
- Do not get closer the tool which charged magnetism to magnetic encoder.



- (1) Magnetic encoder  
(2) Rear hub unit bearing

- 2) Draw the rear drive shaft into specified position.

#### CAUTION:

**Do not hammer drive shaft when installing it.**

- 3) Tighten the axle nut temporarily.
- 4) Install the rear differential assembly.
  - T-type  
<Ref. to DI-32, INSTALLATION, Rear Differential (T-type).>
  - VA-type  
<Ref. to DI-61, INSTALLATION, Rear Differential (VA-type).>

- 5) While applying the parking brake and depressing the brake pedal, tighten a new axle nut to the specified torque and lock it securely.

#### Tightening torque:

**240 N·m (24.5 kgf-m, 177 ft-lb)**

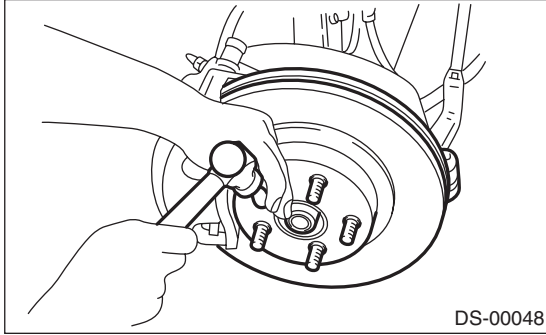
#### CAUTION:

- Install the wheel after installation of axle nut. Failure to follow this rule may damage the wheel bearing.
- Be sure to tighten the axle nut to specified torque. Do not overtighten it as this may damage the wheel bearing.

# Rear Drive Shaft

## DRIVE SHAFT SYSTEM

6) Lock the axle nut securely.



7) Install the wheel.

**Tightening torque:**

**120 N·m (12.2 kgf-m, 88.5 ft-lb)**

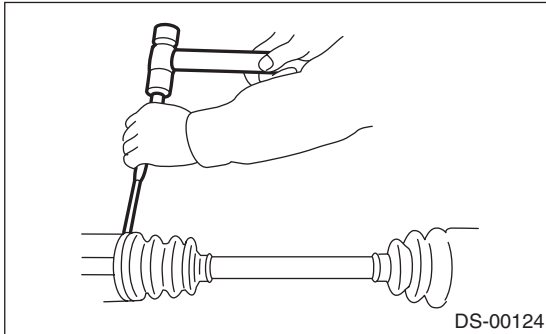
### C: DISASSEMBLY

1) Straighten the bent claw at the larger end of the DOJ boot.

2) Loosen the band by means of screwdriver or pliers.

**CAUTION:**

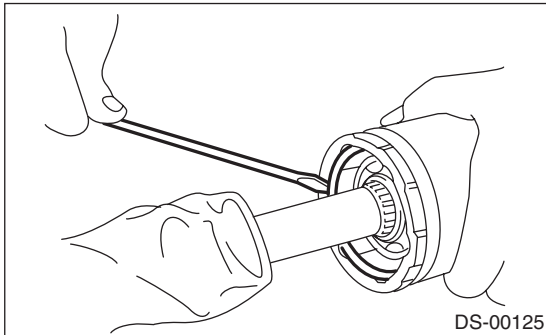
**Be careful not to damage the boot.**



3) Remove the boot band on the small end of DOJ boot in the same manner.

4) Remove the larger end of DOJ boot from DOJ outer race.

5) Pry and remove the round circlip at the neck of DOJ outer race with a screwdriver.



6) Take out the DOJ outer race from the shaft assembly.

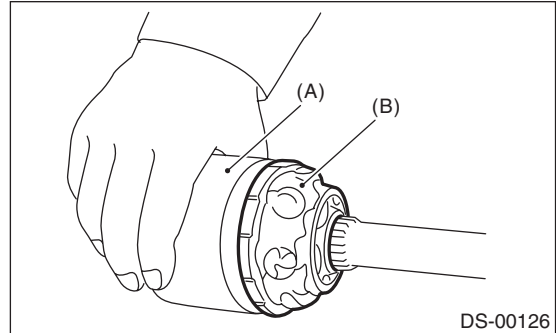
7) Wipe off the grease and take out the ball bearings.

**CAUTION:**

**The grease is a special grease (grease for constant velocity joints). Do not mix with other greases.**

**NOTE:**

Disassemble exercising care not to lose balls (6 pcs).



(A) Outer race

(B) Grease

8) To remove the cage from inner race, turn the cage by a half pitch to the track groove of inner race and shift the cage.

9) Using pliers, remove the snap ring fixing the inner race to the shaft.

10) Take out the DOJ inner race.

11) Take off the DOJ cage from shaft and remove the DOJ boot.

**CAUTION:**

**Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.**

12) Remove the BJ boot or EBJ boot in the same procedure as the DOJ boot.

**NOTE:**

Further disassembly of axle is impossible because the BJ and EBJ cannot be disassembled.

## D: ASSEMBLY

**NOTE:**

Use specified grease.

**BJ, EBJ side:**

**NKG106 (Part No. 28395AG04A)**

**DOJ side:**

**NKG205 (Part No. 28495AG00A)**

1) Install the BJ or EBJ boot in specified position, and fill it with 60 to 70 g (2.12 to 2.47 oz.) of specified grease.

2) Place the DOJ boot at the center of shaft.

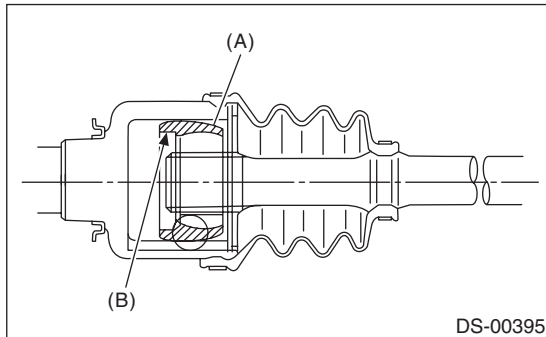
**CAUTION:**

**Be sure to wrap shaft splines with vinyl tape to prevent boot from scratches.**

3) Insert the DOJ cage onto shaft.

**NOTE:**

Insert the cage with the cutout portion facing the shaft end, since the cage has an orientation.

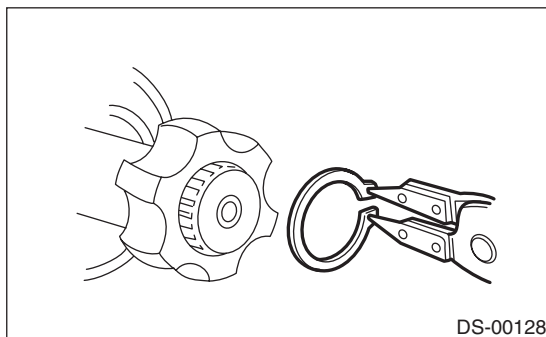


(A) Cage  
(B) Cutout portion

4) Install the DOJ inner race on shaft and fix the snap ring in place with pliers.

**NOTE:**

Confirm that the snap ring is completely fitted in the shaft groove.

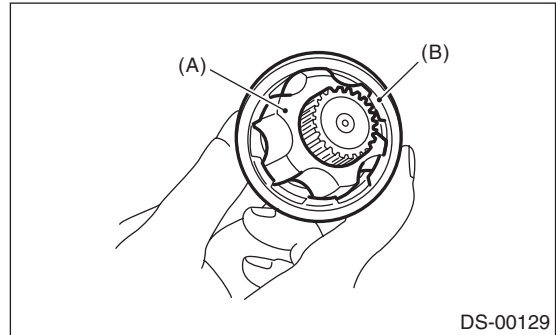


DS-00128

5) Install the cage to inner race fixed upon shaft.

**NOTE:**

Fit the cage with the protruding section aligned with the track on the inner race, and turn by a half pitch.



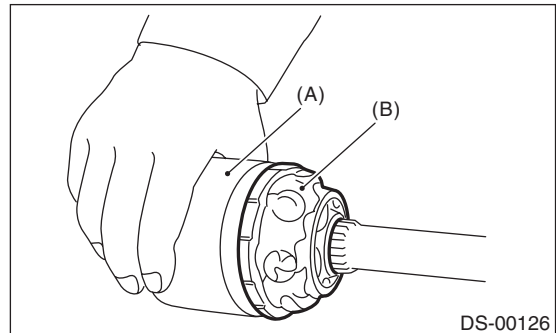
(A) Inner race  
(B) Cage

6) Fill 80 to 90 g (2.82 to 3.17 oz) of specified grease into the inner side of the DOJ outer race.

7) Apply a thin coat of specified grease to the cage pocket and six ball bearings.

8) Insert the six ball bearings into the cage pocket.

9) Align the outer race track and ball positions, and place the shaft, inner race, cage and ball bearings in the original positions, and then fix outer race in place.



(A) Outer race  
(B) Grease

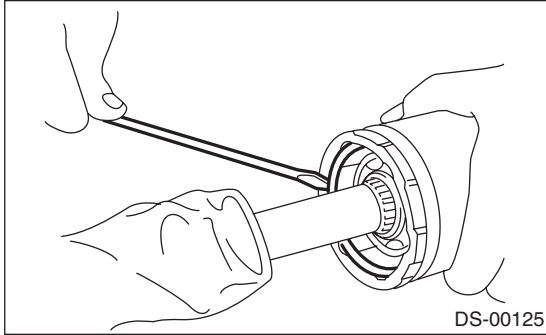
# Rear Drive Shaft

## DRIVE SHAFT SYSTEM

10) Install the snap ring in the groove on the DOJ outer race.

**NOTE:**

- Assure that the balls, cage and inner race are completely fitted in the outer race of DOJ.
- Use care not to place the matched position of snap ring in the ball groove of outer race.
- Pull the shaft lightly and assure that the circlip is completely fitted in the groove.



11) Apply an even coat of the specified grease [20 to 30 g (0.71 to 1.06 oz)] to the entire inner surface of boot. Also apply grease to the shaft.

12) Install the DOJ boot taking care not to twist it.

**NOTE:**

- The inside of the larger end of DOJ boot and the boot groove shall be cleaned so as to be free from grease and other substances.
- When installing the DOJ boot, position the outer race of DOJ at center of the stroke.

13) Put a new band through the clip and wind twice in the band groove of the boot.

14) Pinch the end of band with pliers. Hold the clip and tighten securely.

**NOTE:**

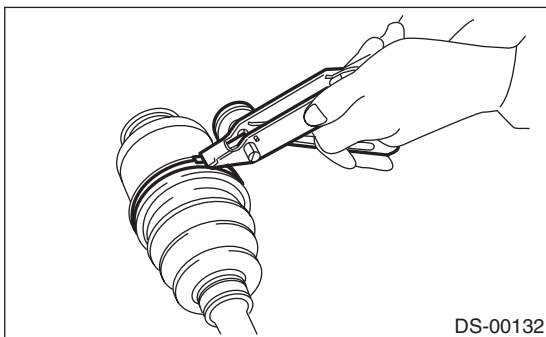
When tightening boot, use care so that the air within the boot is appropriate.

15) Tighten the band using the ST.

ST 925091000 BAND TIGHTENING TOOL

**NOTE:**

Tighten the band until it cannot be moved by hand.

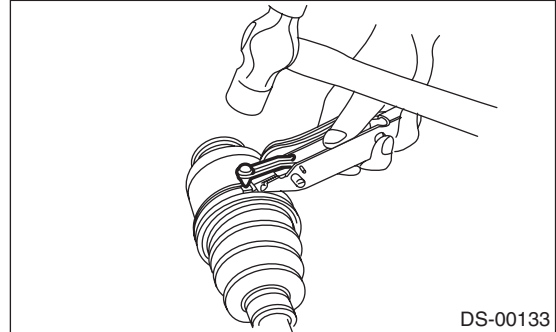


16) Tap the clip with the punch provided at the end of the ST.

ST 925091000 BAND TIGHTENING TOOL

**NOTE:**

Tap to an extent that the boot underneath is not damaged.



17) Cut off the band with an allowance of about 10 mm (0.39 in) left from the clip and bend this allowance over the clip.

**NOTE:**

Be careful so that the end of the band is in close contact with clip.

18) Install the BJ boot or EBJ boot in the same procedure as a DOJ boot.

19) Extend and retract the DOJ repeatedly to provide an equal coating of grease.

## E: INSPECTION

Check the removed parts for damage, wear, corrosion etc. Repair or replace if defective.

- DOJ (Double Offset Joint)

Check for seizure, corrosion, damage, wear and excessive play.

- EBJ (High-efficiency Compact Ball Fixed Joint)

Check for seizure, corrosion, damage, wear and excessive play.

- Shaft

Check for excessive bending, twisting, damage and wear.

- BJ (Bell Joint)

Check for seizure, corrosion, damage and excessive play.

- Boot

Check for wear, warping, breakage and scratches.

- Grease

Check for discoloration and fluidity.

## 8. General Diagnostic Table

### A: INSPECTION

**NOTE:**

Vibration while cruising may be caused by an unbalanced tire, improper tire inflation pressure, improper wheel alignment, etc.

Symptoms	Possible cause	Corrective action
<b>Noise or vibration from propeller shaft</b>	Center bearing	Check the center bearing. <Ref. to DS-12, CENTER BEARING FREE PLAY, INSPECTION, Propeller Shaft.>
	Runout of propeller shaft	Check for deflection of the propeller shaft. <Ref. to DS-12, RUNOUT OF PROPELLER SHAFT, INSPECTION, Propeller Shaft.>
	Loose or gap at connections	Check the joints and connectors. <Ref. to DS-12, JOINTS AND CONNECTIONS, INSPECTION, Propeller Shaft.> Check the spline and bearing. <Ref. to DS-12, SPLINES AND BEARING, INSPECTION, Propeller Shaft.>
<b>Abnormal wheel vibration</b>	Wheel is out of balance.	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-7, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-25, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-16, INSPECTION, Rear Shock Absorber.>
	Front drive shaft	Check the front drive shaft. <Ref. to DS-26, INSPECTION, Front Drive Shaft.>
	Rear drive shaft	Check the rear drive shaft. <Ref. to DS-30, INSPECTION, Rear Drive Shaft.>
	Front hub unit bearing	Check the front hub unit bearing. <Ref. to DS-18, INSPECTION, Front Hub Unit Bearing.>
	Rear hub unit bearing	Check the rear hub unit bearing. <Ref. to DS-22, INSPECTION, Rear Hub Unit Bearing.>
<b>Noise from the underbody</b>	Wheel is out of balance.	Check the wheel balance. <Ref. to WT-9, ADJUSTMENT, Wheel Balancing.>
	Front wheel alignment	Check the front wheel alignment. <Ref. to FS-8, INSPECTION, Wheel Alignment.>
	Rear wheel alignment	Check the rear wheel alignment. <Ref. to RS-7, INSPECTION, Wheel Alignment.>
	Front strut	Check the front strut. <Ref. to FS-25, INSPECTION, Front Strut.>
	Rear shock absorber	Check the rear shock absorber. <Ref. to RS-16, INSPECTION, Rear Shock Absorber.>

# General Diagnostic Table

DRIVE SHAFT SYSTEM

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# General Description

ABS

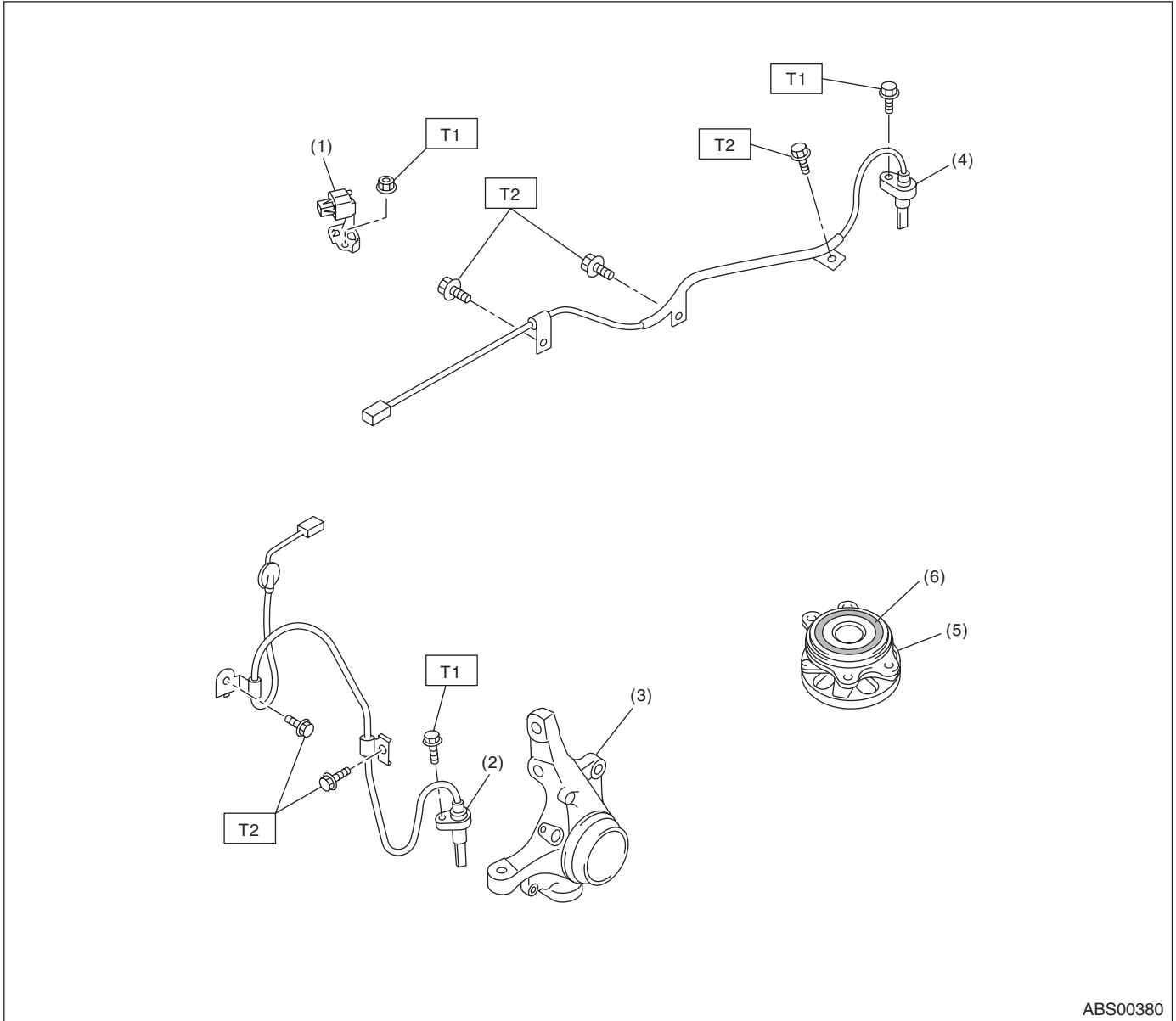
## 1. General Description

### A: SPECIFICATION

Item			Specification or identification	
ABS wheel speed sensor	ABS wheel speed sensor gap (for reference)		Front	0.77 — 1.43 mm (0.030 — 0.056 in)
			Rear	0.64 — 1.56 mm (0.025 — 0.061 in)
	Identifications of harness (marks, color)	Front	RH	K1 (White)
			LH	K2 (Yellow)
		Rear	RH	K5 (White)
			LH	K6 (Yellow)
G sensor	G sensor voltage		2.3±0.2 V	
ABSCM&H/U identification	AT (Except for OUTBACK)		J9	
	MT (Except for OUTBACK)		JA	
	AT (OUTBACK)		JB	
	MT (OUTBACK)		JE	

## B: COMPONENT

### 1. ABS WHEEL SPEED SENSOR



ABS00380

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| (1) G sensor                        | (4) Rear ABS wheel speed sensor LH |
| (2) Front ABS wheel speed sensor LH | (5) Hub unit bearing               |
| (3) Front housing                   | (6) Magnetic encoder               |

**Tightening torque: N·m (kgf·m, ft·lb)**

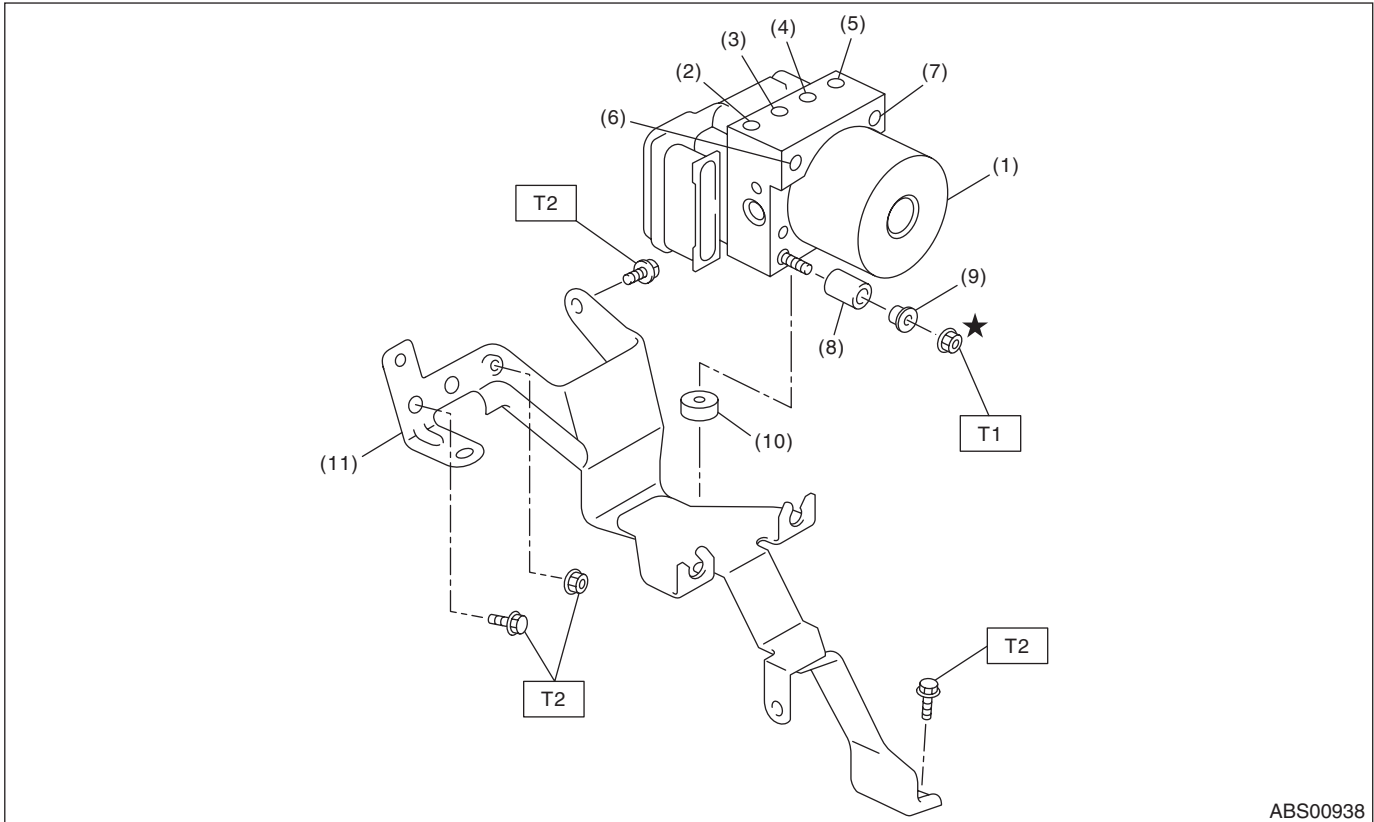
**T1: 7.5 (0.76, 5.5)**

**T2: 33 (3.3, 24)**

# General Description

ABS

## 2. ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)



ABS00938

- |   |                     |              |
|---|---------------------|--------------|
| (1) ABS control module and hydraulic control unit (ABSCM&H/U) | (6) Primary inlet   | (11) Bracket |
| (2) Front outlet RH   | (7) Secondary inlet |              |
| (3) Rear outlet LH  | (8) Damper          |              |
| (4) Rear outlet RH  | (9) Spacer          |              |
| (5) Front outlet LH   | (10) Damper         |              |

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**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

**T2: 33 (3.3, 24)**

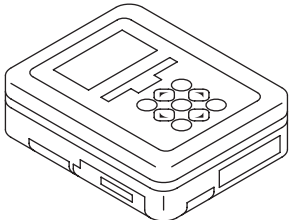
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### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Pressure gauge	Used for measuring oil pressure.
Oscilloscope	Used for measuring the sensor.
TORX® bit E5	Used for replacing the ABSCM.

# ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)

ABS

## 2. ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Use compressed air to remove water and dust around the ABSCM&H/U.

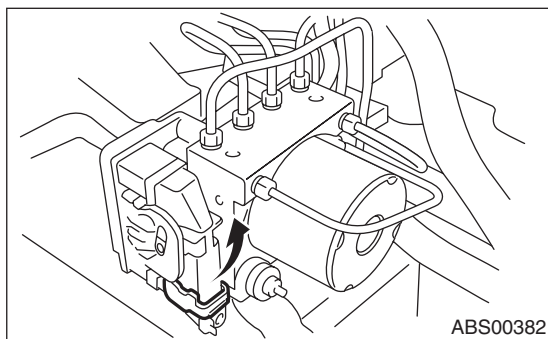
#### NOTE:

If the terminals become dirty, it may cause improper contact.

- 3) Lift the lock lever and disconnect the ABSCM&H/U connector.

#### CAUTION:

**Do not pull on the harness when disconnecting the connector.**



- 4) Remove the harness clip.
- 5) Disconnect the brake pipes from the ABSCM&H/U.
- 6) Wrap the brake pipe with a vinyl bag so as not to spill the brake fluid on the vehicle body.

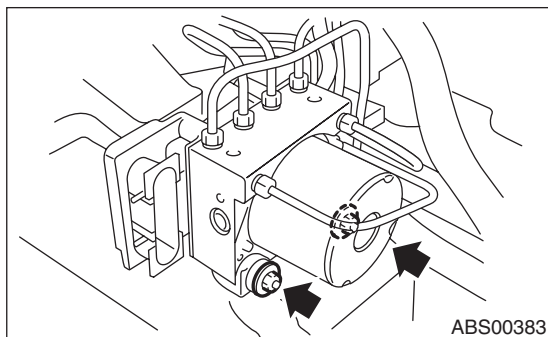
#### CAUTION:

**If brake fluid is spilled on the vehicle body, wash it off immediately with water and wipe clean.**

- 7) Remove the nuts and remove the ABSCM&H/U.

#### CAUTION:

- Do not drop or bump the ABSCM&H/U.
- Do not turn the ABSCM&H/U upside down or place it sideways for storage.
- Be careful not to let foreign matter enter into ABSCM&H/U.
- Be careful that no water enters the connectors.



- 8) Remove the ABSCM&H/U bracket.

### B: INSTALLATION

- 1) Install the ABSCM&H/U bracket.

#### Tightening torque:

**33 N·m (3.3 kgf·m, 24 ft·lb)**

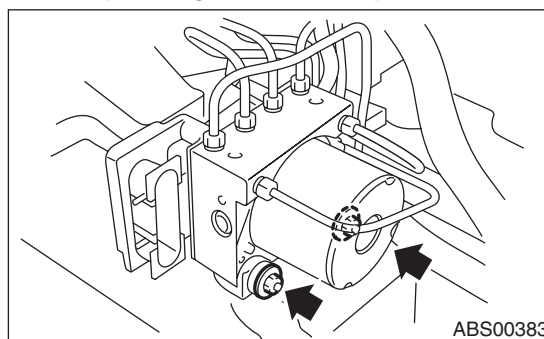
- 2) Align the damper groove of the ABSCM&H/U to the bracket side claw, and install the ABSCM&H/U with new nuts (Part No. 023506000).

#### NOTE:

Check the identification marks of the ABSCM&H/U.

#### Tightening torque:

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**



- 3) Connect the brake pipes to their correct ABSCM&H/U positions.

#### Tightening torque:

**15 N·m (1.5 kgf·m, 10.8 ft·lb)**

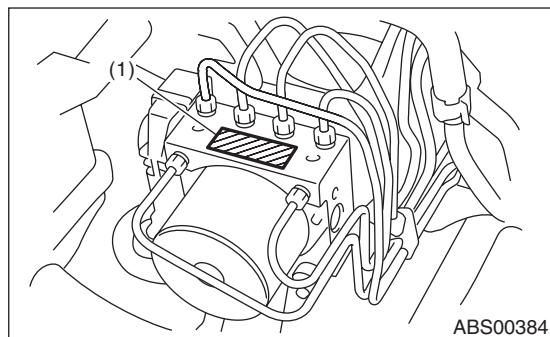
- 4) Using a harness clip, secure the ABSCM&H/U harness to the bracket.
- 5) Connect the connector to the ABSCM&H/U.

#### NOTE:

- Be sure to remove all foreign matter from inside the connector before connecting.
  - Make sure the ABSCM&H/U connector is securely locked.
- 6) Bleed air from the brake system.

## C: INSPECTION

- 1) Check the condition of connection and settlement of connector.
- 2) Check the mark used for ABSCM&H/U identification. Refer to "SPECIFICATION" for the identification mark. <Ref. to ABS-2, SPECIFICATION, General Description.>



(1) Identification mark

### 1. CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE

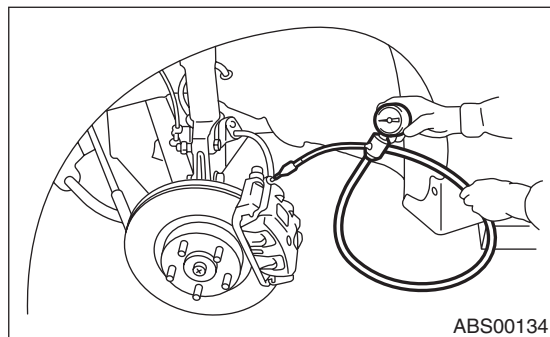
- 1) Lift up the vehicle, and remove the wheels.
- 2) Remove the air bleeder screws from FL and FR caliper bodies.
- 3) Connect two pressure gauges to FL and FR caliper bodies.

#### CAUTION:

- Use a pressure gauge used exclusively for brake fluid measurement.
- Do not use the pressure gauge used for the measurement of transmission oil. Doing so will cause the piston seal to expand and deform.

#### NOTE:

Wrap sealing tape around the pressure gauge.



- 4) Bleed air from the pressure gauges and the FL and FR caliper bodies.
- 5) Perform ABS sequence control. <Ref. to ABS-10, ABS Sequence Control.>
- 6) When the hydraulic unit begins to work, first the FL side performs decompression, hold and compression, and then the FR side performs decompression, hold and compression.

- 7) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets the standard values. Depress the brake pedal and check that the kick-back is normal, and tightness is normal.

	Front wheel	Rear wheel
Initial value	3,500 kPa (36 kgf/cm <sup>2</sup> , 511 psi)	3,500 kPa (36 kgf/cm <sup>2</sup> , 511 psi)
When depressurized	500 kPa (5 kgf/cm <sup>2</sup> , 73 psi) or less	500 kPa (5 kgf/cm <sup>2</sup> , 73 psi) or less
When pressurized	3,500 kPa (36 kgf/cm <sup>2</sup> , 511 psi) or more	3,500 kPa (36 kgf/cm <sup>2</sup> , 511 psi) or more

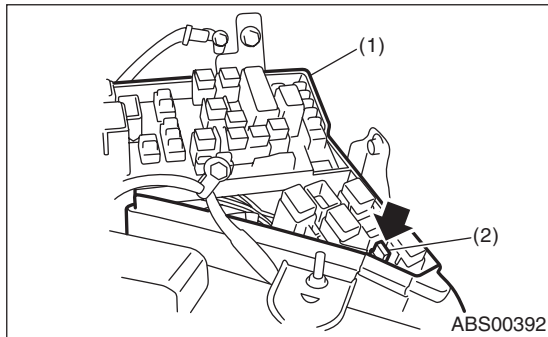
- 8) Disconnect the pressure gauges from FL and FR caliper bodies.
- 9) Install the air bleeder screws of FL and FR caliper bodies.
- 10) Remove the air bleeder screws from RL and RR caliper bodies.
- 11) Connect two pressure gauges to RL and RR caliper bodies.
- 12) Bleed air from the brake system.
- 13) Bleed air from RL and RR caliper bodies, and pressure gauge.
- 14) Perform ABS sequence control. <Ref. to ABS-10, ABS Sequence Control.>
- 15) When the hydraulic unit begins to work, first the RR side performs decompression, hold and compression, and then the RL side performs decompression, hold and compression.
- 16) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets specification. Depress the brake pedal and check that the kick-back is normal, and tightness is normal.
- 17) Disconnect the pressure gauge from the RL and RR caliper bodies.
- 18) Install the air bleeder screws of RL and RR caliper bodies.
- 19) Bleed air from the brake system.

# ABS Control Module and Hydraulic Control Unit (ABSCM&H/U)

ABS

## 2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER

1) Install the spare fuse to the FWD connector located in the main fuse box for models without AT VTD.



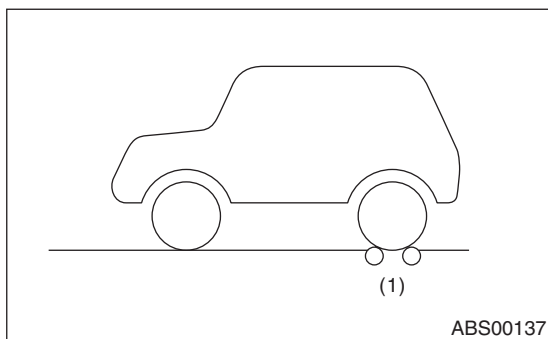
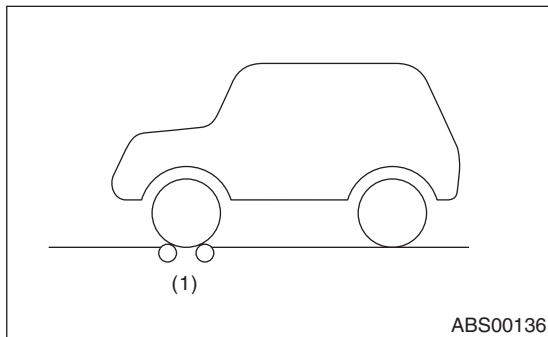
- (1) Main fuse box
- (2) FWD connector

2) Since the MT model and AT VTD model cannot cut off the AWD circuit, set the wheels other than the measured one on free rollers.

3) Prepare for ABS sequence control.

<Ref. to ABS-10, ABS Sequence Control.>

4) Set the front wheels or rear wheels on the brake tester and set the gear to "neutral".



- (1) Brake tester

5) Operate the brake tester.

6) Perform ABS sequence control.

<Ref. to ABS-10, ABS Sequence Control.>

7) When the hydraulic unit begins to work, check the following work sequence.

(1) The FL wheel performs decompression, hold and compression in sequence, and subsequently the FR wheel repeats the cycle.

(2) The RR wheel performs decompression, hold and compression in sequence, and subsequently the RL wheel repeats the cycle.

8) Read values indicated on the brake tester and check if the fluctuation of the values between decompression and compression meets specification.

	Front wheel	Rear wheel
Initial value	1,000 N (102 kgf, 225 lb)	1,000 N (102 kgf, 225 lb)
When depressurized	500 N (51 kgf, 112 lb) or less	500 N (51 kgf, 112 lb) or less
When pressurized	1,000 N (102 kgf, 225 lb) or more	1,000 N (102 kgf, 225 lb) or more

9) After the inspection, depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

## D: REPLACEMENT

### CAUTION:

- Because the seal of the ABSCM cannot be replaced, do not pull or peel it by lifting it up.
- Because the screw of the H/U will become slightly worn in every replacement procedure, 5 times is the maximum number of times for replacement. If a problem is found such as not being able to torque the screw to specifications even before 5 replacement operations are performed, replace the H/U body.
- When installing the ABSCM, always use new screws.
- When the sealing surface of the ABSCM or H/U is dirty or damaged and it cannot be removed or repaired, replace with a new part.

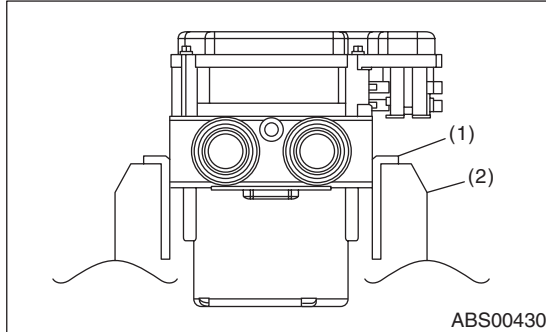
1) Remove the ABSCM&H/U bracket. <Ref. to ABS-6, REMOVAL, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

2) To prevent entry of foreign objects and brake fluid leakage, plug the oil pressure port of the ABSCM&H/U using a screw plug, etc.

3) Set the pump motor section of the removed AB-SCM&H/U face down on a vise.

**NOTE:**

Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.

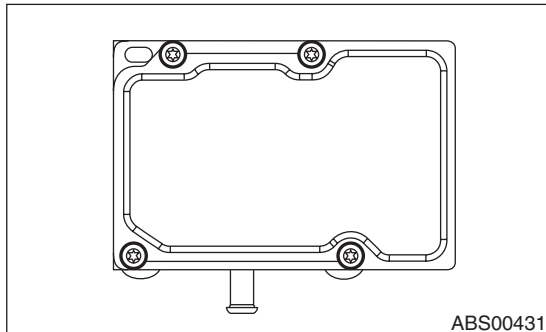


- (1) Aluminum plate, etc.
- (2) Vise

4) Using TORX® bit E5, remove the four screws of ABSCM.

**NOTE:**

These screws cannot be reused.



5) Slowly pull out the ABSCM upward from the H/U.

**NOTE:**

To prevent damaging of coil section, remove the ABSCM straight up from H/U without twisting.

6) Make sure there is no dirt or damage on the sealing surface of the H/U.

**CAUTION:**

- Do not clean the ABSCM and H/U by applying compressed air.
- Even if damage is found on the H/U seal, do not attempt repair by filing or with a metal scraper. To remove the seal residue, always use a plastic scraper. Do not use chemical such as paint thinner, etc., to clean.

7) Position the coil of the new ABSCM to align with the H/U valve.

8) To prevent deformation of the ABSCM housing cover, hold the corner of ABSCM and install it to the H/U without tilting.

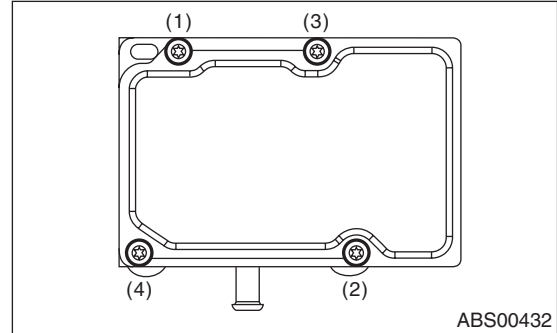
9) Using a TORX® bit E5, attach/tighten new screws in the order of (1) through (4).

**CAUTION:**

**Always use new screws.**

**Tightening torque:**

**1.5 N·m (0.15 kgf·m, 1.1 ft-lb)**



10) Check that there is no foreign matter in mating surface between the ABSCM and H/U.

11) Using a TORX® bit E5, tighten the screws in the order of (1) through (4) again.

**Tightening torque:**

**3 N·m (0.3 kgf·m, 2.2 ft-lb)**

12) Check that there is no gap in the mating surface between ABSCM and H/U.

13) Install the ABSCM&H/U to the vehicle.



## 3. ABS Sequence Control

### A: OPERATION

- 1) While the ABS sequence control is being performed, the operation of the hydraulic unit can be checked using the brake tester or pressure gauge after the hydraulic unit solenoid valve operation.
- 2) ABS sequence control can be started by the Subaru Select Monitor.

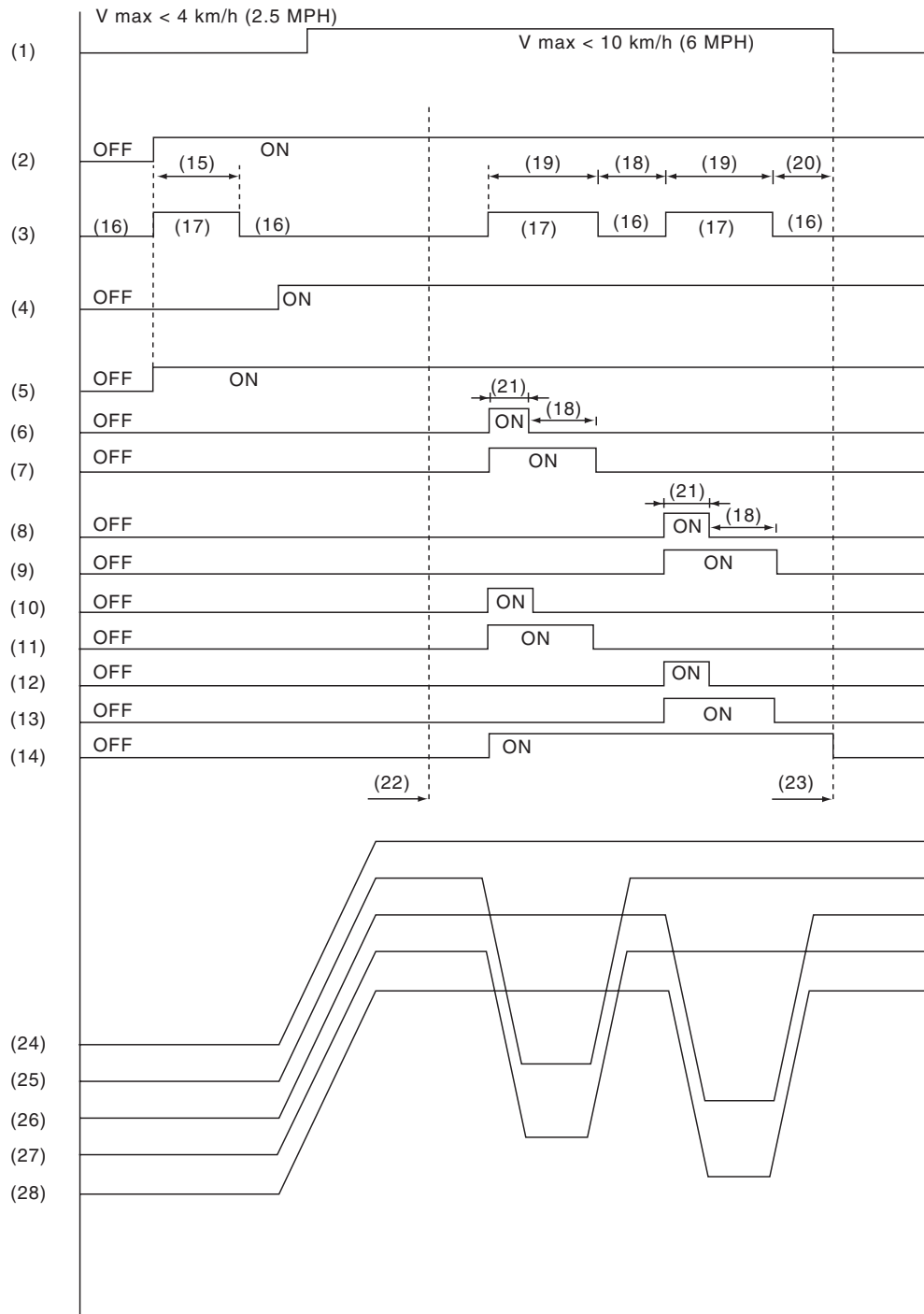
#### 1. ABS SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

**NOTE:**

In the event of any trouble, the ABS sequence control will not operate.

- 1) Connect the Subaru Select Monitor to data link connector under the driver's side instrument panel lower cover.
- 2) Turn the ignition switch to ON.
- 3) Run the Subaru Select Monitor.
- 4) Set the Subaru Select Monitor to "Brake Control" mode.
- 5) When the "Function check sequence" is selected, the "ABS sequence control" will start.
- 6) Execute the following operations when the message "Press the brake pedal so that the brake pedal force is between 100 and 150 kgf" is displayed.
  - (1) [When the brake tester is used, press brake pedal pad with a force of 1,000 N (102 kgf, 225 lb). ]
  - (2) When using a pressure gauge, press the brake pedal so that the pressure gauge indicates 3,500 kPa (36 kg/cm<sup>2</sup>, 511 psi).
- 7) "OK" will be displayed. Select the «OK».
- 8) The brake system being operated is displayed on the Subaru Select Monitor.

## 2. CONDITIONS FOR ABS SEQUENCE CONTROL



ABS00943

# ABS Sequence Control

## ABS

---

- |                             |                             |                                 |
|-----------------------------|-----------------------------|---------------------------------|
| (1) All wheel speed         | (11) RR compression valve   | (20) 0.6 sec.                   |
| (2) Ignition key            | (12) RL decompression valve | (21) 0.4 sec.                   |
| (3) ABS warning light       | (13) RL compression valve   | (22) Point A                    |
| (4) Stop light switch       | (14) Pump motor             | (23) Reset                      |
| (5) Valve relay             | (15) 1.5 sec.               | (24) Master cylinder pressure   |
| (6) FL decompression valve  | (16) Light OFF              | (25) FL wheel cylinder pressure |
| (7) FL compression valve    | (17) Light ON               | (26) FR wheel cylinder pressure |
| (8) FR decompression valve  | (18) 1.0 sec.               | (27) RR wheel cylinder pressure |
| (9) FR compression valve    | (19) 1.4 sec.               | (28) RL wheel cylinder pressure |
| (10) RR decompression valve |                             |                                 |

### NOTE:

The control operation starts from point A.

## **B: SPECIFICATION**

### **1. CONDITIONS FOR COMPLETION OF ABS SEQUENCE CONTROL**

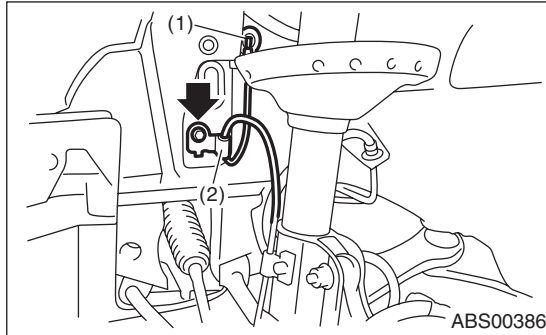
When the following conditions develop, the ABS sequence control stops and ABS operation is returned to the normal control mode.

- 1) When the speed of at least one wheel reaches 10 km/h (6 MPH).
- 2) When the brake pedal is released during ABS sequence control and the stop light switch becomes OFF.
- 3) After completion of ABS sequence control.
- 4) When a malfunction is detected.

## 4. Front ABS Wheel Speed Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the ABS wheel speed sensor connector located next to the front strut mounting house in the engine compartment.
- 3) Remove the sensor harness bracket.

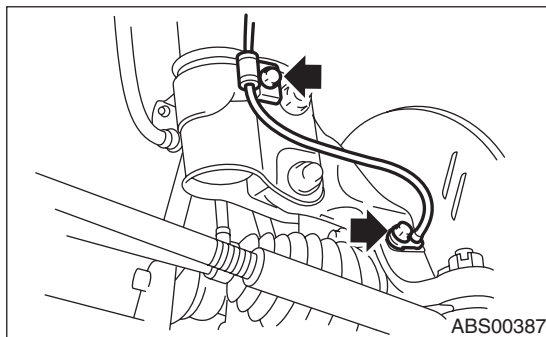


- (1) To the front ABS wheel speed sensor connector
- (2) Sensor harness bracket

- 4) Remove the bolts which secure the sensor harness to the front strut.
- 5) Remove the front ABS wheel speed sensor from housing.

#### CAUTION:

- Be careful not to damage the sensor.
- Do not apply excessive force to the sensor harness.



### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

**Sensor:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

**Bracket:**

**33 N·m (3.3 kgf-m, 24 ft-lb)**

#### CAUTION:

Be careful not to damage the sensor.

#### NOTE:

- Check the identification (mark) on the harness to make sure there is no warpage. (RH: K1 (White), LH: K2 (Yellow))
- Check if the harness is not pulled and does not come in contact with the suspension or body during steering wheel effort.

### C: INSPECTION

#### 1. CHECK WITH SUBARU SELECT MONITOR

- 1) Connect the Subaru Select Monitor to the data link connector.
- 2) Select {Current Data Display & Save}. Check if the speed indicated on the display changes in the same manner as the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position.
- 3) If the speed indicated on the display does not change, check the ABS wheel speed sensor. <Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>

# Front ABS Wheel Speed Sensor

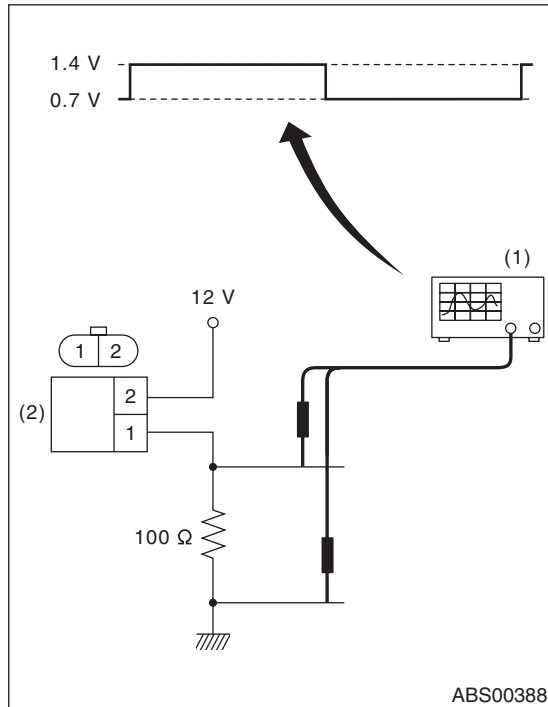
ABS

## 2. ABS WHEEL SPEED SENSOR

- 1) Check the tip of the ABS wheel speed sensor for foreign particles or damage. If necessary, clean the tip or replace the ABS wheel speed sensor.
- 2) Connect a 12 V power supply to No. 2 terminal of sensor connector as shown in the figure, then attach resistance to the No. 1 terminal. Rotate the wheel at about 2.75 km/h (2 MPH), and measure the voltage using an oscilloscope.

**Standard value of output voltage:**

**0.7 — 1.4 V**



- (1) Oscilloscope
- (2) ABS wheel speed sensor

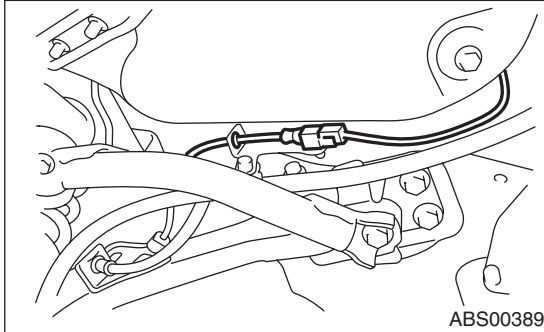
### NOTE:

Check the ABS wheel speed sensor cable for discontinuity. If necessary, replace with a new part.

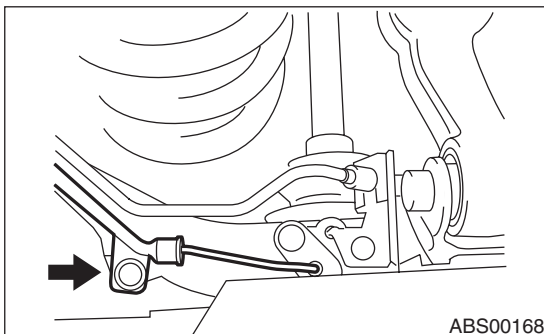
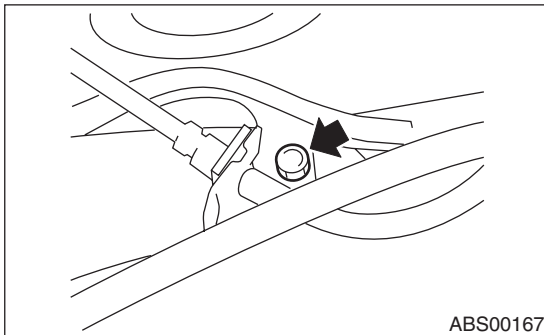
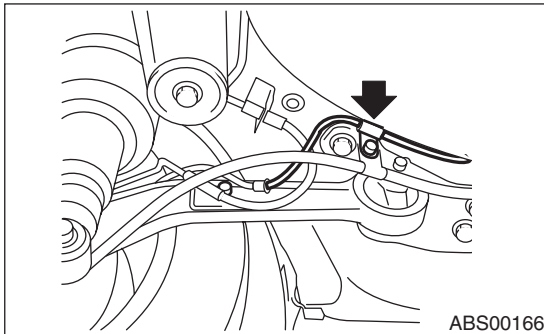
## 5. Rear ABS Wheel Speed Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the connector from the rear ABS wheel speed sensor.



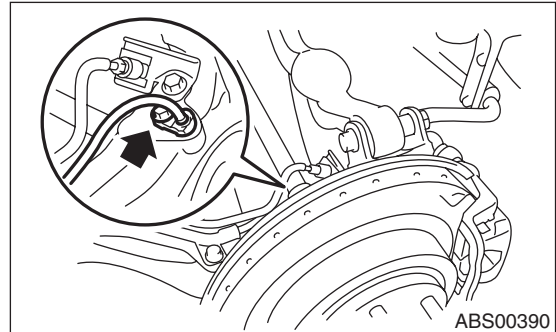
- 3) Remove the sensor harness bracket from the rear arm.



- 4) Remove the rear ABS wheel speed sensor from the rear arm.

### CAUTION:

- Be careful not to damage the sensor.
- Do not apply excessive force to the sensor harness.



### B: INSTALLATION

Install in the reverse order of removal.

### CAUTION:

Be careful not to damage the sensor.

### Tightening torque:

**Sensor:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

**Bracket:**

**33 N·m (3.3 kgf-m, 24 ft-lb)**

### NOTE:

Check the identification (mark) on the harness to make sure there is no warpage. (RH: K5 (White), LH: K6 (Yellow))

### C: INSPECTION

#### 1. ABS WHEEL SPEED SENSOR

<Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>

## 6. Front Magnetic Encoder

### A: REMOVAL

Refer to “Front Hub Bearing” for removal, because the front magnetic encoder is integrated with front hub bearing.

<Ref. to DS-17, REMOVAL, Front Hub Unit Bearing.>

### B: INSTALLATION

Refer to “Front Hub Bearing” for installation, because the front magnetic encoder is integrated with front hub bearing.

<Ref. to DS-18, INSTALLATION, Front Hub Unit Bearing.>

### C: INSPECTION

Visually check the magnetic encoder for any damage. If necessary, replace with a new hub unit bearing.

#### NOTE:

Because the magnetic encoder is integrated with front hub unit bearing assembly, replace the hub unit bearing with a new part if there is any defect found on the magnetic encoder.

## 7. Rear Magnetic Encoder

### A: REMOVAL

Refer to “Rear Hub Unit Bearing” for removal, because the rear magnetic encoder is integrated with rear hub unit bearing.

<Ref. to DS-19, REMOVAL, Rear Hub Unit Bearing.>

### B: INSTALLATION

Refer to “Rear Hub Unit Bearing” for installation, because the rear magnetic encoder is integrated with rear hub unit bearing.

<Ref. to DS-20, INSTALLATION, Rear Hub Unit Bearing.>

### C: INSPECTION

Visually check the magnetic encoder parts for any damage. If necessary, replace with a new hub unit bearing.

#### NOTE:

Because the magnetic encoder is integrated with rear hub unit bearing assembly, replace the hub unit bearing with a new part if there is any defect found on the magnetic encoder.



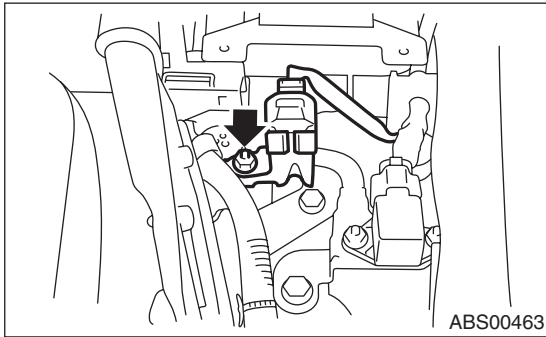
## 8. G Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box.  
<Ref. to EI-54, REMOVAL, Console Box.>
- 3) Disconnect the connector from G sensor.
- 4) Remove the G sensor from the body.

**CAUTION:**

- Do not drop or bump the G sensor.
- The G sensor integrated with the bracket. Do not disassemble.



### B: INSTALLATION

Install in the reverse order of removal.

**CAUTION:**

Do not drop or bump the G sensor.

**Tightening torque:**

**7.5 N·m (0.76 kgf·m, 5.5 ft·lb)**

### C: INSPECTION

Step	Check	Yes	No
<b>1 CHECK G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Set the Subaru Select Monitor to the {Brake Control} mode. 4) Set the display in the {Current Data Display & Save} mode. 5) Read the G sensor output value.	Is the value $-1.2 \text{ — } 1.2 \text{ m/s}^2$ when the vehicle is in horizontal position?	Go to step 2.	Repair the harness connector between the G sensor and ABSCM&H/U. Or replace G sensor.
<b>2 CHECK G SENSOR.</b> 1) Remove the console box. 2) Remove the G sensor from vehicle. (Do not disconnect the connector.) 3) Read the Subaru Select Monitor display.	Is the value $8.1 \text{ — } 11.2 \text{ m/s}^2$ when G sensor is inclined forward to $90^\circ$ ?	Go to step 3.	Repair the harness connector between the G sensor and ABSCM&H/U. Or replace G sensor.
<b>3 CHECK G SENSOR.</b> Read the Subaru Select Monitor display.	Is the value $-8.1 \text{ — } -11.2 \text{ m/s}^2$ when G sensor is inclined backward $90^\circ$ ?	G sensor is normal.	Repair the harness connector between the G sensor and ABSCM&H/U. Or replace G sensor.

# Basic Diagnostic Procedure

ABS (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### CAUTION:

Remove foreign matter (dust, water, oil etc.) from the ABSCM&H/U connector during removal and installation.

#### NOTE:

- To check harness for open or short circuits, shake the suspected trouble spot or connector.
- Refer to "Check List for Interview". <Ref. to ABS(diag)-4, Check List for Interview.>

	Step	Check	Yes	No
1	<p><b>CHECK PRE-INSPECTION.</b></p> <p>1) Ask the customer when and how the trouble occurred using the interview check list. &lt;Ref. to ABS(diag)-4, Check List for Interview.&gt;</p> <p>2) Before performing diagnostics, check the components which might affect ABS problems. &lt;Ref. to ABS(diag)-8, INSPECTION, General Description.&gt;</p>	Are components which might affect the ABS problem operating correctly?	Go to step 2.	Repair or replace each component.
2	<p><b>CHECK INDICATION OF DTC ON SCREEN.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Connect the Subaru Select Monitor to the data link connector.</p> <p>3) Turn the ignition switch to ON and start up the Subaru Select Monitor.</p> <p>NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. &lt;Ref. to ABS(diag)-17, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.&gt;</p> <p>4) Read the DTC. &lt;Ref. to ABS(diag)-22, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p> <p>5) Record all DTCs and freeze frame data.</p>	Is DTC displayed?	Go to step 4.	Go to step 3.
3	<p><b>PERFORM GENERAL DIAGNOSTICS.</b></p> <p>1) Perform the inspection using "General Diagnostic Table". &lt;Ref. to ABS(diag)-67, General Diagnostic Table.&gt;</p> <p>2) Perform the Clear Memory Mode. &lt;Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.&gt;</p> <p>3) Perform the Inspection Mode. &lt;Ref. to ABS(diag)-23, Inspection Mode.&gt;</p> <p>4) Read the DTC. &lt;Ref. to ABS(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.&gt;</p> <p>Check the DTC is not displayed.</p>	Does the ABS warning light go off after turning the ignition switch to ON?	Finish the diagnosis.	Check using "ABS Diagnostic Procedure". <Ref. to ABS(diag)-20, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>

# Basic Diagnostic Procedure

ABS (DIAGNOSTICS)

	Step	Check	Yes	No
4	<b>PERFORM DIAGNOSIS.</b> 1) Refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, LIST, List of Diagnostic Trouble Code (DTC).> 2) Correct the cause of trouble. 3) Perform the Clear Memory Mode. <Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Perform the Inspection Mode. <Ref. to ABS(diag)-23, Inspection Mode.> 5) Read the DTC. <Ref. to ABS(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Repeat step 1 to 4 until DTC does not appear.	Finish the diagnosis.

# Check List for Interview

ABS (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

Check the following items regarding condition of the vehicle.

#### 1. STATE OF ABS WARNING LIGHT

ABS warning light illuminates.	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once <input type="checkbox"/> Does not come on When and for how long does it illuminate?		
Ignition key position	<input type="checkbox"/> LOCK <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)		
Timing	<input type="checkbox"/> Immediately after turning the ignition ON. <input type="checkbox"/> Immediately after turning the ignition to START.		
	<input type="checkbox"/> While accelerating	—	km/h
		—	MPH
	<input type="checkbox"/> While driving at a constant speed	km/h	MPH
	<input type="checkbox"/> While decelerating	—	km/h
		—	MPH
	<input type="checkbox"/> When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When other electrical parts are operating		
	<ul style="list-style-type: none"> <li>• Parts name:</li> <li>• Operating condition:</li> </ul>		

# Check List for Interview

ABS (DIAGNOSTICS)

## 2. STATE OF BRAKE WARNING LIGHT

Brake warning light illuminates.	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once <input type="checkbox"/> Does not come on <input type="checkbox"/> When pulling the parking brake lever. <input type="checkbox"/> When releasing the parking brake lever. When and for how long does it illuminate?		
Ignition key position	<input type="checkbox"/> LOCK <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)		
Timing	<input type="checkbox"/> Immediately after turning the ignition ON. <input type="checkbox"/> Immediately after turning the ignition to START.		
	<input type="checkbox"/> While accelerating	—	km/h
		—	MPH
	<input type="checkbox"/> While driving at a constant speed	km/h	MPH
	<input type="checkbox"/> While decelerating	—	km/h
		—	MPH
	<input type="checkbox"/> When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When other electrical parts are operating		
	• Parts name: • Operating condition:		

## Check List for Interview

ABS (DIAGNOSTICS)

### 3. SYMPTOMS

ABS operating condition	<input type="checkbox"/> Does not operate.		
	<input type="checkbox"/> Operates only when applying the brakes suddenly.	Vehicle speed:	km/h
			MPH
	Procedures for stepping on the brake pedal:		
	a) Operating time:		Sec.
	b) Operating noise: <input type="checkbox"/> Occurs. / <input type="checkbox"/> Does not occur.		
	What kind of noise?	<input type="checkbox"/> Knocking <input type="checkbox"/> Gong gong <input type="checkbox"/> Thump <input type="checkbox"/> Buzz <input type="checkbox"/> Gong gong buzz <input type="checkbox"/> Others:	
c) Reaction force of brake pedal			
	<input type="checkbox"/> Sticks <input type="checkbox"/> Weak pedal resistance <input type="checkbox"/> Strong pedal resistance <input type="checkbox"/> Others:		
Condition of vehicle	a) Directional stability cannot be obtained or the steering does not respond when applying brakes: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	When:	<input type="checkbox"/> When turning to the right <input type="checkbox"/> When turning to the left <input type="checkbox"/> When spinning out <input type="checkbox"/> Others:	
	b) Directional stability cannot be obtained or the steering does not respond when accelerating: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	When:	<input type="checkbox"/> When turning to the right <input type="checkbox"/> When turning to the left <input type="checkbox"/> When spinning out <input type="checkbox"/> Others:	
	c) Poor brake performance: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	What kind:	<input type="checkbox"/> Braking distance is long. <input type="checkbox"/> Brakes lock or drag. <input type="checkbox"/> Pedal stroke is long. <input type="checkbox"/> Pedal sticks. <input type="checkbox"/> Others:	
	d) Poor acceleration: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	What kind:	<input type="checkbox"/> Fails to accelerate. <input type="checkbox"/> Engine stalls. <input type="checkbox"/> Others:	
	e) Occurrence of vibration: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	• Where		
	• What kind:		
	f) Occurrence of noise: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
	• Where		
• What kind:			
g) Other troubles occurred: <input type="checkbox"/> Yes / <input type="checkbox"/> No			
What kind:			

# Check List for Interview

ABS (DIAGNOSTICS)

## 4. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others:	
	b) Ambient temperature	°C (°F)	
	c) Road	<input type="checkbox"/> Inner city <input type="checkbox"/> Suburbs <input type="checkbox"/> Highway <input type="checkbox"/> Local street <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Paved road <input type="checkbox"/> Gravel road <input type="checkbox"/> Muddy road <input type="checkbox"/> Sandy place <input type="checkbox"/> Others:	
	d) Road surface	<input type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Covered with fresh snow <input type="checkbox"/> Covered with hardened snow <input type="checkbox"/> Frozen slope <input type="checkbox"/> Others:	
Condition	a) Brakes	Deceleration: <span style="float: right;">G</span> <input type="checkbox"/> Intermittent / <input type="checkbox"/> Temporary	
	b) Accelerator	Acceleration: <span style="float: right;">G</span> <input type="checkbox"/> Intermittent / <input type="checkbox"/> Temporary	
	c) Vehicle speed	km/h	MPH
		<input type="checkbox"/> Advancing <input type="checkbox"/> While accelerating <input type="checkbox"/> While decelerating <input type="checkbox"/> At low speed <input type="checkbox"/> When turning <input type="checkbox"/> Others:	
	d) Tire inflation pressure	Front RH tire:	kPa
		Front LH tire:	kPa
		Rear RH tire:	kPa
		Rear LH tire:	kPa
	e) Degree of wear	Front RH tire:	
		Front LH tire:	
		Rear RH tire:	
		Rear LH tire:	
	f) Genuine parts are used:	<input type="checkbox"/> Yes / <input type="checkbox"/> No	
g) Tire chain is attached:	<input type="checkbox"/> Yes / <input type="checkbox"/> No		
h) T-type tire is used:	<input type="checkbox"/> Yes / <input type="checkbox"/> No		
i) Condition of suspension alignment:			
j) Loaded state:			
k) Repair parts are used:	<input type="checkbox"/> Yes / <input type="checkbox"/> No		
Contents:			
l) Others:			

# General Description

ABS (DIAGNOSTICS)

## 3. General Description

### A: CAUTION

#### 1. SUPPLEMENTAL RESTRAINT SYSTEM "AIRBAG"

Airbag system wiring harness is routed near the ABS wheel speed sensor and ABSCM&H/U.

#### CAUTION:

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the ABS wheel speed sensor and ABSCM&H/U.

### B: INSPECTION

Before performing diagnosis, check the following item which might affect ABS problems.

#### 1. BATTERY

Measure the battery voltage and check electrolyte.

#### Standard voltage:

12 V or more

#### Specific gravity:

1.260 or more

#### 2. GROUND

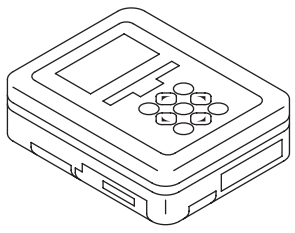
Check the tightening torque of ground (GB-7) bolt of ABS.

#### Tightening torque:

13 N·m (1.3 kgf·m, 9.6 ft·lb)

### C: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

### 3. BRAKE FLUID

- 1) Check the brake fluid level.
- 2) Check the brake fluid for leaks.

### 4. HYDRAULIC UNIT

Check the hydraulic unit.

- When using the brake tester <Ref. to ABS-8, CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
- When not using the brake tester <Ref. to ABS-7, CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

### 5. BRAKE DRAG

Check for brake drag.

### 6. BRAKE PAD AND ROTOR

Check the brake pad and rotor.

- Front <Ref. to BR-15, INSPECTION, Front Brake Pad.> <Ref. to BR-16, INSPECTION, Front Disc Rotor.>
- Rear <Ref. to BR-22, INSPECTION, Rear Brake Pad.> <Ref. to BR-24, INSPECTION, Rear Disc Rotor.>

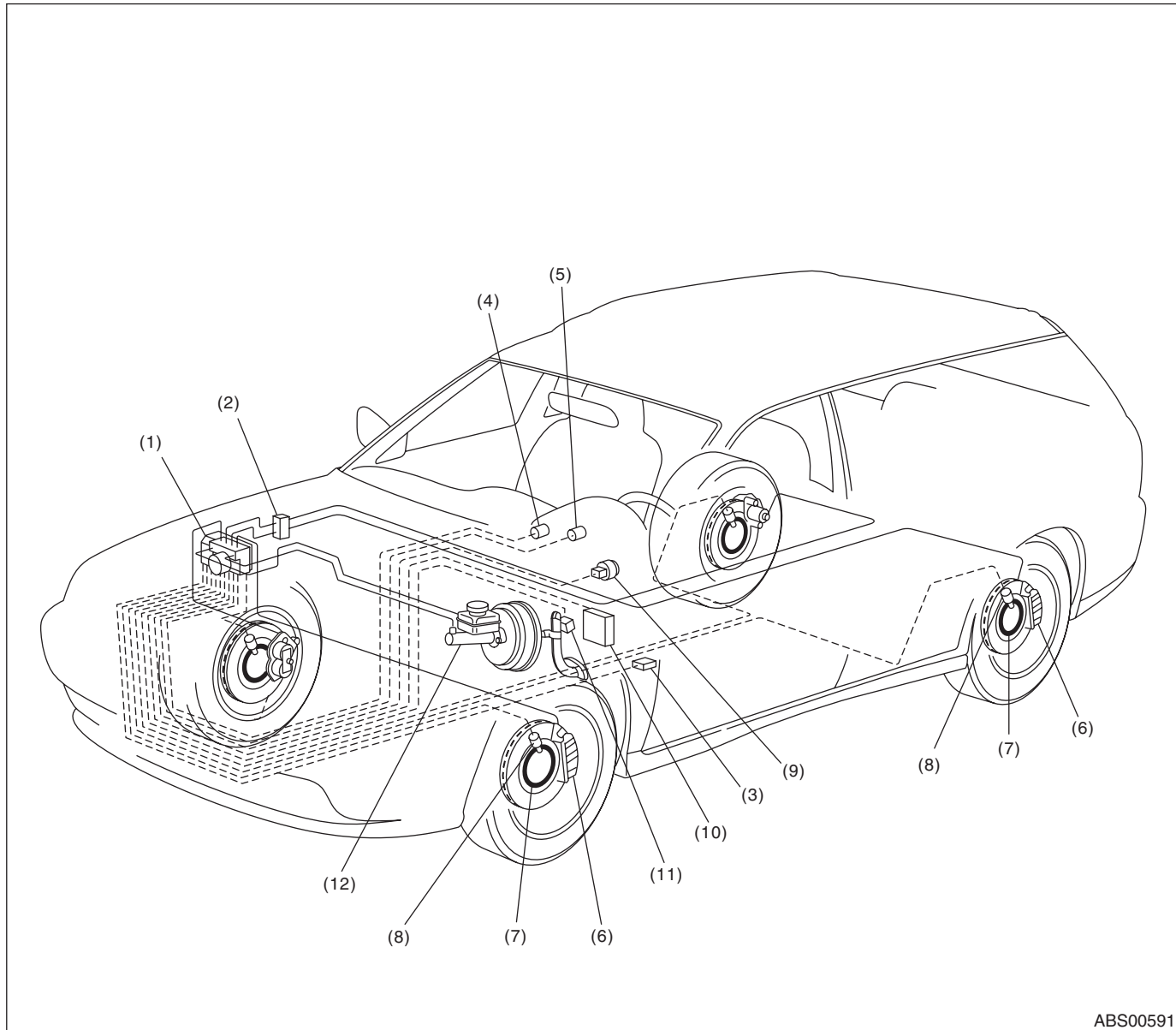
### 7. TIRE

Check the tire specifications, tire wear and air pressure. <Ref. to WT-2, SPECIFICATION, General Description.>



## 4. Electrical Component Location

### A: LOCATION

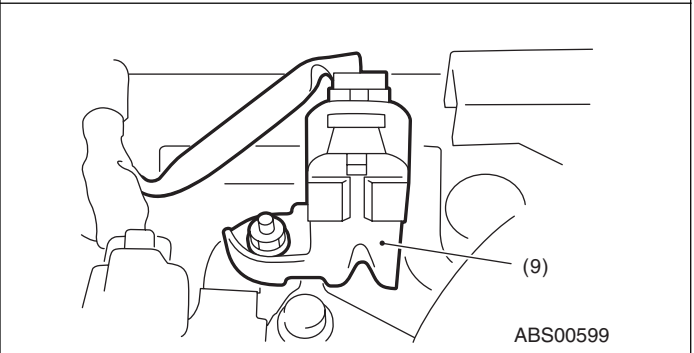
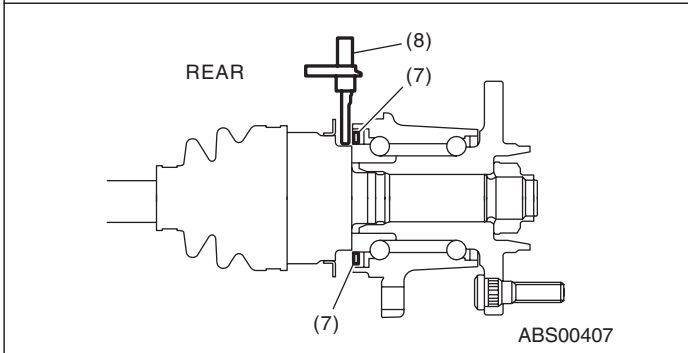
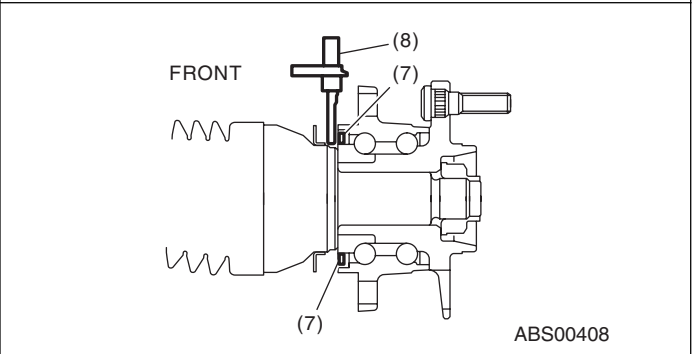
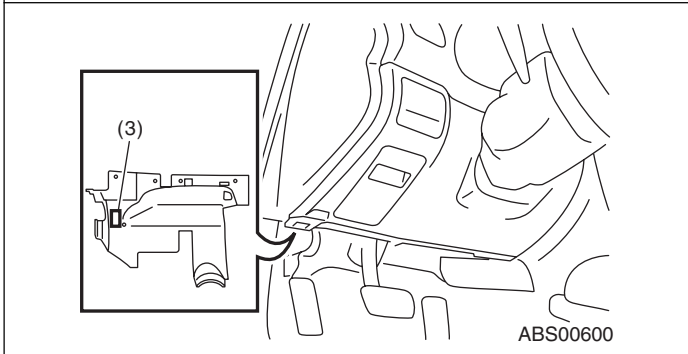
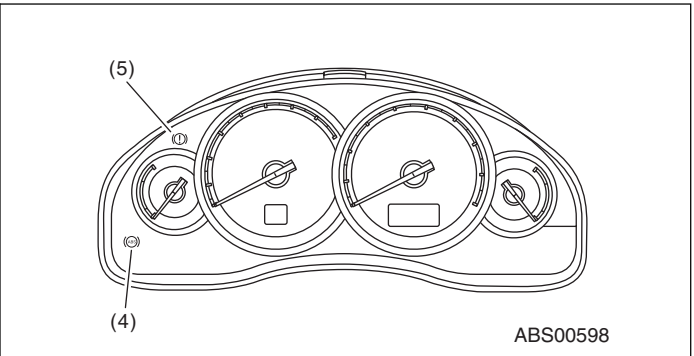
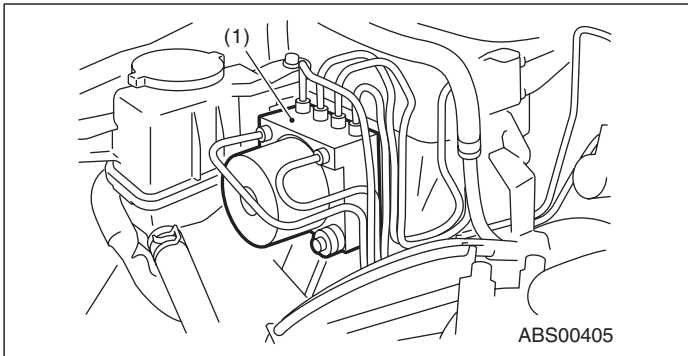


ABS00591

- |   |                                 |   |
|---|---------------------------------|---|
| (1) ABS control module and hydraulic control unit (ABSCM&H/U) | (4) ABS warning light           | (9) G sensor                                      |
| (2) Two-way connector   | (5) Brake and EBD warning light | (10) Transmission control module (TCM) (AT model) |
| (3) Data link connector (For Subaru Select Monitor)           | (6) Caliper body                | (11) Stop light switch                            |
|   | (7) Magnetic encoder seal       | (12) Master cylinder                              |
|   | (8) ABS wheel speed sensor      |   |

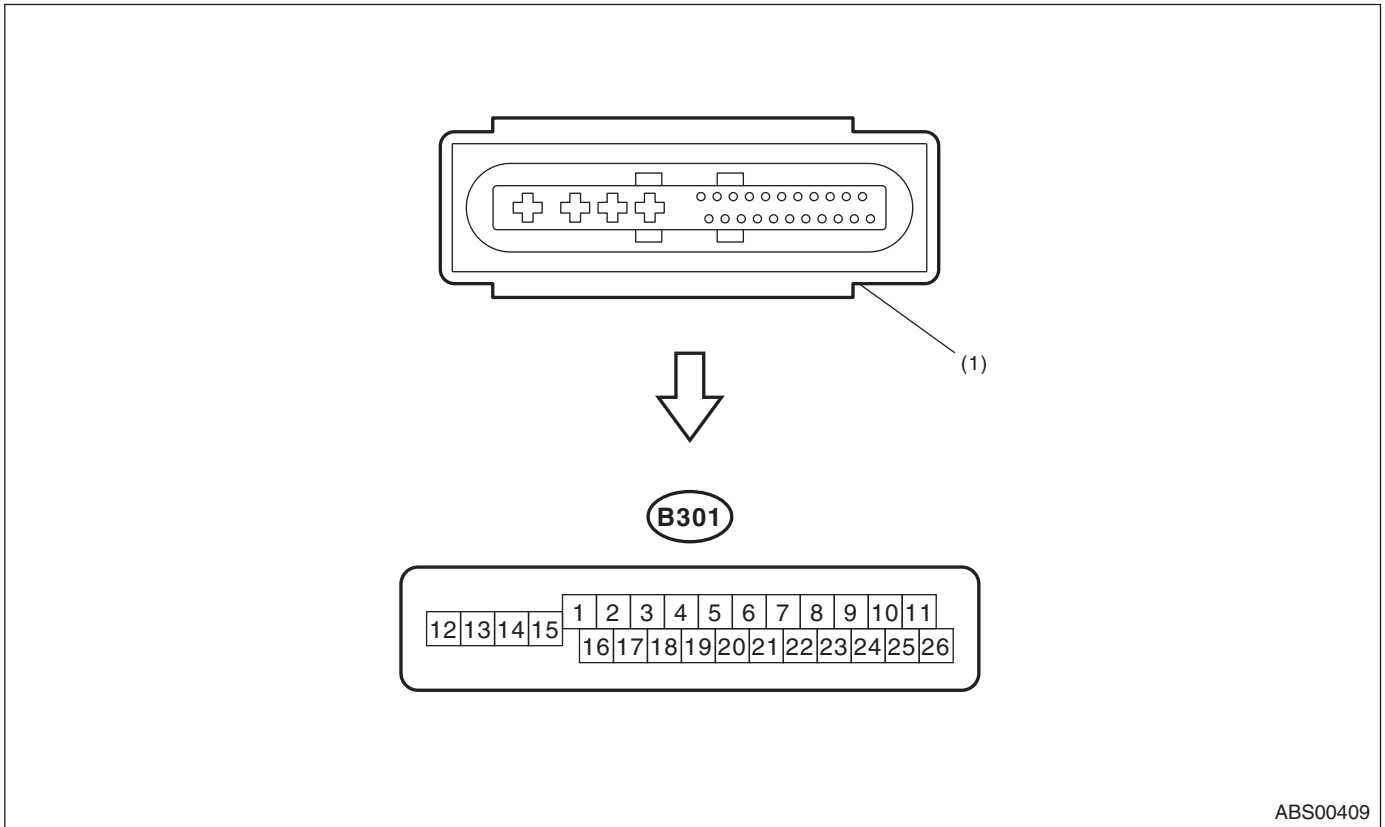
# Electrical Component Location

## ABS (DIAGNOSTICS)



## 5. Control Module I/O Signal

### A: ELECTRICAL SPECIFICATION



ABS00409

- (1) ABS control module and hydraulic control unit (ABSCM&H/U) connector

**NOTE:**

- Terminal numbers in ABSCM&H/U connector are shown in the figure.
- ABS warning light illuminates when the connector is removed from ABSCM&H/U.

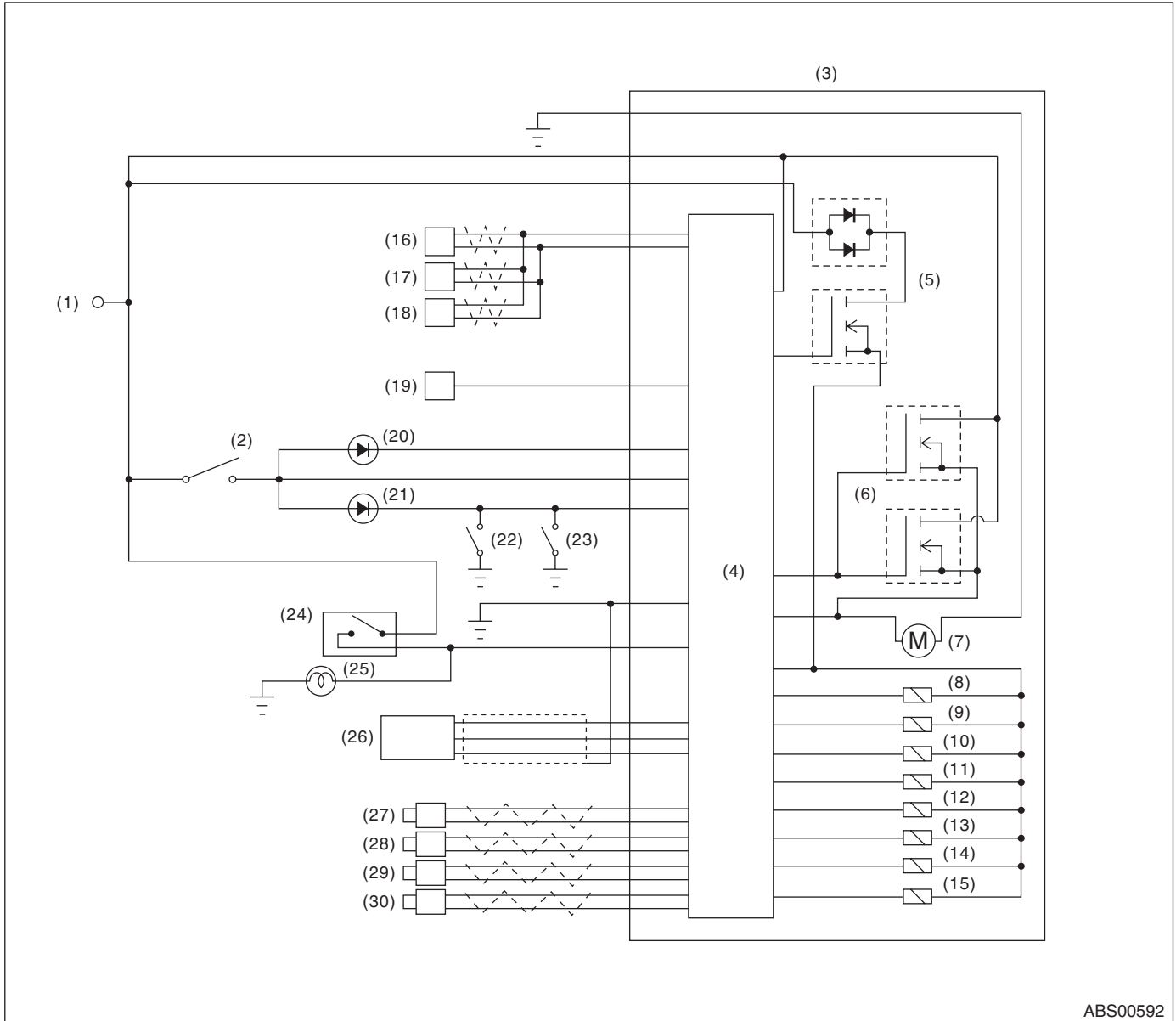
## Control Module I/O Signal

### ABS (DIAGNOSTICS)

Description		Terminal No. (+) — (-)	Input/Output signal	
			Measured value and measuring conditions	
ABS wheel speed sensor (Wheel speed sensor)	Front LH wheel	Power supply	16 — 15	4.5 — 16.5 V
		Signal	1	5.9 — 16.8 mA: Rectangle waveform
	Front RH wheel	Power supply	5 — 15	4.5 — 16.5 V
		Signal	6	5.9 — 16.8 mA: Rectangle waveform
	Rear LH wheel	Power supply	2 — 15	4.5 — 16.5 V
		Signal	17	5.9 — 16.8 mA: Rectangle waveform
Rear RH wheel	Power supply	3 — 15	4.5 — 16.5 V	
	Signal	4	5.9 — 16.8 mA: Rectangle waveform	
CAN communication line (+)		26	2.5 — 1.5 V pulse signal	
CAN communication line (-)		11	3.5 — 2.5 V pulse signal	
Valve relay power supply *1		14 — 15	10 — 15 V	
Motor relay power supply *1		13 — 15	10 — 15 V	
G sensor	Power supply		24 — 10	4.75 — 5.25 V
	Ground		10	—
	Output		21 — 10	2.1 — 2.5 V when the vehicle is on level surface
Stop light switch *1		20 — 15	1.5 V or less when the stop light is OFF; otherwise, 10 — 15 V when the stop light is ON.	
ABS warning light		22 — 15	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds and 1.5 V or less after 1.5 seconds passed.	
Brake warning light (EBD warning light)		8 — 15	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds and 1.5 V or less after 1.5 seconds passed.	
Subaru Select Monitor		7 — 15	1.5 V or less when no data is received. 0 ↔ 12 V pulse (in communication)	
Power supply *1		18 — 15	10 — 15 V when the ignition switch is ON.	
Grounding line		15	—	
Vehicle speed output signal		23 — 15	0 ↔ 5 V pulse	

\*1: Measure the I/O signal voltage after removing the connector from the ABSCM&H/U terminal.

## B: WIRING DIAGRAM



ABS00592

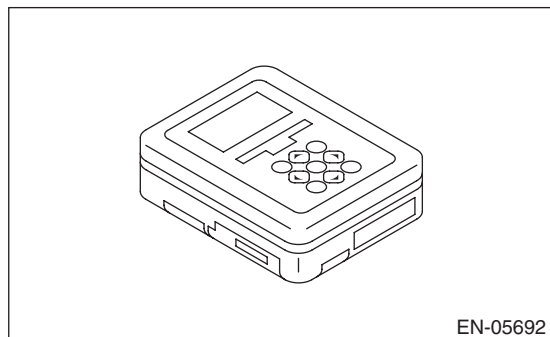
- |   |  |                                      |
|---|--|--------------------------------------|
| (1) Battery   | (11) Front outlet solenoid valve RH    | (21) Brake warning light             |
| (2) Ignition switch   | (12) Rear inlet solenoid valve LH      | (22) Parking brake switch            |
| (3) ABS control module and hydraulic control unit (ABSCM&H/U) | (13) Rear outlet solenoid valve LH     | (23) Brake fluid level switch        |
| (4) ABS control module  | (14) Rear inlet solenoid valve RH      | (24) Stop light switch               |
| (5) Valve relay   | (15) Rear outlet solenoid valve RH     | (25) Stop light                      |
| (6) Motor relay   | (16) Body integrated unit              | (26) G sensor                        |
| (7) Motor   | (17) Engine control module (ECM)       | (27) Front ABS wheel speed sensor LH |
| (8) Front inlet solenoid valve LH                             | (18) Transmission control module (TCM) | (28) Front ABS wheel speed sensor RH |
| (9) Front outlet solenoid valve LH                            | (19) Data link connector               | (29) Rear ABS wheel speed sensor LH  |
| (10) Front inlet solenoid valve RH                            | (20) ABS warning light                 | (30) Rear ABS wheel speed sensor RH  |

## 6. Subaru Select Monitor

### A: OPERATION

#### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to ABS(diag)-8, SPECIAL TOOL, PREPARATION TOOL, General Description.>



2) Prepare the personal computer in which the Subaru Select Monitor has been installed.

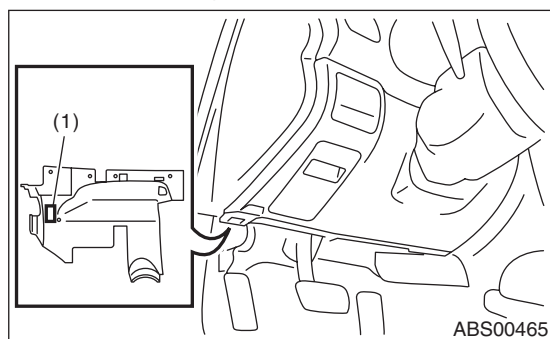
3) Connect the USB cable to the SDI (Subaru Diagnostic Interface) and the USB port of the personal computer (port for Subaru Select Monitor).

**NOTE:**

The port for Subaru Select Monitor is the USB port used for installing the Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.

5) Connect the SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect scan tools other than the Subaru Select Monitor.**

6) Start up the personal computer.

7) Turn the ignition switch to ON (engine OFF) and start up the "PC application help for Subaru Select Monitor".

8) Select {Each System Check} in «Main Menu».

9) On the «System Selection Menu» display screen, select the {Brake Control}.

10) Click on the [OK] after the {ABS} is displayed.

11) On the «Brake Control Diagnosis» display screen, select the {Diagnostic Trouble Code}.

12) Record the DTC and data.

**NOTE:**

- For detailed operation procedure, refer to the "PC application help for Subaru Select Monitor".

- For details concerning DTCs, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>

- Up to 3 DTCs are displayed in the order of detection.

- If a particular DTC is not stored in memory properly at the occurrence of problem (due to a drop in ABSCM&H/U power supply etc.), the DTC suffixed with a question mark "?" is displayed on Subaru Select Monitor display screen. This shows it may be an unreliable reading.

13) If communication is not possible between the ABS and the Subaru Select Monitor, check the communication circuit. <Ref. to ABS(diag)-17, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

14) When DTC is not displayed, check the meter circuit and CAN communication circuit. <Ref. to ABS(diag)-20, WITHOUT DTC, INSPECTION, Subaru Select Monitor.>

Display	Contents to be monitored
Current	The current DTC is displayed on Subaru Select Monitor display screen.
Old	The latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.
Older	The second latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.
Third previous	The third latest DTC in previous problems is displayed on Subaru Select Monitor display screen.

## 2. READ CURRENT DATA

- 1) Select {Each System Check} in «Main Menu».
  - 2) On the «System Selection Menu» display screen, select the {Brake Control}.
  - 3) Click on the [OK] after the {ABS} is displayed.
  - 4) Select {Current Data Display & Save} in «Brake Control Diagnosis» display screen.
  - 5) On the «Display Menu» screen, select the data display method.
  - 6) Using the scroll key, scroll the display screen up or down until necessary data is shown.
- A list of the support data is shown in the following table.

Display	Contents to be monitored	Unit of measure
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed.	km/h or MPH
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed.	km/h or MPH
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed.	km/h or MPH
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed.	km/h or MPH
BLS Signal	Brake ON/OFF is displayed.	ON or OFF
G Sensor	Vehicle acceleration detected by analog G sensor is displayed.	m/s (m/s <sup>2</sup> )
Valve Relay Signal	Valve relay operation signal is displayed.	ON or OFF
ABS Warning Light	ON operation of the ABS warning light is displayed.	ON or OFF
EBD Warning Light	ON operation of the EBD warning light is displayed.	ON or OFF
Motor Relay Monitor	Motor relay monitor voltage is displayed.	V
IG Power Supply Voltage	Voltage supplied to ABSCM&H/U is displayed.	V
ABS Control Flag	ABS control condition is displayed.	ON or OFF
ABS OK B Signal	ABS system normal/abnormal is displayed.	OK or NG

**NOTE:**

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

# Subaru Select Monitor

## ABS (DIAGNOSTICS)

### 3. CLEAR MEMORY MODE

- 1) Select {Each System Check} in «Main Menu».
- 2) On the «System Selection Menu» display screen, select the {Brake Control}.
- 3) Click on the [OK] after the {ABS} is displayed.
- 4) On the «Brake Control Diagnosis» display screen, select the {Clear Memory}.
- 5) When the “Clear Memory?” is shown on the screen, press «YES» button.
- 6) When “Done” and “Turn ignition switch to OFF” is shown on the display screen, turn the ignition switch to OFF.

#### NOTE:

For detailed operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 4. ABS SEQUENCE CONTROL

Display	Contents to be monitored	Index No.
ABS sequence control	Operate the valve and pump motor continuously to perform the ABS sequence control.	<Ref. to ABS-10, ABS Sequence Control.>

### 5. FREEZE FRAME DATA

#### NOTE:

- Data stored at the time of trouble occurrence is shown on the display.
- Each time a trouble occurs, the latest information is stored in the freeze frame data in memory.
- Up to 3 freeze frame data will be stored.
- If freeze frame data is not stored in memory properly (due to a drop in ABS control module power supply etc.), a DTC suffixed with a question mark “?” is displayed on Subaru Select Monitor display screen. This shows it may be an unreliable reading.

Display	Contents to be monitored
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed in km/h or MPH.
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed in km/h or MPH.
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed in km/h or MPH.
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed in km/h or MPH.
IG Power Supply Voltage	Voltage supplied (V) to ABSCM&H/U is displayed.
G Sensor	Vehicle acceleration detected by analog G sensor is displayed.
Motor Relay Monitor	Motor relay condition is displayed.
BLS Signal	Brake ON/OFF is displayed.
Vehicle Speed	Vehicle speed calculated by ABS control module is displayed.
ABS Control Flag	ABS control condition is displayed.
Power Supply Failure	Whether abnormal voltage occurred or not is displayed during malfunction.



## B: INSPECTION

### 1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

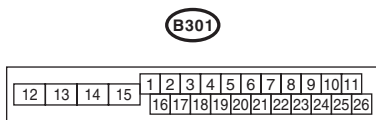
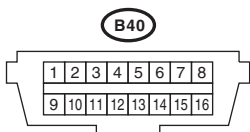
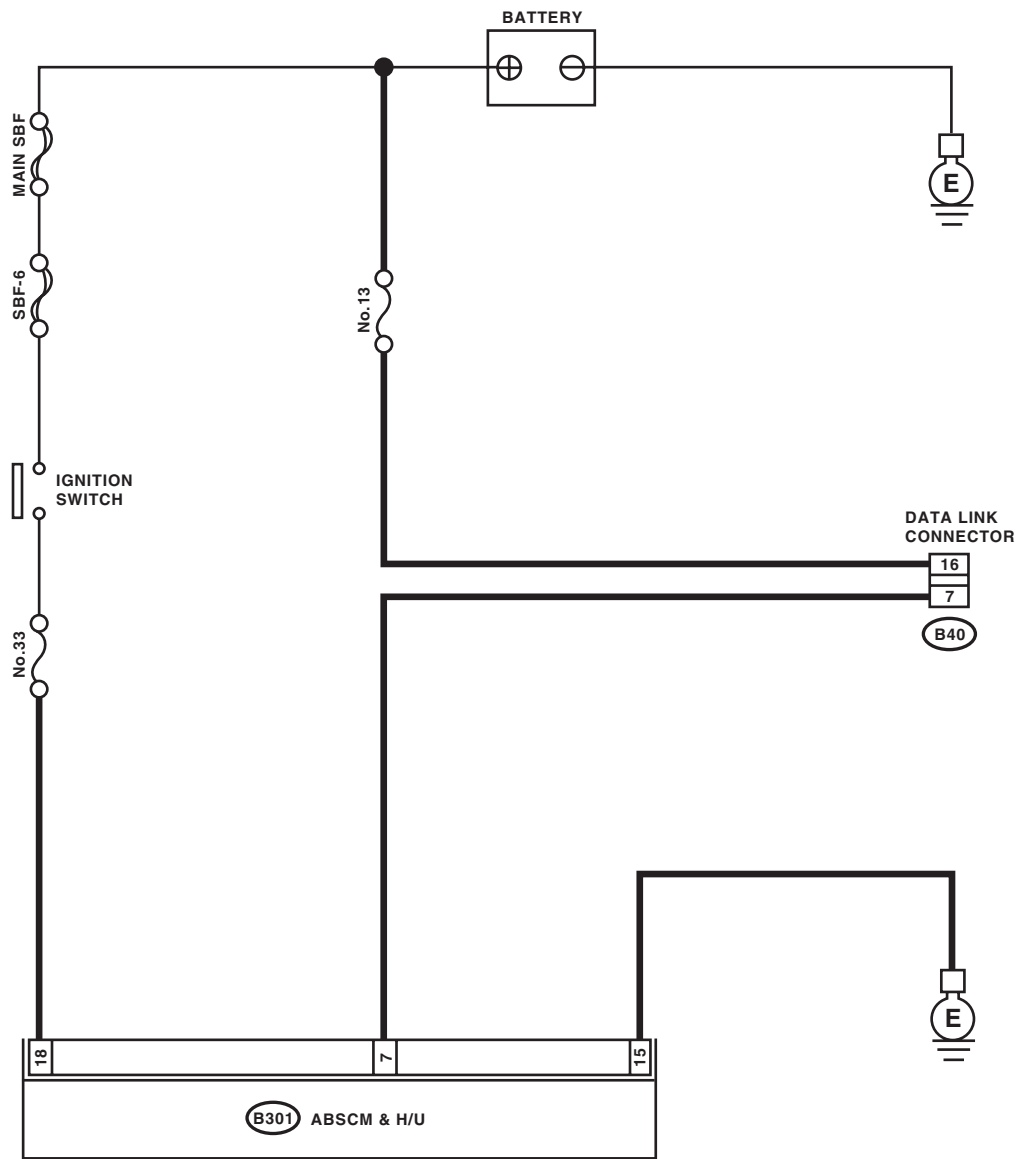
**DETECTING CONDITION:**

Defective harness connector

**TROUBLE SYMPTOM:**

Communication is impossible between ABS and Subaru Select Monitor.

**WIRING DIAGRAM:**



# Subaru Select Monitor

## ABS (DIAGNOSTICS)

Step	Check	Yes	No	
<b>1</b>	<b>CHECK IGNITION SWITCH.</b>	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select ABS mode using Subaru Select Monitor.
<b>2</b>	<b>CHECK BATTERY.</b> 1) Turn the ignition switch to OFF. 2) Measure the battery voltage.	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
<b>3</b>	<b>CHECK BATTERY TERMINAL.</b>	Is there poor contact at the battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
<b>4</b>	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be performed normally.	Are the system name and model year displayed on Subaru Select Monitor?	Go to step 8.	Go to step 5.
<b>5</b>	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Are the system name and model year displayed on Subaru Select Monitor?	Replace the ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
<b>6</b>	<b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U, ECM and TCM. 3) Measure the resistance between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
<b>7</b>	<b>CHECK OUTPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control module and data link connector.
<b>8</b>	<b>CHECK HARNESS CONNECTOR BETWEEN ABSCM&amp;H/U AND DATA LINK CONNECTOR.</b> Measure the resistance between ABSCM&H/U connector and data link connector. <b>Connector &amp; terminal</b> <b>(B301) No. 7 — (B40) No. 7:</b>	Is the resistance less than 0.5 Ω?	Go to step 9.	Repair harness and connector between ABSCM&H/U and data link connector.
<b>9</b>	<b>CHECK INSTALLATION OF ABSCM&amp;H/U CONNECTOR.</b> Turn the ignition switch to OFF.	Is the ABSCM&H/U connector inserted into ABSCM&H/U until the clamp locks onto it?	Go to step 10.	Insert ABSCM&H/U connector into ABSCM&H/U.
<b>10</b>	<b>CHECK THE POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the ignition power supply voltage between ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 18 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit of harness between ABSCM&H/U and battery.

# Subaru Select Monitor

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>11 CHECK HARNESS CONNECTOR BETWEEN ABSCM&amp;H/U AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Measure the resistance of the harness between ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal (B301) No. 15 — Chassis ground:</i>	Is the resistance less than 0.5 Ω?	Go to step 12.	Repair the open circuit of the harness between ABSCM&H/U and connector, and poor contact.
<b>12 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in the control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

# Subaru Select Monitor

## ABS (DIAGNOSTICS)

### 2. WITHOUT DTC

#### DETECTING CONDITION:

- Defective combination meter
- Open circuit of harness

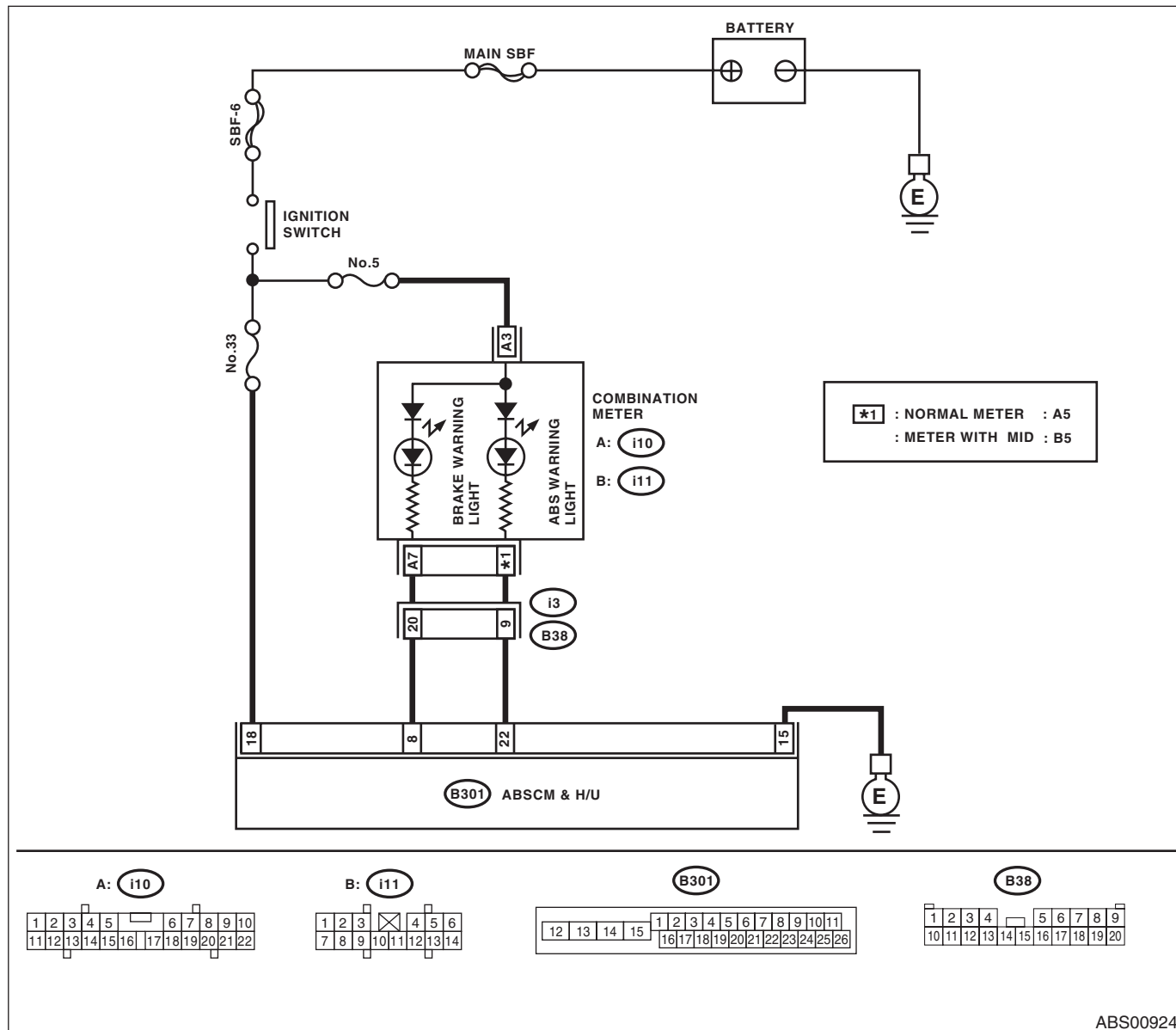
#### TROUBLE SYMPTOM:

- ABS warning light does not go off.
- "NO TROUBLE CODE" will be displayed on the Subaru Select Monitor.

#### NOTE:

When the ABS warning light is OFF and "NO TROUBLE CODE" is displayed on Subaru Select Monitor, the system is in normal condition.

#### WIRING DIAGRAM:



# Subaru Select Monitor

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK SUBARU SELECT MONITOR DATA.</b> 1) Select {Current Data Display & Save} in the Subaru Select Monitor. 2) Read the condition of "ABS warning light".	Is "ON" indicated?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 2.
<b>2 CHECK WIRING HARNESS.</b> Measure the resistance between ABSCM connector and combination meter connector. <i>Connector &amp; terminal</i> <i>Normal meter model</i> <i>(i10) No. 5 — (B301) No. 22:</i> <i>Meter model with MID</i> <i>(i11) No. 5 — (B301) No. 22:</i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair harness and connector between ABSCM&H/U and combination meter.
<b>3 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in ABSCM connector and combination meter connector?	Repair the connector.	Check the combination meter.

## Read Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

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### **7. Read Diagnostic Trouble Code (DTC)**

#### **A: OPERATION**

For details about reading of DTCs, refer to “Subaru Select Monitor”. <Ref. to ABS(diag)-14, Subaru Select Monitor.>

## **8. Inspection Mode**

### **A: PROCEDURE**

Reproduce the malfunction occurrence condition as much as possible.

Drive the vehicle at a speed of 40 km/h (25 MPH) or more for at least one minute.

### **9. Clear Memory Mode**

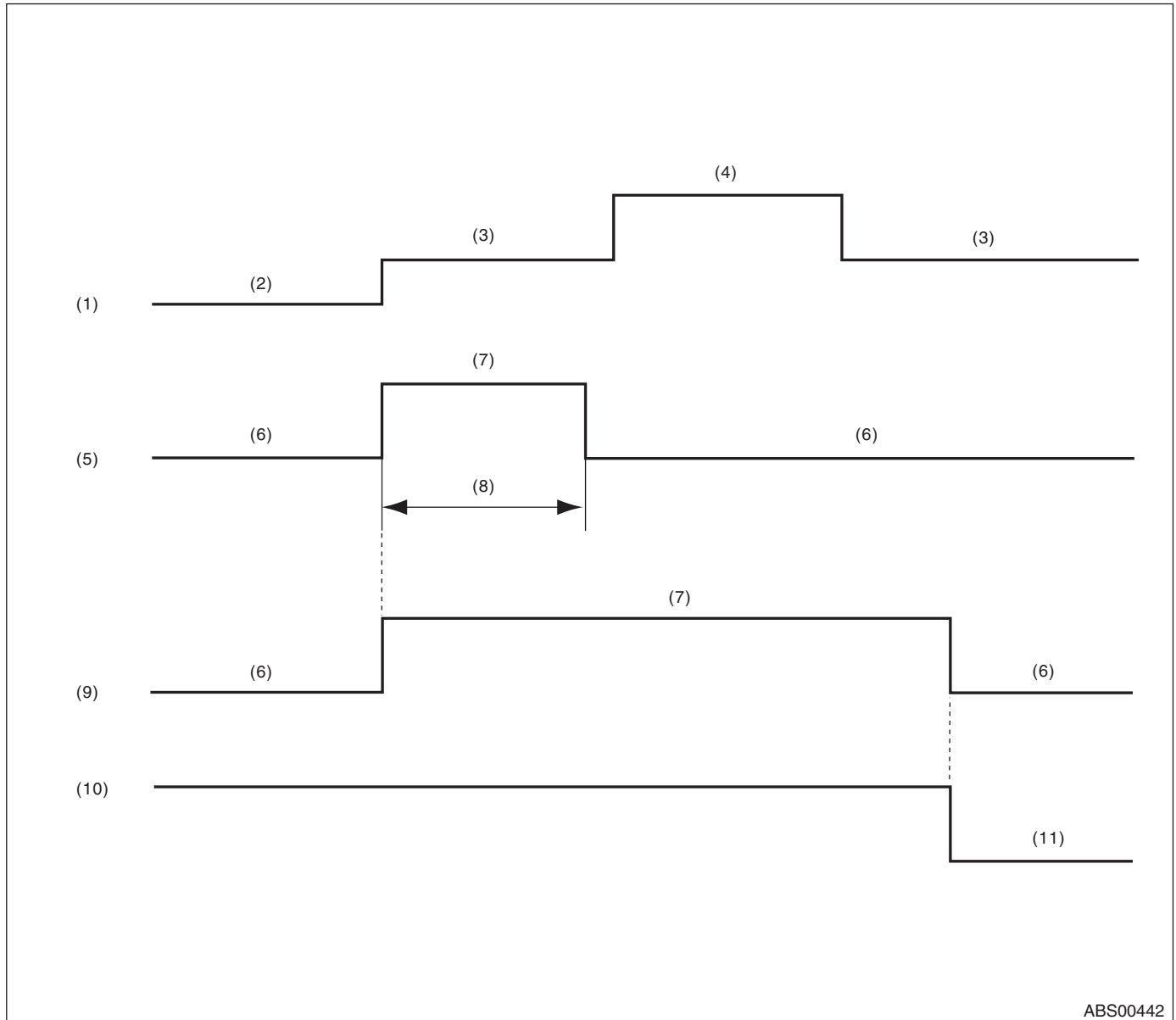
#### **A: OPERATION**

For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to ABS(diag)-14, Subaru Select Monitor.>



## 10. ABS Warning Light / Brake Warning Light Illumination Pattern

### A: INSPECTION



ABS00442

- (1) Ignition switch
- (2) OFF
- (3) ON
- (4) Engine start

- (5) ABS warning light
- (6) Light OFF
- (7) Light ON
- (8) 1.5 sec.

- (9) Brake warning light  
(EBD warning light)
- (10) Parking brake
- (11) Released

# ABS Warning Light / Brake Warning Light Illumination Pattern

## ABS (DIAGNOSTICS)

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- 1) When the ABS warning light and brake warning light do not illuminate in accordance with this illumination pattern, it can be thought that there is an electrical problem.
- 2) When the ABS warning light remains constantly OFF, check the combination meter circuit. <Ref. to ABS(diag)-27, ABS WARNING LIGHT DOES NOT COME ON, ABS Warning Light / Brake Warning Light Illumination Pattern.>
- 3) When ABS warning light does not go off, check the combination meter circuit. <Ref. to ABS(diag)-29, ABS WARNING LIGHT DOES NOT GO OFF, ABS Warning Light / Brake Warning Light Illumination Pattern.>
- 4) When the brake warning light does not go off, check the brake warning circuit and the combination meter circuit. <Ref. to ABS(diag)-31, BRAKE WARNING LIGHT DOES NOT GO OFF, ABS Warning Light / Brake Warning Light Illumination Pattern.>

### NOTE:

Even though the ABS warning light does not go off after approximately 1.5 seconds from ABS warning light illumination, the ABS function operates normally when the warning light goes off while driving at approximately 12 km/h (7 MPH). However, the ABS system does not work while the ABS warning light is illuminated.

# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

## B: ABS WARNING LIGHT DOES NOT COME ON

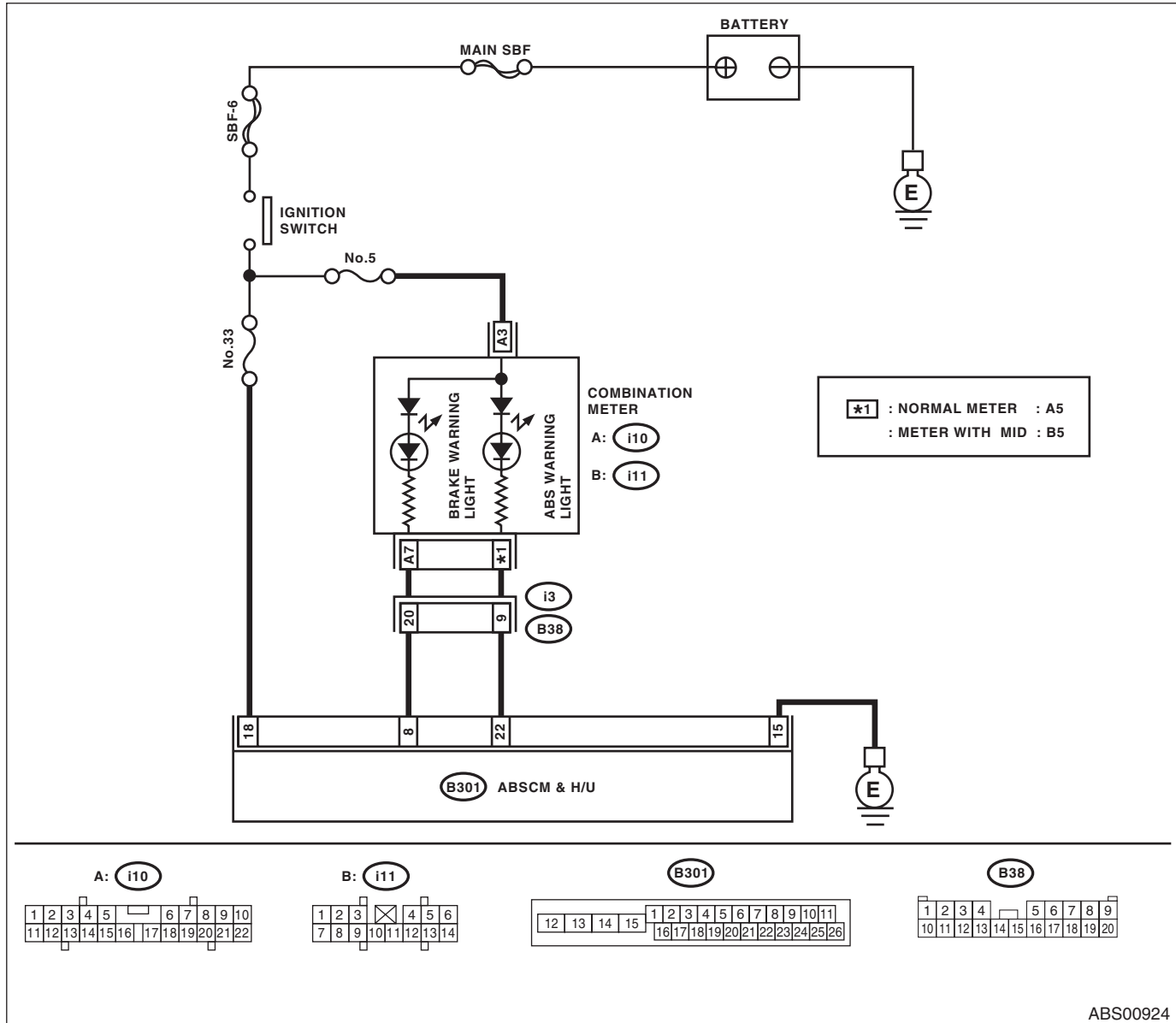
### DETECTING CONDITION:

- Defective combination meter
- Defective harness

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), ABS warning light does not come on.

### WIRING DIAGRAM:



ABS00924

# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK ILLUMINATION OF OTHER LIGHTS.</b> Turn the ignition switch to ON. (engine OFF)	Do other warning lights illuminate?	Go to step 2.	Check the combination meter.
<b>2 READ DTC.</b> Read the DTC. <Ref. to ABS(diag)-22, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
<b>3 CHECK GROUND SHORT OF HARNESS.</b> 1) Turn the ignition OFF. 2) Disconnect the connector (B301) from the ABSCM&H/U. 3) Disconnect the connector (i10) from combination meter. 4) Measure the resistance between ABSCM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 22 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair harness and connector between ABSCM&H/U and combination meter.
<b>4 CHECK ABSCM.</b> 1) Connect the connector (B301) to the ABSCM&H/U. 2) Turn the ignition to ON. 3) Measure the resistance between the combination meter connector and chassis ground soon after the ignition switch is turned to ON (within 1.5 seconds). <b>Connector &amp; terminal</b> <b>Normal meter model</b> <b>(i10) No. 5 — Chassis ground:</b> <b>Meter model with MID</b> <b>(i11) No. 5 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Check the combination meter.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

## C: ABS WARNING LIGHT DOES NOT GO OFF

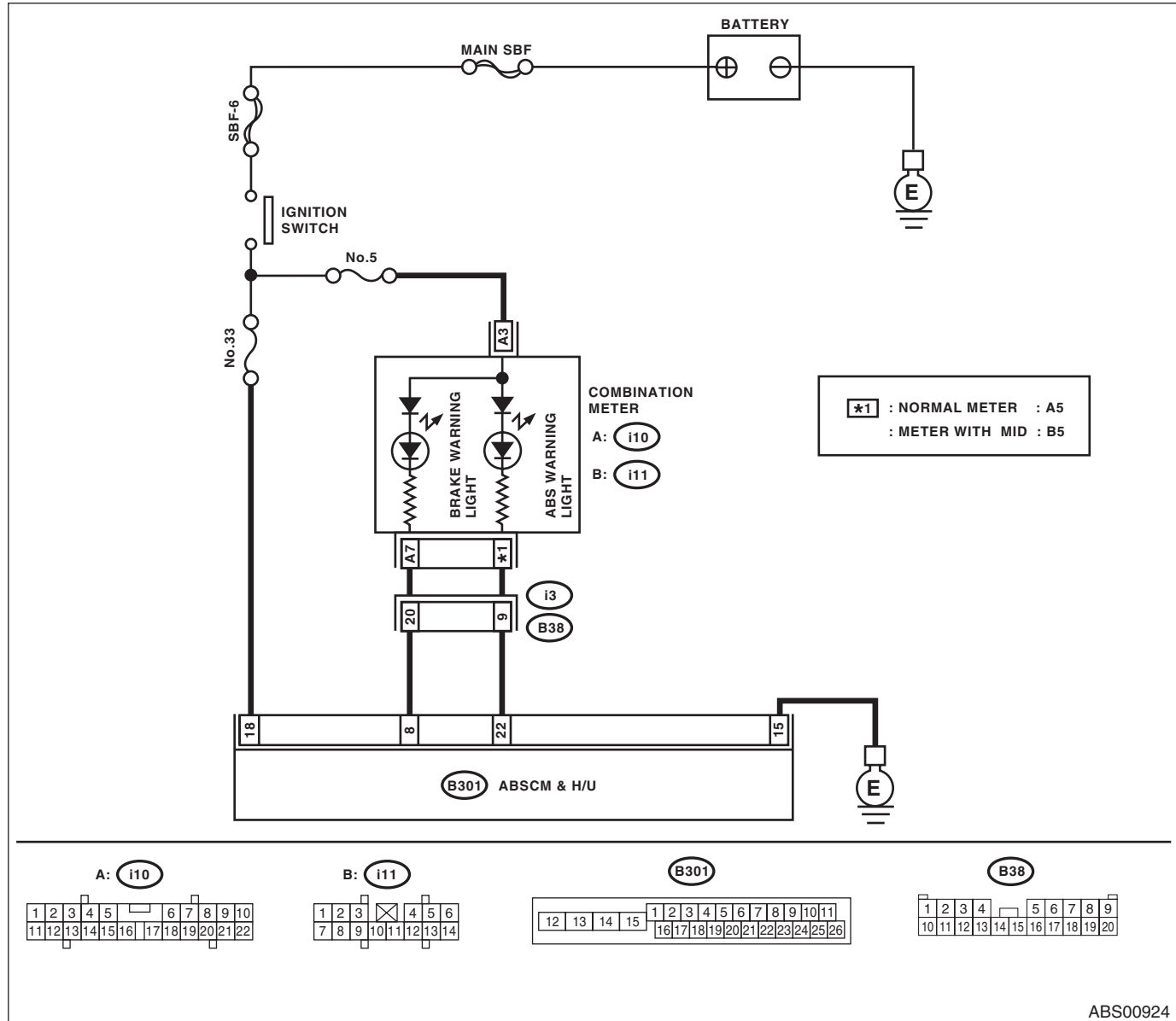
### DETECTING CONDITION:

- Defective combination meter
- Open circuit of harness

### TROUBLE SYMPTOM:

When starting the engine, the ABS warning light is kept on.

### WIRING DIAGRAM:



# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 READ DTC.</b> Read the DTC. <Ref. to ABS(diag)-22, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2 CHECK WIRING HARNESS.</b> 1) Turn the ignition OFF. 2) Disconnect the connector (B301) from the ABSCM&H/U. 3) Disconnect the connector (i10) from combination meter. 4) Measure the resistance between ABSCM connector and combination meter connector. <i><b>Connector &amp; terminal</b></i> <i><b>Normal meter model</b></i> <i><b>(B301) No. 22 — (i10) No. 5:</b></i> <i><b>Meter model with MID</b></i> <i><b>(B301) No. 22 — (i11) No. 5:</b></i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair harness and connector between ABSCM&H/U and combination meter.
<b>3 CHECK POOR CONTACT IN CONNECTOR.</b> Check for poor contact in all connectors.	Is there poor contact?	Repair the connector.	Go to step 4.
<b>4 CHECK ABSCM.</b> 1) Connect the connector (B301) to the ABSCM&H/U. 2) Turn the ignition switch to ON. 3) Measure the resistance between combination meter connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>Normal meter model</b></i> <i><b>(i10) No. 5 — Chassis ground:</b></i> <i><b>Meter model with MID</b></i> <i><b>(i11) No. 5 — Chassis ground:</b></i>	Is the resistance less than 0.5 Ω?	Check the combination meter.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

## D: BRAKE WARNING LIGHT DOES NOT GO OFF

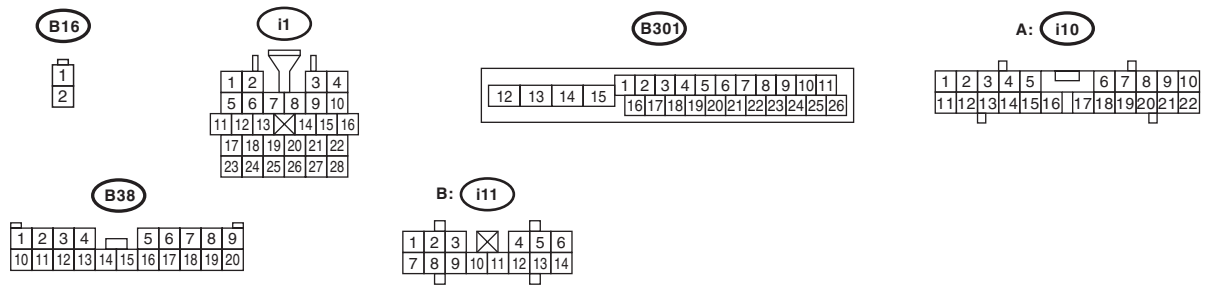
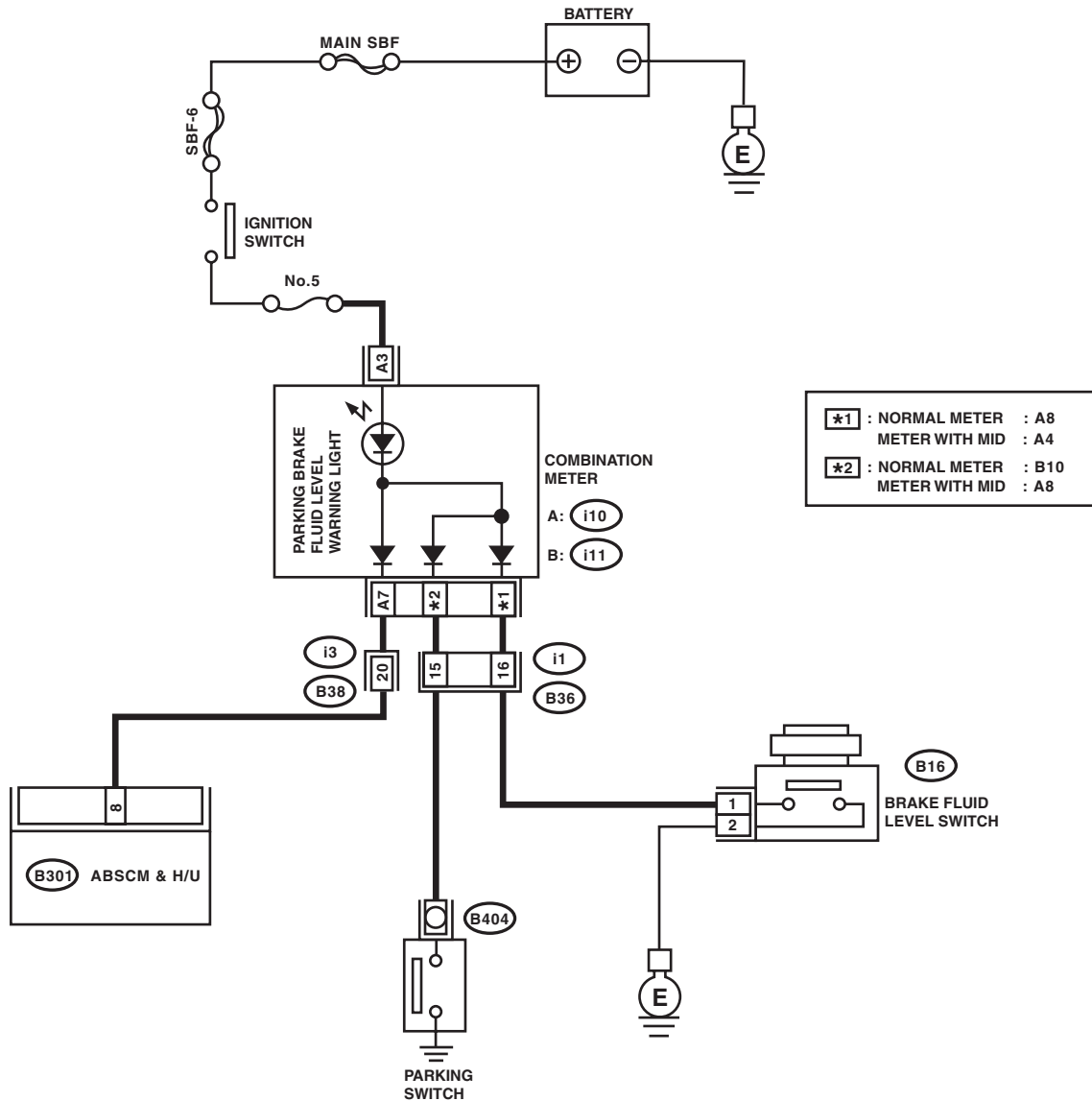
### DETECTING CONDITION:

- Brake warning light circuit is shorted.
- Defective sensor/connector

### TROUBLE SYMPTOM:

After starting the engine, the brake warning light remains lit though the parking lever is released.

### WIRING DIAGRAM:



ABS00994

# ABS Warning Light / Brake Warning Light Illumination Pattern

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INSTALLATION OF ABSCM&amp;H/U CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Check that the ABSCM&H/U connector is inserted to ABSCM&H/U until the clamp locks onto it.	Is the connector firmly inserted?	Go to step 2.	Insert the ABSCM&H/U connector until the clamp locks completely.
<b>2 READ DTC.</b> Read the DTC. <Ref. to ABS(diag)-22, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
<b>3 CHECK BRAKE FLUID AMOUNT.</b> Check the amount of brake fluid in the reservoir tank of the master cylinder.	Is the amount of brake fluid between the lines of "MAX" and "MIN"?	Go to step 4.	Replenish brake fluid to the specified value.
<b>4 CHECK BRAKE FLUID LEVEL SWITCH.</b> 1) Disconnect the level switch connector (B16) from master cylinder. 2) Measure the resistance of master cylinder terminals. <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Replace the master cylinder.
<b>5 CHECK PARKING BRAKE SWITCH.</b> 1) Disconnect the connector (B404) from parking brake switch. 2) Release the parking brake. 3) Measure the resistance between parking brake switch terminal and chassis ground.	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Replace the parking brake switch.
<b>6 CHECK GROUND SHORT OF HARNESS.</b> 1) Disconnect the connector (i10) and (i11) from the combination meter. 2) Measure the resistance between combination meter connector and chassis ground. <i>Connector &amp; terminal</i> <i>Normal meter model</i> <i>(i10) No. 8 — Chassis ground:</i> <i>(i11) No. 10 — Chassis ground:</i> <i>Meter model with MID</i> <i>(i10) No. 8 — Chassis ground:</i> <i>(i10) No. 4 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the harness connector between combination meter and parking brake switch.
<b>7 CHECK HARNESS.</b> 1) Disconnect the connector (B301) from the ABSCM&H/U. 2) Disconnect the connector (i10) from combination meter. 3) Measure the resistance between the ABSCM&H/U connector and combination meter connector. <i>Connector &amp; terminal</i> <i>(B301) No. 8 — (i10) No. 7:</i>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 8.	Repair the harness between the ABSCM&H/U and the combination meter.
<b>8 CHECK POOR CONTACT IN CONNECTOR.</b> Check for poor contact in all connectors.	Is there poor contact?	Repair the connector.	Go to step 9.
<b>9 CHECK ABSCM.</b> 1) Connect the connector to the ABSCM&H/U. 2) Turn the ignition switch to ON. 3) Measure the resistance between combination meter connector and chassis ground. <i>Connector &amp; terminal</i> <i>(i10) No. 7 — Chassis ground:</i>	Is the resistance less than 0.5 $\Omega$ ?	Check the combination meter.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>



# List of Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## 11. List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Content of diagnosis		Display	Reference target
C0101	ABS wheel speed sensor malfunction (Broken wire, short)	Rear ABS wheel speed sensor RH	Rear Right ABS Sensor Circuit Open or Shorted Battery	<Ref. to ABS(diag)-36, DTC C0101 ABS WHEEL SPEED SENSOR MALFUNCTION RR SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0102		Rear ABS wheel speed sensor LH	Rear Left ABS Sensor Circuit Open or Shorted Battery	<Ref. to ABS(diag)-36, DTC C0102 ABS WHEEL SPEED SENSOR MALFUNCTION RL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0103		Front ABS wheel speed sensor RH	Front Right ABS Sensor Circuit Open or Shorted Battery	<Ref. to ABS(diag)-36, DTC C0103 ABS WHEEL SPEED SENSOR MALFUNCTION FR SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0104		Front ABS wheel speed sensor LH	Front Left ABS Sensor Circuit Open or Shorted Battery	<Ref. to ABS(diag)-37, DTC C0104 ABS WHEEL SPEED SENSOR MALFUNCTION FL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0105	ABS wheel speed sensor malfunction (ABS wheel speed sensor abnormal signal)	Abnormal signal of rear ABS wheel speed sensor RH	Rear Right ABS Sensor Signal	<Ref. to ABS(diag)-39, DTC C0105 REAR ABS WHEEL SPEED SENSOR RH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0106		Abnormal signal of rear ABS wheel speed sensor LH	Rear Left ABS Sensor Signal	<Ref. to ABS(diag)-39, DTC C0106 REAR ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0107		Abnormal signal of front ABS wheel speed sensor RH	Front Right ABS Sensor Signal	<Ref. to ABS(diag)-39, DTC C0107 FRONT ABS WHEEL SPEED SENSOR RH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0108		Abnormal signal of front ABS wheel speed sensor LH	Front Left ABS Sensor Signal	<Ref. to ABS(diag)-40, DTC C0108 FRONT ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0109	Power voltage malfunction		Power Supply Voltage Failure	<Ref. to ABS(diag)-52, DTC C0109 POWER VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0110	ABS control module malfunction		ECM	<Ref. to ABS(diag)-50, DTC C0110 ABS CONTROL MODULE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### ABS (DIAGNOSTICS)

DTC	Content of diagnosis		Display	Reference target
C0111	Motor/motor relay on failure		Motor and Motor Relay	<Ref. to ABS(diag)-57, DTC C0111 MOTOR/MOTOR RELAY MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0114	Defective valve relay		Valve Relay	<Ref. to ABS(diag)-55, DTC C0114 VALVE RELAY MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0115	ABS wheel speed sensor malfunction (ABS wheel speed sensor abnormal signal)	Abnormal ABS wheel speed sensor on any one of four sensors	Any One of Four ABS Sensors Signal	<Ref. to ABS(diag)-43, DTC C0115 ABS WHEEL SPEED SENSOR SIGNAL MALFUNCTION IN ONE OF FOUR WHEELS, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0116	Stop light switch circuit malfunction		Brake Light Switch	<Ref. to ABS(diag)-59, DTC C0116 FAULTY STOP LIGHT SWITCH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0118	Faulty G sensor output voltage		G Sensor Failure	<Ref. to ABS(diag)-61, DTC C0118 G SENSOR OUTPUT VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0119	Abnormal G sensor output signal		G Sensor Signal	<Ref. to ABS(diag)-64, DTC C0119 G SENSOR OUTPUT VOLTAGE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0120	Inlet valve malfunction in hydraulic unit	Front inlet valve LH	FL Hold Valve malfunction	<Ref. to ABS(diag)-45, DTC C0120 FRONT INLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0121	Outlet valve malfunction in hydraulic unit	Front outlet valve LH	FL Pressure Reducing Valve malfunction	<Ref. to ABS(diag)-47, DTC C0121 FRONT OUTLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0122	Inlet valve malfunction in hydraulic unit	Front inlet valve RH	FR Hold Valve malfunction	<Ref. to ABS(diag)-45, DTC C0122 FRONT INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0123	Outlet valve malfunction in hydraulic unit	Front outlet valve RH	FR Pressure Reducing Valve malfunction	<Ref. to ABS(diag)-47, DTC C0123 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0124	Inlet valve malfunction in hydraulic unit	Rear inlet valve LH	RL Hold Valve malfunction	<Ref. to ABS(diag)-45, DTC C0124 REAR INLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

DTC	Content of diagnosis		Display	Reference target
C0125	Outlet valve malfunction in hydraulic unit	Rear outlet valve LH	RL Pressure Reducing Valve malfunction	<Ref. to ABS(diag)-47, DTC C0125 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0126	Inlet valve malfunction in hydraulic unit	Rear inlet valve RH	RR Hold Valve malfunction	<Ref. to ABS(diag)-46, DTC C0126 REAR INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0127	Outlet valve malfunction in hydraulic unit	Rear outlet valve RH	RR Pressure Reducing Valve malfunction	<Ref. to ABS(diag)-48, DTC C0127 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0140	Defective CAN communication		Improper CAN communication	<Ref. to ABS(diag)-54, DTC C0140 CAN COMMUNICATION MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

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### 12. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

#### **A: DTC C0101 ABS WHEEL SPEED SENSOR MALFUNCTION RR SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH)**

NOTE:

Refer to DTC C0104 for diagnostic procedure. <Ref. to ABS(diag)-37, DTC C0104 ABS WHEEL SPEED SENSOR MALFUNCTION FL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **B: DTC C0102 ABS WHEEL SPEED SENSOR MALFUNCTION RL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH)**

NOTE:

Refer to DTC C0104 for diagnostic procedure. <Ref. to ABS(diag)-37, DTC C0104 ABS WHEEL SPEED SENSOR MALFUNCTION FL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **C: DTC C0103 ABS WHEEL SPEED SENSOR MALFUNCTION FR SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH)**

NOTE:

Refer to DTC C0104 for diagnostic procedure. <Ref. to ABS(diag)-37, DTC C0104 ABS WHEEL SPEED SENSOR MALFUNCTION FL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## D: DTC C0104 ABS WHEEL SPEED SENSOR MALFUNCTION FL SENSOR (BROKEN WIRE, INPUT VOLTAGE TOO HIGH)

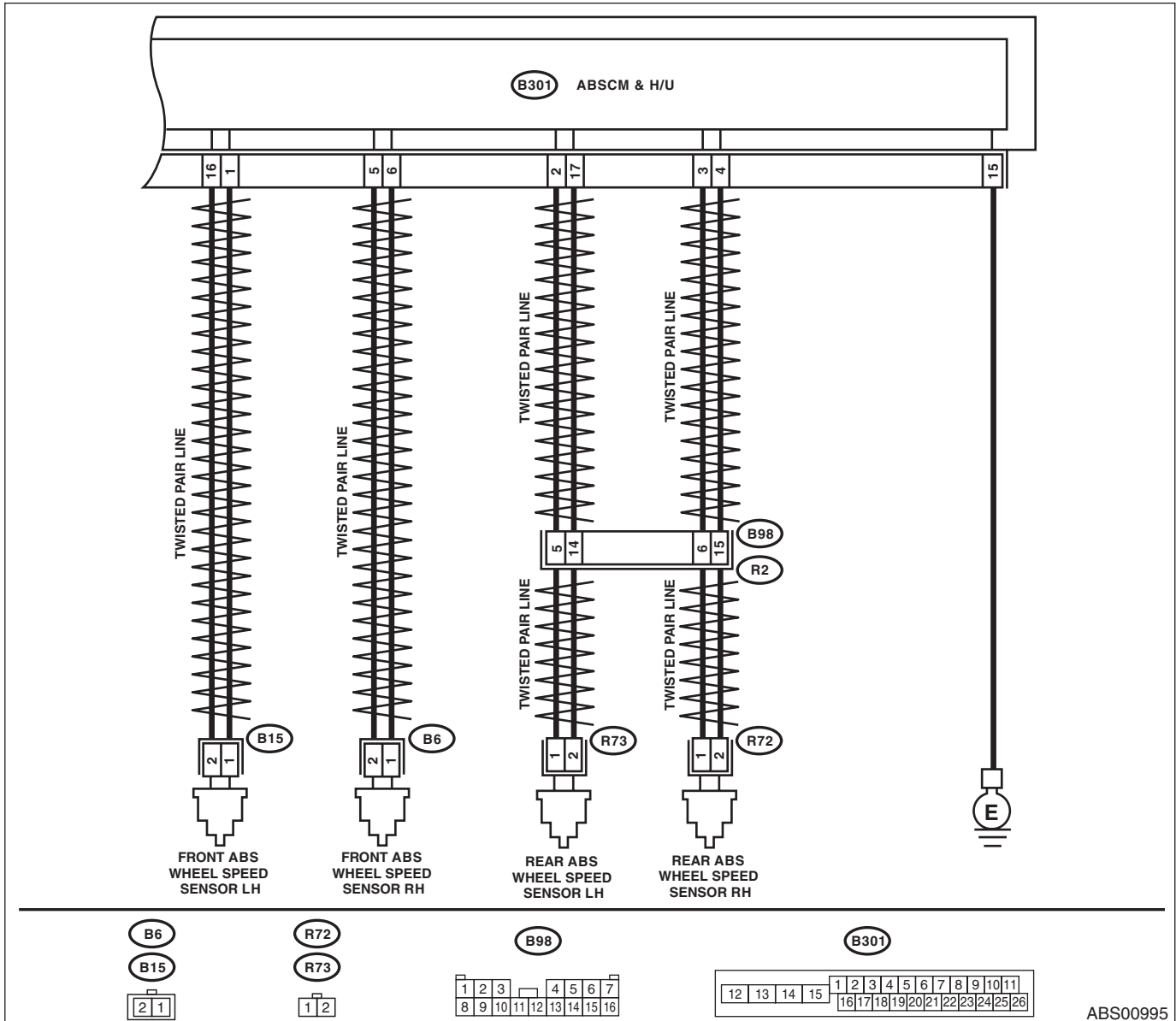
### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor (broken wire, input voltage too high)
- Defective harness connector

### TROUBLE SYMPTOM:

ABS does not operate.

### WIRING DIAGRAM:



ABS00995

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTOR.</b> Check if there is poor contact between ABSCM&H/U and ABS wheel speed sensor.	Is there poor contact?	Repair the connector.	Go to step 2.
<b>2 CHECK HARNESS CONNECTOR BETWEEN ABSCM&amp;H/U AND ABS WHEEL SPEED SENSOR.</b> 1) Disconnect the connector (B301) from the ABSCM&H/U. 2) Disconnect the connector from the ABS wheel speed sensor. 3) Measure the resistance between ABSCM&H/U connector and ABS wheel speed sensor connector. <i>Connector &amp; terminal</i> <b>DTC C0101</b> (B301) No. 3 — (R72) No. 1: (B301) No. 4 — (R72) No. 2: <b>DTC C0102</b> (B301) No. 2 — (R73) No. 1: (B301) No. 17 — (R73) No. 2: <b>DTC C0103</b> (B301) No. 5 — (B6) No. 2: (B301) No. 6 — (B6) No. 1: <b>DTC C0104</b> (B301) No. 16 — (B15) No. 2: (B301) No. 1 — (B15) No. 1:	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the harness connector between ABSCM&H/U and ABS wheel speed sensor.
<b>3 CHECK GROUND SHORT OF HARNESS.</b> Measure the resistance between the ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal</i> <b>DTC C0101</b> (B301) No. 4 — Chassis ground: <b>DTC C0102</b> (B301) No. 17 — Chassis ground: <b>DTC C0103</b> (B301) No. 6 — Chassis ground: <b>DTC C0104</b> (B301) No. 1 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the harness connector between ABSCM&H/U and ABS wheel speed sensor.
<b>4 CHECK ABS WHEEL SPEED SENSOR POWER SUPPLY CIRCUIT.</b> 1) Connect ABSCM&H/U connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ABS wheel speed sensor connector and chassis ground. <i>Connector &amp; terminal</i> <b>DTC C0101</b> (R72) No. 1 (+) — Chassis ground (-): <b>DTC C0102</b> (R73) No. 1 (+) — Chassis ground (-): <b>DTC C0103</b> (B6) No. 2 (+) — Chassis ground (-): <b>DTC C0104</b> (B15) No. 2 (+) — Chassis ground (-):	Is the voltage 5 — 16 V?	Go to step 6.	Go to step 5.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK THE ABSCM&amp;H/U POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Turn the ignition switch to ON. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 18 (+) — (B301) No. 15 (-):</b>	Is the voltage 10 — 15 V?	Go to step 6.	Check the generator, battery and ABSCM&H/U power supply circuit.
<b>6 CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Is the pattern the same waveform as shown in the figure?	Go to step 7.	Replace the ABS wheel speed sensor.
<b>7 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 8.
<b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

## **E: DTC C0105 REAR ABS WHEEL SPEED SENSOR RH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL)**

NOTE:

Refer to DTC C0108 for diagnostic procedure. <Ref. to ABS(diag)-40, DTC C0108 FRONT ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **F: DTC C0106 REAR ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL)**

NOTE:

Refer to DTC C0108 for diagnostic procedure. <Ref. to ABS(diag)-40, DTC C0108 FRONT ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **G: DTC C0107 FRONT ABS WHEEL SPEED SENSOR RH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL)**

NOTE:

Refer to DTC C0108 for diagnostic procedure. <Ref. to ABS(diag)-40, DTC C0108 FRONT ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## H: DTC C0108 FRONT ABS WHEEL SPEED SENSOR LH MALFUNCTION (ABS WHEEL SPEED SENSOR ABNORMAL SIGNAL)

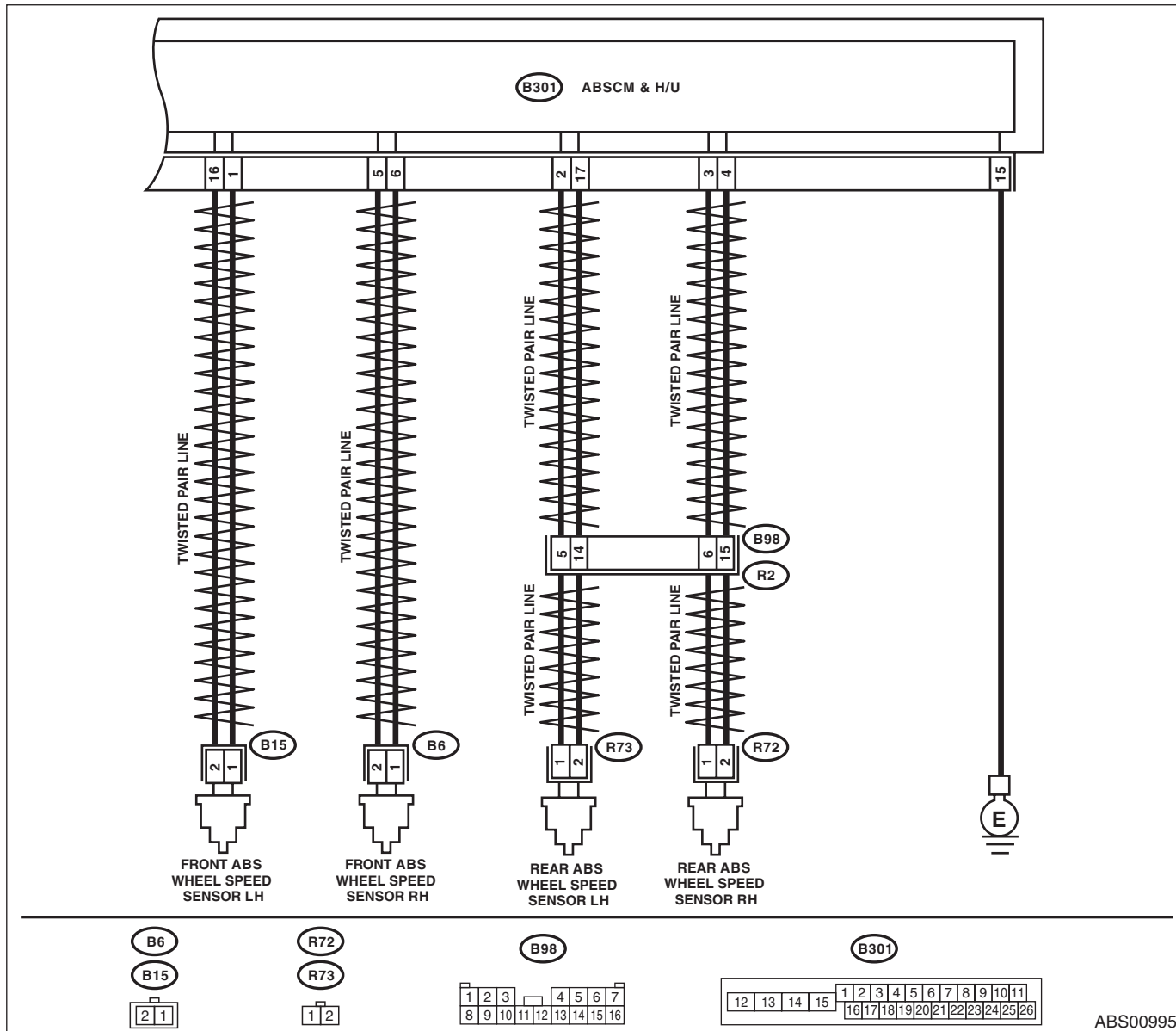
### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, abnormal signal, etc.)
- Defective harness connector

### TROUBLE SYMPTOM:

ABS does not operate.

### WIRING DIAGRAM:



ABS00995



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK OUTPUT OF ABS WHEEL SPEED SENSOR USING SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in the Subaru Select Monitor. 2) Read the defective ABS wheel speed sensor output.	Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?	Go to step 2.	Go to step 7.
2	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connectors between ABSCM&H/U and ABS wheel speed sensor?	Repair the connector.	Go to step 3.
3	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 4.	Install the radio wave devices and electric components properly.
4	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Check if the noise sources (such as an antenna) are installed near the sensor harness.	Are noise sources installed?	Install the noise sources apart from sensor harness.	Go to step 5.
5	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.
7	<b>CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.</b>	Is the ABS wheel speed sensor installation bolt tightened 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 8.	Tighten the ABS wheel speed sensor installation bolts.
8	<b>CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Does the oscilloscope indicate the waveform pattern like shown in the figure when the tire is slowly turned? Does the oscilloscope indication repeat the waveform pattern like shown in the figure when the tire is slowly turned in equal speed for one rotation or more?	Go to step 10.	Go to step 9.
9	<b>CHECK ABS WHEEL SPEED SENSOR OR MAGNETIC ENCODER.</b>	Are there foreign matter, breakage or damage at the tip of ABS wheel speed sensor or magnetic encoder?	Remove dirt thoroughly. Also replace the ABS wheel speed sensor or magnetic encoder as a unit with hub unit bearing if it is broken or damaged.	Go to step 10.
10	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 11.	Install the radio wave devices and electric components properly.
11	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Check if the noise sources (such as an antenna) are installed near the sensor harness.	Is the noise sources installed?	Go to step 12.	Install the noise sources apart from sensor harness.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>12 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 13.
<b>13 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference. <b>NOTE:</b> Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

## I: DTC C0115 ABS WHEEL SPEED SENSOR SIGNAL MALFUNCTION IN ONE OF FOUR WHEELS

### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, abnormal signal, etc.)
- Defective magnetic encoder
- When a wheel is turned freely for a long time

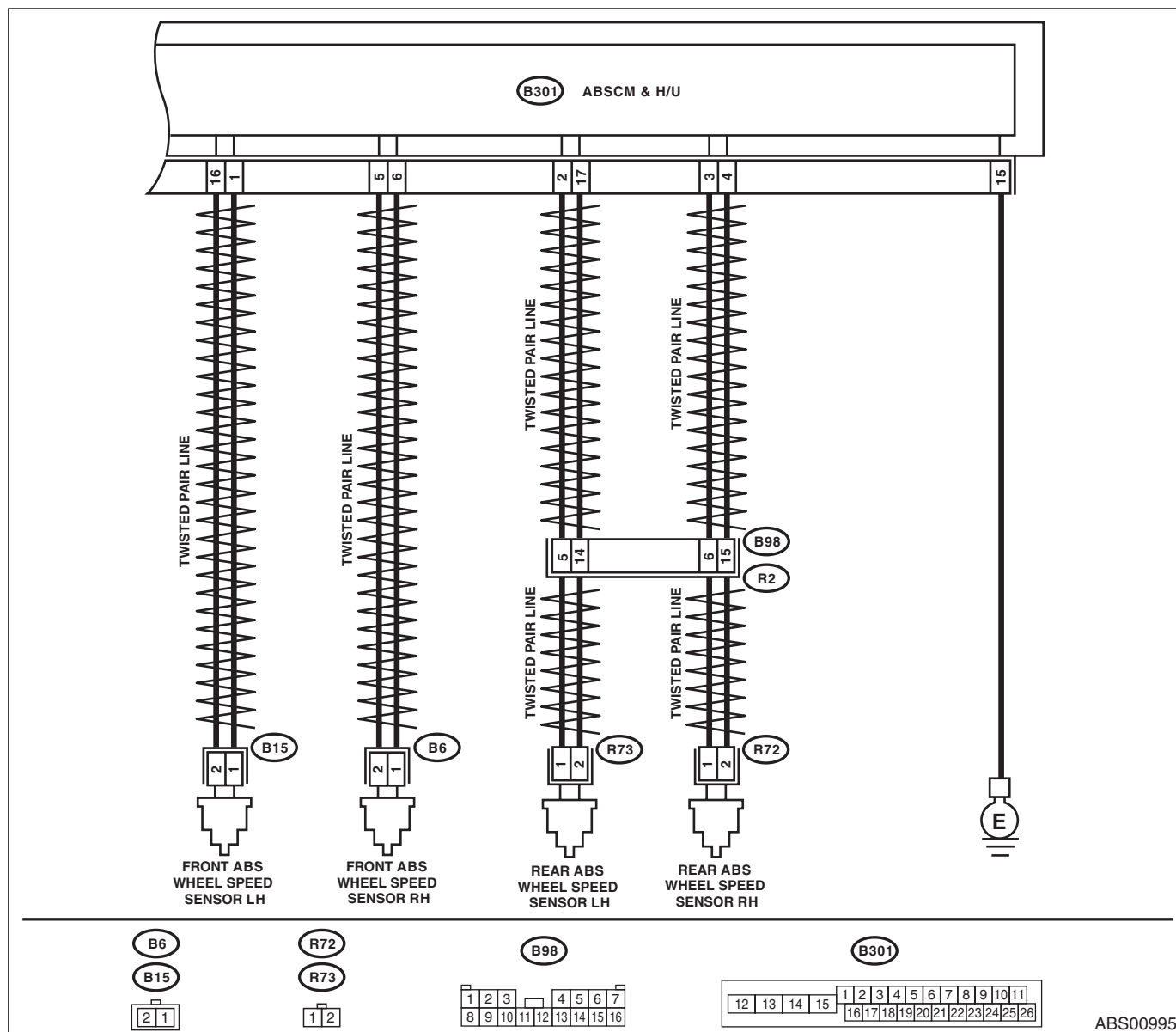
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.

### NOTE:

Brake warning light illuminates as well as the ABS warning light.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>WHETHER A WHEEL TURNED FREELY OR NOT.</b> Check if the wheels have been turned freely for one minute or more, such as when the vehicle is jacked-up, under full-lock cornering or when the wheels are not in contact with road surface.	Did the wheels turn freely?	ABS is normal. Erase the memory. NOTE: This diagnostic trouble code may sometimes occur if the wheels turn freely for a long time, for example when the vehicle is towed or jacked-up, or when steering wheel is continuously turned all the way.	Go to step 2.
<b>2</b> <b>CHECK TIRE SPECIFICATIONS.</b> Turn the ignition switch to OFF.	Are the tire specifications correct?	Go to step 3.	Replace the tire.
<b>3</b> <b>CHECK WEAR OF TIRE.</b>	Is the tire worn excessively?	Replace the tire.	Go to step 4.
<b>4</b> <b>CHECK TIRE INFLATION PRESSURE.</b>	Is the tire pressure correct?	Go to step 5.	Adjust the tire pressure.
<b>5</b> <b>CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.</b>	Are the ABS wheel speed sensor installation bolts tightened 7.5 N-m (0.76 kgf-m, 5.5 ft-lb)? (For four wheels)	Go to step 6.	Tighten the ABS wheel speed sensor installation bolts.
<b>6</b> <b>CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Does the oscilloscope indicate the waveform pattern like shown in the figure when the tire is slowly turned? Does the oscilloscope indication repeat the waveform pattern like shown in the figure when the tire is slowly turned in equal speed for one rotation or more?	Go to step 8.	Go to step 7.
<b>7</b> <b>CHECK ABS WHEEL SPEED SENSOR OR MAGNETIC ENCODER.</b>	Are there foreign matter, breakage or damage at the tip of ABS wheel speed sensor or magnetic encoder?	Remove dirt thoroughly. Also replace the ABS wheel speed sensor or magnetic encoder as a unit with hub unit bearing if it is broken or damaged.	Go to step 8.
<b>8</b> <b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to ABS(diag)-16, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 9.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No	
9	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

## **J: DTC C0120 FRONT INLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

NOTE:

Refer to DTC C0126 for diagnostic procedure. <Ref. to ABS(diag)-46, DTC C0126 REAR INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **K: DTC C0122 FRONT INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

NOTE:

Refer to DTC C0126 for diagnostic procedure. <Ref. to ABS(diag)-46, DTC C0126 REAR INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **L: DTC C0124 REAR INLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

NOTE:

Refer to DTC C0126 for diagnostic procedure. <Ref. to ABS(diag)-46, DTC C0126 REAR INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## M: DTC C0126 REAR INLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)

### DTC DETECTING CONDITION:

- Defective harness connector
- Defective inlet solenoid valve in ABSCM&H/U

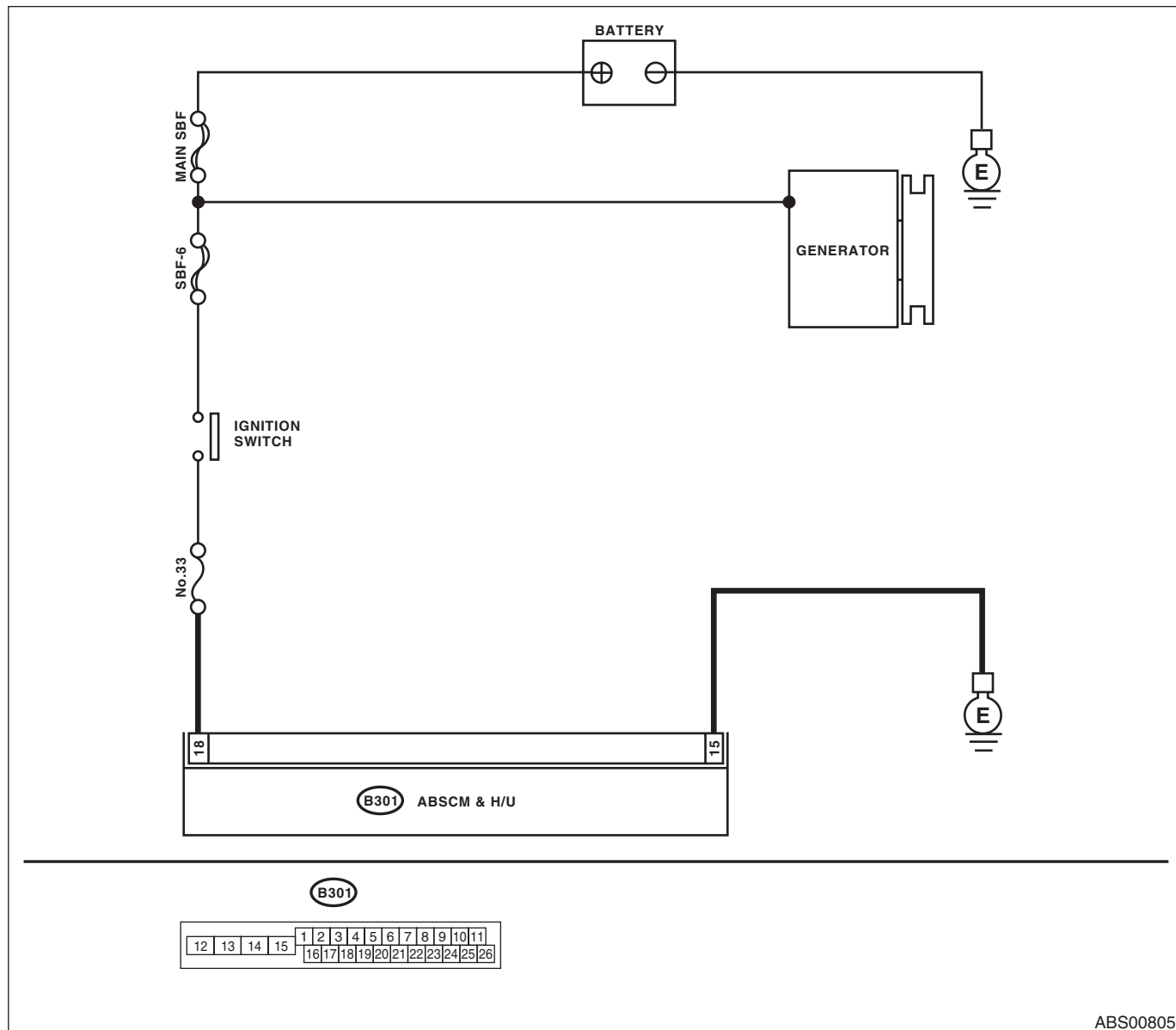
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.

### NOTE:

Brake warning light illuminates as well as the ABS warning light.

### WIRING DIAGRAM:



ABS00805

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Run the engine at idle. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal (B301) No. 18 (+) — Chassis ground (-):</i>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the ABSCM&H/U power circuit.
<b>2 CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal (B301) No. 15 — Chassis ground:</i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ABSCM&H/U ground harness.
<b>3 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair the connector.	Go to step 4.
<b>4 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

## **N: DTC C0121 FRONT OUTLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

### NOTE:

Refer to DTC C0127 for diagnostic procedure. <Ref. to ABS(diag)-48, DTC C0127 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **O: DTC C0123 FRONT OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

### NOTE:

Refer to DTC C0127 for diagnostic procedure. <Ref. to ABS(diag)-48, DTC C0127 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **P: DTC C0125 REAR OUTLET SOLENOID VALVE LH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)**

### NOTE:

Refer to DTC C0127 for diagnostic procedure. <Ref. to ABS(diag)-48, DTC C0127 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## Q: DTC C0127 REAR OUTLET SOLENOID VALVE RH MALFUNCTION IN ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM&H/U)

### DTC DETECTING CONDITION:

- Defective harness connector
- Defective outlet solenoid valve in ABSCM&H/U

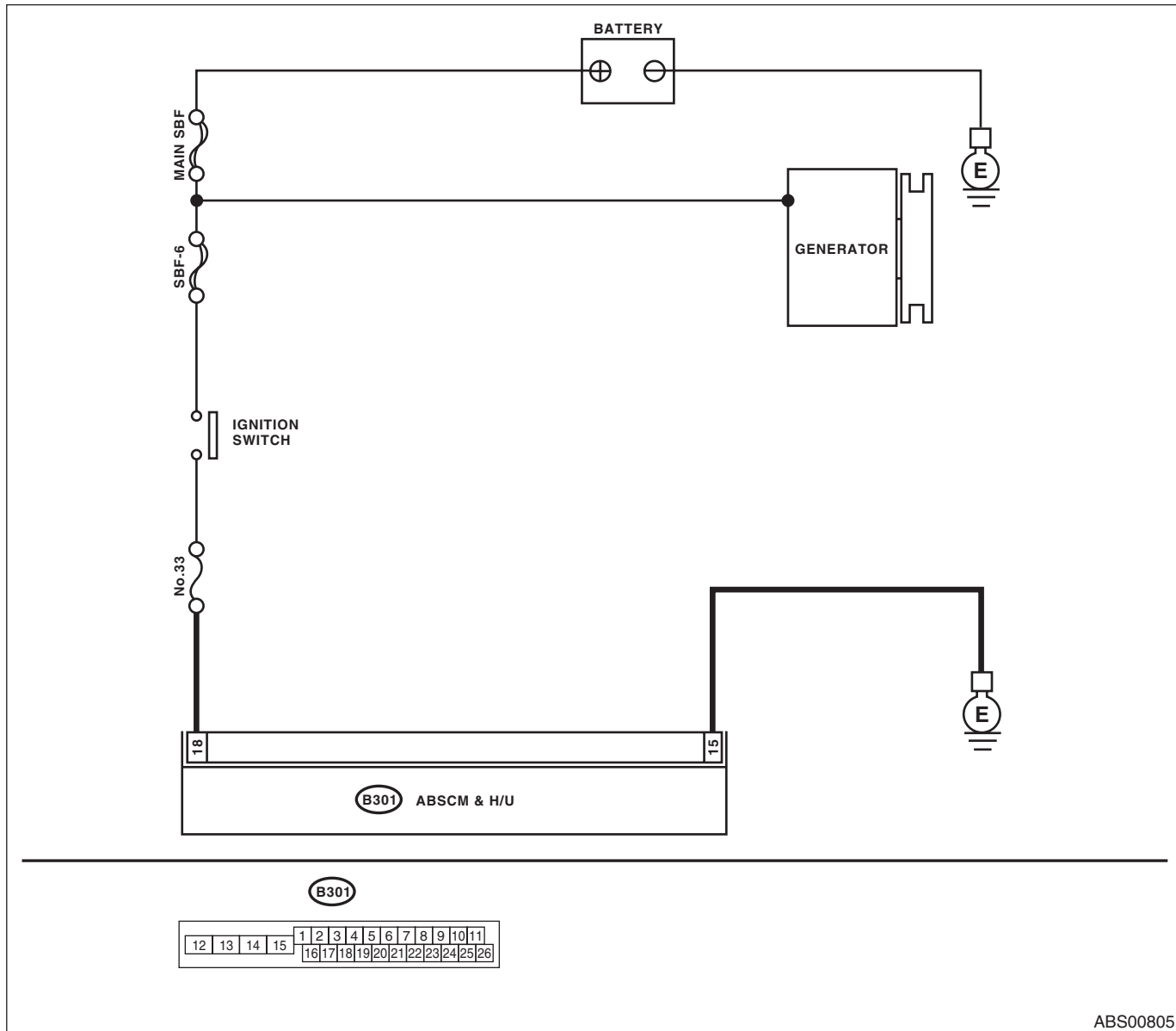
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.

### NOTE:

Brake warning light illuminates as well as the ABS warning light.

### WIRING DIAGRAM:



ABS00805



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Run the engine at idle. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B301) No. 18 (+) — Chassis ground (-):</i>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the ABSCM&H/U power circuit.
<b>2</b> <b>CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B301) No. 15 — Chassis ground:</i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ABSCM&H/U ground harness.
<b>3</b> <b>CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair the connector.	Go to step 4.
<b>4</b> <b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 5.
<b>5</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## R: DTC C0110 ABS CONTROL MODULE MALFUNCTION

### DTC DETECTING CONDITION:

Defective ABSCM&H/U

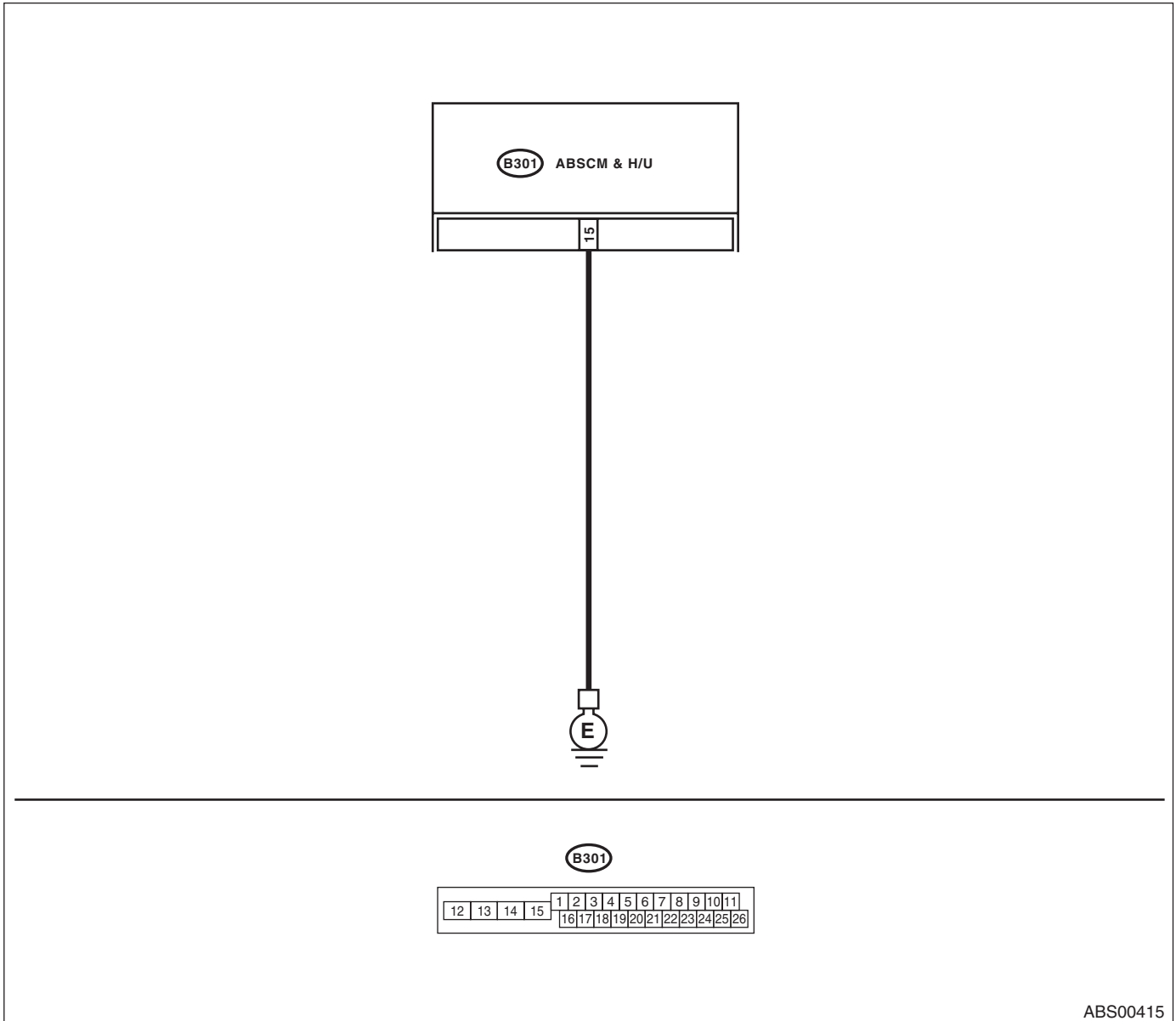
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.

### NOTE:

Brake warning light illuminates as well as the ABS warning light.

### WIRING DIAGRAM:



ABS00415

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Measure the resistance between the ABSCM&H/U and chassis ground. <b>Connector &amp; terminal (B301) No. 15 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 2.	Repair the ABSCM&H/U ground harness.
2	<b>CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact of the connector between the battery, ignition switch and ABSCM&H/U?	Repair the connector.	Go to step 3.
3	<b>CHECK CAUSE OF SIGNAL NOISE.</b>	Is the car telephone or the radio properly installed?	Go to step 4.	Properly install the car telephone or the wireless transmitter.
4	<b>CHECK CAUSE OF SIGNAL NOISE.</b>	Is there a noise source (such as an antenna) installed near the sensor harness?	Install the noise source apart from the sensor harness.	Go to step 5.
5	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
6	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## S: DTC C0109 POWER VOLTAGE MALFUNCTION

### DTC DETECTING CONDITION:

Power supply voltage of the ABSCM&H/U is too low or too high.

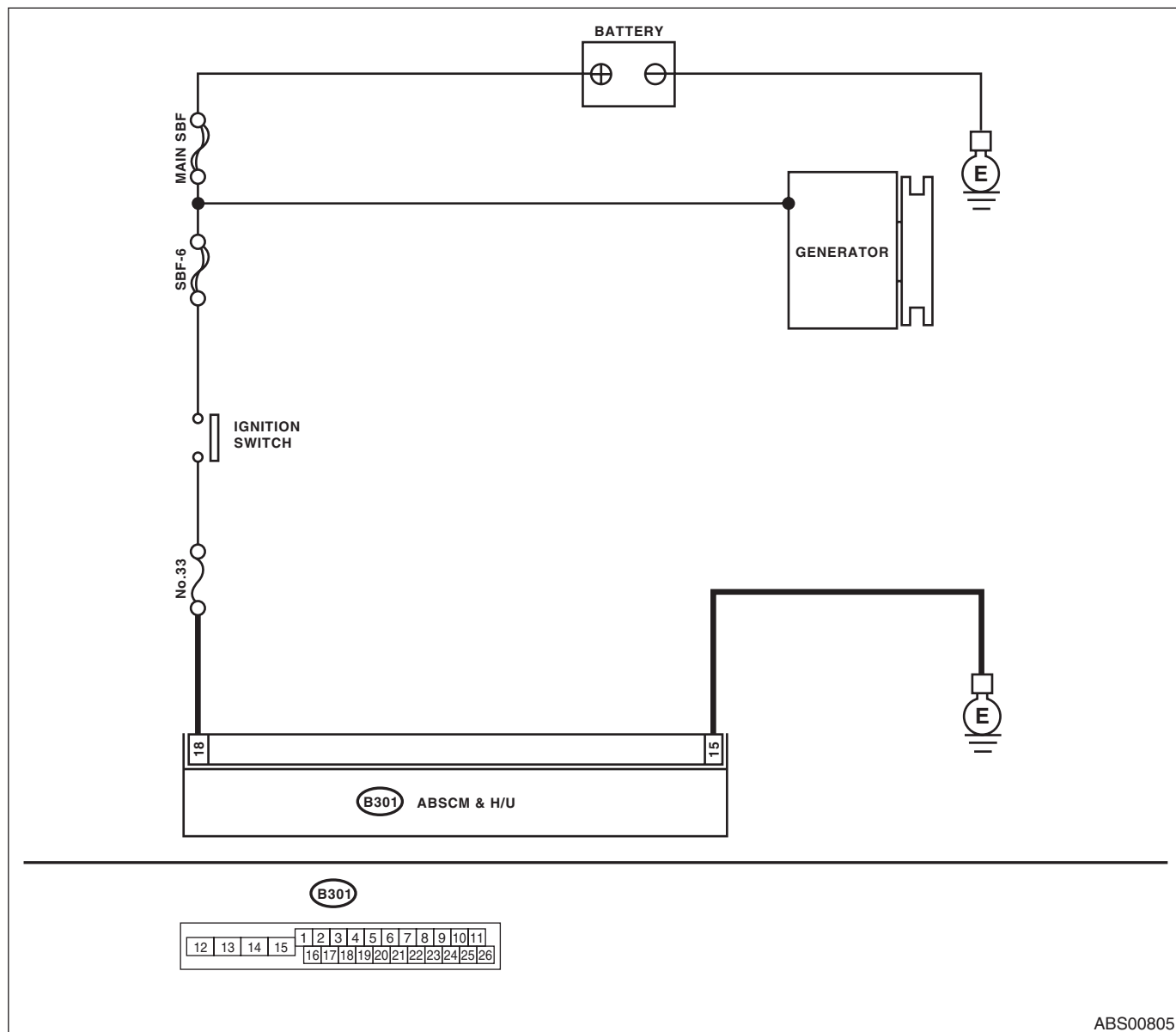
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD may not operate.

### NOTE:

If EBD does not operate, the brake warning light illuminates in addition to ABS warning light. Both warning lights go off if voltage returns.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK GENERATOR.</b> 1) Start the engine. 2) Run the engine at idle after warming up. 3) Measure the voltage between generator terminal B and chassis ground. <b>Terminals</b> <b>Generator B terminal (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the generator.
<b>2 CHECK BATTERY TERMINAL.</b> Turn the ignition switch to OFF.	Are the positive and negative battery terminals tightened securely?	Go to step 3.	Tighten the terminal.
<b>3 CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Disconnect the ABSCM&H/U connectors. 2) Run the engine at idle. 3) Operate devices such as headlights, air conditioner, defogger, etc. which produce an electrical load. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 18 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 4.	Repair the ABSCM&H/U power circuit.
<b>4 CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 15 — Chassis ground:</b>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 5.	Repair the ABSCM&H/U ground harness.
<b>5 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair the connector.	Go to step 6.
<b>6 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
<b>7 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

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## T: DTC C0140 CAN COMMUNICATION MALFUNCTION

### DTC DETECTING CONDITION:

Defective CAN communication

### TROUBLE SYMPTOM:

Possibly the vehicle speed cannot output on CAN.

	Step	Check	Yes	No
1	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Repair it according to DTC of LAN system.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

## U: DTC C0114 VALVE RELAY MALFUNCTION

### DTC DETECTING CONDITION:

Defective valve relay

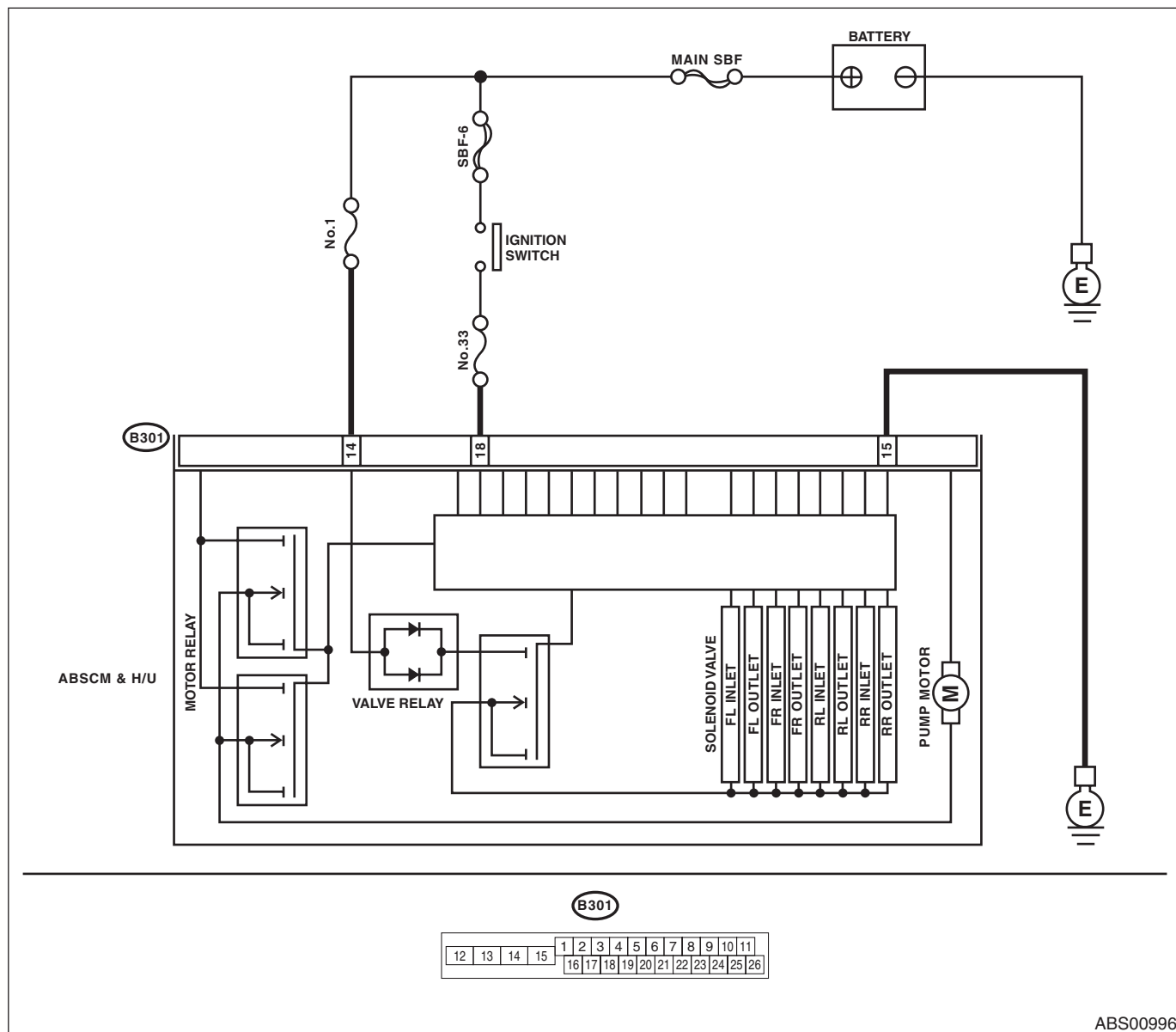
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate depending on the trouble contents.

### NOTE:

Brake warning light illuminates as well as ABS warning light when EBD does not operate.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Run the engine at idle. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 18 (+) — Chassis ground (-):</b> <b>(B301) No. 14 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the harness connector between battery and ABSCM&H/U.
<b>2 CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 15 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ABSCM&H/U ground harness.
<b>3 CHECK VALVE RELAY IN ABSCM&amp;H/U.</b> Measure the resistance between the ABSCM&H/U terminals. <b>Terminals</b> <b>No. 14 — No. 15:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>
<b>4 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair the connector.	Go to step 5.
<b>5 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 6.
<b>6 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.



## V: DTC C0111 MOTOR/MOTOR RELAY MALFUNCTION

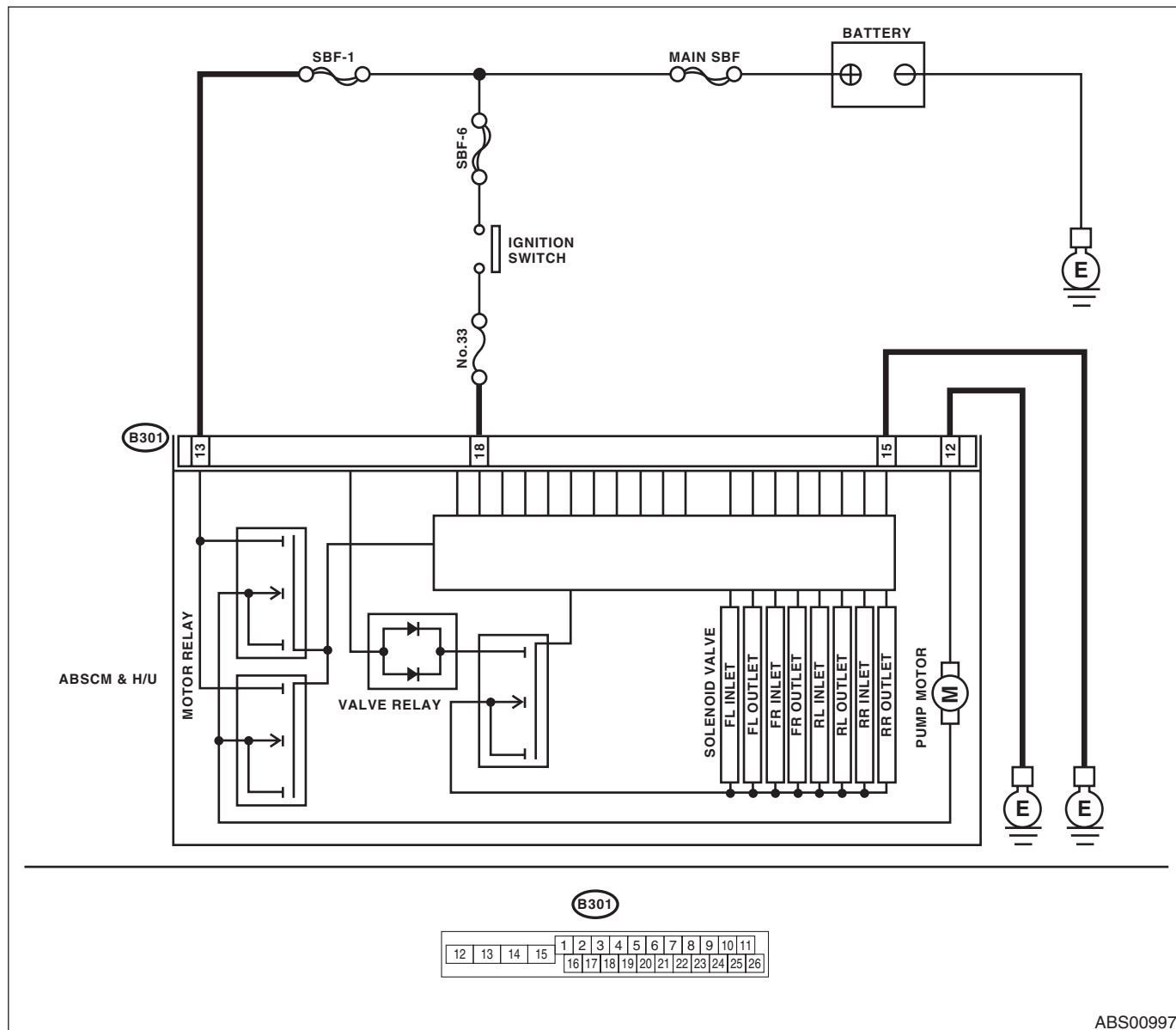
### DTC DETECTING CONDITION:

- Defective motor
- Defective motor relay
- Defective harness connector

### TROUBLE SYMPTOM:

ABS does not operate.

### WIRING DIAGRAM:



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ABS (DIAGNOSTICS)

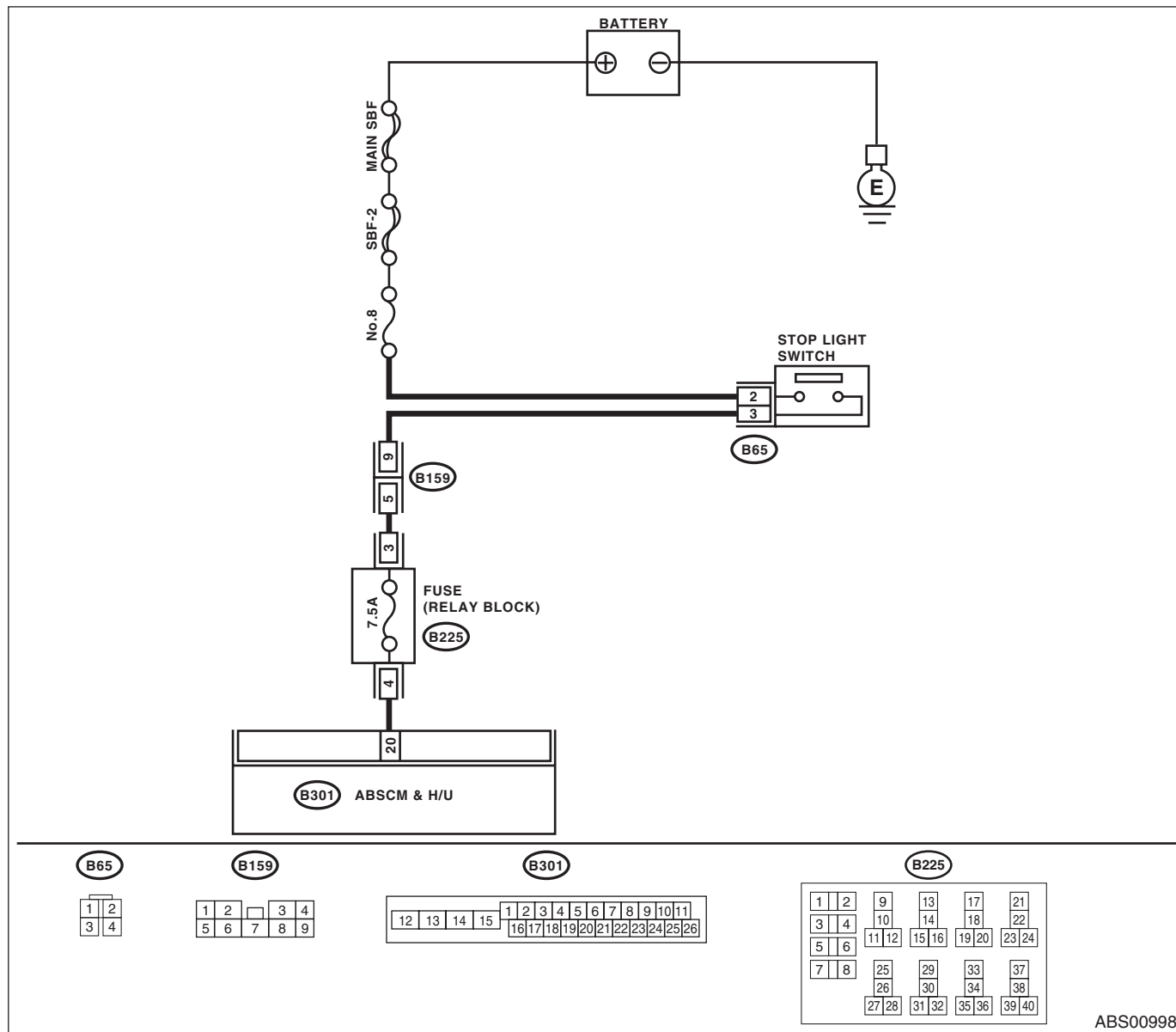
Step	Check	Yes	No
<b>1 CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Turn the ignition switch to ON. 4) Measure the voltage between ABSCM&H/U connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B301) No. 13 (+) — Chassis ground (-):</b></i>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the harness connector between battery and ABSCM&H/U.
<b>2 CHECK INSTALLATION OF MOTOR GROUND.</b>	Is the motor ground terminal installation bolt tightened 33 N·m (3.3 kgf·m, 24.3 ft-lb)?	Go to step 3.	Tighten the motor ground terminal installation bolt.
<b>3 CHECK GROUND CIRCUIT OF MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B301) No. 12 — Chassis ground:</b></i>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the ABSCM&H/U ground harness.
<b>4 CHECK INPUT VOLTAGE OF ABSCM&amp;H/U.</b> 1) Run the engine at idle. 2) Measure the voltage between ABSCM&H/U connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B301) No. 18 (+) — Chassis ground (-):</b></i>	Is the voltage 10 — 15 V?	Go to step 5.	Repair the harness connector between battery, ignition switch and ABSCM&H/U.
<b>5 CHECK THE ABSCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B301) No. 15 — Chassis ground:</b></i>	Is the resistance less than 0.5 Ω?	Go to step 6.	Repair the ABSCM&H/U ground harness.
<b>6 CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between generator, battery and ABSCM&H/U?	Repair the connector.	Go to step 7.
<b>7 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM&H/U. <Ref. to ABS-6, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 8.
<b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

## W: DTC C0116 FAULTY STOP LIGHT SWITCH

### DTC DETECTING CONDITION:

Defective stop light switch

### WIRING DIAGRAM:



ABS00998

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT OF STOP LIGHT SWITCH USING SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in the Subaru Select Monitor. 2) Release the brake pedal. 3) Read the stop light switch signal in Subaru Select Monitor.	Is "OFF" displayed on the screen?	Go to step 2.	Go to step 3.
<b>2 CHECK OUTPUT OF STOP LIGHT SWITCH USING SUBARU SELECT MONITOR.</b> 1) Depress the brake pedal. 2) Read the stop light switch output in Subaru Select Monitor.	Is "ON" displayed on the screen?	Go to step 6.	Go to step 3.
<b>3 CHECK IF STOP LIGHTS COME ON.</b> Depress the brake pedal.	Does the stop light illuminate?	Go to step 4.	Repair the stop light circuit.
<b>4 CHECK FUSE.</b> Check the fuse (B225).	Is the fuse OK?	Go to step 5.	Replace the fuse.
<b>5 CHECK OPEN CIRCUIT IN HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Depress the brake pedal. 4) Measure the voltage between ABSCM&H/U connector and chassis ground.  <i>Connector &amp; terminal (B301) No. 20 (+) — Chassis ground (-):</i>	Is the voltage 10 — 15 V?	Go to step 6.	Repair the harness between stop light switch and ABSCM&H/U connector.
<b>6 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in the connector between stop light switch and ABSCM&H/U?	Repair the connector.	Go to step 7.
<b>7 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 8.
<b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## X: DTC C0118 G SENSOR OUTPUT VOLTAGE MALFUNCTION

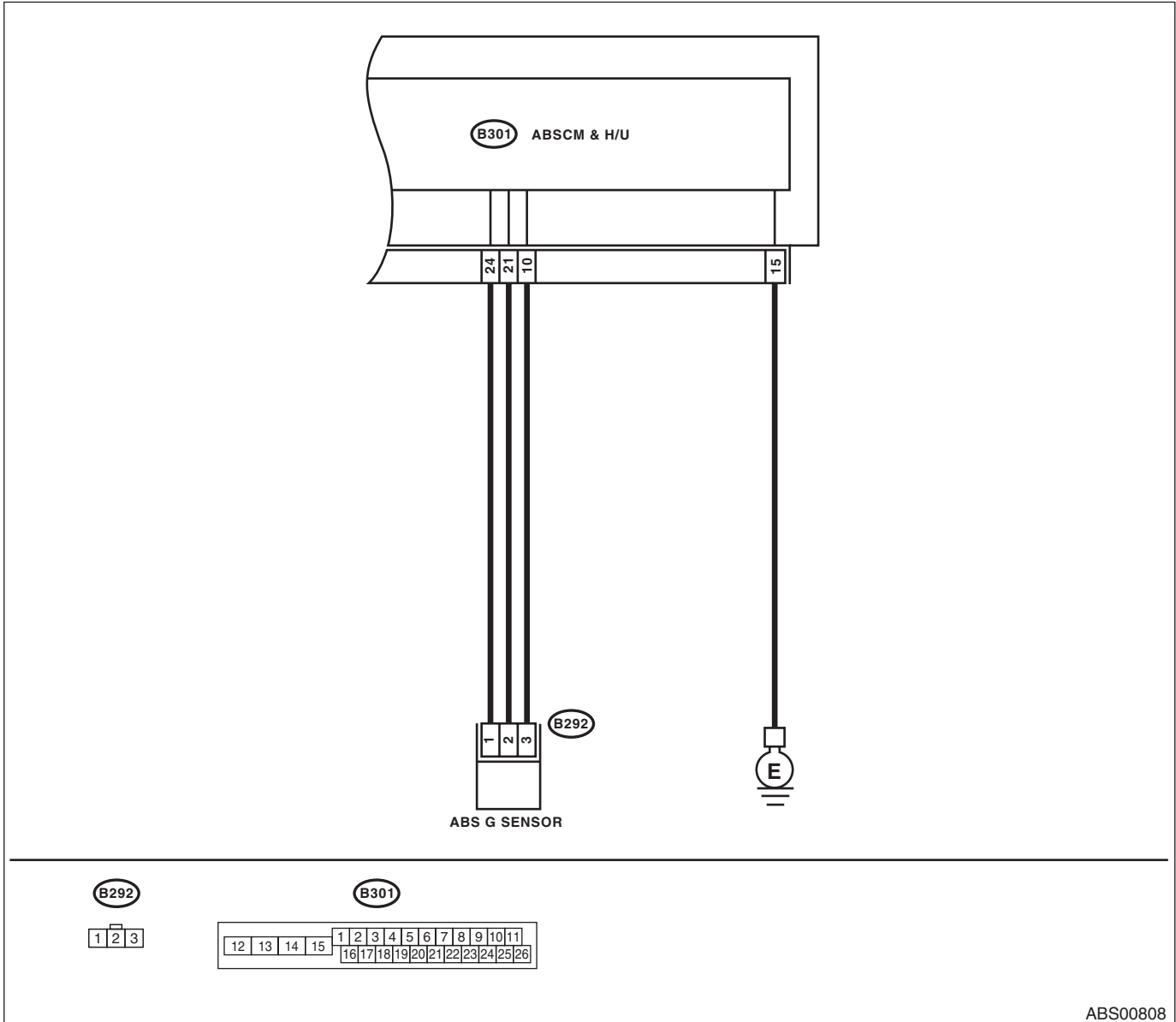
### DTC DETECTING CONDITION:

Defective G sensor

### TROUBLE SYMPTOM:

ABS does not operate.

### WIRING DIAGRAM:



ABS00808

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK OUTPUT OF G SENSOR USING SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in the Subaru Select Monitor. 2) Read the G sensor output on Subaru Select Monitor.	Is the reading indicated on display $-1.2$ — $1.2$ m/s when the G sensor is horizontal?	Go to step 2.	Go to step 5.
<b>2 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in connectors between ABSCM&H/U and G sensor?	Repair the connector.	Go to step 3.
<b>3 CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 4.
<b>4 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.
<b>5 CHECK INPUT VOLTAGE OF G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the console box. 3) Remove the G sensor from vehicle. (Do not disconnect the connector.) 4) Turn the ignition switch to ON. 5) Measure the voltage between G sensor connector terminals. <i>Connector &amp; terminal</i> <i>(B292) No. 1 (+) — No. 3 (-):</i>	Is the voltage $4.75$ — $5.25$ V?	Go to step 6.	Repair the harness connector between the G sensor and ABSCM&H/U.
<b>6 CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Measure the resistance between ABSCM&H/U connector terminals. <i>Connector &amp; terminal</i> <i>(B301) No. 21 — No. 10:</i>	Is the resistance between $3.6$ — $3.8$ k $\Omega$ ?	Go to step 7.	Repair the harness connector between the G sensor and ABSCM&H/U.
<b>7 CHECK GROUND SHORT IN G SENSOR OUTPUT HARNESS.</b> 1) Disconnect the connector from G sensor. 2) Measure the resistance between the ABSCM&H/U connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B301) No. 21 — Chassis ground:</i>	Is the resistance $1$ M $\Omega$ or more?	Go to step 8.	Repair the harness between the G sensor and ABSCM&H/U.
<b>8 CHECK G SENSOR.</b> 1) Connect the connector to G sensor. 2) Connect the connector to ABSCM&H/U. 3) Turn the ignition switch to ON. 4) Measure the voltage between G sensor connector terminals. <i>Connector &amp; terminal</i> <i>(B292) No. 2 (+) — No. 3 (-):</i>	Is the voltage $2.1$ — $2.5$ V when G sensor is in horizontal position?	Go to step 9.	Replace G sensor. <Ref. to ABS-18, G Sensor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

	Step	Check	Yes	No
9	<b>CHECK G SENSOR.</b> Measure the voltage between G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B292) No. 2 (+) — No. 3 (-):</b>	Is the voltage 3.6 — 4.1 V when the G sensor is inclined forward to 90°?	Go to step 10.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
10	<b>CHECK G SENSOR.</b> Measure the voltage between G sensor connector terminals. <b>Connector &amp; terminal</b> <b>(B292) No. 2 (+) — No. 3 (-):</b>	Is the voltage 0.5 — 1.0 V when G sensor is inclined back 90°?	Go to step 11.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
11	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connectors between ABSCM&H/U and G sensor?	Repair the connector.	Go to step 12.
12	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 13.
13	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

## Y: DTC C0119 G SENSOR OUTPUT VOLTAGE MALFUNCTION

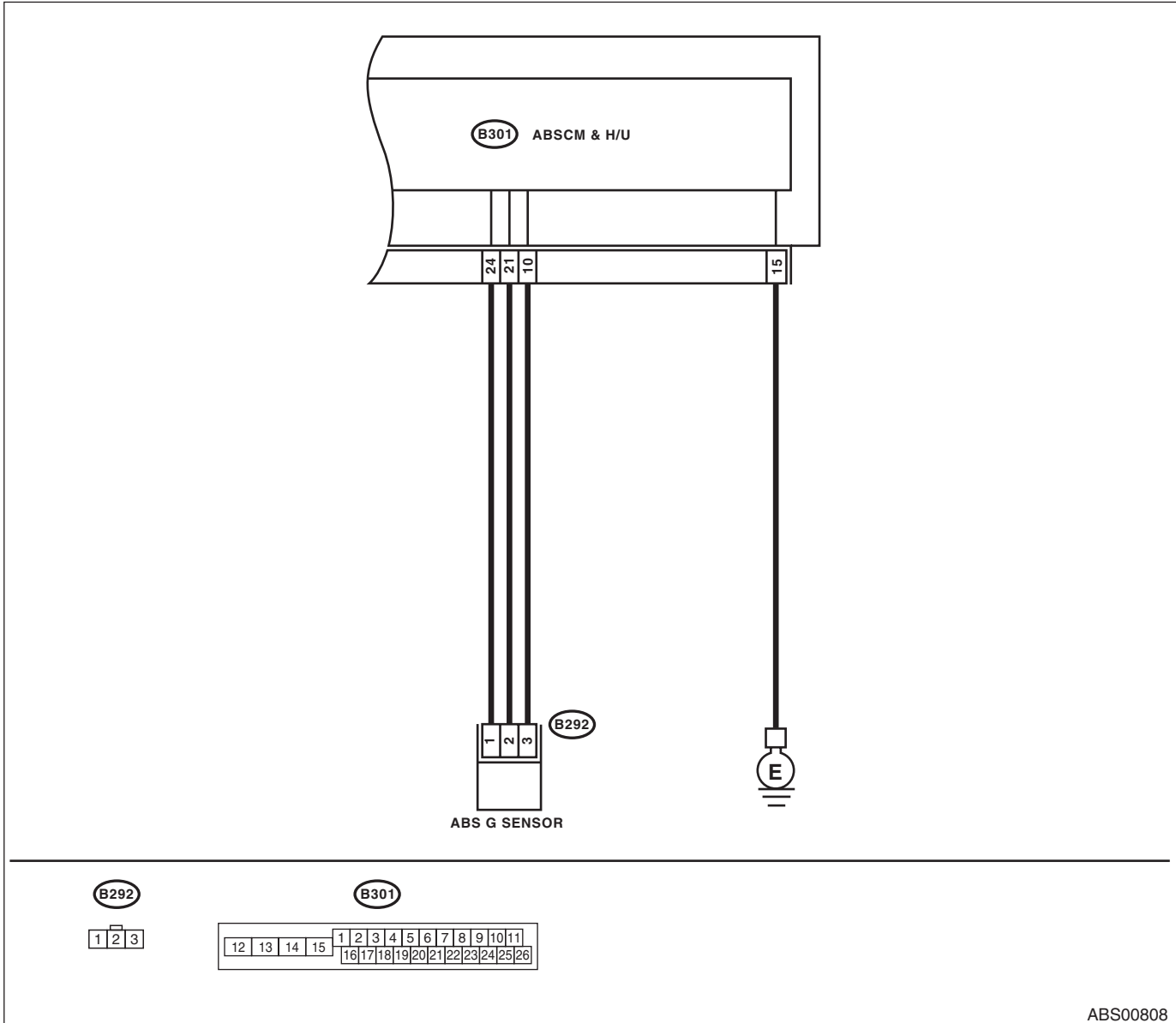
### DTC DETECTING CONDITION:

Defective G sensor

### TROUBLE SYMPTOM:

ABS does not operate.

### WIRING DIAGRAM:



ABS00808



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b>	<b>WHETHER A WHEEL TURNED FREELY OR NOT.</b>	ABS is normal. Erase the memory.	Go to step 2.
<b>2</b>	<b>CHECK OUTPUT OF G SENSOR USING SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in the Subaru Select Monitor. 2) Read the Subaru Select Monitor display.	Go to step 3.	Go to step 8.
<b>3</b>	<b>CHECK OUTPUT OF G SENSOR USING SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the console box. 3) Remove the G sensor from vehicle. (Do not disconnect the connector.) 4) Turn the ignition switch to ON. 5) Select {Current Data Display & Save} in the Subaru Select Monitor. 6) Read the Subaru Select Monitor display.	Go to step 4.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
<b>4</b>	<b>CHECK OUTPUT OF G SENSOR USING SUBARU SELECT MONITOR.</b> Read the Subaru Select Monitor display.	Go to step 5.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
<b>5</b>	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Repair the connector.	Go to step 6.
<b>6</b>	<b>CHECK ABSCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 7.
<b>7</b>	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.
<b>8</b>	<b>CHECK OPEN CIRCUIT IN G SENSOR OUTPUT HARNESS AND GROUND HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ABSCM&H/U connectors. 3) Measure the resistance between ABSCU&H/U connector terminals. <b>Connector &amp; terminal</b> <b>(B301) No. 21 — No. 10:</b>	Go to step 9.	Repair the harness connector between the G sensor and ABSCM&H/U.
<b>9</b>	<b>CHECK GROUND SHORT OF HARNESS.</b> Measure the resistance between the ABSCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B301) No. 21 — Chassis ground:</b>	Go to step 10.	Repair the harness connector between the G sensor and ABSCM&H/U.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### ABS (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK G SENSOR.</b> 1) Remove the console box. 2) Remove the G sensor from vehicle. 3) Connect the connector to G sensor. 4) Connect the connector to ABSCM&H/U. 5) Turn the ignition switch to ON. 6) Measure the voltage between G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B292) No. 2 (+) — No. 3 (-):</b></i>	Is the voltage 2.1 — 2.5 V when G sensor is in horizontal position?	Go to step 11.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
<b>11 CHECK G SENSOR.</b> Measure the voltage between G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B292) No. 2 (+) — No. 3 (-):</b></i>	Is the voltage 3.6 — 4.1 V when the G sensor is inclined forward to 90°?	Go to step 12.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
<b>12 CHECK G SENSOR.</b> Measure the voltage between G sensor connector terminals. <i><b>Connector &amp; terminal</b></i> <i><b>(B292) No. 2 (+) — No. 3 (-):</b></i>	Is the voltage 0.5 — 1.0 V when G sensor is inclined back 90°?	Go to step 13.	Replace G sensor. <Ref. to ABS-18, G Sensor.>
<b>13 CHECK ABSCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the ABSCM only. <Ref. to ABS-8, REPLACEMENT, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Go to step 14.
<b>14 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to ABS(diag)-33, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

## 13. General Diagnostic Table

### A: INSPECTION

Symptom		Problem parts
Vehicle instability during braking	Vehicle is pulled to either right or left side.	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve)</li> <li>• ABS wheel speed sensor</li> <li>• Brake (caliper, piston and pad)</li> <li>• Wheel alignment</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> <li>• Road surface (uneven, camber)</li> </ul>
	Vehicle spins.	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve)</li> <li>• ABS wheel speed sensor</li> <li>• Brake (pad)</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>
Poor brake performance	Long braking/stopping distance	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve)</li> <li>• Brake (pad)</li> <li>• Air in brake line</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>
	Wheel locks.	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve, motor)</li> <li>• ABS wheel speed sensor</li> <li>• Incorrect wiring or piping connections</li> </ul>
	Brake drag	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve)</li> <li>• ABS wheel speed sensor</li> <li>• Master cylinder</li> <li>• Brake (caliper and piston)</li> <li>• Parking brake</li> <li>• Axle &amp; wheels</li> <li>• Brake pedal play</li> </ul>
	Long brake pedal stroke	<ul style="list-style-type: none"> <li>• Air in brake line</li> <li>• Brake pedal play</li> </ul>
	Vehicle vertical pitching	<ul style="list-style-type: none"> <li>• Suspension play or fatigue (reduced damping)</li> <li>• Incorrect wiring or piping connections</li> <li>• Road surface (uneven)</li> </ul>
	Unstable or uneven braking	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (solenoid valve)</li> <li>• ABS wheel speed sensor</li> <li>• Brake (caliper, piston and pad)</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> <li>• Road surface (uneven)</li> </ul>
	Excessive pedal vibration	<ul style="list-style-type: none"> <li>• Incorrect wiring or piping connections</li> <li>• Road surface (uneven)</li> </ul>
Vibration and/or noise (while driving on slippery roads)	Noise from the ABSCM&H/U	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (mount bushing)</li> <li>• ABS wheel speed sensor</li> <li>• Brake line</li> </ul>
	Noise from front of vehicle	<ul style="list-style-type: none"> <li>• ABSCM&amp;H/U (mount bushing)</li> <li>• ABS wheel speed sensor</li> <li>• Master cylinder</li> <li>• Brake (caliper, piston, pad and rotor)</li> <li>• Brake line</li> <li>• Brake booster and check valve</li> <li>• Suspension play or fatigue</li> </ul>
	Noise from rear of vehicle	<ul style="list-style-type: none"> <li>• ABS wheel speed sensor</li> <li>• Brake (caliper, piston, pad and rotor)</li> <li>• Parking brake</li> <li>• Brake line</li> <li>• Suspension play or fatigue</li> </ul>

# General Diagnostic Table

ABS (DIAGNOSTICS)

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# General Description

VEHICLE DYNAMICS CONTROL (VDC)

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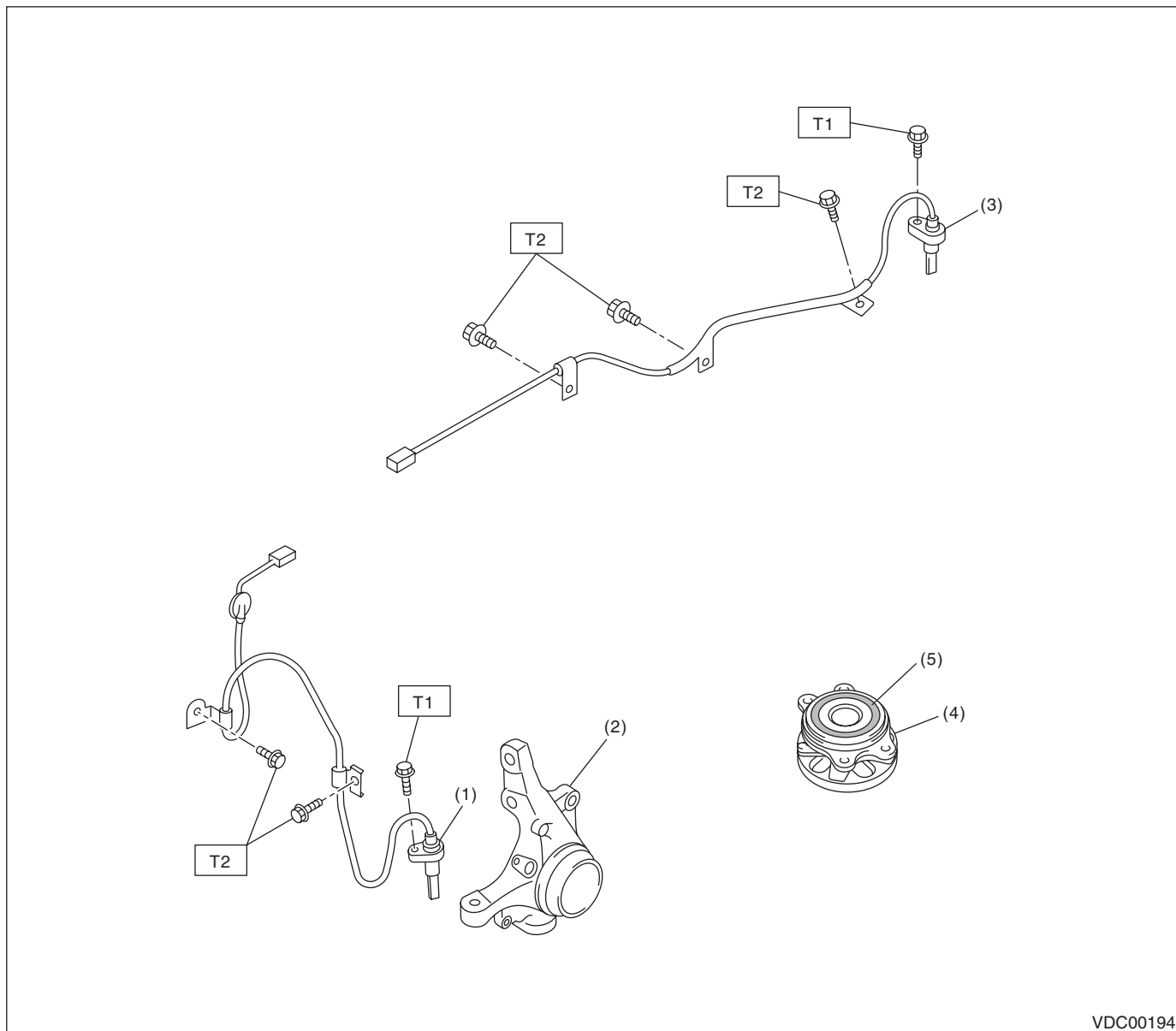
## 1. General Description

### A: SPECIFICATION

Item			Specification or identification	
ABS wheel speed sensor	ABS wheel speed sensor gap (for reference)	Front	0.77 — 1.43 mm (0.030 — 0.056 in)	
		Rear	0.64 — 1.56 mm (0.025 — 0.061 in)	
	Identifications of harness (marks, color)	Front	RH	K1 (White)
			LH	K2 (Yellow)
		Rear	RH	K5 (White)
			LH	K6 (Yellow)
VDCCM&H/U Identification	AT(2.5GT SED, OBK 2.5XT, OBK 3.0R)		T3	
	AT (other than above)		T7	
	MT		T4	

## B: COMPONENT

### 1. ABS WHEEL SPEED SENSOR



VDC00194

- |                                  |                      |
|----------------------------------|----------------------|
| (1) Front ABS wheel speed sensor | (4) Hub unit bearing |
| (2) Front housing                | (5) Magnetic encoder |
| (3) Rear ABS wheel speed sensor  |                      |

**Tightening torque: N·m (kgf·m, ft·lb)**

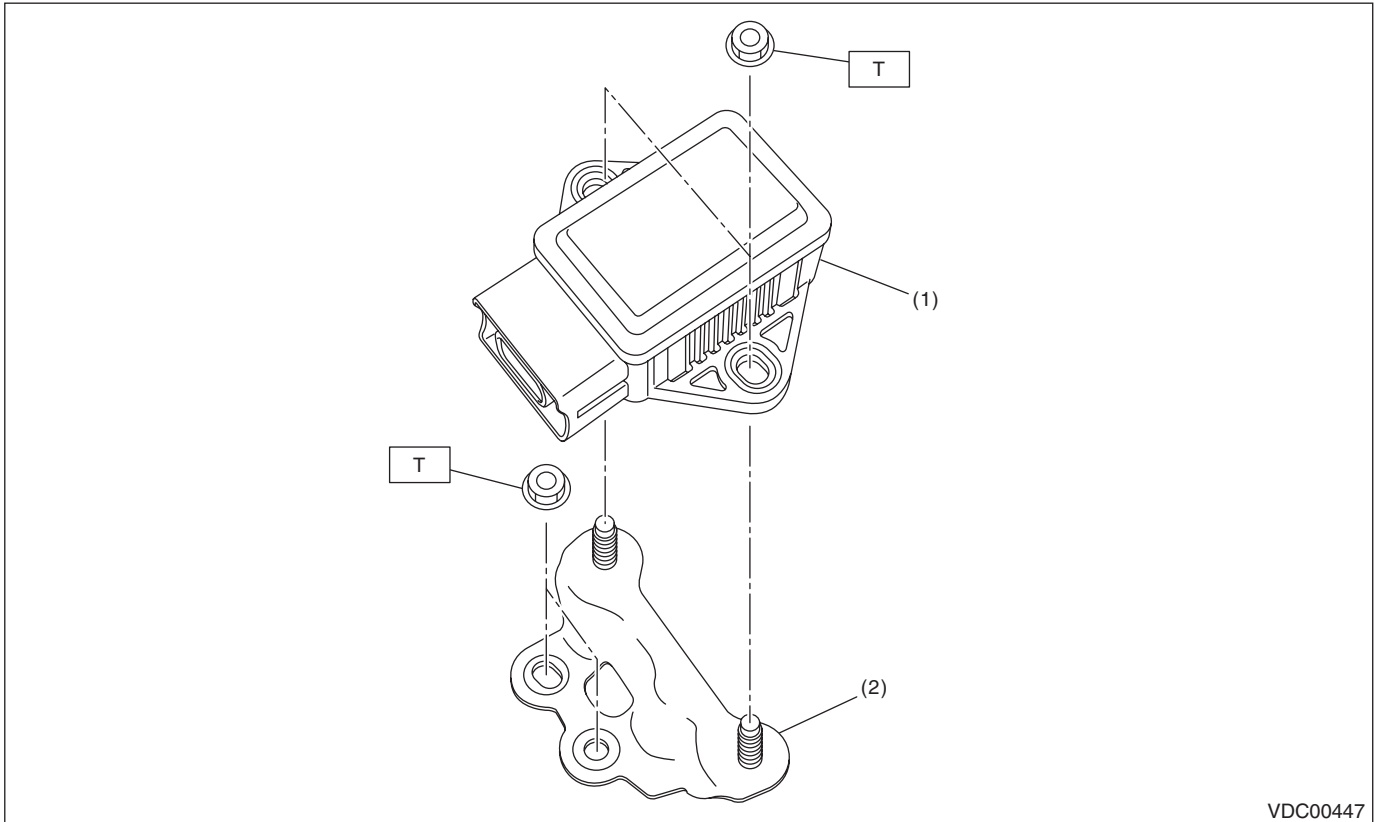
**T1: 7.5 (0.76, 5.5)**

**T2: 33 (3.4, 24)**

# General Description

VEHICLE DYNAMICS CONTROL (VDC)

## 2. YAW RATE & LATERAL G SENSOR



VDC00447

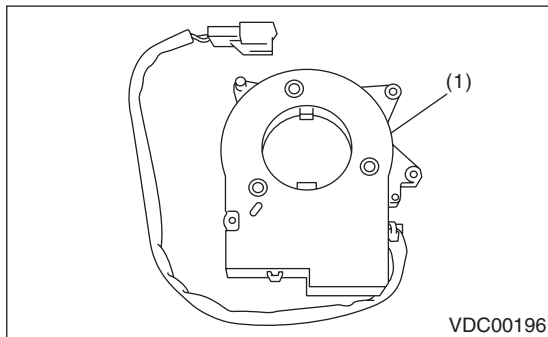
(1) Yaw rate & lateral G sensor

(2) Bracket

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 7.5 (0.76, 5.5)**

## 3. STEERING ANGLE SENSOR



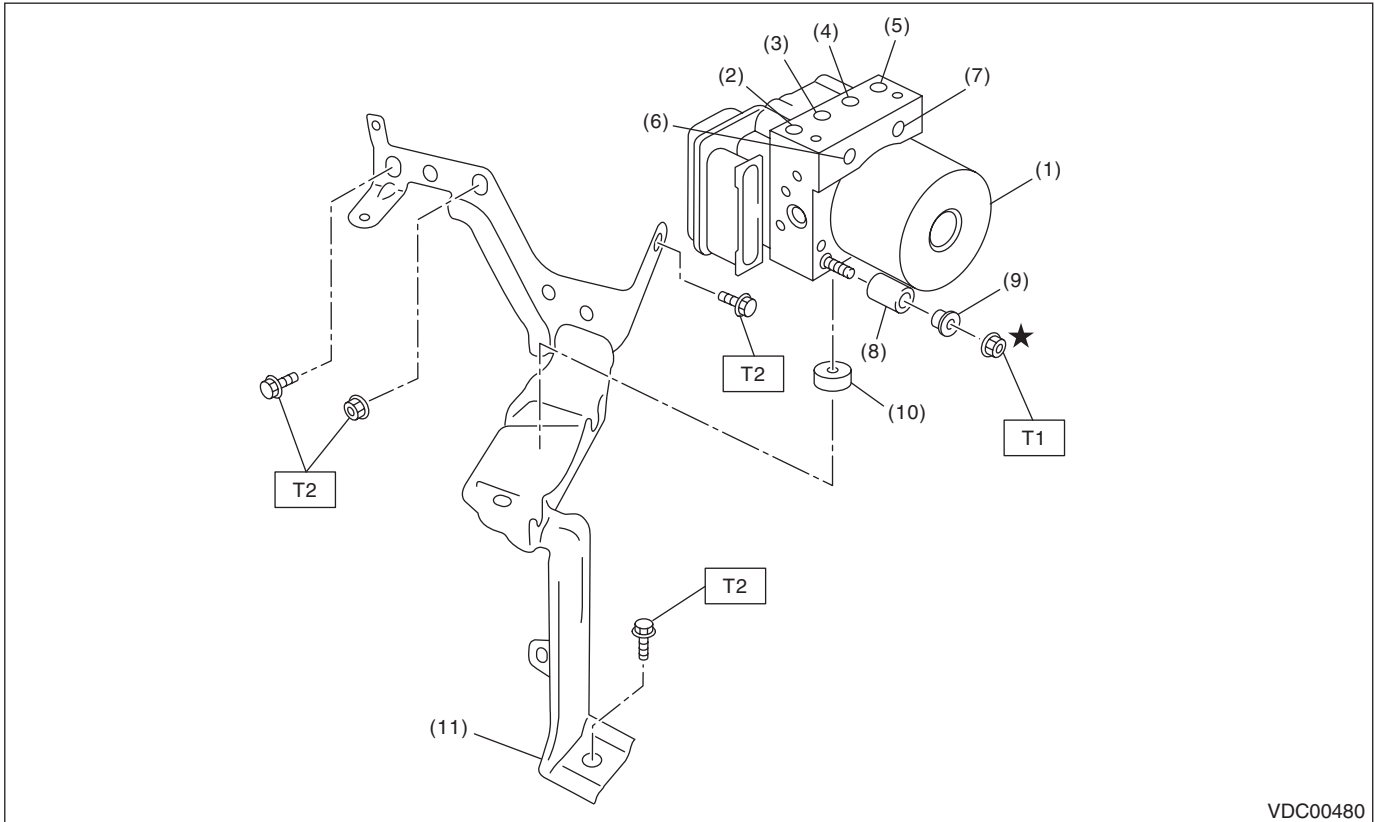
VDC00196

(1) Steering angle sensor

# General Description

VEHICLE DYNAMICS CONTROL (VDC)

## 4. VDC CONTROL MODULE & HYDRAULIC CONTROL UNIT (VDCCM&H/U)



VDC00480

- |   |                     |             |
|---|---------------------|-------------|
| (1) VDC control module & hydraulic control unit (VDCCM&H/U) | (5) Front LH outlet | (10) Damper |
| (2) Front RH outlet   | (6) Primary inlet   |             |
| (3) Rear LH outlet  | (7) Secondary inlet |             |
| (4) Rear RH outlet  | (8) Damper          |             |
|   | (9) Spacer          |             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

**T2: 33 (3.4, 24)**

### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.



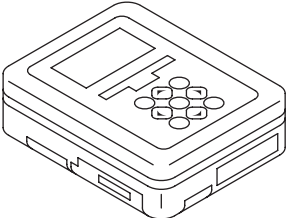
# General Description

VEHICLE DYNAMICS CONTROL (VDC)

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## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Pressure gauge	Used for measuring oil pressure.
Oscilloscope	Used for measuring the sensor.

# VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

VEHICLE DYNAMICS CONTROL (VDC)

## 2. VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Use compressed air to remove moisture and dust around the VDCCM&H/U.

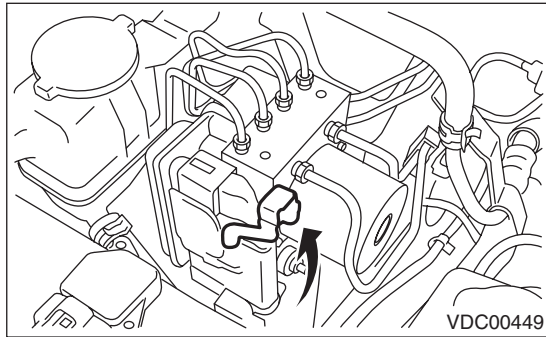
#### NOTE:

If the terminals become dirty, it may cause improper contact.

- 3) Lift the lock lever and Disconnect the VDCCM&H/U connector.

#### CAUTION:

Do not pull on the harness when disconnecting the connector.

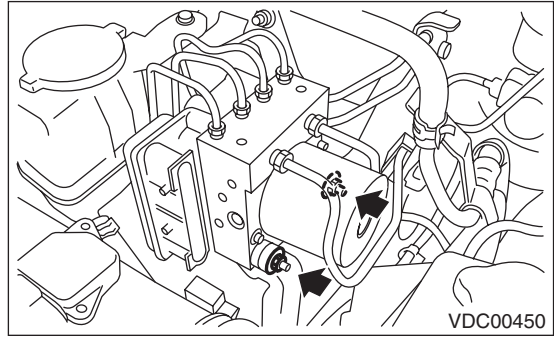


- 4) Disconnect the brake pipes from the VDCCM&H/U.
- 5) Wrap the brake pipe with a vinyl bag so as not to spill the brake fluid on the vehicle body.

#### CAUTION:

If brake fluid is spilled on the vehicle body, wash it off immediately with water and wipe clean.

- 6) Remove the nuts and remove the VDCCM&H/U.



#### CAUTION:

- Do not drop or bump the VDCCM&H/U.
- Do not turn the VDCCM&H/U upside down or place it sideways during storage.
- Be careful not to let foreign matter enter the VDCCM&H/U.
- Be careful that no water enters the connectors.

- 7) Remove the VDCCM&H/U bracket.

### B: INSTALLATION

- 1) Install the VDCCM&H/U bracket.

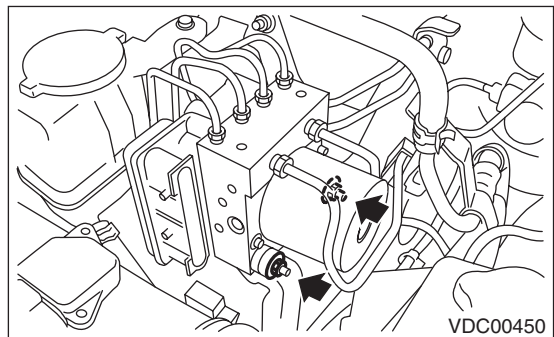
#### Tightening torque:

**33 N·m (3.4 kgf-m, 24 ft-lb)**

- 2) Install the VDCCM&H/U with a new nut (Part No. 023506000) by aligning the damper groove of the VDCCM&H/U to the bracket side claw.

#### Tightening torque:

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



# VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

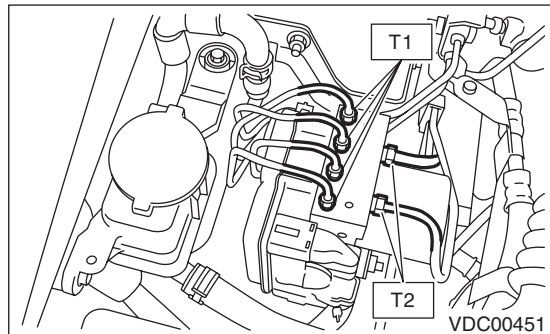
## VEHICLE DYNAMICS CONTROL (VDC)

3) Connect the brake pipes to their correct VDC-CM&H/U positions.

### Tightening torque:

**T1: 15 N·m (1.5 kgf-m, 11.1 ft-lb)**

**T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)**



4) Connect the VDCCM&H/U connector.

### NOTE:

- Be sure to remove all foreign matter from inside the connector before connecting.
- Make sure the VDCCM&H/U connector is securely locked.

5) Bleed air from the brake system.

6) Check the parameter to confirm that the applied models and grades of the relevant vehicle are included. <Ref. to VDC(diag)-17, PARAMETER CHECK, OPERATION, Subaru Select Monitor.>

7) If the applied model and grade of the target vehicle are not included on the {Parameter Check} display screen, perform parameter selection and registration. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>

### NOTE:

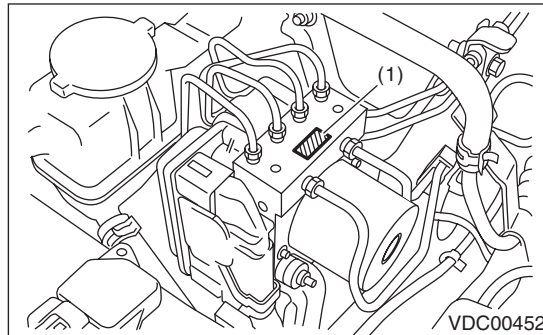
- When the VDCCM&H/U is replaced with a new part, be sure to perform the selection and registration operation.
- For the selection and registration of parameter, the Subaru Select Monitor is required.
- When no data is registered, ABS/EBD/VDC warning light illuminates and the DTC "Parameter selection failure" is detected.

## C: INSPECTION

1) Check the condition of connection and settlement of connector.

2) Check the mark used for VDCCM&H/U identification.

Refer to "SPECIFICATION" for the identification mark. <Ref. to VDC-2, SPECIFICATION, General Description.>



(1) Identification mark

### 1. CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE

<Ref. to ABS-7, CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

### 2. CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER

<Ref. to ABS-8, CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER, INSPECTION, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>

### 3. CHECKING THE HYDRAULIC UNIT VDC OPERATION USING A PRESSURE GAUGE

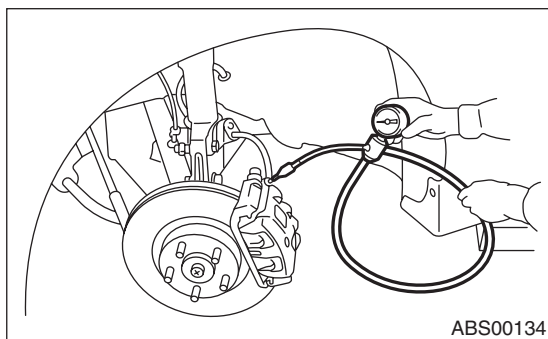
- 1) Lift up the vehicle, and remove the wheels.
- 2) Remove the air bleeder screws from FL and FR caliper bodies.
- 3) Connect two pressure gauges to FL and FR caliper bodies.

**CAUTION:**

- Use a pressure gauge used exclusively for brake fluid measurement.
- Do not use a pressure gauge used for the measuring transmission oil pressure, as the piston seal may expand and deform.

**NOTE:**

Wrap sealing tape around the pressure gauge.



- 4) Bleed air from the pressure gauge.
- 5) Perform VDC sequence control.  
<Ref. to VDC-13, VDC Sequence Control.>
- 6) When the hydraulic unit begins to work, first the FL side performs compression, hold, and decompression, and then the FR side performs compression, hold, and decompression.
- 7) Read values indicated on the pressure gauge and check if the fluctuation of the values between decompression and compression meets specification. Depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

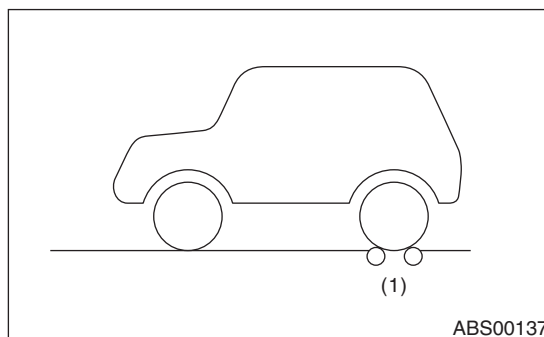
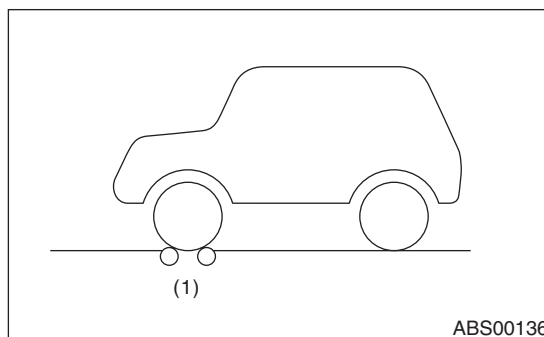
	Front wheel	Rear wheel
When pressurized	3,000 kPa (31 kgf/cm <sup>2</sup> , 441 psi) or more	3,000 kPa (31 kgf/cm <sup>2</sup> , 441 psi) or more
When depressurized	500 kPa (5 kgf/cm <sup>2</sup> , 73 psi) or less	500 kPa (5 kgf/cm <sup>2</sup> , 73 psi) or less

- 8) Disconnect the pressure gauges from FL and FR caliper bodies.
- 9) Install the air bleeder screws of FL and FR caliper bodies.
- 10) Remove the air bleeder screws from RL and RR caliper bodies.
- 11) Connect two pressure gauges to RL and RR caliper bodies.

- 12) Bleed air from RL and RR caliper bodies, and pressure gauge.
- 13) Perform VDC sequence control.  
<Ref. to VDC-13, VDC Sequence Control.>
- 14) When the hydraulic unit begins to work, first the RR side performs compression, hold, and decompression, and then the RL side performs compression, hold, and decompression.
- 15) Read the values indicated on the pressure gauges and check if it is within specification. Depress the brake pedal and check that it is not abnormally hard, and tightness is normal.
- 16) Disconnect the pressure gauge from the RL and RR caliper bodies.
- 17) Install the air bleeder screws of RL and RR caliper bodies.
- 18) Bleed air from the brake line.

### 4. CHECK HYDRAULIC UNIT VDC OPERATION WITH BRAKE TESTER

- 1) Set wheels other than the one to measure free rollers.
- 2) Prepare to operate the VDC sequence control.  
<Ref. to VDC-13, VDC Sequence Control.>
- 3) Set the front wheels or rear wheels on the brake tester and set the select lever position to the “N” range.



(1) Brake tester

- 4) Operate the brake tester.
- 5) Perform VDC sequence control.  
<Ref. to VDC-13, VDC Sequence Control.>

# VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)

## VEHICLE DYNAMICS CONTROL (VDC)

6) When the hydraulic unit begins to work, check the following work sequence.

(1) The FL wheel performs compression, hold and decompression in sequence, and subsequently the FR wheel repeats the cycle.

(2) The RR wheel performs compression, hold and decompression in sequence, and subsequently the RL wheel repeats the cycle.

7) Read values indicated on the brake tester and check if the fluctuation of the values between decompression and compression meets specification.

	Front wheel	Rear wheel
When pressurized	2,000 N (203 kgf, 447 lb) or more	2,000 N (203 kgf, 447 lb) or more
When depressurized	500 N (51 kgf, 112 lb) or less	500 N (51 kgf, 112 lb) or less

8) After the inspection, depress the brake pedal and check that it is not abnormally hard, and tightness is normal.

## D: REPLACEMENT

### CAUTION:

- Because the pressure sensor built into the H/U is easily damaged by static electricity, start the operation after performing static electricity measures.

- Be careful not to touch the sensors in the H/U to prevent damage.

- Because the seal of the VDCCM cannot be replaced, do not pull or peel it by lifting it up.

- Because the screw of the H/U will become slightly worn in every replacement procedure, 5 times is the maximum number of times for replacement. If a problem is found such as not being able to torque the screw to specifications even before 5 replacement operations are performed, replace the H/U body.

- When installing the VDCCM, always use new screws.

- When the sealing surface of the VDCCM or H/U is dirty or damaged and it cannot be cleaned or repaired, replace with a new part.

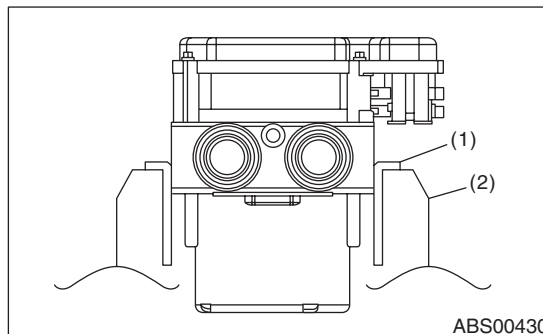
1) Remove the VDCCM&H/U. <Ref. to VDC-7, REMOVAL, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

2) To prevent entry of foreign objects and brake fluid leakage, plug the oil pressure port of the VDCCM&H/U using a screw plug, etc.

3) Set the pump motor section of the removed VDCCM&H/U face down on a vise.

### NOTE:

Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.



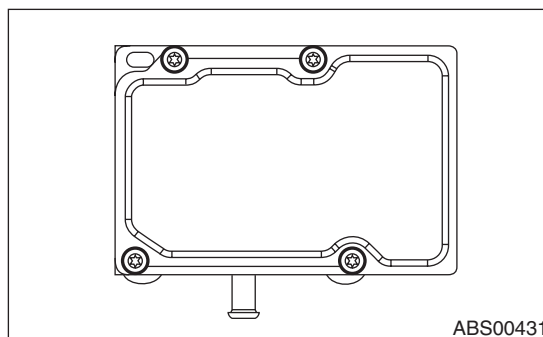
(1) Aluminum plate, etc.

(2) Vise

4) Using TORX® bit E5, remove the four screws of VDCCM.

### NOTE:

These screws cannot be reused.



5) Slowly pull out the VDCCM upward from the H/U.

### NOTE:

To prevent damaging of coil section, remove the VDCCM straight up from H/U without twisting.

6) Make sure there is no dirt or damage on the sealing surface of the H/U.

### CAUTION:

- Do not clean the VDCCM&H/U by applying compressed air.

- Even if damage is found on the H/U seal, do not attempt repair by filing or with a metal scraper. To remove the seal residue, always use a plastic scraper. Do not use chemical such as paint thinner, etc., to clean.

7) Position the coil of the new VDCCM to align with the H/U valve.

8) To prevent deformation of the VDCCM housing cover, hold the corner of VDCCM and install it to the H/U without tilting.

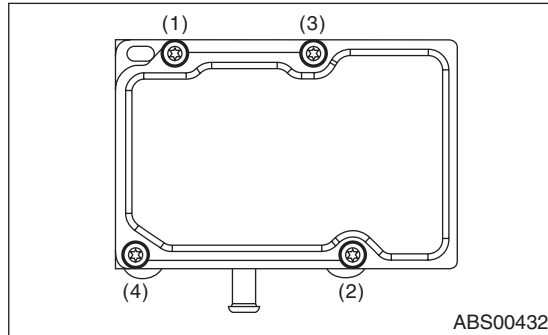
9) Using a TORX<sup>®</sup> bit E5, attach/tighten new screws in the order of (1) through (4).

**CAUTION:**

**Always use new screws.**

**Tightening torque:**

**1.5 N·m (0.15 kgf·m, 1.1 ft·lb)**



10) Check that there is no foreign matter in mating surface between the VDCCM&H/U.

11) Using a TORX<sup>®</sup> bit E5, tighten the screws in the order of (1) through (4) again.

**Tightening torque:**

**3 N·m (0.3 kgf·m, 2.2 ft·lb)**

12) Check that there is no gap in the mating surface between VDCCM&H/U.

13) Install the VDCCM&H/U to the vehicle.

14) Bleed air from the brake system.

15) Perform the selection and registration operation of parameter. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>

**NOTE:**

- After replacing the VDCCM, be sure to perform the selection and registration operation of parameter.

- For the selection and registration of parameter, the Subaru Select Monitor is required.

- When no data is registered, ABS/EBD/VDC warning light illuminates and the DTC “Parameter selection failure” is detected.

16) Check the parameter to confirm that the applied models and grades of the relevant vehicle are included. <Ref. to VDC(diag)-17, PARAMETER CHECK, OPERATION, Subaru Select Monitor.>

17) If the applied models and grades of the relevant vehicle are not included, perform the selection and registration operation of parameter with the {Confirm Parameter} screen again. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>

18) Execute Clear Memory after parameter selection and registration operations because the DTC for “Parameter selection failure” is memorized.

## E: ADJUSTMENT

When the following replacement, removal and installation are performed, be sure to perform the centering of the steering angle sensor and zero point setting of yaw rate & lateral G sensor.

- VDCCM&H/U
- Steering angle sensor
- Yaw rate & lateral G sensor
- Steering wheel parts (Including airbag)
- Suspension parts
- Wheel alignment adjustment

1) Park the vehicle straight on a level surface. (Engine operation in the “P” or “N” range)

2) Check that steering wheel is positioned at the center. (When the center position is not correct, adjust the wheel alignment.)

3) Set the Subaru Select Monitor to the vehicle, and select {Set up mode for Neutral of Steering Angle Sensor & Lateral G Sensor 0 point} in the “Function check sequence” screen. (Follow the steps on the display.)

4) On the “Brake Control System” display screen, select {Current Data Display & Save}, and check that the steering angle sensor shows “0 deg”.

5) When the “0 deg” is not displayed, repeat the above steps and check that the “0 deg” is displayed.

6) Drive the vehicle for 10 minutes, and check that the ABS and VDC warning light is not illuminated.

7) Check that there is no unnecessary VDC operation or steering control loss. If there is a problem, repeat the steps above.

# ABS Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

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## 3. ABS Sequence Control

### A: OPERATION

<Ref. to ABS-10, OPERATION, ABS Sequence Control.>

#### 1. ABS SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

<Ref. to ABS-10, ABS SEQUENCE CONTROL WITH SUBARU SELECT MONITOR, OPERATION, ABS Sequence Control.>

#### 2. CONDITIONS FOR ABS SEQUENCE CONTROL

<Ref. to ABS-11, CONDITIONS FOR ABS SEQUENCE CONTROL, OPERATION, ABS Sequence Control.>

### B: SPECIFICATION

#### 1. CONDITIONS FOR COMPLETION OF ABS SEQUENCE CONTROL

<Ref. to ABS-12, CONDITIONS FOR COMPLETION OF ABS SEQUENCE CONTROL, SPECIFICATION, ABS Sequence Control.>

## 4. VDC Sequence Control

### A: OPERATION

- 1) While the VDC sequence control is performed, the operation of the hydraulic unit can be checked using the brake tester or pressure gauge after the hydraulic unit solenoid valve is operated.
- 2) VDC sequence control can be started by Subaru Select Monitor.

### 1. VDC SEQUENCE CONTROL WITH SUBARU SELECT MONITOR

#### NOTE:

In the event of any trouble, sequence control will not operate.

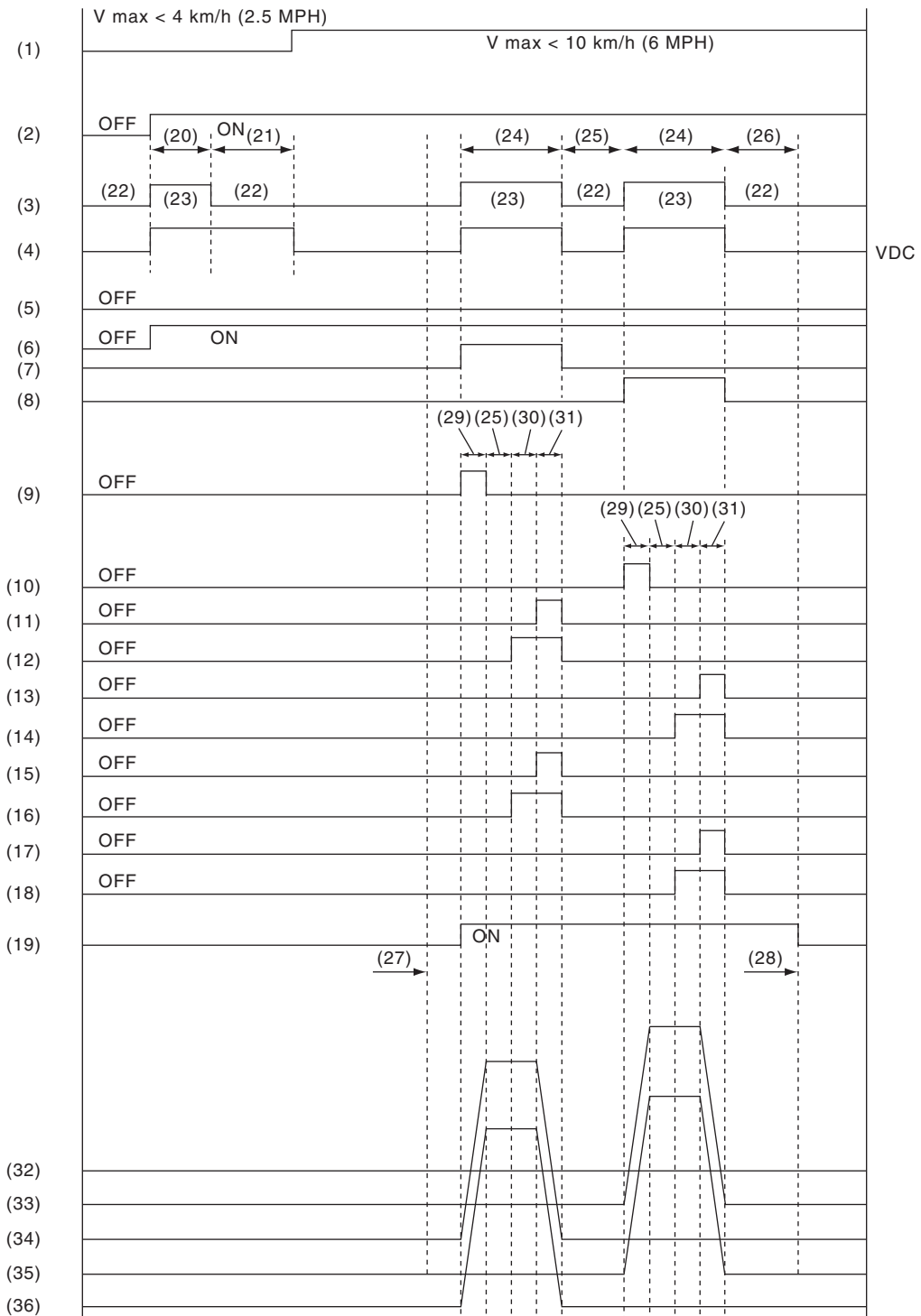
- 1) Connect the Subaru Select Monitor to data link connector under the driver's side instrument panel lower cover.
- 2) Turn the ignition switch to ON.
- 3) Run the Subaru Select Monitor.
- 4) Set the Subaru Select Monitor to "Brake Control" mode.
- 5) When the "VDC Inspection Mode" is selected from the "Function check sequence" menu, the "VDC sequence control" will start.
- 6) "OK" will be displayed. Select the "OK".
- 7) Operation points will be displayed on Subaru Select Monitor.



# VDC Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

## 2. CONDITIONS FOR VDC SEQUENCE CONTROL



VDC00275

# VDC Sequence Control

VEHICLE DYNAMICS CONTROL (VDC)

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(1) All wheel speed	(13) FR decompression valve	(25) 1 second
(2) Ignition key	(14) FR compression valve	(26) 1.6 seconds
(3) ABS warning light	(15) RR decompression valve	(27) Point A
(4) VDC warning light	(16) RR compression valve	(28) Reset
(5) Stop light switch	(17) RL decompression valve	(29) 0.8 seconds
(6) Valve relay	(18) RL compression valve	(30) 1.2 seconds
(7) VDC switching valve 1 FL	(19) Pump motor	(31) 0.4 seconds
(8) VDC switching valve 1 FR	(20) 1.5 seconds	(32) Master cylinder pressure
(9) VDC switching valve 2 FL	(21) Approx. 3 seconds	(33) FR wheel cylinder pressure
(10) VDC switching valve 2 FR	(22) Light OFF	(34) FL wheel cylinder pressure
(11) FL decompression valve	(23) Light ON	(35) RL wheel cylinder pressure
(12) FL compression valve	(24) 3.4 seconds	(36) RR wheel cylinder pressure

## NOTE:

The control operation starts from point A.

## B: SPECIFICATION

### 1. CONDITIONS FOR COMPLETION OF VDC SEQUENCE CONTROL

When the following conditions develop, the VDC sequence control stops and VDC operation is returned to the normal control mode.

- 1) When the speed of at least one wheel reaches 10 km/h (6 MPH).
- 2) When the brake pedal is pressed during sequence control and the stop light switch is set to ON.
- 3) After completion of VDC sequence control.
- 4) When a malfunction is detected.

# Yaw Rate and Lateral G Sensor

VEHICLE DYNAMICS CONTROL (VDC)

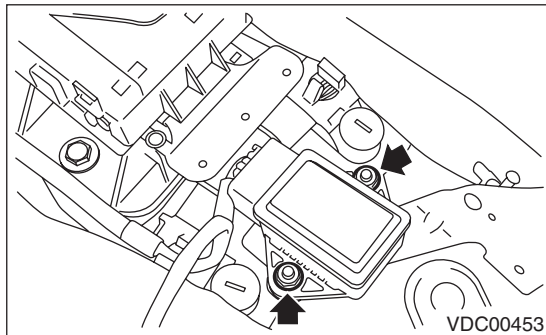
## 5. Yaw Rate and Lateral G Sensor

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box.  
<Ref. to EI-54, Console Box.>
- 3) Disconnect the connector from yaw rate & lateral G sensor.
- 4) Remove the yaw rate & lateral G sensor.

### B: INSTALLATION

Install in the reverse order of removal.



**Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**

**CAUTION:**

After completion of installation, set the following two positions.

- Positioning to the center of steering angle sensor
- Positioning the yaw rate & lateral G sensors to zero.

The above procedure is required VDCCM&H/U to identify the vehicle position afterward. For the setting procedures of the 2 steps above, refer to “VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)”. <Ref. to VDC-11, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

### C: INSPECTION

#### 1. YAW RATE & LATERAL G SENSOR

Step	Check	Yes	No
<b>1 CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor connector to the data link connector. 3) Turn the ignition switch to ON. 4) Set the Subaru Select Monitor connector to the {Brake Control} mode. 5) Select {Current Data Display & Save}. 6) Read the output of the yaw rate & lateral G sensor.	Are the indicated values when the vehicle is placed horizontally, Lateral G sensor: -1.5 — 1.5 m/s, Yaw rate sensor:-4 — 4 deg/s?	Go to step 2.	Repair the harness connector between yaw rate & lateral G sensor and VDCCM&H/U. Or replace the yaw rate & lateral G sensor.
<b>2 CHECK LATERAL G SENSOR.</b> 1) Remove the console box. 2) Remove the yaw rate & lateral G sensors from vehicle. (Do not disconnect the connector.) 3) Read the display of Subaru Select Monitor. NOTE: When the yaw rate & lateral G sensor is moved with its power supply on, DTC of yaw rate & lateral G sensor may be recorded.	Is the value 6.8 — 12.8 m/s when the yaw rate & lateral G sensor is inclined 90° to the right?	Go to step 3.	Repair the harness connector between yaw rate & lateral G sensor and VDCCM&H/U. Or replace the yaw rate & lateral G sensor.
<b>3 CHECK LATERAL G SENSOR.</b> Read the display of Subaru Select Monitor. NOTE: When the yaw rate & lateral G sensor is moved with its power supply on, DTC of yaw rate & lateral G sensor may be recorded.	Is the value -6.8 — -12.8 m/s when the yaw rate & lateral G sensor is inclined 90° to the left?	Yaw rate & lateral G sensors are normal.	Repair the harness connector between yaw rate & lateral G sensor and VDCCM&H/U. Or replace the yaw rate & lateral G sensor.

## 6. Steering Angle Sensor

### A: REPLACEMENT

**CAUTION:**

- Do not perform the removal except when the replacement.
- When replacing three times or more, replace the combination switch as assembly to protect the threads.

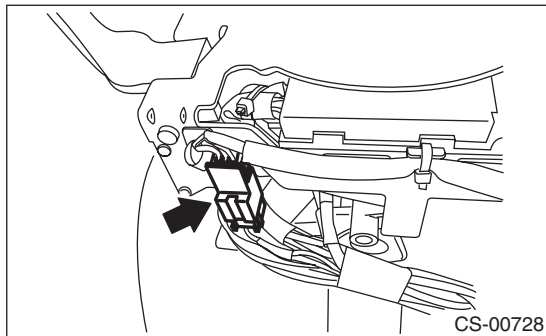
- 1) Set the steering wheel in a straight-ahead position.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the airbag module.  
<Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

**WARNING:**

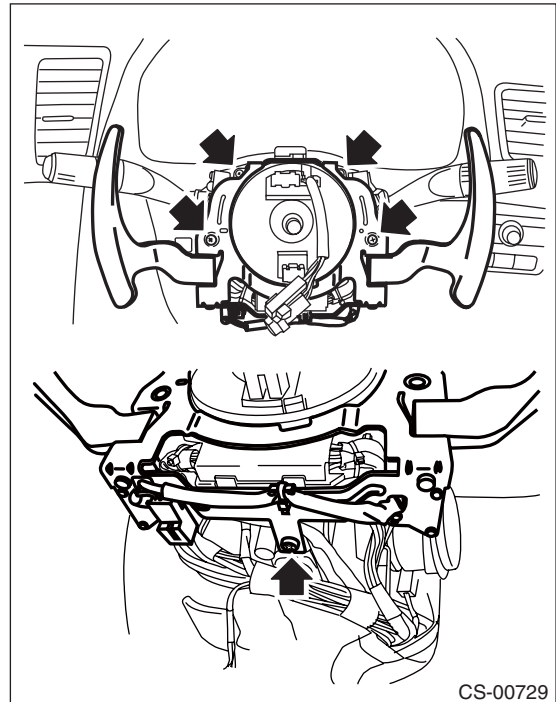
Always refer to "Airbag System" when performing the airbag module repair service.

<Ref. to AB-4, CAUTION, General Description.>

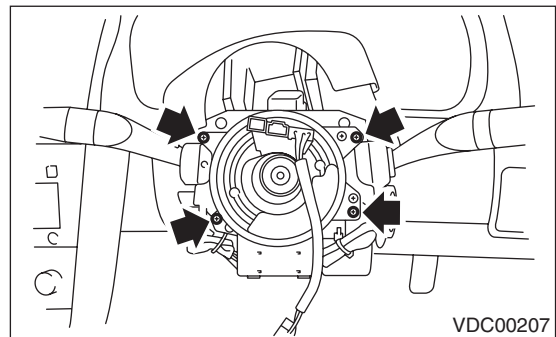
- 4) Remove the steering wheel.  
<Ref. to PS-14, REMOVAL, Steering Wheel.>
- 5) Remove the screws and remove the steering column lower cover.
- 6) Remove the two screws securing the steering column upper cover.
- 7) Disconnect the connector of paddle shift assembly. (Model with paddle shift)



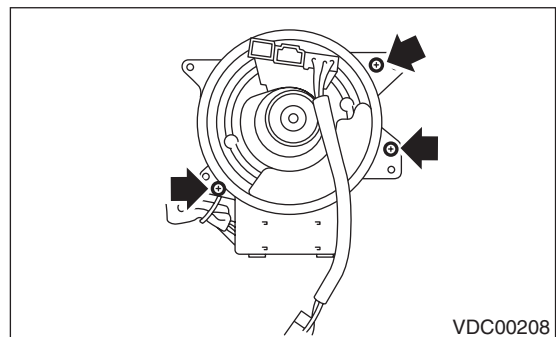
- 8) Remove the paddle shift assembly. (Model with paddle shift)



- 9) Disconnect the connector of roll connector and steering angle sensor.
- 10) Remove the screws which secure the roll connector to steering column.



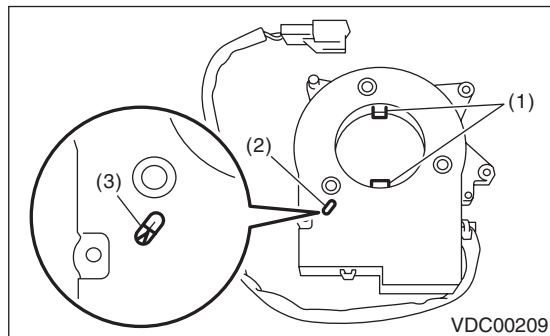
- 11) Remove the vinyl tape binding the harness, and remove the steering angle sensor from roll connector.



# Steering Angle Sensor

## VEHICLE DYNAMICS CONTROL (VDC)

12) Turn the protrusion portion of new steering angle sensor to match the alignment mark of inspection hole.



- (1) Protrusion portion
- (2) Inspection hole
- (3) Alignment mark

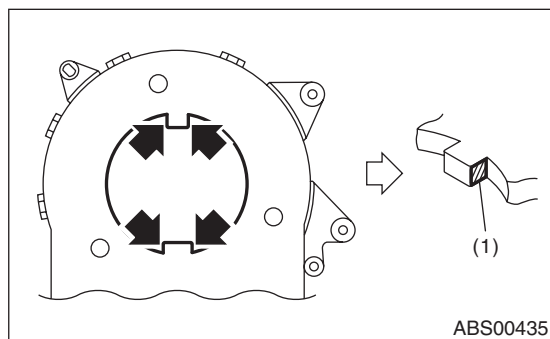
### CAUTION:

**Be careful not to allow foreign matter to enter into inspection hole.**

13) Align the center of roll connector.

<Ref. to AB-24, INSTALLATION, Roll Connector.>

14) Apply a thin coat of grease that is supplied with the new part, to the 4 protruding sections of the steering angle sensor.

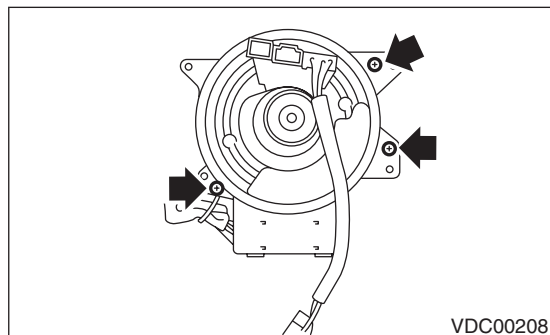


- (1) Apply grease.

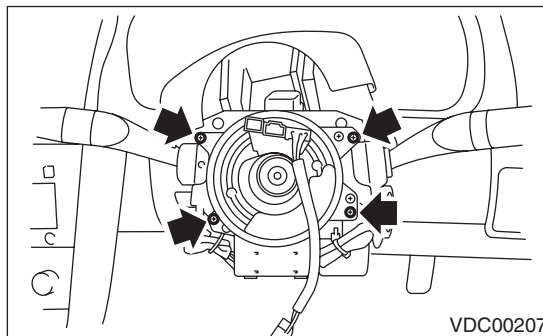
15) Align the position of the protrusion and install roll connector to steering angle sensor.

### Tightening torque:

**0.5 N·m (0.05 kgf·m, 0.36 ft·lb)**



16) Install the roll connector to combination switch and bind the harness with vinyl tape as originally bound.



17) Install the paddle shift. (Model with paddle shift)

18) Install the steering wheel.

<Ref. to PS-14, INSTALLATION, Steering Wheel.>

### Tightening torque:

**44 N·m (4.5 kgf·m, 32.5 ft·lb)**

19) Install the airbag module to the steering wheel.

<Ref. to AB-14, INSTALLATION, Driver's Airbag Module.>

### WARNING:

**Always refer to "Airbag System" before performing the service operation.**

<Ref. to AB-4, CAUTION, General Description.>

20) Connect the ground cable to the battery.

### CAUTION:

**After completion of installation, adjust the following two positions.**

- Positioning to the center of steering angle sensor
- Positioning the yaw rate & lateral G sensors to zero.

The above procedure is required for the VDC-CM to identify vehicle position afterward. For the setting procedures of the 2 steps above, refer to "VDC Control Module and Hydraulic Control Unit (VDCCM&H/U)". <Ref. to VDC-11, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

## 7. Front ABS Wheel Speed Sensor

### A: NOTE

Vehicles equipped with VDC have the same ABS wheel speed sensor as installed on vehicles equipped with ABS. Refer to "Front ABS Wheel Speed Sensor" for removal, installation and inspection procedures.

<Ref. to ABS-13, Front ABS Wheel Speed Sensor.>

## Rear ABS Wheel Speed Sensor

VEHICLE DYNAMICS CONTROL (VDC)

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### 8. Rear ABS Wheel Speed Sensor

#### A: NOTE

Vehicles equipped with VDC have the same ABS wheel speed sensor as installed on vehicles equipped with ABS. Refer to "Rear ABS Wheel Speed Sensor" for removal, installation and inspection procedures.

<Ref. to ABS-15, Rear ABS Wheel Speed Sensor.>

## 9. Front Magnetic Encoder

### A: NOTE

Vehicles equipped with VDC have the same magnetic encoder as installed on vehicles equipped with ABS. Refer to "Front Magnetic Encoder" for removal, installation and inspection procedures.

<Ref. to ABS-16, Front Magnetic Encoder.>



### 10.Rear Magnetic Encoder

#### A: NOTE

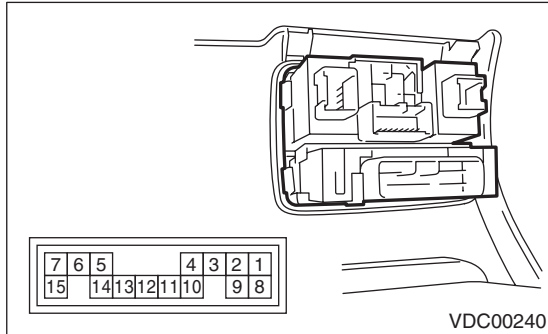
Vehicles equipped with VDC have the same magnetic encoder as installed on vehicles equipped with ABS. Refer to “Rear Magnetic Encoder” for removal, installation and inspection procedures.

<Ref. to ABS-17, Rear Magnetic Encoder.>

## 11.VDC OFF Switch

### A: REMOVAL

- 1) Remove the instrument panel lower cover.
- 2) Remove the screws, and then remove the VDC OFF switch.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between the VDC OFF switch terminals.

Switch position	Terminal No.	Standard
OFF	5 — 15	1 M $\Omega$ or more
ON	5 — 15	Less than 1 $\Omega$

If NG, replace the VDC OFF switch.

## VDC OFF Switch

VEHICLE DYNAMICS CONTROL (VDC)

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# Basic Diagnostic Procedure

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### CAUTION:

Remove foreign matter (dust, water, oil etc.) from the VDCCM&H/U connector during removal and installation.

#### NOTE:

- To check the harness for broken wires or short circuits, shake problem spot or connector.
- Refer to "Check List for Interview". <Ref. to VDC(diag)-4, Check List for Interview.>

	Step	Check	Yes	No
1	<p><b>CHECK PRE-INSPECTION.</b></p> <p>1) Ask the customer when and how the trouble occurred using the interview check list. &lt;Ref. to VDC(diag)-4, Check List for Interview.&gt;</p> <p>2) Before performing diagnostics, check the component which might affect VDC problems. &lt;Ref. to VDC(diag)-8, INSPECTION, General Description.&gt;</p>	Is the component that might influence the VDC problem normal?	Go to step 2.	Repair or replace each component.
2	<p><b>CHECK INDICATION OF DTC.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Connect the Subaru Select Monitor to the data link connector.</p> <p>3) Turn the ignition switch to ON and run the Subaru Select Monitor.</p> <p>4) Read the DTC using the Subaru Select Monitor. &lt;Ref. to VDC(diag)-21, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p> <p>NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. &lt;Ref. to VDC(diag)-18, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.&gt;</p> <p>5) Record all DTCs and freeze frame data.</p>	Is DTC displayed on the Subaru Select Monitor?	Go to step 4.	Go to step 3.
3	<p><b>PERFORM GENERAL DIAGNOSTICS.</b></p> <p>1) Perform the inspection by referring to "General Diagnostic Table". &lt;Ref. to VDC(diag)-100, INSPECTION, General Diagnostic Table.&gt;</p> <p>2) Perform the Clear Memory Mode. &lt;Ref. to VDC(diag)-23, OPERATION, Clear Memory Mode.&gt;</p> <p>3) Perform the Inspection Mode. &lt;Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.&gt;</p> <p>4) Read the DTC. &lt;Ref. to VDC(diag)-21, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p> <p>5) Check the DTC is not displayed.</p>	Do the VDC warning light and ABS warning light go off after starting the engine?	Finish the diagnosis.	Check the combination meter circuit. <Ref. to VDC(diag)-29, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.> <Ref. to VDC(diag)-31, VDC WARNING LIGHT AND VDC OFF INDICATOR LIGHT DO NOT GO OFF, Warning Light Illumination Pattern.>

# Basic Diagnostic Procedure

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
4	<p><b>PERFORM DIAGNOSIS.</b></p> <p>1) Refer to "List of Diagnostic Trouble Code (DTC)".</p> <p>NOTE: For the DTC list, refer to "List of Diagnostic Trouble Code (DTC)". &lt;Ref. to VDC(diag)-34, LIST, List of Diagnostic Trouble Code (DTC).&gt;</p> <p>2) Correct the cause of trouble.</p> <p>3) Perform the Clear Memory Mode. &lt;Ref. to VDC(diag)-23, OPERATION, Clear Memory Mode.&gt;</p> <p>4) Perform the Inspection Mode. &lt;Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.&gt;</p> <p>5) Read the DTC. &lt;Ref. to VDC(diag)-21, OPERATION, Read Diagnostic Trouble Code (DTC).&gt;</p>	Is DTC displayed?	Repeat step 4 until DTC is not shown.	Finish the diagnosis.

# Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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## 2. Check List for Interview

### A: CHECK

Check the following item about the vehicle's state.

#### 1. STATE OF ABS WARNING LIGHT

ABS warning light illuminates.	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once <input type="checkbox"/> Does not come on • When/How long does it illuminate?		
Ignition key position	<input type="checkbox"/> LOCK <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)		
Timing	<input type="checkbox"/> Immediately after turning the ignition switch to ON <input type="checkbox"/> Immediately after turning the ignition switch to START		
	<input type="checkbox"/> While accelerating	—	km/h
		—	MPH
	<input type="checkbox"/> While driving at a constant speed	km/h	MPH
	<input type="checkbox"/> While decelerating	—	km/h
		—	MPH
	<input type="checkbox"/> When turning to the right	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When turning to the left	Steering angle:	deg
		Steering time:	Sec.
	<input type="checkbox"/> When other electrical parts are operating		
	• Part name: • Operating condition:		

# Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 2. STATE OF VDC WARNING LIGHT AND VDC OFF INDICATOR LIGHT

VDC warning light and VDC OFF indicator light illuminate.	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once <input type="checkbox"/> Does not come on • When/How long does it illuminate?			
Ignition key position	<input type="checkbox"/> LOCK <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)			
Timing	<input type="checkbox"/> Immediately after turning the ignition switch to ON <input type="checkbox"/> Immediately after turning the ignition switch to START			
	<input type="checkbox"/> While accelerating	—	km/h	
		—	MPH	
	<input type="checkbox"/> While driving at a constant speed	km/h	MPH	
	<input type="checkbox"/> While decelerating	—	km/h	
		—	MPH	
	<input type="checkbox"/> When turning to the right	Steering angle:	deg	
		Steering time:	Sec.	
	<input type="checkbox"/> When turning to the left	Steering angle:	deg	
		Steering time:	Sec.	
<input type="checkbox"/> When other electrical parts are operating				
• Part name:				
• Operating condition:				

## 3. STATE OF VDC INDICATOR LIGHT

VDC operation indicator light illuminate.	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once <input type="checkbox"/> Does not come on • When/How long does it illuminate?			
Ignition key position	<input type="checkbox"/> LOCK <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)			
Timing	<input type="checkbox"/> Immediately after turning the ignition switch to ON <input type="checkbox"/> Immediately after turning the ignition switch to START			
	<input type="checkbox"/> While accelerating	—	km/h	
		—	MPH	
	<input type="checkbox"/> While driving at a constant speed	km/h	MPH	
	<input type="checkbox"/> While decelerating	—	km/h	
		—	MPH	
	<input type="checkbox"/> When turning to the right	Steering angle:	deg	
		Steering time:	Sec.	
	<input type="checkbox"/> When turning to the left	Steering angle:	deg	
		Steering time:	Sec.	
<input type="checkbox"/> When other electrical parts are operating				
• Part name:				
• Operating condition:				

## Check List for Interview

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### 4. CONDITIONS UNDER WHICH TROUBLE OCCURS

Environment	a) Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others:
	b) Ambient temperature	°C ( °F)
	c) Road	<input type="checkbox"/> Inner city <input type="checkbox"/> Suburbs <input type="checkbox"/> Highway <input type="checkbox"/> Local street <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Paved road <input type="checkbox"/> Gravel road <input type="checkbox"/> Muddy road <input type="checkbox"/> Sandy place <input type="checkbox"/> Straight road <input type="checkbox"/> Sharp curve <input type="checkbox"/> Gentle curve <input type="checkbox"/> S-curve <input type="checkbox"/> Road with a slope on both sides <input type="checkbox"/> Others:
	d) Road surface	<input type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Covered with fresh snow <input type="checkbox"/> Covered with hardened snow <input type="checkbox"/> Frozen slope <input type="checkbox"/> Others:



# Check List for Interview

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Condition	a) Brakes	Deceleration: <span style="float: right;">G</span>
		<input type="checkbox"/> Continuous / <input type="checkbox"/> Intermittent
	b) Accelerator	Acceleration: <span style="float: right;">G</span>
		<input type="checkbox"/> Continuous / <input type="checkbox"/> Intermittent
	c) Vehicle speed	km/h <span style="margin-left: 100px;">MPH</span>
		<input type="checkbox"/> Advancing
		<input type="checkbox"/> While accelerating
		<input type="checkbox"/> While decelerating
		<input type="checkbox"/> At low speed
		<input type="checkbox"/> When turning
		<input type="checkbox"/> Others:
	d) Tire inflation pressure	Front RH tire: <span style="float: right;">kPa</span>
		Front LH tire: <span style="float: right;">kPa</span>
		Rear RH tire: <span style="float: right;">kPa</span>
		Rear LH tire: <span style="float: right;">kPa</span>
	e) Degree of wear	Front RH tire:
		Front LH tire:
		Rear RH tire:
		Rear LH tire:
	f) Steering wheel	<input type="checkbox"/> Sharp turning
	<input type="checkbox"/> Gentle turning	
	<input type="checkbox"/> Straight forward motion	
	<input type="checkbox"/> Gentle return	
	<input type="checkbox"/> Sharp return	
g) Tire/Wheel size	<input type="checkbox"/> Specified size	
	<input type="checkbox"/> Except specification (      )	
h) Tire variation	<input type="checkbox"/> Summer tire	
	<input type="checkbox"/> Studless tire (Brand:      )	
i) Tire chain is attached: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
j) T-type tire is used: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
k) Condition of suspension alignment:		
l) Loading state:		
m) Repair parts are used: <input type="checkbox"/> Yes / <input type="checkbox"/> No		
• Contents:		
n) Others:		

# General Description

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 3. General Description

### A: CAUTION

#### 1. SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

Airbag system wiring harness is routed near the ABS wheel speed sensor and VDCCM&H/U.

#### CAUTION:

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the ABS wheel speed sensor and VDCCM&H/U.

### B: INSPECTION

Before performing diagnosis, check the following items which might affect VDC problems.

#### 1. BATTERY

Measure the battery voltage and check electrolyte.

#### Standard voltage:

12 V or more

#### Specific gravity:

1.260 or more

#### 2. GROUND

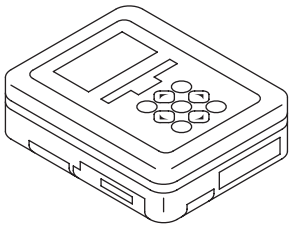
Check the tightening torque of ground (GB-4) bolt of VDC.

#### Tightening torque:

13 N·m (1.3 kgf·m, 9.6 ft·lb)

### C: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

#### 3. BRAKE FLUID

- 1) Check the brake fluid level.
- 2) Check the brake fluid for leaks.

#### 4. HYDRAULIC UNIT

Check the hydraulic unit.

- With brake tester <Ref. to VDC-8, CHECKING THE HYDRAULIC UNIT ABS OPERATION WITH THE BRAKE TESTER, INSPECTION, VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U).>
- Without brake tester <Ref. to VDC-8, CHECKING THE HYDRAULIC UNIT ABS OPERATION BY PRESSURE GAUGE, INSPECTION, VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U).>

#### 5. BRAKE DRAG

Check for brake drag.

#### 6. BRAKE PAD AND ROTOR

Check the brake pad and rotor.

- Front <Ref. to BR-15, INSPECTION, Front Brake Pad.> <Ref. to BR-16, INSPECTION, Front Disc Rotor.>
- Rear <Ref. to BR-22, INSPECTION, Rear Brake Pad.> <Ref. to BR-24, INSPECTION, Rear Disc Rotor.>

#### 7. TIRE

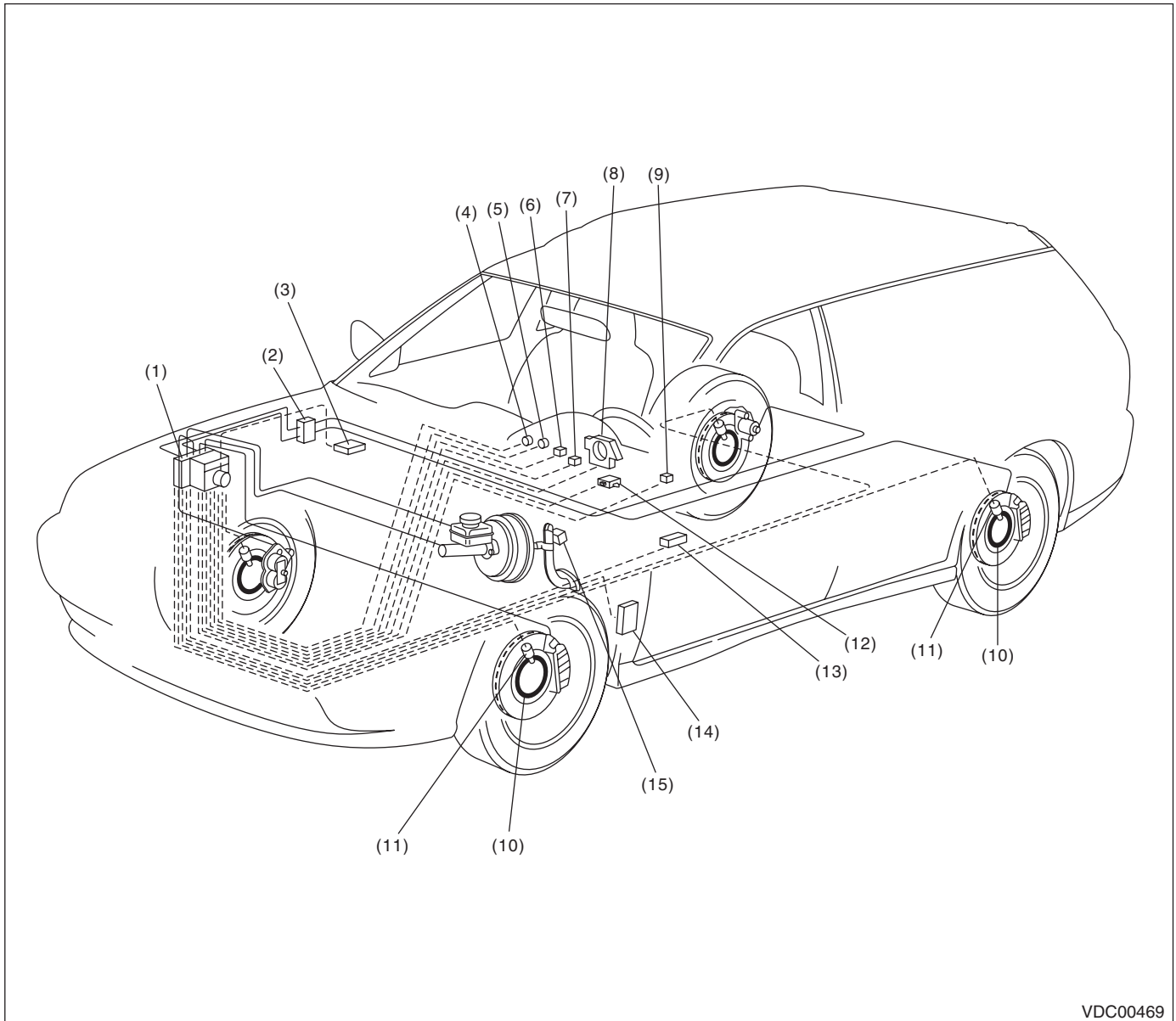
Check the tire specifications, tire wear and air pressure. <Ref. to WT-2, SPECIFICATION, General Description.>

# Electrical Component Location

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 4. Electrical Component Location

### A: LOCATION

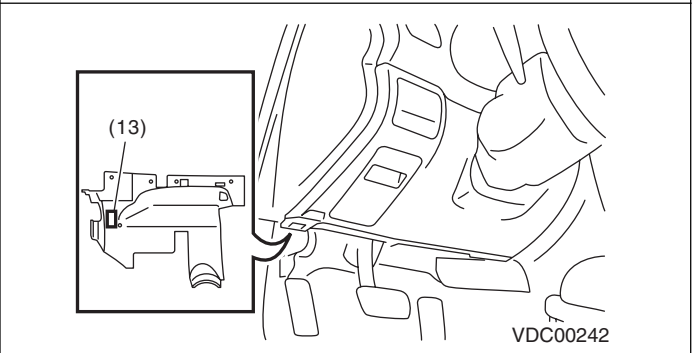
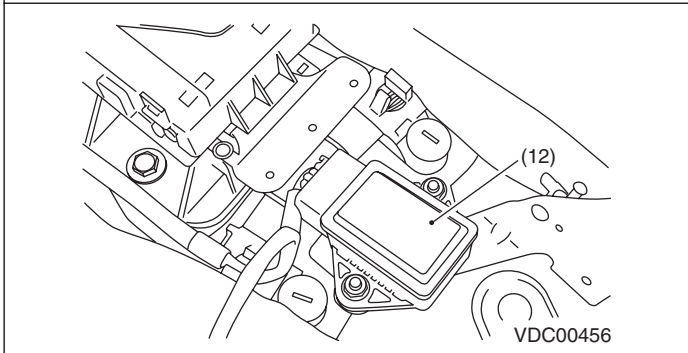
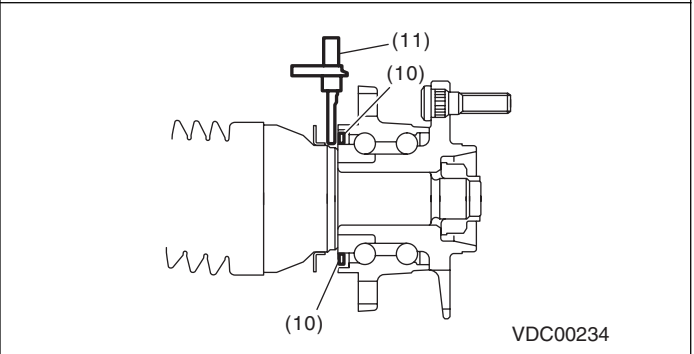
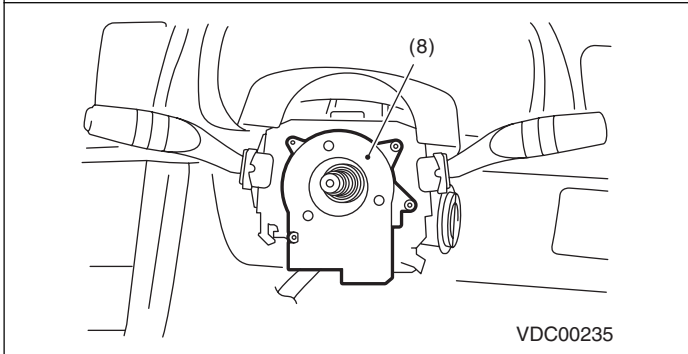
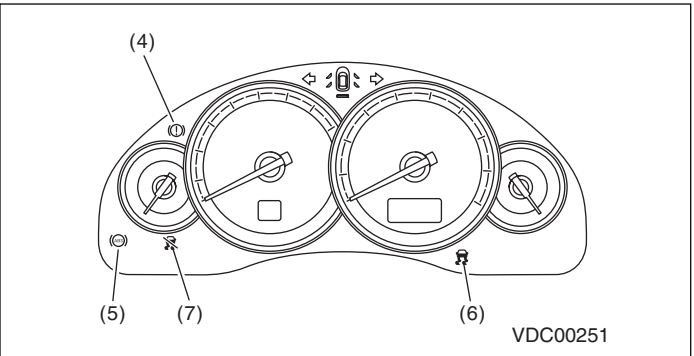
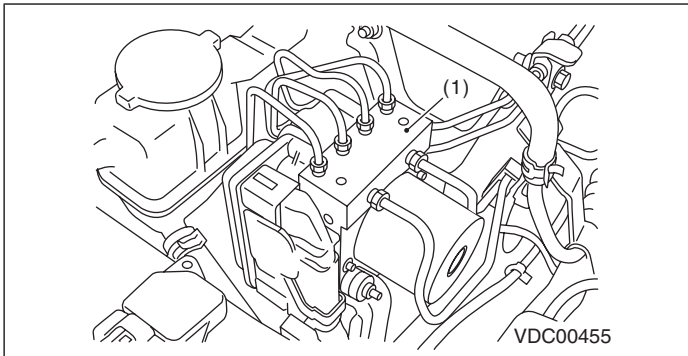


VDC00469

- |   |   |                                  |
|---|---|----------------------------------|
| (1) VDC control module and hydraulic control unit (VDCCM&H/U) | (5) ABS warning light                             | (10) Magnetic encoder            |
| (2) Connector   | (6) VDC indicator light                           | (11) ABS wheel speed sensor      |
| (3) Transmission control module (TCM)                         | (7) VDC warning light and VDC OFF indicator light | (12) Yaw rate & lateral G sensor |
| (4) Brake warning light (EBD warning light)                   | (8) Steering angle sensor                         | (13) Data link connector         |
|   | (9) VDC OFF switch                                | (14) Engine control module (ECM) |
|   |   | (15) Stop light switch           |

# Electrical Component Location

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

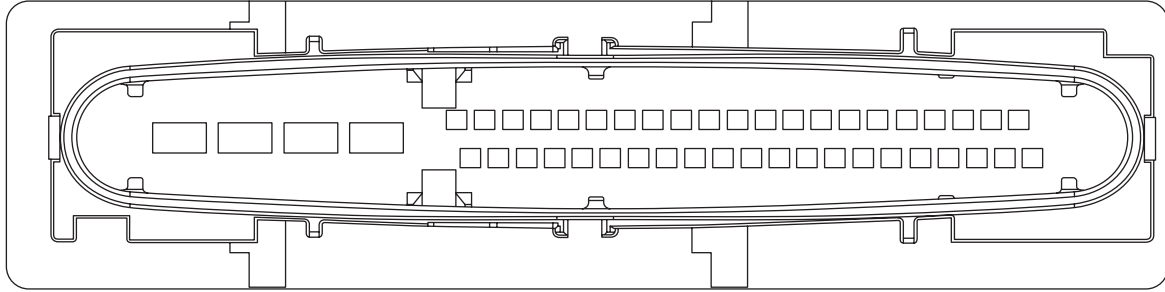


# Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 5. Control Module I/O Signal

### A: ELECTRICAL SPECIFICATION



**B310**

22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
				26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

VDC00457

**NOTE:**

- Terminal numbers in VDCCM&H/U connector are shown in the figure.
- When the connector is removed from VDCCM&H/U, the ABS warning light, VDC warning light and VDC OFF indicator light illuminate.

## Control Module I/O Signal

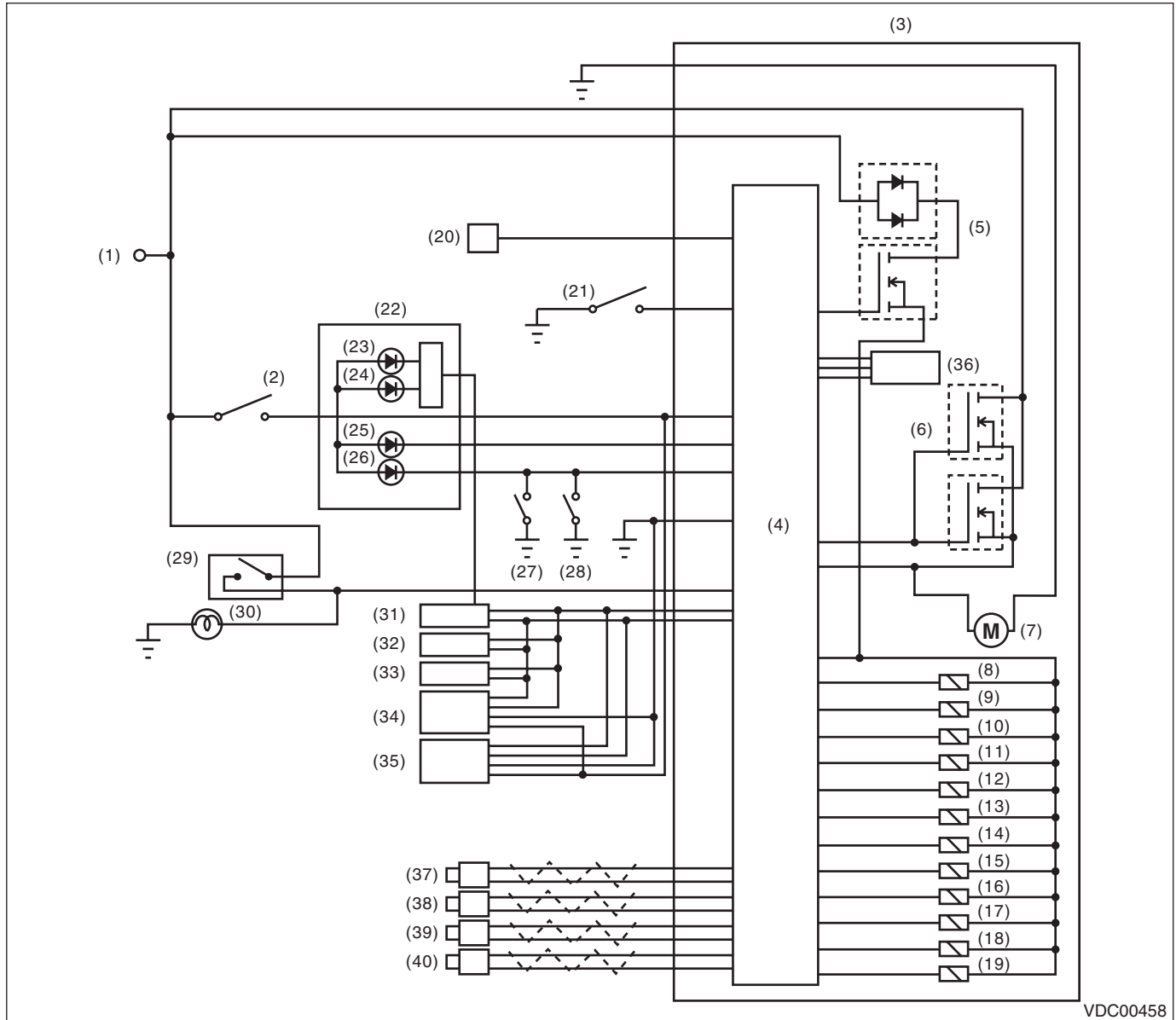
### VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Content		Terminal No. (+) — (-)	Input/Output signal	
			Measured value and measuring conditions	
Power supply		28 — 25	10 — 15 V when the ignition switch is ON.	
ABS wheel speed sensor	Front LH wheel	Power supply	26 — 25	4.5 — 16.5 V
		Signal	1	5.9 — 16.8 mA: Rectangle waveform
	Front RH wheel	Power supply	5 — 25	4.5 — 16.5 V
		Signal	6	5.9 — 16.8 mA: Rectangle waveform
	Rear LH wheel	Power supply	2 — 25	4.5 — 16.5 V
		Signal	27	5.9 — 16.8 mA: Rectangle waveform
	Rear RH wheel	Power supply	3 — 25	4.5 — 16.5 V
		Signal	4	5.9 — 16.8 mA: Rectangle waveform
CAN communication line (+)		35	2.5 — 1.5 V pulse signal	
CAN communication line (-)		10	3.5 — 2.5 V pulse signal	
Valve relay power supply		24 — 25	10 — 15 V when the ignition switch is ON.	
Motor relay power supply		23 — 22	10 — 15 V when the ignition switch is ON.	
ABS warning light		32 — 25	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds, and 1.5 V or less after 1.5 seconds passed.	
Brake warning light (EBD warning light)		8 — 25	After turning the ignition switch to ON, 10 — 15 V during 1.5 seconds, and 1.5 V or less after 1.5 seconds passed.	
Stop light switch		30 — 25	1.5 V or less when the stop light is OFF; otherwise, 10 — 15 V when the stop light is ON.	
Subaru Select Monitor		7 — 25	0 ↔ 12 V pulse (in communication)	
Vehicle speed output signal		33	0 ↔ 12 V pulse	
Ground		25	—	

# Control Module I/O Signal

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## B: WIRING DIAGRAM



VDC00458

- |   |  |  |
|---|--|--|
| (1) Battery   | (14) Rear inlet solenoid valve RH                  | (27) Parking brake switch              |
| (2) Ignition switch   | (15) Rear outlet solenoid valve RH                 | (28) Brake fluid level switch          |
| (3) VDC control module and hydraulic control unit (VDCCM&H/U) | (16) Primary cut solenoid valve                    | (29) Stop light switch                 |
| (4) VDC control module  | (17) Primary suction solenoid valve                | (30) Stop light                        |
| (5) Valve relay   | (18) Secondary cut solenoid valve                  | (31) Body integrated unit              |
| (6) Motor relay   | (19) Secondary suction solenoid valve              | (32) Engine control module (ECM)       |
| (7) Motor   | (20) Data link connector                           | (33) Transmission control module (TCM) |
| (8) Front inlet solenoid valve LH                             | (21) VDC OFF switch                                | (34) Steering angle sensor             |
| (9) Front outlet solenoid valve LH                            | (22) Combination meter                             | (35) Yaw rate & lateral G sensor       |
| (10) Front inlet solenoid valve RH                            | (23) VDC indicator light                           | (36) Pressure sensor                   |
| (11) Front outlet solenoid valve RH                           | (24) VDC warning light and VDC OFF indicator light | (37) Front ABS wheel speed sensor LH   |
| (12) Rear inlet solenoid valve LH                             | (25) ABS warning light                             | (38) Front ABS wheel speed sensor RH   |
| (13) Rear outlet solenoid valve LH                            | (26) Brake warning light                           | (39) Rear ABS wheel speed sensor LH    |
|   |  | (40) Rear ABS wheel speed sensor RH    |

# Subaru Select Monitor

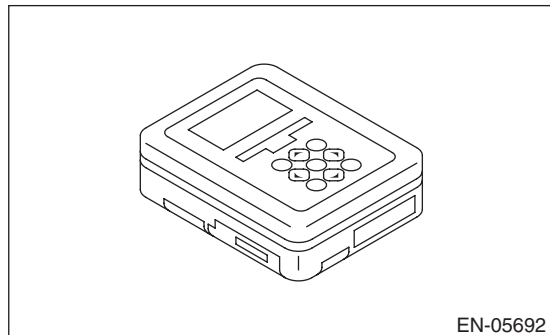
## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### 6. Subaru Select Monitor

#### A: OPERATION

##### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

1) Prepare the Subaru Select Monitor kit. <Ref. to VDC(diag)-8, SPECIAL TOOL, PREPARATION TOOL, General Description.>

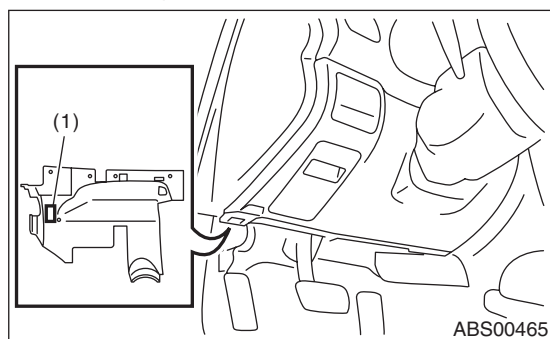


2) Prepare PC with Subaru Select Monitor installed.  
3) Connect the SDI (Subaru Diagnostic Interface) to the PC USB port (exclusively for Subaru Selector Monitor) using a USB cable.

#### NOTE:

Port exclusively for Subaru Select Monitor refers to the USB port used when installing Subaru Select Monitor.

4) Connect the diagnosis cable to the SDI.  
5) Connect the SDI to the data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

6) Start the PC.  
7) Turn the ignition switch to ON (engine OFF) and run the "PC application help for Subaru Select Monitor".  
8) On the «Main Menu», select {Each System Check}.  
9) On the «System Selection Menu», select {Brake Control}.  
10) Click the [OK] button after the {VDC} is displayed.  
11) On the «Brake Control Diagnosis» screen, select {DTC Display}.

12) Record the DTC and data.

#### NOTE:

- For detailed operation procedure, refer to the «help on PC application for Subaru Select Monitor».
- For details concerning DTCs, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>
- Up to 3 DTCs are displayed in the order of detection.
- If a particular DTC is not stored in memory properly at the occurrence of problem (due to a drop in VDCCM&H/U power supply etc.), the DTC suffixed with a question mark "?" is displayed on Subaru Select Monitor display screen. This shows it may be an unreliable reading.

13) If VDC and Subaru Select Monitor cannot communicate, check the communication circuit. <Ref. to VDC(diag)-18, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

Display	Contents to be monitored
Current	The current DTC is displayed on Subaru Select Monitor display screen.
Previous	The latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.
Second previous	The second latest DTC in previous troubles is displayed on Subaru Select Monitor display screen.
Third previous	The third latest DTC in previous problems is displayed on Subaru Select Monitor display screen.



# Subaru Select Monitor

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### 2. READ CURRENT DATA

- 1) On the «Main Menu» display, select {Each System Check}.
  - 2) On the «System Selection Menu», select {Brake Control}.
  - 3) Click the [OK] button after the {VDC} is displayed.
  - 4) On the «Brake Control Diagnosis» screen, select {Current Data Display & Save}.
  - 5) On the «Data Display Menu», select the data display method.
  - 6) Using the scroll key, scroll the display screen up or down until necessary data is shown.
- A list of the support data is shown in the following table.

Display	Contents to be monitored	Unit of measure
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed.	km/h or MPH
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed.	km/h or MPH
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed.	km/h or MPH
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed.	km/h or MPH
Steering Angle Sensor	Steering angle detected by steering angle sensor is displayed.	deg
Yaw Rate Sensor	Vehicle angular speed detected by yaw rate sensor is displayed.	deg/s
Pressure Sensor	Brake fluid pressure detected by pressure sensor is displayed.	bar
Lateral G Sensor	Vehicle lateral acceleration detected by lateral G sensor is displayed.	m/s (m/s <sup>2</sup> )
IG power supply voltage	Voltage supplied to VDCCM&H/U is displayed.	V
E/G Control Prohibited Flag	Engine control command signal is displayed.	1 or 0
ABS Control Flag	ABS operation condition is displayed.	ON or OFF
EBD Control Flag	EBD operation condition is displayed.	ON or OFF
TCS Control Flag	TCS operation condition is displayed.	ON or OFF
VDC Control Flag	VDC operation condition is displayed.	ON or OFF
VDC OFF Light	ON/OFF condition of VDC OFF indicator light is displayed.	ON or OFF
EBD Warning Light	ON operation of the EBD warning light is displayed.	ON or OFF
ABS Warning Light	ON operation of the ABS warning light is displayed.	ON or OFF
VDC Warning Light	ON operation of the VDC warning light is displayed.	ON or OFF
Valve Relay Signal	Valve relay operation signal is displayed.	ON or OFF
Motor Relay Signal	Motor relay operation signal is displayed.	ON or OFF
Motor Relay Monitor	Voltage applied to the motor relay is displayed.	V
OFF Switch Signal	Operation condition of VDC OFF switch is displayed.	ON or OFF
Brake Switch	Brake ON/OFF is displayed.	ON or OFF

#### NOTE:

For details concerning the operation procedure, refer to the «help on PC application for Subaru Select Monitor».

### 3. CLEAR MEMORY MODE

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Brake Control}.
- 3) Click the [OK] button after the {VDC} is displayed.
- 4) On the «Brake Control Diagnosis», select {Clear Memory}.
- 5) When the “Clear Memory?” is shown on the screen, click the [YES] button.
- 6) When “Done” and “Turn ignition switch to OFF” are shown on the display screen, turn the ignition switch to OFF.

#### NOTE:

For detailed operation procedure, refer to the «help on PC application for Subaru Select Monitor».

# Subaru Select Monitor

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### 4. FUNCTION CHECK

Display	Contents of display	Index No.
ABS sequence control	Operate the valve and pump motor continuously to perform the ABS sequence control.	<Ref. to ABS-10, ABS Sequence Control.>
VDC confirmation mode	Operate the valve and pump motor continuously to perform the VDC sequence control.	<Ref. to VDC-13, VDC Sequence Control.>
Set up mode for Neutral of Steering Angle Sensor & Lateral G Sensor 0 Point is not normal	Set the steering angle sensor neutral position and the lateral G sensor "0" point.	<Ref. to VDC-17, Steering Angle Sensor.>

### 5. FREEZE FRAME DATA

#### NOTE:

- Data stored at the time of trouble occurrence is shown on the display.
- Each time a trouble occurs, the latest information is stored in the freeze frame data in memory.
- If a freeze frame data is not properly stored in memory (due to a drop in VDCCM power supply, etc.), a DTC suffixed with a question mark "?" appears on the Subaru Select Monitor display. This shows it may be an unreliable reading.

Display	Contents to be monitored
EAM signal	Engine control command signal is displayed.
VDC Control Flag	VDC control condition is displayed.
EBD Control Flag	EBD control condition is displayed.
TCS Control Flag	TCS control condition is displayed.
ABS Control Flag	ABS control condition is displayed.
VDC OFF light	ON/OFF condition of the VDC operated by the driver is displayed.
Brake Switch	Brake ON/OFF is displayed.

Display	Contents to be monitored
Steering angle sensor	Steering angle detected by steering angle sensor is displayed.
Yaw rate sensor	Vehicle angular speed detected by yaw rate sensor is displayed.
Lateral G Sensor	Vehicle lateral acceleration detected by lateral G sensor is displayed.
Pressure Sensor	Brake fluid pressure detected by pressure sensor is displayed.
Vehicle Speed	Vehicle speed calculated by VDC control module is displayed.
FR Wheel Speed	Wheel speed detected by front ABS wheel speed sensor RH is displayed in km/h or MPH.
FL Wheel Speed	Wheel speed detected by front ABS wheel speed sensor LH is displayed in km/h or MPH.
RR Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor RH is displayed in km/h or MPH.
RL Wheel Speed	Wheel speed detected by rear ABS wheel speed sensor LH is displayed in km/h or MPH.
Acceleration opening angle signal	Acceleration opening is displayed.
Engine Speed	Engine speed on malfunction occurrence is displayed.
Gear position	Gear position on malfunction occurrence is displayed.
IG power supply voltage	Voltage supplied to VDC control module is displayed.
Absolute angle recognition flag	Whether the absolute angle of the steering angle sensor was determined is displayed.

### 6. PARAMETER SELECTION

#### CAUTION:

- **Subaru Select Monitor is required for parameter selection.**
- **This function can be used for the replacement VDCCM&H/U and VDCCM.**

#### NOTE:

- When a VDCCM is replaced with a replacement, use this function to select and register parameters to the VDCCM.
  - For confirmation of applied models, refer to the "Model number plate" attached to the vehicles. <Ref. to ID-2, IDENTIFICATION, Identification.>
  - If a wrong applied model is written, it can be re-written.
  - When no data is registered, ABS/EBD/VDC warning light illuminates and the DTC "Parameter selection failure" is detected.
- 1) Connect the Subaru Select Monitor.
  - 2) On the «Main Menu» display, select {Each System Check}.
  - 3) On the «System Selection Menu», select {Brake Control}.
  - 4) Click the [OK] button after the {VDC} is displayed.
  - 5) On the «Brake Control Diagnosis», select {Parameter Selection}.
  - 6) Check the applied model indicated in the "Model number plate". <Ref. to ID-2, IDENTIFICATION, Identification.>
  - 7) Enter the applied model of 7-digit alphanumeric characters and press the [Enter] key.
  - 8) When the confirmation screen indicating the vehicle information appears, check that the correct applied model and grade are displayed and click the [OK] button.

#### NOTE:

- When the displayed applied model and grade are different from those of the vehicle, perform registration operations again after clicking the [OK] button.
- 9) Execute Clear Memory after parameter selection and registration operations because the DTC for "Parameter selection failure" is memorized.

### 7. PARAMETER CHECK

#### NOTE:

The parameter data registered in the VDCCM is shown on the display.

- 1) Connect the Subaru Select Monitor.
- 2) On the «Main Menu» display, select {Each System Check}.
- 3) On the «System Selection Menu», select {Brake Control}.
- 4) Click the [OK] button after the {VDC} is displayed.
- 5) On the «Brake Control Diagnosis», select {Parameter Check}.
- 6) On the {Parameter Check} display screen, check that the applied model and grade of the target vehicle are included, and click the [OK] button.
- 7) If the applied model and grade of the target vehicle are not included on the {Parameter Check} display screen, perform parameter selection and registration. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>

# Subaru Select Monitor

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## B: INSPECTION

### 1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

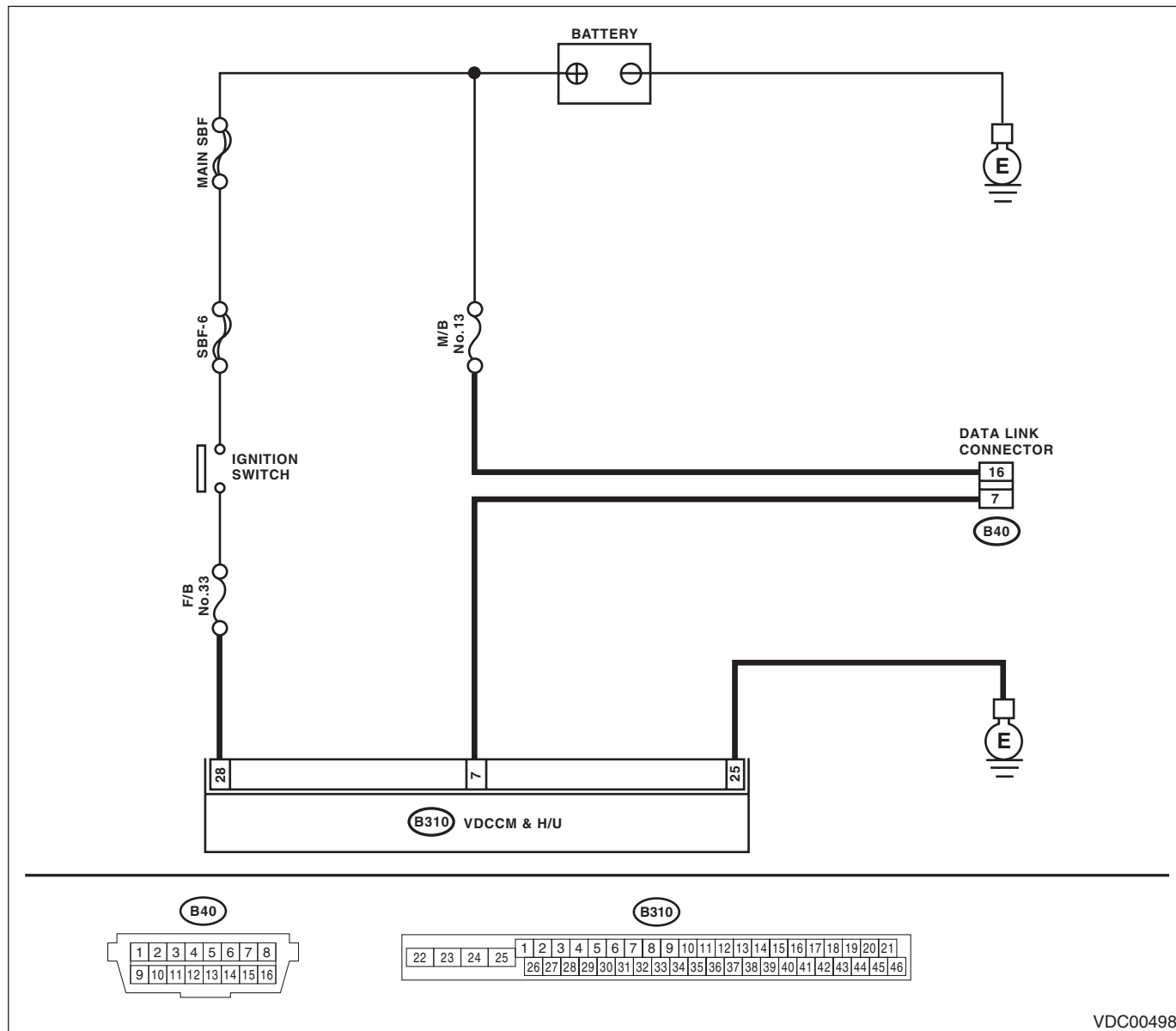
#### DETECTING CONDITION:

Defective harness connector

#### TROUBLE SYMPTOM:

Communication is impossible between VDC and Subaru Select Monitor.

#### WIRING DIAGRAM:



VDC00498

# Subaru Select Monitor

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK IGNITION SWITCH.</b>	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select VDC mode using Subaru Select Monitor.
2	<b>CHECK BATTERY.</b> 1) Turn the ignition switch to OFF. 2) Measure the battery voltage.	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
3	<b>CHECK BATTERY TERMINAL.</b>	Is there poor contact at the battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
4	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be performed normally.	Are the system name and model year displayed on Subaru Select Monitor?	Go to step 8.	Go to step 5.
5	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Are the system name and model year displayed on Subaru Select Monitor?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6	<b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U, ECM and TCM. 3) Measure the resistance between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the harness and connector between each control module and data link connector.
7	<b>CHECK OUTPUT SIGNAL FOR VDCCM&amp;H/U.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control module and data link connector.
8	<b>CHECK THE HARNESS CONNECTOR BETWEEN VDCCM&amp;H/U AND DATA LINK CONNECTOR.</b> Measure the resistance between VDCCM&H/U connector and data link connector. <b>Connector &amp; terminal</b> <b>(B310) No. 7 — (B40) No. 7:</b>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 9.	Repair harness and connector between VDCCM&H/U and data link connector.
9	<b>CHECK INSTALLATION OF VDCCM&amp;H/U CONNECTOR.</b> Turn the ignition switch to OFF.	Is the VDCCM&H/U connector inserted into VDCCM&H/U until the clamp locks onto it?	Go to step 10.	Insert VDCCM&H/U connector into VDCCM&H/U.
10	<b>CHECK POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the ignition power supply voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 28 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 11.	Repair open circuit in harness between VDCCM&H/U and battery.

# Subaru Select Monitor

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>11 CHECK THE HARNESS CONNECTOR BETWEEN VDCCM&amp;H/U AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Measure the resistance of harness between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 12.	Repair the open circuit of VDCCM&H/U ground harness and poor contact of connector.
<b>12 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in control module power supply, ground circuit and data link connector?	Repair the connector.	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

## Read Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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### 7. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

For details concerning DTC reading procedure, refer to "Subaru Select Monitor". <Ref. to VDC(diag)-14, Subaru Select Monitor.>

# Inspection Mode

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

---

## 8. Inspection Mode

### A: PROCEDURE

Reproduce the malfunction occurrence condition as much as possible.

Drive the vehicle at least ten minutes.

#### NOTE:

Make sure the vehicle is not dragged to one side under usual driving condition.



## Clear Memory Mode

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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### 9. Clear Memory Mode

#### A: OPERATION

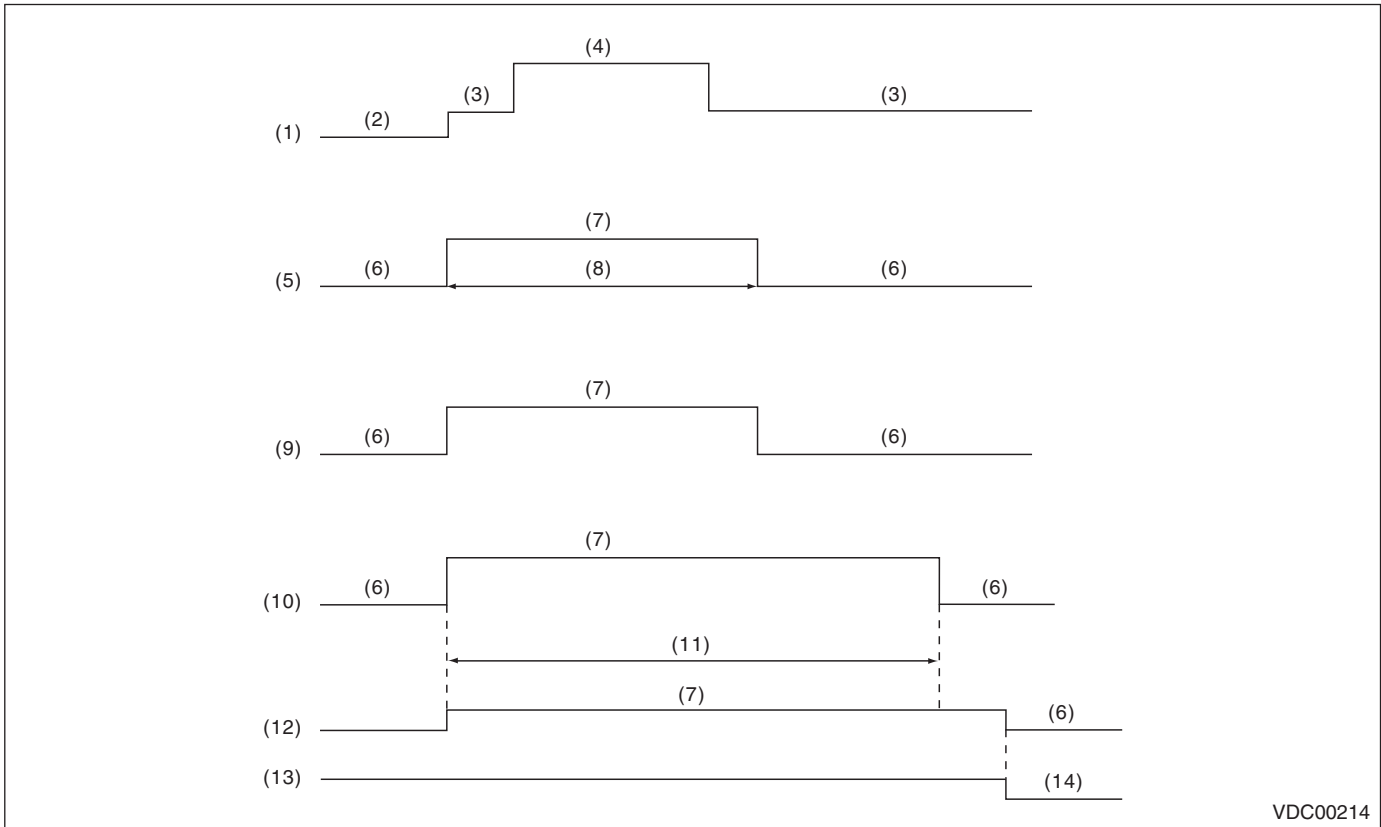
For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to VDC(diag)-14, Subaru Select Monitor.>

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 10.Warning Light Illumination Pattern

### A: INSPECTION



- |                       |  |  |
|-----------------------|--|--|
| (1) Ignition switch   | (8) 2 sec.   | (12) Brake warning light (EBD warning light) |
| (2) OFF               | (9) VDC indicator light  | (13) Parking brake                           |
| (3) ON                | (10) VDC warning light and VDC OFF indicator light             | (14) Released                                |
| (4) Engine start      | (11) Several seconds (depending on engine coolant temperature) |  |
| (5) ABS warning light |  |  |
| (6) Light OFF         |  |  |
| (7) Light ON          |  |  |

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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1) When warning lights or indicator lights do not illuminate in accordance with this illumination pattern, there must be an electrical malfunction.

2) When warning lights or indicator lights remain constantly OFF, check the combination meter circuit or CAN communication circuit. <Ref. to VDC(diag)-26, VDC WARNING LIGHT, VDC OFF INDICATOR LIGHT AND VDC INDICATOR LIGHT DO NOT COME ON, Warning Light Illumination Pattern.>

3) When ABS warning light does not go off, check the combination meter circuit. <Ref. to VDC(diag)-29, ABS WARNING LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.>

4) When the VDC indicator light, VDC warning light and VDC OFF indicator light do not go off, check the combination meter circuit or CAN communication circuit. <Ref. to VDC(diag)-30, VDC INDICATOR LIGHT DOES NOT GO OFF, Warning Light Illumination Pattern.>

## NOTE:

- Even though the ABS warning light does not go off after 2 seconds from ABS warning light illumination, the ABS system operates normally when the warning light goes off while driving at approximately 12 km/h (7 MPH). However, the ABS system does not work while the ABS warning light is illuminated.
- It may take several minutes before VDC warning light and VDC OFF indicator light goes off if the vehicle is parked under low temperature for a specified time. This is not defective because it is resulted from low engine coolant temperature.
- With the vehicle jack-up/lift-up or set on free rollers, when the wheels lock or spin after starting the engine, ABS warning light, VDC warning light and VDC OFF indicator light may illuminate because VDCCM&H/U detects the abnormal conditions from ABS wheel speed sensors. In this case, this is not a malfunction. Perform the Clear Memory Mode.

## Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### **B: VDC WARNING LIGHT, VDC OFF INDICATOR LIGHT AND VDC INDICATOR LIGHT DO NOT COME ON**

#### **DETECTING CONDITION:**

- Defective combination meter
- Defective CAN communication

#### **TROUBLE SYMPTOM:**

When the ignition switch is turned to ON (engine OFF), VDC indicator light, VDC warning light and VDC OFF indicator light do not come on.

#### **NOTE:**

When pressing the VDC OFF switch for 10 seconds or more, the VDC OFF indicator light goes off and cannot operate any more. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK OTHER INDICATOR LIGHT.</b> Turn the ignition switch to ON.	Does other indicator light illuminate soon after "ON".	Go to step 2.	Perform the self-diagnosis of combination meter.
<b>2</b>	<b>CHECK VDCCM.</b> When the engine does not start, display the current data of VDCCM using Subaru Select Monitor.	Is "VDC warning light" output set to "ON"?	Go to step 3.	Replace the VDCCM only.
<b>3</b>	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 4.
<b>4</b>	<b>CHECK COMBINATION METER.</b> Check the combination meter.	Is combination meter OK?	Replace the VDCCM only.	Repair the combination meter assembly.

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## C: ABS WARNING LIGHT DOES NOT COME ON

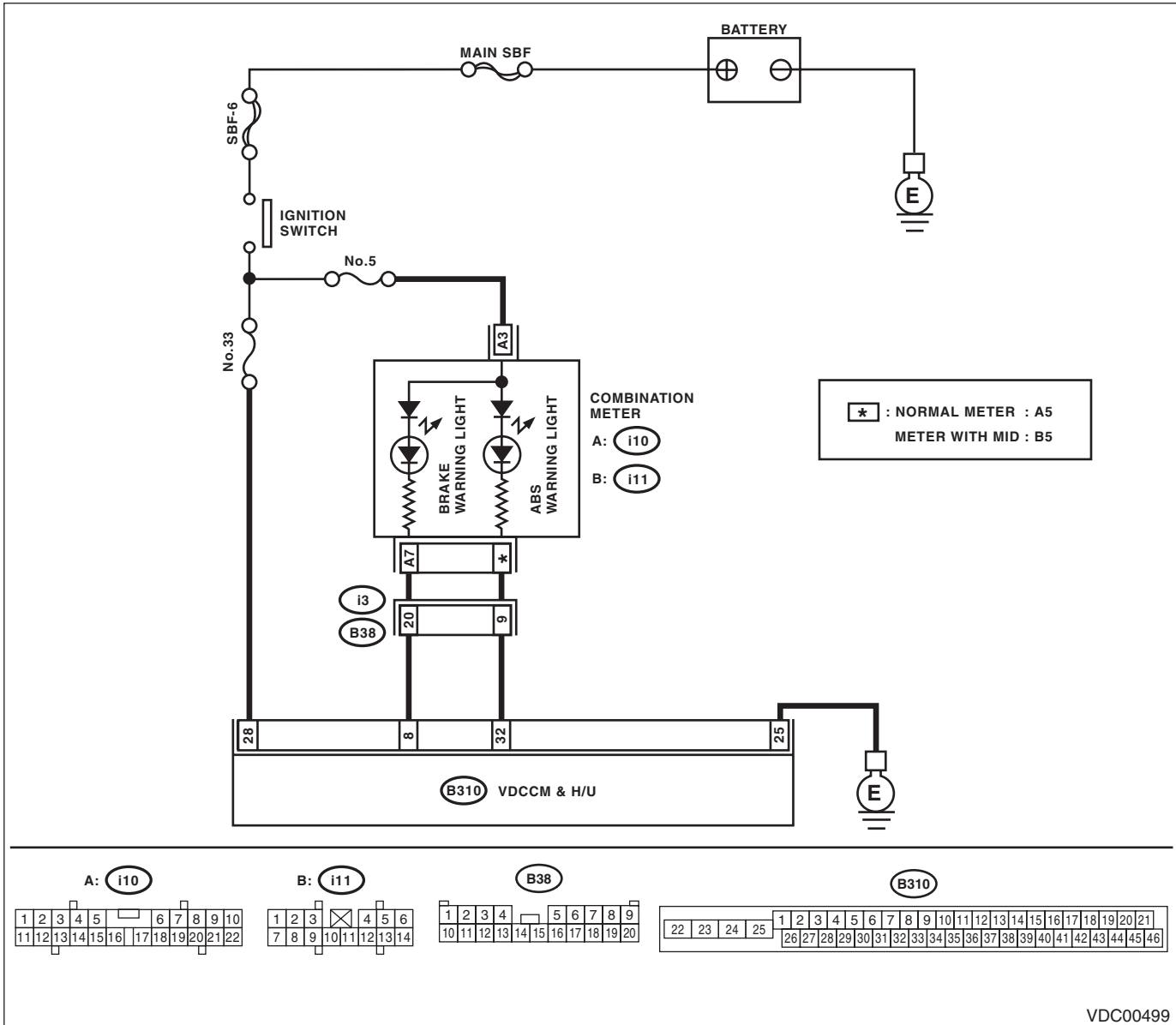
### DETECTING CONDITION:

- Defective combination meter
- Defective harness

### TROUBLE SYMPTOM:

When the ignition switch is turned to ON (engine OFF), ABS warning light does not come on.

### WIRING DIAGRAM:



VDC00499

## Warning Light Illumination Pattern

### VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK OTHER LIGHTS TURN ON.</b> Turn the ignition switch to ON. (engine OFF)	Do other warning lights illuminate?	Go to step 2.	Check the combination meter.
<b>2</b> <b>READ DTC.</b> Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
<b>3</b> <b>CHECK GROUND SHORT CIRCUIT OF HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector (B310) from the VDCCM&H/U. 3) Disconnect the connector (i10) or (i11) from the combination meter. 4) Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 32 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the harness connector between VDCCM&H/U and combination meter.
<b>4</b> <b>CHECK VDCCM.</b> 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition switch to ON. 3) Measure the resistance between the combination meter connector and chassis ground soon after the ignition switch is turned to ON (within 2 seconds). <b>Connector &amp; terminal</b> <b>Normal meter model</b> <b>(i10) No. 5 — Chassis ground:</b> <b>Meter model with MID</b> <b>(i11) No. 5 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Check the combination meter.	Replace the VDCCM only.

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## D: ABS WARNING LIGHT DOES NOT GO OFF

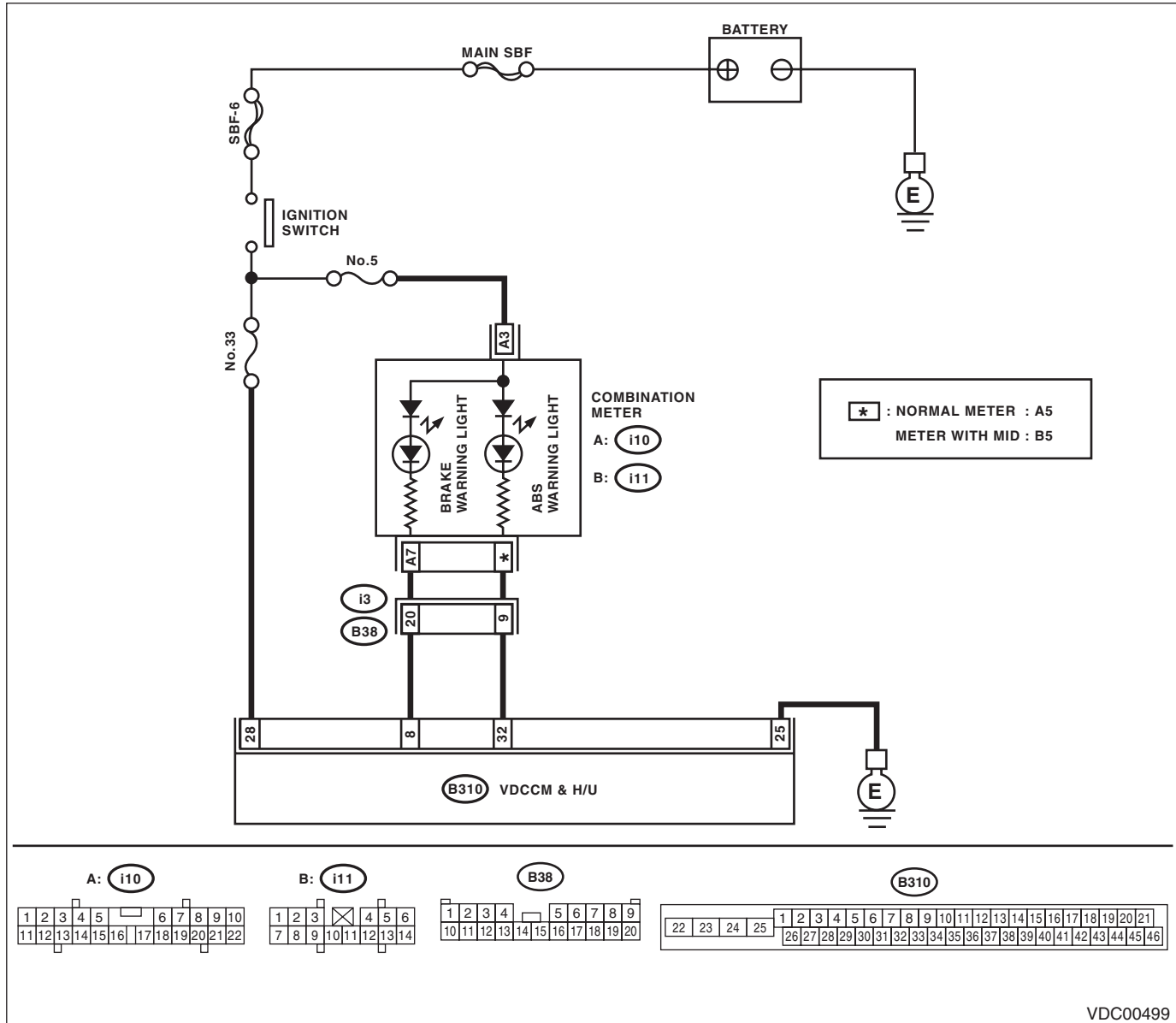
### DETECTING CONDITION:

- Defective combination meter
- Open circuit of harness

### TROUBLE SYMPTOM:

When starting the engine, the ABS warning light is kept ON.

### WIRING DIAGRAM:



VDC00499

## Warning Light Illumination Pattern

### VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 READ DTC.</b> Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2 CHECK WIRING HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector (B310) from the VDCCM&H/U. 3) Disconnect the connector (i10) or (i11) from the combination meter. 4) Measure the resistance between VDCCM&H/U connector and combination meter connector. <b>Connector &amp; terminal</b> <b>Normal meter model</b> <b>(B310) No. 32 — (i10) No. 5:</b> <b>Meter model with MID</b> <b>(B310) No. 32 — (i11) No. 5:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the harness connector between VDCCM&H/U and combination meter.
<b>3 CHECK POOR CONTACT IN CONNECTOR.</b> Check for poor contact in all connectors.	Is there poor contact?	Repair the connector.	Go to step 4.
<b>4 CHECK VDCCM.</b> 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition switch to ON. 3) Measure the resistance between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <b>Normal meter model</b> <b>(i10) No. 5 — Chassis ground:</b> <b>Meter model with MID</b> <b>(i11) No. 5 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Check the combination meter.	Replace the VDCCM only.

## E: VDC INDICATOR LIGHT DOES NOT GO OFF

### DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication

### TROUBLE SYMPTOM:

When starting the engine, VDC indicator light is kept ON.

Step	Check	Yes	No
<b>1 READ DTC.</b> Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2 CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 3.
<b>3 CHECK COMBINATION METER.</b> Check the combination meter.	Is combination meter OK?	Replace the VDCCM only.	Repair the combination meter.



# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## F: VDC WARNING LIGHT AND VDC OFF INDICATOR LIGHT DO NOT GO OFF

### DETECTING CONDITION:

- Defective combination meter
- Defective CAN communication
- Defective engine
- VDC OFF switch is shorted.

### TROUBLE SYMPTOM:

When starting the engine, VDC OFF indicator light is kept ON.

### NOTE:

When pressing the VDC OFF switch for 10 seconds or more, the VDC OFF indicator light goes off and cannot operate any more. When turning the ignition switch from OFF to ON, the OFF operation enabled status is restored.

Step	Check	Yes	No	
1	<b>READ DTC.</b> Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
2	<b>CHECK ENGINE.</b>	Does the malfunction indicator light illuminate?	Repair the engine.	Go to step 3.
3	<b>CHECK ENGINE COOLANT TEMPERATURE.</b> Warm up the engine and check if VDC warning light and VDC OFF indicator light illumination condition changes.	When the engine coolant temperature is too low, VDC warning light and VDC OFF indicator light illuminate. Do the lights go off when the engine is warmed-up?	Normal operation	Go to step 4.
4	<b>CHECK VDC OFF SWITCH.</b> Remove and check VDC OFF switch.	Is the VDC OFF switch normal?	Go to step 5.	Replace the VDC OFF switch.
5	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 6.
6	<b>CHECK COMBINATION METER.</b> Check the combination meter.	Is combination meter OK?	Replace the VDCCM only.	Repair the combination meter.

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## G: BRAKE WARNING LIGHT DOES NOT GO OFF

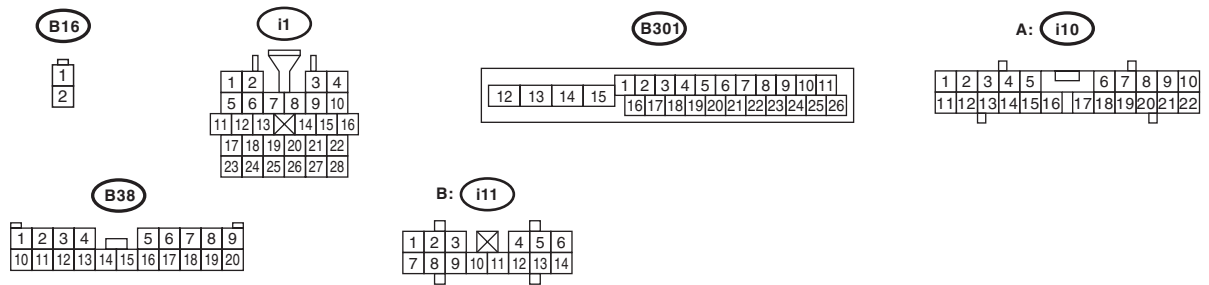
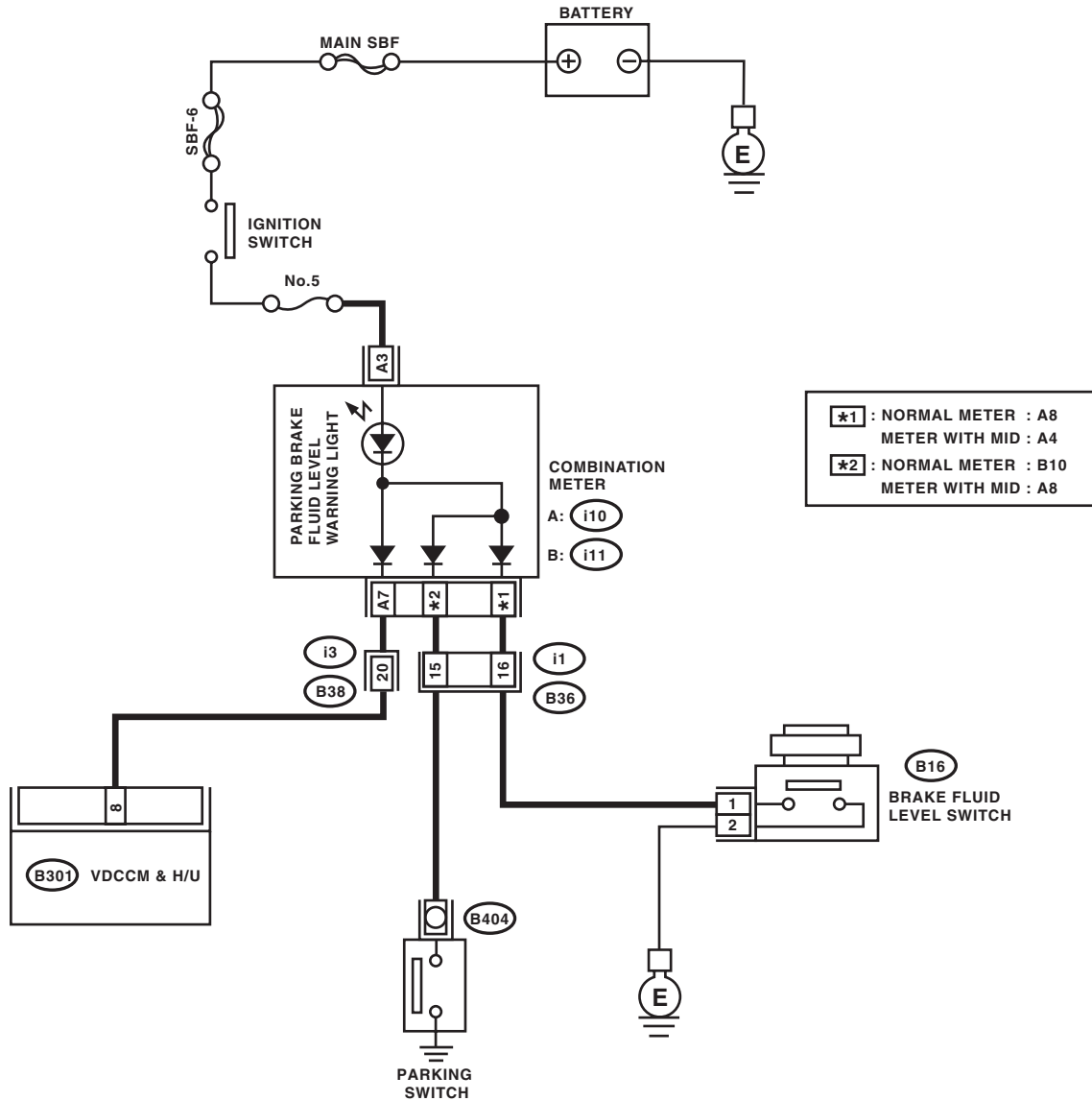
### DETECTING CONDITION:

- Brake warning light circuit is shorted.
- Defective sensor/connector

### TROUBLE SYMPTOM:

After starting the engine, the brake warning light remains lit though the parking lever is released.

### WIRING DIAGRAM:



VDC00500

# Warning Light Illumination Pattern

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK INSTALLATION OF VDCCM&amp;H/U CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Check that the VDCCM&H/U connector is inserted until it is locked by clamp.	Is the connector firmly inserted?	Go to step 2.	Insert the VDCCM&H/U connector until it is locked by clamp.
<b>2 READ DTC.</b> Read the DTC. <Ref. to VDC(diag)-21, Read Diagnostic Trouble Code (DTC).>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
<b>3 CHECK BRAKE FLUID AMOUNT.</b> Check the amount of brake fluid in the reservoir tank of master cylinder.	Is the amount of brake fluid between the lines of "MAX" and "MIN"?	Go to step 4.	Replenish brake fluid to the specified value.
<b>4 CHECK BRAKE FLUID LEVEL SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the level switch connector (B16) from master cylinder. 3) Measure the resistance of master cylinder terminals.  <i>Terminals</i> <i>No. 1 — No. 2:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Replace the master cylinder.
<b>5 CHECK PARKING BRAKE SWITCH.</b> 1) Disconnect the connector (B404) from parking brake switch. 2) Release the parking brake. 3) Measure the resistance between parking brake switch terminal and chassis ground.	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Replace the parking brake switch.
<b>6 CHECK GROUND SHORT OF HARNESS.</b> 1) Disconnect the connectors (i10 and i11) from the combination meter. 2) Measure the resistance between combination meter connector and chassis ground.  <i>Connector &amp; terminal</i> <i>Normal meter model</i> <i>(i10) No. 8 — Chassis ground:</i> <i>(i11) No. 10 — Chassis ground:</i> <i>Meter model with MID</i> <i>(i10) No. 8 — Chassis ground:</i> <i>(i10) No. 4 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the harness connector between combination meter brake fluid level switch and parking brake switch.
<b>7 CHECK HARNESS CONNECTOR.</b> 1) Disconnect the connector (B310) from the VDCCM&H/U. 2) Disconnect the connector (i10) from combination meter. 3) Measure the resistance between VDCCM&H/U connector and combination meter connector.  <i>Connector &amp; terminal</i> <i>(B310) No. 8 — (i10) No. 7:</i>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 8.	Repair the harness connector between VDCCM&H/U and combination meter.
<b>8 CHECK POOR CONTACT IN CONNECTOR.</b> Check for poor contact in all connectors.	Is there poor contact?	Repair the connector.	Go to step 9.
<b>9 CHECK VDCCM.</b> 1) Connect the connector (B310) to VDCCM&H/U. 2) Turn the ignition to ON. 3) Measure the resistance between combination meter connector and chassis ground.  <i>Connector &amp; terminal</i> <i>(i10) No. 7 — Chassis ground:</i>	Is the resistance less than 0.5 $\Omega$ ?	Check the combination meter.	Replace the VDCCM only.

## List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

### 11. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0021	07B0H	Front Right ABS Sensor Circuit Open or Shorted Battery	Open/high input of front ABS wheel speed sensor RH	<Ref. to VDC(diag)-39, DTC C0021 FRONT RIGHT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0022	072FH 0736H 0737H 0738H 073AH 073CH	Front Right ABS Sensor Signal	Front ABS wheel speed sensor RH signal malfunction	<Ref. to VDC(diag)-42, DTC C0022 FRONT RIGHT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0023	06B0H	Front Left ABS Sensor Circuit Open or Shorted Battery	Open/high input of front ABS wheel speed sensor LH	<Ref. to VDC(diag)-39, DTC C0023 FRONT LEFT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0024	062FH 0636H 0637H 0638H 063AH 063CH	Front Left ABS Sensor Signal	Front ABS wheel speed sensor LH signal malfunction	<Ref. to VDC(diag)-42, DTC C0024 FRONT LEFT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0025	09B0H	Rear Right ABS Sensor Circuit Open or Shorted Battery	Open/high input of rear ABS wheel speed sensor RH	<Ref. to VDC(diag)-39, DTC C0025 REAR RIGHT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0026	092FH 0936H 0937H 0938H 093AH 093CH	Rear Right ABS Sensor Signal	Rear ABS wheel speed sensor RH signal malfunction	<Ref. to VDC(diag)-42, DTC C0026 REAR RIGHT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0027	08B0H	Rear Left ABS Sensor Circuit Open or Shorted Battery	Open/high input of rear ABS wheel speed sensor LH	<Ref. to VDC(diag)-40, DTC C0027 REAR LEFT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0028	082FH 0836H 0837H 0838H 083AH 083CH	Rear Left ABS Sensor Signal	Rear ABS wheel speed sensor LH signal malfunction	<Ref. to VDC(diag)-43, DTC C0028 REAR LEFT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0029	0A11H 0A21H 0A42H 0A46H 0A50H	Any One of Four ABS Sensors Signal	ABS wheel speed sensor signal malfunction in one of four wheels	<Ref. to VDC(diag)-46, DTC C0029 ANY OF WHEEL SENSORS SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0031	0DB8H 0DC0H	FR hold valve malfunction	Front inlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0031 FR HOLD VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0032	0EB8H 0EC0H	FR pressure reducing valve malfunction	Front outlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0032 FR PRESSURE REDUCING VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0033	0BB8H 0BC0H	FL hold valve malfunction	Front inlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0033 FL HOLD VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0034	0CB8H 0CC0H	FL pressure reducing valve malfunction	Front outlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0034 FL PRESSURE REDUCING VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0035	11B8H 11C0H	RR hold valve malfunction	Rear inlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0035 RR HOLD VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0036	12B8H 12C0H	RR pressure reducing valve malfunction	Rear outlet solenoid valve RH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-48, DTC C0036 RR PRESSURE REDUCING VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0037	0FB8H 0FC0H	RL hold valve malfunction	Rear inlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-49, DTC C0037 RL HOLD VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0038	10B8H 10C0H	RL pressure reducing valve malfunction	Rear outlet solenoid valve LH malfunction in VDCCM&H/U	<Ref. to VDC(diag)-49, DTC C0038 RL PRESSURE REDUCING VALVE MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0039	0FB5H 11B5H 1AB5H	Any one of four solenoid valves	Solenoid valve malfunction in one of four wheels	<Ref. to VDC(diag)-49, DTC C0039 ANY ONE OF FOUR SOLENOID VALVES, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0041	—	ECM	VDC control module malfunction	<Ref. to VDC(diag)-52, DTC C0041 ECM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1620H 1630H 16C0H	Parameter selection error	VDC control module parameter selection failure	<Ref. to VDC(diag)-54, DTC C0041 PARAMETER SELECTION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0042	0316H 031CH 0322H 0324H	Power Supply Voltage Failure	Power voltage malfunction	<Ref. to VDC(diag)-55, DTC C0042 POWER SUPPLY VOLTAGE FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0044	2921H	TCM communication circuit	CAN communication failure of transmission control module	<Ref. to VDC(diag)-57, DTC C0044 TCM COMMUNICATION CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0045	2922H 2932H	Incorrect VDC Control Module specifications	Different VDC control module specification	<Ref. to VDC(diag)-58, DTC C0045 INCORRECT VDC CONTROL MODULE SPECIFICATIONS, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	2923H	TCM malfunction	AT control module malfunction	<Ref. to VDC(diag)-59, DTC C0045 TCM MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0047	150EH	Improper CAN Commu- nication	Improper CAN commu- nication	<Ref. to VDC(diag)-60, DTC C0047 CAN COM- MUNICATION, Diagnostic Procedure with Diag- nostic Trouble Code (DTC).>
	1512H			
	1513H			
	1514H			
	1518H			
	1519H			
	151AH			
	151BH			
	151DH			
	151EH			
	151FH			
	1520H			
	1531H			
1540H				
15C0H				
C0051	021FH	Valve Relay	Valve Relay	<Ref. to VDC(diag)-62, DTC C0051 VALVE RELAY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	0220H			
	0221H			
	0280H			
	0281H			
	02B0H			
	02B1H			
02C0H				
C0052	0580H	Motor and Motor Relay	Motor/motor relay OFF malfunction	<Ref. to VDC(diag)-64, DTC C0052 MOTOR AND MOTOR RELAY OFF FAILURE, Diagnostic Proce- dure with Diagnostic Trouble Code (DTC).>
	05A0H	Motor and motor relay ON failure	Motor/motor relay ON malfunction	<Ref. to VDC(diag)-66, DTC C0052 MOTOR AND MOTOR RELAY ON FAILURE, Diagnostic Proce- dure with Diagnostic Trouble Code (DTC).>
	0560H	Motor malfunction	Motor	<Ref. to VDC(diag)-67, DTC C0052 MOTOR MALFUNCTION, Diagnostic Procedure with Diag- nostic Trouble Code (DTC).>
C0054	04B0H	Brake Light Switch	BLS open circuit	<Ref. to VDC(diag)-68, DTC C0054 BLS CIR- CUIT OPEN, Diagnostic Procedure with Diagnos- tic Trouble Code (DTC).>
	043CH	BLS ON Malfunction	BLS ON malfunction	<Ref. to VDC(diag)-70, DTC C0054 BLS ON MALFUNCTION, Diagnostic Procedure with Diag- nostic Trouble Code (DTC).>
	04C1H	BLS OFF Malfunction	BLS OFF malfunction	<Ref. to VDC(diag)-72, DTC C0054 BLS OFF MALFUNCTION, Diagnostic Procedure with Diag- nostic Trouble Code (DTC).>
C0057	2931H	ECM communication circuit	CAN communication failure of engine control module	<Ref. to VDC(diag)-74, DTC C0057 ECM COM- MUNICATION CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	2933H	ECM control system	Coordinate control prohibition of engine control module	<Ref. to VDC(diag)-75, DTC C0057 ECM CON- TROL SYSTEM, Diagnostic Procedure with Diag- nostic Trouble Code (DTC).>
C0061	19B8H 19C0H	VDC switching valve 1 (S)	Secondary cut valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-49, DTC C0061 NORMAL OPENING VALVE 1 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0062	1AB8H 1AC0H	VDC switching valve 1 (P)	Primary cut valve mal- function in VDCCM&H/U	<Ref. to VDC(diag)-49, DTC C0062 NORMAL OPENING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0063	1BB8H 1BC0H	VDC switching valve 2 (S)	Secondary suction valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-49, DTC C0063 NORMAL CLOSING VALVE 1 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0064	1CB8H 1CC0H	VDC switching valve 2 (P)	Primary suction valve malfunction in VDCCM&H/U	<Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0071	2130H	Steering angle sensor offset is too big	Excessive steering angle sensor output offset	<Ref. to VDC(diag)-76, DTC C0071 STEERING ANGLE SENSOR OFFSET IS TOO BIG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	2134H	Change range of steering angle sensor is too big	Excessive variation amount of steering angle sensor output	<Ref. to VDC(diag)-78, DTC C0071 CHANGE RANGE OF STEERING ANGLE SENSOR IS TOO BIG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	212EH 2132H 2136H 2138H 213CH 2150H 2151H 2152H 2153H 2154H 2155H 2156H 2157H 2158H 2159H 215AH	Steering angle sensor malfunction	Steering angle sensor output	<Ref. to VDC(diag)-80, DTC C0071 STEERING ANGLE SENSOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	2104H	Steering angle sensor power supply malfunction	Steering angle sensor power supply malfunction	<Ref. to VDC(diag)-82, DTC C0071 STEERING ANGLE SENSOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1E03H 1E1AH 1E1EH 1E22H 1E26H 1E28H 1E2CH 1E34H 1E38H 1E3AH 1E3CH 1E3FH 1EACH	Abnormal yaw rate sensor output	Yaw rate sensor output	<Ref. to VDC(diag)-84, DTC C0072 ABNORMAL YAW RATE SENSOR OUTPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0072	1E04H 1E05H 1E07H	Yaw rate sensor power/output	Yaw rate sensor power supply/output	<Ref. to VDC(diag)-86, DTC C0072 VOLTAGE INPUTTED TO YAW RATE SENSOR EXCEEDS SPECIFICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1EAAH	Abnormal yaw rate sensor reference voltage	Yaw rate sensor reference	<Ref. to VDC(diag)-88, DTC C0072 ABNORMAL YAW RATE SENSOR REFERENCE VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1E30H	Change range of yaw rate sensor signal is too big	Excessive variation amount of yaw rate sensor output	<Ref. to VDC(diag)-90, DTC C0072 CHANGE RANGE OF YAW RATE SENSOR SIGNAL IS TOO BIG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1E06H 1EABH 1EAEH	Yaw rate sensor communication	Yaw rate sensor communication	<Ref. to VDC(diag)-93, DTC C0072 YAW RATE SENSOR COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

DTC	Detailed code	Display	Content of diagnosis	Reference target
C0073	1D46H 1D47H	Lateral G sensor offset is too big	Excessive amount of lateral G sensor output offset	<Ref. to VDC(diag)-95, DTC C0073 LATERAL G SENSOR OFFSET IS TOO BIG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1D44H 1D45H 1DA0H 1DA2H	Abnormal lateral G sensor output	Lateral G sensor output	<Ref. to VDC(diag)-95, DTC C0073 ABNORMAL LATERAL G SENSOR OUTPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1D49H	Excessive lateral G sensor signal	Excessive lateral G sensor output	<Ref. to VDC(diag)-96, DTC C0073 EXCESSIVE LATERAL G SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
	1DA4H	Lateral G sensor communication	Lateral G sensor communication	<Ref. to VDC(diag)-92, DTC C0073 LATERAL G SENSOR COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0074	1F4EH 1F90H 1FA1H 1FB0H 1FB1H 1FC0H	Pressure sensor	Pressure sensor	<Ref. to VDC(diag)-98, DTC C0074 PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
C0081	2201H 2202H	System malfunction	System malfunction	<Ref. to VDC(diag)-99, DTC C0081 SYSTEM FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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### 12. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

#### **A: DTC C0021 FRONT RIGHT ABS SENSOR CIRCUIT OPEN OR SHORT**

**NOTE:**

For the diagnostic procedure, refer to DTC C0027 “RL WHEEL SPEED SENSOR CIRCUIT OPEN/HIGH INPUT”. <Ref. to VDC(diag)-40, DTC C0027 REAR LEFT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **B: DTC C0023 FRONT LEFT ABS SENSOR CIRCUIT OPEN OR SHORT**

**NOTE:**

For the diagnostic procedure, refer to DTC C0027 “RL WHEEL SPEED SENSOR CIRCUIT OPEN/HIGH INPUT”. <Ref. to VDC(diag)-40, DTC C0027 REAR LEFT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **C: DTC C0025 REAR RIGHT ABS SENSOR CIRCUIT OPEN OR SHORT**

**NOTE:**

For the diagnostic procedure, refer to DTC C0027 “RL WHEEL SPEED SENSOR CIRCUIT OPEN/HIGH INPUT”. <Ref. to VDC(diag)-40, DTC C0027 REAR LEFT ABS SENSOR CIRCUIT OPEN OR SHORT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## D: DTC C0027 REAR LEFT ABS SENSOR CIRCUIT OPEN OR SHORT

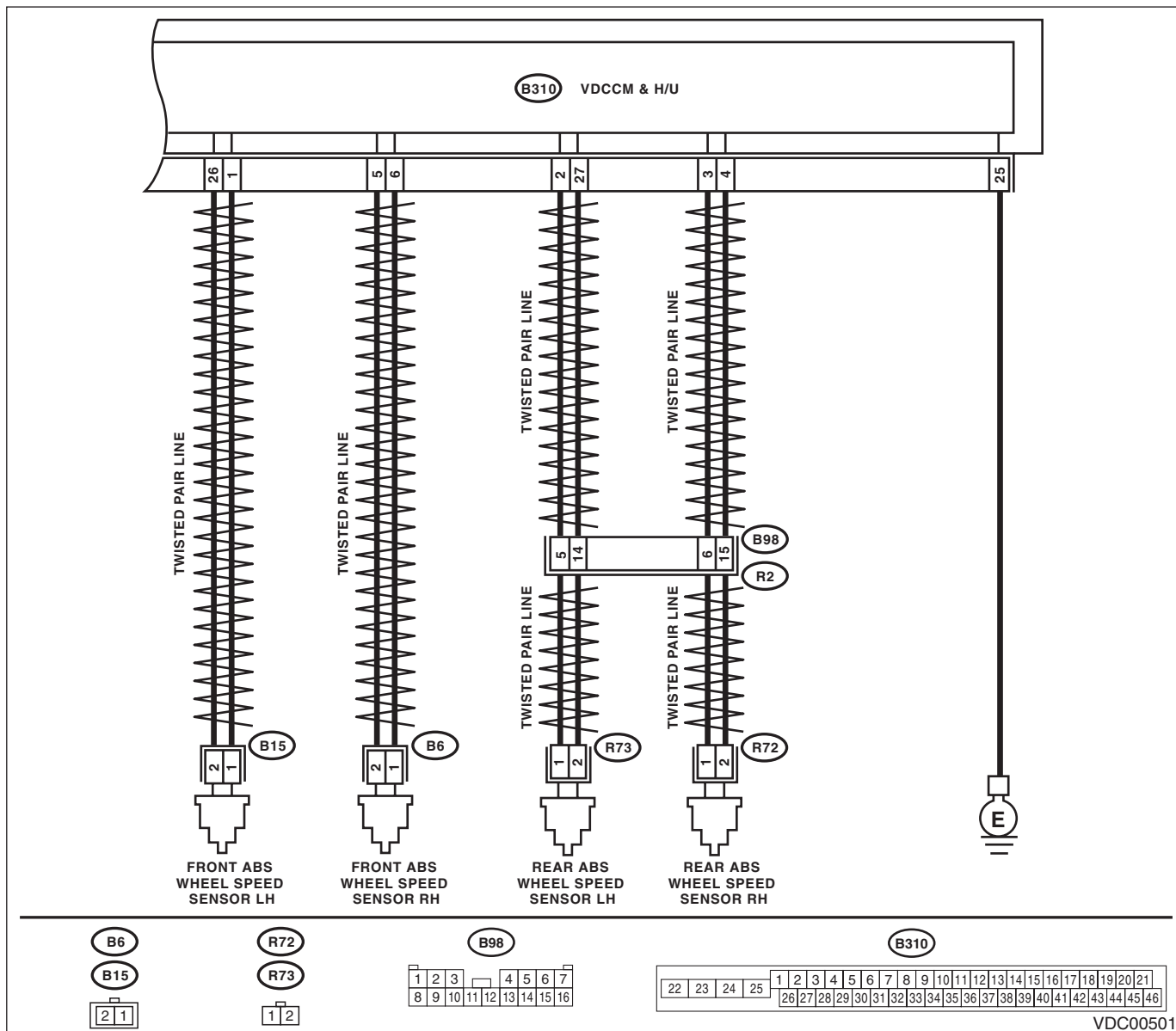
### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor (broken wire, input voltage too high)
- Defective harness connector

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00501

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTOR.</b> Check if there is poor contact between VDCCM&H/U and ABS wheel speed sensor.	Is there poor contact?	Repair the connector.	Go to step 2.
<b>2 CHECK HARNESS CONNECTOR BETWEEN VDCCM&amp;H/U AND ABS WHEEL SPEED SENSOR.</b> 1) Disconnect the connector (B310) from the VDCCM&H/U. 2) Disconnect the connector from the ABS wheel speed sensor. 3) Measure the resistance between VDCCM&H/U connector and ABS wheel speed sensor connector. <b>Connector &amp; terminal</b> <b>DTC C0021</b> (B310) No. 6 — (B6) No. 1: (B310) No. 5 — (B6) No. 2: <b>DTC C0023</b> (B310) No. 1 — (B15) No. 1: (B310) No. 26 — (B15) No. 2: <b>DTC C0025</b> (B310) No. 3 — (R72) No. 1: (B310) No. 4 — (R72) No. 2: <b>DTC C0027</b> (B310) No. 2 — (R73) No. 1: (B310) No. 27 — (R73) No. 2:	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the harness connector between VDCCM&H/U and ABS wheel speed sensor.
<b>3 CHECK GROUND SHORT OF HARNESS.</b> Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>DTC C0021</b> (B310) No. 6 — Chassis ground: <b>DTC C0023</b> (B310) No. 1 — Chassis ground: <b>DTC C0025</b> (B310) No. 4 — Chassis ground: <b>DTC C0027</b> (B310) No. 27 — Chassis ground:	Is the resistance 1 MΩ or more?	Go to step 4.	Repair the harness connector between VDCCM&H/U and ABS wheel speed sensor.
<b>4 CHECK ABS WHEEL SPEED SENSOR POWER SUPPLY CIRCUIT.</b> 1) Connect the VDCCM&H/U connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ABS wheel speed sensor connector and chassis ground. <b>Connector &amp; terminal</b> <b>DTC C0021</b> (B6) No. 2 (+) — Chassis ground (-): <b>DTC C0023</b> (B15) No. 2 (+) — Chassis ground (-): <b>DTC C0025</b> (R72) No. 1 (+) — Chassis ground (-): <b>DTC C0027</b> (R73) No. 1 (+) — Chassis ground (-):	Is the voltage 5 — 16 V?	Go to step 6.	Go to step 5.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK THE VDCCM&amp;H/U POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the VDCCM&H/U connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector terminals. <b>Connector &amp; terminal</b> <b>(B310) No. 28 (+) — (B310) No. 25 (-):</b>	Is the voltage 10 — 15 V?	Go to step 6.	Check the generator, battery and VDCCM&H/U power supply circuit.
<b>6 CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to ABS-15, ABS WHEEL SPEED SENSOR, INSPECTION, Rear ABS Wheel Speed Sensor.>	Is the pattern the same waveform as shown in the figure?	Go to step 7.	Replace the ABS wheel speed sensor.
<b>7 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
<b>8 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

### E: DTC C0022 FRONT RIGHT ABS SENSOR SIGNAL

**NOTE:**

For the diagnostic procedure, refer to DTC C0028 “RL WHEEL SPEED SENSOR SIGNAL”. <Ref. to VDC(diag)-43, DTC C0028 REAR LEFT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### F: DTC C0024 FRONT LEFT ABS SENSOR SIGNAL

**NOTE:**

For the diagnostic procedure, refer to DTC C0028 “RL WHEEL SPEED SENSOR SIGNAL”. <Ref. to VDC(diag)-43, DTC C0028 REAR LEFT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### G: DTC C0026 REAR RIGHT ABS SENSOR SIGNAL

**NOTE:**

For the diagnostic procedure, refer to DTC C0028 “RL WHEEL SPEED SENSOR SIGNAL”. <Ref. to VDC(diag)-43, DTC C0028 REAR LEFT ABS SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## H: DTC C0028 REAR LEFT ABS SENSOR SIGNAL

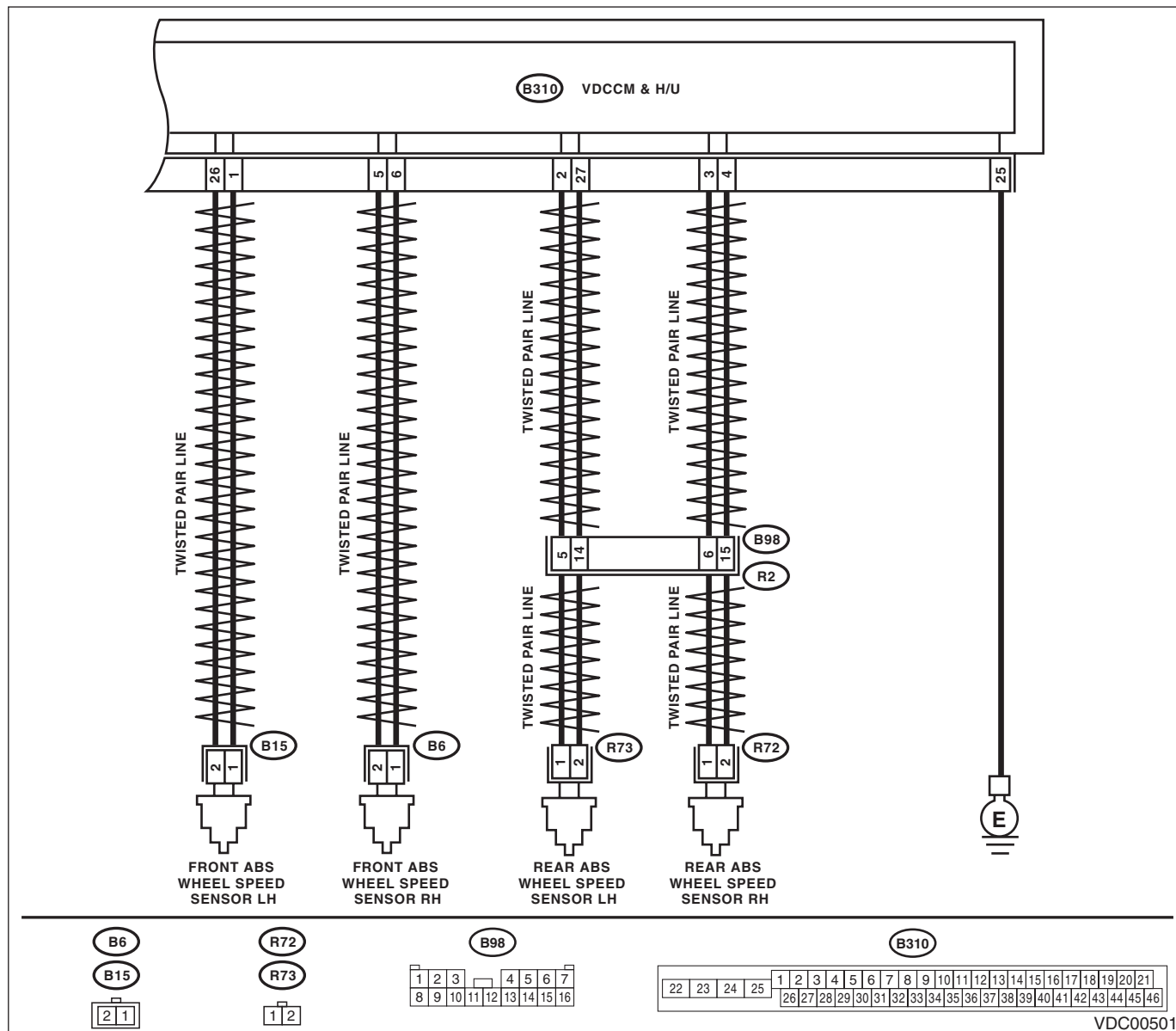
### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, irregular signal, etc.)
- Defective harness connector

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00501

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK OUTPUT OF ABS WHEEL SPEED SENSOR USING SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Read the defective ABS wheel speed sensor output.	Does the speed indicated on the display change in response to the speedometer reading during acceleration/deceleration when the steering wheel is in the straight-ahead position?	Go to step 2.	Go to step 7.
2	<b>CHECK POOR CONTACT IN CONNECTOR.</b> Turn the ignition switch to OFF.	Is there poor contact in connectors between VDCCM&H/U and ABS wheel speed sensor?	Repair the connector.	Go to step 3.
3	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 4.	Install the radio wave devices and electronic components properly.
4	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Check if the noise sources (such as an antenna) are installed near the sensor harness.	Are noise sources installed?	Install the noise sources apart from sensor harness.	Go to step 5.
5	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.
7	<b>CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.</b>	Is the ABS wheel speed sensor installation bolt tightened 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 8.	Tighten the ABS wheel speed sensor installation bolts.
8	<b>CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. <Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.>	Does the oscilloscope indicate the waveform pattern like shown in the figure when the tire is slowly turned? Does the oscilloscope indication repeat the waveform pattern like shown in the figure when the tire is slowly turned in equal speed for one rotation or more?	Go to step 10.	Go to step 9.
9	<b>CHECK ABS WHEEL SPEED SENSOR OR MAGNETIC ENCODER.</b>	Are there foreign matter, breakage or damage at the tip of ABS wheel speed sensor or magnetic encoder?	Remove dirt thoroughly. Also replace the ABS wheel speed sensor or magnetic encoder as a unit with hub unit bearing if it is broken or damaged.	Go to step 10.
10	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Make sure the radio wave devices and electronic components are installed correctly.	Are the radio wave devices and electronic components installed correctly?	Go to step 11.	Install the radio wave devices and electronic components properly.
11	<b>CHECK CAUSE OF SIGNAL NOISE.</b> Check if the noise sources (such as an antenna) are installed near the sensor harness.	Is the noise sources installed?	Go to step 12.	Install the noise sources apart from sensor harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>12 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. <Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.> 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 13.
<b>13 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference. <b>NOTE:</b> Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## I: DTC C0029 ANY OF WHEEL SENSORS SIGNAL

### DTC DETECTING CONDITION:

- Defective ABS wheel speed sensor signal (noise, irregular signal, etc.)
- Defective magnetic encoder
- When a wheel is turned freely for a long time

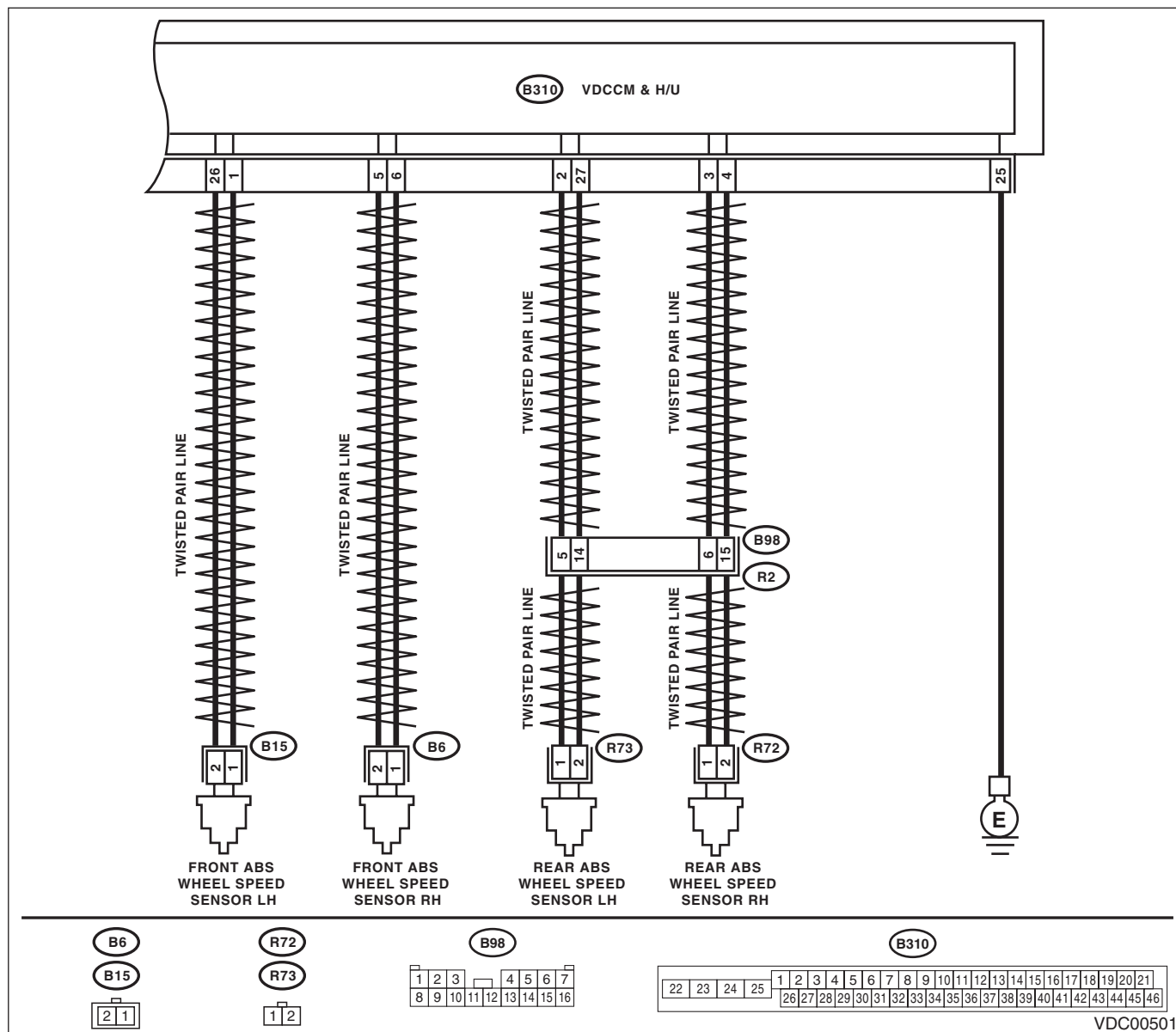
### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD may not operate.

### NOTE:

Brake warning light illuminates as well as ABS warning light when EBD does not operate.

### WIRING DIAGRAM:



VDC00501



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<p><b>WHETHER A WHEEL TURNED FREELY OR NOT.</b> Check if the wheels have been turned freely for one minute or more, such as when the vehicle is jacked-up, under full-lock cornering or when the wheels are not in contact with road surface.</p>	Did the wheels turn freely?	VDC is normal. Erase the memory. NOTE: This diagnostic trouble code may sometimes occur if the wheels turn freely for a long time, for example when the vehicle is towed or jacked-up, or when steering wheel is continuously turned all the way.	Go to step 2.
2	<p><b>CHECK TIRE SPECIFICATIONS.</b> Turn the ignition switch to OFF.</p>	Are the tire specifications correct?	Go to step 3.	Replace the tire.
3	<p><b>CHECK WEAR OF TIRE.</b></p>	Is the tire worn excessively?	Replace the tire.	Go to step 4.
4	<p><b>CHECK TIRE INFLATION PRESSURE.</b></p>	Is the tire pressure correct?	Go to step 5.	Adjust the tire pressure.
5	<p><b>CHECK INSTALLATION OF ABS WHEEL SPEED SENSOR.</b></p>	Are the ABS wheel speed sensor installation bolts tightened 7.5 N-m (0.76 kgf-m, 5.5 ft-lb)? (For four wheels)	Go to step 6.	Tighten the ABS wheel speed sensor installation bolts.
6	<p><b>CHECK ABS WHEEL SPEED SENSOR SIGNAL.</b> 1) Install the ABS wheel speed sensor. 2) Prepare an oscilloscope. 3) Check the ABS wheel speed sensor. &lt;Ref. to ABS-14, ABS WHEEL SPEED SENSOR, INSPECTION, Front ABS Wheel Speed Sensor.&gt;</p>	Does the oscilloscope indicate the waveform pattern like shown in the figure when the tire is slowly turned? Does the oscilloscope indication repeat the waveform pattern like shown in the figure when the tire is slowly turned in equal speed for one rotation or more?	Go to step 8.	Go to step 7.
7	<p><b>CHECK ABS WHEEL SPEED SENSOR OR MAGNETIC ENCODER.</b></p>	Are there foreign matter, breakage or damage at the tip of ABS wheel speed sensor or magnetic encoder?	Remove dirt thoroughly. Also replace the ABS wheel speed sensor or magnetic encoder as a unit with hub unit bearing if it is broken or damaged.	Go to step 8.
8	<p><b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. &lt;Ref. to VDC(diag)-22, PROCEDURE, Inspection Mode.&gt; 4) Read the DTC.</p>	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 9.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
9	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

### **J: DTC C0031 FR HOLD VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to DTC C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **K: DTC C0032 FR PRESSURE REDUCING VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to DTC C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **L: DTC C0033 FL HOLD VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **M: DTC C0034 FL PRESSURE REDUCING VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **N: DTC C0035 RR HOLD VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **O: DTC C0036 RR PRESSURE REDUCING VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 "VDC SWITCHING VALVE 2 (P)". <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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## **P: DTC C0037 RL HOLD VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **Q: DTC C0038 RL PRESSURE REDUCING VALVE MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **R: DTC C0039 ANY ONE OF FOUR SOLENOID VALVES**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **S: DTC C0061 NORMAL OPENING VALVE 1 MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **T: DTC C0062 NORMAL OPENING VALVE 2 MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **U: DTC C0063 NORMAL CLOSING VALVE 1 MALFUNCTION**

**NOTE:**

For the diagnostic procedure, refer to C0064 “VDC SWITCHING VALVE 2 (P)”. <Ref. to VDC(diag)-50, DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## V: DTC C0064 NORMAL CLOSING VALVE 2 MALFUNCTION

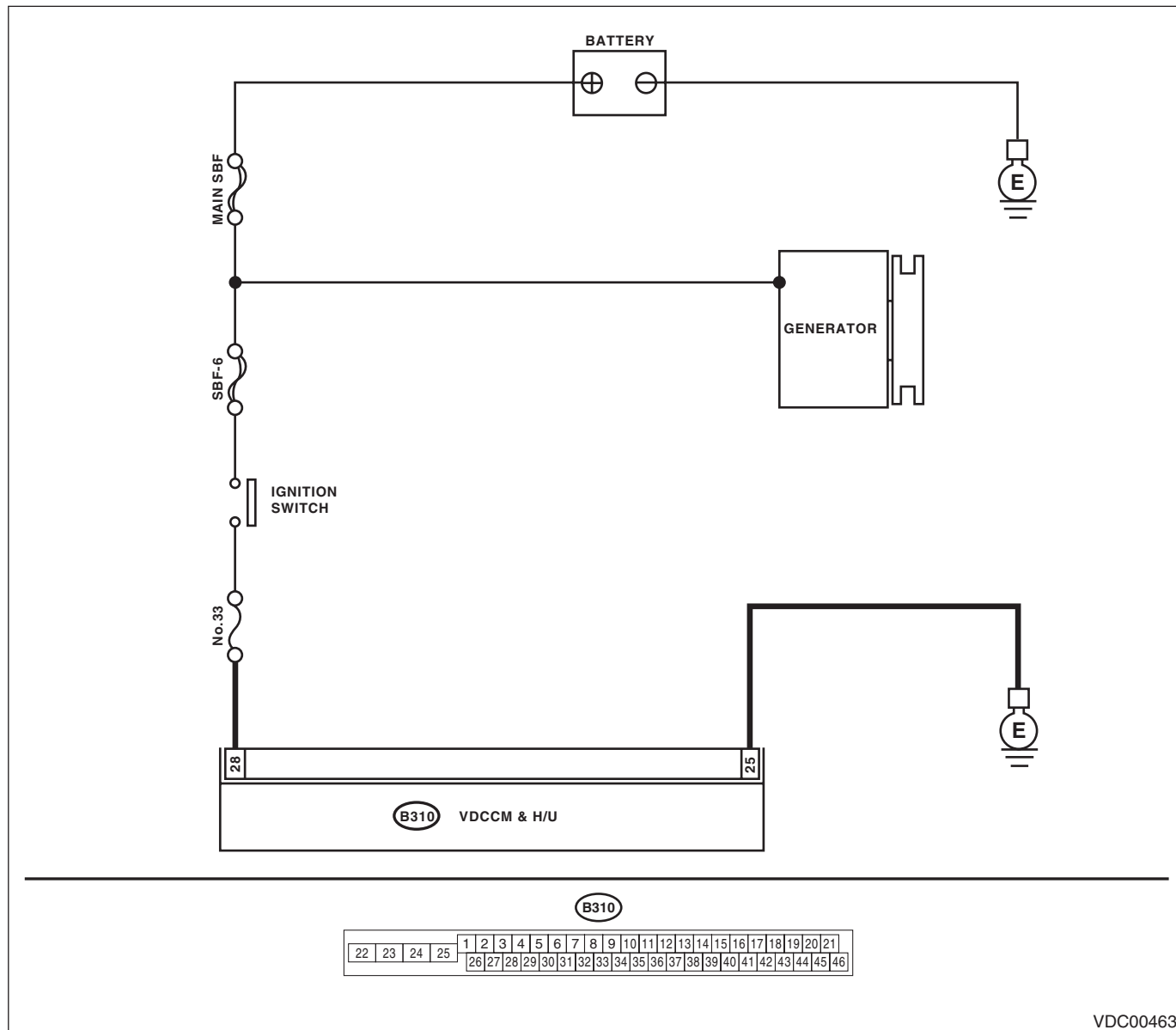
### DTC DETECTING CONDITION:

- Defective harness connector
- Defective VDCH/U solenoid valve

### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00463

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK THE VDCCM&amp;H/U INPUT VOLTAGE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Run the engine at idle. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 28 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
<b>2 CHECK THE VDCCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the VDCCM&H/U ground harness.
<b>3 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 4.
<b>4 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
<b>5 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## W: DTC C0041 ECM

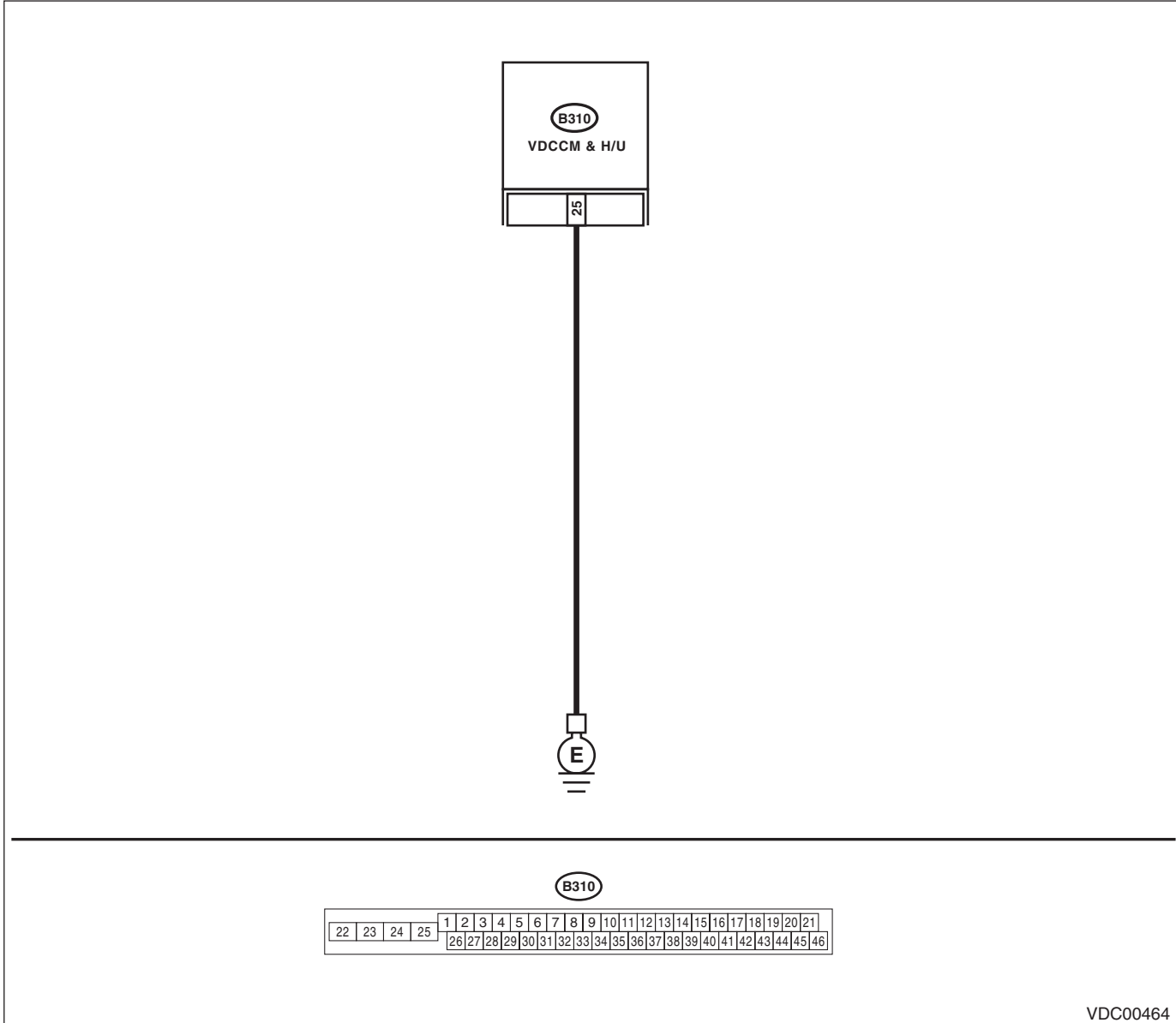
### DTC DETECTING CONDITION:

Defective VDCCM&H/U

### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00464

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK THE VDCCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Measure the resistance between VDCCM&H/U and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 2.	Repair the VDCCM&H/U ground harness.
<b>2 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact of the connector between the battery, ignition switch and VDCCM&H/U?	Repair the connector.	Go to step 3.
<b>3 CHECK CAUSE OF SIGNAL NOISE.</b>	Are the radio wave devices and electronic components installed correctly?	Go to step 4.	Install the radio wave devices and electronic components properly.
<b>4 CHECK CAUSE OF SIGNAL NOISE.</b>	Is there a noise source (such as an antenna) installed near the sensor harness?	Install the noise sources apart from the sensor harness.	Go to step 5.
<b>5 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
<b>6 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## X: DTC C0041 PARAMETER SELECTION ERROR

### DTC DETECTING CONDITION:

VDCCM parameter selection failure

### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

### NOTE:

When the VDCCM or VDCCM&H/U is replaced, this DTC may be memorized.

	Step	Check	Yes	No
1	<b>CHECK VDCCM&amp;H/U REPLACEMENT HISTORY.</b>	Is there replacement history of VDCCM alone?	Go to step 2.	Go to step 3.
2	<b>CHECK VDCCM IDENTIFICATION NUMBER.</b> Check the identification number on the sticker attached on the VDCCM side.	Is the identification number correct? AT: T3 MT: T4	Go to step 4.	Replace the VDCCM only.
3	<b>CHECK VDCCM&amp;H/U IDENTIFICATION NUMBER.</b> Check the identification number stamped on the upper side of the H/U.	Is the identification number correct? AT: T3 MT: T4	Go to step 4.	Replace the VDCCM&H/U.
4	<b>CHECK PARAMETER SELECTED FOR VDCCM.</b> <Ref. to VDC(diag)-17, PARAMETER CHECK, OPERATION, Subaru Select Monitor.>	Does the parameter registered to the VDCCM match with the target vehicle?	Replace the VDCCM only.	Select and register the correct parameter. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## Y: DTC C0042 POWER SUPPLY VOLTAGE FAILURE

### DTC DETECTING CONDITION:

CHECK THE VDCCM&H/U power supply voltage.

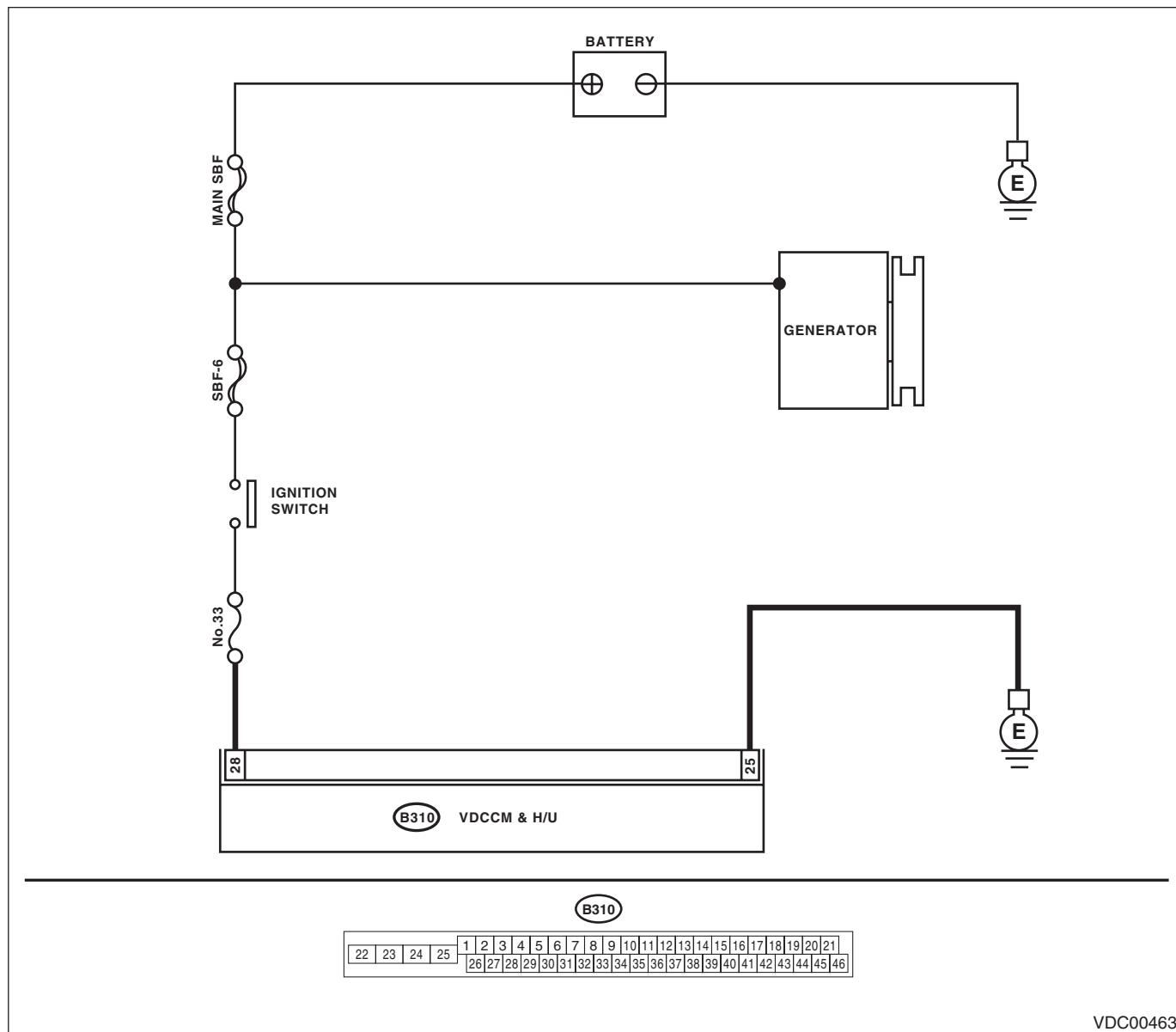
### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD may not operate.
- VDC does not operate.

### NOTE:

Warning lights go off if voltage returns.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK GENERATOR.</b> 1) Start the engine. 2) Run the engine at idle after warming up. 3) Measure the voltage between generator terminal B and chassis ground. <b>Terminals</b> <b>Generator B terminal (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the generator.
<b>2 CHECK BATTERY TERMINAL.</b> Turn the ignition switch to OFF.	Are the positive and negative battery terminals clamped tightly?	Go to step 3.	Tighten the terminal.
<b>3 CHECK THE VDCCM&amp;H/U INPUT VOLTAGE.</b> 1) Disconnect the connector from the VDCCM&H/U. 2) Run the engine at idle. 3) Operate devices such as headlights, air conditioner, defogger, etc. which produce an electrical load. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 28 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 4.	Repair the power supply circuit.
<b>4 CHECK THE VDCCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b>	Is the resistance less than 0.5 $\Omega$ ?	Go to step 5.	Repair the VDCCM&H/U ground harness.
<b>5 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 6.
<b>6 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
<b>7 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## Z: DTC C0044 TCM COMMUNICATION CIRCUIT

### DTC DETECTING CONDITION:

No CAN signal from TCM.

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

	Step	Check	Yes	No
1	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in TCM connector?	Repair the connector.	Go to step 3.
3	<b>CHECK TCM.</b>	Is the TCM normal?	Go to step 4.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).> <Ref. to 5AT-59, Transmission Control Module (TCM).>
4	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only.	Go to step 5.
5	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AA:DTC C0045 INCORRECT VDC CONTROL MODULE SPECIFICATIONS

### DTC DETECTING CONDITION:

Different control module specification

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### NOTE:

When parameter selection for VDCCM is improper, this DTC may be memorized.

Step	Check	Yes	No
<b>1</b>	<b>CHECK VDCCM REPLACEMENT HISTORY.</b> Is there replacement history of VDCCM alone?	Go to step 2.	Go to step 3.
<b>2</b>	<b>CHECK VDCCM IDENTIFICATION NUMBER.</b> Check the identification number on the sticker attached on the VDCCM side. AT: T3 MT: T4	Go to step 4.	Replace the VDCCM only.
<b>3</b>	<b>CHECK VDCCM&amp;H/U IDENTIFICATION NUMBER.</b> Check the identification number stamped on the upper side of the H/U. AT: T3 MT: T4	Go to step 4.	Replace the VDCCM&H/U.
<b>4</b>	<b>CHECK PARAMETER SELECTED FOR VDCCM.</b> <Ref. to VDC(diag)-17, PARAMETER CHECK, OPERATION, Subaru Select Monitor.> Does the parameter registered to the VDCCM match with the target vehicle?	Go to step 5.	Select and register the correct parameter. <Ref. to VDC(diag)-17, PARAMETER SELECTION, OPERATION, Subaru Select Monitor.>
<b>5</b>	<b>CHECK TCM SPECIFICATION.</b> Check the TCM specification. Is the specification of TCM same as vehicle specification?	Go to step 6.	Replace the TCM. <Ref. to 4AT-64, Transmission Control Module (TCM).> <Ref. to 5AT-59, Transmission Control Module (TCM).>
<b>6</b>	<b>CHECK AT SYSTEM.</b> 1) Start the engine. 2) Check the DTC in AT system. Is DTC of AT system displayed?	Repair the AT system.	Go to step 7.
<b>7</b>	<b>CHECK ECM SPECIFICATION.</b> Check the ECM specification. Is the specification of ECM same as vehicle specification?	Go to step 8.	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>8</b>	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC. Is the same DTC displayed?	Replace the VDCCM only.	Go to step 9.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
9	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

## AB:DTC C0045 TCM MALFUNCTION

### DTC DETECTING CONDITION:

Defective TCM

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

	Step	Check	Yes	No
1	<b>CHECK AT SYSTEM.</b> 1) Start the engine. 2) Check the DTC in AT system.	Is DTC of AT system displayed?	Repair the AT system.	Go to step 2.
2	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only.	Go to step 3.
3	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AC:DTC C0047 CAN COMMUNICATION

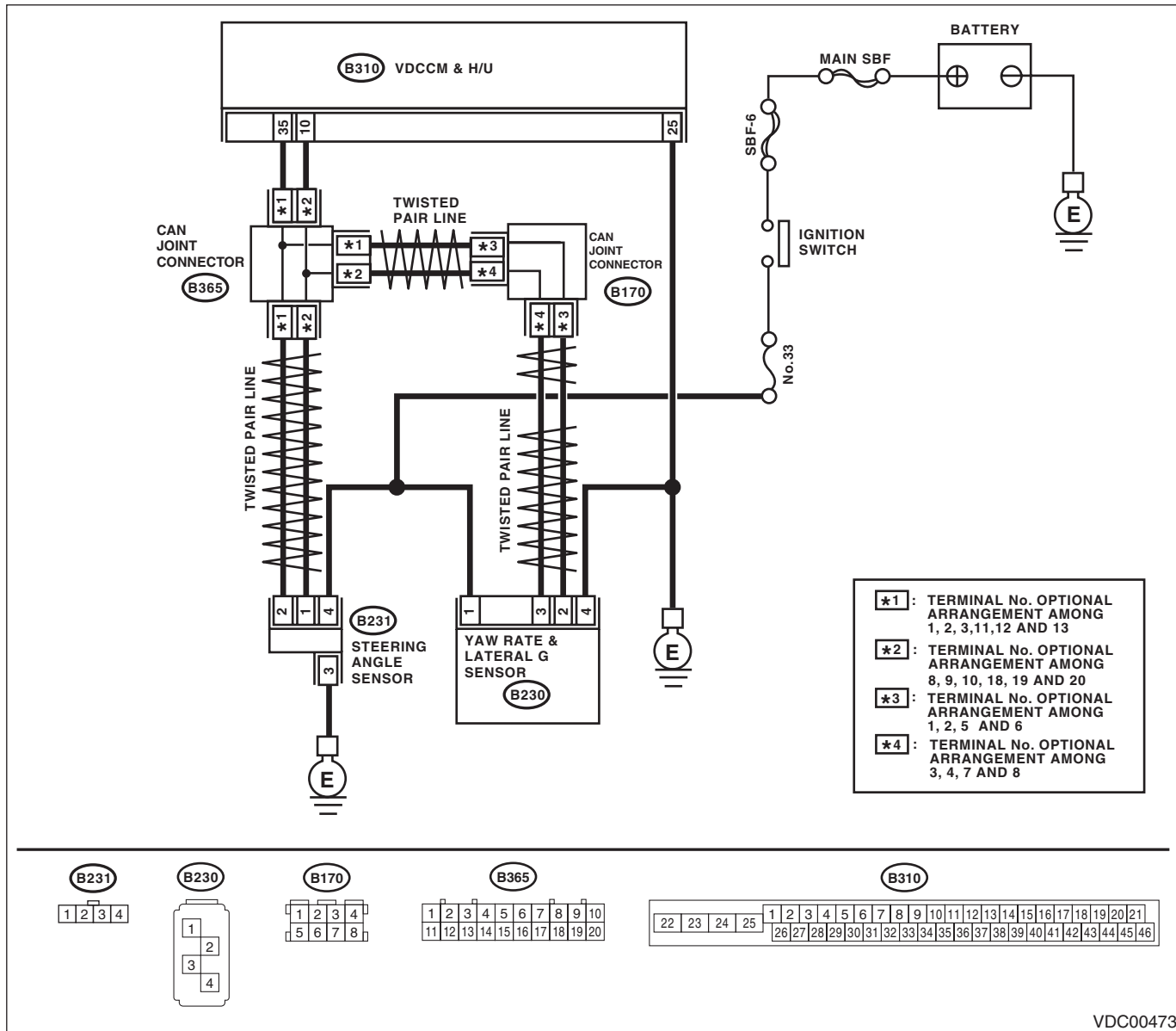
### DTC DETECTING CONDITION:

CAN communication line circuit is open or shorted.

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
1	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system. Go to step 2.
2	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in VDCCM&H/U connector?	Repair the connector. Go to step 3.
3	<b>CHECK OUTPUT OF STEERING ANGLE SENSOR.</b> Connect the Subaru Select Monitor and check output of the steering angle sensor.	Does the output signal change?	Go to step 4. Check output of the steering angle sensor. <Ref. to VDC(diag)-80, DTC C0071 STEERING ANGLE SENSOR MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
4	<b>CHECK OUTPUT OF YAW RATE &amp; LATERAL G SENSOR.</b> Connect the Subaru Select Monitor and check output of the yaw rate & lateral G sensor.	Does the output signal change?	Go to step 5. Check output of the yaw rate & lateral G sensor. <Ref. to VDC(diag)-93, DTC C0072 YAW RATE SENSOR COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
5	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).> Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AD:DTC C0051 VALVE RELAY

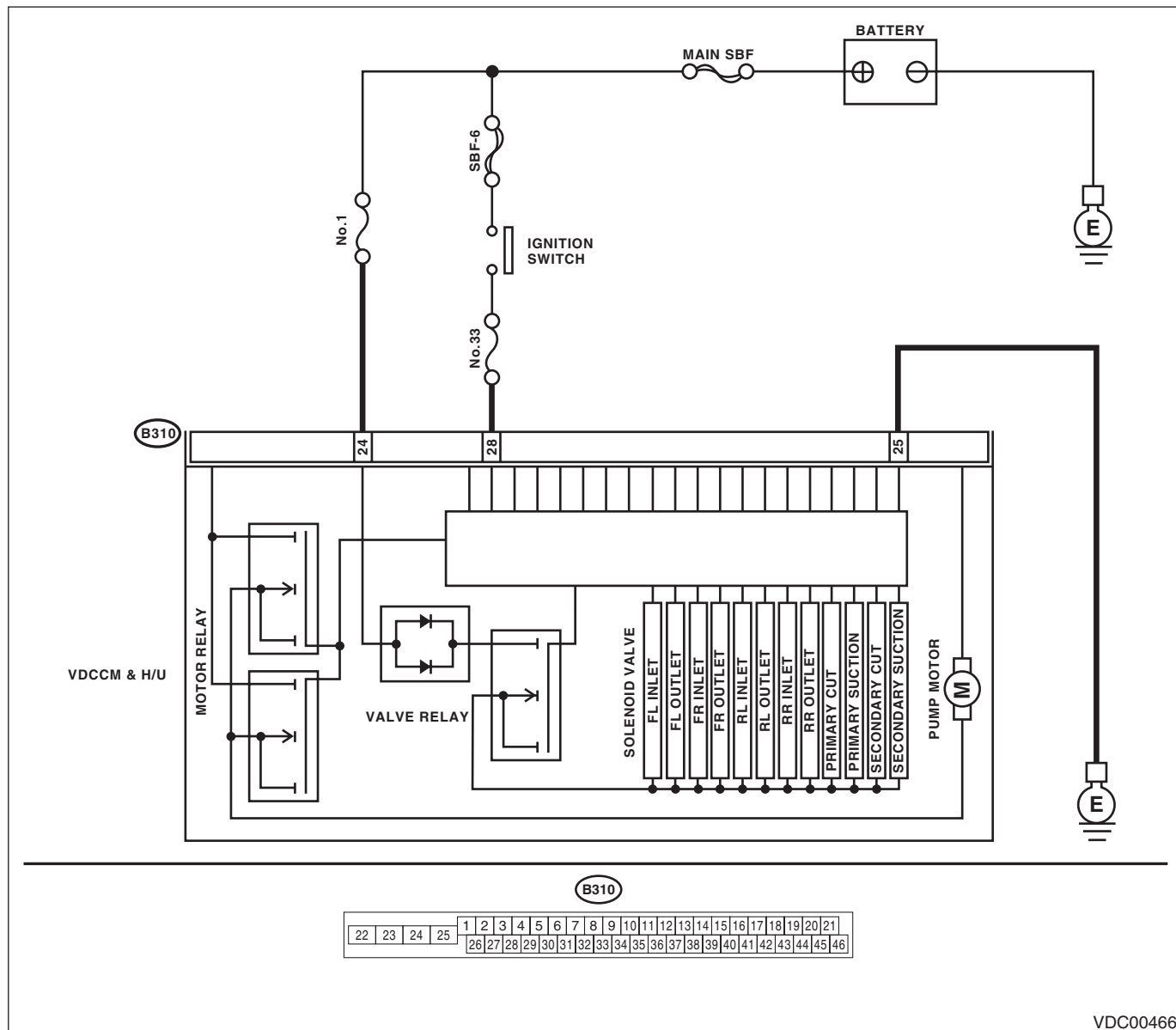
### DTC DETECTING CONDITION:

Defective valve relay

### TROUBLE SYMPTOM:

- ABS does not operate.
- EBD does not operate.
- VDC does not operate.

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK THE VDCCM&amp;H/U INPUT VOLTAGE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Run the engine at idle. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 28 (+) — Chassis ground (-):</b> <b>(B310) No. 24 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit.
<b>2 CHECK THE VDCCM&amp;H/U INPUT VOLTAGE.</b> Calculate the voltage difference measured in step 1. A: (B310) No. 28 (+) — Chassis ground (-): B: (B310) No. 24 (+) — Chassis ground (-):	Is the voltage difference between A and B 2 V or more?	Repair the power supply circuit.	Go to step 3.
<b>3 CHECK THE VDCCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the VDCCM&H/U ground harness.
<b>4 CHECK THE VDCCM&amp;H/U VALVE RELAY.</b> Measure the resistance between VDCCM&H/U connector terminals. <b>Connector &amp; terminal</b> <b>(B310) No. 24 — (B310) No. 25:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the VDCCM&H/U.
<b>5 CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 6.
<b>6 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
<b>7 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AE:DTC C0052 MOTOR AND MOTOR RELAY OFF FAILURE

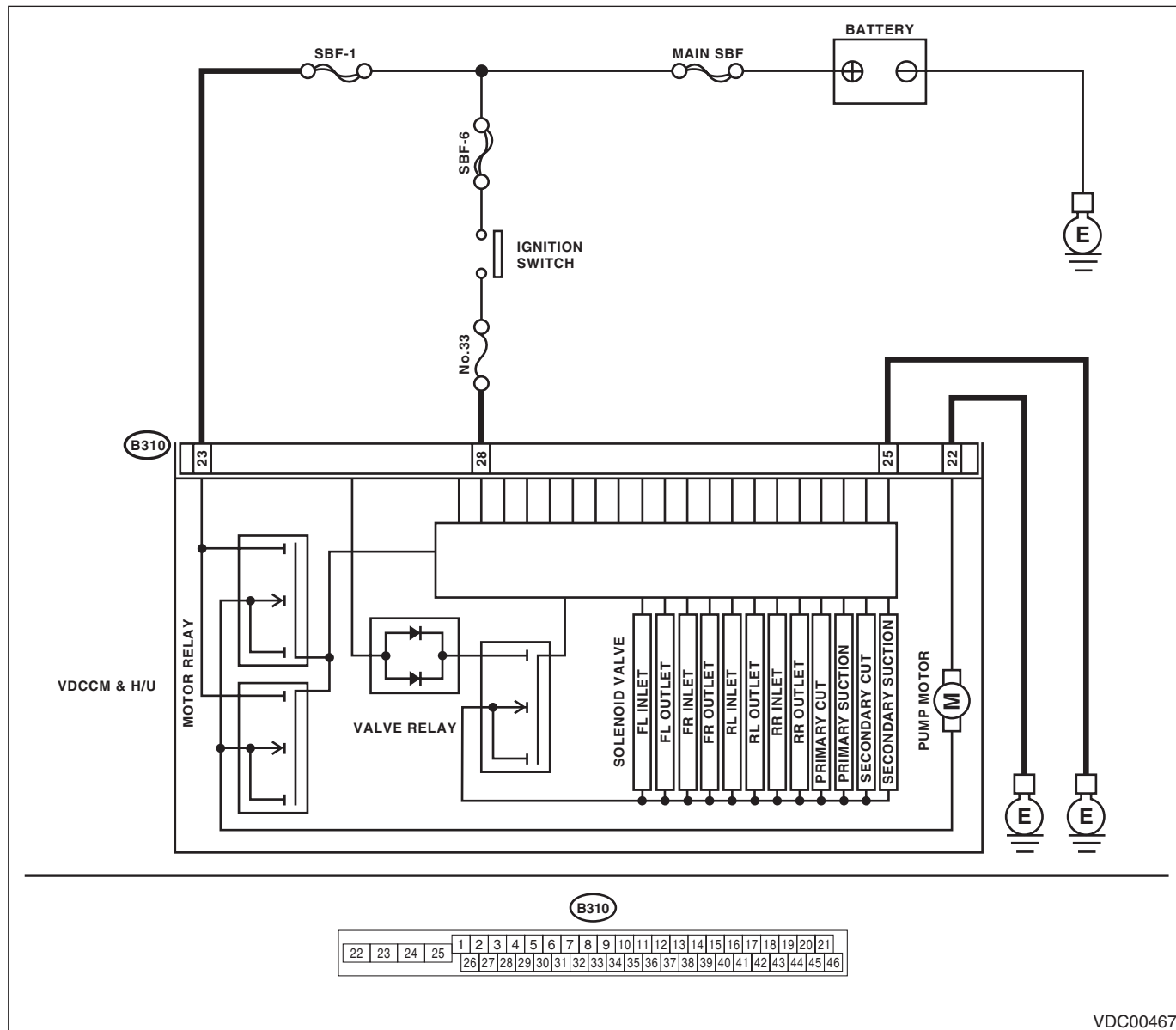
### DTC DETECTING CONDITION:

- Defective motor and motor relay
- Defective harness connector

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD may not operate.

### WIRING DIAGRAM:



VDC00467

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK THE VDCCM&amp;H/U INPUT VOLTAGE.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Turn the ignition switch to ON. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 23 (+) — Chassis ground (-):</b> <b>(B310) No. 28 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the VDCCM&H/U power supply circuit.
<b>2 CHECK INSTALLATION OF MOTOR GROUND.</b>	Is the motor ground terminal installation bolt tightened 33 N·m (3.4 kgf·m, 24.3 ft·lb)?	Go to step 3.	Tighten the motor ground terminal installation bolt.
<b>3 CHECK THE VDCCM&amp;H/U GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 25 — Chassis ground:</b> <b>(B310) No. 22 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the VDCCM&H/U ground harness.
<b>4 CHECK VDCCM&amp;H/U MOTOR RELAY.</b> Measure the resistance between VDCCM&H/U connector terminals. <b>Terminals</b> <b>No. 23 — No. 22:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the VDCCM&H/U.
<b>5 CHECK POOR CONTACT IN CONNECTORS.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between generator, battery and VDCCM&H/U?	Repair the connector.	Go to step 6.
<b>6 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
<b>7 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AF:DTC C0052 MOTOR AND MOTOR RELAY ON FAILURE

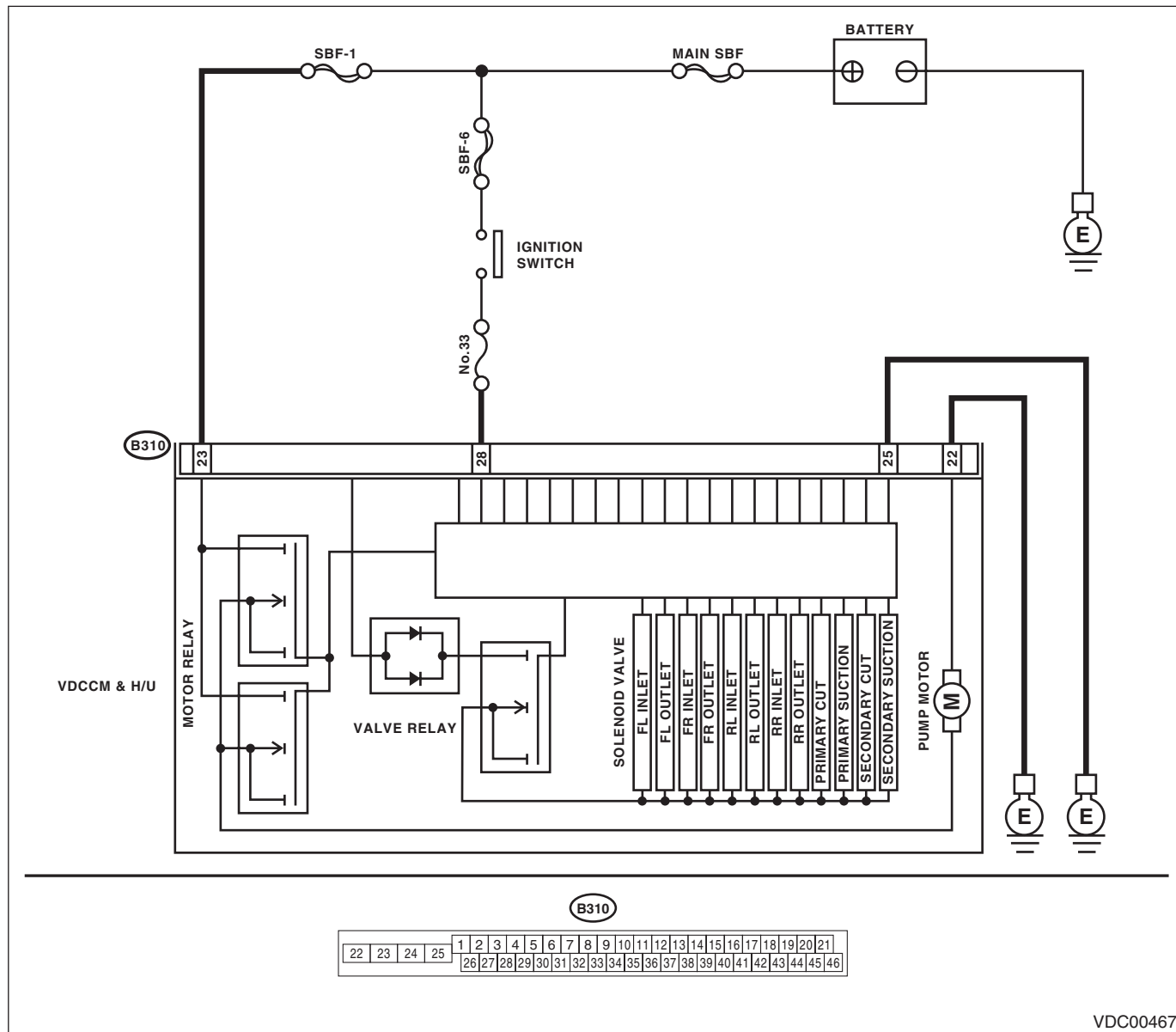
### DTC DETECTING CONDITION:

- Defective motor relay
- Defective harness connector

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD may not operate.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK VDCCM&amp;H/U MOTOR RELAY.</b> 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U connector terminals. <b>Terminals</b> <b>No. 23 — No. 22:</b>	Is the resistance 1 MΩ or more?	Go to step 2.	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
2	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 3.
3	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs. NOTE: Though the ABS warning light remains on at this time, it is normal. Drive the vehicle at 12 km/h (7 MPH) or more in order to turn ABS warning light off. Be sure to drive the vehicle and check that the warning light goes off.

## AG:DTC C0052 MOTOR MALFUNCTION

### DTC DETECTING CONDITION:

- Defective motor
- Defective motor relay
- Defective harness connector

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.
- EBD may not operate.

### NOTE:

For the diagnostic procedure, refer to DTC C0052 "MOTOR/MOTOR RELAY OFF FAILURE". <Ref. to VDC(diag)-64, DTC C0052 MOTOR AND MOTOR RELAY OFF FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AH:DTC C0054 BLS CIRCUIT OPEN

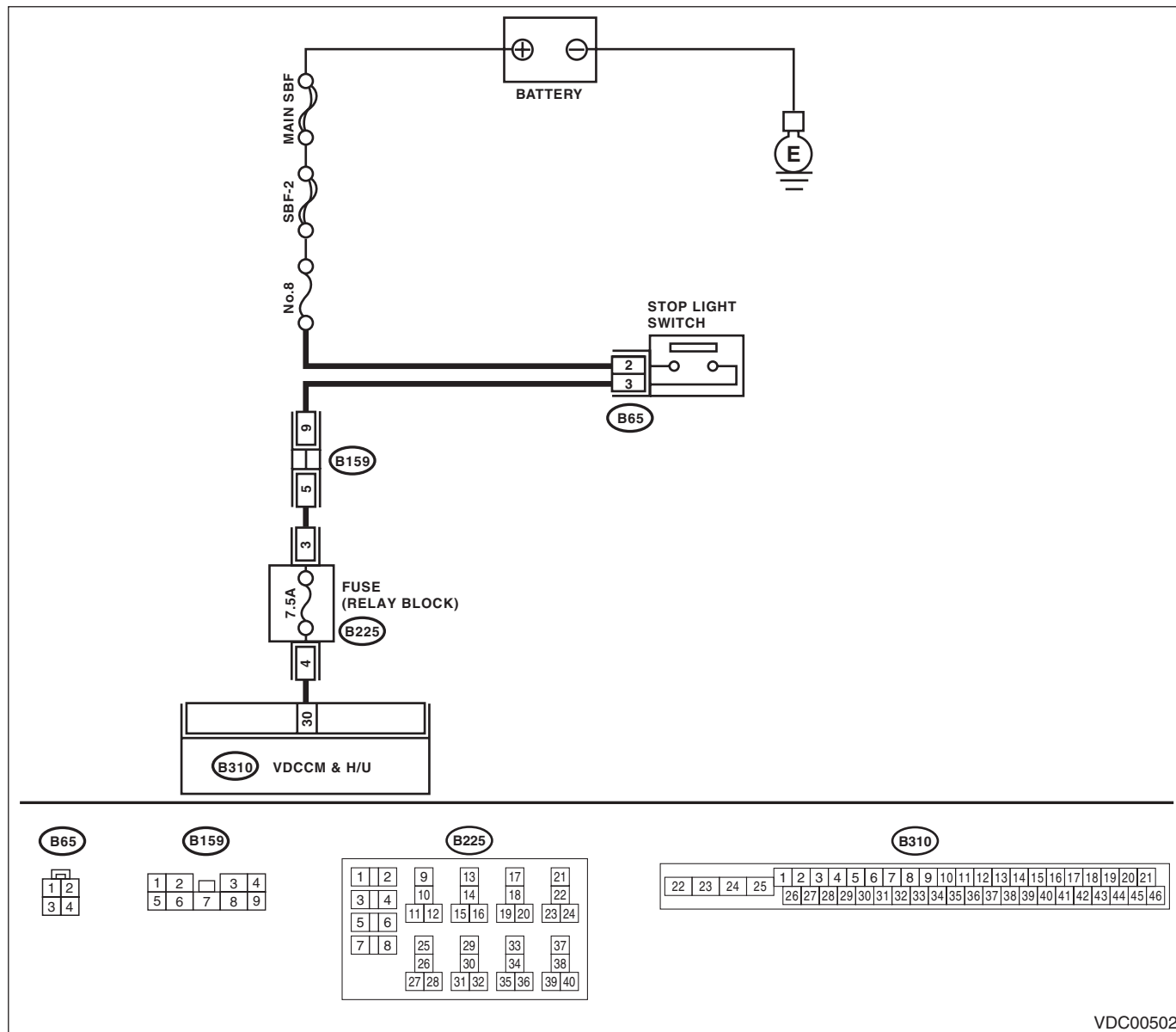
### DTC DETECTING CONDITION:

Defective stop light switch

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00502

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Release the brake pedal. 3) Read the stop light switch output in Subaru Select Monitor.	Is OFF displayed on the display screen?	Go to step 2.	Go to step 3.
2	<b>CHECK OUTPUT OF STOP LIGHT SWITCH WITH SUBARU SELECT MONITOR.</b> 1) Depress the brake pedal. 2) Read the stop light switch output in Subaru Select Monitor.	Is ON displayed on the display screen?	Go to step 6.	Go to step 3.
3	<b>CHECK IF STOP LIGHTS COME ON.</b> Depress the brake pedal.	Does the stop light illuminate?	Go to step 4.	Repair the stop light circuit.
4	<b>CHECK FUSE.</b> Check the fuse (B225).	Is the fuse OK?	Go to step 5.	Replace the fuse.
5	<b>CHECK OPEN CIRCUIT OF HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the VDCCM&H/U. 3) Depress the brake pedal. 4) Measure the voltage between VDCCM&H/U connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B310) No. 30 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 6.	Repair the harness between stop light switch and VDCCM&H/U connector.
6	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in connector between stop light switch and VDCCM&H/U?	Repair the connector.	Go to step 7.
7	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
8	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AI: DTC C0054 BLS ON MALFUNCTION

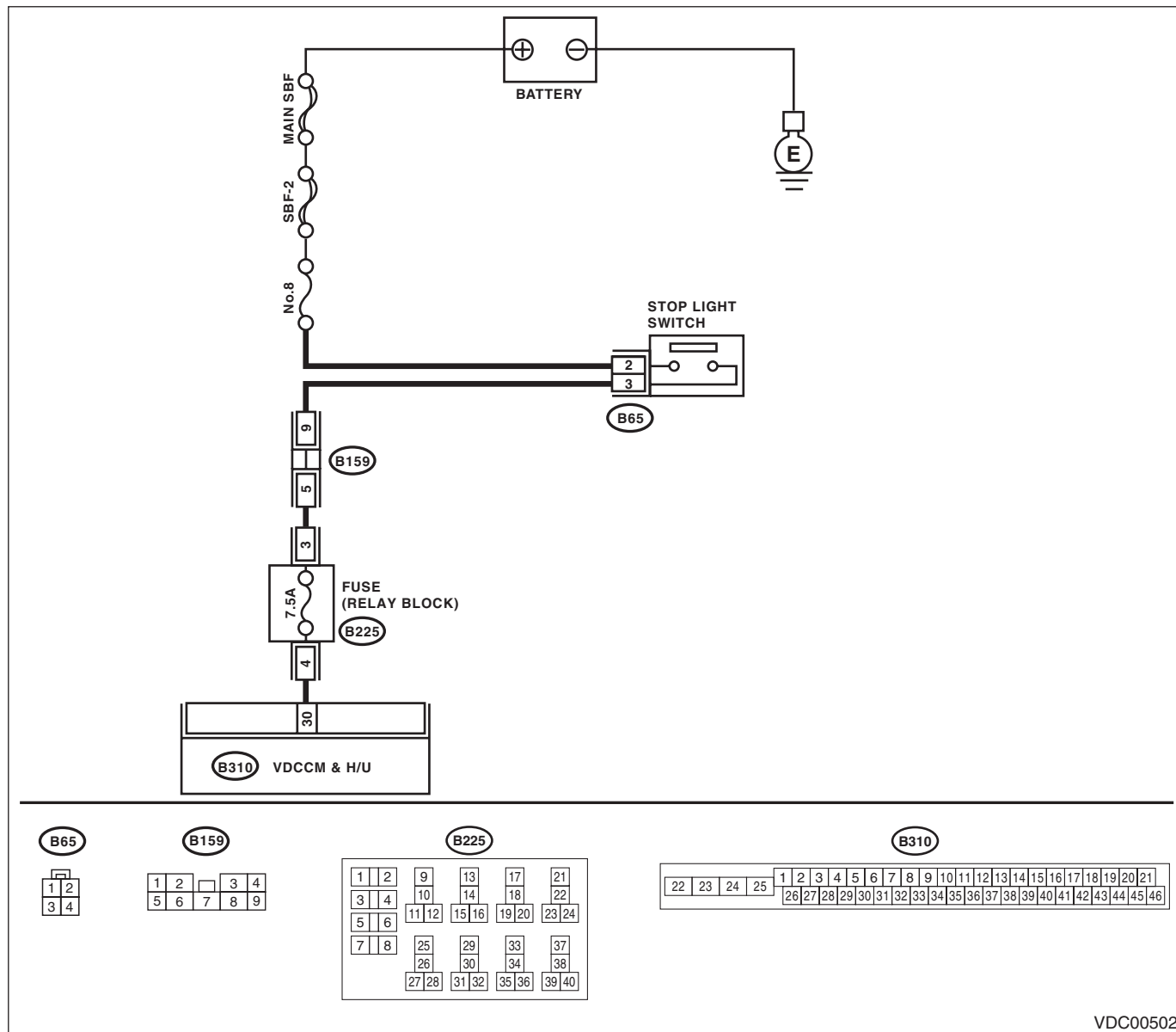
### DTC DETECTING CONDITION:

Defective stop light switch

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00502



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the stop light switch connector. 3) Measure the resistance of stop light switch terminals.	Is the resistance 1 MΩ or more when switch is OFF (when pedal is not depressed)?	Go to step 2.	Replace the stop light switch.
2	<b>INTERVIEWING CUSTOMERS.</b> Make sure that the operation was performed in which accelerator pedal and brake pedal were depressed simultaneously (with depressing brake pedal with left foot).	Were the acceleration pedal and brake pedal depressed simultaneously?	System is normal. (DTC may be recorded while brake is applied during driving.)	Go to step 3.
3	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
4	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AJ:DTC C0054 BLS OFF MALFUNCTION

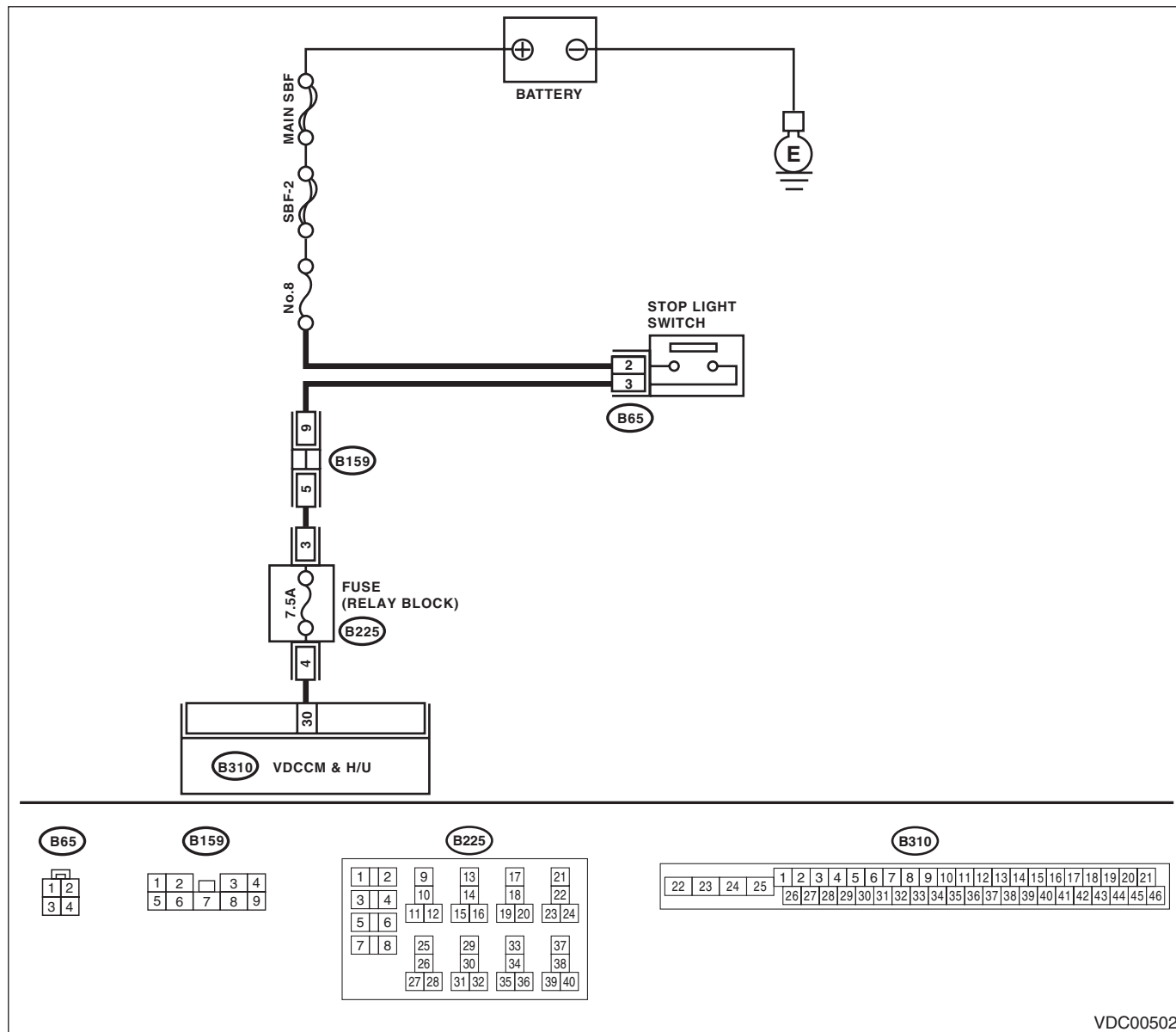
### DTC DETECTING CONDITION:

Defective stop light switch

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00502

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK STOP LIGHT SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the stop light switch connector. 3) Measure the resistance of stop light switch terminals.	Is the resistance 0.5 Ω or less when the switch is ON (when pedal is depressed)?	Go to step 2.	Replace the stop light switch.
2	<b>CHECK POWER SUPPLY OF STOP LIGHT SWITCH.</b> Measure the voltage between the stop light switch terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B65) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 3.	Repair the power supply circuit of stop light.
3	<b>CHECK STOP LIGHT SWITCH HARNESS.</b> 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U and stop light switch. <b>Connector &amp; terminal</b> <b>(B65) No. 3 — (B310) No. 30:</b>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the stop light switch circuit.
4	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in connector between stop light switch and VDCCM&H/U?	Repair the connector.	Go to step 5.
5	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
6	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AK:DTC C0057 ECM COMMUNICATION CIRCUIT

### DTC DETECTING CONDITION:

No CAN signal from ECM.

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

	Step	Check	Yes	No
1	<b>CHECK LAN SYSTEM.</b> Perform the diagnosis for LAN system. <Ref. to LAN(diag)-24, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is there any fault in LAN system?	Perform the diagnosis according to DTC for LAN system.	Go to step 2.
2	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in ECM connector?	Repair the connector.	Go to step 3.
3	<b>CHECK ECM.</b>	Is ECM normal?	Go to step 4.	Replace the ECM.
4	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AL:DTC C0057 ECM CONTROL SYSTEM

### DTC DETECTING CONDITION:

ECM coordinate control prohibition

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### NOTE:

Warning lights go off if ECM coordinate control is recovered.

	Step	Check	Yes	No
1	<b>CHECK WARNING LIGHT.</b> Check whether the VDC warning light illuminates after driving for more than 1 minute at a speed of 10 km/h or more.	Does the VDC warning light illuminate?	Go to step 2.	VDC is normal. Perform the Clear Memory Mode. NOTE: If cranking operation is performed while driving, DTC may be memorized.
2	<b>CHECK POOR CONTACT IN CONNECTORS.</b>	Is there poor contact in ECM connector?	Repair the connector.	Go to step 3.
3	<b>CHECK ECM.</b>	Is ECM normal?	Go to step 4.	Replace the ECM.
4	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	It results from a temporary noise interference.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AM:DTC C0071 STEERING ANGLE SENSOR OFFSET IS TOO BIG

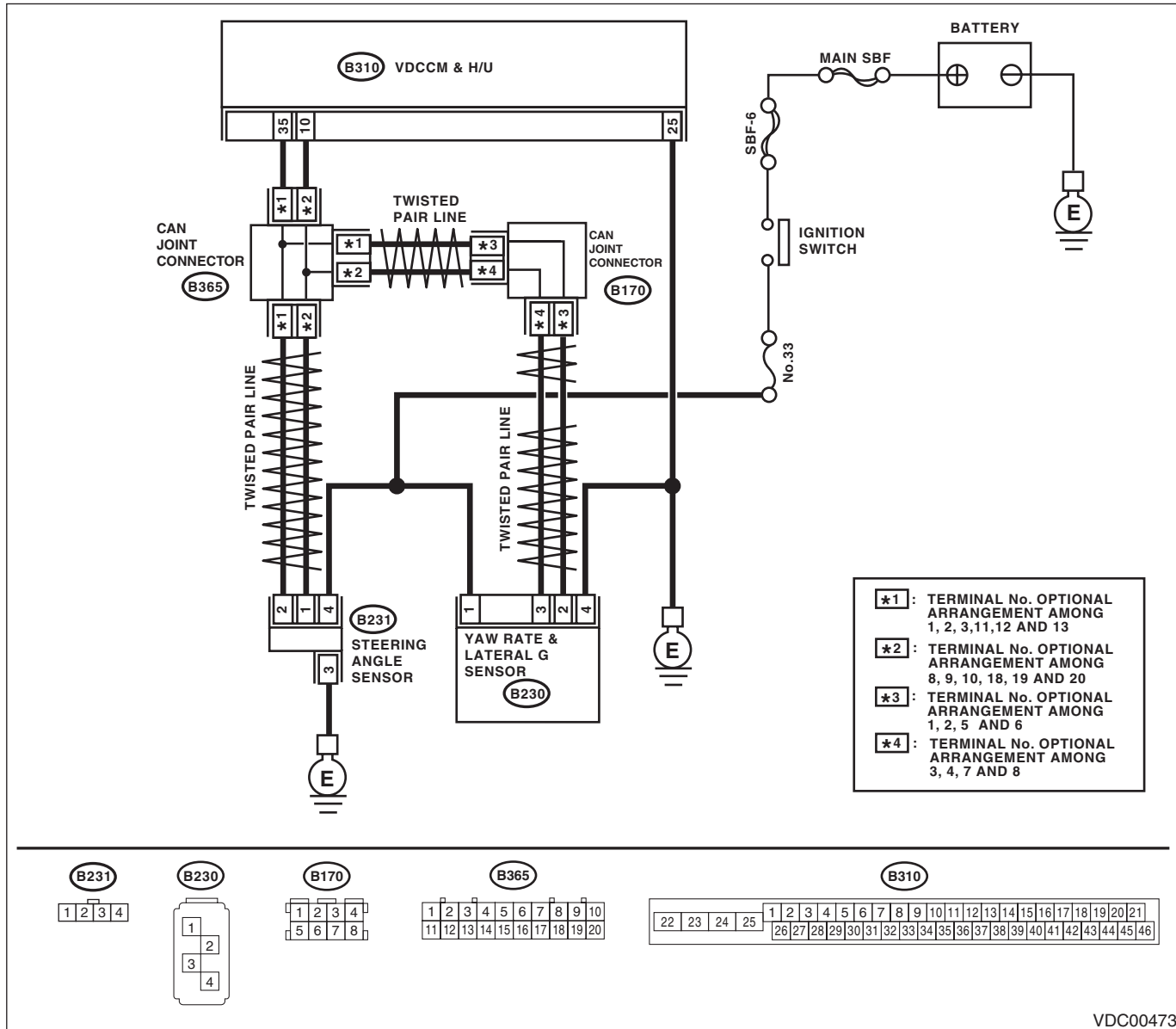
### DTC DETECTING CONDITION:

Defective steering angle sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK STEERING WHEEL.</b> 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Check the steering wheel for deviation from center.	Is the deviation from the center of steering wheel less than 5°?	Go to step 2.	Perform the centering adjustment of steering wheel.
<b>2</b> <b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 3.
<b>3</b> <b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AN:DTC C0071 CHANGE RANGE OF STEERING ANGLE SENSOR IS TOO BIG

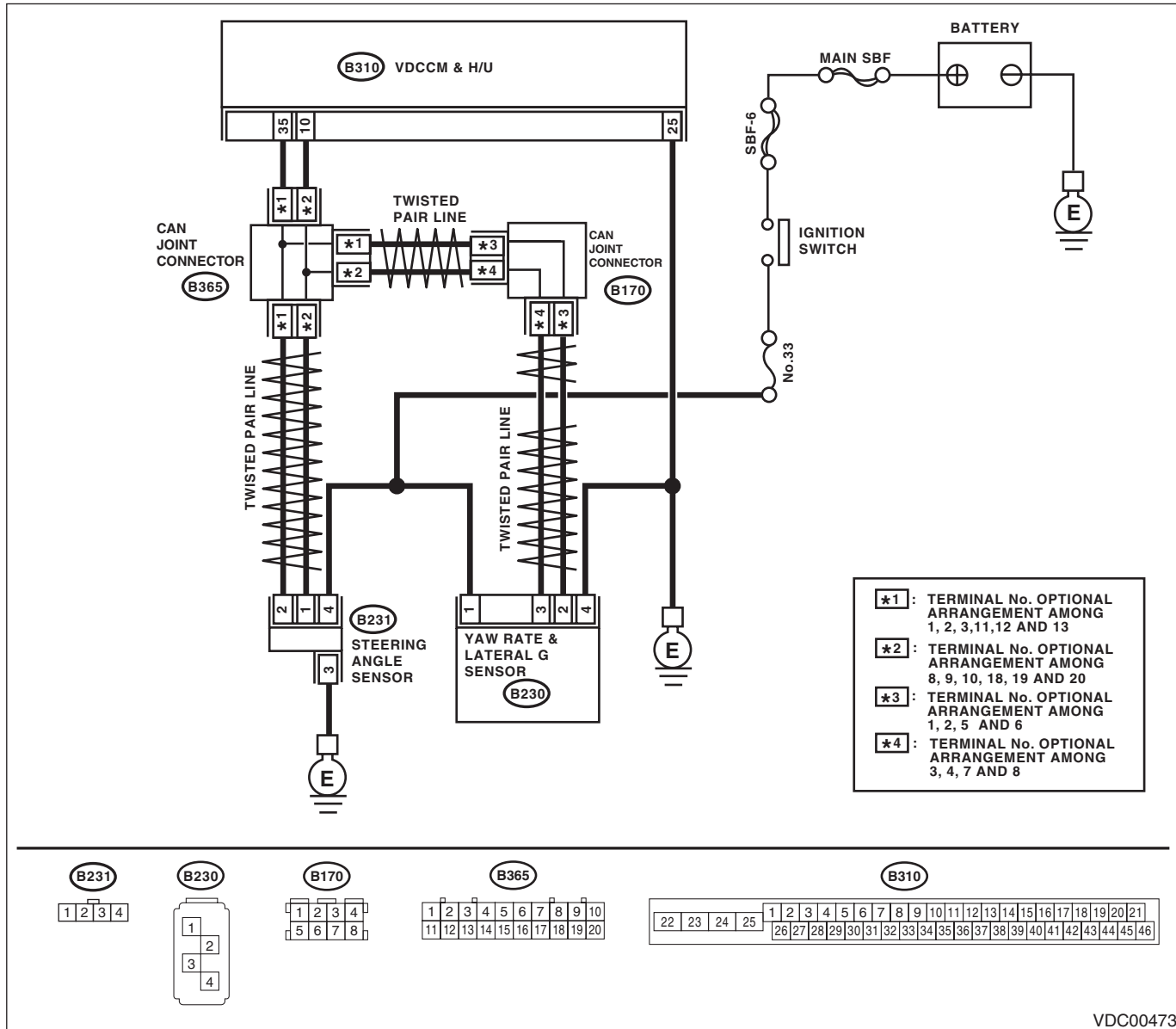
### DTC DETECTING CONDITION:

Defective steering angle sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 2.
<b>2</b> <b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AO:DTC C0071 STEERING ANGLE SENSOR MALFUNCTION

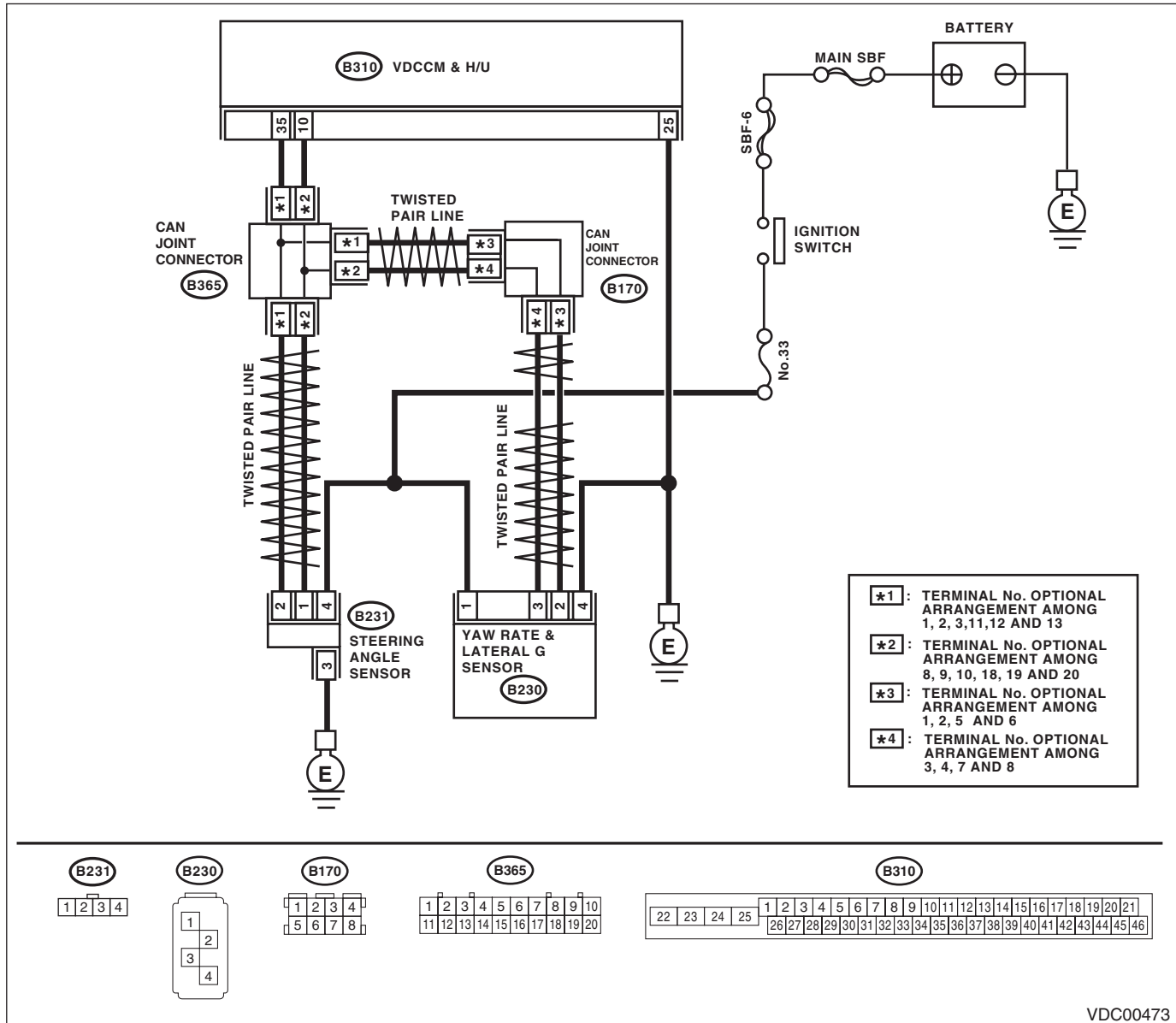
### DTC DETECTING CONDITION:

Signal does not come from steering angle sensor.

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY FOR STEERING ANGLE SENSOR.</b></p> <ol style="list-style-type: none"> <li>1) Turn the ignition switch to OFF.</li> <li>2) Disconnect the connector from steering angle sensor.</li> <li>3) Turn the ignition switch to ON.</li> <li>4) Measure the voltage between the steering angle sensor and chassis ground.</li> </ol> <p><b>Connector &amp; terminal</b> <b>(B231) No. 4 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 10 — 15 V?</p>	<p>Go to step 2.</p>	<p>Repair the power supply circuit of steering angle sensor.</p>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>2 CHECK GROUND CIRCUIT OF STEERING ANGLE SENSOR.</b> Measure the resistance between steering angle sensor and chassis ground. <i>Connector &amp; terminal</i> <i>(B231) No. 3 — Chassis ground:</i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair ground circuit in the steering angle sensor.
<b>3 CHECK STEERING ANGLE SENSOR HARNESS.</b> 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U and steering angle sensor. <i>Connector &amp; terminal</i> <i>(B231) No. 1 — (B310) No. 10:</i> <i>(B231) No. 2 — (B310) No. 35:</i>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the harness between the steering angle sensor and VDCCM&H/U.
<b>4 CHECK GROUND SHORT CIRCUIT OF STEERING ANGLE SENSOR HARNESS.</b> Measure the resistance between steering angle sensor and chassis ground. <i>Connector &amp; terminal</i> <i>(B231) No. 1 — Chassis ground:</i> <i>(B231) No. 2 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the harness between the steering angle sensor and VDCCM&H/U.
<b>5 CHECK STEERING ANGLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 6.	Go to step 8.
<b>6 CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Replace the steering angle sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 9.
<b>7 CHECK STEERING ANGLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
<b>8 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
<b>9 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Original steering angle sensor malfunction

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AP:DTC C0071 STEERING ANGLE SENSOR MALFUNCTION

### DTC DETECTING CONDITION:

Defective steering angle sensor

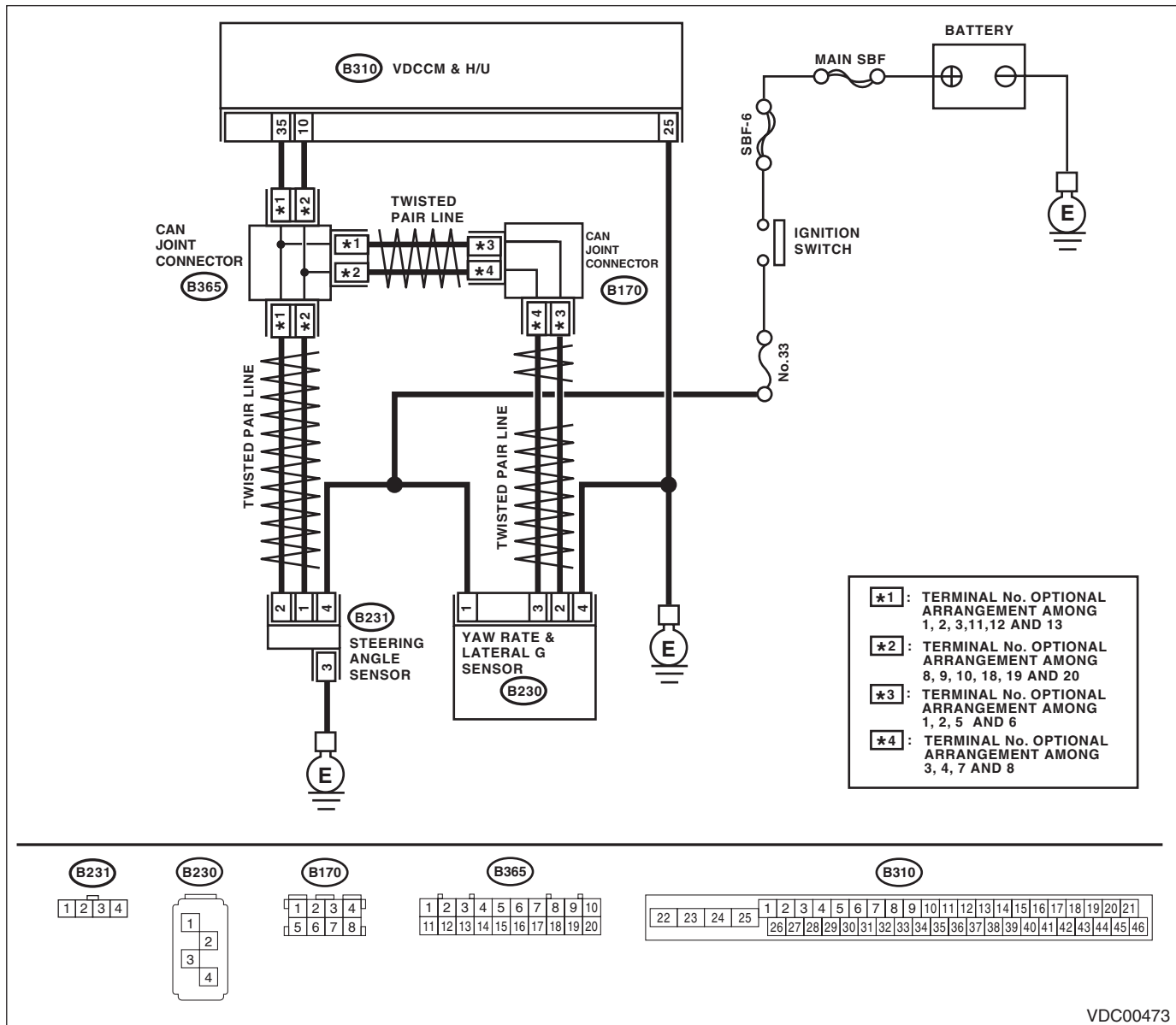
### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### NOTE:

- Warning light does not illuminate though problem is detected.
- The ABS and VDC operate normally if voltage returns.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK POWER SUPPLY FOR STEERING ANGLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from steering angle sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between the steering angle sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B231) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit of steering angle sensor.
2	<b>CHECK GROUND CIRCUIT OF STEERING ANGLE SENSOR.</b> Measure the resistance between steering angle sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B231) No. 3 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair ground circuit in the steering angle sensor.
3	<b>CHECK STEERING ANGLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 4.	Go to step 5.
4	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Replace the steering angle sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 6.
5	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
6	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Original steering angle sensor malfunction

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AQ:DTC C0072 ABNORMAL YAW RATE SENSOR OUTPUT

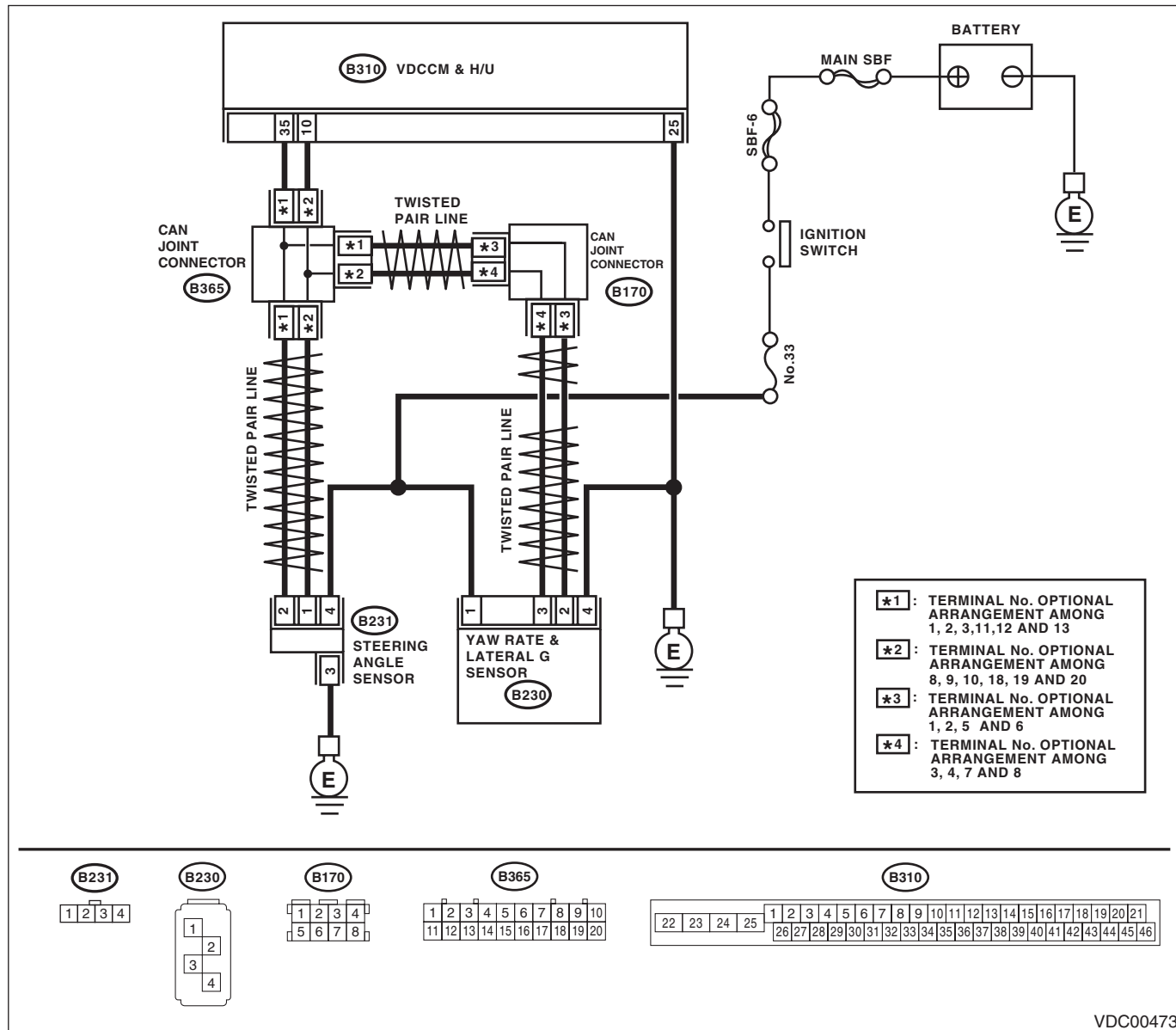
### DTC DETECTING CONDITION:

Defective yaw rate sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DRIVING PLACE.</b> Check if the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Did the vehicle run the road with banks or sandy surface (which does not mean a dirt road)?	VDCCM&H/U may record DTC when the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Go to step 2.
2	<b>CHECK YAW RATE &amp; LATERAL G SENSOR INSTALLATION.</b>	Is the yaw rate & lateral G sensor installation bolt tightened to 7.5 N·m (0.76 kgf·m, 5.5 ft·lb)?	Go to step 3.	Tighten the yaw rate & lateral G sensor installation bolt.
3	<b>CHECK OUTPUT OF YAW RATE &amp; LATERAL G SENSOR WITH SUBARU SELECT MONITOR.</b> 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Select {Current Data Display & Save} in Subaru Select Monitor. 4) Read the yaw rate output displayed on display.	Is the reading indicated on monitor display -4 — 4 deg/s?	Go to step 4.	Replace the yaw rate & lateral G sensor.
4	<b>CHECK OUTPUT OF STEERING ANGLE SENSOR WITH SUBARU SELECT MONITOR.</b> 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Select {Current Data Display & Save} in Subaru Select Monitor. 4) Read the steering angle sensor output displayed on display.	Is the reading indicated on monitor display -5 — 5°?	Go to step 5.	Perform the centering adjustment of steering wheel.
5	<b>CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 6.	Go to step 7.
6	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Replace the yaw rate & lateral G sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
7	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
8	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Malfunction is found in original yaw rate & lateral G sensor.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AR:DTC C0072 VOLTAGE INPUTTED TO YAW RATE SENSOR EXCEEDS SPECIFICATION

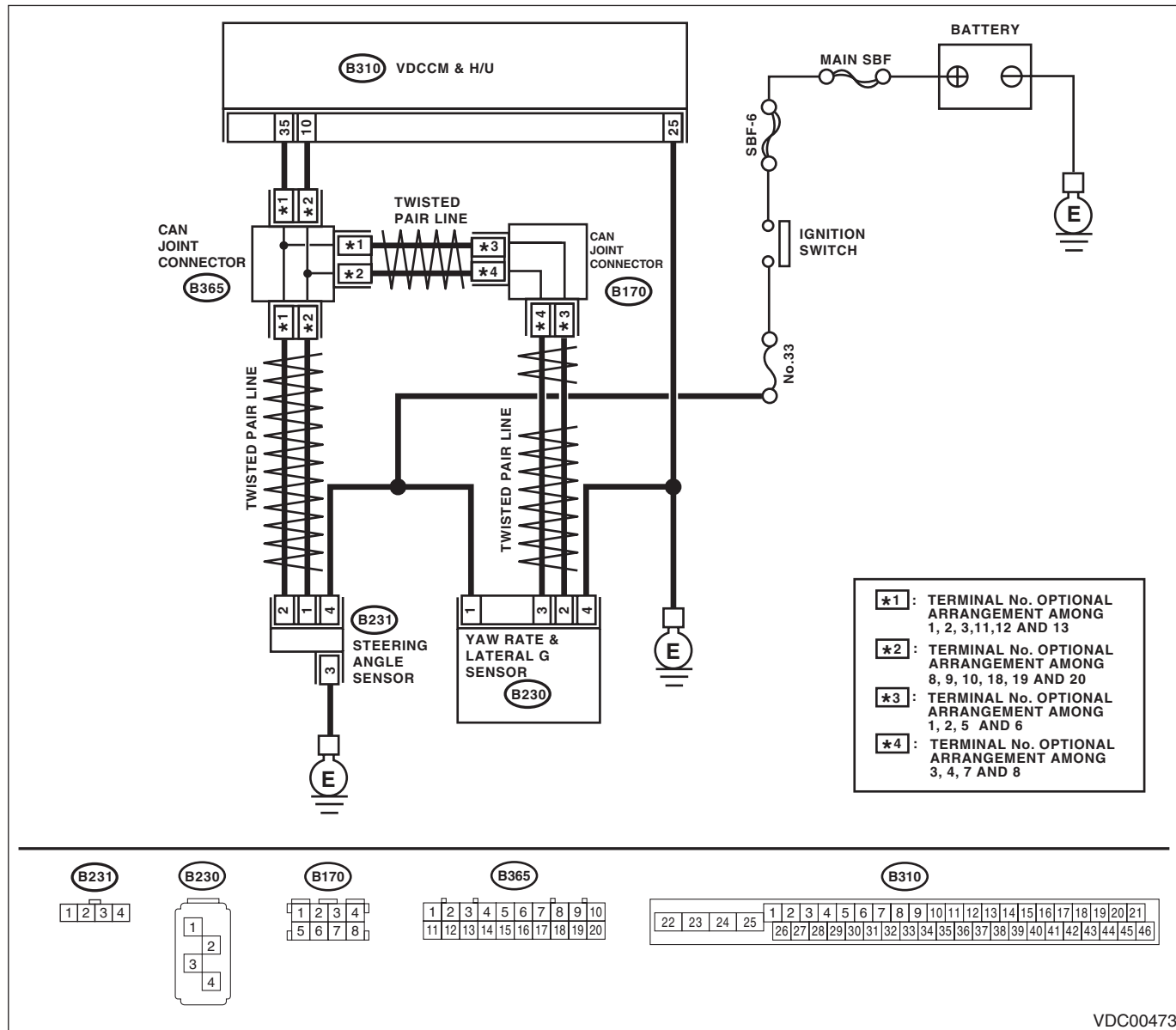
### DTC DETECTING CONDITION:

Defective yaw rate sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK YAW RATE &amp; LATERAL G SENSOR POWER SUPPLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit of the yaw rate & lateral G sensor.
2	<b>CHECK YAW RATE &amp; LATERAL G SENSOR GROUND CIRCUIT.</b> Measure the resistance between the yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 4 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ground circuit of the yaw rate & lateral G sensor.
3	<b>CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the yaw rate & lateral G sensor.	Go to step 4.
4	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AS:DTC C0072 ABNORMAL YAW RATE SENSOR REFERENCE VOLTAGE

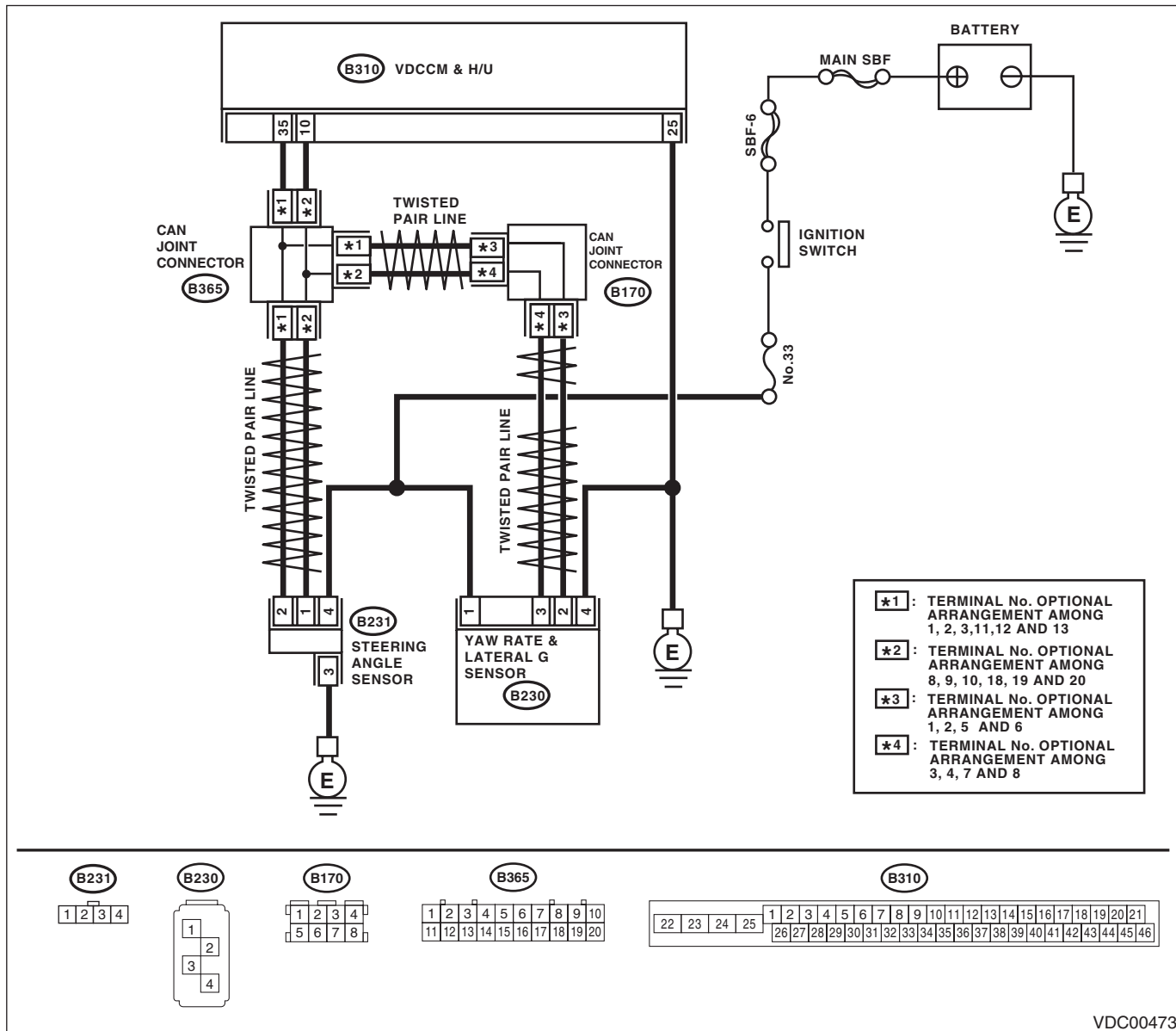
### DTC DETECTING CONDITION:

Defective yaw rate sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK POWER SUPPLY FOR YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit of the yaw rate & lateral G sensor.
2	<b>CHECK YAW RATE &amp; LATERAL G SENSOR GROUND CIRCUIT.</b> Measure the resistance between the yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 4 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ground circuit of the yaw rate & lateral G sensor.
3	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the yaw rate & lateral G sensor.	Go to step 4.
4	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AT:DTC C0072 CHANGE RANGE OF YAW RATE SENSOR SIGNAL IS TOO BIG

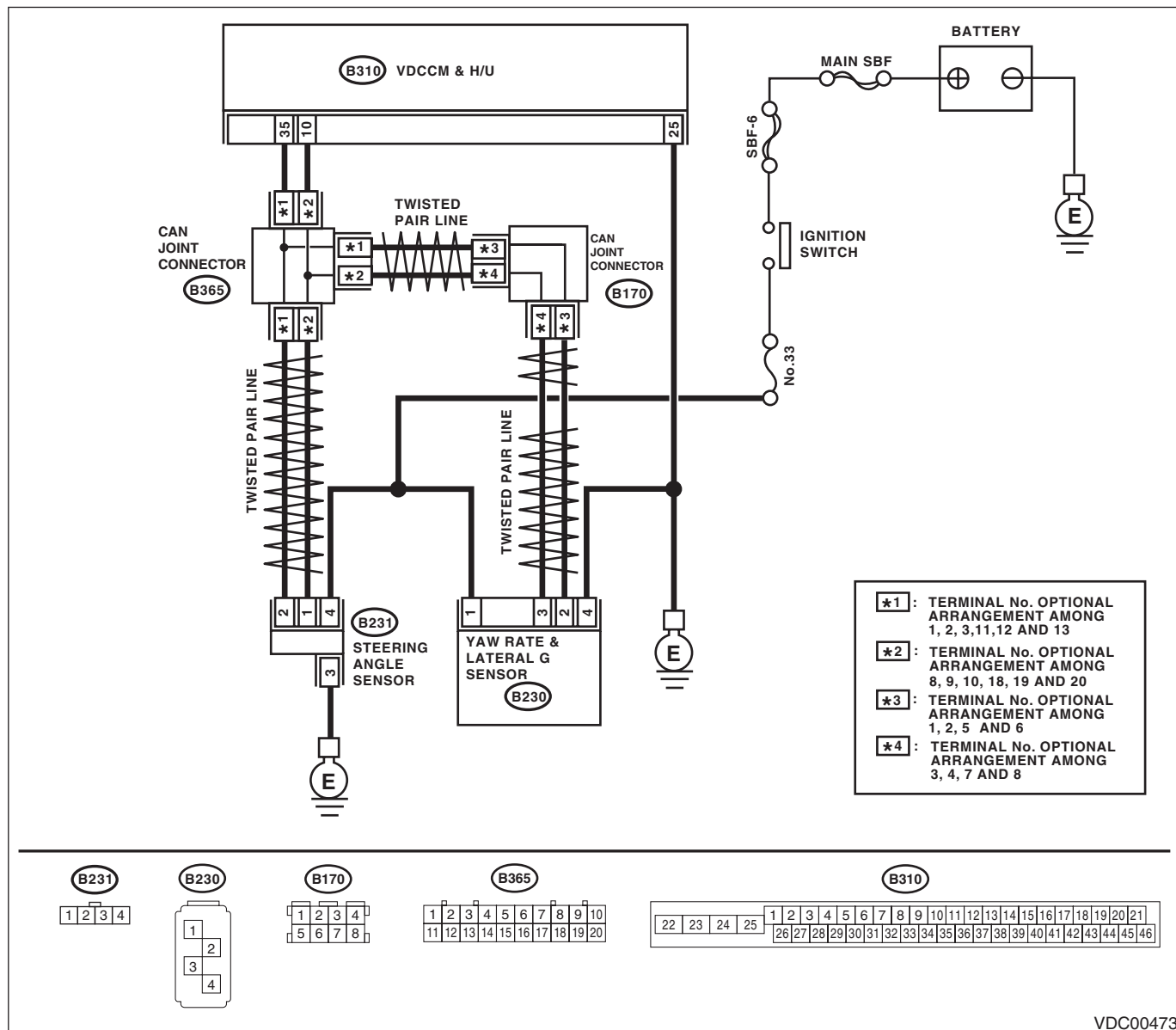
### DTC DETECTING CONDITION:

Defective yaw rate sensor

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DRIVING PLACE.</b> Check if the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Did the vehicle run the road with banks or sandy surface (which does not mean a dirt road)?	VDCCM&H/U may record DTC when the vehicle ran the road with banks or sandy surface (which does not mean a dirt road).	Go to step 2.
2	<b>CHECK YAW RATE &amp; LATERAL G SENSOR INSTALLATION.</b>	Is the yaw rate & lateral G sensor installation bolt tightened to 7.5 N·m (0.76 kgf·m, 5.5 ft·lb)?	Go to step 3.	Tighten the yaw rate & lateral G sensor installation bolt.
3	<b>CHECK YAW RATE &amp; LATERAL G SENSOR POWER SUPPLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 — 15 V?	Go to step 4.	Repair the power supply circuit of the yaw rate & lateral G sensor.
4	<b>CHECK YAW RATE &amp; LATERAL G SENSOR GROUND CIRCUIT.</b> Measure the resistance between the yaw rate & lateral G sensor and chassis ground. <b>Connector &amp; terminal</b> <b>(B230) No. 4 — Chassis ground:</b>	Is the resistance less than 0.5 Ω?	Go to step 5.	Repair the ground circuit of the yaw rate & lateral G sensor.
5	<b>CHECK OUTPUT OF YAW RATE &amp; LATERAL G SENSOR WITH SUBARU SELECT MONITOR.</b> 1) Drive the vehicle on a flat road. 2) Park the vehicle straight. 3) Select {Current Data Display & Save} in Subaru Select Monitor. 4) Read the yaw rate output displayed on display.	Is the reading indicated on monitor display -4 — 4 deg/s?	Go to step 6.	Replace the yaw rate & lateral G sensor.
6	<b>CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 7.	Go to step 8.
7	<b>CHECK THE VDCCM&amp;H/U.</b> 1) Turn the ignition switch to OFF. 2) Replace the yaw rate & lateral G sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 9.
8	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
9	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Malfunction is found in original yaw rate & lateral G sensor.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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### **AU:DTC C0073 LATERAL G SENSOR COMMUNICATION**

#### **DTC DETECTING CONDITION:**

Communication failure between lateral G sensor and VDCCM

#### **TROUBLE SYMPTOM:**

- ABS does not operate.
- VDC does not operate.

#### **NOTE:**

For the diagnostic procedure, refer to DTC C0072 “YAW RATE SENSOR COMMUNICATION”. <Ref. to VDC(diag)-93, DTC C0072 YAW RATE SENSOR COMMUNICATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AV:DTC C0072 YAW RATE SENSOR COMMUNICATION

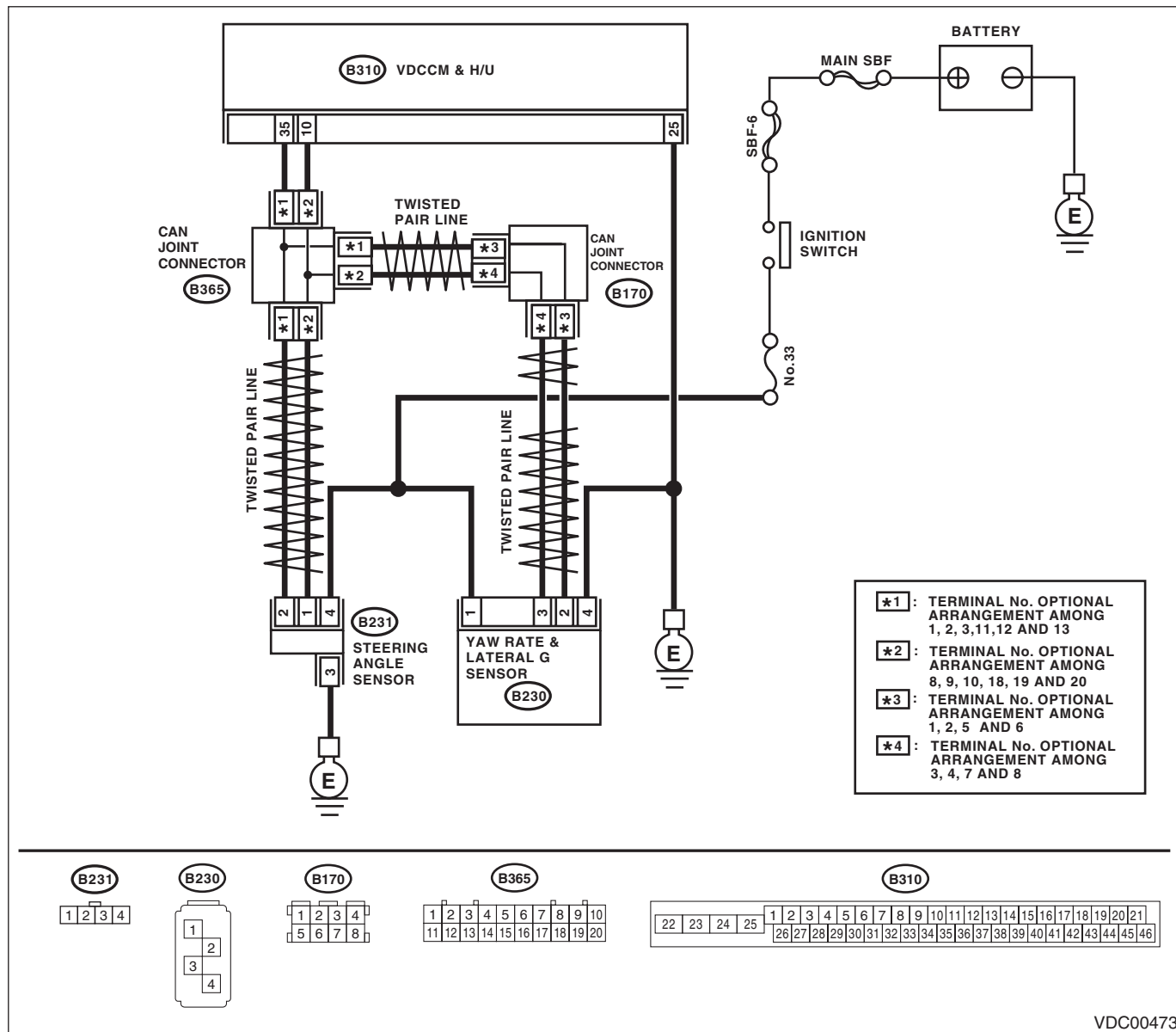
### DTC DETECTING CONDITION:

Communication failure between yaw rate sensor and VDCCM

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY FOR YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from yaw rate & lateral G sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between yaw rate & lateral G sensor and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B230) No. 1 (+) — Chassis ground (-):</b></i>	Is the voltage 10 — 15 V?	Go to step 2.	Repair the power supply circuit of the yaw rate & lateral G sensor.
<b>2 CHECK YAW RATE &amp; LATERAL G SENSOR GROUND CIRCUIT.</b> Measure the resistance between the yaw rate & lateral G sensor and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B230) No. 4 — Chassis ground:</b></i>	Is the resistance less than 0.5 Ω?	Go to step 3.	Repair the ground circuit of the yaw rate & lateral G sensor.
<b>3 CHECK YAW RATE &amp; LATERAL G SENSOR HARNESS.</b> 1) Disconnect the connector from the VDCCM&H/U. 2) Measure the resistance between VDCCM&H/U and yaw rate & lateral G sensor. <i><b>Connector &amp; terminal</b></i> <i><b>(B230) No. 3 — (B310) No. 10:</b></i> <i><b>(B230) No. 2 — (B310) No. 35:</b></i>	Is the resistance less than 0.5 Ω?	Go to step 4.	Repair the harness between yaw rate & lateral G sensor and VDCCM & H/U.
<b>4 CHECK GROUND SHORT CIRCUIT FOR YAW RATE &amp; LATERAL G SENSOR HARNESS.</b> Measure the resistance between the yaw rate & lateral G sensor and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B230) No. 2 — Chassis ground:</b></i> <i><b>(B230) No. 3 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 5.	Repair the harness between yaw rate & lateral G sensor and VDCCM & H/U.
<b>5 CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Go to step 6.	Go to step 7.
<b>6 CHECK YAW RATE &amp; LATERAL G SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Replace the yaw rate & lateral G sensor. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 8.
<b>7 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.
<b>8 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Malfunction is found in original yaw rate & lateral G sensor.



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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### **AW:DTC C0073 LATERAL G SENSOR OFFSET IS TOO BIG**

**NOTE:**

For the diagnostic procedure, refer to DTC C0073 “EXCESSIVE LATERAL G SENSOR SIGNAL”. <Ref. to VDC(diag)-96, DTC C0073 EXCESSIVE LATERAL G SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **AX:DTC C0073 ABNORMAL LATERAL G SENSOR OUTPUT**

**NOTE:**

For the diagnostic procedure, refer to DTC C0073 “EXCESSIVE LATERAL G SENSOR SIGNAL”. <Ref. to VDC(diag)-96, DTC C0073 EXCESSIVE LATERAL G SENSOR SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AY:DTC C0073 EXCESSIVE LATERAL G SENSOR SIGNAL

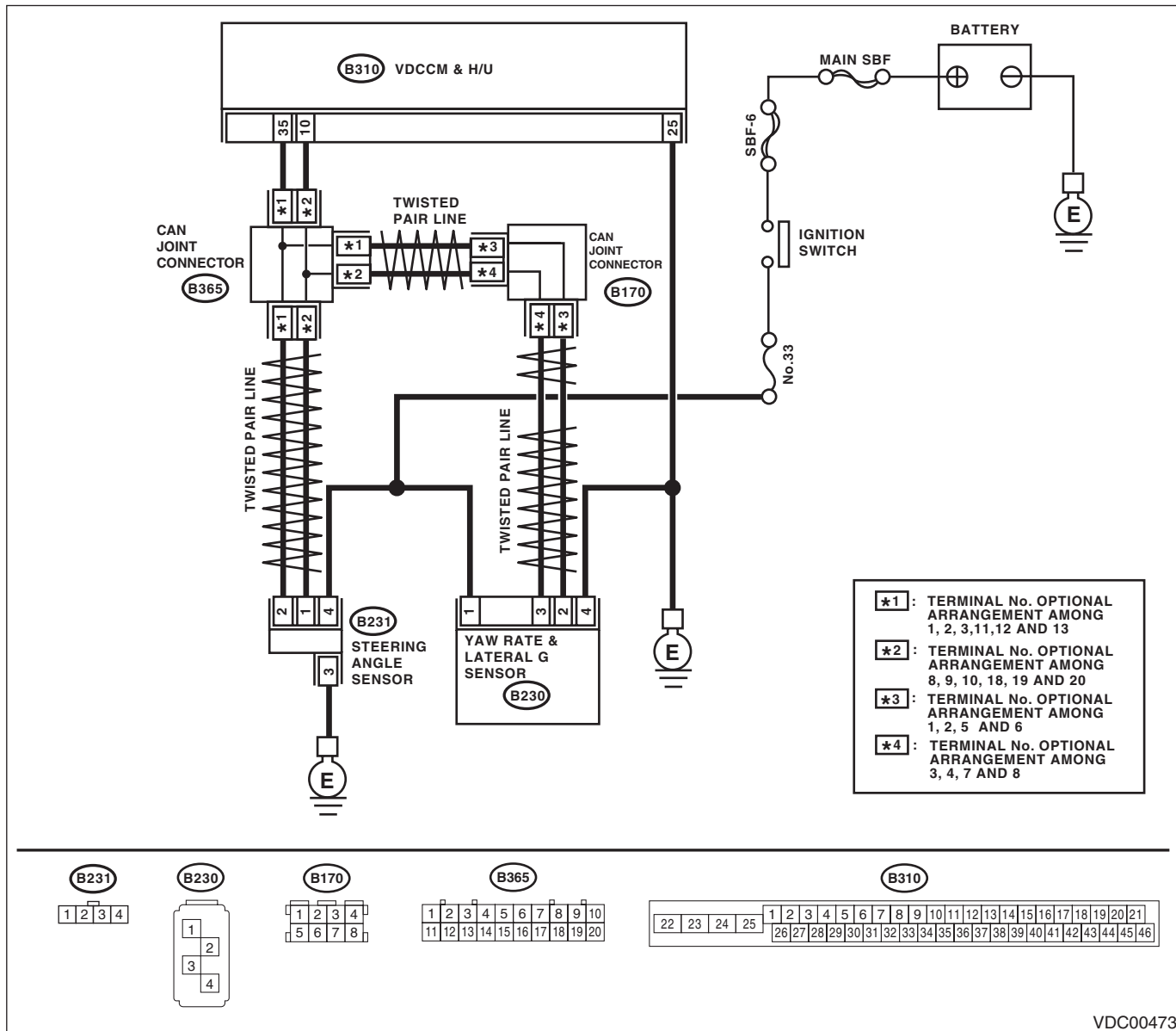
### DTC DETECTING CONDITION:

Lateral G sensor malfunction

### TROUBLE SYMPTOM:

VDC does not operate.

### WIRING DIAGRAM:



VDC00473

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK YAW RATE &amp; LATERAL G SENSOR INSTALLATION.</b>	Is the yaw rate & lateral G sensor installation bolt tightened to 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)?	Go to step 2.	Tighten the yaw rate & lateral G sensor installation bolt.
<b>2 CHECK LATERAL G SENSOR OUTPUT.</b> 1) Park the vehicle on a level surface. 2) Select {Current Data Display & Save} in Subaru Select Monitor. 3) Read the lateral G sensor output displayed on screen.	Is the indicated reading on the monitor display $-1.5 — 1.5 \text{ m/s}^2$ ?	Go to step 3.	Replace the yaw rate & lateral G sensor.
<b>3 CHECK LATERAL G SENSOR OUTPUT.</b> 1) Turn the ignition switch to OFF. 2) Remove the yaw rate & lateral G sensors from vehicle. 3) Turn the ignition switch to ON, and select {Current Data Display & Save} in Subaru Select Monitor. 4) Read the lateral G sensor output displayed on screen.	When the yaw rate & lateral G sensor is inclined $90^\circ$ to the right, is the indicated value $6.8 — 12.8 \text{ m/s}^2$ ?	Go to step 4.	Replace the yaw rate & lateral G sensor.
<b>4 CHECK LATERAL G SENSOR.</b> Read the lateral G sensor output displayed on screen.	When the yaw rate & lateral G sensor is inclined $90^\circ$ to the left, is the indicated value $-6.8 — -12.8 \text{ m/s}^2$ ?	Go to step 5.	Replace the yaw rate & lateral G sensor.
<b>5 CHECK POOR CONTACT IN CONNECTORS.</b> Turn the ignition switch to OFF.	Is there poor contact in connector between VDCCM& H/U and yaw rate & lateral G sensor?	Repair the connector.	Go to step 6.
<b>6 CHECK THE VDCCM&amp;H/U.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM only. <Ref. to VDC-10, REPLACEMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 7.
<b>7 CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC.	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## AZ:DTC C0074 PRESSURE SENSOR

### DTC DETECTING CONDITION:

Defective pressure sensor

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No	
1	<b>CHECK STOP LIGHT SWITCH CIRCUIT.</b> Check stop light switch open circuit.	Is the stop light switch circuit OK?	Go to step 2.	Repair the stop light switch circuit. NOTE: If there is malfunction in the stop light circuit, DTC may be memorized.
2	<b>CHECK OUTPUT OF PRESSURE SENSOR WITH SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Read the pressure sensor output displayed on display.	When the brake pedal is released, is the displayed value -40 — 40 bar?	Go to step 3.	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
3	<b>CHECK OUTPUT OF PRESSURE SENSOR WITH SUBARU SELECT MONITOR.</b> 1) Select {Current Data Display & Save} in Subaru Select Monitor. 2) Read the pressure sensor output displayed on display.	When operating the brake pedal, does the pressure sensor output value on the display change according to the brake pedal operation?	Go to step 4.	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
4	<b>CHECK PRESSURE SENSOR.</b> 1) Erase the memory. 2) Perform the Inspection Mode. 3) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 5.
5	<b>CHECK OTHER DTC DETECTION.</b>	Is any other DTC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	It results from a temporary noise interference.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## BA:DTC C0081 SYSTEM FAILURE

### DTC DETECTING CONDITION:

VDC long time sequential control

### TROUBLE SYMPTOM:

- ABS does not operate.
- VDC does not operate.

Step	Check	Yes	No
<b>1</b> <b>CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in the VDCCM& H/U and yaw rate & lateral G sensor connector?	Repair the connector.	Go to step 2.
<b>2</b> <b>CHECK THE VDCCM&amp;H/U.</b> 1) Replace the yaw rate & lateral G sensor. 2) Connect all connectors. 3) Erase the memory. 4) Perform the Inspection Mode. 5) Read the DTC.	Is the same DTC displayed?	Replace the VDCCM&H/U.	Malfunction is found in original yaw rate & lateral G sensor.

# General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

## 13. General Diagnostic Table

### A: INSPECTION

Symptom		Main probable cause	Other probable cause
Poor brake performance	Long braking/ stopping distance	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Brake pad</li> <li>• Aeration to brake line</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Master cylinder</li> <li>• Brake caliper</li> <li>• Disc rotor</li> <li>• Brake pipe</li> <li>• Brake booster</li> </ul>
	Wheel lock	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Brake caliper</li> <li>• Brake pipe</li> </ul>
	Brake drag	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Master cylinder</li> <li>• Brake caliper</li> <li>• Parking brake</li> <li>• Axle and wheels</li> <li>• Brake pedal play</li> </ul>	<ul style="list-style-type: none"> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Brake pad</li> <li>• Brake pipe</li> </ul>
	Long brake pedal stroke	<ul style="list-style-type: none"> <li>• Aeration to brake line</li> <li>• Brake pedal play</li> </ul>	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Master cylinder</li> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Brake pipe</li> <li>• Brake booster</li> </ul>
	Vehicle vertical pitching	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Road surface (uneven)</li> <li>• Suspension play or fatigue (reduced damping)</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> </ul>
Poor brake performance	Unstable or uneven braking	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Road surface (uneven)</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Master cylinder</li> <li>• Disc rotor</li> <li>• Brake pipe</li> <li>• Axle and wheels</li> <li>• Road with crowns or banks</li> <li>• Suspension play or fatigue (poor damping)</li> </ul>

# General Diagnostic Table

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptom		Main probable cause	Other probable cause
Vibration or noise • When braking suddenly • When accelerating suddenly • While driving on a slippery road	Excessive brake pedal vibration	<ul style="list-style-type: none"> <li>• Road surface (uneven)</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Brake booster</li> <li>• Suspension play or fatigue (poor damping)</li> </ul>
	Noise from VDCH/U	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U (mount bushing)</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Brake pipe</li> </ul>	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> </ul>
	Noise from the front side of vehicle	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U (mount bushing)</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Master cylinder</li> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Disc rotor</li> <li>• Brake pipe</li> <li>• Brake booster</li> <li>• Suspension play or fatigue (poor damping)</li> </ul>	<ul style="list-style-type: none"> <li>• Axle and wheels</li> <li>• Tire specifications, tire wear and air pressures</li> </ul>
	Noise from the rear side of vehicle	<ul style="list-style-type: none"> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Disc rotor</li> <li>• Parking brake</li> <li>• Brake pipe</li> <li>• Suspension play or fatigue (poor damping)</li> </ul>	<ul style="list-style-type: none"> <li>• Axle and wheels</li> <li>• Tire specifications, tire wear and air pressures</li> </ul>
Engine does not accelerate or goes into a stall when accelerating suddenly or driving on a slippery surface.		<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Master cylinder</li> <li>• Brake caliper</li> <li>• Parking brake</li> <li>• Incorrect wiring or piping</li> </ul>	<ul style="list-style-type: none"> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Brake pad</li> <li>• Brake pipe</li> </ul>

# General Diagnostic Table

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptom		Main probable cause	Other probable cause
Poor change-direction-operation stability of TCS	Deviation to right or left direction	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Wheel alignment</li> <li>• Road surface (uneven)</li> <li>• Road with crowns or banks</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Disc rotor</li> <li>• Brake pipe</li> <li>• Axle and wheels</li> <li>• Suspension play or fatigue (poor damping)</li> </ul>
	Vehicle spin	<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Brake pad</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> </ul>	<ul style="list-style-type: none"> <li>• Brake caliper</li> <li>• Brake pipe</li> </ul>
Steering wheel drag while driving		<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Incorrect wiring or piping connections</li> <li>• Power steering system</li> </ul>	<ul style="list-style-type: none"> <li>• Brake caliper</li> <li>• Brake pad</li> <li>• Disc rotor</li> <li>• Wheel alignment</li> <li>• Road surface (uneven)</li> <li>• Road with crowns or banks</li> <li>• Suspension play or fatigue (poor damping)</li> <li>• Tire specifications, tire wear and air pressures</li> </ul>
VDC operates while driving normally.		<ul style="list-style-type: none"> <li>• VDCCM&amp;H/U</li> <li>• Defective ABS wheel speed sensor or sensor gap</li> <li>• Defective steering angle sensor or improper neutral position</li> <li>• Defective yaw rate &amp; lateral G sensor or improper installation</li> <li>• Wheel alignment</li> <li>• Road surface (uneven)</li> <li>• Road with crowns or banks</li> <li>• Suspension play or fatigue (poor damping)</li> <li>• Tire specifications, tire wear and air pressures</li> <li>• Incorrect wiring or piping connections</li> <li>• Power steering system</li> </ul>	



# General Diagnostic Table

## VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

Symptom	Main probable cause	Other probable cause
VDC OFF indicator light does not come on when the VDC OFF switch is depressed. NOTE: When pressing VDC OFF switch for 10 seconds or more, VDC OFF indicator light goes off and cannot operate any more. When turning the ignition switch from OFF to ON, the previous status is restored.	<ul style="list-style-type: none"><li>• Harness</li><li>• Indicator light bulb</li><li>• VDC OFF switch</li></ul>	

# General Diagnostic Table

VEHICLE DYNAMICS CONTROL (VDC) (DIAGNOSTICS)

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# General Description

## BRAKE

### 1. General Description

#### A: SPECIFICATION

Model		2.5 i, 2.5 i-LTD, OUTBACK 2.5i, -LTD, OUTBACK 3.0 R, -LTD, -LLB, OUTBACK 2.5XT -LTD	2.5GT-LTD, 3.0 R-LTD, 2.5GT-B
Front disc brake	Size	16-inch type	
	Type	Disc (Floating type, ventilated)	
	Effective disc diameter	mm (in)	244 (4.61)
	Disc thickness × Diameter	mm (in)	24 × 294 (0.94 × 11.57)
	Effective cylinder diameter	42.8 (1.685) × 2	
	Pad dimensions (Length × Width × Thickness)	mm (in)	117.8 × 50.5 × 11.0 (4.638 × 1.988 × 0.433)
	Clearance adjustment	Automatic adjustment	
Rear disc brake	Size	15-inch type	
	Type	Disc (Floating type, solid)	Disc (Floating type, ventilated)
	Effective disc diameter	mm (in)	238 (9.37)
	Disc thickness × Diameter	mm (in)	10 × 274 (0.39 × 10.79)
	Effective cylinder diameter	mm (in)	38.1 (1.500)
	Pad dimensions (Length × Width × Thickness)	mm (in)	92.0 × 33.0 × 9.0 (3.622 × 1.299 × 0.354)
	Clearance adjustment	Automatic adjustment	
Master cylinder	Type	Tandem	
	Effective diameter	mm (in)	23.8 (15/16)
	Reservoir type	Sealed type	
	Brake fluid reservoir capacity	cm <sup>3</sup> (cu in)	205 (12.51)
Brake booster	Type	Vacuum suspended	
	Effective diameter	mm (in)	208 + 229 (8.19 + 9.02)
Brake line		Dual circuit system	
Brake fluid <b>CAUTION:</b> • Avoid mixing brake fluid of different brands to prevent fluid performance from degrading. • When filling with brake fluid, be careful not to allow any dust to enter the reservoir. • Use new SUBARU genuine brake fluid when replacing or refilling the fluid.		FMVSS No. 116, DOT3, or DOT4	

# General Description

BRAKE

**NOTE:**

Refer to “PB” section for parking brake specifications. <Ref. to PB-2, SPECIFICATION, General Description.>

Item			Standard	Limit	
Front brake	Pad thickness	mm (in)	Excluding 17-inch type	11 (0.43)	1.5 (0.059)
			17-inch type	11 (0.43)	1.5 (0.059)
	Disc thickness	mm (in)	Excluding 17-inch type	24 (0.94)	22 (0.87)
			17-inch type	30 (1.18)	28 (1.10)
Disc runout	mm (in)		—	0.05 (0.0020)	
Rear brake (disc type)	Pad thickness	mm (in)	Solid disc	9.0 (0.354)	1.5 (0.059)
			Ventilated disc	9.0 (0.354)	1.5 (0.059)
	Disc thickness	mm (in)	Solid disc	10 (0.39)	8.5 (0.335)
			Ventilated disc	18 (0.71)	16 (0.63)
Disc runout	mm (in)		—	0.05 (0.0020)	
Parking brake	Inside diameter	mm (in)		170 (6.69)	171 (6.73)
	Lining thickness	mm (in)		3.2 (0.126)	1.5 (0.059)
	Lever stroke				5 — 6 notches/200 N (20 kgf, 45 lb)

		Brake pedal force N (kgf, lb)	Fluid pressure kPa (kgf/cm <sup>2</sup> , psi)
Brake booster	Brake fluid pressure with engine stopped	147 (15, 33)	545 (6, 79)
		294 (30, 66)	1,564 (16, 227)
	Brake fluid pressure with engine running and vacuum pressure at 66.7 kPa (500 mmHg, 19.69 inHg)	147 (15, 33)	6,003 (61, 870)
		294 (30, 66)	11,273 (115, 1,635)

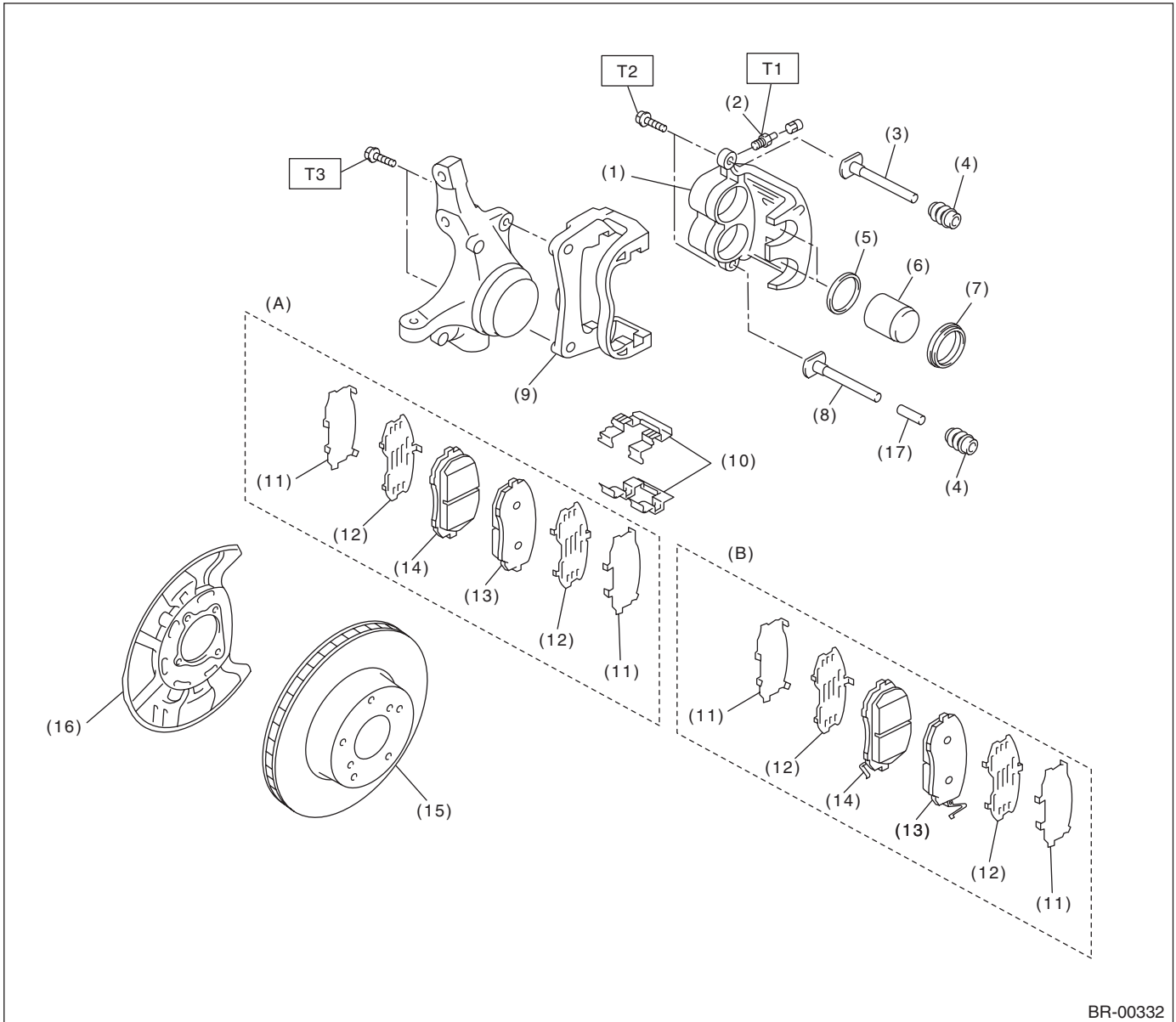
Brake pedal	Free play	mm (in)	0.5 — 2 (0.02 — 0.08) [When pulling the brake pedal upward with a force of less than 10 N (1 kgf, 2 lb).]
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# General Description

## BRAKE

### B: COMPONENT

#### 1. FRONT DISC BRAKE



BR-00332

(A) 16-inch type

(B) 17-inch type

- (1) Caliper body
- (2) Air bleeder screw
- (3) Guide pin (black)
- (4) Pin boot
- (5) Piston seal
- (6) Piston
- (7) Piston boot
- (8) Lock pin (silver)

- (9) Support
- (10) Pad clip
- (11) Outer shim
- (12) Inner shim
- (13) Pad (outside)
- (14) Pad (inside)
- (15) Disc rotor

(16) Disc cover

(17) Bushing

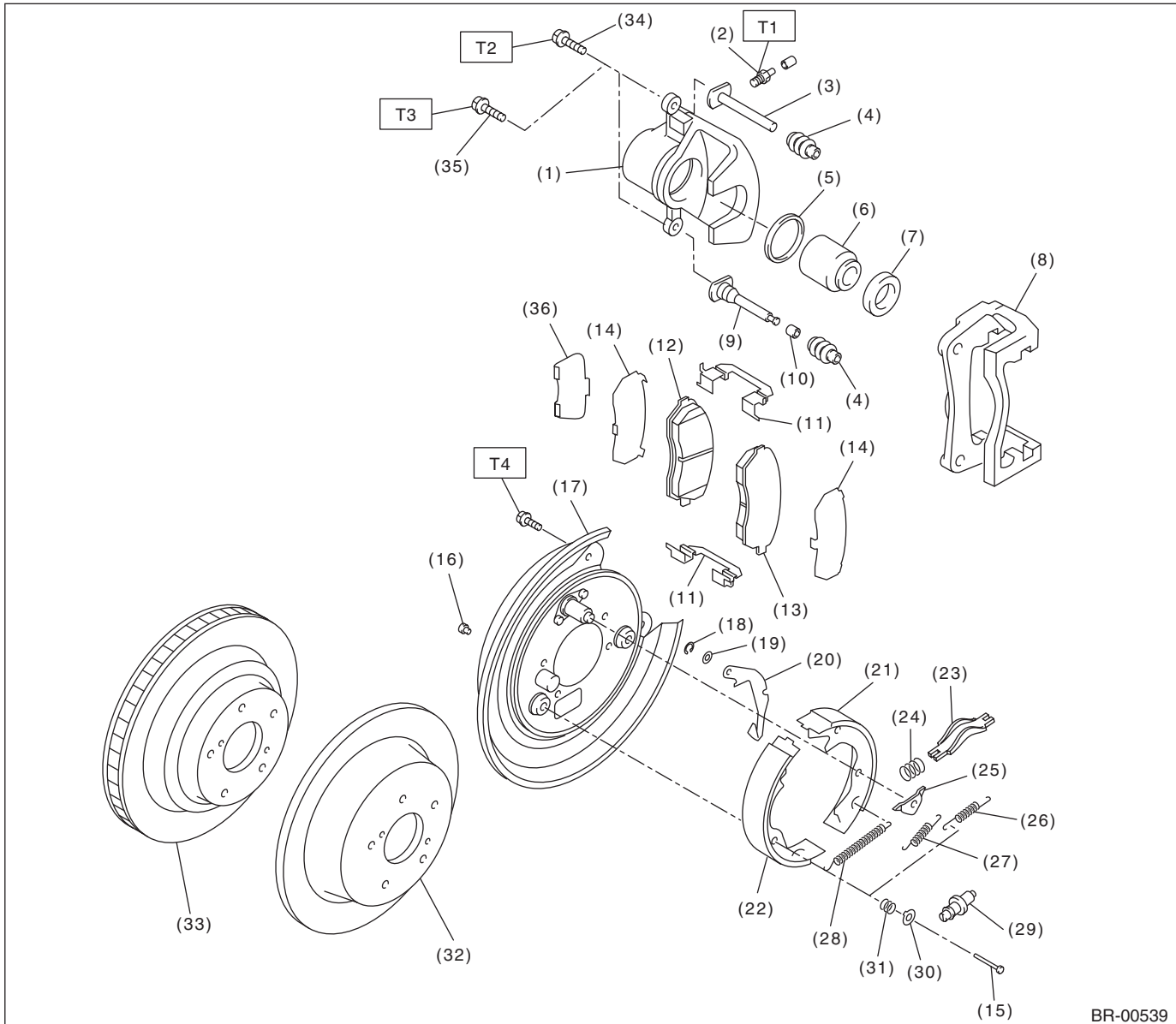
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 27 (2.8, 19.9)**

**T3: 120 (12.2, 88.5)**

## 2. REAR DISC BRAKE



BR-00539

- |                       |                                     |                                       |
|-----------------------|-------------------------------------|---------------------------------------|
| (1) Caliper body      | (15) Shoe hold-down pin             | (29) Adjuster                         |
| (2) Air bleeder screw | (16) Cover                          | (30) Shoe hold-down cup               |
| (3) Guide pin (black) | (17) Back plate                     | (31) Shoe hold-down spring            |
| (4) Pin boot          | (18) Retainer                       | (32) Disc rotor (solid type)          |
| (5) Piston seal       | (19) Spring washer                  | (33) Disc rotor (ventilated type)     |
| (6) Piston            | (20) Parking brake lever            | (34) Bolt (for solid disc brake)      |
| (7) Piston boot       | (21) Parking brake shoe (secondary) | (35) Bolt (for ventilated disc brake) |
| (8) Support           | (22) Parking brake shoe (primary)   | (36) Shim (for solid disc brake)      |
| (9) Lock pin (silver) | (23) Strut                          |                                       |
| (10) Bushing          | (24) Strut shoe spring              |                                       |
| (11) Pad clip         | (25) Shoe guide plate               |                                       |
| (12) Inner pad        | (26) Secondary shoe return spring   |                                       |
| (13) Outer pad        | (27) Primary shoe return spring     |                                       |
| (14) Shim             | (28) Adjusting spring               |                                       |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 27 (2.8, 19.9)**

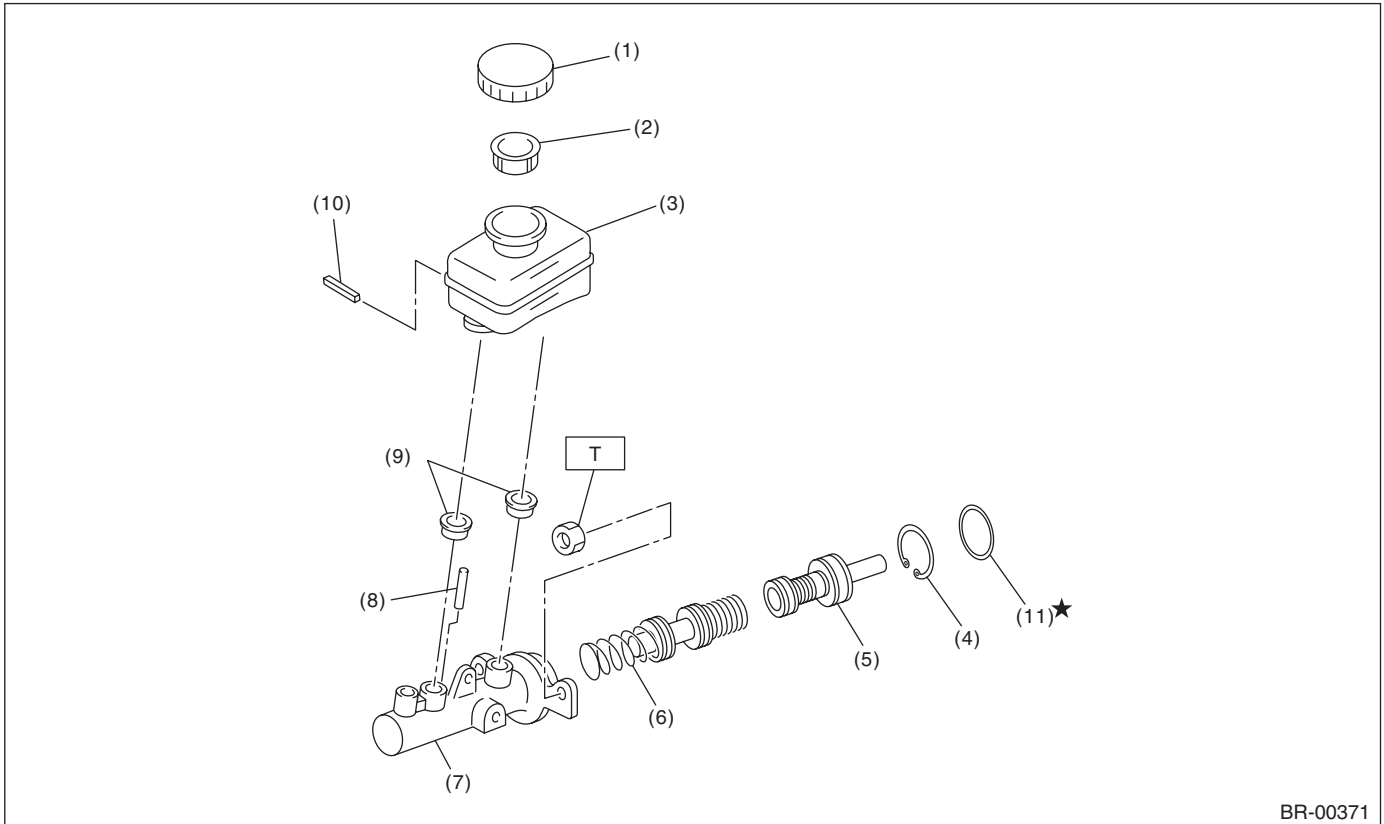
**T3: 37 (3.7, 27.2)**

**T4: 66 (6.7, 48.7)**

# General Description

BRAKE

## 3. MASTER CYLINDER



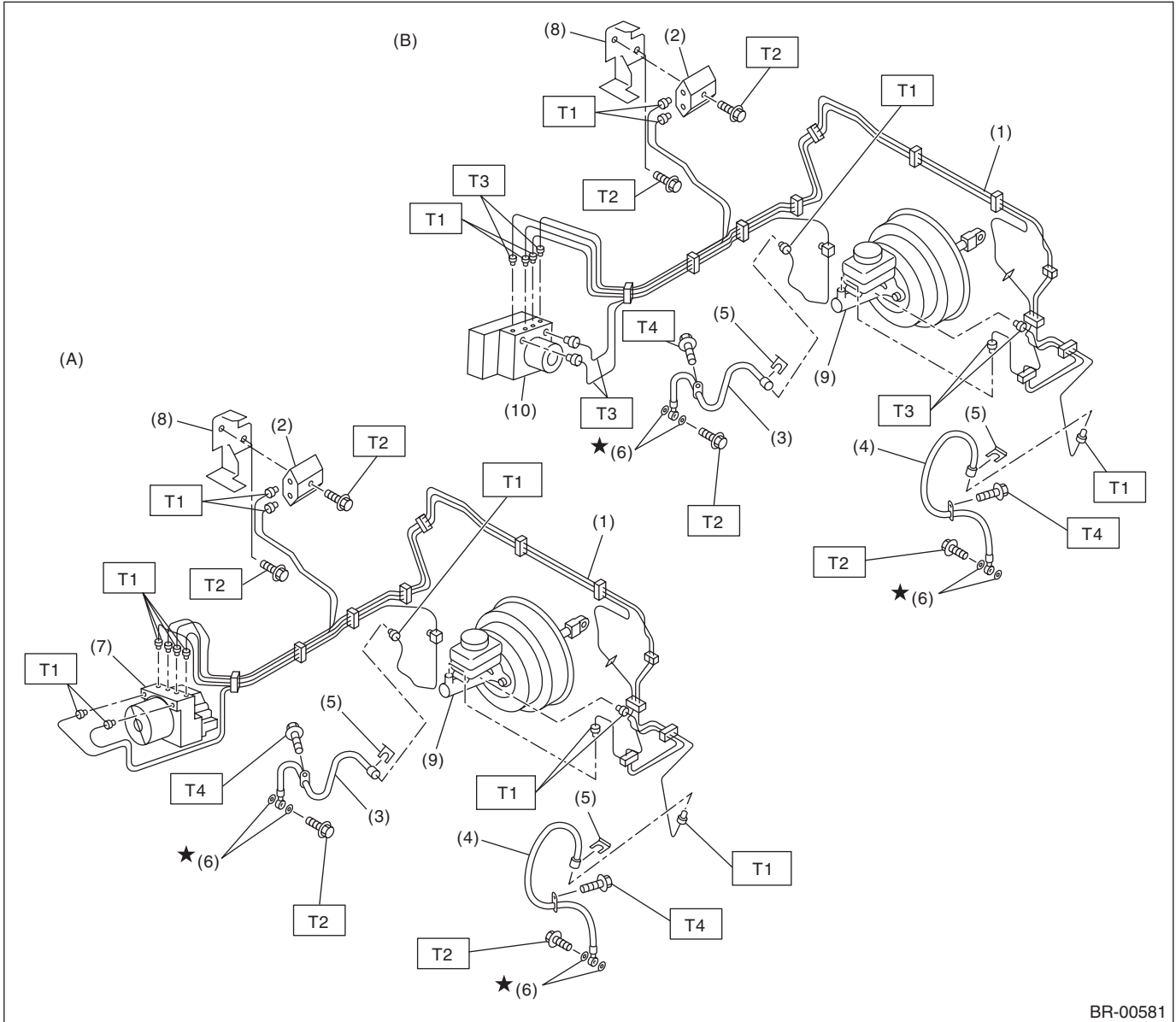
BR-00371

- |                    |                      |             |
|--------------------|----------------------|-------------|
| (1) Cap            | (6) Secondary piston | (11) O-ring |
| (2) Filter         | (7) Cylinder body    |             |
| (3) Reservoir tank | (8) Cylinder pin     |             |
| (4) C-ring         | (9) Seal             |             |
| (5) Primary piston | (10) Pin             |             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 13 (1.3, 9.6)**

## 4. FRONT BRAKE PIPES AND HOSES



BR-00581

(A) Model with ABS

(B) Model with vehicle dynamics control (VDC)

- (1) Front brake pipe ASSY
- (2) Two-way connector
- (3) Front brake hose RH
- (4) Front brake hose LH
- (5) Clamp
- (6) Gasket

- (7) ABS control module and hydraulic control unit (ABSCM&H/U)
- (8) Bracket
- (9) Master cylinder
- (10) VDC control module and hydraulic control unit (VDCCM&H/U)

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 15 (1.5, 10.8)**

**T2: 18 (1.8, 13.0)**

**T3: 19 (1.9, 14.0)**

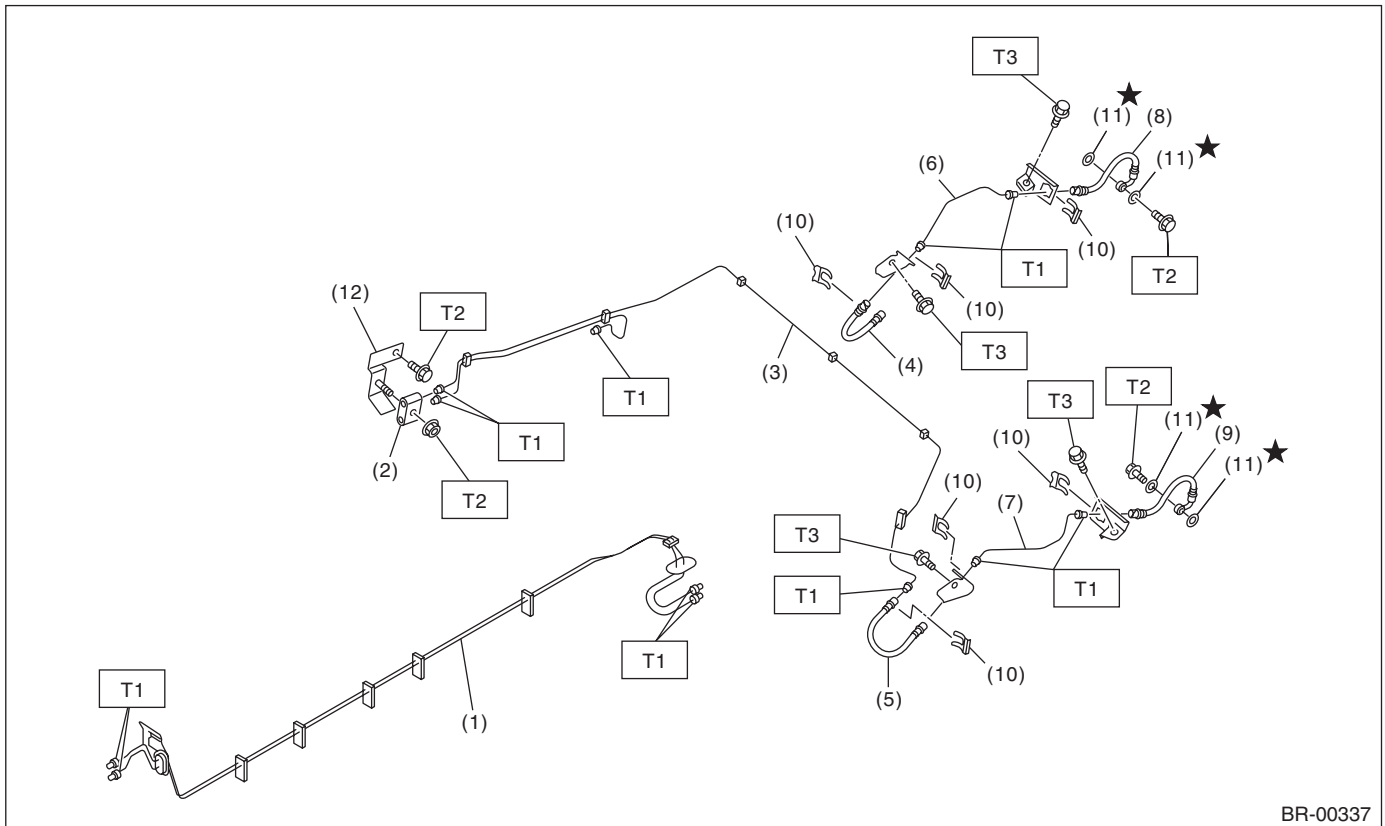
**T4: 33 (3.4, 24.3)**



# General Description

## BRAKE

### 5. CENTER AND REAR BRAKE PIPES AND HOSES



BR-00337

- |                            |                             |
|----------------------------|-----------------------------|
| (1) Center brake pipe ASSY | (7) Rear brake pipe LH      |
| (2) Two-way connector      | (8) Rear brake hose rear RH |
| (3) Rear brake pipe ASSY   | (9) Rear brake hose rear LH |
| (4) Rear brake hose RH     | (10) Clamp                  |
| (5) Rear brake hose LH     | (11) Gasket                 |
| (6) Rear brake pipe RH     | (12) Bracket                |

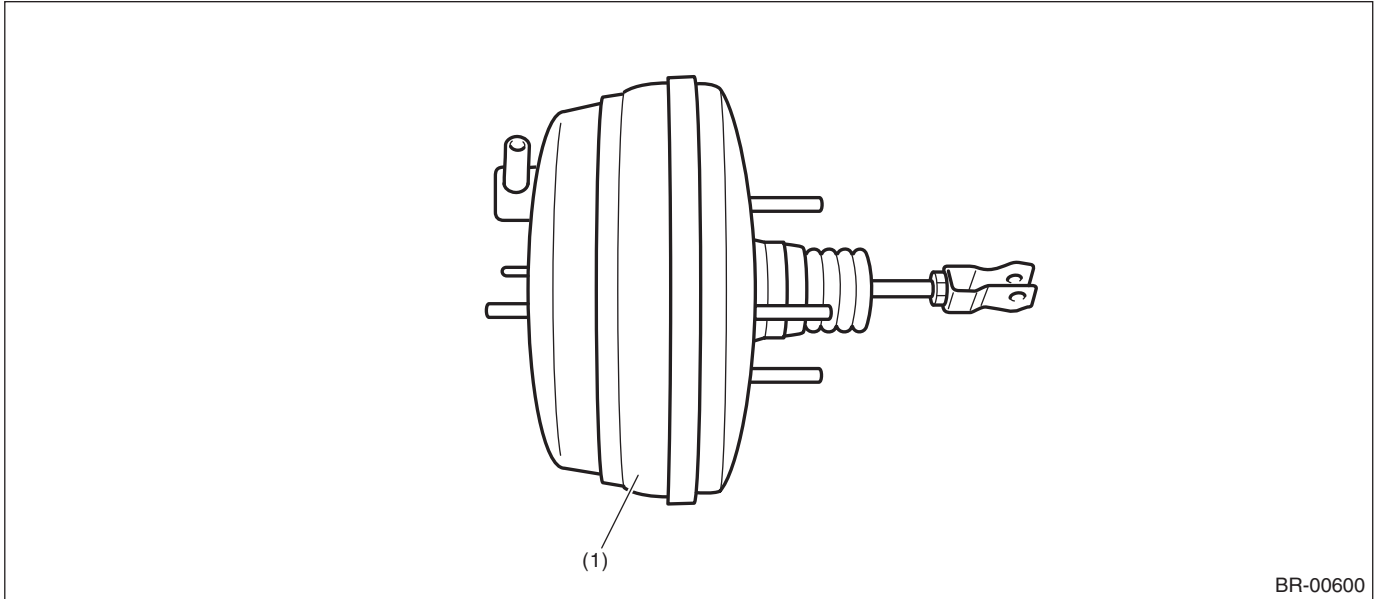
**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 15 (1.5, 10.8)**

**T2: 18 (1.8, 13.0)**

**T3: 33 (3.4, 24.3)**

## 6. BRAKE BOOSTER



(1) Brake booster

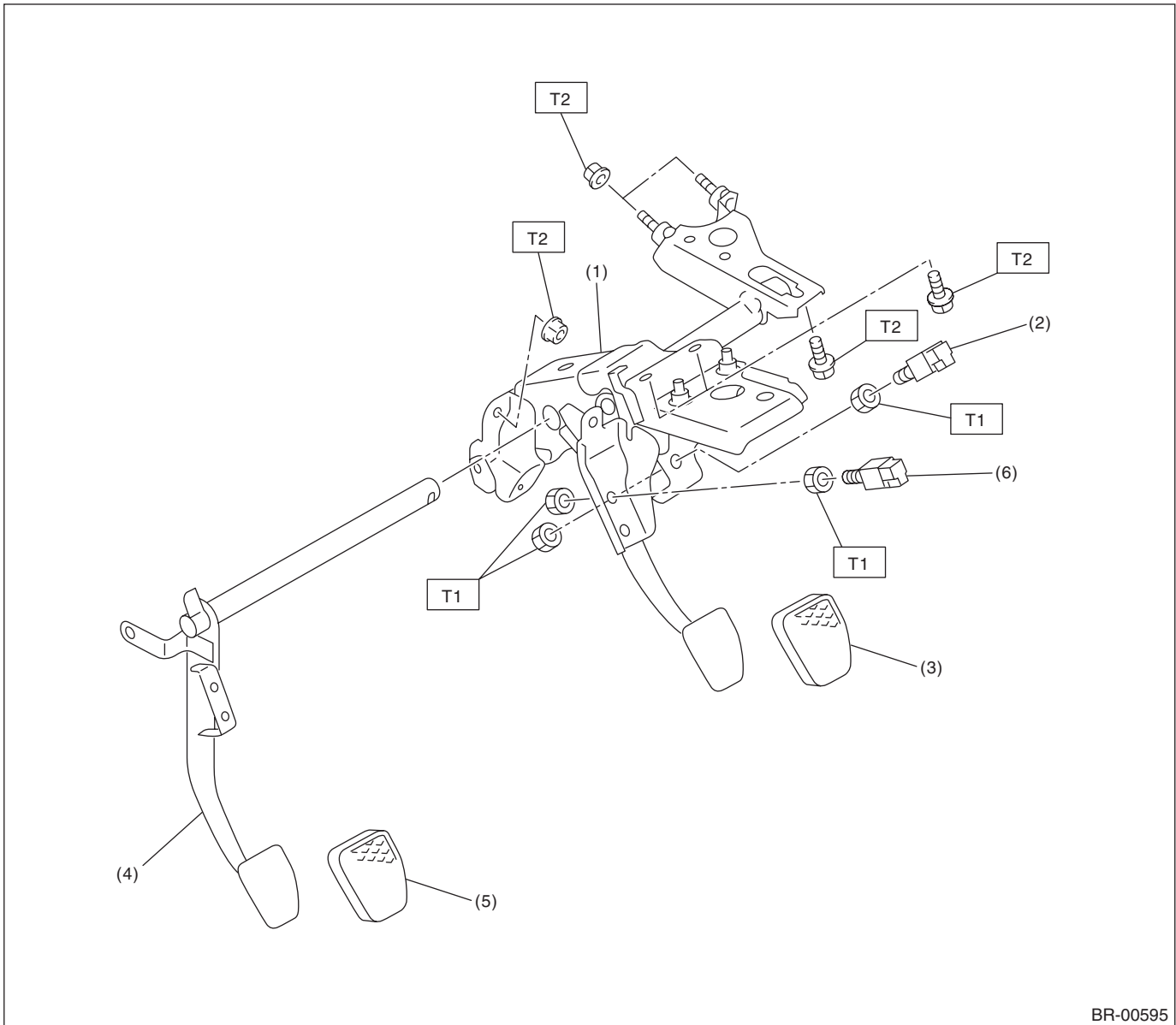
BR-00600

# General Description

## BRAKE

### 7. BRAKE PEDAL

- MT model



BR-00595

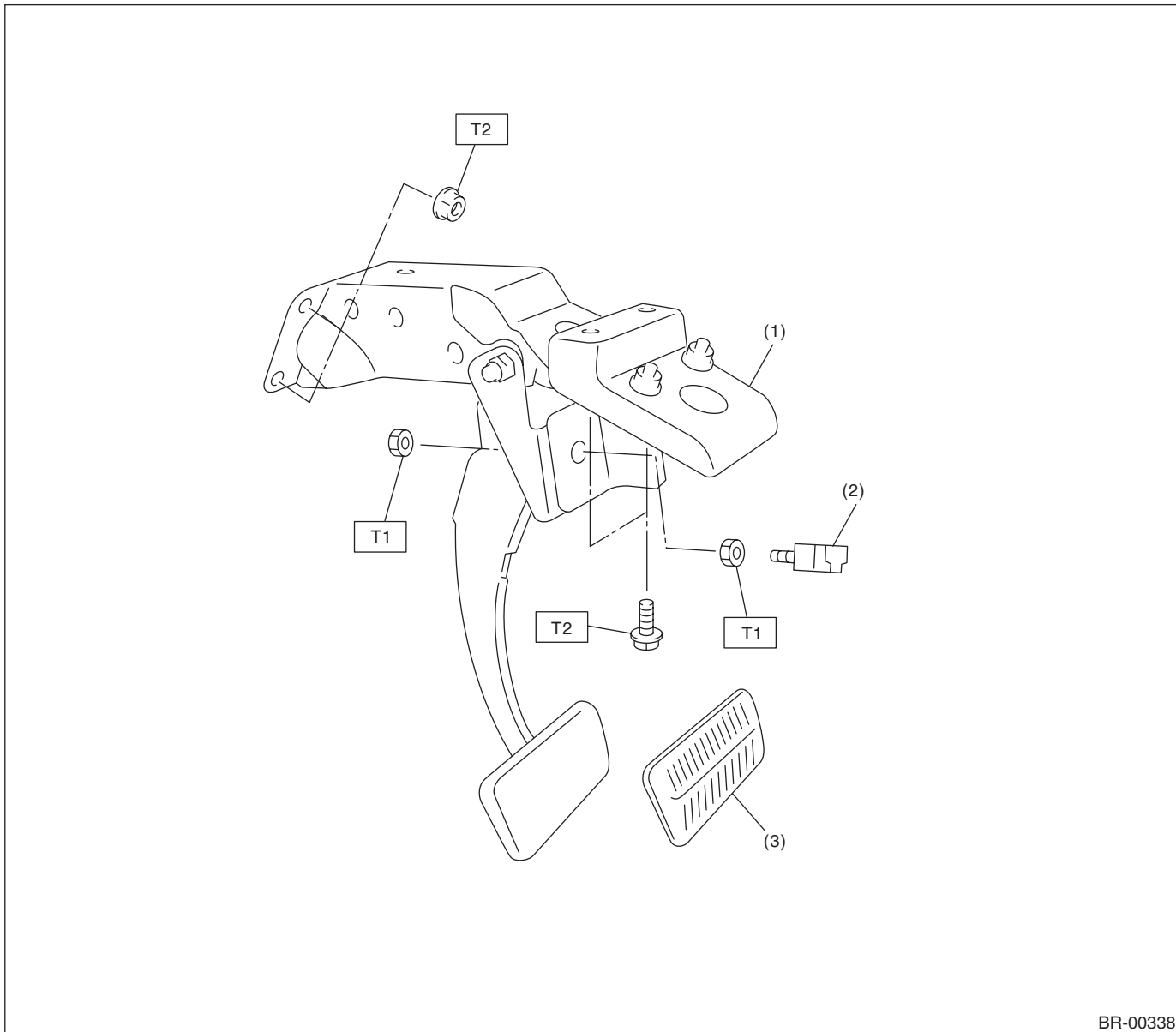
- |                       |                      |
|-----------------------|----------------------|
| (1) Brake pedal ASSY  | (4) Clutch pedal     |
| (2) Stop light switch | (5) Clutch pedal pad |
| (3) Brake pedal pad   | (6) Clutch switch    |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 18 (1.8, 13.0)**

- AT model



- (1) Brake pedal ASSY
- (2) Stop light switch

- (3) Brake pedal pad

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 18 (1.8, 13.0)**

# General Description

BRAKE

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## C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.

## D: PREPARATION TOOL

### 1. GENERAL TOOL

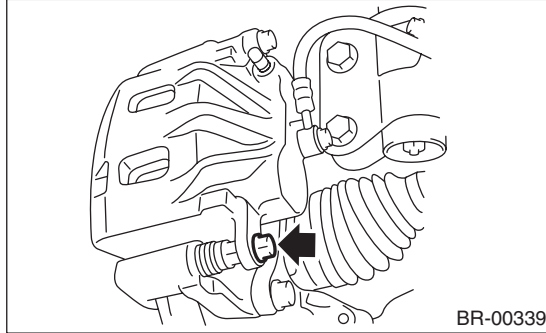
TOOL NAME	REMARKS
Snap ring pliers	Used for removing and installing snap rings.

## 2. Front Brake Pad

### A: REMOVAL

#### 1. 16-INCH TYPE

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the caliper bolt.

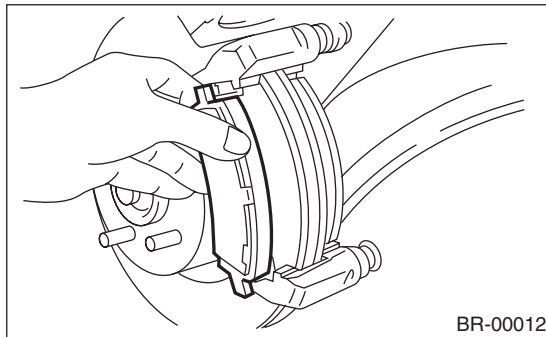


- 3) Raise the caliper body and support it.

**NOTE:**

Do not disconnect the brake hose from the caliper body.

- 4) Remove the pad.

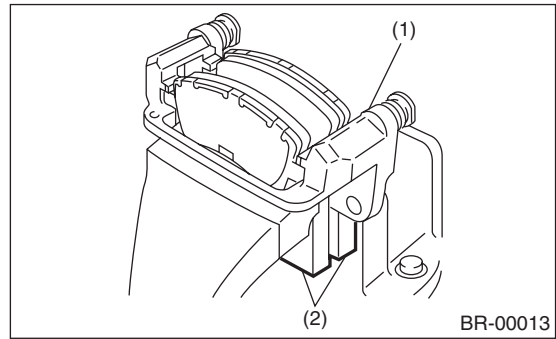


**NOTE:**

If the brake pad is difficult to remove, proceed as follows:

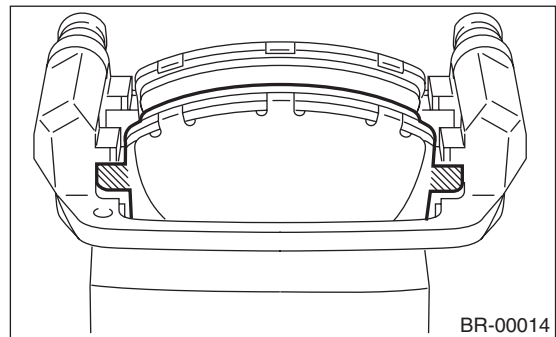
- (1) Remove the caliper body from support.
- (2) Remove the support.

- (3) Place the support between wooden blocks in the vise.



- (1) Support
- (2) Wooden block

- (4) Attach a rod of 12 mm (0.47 in) diameter or less to the shaded area of the brake pad, and strike the rod with a hammer to drive brake pad out.



#### 2. 17-INCH TYPE

Refer to 16-inch type. <Ref. to BR-13, 16-INCH TYPE, REMOVAL, Front Brake Pad.>

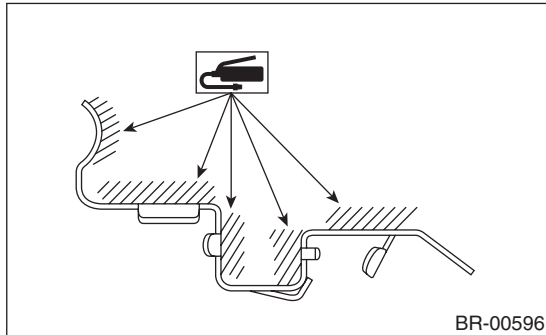
# Front Brake Pad

## BRAKE

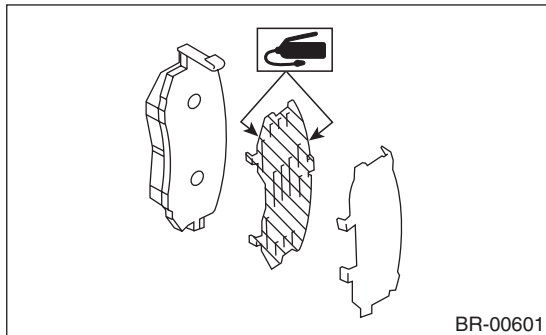
### B: INSTALLATION

#### 1. 16-INCH TYPE

1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



2) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to both surfaces of the pad inner shim.



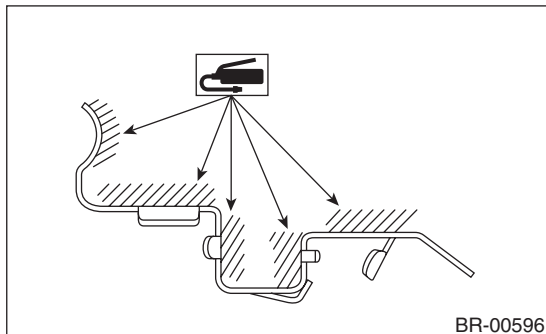
3) Install the pad to support.  
4) Install the caliper body to the support.

#### **Tightening torque:**

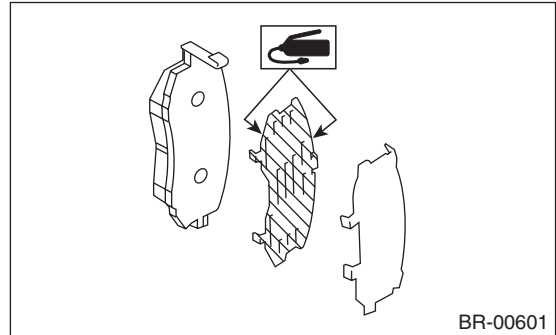
**27 N·m (2.8 kgf·m, 19.9 ft·lb)**

#### 2. 17-INCH TYPE

1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



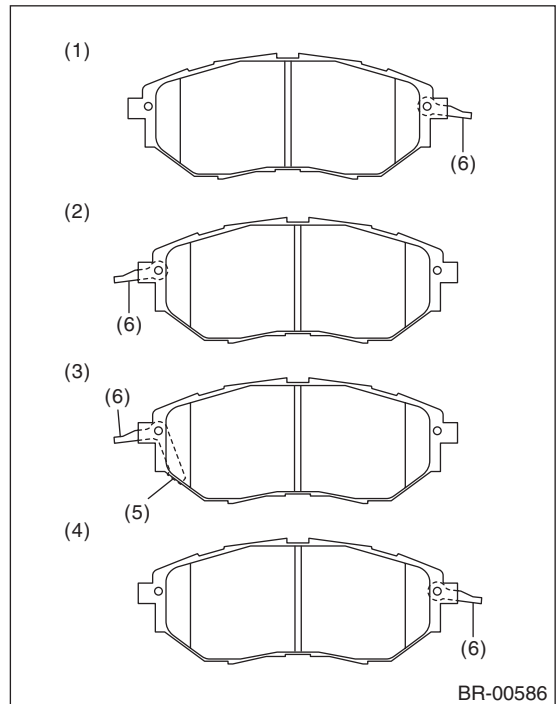
2) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to both surfaces of the pad inner shim.



3) Install the pad to support.

#### **NOTE:**

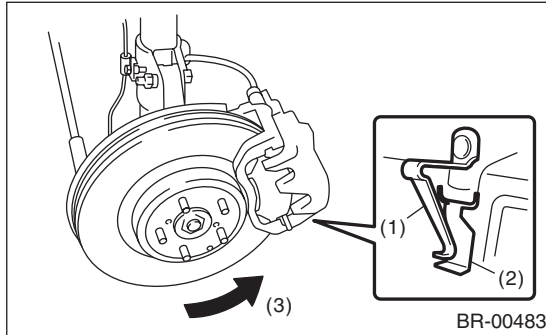
Install the pad indicator in proper direction.



- (1) LH – IN
- (2) LH – OUT
- (3) RH – IN
- (4) RH – OUT
- (5) Pad indicator
- (6) Pad return spring

**CAUTION:**

- Be sure to install so that the pad return spring faces the input side of the direction of brake rotor rotation, as shown in the figure.
- Correctly install the pad return spring to the supporting surface of the pad clip as shown in the figure.
- If the pad return spring is deformed or damaged, replace the brake pad.



- (1) Pad return spring
- (2) Supporting surface of pad clip
- (3) Direction of brake rotor rotation

4) Install the caliper body to the support.

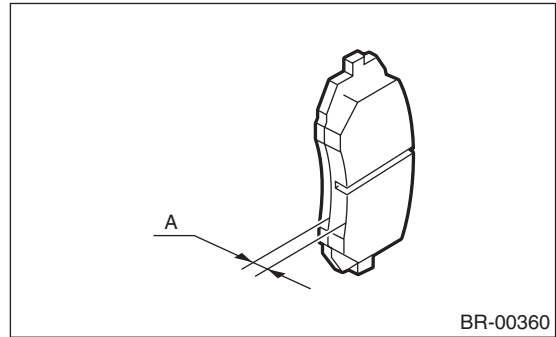
**Tightening torque:**

**27 N·m (2.8 kgf·m, 19.9 ft·lb)**

## C: INSPECTION

### 1. 16-INCH TYPE

Check the pad thickness A.



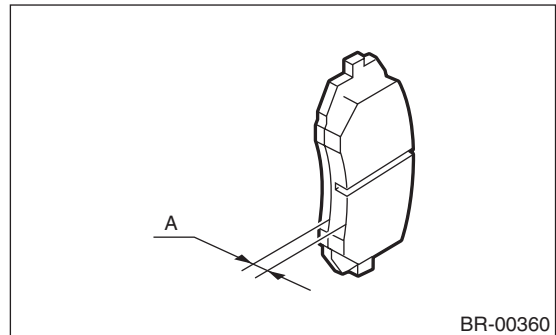
Pad thickness mm (in)	Standard	11 (0.43)
	Wear limit	1.5 (0.059)

**NOTE:**

- Always replace the pads of both sides as a set.
- Replace pad clips if they are twisted or worn.
- Replace the pad if there is oil or grease on it.

### 2. 17-INCH TYPE

Check the pad thickness A.



Pad thickness mm (in)	Standard	11 (0.43)
	Wear limit	1.5 (0.059)

**NOTE:**

- Always replace the pads of both sides as a set.
- Replace the pad if there is oil or grease on it.

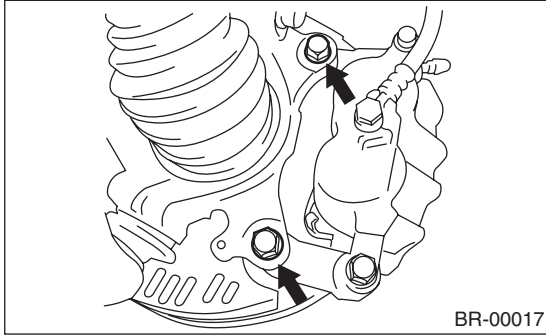


## 3. Front Disc Rotor

### A: REMOVAL

#### 1. 16-INCH TYPE

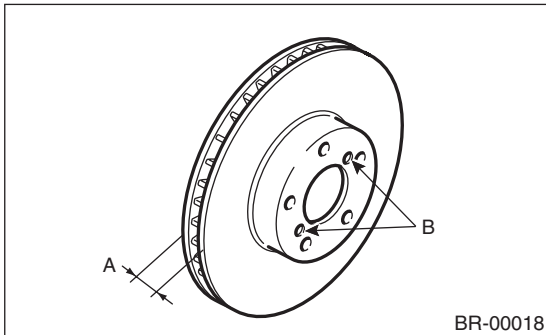
- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the caliper body and the support from housing, and suspend it from the strut using a wire.



- 3) Remove the disc rotor.

#### NOTE:

If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threaded section (B) of the rotor, then remove the rotor.



- 4) Remove mud and foreign matter from the caliper body assembly and the support.

#### 2. 17-INCH TYPE

Refer to 16-inch type. <Ref. to BR-16, 16-INCH TYPE, REMOVAL, Front Disc Rotor.>

### B: INSTALLATION

- 1) Install the disc rotor.
- 2) Install the caliper body and the support to housing.

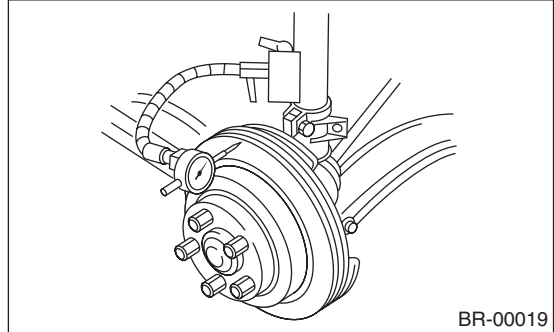
#### Tightening torque:

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

- 3) Install the front wheels.

### C: INSPECTION

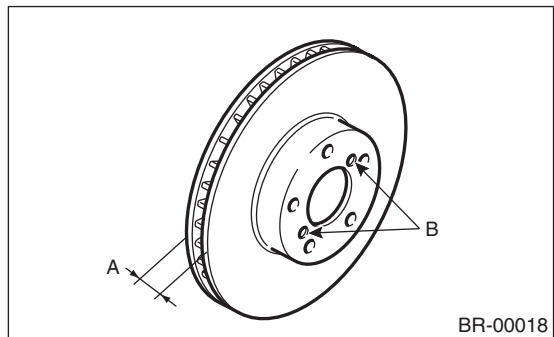
- 1) Check the front wheel bearing play and axle hub runout before the inspection of disc rotor runout limit. <Ref. to DS-16, INSPECTION, Front Axle.>
- 2) Secure the disc rotor by tightening the five wheel nuts.
- 3) Set a dial gauge 10 mm (0.39 in) inward from the disc rotor outer circumference. Rotate the disc rotor to check runout. If the runout of disc rotor exceeds the service limit, resurface the disc rotor. After re-surfacing, check disc rotor thickness as in step 4).



#### Disc rotor runout limit:

**0.05 mm (0.0020 in)**

- 4) Set a micrometer 10 mm (0.39 in) inward from the disc rotor outer perimeter, and then measure the disc rotor thickness. If the thickness of the disc rotor exceeds the service limit, replace with a new disc rotor.



		Standard	Limit	Disc rotor outer diameter
Disc rotor thickness A mm (in)	16"	24 (0.94)	22 (0.87)	294 (11.57)
	17"	30 (1.18)	28 (1.10)	316 (12.44)

## 4. Front Disc Brake Assembly

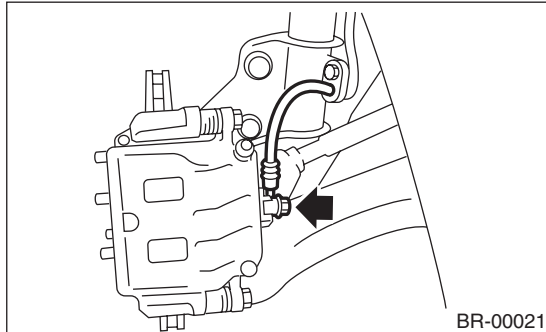
### A: REMOVAL

#### 1. 16-INCH TYPE

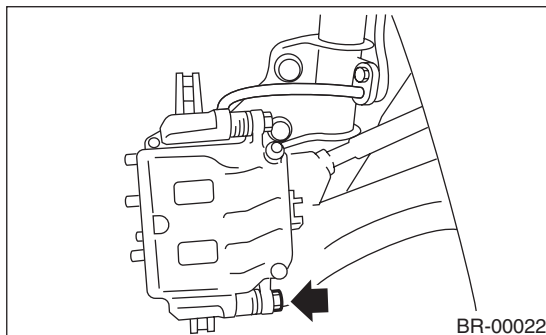
**CAUTION:**

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

- 1) Lift up the vehicle, and remove the front wheels.
- 2) Remove the union bolt, and disconnect the brake hose from the caliper body assembly.



- 3) Remove the bolt securing the lock pin to caliper body.

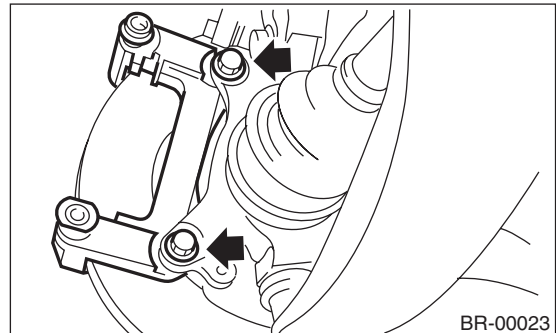


- 4) Raise the caliper body, and then move it toward vehicle center to separate it from the support.

- 5) Remove the support from housing.

**NOTE:**

Remove the support only when replacing the rotor or support. It need not be removed when servicing the caliper body assembly.



- 6) Remove mud and foreign matter from the caliper body assembly and the support.

#### 2. 17-INCH TYPE

Refer to 16-inch type. <Ref. to BR-17, 16-INCH TYPE, REMOVAL, Front Disc Brake Assembly.>

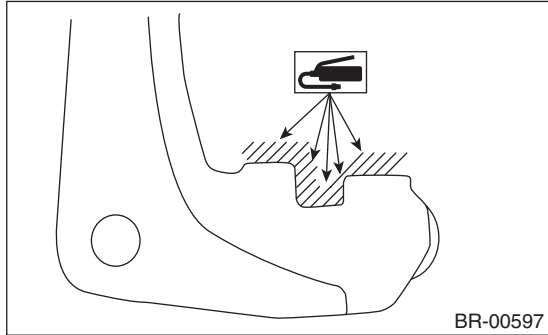
# Front Disc Brake Assembly

BRAKE

## B: INSTALLATION

### 1. 16-INCH TYPE

1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the support.

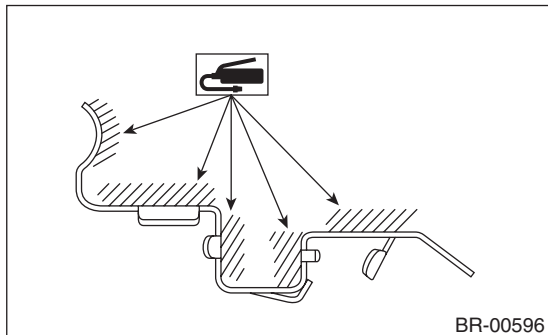


2) Install the support to the housing.

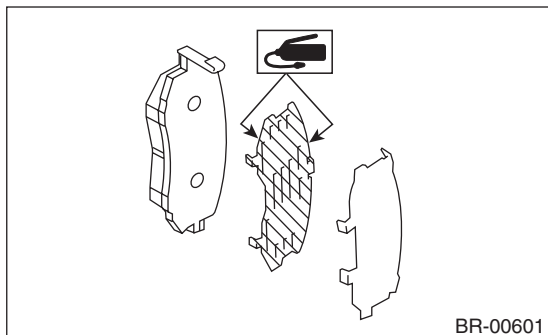
**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

3) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



4) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to both surfaces of the pad inner shim.



5) Install the pad to support.

6) Install the caliper body to the support.

**Tightening torque:**

**27 N·m (2.8 kgf·m, 19.9 ft·lb)**

7) Connect the brake hose using a new brake hose gasket.

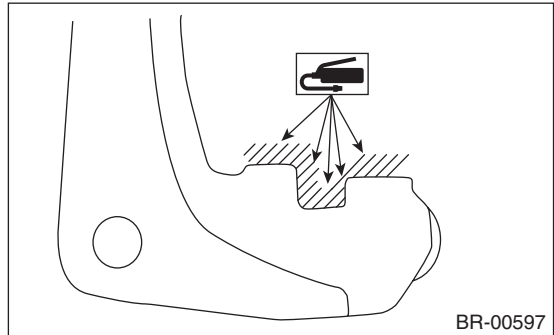
**Tightening torque:**

**18 N·m (1.8 kgf·m, 13.0 ft·lb)**

8) Bleed air from the brake system.

### 2. 17-INCH TYPE

1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the support.

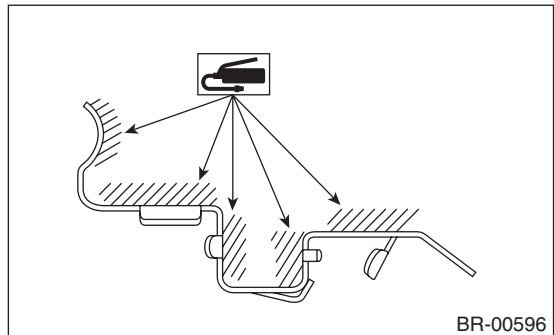


2) Install the support to the housing.

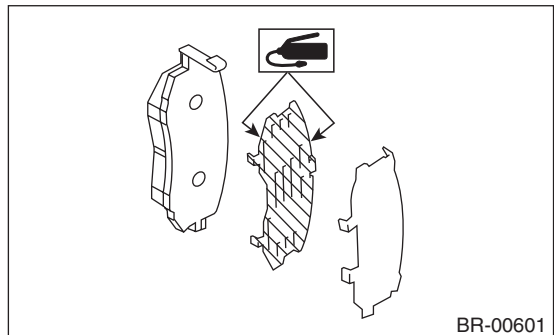
**Tightening torque:**

**120 N·m (12.2 kgf·m, 88.5 ft·lb)**

3) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



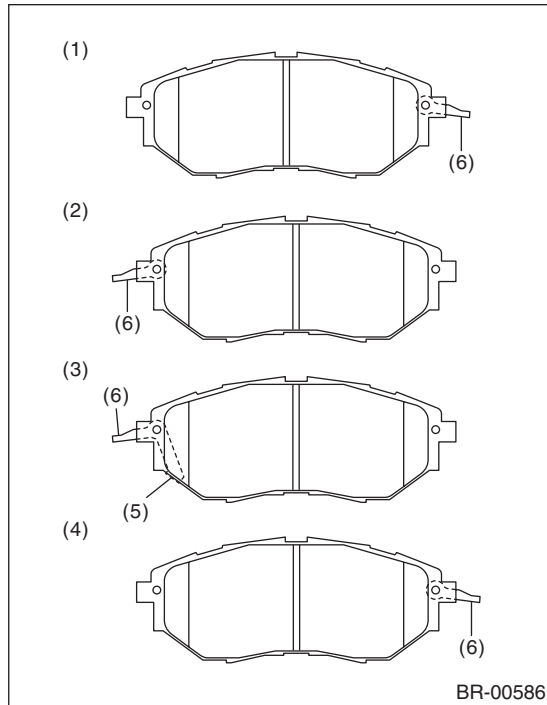
4) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to both surfaces of the pad inner shim.



5) Install the pad to support.

**NOTE:**

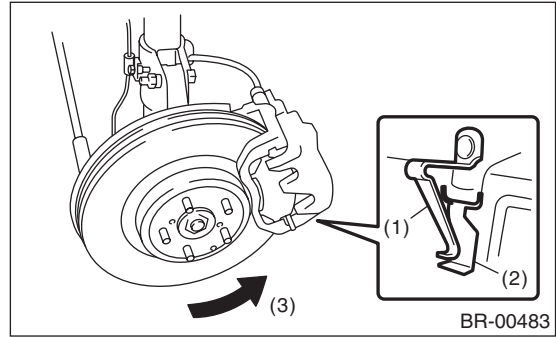
Install the pad indicator in proper direction.



- (1) LH – IN
- (2) LH – OUT
- (3) RH – IN
- (4) RH – OUT
- (5) Pad indicator
- (6) Pad return spring

**CAUTION:**

- Be sure to install so that the pad return spring faces the input side of the direction of brake rotor rotation, as shown in the figure.
- Correctly install the pad return spring to the supporting surface of the pad clip as shown in the figure.
- If the pad return spring is deformed or damaged, replace the brake pad.



- (1) Pad return spring
- (2) Supporting surface of pad clip
- (3) Direction of brake rotor rotation

6) Install the caliper body to the support.

7) Connect the brake hose using a new brake hose gasket.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**

8) Bleed air from the brake system.

# Front Disc Brake Assembly

## BRAKE

### C: DISASSEMBLY

#### 1. 16-INCH TYPE

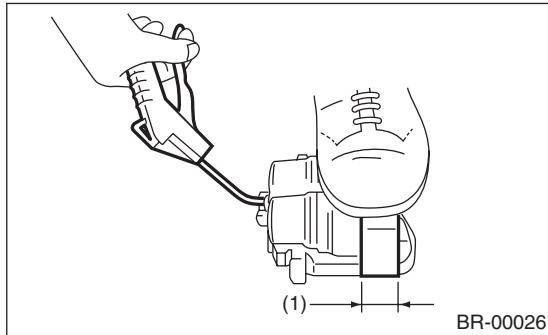
1) Remove mud and foreign matter from the caliper body assembly and the support.

#### CAUTION:

**Be careful not to allow foreign matter to enter the brake hose connector.**

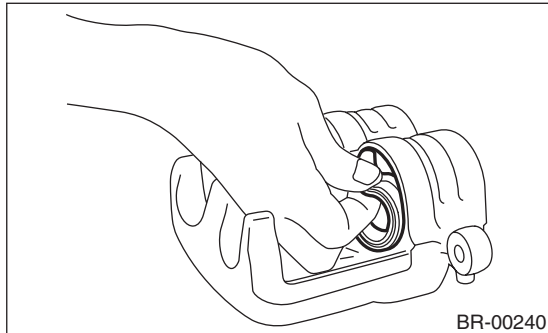
2) Place a wooden block in the caliper body as shown in the figure to prevent the piston from jumping out and being damaged.

3) Gradually apply compressed air via the brake hose installation hole to push the piston out.



(1) Place a wooden block of 30 mm (1.18 in) width.

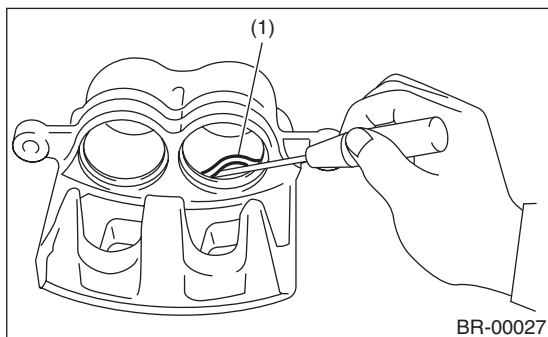
4) Remove the piston boot.



5) Remove the piston seal from caliper body cylinder.

#### CAUTION:

**Do not damage the cylinder and piston seal groove.**



(1) Piston seal

6) Remove the guide pin and boot from caliper body.

#### 2. 17-INCH TYPE

Refer to 16-inch type. <Ref. to BR-20, 16-INCH TYPE, DISASSEMBLY, Front Disc Brake Assembly.>

### D: ASSEMBLY

#### 1. 16-INCH TYPE

1) Clean the inside of the caliper body using brake fluid.

2) Apply a coat of brake fluid to piston seal and install piston seal in the groove on caliper body.

3) Apply a coat of brake fluid to the inner surface of cylinder and the entire outer surface of the piston.

4) Apply a coat of specified grease to the boot, and fit to the groove on the ends of the cylinder.

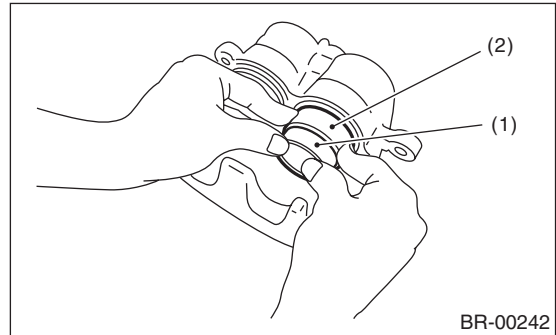
#### Grease:

**NIGLUBE RX-2 (Part No. 000041000)**

5) Insert the piston into cylinder.

#### CAUTION:

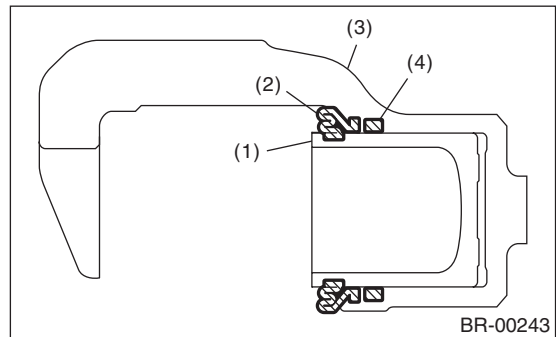
**Do not force the piston into cylinder.**



(1) Piston

(2) Piston boot

6) Position the boot in the grooves on cylinder and piston.



(1) Piston

(2) Piston boot

(3) Caliper body

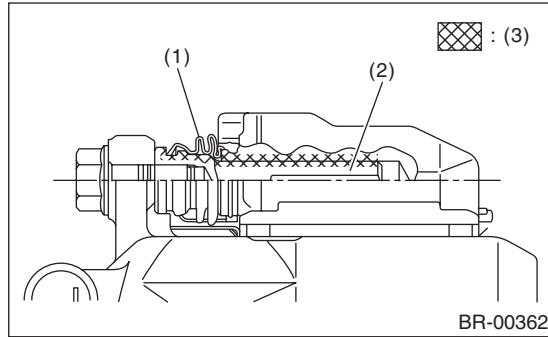
(4) Piston seal

7) Apply a coat of specified grease to the lock pin and guide pin outer surface, cylinder inner surface, and boot grooves.

**Grease:**

***NIGLUBE RX-2 (Part No. 000041000)***

8) Insert the lock pin and guide pin boot into the support.



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Grease applied area

## 2. 17-INCH TYPE

Refer to 16-inch type. <Ref. to BR-20, 16-INCH TYPE, ASSEMBLY, Front Disc Brake Assembly.>

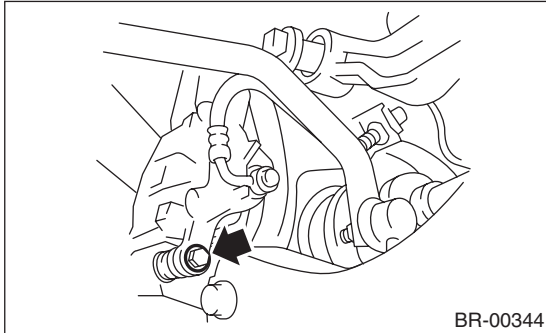
### E: INSPECTION

- 1) Repair or replace the faulty parts.
- 2) Check the caliper body and piston for uneven wear, damage or rust.
- 3) Check the rubber parts for damage or deterioration.

## 5. Rear Brake Pad

### A: REMOVAL

- 1) Lift up the vehicle, then remove the rear wheels.
- 2) Remove the caliper bolt.



- 3) Raise the caliper body and support it.

**NOTE:**

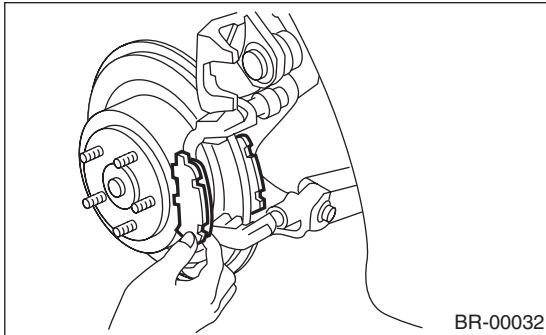
Do not disconnect the brake hose from the caliper body.

- 4) Remove the pad.

**NOTE:**

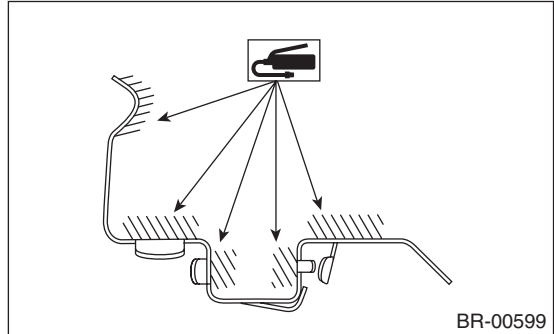
If it is difficult to remove the brake pad, use the same procedure as front disc brake pad.

<Ref. to BR-13, REMOVAL, Front Brake Pad.>



### B: INSTALLATION

- 1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



- 2) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to the contact surface between the pad and shim.

- 3) Install the pad to support.

- 4) Install the caliper body to the support.

**Tightening torque:**

**Solid disc brake model**

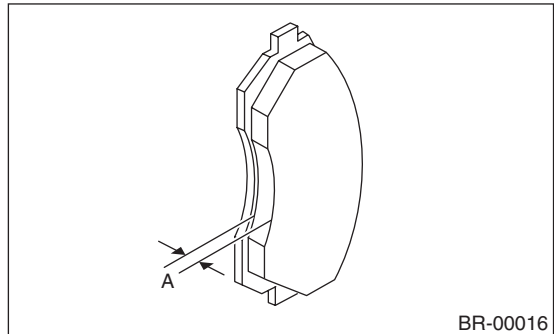
**27 N·m (2.8 kgf-m, 19.9 ft-lb)**

**Ventilated disc brake model**

**37 N·m (3.7 kgf-m, 27.2 ft-lb)**

### C: INSPECTION

Check the pad thickness A.



Type of disc rotor		Solid	Ventilated
Pad thickness	Standard	9.0 (0.35)	9.0 (0.35)
	Wear limit	1.5 (0.059)	1.5 (0.059)

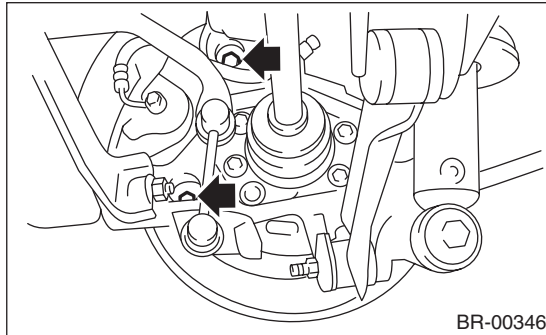
**NOTE:**

- Always replace the pads of both sides as a set.
- Replace pad clips if they are twisted or worn.
- A wear indicator is installed on the inner disc brake pad. If the pad is worn to the limit, the end of wear indicator contacts disc rotor, and a squeaking sound is heard as the wheel rotates. If the sound is heard, replace the pad.
- Replace the pad if there is oil or grease on it.

## 6. Rear Disc Rotor

### A: REMOVAL

- 1) Lift up the vehicle, then remove the rear wheels.
- 2) Release the parking brake.
- 3) Remove the two mounting bolts, and remove the disc brake assembly.

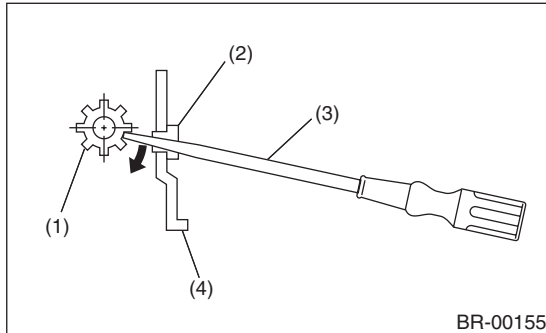


- 4) Suspend the disc brake assembly so that the hose is not stretched.
- 5) Remove the disc rotor.

#### NOTE:

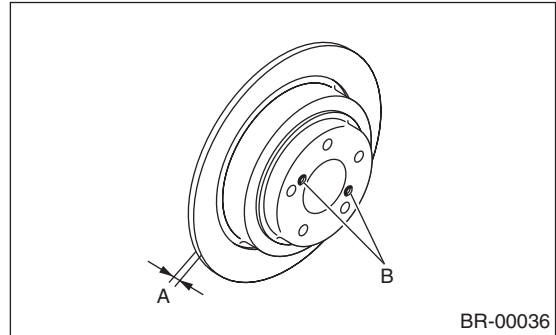
If it is difficult to remove the disc rotor, perform the following two methods in order.

- (1) Turn the adjusting screw using a flat tip screwdriver until the brake shoe is far enough away to allow removal of the disc rotor.



- (1) Adjusting screw
- (2) Cover
- (3) Flat tip screwdriver
- (4) Back plate

- (2) If it is difficult to remove the disc rotor from the hub, drive an 8 mm bolt into the threads B of the rotor, then remove the rotor.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the parking brake. <Ref. to PB-8, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

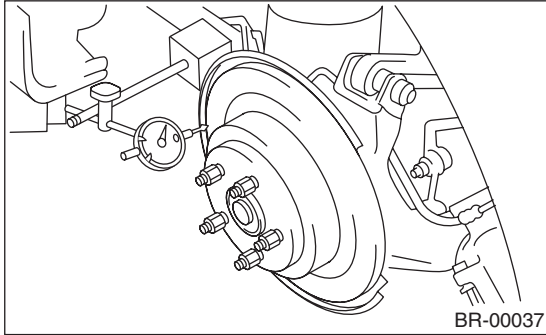


# Rear Disc Rotor

## BRAKE

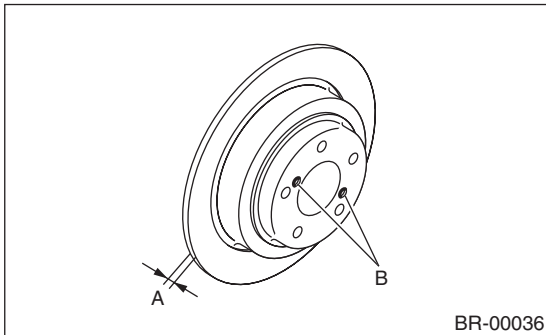
### C: INSPECTION

- 1) Check the rear wheel bearing play and axle hub runout before inspecting the disc rotor runout limit. <Ref. to DS-22, INSPECTION, Rear Hub Unit Bearing.>
- 2) Secure the disc rotor by tightening the five wheel nuts.
- 3) Set a dial gauge 10 mm (0.39 in) inward from the disc rotor outer circumference. Rotate the disc rotor to check runout. If the runout of disc rotor exceeds the service limit, resurface the disc rotor. After resurfacing, check disc rotor thickness as in step 4).



**Disc rotor runout limit:**  
**0.05 mm (0.0020 in)**

- 4) Set a micrometer 10 mm (0.39 in) inward from the disc rotor outer perimeter, and then measure the disc rotor thickness. If the thickness of disc rotor exceeds the service limit, replace with a new disc rotor.



		Standard	Limit	Disc outer dia.
Disc rotor thickness A mm (in)	Solid disc	10 (0.39)	8.5 (0.335)	274 (10.79)
	Ventilated disc	18 (0.71)	16 (0.63)	290 (11.42)

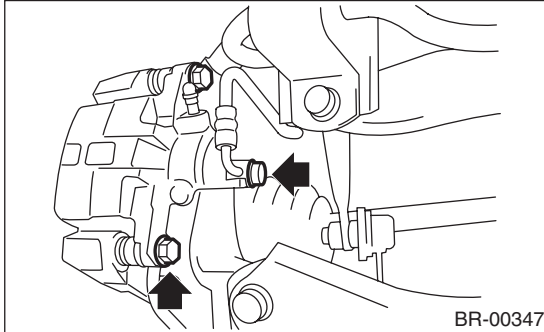
## 7. Rear Disc Brake Assembly

### A: REMOVAL

**CAUTION:**

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

- 1) Lift up the vehicle, then remove the rear wheels.
- 2) Disconnect the brake hose from caliper body assembly.
- 3) Remove the caliper lower bolt.



- 4) Raise the caliper body, and then move it toward vehicle center to separate it from the support.
- 5) Remove the support from housing.

**NOTE:**

Remove the support only when replacing the rotor or support. It need not be removed when servicing the caliper body assembly.

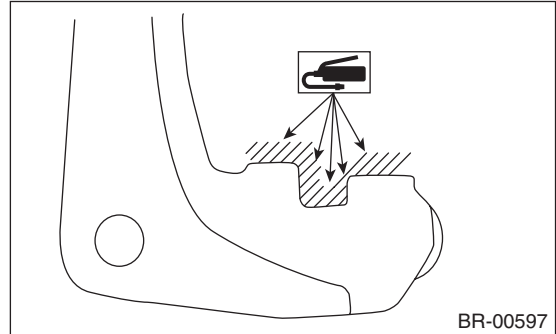
- 6) Remove mud and foreign matter from the caliper body assembly and the support.

**CAUTION:**

Be careful not to allow foreign matter to enter the brake hose connector.

### B: INSTALLATION

- 1) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the support.

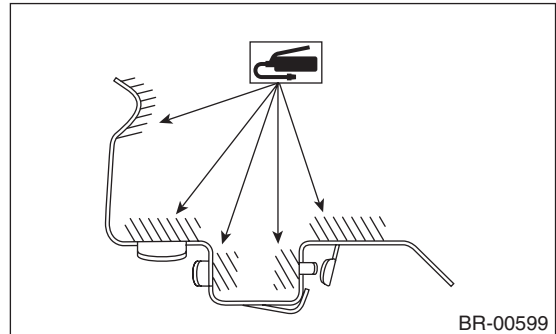


- 2) Install the support to the housing.

**Tightening torque:**

**66 N·m (6.7 kgf-m, 48.7 ft-lb)**

- 3) Apply a thin coat of Molykote M7439 (Part No. K0777YA000) to the pad clip.



- 4) Apply a thin coat of Molykote AS880N (Part No. K0779YA010) to the contact surface between the pad and shim.
- 5) Install the pad to support.
- 6) Install the caliper body to the support.

**Tightening torque:**

**Solid disc brake model**

**27 N·m (2.8 kgf-m, 19.9 ft-lb)**

**Ventilated disc brake model**

**37 N·m (3.7 kgf-m, 27.2 ft-lb)**

- 7) Connect the brake hose using a new brake hose gasket.

**Tightening torque:**

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**

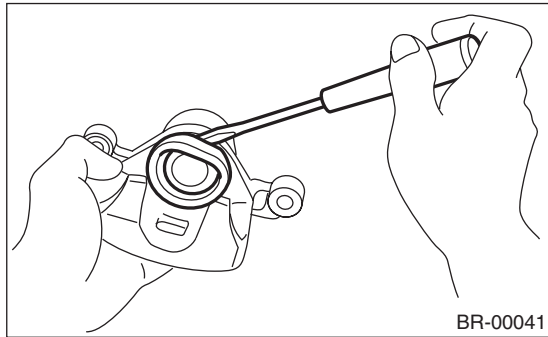
- 8) Bleed air from the brake system.

# Rear Disc Brake Assembly

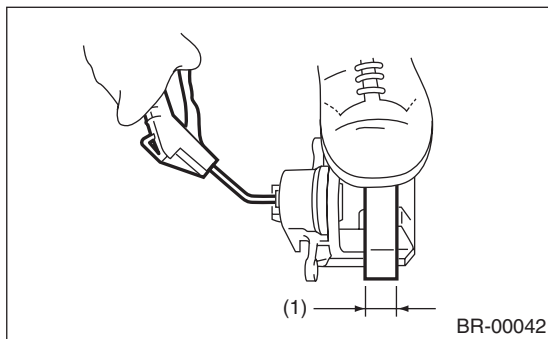
## BRAKE

### C: DISASSEMBLY

- 1) Remove the piston boot.



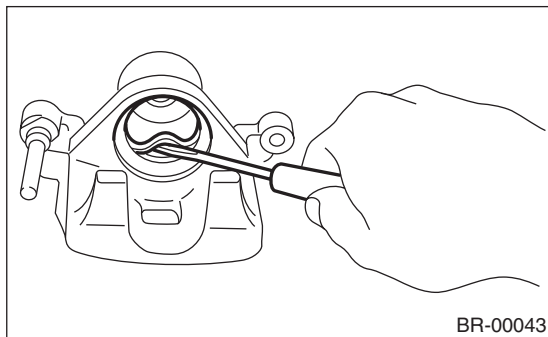
- 2) Place a wooden block in the caliper body as shown in the figure to prevent the piston from jumping out and being damaged.
- 3) Gradually apply compressed air via the brake hose installation hole to push the piston out.



- (1) Place a wooden block of 30 mm (1.18 in) width.

- 4) Remove the piston seal from caliper body cylinder.

**CAUTION:**  
Do not damage the cylinder and piston seal groove.



- 5) Remove the lock pin sleeve and boot from caliper body.
- 6) Remove the guide pin boot.

### D: ASSEMBLY

- 1) Clean the inside of the caliper body using brake fluid.
- 2) Apply a coat of brake fluid to piston seal and install piston seal in the groove on caliper body.
- 3) Apply a coat of brake fluid to the inner surface of cylinder and the entire outer surface of the piston.
- 4) Apply a coat of specified grease to the boot and fit to the groove on the ends of cylinder.

**Grease:**

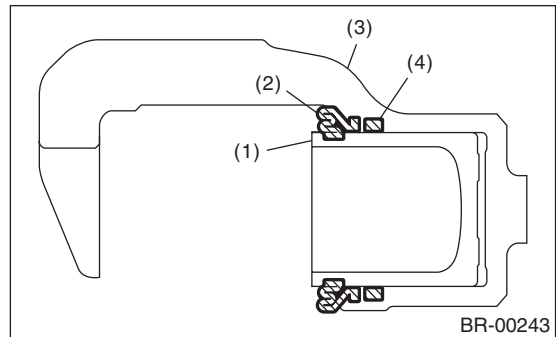
**NIGLUBE RX-2 (Part No. 000041000)**

- 5) Insert the piston into cylinder.

**CAUTION:**

**Do not force the piston into cylinder.**

- 6) Position the boot in the grooves on piston and cylinder.

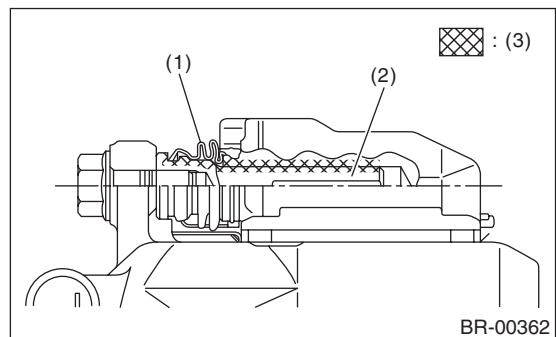


- (1) Piston
- (2) Piston boot
- (3) Caliper body
- (4) Piston seal

- 7) Apply a coat of specified grease to the guide pin, outer surface, sleeve outer surface, cylinder inner surface, and boot grooves.

**Grease:**

**NIGLUBE RX-2 (Part No. 000041000)**



- (1) Pin boot
- (2) Lock pin or guide pin
- (3) Grease applied area

- 8) Insert the guide pin boot to the support.
- 9) Install the lock pin boot to the support, and then insert the lock pin sleeve into the specified position.

### **E: INSPECTION**

- 1) Repair or replace the faulty parts.
- 2) Check the caliper body and piston for uneven wear, damage or rust.
- 3) Check the rubber parts for damage or deterioration.

## 8. Master Cylinder

### A: REMOVAL

**CAUTION:**

Do not allow brake fluid to come in contact with vehicle body. If it does, wash off with water and wipe away completely.

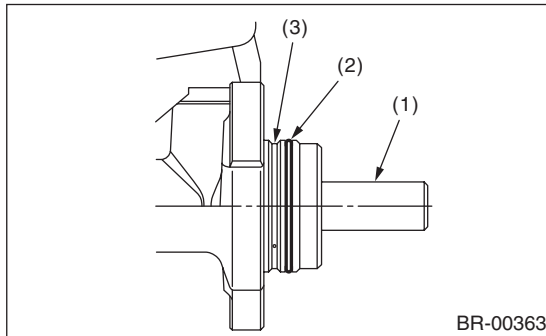
- 1) Drain brake fluid from the reservoir tank completely.
- 2) Disconnect the harness connector of the fluid level gauge.
- 3) Remove the brake pipe from the master cylinder.
- 4) Remove the master cylinder mounting nuts, and remove the master cylinder from the brake booster.

### B: INSTALLATION

- 1) Replace the O-ring for the master cylinder with a new part.

**CAUTION:**

Be careful not to install the O-ring in the wrong location.



- (1) Primary piston
- (2) O-ring
- (3) Do not install the O-ring on this groove.

- 2) Install in the reverse order of removal.

**Tightening torque:**

**Master cylinder mounting nut**  
**13 N·m (1.3 kgf-m, 9.6 ft-lb)**

**Piping flare nut**  
**Model with ABS**  
**15 N·m (1.5 kgf-m, 10.8 ft-lb)**  
**Model with VDC**  
**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

**CAUTION:**

Be sure to use recommended brake fluid.  
 3) Bleed air from brake system. <Ref. to BR-36, PROCEDURE, Air Bleeding.>

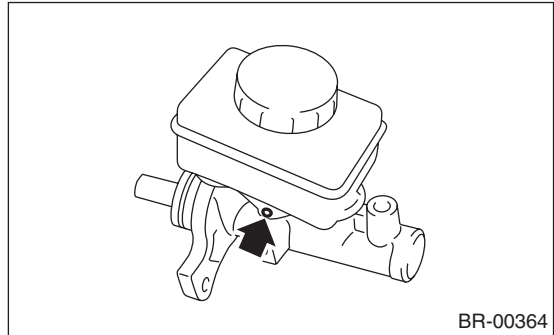
### C: REPLACEMENT

- 1) Remove mud and dirt from the surface of brake master cylinder.
- 2) Secure the master cylinder in a vise.

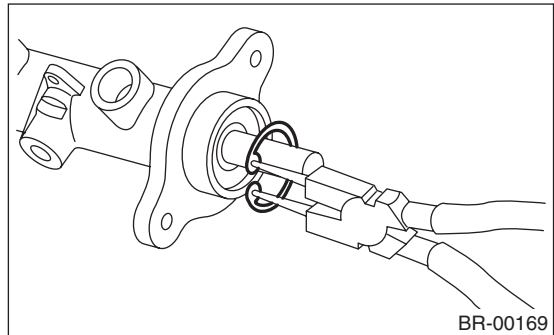
**NOTE:**

To avoid damaging the master cylinder, place between aluminum plates or other material when holding with a vise.

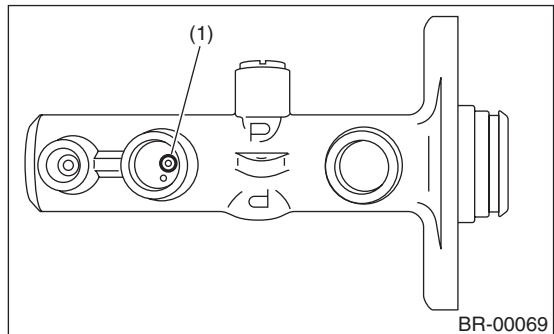
- 3) Remove the pin which secures the master cylinder and reservoir tank, then remove the reservoir tank and seal.



- 4) While pushing in the primary piston, remove the C-ring using pliers.



- 5) While pushing in the primary piston, remove the straight pin from the port on the reservoir tank attachment location using a magnet pick-up tool.



- (1) Straight pin

- 6) Extract the primary piston assembly and secondary piston assembly straight out while taking care not to scratch the inner surface of the cylinder.

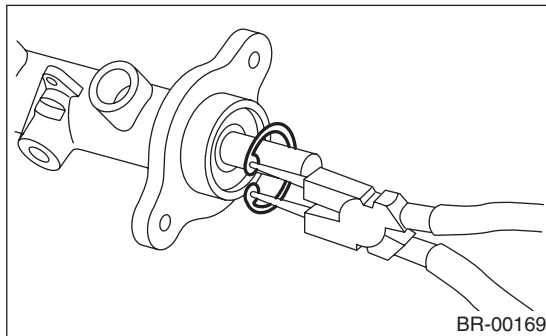
7) Clean the inside of master cylinder with brake fluid. Check the inside of the cylinder for damage, deformation and wear. Replace the master cylinder as assembly if faulty.

8) Apply brake fluid to the inner surface of master cylinder and piston assembly.

9) Make sure that the inner surface of master cylinder and the piston assembly are free of foreign matter. Install the primary piston assembly and the secondary piston assembly to master cylinder, while taking care not to scratch the master cylinder inner surface.

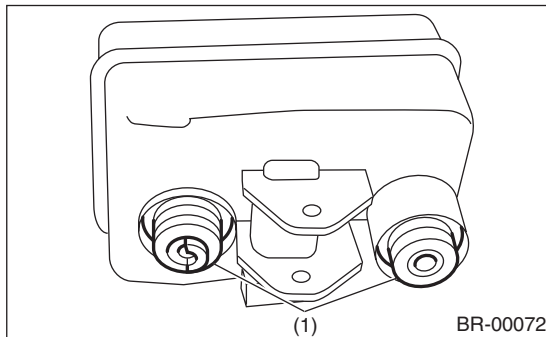
10) While pushing-in the primary piston, install the cylinder pin.

11) While pushing-in the primary piston, install the C-ring to the groove using pliers.



**CAUTION:**  
Make sure the C-ring is installed to the groove securely.

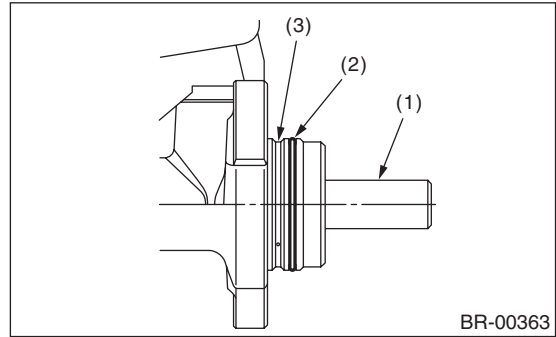
12) Install the seal to reservoir tank.



(1) Seal

13) Install the reservoir tank to the master cylinder, and secure with pin.

14) Replace the O-ring for the master cylinder with a new part.



(1) Primary piston

(2) O-ring

(3) Do not install the O-ring on this groove.

## D: INSPECTION

Inspect for oil leakage from the master cylinder.

### NOTE:

After replacing the piston kit, if an oil leakage is found even though there is no damage or scratches on the inside of the cylinder, the master cylinder inner wall may be worn. In this case, replace the master cylinder as an assembly.

## 9. Brake Booster

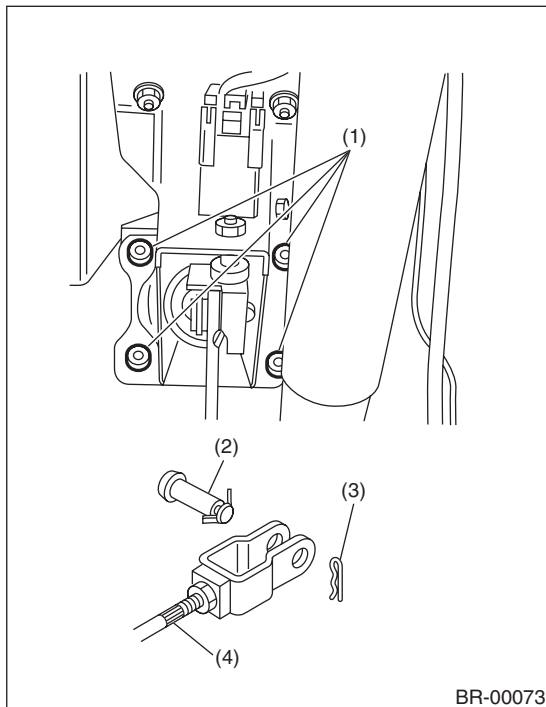
### A: REMOVAL

1) Remove or disconnect the following parts in the engine compartment.

- (1) Disconnect the connector of brake fluid level gauge.
- (2) Remove the brake pipe from the master cylinder.
- (3) Remove the master cylinder installation nut.
- (4) Disconnect the vacuum hose from brake booster.

2) Remove the following parts from the pedal bracket.

- (1) Snap pin and clevis pin
- (2) Four brake booster installation nuts



- (1) Nut
- (2) Clevis pin
- (3) Snap pin
- (4) Operating rod

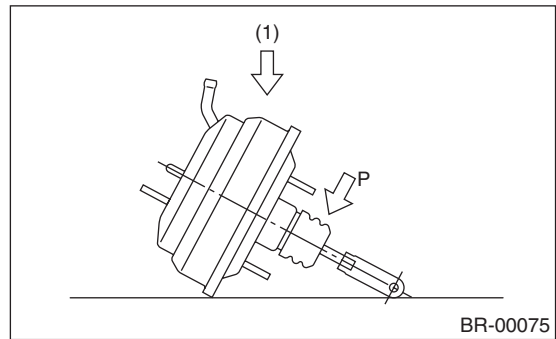
3) Remove the brake booster while avoiding the brake pipe.

#### NOTE:

- Make sure that the booster shell and vacuum pipe are not subject to strong impacts.
- Be careful not to drop the brake booster. If the booster is dropped, replace it.
- Use special care when handling the operating rod. If excessive force is applied to the operating rod, the angle may change by  $\pm 3^\circ$ , and it may result in damage to power piston cylinder.
- Be careful when placing the brake booster on floor.
- Do not change the push rod length.

#### CAUTION:

- **Do not disassemble the brake booster.**
- **If external force is applied from above when brake booster is placed in this position, the resin portion as indicated by "P" may become damaged.**



- (1) Force

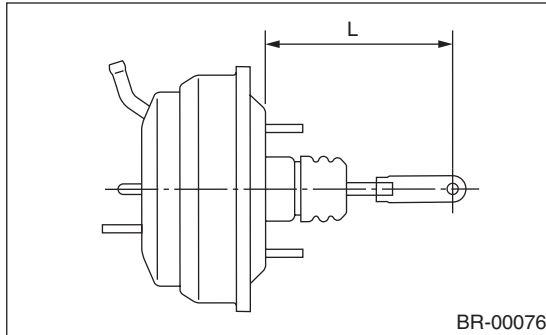
## B: INSTALLATION

1) Check and adjust the operating rod of the brake booster.

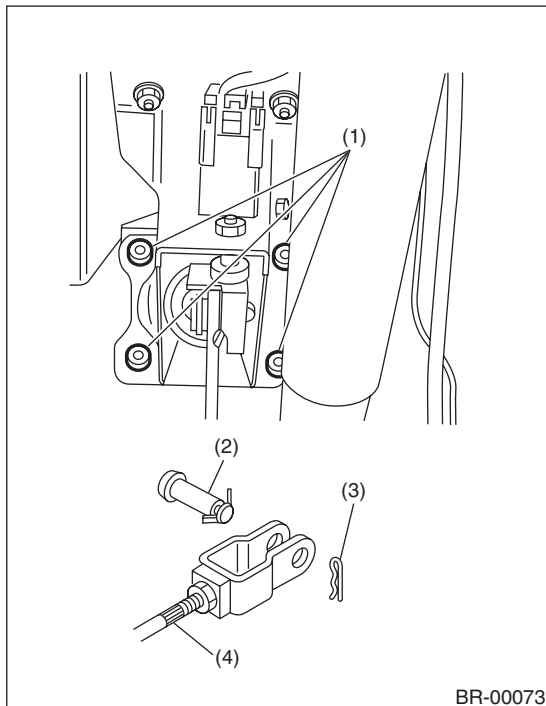
### Specification L:

**136.5 mm (5.38 in)**

If it is out of specification, adjust it with the brake booster operating rod.



- 2) Mount the brake booster in position.
- 3) Connect the operating rod to brake pedal with clevis pin and snap pin.



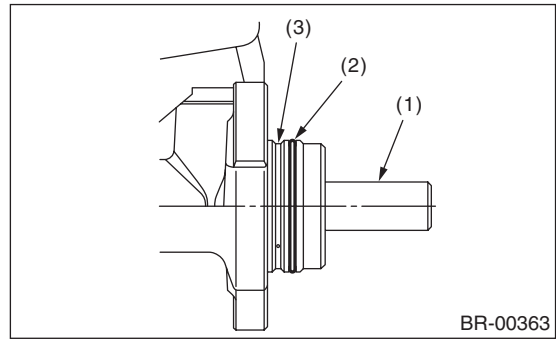
- (1) Nut
- (2) Clevis pin
- (3) Snap pin
- (4) Operating rod

### NOTE:

Apply a thin coat of SUNLIGHT 2 (Part No. 003602010) to the clevis pin.

4) Connect the vacuum hose to the brake booster.

5) After replacing the O-ring, install the master cylinder to brake booster.



- (1) Primary piston
- (2) O-ring
- (3) Do not install the O-ring on this groove.

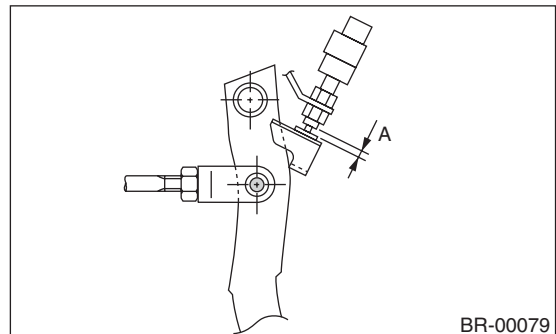
- 6) Connect the brake pipes to the master cylinder.
- 7) Connect the connector of the brake fluid level gauge.
- 8) Measure the clearance between the threaded end of the stop light switch and the stopper. If it is not within the specification, adjust it by adjusting the position of the stop light switch. <Ref. to BR-45, ADJUSTMENT, Stop Light Switch.>

### CAUTION:

**Be careful not to rotate the stop light switch.**

### Stop light switch clearance A:

**0.3 mm (0.012 in)**



- 9) Apply grease to the operating rod connecting pin to prevent it from wear.
- 10) Bleed air from brake system.

### Tightening torque (air bleeder screw):

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**

11) Perform a road test to make sure the brakes do not drag.



# Brake Booster

## BRAKE

### C: INSPECTION

#### 1. OPERATION CHECK (WITHOUT GAUGES)

##### CAUTION:

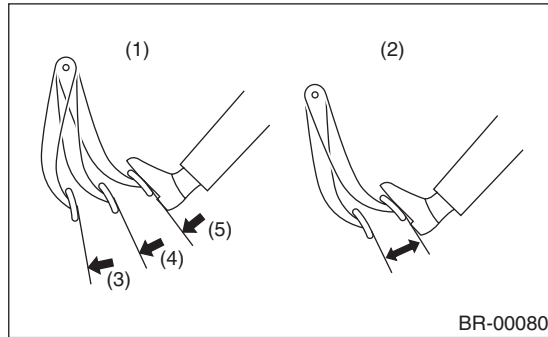
When checking operation, be sure to apply the parking brake securely.

##### • Check without gauges

This method can not determine exactly what part is defective. But it is possible to identify the outline of the defect by performing the check according to the following procedures.

##### • Air tightness check

Start the engine, and idle it for 1 to 2 minutes, then turn it OFF. Depress the brake pedal several times applying the normal pedal force. The pedal stroke should be the longest at the 1st depression, and it should become shorter at each successive depression. If no change occurs in the pedal height when pressed, the brake booster is faulty.



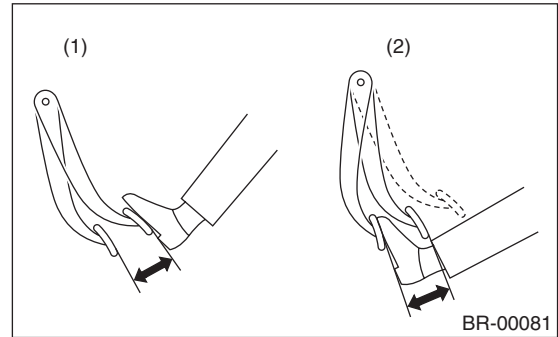
- (1) Normal operation
- (2) Not OK
- (3) 1st
- (4) 2nd
- (5) 3rd

##### NOTE:

- In case of defective operation, inspect the condition of the check valve and vacuum hose as well.
- Replace them if faulty, and perform the test again.
- If no improvement is observed, check precisely with gauges.

##### • Operation check

- 1) While the engine is OFF, depress the brake pedal several times applying the same pedal force, to check for a change in pedal height.



- (1) When engine is stopped
- (2) When engine is started

- 2) With the brake pedal depressed, start the engine.

- 3) As the engine starts, the brake pedal should move slowly toward the floor. If the pedal height does not change, the brake booster is faulty.

##### NOTE:

If faulty, check precisely with gauges.

##### • Loaded air tightness check

Depress the brake pedal while the engine is running, and turn the engine to OFF while the pedal is depressed. Keep the pedal depressed for 30 seconds. If the pedal height does not change, the function of brake booster is normal. If the pedal height increases, it is faulty.

##### NOTE:

If faulty, check precisely with gauges.

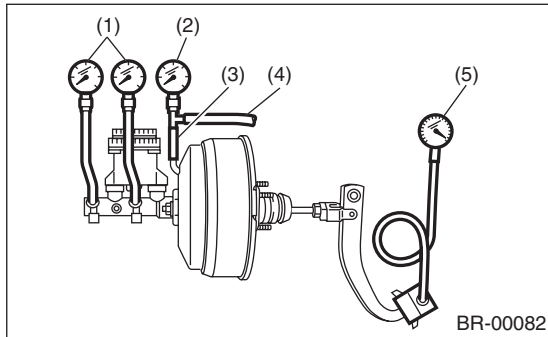
## 2. OPERATION CHECK (WITH GAUGES)

### CAUTION:

When checking operation, be sure to apply the parking brake securely.

#### • Check with gauges

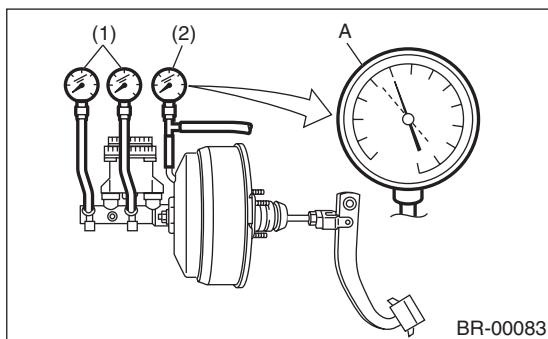
Connect the gauge as shown in the figure. After bleeding air from the pressure gauge, perform the checks.



- (1) Pressure gauge
- (2) Vacuum gauge
- (3) Adapter hose
- (4) Vacuum hose
- (5) Pedal force gauge

#### • Air tightness check

1) Start the engine and keep it running until vacuum pressure indicates point A of the vacuum gauge = 66.7 kPa (500 mmHg, 19.69 inHg). Do not depress the brake pedal at this time.



- (1) Pressure gauge
- (2) Vacuum gauge

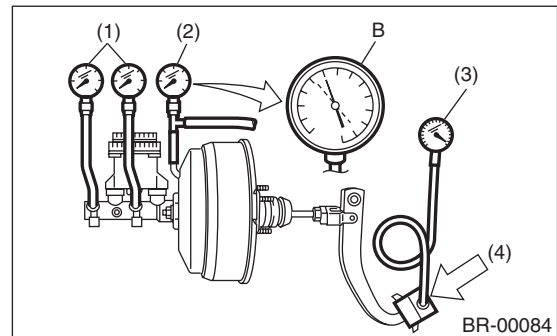
2) Stop the engine and check the gauge. If the vacuum pressure drop within 15 seconds after stopping the engine is 3.3 kPa (25 mmHg, 0.98 inHg) or less, the function of brake booster is normal.

If faulty, the cause may be one of the following.

- Check valve malfunction
- Leak from vacuum hose
- Leak from shell joint section or stud bolt welded section
- Damaged diaphragm
- Leak from valve body seal and bearing section
- Leak from plate and seal assembly section
- Leak from poppet valve assembly section

#### • Loaded air tightness check

1) Start the engine and depress the brake pedal with a pedal force of 196 N (20 kgf, 44 lb). Keep the engine running and keep the pedal pressed until a vacuum of point B = 66.7 kPa (500 mmHg, 19.69 inHg) is indicated on the vacuum gauge.



- (1) Pressure gauge
- (2) Vacuum gauge
- (3) Pedal force gauge
- (4) Depressed

# Brake Booster

## BRAKE

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2) Stop the engine and check the vacuum gauge. If the vacuum pressure drop within 15 seconds after stopping the engine is 3.3 kPa (25 mmHg, 0.98 inHg) or less, the function of brake booster is normal.

If defective, refer to "AIR TIGHTNESS CHECK".

<Ref. to BR-32, INSPECTION, Brake Booster.>

3) If the brake booster is faulty, replace it with a new part.

### • Lack of boost action check

Turn the engine OFF, and set the value of the vacuum gauge to "0". Then, check the fluid pressure when the brake pedal is depressed. The pressure must be greater than the specification listed.

Brake pedal operation force N (kgf, lb)	147 (15, 33)	294 (30, 66)
Fluid pressure kPa (kg/cm <sup>2</sup> , psi)	545 (6, 79)	1,564 (16, 227)

### • Boosting action check

Set the vacuum gauge reading to 66.7 kPa (500 mmHg, 19.69 inHg) with the engine running. Then, check the fluid pressure when the brake pedal is depressed. The pressure must be greater than the specification listed.

Brake pedal operation force N (kgf, lb)	147 (15, 33)	294 (30, 66)
Fluid pressure kPa (kg/cm <sup>2</sup> , psi)	6,003 (61, 871)	11,273 (115, 1,635)

## 10.Brake Fluid

### A: INSPECTION

1) Check that the brake fluid level is between “MIN” and “MAX”. If out of the specified range, refill or drain fluid. If the fluid level is close to “MIN”, check the brake pad for wear and refill the fluid.

2) Check the fluid for discoloration. If the fluid color has changed excessively, drain the fluid and refill with new fluid.

### B: REPLACEMENT

#### CAUTION:

- Do not let brake fluid come into contact with the painted surface of the vehicle body. Wash away with water immediately and wipe off if it is spilled by accident.
- Avoid mixing brake fluid of different brands to prevent fluid performance from degrading.
- Be careful not to allow dirt or dust to enter the reservoir tank.

#### NOTE:

- During the operation, keep the reservoir tank filled with brake fluid to eliminate entry of air.
  - Operate the brake pedal slowly.
  - For convenience and safety, two people should work together.
  - The required amount of brake fluid is approximately 500 ml (16.9 US fl oz, 17.6 Imp fl oz) for the entire brake system.
- 1) Lift up the vehicle and set rigid racks at the specified locations, or keep the vehicle lifted.
  - 2) Remove both the front and rear wheels.
  - 3) Drain brake fluid from the reservoir tank.
  - 4) Refill the reservoir tank with the recommended brake fluid.

#### **Recommended brake fluid:**

**Refer to the specification. <Ref. to BR-2, SPECIFICATION, General Description.>**

Perform the same procedure as for bleeding the brake line, until new brake fluid comes out from vinyl tube. <Ref. to BR-36, PROCEDURE, Air Bleeding.>

## 11. Air Bleeding

### A: PROCEDURE

**CAUTION:**

- Do not let brake fluid come into contact with the painted surface of the vehicle body. Wash away with water immediately and wipe off if it is spilled by accident.
- Avoid mixing brake fluid of different brands to prevent fluid performance from degrading.
- Be careful not to allow dirt or dust to enter the reservoir tank.

#### 1. MASTER CYLINDER

**NOTE:**

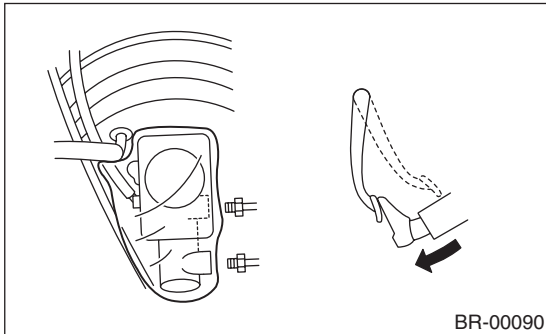
- When the master cylinder is disassembled or the reservoir tank is empty, bleed the master cylinder.
- If bleeding of the master cylinder is not necessary, omit the following procedures, and perform bleeding of the brake line. <Ref. to BR-36, BRAKE LINE, PROCEDURE, Air Bleeding.>

1) Fill the reservoir tank of the master cylinder with brake fluid.

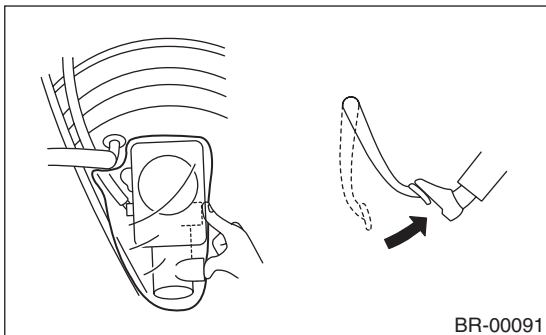
**NOTE:**

While bleeding air, keep the reservoir tank filled with brake fluid to prevent entry of air.

- 2) Disconnect the brake line at primary and secondary sides.
- 3) Wrap the master cylinder with a plastic bag.
- 4) Depress the brake pedal slowly and hold it.



5) Plug the outlet plug with your finger, and then release the brake pedal.



- 6) Repeat the step 4) and 5) several times.
- 7) Remove the plastic bag.

8) Install the brake pipe to the master cylinder.

**Tightening torque:**

**Model with ABS**

**15 N·m (1.5 kgf-m, 10.8 ft-lb)**

**Model with VDC**

**19 N·m (1.9 kgf-m, 14.0 ft-lb)**

9) Bleed air from the brake line. <Ref. to BR-36, BRAKE LINE, PROCEDURE, Air Bleeding.>

#### 2. BRAKE LINE

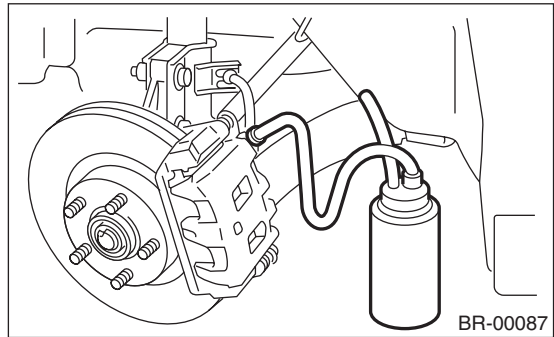
1) When the master cylinder is disassembled or the reservoir tank is empty, bleed the master cylinder before bleeding the brake line. <Ref. to BR-36, MASTER CYLINDER, PROCEDURE, Air Bleeding.>

2) Fill the reservoir tank of the master cylinder with brake fluid.

**NOTE:**

While bleeding air, keep the reservoir tank filled with brake fluid to prevent entry of air.

3) Attach one end of the vinyl tube to the air bleeder and the other end to the brake fluid container.



4) Depress the brake pedal several times, and hold it.

5) Loosen the air bleeder screw to drain brake fluid. Tighten the air bleeder quickly, and release the brake pedal.

6) Repeat the steps 4) to 5) until there are no more air bubbles in the vinyl tube.

7) Repeat the steps from 2) to 6) above to bleed air from each wheel.

**NOTE:**

Perform the operation in the order from the farthest wheel cylinder from the master cylinder.

8) Securely tighten the air bleeder screws.

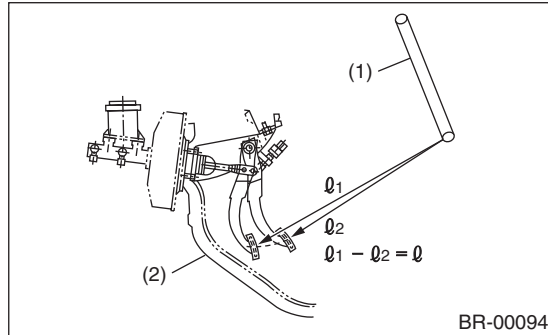
**Tightening torque:**

**8 N·m (0.8 kgf-m, 5.8 ft-lb)**

9) Check that there are no brake fluid leaks in the entire system.

10) Check the pedal stroke.

Run the engine at idle after warming up the engine, and depress the brake pedal with a force of 500 N (51 kgf, 112 lb). Measure the distance between the brake pedal and steering wheel. Release the pedal, and measure the distance between pedal and steering wheel again.



- (1) Steering wheel
- (2) Toe board

**Specification of pedal stroke:**

**When depressing the pedal with a force of 500 N (51 kgf, 112 lbf).**

**95 mm (3.74 in) or less**

11) If the distance is more than specification, there is a possibility of air being caught in the brake line. Bleed the brake line of all air until the pedal stroke meets the specification.

12) Operate the hydraulic control unit in the sequence control mode. <Ref. to ABS-10, ABS Sequence Control.>

13) Check the pedal stroke again.

14) If the distance is more than specification, there is a possibility of air being caught in the hydraulic unit. Repeat above steps 2) to 9) until the pedal stroke meets the specification.

15) Fill the reservoir tank with brake fluid up to the "MAX" level.

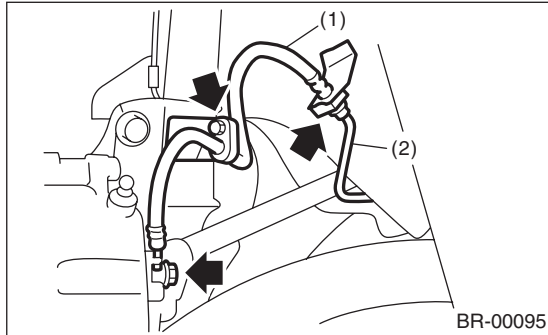
16) Test run the vehicle and ensure that the brakes operate normally.

## 12.Brake Hose

### A: REMOVAL

#### 1. FRONT BRAKE HOSE

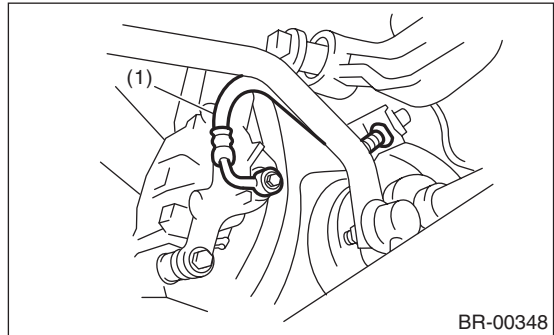
- 1) Separate the brake pipe from brake hose using a flare nut wrench.
- 2) Remove the clamp, the strut mount bolts, and union bolt.



- (1) Brake hose
- (2) Brake pipe

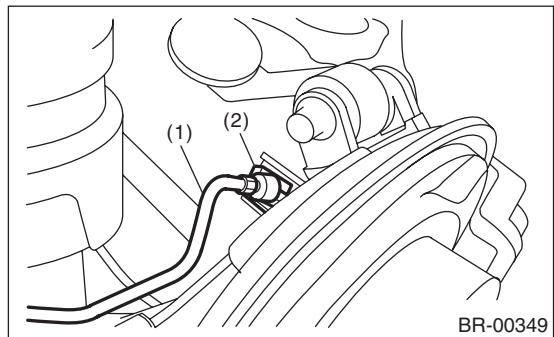
#### 2. REAR BRAKE HOSE

- 1) Remove the union bolt from the rear brake caliper.

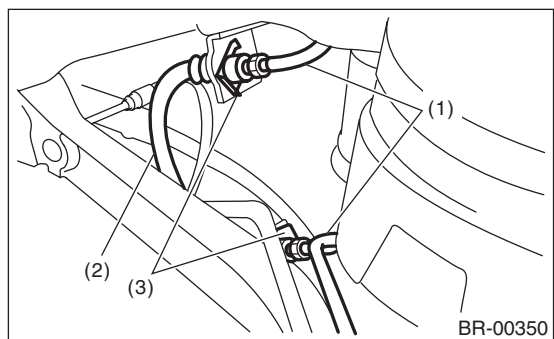


- (1) Brake hose

- 2) Separate the brake pipe from brake hose using a flare nut wrench.
- 3) Remove the clamp, and then remove the brake hose.



- (1) Brake pipe
- (2) Brake hose clamp



- (1) Brake pipe
- (2) Brake hose
- (3) Brake hose clamp

## B: INSTALLATION

### 1. FRONT BRAKE HOSE

- 1) Secure the brake hose to strut mount.

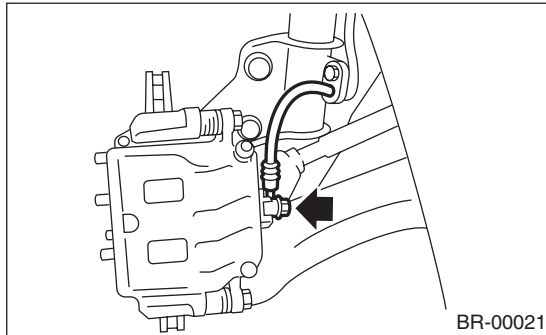
**Tightening torque:**

**33 N·m (3.4 kgf-m, 24.3 ft-lb)**

- 2) Install the brake hose to the caliper using a new gasket.

**Tightening torque (union bolt):**

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**



- 3) Position the disc in straight position and route the brake hose through the hole in the bracket on the wheel apron side.

**CAUTION:**

**Do not twist the brake hose.**

- 4) Temporarily tighten the flare nut which connects brake pipe and hose.
- 5) Secure the brake hose to wheel apron bracket with clamp.
- 6) Tighten the flare nut to the specified torque.

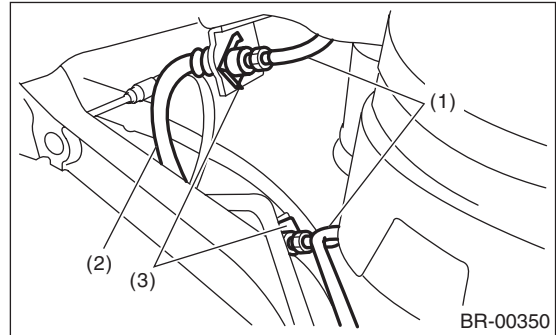
**Tightening torque (brake pipe flare nut):**

**15 N·m (1.5 kgf-m, 10.8 ft-lb)**

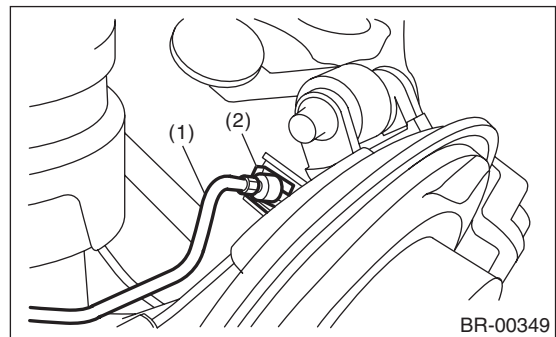
- 7) Bleed air from brake system.

### 2. REAR BRAKE HOSE

- 1) Route the brake hose through the hole of bracket, and lightly tighten the flare nut to connect brake pipe.
- 2) Insert the clamp to secure brake hose.



- (1) Brake pipe
- (2) Brake hose
- (3) Brake hose clamp

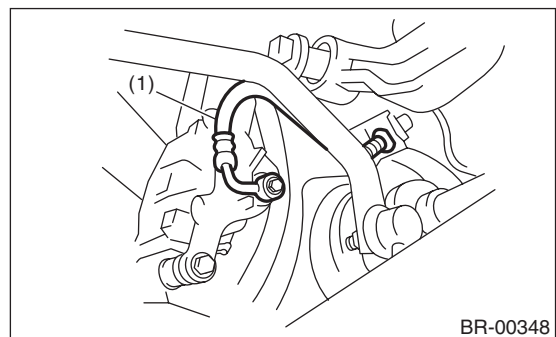


- (1) Brake pipe
- (2) Brake hose clamp

- 3) Install the brake hose to rear brake caliper using a new gasket.

**Tightening torque (union bolt):**

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**



- (1) Brake hose

- 4) Tighten the flare nut to the specified torque.

**Tightening torque (brake pipe flare nut):**

**15 N·m (1.5 kgf-m, 10.8 ft-lb)**

- 5) Bleed air from the brake system.



### **C: INSPECTION**

Make sure there are no cracks, breakage or damage on hoses. Check the joint for fluid leakage. If any cracks, breakage, damage or fluid leakage is found, repair or replace the hose.

## 13. Brake Pipe

### A: REMOVAL

NOTE:

The airbag system wiring harness is routed near the center brake pipe.

**CAUTION:**

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the center brake pipe.
- When removing the brake pipe, do not bend.

### B: INSTALLATION

NOTE:

The airbag system wiring harness is routed near the center brake pipe.

**CAUTION:**

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the center brake pipe.
- When installing the brake pipe, do not bend.
- After installing the brake pipe and hose, perform air bleed.
- After installing the brake hoses, make sure that they do not contact the tires or suspension assembly, etc.

**Brake pipe tightening torque:**

*<Ref. to BR-7, FRONT BRAKE PIPES AND HOSES, COMPONENT, General Description.>*

*<Ref. to BR-8, CENTER AND REAR BRAKE PIPES AND HOSES, COMPONENT, General Description.>*

### C: INSPECTION

Make sure there are no cracks, breakage or damage on hoses. Check the joint for fluid leakage. If any cracks, breakage, damage or fluid leakage is found, repair or replace the pipes.

NOTE:

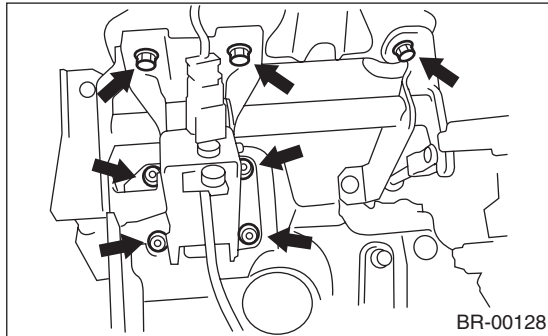
Use a mirror when inspecting back sides and other locations which are hard to see.

## 14. Brake Pedal

### A: REMOVAL

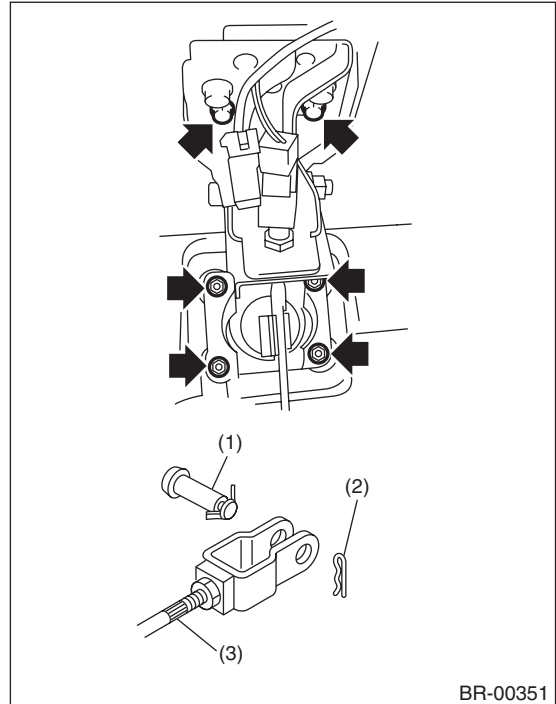
#### 1. MT MODEL

- 1) Remove the steering shaft.
- 2) Disconnect the connector (stop light switch etc.) from the pedal bracket.
- 3) Remove the clevis pin which secures the lever and push rod.
- 4) Remove the nut which secures the clutch master cylinder.
- 5) Remove the bolt and nut which secures the pedal bracket.



#### 2. AT MODEL

- 1) Remove the steering shaft.
- 2) Disconnect the connector (stop light switch etc.) from the pedal bracket.
- 3) Remove the clevis pin which secures the lever and push rod.
- 4) Remove the bolt and nut which secures the pedal bracket.



- (1) Clevis pin
- (2) Snap pin
- (3) Operating rod

### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### CAUTION:

**Always use a new clevis pin.**

- 2) Check the brake pedal after installation. <Ref. to BR-43, INSPECTION, Brake Pedal.>

## C: INSPECTION

1) Move the brake pedal pads in a horizontal direction with a force of approx. 10 N (1 kgf, 2 lb), and check that the pedal deflection is in the range of specifications.

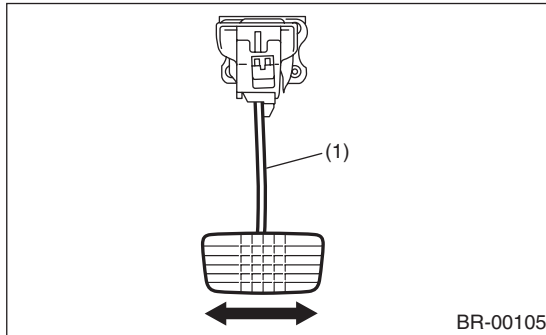
### CAUTION:

If excessive deflection is noted, replace with a new bushing.

### *Deflection of brake pedal:*

#### *Limit*

**5.0 mm (0.197 in) or less**



(1) Brake pedal

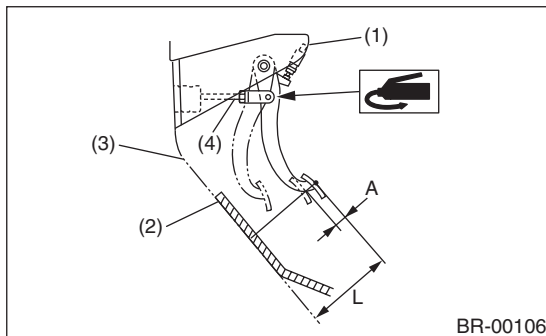
2) Check the position of the pedal pad.

### *Pedal height L:*

**150 — 160 mm (5.91 — 6.30 in)**

### *Brake pedal free play A:*

**0.5 — 2 mm (0.02 — 0.08 in) [When pulling the brake pedal upward with a force of less than 10 N (1 kgf, 2 lb).]**



- (1) Stop light switch
- (2) Mat
- (3) Toe board
- (4) Brake booster operating rod

3) If it is not within the specification, adjust it by adjusting the brake booster operating rod length.

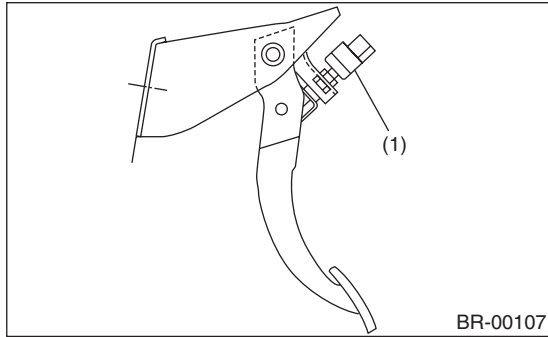
# Stop Light Switch

BRAKE

## 15. Stop Light Switch

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Disconnect the stop light switch connector.
- 3) Loosen the nuts, unscrew the stop light switch, and remove stop light switch.



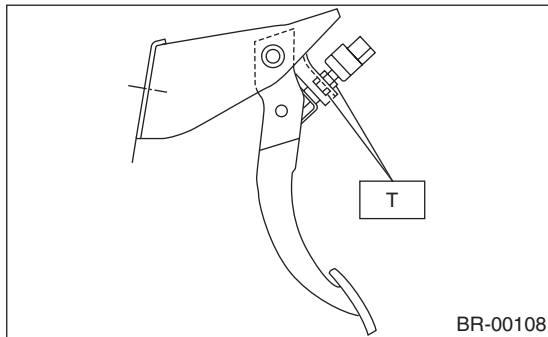
(1) Stop light switch

### B: INSTALLATION

- 1) Install the stop light switch onto the bracket with screws and position it with the nut.
  - 2) Adjust the stop light switch position, and then tighten the nut.
- <Ref. to BR-45, ADJUSTMENT, Stop Light Switch.>

#### Tightening torque:

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**

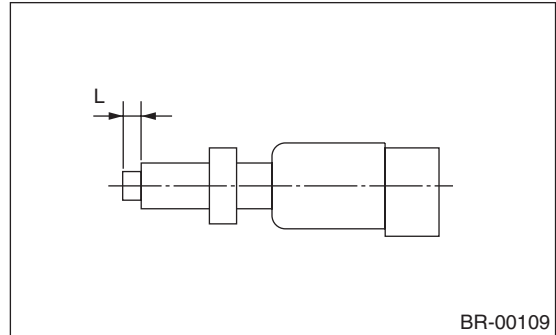


### C: INSPECTION

#### 1. CHECK SPECIFIED POSITION

- 1) If the stop light switch does not operate properly (or if it is not secured at the specified position), replace with a new part.

**Specified position L:**  
**2 mm (0.079 in)**

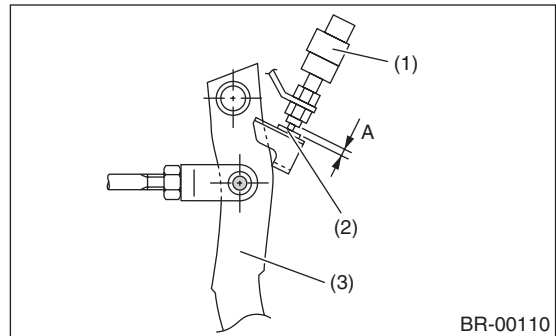


- 2) Measure the clearance between the threaded end of the stop light switch and the stopper.

#### CAUTION:

**Be careful not to rotate the stop light switch.**

**Stop light switch clearance A:**  
**0.3 mm (0.012 in)**



- (1) Stop light switch
- (2) Stopper
- (3) Brake pedal

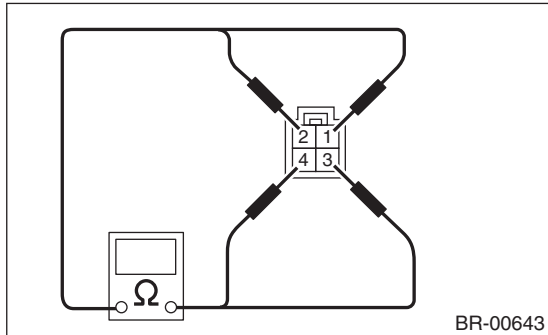
- 3) If it is not within the specification, adjust it by adjusting the position of the stop light switch.

#### CAUTION:

**Be careful not to rotate the stop light switch.**

## 2. CHECK RESISTANCE

- 1) If the stop light switch does not operate properly, replace with a new part.
- 2) Measure the resistance of stop light switch terminals.



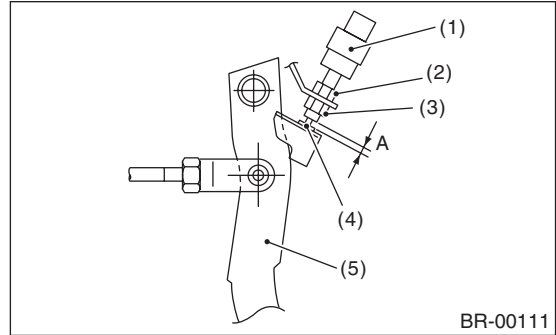
Pedal	Terminal No.	Standard value
Released	1 and 4	Less than 1 Ω
	2 and 3	1 MΩ or more
Depressed	1 and 4	1 MΩ or more
	2 and 3	Less than 1 Ω

## D: ADJUSTMENT

Loosen the lock nut, and adjust the stop light switch position until the clearance between the threaded end of the stop light switch and stopper (A) becomes 0.3 mm (0.012 in). Then, tighten the lock nut.

### Tightening torque:

**8 N·m (0.8 kgf·m, 5.8 ft·lb)**



- (1) Stop light switch
- (2) Lock nut A
- (3) Lock nut B
- (4) Stopper
- (5) Brake pedal

### NOTE:

Tighten lock nut B until the threaded end of switch contacts the stopper. Hold the switch so that it does not rotate, and loosen the lock nut B approx. 60°. The clearance (A) will become 0.3 mm (0.012 in).

# General Diagnostic Table

BRAKE

## 16. General Diagnostic Table

### A: INSPECTION

	Trouble and possible cause	Corrective action
<b>1. Insufficient braking</b>	(1) Fluid leakage from the hydraulic mechanism	Correct or replace. (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose)
	(2) Entry of air into the hydraulic mechanism	Bleed air.
	(3) Wear, deteriorated surface material, water or fluid on lining	Replace, grind or clean.
	(4) Improper operation of master cylinder, disc caliper, brake booster or check valve	Correct or replace.
<b>2. Unstable or uneven braking</b>	(1) Fluid on lining or rotor	Correct the cause of fluid leakage, and clean or replace.
	(2) Rotor defective	Repair or replace the rotor.
	(3) Improper lining contact, deteriorated surface, deteriorated or worn lining material	Repair by grinding, or replace.
	(4) Deformed back plate	Correct or replace.
	(5) Overinflation of tires	Adjust the air pressure.
	(6) Defective wheel alignment	Adjust alignment.
	(7) Loose back plate or support installation bolt	Tighten to the specified torque.
	(8) Faulty wheel bearing	Replace.
	(9) Defective hydraulic system	Replace the cylinder, brake pipe or hose.
	(10) Unstable performance of the parking brake	Check, adjust or replace the rear brake and cable system.
<b>3. Excessive pedal stroke</b>	(1) Entry of air into the hydraulic mechanism	Bleed air.
	(2) Excessive play in the master cylinder push rod	Adjust.
	(3) Fluid leakage from the hydraulic mechanism	Correct or replace. (cup, piston seal, piston boot, master cylinder piston kit, pipe or hose)
	(4) Improper lining contact or worn lining	Correct or replace.
<b>4. Brake dragging or improper brake return</b>	(1) Insufficient pedal play	Adjust play.
	(2) Improper master cylinder return	Clean or replace the cylinder.
	(3) Clogged hydraulic system	Replace.
	(4) Improper return or adjustment of parking brake	Repair or adjust.
	(5) Weakened spring tension or breakage of shoe return spring	Replace the spring.
	(6) Improper disc caliper operation	Correct or replace.
	(7) Faulty wheel bearing	Replace.
<b>5. Brake noise (1) (creaking sound)</b>	(1) Hardened or deteriorated brake pad	Replace the pad.
	(2) Worn brake pad	Replace the pad.
	(3) Loose back plate or support installation bolt	Tighten to the specified torque.
	(4) Loose wheel bearing	Tighten to the specified torque.
	(5) Dirty rotor	Clean the rotor, or clean and replace brake assembly.
<b>6. Brake noise (2) (hissing sound)</b>	(1) Worn brake pad	Replace the pad.
	(2) Improperly installed pad	Correct or replace the pad.
	(3) Loose or bent rotor	Retighten or replace.
<b>7. Brake noise (3) (click sound)</b>	Excessively worn pad or support	Replace the pad or the support.

# General Description

## PARKING BRAKE

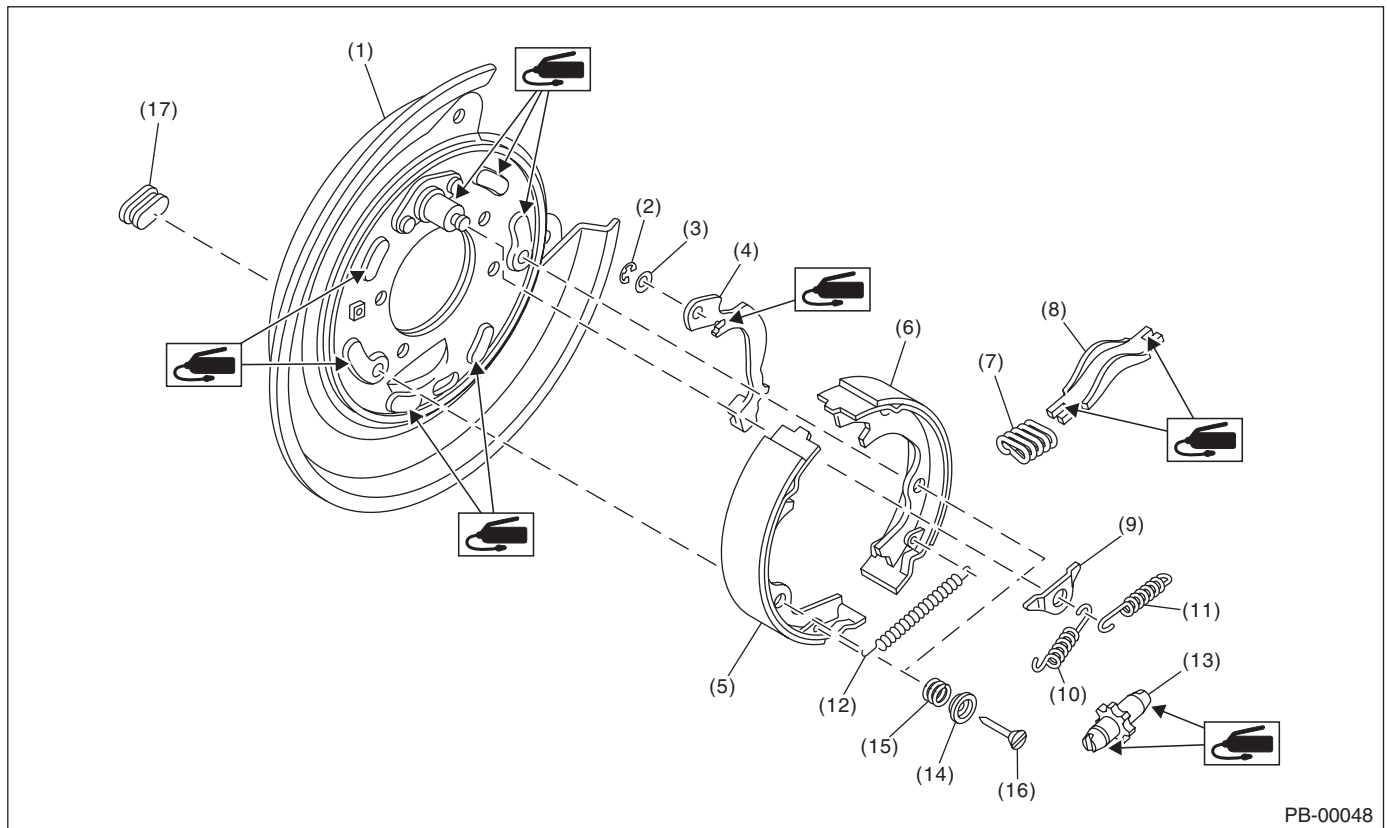
### 1. General Description

#### A: SPECIFICATION

Type		Mechanical, drum in disc rear brakes
Effective drum diameter	mm (in)	170 (6.69)
Lining dimensions (Length × Width × Thickness)	mm (in)	163.1 × 30.0 × 3.2 (6.421 × 1.181 × 0.126)
Clearance adjustment		Manual adjustment
Lever stroke	notches/N (kgf, lb)	5 — 6/200 (20.4, 45)

#### B: COMPONENT

##### 1. PARKING BRAKE (REAR DISC BRAKE)

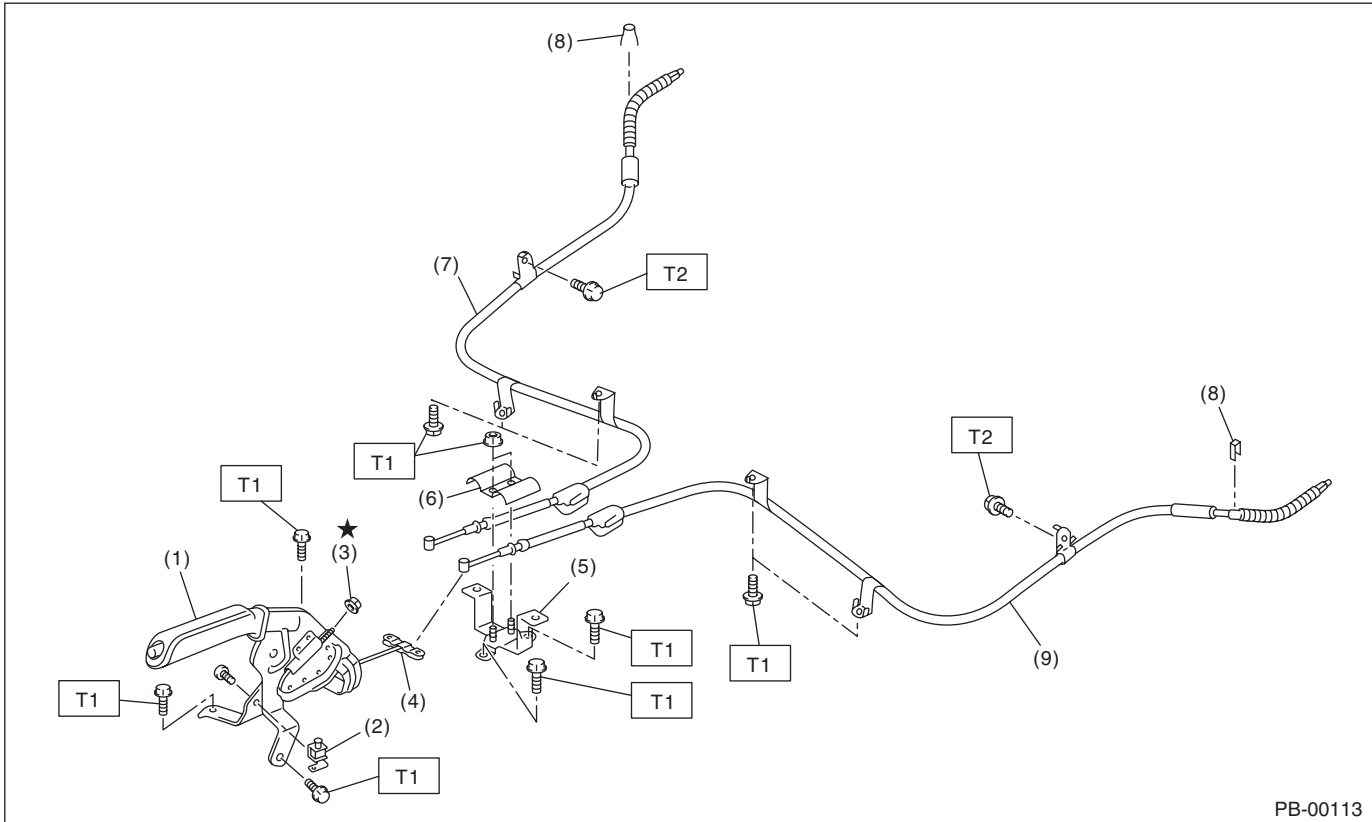


PB-00048

- |                                    |                              |                            |
|------------------------------------|------------------------------|----------------------------|
| (1) Back plate                     | (7) Strut spring             | (13) Adjuster              |
| (2) Retainer                       | (8) Strut                    | (14) Shoe hold-down cup    |
| (3) Spring washer                  | (9) Shoe guide plate         | (15) Shoe hold-down spring |
| (4) Lever                          | (10) Primary return spring   | (16) Shoe hold-down pin    |
| (5) Parking brake shoe (Primary)   | (11) Secondary return spring | (17) Adjusting hole cover  |
| (6) Parking brake shoe (Secondary) | (12) Adjusting spring        |                            |



## 2. PARKING BRAKE CABLE



PB-00113

- |                                      |                            |
|--------------------------------------|----------------------------|
| (1) Parking brake lever              | (6) Clamp                  |
| (2) Parking brake switch             | (7) Parking brake cable RH |
| (3) Adjusting nut (Self-locking nut) | (8) Clamp                  |
| (4) Equalizer                        | (9) Parking brake cable LH |
| (5) Bracket                          |                            |

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 18 (1.8, 13.0)**

**T2: 33 (3.4, 24.3)**

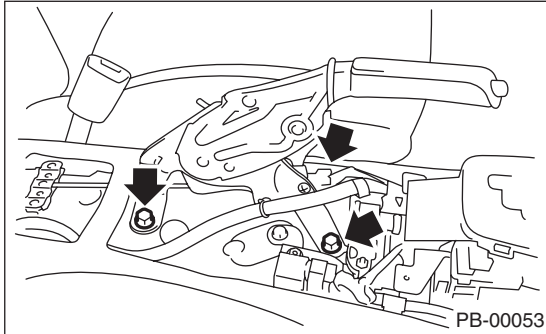
### C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine grease etc. or equivalent. Do not mix grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before securing a part in a vise, place cushioning material such as wood blocks, aluminum plate or cloth between the part and the vise.
- Make sure grease does not come into contact with the parking shoes.

## 2. Parking Brake Lever

### A: REMOVAL

- 1) Set the wheel stoppers to tires.
- 2) Remove the console box.
- 3) Disconnect the parking brake switch connector.
- 4) Remove the parking cable adjusting nut (self-locking nut).
- 5) Remove the parking brake lever.



### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### **Tightening torque:**

##### **Parking brake lever**

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**

- 2) Install a new adjusting nut (self-locking nut).
- 3) Be sure to adjust the lever stroke. <Ref. to PB-4, ADJUSTMENT, Parking Brake Lever.>

### C: INSPECTION

- 1) Operate the parking brake lever 3 to 4 times and fully return the lever.
- 2) While slowly pulling the parking brake lever upward, count the notches.

#### **Lever stroke:**

**5 to 6 notches when pulled with a force of 200 N (20.4 kgf, 45 lb)**

If it is not within the specified value, adjust the parking brake. <Ref. to PB-8, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

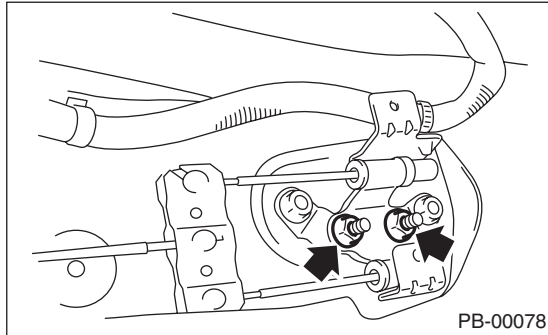
### D: ADJUSTMENT

Adjust the parking lever stroke. <Ref. to PB-8, LEVER STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

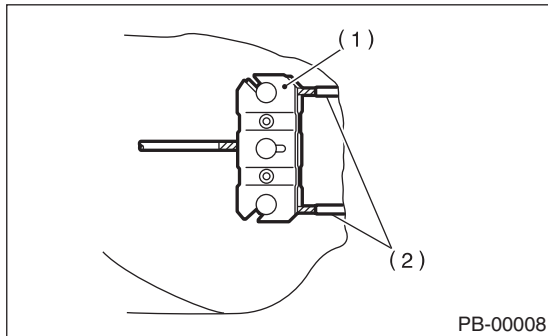
## 3. Parking Brake Cable

### A: REMOVAL

- 1) Remove the rear seat cushion.
- 2) Remove the console box.
- 3) Remove the parking cable adjusting nut (self-locking nut).
- 4) Remove the parking brake lever. <Ref. to PB-4, REMOVAL, Parking Brake Lever.>
- 5) Roll up the floor mat and remove the clamps.



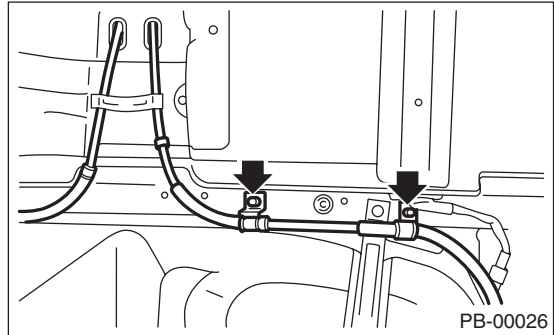
- 6) Remove the inner cable end from equalizer.



- (1) Equalizer
- (2) Inner cable end

- 7) Lift up the vehicle, and then remove the rear wheels.
- 8) Remove the parking brake cable from rear brake. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

- 9) Remove the clamp from the rear brake.
- 10) Remove the cable clamp from the rear arm bracket.
- 11) Remove the cable clamp from rear floor.



- 12) Remove the cable assembly.

### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### NOTE:

- Be sure to pass the cable through the tunnel in the cable guide.
- 2) Be sure to adjust the lever stroke. <Ref. to PB-4, ADJUSTMENT, Parking Brake Lever.>

### C: INSPECTION

- Check and replace the removed cable if damaged, rusty or faulty.
- 1) Check the cable for smooth operation.
- 2) Check the inner cable for damage and rust.
- 3) Check the outer cable for damage, bends and cracks.
- 4) Check the boot for damage, cracks, and corrosion.

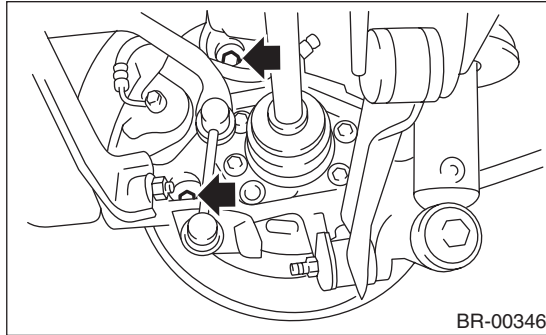
# Parking Brake Assembly (Rear Disc Brake)

## PARKING BRAKE

### 4. Parking Brake Assembly (Rear Disc Brake)

#### A: REMOVAL

- 1) Release the parking brake.
- 2) Remove the two mounting bolts and remove the brake caliper assembly.

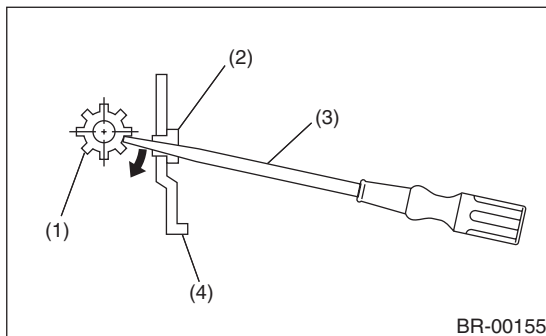


- 3) Suspend the brake caliper assembly so that the hose is not stretched.
- 4) Remove the disc rotor.

#### NOTE:

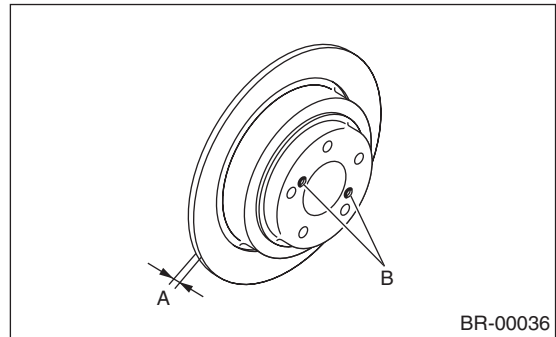
If the disc rotor is difficult to remove, try the following two methods in order.

- (1) Turn the adjusting screw using a flat tip screwdriver until the brake shoe moves adequately away from the disc rotor.

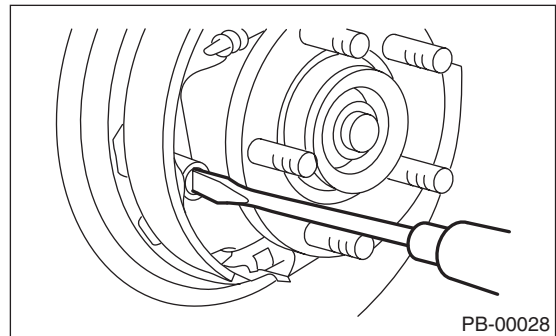


- (1) Adjuster
- (2) Adjusting hole cover (rubber)
- (3) Flat tip screwdriver
- (4) Back plate

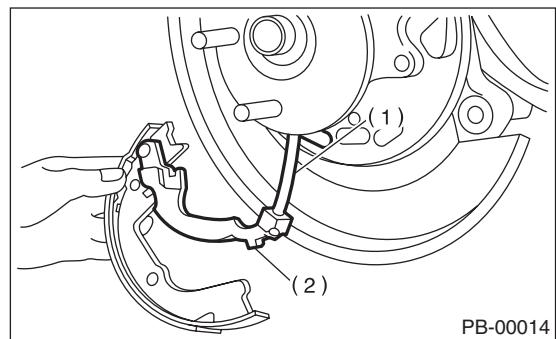
- (2) If disc rotor is seized on the hub, drive the disc rotor out by pushing two 8 mm bolts in holes B on the rotor.



- 5) Remove the shoe return spring from the parking brake assembly.
- 6) Remove the front shoe hold down spring and pin.



- 7) Remove the strut and strut spring.
- 8) Remove the adjuster assembly from the parking brake assembly.
- 9) Remove the brake shoe.
- 10) Remove the rear shoe hold down spring and pin with pliers.
- 11) Remove the parking brake cable from lever.



- (1) Parking brake cable
- (2) Lever

- 12) Using a flat tip screwdriver, raise the retainer. Remove the parking lever and washer from brake shoe.

## B: INSTALLATION

### CAUTION:

Be sure the lining surface is free from oil and grease.

1) Apply brake grease to the following locations.

#### Brake grease:

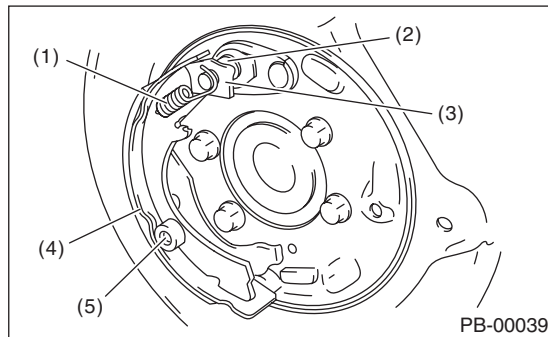
##### Brake Grease (Part No. 003602002)

- Six contact surfaces of the shoe rim and back plate gasket
- Contact surface of the shoe wave and the anchor pin
- Contact surface of the lever and strut
- Contact surface of the shoe wave and the adjuster assembly
- Contact surface of the shoe wave and the strut
- Contact surface of the lever and the shoe wave

2) Insert the primary side brake shoe into the anchor pin groove.

3) Secure the brake shoe with the shoe hold-down pin and cup.

4) Install the plate to the anchor pin, then install the primary return spring.



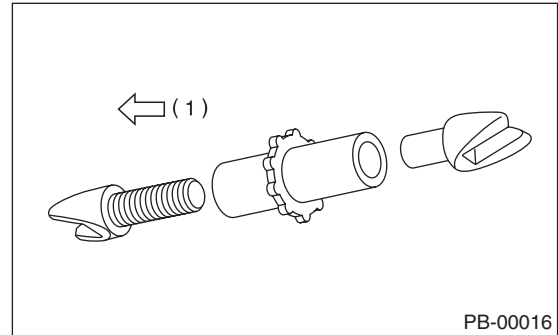
- (1) Primary return spring
- (2) Anchor pin
- (3) Plate
- (4) Primary shoe
- (5) Shoe hold-down pin and shoe hold-down cup

5) Install the parking brake cable to the lever.

6) Install the strut and adjuster, then secure the secondary side brake shoe with the shoe hold-down pin and cup.

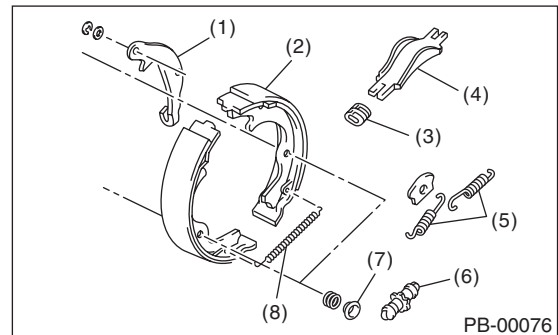
### NOTE:

- Install the strut spring of both right and left wheel facing vehicle front.
- Install the adjuster assembly with screw section on the left side.



(1) LH

7) Install the secondary return spring and the adjusting spring.



- (1) Lever
- (2) Secondary brake shoe
- (3) Strut spring
- (4) Strut
- (5) Return spring
- (6) Adjuster
- (7) Shoe hold-down cup
- (8) Adjusting spring

8) Adjust the parking brake. <Ref. to PB-8, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

# Parking Brake Assembly (Rear Disc Brake)

## PARKING BRAKE

9) Drive the vehicle to break-in the parking brake lining.

- (1) Drive the vehicle at about 35 km/h (22 MPH).
- (2) With the parking brake release button pushed in, pull the parking brake lever gently.
- (3) Drive the vehicle for about 200 m (0.12 miles) in this condition.
- (4) Wait 5 to 10 minutes for the parking brake to cool down. Repeat again from step (1).
- (5) After breaking-in, re-adjust the parking brakes.

## C: INSPECTION

1) Measure the brake disc rotor inside diameter. If the disc is scored or worn, replace the brake disc rotor.

### **Disc rotor inside diameter:**

#### **Standard:**

**170 mm (6.69 in)**

#### **Service limit:**

**171 mm (6.73 in)**

2) Measure the lining thickness. If it exceeds the limit, replace shoe assembly.

### **Lining thickness:**

#### **Standard:**

**3.2 mm (0.126 in)**

#### **Service limit:**

**1.5 mm (0.059 in)**

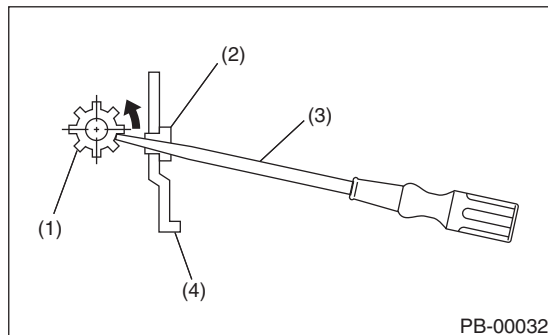
### **NOTE:**

Replace the right and left brake shoe as a set.

## D: ADJUSTMENT

### 1. SHOE CLEARANCE

- 1) Return the parking brake lever fully.
- 2) Remove the adjusting hole cover from the back plate.
- 3) Turn the adjusting screw using a flat tip screwdriver until the brake shoe is in close contact with the disc rotor.



- (1) Adjusting screw
- (2) Adjusting hole cover (rubber)
- (3) Flat tip screwdriver
- (4) Back plate

4) Turn back (downward) the adjusting screw 3 to 4 notches.

### **CAUTION:**

**Check there is no brake drag.**

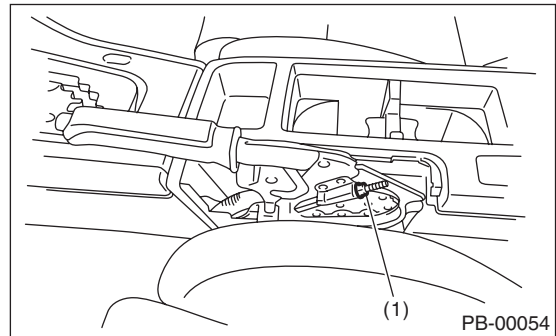
- 5) Install the adjusting hole cover to the back plate.
- 6) Adjust the parking lever stroke. <Ref. to PB-8, LEVER STROKE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>

### 2. LEVER STROKE

- 1) Adjust the shoe clearance before adjusting lever stroke. <Ref. to PB-8, SHOE CLEARANCE, ADJUSTMENT, Parking Brake Assembly (Rear Disc Brake).>
- 2) Remove the parking lever cover.
- 3) Operate the parking brake lever 3 to 4 times.
- 4) Turn the adjusting nut until the lever stroke is at the specified value.

### **Lever stroke:**

**5 to 6 notches when pulled with a force of 200 N (20.4 kgf, 45 lb)**



(1) Adjusting nut (Self-locking nut)

- 5) Check there is no brake drag.
- 6) Install the parking lever cover.

## 5. General Diagnostic Table

### A: INSPECTION

Symptoms	Possible cause	Corrective action
Brake drag	Parking brake lever not adjusted correctly.	Adjust.
	Parking brake cable does not move.	Correct or replace.
	Parking brake shoe clearance is maladjusted.	Adjust.
	Return spring is faulty.	Replace.
Noise from brake	Return spring is faulty.	Replace.
	Shoe hold-down spring faulty.	Replace.

# General Diagnostic Table

PARKING BRAKE

---



# General Description

## POWER ASSISTED SYSTEM (POWER STEERING)

### 1. General Description

#### A: SPECIFICATION

Model		Except for 3.0 R	3.0 R	
Whole system	Minimum turning radius	m (ft)		
	Steering angle	Inner wheel	Except for 3.0 R, 2.5 GT spec. B: 5.4 (17.8) 3.0 R, 2.5 GT spec. B: 5.8 (19)	
		Outer wheel	Except for 3.0 R, 2.5 GT spec. B: 37.6°±1.5° 3.0 R, 2.5 GT spec. B: 33.8°±1.5°	
	Steering wheel diameter	mm (in)		
	Lock to lock turn	3.0 R, 2.5 GT-B: 2.6, 2.5 GT: 2.8, Others: 3.2		
Gearbox	Type	Rack and Pinion, Integral		
	Backlash	0 (Automatic adjusting)		
	Valve (Power steering system)	Rotary valve		
Pump (Power steering system)	Type	Vane pump		
	Oil tank	Installed on body		
	Specific output	cm <sup>3</sup> (cu in)/rev.	8.5 (0.519)	9.6 (0.586)
	Relief pressure	kPa (kg/cm <sup>2</sup> , psi)	7,350 — 8,050 (75 — 82, 1,067 — 1,167)	8,300 — 9,000 (85 — 92, 1,204 — 1,305)
	Hydraulic fluid control	Engine speed sensitive		
	Hydraulic fluid	ℓ (USqt, Imp qt)	1,000 rpm: 6.15 (6.5, 5.4) 3,000 rpm: 5.5 (5.8, 4.8)	1,000 rpm: 6.5 (6.9, 5.7) 3,000 rpm: 5.5 (5.8, 4.8)
	RPM range	rpm	680 — 9,600	
Direction of rotation	Clockwise			
Hydraulic oil (Power steering system)	Capacity	Oil tank	0.2 (0.2, 0.2)	
		Whole system	0.7 (0.7, 0.6)	

# General Description

## POWER ASSISTED SYSTEM (POWER STEERING)

Steering wheel	Free play	mm (in)	17 (0.67)		
Steering shaft	Clearance between the steering wheel and column cover	mm (in)	3.0 (0.12)		
Steering gearbox (Power steering system)	Rack shaft play in the radial direction	Right-turn steering	mm (in)	0.12 (0.005) or less	
		Input shaft play	In radial direction	mm (in)	0.26 (0.01) or less
			In axial direction	mm (in)	Without play
	Rotation resistance	N (kgf, lb)	Maximum allowable value: 11.3 (1.15, 2.54) or less Difference between right and left sliding resistance: 24% or less		
Oil pump (Power steering system)	Pulley shaft	Radial play	mm (in)	0.4 (0.016) or less	
		Axial play	mm (in)	0.9 (0.035) or less	
	Pulley	Ditch deflection	mm (in)	1.0 (0.039) or less	
		Rotation resistance	N (kgf, lb)	9.22 (0.94, 2.07) or less	
	Regular pressure (Unloaded)	kPa (kg/cm <sup>2</sup> , psi)	981(10, 142) or less		
Steering wheel effort (Power steering system)	At standstill with engine idling on paved road	N (kgf, lb)	29.4 (3.0, 6.6) or less		
	At standstill with engine stalled on paved road	N (kgf, lb)	294.2 (30, 66.2) or less		

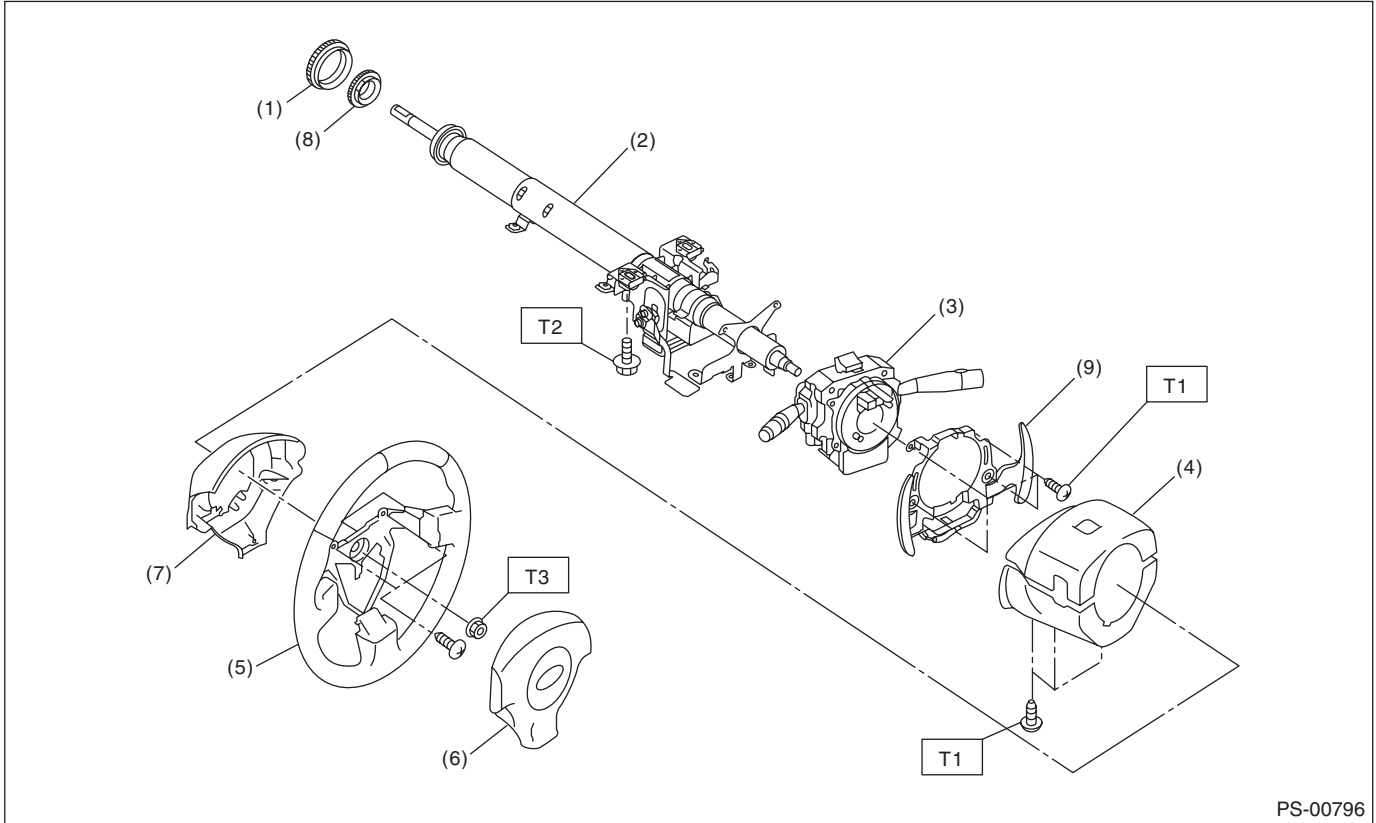
Recommended power steering fluid
SUBARU ATF or ATF DEXRON III

# General Description

POWER ASSISTED SYSTEM (POWER STEERING)

## B: COMPONENT

### 1. STEERING WHEEL AND COLUMN



PS-00796

- |                             |                                |
|-----------------------------|--------------------------------|
| (1) Bushing                 | (6) Airbag module              |
| (2) Steering shaft          | (7) Steering wheel lower cover |
| (3) Steering roll connector | (8) Insulator                  |
| (4) Column cover            | (9) Paddle shift               |
| (5) Steering wheel          |                                |

**Tightening torque: N·m (kgf-m, ft-lb)**

**T1: 1.2 (0.12, 0.9)**

**T2: 25 (2.5, 18.1)**

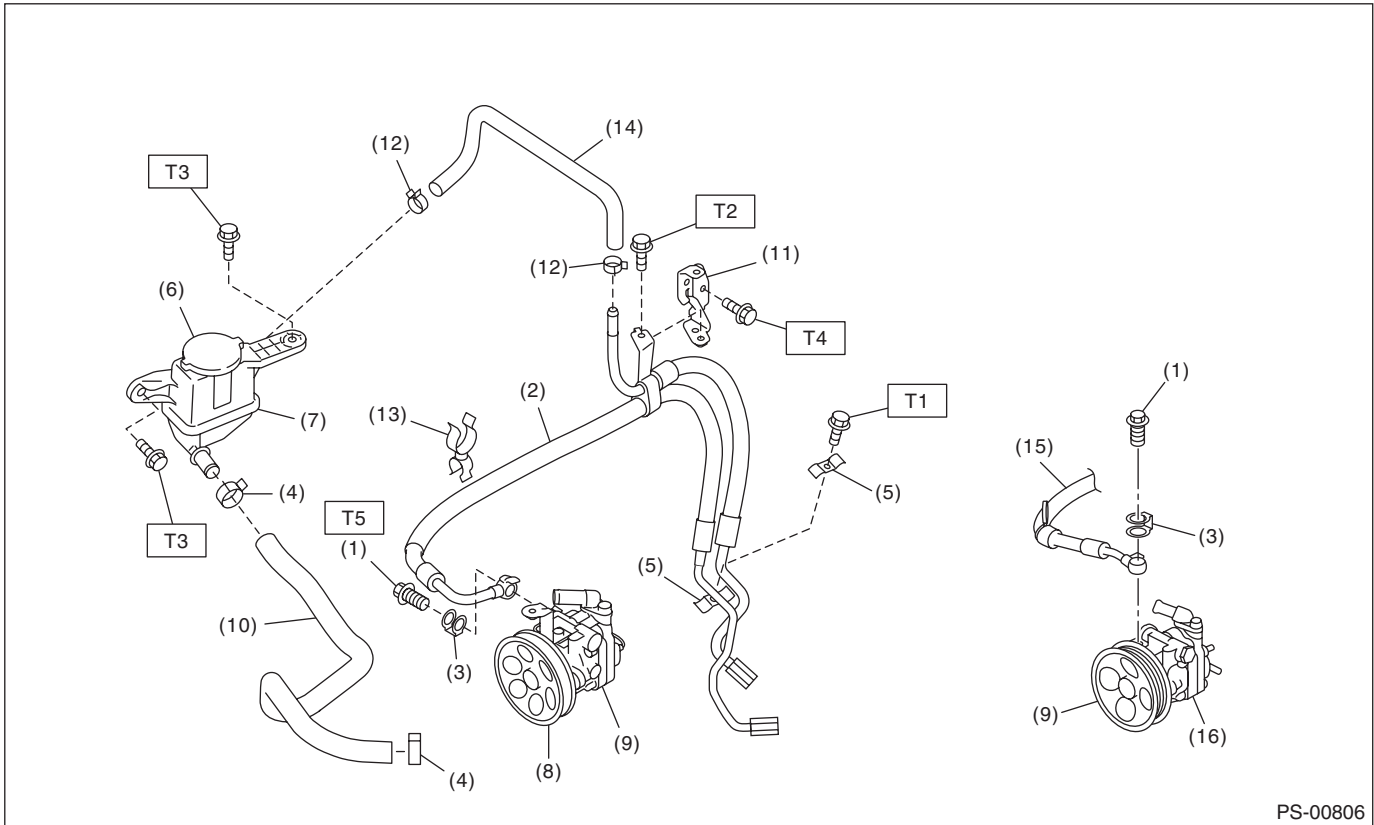
**T3: 39 (4.0, 28.8)**

# General Description

POWER ASSISTED SYSTEM (POWER STEERING)

## 2. POWER ASSISTED SYSTEM

- Hose and tank



PS-00806

- |                     |                          |
|---------------------|--------------------------|
| (1) Eye bolt        | (9) Oil pump (H4 model)  |
| (2) Hose (H4 model) | (10) Suction hose        |
| (3) Eye bolt gasket | (11) Hose bracket        |
| (4) Clip            | (12) Clip                |
| (5) Clamp E         | (13) Clip                |
| (6) Cap             | (14) Return hose         |
| (7) Reservoir tank  | (15) Hose (H6 model)     |
| (8) Pulley          | (16) Oil pump (H6 model) |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.53)**

**T2: 10 (1.02, 7.4)**

**T3: 13 (1.32, 9.6)**

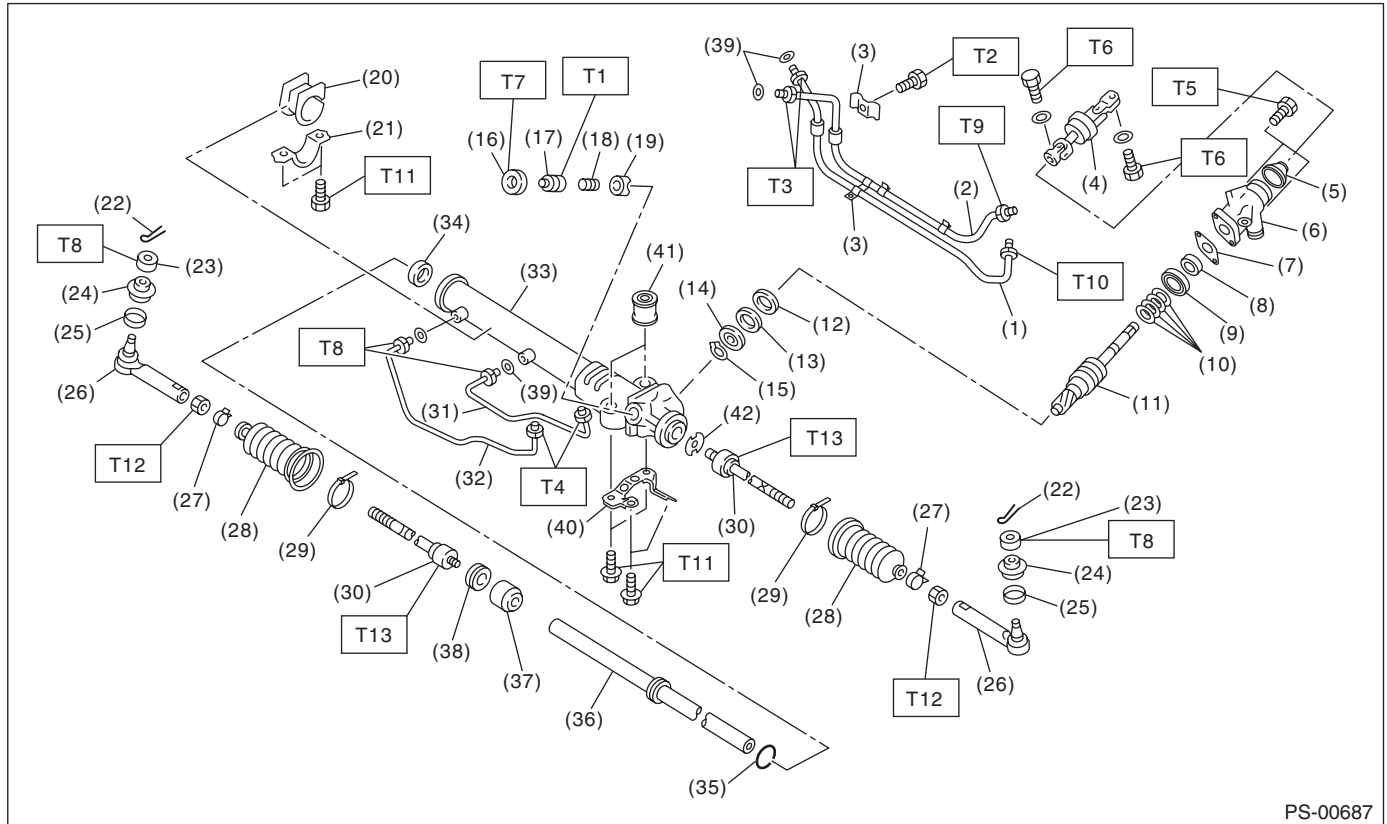
**T4: 18 (1.84, 13.3)**

**T5: 40 (4.1, 29.5)**

# General Description

## POWER ASSISTED SYSTEM (POWER STEERING)

### • Gearbox



PS-00687

(1) Pipe C	(20) Adapter	(39) O-ring
(2) Pipe D	(21) Clamp	(40) Bracket
(3) Clamp plate	(22) Cotter pin	(41) Bushing
(4) Universal joint	(23) Castle nut	(42) Lock washer
(5) Dust seal	(24) Dust cover	
(6) Valve housing	(25) Clip	
(7) Gasket	(26) Tie-rod end	
(8) Oil seal	(27) Clip	
(9) Bushing	(28) Boot	
(10) Seal ring	(29) Band	
(11) Pinion & valve ASSY	(30) Tie-rod	
(12) Oil seal	(31) Pipe B	
(13) Back-up washer	(32) Pipe A	
(14) Ball bearing	(33) Steering body	
(15) Snap ring	(34) Oil seal	
(16) Lock nut	(35) Piston ring	
(17) Adjusting screw	(36) Rack	
(18) Spring	(37) Rack bushing	
(19) Sleeve	(38) Holder	

#### **Tightening torque:N-m (kgf-m, ft-lb)**

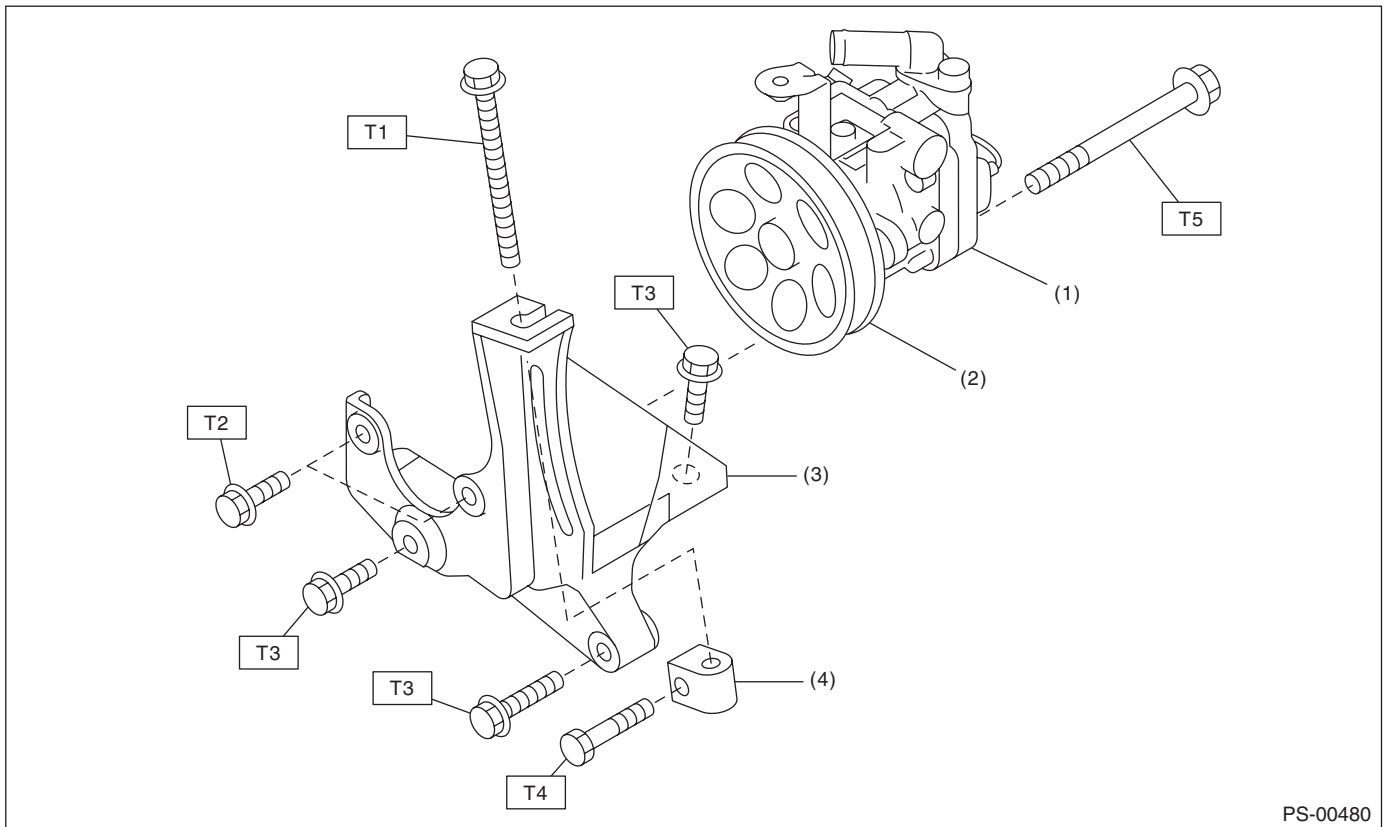
<b>T1: 3.9 (0.4, 2.9)</b>
<b>T2: 10 (1.02, 7.4)</b>
<b>T3: 15 (1.5, 10.8)</b>
<b>T4: 17 (1.7, 12.5)</b>
<b>T5: 20 (2.0, 14.8)</b>
<b>T6: 24 (2.4, 17.4)</b>
<b>T7: 25 (2.5, 18.1)</b>
<b>T8: 27 (2.75, 19.9)</b>
<b>T9: 29 (3.0, 21.4)</b>
<b>T10: 37 (3.8, 27.3)</b>
<b>T11: 60 (6.1, 44.1)</b>
<b>T12: 85 (8.7, 62.7)</b>
<b>T13: 90 (9.1, 65.8)</b>

# General Description

POWER ASSISTED SYSTEM (POWER STEERING)

## 3. OIL PUMP

- H4 model



PS-00480

- (1) Oil pump
- (2) Pulley
- (3) Bracket
- (4) Belt tension nut

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 8 (0.8, 5.8)**

**T2: 15.7 (1.6, 11.6)**

**T3: 22 (2.2, 15.9)**

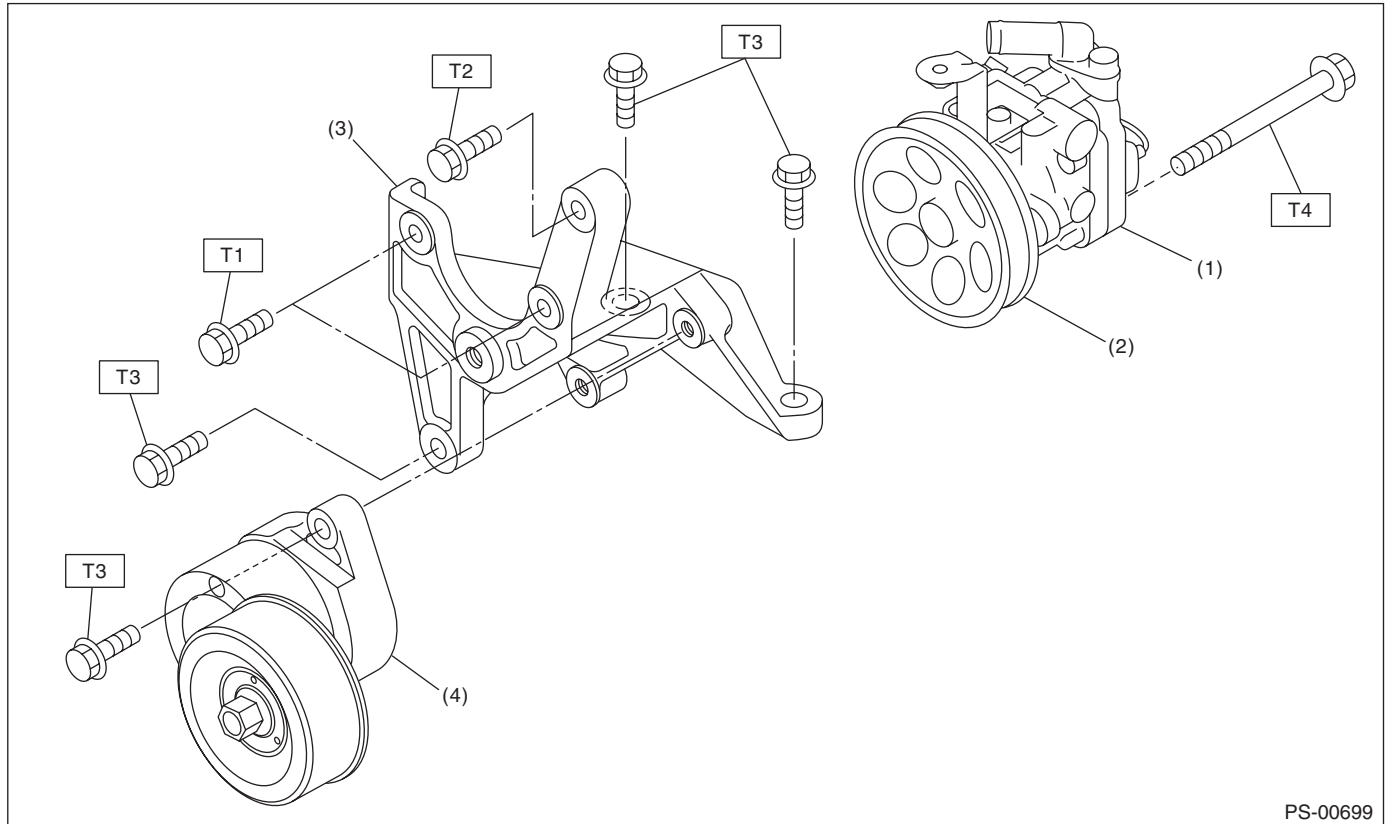
**T4: 25 (2.5, 18.1)**

**T5: 48.4 (4.9, 35.7)**

# General Description

## POWER ASSISTED SYSTEM (POWER STEERING)

- H6 model



PS-00699

- (1) Oil pump
- (2) Pulley
- (3) Bracket
- (4) Belt tensioner

### **Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 15.7 (1.6, 11.6)**

**T2: 25 (2.5, 18.4)**

**T3: 33 (3.4, 24.3)**

**T4: 37.3 (3.8, 27.5)**

## **C: CAUTION**

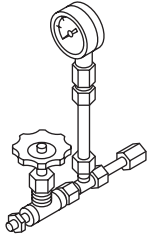
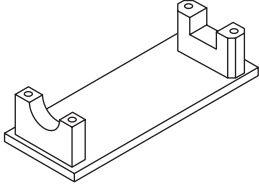
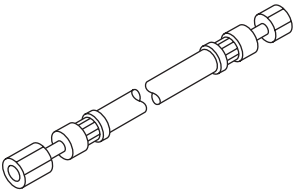
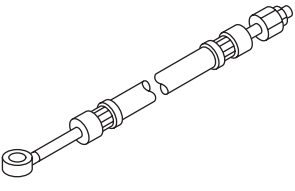
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Use SUBARU genuine power steering fluid, grease etc. or the equivalent. Do not mix fluid, grease etc. of different grades or manufacturers.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before securing a part on a vise, place cushioning material such as wooden blocks, aluminum plate or cloth between the part and the vise.

# General Description

POWER ASSISTED SYSTEM (POWER STEERING)

## D: PREPARATION TOOL

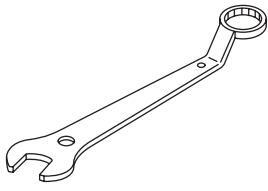
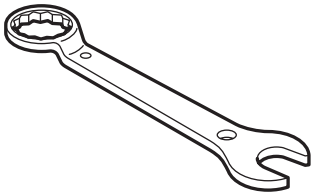
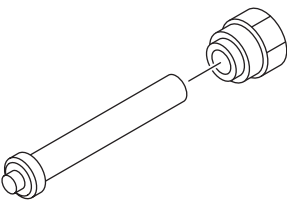
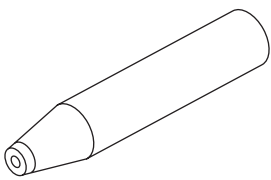
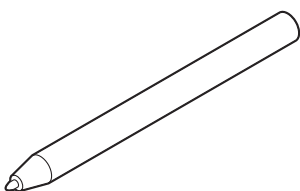
### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-925711000</p>	925711000	PRESSURE GAUGE	Used for measuring oil pressure.
 <p>ST-926200000</p>	926200000	STAND	<ul style="list-style-type: none"> <li>Used when inspecting characteristic of gear-box assembly and disassembling it.</li> <li>Used together with BOSS D (34199AG000).</li> </ul>
 <p>ST34099AC010</p>	34099AC010	ADAPTER HOSE A	Used together with PRESSURE GAUGE (925711000).
 <p>ST34099AC020</p>	34099AC020	ADAPTER HOSE B	Used together with PRESSURE GAUGE (925711000).



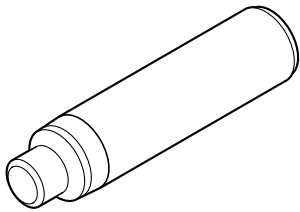
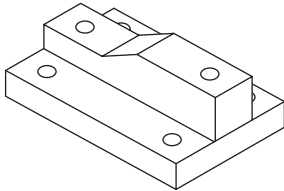
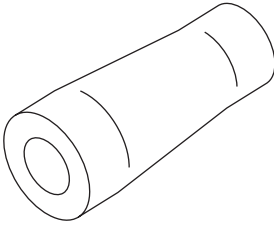
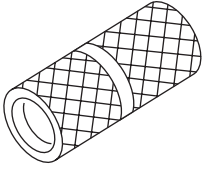
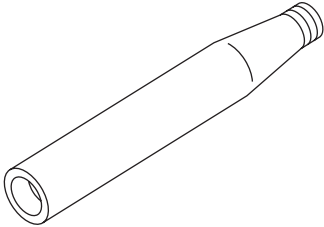
## General Description

### POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-926230000</p>	926230000	SPANNER	For the lock nut when adjusting backlash of gearbox.
 <p style="text-align: center;">ST34099PA100</p>	34099PA100	SPANNER	Used when measuring the rotating resistance of gearbox assembly.
 <p style="text-align: center;">ST-926420000</p>	926420000	PLUG	When fluid leaks from pinion side of gearbox assembly, remove pipe B from valve housing, attach this tool and check fluid leaking points.
 <p style="text-align: center;">ST-926390001</p>	926390001	COVER & REMOVER ASSY	Used for assembling rack assembly.
 <p style="text-align: center;">ST34099FA060</p>	34099FA060	PUNCH HOLDER	Used for crimping.

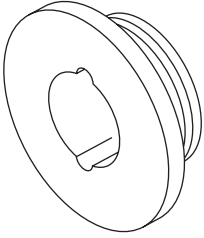
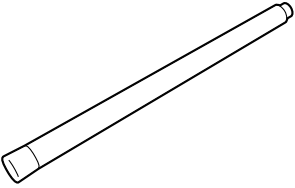
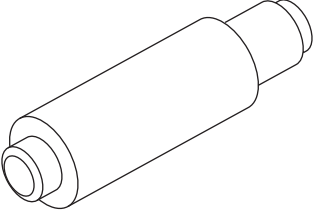
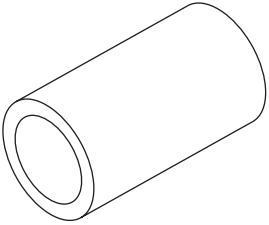
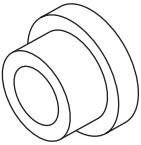
# General Description

## POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST34199FE000</p>	34199FE000	INSTALLER & REMOVER	Used for removing and installing the rack oil seal (outer & inner).
 <p>ST34199AG000</p>	34199AG000	BOSS D	<ul style="list-style-type: none"> <li>• Used when inspecting characteristic of gear-box assembly and disassembling it.</li> <li>• Used together with STAND (926200000).</li> </ul>
 <p>ST34199AG030</p>	34199AG030	GUIDE	Used for installing seal ring of rack.
 <p>ST34199AG070</p>	34199AG070	FORMER	Used for forming seal ring of pinion.
 <p>ST34199AG020</p>	34199AG020	GUIDE	Used for installing seal ring of pinion.

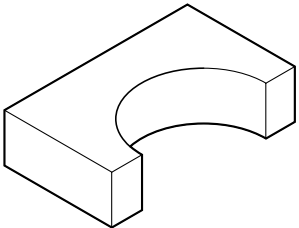
## General Description

### POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST34199AG050</p>	34199AG050	GUIDE G (24)	<ul style="list-style-type: none"> <li>• Used for forming seal ring of rack.</li> <li>• Used together with the FORMER PISTON (34199AG080).</li> </ul>
 <p style="text-align: center;">ST-927580000</p>	927580000	OIL SEAL REMOVER	Used for removing oil seal.
 <p style="text-align: center;">ST34199AG090</p>	34199AG090	INSTALLER & REMOVER	<ul style="list-style-type: none"> <li>• Used for installing oil seal of valve housing.</li> <li>• Used together with the SEAL INSTALLER. (34099FA130)</li> <li>• Used for installing ball bearing of valve housing.</li> <li>• Used for removing oil seal and ball bearing from valve housing.</li> </ul>
 <p style="text-align: center;">ST34199AG080</p>	34199AG080	FORMER PISTON	<ul style="list-style-type: none"> <li>• Used for forming seal ring of rack.</li> <li>• Used together with the GUIDE G (24) (34199AG050).</li> </ul>
 <p style="text-align: center;">ST34199AG010</p>	34199AG010	INSTALLER	Used for pressing-fit oil seal of gearbox cylinder.

# General Description

POWER ASSISTED SYSTEM (POWER STEERING)

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST34199XA050</p>	34199XA050	BASE	Used for crimping.

# Steering Wheel

POWER ASSISTED SYSTEM (POWER STEERING)

## 2. Steering Wheel

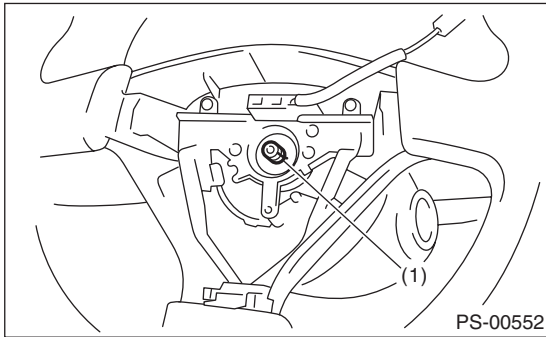
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Set the tire to the straight-ahead position.
- 3) Remove the airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

#### WARNING:

**Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>**

- 4) Place alignment marks on the steering wheel and steering shaft.



(1) Alignment mark

- 5) Remove the steering wheel nut, and then draw out the steering wheel from shaft using steering puller.

### B: INSTALLATION

#### WARNING:

**Always refer to "Airbag System" before performing service on the airbag modules. <Ref. to AB-4, CAUTION, General Description.>**

- 1) Align the center position of the roll connector. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>
- 2) Install in the reverse order of removal.

#### NOTE:

Align the alignment marks on the steering wheel and steering shaft.

#### Tightening torque:

**39 N·m (4.0 kgf-m, 28.8 ft-lb)**

#### Column cover-to-steering wheel clearance:

**2 — 4 mm (0.08 — 0.16 in)**

#### CAUTION:

Insert the roll connector guide pin into the guide hole on the lower end of the steering wheel surface. Avoid damaging the pin.

### C: INSPECTION

- 1) Check the steering wheel for deformation. If the deformation is excessive, replace the steering wheel.
- 2) Check the splines on the steering wheel for damage. If the damage is excessive, replace the steering wheel.

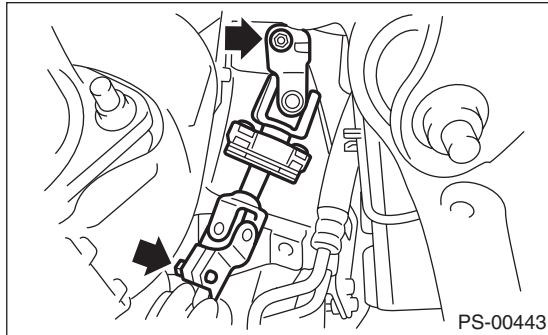
# Universal Joint

POWER ASSISTED SYSTEM (POWER STEERING)

## 3. Universal Joint

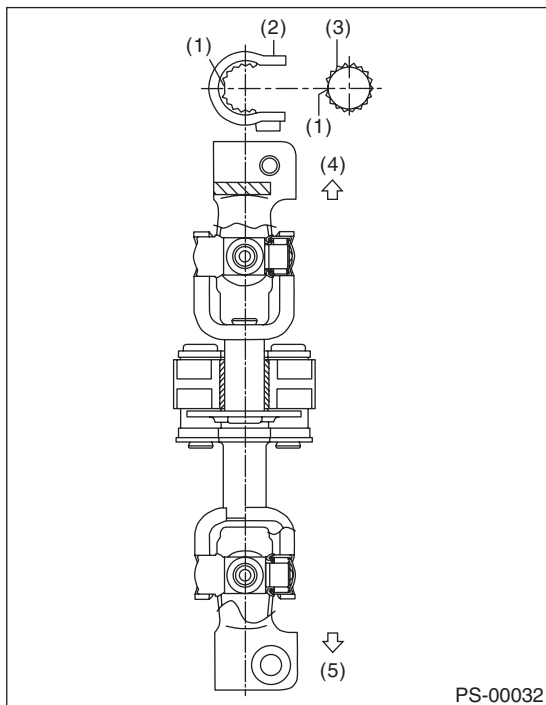
### A: REMOVAL

- 1) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 2) Place alignment marks on universal joint.
- 3) Remove the universal joint bolt, and then remove the universal joint.



### B: INSTALLATION

- 1) Align the cutout portion at serrated section of the column shaft and yoke, then install the universal joint into column shaft.



- (1) Cutout portion
- (2) Yoke
- (3) Column shaft
- (4) Column shaft side
- (5) Gearbox side

- 2) Install the universal joint to the serrations of gearbox assembly by matching alignment marks.
- 3) Tighten the bolt.

#### **Tightening torque:**

**24 N·m (2.4 kgf-m, 17.7 ft-lb)**

#### **CAUTION:**

**Excessively large tightening torque of universal joint bolts may lead to heavy steering wheel operation.**

- 4) Align the center position of the roll connector. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>
- 5) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>

# Universal Joint

POWER ASSISTED SYSTEM (POWER STEERING)

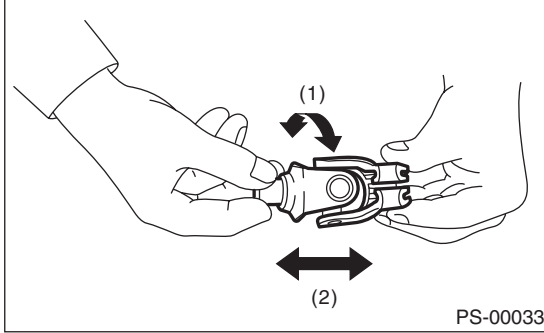
## C: INSPECTION

Check for wear, damage or any other faults. Replace as necessary.

### Service limit:

**Universal joint play: 0 mm (0 in)**

**Maximum swing torque: 0.3 N (0.03 kgf, 0.07 lb)**

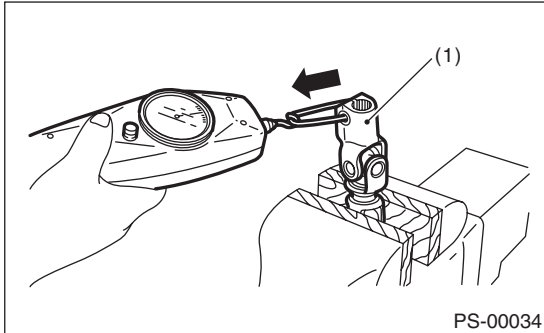


- (1) Swing torque
- (2) Play

Measure the swing torque of universal joint.

### Service limit:

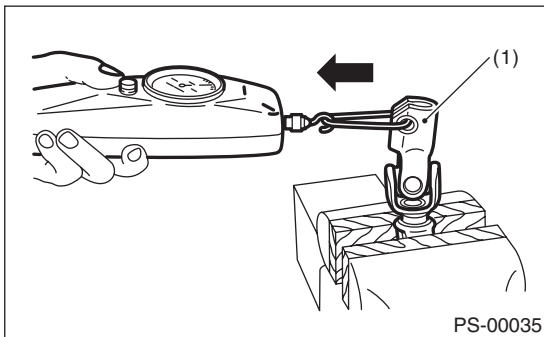
**Maximum load: 3.8 N (0.39 kgf, 0.86 lb) or less**



- (1) Yoke (Gearbox side)

### Service limit:

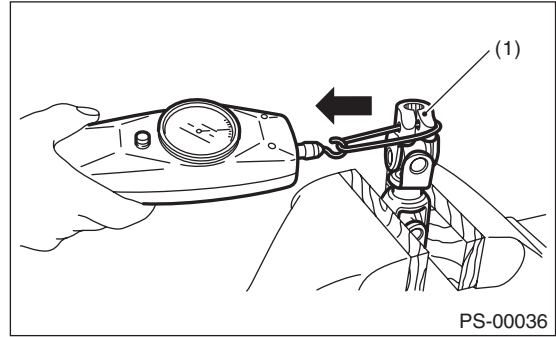
**Maximum load: 3.8 N (0.39 kgf, 0.86 lb) or less**



- (1) Yoke (Gearbox side)

### Service limit:

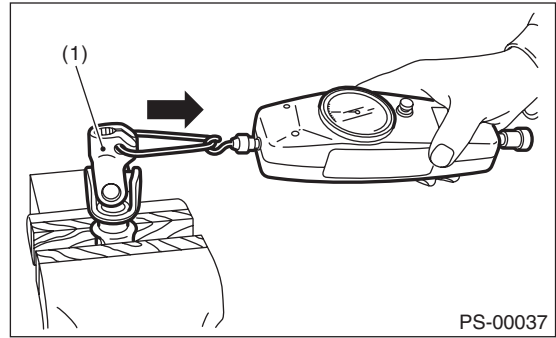
**Maximum load: 7.3 N (0.74 kgf, 1.64 lb) or less**



- (1) Yoke (Steering column side)

### Service limit:

**Maximum load: 7.3 N (0.74 kgf, 1.64 lb) or less**



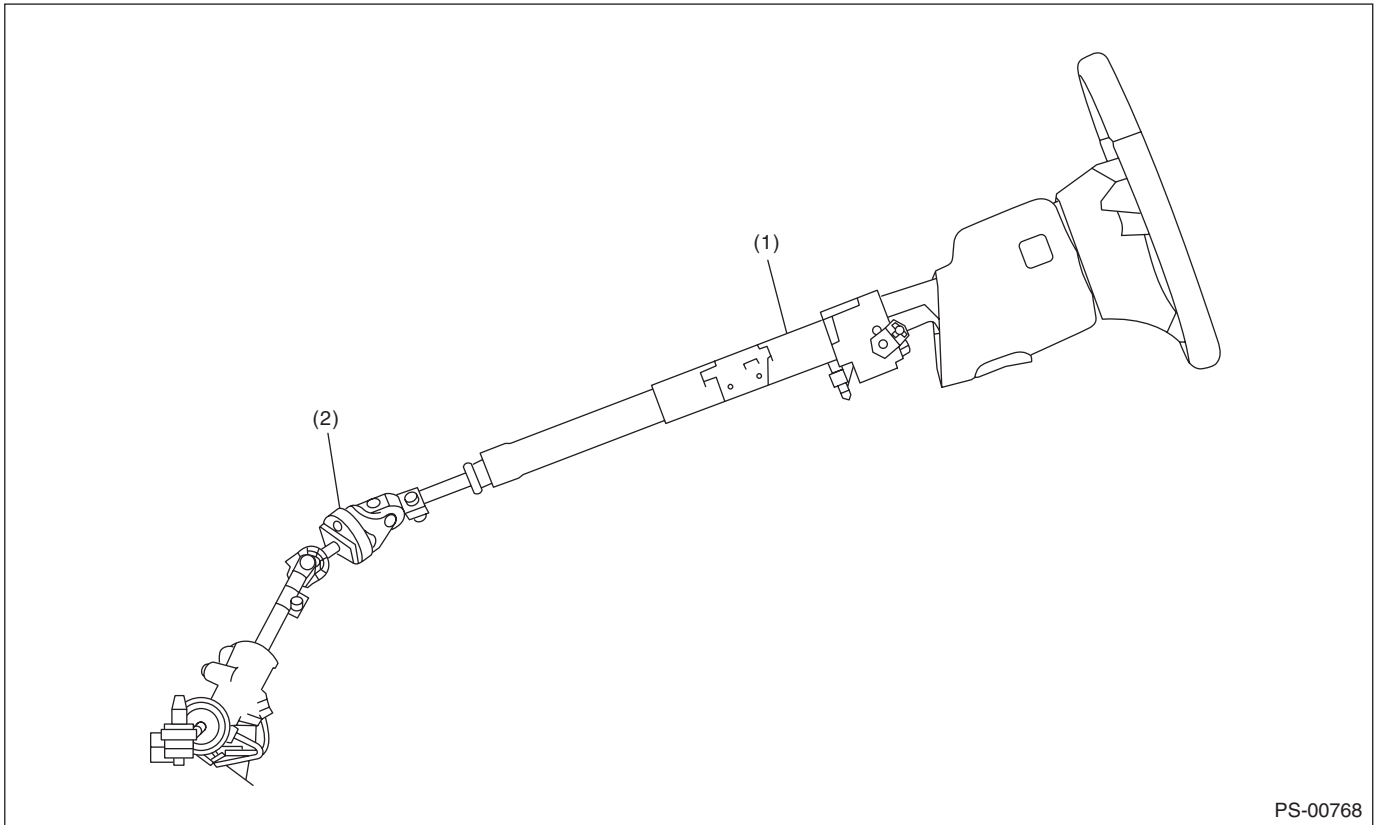
- (1) Yoke (Steering column side)

# Tilt Steering Column

POWER ASSISTED SYSTEM (POWER STEERING)

## 4. Tilt Steering Column

### A: REMOVAL



PS-00768

(1) Tilt steering column

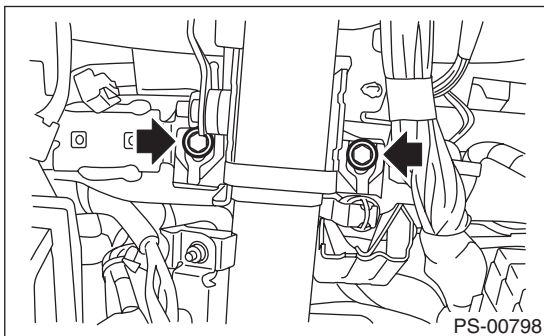
(2) Universal joint

- 1) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 2) Remove the universal joint. <Ref. to PS-15, REMOVAL, Universal Joint.>
- 3) Remove the instrument panel lower cover under.
- 4) Remove the instrument panel lower cover upper.
- 5) Remove all connectors from the steering column.
- 6) Remove the two bolts under instrument panel securing the steering column.

7) Pull out the steering shaft assembly from the hole on toe board.

#### CAUTION:

- Be sure to remove the universal joint before removing steering shaft assembly installing bolts when removing steering shaft assembly or when lowering it for servicing other parts.
- Do not loosen the tilt lever when the steering column is not secured to the vehicle.



PS-00798

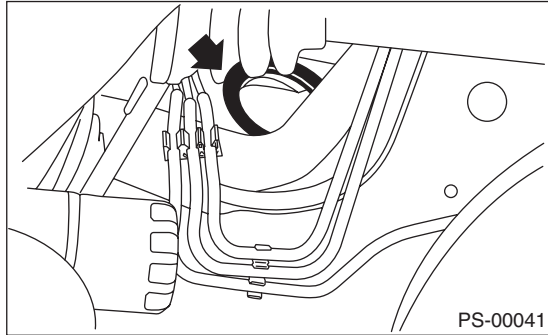


# Tilt Steering Column

## POWER ASSISTED SYSTEM (POWER STEERING)

### B: INSTALLATION

- 1) Install the grommet to the toe board.



- 2) Insert the end of the steering shaft into the toe board grommet.
- 3) With the tilt lever secured, tighten the steering shaft mounting bolts under instrument panel.

#### **Tightening torque:**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

- 4) Connect all the connectors under the instrument panel.
- 5) Connect the airbag system connector at the harness spool.

#### **NOTE:**

Make sure to apply double lock.

- 6) Install the instrument panel lower cover with tilt lever held in the lowered position.
- 7) Install the universal joint. <Ref. to PS-15, INSTALLATION, Universal Joint.>
- 8) Align the center position of the roll connector. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>
- 9) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>

#### **CAUTION:**

**Insert the roll connector guide pin into the guide hole on lower end of steering wheel surface to prevent damage.**

### C: DISASSEMBLY

Remove the two screws securing the upper steering column covers, and the two screws securing the combination switch, and then remove related parts.

### D: ASSEMBLY

Insert the combination switch to the upper column shaft, and install the upper column cover. Then route the ignition key harness and combination switch harness between the column cover mounting bosses.

#### **Tightening torque:**

**1.2 N·m (0.12 kgf·m, 0.9 ft·lb)**

#### **CAUTION:**

**Do not overtorque the screw.**

### E: INSPECTION

#### 1. BASIC INSPECTION

Measure the overall length of steering column. If not within specification, replace it.

#### **Standard: Overall length L**

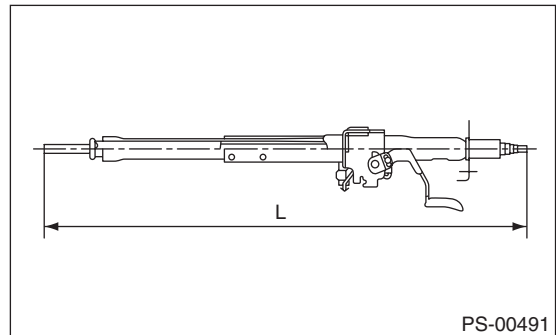
**Tilt & telescopic column (measure the minimum length)**

**Except for OUTBACK model**

**818.6<sup>+1.5</sup> mm<sub>-1.5</sub> (32.23<sup>+0.059</sup> in<sub>-0.059</sub>)**

**OUTBACK model**

**810.4<sup>+1.5</sup> mm<sub>-1.5</sub> (31.89<sup>+0.059</sup> in<sub>-0.059</sub>)**



#### 2. INSPECTION OF AIRBAG SYSTEM

Refer to "Airbag System" for airbag inspection procedure. <Ref. to AB-14, INSPECTION, Driver's Airbag Module.>

# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

## 5. Steering Gearbox

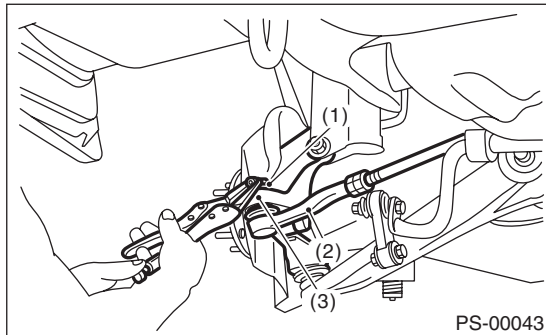
### A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.
- 3) Loosen the front wheel nuts.
- 4) Lift up the vehicle, and remove the front wheels.
- 5) Remove the under cover. <Ref. to EI-26, REMOVAL, Front Under Cover.>
- 6) Remove the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

#### WARNING:

**Be careful not to burn yourself because the exhaust pipe is hot.**

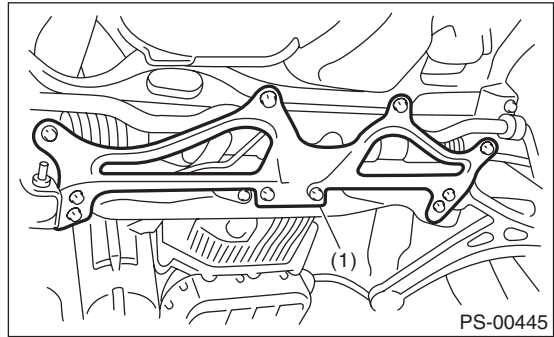
- 7) After pulling off the cotter pin and removing the castle nut, use a puller to remove the tie-rod end from the knuckle arm.



- (1) Castle nut
- (2) Tie-rod end
- (3) Knuckle arm

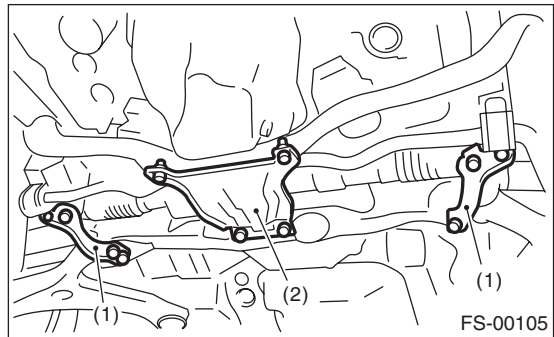
- 8) Remove the front crossmember support plate, jack-up plate and front stabilizer. <Ref. to FS-17, REMOVAL, Front Stabilizer.>

- Large type



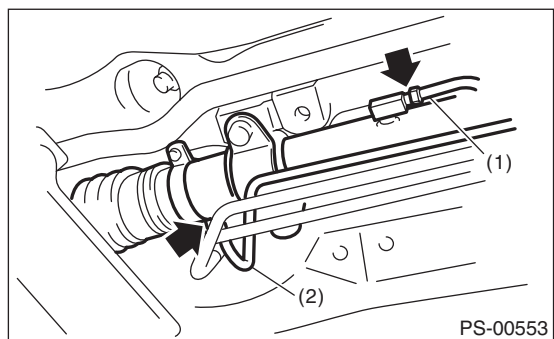
- (1) Front crossmember support plate

- Small type



- (1) Crossmember support plate
- (2) Jack-up plate

- 9) Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



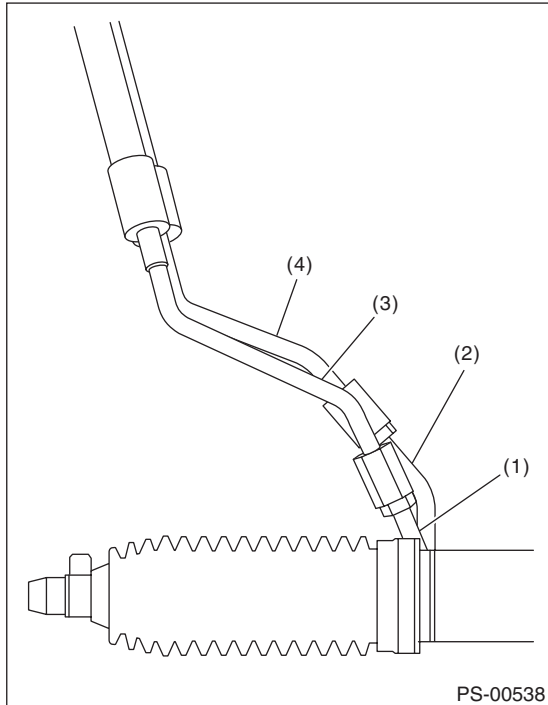
- (1) Pipe A
- (2) Pipe B

# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

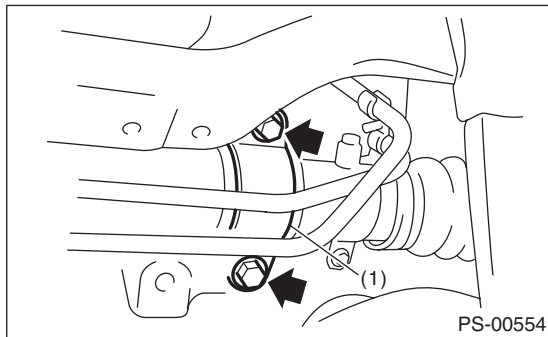
10) Remove the universal joint. <Ref. to PS-15, REMOVAL, Universal Joint.>

11) Disconnect the pipe C from pressure hose first, then disconnect pipe D from the return hose.



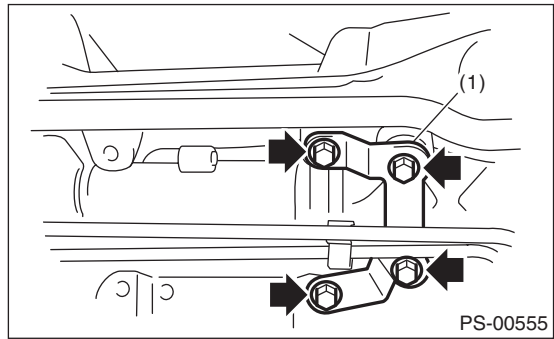
- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

12) Remove the clamp bolts securing the gearbox to the crossmember, and remove the clamp.



- (1) Clamp

13) Remove the bolts which secure the gearbox bracket, and remove the bracket and gearbox.

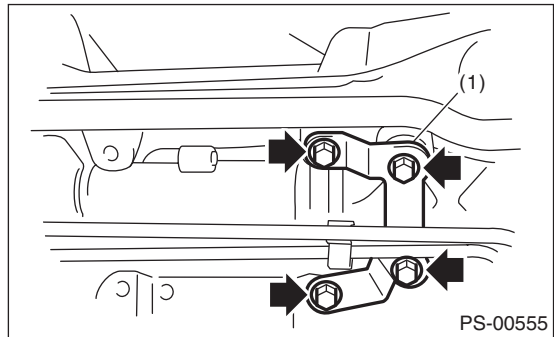


- (1) Bracket

## B: INSTALLATION

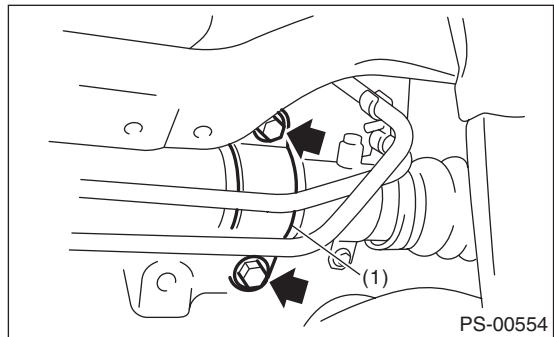
1) Insert the gearbox into crossmember, being careful not to damage gearbox boot.

2) Install the gearbox and bracket. Temporarily tighten the bolts.



- (1) Bracket

3) Insert bolts through the clamp to temporarily tighten the gearbox to the crossmember bracket.



- (1) Clamp

4) Tighten the bolts temporarily holding the gearbox clamp and bracket together to the specified torque.

**Tightening torque:**

**60 N·m (6.1 kgf·m, 44.1 ft·lb)**

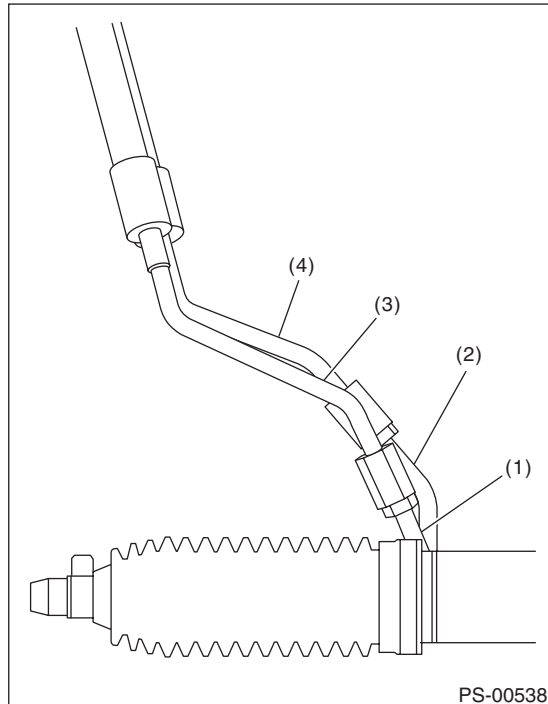
# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

5) Connect pipe D to the return hose, then connect pipe C to the pressure hose.

### **Tightening torque:**

**15 N·m (1.5 kgf-m, 10.8 ft-lb)**



- (1) Pipe C
- (2) Pipe D
- (3) Pressure hose
- (4) Return hose

6) Install the universal joint. <Ref. to PS-15, INSTALLATION, Universal Joint.>

7) Connect the tie-rod end and knuckle arm, and tighten with castle nut.

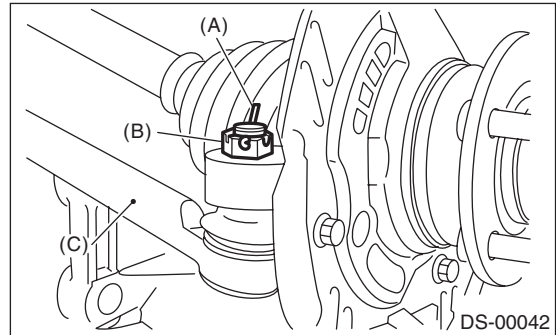
### **Castle nut tightening torque:**

**27 N·m (2.75 kgf-m, 19.9 ft-lb)**

### **CAUTION:**

**When connecting, do not hit the cap at the bottom of tie-rod end with hammer.**

8) After tightening the castle nut to the specified tightening torque, tighten it further within 60° until the cotter pin hole is aligned with slot in the nut. Fit the cotter pin into the nut, and then bend the pin to lock.



- (A) Cotter pin
- (B) Castle nut
- (C) Tie-rod end

9) Install the front stabilizer. <Ref. to FS-17, INSTALLATION, Front Stabilizer.>

10) Install the front crossmember support plate and jack-up plate.

11) Install the front exhaust pipe assembly. (Non-turbo model) <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

12) Install the under cover. <Ref. to EI-26, INSTALLATION, Front Under Cover.>

13) Install the front wheels.

14) Tighten the wheel nuts to the specified torque.

### **Tightening torque:**

**90 N·m (9.1 kgf-m, 65.8 ft-lb)**

15) Lower the vehicle.

16) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>

17) Align the center position of the roll connector. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>

18) Install the steering wheel. <Ref. to PS-14, INSTALLATION, Steering Wheel.>

19) Connect the battery ground cable to the battery.

20) Pour fluid into the oil tank, and bleed air. <Ref. to PS-55, Power Steering Fluid.>

21) Check for fluid leaks.

22) Check the fluid level in oil tank.

# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

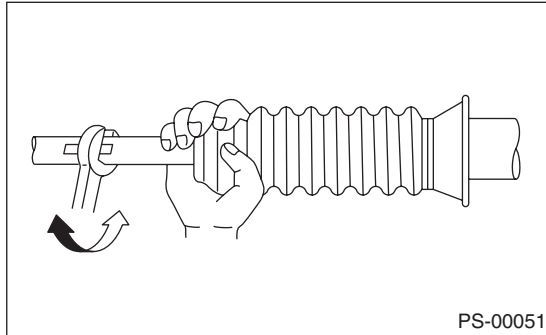
23) After adjusting toe-in and steering angle, tighten the lock nut on tie-rod end.

### Tightening torque:

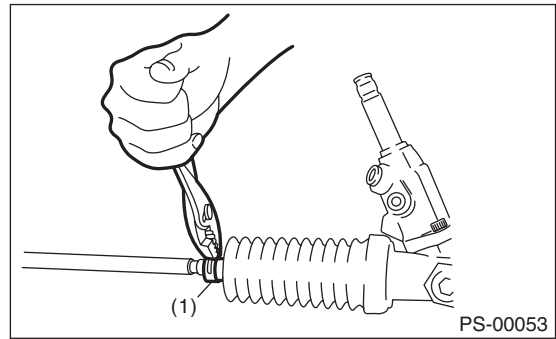
**85 N·m (8.7 kgf-m, 62.7 ft-lb)**

### NOTE:

When adjusting toe-in, hold the boot as shown to prevent it from being rotated or twisted. If it becomes twisted, straighten it.



4) Remove the small clip from the boot using pliers, and then move the boot to tie-rod end side.

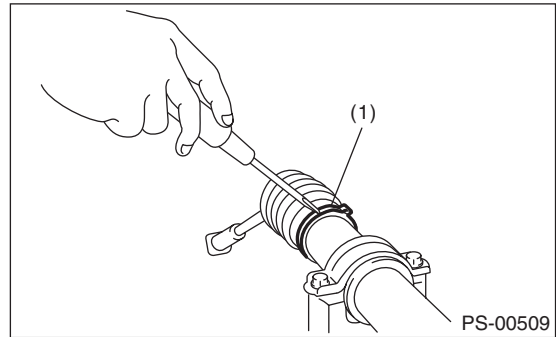


(1) Clip

5) Using a flat tip screwdriver, remove the band from boot.

### NOTE:

Replace the boot if there is damage, cracks or deterioration.



(1) Band

## C: DISASSEMBLY

### 1. RACK HOUSING ASSEMBLY

1) Disconnect the four pipes from gearbox.

### NOTE:

Remove the pipes C and D, which are fixed to clamp plate, as a unit.

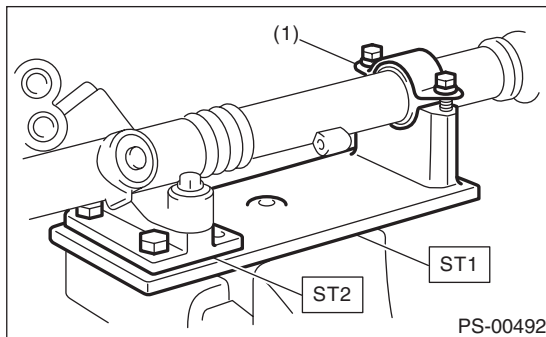
2) Secure the gearbox removed from vehicle in a vise using ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

### CAUTION:

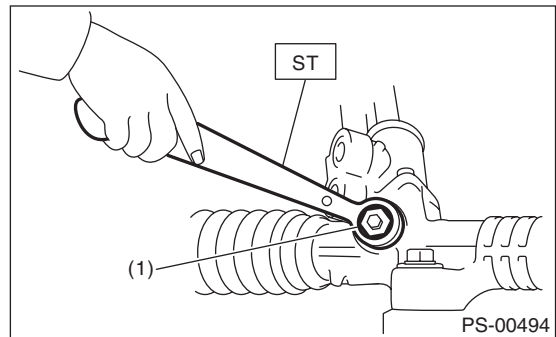
**Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.**



(1) Clamp

6) Using the ST, loosen the lock nut.

ST 926230000 SPANNER



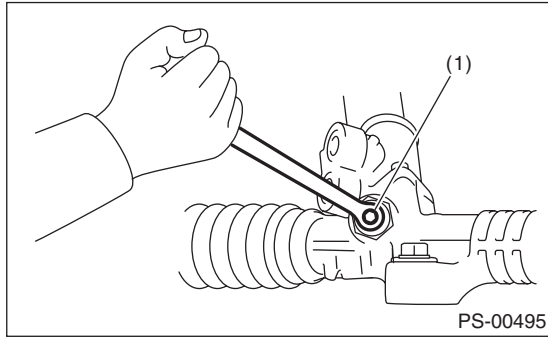
(1) Lock nut

3) Remove the tie-rod end and lock nut from gearbox.

# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

7) Tighten the adjusting screw until it can no longer be tightened.

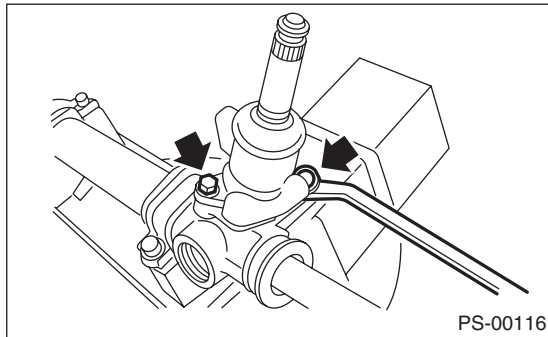


(1) Adjusting screw

8) Using the ST, remove the tie-rod.  
ST 926230000 SPANNER

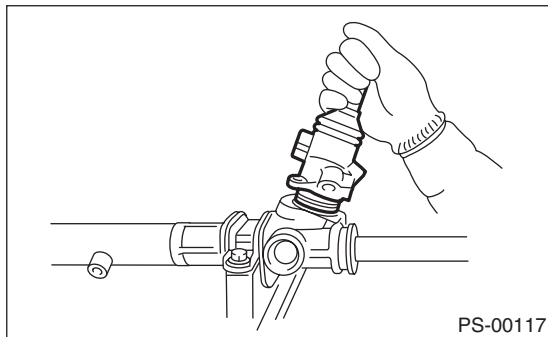
9) Loosen the adjusting screw, and remove the spring and sleeve.

10) Remove the two bolts securing valve assembly.



PS-00116

11) Carefully draw out the input shaft and remove the valve assembly.

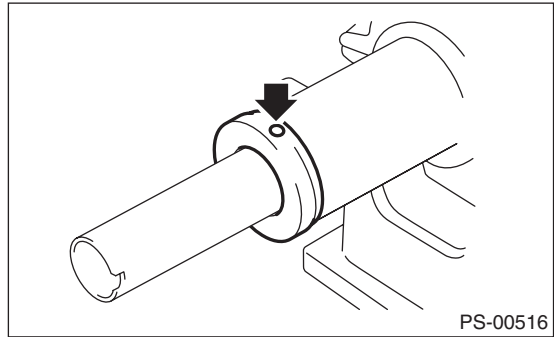


PS-00117

12) Using a drill, release the crimping of holder.

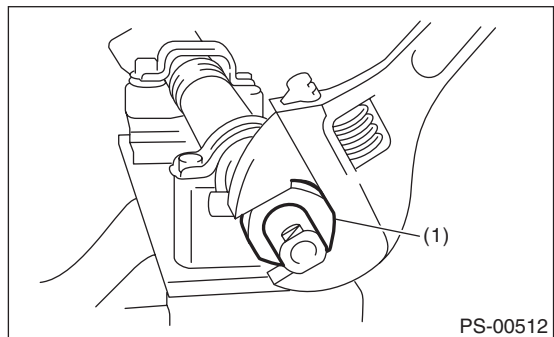
**CAUTION:**

**Make a hole of 2 mm (0.08 in) depth using a drill with 3 mm (0.12 in) diameter.**



PS-00516

13) Remove the holder.



PS-00512

(1) Holder

# Steering Gearbox

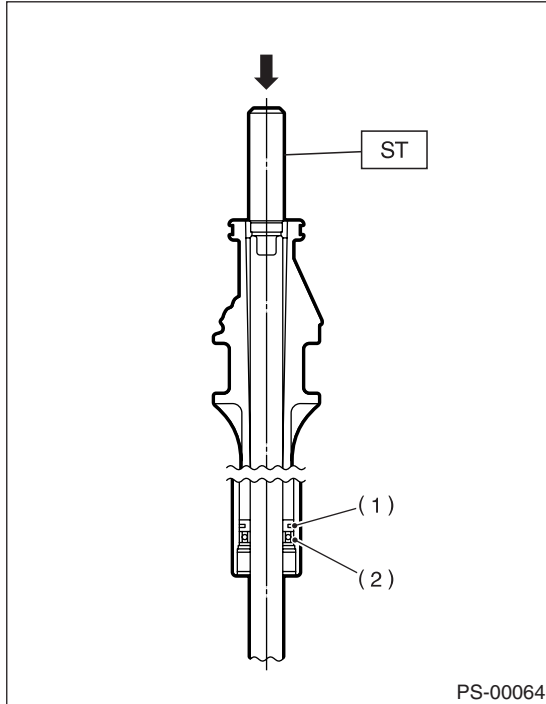
## POWER ASSISTED SYSTEM (POWER STEERING)

14) Attach the ST to the pinion housing side of the rack and push out the rack along with the outer side oil seal.

ST 34199FE000 INSTALLER & REMOVER

### NOTE:

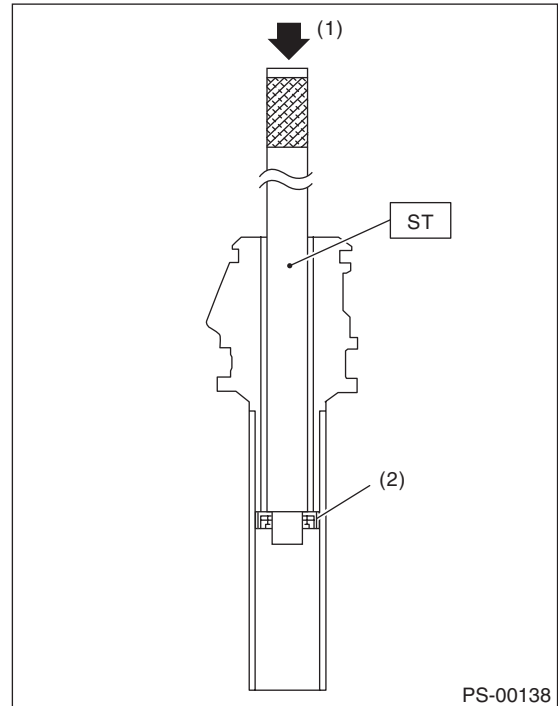
Plug the connecting section of the steering body pipe to prevent the fluid from flowing out.



- (1) Rack piston
- (2) Outer side oil seal

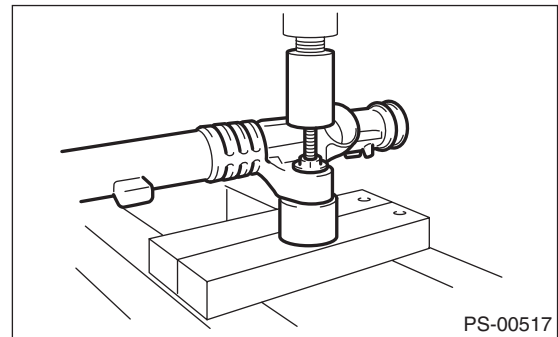
15) Insert the ST from pinion housing side and remove the oil seal using a press.

ST 927580000 OIL SEAL REMOVER



- (1) Press
- (2) Oil seal

16) Using a press, remove the bushing of gearbox installation portion.



# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

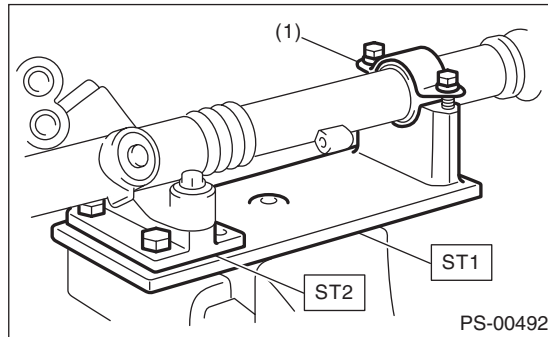
## 2. CONTROL VALVE

- 1) Disconnect the pipes A and B from gearbox.
- 2) Secure the gearbox removed from vehicle in a vise using ST.

ST1 926200000 STAND  
ST2 34199AG000 BOSS D

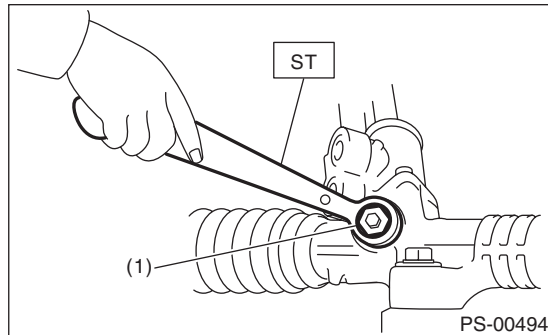
### CAUTION:

Secure the gearbox in a vise using ST as shown in the figure. Do not secure the gearbox without this ST.



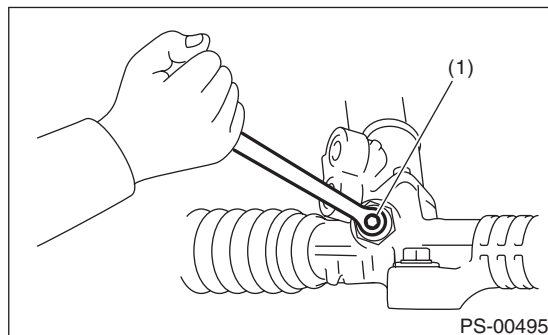
(1) Clamp

- 3) Using the ST, loosen the lock nut.  
ST 926230000 SPANNER



(1) Lock nut

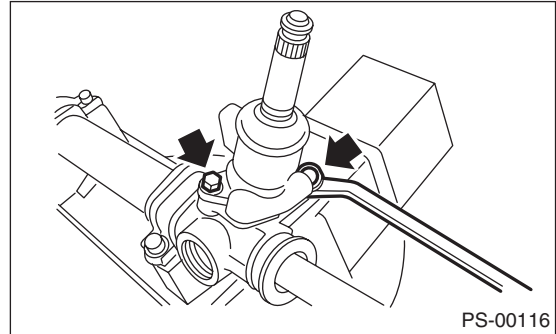
- 4) Tighten the adjusting screw until it can no longer be tightened.



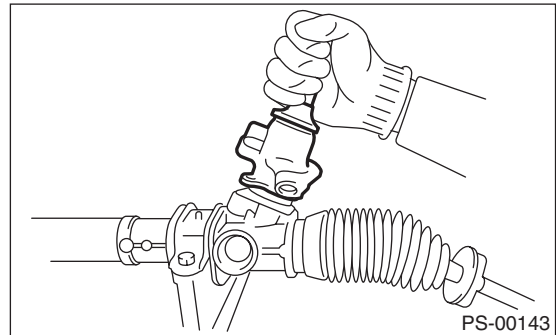
(1) Adjusting screw

- 5) Loosen the adjusting screw, and remove the spring and sleeve.

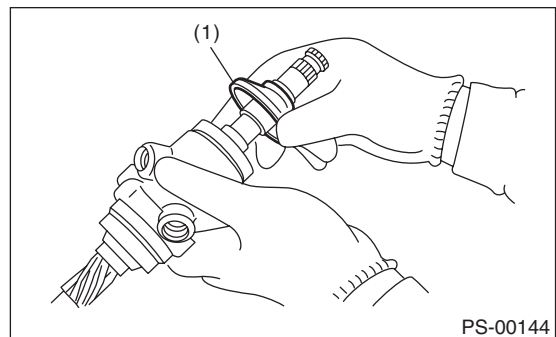
- 6) Remove the two bolts securing valve assembly.



- 7) Carefully draw out the input shaft and remove the valve assembly.

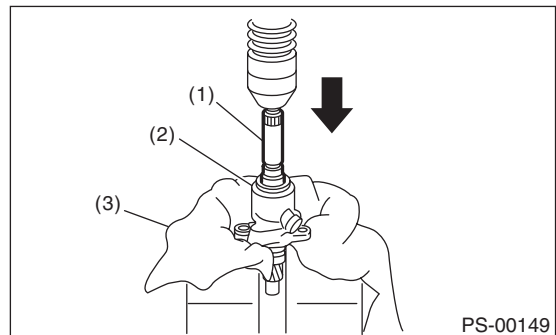


- 8) Put a vinyl tape around the spline portion, and slide the dust cover to remove.



(1) Dust cover

- 9) Using a press, remove the pinion & valve assembly from valve housing.



- (1) Pinion & valve ASSY
- (2) Valve housing
- (3) Cloth



# Steering Gearbox

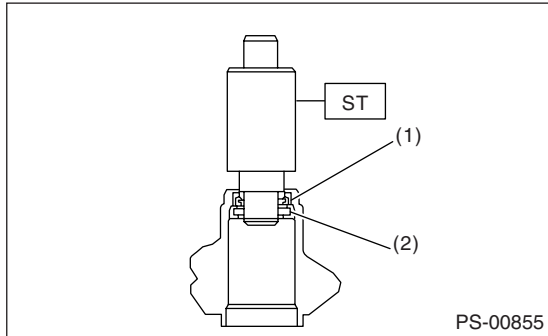
## POWER ASSISTED SYSTEM (POWER STEERING)

10) Using the ST and a press, remove the bushing and oil seal from the valve housing.

ST 34199AG090 INSTALLER & REMOVER

### CAUTION:

- Do not apply a force to the end surface of valve housing.
- Do not reuse the oil seal after removal.

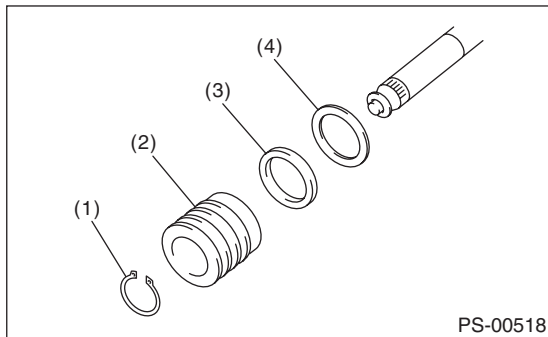


- (1) Oil seal
- (2) Bushing

11) Using a snap ring pliers, remove the snap ring, valve, oil seal and back-up washer.

### CAUTION:

Be careful not to scratch the pinion and valve assembly.

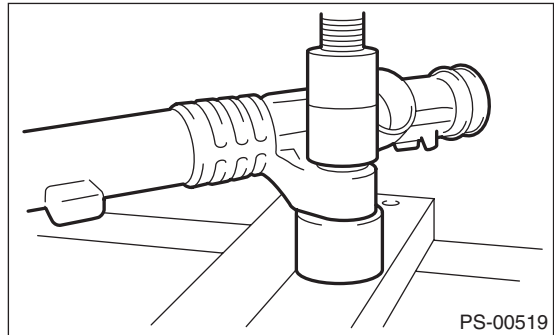


- (1) Snap ring
- (2) Valve
- (3) Oil seal
- (4) Back-up ring

## D: ASSEMBLY

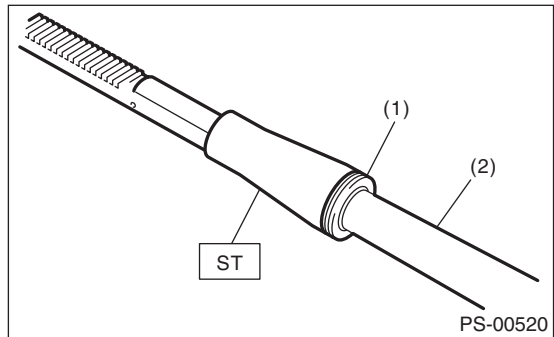
### 1. RACK HOUSING ASSEMBLY

1) Using a press, install the bushing to gearbox installation portion.



2) Insert the ST to rack.

ST 34199AG030 GUIDE



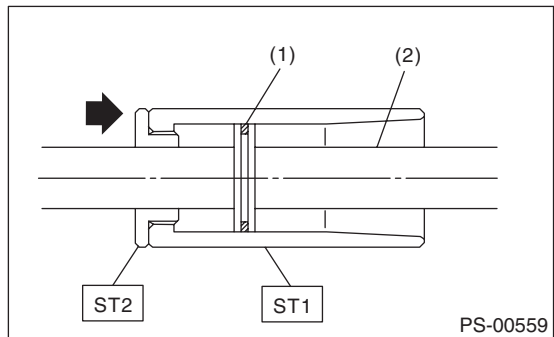
- (1) Seal ring
- (2) Rack

3) Install the seal ring to piston portion of rack.

4) Using the ST, form the seal ring properly.

ST1 34199AG080 FORMER PISTON

ST2 34199AG050 GUIDE G (24)



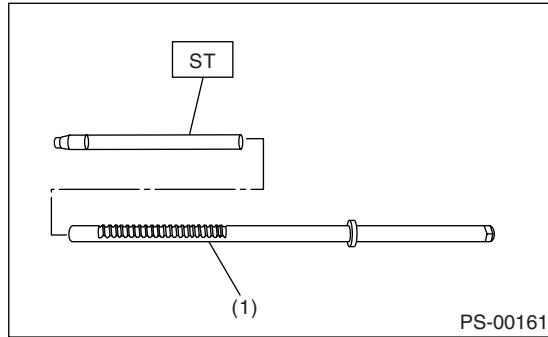
- (1) Seal ring
- (2) Rack

# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

5) Fit the ST over toothed portion of rack assembly, and insert the oil seal to rack.

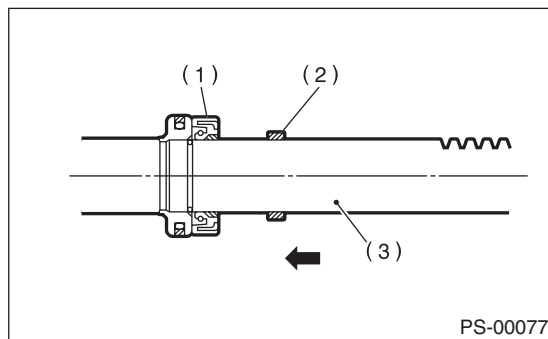
ST 926390001 COVER & REMOVER



(1) Rack ASSY

6) Remove the ST from rack assembly.

7) Install the back-up washer from the gear side of rack.



(1) Oil seal  
(2) Back-up washer  
(3) Rack

8) Check the threaded end of holder and gearbox cylinder end for burrs, damage, etc. Correct if faulty.

9) Apply a coat of grease to the grooves in rack, sliding surface of sleeve and sealing surface of piston. Then insert the rack into steering body from cylinder side.

10) Temporarily tighten the new holder to gearbox cylinder.

11) Put a mark at the specified position from the end surface of the ST as shown in the figure.

**Specified position:**

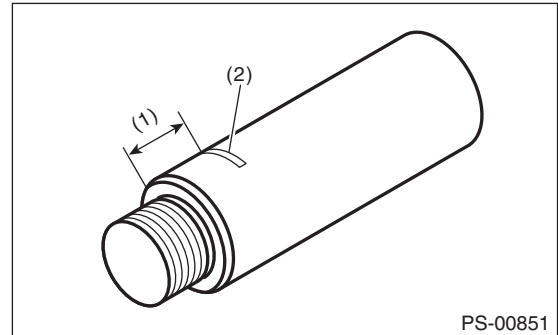
**Except for 2.5 GT-B:**

**13.5 mm (0.53 in)**

**2.5 GT-B:**

**18.9 mm (0.74 in)**

ST 34199FE000 INSTALLER & REMOVER

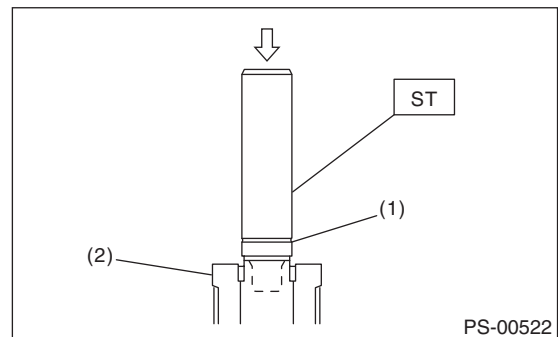


(1) 13.5 mm (0.53 in) or 18.9 mm (0.74 in)  
(2) Put a mark.

12) Attach the ST to the rack end surface.

ST 34199FE000 INSTALLER & REMOVER

13) Using a press, press-fit until the mark on the ST is aligned to the end surface of the holder.



(1) Marked position  
(2) Holder

14) Remove the ST and the holder.

15) Insert the outer side oil seal to the rack in the same procedure as in step 5) and 6).

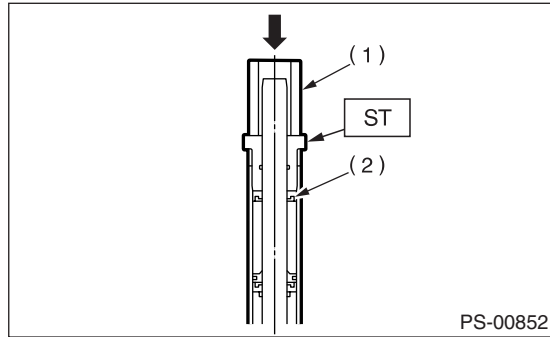
ST 926390001 COVER & REMOVER

# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

16) Put the ST and pipe through the rack and press-fit the outer side oil seal using a press.

ST 34199AG010 INSTALLER

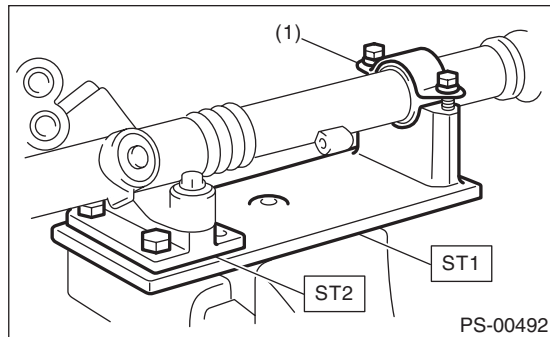


- (1) Pipe
- (2) Outer side oil seal

17) Secure the gearbox in a vise using ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D



- (1) Clamp

18) Tighten the new holder.

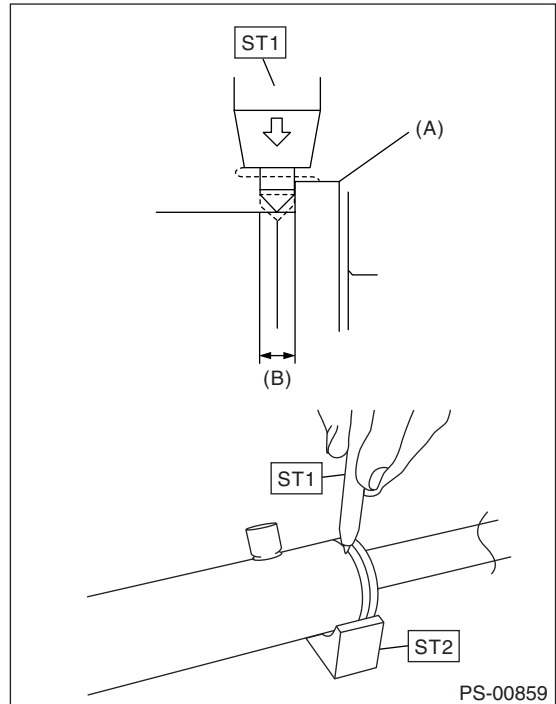
**Tightening torque:**

**70 N·m (7.1 kgf·m, 51.6 ft·lb)**

19) Using the ST, crimp so that the diameter of punch hole is 2 — 2.5 mm (0.08 — 0.10 in) and is aligned to the position of 2 mm (0.08 in) from gearbox cylinder end surface.

ST1 34099FA060 PUNCH HOLDER

ST2 34199XA050 BASE

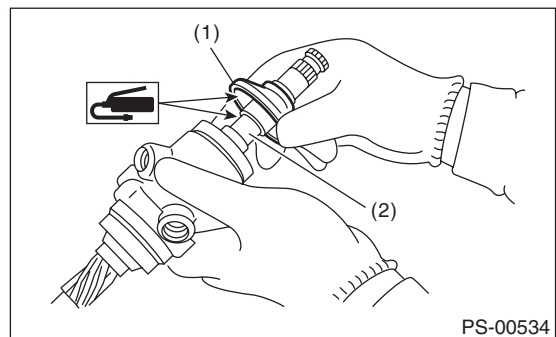


- (A) Holder
- (B) 2 mm (0.08 in)

20) Put a vinyl tape around the spline portion and apply genuine grease to the dust cover and install to valve assembly.

**CAUTION:**

**Be sure to install the dust cover to groove of shaft.**

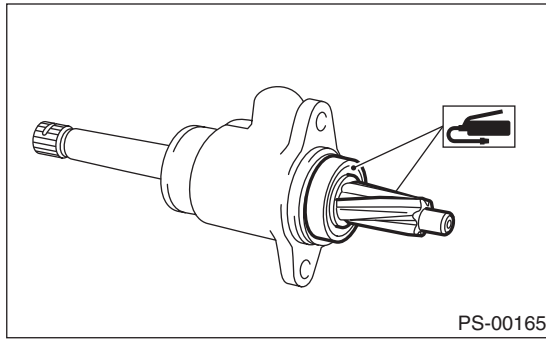


- (1) Dust cover
- (2) Groove

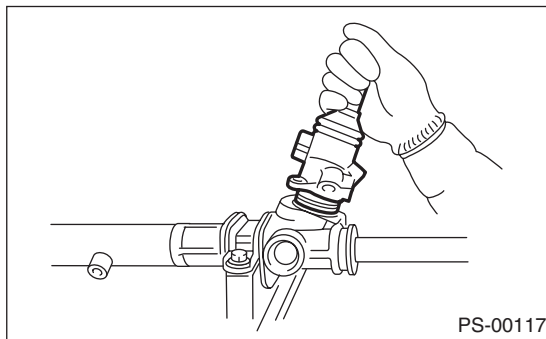
# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

21) Apply the genuine grease to the pinion gear and bearing of valve assembly.



22) Install a new gasket on valve assembly. Insert the valve assembly into place while facing the rack teeth toward pinion.



23) Tighten the bolts alternately to secure the valve assembly.

**Tightening torque:**

**20 N·m (2.0 kgf·m, 14.8 ft·lb)**

**CAUTION:**

**Be sure to alternately tighten the bolts.**

24) Temporarily install the tie-rod to rack end, and then operate the rack from lock to lock for two or three times to make it fit in.

**CAUTION:**

**Operating the rack from lock to lock without installing tie-rods may damage the oil seal. Always install the left and right tie-rods.**

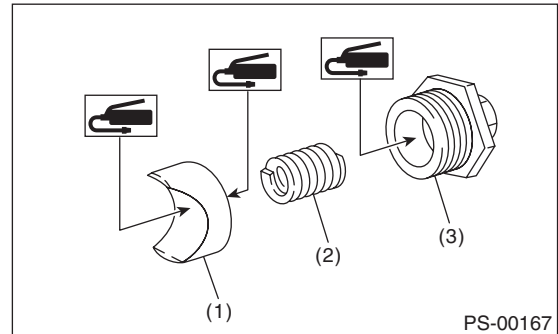
25) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

**Liquid gasket:**

**THREE BOND 1141**

26) Apply a coat of grease to the sliding surface of sleeve and seating surface of spring, and then insert the sleeve into steering body.

Charge the adjusting screw with grease, and then insert the spring into adjusting screw. Then install on the steering body.



- (1) Sleeve
- (2) Spring
- (3) Adjusting screw

27) Tighten the adjusting screw to the specified torque, then loosen it.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

28) Tighten the adjusting screw to the specified torque, then loosen it 20°.

**Tightening torque:**

**3.9 N·m (0.4 kgf·m, 2.9 ft·lb)**

29) Remove the tie-rod.

30) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-37, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

31) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

### Liquid gasket:

**THREE BOND 1141**

ST 926230000 SPANNER

### Tightening torque (lock nut):

**25 N·m (2.5 kgf-m, 18.1 ft-lb)**

### NOTE:

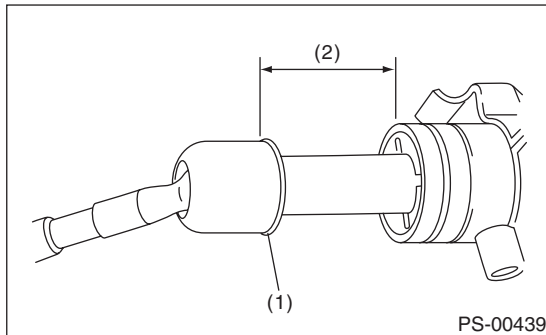
Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

32) Extend the rack approx. 40 mm (1.57 in) from steering body.

33) Install the tie-rod and new lock washer into rack.

### Tightening torque:

**90 N·m (9.1 kgf-m, 65.8 ft-lb)**



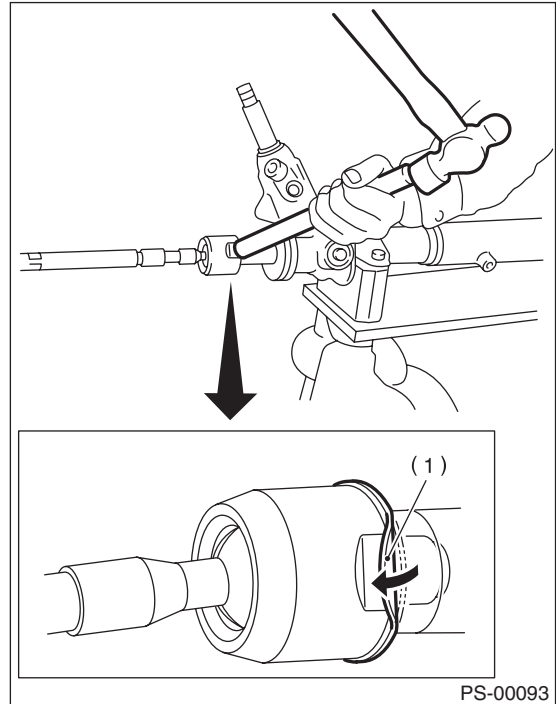
(1) Lock washer

(2) Approx. 40 mm (1.57 in)

34) Bend the lock washer and crimp it.

### CAUTION:

**Be careful not to scratch the rack when crimping lock washer.**



(1) Lock washer

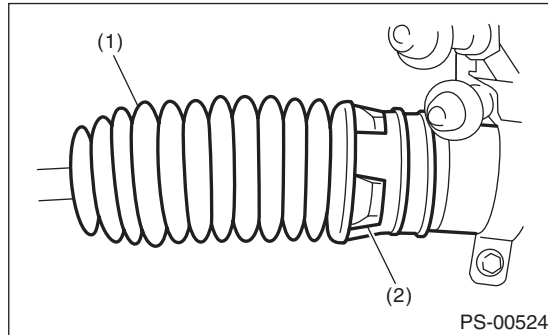
# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

35) Apply a coat of grease to the tie-rod groove, and then install the boot to the housing.

### CAUTION:

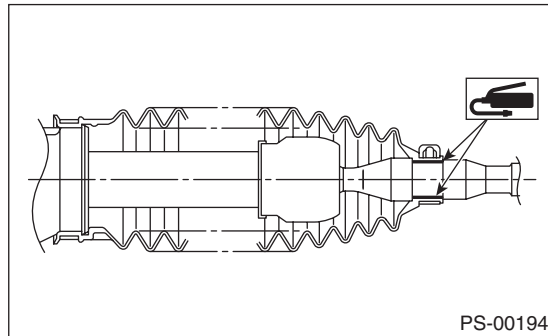
Right side boot has groove for identification, be sure to install the right and left of boot.



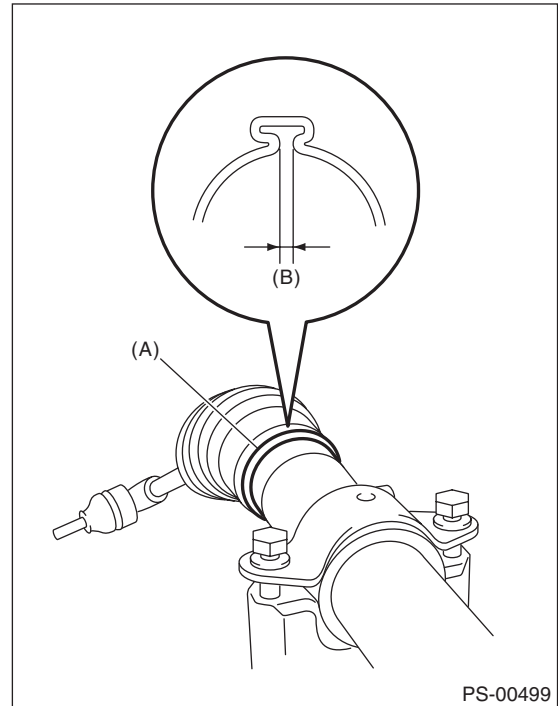
- (1) Right side boot
- (2) Groove for identification

### NOTE:

Make sure that the boot is installed without unusual inflation or deflation.

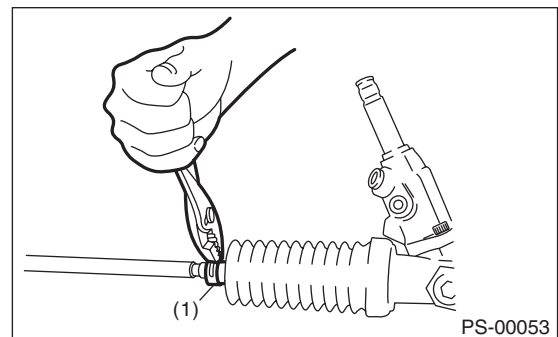


36) Install a new boot band. Using band clamp pliers, crimp it so that the clearance of crimping portion becomes 2 mm (0.079 in) or less.



- (A) Boot band
- (B) 2 mm (0.079 in) or less

37) Fix the boot end with small clip.



- (1) Clip

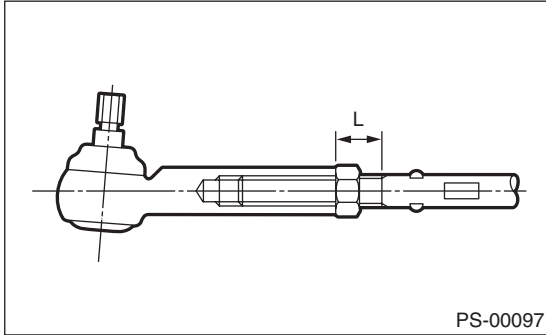
38) After installing, check that the boot end is installed to the groove of the tie-rod.

# Steering Gearbox

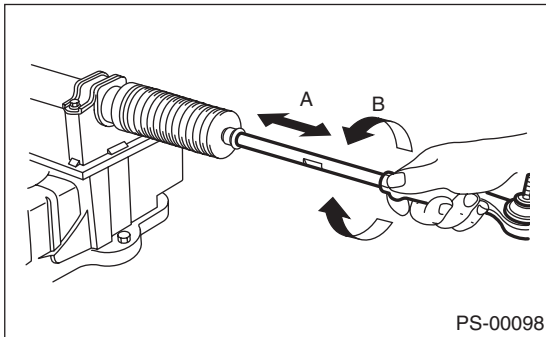
## POWER ASSISTED SYSTEM (POWER STEERING)

39) If the tie-rod end has been removed, screw in lock nut and tie-rod end to the screwed portion of tie-rod, and tighten the lock nut temporarily in a position as shown in the figure.

**Installed tie-rod length L:**  
**31 mm (1.22 in)**



40) Inspect the gearbox as follows:  
Holding the "A" tie-rod end, repeat movement from lock to lock two or three times as quickly as possible.  
Holding the "B" tie-rod end, turn a few times as slowly as possible.  
Finally, make sure that the boot is installed in the specified position without inflating.



41) Remove the gearbox from ST.  
ST1 92620000 STAND  
ST2 34199AG000 BOSS D

42) Install the four pipes on gearbox.  
(1) Connect the pipes A and B to the four pipe joints of gearbox.

**Tightening torque:**

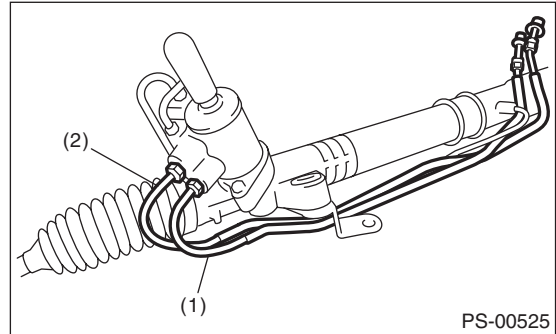
**Refer to the component parts. <Ref. to PS-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>**

(2) Connect the pipes C and D to gearbox.

**Tightening torque:**

**Pipe C: 37 N·m (3.8 kgf-m, 27.3 ft-lb)**

**Pipe D: 29 N·m (3.0 kgf-m, 21.4 ft-lb)**



(1) Pipe C

(2) Pipe D

# Steering Gearbox

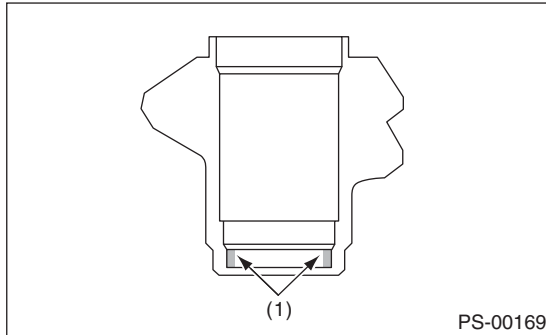
POWER ASSISTED SYSTEM (POWER STEERING)

## 2. CONTROL VALVE ASSEMBLY

**Specified steering grease:**

**VALIANT GREASE M2 (Part No. 003608001)**

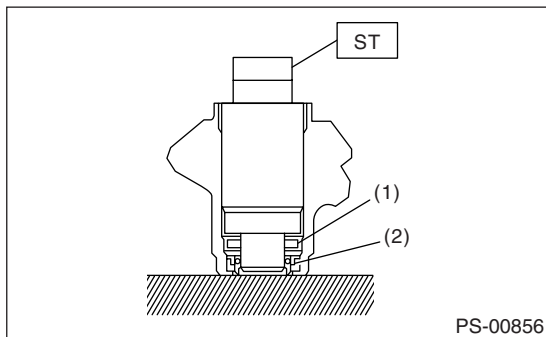
- 1) Clean all parts and tools before reassembling.
- 2) Apply a coat of specified power steering fluid to the inner wall of valve housing.



- (1) Apply fluid.

- 3) Apply a coat of grease to the oil seal.
- 4) Verify the direction of oil seal.
- 5) Using the ST and a press, install the oil seal and bushing in valve housing.

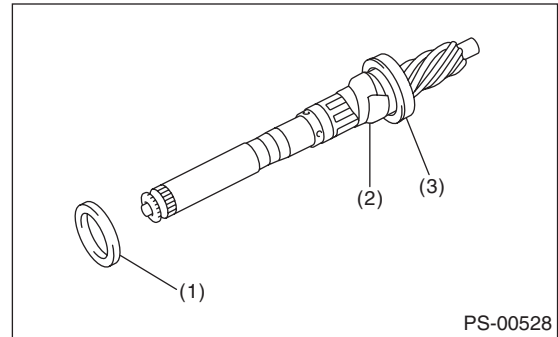
ST 34199AG090 INSTALLER & REMOVER



- (1) Bushing
- (2) Oil seal

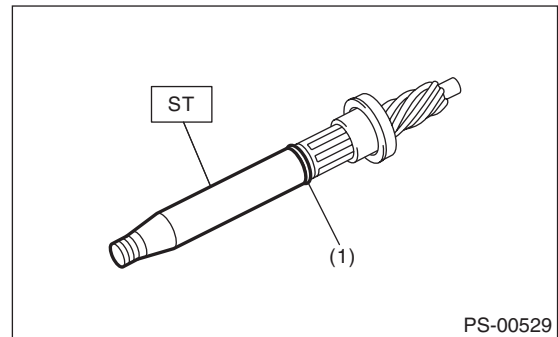
- 6) Apply vinyl tape to the groove of pinion.

- 7) Install the back-up ring and oil seal to pinion, and then remove the vinyl tape.



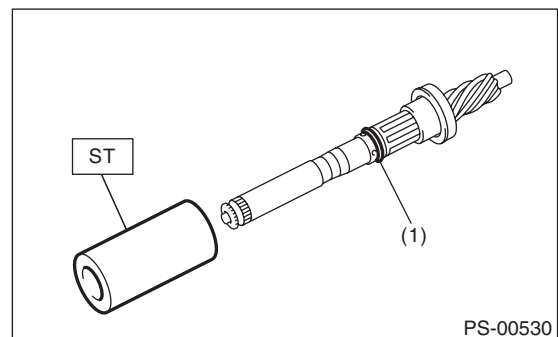
- (1) Oil seal
- (2) Vinyl tape
- (3) Back-up ring

- 8) Attach the ST to pinion, and install the seal ring.  
ST 34199AG020 GUIDE



- (1) Seal ring

- 9) Remove the ST GUIDE, and form the seal ring properly using ST FORMER.  
ST 34199AG070 FORMER



- (1) Seal ring

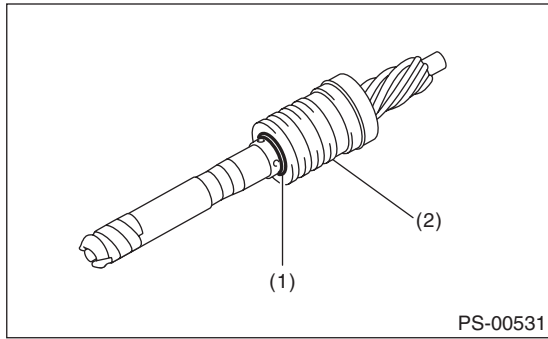
- 10) Put vinyl tape around pinion shaft spline to protect oil seal from damage.



# Steering Gearbox

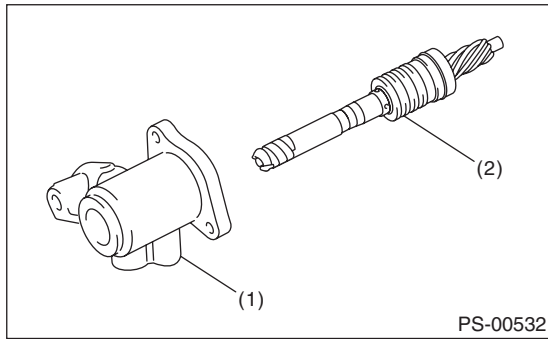
## POWER ASSISTED SYSTEM (POWER STEERING)

11) Install the valve to pinion, and install the snap ring.



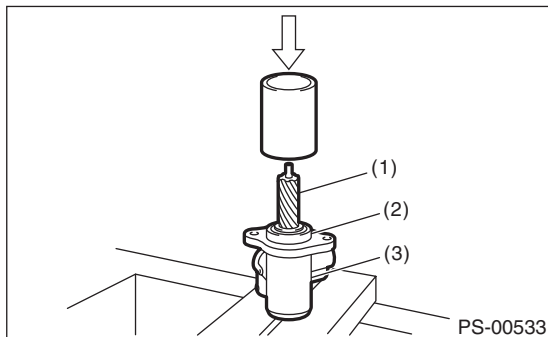
- (1) Snap ring
- (2) Valve

12) Attach the pinion and valve assembly into the valve housing.



- (1) Valve housing
- (2) Pinion & valve ASSY

13) Using a press, push the outer race of bearing and press-fit the pinion & valve assembly into housing.

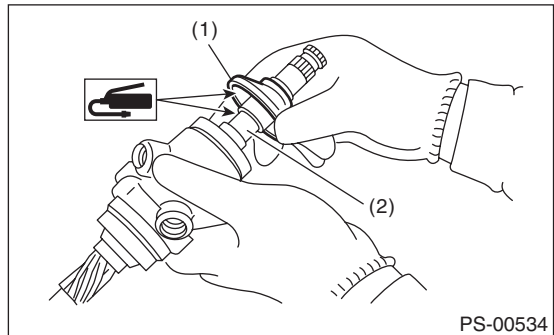


- (1) Pinion & valve ASSY
- (2) Bearing
- (3) Housing

14) Apply the specified grease to dust cover.  
15) Install the dust cover on valve assembly.

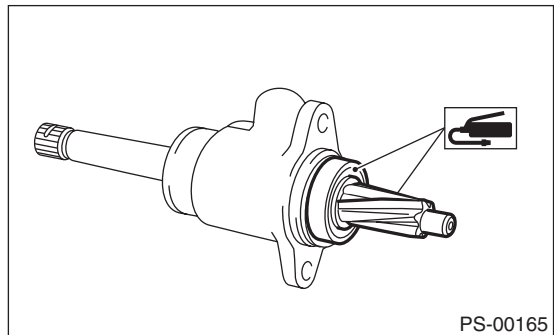
### CAUTION:

Be sure to install the dust cover to groove of shaft.

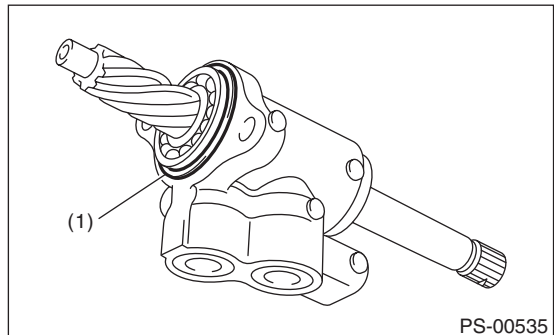


- (1) Dust cover
- (2) Groove

16) Apply the genuine grease to the pinion gear and bearing of valve assembly.



17) Install new O-ring to valve assembly.

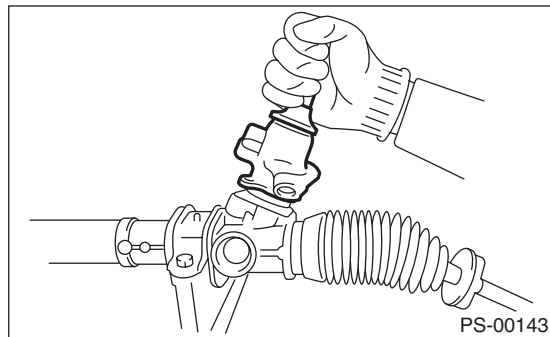


- (1) O-ring

# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

18) Insert the valve assembly into place while facing the rack teeth toward pinion.



19) Tighten the bolts alternately to secure the valve assembly.

**Tightening torque:**

**20 N·m (2.0 kgf·m, 14.8 ft·lb)**

**CAUTION:**

**Be sure to alternately tighten the bolts.**

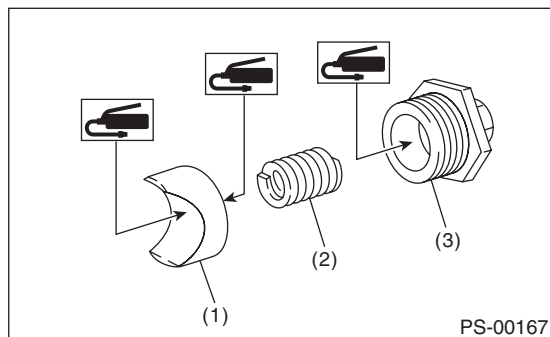
20) Apply liquid gasket to 1/3 or more of entire perimeter of adjusting screw thread.

**Liquid gasket:**

**THREE BOND 1141 (Part No. 004403006)**

21) Apply a coat of grease to the sliding surface of sleeve and seating surface of spring, and then insert the sleeve into steering body.

Charge the adjusting screw with grease, and then insert the spring into adjusting screw. Then install on the steering body.



- (1) Sleeve
- (2) Spring
- (3) Adjusting screw

22) Tighten the adjusting screw to the specified torque, then loosen it.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

23) Tighten the adjusting screw to the specified torque, then loosen it 20°.

**Tightening torque:**

**3.9 N·m (0.4 kgf·m, 2.9 ft·lb)**

24) Adjust the turning resistance of gearbox so that it is within specification using adjusting screw. <Ref. to PS-37, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>

25) Apply liquid gasket to lock nut and install it into adjusting screw. While holding the adjusting screw with wrench, tighten the lock nut using ST.

**Liquid gasket:**

**THREE BOND 1141**

ST 926230000 SPANNER

**Tightening torque (lock nut):**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

**NOTE:**

Hold the adjusting screw with a wrench to prevent it from turning while tightening lock nut.

26) Remove the gearbox from ST.

ST1 926200000 STAND

ST2 34199AG000 BOSS D

27) Install the four pipes on gearbox.

(1) Connect the pipes A and B to gearbox.

**Tightening torque:**

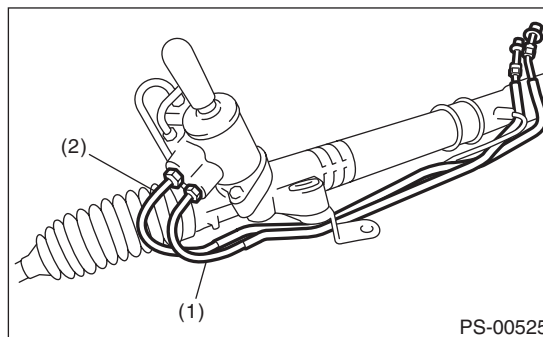
**Refer to the component parts. <Ref. to PS-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>**

(2) Connect the pipes C and D to gearbox.

**Tightening torque:**

**Pipe C: 37 N·m (3.8 kgf·m, 27.3 ft·lb)**

**Pipe D: 29 N·m (3.0 kgf·m, 21.4 ft·lb)**



- (1) Pipe C
- (2) Pipe D

# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

### E: INSPECTION

#### 1. BASIC INSPECTION

1) Clean all the disassembled parts, and check for wear, damage or any other faults, then repair or replace as necessary.

2) When disassembling, check the inside of gearbox for water. If any water is found, carefully check the boot for damage, input shaft dust seal, adjusting screw and boot clips for poor sealing. If faulty, replace with new parts.

No.	Parts	Inspection	Corrective action
1	Input shaft	(1) Bent input shaft (2) Damage on serration	If the bend or damage is excessive, replace the entire gearbox.
2	Dust seal	(1) Crack or damage (2) Wear	If the outer wall slips, the lip is worn out or damage is found, replace it with a new part.
3	Rack & pinion	Poor mating of rack with pinion	(1) Adjust the backlash properly. By measuring the turning torque of the gearbox and sliding resistance of rack, check if the rack & pinion engage uniformly and smoothly with each other. (Refer to Service limit.) (2) Pull out the entire rack to allow viewing of the teeth, and check for damage. Even if abnormality is found in either (1) or (2), replace the entire gearbox.
4	Gearbox unit	(1) Bending of the rack shaft (2) Bending of the cylinder portion (3) Crack or damage on the cast iron portion	Replace the gearbox with a new part.
		(4) Wear or damage on rack bushing	If the free play of rack shaft in radial direction is out of the specified range, replace the gearbox with new part. (Refer to Service limit.)
		(5) Wear on input shaft bearing	If the free play of input shaft in radial and axial direction is out of the specified range, replace the gearbox with a new part. (Refer to Service limit.)
5	Boot	Crack, damage or deterioration	Replace.
6	Tie-rod	(1) Looseness of ball joint (2) Bend of tie-rod	Replace.
7	Tie-rod end	Damage or deterioration of dust seal	Replace.
8	Adjusting screw spring	Deterioration	Replace.
9	Boot clip	Deterioration	Replace.
10	Sleeve	Damage	Replace.
11	Pipe	(1) Damage to flared surface (2) Damage to flare nut (3) Damage to pipe	Replace.

# Steering Gearbox

POWER ASSISTED SYSTEM (POWER STEERING)

## 2. SERVICE LIMIT

Make a measurements as follows. If it exceeds the specified service limits, adjust or replace.

NOTE:

When making a measurement, vise the gearbox using ST. Never vise the gearbox by inserting aluminum plates etc. between vise and gearbox.

ST1 926200000 STAND  
ST2 34199AG000 BOSS D

## 3. RACK SHAFT PLAY IN THE RADIAL DIRECTION

*Right-turn steering:*

**Service limit**

**0.12 mm (0.005 in) or less**

**On condition**

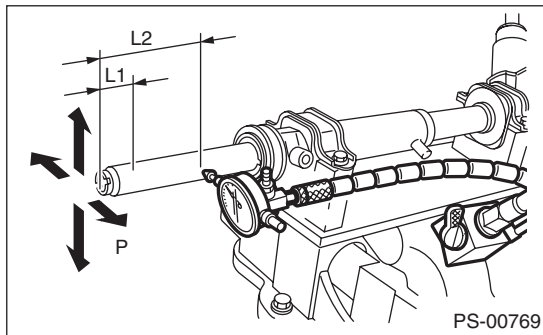
**Weighting point**

**L1: 10 mm (0.39 in)**

**P: 98 N (10 kgf, 22 lb)**

**Measuring point**

**L2: 25 mm (0.98 in)**



## 4. INPUT SHAFT PLAY

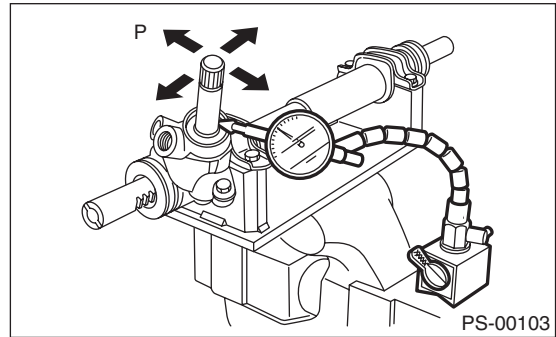
*In radial direction:*

**Service limit**

**0.26 mm (0.01 in) or less**

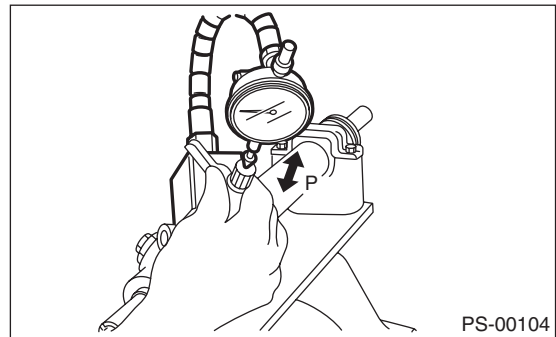
**On condition**

**P: 98 N (10 kgf, 22 lb)**



*In axial direction:*

**Without play**



## 5. TURNING RESISTANCE OF GEARBOX

Using the ST, measure the gearbox turning resistance.

ST 34099PA100 SPANNER

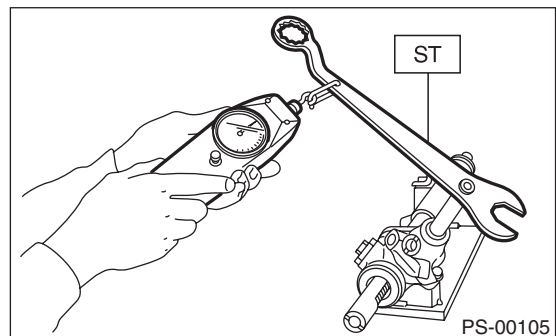
**Service limit:**

**Maximum allowable resistance:**

**11.3 N (1.15 kgf, 2.54 lb) or less.**

**Difference between right and left turning resistance:**

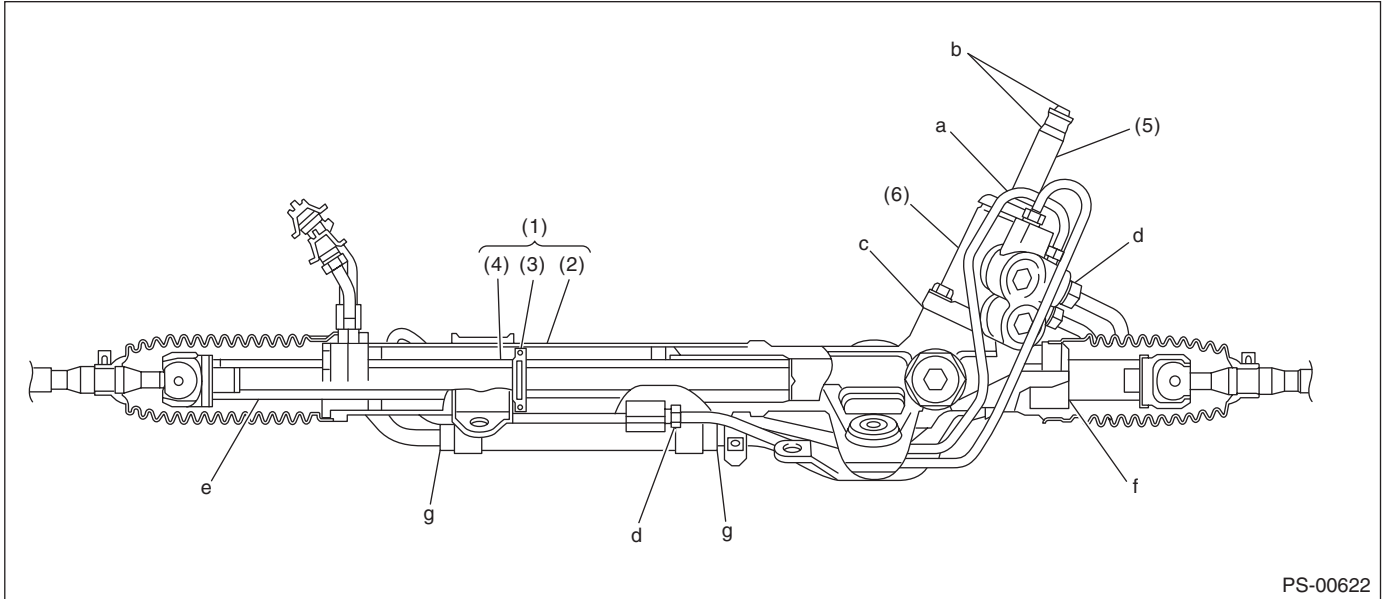
**24% or less**



# Steering Gearbox

## POWER ASSISTED SYSTEM (POWER STEERING)

### 6. OIL LEAKAGE



PS-00622

- (1) Power cylinder  
(2) Cylinder

- (3) Rack piston  
(4) Rack axle

- (5) Input shaft  
(6) Valve housing

1) Lift up the vehicle.

2) If a fluid leak is found, clean the fluid completely from the suspect area, and turn the steering wheel 30 to 40 times to the left and right from lock to lock, with the engine running, and check again for leaks immediately, and also after a few hours have passed.

3) Cause and solution for oil leakage from "a"  
The oil seal is damaged. Replace the valve assembly with a new part.

4) Cause and solution for oil leakage from "b"  
The torsion bar O-ring is damaged. Replace the valve assembly with a new part.

5) Cause and solution for oil leakage from "c"  
The oil seal is damaged. Replace the valve assembly or oil seal with a new part.

6) Cause and solution for oil leakage from "d".  
The pipe is damaged. Replace the faulty pipe or O-ring.

7) Cause and solution for oil leakage from "g".  
The hose is damaged. Replace the hose with a new part.

8) If leak is other than a, b, c, d or g, or if oil is leaking from gearbox, move the right and left boots toward tie-rod end side, respectively, with the gearbox mounted to the vehicle, and remove fluid from surrounding portions. Then, turn the steering wheel from lock to lock about 30 to 40 times with the engine running, and make comparison of the leaked portion immediately after and several hours after this operation.

(1) Leakage from "e"

The cylinder seal is damaged. Replace the rack bushing with a new part.

(2) Leakage from "f"

There are two possible causes. Perform the following step first. Remove the pipe assembly B from the valve housing, and close the circuit using ST.

ST 926420000 PLUG

Turn the steering wheel from lock to lock approx. 30 to 40 times with the engine running, then inspect the leaked portion immediately after and several hours after this operation.

- If leakage from "f" is noted again:  
The oil seal of pinion and valve assembly is damaged. Replace the pinion & valve assembly with a new part. Or replace the oil seal and the parts that are damaged during disassembly with new parts.

- If oil stops leaking from "f":

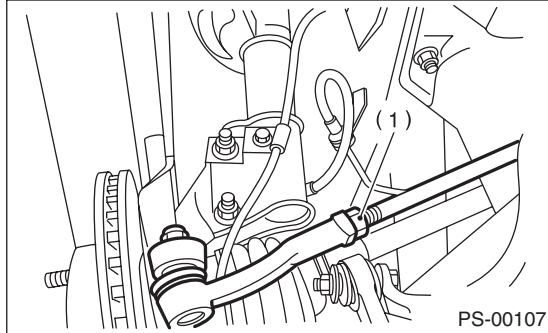
The oil seal of rack housing is damaged. Replace the oil seal and parts that are damaged during disassembly with new parts.

## F: ADJUSTMENT

1) Adjust the front toe.  
 <Ref. to FS-13, FRONT WHEEL TOE-IN, INSPECTION, Wheel Alignment.>

### **Standard of front toe:**

**IN 3 — OUT 3 mm (IN 0.12 — OUT 0.12 in)**



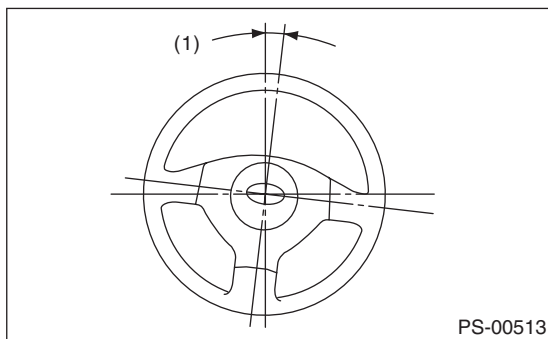
(1) Lock nut

2) Adjust the steering angle of the wheels.

### **Standard of steering angle:**

Model	Excluding 2.5 GT spec. B	2.5 GT spec. B
Inner wheel	$37.6^{\circ} \pm 1.5^{\circ}$	$33.8^{\circ} \pm 1.5^{\circ}$
Outer wheel	$33.0^{\circ} \pm 1.5^{\circ}$	$30.2^{\circ} \pm 1.5^{\circ}$

3) If the steering wheel spokes are not horizontal when wheels are set in the straight ahead position, or error is more than  $5^{\circ}$  on the periphery of the steering wheel, correctly re-install the steering wheel.



(1)  $5^{\circ}$  or less

4) If the steering wheel spokes are not horizontal with vehicle set in the straight ahead position after this adjustment, correct it by turning the right and left tie-rods in the opposite direction from each other by the same angle.

# Pipe Assembly

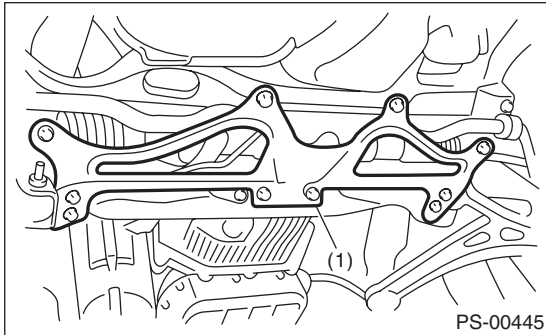
## POWER ASSISTED SYSTEM (POWER STEERING)

### 6. Pipe Assembly

#### A: REMOVAL

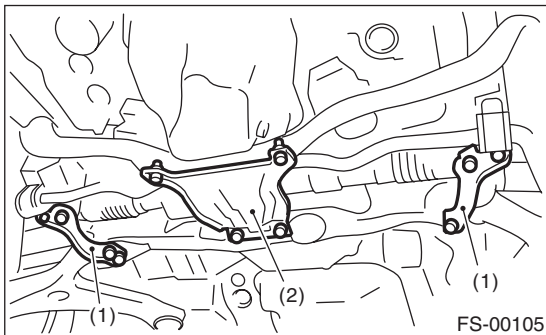
- 1) Disconnect the ground cable from the battery.
- 2) Lift up the vehicle, and then remove the front crossmember support plate and jack-up plate.

- Large type



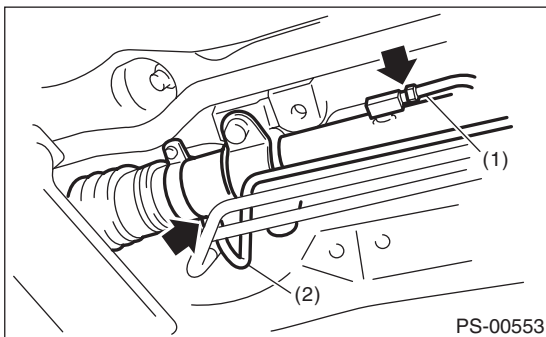
(1) Front crossmember support plate

- Small type



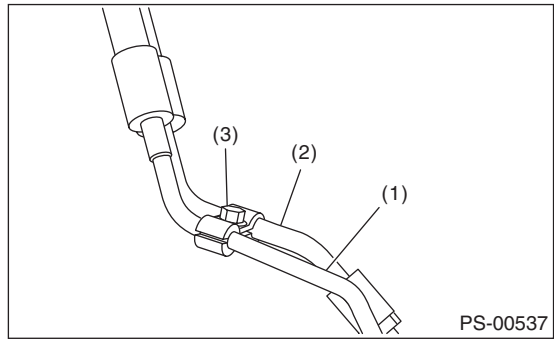
(1) Crossmember support plate  
(2) Jack-up plate

- 3) Remove the one pipe joint at the center of the gearbox, and connect the vinyl hose to the pipe and the joint. Discharge the fluid by turning the steering wheel fully clockwise and counterclockwise. Discharge the fluid similarly from other pipes.



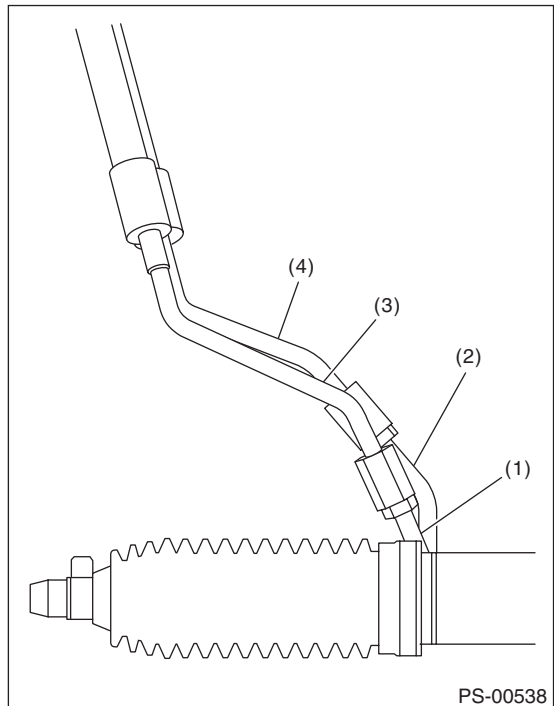
(1) Pipe A  
(2) Pipe B

- 4) Remove the clamp E from return hose and pressure hose.



(1) Return hose  
(2) Pressure hose  
(3) Clamp E

- 5) Disconnect the pipe D from return hose and pipe C from pressure hose.



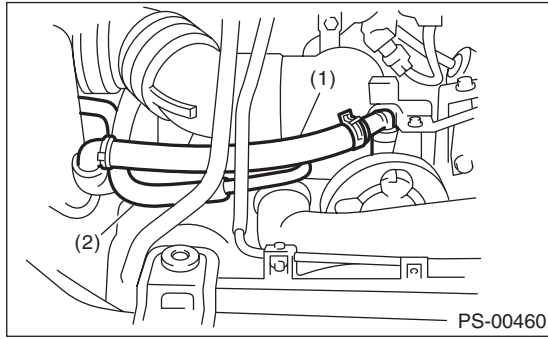
(1) Pipe C  
(2) Pipe D  
(3) Pressure hose  
(4) Return hose

- 6) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

# Pipe Assembly

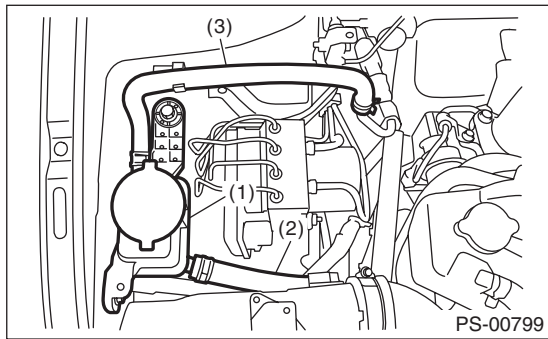
POWER ASSISTED SYSTEM (POWER STEERING)

7) Disconnect the suction hose and pressure hose from oil pump.



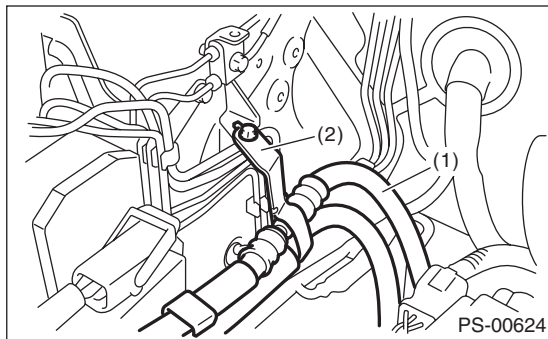
- (1) Suction hose
- (2) Pressure hose

8) Disconnect the suction hose and return hose from the reservoir tank.



- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

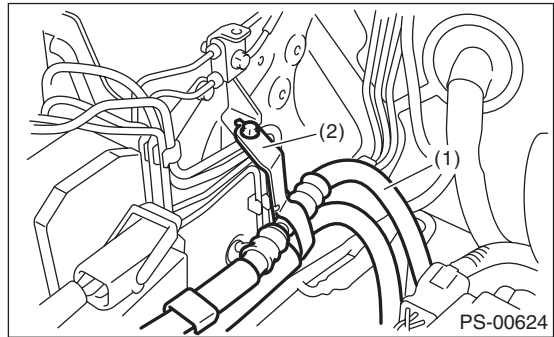
9) Remove the hose bracket and take out the hose assembly from vehicle.



- (1) Hose ASSY
- (2) Hose bracket

## B: INSTALLATION

1) Temporarily tighten the hose bracket bolt.

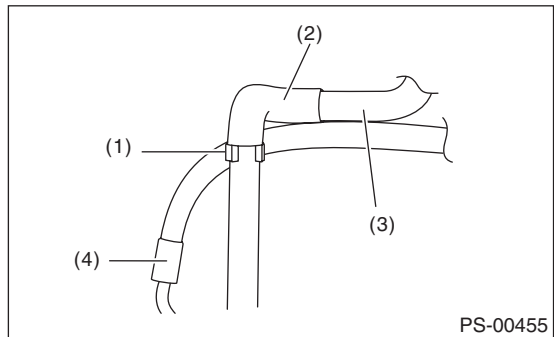


- (1) Hose ASSY
- (2) Hose bracket

2) Install the plastic clip to the pressure hose and suction hose.

### CAUTION:

Align the installation position of the plastic clip with the protector edge of the suction hose.



- (1) Plastic clip
- (2) Protector
- (3) Suction hose
- (4) Pressure hose



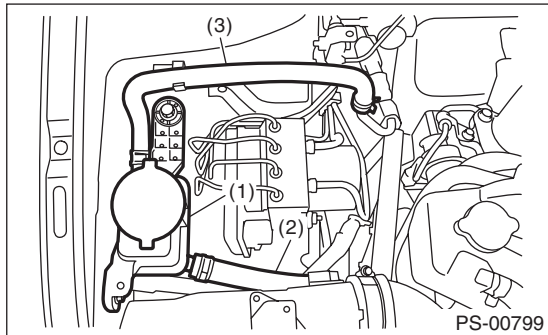
# Pipe Assembly

## POWER ASSISTED SYSTEM (POWER STEERING)

3) Connect the suction hose and return hose to the reservoir tank.

**CAUTION:**

**Firmly insert the plastic clip of return hose to the bracket.**

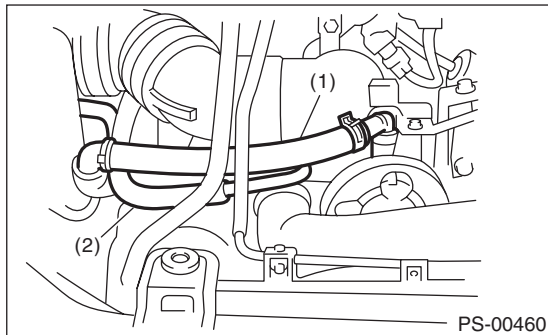


- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

4) Connect the suction hose and pressure hose to the oil pump. Tighten the eye bolt of pressure hose.

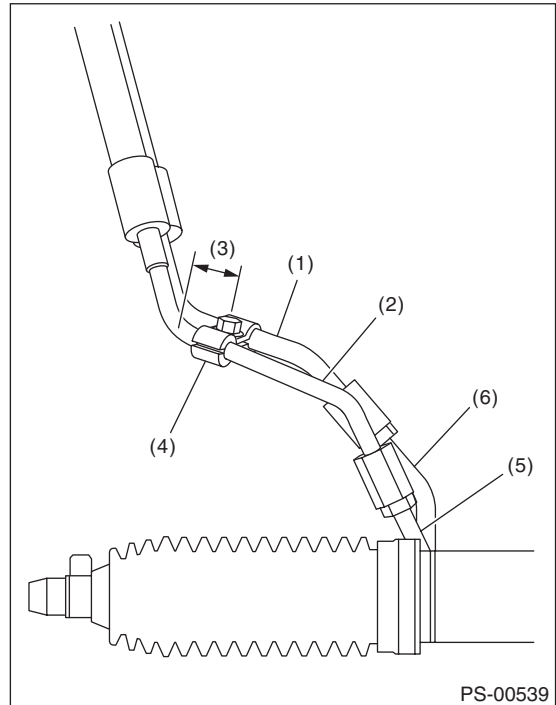
**Tightening torque:**

**40 N·m (4.1 kgf·m, 29.5 ft·lb)**



- (1) Suction hose
- (2) Pressure hose

5) Temporarily connect pressure hose and pipe C, and the return hose and pipe D. Place clamp E in the position shown in the figure, and tighten the bolt temporarily.



- (1) Return hose
- (2) Pressure hose
- (3) Approx. 18 mm (0.71 in)
- (4) Clamp E
- (5) Pipe C
- (6) Pipe D

6) Tighten clamp E.

**Tightening torque:**

**7.4 N·m (0.75 kgf·m, 5.4 ft·lb)**

7) Tighten the pressure hose and pipe C, and the return hose and pipe D.

**Tightening torque:**

**15 N·m (1.5 kgf·m, 10.8 ft·lb)**

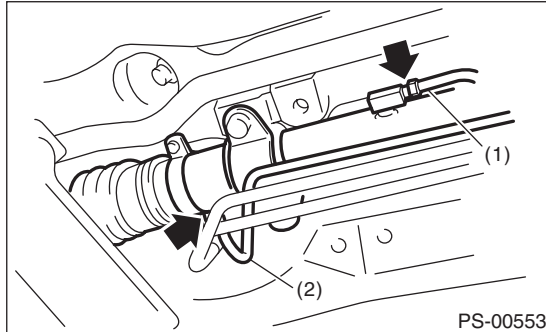
# Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

8) Connect pipes A and B to the four pipe joints of the gearbox.

### **Tightening torque:**

**Refer to "COMPONENT" of "General Description". <Ref. to PS-5, POWER ASSISTED SYSTEM, COMPONENT, General Description.>**



- (1) Pipe A
- (2) Pipe B

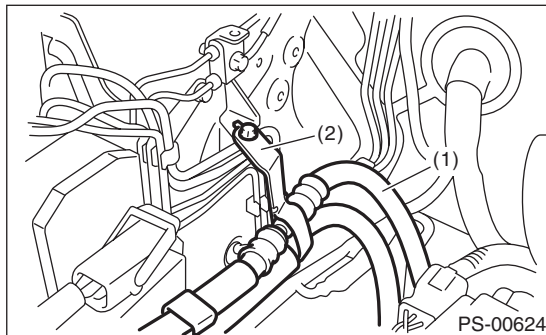
9) Install the front crossmember support plate and jack-up plate.

10) Lower the vehicle.

11) Tighten the bolts which hold the hose bracket.

### **Tightening torque:**

**10 N·m (1.02 kgf·m, 7.4 ft·lb)**



- (1) Hose ASSY
- (2) Hose bracket

12) Install the air intake duct. <Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

13) Connect the battery ground cable to the battery.

14) Fill with the specified fluid.

### **CAUTION:**

**Never start the engine before feeding the fluid otherwise the vane pump might be seized.**

15) Finally, check the clearance between pipes or hoses as shown in the figure indicated in "General Diagnostic Table". <Ref. to PS-60, INSPECTION OF CLEARANCE, INSPECTION, General Diagnostic Table.>

# Pipe Assembly

## POWER ASSISTED SYSTEM (POWER STEERING)

### C: INSPECTION

Check all disassembled parts for wear, damage or other problems. Repair or replace the defective parts as necessary.

Part	Maintenance parts	Corrective action
Pipe	<ul style="list-style-type: none"> <li>• O-ring fitting surface damage</li> <li>• Nut damage</li> <li>• Pipe damage</li> </ul>	Replace with a new part.
Clamp	<ul style="list-style-type: none"> <li>• Loose clamps</li> </ul>	Replace with a new part.
Hose	<ul style="list-style-type: none"> <li>• Flare surface damage</li> <li>• Flare nut damage</li> <li>• Outer surface cracks</li> <li>• Outer surface wear</li> <li>• Clip damage</li> <li>• End coupling or adapter deformation</li> </ul>	Replace with a new part.

#### CAUTION:

**Although the surface layer materials of rubber hoses have excellent weathering resistance, heat resistance and resistance for low temperature brittleness, they are likely to be damaged chemically by brake fluid, battery electrolyte, engine oil and automatic transmission fluid and their service lives are to be very shortened. Wipe off hoses immediately if any of these come into contact with the hoses. Since resistances for heat or low temperature brittleness are gradually declining according to time accumulation of hot or cold conditions for the hoses and their service lives are shortening accordingly, it is necessary to perform careful inspection frequently when the vehicle is used in hot weather areas, cold weather areas and a driving condition in which many steering operations are required in short time.**

**Continuous discharge of the relief valve for 5 seconds or more will reduce the service lives of hoses, oil pump, fluid, etc., due to over heating.**

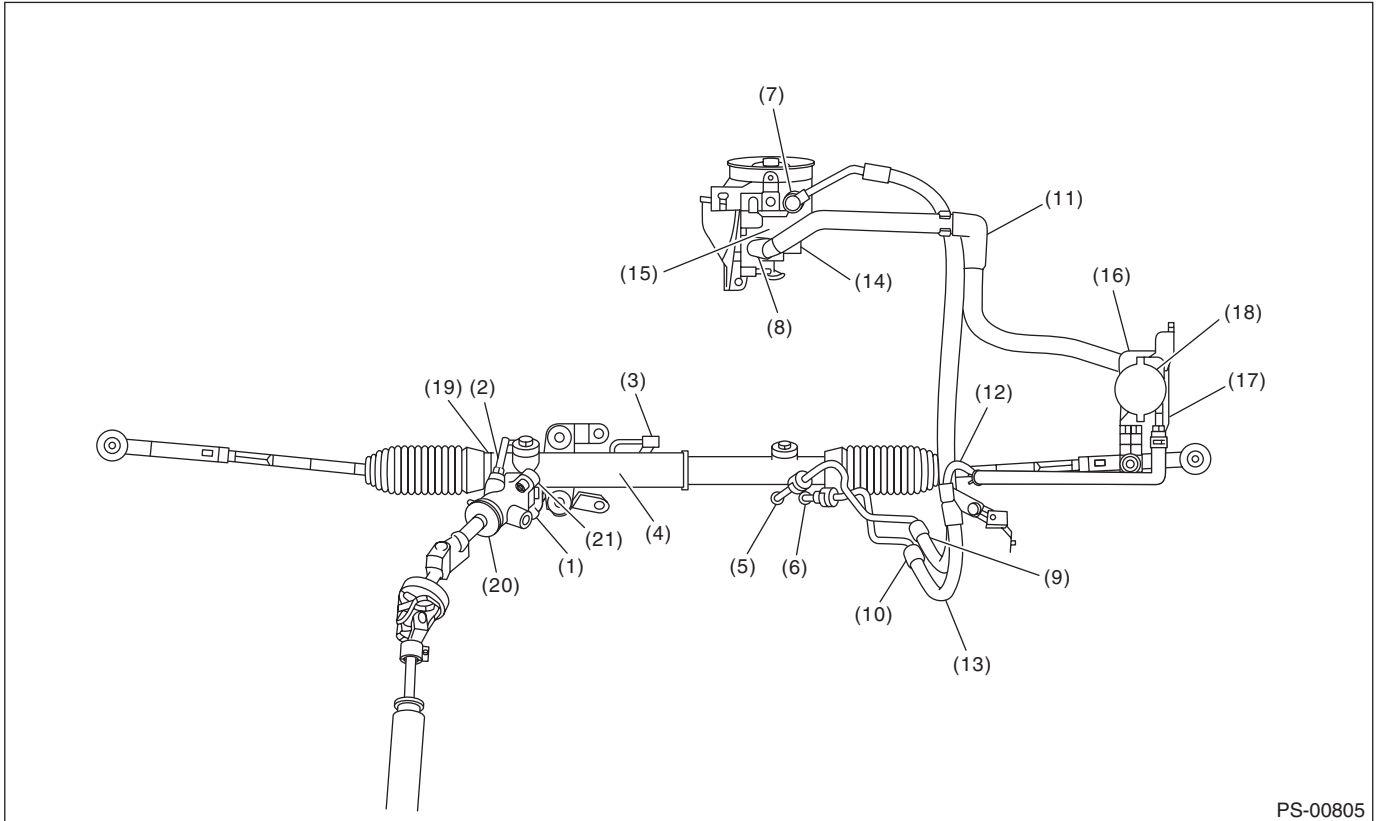
Trouble	Possible cause	Corrective action
Pressure hose burst	Excessive holding time of relief status	Instruct customers.
	Malfunction of the relief valve	Replace the oil pump.
	Poor cold characteristic of fluid	Replace fluid.
Disconnection of the return hose	Improper connection	Repair.
	Loosening of the clip	Retighten.
	Poor cold characteristic of fluid	Replace fluid.
Fluid slightly leaking out of hose	Wrong layout, tensioned	Replace the hose.
	Excessive play of engine due to deterioration of engine mounting rubber	Replace the parts if defective.
	Improper stop position of pitching stopper	Replace the parts if defective.
Crack on hose	Excessive holding time of relief status	Replace. Instruct customers.
	Excessive tightening torque for return hose clip	Replace.
	Power steering fluid, engine oil, electrolyte adhere on the hose surface	Replace. Be careful during service work.
	Too many uses in extremely cold weather	Replace. Instruct customers.

# Pipe Assembly

POWER ASSISTED SYSTEM (POWER STEERING)

## NOTE:

There are conditions in which a fluid leak is diagnosed, but is not actually leaking. This is because the fluid spilt during the last maintenance was not completely wiped off. Be sure to wipe off spilt fluid thoroughly after maintenance.



PS-00805

Fluid leaking area	Possible cause	Corrective action
Leakage from pipe and hose connections numbered with (1) through (8) in the figure	Insufficient tightening of flare nut, adhesion of dirt, damage to flare or flare nut or eye bolt	Loosen and retighten. Replace if ineffective.
	Improper installation of hose or clamp	Retighten or replace the clamp.
	Damaged O-ring or gasket	Replace the O-ring, gasket pipe or hose with new part, if still no improvement, replace the gearbox as well.
Leakage from hose (9) through (13) in the figure	Crack or damage in hose	Replace with a new part.
	Crack or damage in hose hardware	Replace with a new part.
Leakage from surrounding of cast iron portion of oil pump, (14) and (15) in the figure	Damaged O-ring	Replace the oil pump.
	Damaged gasket	Replace the oil pump.
Leakage from oil tank, (16) and (17) in the figure	Crack in oil tank	Replace the oil tank.
Leakage from filler neck of (18)	Damaged cap gasket	Replace the cap.
	Crack in root of filler neck	Replace the oil tank.
	Fluid level too high	Adjust the fluid level.
Leakage from power cylinder of gearbox area (19) in the figure	Damaged oil seal	Replace the oil seal.
Leakage from (20), (21) in the figure and control valve of gearbox	Damaged gasket or oil seal	Replace the problem parts.
	Damage in control valve	Replace the control valve.

# Oil Pump

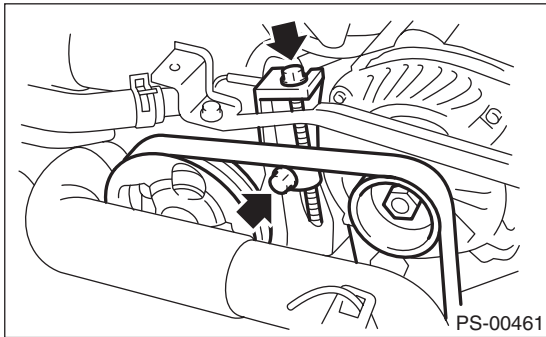
## POWER ASSISTED SYSTEM (POWER STEERING)

### 7. Oil Pump

#### A: REMOVAL

##### 1. H4 MODEL

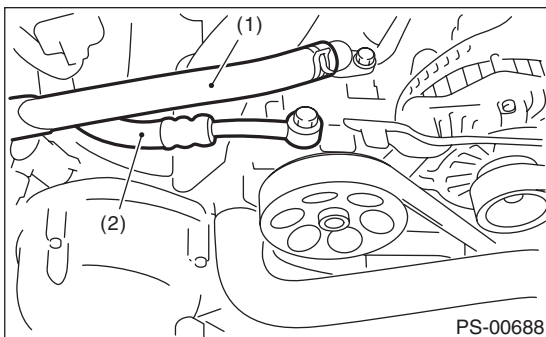
- 1) Disconnect the ground cable from the battery.
- 2) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>  
<Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
- 3) Remove the pulley belt cover.
- 4) Loosen the belt tension securing bolt and generator securing bolt, then remove the power steering pump V-belt.



- 5) Disconnect the connector from the power steering pressure switch.
- 6) Disconnect the pressure hose and suction hose from the oil pump.

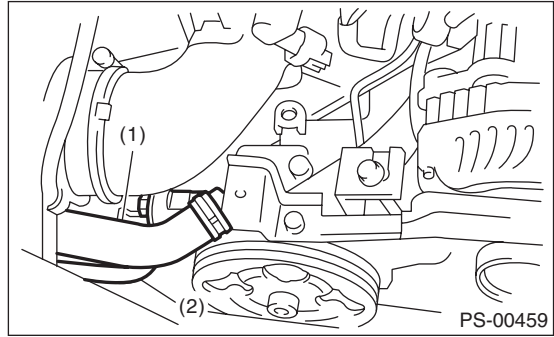
#### CAUTION:

- Do not allow fluid to come into contact with the pulley belt.
- To prevent foreign matter from entering the hose and pipe, cover the open ends with clean cloth.
- Non-turbo model



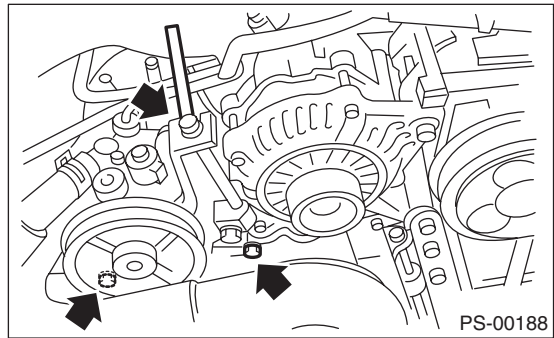
- (1) Suction hose
- (2) Pressure hose

- Turbo model



- (1) Suction hose
- (2) Pressure hose

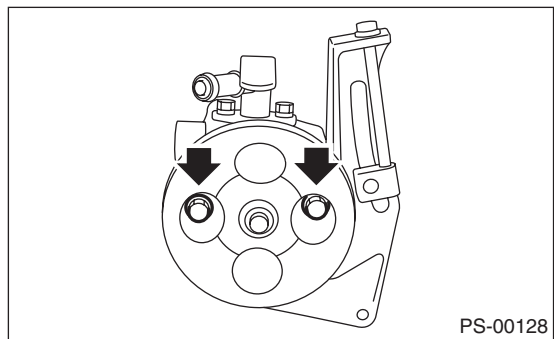
- 7) Remove the installation bolt of the power steering pump bracket.



- 8) Place the oil pump bracket in a vise, and remove the two bolts from the front side of the oil pump.

#### CAUTION:

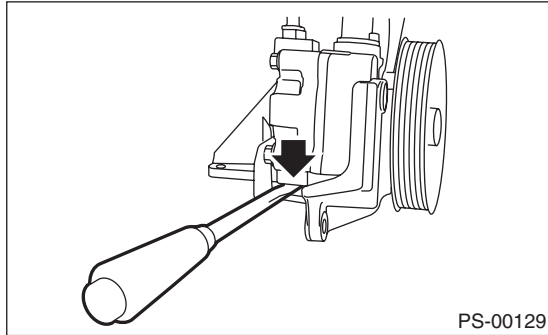
When securing the oil pump bracket in a vise, hold the oil pump bracket with the least possible force between two pieces of wood.



# Oil Pump

## POWER ASSISTED SYSTEM (POWER STEERING)

- 9) Remove the bolt from the rear side of oil pump.
- 10) Disassemble the oil pump and bracket by inserting a flat tip screwdriver as shown in the figure.

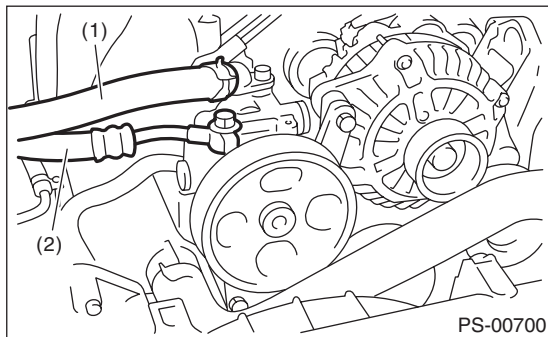


## 2. H6 MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the cover of the pulley belt.
- 3) Remove the V-belts.
- 4) Remove the power steering pressure switch connector.
- 5) Remove the tensioner adjuster.
- 6) Disconnect the pressure hose and suction hose from the oil pump.

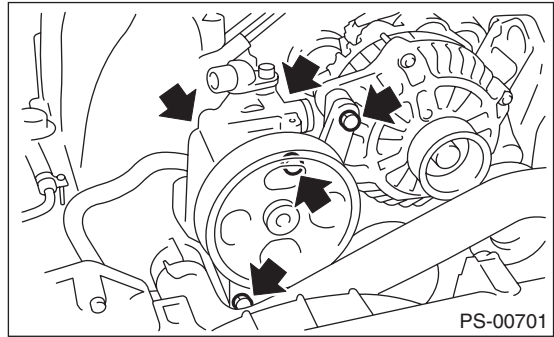
### CAUTION:

- Do not allow fluid to flow from the hose end and contact the pulley belt.
- To prevent foreign objects from entering the hose, cover the hose openings with a clean cloth.



- (1) Suction hose
- (2) Pressure hose

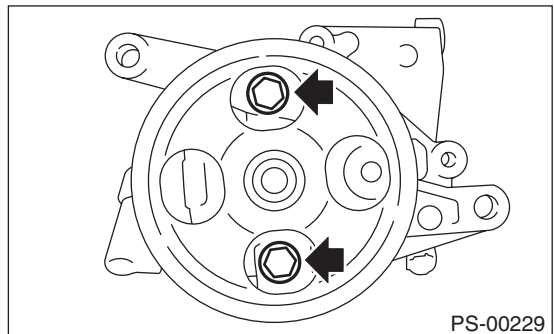
- 7) Remove the bolts which holds the power steering pump bracket.



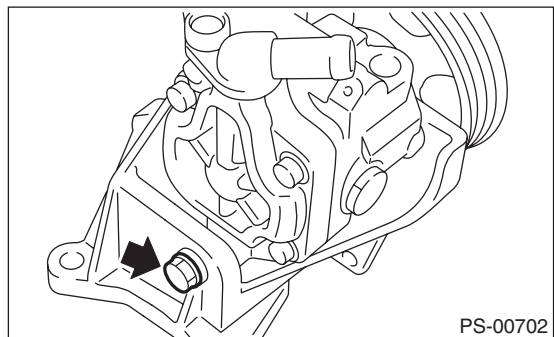
- 8) Place the oil pump bracket in a vise, and remove the two bolts from the front side of the oil pump.

### CAUTION:

- When securing the oil pump bracket in a vise, hold the oil pump bracket with the least possible force between two pieces of wood.**



- 9) Remove the bolt from the back side of the oil pump.



- 10) Remove the oil pump from the bracket.

# Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

## B: INSTALLATION

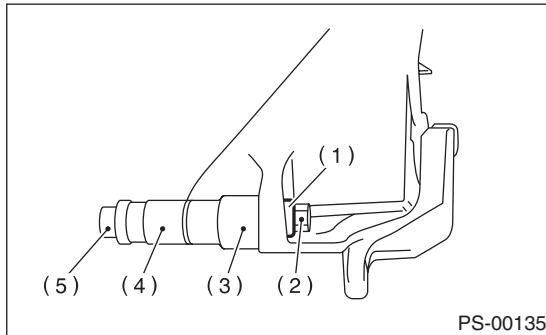
### 1. H4 MODEL

1) Install the oil pump to bracket.

(1) Place the oil pump bracket in a vise. Tighten the bushing using a 12.7 mm (1/2") type, 14 and 21 mm box wrench until it is in contact with the oil pump mounting surface.

#### CAUTION:

When securing the oil pump bracket in a vise, hold the oil pump bracket with the least possible force between two pieces of wood.

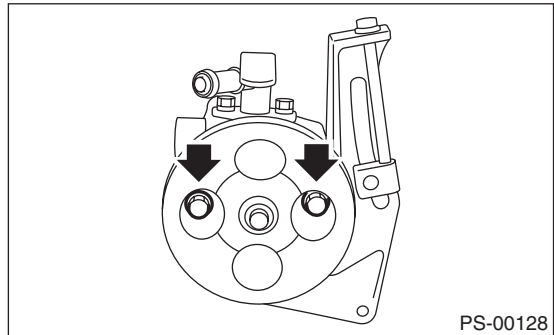


- (1) Bushing
- (2) Nut
- (3) 21 mm
- (4) 14 mm
- (5) Bolt

(2) Tighten the bolts which hold the oil pump to the bracket.

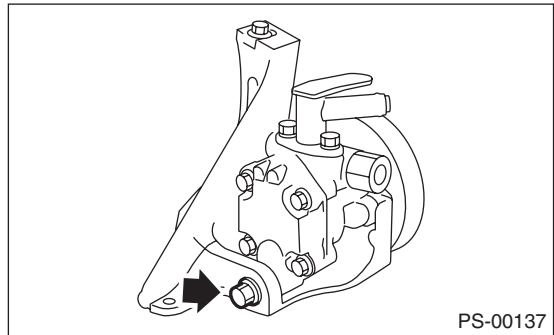
**Tightening torque:**

**15.7 N·m (1.6 kgf-m, 11.6 ft-lb)**



**Tightening torque:**

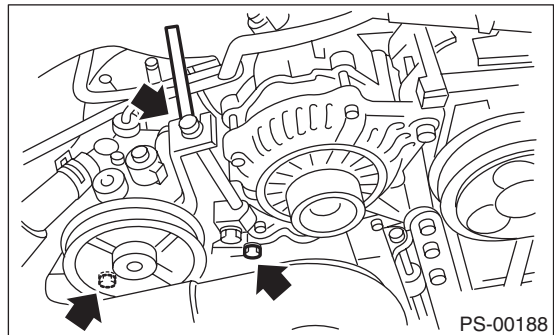
**48.4 N·m (4.9 kgf-m, 35.7 ft-lb)**



2) Attach the installation bolts of the power steering pump bracket.

**Tightening torque:**

**<Ref. to PS-7, OIL PUMP, COMPONENT, General Description.>**



# Oil Pump

## POWER ASSISTED SYSTEM (POWER STEERING)

3) After installing the oil pump, fill the fluid while rotating the pulley by hand and bleed the air from the oil pump.

### CAUTION:

**Always fill the oil pump with the fluid to prevent abnormal noise and seizure of the oil pump.**

4) Connect the pressure hose and suction hose.

### Tightening torque:

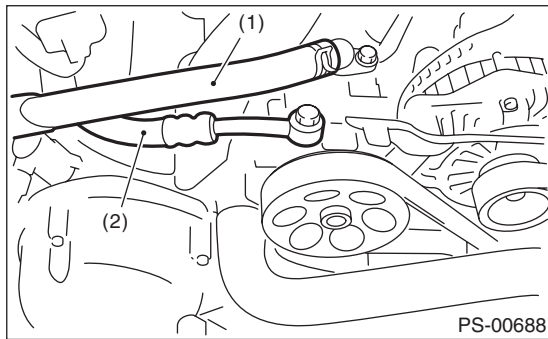
#### Eye bolt

**40 N·m (4.1 kgf·m, 29.5 ft·lb)**

### CAUTION:

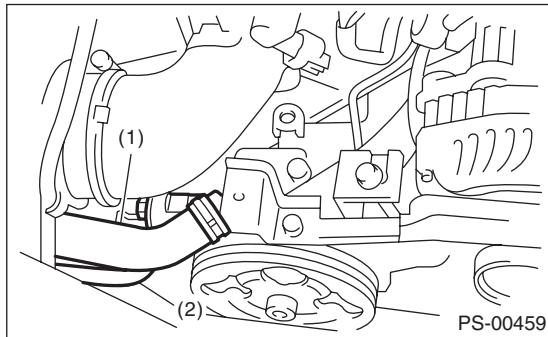
**Be careful when installing; If the hose is twisted it may come into contact with other parts.**

- Non-turbo model



- (1) Suction hose
- (2) Pressure hose

- Turbo model



- (1) Suction hose
- (2) Pressure hose

5) Connect the power steering pressure switch connector.

6) Install the V-belts to the oil pump.

7) Check the tension of the V-belt.

<Ref. to ME(H4SO)-39, INSPECTION, V-belt.>

8) Tighten the lock bolt of the belt tension nut.

### Tightening torque:

**25 N·m (2.5 kgf·m, 18.4 ft·lb)**

9) Install the pulley belt cover.

10) Install the air intake duct.

<Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

11) Connect the battery ground cable to the battery.

12) Fill with the specified power steering fluid. <Ref. to PS-55, Power Steering Fluid.>

### CAUTION:

**Never start the engine before feeding the fluid otherwise the vane pump might be seized.**

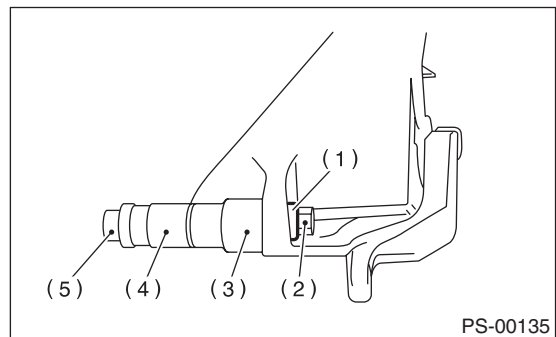
## 2. H6 MODEL

1) Install the oil pump to bracket.

(1) Place the oil pump bracket in a vise. Tighten the bushing using a 12.7 mm (1/2") type 14- and 21- mm box wrench until it is in contact with the oil pump mounting surface.

### CAUTION:

**When securing the oil pump bracket in a vice, hold the oil pump bracket with the least possible force between two pieces of wood.**



- (1) Bushing
- (2) Nut
- (3) 21 mm
- (4) 14 mm
- (5) Bolt

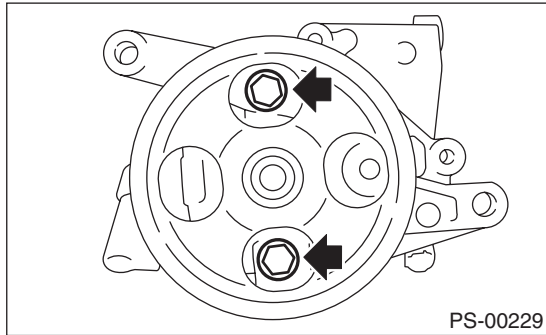


# Oil Pump

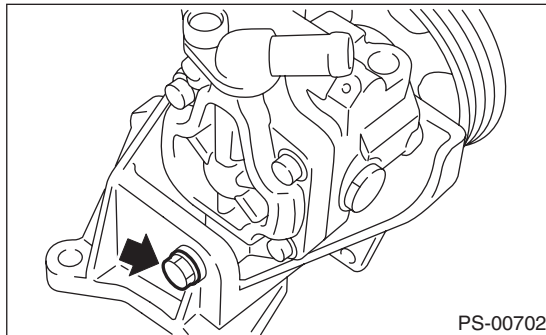
## POWER ASSISTED SYSTEM (POWER STEERING)

(2) Tighten the bolt which attaches the oil pump to the bracket.

**Tightening torque:**  
**15.7 N·m (1.6 kgf-m, 11.6 ft-lb)**

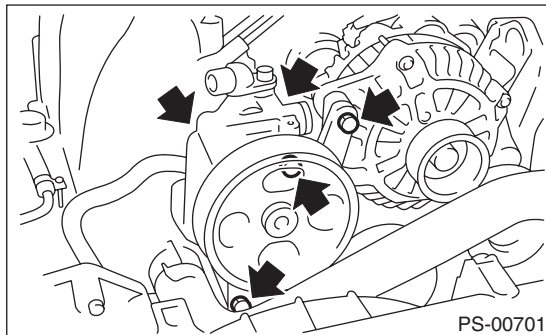


**Tightening torque:**  
**37.3 N·m (3.8 kgf-m, 27.5 ft-lb)**



2) Tighten the bolt which attaches the power steering pump bracket.

**Tightening torque:**  
**<Ref. to PS-7, OIL PUMP, COMPONENT, General Description.>**

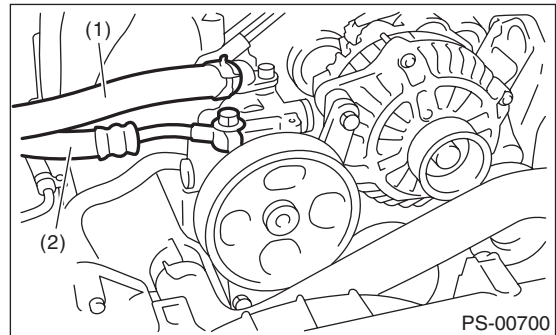


3) After installing the oil pump, fill the fluid while rotating the pulley by hand and bleed the air from the oil pump.

**CAUTION:**  
**Always fill the oil pump with the fluid to prevent abnormal noise and seizure of the oil pump.**  
4) Connect the pressure hose and suction hose.

**Tightening torque:**  
**Eye bolt**  
**40 N·m (4.1 kgf-m, 29.5 ft-lb)**

**CAUTION:**  
**Be careful when installing; If the hose is twisted it may come into contact with other parts.**



- (1) Suction hose
- (2) Pressure hose

- 5) Connect the power steering pressure switch connector.
- 6) Install the tensioner adjuster.
- 7) Install the V-belts.
- 8) Install the cover of the pulley belt.
- 9) Connect the ground cable to the battery.
- 10) Pour the specified power steering fluid. <Ref. to PS-55, Power Steering Fluid.>

**CAUTION:**  
**Never start the engine before feeding the fluid otherwise the vane pump might be seized.**

# Oil Pump

POWER ASSISTED SYSTEM (POWER STEERING)

## C: INSPECTION

### 1. BASIC INSPECTION

Perform the following inspection procedures and replace faulty parts.

No.	Parts	Inspection	Corrective action
1	Oil pump (Exterior)	(1) Crack, damage or oil leakage	Replace the oil pump with a new part.
		(2) Play of pulley shaft	Measure the radial play and axial play. If any of these exceeds the service limit, replace the oil pump with a new part.
2	Pulley	(1) Damage	Replace with a new part.
		(2) Bend	Measure the V groove deflection. If it exceeds the service limit, replace the pulley with a new part.
3	Oil pump (Interior)	(1) Faulty or seized of vane pump	Check the rotating resistance of pulley. If it exceeds the service limit, replace the oil pump with new part.
		(2) Bend in the shaft or damage to bearing	If the a string is wrapped on the pulley and rotated, and the oil pump emits a noise that is markedly different in tone and loudness from a sound of a new oil pump, replace the oil pump with a new part.
4	O-ring	Cracking or deterioration	Replace with a new part.
5	Bracket	Crack	Replace with a new part.

### 2. SERVICE LIMIT

Make a measurements as follows. If it exceeds the service limit, replace with a new part.

#### CAUTION:

- When securing the oil pump on a vise, hold the oil pump with the least possible force between two pieces of wood.
- Do not set the outside of flow control valve or pulley on a vise; otherwise outside or pulley might be deformed. Select properly sized wood pieces.

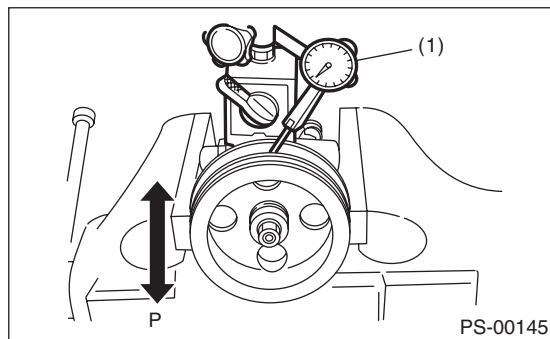
1) Play of the pulley shaft

#### Condition:

**P: When applying the force of 9.8 N (1.0 kgf, 2.2 lb)**

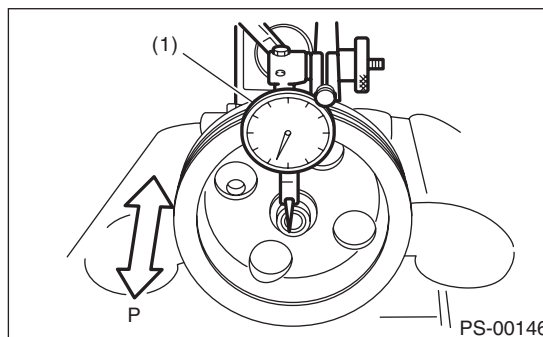
#### Service limit:

**Play in the radial direction (Direction ◀ ▶) 0.4 mm (0.016 in) or less**



(1) Dial gauge

**Axial play (Direction ⇐ ⇒) 0.9 mm (0.035 in) or less**



(1) Dial gauge

# Oil Pump

## POWER ASSISTED SYSTEM (POWER STEERING)

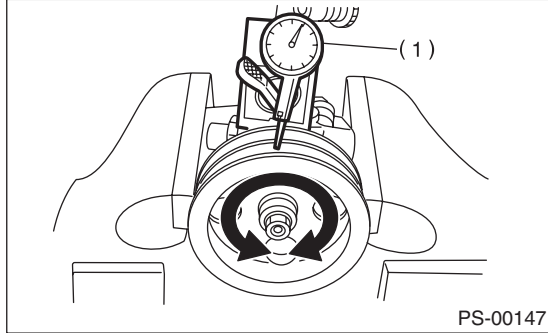
### 2) Deflection of the pulley groove

#### Service limit:

**1.0 mm (0.039 in) or less**

#### NOTE:

Read the value for one surface of V ditch, and then the value for another off the dial gauge.



(1) Dial gauge

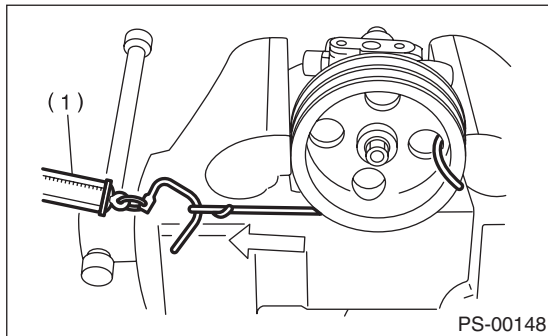
### 3) Rotating resistance of pulley

#### Service limit:

**Maximum load: 9.22 N (0.94 kgf, 2.07 lb) or less**

#### NOTE:

- A rather higher value may be indicated when pulley starts turning.
- Measure the load during rotation to make a judgment.



(1) Spring scale

## 3. HYDRAULIC PRESSURE

#### NOTE:

• To measure hydraulic pressure correctly, be sure to complete all the items in "INSPECTION", prior to performing the measurement. <Ref. to PS-56, INSPECTION, General Diagnostic Table.>

- Do not leave the valve of pressure gauge closed or hold the steering wheel at lock for 5 seconds or more in any case, this can damage the oil pump.
- Before attaching a pressure gauge, place cloth at locations where fluid is expected to spill. Wipe off any spilt fluid completely after the measurement.

#### 1) Regular pressure measurement

(1) Connect the ST1, ST2 and ST3.

ST1 925711000 PRESSURE GAUGE

ST2 34099AC020 ADAPTER HOSE B

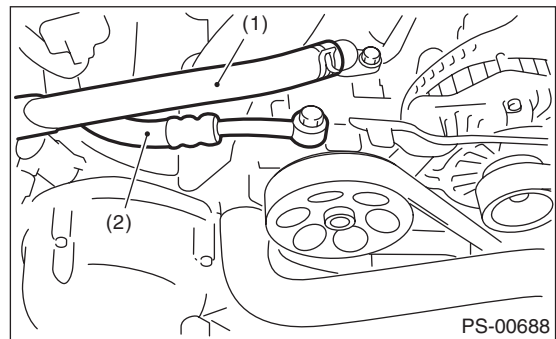
ST3 34099AC010 ADAPTER HOSE A

(2) Remove the air intake duct.

(3) Disconnect the pipe C from pump.

(4) Using the gasket (Part No. 34621AC021) and bolt (Part No. 34620AC010), install the ST2 to pump instead of pressure hose.

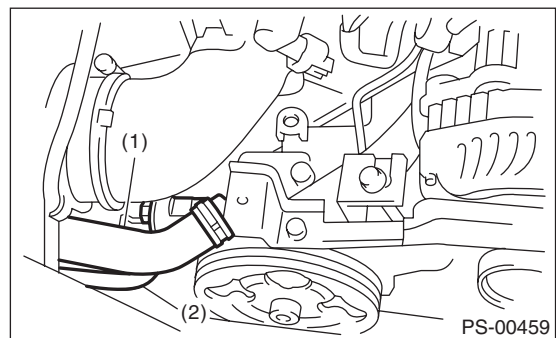
- Non-turbo model



(1) Suction hose

(2) Pressure hose

- Turbo model



(1) Suction hose

(2) Pressure hose

(5) Attach the ST3 to the end of pressure hose which is removed from pump.

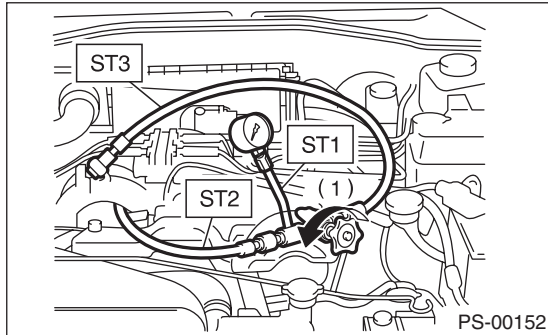
(6) Replenish power steering fluid up to the specified level.

# Oil Pump

## POWER ASSISTED SYSTEM (POWER STEERING)

- (7) Open the valve, and start the engine.
- (8) Measure the regular pressure.

ST1 925711000 PRESSURE GAUGE  
ST2 34099AC020 ADAPTER HOSE B  
ST3 34099AC010 ADAPTER HOSE A



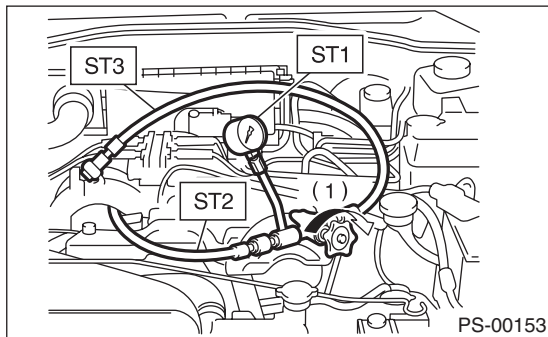
(1) Valve

### Service limit:

**981 kPa (10 kg/cm<sup>2</sup>, 142 psi) or less**

- (9) If it is not within the specification, replace the problem part for the following problems. (Pipe or hose clogged, leaks from fluid line, and mixture of foreign matter in fluid line)
- 2) Measure the relief pressure.
  - (1) Using the STs, measure the relief pressure.
  - (2) Close the valve.
  - (3) Measure the relief pressure.

ST1 925711000 PRESSURE GAUGE  
ST2 34099AC020 ADAPTER HOSE B  
ST3 34099AC010 ADAPTER HOSE A



(1) Valve

### Service limit:

#### H4 model:

**7,350 — 8,050 kPa  
(75 — 82 kg/cm<sup>2</sup>, 1,067 — 1,165 psi)**

#### H6 model:

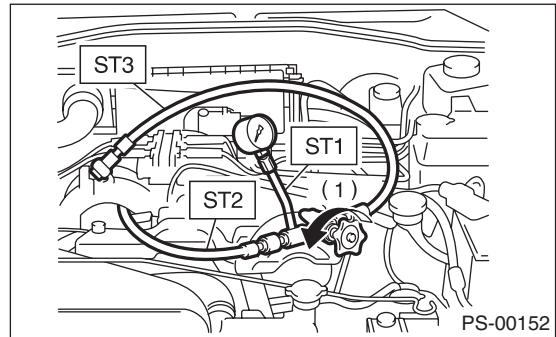
**8,300 — 9,000 kPa  
(85 — 92 kg/cm<sup>2</sup>, 1,204 — 1,305 psi)**

- (4) If it is not within the specification, replace the oil pump.

- 3) Measure the working pressure.

- (1) Using the ST, measure the working pressure.
- (2) Open the valve.
- (3) Measure the working pressure of control valve by turning steering wheel from stop to stop.

ST1 925711000 PRESSURE GAUGE  
ST2 34099AC020 ADAPTER HOSE B  
ST3 34099AC010 ADAPTER HOSE A



(1) Valve

### Service limit:

**7,650 — 8,330 kPa  
(78 — 85 kg/cm<sup>2</sup>, 1,110 — 1,208 psi)**

- (4) If it is out of specification, measure the steering effort. <Ref. to PS-59, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>If it is not within specification, replace the control valve itself or control valve and pinion as a single unit, using new parts.

# Reservoir Tank

POWER ASSISTED SYSTEM (POWER STEERING)

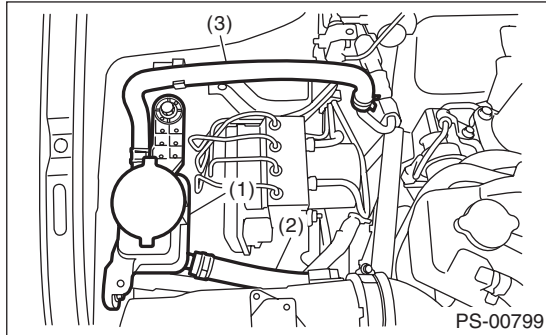
## 8. Reservoir Tank

### A: REMOVAL

- 1) Drain fluid from the reservoir tank.
- 2) Disconnect the hose from reservoir tank.

#### CAUTION:

To prevent foreign matter from entering the hose and pipe, cover the open ends of them with clean cloth.



- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

- 3) Remove the reservoir tank from the body.

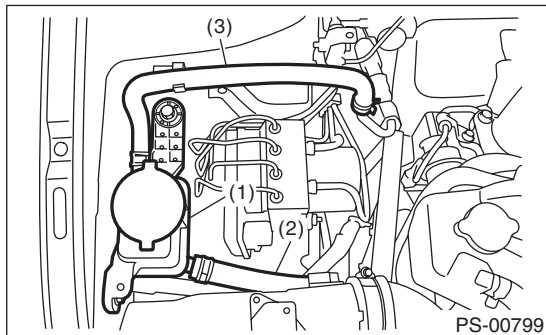
### B: INSTALLATION

- 1) Install the reservoir tank to the body.

#### Tightening torque:

**13 N·m (1.32 kgf·m, 9.6 ft·lb)**

- 2) Connect the hose to the reservoir tank.



- (1) Reservoir tank
- (2) Suction hose
- (3) Return hose

- 3) Replenish power steering fluid up to the specified level. <Ref. to PS-55, Power Steering Fluid.>

### C: INSPECTION

Check the reservoir tank for cracks, breakage or damage. If a failure is found, replace the reservoir tank.

# Power Steering Fluid

POWER ASSISTED SYSTEM (POWER STEERING)

## 9. Power Steering Fluid

### A: SPECIFICATION

Recommended power steering fluid
SUBARU ATF or ATF DEXRON III

### B: INSPECTION

1) Check the power steering fluid for deterioration or contamination. If the fluid is highly deteriorated or contaminated, drain it and refill with new fluid.

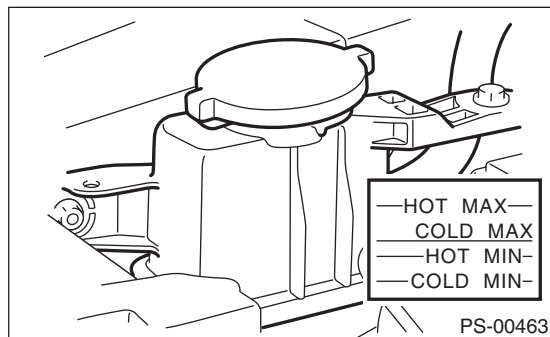
2) Check the joints and units for oil leakage. If any oil leaks are found, repair or replace the applicable part.

3) Inspect the fluid level of reservoir tank with vehicle on level surface and engine stopped.

If the level is at "MIN." point or below, add fluid to keep the level in the specified range of the indicator. If fluid level is at "MAX." point or above, drain fluid by using a syringe or the like.

(1) Check at power steering fluid temperature 20°C (68°F); read the fluid level on the "COLD" side.

(2) Check at power steering fluid temperature 80°C (176°F); read the fluid level on the "HOT" side.



### C: REPLACEMENT

1) Lift up the vehicle.  
2) Remove the crossmember support.  
3) Remove the pipe joint in the center of gearbox, and connect the vinyl hose to the pipe and joint. Wipe fluid off while turning the steering wheel.

4) Add the specified fluid to reservoir tank at "MAX" level.

5) Maintaining the fluid level of Step 4), continue to turn the steering wheel slowly from lock to lock until the bubbles stop appearing on oil surface.

6) If the steering wheel is turned in a low fluid level condition, air will be sucked into the pipe. If air has entered, leave it for about half an hour and then repeat step 5) again.

7) Start the engine and let it idle.

8) Continue to turn the steering wheel slowly from lock to lock again until the bubbles stop appearing on oil surface, while keeping the fluid at the level in Step 4).

Normally bubbles will stop appearing after turning the steering wheel from lock to lock three times.

9) In case bubbles do not stop appearing in the tank, leave it about half an hour and then do the step 4) all over again.

10) Lower the vehicle, and then idle the engine.

11) Continue to turn the steering wheel from lock to lock until the bubbles stop appearing and change of the fluid level is within 3 mm (0.12 in).

12) In case the following happens, leave it about half an hour and then do step 8) to 11) again.

(1) The fluid level changes 3 mm (0.12 in) or more.

(2) Bubbles remain on the upper surface of the fluid.

(3) Grinding noise is generated from oil pump.

13) Check the fluid leakage after turning steering wheel from lock to lock with engine running.

# General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

## 10. General Diagnostic Table

### A: INSPECTION

Trouble	Possible cause	Corrective action
<ul style="list-style-type: none"> <li>Steering effort is heavy in all ranges.</li> <li>Steering effort is heavy at stand still.</li> <li>Steering wheel vibrates when turning.</li> </ul>	1. Pulley belt <ul style="list-style-type: none"> <li>Unequal length of pulley belts</li> <li>Contact with oil or grease</li> <li>Looseness or damage of the pulley belt</li> <li>Poor uniformity of the pulley belt cross section</li> <li>Pulley belt touches to pulley bottom</li> <li>Poor revolution of pulleys (except oil pump pulley)</li> <li>Poor revolution of oil pump pulley</li> </ul>	Adjust or replace.
	2. Tire and wheel <ul style="list-style-type: none"> <li>Improper tire out of specifications<sup>*1</sup></li> <li>Improper wheel out of specifications<sup>*1</sup></li> <li>Tires not properly inflated</li> </ul>	Replace or reinflate.
	3. Fluid <ul style="list-style-type: none"> <li>Low fluid level</li> <li>Air entry in fluid</li> <li>Dust entry in fluid</li> <li>Fluid deterioration</li> <li>Inadequate warm-up of fluid<sup>*2</sup></li> </ul>	Refill, bleed air, replace or instruct customer.
	4. Idle speed <ul style="list-style-type: none"> <li>Lower idle speed</li> <li>Excessive drop of idle speed at start or when turning the steering wheel<sup>*3</sup></li> </ul>	Adjust or instruct customer.
	5. Measure the hydraulic pressure. <Ref. to PS-51, INSPECTION, Oil Pump.>	Replace the problem parts.
	6. Measure the steering wheel effort. <Ref. to PS-59, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust or replace.
<ul style="list-style-type: none"> <li>Vehicle leads to one side or the other.</li> <li>Returning force of steering wheel to center is poor.</li> <li>Steering wheel vibrates when turning.</li> </ul>	1. Fluid line <ul style="list-style-type: none"> <li>Folded hose</li> <li>Flattened pipe</li> </ul>	Correct or replace.
	2. Tire and wheel <ul style="list-style-type: none"> <li>Flat tire</li> <li>Mixed use of different tires</li> <li>Mixed use of different wheels</li> <li>Abnormal wear of tire</li> <li>Unequal tread remaining</li> <li>Unequal pressure of tire</li> </ul>	Adjust, fix or replace.
	3. Front alignment <ul style="list-style-type: none"> <li>Improper or unequal caster</li> <li>Improper or unequal toe-in</li> <li>Loose suspension connections</li> </ul>	Adjust or retighten.
	4. Others <ul style="list-style-type: none"> <li>Damaged joint assembly</li> <li>Unbalanced height</li> <li>Unbalanced weight</li> </ul>	Replace, adjust or instruct customer.
	5. Measure the steering wheel effort. <Ref. to PS-59, MEASUREMENT OF STEERING EFFORT, INSPECTION, General Diagnostic Table.>	Adjust or replace.

<sup>\*1</sup> If the tires or wheels are wider than standard, the load to the power steering system is increased. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before reaching maximum turning angle. In this case, steering effort may be heavy. When the measured hydraulic pressure is normal, there is no abnormal thing.

<sup>\*2</sup> In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn the steering wheel from stop to stop several times to warm-up fluid. If steering effort reduces normally, function is normal.

<sup>\*3</sup> In cold weather or with insufficient warm-up of the engine, steering effort may be heavy due to excessive drop of idle rpm when turning the steering wheel. In this case, start the vehicle with increasing engine speed than usual. If steering effort reduces normally, function is normal.

# General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

## 1. NOISE AND VIBRATION

### CAUTION:

**Do not keep the relief valve operated for five seconds or more at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.**

### NOTE:

- A screeching noise may be heard immediately after the engine start in extremely cold conditions. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristics in extremely cold condition.
- The oil pump normally makes a small whining noise due to its mechanism. Even if a noise is heard when steering wheel is turned at stand still, there is no abnormal function in the system provided that the noise eliminates when the vehicle is driving.
- When turning the steering wheel with the brake applied when the vehicle is parked, a screeching noise may be generated by the brake disc and pads. This is not a fault in the steering system.
- There may be a small vibration around the steering devices when turning the steering wheel at standstill, even though the component parts are operating properly.

Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.

These conditions do not indicate a problem in the system.

Confirm vibration for an AT model, by applying the parking brake on a concrete surface, shifting into the "D" range, and turning the steering wheel repeatedly from slow to rapid, step by step.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Do not keep this condition for 5 seconds or more.)	Normal operation
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is defective.	Replace the oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary. <Ref. to PS-44, INSPECTION, Pipe Assembly.>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loose oil pump pulley or other pulley(s)	Retighten.
	Looseness of linkage, play of steering, improper tightening (looseness) of suspension joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace faulty parts in the gearbox or oil pump.
Knocking When turning steering wheel in both directions with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Insufficient tightening or play in the tie-rod or tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Air in vane pump	Inspect and retighten the fluid line connection. Refill the fluid and vent air.
	Vane pump seizing	Replace the oil pump.
	Oil pump pulley bearing seized	Replace the oil pump.
	Folded hose, flattened pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Improper adjustment of pulley belt Damaged or over tensioned pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Runout or dirty V-groove surface of oil pump pulley	Clean or replace.



## General Diagnostic Table

### POWER ASSISTED SYSTEM (POWER STEERING)

Trouble	Possible cause	Corrective action
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix the faulty part causing aeration. Replace the fluid and vent air.
	Damaged pipe of gearbox	Replace the pipe.
	Faulty inside of hose or pipe Flattened hose or pipe	Correct or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install cap.
Whistle (continuous) While engine is running.	Faulty pipe of gearbox or faulty hose	Replace the faulty parts of the gearbox or the hose.
Whine or growl (intermittent or continuous) While engine is running with/ without steering turned.	Looseness of oil pump, oil pump bracket attachment	Retighten.
	Fault inside of oil pump or hose	Replace the oil pump or hose, if the noise can be heard when vehicle is running as well as being stopped.
	Torque converter growl, air conditioner compression growl	Remove the power steering pulley belt and check.
Grinding noise (continuous) While engine is running with the steering turned.	Fault inside of gearbox	Replace the faulty parts of gearbox.
	Faulty steering shaft bearing	Apply grease or replace.
	Occurs when turning the steering wheel with brakes (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running with/ without steering turned.	Engine speed is too low.	Adjust, and notify customer.
	Air in vane pump	Repair faulty part Vent air.
	Damaged valve in oil pump or gearbox	Replace the faulty parts in gearbox and oil pump.
	Excessive play in steering, looseness of suspension parts	Retighten.

# General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

## 2. MEASUREMENT OF STEERING EFFORT

Step	Check	Yes	No
<b>1 CHECK STEERING EFFORT.</b> 1) Stop the vehicle on paved road. 2) Start the engine. 3) Run the engine at idle. 4) Install a spring scale on the steering wheel. 5) Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.  NOTE: When turning the steering more quickly than necessary from a direction to the other direction at an engine speed of 2,000 rpm or more, steering effort may be heavy. This is caused by flow characteristic of the fluid in the oil pump and is not a defect.	Is the steering effort less than 29.4 N (3.0 kgf, 6.6 lb)?	Go to step 2.	Adjust the backlash.
<b>2 CHECK STEERING EFFORT.</b> 1) Stop the engine. 2) Pull the spring scale at a right angle to the steering wheel, and measure both right and left steering wheel efforts.	Is the steering effort less than 294.2 N (30 kgf, 66.2 lb)?	Go to step 3.	Perform the adjustment.
<b>3 CHECK STEERING WHEEL EFFORT.</b> 1) Remove the universal joint. 2) Measure the steering wheel effort.	Is steering effort less than 2.26 N (0.23 kgf, 0.51 lb)?	Go to step 4.	Check, adjust and replace if necessary.
<b>4 CHECK STEERING WHEEL EFFORT.</b> Measure the steering wheel effort.	Is the difference of steering effort between right and left less than 20%?	Go to step 5.	Check, adjust and replace if necessary.
<b>5 CHECK UNIVERSAL JOINT.</b> Measure the swing torque of the joint (yoke of steering column side). <Ref. to PS-16, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 7.3 N (0.74 kgf, 1.64 lb)?	Go to step 6.	Replace with a new part.
<b>6 CHECK UNIVERSAL JOINT.</b> Measure the swing torque of the joint (yoke of gearbox side). <Ref. to PS-16, INSPECTION, Universal Joint.>	Is the swing torque of the universal joint less than 3.8 N (0.39 kgf, 0.86 lb)?	Go to step 7.	Replace with a new part.
<b>7 CHECK FRONT WHEEL.</b> Check the front wheels.	Does the front wheels have unsteady revolution or rattling, or does the brake drag?	Inspect, readjust and replace if necessary.	Go to step 8.
<b>8 CHECK TIE-ROD ENDS.</b> Remove the tie-rod ends.	If the tie-rod ends of suspension have unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 9.
<b>9 BALL JOINT CHECK.</b> Remove the ball joint.	If the ball joints of suspension have unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step 10.
<b>10 CHECK GEARBOX.</b> Measure the rotating of gearbox. <Ref. to PS-37, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>	Is the rotating resistance of steering gearbox less than 11.3 N (1.15 kgf, 2.54 lb)? Is the difference between right and left sides less than 24%?	Steering effort is normal.	Readjust the backlash, and if ineffective, replace the faulty parts.

## General Diagnostic Table

### POWER ASSISTED SYSTEM (POWER STEERING)

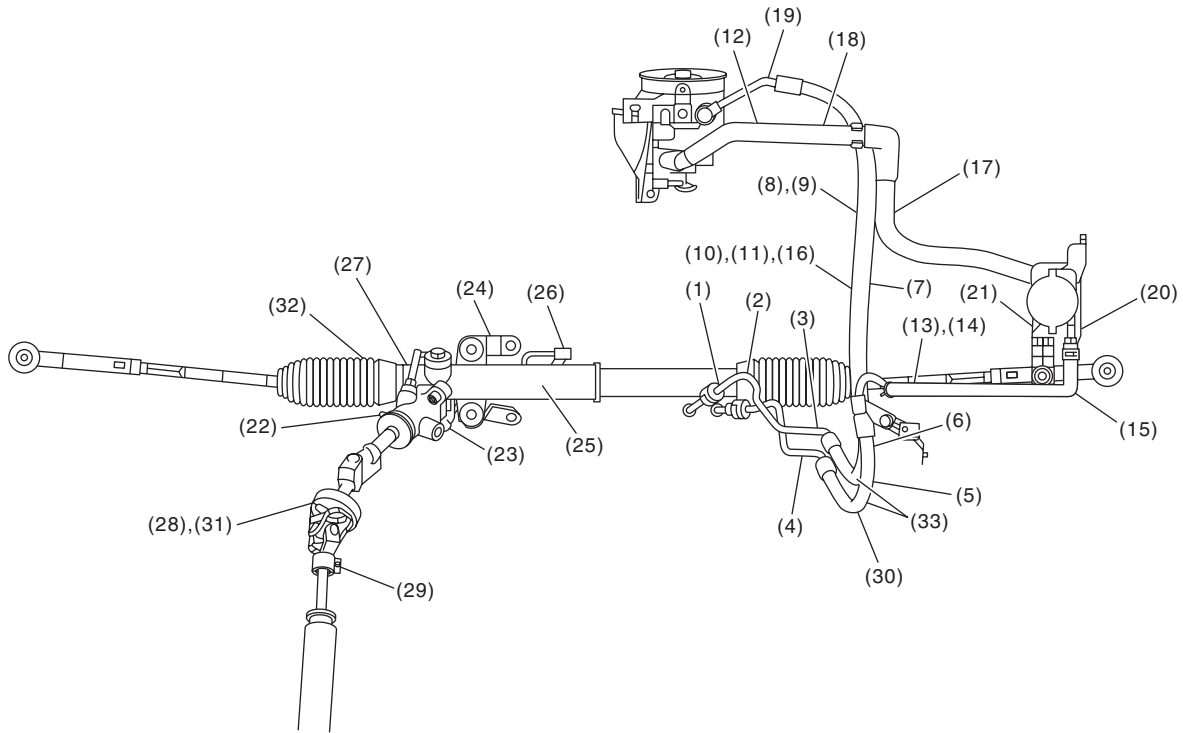
#### 3. INSPECTION OF CLEARANCE

This table lists various clearances that must be correctly adjusted to ensure the normal vehicle driving without interfering noise, or any other faults.

Location	Minimum allowance mm (in)
(1) Crossmember to-Hose ASSY	3 (0.12)
(2) Front exhaust pipe to Hose ASSY (Turbo model)	15 (0.59)
(3) Front frame side to Hose ASSY	10 (0.39)
(4) Turbo cover to Hose ASSY (Turbo model)	10 (0.39)
(5) Master cylinder to Return hose (Turbo model)	10 (0.39)
(6) Master cylinder to Hose clip (Model with vehicle dynamics control (VDC))	10 (0.39)
(7) VDC H/U to Hose ASSY (Model with vehicle dynamics control (VDC))	5 (0.20)
(8) Air cleaner to Hose ASSY (Turbo model)	5 (0.20)
(9) Air boot to Hose ASSY	10 (0.39)
(10) Protector to Hose ASSY (Turbo model, DOHC non-turbo model)	10 (0.39)
(11) Blow-by hose to Hose ASSY (Turbo model)	8 (0.31)
(12) Over flow hose to Hose ASSY (Turbo model)	8 (0.31)
(13) Brake pipe to Return hose (Model with ABS)	10 (0.39)
(14) Front suspension bracket to Return hose	5 (0.20)
(15) Front wheel apron to Return hose	5 (0.20)
(16) VDC H/U bracket to Suction hose (Model with vehicle dynamics control (VDC))	5 (0.20)
(17) Air cleaner case to Suction hose	5 (0.20)
(18) Air intake duct to Suction hose (Turbo model)	10 (0.39)
(19) Air duct to Suction hose (Turbo model)	10 (0.39)
(20) Front wheel apron to Reservoir tank	5 (0.20)
(21) VDC H/U to Reservoir tank (Model with vehicle dynamics control (VDC))	5 (0.20)
(22) Valve housing to DOJ (MT model)	12 (0.47)
(23) Valve housing to Crossmember (Hole)	1 (0.04)
(24) Bracket to Crossmember	1 (0.04)
(25) Cylinder to Crossmember	5 (0.20)
(26) Elbow to Crossmember	1 (0.04)
(27) Cylinder to Exhaust pipe	18 (0.71)
(28) Universal joint coupling to Turbo cover (Turbo model)	15 (0.59)
(29) Universal joint column side yoke to Master cylinder (Closest point of approach when the universal joint turns by 360°) (OUTBACK model)	5 (0.20)
(30) Cruise control to Hose ASSY (Model with cruise control)	10 (0.39)
(31) Universal joint coupling to ATF level gauge (LHD model)	10 (0.39)
(32) Boot to Exhaust pipe (LHD model)	18 (0.71)
(33) Return hose to Pressure hose	No contact between hoses

# General Diagnostic Table

## POWER ASSISTED SYSTEM (POWER STEERING)



PS-00772

# General Diagnostic Table

POWER ASSISTED SYSTEM (POWER STEERING)

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# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 1. General Description

### A: SPECIFICATION

#### 1. HEATER SYSTEM

Item		Specification	On condition
Heating capacity		5.1 kW (4,385 kcal/h, 17,401 BTU/h) or more	<ul style="list-style-type: none"> <li>• Mode selector switch: HEAT</li> <li>• Temperature control switch: FULL HOT</li> <li>• Temperature difference between hot water and inlet air: 65°C (149°F)</li> <li>• How water flow rate: 360 ℓ (95.1 US gal, 79.2 Imp gal)/h</li> </ul>
Air flow rate		320 m <sup>3</sup> (11,301 cu ft)/h	Heat mode (FRESH), FULL HOT at 12.5 V
Max air flow rate		510 m <sup>3</sup> (18.01 cu ft)/h	<ul style="list-style-type: none"> <li>• Temperature control switch: FULL COLD</li> <li>• Blower fan speed: Auto A/C: 6th position Manual A/C: 4th position</li> <li>• Mode selector lever: RECIRC</li> </ul>
Heater core size (height × length × width)		264 × 110 × 27 mm (10.4 × 4.33 × 1.06 in)	—
Blower motor	Type	Magnet motor 220 W or less	12 V
	Fan type and size (diameter × width)	Sirocco fan type 150 × 75 mm (5.91 × 2.95 in)	—

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

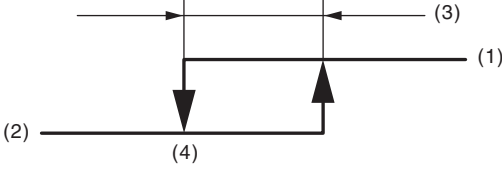
## 2. A/C SYSTEM

- Auto A/C model

Item		Specification
Type of air conditioner		Reheat air-mix type
Cooling capacity		5.3 kW (4,557 kcal/h, 18,084 BTU/h)
Refrigerant		HFC-134a (CH <sub>2</sub> FCF <sub>3</sub> ) [0.4±0.03 kg (0.88±0.07 lb)]
Compressor	Type	Scroll, constant volume (SCSA 08C)
	Discharge	74.5 cc (4.55 cu in)/rev
	Max. permissible speed	9,000 rpm
Magnet clutch	Type	Dry, single-disc type
	Power consumption	35 W
	Type of belt	2.5 L SOHC Non-turbo and 2.5 L DOHC Turbo model: V-belt 4 PK 3.0 L DOHC Non-turbo model: V-belt 6 PK
	Pulley dia. (effective dia.)	93 mm (3.7 in)
	Pulley ratio	1.43
Condenser	Type	Corrugated fin (Sub cool type)
	Core face area	0.193 m <sup>2</sup> (2.077 sq ft)
	Core thickness	16 mm (0.63 in)
	Radiation area	5.72 m <sup>2</sup> (61.57 sq ft)
Receiver drier	Effective inner capacity	190 cm <sup>3</sup> (11.6 cu in)
Expansion valve	Type	Externally equalizing
Evaporator	Type	Single tank
	Dimensions (W × H × T)	298.6 × 151 × 38 mm (11.76 × 5.94 × 1.50 in)
Blower fan	Fan type	Sirocco fan
	Outer diameter × width	150 × 75 mm (5.91 × 2.95 in)
	Power consumption	220 W
Condenser fan (Sub fan)	Motor type	Magnet
	Power consumption	2.5 L SOHC Non-turbo model: 90 W 2.5 L DOHC Turbo model: 120 W 3.0 L DOHC Non-turbo model: 160 W
	Fan outer diameter	2.5 L SOHC Non-turbo model: 300 mm (11.8 in) 2.5 L DOHC Turbo and 3.0 L DOHC Non-turbo model: 320 mm (12.6 in)
Radiator fan (Main fan)	Motor type	Magnet
	Power consumption	2.5 L SOHC Non-turbo model: 90 W 2.5 L DOHC Turbo model: 120 W 3.0 L DOHC Non-turbo model: 160 W
	Fan outer diameter	2.5 L SOHC Non-turbo model: 300 mm (11.8 in) 2.5 L DOHC Turbo and 3.0 L DOHC Non-turbo model: 320 mm (12.6 in)
Idling speed (A/C ON)	MPFI model	800±100 rpm

# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

Item			Specification
Triple switch (Pressure switch)	Low-pressure switch operating pressure	ON → OFF	196±20 kPa (2.00±0.20 kg/cm <sup>2</sup> , 28.4±2.9 psi)
		OFF → ON	225 <sup>+25</sup> <sub>-29</sub> kPa (2.29 <sup>+0.25</sup> <sub>-0.30</sub> kg/cm <sup>2</sup> , 32.6 <sup>+3.6</sup> <sub>-4.2</sub> psi)
	High-pressure switch operating pressure	ON → OFF	3,140 <sup>+50</sup> <sub>-200</sub> kPa (32.02 <sup>+0.51</sup> <sub>-2.04</sub> kg/cm <sup>2</sup> , 455.4 <sup>+7.25</sup> <sub>-29.0</sub> psi)
		OFF → ON	2,550±200 kPa (26.00±2.04 kg/cm <sup>2</sup> , 369.8±29.0 psi)
	Middle-pressure switch operating pressure	ON → OFF	1,370±120 kPa (13.97±1.22 kg/cm <sup>2</sup> , 198.65±17.35 psi)
		OFF → ON	1,770±80 kPa (18.05±0.82 kg/cm <sup>2</sup> , 256.81±11.60 psi)
Thermo-control amplifier working temperature (Evaporator outlet air)		 <p style="text-align: right;">AC-01681</p> <p>(1) ON (2) OFF (3) 1°C (33.8°F) (4) 4<sup>+8.0</sup><sub>0</sub>°C (39.2<sup>+46.4</sup><sub>0</sub>°F)</p>	



# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

- Manual A/C model

Item		Specification	
Type of air conditioner		Reheat air-mix type	
Cooling capacity		5.3 kW (4,557 kcal/h, 18,084 BTU/h)	
Refrigerant		HFC-134a (CH <sub>2</sub> FCF <sub>3</sub> ) [0.4±0.03 kg (0.88±0.07 lb)]	
Compressor	Type	Scroll, constant volume (SCSA 08C)	
	Discharge	74.5 cc (4.55 cu in)/rev	
	Max. permissible speed	9,000 rpm	
Magnet clutch	Type	Dry, single-disc type	
	Power consumption	35 W	
	Type of belt	V-belt 4 PK	
	Pulley dia. (effective dia.)	93 mm (3.7 in)	
Condenser	Pulley ratio	1.43	
	Type	Corrugated fin (Sub cool type)	
	Core face area	0.193 m <sup>2</sup> (2.077 sq ft)	
	Core thickness	16 mm (0.63 in)	
Receiver drier	Radiation area	5.7 m <sup>2</sup> (61.57 sq ft)	
	Effective inner capacity	190 cm <sup>3</sup> (11.6 cu in)	
Expansion valve	Type	Externally equalizing	
Evaporator	Type	Single tank	
	Dimensions (W × H × T)	298.6 × 151 × 38 mm (11.7 × 5.94 × 1.50 in)	
Blower fan	Fan type	Sirocco fan	
	Outer diameter × width	150 × 75 mm (5.91 × 2.95 in)	
	Power consumption	220 W	
Condenser fan (Sub fan)	Motor type	Magnet	
	Power consumption	90 W	
	Fan outer diameter	300 mm (11.8 in)	
Radiator fan (Main fan)	Motor type	Magnet	
	Power consumption	90 W	
	Fan outer diameter	300 mm (11.8 in)	
Idling speed (A/C ON)		MPFI model 800±100 rpm	
Triple switch (Pressure switch)	Low-pressure switch operating pressure	ON → OFF	196±20 kPa (2.00±0.20 kg/cm <sup>2</sup> , 28.4±2.9 psi)
		OFF → ON	225 <sup>+25</sup> <sub>-29</sub> kPa (2.29 <sup>+0.25</sup> <sub>-0.30</sub> kg/cm <sup>2</sup> , 32.6 <sup>+3.6</sup> <sub>-4.2</sub> psi)
	High-pressure switch operating pressure	ON → OFF	3,140 <sup>+50</sup> <sub>-200</sub> kPa (32.02 <sup>+0.51</sup> <sub>-2.04</sub> kg/cm <sup>2</sup> , 455.4 <sup>+7.25</sup> <sub>-29.0</sub> psi)
		OFF → ON	2,550±200 kPa (26.00±2.04 kg/cm <sup>2</sup> , 369.8±29.0 psi)
	Middle-pressure switch operating pressure	ON → OFF	1,370±120 kPa (13.97±1.22 kg/cm <sup>2</sup> , 198.65±17.35 psi)
		OFF → ON	1,770±80 kPa (18.05±0.82 kg/cm <sup>2</sup> , 256.81±11.60 psi)

# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

Item	Specification
Thermo control amplifier working temperature (Evaporator outlet air)	<div style="text-align: center;"> </div> <p style="text-align: right; margin-right: 50px;">AC-01681</p> <p>(1) ON                      (2) OFF                      (3) 1°C (33.8°F)                      (4) 4<sup>+8.0</sup><sub>0</sub>°C (39.2<sup>+46.4</sup><sub>0</sub>°F)</p>

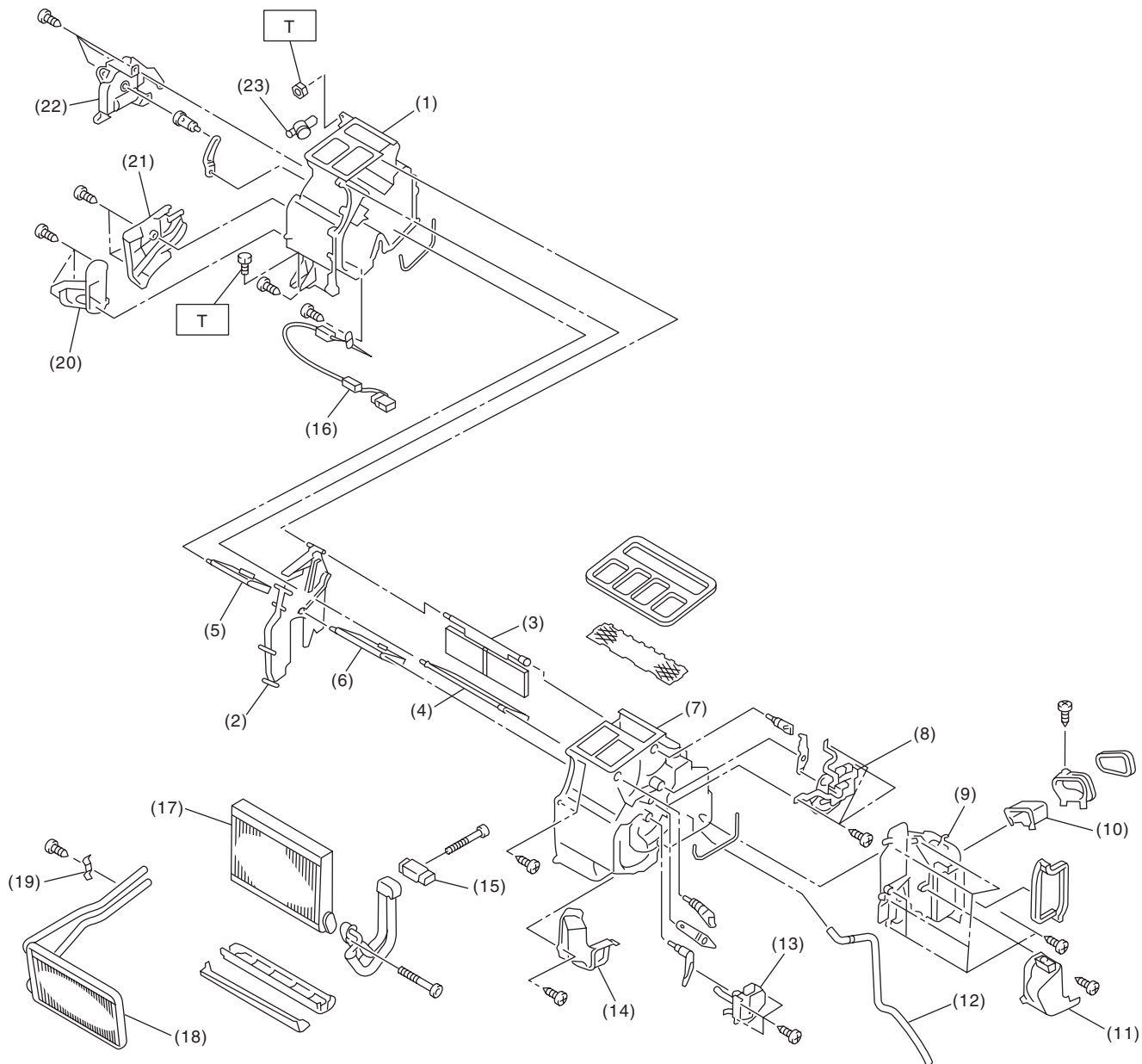
# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## B: COMPONENT

### 1. HEATER COOLING UNIT

- Auto A/C model



AC-01431

## General Description

### HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

---

(1) Heater unit case LH	(10) Grommet	(19) Heater pipe clamp
(2) Separator	(11) Pipe cover	(20) Foot duct LH
(3) Mode door RR	(12) Drain hose	(21) Heater core cover
(4) Mode door FR	(13) Air mix door actuator RH	(22) Air mix door actuator LH
(5) Air mix door LH	(14) Foot duct RH	(23) Aspirator
(6) Air mix door RH	(15) Expansion valve	
(7) Heater unit case RH	(16) Evaporator sensor	
(8) Mode door actuator	(17) Evaporator	
(9) Evaporator cover	(18) Heater core	

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***Tightening torque:N-m (kgf-m, ft-lb)***

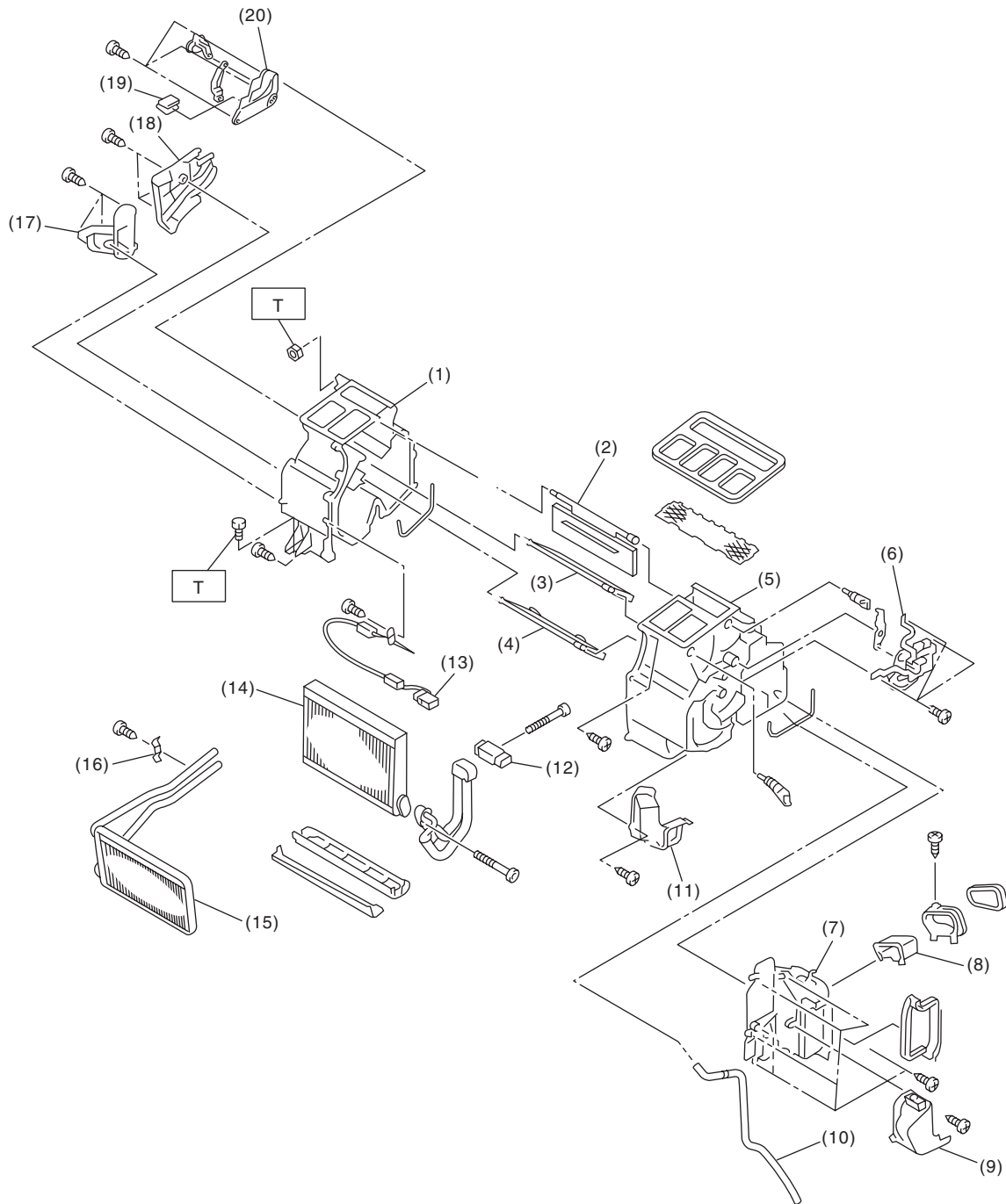
***T: 7.5 (0.76, 5.5)***

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# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

- Manual A/C model



AC-01430

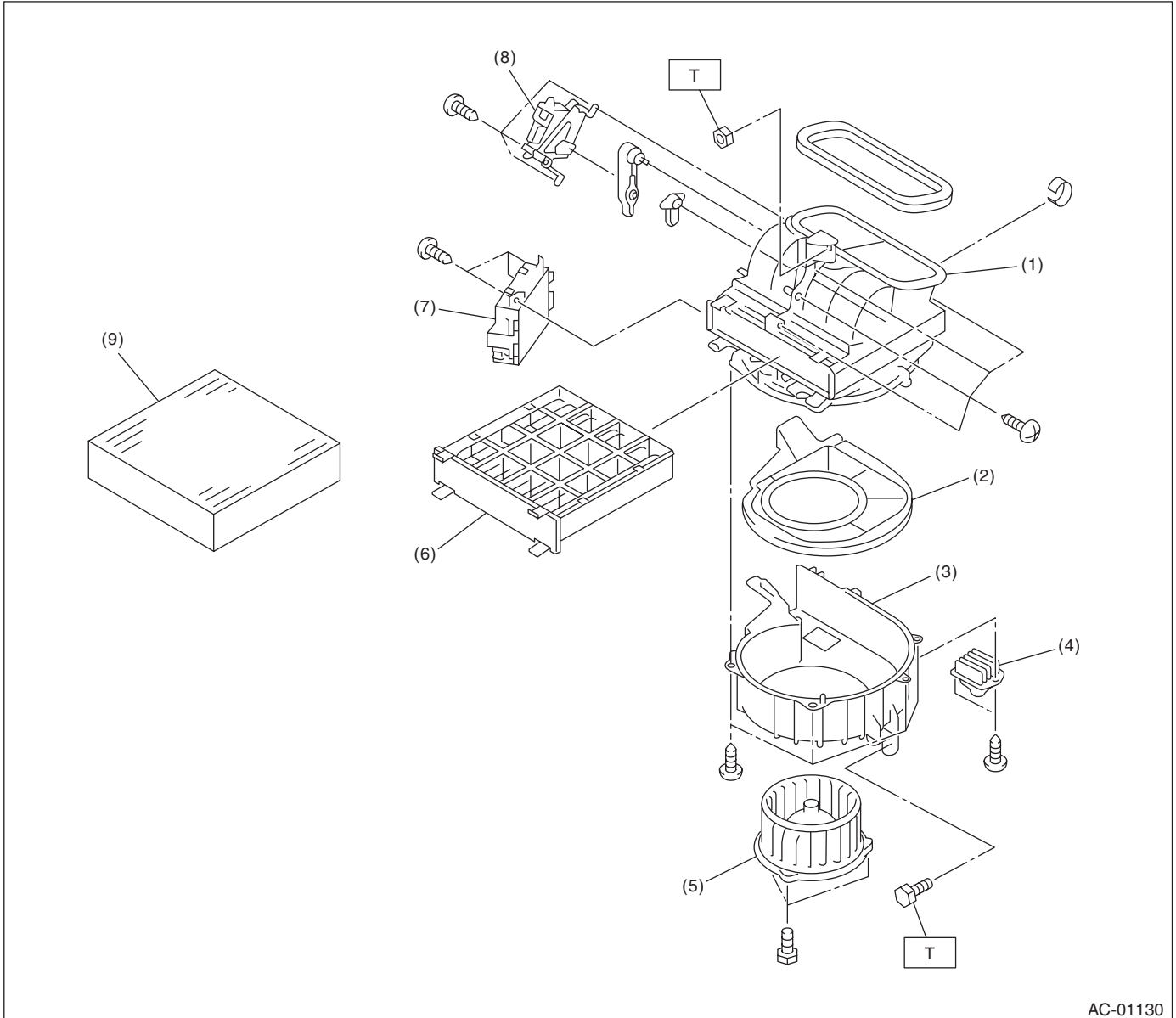
# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

- |                         |                        |                           |
|-------------------------|------------------------|---------------------------|
| (1) Heater unit case LH | (9) Pipe cover         | (17) Foot duct LH         |
| (2) Mode door RR        | (10) Drain hose        | (18) Heater core cover    |
| (3) Mode door FR        | (11) Foot duct RH      | (19) Clip                 |
| (4) Air mix door        | (12) Expansion valve   | (20) Air mix door linkage |
| (5) Heater unit case RH | (13) Thermo amplifier  |                           |
| (6) Mode door actuator  | (14) Evaporator        |                           |
| (7) Evaporator cover    | (15) Heater core       |                           |
| (8) Grommet             | (16) Heater pipe clamp |                           |

**Tightening torque:N-m (kgf-m, ft-lb)**  
**T: 7.5 (0.76, 5.5)**

## 2. BLOWER MOTOR UNIT



- |   |                                   |            |
|---|-----------------------------------|------------|
| (1) Upper case  | (5) Blower motor                  | (9) Filter |
| (2) Blower plate  | (6) Filter cover                  |            |
| (3) Lower case  | (7) Control unit (Auto A/C model) |            |
| (4) Power Transistor (Auto A/C model)<br>Blower Resistor (Manual A/C model) | (8) Intake door actuator          |            |

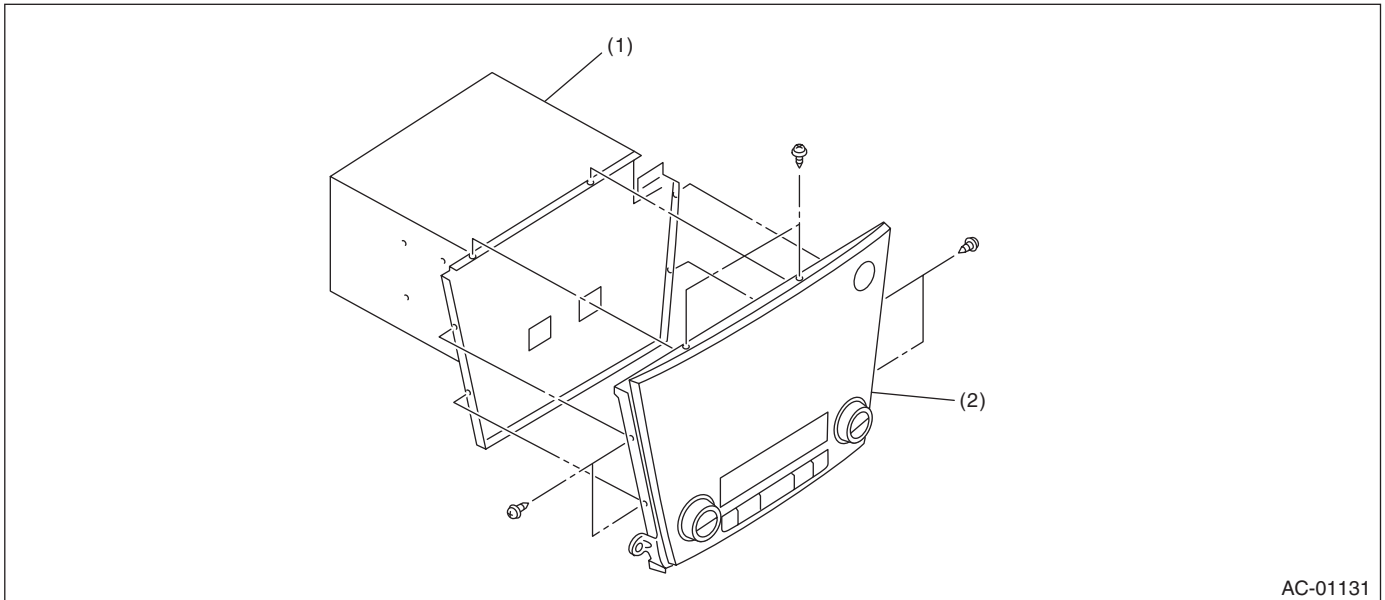
**Tightening torque:N-m (kgf-m, ft-lb)**  
**T: 7.5 (0.76, 5.5)**

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 3. CONTROL PANEL

- Auto A/C model

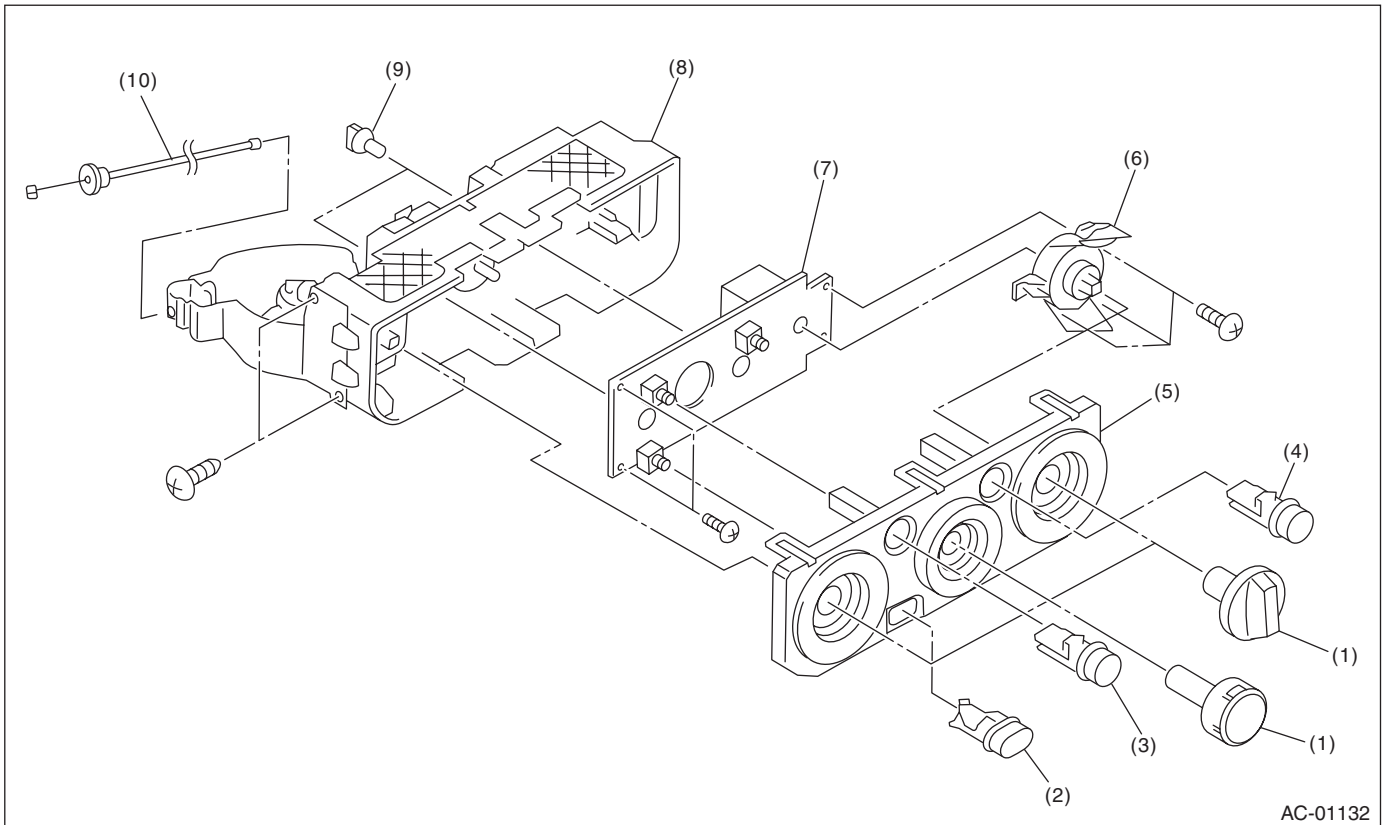


AC-01131

(1) Audio ASSY

(2) Control panel

- Manual A/C model



AC-01132

(1) Dial

(2) A/C switch

(3) FRESH/RECIRC switch

(4) Rear window defogger switch

(5) Heater control panel

(6) Air flow control switch

(7) Switch board

(8) Heater control base

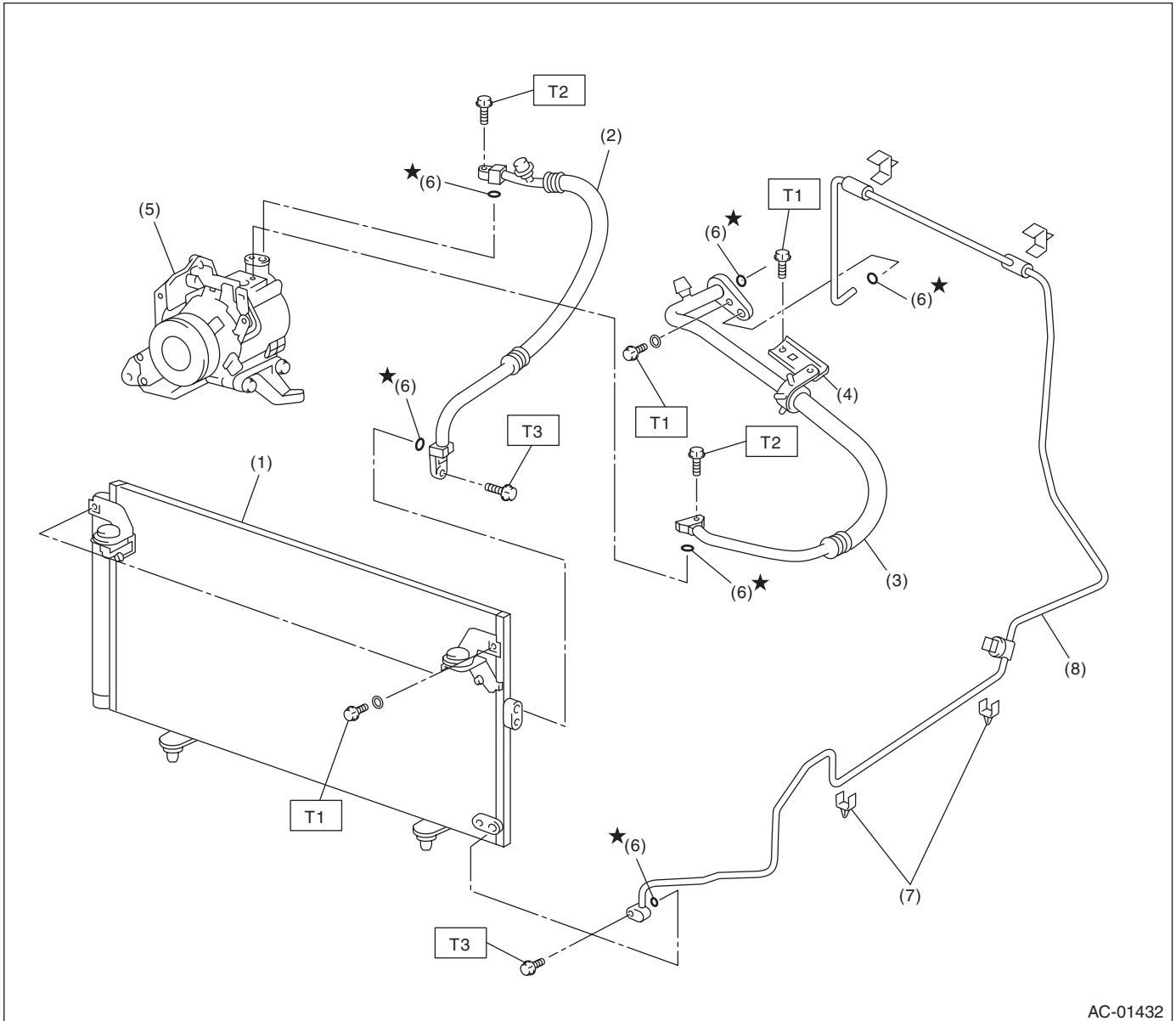
(9) Light

(10) Temperature control cable

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 4. AIR CONDITIONING UNIT



AC-01432

- |                          |                |
|--------------------------|----------------|
| (1) Condenser            | (5) Compressor |
| (2) Hose (High-pressure) | (6) O-ring     |
| (3) Hose (Low-pressure)  | (7) Clamp      |
| (4) Bracket              | (8) Tube       |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

**T2: 10 (1.0, 7.4)**

**T3: 5 (0.5, 3.7)**

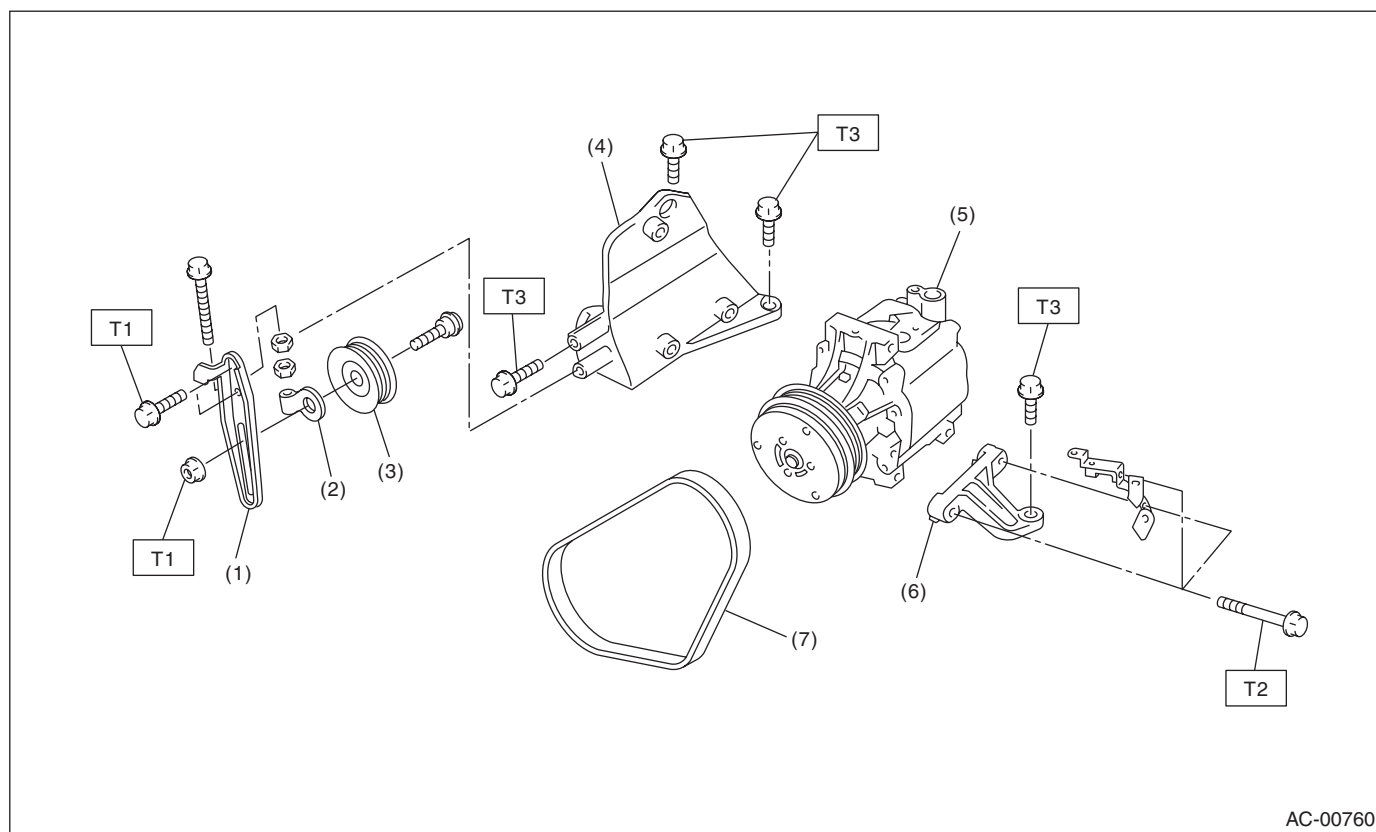


# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 5. COMPRESSOR

- H4 model



- (1) Idler pulley bracket
- (2) Idler pulley adjuster
- (3) Idler pulley
- (4) Compressor upper bracket

- (5) Compressor
- (6) Compressor lower bracket
- (7) V-belt

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 23.0 (2.35, 17.0)**

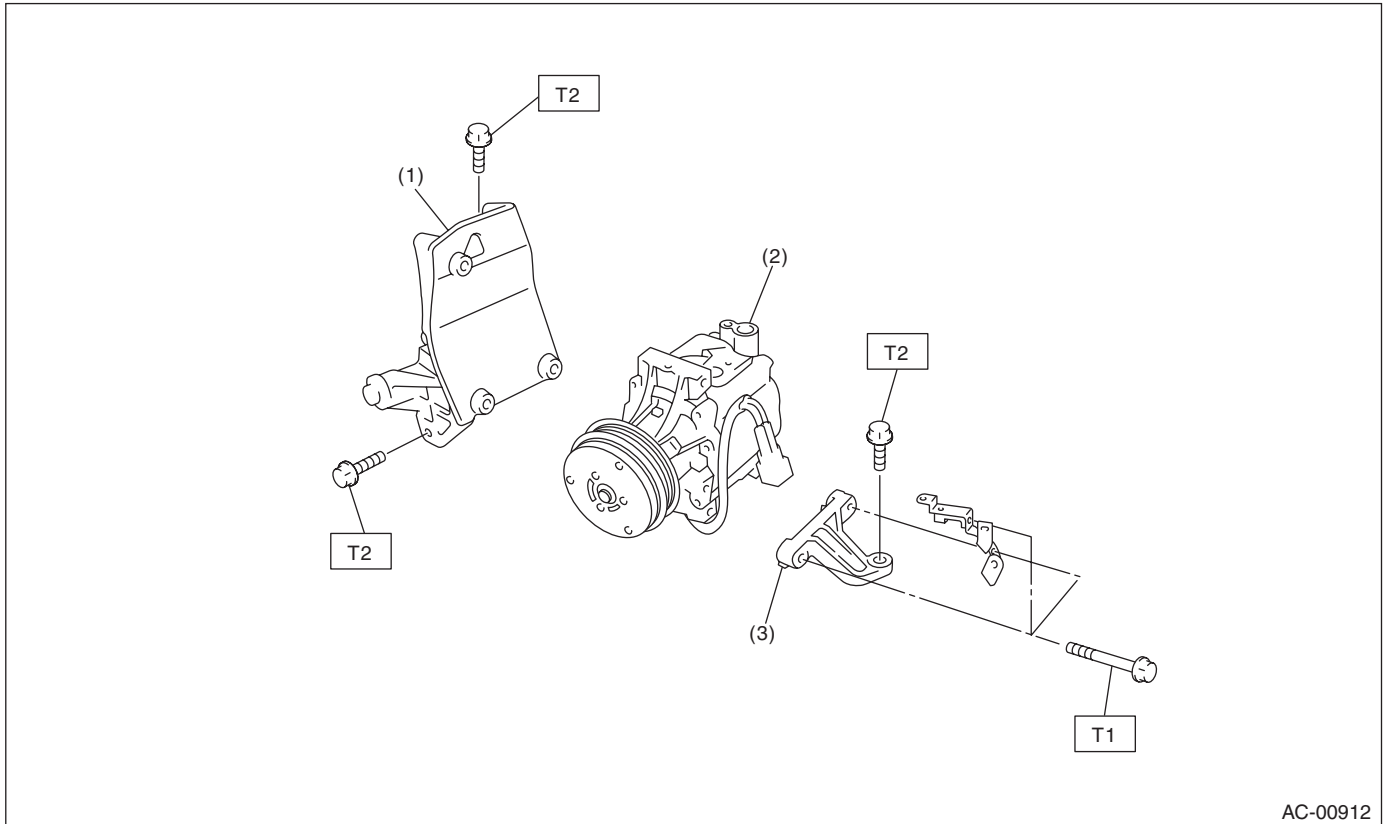
**T2: 28.9 (2.95, 21.3)**

**T3: 36 (3.7, 26.6)**

# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

- H6 model



- (1) Compressor upper bracket
- (2) Compressor
- (3) Compressor lower bracket

**Tightening torque: N·m (kgf·m, ft·lb)**

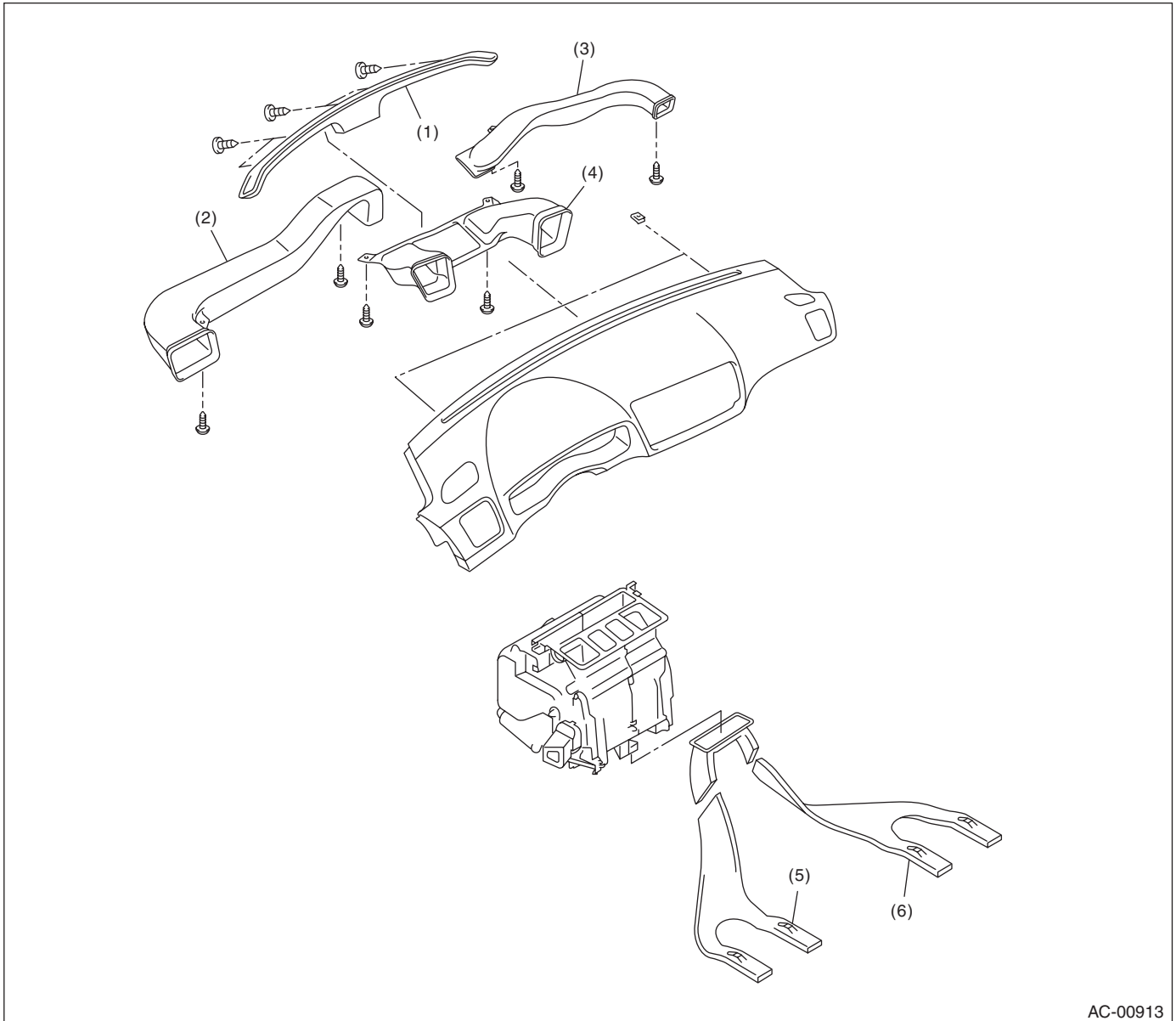
**T1: 28.9 (2.95, 21.3)**

**T2: 36 (3.7, 26.6)**

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 6. HEATER DUCT



AC-00913

- (1) Front defroster nozzle
- (2) Side ventilation duct (LH)

- (3) Side ventilation duct (RH)
- (4) Center ventilation duct

- (5) Rear heater duct (LH)
- (6) Rear heater duct (RH)

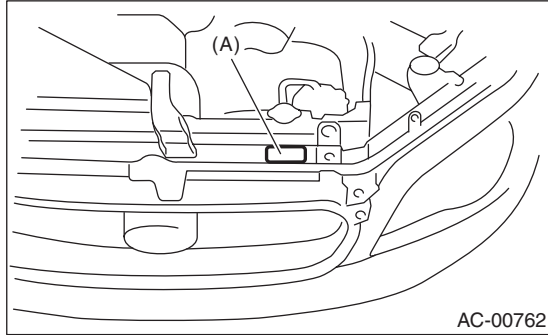
# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

### C: CAUTION

#### 1. HFC-134A A/C SYSTEM

- The cooling system components for the HFC-134a system such as the refrigerant and compressor oil are different from the conventional CFC-12 system components and they are incompatible with each other.
- Vehicles with the HFC-134a system can be identified by the label (A) attached to the vehicle. Before maintenance, check which A/C system is installed to the vehicle.



#### 2. COMPRESSOR OIL

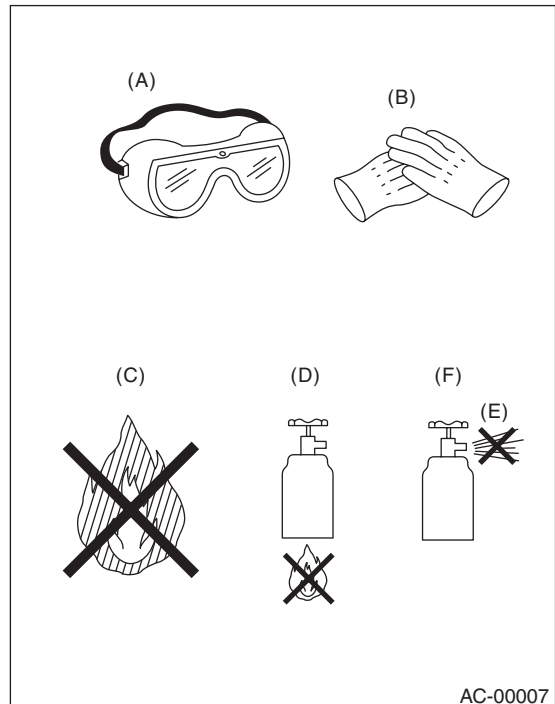
- HFC-134a compressor oil has no compatibility with that of CFC-12 system.
  - Use only Denso Oil 8, the manufacturer-authorized compressor oil for the HFC-134a system.
  - Do not mix multiple compressor oils.
- If CFC-12 compressor oil is used in the HFC-134a A/C system, the compressor may become stuck due to poor lubrication, or the refrigerant may leak due to swelling of rubber parts.
- On the other hand, if HFC-134a compressor oil is used in a CFC-12 A/C system, the durability of the A/C system will be lowered.
- HFC-134a compressor oil is very hygroscopic. When replacing or installing/removing A/C parts, immediately isolate the oil from atmosphere using a plug or tape. In order to avoid moisture, store the oil in a container with its cap tightly closed.

#### 3. REFRIGERANT

- CFC-12 refrigerant cannot be used in a HFC-134a A/C system. HFC-134a refrigerant, also cannot be used in a CFC-12 A/C system.
- If an incorrect or no refrigerant is used, it will result in poor lubrication and the compressor itself may be damaged.

#### 4. HANDLING OF REFRIGERANT

- The refrigerant boils at approx.  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ). When handling it, be sure to wear protective goggles and protective gloves. Direct contact of the refrigerant with skin may cause frostbite. If the refrigerant gets into your eye, avoid rubbing your eyes with your hands. Wash your eye with plenty of water, and receive medical treatment from an eye doctor.
- Do not heat a service can. If a service can is directly heated, or put into boiling water, the inside pressure will become extremely high. This may cause the can to explode. If a service can must be warmed up, use warm water of  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) or less.
- Do not drop or impact a service can. (Observe the precautions and operation procedure described on the refrigerant can.)
- When the engine is running, do not open the high-pressure valve of the manifold gauge. High-pressure gas can back-flow resulting in an explosion of the can.
- Provide good ventilation and do not work in a closed area.
- In order to prevent global warming, avoid releasing HFC-134a into the atmosphere. Using a refrigerant recovery system, discharge and recycle the gas.



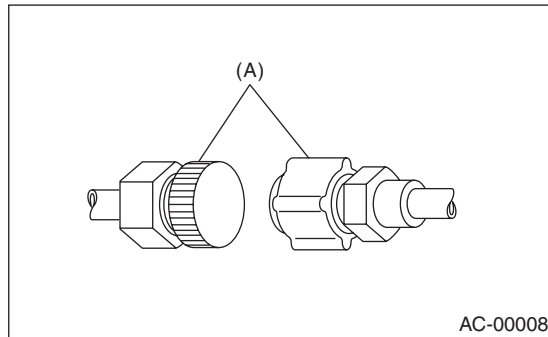
- (A) Goggles
- (B) Gloves
- (C) Avoid open flame
- (D) No direct heat on container
- (E) Do not discharge
- (F) Loosen

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

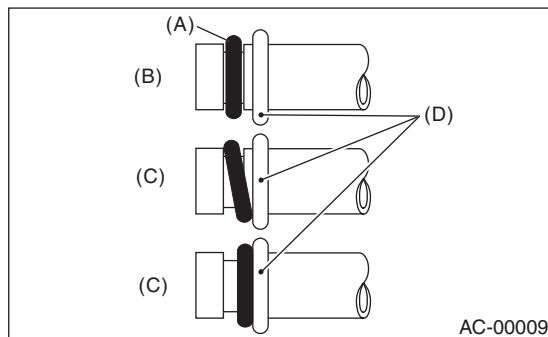
## 5. O-RING CONNECTIONS

- Always use a new O-ring.
- In order to keep the O-rings free of lint which can cause a refrigerant gas leak, perform operations without gloves and cloth.
- Apply compressor oil to O-rings to avoid sticking, before installation.
- Use a torque wrench to tighten the O-ring fittings. Over-tightening will cause damage to the O-ring and cause tube end distortion.
- If the work is interrupted before completing pipe connections, recap the tubes, components and fittings with a plug or tape to prevent foreign matter from entering.



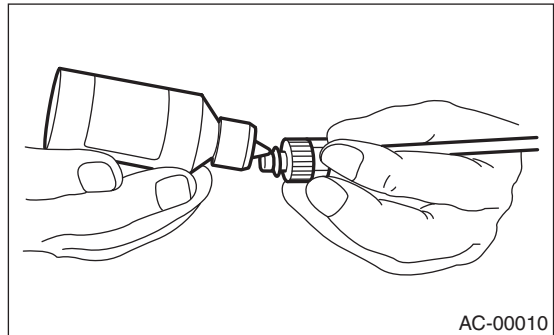
(A) Seal

- Visually check the surfaces and mating surfaces of O-rings, threads and connecting points. If a failure is found, replace the applicable parts.
- Install the O-rings at a right angle to tube beads.



- (A) O-ring
- (B) OK
- (C) NG
- (D) Groove

- Use compressor oil specified in the service manual to lubricate the O-rings. Apply oil to the top and sides of O-rings before installation. Apply compressor oil to grooves of the tube.



- After tightening, use a clean cloth to remove excess compressor oil from the connections and any oil which may have run on the vehicle body or other parts.
- If any leakage is suspected after tightening, do not tighten the connections further, but disconnect the connections, remove the O-rings, and check the O-rings, threads, and connections.

## D: PREPARATION TOOL

### CAUTION:

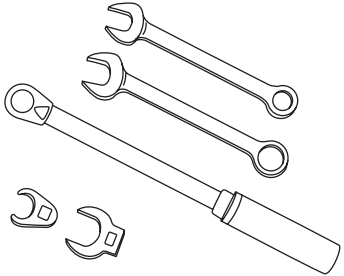
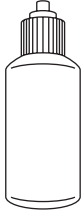
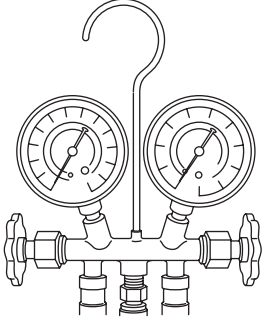
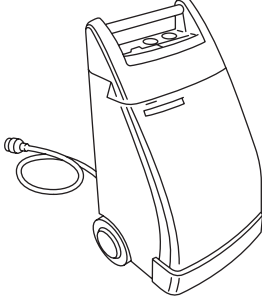
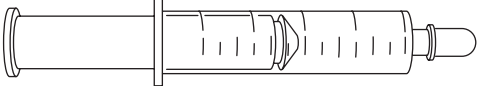
When working on vehicles with a HFC-134a system, only use HFC-134a specified tools and parts. Do not mix CFC-12 tools and parts. If HFC-134a and CFC-12 refrigerant or compressor oil is mixed, it will result in poor lubrication and the compressor itself may be damaged.

In order to prevent the mixture of HFC-134a and CFC-12 parts and liquid, the tool and screw type and the type of service valves used are different. The gas leak detectors for the HFC-134a and CFC-12 systems must also not be interchanged.

	HFC-134a	CFC-12
Tool & screw type	Millimeter size	Inch size
Valve type	Quick joint type	Screw-in type

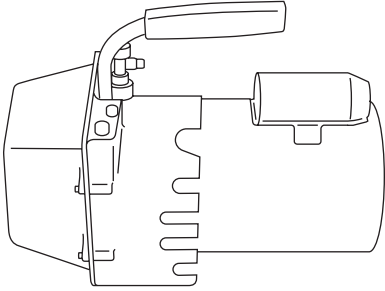
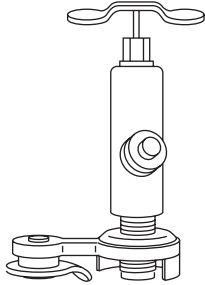
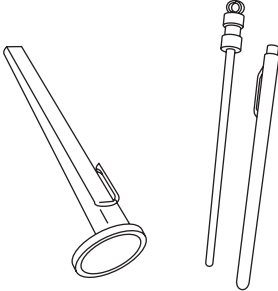
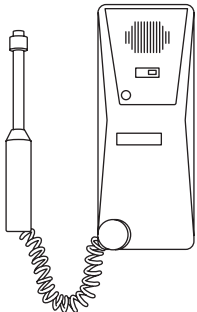
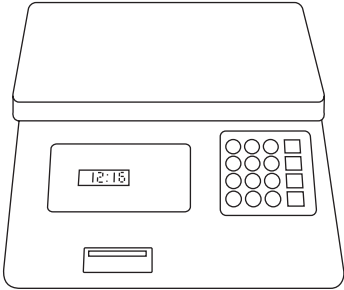
# General Description

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

ILLUSTRATION	NAME AND FUNCTION
 <p style="text-align: right;">AC-00213</p>	<p><b>Wrench</b></p> <p>Various <b>WRENCHES</b> will be required to service any A/C system. 7 to 40 N·m (0.7 to 4.1 kgf-m, 5 to 30 ft-lb) torque wrench and various crow-foot wrenches will be needed. Open end or flare nut wrenches will be needed to hold the tube and hose fittings.</p>
 <p style="text-align: right;">AC-00012</p>	<p><b>Applicator bottle</b></p> <p>A small <b>APPLICATOR BOTTLE</b> is recommended to apply compressor oil to the various parts. It can be available at a hardware or drug store.</p>
 <p style="text-align: right;">AC-00013</p>	<p><b>Manifold gauge set</b></p> <p>A <b>MANIFOLD GAUGE SET</b> (with hoses) is available either from a refrigerant supplier or an automotive equipment supplier.</p>
 <p style="text-align: right;">AC-00014</p>	<p><b>Refrigerant recovery system</b></p> <p>A <b>REFRIGERANT RECOVERY SYSTEM</b> is used for the recovery and recycling of A/C system refrigerant after contaminants and moisture have been removed from the refrigerant.</p>
 <p style="text-align: right;">AC-00015</p>	<p><b>Syringe</b></p> <p>A graduated plastic <b>SYRINGE</b> will be needed to add oil into the system again. A syringe can be available at a pharmacy or drug store.</p>

# General Description

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

ILLUSTRATION	NAME AND FUNCTION
 <p style="text-align: right;">AC-00016</p>	<p>Vacuum pump A <b>VACUUM PUMP</b> is necessary (for a good working condition), and is available either at a refrigerant supplier or an automotive equipment supplier.</p>
 <p style="text-align: right;">AC-00017</p>	<p>Can tap A <b>CAN TAP</b> for the 397 g (14 oz.) can is available at an automotive equipment supplier.</p>
 <p style="text-align: right;">AC-00018</p>	<p>Thermometer A Pocket <b>THERMOMETER</b> is available either at a industrial hardware store or a refrigerant supplier.</p>
 <p style="text-align: right;">AC-00019</p>	<p>Electronic leak detector An <b>ELECTRONIC LEAK DETECTOR</b> can be available either at a specialty tool supplier or an A/C equipment supplier.</p>
 <p style="text-align: right;">AC-00020</p>	<p>Weight scale A <b>WEIGHT SCALE</b> such as an electronic charging scale or a bath-room scale with digital display will be needed, if a 13.6 kg (30 lb) refrigerant container is used.</p>

# Refrigerant Pressure with Manifold Gauge Set

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## 2. Refrigerant Pressure with Manifold Gauge Set

### A: PROCEDURE

- 1) Place the vehicle in the shade and windless condition.
- 2) Connect the manifold gauge set.
- 3) Open the front windows and close all doors.
- 4) Open the front hood.
- 5) Increase the engine to 1,500 rpm.
- 6) Turn on the A/C switch.
- 7) Turn the temperature control switch to MAX COOL.
- 8) Put in RECIRC position.
- 9) Turn the blower control switch to HI.
- 10) Read the gauge.

#### Standard:

**Low: 127 — 196 kPa (1.3 — 2.0 kg/cm<sup>2</sup>, 18 — 28 psi)**

**High: 1,471 — 1,667 kPa (15 — 17 kg/cm<sup>2</sup>, 213 — 242 psi)**

**Ambient temperature: 30 — 35°C (86 — 95°F)**

### B: INSPECTION

Symptom	Probable cause	Repair order
High-pressure side is unusually high.	<ul style="list-style-type: none"><li>• Defective condenser fan motor</li><li>• Clogged condenser fin</li><li>• Too much refrigerant</li><li>• Air inside the system</li><li>• Defective receiver dryer</li></ul>	<ul style="list-style-type: none"><li>• Replace the fan motor.</li><li>• Clean the condenser fin.</li><li>• Discharge refrigerant.</li><li>• Replace the receiver dryer.</li><li>• After evacuating again, charge an appropriate amount of refrigerant.</li></ul>
High-pressure side is unusually low.	<ul style="list-style-type: none"><li>• Defective compressor</li><li>• Not enough refrigerant</li><li>• Clogged expansion valve</li><li>• Expansion valve frozen temporarily by moisture.</li></ul>	<ul style="list-style-type: none"><li>• Replace the compressor.</li><li>• Check for leaks.</li><li>• Replace the expansion valve.</li><li>• Fully evacuate the expansion valve.</li></ul>
Low-pressure side is unusually high.	<ul style="list-style-type: none"><li>• Defective compressor</li><li>• Defective expansion valve</li><li>• Too much refrigerant</li></ul>	<ul style="list-style-type: none"><li>• Replace the compressor.</li><li>• Replace the expansion valve.</li><li>• Discharge refrigerant.</li></ul>
Low-pressure side is unusually low.	<ul style="list-style-type: none"><li>• Not enough refrigerant</li><li>• Clogged expansion valve</li><li>• Expansion valve frozen temporarily by moisture.</li><li>• Saturated receiver dryer</li></ul>	<ul style="list-style-type: none"><li>• Check for leaks.</li><li>• Replace the expansion valve.</li><li>• Replace the receiver dryer.</li></ul>



# Refrigerant Recovery Procedure

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

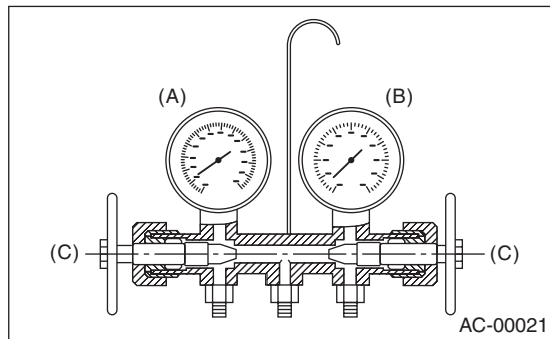
## 3. Refrigerant Recovery Procedure

### A: PROCEDURE

#### CAUTION:

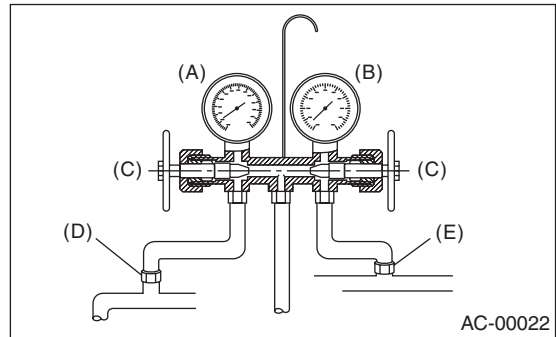
- During operation, be sure to wear protective goggles and protective gloves.
- Connect the refrigerant recovery system with the manifold gauge set to discharge the refrigerant from the A/C system and recycle the gas.
- When recycling the discharged refrigerant, keep service cans on hand. Because the recovery rate with the recovery system is approx. 90%, service cans are necessary to charge the refrigerant.
- Follow the detailed operation procedure described in the operation manual attached to the refrigerant recovery system.

- 1) Perform the compressor oil return operation. <Ref. to AC-26, PROCEDURE, Compressor Oil.>
- 2) Stop the engine.
- 3) Make sure the valves on low/high pressure sides of manifold gauge set are fully closed.



- (A) Low-pressure gauge  
(Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close

- 4) Install the low/high pressure hoses to the service ports on the low/high pressure sides of the vehicle respectively.



- (A) Low-pressure gauge  
(Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close
- (D) Low-pressure side service port
- (E) High-pressure side service port

- 5) Connect the center hose to the refrigerant recovery system.
- 6) Follow the operation manual to activate the refrigerant recovery system.

# Refrigerant Charging Procedure

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 4. Refrigerant Charging Procedure

### A: PROCEDURE

#### CAUTION:

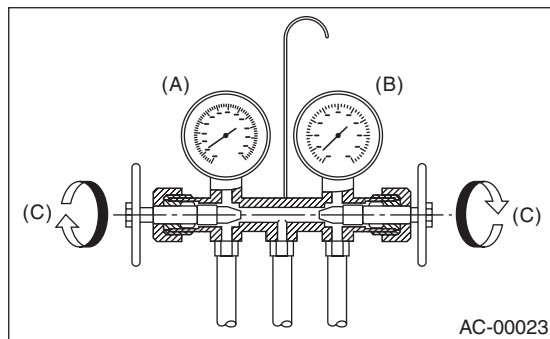
- During operation, be sure to wear protective goggles and protective gloves.
- Before charging the refrigerant, evacuate the system to remove small amounts of moisture remaining in the system.

The moisture in the system can be completely evacuated only under the minimum vacuum level. The minimum vacuum level affects the temperature in the system.

- The list below shows the vacuum values necessary to boil water at various temperatures. In addition, the vacuum levels indicated on the gauge are approx. 3.3 kPa (25 mmHg, 0.98 inHg) lower than those measured at 304.8 m (1,000 ft) above sea level.

Vacuum level required to boil water (at sea level)	
Temperature	Vacuum
1.7°C (35°F)	100.9 kPa (757 mmHg, 29.8 inHg)
7.2°C (45°F)	100.5 kPa (754 mmHg, 29.7 inHg)
12.8°C (55°F)	99.8 kPa (749 mmHg, 29.5 inHg)
18.3°C (65°F)	99.2 kPa (744 mmHg, 29.3 inHg)
23.9°C (75°F)	98.5 kPa (739 mmHg, 29.1 inHg)
29.4°C (85°F)	97.2 kPa (729 mmHg, 28.7 inHg)
35°C (95°F)	95.8 kPa (719 mmHg, 28.3 inHg)

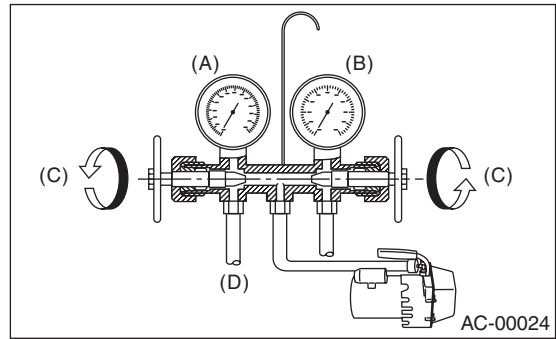
- 1) Close the valves on low/high pressure sides of the manifold gauge.



- (A) Low-pressure gauge (Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close

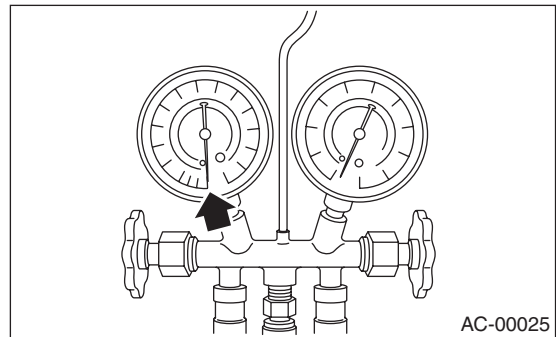
- 2) Install the low/high pressure hoses to the corresponding service ports on the vehicle.
- 3) Connect the center hose of the manifold gauge set with the vacuum pump.

- 4) Carefully open the valves on the low/high pressure sides to activate the vacuum pump.

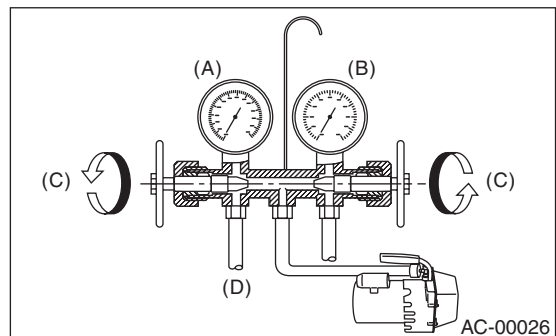


- (A) Low-pressure gauge (Compound pressure gauge)
- (B) High-pressure gauge
- (C) Slowly open
- (D) Vacuum pump turn on

- 5) After the low-pressure gauge reaches 100.0 kPa (750 mmHg, 29.5 inHg) or higher, evacuate the system for approx. 15 minutes. (Continue evacuation).



- 6) After 15 minutes of evacuation, if the reading shows 100.0 kPa (750 mmHg, 29.5 inHg) or higher, close the valves on the both sides to stop the vacuum pump.

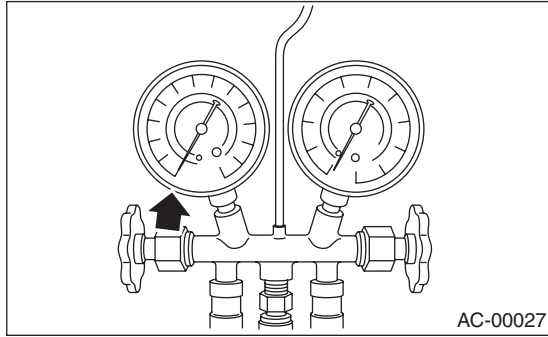


- (A) Low-pressure gauge (Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close
- (D) Vacuum pump turn off

# Refrigerant Charging Procedure

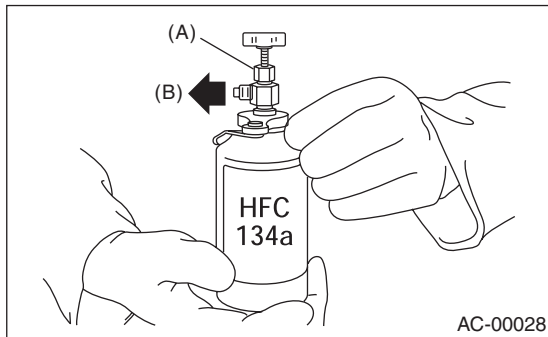
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

7) Note the low-pressure gauge reading.



8) Leave it at least 5 minutes, and then check the low-pressure gauge reading for any changes. If the gauge indicator shows near zero point, it is a sign of leakage. Check pipe connector points, repair them, and make sure there is no leakage.

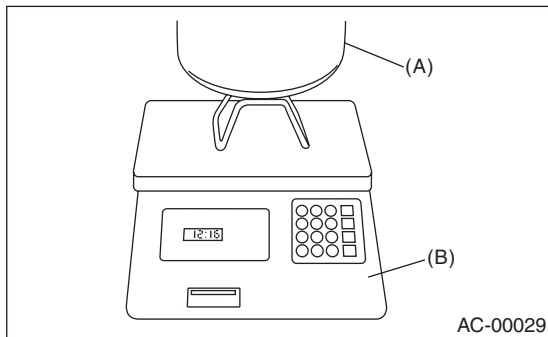
9) Follow the can tap operation manual, install to the refrigerant can.



- (A) Tap valve
- (B) Center manifold hose

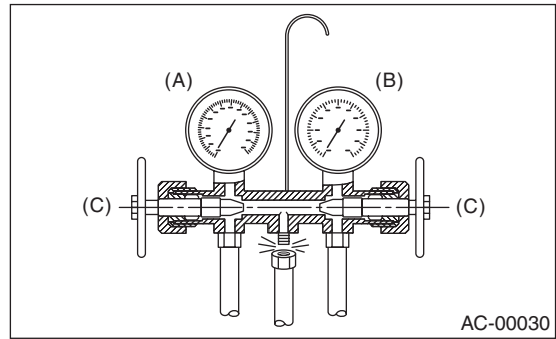
10) Disconnect the center manifold hose from the vacuum pump, and connect the hose to the tap valve.

11) When a 13.6 kg (30 lb) refrigerant container is used, measure the weight of the refrigerant amount to use using a scale.



- (A) Refrigerant container (HFC-134a)
- (B) Weight scale

12) Confirm that all the 3 hoses are connected securely to the manifold gauge set.



- (A) Low-pressure gauge  
(Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close

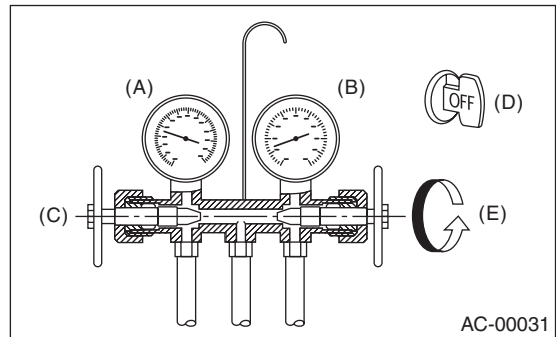
13) Open the valve on the HFC-134a source.

14) Loosen the center hose connection on the manifold gauge set (if applicable, press a purge valve on the manifold gauge set) for a few seconds to allow the air in the center hose to escape by the refrigerant pressure.

15) Stop the engine and carefully open the high-pressure valve.

### CAUTION:

**Do not open the low-pressure valve.**



- (A) Low-pressure gauge  
(Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close
- (D) Ignition switch OFF
- (E) Slowly open

### CAUTION:

**Never run the engine while charging from the high-pressure side.**

16) Close the high-pressure valve when the low-pressure gauge reaches 98 kPa (1 kg/cm<sup>2</sup>, 14 psi). Using a leak tester, check the system for leaks. If any leakage is found after the refrigerant recovery is completed, repair the applicable area.

# Refrigerant Charging Procedure

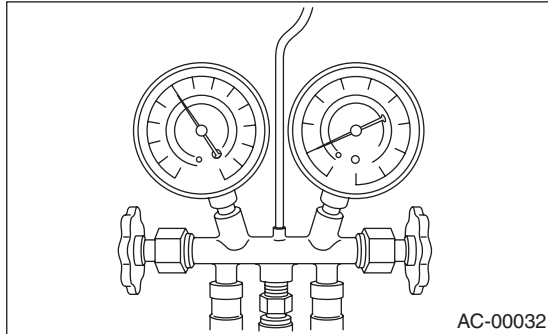
## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

17) After confirming that there are no leaks with the leak test, charge the required amount of refrigerant.

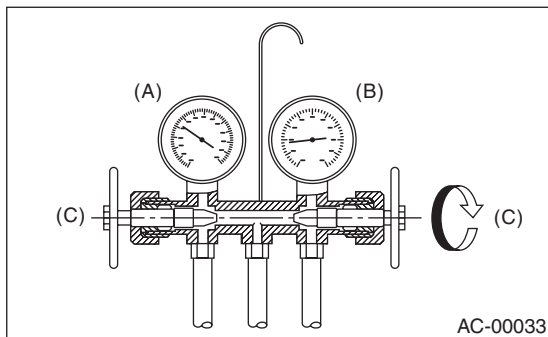
### CAUTION:

**Never run the engine while charging from the high-pressure side.**

- 18) Close the high-pressure valve when;
- the readings of low-/high-pressure gauges become almost equal, after the charging speed is reduced,
  - the HFC-134a source becomes empty, or the system is full with the gas.



19) If the HFC-134a source is empty, close the high-pressure valve, close the valve on the can tap, and replace the HFC-134a source with a new part to restart the operation.



- (A) Low-pressure gauge  
(Compound pressure gauge)
- (B) High-pressure gauge
- (C) Close

20) Confirm that both the low-/high-pressure valves can be closed. Start the engine with the A/C switch OFF.

21) Quickly repeat ON-OFF cycles a few times to prevent initial compressor damage.

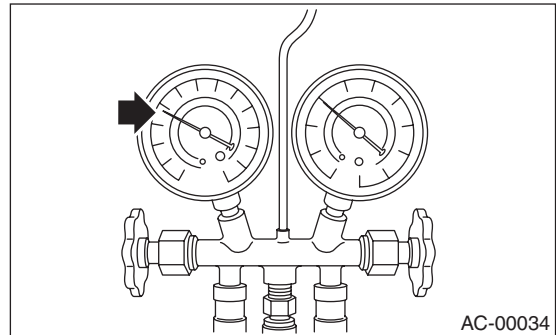
22) Set up the vehicle to the following status:

- A/C switch ON
- Engine running at 1,500 rpm
- Blower speed setting to "HI"
- Temperature setting to "MAX COOL"
- Air inlet setting to "RECIRC"
- Window open

23) While reading the low-pressure gauge, carefully open the low-pressure valve with the refrigerant source connected and the service hose purged.

### CAUTION:

**Never open the high-pressure valve with the engine running. The high-pressure gas will back-flow resulting in an explosion of the can.**



24) Adjust the refrigerant flow to maintain the pressure on the low-pressure side at 276 kPa (2.81 kg/cm<sup>2</sup>, 40 psi) max.

25) After the system is fully charged, close the low-pressure valve.

26) Close the valve on the refrigerant source.

Refrigerant amount		
Refrigerant	Minimum	Maximum
HFC-134a	370 g (0.82 lb)	430 g (0.95 lb)

27) Disconnect the hose from the service port, and install the service port cap.

# Refrigerant Leak Check

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 5. Refrigerant Leak Check

### A: INSPECTION

1) Operate the A/C system for approx. 10 minutes, and check that the high-side pressure shows at least 690 kPa (7.03 kg/cm<sup>2</sup>, 100 psi). Then stop the engine to start the leak test.

2) Starting from the connection between high-pressure pipe and evaporator, check the system for leaks along the high-pressure side through the compressor. The following items must be checked thoroughly.

3) Check the joint and seam between pressure switch (dual switch) and high-pressure pipe.

4) Check the connections between condenser and pipes, and welded joints on the condenser.

The leak tester may detect the oil on the condenser fins as a leak.

5) Check the joint between compressor and hoses.

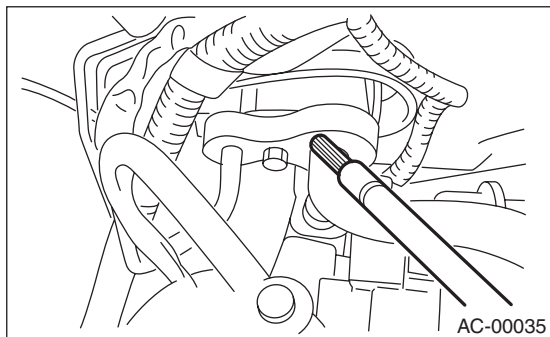
6) Check the machined area of the compressor and other joints on the compressor.

7) Check the compressor shaft seal at the area near the center of compressor clutch pulley.

Some shaft seals show a slight amount of leakage, about 3 g (0.1 oz) per year. This is not a problem.

8) Starting from the connection between low-pressure pipe and evaporator, check the system for leakage along the low-pressure side through the compressor. The following items must be checked thoroughly.

- Connection between 2 parts
- Connection between pipe and plate

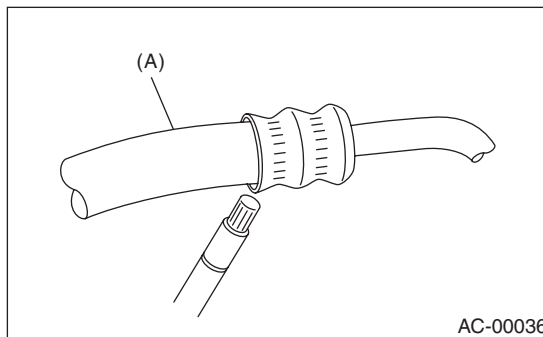


9) Visually check the rubber area of the flexible hose for cracks.

Check the entire length of the flexible hose, especially the connection with the metal hose end.

### CAUTION:

**Carefully check the external surface of hoses and tubes at approx. 25 mm (0.98 in) per second.**

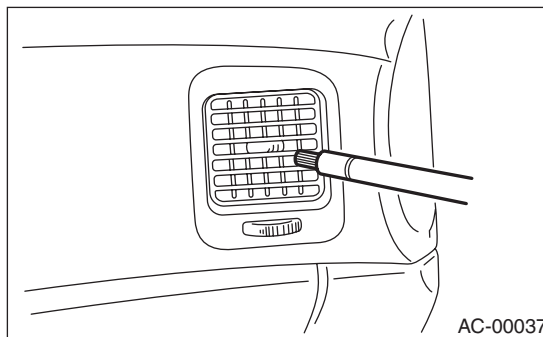


(A) Flexible hose

10) Disconnect the drain hose from the heater case, and check the hose end for at least 10 seconds.

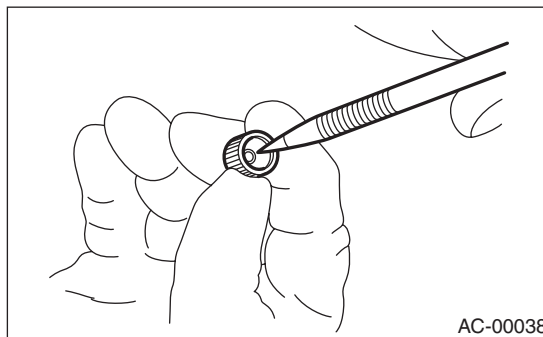
After the test is finished, reconnect the drain hose.

11) Turn the ignition key to the ON position, and run the blower at high speed for approx. 1 minute. Stop the blower to check the ventilation grill on the instrument panel. While moving the tester closer to the grill, run the blower for 1 or 2 seconds, then stop it. Check the grill at that point for at least 10 seconds.



12) Check the valve in the service port.

13) Visually check the rubber seal in the service port cap.



# Compressor Oil

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## 6. Compressor Oil

### A: PROCEDURE

NOTE:

Before making repairs, perform the oil return operation to return the compressor oil in circulation with the refrigerant to the compressor.

- 1) Increase the engine to 1,500 rpm.
- 2) Turn on the A/C switch.
- 3) Turn the temperature control switch to MAX COOL.
- 4) Put in RECIRC position.
- 5) Turn the blower control switch to HI.
- 6) Leave in this condition for 10 minutes.

### B: REPLACEMENT

NOTE:

- If a component has been replaced, add an appropriate amount of compressor oil (same as the amount of remaining oil in removed component).
- When replacing the compressor, the new compressor will already have the specified amount of oil in it. Adjust the oil amount (so that the amount remains the same as that of the removed compressor) and install the new compressor.

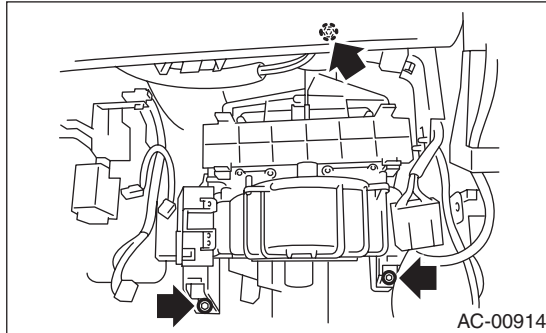
# Blower Motor Unit Assembly

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 7. Blower Motor Unit Assembly

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Disconnect the connectors of the A/C control module, intake door actuator, blower motor, power transistor and blower resistor.
- 4) Loosen the bolt and nut to remove blower motor unit assembly.



### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Refer to “COMPONENT” of “General Description”.** <Ref. to AC-7, HEATER COOLING UNIT, COMPONENT, General Description.>  
<Ref. to AC-10, BLOWER MOTOR UNIT, COMPONENT, General Description.>

# Blower Motor

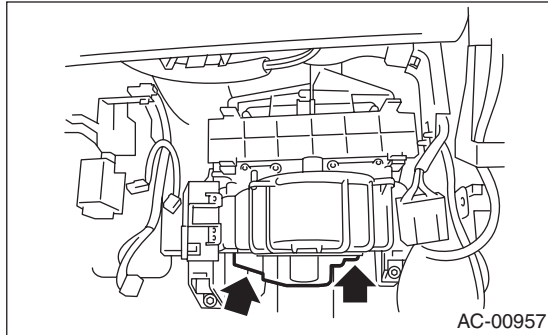
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## 8. Blower Motor

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the glove box lower cover. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Disconnect the connector of the blower motor.
- 4) Loosen the screw to remove the blower motor.

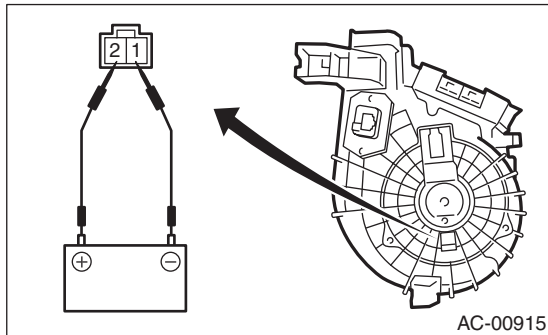


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Connect the battery positive (+) terminal to terminal No. 2 of blower motor connector, and negative (-) terminal to terminal No. 1. Check the blower motor for smooth rotation.





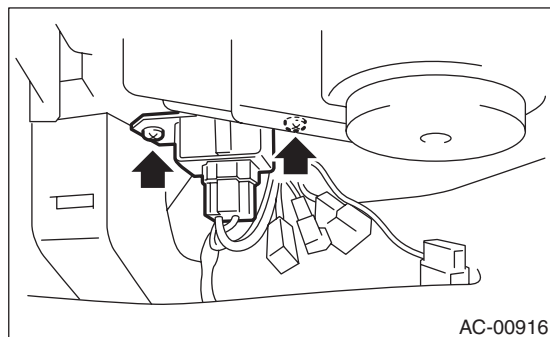
## Power Transistor (Auto A/C Model)

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

### 9. Power Transistor (Auto A/C Model)

#### A: REMOVAL

- 1) Remove the glove box lower cover on passenger's side. <Ref. to EI-52, REMOVAL, Glove Box.>
- 2) Disconnect the power transistor connector.
- 3) Remove the two screws and remove the power transistor.



#### B: INSTALLATION

Install in the reverse order of removal.

# Blower Resistor (Manual A/C Model)

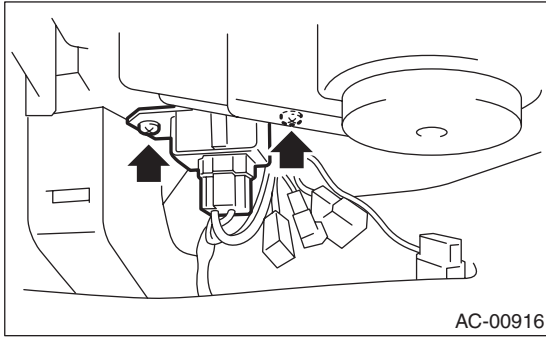
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## 10. Blower Resistor (Manual A/C Model)

### A: REMOVAL

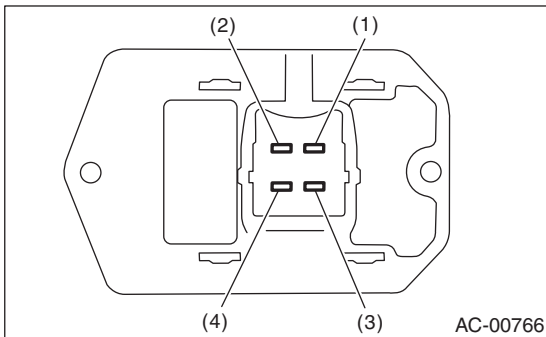
- 1) Remove the glove box lower cover on passenger's side. <Ref. to EI-52, REMOVAL, Glove Box.>
- 2) Disconnect the blower resistor connector.
- 3) Remove the two screws and remove the blower resistor.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION



Measure the blower resistor resistance.

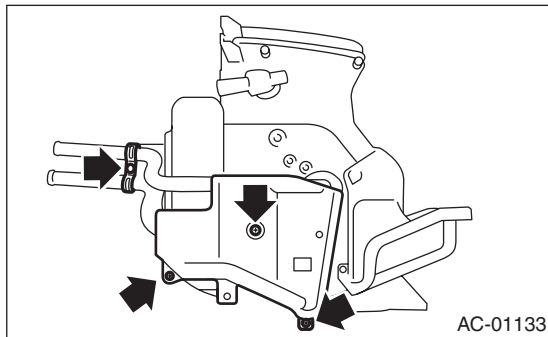
Terminal No.	Standard
4 and 2	Approx. 0.44 $\Omega$
4 and 3	Approx. 1.12 $\Omega$
4 and 1	Approx. 2.92 $\Omega$

If NG, replace the blower resistor.

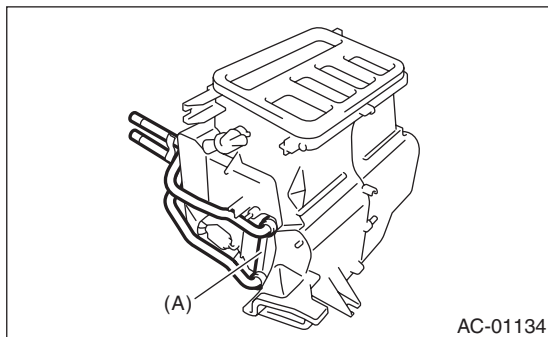
## 11.Heater Core

### A: REMOVAL

- 1) Remove the heater and cooling unit. <Ref. to AC-37, REMOVAL, Heater and Cooling Unit.>
- 2) Remove the screws and remove the heater core cover and pipe clamp.



- 3) Remove the heater core (A).



### B: INSTALLATION

Install in the reverse order of removal.

## Control Panel (Auto A/C Model)

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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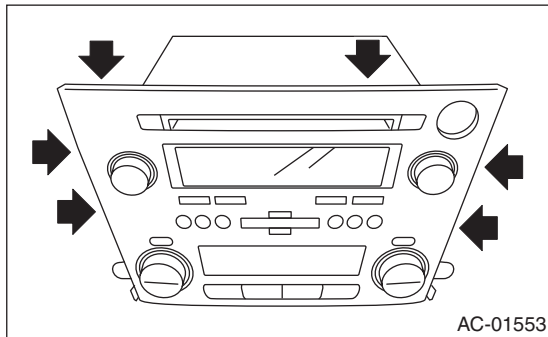
### 12. Control Panel (Auto A/C Model)

#### A: REMOVAL

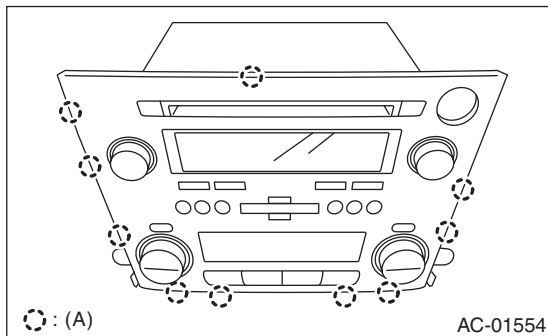
- 1) Remove the audio assembly. <Ref. to ET-4, REMOVAL, Audio.>
- 2) Remove the six screws.

#### NOTE:

When working with the removed audio assembly with its back facing down, place wooden blocks between the audio assembly and the workbench to prevent the ground terminal from folding.



- 3) Use a fine flat tip screwdriver to lift the hooks in 10 locations gradually. Starting from the sides, proceed to loosen the lower hooks, then the upper hooks, then remove.



(A) Hook

- 4) Pull the panel straight out to remove.

#### CAUTION:

**Be careful not to touch the circuit board of the panel to prevent damage by static electricity.**

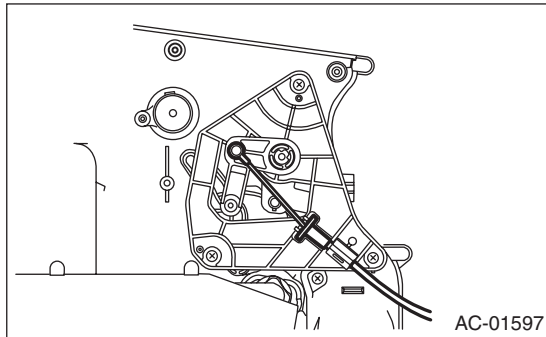
#### B: INSTALLATION

- 1) After attaching the hooks, push the center of the panel by hand and secure the connection between the circuit board and the connector.
- 2) Install in the reverse order of removal.

### 13. Control Unit (Manual A/C Model)

#### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 3) Remove the control wires.



- 4) Remove the audio assembly. <Ref. to ET-4, REMOVAL, Audio.>
- 5) Loosen the screw to remove the control unit from the bracket.

#### B: INSTALLATION

Install in the reverse order of removal.

## Control Unit (Auto A/C Model)

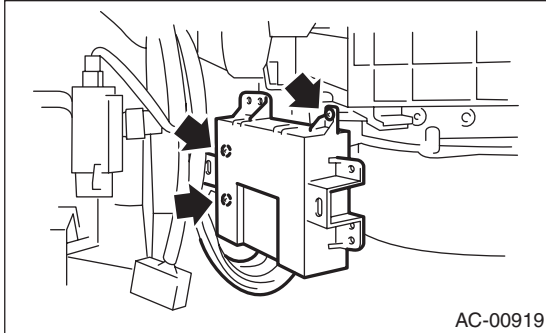
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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### 14. Control Unit (Auto A/C Model)

#### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the screw, disconnect the connector and remove the control unit.



#### B: INSTALLATION

Install in the reverse order of removal.

# Compressor

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 15. Compressor

### A: INSPECTION

#### 1. MAGNETIC CLUTCH CLEARANCE

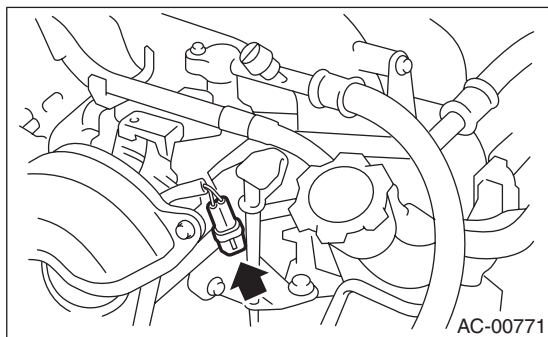
Check the clearance of the entire circumference around the drive plate and pulley.

#### Standard:

$0.45 \pm 0.15 \text{ mm}$  ( $0.0177 \pm 0.0059 \text{ in}$ )

#### 2. MAGNETIC CLUTCH OPERATION

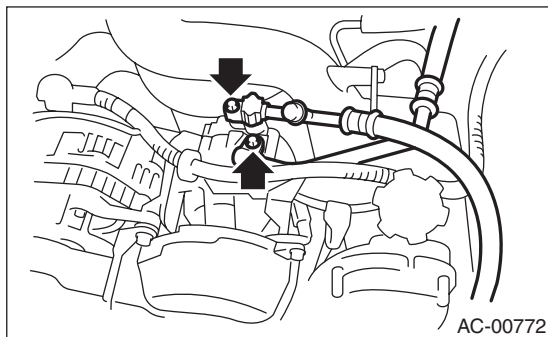
- 1) Disconnect the compressor connector.
- 2) Connect the battery positive (+) terminal to terminal No. 1 of the compressor connector, and the negative (-) terminal to terminal No. 2.



- 3) Check the magnet clutch engagement. If there is a problem, replace the compressor.

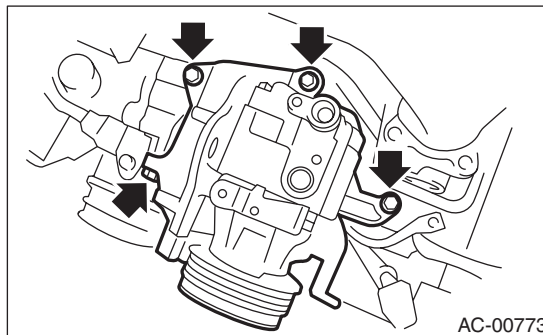
### B: REMOVAL

- 1) Perform the compressor oil return operation. <Ref. to AC-26, PROCEDURE, Compressor Oil.>
- 2) Turn the A/C switch to OFF and stop the engine.
- 3) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 4) Disconnect the ground cable from battery.
- 5) Remove the V-belts. <Ref. to ME(H4SO)-37, REMOVAL, V-belt.> <Ref. to ME(H4DOTC)-37, REMOVAL, V-belt.> <Ref. to ME(H6DO)-40, REMOVAL, V-belt.>
- 6) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
- 7) Remove the bolt and remove the low-pressure hose and high-pressure hose.

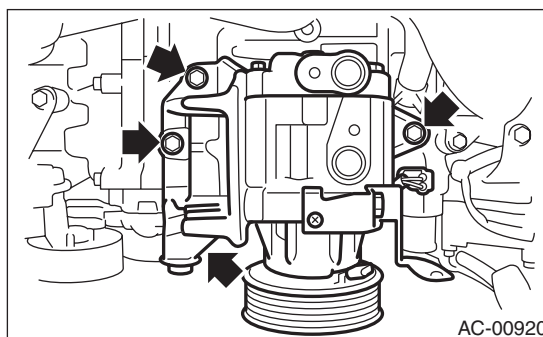


- 8) Disconnect the compressor harness from the body harness.
- 9) Remove the bolts and remove the compressor bracket.

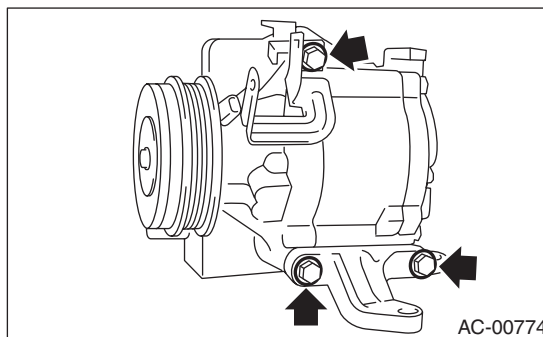
- H4 model



- H6 model



- 10) Remove the bolts, then remove the bracket from the compressor.



### C: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Replace the O-rings on low-/high-pressure hoses with new parts, then apply compressor oil.
- 3) After replacing the compressor, adjust the amount of compressor oil. <Ref. to AC-26, PROCEDURE, Compressor Oil.>
- 4) Charge refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>

#### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to AC-12, AIR CONDITIONING UNIT, COMPONENT, General Description.> <Ref. to AC-13, COMPRESSOR, COMPONENT, General Description.>

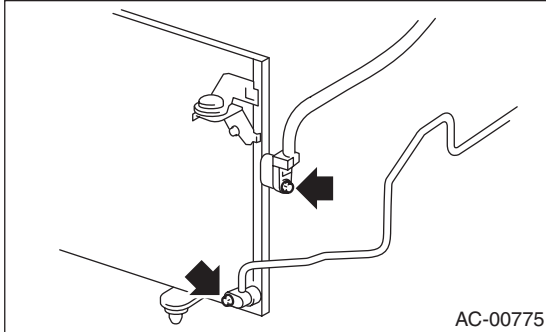
# Condenser

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

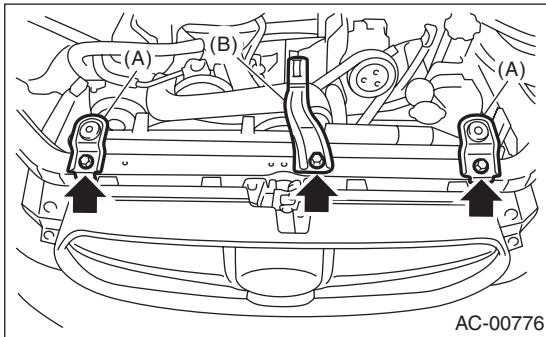
## 16. Condenser

### A: REMOVAL

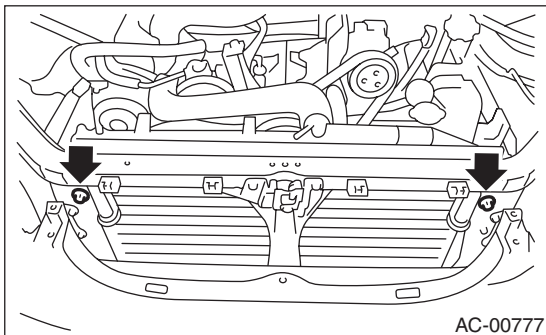
- 1) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 2) Disconnect the ground cable from battery.
- 3) Disconnect the pressure hose and pipe from the condenser.



- 4) Remove the radiator bracket (A) and hood stay (B).



- 5) Remove the front grille. <Ref. to EI-24, REMOVAL, Front Grille.>
- 6) Remove two bolts. While lifting the condenser, pull out through space between the radiator and the radiator panel.



### CAUTION:

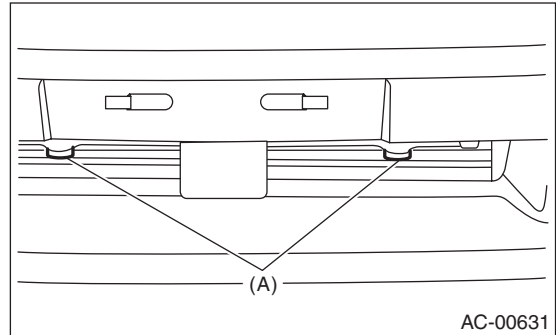
- Be careful not to damage the condenser fins. If a damaged fin is found, repair it using a thin screwdriver.
- If the condenser is replaced, add an appropriate amount of compressor oil to the compressor. <Ref. to AC-26, REPLACEMENT, Compressor Oil.>

### B: INSTALLATION

- 1) Install in the reverse order of removal.

### CAUTION:

Replace the O-rings on hoses or pipes with new parts, and then apply compressor oil. Confirm that lower guide (A) of condenser fits into holes on radiator panel.



- 2) Charge refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>

### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to AC-12, AIR CONDITIONING UNIT, COMPONENT, General Description.> <Ref. to CO(H4SO)-5, RADIATOR & RADIATOR FAN, COMPONENT, General Description.>

### C: INSPECTION

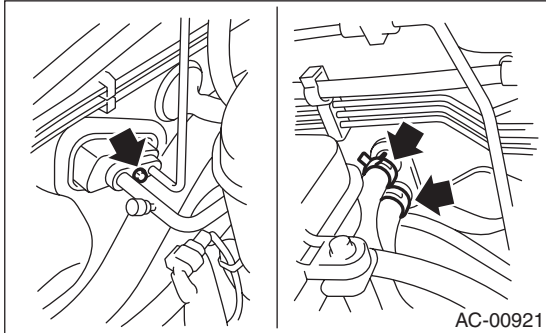
- 1) Check to see that the condenser fins are not clogged with debris or insects. Blow with compressed air or flush fins with water as needed.
- 2) Inspect for oil leakage from the condenser. If a failure is found, replace the condenser with a new part.



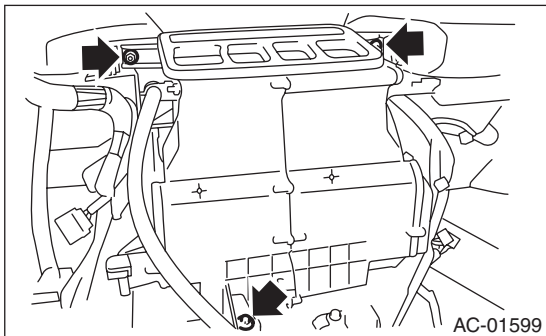
## 17.Heater and Cooling Unit

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 3) Drain engine coolant from the radiator.
- 4) Remove the bolts securing expansion valve and pipe in engine compartment. Release the heater hose clamps in engine compartment to remove the hoses.



- 5) Remove the instrument panel. <Ref. to EI-57, REMOVAL, Instrument Panel Assembly.>
- 6) Remove the support beam.
- 7) Remove the blower motor unit assembly. <Ref. to AC-27, REMOVAL, Blower Motor Unit Assembly.>
- 8) Disconnect the actuator connector.
- 9) Remove the bolt and nuts and remove the heater and cooling unit.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Charge refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>

#### **Tightening torque:**

**Refer to “COMPONENT” of “General Description”. <Ref. to AC-7, HEATER COOLING UNIT, COMPONENT, General Description.>**

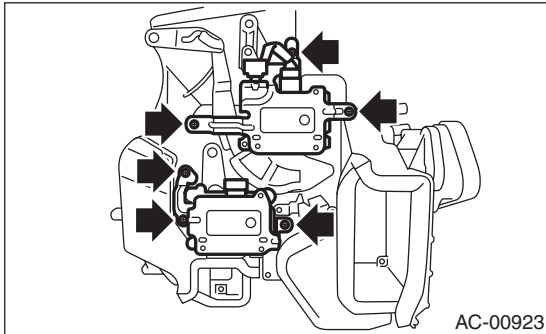
# Evaporator

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

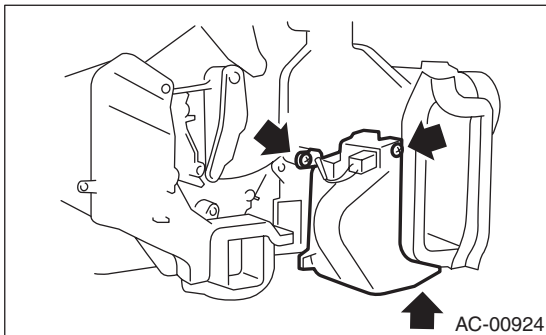
## 18. Evaporator

### A: REMOVAL

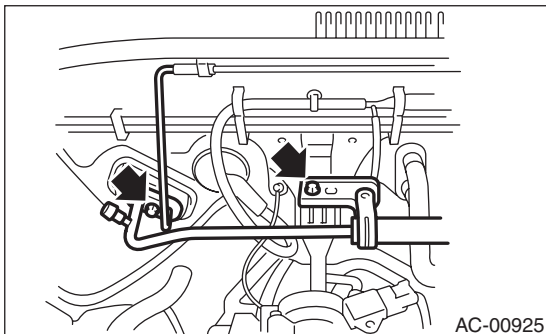
- 1) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
- 2) Disconnect the ground cable from battery.
- 3) Remove the blower motor unit assembly. <Ref. to AC-27, REMOVAL, Blower Motor Unit Assembly.>
- 4) Disconnect the connector, remove the screw and then remove the air-mix door actuator and mode door actuator.



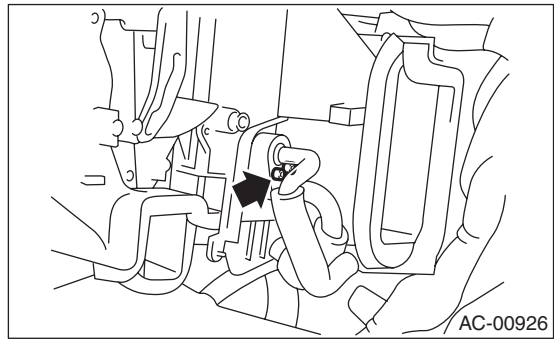
- 5) Disconnect the connector, remove the pipe cover and evaporator sensor.



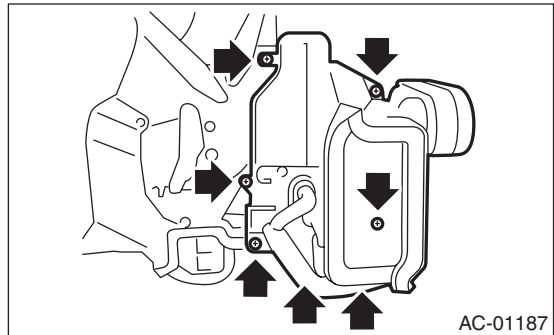
- 6) Remove the bolts securing expansion valve and pipe in engine compartment.



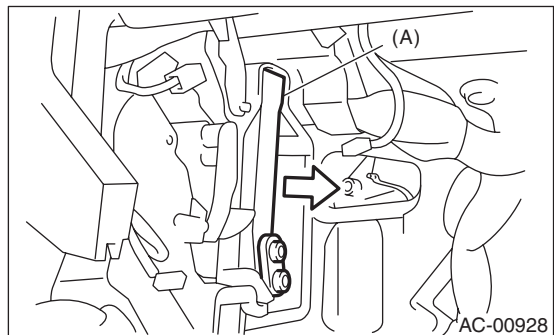
- 7) Remove the bolt which holds the pipe to the evaporator.



- 8) Remove the screws and clip to remove the evaporator cover.



- 9) Pull out the evaporator (A) in the direction of the arrow.



### CAUTION:

If the evaporator is replaced, add an appropriate amount of compressor oil to evaporator. <Ref. to AC-26, REPLACEMENT, Compressor Oil.>

### B: INSTALLATION

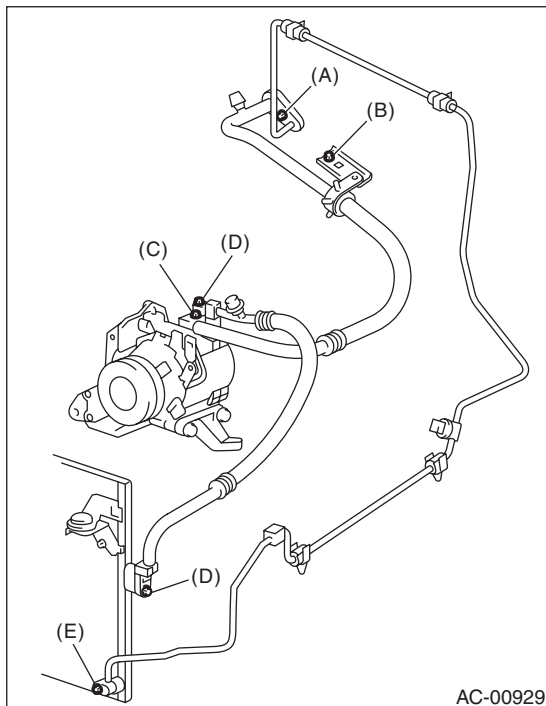
Install in the reverse order of removal.

## 19.Hose and Tube

### A: REMOVAL

#### CAUTION:

- When disconnecting/connecting hoses, do not apply an excessive force to them. After installing, check that no torsion or excessive tension applied to the hoses.
  - Seal the disconnected hose with a plug or vinyl tape to prevent foreign matter from entering.
- 1) Disconnect the ground cable from battery.
  - 2) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Recovery Procedure.>
  - 3) Remove the evaporator unit mounting bolt (A) and low-pressure hose bracket bolt (B).
  - 4) Remove the low-pressure hose attaching bolts (C).
  - 5) Disconnect the low-pressure hose from evaporator unit.
  - 6) Disconnect the low-pressure hose from compressor.
  - 7) Remove the low-pressure hose from vehicle.
  - 8) Remove the high-pressure hose attaching bolt (D).
  - 9) Disconnect the high-pressure hose from compressor.
  - 10) Disconnect the high-pressure hose from condenser.
  - 11) Remove the high-pressure hose from vehicle.
  - 12) Remove the high-pressure tube attaching bolt (E).
  - 13) Remove the high-pressure tube from vehicle.



### B: INSTALLATION

#### CAUTION:

- When disconnecting or connecting the hoses, do not apply excessive force. After installing, check that no torsion or excessive tension applied to the hoses.
  - Seal the disconnected hose with a plug or vinyl tape to prevent foreign matter from entering.
- 1) Install in the reverse order of removal.
  - 2) Charge refrigerant. <Ref. to AC-22, PROCEDURE, Refrigerant Charging Procedure.>

#### Tightening torque:

Refer to “COMPONENT” of “General Description”. <Ref. to AC-12, AIR CONDITIONING UNIT, COMPONENT, General Description.>

### C: INSPECTION

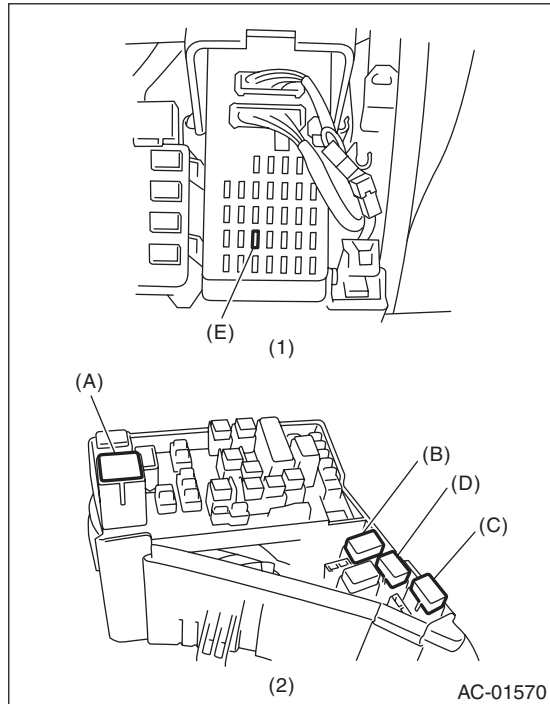
Check the hoses for cracks, damage and expansion. If any fault is found, replace with new parts.

# Relay and Fuse

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 20. Relay and Fuse

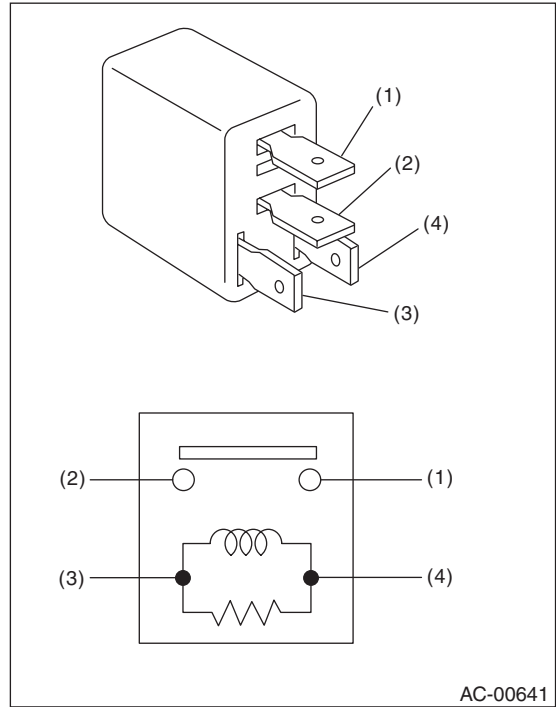
### A: LOCATION



- (1) Joint box
- (2) Main fuse box

Main fan relay 1	(A)
Main fan relay 2	(B)
Sub fan relay	(C)
A/C relay	(D)
A/C Fuse	(E)

### B: INSPECTION



- (3) — (4): Continuity exists
- (1) — (2): Continuity does not exist

While applying battery voltage to the terminal between (3) and (4), check continuity between (1) and (2). If no continuity exists, replace the relay with a new part.

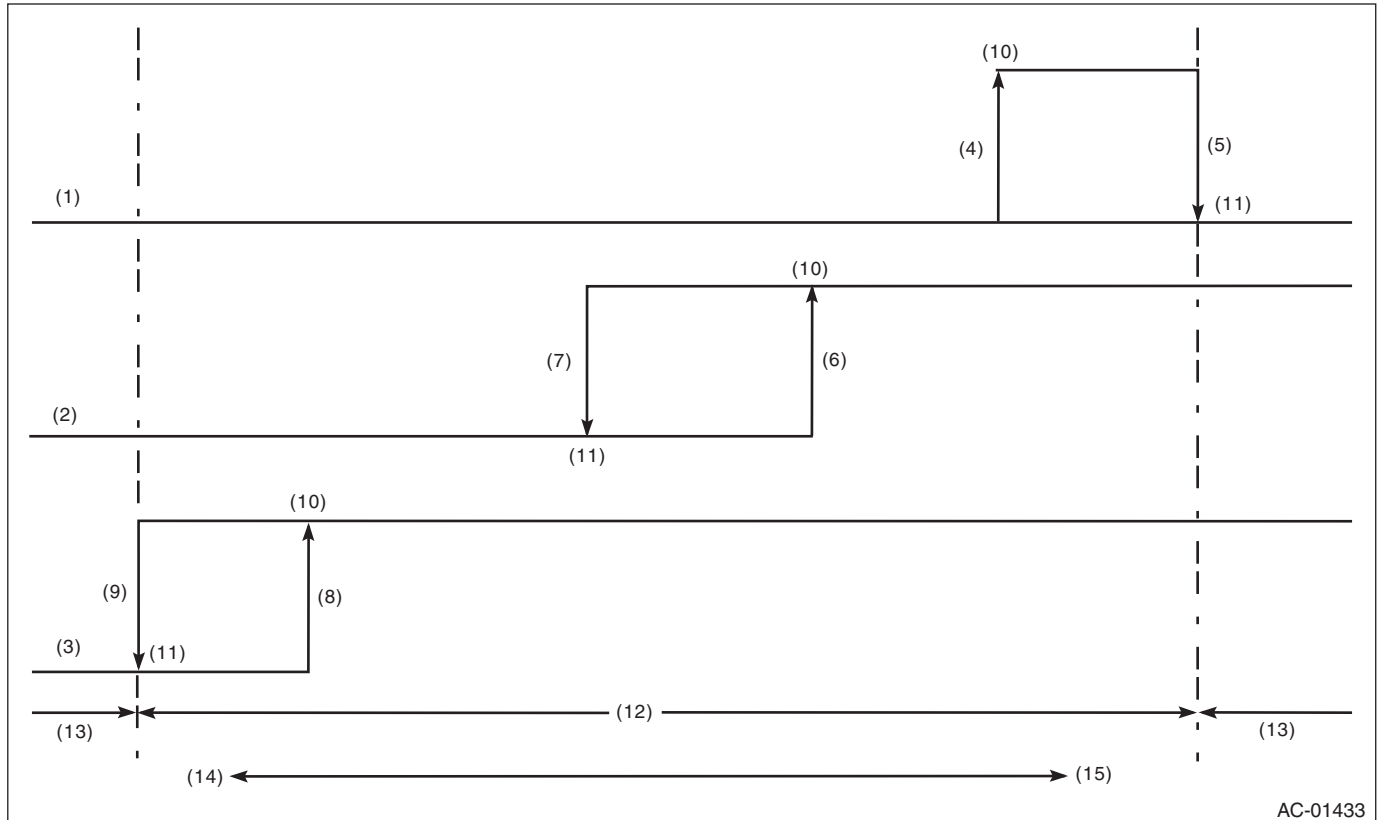
# Pressure Switch (Triple Pressure Switch)

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 21. Pressure Switch (Triple Pressure Switch)

### A: INSPECTION

- 1) Connect the manifold gauge to the service valve on the high-pressure side.
- 2) Start the air conditioner, and check the operating pressure of switch by turning the compressor (magnet clutch) to ON/OFF. Operation of each switch is as follows.



AC-01433

(1) High pressure switch	(7) $1370 \pm 120$ kPa ( $13.97 \pm 1.22$ kg/cm <sup>2</sup> , $198.65 \pm 14.5$ psi)	(10) ON
(2) Middle pressure switch	(8) $225^{+25}_{-29}$ kPa ( $2.99^{+0.25}_{-0.3}$ kg/cm <sup>2</sup> , $3.6^{+32.6}_{-4.2}$ psi)	(11) OFF
(3) Low pressure switch	(9) $196 \pm 20$ kPa ( $2.0 \pm 0.2$ kg/cm <sup>2</sup> , $28.4 \pm 2.9$ psi)	(12) Operative range of compressor
(4) $2550 \pm 200$ kPa ( $24 \pm 2$ kg/cm <sup>2</sup> , $341 \pm 28$ psi)		(13) Inoperative range of compressor
(5) $3140^{+50}_{-200}$ kPa ( $32.02^{+0.51}_{-2.04}$ kg/cm <sup>2</sup> , $455.4^{+72.5}_{-29.0}$ psi)		(14) Low pressure
(6) $1770 \pm 80$ kPa ( $18.05 \pm 0.82$ kg/cm <sup>2</sup> , $256.81 \pm 11.6$ psi)		(15) High pressure

#### NOTE:

- High pressure switch turns the compressor (magnet clutch) to OFF when the refrigerant pressure becomes extremely high to prevent the evaporator, air conditioner piping and expansion valve from getting damaged or frozen.
- Middle pressure switch effectively controls the radiator fan output by judging hight load/low load in normal range.
- Low pressure switch turns the compressor (magnet clutch) to OFF, judging as low refrigerant level when the refrigerant pressure becomes extremely low, to prevent the possible seizure if the compressor rotates.

# Actuator

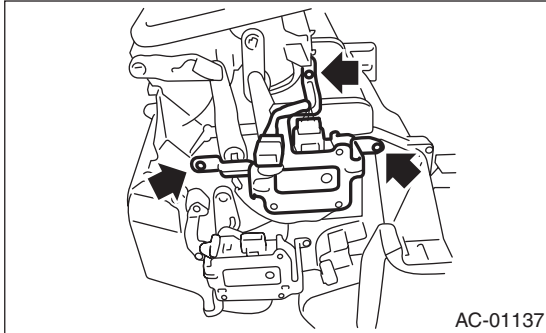
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 22. Actuator

### A: REMOVAL

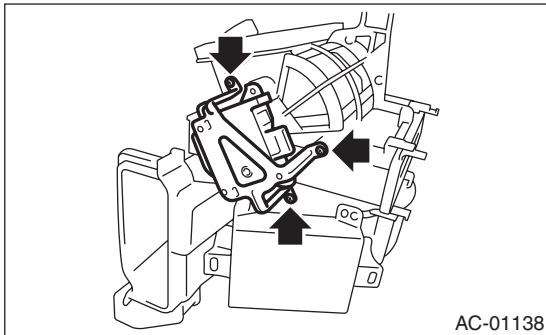
#### 1. MODE DOOR ACTUATOR

Disconnect the connector, remove the screw, and then remove the mode door actuator from the heater and cooling unit.



#### 2. INTAKE DOOR ACTUATOR

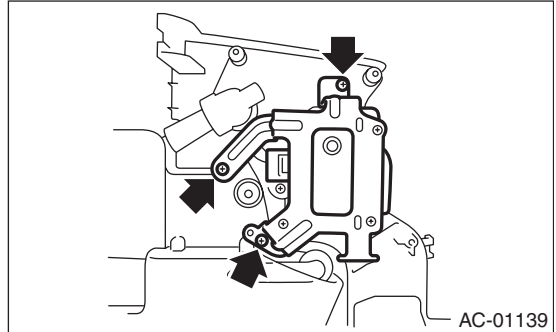
Disconnect the connector, remove the screw, and then remove the intake door actuator from the blower motor unit.



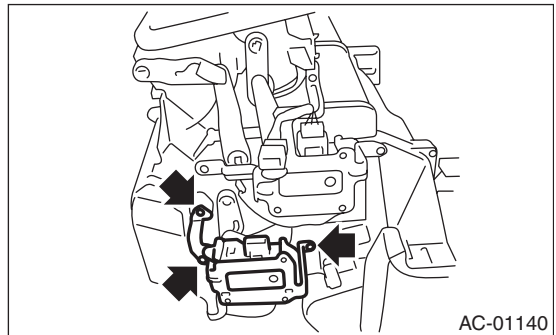
#### 3. AIR MIX DOOR ACTUATOR (AUTO A/C MODEL)

Disconnect the connector, remove the screw, and then remove the air mix door actuator from the heater and cooling unit.

- Driver's side



- Passenger's side



### B: INSTALLATION

Install in the reverse order of removal.

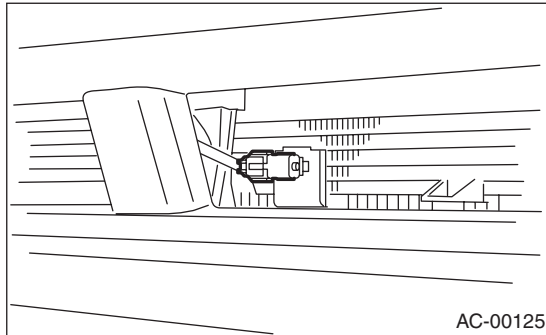
## Ambient Sensor (Auto A/C Model)

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

### 23. Ambient Sensor (Auto A/C Model)

#### A: REMOVAL

- 1) Open the front hood.
- 2) Disconnect the ground cable from battery.
- 3) Disconnect the ambient sensor connector.
- 4) Remove the ambient sensor from the radiator lower panel.



#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

<Ref. to AC(diag)-29, AMBIENT SENSOR, Diagnostic Procedure for Sensors.>

## Sunload Sensor (Auto A/C Model)

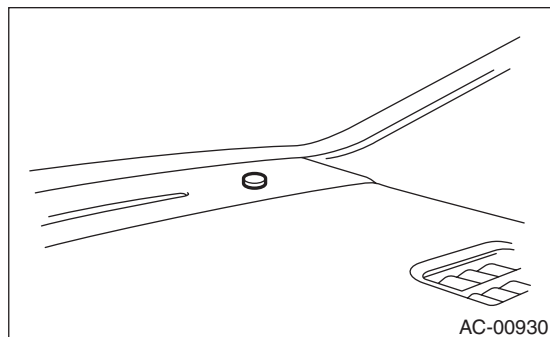
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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### 24. Sunload Sensor (Auto A/C Model)

#### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Disconnect the connector and remove the sunload sensor.



#### CAUTION:

Be careful not to damage the interior trims when removing the sensor.

#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

<Ref. to AC(diag)-35, SUNLOAD SENSOR, Diagnostic Procedure for Sensors.>



## In-vehicle Sensor (Auto A/C Model)

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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### 25. In-vehicle Sensor (Auto A/C Model)

#### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the console side panel of the driver's side. <Ref. to EI-55, REMOVAL, Center Console.>
- 3) Disconnect the connector and aspirator hose, remove the claw and remove the in-vehicle sensor from the center console frame.

#### CAUTION:

**Be careful not to damage the sensors and interior trims when removing.**

#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

<Ref. to AC(diag)-31, IN-VEHICLE SENSOR, Diagnostic Procedure for Sensors.>

# Air Vent Grille

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

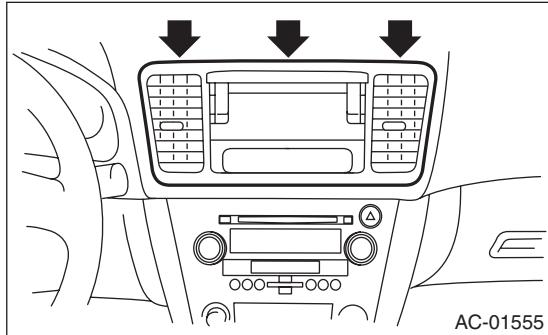
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## 26. Air Vent Grille

### A: REMOVAL

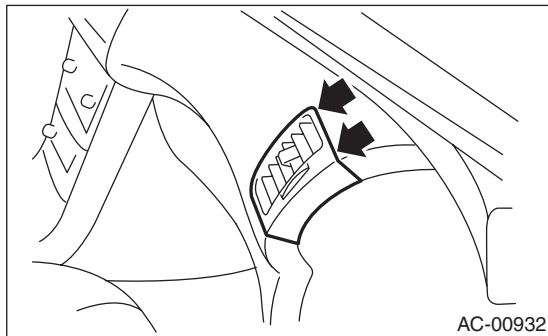
#### 1. CENTER GRILLE

- 1) Disconnect the ground cable from battery.
- 2) Remove the three claws and connector to remove center air vent grill.



#### 2. SIDE GRILLE

Remove the catch in 2 locations to remove the side air vent grill.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

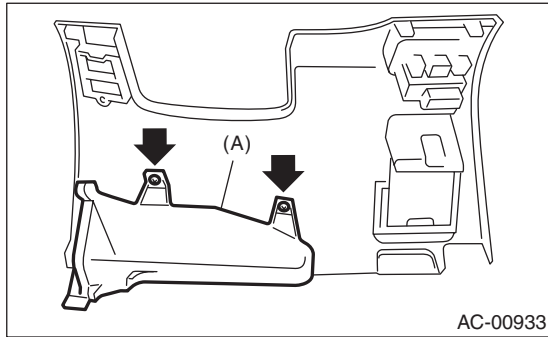
- 1) Check that the direction and amount of air can be adjusted smoothly.
- 2) Check that the adjustment can be maintained in each position.

## 27.Heater Duct

### A: REMOVAL

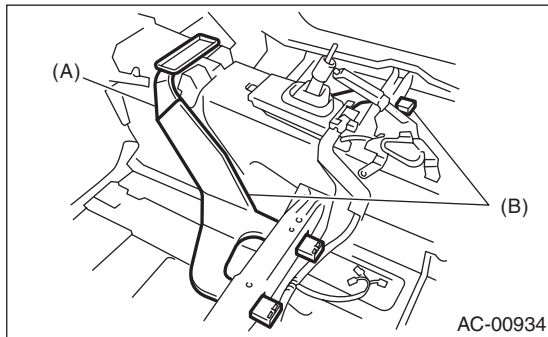
#### 1. FRONT HEATER DUCT

- 1) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 2) Remove the screws and detach the front heater duct (A).



#### 2. REAR HEATER DUCT

- 1) Remove the heater cooling unit. <Ref. to AC-37, REMOVAL, Heater and Cooling Unit.>
- 2) Remove the front seats. <Ref. to SE-9, REMOVAL, Front Seat.>
- 3) Remove the front side sill cover.
- 4) Pull off the floor mat to remove the rear center heater duct (A) and rear heater duct LH, RH (B).



### B: INSTALLATION

Install in the reverse order of removal.

# Heater Vent Duct

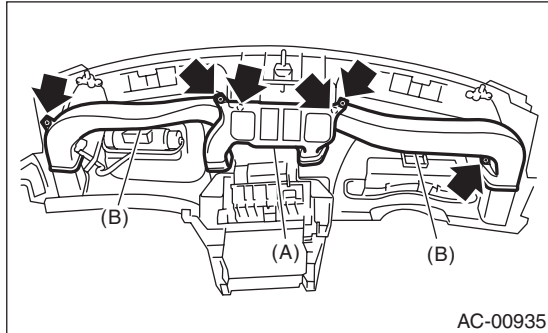
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## 28.Heater Vent Duct

### A: REMOVAL

- 1) Remove the instrument panel. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 2) Remove the screws and detach the center vent duct (A).
- 3) Remove the screws and detach the side vent duct (B).
- 4) Remove the insulator, remove the screws and detach the defroster duct.



### B: INSTALLATION

Install in the reverse order of removal.

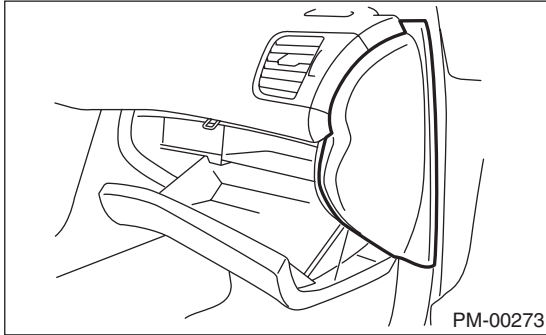
# A/C Filter

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

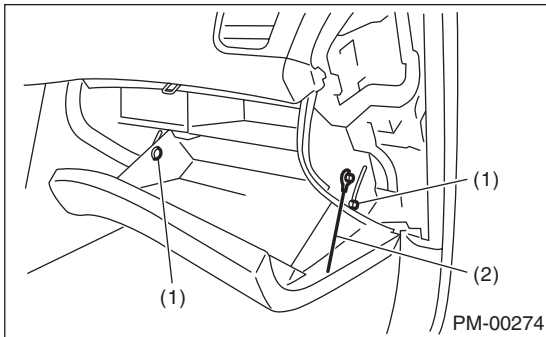
## 29. A/C Filter

### A: REPLACEMENT

1) Remove the instrument panel side cover.

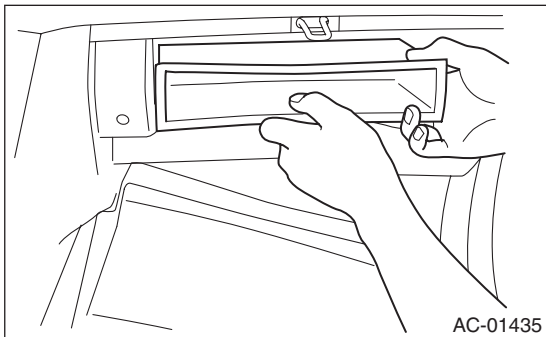


2) Remove the clip and the damper (string).

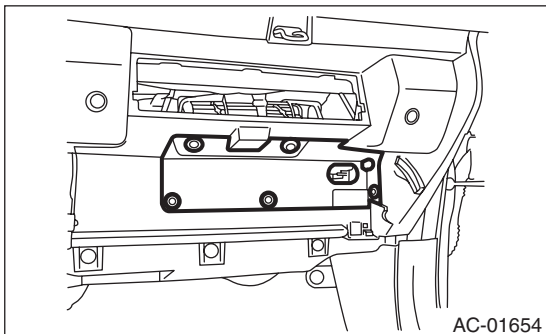


- (1) Clip
- (2) Damper

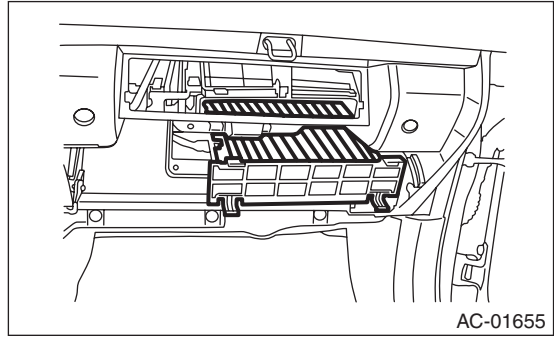
3) Remove the upper storage box.



4) Remove the screws, and then remove the cover.



5) Remove the A/C filter.



6) Install in the reverse order of removal.

# General Diagnostic Table

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 30. General Diagnostic Table

### A: INSPECTION

Symptom		Repair order
Blower motor	Does not operate.	Fuse
		Blower motor relay
		Blower motor
		Blower motor resistor
		Blower switch
		Wiring harness
	Noise	Blower motor
Compressor	Does not operate.	Refrigerant
		Fuse
		Air conditioning relay
		Magnet clutch
		Compressor
		Pressure switch
		A/C switch
		Blower switch
		Wiring harness
	Noise	V-belt
		Magnet clutch
		Compressor
Cold air not emitted.	Refrigerant	
	V-belt	
	Magnet clutch	
	Compressor	
	Pressure switch	
	A/C switch	
	Blower switch	
	Wiring harness	
	Heater duct	
	Heater vent duct	
Warm air not emitted.	Engine coolant	
	Blower switch	
	Heater core	
	Heater cock solenoid valve	
Temperature of air from vents does not change.	Engine coolant	
	Air mix door actuator (Auto A/C)	
	Wiring harness (Auto A/C)	
	Temperature control cable (Manual A/C)	
Unable to switch blow vents.	Mode door actuator	
	Air flow switch	
	Wiring harness	
Unable to switch suction vents.	Air inlet select switch	
	Intake door actuator	
	Wiring harness	

# Basic Diagnostic Procedure

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

Step	Check	Yes	No
<b>1 START INSPECTIONS.</b> 1) Perform the pre-inspection. <Ref. to AC(diag)-3, INSPECTION, General Description.> 2) Perform the self-diagnosis. <Ref. to AC(diag)-9, OPERATION, Diagnostic Chart for Self-diagnosis.>	Does the self-diagnosis operate?	Go to step 2.	<Ref. to AC(diag)-14, A/C OR SELF-DIAGNOSIS SYSTEMS DO NOT OPERATE, Diagnostics for A/C System Malfunction.>
<b>2 IDENTIFY MALFUNCTION PART.</b> Identify the malfunction part with self-diagnosis.	Can the malfunction part be confirmed?	Repair the malfunctioning part in accordance with each diagnostic chart.	Go to step 3.
<b>3 CHECK COMPARTMENT TEMPERATURE.</b> 1) Turn on the A/C switch. 2) Turn the temperature control dial at maximum cool position. 3) Check the compartment temperature change.	Does the compartment temperature change?	Go to step 4.	<Ref. to AC(diag)-18, COMPARTMENT TEMPERATURE DOES NOT CHANGE, OR A/C SYSTEM DOES NOT RESPOND PROMPTLY, Diagnostics for A/C System Malfunction.>
<b>4 CHECK A/C SYSTEM RESPONSE.</b> Change the temperature setting, and check the response of A/C system.	Does the A/C system respond quickly?	A/C system is normal.	<Ref. to AC(diag)-18, COMPARTMENT TEMPERATURE DOES NOT CHANGE, OR A/C SYSTEM DOES NOT RESPOND PROMPTLY, Diagnostics for A/C System Malfunction.>

# General Description

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 2. General Description

### A: CAUTION

- 1) Never connect the battery in reverse polarity. Doing so may immediately damage the auto A/C control module.
- 2) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as auto A/C control module etc.
- 3) Before disconnecting the connectors of sensors and the auto A/C control module, be sure to turn off the ignition switch. Auto A/C control module may be damaged.
- 4) Every A/C-related part is a precision part. Do not drop them.
- 5) Airbag system wiring harness is routed near the A/C control panel and junction box.

### CAUTION:

- Do not use electrical test equipment on wiring harness and connector circuits of the airbag system.
- Be careful not to damage the airbag system wiring harness when servicing the A/C control panel and junction box.

### B: INSPECTION

Before performing the diagnosis, check the following items which may cause problems in the A/C system.

#### 1. BATTERY

- 1) Measure the battery voltage and specific gravity of electrolyte.

**Standard voltage: 12 V**

**Specific gravity: 1.260 or more**

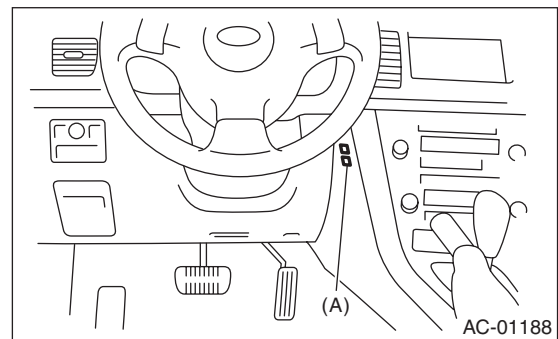
- 2) Check the condition of the fuses for A/C system power supply and other fuses.
- 3) Check the condition of harness and harness connector connections.

#### 2. ASPIRATOR HOSE

- 1) Turn the ignition switch to ON, and press the A/C switch.
- 2) Turn the temperature control dial to maximum hot position.
- 3) Turn the air flow control dial to "DEF" position.
- 4) Turn the fan dial to MAX.
- 5) Put a strip of paper close to the front side of in-vehicle sensor suction port (A) located in the driver's side console side panel, and check that air is being sucked into the port by seeing the paper moving towards the port.

### NOTE:

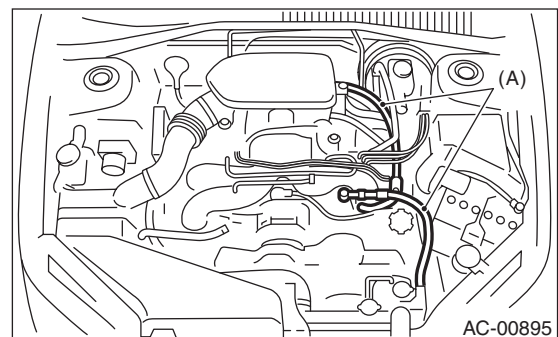
Be careful not to let the paper get sucked into the port.



- 6) If the paper does not move at all, remove the driver's side console side panel <Ref. to EI-55, REMOVAL, Center Console.> and check for improper connection of the aspirator hose, in-vehicle sensor and heater unit, and repair them if necessary.

#### 3. A/C LINE

Check the connection for A/C line (A) and lower side high-pressure pipe.



#### 4. CONTROL LINKAGE

- 1) Check the state of mode door linkage.
- 2) Check the state of air mix door linkage.
- 3) Check the state of FRESH/RECIRC door linkage.



## General Description

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

#### 5. CONTROL SWITCHES

Start the engine and warm-up completely.

##### 1) Inspection using switches

No.	Point to check	Switch operation	Judgment standard
1	OFF switch	Press the OFF switch.	Setting temperature display goes out. <ul style="list-style-type: none"> <li>• Blower fan: OFF</li> <li>• Inlet opening: FRESH</li> <li>• Compressor: OFF</li> </ul>
2	AUTO switch, driver's side temperature control dial and passenger's side temperature control dial	1) Press the AUTO switch. 2) Turn the temperature control dial to the left fully, and set to 18°C (65°F) (maximum cool position).	AUTO display illuminates. <ul style="list-style-type: none"> <li>• Outlet air temperature: COOL</li> <li>• Blower fan: HI (AUTO)</li> <li>• Outlet opening: FACE</li> <li>• Inlet opening: AUTO</li> <li>• Compressor: AUTO</li> </ul>
		3) Turn the temperature control dial to the right slowly, and change the setting from 18°C (65°F) (maximum cool position) to 32°C (85°F).	<ul style="list-style-type: none"> <li>• Outlet air temperature: COOL → HOT</li> <li>• Blower fan: AUTO</li> <li>• Outlet opening: FACE → B/L → FOOT</li> <li>• Inlet opening: AUTO</li> <li>• Compressor: AUTO</li> </ul>
		4) Turn the temperature control dial to the right fully, and set to 32°C (85°F) (maximum hot position).	<ul style="list-style-type: none"> <li>• Outlet air temperature: HOT</li> <li>• Blower fan: HI (AUTO)</li> <li>• Outlet opening: FOOT</li> <li>• Inlet opening: FRESH (AUTO)</li> <li>• Compressor: AUTO</li> </ul>
3	Defroster switch	Press the defroster switch.	Defroster switch indicator illuminates. <ul style="list-style-type: none"> <li>• Outlet air temperature: AUTO</li> <li>• Blower fan: AUTO</li> <li>• Outlet opening: DEF</li> <li>• Inlet opening: FRESH</li> <li>• Compressor: ON</li> </ul>
4	FRESH/RECIRC switch	Press the FRESH/RECIRC switch.	Inlet opening switches RECIRC → FRESH or FRESH → RECIRC each time pressing the switch.
5	MODE switch	Press the MODE switch.	Outlet opening switches FACE → B/L → FOOT → F/D each time pressing the switch.
6	FAN switch	Press the FAN switch (+).	Inlet opening switches LO → M1 → M2 → M3 → M4 → HI each time pressing the switch.

##### 2) Compressor operation inspection

No.	Point to check	Switch operation	Judgment standard
1	Compressor	1) Turn the A/C switch to ON. 2) Set the FAN switch between LO and HI.	Compressor: ON

##### 3) Inspection of illumination control

No.	Point to check	Switch operation	Judgment standard
1	Illumination	Turn the lighting switch to ON.	Illumination comes on.

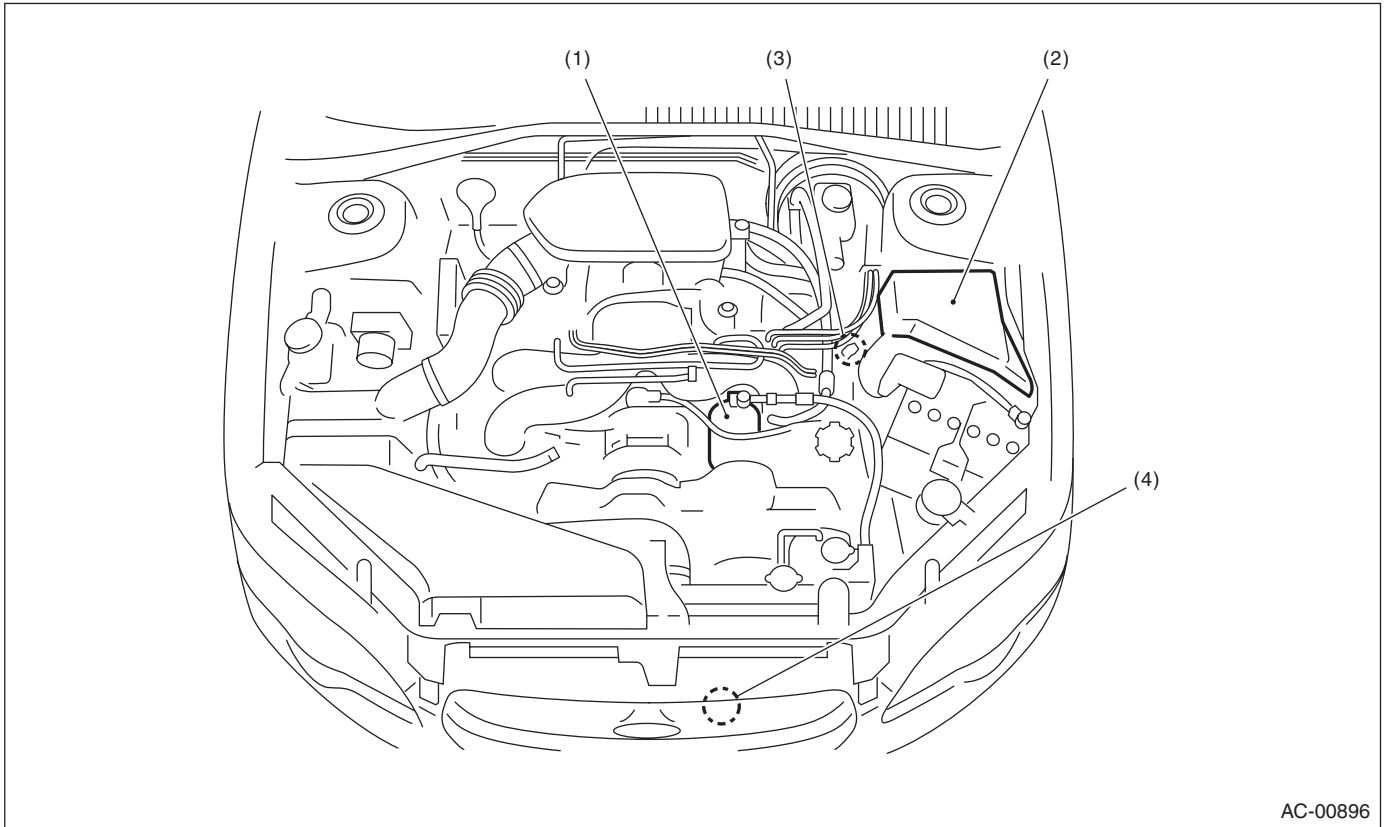
# Electrical Component Location

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 3. Electrical Component Location

### A: LOCATION

#### 1. ENGINE COMPARTMENT

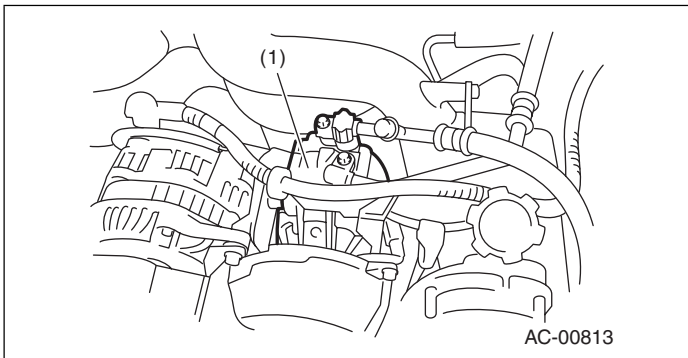


AC-00896

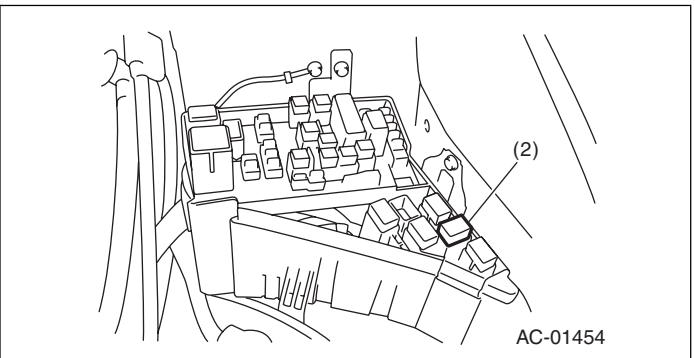
(1) A/C compressor  
(2) A/C relay

(3) Pressure switch

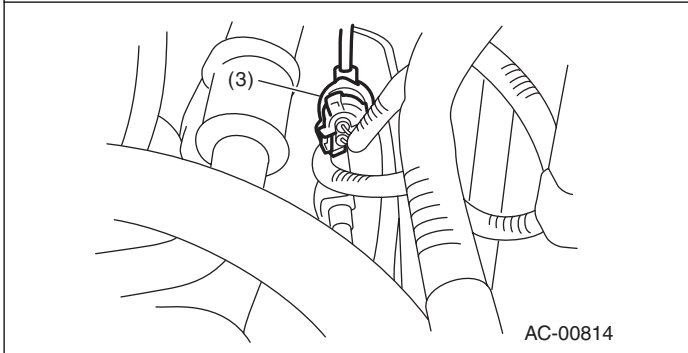
(4) Ambient sensor



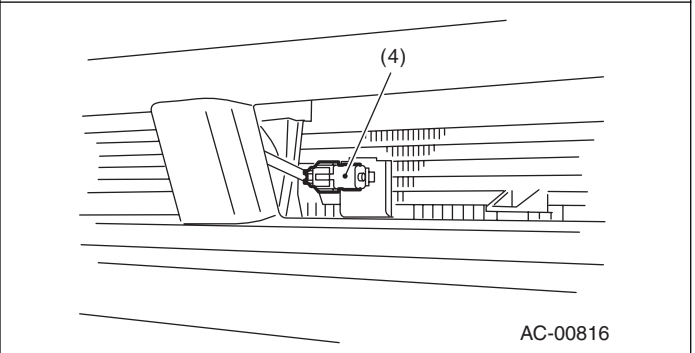
AC-00813



AC-01454



AC-00814

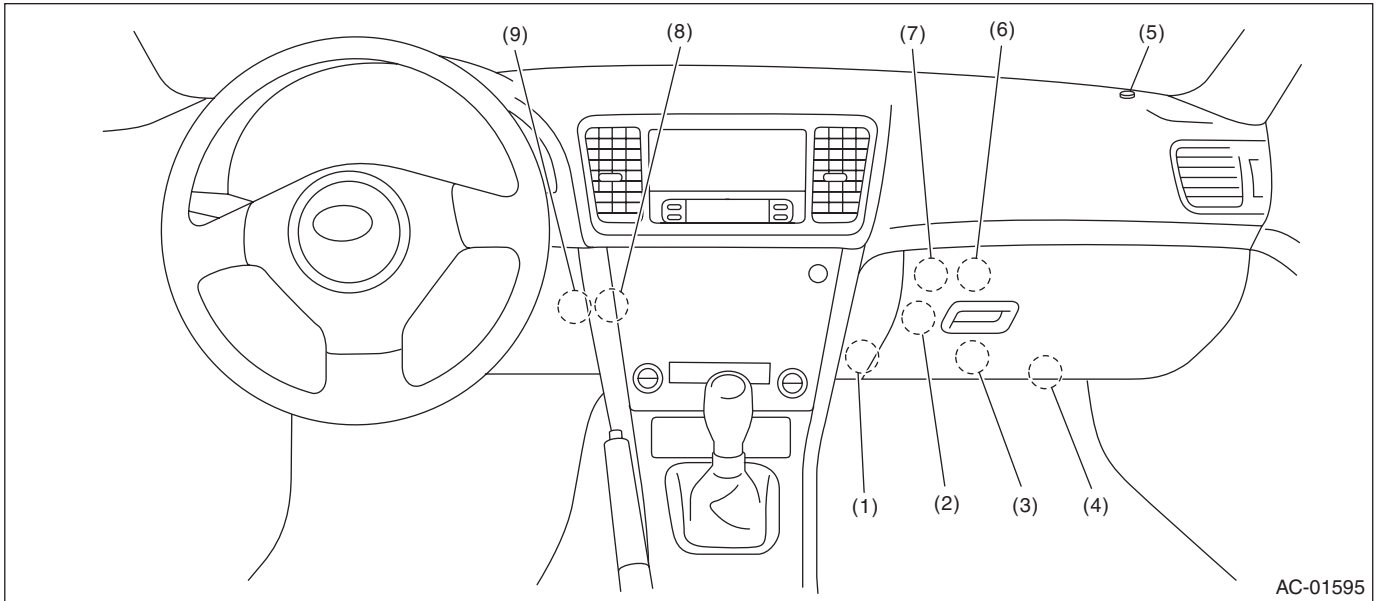


AC-00816

# Electrical Component Location

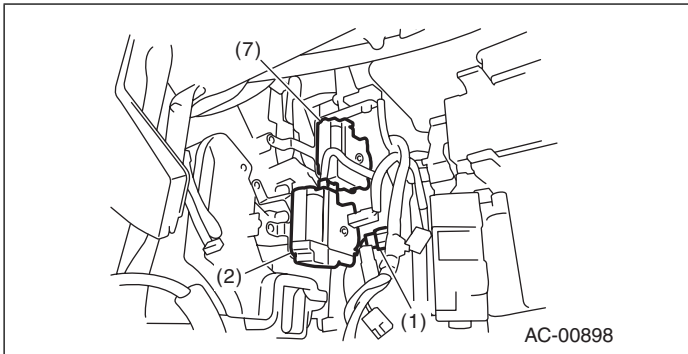
HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 2. PASSENGER COMPARTMENT

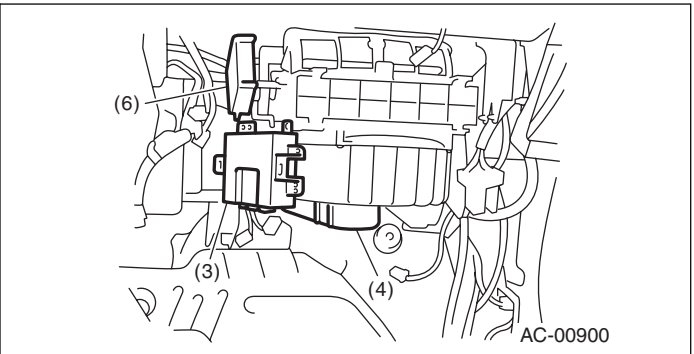


AC-01595

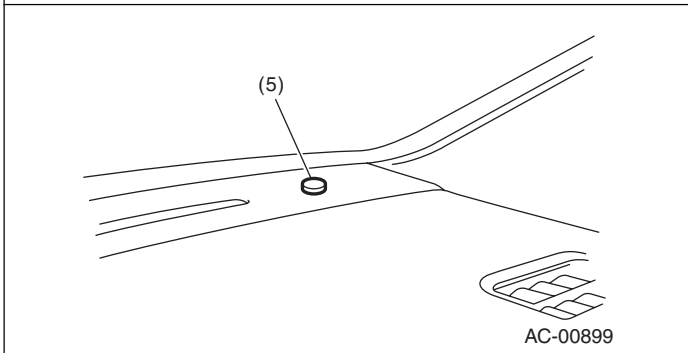
- |  |                          |   |
|--|--------------------------|---|
| (1) Evaporator sensor                      | (4) Blower motor         | (7) Mode door actuator                  |
| (2) Passenger's side air mix door actuator | (5) Sunload sensor       | (8) In-vehicle sensor                   |
| (3) Auto A/C control module                | (6) Intake door actuator | (9) Driver's side air mix door actuator |



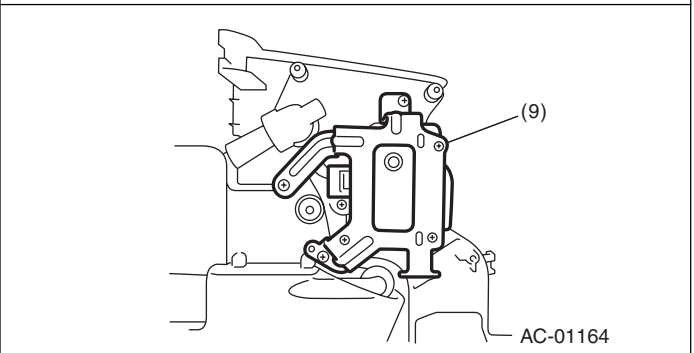
AC-00898



AC-00900



AC-00899



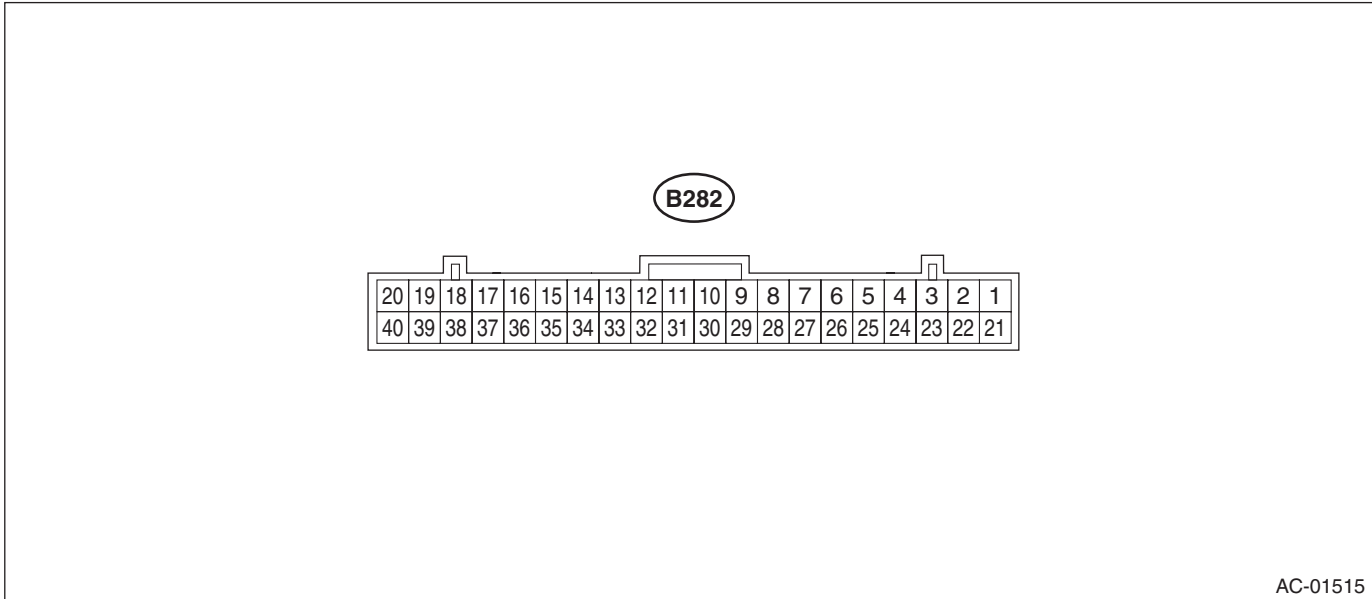
AC-01164

# Auto A/C Control Module I/O Signal

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 4. Auto A/C Control Module I/O Signal

### A: ELECTRICAL SPECIFICATION



AC-01515

# Auto A/C Control Module I/O Signal

## HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Terminal No.	Remarks	Measuring condition	Standard
1	Battery power supply	Ignition switch: OFF	Battery voltage
3	Mode door actuator position signal	Mode door: FACE position	4 V
		Mode door: DEF position	1 V
4	Air mix door actuator (passenger's side) position signal	Air mix door: Maximum cool position	4 V
		Air mix door: Maximum hot position	1 V
5	In-vehicle sensor	Ignition switch: ON	25°C: 1 — 5 V 40°C: 1 — 5 V
6	Sunload sensor	Ignition switch: ON, With Sunload (No sunload: 0 V)	Sunlight: 3 V Indoor light: 3 V
8	Each potentiometer and sunload sensor power supply	Ignition switch: ON	5 V
9	CAN LO	—	*1
10	CAN HI	—	*1
11	Blower motor voltage feedback	Ignition switch : ON, Blower switch : ON	0.45 — 10 V
12	Blower motor control signal	Ignition switch : ON, Blower switch : ON	9.05 V
13	RAM monitor Tx	Outputs the RAM value when the terminal No. 33 (RAMver) is connected to GND.	*1
14	RAM monitor Rx		*1
15	Magnet clutch ON demand signal output sensor GND	Ignition switch: ON, Blower switch: ON, A/C switch: ON	HI: 5.5 V LO: 2.0 V
16	Mode servo drive signal	When the actuator is operating 16 (+) - 36 (-): rotate to the FACE side 16 (-) - 36 (+): rotate to the DEF side 16 - 36 short: brake	0 or 12 V
36			
17	Air mix door actuator (passenger's side) drive signal	When the actuator is operating 17 (+) - 37 (-): rotate to the COOL side 17 (-) - 37 (+): rotate to the HOT side 17 - 37 short: brake	0 or 12 V
37			
18	Air mix door actuator (driver's side)	When the actuator is operating 18 (+) - 38 (-): rotate to the COOL side 18 (-) - 38 (+): rotate to the HOT side 18 - 38 short: brake	0 or 12 V
38			
20	Intake door actuator drive signal	When the intake door actuator is operating	0.7 V or less
40			
21	Ignition power supply	Ignition switch: ON	Battery voltage
22	Pressure switch signal	Ignition switch: ON	Normal: ON Abnormal: OFF
24	Air mix door actuator (driver's side) position signal	Air mix door: Maximum cool position	4 V
		Air mix door: Maximum hot position	1 V
25	After-evaporator sensor signal	Changes by the temperature after the evaporator	1 — 4.5 V
26	VER switch signal (FOOT switch)	When switching FOOT	0 V
27	Sensor ground	Always	0 V
28	Control module GND	Always	0 V
32	Heater main relay drive signal	Ignition switch: ON	Battery voltage
33	RAM monitor ON signal	RAM monitor ON	0 V
34	Heater control panel communication	—	*1
35	Heater control panel communication	—	*1

\*1: Unable to measure the voltage for digital signal.

## B: WIRING DIAGRAM

### 1. AIR CONDITIONER AUTO A/C MODEL

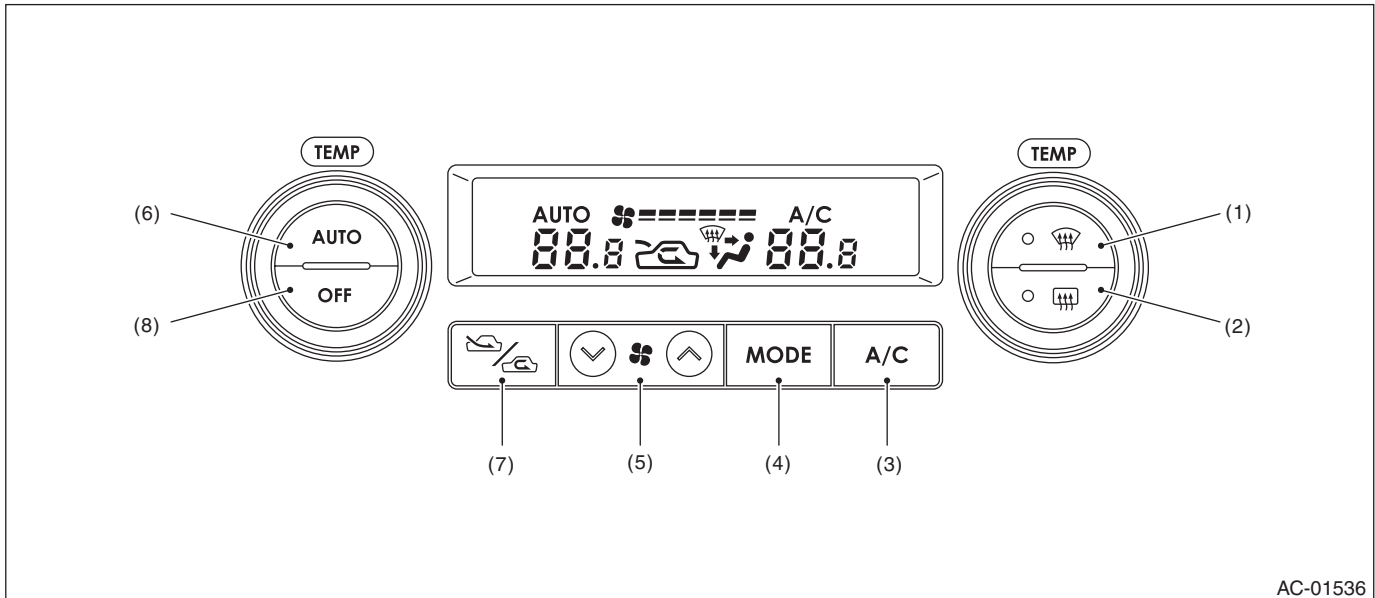
<Ref. to WI-140, WIRING DIAGRAM, Air Conditioning System.>

# Diagnostic Chart for Self-diagnosis

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 5. Diagnostic Chart for Self-diagnosis

### A: OPERATION



AC-01536

- |                                 |                             |                         |
|---------------------------------|-----------------------------|-------------------------|
| (1) Front defroster switch      | (4) Air flow control switch | (7) FRESH/RECIRC switch |
| (2) Rear window defogger switch | (5) FAN switch              | (8) OFF switch          |
| (3) A/C switch                  | (6) AUTO switch             |                         |

#### NOTE:

For A/C system self-diagnosis, there is one that checks the control panel, and the other that checks the whole control system (sensor, actuator, blower motor, etc.). Perform the self-diagnosis for control panel first, and then perform the self-diagnosis for control system.

# Diagnostic Chart for Self-diagnosis

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 1. A/C CONTROL PANEL SELF-DIAGNOSIS

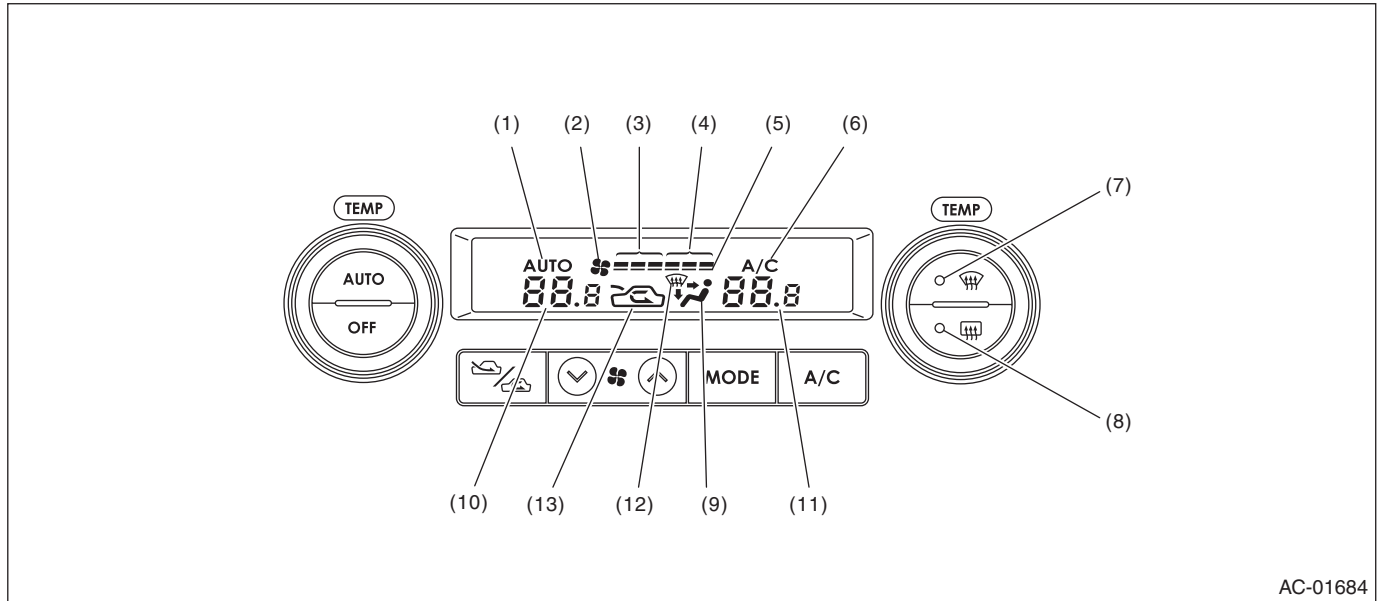
Step	Check	Yes	No
<b>1 PERFORM A/C CONTROL PANEL SELF-DIAGNOSIS FUNCTION.</b> 1) Turn the ignition switch to OFF. 2) Turn the ignition switch to ON with the AUTO switch and MODE switch pressed at the same time. 3) All the screen display illuminate (for approx. 5 seconds) and the self-diagnosis mode starts.	Does the self-diagnosis function operate?	Go to step 2.	<Ref. to AC(diag)-14, A/C OR SELF-DIAGNOSIS SYSTEMS DO NOT OPERATE, Diagnostics for A/C System Malfunction.>
<b>2 CHECK SCREEN DISPLAY.</b> Check the illumination condition while the display is illuminated.	Does all the screen display and indicators illuminate?	Go to step 3.	Replace the A/C control panel.
<b>3 CHECK SCREEN DISPLAY.</b> After the illumination ends, check the display.	Are the numbers 11 — 14 displayed at the setting temperature display area?	Go to step 5.	Go to step 4.
<b>4 CHECK SWITCH AND TEMPERATURE CONTROL DIAL INPUT.</b> 1) Operate each switch or dial according to the switch check table. 2) Check the display or indicator illumination condition when operating the switch or dial. <Ref. to AC(diag)-11, SWITCH CHECK TABLE, OPERATION, Diagnostic Chart for Self-diagnosis.>	Does the input of each switch or dial correspond to the switch check list?	Go to step 5.	Replace the heater control panel.
<b>5 CHECK A/C CONTROL PANEL COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector of the auto A/C control module. 3) Using a suitable lead wire, short the terminal No. 34 and No. 35 of auto A/C control module vehicle side connector (B282). 4) Turn the ignition switch to ON with the A/C switch and AUTO switch pressed at the same time. 5) Check the screen display when operating each switch and dial.	Is "CL" displayed on the screen when operating each switch and dial?	Go to step 6.	Go to step 7.
<b>6 CHECK A/C CONTROL PANEL COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the lead wire used to short the terminals. 3) Turn the ignition switch to ON with the A/C switch and AUTO switch pressed at the same time. 4) Check the screen display when operating each switch and dial.	Is "OP" displayed on the screen when operating each switch and dial?	A/C control panel and body harness are normal.	Go to step 7.
<b>7 CHECK HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the A/C control panel connector (i88). 3) Measure the resistance between connectors with a tester. <b>Connector &amp; terminal</b> (i88) No. 7 — (B282) No. 34: (i88) No. 3 — (B282) No. 35:	Is the resistance less than 10 Ω?	Go to step 8.	Repair the open circuit of the harness between A/C control panel and auto A/C control module.

# Diagnostic Chart for Self-diagnosis

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>8</b> <b>CHECK HARNESS.</b> Measure the resistance between connectors with a tester. <i>Connector &amp; terminal (i88) No. 7 — No. 3:</i>	Is the resistance less than 10 Ω?	Repair the short circuit of the harness between A/C control panel and auto A/C control module.	Replace the A/C control panel.

## 2. SWITCH CHECK TABLE



AC-01684

Switch	Display screen	Switch	Display screen
A/C switch	(6)	FAN switch (+)	(4)
AUTO switch	(1)	FAN switch (-)	(3)
Air flow control switch	(9)	Driver's side temperature control dial	(9), (10), (12)
FRESH/RECIRC	(13)	Passenger's side temperature control dial	(9), (11), (12)
Defroster switch	(7), (12)	OFF switch	(2), (5)
Rear defogger switch	(8)		



## Diagnostic Chart for Self-diagnosis

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

### 3. A/C CONTROL SYSTEM SELF-DIAGNOSIS

Step	Check	Yes	No
<p><b>1 SET SELF-DIAGNOSIS MODE BY OPERATING A/C CONTROL PANEL.</b></p> <p>1) Start the engine with the A/C switch and front defroster switch pressed.</p> <p>NOTE: Self-diagnosis can also be performed with ignition switch ON, but start the engine because observing the magnet clutch operation is difficult.</p> <p>2) All the indicators blink four times.</p>	Does the self-diagnosis function operate?	Go to step 2.	<Ref. to AC(diag)-14, A/C OR SELF-DIAGNOSIS SYSTEMS DO NOT OPERATE, Diagnostics for A/C System Malfunction.>
<p><b>2 CHECK EACH SENSOR AND POTENTIOMETER.</b></p> <p>1) After the indicators stop blinking, automatically change to the Inspection Mode of sensor and potentiometer.</p> <p>NOTE: Display items can be changed each time the A/C switch is pressed. (Step Operation)</p> <p>2) When malfunction occurs in each sensor and potentiometer, codes are displayed on the screen. When no malfunction occurs in each sensor and potentiometer, code "20" is displayed on the screen.</p> <p>3) Identify the defective sensor according to the sensor check table. &lt;Ref. to AC(diag)-13, SENSOR CHECK TABLE, OPERATION, Diagnostic Chart for Self-diagnosis.&gt;</p>	Are other codes except "20" displayed?	Repair the defective sensor. <Ref. to AC(diag)-29, Diagnostic Procedure for Sensors.>	Go to step 3.
<p><b>3 CHECK EACH ACTUATOR, BLOWER FAN AND MAGNET CLUTCH.</b></p> <p>1) After completing each sensor and potentiometer inspection, change to the Inspection Mode of actuator, blower fan and magnet clutch by pressing the defroster switch.</p> <p>2) Each mode will change and operate automatically every four seconds.</p> <p>NOTE: Operation mode items can be changed each time the A/C switch is pressed. (Step Operation)</p> <p>3) Check the operation of actuator, blower fan and magnet clutch in each mode according to the operating mode table. &lt;Ref. to AC(diag)-13, OPERATING MODE TABLE, OPERATION, Diagnostic Chart for Self-diagnosis.&gt;</p>	Do the actuator, blower fan and magnet clutch operate as described in the operating mode table?	A/C control system is normal. Press the OFF switch and complete the self-diagnosis function.	Repair the defective part in accordance with each diagnostic chart. <Ref. to AC(diag)-14, Diagnostics for A/C System Malfunction.> or <Ref. to AC(diag)-22, Diagnostic Procedure for Actuators.>

# Diagnostic Chart for Self-diagnosis

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 4. SENSOR CHECK TABLE

**NOTE:**

When the sunload sensor check is performed indoors or in the shade, it could be diagnosed as having an open circuit. Always check the sunload sensor with the sun shining on it.

Display screen (Malfunction at present) *1	Sensor	Trouble contents
21/AUTO Blink	In-vehicle sensor	Open
-21/AUTO Blink		Short
22/AUTO Blink	Ambient sensor	Sensor trouble or communication failure
23/AUTO Blink	Evaporator sensor	Open
-23/AUTO Blink		Short
24/AUTO Blink	Engine coolant temperature sensor	Sensor trouble or communication failure
25 Blink	Sunload sensor	Open *2
-25/AUTO Blink		Short
26/AUTO Blink	Driver's side air mix door actuator potentiometer	COOL
27/AUTO Blink		HOT
-26/AUTO Blink	Passenger's side air mix door actuator potentiometer	COOL
-27/AUTO Blink		HOT
28/AUTO Blink	Mode door actuator potentiometer	FACE
29/AUTO Blink		DEF
20 Blink	When all conditions are normal	

\*1: AUTO display does not blink when past malfunction occurred. Past malfunction means that abnormal signals were continuously input for a certain time in the past.

\*2: Present malfunction only is displayed for sunload sensor open circuit.

## 5. OPERATING MODE TABLE

Display screen	FRESH/RECIRC door	Mode door	Air mix door*	Blower fan	A/C compressor (Magnet clutch)
31	FRESH	FACE	Maximum cool	LO	OFF
32	RECIRC	FACE	Maximum cool	LO	ON
33	RECIRC	FACE	Maximum cool	M1	ON
34	FRESH	B/L	50%	M1	ON
35	FRESH	FOOT	50%	M1	ON
36	FRESH	FOOT	Maximum hot	M3	ON
37	FRESH	F/D	Maximum hot	M3	ON
38	FRESH	DEF	Maximum hot	HI	ON

\* Same opening angle for both driver's and passenger's side

# Diagnostics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

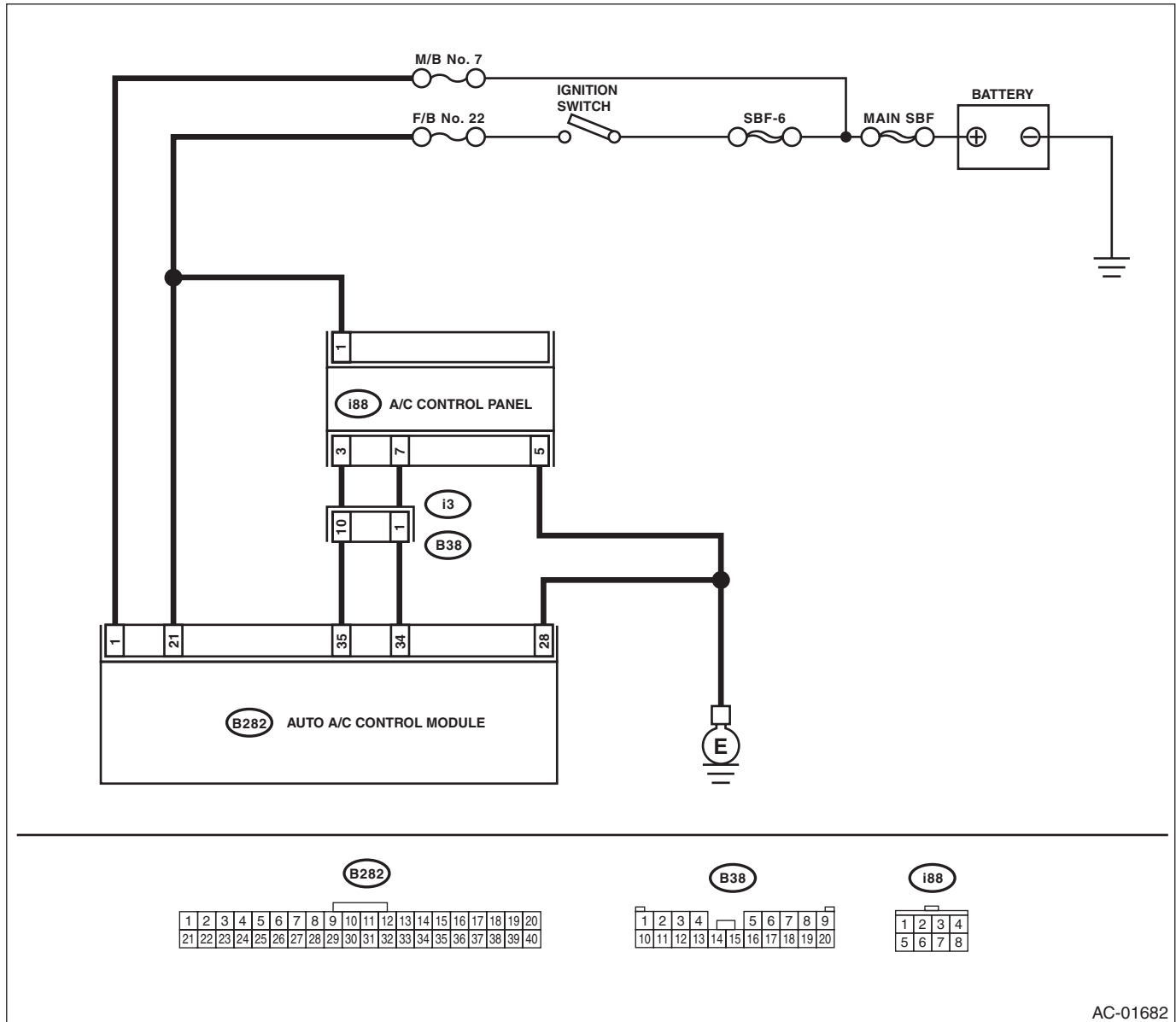
## 6. Diagnostics for A/C System Malfunction

### A: A/C OR SELF-DIAGNOSIS SYSTEMS DO NOT OPERATE

#### TROUBLE SYMPTOM:

- Set temperature is not indicated on the display, switch LEDs are faulty and switches do not operate.
- Self-diagnosis system does not operate.

#### WIRING DIAGRAM:



# Diagnostics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 7 from main fuse box. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 2.
<b>2 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22 from the fuse & relay box. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 3.
<b>3 CHECK A/C CONTROL PANEL POWER CIRCUIT.</b> Measure the voltage between A/C control panel harness connector terminal and chassis ground after turning the ignition switch to ON. <i>Connector &amp; terminal</i> <i>(i88) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Check for open or short circuit in the harness between A/C control panel and fuse.
<b>4 CHECK A/C CONTROL PANEL GROUND POWER CIRCUIT.</b> Measure the resistance of harness between A/C control panel and chassis ground after turning the ignition switch to OFF. <i>Connector &amp; terminal</i> <i>(i88) No. 5 — Chassis ground:</i>	Is resistance less than 10 $\Omega$ ?	Go to step 5.	Repair the harness for ground line.
<b>5 CHECK AUTO A/C CONTROL MODULE POWER CIRCUIT.</b> Measure the voltage between auto A/C control module connector terminal and chassis ground after turning the ignition switch to OFF. <i>Connector &amp; terminal</i> <i>(B282) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 6.	Check open or short circuit of harness between auto A/C control module and fuse.
<b>6 CHECK AUTO A/C CONTROL MODULE POWER CIRCUIT.</b> Measure the voltage between auto A/C control module connector terminal and chassis ground after turning the ignition switch to the ON position. <i>Connector &amp; terminal</i> <i>(B282) No. 21 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 7.	Check open or short circuit of harness between auto A/C control module and fuse.
<b>7 CHECK AUTO A/C CONTROL MODULE GROUND CIRCUIT.</b> Measure the resistance of harness between auto A/C control module and chassis ground. <i>Connector &amp; terminal</i> <i>(B282) No. 28 — Chassis ground:</i>	Is resistance less than 5 $\Omega$ ?	Go to step 8.	Repair the harness for ground line.
<b>8 CHECK COMMUNICATION CIRCUIT.</b> Measure the resistance of harness between A/C control panel and auto A/C control module. <i>Connector &amp; terminal</i> <i>(i88) No. 3 — (B282) No. 35:</i> <i>(i88) No. 7 — (B282) No. 34:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the harness.
<b>9 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostics for A/C System Malfunction

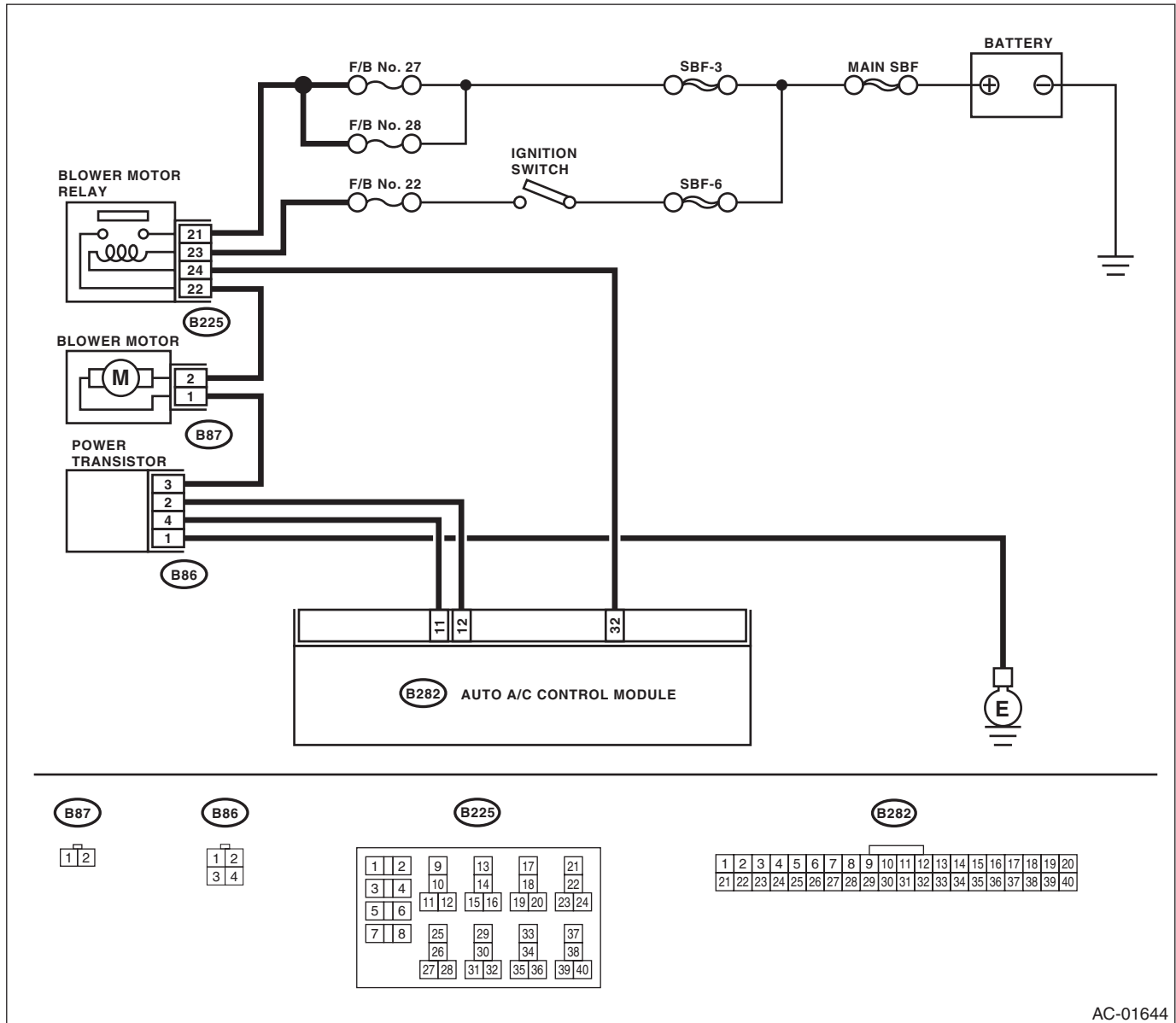
HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## B: BLOWER FAN DOES NOT ROTATE

### TROUBLE SYMPTOM:

- Blower motor does not rotate.
- Blower motor does not rotate in "HI".

### WIRING DIAGRAM:



AC-01644

# Diagnostics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

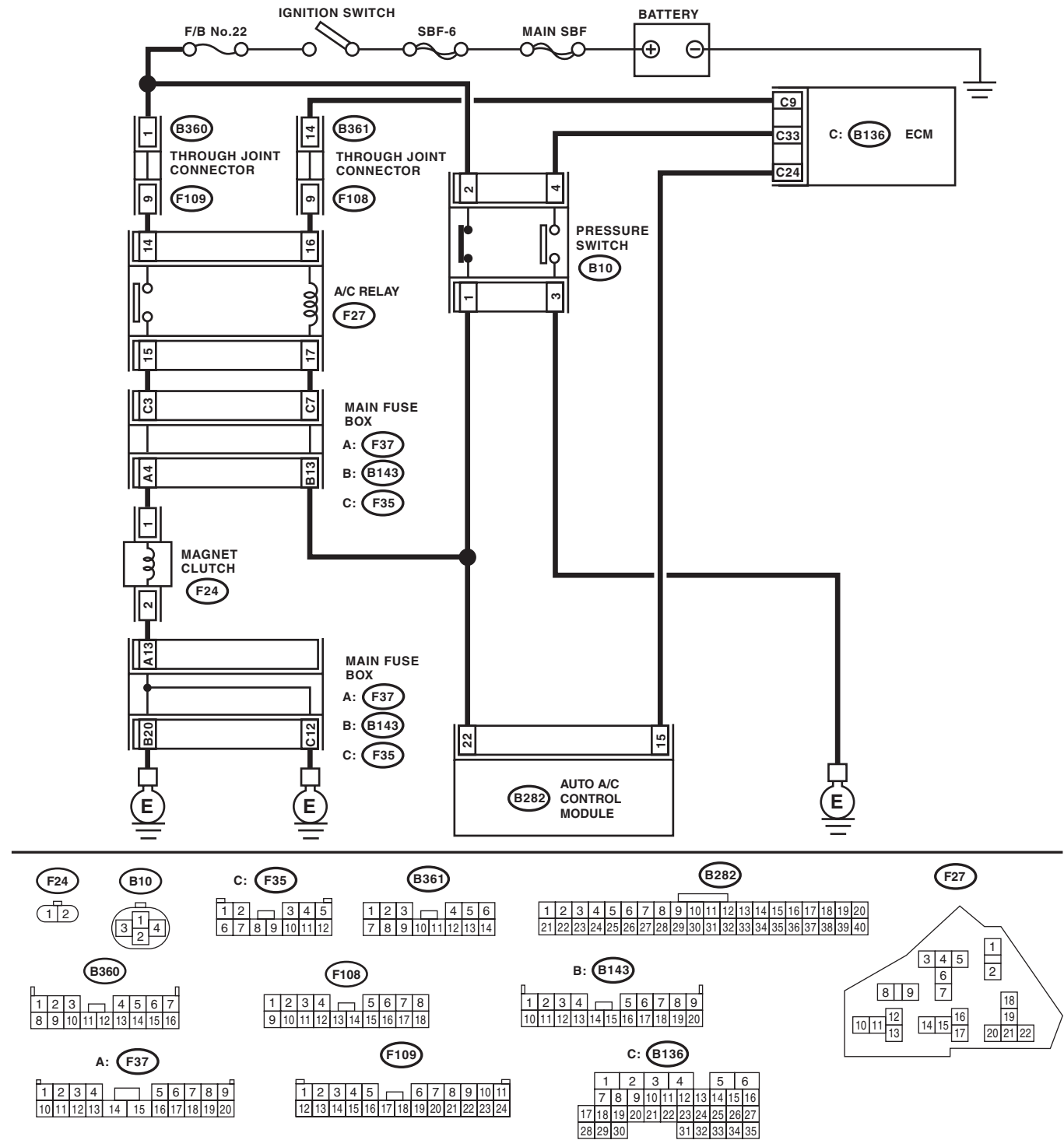
Step	Check	Yes	No
<b>1 CHECK FUSE.</b> 1) Remove fuse No. 22, 27 and 28 from fuse & relay box. 2) Check the condition of fuse.	Is any fuse blown out?	Replace the fuse.	Go to step 2.
<b>2 CHECK POWER SUPPLY FOR BLOWER MOTOR.</b> 1) Turn the ignition switch to ON. 2) Turn the blower switch to ON. 3) Measure the voltage between blower motor and chassis ground. <b>Connector &amp; terminal</b> <b>(B87) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Repair the open circuit of blower motor power supply line harness.
<b>3 CHECK BLOWER MOTOR RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the blower motor relay. 3) Connect the battery positive (+) terminal to terminal No. 23 of blower motor relay, and negative (-) terminal to terminal No. 24. 4) Measure the resistance between terminals No. 21 and No. 22. <b>Terminals</b> <b>(B225) No. 21 — (B225) No. 22:</b>	Is resistance less than 1 $\Omega$ ?	Go to step 4.	Replace the blower motor relay.
<b>4 CHECK BLOWER MOTOR.</b> 1) Disconnect the connector from the blower motor. 2) Connect the battery positive (+) terminal to terminal No. 2 of blower motor connector, and negative (-) terminal to terminal No. 1. 3) Make sure the blower motor runs.	Does the blower motor run?	Go to step 5.	Replace the blower motor.
<b>5 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnosics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## C: COMPARTMENT TEMPERATURE DOES NOT CHANGE, OR A/C SYSTEM DOES NOT RESPOND PROMPTLY

WIRING DIAGRAM:



AC-01683

# Diagnostics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22 from fuse & relay box. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 2.
<b>2 CHECK POWER SUPPLY TO A/C RELAY AND AUTO A/C CONTROL MODULE.</b> 1) Disconnect the A/C relay and auto A/C control module harness connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between A/C relay connector terminal and chassis ground. 4) Measure the voltage between auto A/C control module harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 17 (+) — Chassis ground (-):</b> <b>(B282) No. 22 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 5.	Go to step 3.
<b>3 CHECK POWER SUPPLY FOR PRESSURE SWITCH.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the pressure switch harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between pressure switch harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B10) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 4.	Check for open or short circuit in the harness between fuse and pressure switch.
<b>4 CHECK HARNESS BETWEEN PRESSURE SWITCH AND A/C RELAY, AUTO A/C CONTROL MODULE.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between pressure switch connector and A/C relay connector. 3) Measure the resistance of harness between pressure switch connector and auto A/C control module connector. <b>Connector &amp; terminal</b> <b>(B10) No. 1 — (F27) No. 17:</b> <b>(B10) No. 1 — (B282) No. 22:</b>	Is the resistance less than 1 $\Omega$ ?	Check the pressure switch. <Ref. to AC-41, INSPECTION, Pressure Switch (Triple Pressure Switch).>	Repair the harness.
<b>5 CHECK POWER SUPPLY FOR A/C RELAY.</b> Measure the voltage between A/C relay connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 14 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 6.	Check open or short circuit of harness between fuse and A/C relay.
<b>6 CHECK A/C RELAY.</b> Check the A/C relay. <Ref. to AC-40, INSPECTION, Relay and Fuse.>	Is there a malfunction in the A/C relay?	Replace the A/C relay.	Go to step 7.



## Diagnostics for A/C System Malfunction

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>7 CHECK A/C ON SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Connect the A/C relay and all disconnected connectors. 3) Start the engine and turn the AUTO switch to ON. 4) Turn the temperature control dial at maximum cool position. 5) Measure the voltage between auto A/C control module harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B282) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 5.5 V or more?	Go to step 9.	Go to step 8.
<b>8 CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of auto A/C control module and ECM. 3) Measure the resistance of harness between auto A/C control module connector and ECM connector. <b>Connector &amp; terminal</b> <b>(B282) No. 15 — (B136) No. 24:</b>	Is the resistance less than 1 $\Omega$ ?	Replace the auto A/C control module.	Repair the harness.
<b>9 CHECK MAGNET CLUTCH ON SIGNAL.</b> 1) Stop the engine, and turn the AUTO switch to OFF. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 10.	Check for open or short circuit in the harness between A/C relay and ECM.
<b>10 CHECK MAGNET CLUTCH ON SIGNAL.</b> 1) Start the engine and turn the AUTO switch to ON. 2) Turn the temperature control dial at maximum cool position. 3) Measure the voltage between ECM connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 0 V?	Go to step 11.	Replace the ECM.
<b>11 CHECK POWER SUPPLY FOR MAGNET CLUTCH.</b> 1) Stop the engine, and turn the AUTO switch to OFF. 2) Disconnect the harness connector of magnet clutch. 3) Start the engine and turn the AUTO switch to ON. 4) Turn the temperature control dial at maximum cool position. 5) Measure the voltage between magnet clutch harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F24) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 12.	Check for open or short circuit in the harness between A/C relay and magnet clutch.

# Diagnostics for A/C System Malfunction

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

	Step	Check	Yes	No
12	<b>CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND ECM.</b> 1) Stop the engine, and turn the AUTO switch to OFF. 2) Measure the resistance between magnet clutch harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F24) No. 2 — Chassis ground:</b>	Is the resistance less than 1 $\Omega$ ?	Inspect the compressor. <Ref. to AC-35, INSPECTION, Compressor.>	Repair the harness.

# Diagnostic Procedure for Actuators

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

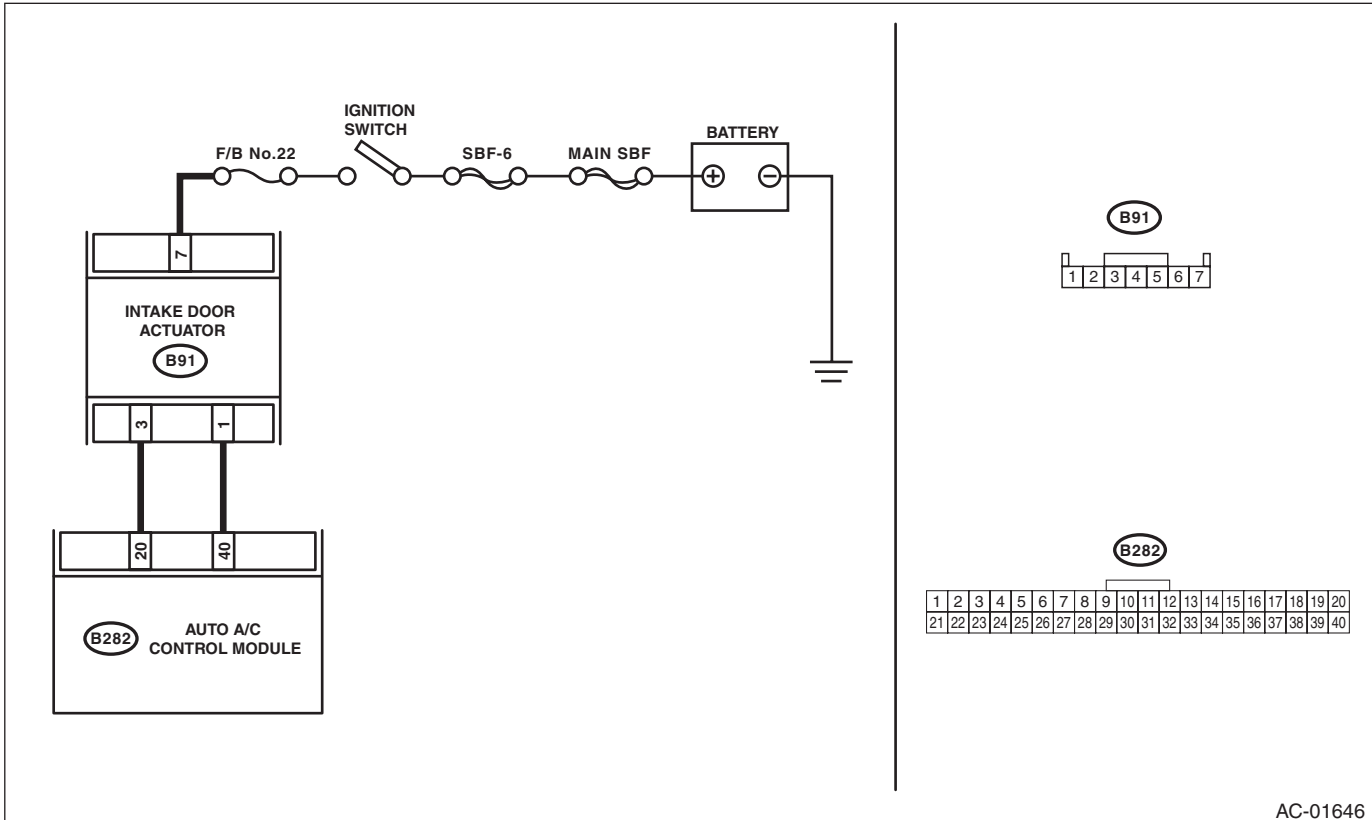
## 7. Diagnostic Procedure for Actuators

### A: INTAKE DOOR ACTUATOR

**TROUBLE SYMPTOM:**

FRESH/RECIRC mode is not changed.

**WIRING DIAGRAM:**



AC-01646

# Diagnostic Procedure for Actuators

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY FOR INTAKE DOOR ACTUATOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the intake door actuator connector.                      3) Turn the ignition switch to ON.                      4) Measure the voltage between intake door actuator connector and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(B91) No. 7 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 7 V (at normal temperature)?</p>	<p>Go to step 2.</p>	<p>Check for open or short circuit in the harness between intake door actuator and fuse.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND INTAKE DOOR ACTUATOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the auto A/C control module connector.                      3) Measure the resistance between intake door actuator connector and auto A/C control module connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 20 — (B91) No. 3:</b>  <b>(B282) No. 40 — (B91) No. 1:</b></p>	<p>Is the resistance less than 1 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness between auto A/C control module and intake door actuator.</p>
<p><b>3</b></p> <p><b>CHECK OPERATION OF INTAKE DOOR ACTUATOR.</b></p> <p>1) Connect the intake door actuator connector.                      2) Ground the auto A/C control module connector with a suitable wire.                      3) Turn the ignition switch to ON, and check the operation of intake door actuator.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 20 — Chassis ground:</b></p>	<p>Does the actuator move to the FRESH side?</p>	<p>Go to step 4.</p>	<p>Replace the intake door actuator.</p>
<p><b>4</b></p> <p><b>CHECK OPERATION OF INTAKE DOOR ACTUATOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Ground the auto A/C control module connector with a suitable wire.                      3) Turn the ignition switch to ON, and check the operation of intake door actuator.</p> <p><b>Connector &amp; terminal:</b>  <b>(B282) No. 40 — Chassis ground:</b></p>	<p>Does the actuator move to the RECIRC side?</p>	<p>Replace the auto A/C control module.</p>	<p>Replace the intake door actuator.</p>

# Diagnostic Procedure for Actuators

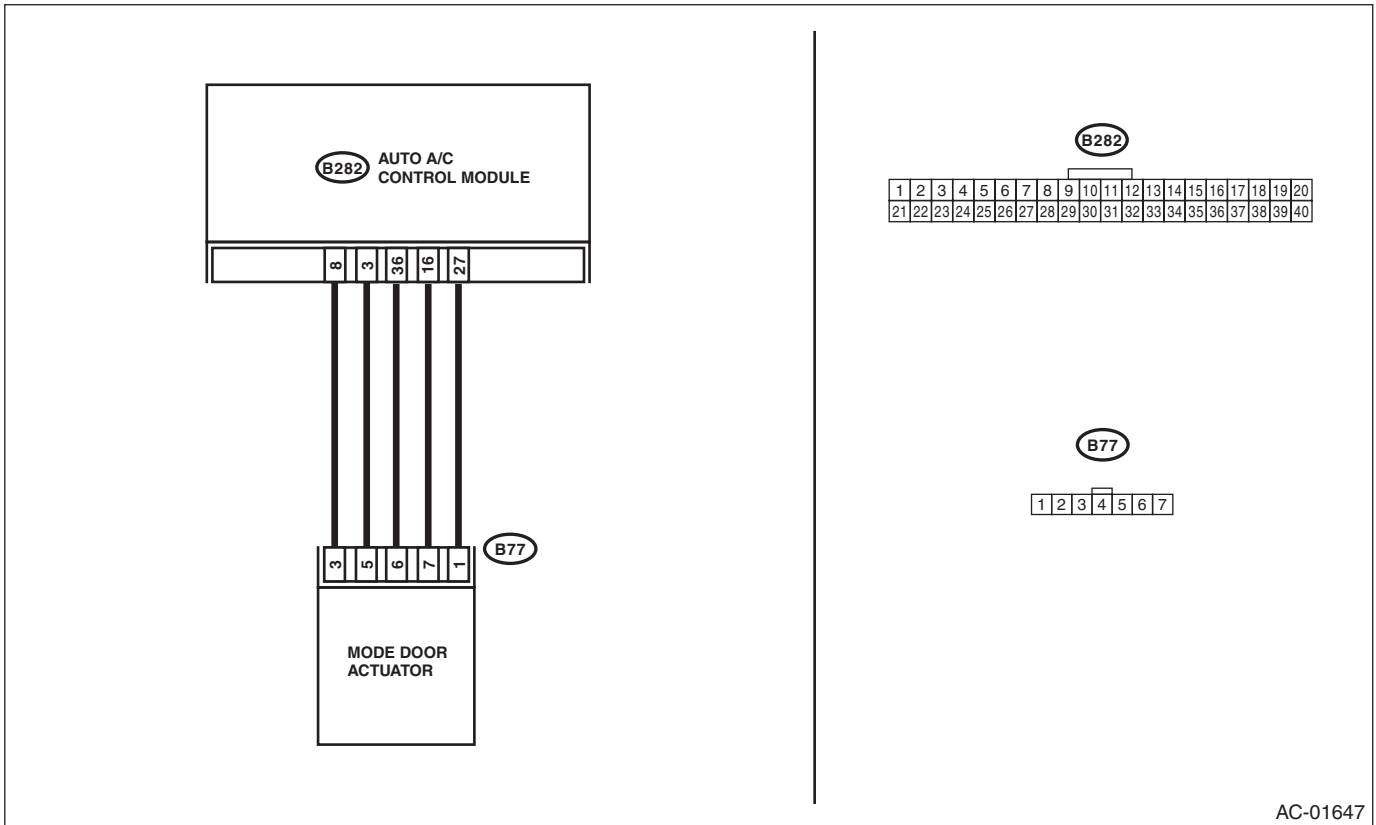
HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## B: MODE DOOR ACTUATOR

### TROUBLE SYMPTOM:

Air flow outlet is not changed.

### WIRING DIAGRAM:



# Diagnostic Procedure for Actuators

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK POWER SUPPLY FOR MODE DOOR ACTUATOR POSITION SENSOR.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the mode door actuator connector.                      3) Turn the ignition switch and AUTO switch to ON.                      4) Measure the voltage between auto A/C control module connector terminals.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 8 (+) — (B282) No. 27 (-):</b></p>	Is the voltage approx. 5 V?	Go to step 2.	Replace the auto A/C control module.
<p><b>2 CHECK POWER SUPPLY FOR MODE DOOR ACTUATOR.</b></p> <p>Measure the voltage between auto A/C control module connector and chassis ground after turning the air flow control switch to FACE position.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 16 (+) — Chassis ground (-):</b></p>	Is the voltage 7 V (at normal temperature)?	Go to step 3.	Replace the auto A/C control module.
<p><b>3 CHECK POWER SUPPLY FOR MODE DOOR ACTUATOR.</b></p> <p>Measure the voltage between auto A/C control module connector and chassis ground after turning the air flow control switch to DEF position.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 36 (+) — Chassis ground (-):</b></p>	Is the voltage 7 V (at normal temperature)?	Go to step 4.	Replace the auto A/C control module.
<p><b>4 CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND MODE DOOR ACTUATOR.</b></p> <p>1) Turn the A/C and ignition switch to OFF.                      2) Disconnect the auto A/C control module connector.                      3) Measure the resistance between auto A/C control module and mode door actuator connector.</p> <p><b>Connector &amp; terminal</b>  <b>(B77) No. 1 — (B282) No. 27:</b>  <b>(B77) No. 3 — (B282) No. 8:</b>  <b>(B77) No. 5 — (B282) No. 3:</b>  <b>(B77) No. 6 — (B282) No. 36:</b>  <b>(B77) No. 7 — (B282) No. 16:</b></p>	Is the resistance less than 1 Ω?	Go to step 5.	Repair the harness between auto A/C control module and mode door actuator.
<p><b>5 CHECK MODE DOOR ACTUATOR POSITION SWITCH SIGNAL.</b></p> <p>1) Connect the connector of auto A/C control module and mode door actuator.                      2) Turn the ignition switch and AUTO switch to ON.                      3) Check the voltage between auto A/C control module connector terminals while changing the mode between DEF and FACE.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 3 (+) — (B282) No. 27 (-):</b></p>	Does the voltage change between 1 V (DEF) and 4 V (FACE)?	Go to step 6.	Replace the mode door actuator.
<p><b>6 CHECK POOR CONTACT.</b></p> <p>Check poor contact of auto A/C control module and connector.</p>	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostic Procedure for Actuators

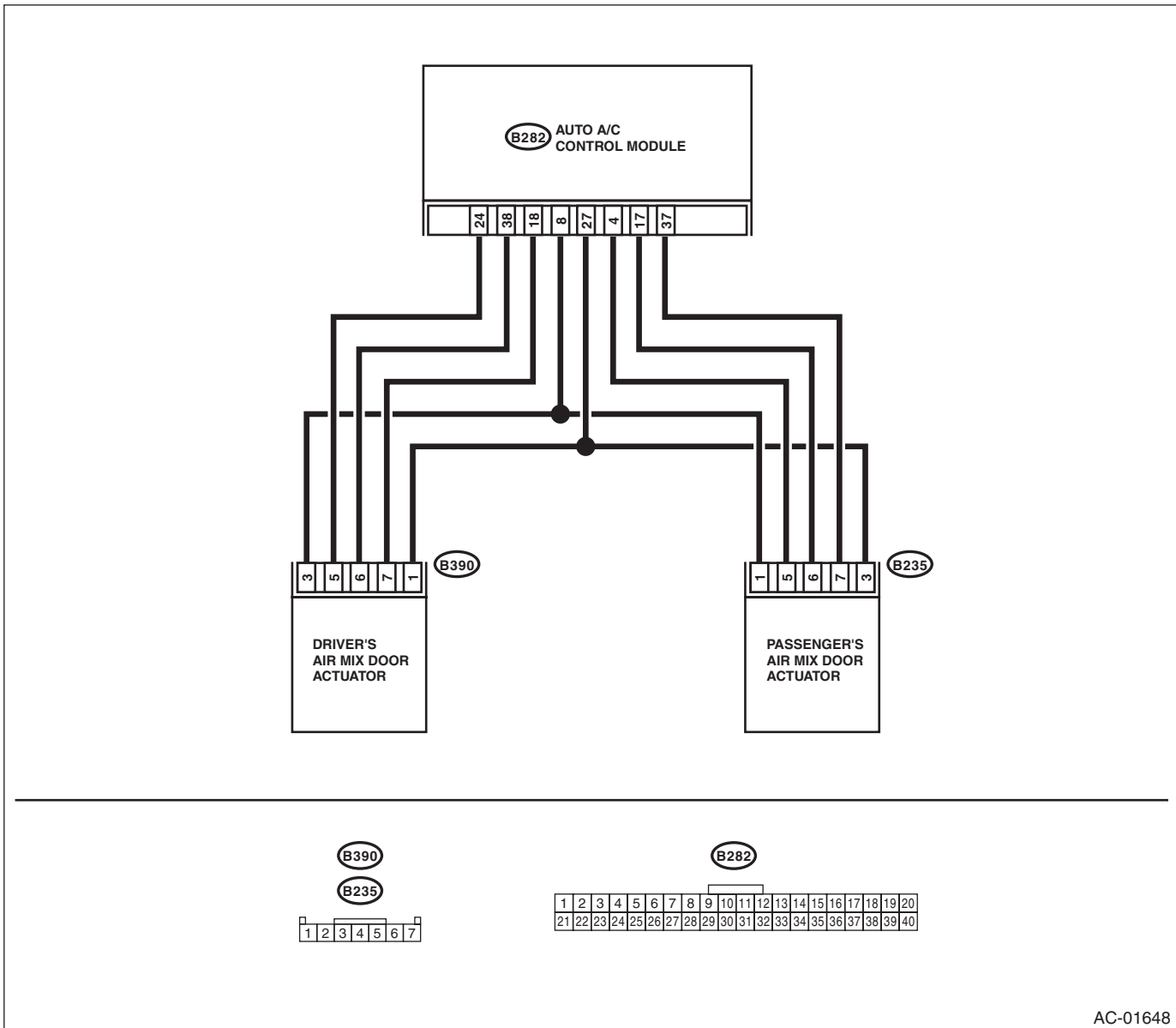
HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## C: AIR MIX DOOR ACTUATOR

### TROUBLE SYMPTOM:

Outlet air temperature does not change.

### WIRING DIAGRAM:



# Diagnostic Procedure for Actuators

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK POWER SUPPLY FOR AIR MIX DOOR ACTUATOR POSITION SWITCH.</b>                      1) Turn the ignition switch to OFF.                      2) Disconnect the air mix door actuator connector.                      3) Turn the ignition switch and AUTO switch to ON.                      4) Measure the voltage between auto A/C control module connector terminals.</p> <p><b>Connector &amp; terminal</b>  <b>(B282) No. 8 (+) — (B282) No. 27 (-):</b></p>	Is the voltage approx. 5 V?	Go to step 2.	Replace the auto A/C control module.
<p><b>2</b></p> <p><b>CHECK POWER SUPPLY FOR AIR MIX DOOR ACTUATOR.</b>                      Measure the voltage between auto A/C control module connector and chassis ground after turning the temperature control dial to maximum COOL position.</p> <p><b>Connector &amp; terminal</b>  <b>Driver's side</b>  <b>(B282) No. 18 (+) — Chassis ground (-):</b>  <b>Passenger's side</b>  <b>(B282) No. 17 (+) — Chassis ground (-):</b></p>	Is the voltage 7 V (at normal temperature)?	Go to step 3.	Replace the auto A/C control module.
<p><b>3</b></p> <p><b>CHECK POWER SUPPLY FOR AIR MIX DOOR ACTUATOR.</b>                      Measure the voltage between auto A/C control module connector and chassis ground after turning the temperature control dial to maximum HOT position.</p> <p><b>Connector &amp; terminal</b>  <b>Driver's side</b>  <b>(B282) No. 38 (+) — Chassis ground (-):</b>  <b>Passenger's side</b>  <b>(B282) No. 37 (+) — Chassis ground (-):</b></p>	Is the voltage 7 V (at normal temperature)?	Go to step 4.	Replace the auto A/C control module.
<p><b>4</b></p> <p><b>CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND AIR MIX DOOR ACTUATOR.</b>                      1) Turn the A/C and ignition switch to OFF.                      2) Disconnect the auto A/C control module connector.                      3) Measure the resistance between auto A/C control module and air mix door actuator connector.</p> <p><b>Connector &amp; terminal</b>  <b>Driver's side</b>  <b>(B390) No. 1 — (B282) No. 27:</b>  <b>(B390) No. 3 — (B282) No. 8:</b>  <b>(B390) No. 5 — (B282) No. 24:</b>  <b>(B390) No. 6 — (B282) No. 38:</b>  <b>(B390) No. 7 — (B282) No. 18:</b>  <b>Passenger's side</b>  <b>(B235) No. 1 — (B282) No. 8:</b>  <b>(B235) No. 3 — (B282) No. 27:</b>  <b>(B235) No. 5 — (B282) No. 4:</b>  <b>(B235) No. 6 — (B282) No. 17:</b>  <b>(B235) No. 7 — (B282) No. 37:</b></p>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the harness between auto A/C control module and air mix door actuator.



## Diagnostic Procedure for Actuators

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>5</b> <b>CHECK AIR MIX DOOR ACTUATOR POSITION SWITCH SIGNAL.</b> 1) Connect the connector of auto A/C control module and air mix door actuator. 2) Turn the ignition switch and AUTO switch to ON. 3) Check the voltage between auto A/C control module connector terminals while changing the setting temperature between maximum COOL and maximum HOT. <b>Connector &amp; terminal</b> <i>Driver's side</i> (B282) No. 24 (+) — (B282) No. 27 (-): <i>Passenger's side</i> (B282) No. 4 (+) — (B282) No. 27 (-):	Does the voltage change between 1 V (Max. HOT) and 4 V (Max. COOL)?	Go to step 6.	Replace the air mix door actuator.
<b>6</b> <b>CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module and connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostic Procedure for Sensors

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

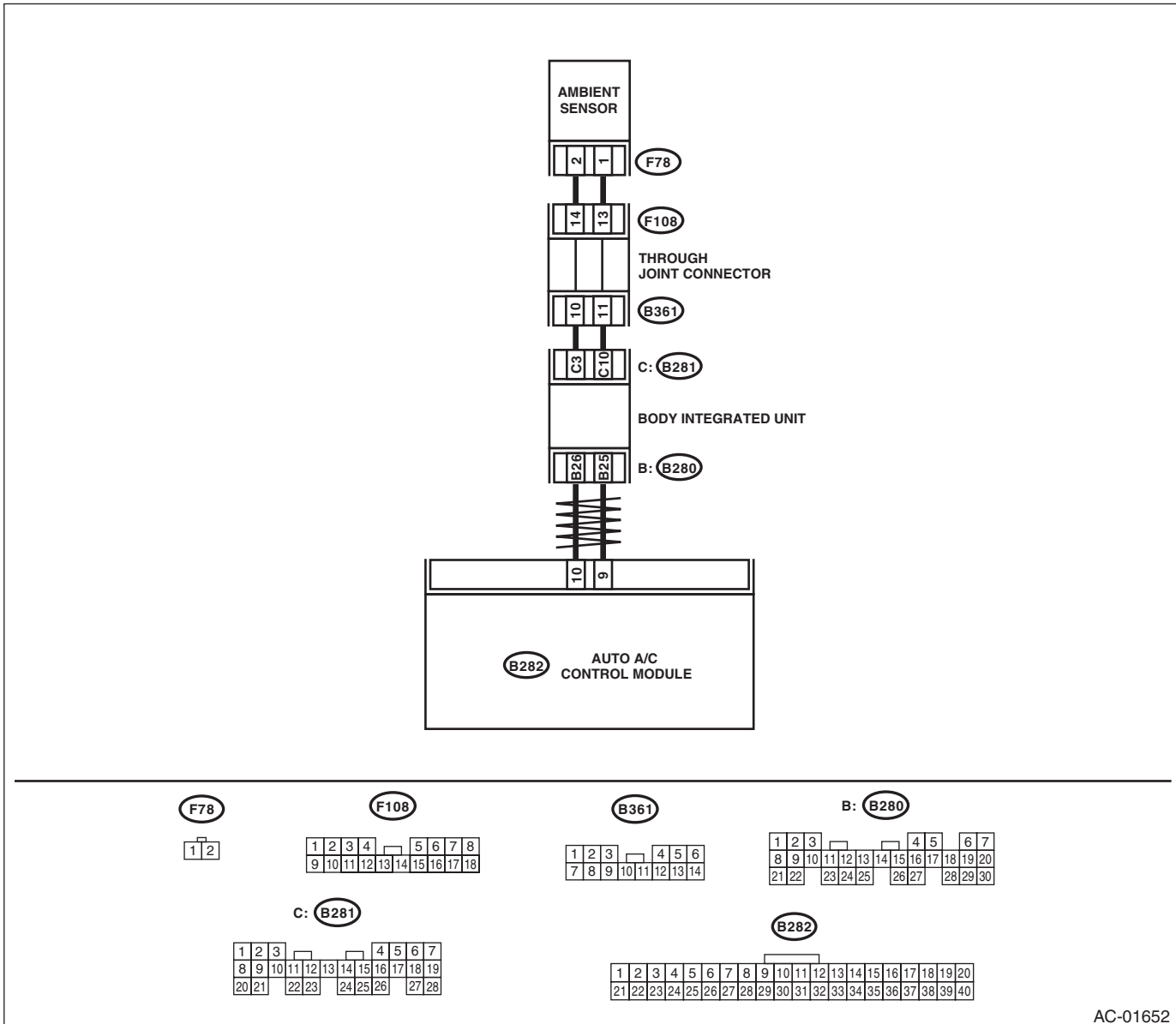
## 8. Diagnostic Procedure for Sensors

### A: AMBIENT SENSOR

**TROUBLE SYMPTOM:**

Fan speed is not switched when the fan speed control dial is in AUTO position.

**WIRING DIAGRAM:**



AC-01652

## Diagnostic Procedure for Sensors

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK AMBIENT SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ambient sensor. 3) Measure the resistance between connector terminals of ambient sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance approximately 2.2 k $\Omega$ at 25°C (77°F)?	Go to step 2.	Replace the ambient sensor.
<b>2 CHECK INPUT SIGNAL FOR AMBIENT SENSOR.</b> 1) Turn the ignition to ON. 2) Measure the voltage between connector (F78) terminals. <b>Connector &amp; terminal</b> <b>(F78) No. 1 (+) — No. 2 (-):</b>	Is the voltage approx. 5 V?	Go to step 6.	Go to step 3.
<b>3 CHECK OUTPUT SIGNAL OF BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to OFF. 2) Draw out the body integrated unit. 3) Disconnect the connector from ambient sensor. 4) Turn the ignition switch to ON. 5) Measure the voltage between connector terminals of body integrated unit. <b>Connector &amp; terminal</b> <b>(B281) No. 3 (+) — No. 10 (-):</b>	Is the voltage approx. 5 V?	Go to step 4.	Go to step 6.
<b>4 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND AMBIENT SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from body integrated unit. 3) Measure the resistance of harness between body integrated unit and ambient sensor. <b>Connector &amp; terminal</b> <b>(F78) No. 1 — (B281) No. 10:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between body integrated unit and ambient sensor.
<b>5 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND AMBIENT SENSOR.</b> Measure the resistance of harness between body integrated unit and ambient sensor. <b>Connector &amp; terminal</b> <b>(F78) No. 2 — (B281) No. 3:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between body integrated unit and ambient sensor.
<b>6 CHECK DTC.</b> 1) Connect the connectors of body integrated unit and ambient sensor as originally connected. 2) Read the DTC of body integrated unit using Subaru Select Monitor.	Is DTC "U xxx" of CAN communication displayed?	Check the communication circuit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Go to step 7.
<b>7 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostic Procedure for Sensors

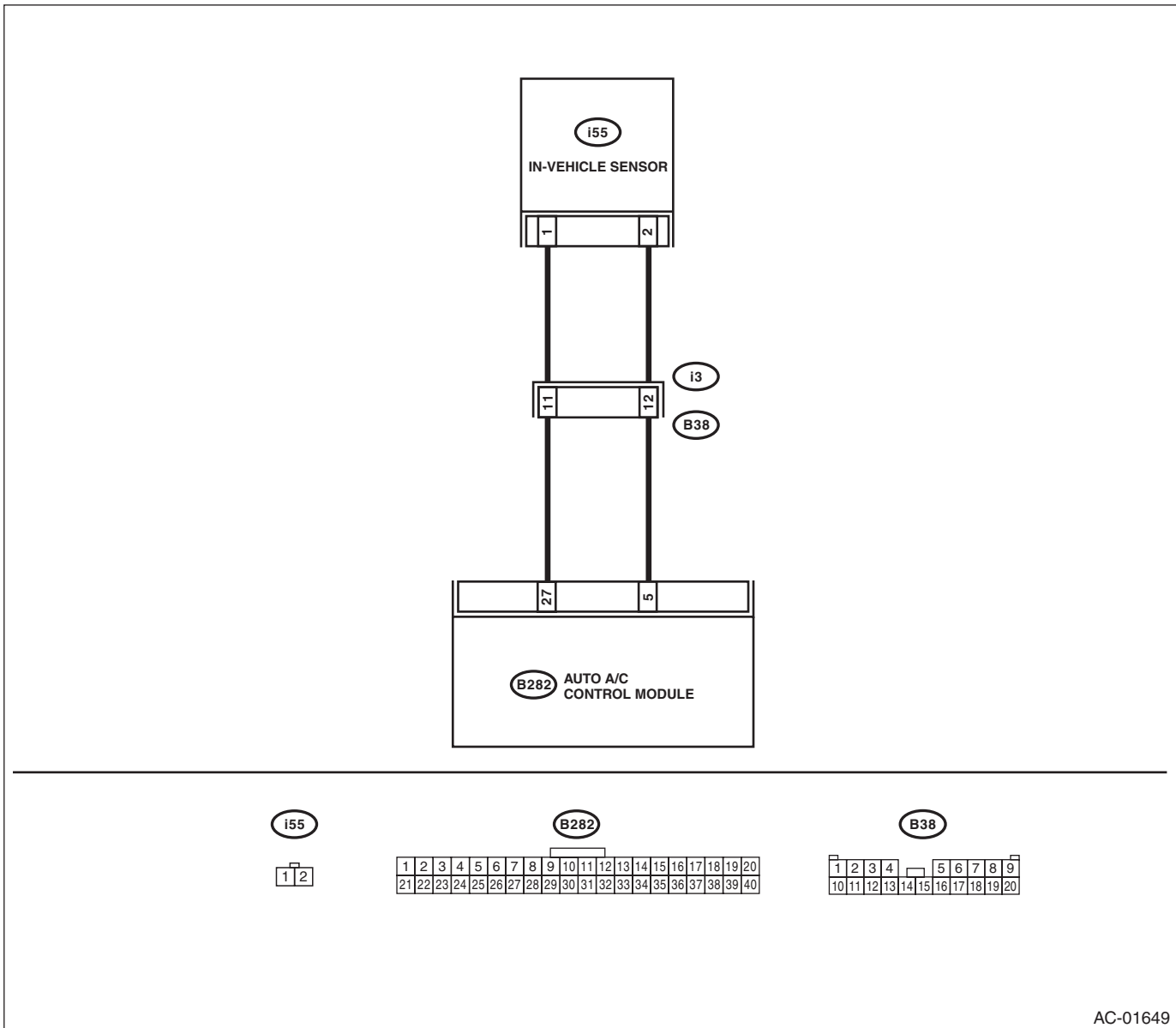
HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## B: IN-VEHICLE SENSOR

### TROUBLE SYMPTOM:

Blower fan speed, outlet port and inlet port do not change after turning the AUTO switch to ON

### WIRING DIAGRAM:



AC-01649

## Diagnostic Procedure for Sensors

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

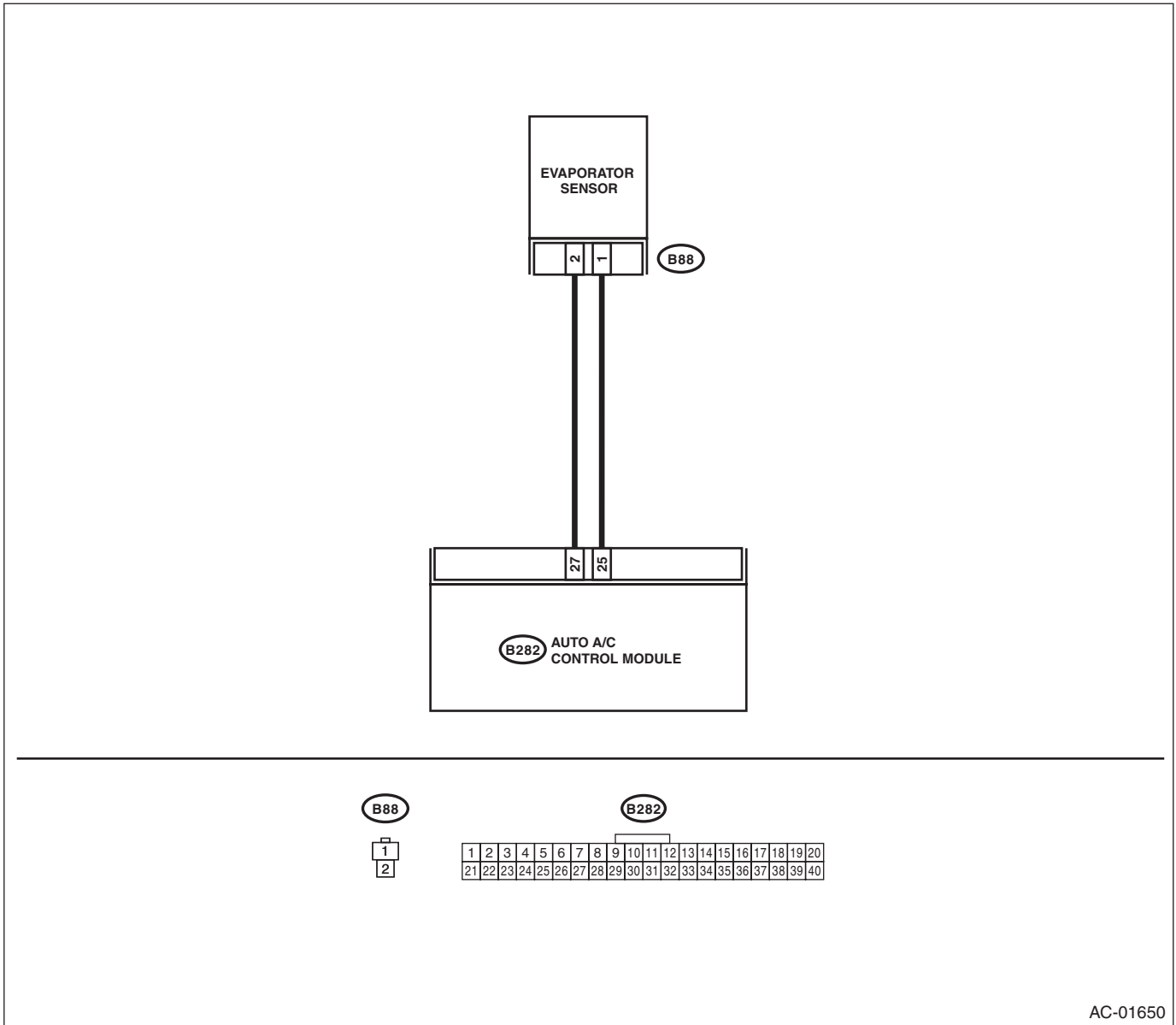
Step	Check	Yes	No
<b>1 CHECK IN-VEHICLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the driver's side lower cover. 3) Disconnect the connector from in-vehicle sensor. 4) Measure the resistance between connector terminals of in-vehicle sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance approximately 2.7 k $\Omega$ at 20°C (68°F)?	Go to step 2.	Replace the in-vehicle sensor.
<b>2 CHECK INPUT SIGNAL FOR IN-VEHICLE SENSOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between in-vehicle sensor harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(i55) No. 2 (+) — No. 1 (-):</b>	Is the voltage approx. 5 V?	Go to step 6.	Go to step 3.
<b>3 CHECK AUTO A/C CONTROL MODULE OUTPUT SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Remove the auto A/C control module. 3) Turn the ignition switch to ON. 4) Measure the voltage between connector terminals of auto A/C control module. <b>Connector &amp; terminal</b> <b>(B282) No. 5 (+) — (B282) No. 27 (-):</b>	Is the voltage approx. 5 V?	Go to step 4.	Go to step 6.
<b>4 CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND IN-VEHICLE SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the auto A/C control module. 3) Measure the resistance of harness between auto A/C control module and in-vehicle sensor. <b>Connector &amp; terminal</b> <b>(i55) No. 2 — (B282) No. 5:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the harness between auto A/C control module and in-vehicle sensor.
<b>5 CHECK HARNESS BETWEEN AUTO A/C CONTROL MODULE AND IN-VEHICLE SENSOR.</b> Measure the resistance of harness between auto A/C control module and in-vehicle sensor. <b>Connector &amp; terminal</b> <b>(i55) No. 1 — (B282) No. 27:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the harness between auto A/C control module and in-vehicle sensor.
<b>6 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostic Procedure for Sensors

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## C: EVAPORATOR SENSOR

WIRING DIAGRAM:



AC-01650

## Diagnostic Procedure for Sensors

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK EVAPORATOR SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Remove the glove box. 3) Disconnect the connector from evaporator sensor. 4) Measure the resistance between connector terminals of the evaporator sensor. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance approximately 3.3 k $\Omega$ at 20°C (68°F)?	Go to step 2.	Replace the evaporator sensor.
<b>2 CHECK INPUT SIGNAL FOR EVAPORATOR SENSOR.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between connector (B88) terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B88) No. 1 (+) — No. 2 (-):</b>	Is the voltage approx. 5 V?	Go to step 6.	Go to step 3.
<b>3 CHECK AUTO A/C CONTROL MODULE OUTPUT SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Remove the auto A/C control module. 3) Turn the ignition switch to ON. 4) Measure the voltage between connector terminals of auto A/C control module. <b>Connector &amp; terminal</b> <b>(B282) No. 25 (+) — No. 27 (-):</b>	Is the voltage approx. 5 V?	Go to step 4.	Go to step 6.
<b>4 CHECK HARNESS CONNECTOR BETWEEN AUTO A/C CONTROL MODULE AND EVAPORATOR SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the auto A/C control module. 3) Measure the resistance of harness between auto A/C control module and evaporator sensor. <b>Connector &amp; terminal</b> <b>(B88) No. 2 — (B282) No. 27:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Repair the open circuit of harness between auto A/C control module and evaporator sensor.
<b>5 CHECK HARNESS CONNECTOR BETWEEN AUTO A/C CONTROL MODULE AND EVAPORATOR SENSOR.</b> Measure the resistance of harness between auto A/C control module and evaporator sensor. <b>Connector &amp; terminal</b> <b>(B88) No. 1 — (B282) No. 25:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 6.	Repair the open circuit of harness between auto A/C control module and evaporator sensor.
<b>6 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

# Diagnostic Procedure for Sensors

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## D: SUNLOAD SENSOR

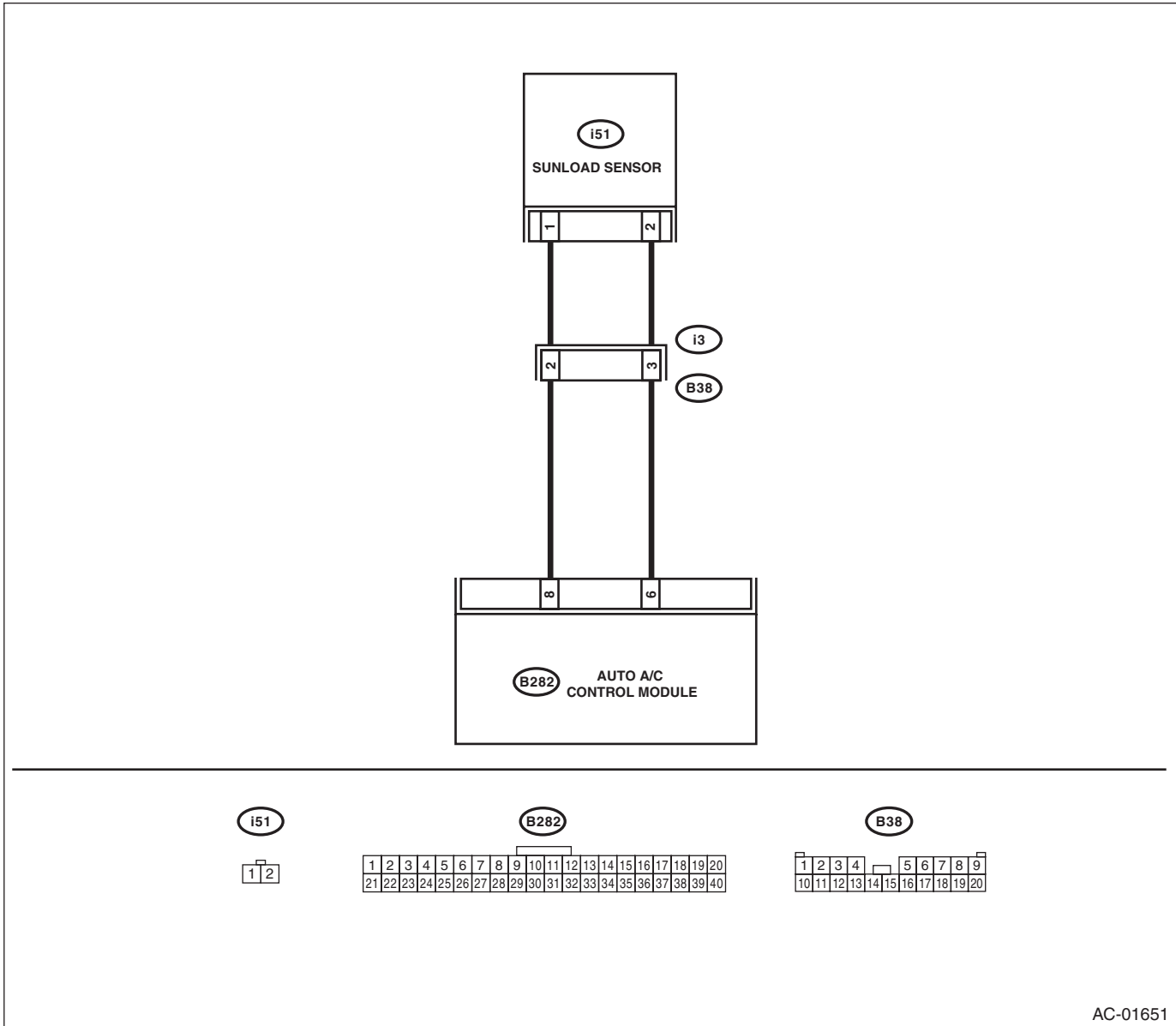
### TROUBLE SYMPTOM:

- Sensor identifies that sunlight is at maximum. Then, A/C system is controlled to COOL side.
- Sensor identifies that sunlight is at minimum. Then, A/C system is controlled to HOT side.

### NOTE:

When the sunload sensor check is performed indoors or in the shade, it could be diagnosed as having an open circuit. Always check the sunload sensor with the sun shining on it.

### WIRING DIAGRAM:



AC-01651



## Diagnostic Procedure for Sensors

### HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY VOLTAGE FOR SUNLOAD SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from sunload sensor. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage for sunload sensor. <i>Connector &amp; terminal (i51) No. 1 (+) — No. 2 (-):</i>	Is the voltage approx. 5 V?	Go to step 4.	Go to step 2.
<b>2 CHECK HARNESS CONNECTOR BETWEEN AUTO A/C CONTROL MODULE AND SUNLOAD SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the auto A/C control module. 3) Measure the resistance of the harness between the auto A/C control module and sunload sensor. <i>Connector &amp; terminal (i51) No. 2 — (B282) No. 6:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Repair the harness between auto A/C control module and sunload sensor.
<b>3 CHECK HARNESS CONNECTOR BETWEEN AUTO A/C CONTROL MODULE AND SUNLOAD SENSOR.</b> Measure the resistance of the harness between the auto A/C control module and sunload sensor. <i>Connector &amp; terminal (i51) No. 1 — (B282) No. 8:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 4.	Repair the harness between auto A/C control module and sunload sensor.
<b>4 CHECK INPUT VOLTAGE FOR AUTO A/C CONTROL MODULE.</b> 1) Connect the connectors of sunload sensor and auto A/C control module. 2) Turn the ignition switch to ON. 3) Measure the voltage between connector terminals of auto A/C control module. <i>Connector &amp; terminal (B282) No. 8 (+) — (B282) No. 6 (-):</i>	Is the voltage approx. 2.5 V?	Go to step 5.	Replace the sunload sensor.
<b>5 CHECK POOR CONTACT.</b> Check poor contact of auto A/C control module connector.	Is there poor contact in connector?	Repair the connector.	Replace the auto A/C control module.

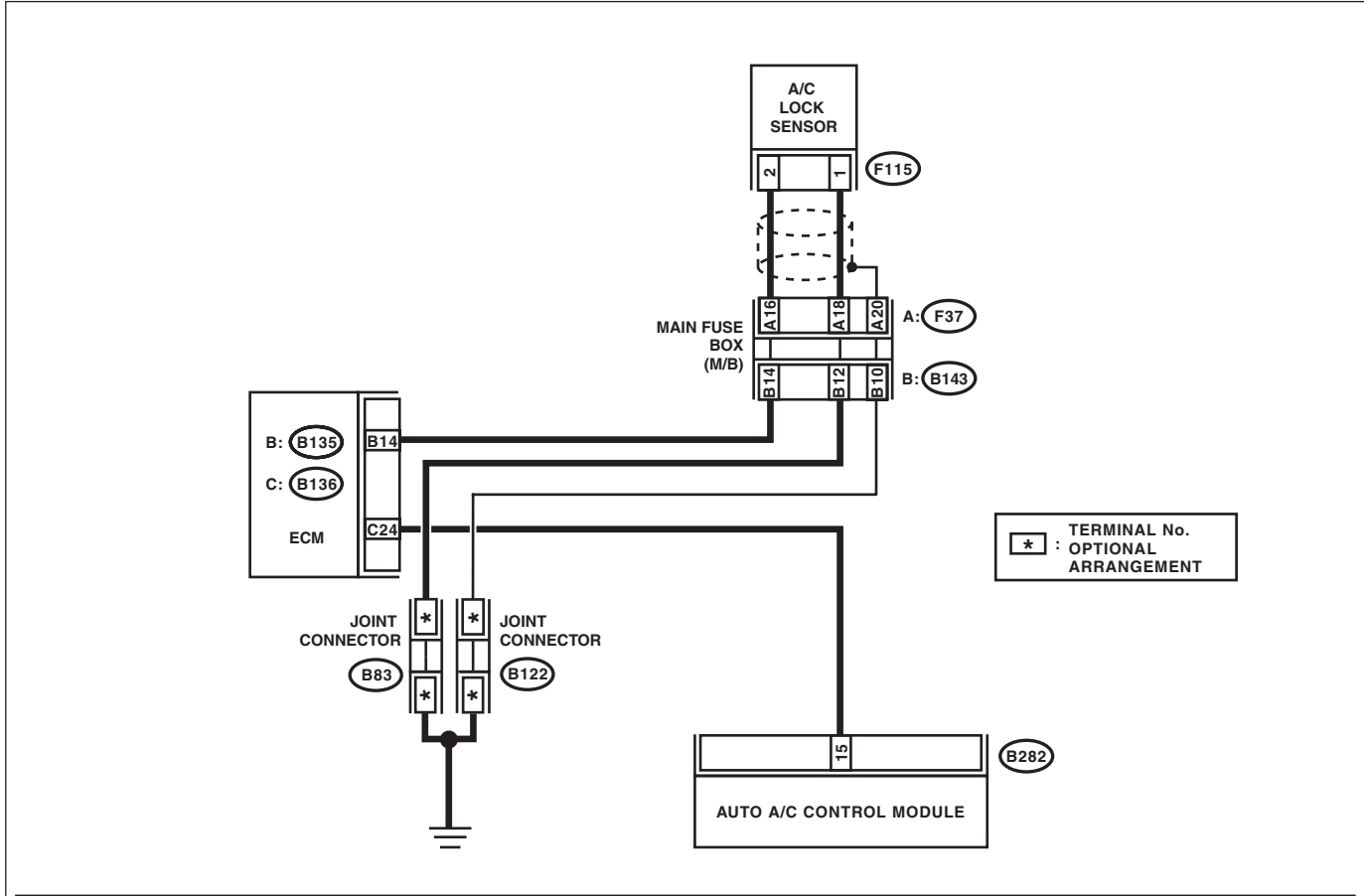
# Diagnostic Procedure for Sensors

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## E: A/C LOCK SENSOR

H6 model

WIRING DIAGRAM:



F115



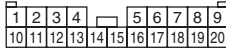
B83



B122



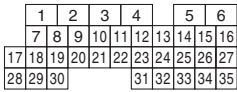
A: F37



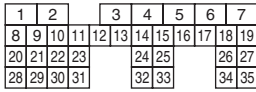
B: B143



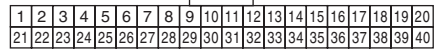
C: B136



B: B135



B282



AC-01653

# Diagnostic Procedure for Sensors

## HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK A/C LOCK SENSOR SIGNAL.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Start the engine and turn the A/C switch to ON. 4) Read the data of A/C lock signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H6DO)(diag)-36, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>	Is the A/C lock signal switch ON?	Go to step 4.	Go to step 2.
<b>2 CHECK A/C LOCK SENSOR SIGNAL.</b> 1) Start the engine and turn the A/C switch to ON. 2) Measure the voltage between auto A/C control module harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B282) No. 15 (+) — Chassis ground (-):</b>	Is the voltage 7 — 14 V?	Replace the auto A/C control module.	Go to step 3.
<b>3 CHECK ECM.</b> Measure the voltage between ECM and chassis ground. <b>Connector &amp; terminal</b> <b>(B136) No. 24 (+) — Chassis ground (-):</b>	Is the voltage 7 — 14 V?	Repair the harness between the ECM and the auto A/C control module connector.	Replace the ECM.
<b>4 CHECK A/C LOCK SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 14 — Chassis ground:</b>	Is the resistance between 240 — 290 $\Omega$ ?	Replace the ECM.	Go to step 5.
<b>5 CHECK A/C LOCK SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the main fuse box harness connector. 3) Measure the resistance between main fuse box terminal. <b>Connector &amp; terminal</b> <b>(F37) No. 16 — No. 18:</b>	Is the resistance between 240 — 290 $\Omega$ ?	Go to step 7.	Go to step 6.
<b>6 CHECK A/C LOCK SENSOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the A/C lock sensor connector. 3) Measure the resistance between A/C lock sensor terminals. <b>Connector &amp; terminal</b> <b>(F115) No. 1 — No. 2:</b>	Is the resistance between 240 — 290 $\Omega$ ?	Repair or Replace the harness between A/C lock sensor and main fuse box.	Replace the A/C compressor assembly. (A/C lock switch malfunction)
<b>7 CHECK MAIN FUSE BOX.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector and then measure the resistance between main fuse box terminal. <b>Connector &amp; terminal</b> <b>(F37) No. 16 — (B143) No. 12:</b> <b>(F37) No. 18 — (B143) No. 14:</b>	Is the resistance less than 10 $\Omega$ ?	Repair or Replace the harness between A/C lock sensor and main fuse box.	Replace the main fuse box.

# Diagnostics with Phenomenon

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

## 9. Diagnostics with Phenomenon

### A: INSPECTION

Symptom	Problem parts
A/C system fails to operate.	<ul style="list-style-type: none"> <li>• Fuse (M/B No. 8, F/B No. 22, 31)</li> <li>• Connector (Poor contact)</li> <li>• Ground</li> <li>• Auto A/C control module</li> <li>• Blower fan motor</li> <li>• Blower fan relay</li> <li>• A/C relay</li> <li>• Compressor (Magnet clutch)</li> <li>• Evaporator sensor</li> </ul>
Fuse is blown out.	<ul style="list-style-type: none"> <li>• Fuse (M/B No. 8, F/B No. 22, 31)</li> <li>• Connector (Poor contact)</li> </ul>
Illumination cannot dim.	<ul style="list-style-type: none"> <li>• Fuse (M/B No. 8, F/B No. 22, 31)</li> <li>• Connector (Poor contact)</li> <li>• Auto A/C control module</li> <li>• Body integrated unit</li> </ul>
Blower fan does not rotate or fan speed cannot be controlled.	<ul style="list-style-type: none"> <li>• Fuse (F/B No. 22, 27, 28)</li> <li>• Connector (Poor contact)</li> <li>• Ground</li> <li>• Auto A/C control module</li> <li>• Blower fan motor</li> <li>• Blower fan relay</li> </ul>
Unable to switch suction vents.	<ul style="list-style-type: none"> <li>• Connector (Poor contact)</li> <li>• Auto A/C control module</li> <li>• Intake door actuator</li> </ul>
Unable to switch vents.	<ul style="list-style-type: none"> <li>• Connector (Poor contact)</li> <li>• Auto A/C control module</li> <li>• Mode door actuator</li> </ul>
The compartment temperature does not rise. (Warm air does not come out.)	<ul style="list-style-type: none"> <li>• Connector (Poor contact)</li> <li>• Auto A/C control module</li> <li>• Air mix door actuator</li> <li>• In-vehicle sensor, ambient sensor, evaporator sensor and sunload sensor</li> <li>• In-vehicle sensor aspirator hose</li> </ul>
The compartment temperature does not lower. (Cold air does not come out.)	<ul style="list-style-type: none"> <li>• Connector (Poor contact)</li> <li>• Auto A/C control module</li> <li>• Air mix door actuator</li> <li>• A/C relay</li> <li>• Compressor (Magnet clutch)</li> <li>• Radiator fan motor</li> <li>• Radiator fan relay</li> <li>• In-vehicle sensor, ambient sensor, evaporator sensor and sunload sensor</li> <li>• In-vehicle sensor aspirator hose</li> </ul>
Compartment temperature is higher or lower than setting temperature.	<ul style="list-style-type: none"> <li>• Auto A/C control module</li> <li>• Air mix door actuator</li> <li>• In-vehicle sensor, ambient sensor, evaporator sensor and sunload sensor</li> <li>• In-vehicle sensor aspirator hose</li> </ul>
Compartment temperature does not quickly respond to setting temperature.	<ul style="list-style-type: none"> <li>• Air mix door actuator</li> <li>• In-vehicle sensor, ambient sensor, evaporator sensor and sunload sensor</li> <li>• In-vehicle sensor aspirator hose</li> </ul>
Radiator fan does not rotate during A/C operation.	<ul style="list-style-type: none"> <li>• Radiator fan motor</li> <li>• Radiator fan relay</li> </ul>

# Diagnostics with Phenomenon

HVAC SYSTEM (AUTO A/C) (DIAGNOSTICS)

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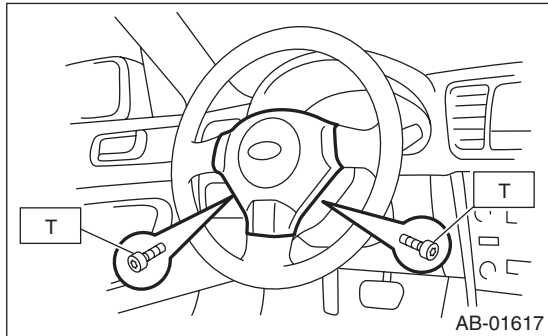
# General Description

## AIRBAG SYSTEM

### 1. General Description

#### A: COMPONENT

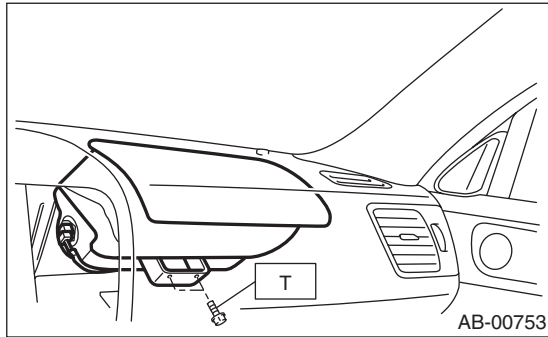
#### 1. DRIVER'S AIRBAG MODULE



**Tightening torque:**

**10 N·m (1.0 kgf·m, 7.2 ft·lb)**

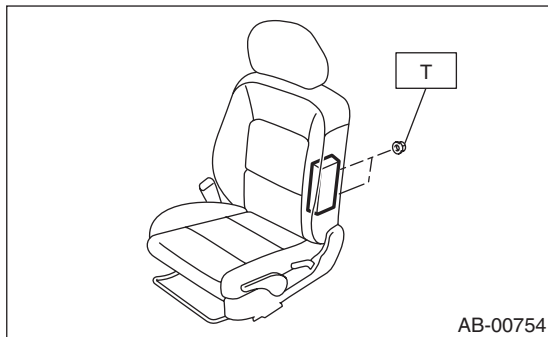
#### 2. PASSENGER'S AIRBAG MODULE



**Tightening torque:**

**7.4 N·m (0.75 kgf·m, 5.5 ft·lb)**

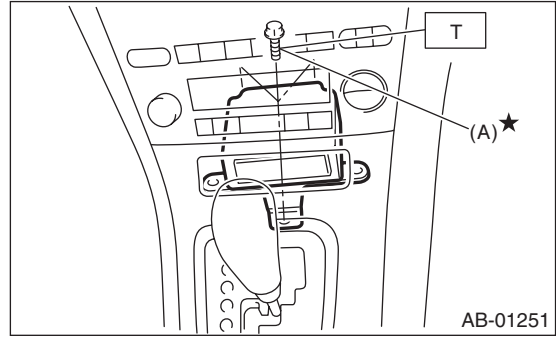
#### 3. SIDE AIRBAG MODULE



**Tightening torque:**

**6 N·m (0.61 kgf·m, 4.4 ft·lb)**

#### 4. AIRBAG CONTROL MODULE



(A) Bolt

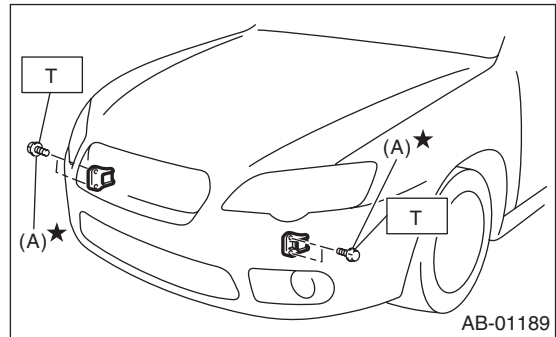
**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.1 ft·lb)**

**CAUTION:**

**Do not reuse mounting bolts and nuts.**

#### 5. FRONT SUB SENSOR



(A) Bolt

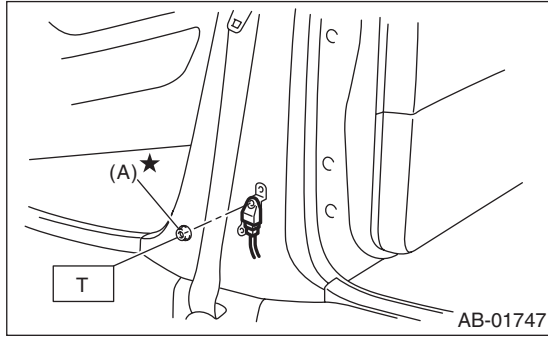
**Tightening torque:**

**13 N·m (1.32 kgf·m, 9.6 ft·lb)**

**CAUTION:**

**Do not reuse mounting bolts and nuts.**

## 6. SIDE AIRBAG SENSOR

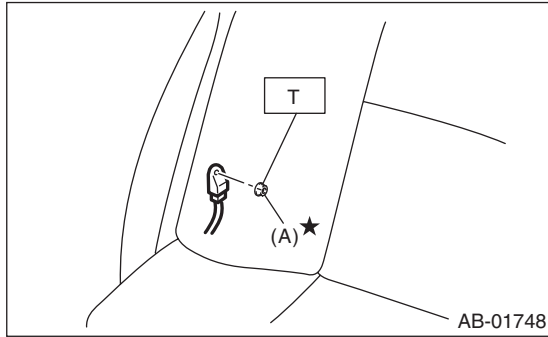


(A) Nut

**Tightening torque:**  
**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**

**CAUTION:**  
Do not reuse mounting bolts and nuts.

## 7. CURTAIN AIRBAG SENSOR

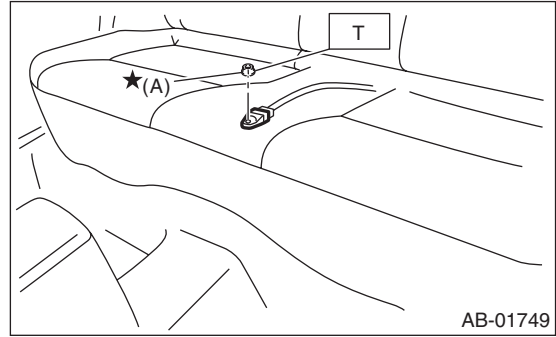


(A) Nut

**Tightening torque:**  
**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**

**CAUTION:**  
Do not reuse mounting bolts and nuts.

## 8. SATELLITE SAFING SENSOR

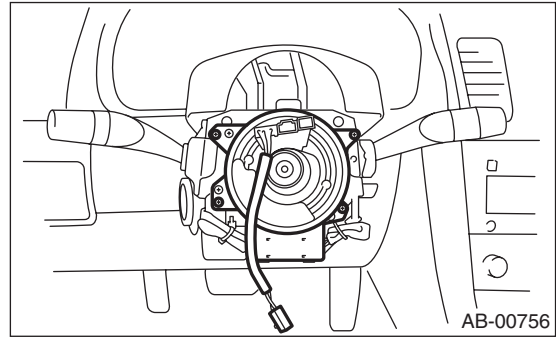


(A) Nut

**Tightening torque:**  
**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**

**CAUTION:**  
Do not reuse mounting bolts and nuts.

## 9. STEERING ROLL CONNECTOR

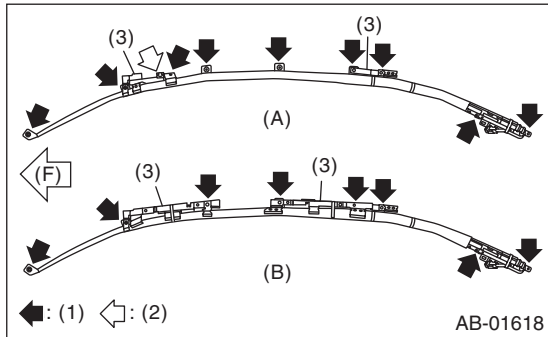


# General Description

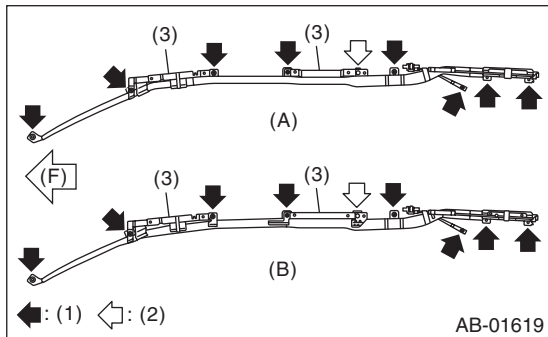
## AIRBAG SYSTEM

### 10. CURTAIN AIRBAG MODULE

- Sedan model



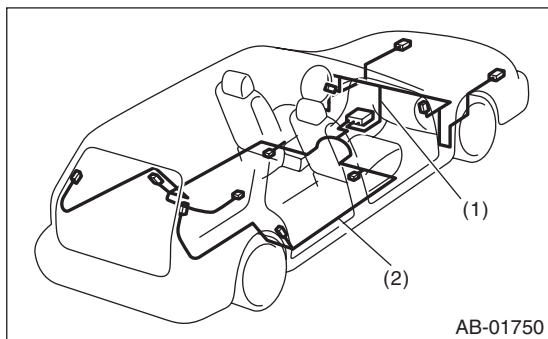
- Wagon model



- |                            |                 |
|----------------------------|-----------------|
| (A) Model with sunroof     | (1) Bolt        |
| (B) Models without sunroof | (2) Clip        |
| (F) Front side of vehicle  | (3) Plate guard |

**Tightening torque:**  
**7.5 N·m (0.77 kgf-m, 5.5 ft-lb)**

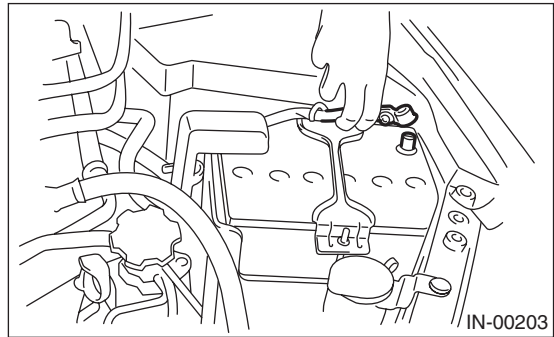
### 11. AIRBAG HARNESS



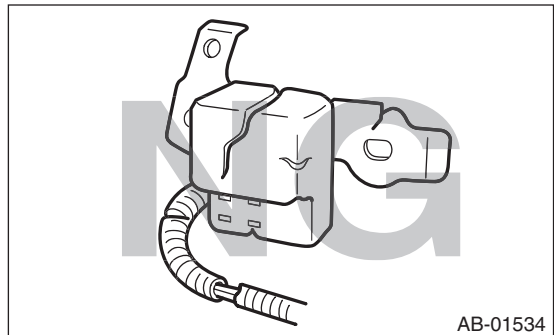
- (1) Airbag main harness
- (2) Airbag rear harness

### B: CAUTION

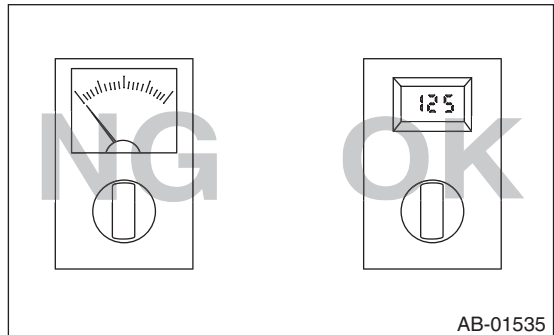
- When servicing a vehicle, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more before starting work.
- The airbag system is fitted with a backup power source. After disconnecting the battery ground cable, the airbag may deploy if you do not wait for 20 seconds or more before starting airbag system servicing.



- If sensors, airbag module, airbag control module, pretensioner or harness is deformed or damaged, replace with new part.

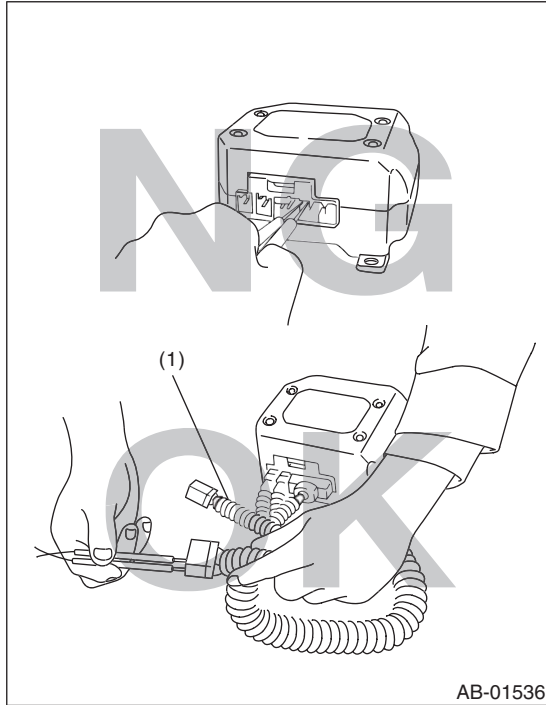


- Do not use the airbag system and pretensioners on other vehicles. When replacing parts, be sure to replace them with new parts.
- When checking the airbag system, be sure to use a digital circuit tester. Use of an analog circuit tester may cause the airbag to activate erroneously due to a minimal current inside tester.

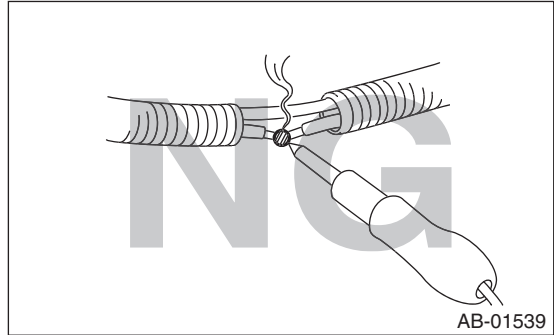




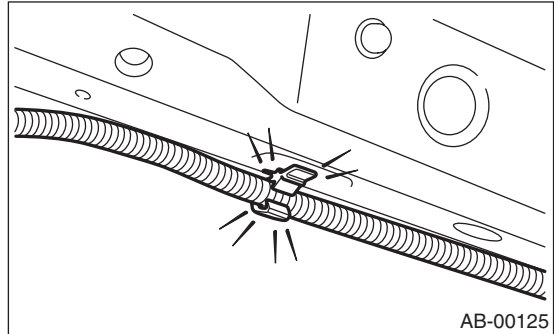
- When checking, use a test harness (1). Damage to connector terminal causes malfunction. Do not directly put the tester probe on airbag connector terminal.



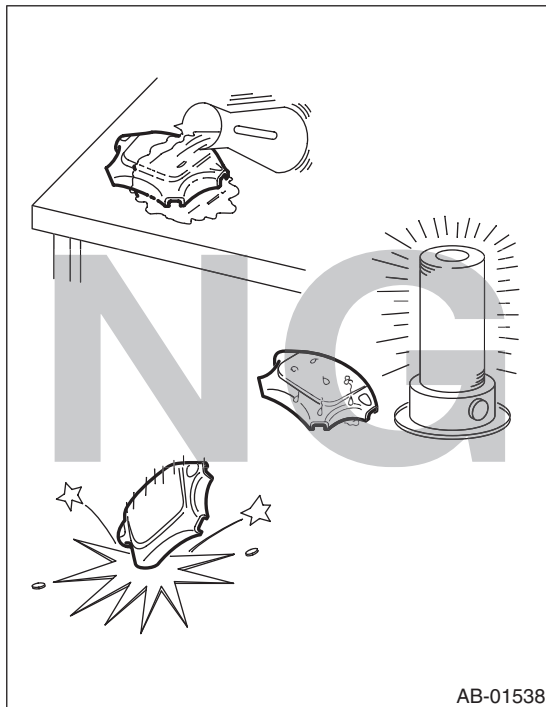
- If damage, open circuit or rust is found on airbag system wiring harness, do not use a soldering equipment to repair. Replace the faulty harness with a new genuine part.



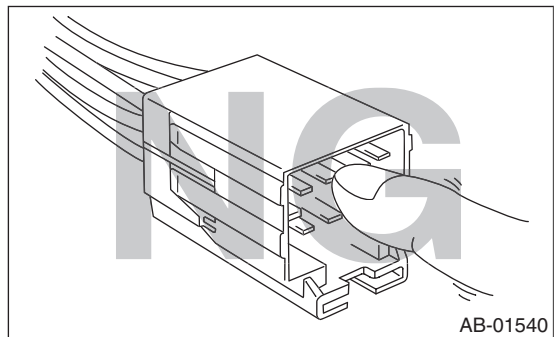
- Install the wiring harness securely with the specified clips to avoid interference or tangled with other parts.



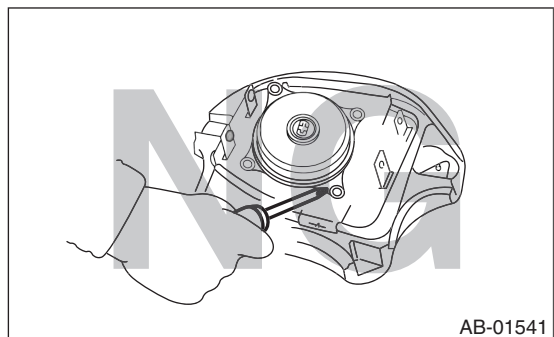
- Do not drop the airbag system parts, or keep them at high temperature of 93°C (199°F) or more, or let water, oil or grease get on them; the internal parts may be damaged and reliability greatly lowered.



- Do not allow water or oil to come in contact with the connector terminals. Also do not touch the connector terminals.



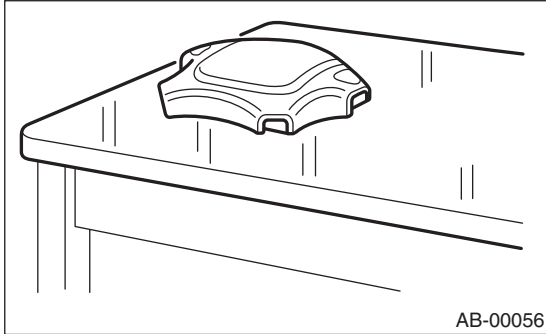
- The driver's, passenger's, side, curtain airbag modules, and the pretensioner must not be disassembled.



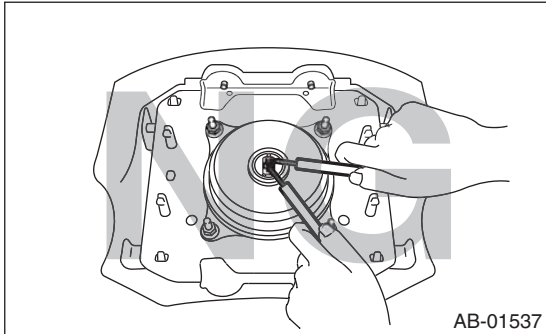
# General Description

## AIRBAG SYSTEM

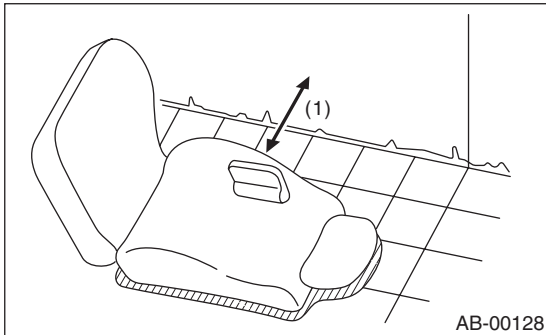
- The airbag module cannot be used again if deployed once.
- After removal, keep the airbag module with the pad side facing upward on a dry, clean and flat surface away from heat, light sources, moisture and dust.



- Do not check continuity of the airbag modules for driver's side, passenger's side and curtain, or the pretensioner.

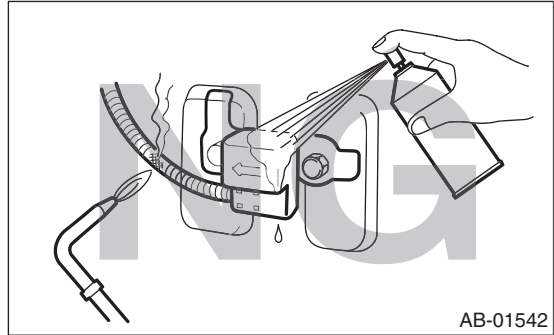


- The removed front seat with airbag module must be kept at least 200 mm (8 in) away from walls and other objects.



(1) 200 mm (8 in) or more

- When painting or performing sheet metal work on the side of the vehicle, including the side sill, center pillar and front and rear doors, remove the side airbag sensors and wiring harness of the airbag system.



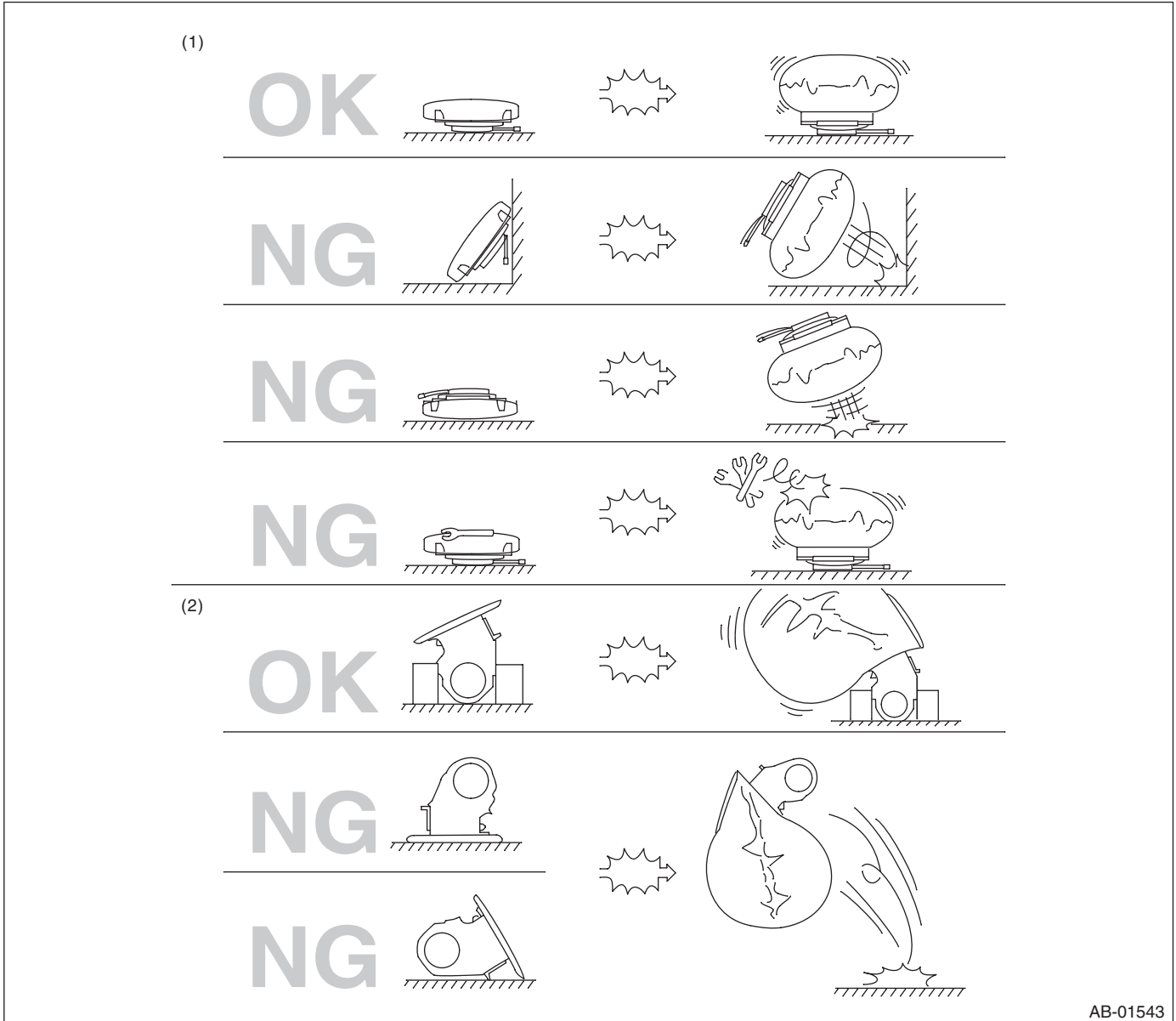
- Do not discard undeployed airbag module. They could easily cause a serious accident if accidentally deployed.

- When painting or performing sheet metal work on the front part of the vehicle, including the front wheel apron, front fender and front side frame, remove the front sub sensors and wiring harness of airbag system.

# General Description

AIRBAG SYSTEM

- When storing a removed airbag module, do not place it with the pad side facing downward. Do not place any objects on the airbag module. Do not pile airbag modules on top of each other. If the airbag inflates for some reason when an airbag module pad is touching other objects, it may cause serious accident.



(1) Driver's airbag module

(2) Passenger's airbag module

## C: PREPARATION TOOL

### 1. GENERAL TOOL

TOOL NAME	REMARKS
TORX® T30	Used for removing and installing driver's airbag module.

# Airbag Connector

AIRBAG SYSTEM

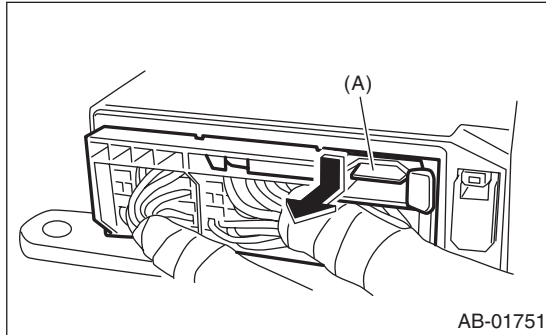
## 2. Airbag Connector

### A: PROCEDURE

#### 1. AIRBAG CONTROL MODULE

1) How to disconnect:

Press the lock lever plate (A) and pull out the lock lever.



2) How to connect:

Insert the connector, push the lock lever in securely.

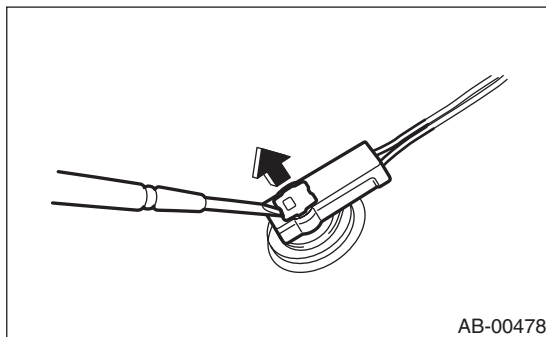
#### CAUTION:

**Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.**

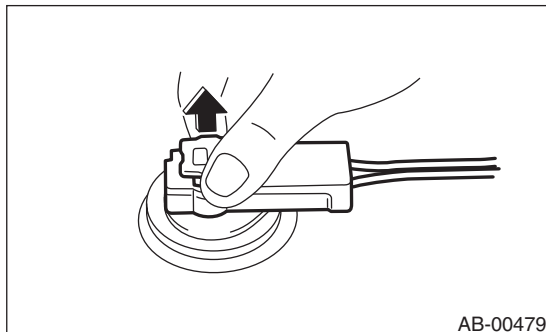
#### 2. DRIVER'S AIRBAG MODULE, PRETENSIONER AND CURTAIN AIRBAG MODULE

1) How to disconnect:

(1) Using a flat tip screwdriver, pry the push lock upward to unlock.



(2) Pull the connector to disconnect from the driver's airbag module assembly or the retractor assembly.

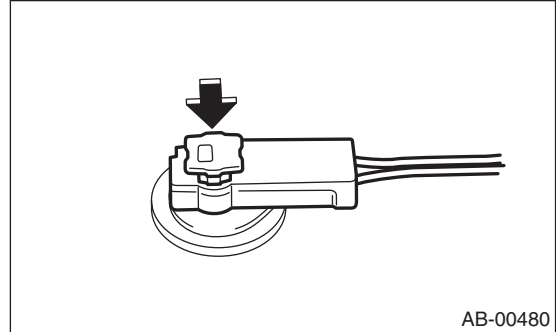


2) How to connect:

Connect the connector in the reverse order of disconnecting. At this time, be sure to insert the push lock until a clicking sound is heard.

#### CAUTION:

- **Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.**
- **Be sure to push the push lock in securely.**



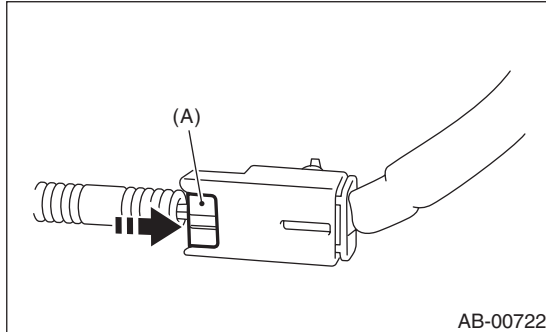
#### NOTE:

The connector cannot be connected when the push lock is in the lock position. Move the push lock to the release position and connect the connector.

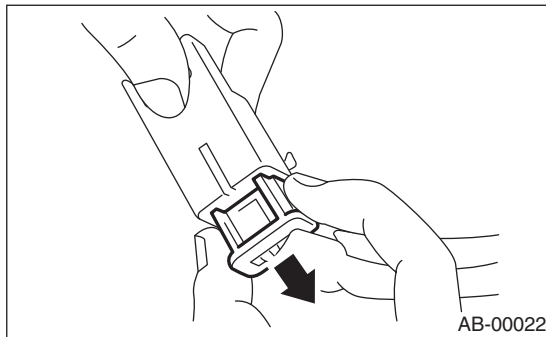
### 3. DRIVER'S AIRBAG (BETWEEN AIRBAG MAIN HARNESS AND ROLL CONNECTOR) AND SIDE AIRBAG

1) How to disconnect:

(1) Push the slide lock (A) in the direction of arrow.



(2) With the slide lock pushed, disconnect the connector.

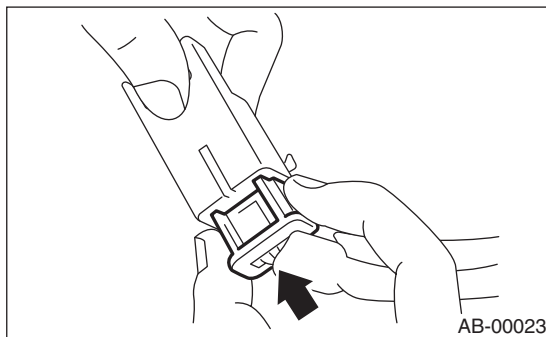


**CAUTION:**  
When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.

2) How to connect:

Holding the connector, push it in securely until a clicking sound is heard.

**CAUTION:**  
Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.

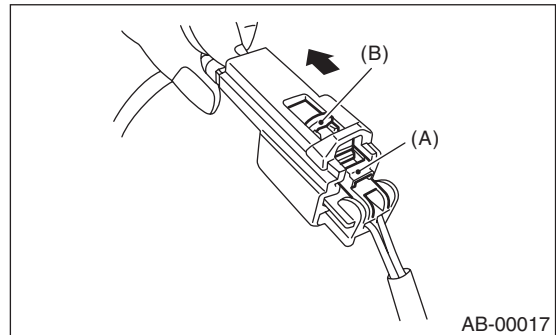


### 4. SIDE AIRBAG

1) How to disconnect:

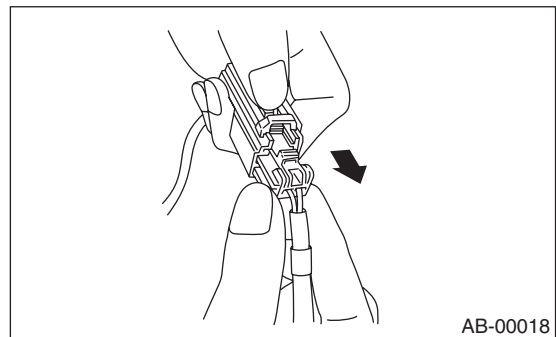
(1) Push the lock arm (A).

(2) With the lock arm (A) pushed in, move the slide lock (B) in the direction of arrow.



(3) With the slide lock moved, release the lock arm (return to original position) and disconnect the connector.

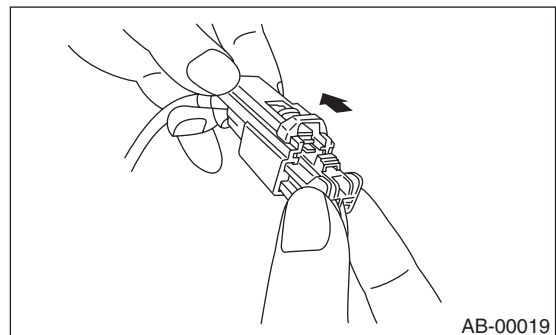
**CAUTION:**  
When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.



2) How to connect:

Holding the connector, push it in securely until a clicking sound is heard.

**CAUTION:**  
Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.



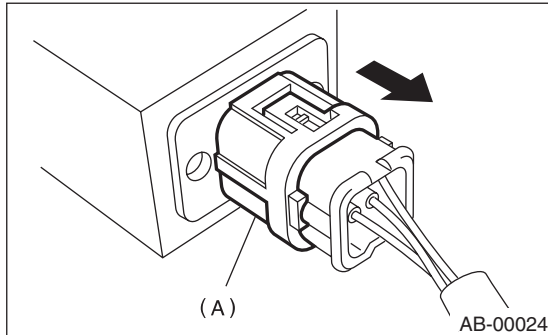
# Airbag Connector

## AIRBAG SYSTEM

### 5. FRONT SUB SENSOR, SIDE AIRBAG SENSOR, CURTAIN AIRBAG SENSOR AND SATELLITE SAFING SENSOR

1) How to disconnect:  
Holding outer part (A), pull it in the direction of arrow.

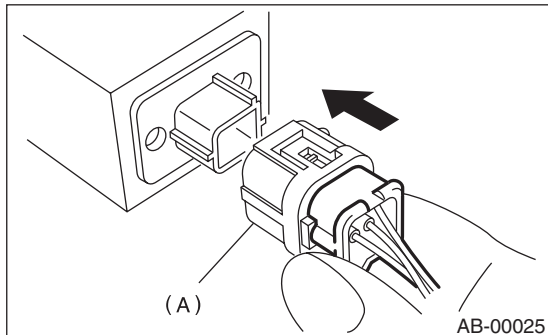
**CAUTION:**  
When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.



2) How to connect:  
Holding the connector, push it in securely until a clicking sound is heard.

**CAUTION:**

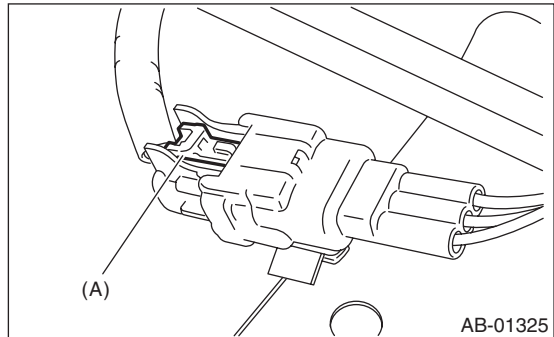
- Do not touch the outer side section or else the outer side (A) will move back.
- Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.



### 6. PASSENGER DETECTION SYSTEM (BETWEEN AIRBAG REAR HARNESS AND SEAT HARNESS) AND BELT TENSION SENSOR

1) How to disconnect:  
Push lock arm (A), then disconnect the connector.

**CAUTION:**  
When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.



2) How to connect:  
Holding the connector, push it in securely until a clicking sound is heard.

**CAUTION:**  
Be sure to insert the connector in until it is locked. Then pull it lightly to make sure that it is locked.

## 3. Inspection Locations After a Collision

### A: REPLACEMENT

Replace the following parts when the airbag is deployed.

#### 1. FRONT COLLISION

- 1) Driver's airbag module
- 2) Passenger's airbag module
- 3) Driver's seat belt (Pretensioner)
- 4) Passenger's seat belt (Pretensioner)
- 5) Airbag control module
- 6) Front sub sensor (L/R)
- 7) Roll connector
- 8) Instrument panel (for integrating with passenger's airbag module)
- 9) Passenger's side seat cushion pad and frame assembly

#### 2. SIDE COLLISION

- 1) Airbag control module
- 2) Satellite safing sensor
- 3) Side airbag module (operating side seat backrest)
- 4) Side airbag sensor (operating side)
- 5) Curtain airbag module (operating side)
- 6) Curtain airbag sensor (operating side)

#### 3. INSPECTION OF OTHER PARTS

Check for the following parts, and replace the damaged parts with new parts.

- 1) Steering wheel and steering shaft  
Check the steering shaft for mounting conditions and deflection of front and rear, upward and downward directions, and deflection of front and rear direction with tilt lever released. (After a collision, absorbing part of steering shaft may have been operated.)
- 2) Check the direct type connector of drivers airbag module, curtain airbag module and pretensioner, etc. for damage, and also check each harness for pinch and connector damage. Replace the harness as a unit if damage is found.
- 3) Check the seat cushion frame, backrest, slide rail and headrest for deformation, distortion, crack, and installing condition and play.
- 4) For the passenger's seat, replace the seat cushion pad and frame assembly with a new part if the seat cushion pad and frame assembly is deformed or cracked.
- 5) If there are tears or loosening in the passenger's side seat cushion cover, it may interfere with the proper operation of the passenger detection system. Replace with a new cushion cover.

6) Be sure to perform the system calibration for the occupant detection system after removing or replacing the passenger seat cushion cover. Failure to do so may cause improper operation of the occupant detection system. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

7) Use the Subaru Select Monitor to check whether the passenger's seat belt buckle switch is operating normally.

### B: INSPECTION

If the vehicle is involved in a collision, even if it is a slight collision, be sure to check the following systems.

#### 1. DRIVER'S AIRBAG MODULE

1) Check for the following, and replace the damaged parts with new parts.

- Airbag module is cracked or deformed.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.
- The module surface is fouled with grease, oil, water or cleaning solvent.

2) When installing a new driver's airbag module, check for the following, and replace the damaged parts with new parts.

- The steering wheel is in the way, making it difficult to install the airbag module.
- The clearance between the driver's airbag module and steering wheel is not constant.
- When steering wheel deformation in axial and vertical directions exceed limits.

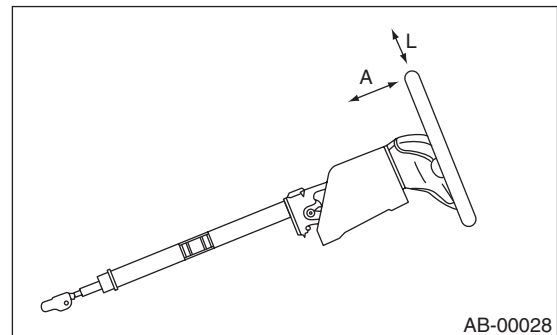
#### Specification:

##### **Axial deflection A**

**Less than 6 mm (0.24 in)**

##### **Vertical deflection L**

**Less than 15 mm (0.59 in)**



# Inspection Locations After a Collision

## AIRBAG SYSTEM

### 2. PASSENGER'S AIRBAG MODULE

Check for the following, and replace the damaged parts with new parts.

- Airbag module and instrument panel are cracked or deformed.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.
- Mounting bracket is cracked or deformed.

### 3. SIDE AIRBAG MODULE

Check for the following, and replace the damaged parts with new parts.

- Front seat, airbag module and mounting bracket are damaged or deformed.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.

### 4. CURTAIN AIRBAG MODULE

Check for the following, and replace the damaged parts with new parts.

- Airbag cover is scratched or torn.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.
- Mounting bracket and securing clip are cracked or deformed.

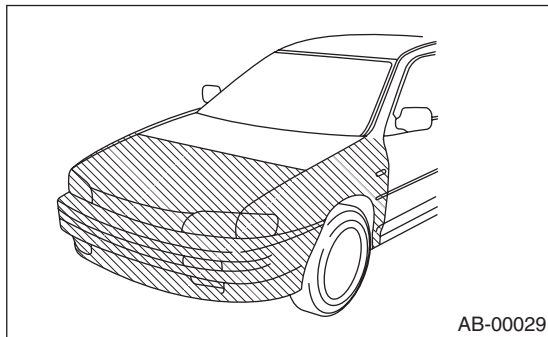
### 5. AIRBAG CONTROL MODULE

Check for the following, and replace the damaged parts with new parts.

- Control module is cracked or deformed.
- Mounting bracket is cracked or deformed.
- Connector is scratched, cracked or deformed.
- Airbag is deployed.
- Side airbag is deployed.
- Curtain airbag is deployed.

### 6. FRONT SUB SENSOR

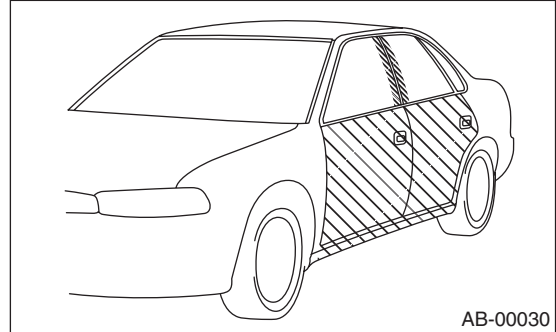
If the section of vehicle as shown in the figure is damaged, check the following items and replace the damaged parts with new parts.



- Front sub sensor is cracked or deformed.
- Mounting bracket is cracked or deformed.
- Connector is scratched, cracked or deformed.
- Airbag is deployed.

### 7. SATELLITE SAFING SENSOR, SIDE AIRBAG SENSOR AND CURTAIN AIRBAG SENSOR

If the section of vehicle as shown in the figure is damaged, check the following items and replace the damaged parts with new parts.



- Satellite safing sensor, Side airbag sensor and curtain airbag sensor are cracked or deformed.
- Mounting bracket is cracked or deformed.
- Satellite safing sensor is cracked or deformed.
- Connector is scratched, cracked or deformed.
- Side airbag or curtain airbag is deployed. (operating side)

### 8. ROLL CONNECTOR

Check for the following, and replace the damaged parts with new parts.

Combination switch or steering roll connector is cracked or deformed.

### 9. STEERING SHAFT

Check for the following, and replace the damaged parts with new parts.

Overall length of steering column should be within specification.

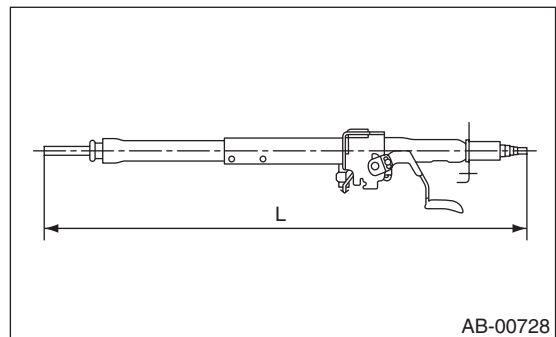
**Specification:**

**Overall length L**

**Tilt and telescopic column (measure while minimized)**

**Except for OUTBACK model**  
 $818.6^{+1.5}_{-1.5} \text{ mm } (32.23^{+0.059}_{-0.059} \text{ in})$

**OUTBACK model**  
 $810.4^{+1.5}_{-1.5} \text{ mm } (31.89^{+0.059}_{-0.059} \text{ in})$





## 10. DRIVER'S SEAT

Check for the following, and replace the damaged parts with new parts.

- Seat belt buckle body/bracket is cracked or deformed.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.

## 11. PASSENGER'S SEAT

1) Check for the following, and replace the damaged parts with new parts.

- Seat belt buckle body, bracket or connector is scratched, cracked or deformed.
- Backrest frame for crack or deformation
- Headrest for deformation or play
- If the seat cushion cover and seat backrest cover is scratched or coming loose, replace with a new cover and readjust the system. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

### **CAUTION:**

**If any of the following applies, replace the seat cushion pad and frame assembly. Do not disassemble.**

- **Cracks or deformation found in the seat cushion frame or seat cushion pad.**
- **Scratches, cracks, or deformation found on the passenger detection system pressure sensor hoses or passenger detection control module, or attachment brackets of the control module.**
- **Harness and/or connector is cracked, deformed or open. Harness wire is exposed.**

2) After checking the installing condition of passenger's seat, perform the system calibration of occupant detection system. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

## 12. BELT TENSION SENSOR

Check for the following, and replace the damaged parts with new parts.

- Belt tension sensor is scratched, cracked, or deformed.
- Harness and/or connector is cracked, deformed or open. Harness wire is exposed.

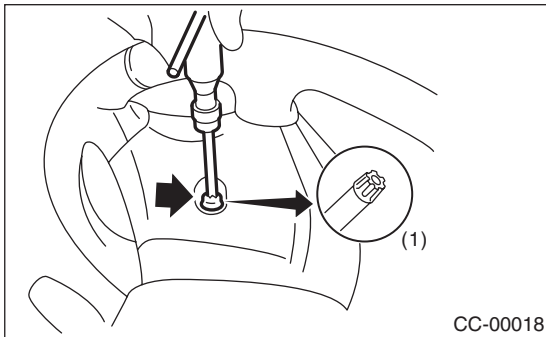
## 4. Driver's Airbag Module

### A: REMOVAL

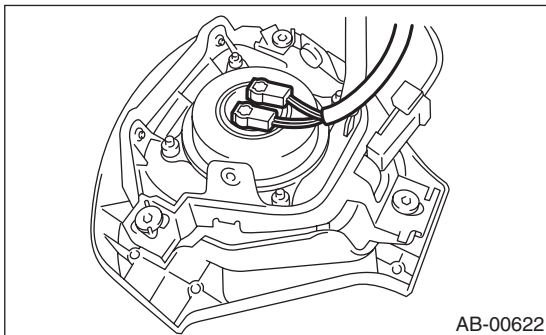
#### CAUTION:

Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

- 1) Position the front wheels straight ahead. (After moving a vehicle 5 m (16 ft) or more with front wheels positioned straight ahead, make sure that the vehicle moves straight ahead.)
- 2) Turn the ignition switch to OFF.
- 3) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 4) Using TORX® bit T30 (1), remove the two TORX® bolts on the side of steering wheel.



- 5) Disconnect the horn harness.
- 6) Disconnect the airbag connector on the back of airbag module, and then remove the airbag module. <Ref. to AB-8, PROCEDURE, Airbag Connector.>



- 7) Refer to "CAUTION" for handling of a removed airbag module. <Ref. to AB-4, CAUTION, General Description.>

### B: INSTALLATION

#### CAUTION:

- Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>
- To prevent the misconnection, the connector is colored. Connect the harness side connector to the same color of module side connector. Install in the reverse order of removal.

#### Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

### C: INSPECTION

#### CAUTION:

Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

Check for the following, and replace the damaged parts with new parts.

Airbag module, harness, connector and mounting bracket are damaged. <Ref. to AB-11, DRIVER'S AIRBAG MODULE, INSPECTION, Inspection Locations After a Collision.>

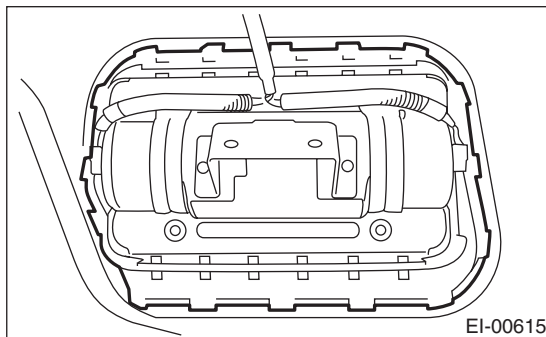
## 5. Passenger's Airbag Module

### A: REMOVAL

**CAUTION:**

Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the instrument panel. <Ref. to EI-57, INSTRUMENT PANEL (EXCLUDING STEERING SUPPORT BEAM), REMOVAL, Instrument Panel Assembly.>
- 4) Remove the claw, and remove the passenger's airbag module.



- 5) Refer to "CAUTION" for handling of a removed airbag module. <Ref. to AB-4, CAUTION, General Description.>

### B: INSTALLATION

**CAUTION:**

Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

Install in the reverse order of removal.

**Tightening torque:**

*7.4 N·m (0.75 kgf-m, 5.5 ft-lb)*

### C: INSPECTION

**CAUTION:**

Refer to "CAUTION" of "General Description" before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

Check for the following, and replace the damaged parts with new parts.

Airbag module, harness, connector and mounting bracket are damaged. <Ref. to AB-12, PASSENGER'S AIRBAG MODULE, INSPECTION, Inspection Locations After a Collision.>

## 6. Side Airbag Module

### A: REMOVAL

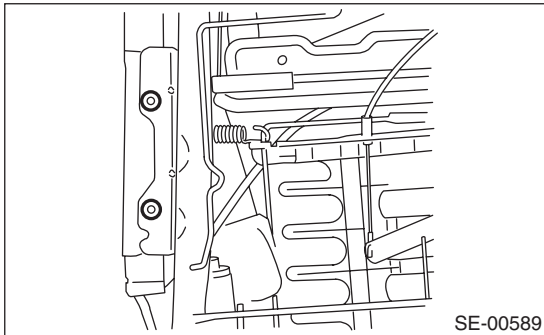
**CAUTION:**

Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

**NOTE:**

Remove the passenger’s side by referring to driver’s side.

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the front seats. <Ref. to SE-9, REMOVAL, Front Seat.>
- 4) Disconnect the connector from the back side of seat cushion assembly, then remove the side airbag harness.
- 5) Remove the backrest cover. <Ref. to SE-9, DISASSEMBLY, Front Seat.>
- 6) Remove the nuts, and remove the side airbag module assembly from the back rest frame assembly.



### B: INSTALLATION

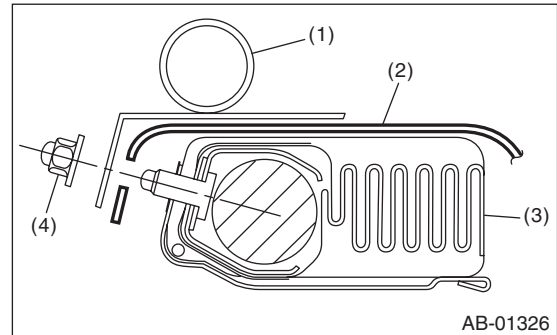
**CAUTION:**

- Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>
- Be sure to perform the system calibration for occupant detection system after passenger’s seat installation. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

- 1) Make sure that there is no foreign matter on side airbag module.
- 2) Install the side airbag module (A) to backrest frame assembly.

**CAUTION:**

When attaching the side airbag module assembly, make sure to sandwich the seat backrest cover between the seat backrest side bracket and side airbag module.



- (1) Backrest frame ASSY
- (2) Backrest cover
- (3) Side airbag module ASSY
- (4) Hexagon cap nut

**Tightening torque:**

**6.0 N·m (0.61 kgf-m, 4.4 ft-lb)**

- 3) Install the backrest cover. <Ref. to SE-15, ASSEMBLY, Front Seat.>
- 4) Draw the side airbag harness around the back side of seat cushion assembly.
- 5) Recline the seat or slide it backward and forward, and check there is no contact between the seat backrest assembly, cushion cover assembly and side airbag harness.

## C: INSPECTION

### CAUTION:

Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

Check for the following, and replace the damaged parts with new parts. <Ref. to AB-12, SIDE AIRBAG MODULE, INSPECTION, Inspection Locations After a Collision.>

1) With side collision (when side airbag is deployed)

- Side airbag module assembly
- Satellite safing sensor
- Side airbag sensor
- Backrest pad assembly
- Backrest frame assembly
- Backrest cover assembly

2) When damage is found by visual check

- Headrest assembly
- Bushing
- Slide rail OUT (Driver's side)
- Slide rail IN (Driver's side)
- Seat cushion pad and frame assembly
- Seat hinge cover
- Seat lifter lever
- Reclining lever
- Side airbag harness and connector on body side
- Satellite safing sensor cover and mounting bracket

3) With side collision (when side airbag is not deployed)

Check the seat, airbag module, sensor visually, and then replace them with new parts if damaged or cracked.

Specially inspect the damage of airbag module body, mounting bracket and harness connector.

4) Without side collision (dirt and damage of cover)

Replace the corresponding part with a new part.

# Curtain Airbag Module

## AIRBAG SYSTEM

### 7. Curtain Airbag Module

#### A: REMOVAL

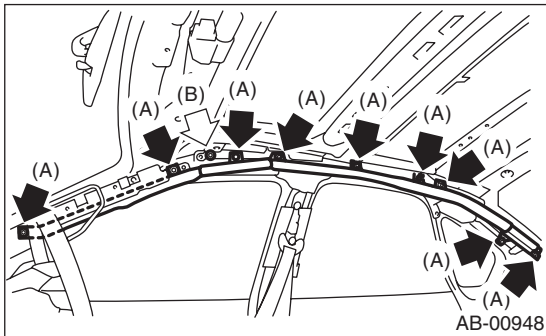
##### CAUTION:

Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

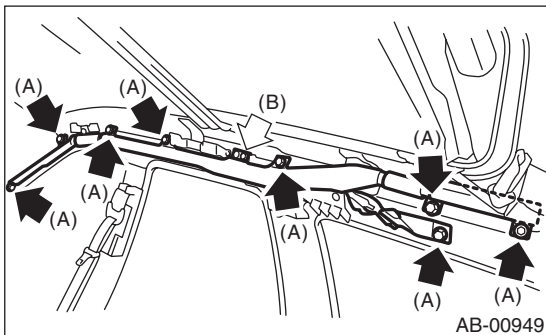
- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the rear quarter trim. (Sedan model) <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 4) Remove the quarter rear pillar trim. (Wagon model) <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>
- 5) Remove the roof trim. <Ref. to EI-67, REMOVAL, Roof Trim.>
- 6) Disconnect the curtain airbag module connector.
- 7) Remove bolt (A) and clip (B), and then remove the curtain airbag module.

##### CAUTION:

- Be careful not to damage the curtain airbag module during removal.
- Never open the curtain airbag module before deploying it. Never reuse the deployed curtain airbag module.
- Sedan model



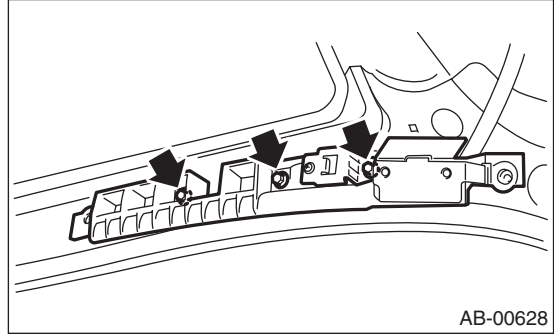
- Wagon model



##### NOTE:

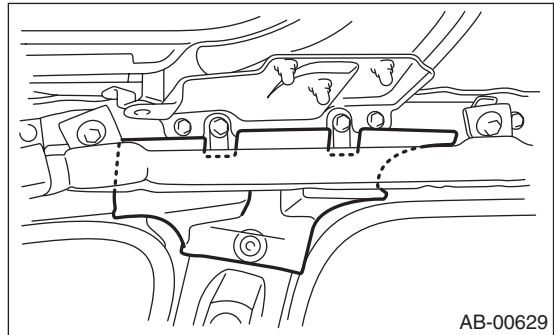
Remove the rear center seat belt retractor on the RH side before servicing.

- 8) Remove the airbag guide A from the front pillar.

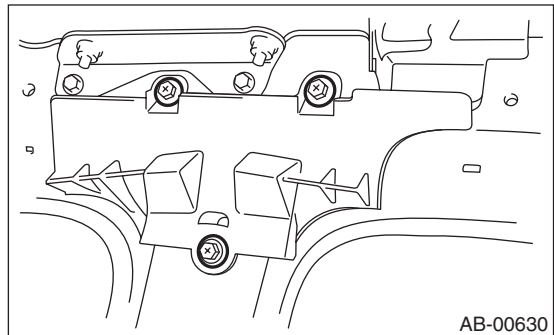


- 9) Remove the airbag guide B from the center pillar.

- Sedan model

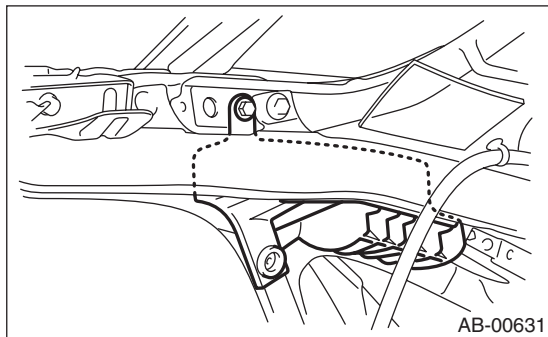


- Wagon model

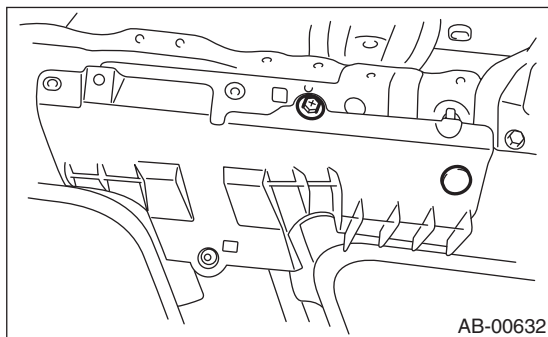


10) Remove airbag guide C from quarter pillar.

- Sedan model



- Wagon model



## B: INSTALLATION

### CAUTION:

- Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>
- When installing the curtain airbag module, install a specified part at specified place.
- Be careful not to damage the curtain airbag module during removal.
- Never open the curtain airbag module before deploying it. Never reuse the deployed curtain airbag module.
- Make sure that there are no foreign matter on airbag module.

Install in the reverse order of removal.

### Tightening torque:

**7.5 N·m (0.77 kgf-m, 5.5 ft-lb)**

## C: INSPECTION

### CAUTION:

Refer to “CAUTION” of “General Description” before handling the airbag module. <Ref. to AB-4, CAUTION, General Description.>

Check for the following, and replace the damaged parts with new parts. <Ref. to AB-12, CURTAIN AIRBAG MODULE, INSPECTION, Inspection Locations After a Collision.>

1) With side collision (when curtain airbag is deployed)

- Curtain airbag module assembly
  - Satellite safing sensor
  - Curtain airbag sensor
  - Roof trim
  - Front pillar upper trim
  - Center pillar upper trim
  - Rear quarter pillar trim
  - Airbag guide A, B, C
- 2) When damage is found by visual check
- Assist grip
  - Assist grip bracket
  - Curtain airbag harness and connector on body side
  - Satellite safing sensor cover and mounting bracket

3) With side collision (when curtain airbag is not deployed)

Check the roof trim, pillar trim and airbag module visually, and then replace them with new parts if damaged or cracked.

Specially inspect the damage of airbag module body, mounting bracket and harness connector.

4) Without side collision (dirt and damage of cover)  
Replace the corresponding part with a new part.

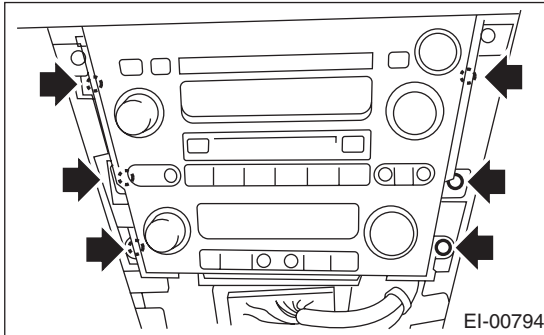
## 8. Airbag Control Module

### A: REMOVAL

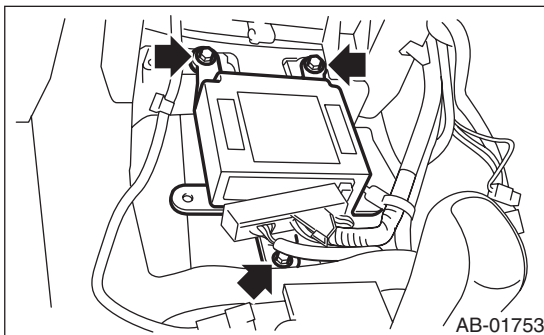
#### CAUTION:

- Do not disassemble the airbag control module.
- If the airbag control module is deformed or if the fault occurs by water, replace the airbag control module with a new part.
- Do not drop the airbag control module.
- After removal, keep the airbag control module on a dry, clean surface away from moisture, heat and dust.

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the center console. <Ref. to EI-55, REMOVAL, Center Console.>
- 4) Remove screws and pull out the audio unit assembly, and disconnect the connector for removal.



- 5) Disconnect the connector from airbag control module.
- 6) Remove the bolts and remove airbag control module.



### B: INSTALLATION

#### CAUTION:

- Do not reuse the bolt and nut.
- Always use new bolts and nuts for them.
- Be sure to put the water protection cover over the connector.

Install in the reverse order of removal.

#### Tightening torque:

25 N·m (2.5 kgf·m, 18.1 ft·lb)

### C: INSPECTION

Check for the following, and replace the damaged parts with new parts.

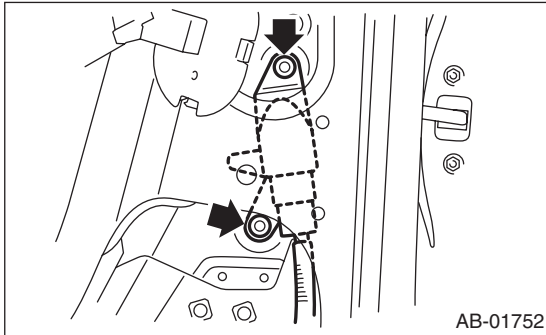
- Control module, connector, and mounting bracket are damaged.
- Airbag is deployed.
- Side airbag is deployed.
- Curtain airbag is deployed.



## 9. Side Airbag Sensor

### A: REMOVAL

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the center pillar lower trim. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>
- 4) Remove the center pillar inner protector lower.
- 5) Remove the front outer seat belt retractor. <Ref. to SB-13, OUTER SEAT BELT ASSEMBLY, REMOVAL, Front Seat Belt.>
- 6) Remove the nuts to remove the side airbag sensor.



#### CAUTION:

Do not separate the side airbag sensor and bracket. It cause the airbag system malfunction.

If the sensor is removed from the bracket, replace them with new parts.

- 7) Disconnect the airbag connector.

### B: INSTALLATION

#### CAUTION:

- Do not reuse the bolt and nut.
- Always use new bolts and nuts for them.

Install in the reverse order of removal.

#### *Tightening torque:*

**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**

### C: INSPECTION

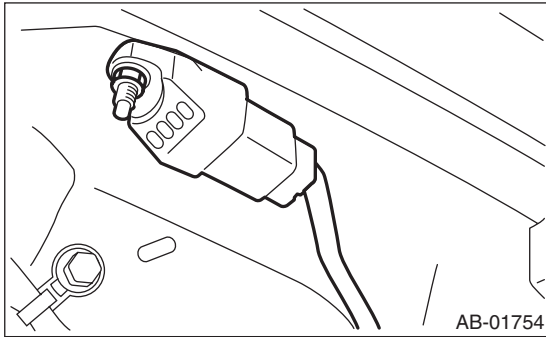
Check for the following, and replace the damaged parts with new parts.

- Mounting bracket or connector of side airbag sensor is damaged.
- Side airbag is deployed.

## 10. Curtain Airbag Sensor

### A: REMOVAL

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the rear seat. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 4) Remove the nuts to remove the curtain airbag sensor.



- 5) Disconnect the airbag connector.

### B: INSTALLATION

#### CAUTION:

- Do not reuse the bolt and nut.
- Always use new bolts and nuts for them.

Install in the reverse order of removal.

#### *Tightening torque:*

*8.0 N·m (0.82 kgf-m, 5.9 ft-lb)*

### C: INSPECTION

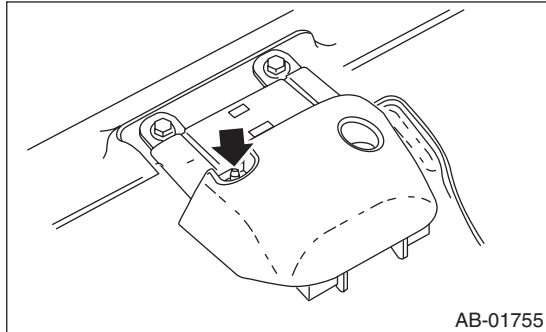
Check for the following, and replace the damaged parts with new parts.

- Curtain airbag sensor connector is damaged.
- Curtain airbag is deployed.

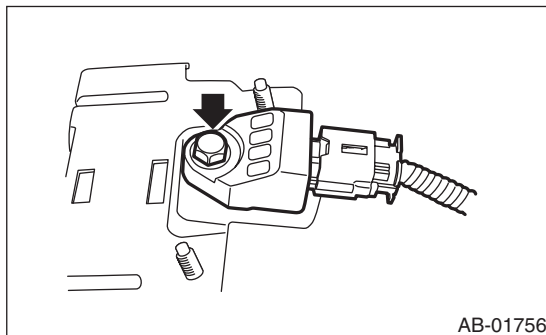
## 11. Satellite Safing Sensor

### A: REMOVAL

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the rear seat cushion. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 4) Remove the nut and remove the cover.



- 5) Remove the bolt, and then detach the satellite safing sensor.



- 6) Disconnect the airbag connector.

### B: INSTALLATION

#### CAUTION:

- Do not reuse the bolt and nut.
- Always use new bolts and nuts for them.

Install in the reverse order of removal.

#### *Tightening torque:*

**8.0 N·m (0.82 kgf-m, 5.9 ft-lb)**

### C: INSPECTION

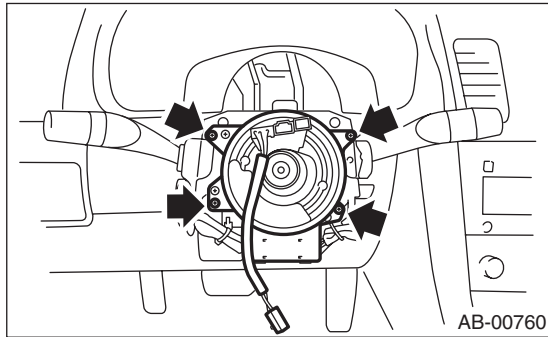
Check for the following, and replace the damaged parts with new parts.

- Mounting bracket or connector of satellite safing sensor is damaged.
- Side airbag or curtain is deployed.

## 12.Roll Connector

### A: REMOVAL

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the driver's airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>
- 4) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 5) Remove the steering column cover.
- 6) Remove the screws, and then remove the roll connector.



### B: INSTALLATION

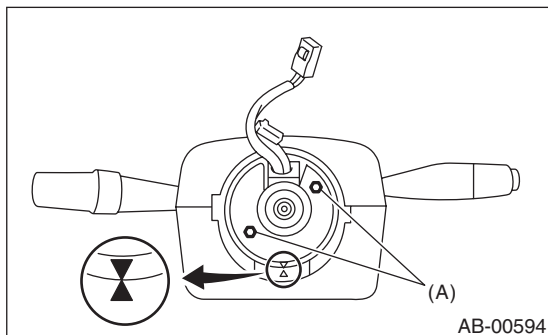
- 1) Install in the reverse order of removal.
- 2) Before installing the steering wheel, be sure to adjust the direction of roll connector with steering. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>

### C: INSPECTION

Check for the following, and replace the damaged parts with new parts.  
Combination switch and roll connector are cracked or deformed.

### D: ADJUSTMENT

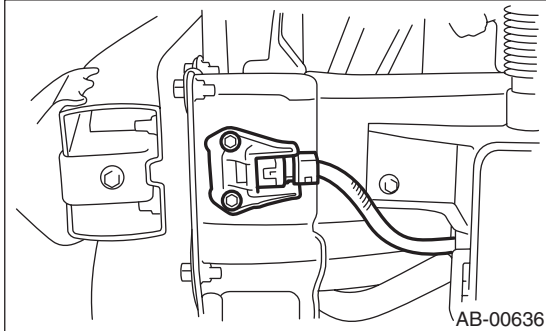
- 1) Check that front wheels are positioned in straight ahead direction.
- 2) Turn the roll connector pin (A) clockwise until it stops.
- 3) Turn the roll connector pins (A) approx. 3.25 turns until "▲" marks are aligned.



## 13. Front Sub Sensor

### A: REMOVAL

- 1) Turn the ignition switch to OFF.
- 2) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 3) Remove the front bumper face. <Ref. to EI-30, FRONT BUMPER FACE, REMOVAL, Front Bumper.>
- 4) Remove the bolt, and then detach the front sub sensor.



- 5) Disconnect the connector from front sub sensor.

### B: INSTALLATION

#### CAUTION:

- Do not reuse the bolt and nut.
- Always use new bolts and nuts for them.

Install in the reverse order of removal.

#### Tightening torque:

**13 N·m (1.32 kgf-m, 9.6 ft-lb)**

### C: INSPECTION

Check for the following, and replace the damaged parts with new parts.

- Front sub sensor, mounting bracket and connector are damaged.
- Airbag is deployed.

# Front Sub Sensor

AIRBAG SYSTEM

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# Basic Diagnostic Procedure

## AIRBAG SYSTEM (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

	Step	Check	Yes	No
1	<b>CHECK WARNING LIGHT.</b> Check whether the airbag warning light in the combination meter is lit.	Does the airbag warning light illuminate?	Go to step 2.	Perform the diagnosis according to phenomenon of the problem.
2	<b>READ DTC.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON and run the Subaru Select Monitor. 4) Read the DTC. <Ref. to AB(diag)-35, OPERATION, Read Diagnostic Trouble Code (DTC).> NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to AB(diag)-32, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 5) Record all DTCs and freeze frame data.	Is DTC displayed?	Go to step 3.	<Ref. to AB(diag)-39, Airbag Warning Light Failure.> Go to "Airbag Warning Light Failure".
3	<b>PERFORM DIAGNOSIS.</b> 1) Judge the possible cause from "List of Diagnostic Trouble Code". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).> 2) Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". 3) Repair the trouble cause. 4) Perform the Clear Memory Mode. <Ref. to AB(diag)-37, Clear Memory Mode.> 5) Perform the Inspection Mode. <Ref. to AB(diag)-36, Inspection Mode.> 6) Read any other DTCs displayed.	Is DTC displayed?	Perform the procedure 1) to 5) in step 3.	Finish the diagnosis.

# Check List for Interview

AIRBAG SYSTEM (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

Customer's Name		Inspector's Name	
Date Vehicle Brought in	/ /	Registration No.	
Odometer Reading	km miles	V.I.N.	
Date Problem Occurred	/ /	Registration Year	/ /
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others:		
Temperature	°C ( °F)		
Road Condition	<input type="checkbox"/> Flat road <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Gravel road <input type="checkbox"/> Others:		
Vehicle Operation	<input type="checkbox"/> Starting <input type="checkbox"/> Idling <input type="checkbox"/> Driving <input type="checkbox"/> Constant speed <input type="checkbox"/> Accelerating <input type="checkbox"/> Decelerating <input type="checkbox"/> Turning <input type="checkbox"/> Others:		
Details of Problem			
Airbag Warning Light Operation	<input type="checkbox"/> Normal (After turning the ignition switch to ON, lit for approximately 6 seconds and goes off.) <input type="checkbox"/> Remains ON <input type="checkbox"/> Remains OFF		
DTC output	<input type="checkbox"/> OK code <input type="checkbox"/> DTC: (Code: )		



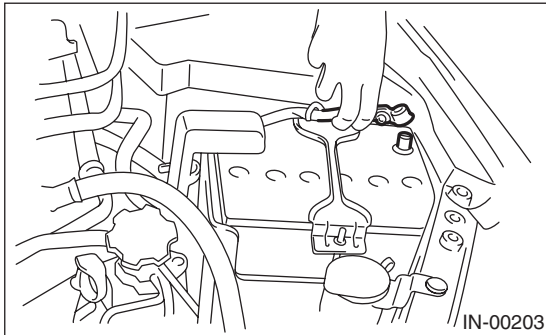
# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

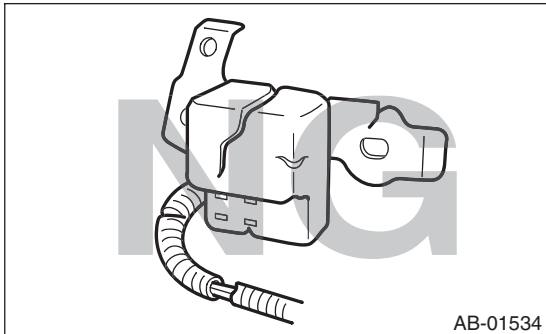
### 3. General Description

#### A: CAUTION

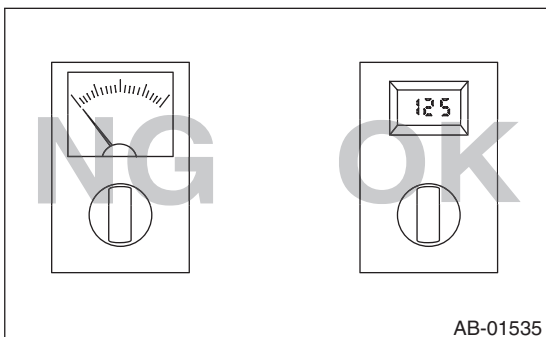
- When servicing a vehicle, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more before starting work.
- The airbag system is fitted with a backup power source. If the airbag system is serviced within 20 seconds after the ground cable is disconnected, it may inflate.



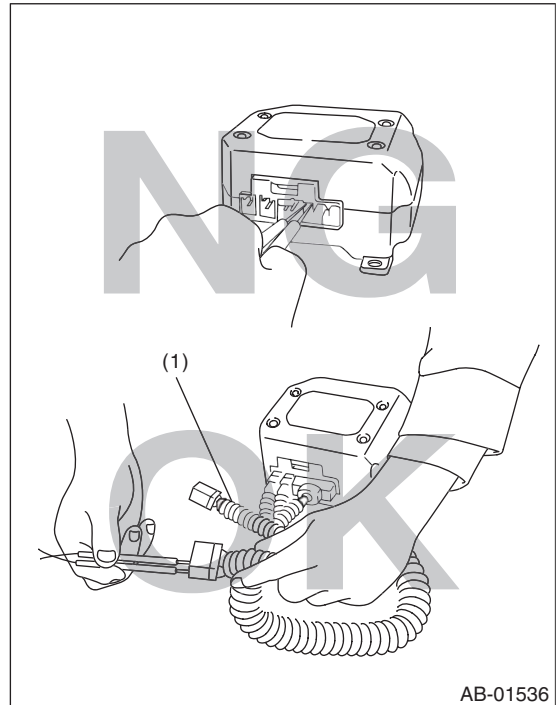
- If sensors, airbag module, airbag control module, pretensioner or harness is deformed or damaged, replace with new parts.



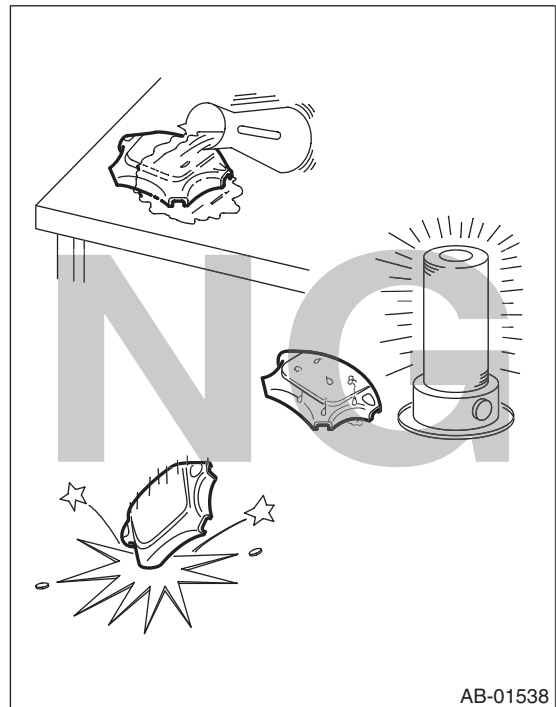
- Do not use the airbag system and pretensioners on other vehicles. When replacing parts, be sure to replace them with new parts.
- When checking the airbag system, be sure to use a digital circuit tester. Use of an analog circuit tester may cause the airbag to activate erroneously due to a minimal current inside tester.



- When checking, use a test harness (1). Damage to connector terminal causes malfunction. Do not directly put the tester probe on airbag connector terminal.



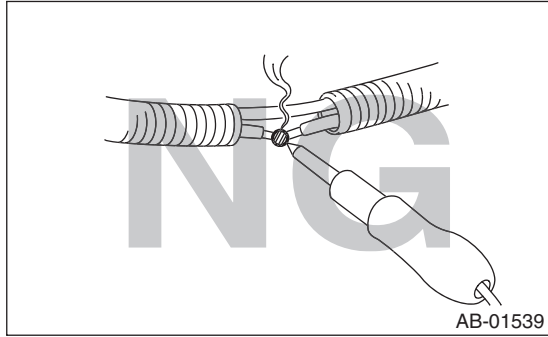
- Do not drop the airbag system parts, or keep them at high temperature of 93°C (199°F) or more, or let water, oil or grease get on them; the internal parts may be damaged and reliability greatly lowered.



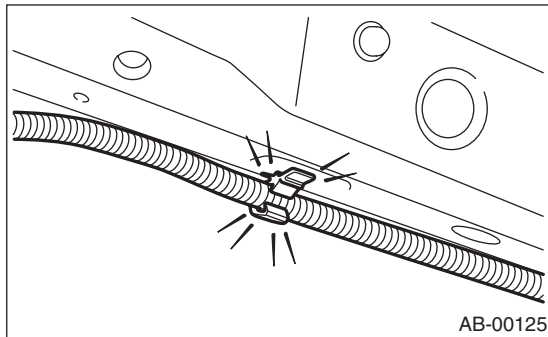
# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

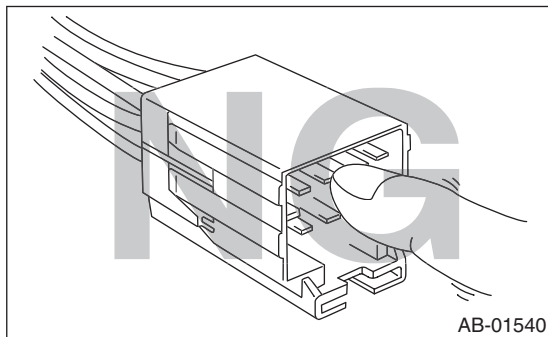
- If damage, open circuit or rust is found on airbag system wiring harness, do not use a soldering equipment to repair. Replace the faulty harness with a new genuine part.



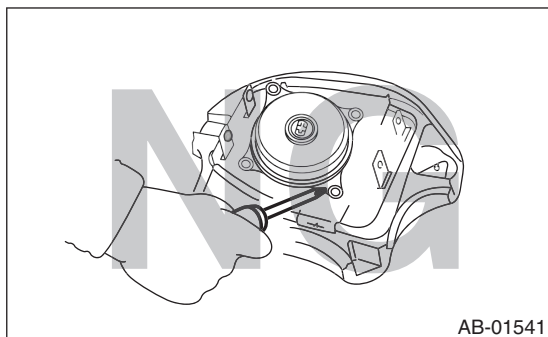
- Install the wiring harness securely with the specified clips to avoid interference or tangled with other parts.



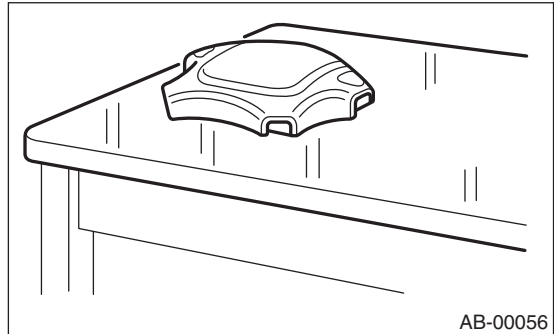
- Do not allow water or oil to come in contact with the connector terminals. Also, do not touch the connector terminals.



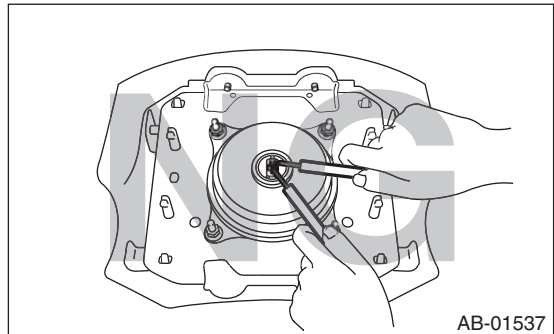
- Do not disassemble driver's airbag module, passenger's airbag module, side or curtain airbag modules, or pretensioner.



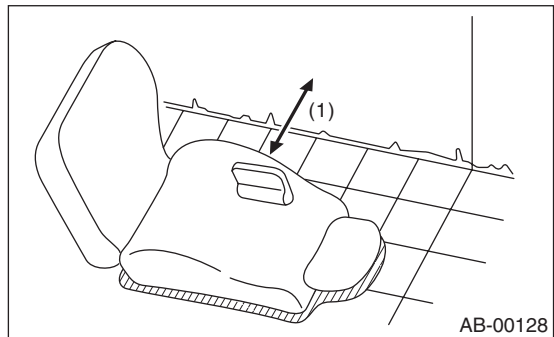
- The airbag module cannot be used again if deployed once.
- After removal, keep the airbag module with the pad side facing upward on a dry, clean and flat surface away from heat, light sources, moisture and dust.



- Do not check continuity of the airbag modules for driver's side, passenger's side and curtain, or the pretensioner.



- The removed front seat with airbag module must be kept at least 200 mm (8 in) away from walls and other objects.



(1) 200 mm (8 in) or more

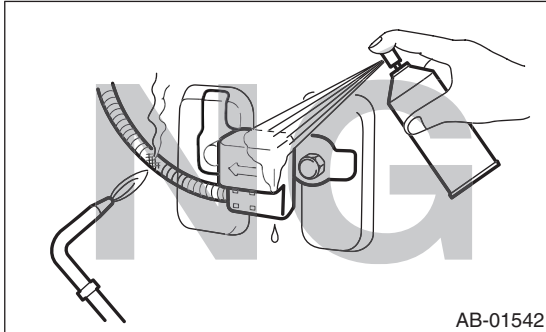
- When painting or performing sheet metal work on the front part of the vehicle, including the front wheel apron, front fender and front side frame, remove the front sub sensors and wiring harness of airbag system.

## General Description

### AIRBAG SYSTEM (DIAGNOSTICS)

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- When painting or repairing sheet metal work on the side of the vehicle, including the side sill, center pillar, front and rear doors, rear crossmember and rear floorpan, remove the side airbag sensors, satellite safing sensor and wiring harness of the airbag system.

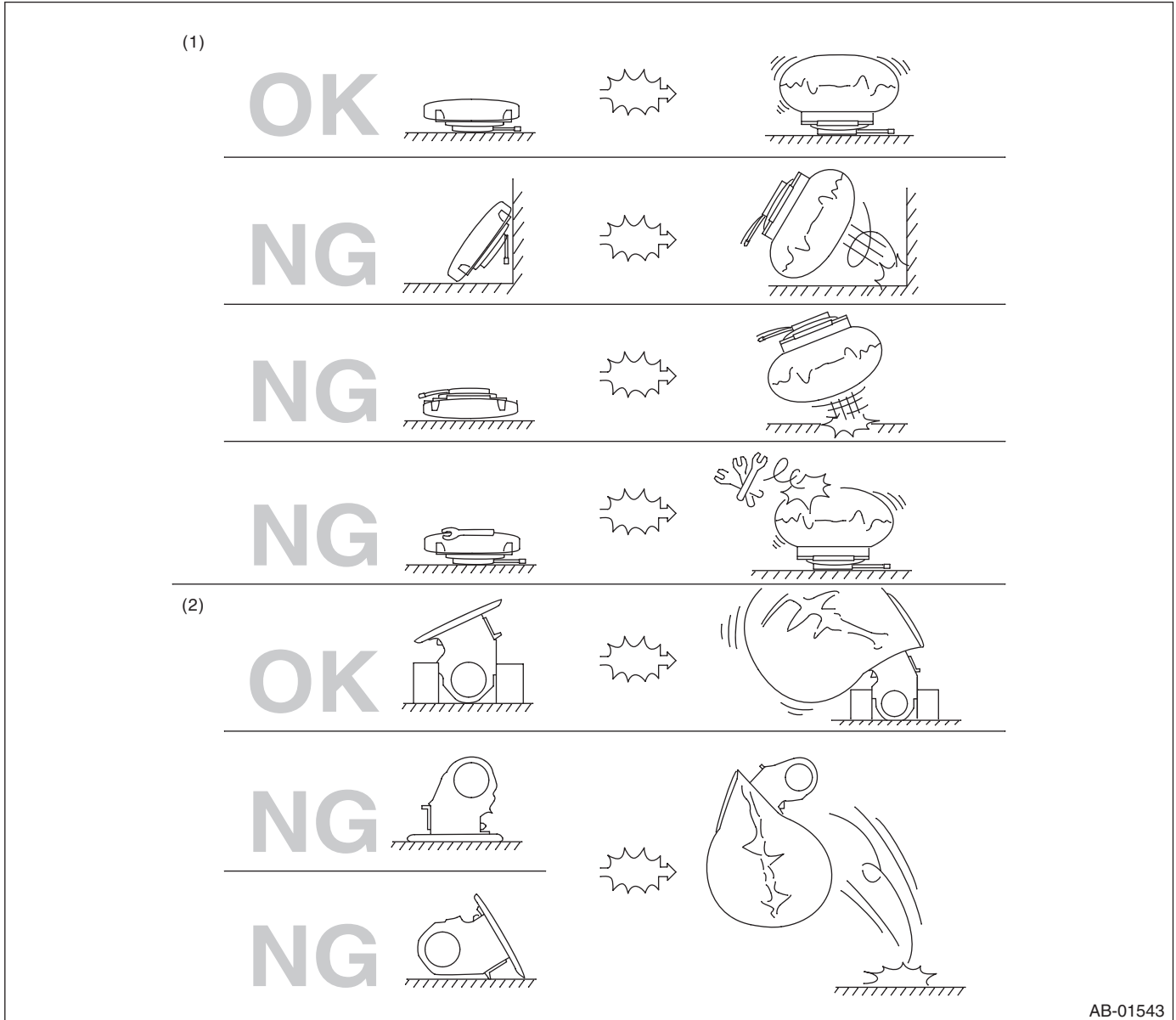


- Do not discard undeployed airbag module. They could easily cause a serious accident if accidentally deployed.

# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

- When storing a removed airbag module, do not place it with the pad side facing downward. Do not place any objects on the airbag module. Do not pile up the airbag module. If the airbag inflates for some reason when an airbag module pad is touching other objects, it may cause serious accident.



AB-01543

(1) Driver's airbag module

(2) Passenger's airbag module

### B: INSPECTION

Measure the battery voltage and check electrolyte.

**Standard voltage: 12 V**

**Specific gravity: 1.260 or more**

# General Description

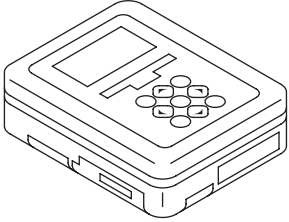
## AIRBAG SYSTEM (DIAGNOSTICS)

### C: PREPARATION TOOL

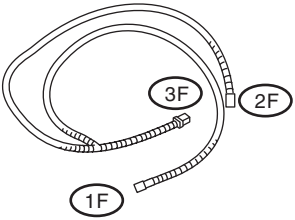
#### CAUTION:

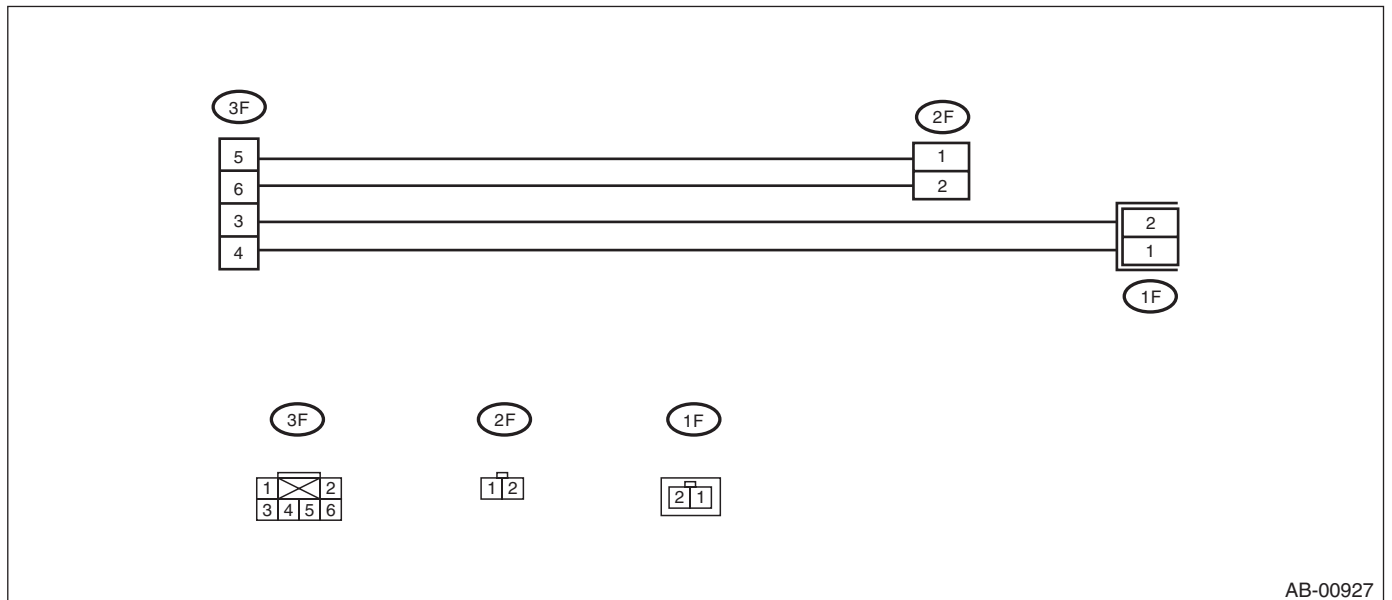
To measure the voltage and resistance of airbag system component, be sure to use the specified test harness.

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

#### • TEST HARNESS F

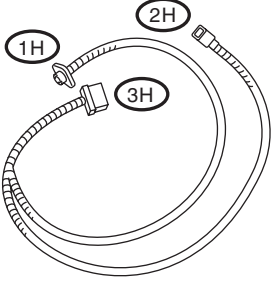
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299FC010</p>	98299FC010	TEST HARNESS F	Used when measuring voltage and resistance of airbag module harnesses.

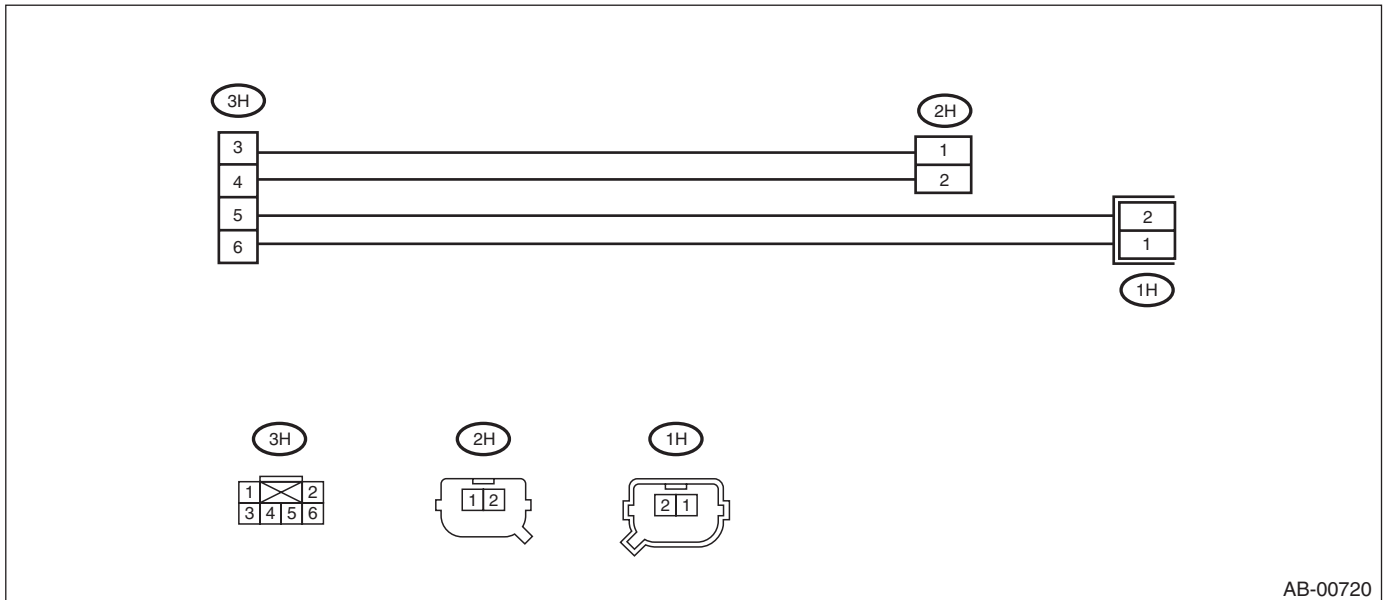


AB-00927

# General Description

• TEST HARNESS H

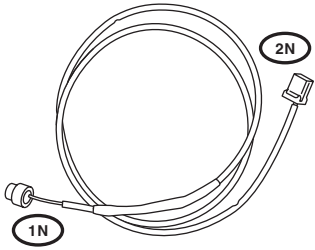
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299FA030</p>	98299FA030	TEST HARNESS H	Used when measuring voltage and resistance of front sub sensor and satellite safing sensor.

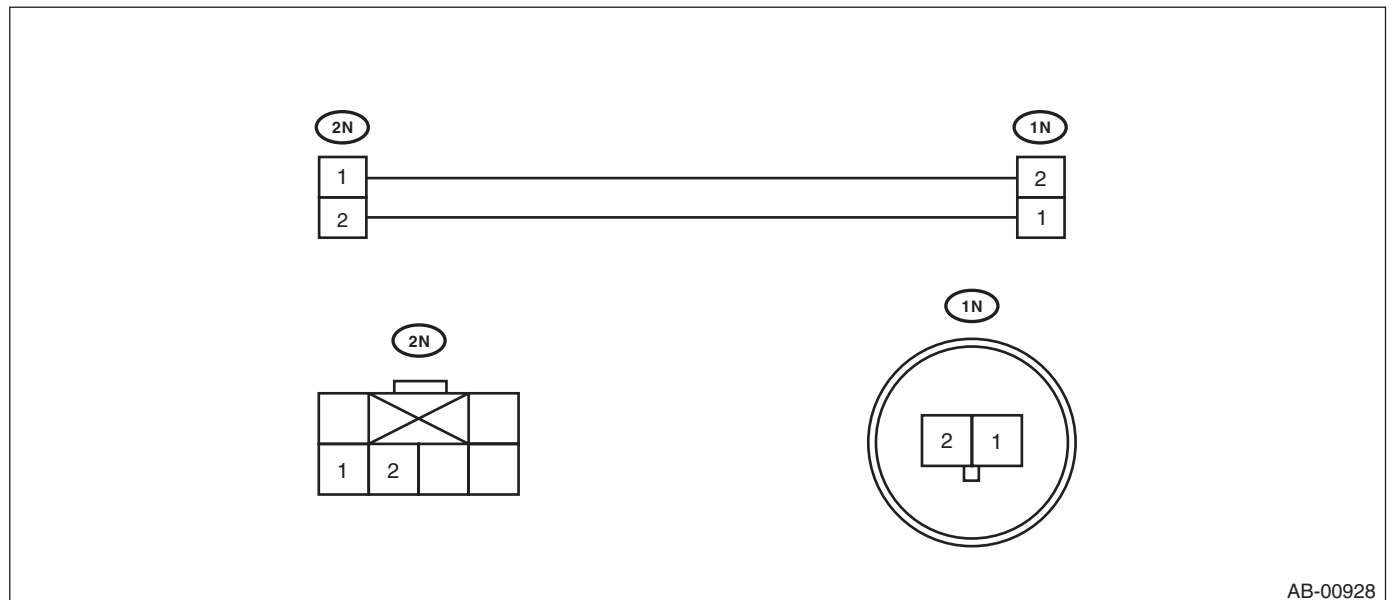


# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

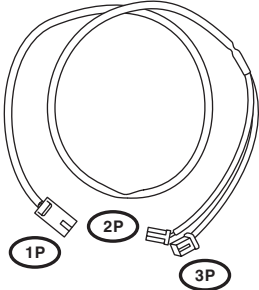
- TEST HARNESS N

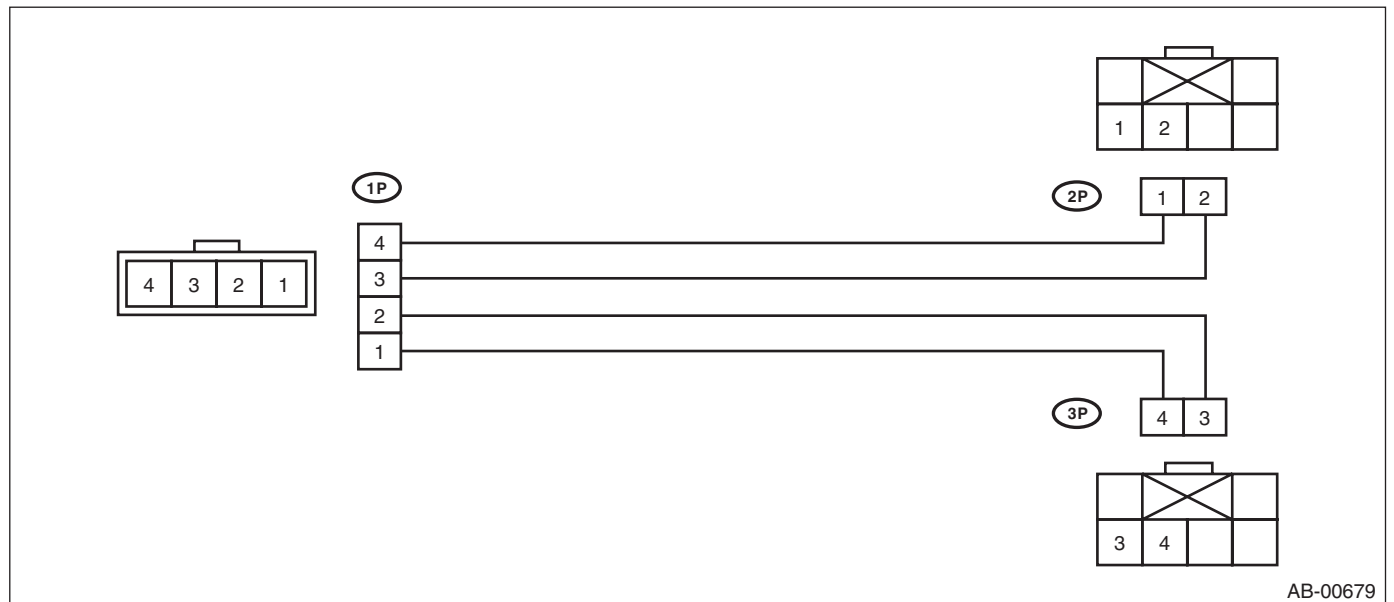
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299SA000</p>	98299SA000	TEST HARNESS N	Used when measuring voltage and resistance of driver's airbag module and seat belt pretensioner.



# General Description

• TEST HARNESS P

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299SA020</p>	98299SA020	TEST HARNESS P	Used when measuring voltage and resistance of driver's airbag module harness and passenger's airbag module harness.

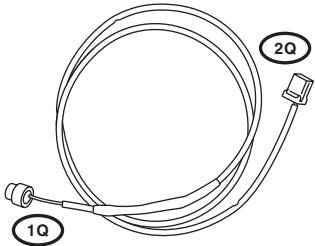


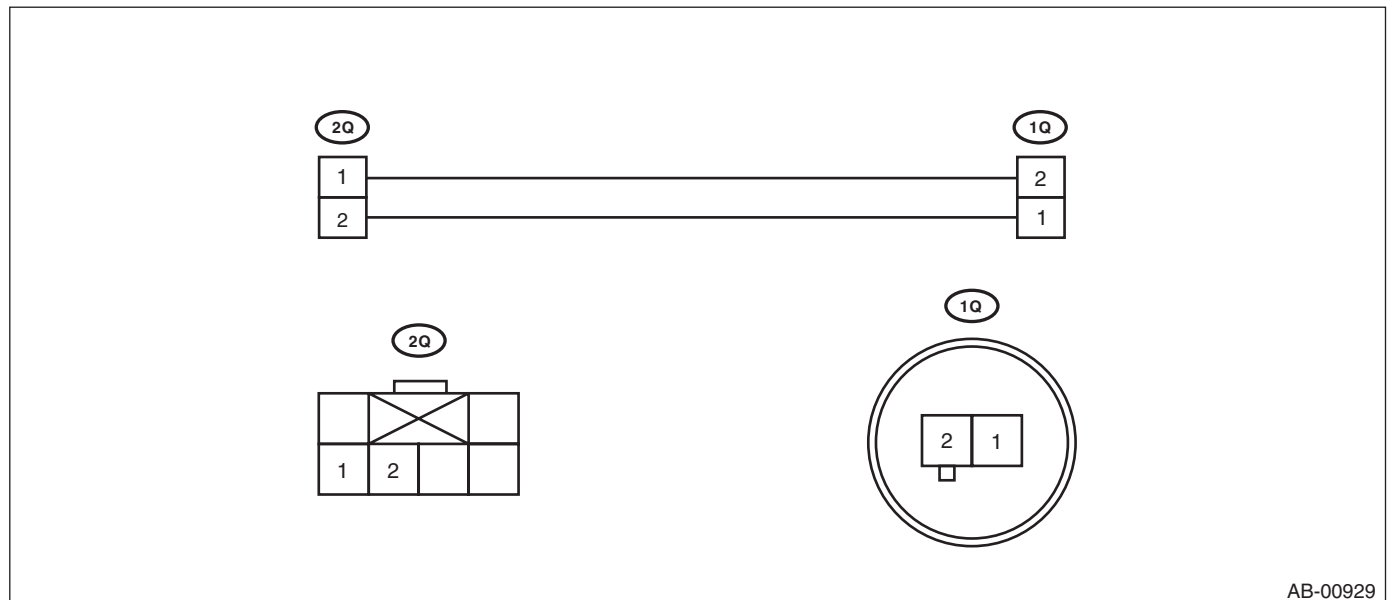


# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

- TEST HARNESS Q

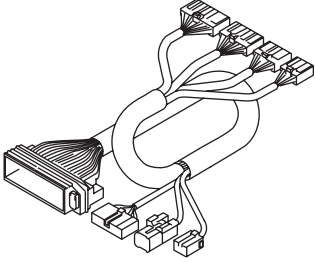
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299SA040</p>	98299SA040	TEST HARNESS Q	Used when measuring voltage and resistance of driver's airbag module.



# General Description

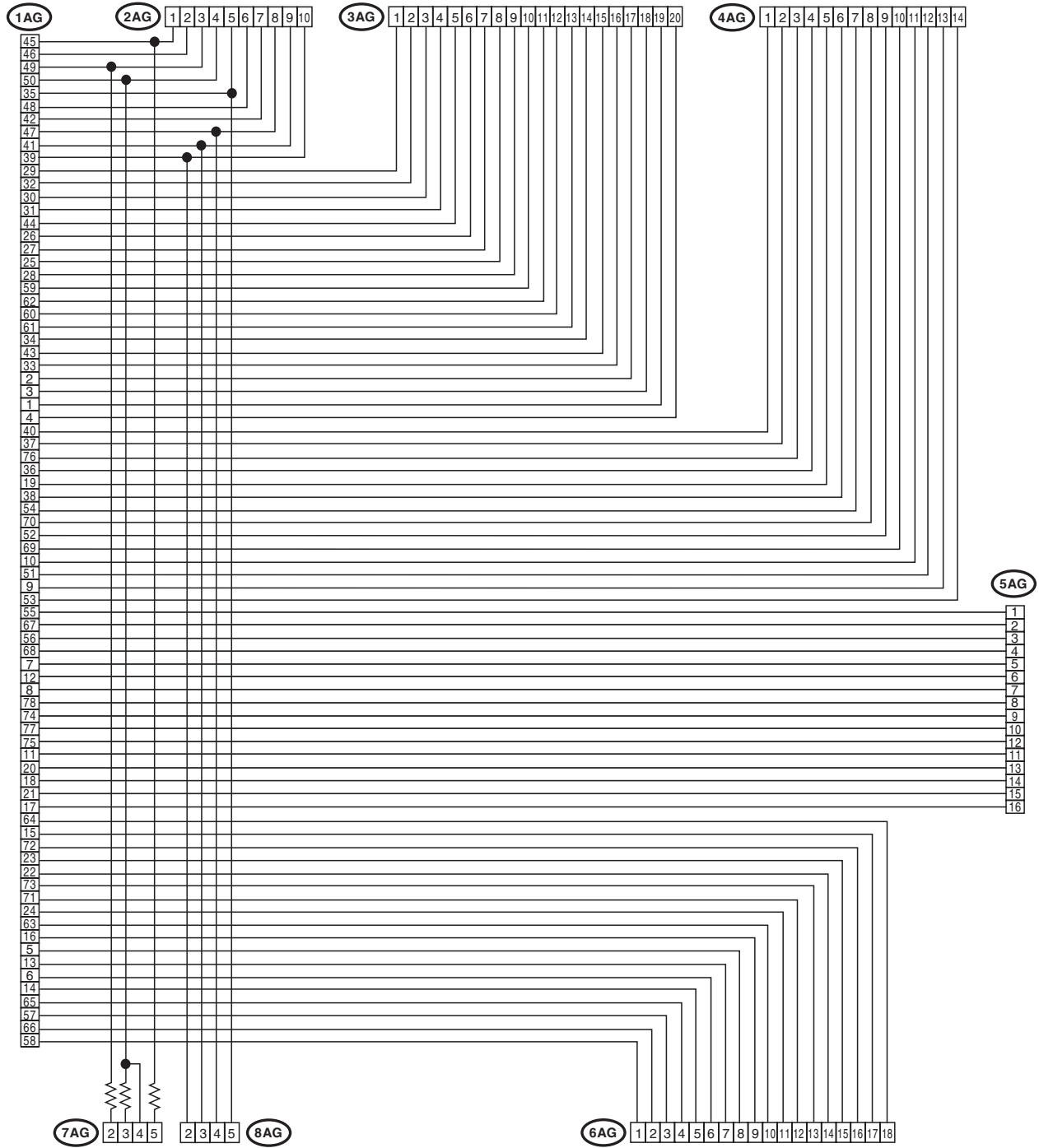
AIRBAG SYSTEM (DIAGNOSTICS)

- TEST HARNESS AG

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299AG070</p>	98299AG070	TEST HARNESS AG	Used when measuring voltage and resistance of airbag control module.

# General Description

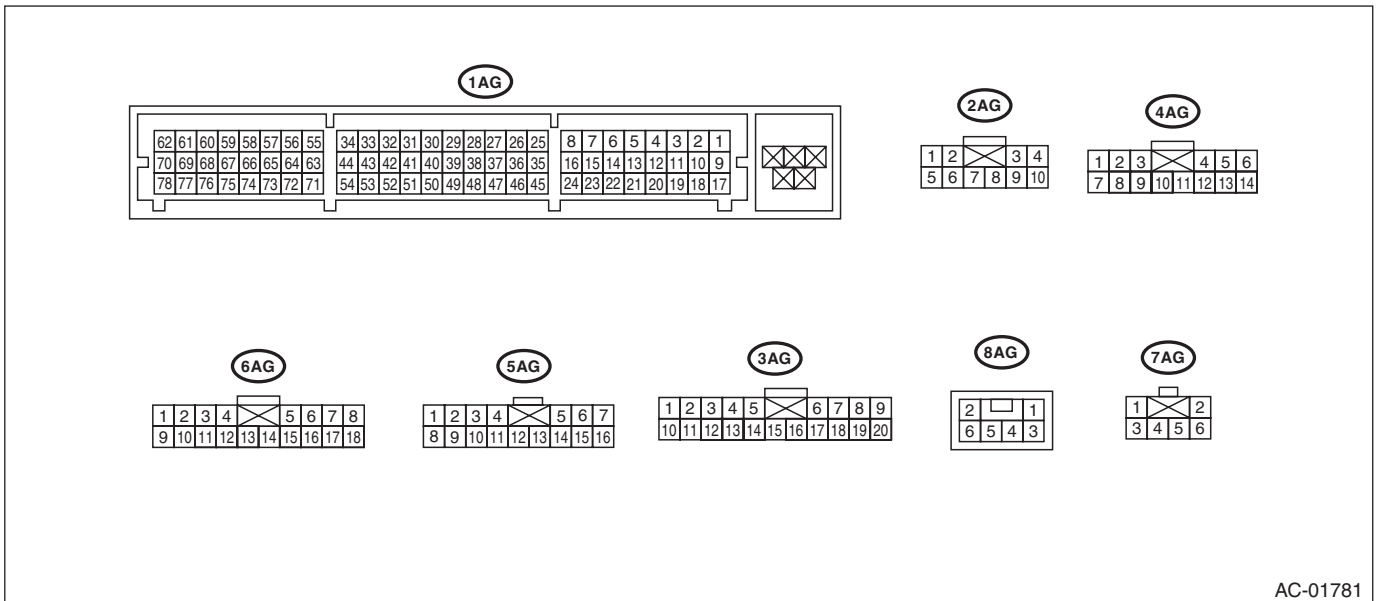
## AIRBAG SYSTEM (DIAGNOSTICS)



AB-01780

# General Description

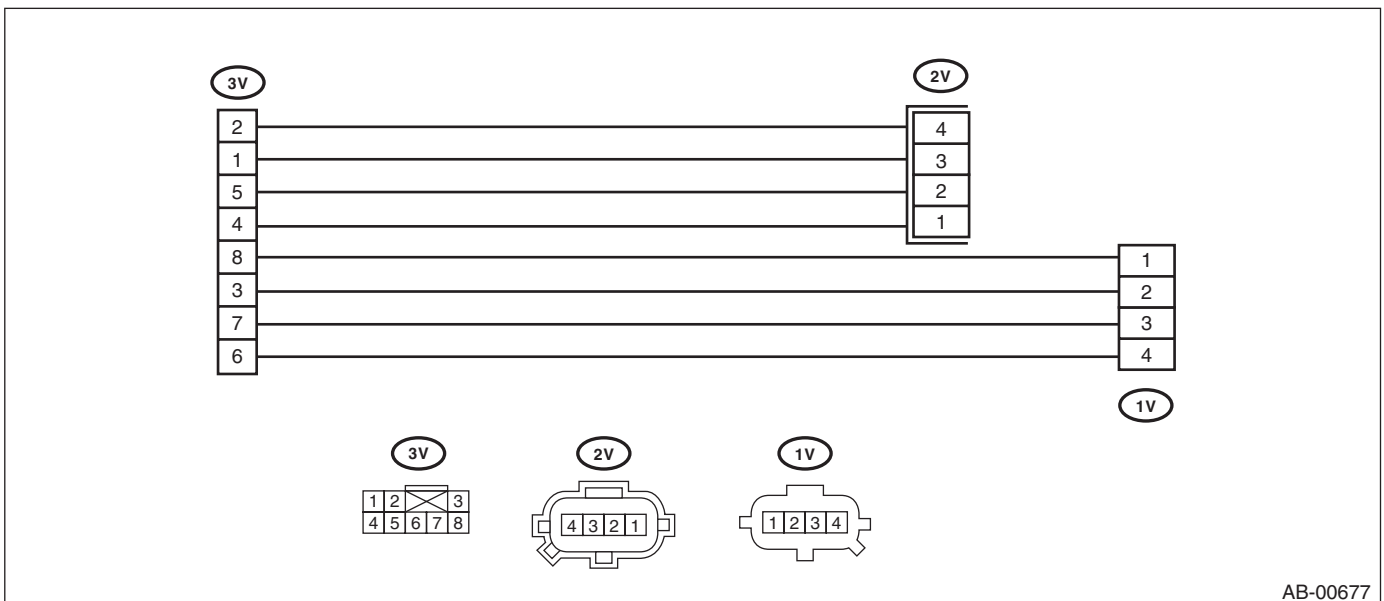
## AIRBAG SYSTEM (DIAGNOSTICS)



AC-01781

### • TEST HARNESS V

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
<p>ST98299AG010</p>	98299AG010	TEST HARNESS V	Used when measuring voltage and resistance of side airbag sensor and curtain airbag sensor.

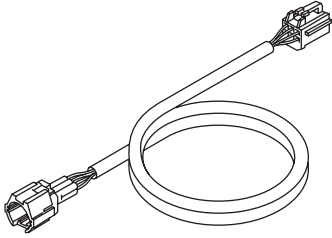


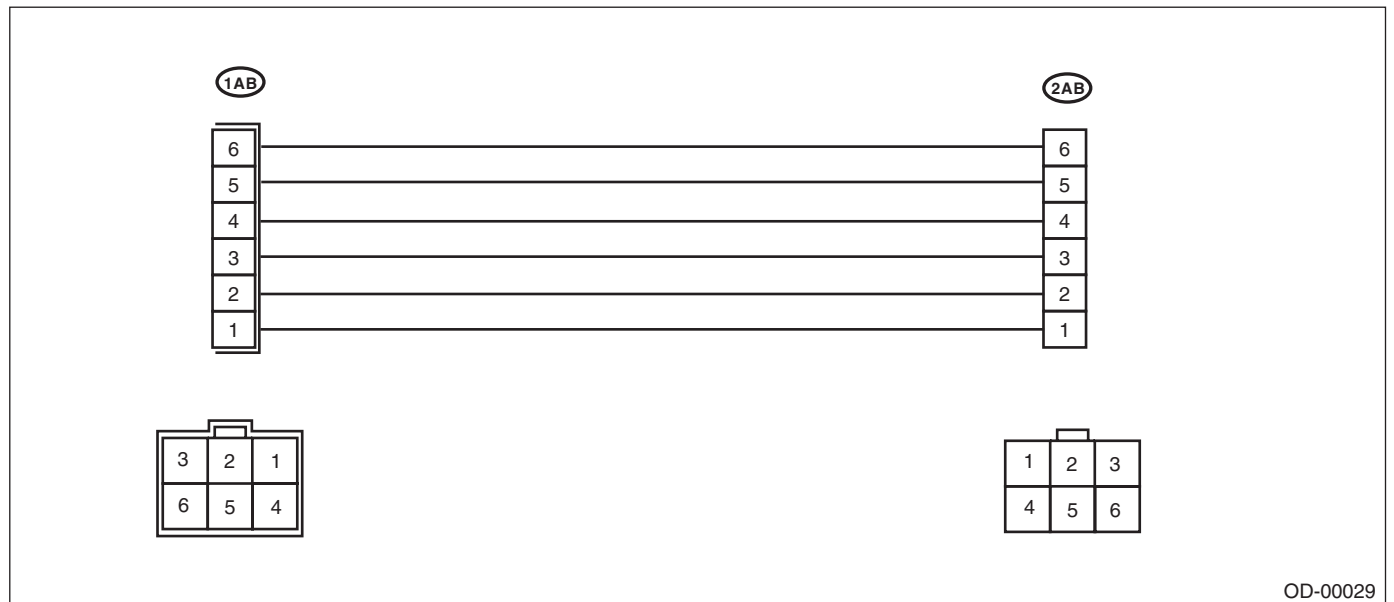
AB-00677

# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

- TEST HARNESS AB

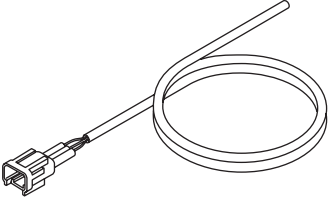
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299XA000</p>	98299XA000	TEST HARNESS AB	Used when measuring voltage and resistance of occupant detection system.

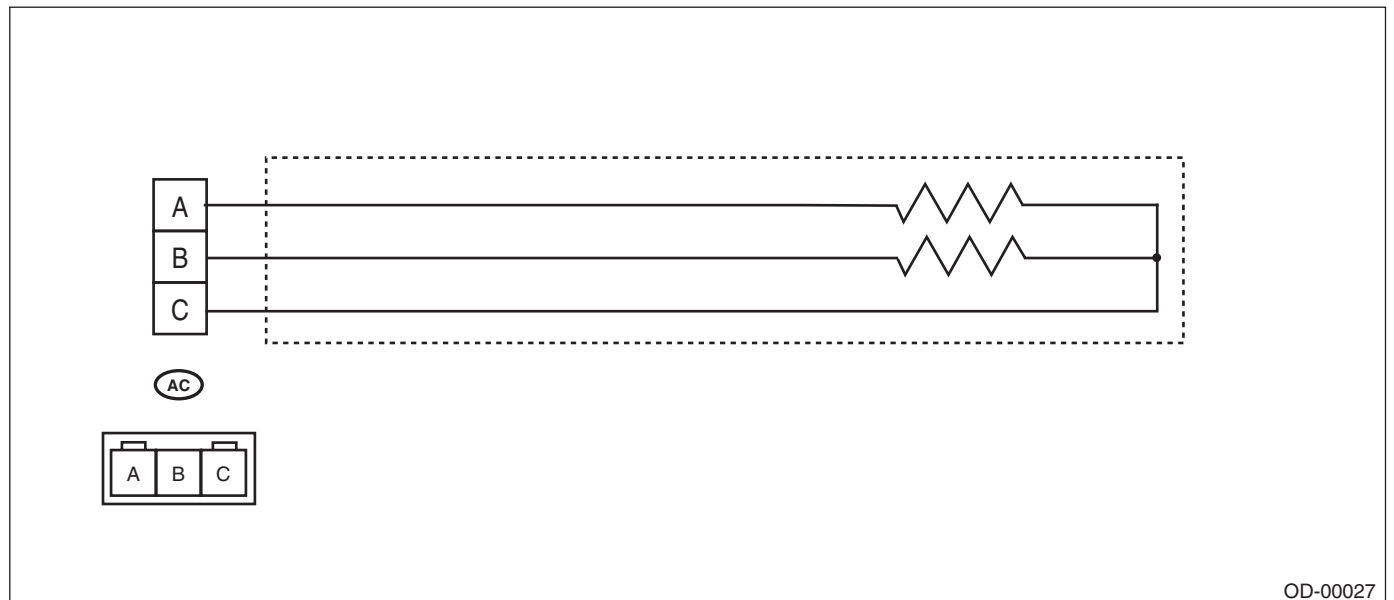


OD-00029

# General Description

- TEST HARNESS AC

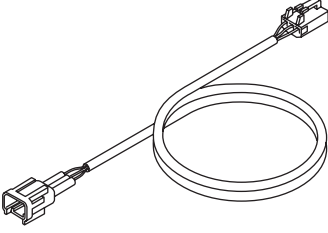
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST98299XA010	98299XA010	TEST HARNESS AC	Used for diagnosing seat belt tension sensor.

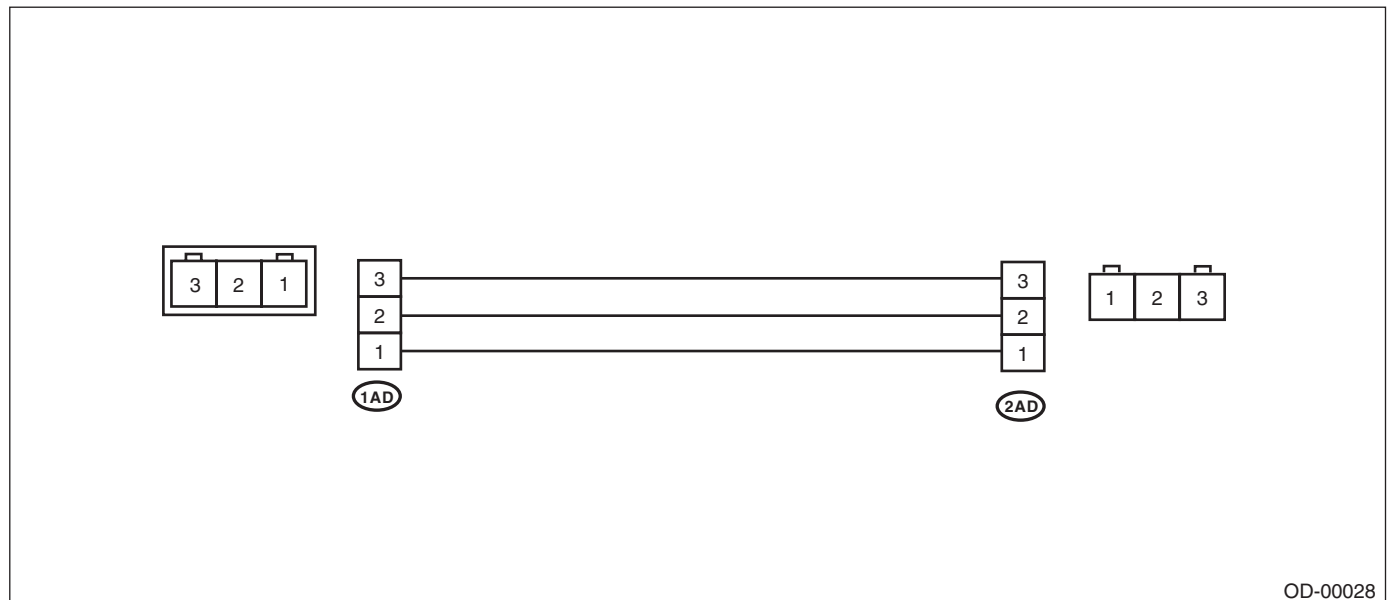


# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

- TEST HARNESS AD

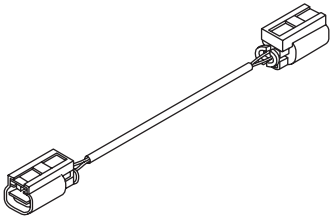
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299XA020</p>	98299XA020	TEST HARNESS AD	Used when measuring voltage and resistance of the seat belt tension sensor.

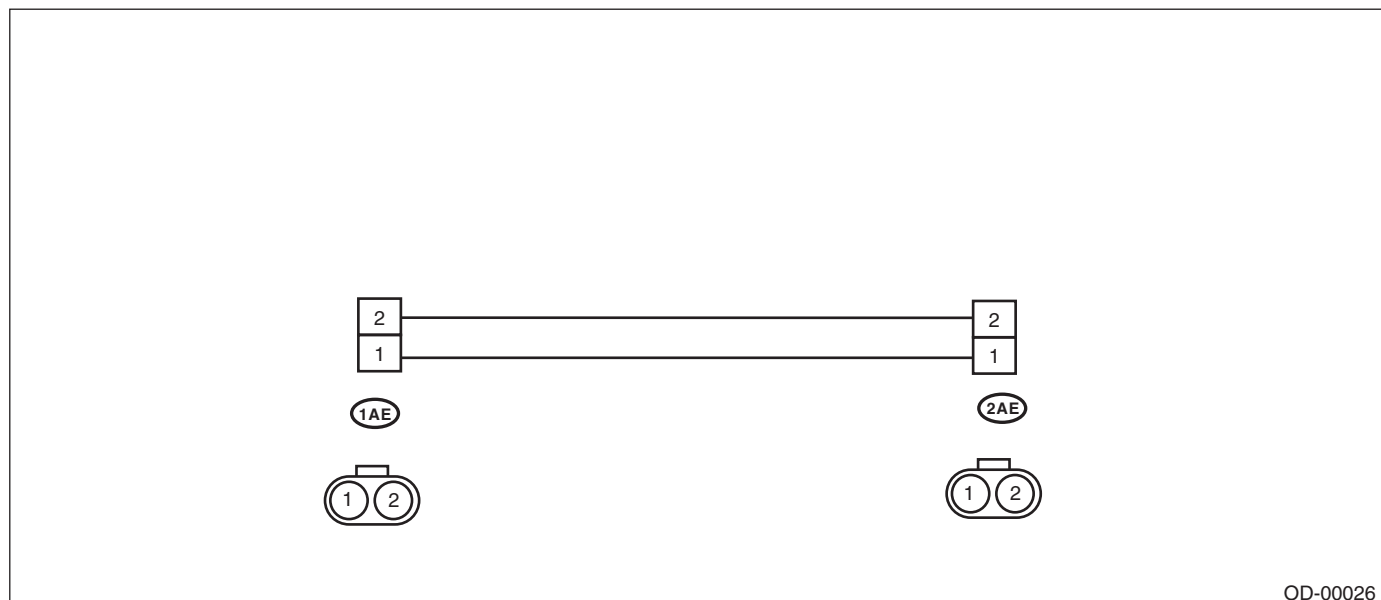


# General Description

AIRBAG SYSTEM (DIAGNOSTICS)

## • TEST HARNESS AE

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST98299XA030	98299XA030	TEST HARNESS AE	<ul style="list-style-type: none"><li>• Used for diagnosing seat belt tension sensor.</li><li>• Used together with the test harness Y.</li></ul>

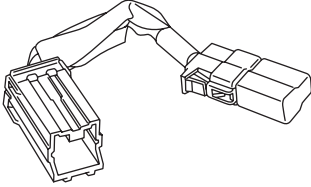


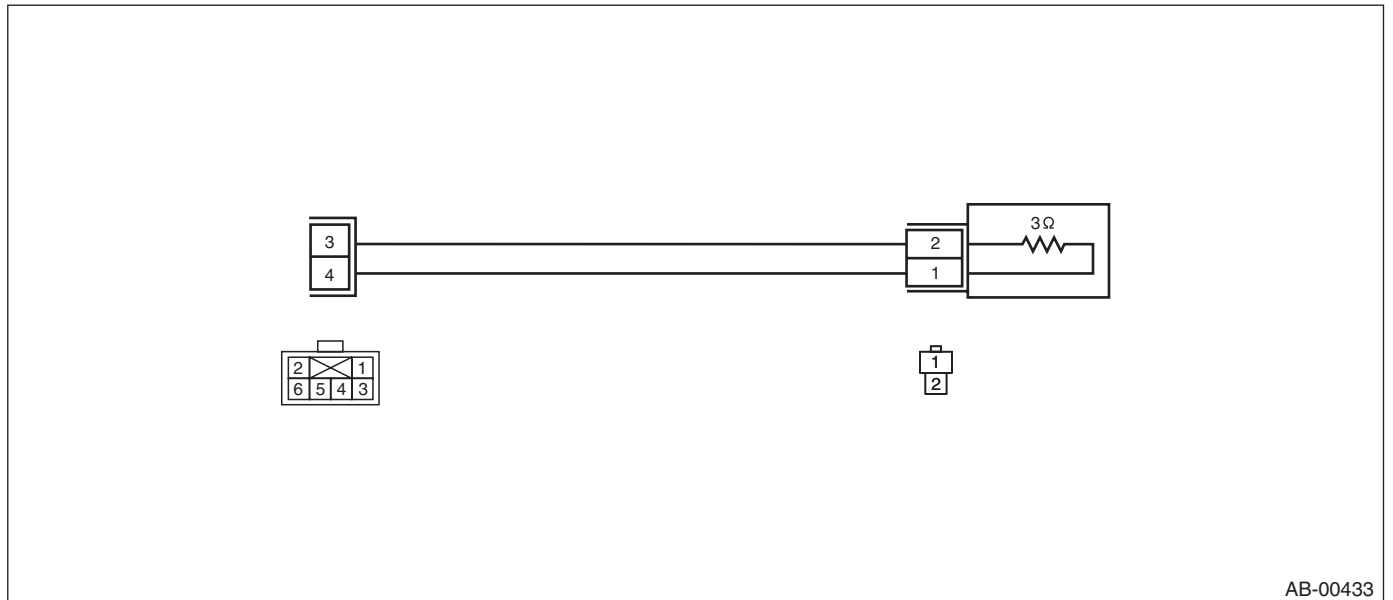


# General Description

## AIRBAG SYSTEM (DIAGNOSTICS)

### • AIRBAG RESISTOR

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST98299PA040	98299PA040	AIRBAG RESISTOR	Used in replacement of airbag module for which resistance value is same as airbag module. Two ST are required for diagnosis of two-stage inflator type airbag module.

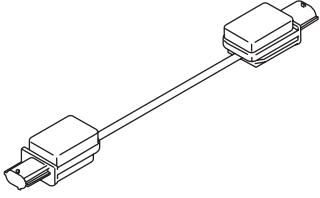


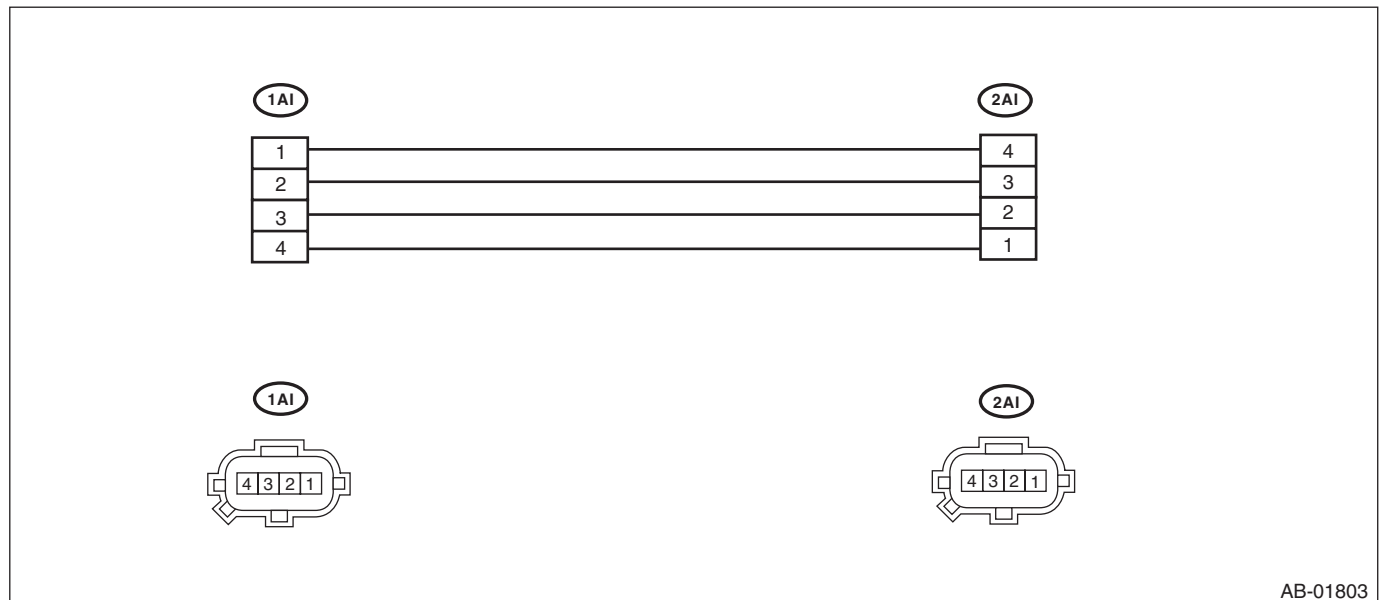
AB-00433

# General Description

AIRBAG SYSTEM (DIAGNOSTICS)

• TEST HARNESS AI

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299AG090</p>	98299AG090	TEST HARNESS AI	<ul style="list-style-type: none"> <li>• Used when diagnosing the side airbag sensor and curtain airbag sensor.</li> <li>• Used together with the test harness V.</li> </ul>



# General Description

AIRBAG SYSTEM (DIAGNOSTICS)

---

## 2. GENERAL TOOL

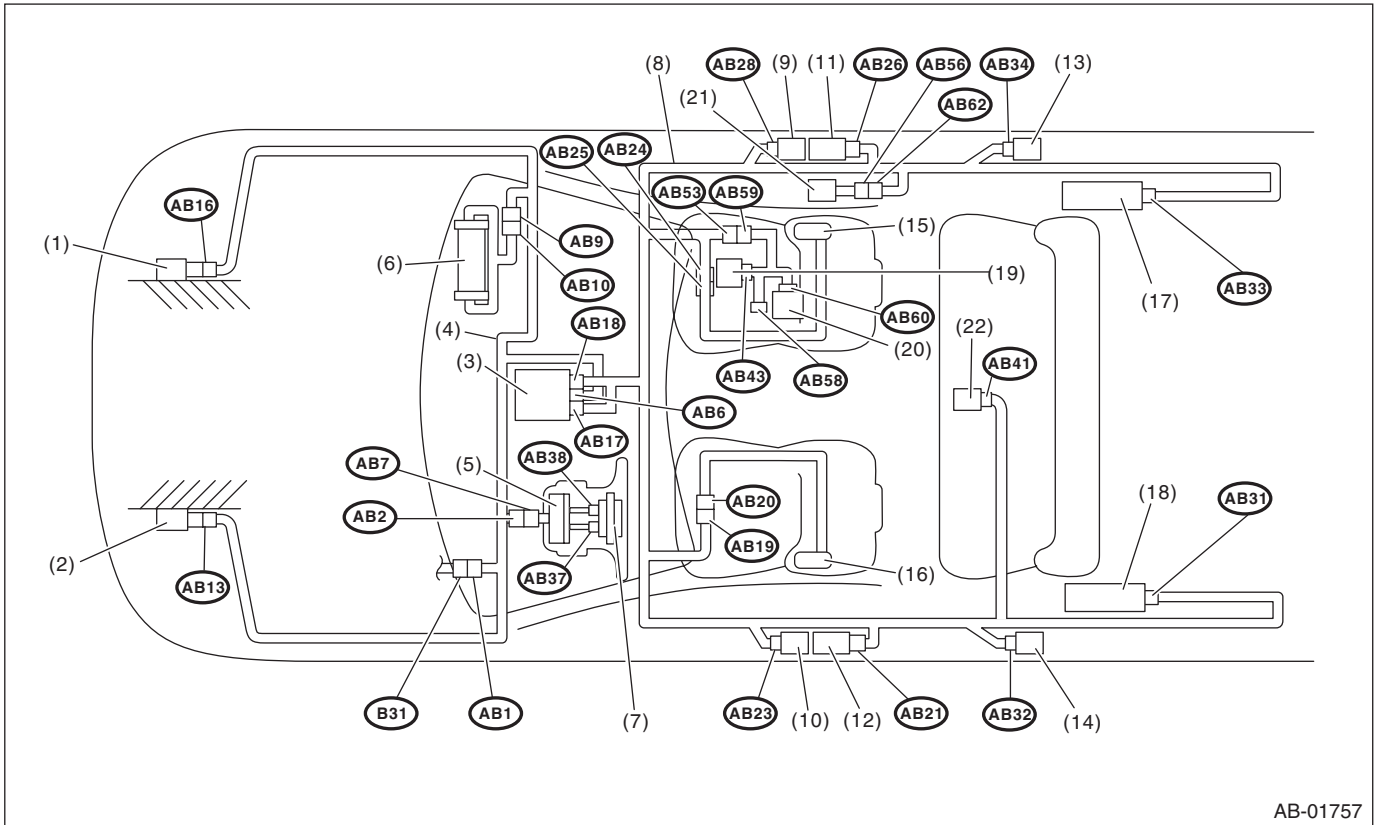
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.
Oscilloscope	Used for measuring the sensor.

# Electrical Component Location

AIRBAG SYSTEM (DIAGNOSTICS)

## 4. Electrical Component Location

### A: LOCATION



- |                                 |                                  |  |
|---------------------------------|----------------------------------|--|
| (1) Front sub sensor (RH)       | (9) Side airbag sensor (RH)      | (17) Curtain airbag inflator (RH)      |
| (2) Front sub sensor (LH)       | (10) Side airbag sensor (LH)     | (18) Curtain airbag inflator (LH)      |
| (3) Airbag control module       | (11) Seat belt pretensioner (RH) | (19) Occupant detection control module |
| (4) Airbag main harness         | (12) Seat belt pretensioner (LH) | (20) Buckle switch (RH)                |
| (5) Roll connector              | (13) Curtain airbag sensor (RH)  | (21) Belt tension sensor               |
| (6) Passenger's airbag inflator | (14) Curtain airbag sensor (LH)  | (22) Satellite safing sensor           |
| (7) Driver's airbag inflator    | (15) Side airbag inflator (RH)   |  |
| (8) Airbag rear harness         | (16) Side airbag inflator (LH)   |  |

## Electrical Component Location

### AIRBAG SYSTEM (DIAGNOSTICS)

Connector No.	(AB1)	(AB2)	(AB6)	(AB7)	(AB9)	(AB10)	(AB13)	(AB16)	(AB17)	(AB18)	(AB19)	(AB20)
Pin	10	4	30	4	4	4	2	2	20	20	2	2
Color	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Male/Female	Female	Female	Female	Male	Female	Male	Female	Female	Female	Female	Female	Male
Connector No.	(AB21)	(AB23)	(AB24)	(AB25)	(AB26)	(AB28)	(AB31)	(AB32)	(AB33)	(AB34)	(AB37)	(AB38)
Pin	2	4	2	2	2	4	2	4	2	4	2	2
Color	Black	Yellow	Yellow	Yellow	Black	Yellow	Black	Yellow	Black	Yellow	Orange	Black
Male/Female	Female	Female	Female	Male	Female	Female	Female	Female	Female	Female	Female	Female
Connector No.	(AB41)	(AB43)	(AB53)	(AB56)	(AB58)	(AB59)	(AB60)	(AB62)				
Pin	2	18	6	3	3	6	2	3				
Color	Yellow	Black	Gray	Brown	Gray	Gray	Yellow	Brown				
Male/Female	Female	Female	Female	Male	Female	Male	Male	Female				

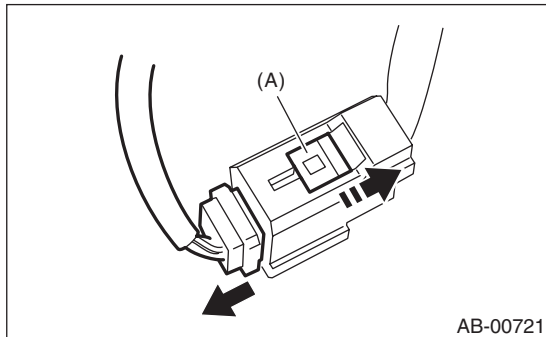
## 5. Airbag Connector

### A: PROCEDURE

#### 1. BUCKLE SWITCH

1) How to disconnect:

- (1) Move the slide lock (A) in the direction of arrow.
- (2) While holding the slide lock (A) in the moved position, disconnect the connector.

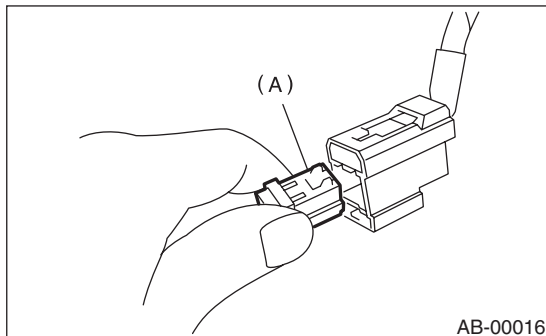


**CAUTION:**

When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.

2) How to connect:

Holding the connector (A), and push it in carefully until a clicking sound is heard.



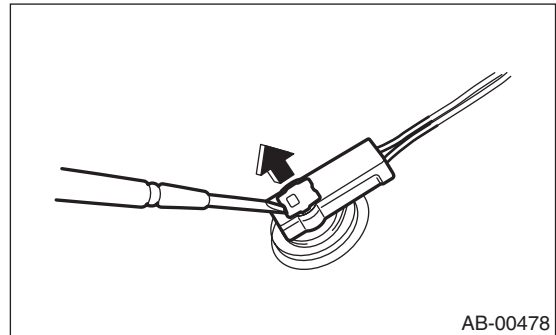
**CAUTION:**

Be sure to insert the connector in until it is locked. Then pull it gently to make sure that it is locked.

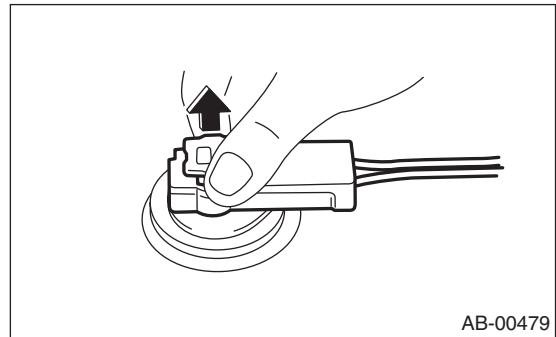
#### 2. DRIVER'S AIRBAG MODULE, PRETENSIONER AND CURTAIN AIRBAG

1) How to disconnect:

- (1) Using a flat tip screwdriver, pry the push lock upward to unlock.



- (2) Pull the connector to disconnect from the driver's airbag module assembly or the retractor assembly.

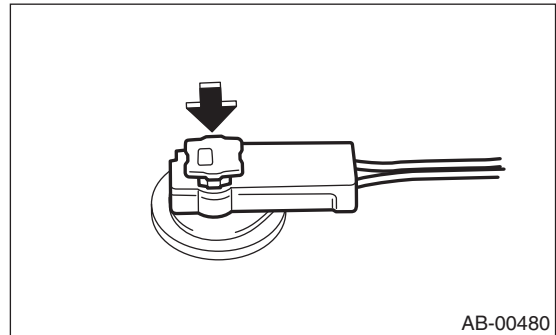


2) How to connect:

Connect the connector in the reverse order of disconnecting. At this time, be sure to insert the push lock until a clicking sound is heard.

**CAUTION:**

- Be sure to insert the connector in until it is locked. Then pull it gently to make sure that it is locked.
- Be sure to push the push lock in securely.



**NOTE:**

The connector cannot be connected when the push lock is in the lock position. To connect the connector, set the push lock to unlock position.

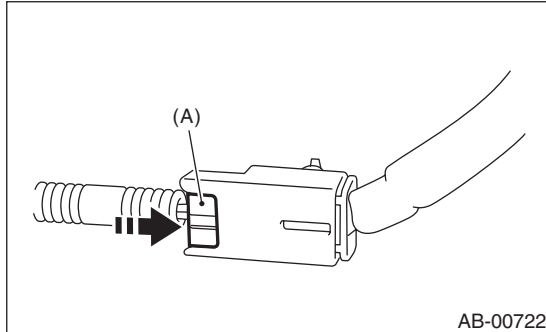
# Airbag Connector

## AIRBAG SYSTEM (DIAGNOSTICS)

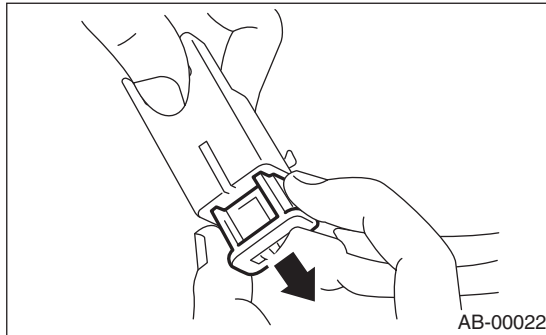
### 3. DRIVER'S AIRBAG (BETWEEN AIRBAG MAIN HARNESS AND ROLL CONNECTOR) AND SIDE AIRBAG

1) How to disconnect:

(1) Push the slide lock (A) in the direction of arrow.



(2) With the slide lock pushed, disconnect the connector.

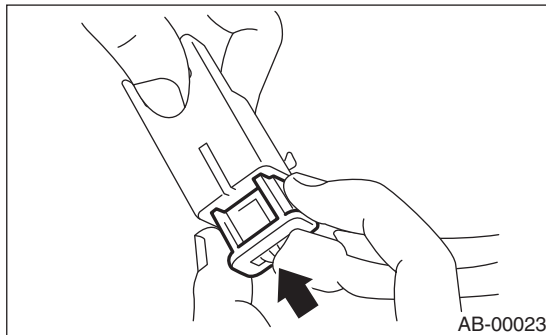


**CAUTION:**  
When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.

2) How to connect:

Holding the connector, push it in securely until a clicking sound is heard.

**CAUTION:**  
Be sure to insert the connector in until it is locked. Then pull it gently to make sure that it is locked.

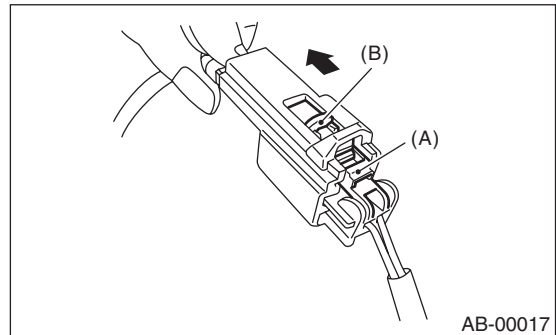


### 4. SIDE AIRBAG

1) How to disconnect:

(1) Push the lock arm (A).

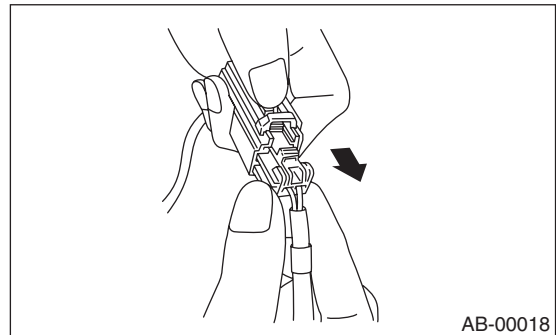
(2) With the lock arm (A) pushed in, move the slide lock (B) in the direction of arrow.



(3) While holding the slide lock in that position, release the lock arm (back to the original position), and disconnect the connector.

**CAUTION:**

When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.



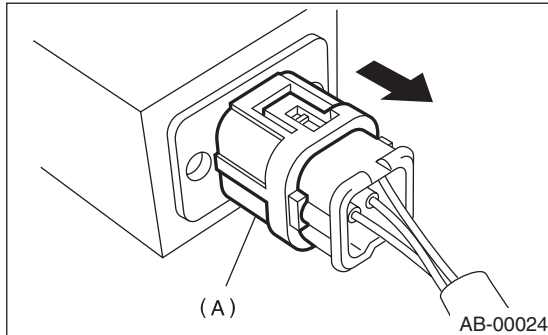
## 5. FRONT SUB SENSOR, SIDE AIRBAG SENSOR, CURTAIN AIRBAG SENSOR AND SATELLITE SAFING SENSOR

1) How to disconnect:

Holding outer part (A), pull it in the direction of arrow.

### CAUTION:

When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.

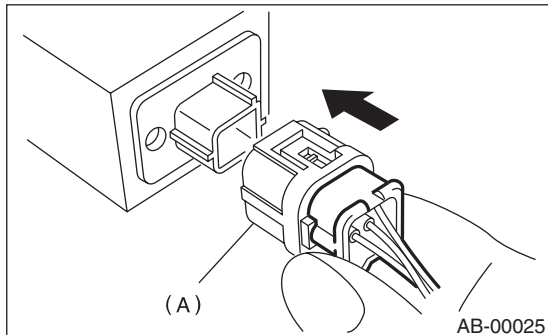


2) How to connect:

Holding the connector, push it in securely until a clicking sound is heard.

### CAUTION:

- Do not touch the outer side section or else the outer side (A) will move back.
- Be sure to insert the connector in until it is locked. Then pull it gently to make sure that it is locked.



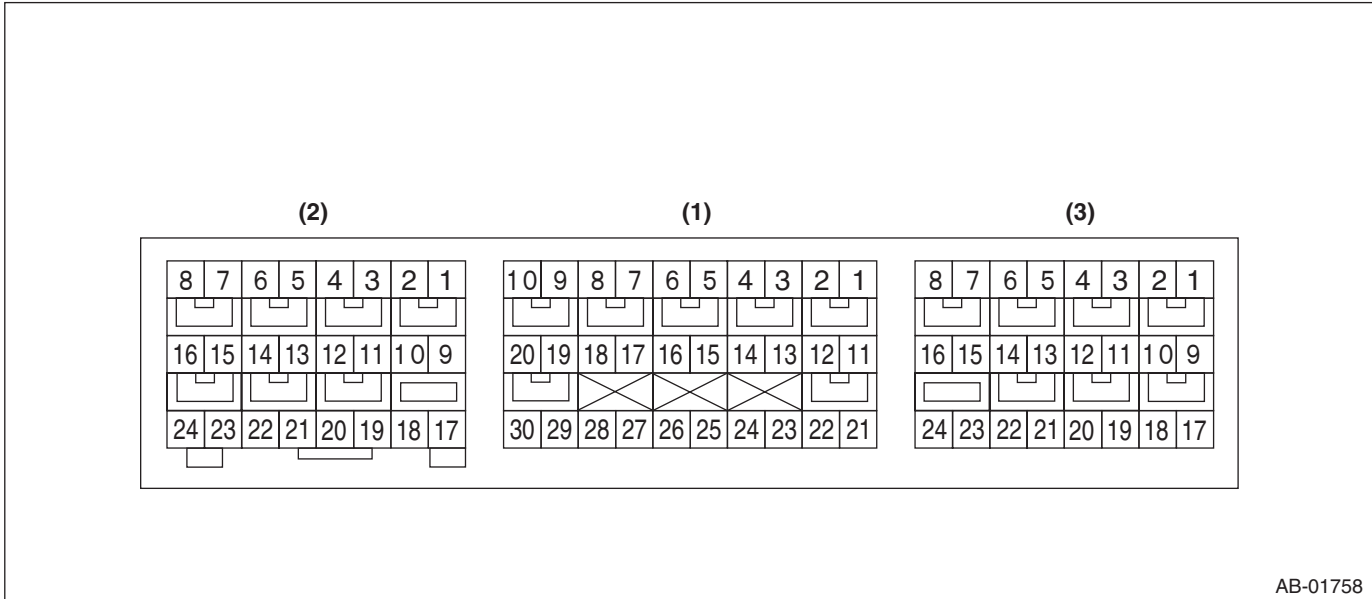


# Airbag Control Module I/O Signal

AIRBAG SYSTEM (DIAGNOSTICS)

## 6. Airbag Control Module I/O Signal

### A: ELECTRICAL SPECIFICATION



AB-01758

- Terminal numbers in airbag control module connector are shown in the figure.
- Airbag warning light illuminates when the connector is removed from airbag control module.

# Airbag Control Module I/O Signal

AIRBAG SYSTEM (DIAGNOSTICS)

Item	Control module terminal No.	
Data link connector	(1)-16	
Combination meter	(1)-11	
Battery power supply	Dedicated fuse (1)-21	
Passenger's airbag module level one	+	(1)-4
	-	(1)-3
Passenger's airbag module level two	+	(1)-1
	-	(1)-2
Driver's airbag module level one	+	(1)-5
	-	(1)-6
Driver's airbag module level two	+	(1)-8
	-	(1)-7
Front sub sensor LH	Power supply and communication	(1)-30
	GND	(1)-28
Front sub sensor RH	Power supply and communication	(1)-29
	GND	(1)-27
Ground line (GND)		(1)-25
		(1)-26
Passenger's airbag OFF indicator	(1)-17	
Passenger's airbag ON indicator	(1)-23	
Passenger's seat belt warning light (integrated module)	(1)-15	
Seat belt pretensioner LH	+	(2)-5
	-	(2)-6
Side airbag sensor LH Curtain airbag sensor LH	+	(2)-24
	-	(2)-23
Side airbag module LH	+	(2)-1
	-	(2)-2
Curtain airbag module LH	+	(2)-4
	-	(2)-3
Seat belt pretensioner RH	+	(3)-4
	-	(3)-3
Side airbag sensor RH Curtain airbag sensor RH	+	(3)-17
	-	(3)-18
Side airbag module RH	+	(3)-8
	-	(3)-7
Curtain airbag module RH	+	(3)-5
	-	(3)-6
Satellite safing sensor	+	(2)-20
	-	(2)-21
Occupant detection control module	+	(3)-16
	-	(3)-24

## B: WIRING DIAGRAM

Refer to the WI section wiring diagram. <Ref. to WI-150, WIRING DIAGRAM, Airbag System.>

## 7. Subaru Select Monitor

### A: OPERATION

#### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

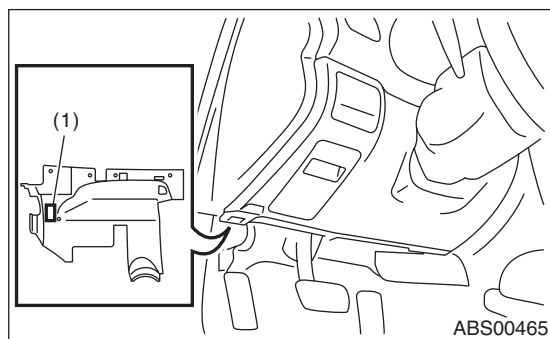
When malfunction of airbag system occurs, the DTC stored in airbag control module will be read out.

1) Prepare the Subaru Select Monitor kit. <Ref. to AB(diag)-8, SPECIAL TOOL, PREPARATION TOOL, General Description.>

2) Connect the diagnosis cable to the Subaru Select Monitor.

3) Connect the Subaru Select Monitor to the data link connector.

(1) Data link connector is located in the lower portion of instrument panel (on the driver's side).



(1) Data link connector

(2) Connect the diagnosis cable to the data link connector.

#### **CAUTION:**

**Do not connect scan tools other than the Subaru Select Monitor.**

4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.

5) On the «Main Menu», select {Each System Check}.

6) On the «System Selection Menu», select {Airbag System}.

7) After {Airbag System} is displayed, select [OK].

8) Select the {Diagnostic Trouble Code} in «Airbag System».

#### **NOTE:**

- For details concerning operation procedures, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".

- For details concerning DTCs, refer to List of Diagnostic Trouble Code (DTC). <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>

## 2. DISPLAY OF STATUS INFORMATION

Check the operating condition of each sensor in the event of malfunction in the seat belt buckle switch, or when the seat belt buckle switch has been replaced.

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Airbag System}.
- 3) Select the {Status Data} in «Airbag System».

The following table is for support data.

Item	Display
Seat position sensor LH	— <sup>*5</sup>
Seat position sensor RH	— <sup>*5</sup>
Seat belt buckle switch LH	— <sup>*9</sup>
Seat belt buckle switch RH	Belted <sup>*6</sup> /Unbelted <sup>*7</sup> /Other <sup>*8</sup> /Initial Setting <sup>*4</sup> /— <sup>*9</sup>
Passenger's airbag control status	ON <sup>*10</sup> /OFF <sup>*11</sup> /Initial Setting <sup>*4</sup>

\*1: The seat position is forward.

\*2: The seat position is rearward.

\*3: Displayed when data other than before and behind the seat, such as the breakdown etc, is input.

\*4: Displayed when it is initial.

\*5: Seat position sensor not supported

\*6: Seat belt fastened

\*7: Seat belt not fastened

\*8: Displayed when data other than belt fastened or not fastened, such as breakdowns is input.

\*9: Seat belt buckle switch not supported

\*10: Passenger's airbag operating state

\*11: Passenger's airbag non-operating state

### NOTE:

For details concerning operation procedures, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".

## 3. CLEAR MEMORY MODE

Clear the DTC stored in the airbag control module after repairing the airbag system. (After the breakdown is recovered, the breakdown code for completed recoveries are read out when the next breakdown occurs if the memory clear work is not performed.)

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Airbag System}.
- 3) Select the {Clear Memory} in «Airbag System».
- 4) When the "Clear Memory?" is shown on the screen, press [OK].
- 5) When "Done" is displayed, end the Subaru Select Monitor.

### NOTE:

For details concerning the operation procedure, refer to the «help on PC application for Subaru Select Monitor».

# Subaru Select Monitor

AIRBAG SYSTEM (DIAGNOSTICS)

## B: INSPECTION

### 1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

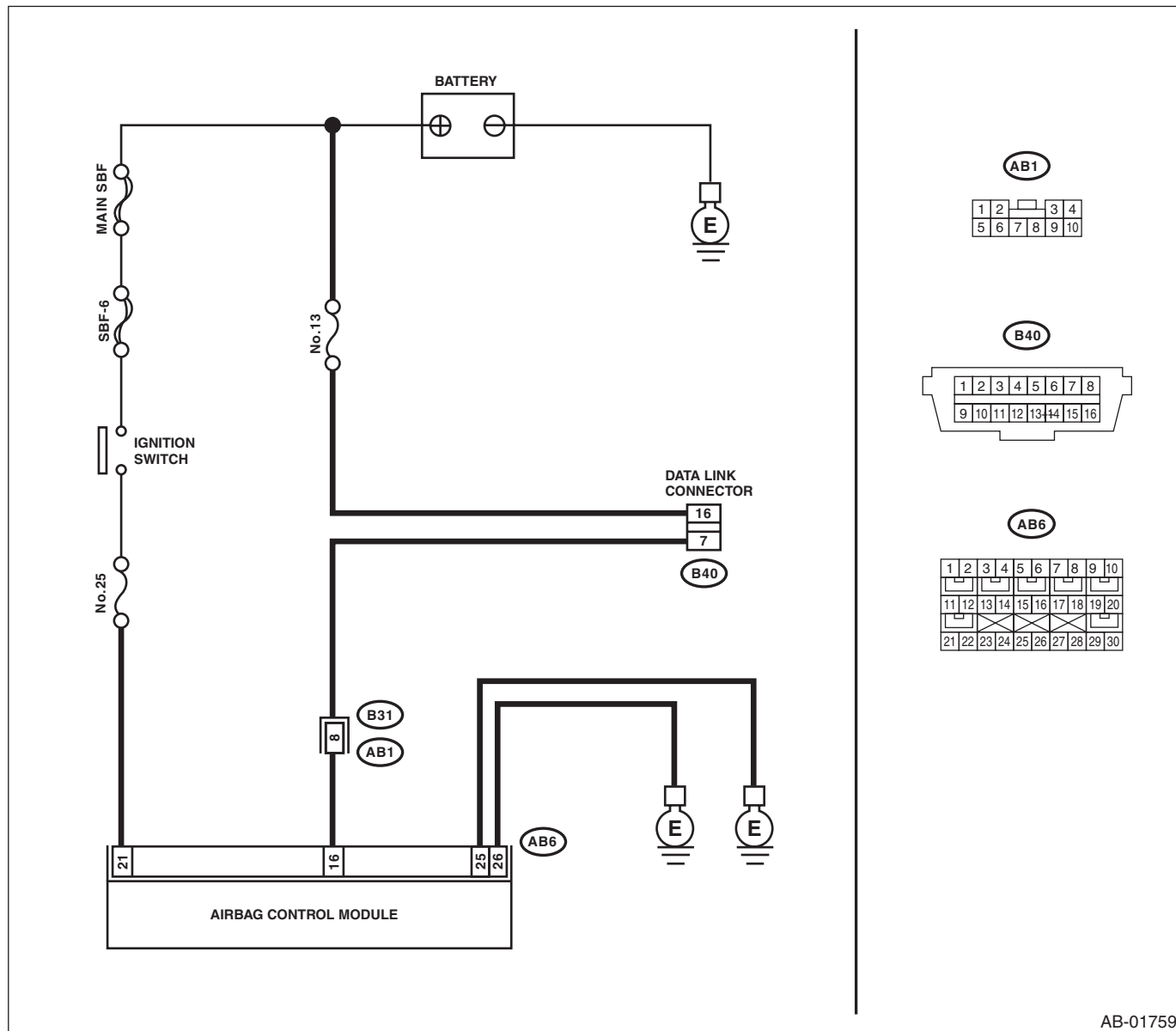
#### DETECTING CONDITION:

Defective harness connector

#### TROUBLE SYMPTOM:

Communication is impossible between the airbag control module and the Subaru Select Monitor.

#### WIRING DIAGRAM:



AB-01759

# Subaru Select Monitor

## AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK IGNITION SWITCH.</b>	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select the airbag mode using the Subaru Select Monitor.
2	<b>CHECK BATTERY.</b> 1) Turn the ignition switch to OFF. 2) Measure the battery voltage.	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
3	<b>CHECK BATTERY TERMINAL.</b>	Is there poor contact at battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
4	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be performed normally.	Is the system name displayed on Subaru Select Monitor?	Go to step 10.	Go to step 5.
5	<b>CHECK FUSE NO. 25 (IN FUSE &amp; RELAY BOX).</b> Remove the fuse No. 25 and perform visual inspection.	Is the fuse No. 25 (in fuse & relay box) blown out?	Replace the fuse No. 25. If fuse No. 25 is blown out again, check the power supply circuit.	Go to step 6.
6	<b>CHECK AIRBAG CONTROL MODULE CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait 20 seconds or more. 2) Confirm that the connector of airbag control module (AB6) is securely connected.	Is the connector of the airbag control module securely connected?	Go to step 7.	Connect the connector of the airbag control module.
7	<b>CHECK SUBARU SELECT MONITOR COMMUNICATION.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the airbag control module connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Is the system name displayed on Subaru Select Monitor?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 8.
8	<b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the airbag control module, ABSCM&H/U, ECM and TCM. 3) Measure the resistance between data link connector and chassis ground. <b>Connector &amp; terminal (B40) No. 7 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 9.	Repair the harness and connector between each control module and data link connector. (Replace the harness without repairing the airbag harness.)
9	<b>CHECK OUTPUT SIGNAL TO THE AIRBAG CONTROL MODULE.</b> 1) Turn the ignition switch to ON in the condition of step 8. 2) Measure the voltage between data link connector and chassis ground. <b>Connector &amp; terminal (B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 10.	Repair the harness and connector between each control module and data link connector. (Replace the harness without repairing the airbag harness.)

# Subaru Select Monitor

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK THE HARNESS BETWEEN THE AIRBAG CONTROL MODULE AND DATA LINK CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB6) from airbag control module. 3) Connect the connector (1AG) in the test harness AG to the connector (AB6). 4) Measure the resistance between connector (4AG) in the test harness AG and the data link connector. <b>Connector &amp; terminal (4AG) No. 1 — (B40) No. 7:</b>	Is the resistance less than 10 Ω?	Go to step 11.	Repair the harness between the airbag control module and the data link connector. Or replace the airbag main harness along with the bulkhead harness.
<b>11 CHECK POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between connector (2AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal (2AG) No. 1 — Chassis ground:</b>	Is the voltage 10 V or more?	Go to step 12.	Repair the harness between the airbag control module and the battery. Or replace the airbag main harness along with the bulkhead harness.
<b>12 CHECK BETWEEN THE AIRBAG CONTROL MODULE AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between connector (2AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal (2AG) No. 4 — Chassis ground: (2AG) No. 3 — Chassis ground:</b>	Is the resistance less than 10 Ω?	Go to step 13.	Repair the harness between the airbag control module and the chassis ground. Or replace the airbag main harness along with the bulkhead harness.
<b>13 CHECK POOR CONTACT IN CONNECTOR.</b>	Is there poor contact in the control module power supply, ground circuit and data link connector?	Repair the connector. (For airbag system connectors, do not repair but replace the entire harness.)	Replace the airbag control module only. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

## 2. WITHOUT DTC

### DETECTING CONDITION:

- Defective combination meter
- Open circuit in harness

### TROUBLE SYMPTOM:

- Airbag warning light remains on.
- “NO TROUBLE CODE” will be displayed on the Subaru Select Monitor.

For detailed operation procedures, refer to “Airbag Warning Light Failure”. <Ref. to AB(diag)-39, Airbag Warning Light Failure.>

### NOTE:

- For detailed operation procedures, refer to “Airbag Warning Light Failure”. <Ref. to AB(diag)-39, Airbag Warning Light Failure.>
- When the airbag warning light is OFF and “NO TROUBLE CODE” is displayed on Subaru Select Monitor, the system is operating properly.

### **8. Read Diagnostic Trouble Code (DTC)**

#### **A: OPERATION**

For details concerning DTC reading procedure, refer to "Subaru Select Monitor". <Ref. to AB(diag)-30, Subaru Select Monitor.>



### **9. Inspection Mode**

#### **A: PROCEDURE**

Recreate the circumstance by referring to the conditions described in the checklist.

## 10. Clear Memory Mode

### A: OPERATION

- Clear the memory in the following steps after the malfunction is repaired.
- For details concerning DTC clear operation, refer to “Subaru Select Monitor”. <Ref. to AB(diag)-30, Subaru Select Monitor.>

# Airbag Warning Light Illumination Pattern

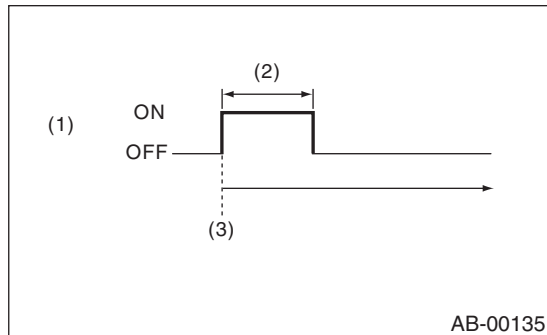
AIRBAG SYSTEM (DIAGNOSTICS)

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## 11. Airbag Warning Light Illumination Pattern

### A: INSPECTION

Turn the ignition switch to ON, and confirm that the airbag warning light remains on for approx. 6 seconds then turns off afterwards.



- (1) Airbag warning light
- (2) Approx. 6 sec.
- (3) Ignition switch ON

## 12. Airbag Warning Light Failure

### A: AIRBAG WARNING LIGHT REMAINS ON

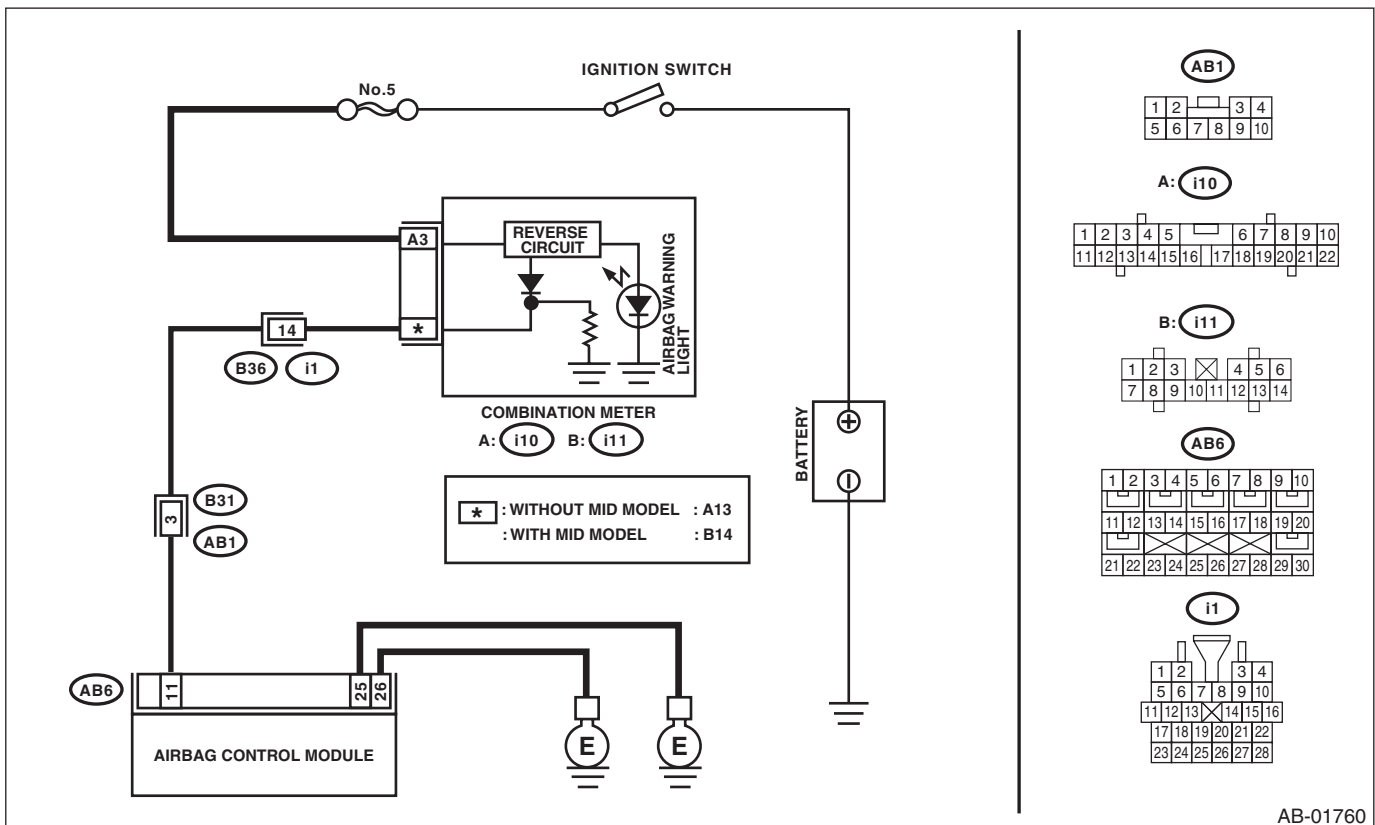
#### DETECTING CONDITION:

- Airbag warning light is faulty.
- Airbag control module to airbag warning light circuit is shorted or open.
- Grounding circuit is faulty.
- Airbag control module is faulty.
- Connection of (AB1) and (B31) is improper.
- Connection of (AB6) to airbag control module is improper.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



# Airbag Warning Light Failure

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 READ DTC.</b> Read the DTC. <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2 CHECK POOR CONTACT.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Confirm that there is solid connection between the airbag control module and connector (AB6).	Is there poor contact in connector (AB6)?	If the poor contact of the connector is not fixed, replace the airbag main harness along with body harness or replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 3.
<b>3 CHECK AIRBAG MAIN HARNESS.</b> 1) Remove the instrument panel lower cover and disconnect the connectors (AB7) and (AB2). 2) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 3) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 4) Connect the battery ground terminal and turn the ignition switch to ON. 5) Connect the connectors (7AG) and (8AG) in the test harness AG. NOTE: After the fault has been cleared, disconnect the connectors (7AG) and (8AG).	Does the airbag warning light go off?	Go to step 4.	Go to step 5.
<b>4 CHECK GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB6) from airbag control module. 3) Connect the connector (1AG) in the test harness AG to the chassis harness connector (AB6). 4) Measure the resistance between connector (2AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(2AG) No. 4 — Chassis ground:</b> <b>(2AG) No. 3 — Chassis ground:</b>	Is the resistance less than 10 Ω?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Repair the chassis ground circuit.
<b>5 CHECK AIRBAG MAIN HARNESS AND BULKHEAD HARNESS.</b> 1) Disconnect the connectors (7AG) and (8AG). 2) Remove the combination meter. 3) Measure the resistance between the combination meter connector and test harness AG connector (2AG). <b>Connector &amp; terminal</b> <b>Model without MID</b> <b>(2AG) No. 5 — (i10) No. 13:</b> <b>Model with MID</b> <b>(2AG) No. 5 — (i11) No. 14:</b>	Is the resistance less than 10 Ω?	Check the combination meter.	Go to step 6.

# Airbag Warning Light Failure

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>6</b> <b>CHECK POOR CONTACT OF CONNECTORS (AB1) AND (B31).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground terminal, and wait 20 seconds or more. 2) Confirm that there is a firm contact between connectors (AB1) and (B31).	Is there poor contact in connectors (AB1) and (B31)?	Repair the bulk-head harness or replace the airbag main harness along with body harness.	Go to step 7.
<b>7</b> <b>CHECK AIRBAG MAIN HARNESS.</b> Check the airbag main harness for defect.	Is there any defect in the airbag main harness?	Replace the airbag main harness along with bulk-head harness.	Repair the bulk-head harness.

# Airbag Warning Light Failure

AIRBAG SYSTEM (DIAGNOSTICS)

## B: AIRBAG WARNING LIGHT REMAINS OFF

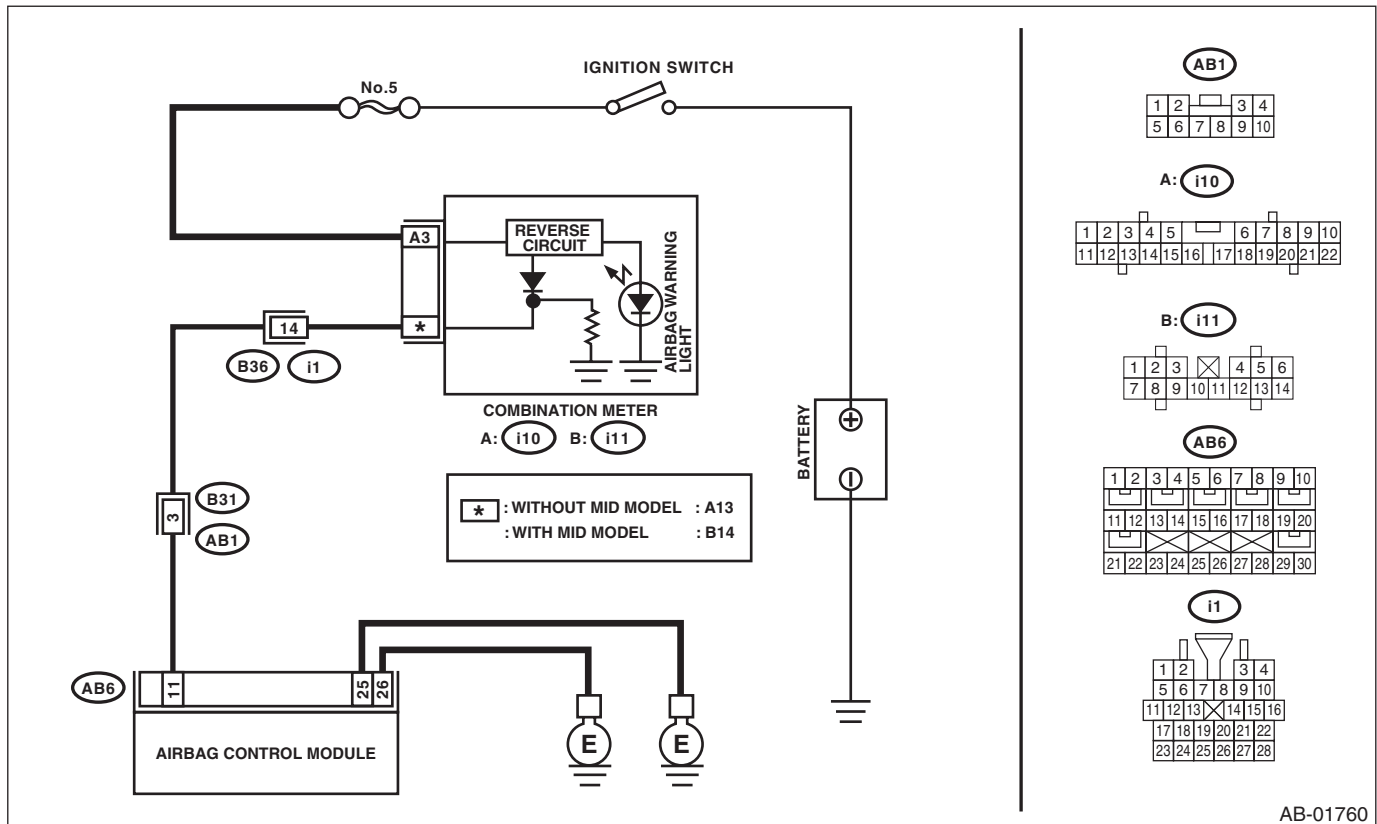
### DETECTING CONDITION:

- Fuse No. 5 (in fuse box) is brown out.
- Body harness circuit is open.
- Airbag warning light is faulty.
- Airbag main harness is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01760

# Airbag Warning Light Failure

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK COMBINATION METER.</b> Turn the ignition switch to ON, and confirm that warning light of combination meter illuminates.	Do warning lights except for airbag illuminate?	Go to step 2.	Check the combination meter.
<b>2 CHECK DTC.</b> Read the DTC. <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 3.
<b>3 CHECK FUSE NO. 5 (IN MAIN FUSE BOX).</b> Remove the fuse No. 5 and perform visual inspection.	Is the fuse No. 5 (in main fuse box) blown out?	Replace the fuse No. 5. If the fuse No. 5 is blown out again, go to step 4.	Go to step 4.
<b>4 CHECK AIRBAG WARNING LIGHT CIRCUIT (IN COMBINATION METER).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB1) and (B31). 3) Connect the battery ground terminal and turn the ignition switch to ON.	Does airbag warning light illuminate?	Go to step 5.	Check the combination meter.
<b>5 CHECK AIRBAG MAIN HARNESS.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Connect the connector (AB1) and (B31). 3) Disconnect the connector (AB6) from airbag control module. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does airbag warning light illuminate?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Replace the airbag main harness along with bulkhead harness.



## List of Diagnostic Trouble Code (DTC)

AIRBAG SYSTEM (DIAGNOSTICS)

### 13. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Display	Diagnosis content	Reference
11	Driver's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit is open, shorted or shorted to ground.</li> <li>• Airbag module harness (Driver's side) circuit is open, shorted or shorted to ground.</li> <li>• Roll connector circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Driver's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-52, DTC 11 DRIVER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
12	Passenger's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit is open, shorted or shorted to ground.</li> <li>• Airbag module harness (Passenger's side) circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Passenger's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-55, DTC 12 PASSENGER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
15	Driver's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit (Driver's side) is shorted to power supply.</li> <li>• Airbag module harness circuit (Driver's side) is shorted to power supply.</li> <li>• Roll connector is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> <li>• Driver's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-58, DTC 15 DRIVER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
16	Passenger's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit (Passenger's side) is shorted to power supply.</li> <li>• Airbag module harness circuit (Passenger's side) is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> <li>• Passenger's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-61, DTC 16 PASSENGER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
21	Airbag ECM failure	Airbag control module is faulty.	<Ref. to AB(diag)-63, DTC 21 AIRBAG ECM FAILURE, Diagnostic Chart with Trouble Code.>
22	Front Airbag Firing output	Front airbag module and seat belt pretensioner (LH/RH) are inflated.	<Ref. to AB(diag)-64, DTC 22 FRONT AIRBAG FIRING OUTPUT, Diagnostic Chart with Trouble Code.>
26	Passenger's Airbag indicator failure	<ul style="list-style-type: none"> <li>• Passenger's airbag indicator is faulty.</li> <li>• Airbag control module is faulty.</li> <li>• Airbag main harness circuit is open, shorted or shorted to ground.</li> <li>• Body harness circuit is open.</li> </ul>	<Ref. to AB(diag)-65, DTC 26 PASSENGER'S AIRBAG INDICATOR FAILURE, Diagnostic Chart with Trouble Code.>
27	ODS Communication error	<ul style="list-style-type: none"> <li>• Occupant detection control module communication is faulty.</li> <li>• Airbag rear harness circuit is open, shorted, shorted to ground or shorted to power supply.</li> <li>• Occupant detection harness is faulty.</li> <li>• Airbag control module is faulty.</li> <li>• Occupant detection system is faulty.</li> </ul>	<Ref. to AB(diag)-67, DTC 27 ODS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# List of Diagnostic Trouble Code (DTC)

AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
29	ODS Failure	<ul style="list-style-type: none"> <li>Occupant detection sensor is faulty.</li> <li>Occupant detection control module is faulty.</li> <li>Occupant detection harness is faulty.</li> <li>Fuse No. 25 (in joint box) is blown.</li> </ul>	Refer to "Occupant Detection System" for details on DTC 29. <Ref. to OD(diag)-26, DTC 29 ODS FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2A	ODS Calibration error	System calibration (Rezeroing) of the occupant detection system was not ended normally.	Refer to "Occupant Detection System" for details on DTC 2A. <Ref. to OD(diag)-23, DTC 2A ODS CALIBRATION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2B	ODS Erroneous Parts	<ul style="list-style-type: none"> <li>Wrong airbag control module was installed.</li> <li>Wrong occupant detection system was installed.</li> <li>Occupant detection system is faulty.</li> </ul>	Refer to "Occupant Detection System" for DTC 2B. <Ref. to OD(diag)-23, DTC 2B ODS SYSTEM WRONG PARTS, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2C	Belt Tension Sensor failure	<ul style="list-style-type: none"> <li>Passenger's seat belt tension sensor is faulty.</li> <li>Occupant detection system is faulty.</li> <li>Airbag rear harness circuit is open, shorted, shorted to ground or shorted to power supply.</li> <li>Occupant detection harness is faulty.</li> </ul>	Refer to "Occupant Detection System" for details on DTC 2C. <Ref. to OD(diag)-24, DTC 2C BELT TENSION SENSOR FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
33	Front Sub Sensor RH failure	Front sub sensor (RH) is faulty.	<Ref. to AB(diag)-68, DTC 33 FRONT SUB SENSOR RH FAILURE, Diagnostic Chart with Trouble Code.>
34	Front Sub Sensor LH failure	Front sub sensor (LH) is faulty.	<Ref. to AB(diag)-68, DTC 34 FRONT SUB SENSOR LH FAILURE, Diagnostic Chart with Trouble Code.>
37	Buckle Switch RH failure	<ul style="list-style-type: none"> <li>Passenger's buckle switch circuit is open, shorted or shorted to ground.</li> <li>Occupant detection system is faulty.</li> <li>Occupant detection harness is faulty.</li> </ul>	Refer to "Occupant Detection System" for DTC 37. <Ref. to OD(diag)-27, DTC 37 BUCKLE SWITCH RH FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
39	Seatbelt Warning failure	<ul style="list-style-type: none"> <li>Airbag control module is faulty.</li> <li>Body integrated unit is faulty.</li> <li>Harness circuits between body integrated unit and airbag control module are open, shorted or shorted to ground.</li> </ul>	<Ref. to AB(diag)-69, DTC 39 SEAT BELT WARNING FAILURE, Diagnostic Chart with Trouble Code.>

## List of Diagnostic Trouble Code (DTC)

### AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
41	Side Airbag RH failure	<ul style="list-style-type: none"> <li>• Side airbag harness (RH) circuit is faulty.</li> <li>• Side airbag module (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-71, DTC 41 SIDE AIRBAG RH FAILURE, Diagnostic Chart with Trouble Code.>
42	Side Airbag LH failure	<ul style="list-style-type: none"> <li>• Side airbag harness (LH) circuit is faulty.</li> <li>• Side airbag module (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-73, DTC 42 SIDE AIRBAG LH FAILURE, Diagnostic Chart with Trouble Code.>
45	Side Airbag RH failure	<ul style="list-style-type: none"> <li>• Side airbag harness (RH) is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-75, DTC 45 SIDE AIRBAG RH FAILURE, Diagnostic Chart with Trouble Code.>
46	Side Airbag LH failure	<ul style="list-style-type: none"> <li>• Side airbag harness (LH) is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-77, DTC 46 SIDE AIRBAG LH FAILURE, Diagnostic Chart with Trouble Code.>
53	Side Airbag Sensor RH failure	Side airbag sensor (RH) is faulty.	<Ref. to AB(diag)-83, DTC 53 SIDE AIRBAG SENSOR RH FAILURE, Diagnostic Chart with Trouble Code.>
54	Side Airbag Sensor LH failure	Side airbag sensor (LH) is faulty.	<Ref. to AB(diag)-83, DTC 54 SIDE AIRBAG SENSOR LH FAILURE, Diagnostic Chart with Trouble Code.>
55	Side Curtain Airbag Firing output	<ul style="list-style-type: none"> <li>• Side airbag module and curtain airbag module are deployed.</li> <li>• Curtain airbag module is deployed.</li> </ul>	<Ref. to AB(diag)-83, DTC 55 SIDE CURTAIN AIRBAG FIRING OUTPUT, Diagnostic Chart with Trouble Code.>
58	Curtain Airbag Sensor RH failure	Curtain airbag sensor (RH) is faulty.	<Ref. to AB(diag)-88, DTC 58 CURTAIN AIRBAG SENSOR RH FAILURE, Diagnostic Chart with Trouble Code.>
59	Curtain Airbag Sensor LH failure	Curtain airbag sensor (LH) is faulty.	<Ref. to AB(diag)-88, DTC 59 CURTAIN AIRBAG SENSOR LH FAILURE, Diagnostic Chart with Trouble Code.>
61	Belt Pretensioner RH failure	<ul style="list-style-type: none"> <li>• Seat belt pretensioner (RH) circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Pretensioner is faulty.</li> <li>• Pretensioner harness is faulty.</li> </ul>	<Ref. to AB(diag)-89, DTC 61 BELT PRETENSIONER RH FAILURE, Diagnostic Chart with Trouble Code.>
62	Belt Pretensioner LH failure	<ul style="list-style-type: none"> <li>• Seat belt pretensioner (LH) circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Pretensioner is faulty.</li> <li>• Pretensioner harness is faulty.</li> </ul>	<Ref. to AB(diag)-92, DTC 62 BELT PRETENSIONER LH FAILURE, Diagnostic Chart with Trouble Code.>

# List of Diagnostic Trouble Code (DTC)

## AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
65	Belt Pretensioner RH failure	<ul style="list-style-type: none"> <li>• Seat belt pretensioner (RH) circuit is shorted to power supply.</li> <li>• Pretensioner is faulty.</li> <li>• Pretensioner harness is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-95, DTC 65 BELT PRETENSIONER RH FAILURE, Diagnostic Chart with Trouble Code.>
66	Belt Pretensioner LH failure	<ul style="list-style-type: none"> <li>• Seat belt pretensioner (LH) circuit is shorted to power supply.</li> <li>• Pretensioner is faulty.</li> <li>• Pretensioner harness is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-97, DTC 66 BELT PRETENSIONER LH FAILURE, Diagnostic Chart with Trouble Code.>
71	Driver's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit is open, shorted or shorted to ground.</li> <li>• Airbag module harness (Driver's side) circuit is open, shorted or shorted to ground.</li> <li>• Roll connector circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Driver's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-99, DTC 71 DRIVER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
72	Passenger's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit is open, shorted or shorted to ground.</li> <li>• Airbag module harness (Passenger's side) circuit is open, shorted or shorted to ground.</li> <li>• Airbag control module is faulty.</li> <li>• Passenger's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-102, DTC 72 PASSENGER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
75	Driver's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit (Driver's side) is shorted to power supply.</li> <li>• Airbag module harness circuit (Driver's side) is shorted to power supply.</li> <li>• Roll connector is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> <li>• Driver's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-105, DTC 75 DRIVER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
76	Passenger's Airbag failure	<ul style="list-style-type: none"> <li>• Airbag main harness circuit (Passenger's side) is shorted to power supply.</li> <li>• Airbag module harness circuit (Passenger's side) is shorted to power supply.</li> <li>• Airbag control module is faulty.</li> <li>• Passenger's airbag module is faulty.</li> </ul>	<Ref. to AB(diag)-108, DTC 76 PASSENGER'S AIRBAG FAILURE, Diagnostic Chart with Trouble Code.>
91	Curtain Airbag Module RH failure	<ul style="list-style-type: none"> <li>• Curtain airbag harness (RH) circuit is faulty.</li> <li>• Curtain airbag module (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-110, DTC 91 CURTAIN AIRBAG MODULE RH FAILURE, Diagnostic Chart with Trouble Code.>
92	Curtain Airbag Module LH failure	<ul style="list-style-type: none"> <li>• Curtain airbag harness (LH) circuit is faulty.</li> <li>• Curtain airbag module (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-113, DTC 92 CURTAIN AIRBAG MODULE LH FAILURE, Diagnostic Chart with Trouble Code.>
95	Curtain Airbag Module RH failure	<ul style="list-style-type: none"> <li>• Curtain airbag harness (RH) is shorted to power supply.</li> <li>• Curtain airbag module (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-116, DTC 95 CURTAIN AIRBAG MODULE RH FAILURE, Diagnostic Chart with Trouble Code.>
96	Curtain Airbag Module LH failure	<ul style="list-style-type: none"> <li>• Curtain airbag harness (LH) is shorted to power supply.</li> <li>• Curtain airbag module (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-118, DTC 96 CURTAIN AIRBAG MODULE LH FAILURE, Diagnostic Chart with Trouble Code.>

## List of Diagnostic Trouble Code (DTC)

### AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
E2 E3 E4	Front Sensor Bus RH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (RH) between airbag control module and front sub sensor.</li> <li>• Front sub sensor (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-120, DTC E2 FRONT SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-120, DTC E3 FRONT SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-121, DTC E4 FRONT SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>
E6 E7 E8	Front Sensor Bus LH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (LH) between airbag control module and front sub sensor.</li> <li>• Front sub sensor (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-123, DTC E6 FRONT SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-123, DTC E7 FRONT SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-124, DTC E8 FRONT SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>
E9 EA EB EC	Side Sensor Bus RH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (RH) between airbag control module and side sensor.</li> <li>• Side airbag sensor (RH) or curtain airbag sensor (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-126, DTC E9 SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-126, DTC EA SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-126, DTC EB SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-127, DTC EC SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>

# List of Diagnostic Trouble Code (DTC)

AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
ED EE	Side Sensor Bus RH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (RH) between airbag control module and side sensor.</li> <li>• Side airbag sensor (RH) or curtain airbag sensor (RH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-130, DTC ED SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-131, DTC EE SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>
F1 F2 F3 F4	Side Sensor Bus LH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (LH) between airbag control module and side sensor.</li> <li>• Side airbag sensor (LH) or curtain airbag sensor (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-134, DTC F1 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-134, DTC F2 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-134, DTC F3 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-135, DTC F4 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>
F5 F6	Side Sensor Bus LH Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness (LH) between airbag control module and side sensor.</li> <li>• Side airbag sensor (LH) or curtain airbag sensor (LH) is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<p>&lt;Ref. to AB(diag)-138, DTC F5 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt; &lt;Ref. to AB(diag)-139, DTC F6 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.&gt;</p>

## List of Diagnostic Trouble Code (DTC)

### AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
F8 F9 FA	Satellite Sensor Bus Communication error	<ul style="list-style-type: none"> <li>• Open or short circuit in harness between airbag control module and satellite safing sensor.</li> <li>• Satellite safing sensor is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-142, DTC F8 SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.> <Ref. to AB(diag)-142, DTC F9 SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.> <Ref. to AB(diag)-143, DTC FA SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>
3A	Front Sub Sensor RH False installation	<ul style="list-style-type: none"> <li>• Front sensor (RH) is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-145, DTC 3A FRONT SUB SENSOR RH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>
3B	Front Sub Sensor LH False installation	<ul style="list-style-type: none"> <li>• Front sensor (LH) is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-145, DTC 3B FRONT SUB SENSOR LH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>
3C	Satellite Sensor Bus failure	Satellite safing sensor is faulty.	<Ref. to AB(diag)-145, DTC 3C SATELLITE SENSOR BUS FAILURE, Diagnostic Chart with Trouble Code.>
3D	Satellite Sensor False installation	<ul style="list-style-type: none"> <li>• Satellite safing sensor is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-145, DTC 3D SATELLITE SENSOR FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>
5A	Side Airbag Sensor RH False installation	<ul style="list-style-type: none"> <li>• Side A/B sensor is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-146, DTC 5A SIDE AIRBAG SENSOR RH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>
5B	Side Airbag Sensor LH False installation	<ul style="list-style-type: none"> <li>• Side A/B sensor is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-146, DTC 5B SIDE AIRBAG SENSOR LH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>
5C	Curtain Airbag Sensor RH False installation	<ul style="list-style-type: none"> <li>• Curtain A/B sensor is misinstalled.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to AB(diag)-146, DTC 5C CURTAIN AIRBAG SENSOR RH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>

# List of Diagnostic Trouble Code (DTC)

AIRBAG SYSTEM (DIAGNOSTICS)

DTC	Display	Diagnosis content	Reference
5D	Curtain Airbag Sensor LH False installation	<ul style="list-style-type: none"><li>• Curtain A/B sensor is misinstalled.</li><li>• Airbag control module is faulty.</li></ul>	<Ref. to AB(diag)-146, DTC 5D CURTAIN AIRBAG SENSOR LH FALSE INSTALLATION, Diagnostic Chart with Trouble Code.>



# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## 14. Diagnostic Chart with Trouble Code

### A: DTC 11 DRIVER'S AIRBAG FAILURE

#### DTC DETECTING CONDITION:

- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (Driver's side) circuit is open, shorted or shorted to ground.
- Roll connector circuit is open, shorted or shorted to ground.
- Driver's airbag module is faulty.
- Airbag control module is faulty.

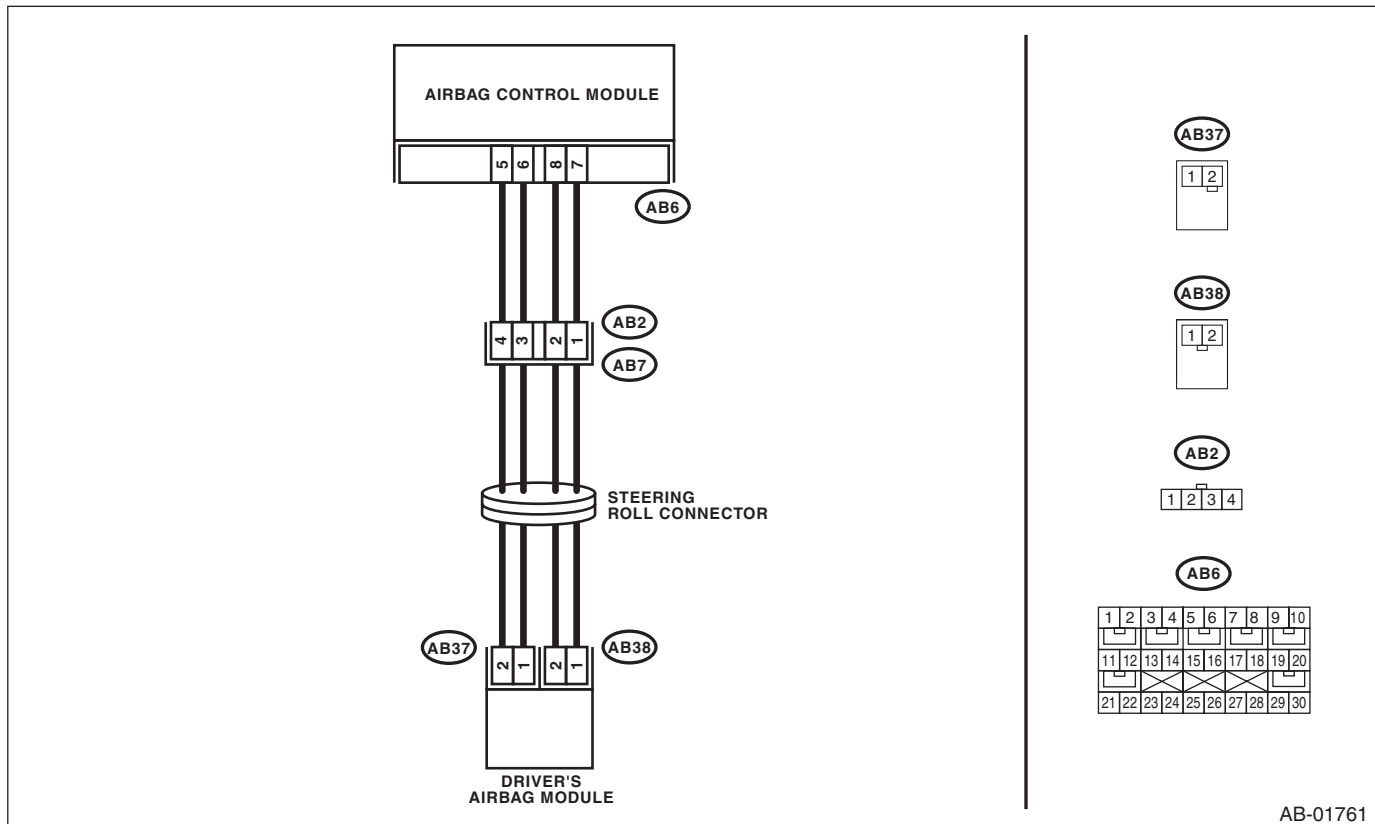
#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

#### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the driver's airbag module.	Is there poor contact?	Replace the airbag harness.	Go to step 2.
<b>2 CHECK DRIVER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the driver's airbag module. 3) Connect the connector (1N) in the test harness N to the connector (AB38). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the connector (1Q) in the test harness Q to connector (AB37). 6) Connect the airbag resistor to the connector (2Q) in the test harness Q. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the driver's airbag module. <Ref. to AB-14, Driver's Airbag Module.>	Go to step 3.
<b>3 CHECK ROLL CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the test harness N from connector (AB38). 3) Disconnect the test harness Q from connector (AB37). 4) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 5) Connect the connector (1P) in the test harness P to connector (AB2). 6) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the roll connector. <Ref. to AB-24, Roll Connector.>	Go to step 4.
<b>4 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Measure the resistance between connector (3AG) in the test harness AG and connectors (2P) and (3P) in the test harness P. <b>Connector &amp; terminal</b> (3AG) No. 1 — (2P) No. 1: (3AG) No. 3 — (2P) No. 2: (3AG) No. 2 — (3P) No. 3: (3AG) No. 4 — (3P) No. 4:	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag main harness along with body harness.

## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> Measure the resistance between connector (3AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <i>(3AG) No. 1 — (3AG) No. 3:</i> <i>(3AG) No. 3 — Chassis ground:</i> <i>(3AG) No. 1 — Chassis ground:</i> <i>(3AG) No. 2 — (3AG) No. 4:</i> <i>(3AG) No. 2 — Chassis ground:</i> <i>(3AG) No. 4 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag main harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.
<b>7 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## B: DTC 12 PASSENGER'S AIRBAG FAILURE

### DTC DETECTING CONDITION:

- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (Passenger's side) circuit is open, shorted or shorted to ground.
- Passenger's airbag module is faulty.
- Airbag control module is faulty.

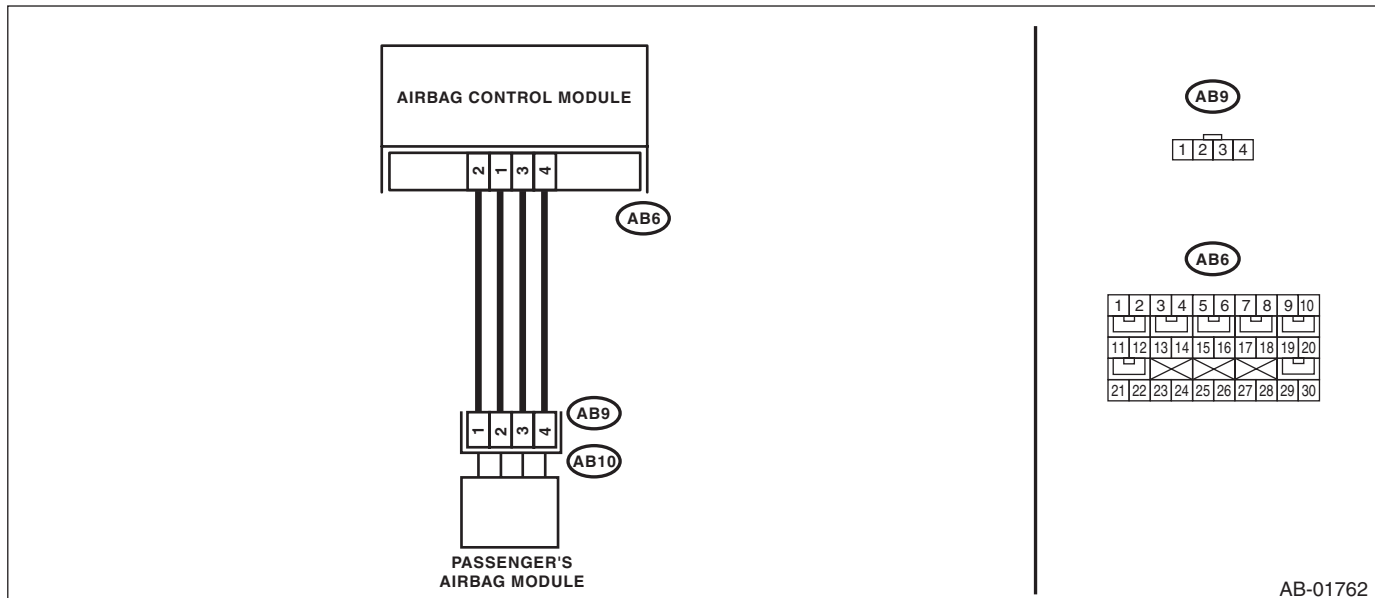
### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the passenger's airbag module.	Is there poor contact?	Replace the airbag harness.	Go to step 2.
<b>2 CHECK PASSENGER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the instrument panel side cover on the passenger's side and disconnect the connector (AB10) from (AB9). 3) Connect the connector (1P) in the test harness P to connector (AB9). 4) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the passenger's airbag module. <Ref. to AB-15, Passenger's Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Measure the resistance between connector (3AG) in the test harness AG and connectors (2P) and (3P) in the test harness P. <b>Connector &amp; terminal</b> <b>(3AG) No. 9 — (2P) No. 1:</b> <b>(3AG) No. 7 — (2P) No. 2:</b> <b>(3AG) No. 8 — (3P) No. 3:</b> <b>(3AG) No. 6 — (3P) No. 4:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> Measure the resistance between connectors (3AG) in the test harness AG, and between connector (3AG) and chassis ground. <b>Connector &amp; terminal</b> <b>(3AG) No. 9 — (3AG) No. 7:</b> <b>(3AG) No. 9 — Chassis ground:</b> <b>(3AG) No. 7 — Chassis ground:</b> <b>(3AG) No. 8 — (3AG) No. 6:</b> <b>(3AG) No. 8 — Chassis ground:</b> <b>(3AG) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag main harness along with body harness.
<b>5 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 6.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
6	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### C: DTC 15 DRIVER'S AIRBAG FAILURE

#### DTC DETECTING CONDITION:

- Airbag main harness circuit (Driver's side) is shorted to power supply.
- Airbag module harness circuit (Driver's side) is shorted to power supply.
- Roll connector is shorted to power supply.
- Driver's airbag module is faulty.
- Airbag control module is faulty.

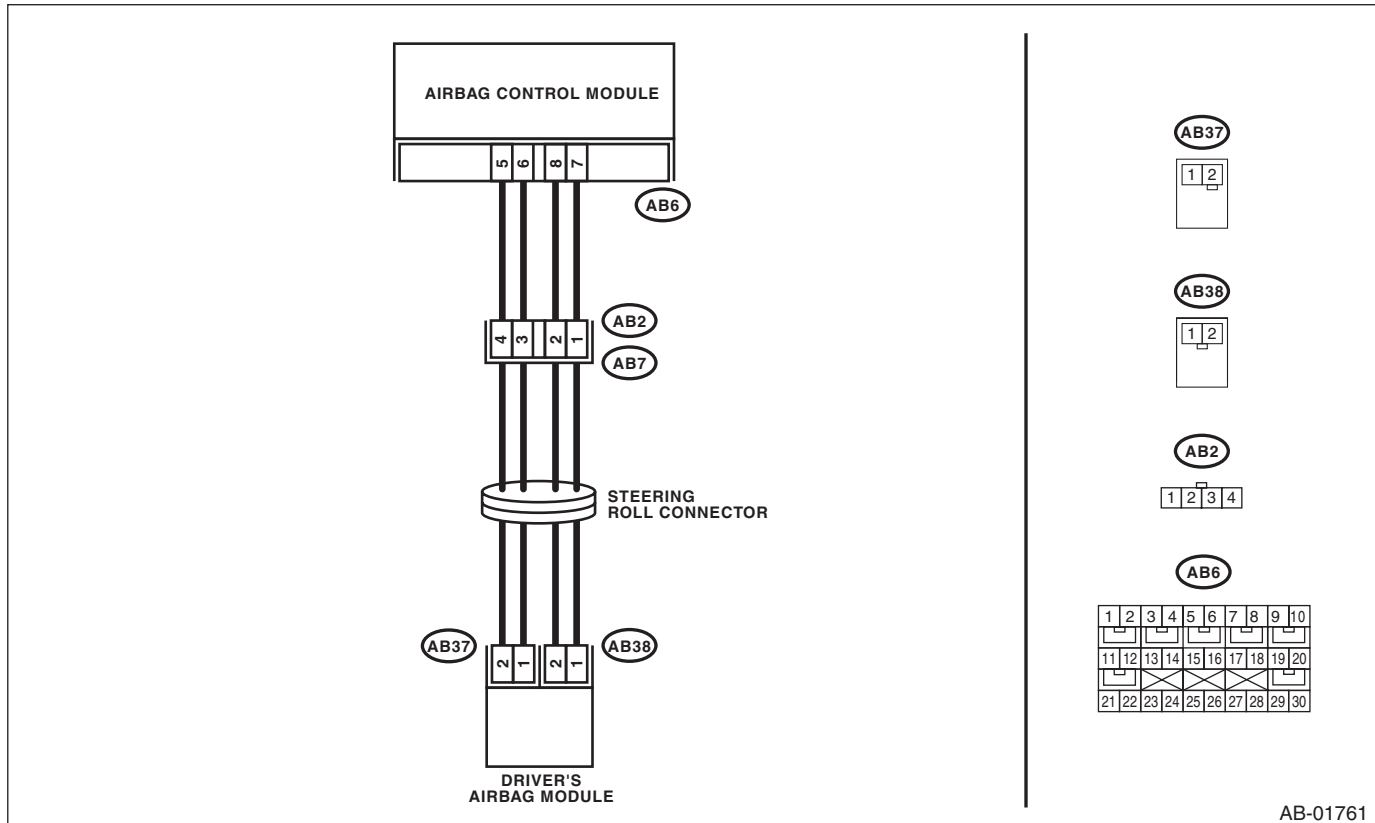
#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

#### WIRING DIAGRAM:



AB-01761

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the driver's airbag module.	Is there poor contact?	Replace the airbag harness.	Go to step 2.
<b>2 CHECK DRIVER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the driver's airbag module. 3) Connect the connector (AB38) to the connector (1N) in the test harness N. 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the connector (1Q) in the test harness Q to connector (AB37). 6) Connect the airbag resistor to the connector (2Q) in the test harness Q. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the driver's airbag module. <Ref. to AB-14, Driver's Airbag Module.>	Go to step 3.
<b>3 CHECK ROLL CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the test harness N from connector (AB38). 3) Disconnect the test harness Q from connector (AB37). 4) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 5) Connect the connector (1P) in the test harness P to connector (AB2). 6) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the roll connector. <Ref. to AB-24, Roll Connector.>	Go to step 4.
<b>4 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Connect the battery ground terminal and turn the ignition switch to ON. (engine OFF) 6) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> (3AG) No. 3 (+) — Chassis ground (-): (3AG) No. 1 (+) — Chassis ground (-): (3AG) No. 2 (+) — Chassis ground (-): (3AG) No. 4 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 5.	Replace the airbag main harness along with body harness.



## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>5</b>	<b>CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step <b>6</b> .
<b>6</b>	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## D: DTC 16 PASSENGER'S AIRBAG FAILURE

### DTC DETECTING CONDITION:

- Airbag main harness circuit (Passenger's side) is shorted to power supply.
- Airbag module harness circuit (Passenger's side) is shorted to power supply.
- Passenger's airbag module is faulty.
- Airbag control module is faulty.

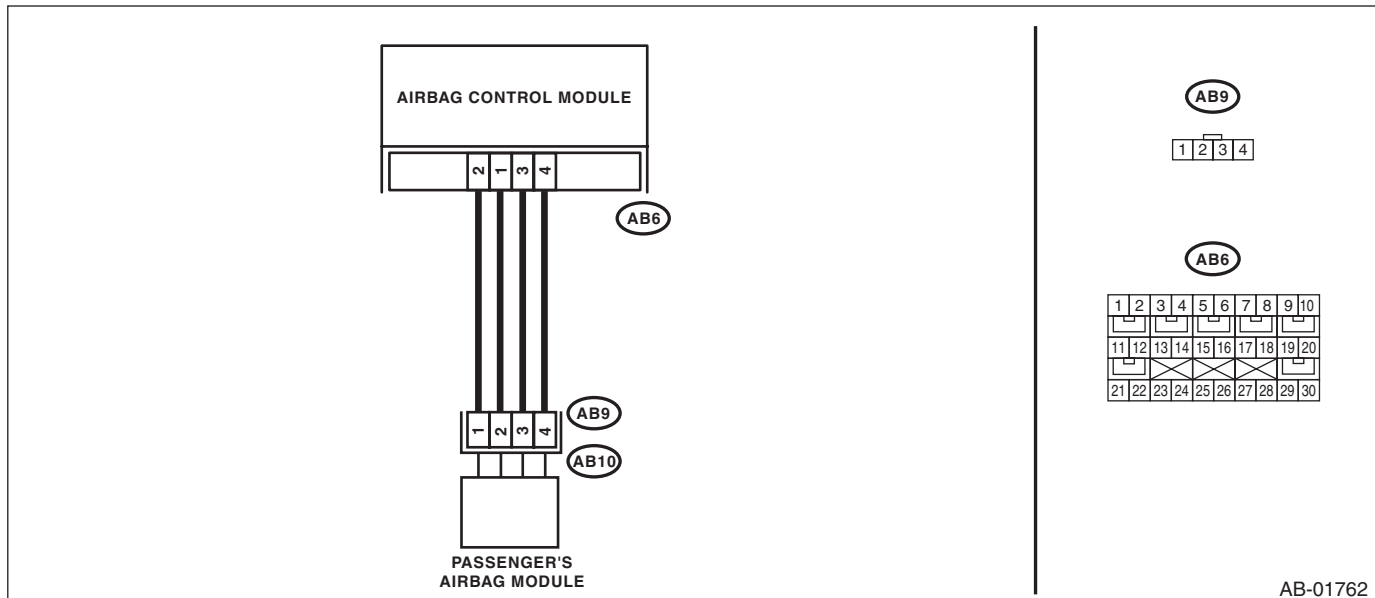
### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the passenger's airbag module.	Is there poor contact?	Replace the airbag harness along with chassis harness.	Go to step 2.
<b>2 CHECK PASSENGER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the instrument panel side cover on the passenger's side and disconnect the connector (AB10) from (AB9). 3) Connect the connector (1P) in the test harness P to connector (AB9). 4) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the passenger's airbag module. <Ref. to AB-15, Passenger's Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Connect the battery ground terminal and turn the ignition switch to ON. (engine OFF) 6) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <i>Connector &amp; terminal</i> (3AG) No. 9 (+) — Chassis ground (-): (3AG) No. 7 (+) — Chassis ground (-): (3AG) No. 8 (+) — Chassis ground (-): (3AG) No. 6 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## E: DTC 21 AIRBAG ECM FAILURE

### DTC DETECTING CONDITION:

Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.

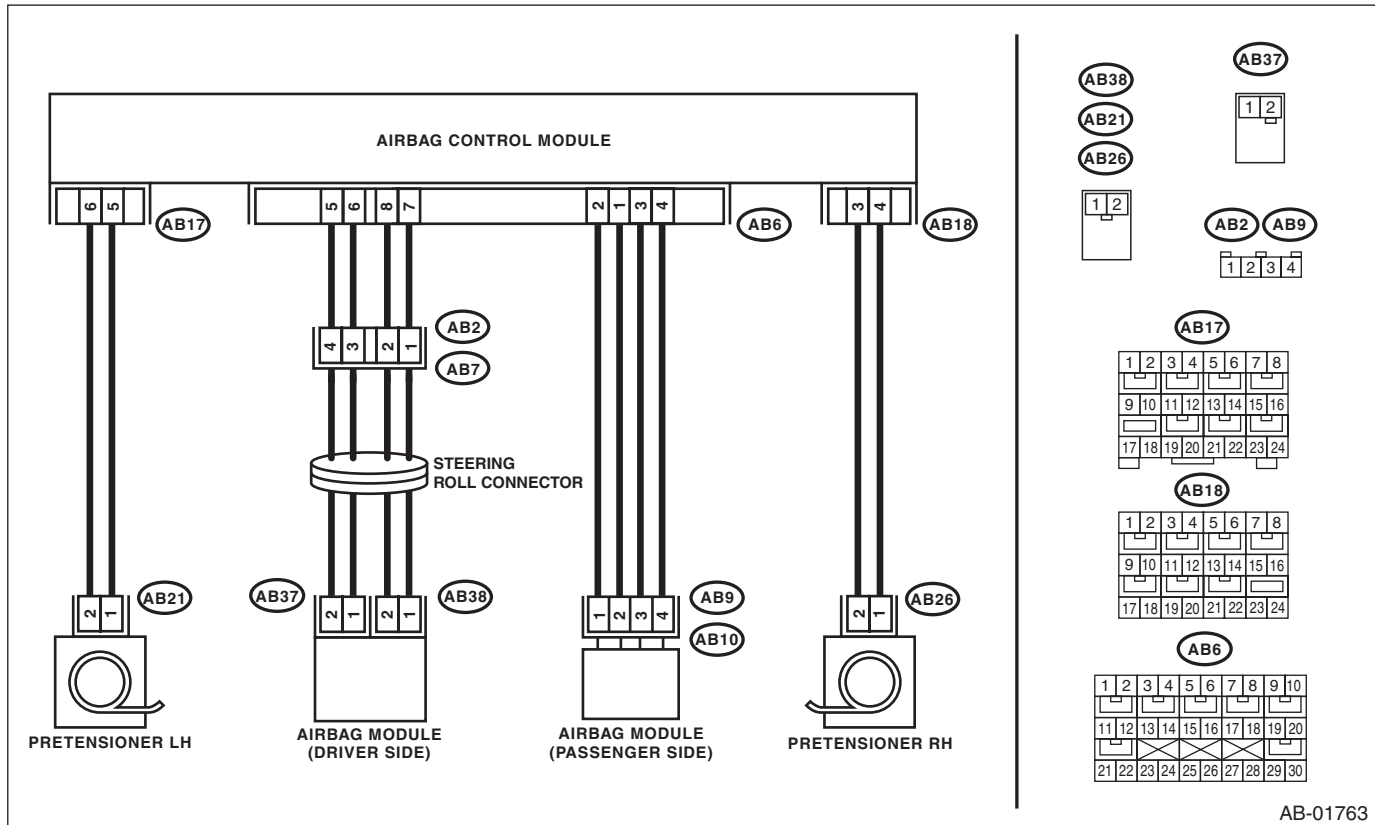
	Step	Check	Yes	No
1	<b>CHECK IF DTC 21 IS INDICATED.</b> Read the DTC. <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Does the Subaru Select Monitor display DTC21?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Perform the Clear Memory Mode. <Ref. to AB(diag)-31, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### F: DTC 22 FRONT AIRBAG FIRING OUTPUT

#### WIRING DIAGRAM:



AB-01763

This DTC is indicated when the front airbag module and the pretensioner are deployed.

Once this DTC is displayed, the memory cannot be cleared. Therefore replace the following parts.

- Airbag control module <Ref. to AB-20, Airbag Control Module.>
- Driver's airbag module <Ref. to AB-14, Driver's Airbag Module.>
- Passenger's airbag module <Ref. to AB-15, Passenger's Airbag Module.>
- Front sub sensor of both sides <Ref. to AB-25, Front Sub Sensor.>
- Front outer seat belt with pretensioner of both sides. <Ref. to SB-13, Front Seat Belt.>
- Steering roll connector <Ref. to AB-24, Roll Connector.>
- Occupant detection system (passenger's seat cushion & frame assembly) <Ref. to SE-9, Front Seat.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## G: DTC 26 PASSENGER'S AIRBAG INDICATOR FAILURE

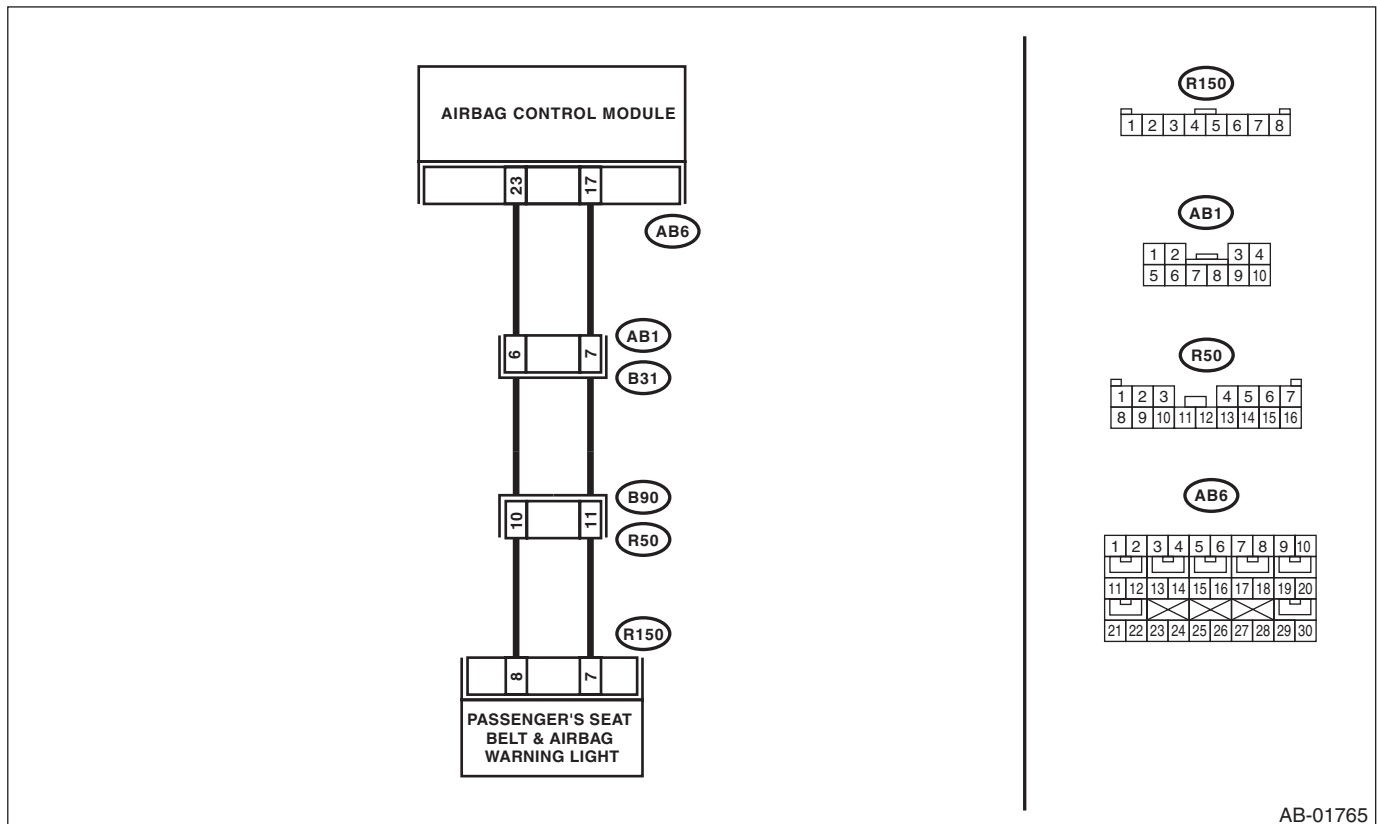
### DTC DETECTING CONDITION:

- Passenger's airbag indicator is faulty.
- Airbag control module is faulty.
- Airbag main harness circuit is open.
- Body harness circuit is open.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK POOR CONTACT.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Confirm that firm contact is secured for the connector between the airbag control module and map light.	Is there poor contact in any connector?	Replace the airbag harness connector.	Go to step 2.
<b>2</b> <b>CHECK AIRBAG MAIN HARNESS.</b> 1) Disconnect the connector (AB6) from airbag control module. 2) Connect the battery ground terminal and turn the ignition switch to ON. NOTE: Neither of ON/OFF illuminates when it is normal.	Does the passenger's airbag indicator illuminate?	Go to step 3.	Go to step 4.
<b>3</b> <b>CHECK AIRBAG MAIN HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Remove the map light and disconnect the connector (R150). 3) Connect the connector (1AG) in the test harness AG to the connector (AB6). 4) Measure the resistance between connector (2AG) in the test harness AG and chassis ground. <i>Connector &amp; terminal</i> <i>(2AG) No. 9 — (2AG) No. 8:</i> <i>(2AG) No. 9 — Chassis ground:</i> <i>(2AG) No. 8 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Replace the map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>	Repair the bulkhead harness. Or replace the airbag main harness along with body harness.
<b>4</b> <b>CHECK AIRBAG HARNESS.</b> 1) Connect the connectors (7AG) and (8AG) in the test harness AG. 2) Connect the battery ground terminal and turn the ignition switch to ON.	Does the passenger's airbag indicator illuminate?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5</b> <b>CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector (1AG) in the test harness AG to the connector (AB6). 3) Measure the resistance between connector (2AG) in the test harness AG and connector (R150). <i>Connector &amp; terminal</i> <i>(2AG) No. 9 — (R150) No. 7:</i> <i>(2AG) No. 8 — (R150) No. 8:</i>	Is the resistance less than 10 $\Omega$ ?	Go to step 6.	Repair the bulkhead harness. Or replace the airbag main harness along with body harness.
<b>6</b> <b>CHECK BODY HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between connector (R150) and chassis ground. <i>Connector &amp; terminal</i> <i>(R150) No. 4 — Chassis ground:</i>	Is the voltage 10 V or more?	Replace the map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>	Repair the map light power supply line.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## H: DTC 27 ODS COMMUNICATION ERROR

### DTC DETECTING CONDITION:

- Communication to the occupant detection control module is faulty.
- Airbag rear harness circuit is open, shorted, shorted to ground or shorted to power supply.
- Occupant detection harness (seat harness) is faulty.
- Occupant detection system is faulty.
- Airbag control module is faulty.

Step	Check	Yes	No
<b>1</b> <b>CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the occupant detection control module.	Is there poor contact?	Reconnect the connector. If defective is not improved, replace the airbag rear harness along with the body harness or the occupant detection harness (seat harness).	Go to step 2.
<b>2</b> <b>CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB18) from airbag control module. 3) Disconnect the connectors (AB59) and (AB53) under the passenger's seat. 4) Connect the connector (1AG) in the test harness AG to the connector (AB18). 5) Connect the connector (1AB) in the test harness AB to the connector (AB53). 6) Measure the resistance between connector (6AG) in the test harness AG and connector (2AB) in the test harness AB.  <i><b>Connector &amp; terminal</b></i> <i><b>(6AG) No. 9 — (2AB) No. 1:</b></i> <i><b>(6AG) No. 11 — (2AB) No. 2:</b></i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3</b> <b>CHECK AIRBAG HARNESS.</b> Measure the resistance between connector (3U) in the test harness U and chassis ground.  <i><b>Connector &amp; terminal</b></i> <i><b>(6AG) No. 9 — Chassis ground:</b></i> <i><b>(6AG) No. 9 — (6AG) No. 11:</b></i>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4</b> <b>CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between connector (2AB) in the test harness AB and chassis ground.  <i><b>Connector &amp; terminal</b></i> <i><b>(2AB) No. 3 — chassis ground:</b></i>	Is the voltage 9 V or more?	Replace the occupant detection harness (seat harness). If defective is not improved, replace the occupant detection system (seat cushion & frame assembly), and then the airbag control module in this order.	Check the battery voltage and fuse. If there is no fault, replace the airbag rear harness along with body harness or replace the body harness.



## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

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#### **I: DTC 29 ODS FAILURE**

**NOTE:**

Refer to “Occupant Detection System” for details on DTC 29. <Ref. to OD(diag)-26, DTC 29 ODS FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **J: DTC 2A ODS CALIBRATION ERROR**

**NOTE:**

Refer to “Occupant Detection System” for details on DTC 2A. <Ref. to OD(diag)-23, DTC 2A ODS CALIBRATION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **K: DTC 2B ODS SYSTEM WRONG PARTS**

**NOTE:**

Refer to “Occupant Detection System” for details on DTC 2B. <Ref. to OD(diag)-23, DTC 2B ODS SYSTEM WRONG PARTS, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **L: DTC 2C BELT TENSION SENSOR FAILURE**

**NOTE:**

Refer to “Occupant Detection System” for details on DTC 2C. <Ref. to OD(diag)-24, DTC 2C BELT TENSION SENSOR FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### **M: DTC 33 FRONT SUB SENSOR RH FAILURE**

**DTC DETECTING CONDITION:**

Front sub sensor (RH) is faulty.

If DTC 33 is displayed, the circuit within the front sub sensor (RH) is faulty.

Replace the front sub sensor (RH). <Ref. to AB-25, Front Sub Sensor.>

#### **N: DTC 34 FRONT SUB SENSOR LH FAILURE**

**DTC DETECTING CONDITION:**

Front sub sensor (LH) is faulty.

If DTC 34 is displayed, the circuit within the front sub sensor (LH) is faulty.

Replace the front sub sensor (LH). <Ref. to AB-25, Front Sub Sensor.>

#### **O: DTC 37 BUCKLE SWITCH RH FAILURE**

**NOTE:**

Refer to “Occupant Detection System” for details on DTC 37. <Ref. to OD(diag)-27, DTC 37 BUCKLE SWITCH RH FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Chart with Trouble Code

## P: DTC 39 SEAT BELT WARNING FAILURE

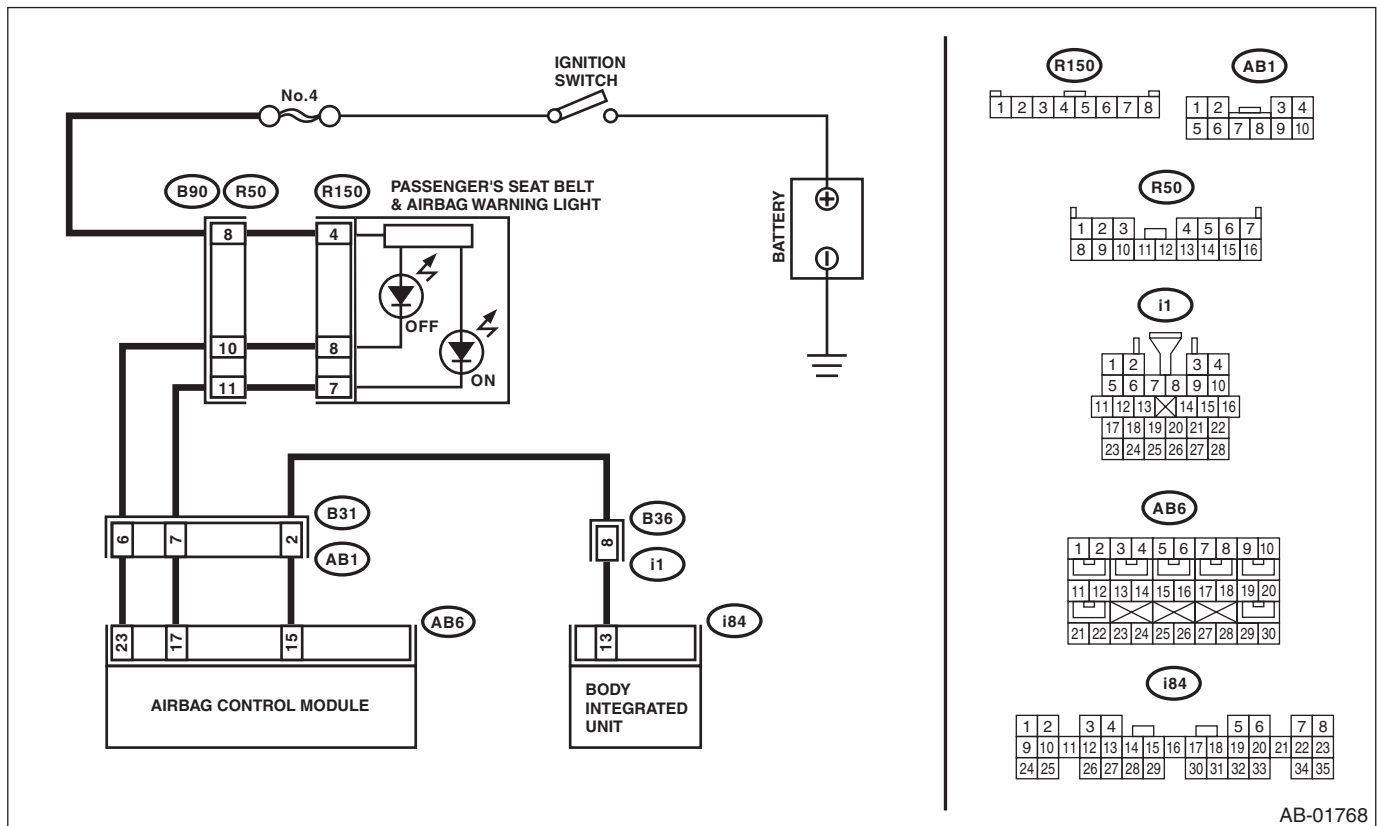
### DTC DETECTING CONDITION:

- Airbag control module is faulty.
- Body integrated unit is faulty.
- Harness circuits between body integrated unit and airbag control module are open, shorted or shorted to ground.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01768

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB6) from airbag control module. 3) Connect the battery ground terminal and turn the ignition switch to ON.	Does the passenger's seat belt warning light blink for 6 seconds and go off?	Go to step 3.	Go to step 2.
<b>2</b> <b>CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to OFF. 2) Connect the connector (1AG) in the test harness AG to the connector (AB6). 3) Measure the resistance between connector (2AG) in the test harness AG and chassis ground. <i>Connector &amp; terminal (2AG) No. 10 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Replace the body integrated unit.	Repair the bulk-head harness. Or replace the airbag main harness along with body harness.
<b>3</b> <b>CHECK AIRBAG HARNESS.</b> 1) Connect the connectors (7AG) and (8AG) in the test harness AG in the condition of step 2. 2) Turn the ignition switch to ON.	Does the passenger's seat belt warning light blink for 6 seconds, then repeatedly light and go off?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 4.
<b>4</b> <b>CHECK AIRBAG HARNESS.</b> 1) Disconnect the connectors (7AG) and (8AG) in the test harness AG in the condition of step 3. 2) Measure the resistance between connector (2AG) in the test harness AG and connector (i84). <i>Connector &amp; terminal (2AG) No. 10 — (i84) No. 13:</i>	Is the resistance less than 10 $\Omega$ ?	Replace the body integrated unit.	Repair the bulk-head harness. Or replace the airbag main harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## Q: DTC 41 SIDE AIRBAG RH FAILURE

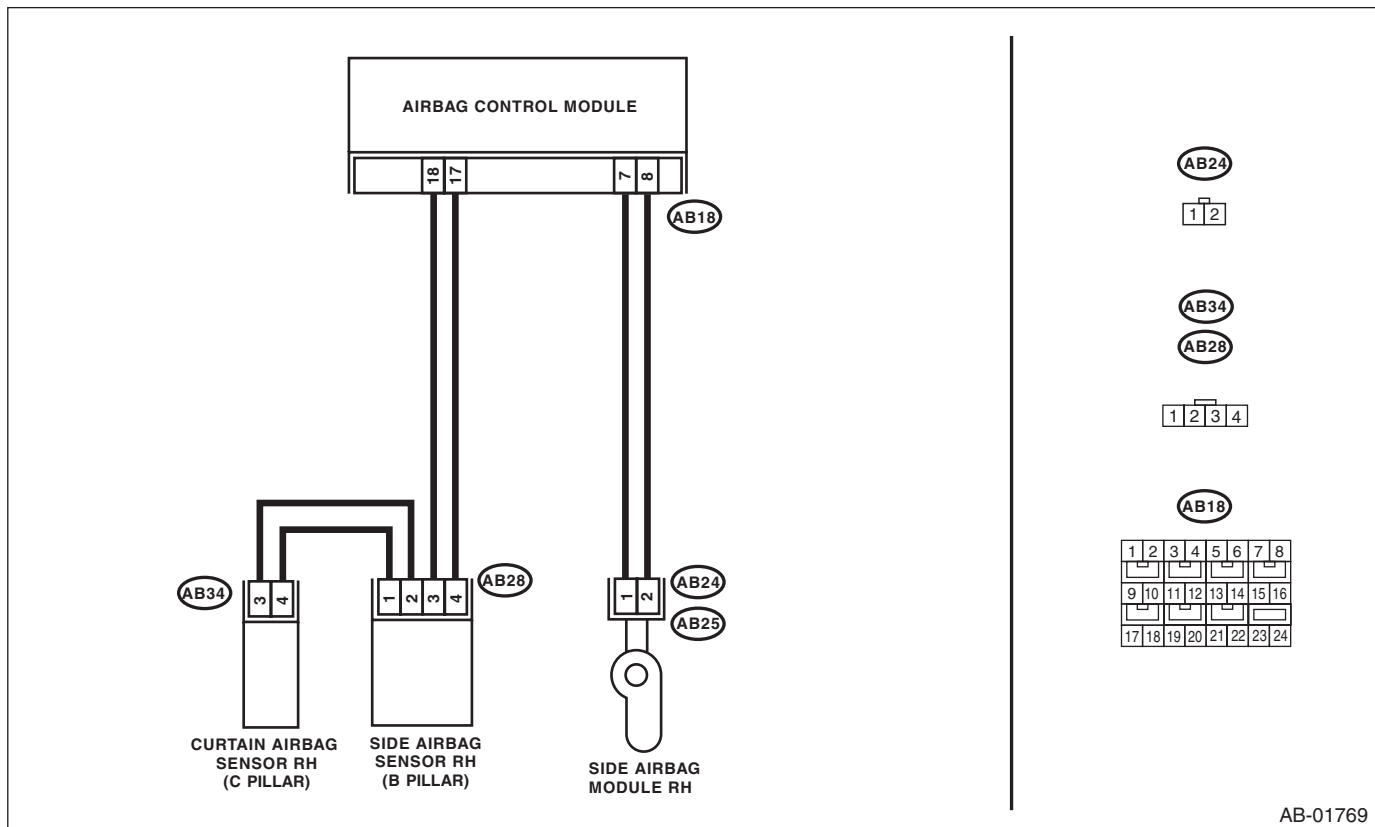
### DTC DETECTING CONDITION:

- Side airbag harness (RH) is faulty.
- Side airbag module (RH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



Step	Check	Yes	No
1	<b>CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module RH and the side airbag sensor RH.	Is there poor contact?  Replace the airbag rear harness along with body harness.	Go to step 2.

## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>2 CHECK SIDE AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB25) and (AB24), and connect the connector (1F) in test harness F to connector (AB24). 3) Connect the airbag resistor to the connector (3F) of test harness F. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the side airbag module (RH). <Ref. to AB-16, REMOVAL, Side Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect the connector (AB33) from curtain airbag module (RH). 4) Disconnect the airbag resistor from test harness F. 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Measure the resistance between connector (5AG) in the test harness AG and connector (3F) in the test harness F. <i>Connector &amp; terminal</i> <i>(5AG) No. 5 — (3F) No. 4:</i> <i>(5AG) No. 7 — (3F) No. 3:</i>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS RH).</b> Measure the resistance between connector (5AG) terminals in the test harness AG. <i>Connector &amp; terminal</i> <i>(5AG) No. 5 — (5AG) No. 7:</i>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS RH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <i>Connector &amp; terminal</i> <i>(5AG) No. 5 — Chassis ground:</i> <i>(5AG) No. 7 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.
<b>7 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## R: DTC 42 SIDE AIRBAG LH FAILURE

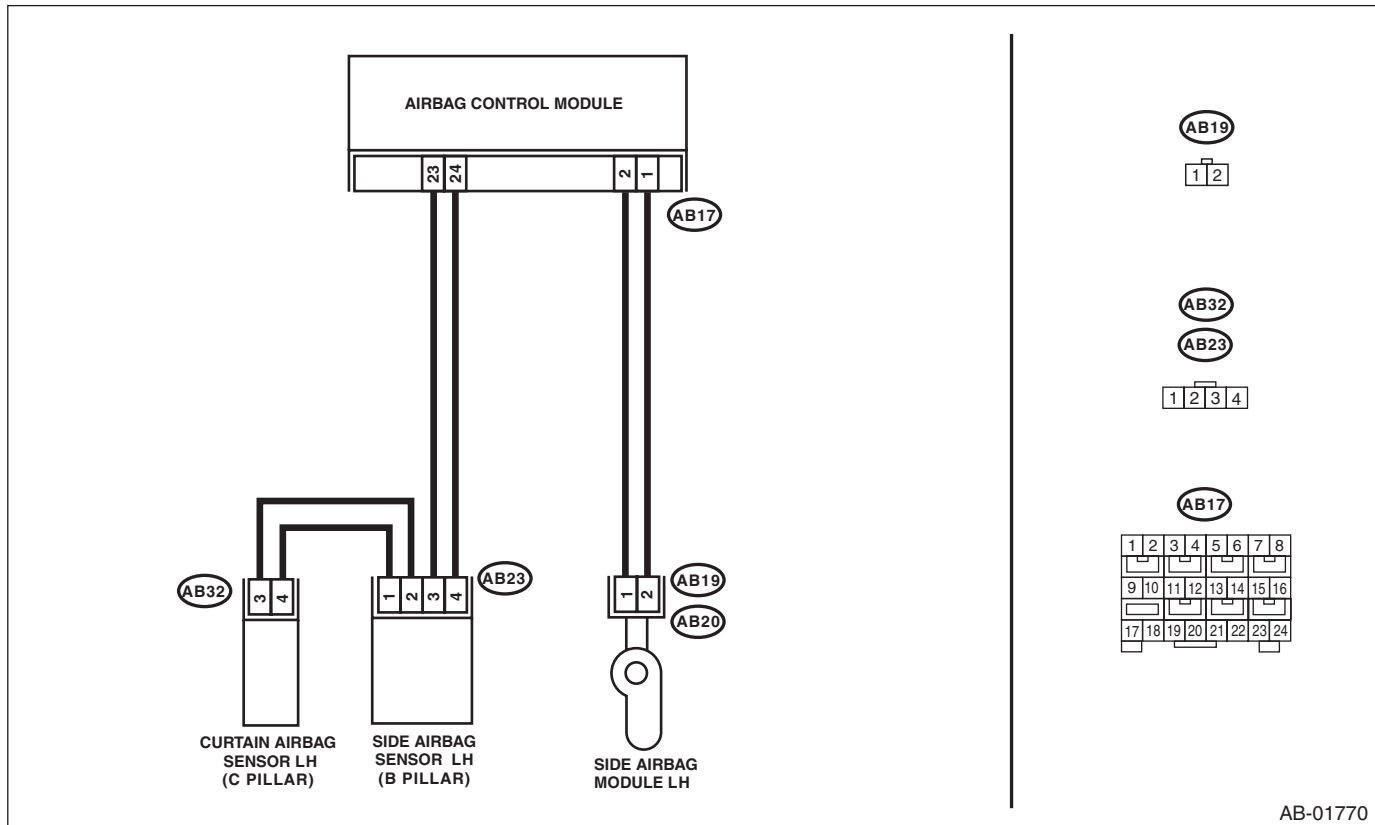
### DTC DETECTING CONDITION:

- Side airbag harness (LH) is faulty.
- Side airbag module (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<b>CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module LH and the side airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.

## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>2 CHECK SIDE AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB20) and (AB19), and connect the connector (1F) in test harness F to connector (AB19). 3) Connect the airbag resistor to the connector (3F) of test harness F. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the side airbag module (LH). <Ref. to AB-16, REMOVAL, Side Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect the connector (AB31) from curtain airbag module (LH). 4) Disconnect the airbag resistor from test harness. 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Measure the resistance between connector (5AG) in the test harness AG and connector (3F) in the test harness F. <b>Connector &amp; terminal</b> <b>(5AG) No. 1 — (3F) No. 3:</b> <b>(5AG) No. 3 — (3F) No. 4:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS LH).</b> Measure the resistance between connector (5AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <b>(5AG) No. 1 — (5AG) No. 3:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS LH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(5AG) No. 1 — Chassis ground:</b> <b>(5AG) No. 3 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.
<b>7 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## S: DTC 45 SIDE AIRBAG RH FAILURE

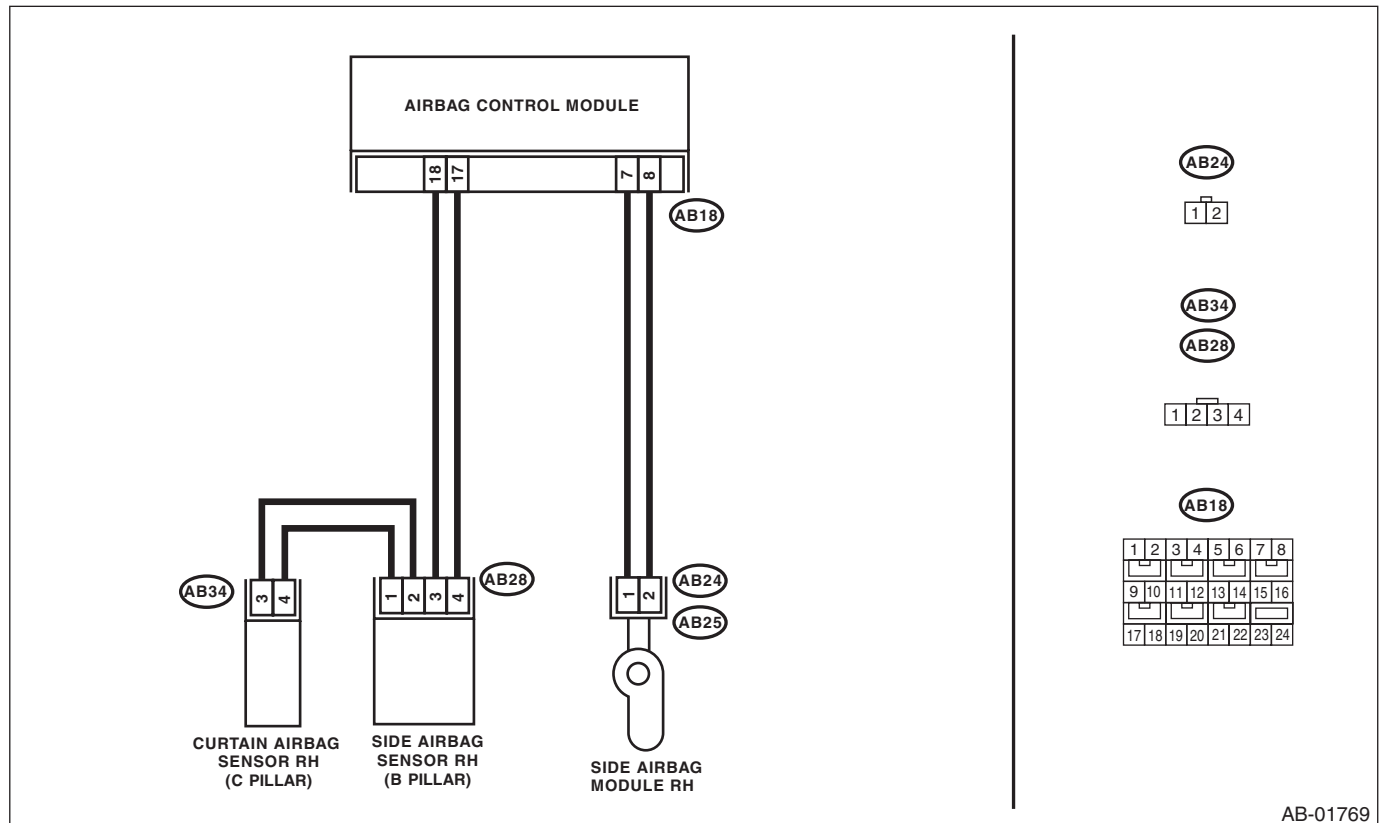
### DTC DETECTING CONDITION:

- Side airbag harness (RH) is shorted to power supply.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01769



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module RH and the side airbag sensor RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SIDE AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB25) and (AB24), and connect the connector (1F) in test harness F to connector (AB24). 3) Connect the airbag resistor to the connector (3F) of test harness F. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the side airbag module (RH). <Ref. to AB-16, REMOVAL, Side Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect the connector (AB33) from curtain airbag module (RH). 4) Disconnect the airbag resistor from test harness. 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(5AG) No. 5 (+) — Chassis ground (-):</b> <b>(5AG) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## T: DTC 46 SIDE AIRBAG LH FAILURE

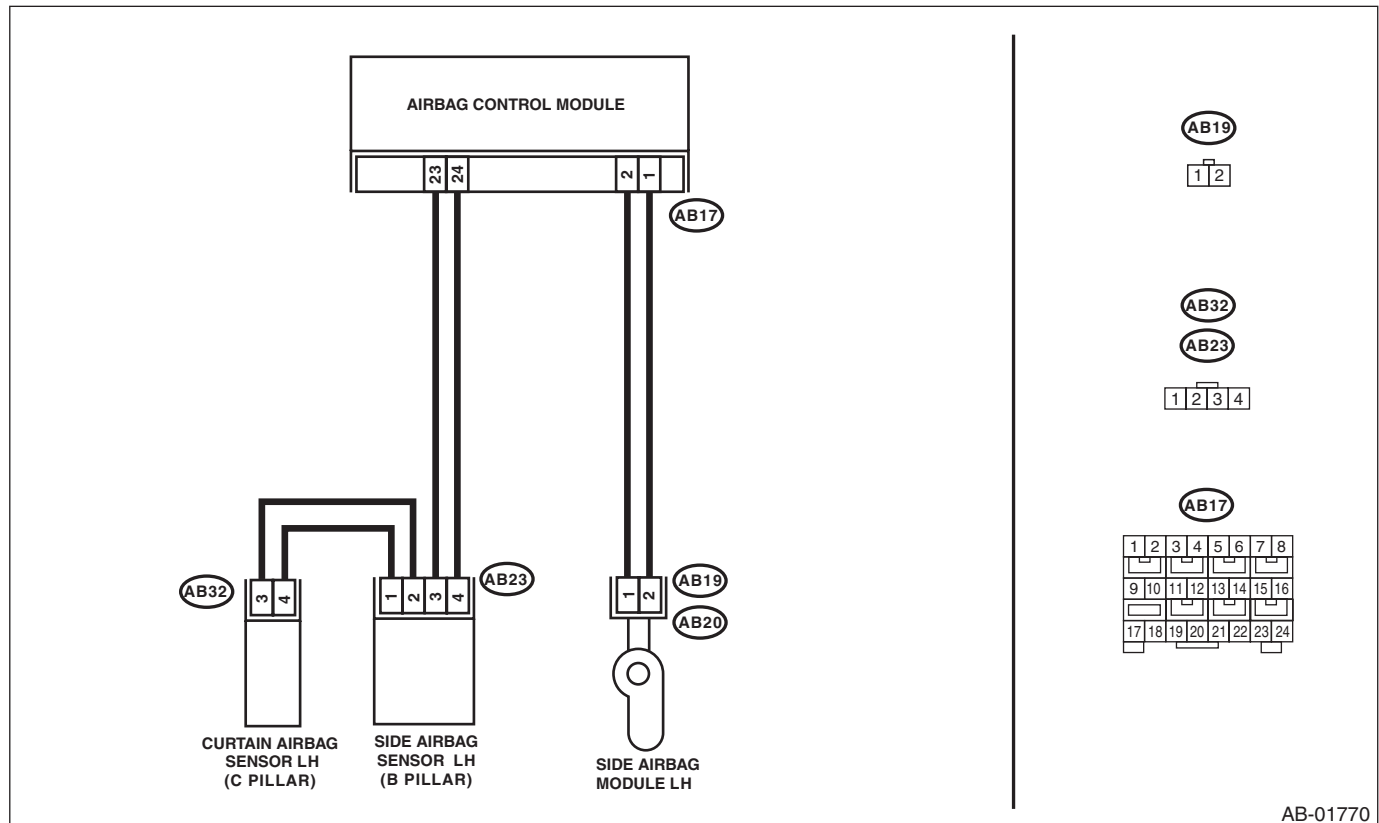
### DTC DETECTING CONDITION:

- Side airbag harness (LH) is shorted to power supply.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01770

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module LH and the side airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SIDE AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB20) and (AB19), and connect the connector (1F) in test harness F to connector (AB19). 3) Connect the airbag resistor to the connector (3F) of test harness F. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the side airbag module (LH). <Ref. to AB-16, REMOVAL, Side Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG MODULE HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect the connector (AB31) from curtain airbag module (LH). 4) Disconnect the airbag resistor from test harness. 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(5AG) No. 3 (+) — Chassis ground (-):</b> <b>(5AG) No. 1 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## U: DTC 51 SIDE AIRBAG SENSOR RH FAILURE

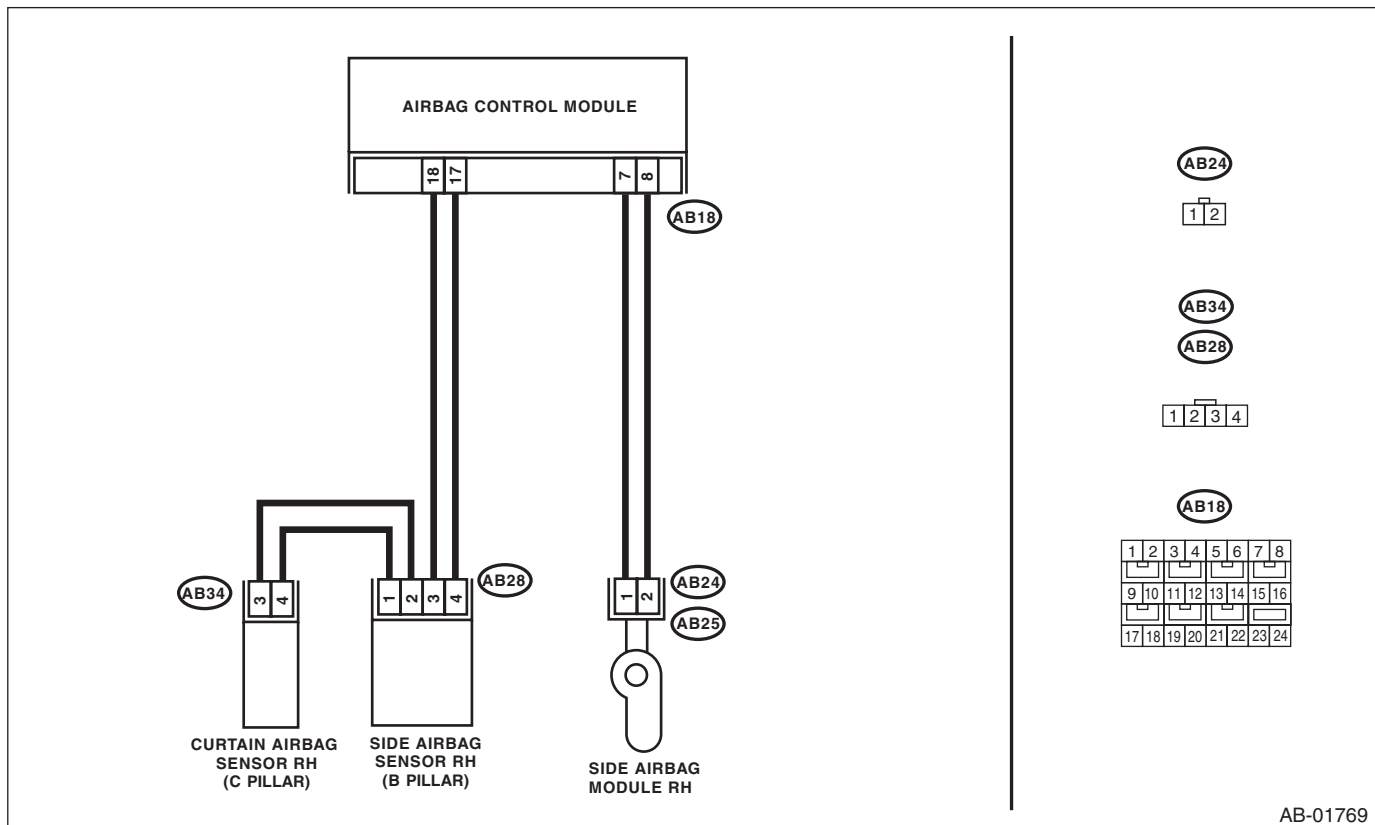
### DTC DETECTING CONDITION:

- Side airbag sensor (RH) is faulty.
- Side airbag harness (RH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01769

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module RH and the side airbag sensor RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG SENSOR HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect the connector (AB33) from curtain airbag module (RH). 4) Disconnect the connectors (AB25) and (AB24). 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Disconnect the connector (AB28) from side airbag sensor (RH), and connect the connector (2V) in test harness V to connector (AB28). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <i><b>Connector &amp; terminal</b></i> <i><b>(5AG) No. 14 — (3V) No. 1:</b></i> <i><b>(5AG) No. 16 — (3V) No. 2:</b></i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG SENSOR HARNESS RH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(5AG) No. 14 — Chassis ground:</b></i> <i><b>(5AG) No. 16 — Chassis ground:</b></i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the side airbag sensor (RH). <Ref. to AB-21, Side Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## V: DTC 52 SIDE AIRBAG SENSOR LH FAILURE

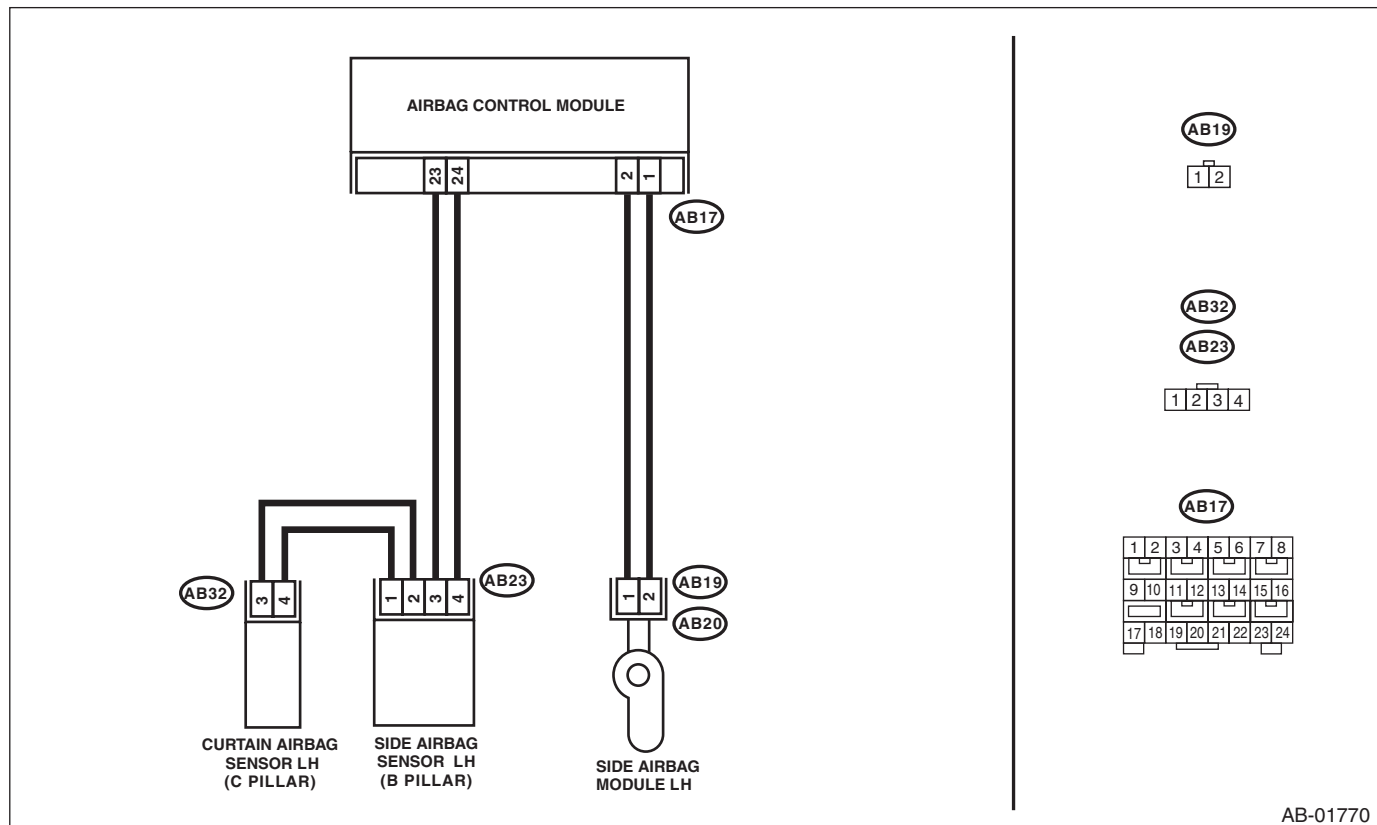
### DTC DETECTING CONDITION:

- Side airbag sensor (LH) is faulty.
- Side airbag harness (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01770

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, side airbag module LH and the side airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG SENSOR HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect the connector (AB31) from curtain airbag module (LH). 4) Disconnect the connectors (AB20) and (AB19). 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Disconnect the connector (AB23) from side airbag sensor (LH), and connect the connector (2V) in test harness V to connector (AB23). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <b>Connector &amp; terminal</b> <b>(5AG) No. 8 — (3V) No. 1:</b> <b>(5AG) No. 10 — (3V) No. 2:</b>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (SIDE AIRBAG SENSOR HARNESS LH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(5AG) No. 8 — Chassis ground:</b> <b>(5AG) No. 10 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the side airbag sensor (LH). <Ref. to AB-21, Side Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## **W: DTC 53 SIDE AIRBAG SENSOR RH FAILURE**

### **DTC DETECTING CONDITION:**

Side airbag sensor (RH) is faulty.

When DTC 53 is displayed, the circuit within the side airbag sensor (RH) is faulty.

Replace the side airbag sensor (RH). <Ref. to AB-21, Side Airbag Sensor.>

## **X: DTC 54 SIDE AIRBAG SENSOR LH FAILURE**

### **DTC DETECTING CONDITION:**

Side airbag sensor (LH) is faulty.

When DTC 54 is displayed, the circuit within the side airbag sensor (LH) is faulty.

Replace the side airbag sensor (LH). <Ref. to AB-21, Side Airbag Sensor.>

## **Y: DTC 55 SIDE CURTAIN AIRBAG FIRING OUTPUT**

This DTC is displayed when the side airbag module and curtain airbag module are deployed.

Once this DTC is displayed, the memory cannot be cleared. Replace the following parts.

- Airbag control module <Ref. to AB-20, Airbag Control Module.>
- Front seat with side airbag module (Operating side) <Ref. to SE-9, Front Seat.>
- Side airbag sensor (Operating side) <Ref. to AB-21, Side Airbag Sensor.>
- Curtain airbag module (Operating side) <Ref. to AB-18, Curtain Airbag Module.>
- Curtain airbag sensor (Operating side) <Ref. to AB-22, Curtain Airbag Sensor.>



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### Z: DTC 56 CURTAIN AIRBAG SENSOR RH FAILURE

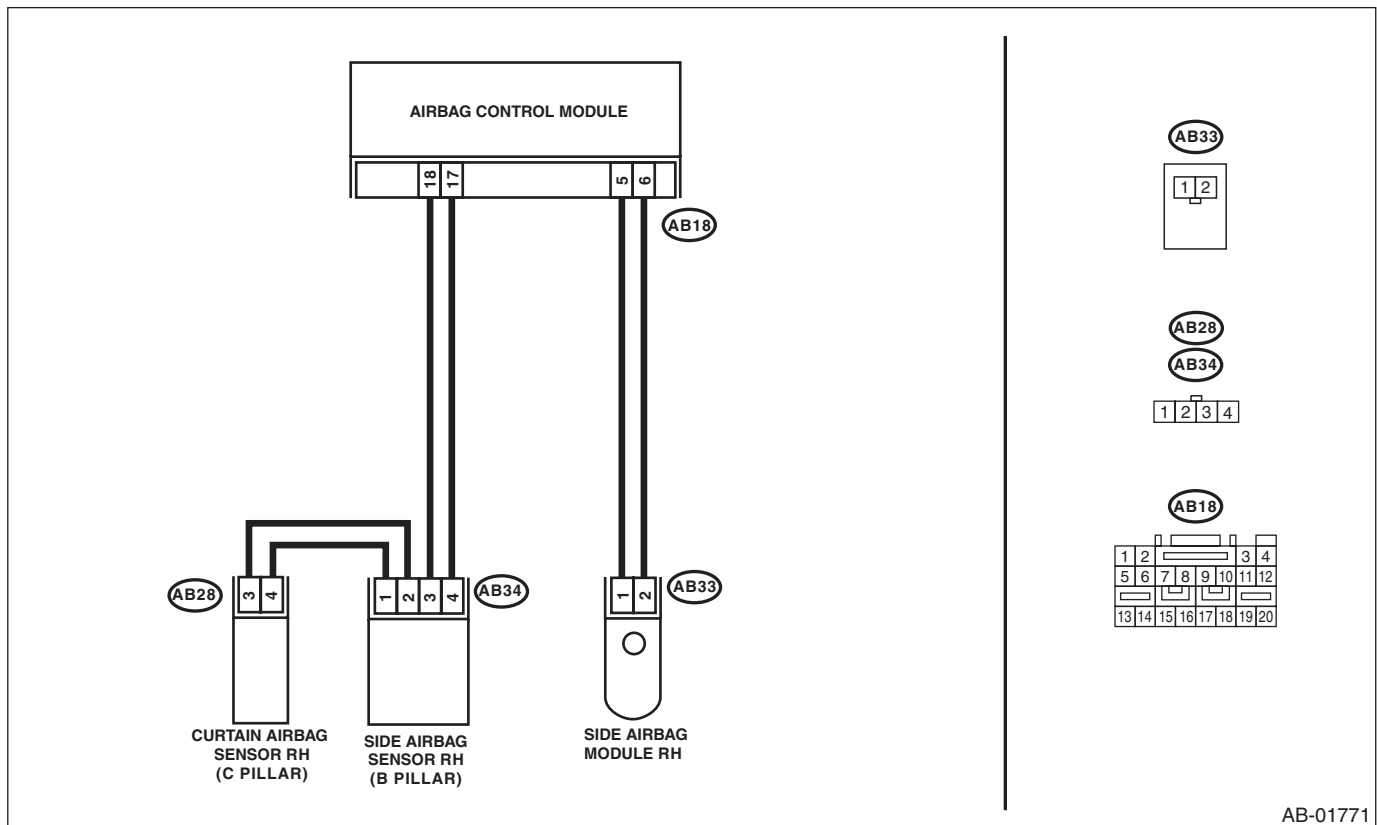
#### DTC DETECTING CONDITION:

- Curtain airbag sensor (RH) is faulty.
- Curtain airbag harness (RH) is faulty.
- Airbag control module is faulty.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



AB-01771

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module RH and the curtain airbag sensor RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG SENSOR HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect connector (AB24) from side airbag module (RH). 4) Disconnect the connector (AB33) from curtain airbag module. 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Disconnect the connector (AB34) from curtain airbag sensor (RH), and connect the connector (2V) in test harness V to connector (AB34). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 14 — (3V) No. 1:</i> <i>(5AG) No. 16 — (3V) No. 2:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG SENSOR HARNESS RH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <i>(5AG) No. 14 — Chassis ground:</i> <i>(5AG) No. 16 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the curtain airbag sensor (RH). <Ref. to AB-22, Curtain Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AA:DTC 57 CURTAIN AIRBAG SENSOR LH FAILURE

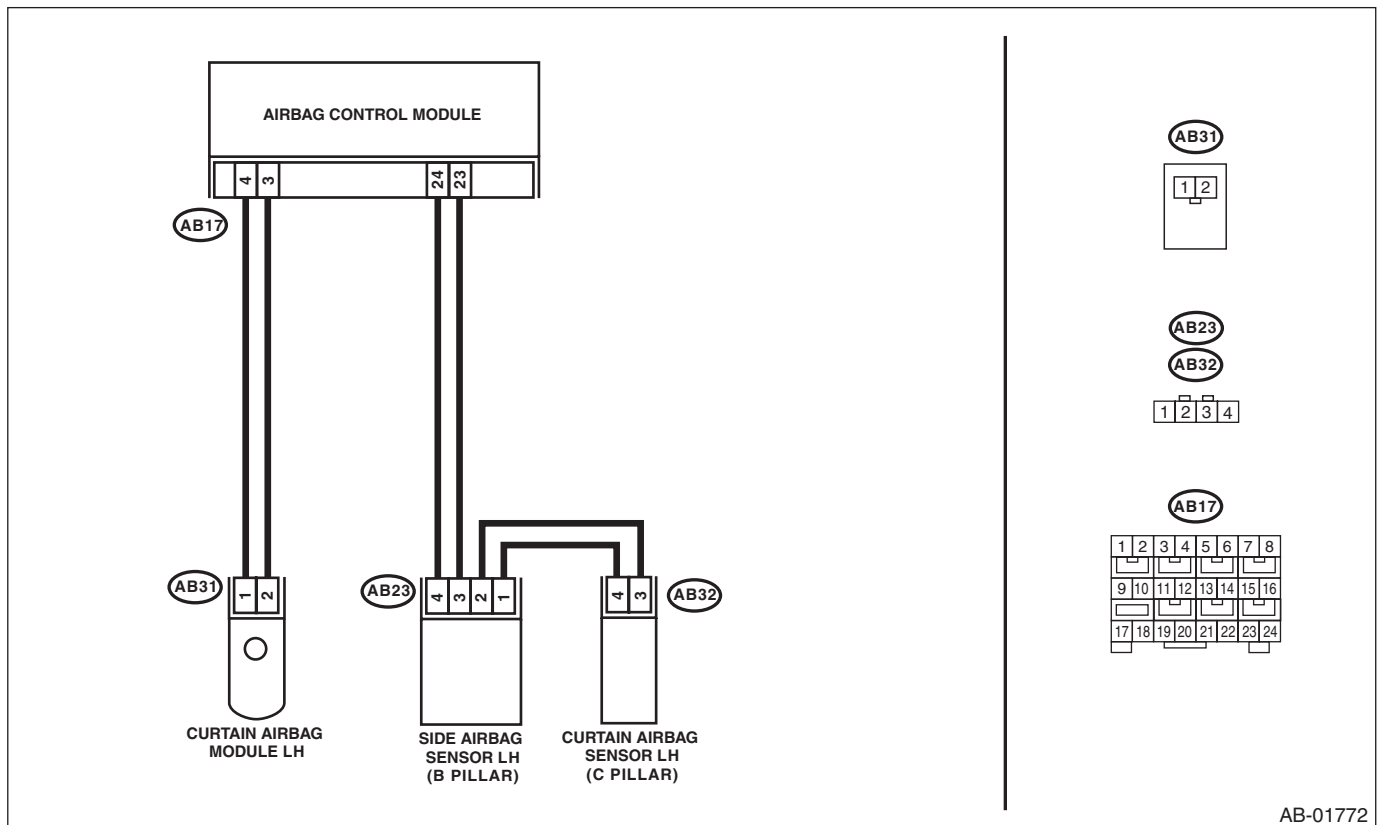
### DTC DETECTING CONDITION:

- Curtain airbag sensor (LH) is faulty.
- Curtain airbag harness (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01772

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module LH and the curtain airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG SENSOR HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect connector (AB19) from side airbag module (LH). 4) Disconnect the connector (AB31) from curtain airbag module. 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Disconnect the connector (AB32) from curtain airbag sensor (LH), and connect the connector (2V) in test harness V to connector (AB32). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 8 — (3V) No. 1:</i> <i>(5AG) No. 10 — (3V) No. 2:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG SENSOR HARNESS LH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <i>(5AG) No. 8 — Chassis ground:</i> <i>(5AG) No. 10 — Chassis ground:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the curtain airbag sensor (LH). <Ref. to AB-22, Curtain Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **AB:DTC 58 CURTAIN AIRBAG SENSOR RH FAILURE**

#### **DTC DETECTING CONDITION:**

Curtain airbag sensor (RH) is faulty.

If DTC 58 is displayed, the circuit within the curtain airbag sensor (RH) is faulty.

Replace the curtain airbag sensor (RH). <Ref. to AB-22, Curtain Airbag Sensor.>

### **AC:DTC 59 CURTAIN AIRBAG SENSOR LH FAILURE**

#### **DTC DETECTING CONDITION:**

Curtain airbag sensor (LH) is faulty.

If DTC 59 is displayed, the circuit within the curtain airbag sensor (LH) is faulty.

Replace the curtain airbag sensor (LH). <Ref. to AB-22, Curtain Airbag Sensor.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AD:DTC 61 BELT PRETENSIONER RH FAILURE

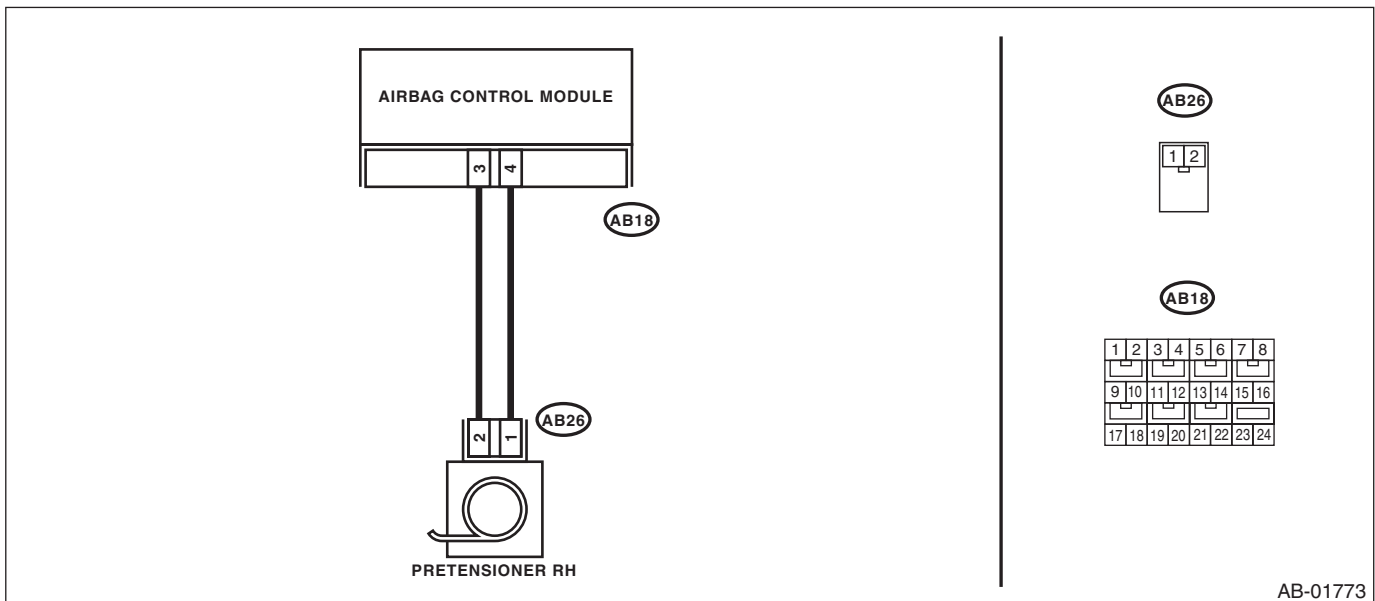
### DTC DETECTING CONDITION:

- Seat belt pretensioner (RH) circuit is open, shorted or shorted to ground.
- Airbag control module is faulty.
- Pretensioner is faulty.
- Pretensioner harness is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the seat belt pretensioner RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SEAT BELT PRETENSIONER.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Connect the connector (1N) in the test harness N to the connector (AB26). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the seat belt pretensioner (RH). <Ref. to SB-13, Front Seat Belt.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from test harness. 3) Disconnect connector (AB24) from side airbag module (RH). 4) Disconnect the connector (AB33) from curtain airbag module (RH). 5) Disconnect the connectors (AB17) and (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Measure the resistance between connector (3AG) in the test harness AG and connector (2N) in the test harness N. <b>Connector &amp; terminal</b> <b>(3AG) No. 18 — (2N) No. 1:</b> <b>(3AG) No. 20 — (2N) No. 2:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS RH).</b> Measure the resistance between connector (3AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <b>(3AG) No. 18 — (3AG) No. 20:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS RH).</b> Measure the resistance between connector (3AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(3AG) No. 18 — Chassis ground:</b> <b>(3AG) No. 20 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
7	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AE:DTC 62 BELT PRETENSIONER LH FAILURE

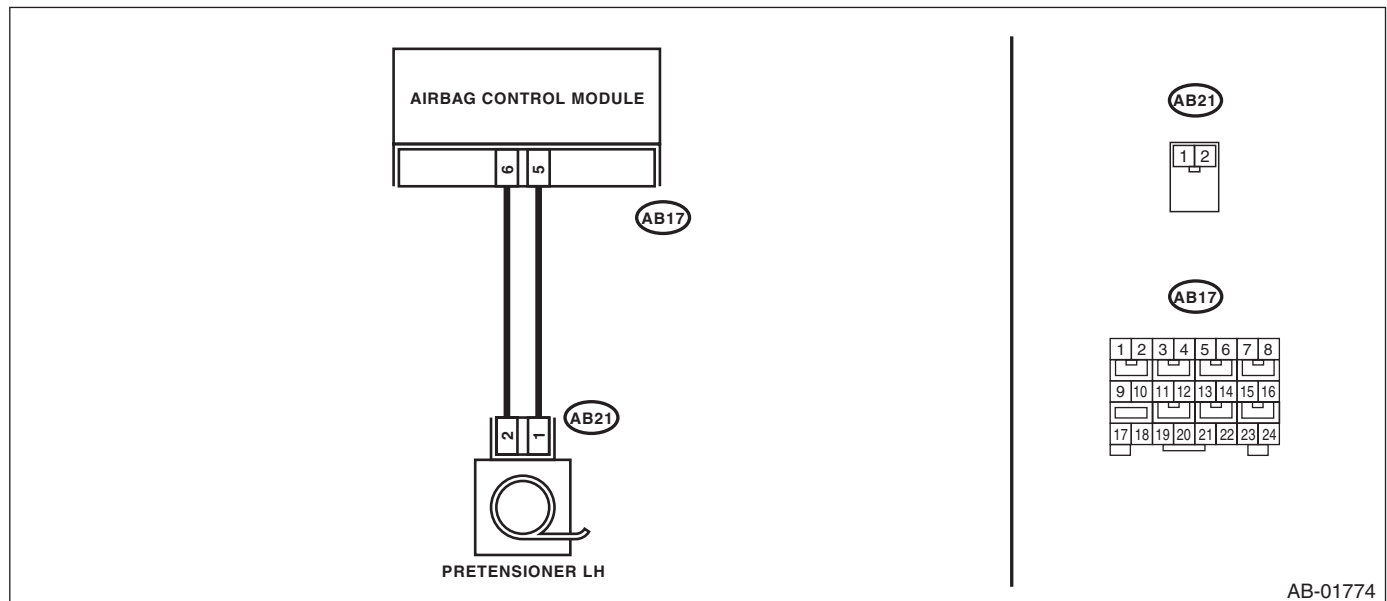
#### DTC DETECTING CONDITION:

- Seat belt pretensioner (LH) circuit is open, shorted or shorted to ground.
- Airbag control module is faulty.
- Pretensioner is faulty.
- Pretensioner harness is faulty.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the seat belt pretensioner LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SEAT BELT PRETENSIONER.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Connect the connector (1N) in the test harness N to the connector (AB21). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the seat belt pretensioner (LH). <Ref. to SB-13, Front Seat Belt.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from test harness. 3) Disconnect connector (AB19) from side airbag module (LH). 4) Disconnect the connector (AB31) from curtain airbag module (LH). 5) Disconnect the connectors (AB17) and (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Measure the resistance between connector (3AG) in the test harness AG and connector (2N) in the test harness N. <b>Connector &amp; terminal</b> <b>(3AG) No. 12 — (2N) No. 1:</b> <b>(3AG) No. 10 — (2N) No. 2:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS LH).</b> Measure the resistance between connector (3AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <b>(3AG) No. 10 — (3AG) No. 12:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS LH).</b> Measure the resistance between connector (3AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(3AG) No. 10 — Chassis ground:</b> <b>(3AG) No. 12 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
7	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AF:DTC 65 BELT PRETENSIONER RH FAILURE

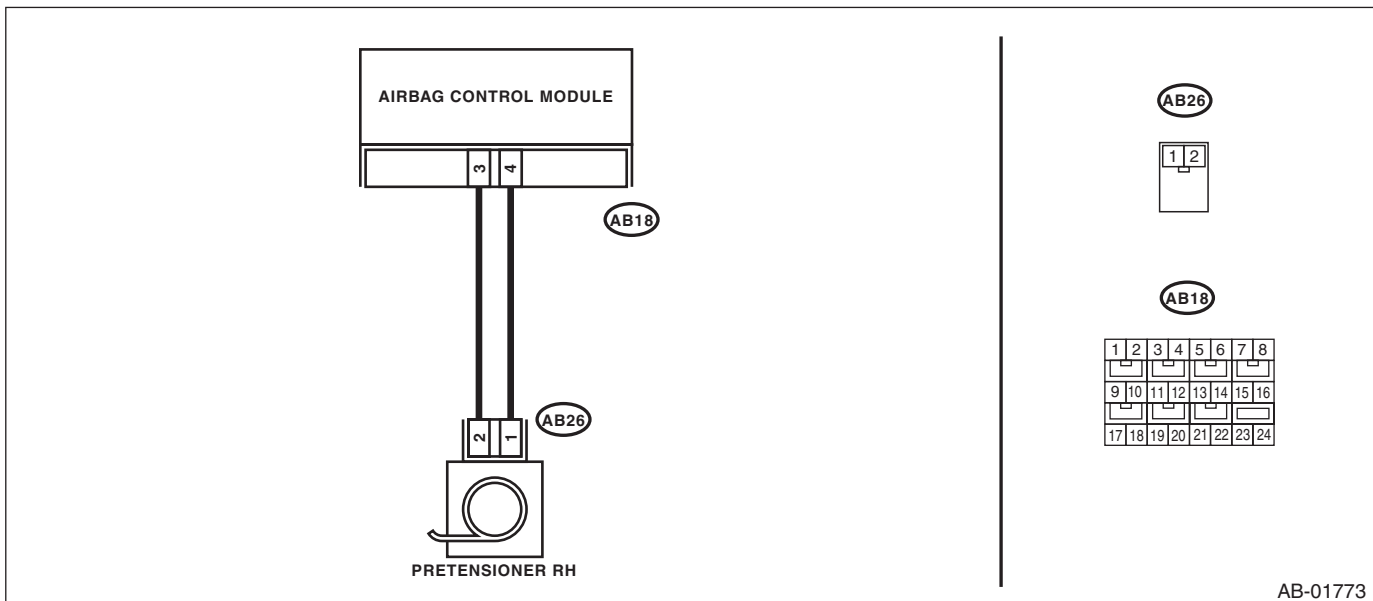
### DTC DETECTING CONDITION:

- Seat belt pretensioner (RH) circuit is shorted to power supply.
- Pretensioner is faulty.
- Pretensioner harness is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the seat belt pretensioner RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SEAT BELT PRETENSIONER.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Connect the connector (1N) in the test harness N to the connector (AB26). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the seat belt pretensioner (RH). <Ref. to SB-13, Front Seat Belt.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from test harness. 3) Disconnect connector (AB24) from side airbag module (RH). 4) Disconnect the connector (AB33) from curtain airbag module (RH). 5) Disconnect the connectors (AB17) and (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> <b>(3AG) No. 20 (+) — Chassis ground (-):</b> <b>(3AG) No. 18 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AG:DTC 66 BELT PRETENSIONER LH FAILURE

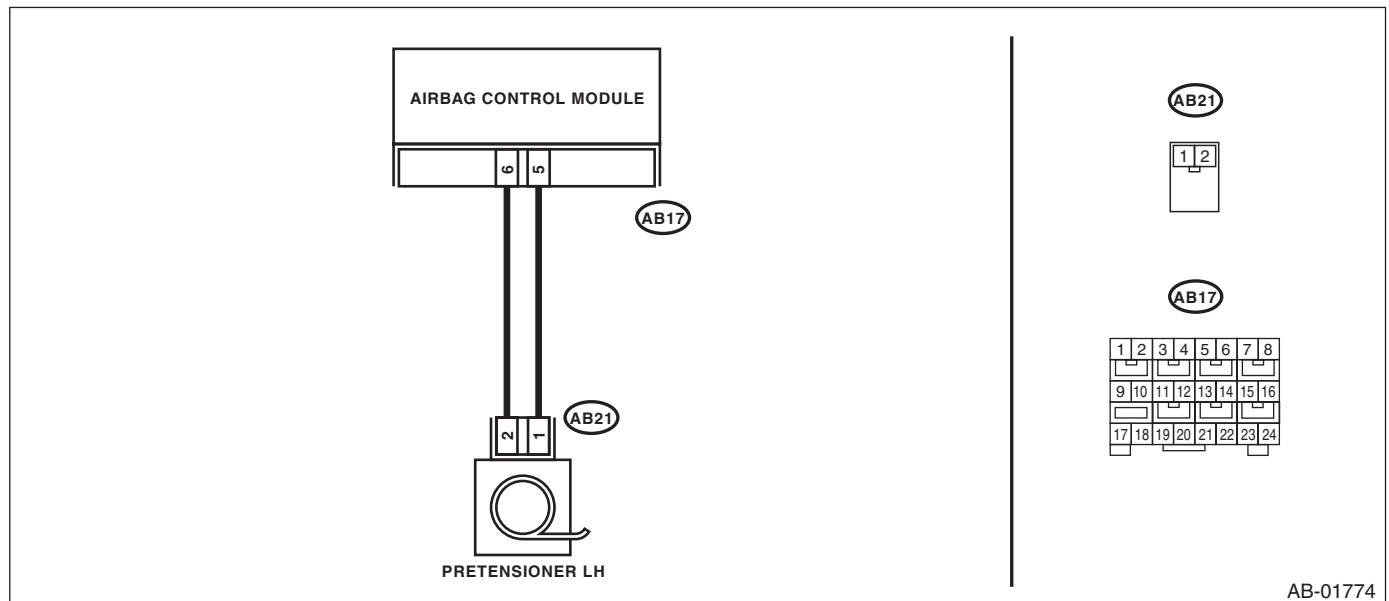
### DTC DETECTING CONDITION:

- Seat belt pretensioner (LH) circuit is shorted to power supply.
- Pretensioner is faulty.
- Pretensioner harness is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the seat belt pretensioner LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SEAT BELT PRETENSIONER.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Connect the connector (1N) in the test harness N to the connector (AB21). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the seat belt pretensioner (LH). <Ref. to SB-13, Front Seat Belt.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (PRETENSIONER HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from test harness. 3) Disconnect connector (AB19) from side airbag module (LH). 4) Disconnect the connector (AB31) from curtain airbag module (LH). 5) Disconnect the connectors (AB17) and (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> <b>(3AG) No. 10 (+) — Chassis ground (-):</b> <b>(3AG) No. 12 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AH:DTC 71 DRIVER'S AIRBAG FAILURE

### DTC DETECTING CONDITION:

- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (driver's side) circuit is open, shorted or shorted to ground.
- Roll connector circuit is open, shorted or shorted to ground.
- Driver's airbag module is faulty.
- Airbag control module is faulty.

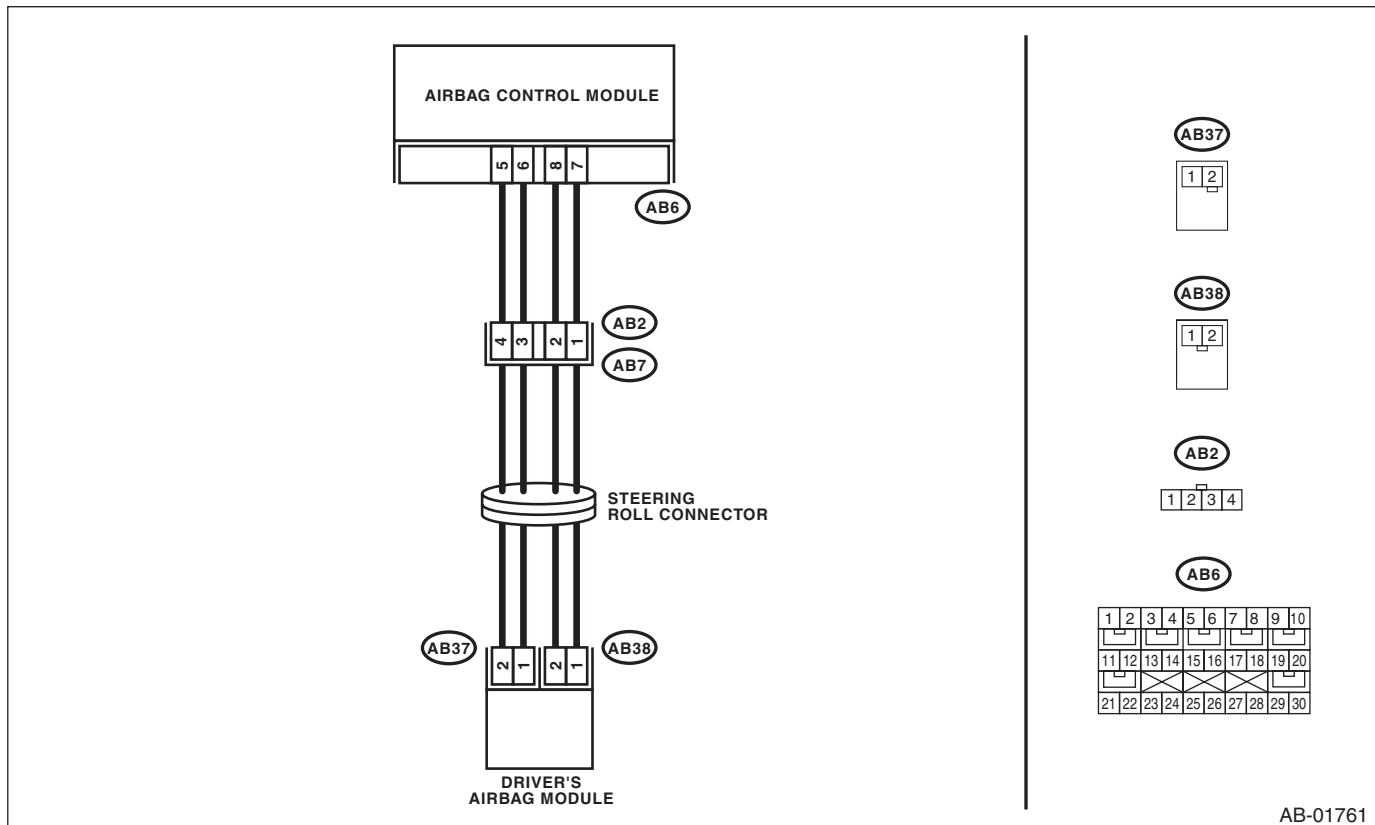
### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

### WIRING DIAGRAM:



AB-01761



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the driver's airbag module.	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK DRIVER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the driver's airbag module. 3) Connect the connector (1N) in the test harness N to the connector (AB38). 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the connector (1Q) in the test harness Q to connector (AB37). 6) Connect the airbag resistor to the connector (2Q) in the test harness Q. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the driver's airbag module. <Ref. to AB-14, Driver's Airbag Module.>	Go to step 3.
<b>3 CHECK ROLL CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the test harness N from connector (AB38). 3) Disconnect the test harness Q from connector (AB37). 4) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 5) Connect the connector (1P) in the test harness P to connector (AB2). 6) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the roll connector. <Ref. to AB-24, Roll Connector.>	Go to step 4.
<b>4 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Measure the resistance between connector (3AG) in the test harness AG and connectors (2P) and (3P) in the test harness P. <b>Connector &amp; terminal</b> (3AG) No. 1 — (2P) No. 1: (3AG) No. 3 — (2P) No. 2: (3AG) No. 2 — (3P) No. 3: (3AG) No. 4 — (3P) No. 4:	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag main harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>5 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> Measure the resistance between connectors (3AG) in the test harness AG, and between connector (3AG) and chassis ground. <b>Connector &amp; terminal</b> <i>(3AG) No. 1 — (3AG) No. 3:</i> <i>(3AG) No. 3 — Chassis ground:</i> <i>(3AG) No. 1 — Chassis ground:</i> <i>(3AG) No. 2 — (3AG) No. 4:</i> <i>(3AG) No. 2 — Chassis ground:</i> <i>(3AG) No. 4 — Chassis ground:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 6.	Replace the airbag main harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.
<b>7 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AI: DTC 72 PASSENGER'S AIRBAG FAILURE

#### DTC DETECTING CONDITION:

- Airbag main harness circuit is open, shorted or shorted to ground.
- Airbag module harness (Passenger's side) circuit is open, shorted or shorted to ground.
- Passenger's airbag module is faulty.
- Airbag control module is faulty.

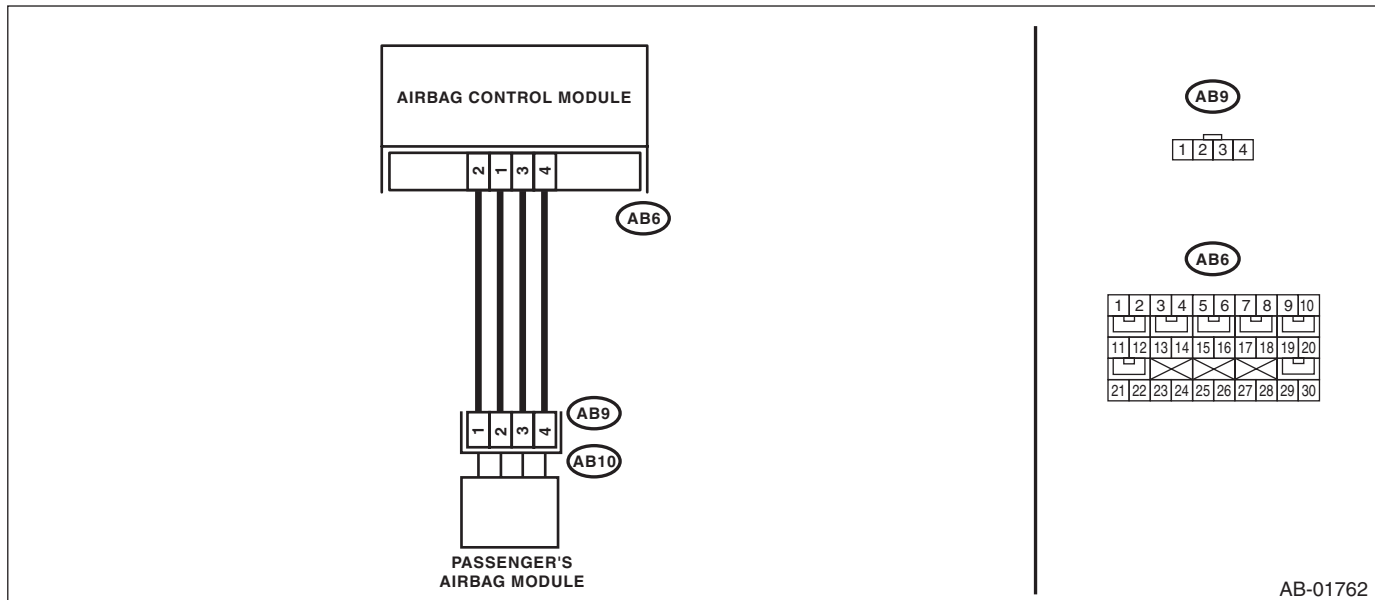
#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

#### WIRING DIAGRAM:



AB-01762

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the passenger's airbag module.	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK PASSENGER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the instrument panel side cover on the passenger's side and disconnect the connector (AB10) from (AB9). 3) Connect the connector (1P) in the test harness P to connector (AB9). 4) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the passenger's airbag module. <Ref. to AB-15, Passenger's Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Measure the resistance between connector (3AG) in the test harness AG and connectors (2P) and (3P) in the test harness P. <b>Connector &amp; terminal</b> <b>(3AG) No. 9 — (2P) No. 1:</b> <b>(3AG) No. 7 — (2P) No. 2:</b> <b>(3AG) No. 8 — (3P) No. 3:</b> <b>(3AG) No. 6 — (3P) No. 4:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> Measure the resistance between connectors (3AG) in the test harness AG, and between connector (3AG) and chassis ground. <b>Connector &amp; terminal</b> <b>(3AG) No. 9 — (3AG) No. 7:</b> <b>(3AG) No. 9 — Chassis ground:</b> <b>(3AG) No. 7 — Chassis ground:</b> <b>(3AG) No. 8 — (3AG) No. 6:</b> <b>(3AG) No. 8 — Chassis ground:</b> <b>(3AG) No. 6 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag main harness along with body harness.
<b>5 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 6.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>6</b>	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AJ:DTC 75 DRIVER'S AIRBAG FAILURE

### DTC DETECTING CONDITION:

- Airbag main harness circuit (Driver's side) is shorted to power supply.
- Airbag module harness circuit (Driver's side) is shorted to power supply.
- Roll connector is shorted to power supply.
- Driver's airbag module is faulty.
- Airbag control module is faulty.

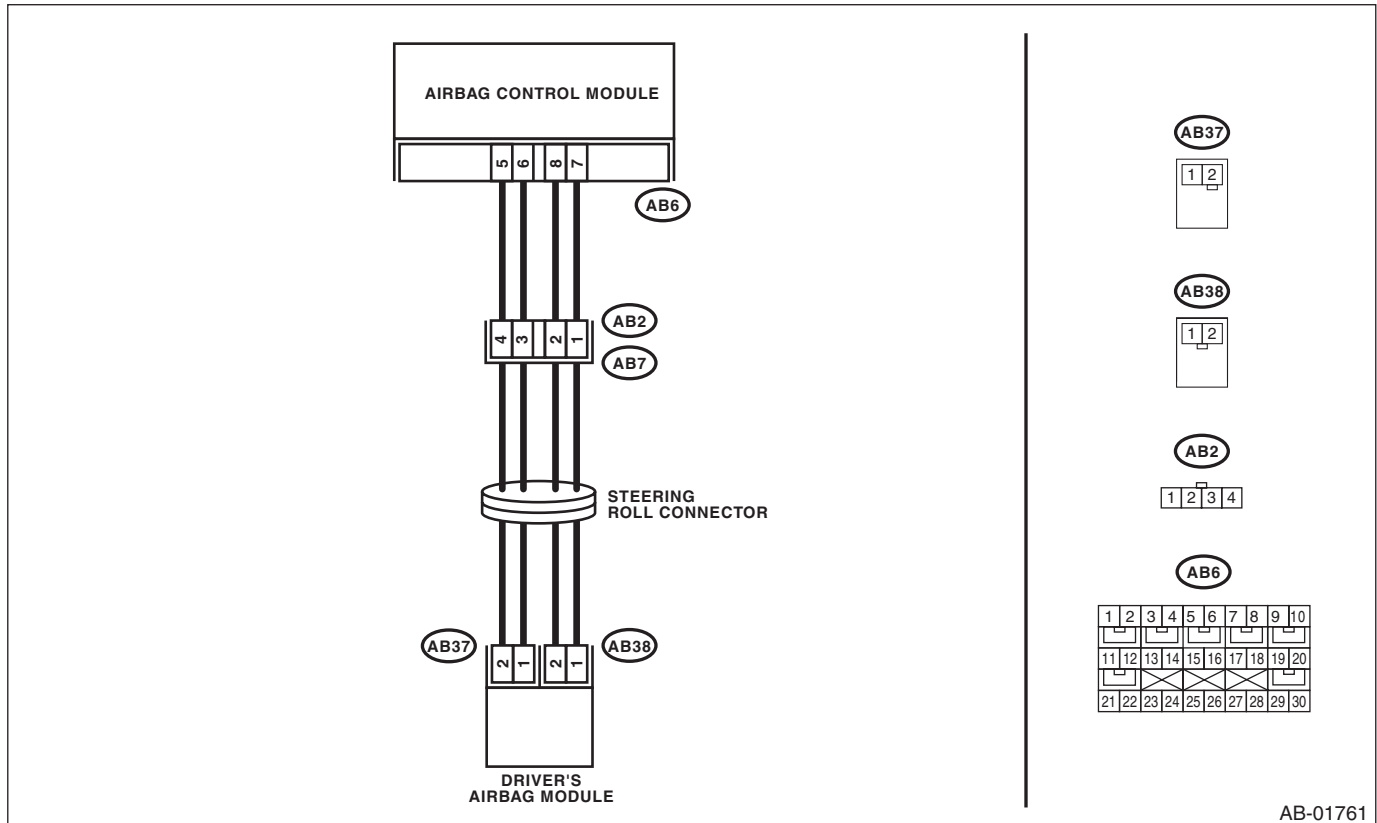
### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the driver's airbag module.	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK DRIVER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the driver's airbag module. 3) Connect the connector (AB38) to the connector (1N) in the test harness N. 4) Connect the airbag resistor to the connector (2N) of test harness N. 5) Connect the connector (1Q) in the test harness Q to connector (AB37). 6) Connect the airbag resistor to the connector (2Q) in the test harness Q. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the driver's airbag module. <Ref. to AB-14, Driver's Airbag Module.>	Go to step 3.
<b>3 CHECK ROLL CONNECTOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the test harness N from connector (AB38). 3) Disconnect the test harness Q from connector (AB37). 4) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 5) Connect the connector (1P) in the test harness P to connector (AB2). 6) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 7) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the roll connector. <Ref. to AB-24, Roll Connector.>	Go to step 4.
<b>4 CHECK AIRBAG MAIN HARNESS (DRIVER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Connect the battery ground terminal and turn the ignition switch to ON. (engine OFF) 6) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> (3AG) No. 3 (+) — Chassis ground (-): (3AG) No. 1 (+) — Chassis ground (-): (3AG) No. 2 (+) — Chassis ground (-): (3AG) No. 4 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 5.	Replace the airbag main harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>5</b> <b>CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step <b>6</b> .
<b>6</b> <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AK:DTC 76 PASSENGER'S AIRBAG FAILURE

#### DTC DETECTING CONDITION:

- Airbag main harness circuit (Passenger's side) is shorted to power supply.
- Airbag module harness circuit (Passenger's side) is shorted to power supply.
- Passenger's airbag module is faulty.
- Airbag control module is faulty.

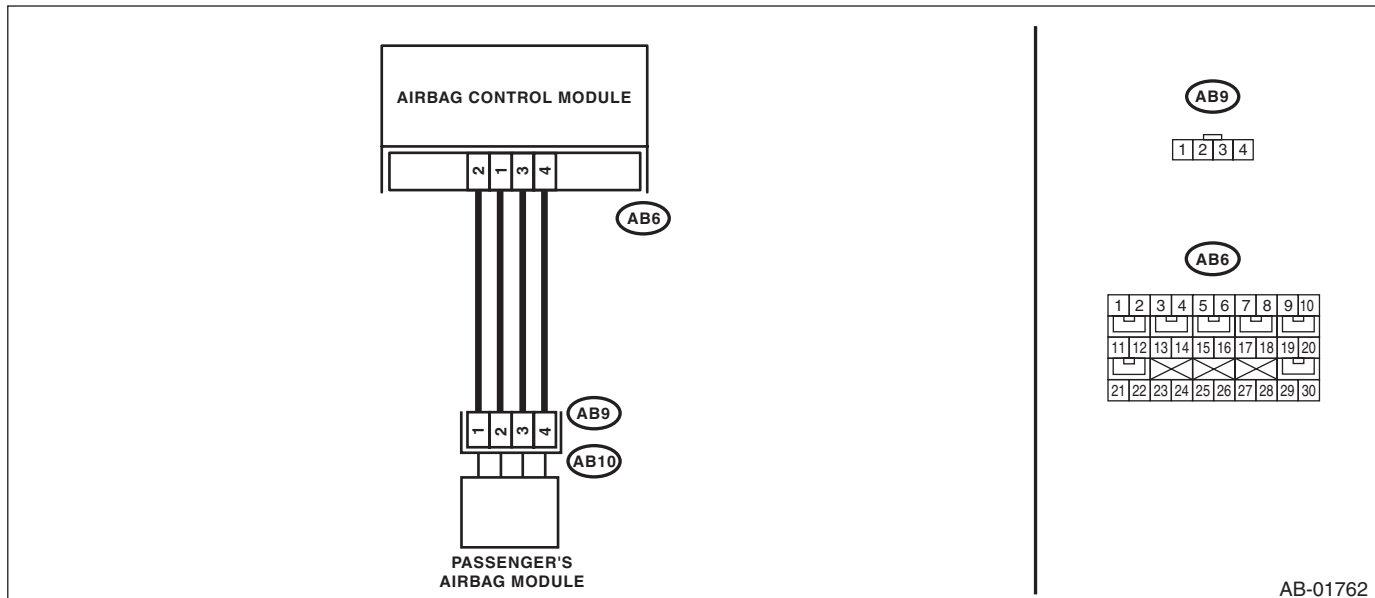
#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from the battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### NOTE:

Prior to starting work, prepare two airbag resistors (98299PA040).

#### WIRING DIAGRAM:



# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module and the passenger's airbag module.	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK PASSENGER'S AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Remove the instrument panel side cover on the passenger's side and disconnect the connector (AB10) from (AB9). 3) Connect the connector (1P) in the test harness P to connector (AB9). 4) Connect the airbag resistor to the connectors (2P) and (3P) of test harness P. 5) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the passenger's airbag module. <Ref. to AB-15, Passenger's Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG MAIN HARNESS (PASSENGER'S AIRBAG HARNESS).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the airbag resistor from the connectors (2P) and (3P) of test harness P. 3) Remove the instrument panel lower cover and disconnect the connector (AB7) from (AB2). 4) Disconnect the connector (AB6) from the airbag control module, and connect the connector (1AG) in the test harness AG. 5) Measure the voltage between connector (3AG) in the test harness AG and chassis ground. <i>Connector &amp; terminal</i> <i>(3AG) No. 9 (+) — Chassis ground (-):</i> <i>(3AG) No. 7 (+) — Chassis ground (-):</i> <i>(3AG) No. 8 (+) — Chassis ground (-):</i> <i>(3AG) No. 6 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AL:DTC 91 CURTAIN AIRBAG MODULE RH FAILURE

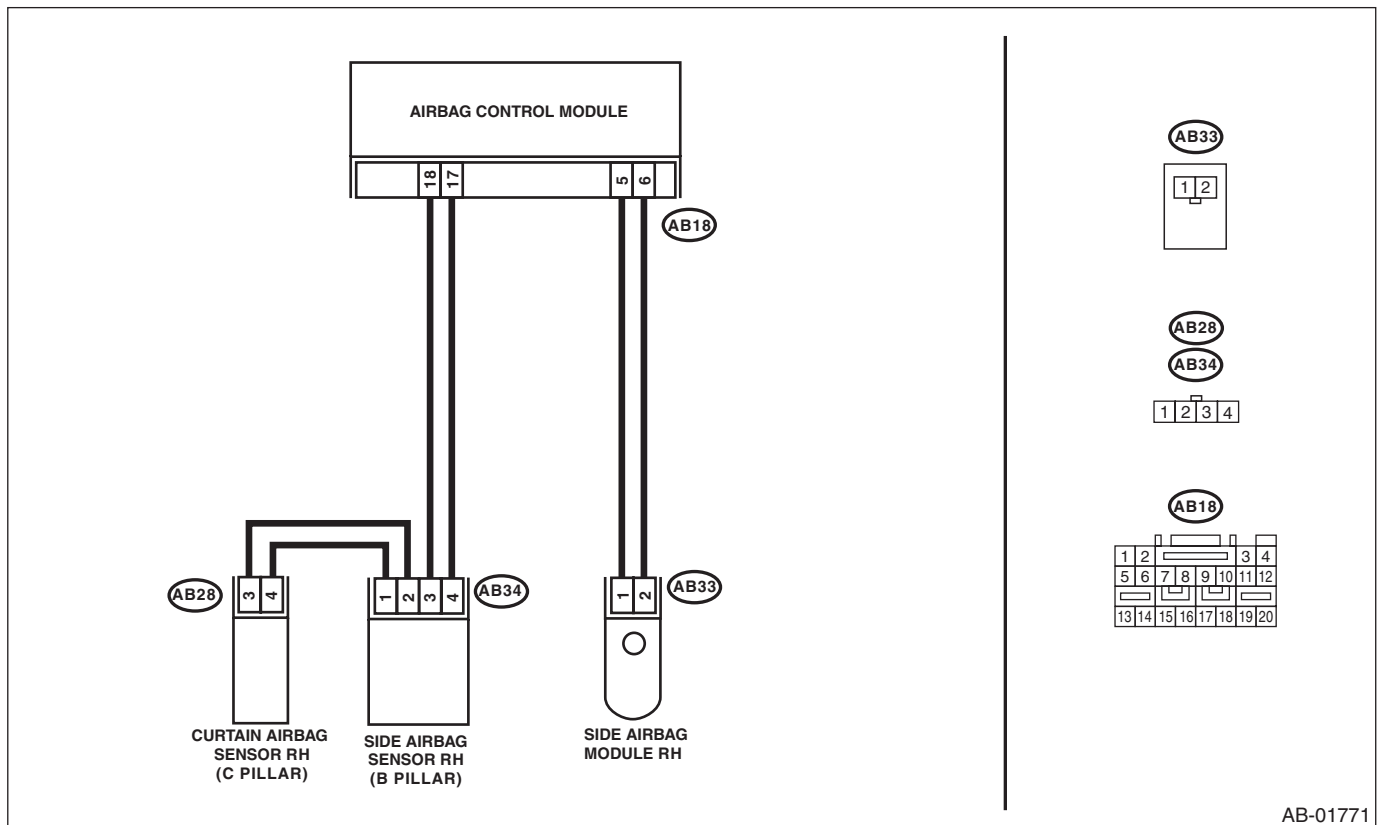
#### DTC DETECTING CONDITION:

- Curtain airbag harness (RH) is faulty.
- Curtain airbag module (RH) is faulty.
- Airbag control module is faulty.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



AB-01771

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module RH and the curtain airbag sensor RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK CURTAIN AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB33) and (AB40), and connect the connector (N) in test harness N to connector (AB33). 3) Connect the airbag resistor to the connector (2N) of test harness N. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the curtain airbag module (RH). <Ref. to AB-18, Curtain Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect connector (AB24) from side airbag module (RH). 4) Disconnect the airbag resistor from test harness N. 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Measure the resistance between connector (6AG) in the test harness AG and connector (2N) in the test harness N. <b>Connector &amp; terminal</b> <b>(6AG) No. 6 — (3F) No. 4:</b> <b>(6AG) No. 8 — (2N) No. 3:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS RH).</b> Measure the resistance between connector (6AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <b>(6AG) No. 6 — (6AG) No. 8:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS RH).</b> Measure the resistance between connector (6AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(6AG) No. 6 — Chassis ground:</b> <b>(6AG) No. 8 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
7	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AM:DTC 92 CURTAIN AIRBAG MODULE LH FAILURE

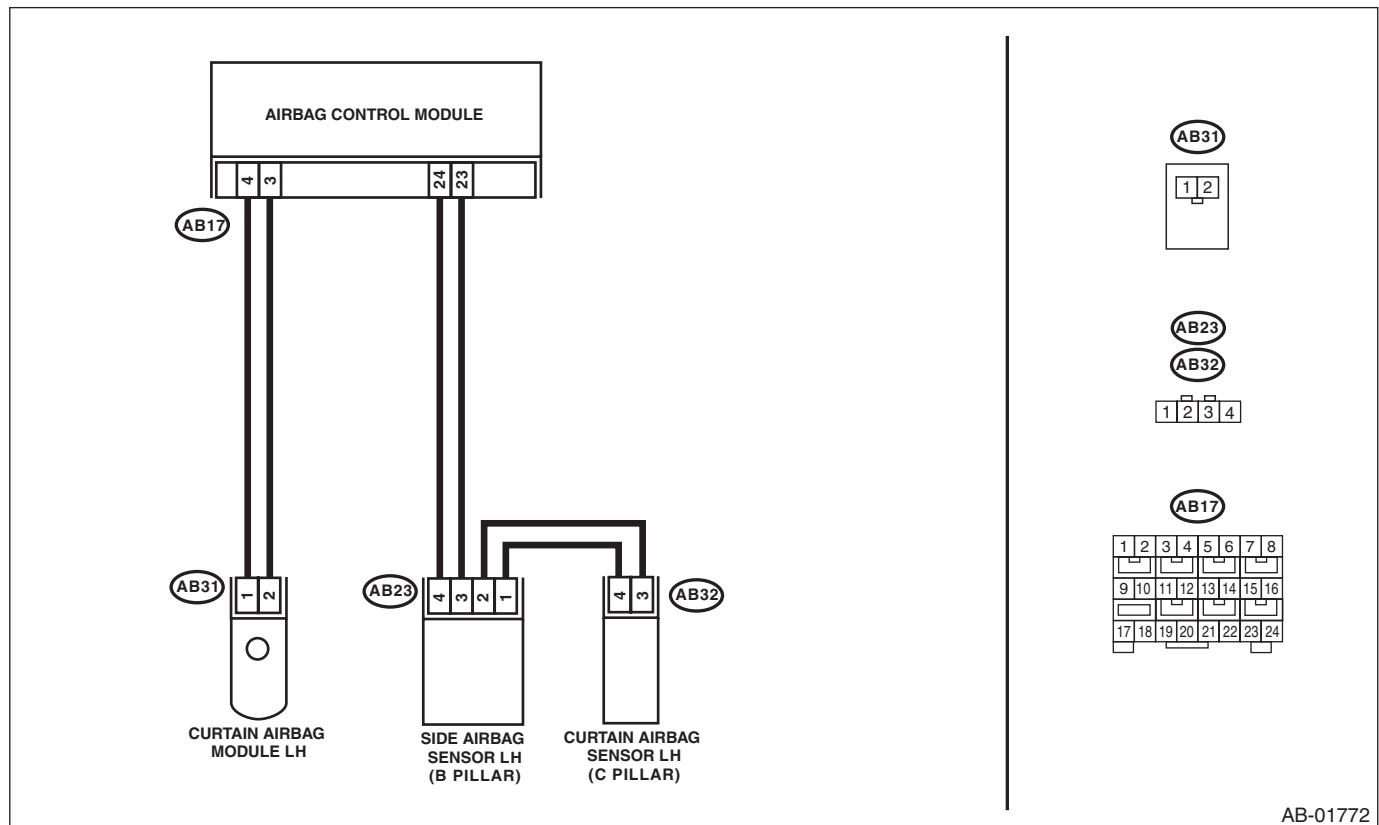
### DTC DETECTING CONDITION:

- Curtain airbag harness (LH) is faulty.
- Curtain airbag module (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01772

## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module LH and the curtain airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK CURTAIN AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB31) and (AB39), and connect the connector (N) in test harness N to connector (AB31). 3) Connect the airbag resistor to the connector (2N) of test harness N. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the curtain airbag module (LH). <Ref. to AB-18, Curtain Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect connector (AB19) from side airbag module (LH). 4) Disconnect the airbag resistor from test harness N. 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Measure the resistance between connector (6AG) in the test harness AG and connector (2N) in the test harness N. <b>Connector &amp; terminal</b> <b>(6AG) No. 1 — (3F) No. 3:</b> <b>(6AG) No. 3 — (2N) No. 4:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS LH).</b> Measure the resistance between connector (6AG) terminals in the test harness AG. <b>Connector &amp; terminal</b> <b>(6AG) No. 1 — (6AG) No. 3:</b>	Is the resistance 1 MΩ or more?	Go to step 5.	Replace the airbag rear harness along with body harness.
<b>5 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS LH).</b> Measure the resistance between connector (6AG) in the test harness AG and chassis ground. <b>Connector &amp; terminal</b> <b>(6AG) No. 1 — Chassis ground:</b> <b>(6AG) No. 3 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<b>6 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 7.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
7	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AN:DTC 95 CURTAIN AIRBAG MODULE RH FAILURE

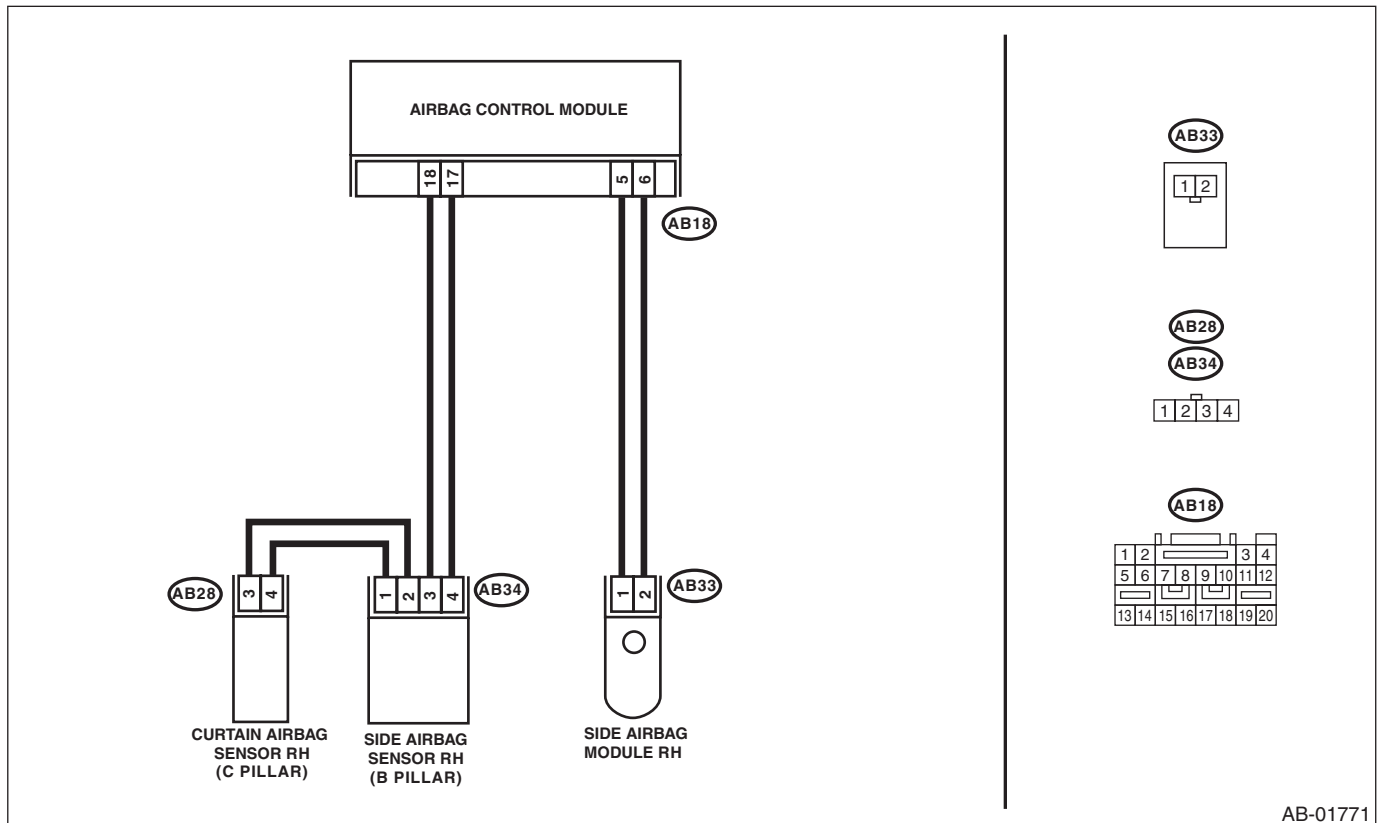
#### DTC DETECTING CONDITION:

- Curtain airbag harness (RH) is shorted to power supply.
- Airbag control module is faulty.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



AB-01771

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module RH and the curtain airbag sensor RH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK CURTAIN AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB33) and (AB40), and connect the connector (N) in test harness N to connector (AB33). 3) Connect the airbag resistor to the connector (2N) of test harness N. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the curtain airbag module (RH). <Ref. to AB-18, Curtain Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect connector (AB24) from side airbag module (RH). 4) Disconnect the airbag resistor from test harness N. 5) Disconnect the connector (AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB18). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (6AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> <b>(6AG) No. 6 (+) — Chassis ground (-):</b> <b>(6AG) No. 8 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

### AO:DTC 96 CURTAIN AIRBAG MODULE LH FAILURE

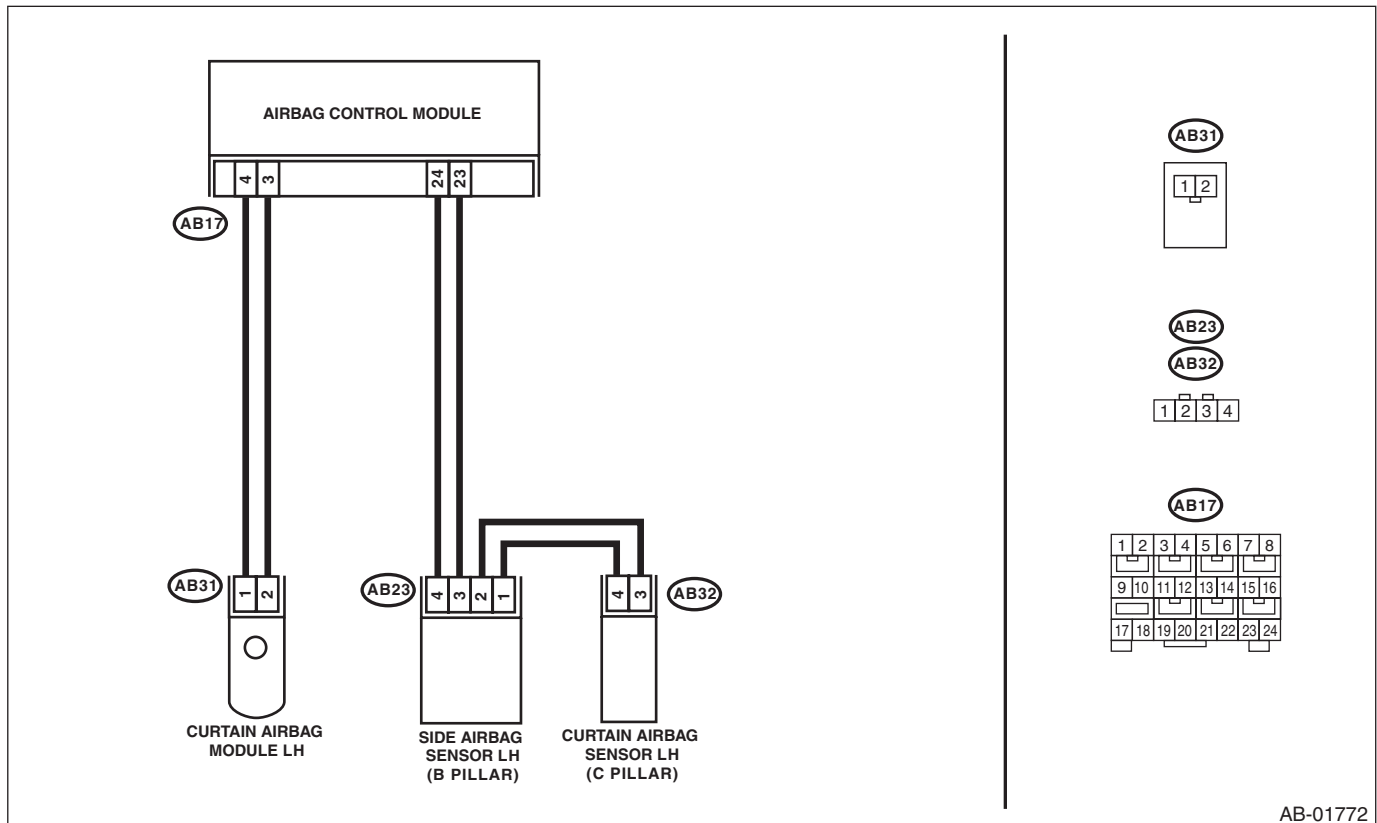
#### DTC DETECTING CONDITION:

- Curtain airbag harness (LH) is shorted to power supply.
- Airbag control module is faulty.

#### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground terminal from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors of the driver's and passenger's seats for safety.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

#### WIRING DIAGRAM:



AB-01772

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the airbag control module, curtain airbag module LH and the curtain airbag sensor LH.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK SIDE AIRBAG MODULE.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the connectors (AB31) and (AB39), and connect the connector (N) in test harness N to connector (AB31). 3) Connect the airbag resistor to the connector (2N) of test harness N. 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the curtain airbag module (LH). <Ref. to AB-18, Curtain Airbag Module.>	Go to step 3.
<b>3 CHECK AIRBAG REAR HARNESS (CURTAIN AIRBAG MODULE HARNESS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect connector (AB19) from side airbag module (LH). 4) Disconnect the airbag resistor from test harness N. 5) Disconnect the connector (AB17) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connector (AB17). 7) Connect the battery ground terminal and turn the ignition switch to ON. 8) Measure the voltage between connector (3AG) in the test harness AG and chassis ground.  <b>Connector &amp; terminal</b> <b>(3AG) No. 1 (+) — Chassis ground (-):</b> <b>(3AG) No. 3 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 4.	Replace the airbag rear harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the airbag control module. <Ref. to AB-20, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **AP:DTC E2 FRONT SENSOR BUS RH COMMUNICATION ERROR**

NOTE:

Refer to DTC E4 for details on DTC E2. <Ref. to AB(diag)-121, DTC E4 FRONT SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **AQ:DTC E3 FRONT SENSOR BUS RH COMMUNICATION ERROR**

NOTE:

Refer to DTC E4 for details on DTC E3. <Ref. to AB(diag)-121, DTC E4 FRONT SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AR:DTC E4 FRONT SENSOR BUS RH COMMUNICATION ERROR

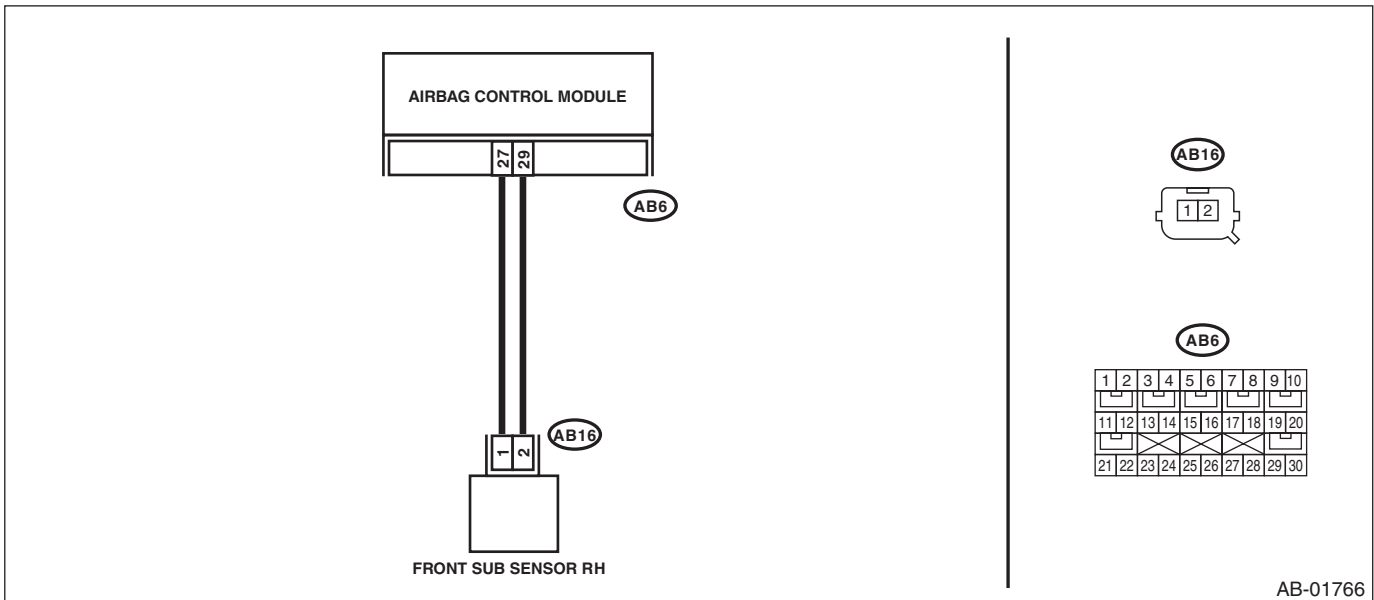
### DTC DETECTING CONDITION:

- Open or short circuit in harness of front sensor bus (RH).
- Front sub sensor (RH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.

### WIRING DIAGRAM:



AB-01766

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB6, AB16) between the airbag control module and the front sub sensor (RH).	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG MAIN HARNESS (FRONT SENSOR BUS RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Remove the instrument panel lower cover and disconnect the connectors (AB7) and (AB2). 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB10) and (AB9). 4) Disconnect the connectors (AB17, AB6, AB18) from airbag control module. 5) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18). 6) Disconnect the front sub sensor (RH), and then connect the connector (1H) in the test harness H to connector (AB16). 7) Measure the resistance between connector (4AG) in the test harness AG and connector (3H) in the test harness H. <b>Connector &amp; terminal</b> <b>(4AG) No. 14 — (3H) No. 5:</b> <b>(4AG) No. 12 — (3H) No. 6:</b>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag main harness along with body harness.
<b>3 CHECK AIRBAG MAIN HARNESS (FRONT SENSOR BUS RH).</b> Measure the resistance between connector (4AG) in the test harness AG and chassis ground, and the resistance between connector (4AG) in the test harness AG and connector (3H) in test harness H. <b>Connector &amp; terminal</b> <b>(4AG) No. 14 — Chassis ground:</b> <b>(4AG) No. 12 — Chassis ground:</b> <b>(4AG) No. 14 — (3H) No. 6:</b> <b>(4AG) No. 12 — (3H) No. 5:</b>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the front sub sensor (RH). <Ref. to AB-25, REMOVAL, Front Sub Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code". <Ref. to AB(diag)-44, LIST, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **AS:DTC E6 FRONT SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC E8 for details on DTC E6. <Ref. to AB(diag)-124, DTC E8 FRONT SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **AT:DTC E7 FRONT SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC E8 for details on DTC E7. <Ref. to AB(diag)-124, DTC E8 FRONT SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>



# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AU:DTC E8 FRONT SENSOR BUS LH COMMUNICATION ERROR

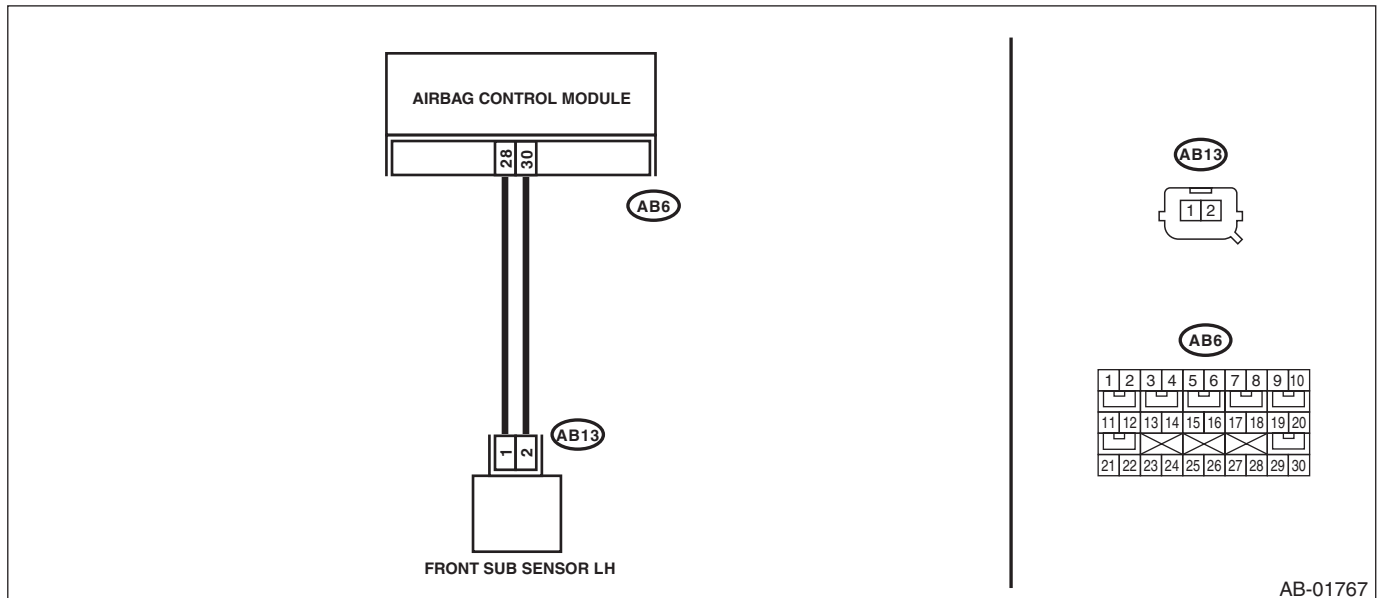
### DTC DETECTING CONDITION:

- Open or short circuit in harness of front sensor bus (LH).
- Front sub sensor (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.

### WIRING DIAGRAM:



AB-01767

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB6, AB13) between the airbag control module and the front sub sensor (LH).	Is there poor contact?	Replace the airbag main harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG MAIN HARNESS (FRONT SENSOR BUS LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Remove the instrument panel lower cover and disconnect the connectors (AB7) and (AB2). 3) Remove the instrument panel side cover on the passenger's side and disconnect the connectors (AB9) and (AB10). 4) Disconnect the connectors (AB17, AB6, AB18) from airbag control module. 5) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18). 6) Disconnect the front sub sensor (LH), and then connect the connector (1H) in the test harness H to connector (AB13). 7) Measure the resistance between connector (4AG) in the test harness AG and connector (3H) in the test harness H. <b>Connector &amp; terminal</b> (4AG) No. 7 — (3H) No. 5: (4AG) No. 9 — (3H) No. 6:	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag main harness along with body harness.
<b>3 CHECK AIRBAG MAIN HARNESS (FRONT SENSOR BUS LH).</b> Measure the resistance between connector (4AG) in the test harness AG and chassis ground, and the resistance between connector (4AG) in the test harness AG and connector (3H) in test harness H. <b>Connector &amp; terminal</b> (4AG) No. 7 — Chassis ground: (4AG) No. 9 — Chassis ground: (4AG) No. 7 — (3H) No. 6: (4AG) No. 9 — (3H) No. 5:	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag main harness along with body harness.
<b>4 CHECK AIRBAG CONTROL MODULE.</b> 1) Connect all connectors. 2) Erase the memory. 3) Perform the Inspection Mode. 4) Read the DTC.	Is the same DTC displayed?	Replace the front sub sensor (LH). <Ref. to AB-25, REMOVAL, Front Sub Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>	Go to step 5.
<b>5 CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code". <Ref. to AB(diag)-44, LIST, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **AV:DTC E9 SIDE SENSOR BUS RH COMMUNICATION ERROR**

NOTE:

Refer to DTC EC for details on DTC E9. <Ref. to AB(diag)-127, DTC EC SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **AW:DTC EA SIDE SENSOR BUS RH COMMUNICATION ERROR**

NOTE:

Refer to DTC EC for details on DTC EA. <Ref. to AB(diag)-127, DTC EC SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **AX:DTC EB SIDE SENSOR BUS RH COMMUNICATION ERROR**

NOTE:

Refer to DTC EC for details on DTC EB. <Ref. to AB(diag)-127, DTC EC SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## AY:DTC EC SIDE SENSOR BUS RH COMMUNICATION ERROR

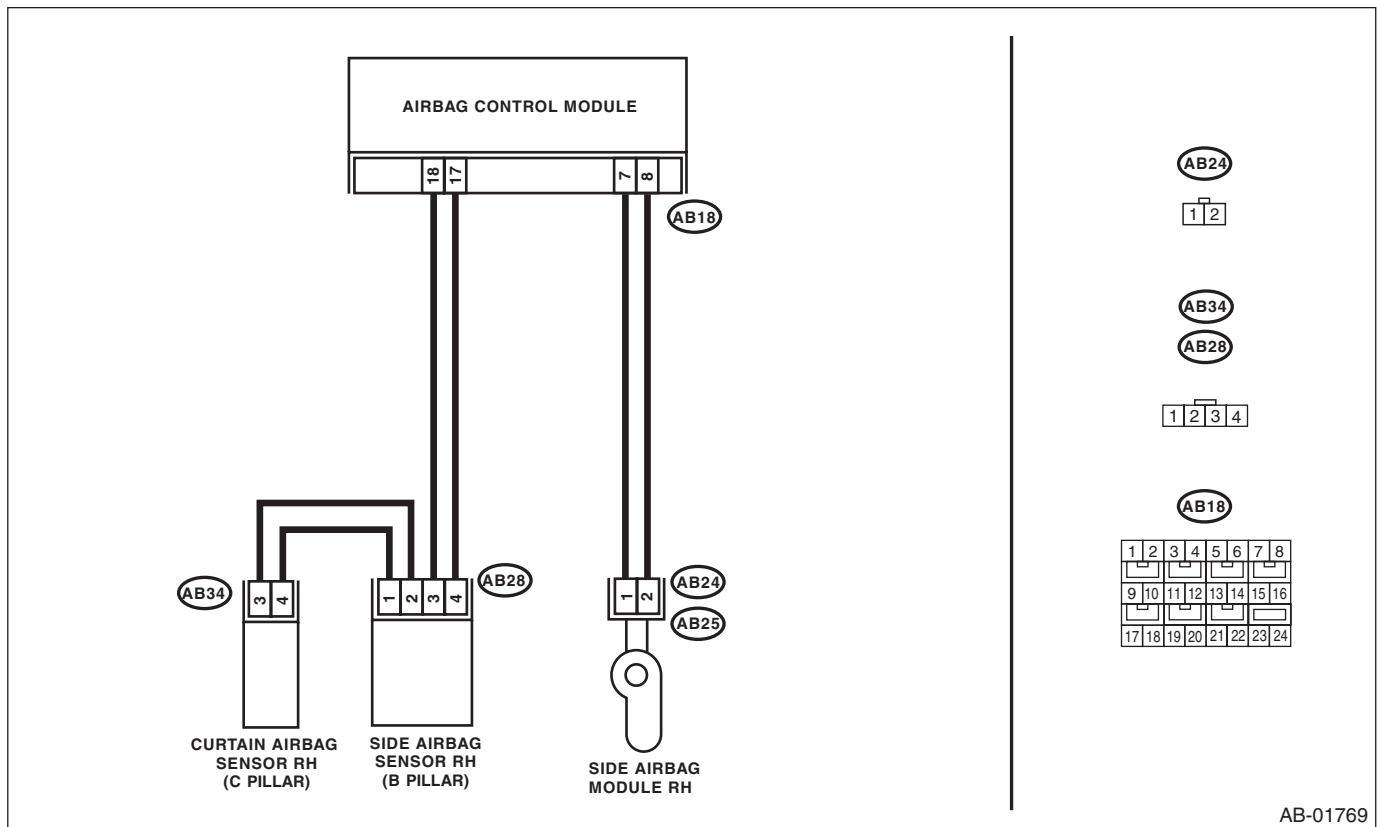
### DTC DETECTING CONDITION:

- Open or short circuit in harness of side sensor bus (RH).
- Side A/B sensor (RH) and curtain airbag sensor (RH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01769

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB18, AB28, AB34) between the airbag control module and the curtain A/B sensor (RH).	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect the connector (AB33) from curtain airbag module (RH). 4) Disconnect connectors (AB25) and (AB24) from side airbag module (RH). 5) Disconnect the connectors (AB17, AB6, AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18). 7) Disconnect the connector (AB28) from side airbag sensor (RH), and connect the connector (2V) in test harness V to connector (AB28). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 16 — (3V) No. 2:</i> <i>(5AG) No. 14 — (3V) No. 1:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR RH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground, and the resistance between connector (5AG) in the test harness AG and connector (3V) in test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 16 — Chassis ground:</i> <i>(5AG) No. 14 — Chassis ground:</i> <i>(5AG) No. 16 — (3V) No. 1:</i> <i>(5AG) No. 14 — (3V) No. 2:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR AND CURTAIN A/B SENSOR RH).</b></p> <p>1) Disconnect the connector (2V) in the test harness V from the connector (AB28) of side airbag sensor (RH).</p> <p>2) Connect the connector (AB28) of side airbag sensor (RH) and the connector (1AI) in the test harness AI.</p> <p>3) Connect the connector (2AI) in the test harness AI and the connector (1V) in the test harness V.</p> <p>4) Disconnect the connector (AB34) from curtain airbag sensor (RH), and connect the connector (2V) in test harness V to connector (AB34).</p> <p>5) Measure the resistance between connector (3V) terminals in the test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(3V) No. 2 — (3V) No. 6:</b>  <b>(3V) No. 1 — (3V) No. 7:</b></p>	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag rear harness along with body harness.
<p><b>5 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR AND CURTAIN A/B SENSOR RH).</b></p> <p>Measure the resistance between connector (3V) in test harness V and chassis ground, and the resistance between connector (3V) in test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(3V) No. 2 — Chassis ground:</b>  <b>(3V) No. 1 — Chassis ground:</b>  <b>(3V) No. 2 — (3V) No. 7:</b>  <b>(3V) No. 1 — (3V) No. 6:</b></p>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<p><b>6 CHECK AIRBAG CONTROL MODULE.</b></p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the same DTC displayed?	Go to step 7.	Go to step 8.
<p><b>7 REPLACE SIDE AIRBAG SENSOR (RH) AND CHECK AIRBAG CONTROL MODULE AFTER REPLACEMENT.</b></p> <p>&lt;Ref. to AB-21, REMOVAL, Side Airbag Sensor.&gt;</p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the system normal?	Go to step 8.	Replace the curtain airbag sensor (RH). <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>
<p><b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b></p>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **AZ:DTC ED SIDE SENSOR BUS RH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC EE for details on DTC ED. <Ref. to AB(diag)-131, DTC EE SIDE SENSOR BUS RH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## BA:DTC EE SIDE SENSOR BUS RH COMMUNICATION ERROR

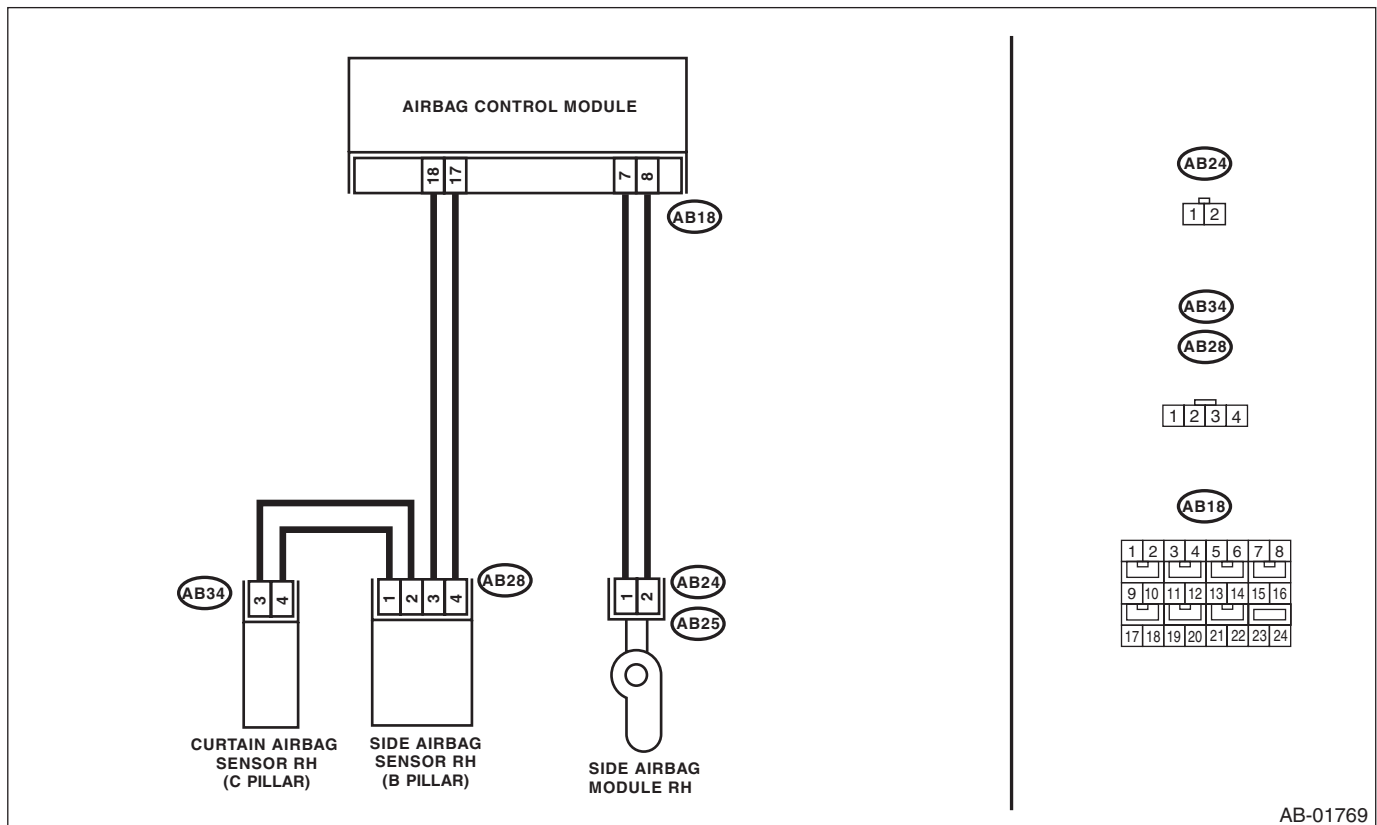
### DTC DETECTING CONDITION:

- Open or short circuit in harness of side sensor bus (RH).
- Side A/B sensor (RH) or curtain airbag sensor (RH) is faulty
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01769



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB18, AB28, AB34) between the airbag control module and the curtain A/B sensor (RH).	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR (RH) AND CURTAIN A/B SENSOR (RH)).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB26) from seat belt pretensioner (RH). 3) Disconnect the connector (AB33) from curtain airbag module (RH). 4) Disconnect connectors (AB25) and (AB24) from side airbag module (RH). 5) Disconnect connector (AB28) from side airbag sensor (RH). 6) Connect the connector (AB28) of side airbag sensor (RH) and the connector (1A1) in the test harness A1. 7) Connect the connector (2A1) in the test harness A1 and the connector (1V) in the test harness V. 8) Disconnect the connector (AB34) from curtain airbag sensor (RH), and connect the connector (2V) in test harness V to connector (AB34). 9) Measure the resistance between connector (3V) terminals in the test harness V. <b>Connector &amp; terminal</b> <i>(3V) No. 2 — (3V) No. 6:</i> <i>(3V) No. 1 — (3V) No. 7:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR AND CURTAIN A/B SENSOR RH).</b> Measure the resistance between connector (3V) in test harness V and chassis ground, and the resistance between connector (3V) in test harness V. <b>Connector &amp; terminal</b> <i>(3V) No. 2 — Chassis ground:</i> <i>(3V) No. 1 — Chassis ground:</i> <i>(3V) No. 2 — (3V) No. 7:</i> <i>(3V) No. 1 — (3V) No. 6:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR (RH)).</b></p> <p>1) Disconnect the connectors (AB17, AB6, AB18) from airbag control module.</p> <p>2) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18).</p> <p>3) Disconnect the connector (AB28) in the side airbag sensor (RH) from the connector (1AI) in the test harness AI.</p> <p>4) Disconnect the connector (2AI) in the test harness AI from the connector (1V) in the test harness V.</p> <p>5) Connect the connector (AB28) of side airbag sensor (RH) and the connector (2V) in the test harness V to the connector (AB28).</p> <p>6) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(5AG) No. 16 — (3V) No. 2:</b>  <b>(5AG) No. 14 — (3V) No. 1:</b></p>	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag rear harness along with body harness.
<p><b>5 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR RH).</b></p> <p>Measure the resistance between connector (5AG) in the test harness AG and chassis ground, and the resistance between connector (5AG) in the test harness AG and connector (3V) in test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(5AG) No. 16 — Chassis ground:</b>  <b>(5AG) No. 14 — Chassis ground:</b>  <b>(5AG) No. 16 — (3V) No. 1:</b>  <b>(5AG) No. 14 — (3V) No. 2:</b></p>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<p><b>6 CHECK AIRBAG CONTROL MODULE.</b></p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the same DTC displayed?	Go to step 7.	Go to step 8.
<p><b>7 REPLACE SIDE AIRBAG SENSOR (RH) AND CHECK AIRBAG CONTROL MODULE AFTER REPLACEMENT.</b></p> <p>&lt;Ref. to AB-21, REMOVAL, Side Airbag Sensor.&gt;</p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the system normal?	Go to step 8.	Replace the curtain airbag sensor (RH). <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.>Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
8 <b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

### **BB:DTC F1 SIDE SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC F4 for details on DTC F1. <Ref. to AB(diag)-135, DTC F4 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **BC:DTC F2 SIDE SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC F4 for details on DTC F2. <Ref. to AB(diag)-135, DTC F4 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **BD:DTC F3 SIDE SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC F4 for details on DTC F3. <Ref. to AB(diag)-135, DTC F4 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## BE:DTC F4 SIDE SENSOR BUS LH COMMUNICATION ERROR

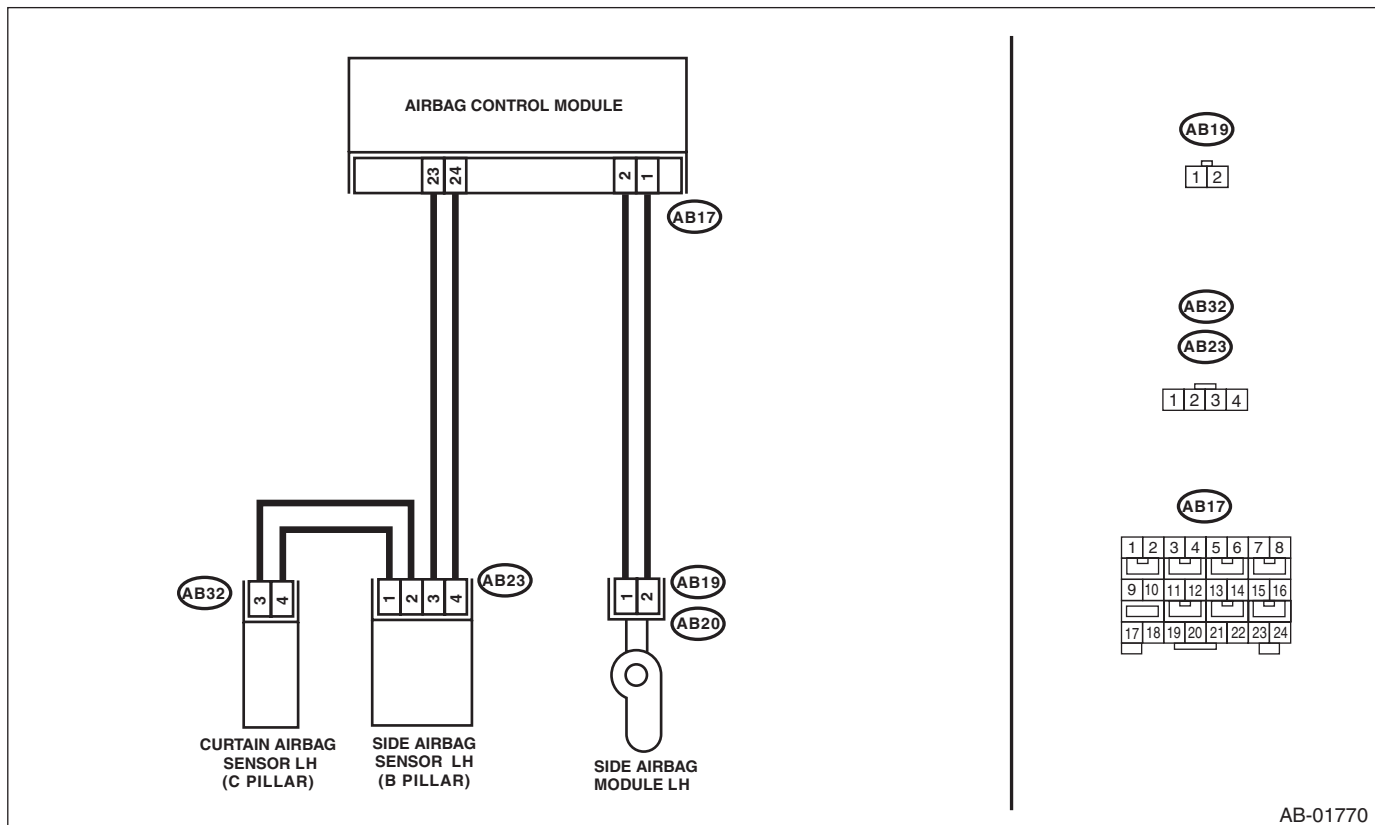
### DTC DETECTING CONDITION:

- Open or short circuit in harness of side sensor bus (LH).
- Side A/B sensor (LH) and curtain airbag sensor (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01770

# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB17, AB23, AB32) between the airbag control module and the curtain A/B sensor (LH).	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR (LH)).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect the connector (AB31) from curtain airbag module (LH). 4) Disconnect connectors (AB19) and (AB20) from side airbag module (LH). 5) Disconnect the connectors (AB17, AB6, AB18) from airbag control module. 6) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18). 7) Disconnect the connector (AB23) from side airbag sensor (LH), and connect the connector (2V) in test harness V to connector (AB23). 8) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 10 — (3V) No. 2:</i> <i>(5AG) No. 8 — (3V) No. 1:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR LH).</b> Measure the resistance between connector (5AG) in the test harness AG and chassis ground, and the resistance between connector (5AG) in the test harness AG and connector (3V) in test harness V. <b>Connector &amp; terminal</b> <i>(5AG) No. 10 — Chassis ground:</i> <i>(5AG) No. 8 — Chassis ground:</i> <i>(5AG) No. 10 — (3V) No. 1:</i> <i>(5AG) No. 8 — (3V) No. 2:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR (LH) AND CURTAIN A/B SENSOR (LH)).</b></p> <p>1) Disconnect the connector (2V) in the test harness V from the connector (AB23) of side airbag sensor (LH).</p> <p>2) Connect the connector (AB23) of side airbag sensor (LH) and the connector (1A1) in the test harness A1.</p> <p>3) Connect the connector (2A1) in the test harness A1 and the connector (1V) in the test harness V.</p> <p>4) Disconnect the connector (AB32) from curtain airbag sensor (LH), and connect the connector (2V) in test harness V to connector (AB32).</p> <p>5) Measure the resistance between connector (3V) terminals in the test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(3V) No. 2 — (3V) No. 6:</b>  <b>(3V) No. 1 — (3V) No. 7:</b></p>	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag rear harness along with body harness.
<p><b>5 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR (LH) AND CURTAIN A/B SENSOR (LH)).</b></p> <p>Measure the resistance between connector (3V) in test harness V and chassis ground, and the resistance between connector (3V) in test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(3V) No. 2 — Chassis ground:</b>  <b>(3V) No. 1 — Chassis ground:</b>  <b>(3V) No. 2 — (3V) No. 7:</b>  <b>(3V) No. 1 — (3V) No. 6:</b></p>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<p><b>6 CHECK AIRBAG CONTROL MODULE.</b></p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the same DTC displayed?	Go to step 7.	Go to step 8.
<p><b>7 REPLACE SIDE AIRBAG SENSOR (LH) AND CHECK AIRBAG CONTROL MODULE AFTER REPLACEMENT.</b></p> <p>&lt;Ref. to AB-21, REMOVAL, Side Airbag Sensor.&gt;</p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the system normal?	Go to step 8.	Replace the curtain airbag sensor (LH). <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>
<p><b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b></p>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **BF:DTC F5 SIDE SENSOR BUS LH COMMUNICATION ERROR**

**NOTE:**

Refer to DTC F6 for details on DTC F5. <Ref. to AB(diag)-139, DTC F6 SIDE SENSOR BUS LH COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## BG:DTC F6 SIDE SENSOR BUS LH COMMUNICATION ERROR

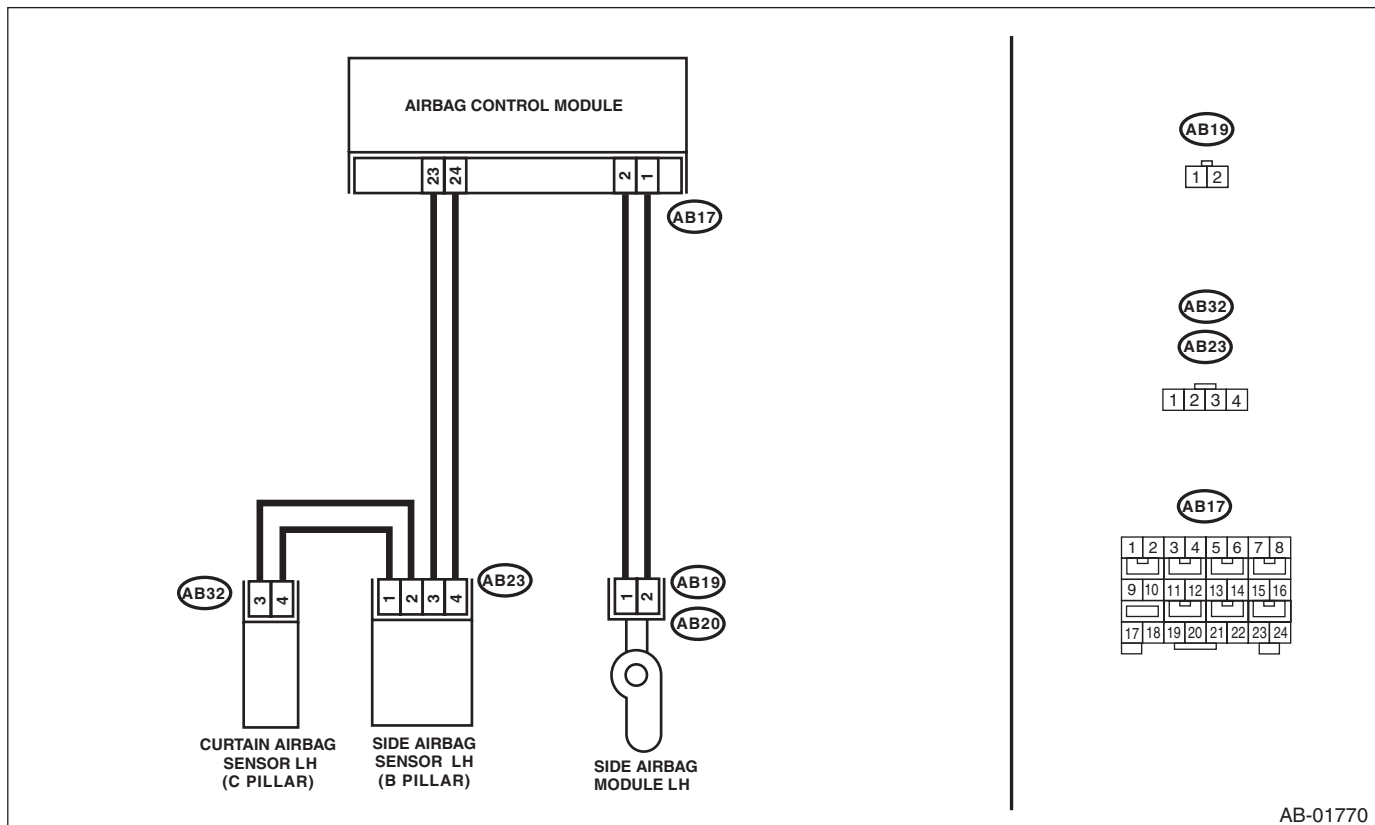
### DTC DETECTING CONDITION:

- Open or short circuit in harness of side sensor bus (LH).
- Side A/B sensor (LH) or curtain airbag sensor (LH) is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



AB-01770



# Diagnostic Chart with Trouble Code

## AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB17, AB23, AB32) between the airbag control module and the curtain A/B sensor (LH).	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.
<b>2 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR (LH) AND CURTAIN A/B SENSOR (LH)).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Disconnect the connector (AB21) from seat belt pretensioner (LH). 3) Disconnect the connector (AB31) from curtain airbag module (LH). 4) Disconnect connectors (AB19) and (AB20) from side airbag module (LH). 5) Disconnect the connector (AB23) in the side airbag sensor (LH). 6) Connect the connector (AB23) of side airbag sensor (LH) and the connector (1A1) in the test harness A1. 7) Connect the connector (2A1) in the test harness A1 and the connector (1V) in the test harness V. 8) Disconnect the connector (AB32) from curtain airbag sensor (LH), and connect the connector (2V) in test harness V to connector (AB32). 9) Measure the resistance between connector (3V) terminals in the test harness V. <b>Connector &amp; terminal</b> <i>(3V) No. 2 — (3V) No. 6:</i> <i>(3V) No. 1 — (3V) No. 7:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Replace the airbag rear harness along with body harness.
<b>3 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR AND CURTAIN A/B SENSOR LH).</b> Measure the resistance between connector (3V) in test harness V and chassis ground, and the resistance between connector (3V) in test harness V. <b>Connector &amp; terminal</b> <i>(3V) No. 6 — Chassis ground:</i> <i>(3V) No. 7 — Chassis ground:</i> <i>(3V) No. 2 — (3V) No. 7:</i> <i>(3V) No. 1 — (3V) No. 6:</i>	Is the resistance 1 MΩ or more?	Go to step 4.	Replace the airbag rear harness along with body harness.

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>4 CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SIDE A/B SENSOR (LH)).</b></p> <p>1) Disconnect the connectors (AB17, AB6, AB18) from airbag control module.</p> <p>2) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18).</p> <p>3) Disconnect the connector (AB23) in the side airbag sensor (LH) from the connector (1AI) in the test harness AI.</p> <p>4) Disconnect the connector (2AI) in the test harness AI from the connector (1V) in the test harness V.</p> <p>5) Connect the connector (2V) in the test harness V to the connector (AB23).</p> <p>6) Measure the resistance between connector (5AG) in the test harness AG and connector (3V) in the test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(5AG) No. 10 — (3V) No. 2:</b>  <b>(5AG) No. 8 — (3V) No. 1:</b></p>	Is the resistance less than 10 Ω?	Go to step 5.	Replace the airbag rear harness along with body harness.
<p><b>5 CHECK AIRBAG REAR HARNESS (BETWEEN SIDE A/B SENSOR (LH) AND CURTAIN A/B SENSOR (LH)).</b></p> <p>Measure the resistance between connector (3V) in the test harness V and chassis ground, and the resistance between connector (5AG) in the test harness AG and connector (3V) in test harness V.</p> <p><b>Connector &amp; terminal</b>  <b>(3V) No. 2 — Chassis ground:</b>  <b>(3V) No. 1 — Chassis ground:</b>  <b>(5AG) No. 10 — (3V) No. 1:</b>  <b>(5AG) No. 8 — (3V) No. 2:</b></p>	Is the resistance 1 MΩ or more?	Go to step 6.	Replace the airbag rear harness along with body harness.
<p><b>6 CHECK AIRBAG CONTROL MODULE.</b></p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the same DTC displayed?	Go to step 7.	Go to step 8.
<p><b>7 REPLACE SIDE AIRBAG SENSOR (LH) AND CHECK AIRBAG CONTROL MODULE AFTER REPLACEMENT.</b></p> <p>&lt;Ref. to AB-21, REMOVAL, Side Airbag Sensor.&gt;</p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	Is the system normal?	Go to step 8.	Replace the curtain airbag sensor (LH). <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.> Replace the airbag control module if not operating normally even after replacing the sensor. <Ref. to AB-20, REMOVAL, Airbag Control Module.>
<p><b>8 CHECK FOR ANY OTHER DTC ON DISPLAY.</b></p>	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

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### **BH:DTC F8 SATELLITE SENSOR BUS COMMUNICATION ERROR**

NOTE:

Refer to DTC FA for details on DTC F8. <Ref. to AB(diag)-143, DTC FA SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

### **BI: DTC F9 SATELLITE SENSOR BUS COMMUNICATION ERROR**

NOTE:

Refer to DTC FA for details on DTC F9. <Ref. to AB(diag)-143, DTC FA SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## BJ:DTC FA SATELLITE SENSOR BUS COMMUNICATION ERROR

Refer to DTC FA for details on DTC F9. <Ref. to AB(diag)-143, DTC FA SATELLITE SENSOR BUS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

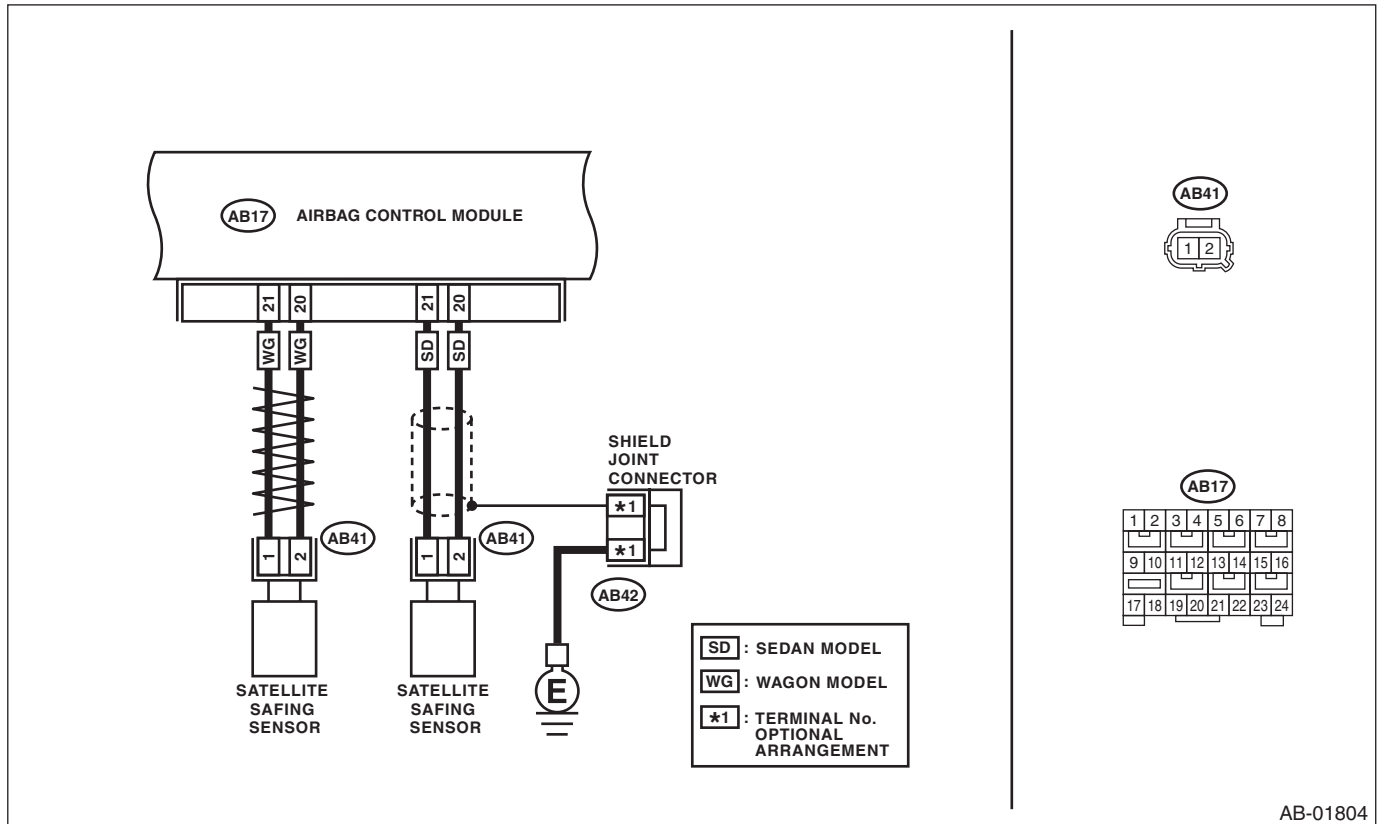
### DTC DETECTING CONDITION:

- Open or short circuit in harness of satellite safing sensor.
- Satellite safing sensor is faulty.
- Airbag control module is faulty.

### CAUTION:

- Before diagnosing the airbag system, be sure to turn the ignition switch to OFF, disconnect the ground cable from battery, and wait 20 seconds or more before starting to work.
- When replacing the airbag module, seat belt pretensioner, roll connector, control module and sensor, reconnect each part and check that the warning light operates properly.
- When inspecting the airbag main harness, disconnect the airbag module connectors and seat belt pretensioners of the driver's and passenger's seats for safety reasons.
- When inspecting the airbag rear harness, disconnect the side airbag module connector, curtain airbag module connector and seat belt pretensioner connector for safety reasons.

### WIRING DIAGRAM:



Step	Check	Yes	No	
1	<b>CHECK POOR CONTACT OF CONNECTORS.</b> Check for poor contact of the connectors (AB17, AB41) between the airbag control module and the satellite safing sensor.	Is there poor contact?	Replace the airbag rear harness along with body harness.	Go to step 2.

## Diagnostic Chart with Trouble Code

### AIRBAG SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>2</b></p> <p><b>CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SATELLITE SAFING SENSOR).</b></p> <p>1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more.</p> <p>2) Disconnect the connectors (AB21, AB26) from seat belt pretensioner.</p> <p>3) Disconnect the connectors (AB31, AB33) from curtain airbag module.</p> <p>4) Disconnect the connectors (AB19), (AB20), (AB24) and (AB25) from the side airbag module.</p> <p>5) Disconnect the connectors (AB17, AB6, AB18) from airbag control module.</p> <p>6) Connect the connector (1AG) in the test harness AG to the connectors (AB17, AB6, AB18).</p> <p>7) Disconnect the connector (AB41) from satellite safing sensor, and then connect the connector (1H) in the test harness H to connector (AB41).</p> <p>8) Measure the resistance between connector (5AG) in the test harness AG and connector (3H) in the test harness H.</p> <p><b>Connector &amp; terminal</b>  <b>(5AG) No. 9 — (3H) No. 5:</b>  <b>(5AG) No. 11 — (3H) No. 6:</b></p>	<p>Is the resistance less than 10 Ω?</p>	<p>Go to step 3.</p>	<p>Replace the airbag rear harness along with body harness.</p>
<p><b>3</b></p> <p><b>CHECK AIRBAG REAR HARNESS (BETWEEN AIRBAG CONTROL MODULE AND SATELLITE SAFING SENSOR).</b></p> <p>Measure the resistance between connector (5AG) in the test harness AG and chassis ground, and the resistance between connector (5AG) in the test harness AG and connector (3H) in test harness H.</p> <p><b>Connector &amp; terminal</b>  <b>(5AG) No. 9 — Chassis ground:</b>  <b>(5AG) No. 11 — Chassis ground:</b>  <b>(5AG) No. 9 — (3H) No. 6:</b>  <b>(5AG) No. 11 — (3H) No. 5:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Go to step 4.</p>	<p>Replace the airbag rear harness along with body harness.</p>
<p><b>4</b></p> <p><b>CHECK AIRBAG CONTROL MODULE.</b></p> <p>1) Connect all connectors.</p> <p>2) Erase the memory.</p> <p>3) Perform the Inspection Mode.</p> <p>4) Read the DTC.</p>	<p>Is the same DTC displayed?</p>	<p>Replace the satellite safing sensor. &lt;Ref. to AB-23, REMOVAL, Satellite Safing Sensor.&gt; Replace the airbag control module if not operating normally even after replacing the sensor. &lt;Ref. to AB-20, REMOVAL, Airbag Control Module.&gt;</p>	<p>Go to step 5.</p>
<p><b>5</b></p> <p><b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b></p>	<p>Is any other DTC displayed?</p>	<p>Check DTC using "List of Diagnostic Trouble Code (DTC)". &lt;Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).&gt;</p>	<p>Finish the diagnosis.</p>

# Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

## BK:DTC 3A FRONT SUB SENSOR RH FALSE INSTALLATION

### DTC DETECTING CONDITION:

Front sub sensor (RH) is misinstalled.

Step	Check	Yes	No
1 <b>REPLACE THE FRONT SUB SENSOR.</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the front sub sensor (RH) with a genuine sensor. <Ref. to AB-25, REMOVAL, Front Sub Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

## BL:DTC 3B FRONT SUB SENSOR LH FALSE INSTALLATION

### DTC DETECTING CONDITION:

Front sub sensor (LH) is misinstalled.

Step	Check	Yes	No
1 <b>REPLACE THE FRONT SUB SENSOR.</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the front sub sensor (LH) with a genuine sensor. <Ref. to AB-25, REMOVAL, Front Sub Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

## BM:DTC 3C SATELLITE SENSOR BUS FAILURE

### DTC DETECTING CONDITION:

Satellite safing sensor is faulty.

Step	Check	Yes	No
1 <b>REPLACE SATELLITE SAFING SENSOR.</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the satellite safing sensor with a genuine sensor. <Ref. to AB-23, REMOVAL, Satellite Safing Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

## BN:DTC 3D SATELLITE SENSOR FALSE INSTALLATION

### DTC DETECTING CONDITION:

Satellite safing sensor is misinstalled.

Step	Check	Yes	No
1 <b>REPLACE SATELLITE SAFING SENSOR.</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the satellite safing sensor with a genuine sensor. <Ref. to AB-23, REMOVAL, Satellite Safing Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

## Diagnostic Chart with Trouble Code

AIRBAG SYSTEM (DIAGNOSTICS)

### BO:DTC 5A SIDE AIRBAG SENSOR RH FALSE INSTALLATION

DTC DETECTING CONDITION:

Side A/B sensor RH is misinstalled.

	Step	Check	Yes	No
1	<b>REPLACE SIDE A/B SENSOR (RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the side A/B sensor (RH) with a genuine sensor. <Ref. to AB-21, REMOVAL, Side Airbag Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

### BP:DTC 5B SIDE AIRBAG SENSOR LH FALSE INSTALLATION

DTC DETECTING CONDITION:

Side A/B sensor LH is misinstalled.

	Step	Check	Yes	No
1	<b>REPLACE SIDE A/B SENSOR (LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the side A/B sensor (LH) with a genuine sensor. <Ref. to AB-21, REMOVAL, Side Airbag Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

### BQ:DTC 5C CURTAIN AIRBAG SENSOR RH FALSE INSTALLATION

DTC DETECTING CONDITION:

Curtain side A/B sensor RH is misinstalled.

	Step	Check	Yes	No
1	<b>REPLACE CURTAIN A/B SENSOR (RH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the curtain A/B sensor (RH) with a genuine sensor. <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

### BR:DTC 5D CURTAIN AIRBAG SENSOR LH FALSE INSTALLATION

DTC DETECTING CONDITION:

Curtain side A/B sensor LH is misinstalled.

	Step	Check	Yes	No
1	<b>REPLACE CURTAIN A/B SENSOR (LH).</b> 1) Turn the ignition switch to OFF, disconnect the ground cable from battery, and wait for 20 seconds or more. 2) Replace the curtain A/B sensor (LH) with a genuine sensor. <Ref. to AB-22, REMOVAL, Curtain Airbag Sensor.>	Does the warning light go off?	Finish the diagnosis.	Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.>

# Basic Diagnostic Procedure

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

	Step	Check	Yes	No
1	<b>CHECK WARNING LIGHT.</b> Check whether the airbag warning light in the combination meter is lit.	Does the airbag warning light illuminate?	Go to step 2.	Perform the diagnosis according to phenomenon of the problem.
2	<b>READ DTC.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. 3) Turn the ignition switch to ON and start up the Subaru Select Monitor. 4) Read the DTC. <Ref. to OD(diag)-17, OPERATION, Read Diagnostic Trouble Code (DTC).> NOTE: If the communication function of the Subaru Select Monitor cannot be executed normally, check the communication circuit. <Ref. to AB(diag)-32, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.> 5) Record all DTCs and freeze frame data.	Is DTC displayed?	Go to step 3.	Go to "Airbag Warning Light Failure". <Ref. to AB(diag)-39, Airbag Warning Light Failure.>
3	<b>PERFORM DIAGNOSIS.</b> 1) Determine the possible cause from "List of Diagnostic Trouble Code". <Ref. to OD(diag)-22, List of Diagnostic Trouble Code (DTC).> 2) Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". 3) Repair the trouble cause. 4) Perform the Clear Memory Mode. <Ref. to OD(diag)-19, Clear Memory Mode.> 5) Perform the Inspection Mode. <Ref. to OD(diag)-18, Inspection Mode.> 6) Read any other DTCs displayed.	Is DTC displayed?	Perform the procedure 1) to 5) in step 3.	Finish the diagnosis.



## Check List for Interview

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### 2. Check List for Interview

#### A: CHECK

Customer's name		Inspector's name	
Date vehicle brought in	/ /	Registration No.	
Odometer reading	km miles	V.I.N.	
Date problem occurred	/ /	Registration year	/ /
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Others:		
Temperature	°C ( °F)		
Road condition	<input type="checkbox"/> Flat road <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Gravel road <input type="checkbox"/> Others:		
Vehicle operation	<input type="checkbox"/> Starting <input type="checkbox"/> Idling <input type="checkbox"/> Driving <input type="checkbox"/> Constant speed <input type="checkbox"/> Accelerating <input type="checkbox"/> Decelerating <input type="checkbox"/> Turning <input type="checkbox"/> Others:		
Details of problem			
Airbag warning light operation	<input type="checkbox"/> Normal (After turning the ignition switch to ON, illuminates for 6 seconds then goes off.) <input type="checkbox"/> Remains ON <input type="checkbox"/> Remains OFF		
Passenger's airbag ON/OFF indicator does not operate.	<input type="checkbox"/> Normal (After turning the ignition switch to ON, illuminates for 6 seconds then goes off for 2 seconds; Lights ON (adult) or OFF (children/unoccupied).) <input type="checkbox"/> Both remain ON <input type="checkbox"/> Both remain OFF		
DTC output	<input type="checkbox"/> OK code <input type="checkbox"/> DTC: (Code:                    )		

## General Description

### OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

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### 3. General Description

#### A: CAUTION

1) If the seat cushion cover is removed or replaced, make sure to perform passenger detection system adjustment after installing the seat to the vehicle. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

Failure to do so may cause improper operation of the passenger detection system.

2) The passenger detection system (passenger seat only) control unit and the passenger detection sensor are fixed to the seat cushion frame. Never remove the passenger detection control unit or the pressure sensor from the seat cushion frame.

3) Do not replace the seat cushion pad by itself. Always replace the seat cushion pad and frame assembly as a set. The seat cushion pad and cushion frame are adjusted as a set at the time of manufacture. If cushion pads and cushion frames are combined from those of other vehicles or other sets, the passenger detection system may not operate properly.

4) If the seat cushion cover is removed, make sure to replace the hang wire on the seat cushion side with a new wire.

5) Never connect the battery in reverse polarity. Occupant detection system may be destroyed instantly.

6) Do not disconnect the battery terminals while the engine is running.

A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as occupant detection control module.

7) Before disconnecting the connectors of each sensor and control module, be sure to turn the ignition switch to OFF and wait for 20 seconds or more. Occupant detection control module may be damaged.

8) All passenger detection system parts are precision components. Do not drop them.

#### CAUTION:

- Do not use electrical test equipment on the airbag system wiring harness and connector circuit.
- Be careful not to damage the airbag system wiring harness when servicing the occupant detection system.
- Refer to “Airbag System” when repairing the occupant detection system. <Ref. to AB(diag)-4, CAUTION, General Description.>

#### B: INSPECTION

Measure the battery voltage and check electrolyte.

##### **Standard voltage:**

**12 V**

##### **Specific gravity:**

**1.260 or more**

##### **Fluid level:**

**Between the upper level and lower level**

# General Description

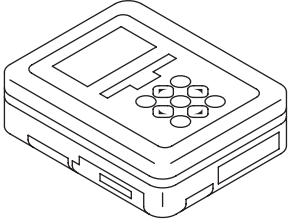
OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## C: PREPARATION TOOL

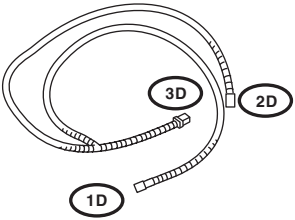
### CAUTION:

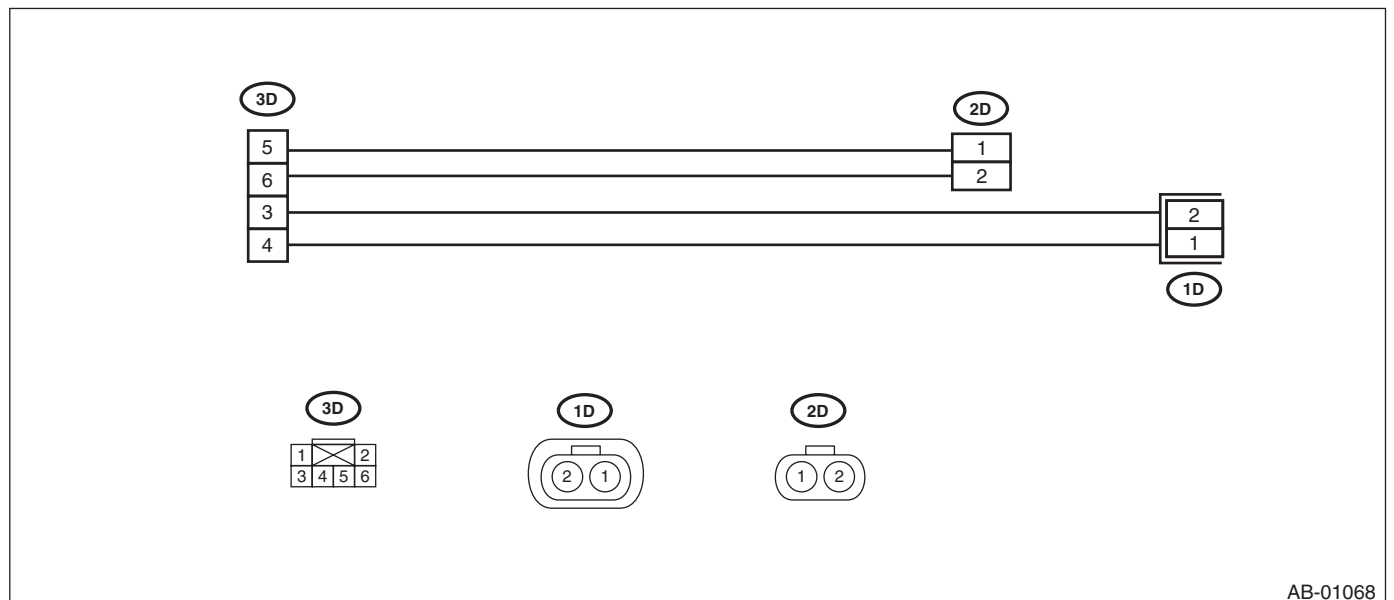
To measure the voltage and resistance of airbag system and occupant detection system components, be sure to use the specified test harness.

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

### • TEST HARNESS D

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299AG060</p>	98299AG060	TEST HARNESS D	Used when measuring voltage and resistance of the front seat belt buckle switch.

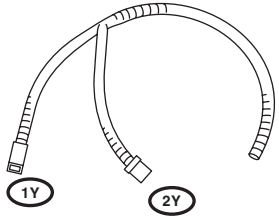


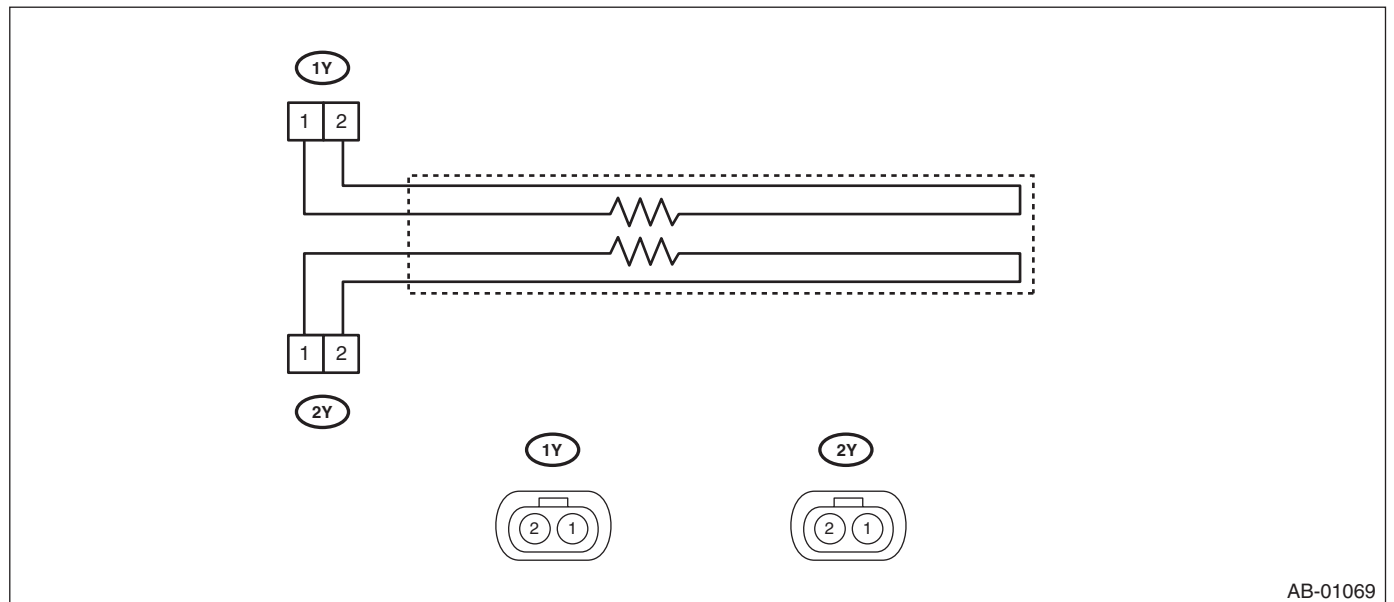
AB-01068

# General Description

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

- TEST HARNESS Y

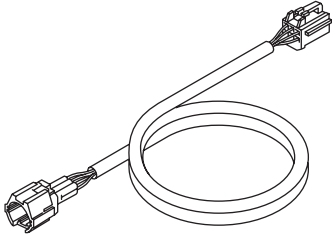
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299AG040</p>	98299AG040	TEST HARNESS Y	Used for diagnosing seat belt buckle switch.

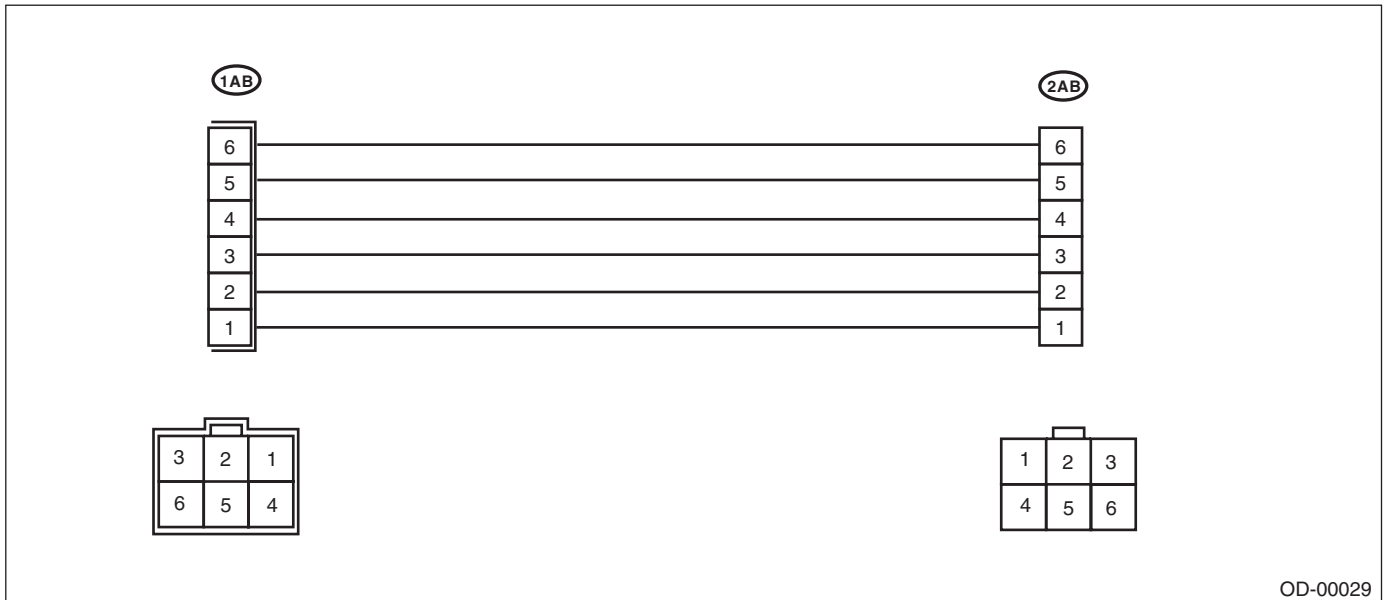


# General Description

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

- TEST HARNESS AB

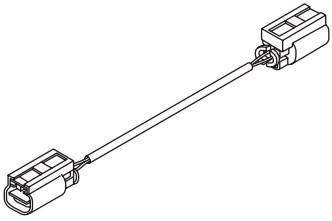
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST98299XA000</p>	98299XA000	TEST HARNESS AB	Used when measuring voltage and resistance of occupant detection system.

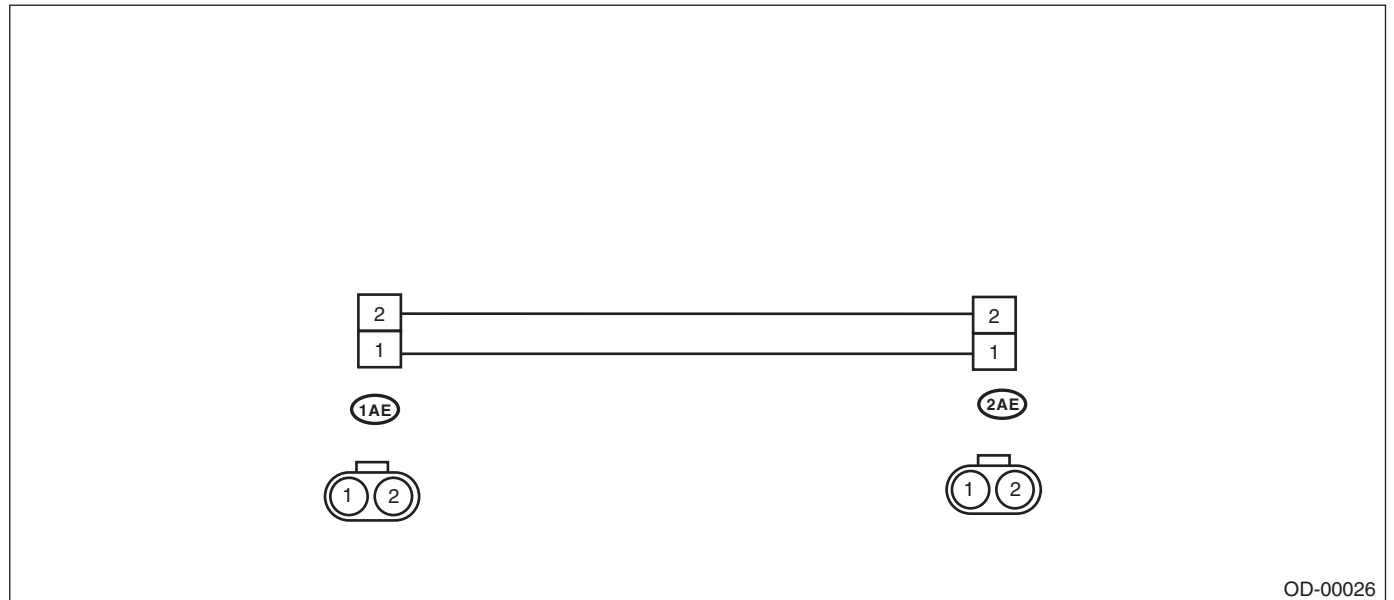


# General Description

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

- TEST HARNESS AE

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST98299XA030	98299XA030	TEST HARNESS AE	Test harness Y adapter harness Used for diagnosing seat belt buckle switch.

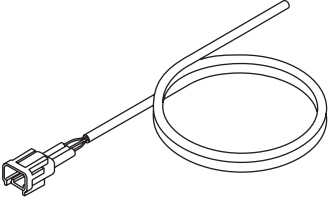


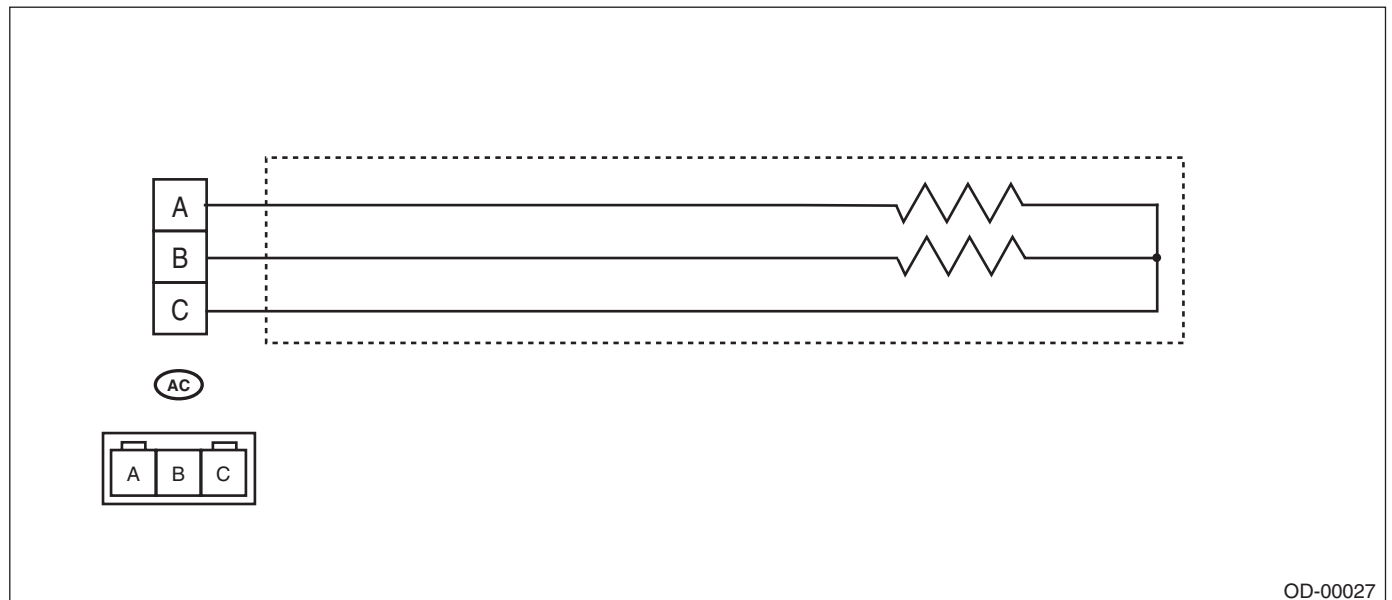
OD-00026

# General Description

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### • TEST HARNESS AC

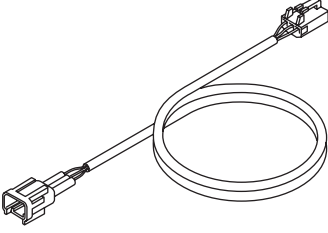
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST98299XA010	98299XA010	TEST HARNESS AC	Used for diagnosing the seat belt tension sensor.

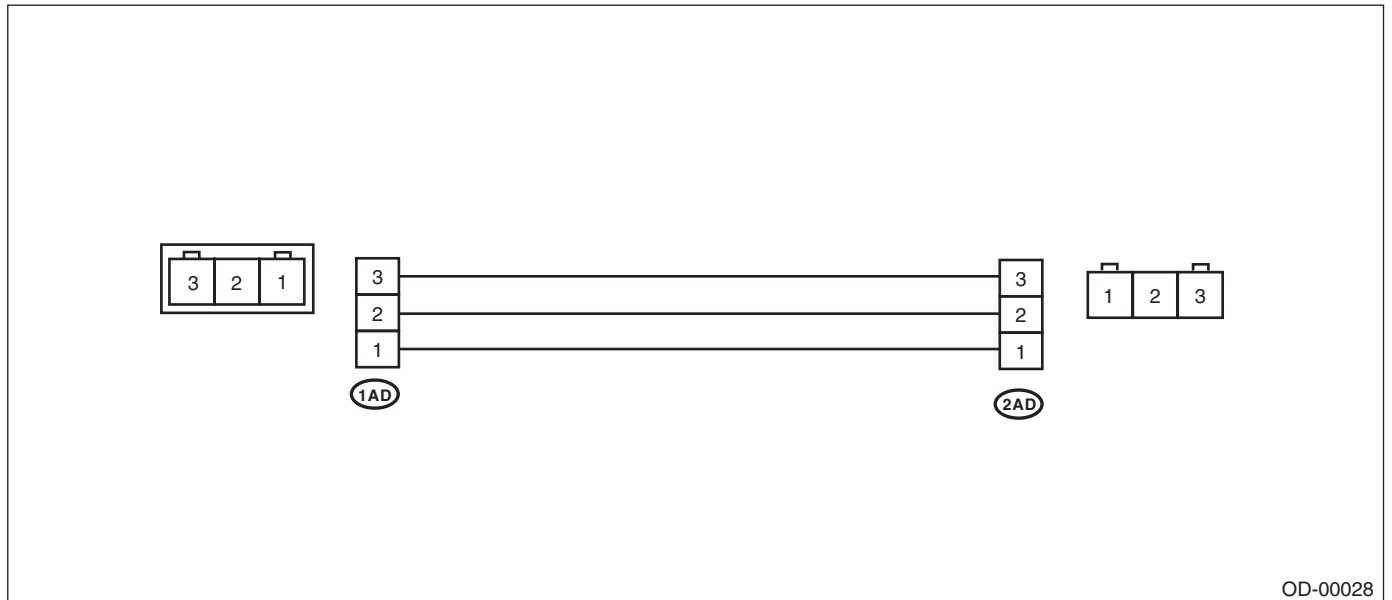


# General Description

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### • TEST HARNESS AD

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST98299XA020</p>	98299XA020	TEST HARNESS AD	Used when measuring voltage and resistance of the seat belt tension sensor.



### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

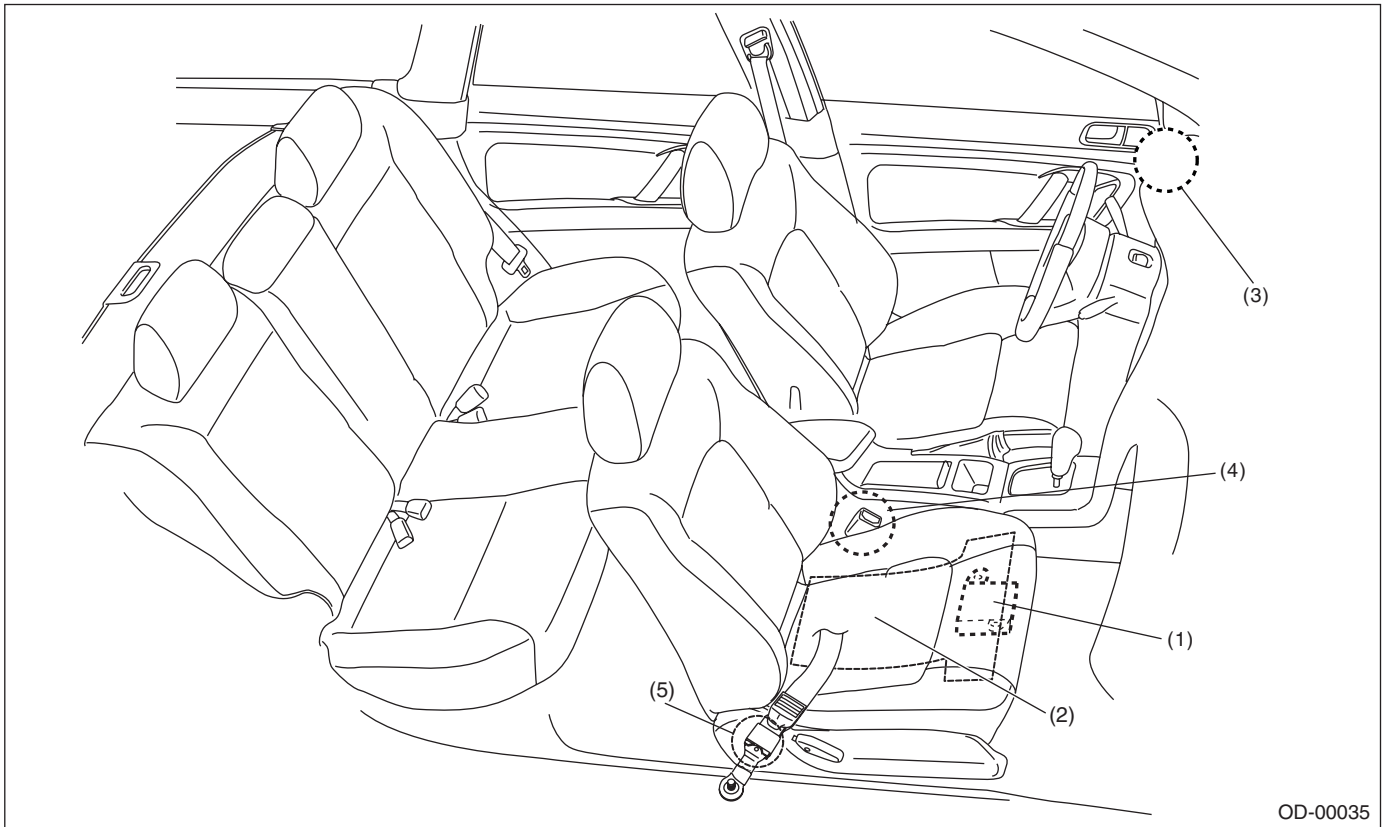


# Electrical Component Location

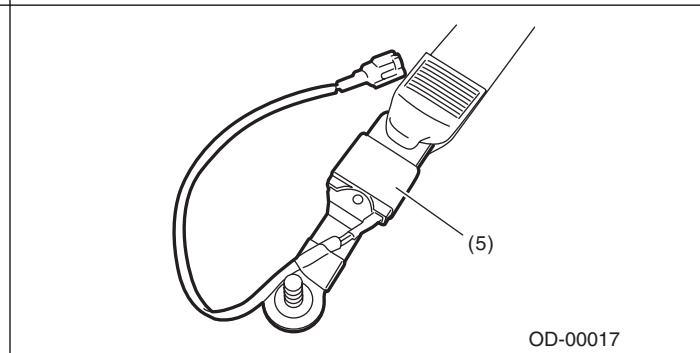
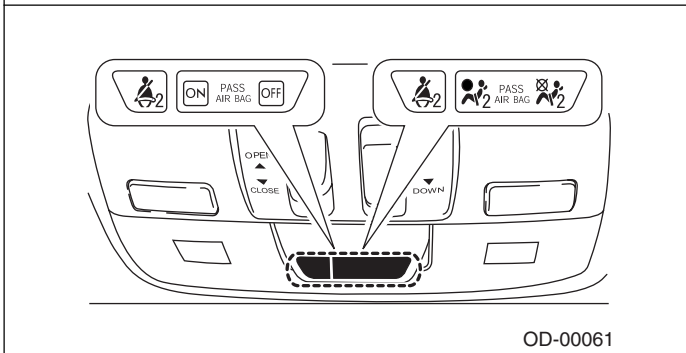
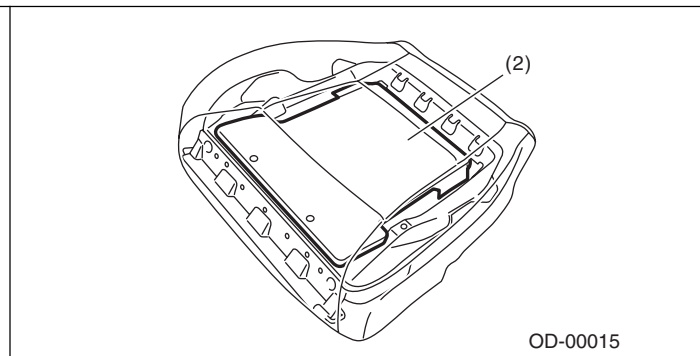
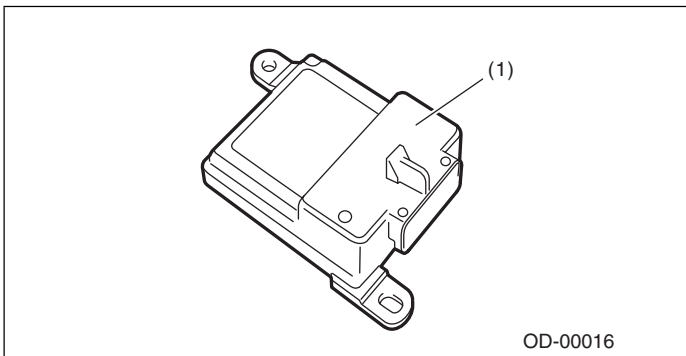
OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## 4. Electrical Component Location

### A: LOCATION



- |                                       |   |                              |
|---------------------------------------|---|------------------------------|
| (1) Occupant detection control module | (3) Airbag ON/OFF indicator light (Map light) | (5) Seat belt tension sensor |
| (2) Occupant detection sensor         | (4) Buckle switch (Passenger's seat)          |                              |



# Airbag Connector

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

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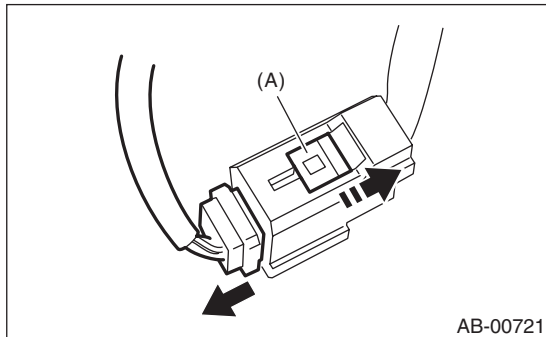
### 5. Airbag Connector

#### A: PROCEDURE

##### 1. BUCKLE SWITCH

1) How to disconnect:

- (1) Move the slide lock (A) in the direction of arrow.
- (2) While holding the slide lock (A) in the moved position, disconnect the connector.

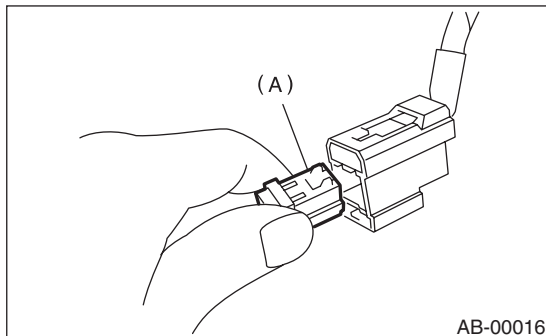


#### CAUTION:

**When pulling the slide lock or disconnecting connector, be sure to hold the connector, not the harness.**

2) How to connect:

Holding the connector (A), and push it in carefully until a clicking sound is heard.



#### CAUTION:

**Be sure to insert the connector in until it is locked. Then pull it gently to make sure that it is locked.**

## Control Module I/O Signal

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### 6. Control Module I/O Signal

#### A: ELECTRICAL SPECIFICATION

##### CAUTION:

Never remove the occupant detection control module, occupant detection sensor or seat frame because they are integrated into one unit.

Terminal name	Terminal No.	Input/Output value	Remarks	
IG – power supply	9	9 — 16 V	When ignition switch ON	
Airbag control module communication (COM)	10	Open collector terminal	Communication line	
Airbag control module communication (GND)	5	0 V	Ground	
Belt tension sensor	(Vcc)	4	0 — 5 V	Belt tension sensor power supply
	(Vout)	16	0.5 — 4.5 V	Sensor output voltage
	(GND)	14	0 V	Sensor ground
Occupant detection sensor	(Vcc)	6	0 — 5 V	Pressure sensor power supply
	(Vout)	7	0.5 — 4.5 V	Sensor output voltage
	(GND)	15	0 V	Sensor ground
Buckle switch	1	0 — IG voltage	Ignition voltage when switch ON	
Buckle switch (GND)	2	0 V	Switch ground	

#### B: WIRING DIAGRAM

Refer to the electrical wiring diagram. <Ref. to WI-155, WIRING DIAGRAM, Occupant Detection System.>

# Subaru Select Monitor

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### 7. Subaru Select Monitor

#### A: OPERATION

##### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

When malfunction of the airbag system and the occupant detection system occur, the DTC stored in airbag control module will be read out.

Refer to the DTC readout of the airbag system (diagnosis). <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>

NOTE:

- For details concerning the operation procedure, refer to the PC Application Help for Subaru Select Monitor.
- For details concerning DTCs, refer to the “List of Diagnostic Trouble Code (Airbag system, Occupant detection system)”. <Ref. to AB(diag)-44, List of Diagnostic Trouble Code (DTC).> <Ref. to OD(diag)-22, List of Diagnostic Trouble Code (DTC).>

##### 2. DISPLAY OF STATUS INFORMATION

Check the operating condition of each sensor in the event of malfunction in the seat belt buckle switch and seat position sensor, or when the seat belt buckle switch and seat position sensor has been replaced.

1) Select {Each System Check} in «Main Menu».

2) On the «System Selection Menu» display screen, select the {Airbag System}.

3) On the «Airbag System» display screen, select the {Status Data}.

The following table is for support data.

Contents	Display Contents
Seat position sensor LH	—*5
Seat position sensor RH	—*5
Seat belt buckle switch LH	—*9
Seat belt buckle switch RH	Belted *6/Unbelted*7 /Other *8/Initial Setting *4 /—*9
Passenger's airbag control status	ON *10/OFF *11 /Initial Setting *4

\*1: The seat position is forward.

\*2: The seat position is rearward.

\*3: Displayed when data other than before and behind the seat, such as the breakdown etc, is input.

\*4: Displayed when it is initial.

\*5: Seat position sensor not supported

\*6: Seat belt fastened

\*7: Seat belt not fastened

\*8: Displayed when data other than belt fastened or not fastened, such as breakdowns is input.

\*9: Seat belt buckle switch not supported

\*10: Passenger's airbag operating state

\*11: Passenger's airbag non-operating state

NOTE:

For details concerning operation procedures, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.

### 3. CLEAR MEMORY MODE

Clear the DTC stored in the airbag control module after repairing the airbag system and occupant detection system. (After the breakdown is recovered, the breakdown code for completed recoveries are read out when the next breakdown occurs if the memory clear work is not performed.)

- 1) Select {Each System Check} in «Main Menu».
- 2) On the «System Selection Menu» display screen, select the {Airbag System}.
- 3) On the «Airbag System» display screen, select the {Clear Memory}.
- 4) When the “Clear Memory?” is shown on the screen, select the [OK].
- 5) When “Done” is displayed, terminate the Subaru Select Monitor and turn the ignition switch to OFF.

#### NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

### 4. SYSTEM CALIBRATION (REZEROING)

#### NOTE:

When replacing the occupant detection system, or removing and disassembling the passenger's seat, always perform the system calibration after installing a seat in the vehicle.

#### CAUTION:

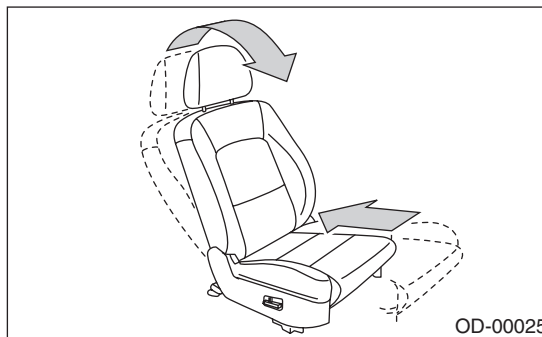
**When the trouble occurs in the system during calibration process, “Occupant detection calibration failure” is detected in the DTC 2A of the airbag system and the airbag warning light lights. In this case, after turning the ignition switch to OFF once, redo the system calibration (Rezeroing), or after clearing the cause of the failure, perform the system calibration again.**

- 1) Park empty vehicle on a level surface.
- 2) Select {Each System Check} in «Main Menu».
- 3) On the «System Selection Menu» display screen, select the {Occupant Detection System}.
- 4) On the «Occupant Detection System» display screen, select the {Zero Point Adjustment}.

5) «See service manual. And check vehicle condition for successfully completing the rezeroing.» is displayed. Check the following to adjust the condition of the vehicle.

- Adjust the seat backrest to be fully upright. (For models with power seats, press the power seat button until the backrest comes to a stop.)
- Adjust the seat slide position all the way back. (For models with power seats, press the power seat button until the seat slide does not move any further.)
- Do not place anything on the top of the seat cushion.
- Sit on the seat cushion to smooth the seat surface.
- Check that the passenger's seat belt is not inserted into the buckle, not tense or not stuck.
- Check that ambient temperature is in a range from 0 to 40°C.

6) When the «Re-zeroing Adjust the passenger seat to the condition shown in service manual» is displayed, slide the passenger seat all the way to the back, check that the backrest is adjusted to all the way up, and select the [OK].



7) When the «Re-zeroing Unbuckle the Passenger seat belt Continue: OK, Quit: NO» is displayed, make sure the passenger's seat belt is disconnected from the buckle and select the [OK].

8) When the «Re-zeroing Empty the passenger seat Continue: OK, Quit: NO» is displayed, make sure that the passenger's seat is empty, the airbag OFF indicator illuminates and the airbag ON indicator does not illuminate, and select the [OK].

#### NOTE:

- After selecting the [OK], «Now processing... Wait for a while. Do not touch or give impact to vehicle and seat» is displayed. Do not touch or rock the vehicle while the message is displayed.
- During the system calibration process, if the «Re-zeroing is unsuccessful See service manual Press OK to END» is displayed, go to step 10).

# Subaru Select Monitor

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

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9) When the re-zeroing is ended normally, the «Re-zeroing is successfully completed Press OK to END» is displayed. and then turn the ignition switch to OFF to finish the diagnosis.

10) During the system calibration process, if «Re-zeroing is unsuccessful See service manual Press OK to END» is displayed, turn the ignition switch to OFF once and turn it ON again, then read the DTC of the airbag system. <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>

When DTC is input, fix the fault and then perform the system calibration. When DTC is not input, check the seat and vehicle status and then perform the system calibration again. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

### NOTE:

When the re-zeroing is unsuccessful, there could be occupant detection system failure or improper seat and vehicle status. When the airbag warning light illuminates, read the DTC of the airbag system, and perform the diagnosis while referring to “List of Diagnostic Trouble Code”. <Ref. to AB(diag)-30, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> <Ref. to AB(diag)-44, LIST, List of Diagnostic Trouble Code (DTC).>

## B: INSPECTION

### 1. COMMUNICATION FOR INITIALIZING IMPOSSIBLE

#### DETECTING CONDITION:

Defective harness connector

#### TROUBLE SYMPTOM:

Communication is impossible between the airbag control module and the Subaru Select Monitor.

Refer to “Initial Communication Impossible” in the DTC of the airbag system (diagnosis). <Ref. to AB(diag)-32, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, INSPECTION, Subaru Select Monitor.>

### 2. WITHOUT DTC

#### DETECTING CONDITION:

- Defective combination meter
- Open circuit of harness

#### TROUBLE SYMPTOM:

- Airbag warning light remains on.
- “NO TROUBLE CODE” will be displayed on the Subaru Select Monitor.

#### NOTE:

- For detailed operation procedures, refer to “Airbag Warning Light Failure”. <Ref. to AB(diag)-39, Airbag Warning Light Failure.>
- When the airbag warning light is OFF and “NO TROUBLE CODE” is displayed on Subaru Select Monitor, the system is operating properly.

## Read Diagnostic Trouble Code (DTC)

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

---

### 8. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

For details on reading DTCs, refer to “Airbag System (Diagnosis) Subaru Select Monitor”. <Ref. to AB(diag)-30, Subaru Select Monitor.>

## Inspection Mode

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

---

### 9. Inspection Mode

#### A: PROCEDURE

Recreate the circumstance by referring to the conditions described in the checklist.



### 10. Clear Memory Mode

#### A: OPERATION

- Clear the memory in the following steps after the malfunction is repaired.
- For details to clear the DTC, refer to “Airbag System (Diagnosis) Subaru Select Monitor”. <Ref. to AB(diag)-30, Subaru Select Monitor.>

# Airbag Warning Light Illumination Pattern

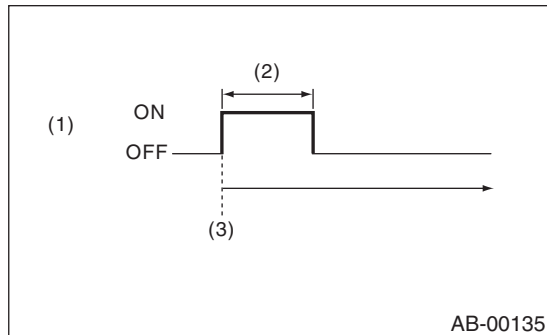
OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

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## 11. Airbag Warning Light Illumination Pattern

### A: INSPECTION

Turn the ignition switch to ON, and confirm that the airbag warning light remains on for approx. 6 seconds and then goes off afterwards.



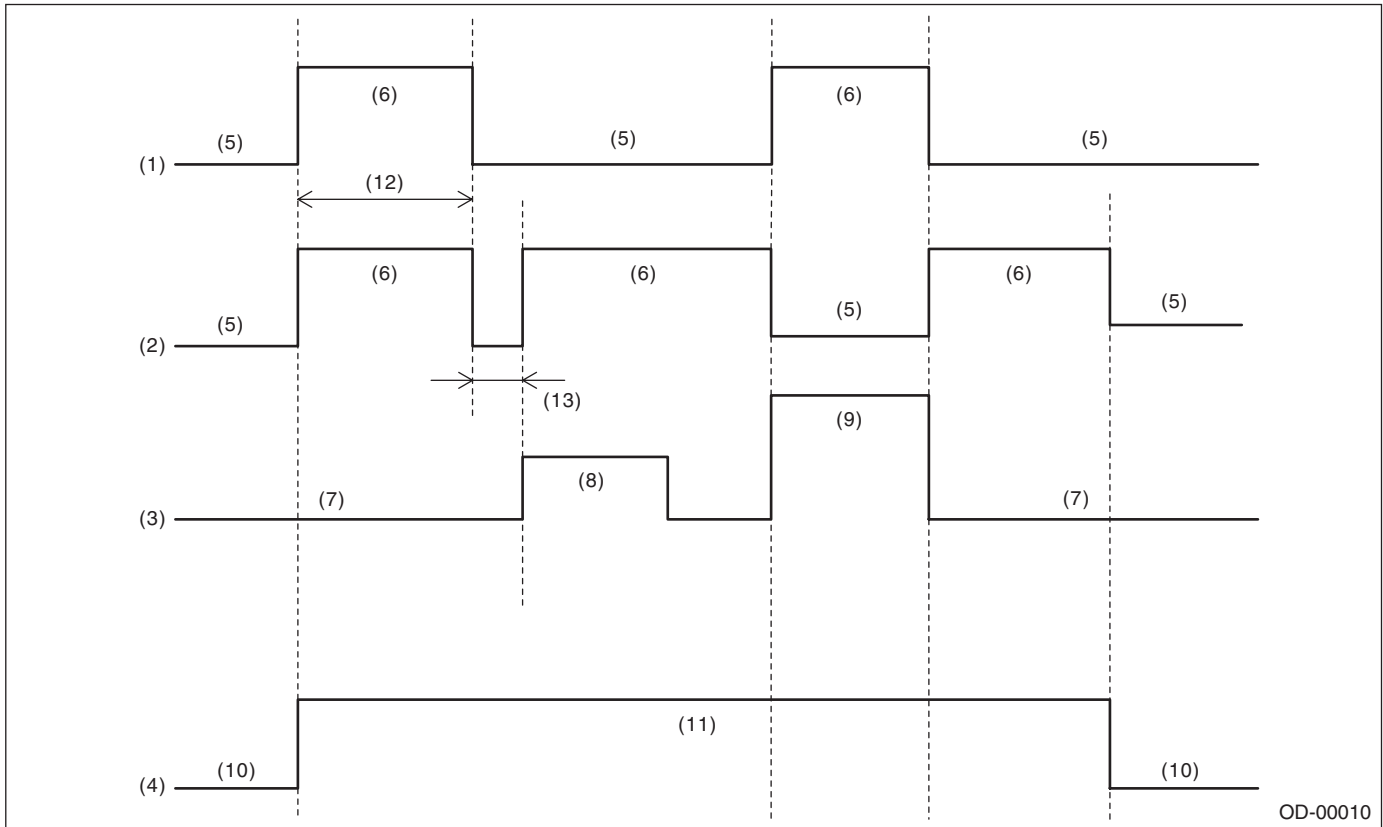
- (1) Airbag warning light
- (2) Approx. 6 sec.
- (3) Ignition switch ON

# Passenger's Airbag ON/OFF Indicator Light Illumination Pattern

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## 12. Passenger's Airbag ON/OFF Indicator Light Illumination Pattern

### A: INSPECTION



OD-00010

- |  |                     |                     |
|--|---------------------|---------------------|
| (1) Passenger's airbag ON indicator light  | (4) Ignition switch | (9) Adult           |
| (2) Passenger's airbag OFF indicator light | (5) Light OFF       | (10) OFF            |
| (3) Occupant seating                       | (6) Light ON        | (11) ON             |
|  | (7) Empty           | (12) Approx. 6 sec. |
|  | (8) Child           | (13) Approx. 2 sec. |

## List of Diagnostic Trouble Code (DTC)

### OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## 13. List of Diagnostic Trouble Code (DTC)

### A: LIST

DTC	Display	Diagnosis content	Reference
2A	ODS Calibration Error	System calibration (Rezeroing) was not completed normally.	<Ref. to OD(diag)-23, DTC 2A ODS CALIBRATION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2B	ODS System Wrong Parts	<ul style="list-style-type: none"> <li>• Wrong airbag control module was installed.</li> <li>• Wrong occupant detection system was installed.</li> <li>• Occupant detection system is faulty.</li> </ul>	<Ref. to OD(diag)-23, DTC 2B ODS SYSTEM WRONG PARTS, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2C	Belt Tension Sensor Failure	<ul style="list-style-type: none"> <li>• Passenger's seat belt tension sensor is faulty.</li> <li>• Airbag main harness circuit is open or shorted.</li> <li>• Occupant detection system is faulty.</li> <li>• Occupant detection harness is faulty.</li> </ul>	<Ref. to OD(diag)-24, DTC 2C BELT TENSION SENSOR FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
27	ODS Communication Error	<ul style="list-style-type: none"> <li>• Occupant detection control module and airbag control module communication is faulty.</li> <li>• Airbag rear harness circuit is open, shorted, shorted to ground or shorted to power supply.</li> <li>• Occupant detection harness is faulty.</li> <li>• Occupant detection system is faulty.</li> <li>• Airbag control module is faulty.</li> </ul>	<Ref. to OD(diag)-25, DTC 27 ODS COMMUNICATION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
29	ODS Failure	<ul style="list-style-type: none"> <li>• Occupant detection sensor is faulty.</li> <li>• Occupant detection control module is faulty.</li> <li>• Occupant detection harness is faulty.</li> <li>• Fuse No. 25 (in joint box) is blown.</li> </ul>	<Ref. to OD(diag)-26, DTC 29 ODS FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
37	Buckle Switch RH Failure	<ul style="list-style-type: none"> <li>• Passenger's buckle switch circuit is open, shorted or shorted to ground.</li> <li>• Occupant detection system is faulty.</li> <li>• Occupant detection harness is faulty.</li> </ul>	<Ref. to OD(diag)-27, DTC 37 BUCKLE SWITCH RH FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## 14. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC 2A ODS CALIBRATION ERROR

#### DTC DETECTING CONDITION:

System calibration (Rezeroing) was not completed properly.

	Step	Check	Yes	No
1	<b>PERFORM RE-ZEROING.</b> Perform system calibration using the Subaru Select Monitor. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>	Did the system calibration complete properly?	Finish the diagnosis.	Follow the system calibration procedures. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

### B: DTC 2B ODS SYSTEM WRONG PARTS

#### DTC DETECTING CONDITION:

- Wrong airbag control module is installed.
- Wrong occupant detection system is installed.

	Step	Check	Yes	No
1	<b>CHECK OCCUPANT DETECTION SYSTEM.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Replace the passenger's seat cushion pad and frame assembly. <Ref. to SE-9, REMOVAL, Front Seat.> <Ref. to SE-15, PASSENGER'S SEAT, DISASSEMBLY, Front Seat.> 3) Connect the ground cable to the battery. 4) Connect Subaru Select Monitor to the vehicle and perform the system calibration. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>	Did the system calibration complete properly?	Finish the diagnosis.	Go to step 2.
2	<b>CHECK AIRBAG CONTROL SYSTEM.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Replace the airbag control module. <Ref. to AB-20, REMOVAL, Airbag Control Module.> 3) Connect the ground cable to the battery. 4) Connect Subaru Select Monitor to the vehicle and perform the system calibration. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>	Did the system calibration complete properly?	Finish the diagnosis.	Check between the occupant detection control module and airbag control module.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

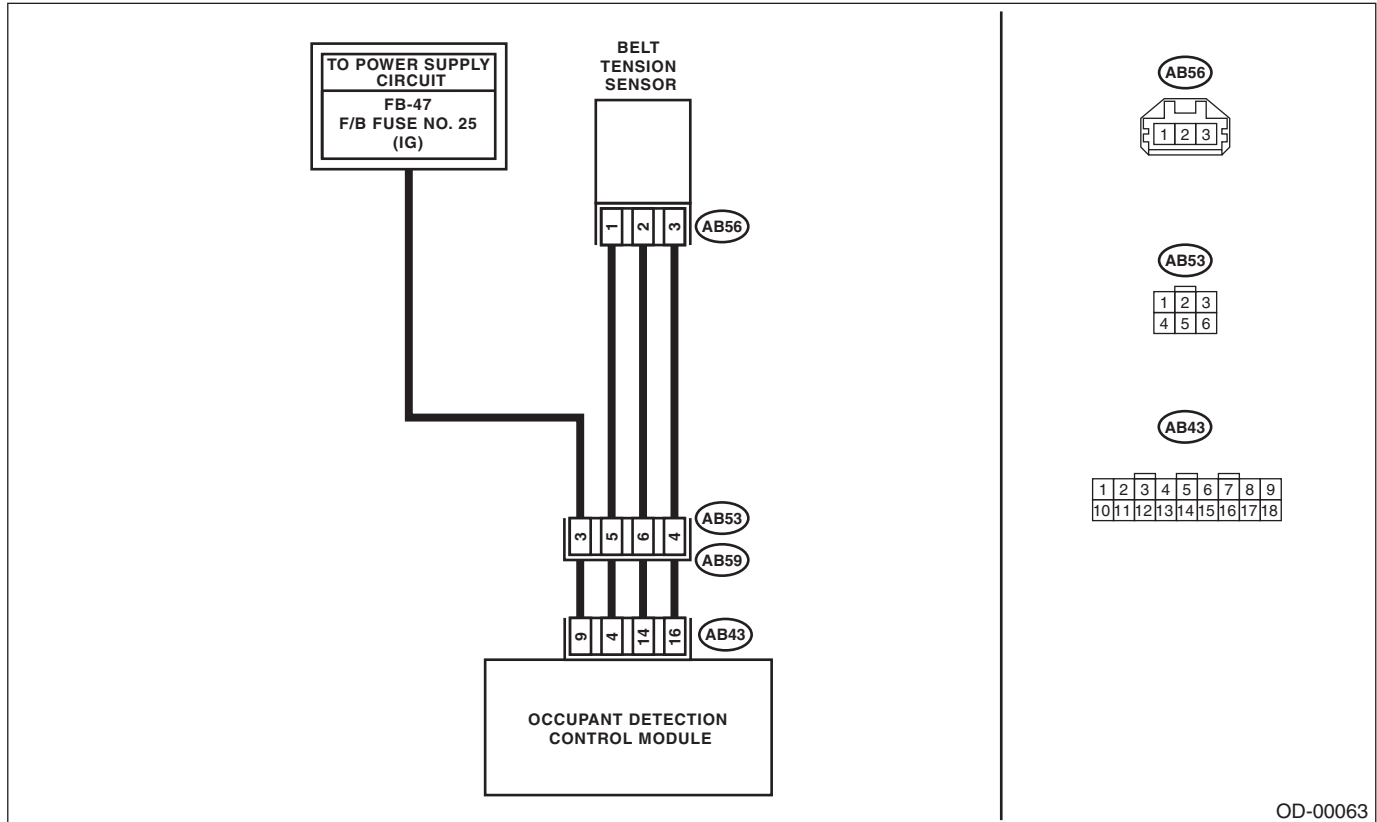
## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### C: DTC 2C BELT TENSION SENSOR FAILURE

#### DTC DETECTING CONDITION:

- Passenger's seat belt tension sensor is faulty.
- Airbag main harness circuit is open or shorted.
- Occupant detection control module is faulty.

#### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the occupant detection control module and belt tension sensor.	Is there poor contact?	Reconnect the connector. If the fault is not fixed, replace the airbag harness.	Go to step 2.
<b>2 CHECK THE BELT TENSION SENSOR.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the belt tension sensor connector (AB56) from the airbag harness. 3) Connect the test harness AC to the connector (AB56). 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for approximately 6 seconds and go off?	Replace the seat belt outer. <Ref. to SB-13, OUTER SEAT BELT ASSEMBLY, REMOVAL, Front Seat Belt.>	Go to step 3.
<b>3 CHECK AIRBAG HARNESS.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait for 20 seconds or more. 2) Disconnect the test harness AC from the belt tension sensor connector (AB56). 3) Connect the test harness AD (1AD) to the connector (AB56). 4) Disconnect the airbag harness connector (AB53), and connect connector (1AB) of test harness AB. 5) Measure the resistance between test harness terminals. <b>Connector &amp; terminal</b> <b>(2AB) No. 5 — (2AD) No. 1:</b> <b>(2AB) No. 4 — (2AD) No. 3:</b> <b>(2AB) No. 6 — (2AD) No. 2:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 4.	Replace the airbag harness along with chassis harness.
<b>4 CHECK AIRBAG HARNESS.</b> Measure the resistance between test harness terminals, and between test harness terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(2AB) No. 4 — (2AD) No. 1:</b> <b>(2AB) No. 4 — (2AD) No. 2:</b> <b>(2AB) No. 4 — chassis ground:</b> <b>(2AB) No. 5 — (2AD) No. 2:</b> <b>(2AB) No. 5 — chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 5.	Replace the airbag harness along with chassis harness.
<b>5 CHECK AIRBAG HARNESS.</b> 1) Connect the battery ground terminal and turn the ignition switch to ON. 2) Measure the voltage between test harness and chassis ground. <b>Connector &amp; terminal</b> <b>(2AD) No. 1 — chassis ground:</b> <b>(2AD) No. 3 — chassis ground:</b>	Is the voltage 1 V or less?	Replace the airbag harness along with chassis harness.	Check the seat harness, and if any fault is found, replace the seat harness. If no fault is found in the seat harness, replace the seat cushion frame assembly. <Ref. to SE-15, DISASSEMBLY, Front Seat.>

### D: DTC 27 ODS COMMUNICATION ERROR

Perform the diagnosis following diagnostic procedures for the airbag system. <Ref. to AB(diag)-67, DTC 27 ODS COMMUNICATION ERROR, Diagnostic Chart with Trouble Code.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

### E: DTC 29 ODS FAILURE

#### DTC DETECTING CONDITION:

- Occupant detection sensor is faulty.
- Occupant detection control module is faulty.
- Occupant detection harness is faulty.
- Rear airbag harness is faulty.
- Fuse No. 25 (in joint box) is blown.

	Step	Check	Yes	No
1	<b>CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the occupant detection control module and airbag control module.	Is there poor contact?	Reconnect the connector. If the fault is not fixed, replace the airbag harness.	Go to step 2.
2	<b>CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> Read diagnostic trouble code (DTC) for the airbag system.	Is "2C Belt Tension Sensor failure or 37 Buckle Switch failure" displayed in the diagnostics code?	Perform the diagnosis according to each DTC.	Check the seat harness, and if any fault is found, replace the seat harness. If the fault is not fixed, replace the occupant detection system. <Ref. to SE-15, PASSENGER'S SEAT, DISASSEMBLY, Front Seat.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

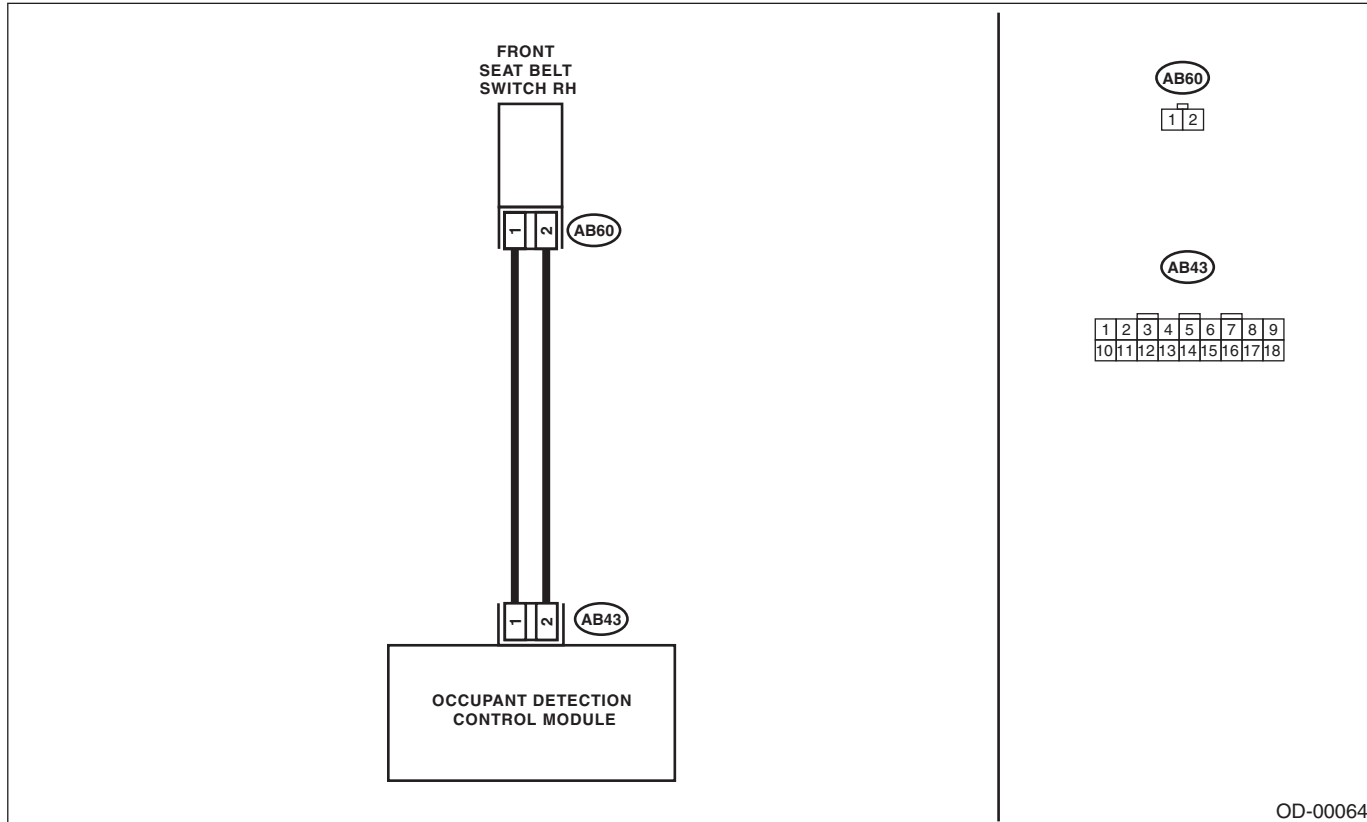
OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

## F: DTC 37 BUCKLE SWITCH RH FAILURE

### DTC DETECTING CONDITION:

- Passenger's buckle switch circuit is open, shorted or shorted to ground.
- Seat harness circuit is open, shorted or shorted to ground.
- Occupant detection control module is faulty.

### WIRING DIAGRAM:



OD-00064

Step	Check	Yes	No
<b>1</b> <b>CHECK POOR CONTACT IN CONNECTORS.</b> Check for poor contact of the connectors between the occupant detection control module and buckle switch.	Is there poor contact?	Reconnect the connector. If the fault is not fixed, replace the airbag harness.	Go to step 2.
<b>2</b> <b>CHECK THE BUCKLE SWITCH.</b> 1) Turn the ignition switch to OFF, disconnect the battery ground terminal, and wait for 20 seconds. 2) Disconnect the buckle switch connector (AB60). 3) Connect the test harness AE1 and test harness connector Y to the buckle switch connector (AB60). 4) Connect the battery ground terminal and turn the ignition switch to ON.	Does the airbag warning light illuminate for 6 seconds and go off?	Replace the buckle switch. <Ref. to SB-13, INNER SEAT BELT ASSEMBLY, REMOVAL, Front Seat Belt.>	Check the seat harness, and if any fault is found, replace the seat harness. If the fault is not fixed, replace the occupant detection system.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

OCCUPANT DETECTION SYSTEM (DIAGNOSTICS)

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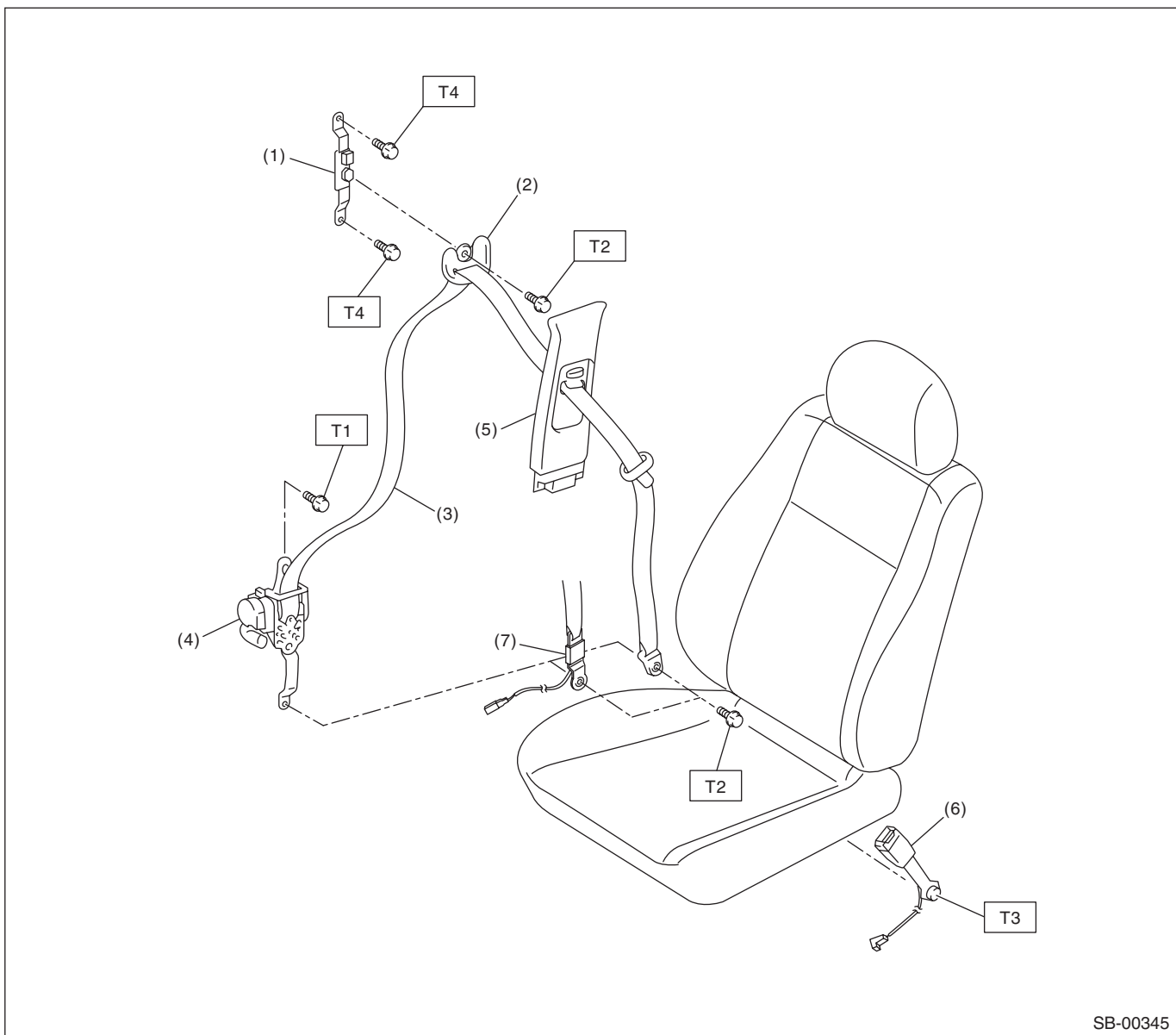
# General Description

## SEAT BELT SYSTEM

### 1. General Description

#### A: COMPONENT

#### 1. FRONT SEAT BELT



- |                            |  |
|----------------------------|--|
| (1) Adjustable anchor ASSY | (5) Center pillar upper trim                       |
| (2) Shoulder anchor        | (6) Inner seat belt ASSY                           |
| (3) Outer seat belt ASSY   | (7) Belt tension sensor<br>(Passenger's side only) |
| (4) Seat belt retractor    |  |

**Tightening torque: N·m (kgf·m, ft·lb)**

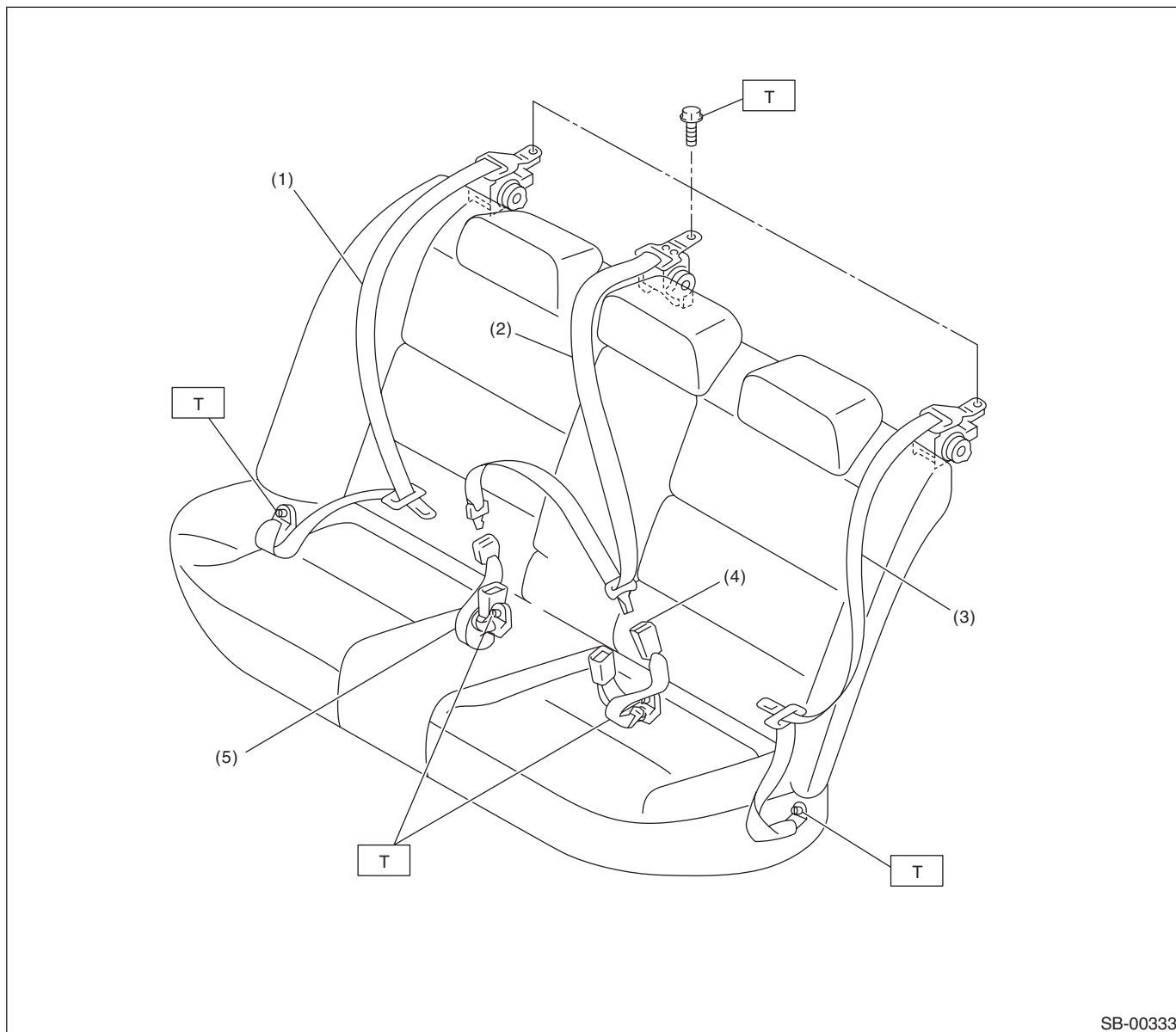
**T1: 7.5 (0.76, 5.5)**

**T2: 30 (3.1, 22)**

**T3: 38 (3.9, 28)**

**T4: 53 (5.4, 39)**

## 2. REAR SEAT BELT (SEDAN MODEL)



SB-00333

- |                                    |                              |
|------------------------------------|------------------------------|
| (1) Outer seat belt RH ASSY        | (4) Center seat belt LH ASSY |
| (2) Shoulder seat belt center ASSY | (5) Center seat belt RH ASSY |
| (3) Outer seat belt LH ASSY        |                              |

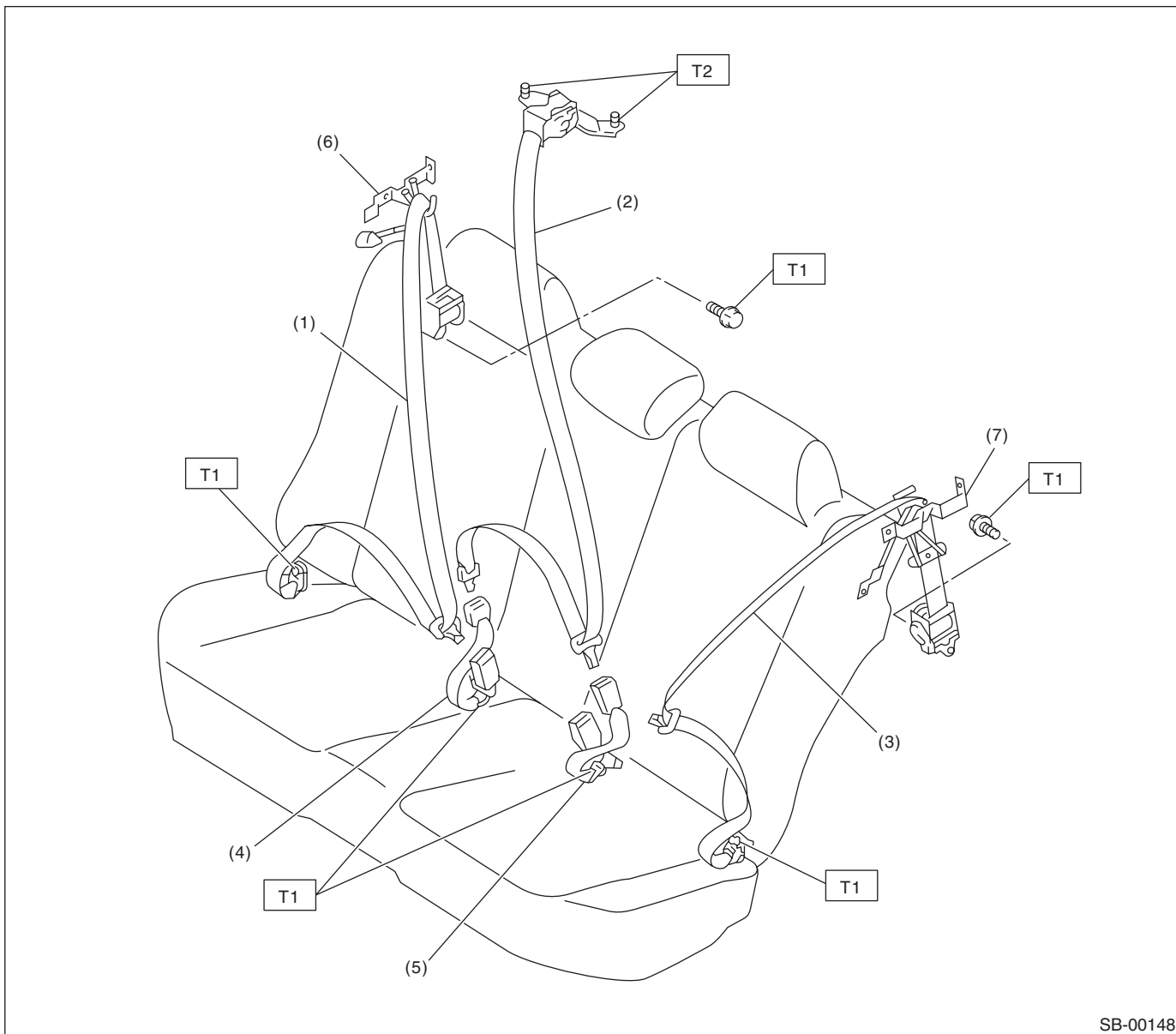
**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 30 (3.1, 22)**

# General Description

## SEAT BELT SYSTEM

### 3. REAR SEAT BELT (WAGON MODEL)



- |                                    |                              |
|------------------------------------|------------------------------|
| (1) Outer seat belt RH ASSY        | (5) Center seat belt LH ASSY |
| (2) Shoulder seat belt center ASSY | (6) Outer belt guide RH      |
| (3) Outer seat belt LH ASSY        | (7) Outer belt guide LH      |
| (4) Center seat belt RH ASSY       |                              |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 30 (3.1, 22)**

**T2: 53 (5.4, 39.1)**

## B: CAUTION

- Before starting the work, turn the ignition switch to OFF, disconnect the battery ground cable and wait for 20 seconds or more.
- The pretensioner system has a backup power source. The pretensioner might deploy if you do not wait for 20 seconds or more before starting work.
- Do not drop or apply any impact to the pretensioner.
- If oil, grease or water gets on the pretensioner, wipe it off immediately with a dry cloth.
- Do not expose the pretensioner to high temperature or flame.
- Do not allow current to flow through or voltage to reach the pretensioner. Do not use a circuit tester to check resistance of the pretensioner.
- Do not disassemble or attempt to repair the pretensioner. If it is dented, cracked or deformed, replace it with a new part.
- Do not use the airbag or pretensioner parts from other vehicles. Always replace parts with new parts.
- When handling a seat belt with deployed pretensioner, wear gloves and goggles. Wash your hands afterwards.
- Do not reuse a seat belt with deployed pretensioner.
- If material from the airbag enters the eyes or contacts skin during deployment, wash it away with clean water, and then consult a doctor.

## C: PREPARATION TOOL

### 1. GENERAL TOOL

TOOL NAME	REMARKS
TORX® T50	Used for removing and installing the inner seat belt assembly.

## 2. Pretensioner Connector

### A: PROCEDURE

Refer to airbag connectors in the airbag section.  
<Ref. to AB-8, PROCEDURE, Airbag Connector.>

## 3. Inspection Locations After a Collision

### A: INSPECTION

Check for the following, and replace with new parts if necessary.

- Center pillar lower trim is discolored or cracked.
- Wiring harness and connector are damaged.



# Seat Belt Warning System

## SEAT BELT SYSTEM

### 4. Seat Belt Warning System

#### A: WIRING DIAGRAM

<Ref. to WI-154, WIRING DIAGRAM, Seat Belt Warning System.>

#### B: INSPECTION

##### TROUBLE SYMPTOM:

- Driver's side seat belt warning light does not turn on or off.
- Warning buzzer does not beep.

	Step	Check	Yes	No
1	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Sit on the driver's seat and passenger's seat. 2) Prepare the Subaru Select Monitor kit. 3) Turn the ignition switch to ON (engine OFF), and run the "PC application help for Subaru Select Monitor". 4) Read the data of ignition power supply voltage from Subaru Select Monitor. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the voltage 10 V or more?	Go to step 2.	Check the ignition switch circuit.
2	<b>CHECK BODY INTEGRATED UNIT.</b> Read the data of the belt warning switch. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the belt warning display ON?	Go to step 3.	Turn the belt warning ON with unit customization.
3	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Read the data of the driver's seat belt switch. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.> 2) Connect and disconnect the seat belt buckle.	Does the seat belt SW display turn ON ←→ OFF according to the operation?	Go to step 8.	Go to step 4.
4	<b>CHECK HARNESS.</b> 1) Disconnect the negative terminal from the battery, and wait for more than 20 seconds. 2) Measure the resistance between the body integrated unit and the seat belt buckle switch LH. <b>Connector &amp; terminal</b> <b>(i84) No. 4 — (R8) No. 3:</b>	Is the harness normal?	Go to step 5.	Repair the harness.
5	<b>CHECK HARNESS.</b> Check for short circuit to battery, open circuit and short circuit to ground between the seat belt buckle switch LH and chassis ground. <b>Connector &amp; terminal</b> <b>(R8) No. 1 — Chassis ground:</b>	Is the harness normal?	Go to step 6.	Repair the harness.
6	<b>CHECK SEAT BELT BUCKLE SWITCH LH.</b> 1) Insert the tongue plate to the driver's seat belt buckle. 2) Check for short circuit to battery and open circuit between the seat belt switch LH connectors (R8). <b>Connector &amp; terminal</b> <b>(R8) No. 1 — (R8) No. 3:</b>	Is the resistance less than 10 Ω?	Go to step 7.	Replace the inner belt assembly LH. <Ref. to SB-13, REMOVAL, Front Seat Belt.>

# Seat Belt Warning System

SEAT BELT SYSTEM

Step	Check	Yes	No
<p><b>7</b>     <b>CHECK SEAT BELT BUCKLE SWITCH LH.</b>            1) Disconnect the driver's seat belt buckle and the tongue plate.            2) Measure the resistance between the terminals of the seat belt switch LH connectors (R8).  <b>Connector &amp; terminal</b>  <b>(R8) No. 1 — (R8) No. 3:</b></p>	<p>Is the resistance 1 MΩ or more?</p>	<p>Replace the body integrated unit.            &lt;Ref. to SL-55, REMOVAL, Body Integrated Unit.&gt;</p>	<p>Replace the inner belt assembly LH.            &lt;Ref. to SB-13, REMOVAL, Front Seat Belt.&gt;</p>
<p><b>8</b>     <b>CHECK BODY INTEGRATED UNIT.</b>            1) Read the data of the passenger's seat belt switch. &lt;Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.&gt;            2) Connect and disconnect the seat belt buckle.</p>	<p>Does the seat belt SW display turn ON ←→ OFF according to the operation?</p>	<p>Go to step 12.</p>	<p>Go to step 9.</p>
<p><b>9</b>     <b>CHECK HARNESS.</b>            1) Disconnect the negative terminal from the battery, and wait for more than 20 seconds.            2) Check for short circuit to battery, open circuit and short circuit to ground between the body integrated unit and the airbag control module.  <b>Connector &amp; terminal</b>  <b>(i84) No. 13 — (AB6) No. 15:</b></p>	<p>Is the harness normal?</p>	<p>Go to step 10.</p>	<p>Repair the harness.</p>
<p><b>10</b>    <b>CHECK HARNESS.</b>            Check short circuit to battery, open circuit and short circuit to ground between the airbag control module and the occupant detection control module, between the occupant detection control module and the seat belt buckle switch RH, and between the seat belt buckle switch RH and the chassis ground.  <b>Connector &amp; terminal</b>  <b>(AB18) No. 16 — (AB43) No. 10:</b>  <b>(AB18) No. 24 — (AB43) No. 5:</b>  <b>(AB43) No. 1 — (AB60) No. 1:</b>  <b>(AB43) No. 2 — (AB60) No. 2:</b>  <b>(AB60) No. 1 — Chassis ground:</b>  <b>(AB60) No. 2 — Chassis ground:</b></p>	<p>Is the harness normal?</p>	<p>Go to step 11.</p>	<p>Repair the harness.</p>

# Seat Belt Warning System

## SEAT BELT SYSTEM

Step	Check	Yes	No
<b>11 CHECK AIRBAG CONTROL MODULE, OCCUPANT DETECTION SENSOR AND SEAT BELT BUCKLE SWITCH RH.</b> Check the airbag control module, occupant detection sensor and seat belt buckle switch RH. <ul style="list-style-type: none"> <li>• Airbag control module: &lt;Ref. to AB(diag)-2, Basic Diagnostic Procedure.&gt;</li> <li>• Occupant detection sensor: &lt;Ref. to OD(diag)-2, Basic Diagnostic Procedure.&gt;</li> <li>• Seat belt buckle switch RH: Measure the resistance between the terminals of connectors (AB60).                          Switch ON (When connecting the seat belt) -                          The resistance is less than 10 Ω                          Switch OFF (When disconnecting the seat belt) -                          The resistance is 1 MΩ or more.</li> </ul>	Are airbag control module, occupant detection sensor and seat belt buckle switch RH normal?	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>	<ul style="list-style-type: none"> <li>• Airbag control module malfunction: Replace the airbag control module. &lt;Ref. to AB-20, REMOVAL, Airbag Control Module.&gt;</li> <li>• Occupant detection sensor malfunction: Replace the seat cushion pad &amp; frame assembly. &lt;Ref. to SE-15, PASSENGER'S SEAT, DISASSEMBLY, Front Seat.&gt;</li> <li>• Seat belt buckle switch RH malfunction: Replace the inner seat belt assembly RH. &lt;Ref. to SB-13, INNER SEAT BELT ASSEMBLY, REMOVAL, Front Seat Belt.&gt;</li> </ul>
<b>12 CHECK SEAT BELT WARNING LIGHT.</b> Turn the ignition switch to OFF, disconnect the seat belt of the driver's and passenger's seat.	Does the driver's seat belt warning light blink?	Go to step 15.	Go to step 13.
<b>13 CHECK HARNESS.</b> 1) Disconnect the negative terminal from the battery, and wait for more than 20 seconds. 2) Check for open circuit between the body integrated unit and the combination meter. <b>Connector &amp; terminal</b> <b>(i84) No. 20 — (i10) No. 9:</b>	Is the resistance less than 10 Ω?	Go to step 14.	Repair the harness.
<b>14 CHECK SEAT BELT WARNING LIGHT.</b> 1) Connect the ground cable to the battery. 2) Disconnect the connector from body integrated unit. 3) Short No. 20 of the body integrated unit connector (i84).	Does seat belt warning light illuminate?	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>15 CHECK SEAT BELT WARNING LIGHT.</b> Check the passenger's seat belt warning light.	Does the passenger's seat belt warning light blink?	Go to step 19.	Go to step 16.
<b>16 CHECK HARNESS.</b> 1) Disconnect the negative terminal from the battery, and wait for more than 20 seconds. 2) Check for open circuit between the body integrated unit and the map light. <b>Connector &amp; terminal</b> <b>(B280) No. 27 — (R150) No. 5:</b>	Is the resistance less than 10 Ω?	Go to step 17.	Repair the harness.
<b>17 CHECK HARNESS.</b> 1) Connect the ground cable to the battery. 2) Measure the voltage between the map light connector and chassis ground. <b>Connector &amp; terminal</b> <b>(R150) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 18.	Repair the harness.

# Seat Belt Warning System

SEAT BELT SYSTEM

Step	Check	Yes	No
<b>18 CHECK SEAT BELT WARNING LIGHT.</b> 1) Connect the ground cable to the battery. 2) Disconnect the connector from the map light. 3) Short No. 5 of the map light connector (R150).	Does seat belt warning light illuminate?	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>	Check the map light.
<b>19 CHECK BODY INTEGRATED UNIT.</b> Check if the warning buzzer sounds.	Does the warning buzzer sound?	Go to step 20.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
<b>20 CHECK SEAT BELT WARNING LIGHT.</b> 1) Connect the passenger's seat belt. 2) Wait until the warning buzzer stops sounding. 3) Start the engine, and set the vehicle speed to 15 km/h (9 MPH) or faster.	Does the driver's seat belt warning light blink and buzzer sound?	Go to step 24.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>21 CHECK BODY INTEGRATED UNIT.</b> Read the DTC of body integrated unit using Subaru Select Monitor.	Is DTC U1223 detected?	<ul style="list-style-type: none"> <li>• Check the LAN system. &lt;Ref. to LAN(diag)-67, DTC U1223 CAN-HS VDC/ABS NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).&gt;</li> <li>• Check VDC or ABS.</li> <li>• VDC &lt;Ref. to VDC(diag)-2, Basic Diagnostic Procedure.&gt;</li> <li>• ABS &lt;Ref. to ABS(diag)-2, Basic Diagnostic Procedure.&gt;</li> </ul>	Go to step 22.
<b>22 CHECK BODY INTEGRATED UNIT.</b> Read the data of the "front wheel speed" from the body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Is the data displayed as 999.9 km/h?	<ul style="list-style-type: none"> <li>• Check the LAN system. &lt;Ref. to LAN(diag)-67, DTC U1223 CAN-HS VDC/ABS NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).&gt;</li> <li>• Check VDC or ABS.</li> <li>• VDC &lt;Ref. to VDC(diag)-2, Basic Diagnostic Procedure.&gt;</li> <li>• ABS &lt;Ref. to ABS(diag)-2, Basic Diagnostic Procedure.&gt;</li> </ul>	Go to step 23.

# Seat Belt Warning System

## SEAT BELT SYSTEM

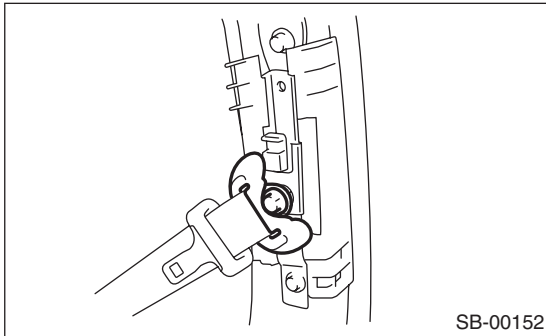
Step	Check	Yes	No
<b>23 CHECK BODY INTEGRATED UNIT.</b> Read the data of the "front wheel speed" from the body integrated unit. <Ref. to LAN(diag)-12, OPERATION, Subaru Select Monitor.>	Does the data indicate the normal vehicle speed?	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>	<ul style="list-style-type: none"> <li>• Check the LAN system. &lt;Ref. to LAN(diag)-67, DTC U1223 CANS VDC/ABS NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).&gt;</li> <li>• Check VDC or ABS.</li> <li>• VDC &lt;Ref. to VDC(diag)-2, Basic Diagnostic Procedure.&gt;</li> <li>• ABS &lt;Ref. to ABS(diag)-2, Basic Diagnostic Procedure.&gt;</li> </ul>
<b>24 CHECK WARNING LIGHT AND BUZZER.</b> Connect the driver's seat belt.	Does the driver's seat belt warning light go off and the buzzer stop sounding?	Go to step 25.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>25 CHECK WARNING LIGHT AND BUZZER.</b> Disconnect the passenger's seat belt.	Does the passenger's seat belt warning light blink and buzzer sound?	Go to step 26.	Go to step 21.
<b>26 CHECK WARNING LIGHT AND BUZZER.</b> Connect the passenger's seat belt.	Does the passenger's seat belt warning light go off and the buzzer stop sounding?	System is normal. Temporary poor contact.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

## 5. Front Seat Belt

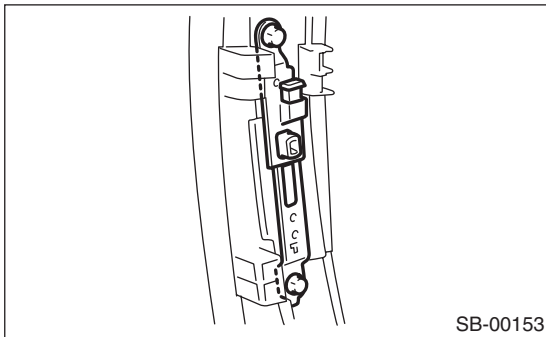
### A: REMOVAL

#### 1. OUTER SEAT BELT ASSEMBLY

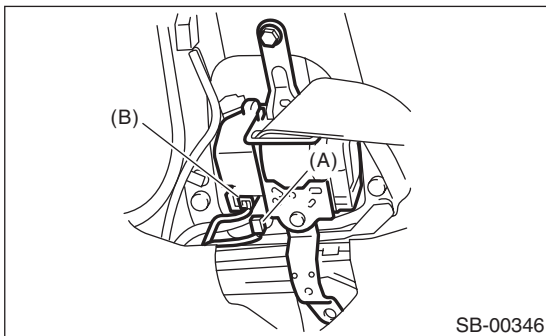
- 1) Fold the backrest all the way forward, and then move the front seat all the way forward.
- 2) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait 20 seconds or more.
- 3) Remove the center pillar lower trim. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>
- 4) Remove the center pillar upper trim. <Ref. to EI-62, REMOVAL, Upper Inner Trim.>
- 5) Remove the bolt, then remove the center pillar inner protector lower.
- 6) Remove the bolt, and then remove the shoulder anchor.



- 7) Remove the bolt, and then remove the adjustable anchor assembly.



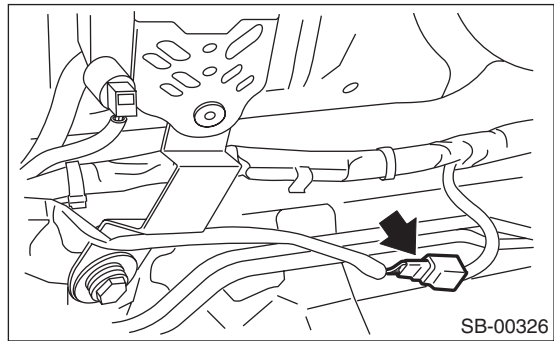
- 8) Disconnect the pretensioner connector (A), remove the bolt, and remove the seat belt retractor.



**NOTE:**

Disconnect the tension reducer connector (B) for the seat belt retractor with a tension reducer function.

- 9) Disconnect the connector of belt tension sensor on passenger's side.

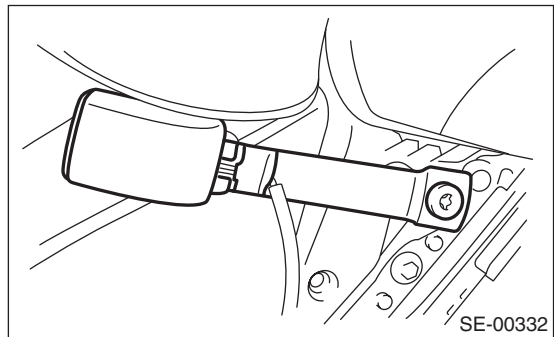


**CAUTION:**

- Do not drop or subject the pretensioner to any impact.
- Since the pretensioner and bracket are integrated as a unit, do not disassemble them.

#### 2. INNER SEAT BELT ASSEMBLY

- 1) Turn the ignition switch to OFF, disconnect the battery ground cable, and wait 20 seconds or more.
- 2) Remove the four bolts in the slide rail LH and RH.
- 3) Disconnect the seat belt warning light connector under the seat.
- 4) Remove the harness clips from slide rail.
- 5) Remove the TORX® bolt, and then remove the inner seat belt assembly.



# Front Seat Belt

## SEAT BELT SYSTEM

### B: INSTALLATION

#### 1. OUTER SEAT BELT ASSEMBLY

Install in the reverse order of removal.

#### CAUTION:

- The parts of driver and passenger's sides are not the same. Before installation, make sure that the correct part is used.
- Be careful not to twist the seat belts during installation.

#### Tightening torque:

<Ref. to SB-2, FRONT SEAT BELT, COMPONENT, General Description.>

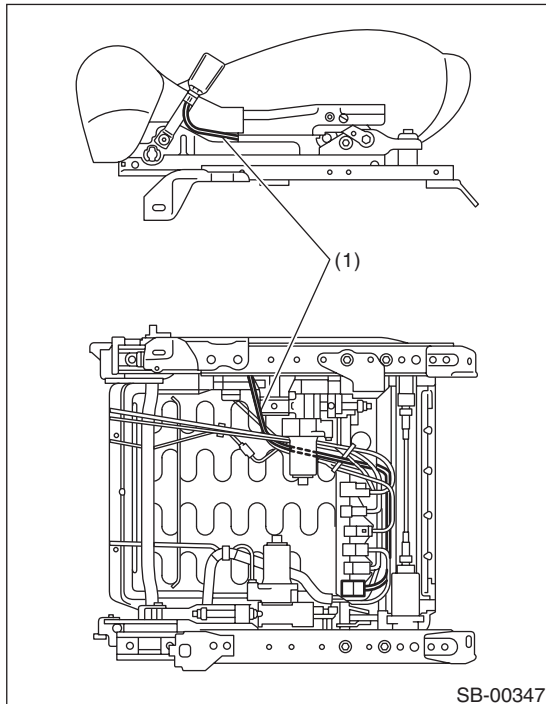
#### 2. INNER SEAT BELT ASSEMBLY

Install in the reverse order of removal.

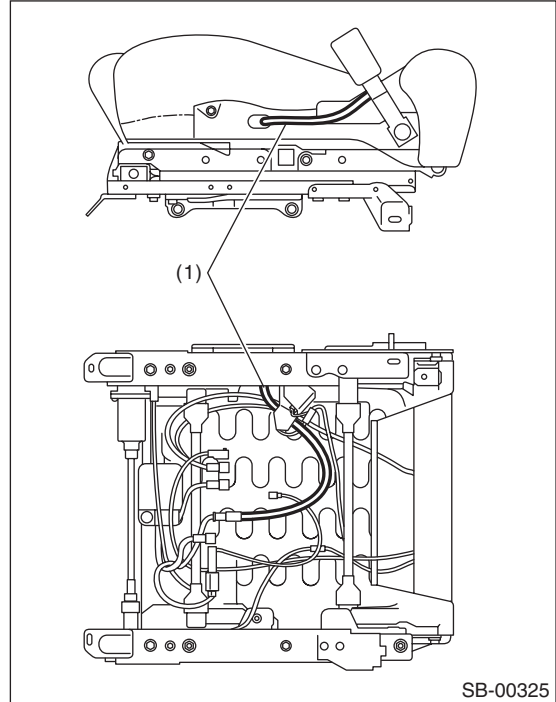
#### CAUTION:

- After the passenger's inner seat belt assembly installation, check that the seat belt buckle switch operates normally using the Subaru Select Monitor in {Status Data} of "Airbag System". <Ref. to AB(diag)-31, DISPLAY OF STATUS INFORMATION, OPERATION, Subaru Select Monitor.> Improper buckle switch operation may cause airbag system malfunction.
- Inner seat belt assembly harness (1) must be routed securely as shown in the figure, as it can affect the performance of the occupant detection system.

- Driver's seat



- Passenger's seat



#### Tightening torque:

<Ref. to SB-2, FRONT SEAT BELT, COMPONENT, General Description.>

### C: INSPECTION

Check for the following, and replace with new parts if necessary.

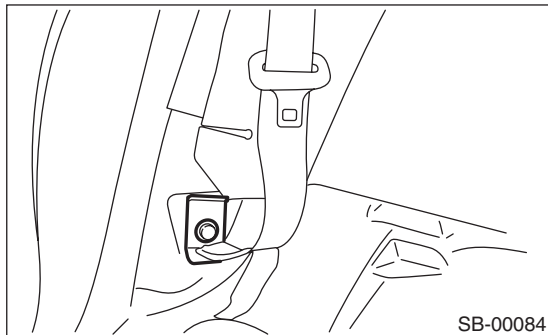
- Pretensioner is cracked or deformed.
- The belt tension sensor is cracked. Or deformed.
- Seat belt is slackened, bent or worn. Seat belt is abnormally wound or extended.
- Inner seat belt assembly is deformed or damaged.
- Seat belt buckle cannot be engaged properly.

## 6. Rear Seat Belt

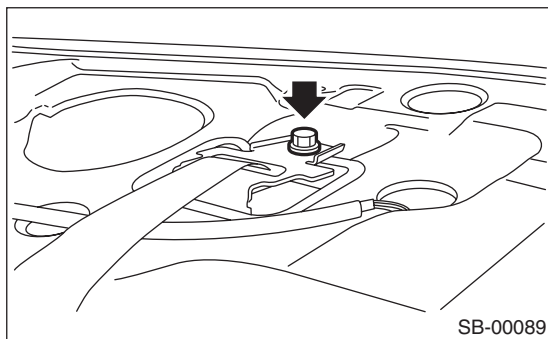
### A: REMOVAL

#### 1. OUTER SEAT BELT RH ASSEMBLY AND LH ASSEMBLY (SEDAN MODEL)

- 1) Remove the rear seat cushion and backrest shoulder. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 2) Remove the seat belt lower anchor bolt.

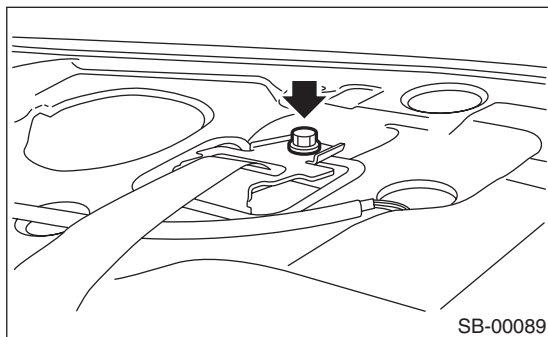


- 3) Remove the rear quarter trim. <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 4) Remove the bolts, and then detach the outer seat belt assembly.



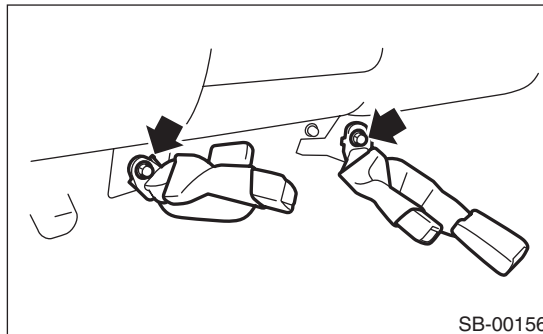
#### 2. SHOULDER SEAT BELT CENTER ASSEMBLY (SEDAN MODEL)

- 1) Remove the rear seat cushion and backrest shoulder. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 2) Remove the rear quarter trim. <Ref. to EI-63, REMOVAL, Rear Quarter Trim.>
- 3) Remove the rear shelf trim. <Ref. to EI-69, REMOVAL, Rear Shelf Trim.>
- 4) Remove the bolts, then remove the shoulder seat belt assembly.



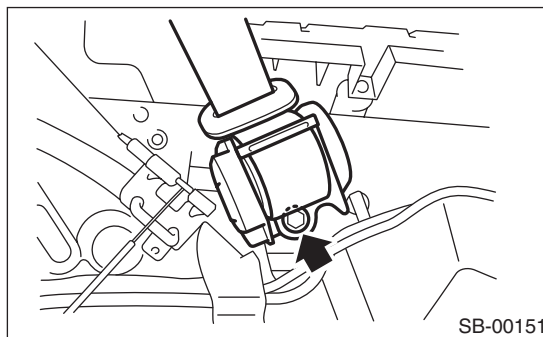
#### 3. CENTER SEAT BELT RH ASSEMBLY AND LH ASSEMBLY (SEDAN MODEL)

- 1) Remove the rear seat cushion. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 2) Remove the bolts, then remove the center seat belt LH assembly.

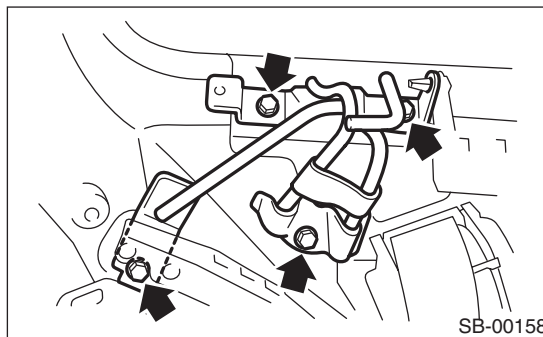


#### 4. OUTER SEAT BELT RH ASSEMBLY AND LH ASSEMBLY (WAGON MODEL)

- 1) Remove the luggage floor box. <Ref. to EI-73, REMOVAL, Luggage Floor Box.>
- 2) Remove the rear seat cushion and backrest shoulder. <Ref. to SE-17, SEDAN MODEL, REMOVAL, Rear Seat.>
- 3) Remove the rear quarter lower trim. <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>
- 4) Remove the bolt to remove outer seat belt retractor.



- 5) Remove the bolt to remove the outer seat belt guide.



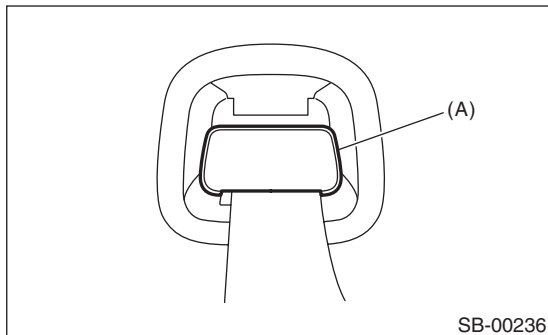


# Rear Seat Belt

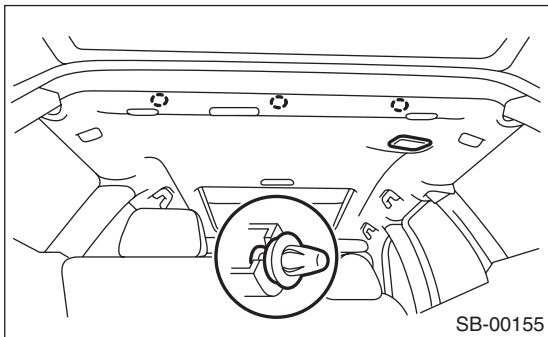
## SEAT BELT SYSTEM

### 5. SHOULDER SEAT BELT CENTER ASSEMBLY (WAGON MODEL)

- 1) Remove the quarter rear pillar trim. <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>
- 2) Remove the cover (A) from roof trim, and then insert it to the inside of roof trim.



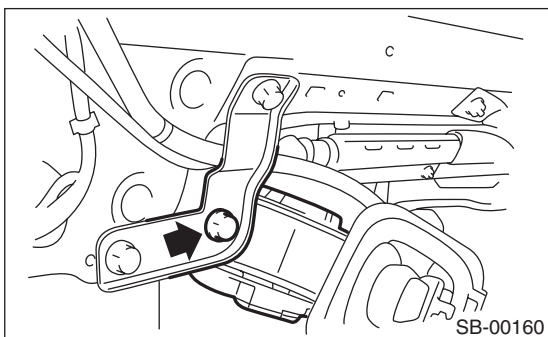
- 3) Remove the clips, and then lower the roof trim end.



#### CAUTION:

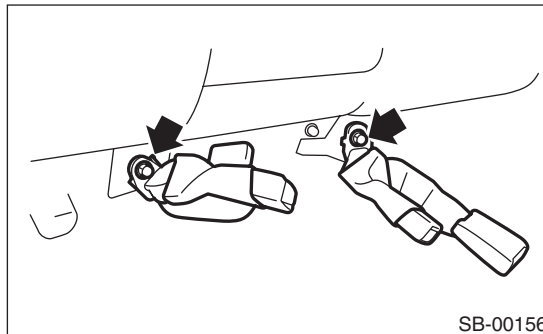
When removing the roof trim clip, do not pull the roof trim end backward with excessive force, otherwise roof trim may be damaged.

- 4) Remove the bolt to remove the seat belt retractor.



### 6. CENTER SEAT BELT RH ASSEMBLY AND LH ASSEMBLY (WAGON MODEL)

- 1) Remove the rear seat cushion. <Ref. to SE-17, SEDAN MODEL, REMOVAL, Rear Seat.>
- 2) Remove the bolts, then remove the center seat belt assembly.

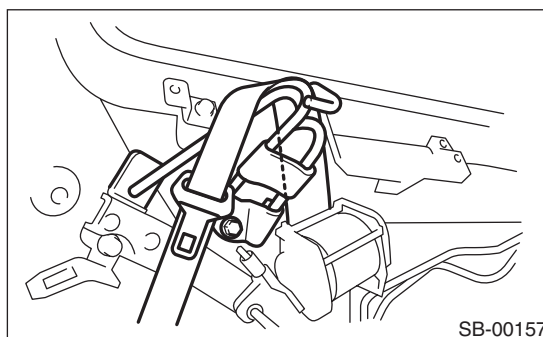


### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

- During installation, make sure that the seat belts are not twisted.
- During installation, make sure that the center seat belt assembly (RH & LH) are properly pulled out from the slit of seat cushions.
- After installation, make sure that the seat belts are smoothly extended and wound.
- If the vehicle is equipped with rear outer seat belts (wagon model), make sure that the seat belts are wound after installing the seat belt guide.



### C: INSPECTION

Check for the following, and replace with new parts if necessary.

- Seat belt is slackened, bent or worn. Seat belt is abnormally wound or extended.
- Inner seat belt assembly is deformed or damaged.
- Seat belt buckle cannot be engaged properly.

# General Description

## LIGHTING SYSTEM

### 1. General Description

#### A: SPECIFICATION

Headlight	Halogen type low beam		12 V — 55 W
	Halogen type high beam		12 V — 60 W
Front turn signal, parking, front side marker light			12 V — 27/8 W
Front fog light	OUTBACK		12 V — 51 W
	Except for OUTBACK		12 V — 55 W
Side turn signal light			12 V — 2.7 W (LED)
Rear combination light	Stop/tail light		12 V — 21/5 W
	Turn signal light		12 V — 21 W
	Wagon	Rear side marker light	12 V — 5 W
Back-up light	Sedan		12 V — 16 W
	Wagon		12 V — 16 W
License plate light			12 V — 5 W
High-mounted stop light	Sedan		12 V — 21 W
	Wagon		12 V — 1.3 W (LED)
Room light			12 V — 8 W
Spot map light			12 V — 8 W
Luggage room light			12 V — 13 W
Trunk room light			12 V — 5 W
Glove box light			12 V — 1.4 W
Door step light			12 V — 3 W

#### B: CAUTION

- Before removing or installing parts, always disconnect the battery ground cable from battery. When replacing the audio, control module and other parts provided with memory functions, record the memory contents before disconnecting the battery ground cable. Otherwise, the memory is cleared.
- Reassemble the parts in the reverse order of disassembly procedure unless otherwise indicated.
- Adjust parts to the given specifications.
- Connect the connectors securely during reassembly.
- After reassembly, make sure functional parts operate smoothly.
- The airbag system wiring harness is routed near electrical parts and switches. Airbag system wiring harnesses and connectors are yellow. Do not use the electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing electrical parts and switches.

#### C: PREPARATION TOOL

##### 1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.

## 2. Headlight and Tail Light System

### A: WIRING DIAGRAM

#### 1. HALOGEN TYPE HEADLIGHT

<Ref. to WI-157, WIRING DIAGRAM, Headlight System.>

#### 2. CLEARANCE LIGHT AND ILLUMINATION LIGHT

<Ref. to WI-164, WIRING DIAGRAM, Clearance Light and Illumination Light System.>

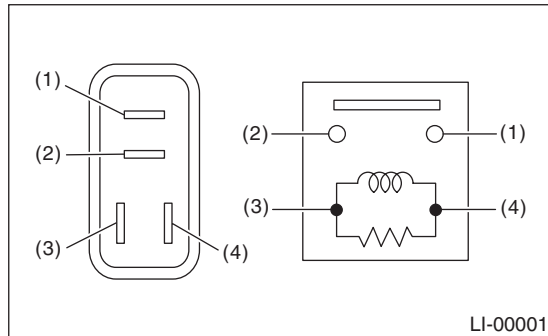
### B: INSPECTION

#### 1. HEADLIGHT SWITCH

<Ref. to LI-11, INSPECTION, Combination Switch (Light).>

#### 2. HEADLIGHT RELAY

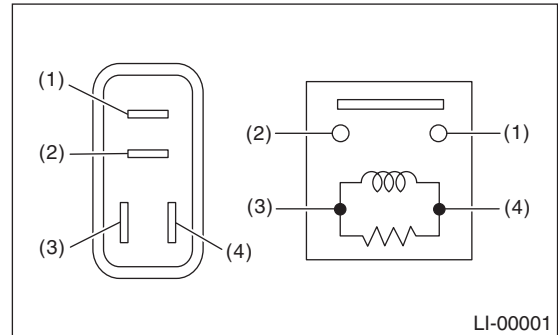
Measure the headlight relay resistance between terminals when connecting terminal No. 4 to the battery positive terminal and terminal No. 3 to the battery ground terminal.



Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 $\Omega$
No		1 M $\Omega$ or more

### 3. TAIL AND ILLUMINATION RELAY

Measure the resistance between the tail and illumination relay terminals when connecting terminal No. 4 to the battery positive terminal and terminal No. 3 to the battery ground terminal.



Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 $\Omega$
No		1 M $\Omega$ or more

# Day Time Running Light System

LIGHTING SYSTEM

## 3. Day Time Running Light System

### A: WIRING DIAGRAM

<Ref. to WI-157, WIRING DIAGRAM, Headlight System.>

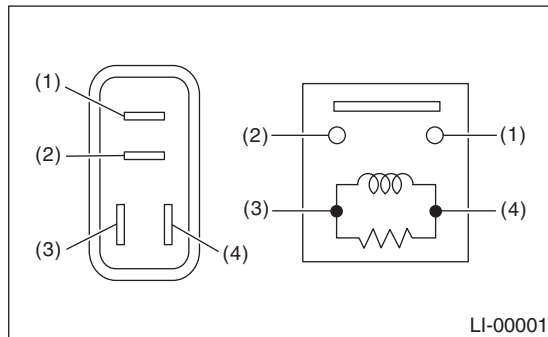
### B: INSPECTION

#### 1. DAYTIME RUNNING LIGHT MODULE CHECK

Step	Check	Yes	No
<b>1 CHECK THE POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the daytime running light module terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B96) No. 2 (+) — Chassis ground (-):</b> <b>(B242) No. 6 (+) — Chassis ground (-):</b>	Is the voltage battery voltage?	Go to step 2.	Check the fuse and the power supply circuit.
<b>2 CHECK THE GROUND CIRCUIT.</b> 1) Disconnect the daytime running light module connector. 2) Measure the resistance between the daytime running light module connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B242) No. 10 (+) — Chassis ground (-):</b>	Is the resistance less than 1 Ω?	Go to step 3.	Check the ground circuit.
<b>3 CHECK THE PARKING SIGNAL.</b> 1) Connect the daytime running light module connector. 2) Measure the resistance between the terminal and chassis ground when pulling parking brake lever and releasing. <b>Connector &amp; terminal</b> <b>(B96) No. 4 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	Go to step 4.	Check the parking brake switch circuit.
<b>4 CHECK THE STARTER SIGNAL.</b> Turn the ignition switch to ON ⇔ Starter and measure the voltage of terminal. <b>Connector &amp; terminal</b> <b>(B96) No. 7 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	Go to step 5.	Check the starter switch circuit.
<b>5 CHECK THE HEADLIGHT SWITCH SIGNAL.</b> Turn the headlight switch to LO ⇔ OFF and measure the voltage of terminal. <b>Connector &amp; terminal</b> <b>(B242) No. 2 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	Go to step 6.	Check the combination switch and the headlight LO circuit.
<b>6 CHECK THE HEADLIGHT SWITCH SIGNAL.</b> Turn the headlight switch to HI ⇔ OFF and measure the voltage of terminal. <b>Connector &amp; terminal</b> <b>(B96) No. 1 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	Go to step 7.	Check the combination switch and the headlight HI circuit.
<b>7 CHECK THE HEADLIGHT SIGNAL.</b> 1) Turn the ignition switch to ON. 2) Turn the headlight from HI to ON/OFF and measure the voltage of terminal. <b>Connector &amp; terminal</b> <b>(B242) No. 5 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	Go to step 8.	Check the headlight HI circuit.
<b>8 CHECK THE HEADLIGHT SIGNAL.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage of terminal on passing of headlight. <b>Connector &amp; terminal</b> <b>(B96) No. 3 (+) — Chassis ground (-):</b>	Does the voltage change to 0⇔ battery voltage?	If the above test is OK, replace the daytime running light module.	Check the headlight HI circuit.

## 2. LOW BEAM RELAY

Measure the resistance between the daytime running relay terminals when connecting terminal No. 4 to the battery positive terminal and terminal No. 3 to the battery ground terminal.



Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 $\Omega$
No		1 M $\Omega$ or more

## 4. Front Fog Light System

### A: WIRING DIAGRAM

#### 1. FRONT FOG LIGHT

<Ref. to WI-160, WIRING DIAGRAM, Front Fog Light System.>

### B: INSPECTION

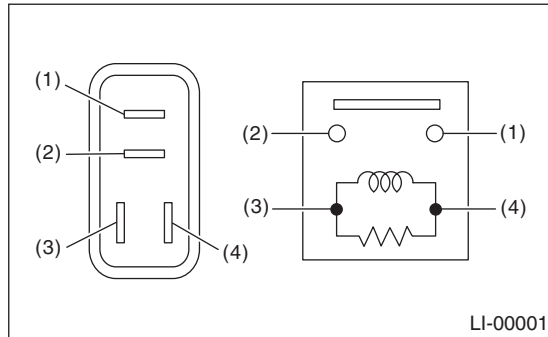
#### 1. FRONT FOG LIGHT SWITCH

Measure the resistance between front fog light switch terminals.

<Ref. to LI-11, INSPECTION, Combination Switch (Light).>

#### 2. FRONT FOG LIGHT RELAY

Connect terminal No. 4 to battery positive terminal and terminal No. 3 to battery ground terminal, and measure the front fog light relay resistance between terminals.



Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 Ω
No		1 MΩ or more

## 5. Turn Signal Light and Hazard Light System

### A: WIRING DIAGRAM

#### 1. TURN SIGNAL LIGHT AND HAZARD LIGHT

<Ref. to WI-169, WIRING DIAGRAM, Turn Signal Light and Hazard Light System.>

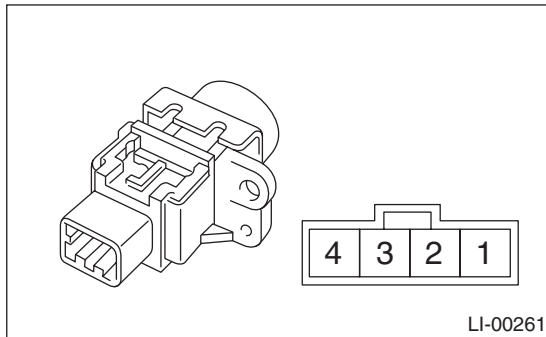
### B: INSPECTION

#### 1. TURN SIGNAL SWITCH

<Ref. to LI-11, INSPECTION, Combination Switch (Light).>

#### 2. HAZARD SWITCH

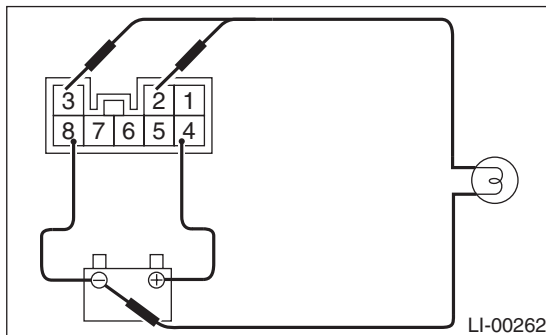
Measure the resistance between hazard switch terminals.



Switch position	Terminal No.	Standard
OFF	2 and 3	1 MΩ or more
ON		Less than 1 Ω

#### 3. TURN SIGNAL AND HAZARD MODULE

Connect the battery and turn signal light bulb to the module. The module is properly functioning if it blinks when power is supplied to the circuit.



# Back-up Light System

LIGHTING SYSTEM

## 6. Back-up Light System

### A: WIRING DIAGRAM

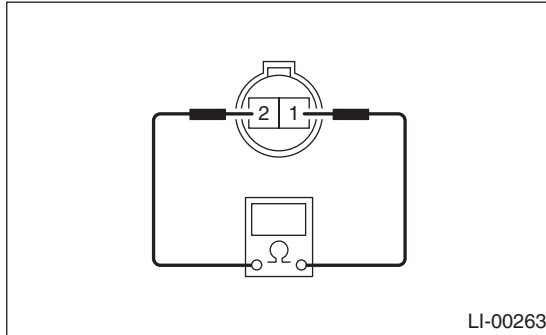
#### 1. BACK-UP LIGHT

<Ref. to WI-161, WIRING DIAGRAM, Back-up Light System.>

### B: INSPECTION

#### 1. BACK-UP LIGHT SWITCH (MT MODEL)

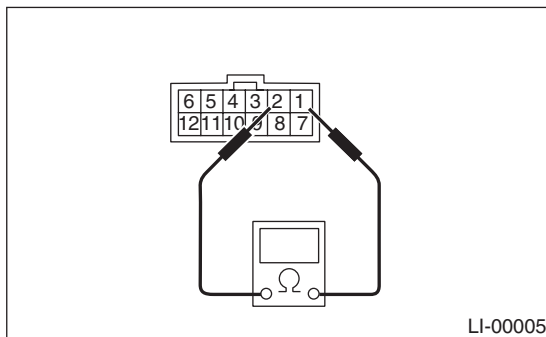
Measure the resistance between the back-up light switch terminals.



Switch position	Terminal No.	Standard
When shift lever is set in reverse position	1 and 2	Less than 1 $\Omega$
Other positions		1 M $\Omega$ or more

#### 2. INHIBITOR SWITCH (4AT MODEL)

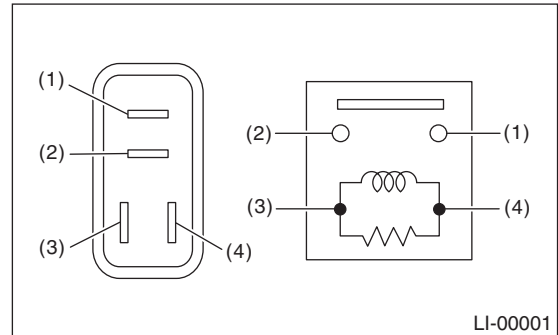
Measure the resistance between the inhibitor switch terminals.



Switch position	Terminal No.	Standard
When the selector lever is in the "R" range	1 and 2	Less than 1 $\Omega$
Other positions		1 M $\Omega$ or more

#### 3. BACK-UP LIGHT RELAY (5AT MODEL)

Measure the resistance between headlight relay terminals when connecting terminal No. 4 to the battery positive terminal and terminal No. 3 to the battery ground terminal.



Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 $\Omega$
No		1 M $\Omega$ or more

#### NOTE:

Checks other than the back-up light relay. <Ref. to 4AT-47, INSPECTION, Inhibitor Switch.>



## 7. Stop Light System

### A: WIRING DIAGRAM

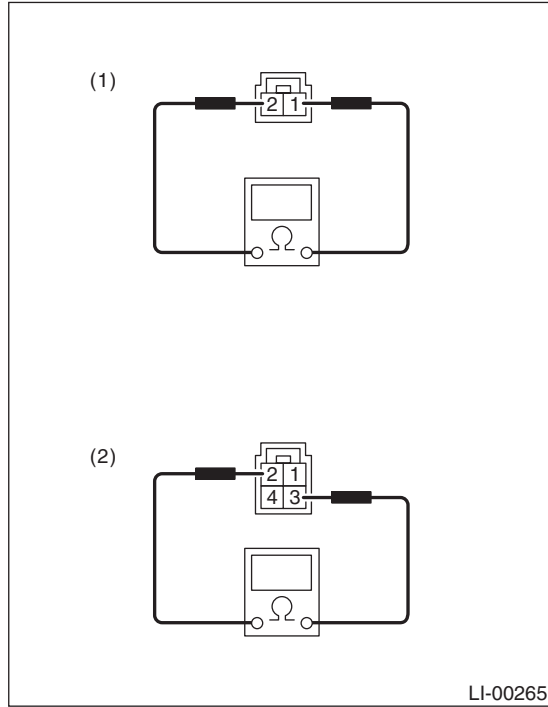
#### 1. STOP LIGHT

<Ref. to WI-163, WIRING DIAGRAM, Stop Light System.>

### B: INSPECTION

#### 1. STOP LIGHT SWITCH

Measure the resistance between stop light switch terminals.



- (1) Models without cruise control
- (2) Models with cruise control

Switch position	Terminal No.	Standard
When brake pedal is depressed	Models without cruise control: 1 and 2	Less than 1 $\Omega$
When brake pedal is released	Models with cruise control: 2 and 3	1 M $\Omega$ or more

# Room Light System

LIGHTING SYSTEM

## 8. Room Light System

### A: WIRING DIAGRAM

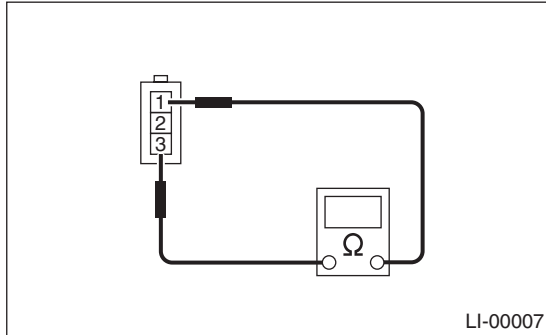
#### 1. ROOM LIGHT

<Ref. to WI-171, WIRING DIAGRAM, Interior Light System.>

### B: INSPECTION

#### 1. DOOR SWITCH

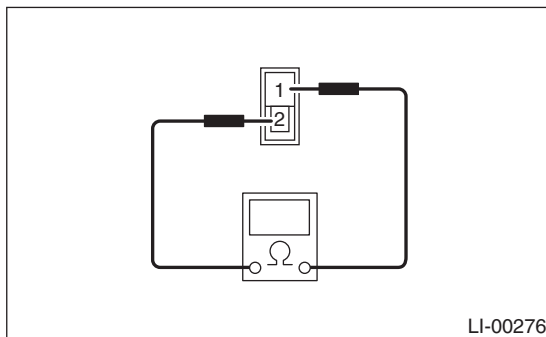
Measure the resistance between door switch terminals.



Switch position	Terminal No.	Standard
When door is opened	1 and 3	Less than 1 Ω
When door is closed		1 MΩ or more

#### 2. REAR GATE LATCH SWITCH

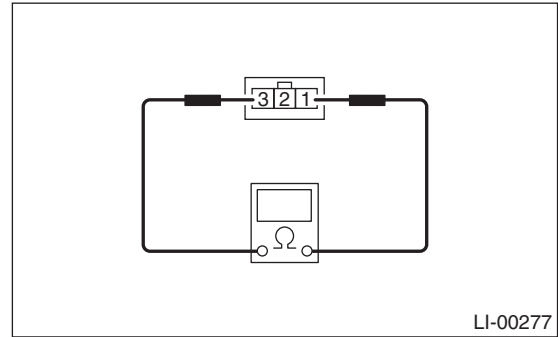
Measure the resistance between rear gate latch switch terminals.



Switch position	Terminal No.	Standard
When rear gate is opened	1 and 2	Less than 1 Ω
When rear gate is closed		1 MΩ or more

#### 3. TRUNK ROOM LIGHT SWITCH

Measure the resistance between the trunk room light switch terminals.

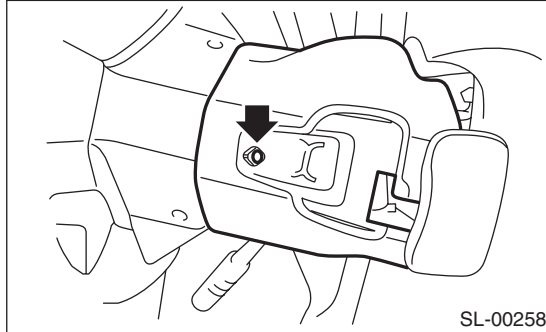


Switch position	Terminal No.	Standard
When trunk lid is opened	1 and 3	Less than 1 Ω
When trunk lid is closed		1 MΩ or more

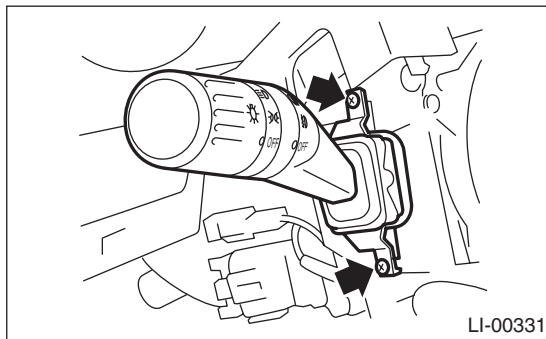
## 9. Combination Switch (Light)

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the screws and remove the steering column covers (upper and lower).



- 3) Disconnect the connector from the combination switch.
- 4) Remove the screws which secure the switch, then remove the combination switch.

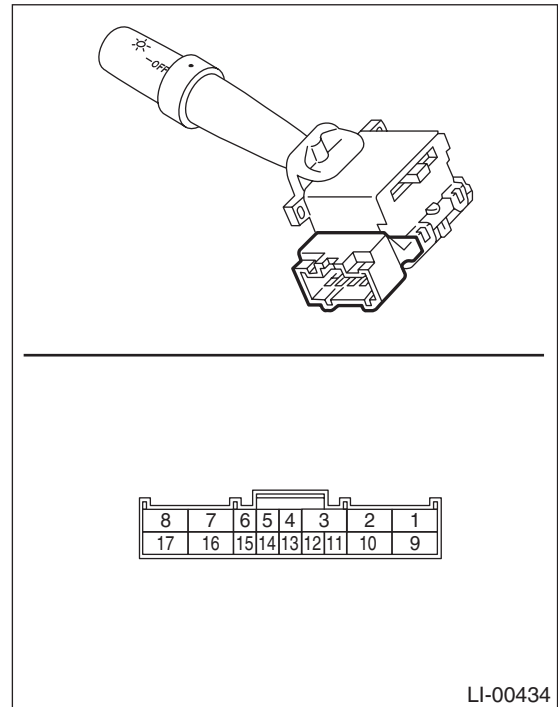


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between combination switch terminals.



#### 1. LIGHTING SWITCH

Switch position	Terminal No.	Standard
OFF	—	1 MΩ or more
Tail	14 and 16	Less than 1 Ω
Head	13, 14 and 16	Less than 1 Ω

#### 2. DIMMER & PASSING SWITCH

Switch position	Terminal No.	Standard
Passing	7, 8 and 16	Less than 1 Ω
Low beam	17 and 16	Less than 1 Ω
High beam	7 and 16	Less than 1 Ω

#### 3. TURN SIGNAL SWITCH

Switch position	Terminal No.	Standard
Left	1 and 2	Less than 1 Ω
Neutral	—	1 MΩ or more
Right	2 and 3	Less than 1 Ω

#### 4. FRONT FOG LIGHT

Switch position	Terminal No.	Standard
OFF	—	1 MΩ or more
ON	11 and 16	Less than 1 Ω

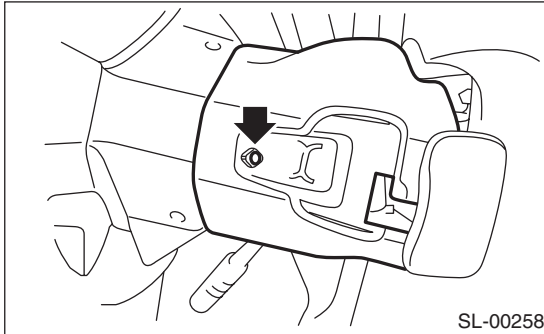
# Combination Base Switch Assembly

LIGHTING SYSTEM

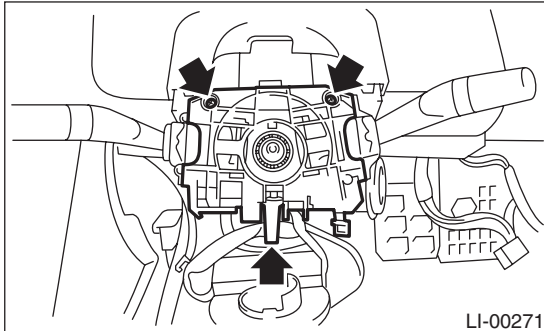
## 10. Combination Base Switch Assembly

### A: REMOVAL

- 1) Remove the driver's airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>
- 2) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 3) Remove the screws and remove the steering column lower cover.



- 4) Remove the combination switch. <Ref. to LI-11, REMOVAL, Combination Switch (Light).> <Ref. to WW-7, REMOVAL, Combination Switch (Wiper).>
- 5) Remove the four screws and remove the roll connector.
- 6) Remove the three screws.



- 7) Disconnect the connector and remove the combination base switch assembly.

### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Before installing the steering wheel, be sure to adjust the direction of roll connector with steering. <Ref. to AB-24, ADJUSTMENT, Roll Connector.>

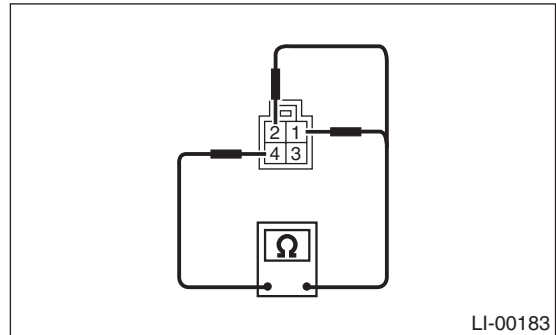
### C: INSPECTION

#### 1. COMBINATION BASE SWITCH ASSEMBLY

Inspect the combination base switch assembly and roll connector for cracks or deformation. If any damage is found, replace with a new part.

#### 2. PARKING SWITCH

Measure the resistance between parking switch terminals.

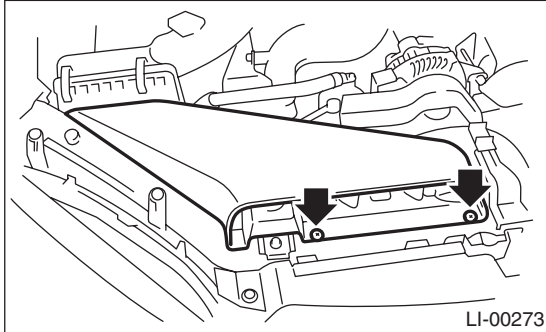


Switch position	Terminal No.	Standard
OFF	2 and 4	Less than 1 $\Omega$
ON	1 and 4	Less than 1 $\Omega$

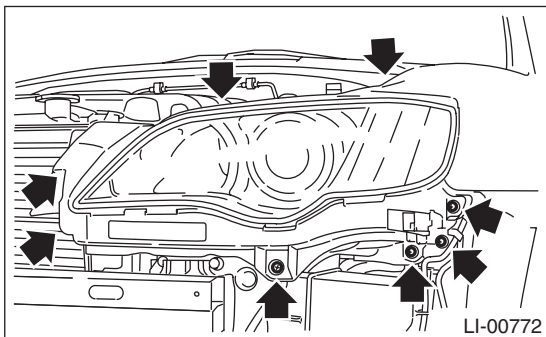
## 11. Headlight Assembly

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the air intake duct. (When removing the headlight RH)



- 3) Remove the front bumper. <Ref. to EI-30, REMOVAL, Front Bumper.>
- 4) Disconnect harness connectors.
- 5) Remove the 5 bolts, disengage 1 clip, then detach the headlight assembly.



### B: INSTALLATION

Install in the reverse order of removal.

### C: ADJUSTMENT

#### 1. HEADLIGHT BEAM ADJUSTMENT

**NOTE:**

The headlight can only be adjusted in the vertical direction but not the horizontal direction.

**CAUTION:**

**Turn off the light before adjusting the headlight beam level. If it is necessary to inspect the beam level, do not keep the light on for two minutes or more.**

**NOTE:**

Before checking the headlight beam level, be sure of the following:

- Check the area around the headlight for any scratches, damage or other types of deformation.
- Make sure that the vehicle is parked on a level surface.
- Make sure that the inflation pressure of tires are correct.
- Check that the vehicle fuel tank is full.

1) Bounce the vehicle several times to normalize the suspension.

2) Make certain that someone is seated in the driver's seat.

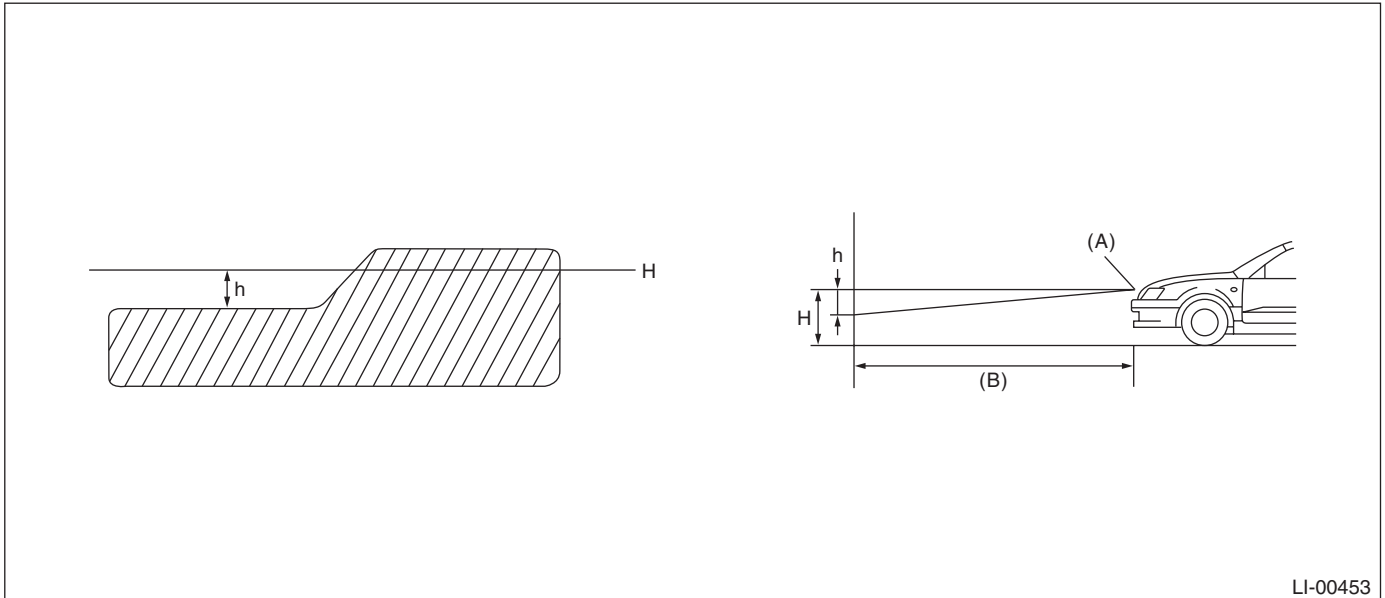
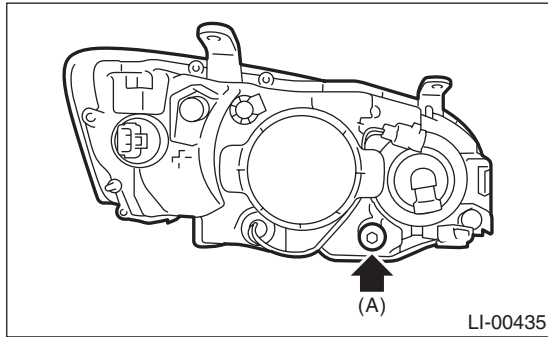
# Headlight Assembly

## LIGHTING SYSTEM

3) Turn the headlights on and then adjust the low beam pattern.

### NOTE:

Adjust the headlight beam level by turning the adjusting screw (A).



(A) Bulb center marking

(B) 3 m (10 ft)

(H) Height of the headlight LOW beam center

h mm (in) at 3 m (10 ft)
21 (0.83)

## 12. Headlight Bulb

### A: REMOVAL

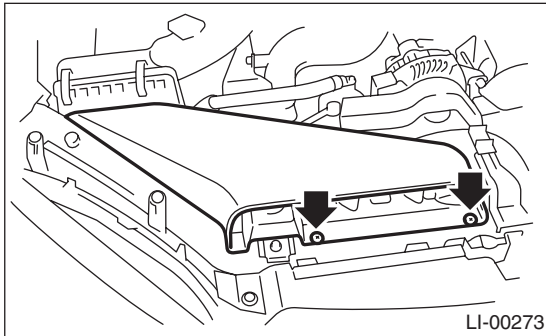
#### 1. HIGH BEAM AND LOW BEAM

##### CAUTION:

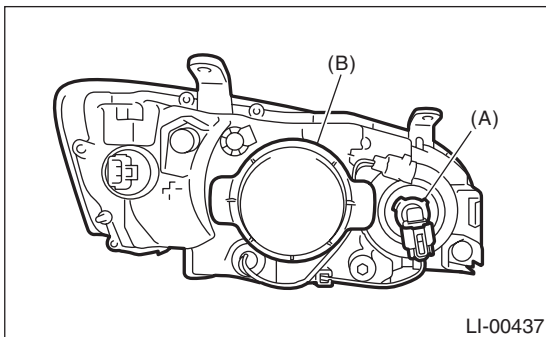
- Because the halogen bulb operates at a high temperature, dirt and oil on the bulb surface reduces the bulb's service life. Hold the flange portion when replacing the bulb. Never touch the glass portion.

- Do not leave the headlight without a bulb for a long time. Dust, moisture, etc. entering the headlight may affect its performance.

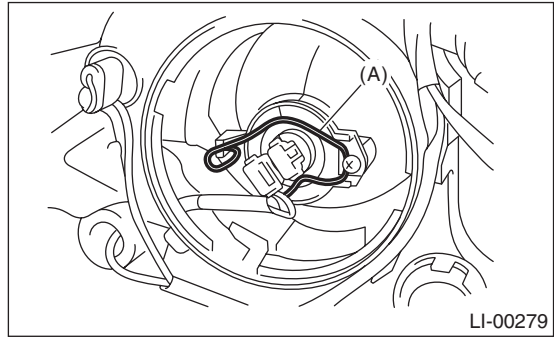
- 1) Disconnect the ground cable from the battery.
- 2) Remove the air intake duct. (When removing the headlight bulb RH)



- 3) Remove the battery cover. (When removing the headlight bulb LH)
- 4) Tilt the washer tank filler neck. (When removing the headlight bulb LH)
- 5) Disconnect the harness connector.
- 6) Remove the bulb assembly (A) then remove the high beam. To remove the low beam, remove the back cover (B), and then go to Step 7.



- 7) Remove the light bulb retaining spring (A) to remove bulb.



### B: INSTALLATION

Install in the reverse order of removal.

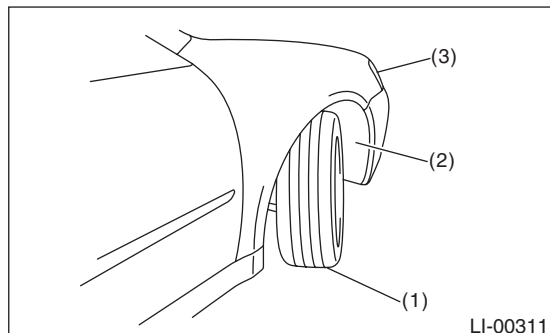
### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification.  
<Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

### 13. Front Turn Signal Light Bulb

#### A: REMOVAL

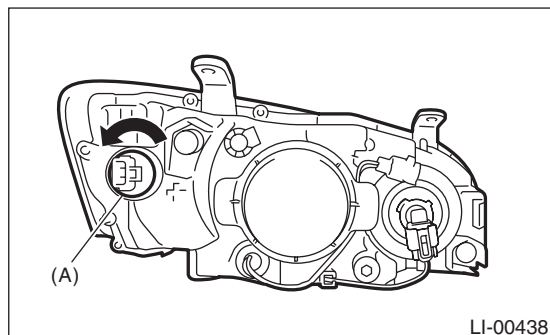
1) When removing the turn signal light bulb, fully turn the steering wheels to opposite direction from the turn signal light bulb to remove.



- (1) Turn the steering wheel fully.
- (2) Mud guard
- (3) Front turn signal light

2) Turn the mud guard inward.

3) Turn socket (A) from the wheel arch, and remove the front turn signal light bulb.



#### CAUTION:

**ON the 5AT model, the turn signal light bulb LH cannot be removed from the wheel arch. Remove the bulb from the engine compartment, by removing the battery.**

#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification.  
<Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.



## 14. Parking Light Bulb

### A: SPECIFICATION

The parking light bulb is integrated into the front turn signal light bulb as a unit; therefore, refer to "Front Turn Signal Light Bulb" for the removal procedure. <Ref. to LI-16, REMOVAL, Front Turn Signal Light Bulb.>

## Front Side Marker Light Bulb

LIGHTING SYSTEM

---

### 15. Front Side Marker Light Bulb

#### A: SPECIFICATION

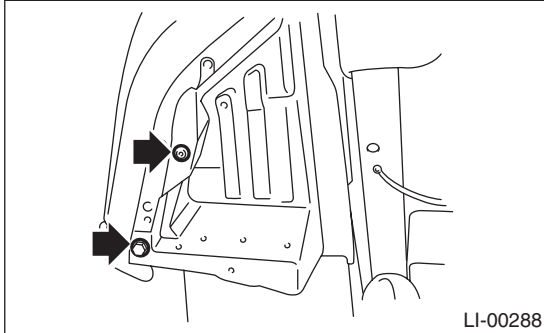
The front side marker light bulb is integrated into the front turn signal light bulb as a unit; therefore, refer to "Front Turn Signal Light Bulb" for the removal procedures. <Ref. to LI-16, REMOVAL, Front Turn Signal Light Bulb.>

## 16. Front Fog Light Assembly

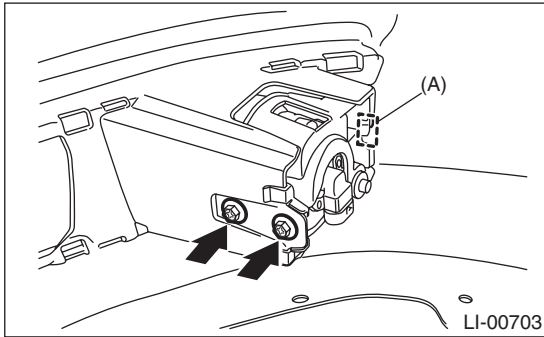
### A: REMOVAL

#### 1. EXCEPT FOR OUTBACK MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Disengage the two clips, and then turn over the lower mud guard.

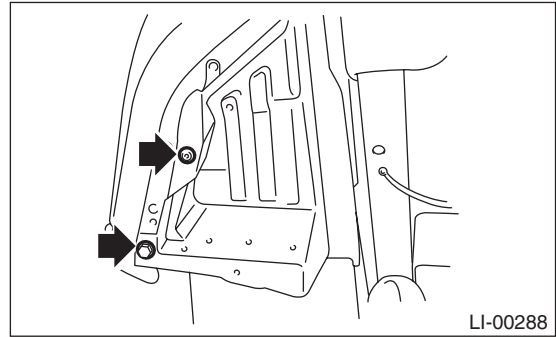


- 3) Disconnect the harness connector.
- 4) Remove the mounting bolts and claw (A), and detach the fog light assembly by pulling it backward.

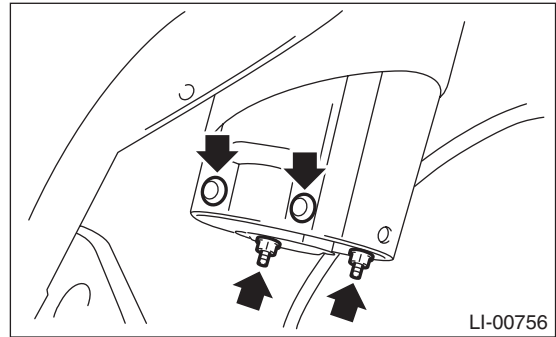


#### 2. OUTBACK MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Disengage the two clips, and then turn over the lower mud guard.



- 3) Disconnect the harness connector.
- 4) Remove the mounting nuts and clips, and detach the fog light assembly by pulling it out.



### B: INSTALLATION

Install in the reverse order of removal.

### C: ADJUSTMENT

#### 1. FOG LIGHT AIMING

##### NOTE:

Before checking the fog light beam level, be sure of the following:

- The area around the fog light has not sustained any accident, damage or other type of deformation.
- Vehicle is parked on a level surface.
- The inflation pressure of tires is correct.
- Vehicle's fuel tank is fully filled.

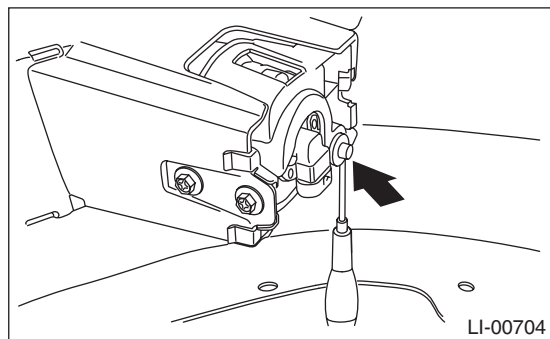
- 1) Bounce the vehicle several times to normalize the suspension.
- 2) Make certain that someone is seated in the driver's seat.
- 3) Measure the height of the center of fog light.
- 4) Loosen the screws and clips of the mud guard, and then turn over the front mud guard.

# Front Fog Light Assembly

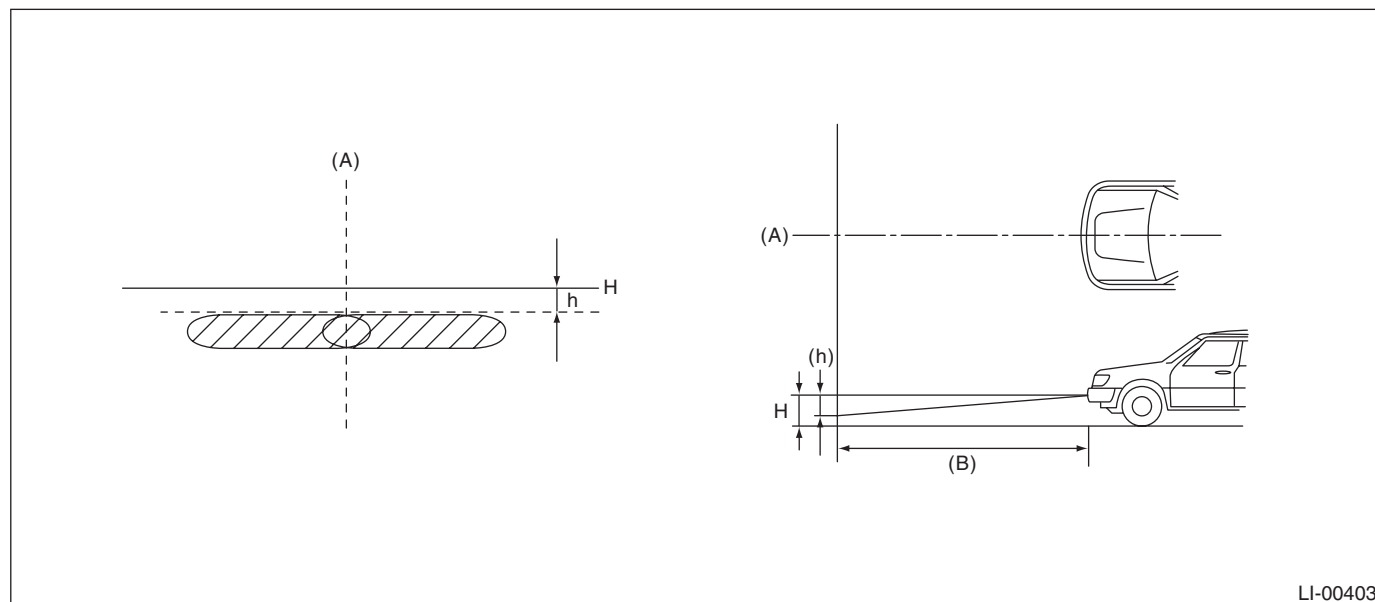
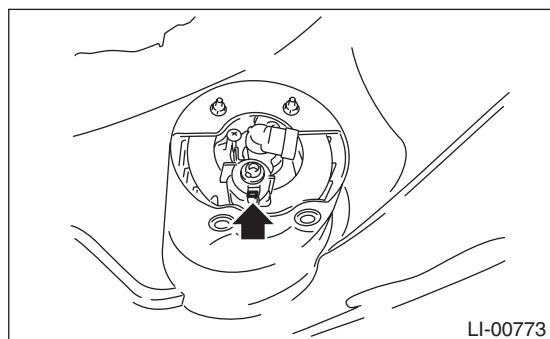
## LIGHTING SYSTEM

5) Adjust the fog light pattern by inserting a Philips screwdriver to the aiming screw hole.

- Except for OUTBACK model



- OUTBACK model



(A) Vehicle center

(B) 3 m (10 ft)

(H) Height of fog light center

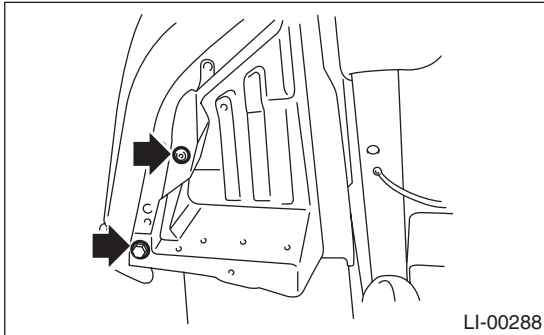
h mm (in) at 3 m (10 ft)
40 (1.58)

## 17. Front Fog Light Bulb

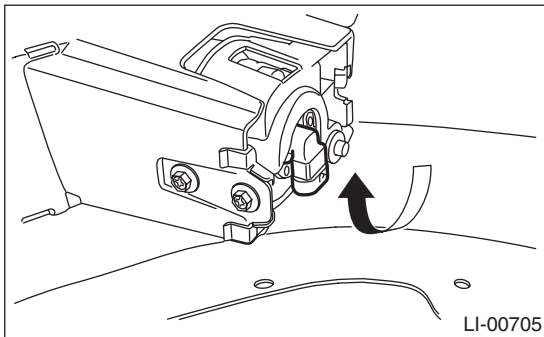
### A: REMOVAL

#### 1. EXCEPT FOR OUTBACK MODEL

- 1) Disconnect the ground cable from battery.
- 2) Disengage the two clips, and then turn over the lower mud guard.

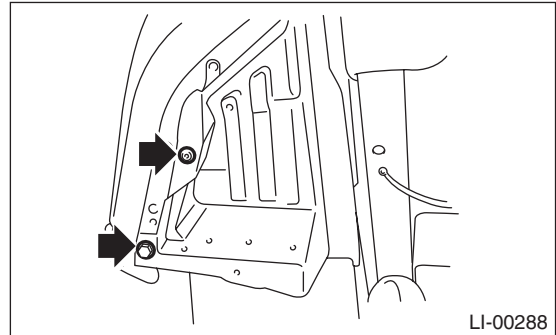


- 3) Disconnect the harness connector.
- 4) Retain the bulb then detach the fog light bulb.

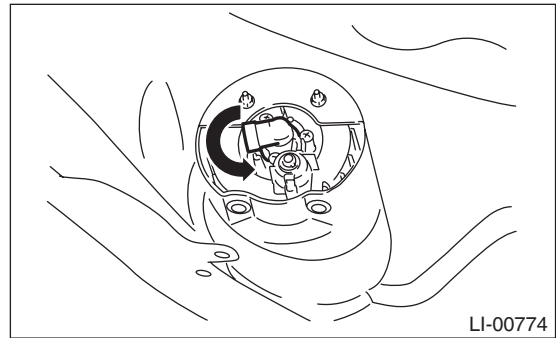


#### 2. OUTBACK MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Disengage the two clips, and then turn over the lower mud guard.



- 3) Disconnect the harness connector.
- 4) Remove the back cover.



- 5) Remove the spring retainer then detach the fog light bulb.

### B: INSTALLATION

Install in the reverse order of removal.

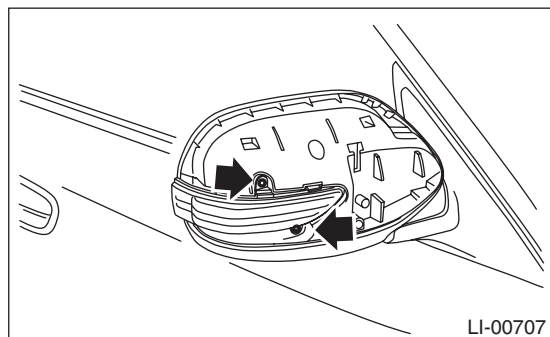
### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

## 18. Side Turn Signal Light Assembly

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the scalp cap. <Ref. to GW-18, REPLACEMENT, Scalp Cap.>
- 3) Remove the mirror. <Ref. to GW-20, REPLACEMENT, Outer Mirror.>
- 4) Disconnect the harness connector, remove the 2 mounting screws and then remove the side turn signal light assembly.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Install the side turn signal light assembly and check that it blinks normally.
- 2) If it does not blink normally, replace the side turn signal light assembly with a new part.

#### NOTE:

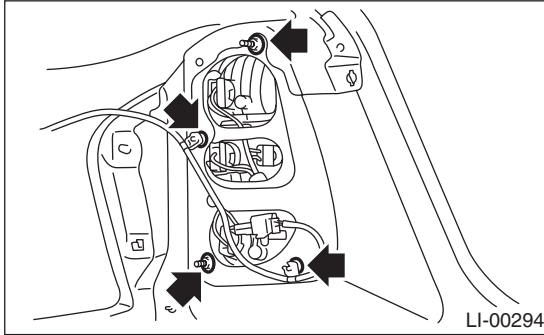
Since LED (Light Emitting Diode) is used for the side turn signal light, replace the side turn signal light assembly if the LED burns out.

## 19. Rear Combination Light Assembly

### A: REMOVAL

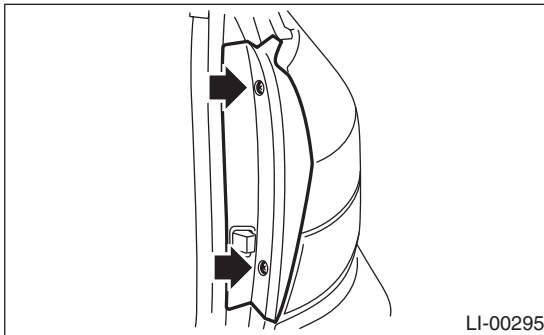
#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from battery.
- 2) Remove the trunk room side trim. <Ref. to EI-70, REMOVAL, Trunk Room Trim.>
- 3) Remove the four nuts, and then detach the rear combination light after disconnecting the connector.

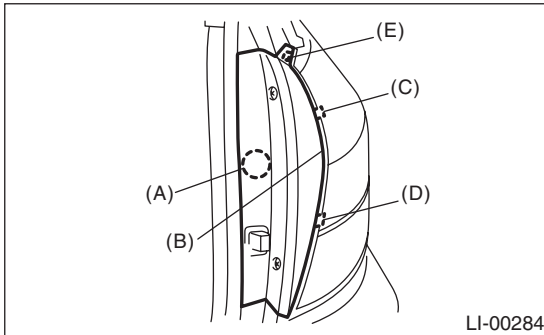


#### 2. WAGON MODEL

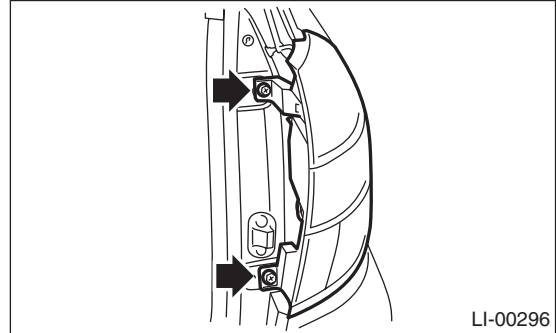
- 1) Disconnect the ground cable from battery.
- 2) Remove the clip.



- 3) While pressing the section (A), insert your finger or a flat-tip screwdriver wrapped with tape into the clearance (B) to remove claws in the order of (C), (D), (E), and remove the rear combination cover.



- 4) Remove the two bolts, and then detach the rear combination light by pulling it to the rear side of vehicle.



- 5) After turning the sockets of the tail/stop light bulbs and rear turn signal light bulbs, remove the rear combination light.

### B: INSTALLATION

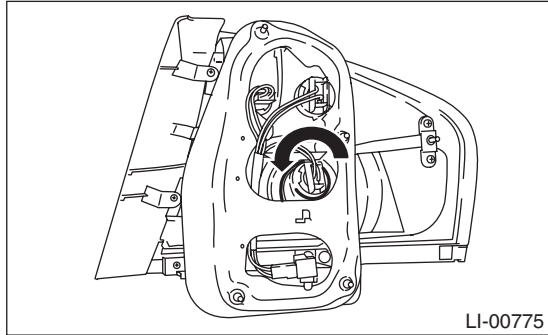
Install in the reverse order of removal.

## 20. Tail/Stop Light Bulb

### A: REMOVAL

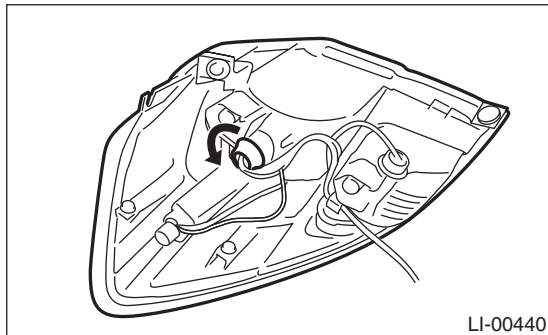
#### 1. SEDAN MODEL

- 1) Remove the trunk side trim cover.
- 2) Turn the socket and remove the bulb.



#### 2. WAGON MODEL

- 1) Remove the rear combination light assembly. <Ref. to LI-23, WAGON MODEL, REMOVAL, Rear Combination Light Assembly.>
- 2) Turn the socket and remove the bulb.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

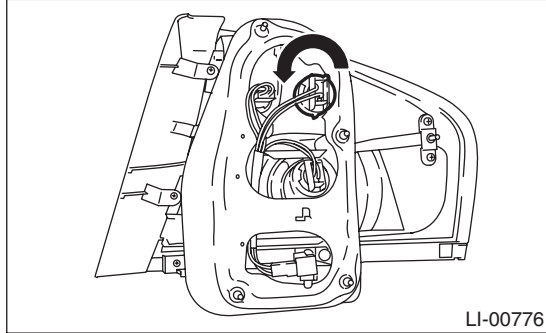


## 21. Rear Turn Signal Light Bulb

### A: REMOVAL

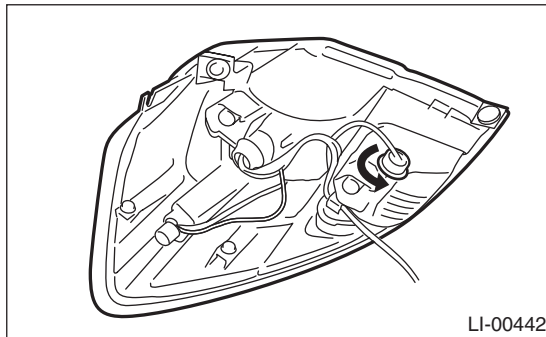
#### 1. SEDAN MODEL

- 1) Remove the trunk side trim cover.
- 2) Turn the socket and remove the bulb.



#### 2. WAGON MODEL

- 1) Remove the rear combination light assembly.  
<Ref. to LI-23, WAGON MODEL, REMOVAL, Rear Combination Light Assembly.>
- 2) Turn the socket and remove the bulb.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

# Rear Side Marker Light Bulb

LIGHTING SYSTEM

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## 22.Rear Side Marker Light Bulb

### A: REMOVAL

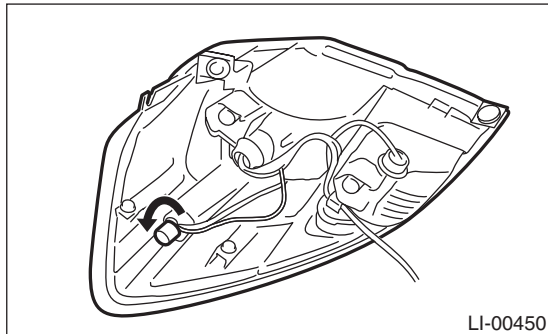
#### 1. SEDAN MODEL

The rear side marker light bulb is integrated into the tail/stop light bulb as a single unit. <Ref. to LI-24, SEDAN MODEL, REMOVAL, Tail/Stop Light Bulb.>

#### 2. WAGON MODEL

1) Remove the rear combination light assembly. <Ref. to LI-23, WAGON MODEL, REMOVAL, Rear Combination Light Assembly.>

2) Turn the socket and remove the bulb.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

## 23. Back-up Light Assembly

### A: REMOVAL

#### 1. SEDAN MODEL

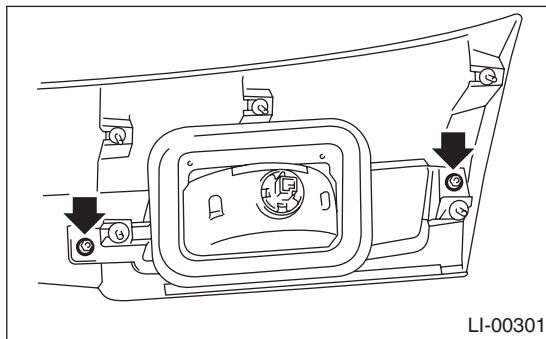
Remove the rear combination light. <Ref. to LI-23, REMOVAL, Rear Combination Light Assembly.>

#### 2. WAGON MODEL

1) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>

2) Disconnect the harness connector and remove the rear gate garnish. <Ref. to EI-75, REMOVAL, Rear Gate Garnish.>

3) Remove the attachment nuts and remove the back-up light assembly.



### B: INSTALLATION

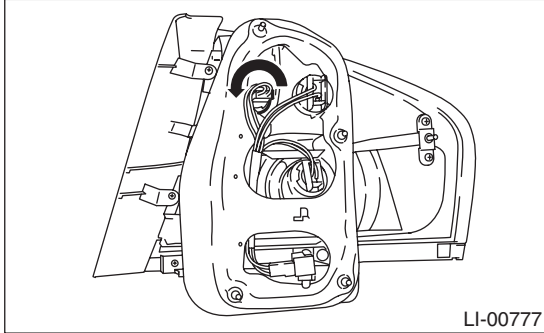
Install in the reverse order of removal.

## 24. Back-up Light Bulb

### A: REMOVAL

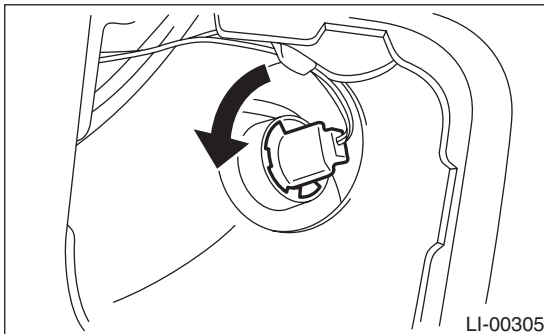
#### 1. SEDAN MODEL

- 1) Remove the trunk side trim cover.
- 2) Turn the socket and remove the bulb.



#### 2. WAGON MODEL

- 1) Remove the bulb inspection cover of the rear gate trim.
- 2) Turn the socket and remove the bulb.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

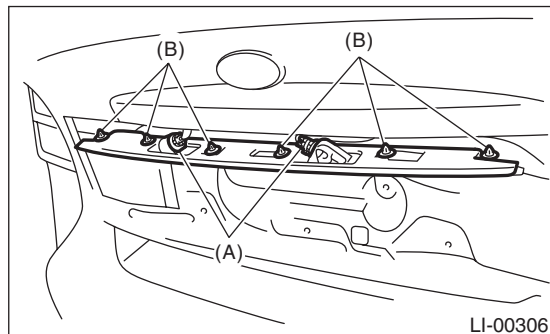
- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

## 25. License Plate Light Assembly

### A: REMOVAL

#### 1. SEDAN MODEL

- 1) Remove the trunk lid garnish. <Ref. to EI-74, REMOVAL, Trunk Lid Garnish.>
- 2) Remove the trunk lid trim. <Ref. to EI-70, TRUNK LID TRIM, REMOVAL, Trunk Room Trim.>
- 3) Turn and remove the bulb socket (A). Disengage clip (B) and remove the license plate light assembly.



### B: INSTALLATION

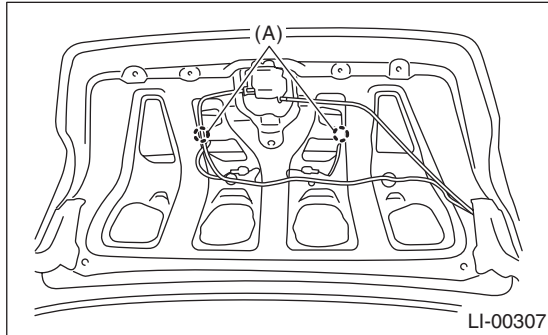
Install in the reverse order of removal.

## 26. License Plate Light

### A: REMOVAL

#### 1. SEDAN MODEL

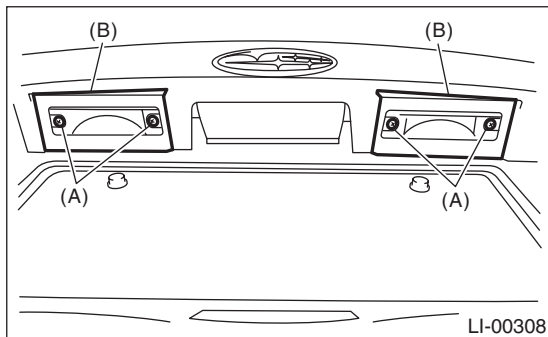
- 1) Remove the trunk lid trim. <Ref. to EI-70, TRUNK LID TRIM, REMOVAL, Trunk Room Trim.>
- 2) Turn and remove the bulb socket (A).



- 3) Remove the bulb.

#### 2. WAGON MODEL

- 1) Remove the license plate light mounting screw (A) and then remove the lens (B).



- 2) Remove the bulb.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

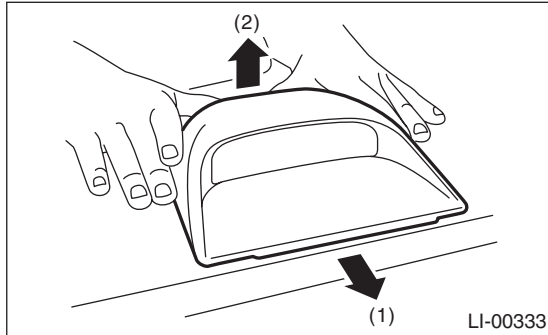
- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

## 27.High-mounted Stop Light

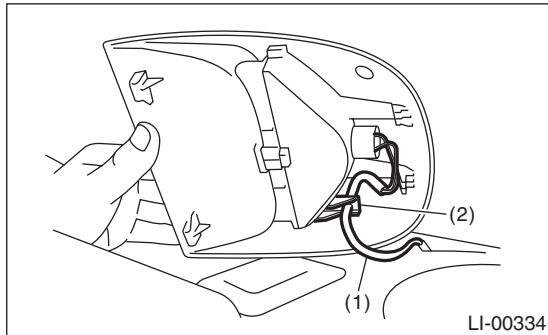
### A: REMOVAL

#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from battery.
- 2) Push the high-mounted stop light towards the rear of the vehicle (1), raise the rear end (2) and remove the clips to remove the stop light.

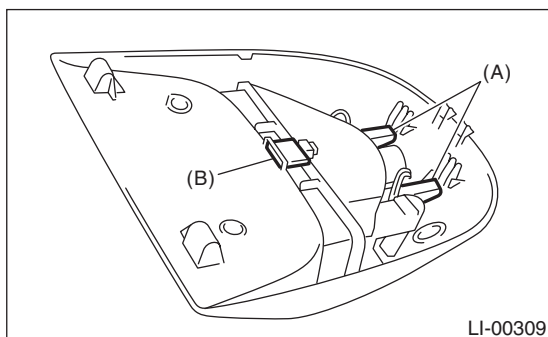


- 3) Remove the harness from the clamp.

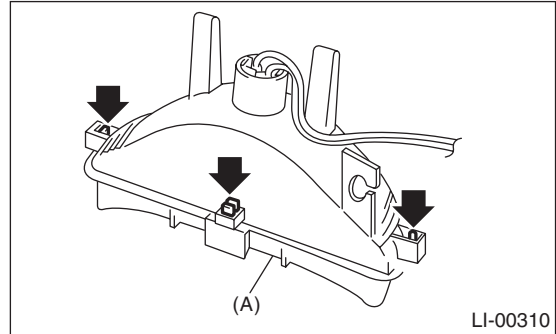


- (1) Harness
- (2) Clamp

- 4) Disengage two claws (A), pull out the high-mounted stop light from the cover and remove claw (B).



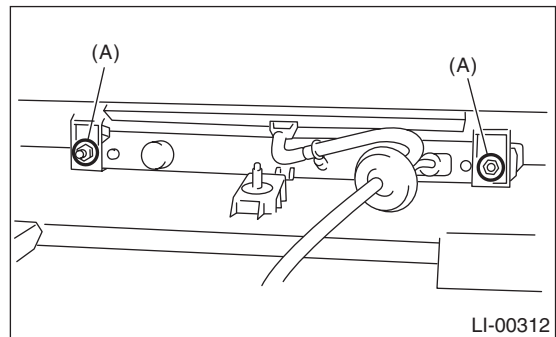
- 5) Disengage the three claws and remove lens (A).



- 6) Remove the bulb.

#### 2. WAGON MODEL

- 1) Disconnect the ground cable from battery.
- 2) Remove the roof spoiler. <Ref. to EI-41, REMOVAL, Roof Spoiler.>
- 3) Remove the nuts (A), then detach the high-mounted stop light.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

#### 1. SEDAN MODEL

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

#### 2. WAGON MODEL

- 1) Install the high-mounted stop light to test if it illuminates normally.
- 2) If the high-mounted stop light does not illuminate, replace it with a new part.

#### NOTE:

Since LED (Light Emitting Diodes) is used for the high-mounted stop light of the wagon model, replace the high-mounted stop light as an assembly when the LED burns out.

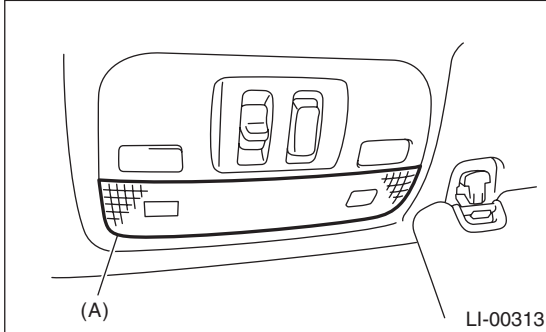
# Spot Map Light

## LIGHTING SYSTEM

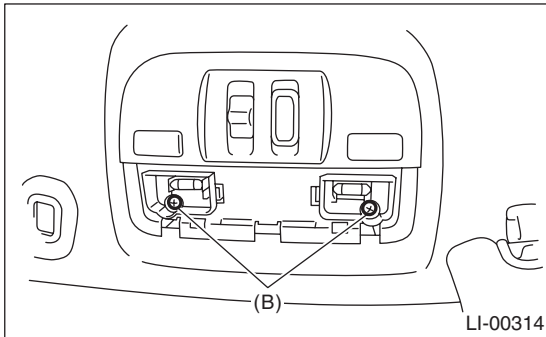
### 28. Spot Map Light

#### A: REMOVAL

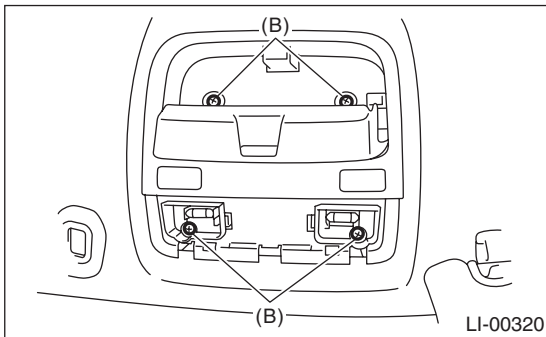
- 1) Disconnect the ground cable from battery.
- 2) Remove the lens (A) and spot map light mounting screws (B).



- Model with sunroof



- Model without sunroof



- 3) Disconnect the harness connectors and remove the spot map light.

#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

##### 1. SPOT MAP LIGHT BULB

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

##### 2. SPOT MAP LIGHT SWITCH

Measure the resistance between spot map light switch terminals.

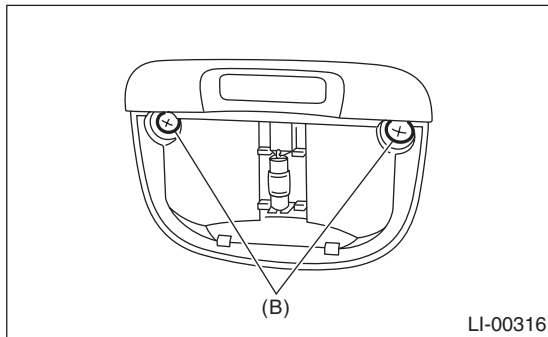
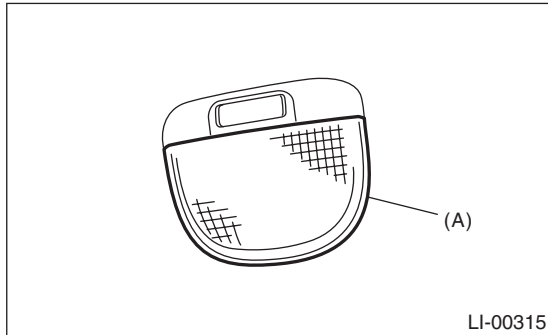
Switch position	Terminal No.	Standard
OFF	—	1 M $\Omega$ or more
ON	1 and 2	18 $\pm$ 5.4 $\Omega$



## 29. Room Light

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the lens (A) and mounting screws (B).



- 3) Disconnect the harness connector and remove the room light.

### B: INSTALLATION

Install in the reverse order of removal.

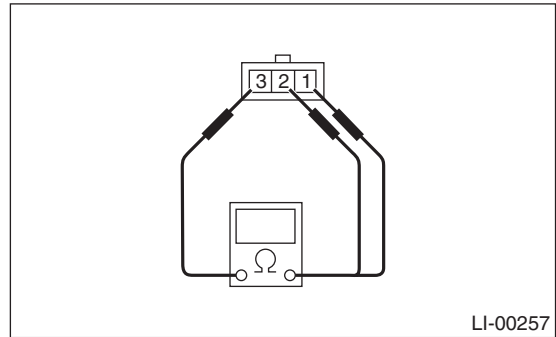
### C: INSPECTION

#### 1. ROOM LIGHT BULB

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

#### 2. ROOM LIGHT SWITCH

Measure the resistance between room light switch terminals.

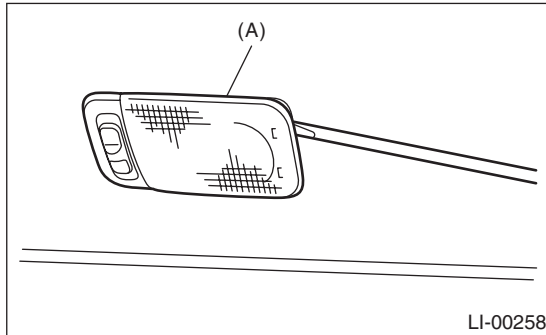


Switch position	Terminal No.	Standard
OFF	—	1 MΩ or more
ON	1 and 3	1.5±0.5 Ω
DOOR	2 and 3	1.5±0.5 Ω

## 30. Luggage Room Light

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the luggage room light body (A).



- 3) Disconnect the harness connector and remove the lens.

### B: INSTALLATION

Install in the reverse order of removal.

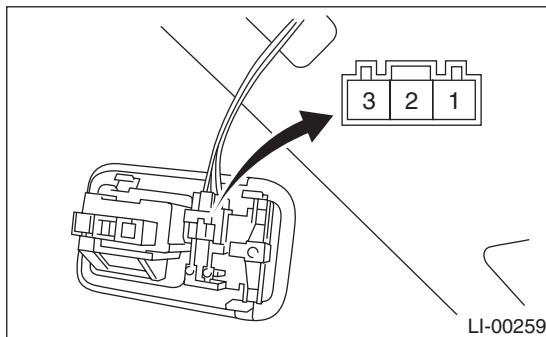
### C: INSPECTION

#### 1. LUGGAGE ROOM LIGHT BULB

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

#### 2. LUGGAGE ROOM LIGHT SWITCH

Measure the resistance between luggage room light switch terminals.

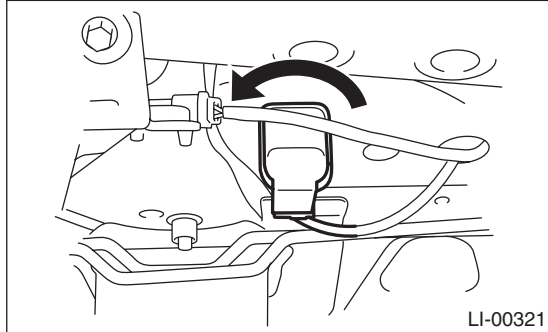


Switch position	Terminal No.	Standard
OFF	—	1 M $\Omega$ or more
ON	1 and 2	1.5 $\pm$ 0.5 $\Omega$
DOOR	2 and 3	1.5 $\pm$ 0.5 $\Omega$

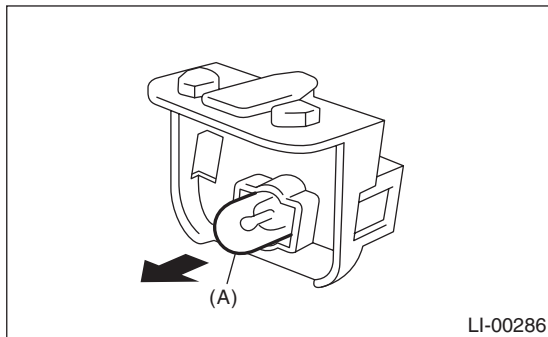
## 31. Trunk Room Light

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Turn the trunk room light counterclockwise 60° to remove it and disconnect the harness connector.



- 3) Remove bulb (A).



### B: INSTALLATION

Install in the reverse order of removal.

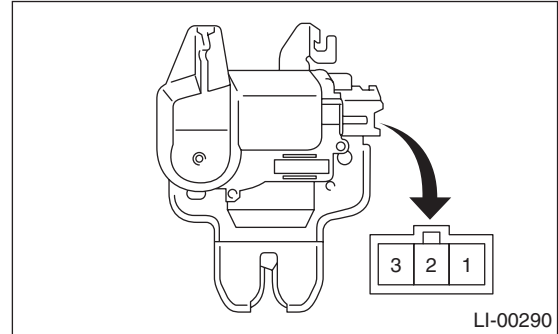
### C: INSPECTION

#### 1. TRUNK ROOM LIGHT BULB

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification. <Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

#### 2. TRUNK LID SWITCH (TRUNK ROOM LIGHT SWITCH)

Measure the resistance between trunk lid switch terminals.

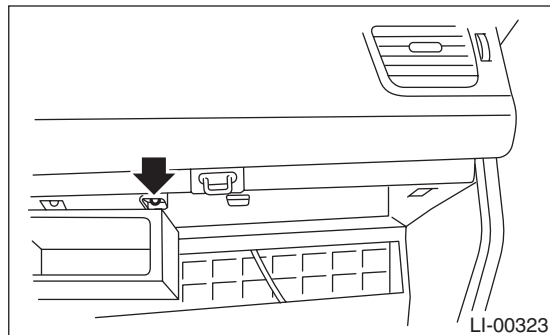


Trunk lid position	Terminal No.	Standard
Close	1 and 3	1 MΩ or more
Open		1.5±0.5 Ω

## 32. Glove Box Light

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Disconnect the harness connector.
- 4) Remove the glove box light.



### B: INSTALLATION

Install in the reverse order of removal.

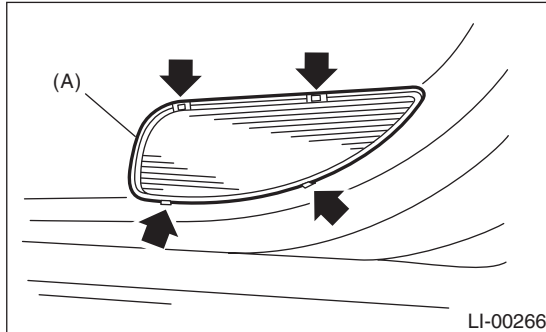
### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification.  
<Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

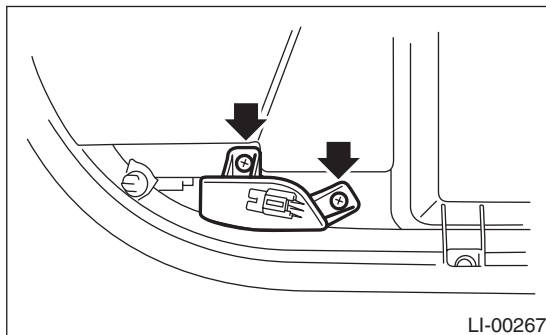
## 33. Door Step Light

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove lens (A), and then remove the door step light bulb.



- 3) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 4) Disconnect the harness connector.
- 5) Remove the mounting screw from the rear side of trim and remove the door step light.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Visually check the bulb for blow out.
- 2) Check the bulb specification.  
<Ref. to LI-2, SPECIFICATION, General Description.>
- 3) If NG, replace the bulb with a new part.

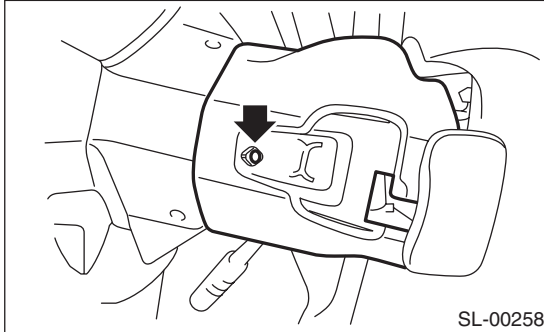
# Ignition Switch Illumination

LIGHTING SYSTEM

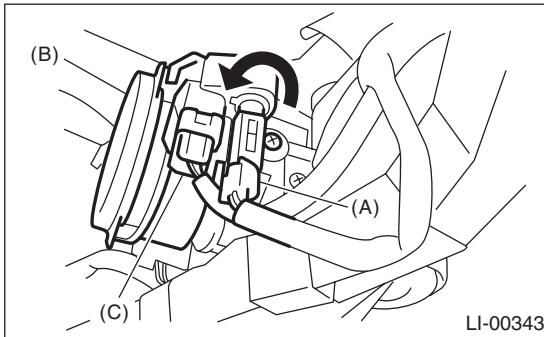
## 34. Ignition Switch Illumination

### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the screws, and detach the upper column cover and lower column cover.



- 3) Disconnect the ignition switch illumination connector (A).
- 4) Turn the ignition switch illumination connector to the left and disconnect it.



- (A) Ignition switch illumination connector
- (B) Ignition switch illumination
- (C) Immobilizer antenna connector

### B: INSTALLATION

Install in the reverse order of removal.

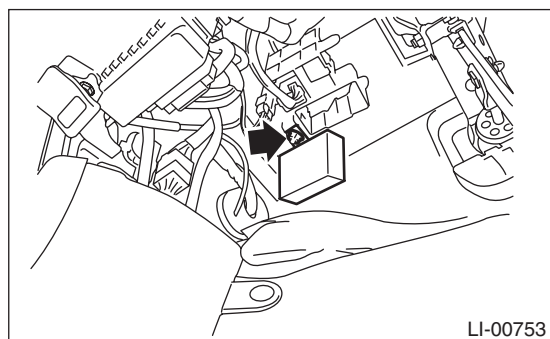
### C: INSPECTION

Step	Check	Yes	No
<b>1</b> <b>CHECK THE IGNITION SWITCH ILLUMINATION.</b> Make sure the ignition switch illumination illuminates when driver's side door is open.	Does the ignition switch illumination illuminate?	Ignition switch illumination is normal.	Go to step 2.
<b>2</b> <b>CHECK THE IGNITION SWITCH ILLUMINATION.</b> Make sure the ignition switch illumination blinks when the ignition switch is turned to ON.	Does the ignition switch illumination blink?	Check the function setting of body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Check the ignition switch illumination circuit. <Ref. to SL-21, CHECK IGNITION SWITCH ILLUMINATION, INSPECTION, Keyless Entry System.>

## 35. Day Time Running Light Unit

### A: REMOVAL

- 1) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 2) Remove the fuse box and disconnect the connector.
- 3) Remove the mounting nuts, and detach the day-time running light module.



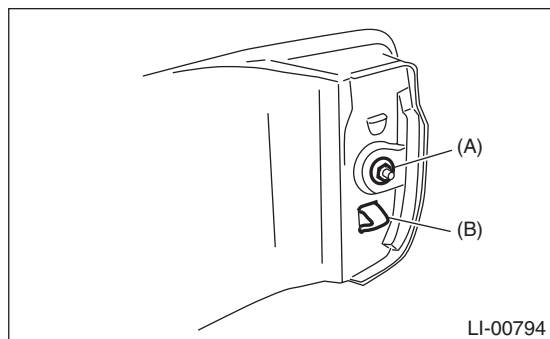
### B: INSTALLATION

Install in the reverse order of removal.

## 36. Reflex Refractor

### A: REMOVAL

- 1) Remove the rear bumper. <Ref. to EI-37, REMOVAL, Rear Bumper.>
- 2) Remove the plastic nuts (A).
- 3) Remove the reflex refractor by pressing the claw (B) of the reflex refractor.



### B: INSTALLATION

Install in the reverse order of removal.



# General Description

## WIPER AND WASHER SYSTEMS

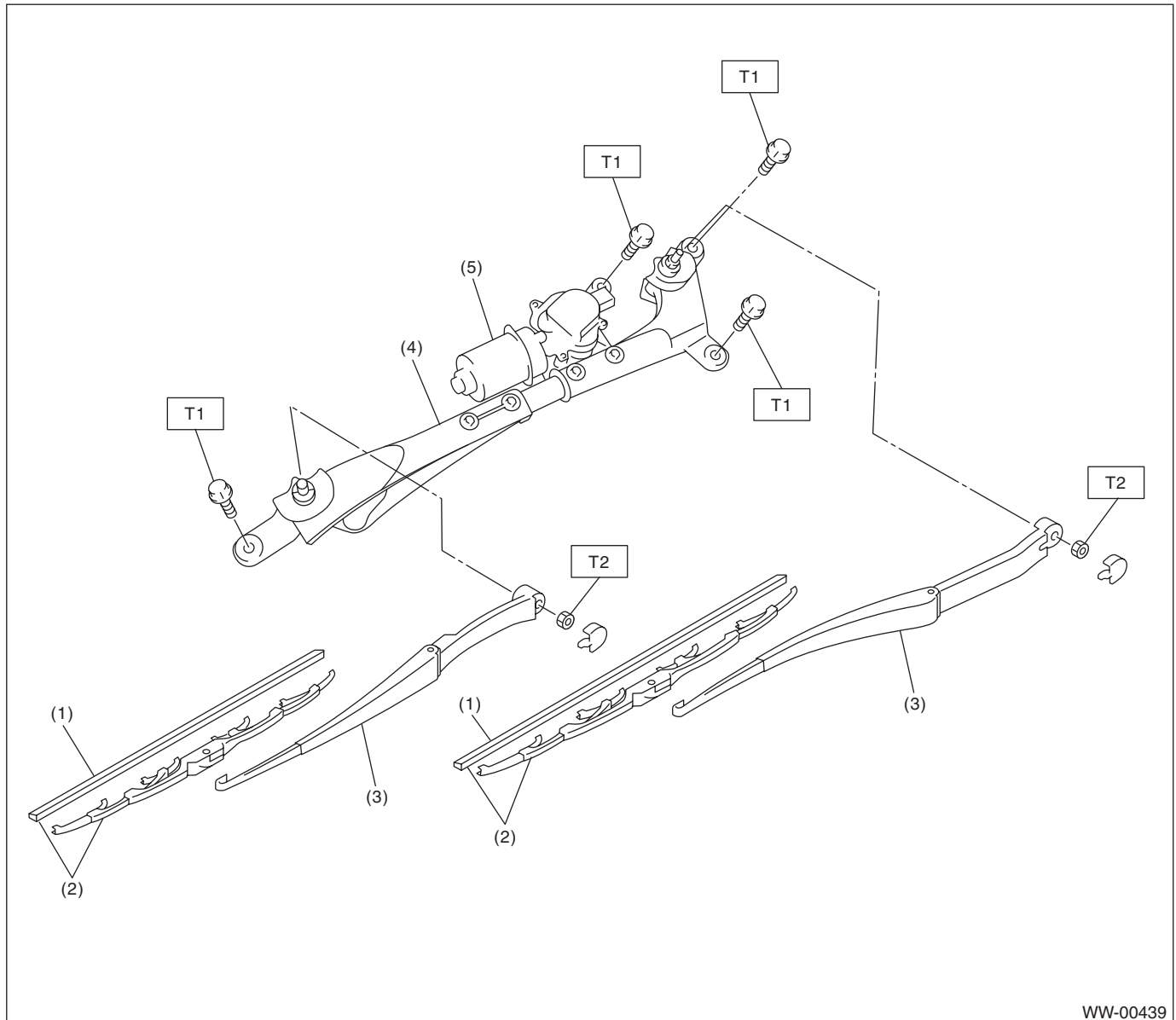
### 1. General Description

#### A: SPECIFICATION

Front wiper motor	Input	12 V — 72 W or less
Rear wiper motor	Input	12 V — 42 W or less
Front washer motor	Pump type	Centrifugal
	Input	12 V — 36 W or less
Rear washer motor	Pump type	Centrifugal
	Input	12 V — 36 W or less

#### B: COMPONENT

##### 1. FRONT WIPER



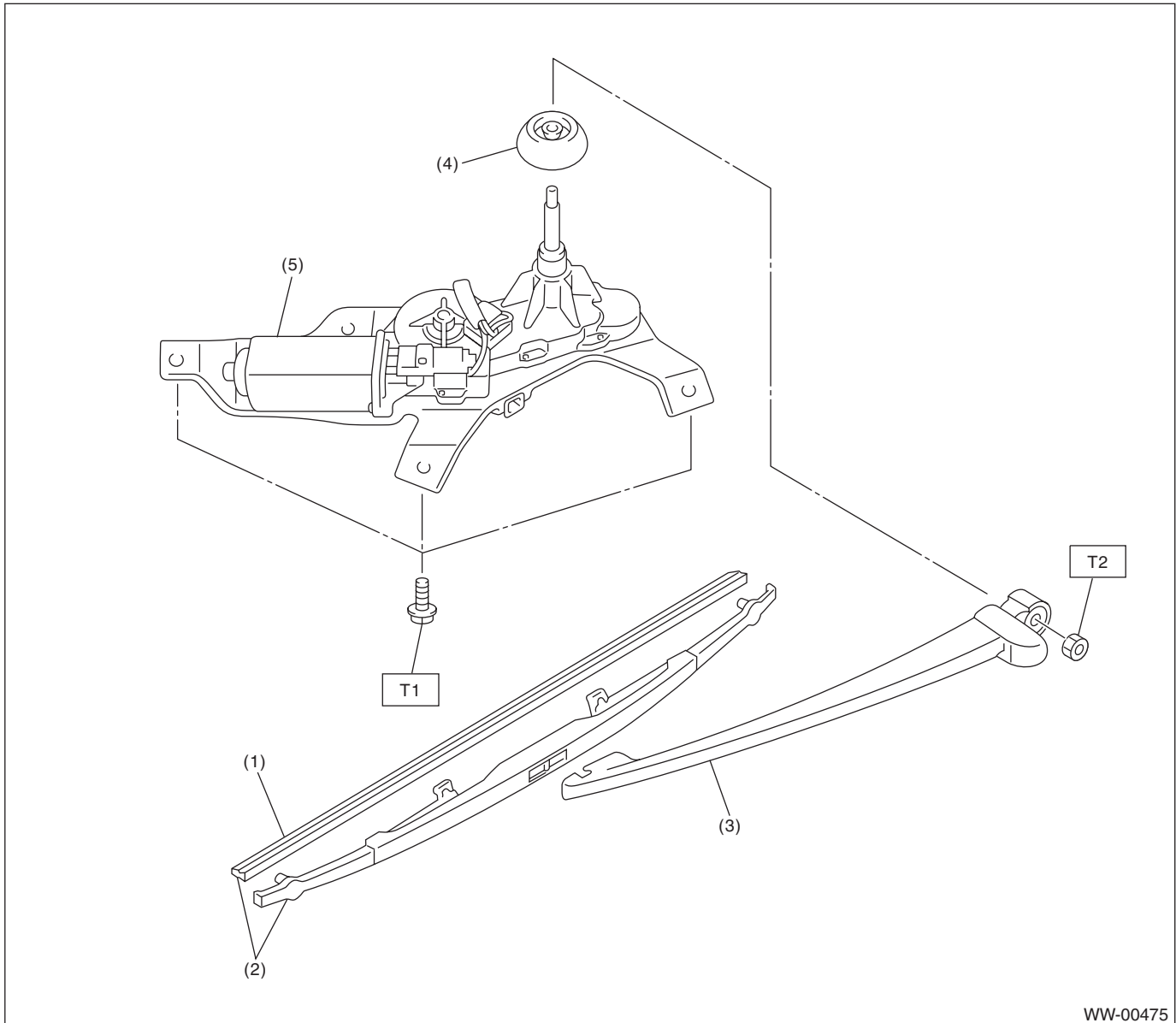
- |                      |                      |
|----------------------|----------------------|
| (1) Wiper rubber     | (4) Wiper link ASSY  |
| (2) Wiper blade ASSY | (5) Wiper motor ASSY |
| (3) Wiper arm        |                      |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.0 (0.61, 4.4)**

**T2: 20 (2.0, 14.5)**

## 2. REAR WIPER (WAGON MODEL)



WW-00475

- |                      |                      |
|----------------------|----------------------|
| (1) Wiper rubber     | (4) Cap              |
| (2) Wiper blade ASSY | (5) Wiper motor ASSY |
| (3) Wiper arm        |                      |

**Tightening torque: N·m (kgf·m, ft·lb)**

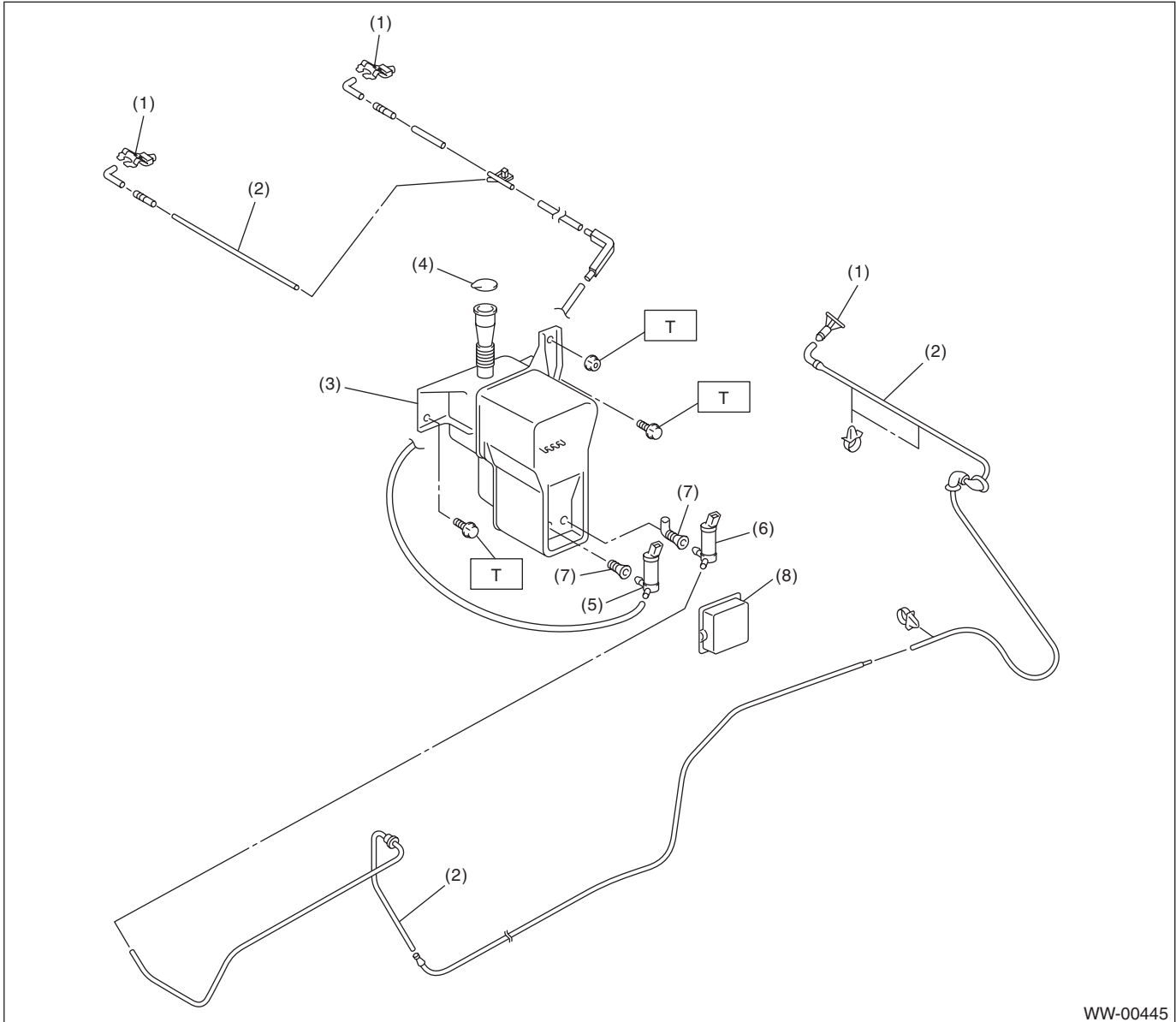
**T1: 7.5 (0.76, 5.5)**

**T2: 8.0 (0.82, 5.9)**

# General Description

## WIPER AND WASHER SYSTEMS

### 3. WASHER TANK



WW-00445

- |                     |                        |
|---------------------|------------------------|
| (1) Washer nozzle   | (5) Front washer motor |
| (2) Washer hose     | (6) Rear washer motor  |
| (3) Washer tank     | (7) Grommet            |
| (4) Washer tank cap | (8) Washer motor cover |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 6.0 (0.61, 4.4)**

### C: CAUTION

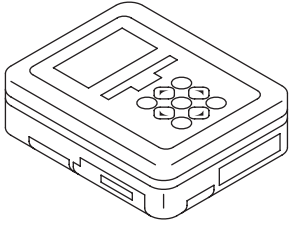
- Connect the connectors and hoses securely during reassembly.
- After reassembly, make sure functional parts operate smoothly.
- Be careful with the airbag system wiring harness which passes near electrical parts and switches.
- All airbag system wiring harness and connectors are colored yellow. Do not use a tester equipment on these circuits.
- Care must be taken when connecting the hoses to pipes so that there are no bends or blockage.
- If even a small amount of silicon oil or grease enters tank and washer fluid passages, an oil film will be formed on the glass and will cause the wiper to chatter and judder. Make sure that no oil comes into contact with the system.

# General Description

WIPER AND WASHER SYSTEMS

## D: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	TOOL NAME	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for settings of each function and trouble-shooting for electrical system.

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for checking voltage and continuity.

# Wiper and Washer System

## WIPER AND WASHER SYSTEMS

---

### 2. Wiper and Washer System

#### A: WIRING DIAGRAM

##### 1. WIPER AND WASHER (FRONT)

<Ref. to WI-175, WIRING DIAGRAM, Front Wiper and Washer System.>

##### 2. WIPER AND WASHER (REAR)

<Ref. to WI-176, WIRING DIAGRAM, Rear Wiper and Washer System.>

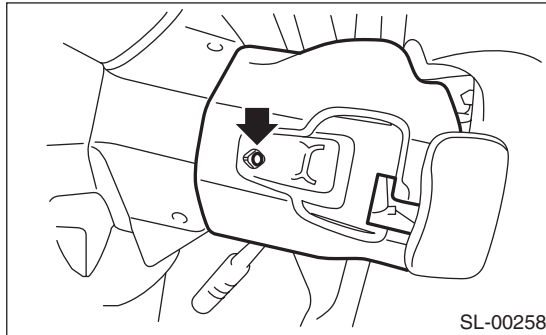
#### B: INSPECTION

Symptom	Repair order
Wiper and washers do not operate.	<ol style="list-style-type: none"><li>1. Wiper fuse (Front: F/B No. 30, Rear: F/B No. 23)</li><li>2. Combination switch</li><li>3. Wiper motor assembly</li><li>4. Wiring harness</li><li>5. Body integrated unit (rear wiper only)</li></ol>
Wipers do not operate in LO or HI.	<ol style="list-style-type: none"><li>1. Combination switch</li><li>2. Wiper motor assembly</li><li>3. Wiring harness</li></ol>
Wipers do not operate in INT.	<ol style="list-style-type: none"><li>1. Combination switch</li><li>2. Wiper motor assembly</li><li>3. Wiring harness</li><li>4. Body integrated unit (rear wiper only)</li></ol>
Washer motor does not operate.	<ol style="list-style-type: none"><li>1. Washer switch</li><li>2. Washer motor</li><li>3. Wiring harness</li></ol>
Wipers do not operate when washer switch is ON.	<ol style="list-style-type: none"><li>1. Wiper motor assembly</li><li>2. Wiring harness</li></ol>
Washer fluid spray does not operate properly.	<ol style="list-style-type: none"><li>1. Washer motor</li><li>2. Washer hose and nozzle</li></ol>

## 3. Combination Switch (Wiper)

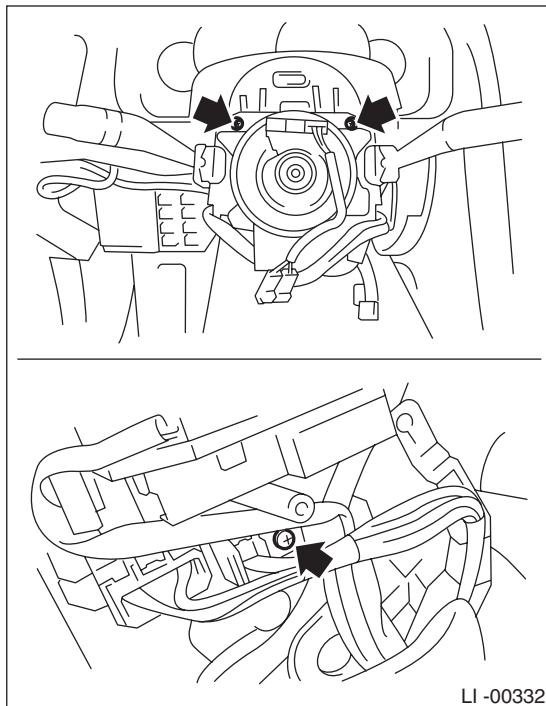
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the driver's airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>
- 3) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 4) Remove the screws and remove the steering column covers (upper & lower).



- 5) Disconnect the connector from the combination switch.

- 6) Remove the three screws, and pull out the combination base switch assembly toward you.



- 7) Remove the screws which secure the switch, then remove the combination switch.

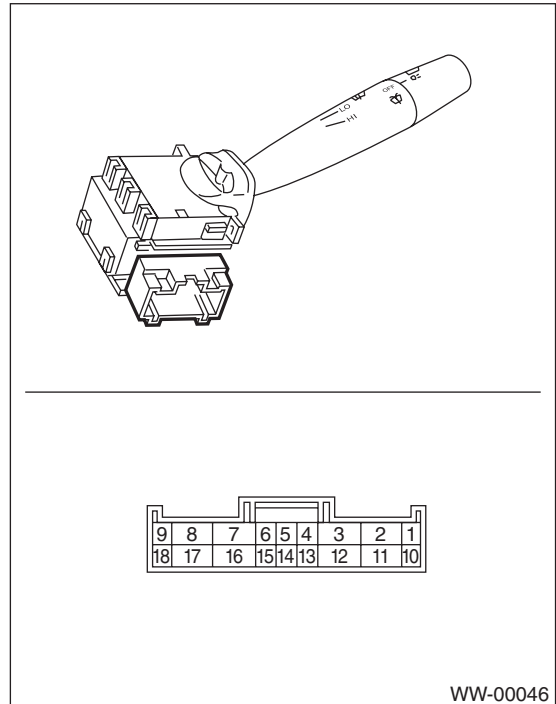
### B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

### 1. COMBINATION SWITCH

- 1) Inspect the continuity between each connector terminal.



	Switch position	Terminal No.	Standard
Front	OFF	7 and 16	Less than 1 Ω
	INT	7 and 16	Less than 1 Ω
	LO	7 and 17	Less than 1 Ω
	HI	8 and 17	Less than 1 Ω
	Washer ON	2 and 11	Less than 1 Ω
Rear	Washer ON	2 and 12	Less than 1 Ω
	OFF	—	1 MΩ or more
	INT	2 and 13	Less than 1 Ω
	ON	2 and 10	Less than 1 Ω
	Washer ON	2 and 12 12 and 10 2 and 10	Less than 1 Ω

- 2) If continuity is not as specified, replace the switch.

# Combination Switch (Wiper)

## WIPER AND WASHER SYSTEMS

### 2. FRONT WIPER

#### 1) Check with Subaru Select Monitor

When the front wiper switch is operated, check the input signal using the Subaru Select Monitor.

(1) Prepare the Subaru Select Monitor kit. <Ref. to GW-7, PREPARATION TOOL, General Description.>

(2) Turn the ignition switch to ON (engine OFF) and run the “PC application help for Subaru Select Monitor”.

(3) On the “System Selection Menu” display screen, select the {Integ. unit mode}.

(4) Select the {Current Data Display & Save}.

(5) Check the input signal when the front wiper switch is set to LO or HI.

Check	Yes	No
Is the input signal normal?	Finish the diagnosis.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

#### 2) Check the intermittent operation (inspection of the wiper switch alone)

(1) Set the voltage meter between connector terminal No. 7 (+) and No. 2 (-).

(2) Connect the battery to the connector. (Terminal No. 17 — (+), terminal No. 2 & 16 — (-))

(3) Turn the wiper switch to INT.

(4) Connect the battery (+) to the terminal No. 16 for 5 seconds.

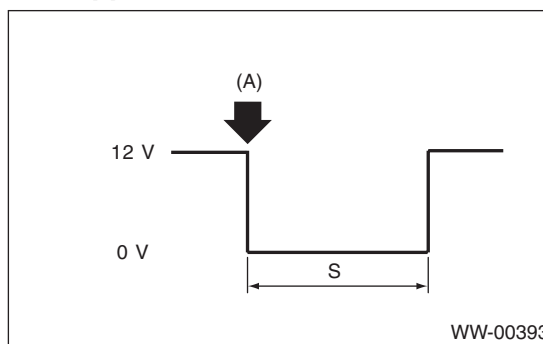
(5) Connect the battery (-) to the terminal No. 16, and check the voltage between terminal No. 7 — No. 2 when performing the intermittent operation.

(6) Perform step 1) to 5) when intermittent control switch is in MIN or MAX. If operation is not as specified, replace the switch.

#### Intermittent stationary time

**MIN: Approx. 2 seconds**

**MAX: Approx. 16 seconds**



(A): Connect the battery (-) to the terminal No. 16.

S: Intermittent downtime (sec.)

### 3. REAR WIPER

#### 1) Check with Subaru Select Monitor

Step	Check	Yes	No
<b>1 CHECK INPUT OF REAR WIPER SWITCH.</b> Check the input from body integrated unit using the Subaru Select Monitor. 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF) and run the “PC application help for Subaru Select Monitor”. 3) On the “System Selection Menu” display screen, select the {Integ. unit mode}. 4) Select the {Current Data Display & Save}. 5) Check the input of the rear wiper switch.	Is the input normal?	Go to step 2.	Check the rear wiper switch. <Ref. to WW-7, INSPECTION, Combination Switch (Wiper).>
<b>2 CHECK OUTPUT OF BODY INTEGRATED UNIT.</b> When the rear wiper switch is operated, check the output using the Subaru Select Monitor. 1) Turn the ignition switch to ON. 2) Operate the rear wiper switch and set to each position of ON and INT. 3) At this time, check the body integrated unit output.	When set to ON, is ON output continuous? When set to INT, is ON/OFF output repeated? (INT OFF time (when vehicle parked): 12 seconds)	Check the rear wiper motor. <Ref. to WW-17, INSPECTION, Rear Wiper Motor.>	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Combination Switch (Wiper)

## 2) Check rear wiper motor circuit

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY CIRCUIT OF THE REAR WIPER MOTOR.</b> 1) Disconnect the harness connector of the rear wiper motor. 2) Turn the ignition switch to ACC. 3) Measure the voltage between the rear wiper motor harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(D43) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	<ul style="list-style-type: none"> <li>• Check the fuse (No. 23 in fuse &amp; relay box).</li> <li>• Check the fusible link (No. 6 in main fuse box).</li> </ul>
<b>2 CHECK GROUND CIRCUIT OF REAR WIPER MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the rear wiper motor harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(D43) No. 3 — Chassis ground:</b>	Is the resistance less than 10 Ω?	Go to step 3.	Repair the open circuit of the rear wiper motor ground circuit.
<b>3 CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND REAR WIPER MOTOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Disconnect the harness connector of the rear wiper motor. 4) Measure the resistance between the harness connector terminals of the body integrated unit and rear wiper motor. <b>Connector &amp; terminal</b> <b>(B280) No. 1 — (D43) No. 2:</b> <b>(B280) No. 8 — (D43) No. 4:</b>	Is the resistance less than 10 Ω?	Go to step 4.	Repair the open circuit of the harness between body integrated unit and rear wiper motor.
<b>4 CHECK OPERATION OF REAR WIPER MOTOR.</b> 1) Remove the rear wiper motor. 2) Check the rear wiper motor. <Ref. to WW-17, INSPECTION, Rear Wiper Motor.>	Does the rear wiper motor rotate normally?	End.	Replace the rear wiper motor.

**NOTE:**

Rear wiper intermittent time (AT model only)

Select lever position (AT model only)	Vehicle speed (km/h (MPH))	Intermittent stopping time (sec.)
Rev.	—	Continuous operation
Except for reverse mode	80 — (50 — )	3
	50 — 80 (31 — 50)	6
	20 — 50 (12 — 31)	9
	0 — 20 (0 — 12)	12



## 4. Wiper Blade

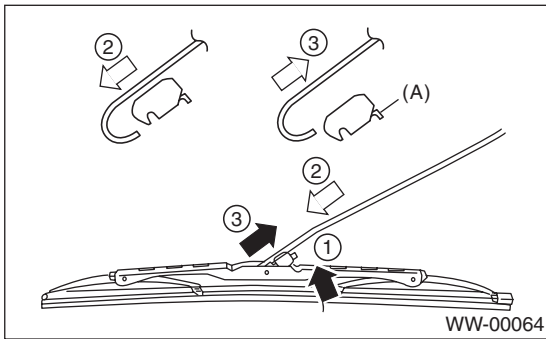
### A: REMOVAL

**CAUTION:**

When replacing the wiper blade, if standing up the wiper arm, be sure to stand up the driver's side wiper arm first, and then passenger's side wiper arm next. Also, when putting the wiper arms back, be sure to start with passenger's side first, then driver's side next. Doing this in the reverse order may result in the driver's side wiper blade hitting the passenger's side wiper arm and causing damage.

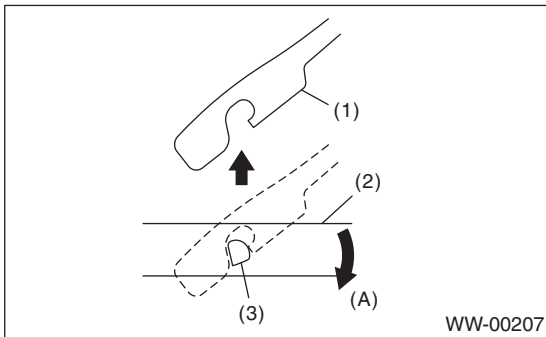
#### 1. FRONT

While pushing the locking clip (A) up, pull out the blade to the direction of the arrow and remove it from the wiper arm.



#### 2. REAR

Turn the blade in the direction of arrow (A) and remove it from arm.



- (A) Turn the wiper blade.
- (1) Wiper arm
- (2) Wiper blade
- (3) Wiper blade attachment section

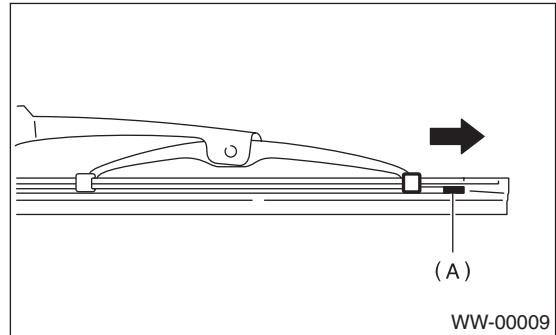
### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Confirm that the clip is locked securely.

### C: DISASSEMBLY

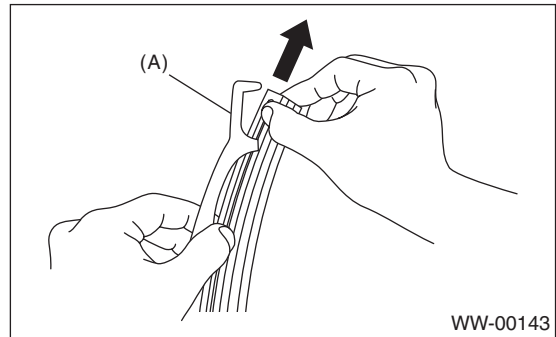
#### 1. FRONT

Pull side (A) of the wiper rubber stopper and remove the rubber from the blade assembly.



#### 2. REAR

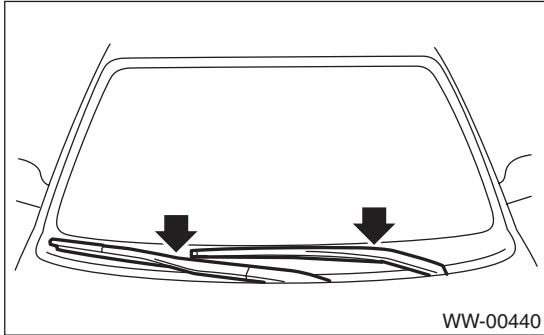
Pull the wiper rubber top slightly from stopper (A) and pull out completely.



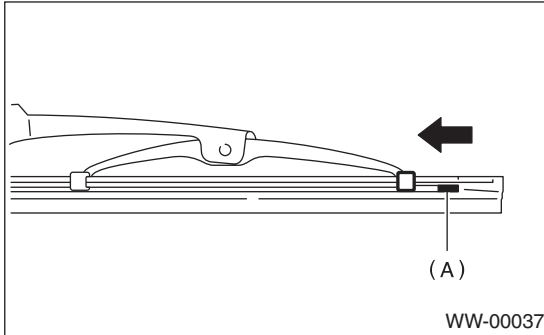
## D: ASSEMBLY

### 1. FRONT

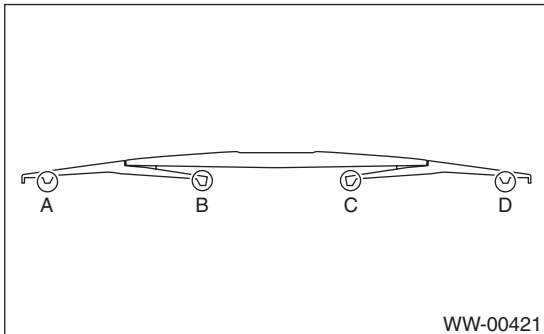
1) Insert the wiper rubber onto the blade so that the stopper is in the position shown in the figure.



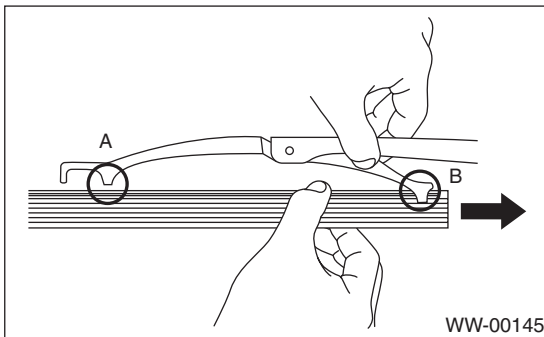
2) Make sure the wiper rubber is securely fastened to the pull stopper (A).



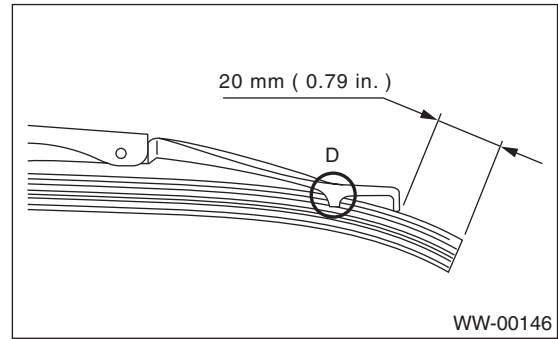
### 2. REAR



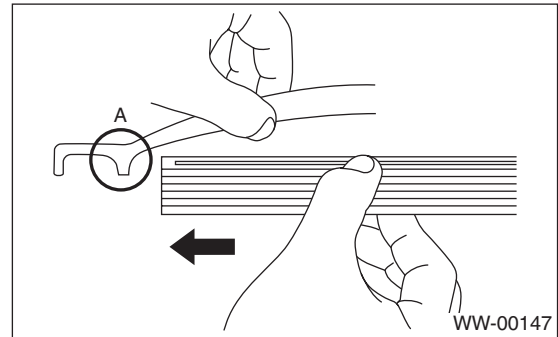
1) Insert the wiper rubber into claw B.



2) Insert the wiper rubber until its top end protrudes approx. 20 mm (0.79 in) from stopper D.



3) Insert the wiper rubber into claw A.



## E: INSPECTION

1) When the wiper does not operate properly, inspect the following item.

- Make sure the movable part of wiper blade assembly moves smoothly.
- Make sure the wiper rubber is not deformed or damaged.

2) If damaged, replace with a new part.

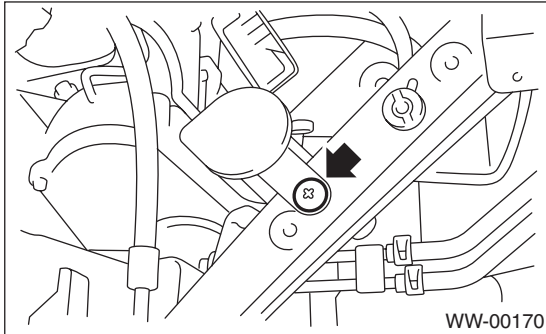
# Washer Tank and Motor

## WIPER AND WASHER SYSTEMS

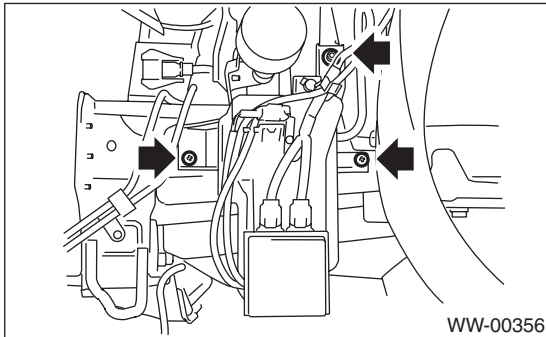
### 5. Washer Tank and Motor

#### A: REMOVAL

- 1) Open the front hood.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the front bumper. <Ref. to EI-30, REMOVAL, Front Bumper.>
- 4) Remove the clip holding washer water supply tap.



- 5) Remove the two bolts and one nut, hose, connector and washer motor cover, and then remove the washer tank.



#### B: INSTALLATION

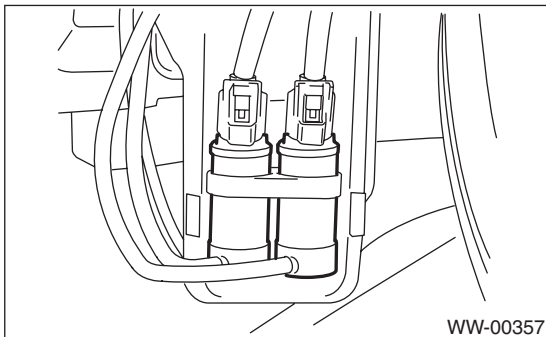
Install in the reverse order of removal.

#### Tightening torque:

**6.0 N·m (0.61 kgf-m, 4.4 ft-lb)**

#### C: DISASSEMBLY

Pull out the washer motor from the tank.

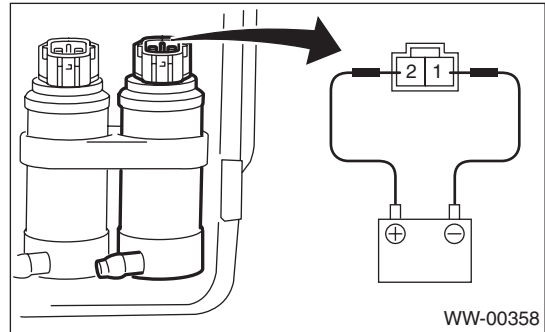


#### D: ASSEMBLY

- 1) Assemble in the reverse order of disassembly.
- 2) Confirm that water does not leak from installation area of motor.

#### E: INSPECTION

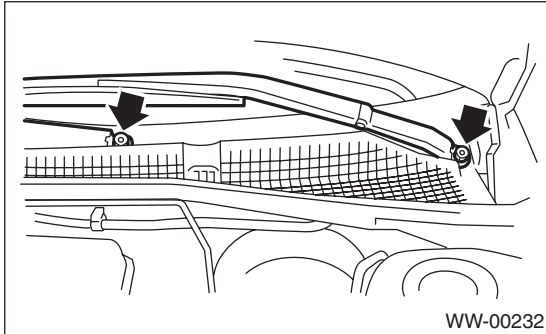
Apply battery voltage to the connector terminal of the washer motor and make sure the motor operates.



## 6. Front Wiper Arm

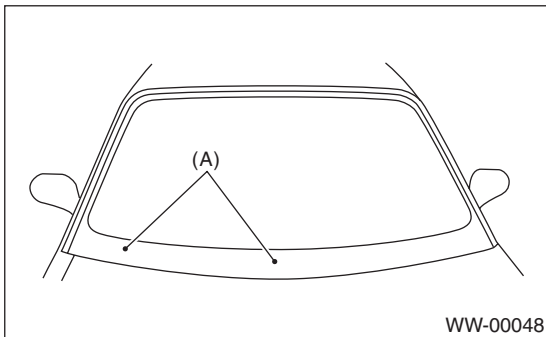
### A: REMOVAL

- 1) Open the front hood.
- 2) Remove the cap.
- 3) Remove the nut and remove the wiper arm.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Operate the wiper once.
- 3) Align the wiper blade to ceramic print point mark (A) of front window panel.



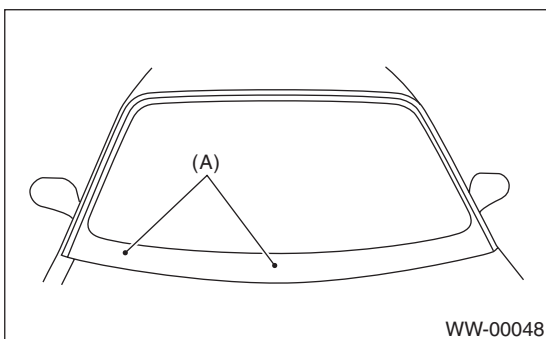
#### **Tightening torque:**

Refer to "COMPONENT" of "General Description".

<Ref. to WW-2, FRONT WIPER, COMPONENT, General Description.>

### C: ADJUSTMENT

Operate the wiper once. Align the wiper blade to ceramic print point mark (A) of front window panel.



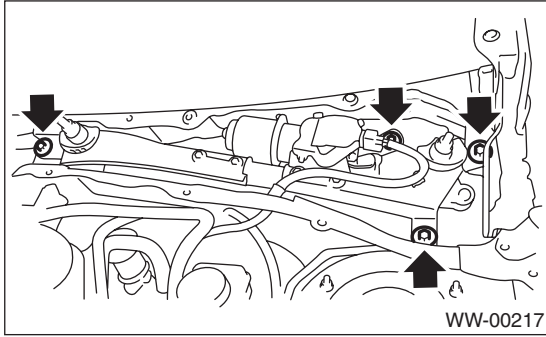
# Front Wiper Motor and Link

## WIPER AND WASHER SYSTEMS

### 7. Front Wiper Motor and Link

#### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the cowl panel. <Ref. to EI-40, REMOVAL, Cowl Panel.>
- 3) Disconnect the connector of wiper motor assembly.
- 4) Remove the bolt, and then remove the wiper assembly.



#### NOTE:

The wiper motor and wiper link is an assembly part and is not to be disassembled.

#### B: INSTALLATION

Install in the reverse order of removal.

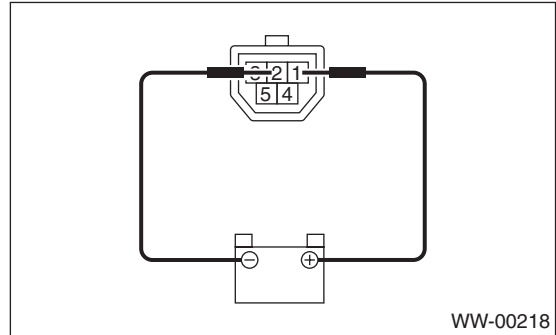
#### Tightening torque:

Refer to "COMPONENT" of "General Description".

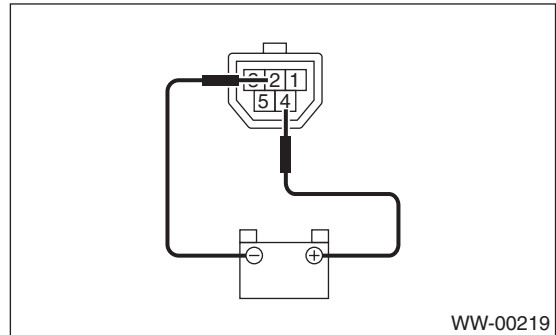
<Ref. to WW-2, FRONT WIPER, COMPONENT, General Description.>

#### C: INSPECTION

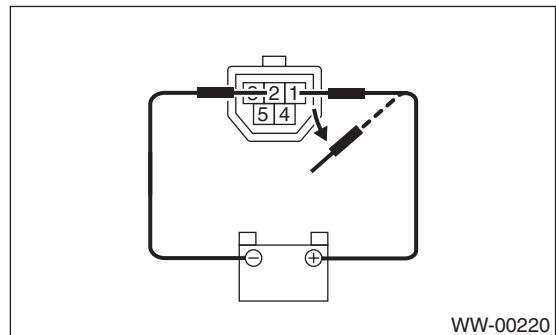
- 1) When the battery is connected to the terminal of connectors, confirm that the wiper motor operates at low speed.



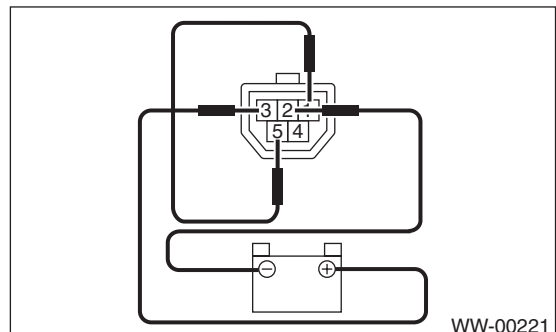
- 2) When the battery is connected to the terminal of connectors, confirm that the wiper motor operates at high speed.



- 3) Connect the battery to the terminals to the connector, then run the wiper motor at low speed and disconnect the terminal in mid motion.



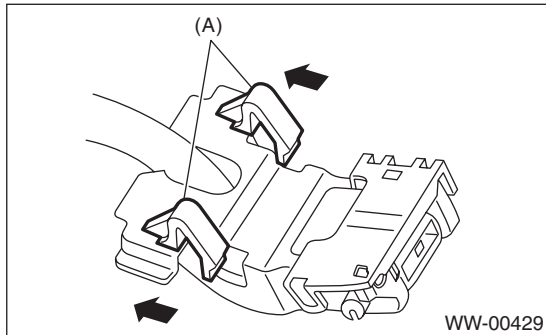
- 4) Connect the battery and confirm that the wiper motor stops at the automatic stop position after the wiper motor operates at low speed again.



## 8. Front Washer Nozzle

### A: REMOVAL

- 1) Remove the front hood insulator. <Ref. to EB-13, FRONT HOOD INSULATOR, REMOVAL, Front Hood.>
- 2) Hold the claw (A) of the washer nozzle towards the direction of the arrow, and remove the washer nozzle.



- 3) Remove the washer hose from the washer nozzle.

### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the washer nozzle position.

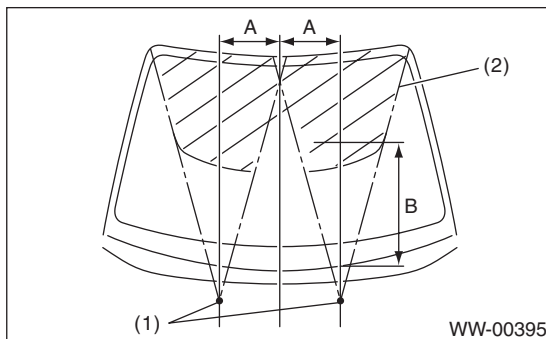
### C: INSPECTION

- Make sure the nozzle and hose are not clogged.
- Make sure the hose is not bent.
- While the vehicle is at a standstill and the wiper switch is turned OFF, make sure that the washer injection position is as shown in the figure.

#### **Spray position:**

**A: 250 mm (9.84 in)**

**B: 535 mm (21.06 in)**

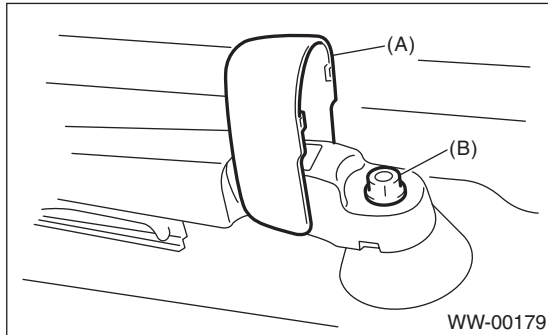


- (1) Nozzle
- (2) Spray area (shaded area)

### 9. Rear Wiper Arm

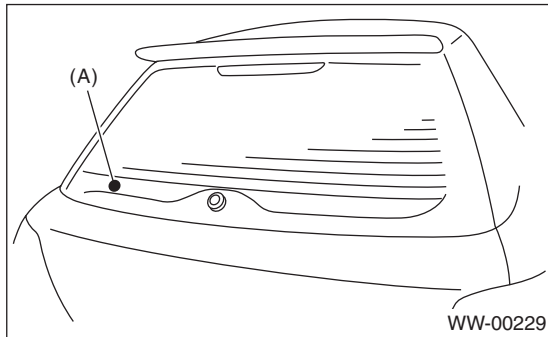
#### A: REMOVAL

- 1) Detach the wiper arm cover (A).
- 2) Remove the nut (B) to remove the wiper arm.



#### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Operate the rear wiper once.
- 3) Align the blade with the marking (A) of the glass.



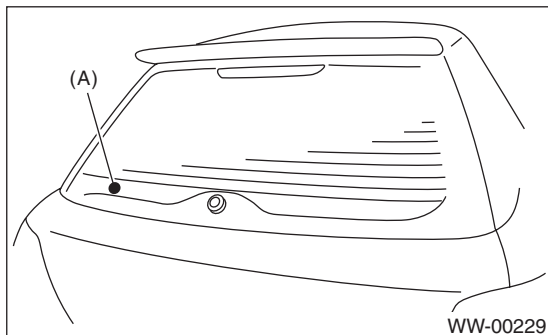
#### **Tightening torque:**

**Refer to "COMPONENT" of "General Description".**

**<Ref. to WW-3, REAR WIPER (WAGON MODEL), COMPONENT, General Description.>**

#### C: ADJUSTMENT

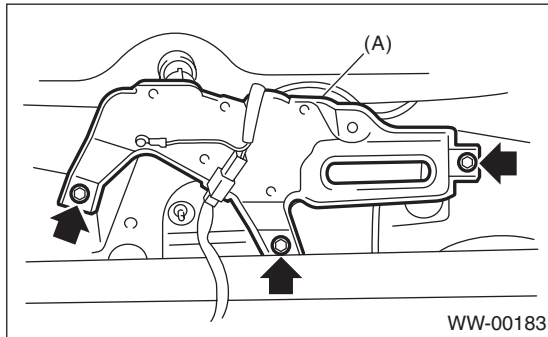
- 1) Operate the rear wiper once.
- 2) Align the blade with the marking (A) of the glass.



## 10.Rear Wiper Motor

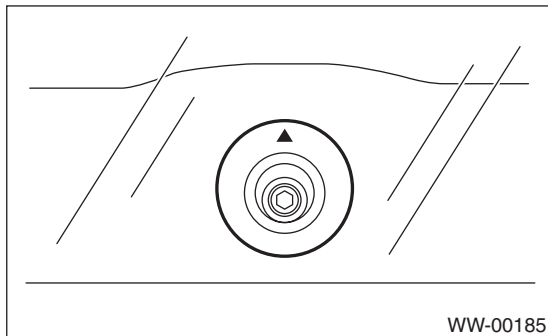
### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear wiper arm. <Ref. to WW-16, REMOVAL, Rear Wiper Arm.>
- 3) Remove the rear gate lower trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 4) Disconnect the harness connector of wiper motor assembly.
- 5) Remove the bolts to remove wiper motor assembly (A).



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Be sure that the pivot cap with the arrow mark facing up, as shown in the figure.



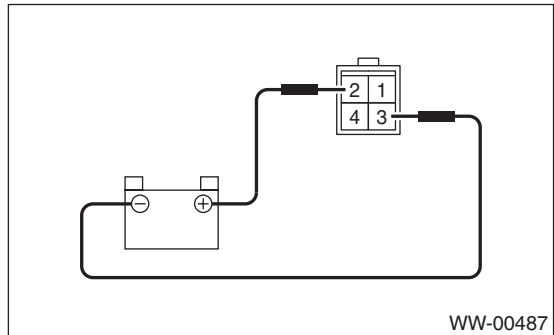
#### Tightening torque:

Refer to "COMPONENT" of "General Description".

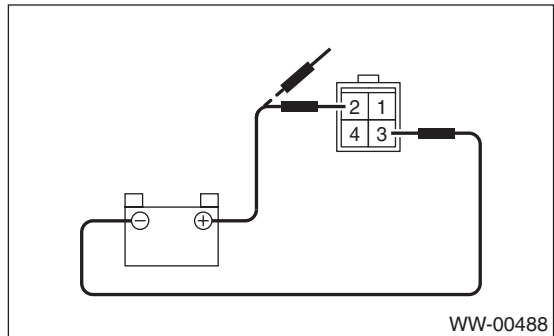
<Ref. to WW-3, REAR WIPER (WAGON MODEL), COMPONENT, General Description.>

### C: INSPECTION

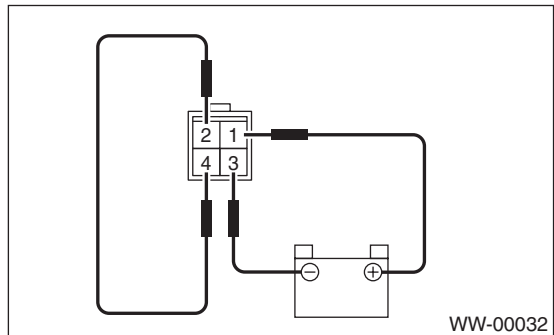
- 1) Connect the battery to the wiper motor connector and confirm that wiper motor operates.



- 2) Connect the battery to the terminals to the connector, then run the wiper motor at low speed and disconnect the terminal in mid motion.



- 3) Connect the battery and confirm that the wiper motor stops at the automatic stop position after the wiper motor operates at low speed again.

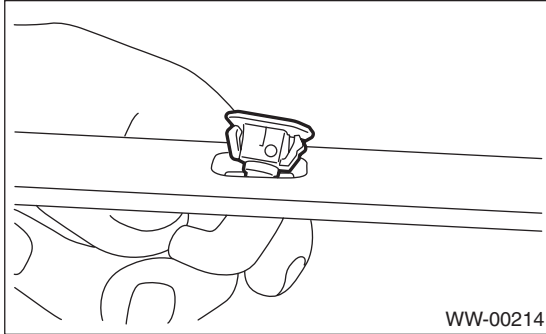




### 11.Rear Washer

#### A: REMOVAL

- 1) Remove the roof spoiler. <Ref. to EI-41, REMOVAL, Roof Spoiler.>
- 2) Remove the washer hose from washer nozzle.
- 3) Push the claw of the nozzle from the reverse side of roof spoiler with a flat tip screwdriver or equivalent, and remove the washer nozzle.



#### B: INSTALLATION

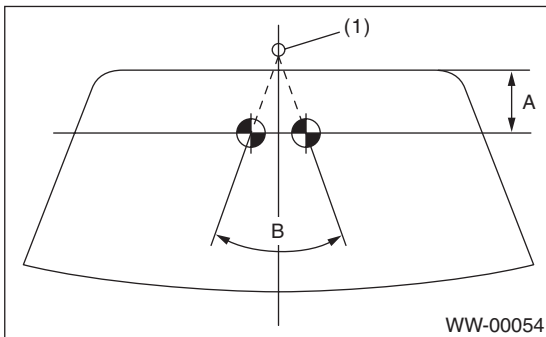
Install in the reverse order of removal.

#### C: INSPECTION

- Make sure the nozzle and hose are not clogged.
- Make sure the hose is not bent.
- While the vehicle is at a standstill, make sure that the washer injection position is as shown in the figure.

#### NOTE:

Washer injection position can not be adjusted.



- (1) Nozzle
- (A) 70 mm (2.76 in)
- (B) 70°

# General Description

ENTERTAINMENT

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## 1. General Description

### A: CAUTION

- Before disassembling or reassembling parts, always disconnect the battery ground cable from battery. When replacing the audio, control module and other parts provided with memory functions, record the memory contents before disconnecting the battery ground cable. Otherwise, the memory is cleared.
- Reassemble the parts in the reverse order of disassembly procedure unless otherwise indicated.
- Adjust parts to the given specifications.
- Connect the connectors securely during reassembly.
- After reassembly, make sure functional parts operate smoothly.

### B: PREPARATION TOOL

#### 1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Conductive silver composition (DUPONT No. 4817 or equivalent)	Used for repairing antenna wire.

## 2. Audio System

### A: WIRING DIAGRAM

<Ref. to WI-178, WIRING DIAGRAM, Audio System.>

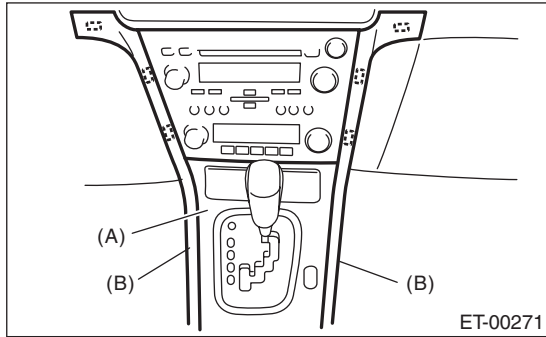
### B: INSPECTION

Symptom	Repair order
No power coming in. (No display and no sound from speakers)	<ol style="list-style-type: none"> <li>1. Check the fuse and power supply for audio.</li> <li>2. Check the audio ground.</li> <li>3. Remove the audio and repair them.</li> </ol>
A specific speaker does not operate.	<ol style="list-style-type: none"> <li>1. Check the speaker.</li> <li>2. Check the output circuit between audio and speaker.</li> </ol>
Audio generates noise with engine is running.	<ol style="list-style-type: none"> <li>1. Check the audio ground.</li> <li>2. Check the generator.</li> <li>3. Check the ignition coil.</li> <li>4. Remove the audio and repair them.</li> </ol>
Volume is low in AM and FM modes or interference noise occurs.	<ol style="list-style-type: none"> <li>1. Check the antenna.</li> <li>2. Check the antenna amplifier.</li> <li>3. Check the noise suppressor.</li> <li>4. Check the audio ground.</li> <li>5. Remove the audio and repair them.</li> </ol>

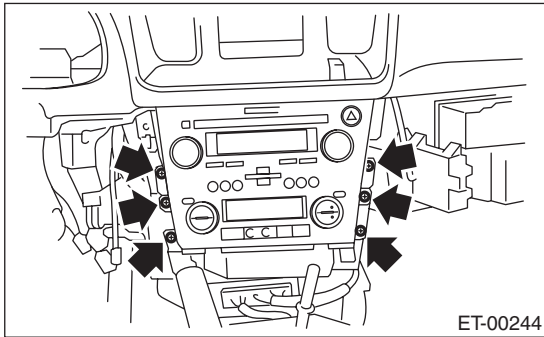
## 3. Audio

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 3) Remove the console front panel (A). <Ref. to EI-55, REMOVAL, Center Console.>
- 4) Remove the console side garnish (B). <Ref. to EI-55, REMOVAL, Center Console.>



- 5) Remove the screws, and partially pull the audio out from center console.

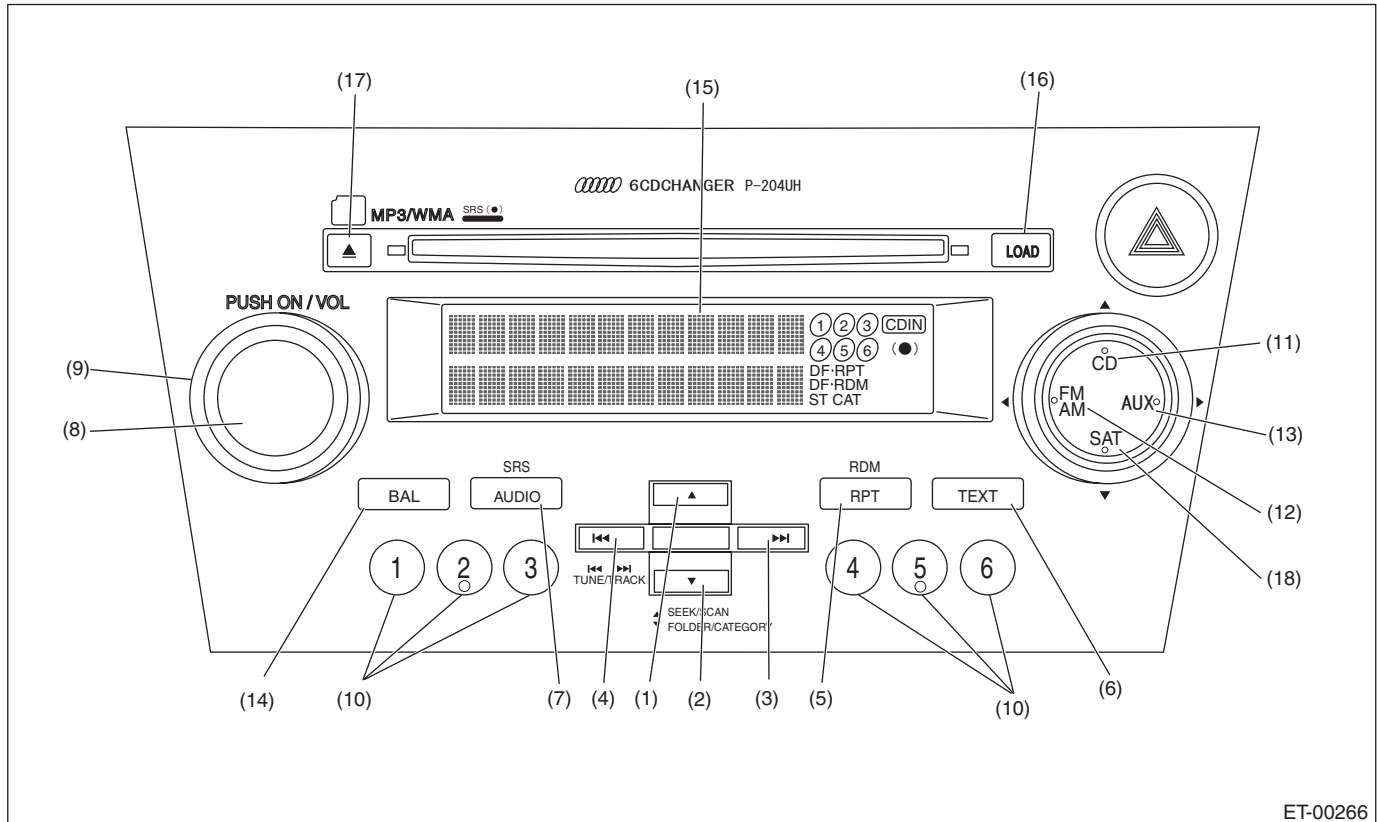


- 6) Disconnect the harness connector and antenna feeder cord, and then remove the audio.

### B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION



ET-00266

- |                              |                       |                   |
|------------------------------|-----------------------|-------------------|
| (1) SEEK / SCAN UP switch    | (7) AUDIO switch      | (13) AUX switch   |
| (2) SEEK / SCAN DOWN switch  | (8) PUSH/POWER switch | (14) BAL switch   |
| (3) TUNE / TRACK UP switch   | (9) VOLUME            | (15) VDF display  |
| (4) TUNE / TRACK DOWN switch | (10) Presets 1 — 6    | (16) LOAD switch  |
| (5) RPT switch               | (11) CD switch        | (17) EJECT switch |
| (6) TEXT switch              | (12) FM/AM switch     | (18) SAT switch   |

### NOTE:

- For self diagnosis of the audio system, there is a communications check (communication condition between the audio and the control panel) and a switch check. Perform a communications check first and make sure it is operating normally before proceeding to the inspection of switches.
- Complete operations from when the self diagnosis mode of step 1 operates and the buzzer sounds, to pressing the preset 1 switch in 4., within 15 seconds. If 15 seconds or more pass, a communications error will be displayed.
- During the diagnosis, do not press the POWER (8), FM/AM (12), CD (11), AUX (13), SAT (18) switches. Pressing these switches will disengage the self diagnosis mode. For the CD, AUX switch, the self diagnosis mode will be disengaged if the disc load and unit are connected.



# Audio

ENTERTAINMENT

## 1. SELF DIAGNOSIS OF THE CONTROL PANEL AND AUDIO

Step	Check	Yes	No
<b>1 SETTING THE SELF-DIAGNOSIS MODE BY OPERATING THE CONTROL PANEL.</b> 1) Turn the audio system OFF with the ignition switch ACC or ON. 2) With the TUNE/TRACK UP switch and the SEEK/SCAN DOWN switch held down, hold the RPT switch down for 2 seconds or more. 3) A buzzer will sound and all the VFD display will illuminate, and then the unit will enter the diagnosis mode.	Does the self diagnosis mode of the control panel operate?	Go to step 3.	Go to step 2.
<b>2 CHECK BUZZER.</b>	Did the buzzer sound when going into the diagnosis mode?	Go to step 3.	Check the connection of harness connector, and if there are no problems found, repair or replace the audio unit and control panel. <Ref. to ET-4, REMOVAL, Audio.>
<b>3 CHECK THE VFD DISPLAY.</b>	Did all the VFD display illuminate?	Go to step 4.	<Ref. to ET-4, REMOVAL, Audio.>
<b>4 CHECK THE COMMUNICATION STATUS.</b> Press the preset 1 switch, and confirm the VFD display section of the control panel.	Is the «Main Check!» or «Sub Check!» displayed on the VFD display?	Repair or replace the audio unit. <Ref. to ET-4, REMOVAL, Audio.>	Go to step 5.
<b>5 CHECK SWITCH.</b> Operate the switches in the following list, and check the display content on the VFD display.	Does the switch check list and the operated switches match? <Ref. to ET-6, SWITCH CHECK LIST, INSPECTION, Audio.>	The self-diagnosis of the audio unit is normal.	Repair or replace the audio unit. <Ref. to ET-4, REMOVAL, Audio.>

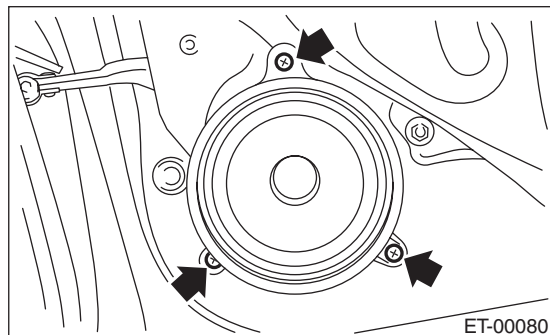
## 2. SWITCH CHECK LIST

Switch	Display
TUNE/TRACK $\wedge$	 UP OK
TUNE/TRACK $\vee$	 DOWN OK
SEEK/SCAN $\wedge$	$\triangle$ UP OK
SEEK/SCAN $\vee$	$\nabla$ DOWN OK
EJECT	EJECT OK
RPT	RPT OK
VOL UP	VOL UP OK
VOL DOWN	VOL DOWN OK
TONE/BAL	BAL OK
1 (Preset)	P-1 OK
2 (Preset)	P-2 OK
3 (Preset)	P-3 OK
4 (Preset)	P-4 OK
5 (Preset)	P-5 OK
6 (Preset)	P-6 OK
LOAD	LOAD OK
AUDIO	AUDIO OK
TEXT	TEXT OK

## 4. Front Speaker

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the front speaker mounting screws.



- 4) Disconnect the harness connector and remove the front speaker.

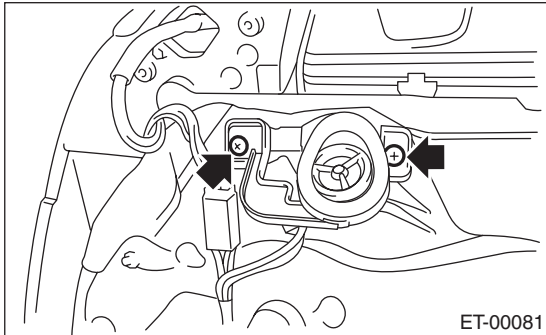
### B: INSTALLATION

Install in the reverse order of removal.

## 5. Tweeter

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the tweeter mounting screws.



- 4) Disconnect the harness connector and remove the tweeter.

### B: INSTALLATION

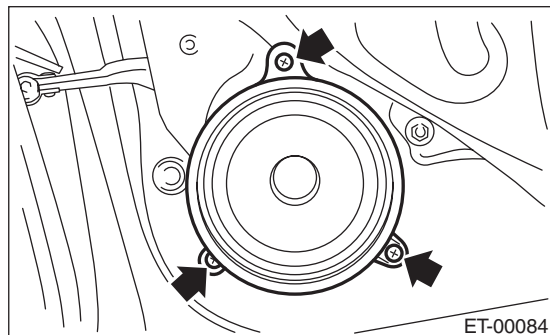
Install in the reverse order of removal.



## 6. Rear Speaker

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the rear speaker mounting screws.



- 4) Disconnect the harness connector and remove the rear speaker.

### B: INSTALLATION

Install in the reverse order of removal.

## 7. Antenna

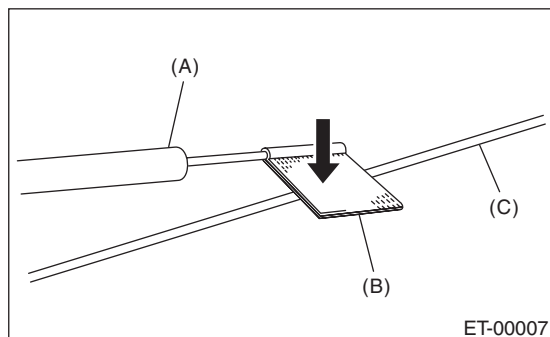
### A: INSPECTION

Measure the resistance between the antenna terminal and each antenna wire.

If an antenna wire is OK, resistance will be less than  $1\ \Omega$ . If an antenna wire is broken, resistance will be more than  $1\ M\Omega$ .

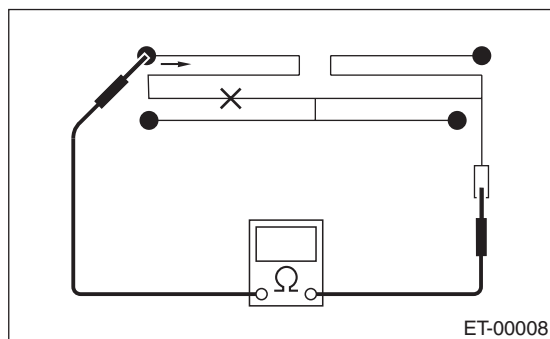
#### NOTE:

When checking the continuity, wind a piece of aluminum foil around the tip of tester probe and press foil against the antenna wire with your finger.



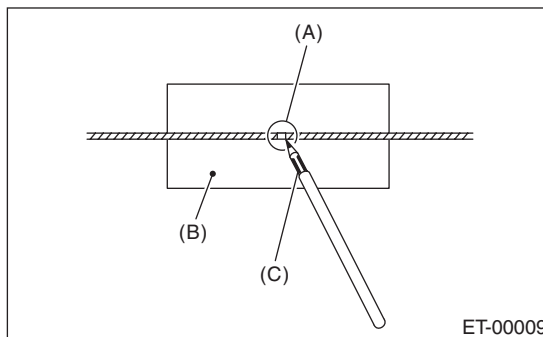
- (A) Tester probe
- (B) Aluminum foil
- (C) Antenna wire

To locate the broken point, move the probe along antenna wire.



### B: REPAIR

- 1) Clean the antenna wire and surrounding area with a cloth dampened by alcohol.
- 2) Paste a thin masking film on the glass along broken wire.
- 3) Apply the conductive silver composition (DU-PONT No. 4817) on the broken portion with a drawing pen.



- (A) Broken portion
- (B) Masking film
- (C) Conductive silver composition

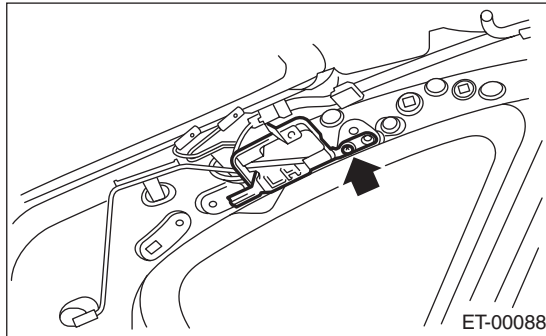
- 4) Dry out the deposited portion.
- 5) After repair has been completed, measure the resistance in repaired wire.

## 8. Antenna Amplifier

### A: REMOVAL

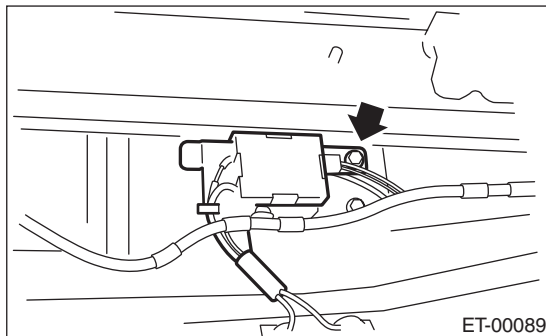
#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear quarter trim. <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 3) Disconnect the harness connectors and terminals.
- 4) Remove the curtain airbag module. <Ref. to AB-18, REMOVAL, Curtain Airbag Module.>
- 5) Remove the screws and detach the antenna amplifier.



#### 2. WAGON MODEL

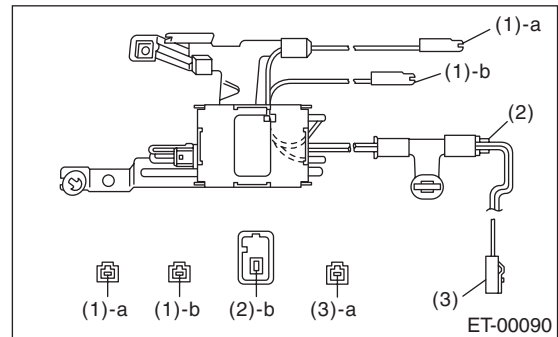
- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 3) Disconnect the harness connectors and terminals.
- 4) Remove the screws and detach the antenna amplifier.



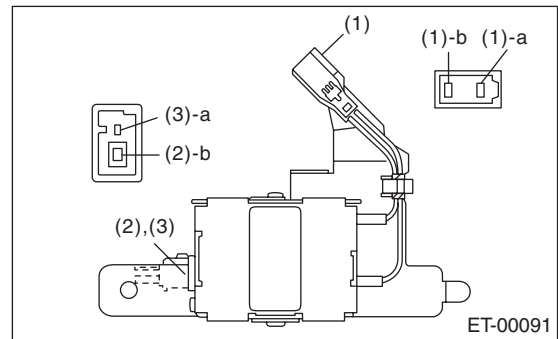
### C: INSPECTION

Measure the resistance of antenna amplifier.

#### • SEDAN MODEL



#### • WAGON MODEL



Terminal No.	Standard
(1)-a and Amplifier body	10 kΩ or more
(1)-b and Amplifier body	10 kΩ or more
(2)-b and Amplifier body	10 kΩ or more
(3)-a and Amplifier body	10 kΩ or more

### B: INSTALLATION

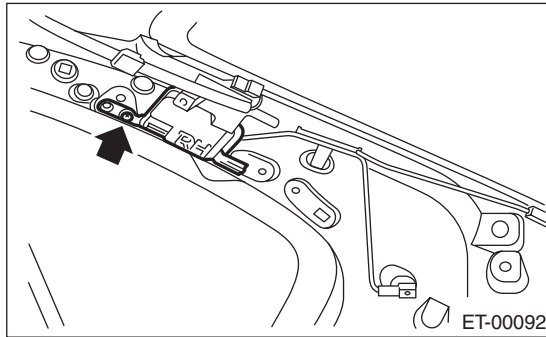
Install in the reverse order of removal.

## 9. Noise Suppressor

### A: REMOVAL

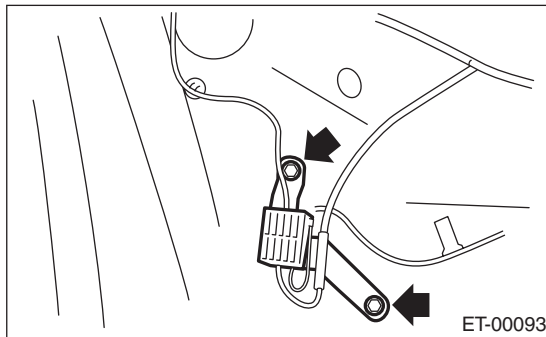
#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear quarter trim. <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 3) Remove the curtain airbag module. <Ref. to AB-18, REMOVAL, Curtain Airbag Module.>
- 4) Disconnect harness connector from the noise suppressor.
- 5) Remove the harness clip.
- 6) Remove the screws and detach the noise suppressor.



#### 2. WAGON MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 3) Disconnect harness connector from the noise suppressor.
- 4) Remove the screws and detach the noise suppressor.



### B: INSTALLATION

Install in the reverse order of removal.

## 10. Navigation System

### A: WIRING DIAGRAM

<Ref. to WI-182, WIRING DIAGRAM, Navigation System.>

### B: INSPECTION

#### 1. CHECK THE OPERATION OF THE NAVIGATION

Start the engine, and then inspect that the opening screen is displayed.

Standard value: The opening screen should be displayed.

OK: Normal

NG: When not displayed, check the signal line connector and the audio connector. If there are no problems in the connecting lines or the lines were repaired, check that the opening screen is displayed.

At this point, if the display is not viewable, the unit is defective.

#### 2. CHECK THE DVD-ROM

An opening screen is displayed, then it switches to the map screen after a while.

When a screen other than the opening screen is displayed, press the «MAP» key.

Standard value: The map screen should be displayed.

OK: Normal

NG: If the map screen is not displayed, check whether the DVD-ROM is set in the navigation system, whether the correct side is set, type of the DVD-ROM, the existence of any scratches, etc. If there are no problems on the DVD-ROM, the main body is defective.

#### 3. CHECK EACH CONNECTION

If there are no problems in the inspections of 1 and 2 above, use "<Ref. to WI-182, WIRING DIAGRAM, Navigation System.>" of the navigation device to perform inspection.

#### 4. SWITCHING TO CONNECTION INSPECTION MODE

1) Press the menu key.

2) Select the navigation setup from the menu screen.

3) Select the navigation information from the navigation setup screen.

4) Select the vehicle signal from the navigation information screen.

5) The display will switch to the vehicle signal (for connection inspection) screen.

6) Check that the display changes according to each operation

ON: Normal

NG: Check the circuit when the display does not change.

#### 5. CHECK THE GPS ANTENNA

NOTE:

When checking the GPS antenna, perform the check operation outdoors to improve the receiver sensitivity.

Make sure that a value other than "zero" is displayed in the GPS item.

OK: Normal

NG: If "No positioning" is displayed, check the GPS antenna connection.

If the GPS display is red, the main unit could be faulty.

#### 6. CHECK THE BACK SENSOR

NOTE:

Before starting inspections, inspect the safety around the rear end of the vehicle.

1) Turn the ignition switch to ON.

2) Pull the parking brake and depress the brake, then put the gear in reverse.

3) Make sure that "On" is lit in the back sensor item.

Standard Value: "On" should be lit.

OK: Normal

NG: If "On" does not light, check the signal line connection. If there are no problems, the unit could be faulty.

### **7. CHECK THE ILLUMINATION**

1) Turn the lighting switch to level 1.

**NOTE:**

Make sure that the bright switch is not turned ON at this time.

2) Make sure that "On" lights in the illumination item, then the screen fades out.

Standard Value: "On" should be lit.

OK: Normal

NG: If "On" does not light, check the signal line connection. If there are no problems, the unit could be faulty.

### **8. CHECK THE PARKING SIGNAL**

**NOTE:**

The side brake signal is normally "OFF", so operating it will produce no change.

### **9. CHECK SPEED SENSOR**

**NOTE:**

- Before starting inspections, inspect the safety around the vehicle.

- Lift up the vehicle as necessary.

- When the diagnostic trouble code is input in the VDCCM, perform the Clear Memory operation.

1) Move the vehicle 2 to 3 meters (6.6 to 9.8 ft).

2) Check that the numbers from the speed sensor are displayed.

Standard value: Vehicle speed is to be shown in numbers.

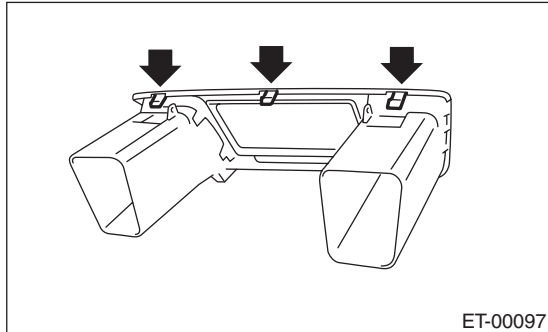
OK: Normal

NG: If vehicle speed is not displayed, check the signal line connection. If there are no problems, the unit could be faulty.

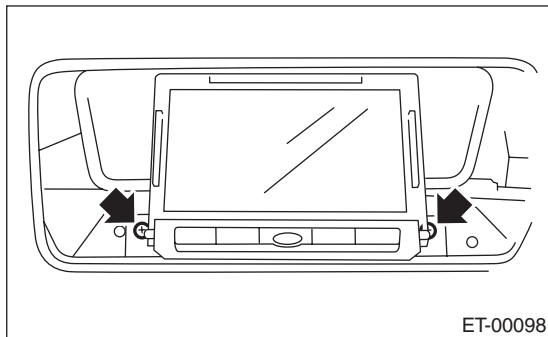
## 11. Navigation Display

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the clip, and remove the center upper panel.



- 3) Remove the display mounting screws.



- 4) Disconnect the harness connector and remove the navigation display.

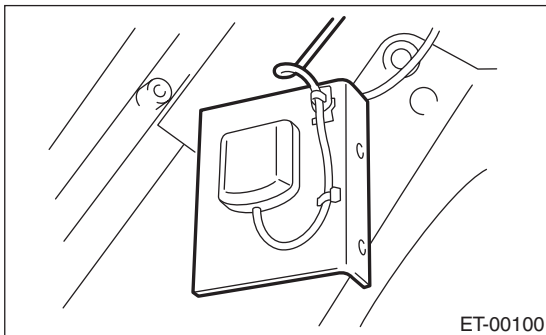
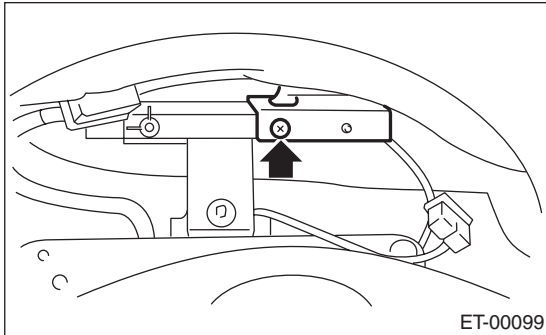
### B: INSTALLATION

Install in the reverse order of removal.

## 12. GPS Antenna

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
- 3) Remove the GPS antenna mounting screws to remove the GPS antenna.



- 4) Remove the audio. <Ref. to ET-4, REMOVAL, Audio.>
- 5) Remove the GPS antenna cord connector from the steering support beam stay (on the driver's side).

### B: INSTALLATION

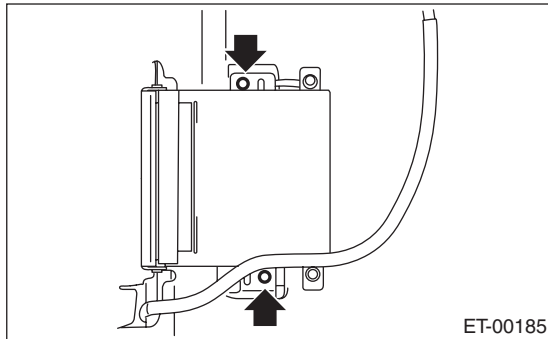
Install in the reverse order of removal.



## 13. Navigation Body

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Slide the driver's seat to the forward position.
- 3) Disconnect the connector.
- 4) Remove the bolts and then remove the navigation unit.



### B: INSTALLATION

Install in the reverse order of removal.

## 14.AUX Input Terminal

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 3) Disconnect the harness connector, and remove the AUX input terminal from the console box.

### B: INSTALLATION

Install in the reverse order of removal.

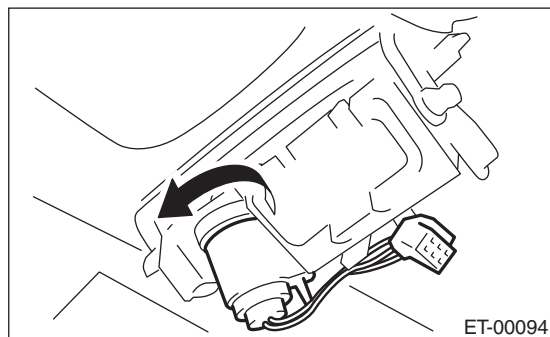
## 15. Front Accessory Power Supply Socket

### A: WIRING DIAGRAM

<Ref. to WI-180, WIRING DIAGRAM, Front Accessory Power Supply Socket System.>

### B: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console front panel. <Ref. to EI-55, REMOVAL, Center Console.>
- 3) Disconnect the harness connector, and remove the accessory power supply socket.



### C: INSTALLATION

Install in the reverse order of removal.

# Rear Accessory Power Supply Socket

ENTERTAINMENT

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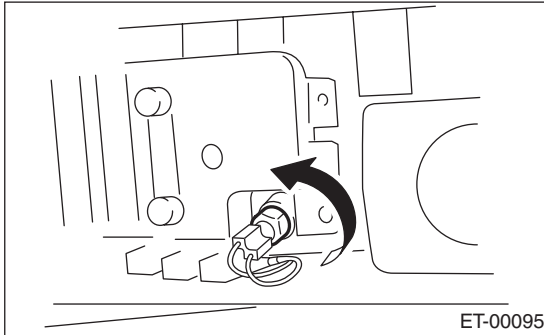
## 16. Rear Accessory Power Supply Socket

### A: WIRING DIAGRAM

<Ref. to WI-181, WIRING DIAGRAM, Rear Accessory Power Supply Socket System.>

### B: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 3) Disconnect the harness connector, and remove the accessory power supply socket.



### C: INSTALLATION

Install in the reverse order of removal.

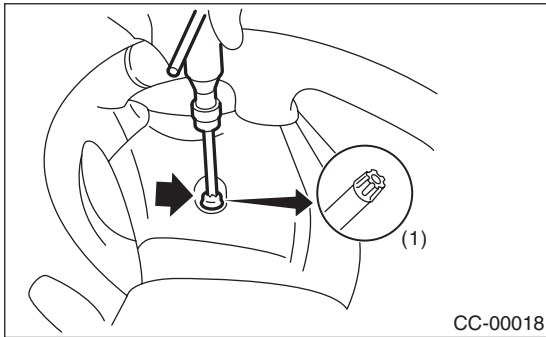
## 17. Steering Satellite Switch

### A: REMOVAL

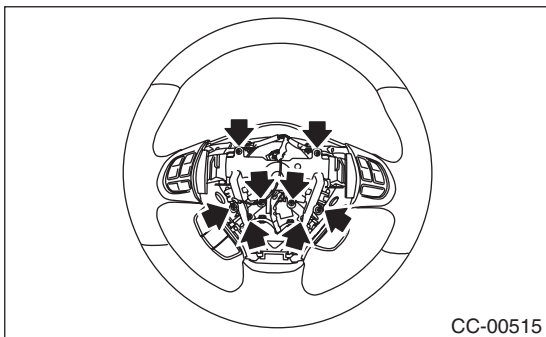
**WARNING:**

Before servicing, be sure to read the notes in the “AB” section for proper handling of the driver’s airbag module. <Ref. to AB-4, CAUTION, General Description.>

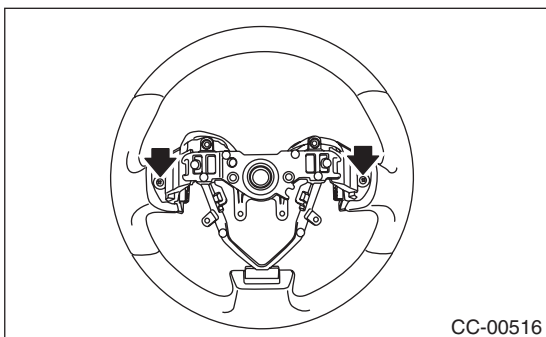
- 1) Set the front wheels in straight ahead position.
- 2) Turn the ignition switch to OFF.
- 3) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 4) Using TORX® bit T30 (1), loosen two TORX® bolts which secure the driver’s airbag module.



- 5) Disconnect the airbag module connector on back of the airbag module. <Ref. to AB-8, PROCEDURE, Airbag Connector.>
- 6) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 7) Remove the screws to remove the lower cover from steering wheel.



- 8) Loosen the screws on the backside of the steering wheel and remove the satellite switch.

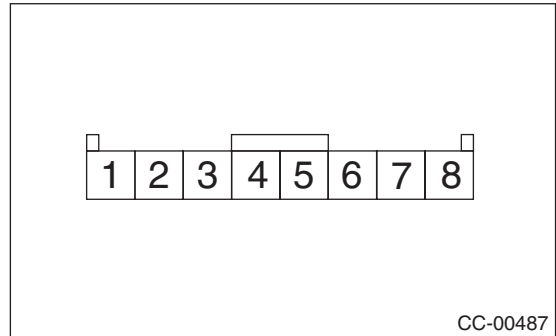


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between satellite switch connector terminals.



Switch	Position	Terminal No.	Standard value
Mute Volume (+) Volume (-) Mode Seek (∧) Seek (∨)	All OFF	4 and 5	Approx. 4.7 kΩ
Mute	ON	4 and 5	Approx. 22 Ω
Volume (+)	ON	4 and 5	Approx. 90 Ω
Volume (-)	ON	4 and 5	Approx. 200 Ω
Mode	ON	4 and 5	Approx. 360 Ω
Seek (∧)	ON	4 and 5	Approx. 690 Ω
Seek (∨)	ON	4 and 5	Approx. 1.15 kΩ

If NG, replace the cruise control command switch.

# Steering Satellite Switch

ENTERTAINMENT

---

### 1. General Description

#### A: CAUTION

- Before disassembling or reassembling parts, always disconnect the battery ground cable from battery. When replacing the audio, control module and other parts provided with memory functions, record the memory contents before disconnecting the battery ground cable. Otherwise, the memory is cleared.
- Reassemble the parts in the reverse order of disassembly procedure unless otherwise indicated.
- Adjust parts to the given specifications.
- Connect the connectors securely during reassembly.
- After reassembly, make sure functional parts operate smoothly.

#### B: PREPARATION TOOL

##### 1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
TORX® bit T30	Used for removing/installing driver's airbag module.

## 2. Horn System

### A: WIRING DIAGRAM

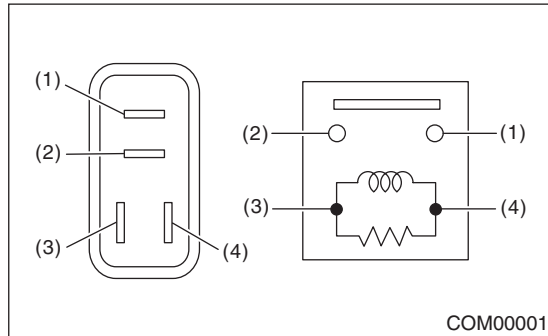
#### 1. HORN

<Ref. to WI-185, WIRING DIAGRAM, Horn System.>

### B: INSPECTION

#### 1. HORN RELAY

Measure the security horn relay resistance between terminals (indicated in the table below) when connecting terminal No. 4 to battery positive terminal and terminal No. 3 to battery ground terminal.



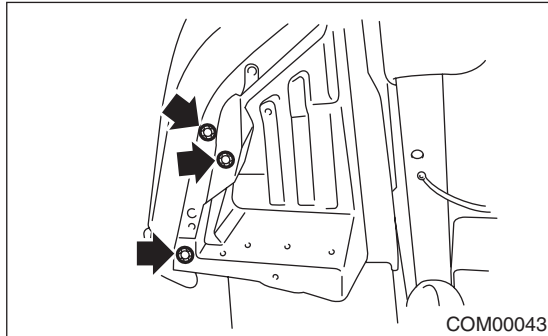
Continuity	Terminal No.	Standard
Yes	1 and 2	Less than 1 $\Omega$
No		1 M $\Omega$ or more



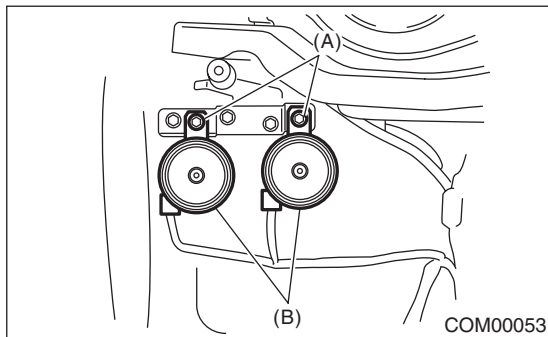
### 3. Horn

#### A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the three clips and peel the right side lower mud guard upward.



- 3) Remove the horn bracket mounting bolt (A).
- 4) Disconnect the harness connector and remove the horn assembly (B).

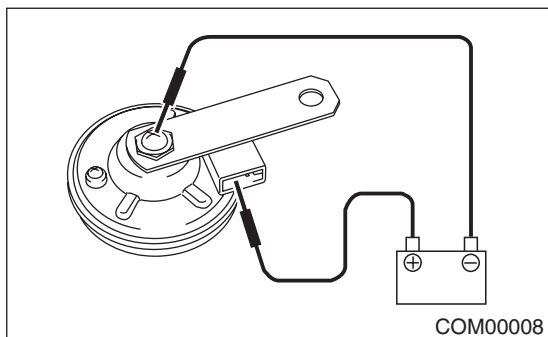


#### B: INSTALLATION

Install in the reverse order of removal.

#### C: INSPECTION

With 12 V direct current supplied between horn terminals, check that the horn sounds properly.



## 4. Horn Switch

### A: REMOVAL

**CAUTION:**

Before servicing, be sure to read the notes in the AB section for proper handling of the driver's airbag module. <Ref. to AB-4, CAUTION, General Description.>

**NOTE:**

Horn switch is a unit with the driver's airbag module.

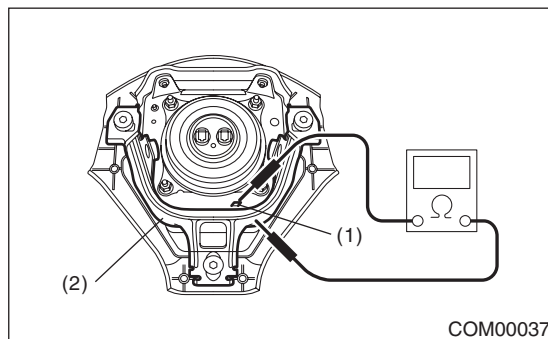
- 1) Disconnect the ground cable from battery.
- 2) Remove the driver's airbag module. <Ref. to AB-14, REMOVAL, Driver's Airbag Module.>

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the resistance between horn switch terminal and airbag module bracket.



- (1) Airbag module bracket
- (2) Horn switch terminal

Switch position	Terminal No.	Resistance
When horn switch is pushed.	Horn switch terminal and airbag module bracket	Less than 1 Ω
When horn switch is not pushed.		1 MΩ or more

# Horn Switch

COMMUNICATION SYSTEM

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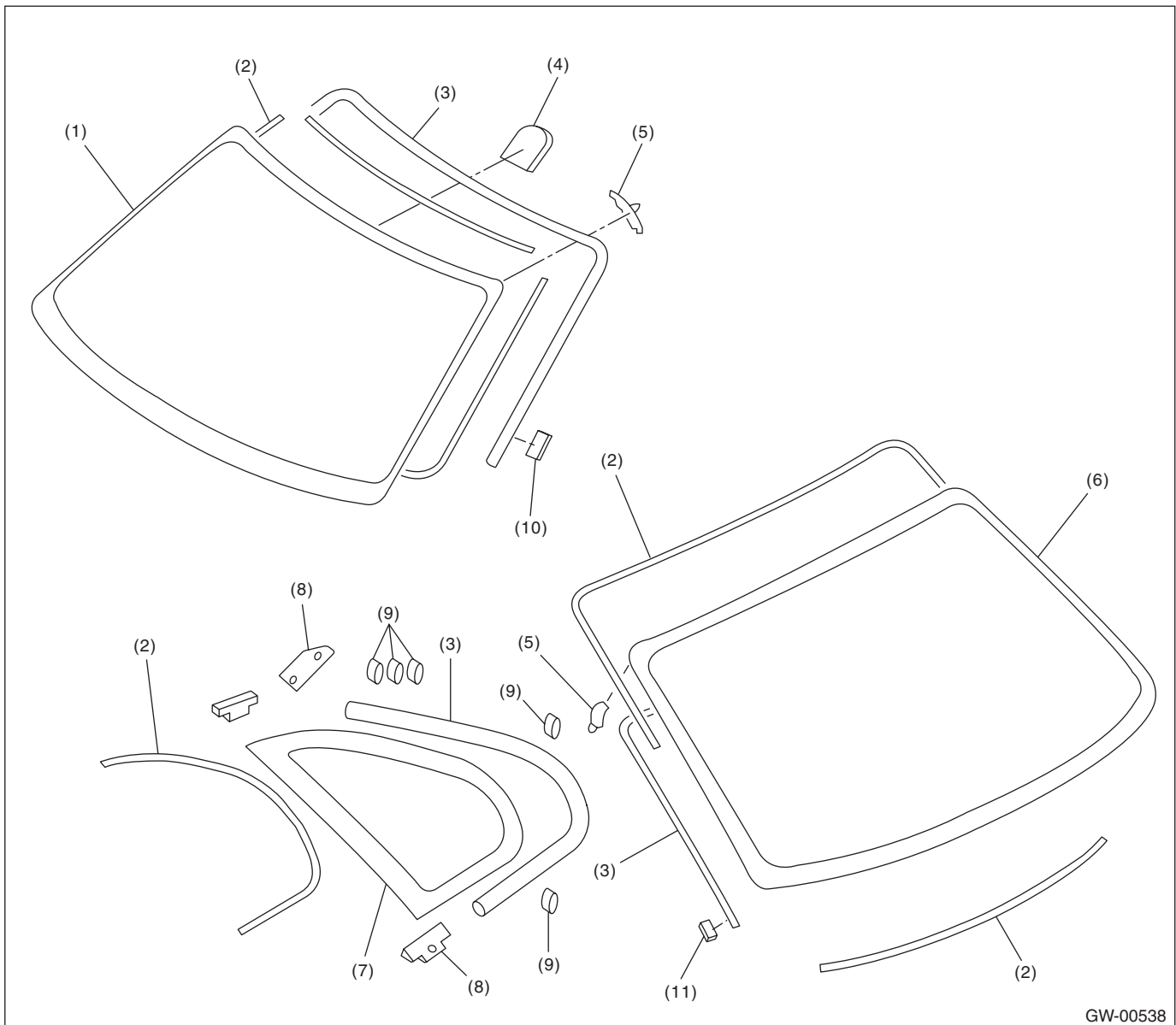
# General Description

GLASS/WINDOWS/MIRRORS

## 1. General Description

### A: COMPONENT

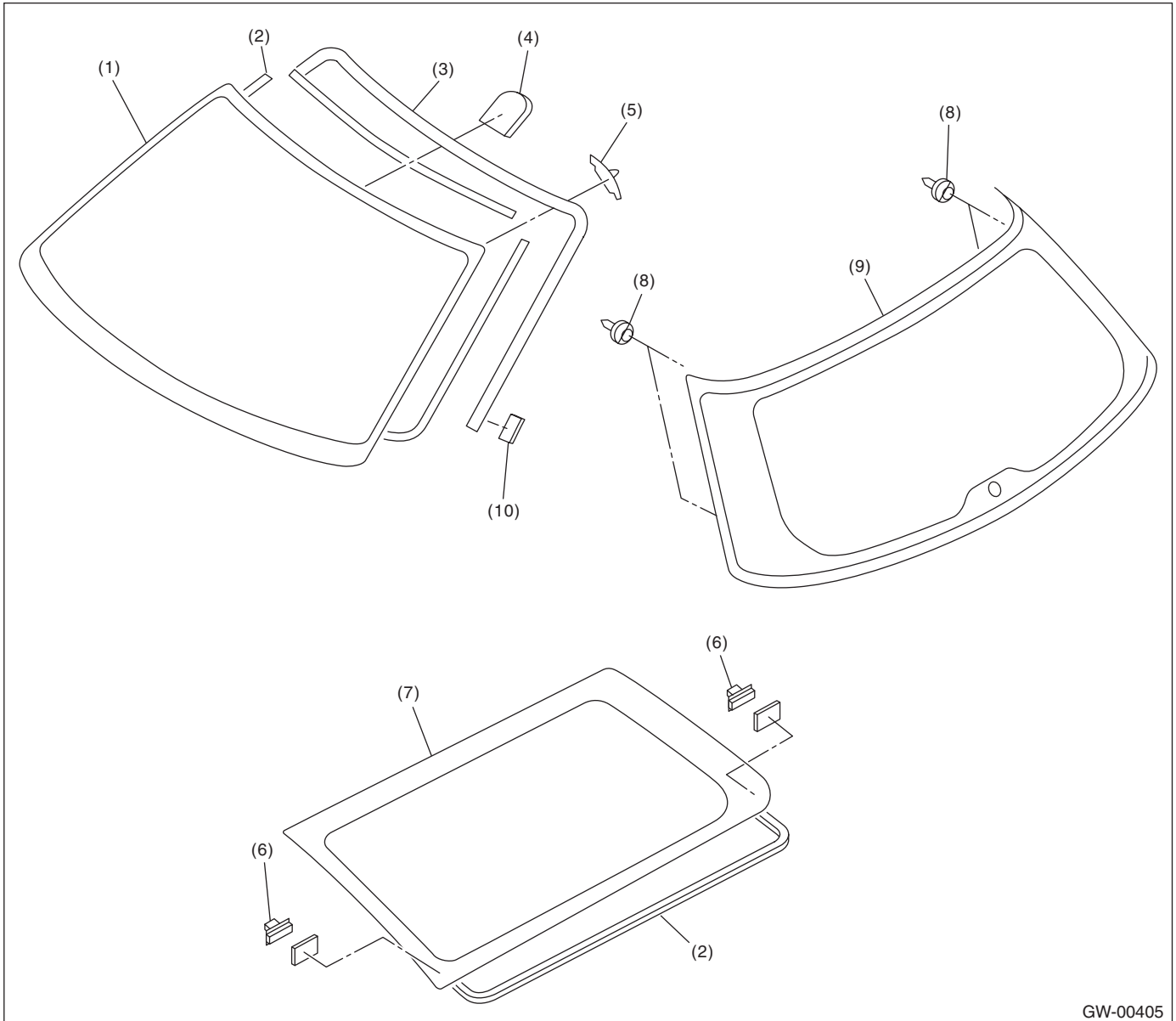
#### 1. FIXED GLASS (SEDAN MODEL)



GW-00538

- |                           |                       |             |
|---------------------------|-----------------------|-------------|
| (1) Windshield glass      | (5) Locating pin      | (9) Clip    |
| (2) Dam rubber            | (6) Rear window glass | (10) Seal   |
| (3) Molding               | (7) Six light glass   | (11) Spacer |
| (4) Rearview mirror mount | (8) Bracket           |             |

## 2. FIXED GLASS (WAGON MODEL)



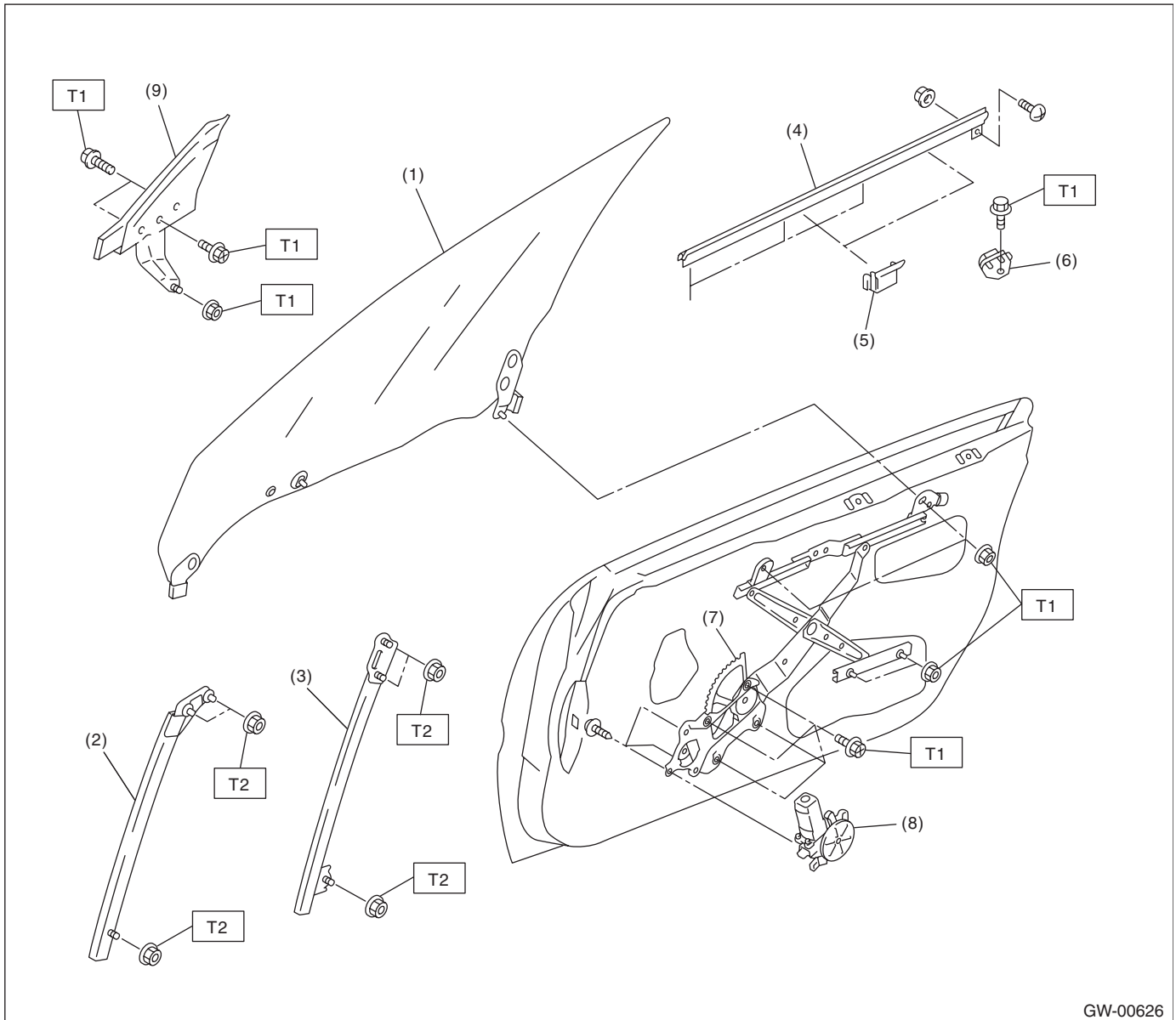
GW-00405

- |                           |                        |                     |
|---------------------------|------------------------|---------------------|
| (1) Windshield glass      | (5) Locating pin       | (8) Locating pin    |
| (2) Dam rubber            | (6) Fastener           | (9) Rear gate glass |
| (3) Molding               | (7) Rear quarter glass | (10) Seal           |
| (4) Rearview mirror mount |                        |                     |

# General Description

GLASS/WINDOWS/MIRRORS

## 3. FRONT DOOR GLASS



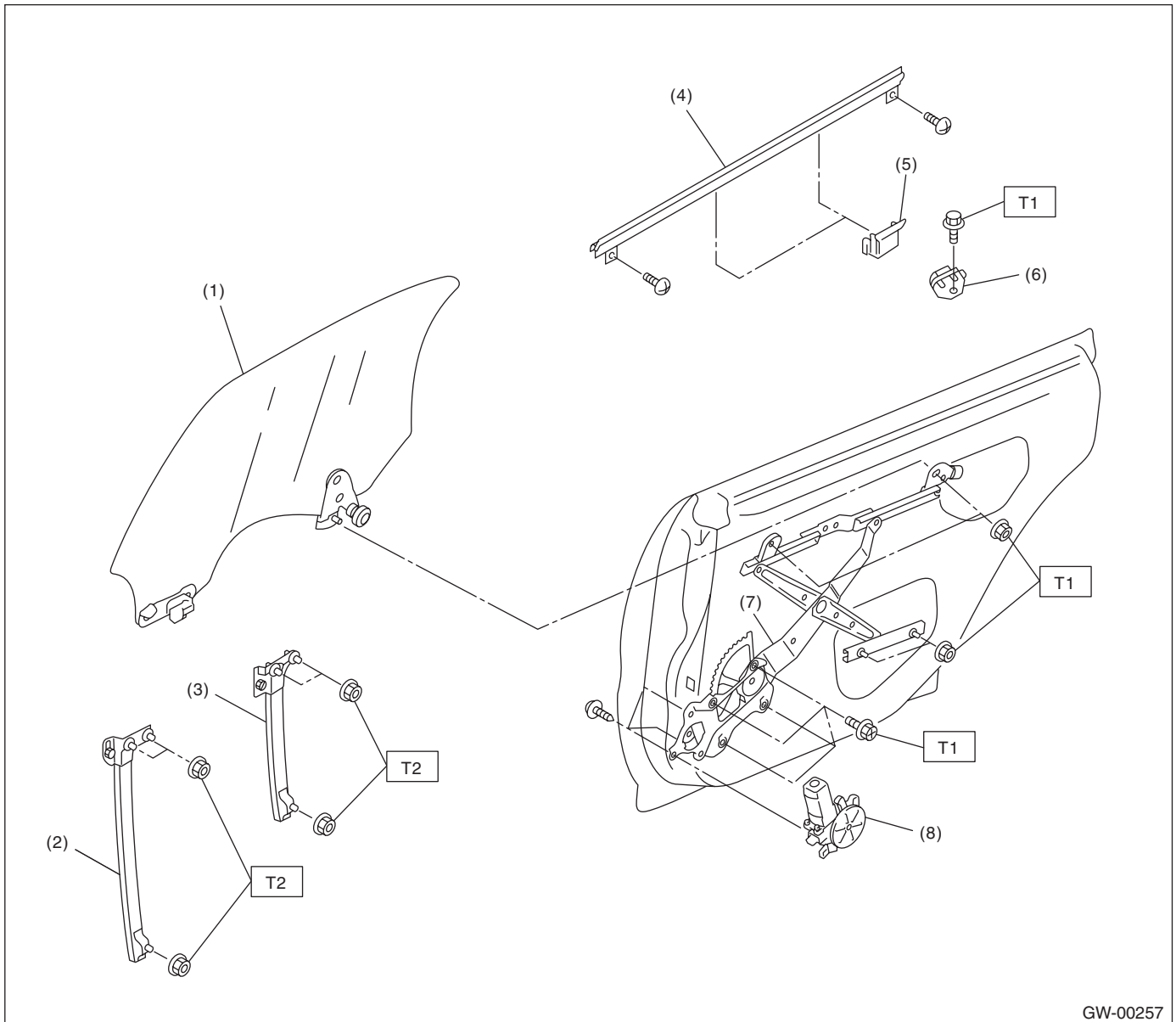
- |                        |                        |
|------------------------|------------------------|
| (1) Glass              | (6) Stabilizer (inner) |
| (2) Door sash (front)  | (7) Regulator ASSY     |
| (3) Door sash (rear)   | (8) Motor ASSY         |
| (4) Weather strip      | (9) Mirror gusset      |
| (5) Stabilizer (outer) |                        |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.4 (0.75, 5.5)**

**T2: 13.7 (1.4, 10.1)**

## 4. REAR DOOR GLASS



GW-00257

- |                       |                        |
|-----------------------|------------------------|
| (1) Glass             | (5) Stabilizer (outer) |
| (2) Door sash (front) | (6) Stabilizer (inner) |
| (3) Door sash (rear)  | (7) Regulator ASSY     |
| (4) Weather strip     | (8) Motor ASSY         |

**Tightening torque: N·m (kgf·m, ft·lb)**

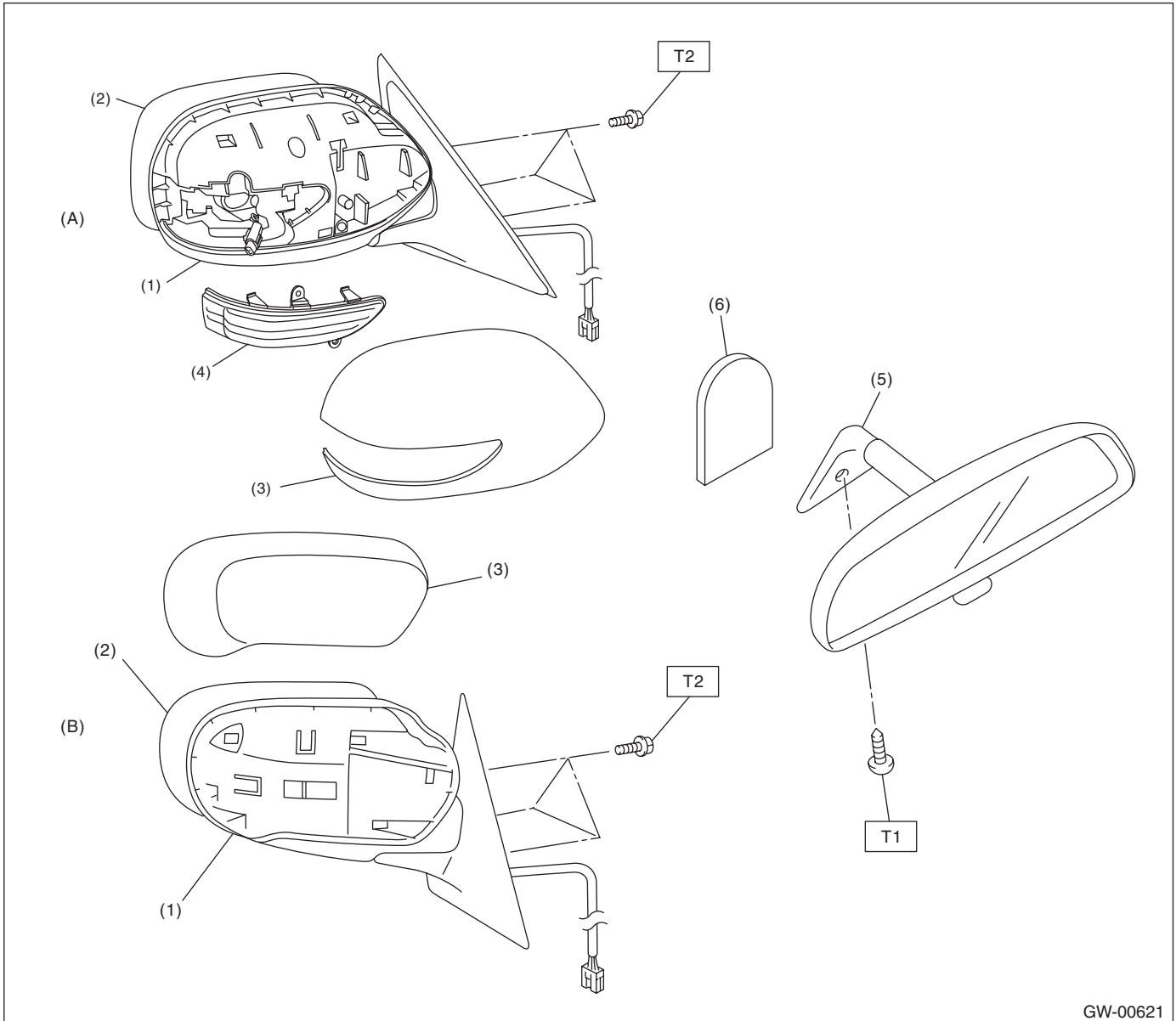
**T1: 7.4 (0.75, 5.5)**

**T2: 13.7 (1.4, 10.1)**

# General Description

## GLASS/WINDOWS/MIRRORS

### 5. MIRROR



GW-00621

(A) Model with side turn signal light

(B) Model without side turn signal light

(1) Outer mirror

(4) Side turn signal light

(2) Mirror

(5) Rearview mirror

(3) Scalp cap

(6) Mount

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 1.9 (0.19, 1.4)**

**T2: 4.5 (0.46, 3.3)**

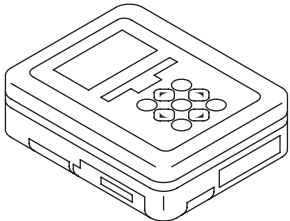
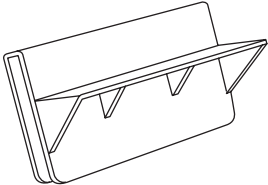
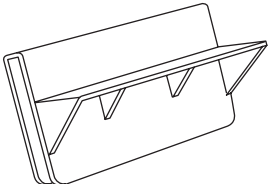
### B: CAUTION

- When electrical connectors are disconnected, always conduct an operational check after connecting them again.
- Avoid impact and damage to the glass.



## C: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and troubleshooting for electrical system.
 ST61299AE000	61299AE000	SPACER	Used for adjusting the upper end position of the front door glass. (Glass thickness: 5 mm (0.197 in))
 ST61299AE010	61299AE010	SPACER	Used for adjusting the upper end position of rear door glass. (Glass thickness: 4 mm (0.157 in))

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for checking voltage and continuity.
Piano wire	Used for removing the window glass.
Windshield glass knife	Used for removing the window glass.
TORX® T20	Used for removing and installing the rearview mirror.

# Power Window System

GLASS/WINDOWS/MIRRORS

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## 2. Power Window System

### A: WIRING DIAGRAM

<Ref. to WI-186, Power Window System.>

### B: INSPECTION

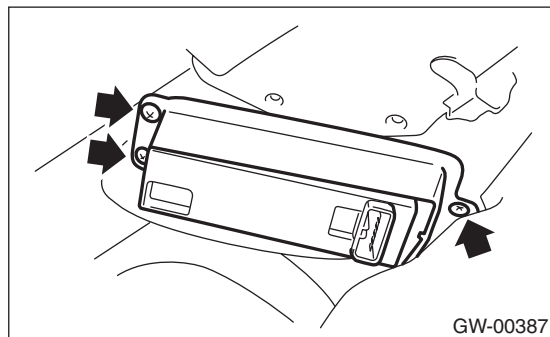
Symptom	Repair order
All power windows do not operate.	<ol style="list-style-type: none"><li>1. Fuse (SBF-4)</li><li>2. Power window circuit breaker</li><li>3. Power window relay</li><li>4. Wiring harness</li><li>5. Body integrated unit</li></ol>
Particular window does not operate.	<ol style="list-style-type: none"><li>1. Power window main switch</li><li>2. Power window sub-switch</li><li>3. Power window motor</li><li>4. Wiring harness</li></ol>
"Window Lock" does not operate.	Power window main switch

## 3. Power Window Control Switch

### A: REMOVAL

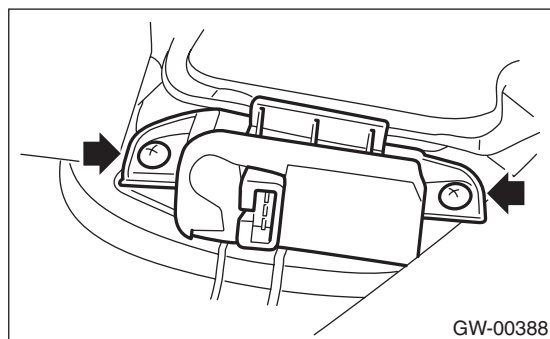
#### 1. MAIN SWITCH

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim.  
<Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Disconnect the harness connector.
- 4) Remove the screws from the reverse side of the front door trim to remove the power window main switch.



#### 2. SUB-SWITCH

- 1) Disconnect the ground cable from the battery.
- 2) Remove the door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Disconnect the connector.
- 4) Remove the screws from the reverse side of door trim to remove the power window sub-switch.



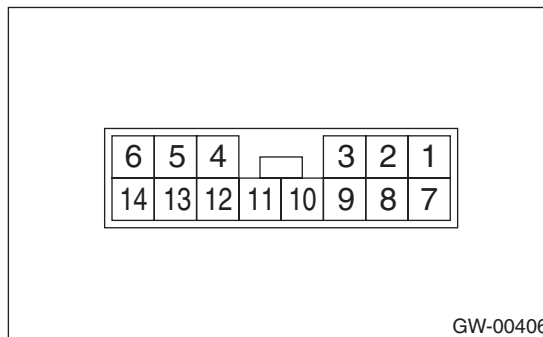
### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

#### 1. MAIN SWITCH

Measure the switch resistance.



	Switch position	Terminal No.	Standard
Driver's side	UP	10 and 2 7 and 1	Less than 1 Ω
	OFF	2 and 7 1 and 2	Less than 1 Ω
	DOWN	10 and 1 7 and 2	Less than 1 Ω
	AUTO DOWN	10 and 1 7 and 2	Less than 1 Ω
Passenger's side	UP	10 and 14 7 and 11	Less than 1 Ω
	OFF	7 and 14 7 and 11	Less than 1 Ω
	DOWN	10 and 11 7 and 14	Less than 1 Ω
Rear RH seat	UP	10 and 13 7 and 12	Less than 1 Ω
	OFF	7 and 13 7 and 12	Less than 1 Ω
	DOWN	10 and 12 7 and 13	Less than 1 Ω
Rear LH seat	UP	10 and 8 7 and 9	Less than 1 Ω
	OFF	7 and 8 7 and 9	Less than 1 Ω
	DOWN	9 and 10 7 and 8	Less than 1 Ω

Replace the main switch if faulty.

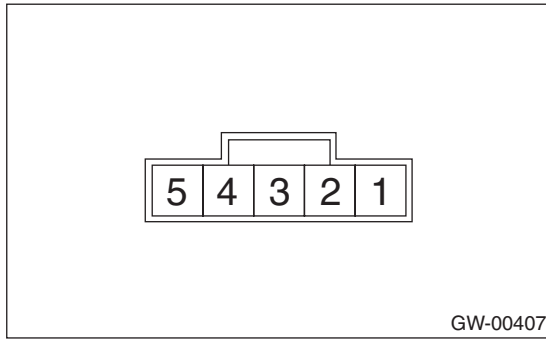
# Power Window Control Switch

GLASS/WINDOWS/MIRRORS

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## 2. SUB-SWITCH

Measure the switch resistance.



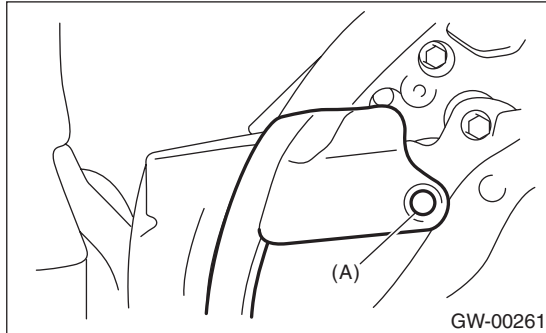
	Switch position	Terminal No.	Standard
Passenger's side and rear seat	UP	2 and 3 4 and 5	Less than 1 $\Omega$
	OFF	1 and 2 4 and 5	Less than 1 $\Omega$
	DOWN	1 and 2 3 and 4	Less than 1 $\Omega$

Replace the sub-switch if faulty.

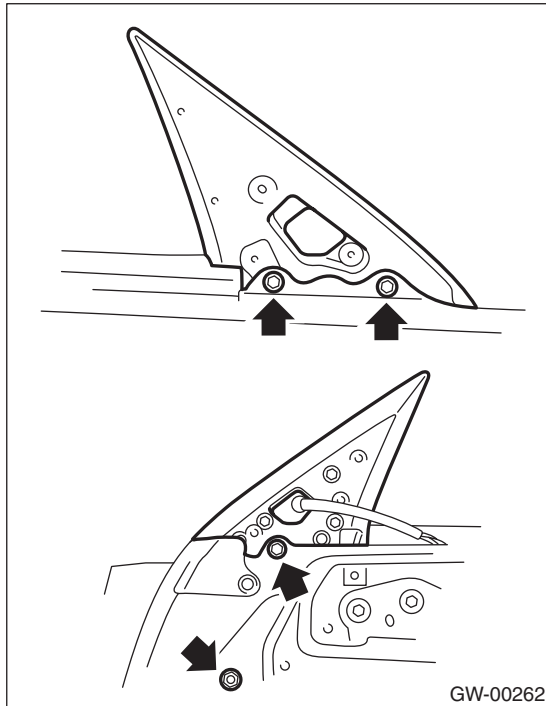
## 4. Front Door Glass

### A: REMOVAL

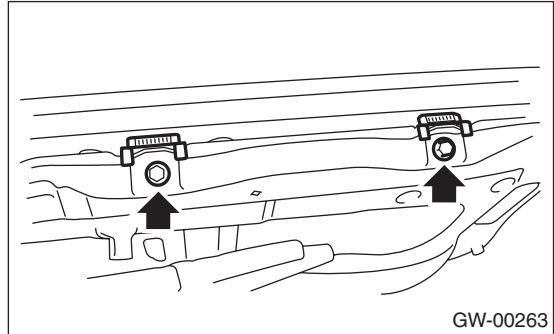
- 1) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 2) Remove the sealing cover. <Ref. to EB-19, REMOVAL, Front Sealing Cover.>
- 3) Remove the outer mirror assembly. <Ref. to GW-19, REMOVAL, Outer Mirror Assembly.>
- 4) Remove clip (A), and remove the front end of the weather strip.



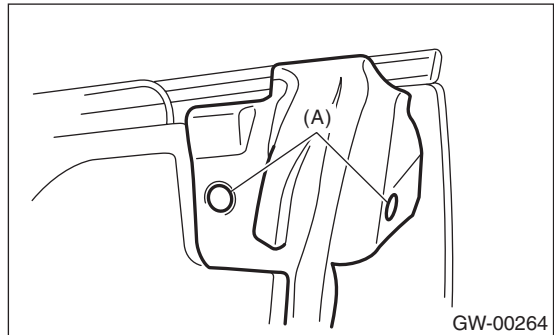
- 5) Remove the gusset.



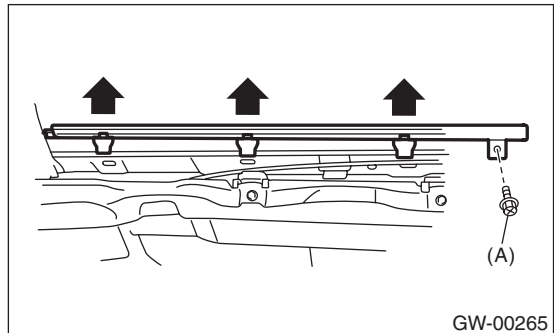
- 6) Remove the stabilizers.



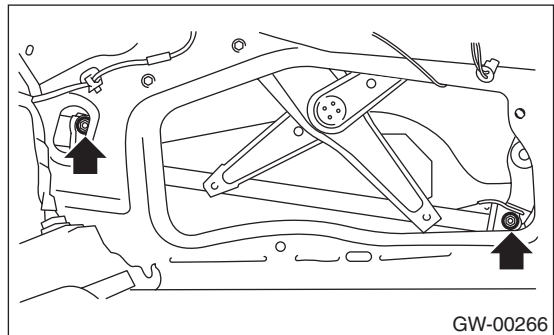
- 7) Remove clips (A), and remove the rear end of the weather strip.



- 8) Remove screw (A) from the rear end of the weather strip outer, to remove the weather strip outer.



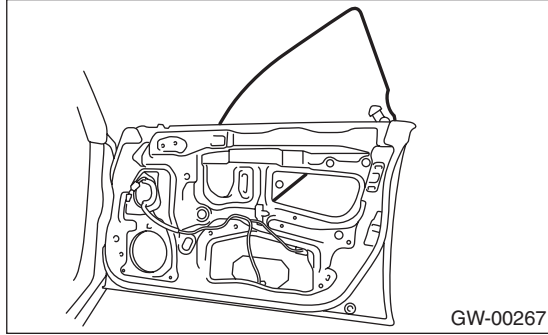
- 9) Operate the power window switch to move the glass to the position shown in the figure, then remove the two nuts through the service holes.



# Front Door Glass

## GLASS/WINDOWS/MIRRORS

10) Remove the door glass.



### CAUTION:

- Since the gear may be disengaged, do not turn regulator in the closing direction after removing glass.
- Avoid impact and damage to the glass.

## B: INSTALLATION

1) Install in the reverse order of removal.

### CAUTION:

Make sure that the glass stay is placed securely in sash.

2) Adjust the front door glass. <Ref. to GW-12, ADJUSTMENT, Front Door Glass.>

### Tightening torque:

Refer to “COMPONENT” of “General Description”. <Ref. to GW-4, FRONT DOOR GLASS, COMPONENT, General Description.>

## C: ADJUSTMENT

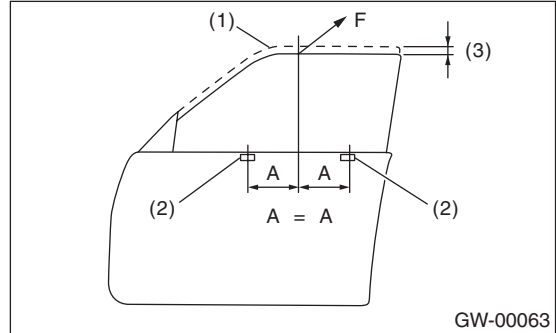
### NOTE:

Before adjustment, ensure that all adjusting bolts of stabilizer, upper stopper and sash are loose and door glass rises until it makes contact with the weather strip.

1) Temporarily tighten the adjusting bolt on one side of the rear sash, at the midpoint of the slotted hole in the inner panel.

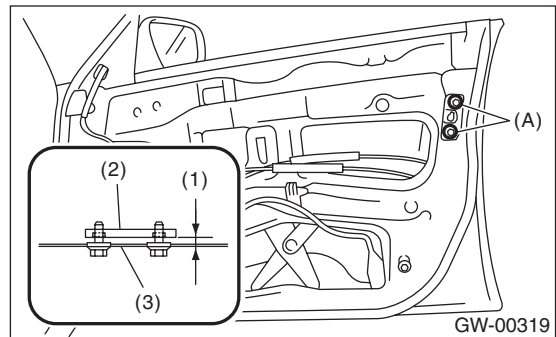
2) Temporarily tighten the regulator B channel at the top position of slotted hole.

3) Lower the door glass 10 — 15 mm (0.39 — 0.59 in) from fully closed position. While applying an outward pressure (F) of  $45.0 \pm 5.0$  N ( $4.5 \pm 0.5$  kgf,  $9.9 \pm 1.1$  lb) to the upper edge of the glass above the midpoint of the two outer stabilizers, press the inner stabilizer to the glass at a pressure of  $25 \pm 5$  N ( $2.5 \pm 0.5$  kgf,  $5.5 \pm 1.1$  lb) to secure it.

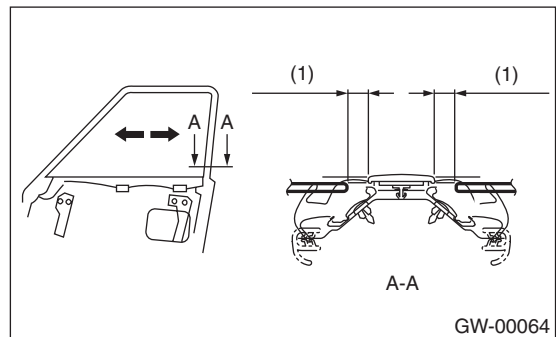


- (1) Fully closed position
- (2) Stabilizer
- (3) 10 — 15 mm (0.39 — 0.59 in)

4) To adjust the clearance between front glass and center pillar cover, loosen nuts (A), and move the glass sash back and forth until the clearance becomes the value shown.

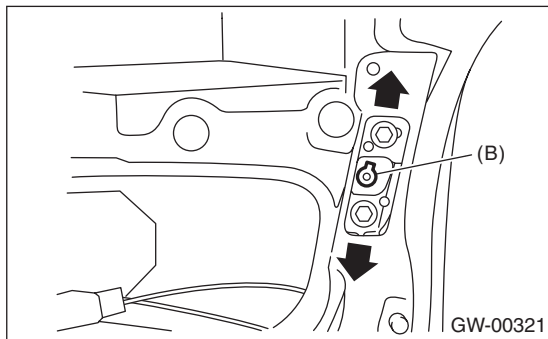
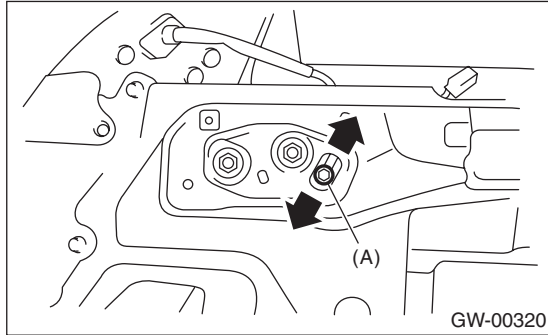


- (1) Adjust the lines parallel
- (2) Sash
- (3) Inner panel

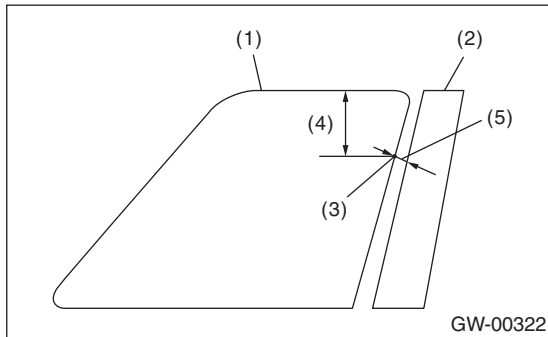


- (1) 11 mm (0.433 in)

5) To adjust the upper end and lower end of the center pillar, loosen the stopper bolt (A) or nut (B) securing the door sash (front, rear), and move the stopper position until the clearance between center pillar cover is equal.

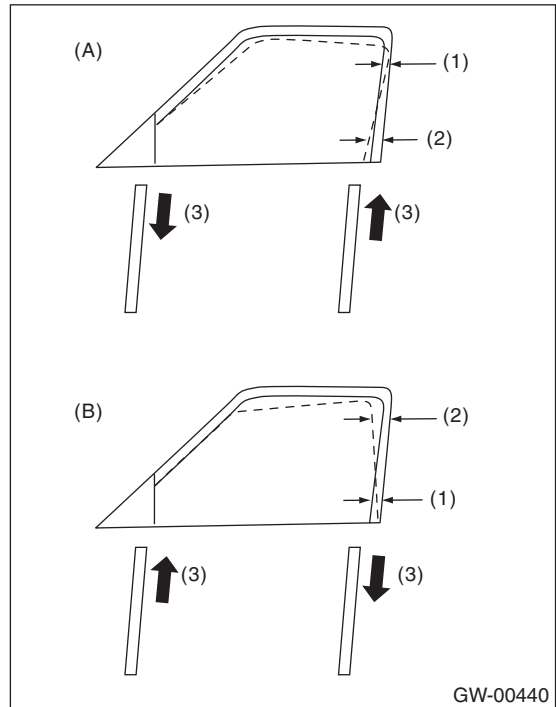


**CAUTION:**  
Measure the clearance between center pillar at 50 mm (1.969 in) from upper end of window glass.



- (1) Glass
- (2) Center pillar cover
- (3) Check point
- (4) 50 mm (1.969 in)
- (5) 11 mm (0.433 in)

6) Adjust so that the upper and lower ends of the center pillar are the same size.

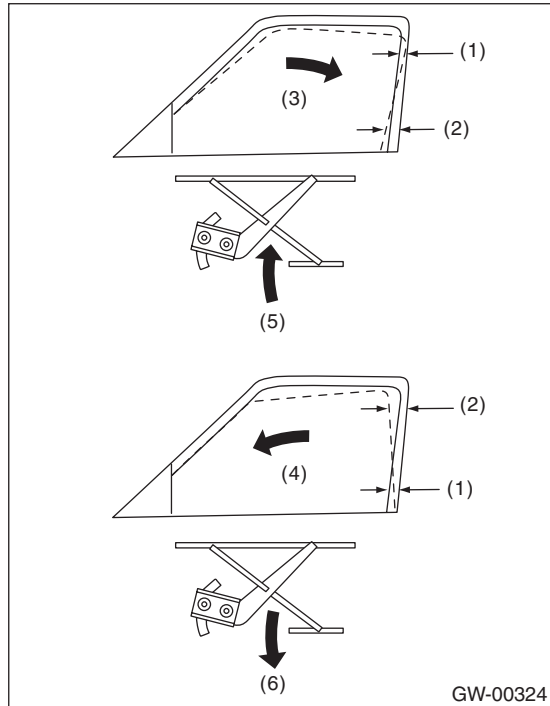


- (A) Glass tilts too far rearward
- (B) Glass tilts too far forward
- (1) Narrow
- (2) Wide
- (3) Stopper adjusting direction

# Front Door Glass

## GLASS/WINDOWS/MIRRORS

7) After adjusting the clearance between the center pillar, raise and lower the glass several times to check glass contact to the stopper when the glass is fully closed. Adjust the centerpillar clearance to contact the front and rear stopper simultaneously.

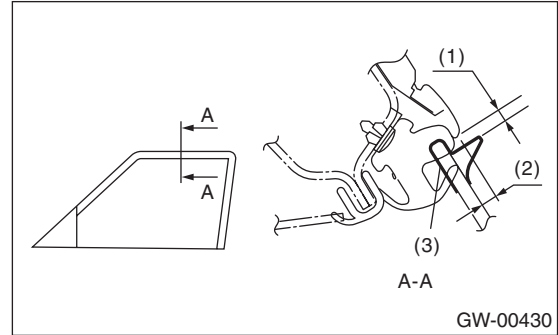


- (1) Narrow
- (2) Wide
- (3) When the stopper of the door sash (front) contacts first
- (4) When the stopper of the door sash (rear) contacts first
- (5) Raise B channel
- (6) Lower B channel

8) For glass stroke adjustment, attach special tool to the glass, close door, and raise the glass to the top edge using regulator until positional relationship between glass and weather strip becomes as shown. And secure the glass so that the upper stopper touches the glass holder without fail.

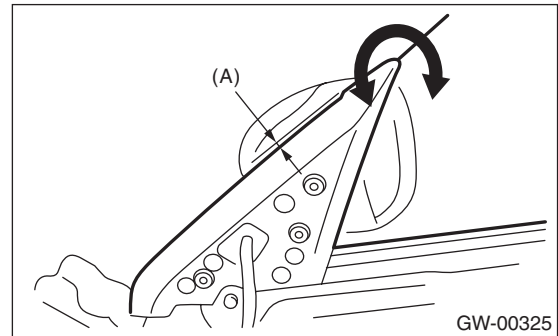
ST 61299AE000 SPACER

(Glass thickness: 5 mm (0.197 in) for front door glass)



- (1) 3.2 — 4.8 mm (0.126 — 0.189 in)
- (2) When re-using weather strip: 5.5 mm (0.217 in)  
When replacing the weather strip: 3 mm (0.118 in)
- (3) ST

For preventing wind noise, adjust the glass at the position where the tip of the gusset is raised up slightly.



- (A) 0 — 1.5 mm (0 — 0.059 in)

9) After stabilizer adjustment, carry out glass cohesion adjustment. First, visually ensure the positional relationship between the retainer & molding and the glass of the roof side, then start the rear sash adjustment. Attach the ST to the glass and adjust two adjusting bolts alternately step by step, to obtain dimensions shown below (cross-section A).

### NOTE:

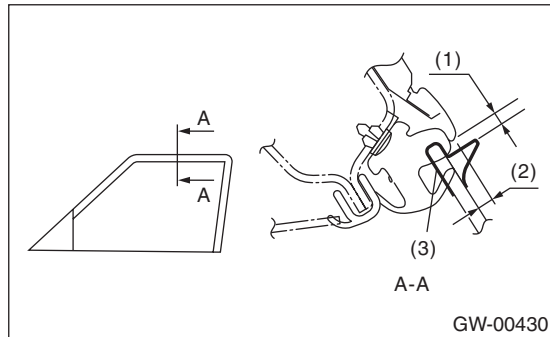
If two nuts are loosened at the same time, the sash moves back and forth. Therefore, when one nut is adjusted, secure the other.



10) Make the same adjustment of two adjusting bolts of rear sash.

ST 61299AE000 SPACER

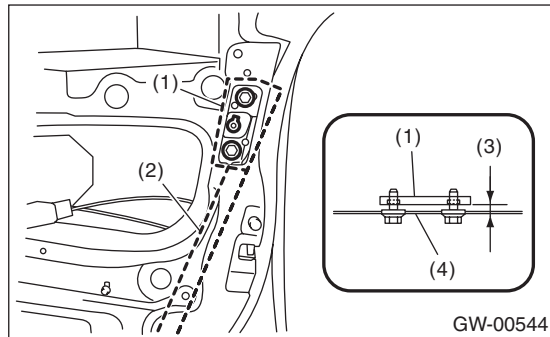
(Glass thickness: 5 mm (0.197 in) for front door glass)



- (1) 3.2 — 4.8 mm (0.126 — 0.189 in)
- (2) When re-using weather strip: 5.5 mm (0.217 in)  
When replacing the weather strip: 3 mm (0.118 in)
- (3) ST

**NOTE:**

Do not tilt the sash bracket to inner panel during adjustment. If tilting, the regulator does not operate smoothly.



- (1) Sash bracket
- (2) Rear sash
- (3) Adjust the lines parallel
- (4) Inner panel

11) Make adjustment of front sash in the same manner as that of rear sash.

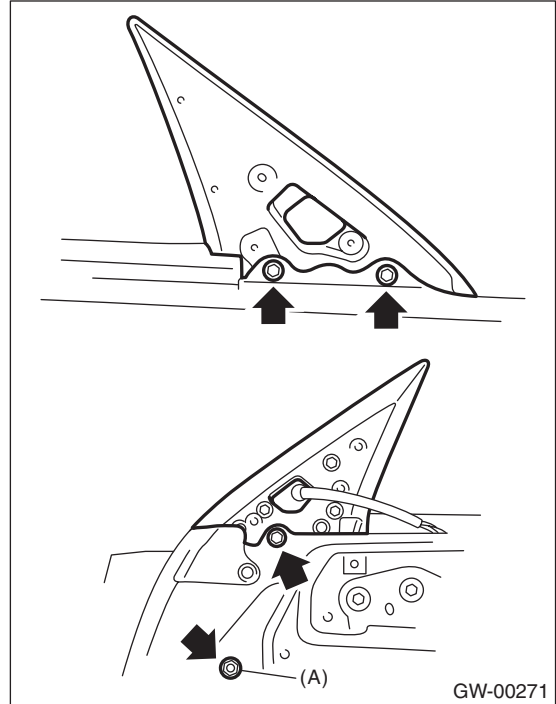
**NOTE:**

Although front and rear sashes must, as a rule, be adjusted in the same manner, in some door installation, the adjustment in a different manner may be required. However, adjustment of one sash to the maximum amount and the other to the minimum amount is not permitted. Such adjustment may result in applying excessive load against regulator.

12) After adjustments, tighten the nuts.

13) After adjustment of the glass, close the door. If there is a gap between outer lip of gusset and glass surface, adjust the gap by adjusting bolt (A) at the attachment hardware at the lower side of the gusset to prevent generation of wind noise.

14) During adjustment, loosen the other three clamping bolts.



15) After adjustment, tighten the bolts and nuts.

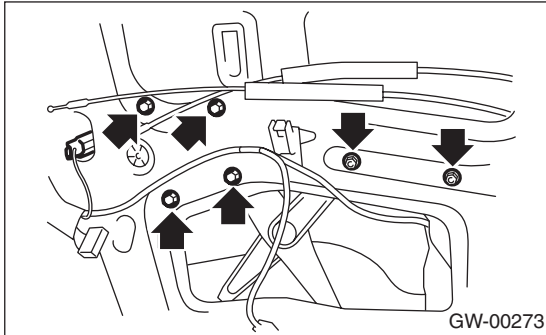
# Front Regulator and Motor Assembly

GLASS/WINDOWS/MIRRORS

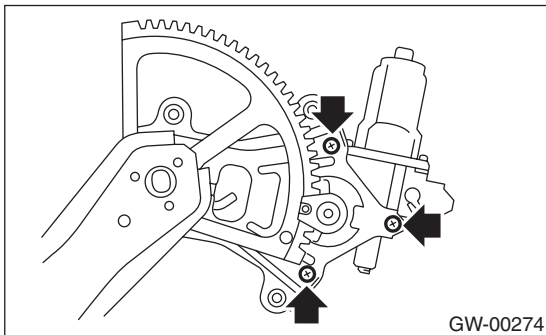
## 5. Front Regulator and Motor Assembly

### A: REMOVAL

- 1) Remove the door glass. <Ref. to GW-11, REMOVAL, Front Door Glass.>
- 2) Disconnect the motor connector.
- 3) Remove the four bolts and two nuts to remove regulator assembly.



- 4) Remove the screws to remove motor assembly.



#### NOTE:

When removing the motor assembly, secure the arm correctly. Otherwise the regulator arm moves with the force of balancing spring.

### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the front door glass. <Ref. to GW-12, ADJUSTMENT, Front Door Glass.>

#### **Tightening torque:**

**Refer to "COMPONENT" of "General Description". <Ref. to GW-4, FRONT DOOR GLASS, COMPONENT, General Description.>**

### C: INSPECTION

- 1) Make sure that the power window motor rotates properly when the battery voltage is applied to the terminals of motor connector.
- 2) Change polarity of battery connection to terminals to ensure that the motor rotates in reverse direction.

## 6. Remote Control Mirror System

### A: WIRING DIAGRAM

<Ref. to WI-190, Remote Control Mirror System.>

### B: INSPECTION

Symptom	Repair order
All function does not operate.	<ol style="list-style-type: none"> <li>1. Fuse (F/B No. 6)</li> <li>2. Mirror switch</li> <li>3. Wiring harness</li> </ol>
One side of the mirror motor does not operate.	<ol style="list-style-type: none"> <li>1. Mirror switch</li> <li>2. Mirror motor</li> <li>3. Wiring harness</li> </ol>
Mirror heater does not operate.	<ol style="list-style-type: none"> <li>1. Mirror switch</li> <li>2. Mirror heater</li> <li>3. Wiring harness</li> </ol>

# Scalp Cap

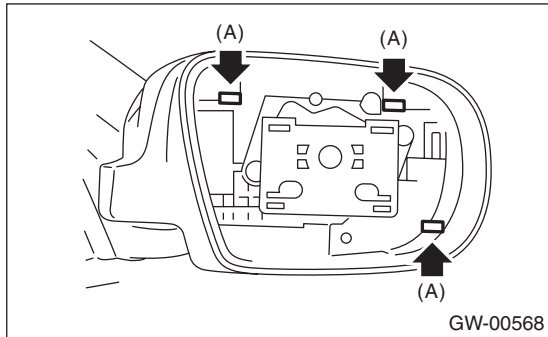
GLASS/WINDOWS/MIRRORS

## 7. Scalp Cap

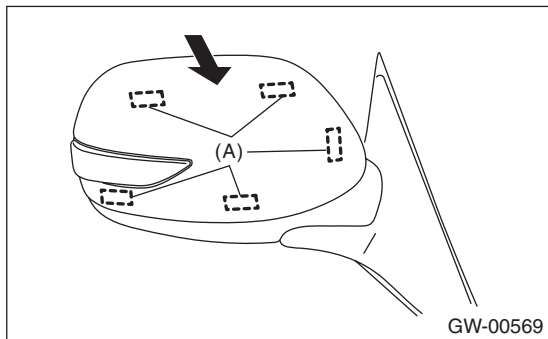
### A: REPLACEMENT

#### 1. MODEL WITH SIDE TURN SIGNAL LIGHT

- 1) Remove the outer mirror. <Ref. to GW-20, REPLACEMENT, Outer Mirror.>
- 2) Press-in the upper side clips (A) from inside of outer mirror.



- 3) Pull the scalp cap frontward of outer mirror, remove the upper side clips (A), and then remove the scalp cap.



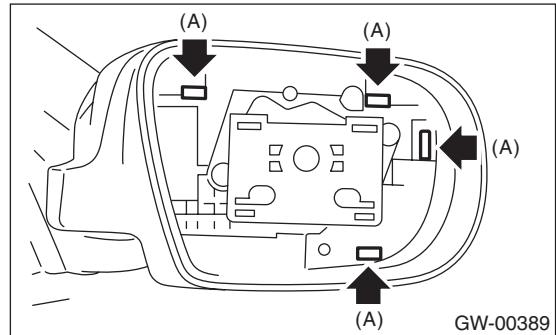
- 4) Install the scalp cap securely.

#### CAUTION:

Do not remove the scalp cap forcibly. The lower hooks may be damaged.

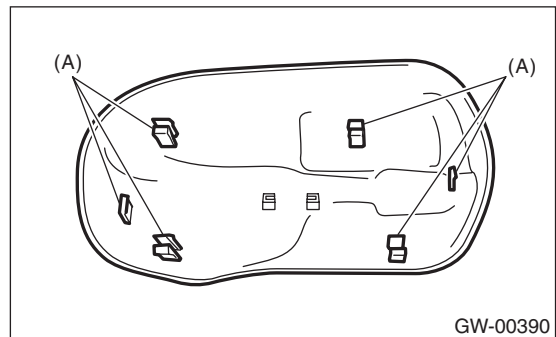
#### 2. MODEL WITHOUT SIDE TURN SIGNAL LIGHT

- 1) Remove the mirror. <Ref. to GW-20, REPLACEMENT, Outer Mirror.>
- 2) Press-in the clips (A) from inside of outer mirror.



- 3) Pull the scalp cap towards the front of the outer mirror, then remove the scalp cap.

- 4) Align clip (A) on the reverse side of the scalp cap and the clip attachment hole of the outer mirror, and push the scalp cap in.

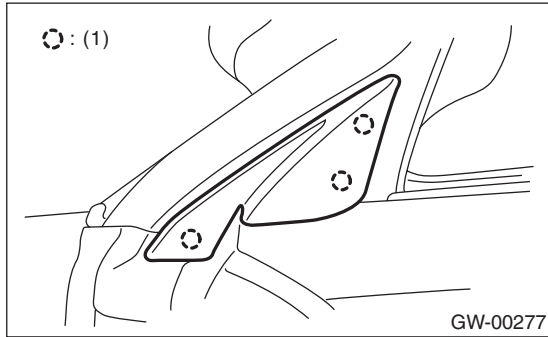


- 5) Install the scalp cap securely.

## 8. Outer Mirror Assembly

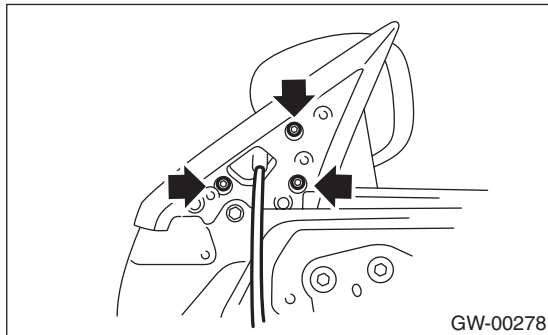
### A: REMOVAL

1) Remove the mirror gusset cover.



(1) Hook

- 2) Remove the door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Disconnect the outer mirror connector.
- 4) Remove the screws to remove outer mirror assembly.



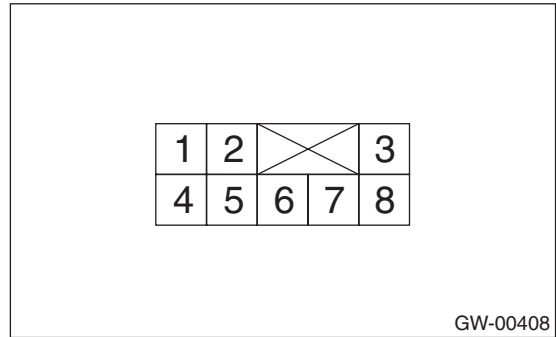
### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

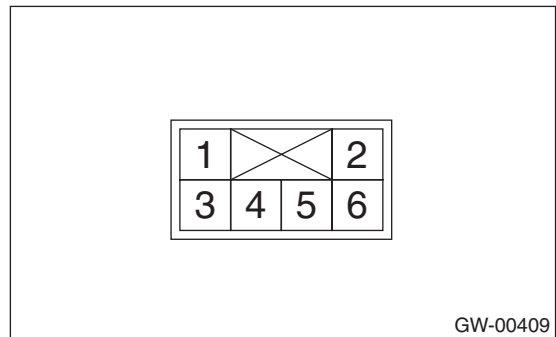
Check that the rearview mirror moves properly when the battery voltage is applied to terminals.

- Model with side turn signal light



Switch position	Terminal No.
OFF	—
UP	6 (+) and 3 (-)
DOWN	3 (+) and 6 (-)
LEFT	7 (+) and 3 (-)
RIGHT	3 (+) and 7 (-)

- Model without side turn signal light



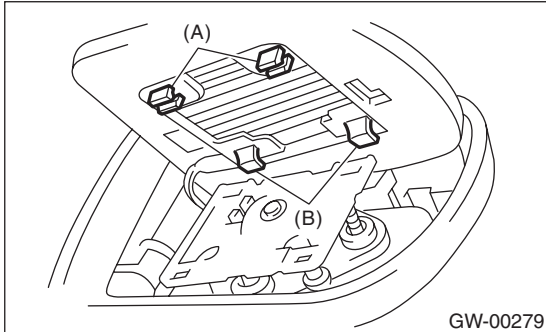
Switch position	Terminal No.
OFF	—
UP	4 (+) and 2 (-)
DOWN	2 (+) and 4 (-)
LEFT	5 (+) and 2 (-)
RIGHT	2 (+) and 5 (-)

Replace the outer mirror assembly if defective.

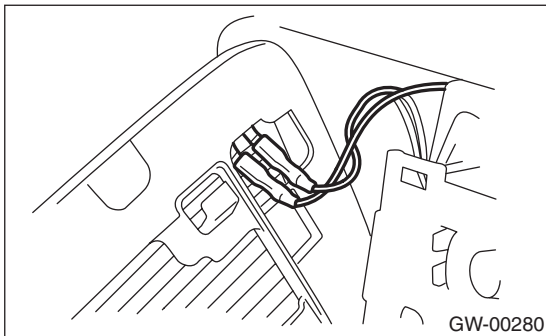
## 9. Outer Mirror

### A: REPLACEMENT

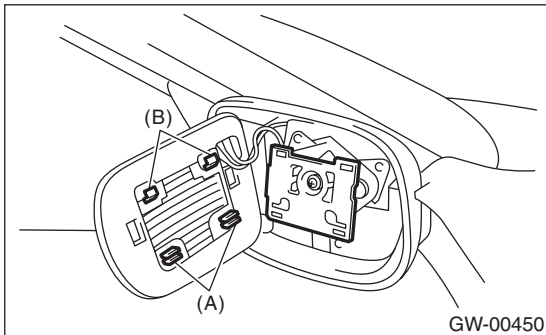
- 1) Face the mirror upward.
- 2) Use a flat tip screwdriver to remove clip (A).
- 3) Lift the lower mirror up to remove hooks (B).



- 4) Disconnect the mirror heater connector from side of the mirror. (Model with mirror heater)



- 5) Catch the hooks (B) and install clips (A).



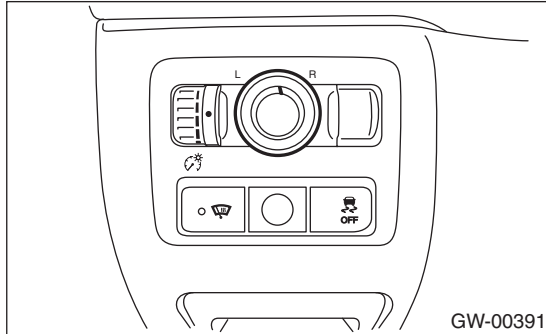
#### CAUTION:

- When removing the mirror, be careful not to damage the back surface of mirror with a flat tip screwdriver.
- When installing the mirror, insert the hook and clip securely.

## 10. Remote Control Mirror Switch

### A: REMOVAL

- 1) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 2) Disconnect the connector.



- 3) Remove the remote control mirror switch from instrument panel lower cover.

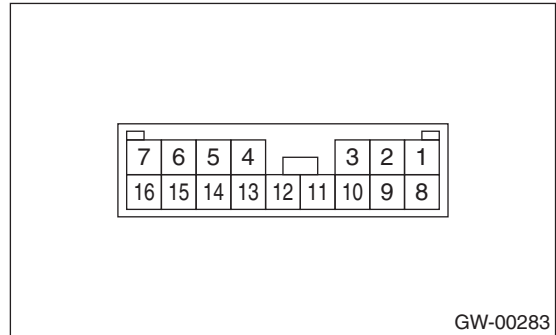
### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

#### 1. REMOTE CONTROL MIRROR SWITCH

Move the remote control mirror switch to each position and check continuity between terminals.



- Change over switch R

Switch position	Terminal No.	Standard
OFF	—	1 MΩ or more
UP	10 and 12 15 and 14	Less than 1 Ω
DOWN	10 and 15 12 and 14	Less than 1 Ω
LEFT	10 and 11 15 and 14	Less than 1 Ω
RIGHT	10 and 15 11 and 14	Less than 1 Ω

- Change over switch L

Switch position	Terminal No.	Standard
OFF	—	1 MΩ or more
UP	10 and 8 15 and 14	Less than 1 Ω
DOWN	10 and 15 8 and 14	Less than 1 Ω
LEFT	10 and 9 15 and 14	Less than 1 Ω
RIGHT	10 and 15 9 and 14	Less than 1 Ω

Replace the remote control mirror switch if defective.

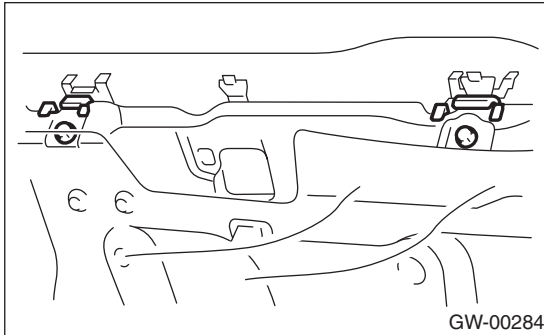
# Rear Door Glass

GLASS/WINDOWS/MIRRORS

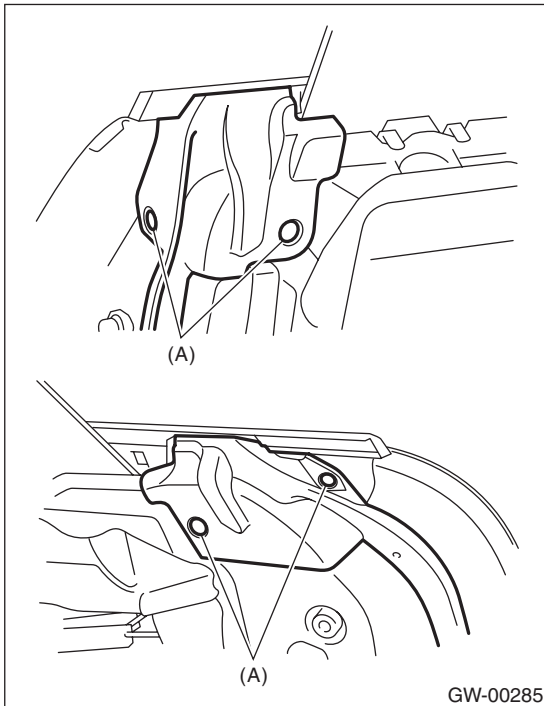
## 11. Rear Door Glass

### A: REMOVAL

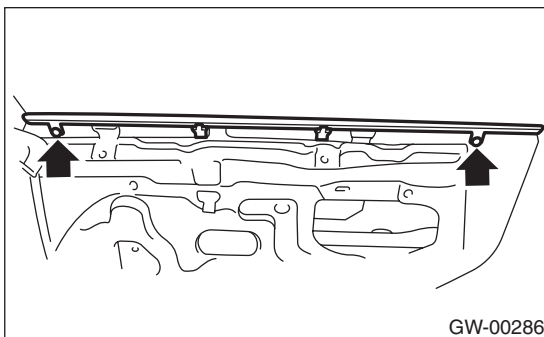
- 1) Remove the rear door trim.  
<Ref. to EI-49, REMOVAL, Door Trim.>
- 2) Remove the sealing cover. <Ref. to EB-23, REMOVAL, Rear Sealing Cover.>
- 3) Remove the stabilizers.



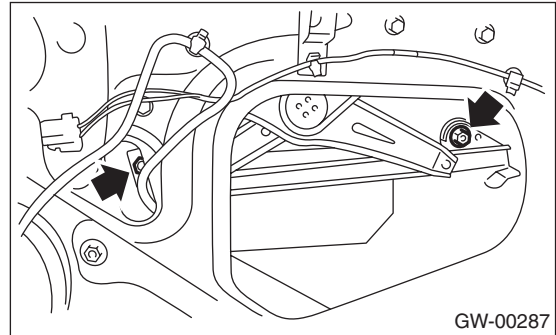
- 4) Remove clips (A), and remove the front end and rear end of the weather strip.



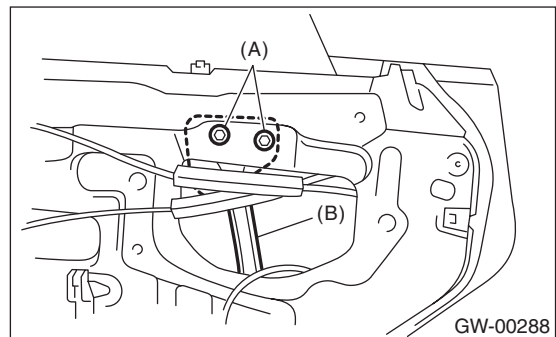
- 5) Remove the two screws to remove the weather strip outer.



- 6) Operate the power window switch to move the glass to the position shown in the figure, then remove the two nuts through the service holes.



- 7) Remove the rear sash retaining nuts (A) and move the rear sash (B) rearward.



- 8) Remove the door glass.

### CAUTION:

- Since the gear may be disengaged, do not turn regulator in the closing direction after removing glass.
- Avoid impact and damage to the glass.

### B: INSTALLATION

- 1) Install in the reverse order of removal.

### CAUTION:

Make sure that the glass stay is placed securely in sash.

- 2) Adjust the rear door glass. <Ref. to GW-23, ADJUSTMENT, Rear Door Glass.>

### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to GW-5, REAR DOOR GLASS, COMPONENT, General Description.>

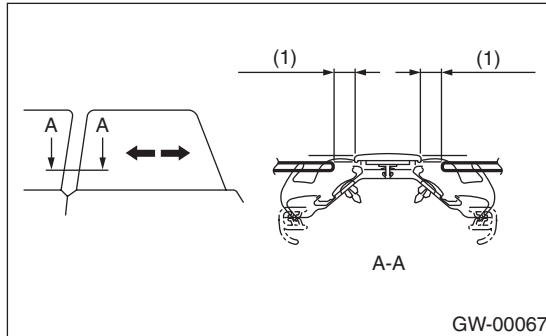


## C: ADJUSTMENT

**NOTE:**

The rear door glass, as a rule, should be adjusted in the same manner as the front door glass, although they are different in dimension. <Ref. to GW-12, ADJUSTMENT, Front Door Glass.>

1) Adjust the glass position using the dimensions in the figure as a guide.



(1) 11 mm (0.433 in)

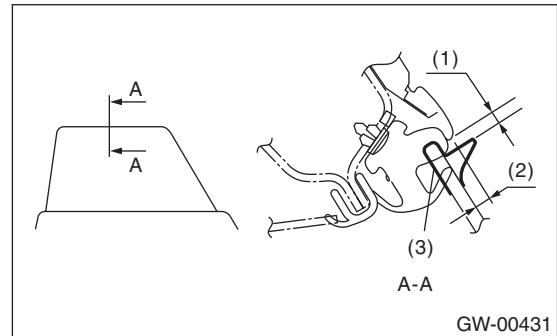
**NOTE:**

- If dimensions are smaller than the given dimensions, glass may get caught in weather strip during lifting/lowering operation and may not be fully open.
- After adjustment, move the glass up and down to check whether it is caught.

2) Attach the special tool to the glass, and adjust the glass adhesion until the dimensional value becomes as shown below.

ST 61299AE010 SPACER

(Glass thickness: 4 mm (0.157 in) for rear door glass)



(1) 3.2 — 4.8 mm (0.126 — 0.189 in)

(2) When re-using the weather strip: 5.5 mm (0.217 in)  
When replacing the weather strip: 5.0 mm (0.179 in)

(3) ST

**NOTE:**

- If rear glass adhesion is higher than necessary, glass may get caught in weather strip of center pillar corner, resulting in early wear of weather strip. Be careful when adjusting.
- After adjustment, move the glass up and down to check whether it is caught.

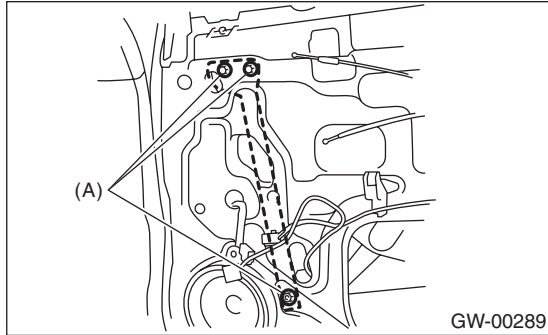
# Rear Regulator and Motor Assembly

GLASS/WINDOWS/MIRRORS

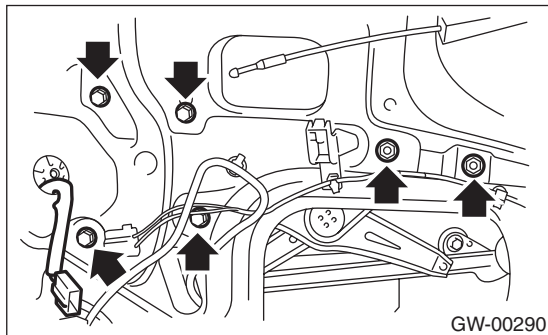
## 12. Rear Regulator and Motor Assembly

### A: REMOVAL

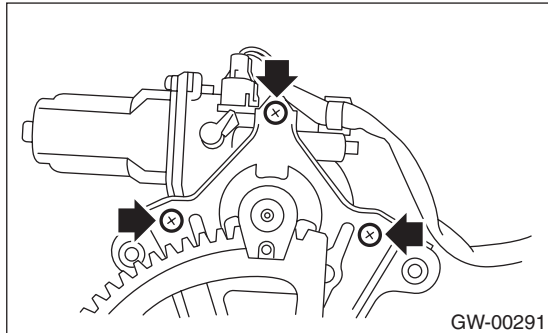
- 1) Remove the rear door glass. <Ref. to GW-22, REMOVAL, Rear Door Glass.>
- 2) Remove the nut (A) to remove the front sash.



- 3) Disconnect the motor connector.
- 4) Remove the four bolts and two nuts to remove regulator assembly.



- 5) Remove the screws to remove motor assembly.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Adjust the rear door glass. <Ref. to GW-23, ADJUSTMENT, Rear Door Glass.>

#### Tightening torque:

Refer to “COMPONENT” of “General Description”. <Ref. to GW-5, REAR DOOR GLASS, COMPONENT, General Description.>

### C: INSPECTION

- 1) Make sure that the power window motor rotates properly when the battery voltage is applied to the terminals of motor connector.
- 2) Change polarity of battery connection to terminals to ensure that the motor rotates in reverse direction.

## 13. Windshield Glass

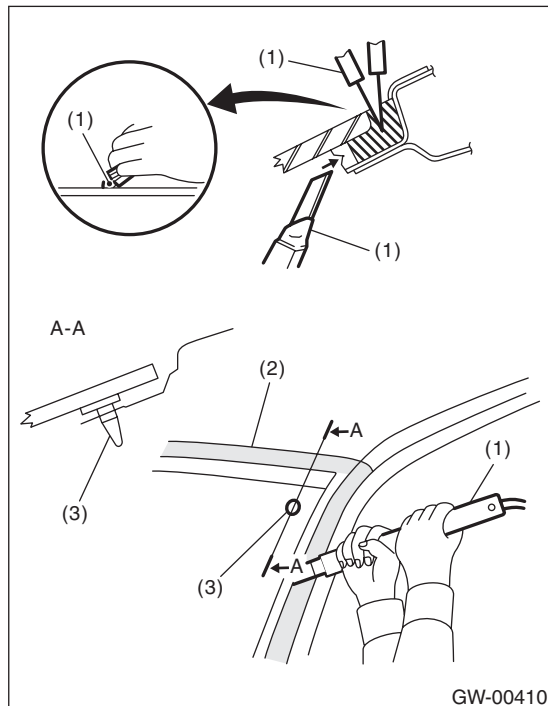
### A: REMOVAL

#### 1. USING WINDSHIELD GLASS KNIFE

- 1) Remove the cowl panel.  
<Ref. to EI-40, REMOVAL, Cowl Panel.>
- 2) Remove the molding.
- 3) Tape the body side of the circumference of windshield glass for protection.
- 4) Apply sufficient amount of soapy water to the adhesive part.
- 5) Insert the windshield glass knife into the adhesive.
- 6) While holding the knife edge and windshield glass edge at a right angle, move the windshield glass knife in parallel to the windshield glass edge along the surface and edge of windshield glass to cut the adhesive part.

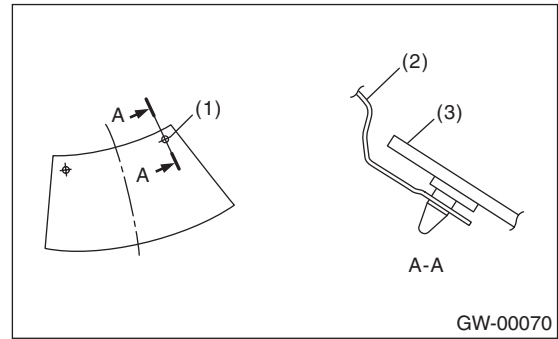
#### NOTE:

- Do not twist the windshield glass knife.
- Cutting of adhesive part shall be started with wider gap between windshield glass and body.



- (1) Windshield glass knife
- (2) Tape for protection
- (3) Locating pin

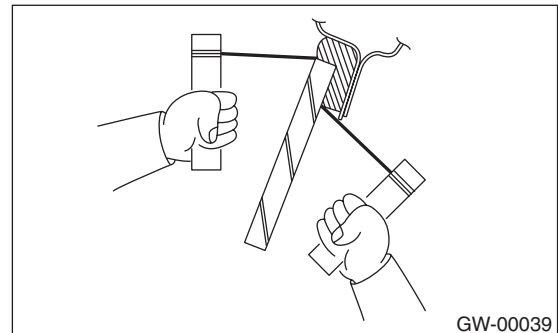
- The locating pins are bonded to the corners of glass. Use piano wire to disconnect the pins.



- (1) Locating pin
- (2) Body panel
- (3) Windshield glass

#### 2. USING PIANO WIRE

- 1) Remove the cowl panel.  
<Ref. to EI-40, REMOVAL, Cowl Panel.>
- 2) Remove the molding.
- 3) Tape the body side of the circumference of windshield glass for protection.
- 4) Make a hole in the adhesive part using drill or knife.
- 5) Pass the piano wire through the hole, and attach both the wire ends securely to pieces of wood.



- 6) Pull the wire ends alternately to cut off the adhesive part.

#### CAUTION:

- Do not tightly pull the piano wire against the windshield glass edge.
- Be careful not to damage interior and exterior parts.
- When removal is made with area close to instrument panel, place a protection plate over it. Pay particular attention to the removal.
- Do not cross piano wires. Otherwise they may be cut.

# Windshield Glass

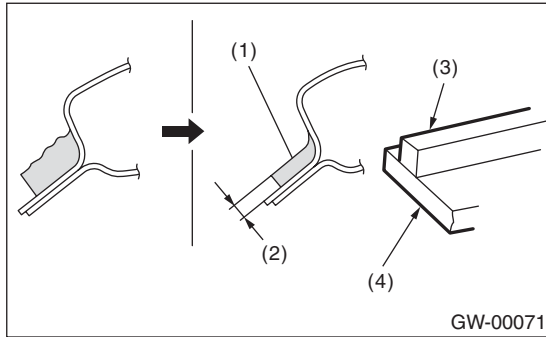
GLASS/WINDOWS/MIRRORS

## B: INSTALLATION

- 1) Clean the external circumference of windshield glass with alcohol or white gasoline.
- 2) Remove the adhesive layer on the body using cutter knife to obtain smooth face of 2 mm (0.08 in) thick.

### CAUTION:

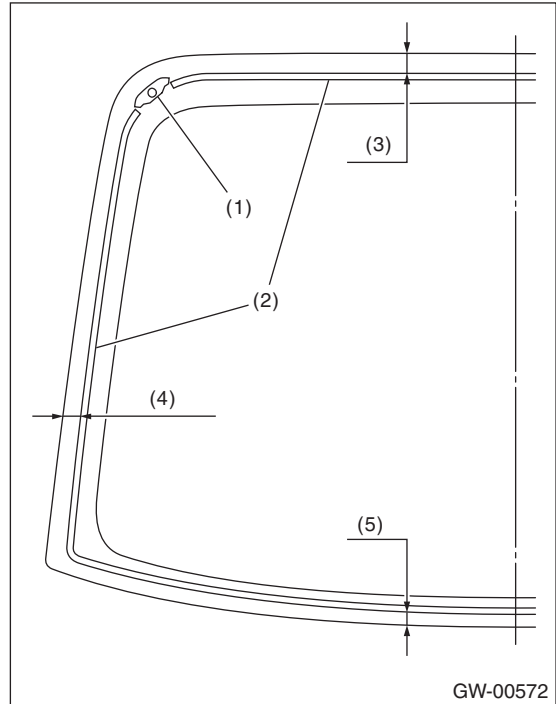
Be careful not to damage the body and paint surface.



- (1) Adhesive
- (2) 2 mm (0.08 in)
- (3) Dam rubber
- (4) Glass

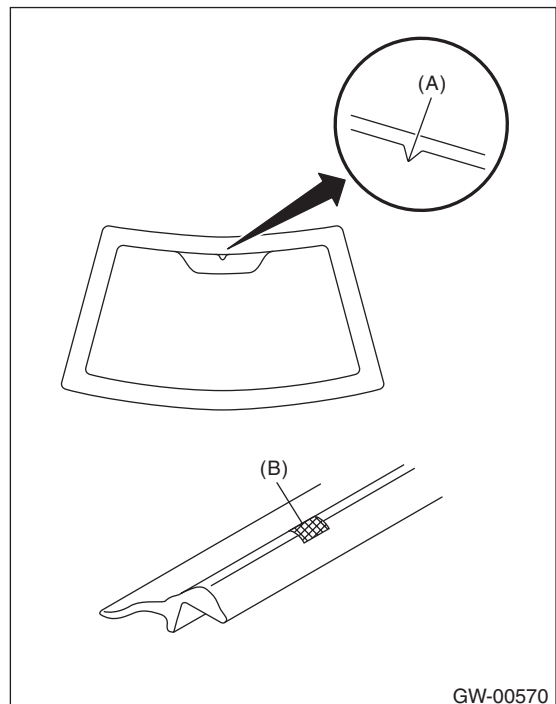
- 3) Clean the body with alcohol or white gasoline to eliminate cutting powder, dust and dirt completely from body.

- 4) Install the dam rubber.



- (1) Locating pin (adhered)
- (2) Dam rubber
- (3) 11 mm (0.433 in)
- (4) 11 mm (0.433 in)
- (5) 9 mm (0.354 in)

- 5) Fit the mark (B) on molding to the notch (A) of glass side, and install the molding to entire perimeter of glass.



6) Apply two types of primers to the adhesive layer of glass using sponge.

**Glass primer:**

**Dow Automotive  
ESSEX U-401, U-402**

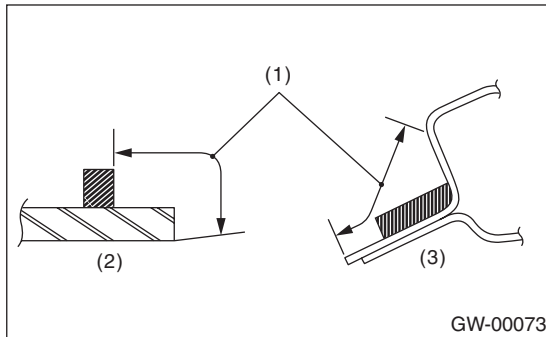
7) Apply the primer to the adhesive layer of body.

**Painted surface primer:**

**Dow Automotive  
ESSEX U-413**

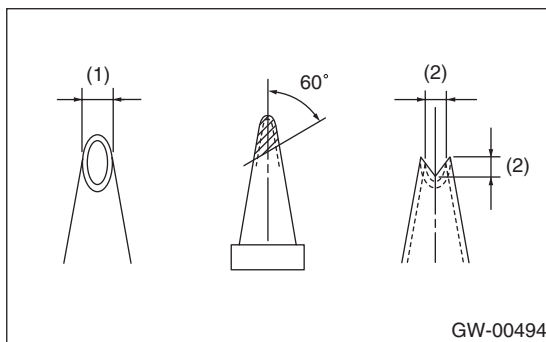
**NOTE:**

- Primer once attached to the painted surface of the body and internal trim is hard to wipe off. Mask the circumference of such area.
- Let primer dry for about ten minutes before installing the glass.
- Do not touch the surface coated with primer.



- (1) Application of primer
- (2) Glass side
- (3) Body side

8) Cut off the cartridge nozzle tip as shown and set it in sealant gun.

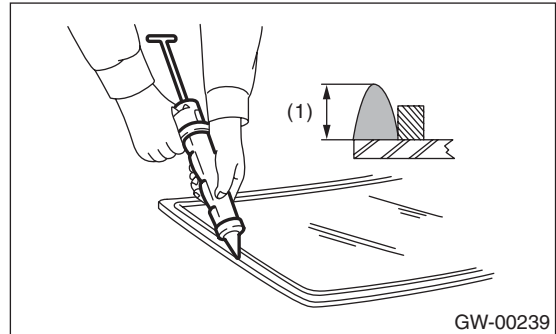


- (1) 10 mm (0.39 in)
- (2) 15 mm (0.59 in)

9) Apply adhesive to the glass end surface as shown.

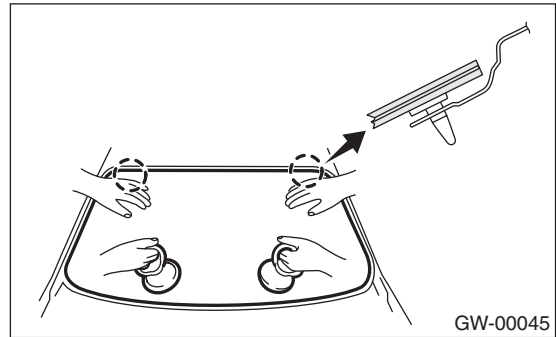
**Adhesive:**

**Dow Automotive  
ESSEX U-400HV or equivalent**



- (1) 9 — 12 mm (0.35 — 0.47 in)

10) Fit the locating pins, and install windshield glass using suction rubber cup.



- 11) Lightly press the windshield glass for tight fit.
- 12) Make flush the adhesive surface juttred out using spatula.
- 13) After completion of all work, allow the vehicle to stand for about 24 hours.

**NOTE:**

- When door is opened/closed after glass is bonded, always lower the door glass first, and then open/close it carefully.
- Move the vehicle slowly.
- For minimum drying time and vehicle standing time before driving after bonding, follow instructions or instruction manual from the adhesive manufacturer.

14) After curing of adhesive, pour the water on external surface of vehicle to check that there are no water leaks.

**NOTE:**

When a vehicle is returned to the user, tell him or her that the vehicle should not be subjected to heavy impact for at least three days.

15) Install the cowl panel.

<Ref. to EI-40, INSTALLATION, Cowl Panel.>

## 14.Rear Gate Glass

### A: REMOVAL

- 1) Remove the rear wiper motor.  
<Ref. to WW-17, REMOVAL, Rear Wiper Motor.>
- 2) Disconnect the electrical connectors from rear defogger terminal.
- 3) Remove the glass in the same procedure as for windshield glass. <Ref. to GW-25, REMOVAL, Windshield Glass.>

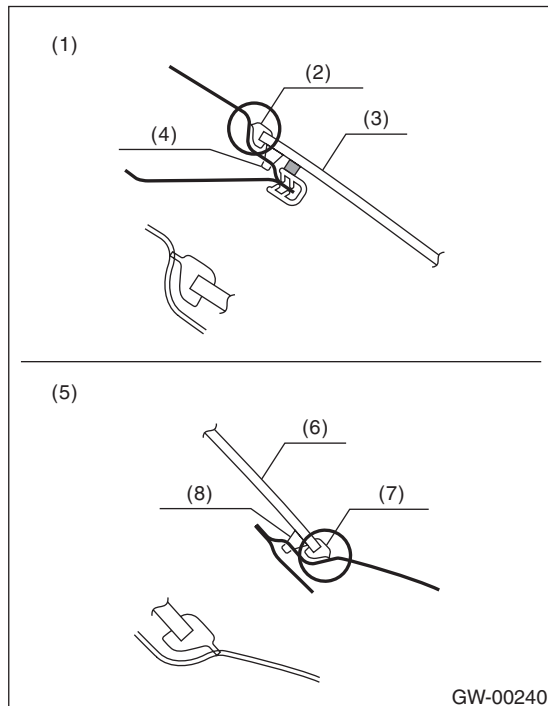
### B: INSTALLATION

- 1) Apply adhesive in the same procedure as for windshield glass. <Ref. to GW-26, INSTALLATION, Windshield Glass.>
- 2) Insert the glass clip pin into rear gate hole, push on the area around the clip pin to secure it, and then push lightly all around the area to seal it.
- 3) About one hour after installation, conduct a leak test.

- 4) After completion of all work, allow the vehicle to stand for about 24 hours.

#### NOTE:

- When door is opened/closed after glass is bonded, always lower the door glass first, and then open/close it carefully.
  - Move the vehicle slowly.
  - For minimum drying time and vehicle standing time before driving after bonding, follow instructions or instruction manual from the adhesive manufacturer.
  - When a vehicle is returned to the user, tell him or her that the vehicle should not be subjected to heavy impact for at least three days.
- 5) Connect the rear defogger terminals.
  - 6) Install the rear wiper.  
<Ref. to WW-17, INSTALLATION, Rear Wiper Motor.>



- (1) Upside
- (2) Molding
- (3) Glass
- (4) Adhesive
- (5) Downside
- (6) Glass
- (7) Molding
- (8) Adhesive

## 15. Rear Window Glass

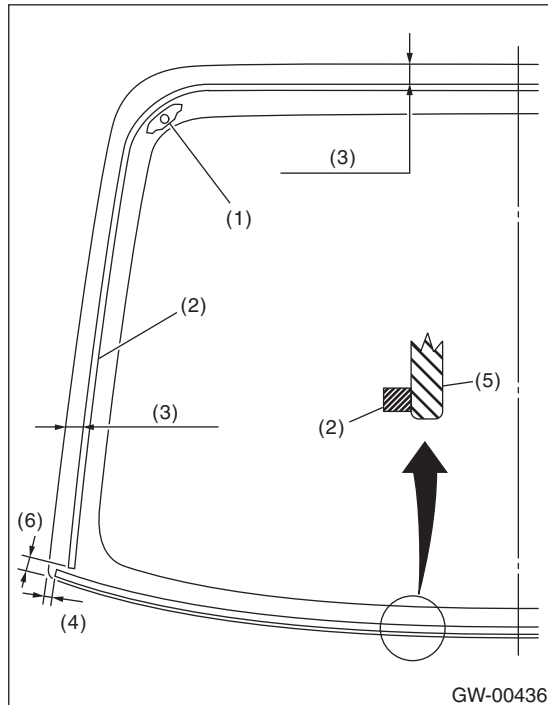
### A: REMOVAL

1) Disconnect the electrical connectors from rear defogger terminal.

2) Remove the glass in the same procedure as for windshield glass. <Ref. to GW-25, REMOVAL, Windshield Glass.>

### B: INSTALLATION

1) Adhere the dam rubber.



- (1) Locating pin (adhered)
- (2) Dam rubber
- (3) 11 mm (0.433 in)
- (4) 4 mm (0.157 in)
- (5) Rear window glass
- (6) 40 mm (1.575 in)

2) Install the glass in the same procedure as for windshield glass. <Ref. to GW-26, INSTALLATION, Windshield Glass.>

3) Connect the rear defogger and antenna terminal connectors.

4) After completion of all work, allow the vehicle to stand for about 24 hours.

#### NOTE:

- When door is opened/closed after glass is bonded, always lower the door glass first, and then open/close it carefully.
- Move the vehicle slowly.
- For minimum drying time and vehicle standing time before driving after bonding, follow instructions or instruction manual from the adhesive manufacturer.

5) After curing of adhesive, pour the water on external surface of vehicle to check that there are no water leaks.

#### NOTE:

When a vehicle is returned to the user, tell him or her that the vehicle should not be subjected to heavy impact for at least three days.

# Rear Window Defogger System

GLASS/WINDOWS/MIRRORS

---

## 16.Rear Window Defogger System

### A: WIRING DIAGRAM

<Ref. to WI-191, Rear Defogger System.>

### B: INSPECTION

Symptom	Repair order
Rear window defogger does not operate.	<ol style="list-style-type: none"><li>1. Fuse (M/B No. 10) (F/B No. 22)</li><li>2. Rear defogger relay</li><li>3. Defogger switch</li><li>4. Rear defogger condenser</li><li>5. Defogger wire</li><li>6. Wiring harness</li><li>7. Body integrated unit</li></ol>

#### NOTE:

Rear window defogger system can be customized on the Subaru Select Monitor.

System name	Initial setting	Customize setting
Rear window defogger timer	OFF after 15 min.	Repeat 15 min. operation and 2 min. stop.



## 17. Rear Window Defogger

### A: INSPECTION

#### 1. CHECK WITH SUBARU SELECT MONITOR

**CAUTION:**

Check that the rear window defogger timer is in initial setting or customize setting before performing inspection.

1) Check the input signal when the rear window defogger switch is operated using Subaru Select Monitor.

(1) Prepare the Subaru Select Monitor kit. <Ref. to GW-7, PREPARATION TOOL, General Description.>

(2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".

(3) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.

(4) Select the {Current Data Display & Save}.

(5) Display the data of rear window defogger switch.

2) After rear defogger switch is set to ON, check whether it turns to OFF in 15 minutes or repeats 15 minutes operation and 2 minutes stop?

3) When it becomes OFF on above 2), it is normal. When it repeats 15 minutes operation and 2 minutes stop, replace body integrated unit.

#### 2. HEAT WIRE INSPECTION

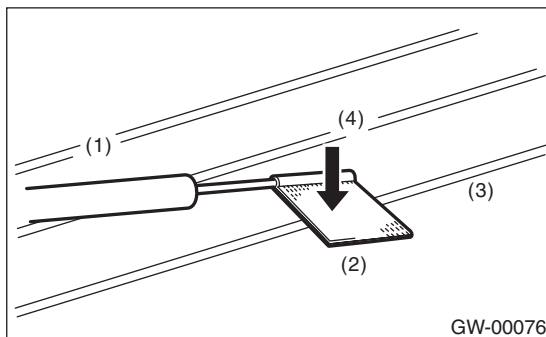
**CAUTION:**

Use a dry and soft cloth when wiping dirt off the glass. Move the cloth along the heat wire to avoid damaging it.

1) Turn the ignition switch to ON.

2) Turn the defogger switch to ON.

3) Wrap the tips of tester probe with aluminum foil to avoid damage to heat wire.

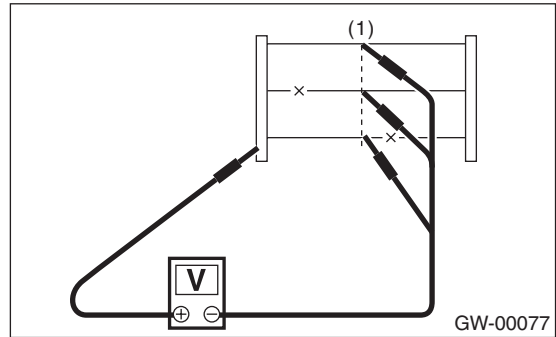


- (1) Tester probe
- (2) Aluminum foil
- (3) Heat wire
- (4) Press

4) Measure the voltage at heat wire center with DC voltmeter.

**Standard voltage:**

**Approx. 6 V**



(1) Center of heat wire

Voltage	Criteria
Approx. 6 V	Normal operation
Approx. 12 V or 0 V	Open

**NOTE:**

- If the measured value is 12 V, heat wire is open between heat wire center and positive (+) terminal of tester probe.

- If it is 0 V, the circuit is open between heat wire center and ground.

5) Connect the tester probe of positive lead of voltmeter to positive terminal of heat wire and move tester probe of negative lead along the heat wire up to the negative terminal end. If voltage changes from zero to several volts during movement of tester probe, heat wire is open at the voltage change point.

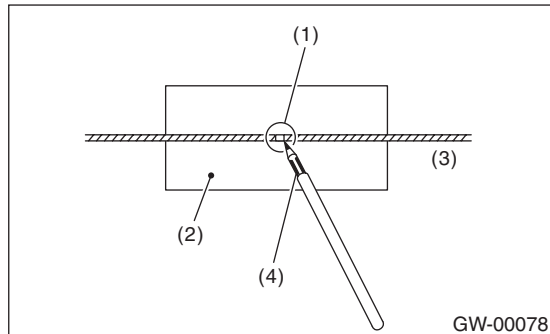
## Rear Window Defogger

GLASS/WINDOWS/MIRRORS

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### B: REPAIR

- 1) Clean the broken portion with alcohol or white gasoline.
- 2) Mask both side of wire with thin film.
- 3) Apply the conductive silver composition (DUPONT No. 4817) to the broken portion.



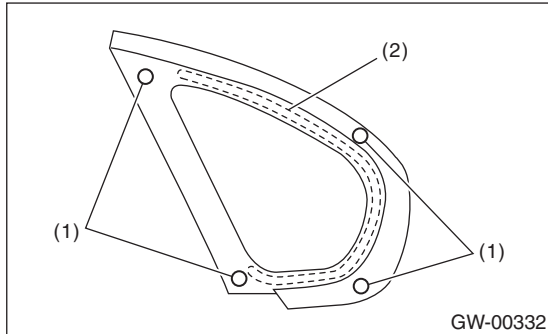
- (1) Broken portion
- (2) Thin film
- (3) Broken wire
- (4) Conductive silver composition (DUPONT No. 4817)

- 4) After repair, check the wire.

## 18.Rear Quarter Glass

### A: REMOVAL

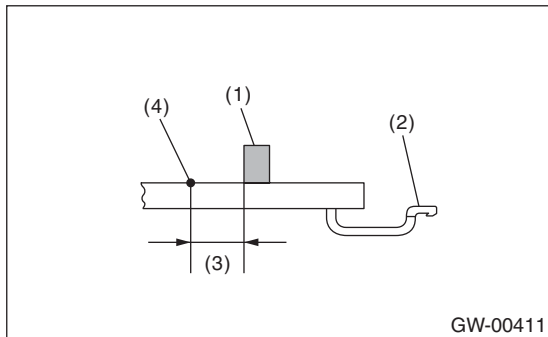
Remove the glass in the same procedure as for windshield glass. <Ref. to GW-25, REMOVAL, Windshield Glass.>



- (1) Locating pin
- (2) Dam rubber

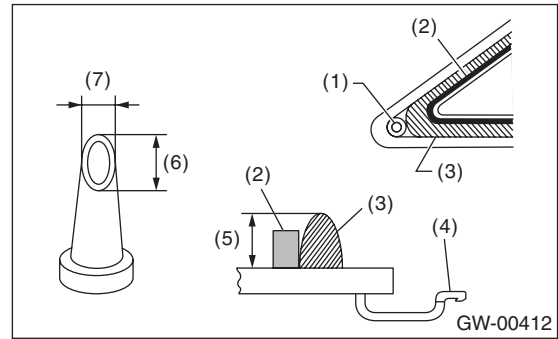
### B: INSTALLATION

1) Install the dam rubber.



- (1) Dam rubber
- (2) Molding
- (3) 10.5 mm (0.413 in) (constant)
- (4) Ceramic terminal

2) Cut out the nozzle head and apply adhesive to the glass end surface as shown.



- (1) Locating pin
- (2) Dam rubber
- (3) Adhesive
- (4) Molding
- (5) 8 — 10 mm (0.31 — 0.39 in)
- (6) 15 mm (0.59 in)
- (7) 10 mm (0.39 in)

3) Install the glass in the same procedure as for windshield glass. <Ref. to GW-26, INSTALLATION, Windshield Glass.>

4) After completion of all work, allow the vehicle to stand for about 24 hours.

#### NOTE:

- When door is opened/closed after glass is bonded, always lower the door glass first, and then open/close it carefully.
- Move the vehicle slowly.
- For minimum drying time and vehicle standing time before driving after bonding, follow instructions or instruction manual from the adhesive manufacturer.

5) After curing of adhesive, pour the water on external surface of vehicle to check that there are no water leaks.

#### NOTE:

When a vehicle is returned to the user, tell him or her that the vehicle should not be subjected to heavy impact for at least three days.

### 19.Sunroof Glass

#### A: PROCEDURE

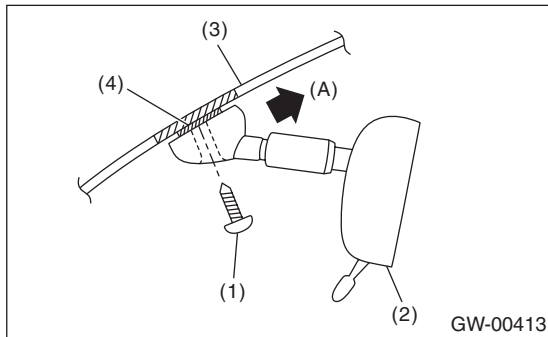
For sunroof glass removal, installation and adjustment, refer section of sunroof.

- Removal <Ref. to SR-6, REMOVAL, Glass Lid.>
- Installation <Ref. to SR-7, INSTALLATION, Glass Lid.>
- Adjustment <Ref. to SR-7, ADJUSTMENT, Glass Lid.>

## 20. Rearview Mirror

### A: REMOVAL

- 1) Remove the TORX<sup>®</sup> screw (1).
- 2) Slide the rearview mirror (2) to the upper side (A) of the windshield glass (3), and remove the rearview mirror from the button (4).



#### CAUTION:

- Be careful not to damage the mirror surface.
- Be careful not to damage the windshield glass.

### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

Refer to “**COMPONENT**” of “*General Description*”. <Ref. to GW-6, **MIRROR, COMPONENT, General Description.**>

#### CAUTION:

When tightening the mounting TORX<sup>®</sup> screw, be sure to observe the tightening torque. Otherwise, the mount may be damaged in over-torque conditions.

### C: INSPECTION

- Check that the mirror is not damaged.
- Check that the spring is not damaged.

# Wiper Deicer System

GLASS/WINDOWS/MIRRORS

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## 21. Wiper Deicer System

### A: WIRING DIAGRAM

<Ref. to WI-177, Wiper Deicer System.>

### B: INSPECTION

Symptom	Repair order
Wiper deicer does not operate.	<ol style="list-style-type: none"><li>1. Fuse (F/B No. 4, 9)</li><li>2. Wiper deicer relay</li><li>3. Wiper deicer switch</li><li>4. Wiring harness</li><li>5. Body integrated unit</li></ol>

Refer to “Rear Window Defogger” for inspection.  
<Ref. to GW-31, INSPECTION, Rear Window Defogger.>

#### NOTE:

Wiper deicer system can be customized on the Subaru Select Monitor.

System name	Initial setting	Customize setting
Wiper deicer timer	OFF after 15 min.	Continuous operation*

\*: When one of the following conditions occurs, continuous operation is suspended and turned off after 15 min.

- Ambient temperature at 5°C (41°F) or more continues for 10 seconds
- Malfunction occurs on ambient sensor.
- Vehicle speed below 15 km/h (9 MPH) continues 15 min.
- Malfunction occurs in CAN communication.

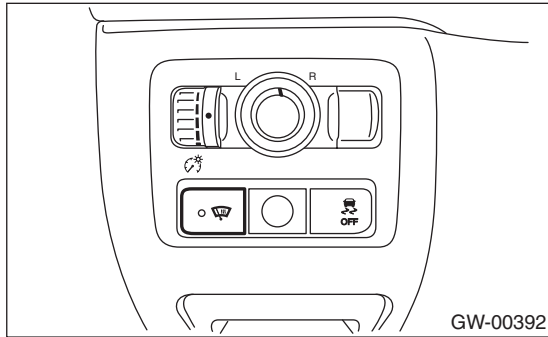
### C: REPAIR

Refer to “Rear Window Defogger” for repair.  
<Ref. to GW-32, REPAIR, Rear Window Defogger.>

## 22. Wiper Deicer Switch

### A: REMOVAL

- 1) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 2) Disconnect the harness connector and remove wiper deicer switch.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

#### 1. CHECK WITH SUBARU SELECT MONITOR

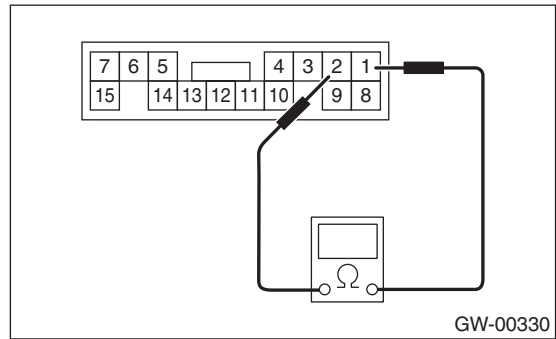
##### CAUTION:

**Check whether the wiper deicer timer is in initial setting or customize setting before performing inspection.**

- 1) Check the input signal when the wiper deicer switch is operated using Subaru Select Monitor.
  - (1) Prepare the Subaru Select Monitor kit. <Ref. to GW-7, PREPARATION TOOL, General Description.>
  - (2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".
  - (3) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
  - (4) Select the {Current Data Display & Save}.
  - (5) Display the data of wiper deicer switch.
- 2) After the wiper deicer switch is set to ON, check whether it turns OFF in 15 minutes or operates continuously.
- 3) When it becomes OFF on above 2), it is normal. When it operates continuously, replace the body integrated unit.

#### 2. CHECK SWITCH.

Remove the wiper deicer switch, and measure the switch resistance.



Switch position	Terminal No.	Standard
OFF	1 and 2	1 MΩ or more
ON		Less than 1 Ω

Replace the wiper deicer switch if faulty.

# Wiper Deicer Switch

GLASS/WINDOWS/MIRRORS

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# General Description

BODY STRUCTURE

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## 1. General Description

### A: PREPARATION TOOL

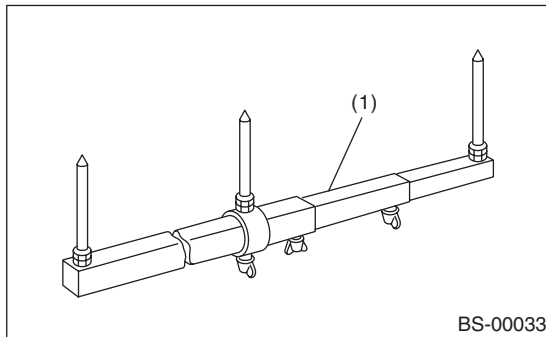
TOOL NAME	REMARKS
Tram tracking gauge	Used for measuring dimension.
Tape measure	Used for measuring dimension.

## 2. Datum Dimensions

### A: MEASUREMENT

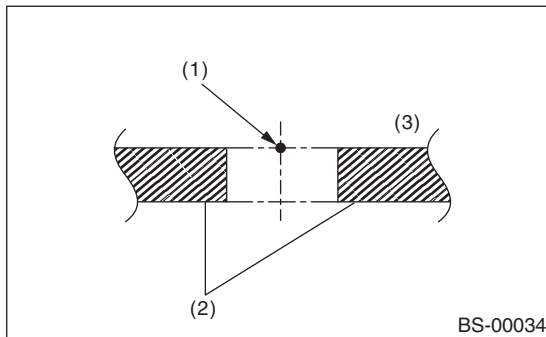
NOTE:

- Using a tram tracking gauge, measure all the dimensions.
- When using a tape measure, carefully measure dimensions without letting the tape measure sag or twist.
- Measure the linear dimensions between cores of holes.
- Suffixes “RH” and “LH” indicate right-hand and left-hand.



(1) Tram tracking gauge

- Measure at the center of the circle around the outside of the body panel.



- (1) Datum points
- (2) Body panel
- (3) Outside

# Datum Dimensions

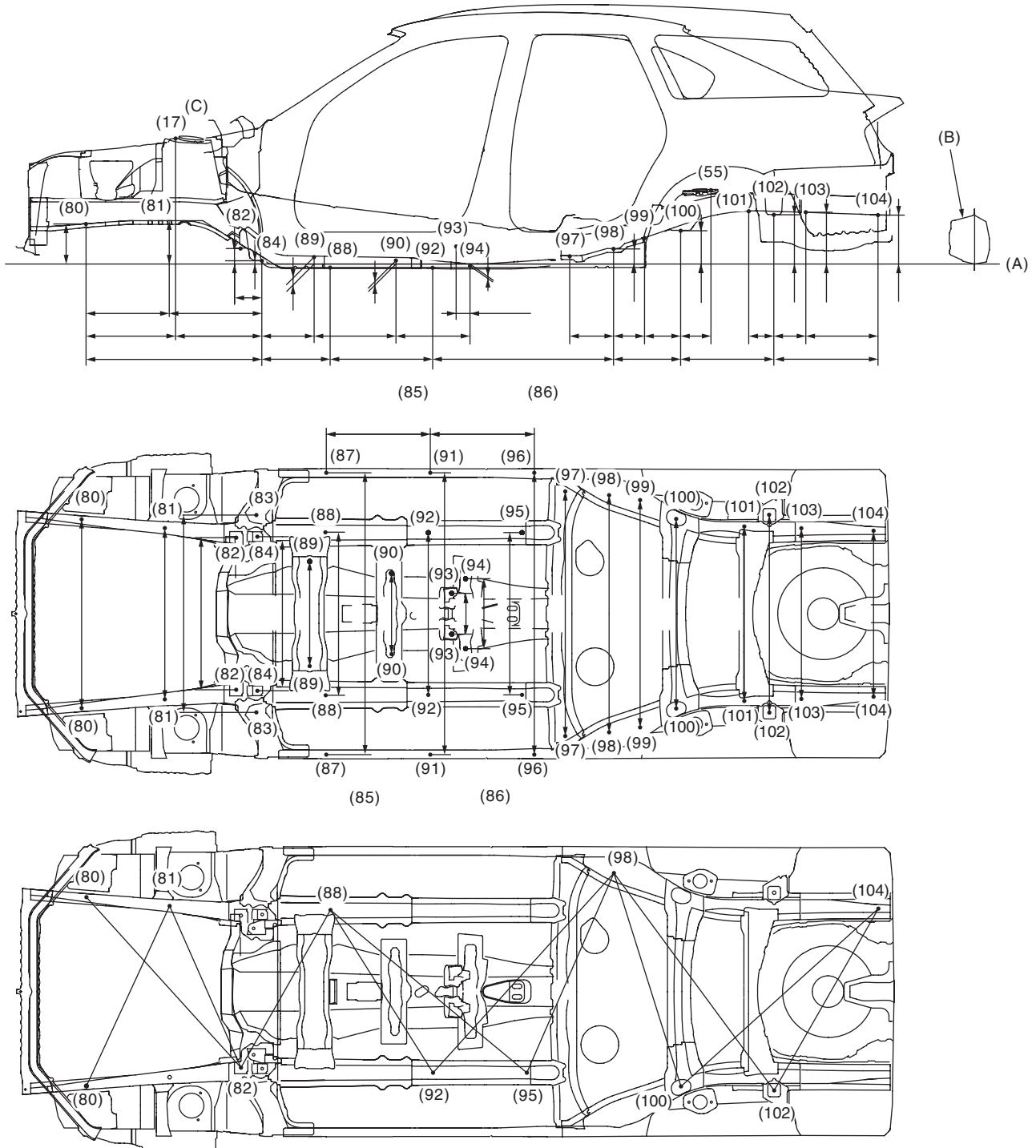
## BODY STRUCTURE

### 1. CENTER STRUCTURE

#### NOTE:

- Longitudinal dimensions are projected dimensions.
- The height dimensions are the vertical distances from the gauge point on the assumed horizontal line through the side sill flange joint (bending angle point).
- Diagonal dimensions are the actual dimensions between reference points. The values in brackets are projected dimensions for reference.

Unit: mm



BS-01530

# Datum Dimensions

## BODY STRUCTURE

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(A) Standard line	(B) Side sill	(C) Upper face
(80) Gauge hole (symmetrical)	(89) Transmission crossmember mounting hole (symmetrical)	(98) Trailing arm mounting hole (symmetrical)
(81) Front crossmember mounting hole (symmetrical), Lower surface rear	(90) Gauge hole (symmetrical)	(99) Trailing arm mounting hole (symmetrical)
(82) Front arm mounting hole (symmetrical)	(91) Under cover mounting hole (symmetrical)	(100) Rear suspension crossmember mounting hole (symmetrical)
(83) Strut mount mounting hole (symmetrical)	(92) Under cover mounting hole (symmetrical)	(101) Canister hose mounting hole (symmetrical)
(84) Strut mount mounting hole (symmetrical)	(93) Center bearing mounting hole (symmetrical)	(102) Rear suspension crossmember mounting hole (symmetrical)
(85) Transmission crossmember mounting hole (symmetrical)	(94) Exhaust cover mounting hole (symmetrical)	(103) Gauge hole (symmetrical)
(86) Drain hose mounting hole (symmetrical)	(95) Weight reduction hole (symmetrical)	(104) Weight reduction hole (symmetrical)
(87) Under cover mounting hole (symmetrical)	(96) Under cover mounting hole (symmetrical)	
(88) Under cover mounting hole (symmetrical)	(97) Fuel protector mounting hole (symmetrical)	

## Datum Dimensions

### BODY STRUCTURE

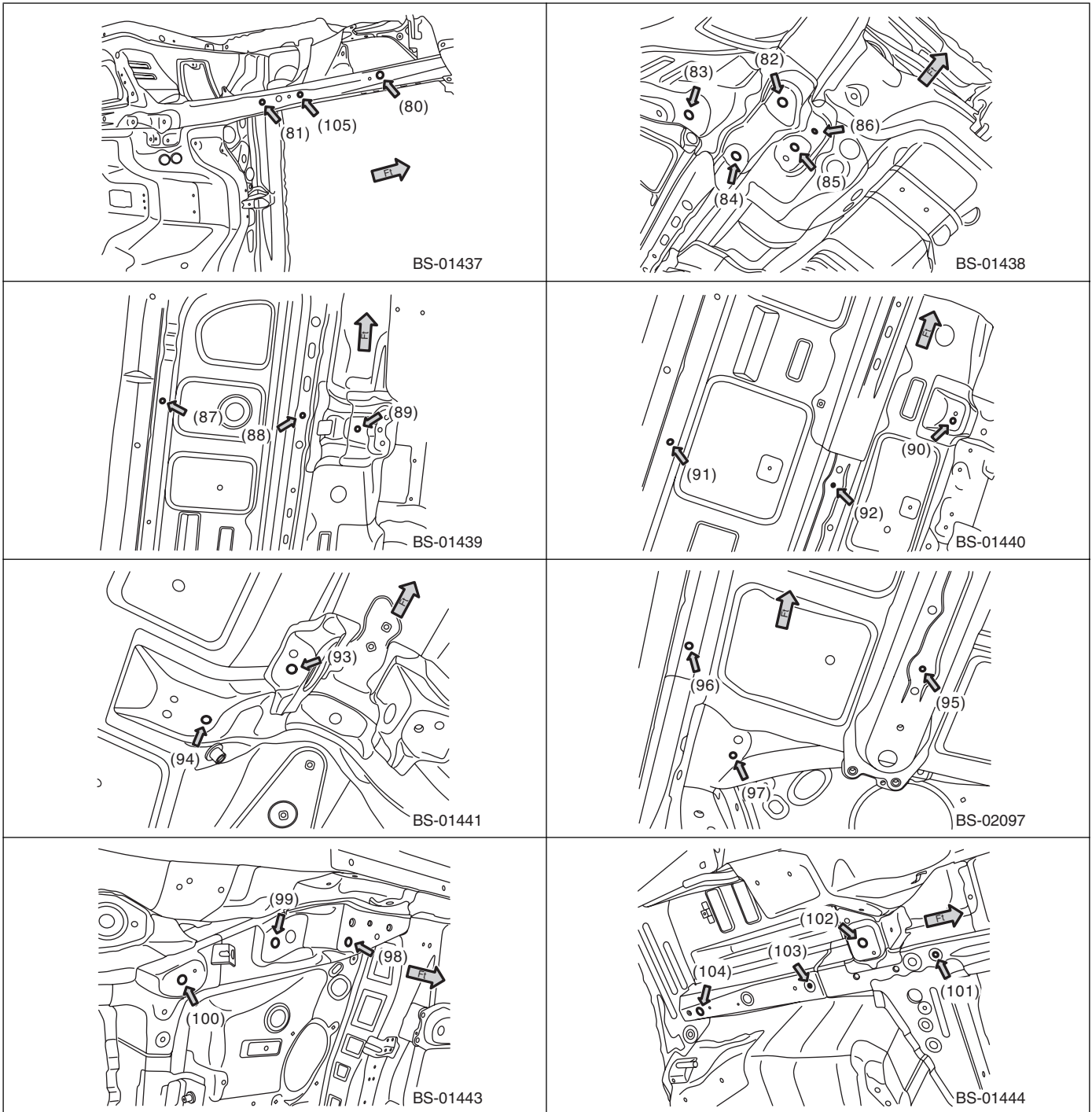
Point of measurement	Dimension mm (in)
Datum line to (80)	198 (7.80)
Datum line to (81)	212 (8.35)
Datum line to (82)	77 (3.03)
Datum line to (84)	17(0.07)
Datum line to (89)	(4AT and MT) 35 (1.38) (5AT) 56 (2.20)
Datum line to (90)	18 (0.71)
Datum line to (94)	-9 (-0.35)
Datum line to (98)	75 (2.95)
Datum line to (100)	164 (6.46)
Datum line to (102)	243 (9.57)
Datum line to (103)	255 (10.04)
Datum line to (104)	241 (9.49)
(17) to (80)	439 (17.28)
(17) to (84)	423 (16.65)
(80) to (81)	408 (16.06)
(80) to (84)	862 (33.94)
(81) to (84)	454 (17.87)
(82) to (84)	104 (4.09)
(84) to (88)	335 (13.19)
(84) to (89)	(4AT and MT) 257 (10.12) (5AT) 357 (14.06)
(88) to (92)	503 (19.80)
(89) to (90)	302 (11.89)
(90) to (94)	363 (14.29)
(92) to (98)	887 (34.92)
(93) to (94)	68 (2.68)
(97) to (98)	215 (8.46)
(98) to (99)	152 (5.98)
(98) to (100)	329 (12.95)
(99) to (100)	177 (6.97)
(100) to (55)	149 (5.87)
(100) to (102)	457 (17.99)
(101) to (102)	123 (4.84)
(102) to (103)	157 (6.18)
(102) to (104)	505 (19.88)
(103) to (104)	348 (13.70)
(80) RH to (80) LH	926 (36.46)
(81) RH to (81) LH	840 (33.07)
(82) RH to (82) LH	746 (29.37)
(83) RH to (83) LH	968 (38.11)
(84) RH to (84) LH	756 (29.76)
(87) RH to (87) LH	1,382 (54.41)
(87) to (91)	510 (20.08)
(88) RH to (88) LH	800 (31.50)
(89) RH to (89) LH	(4AT and MT) 529 (20.83) (5AT) 433 (17.05)
(90) RH to (90) LH	396 (15.59)
(91) RH to (91) LH	1,382 (54.41)
(91) to (96)	510 (20.08)

Point of measurement	Dimension mm (in)
(92) RH to (92) LH	796 (31.34)
(93) RH to (93) LH	200 (7.87)
(94) RH to (94) LH	343 (13.50)
(95) RH to (95) LH	796 (31.34)
(96) RH to (96) LH	1,382 (54.51)
(97) RH to (97) LH	1,200 (47.24)
(98) RH to (98) LH	1,163 (45.49)
(99) RH to (99) LH	1,115 (43.90)
(100) RH to (100) LH	930 (36.61)
(101) RH to (101) LH	856 (33.70)
(102) RH to (102) LH	970 (38.19)
(103) RH to (103) LH	836 (32.91)
(104) RH to (104) LH	814 (32.05)
(85)	Height 86 (3.39), Width 620 (24.41)
(86)	Height 117 (4.61), Width 600 (23.62)

Point of measurement	Dimension/Projected Dimensions For Reference mm (in)
(80) RH to (82) LH	1,135 (44.68)/1,128 (44.41)
(80) LH to (81) RH	973 (38.31)/973 (38.31)
(81) RH to (82) LH	877 (34.53)/867 (34.13)
(82) LH to (88) LH	894 (35.20)/889 (35.00)
(88) RH to (92) LH	943 (37.13)/943 (37.13)
(88) RH to (95) LH	1,251 (49.25)/1,251 (49.25)
(92) LH to (98) RH	1,325 (52.17)/1,321 (52.01)
(95) LH to (98) RH	1,072 (42.20)/1,069 (42.09)
(98) RH to (100) LH	1,101 (43.35)/1,097 (43.19)
(98) RH to (102) LH	1,335 (52.56)/1,325 (52.17)
(100) LH to (104) RH	1,305 (51.38)/1,303 (51.30)
(102) LH to (104) RH	1,028 (40.47)/1,028 (40.47)

# Datum Dimensions

## BODY STRUCTURE



### NOTE:

For reference point (17) Strut mounting hole (symmetrical), refer to "Datum Dimensions". <Ref. to BS-8, FRONT STRUCTURE, MEASUREMENT, Datum Dimensions.>

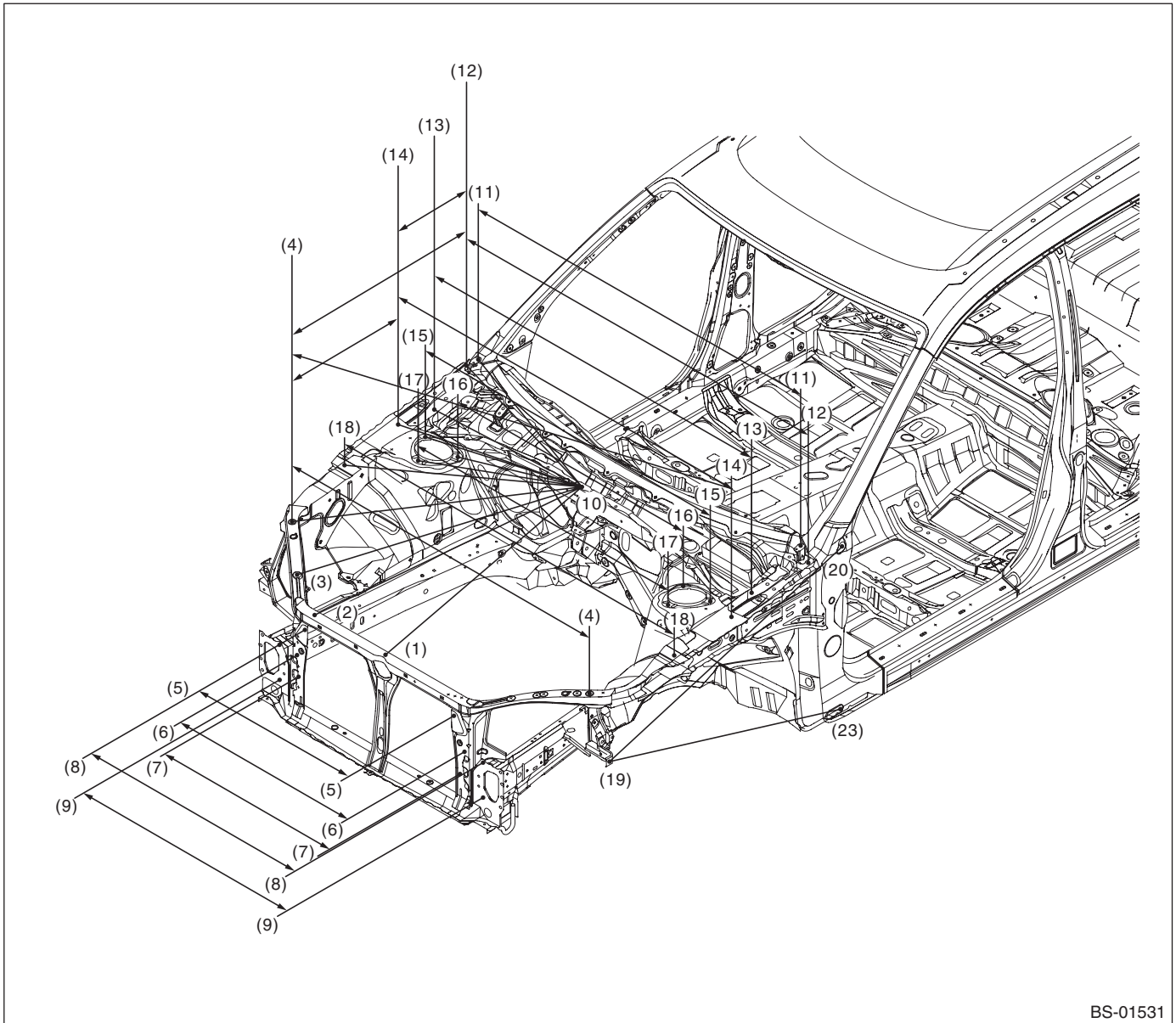
For reference point (55) Rear suspension mounting hole (symmetrical), refer to "Datum Dimensions". <Ref. to BS-11, INSIDE, MEASUREMENT, Datum Dimensions.>

# Datum Dimensions

## BODY STRUCTURE

### 2. FRONT STRUCTURE

- Common for wagon and sedan model



BS-01531

- |   |  |   |
|---|--|---|
| (1) Repair location hole (body center)                    | (9) Bumper beam mounting hole (symmetrical), lower side    | (16) Strut mount mounting hole (symmetrical), rear inside |
| (2) Radiator mounting hole                                | (10) Cowl panel mounting hole (body center)                | (17) Strut mount mounting hole (symmetrical), front       |
| (3) Headlight mounting hole (symmetrical)                 | (11) Fender mounting hole (symmetrical)                    | (18) Fender mounting hole (symmetrical)                   |
| (4) Reinforcement fender mounting hole (symmetrical)      | (12) Location hole (symmetrical)                           | (19) Fender mounting hole (symmetrical)                   |
| (5) Air conditioner condenser mounting hole (symmetrical) | (13) Hood hinge mounting hole (symmetrical), front         | (20) Fender mounting hole (symmetrical)                   |
| (6) Beam corner side mounting hole (symmetrical)          | (14) Fender extension mounting hole (symmetrical)          | (23) Fender mounting hole (symmetrical)                   |
| (7) Heat insulation cover mounting hole (symmetrical)     | (15) Strut mount mounting hole (symmetrical), rear outside |   |
| (8) Bumper beam mounting hole (symmetrical), upper side   |  |   |

# Datum Dimensions

Point of measurement	Datum dimension mm (in)
(1) — (10)	893 (35.16)
(2) — (10)	948 (37.32)
(3) — (10)	934 (36.77)
(4) — (10)	918 (36.14)
(4) — (4)	1,314 (51.73)
(4) — (12)	882 (34.72)
(4) — (14)	557 (21.93)
(4) RH — (14) LH	1,498 (58.98)
(4) LH — (14) RH	1,498 (58.98)
(5) — (5)	658 (25.91)
(6) — (6)	740 (29.13)
(7) — (7)	700 (27.56)
(8) — (8)	900 (35.43)
(9) — (9)	900 (35.43)
(10) — (11)	755 (29.72)
(10) — (12)	794 (31.26)
(10) — (13)	707 (27.83)
(10) — (14)	745 (29.33)
(10) — (15)	639 (25.16)
(10) — (16)	512 (20.16)
(10) — (17)	585 (23.03)
(10) — (18)	804 (31.65)
(11) — (11)	1,422 (55.98)
(12) — (12)	1,508 (59.37)
(12) — (14)	326 (12.83)
(13) — (13)	1,402 (55.20)
(14) — (14)	1,472 (57.95)
(15) — (15)	1,258 (49.53)
(16) — (16)	995 (39.17)
(17) — (17)	1,104 (43.46)
(18) — (18)	1,456 (57.32)
(19) — (20)	1,064 (41.89)
(19) — (23)	1,035 (40.75)

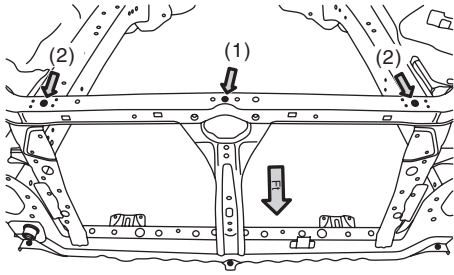
**NOTE:**

- The reference points (1) and (10) are at the body center, while the other points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.

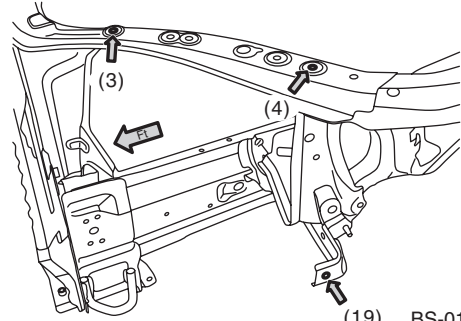


# Datum Dimensions

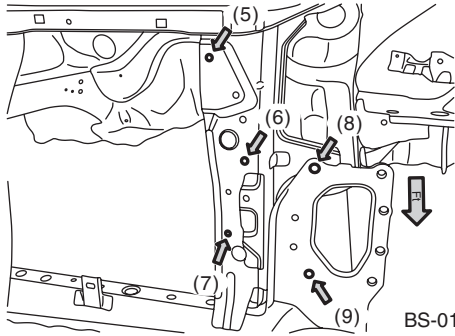
## BODY STRUCTURE



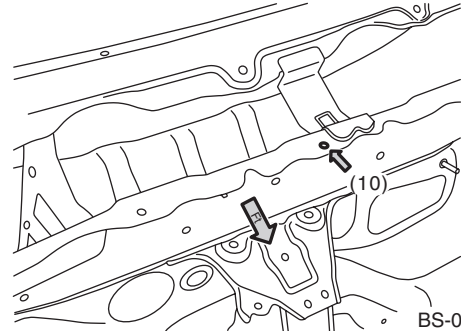
BS-01445



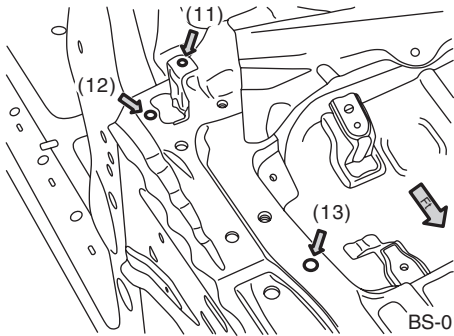
(19) BS-01446



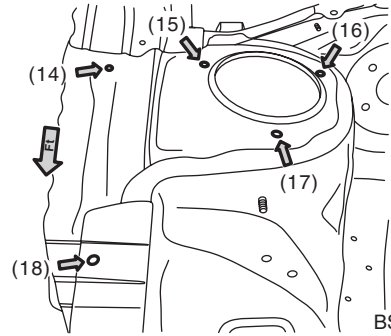
BS-01447



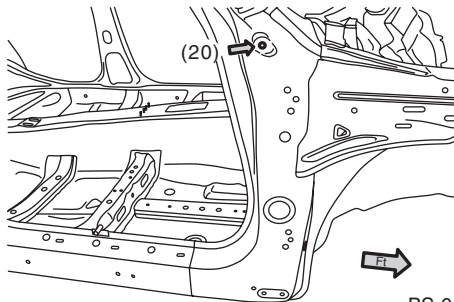
BS-01491



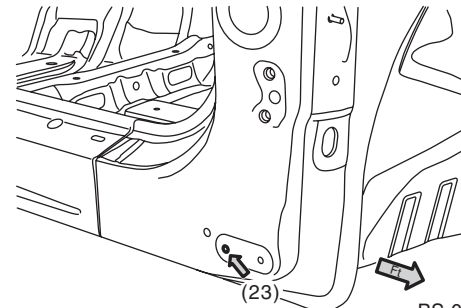
BS-01492



BS-01450



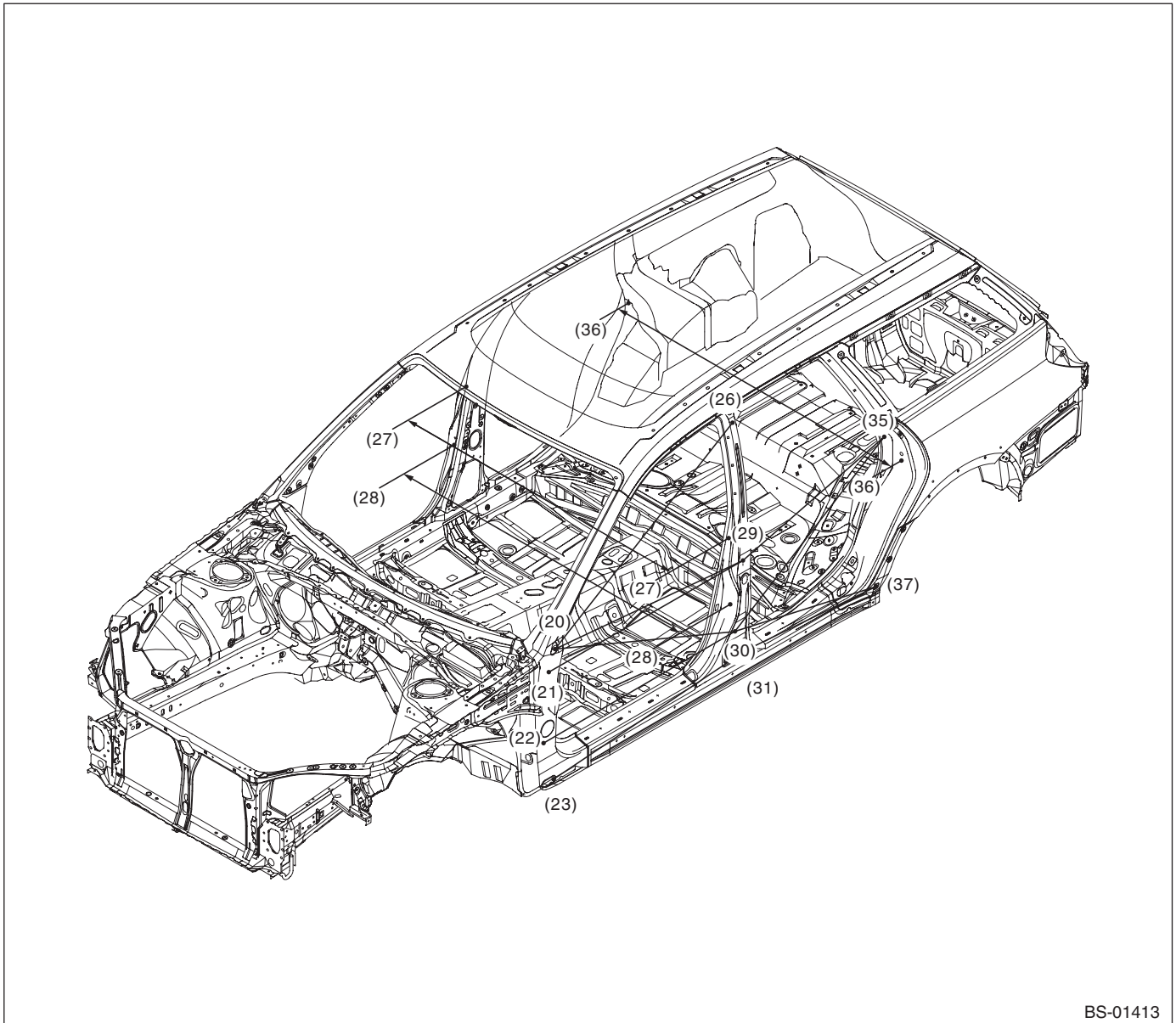
BS-01451



BS-01452

## 3. INSIDE

- Common for wagon and sedan model, 1



BS-01413

- |   |  |  |
|---|--|--|
| (20) Fender mounting hole (symmetrical)                             | (27) Weatherstrip mounting hole (symmetrical)          | (31) Gauge hole (symmetrical)                      |
| (21) Front door hinge upper mounting hole (symmetrical), upper side | (28) Front door striker mounting hole (symmetrical)    | (35) Weatherstrip mounting hole (symmetrical)      |
| (22) Front door hinge lower mounting hole (symmetrical), upper side | (29) Rear door hinge upper mounting hole (symmetrical) | (36) Rear door striker mounting hole (symmetrical) |
| (23) Fender mounting hole (symmetrical)                             | (30) Rear door hinge lower mounting hole (symmetrical) | (37) Protector mounting hole (symmetrical)         |
| (26) Gauge hole (symmetrical)                                       |  |  |

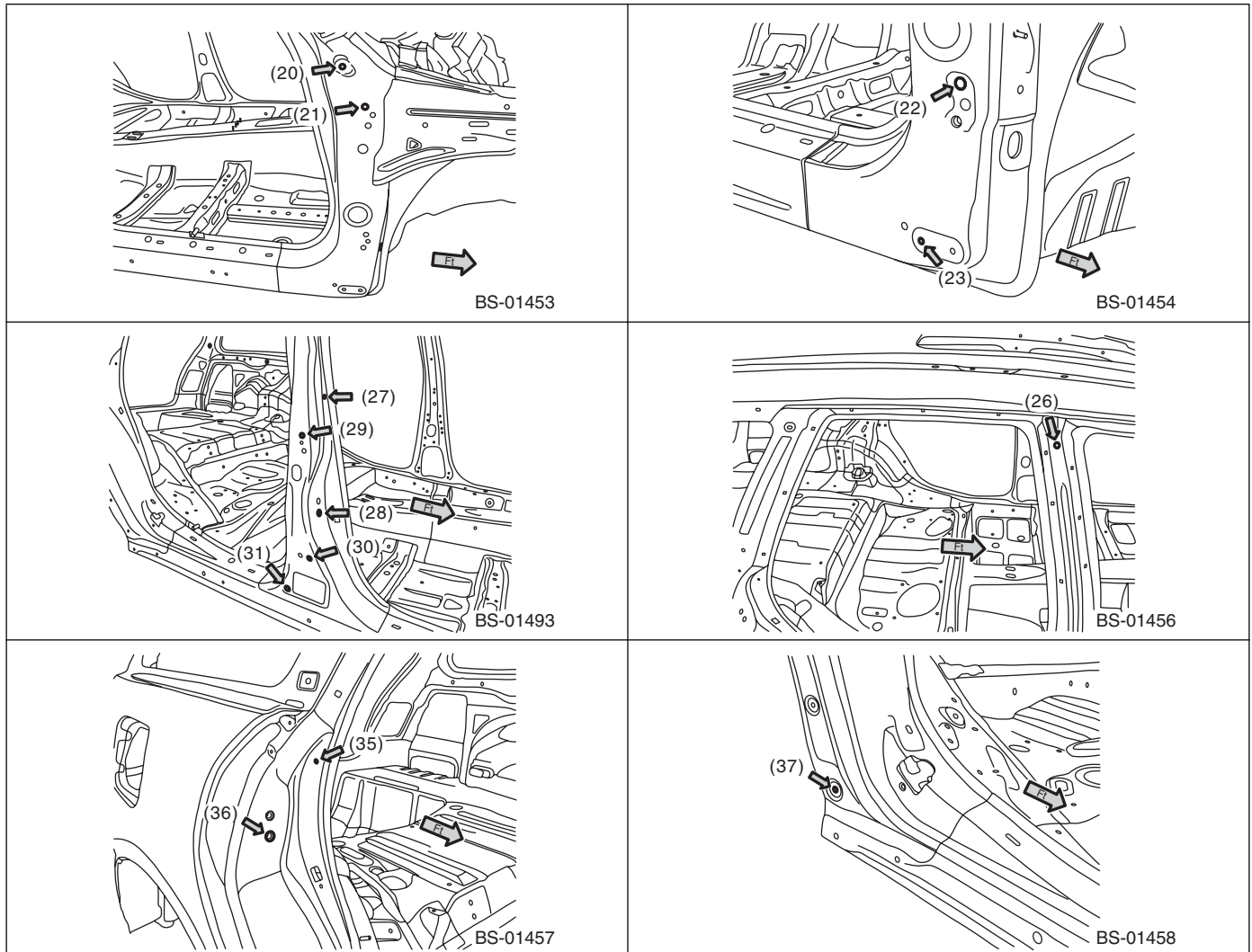
# Datum Dimensions

## BODY STRUCTURE

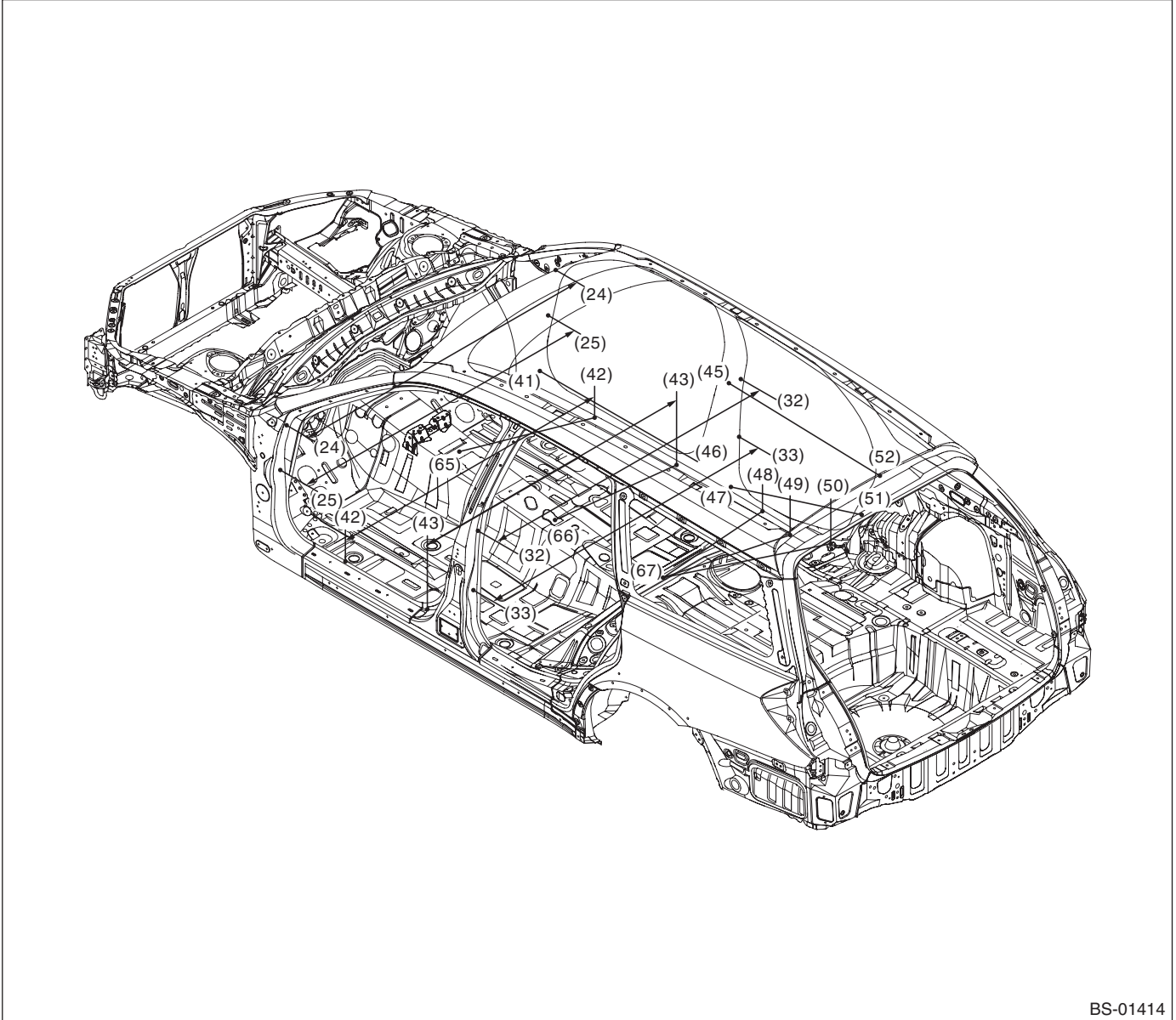
Point of measurement	Datum dimension mm (in)
(20) — (26)	1,232 (48.50)
(20) — (29)	1,034 (40.71)
(20) — (30)	1,066 (41.97)
(21) — (29)	1,080 (42.52)
(22) — (30)	1,055 (41.54)
(23) — (31)	1,070 (42.13)
(27) — (27)	1,448 (57.01)
(28) — (28)	1,523 (59.96)
(29) — (35)	863 (33.98)
(30) — (35)	1,002 (39.45)
(30) — (37)	753 (29.65)
(31) — (37)	679 (26.73)
(36) — (36)	1,506 (59.29)

### NOTE:

- All reference points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.



- Common for wagon and sedan model, 2



BS-01414

- |   |   |  |
|---|---|--|
| (24) Weatherstrip mounting hole (symmetrical)       | (43) Harness clip mounting hole (symmetrical) | (50) Side sill cover mounting hole (symmetrical) |
| (25) Front door checker mounting hole (symmetrical) | (45) Trim clip mounting hole (symmetrical)    | (51) Gauge hole (symmetrical)                    |
| (32) Weatherstrip mounting hole (symmetrical)       | (46) Trim clip mounting hole (symmetrical)    | (52) Trim clip mounting hole (symmetrical)       |
| (33) Rear door checker mounting hole (symmetrical)  | (47) Harness clip mounting hole (symmetrical) | (65) Airbag unit mounting hole (body center)     |
| (41) Side sill cover mounting hole (symmetrical)    | (48) Harness clip mounting hole (symmetrical) | (66) Side sill cover mounting hole (symmetrical) |
| (42) Harness clip mounting hole (symmetrical)       | (49) Harness clip mounting hole (symmetrical) | (67) Floor mat mounting hole (body center)       |

# Datum Dimensions

## BODY STRUCTURE

---

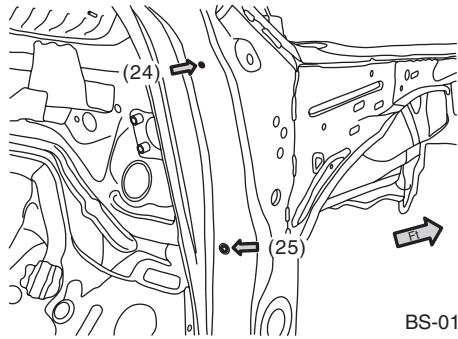
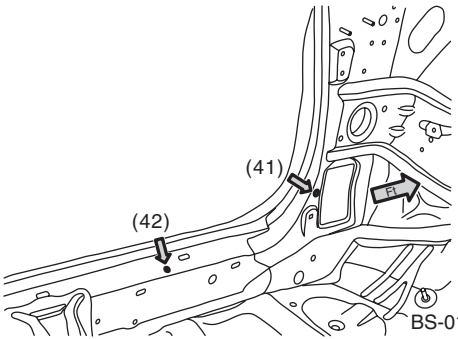
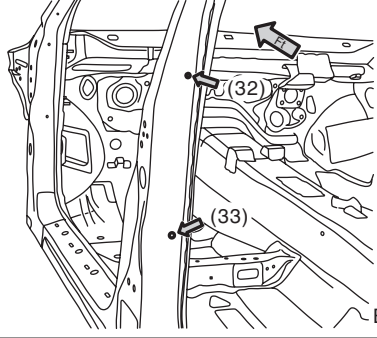
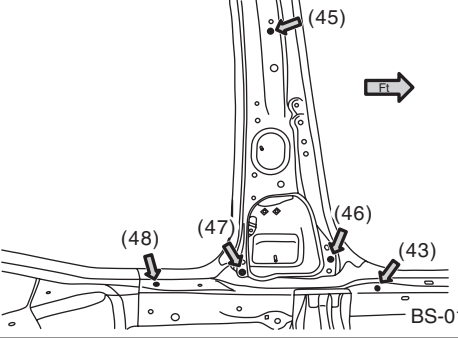
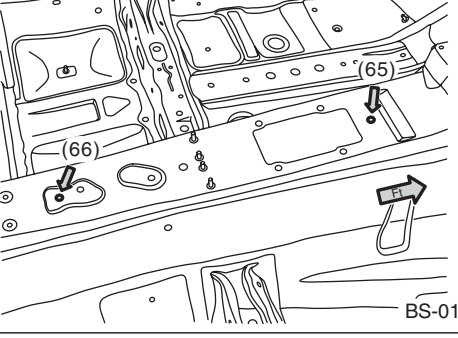
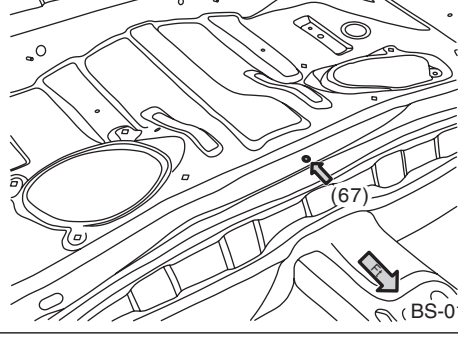
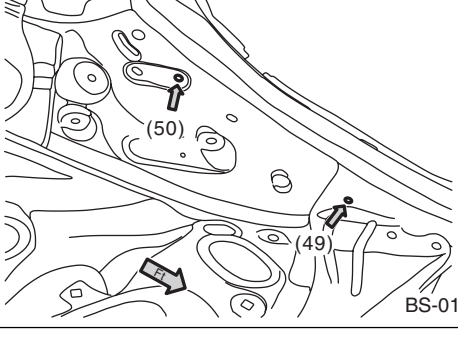
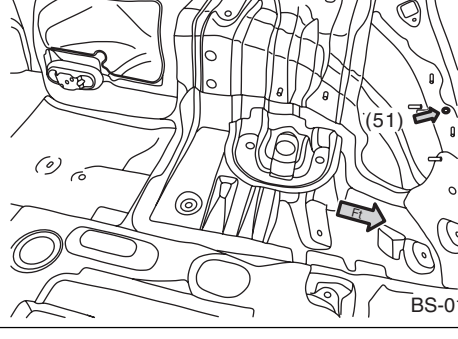
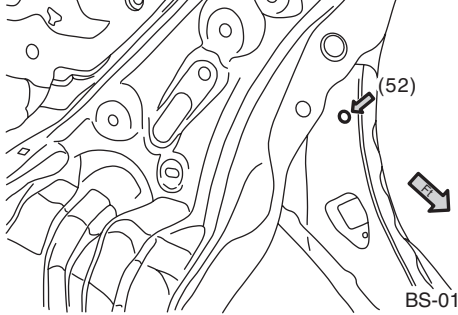
Point of measurement	Datum dimension mm (in)
(24) — (24)	1,482 (58.35)
(25) — (25)	1,476 (58.11)
(32) — (32)	1,448 (57.01)
(33) — (33)	1,464 (57.64)
(41) — (46)	863 (33.98)
(42) — (42)	1,373 (54.06)
(42) — (65)	706 (27.80)
(43) — (43)	1,373 (54.06)
(43) — (66)	693 (27.28)
(45) — (52)	838 (32.99)
(47) — (51)	740 (29.13)
(48) — (67)	711 (27.99)
(49) — (67)	649(25.55)
(50) — (67)	704 (27.72)

### NOTE:

- The reference points (65), (66), and (67) are at the body center, while the other points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.

# Datum Dimensions

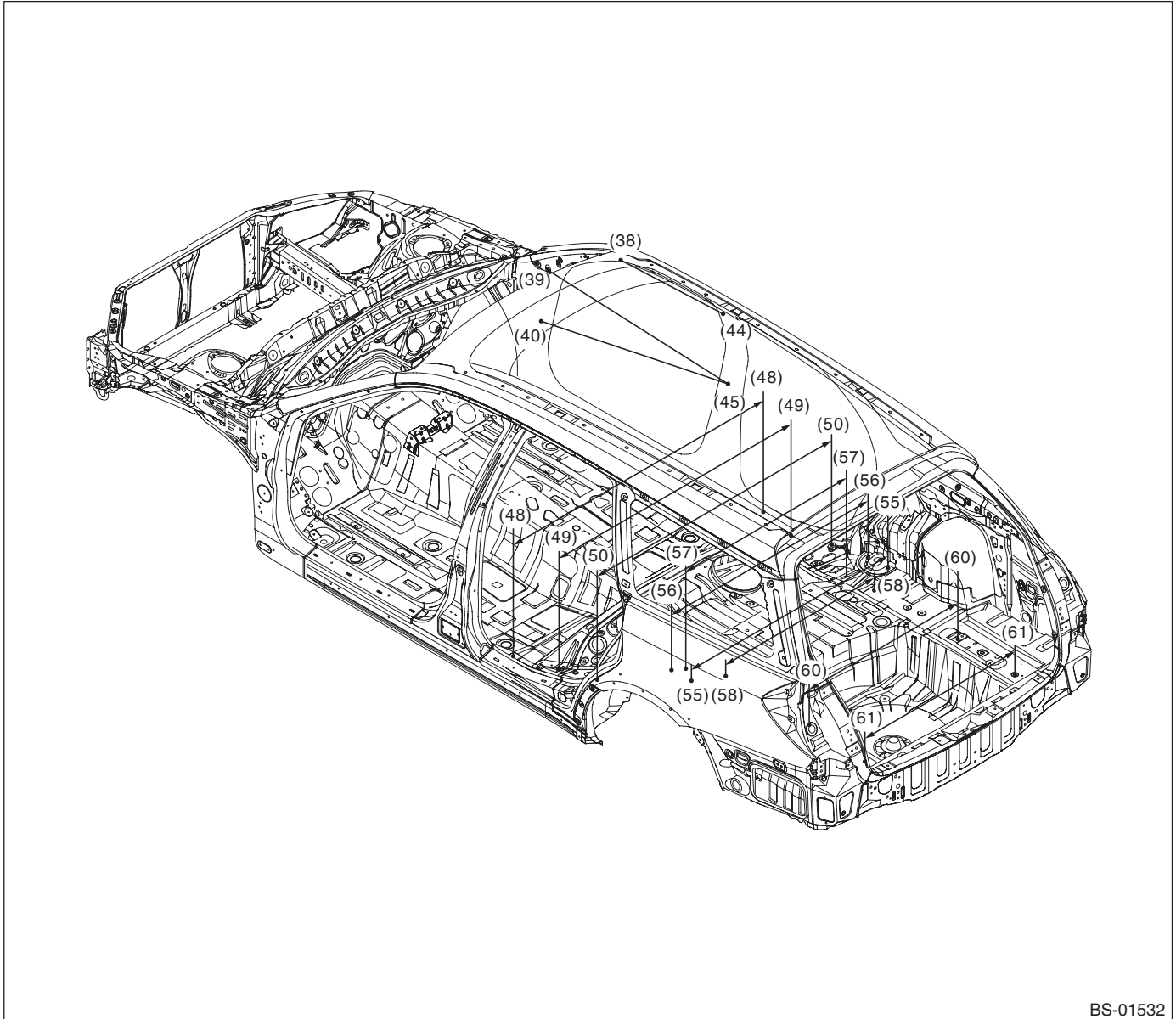
## BODY STRUCTURE

 <p>BS-01459</p>	 <p>BS-01460</p>
 <p>BS-01494</p>	 <p>BS-01462</p>
 <p>BS-01463</p>	 <p>BS-01464</p>
 <p>BS-01465</p>	 <p>BS-01466</p>
 <p>BS-01467</p>	<p><b>SUBARU.</b></p>

# Datum Dimensions

## BODY STRUCTURE

- Common for wagon and sedan model, 3



BS-01532

- |  |  |   |
|--|--|---|
| (38) Trim clip mounting hole (symmetrical)     | (48) Harness clip mounting hole (symmetrical)          | (56) Rear suspension mounting hole (symmetrical), front |
| (39) ED hole (symmetrical)                     | (49) Harness clip mounting hole (symmetrical)          | (57) Rear seat hinge mounting hole (symmetrical)        |
| (40) Hood lock lever arrest hole (symmetrical) | (50) Side sill cover mounting hole (symmetrical)       | (60) Gauge hole (symmetrical)                           |
| (44) Trim clip mounting hole (symmetrical)     | (55) Rear suspension mounting hole (symmetrical), rear | (61) Gauge hole (symmetrical)                           |
| (45) Trim clip mounting hole (symmetrical)     |  |   |

# Datum Dimensions

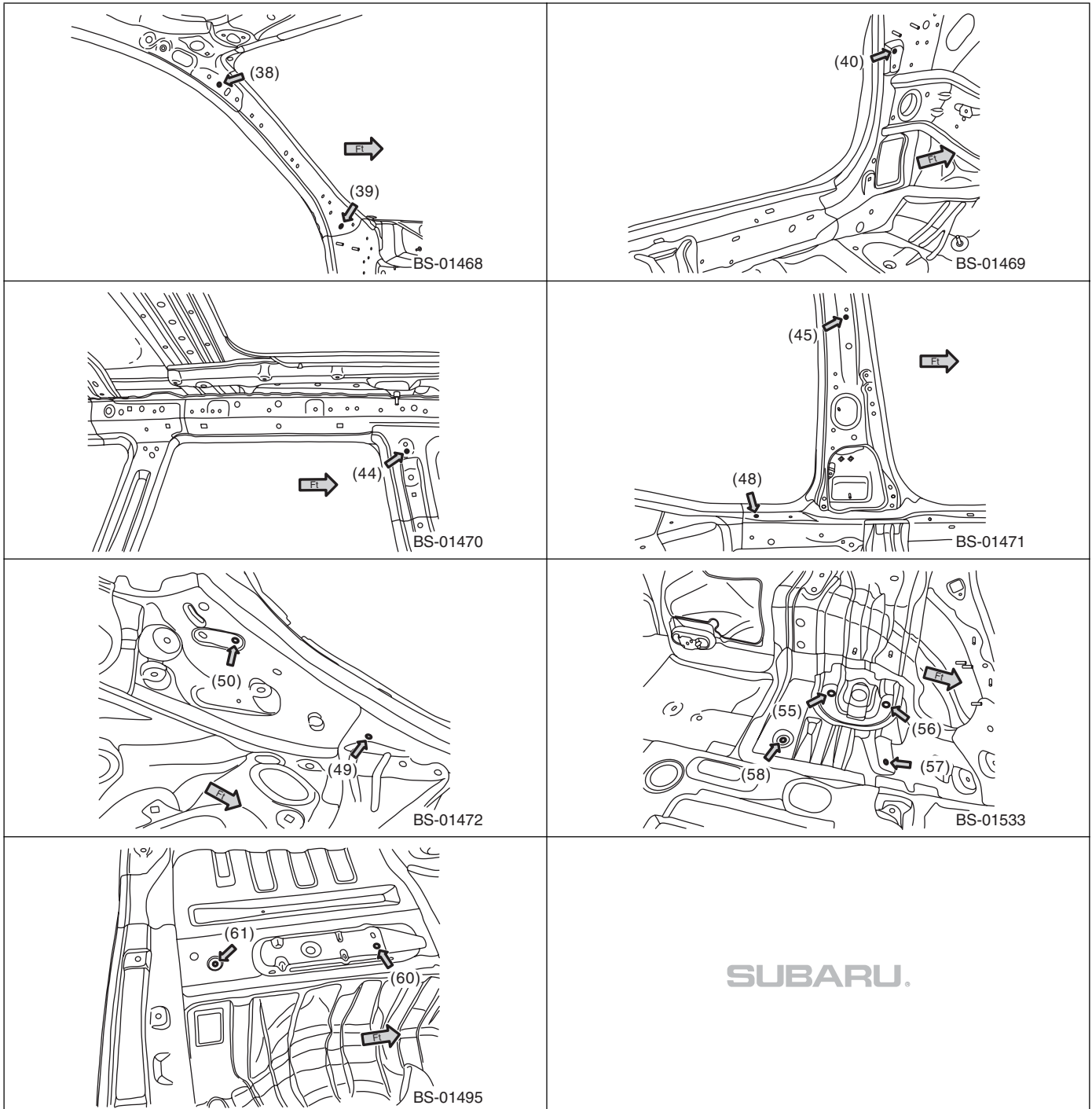
## BODY STRUCTURE

Point of measurement	Datum dimension mm (in)
(38) — (44)	586 (23.07)
(39) — (45)	993 (39.09)
(40) — (45)	1,043 (41.06)
(48) — (48)	1,380 (54.33)
(49) — (49)	1,280 (50.39)
(50) — (50)	1,294 (50.94)

Point of measurement	Datum dimension mm (in)
(55) — (55)	1,084 (42.68)
(56) — (56)	1,090 (42.91)
(57) — (57)	886 (34.88)
(58) — (58)	820 (32.28)
(60) — (60)	820 (32.28)
(61) — (61)	840 (33.07)

### NOTE:

- All reference points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.



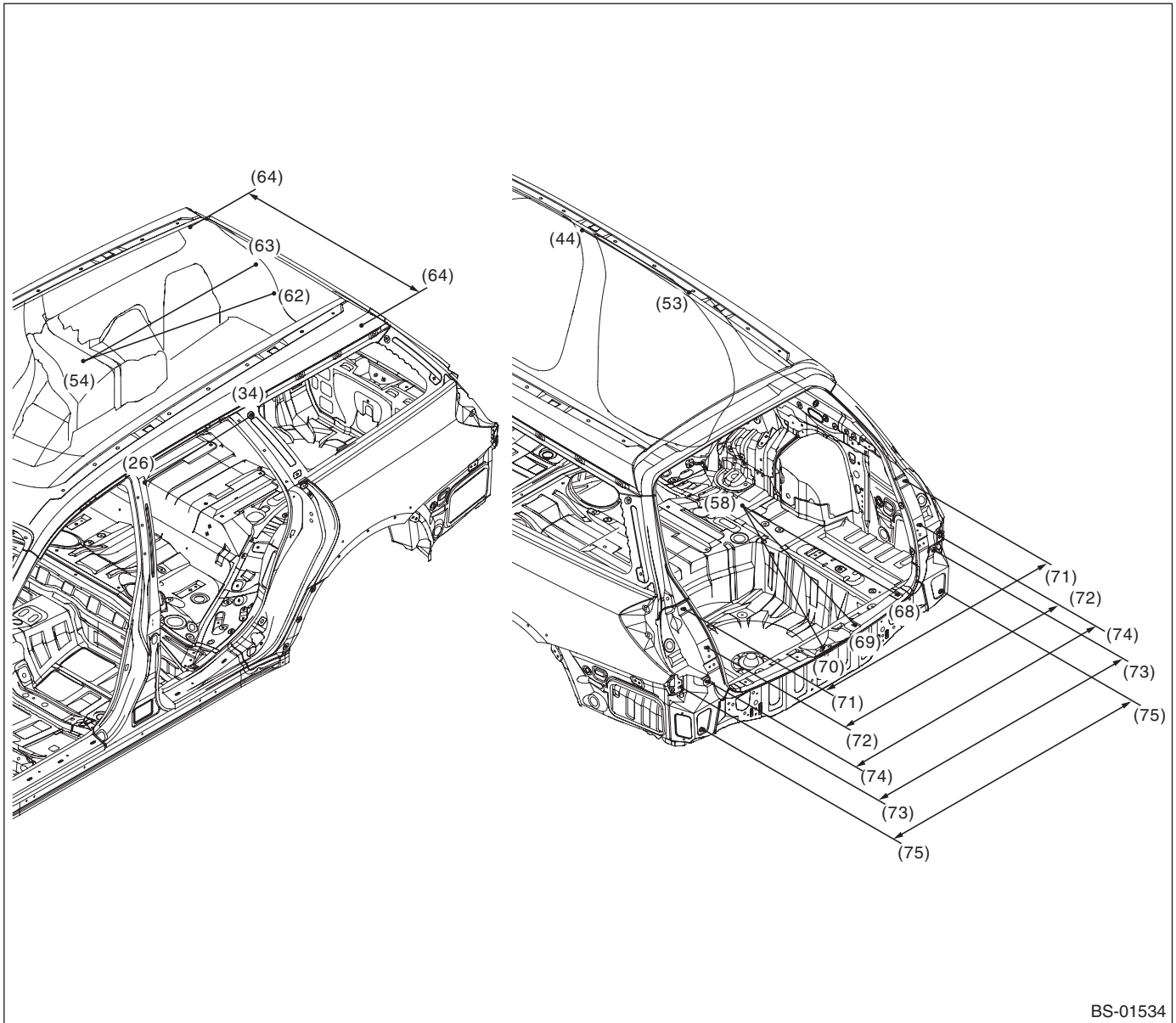


# Datum Dimensions

## BODY STRUCTURE

### 4. REAR

- Wagon model



BS-01534

(26) Gauge hole (symmetrical)	(62) Trim clip mounting hole (symmetrical)	(70) Repair location hole (body center)
(34) Rear quarter glass mounting hole (symmetrical)	(63) Trim clip mounting hole (symmetrical)	(71) Combination light mounting hole (symmetrical)
(44) Trim clip mounting hole (symmetrical)	(64) Harness clip mounting hole (symmetrical)	(72) Buffer mounting hole (symmetrical)
(53) Trim clip mounting hole (symmetrical)	(68) Trim clip mounting hole (symmetrical)	(73) Bumper mounting hole (symmetrical)
(54) Rear seat striker mounting hole (symmetrical)	(69) Trim clip mounting hole (symmetrical)	(74) Bracket corner mounting hole (symmetrical)
(58) Gauge hole (symmetrical)		(75) Gauge hole (symmetrical)

# Datum Dimensions

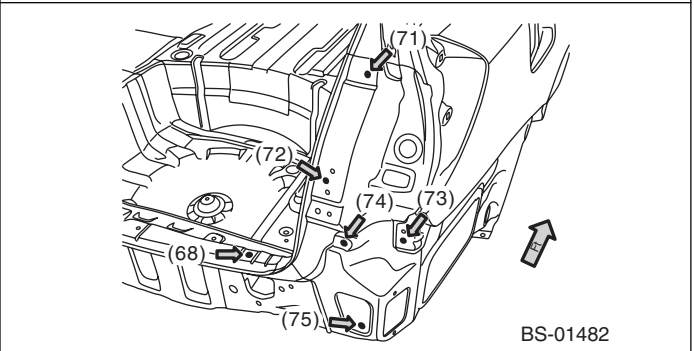
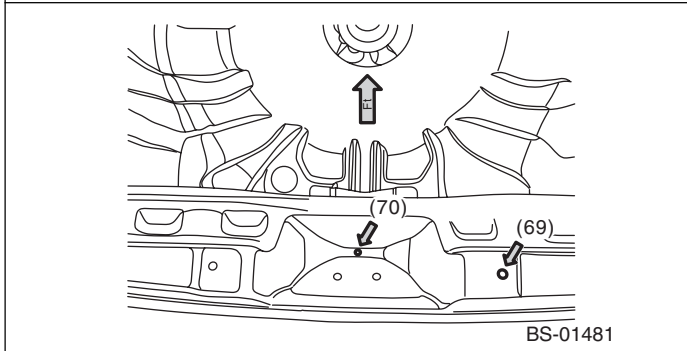
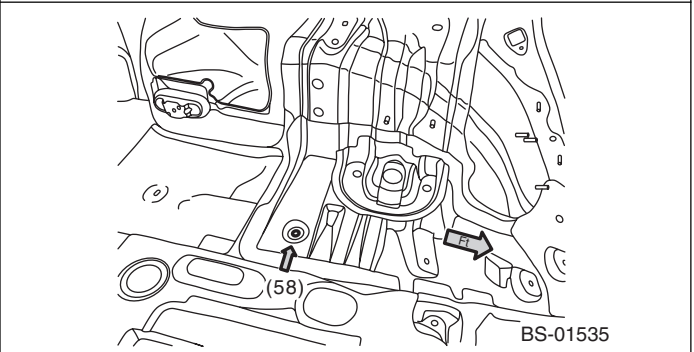
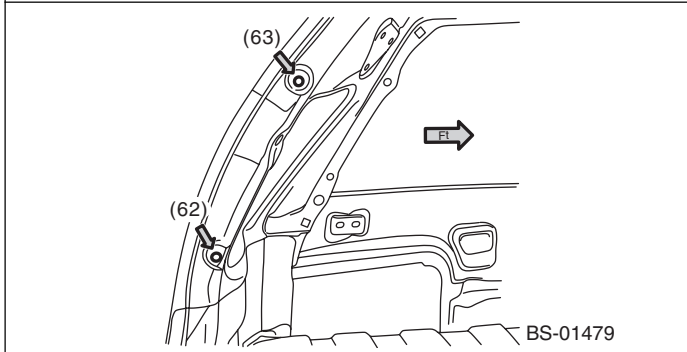
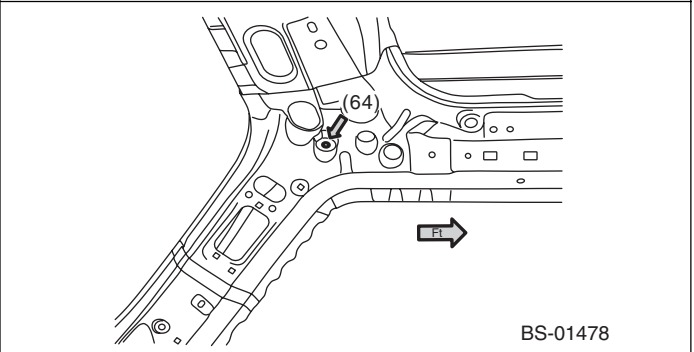
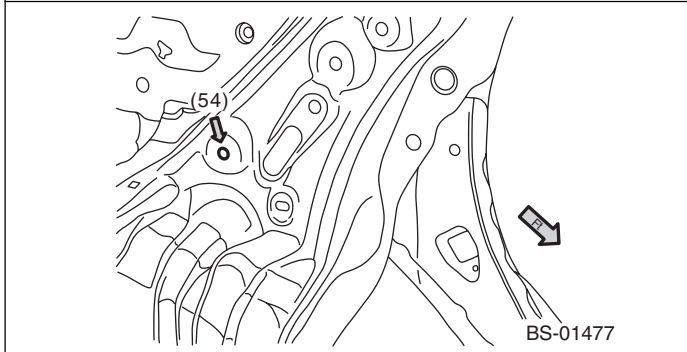
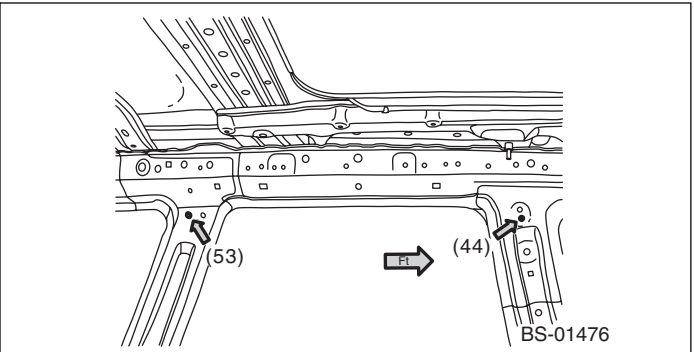
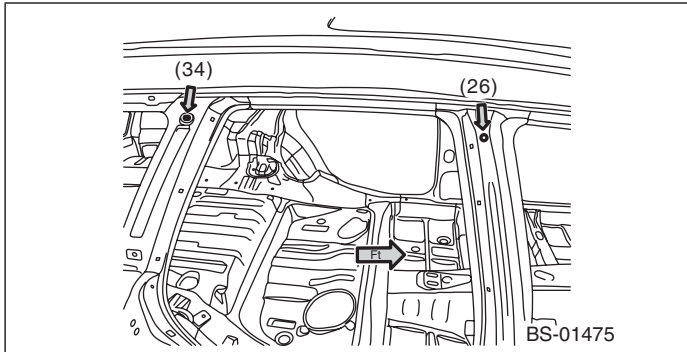
## BODY STRUCTURE

Point of measurement	Datum dimension mm (in)
(26) — (34)	613 (24.13)
(44) — (53)	591 (23.27)
(54) — (62)	969 (38.15)
(54) — (63)	884 (34.80)
(58) — (68)	900 (35.43)
(58) — (69)	958 (37.72)
(58) — (70)	990 (38.98)
(64) — (64)	944 (37.17)
(71) — (71)	1,224 (48.19)

Point of measurement	Datum dimension mm (in)
(72) — (72)	1,173 (46.18)
(73) — (73)	1,438 (56.61)
(74) — (74)	1,250 (49.21)
(75) — (75)	1,320 (59.97)

### NOTE:

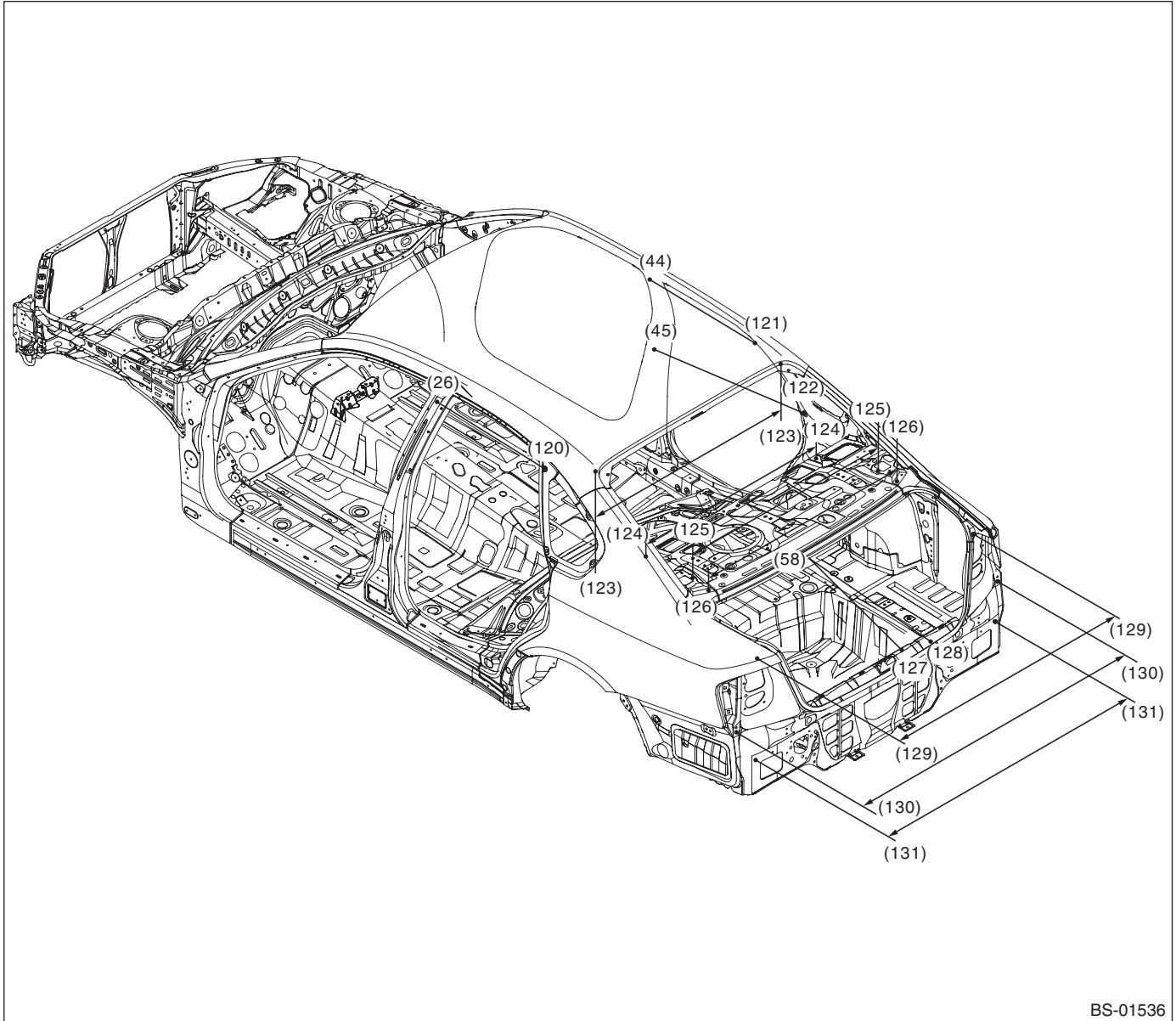
- The reference point (70) is at the body center, while the other points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.



# Datum Dimensions

## BODY STRUCTURE

- Sedan model



BS-01536

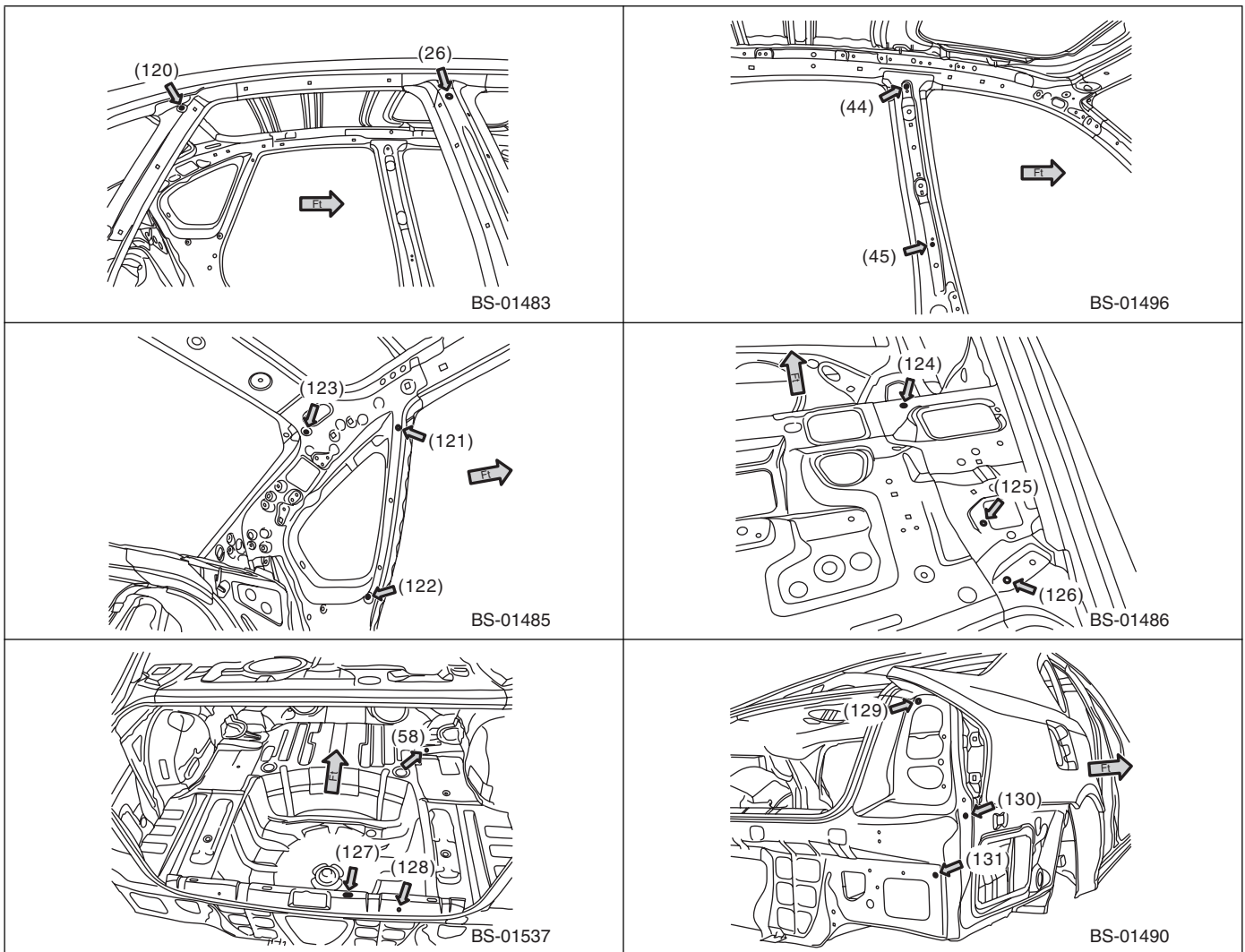
(26) Gauge hole (symmetrical)	(122) Trim clip mounting hole (symmetrical)	(127) Trim clip mounting hole (symmetrical)
(44) Trim clip mounting hole (symmetrical)	(123) Sunroof drain hose clip mounting hole (symmetrical)	(128) ED hole (symmetrical)
(45) Trim clip mounting hole (symmetrical)	(124) Trim clip mounting hole (symmetrical)	(129) Combination light mounting hole (symmetrical)
(58) Gauge hole (symmetrical)	(125) Harness clip mounting hole (symmetrical)	(130) Bumper bracket mounting hole (symmetrical)
(120) Six light glass mounting hole (symmetrical)	(126) Gauge hole (symmetrical)	(131) ED hole (symmetrical)
(121) Trim clip mounting hole (symmetrical)		

# Datum Dimensions

Point of measurement	Datum dimension mm (in)
(26) — (120)	598 (23.54)
(44) — (121)	570 (22.44)
(45) — (122)	835 (32.87)
(58) — (127)	916 (36.06)
(58) — (128)	904 (35.59)
(123) — (123)	1,024 (40.31)
(124) — (124)	940 (37.01)
(125) — (125)	1,024 (40.31)
(126) — (126)	1,040 (40.94)
(129) — (129)	1,191 (46.89)
(130) — (130)	1,442 (56.77)
(131) — (131)	1,322 (52.05)

**NOTE:**

- All reference points are left-right symmetrical.
- The dimensions are the actual dimensions between the reference points.



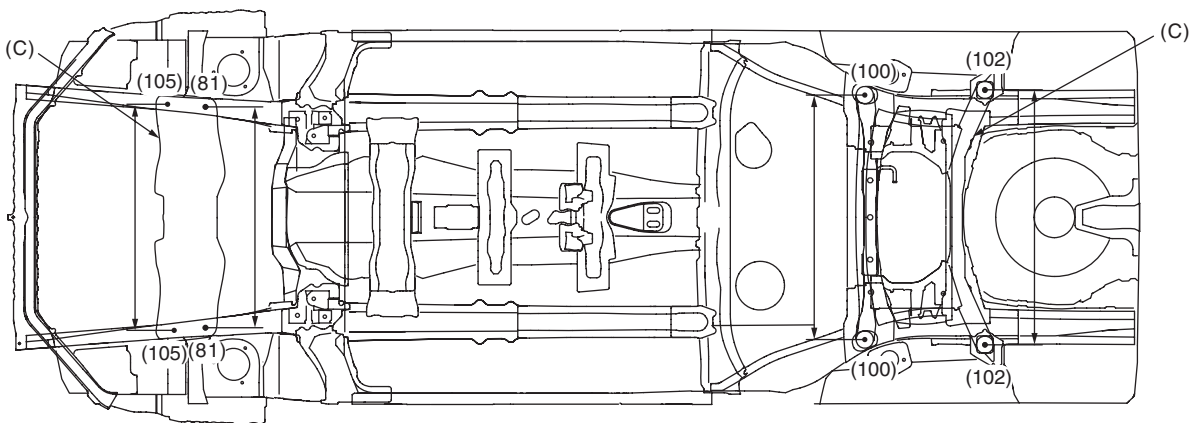
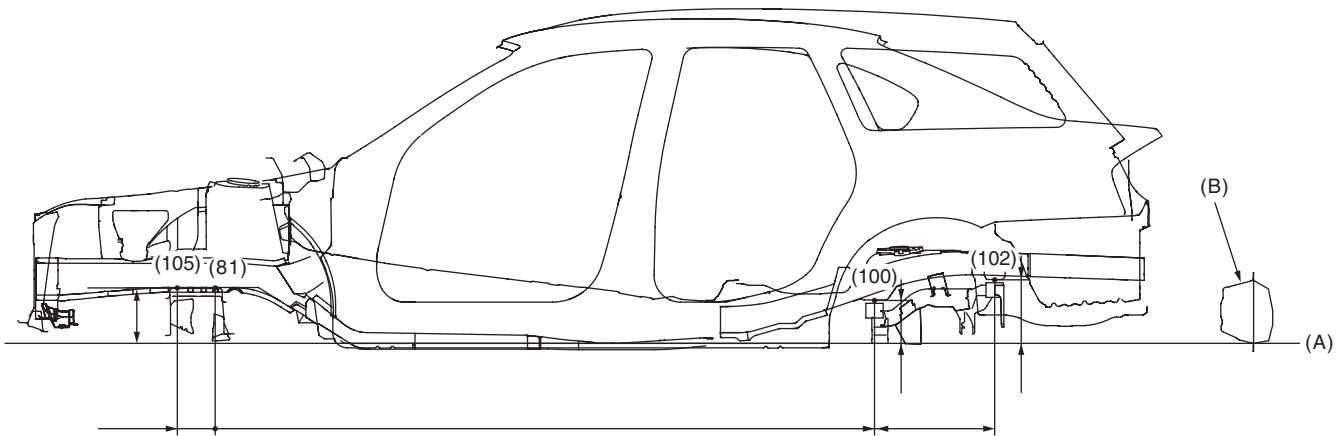
# Datum Dimensions

## BODY STRUCTURE

### 5. SUSPENSION MOUNT

#### NOTE:

- Longitudinal dimensions are projected dimensions.
- The height dimensions are the vertical distances from the gauge point on the assumed horizontal line through the side sill flange joint (bending angle point).
- For the reference point positions, refer to "Datum Dimensions". <Ref. to BS-4, CENTER STRUCTURE, MEASUREMENT, Datum Dimensions.>



BS-01418

# Datum Dimensions

BODY STRUCTURE

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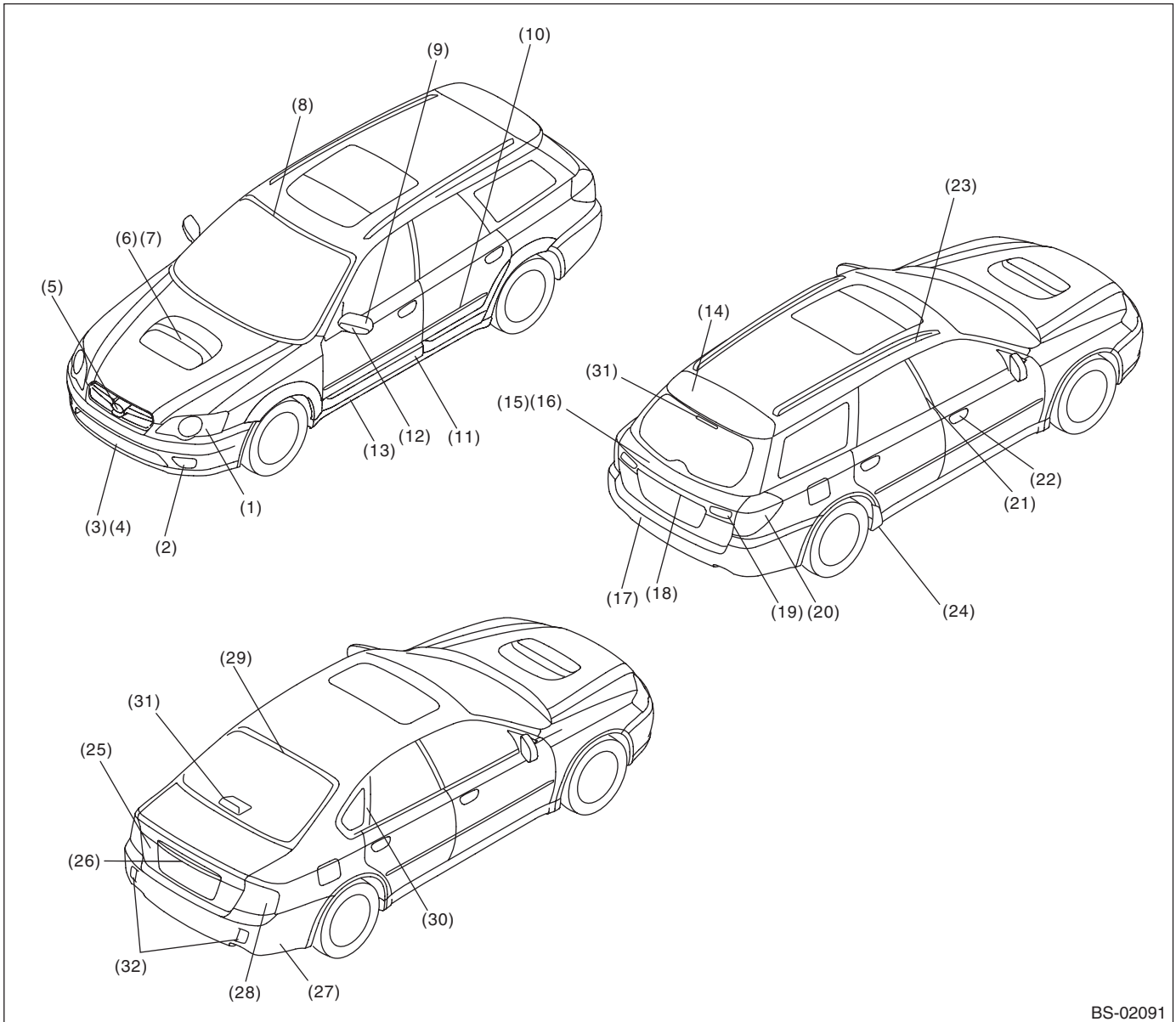
(A) Standard line	(B) Side sill	(C) Crossmember
(81) Front crossmember mounting hole (symmetrical), rear	(102) Rear suspension mounting hole (symmetrical)	(105) Front crossmember mounting hole (symmetrical), front
(100) Rear suspension mounting hole (symmetrical)		

# Plastic Parts and Materials

## BODY STRUCTURE

### 3. Plastic Parts and Materials

#### A: SPECIFICATION



BS-02091

- |                           |                             |                              |
|---------------------------|-----------------------------|------------------------------|
| (1) Headlight             | (12) Side turn light        | (23) Roof rail               |
| (2) Front fog light       | (13) Side spoiler           | (24) Rear quarter protector  |
| (3) Front bumper          | (14) Rear spoiler           | (25) Trunk garnish           |
| (4) Radiator guide        | (15) Rear garnish           | (26) License plate light     |
| (5) Front grille          | (16) License plate light    | (27) Rear bumper             |
| (6) Turbo grille          | (17) Rear bumper            | (28) Rear combination light  |
| (7) Hood duct inner       | (18) Rear gate handle       | (29) Rear window moulding    |
| (8) Front window moulding | (19) Back-up light          | (30) Six light moulding      |
| (9) Door mirror           | (20) Rear combination light | (31) High-mounted stop light |
| (10) Side protector       | (21) Center pillar cover    | (32) Reflex reflector        |
| (11) Side garnish         | (22) Door handle            |                              |

# Plastic Parts and Materials

BODY STRUCTURE

- Wagon model/Common for wagon and sedan model

No.	Part name	Material	
(1)	Headlight	Lens	PC
		Housing	PP
		Extension	PBT + PET
(2)	Front fog light (standard)	Housing	PP - GF40
	Front fog light (OUTBACK)	Lens	PC
		Reflector	UP - GF10
		Bracket	PP - GF30
(3)	Front bumper	Face	PP
		EA foam	Foamed PP
		Fog light cover	PP
		Hook cover	PP
		Guide bracket	POM
		Corner bracket	PP + GF30
(4)	Air intake cover	PP	
(5)	Front grille	ABS	
(6)	Turbo grille	PA + PPE	
(7)	Hood duct inner	PP + EPDM	
(8)	Front window moulding	PVC	
(9)	Door mirror	Body	ASA
		Inner cover	AES
		Outer cover	ABS
		Mirror holder	PP
(10)	Side protector	PP	
(11)	Side Garnish	Door body	PC + PET
		Other than door body	PP
		Side sill end cover	PP + EPDM
(12)	Side turn light	Lens	PMMA + PC
		Housing	PC
(13)	Side spoiler	Engine	PP
(14)	Rear Spoiler	Engine	PC + PET
		High mount lens	PMMA
		High mount housing	ABS
(15)	Rear garnish	Engine	PC + PET
		Moulding	ABS
(16)	License plate light	Lens	PC
		Housing	PBT + PET
(17)	Rear bumper	Face	PP
		EA foam	Foamed PP
(18)	Rear gate handle	PP - GF 20	
(19)	Back-up light	Lens	PMMA
		Housing	ASA
(20)	Rear combination light	Lens	PMMA
		Inner lens	PC
		Housing	ASA
		Reflex reflector	PMMA
		Cover	ASA
(21)	Center pillar cover	ABS	
(22)	Door handle	Handle	PC + PET
		End cover	PP



# Plastic Parts and Materials

## BODY STRUCTURE

No.	Part name		Material
(23)	Roof rail	Front cover	PC + PET
		Center cover (OUTBACK)	PC + PET
		Rear cover	PC + PET
(24)	Rear quarter protector		PP
	Front mud guard	Engine	PE
		Air flap	PE
	Rear mud guard		PE
	Under cover		PP
	Splash board		PP
	Cowl panel	Body, side	PP
		Cover	PP
	Rear wiper	Blade	PBT
		Arm	PET
		Arm cover	PBT

- Sedan model

No.	Part name		Material
(25)	Trunk garnish		PC + PET
(26)	License plate light	Lens	PC
		Housing	ASA
(27)	Rear bumper	Face	PP
		EA foam	Foamed PP
		Corner bracket	POM
(28)	Rear combination light	Lens	PMMA
		Inner lens	PMMA
		Housing	ASA
		Reflex reflector	PMMA
		Cover	ASA
(29)	Rear window moulding		PVC
(30)	Six light moulding		ABS
(31)	High-mounted stop light	Lens	PC
		Case	PP
		Reflector	PBT + PET
(32)	Reflex reflector	Lens	PMMA
		Housing	PC

## 4. List of Plastic Material Notations

### A: SPECIFICATION

Notation symbol	Material name	Notation symbol	Material name
ABS	ABS resin (acrylonitrile-butadiene-styrene resin)	PMMA	Polymethyl methacrylate
AES	Acrylonitrile/ethylene/styrene	PP	Polypropylene
ASA	Acrylonitrile/styrene/acrylate	PPE	Poly (phenylene ether)
EPDM	Ethylene/propylene/dien rubber	PP -GF20	Polypropylene (20% glass fiber content)
GF	Glass fiber	PP - GF30	Polypropylene (30% glass fiber content)
PA	Polyamide	PVC	Polyvinyl chloride
PBT	Poly (butylene terephthalate)	SEPM	Styrene/ethylene/propylene rubber
PC	Polycarbonate	TPO	Thermoplastic olefine
PE	Polyethylene	UP	Unsaturated polyester resin
PET	Polyethylene terephthalate	UP - GF10	Unsaturated polyester resin (10% glass fiber content)

# Body Sealing

## BODY STRUCTURE

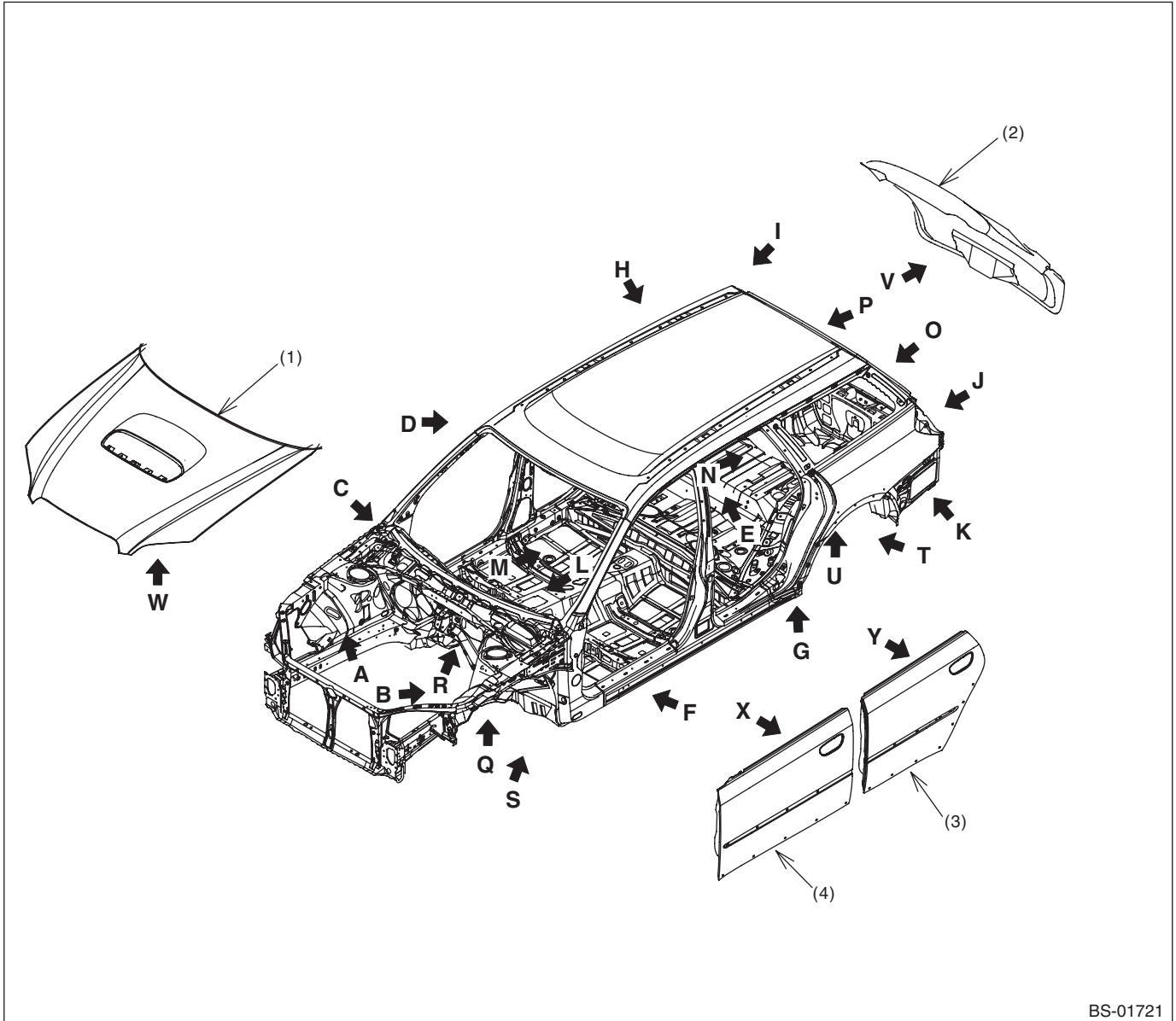
### 5. Body Sealing

#### A: SPECIFICATION

Used material:

**THREE BOND 4104 (004403063)**

- Common for wagon and sedan model



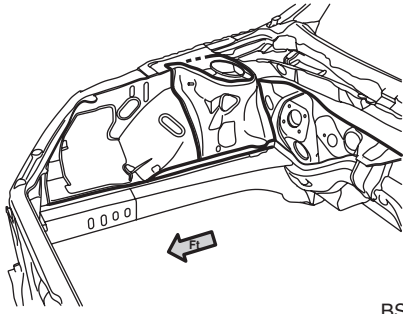
BS-01721

- (1) Front hood
- (2) Rear gate

- (3) Rear door

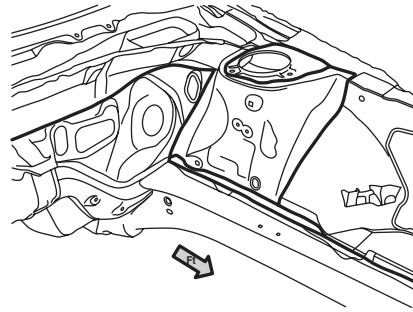
- (4) Front door

View A



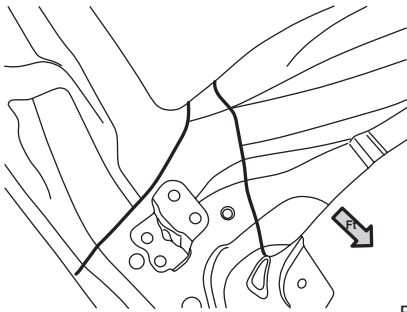
BS-01498

View B



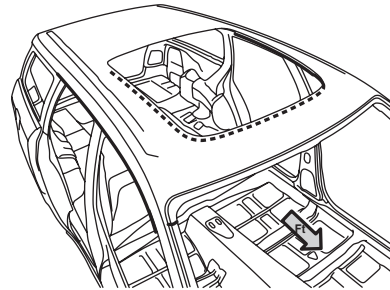
BS-01499

View C



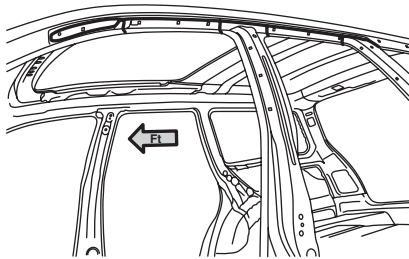
BS-00734

View D



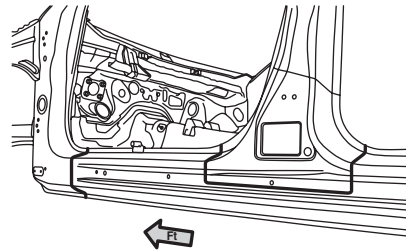
BS-00735

View E



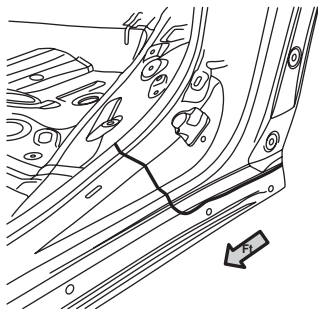
BS-00736

View F



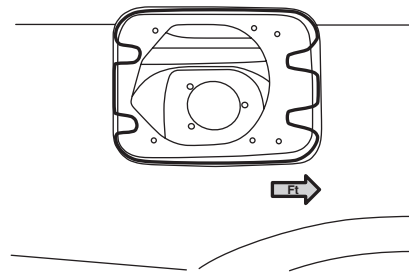
BS-01601

View G



BS-00738

View H

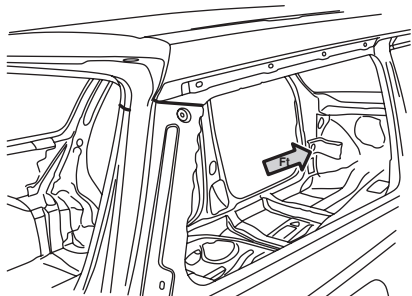


BS-00739

# Body Sealing

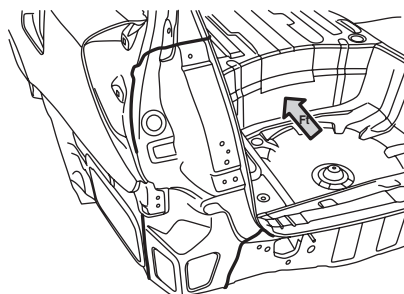
## BODY STRUCTURE

View I



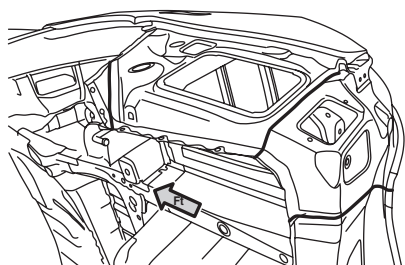
BS-00740

View J



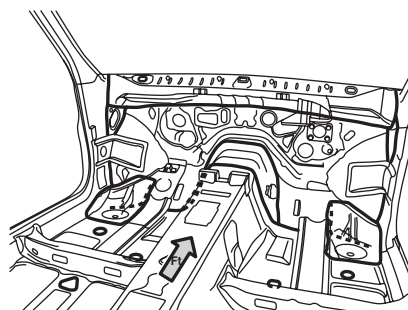
BS-00741

View K



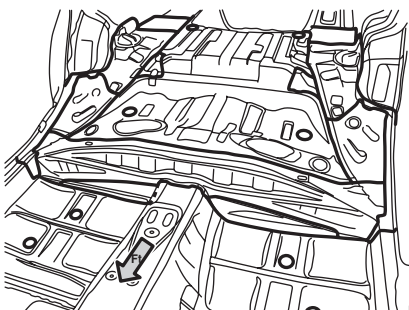
BS-00742

View L



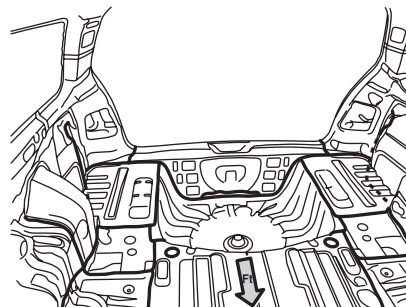
BS-00743

View M



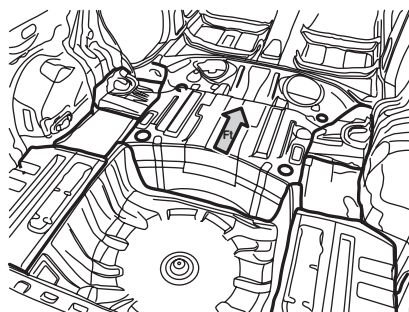
BS-01718

View N



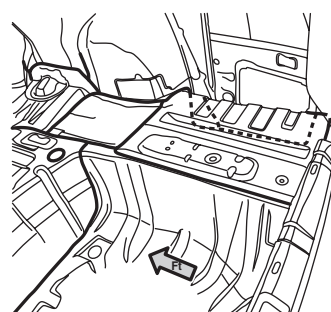
BS-01719

View O



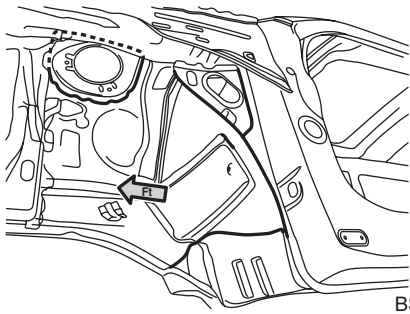
BS-01720

View P



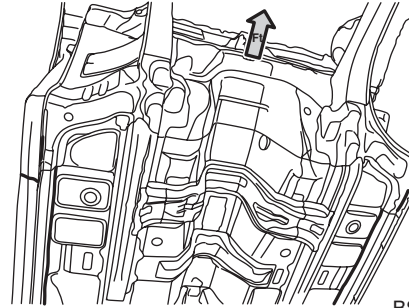
BS-00747

View Q



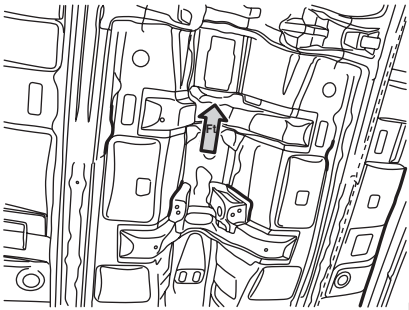
BS-00748

View R



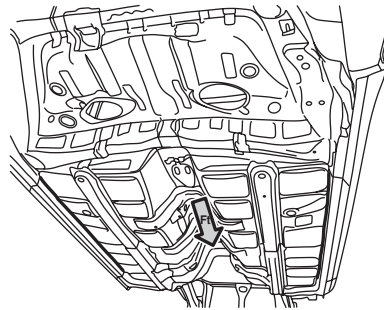
BS-01500

View S



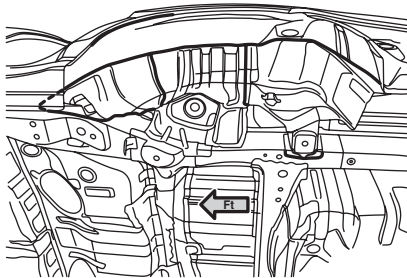
BS-01501

View T



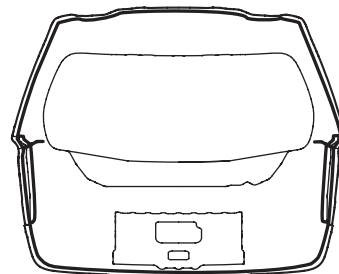
BS-01502

View U



BS-01602

View V



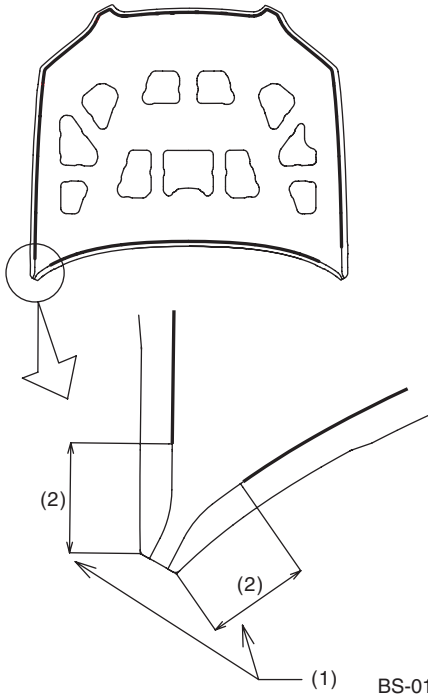
BS-00756

# Body Sealing

## BODY STRUCTURE

View W

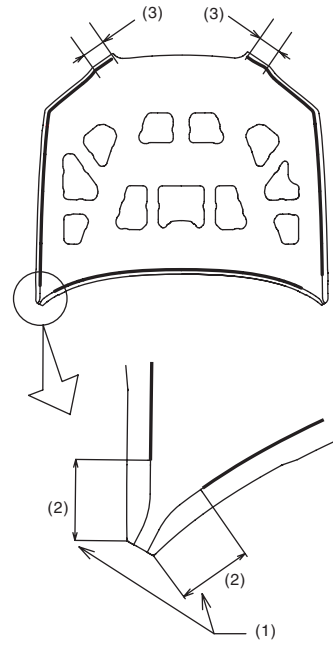
Sedan model and wagon model



- (1) Application not required.
- (2) 50 mm (1.97 in)

BS-01436

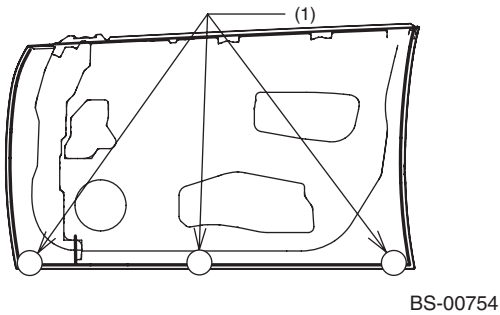
OUTBACK model



- (1) Application not required.
- (2) 50 mm (1.97 in)
- (3) 84 mm (3.31 in) Flatten out after applied in this period.

BS-02095

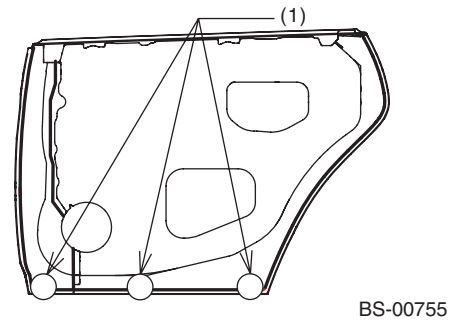
View X



- (1) Do not block the water drain holes.

BS-00754

View Y



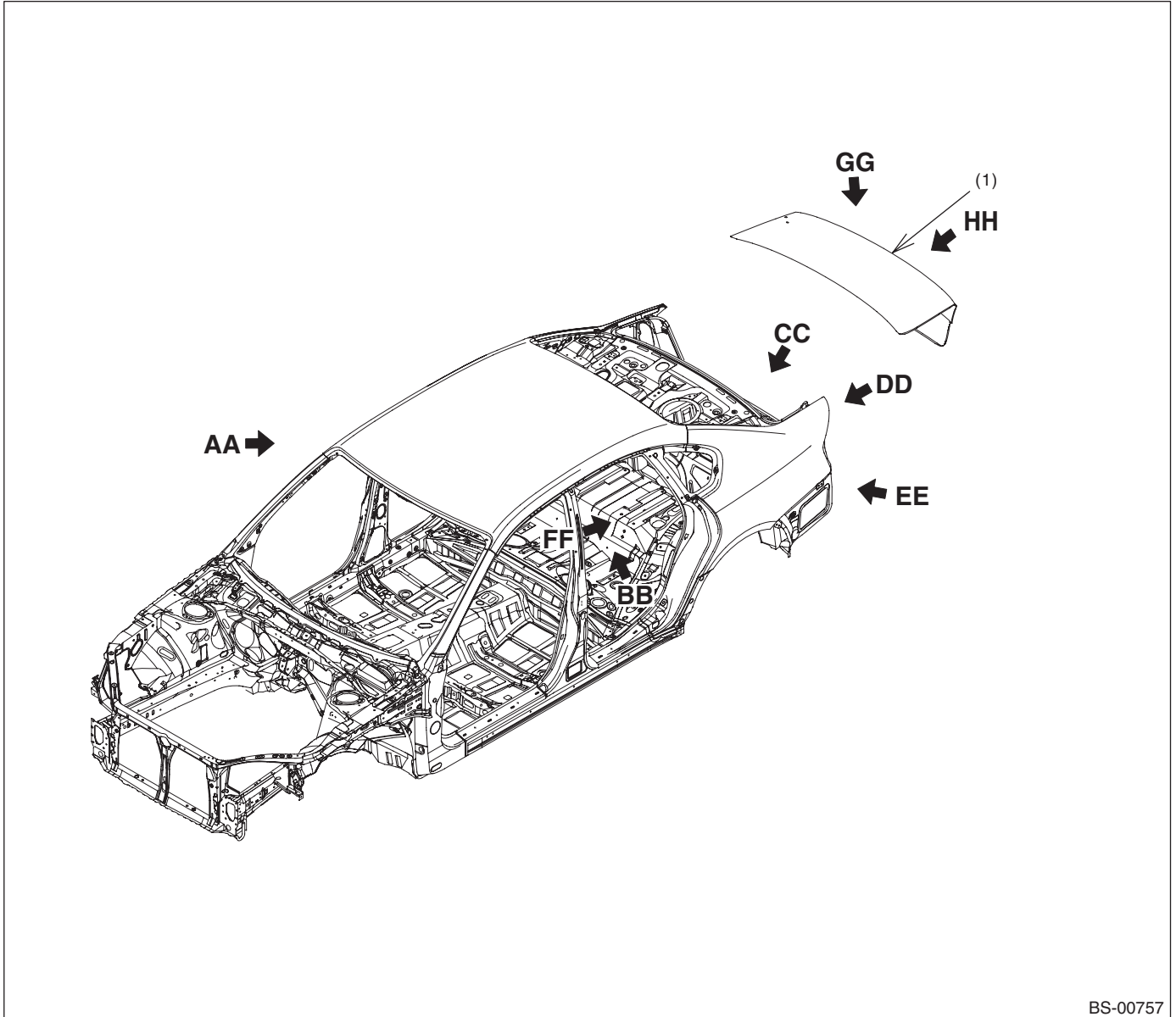
- (1) Do not block the water drain holes.

BS-00755

### CAUTION:

Sealer already has been applied to hood, door, and rear gate in replacement condition.

- Sedan model



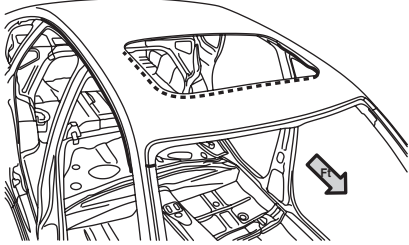
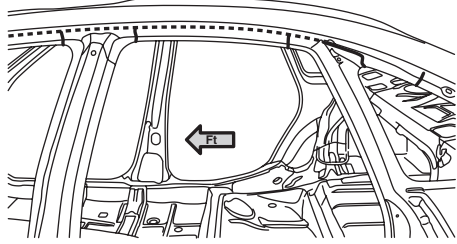
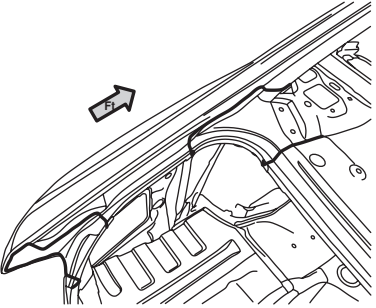
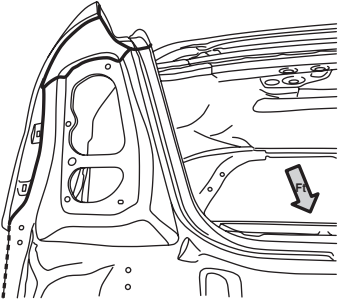
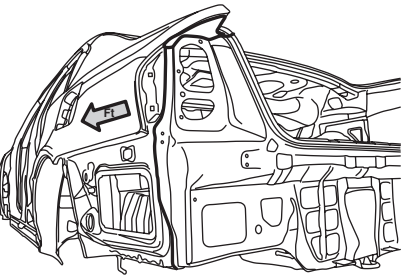
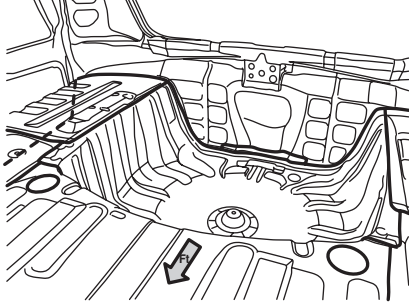
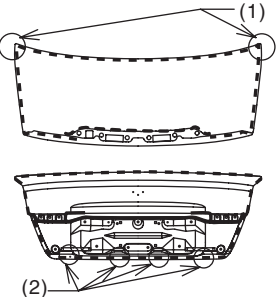
BS-00757

(1) Trunk



# Body Sealing

## BODY STRUCTURE

<p>View AA</p>  <p>BS-00758</p>	<p>View BB</p>  <p>BS-00759</p>
<p>View CC</p>  <p>BS-00760</p>	<p>View DD</p>  <p>BS-00761</p>
<p>View EE</p>  <p>BS-00762</p>	<p>View FF</p>  <p>BS-00763</p>
<p>View GG View HH</p>  <p>(1) (2)</p> <p>BS-00764</p> <p style="text-align: center;">SUBARU.</p> <p><b>CAUTION:</b> Sealer already has been applied to the trunk in replacement condition.</p>	

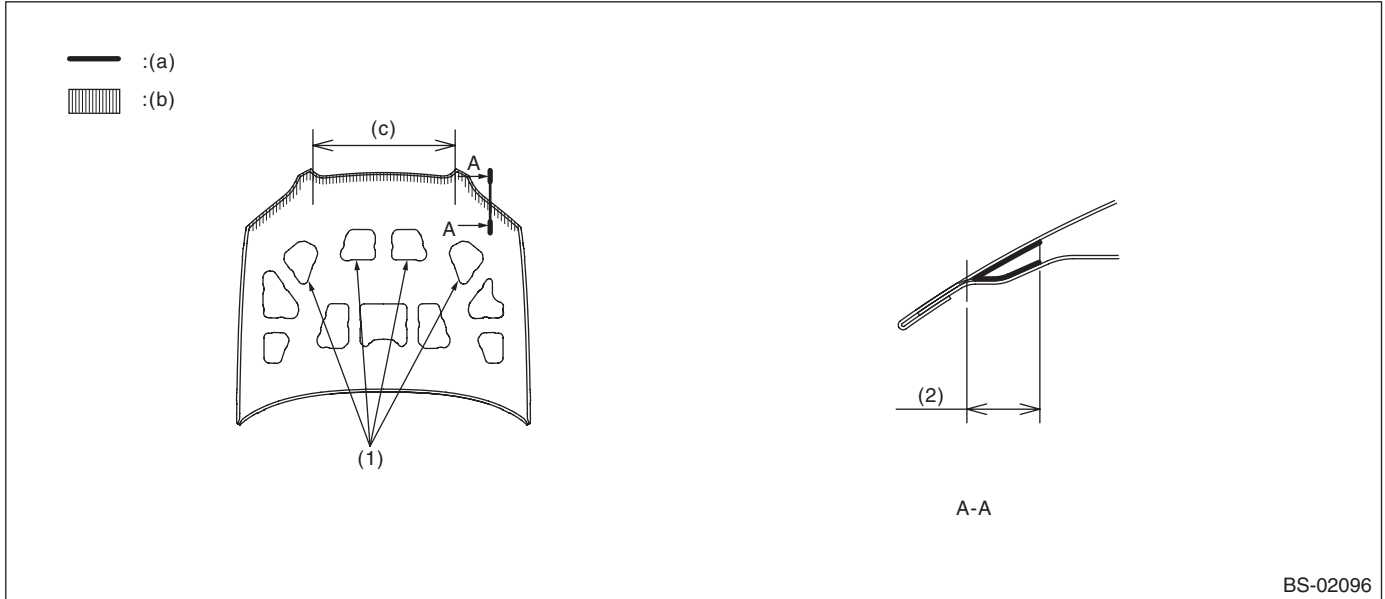
## 6. Anticorrosion Wax

### A: SPECIFICATION

**Used material:**

**Rust-stop aerosol (K0877YA015)**

- Front hood

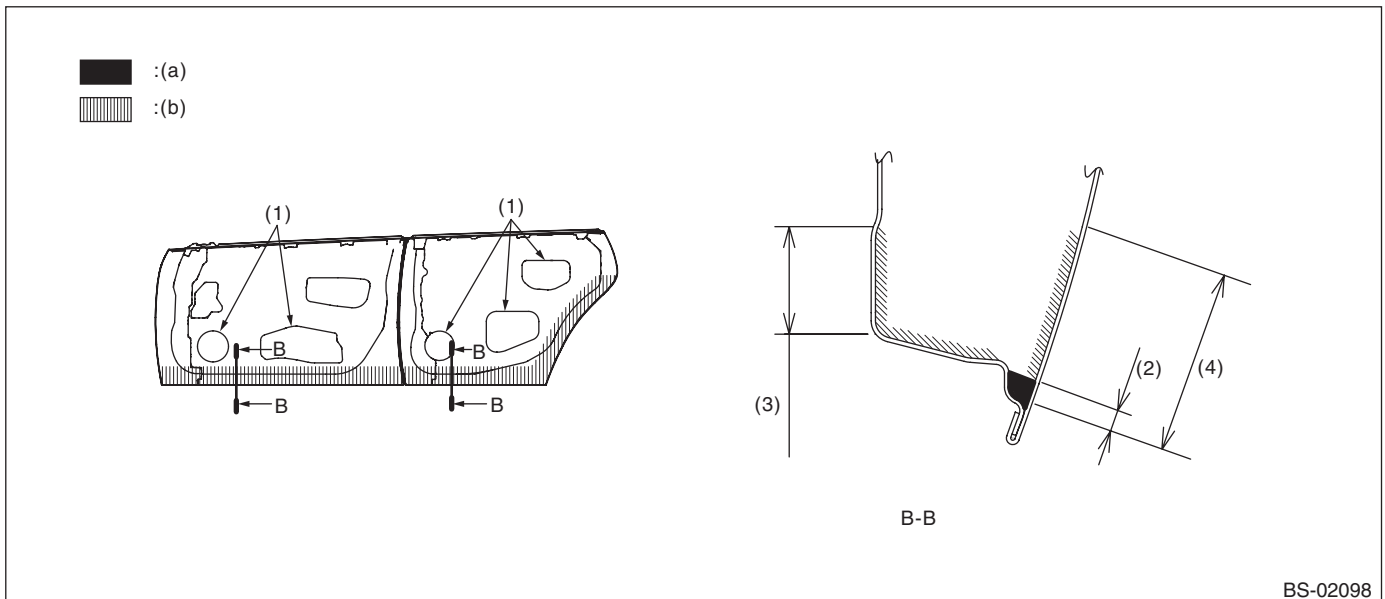


BS-02096

- (a) Application thickness = 50 μm or more
- (b) Application area
- (c) Non-application area (only for OUTBACK model)

- (1) Wax application work openings (2) 10 mm (0.39 in)

- Door (front, rear)



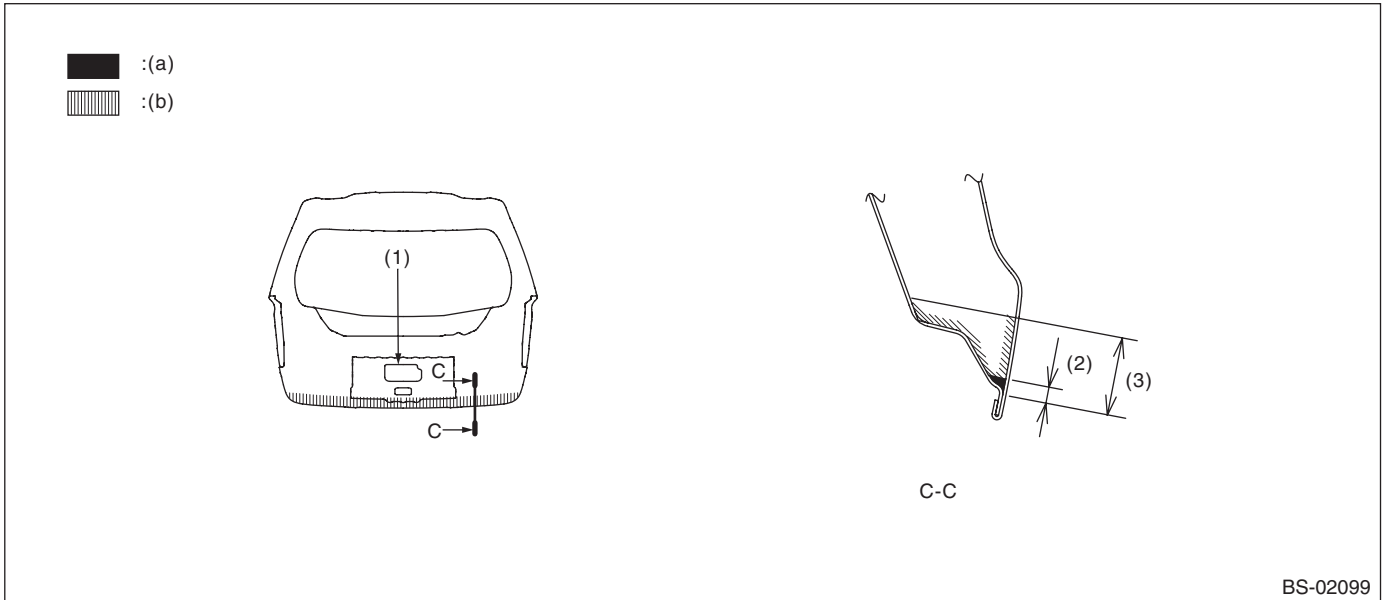
BS-02098

- (a) Wax filling part
- (b) Application area
- (1) Wax application work openings (3) 50 mm (1.97 in) (4) 90 mm (3.54 in)
- (2) 10 mm (0.39 in)

# Anticorrosion Wax

## BODY STRUCTURE

### • Rear gate



(a) Wax filling part

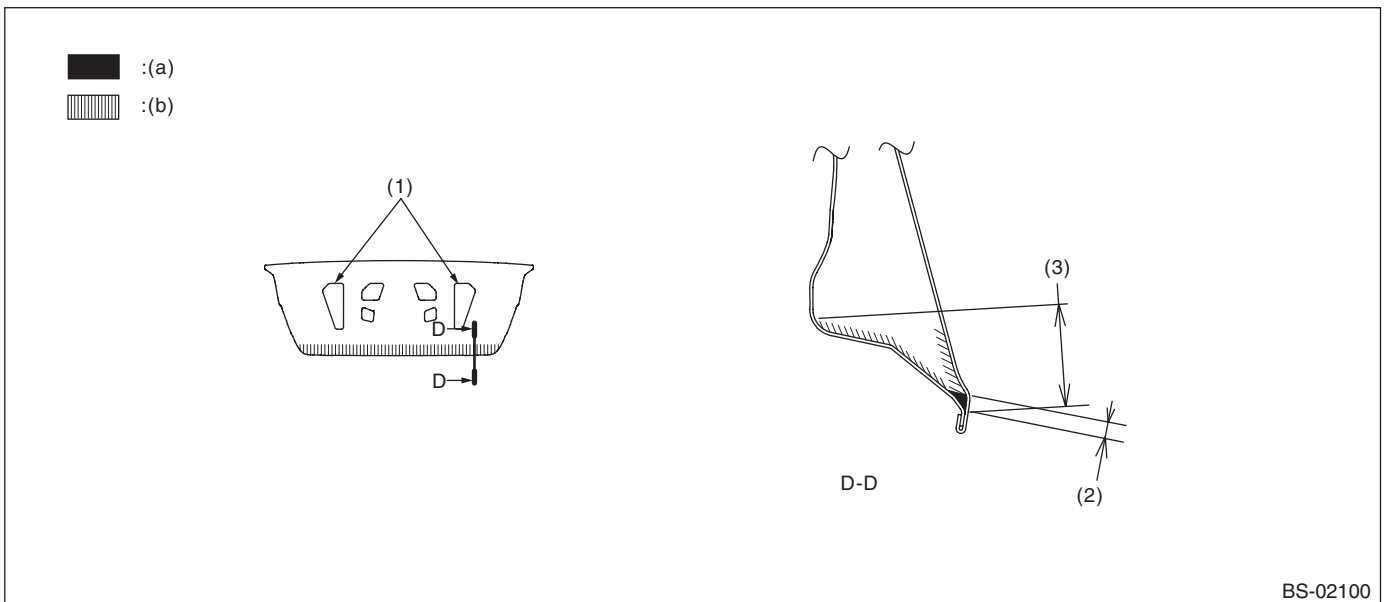
(b) Application area

(1) Wax application work openings

(2) 10 mm (0.39 in)

(3) 40 mm (1.57 in)

### • Trunk



(a) Wax filling part

(b) Application area

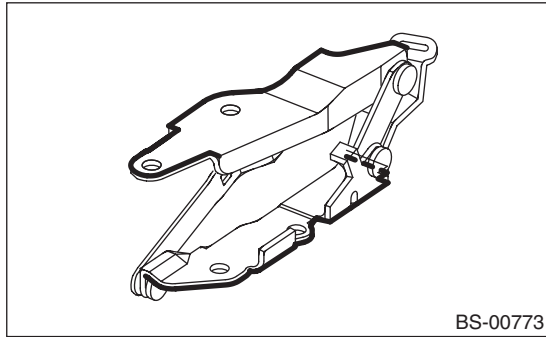
(1) Wax application work openings

(2) 10 mm (0.39 in)

(3) 40 mm (1.57 in)

- Front hood hinge

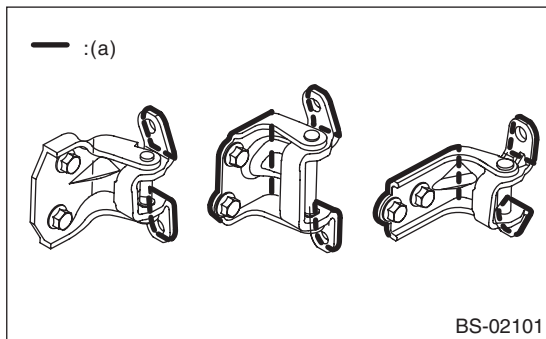
Apply around the installation outer circumference (indicated range) at two locations on the left and right.



(a) Application thickness = 15  $\mu\text{m}$  or more

- Door hinge

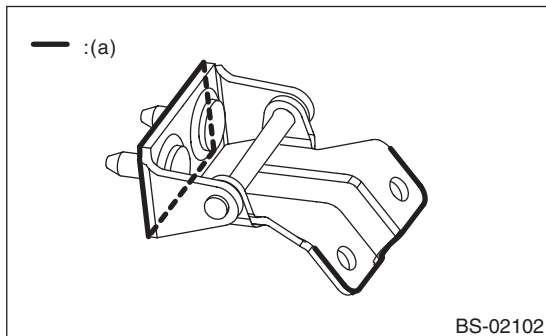
Apply to the installation outer circumference at two locations at the top and bottom (all eight locations).



(a) Application thickness = 15  $\mu\text{m}$  or more

- Rear gate hinge

Apply around the installation outer circumference (plate edges) at two locations on the left and right.

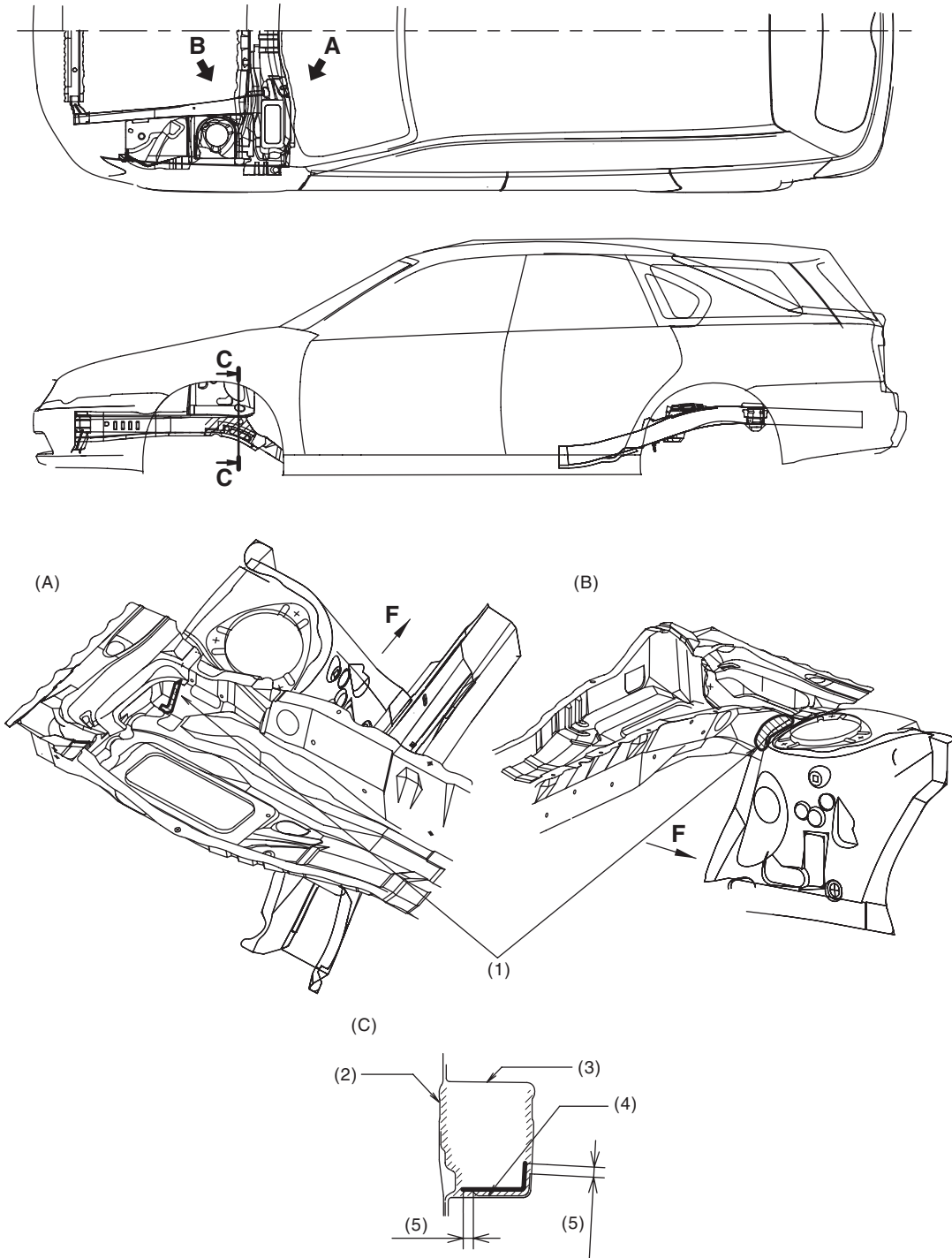


(a) Application thickness = 15  $\mu\text{m}$  or more

# Anticorrosion Wax

## BODY STRUCTURE

- Overall view



BS-01426

(A) View A

(B) View B

(C) Section C — C

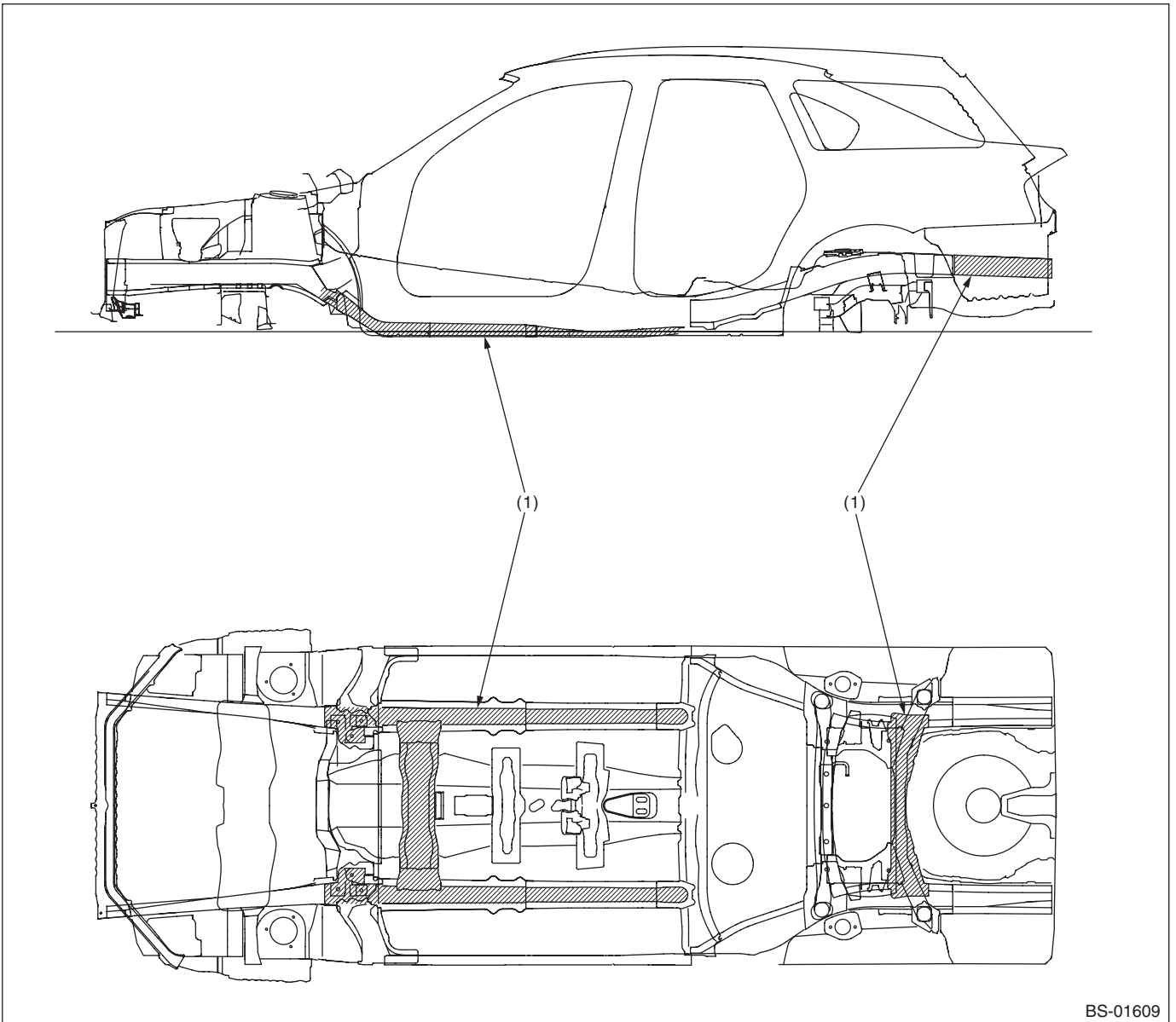
(1) Apply to the contact surface between the front suspension bracket and duct. (15 µm or more)

(2) Closing plate  
(3) Front side frame front

(4) Reinforcement  
(5) 10 mm (0.39 in)

# Anticorrosion Wax

BODY STRUCTURE



BS-01609

- (1) Apply wax to the underside of vehicle.

# Under Coat

## BODY STRUCTURE

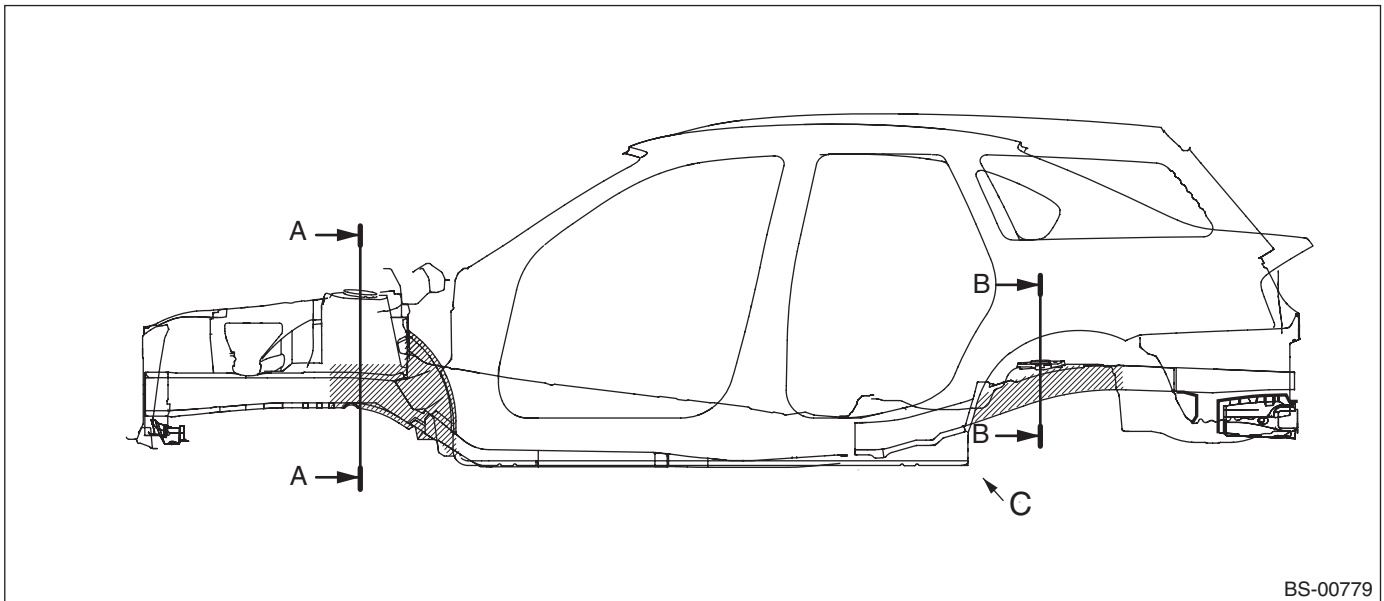
### 7. Under Coat

#### A: SPECIFICATION

**Repair material:**

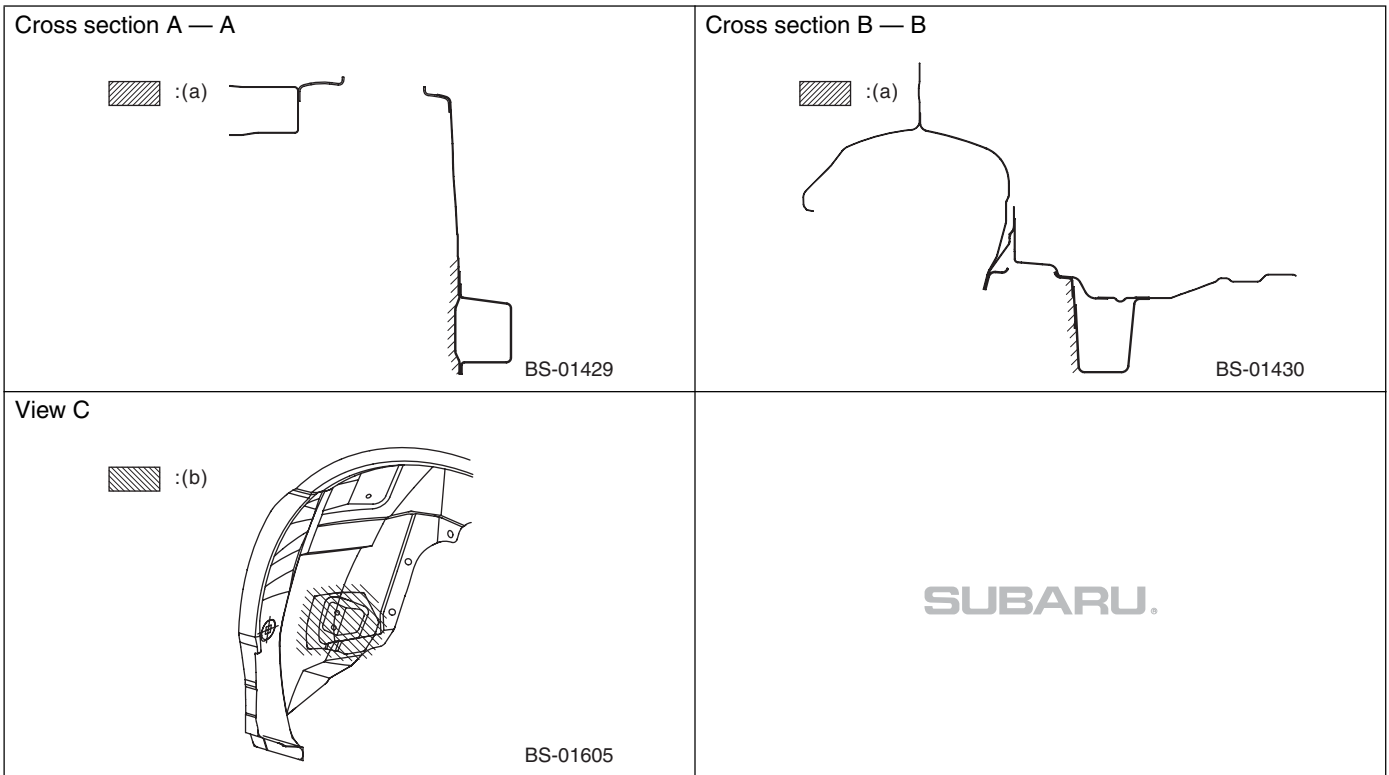
**THREE BOND 6115**

- 1) The application thickness is 0.4 mm or more when no instruction is indicated.
- 2) Take care that under coat does not become attached to other locations than shown in the figures and the following locations.
  - High-temperature parts related to the exhaust pipe
  - Hoses, tubes, and harness parts
  - Installation surfaces of rear suspension, transmission, subframe, etc.
- 3) Application area
  - Side view



(a) Under coat application locations

(b) Under coat application locations  
(Film thickness = 600  $\mu\text{m}$  or more)



(a) Under coat application locations

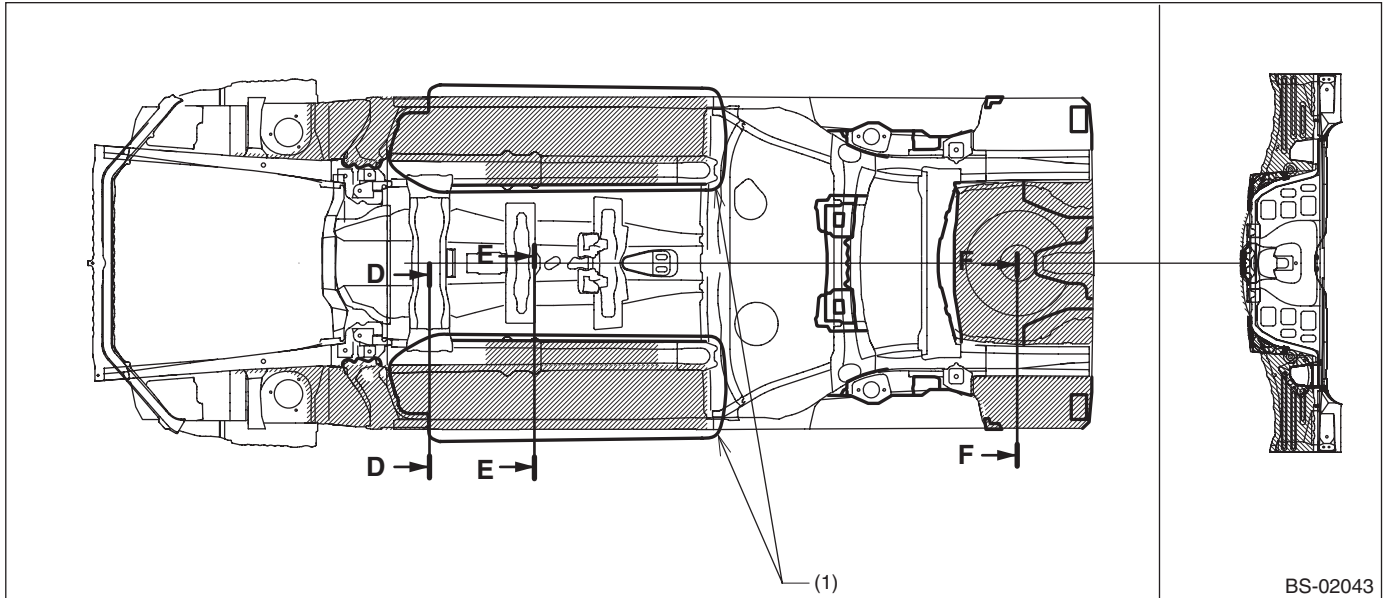
(b) Under coat application locations  
(Film thickness = 600  $\mu$  or more)



# Under Coat

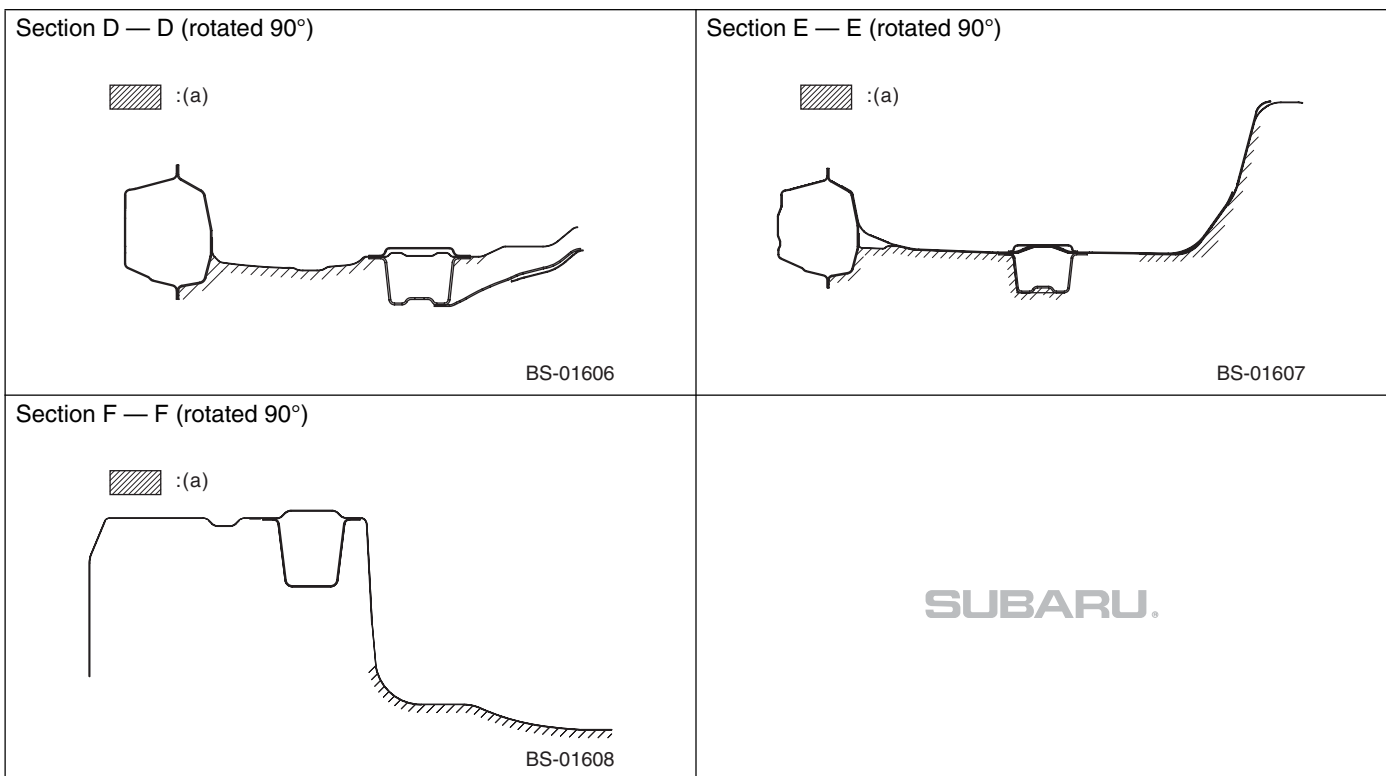
## BODY STRUCTURE

- Bottom view/rear view



BS-02043

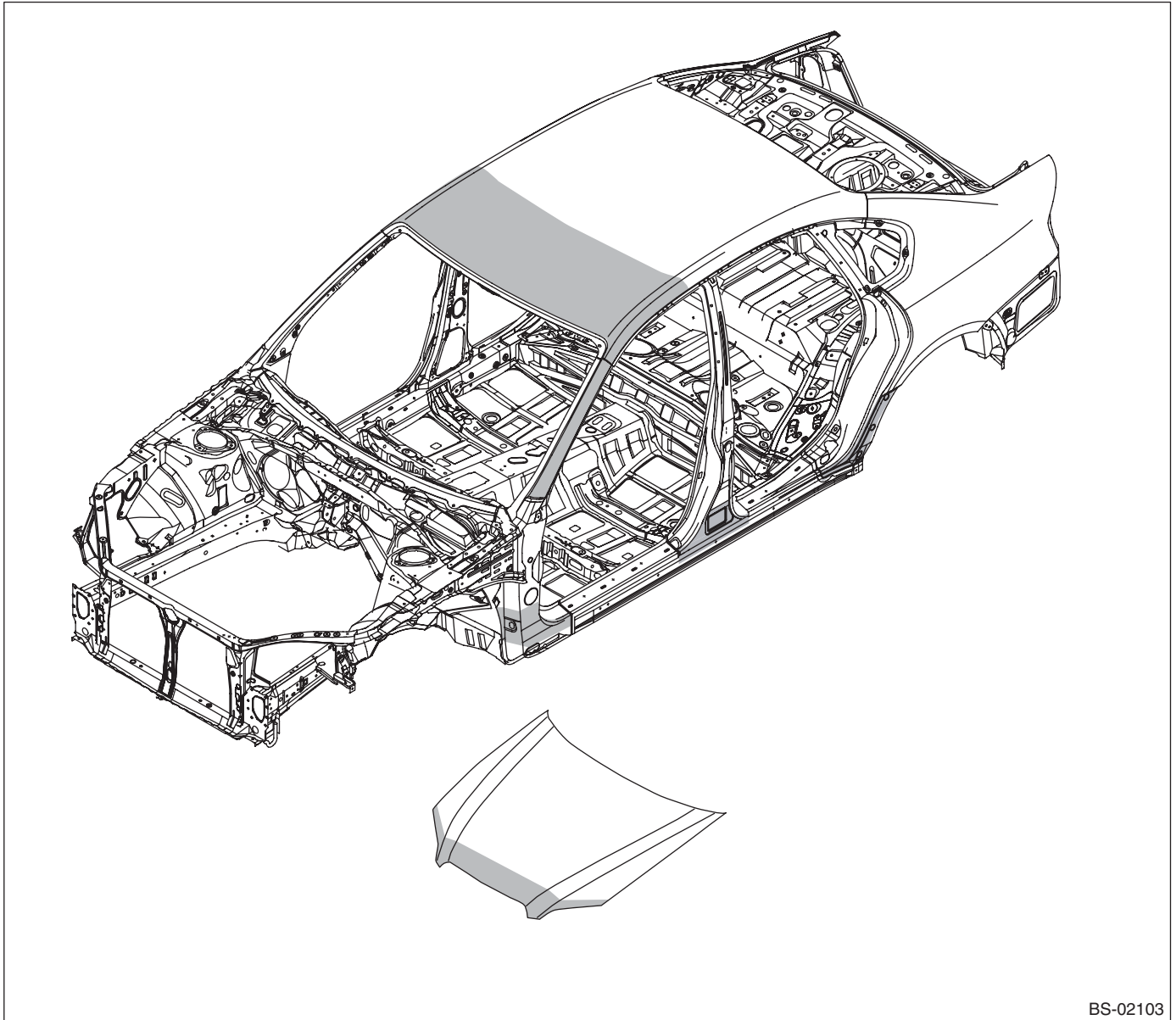
- (1) For models with an under cover, no under coat is required in this area.



- (a) Under coat application locations

## 8. Anti Chipping Coat

### A: SPECIFICATION



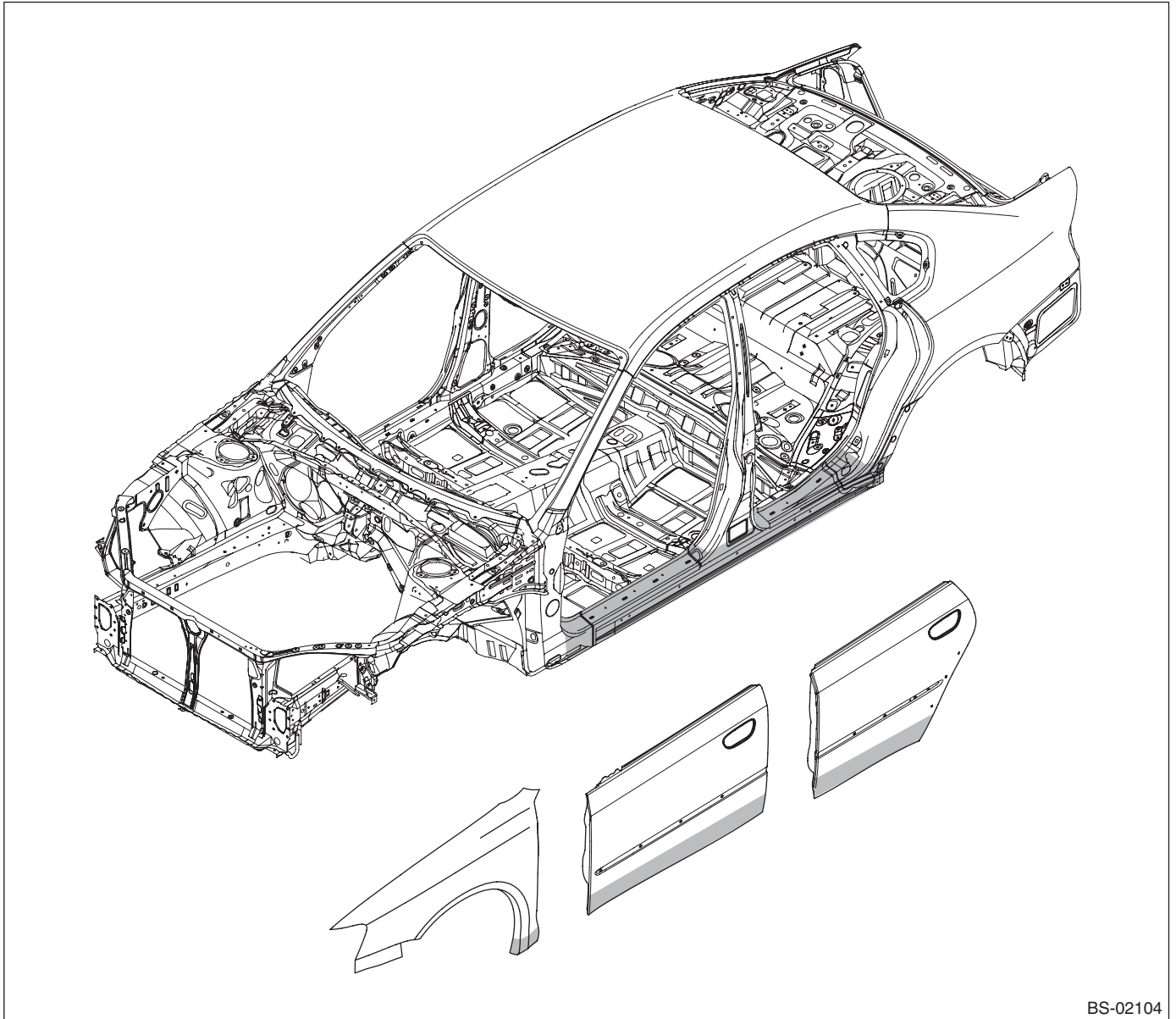
BS-02103

# Stone Guard Coat

BODY STRUCTURE

## 9. Stone Guard Coat

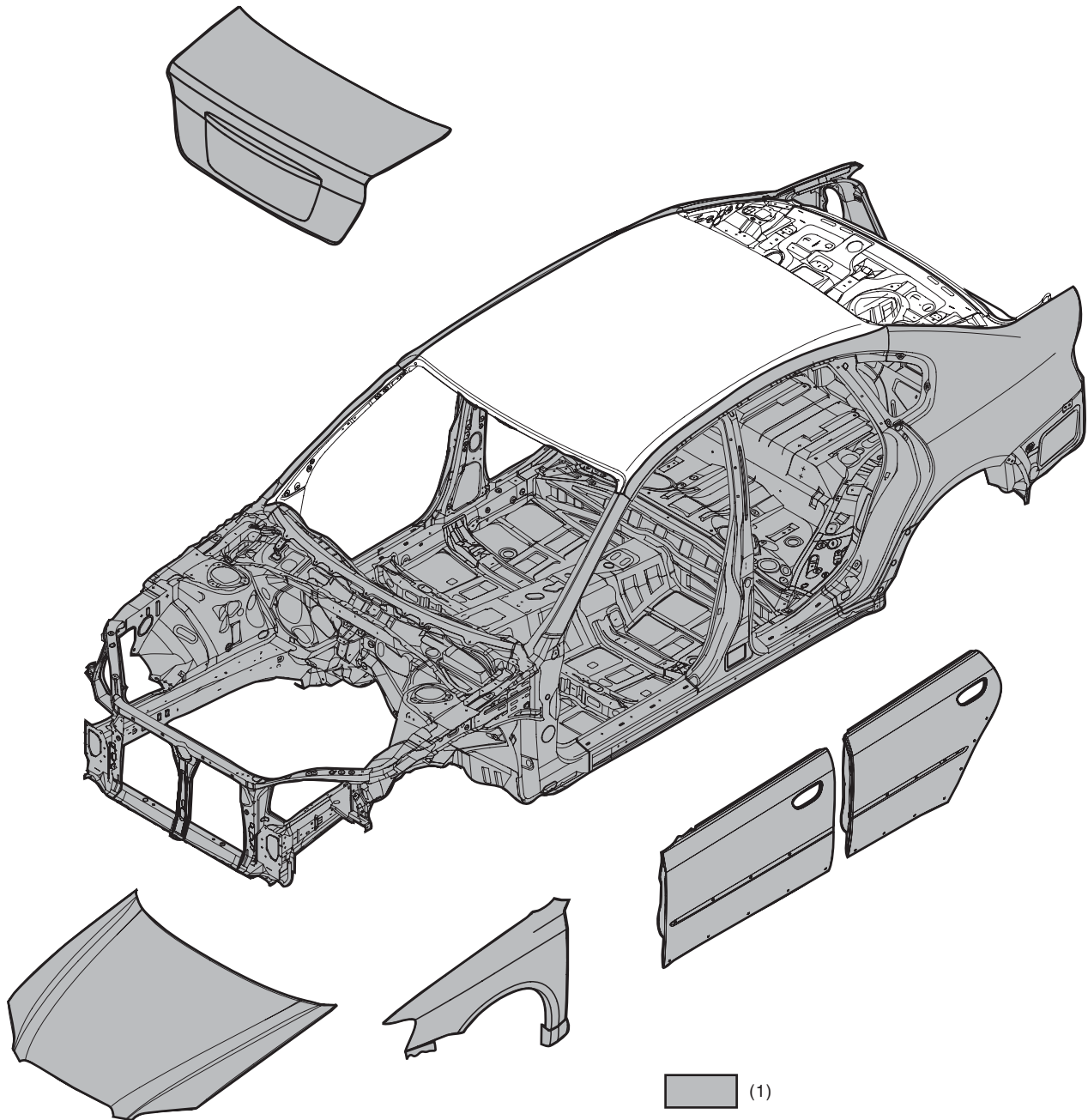
### A: SPECIFICATION



BS-02104

## 10. Galvanized Sheet Metal

### A: SPECIFICATION



BS-02094

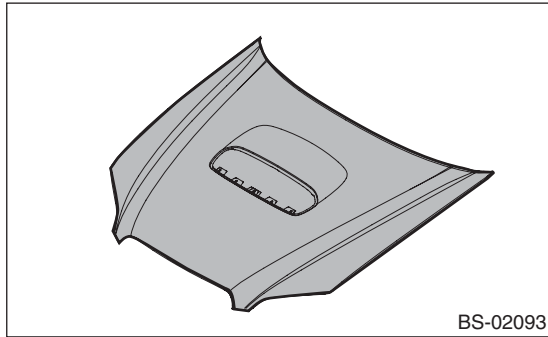
(1) Galvanized on both sides

NOTE:  
Front hood panel is only for OUTBACK model.

## 11. Aluminium Sheet Metal

### A: SPECIFICATION

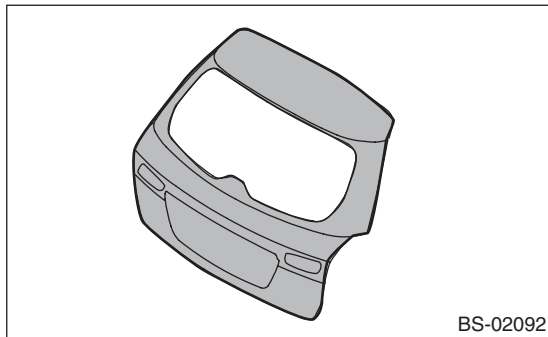
- Front hood panel



#### NOTE:

Only for sedan and wagon model (Excluding OUT-BACK model)

- Rear gate panel



# General Description

INSTRUMENTATION/DRIVER INFO

## 1. General Description

### A: SPECIFICATION

- Normal meter

Combination meter	Speedometer	Stepping motor type
	Tachometer	
	Engine coolant temperature gauge	
	Fuel gauge	
	Malfunction indicator light	LED
	Oil pressure warning light	
	ABS warning light	
	Airbag warning light	
	Seat belt warning light	
	Door open warning light	
	Brake fluid and parking brake warning light	
	Low fuel warning light	
	Charge warning light	
	ATF temperature warning light	
	AWD warning light	
	Tire pressure warning light	
	Vehicle dynamics control (VDC) warning light	
	Vehicle dynamics control (VDC) indicator light	
	Turn signal indicator light	
	HI-beam indicator light	
	Security indicator light	
	Cruise indicator light	
	Cruise set indicator light	
	Front fog light indicator light	
	SPORT indicator light	
	AT select lever position indicator light	
	Light illumination indicator light	
	Meter illumination back-up light	
LCD back light		
Odo/Trip indicator	LCD	
SPORT shift indicator		

# General Description

- Meter without multi-information display

Combination meter	Speedometer	Stepping motor type
	Tachometer	
	Engine coolant temperature gauge	
	Fuel gauge	
	ECO gauge	
	Malfunction indicator light	LED
	Oil pressure warning light	
	ABS warning light	
	Airbag warning light	
	Seat belt warning light	
	Door open warning light	
	Brake fluid and parking brake warning light	
	Low fuel warning light	
	Charge warning light	
	ATF temperature warning light	
	S# change prohibited indicator light	
	AWD warning light	
	Tire pressure warning light	
	Vehicle dynamics control (VDC) warning light	
	Vehicle dynamics control (VDC) indicator light	
	Turn signal indicator light	
	HI-beam indicator light	
	Security indicator light	
	Cruise indicator light	
	Cruise set indicator light	
	Front fog light indicator light	
	Light illumination indicator light	
Meter illumination back-up light		
LCD back light		
AT select lever position&SPORT shift indicator	LCD	
Multi-information Display (Odo/Trip indicator, Instant fuel economy/Average fuel economy, Ambient air temperature/Continuous driving time, Drivable distance, Current time, SI-DRIVE mode, Malfunction warning display)		

## B: CAUTION

- Be careful not to damage the meters and instrument panel.
- Be careful not to damage the meter glass.
- Make sure the electrical connector is connected securely.
- After installation, make sure that each meter operates normally.
- Use gloves to avoid damage and getting fingerprints on the glass surface and meter surfaces.
- Do not apply an excessive force on the printed circuit.
- Do not drop or otherwise apply impact.
- When the combination meter of model with immobilizer has been replaced, be sure to perform the registration of immobilizer.

## C: PREPARATION TOOL

### 1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.

## 2. Combination Meter System

### A: WIRING DIAGRAM

#### 1. COMBINATION METER

<Ref. to WI-192, WIRING DIAGRAM, Combination Meter System.>

### B: INSPECTION

#### 1. SELF-DIAGNOSIS

The self-diagnosis (checking of each meter, warning light, indicator, illumination, LCD, buzzer sound) of combination meter can be performed in the following procedure.

- 1) Turn the ignition switch to ON while turning the small light to OFF.
- 2) Turn the small light switch to ON within 3 seconds after step 1), then press the odo/tripmeter knob three times.
- 3) Turn the small light switch to OFF, and press the odo/trip meter knob three times.
- 4) Turn the small light switch to ON, and press the odo/trip meter knob three times.

#### NOTE:

- Perform the steps described in 2) to 4) within 10 seconds after the ignition switch is turned to ON.
- When the self-diagnosis function operates, the warning light, indicator, and LCD display checks are performed. After this, operation checks are performed in the order of meter, illumination, and buzzer for each press of the odo/trip meter knob button. Normal meter <Ref. to IDI-5, LIST OF SELF-DIAGNOSIS MODE OPERATION, INSPECTION, Combination Meter System.> Meter with multi-information display <Ref. to IDI-7, LIST OF SELF-DIAGNOSIS MODE OPERATION, INSPECTION, Combination Meter System.> Turn the ignition switch to OFF to cancel the self-diagnosis function.
- When the engine starts during diagnosis, the self-diagnosis function is not cancelled, however, once the vehicle starts driving, the self-diagnosis function is deactivated automatically for safety.
- When pressing the odo/trip meter knob four times, the display changes to DTC display mode (ECM, TCM, ABSCM/VDCCM). <Ref. to IDI-16, DTC DISPLAY MODE, INSPECTION, Combination Meter System.>



# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 2. LIST OF SELF-DIAGNOSIS MODE OPERATION

### Normal meter

Speedometer, tachometer, fuel gauge, engine coolant temperature gauge	Microcomputer running type warning light, indicator light	AT select lever position indicator light	Odo/Trip indicator	SPORT shift indicator	Illumination (indicator needle, plate, ring, LCD)	Buzzer (SPORT shift buzzer)
Step 0. Processing to self-diagnosis function						
Operating initial operation	Initial illuminating	Normal	Normal	Initial illuminating	Initial illuminating	Not beep.
Step 1-1. Check each indication after initial operation						
Repeat the sweep operation (After holding on lowest position for one second, reaches to highest position within 5 seconds, and after holding on highest position for one second, reaches to lowest position within 5 seconds).	Light ON	With the highest brightness, illuminate the position sequentially at a cycle of 1.5 seconds. For the illumination order, refer to the illumination order table.	Perform the segment check. For the illumination order, refer to the illumination order table.	Perform the segment check. For the illumination order, refer to the illumination order table.	Illuminate at the highest brightness.	Not beep.
Step 1-2. Press the trip knob (trip knob input is not accepted till the meter indicator needle reaches the highest position): sweep complete, AT select lever position indicator display is set						
After completing sweep in step 1-1, back to lowest position.	Light ON	Keep the position indicated when the trip knob is pressed.	Underbar “_” is displayed.	“1” is displayed.	Illuminate at the highest brightness.	Not beep.
Step 2-1. Press the trip knob, and hold it: Check each meter						
All meters are moved simultaneously in every 0.5 sec. from the lowest position to highest position. Speedometer/ Tachometer: Approx. 5 degrees at every movement. Engine coolant temperature / Fuel gauge: Moves approx. 2 degrees at a time.	Light OFF	Keep the position indicated that set in step 1-2.	Display the current meter directing angle on odometer. Ex.) When the speedometer/ tachometer: 135 degrees and engine coolant temperature gauge/fuel gauge: 54 degrees, displays “135054”.	“▼2” is displayed.	Illuminate at the highest brightness.	Not beep.
Step 2-2. Release the trip knob: Specifying the meter directing position						
Stop at directing position when the trip knob is released.	Light OFF	Keep the position indicated that set in step 1-2.	Display the current meter directing angle on odometer.	“2” is displayed.	Illuminate at the highest brightness.	Not beep.

# Combination Meter System

## INSTRUMENTATION/DRIVER INFO

Speedometer, tachometer, fuel gauge, engine coolant temperature gauge	Microcomputer running type warning light, indicator light	AT select lever position indicator light	Odo/Trip indicator	SPORT shift indicator	Illumination (indicator needle, plate, ring, LCD)	Buzzer (SPORT shift buzzer)
<b>Step 3-1. Press the trip knob, and hold it: Check illumination</b>						
Keep the position that specified at step 2-2.	Light OFF	Varying from the highest brightness (ILL6) to the lowest luminescence (ILL1) every second. After reaching at ILL1, repeat it from ILL6.	Illumination brightness is displayed. (From ILL6 to ILL1)	"▼ 3" is displayed.	Varying from the highest brightness (ILL6) to the lowest luminescence (ILL1) every second. After reaching at ILL1, repeat it from ILL6.	Not beep.
<b>Step 3-2. Release the trip knob: Specifying the illumination brightness</b>						
Keep the position that specified at step 2-2.	Light OFF	Keep the brightness at the time when the trip knob is released.	Displays the brightness level at the time when the trip knob was released.	"3" is displayed.	Keep the brightness at the time when the trip knob is released.	Not beep.
<b>Step 4-1. Press the trip knob: Check the beeping of SPORT shift buzzer (For AT model)</b>						
All meter indicator needle returns to lowest position.	Light OFF	Illuminate at the highest brightness. Keep the position indicated that set in step 1-2.	Illumination brightness is displayed.	"▲▼ 8" is displayed. Blinks with buzzer.	Illuminate at the highest brightness.	SPORT shift buzzer beeps.
<b>Step 4-2. Press the trip knob: Check the VDC indicator light (Model with VDC)</b>						
All meter indicator needle returns to lowest position.	VDC warning light and VDC operation indicator light blink.	Illuminate at the highest brightness. Keep the position indicated that set in step 1-2.	Illumination brightness is displayed.	"4" is displayed.	Illuminate at the highest brightness.	VDC buzzer beeps.
<b>Step 5. Press the trip knob: Complete the self-diagnosis 1 cycle</b>						
All meter indicator needle returns to lowest position, and go back to step 1 after completion.						

• **Illuminating order table**

Illuminating order	1	2	3	4	5	6	7	8	9	10	11	Go back to 1 and repeat
Trip meter A/B	AB	A	B	A	B	A	B	A	B	A	B	
Odo/trip meter	8888.8 888888	00000 000000	1111.1 111111	22222 222222	3333.3 333333	44444 444444	5555.5 555555	66666 666666	7777.7 777777	88888 888888	9999.9 999999	
SPORT shift indicator	8	1	2	3	4	5	1	2	3	4	5	
▲ ▼	▲ ▼	▲	▼	▲	▼	▲	▼	▲	▼	▲	▼	
AT select lever position indicator	P	P	R	R	R	N	N	N	D	D	D	
Display time (sec.)	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	

# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 3. LIST OF SELF-DIAGNOSIS MODE OPERATION

### Meter with multi information display

Speedometer, tachometer, fuel gauge, engine coolant temperature gauge, ECO gauge	Microcomputer running type warning light, indicator light	AT select lever position indicator light	Multi information display	Illumination (indicator needle, plate, ring, LCD)	Buzzer (SPORT shift buzzer, VDC buzzer, speed warning)
Step 0. Processing to self-diagnosis function					
Operating initial operation	Initial illuminating	Normal	TRIP: Normal ODO: Normal	Initial illuminating	Not beep.
Step 1-1. Check each indication after initial operation					
Repeat the sweep operation (After holding on lowest position for one second, reaches to highest position within 5 seconds, and after holding on highest position for one second, reaches to lowest position within 5 seconds).	Light ON	Perform the segment check. For the illumination order, refer to the table 1 of illumination order tables.	STEP 1 is displayed. White illumination: 6 seconds. Yellow illumination: 6 seconds.	Illuminate at the highest brightness.	Not beep.
Step 1-2. Press the trip knob: sweep completes, AT select lever position indicator display is set					
After quitting sweep in step 1-1, back to lowest position. (Until back to lowest position, ignore trip input.)	Light ON	Keep the position indicated when the trip knob is released.	Keep the illumination color indicated when the trip knob is released.	Illuminate at the highest brightness.	Not beep.
Step 2-1. Press the trip knob, and hold it: Check each meter					
Perform the indicator needle check. For the illumination order, refer to the table 2 of illumination order tables.	Light OFF (Low fuel warning light follows the table 2 of tables.)	For the illumination order, refer to the table 2 of illumination order tables.	STEP 2 is displayed. White illumination: 12.5 seconds. Yellow illumination: 12.5 seconds.	Illuminate at the highest brightness.	Not beep.
Step 2-2. Release the trip knob: Specifying the meter directing position					
Stop at directing position when the trip knob is released. (Indicator needle stops moving after movement is completed.)	Light OFF	Keep the position indicated when the trip knob is released.	Keep the illumination color at the time when the trip knob is released.	Illuminate at the highest brightness.	Not beep.
Step 3-1. Press the trip knob, and hold it: Check illumination					
Keep the position that specified at step 2-2.	Light OFF	Keep the position that specified at step 2-2.	STEP 3 is displayed, and illumination brightness is displayed. (from ILL6 to ILL1)	Varying from the highest brightness (ILL6) to the lowest luminescence (ILL1) every second. After reaching at ILL1, repeat it from ILL6.	Not beep.
Step 3-2. Release the trip knob: Specifying the illumination brightness					

# Combination Meter System








## INSTRUMENTATION/DRIVER INFO

Speedometer, tachometer, fuel gauge, engine coolant temperature gauge, ECO gauge	Microcomputer running type warning light, indicator light	AT select lever position indicator light	Multi information display	Illumination (indicator needle, plate, ring, LCD)	Buzzer (SPORT shift buzzer, VDC buzzer, speed warning)
Keep the position that specified at step 2-2.	Light OFF	Keep the position that specified at step 2-2.	Keep the position indicated when the trip knob is pressed.	Keep the brightness at the time when the trip knob is released.	Not beep.
Step 4-1. Press the trip knob: Check the beeping of multi buzzer					
All meter indicator needle returns to lowest position.	Light OFF	P is displayed in white illumination.	STEP 3 WN BUZZER is displayed. White illumination: 1 seconds. Yellow illumination: 1 seconds.	Illuminate at the highest brightness.	Buzzer beeps when multi information display is yellow illumination.
Step 4-2. Press the trip knob: Check the beeping of SPORT shift buzzer (For AT model only, while for MT model, go to the next)					
All meter indicator needle returns to lowest position.	Light OFF	Shift display blinks with buzzer.	STEP 4 SS BUZZER is displayed.	Illuminate at the highest brightness.	SPORT shift buzzer beeps.
Step 4-3. Press the trip knob: Check the beeping of VDC buzzer (For the model with VDC only, while for other models, go to the next)					
All meter indicator needle returns to lowest position.	VDC warning light and VDC operation blink with buzzer.	P is displayed in white illumination.	STEP 4 VDC BUZZER is displayed.	Illuminate at the highest brightness.	VDC buzzer beeps.
Speed meter indicates the start position of speed warning while other meters indicate the lowest position.	Light OFF	P is displayed in white illumination.	STEP 4 SP BUZZER is displayed.	Illuminate at the highest brightness.	VDC buzzer beeps.
Step 5. Press the trip knob: Complete the self-diagnosis 1 cycle					
All meter indicator needle returns to lowest position, and go back to step 1 after completion.					






# Combination Meter System

INSTRUMENTATION/DRIVER INFO

• Illuminating order table  
Display Contents 1

Illuminating order	1	2	3	4	5	6	7	8	9	10	Go back to 1 and repeat
											
AT select lever position indicator	P	N	R	D	All lights ON	1	2	3	4	5	
Display time (sec.)	1	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	
Back-up light	White light ON										

Display Contents 2

Illuminating order	1	2	3	4	5	6	7	8	9	10	Go back to 1 and repeat
Speedometer	0	0	40	60	80	100	80	60	40	0	
Tachometer	0	0	1000	2000	3000	4000	3000	2000	1000	0	
Fuel gauge	Lowest position	EMPTY	Warning light illumination position	1/2	FULL	Highest position	FULL	1/2	Warning light illumination position	EMPTY	
Engine coolant temperature gauge	Lowest position	C	at the first scale	1/2	at the third scale	over the fourth scale (approx .120°C)	at the third scale	1/2	at the first scale	C	
ECO gauge	-Max	0	+Max	0	-Max	0	+Max	0	-Max	0	
Low fuel warning light	Light ON	Light ON	Light ON	Light OFF	Light OFF	Light OFF	Light OFF	Light OFF	Light ON	Light ON	
AT select lever position indicator	P	N	R	D	All lights ON	 1	 2	 3	 4	 5	
Multi meter	STEP 2 is displayed.										
Display time (sec.)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Back-up light (SS of AT model)	White light ON										
Back-up light (Multi information display LCD)	White light ON					Yellow light ON					

# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 4. SYMPTOM CHART

Symptom	Repair order	Reference
Combination meter assembly does not operate.	<ol style="list-style-type: none"> <li>1. Power supply</li> <li>2. Ground circuit</li> <li>3. Combination meter</li> </ol>	<Ref. to IDI-11, CHECK POWER SUPPLY AND GROUND CIRCUIT, INSPECTION, Combination Meter System.>
Speedometer does not operate.	<ol style="list-style-type: none"> <li>1. ABSCM or VDCCM</li> <li>2. Harness</li> <li>3. Combination meter</li> </ol>	<Ref. to IDI-12, CHECK ABSCM OR VDCCM, INSPECTION, Combination Meter System.>
Tachometer does not operate.	<ol style="list-style-type: none"> <li>1. ECM</li> <li>2. Harness</li> <li>3. Combination meter</li> </ol>	<Ref. to IDI-12, CHECK ENGINE CONTROL MODULE (ECM), INSPECTION, Combination Meter System.>
Fuel gauge does not operate.	<ol style="list-style-type: none"> <li>1. Communication circuit</li> <li>2. Fuel level sensor</li> <li>3. Harness</li> <li>4. Combination meter</li> </ol>	<Ref. to IDI-13, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>
Engine coolant temperature gauge does not operate.	<ol style="list-style-type: none"> <li>1. Communication circuit</li> <li>2. Engine coolant temperature sensor</li> <li>3. Harness</li> <li>4. Combination meter</li> </ol>	<Ref. to IDI-14, CHECK ENGINE COOLANT TEMPERATURE SENSOR., INSPECTION, Combination Meter System.>
ECO gauge does not operate.	<ol style="list-style-type: none"> <li>1. Communication circuit</li> <li>2. Combination meter</li> </ol>	<Ref. to IDI-7, LIST OF SELF-DIAGNOSIS MODE OPERATION, INSPECTION, Combination Meter System.> NOTE: After trip meter is reset, average fuel economy is not displayed within 1 km and ECO gauge does not operate.
Error display is shown on the odo/trip meter. (Except for meter with MID)	Communication circuit	<Ref. to IDI-15, COMMUNICATION ERROR DISPLAY, INSPECTION, Combination Meter System.>

### CAUTION:

When measuring the voltage and resistance of each control module or sensor, use a tapered pin with a diameter of less than 0.64 mm (0.025 in) in order to avoid poor contact. Do not insert the pin more than 2 mm (0.08 in).

# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 5. CHECK POWER SUPPLY AND GROUND CIRCUIT

Step	Check	Yes	No
<b>1</b> <b>CHECK POWER SUPPLY FOR COMBINATION METER.</b> 1) Remove the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.> 2) Disconnect the combination meter harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <i>(i10) No. 1 (+) — Chassis ground (-):</i> <i>(i10) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 2.	Check the harness for open or short between the ignition switch and combination meter.
<b>2</b> <b>CHECK POWER SUPPLY FOR COMBINATION METER.</b> Measure the voltage between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <i>(i10) No. 1 (+) — Chassis ground (-):</i> <i>(i10) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open or short between the fuse and combination meter.
<b>3</b> <b>CHECK GROUND CIRCUIT OF COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between combination meter connector and chassis ground. <b>Connector &amp; terminal</b> <b>Normal meter model:</b> <i>(i10) No. 11 — Chassis ground:</i> <i>(i10) No. 12 — Chassis ground:</i> <b>Multi information display model:</b> <i>(i10) No. 11 — Chassis ground:</i> <i>(i10) No. 12 — Chassis ground:</i>	Is resistance less than 10 Ω?	Replace the meter case assembly.	Repair the wiring harness.

# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 6. CHECK ABSCM OR VDCCM

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK VEHICLE SPEED SIGNAL.</b></p> <p>1) Lift up the vehicle and support it with rigid racks.</p> <p>2) Drive the vehicle faster than 10 km/h (6 MPH).</p> <p><b>WARNING:</b> <b>Be careful not to be dragged in by the rotating wheel.</b></p> <p>3) Measure the voltage between combination meter connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(i10) No. 19 (+) — Chassis ground (-):</b></p>	<p>Is the voltage less than 1 V ←→ 5 V or more?</p>	<p>Replace the meter case assembly.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN ABSCM OR VDCCM AND COMBINATION METER.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from ABSCM or VDCCM and combination meter.</p> <p>3) Measure the resistance between ABSCM or VDCCM harness connectors and the combination meter harness connector.</p> <p><b>Connector &amp; terminal</b> <b>Model without VDC</b> <b>(B301) No. 23 — (i10) No. 19:</b> <b>Model with VDC</b> <b>(B310) No. 33 — (i10) No. 19:</b></p>	<p>Is resistance less than 10 Ω?</p>	<p>Model without VDC: Check the ABSCM. &lt;Ref. to ABS(diag)-2, Basic Diagnostic Procedure.&gt;</p> <p>Model with VDC: Check the VDCCM. &lt;Ref. to VDC(diag)-2, Basic Diagnostic Procedure.&gt;</p>	<p>Repair the wiring harness.</p>

## 7. CHECK ENGINE CONTROL MODULE (ECM)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK ECM SIGNAL.</b></p> <p>1) Start the engine.</p> <p>2) Measure the voltage between ECM connector and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 22 (+) — Chassis ground (-):</b></p>	<p>Is the voltage 0 ←→ 14 V or more?</p>	<p>Go to step 2.</p>	<p>Inspect the ECM. &lt;Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.&gt; &lt;Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.&gt; &lt;Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.&gt;</p>
<p><b>2</b></p> <p><b>CHECK HARNESS BETWEEN COMBINATION METER AND ECM.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Disconnect the connector from ECM and combination meter.</p> <p>3) Measure the resistance between ECM harness connector and combination meter harness connector.</p> <p><b>Connector &amp; terminal</b> <b>(B136) No. 22 — (i10) No. 20:</b></p>	<p>Is resistance less than 10 Ω?</p>	<p>Replace the meter case assembly.</p>	<p>Repair the wiring harness.</p>



# Combination Meter System

INSTRUMENTATION/DRIVER INFO

## 8. CHECK FUEL LEVEL SENSOR

	Step	Check	Yes	No
1	<p><b>CHECK COMMUNICATION ERROR DISPLAY.</b></p> <p>1) Turn the ignition switch to ON.</p> <p>2) Check that the error code is displayed in odo/trip meter. (Except for meter with MID)</p>	<p>Is the error code "Er xx" displayed on odo/trip meter? (Except for meter with MID) Or is the DTC of low speed LAN system detected?</p>	<p>Check the communication circuit. &lt;Ref. to IDI-15, COMMUNICATION ERROR DISPLAY, INSPECTION, Combination Meter System.&gt;</p>	<p>Go to step 2.</p>
2	<p><b>CHECK COMBINATION METER.</b></p> <p>1) Remove the fuel sub level sensor. &lt;Ref. to FU(H4SO)-56, REMOVAL, Fuel Sub Level Sensor.&gt; &lt;Ref. to FU(H4DOTC)-66, REMOVAL, Fuel Sub Level Sensor.&gt; &lt;Ref. to FU(H6DO)-57, REMOVAL, Fuel Sub Level Sensor.&gt;</p> <p>2) Short the fuel sub level sensor connector terminal to the chassis ground using a suitable lead line wire with 2 — 6 Ω resistance connected between connector terminal and chassis ground.</p> <p>3) Turn the ignition switch to ON.</p> <p><b>Terminals</b> <b>(R59) No. 1 — Chassis ground:</b></p>	<p>Is the fuel gauge display in combination meter changed to FULL?</p>	<p>Go to step 3.</p>	<p>Check harness for open or short circuits, and if normal, replace the meter case assembly.</p>
3	<p><b>CHECK FUEL LEVEL SENSOR.</b></p> <p>1) Remove the fuel level sensor. &lt;Ref. to FU(H4SO)-55, REMOVAL, Fuel Level Sensor.&gt; &lt;Ref. to FU(H4DOTC)-65, REMOVAL, Fuel Level Sensor.&gt; &lt;Ref. to FU(H6DO)-56, REMOVAL, Fuel Level Sensor.&gt;</p> <p>2) Measure the resistance between fuel level sensor terminals when the float is in FULL or EMPTY position.</p> <p><b>Terminals</b> <b>(R58) No. 1 — No. 4:</b></p>	<p>Is the resistance 1.0 to 3.0 Ω (FULL) and 31 to 33 Ω (EMPTY)?</p>	<p>Go to step 4.</p>	<p>Replace the fuel level sensor.</p>
4	<p><b>CHECK FUEL SUB LEVEL SENSOR.</b></p> <p>1) Remove the fuel sub level sensor. &lt;Ref. to FU(H4SO)-56, REMOVAL, Fuel Sub Level Sensor.&gt; &lt;Ref. to FU(H4DOTC)-66, REMOVAL, Fuel Sub Level Sensor.&gt; &lt;Ref. to FU(H6DO)-57, REMOVAL, Fuel Sub Level Sensor.&gt;</p> <p>2) Measure the resistance between fuel sub level sensor terminals when the float is in FULL or EMPTY position.</p> <p><b>Terminals</b> <b>(R59) No. 1 — No. 2:</b></p>	<p>Is the resistance 1.0 to 3.0 Ω (FULL) and 61 to 63 Ω (EMPTY)?</p>	<p>Go to step 5.</p>	<p>Replace the fuel sub level sensor.</p>
5	<p><b>CHECK HARNESS BETWEEN FUEL SUB-LEVEL SENSOR AND BODY INTEGRATED UNIT.</b></p> <p>1) Disconnect the connector from body integrated unit.</p> <p>2) Check harness for open or short circuits between fuel sub level sensor harness connector terminal and body integrated unit harness connector terminal.</p> <p><b>Connector &amp; terminal</b> <b>(R59) No. 1 — (B281) No. 19:</b></p>	<p>Is harness normal?</p>	<p>Go to step 6.</p>	<p>Repair the wiring harness.</p>

# Combination Meter System

## INSTRUMENTATION/DRIVER INFO

Step	Check	Yes	No
<b>6 CHECK HARNESS BETWEEN FUEL LEVEL SENSOR AND FUEL SUB LEVEL SENSOR.</b> Check harness for open or short circuits between fuel level sensor harness connector terminal and fuel sub level sensor harness connector terminal. <i>Connector &amp; terminal (R58) No. 1 — (R59) No. 2:</i>	Is harness normal?	Go to step 7.	Repair the wiring harness.
<b>7 CHECK FUEL LEVEL SENSOR GROUND CIRCUIT.</b> Check harness for open or short circuits between fuel level sensor harness connector terminal and chassis ground harness connector terminal. <i>Connector &amp; terminal (R58) No. 4 — Chassis ground:</i>	Is harness normal?	Replace the meter case assembly.	Repair the wiring harness.

## 9. CHECK ENGINE COOLANT TEMPERATURE SENSOR

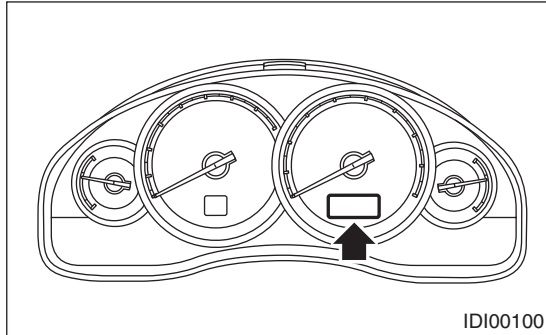
Step	Check	Yes	No
<b>1 CHECK COMMUNICATION ERROR DISPLAY.</b> 1) Turn the ignition switch to ON. 2) Check that the error code is displayed in odo/trip meter. (Except for meter with MID)	Is the error code "Er xx" displayed on odo/trip meter? (Except for meter with MID) Or is the DTC of low speed LAN system detected?	Check the communication circuit. <Ref. to IDI-15, COMMUNICATION ERROR DISPLAY, INSPECTION, Combination Meter System.>	Go to step 2.
<b>2 CHECK ENGINE COOLANT TEMPERATURE SENSOR.</b> Check the engine coolant temperature sensor. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H6DO)(diag)-2, Basic Diagnostic Procedure.>	Is the engine coolant temperature sensor OK?	Replace the meter case assembly.	Replace the engine coolant temperature sensor.

## 10.COMMUNICATION ERROR DISPLAY

**NOTE:**

Communication error display is not displayed on the meter with multi information display.

When the following error code is displayed in the odo/trip meter, inspect the communication circuit since the communication failure is generated between each control module. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>



Error code	Remarks
Er IU	Malfunction in integrated module
Er —	Simultaneous malfunction of high/low speed CAN communication
Er HC	High speed CAN communication failure
Er LC	Low-speed CAN communication failure
Er EG	EGI Communication failure
Er TC	TCM Communication failure
Er Ab	ABSCM/VDCCM communication failure
Er SP	ABSCM/VDCCM DTC information and vehicle speed pulse malfunction
Er SS	Wheel speed data malfunction

# Combination Meter System

## INSTRUMENTATION/DRIVER INFO

### 11.DTC DISPLAY MODE

Display of DTC can be easily performed in odo/trip meter by performing the following procedures.

- 1) Within 3 seconds after turning the ignition switch to ON, set the lighting switch to tail light or headlight position.
- 2) Press the odo/tripmeter knob four times.
- 3) Turn the lighting switch to OFF, and press the odo/trip meter knob four times.
- 4) Set the lighting switch to tail light or headlight position again, and press the odo/tripmeter knob four times.

#### NOTE:

- Perform the steps described in 2) and 4) within 10 seconds.
- Perform checking DTC with the Subaru Select Monitor basically because malfunction history is displayed with a meter.
- When the engine starts during diagnosis, the self-diagnosis function is not cancelled, however, once turning the ignition switch to OFF or the vehicle starts driving, DTC display mode is cancelled automatically for safety.
- When the DTC display mode operates, {ECM}, {TCM}, {ABS/VDC} is displayed cyclically in this order for every three seconds or every press of the trip knob. DTC is displayed in the following table according to type of control module, receiving DTC, DTC detected, No DTC.
- Meter without multi information display

Control module	Condition	Display
ECM	Receiving DTC	Trip "A" + "P (Blink)"
	DTC detected	Trip "A" + "P xxxx"
	No DTC	Trip "A" + "P ----"
TCM	Receiving DTC	Trip "B" + "P (Blink)"
	DTC detected	Trip "B" + "P xxxx"
	No DTC	Trip "B" + "P ----"
ABS/VDCCM	Receiving DTC	Trip "A" + "C (Blink)"
	DTC detected	Trip "A" + "C xxxx"
	No DTC	Trip "A" + "C ----"
When CAN communication error is occurred	—	" ---- "

- Meter without multi information display

Control module	Condition	Display
ECM	Receiving DTC	Trip "A" + "P (Blink)"
	DTC detected	Trip "A" + "P xxxx"
	No DTC	Trip "A" + "P ----"
TCM	Receiving DTC	Trip "B" + "P (Blink)"
	DTC detected	Trip "B" + "P xxxx"
	No DTC	Trip "B" + "P ----"
ABS/VDCCM	Receiving DTC	Trip "A" + "C (Blink)"
	DTC detected	Trip "A" + "C xxxx"
	No DTC	Trip "A" + "C ----"

## 3. Clock System

### A: WIRING DIAGRAM

#### 1. CLOCK

<Ref. to WI-204, WIRING DIAGRAM, Clock System.>

### B: INSPECTION

#### 1. SYMPTOM CHART

Symptom	Repair order	Reference
No display is shown.	1. Power supply 2. Clock body	<Ref. to IDI-17, CHECK POWER SUPPLY AND GROUND CIRCUIT, INSPECTION, Clock System.>
Illumination does not illuminate.	1. Illumination power supply 2. Clock body	<Ref. to IDI-18, CHECK ILLUMINATION CIRCUIT, INSPECTION, Clock System.>
“Acc” or “ign” is displayed.	ACC or ignition power supply	<Ref. to IDI-18, CHECK ACC OR IGNITION POWER SUPPLY, INSPECTION, Clock System.>
“Err” is displayed in all items.	1. Communication circuit between combination meter and clock 2. Clock body	<Ref. to IDI-18, CHECK COMMUNICATION CIRCUIT, INSPECTION, Clock System.>
“Err” is displayed when a particular item is selected.	Communication circuit between combination meter and individual control modules	<Ref. to IDI-15, COMMUNICATION ERROR DISPLAY, INSPECTION, Combination Meter System.>

#### 2. CHECK POWER SUPPLY AND GROUND CIRCUIT

Step	Check	Yes	No
<b>1 CHECK CLOCK POWER SUPPLY.</b> 1) Disconnect the clock harness connector. 2) Measure the voltage between the clock harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i59) No. 10 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Check the harness for a open or short between the fuse and clock.
<b>2 CHECK CLOCK GROUND CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the resistance between the clock harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i59) No. 6 — Chassis ground:</b>	Is resistance less than 10 Ω?	Replace the clock body.	Repair the wiring harness.

# Clock System

## INSTRUMENTATION/DRIVER INFO

### 3. CHECK ILLUMINATION CIRCUIT

Step	Check	Yes	No
<b>1 CHECK ILLUMINATION CIRCUIT POWER SUPPLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the clock harness connector. 3) Turn the ignition switch and lighting switch to ON. 4) Measure the voltage between the clock harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>Normal meter:</b> <i>(i59) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Replace the clock body.	Check the harness for a open or short between the fuse and clock.

### 4. CHECK ACC OR IGNITION POWER SUPPLY

Step	Check	Yes	No
<b>1 CHECK ACC POWER SUPPLY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the clock harness connector. 3) Turn the ignition switch to ACC. 4) Measure the voltage between the clock harness connector and chassis ground. <b>Connector &amp; terminal</b> <i>(i59) No. 9 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 2.	Check for open circuits in the harness between the fuse and the clock.
<b>2 CHECK THE IGNITION POWER SUPPLY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the clock harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>Normal meter:</b> <i>(i59) No. 8 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Replace the clock body.	Check for open circuits in the harness between the fuse and the clock.

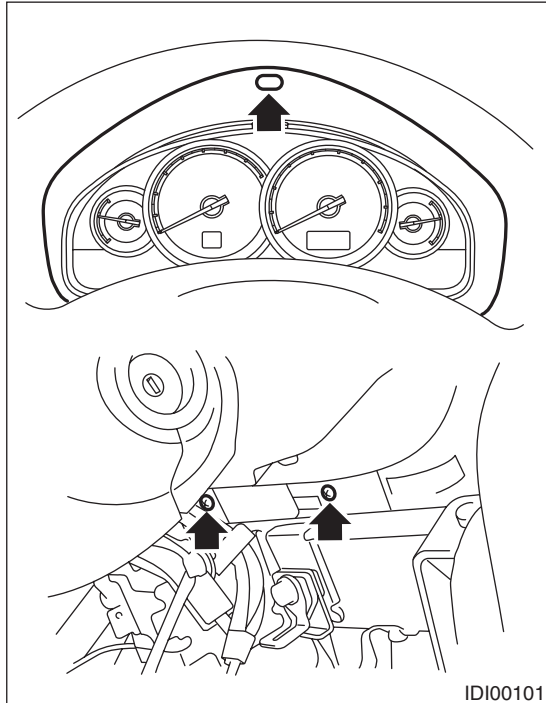
### 5. CHECK COMMUNICATION CIRCUIT

Step	Check	Yes	No
<b>1 CHECK THE HARNESS BETWEEN CLOCK AND COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of the clock and the combination meter. 3) Measure the resistance between the harness connector of the clock and the combination meter. <b>Connector &amp; terminal</b> <b>Normal meter:</b> <i>(i59) No. 5 — (i10) No. 18:</i> <b>Multi meter:</b> <i>(i59) No. 1 — (i10) No. 13:</i>	Is resistance less than 10 $\Omega$ ?	Go to step 2.	Repair the wiring harness.
<b>2 CHECK COMMUNICATION ERROR DISPLAY.</b> 1) Connect all the disconnected connectors. 2) Turn the ignition switch to ON. 3) Check that the error code is displayed in odo/trip meter.	Is the error code "Er xx" displayed on odo/trip meter? (Except for meter with MID)	Check the communication circuit. <Ref. to IDI-15, COMMUNICATION ERROR DISPLAY, INSPECTION, Combination Meter System.>	Replace the clock body.

## 4. Combination Meter

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Set the tilt steering at the lowest position.
- 3) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 4) Remove the screws of the combination meter (one on the upper side, two on lower side) and pull while tilting the meter towards yourself.



- 5) Disconnect the connector in the rear side of combination meter to remove meter.

#### CAUTION:

- Be careful not to damage the meter or instrument panel.
- Pay particular attention to avoid damaging the meter glass.

### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

- Make sure the electrical connector is connected securely.
- Make sure that each meter operates normally.
- When the combination meter of model with immobilizer has been replaced, be sure to perform the registration of immobilizer.

# Combination Meter

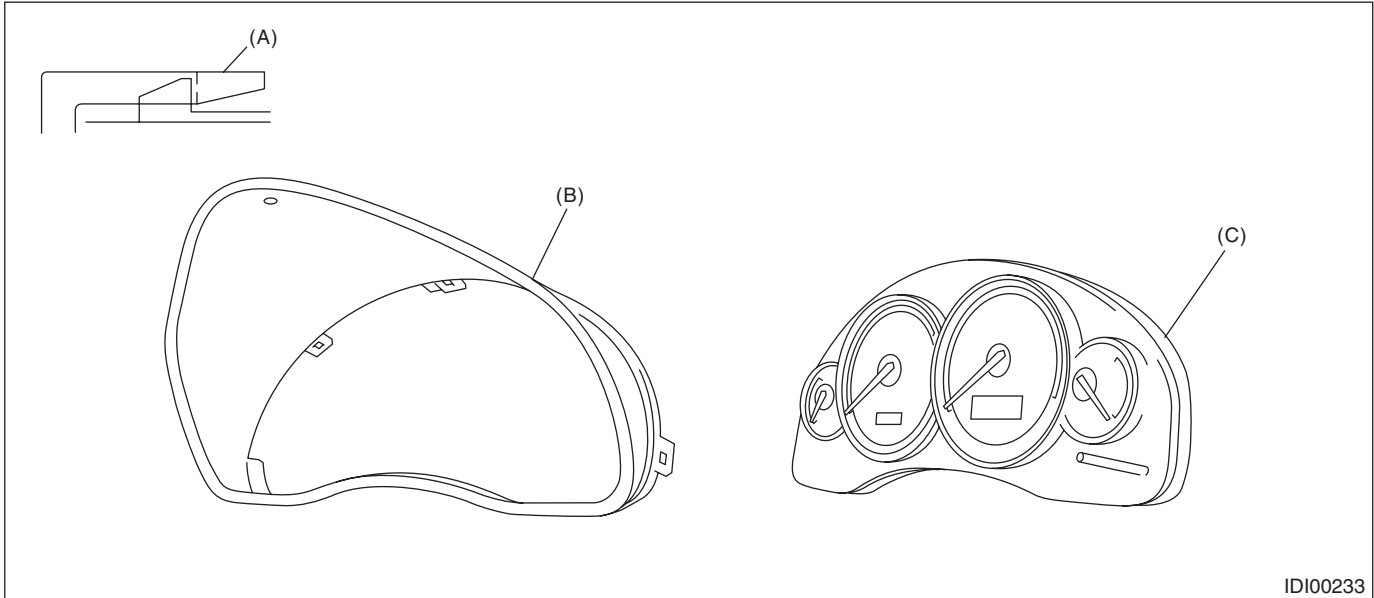
INSTRUMENTATION/DRIVER INFO

## C: DISASSEMBLY

### CAUTION:

- Use gloves to avoid damage and getting fingerprints on the glass surface and meter surfaces.
- Be careful not to apply excessive force to the trip knob.
- Be sure not to touch the meter indicator needle.

Disengage claw (A), and remove the meter glass assembly (B) and meter panel assembly (C).



IDI00233

## 1. BULB REPLACEMENT

LEDs are used for all of warning lights and indicator lights of combination meters, replace the meter case assembly if faulty.

## D: ASSEMBLY

Assemble in the reverse order of disassembly.



## 5. Speedometer

### A: SPECIFICATION

Since the meter case assembly cannot be disassembled, do not remove or inspect the speedometer alone. (Do not remove the cover on the back surface.)

## 6. Tachometer

### A: SPECIFICATION

Since the meter case assembly cannot be disassembled, do not remove or inspect the tachometer alone. (Do not remove the cover on the back surface.)

## 7. Fuel Gauge

### A: SPECIFICATION

Since the meter case assembly cannot be disassembled, do not remove or inspect the fuel gauge alone. (Do not remove the cover on the back surface.)

# Engine Coolant Temperature Gauge

INSTRUMENTATION/DRIVER INFO

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## 8. Engine Coolant Temperature Gauge

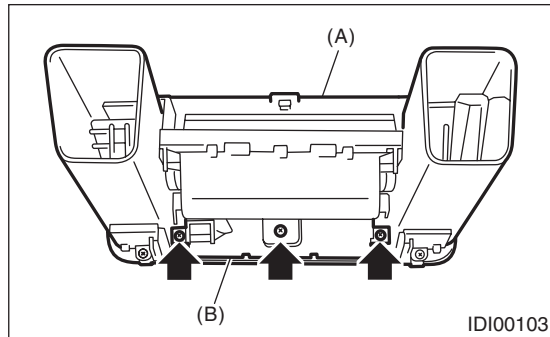
### A: SPECIFICATION

Since the meter case assembly cannot be disassembled, do not remove or inspect the engine coolant temperature gauge alone. (Do not remove the cover on the back surface.)

## 9. Clock

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the center air vent grille. <Ref. to AC-46, REMOVAL, Air Vent Grille.>
- 3) Loosen the screws, and remove clock (B) from center air vent grille (A).



### B: INSTALLATION

Install in the reverse order of removal.

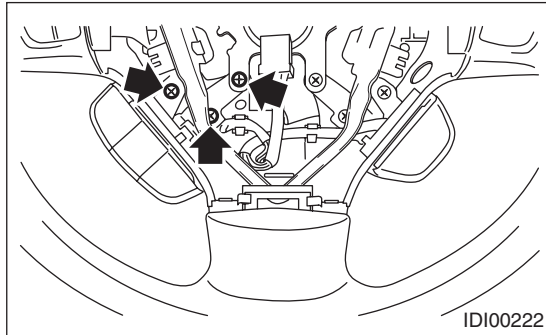
# Multi-information Display Selector

INSTRUMENTATION/DRIVER INFO

## 10. Multi-information Display Selector

### A: REMOVAL

- 1) Remove the airbag module from steering wheel.  
<Ref. to AB-14, REMOVAL, Driver's Airbag Module.>
- 2) Disconnect the roll connector and steering switch connector, and remove the bolts.



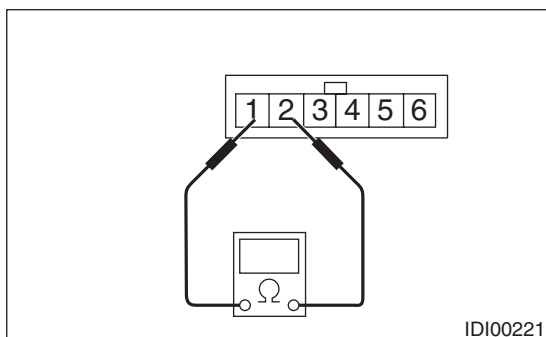
- 3) Remove the multi-information display selector.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

- 1) Remove the airbag module from steering wheel.  
<Ref. to AB-14, REMOVAL, Driver's Airbag Module.>
- 2) Connect tester as shown in the figure, and measure the resistance between the terminals when pressing each switch.



Switch	Resistance value
Not pressed.	1 M $\Omega$ or more
Press ▲.	10 $\Omega$ or less
Press i/SET.	Approx. 1 k $\Omega$
Press ▼.	Approx. 3.67 k $\Omega$

- 3) Replace for faulty switch when the internal resistance is not in the above table. <Ref. to IDI-26, REMOVAL, Multi-information Display Selector.>

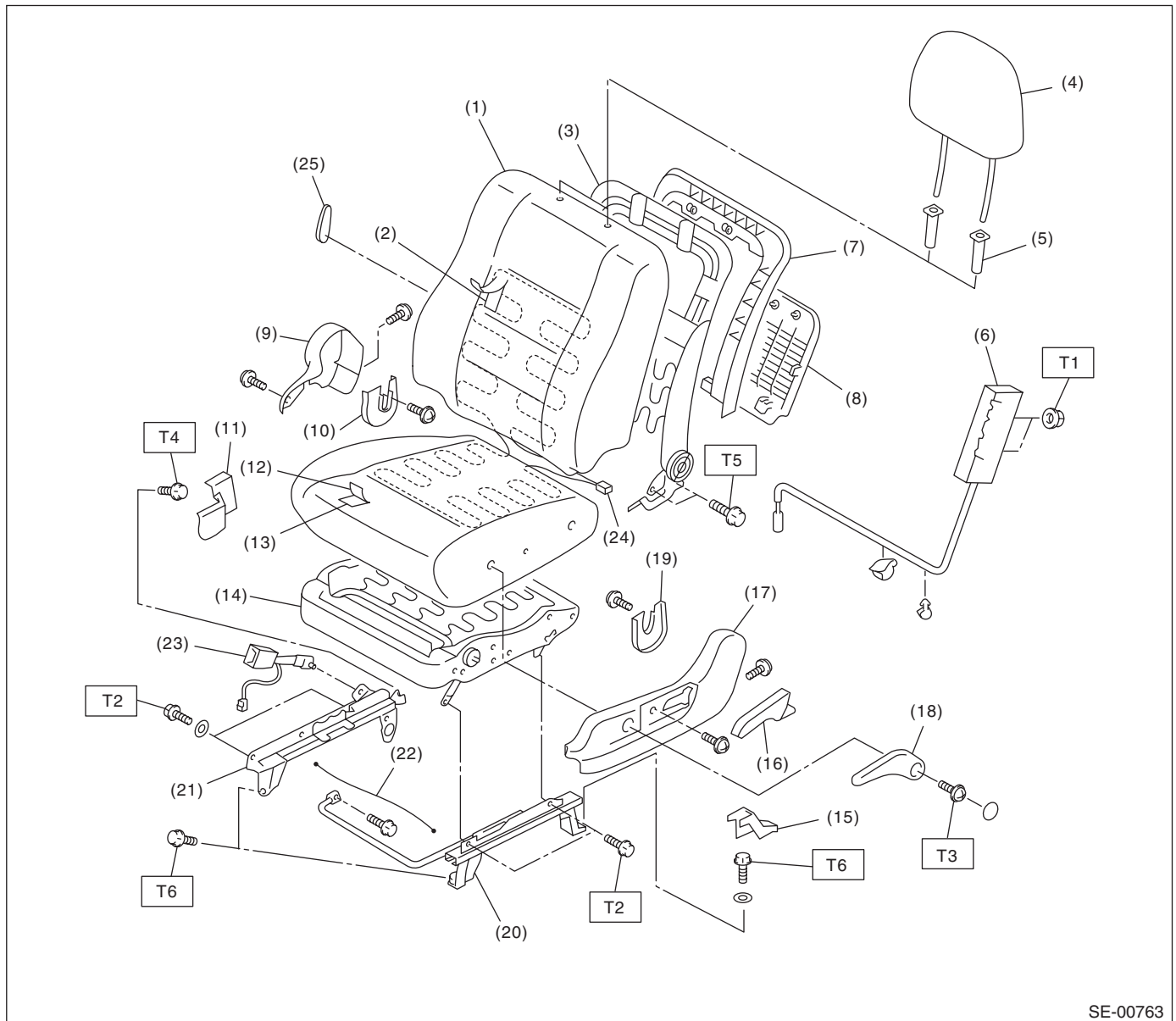
# General Description

SEATS

## 1. General Description

### A: COMPONENT

#### 1. FRONT SEAT LH (MANUAL SEAT)



SE-00763

(1) Backrest cover	(12) Seat cushion cover	(23) Inner seat belt ASSY
(2) Backrest pad	(13) Seat cushion pad	(24) Seat heater unit
(3) Backrest frame ASSY	(14) Seat cushion frame ASSY	(25) Lumbar support lever
(4) Headrest ASSY	(15) Rear bolt cover outside	
(5) Headrest lock bushing	(16) Reclining lever	
(6) Side airbag module	(17) Seat side cover outside	
(7) Cover frame	(18) Lifter lever	
(8) Backrest back cover	(19) Hinge inner cover LH	
(9) Seat side cover inside	(20) Outer slide rail	
(10) Hinge inner cover RH	(21) Inner slide rail	
(11) Rear bolt cover inside	(22) Connecting wire	

#### **Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6 (0.61, 4.43)**

**T2: 10 (1.02, 7.38)**

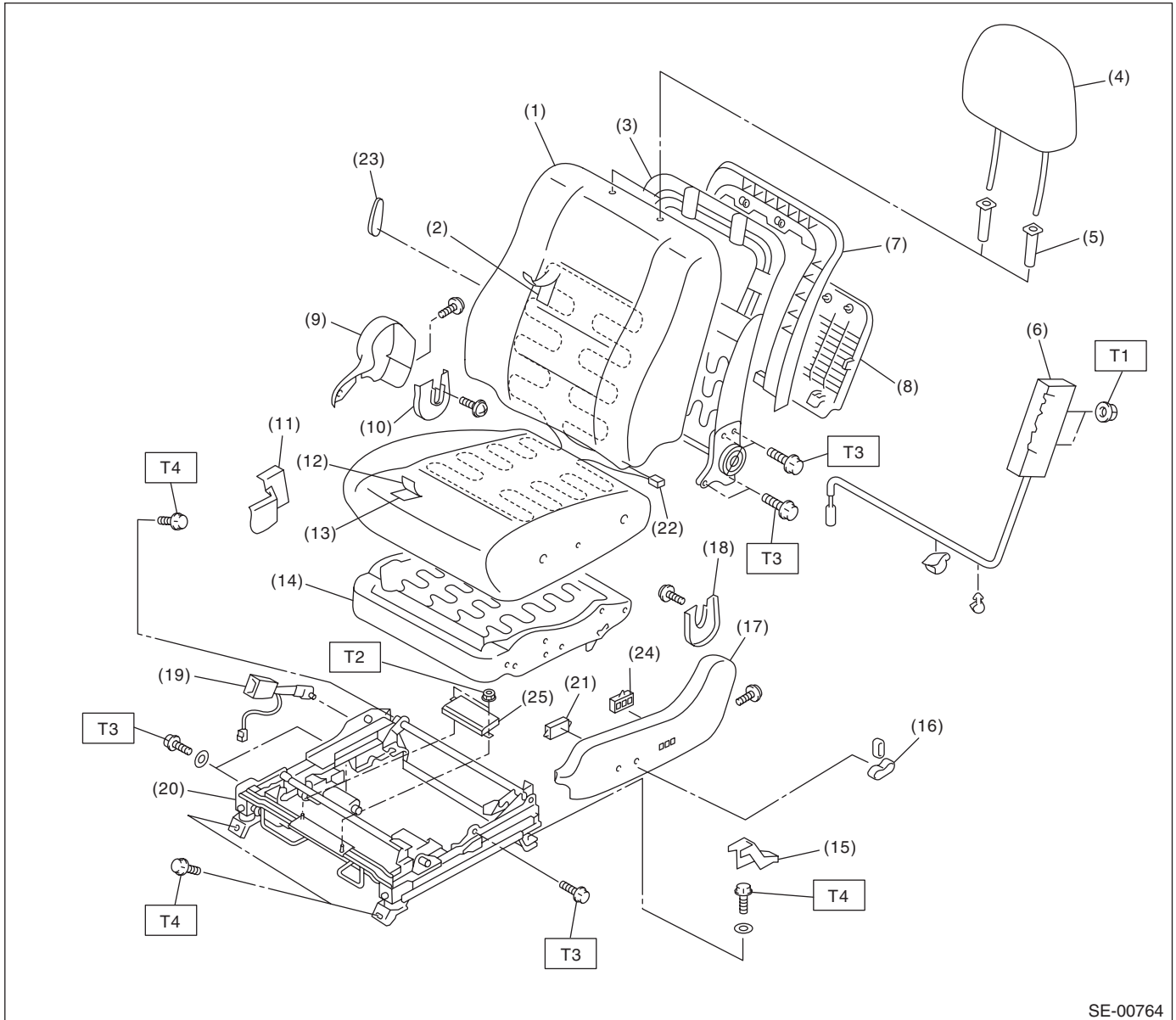
**T3: 22 (2.24, 16.2)**

**T4: 30 (3.06, 22.1)**

**T5: 52 (5.30, 38.4)**

**T6: 53 (5.40, 39.1)**

## 2. FRONT SEAT LH (POWER SEAT)



SE-00764

- |                             |                              |                                      |
|-----------------------------|------------------------------|--------------------------------------|
| (1) Backrest cover          | (12) Seat cushion cover      | (23) Lumber support lever            |
| (2) Backrest pad            | (13) Seat cushion pad        | (24) Memory switch (memory-equipped) |
| (3) Backrest frame ASSY     | (14) Seat cushion frame ASSY | (25) Memory module (memory-equipped) |
| (4) Headrest ASSY           | (15) Rear bolt cover outside |                                      |
| (5) Headrest lock bushing   | (16) Power seat switch knob  |                                      |
| (6) Side airbag module      | (17) Seat side cover outside |                                      |
| (7) Cover frame             | (18) Hinge inner cover LH    |                                      |
| (8) Backrest back cover     | (19) Inner seat belt ASSY    |                                      |
| (9) Seat side cover inside  | (20) Slide rail ASSY         |                                      |
| (10) Hinge inner cover RH   | (21) Power seat switch unit  |                                      |
| (11) Rear bolt cover inside | (22) Seat heater unit        |                                      |

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 6 (0.61, 4.43)**

**T2: 22 (2.24, 16.2)**

**T3: 52 (5.30, 38.4)**

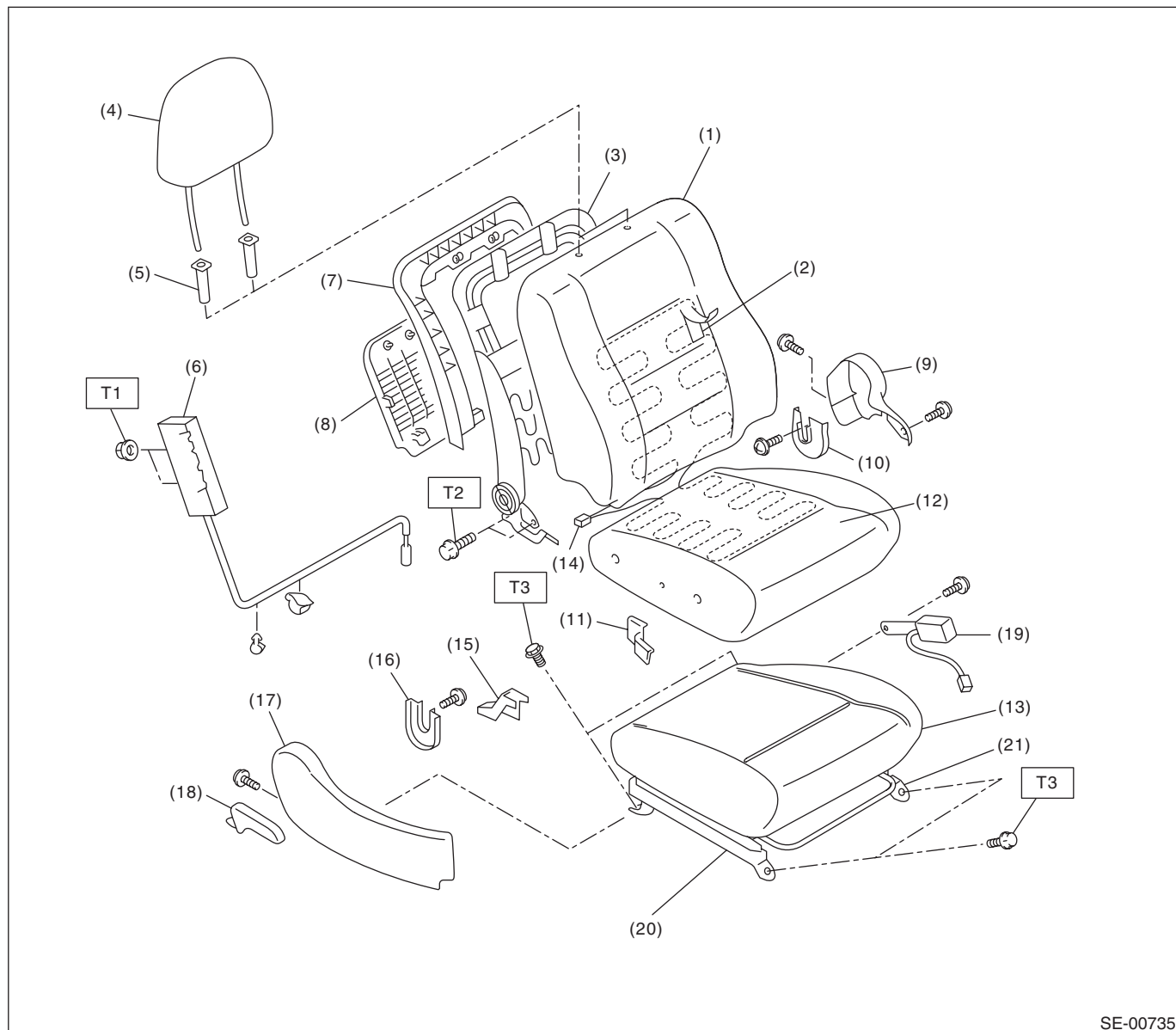
**T4: 53 (5.40, 39.1)**



# General Description

## SEATS

### 3. FRONT SEAT RH (MANUAL SEAT)



- |                           |                                      |                           |
|---------------------------|--------------------------------------|---------------------------|
| (1) Backrest cover        | (10) Hinge inner cover LH            | (18) Reclining lever      |
| (2) Backrest pad          | (11) Rear bolt cover inside          | (19) Inner seat belt ASSY |
| (3) Backrest frame ASSY   | (12) Seat cushion cover              | (20) Outer slide rail     |
| (4) Headrest ASSY         | (13) Seat cushion pad and frame ASSY | (21) Inner slide rail     |
| (5) Headrest lock bushing | (14) Seat heater unit                |                           |
| (6) Side airbag module    | (15) Rear bolt cover outside         |                           |
| (7) Cover frame           | (16) Hinge inner cover RH            |                           |
| (8) Backrest back cover   | (17) Seat side cover outside         |                           |
| (9) Seat cover inside     |                                      |                           |

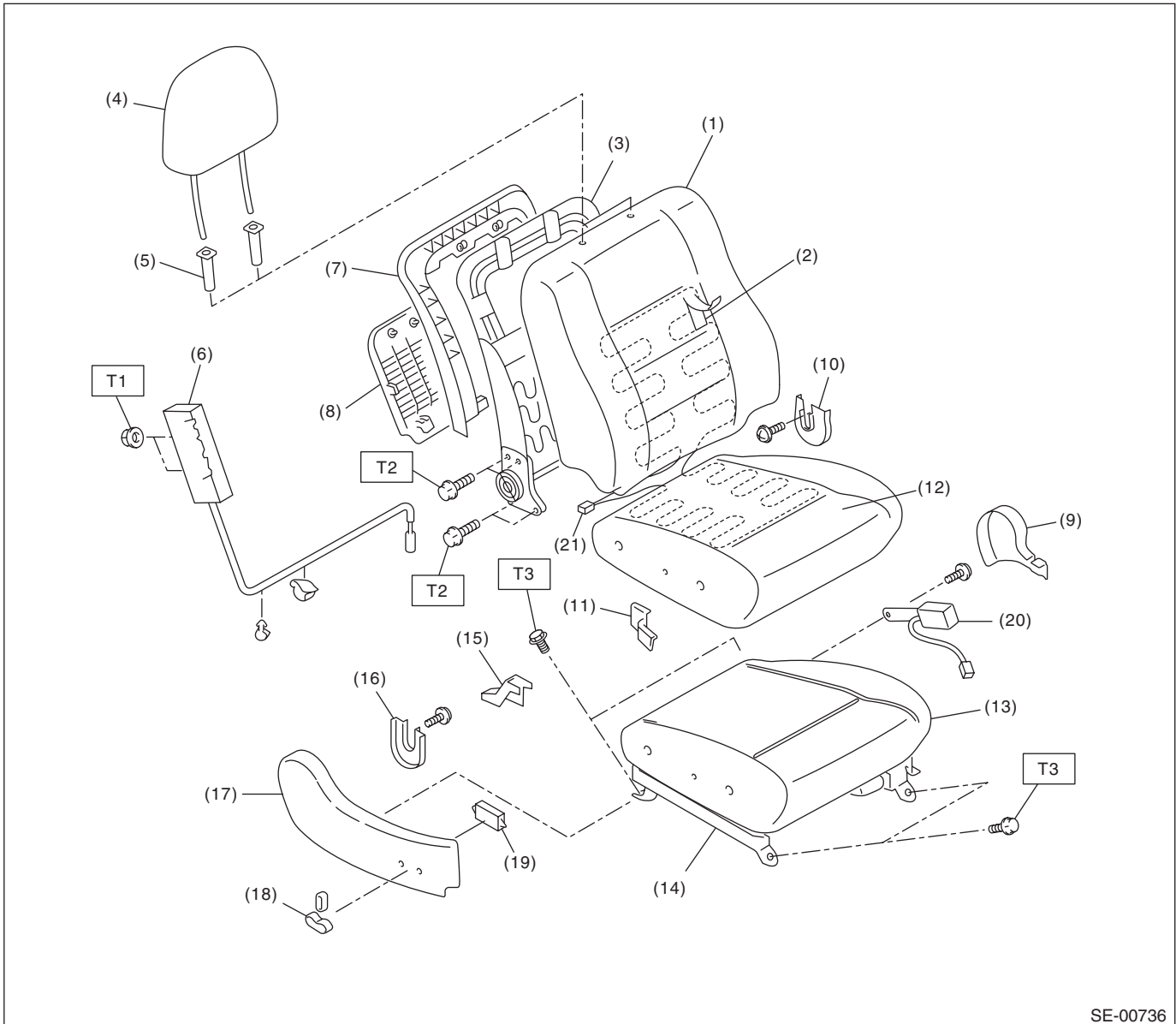
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6 (0.61, 4.43)**

**T2: 52 (5.30, 38.4)**

**T3: 53 (5.40, 39.1)**

## 4. FRONT SEAT RH (POWER SEAT)



- |                            |                                      |                             |
|----------------------------|--------------------------------------|-----------------------------|
| (1) Backrest cover         | (10) Hinge inner cover LH            | (18) Power seat switch knob |
| (2) Backrest pad           | (11) Rear bolt cover inside          | (19) Power seat switch unit |
| (3) Backrest frame ASSY    | (12) Seat cushion cover              | (20) Inner seat belt ASSY   |
| (4) Headrest ASSY          | (13) Seat cushion pad and frame ASSY | (21) Seat heater unit       |
| (5) Headrest lock bushing  | (14) Slide rail ASSY                 |                             |
| (6) Side airbag module     | (15) Rear bolt cover outside         |                             |
| (7) Cover frame            | (16) Hinge inner cover RH            |                             |
| (8) Backrest back cover    | (17) Seat side cover outside         |                             |
| (9) Seat side cover inside |                                      |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6 (0.61, 4.43)**

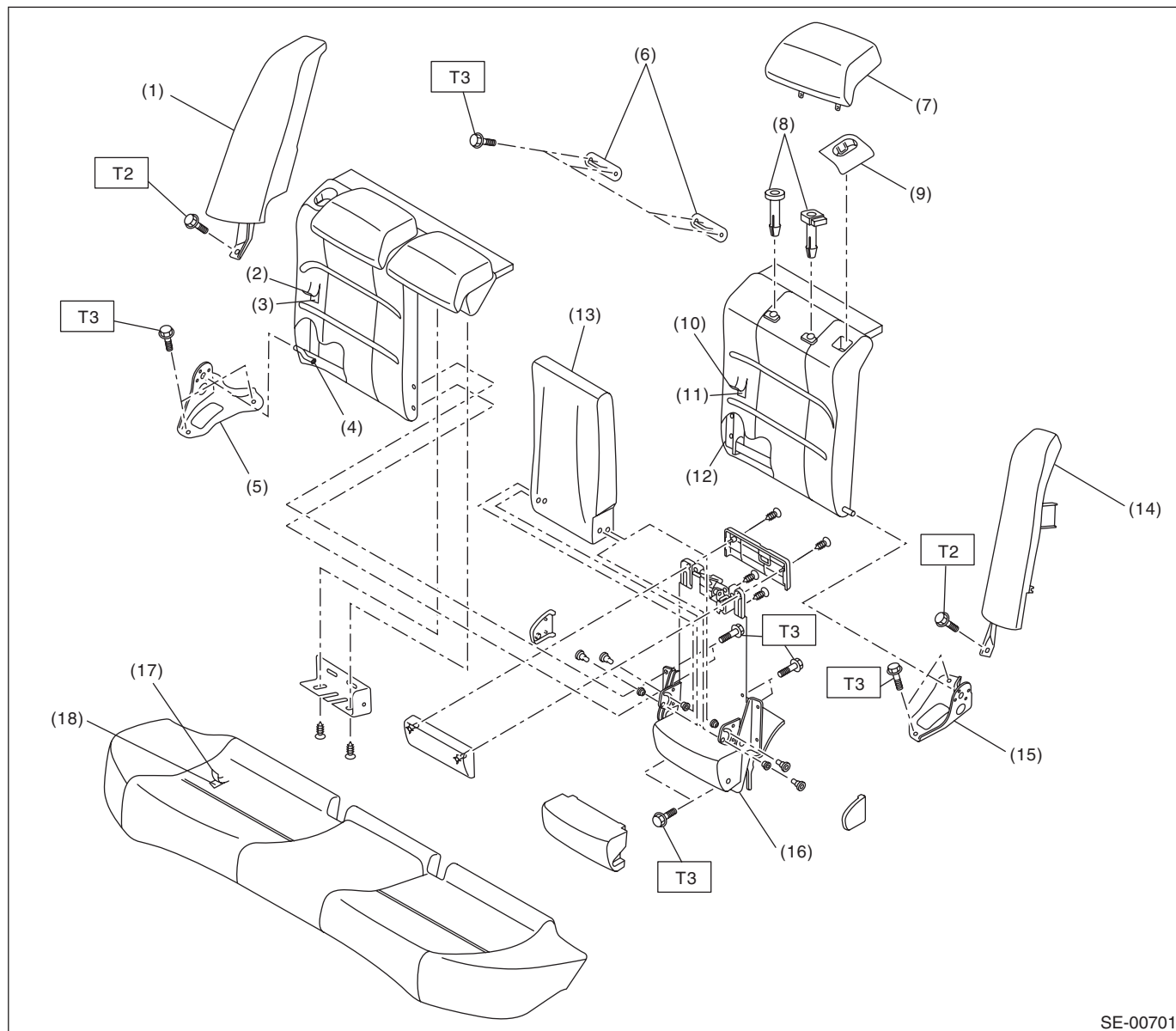
**T2: 52 (5.30, 38.4)**

**T3: 53 (5.40, 39.1)**

# General Description

## SEATS

### 5. REAR SEAT (SEDAN MODEL)



SE-00701

- |                            |                                   |                         |
|----------------------------|-----------------------------------|-------------------------|
| (1) Backrest shoulder RH   | (9) Holder & button cover         | (17) Seat cushion cover |
| (2) Backrest cover RH      | (10) Backrest cover LH            | (18) Seat cushion pad   |
| (3) Backrest pad RH        | (11) Backrest pad LH              |                         |
| (4) Backrest frame RH ASSY | (12) Backrest frame LH ASSY       |                         |
| (5) Hinge ASSY RH          | (13) Armrest                      |                         |
| (6) Backrest striker       | (14) Backrest shoulder LH         |                         |
| (7) Headrest               | (15) Hinge ASSY LH                |                         |
| (8) Headrest bushing       | (16) Trunk through backboard ASSY |                         |

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**Tightening torque: N·m (kgf·m, ft·lb)**

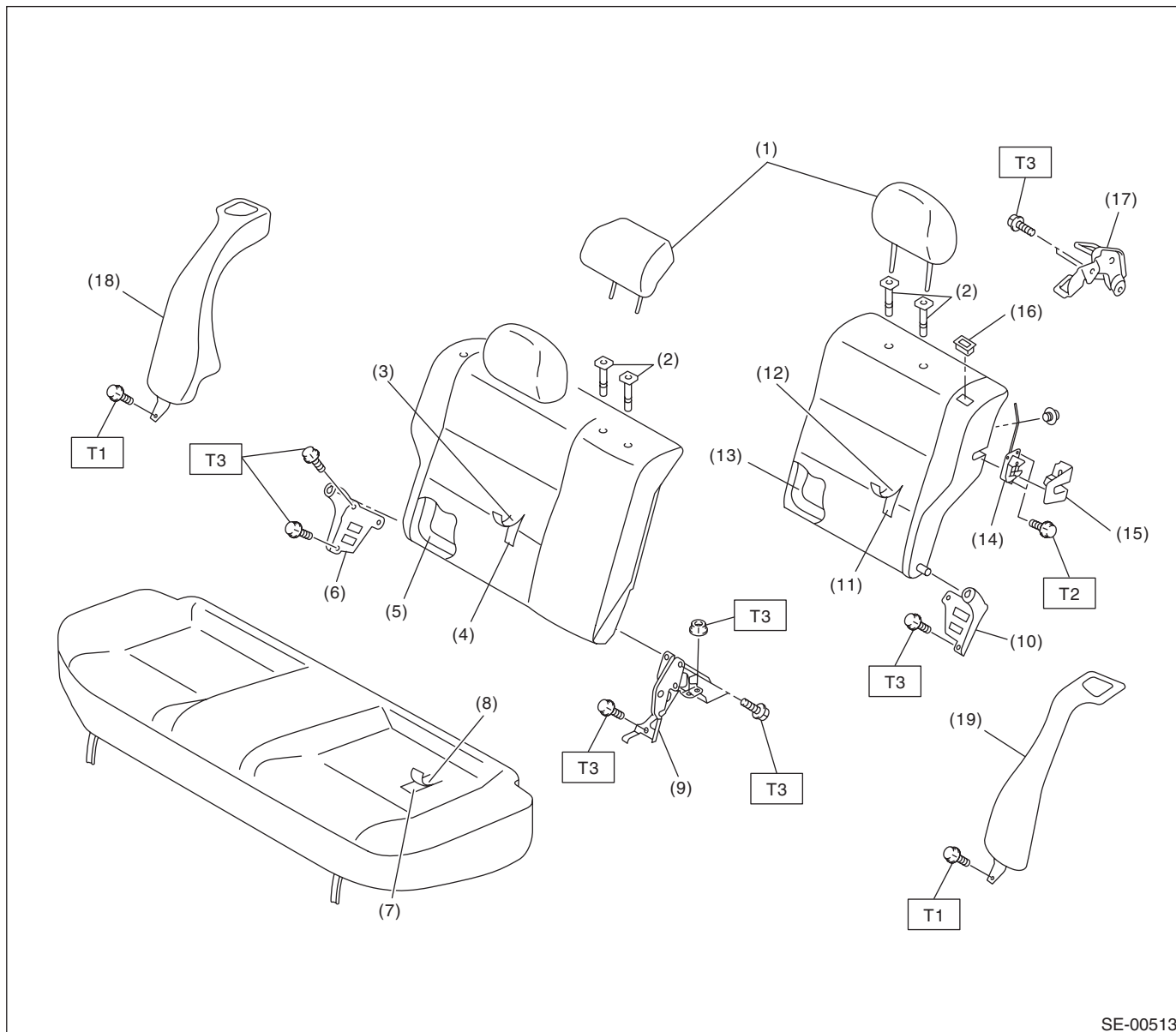
**T1: 9.8 (1.0, 7.23)**

**T2: 13.7 (1.4, 10.1)**

**T3: 25 (2.5, 18.4)**

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## 6. REAR SEAT (WAGON MODEL)



SE-00513

- |                        |                                |
|------------------------|--------------------------------|
| (1) Headrest           | (9) Hinge ASSY center          |
| (2) Headrest bushing   | (10) Hinge ASSY LH             |
| (3) Backrest cover RH  | (11) Backrest pad LH           |
| (4) Backrest pad RH    | (12) Backrest cover LH         |
| (5) Backrest frame RH  | (13) Backrest frame LH         |
| (6) Hinge ASSY RH      | (14) Seat backrest latch       |
| (7) Seat cushion pad   | (15) Seat backrest latch cover |
| (8) Seat cushion cover | (16) Holder & button           |

- |                           |
|---------------------------|
| (17) Striker              |
| (18) Backrest shoulder RH |
| (19) Backrest shoulder LH |

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 13.7 (1.40, 10.1)**

**T2: 17 (1.73, 12.3)**

**T3: 25 (2.5, 18.4)**

# General Description

## SEATS

---

### B: CAUTION

- If the seat cushion cover is removed or replaced, make sure to perform passenger detection system adjustment after installing the seat to the vehicle. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

Failure to do so may cause improper operation of the passenger detection system.

- The passenger detection system (passenger seat only) control unit and the passenger detection sensor are fixed to the seat cushion frame. Never remove the passenger detection control unit or the pressure sensor from the seat cushion frame.

- Do not replace the seat cushion pad by itself. Always replace the seat cushion pad and frame assembly as a set. The seat cushion pad and cushion frame are adjusted as a set at the time of manufacture. If cushion pads and cushion frames are combined from those of other vehicles or other sets, the passenger detection system may not operate properly.

- If the seat cushion cover is removed, make sure to replace the hang wire on the seat cushion side with a new wire.

- When removing the front seat from a side airbag loaded vehicle, follow cautions given in the airbag section. <Ref. to AB-4, CAUTION, General Description.>

### C: PREPARATION TOOL

#### 1. GENERAL TOOL

TOOL NAME	REMARKS
Long nose plier	Used for removing the hog ring.
Hog ring pliers	Used for installing the hog ring.
TORX® T50	Used for removing and installing the inner seat belt assembly.
Circuit tester	Used for checking voltage and continuity.

## 2. Front Seat

### A: REMOVAL

#### CAUTION:

The airbag system is fitted with a backup power source. After disconnecting the battery ground cable, the airbag may deploy if you do not wait for 20 seconds before starting the service of airbag system.

#### NOTE:

- When removing the front seat of memory-equipped power seats, always perform the initialize operation on the memory function after installing the seat to the vehicle. <Ref. to SE-38, ADJUSTMENT, Power Seat System.>
- Failure to do so may cause the abnormal operation of the memory function.

### 1. DRIVER'S SEAT

- 1) Remove the headrest.
- 2) Tilt the backrest forward, and move the seat forward.
- 3) Remove the rear bolt cover, and remove the two bolts at the rear side of the slide rail.
- 4) Move the seat towards the rear, and remove the two bolts at the front side of the slide rail.
- 5) Disconnect the ground cable from battery, and wait for 20 seconds or more before starting work.
- 6) Disconnect the connector under the seat.
  - Seat belt buckle switch connector
  - Side airbag connector
  - Seat heater connector (model with seat heater)
  - Power seat connector (model with power seats)
- 7) Remove the seat from vehicle.

### 2. PASSENGER'S SEAT

#### CAUTION:

Refer to "CAUTION" of "General Description" before starting the work. <Ref. to SE-8, CAUTION, General Description.>

- 1) Remove the headrest.
- 2) Tilt the backrest forward, and move the seat forward.
- 3) Remove the rear bolt cover, and then remove the rear side of slide rail.
- 4) Move the seat backward, remove the front bolt cover, and then remove the bolt at the front side of slide rail.
- 5) Disconnect the ground cable from battery, and wait for 20 seconds or more before starting work.

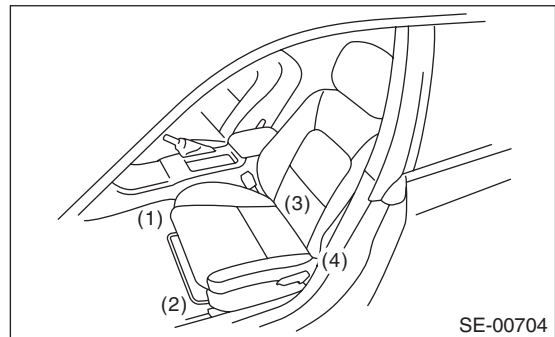
- 6) Disconnect all the connectors of connector holder in the backside of seat cushion.
  - Harness connector of occupant detection control module
  - Side airbag connector
  - Power seat connector (model with power seats)
  - Seat heater connector (model with seat heater)
- 7) Remove the seat from vehicle.

### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Tighten the slide rail installing bolt gradually in several steps to the specified torque in the order as shown in the figure.



#### Tightening torque:

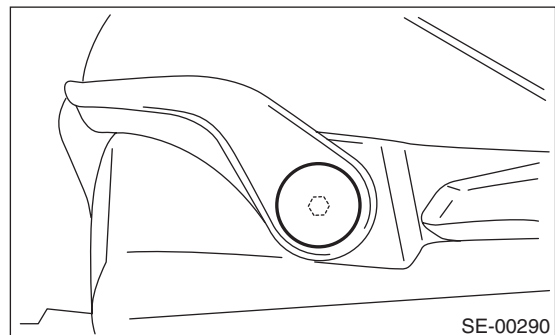
Refer to "COMPONENT" of "General Description". <Ref. to SE-2, COMPONENT, General Description.>

### C: DISASSEMBLY

### 1. DRIVER'S SEAT

#### MANUAL SEAT

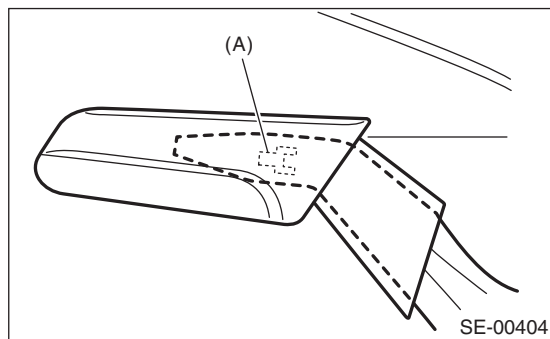
- 1) Remove the seat from vehicle. <Ref. to SE-9, REMOVAL, Front Seat.>
- 2) Remove the seat lifter cover using a flat tip screwdriver and loosen the inner bolt to remove the seat lifter lever.



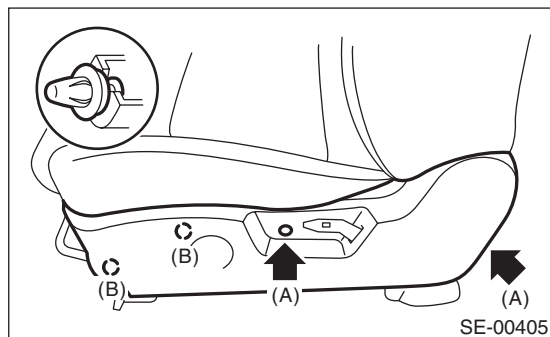
# Front Seat

## SEATS

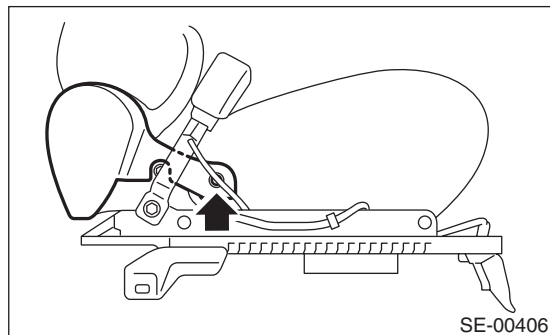
3) Remove hook (A) and detach the reclining lever cover.



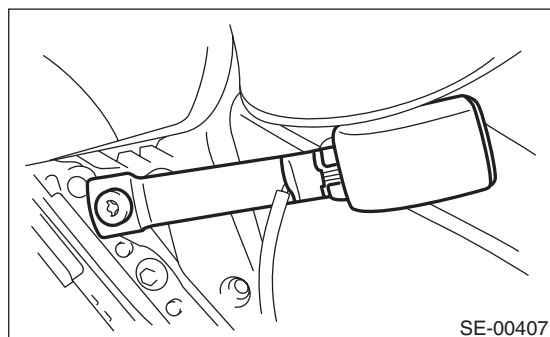
4) Remove screws (A) and clips (B), and then detach the seat side cover outside.



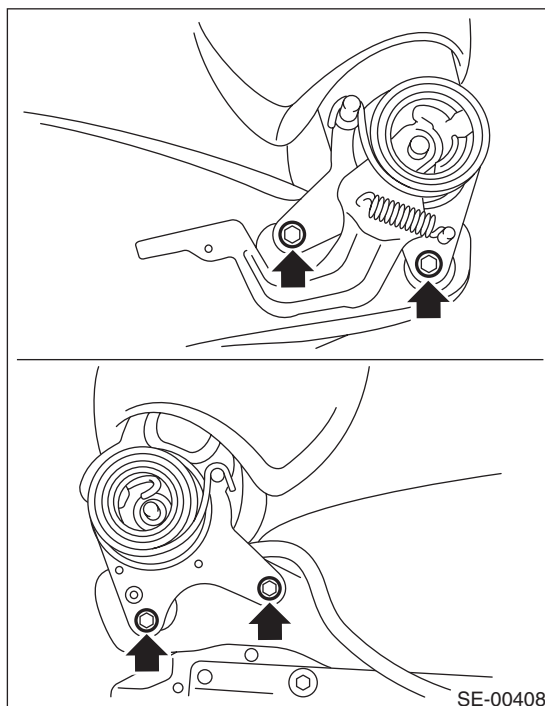
5) Loosen the screws to detach the seat side cover inside.



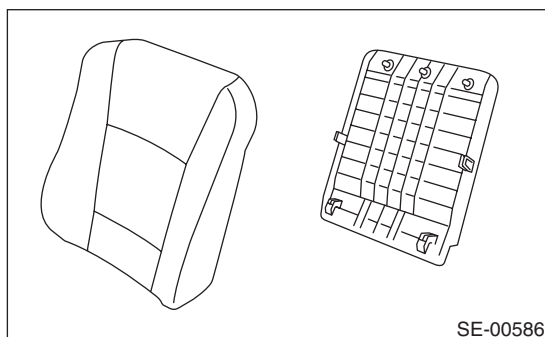
6) Remove the TORX® bolt, and then remove the inner seat belt assembly.



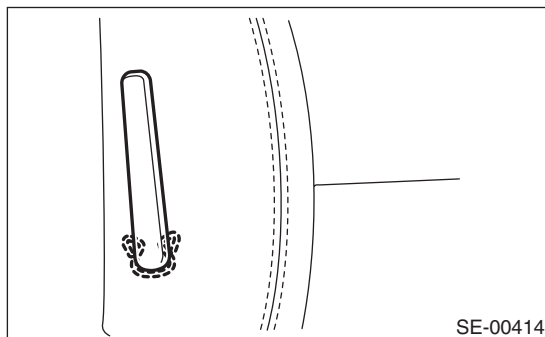
7) Remove the two bolts from the reclining hinge on each left and right side.



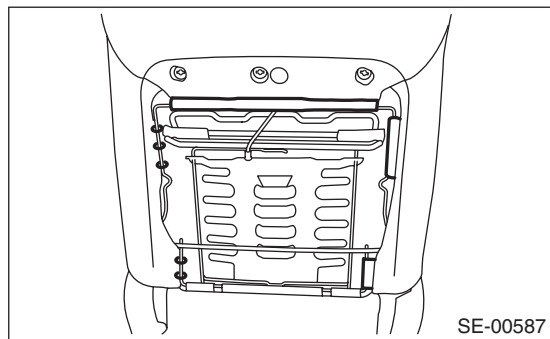
8) Remove the clips and hooks, and then detach the backrest back cover.



9) Remove the lock clip, and then remove the lumbar support lever.



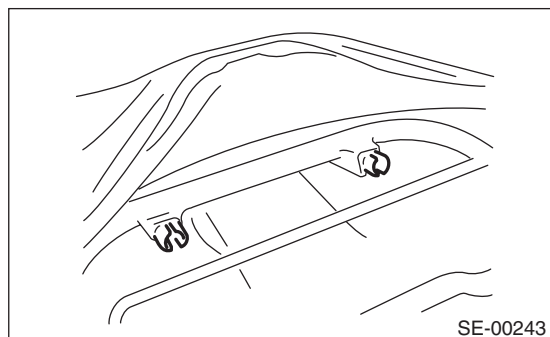
10) Remove the hooks and hog rings at the rear side of backrest.



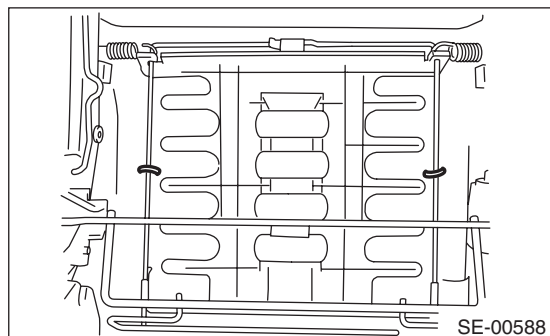
11) Remove the headrest lock bushing.

NOTE:

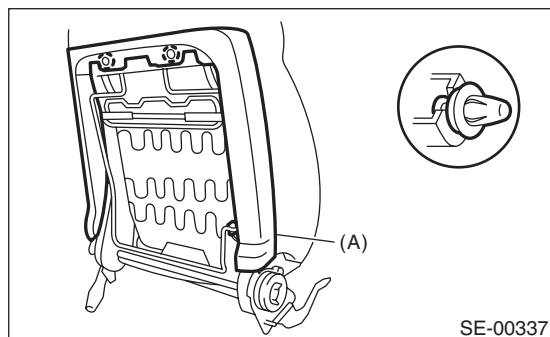
Push outside to remove it from the inside of seat.



12) Remove the hog rings.

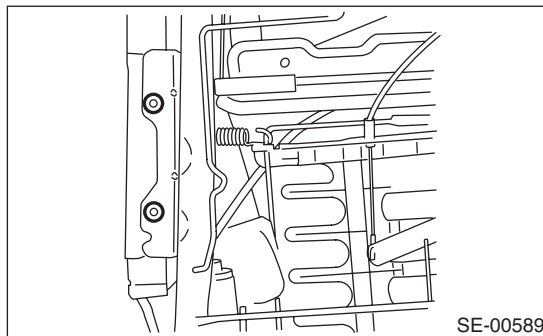


13) Remove the cover frame (A).

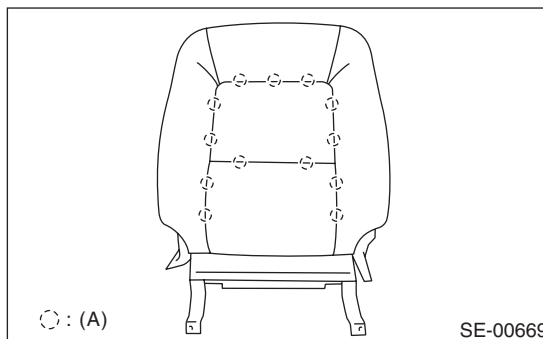


14) Pull out the backrest frame assembly.

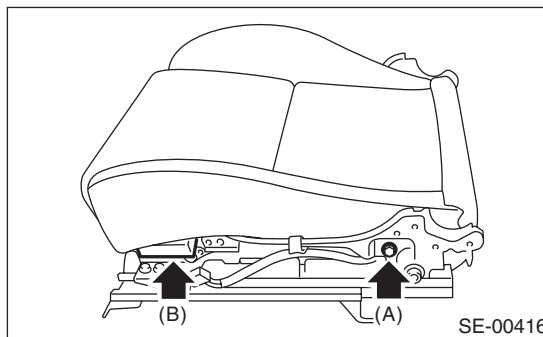
15) Remove the side airbag module.



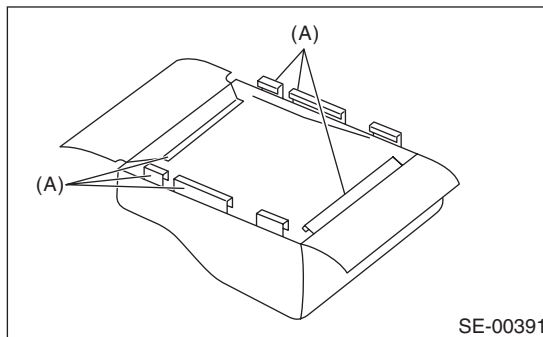
16) Remove the hog rings (A) on the surface side of backrest, and then remove the backrest cover from backrest.



17) Remove the bolt (A) and hook (B) on left and right side, and then remove the seat cushion frame from slide rail assembly.



18) Remove the hooks (A), and then remove the seat cushion from seat cushion frame.

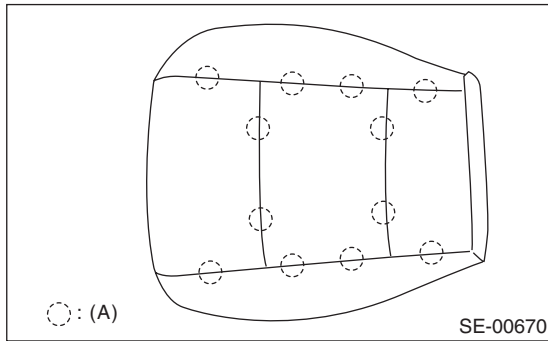




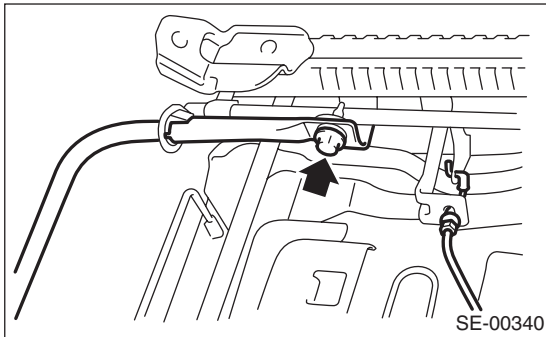
# Front Seat

## SEATS

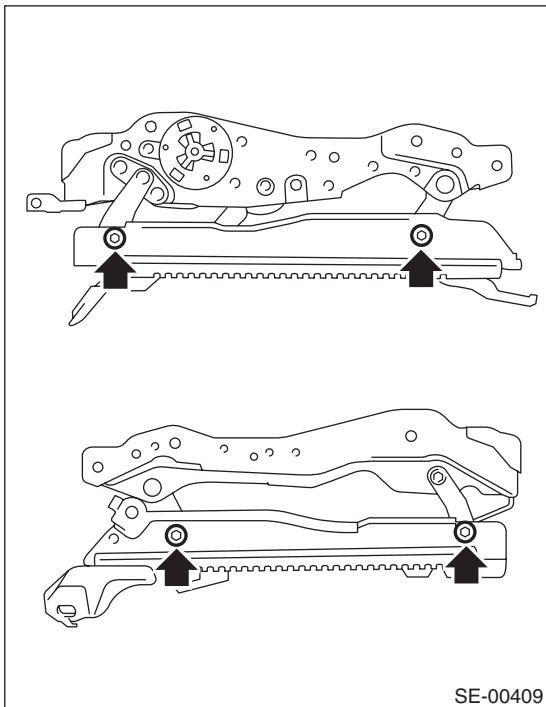
19) Remove the hog rings (A), and then remove the seat cushion cover from seat cushion pad.



20) Remove the bolt of the sliding adjustment bar and connecting wire.



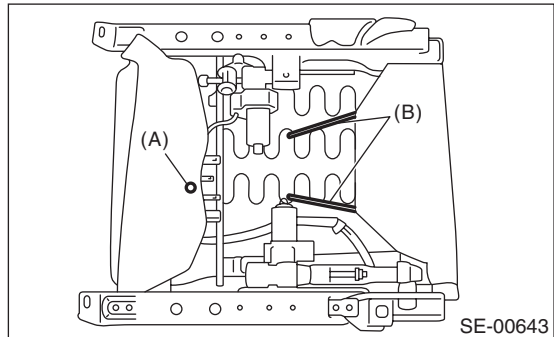
21) Remove the bolts, then remove the slide rail.



## POWER SEAT

1) Remove the seat from vehicle. <Ref. to SE-9, DRIVER'S SEAT, REMOVAL, Front Seat.>

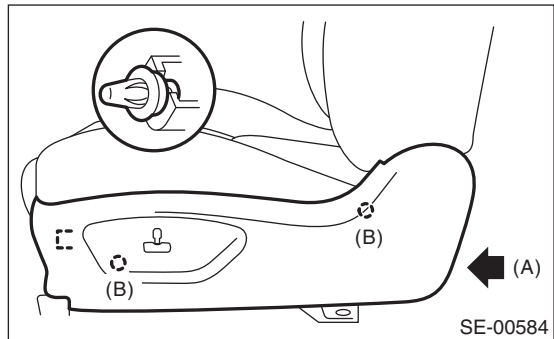
2) Remove the clip (A) and straps (B) on the back of seat cushion.



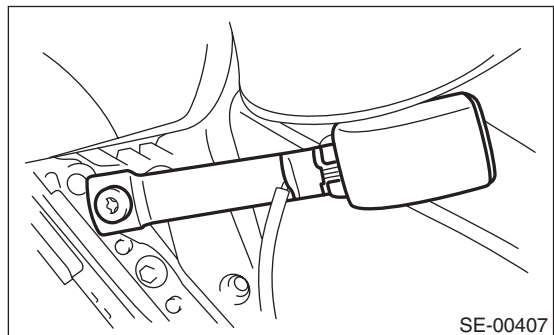
3) Disconnect the following connectors from the backside of seat cushion.

- Side airbag
- Seat heater
- Power seat
- Seat belt

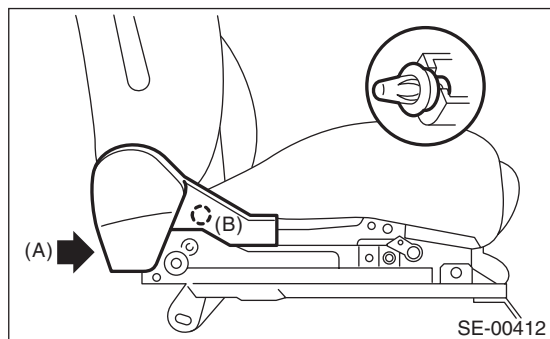
4) Remove the screw (A) and clips (B), and then disconnect the seat switch connector to remove seat side cover outside.



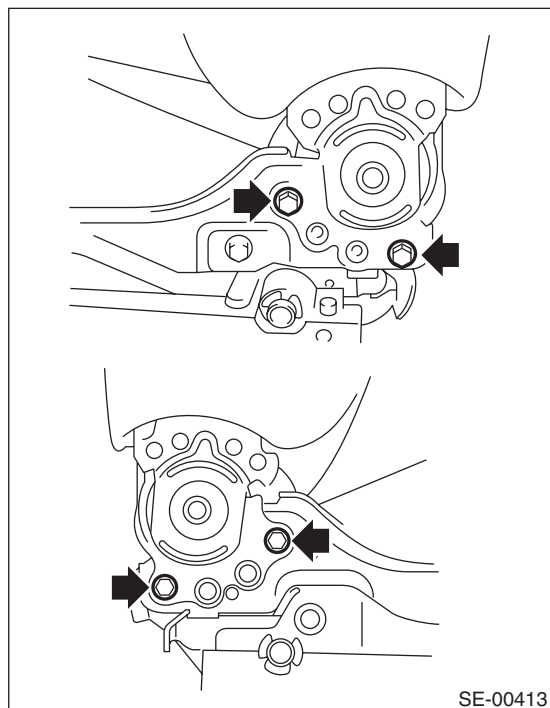
5) Remove the TORX® bolt, and then remove the inner seat belt assembly.



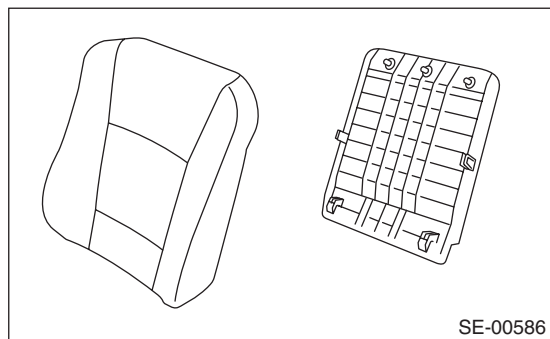
6) Remove the screw (A) and clip (B), and then remove the seat side cover inside.



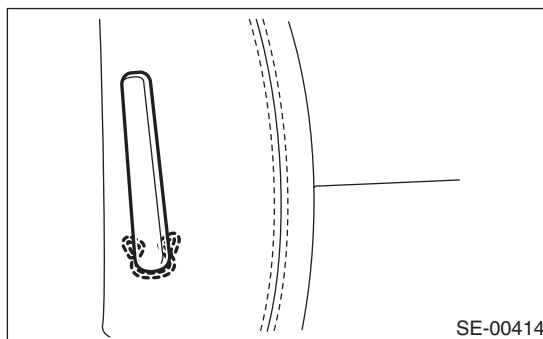
7) Remove the two bolts from the reclining hinge on each left and right side.



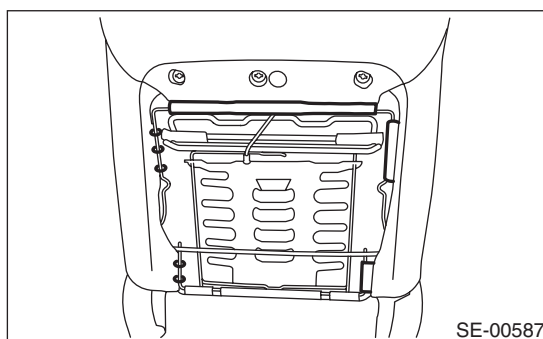
8) Remove the clips and hooks, and then detach the backrest back cover.



9) Remove the lock clip, and then remove the lumbar support lever.

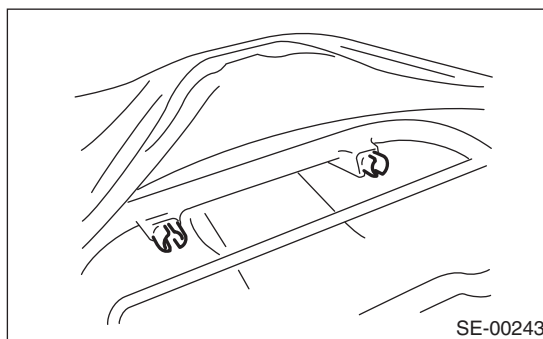


10) Remove the hooks and hog rings at the rear side of backrest.

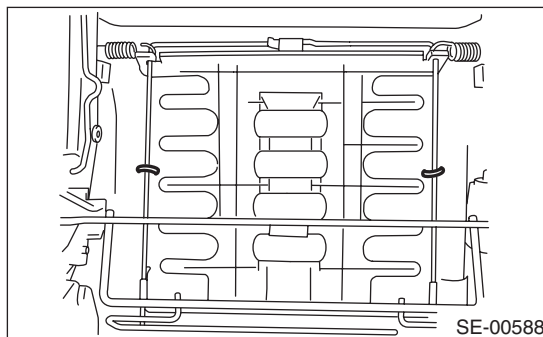


11) Remove the headrest lock bushing.

**NOTE:**  
Push outside to remove it from the inside of seat.



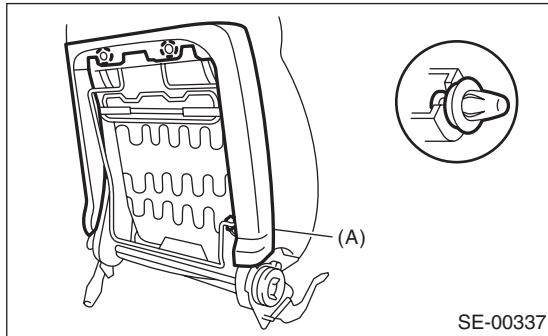
12) Remove the hog rings.



# Front Seat

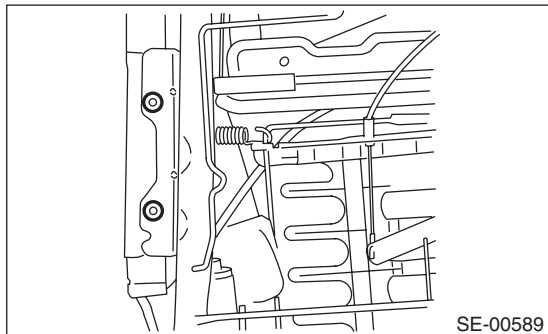
## SEATS

13) Remove the cover frame (A).

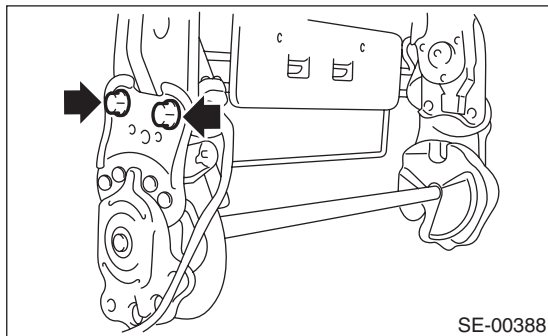


14) Pull out the backrest frame assembly.

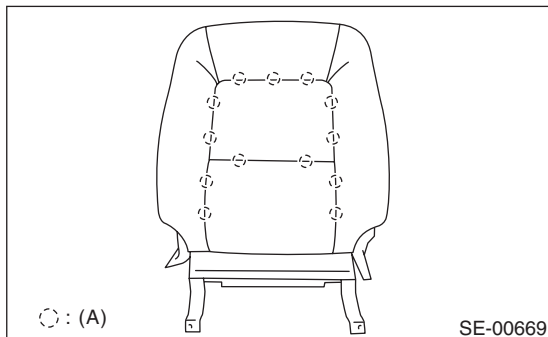
15) Remove the side airbag module.



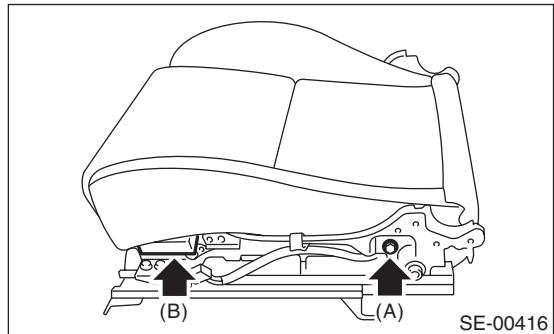
16) Remove the two bolts on each left and right side, and then remove the reclining motor assembly.



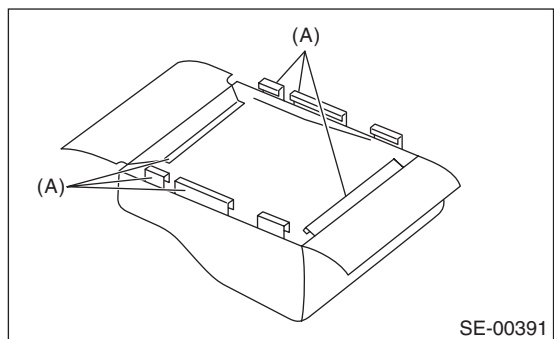
17) Remove the hog rings (A) on the surface side of backrest, and then remove the backrest cover from backrest.



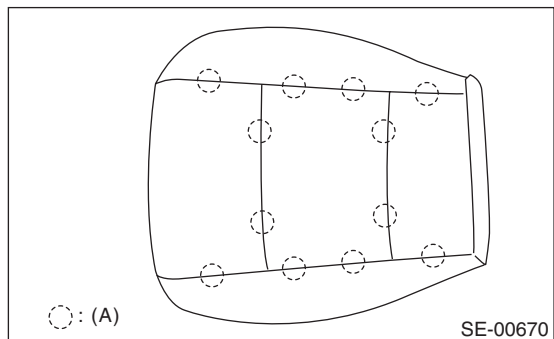
18) Remove the bolt (A) and hook (B) on left and right side, and then remove the seat cushion frame from slide rail assembly.



19) Remove the hooks (A), and then remove the seat cushion from seat cushion frame.



20) Remove the hog rings (A), and then remove the seat cushion cover from seat cushion pad.



## 2. PASSENGER'S SEAT

### CAUTION:

- If the seat cushion cover is removed or replaced, make sure to perform passenger detection system adjustment after installing the seat to the vehicle. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

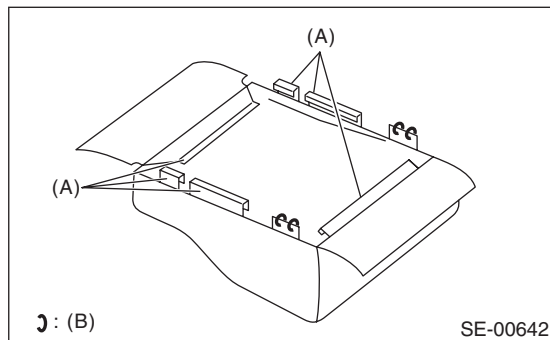
Failure to do so may cause improper activation of passenger's airbag.

- The passenger detection system (passenger seat only) control unit, passenger detection sensor, seat cushion pad and seat cushion frame are considered as a single seat cushion pad and frame assembly. Never remove the passenger detection control unit or the pressure sensor from the seat cushion frame.
- If the seat cushion cover is removed, make sure to replace the hang wire on the seat cushion side with a new wire.

- 1) Remove the seat from vehicle. <Ref. to SE-9, PASSENGER'S SEAT, REMOVAL, Front Seat.>
- 2) Refer to the disassembly procedures for the driver's seat.

### NOTE:

The back side of the seat cushion is affixed by a hook (A) and hog ring (B).



## D: ASSEMBLY

### CAUTION:

When the backrest cover is not installed securely, the side airbag module may not be deployed properly, therefore keep strictly to the following procedure.

- Be careful not to stain or damage the backrest cover during assembly.
- The backrest cover of the side airbag module are to be tightened and fixed together with the attachment nuts for the side airbag module assembly.
- Always use new hog rings.
- Secure the hog ring using hog ring pliers.
- Install the hog rings to the specified points securely and make sure that no wrinkle or twisting on backrest cover.

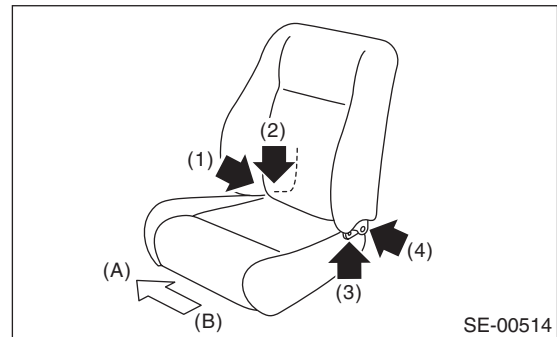
### 1. DRIVER'S SEAT

#### NOTE:

- When installing the inner seat belt assembly, follow the procedure described in the seat belt section. <Ref. to SB-14, INNER SEAT BELT ASSEMBLY, INSTALLATION, Front Seat Belt.>

- Install the backrest assembly and seat cushion assembly in the following procedure.

- 1) Temporarily tighten the four reclining hinge bolts.
- 2) Place the backrest in the most upright position.
- 3) Tighten the reclining hinge bolts in the order of (1) through (4), in two or three steps by gradually increasing the torque until they reach the specified torque.



- (A) Vehicle inside
- (B) Vehicle outside

- 4) Assemble in the reverse order of disassembly.

# Front Seat

## SEATS

### 2. PASSENGER'S SEAT

#### CAUTION:

Make sure to adhere to the following rules when assembling the passenger seat. Improper work procedures can cause the passenger detection system to not operate properly.

- If the seat cushion cover is removed or replaced, make sure to perform passenger detection system adjustment after installing the seat to the vehicle. <Ref. to OD(diag)-15, SYSTEM CALIBRATION (REZEROING), OPERATION, Subaru Select Monitor.>

Failure to do so may cause improper activation of passenger's airbag.

- The passenger detection system (passenger seat only) control unit, passenger detection sensor, seat cushion pad and seat cushion frame are considered as a single seat cushion pad and frame assembly. Never remove the passenger detection control unit or the pressure sensor from the seat cushion frame.

- If the seat cushion cover is removed, make sure to replace the hang wire on the seat cushion side with a new wire.

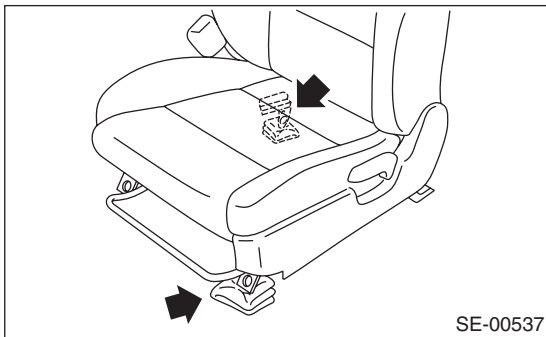
- Make sure to install the hog rings/clips to the specified locations. Do not reuse hog rings.

Assemble in the reverse order of disassembly.

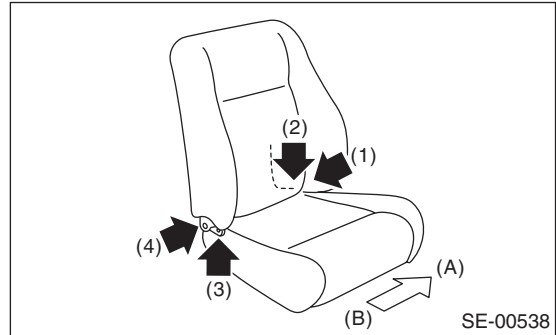
1) Assemble the seat cushion in the reverse order of disassembly.

2) Assemble the backrest in the reverse order of disassembly.

3) When installing the backrest assembly to the seat cushion assembly, fill the gap in the front side of slide rail LH and in the rear side of slide rail RH with cloth etc. in order to stabilize the seat cushion assembly.



4) Temporarily tighten the reclining hinge bolts in the order of (1) through (4) to an extent that the seat backrest assembly is not held securely.



(A) Vehicle inside

(B) Vehicle outside

5) Use the reclining lever to place the backrest in the most upright position, and check the first lock position of recliner.

6) Hold the seat cushion assembly securely, and tighten the reclining hinge bolts in the order described above until they reach the specified torque.

#### CAUTION:

Do not touch the backrest assembly when tightening the reclining hinge bolts.

7) Assemble each harness, inner belt assembly and each cover in the reverse order of removal.

#### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to SE-2, COMPONENT, General Description.>

### E: INSPECTION

Check that no tear or fray on the backrest cover and seat cushion cover.

#### NOTE:

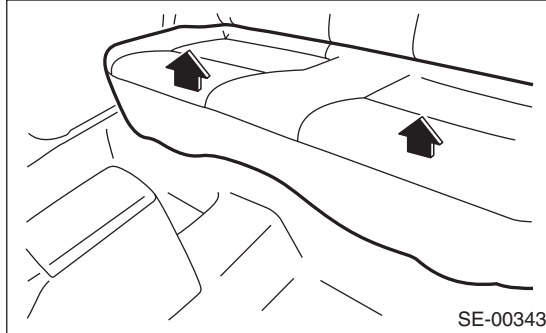
If the door side of the backrest cover is torn or frayed, the side airbag may not be deployed properly. In this case, replace the backrest cover.

## 3. Rear Seat

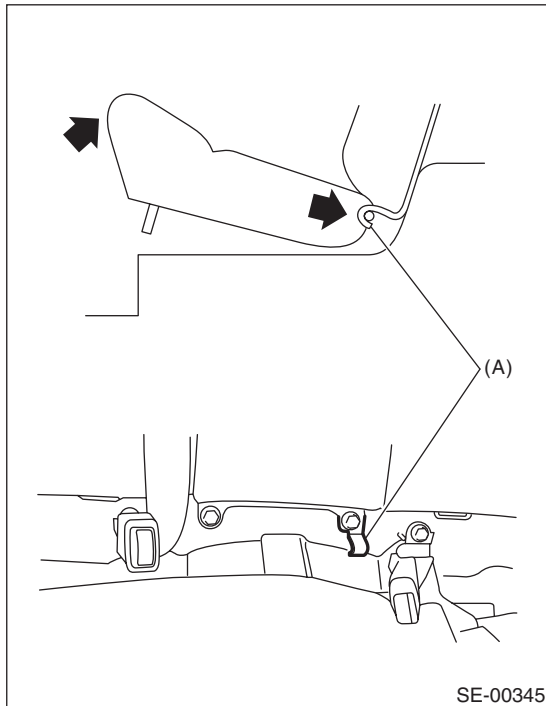
### A: REMOVAL

#### 1. SEDAN MODEL

1) Remove the two hooks while lifting up the rear seat cushion.

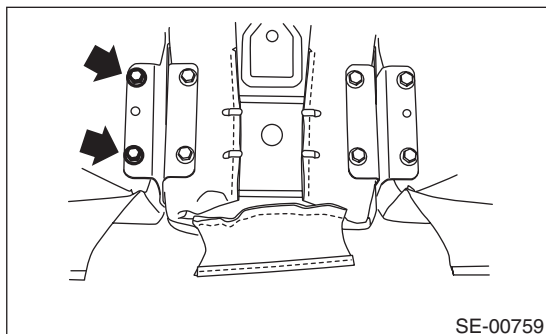


2) Remove the hook (A) by pushing it back while lifting the front side of the seat cushion, and remove the seat cushion.

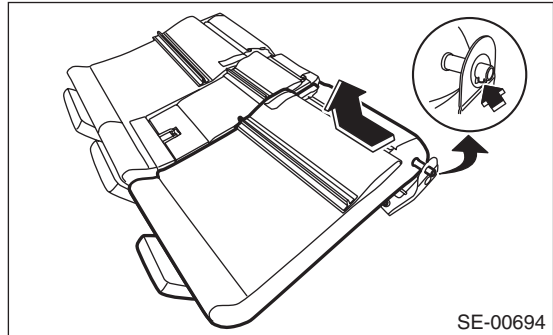


3) Tilt the backrest forward, remove the plastic fastener at the rear mat.

4) Remove the hinge assembly center bolts.



5) Push the entire seat to the direction of arrow and remove backrest assembly LH from the hinge assembly.

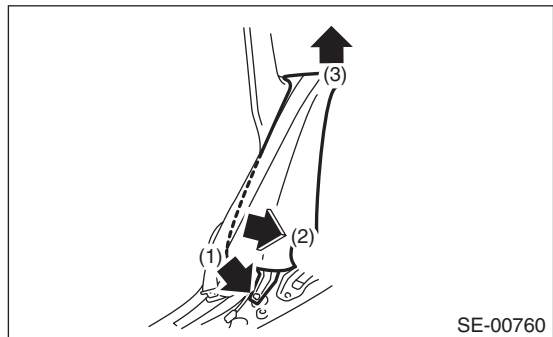


**NOTE:**

The backrest cannot be detached while the cutout on hinge assembly side and the pin on the backrest side are not aligned.

6) Similarly, remove the backrest assembly RH by performing the above step 5).

7) Remove the backrest shoulders (left and right) by performing the following procedures.

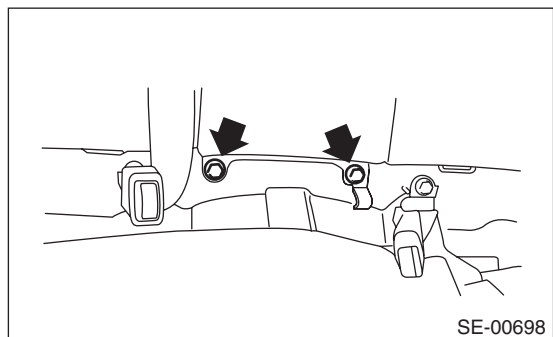


(1) Remove the bolt.

(2) Moving the lower side of backrest shoulder to the direction of arrow, and remove it from the stud bolt.

(3) Lift to remove the backrest shoulder.

8) Remove the two bolts at front side of the hinge assembly center.

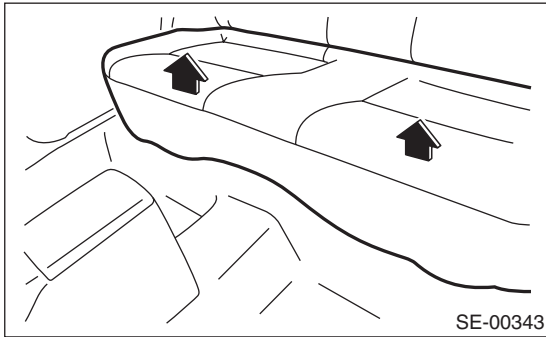


# Rear Seat

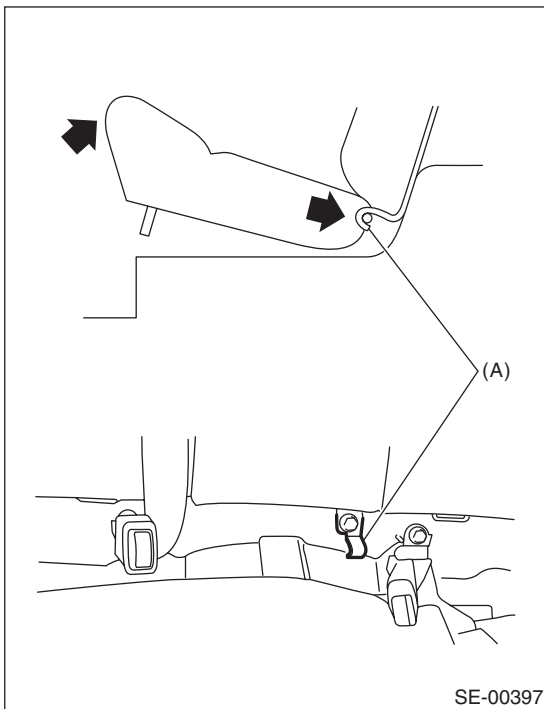
## SEATS

### 2. WAGON MODEL

1) Remove the two hooks while lifting up the rear seat cushion.



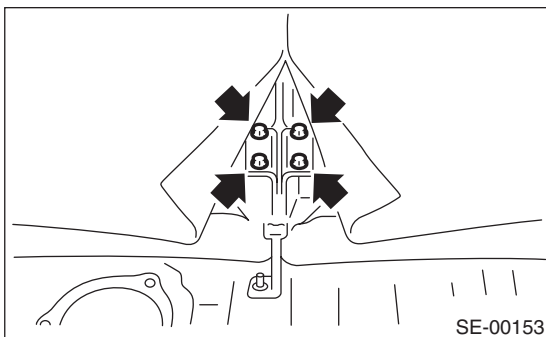
2) Remove the hook (A) by pushing it back while lifting the front side of the seat cushion, and remove the seat cushion.



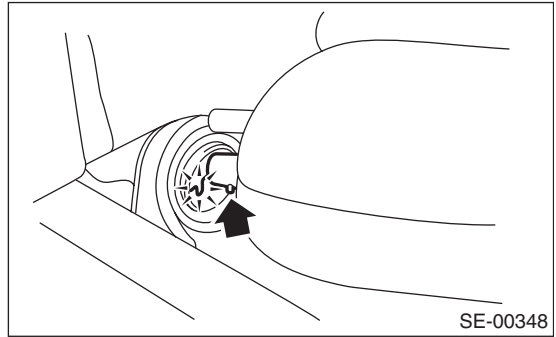
3) Remove the headrest, and then tilt the backrest forward.

4) Remove the luggage floor box. <Ref. to EI-73, REMOVAL, Luggage Floor Box.>

5) Peel the plastic fastener of rear face mat and remove the hinge assembly center bolts.



6) Remove the backrest assembly LH from hinge assembly LH.

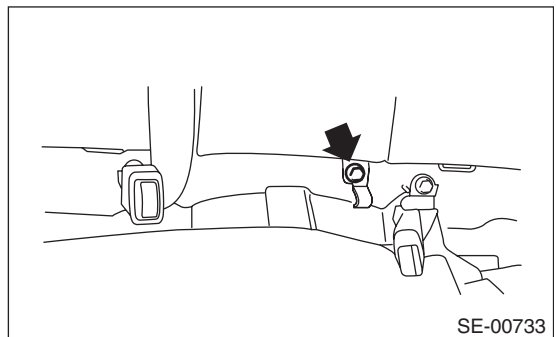


#### NOTE:

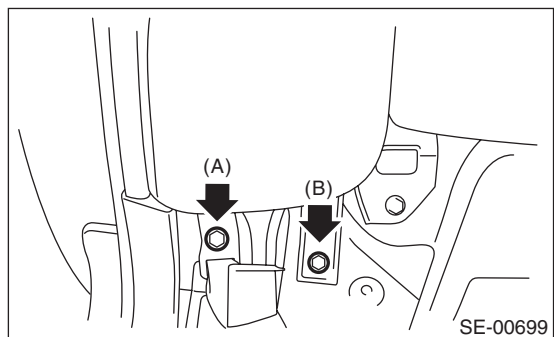
The backrest cannot be detached while the hinge assembly side and the backrest pin are not aligned.

7) Similarly, remove the backrest assembly RH by performing the above step 8).

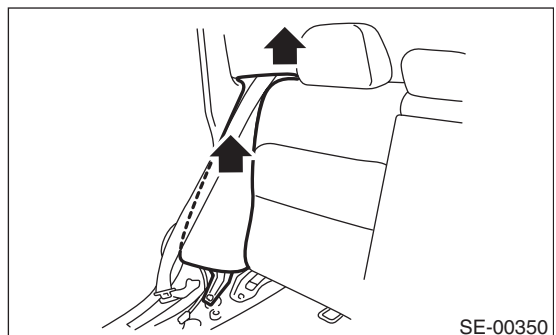
8) Remove the hinge assembly center bolts.



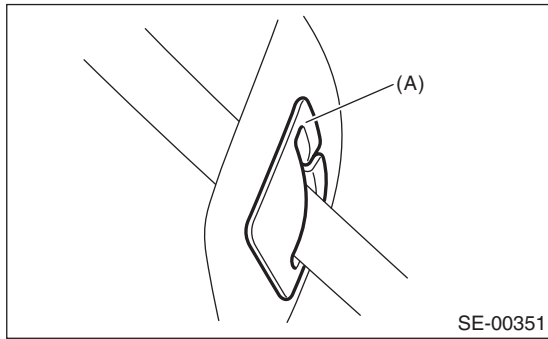
9) Remove the lower anchor bolt (A) of the outer seat belt and backrest shoulder bolt (B).



10) Remove the backrest shoulder with lifting it up.



11) Remove the belt cover (A) from the backrest shoulder, then pull the seat belt out.



## B: INSTALLATION

Install in the reverse order of removal.

### NOTE:

- After installing the backrest, make sure that each seat belt operates normally.
- Make sure that they are properly secured on each hook on the vehicle side.

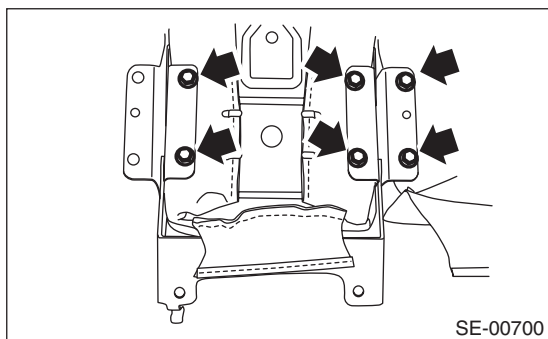
### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to SE-2, COMPONENT, General Description.>

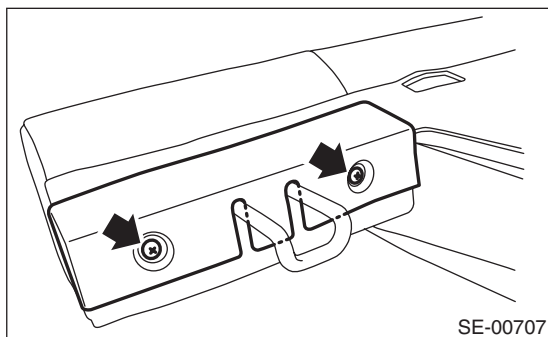
## C: DISASSEMBLY

### 1. SEDAN MODEL

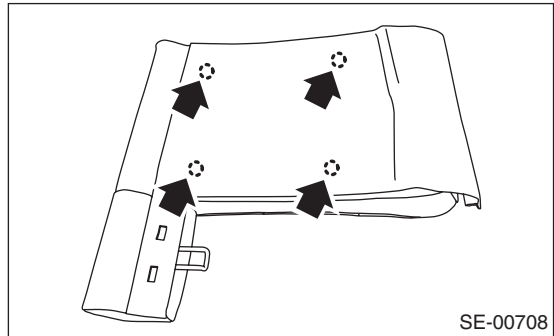
- 1) Remove the rear seat. <Ref. to SE-17, SEDAN MODEL, REMOVAL, Rear Seat.>
- 2) Remove the headrest.
- 3) Remove the hinge assembly center bolts.



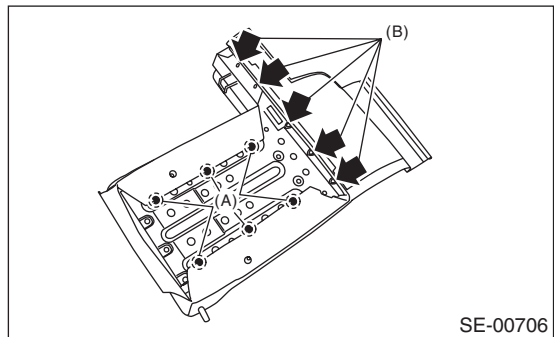
4) Remove the screws and detach the cover.



5) Remove tree clips and peel the back cover.



6) Turn over the backrest cover to remove hog rings (A) and hooks (B).



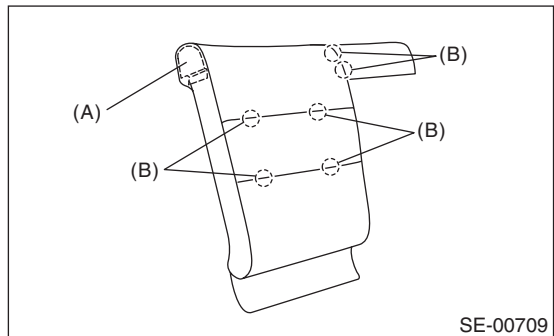
7) Remove the headrest bushing.

8) Remove the button cover.

### CAUTION:

The front and side faces of button cover have claws. Forceful removal can cause damage.

- 9) Remove the plate of shoulder section (A).
- 10) Remove the hog rings (B) on the front side of backrest, and then remove the backrest cover.



11) Remove the seat frame assembly from the backrest pad.

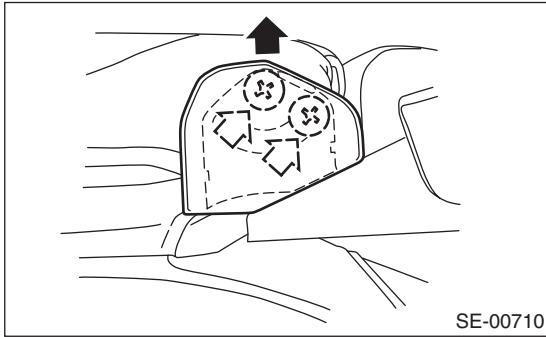
12) Disassemble the backrest assembly LH by referring to above procedures.



# Rear Seat

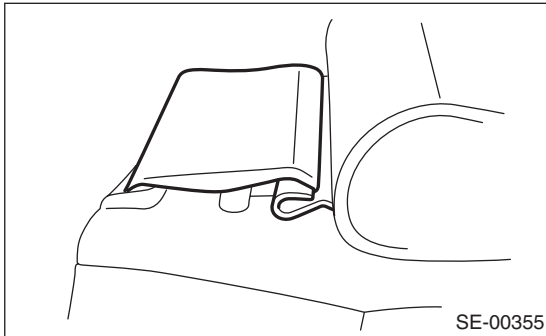
## SEATS

13) Remove the armrest hinge covers on both sides in direction of black arrow, and loosen the screws to remove the armrests.

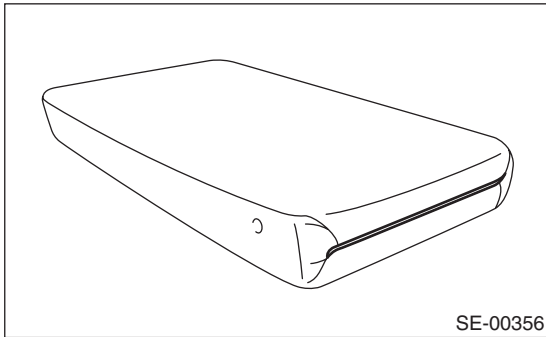


14) Remove the hinge assembly center from trunk through backboard.

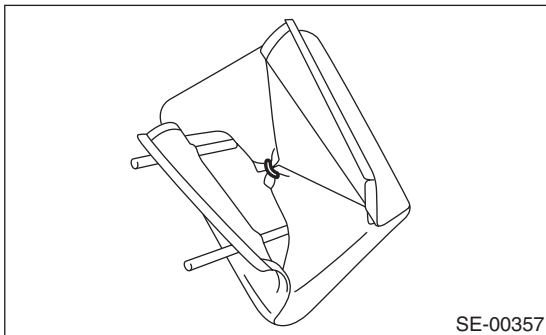
15) Remove the hook, and then detach the center through cover.



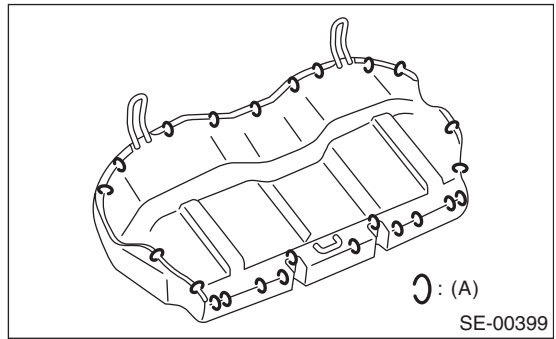
16) Remove the hook, and then remove the armrest cover.



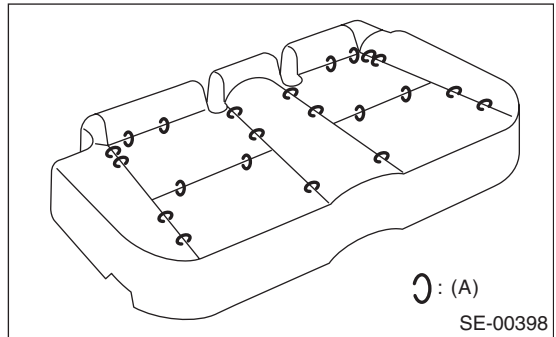
17) Remove the hook and hog ring, and then remove the headrest cover.



18) Remove the hog rings (A) on the rear side of the seat cushion.



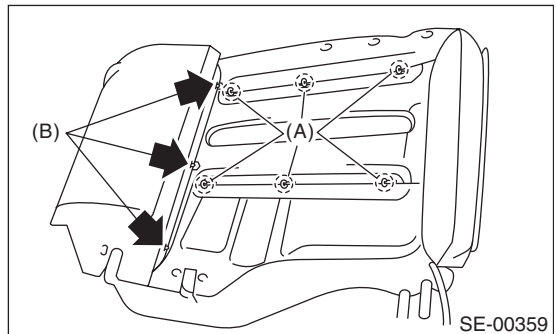
19) Remove the hog rings (A), then remove the seat cushion cover.



## 2. WAGON MODEL

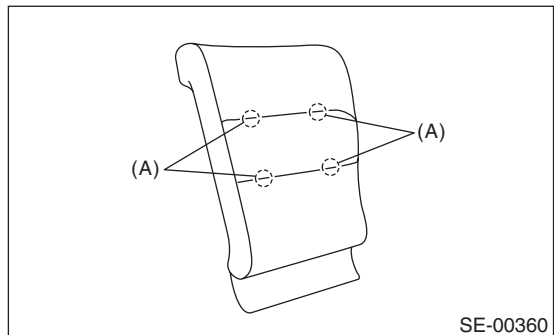
1) Remove the rear seat. <Ref. to SE-18, WAGON MODEL, REMOVAL, Rear Seat.>

2) Remove the hooks at the bottom of backrest assembly LH, and then turn over the backrest cover to remove the hog rings (A) and hooks (B).

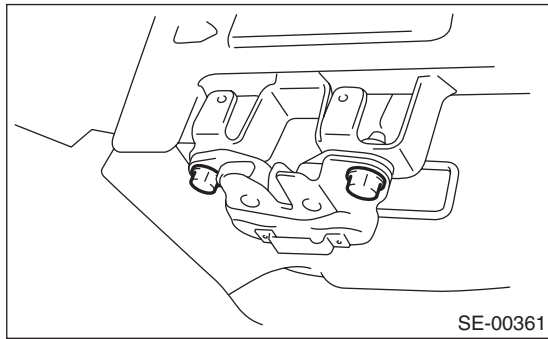


3) Remove the headrest bushing.

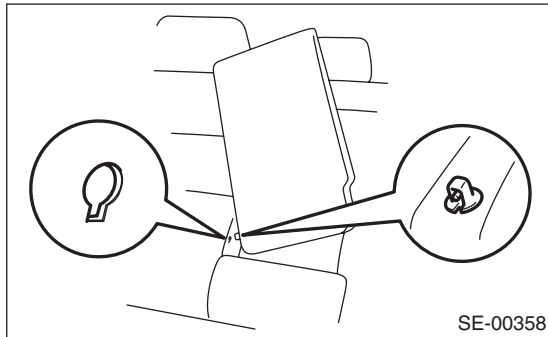
4) Remove the hog rings (A) on the front side of backrest, and then remove the backrest cover.



5) Remove the bolts, and then remove the backrest latch.



6) Loosen the screws to remove the armrest from backrest assembly RH.

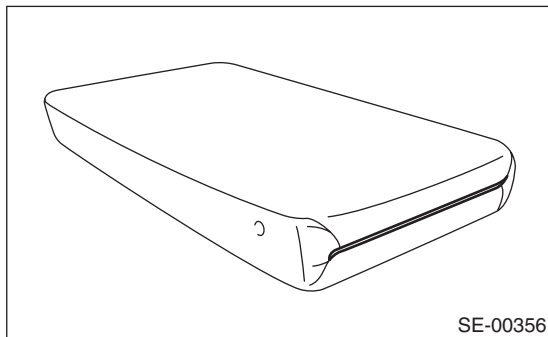


**NOTE:**

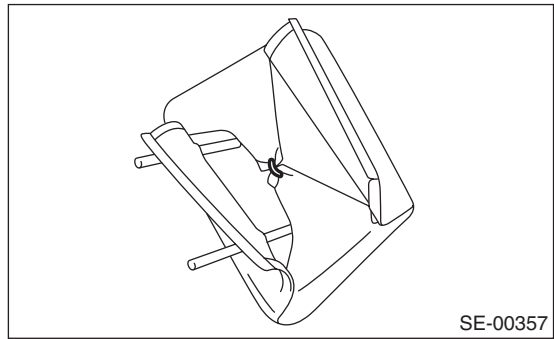
The armrests cannot be detached while the backrest assembly RH and armrest side pin positions are not aligned.

7) Disassemble the backrest assembly RH by referring to above procedures.

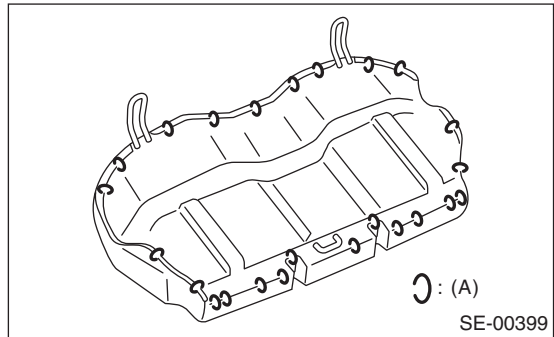
8) Remove the hook, and then remove the armrest cover.



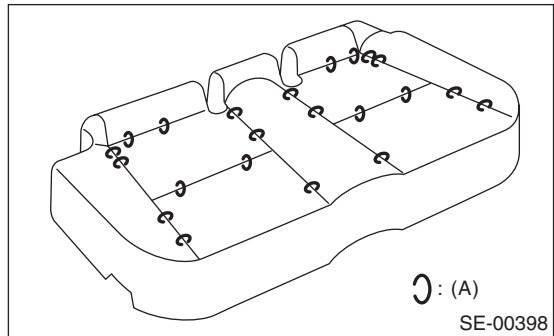
9) Remove the hook and hog ring, and then remove the headrest cover.



10) Remove the hog rings (A) on the rear side of the seat cushion.



11) Remove the hog rings (A), then remove the seat cushion cover.



## D: ASSEMBLY

Assemble in the reverse order of disassembly.

**CAUTION:**

- Always use new hog rings.
- Secure the hog ring using hog ring pliers.
- Install the hog rings to the specified points securely and make sure that no wrinkle or twisting on backrest cover.

**NOTE:**

- Do not contaminate or damage the cover.
- While installing the hog rings, prevent the seat from getting wrinkled.

## E: INSPECTION

Check that no tear or fray on the seat cover.

# Seat Heater System

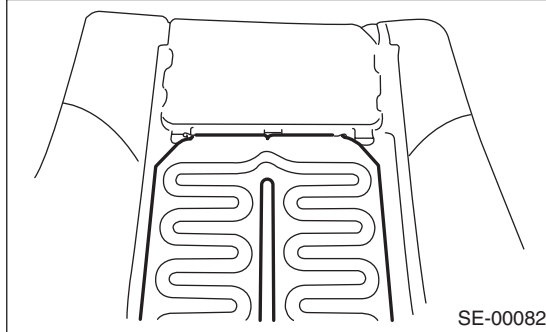
SEATS

## 4. Seat Heater System

### A: REMOVAL

#### 1. SEAT HEATER UNIT

- 1) Remove the front seats. <Ref. to SE-9, REMOVAL, Front Seat.>
- 2) Remove the backrest cover of front seat and seat cushion cover. <Ref. to SE-9, DISASSEMBLY, Front Seat.>
- 3) Remove the hog rings, and then remove the seat heater unit.



#### 2. SEAT HEATER SWITCH

- 1) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 2) Remove the seat heater switch from the console box.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

#### 1. WIRING DIAGRAM

<Ref. to WI-147, WIRING DIAGRAM, Power Seat System.>

#### 2. SEAT HEATER UNIT

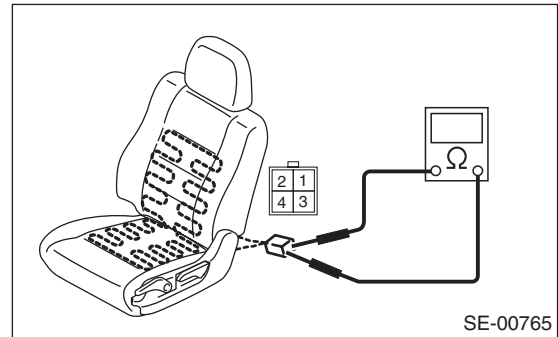
Disconnect the seat heater unit connector, and check the continuity between terminals of connector.

#### Connector & terminal

**No. 1 — No. 3:**

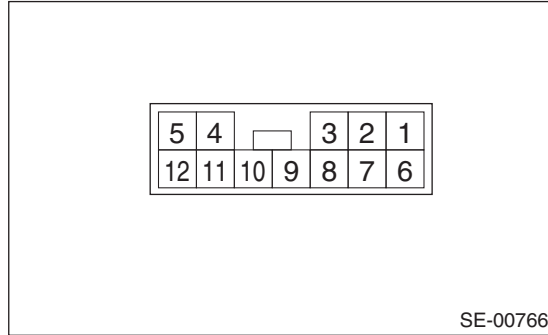
**No. 1 — No. 4:**

**No. 3 — No. 4:**



If no continuity exists, replace the seat heater unit with a new part.

## 3. SEAT HEATER SWITCH



### • CHECK THERMISTOR OUTPUT VOLTAGE

1) Connect the battery to the connector.

#### *With SI-DRIVE*

**Connector terminals No. 12 (+):**

#### *Without SI-DRIVE*

**Connector terminals No. 11 (+):**

2) Measure the voltage between connector and chassis ground.

#### **Connector & terminal:**

#### *With SI-DRIVE*

##### *LHD side seat*

**(C2) No. 8 (+) — Chassis ground (-):**

##### *RHD side seat*

**(C2) No. 6 (+) — Chassis ground (-):**

#### *Without SI-DRIVE*

##### *LHD side seat*

**(C2) No. 2 (+) — Chassis ground (-):**

##### *RHD side seat*

**(C2) No. 4 (+) — Chassis ground (-):**

If voltage is not 1.5 V or more, replace the seat heater switch.

### • CHECK SWITCH OUTPUT VOLTAGE

1) Connect the battery to the connector.

#### *With SI-DRIVE*

**Connector terminals No. 12 (+):**

#### *Without SI-DRIVE*

**Connector terminals No. 11 (+):**

2) Measure the voltage between connector and chassis ground when turning the switch to other than OFF position.

#### **Connector & terminal:**

#### *With SI-DRIVE*

##### *LHD side seat*

**(C2) No. 11 (+) — Chassis ground (-):**

##### *RHD side seat*

**(C2) No. 10 (+) — Chassis ground (-):**

#### *Without SI-DRIVE*

##### *LHD side seat*

**(C2) No. 10 (+) — Chassis ground (-):**

##### *RHD side seat*

**(C2) No. 5 (+) — Chassis ground (-):**

If voltage does not change from 10 V or more to zero, replace the seat heater switch.

## 5. Power Seat System

### A: REMOVAL

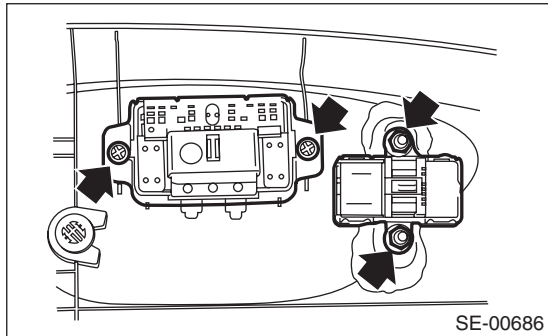
#### CAUTION:

When it is necessary to remove the front seat, disconnect the ground cable from battery and wait for 20 seconds before disconnecting the side airbag module harness connector.

#### 1. POWER SEAT SWITCH

1) Detach the connectors and remove the seat side cover outside. <Ref. to SE-9, DISASSEMBLY, Front Seat.>

2) Remove the screws to remove the power seat switch assembly.



#### NOTE:

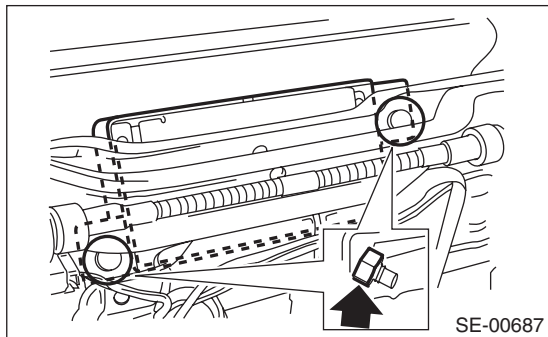
Perform the same procedure when removing the memory switch of memory-equipped seat.

#### 2. MEMORY MODULE (MEMORY-EQUIPPED SEAT)

1) Lift the seat cushion by operating the switch.

2) Remove the front seat from the vehicle.

3) Remove the nut and then remove the memory module.



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

- For the memory-equipped seat, always perform the initialize operation after the installation. <Ref. to SE-38, ADJUSTMENT, Power Seat System.>

- Check the following items after replacing the memory-equipped seat or the memory module.

- AT model

1. Memory feature is restored after turning the ignition switch to ON and shifting to P range.

2. Memory feature is not restored after turning the ignition switch to ON and shifting to other than P range.

- MT model

1. Memory feature is restored after turning ignition switch to ON and pulling parking brake lever.

2. Memory feature is not restored after turning the ignition switch to ON and pushing parking brake lever.

## C: INSPECTION

### 1. WIRING DIAGRAM

<Ref. to WI-147, WIRING DIAGRAM, Power Seat System.>

### 2. TROUBLE SYMPTOM

- Driver's seat (without memory)

Symptom	Criteria
All function fails to operate. <Ref. to SE-27, ALL FUNCTION FAILS TO OPERATE (DRIVER'S SEAT, WITHOUT MEMORY), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Body harness</li> </ul>
A part of function does not operate. <Ref. to SE-27, SOME OF THE MOTORS DO NOT OPERATE (DRIVER'S SEAT, WITHOUT MEMORY), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Relevant motor</li> </ul>

- Driver's seat (memory-equipped)

Symptom	Criteria
Does not operate by manual operation. <Ref. to SE-30, DOES NOT OPERATE IN MANUAL OPERATION (DRIVER'S SEAT, MEMORY-EQUIPPED), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Body harness</li> <li>• Relevant motor and encoder</li> </ul>
A part of function does not operate. <Ref. to SE-31, SOME OF THE MOTORS DO NOT OPERATE. (DRIVER'S SEAT, WITH MEMORY), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Relevant motor and encoder</li> <li>• Memory module</li> </ul>
Fails to store the location to the memory <Ref. to SE-35, FAILS TO STORE THE LOCATION TO THE MEMORY (DRIVER'S SEAT, WITH MEMORY), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Memory switch</li> <li>• Power seat harness</li> <li>• Memory module</li> </ul>
Restoring operation is impossible <Ref. to SE-36, FAILS TO PERFORM THE REPLAY OPERATION (DRIVER'S SEAT, WITH MEMORY), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Memory switch</li> <li>• Memory module</li> <li>• Motor and encoder</li> </ul>
Initial setting is impossible <Ref. to SE-36, INITIALIZATION IS IMPOSSIBLE., INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat harness</li> <li>• Memory module</li> </ul>

- Passenger's seat

Symptom	Criteria
All function fails to operate. <Ref. to SE-37, ALL FUNCTION FAILS TO OPERATE. (PASSENGER'S SEAT), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Body harness</li> </ul>
A part of function does not operate. <Ref. to SE-37, SOME OF THE MOTORS DO NOT OPERATE. (PASSENGER'S SEAT), INSPECTION, Power Seat System.>	<ul style="list-style-type: none"> <li>• Power seat switch</li> <li>• Power seat harness</li> <li>• Relevant motor</li> </ul>

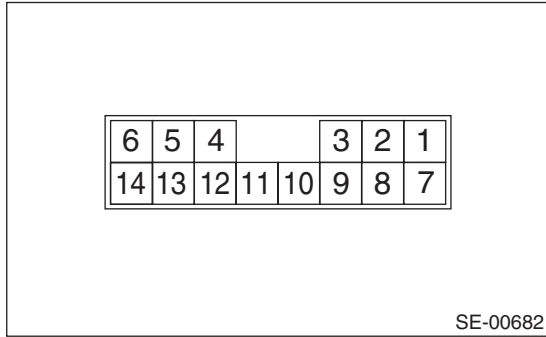
# Power Seat System

SEATS

## 3. CHECK POWER SEAT SWITCH

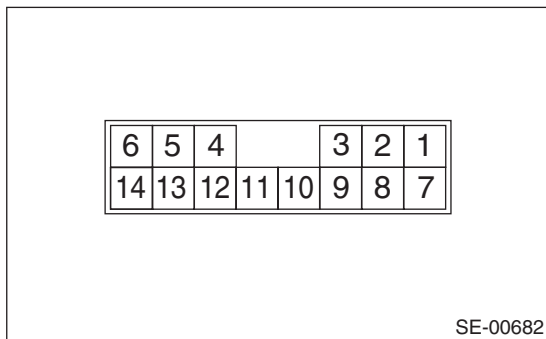
Move each switch and measure the resistance between connector terminals.

- Driver's seat (without memory)



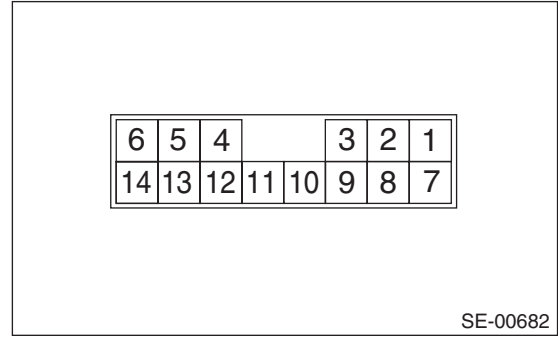
Switch position	Terminal No.	Standard
Slide forward	7 and 14 8 and 13	Less than 10 Ω
Slide backward	7 and 13 8 and 14	Less than 10 Ω
Tilt up	7 and 2 8 and 1	Less than 10 Ω
Tilt down	7 and 1 8 and 2	Less than 10 Ω
Lifter up	7 and 5 8 and 6	Less than 10 Ω
Lifter down	7 and 6 8 and 5	Less than 10 Ω
Reclining forward	7 and 3 8 and 4	Less than 10 Ω
Reclining backward	7 and 4 8 and 3	Less than 10 Ω

- Driver's seat (memory-equipped)



Switch position	Terminal No.	Standard
Slide forward	13 and 7	Less than 10 Ω
Slide backward	14 and 7	Less than 10 Ω
Tilt up	5 and 7	Less than 10 Ω
Tilt down	6 and 7	Less than 10 Ω
Lifter up	2 and 7	Less than 10 Ω
Lifter down	1 and 7	Less than 10 Ω
Reclining forward	4 and 7	Less than 10 Ω
Reclining backward	3 and 7	Less than 10 Ω

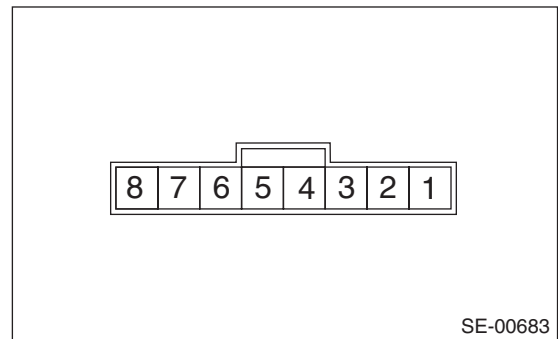
- Passenger's seat



Switch position	Terminal No.	Standard
Slide forward	7 and 13 8 and 14	Less than 10 Ω
Slide backward	7 and 14 8 and 13	Less than 10 Ω
Reclining forward	7 and 4 8 and 3	Less than 10 Ω
Reclining backward	7 and 3 8 and 4	Less than 10 Ω

## 4. CHECK MEMORY SWITCH (MEMORY-EQUIPPED)

Move each switch and measure the resistance between connector terminals.



Switch position	Terminal No.	Standard
Memory 1	3 and 1	Less than 10 Ω
Memory 2	2 and 1	Less than 10 Ω
Set	8 and 1	Less than 10 Ω

## 5. ALL FUNCTION FAILS TO OPERATE (DRIVER'S SEAT, WITHOUT MEMORY)

Step	Check	Yes	No
<b>1</b> <b>CHECK SEAT FUNCTION.</b> Operate each power seat switch and check that each power seat function operates normally.	Does all function fails to operate?	Go to step 2.	Check the motor which does not operate. <Ref. to SE-27, SOME OF THE MOTORS DO NOT OPERATE (DRIVER'S SEAT, WITHOUT MEMORY), INSPECTION, Power Seat System.>
<b>2</b> <b>CHECK FUSE.</b> Check the power seat fuse inside the fuse box.	Is the fuse blown out?	Replace the appropriate fuse.	Go to step 3.
<b>3</b> <b>CHECK POWER SUPPLY CIRCUIT.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the voltage between harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(R190) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Check body harness.
<b>4</b> <b>CHECK POWER SUPPLY CIRCUIT.</b> Measure the resistance between power seat switch harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(R190) No. 8 — Chassis ground:</i>	Is resistance less than 10 Ω?	Replace the power seat switch assembly.	Check body harness.

## 6. SOME OF THE MOTORS DO NOT OPERATE (DRIVER'S SEAT, WITHOUT MEMORY)

- Malfunction of slide operation

Step	Check	Yes	No
<b>1</b> <b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to slide forward and slide backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 2.	Replace the power seat switch assembly.
<b>2</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and slide motor connector. 2) Measure the resistance between the power seat switch connector and slide motor connector. <i>Connector &amp; terminal</i> <i>(R192) No. 1 — (R190) No. 14:</i> <i>(R192) No. 2 — (R190) No. 13:</i>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
<b>3</b> <b>CHECK SLIDE MOTOR.</b> 1) Connect the power seat switch connector and slide motor connector. 2) Apply 12 V voltage to the slide motor and check the motor rotation. <i>Connector &amp; terminal</i> <i>(R190) No. 14 (+) — (R190) No. 13 (-):</i> <i>(R190) No. 13 (+) — (R190) No. 14 (-):</i>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in slide rail.	Slide motor problem. Replace the slide rail assembly.



# Power Seat System

## SEATS

- Malfunction of tilt operation

	Step	Check	Yes	No
1	<b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to tilt up and tilt down. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 2.	Replace the power seat switch assembly.
2	<b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and tilt motor connector. 2) Measure the resistance between power seat switch connector and tilt motor connector. <b>Connector &amp; terminal</b> <b>(R197) No. 2 — (R190) No. 2:</b> <b>(R197) No. 3 — (R190) No. 1:</b>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
3	<b>CHECK TILT MOTOR.</b> 1) Connect the power seat switch connector and tilt motor connector. 2) Apply 12 V voltage to the tilt motor and check the motor rotation. <b>Connector &amp; terminal</b> <b>(R190) No. 2 (+) — (R190) No. 1 (-):</b> <b>(R190) No. 1 (+) — (R190) No. 2 (-):</b>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in tilt mechanism.	Tilt motor problem. Replace the slide rail assembly.

- Malfunction of lifter operation

	Step	Check	Yes	No
1	<b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to lifter up and lifter down. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 2.	Replace the power seat switch assembly.
2	<b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and lifter motor connector. 2) Measure the resistance between the power seat switch connector and lifter motor connector. <b>Connector &amp; terminal</b> <b>(R194) No. 4 — (R190) No. 5:</b> <b>(R194) No. 3 — (R190) No. 6:</b>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
3	<b>CHECK LIFTER MOTOR.</b> 1) Connect the power seat switch connector and lifter motor connector. 2) Apply 12 V voltage to the lifter motor and check the motor rotation. <b>Connector &amp; terminal</b> <b>(R190) No. 5 (+) — (R190) No. 6 (-):</b> <b>(R190) No. 6 (+) — (R190) No. 5 (-):</b>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in lifter mechanism.	Lifter motor problem. Replace the slide rail assembly.

• Malfunction of reclining operation

Step	Check	Yes	No
<b>1</b> <b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to reclining forward and reclining backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is there any problem on the inspection result?	Go to step 2.	Replace the power seat switch assembly.
<b>2</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and reclining motor connector. 2) Measure the resistance between the power seat switch connector and reclining motor connector. <i><b>Connector &amp; terminal</b></i> <i><b>(R191) No. 2 — (R190) No. 3:</b></i> <i><b>(R191) No. 1 — (R190) No. 4:</b></i>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
<b>3</b> <b>CHECK RECLINING MOTOR.</b> 1) Connect the power seat switch connector and reclining motor connector. 2) Apply 12 V voltage to the reclining motor and check the motor rotation. <i><b>Connector &amp; terminal</b></i> <i><b>(R190) No. 3 (+) — (R190) No. 4 (-):</b></i> <i><b>(R190) No. 4 (+) — (R190) No. 3 (-):</b></i>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in reclining hinge.	Reclining motor problem. Replace the reclining motor assembly.

# Power Seat System

SEATS

## 7. DOES NOT OPERATE IN MANUAL OPERATION (DRIVER'S SEAT, MEMORY-EQUIPPED)

	Step	Check	Yes	No
1	<b>CHECK SEAT FUNCTION.</b> Operate each power seat switch and check that each power seat function operates normally.	Does all function fails to operate?	Go to step 2.	Check the motor which does not operate. <Ref. to SE-31, SOME OF THE MOTORS DO NOT OPERATE. (DRIVER'S SEAT, WITH MEMORY), INSPECTION, Power Seat System.>
2	<b>CHECK FUSE.</b> Check the power seat fuse inside the fuse box.	Is the fuse blown out?	Replace the appropriate fuse.	Go to step 3.
3	<b>CHECK POWER SUPPLY CIRCUIT.</b> 1) Disconnect the memory module connector. 2) Measure the voltage between harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(R195) No. 10 (+) — Chassis ground (-):</b> <b>(R196) No. 8 (+) — Chassis ground (-):</b> <b>(R196) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 4.	Check body harness.
4	<b>CHECK POWER SUPPLY CIRCUIT.</b> Measure the resistance between memory module harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(R196) No. 14 — Chassis ground:</b> <b>(R196) No. 12 — Chassis ground:</b>	Is resistance less than 10 Ω?	Go to step 5.	Check body harness.
5	<b>CHECK IGNITION CIRCUIT.</b> Measure the voltage between harness connector and chassis ground while turning the ignition switch to ON. <b>Connector &amp; terminal</b> <b>(R195) No. 11 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 6.	Check body harness.
6	<b>CHECK TRANSMISSION CIRCUIT.</b> Measure the resistance between harness connector and chassis ground in the following condition. <ul style="list-style-type: none"> <li>• AT model: Select lever shifted to P position.</li> <li>• MT model: Parking brake lever pulled.</li> </ul> <b>Connector &amp; terminal</b> <b>(R195) No. 12 — Chassis ground:</b>	Is resistance less than 10 Ω?	Go to step 7.	Check body harness.
7	<b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to reclining forward and reclining backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Replace the memory module.	Replace the power seat switch assembly.

## 8. SOME OF THE MOTORS DO NOT OPERATE. (DRIVER'S SEAT, WITH MEMORY)

- Malfunction of slide operation

Step	Check	Yes	No
<b>1</b> <b>CHECK OPERATION.</b> Check the slide motor rotation while moving the switch to slide forward and slide backward.	Does the motor rotate for one second or more when operating the switch?	Go to step 2.	Encoder defec-tion. Replace the slide rail assembly.
<b>2</b> <b>CHECK SWITCH.</b> 1) Disconnect the harness connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to slide forward and slide backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPEC-TION, Power Seat System.>	Is the inspection result correct?	Go to step 3.	Replace the power seat switch assembly.
<b>3</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and slide motor connector. 2) Measure the resistance between the mem-ory module connector and power seat switch connector.  <i><b>Connector &amp; terminal</b></i> <i><b>(R195) No. 7 — (R190) No. 13:</b></i> <i><b>(R195) No. 6 — (R190) No. 14:</b></i>	Is resistance less than 10 Ω?	Go to step 4.	Check power seat harness.
<b>4</b> <b>CHECK HARNESS.</b> 1) Disconnect the slide motor connector. 2) Measure the resistance between the mem-ory module connector and slide motor connec-tor.  <i><b>Connector &amp; terminal</b></i> <i><b>(R196) No. 16 — (R206) No. 1:</b></i> <i><b>(R196) No. 15 — (R206) No. 2:</b></i>	Is resistance less than 10 Ω?	Go to step 5.	Check power seat harness.
<b>5</b> <b>CHECK SLIDE MOTOR.</b> Apply battery voltage to the memory module connector and check the motor rotation.  <i><b>Connector &amp; terminal</b></i> <i><b>(R196) No. 16 (+) — (R196) No. 15 (-):</b></i> <i><b>(R196) No. 15 (+) — (R196) No. 16 (-):</b></i>	Does the motor rotate nor-mally?	Replace the mem-ory module.	Slide motor prob-lem. Replace the slide rail assembly.

# Power Seat System

## SEATS

- Malfunction of tilt operation

	Step	Check	Yes	No
1	<b>CHECK OPERATION.</b> Check the tilt motor rotation while moving the switch to tilt up and tilt down.	Does the motor rotate for one second or more when operating the switch?	Go to step 2.	Encoder defec-tion. Replace the slide rail assembly.
2	<b>CHECK SWITCH.</b> 1) Disconnect the harness connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to tilt up and tilt down. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 3.	Replace the power seat switch assem-bly.
3	<b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and tilt motor connector. 2) Measure the resistance between the mem-ory module connector and power seat switch connector. <b>Connector &amp; terminal</b> <b>(R195) No. 3 — (R190) No. 5:</b> <b>(R195) No. 2 — (R190) No. 6:</b>	Is resistance less than 10 Ω?	Go to step 4.	Check power seat harness.
4	<b>CHECK HARNESS.</b> 1) Disconnect the tilt motor connector. 2) Measure the resistance between the mem-ory module connector and tilt motor connector. <b>Connector &amp; terminal</b> <b>(R196) No. 4 — (R197) No. 3:</b> <b>(R196) No. 5 — (R197) No. 2:</b>	Is resistance less than 10 Ω?	Go to step 5.	Check power seat harness.
5	<b>CHECK TILT MOTOR.</b> Apply battery voltage to the memory module connector and check the motor rotation. <b>Connector &amp; terminal</b> <b>(R196) No. 4 (+) — (R196) No. 5 (-):</b> <b>(R196) No. 5 (+) — (R196) No. 4 (-):</b>	Does the motor rotate nor-mally?	Replace the mem-ory module.	Tilt motor problem. Replace the slide rail assembly.

• Malfunction of lifter operation

Step	Check	Yes	No
<b>1</b> <b>CHECK OPERATION.</b> Check the lifter motor rotation while turning the switch to lifter up and lifter down.	Does the motor rotate for one second or more when operating the switch?	Go to step 2.	Encoder defec-tion. Replace the slide rail assembly.
<b>2</b> <b>CHECK SWITCH.</b> 1) Disconnect the harness connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to lifter up and lifter down. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 3.	Replace the power seat switch assembly.
<b>3</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and lifter motor connector. 2) Measure the resistance between the mem-ory module connector and power seat switch connector. <i>Connector &amp; terminal</i> <i>(R195) No. 5 — (R190) No. 2:</i> <i>(R195) No. 4 — (R190) No. 1:</i>	Is resistance less than 10 Ω?	Go to step 4.	Check power seat harness.
<b>4</b> <b>CHECK HARNESS.</b> 1) Disconnect the lifter motor connector. 2) Measure the resistance between the mem-ory module connector and lifter motor connec-tor. <i>Connector &amp; terminal</i> <i>(R196) No. 1 — (R194) No. 4:</i> <i>(R196) No. 2 — (R194) No. 3:</i>	Is resistance less than 10 Ω?	Go to step 5.	Check power seat harness.
<b>5</b> <b>CHECK LIFTER MOTOR.</b> Apply battery voltage to the memory module connector and check the motor rotation. <i>Connector &amp; terminal</i> <i>(R196) No. 1 (+) — (R196) No. 2 (-):</i> <i>(R196) No. 2 (+) — (R196) No. 1 (-):</i>	Does the motor rotate nor-mally?	Replace the mem-ory module.	Lifter motor prob-lem. Replace the slide rail assembly.

# Power Seat System

## SEATS

- Malfunction of reclining operation

Step	Check	Yes	No
<b>1</b> <b>CHECK OPERATION.</b> Check the reclining motor rotation while moving the switch to reclining forward and reclining backward.	Does the motor rotate for one second or more when operating the switch?	Go to step 2.	Encoder defec-tion. Replace the reclining motor assembly.
<b>2</b> <b>CHECK SWITCH.</b> 1) Disconnect the harness connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to reclining forward and reclining backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPEC-TION, Power Seat System.>	Is there any problem on the inspection result?	Go to step 3.	Replace the power seat switch assem-bly.
<b>3</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and reclining motor connector. 2) Measure the resistance between the mem-ory module connector and power seat switch connector. <i>Connector &amp; terminal</i> <i>(R195) No. 9 — (R190) No. 4:</i> <i>(R195) No. 8 — (R190) No. 3:</i>	Is resistance less than 10 Ω?	Go to step 4.	Check power seat harness.
<b>4</b> <b>CHECK HARNESS.</b> 1) Disconnect the slide motor connector. 2) Measure the resistance between the mem-ory module connector and reclining motor con-necter. <i>Connector &amp; terminal</i> <i>(R196) No. 6 — (R191) No. 1:</i> <i>(R196) No. 7 — (R191) No. 2:</i>	Is resistance less than 10 Ω?	Go to step 5.	Check power seat harness.
<b>5</b> <b>CHECK RECLINING MOTOR.</b> Apply battery voltage to the memory module connector and check the motor rotation. <i>Connector &amp; terminal</i> <i>(R196) No. 6 (+) — (R196) No. 7 (-):</i> <i>(R196) No. 7 (+) — (R196) No. 6 (-):</i>	Does the motor rotate nor-mally?	Replace the mem-ory module.	Reclining motor problem. Replace the reclining motor assembly.

## 9. FAILS TO STORE THE LOCATION TO THE MEMORY (DRIVER'S SEAT, WITH MEMORY)

Step	Check	Yes	No
<b>1</b> <b>CHECK SWITCH.</b> 1) Disconnect the harness connector of memory switch assembly. 2) Perform the memory switch inspection. <Ref. to SE-26, CHECK MEMORY SWITCH (MEMORY-EQUIPPED), INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 2.	Replace the memory switch assembly.
<b>2</b> <b>CHECK HARNESS.</b> Measure the resistance between the memory switch connector and memory module connector. <i>Connector &amp; terminal</i> <i>(R195) No. 13 — (R198) No. 3:</i> <i>(R195) No. 14 — (R198) No. 2:</i> <i>(R195) No. 15 — (R198) No. 8:</i>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
<b>3</b> <b>CHECK COMBINATION METER.</b> Turn the ignition switch to ON and check the indicator inside the meter while the select lever is in P position.	Does the indicator display P?	Go to step 4.	Check the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
<b>4</b> <b>SYSTEM INITIALIZATION.</b> Perform the memory seat system initialization. <Ref. to SE-38, ADJUSTMENT, Power Seat System.>	Is the initialization completed successfully?	Replace the memory module.	<Ref. to SE-36, INITIALIZATION IS IMPOSSIBLE., INSPECTION, Power Seat System.>



# Power Seat System

SEATS

## 10. FAILS TO PERFORM THE REPLAY OPERATION (DRIVER'S SEAT, WITH MEMORY)

Step	Check	Yes	No
<b>1 CHECK MEMORY FUNCTION.</b> Perform the memory operation of the seat position.	Is the seat position correctly memorized?	Go to step 2.	<Ref. to SE-35, FAILS TO STORE THE LOCATION TO THE MEMORY (DRIVER'S SEAT, WITH MEMORY), INSPECTION, Power Seat System.>
<b>2 CHECK SWITCH.</b> 1) Disconnect the harness connector of memory switch assembly. 2) Perform the memory switch inspection. <Ref. to SE-26, CHECK MEMORY SWITCH (MEMORY-EQUIPPED), INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 3.	Replace the memory switch assembly.
<b>3 CHECK HARNESS.</b> Measure the resistance between the memory switch connector and memory module connector. <i>Connector &amp; terminal</i> <i>(R195) No. 13 — (R198) No. 3:</i> <i>(R195) No. 14 — (R198) No. 2:</i> <i>(R195) No. 15 — (R198) No. 8:</i>	Is resistance less than 10 Ω?	Go to step 4.	Check power seat harness.
<b>4 CHECK COMBINATION METER.</b> Turn the ignition switch to ON and check the indicator light inside the meter. <ul style="list-style-type: none"> <li>• AT model: when the select lever is in P position</li> <li>• MT model: when the parking brake lever is pulled</li> </ul>	Is indicator light displayed?	Go to step 5.	Check the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
<b>5 CHECK OPERATION.</b> Check the rotation of each motor when performing all the power seat switch operation.	Does each motor rotate for one second or more when operating each switch?	Replace the memory module.	Encoder deflection. Replace the appropriate motor.

## 11. INITIALIZATION IS IMPOSSIBLE

Step	Check	Yes	No
<b>1 CHECK OPERATION.</b> Check the rotation of each motor when performing all the power seat switch operation.	Does each motor rotate for one second or more when operating each switch?	Go to step 2.	Encoder deflection. Replace the appropriate motor.
<b>2 CHECK SWITCH.</b> 1) Disconnect the harness connector of power seat switch assembly. 2) Measure the resistance between all the connector terminals of power seat switch assembly. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Replace the memory module.	Replace the power seat switch assembly.

## 12.ALL FUNCTION FAILS TO OPERATE (PASSENGER'S SEAT)

Step	Check	Yes	No
<b>1</b> <b>CHECK SEAT FUNCTION.</b> Operate each power seat switch and check that each power seat function operates normally.	Does all function fails to operate?	Go to step 2.	Check the motor which does not operate. <Ref. to SE-37, SOME OF THE MOTORS DO NOT OPERATE. (PASSENGER'S SEAT), INSPECTION, Power Seat System.>
<b>2</b> <b>CHECK FUSE.</b> Check the power seat fuse inside the fuse box.	Is the fuse blown out?	Replace the appropriate fuse.	Go to step 3.
<b>3</b> <b>CHECK POWER SUPPLY CIRCUIT.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the voltage between harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(R200) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Check body harness.
<b>4</b> <b>CHECK POWER SUPPLY CIRCUIT.</b> Measure the resistance between power seat switch harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(R200) No. 8 — Chassis ground:</i>	Is resistance less than 10 Ω?	Replace the power seat switch assembly.	Check body harness.

## 13.SOME OF THE MOTORS DO NOT OPERATE (PASSENGER'S SEAT)

- Malfunction of slide operation

Step	Check	Yes	No
<b>1</b> <b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to slide forward and slide backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is the inspection result correct?	Go to step 2.	Replace the power seat switch assembly.
<b>2</b> <b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and slide motor connector. 2) Measure the resistance between the power seat switch connector and slide motor connector. <i>Connector &amp; terminal</i> <i>(R202) No. 1 — (R200) No. 13:</i> <i>(R202) No. 2 — (R200) No. 14:</i>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
<b>3</b> <b>CHECK SLIDE MOTOR.</b> 1) Connect the power seat switch connector and slide motor connector. 2) Apply 12 V voltage to the slide motor and check the motor rotation. <i>Connector &amp; terminal</i> <i>(R200) No. 14 (+) — (R200) No. 13 (-):</i> <i>(R200) No. 13 (+) — (R200) No. 14 (-):</i>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in slide rail.	Slide motor problem. Replace the slide motor assembly.

# Power Seat System

## SEATS

- Malfunction of reclining operation

	Step	Check	Yes	No
1	<b>CHECK SWITCH.</b> 1) Disconnect the connector of power seat switch assembly. 2) Measure the resistance between connector terminals when moving the switch to reclining forward and reclining backward. <Ref. to SE-26, CHECK POWER SEAT SWITCH, INSPECTION, Power Seat System.>	Is there any problem on the inspection result?	Go to step 2.	Replace the power seat switch assembly.
2	<b>CHECK HARNESS.</b> 1) Disconnect the power seat switch connector and reclining motor connector. 2) Measure the resistance between the power seat switch connector and reclining motor connector.  <b>Connector &amp; terminal</b> <b>(R201) No. 2 — (R200) No. 4:</b> <b>(R201) No. 1 — (R200) No. 3:</b>	Is resistance less than 10 Ω?	Go to step 3.	Check power seat harness.
3	<b>CHECK RECLINING MOTOR.</b> 1) Connect the power seat switch connector and reclining motor connector. 2) Apply 12 V voltage to the reclining motor and check the motor rotation.  <b>Connector &amp; terminal</b> <b>(R200) No. 3 (+) — (R200) No. 4 (-):</b> <b>(R200) No. 4 (+) — (R200) No. 3 (-):</b>	Does the motor rotate normally?	Check for temporary poor contact or mechanical trouble in reclining hinge.	Reclining motor problem. Replace the reclining motor assembly.

## D: ADJUSTMENT

### NOTE:

The calibration procedures apply only to the memory-equipped seat on the driver's side.

### 1. INITIALIZATING CONDITIONS

Perform the initializing operation to the memory module when the following conditions are met.

- When the seat was removed from vehicle.
- When the memory module was replaced.
- When the slide rail assembly or reclining motor assembly was removed or replaced.
- When the pulse generated while the seat is moving differs from the actual distance. (When memory replay operation is not normally carried out)

### 2. INITIALIZATION PROCEDURE

#### NOTE:

- Initialize the records inside the module by performing all the following steps regardless the item order.
- Buzzer sounds once when keeping the switch operation for three seconds with each seat in lock\* status.
- After the completion of all items for initialization process, the buzzer sounds three times when finishing the final operation and turning the switch from ON to OFF.

1) Move the seat backward using slide switch, and keep the seat lock\* status for three seconds or more.

2) Move the seat downward using tilt switch, and keep the seat lock\* status for three seconds or more.

3) Move the seat downward using lifter switch, and keep the seat lock\* status for three seconds or more.

4) Incline the seat forward using reclining switch, and keep the seat lock\* status for three seconds or more.

\* :Seat lock is the status that there is no pulse output from the encoder within the specified period of time although the switch is being operated.

#### NOTE:

When the following conditions are met, the initializing operation is cancelled even though the procedure is carried out halfway.

- Any operation interval between each initialization procedures from 1) to 4) exceeded 10 second.
- All operations throughout initialization procedure 1) to 4) was not performed.
- During initialization procedure, power supply was cut off, or the voltage to the memory module exceeded the range of operating voltage.

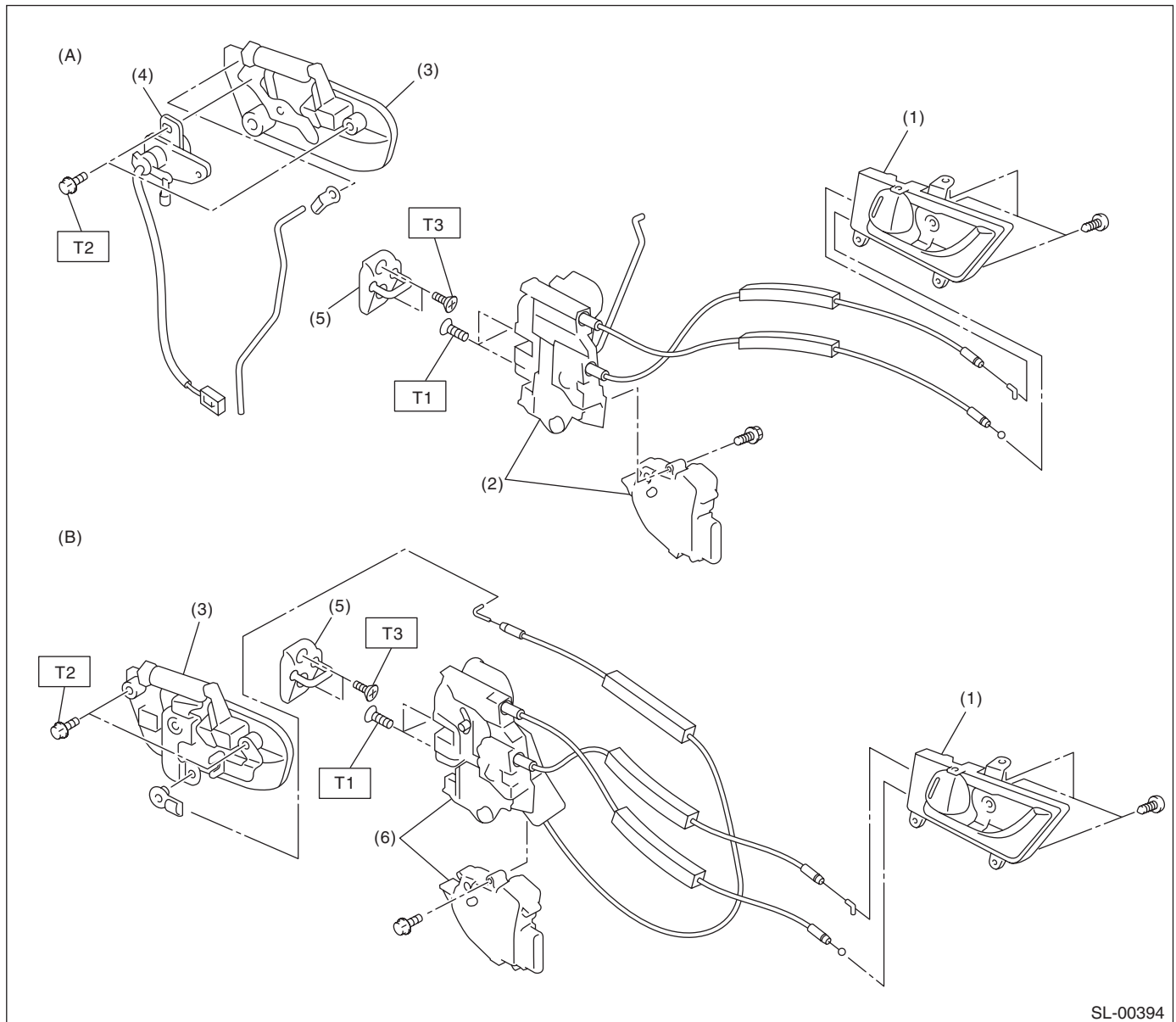
# General Description

## SECURITY AND LOCKS

### 1. General Description

#### A: COMPONENT

#### 1. DOOR LOCK ASSEMBLY



SL-00394

(A) Front

(B) Rear

(1) Inner remote ASSY

(2) Front door latch and door lock actuator ASSY

(3) Door outer handle

(4) Key cylinder (switch)

(5) Striker

(6) Rear door latch and door lock actuator ASSY

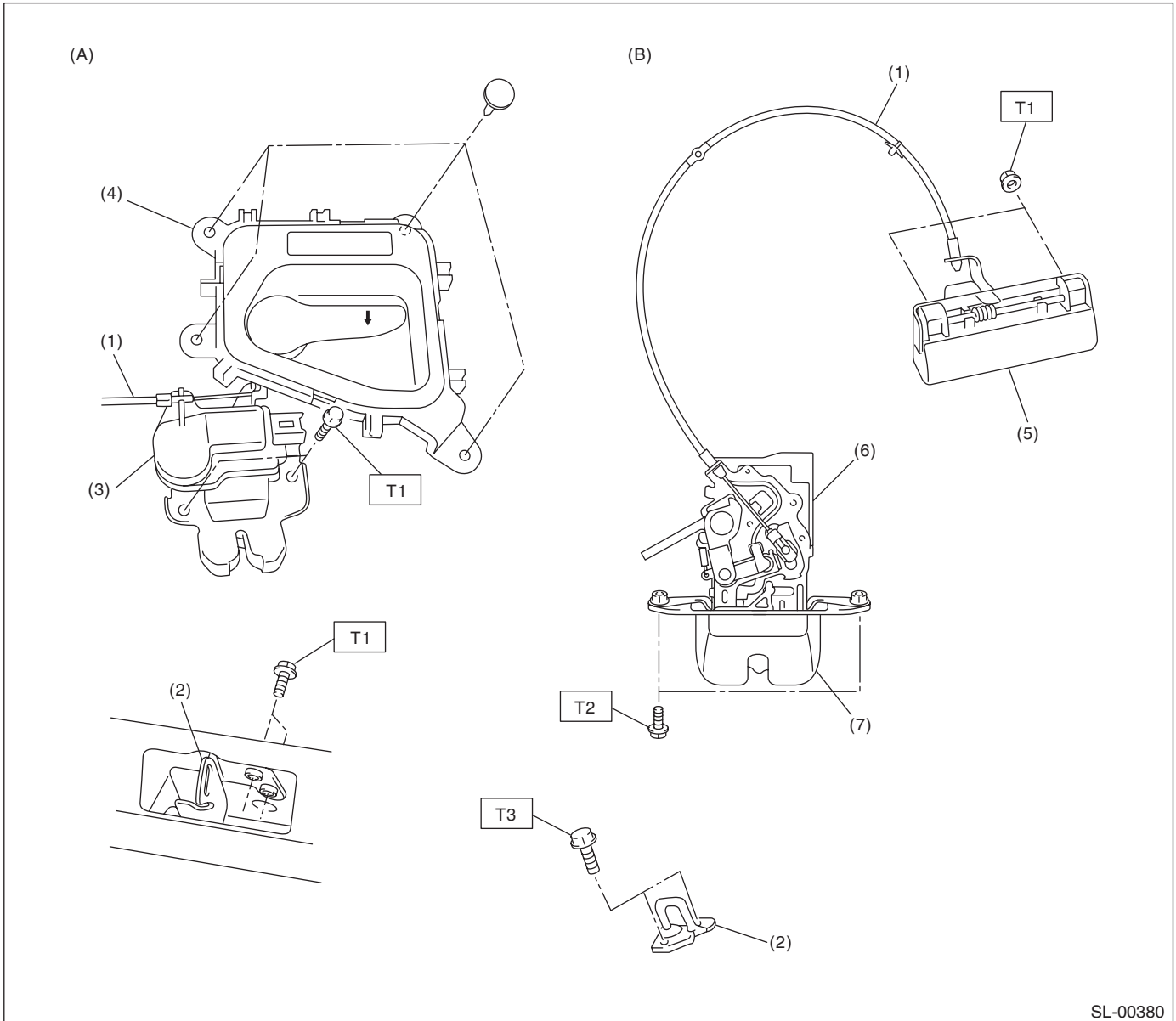
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 6.5 (0.66, 4.8)**

**T2: 7.5 (0.76, 5.5)**

**T3: 18 (1.8, 13.3)**

## 2. TRUNK LID AND REAR GATE LOCK



SL-00380

(A) Trunk

(B) Rear gate

- (1) Cable
- (2) Striker
- (3) Trunk lid lock ASSY
- (4) Trunk lid release handle

- (5) Rear gate outer handle
- (6) Rear gate actuator
- (7) Rear gate latch

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

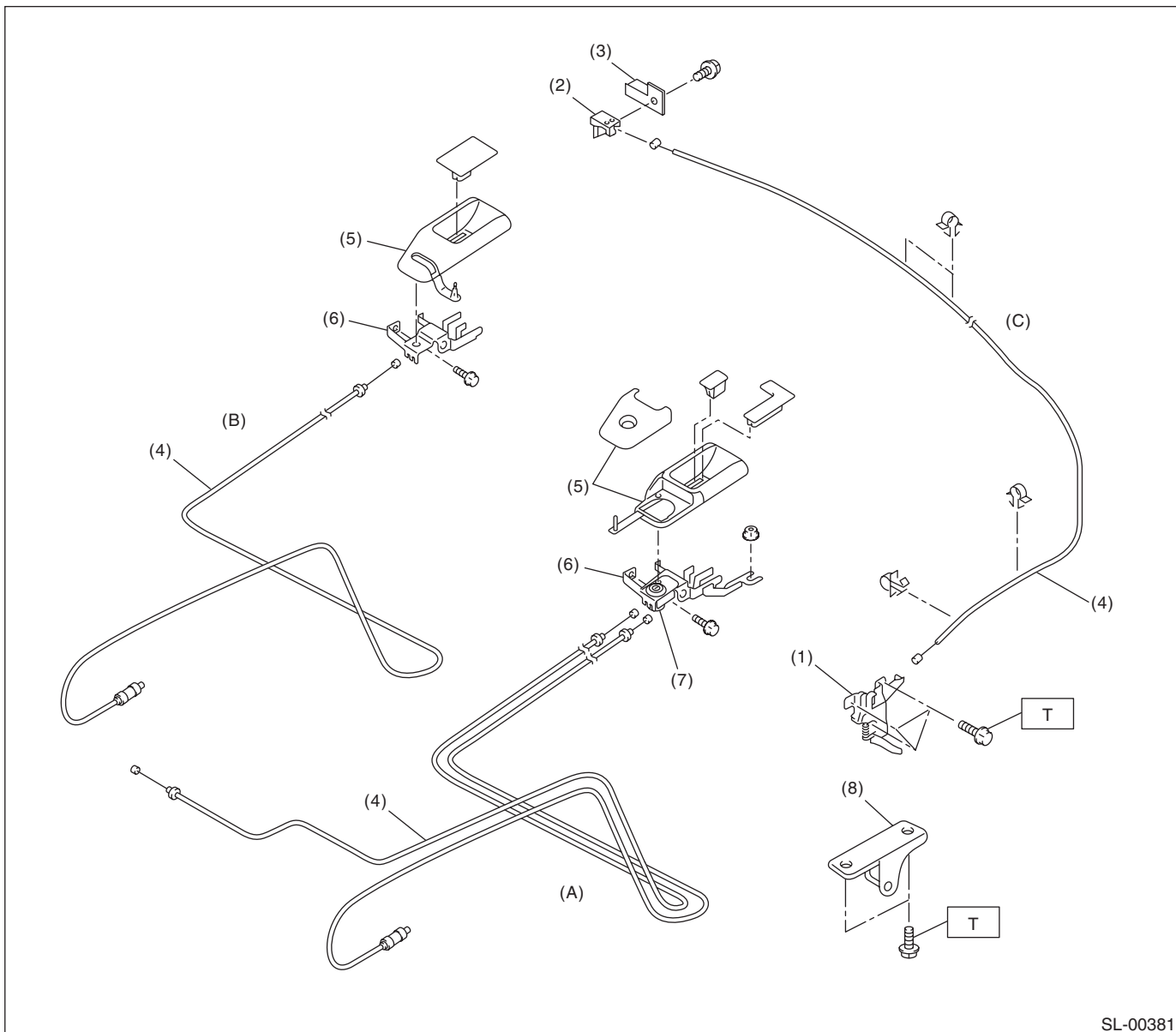
**T2: 18 (1.8, 13.3)**

**T3: 25 (2.5, 18.4)**

# General Description

## SECURITY AND LOCKS

### 3. FRONT HOOD LOCK AND REMOTE OPENERS



SL-00381

(A) Sedan model

(B) Wagon model

(C) Hood

(1) Front hood lock ASSY

(5) Cover

(2) Lever ASSY

(6) Pull handle ASSY

(3) Lever ASSY bracket

(7) Key cylinder

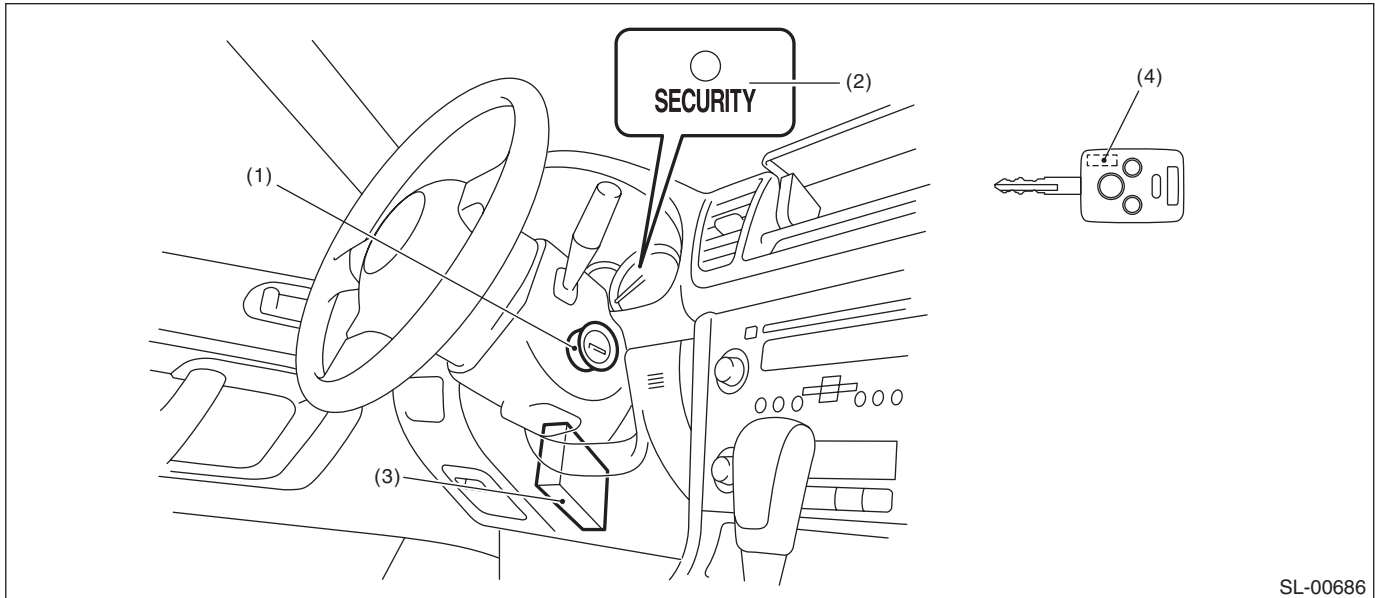
(4) Cable

(8) Striker

**Tightening torque: N·m (kgf·m, ft·lb)**

**T: 33 (3.36, 24.2)**

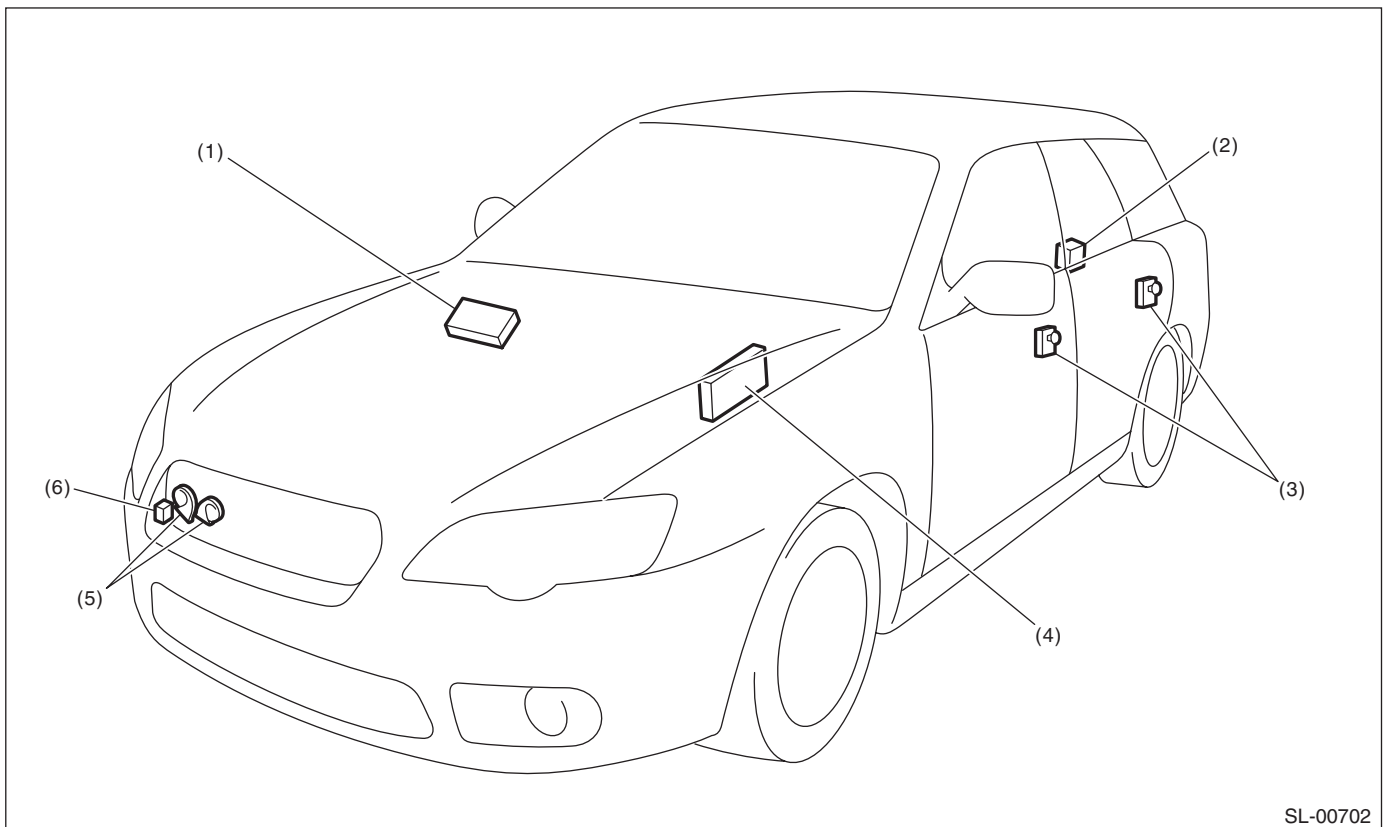
### 4. IMMOBILIZER SYSTEM



SL-00686

- (1) Antenna
- (2) Security indicator light (LED bulb)
- (3) Body integrated unit
- (4) Transponder

### 5. KEYLESS ENTRY SYSTEM



SL-00702

- (1) Keyless entry control module
- (2) Rear gate latch switch (Wagon model)
- (3) Door switch
- (4) Body integrated unit
- (5) Horn
- (6) Keyless buzzer

# General Description

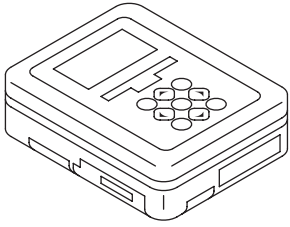
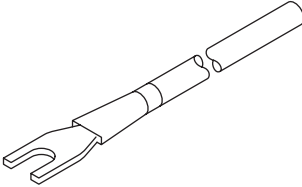
## SECURITY AND LOCKS

### B: CAUTION

- Before disassembling or reassembling parts, always disconnect the battery ground cable from battery. When repairing the audio, control module, etc. which are provided with memory functions, record the memory contents before disconnecting the ground cable from battery. Otherwise, these contents are erased upon disconnection.
- Reassemble the parts in the reverse order of disassembly unless otherwise indicated.
- Adjust the parts to the specifications described in this manual if so designated.
- Connect the connectors securely during reassembly.
- After reassembly, make sure all the functional parts operate smoothly.
- The airbag system wiring harness is routed near electrical parts and switches.
- Do not use the electrical test equipment on the airbag system wiring harnesses and connector circuits.
- Be careful not to damage the airbag system wiring harness when servicing the ignition key cylinder.

### C: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and troubleshooting for electrical system.
 <p>ST-925580000</p>	925580000	PULLER	Used for removing trim clip

#### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Drill	Used for replacing ignition key lock.
Clip remover	Used for removing trim.
Clip clamp pliers	Used for removal of various clips and clamps.



## 2. Door Lock Control System

### A: WIRING DIAGRAM

#### 1. DOOR LOCK CONTROL

<Ref. to WI-216, WIRING DIAGRAM, Keyless Entry System.>

### B: INSPECTION

#### 1. SYMPTOM CHART

Symptom	Repair order	Reference
The door lock control system does not operate.	1. Remove and visually check the fuse No. 3 (in the fuse & relay box) and No. 7 (in the fuse & relay box).	If the fuse is blown out, replace the fuse with a new part. Check the power supply and ground circuit, if the fuse has no abnormality. <Ref. to SL-7, CHECK POWER SUPPLY AND GROUND CIRCUIT, INSPECTION, Door Lock Control System.>
	2. Check the power supply and ground circuit for body integrated unit.	<Ref. to SL-7, CHECK POWER SUPPLY AND GROUND CIRCUIT, INSPECTION, Door Lock Control System.>
	3. Check the door lock switch and the circuit.	<Ref. to SL-8, CHECK DOOR LOCK SWITCH, INSPECTION, Door Lock Control System.>
	4. Check the door lock actuator and the circuit.	<Ref. to SL-9, CHECK DOOR LOCK ACTUATOR AND CIRCUIT, INSPECTION, Door Lock Control System.>
The door lock switch does not operate.	Check the door lock switch.	<Ref. to SL-8, CHECK DOOR LOCK SWITCH, INSPECTION, Door Lock Control System.>
A specific door lock actuator does not operate.	Check the door lock actuator and circuit.	<Ref. to SL-9, CHECK DOOR LOCK ACTUATOR AND CIRCUIT, INSPECTION, Door Lock Control System.>

#### 2. CHECK POWER SUPPLY AND GROUND CIRCUIT

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(i84) No. 34 (+) — Chassis ground (-):</i> <i>(B281) No. 2 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 2.	Check the harness for open or short circuit between body integrated unit and fuse.
<b>2 CHECK GROUND CIRCUIT.</b> Measure the resistance between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 22 — Chassis ground:</i> <i>(B281) No. 8 — Chassis ground:</i> <i>(B281) No. 9 — Chassis ground:</i>	Is the resistance less than 10 Ω?	The power supply and ground circuit are OK.	Repair the harness.

# Door Lock Control System

## SECURITY AND LOCKS

### 3. CHECK DOOR LOCK SWITCH

Step	Check	Yes	No
<p><b>1 CHECK DOOR LOCK SWITCH.</b> Check the input from door lock switch to body integrated unit using Subaru Select Monitor. 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Current Data Display &amp; Save}. 5) Check the input to body integrated unit by operating the door lock switch.</p>	Is the normal input signal displayed when the door lock switch is moved to LOCK/UNLOCK?	The door lock switch is OK.	Go to step 2.
<p><b>2 CHECK DOOR LOCK SWITCH CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between the harness connector terminal and chassis ground when moving the door lock switch to LOCK. <b>Connector &amp; terminal</b> <b>(i84) No. 15 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	Go to step 3.	Go to step 4.
<p><b>3 CHECK DOOR LOCK SWITCH CIRCUIT.</b> Measure the resistance between the harness connector terminal and chassis ground when the door lock switch is moved to UNLOCK. <b>Connector &amp; terminal</b> <b>(i84) No. 29 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	The door lock switch is OK.	Go to step 4.
<p><b>4 CHECK DOOR LOCK SWITCH.</b> 1) Disconnect the door lock switch harness connector. 2) Measure the resistance between the door lock switch terminals when moving the door lock switch to LOCK. <b>Connector &amp; terminal</b> <b>Driver's side:</b> <b>(D7) No. 4 — No. 7:</b> <b>Passenger's side:</b> <b>(D125) No. 4 — No. 3:</b></p>	Is the resistance less than 1 Ω?	Go to step 5.	Replace the door lock switch.
<p><b>5 CHECK DOOR LOCK SWITCH.</b> Measure the resistance between the door lock switch terminals when moving the door lock switch to UNLOCK. <b>Connector &amp; terminal</b> <b>Driver's side:</b> <b>(D7) No. 5 — No. 7:</b> <b>Passenger's side:</b> <b>(D125) No. 1 — No. 3:</b></p>	Is the resistance less than 1 Ω?	Check the harness for open circuits or shorts between the body integrated unit and the door lock switch.	Replace the door lock switch.

## 4. CHECK DOOR LOCK ACTUATOR AND CIRCUIT

Step	Check	Yes	No
<b>1 CHECK OUTPUT SIGNAL.</b> Measure the voltage between the harness connector terminal of body integrated unit and chassis ground when moving the door lock switch to LOCK. <i><b>Connector &amp; terminal</b></i> <i><b>(i84) No. 7 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 2.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>2 CHECK OUTPUT SIGNAL.</b> Measure the voltage between the harness connector terminal of body integrated unit and chassis ground when moving the door lock switch to UNLOCK. <i><b>Connector &amp; terminal</b></i> <i><b>Driver's side:</b></i> <i><b>(i84) No. 23 (+) — Chassis ground (-):</b></i> <i><b>Except for driver's side:</b></i> <i><b>(i84) No. 8 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 3.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>3 CHECK POWER WINDOW MAIN SWITCH OUTPUT SIGNAL.</b> Measure the voltage between the harness connector terminal of the power window main switch and chassis ground when moving the door lock switch to LOCK. <i><b>Connector &amp; terminal</b></i> <i><b>(D7) No. 4 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 4.	Replace the power window main switch. <Ref. to GW-9, Power Window Control Switch.>
<b>4 CHECK POWER WINDOW MAIN SWITCH OUTPUT SIGNAL.</b> Measure the voltage between the harness connector terminal of power window main switch and chassis ground when moving the door lock switch to UNLOCK. <i><b>Connector &amp; terminal</b></i> <i><b>(D7) No. 5 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 5.	Replace the power window main switch. <Ref. to GW-9, Power Window Control Switch.>
<b>5 CHECK DOOR LOCK ACTUATOR.</b> Check the door lock actuator. <ul style="list-style-type: none"> <li>• Front door lock actuator &lt;Ref. to SL-36, Front Door Lock Actuator.&gt;</li> <li>• Rear door lock actuator &lt;Ref. to SL-40, Rear Door Lock Actuator.&gt;</li> <li>• Rear gate latch lock actuator &lt;Ref. to SL-42, Rear Gate Latch Assembly.&gt;</li> </ul>	Is the door lock actuator OK?	Check the harness for open or short circuits between body integrated unit and door lock actuator.	Replace the door lock actuator.

# Keyless Entry System

SECURITY AND LOCKS

## 3. Keyless Entry System

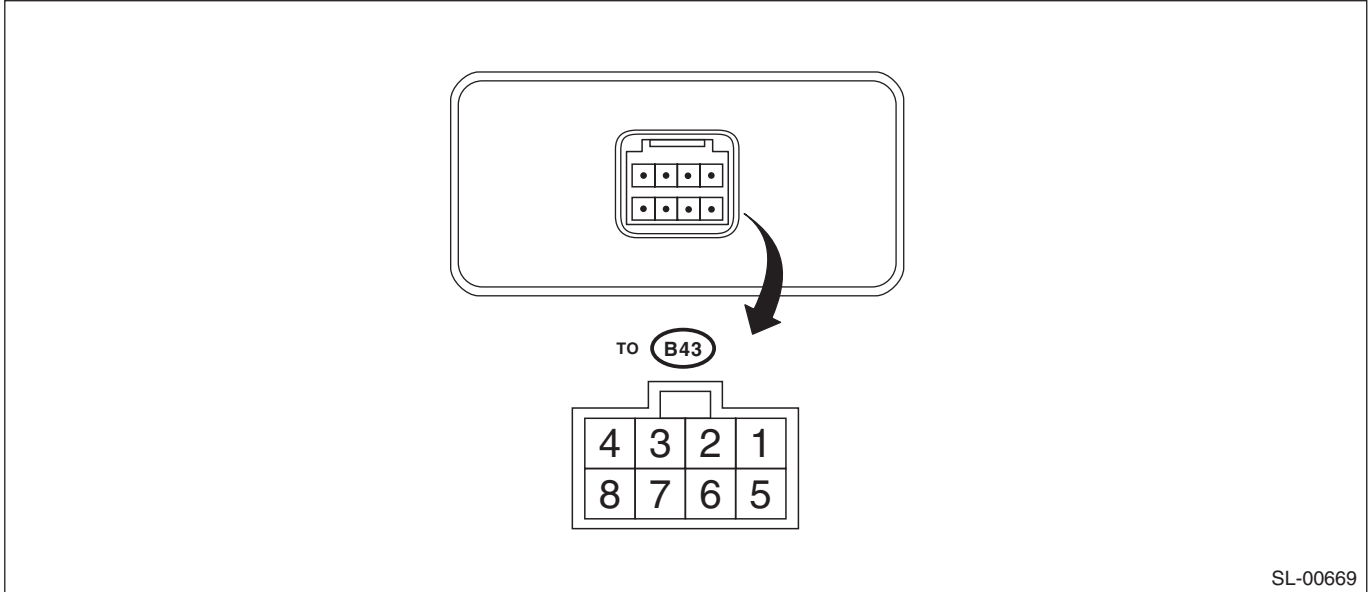
### A: WIRING DIAGRAM

#### 1. KEYLESS ENTRY

<Ref. to WI-216, WIRING DIAGRAM, Keyless Entry System.>

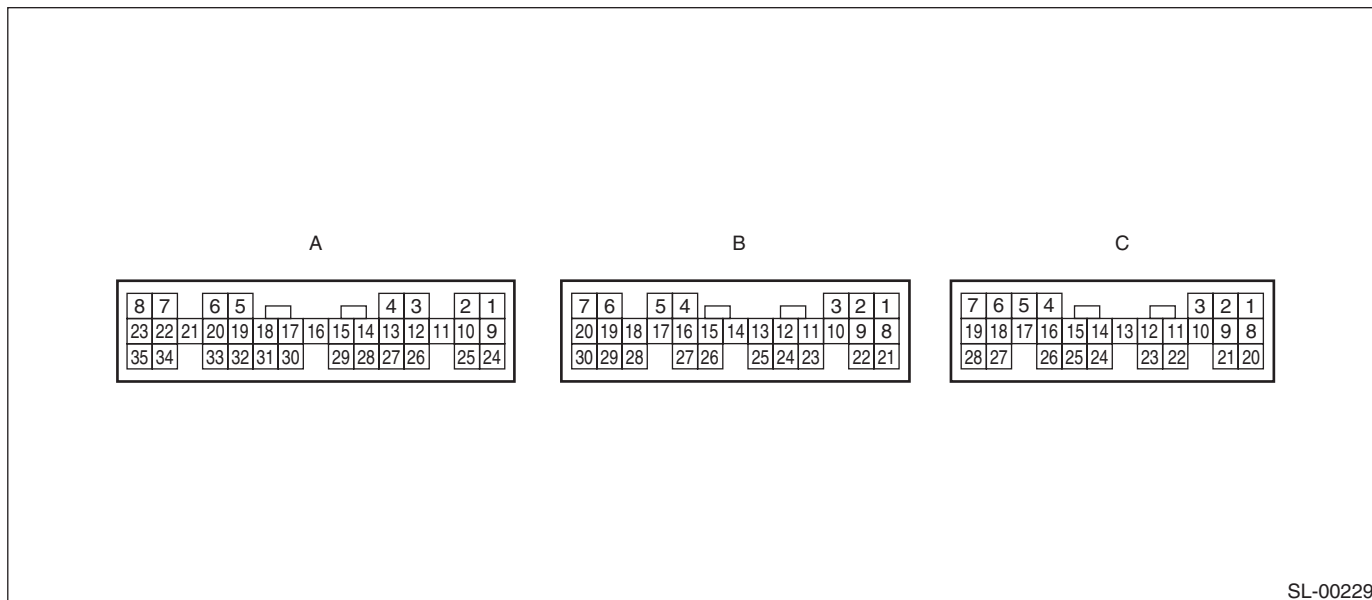
### B: ELECTRICAL SPECIFICATION

#### 1. KEYLESS ENTRY CONTROL MODULE



Remarks	Terminal No.	Measuring condition
-	1	-
-	2	-
Body integrated unit	3 (OUTPUT)	Battery voltage cannot be measured because of digital signal.
Power supply (Backup)	4	Battery voltage is constantly present.
-	5	-
-	6	-
Ground	7	0 V is constantly present.

## 2. BODY INTEGRATED UNIT



SL-00229

Remarks	Terminal No.	Measuring condition
Ignition switch (ON)	A1 (INPUT)	Battery voltage is present when ignition switch is turned to ON.
Keyless buzzer	A6 (INPUT)	0 V is present when pressing the LOCK or UNLOCK button of transmitter.
Driver's side front door lock actuator	A7 (OUTPUT)	Battery voltage is present when pressing the transmitter LOCK button.
Door and rear gate lock actuator	A8 (OUTPUT)	Battery voltage is present when pressing the transmitter UNLOCK button.
Keyless entry control module	A9 (INPUT)	Communication line (Cannot be measured because of digital signal)
Trunk lid switch or rear gate latch switch	A17 (INPUT)	0 V is present when opening the trunk lid or rear gate.
Rear door switch RH	A18 (INPUT)	0 V is present when opening the rear door RH.
Front door switch RH	A19 (INPUT)	0 V is present when opening the front door RH.
Ground	A21	0 V is constantly present.
Trunk lid actuator	A22 (OUTPUT)	Battery voltage is present when pressing the TRUNK button of the transmitter.
Driver's side front door lock actuator	A23 (OUTPUT)	Battery voltage is present when pressing the transmitter UNLOCK button.
Driver's side power window main switch (door lock switch)	A15	0 V is present when pressing the door lock switch to the LOCK side.
Passenger's side door lock switch	A29	0 V is present when pressing the door lock switch to the UNLOCK side.
Rear door switch LH	A31 (INPUT)	0 V is present when opening the rear door LH.
Front door switch LH	A32 (INPUT)	0 V is present when opening the front door LH.
Power supply	A34	Battery voltage is constantly present.
Room light	B3 (INPUT)	<ul style="list-style-type: none"> <li>• 0 V is present when pressing the UNLOCK button of keyless transmitter.</li> <li>• 0 V is present when opening the door.</li> </ul>
Power supply	B7	Battery voltage is constantly present.
Horn circuit	B11 (INPUT)	0 V is present when pressing the panic button of transmitter
Turn signal & hazard circuit	B12 (OUTPUT)	0 V is present when pressing the LOCK or UNLOCK button of transmitter.
Ground	B22	0 V is constantly present.
Power supply	C1	Battery voltage is constantly present.
Power supply	C2	Battery voltage is constantly present.
Key warning switch	C7 (INPUT)	Battery voltage is present when inserting the key into ignition switch.
Ground	C8	0 V is constantly present.
Ground	C9	0 V is constantly present.

# Keyless Entry System

## SECURITY AND LOCKS

### C: INSPECTION

#### 1. SYMPTOM CHART

Symptom	Repair order	Reference
None of the functions of the keyless entry system operate.	1. Check the transmitter battery.	<Ref. to SL-14, CHECK KEYLESS TRANSMITTER BATTERY AND FUNCTION, INSPECTION, Keyless Entry System.>
	2. Remove and visually check the fuse No. 2 (in the fuse & relay box) and No. 7 (in the fuse & relay box).	If the fuse is blown out, replace the fuse with a new part. Check the power supply and ground circuit, if the fuse has no abnormality. <Ref. to SL-7, CHECK POWER SUPPLY AND GROUND CIRCUIT, INSPECTION, Door Lock Control System.>
	3. Check the keyless entry control module.	<Ref. to SL-15, CHECK KEYLESS ENTRY CONTROL MODULE, INSPECTION, Keyless Entry System.>
	4. Check the power supply and ground circuit for body integrated unit.	<Ref. to SL-15, CHECK BODY INTEGRATED UNIT POWER SUPPLY AND GROUND CIRCUIT., INSPECTION, Keyless Entry System.>
	5. Check the key warning switch.	<Ref. to SL-17, CHECK KEY WARNING SWITCH, INSPECTION, Keyless Entry System.>
	6. Check the door switch.	<Ref. to SL-16, CHECK DOOR SWITCH, INSPECTION, Keyless Entry System.>
	7. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
The keyless transmitter cannot be registered.	1. Check the key warning switch.	<Ref. to SL-17, CHECK KEY WARNING SWITCH, INSPECTION, Keyless Entry System.>
	2. Check the door lock switch signal.	<Ref. to SL-20, CHECK DOOR LOCK SWITCH, INSPECTION, Keyless Entry System.>
	3. Check the ignition switch.	<Ref. to SL-23, CHECK IGNITION SWITCH., INSPECTION, Keyless Entry System.>
	4. Check the door switch.	<Ref. to SL-16, CHECK DOOR SWITCH, INSPECTION, Keyless Entry System.>
	5. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Keyless Entry System

## SECURITY AND LOCKS

Symptom	Repair order	Reference
Door lock or unlock does not operate. <b>NOTE:</b> If the door lock control system does not operate when using the door lock switch, check the door lock control system. <Ref. to SL-7, INSPECTION, Door Lock Control System.>	1. Check the transmitter battery.	<Ref. to SL-14, CHECK KEYLESS TRANSMITTER BATTERY AND FUNCTION, INSPECTION, Keyless Entry System.>
	2. Check the keyless entry control module.	<Ref. to SL-15, CHECK KEYLESS ENTRY CONTROL MODULE, INSPECTION, Keyless Entry System.>
	3. Check the key warning switch.	<Ref. to SL-17, CHECK KEY WARNING SWITCH, INSPECTION, Keyless Entry System.>
	4. Check the door switch.	<Ref. to SL-16, CHECK DOOR SWITCH, INSPECTION, Keyless Entry System.>
	5. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
The panic alarm does not operate.	1. Check the keyless transmitter battery and function.	<Ref. to SL-14, CHECK KEYLESS TRANSMITTER BATTERY AND FUNCTION, INSPECTION, Keyless Entry System.>
	2. Check the horn operation.	<Ref. to SL-21, CHECK HORN OPERATION, INSPECTION, Keyless Entry System.>
	3. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
Trunk lid unlock does not operate. (Sedan model)	1. Check the transmitter battery.	<Ref. to SL-14, CHECK KEYLESS TRANSMITTER BATTERY AND FUNCTION, INSPECTION, Keyless Entry System.>
	2. Check the keyless entry control module.	<Ref. to SL-15, CHECK KEYLESS ENTRY CONTROL MODULE, INSPECTION, Keyless Entry System.>
	3. Check the key warning switch.	<Ref. to SL-17, CHECK KEY WARNING SWITCH, INSPECTION, Keyless Entry System.>
	4. Check the trunk lid lock actuator.	<Ref. to SL-19, CHECK TRUNK LID LOCK ACTUATOR, INSPECTION, Keyless Entry System.>
	5. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
Buzzer and hazard light do not operate.	1. Check the buzzer operation.	<Ref. to SL-22, CHECK KEYLESS BUZZER, INSPECTION, Keyless Entry System.>
	2. Check the hazard light operation.	<Ref. to SL-18, CHECK HAZARD LIGHT OPERATION, INSPECTION, Keyless Entry System.>
	3. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
Room light does not operate.	1. Check the room light operation.	<Ref. to SL-17, CHECK ROOM LIGHT OPERATION, INSPECTION, Keyless Entry System.>
	2. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

# Keyless Entry System

## SECURITY AND LOCKS

Symptom	Repair order	Reference
Ignition switch illumination does not operate.	1. Check the ignition switch illumination.	<Ref. to SL-21, CHECK IGNITION SWITCH ILLUMINATION, INSPECTION, Keyless Entry System.>
	2. Check the body integrated unit.	<Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

## 2. CHECK KEYLESS TRANSMITTER BATTERY AND FUNCTION

	Step	Check	Yes	No
1	<b>CHECK KEYLESS TRANSMITTER BATTERY.</b> 1) Remove the battery from the transmitter. <Ref. to SL-56, REMOVAL, Transmitter.> 2) Check the battery voltage. <Ref. to SL-56, INSPECTION, Transmitter.>	Is the voltage 2.5 V or more?	Go to step 2.	Replace the transmitter battery. <Ref. to SL-56, Transmitter.>
2	<b>CHECK KEYLESS TRANSMITTER.</b> Register the keyless transmitter which operates normally on other vehicles to the inspection target vehicle. <Ref. to SL-57, REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR, REPLACEMENT, Transmitter.> 1) Close all the doors and rear gate of inspection target vehicle. 2) Using the keyless transmitter, lock and unlock the doors and rear gate of vehicle.	Does the inspection target vehicle operate lock and unlock normally?	Go to step 3.	Due to vehicle malfunction, continue the keyless entry system diagnosis.
3	<b>CHECK KEYLESS TRANSMITTER.</b> Register the keyless transmitter of inspection target vehicle to the another vehicle which the keyless system operates normally. <Ref. to SL-57, REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR, REPLACEMENT, Transmitter.>	Is the keyless transmitter registered correctly?	Go to step 4.	Replace the keyless transmitter. <Ref. to SL-57, REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR, REPLACEMENT, Transmitter.>
4	<b>CHECK KEYLESS TRANSMITTER.</b> Check the registered keyless transmitter. 1) Close all the doors and rear gate of the vehicle which operates keyless system normally. 2) Using the keyless transmitter, lock and unlock the doors and rear gate of vehicle.	Does the vehicle operate lock and unlock normally?	The keyless transmitter is OK.	Replace the keyless transmitter. <Ref. to SL-57, REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR, REPLACEMENT, Transmitter.>

### CAUTION:

Be sure to reset the keyless transmitter of other vehicle which is registered to the inspection target vehicle, and the vehicle to which the keyless transmitter is registered for inspection, to the condition before performing the inspection. (Register the keyless transmitter again.)



## 3. CHECK KEYLESS ENTRY CONTROL MODULE

Step	Check	Yes	No
<b>1 CHECK DIAGNOSTIC TROUBLE CODE (DTC).</b> 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Diagnostic Trouble Code}. 5) Check if the DTC is displayed.	Is DTC B1500 "Keyless UART com. Malfunction" displayed?	Go to step 2.	Keyless entry control module is normal.
<b>2 CHECK POWER SUPPLY.</b> 1) Disconnect the keyless entry control module harness connector. 2) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal (i96) No. 4 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open circuits and shorts between the keyless entry control module and fuse.
<b>3 CHECK GROUND CIRCUIT.</b> Measure the resistance between harness connector terminal and chassis ground. <i>Connector &amp; terminal (i96) No. 7 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Go to step 4.	Repair the harness.
<b>4 CHECK KEYLESS ENTRY CONTROL MODULE CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between harness connector terminals. <i>Connector &amp; terminal (i84) No. 9 — (i96) No. 3:</i>	Is the resistance less than 10 Ω?	Replace the keyless entry control module. <Ref. to SL-53, Keyless Entry Control Module.>	Repair the harness.

## 4. CHECK BODY INTEGRATED UNIT POWER SUPPLY AND GROUND CIRCUIT

Step	Check	Yes	No
<b>1 CHECK POWER SUPPLY OF BODY INTEGRATED UNIT.</b> 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Current Data Display}. 5) Check the following data display.	Is the data display 10 V or more (BATT voltage (Control), BATT voltage (BACKUP), IG power supply voltage and ACC voltage)?	Go to step 2.	Keyless entry control module is normal.
<b>2 CHECK BODY INTEGRATED UNIT GROUND CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between harness connector terminal and chassis ground. <i>Connector &amp; terminal (B280) No. 22 — Chassis ground: (B281) No. 8 — Chassis ground: (B281) No. 9 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Repair the harness.

# Keyless Entry System

## SECURITY AND LOCKS

### 5. CHECK DOOR SWITCH

	Step	Check	Yes	No
1	<p><b>CHECK DOOR SWITCH CIRCUIT.</b></p> <p>1) Prepare the Subaru Select Monitor kit.</p> <p>2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".</p> <p>3) On the «System Selection Menu», select the {Integ. Unit mode}.</p> <p>4) Select the {Current Data Display}.</p> <p>5) Read the display of data (driver's door, passenger's door, rear right door, rear left door, rear gate switch) when each door is opened/closed.</p>	Is the data displayed ON (opened)/OFF (closed) when each door or rear gate is opened/closed?	The door switch circuit is OK.	Go to step 2.
2	<p><b>CHECK DOOR SWITCH CIRCUIT.</b></p> <p>Measure the voltage between the body integrated unit harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b></p> <p><b>Front door RH:</b> (i84) No. 32 (+) — Chassis ground (-):</p> <p><b>Front door LH:</b> (i84) No. 19 (+) — Chassis ground (-):</p> <p><b>Rear door RH:</b> (i84) No. 18 (+) — Chassis ground (-):</p> <p><b>Rear door LH:</b> (i84) No. 31 (+) — Chassis ground (-):</p> <p><b>Rear gate or trunk lid:</b> (i84) No. 17 (+) — Chassis ground (-):</p>	Is the voltage 10 V or more when each door, rear gate or trunk lid is closed?	The door switch is OK.	Go to step 3.
3	<p><b>CHECK DOOR SWITCH.</b></p> <p>1) Disconnect the door switch harness connector.</p> <p>2) Measure the resistance between door switch terminals.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(R12) Front RH door switch:</b></p> <p><b>(R9) Front LH door switch:</b></p> <p><b>(R16) Rear RH door switch:</b></p> <p><b>(R22) Rear LH door switch:</b></p> <p><b>No. 1 — No. 3:</b></p> <p><b>Rear gate latch switch (Wagon model):</b> (D46) No. 1 — No. 2:</p> <p><b>Trunk lid switch (Sedan model):</b> (R186) No. 1 — No. 3:</p>	Is the resistance 1 M $\Omega$ or more when door switch is pushed?	Go to step 4.	Replace the door switch.
4	<p><b>CHECK DOOR SWITCH.</b></p> <p>Measure the resistance between door switch terminals.</p> <p><b>Connector &amp; terminal</b></p> <p><b>(R12) Front RH door switch:</b></p> <p><b>(R9) Front LH door switch:</b></p> <p><b>(R16) Rear RH door switch:</b></p> <p><b>(R22) Rear LH door switch:</b></p> <p><b>No. 1 — No. 3:</b></p> <p><b>Rear gate latch switch (Wagon model):</b> (D46) No. 1 — No. 2:</p> <p><b>Trunk lid switch (Sedan model):</b> (R186) No. 1 — No. 3:</p>	Is the resistance less than 1 $\Omega$ when door switch is released?	Check the harness for open or short between body integrated unit and door switch.	Replace the door switch.

## 6. CHECK KEY WARNING SWITCH

Step	Check	Yes	No
<b>1 CHECK FUSE.</b> Remove and visually check the fuse No. 14 (in the main fuse box).	Is the fuse blown out?	Replace the fuse with a new part.	Go to step 2.
<b>2 CHECK KEY WARNING SWITCH CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Insert the key into ignition switch. (LOCK position) 3) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B281) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Go to step 4.
<b>3 CHECK KEY WARNING SWITCH CIRCUIT.</b> 1) Remove the key from ignition switch. 2) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B281) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 0 V?	The key warning switch is OK.	Go to step 4.
<b>4 CHECK KEY WARNING SWITCH.</b> 1) Disconnect the key warning switch harness connector. 2) Insert the key into ignition switch. (LOCK position) 3) Measure the resistance between key warning switch terminals. <i>Connector &amp; terminal</i> <i>(B350) No. 3 — No. 4:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 5.	Replace the key warning switch.
<b>5 CHECK KEY WARNING SWITCH.</b> 1) Remove the key from ignition switch. 2) Measure the resistance between key warning switch terminals. <i>Connector &amp; terminal</i> <i>(B350) No. 3 — No. 4:</i>	Is the resistance 1 M $\Omega$ or more?	Check the following: • Harness for open circuits and shorts between the key warning switch and fuse • Harness for open or short between the body integrated unit and key warning switch	Replace the key warning switch.

## 7. CHECK ROOM LIGHT OPERATION

Step	Check	Yes	No
<b>1 CHECK ROOM LIGHT OPERATION.</b> Make sure the room light illuminates when the room light switch is turned to ON.	Does the room light illuminate?	Go to step 2.	Check the room light circuit.
<b>2 CHECK HARNESS BETWEEN ROOM LIGHT AND BODY INTEGRATED UNIT.</b> 1) Disconnect the body integrated unit harness connector and room light harness connector. 2) Measure the resistance between the body integrated unit harness connector terminal and room light harness connector terminal. <i>Connector &amp; terminal</i> <i>(B280) No. 3 — (R52) No. 2:</i>	Is the resistance less than 10 $\Omega$ ?	The room light operation circuit is OK.	Check the harness for open or short between body integrated unit and room light.

# Keyless Entry System

## SECURITY AND LOCKS

### 8. CHECK HAZARD LIGHT OPERATION

	Step	Check	Yes	No
1	<b>CHECK HAZARD LIGHT OPERATION.</b> Make sure the hazard light blinks when hazard switch is turned to ON.	Does the hazard light blink?	Go to step 2.	Check the hazard light circuit.
2	<b>CHECK OUTPUT TO HAZARD LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the key warning switch harness connector. 3) Prepare the Subaru Select Monitor kit. 4) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 5) On the «System Selection Menu», select the {Integ. Unit mode}. 6) Select {ECM customizing}. 7) Check {Hazard answer-back setup}, and then switch to ON setting if necessary. 8) Select the {Current Data Display & Save}. 9) When operate the LOCK/UNLOCK button of transmitter, check the hazard output signal of body integrated unit.	Is output signal is present when operating the transmitter LOCK/UNLOCK button?	Go to step 3.	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
3	<b>CHECK CIRCUIT OF HAZARD LIGHT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Disconnect the turn signal and hazard unit harness connector. 3) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 12 — (B32) No. 8:</b>	Is the resistance less than 10 Ω?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Repair the harness.

## 9. CHECK TRUNK LID LOCK ACTUATOR

Step	Check	Yes	No
<b>1 CHECK TRUNK LID LOCK ACTUATOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the key warning switch harness connector. 3) Prepare the Subaru Select Monitor kit. 4) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 5) On the «System Selection Menu», select the {Integ. Unit mode}. 6) Select the {Current Data Display & Save}. 7) When operating the TRUNK button of the transmitter, check the trunk unlock output signal of the body integrated unit.	Is an output signal present when operating the transmitter TRUNK button?	Go to step 2.	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
<b>2 CHECK THE CIRCUIT OF TRUNK LID ACTUATOR.</b> 1) Disconnect the harness connector of body integrated unit. 2) Disconnect the trunk lid actuator harness connector. 3) Measure the resistance between harness connectors. <i><b>Connector &amp; terminal</b></i> <i><b>(i84) No. 22 — (R186) No. 2:</b></i>	Is the resistance less than 10 Ω?	Go to step 3.	Repair the harness.
<b>3 CHECK THE GROUND CIRCUIT OF TRUNK LID ACTUATOR.</b> 1) Disconnect the trunk lid actuator harness connector. 2) Measure the resistance between harness connector terminal and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(R186) No. 1 — Chassis ground:</b></i>	Is the resistance less than 10 Ω?	Check the trunk lid lock actuator. <Ref. to SL-43, Trunk Lid Lock Assembly.>	Repair the harness.

# Keyless Entry System

## SECURITY AND LOCKS

### 10.CHECK DOOR LOCK SWITCH

	Step	Check	Yes	No
1	<p><b>CHECK DOOR LOCK SWITCH.</b> Check the input signal from door lock switch to body integrated unit using Subaru Select Monitor. 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Current Data Display &amp; Save}. 5) Check the input signal to body integrated unit by operating the door lock switch.</p>	Is the normal input signal displayed when the door lock switch is moved to LOCK/UNLOCK?	The door lock switch is OK.	Go to step 2.
2	<p><b>CHECK DOOR LOCK SWITCH CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between the harness connector terminal and chassis ground when moving the door lock switch to LOCK. <b>Connector &amp; terminal</b> <b>(i84) No. 15 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	Go to step 3.	Go to step 4.
3	<p><b>CHECK DOOR LOCK SWITCH CIRCUIT.</b> Measure the resistance between the harness connector terminal and chassis ground when the door lock switch is moved to UNLOCK. <b>Connector &amp; terminal</b> <b>(i84) No. 29 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	The door lock switch is OK.	Go to step 4.
4	<p><b>CHECK DOOR LOCK SWITCH.</b> 1) Disconnect the door lock switch harness connector. 2) Measure the resistance between the door lock switch terminals when moving the door lock switch to LOCK. <b>Connector &amp; terminal</b> <b>Driver's side:</b> <b>(D7) No. 4 — No. 7:</b> <b>Passenger's side:</b> <b>(D125) No. 4 — No. 3:</b></p>	Is the resistance less than 1 Ω?	Go to step 5.	Replace the door lock switch.
5	<p><b>CHECK DOOR LOCK SWITCH.</b> Measure the resistance between the door lock switch terminals when moving the door lock switch to UNLOCK. <b>Connector &amp; terminal</b> <b>Driver's side:</b> <b>(D7) No. 5 — No. 7:</b> <b>Passenger's side:</b> <b>(D125) No. 1 — No. 3:</b></p>	Is the resistance less than 1 Ω?	Check the harness for open circuits or shorts between the body integrated unit and the door lock switch.	Replace the door lock switch.

## 11. CHECK IGNITION SWITCH ILLUMINATION

	Step	Check	Yes	No
1	<b>CHECK FUSE.</b> Remove and visually check the fuse No. 14 (in the main fuse box).	Is the fuse blown out?	Replace the fuse with a new part.	Go to step 2.
2	<b>CHECK POWER SUPPLY.</b> 1) Disconnect the ignition switch illumination harness connector. 2) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B224) No. 2 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open circuits and shorts between the ignition switch illumination and fuse.
3	<b>CHECK IGNITION SWITCH ILLUMINATION CIRCUIT.</b> 1) Disconnect the harness connector of body integrated unit and ignition switch illumination harness connector. 2) Measure the resistance between body integrated unit harness connector terminal and ignition switch illumination harness connector terminal. <i>Connector &amp; terminal</i> <i>(B280) No. 4 — (B224) No. 1:</i>	Is the resistance less than 10 $\Omega$ ?	Replace the ignition switch illumination bulb with a new part. <Ref. to LI-38, REMOVAL, Ignition Switch Illumination.>	Check the harness for open circuits and shorts between the body integrated unit and ignition switch illumination.

## 12. CHECK HORN OPERATION

	Step	Check	Yes	No
1	<b>CHECK HORN OPERATION.</b> Make sure the horn sounds when the horn switch is pushed.	Does the horn sound?	Go to step 2.	Check the horn circuit.
2	<b>CHECK HORN OPERATION.</b> 1) Disconnect the harness connector of body integrated unit. 2) Connect the harness connector terminal to ground using a suitable lead wire. <i>Connector &amp; terminal</i> <i>(B280) No. 11 (+) — Chassis ground (-):</i>	Does the horn sound?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Check the harness for open circuits and/or shorts between the body integrated unit and horn relay.

# Keyless Entry System

## SECURITY AND LOCKS

### 13.CHECK KEYLESS BUZZER

	Step	Check	Yes	No
1	<b>CHECK KEYLESS BUZZER SOUND.</b> 1) Using the Subaru Select Monitor, set the keyless buzzer sound to ON. 2) Operate the LOCK/UNLOCK button of the transmitter and check whether the keyless buzzer sounds or not.	Does the keyless buzzer sound?	Keyless buzzer is normal.	Go to step 2.
2	<b>CHECK FOR POWER SUPPLY OF KEYLESS BUZZER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the keyless buzzer harness connector. 3) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F102) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open circuits and shorts between the keyless buzzer and fuse.
3	<b>CHECK FOR GROUND CIRCUIT OF KEYLESS BUZZER.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(i84) No. 6 — (F102) No. 1:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 4.	Repair the harness.
4	<b>CHECK KEYLESS BUZZER.</b> 1) Remove the keyless buzzer. 2) Install the keyless buzzer to another vehicle which operates keyless buzzer normally, check the buzzer sounds.	Does the keyless buzzer sound?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.> <Ref. to GW-9, Power Window Control Switch.>	Replace the keyless buzzer.



## 14. CHECK IGNITION SWITCH

Step	Check	Yes	No
<b>1 CHECK FUSIBLE LINK.</b> Remove the fusible link main SBF and SBF-6 (in main fuse box), and visually check.	Is the fusible link blown out?	Replace the fusible link main SBF or SBF-6. If the replaced fusible link has blown out easily, repair the short circuit between the fusible link and the ignition switch.	Go to step 2.
<b>2 CHECK FOR POWER SUPPLY OF IGNITION SWITCH.</b> 1) Disconnect the ignition switch harness connector. 2) Measure the voltage between harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B72) No. 3 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open circuits and shorts between the ignition switch and fusible link.
<b>3 CHECK IGNITION SWITCH.</b> 1) Insert the ignition key into ignition switch, and turn the each position. 2) Measure the resistance between ignition switch terminals. <i>Connector &amp; terminal</i> <i>No. 3 — No. 5: (ACC position)</i> <i>No. 3 — No. 5 — No. 1 — No. 4 (ON position)</i> <i>No. 3 — No. 1 — No. 4 — No. 2 (ST position)</i>	Is the resistance less than 1 $\Omega$ when turning the ignition key to each position?	Ignition switch is normal.	Replace the ignition switch with a new part. <Ref. to SL-48, REPLACEMENT, Ignition Key Lock.>

**CAUTION:**

**When the ignition key lock is replaced, all ignition keys also must be registered. (Refer to the “IMMOBILIZER TEACHING OPERATION MANUAL”.)**

# Security System

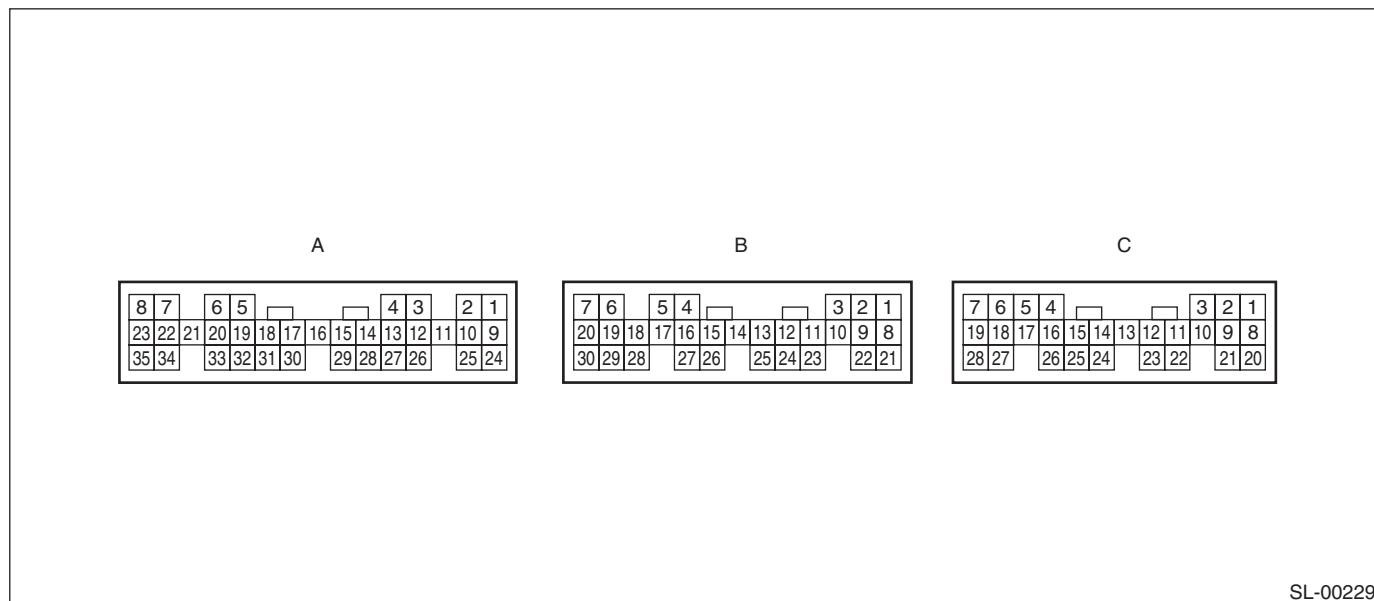
## SECURITY AND LOCKS

### 4. Security System

#### A: WIRING DIAGRAM

<Ref. to WI-212, WIRING DIAGRAM, Security System.>

#### B: ELECTRICAL SPECIFICATION



Remarks	Terminal No.	Measuring condition
Ignition switch	A1 (INPUT)	Battery voltage is present when ignition switch is turned to ON.
Door key cylinder switch	A3	0 V is present when door key cylinder is moved to the LOCK side.
Keyless entry control module	A9 (INPUT)	Communication line (Cannot be measured because of digital signal)
Door key cylinder switch	A12	0 V is present when door key cylinder is moved to UNLOCK side.
Trunk lid switch or rear gate latch switch	A17 (INPUT)	0 V is present when opening the trunk lid or rear gate.
Rear door switch RH	A18 (INPUT)	0 V is present when opening the rear door RH.
Front door switch LH	A19 (INPUT)	0 V is present when opening the front door LH.
Rear door switch LH	A31 (INPUT)	0 V is present when opening the rear door LH.
Front door switch RH	A32 (INPUT)	0 V is present when opening the front door RH.
Security indicator light	A33 (INPUT)	Battery voltage is present when the alarm operation is activated.
Horn relay	B11 (OUTPUT)	Battery voltage is present when the alarm operation is activated.
Turn signal & hazard circuit	B12 (OUTPUT)	Battery voltage is present when the alarm operation is activated.
Ground	B22	0 V is constantly present.
Power supply	C2	Battery voltage is constantly present.
Impact sensor	C5	When not applying vibration to the impact sensor, it repeats displaying the 0 V and battery voltage in every 45 milliseconds.
Ground	C8	0 V is constantly present.
Ground	C9	0 V is constantly present.

## C: INSPECTION

### 1. BASIC DIAGNOSTIC PROCEDURE

Step	Check	Yes	No
<b>1 INITIAL CHECK.</b> Check keyless entry system.	Does the keyless entry system operate normally?	Go to step 2.	Check keyless entry system. <Ref. to SL-12, INSPECTION, Keyless Entry System.>
<b>2 CHECK SECURITY ON/OFF SETTING.</b> 1) Remove the key from ignition switch, and then close all doors. 2) Press the UNLOCK button of the keyless transmitter. 3) Check the security indicator light blinking patterns.	Is the security indicator light blinking patterns as follows? •Model with immobilizer: Blinks in every 3 seconds	Go to step 3.	Check the security indicator light circuit. <Ref. to SL-30, CHECK SECURITY INDICATOR LIGHT CIRCUIT, INSPECTION, Security System.>
<b>3 CHECK SECURITY ON/OFF SETTING.</b> 1) Press the LOCK button of the transmitter. 2) Check the security indicator light blinking patterns.	Is the security indicator light blinking patterns as follows? •When monitoring lag is set to 0 seconds: Blinks twice within 0.5 seconds at 2 second intervals. •When monitoring lag is set to 30 seconds: Blinks three times within 1 second at 0.4 second intervals.	Go to step 6.	Go to step 4.
<b>4 CHANGE THE SETTING OF SECURITY SYSTEM.</b> Change the setting of security system to ON. <Ref. to SL-27, SECURITY SYSTEM ON/OFF SETTING, INSPECTION, Security System.>	Is setting change completed correctly?	Go to step 5.	<ul style="list-style-type: none"> <li>• Check the ignition switch circuit. &lt;Ref. to SL-31, CHECK IGNITION SWITCH CIRCUIT, INSPECTION, Security System.&gt;</li> <li>• Check the door lock switch circuit. &lt;Ref. to SL-20, CHECK DOOR LOCK SWITCH, INSPECTION, Keyless Entry System.&gt;</li> </ul>
<b>5 CHECK THE SETTING CHANGE OF SECURITY SYSTEM.</b> 1) Remove the key from ignition switch, and then close all doors. 2) Press the LOCK button of the transmitter. 3) Check the security indicator light blinking patterns.	Is the security indicator light blinking patterns as follows? •When monitoring lag is set to 0 seconds: Blinks twice within 0.5 seconds at 2 second intervals. •When monitoring lag is set to 30 seconds: Blinks three times within 1 second at 0.4 second intervals.	Go to step 6.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>6 CHECK SECURITY SYSTEM OPERATION.</b> Press the LOCK button of keyless transmitter, and wait for 30 seconds.	Is the blinking pattern of security indicator light blink twice within 0.5 seconds in 2 second cycles?	Go to step 7.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Security System

## SECURITY AND LOCKS

Step	Check	Yes	No
<b>7 CHECK SECURITY SYSTEM CANCEL OPERATION.</b> Insert the key to the door key cylinder to unlock.	Is the security indicator light blinking patterns as follows? •Model with immobilizer: Blinks in every 3 seconds	Press the LOCK button of keyless transmitter, and wait for 30 seconds. Go to step 8.	Check the door key cylinder circuit. <Ref. to SL-32, CHECK DOOR KEY CYLINDER SWITCH AND CIRCUIT, INSPECTION, Security System.>
<b>8 CHECK SECURITY ALARM OPERATION.</b> 1) Unlock all doors using the door lock switch on driver's door. 2) Open any door, trunk or rear gate.	Does the security alarm operate when opening any door, trunk or rear gate?	Go to step 9.	<ul style="list-style-type: none"> <li>• Check the door switch. &lt;Ref. to SL-28, CHECK DOOR SWITCH, INSPECTION, Security System.&gt;</li> <li>• Check the trunk lid switch or rear gate latch switch. &lt;Ref. to SL-29, CHECK TRUNK LID SWITCH (SEDAN) OR REAR GATE LATCH SWITCH (WAGON), INSPECTION, Security System.&gt;</li> </ul>
<b>9 CHECK SECURITY ALARM OPERATION.</b> Check the security alarm operation.	Does all security alarm operate? •Horn sounds •Hazard light blinks •Security indicator light illuminates	Go to step 10.	<ul style="list-style-type: none"> <li>• Check the horn. &lt;Ref. to SL-30, CHECK HORN, INSPECTION, Security System.&gt;</li> <li>• Check the hazard light. &lt;Ref. to SL-31, CHECK HAZARD LIGHT OPERATION, INSPECTION, Security System.&gt;</li> </ul>
<b>10 CHECK SECURITY ALARM CANCEL OPERATION.</b> Press any button of transmitter while operating security alarm. Or turn the ignition switch to OFF → ON three times.	Does all security alarm stop? •Horn •Hazard light	Go to step 11.	Check the ignition switch circuit. <Ref. to SL-31, CHECK IGNITION SWITCH CIRCUIT, INSPECTION, Security System.>
<b>11 CHECK SECURITY SYSTEM CONDITION MEMORY.</b> Check that the system function properly when the battery is not connected temporarily. <Ref. to SL-27, CHECK SECURITY SYSTEM CONDITION MEMORY, INSPECTION, Security System.>	Does the system function properly when the battery is not connected temporarily?	Go to step 12.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>12 CHECK IMPACT SENSOR.</b> Check the sensitivity of impact sensor. <Ref. to SL-51, CHECK IMPACT SENSOR, ADJUSTMENT, Impact Sensor.>	Is the sensibility set properly?	Press the UNLOCK button of keyless transmitter, and finish the diagnosis.	Adjust the sensibility. <Ref. to SL-52, IMPACT SENSITIVITY ADJUSTMENT, ADJUSTMENT, Impact Sensor.>

**NOTE:**

Check the function setting of body integrated unit if any of the following symptoms appear. <Ref. to LAN(di-ag)-2, Basic Diagnostic Procedure.>

- The horn does not sound even when the security system operates. (Siren YES/NO)
- The horn sounds when setting the security to ON using the keyless transmitter. (Impact sensor YES/NO)

## **2. CHECK SECURITY SYSTEM CONDITION MEMORY**

- 1) Remove the key from ignition switch.
- 2) Close all the doors, trunk lid and rear gate.
- 3) Open the front hood.
- 4) Press the LOCK button of transmitter, and then wait until the security indicator light flashes twice for 0.5 sec. at intervals of 2 seconds.
- 5) Disconnect the ground cable from the battery.
- 6) Connect the ground cable to the battery.
- 7) Check that the security indicator light blinks twice within 0.5 seconds at 2 second intervals. When it does not blink, replace the body integrated unit.

## **3. SECURITY SYSTEM ON/OFF SETTING**

- 1) Close all doors, trunk lid and rear gate, and sit down on the driver seat. Press the UNLOCK button of the keyless transmitter.
- 2) Turn the ignition switch to ON.
- 3) Push the centralized door unlock switch down and open the driver's side door at the same time, and hold in this condition for 10 seconds.
- 4) If the security system is ON, it will turn OFF. If OFF, it will turn ON.

# Security System

## SECURITY AND LOCKS

### 4. CHECK DOOR SWITCH

Step	Check	Yes	No
<b>1 CHECK INPUT FROM EACH DOOR SWITCH.</b> 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Current Data Display & Save}. 5) Check the door switch input to the body integrated unit when opening the each door (front RH and LH, rear RH and LH).	Is the input signal detected when opening the each door (front RH and LH, rear RH and LH)?	The door switch circuit is OK.	When the input signal cannot be detected in some door switch, Go to step 2.
<b>2 CHECK DOOR SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Disconnect the harness connector of faulty door switch. 4) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <i>(i84) No. 19 — (R9) No. 1: (front door LH)</i> <i>(i84) No. 32 — (R12) No. 1: (front door RH)</i> <i>(i84) No. 31 — (R22) No. 1: (rear door LH)</i> <i>(i84) No. 18 — (R16) No. 1: (rear door RH)</i>	Is the resistance less than 10 Ω?	Go to step 3.	Repair the harness.
<b>3 CHECK GROUND CIRCUIT OF DOOR SWITCH.</b> 1) Disconnect the harness connector of faulty door switch. 2) Measure the resistance of harness connector and chassis ground. <b>Connector &amp; terminal</b> <i>(R9) No. 3 — Chassis ground: (front door LH)</i> <i>(R12) No. 3 — Chassis ground: (front door RH)</i> <i>(R22) No. 3 — Chassis ground: (rear door LH)</i> <i>(R16) No. 3 — Chassis ground: (rear door RH)</i>	Is the resistance less than 10 Ω?	Go to step 4.	Repair the harness.
<b>4 CHECK DOOR SWITCH.</b> 1) Disconnect the harness connector of faulty door switch. 2) Measure the resistance between door switch terminals. <b>Terminals</b> <b>No. 1 — No. 3:</b>	Is the resistance 1 MΩ or more when door switch is pushed?	Go to step 5.	Replace the door switch.
<b>5 CHECK DOOR SWITCH.</b> Measure the resistance between door switch terminals. <b>Terminals</b> <b>No. 1 — No. 3:</b>	Is the resistance less than 1 Ω when door switch is released?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Replace the door switch.

## 5. CHECK TRUNK LID SWITCH (SEDAN) OR REAR GATE LATCH SWITCH (WAGON)

Step	Check	Yes	No
<p><b>1</b></p> <p><b>CHECK INPUT FROM TRUNK LID SWITCH OR REAR GATE LATCH SWITCH.</b></p> <p>1) Prepare the Subaru Select Monitor kit.                      2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".                      3) On the «System Selection Menu», select the {Integ. Unit mode}.                      4) Select the {Current Data Display &amp; Save}.                      5) Check the input signal to the body integrated unit when opening the trunk lid or rear gate.</p>	<p>Is the input signal present when opening the trunk lid or rear gate?</p>	<p>The trunk lid switch or rear gate latch switch circuit is OK.</p>	<p>Go to step 2.</p>
<p><b>2</b></p> <p><b>CHECK CIRCUIT FOR TRUNK LID SWITCH OR REAR GATE LATCH SWITCH.</b></p> <p>1) Turn the ignition switch to OFF.                      2) Disconnect the harness connector of body integrated unit.                      3) Disconnect the harness connector of the trunk lid switch or the rear gate latch switch.                      4) Measure the resistance between harness connector terminals.</p> <p><b>Connector &amp; terminal</b>  <i>(i84) No. 17 — (D46) No. 2: (Wagon model)</i>  <i>(i84) No. 17 — (R186) No. 3: (Sedan model)</i></p>	<p>Is the resistance less than 10 Ω?</p>	<p>Go to step 3.</p>	<p>Repair the harness.</p>
<p><b>3</b></p> <p><b>CHECK GROUND CIRCUIT OF TRUNK LID SWITCH OR REAR GATE LATCH SWITCH.</b></p> <p>1) Disconnect the harness connector of the trunk lid switch or the rear gate latch switch.                      2) Measure the resistance between harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <i>(D46) No. 1 — Chassis ground: (Wagon model)</i>  <i>(R186) No. 1 — Chassis ground: (Sedan model)</i></p>	<p>Is the resistance less than 10 Ω?</p>	<p>Go to step 4.</p>	<p>Repair the harness.</p>
<p><b>4</b></p> <p><b>CHECK TRUNK LID SWITCH OR REAR GATE LATCH SWITCH.</b></p> <p>1) Disconnect the harness connector of the trunk lid switch or the rear gate latch switch.                      2) Measure the resistance between switch terminals.</p> <p><b>Terminals</b>  <i>No. 1 — No. 2: (Wagon model)</i>  <i>No. 1 — No. 3: (Sedan model)</i></p>	<p>Is the resistance 1 MΩ or more when switch is pushed?</p>	<p>Go to step 5.</p>	<p>Replace the trunk lid switch or the rear gate latch switch.</p>
<p><b>5</b></p> <p><b>CHECK TRUNK LID SWITCH OR REAR GATE LATCH SWITCH.</b></p> <p>Measure the resistance between switch terminals.</p> <p><b>Terminals</b>  <i>No. 1 — No. 2: (Wagon model)</i>  <i>No. 1 — No. 3: (Sedan model)</i></p>	<p>Is the resistance less than 1 Ω when switch is released?</p>	<p>Check the body integrated unit.                      &lt;Ref. to LAN(diag)-2, Basic Diagnostic Procedure.&gt;</p>	<p>Replace the trunk lid switch or the rear gate latch switch.</p>

# Security System

## SECURITY AND LOCKS

### 6. CHECK SECURITY INDICATOR LIGHT CIRCUIT

Step	Check	Yes	No
<b>1 CHECK SECURITY INDICATOR LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Connect the resistor (100 Ω) between body integrated unit harness connector terminal (i84) No. 33 and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 33 — Chassis ground:</b>	Does the security indicator light illuminate?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Go to step 2.
<b>2 CHECK POWER SUPPLY FOR SECURITY INDICATOR LIGHT.</b> 1) Disconnect the connector from the combination meter. 2) Measure the voltage between the combination meter harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(i10) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open or short circuits between combination meter and fuse.
<b>3 CHECK SECURITY INDICATOR LIGHT CIRCUIT.</b> Measure the resistance between the combination meter harness connector terminal and the security control unit harness connector terminal. <b>Connector &amp; terminal</b> <b>(i10) No. 17 — (i84) No. 33:</b>	Is the resistance less than 10 Ω?	Replace the combination meter. <Ref. to IDI-19, Combination Meter.>	Check the harness for open or short circuits between the combination meter and body integrated unit.

### 7. CHECK HORN

Step	Check	Yes	No
<b>1 CHECK HORN OPERATION.</b> Check the horn sounds when the horn switch is pushed.	Does the horn sound?	Go to step 2.	Check the horn circuit.
<b>2 CHECK OUTPUT TO HORN RELAY.</b> 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select {Function Check}. 5) Select {Horn Output} and execute	Does the horn sound?	Horn circuit is OK.	Go to step 3.
<b>3 CHECK HORN RELAY CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Disconnect the main fuse box harness connector (B186). 4) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 11 — (B186) No. 1:</b>	Is the resistance less than 10 Ω?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Repair the harness.



## 8. CHECK HAZARD LIGHT OPERATION

Step	Check	Yes	No
<b>1</b> <b>CHECK HAZARD LIGHT OPERATION.</b> Make sure the hazard light blinks when hazard switch is turned to ON.	Does the hazard light blink?	Go to step 2.	Check the hazard light circuit.
<b>2</b> <b>CHECK OUTPUT TO HAZARD LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the key warning switch harness connector. 3) Prepare the Subaru Select Monitor kit. 4) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 5) On the «System Selection Menu», select the {Integ. Unit mode}. 6) Select {ECM customizing}. 7) Check the {Hazard answer-back setup}, and then switch to ON setting. 8) Select the {Current Data Display & Save}. 9) Check the hazard output signal of body integrated unit when operating the LOCK/UNLOCK button of transmitter.	Is output signal is present when operating the transmitter LOCK/UNLOCK button?	Go to step 3.	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
<b>3</b> <b>CHECK CIRCUIT OF HAZARD LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Disconnect the turn signal and hazard unit harness connector. 4) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 12 — (B32) No. 8:</b>	Is the resistance less than 10 Ω?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Repair the harness.

## 9. CHECK IGNITION SWITCH CIRCUIT

Step	Check	Yes	No
<b>1</b> <b>CHECK IGNITION SWITCH VOLTAGE.</b> 1) Prepare the Subaru Select Monitor kit. 2) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor". 3) On the «System Selection Menu», select the {Integ. Unit mode}. 4) Select the {Current Data Display & Save}. 5) Check the {BATT voltage} and {IG power supply}.	Is the {IG power supply} within ±1 V against {BATT voltage}?	The ignition switch input circuit is OK.	Go to step 2.
<b>2</b> <b>CHECK IGNITION SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of body integrated unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Check the body integrated unit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Check the harness for open or short circuit between the body integrated unit and fuse.

# Security System

## SECURITY AND LOCKS

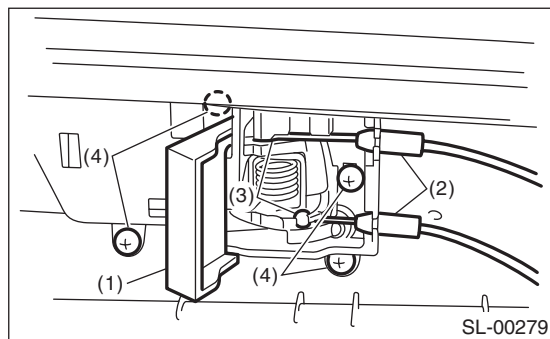
### 10.CHECK DOOR KEY CYLINDER SWITCH AND CIRCUIT

	Step	Check	Yes	No
1	<b>CHECK DOOR KEY CYLINDER SWITCH CIRCUIT.</b> Measure the resistance between the harness connector terminal and chassis ground when moving the door key cylinder switch to UNLOCK. <b>Connector &amp; terminal</b> <b>(i84) No. 12 — Chassis ground:</b>	Is the resistance less than 10 $\Omega$ ?	Door key cylinder switch is OK.	Go to step 2.
2	<b>CHECK DOOR KEY CYLINDER SWITCH.</b> 1) Disconnect the door key cylinder switch harness connector. 2) Measure the resistance between door key cylinder switch terminals when turning the door key cylinder switch to LOCK. <b>Terminals</b> <b>No. 1 — No. 2:</b>	Is the resistance less than 1 $\Omega$ ?	Check the harness for open or short circuits between the body integrated unit and the door key cylinder switch.	Replace the door key cylinder switch.

## 5. Front Inner Remote

### A: REMOVAL

- 1) Remove the door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 2) Remove the back cover (1) of inner remote.
- 3) Remove the cable (2).
- 4) Remove the cable end ball (3).
- 5) Remove the screws (4), and remove the inner remote.



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Make sure the inner remote works correctly after installation.

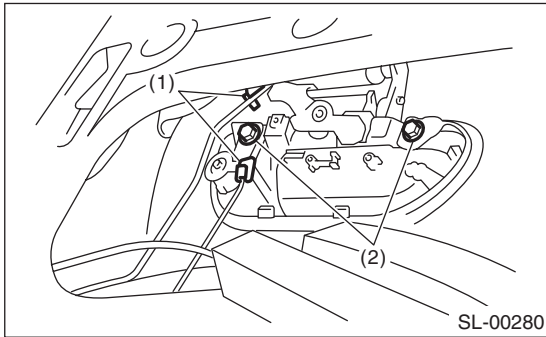
### C: INSPECTION

- 1) Check the cable of the door opener and door lock for deformation. When it is deformed, straighten it because failure operations may occur. When it is unrepairable, replace the front door latch and door lock actuator assembly.
- 2) Check the handle and cable for smooth operation.

### 6. Front Outer Handle

#### A: REMOVAL

- 1) Raise the front door glass to the top position.
- 2) Remove the door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the cable from the front inner remote. <Ref. to SL-33, REMOVAL, Front Inner Remote.>
- 4) Remove the sealing cover. <Ref. to EB-19, REMOVAL, Front Sealing Cover.>
- 5) Remove the rod clamps (1).
- 6) Remove bolts (2), then remove the front outer handle.



#### CAUTION:

Do not apply excessive force to remove the handle from the door panel. The door panel may become deformed.

#### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

*Refer to "COMPONENT" of "General Description". <Ref. to SL-2, DOOR LOCK ASSEMBLY, COMPONENT, General Description.>*

#### NOTE:

Make sure that the outer handle works correctly after installation.

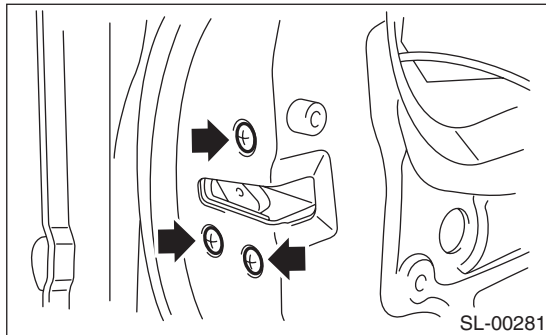
#### C: INSPECTION

- 1) Check the rod for deformation.
- 2) Check the lever and rod for smooth operation.

## 7. Front Door Latch and Door Lock Actuator Assembly

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the cable from the front inner remote. <Ref. to SL-33, REMOVAL, Front Inner Remote.>
- 4) Remove the sealing cover. <Ref. to EB-19, REMOVAL, Front Sealing Cover.>
- 5) Remove the front door glass. <Ref. to GW-11, REMOVAL, Front Door Glass.>
- 6) Remove the rear sash. <Ref. to GW-16, REMOVAL, Front Regulator and Motor Assembly.>
- 7) Open the handle rod cover of the latch assembly.
- 8) Remove the three screws.



- 9) Remove the front door latch & door lock actuator assembly, and disconnect the connector.

### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Refer to “COMPONENT” of “General Description”. <Ref. to SL-2, DOOR LOCK ASSEMBLY, COMPONENT, General Description.>**

#### **NOTE:**

Make sure the lock works correctly after installation.

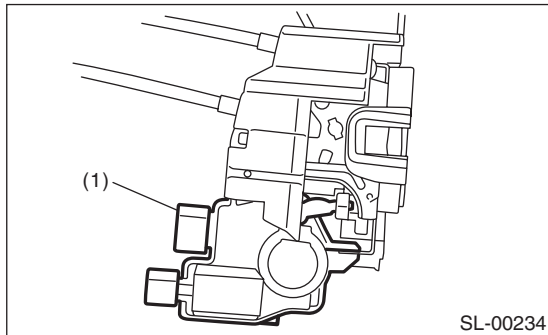
### C: INSPECTION

- 1) Check the rod and cable for deformation. When it is deformed, straighten it because failure operations may occur. When it is unrepairable, replace the front door latch and door lock actuator assembly.
- 2) Check the lever, rod and cable for smooth operation.

## 8. Front Door Lock Actuator

### A: REMOVAL

- 1) Remove the front door latch and door lock actuator assembly. <Ref. to SL-35, REMOVAL, Front Door Latch and Door Lock Actuator Assembly.>
- 2) Remove the claw of front door latch security cover, and then remove the cover.
- 3) Remove the screw from front door latch and door lock actuator, and then remove the door lock actuator.



(1) Front door lock actuator

### B: INSTALLATION

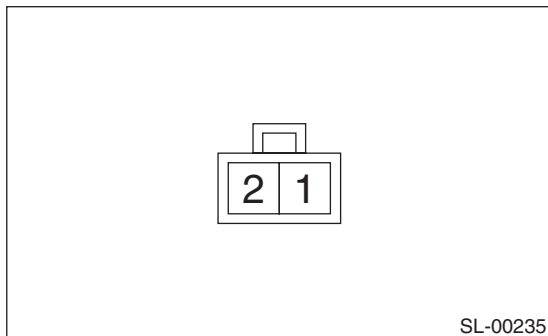
Install in the reverse order of removal.

**NOTE:**

Make sure the lock works correctly after installation.

### C: INSPECTION

- 1) Disconnect the door lock actuator harness connector.
  - 2) Connect the battery to door lock actuator terminals.
- If defective, replace the door lock actuator.

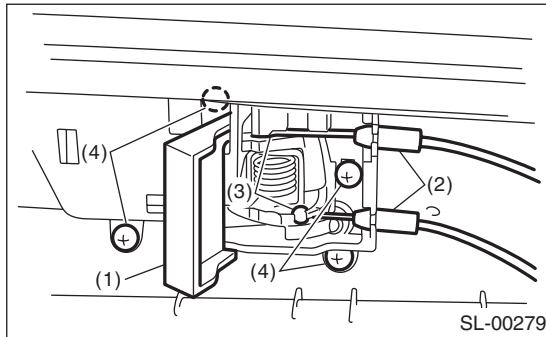


Terminal No.	Actuator operation
No. 2 (+) and No. 1 (-)	Unlock → Lock
No. 1 (+) and No. 2 (-)	Lock → Unlock

## 9. Rear Inner Remote

### A: REMOVAL

- 1) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 2) Remove the back cover (1) of inner remote.
- 3) Remove the cable (2).
- 4) Remove the cable end ball (3).
- 5) Remove screws (4), and remove the inner remote handle.



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Make sure the inner remote works correctly after installation.

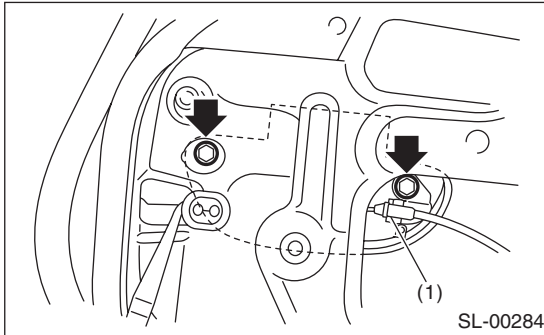
### C: INSPECTION

- 1) Check the cable of the door opener and door lock for deformation. When it is deformed, straighten it because failure operations may occur. When it is unrepairable, replace the rear door latch and door lock actuator assembly.
- 2) Check the handle and cable for smooth operation.
- 3) Check the child safety lock for correct operations.

### 10.Rear Outer Handle

#### A: REMOVAL

- 1) Raise the rear door glass to the top position.
- 2) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the sealing cover. <Ref. to EB-23, REMOVAL, Rear Sealing Cover.>
- 4) Remove the rear door latch assembly. <Ref. to SL-39, REMOVAL, Rear Door Latch and Door Lock Actuator Assembly.>
- 5) Pull out the cable from the cable clamp (1) of the outer handle.
- 6) Remove two bolts.



- 7) Remove the rear outer handle.

#### CAUTION:

Do not apply excessive force to remove the handle from the door panel. The door panel may become deformed.

#### B: INSTALLATION

Install in the reverse order of removal.

#### Tightening torque:

Refer to “COMPONENT” of “General Description”. <Ref. to SL-2, DOOR LOCK ASSEMBLY, COMPONENT, General Description.>

#### NOTE:

Make sure that the outer handle works correctly after installation.

#### C: INSPECTION

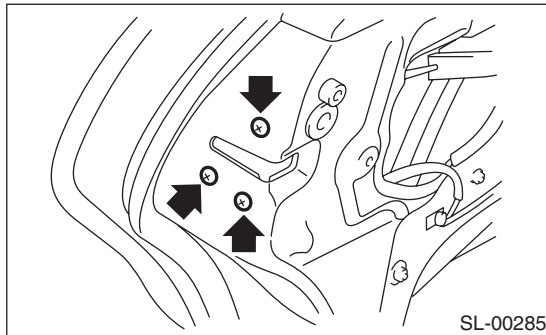
- 1) Check the cable for deformation. When it is deformed, straighten it because failure operations may occur. When it is unrepairable, replace the rear door latch and door lock actuator assembly.
- 2) Check the handle and cable for smooth operation.



## 11. Rear Door Latch and Door Lock Actuator Assembly

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the cable from rear inner remote. <Ref. to SL-37, REMOVAL, Rear Inner Remote.>
- 4) Remove the sealing cover. <Ref. to EB-23, REMOVAL, Rear Sealing Cover.>
- 5) Remove the rear door glass. <Ref. to GW-22, REMOVAL, Rear Door Glass.>
- 6) Remove the rear sash. <Ref. to GW-24, REMOVAL, Rear Regulator and Motor Assembly.>
- 7) Pull out the cable from the cable clamp of the outer handle.
- 8) Remove the three screws.



- 9) Disconnect the connectors, and then remove the rear door latch and door lock actuator assembly.

### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Refer to "COMPONENT" of "General Description". <Ref. to SL-2, DOOR LOCK ASSEMBLY, COMPONENT, General Description.>**

#### **NOTE:**

Make sure the lock works correctly after installation.

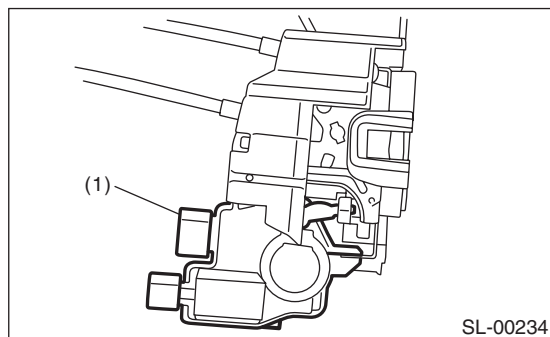
### C: INSPECTION

- 1) Check the cable for deformation. When it is deformed, straighten it because failure operations may occur. When it is unrepairable, replace the rear door latch and door lock actuator assembly.
- 2) Check that the lever and cable operates smoothly.

## 12.Rear Door Lock Actuator

### A: REMOVAL

- 1) Remove the rear door latch and door lock actuator assembly. <Ref. to SL-39, REMOVAL, Rear Door Latch and Door Lock Actuator Assembly.>
- 2) Remove the claw of rear door latch security cover, and then remove the cover.
- 3) Remove the screw from the rear door latch and door lock actuator, and then remove the door lock actuator.



(1) Rear door lock actuator

### B: INSTALLATION

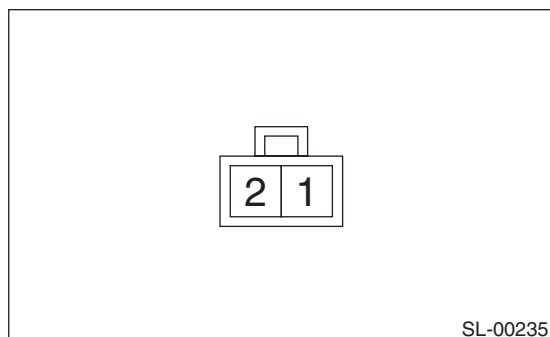
Install in the reverse order of removal.

**NOTE:**

Make sure the lock works correctly after installation.

### C: INSPECTION

- 1) Disconnect the door lock actuator harness connector.
- 2) Connect the battery to door lock actuator terminals. If defective, replace the door lock actuator.

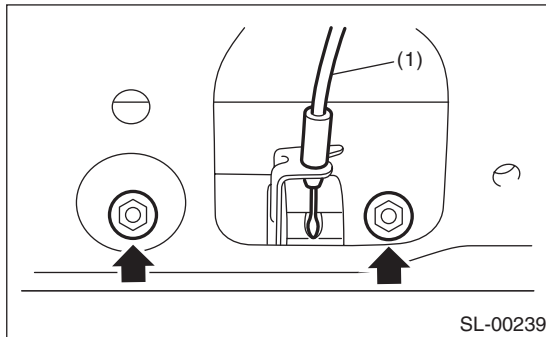


Terminal No.	Actuator operation
No. 2 (+) and No. 1 (-)	Unlock → Lock
No. 1 (+) and No. 2 (-)	Lock → Unlock

## 13. Rear Gate Outer Handle

### A: REMOVAL

- 1) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 2) Remove the rear gate garnish. <Ref. to EI-75, REMOVAL, Rear Gate Garnish.>
- 3) Remove the two nuts, and take out the rear gate outer handle.
- 4) Remove cable (1) of the rear gate handle.



### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Refer to “COMPONENT” of  
“General Description”. <Ref. to SL-3, TRUNK  
LID AND REAR GATE LOCK, COMPONENT,  
General Description.>**

#### **NOTE:**

Make sure that the outer handle works correctly after installation.

### C: INSPECTION

- 1) Check the cable of the rear gate handle for deformation.
- 2) Check the rear gate outer handle and cable of the rear gate handle for smooth operation.

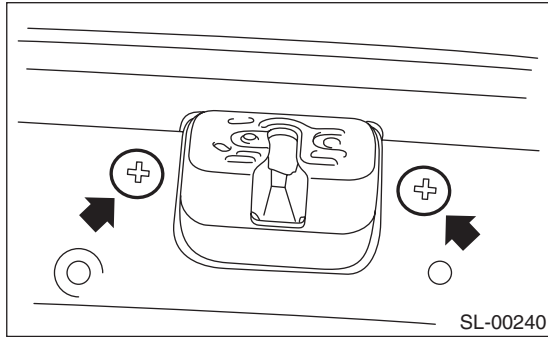
# Rear Gate Latch Assembly

## SECURITY AND LOCKS

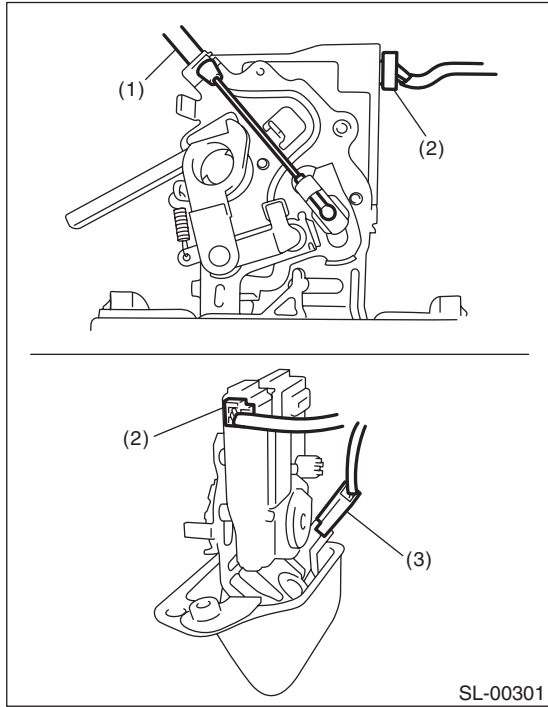
### 14. Rear Gate Latch Assembly

#### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 3) Remove the two screws.



- 4) Disconnect connectors and cables of the rear gate handle.



- (1) Cable
- (2) Rear gate lock actuator connector
- (3) Rear gate latch switch connector

- 5) Remove the rear gate latch assembly.

#### B: INSTALLATION

Install in the reverse order of removal.

##### **Tightening torque:**

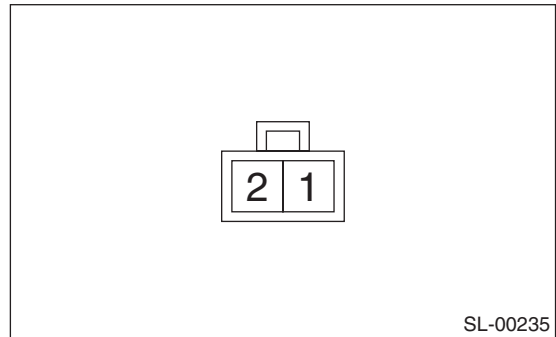
**Refer to "COMPONENT" of "General Description". <Ref. to SL-3, TRUNK LID AND REAR GATE LOCK, COMPONENT, General Description.>**

##### **NOTE:**

Make sure the lock works correctly after installation.

#### C: INSPECTION

- 1) Disconnect the rear gate lock actuator harness connector.
- 2) Connect the battery to rear gate lock actuator terminals.



Terminal No.	Actuator operation
No. 2 (+) and No. 1 (-)	Unlock → Lock
No. 1 (+) and No. 2 (-)	Lock → Unlock

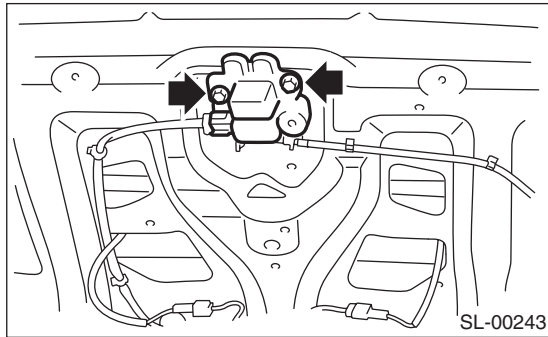
Replace the rear gate latch assembly if faulty.

- 3) Check the cable of the rear gate handle for deformation.
- 4) Check the lever and cable of the rear gate handle for smooth operation.

## 15. Trunk Lid Lock Assembly

### A: REMOVAL

- 1) Remove the trunk lid release handle. <Ref. to SL-44, REMOVAL, Trunk Lid Release Handle.>
- 2) Disconnect the connectors and remove the cable of the trunk opener.
- 3) Remove the two bolts to remove the trunk lid lock assembly.



### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

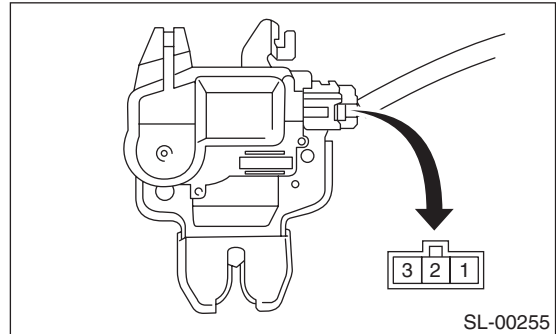
**Refer to “COMPONENT” of “General Description”. <Ref. to SL-3, TRUNK LID AND REAR GATE LOCK, COMPONENT, General Description.>**

#### **NOTE:**

- Apply grease to the movable part.
- Make sure the lock works correctly after installation.

### C: INSPECTION

- 1) Disconnect the trunk lid actuator harness connector.
- 2) Connect the battery to the trunk lid actuator terminals.



Terminal No.	Actuator operation
No. 2 (+) and No. 1 (-)	Lock → Unlock

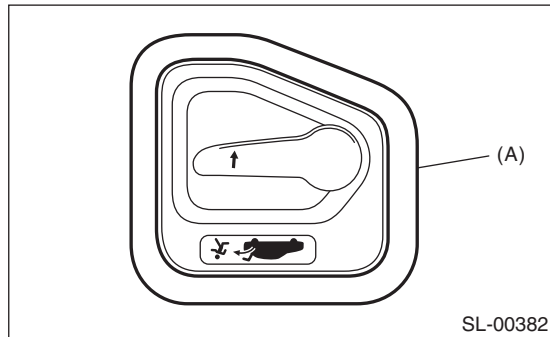
If defective, replace the trunk lid actuator.

- 3) Check the striker for deformation or abnormal wear.
- 4) Check the safety lever for improper movement.
- 5) Check other levers and springs for rust formation or unsmooth movement.
- 6) Check the cable of the trunk opener for smooth operation.

### 16. Trunk Lid Release Handle

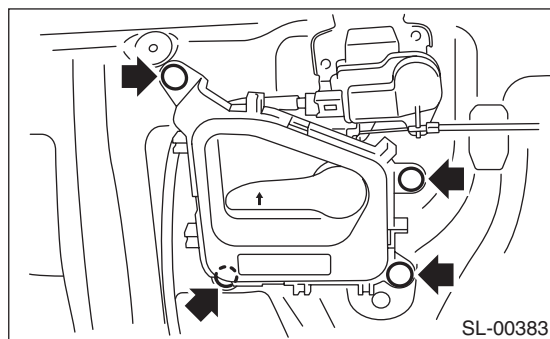
#### A: REMOVAL

1) Remove the cover (A).



2) Remove the trunk lid trim. <Ref. to EI-70, REMOVAL, Trunk Room Trim.>

3) Remove the four clips to remove the trunk lid release handle.



#### B: INSTALLATION

Install in the reverse order of removal.

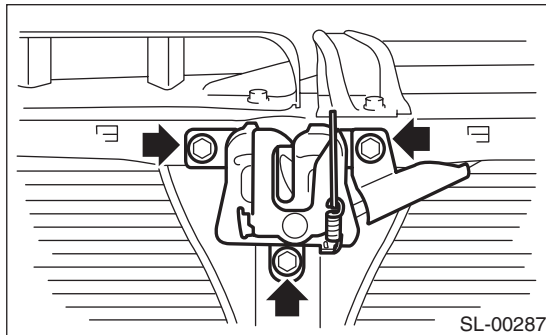
#### C: INSPECTION

Make sure the lever works smoothly.

## 17. Front Hood Lock Assembly

### A: REMOVAL

- 1) Open the front hood.
- 2) Remove the bolts, and then detach the front hood lock assembly.
- 3) Remove the cable from lock assembly.



### B: INSTALLATION

Install in the reverse order of removal.

#### *Tightening torque:*

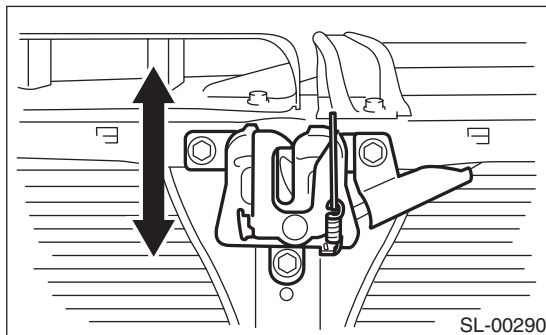
*Refer to "COMPONENT" of "General Description". <Ref. to SL-4, FRONT HOOD LOCK AND REMOTE OPENERS, COMPONENT, General Description.>*

#### NOTE:

- Apply grease to the movable part.
- Make sure the cable works correctly after installation.

### C: ADJUSTMENT

Loosen the bolt, and adjust the lock assembly while moving it up and down.



### D: INSPECTION

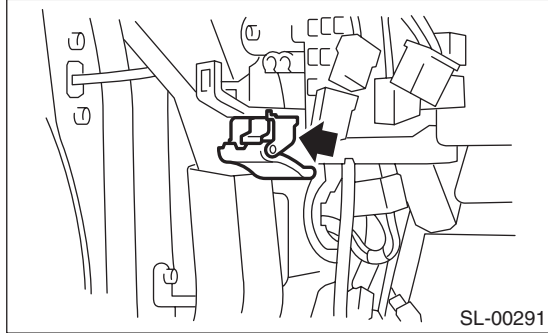
- 1) Check the striker for deformation or abnormal wear.
- 2) Check the safety lever for improper movement.
- 3) Check other levers and springs for rust formation or unsmooth movement.

## 18. Remote Openers

### A: REMOVAL

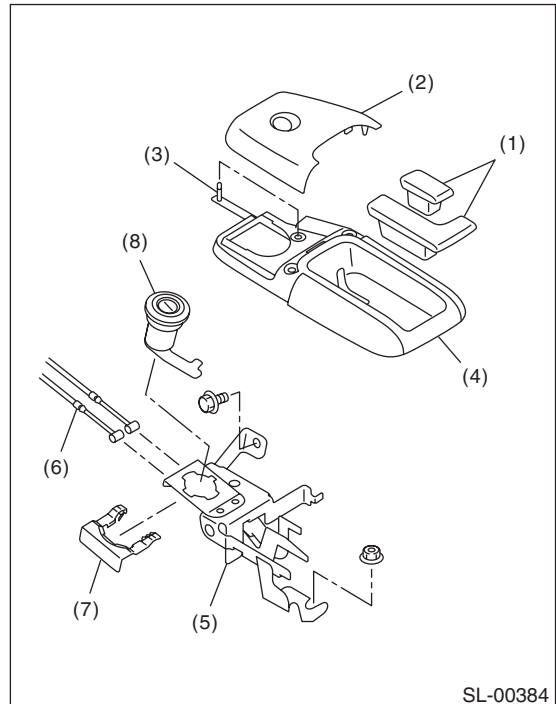
#### 1. FRONT HOOD OPENER

- 1) Remove the cable from the front hood lock.
- 2) Remove the bolt, and then detach the opener lever.



#### 2. TRUNK LID OPENER

- 1) Remove the rear seat. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 2) Remove the center pillar lower trim, side sill cover, rear pillar lower trim and floor mat on the driver's side. Remove the clip holding the cable.
- 3) Remove the opener lever (1) and rear cover (2).
- 4) Remove the pin (3) and remove front cover (4).
- 5) Remove the bolt and nut, and remove the pull handle assembly (5).



- (1) Opener lever
- (2) Rear cover
- (3) Pin
- (4) Front cover
- (5) Pull handle ASSY
- (6) Cable
- (7) Clamp
- (8) Key cylinder

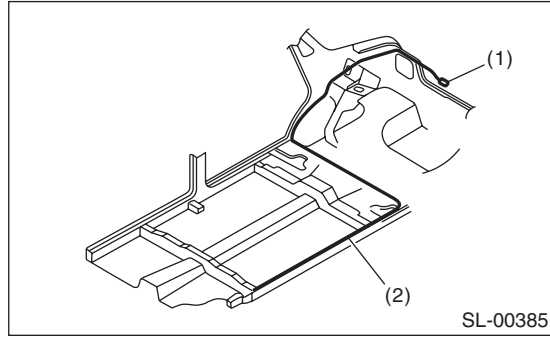
- 6) Remove the cable from the pull handle assembly (5).
- 7) Remove clamp (7) to remove the key cylinder (8).

**CAUTION:**

- Remove the key cylinder in the UNLOCK position.**
- 8) Remove the trunk lid lock assembly from the trunk lid.



9) Remove the cable from the trunk lid lock assembly.



- (1) Trunk lid lock ASSY
- (2) Cable

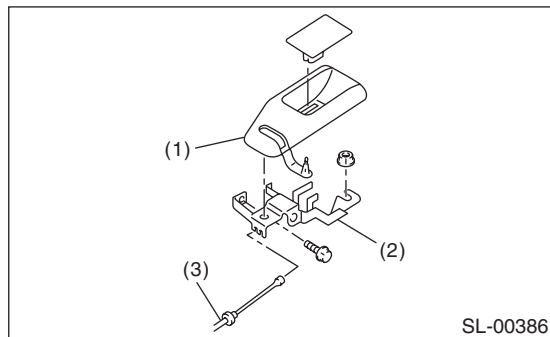
### 3. FUEL FILLER FLAP LID OPENER

#### Sedan model

Check the trunk lid opener. <Ref. to SL-46, TRUNK LID OPENER, REMOVAL, Remote Openers.>

#### Wagon model

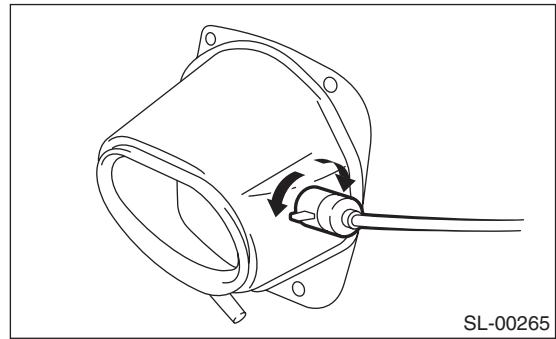
- 1) Remove the rear seat. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 2) Remove the center pillar lower trim, side sill cover, rear pillar lower trim and floor mat on the driver's side. Remove the clip holding the cable.
- 3) Remove the bolt and nut, and then detach the pull handle assembly.



- (1) Cover
- (2) Pull handle ASSY
- (3) Cable

- 4) Remove the cable from pull handle assembly.
- 5) Remove the rear quarter trim RH. <Ref. to EI-63, REMOVAL, Rear Quarter Trim.>

6) Rotate the fuel lock inside the quarter panel to 90° and remove. (Either right or left turn)



### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

Install the key cylinder to the trunk lid in the UNLOCK position.

### C: INSPECTION

Make sure the front hood, trunk lid and fuel filler flap lid open and close smoothly.

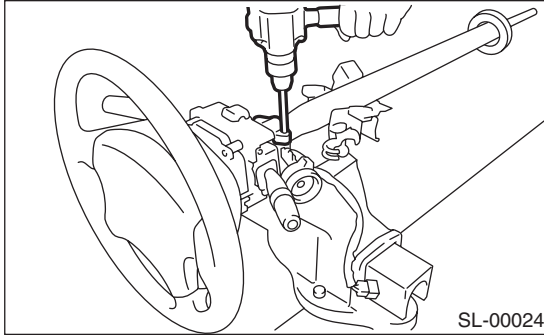
# Ignition Key Lock

## SECURITY AND LOCKS

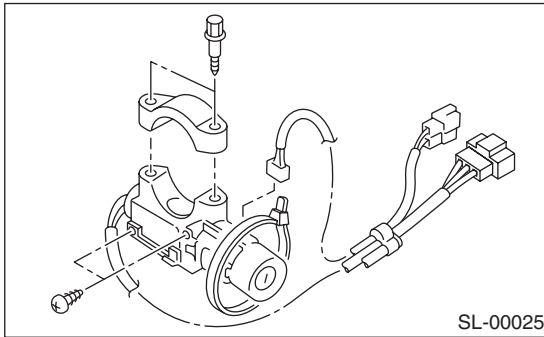
### 19. Ignition Key Lock

#### A: REPLACEMENT

- 1) Disconnect the ground cable from the battery.
- 2) Remove the steering column. <Ref. to PS-17, REMOVAL, Tilt Steering Column.>
- 3) Secure the steering column in a vise. Remove the bolt with a drill.

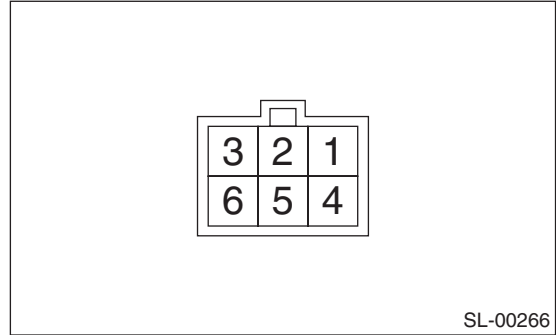


- 4) Remove the ignition key lock.
- 5) Using a new bolt, tighten the bolts all the way.



#### B: INSPECTION

- 1) Remove the instrument panel lower panel.
- 2) Remove the lower column cover.
- 3) Unfasten the fixing clip which secures harness, and then disconnect the connector of the ignition switch from body harness.
- 4) Turn the ignition key plate to each position and check the continuity between terminals of ignition connector.



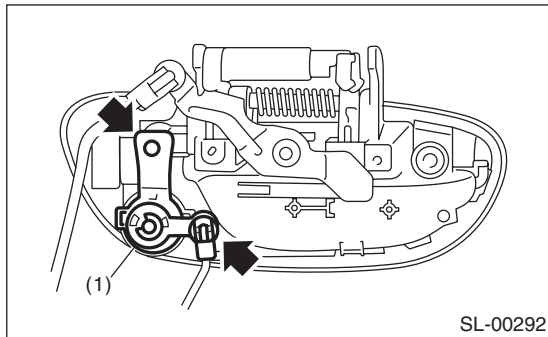
Switch position	Terminal No.	Standard
LOCK	—	—
ACC	No. 3 and No. 5	Less than 1 $\Omega$
ON	No. 3 and No. 5 No. 3 and No. 1 No. 3 and No. 4	Less than 1 $\Omega$
ST	No. 3 and No. 1 No. 3 and No. 4 No. 3 and No. 2	Less than 1 $\Omega$

If NG, replace the ignition switch.

## 20.Key Lock Cylinders

### A: REPLACEMENT

- 1) Raise the front door glass to the top position.
- 2) Remove the door trim. <Ref. to EI-49, REMOV-AL, Door Trim.>
- 3) Remove the sealing cover.
- 4) Remove the rod clamp and the bolt, then replace the key cylinder (1).



### 21. Security Control Unit

#### A: NOTE

The control of security system is carried out in body integrated unit. Refer to the section of body integrated unit for work.

- Removal <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
- Installation <Ref. to SL-55, INSTALLATION, Body Integrated Unit.>

## 22. Impact Sensor

### A: REMOVAL

- 1) Remove the key from ignition switch.
- 2) Close all the doors, trunk lid and rear gate.
- 3) Press the UNLOCK button of the keyless transmitter.
- 4) Change the setting of impact sensor using Subaru Select Monitor.
- 5) Disconnect the ground cable from the battery.
- 6) Remove the impact sensor.

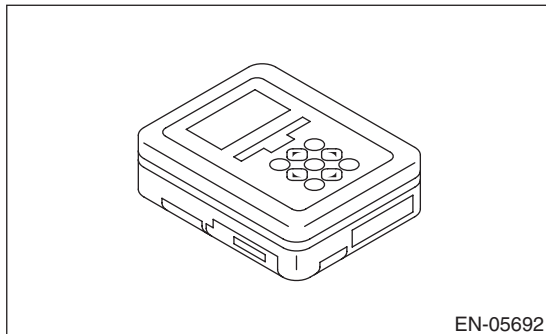
### B: INSTALLATION

- 1) Remove the key from ignition switch.
- 2) Close all the doors, trunk lid and rear gate.
- 3) Press the UNLOCK button of the keyless transmitter.
- 4) Disconnect the ground cable from the battery.
- 5) Install the impact sensor.
- 6) Connect the ground cable to the battery.
- 7) Change the setting of impact sensor using Subaru Select Monitor.

### C: OPERATION

#### 1. IMPACT SENSOR SETTING USING SUBARU SELECT MONITOR

- 1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>



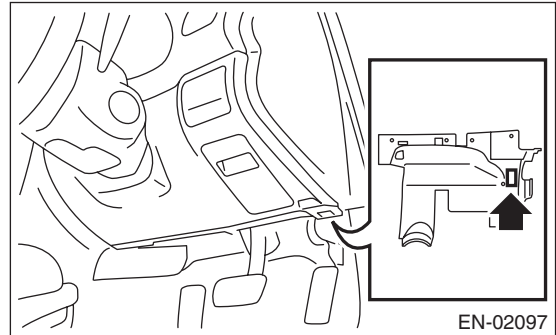
- 2) Prepare PC with Subaru Select Monitor installed.
- 3) Connect USB cable to SDI (Subaru Diagnostic Interface) and PC USB port (Subaru Select Monitor dedicated port).

#### NOTE:

Subaru Select Monitor dedicated port indicates USB port used when installing Subaru Select Monitor.

- 4) Connect the diagnosis cable to SDI.

- 5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

- 6) Start a PC.
- 7) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".
- 8) On the System Selection Menu, select the {Integ. Unit mode}.
- 9) Select {ECM customizing}.
- 10) Make a impact monitor setting.
  - When installing: ON
  - When removing: OFF
- 11) Make a impact monitor ON/OFF setting.
  - When installing: ON
  - When removing: OFF
- 12) Turn the ignition switch to OFF, and then remove the Subaru Select Monitor.

### D: ADJUSTMENT

#### 1. CHECK IMPACT SENSOR

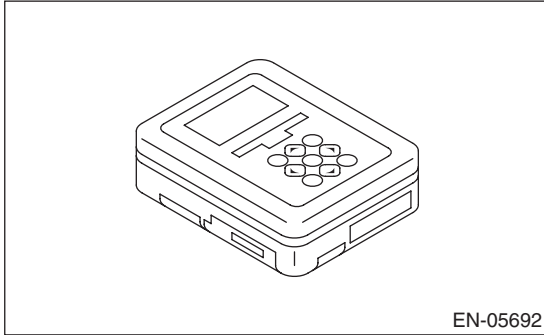
- 1) Remove the key from ignition switch.
- 2) Close all the windows.
- 3) Close all the doors, trunk lid and rear gate. Leave open the front hood.
- 4) Press the LOCK button of the keyless transmitter from outside of vehicle.
- 5) Check that the security indicator light blinks twice within 0.5 seconds in 2 second cycles after 30 seconds.
- 6) Hit the windshield with your palm continuously and check the security alarm operates. Lift up the front hood approx. 12 cm (4.7 in) or more, and then drop it off to check the operation of security alarm.
- 7) If NG, adjust the impact sensitivity.

# Impact Sensor

## SECURITY AND LOCKS

### 2. IMPACT SENSITIVITY ADJUSTMENT

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>

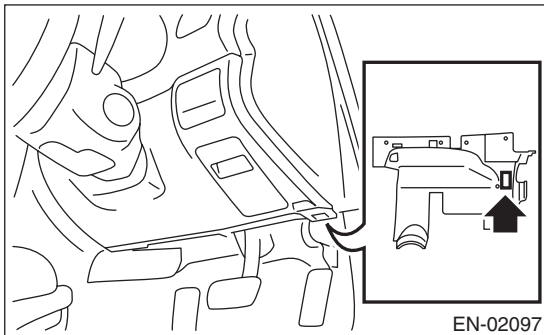


2) Prepare PC with Subaru Select Monitor installed.  
3) Connect USB cable to SDI (Subaru Diagnostic Interface) and PC USB port (Subaru Select Monitor dedicated port).

#### NOTE:

Subaru Select Monitor dedicated port indicates USB port used when installing Subaru Select Monitor.

4) Connect the diagnosis cable to SDI.  
5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

6) Start a PC.  
7) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".  
8) On the System Selection Menu, select the {Impact Sensor}.  
9) Make a {Sensitivity Adjustment Mode}.

- Sensitivity can be adjusted in 11 levels (0 to 10).
- Initial setting is 5.
- Smaller number means more sensitive.
- Larger number means less sensitive.

10) Turn the ignition switch to OFF, and then remove the Subaru Select Monitor.

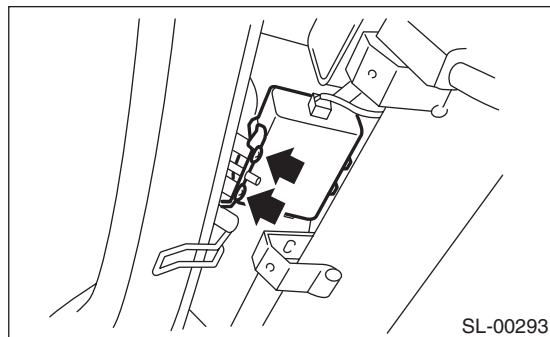
#### NOTE:

- Set the sensor so as not to let the alarm on normal vibration (reclining to the door, hit the ball and etc.).
- Set the sensor to operate the alarm with hitting the door or window glass, etc. continuously like a mayhem by robbery.
- Ask the customer about parking situation for setting, because the alarm operate when the vibration not only the burglar but also the construction etc.

## 23. Keyless Entry Control Module

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 3) Remove the screw, disconnect the connector and remove the keyless entry control module.



### B: INSTALLATION

Install in the reverse order of removal.

## 24. Keyless Buzzer

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front bumper. <Ref. to EI-30, REMOVAL, Front Bumper.>
- 3) Remove the keyless buzzer installed to the back side of the horn bracket.

### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Install the keyless buzzer to another vehicle which operates keyless buzzer normally, check the buzzer sounds. If NG, replace the keyless buzzer.



## 25. Body Integrated Unit

### A: REMOVAL

NOTE:

- When replacing the body integrated unit, check the current setting and note it. <Ref. to LAN(diag)-17, CONFIRMATION OF CURRENT SETTING, OPERATION, Subaru Select Monitor.>

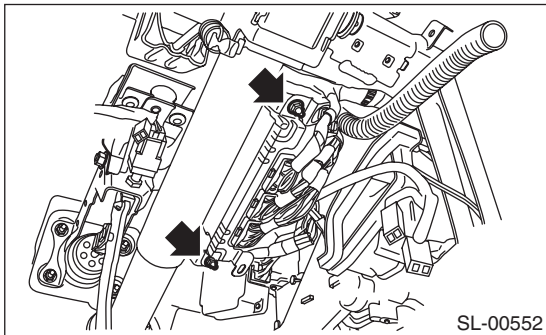
- When replacing the body integrated unit, all immobilizer keys also must be replaced and registered again.

- 1) Disconnect the ground cable from the battery.
- 2) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 3) Disconnect the connector of body integrated unit.

**CAUTION:**

**Be careful to keep water and other foreign materials away from body integrated unit.**

- 4) Remove two mounting nuts for body integrated unit bracket, and remove the body integrated unit.



### B: INSTALLATION

Install in the reverse order of removal.

NOTE:

- When the same body integrated unit is reinstalled in the same vehicle, it is not necessary to register the immobilizer again.

- When replacing a body integrated unit, perform the registration of immobilizer for the model with immobilizer. For detailed procedures, refer to "IMMOBILIZER TEACHING OPERATION MANUAL".

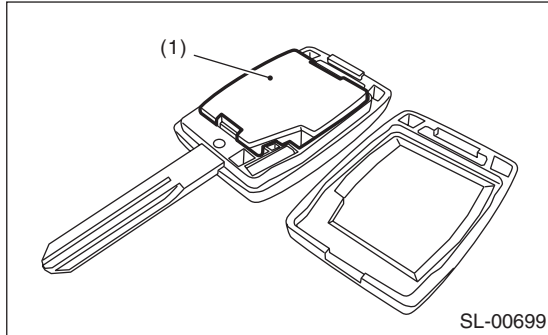
- Make sure that there are no differences from the contents of the current settings after installation. <Ref. to LAN(diag)-17, CONFIRMATION OF CURRENT SETTING, OPERATION, Subaru Select Monitor.>

## 26. Transmitter

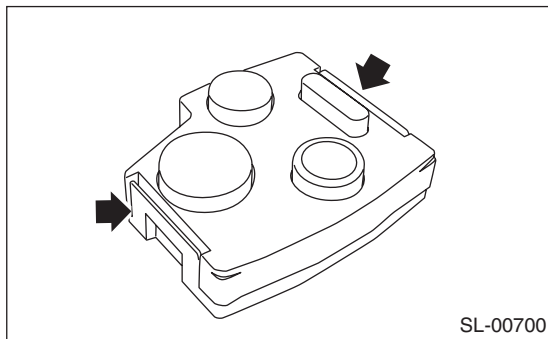
### A: REMOVAL

#### 1. TRANSMITTER BATTERY

1) Disassemble the keyless transmitter, and take out the transmitter case (1).



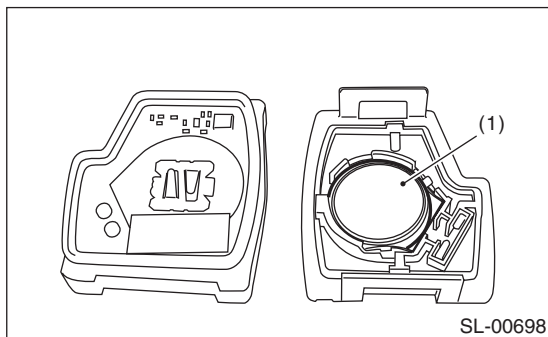
2) Remove the claw, and open the transmitter case.



3) Remove the battery (1) from the transmitter.

#### NOTE:

To prevent static electricity damage to the transmitter printed circuit board, touch the steel area of building with hand to discharge static electricity carried on body or clothes before disassembling the transmitter.



### B: INSTALLATION

#### 1. TRANSMITTER BATTERY

Install in the reverse order of removal.

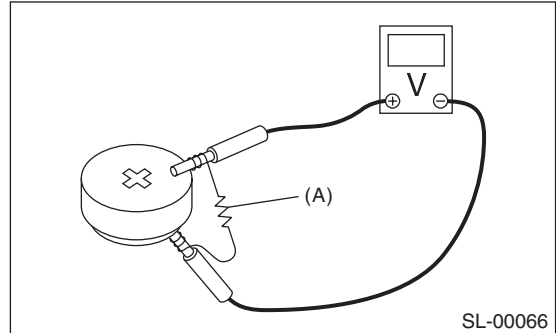
### C: INSPECTION

#### 1. TRANSMITTER BATTERY

Measure the voltage between the keyless transmitter battery (+) terminal and (-) terminal.

#### NOTE:

Battery discharge occurs during the measurement. Complete the measurement within 5 seconds.



(A) Resistance (47 Ω)

Tester connection		Standard
(+)	(-)	
Battery Positive terminal	Battery Ground terminal	2.5 — 3.0 V

If NG, replace the battery. (Use CR1620 or equivalent.)

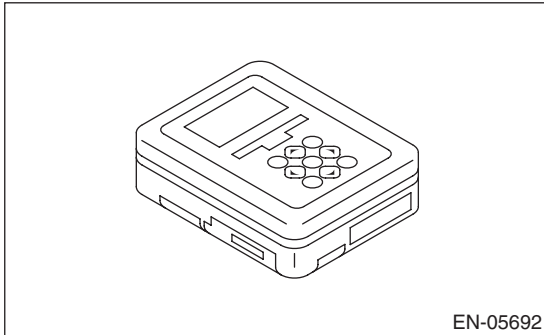
## D: REPLACEMENT

### 1. REGISTRATION OF KEYLESS TRANSMITTER WITH SUBARU SELECT MONITOR

**NOTE:**

- A maximum of four keyless transmitter can be registered for each individual vehicle.
- When replacing or adding the keyless transmitter, new registration of transmitter is necessary.

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H6DO)(diag)-7, PREPARATION TOOL, General Description.>

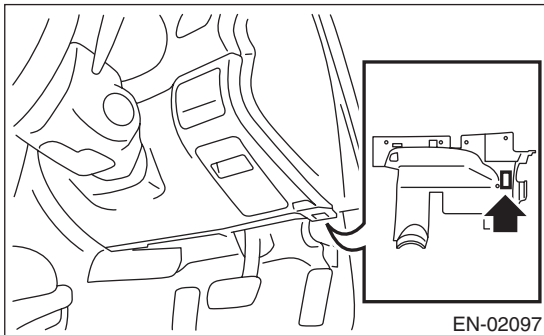


2) Prepare PC with Subaru Select Monitor installed.  
3) Connect USB cable to SDI (Subaru Diagnostic Interface) and PC USB port (Subaru Select Monitor dedicated port).

**NOTE:**

Subaru Select Monitor dedicated port indicates USB port used when installing Subaru Select Monitor.

4) Connect the diagnosis cable to SDI.  
5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).



**CAUTION:**

**Do not connect scan tools other than the Subaru Select Monitor.**

6) Start PC.  
7) Turn the ignition switch to ON (engine OFF), and start "PC application help for Subaru Select Monitor".  
8) On the «Main Menu» of the Subaru Select Monitor, select the "Each System Check" → "Integ. unit mode" → "Keyless transmitter ID registration".

9) Input the 8-digit ID number attached to the plastic bag of the keyless transmitter or inside the transmitter, from left to right. Press the [OK] key.

10) The ID number you have entered will be shown. Make sure that the ID number shown is the same as that of plastic bag or inside of transmitter.

11) Press the [OK] key if the ID number is correct. Press the [END] key if incorrect, to return to the step 3) and try again.

12) «ID registration in process...» is displayed and registration starts.

13) «ID registration done » will be displayed when the registration process is done.

14) To exit, select «END: NO» to return to {8. Keyless transmitter ID registration}. If there are additional keyless transmitters to be registered, select «Next registration: OK» to return to the step 4).

**NOTE:**

- If the registration fails, «ID registration failed. Try again.» will be shown. Select the [OK] key to return to the {8. Transmitter ID registration}. And retry from the step 3).

- «END: NO» is shown on the Subaru Select Monitor when fourth keyless transmitter has been registered. Select the [NO] key to return to {8. Keyless transmitter ID registration}.

### 27. Immobilizer Control Module

#### A: NOTE

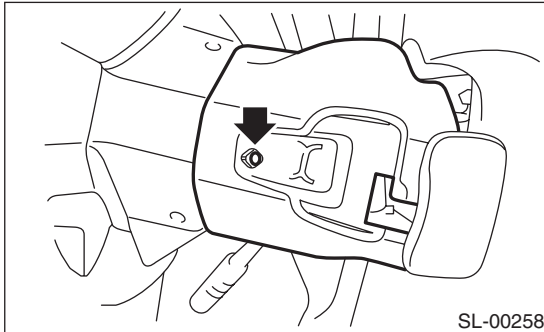
The control of immobilizer system is carried out in body integrated unit. Refer to the section of body integrated unit for work.

- Removal <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
- Installation <Ref. to SL-55, INSTALLATION, Body Integrated Unit.>

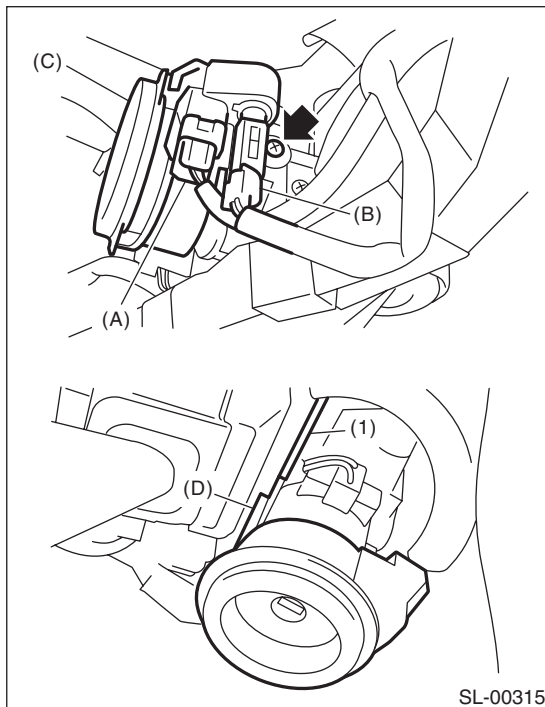
## 28. Immobilizer Antenna

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the screws, and detach the upper column cover and lower column cover.



- 3) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 4) Disconnect the immobilizer antenna connector (A) and ignition switch lighting connector (B).
- 5) Loosen the screw and release the lock (D) at opposite side using flat-tip screwdriver (1), and then detach the immobilizer antenna (C).



### CAUTION:

Do not apply excessive force to remove the immobilizer antenna and lock. Otherwise they may be broken because those parts are the products made of a plastic.

### B: INSTALLATION

Install in the reverse order of removal.

# Immobilizer Antenna

SECURITY AND LOCKS

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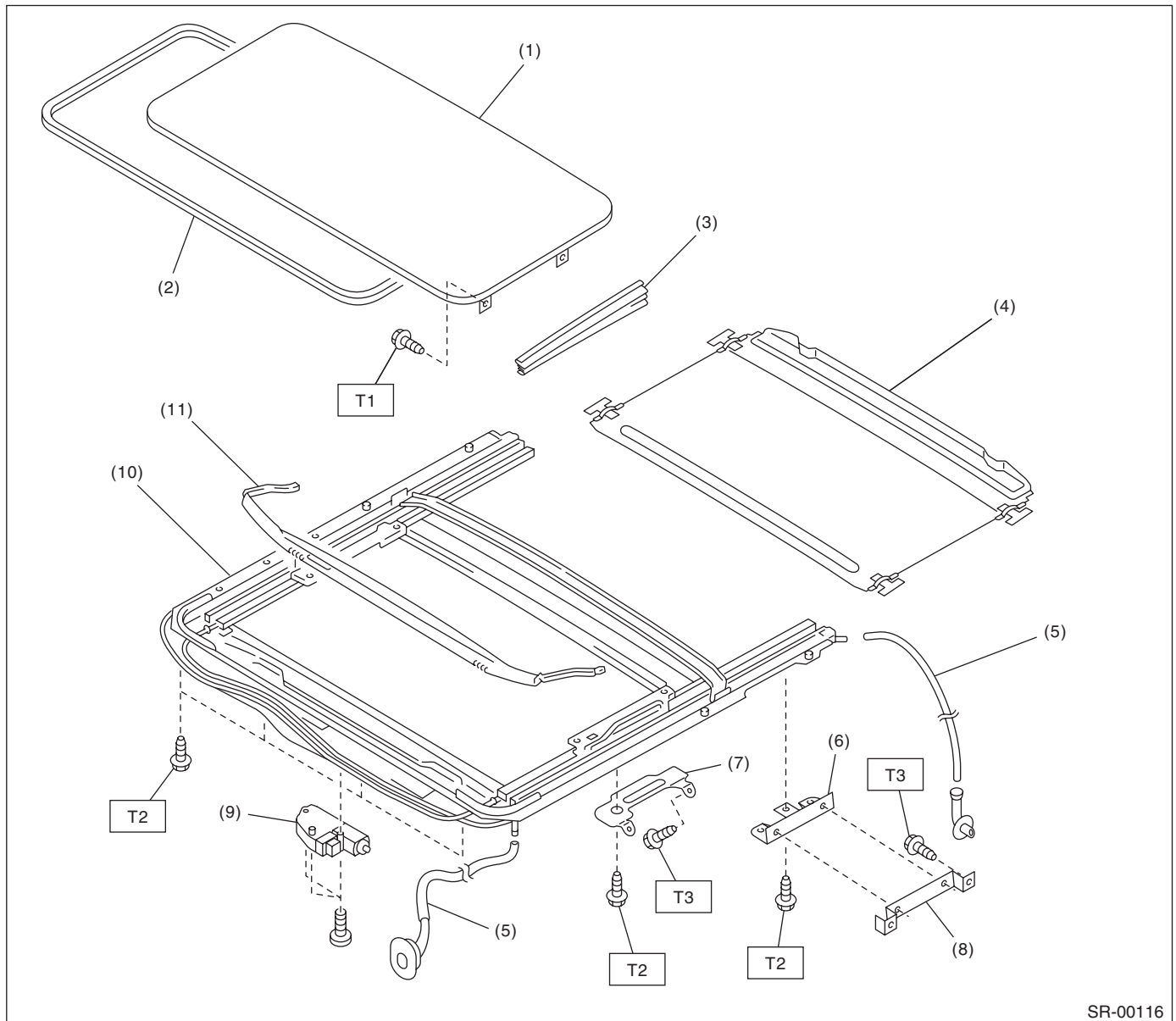
# General Description

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 1. General Description

### A: COMPONENT

#### 1. SEDAN MODEL



SR-00116

- |                                |                                 |
|--------------------------------|---------------------------------|
| (1) Glass lid                  | (7) Assist rail bracket (Front) |
| (2) Weather strip              | (8) Sunroof bracket (Rear)      |
| (3) Cover                      | (9) Motor ASSY                  |
| (4) Sunshade                   | (10) Frame ASSY                 |
| (5) Drain tube                 | (11) Deflector                  |
| (6) Assist rail bracket (Rear) |                                 |

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 4.5 (0.46, 3.3)**

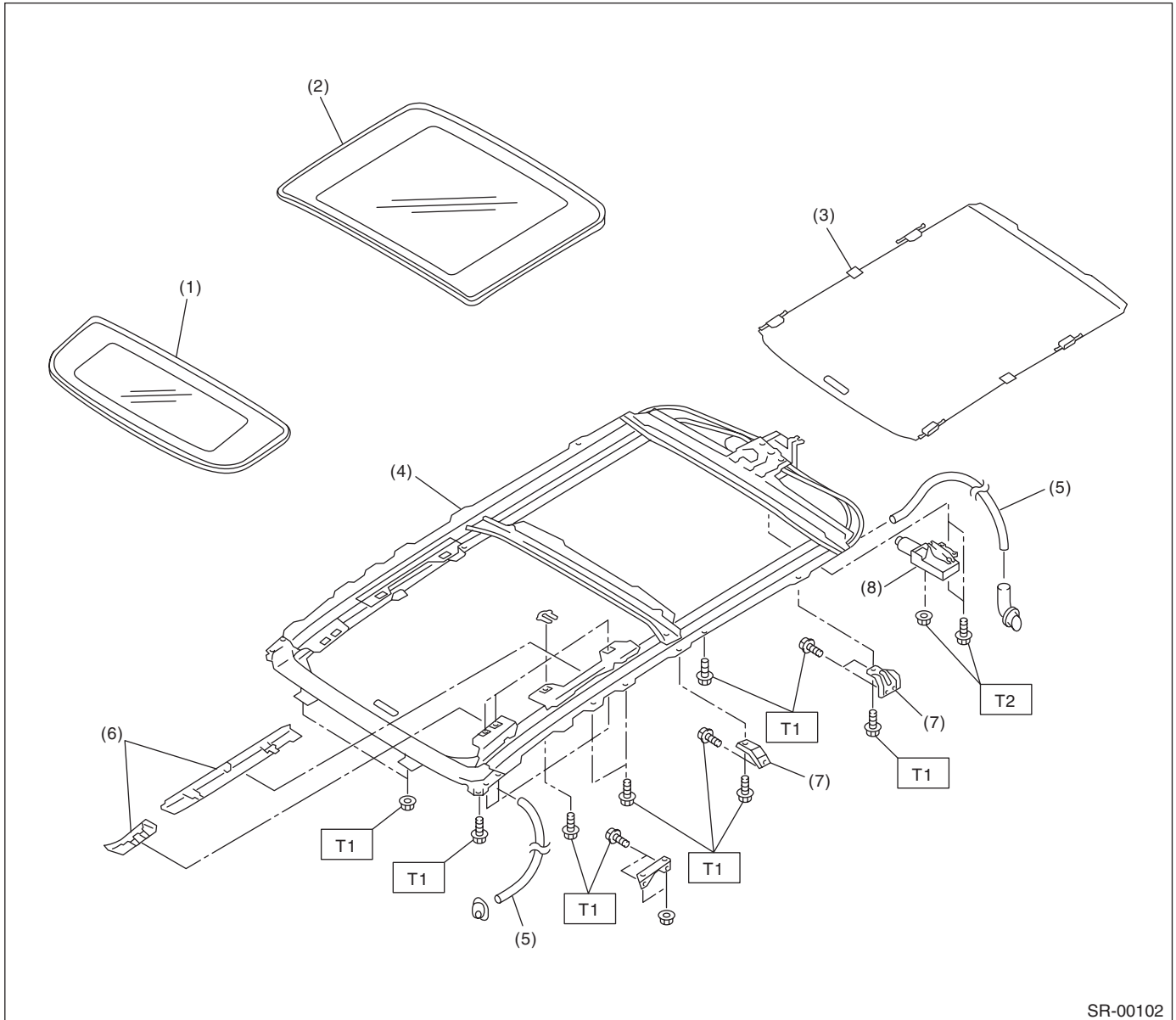
**T2: 6.0 (0.61, 4.4)**

**T3: 7.5 (0.76, 5.3)**

# General Description

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 2. WAGON MODEL



- |                       |                            |
|-----------------------|----------------------------|
| (1) Glass lid (Front) | (5) Drain tube             |
| (2) Glass lid (Rear)  | (6) Cover (Front and rear) |
| (3) Sunshade          | (7) Frame bracket          |
| (4) Frame ASSY        | (8) Motor ASSY             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.3)**

**T2: 4.5 (0.46, 3.0)**



## General Description

### SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

---

#### **B: CAUTION**

- Before disassembling or reassembling parts, always disconnect the battery ground cable from battery. When replacing the audio, control unit, and other parts provided with memory functions, record the memory contents before disconnecting the battery ground cable in order to prevent memory deletion.
- Reassemble the parts in the reverse order of disassembly unless otherwise indicated.
- Adjust parts to the given specifications.
- Connect the connectors securely for reassembly.
- After reassembly, make sure functional parts operate smoothly.

#### **C: PREPARATION TOOL**

##### **1. GENERAL TOOL**

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
TORX® T20	Used for removing and installing the sunroof motor, glass lid and sunshade. (Sedan model)

# Sunroof Control System

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 2. Sunroof Control System

### A: WIRING DIAGRAM

#### 1. SUNROOF

<Ref. to WI-210, WIRING DIAGRAM, Sunroof Control System.>

### B: INSPECTION

Symptom	Inspection order
Water leakage	<ol style="list-style-type: none"><li>1. Check roof panel and glass lid for improper or poor sealing.</li><li>2. Check drain tube for clogging.</li><li>3. Check sunroof frame seal and body for improper fit.</li></ol>
Booming noise, wind noise and other noise	<ol style="list-style-type: none"><li>1. Check glass lid and roof panel for improper clearance.</li><li>2. Check sunshade and roof trim for improper clearance.</li></ol>
Abnormal motor noise	<ol style="list-style-type: none"><li>1. Check installing part of motor for looseness.</li><li>2. Check gears and bearings for wear.</li><li>3. Check cable for wear.</li><li>4. Check cable pipe for deformities.</li></ol>
Failure of sunroof (Motor operates properly.)	<ol style="list-style-type: none"><li>1. Check guide rail for foreign particles.</li><li>2. Check guide rail for improper installation.</li><li>3. Check parts for mutual interference.</li><li>4. Check cable slider for improper clinching.</li><li>5. Check cable for improper installation.</li></ol>
Motor does not rotate or rotate improperly.	<ol style="list-style-type: none"><li>1. Check fuse for blown out.</li><li>2. Check switch for improper function.</li><li>3. Check motor for incorrect terminal voltage.</li><li>4. Check the relay for improper operation.</li><li>5. Check poor grounding system.</li><li>6. Check harness for open or short and terminals for poor connections.</li></ol>
Failure turn of glass lid	Check guide rail for foreign particles.

- Failure turn of glass lid while driving rough road.

Glass lid has auto-reverse function. When applied above specified force to the glass lid, the lid turns back and stops. When operating the glass lid (open or close) while driving the rough road, the lid judges vibration as a force and may causes failure turns. When the failure turn is occurred, need to perform the initialize operation with following procedure.

#### 1. INITIALIZE OPERATION (SEDAN MODEL)

- 1) Tilt up the glass lid.
- 2) Release the switch once, and press the tilt up switch again for 15 seconds.
- 3) When the glass lid is raised a little and returned to tilt up position, release the switch for the moment. (Initialization of position detecting function)
- 4) Keep pressing the tilt up switch within 5 seconds from releasing the switch. The glass lid will tilt down → slides open → slides close automatically. (When 5 seconds pass, the position detecting function is cancelled.)
- 5) Initialize operation is completed.

#### 2. INITIALIZE OPERATION (WAGON MODEL)

- 1) Apply force to the glass lid in the opening direction while the glass lid (rear) is closing, and make it reverse five times in a row.

However, in the following situation, the initialize operation is canceled.

- When the lid is fully closed once during one of the auto-reverse operations five times in a row.
  - When the interval between the auto-reverse operations was 30 seconds or more even once.
- 2) When the operation of glass lid shifts to inching operation\*, fully close the lid by switch operation.
  - 3) Initialize operation is completed.

\* Inching operation: A condition where the glass lid only operates for only at the moment when the switch is pressed, even when the switch is held down.

# Glass Lid

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 3. Glass Lid

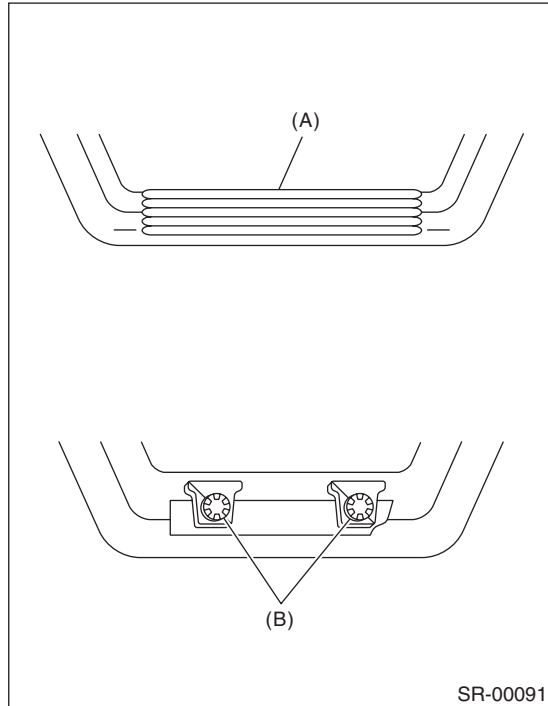
### A: REMOVAL

#### 1. SEDAN MODEL

- 1) Completely close the glass lid, and then open the sunshade.
- 2) Remove the cover (A), and then remove the TORX® bolts (B).

#### CAUTION:

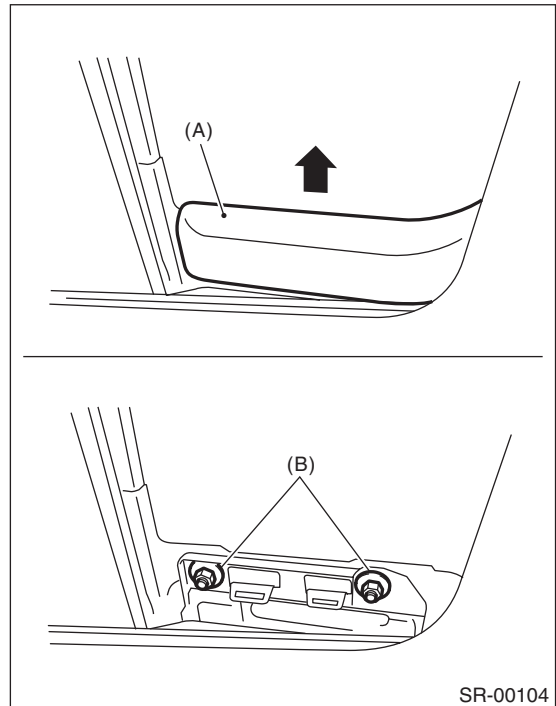
The thread locker is applied to the TORX® bolts, so use the new parts once they are removed.



- 3) Remove the glass lid carefully.

#### 2. WAGON MODEL (FRONT)

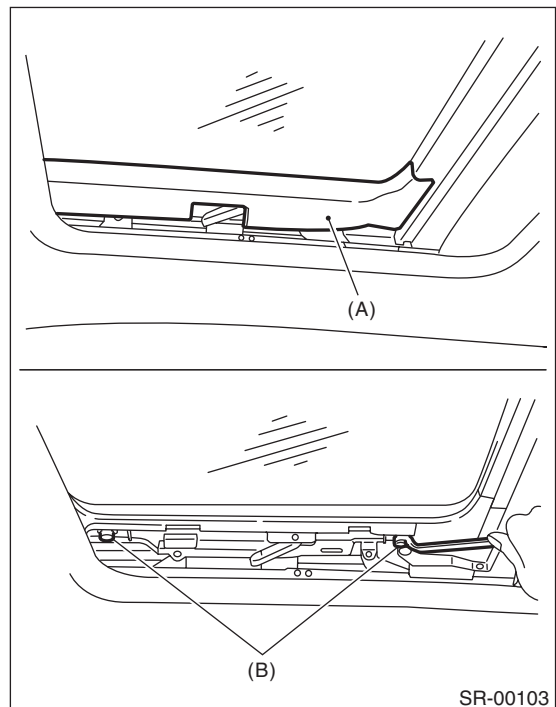
- 1) Open the sunshade.
- 2) Pull out the cover (A) towards the arrow mark, and remove the nuts (B).



- 3) Remove the glass lid (front) carefully.

#### 3. WAGON MODEL (REAR)

- 1) Tilt the glass lid (front) up, then open the sunshade.
- 2) Remove the cover (A), then remove the nuts (B).



- 3) Remove the glass lid carefully.

# Glass Lid

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## B: INSTALLATION

Install in the reverse order of removal.

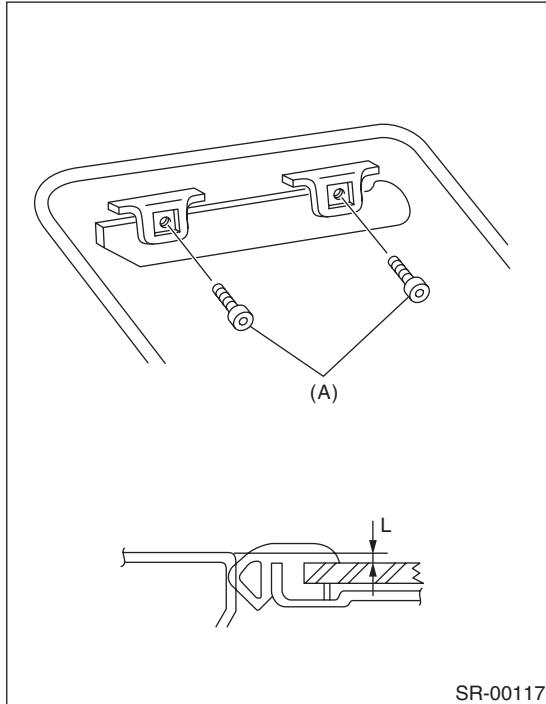
## C: ADJUSTMENT

### 1. SEDAN MODEL

Loosen the glass lid mounting TORX® bolts (A), and then adjust the height with moving the lid.

**Difference in height between glass lid and roof panel L:**

$2.0 \pm 1.0 \text{ mm (} 0.079 \pm 0.039 \text{ in)}$

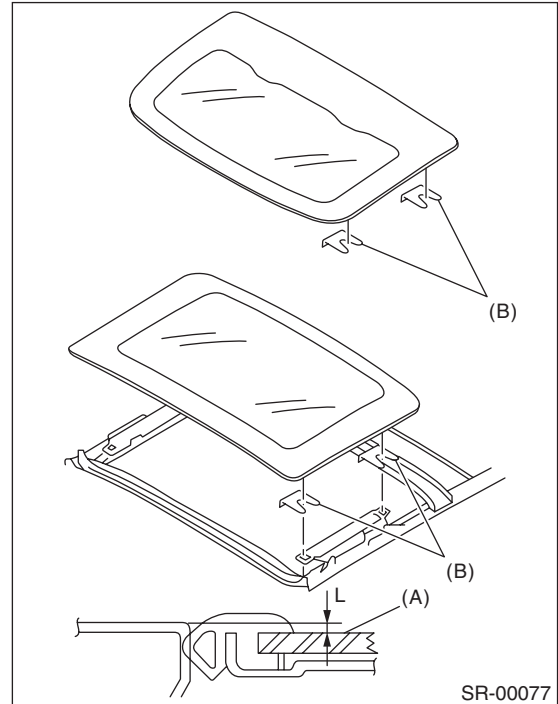


### 2. WAGON MODEL

Loosen the glass lid installation nuts, and adjust the height by adding (max: four pieces) or extracting (min: zero piece) shims (B) (standard: two pieces) between the glass lid (A) and body.

**Difference in height between glass lid and roof panel L:**

$2.0 \pm 1.0 \text{ mm (} 0.079 \pm 0.039 \text{ in)}$



# Glass Lid

## SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

### D: FORCED DRIVE

If glass lid does not operate or is not supplied with power, move the glass lid using the hexagon wrench.

Sedan model: bolt width 4 mm (0.16 in)

Wagon model: bolt width 5 mm (0.20 in)

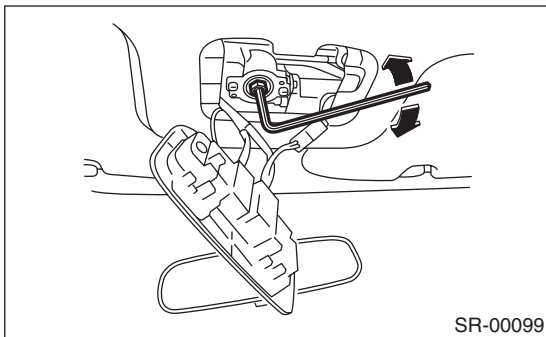
#### 1. SEDAN MODEL

1) Remove the spot map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>

2) Insert the hexagon wrench securely until it touches the motor shaft end.

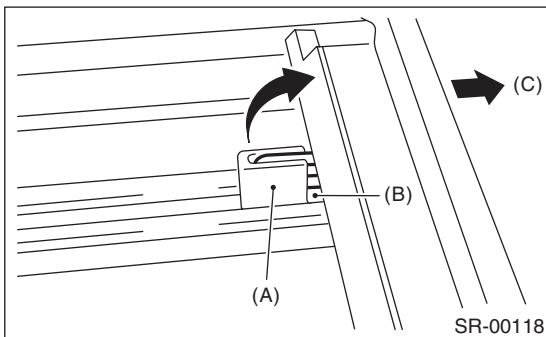
3) Turn the hexagon wrench, and move the glass lid.

- Turning right, the glass lid open.
- Turning left, the glass lid close.



#### 2. WAGON MODEL

1) Slide the slider (A) towards the rear of the vehicle (C), and remove the sun shade from the slider by raising the rod (B).

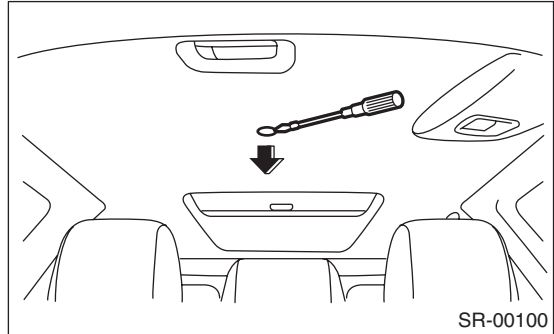


#### CAUTION:

Be careful not to damage the adjacent parts with the rod end when moving the glass lid with the hexagon wrench.

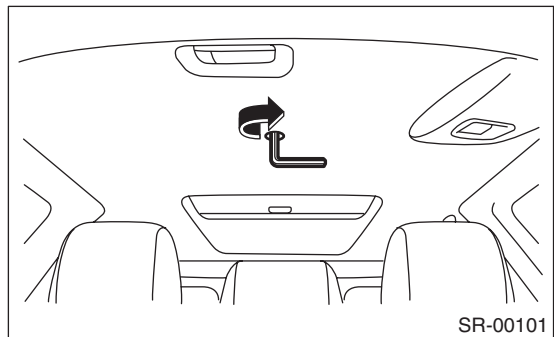
2) Slide the sunshade forward.

3) Remove the plug to the rear of the roof trim.



4) Insert the hexagon wrench securely until it touches the motor shaft end.

5) Turn the wrench to right, and close the glass lid (front and rear).



#### CAUTION:

After a forced operation, make sure to perform an initialize operation. <Ref. to SR-5, INSPECTION, Sunroof Control System.>

# Sunroof Assembly

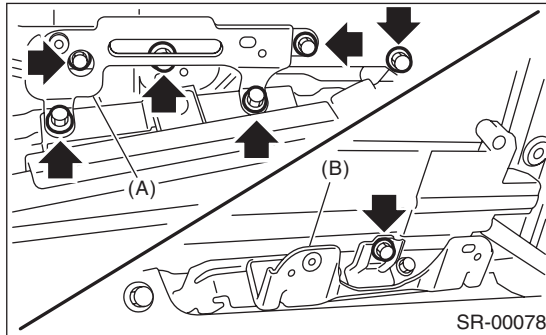
SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 4. Sunroof Assembly

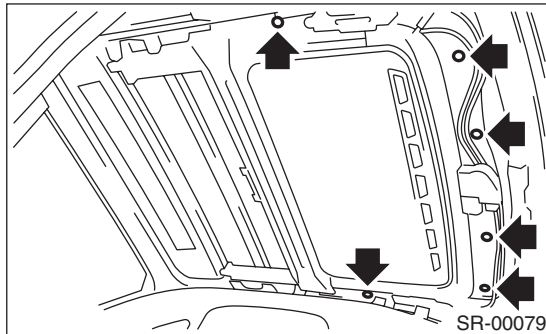
### A: REMOVAL

#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the roof trim. <Ref. to EI-67, SEDAN MODEL, REMOVAL, Roof Trim.>
- 3) Disconnect the harness connector of sunroof motor.
- 4) Remove the glass lid. <Ref. to SR-6, SEDAN MODEL, REMOVAL, Glass Lid.>
- 5) Remove the drain tube from frame assembly.
- 6) Remove the assist rail bracket (front) (A) and sunroof bracket (rear) (B).

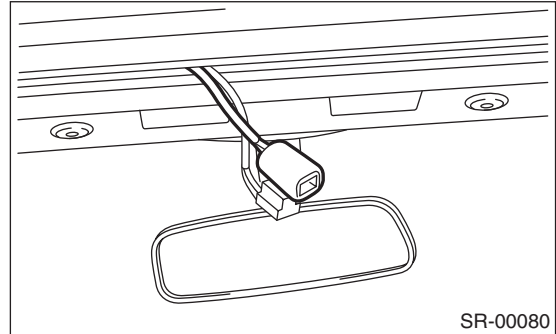


- 7) Remove the nuts, and then remove the frame assembly.

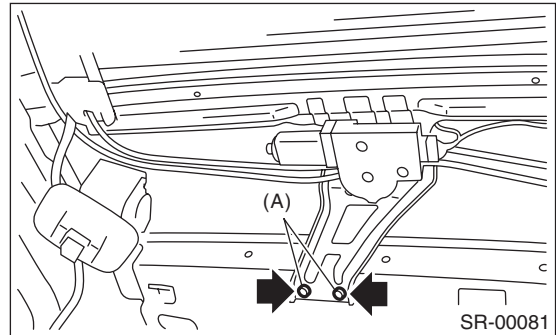


#### 2. WAGON MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the roof trim. <Ref. to EI-67, WAGON MODEL, REMOVAL, Roof Trim.>
- 3) Disconnect the harness connector of the motor assembly.



- 4) Remove the front and rear glass lid. <Ref. to SR-6, WAGON MODEL (FRONT), REMOVAL, Glass Lid.> <Ref. to SR-6, WAGON MODEL (REAR), REMOVAL, Glass Lid.>
- 5) Remove the attachment bolts (A) on the rear frame bracket of the frame assembly.

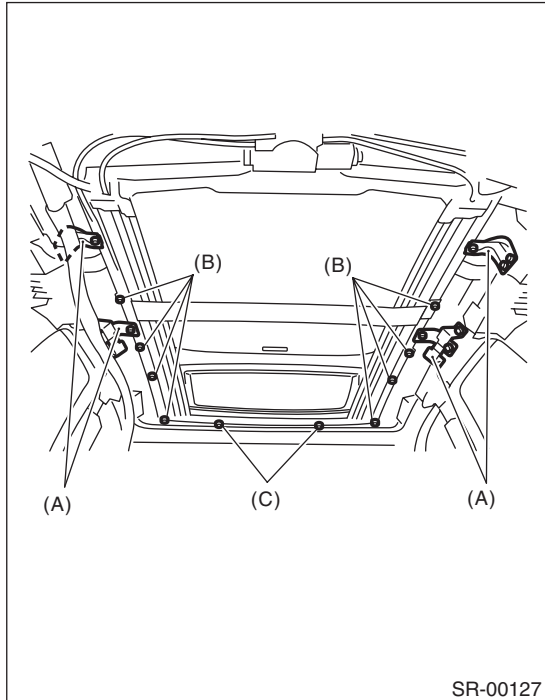


- 6) Remove the drain tube from frame assembly.
- 7) Remove the frame bracket (A).

# Sunroof Assembly

## SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

8) Remove bolts (B) and nuts (C), then remove the frame assembly.



SR-00127

## C: DISASSEMBLY

- 1) Remove the sunroof motor. <Ref. to SR-11, REMOVAL, Sunroof Motor.>
- 2) Remove the sunshade. <Ref. to SR-14, REMOVAL, Sunshade.>

## D: ASSEMBLY

Assemble in the reverse order of disassembly.

## B: INSTALLATION

Install in the reverse order of removal.

### CAUTION:

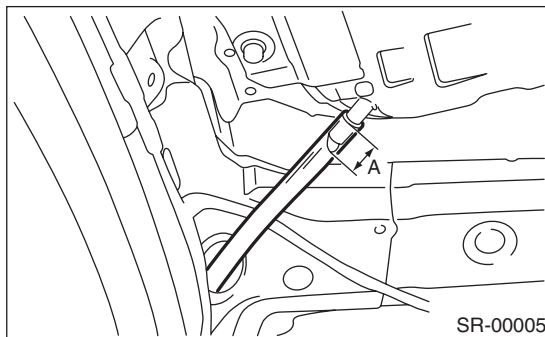
**Be careful not to snag the harness.**

### NOTE:

- Be sure to connect the harness connector.
- When installing the drain tube, insert it securely into drain pipe.

### Length A:

**15 mm (0.59 in) or more**



SR-00005

# Sunroof Motor

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 5. Sunroof Motor

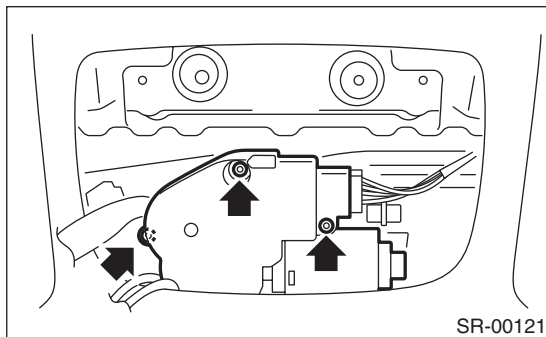
### A: REMOVAL

#### CAUTION:

- When removing the clip, use great care not to damage the roof trim.
- Never rotate the sunroof motor assembly after removing it.

#### 1. SEDAN MODEL

- 1) Completely close the glass lid.
- 2) Disconnect the ground cable from the battery.
- 3) Remove the spot map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>
- 4) Disconnect the harness connector and remove the TORX® bolts, and then remove the motor assembly.

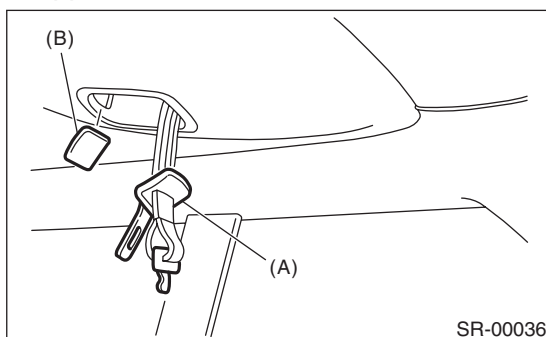


#### CAUTION:

When removing the motor assembly, secure the cable wires to prevent moves.

#### 2. WAGON MODEL

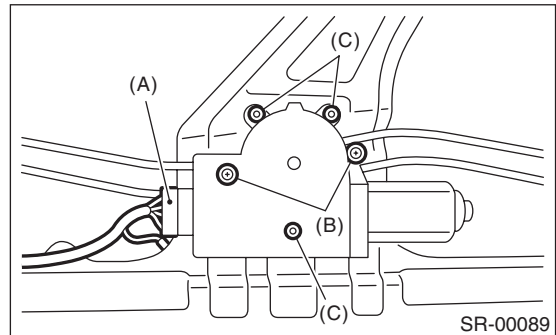
- 1) Fully close the glass lid (front) and glass lid (rear).
- 2) Disconnect the ground cable from the battery.
- 3) Remove the luggage room light. <Ref. to LI-34, ROOM LIGHT SWITCH, REMOVAL, Luggage Room Light.>
- 4) Remove the roof trim. <Ref. to EI-67, WAGON MODEL, REMOVAL, Roof Trim.>
- 5) Pass the seat belt tongue located on the center of the rear seat through the hole, and then pull it out to the opposite side of the trim.



- (A) Tongue  
(B) Cover

- 6) Remove the clips, and let the rear end of the roof trim hang.

- 7) Disconnect the harness connector (A), and then remove the motor assembly mounting bolts (B) and nut (C).



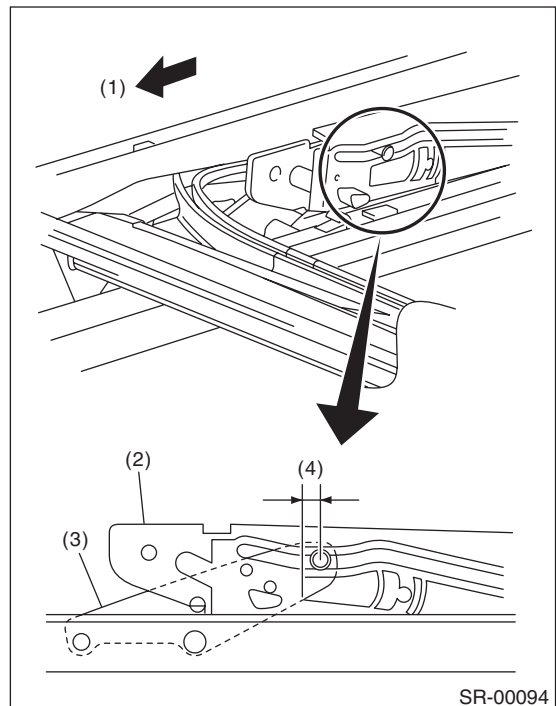
### B: INSTALLATION

#### CAUTION:

When installing the motor assembly, be careful not to move the sunroof cable.

#### 1. SEDAN MODEL

- 1) Align the coulisse assembly and link assembly in the same position.



- (1) Front  
(2) Coulisse ASSY  
(3) Link ASSY  
(4) 4.7 mm (0.185 in)



# Sunroof Motor

## SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

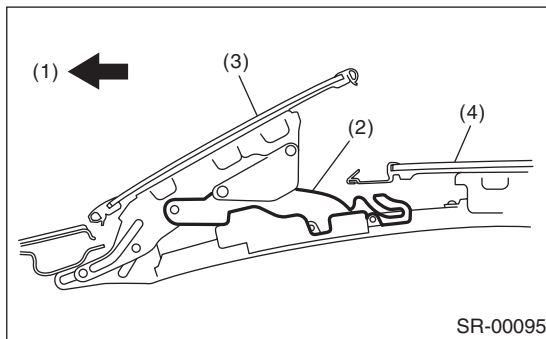
- 2) Install the motor assembly.
- 3) Connect the harness connector of motor assembly, and then connect the battery ground cable to battery.
- 4) Perform the initialize operation of motor.
  - (1) Tilt up the glass lid.
  - (2) Release the switch once, and press the tilt up switch again for 15 seconds.
  - (3) When the glass lid is raised a little and on tilt up position, release the switch for the moment.
  - (4) Keep pressing the tilt up switch within 5 seconds from releasing the switch, glass lid automatically performs the tilts down → slides open → slides close operation, then the initialize operation is completed.
- 5) Check the operation of sunroof with following table.

Operation	Switch position
(1) Glass lid closes completely.	Close
(2) Glass lid tilt up to the top position.	Tilt up
(3) Glass lid closes completely.	Tilt down
(4) Glass lid opens completely.	Open
(5) Glass lid closes 150 mm (5.91 in) away from the completely closed position.	Close
(6) Glass lid closes completely.	Close

- 6) Install the trim in the reverse order of removal.

## 2. WAGON MODEL

Check that the wedge of the glass lid (front) bracket is in contact at the vehicle forward direction end. At this time, the lid is at the fully open position.



- (1) Front
- (2) Wedge
- (3) Glass lid (Front)
- (4) Glass lid (Rear)

- 1) Install the motor assembly.
- 2) After the installation of the motor assembly, check again that the wedge of glass lid (front) bracket part is in contact at the vehicle forward direction end.
- 3) Connect the harness connector of motor assembly, and then connect the battery ground cable to battery.

- 4) Perform the initialize operation of motor.
  - When replacing the motor, fully close the glass once and perform position initialization, because the movement of the glass lid will shift to inching operation.
  - When reusing the motor, operate the auto-reverse function five times in a row to shift to the inching operation, then perform the initialization of position.
- 5) Check the operation of sunroof with following table.

Operation	Switch position
(1) Glass lid (front) and glass lid (rear) closes completely.	Close
(2) Glass lid (front) tilts up to the ventilating position.	Open
(3) Glass lid (front) tilts up to top position, and glass lid (rear) opens to just before the completely open position.	Open
(4) Glass lid (rear) opens completely.	Open
(5) Glass lid (rear) closes at a position 150 mm (5.91 in) from rear end of the tilted up glass lid (front).	Close
(6) Glass lid (rear) closes completely, and glass lid (front) stops in the ventilating position.	Close
(7) Glass lid (front) lowers, and then glass lid (front) and glass lid (rear) closes completely.	Close

- 6) Install the trim in the reverse order of removal.

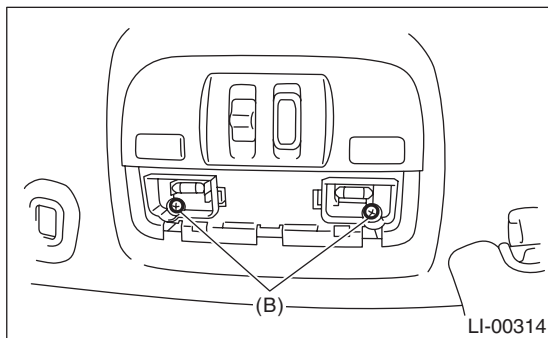
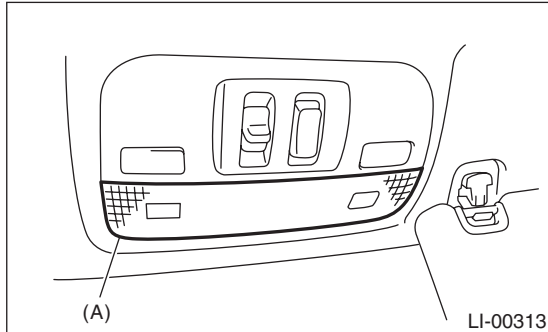
# Sunroof Switch

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

## 6. Sunroof Switch

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the spot map light lens (A) and sunroof switch mounting screws (B).



- 3) Disconnect the harness connector, and then re-remove the sunroof switch.

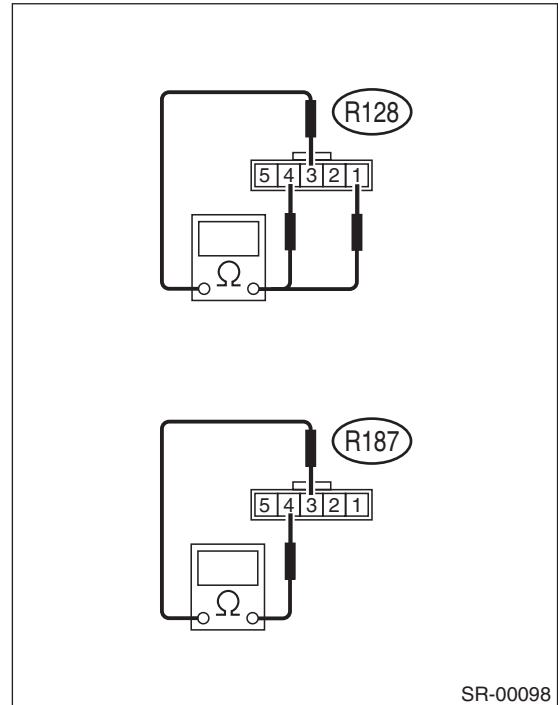
### B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

### 1. SEDAN MODEL

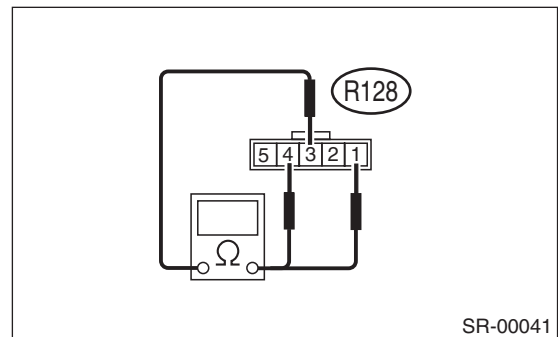
Measure the sunroof switch resistance.



Switch position	Terminal No.	Standard	Connector No.
Open	1 and 3	Less than 1 $\Omega$	R128
Close	3 and 4	Less than 1 $\Omega$	
Tilt up	1 and 3	Less than 1 $\Omega$	R187
Tilt down	3 and 4	Less than 1 $\Omega$	

### 2. WAGON MODEL

Measure the sunroof switch resistance.



Switch position	Terminal No.	Standard
Open	1 and 3	Less than 1 $\Omega$
Close	3 and 4	Less than 1 $\Omega$

#### NOTE:

If glass lid does not operate or is not supplied with power, move the glass lid using the hexagon wrench. <Ref. to SR-8, FORCED DRIVE, Glass Lid.>

# Sunshade

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

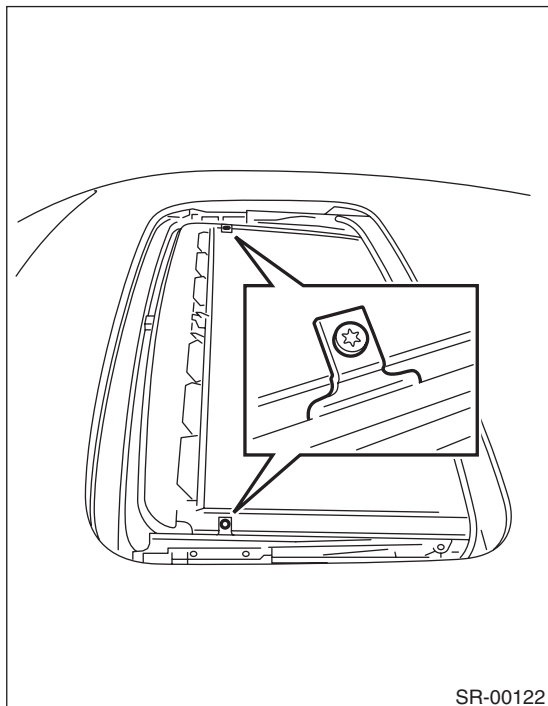
## 7. Sunshade

### A: REMOVAL

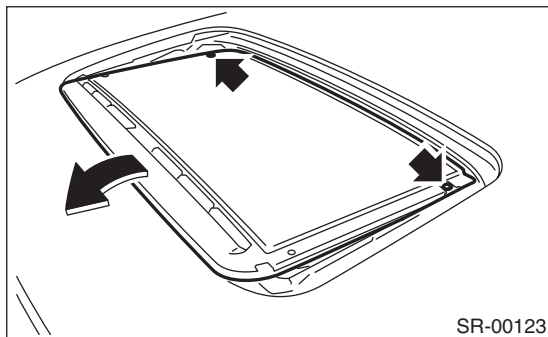
#### 1. SEDAN MODEL

1) Remove the glass lid. <Ref. to SR-6, SEDAN MODEL, REMOVAL, Glass Lid.>

2) Loosen the TORX® bolt to remove the front sunshade bracket.



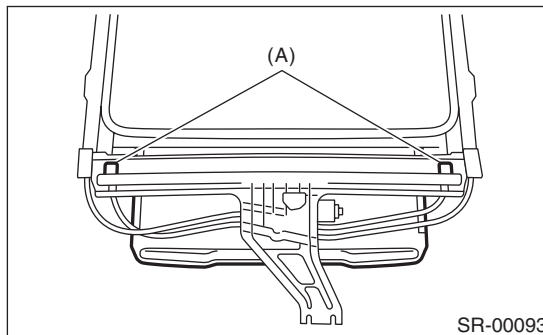
3) Pull the sunshade until the rear sunshade bracket comes into the sight, then loosen the TORX® bolts to remove the sunshade.



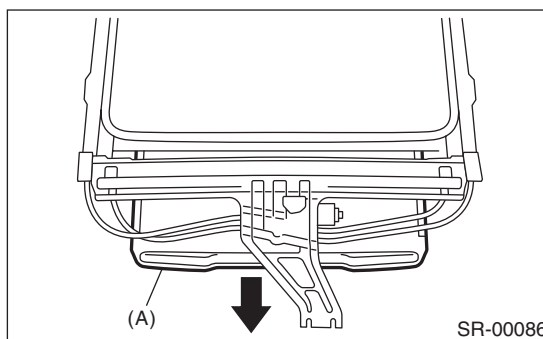
#### 2. WAGON MODEL

1) Remove the frame assembly.

2) Remove the shade stopper (A) of the sunshade.



3) Pull out the sunshade (A) from the sunroof frame.



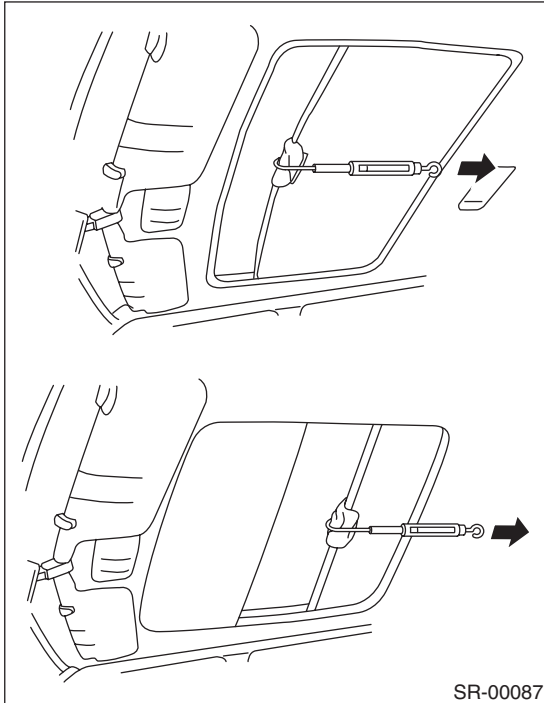
## B: INSTALLATION

Install in the reverse order of removal.

## C: INSPECTION

### 1. CHECK FOR MOVING LOAD OF SUNSHADE

1) Attach a spring scale to sunshade edge using a cloth.



2) Pull the spring scale to measure moving load of the sunshade.

#### ***Moving load of sunshade:***

##### ***Standard***

***18.0±5.0 N (1.8±0.5 kgf, 13±3.7 lbf)***

#### **NOTE:**

Moving load is larger at the beginning of pulling a spring scale, so take a spring scale reading while sunshade sliding smoothly.

3) If moving load exceeds specifications, check the glass lid, sunshade and frame assembly for improper installation.

# Sunshade

SUNROOF/T-TOP/CONVERTIBLE TOP (SUNROOF)

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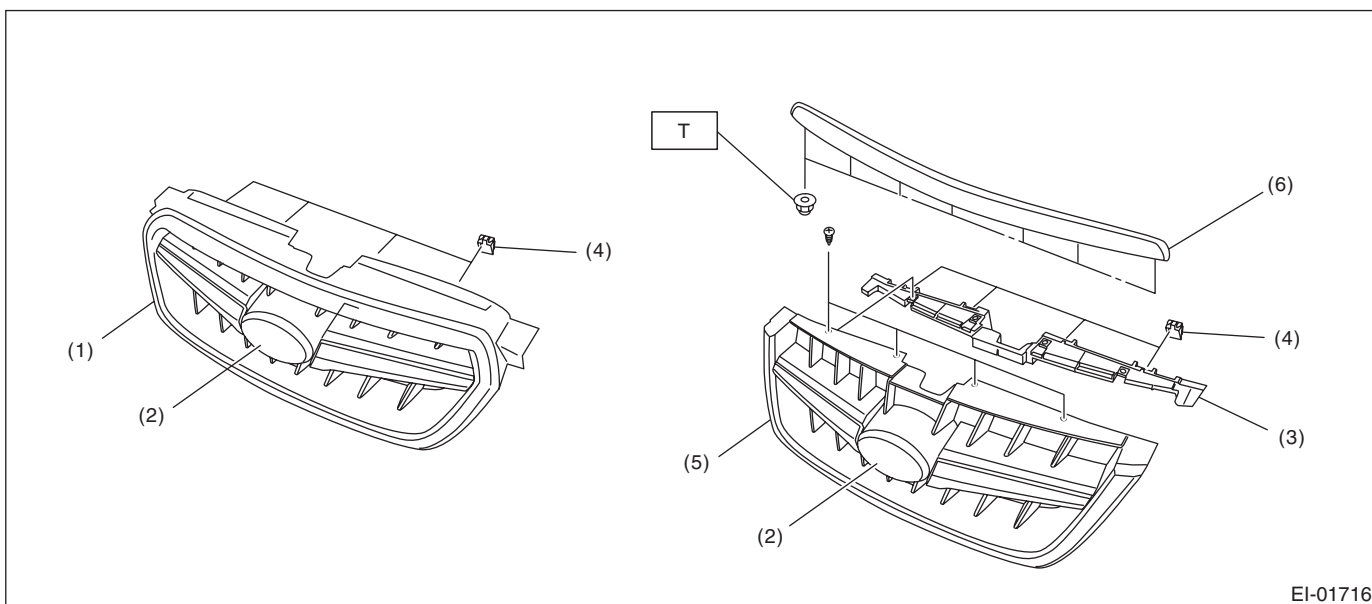
# General Description

EXTERIOR/INTERIOR TRIM

## 1. General Description

### A: COMPONENT

#### 1. FRONT GRILLE



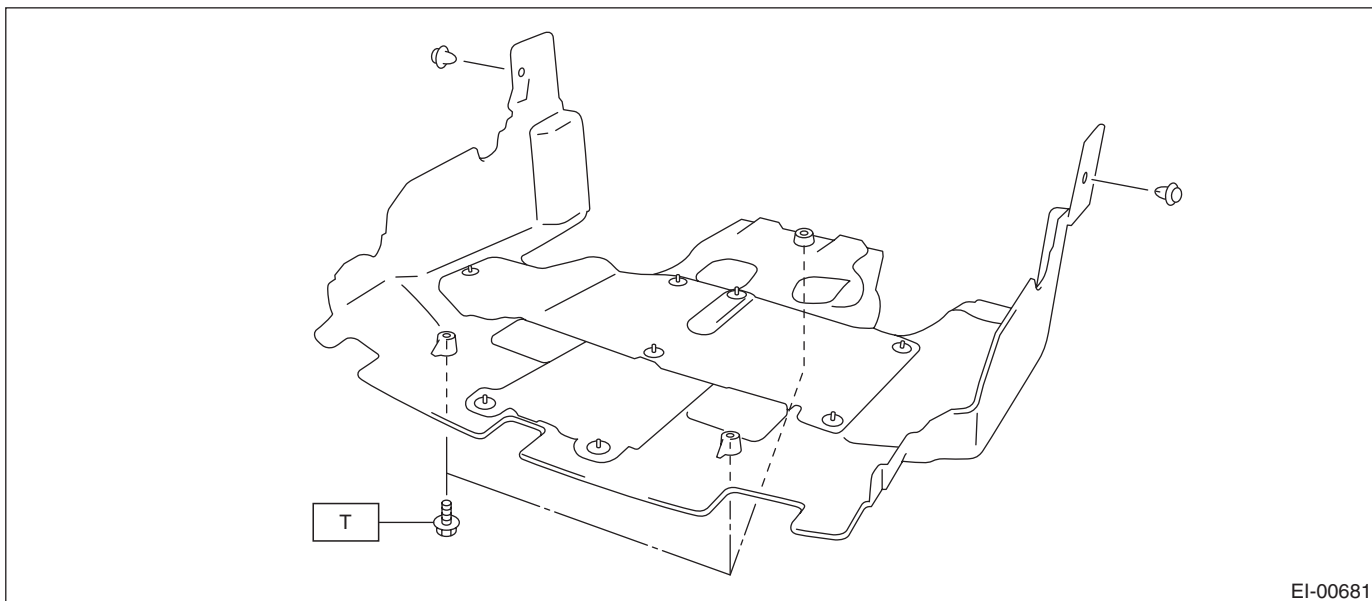
EI-01716

- (1) Front grille ASSY
- (2) Front grille emblem
- (3) Front grille bracket
- (4) Front grille clip

- (5) Front grille ASSY (OUTBACK model)
- (6) Front upper grille (OUTBACK model)

**Tightening torque:N·m (kgf·m, ft·lb)**  
**T: 4.5 (0.45, 3.18)**

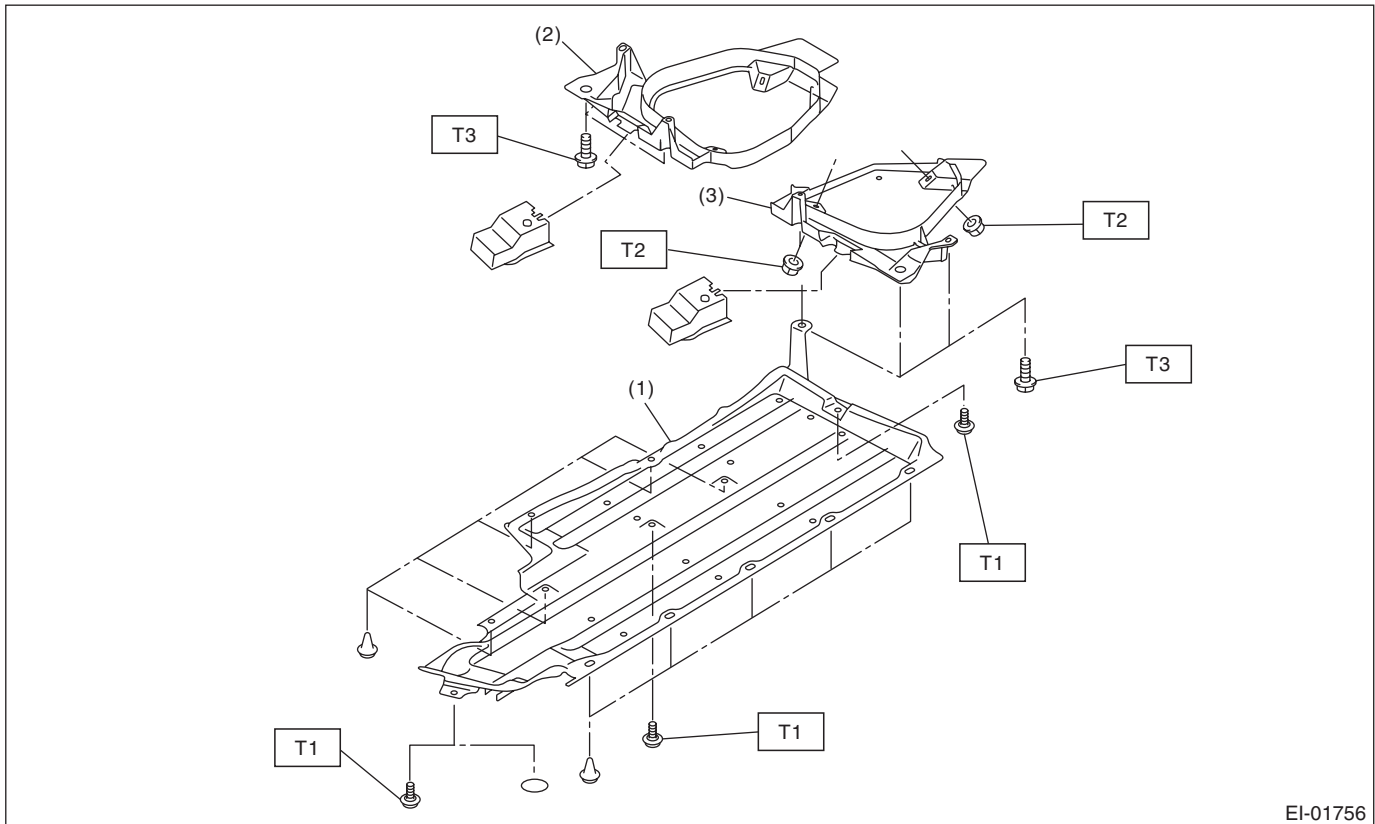
#### 2. UNDER COVER



EI-00681

**Tightening torque:N·m (kgf·m, ft·lb)**  
**T: 18 (1.84, 13.3)**

## 3. UNDER PROTECTOR



EI-01756

- (1) Floor under protector
- (2) Fuel tank protector RH
- (3) Fuel tank protector LH

**Tightening torque: N-m (kgf-m, ft-lb)**

**T1: 7.5 (0.77, 5.53)**

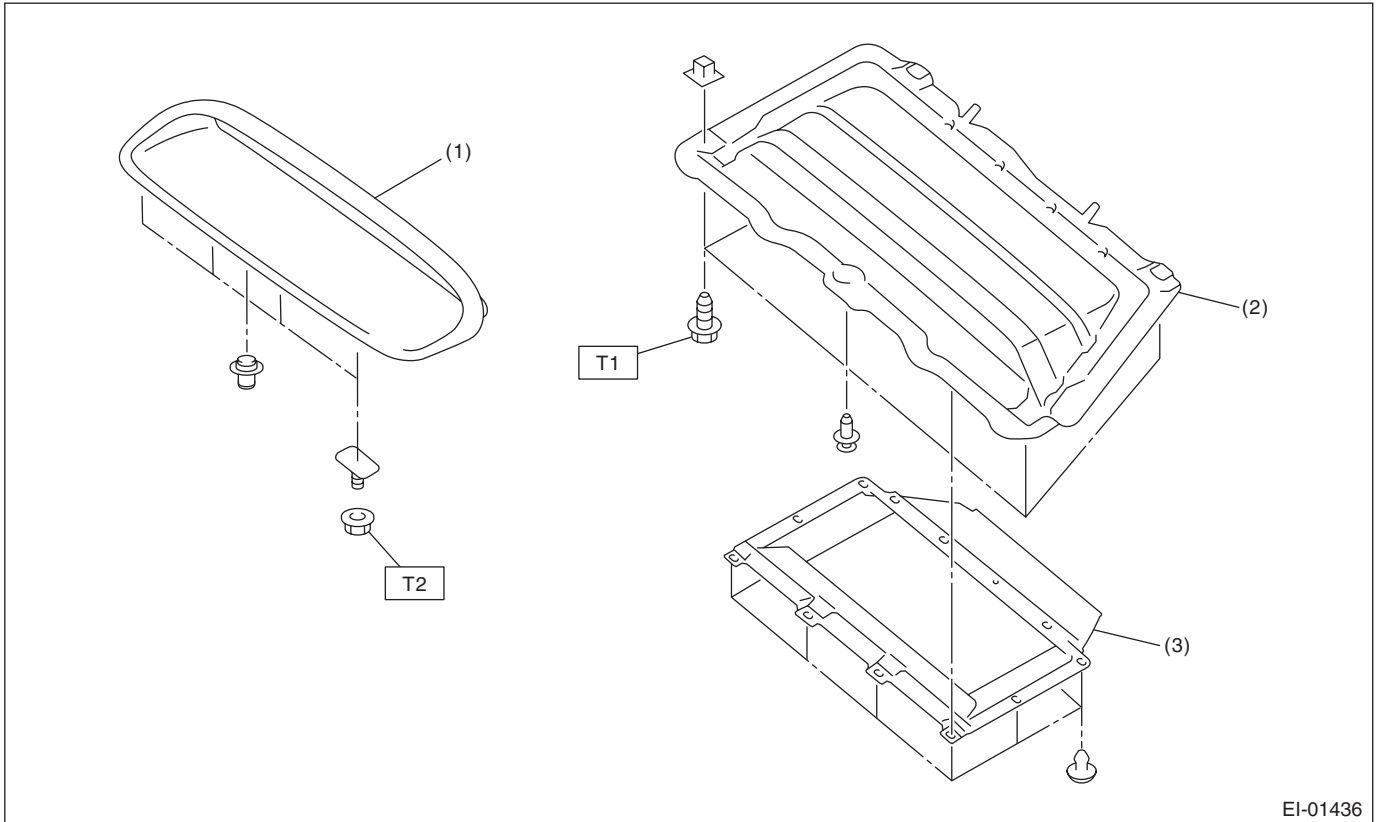
**T2: 9 (0.92, 6.5)**

**T3: 17.5 (0.92, 12.9)**

# General Description

EXTERIOR/INTERIOR TRIM

## 4. FRONT HOOD GRILLE



- (1) Front hood grille
- (2) Grille duct upper
- (3) Grille duct lower

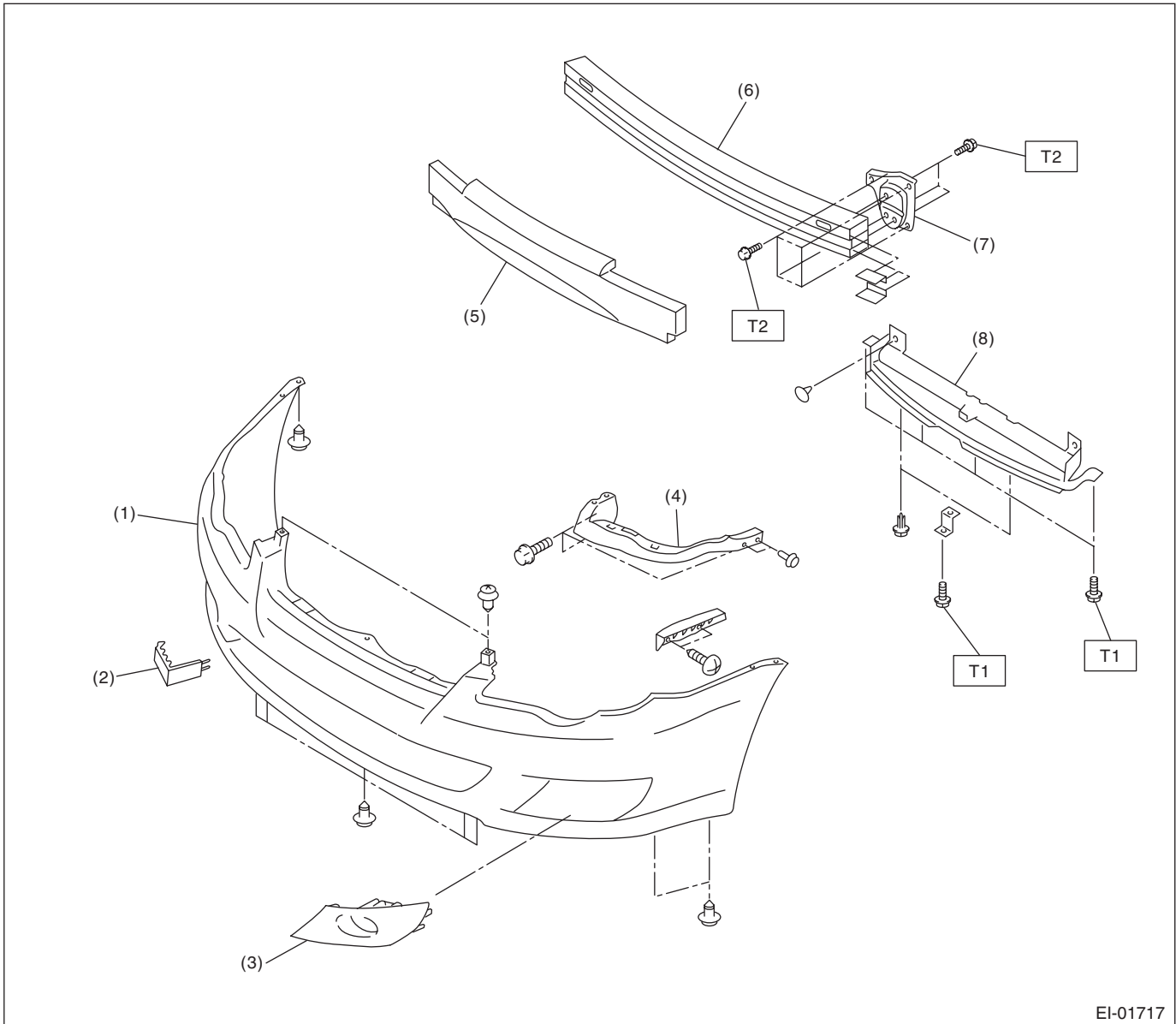
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 1.0 (0.1, 0.72)**

**T2: 4.4 (0.45, 3.18)**



## 5. FRONT BUMPER



EI-01717

- |                       |                               |
|-----------------------|-------------------------------|
| (1) Bumper face       | (5) Energy absorber foam      |
| (2) Towing hook cover | (6) Bumper beam reinforcement |
| (3) Fog light cover   | (7) Bumper beam bracket       |
| (4) Side bracket      | (8) Radiator guide            |

**Tightening torque: N·m (kgf·m, ft·lb)**

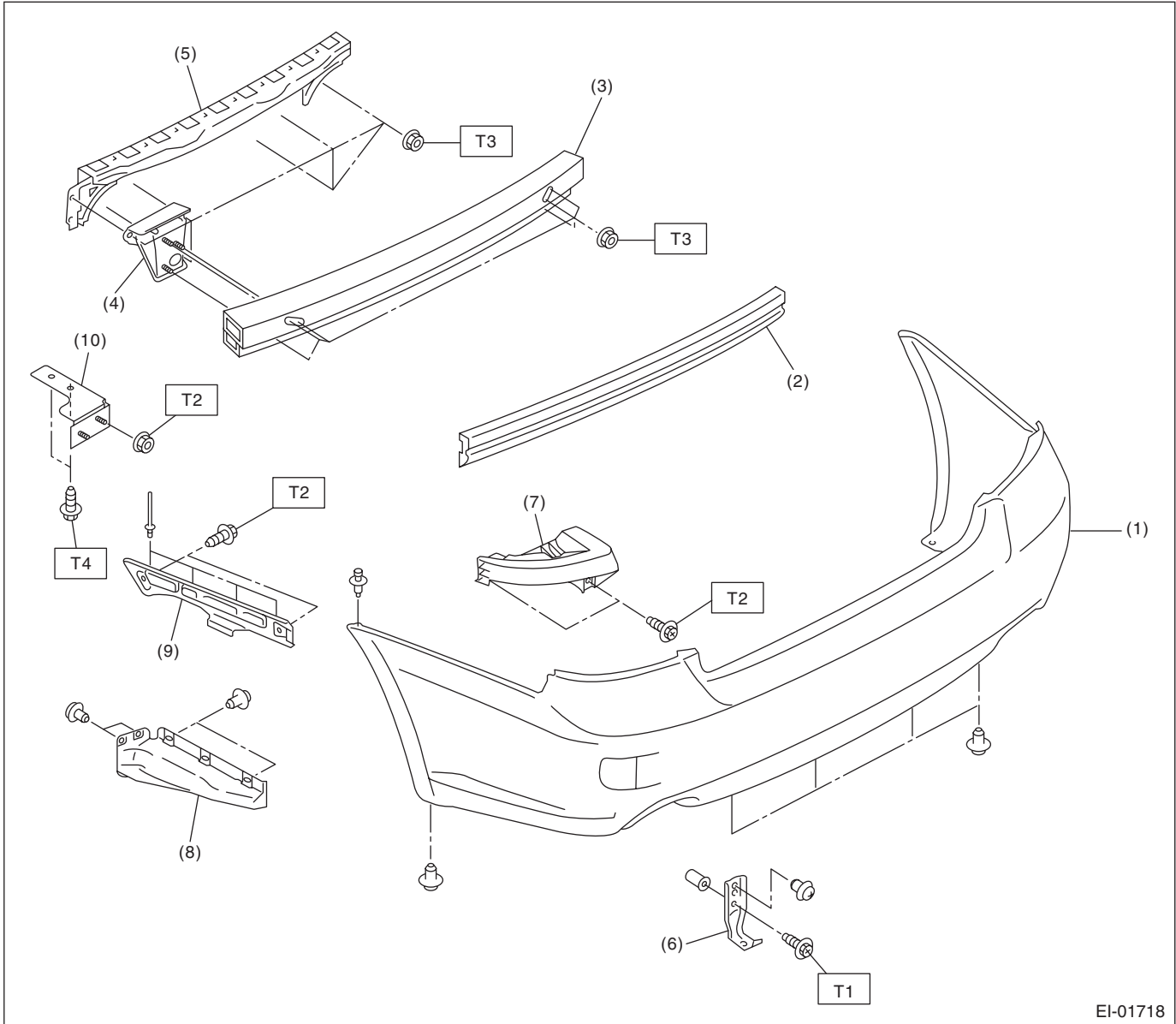
**T1: 7.5 (0.77, 5.53)**

**T2: 33 (3.4, 24)**

# General Description

EXTERIOR/INTERIOR TRIM

## 6. REAR BUMPER (SEDAN MODEL)



EI-01718

- |                               |  |
|-------------------------------|--|
| (1) Bumper face               | (7) Bracket corner   |
| (2) Energy absorber foam      | (8) Bumper side support lower  |
| (3) Bumper beam reinforcement | (9) Bumper side support upper  |
| (4) Bumper beam bracket       | (10) Rear bumper gusset (for installing trailer hitch, OUTBACK only) |
| (5) Beam upper rear           |  |
| (6) Lower bracket             |  |

**Tightening torque: N·m (kgf·m, ft·lb)**

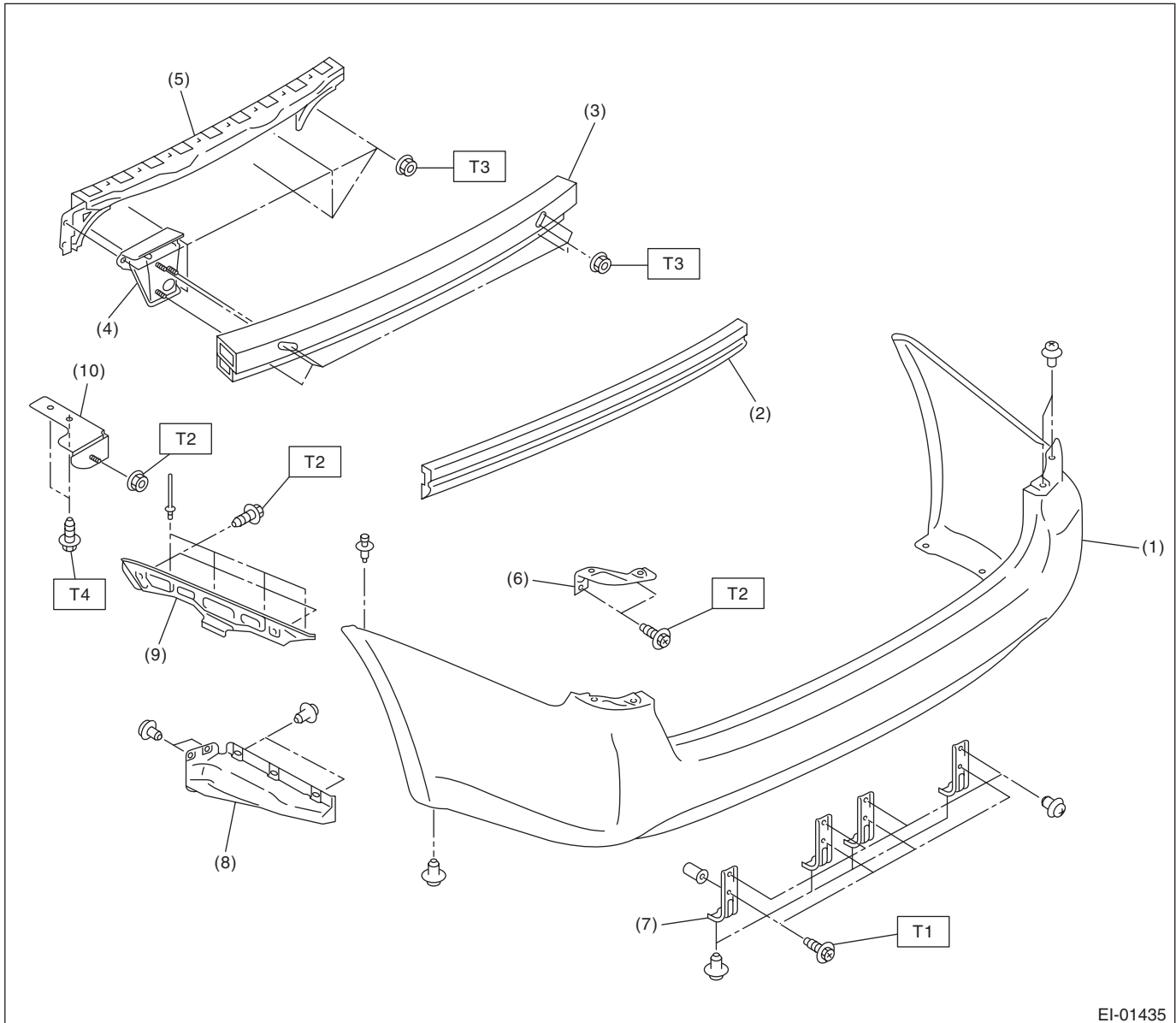
**T1: 2 (0.2, 1.48)**

**T2: 7.5 (0.77, 5.53)**

**T3: 33 (3.4, 24)**

**T4: 72 (7.3, 53.1)**

## 7. REAR BUMPER (WAGON MODEL)



EI-01435

- |                               |  |
|-------------------------------|--|
| (1) Bumper face               | (7) Lower bracket  |
| (2) Energy absorber foam      | (8) Bumper side support lower  |
| (3) Bumper beam reinforcement | (9) Bumper side support upper  |
| (4) Bumper beam bracket       | (10) Rear bumper gusset (for installing trailer hitch, OUTBACK only) |
| (5) Beam upper rear           |  |
| (6) Bracket corner            |  |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 2 (0.2, 1.48)**

**T2: 7.5 (0.77, 5.53)**

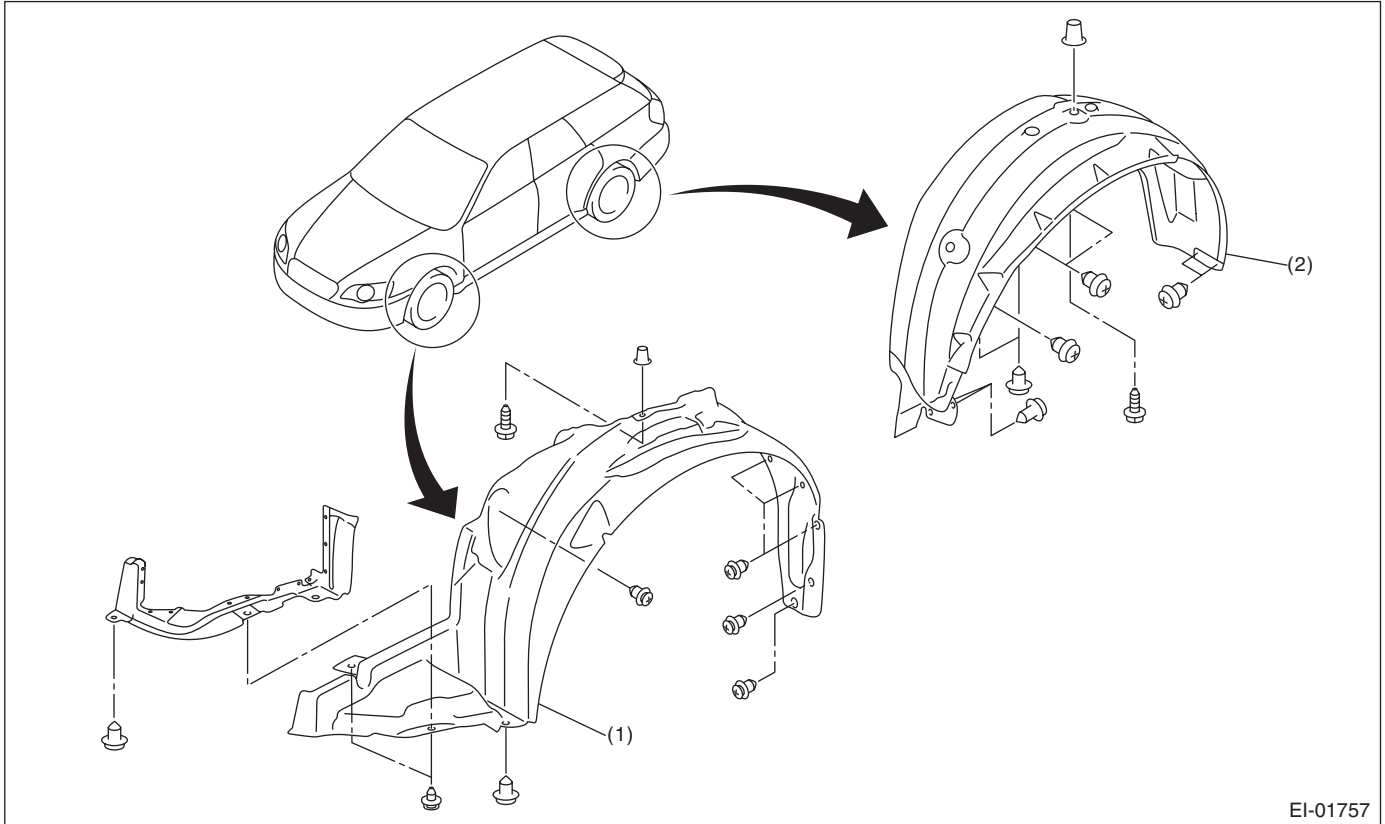
**T3: 33 (3.4, 24)**

**T4: 72 (7.3, 53.1)**

# General Description

EXTERIOR/INTERIOR TRIM

## 8. MUD GUARD

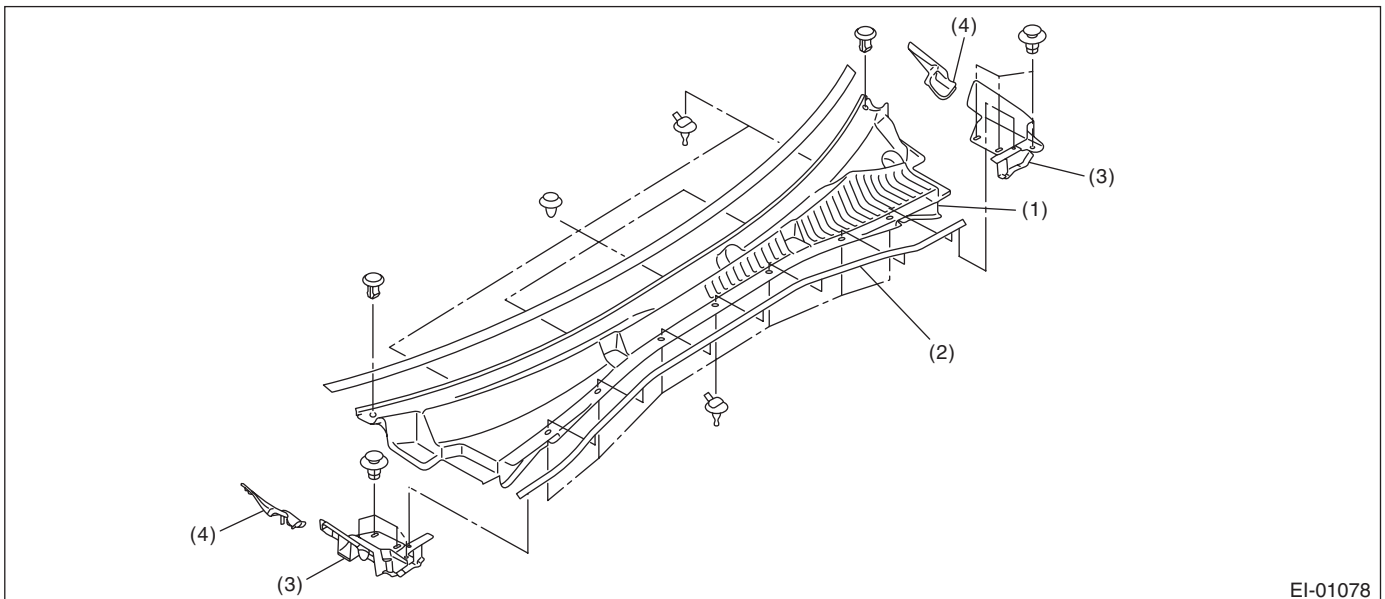


EI-01757

(1) Front mud guard

(2) Rear mud guard

## 9. COWL PANEL



EI-01078

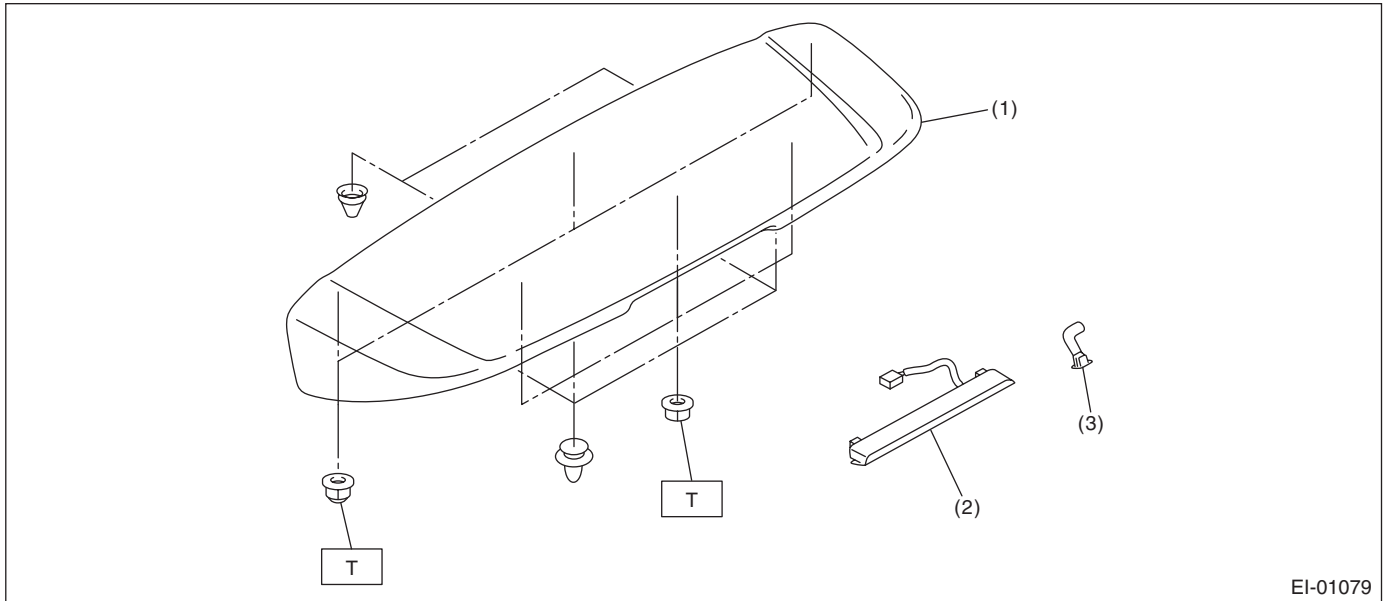
(1) Cowl panel

(3) Cover cowl panel

(4) Cowl side panel

(2) Weather strip

## 10. ROOF SPOILER



EI-01079

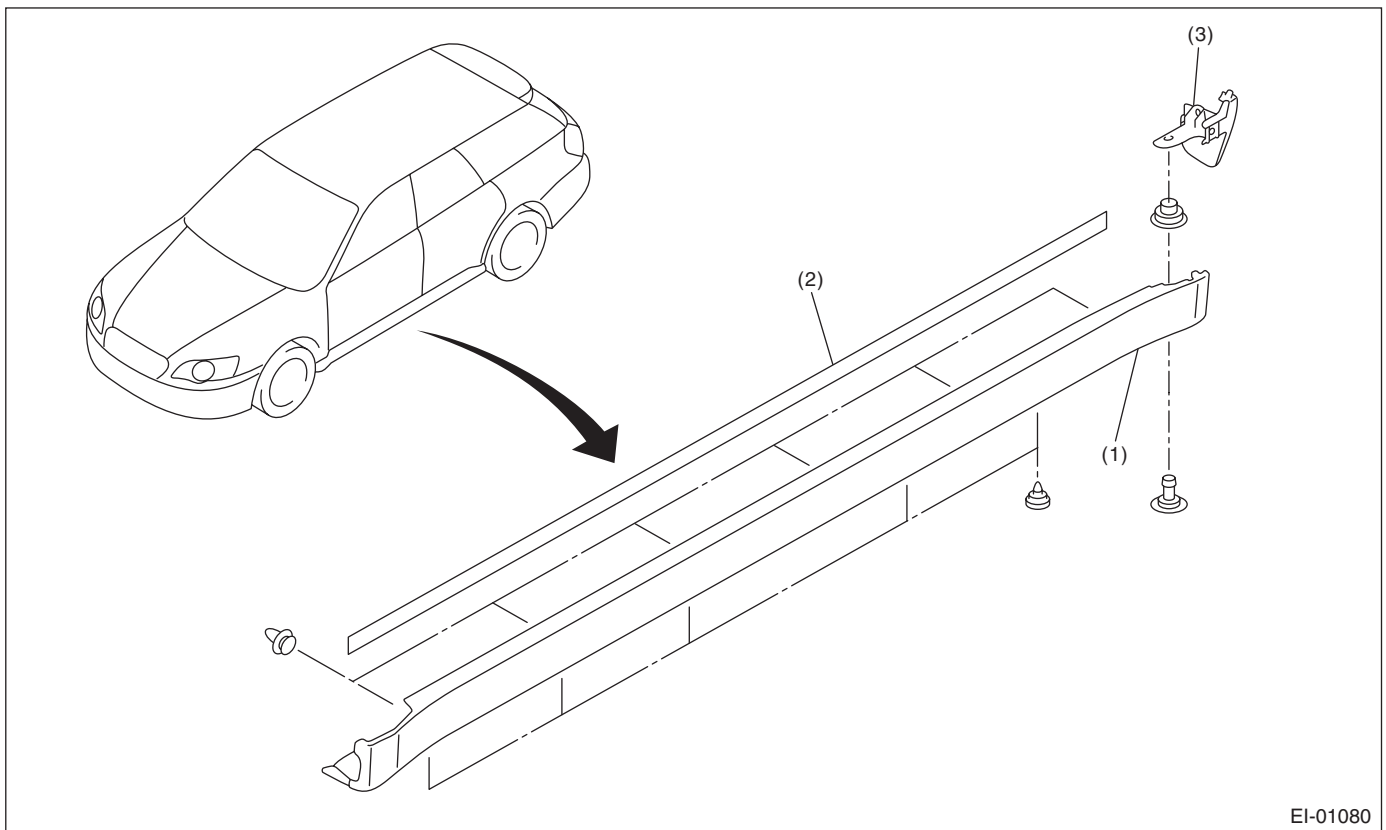
- (1) Roof spoiler
- (2) High-mounted stop light

- (3) Washer nozzle

**Tightening torque: N-m (kgf-m, ft-lb)**

**T: 4.5 (0.46, 3.32)**

## 11. SIDE SILL SPOILER



EI-01080

- (1) Side sill spoiler

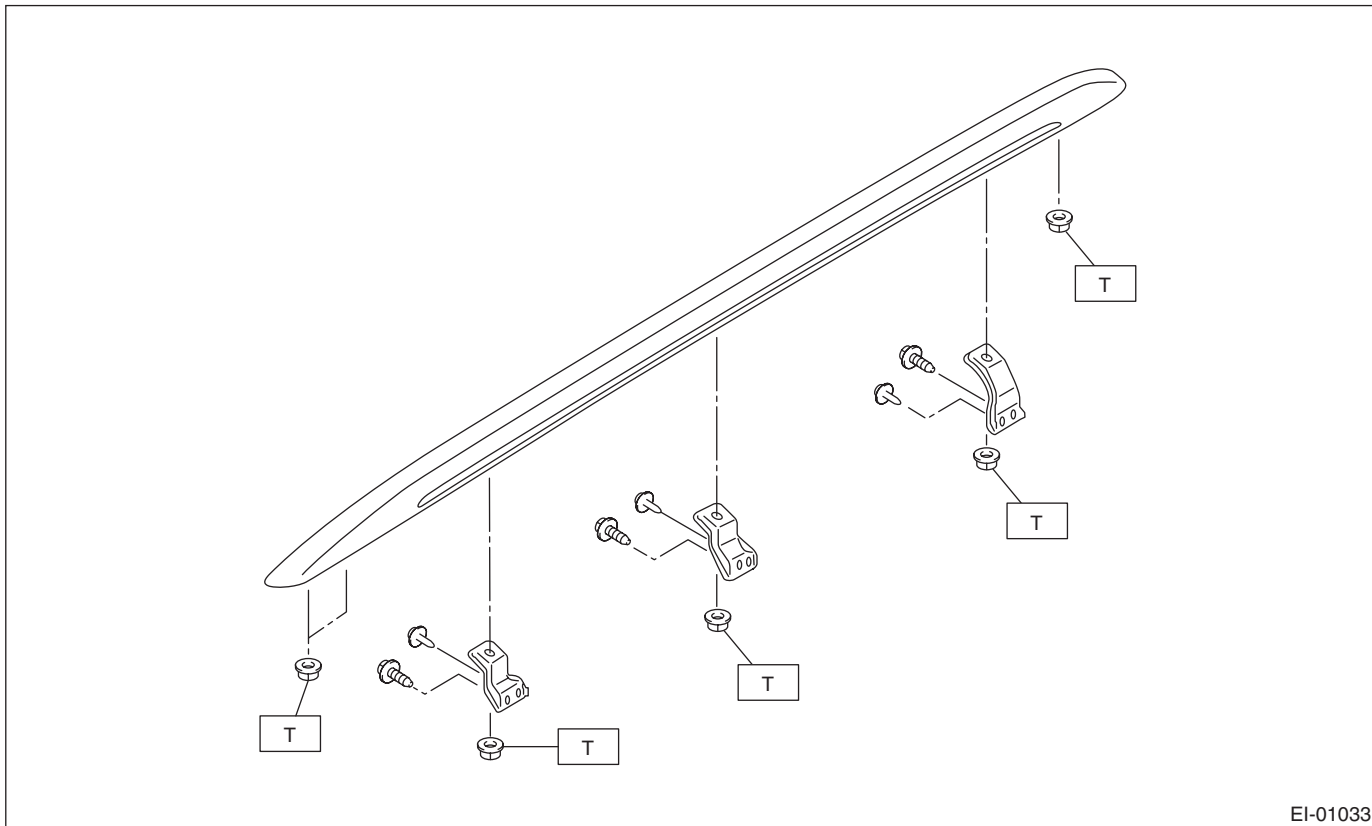
- (2) Double-sided tape

- (3) Air flap side sill end

# General Description

EXTERIOR/INTERIOR TRIM

## 12. ROOF RAIL

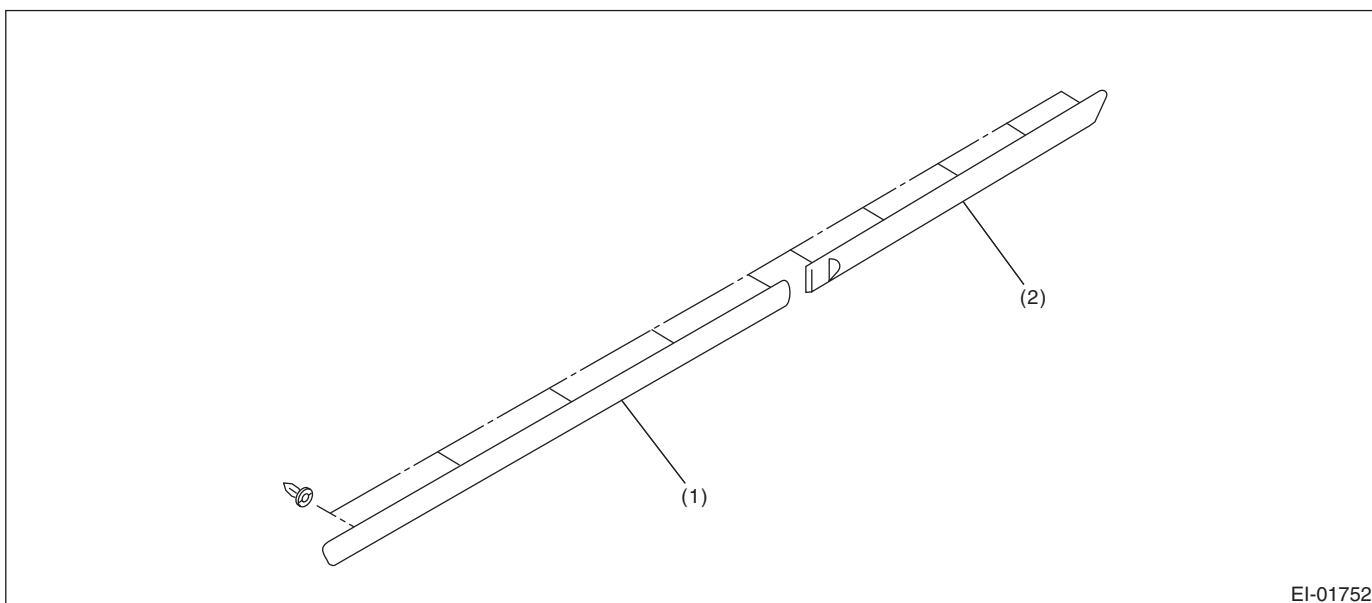


EI-01033

**Tightening torque: N-m (kgf-m, ft-lb)**

**T: 7.5 (0.77, 5.53)**

## 13. SIDE PROTECTOR

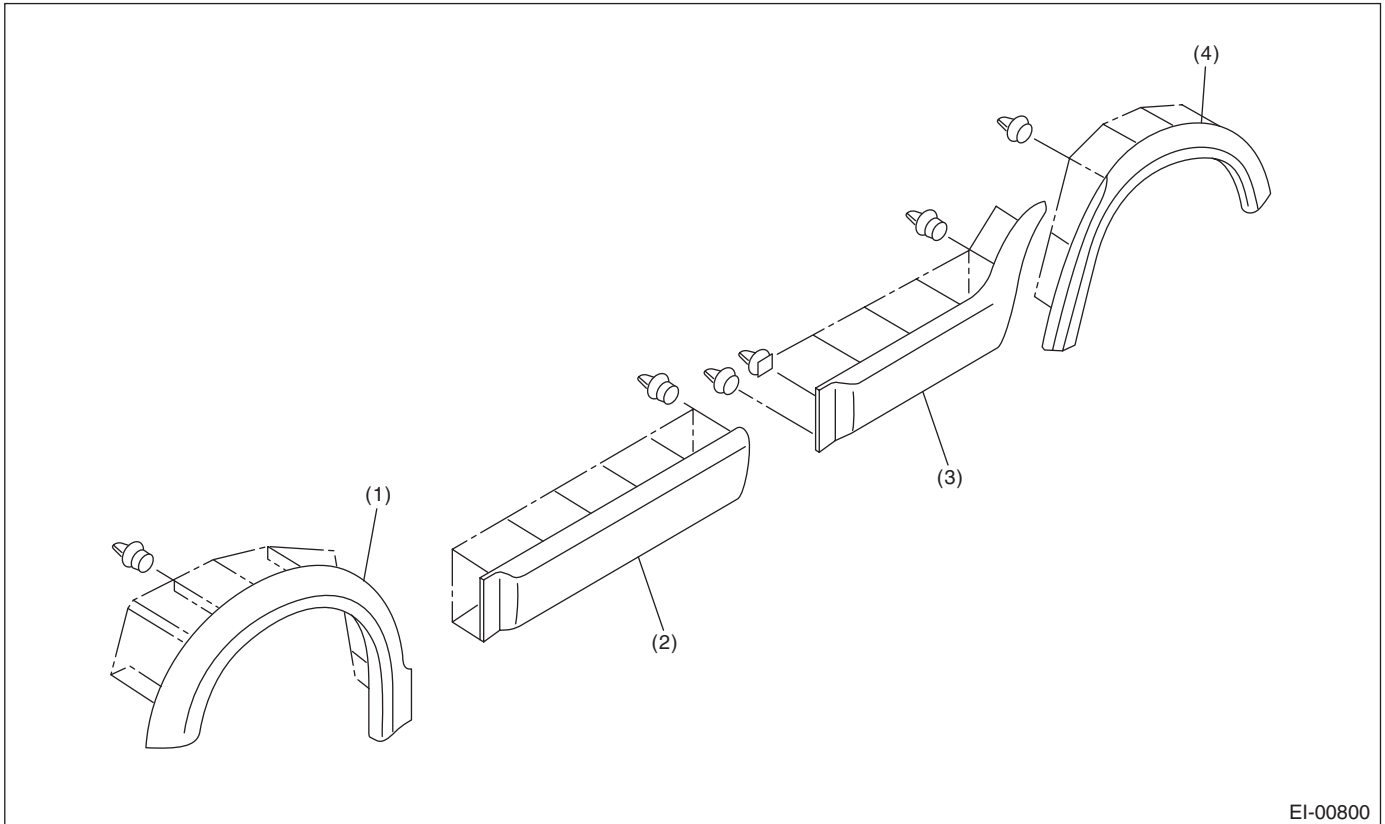


EI-01752

(1) Front door protector

(2) Rear door protector

## 14.SIDE GARNISH

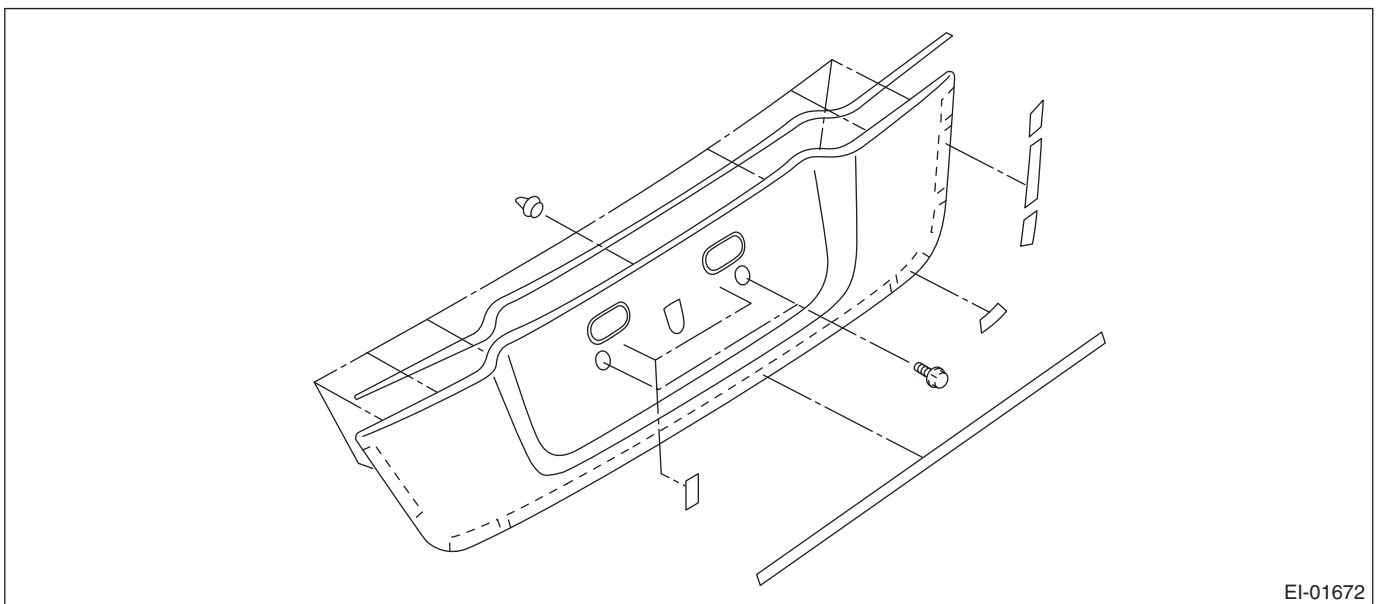


- (1) Front fender garnish
- (2) Front door garnish

- (3) Rear door garnish

- (4) Rear quarter garnish

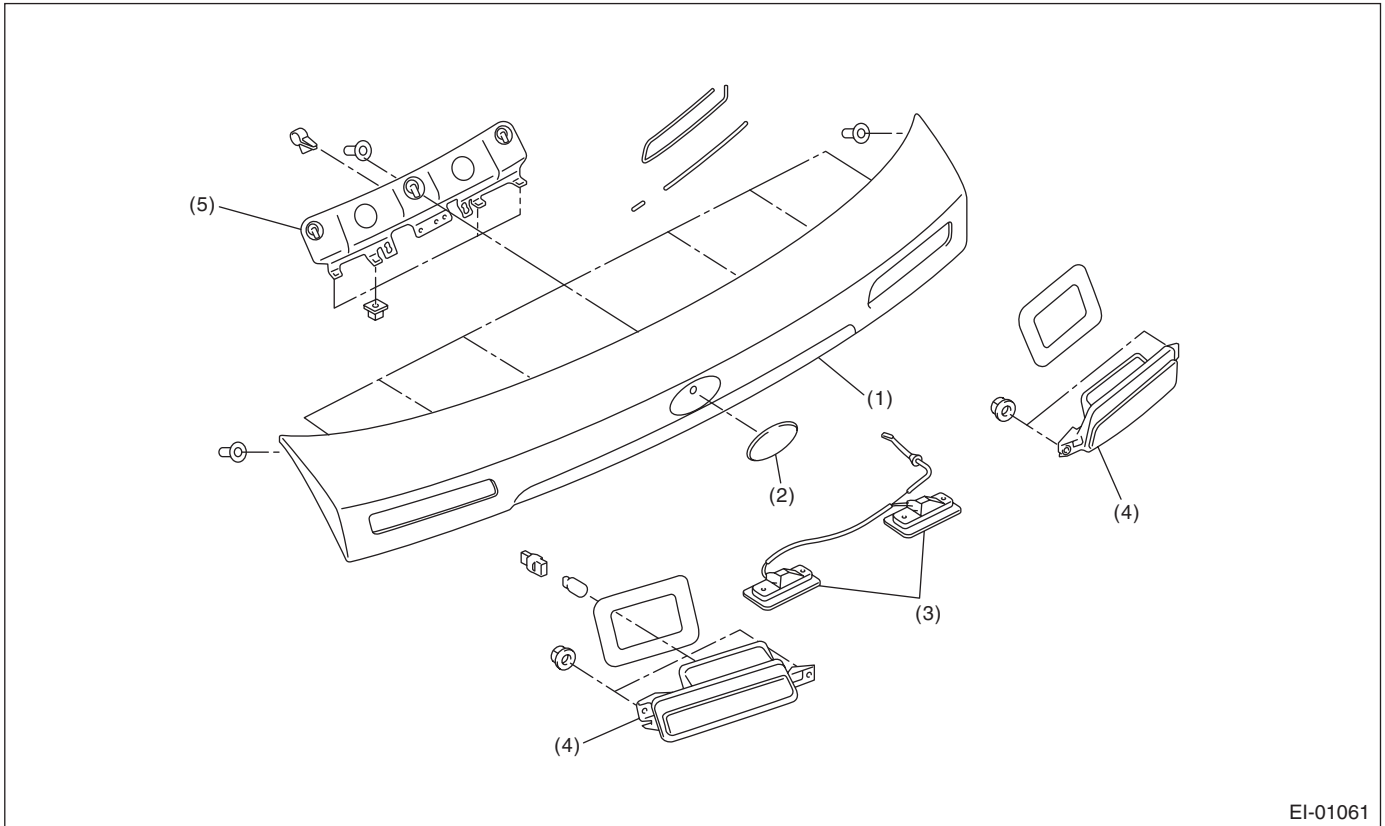
## 15.TRUNK LID GARNISH



# General Description

EXTERIOR/INTERIOR TRIM

## 16.REAR GATE GARNISH



EI-01061

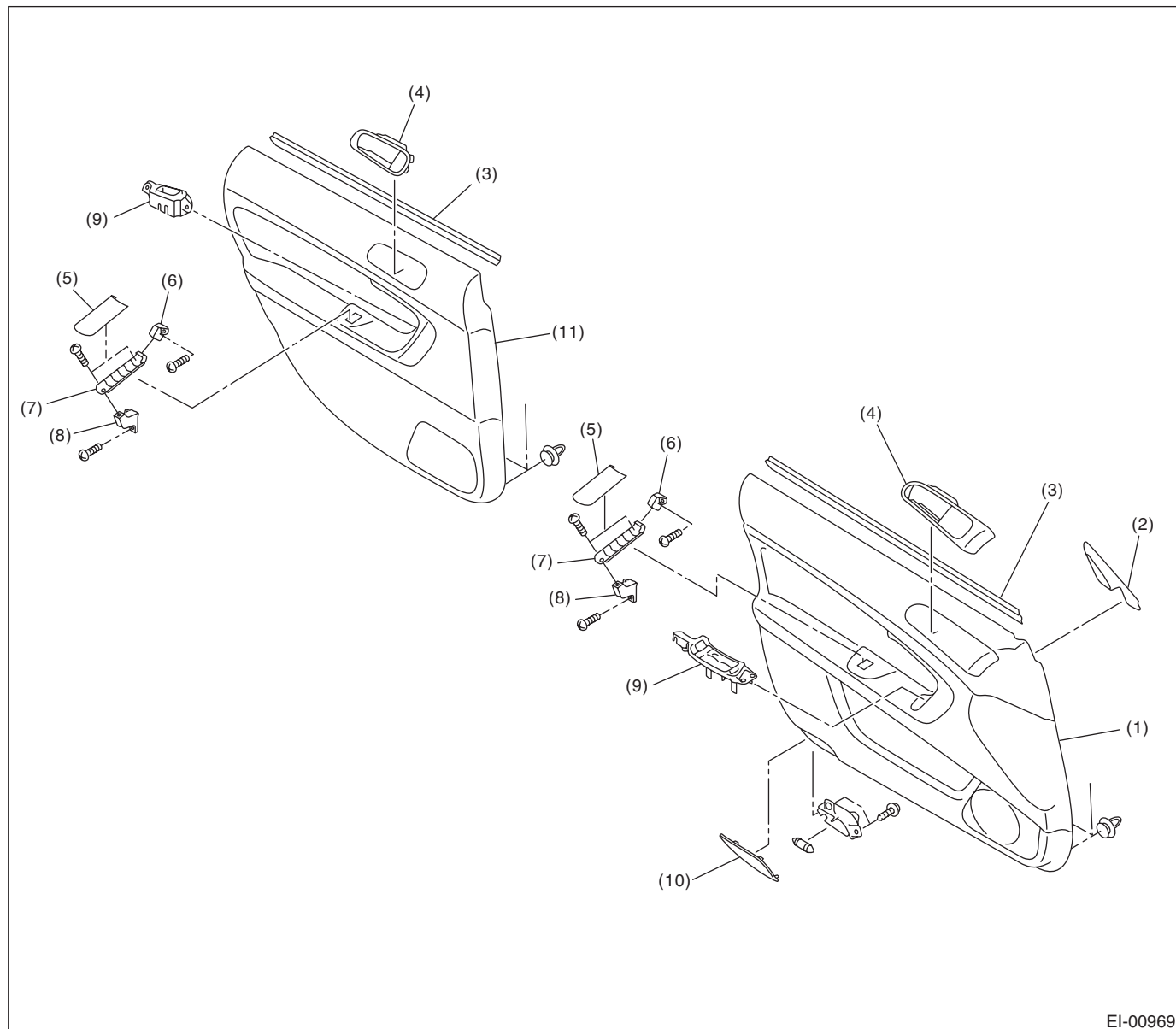
(1) Rear gate garnish  
(2) Ornament

(3) License plate light  
(4) Back-up light

(5) License plate light bracket



## 17.DOOR TRIM

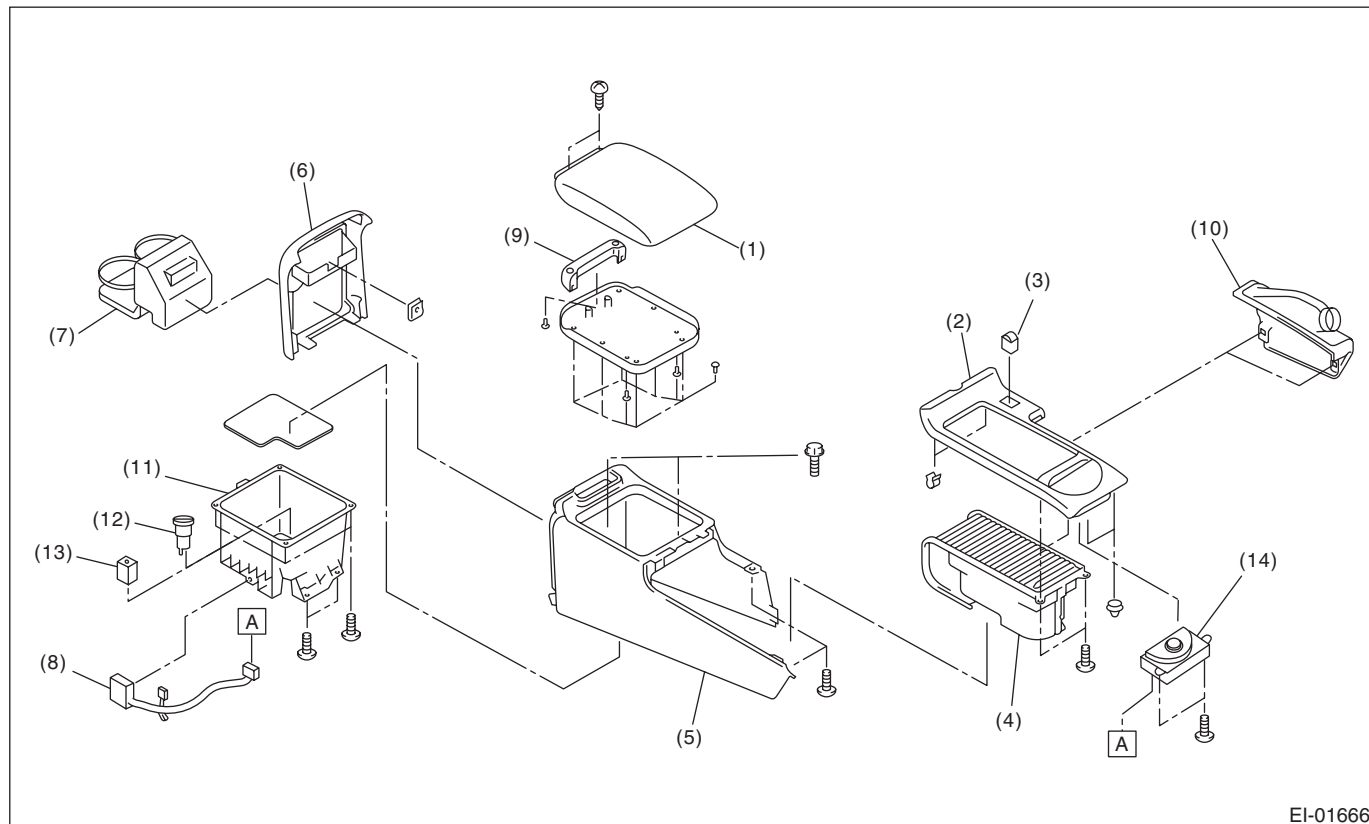


- |                         |                             |                         |
|-------------------------|-----------------------------|-------------------------|
| (1) Front door trim     | (5) Door grip               | (9) Power window switch |
| (2) Gusset cover        | (6) Door grip bracket upper | (10) Step light cover   |
| (3) Upper weather strip | (7) Door grip frame         | (11) Rear door trim     |
| (4) Inner remote cover  | (8) Door grip bracket lower |                         |

# General Description

EXTERIOR/INTERIOR TRIM

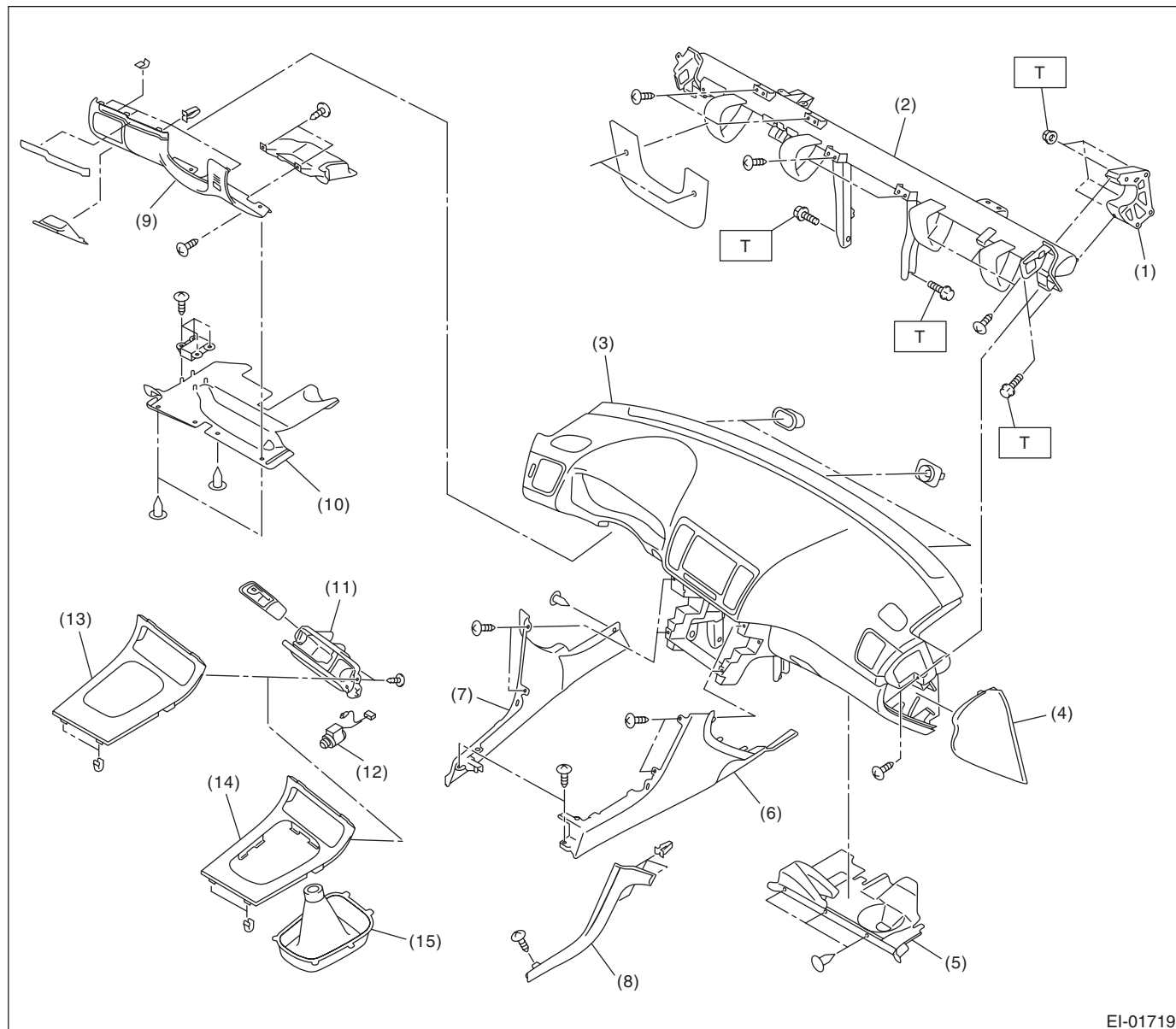
## 18. CONSOLE BOX



EI-01666

- |                        |                               |  |
|------------------------|-------------------------------|--|
| (1) Upper lid          | (6) Rear lid                  | (11) Console pocket                      |
| (2) Console cover      | (7) Rear cup holder           | (12) Front accessory power supply socket |
| (3) Seat heater switch | (8) Console box harness       | (13) AUX input terminal                  |
| (4) Front cup holder   | (9) Lid hinge                 | (14) SI-DRIVE switch                     |
| (5) Console box outer  | (10) Parking brake lever boot |  |

## 19. INSTRUMENT PANEL

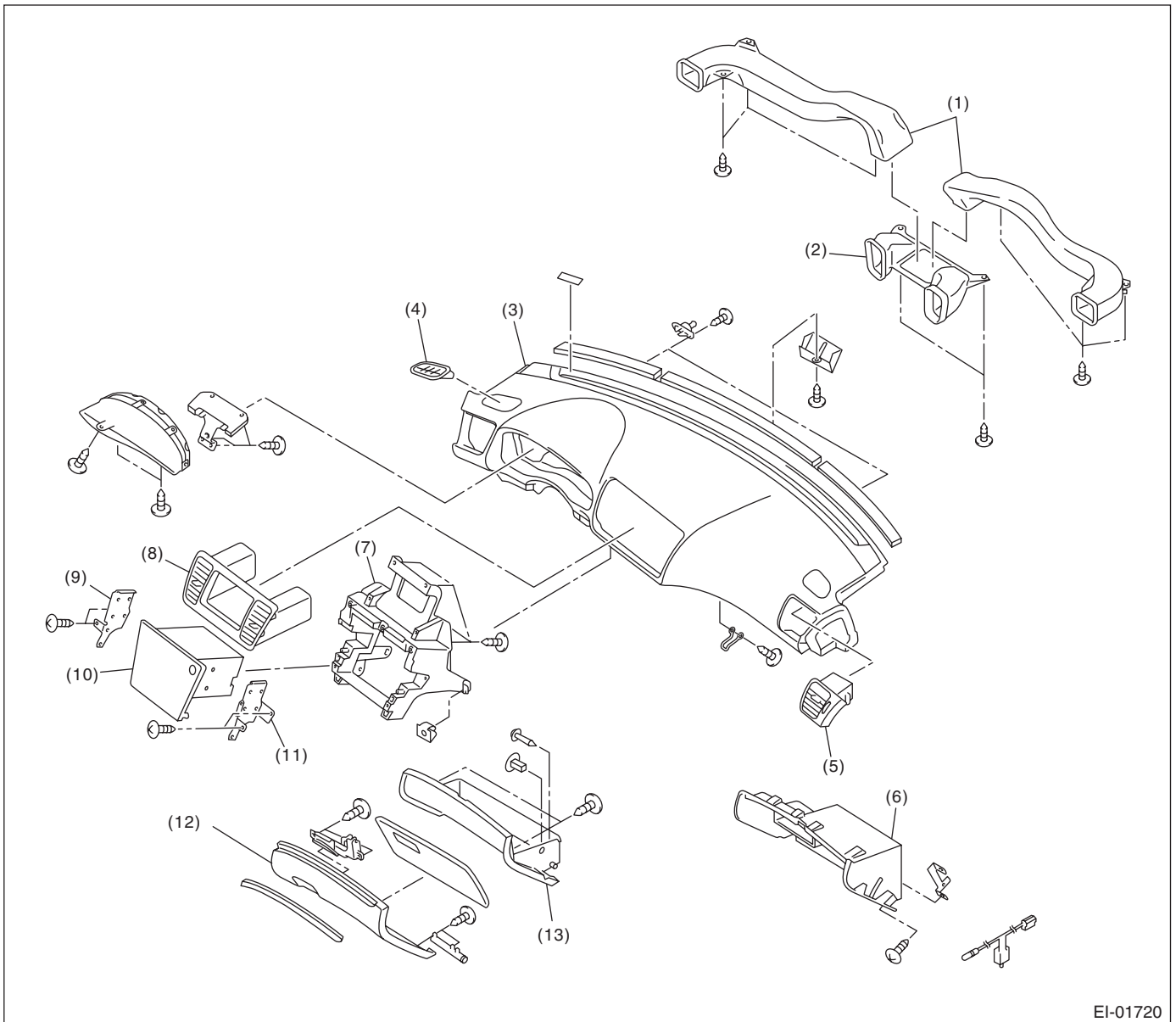


- |                                       |  |                                     |
|---------------------------------------|--|-------------------------------------|
| (1) Steering support beam bracket     | (8) Console side garnish                 | (13) Console front panel (AT model) |
| (2) Steering support beam             | (9) Instrument panel lower cover upper   | (14) Console front panel (MT model) |
| (3) Instrument panel pad & frame ASSY | (10) Instrument panel lower cover under  | (15) Shift lever boot (MT model)    |
| (4) Instrument panel side cover       | (11) Ash tray holder                     |                                     |
| (5) Glove box lower cover             | (12) Front accessory power supply socket |                                     |
| (6) Console side panel RH             |  |                                     |
| (7) Console side panel LH             |  |                                     |

**Tightening torque: N·m (kgf·m, ft·lb)**  
**T: 25 (25.5, 18)**

# General Description

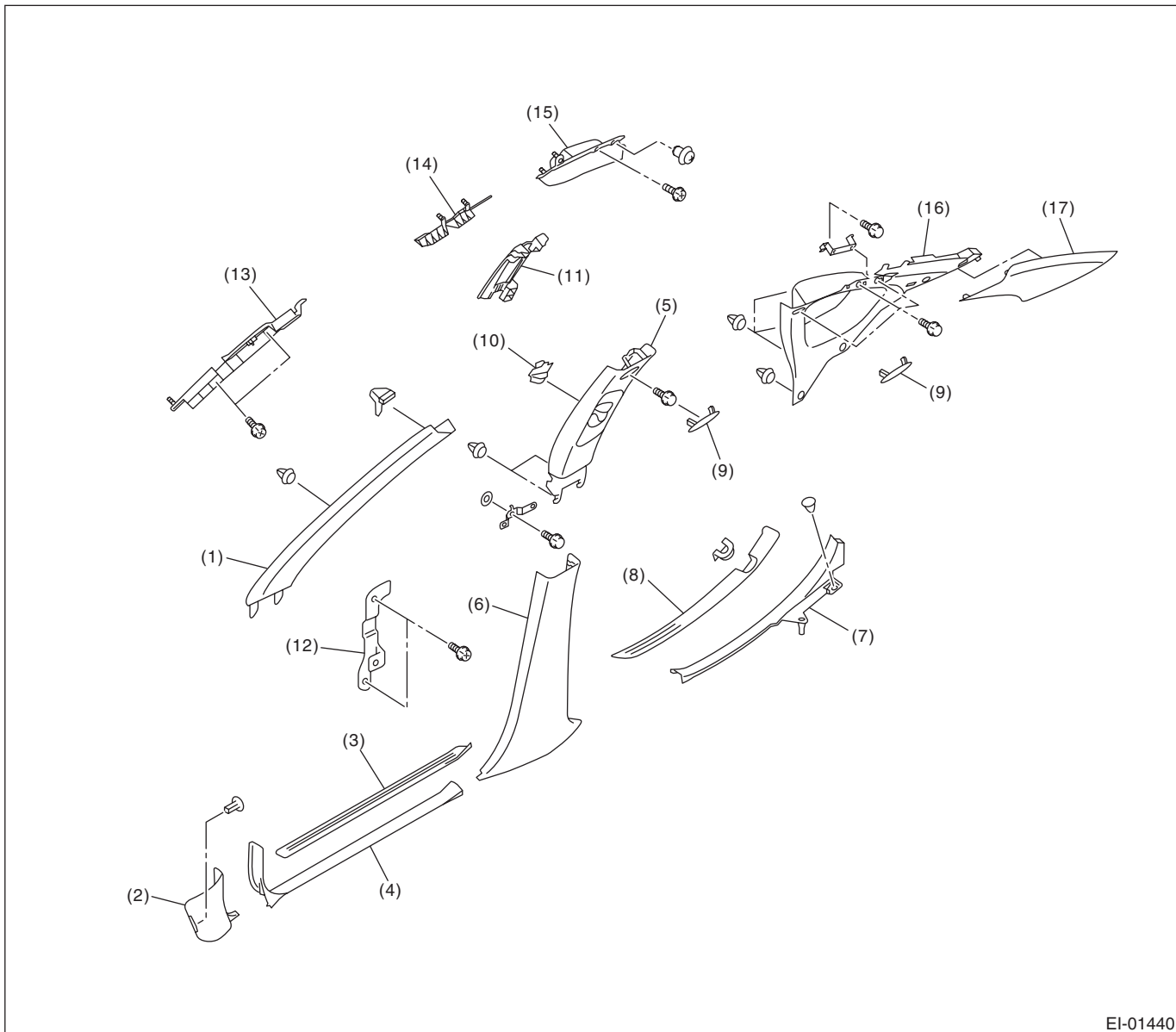
## EXTERIOR/INTERIOR TRIM



EI-01720

- |                                  |                            |                         |
|----------------------------------|----------------------------|-------------------------|
| (1) Air vent side duct           | (6) Glove box panel        | (10) Center panel       |
| (2) Air vent center duct         | (7) Center console frame   | (11) Audio bracket (RH) |
| (3) Instrument panel pad & frame | (8) Air vent center grille | (12) Glove box lid      |
| (4) Air vent defroster grille    | (9) Audio bracket (LH)     | (13) Glove box          |
| (5) Air vent side grille         |                            |                         |

## 20.INNER TRIM (SEDAN MODEL)



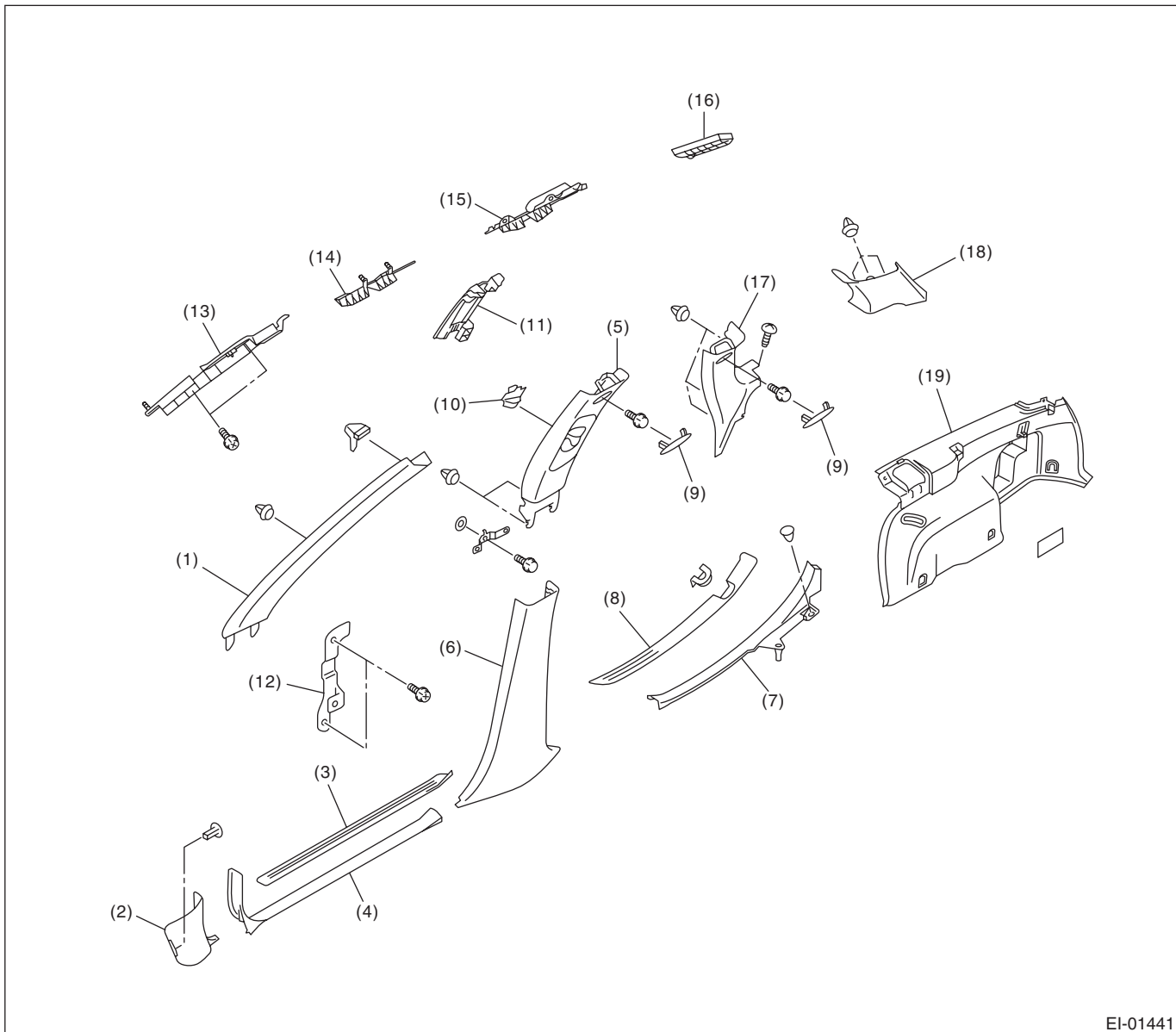
EI-01440

- |                               |  |  |
|-------------------------------|--|--|
| (1) Front pillar upper trim   | (7) Rear inside scuff plate                    | (12) Center pillar inner protector lower |
| (2) Front pillar lower trim   | (8) Rear outside scuff plate                   | (13) Curtain airbag guide front          |
| (3) Front outside scuff plate | (9) Bolt cover                                 | (14) Curtain airbag guide center         |
| (4) Front inside scuff plate  | (10) Seat belt shoulder anchor adjuster button | (15) Curtain airbag guide rear           |
| (5) Center pillar upper trim  | (11) Center pillar inner protector upper       | (16) Rear quarter trim front             |
| (6) Center pillar lower trim  |  | (17) Rear quarter trim rear              |

# General Description

## EXTERIOR/INTERIOR TRIM

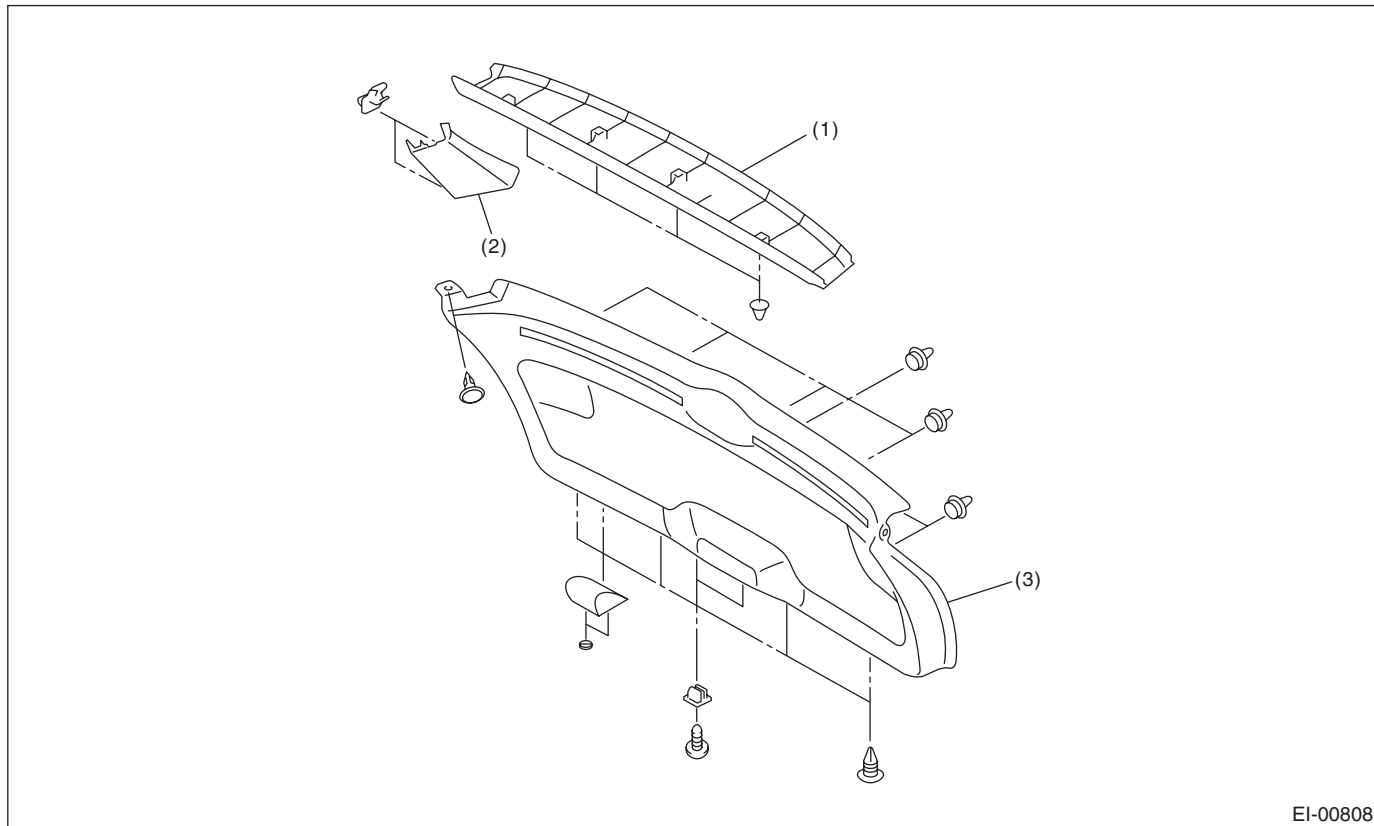
### 21.INNER TRIM (WAGON MODEL)



EI-01441

- |                               |  |                                      |
|-------------------------------|--|--------------------------------------|
| (1) Front pillar upper trim   | (8) Rear outside scuff plate                   | (14) Curtain airbag guide center     |
| (2) Front pillar lower trim   | (9) Bolt cover                                 | (15) Curtain airbag guide rear       |
| (3) Front outside scuff plate | (10) Seat belt shoulder anchor adjuster button | (16) Curtain airbag module protector |
| (4) Front inside scuff plate  | (11) Center pillar inner protector upper       | (17) Rear quarter front pillar trim  |
| (5) Center pillar upper trim  | (12) Center pillar inner protector lower       | (18) Rear quarter rear pillar trim   |
| (6) Center pillar lower trim  | (13) Curtain airbag guide front                | (19) Rear quarter lower trim         |
| (7) Rear inside scuff plate   |  |                                      |

## 22. REAR GATE TRIM



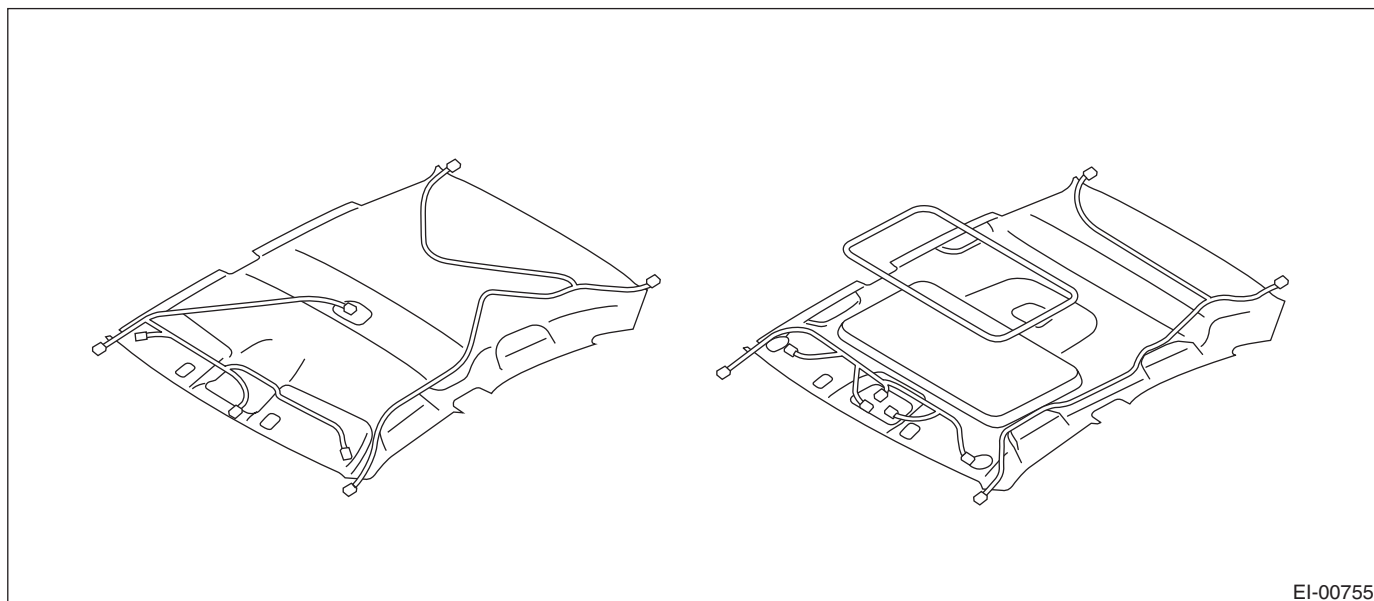
EI-00808

(1) Rear gate panel upper trim

(2) Rear gate panel pillar trim

(3) Rear gate panel lower trim

## 23. ROOF TRIM (SEDAN MODEL)

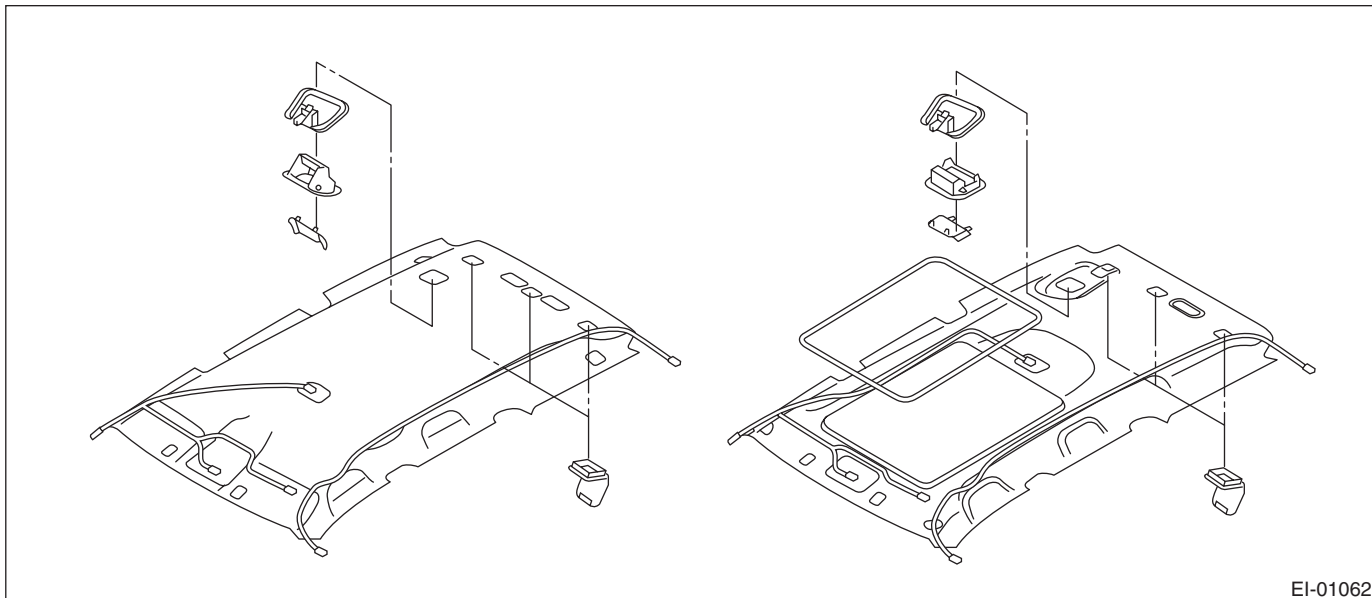


EI-00755

# General Description

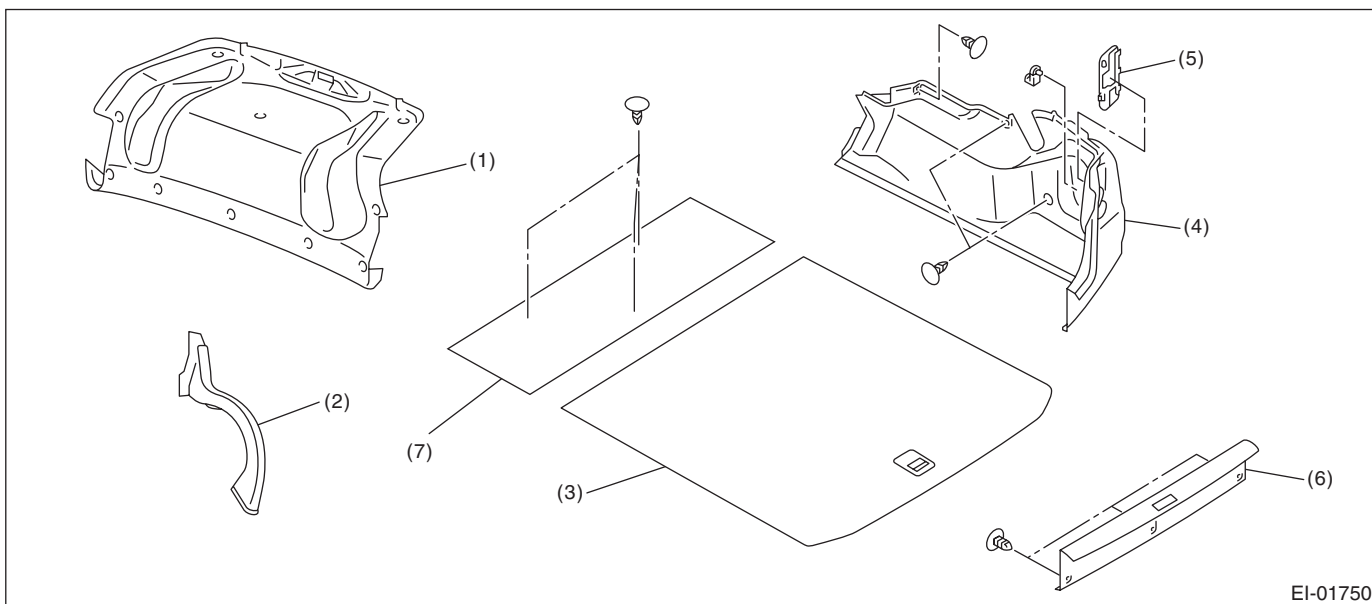
EXTERIOR/INTERIOR TRIM

## 24. ROOF TRIM (WAGON MODEL)



EI-01062

## 25. TRUNK ROOM TRIM



EI-01750

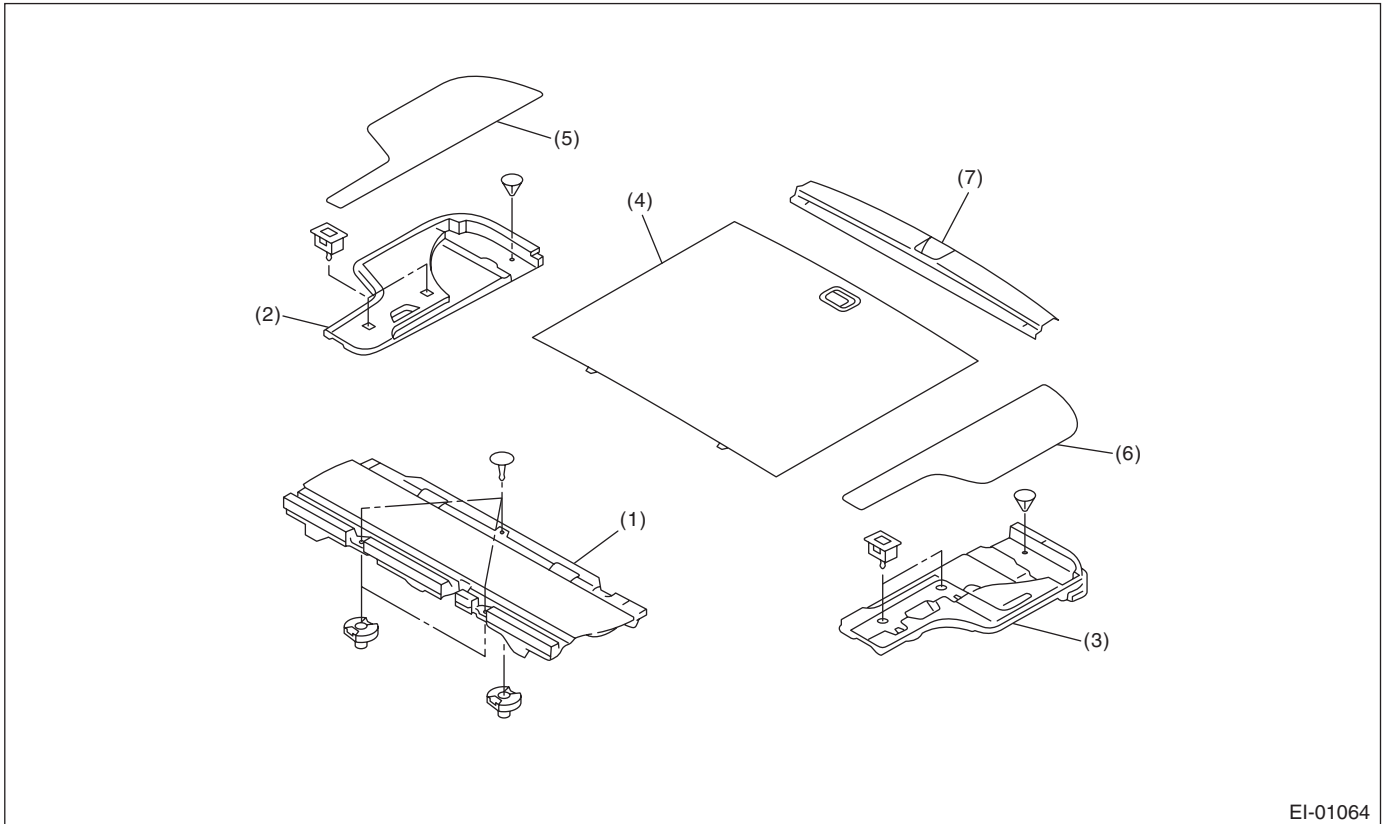
- (1) Trunk lid trim
- (2) Trunk lid arm cover
- (3) Trunk room mat

- (4) Trunk side trim
- (5) Combination light cover
- (6) Trunk room end cover

- (7) Spacer trunk



## 26.LUGGAGE FLOOR MAT



EI-01064

- (1) Front floor mat
- (2) Floor box (RH)
- (3) Floor box (LH)

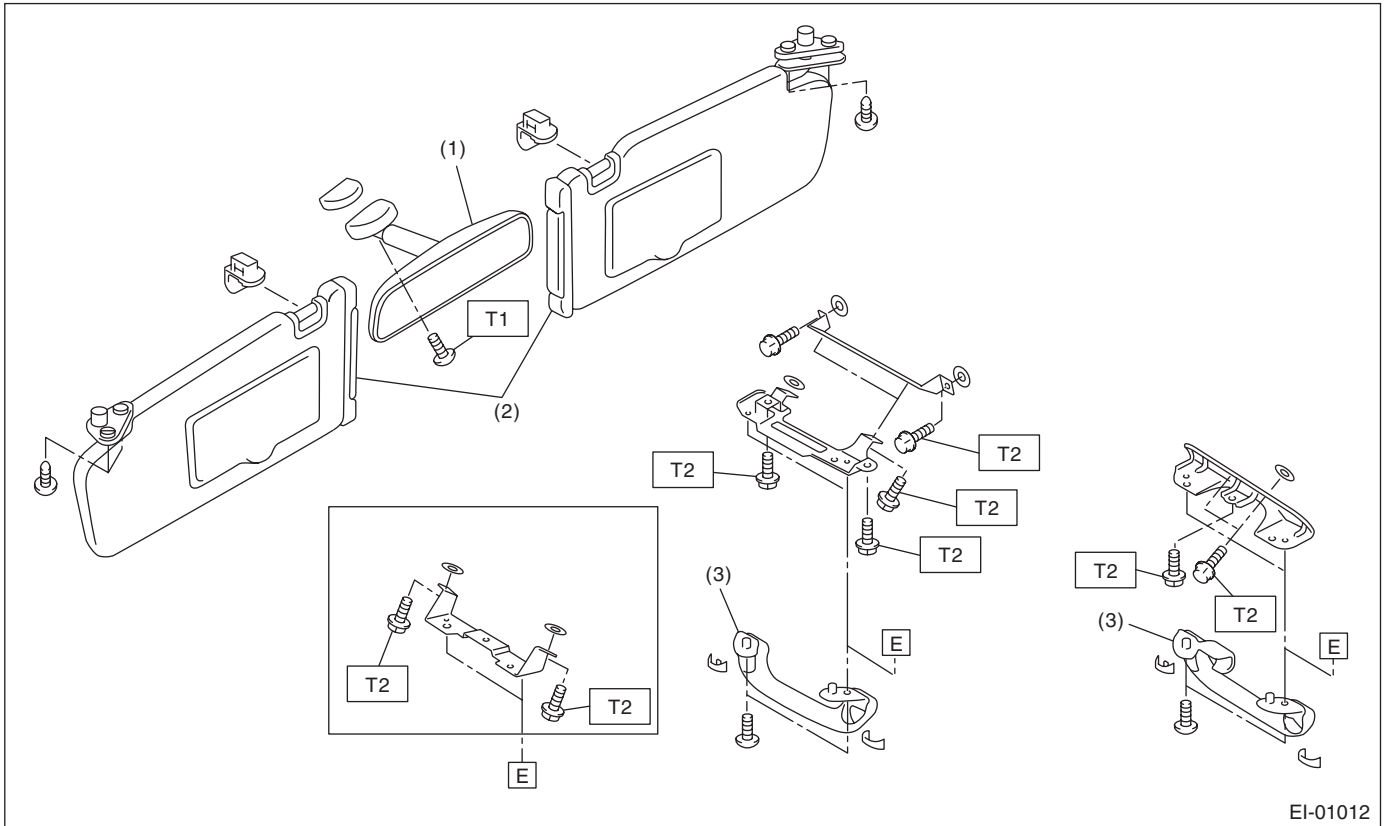
- (4) Center floor mat
- (5) Side floor mat (RH)

- (6) Side floor mat (LH)
- (7) Luggage floor end cover

# General Description

EXTERIOR/INTERIOR TRIM

## 27.ROOM INNER PARTS



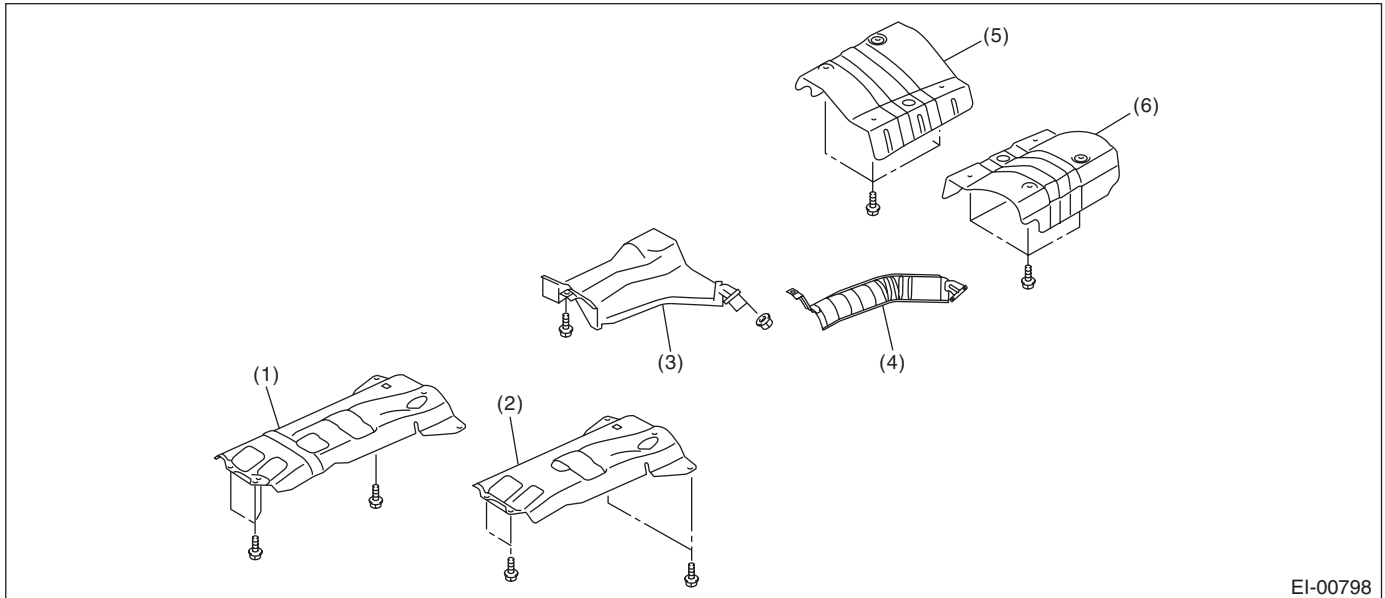
- (1) Room mirror
- (2) Sun visor
- (3) Assist grip

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 2.0 (0.2, 1.48)**

**T2: 7.5 (0.77, 5.53)**

## 28.HEAT SHIELD COVER



EI-00798

- (1) Front heat shield cover  
(4AT model and MT model)
- (2) Front heat shield cover  
(5AT model)

- (3) Center heat shield cover  
(Turbo model)
- (4) Center heat shield cover  
(Non-turbo model)

- (5) Rear heat shield cover RH
- (6) Rear heat shield cover LH

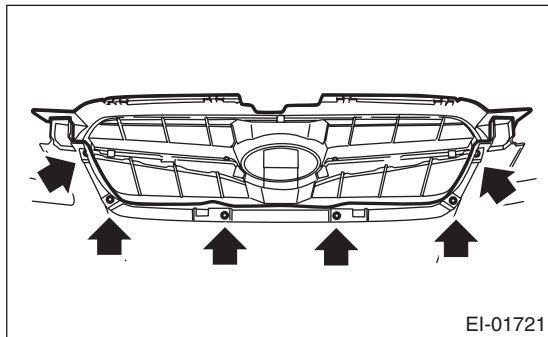
## B: PREPARATION TOOL

TOOL NAME	REMARKS
Clip remover	Used for removing trim.
Clip clamp pliers	Used for removal of various clips and clamps.

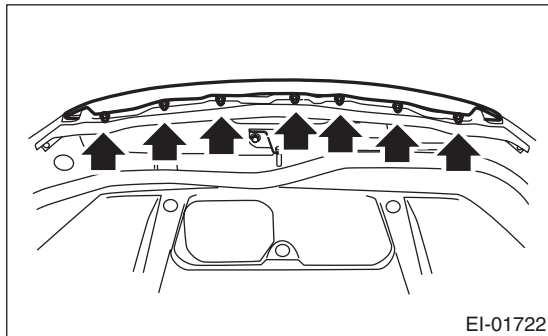
## 2. Front Grille

### A: REMOVAL

- 1) Remove the front bumper face. <Ref. to EI-30, FRONT BUMPER FACE, REMOVAL, Front Bumper.>
- 2) Remove the screws from the reverse side of the bumper face to remove the front grille assembly.



- 3) Remove the hexagon cap nut from the reverse side of the front hood to remove the upper grille. (OUTBACK model)



### B: INSTALLATION

Install in the reverse order of removal.

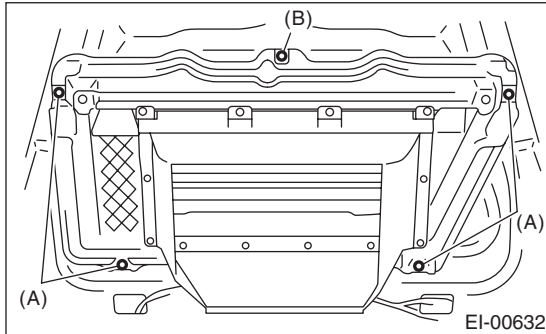
**Tightening torque:**

**4.5 N·m (0.46 kgf·m, 3.32 ft·lb)**

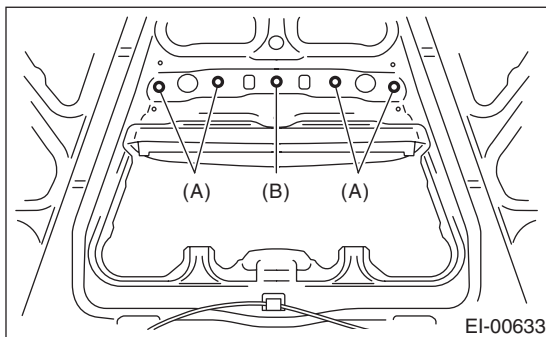
## 3. Front Hood Grille

### A: REMOVAL

- 1) Open the front hood.
- 2) Remove the front hood insulator. <Ref. to EB-13, FRONT HOOD INSULATOR, REMOVAL, Front Hood.>
- 3) Remove screws (A) and clip (B), and remove the front hood duct.

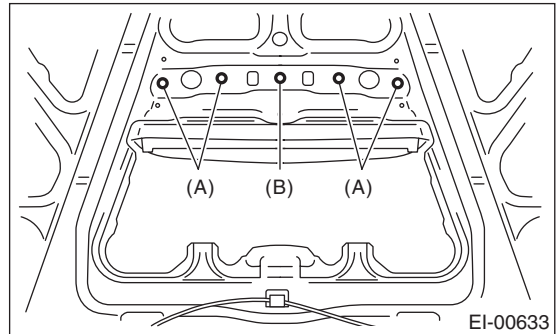


- 4) Loosen the nuts (A), remove the clip (B), and then remove the front hood grille.



### B: INSTALLATION

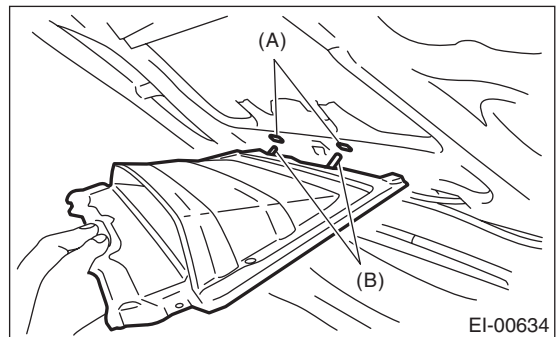
- 1) Fit the clip (B) of the front hood grille, and install the front hood grille using nuts (A).



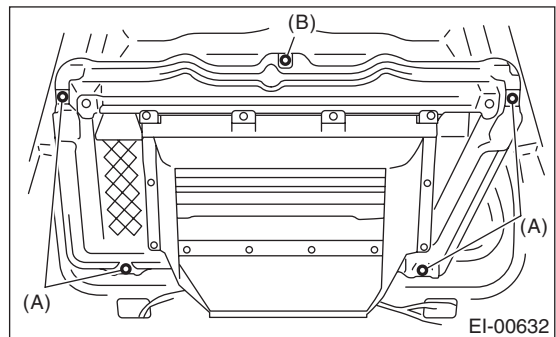
#### Tightening torque:

**4.5 N·m (0.46 kgf-m, 3.32 ft-lb)**

- 2) Insert the hooks (B) of the front hood duct into holes (A) of the front hood.



- 3) Install the front hood duct with screws (A) and clip (B).



# Front Under Cover

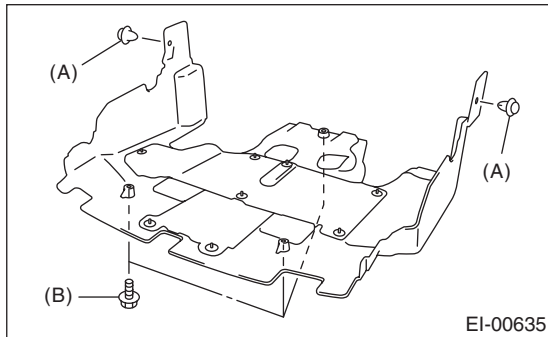
EXTERIOR/INTERIOR TRIM

## 4. Front Under Cover

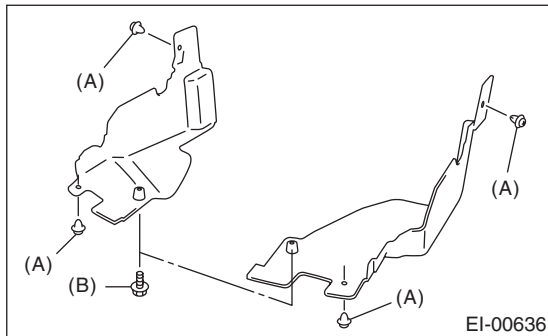
### A: REMOVAL

- 1) Lift up the vehicle.
- 2) Remove clips (A) in front fender and bolts (B), then remove the front under cover.

- Large type



- Small type



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**18 N·m (1.84 kgf·m, 13.3 ft·lb)**

## 5. Floor Under Protector

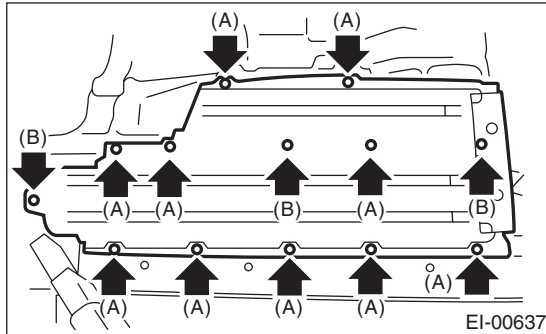
### A: REMOVAL

1) Lift up the vehicle.

NOTE:

A plate type lift cannot be used.

2) Remove the push turn clips (A) and bolts (B), and remove the floor under protector.



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

Refer to "COMPONENT" of  
 "General Description". <Ref. to EI-3, UNDER  
 PROTECTOR, COMPONENT, General  
 Description.>

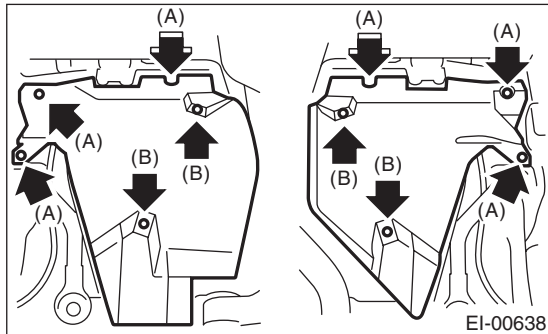
# Fuel Tank Protector

EXTERIOR/INTERIOR TRIM

## 6. Fuel Tank Protector

### A: REMOVAL

- 1) Lift up the vehicle.
- 2) Remove the bolts (A) and nuts (B), and then remove the fuel tank protector.



### B: INSTALLATION

Install in the reverse order of removal.

#### **Tightening torque:**

**Refer to "COMPONENT" of  
"General Description". <Ref. to EI-3, UNDER  
PROTECTOR, COMPONENT, General  
Description.>**

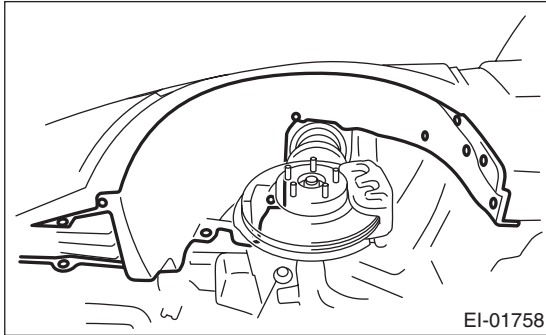


## 7. Mud Guard

### A: REMOVAL

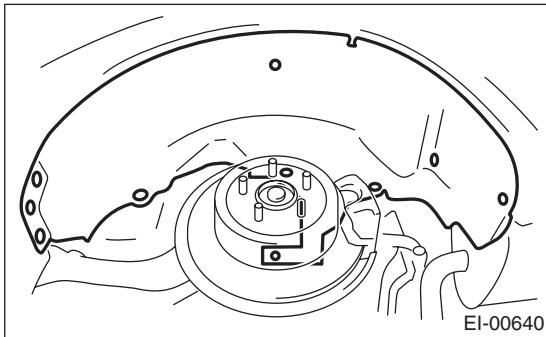
#### 1. FRONT MUD GUARD

- 1) Jack-up the vehicle.
- 2) Remove the front wheels.
- 3) Loosen the screws and clips to remove mud guard.



#### 2. REAR MUD GUARD

- 1) Jack-up the vehicle.
- 2) Remove the rear wheels.
- 3) Loosen the screws and clips to remove the mud guard.



### B: INSTALLATION

Install in the reverse order of removal.

# Front Bumper

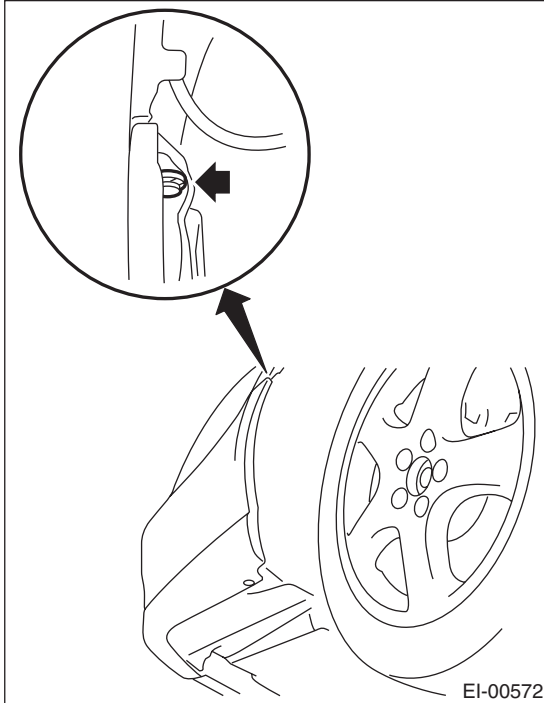
EXTERIOR/INTERIOR TRIM

## 8. Front Bumper

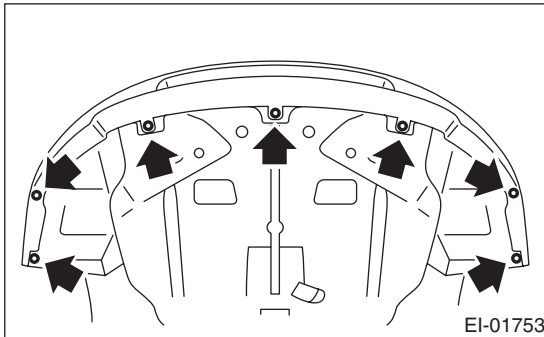
### A: REMOVAL

#### 1. FRONT BUMPER FACE

- 1) Disconnect the ground cable from the battery.
- 2) Turn over the front mud guard, and remove the clips connecting the fender and bumper.



- 3) Remove the clips at the lower side of bumper.

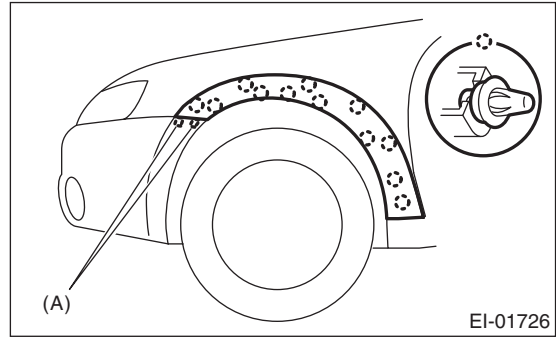


#### NOTE:

Remove the under cover to facilitate the work.  
<Ref. to EI-26, REMOVAL, Front Under Cover.>

- 4) Turn over the mud guard, and disconnect the fog light connector. (Model with fog light)

- 5) For OUTBACK model, remove the side garnish of the front fender.



#### NOTE:

For removing the claw (A) of side garnish from the bumper face.

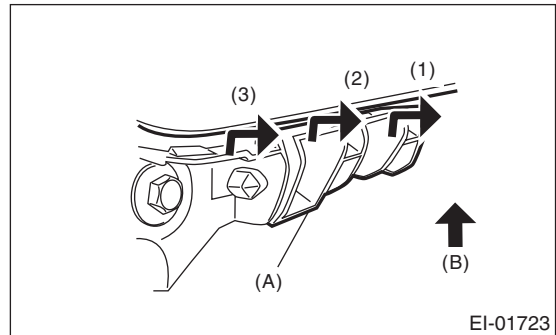
- 6) Detach the flange sections of the bumper face side from the guide bracket (A).

#### CAUTION:

**Do not pull forcibly. It may damage the flange sections of the bumper face side.**

#### NOTE:

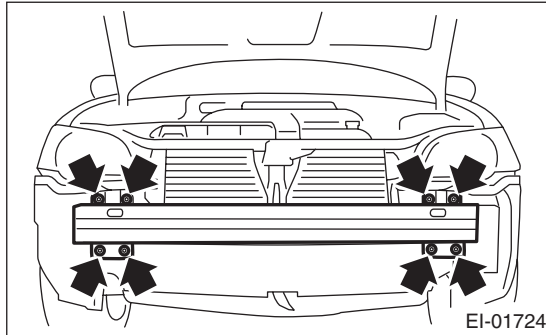
It is easier to detach them from the fender side in the order from (1) to (3), while pulling up the bumper face to the direction of arrow (B) (upward).



- 7) Remove the bumper face from vehicle body.
- 8) Remove the fog light from bumper face. <Ref. to LI-19, REMOVAL, Front Fog Light Assembly.>
- 9) Remove the front grille assembly from bumper face. <Ref. to EI-24, REMOVAL, Front Grille.>

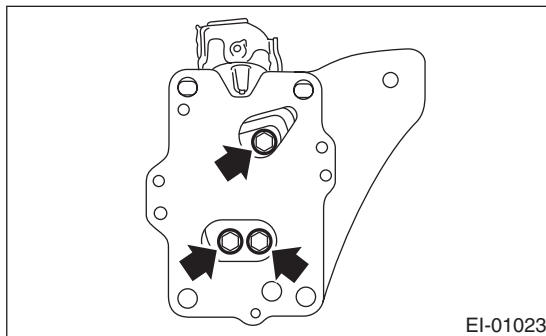
## 2. FRONT BUMPER BEAM ASSEMBLY

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front bumper face. <Ref. to EI-30, FRONT BUMPER FACE, REMOVAL, Front Bumper.>
- 3) Remove the energy absorber foam from bumper beam.
- 4) Remove the headlight assembly. <Ref. to LI-13, REMOVAL, Headlight Assembly.>
- 5) Remove the bolts, and remove the bumper beam assembly from vehicle body.

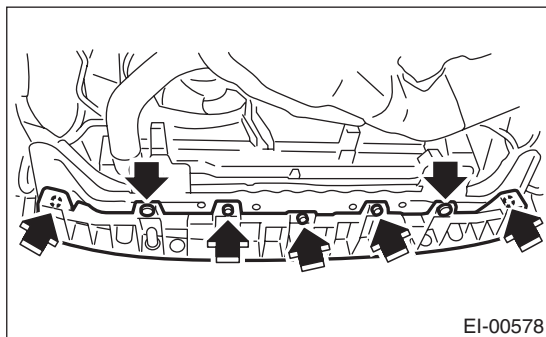


**NOTE:**

- After all bolts are removed, raise the whole bumper beam a little to remove it from vehicle body.
- 6) Remove the bolts and nuts, and disassemble the bumper beam.



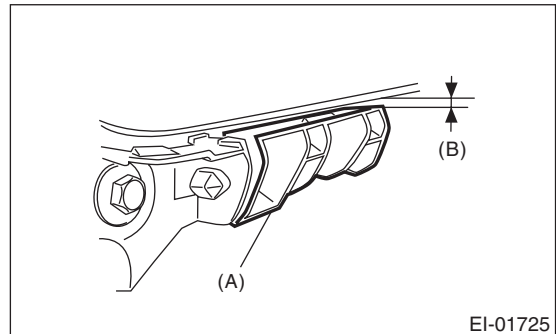
- 7) Remove the under cover.
- 8) Remove the bolts and clips, and remove the radiator guide.



## B: INSTALLATION

### 1. FRONT BUMPER FACE

- 1) Install in the reverse order of removal.
- 2) Fit the bumper face to the gap (B) between the guide bracket (A) and fender securely.



- 3) Replace the double-sided tape with new one, and install it to the side garnish.

### 2. FRONT BUMPER BEAM ASSEMBLY

Install in the reverse order of removal.

**Tightening torque:**

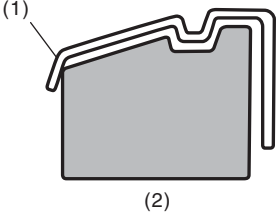
Refer to “COMPONENT” of “General Description”. <Ref. to EI-5, FRONT BUMPER, COMPONENT, General Description.>

# Front Bumper

EXTERIOR/INTERIOR TRIM

## C: REPAIR

### 1. COATING METHOD FOR PP BUMPER

Process No.	Process name	Job contents	
1	Bumper installation	Place the bumper on a paint worktable as required. Use the paint worktable conforming to inner shape of bumper if possible.	 <p>(1) Bumper (2) Set bumper section</p> <p>EI-00234</p>
2	Masking	Mask specified part (black base) with masking tape. Use masking tape for PP (example, Nichiban No. 533, etc.).	
3	Degreasing/cleaning	Clean all parts to be painted with white gasoline, normal alcohol, etc. to remove dirt, oil, fat, etc.	
4	Primer paint	Apply primer to all parts to be painted, using spray gun. Use primer (clear).	
5	Drying	Dry at normal temperature [10 — 15 min. at 20°C (68°F)]. In half-dried condition, PP primer paint is dissolved by solvent, e.g. thinner, etc. Therefore, if dust or dirt must be removed, use ordinary alcohol etc.	
6	Top coat paint (I)	Non-colored	Metallic paint
		Use section (block) paint for top coat. • Paint to be used (for each color): Solid paint Hardener PB Thinner T-301 • Mixture ratio: Main agent : Hardener = 4 : 1 • Viscosity: 10 — 13 sec./20°C (68°F) • Film thickness: 35 — 45 μ • Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm <sup>2</sup> , 36 — 50 psi)	Use section (block) paint for top coat. • Paint to be used (for each color): Metallic paint Hardener PB Thinner T-306 • Mixture ratio: Main agent : Hardener = 10 : 1 • Viscosity: 10 — 13 sec./20°C (68°F) • Film thickness: 15 — 20 μ • Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm <sup>2</sup> , 36 — 50 psi)
7	Drying	Not required.	Dry at normal temperature [at least 10 min. at 20°C (68°F)]. In half-dried condition, avoid dust, dirt.
8	Top coat paint (II)	Not required.	Apply a clear coat to parts with top coat paint (I), three times at 5 — 7 minutes intervals. • Paint to be used: Metallic paint Hardener PB Thinner T-301 • Mixture ratio: Clear coat : Hardener = 6 : 1 • Viscosity: 14 — 16 sec./20°C (68°F) • Film thickness: 25 — 30 μ • Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm <sup>2</sup> , 36 — 50 psi)
9	Drying	60°C (140°F), 60 min. or 80°C (176°F), 30 min. If higher than 80°C (176°F), PP may become be deformed. Keep maximum temperature 80°C (176°F) or less.	
10	Inspection	Check paint.	
11	Removal of mask- ing	Remove the masking tape applied in procedure 2.	

## 2. REPAIR INSTRUCTIONS FOR COLORED PP BUMPER

**NOTE:**

All PP bumpers are provided with a grained surface, and if the surface is damaged, it cannot normally be restored to its former condition. Damages limited to the shallow scratches that cause only a change in the luster of the base material or coating, can be almost fully restored. Before repairing a damaged area, explain this point to the customer and obtain an understanding about the matter. Repair methods are outlined below, based on a classification of the extent of damage.

1) Minor damage causing only a change in the luster of the bumper due to a light touch  
Almost restorable.

Process No.	Process name	Job contents	
1	Cleaning	Clean the area to be repaired using water.	
2	Sanding	Grind the repairing area with #500 sand paper in a "feathering" motion.	
3	Finish	Resin section	Coated section
		Repeatedly apply wax to the affected area using soft cloth (such as flannel). Recommended wax: NITTO KASEI Soft 99 TIRE WAX BLACK, or equivalent.	Perform either the same process as for the resin section or process No. 18 and subsequent in the 3) section, depending on the degree and nature of damage.
		Polish the waxed area with clean cloth after 5 — 10 minutes.	

2) Deep damage caused by scratching with fences etc.  
A dent cannot be repaired but a whitened or swelled part can be removed.

Process No.	Process name	Job contents	
1	Cleaning	Clean the damaged area with water.	
2	Removal of damaged area	Cut off protruding area, if any, due to collision, using a putty knife.	
3	Sanding	Grind the affected area with #100 — #500 sand paper.	
4	Finish	Resin section	Coated section
		Same as step 3 in the "1)" section.	Perform step 12 and subsequent operations in the "3)" section.

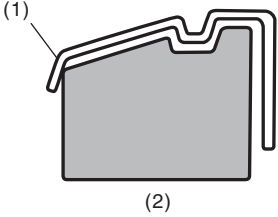
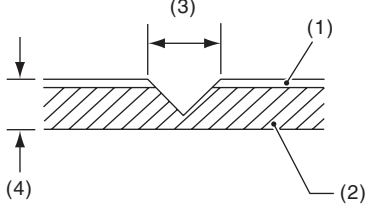
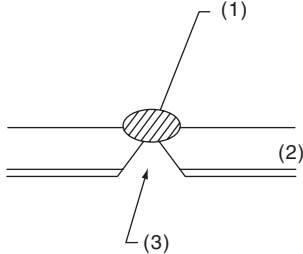
# Front Bumper

## EXTERIOR/INTERIOR TRIM

3) Deep damage such as a break or hole that requires filling

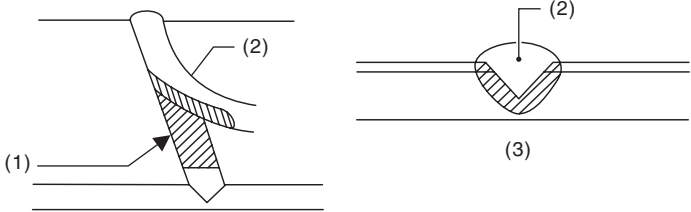

Much of the peripheral grained surface must be sacrificed for repair. The degree of restoration is not really worth the expense. (The surface, however, will become almost flush with adjacent areas.)

Recommended repair kit: PP Part Repair Kit (NRM)

Process No.	Process name	Job contents
1	Bumper removal	Remove the bumper as required.
2	Removal of parts	Remove the parts built into bumper as required.
3	Bumper placement	<p>Place the bumper on a paint worktable as required. It is recommended to use the paint worktable conforming to internal shape of bumper.</p>  <p style="text-align: right;">EI-00234</p> <p>(1) Bumper (2) Set bumper section</p>
4	Surface preparation	Remove dust, oil, etc. from areas to be repaired and surrounding areas, using a suitable solvent (NRM No. 900 Precleno, white gasoline, or alcohol, etc.).
5	Cutting	<p>If the damage is a crack or a hole, cut a guide slit of 20 to 30 mm (0.79 to 1.18 in) in length along the crack or hole up to the bumper base surface. Next, use a knife or grinder to carve a V-shaped groove in the area for repair.</p>  <p style="text-align: right;">EI-00235</p> <p>(1) Paint surface (2) PP base surface (3) 20 — 30 mm (0.79 — 1.18 in) (4) 3 mm (0.12 in)</p>
6	Sanding (I)	Grind beveled surface with sand paper (#40 — #60) to smooth finish.
7	Cleaning	Clean the sanded surface with the same solvent as used in Procedure 4.
8	Temporary welding	<p>Grind the side just opposite the beveled area with sand paper (#40 — #60) and clean using a solvent. Temporarily spot-weld the side, using PP welding rod and heater gun.</p>  <p style="text-align: right;">EI-00236</p> <p>(1) Welded point (Use heater gun and PP welding rod) (2) PP base surface (3) Beveled section</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Do not melt welding rod until it flows out. This results in reduced strength.</li> <li>• Leave the welded spot unattended until it cools completely.</li> </ul>

# Front Bumper

EXTERIOR/INTERIOR TRIM

Process No.	Process name	Job contents
9	Welding	<p>Using a heater gun and PP welding rod, weld the beveled spot while melting both the rod and damaged area.</p>  <p>(1) Welding rod (2) Melt hatched area (3) Section</p> <p>NOTE:</p> <ul style="list-style-type: none"> <li>• Melt the sections indicated by hatched area.</li> <li>• Do not melt the welding rod until it flows out, in order to provide strength.</li> <li>• Always keep the heater gun 1 to 2 cm (0.4 to 0.8 in) away from the welding spot.</li> <li>• Leave the welded spot unattended until it cools completely.</li> </ul> <p style="text-align: right;">EI-00237</p>
10	Sanding (II)	<p>Remove excess part of weld with a putty knife. If a drill or disc wheel is used instead of the knife, operate it at a rate lower than 1,500 rpm and grind the excess part little by little. A higher rpm will cause the PP substrate to melt from the heat.</p>  <p style="text-align: right;">EI-00042</p> <p>Sand the welded spot smooth with #240 sand paper.</p>
11	Masking	<p>Mask the black substrate section using masking tape. Recommended masking tape: Nichiban No. 533 or equivalent</p>
12	Cleaning/degreasing	<p>Completely clean the entire coated area, using solvent similar to that used in Procedure 4.</p>
13	Primer coating	<p>Apply a coat of primer to the repaired surface and its surrounding areas. Mask these areas, if necessary. Recommended primer: Mp/ 364 PP Primer</p> <p>NOTE: Be sure to apply a coat of primer using a spray gun at a pressure of 245 — 343 kPa (2.5 — 3.5 kg/cm<sup>2</sup>, 36 — 50 psi).</p>
14	Leave unattended	<p>Leave the repaired area unattended at 20°C (68°F) for 10 to 15 minutes until primer is half-dry.</p> <p>NOTE: If dirt or dust comes in contact with the coated area, wipe it off with a cloth dampened with alcohol. (Do not use thinner since the coated area tends to melt.)</p>
15	Primer surfacer coating	<p>Apply primer surfacer to the repaired area two or three times at an interval of 3 — 5 minutes.</p> <ul style="list-style-type: none"> <li>• Recommended surfacer: UPS 300 Flex Primer No. 303 UPS 300 Exclusive hardener NPS 725 Exclusive Reducer (thinner)</li> <li>• Mixture ratio: 2 : 1 (UPS 300 : No. 303)</li> <li>• Viscosity: 12 — 14 sec./20°C (68°F)</li> <li>• Coating film thickness: 40 — 50 μ</li> </ul>
16	Drying	<p>Allow the coated surface to dry for 20 minutes at 20°C (68°F) [or 30 minutes at 60°C (140°F)].</p>
17	Sanding (III)	<p>Sand the coated surface and its surrounding areas using #400 sand paper and water.</p>

# Front Bumper

## EXTERIOR/INTERIOR TRIM

Process No.	Process name	Job contents	
18	Cleaning/degreasing	Same as Process No. 12.	
19	Top coat (I)	Non-colored	Metallic paint
		Use a "block" coating method. <ul style="list-style-type: none"> <li>Recommended paint: Suncryl (SC) No. 307 Flex Hardener SC Reducer (thinner)</li> <li>Mixture ratio: Suncryl (SC) : No. 307 Flex Hardener = 3 : 1</li> <li>Viscosity: 11 — 13 sec./20°C (68°F)</li> <li>Coating film thickness: 40 — 50 μ</li> <li>Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm<sup>2</sup>, 36 — 50 psi)</li> </ul>	Use a "block" coating method. <ul style="list-style-type: none"> <li>Recommended paint: Suncryl (SC) No. 307 Flex Hardener SC Reducer (thinner)</li> <li>Mixture ratio: Suncryl (SC) : No. 307 Flex Hardener = 3 : 1</li> <li>Viscosity: 11 — 13 sec./20°C (68°F)</li> <li>Coating film thickness: 20 — 30 μ</li> <li>Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm<sup>2</sup>, 36 — 50 psi)</li> </ul>
20	Leave unattended	Not required.	Leave unattended at 20°C (68°F) for at least 10 minutes until the topcoated area is half-dry. <b>NOTE:</b> Be careful to keep dust or dirt from coming in contact with the affected area.
21	Top coat (II)	Not required.	Apply a clear coat three times at an interval of 3 to 5 minutes. <ul style="list-style-type: none"> <li>Recommended paint: SC710 Overlay Clear No. 307 Flex Hardener SC Reducer (thinner)</li> <li>Mixture ratio: Suncryl (SC) : No. 307 Flex Hardener = 3 : 1</li> <li>Viscosity: 10 — 13 sec./20°C (68°F)</li> <li>Coating film thickness: 20 — 30 μ</li> <li>Spraying pressure: 245 — 343 kPa (2.5 — 3.5 kg/cm<sup>2</sup>, 36 — 50 psi)</li> </ul>
22	Drying	Allow the coated surface to dry for two hours at 20°C (68°F) or 30 minutes at 60°C (140°F). <b>NOTE:</b> Do not allow the temperature to exceed 80°C (176°F) since this will deform the PP substrate.	
23	Inspection	Carefully check the condition of the repaired area.	
24	Removal of masking	Remove the masking tape applied in Process No. 11 and 13.	
25	Parts installation	Install parts on the bumper in reverse order of removal.	
26	Bumper installation	Install the bumper.	

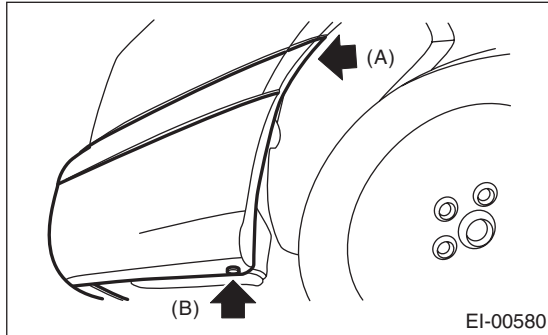


## 9. Rear Bumper

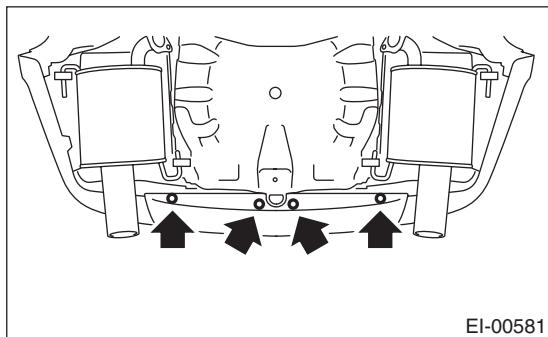
### A: REMOVAL

#### 1. REAR BUMPER FACE (SEDAN MODEL)

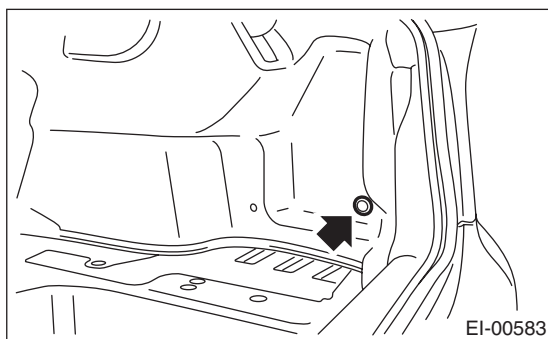
- 1) Disconnect the ground cable from the battery.
- 2) Turn over the mud guard, and remove the bolt (A) inside wheel house, and the clips (B) on the lower side of the bumper.



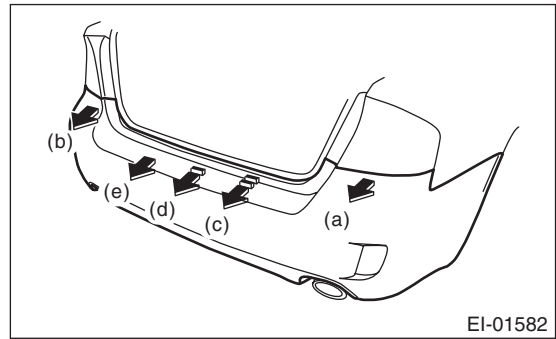
- 3) Remove the clips on the lower side of rear bumper.



- 4) Remove the service hole cover, and remove the bolt.



- 5) Remove the bumper face from the vehicle body in the order from (a) to (e).



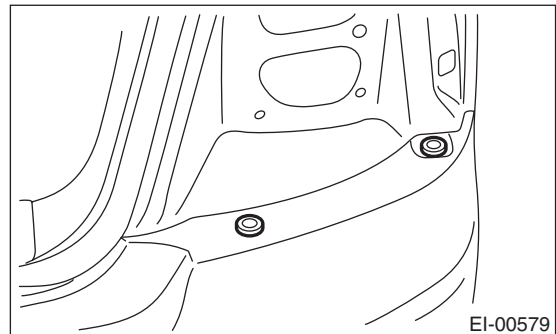
- (1) Detach the engaged section from the corner bracket of the rear combination light RH and LH.
- (2) Detach the engaged section of the bumper face center from one end to the another.

#### NOTE:

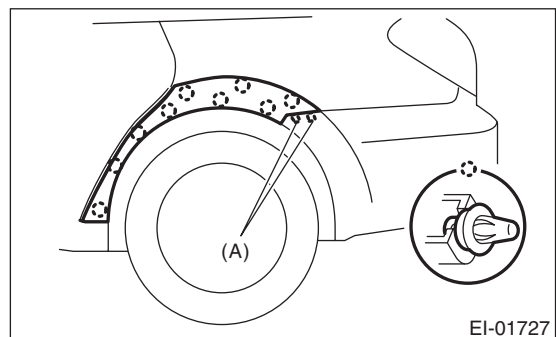
Do not pull with an excessive force. Otherwise the bumper face flange sections may be damaged.

#### 2. REAR BUMPER FACE (WAGON MODEL)

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear combination light assembly. <Ref. to LI-23, REMOVAL, Rear Combination Light Assembly.>
- 3) Remove the two clips.



- 4) For OUTBACK model, remove the side garnish of the rear fender.



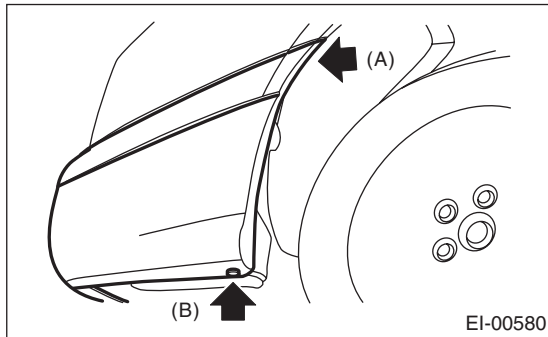
#### NOTE:

For removing the claw (A) of side garnish from the bumper face.

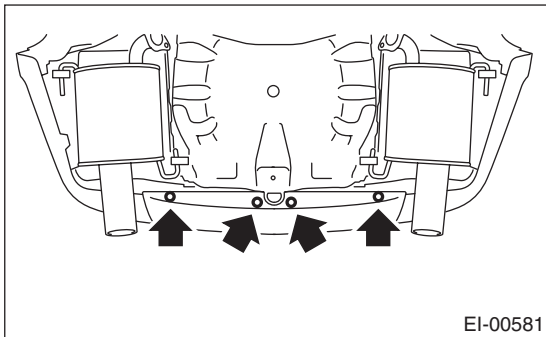
# Rear Bumper

## EXTERIOR/INTERIOR TRIM

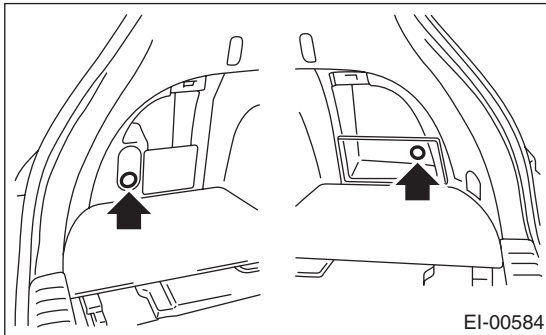
5) Turn over the mud guard, and remove the bolt (A) inside wheel house, and the clips (B) on the lower side of the bumper.



6) Remove the clips on the lower side of rear bumper.

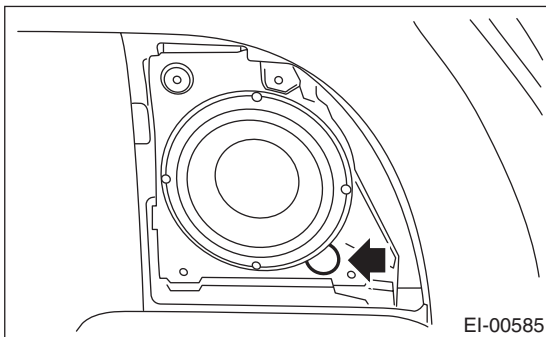


7) Remove the service hole cover, and remove the bolt.

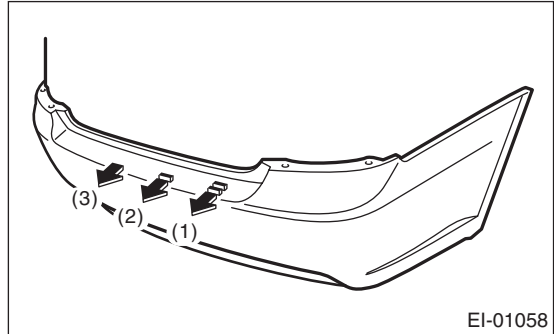


### NOTE:

For models with woofers, remove the woofer cover.



8) Remove the rear bumper from vehicle body.



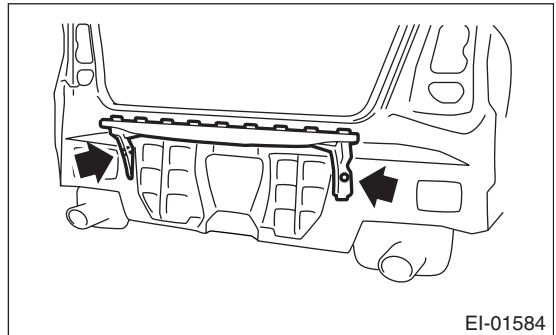
### NOTE:

- Do not pull with an excessive force. Otherwise the bracket installation area may be damaged.
- To facilitate the removal of bracket, detach the engaged sections between bumper face and bracket from one end to the other.

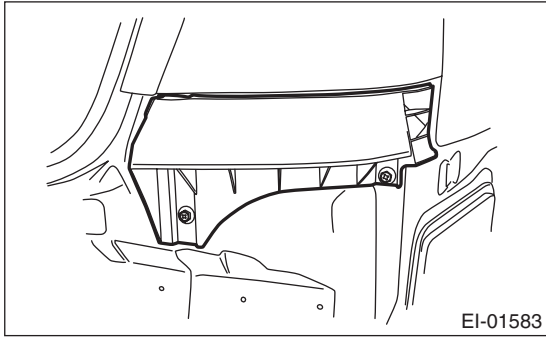
## 3. REAR BUMPER BRACKET

Remove the rear bumper face from vehicle body, and remove each bumper bracket.

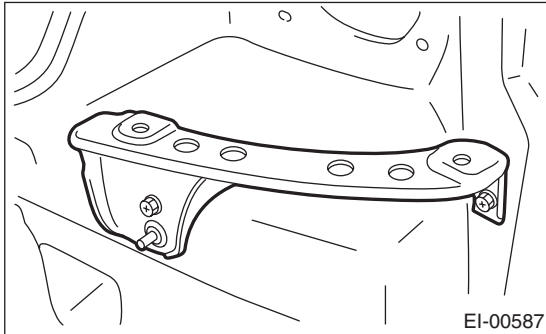
- Upper bracket



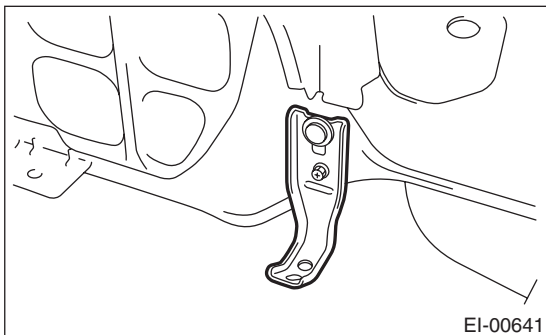
- Corner bracket
  - Sedan model



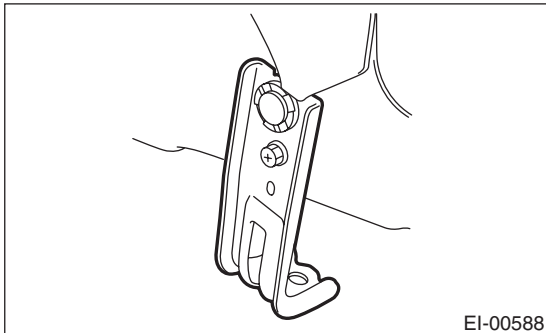
- Wagon model



- Lower bracket
  - Sedan model

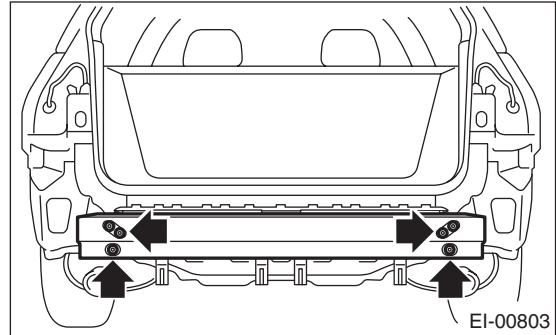


- Wagon model

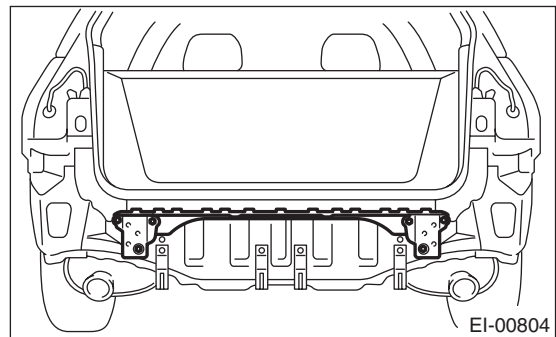


## 4. REAR BUMPER BEAM ASSEMBLY

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear bumper face. <Ref. to EI-37, REAR BUMPER FACE (SEDAN MODEL), REMOVAL, Rear Bumper.>
- 3) Remove the energy absorber foam.
- 4) Remove the nuts, and remove the beam main reinforcement from the vehicle body.



- 5) Remove the nuts, and remove the bumper beam bracket and beam upper rear from the vehicle body.



## B: INSTALLATION

Install in the reverse order of removal.

### NOTE:

- When the side garnish is removed, replace the double-sided tape with new one.
- If the bumper face comes off easily from the beam upper rear, adjust the hook of the bracket side.

### Tightening torque:

Refer to "COMPONENT" of "General Description". <Ref. to EI-6, REAR BUMPER (SEDAN MODEL), COMPONENT, General Description.> <Ref. to EI-7, REAR BUMPER (WAGON MODEL), COMPONENT, General Description.>

## C: REPAIR

Refer to front bumper repair. <Ref. to EI-32, REPAIR, Front Bumper.>

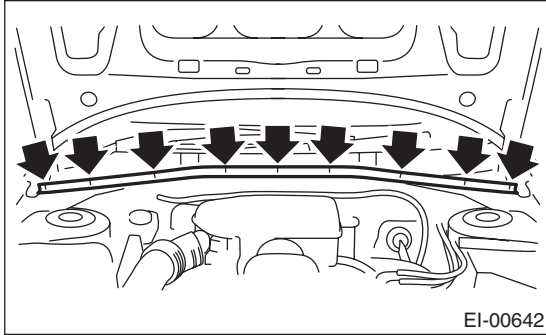
# Cowl Panel

EXTERIOR/INTERIOR TRIM

## 10.Cowl Panel

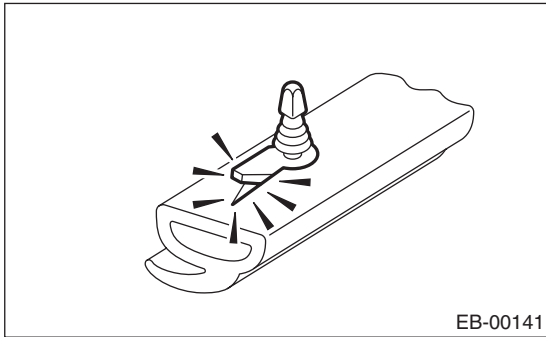
### A: REMOVAL

- 1) Open the front hood.
- 2) Remove the wiper arm. <Ref. to WW-13, REMOVAL, Front Wiper Arm.>
- 3) Remove the weather strip clips, and remove the weather strip.

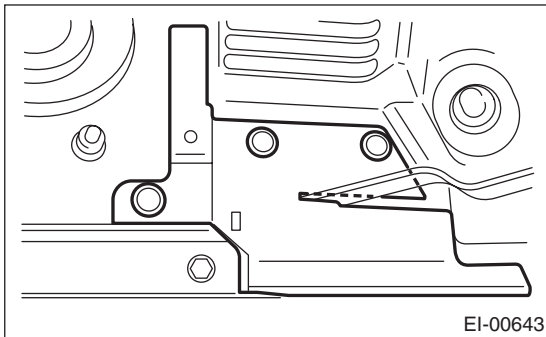


#### NOTE:

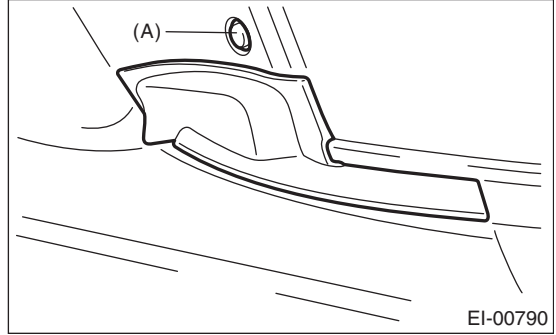
If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use a clip remover to remove.



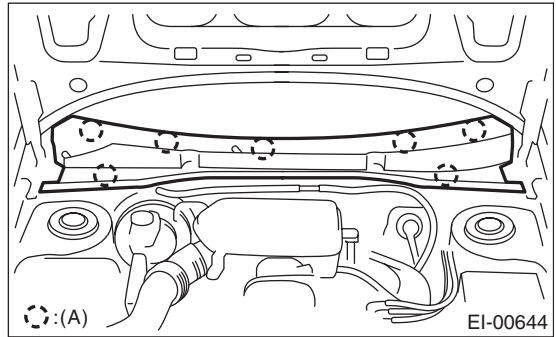
- 4) Remove the clip, and remove the cover cowl panel.



- 5) Remove the cowl panel side and clip (A).



- 6) Remove the clips (A), and remove the cowl panel.



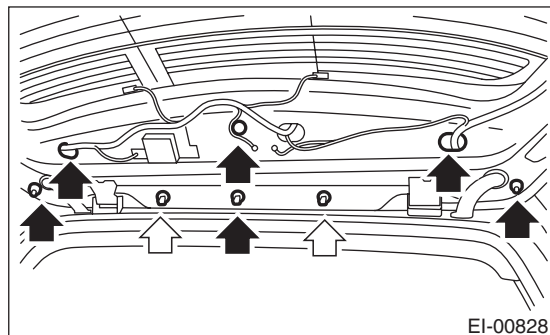
### B: INSTALLATION

Install in the reverse order of removal.

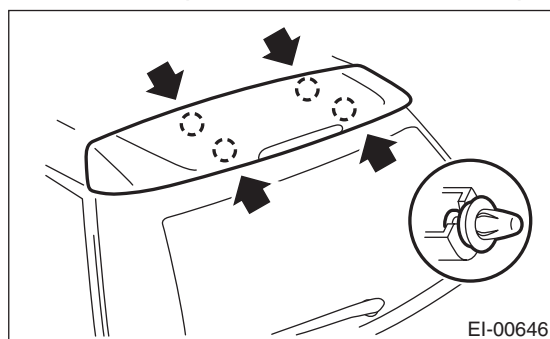
## 11. Roof Spoiler

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 3) Disconnect the connector of high-mounted stop light and the washer hose of rear washer.
- 4) Remove the nut and plastic caps.



- 5) Remove the clips, and remove the roof spoiler.



### B: INSTALLATION

Install in the reverse order of removal.

**Tightening torque:**

**4.5 N·m (0.46 kgf·m, 3.32 ft·lb)**

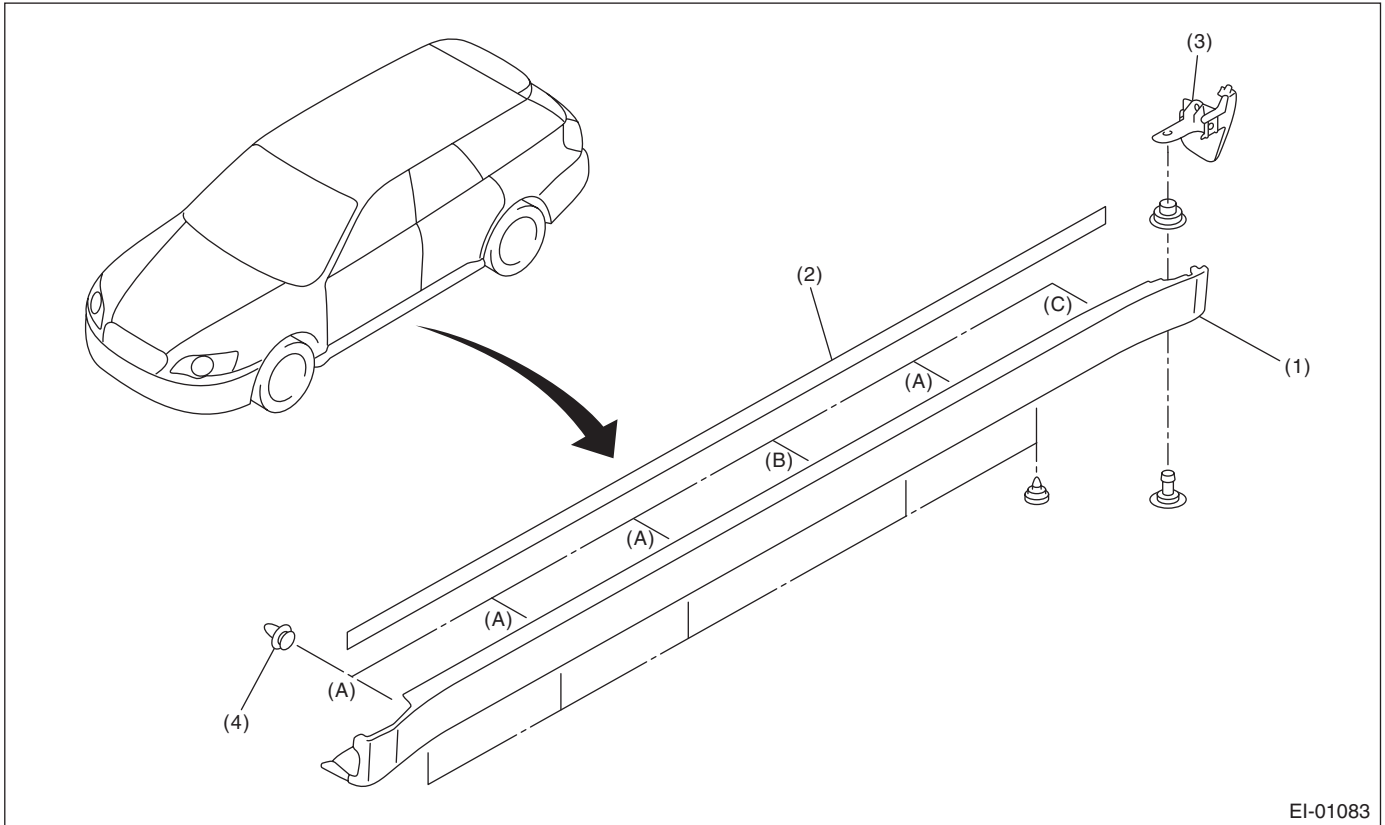
# Side Sill Spoiler

EXTERIOR/INTERIOR TRIM

## 12.Side Sill Spoiler

### A: REMOVAL

Remove the clips (two in the front fender arch, six for side sill spoiler lower area), and remove the side spoiler.



- |                       |                |                |
|-----------------------|----------------|----------------|
| (A) Yellow clip       | (B) Green clip | (C) Black clip |
| (1) Side sill spoiler | (3) End cover  | (4) Clip       |
| (2) Double-sided tape |                |                |

#### NOTE:

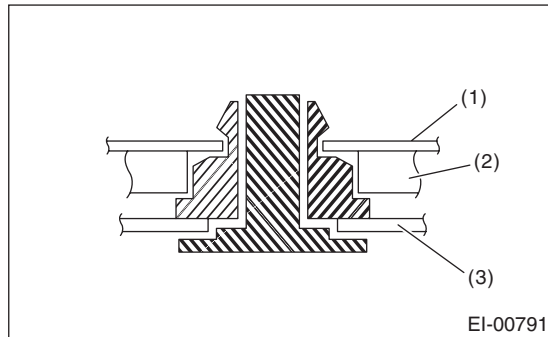
When peeling the double sided tape, refer to removal procedures for the side protector. <Ref. to EI-44, REMOVAL, Side Protector.>

## B: INSTALLATION

Install in the reverse order of removal.

### NOTE:

For the rearmost clip securing the side sill spoiler, install through the end cover.



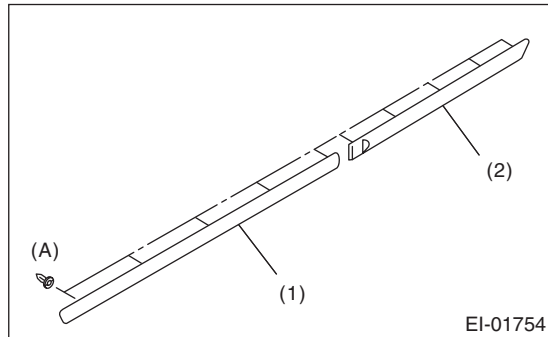
- (1) Vehicle body
- (2) End cover
- (3) Side sill spoiler

# Side Protector

EXTERIOR/INTERIOR TRIM

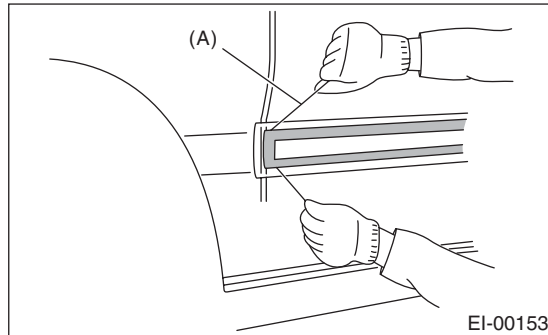
## 13.Side Protector

### A: REMOVAL



- (A) White clip
- (1) Front door protector
- (2) Rear door protector

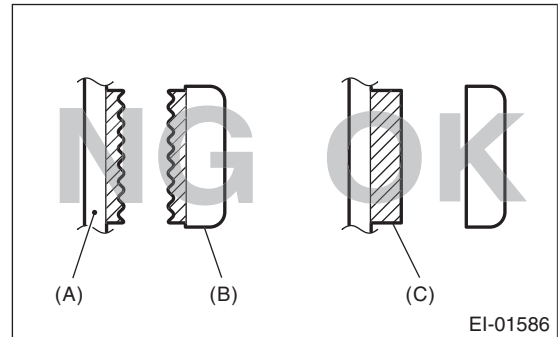
1) Slide in a thin thread (A) of 0.8 mm (0.031 in) diameter or less (fishing line etc.) between the body and the protector, and cut the double-sided tape. Pull the protector, and remove the clip using the clip remover.



#### NOTE:

- To optimize the effect of solvent, slide the thread along body without removing the double-sided tape on the surface of body and spoiler.
- If it is difficult to remove the double-sided tape, warm it up to approx. 40°C (104°F).

- If the double-sided tape remains thick on the surface due to interfacial peeling, apply solvent after slicing off the double-sided tape using a cutter.



- (A) Panel
- (B) Side protector
- (C) Double-sided tape

- 2) Apply masking tape around the double-sided tape remaining on the surface of body or spoiler.
- 3) Apply solvent uniformly on the double-sided tape using a brush.

#### CAUTION:

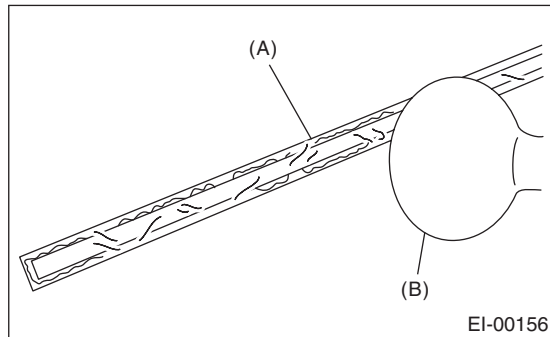
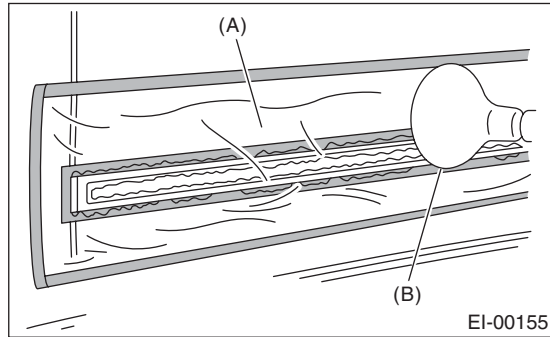
- Do not use solvent to the body which has been repaired with lacquer paint.
- Wipe off immediately when the solvent is attached on surface of the body or spoiler.

#### Solvent:

*3M 8907 or equivalent*



4) Cover the area where solvent is applied using plastic wrap (A), and then heat the double-sided tape for 5 to 10 minutes in 40 — 60°C (104 — 140°F) using a heat light (B).



**CAUTION:**

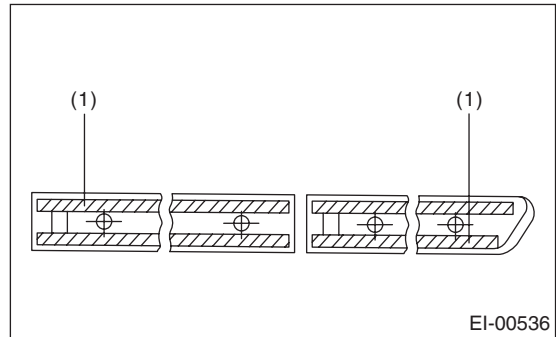
**Do not heat the double-sided tape until the surface becomes white and excessively dried.**

5) Remove the double-sided tape using a plastic spatula.

6) After completely removing the double-sided tape, detach the masking tape and clean the surface using a cotton cloth dampened with white gasoline.

**B: INSTALLATION**

1) Apply primer to the protector surface where the double-sided tape is to be adhered, and then adhere the double-sided tape as shown in the figure.



(1) Double-sided tape: thickness 1.2 mm (0.047 in), width 5 mm (0.197 in)

**Primer:**

**3M K-500 or equivalent**

**Double-sided tape:**

**3M 5531-5 or equivalent**

2) Heat the adhering part using a heat light.

Body side: 40 — 60°C (104 — 140°F)

Protector side: 20 — 30°C (68 — 86°F)

3) Peel off the backing sheet of double-sided tape, align the clip position, and then adhere the tape to the body while taking care to avoid air entering.

**CAUTION:**

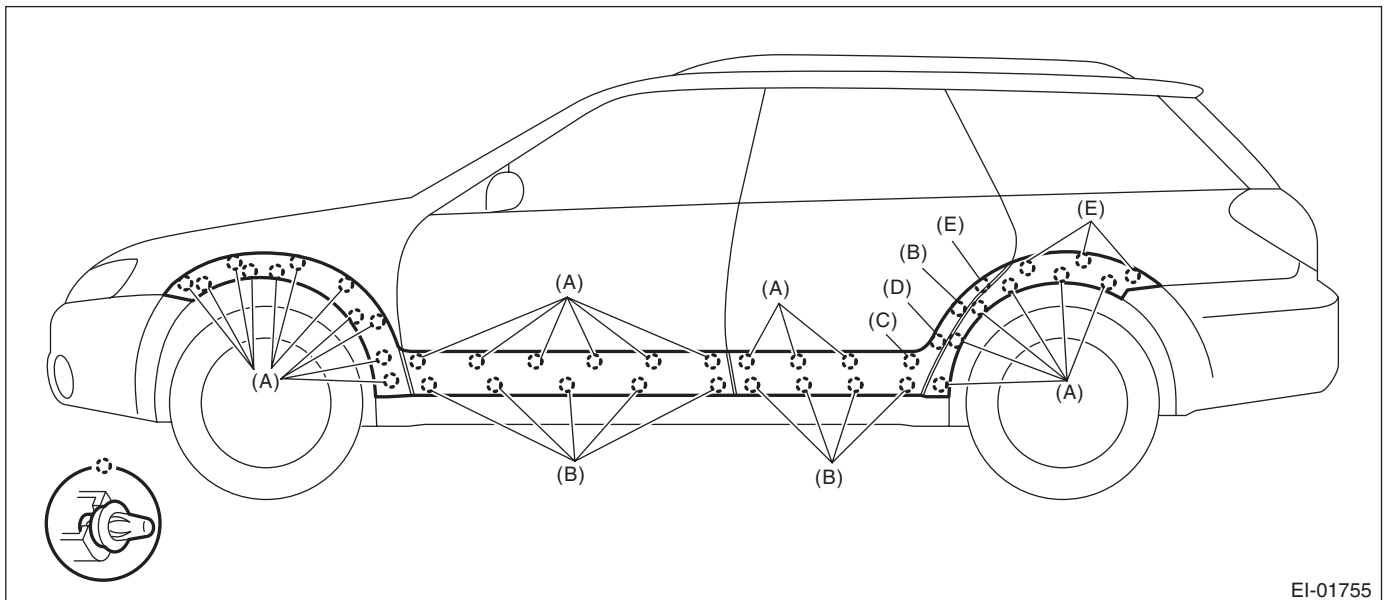
**To keep the adhesion, do not wash the vehicle within 24 hours from installation.**

## Side Garnish

EXTERIOR/INTERIOR TRIM

### 14.Side Garnish

#### A: REMOVAL



EI-01755

(A) Black clip

(B) White clip

(C) Pink clip

(D) Gray clip

(E) Green clip

1) Remove the side sill spoilers. <Ref. to EI-42, REMOVAL, Side Sill Spoiler.>

2) For removal of the side garnish, refer to the removal procedure of "Side Protector". <Ref. to EI-44, REMOVAL, Side Protector.>

#### B: INSTALLATION

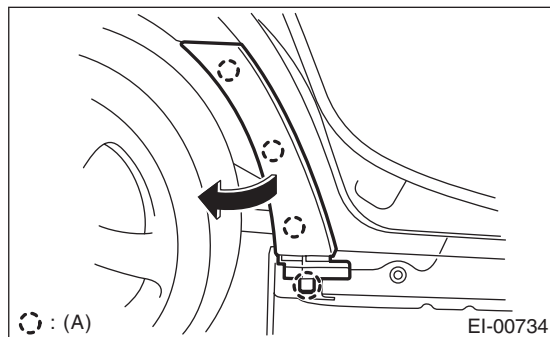
Check the color of the clip, and install in the reverse order of removal.

## 15.Rear Quarter Protector

### A: REMOVAL

1) Remove the side sill spoilers. <Ref. to EI-42, REMOVAL, Side Sill Spoiler.>

2) Remove clips (A) by rotating it rearward using the fender arch as a fulcrum, and then remove the rear quarter protector.



### B: INSTALLATION

Install in the reverse order of removal.

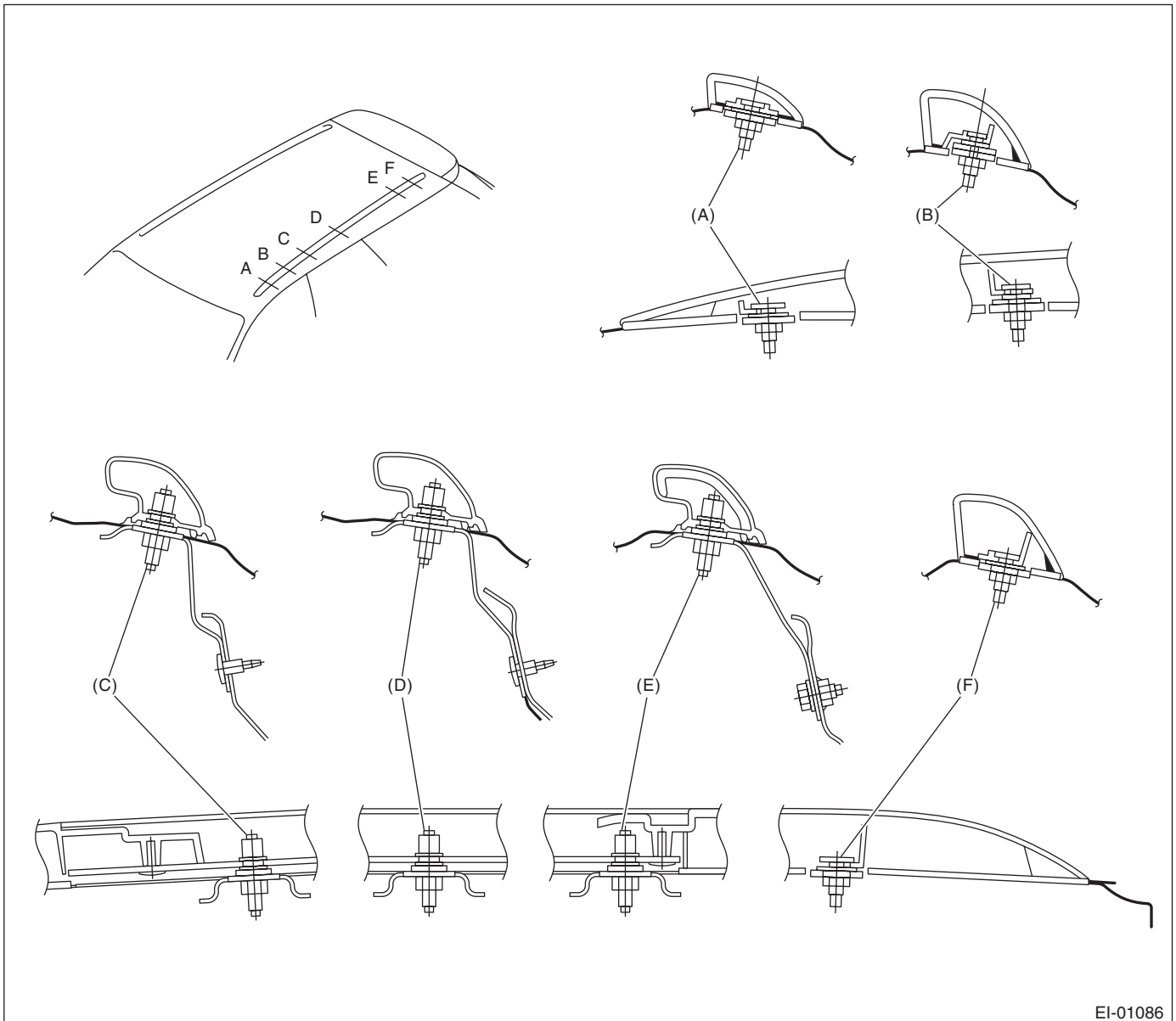
# Roof Rail

EXTERIOR/INTERIOR TRIM

## 16. Roof Rail

### A: REMOVAL

- 1) Remove the roof trim. <Ref. to EI-67, REMOVAL, Roof Trim.>
- 2) Remove the six nuts.



EI-01086

#### NOTE:

Perform the removal procedures by referring to above illustration. (OUTBACK model)

### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

When removing or installing the roof rail, be careful not to scratch the body panel with the stud bolt of roof rail.

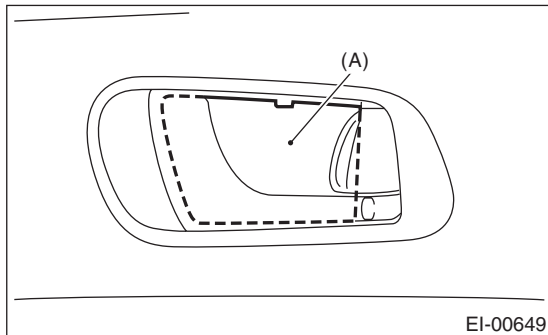
#### Tightening torque:

7.5 N-m (0.77 kgf-m, 5.53 ft-lb)

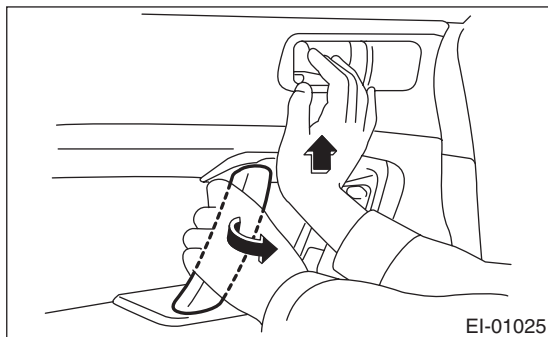
## 17. Door Trim

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the cover (A) at the inner remote area.



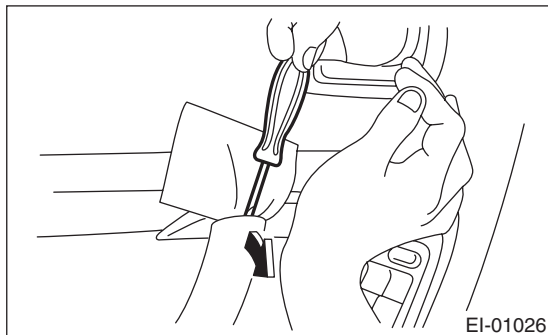
- 3) Push the root of hand grip upward, and remove the hand grip cover by twisting it towards the front of the vehicle.



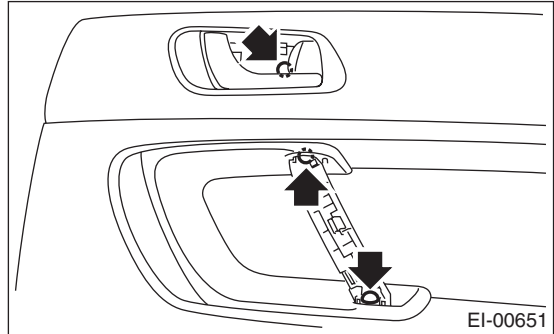
LH side: Counterclockwise  
RH side: Clockwise

#### NOTE:

If it does not come off using the procedures above, apply protective tape to the tip of a flat tip screwdriver and the door trim, and pry out the upper side of the hand grip cover.

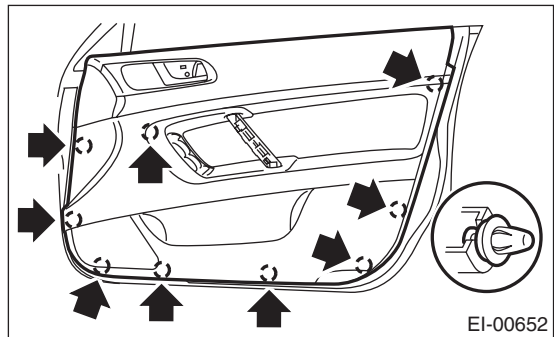


- 4) Loosen the screws.

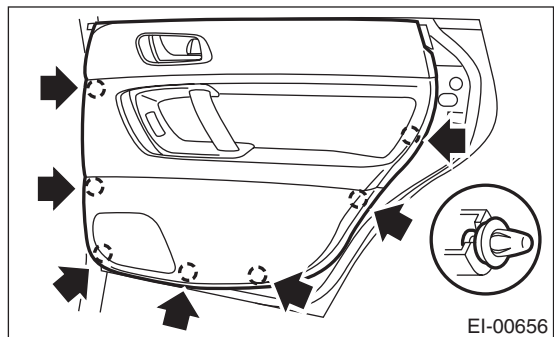


- 5) Remove the clips, and disconnect all connectors and wire cables to remove the door trim.

- Front door trim



- Rear door trim



# Door Trim

EXTERIOR/INTERIOR TRIM

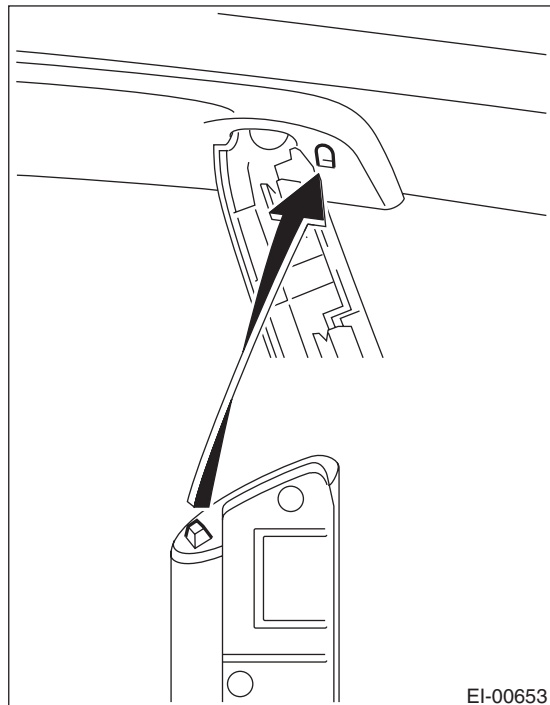
## B: INSTALLATION

Install in the reverse order of removal.

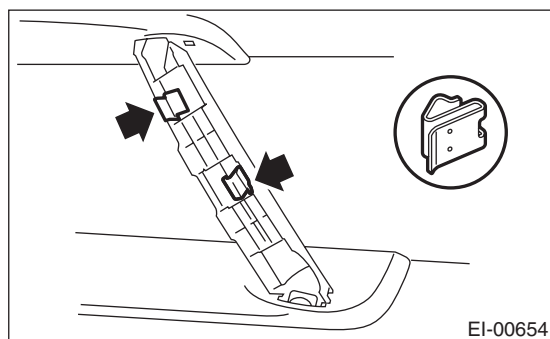
### NOTE:

Be careful not to install the hand grip cover and plate clip of the hand grip in the wrong direction.

- Hand grip cover (front and rear door)  
The side with the protrusion is the upper side.

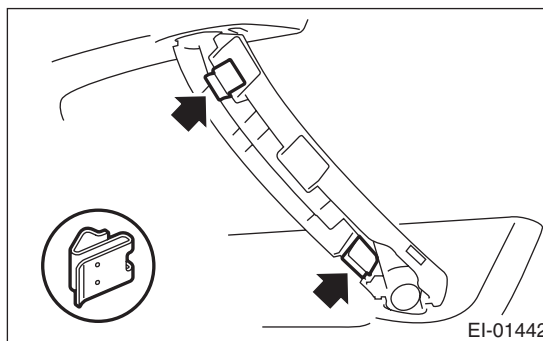


- Bottom clip of the front door faces the opposite direction



- Lower side of the hand grip cover for the front door has a claw.

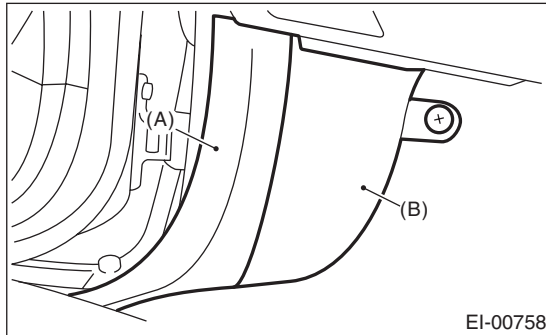
- The bottom clip of the rear door faces the opposite direction



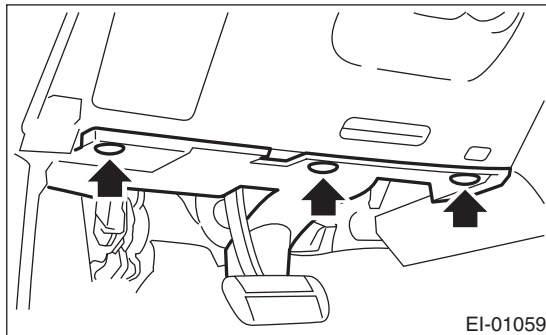
## 18. Instrument Panel Lower Cover

### A: REMOVAL

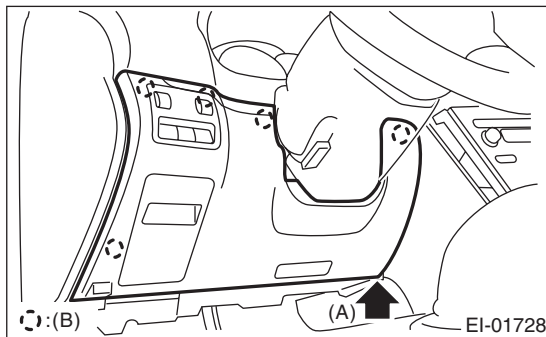
- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door inside scuff plate (A) and front pillar lower trim (B) on the driver's side. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>



- 3) Remove the clips, and remove the instrument panel lower cover under.



- 4) Loosen the screw (A), disconnect the connectors, and remove the instrument panel lower cover upper.



(B) Clip

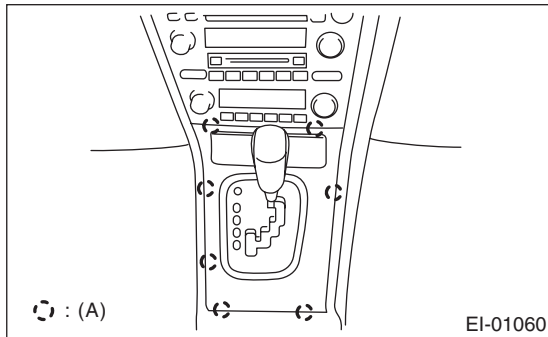
### B: INSTALLATION

Install in the reverse order of removal.

## 19. Glove Box

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 3) Remove the console front panel.

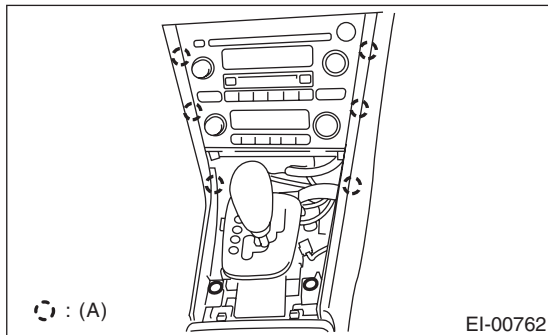


(A) Hook

#### NOTE:

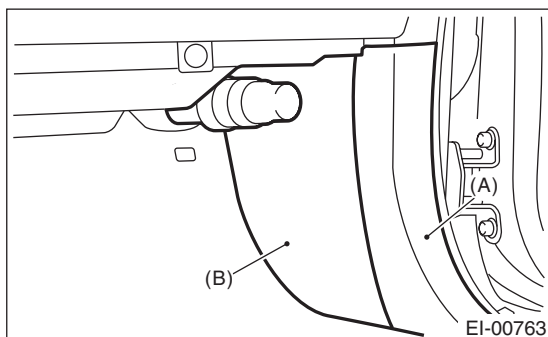
For the AT model, remove the ring indicator.  
For the MT model, remove the shift knob.

- 4) Remove the console side garnish.

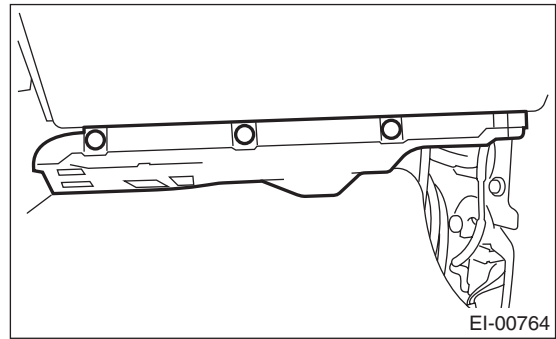


(A) Hook

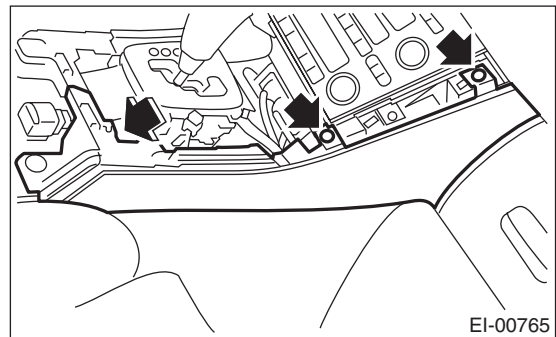
- 5) Remove the front inside scuff plate (A) and front pillar lower trim (B). <Ref. to EI-61, REMOVAL, Lower Inner Trim.>



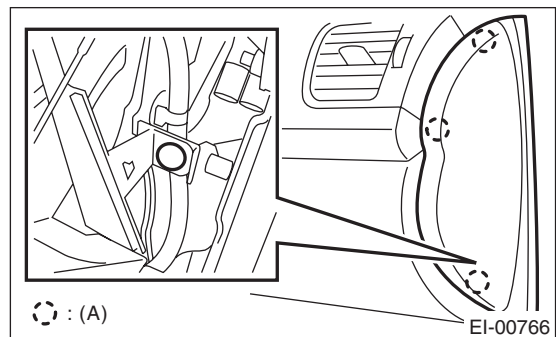
- 6) Remove the clips, and remove the glove box lower cover.



- 7) Remove the console side panel.

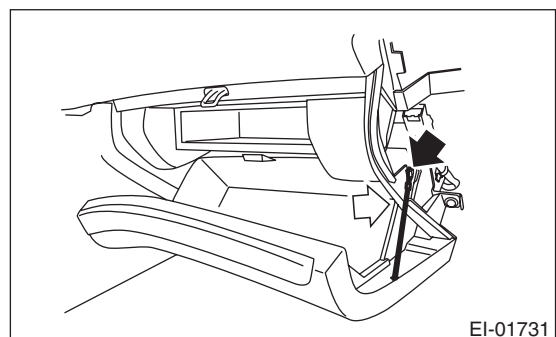


- 8) Remove the instrument panel side cover, and remove the clip.



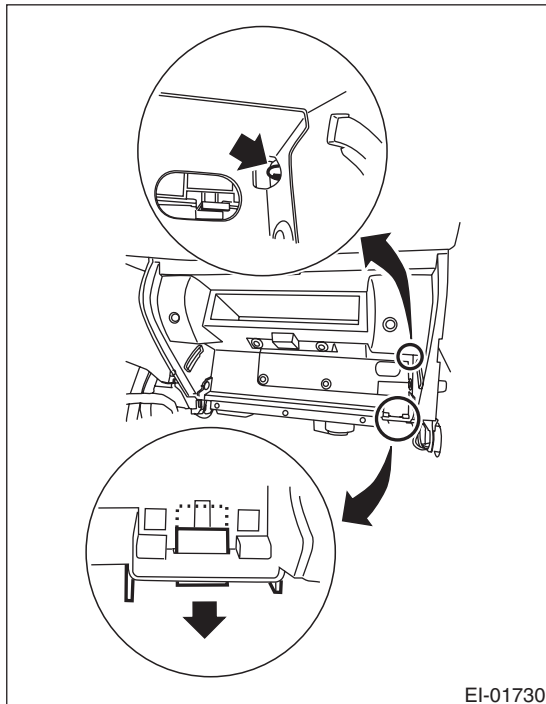
(A) Clip

- 9) Remove the strap of the glove box damper.
- 10) Remove the backside of stopper on one side, and remove the glove box lid.

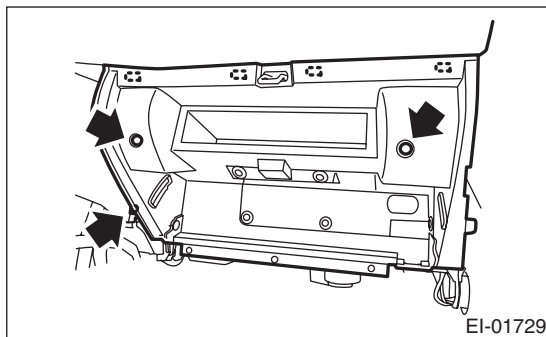




11) Remove the harness holder and connector holder.



12) Remove the screws and upper clip to remove the glove box.



## **B: INSTALLATION**

Install in the reverse order of removal.

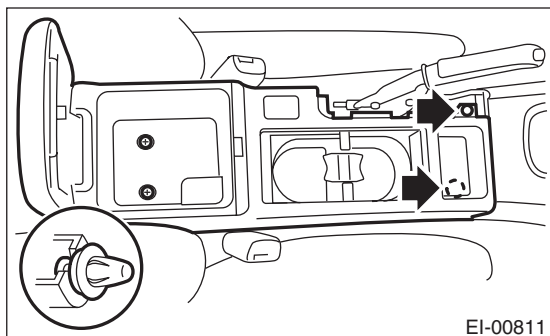
## 20. Console Box

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the parking brake lever cover.



- 3) Remove the bolts and clips.



- 4) Disconnect the connector, and remove the console box.

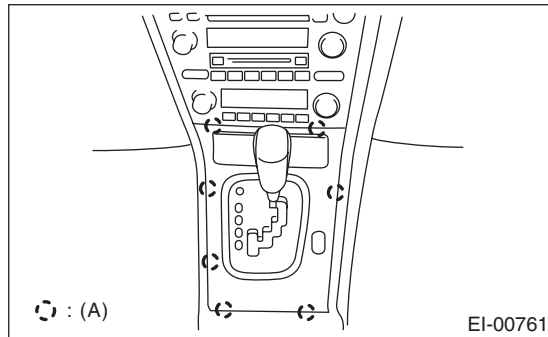
### B: INSTALLATION

Install in the reverse order of removal.

## 21.Center Console

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 3) Remove the console front panel.

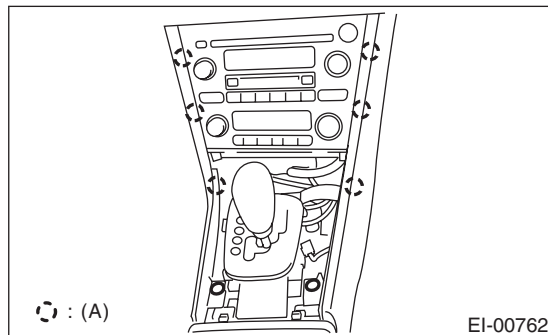


(A) Hook

#### NOTE:

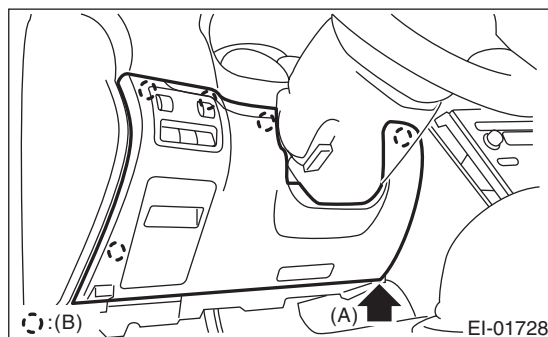
For the AT model, remove the ring indicator.  
For the MT model, remove the shift knob.

- 4) Loosen the screw, remove the hook, and remove the console side garnish.

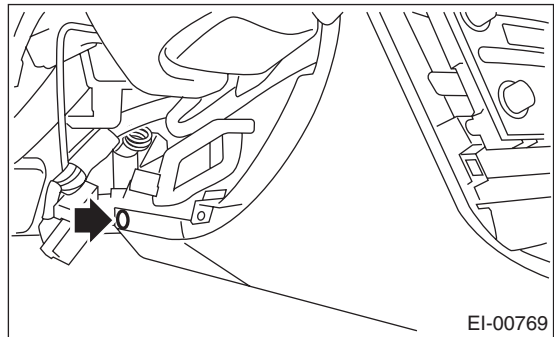


(A) Hook

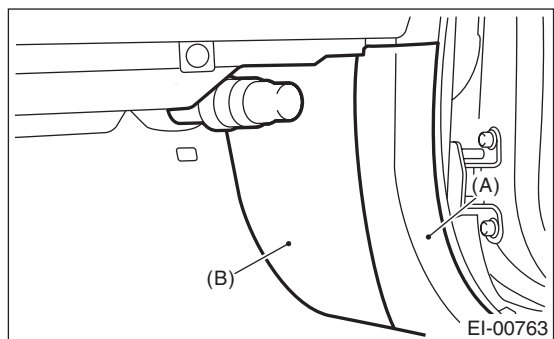
- 5) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>



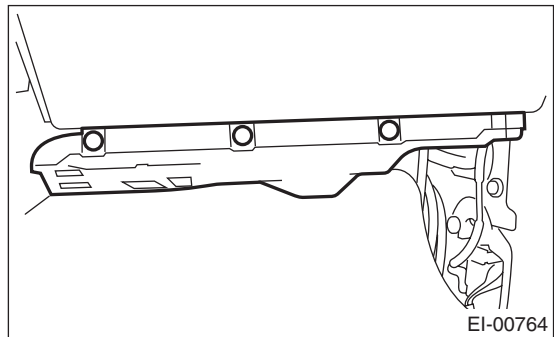
- 6) Remove the clip at the tip of the console side panel.



- 7) Remove the passenger's side front inside scuff plate (A) and front pillar lower trim (B). <Ref. to EI-61, REMOVAL, Lower Inner Trim.>



- 8) Remove the clips, and remove the glove box lower cover.

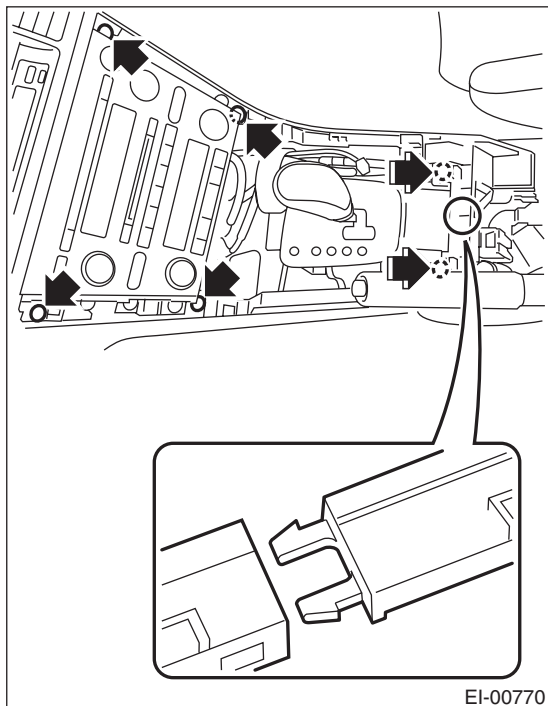


## Center Console

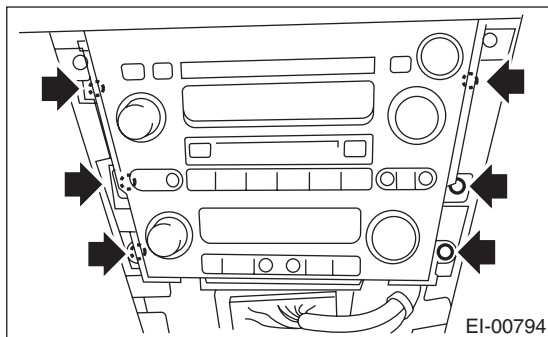
### EXTERIOR/INTERIOR TRIM

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9) Remove the screws, and remove the console side panel.



10) Loosen the screws and pull out the audio unit assembly, and disconnect the connector for removal.



#### NOTE:

The audio unit assembly can be removed without removing the console side panel.

### **B: INSTALLATION**

Install in the reverse order of removal.

## 22. Instrument Panel Assembly

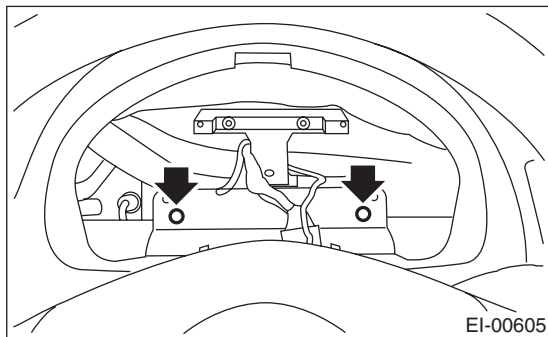
### A: REMOVAL

#### 1. INSTRUMENT PANEL (EXCLUDING STEERING SUPPORT BEAM)

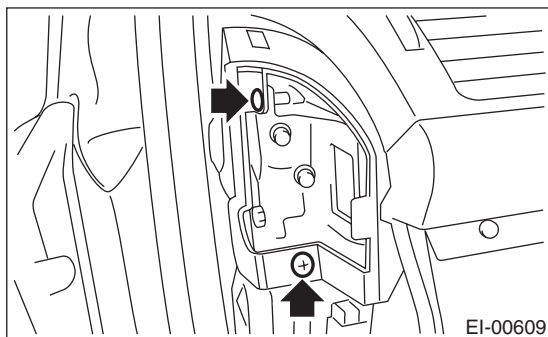
**CAUTION:**

Be careful not to damage the airbag system harness when servicing the instrument panel. Damage may cause the system to malfunction.

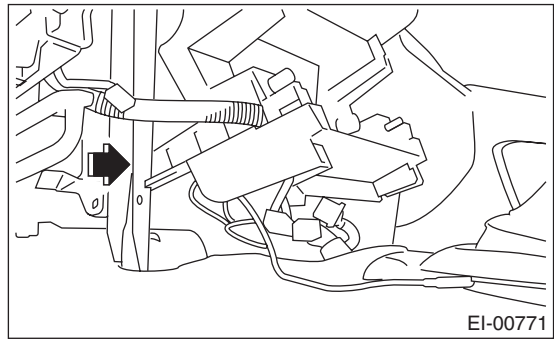
- 1) Disconnect the ground cable from the battery.
- 2) Remove the front pillar upper trim. <Ref. to EI-62, REMOVAL, Upper Inner Trim.>
- 3) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 4) Remove the center console. <Ref. to EI-55, REMOVAL, Center Console.>
- 5) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>
- 6) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>
- 7) Remove the combination meter assembly. <Ref. to IDI-19, REMOVAL, Combination Meter.>
- 8) Remove the screws.



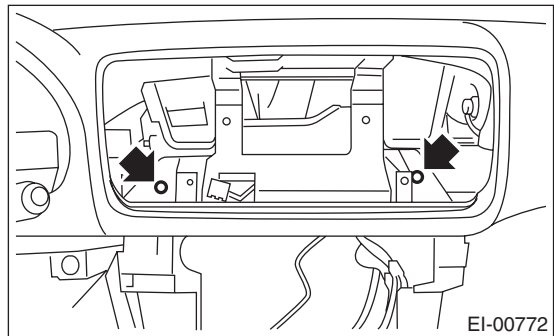
- 9) Remove the driver's side instrument panel side cover, and remove the screws.



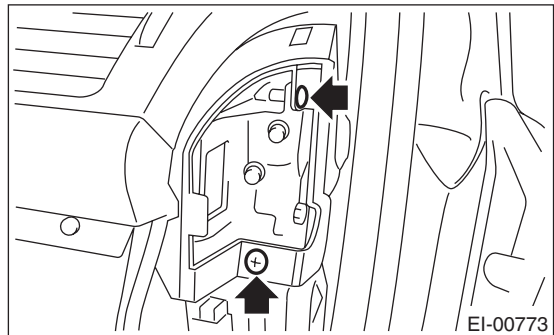
- 10) Remove the screw at the side of the center console.



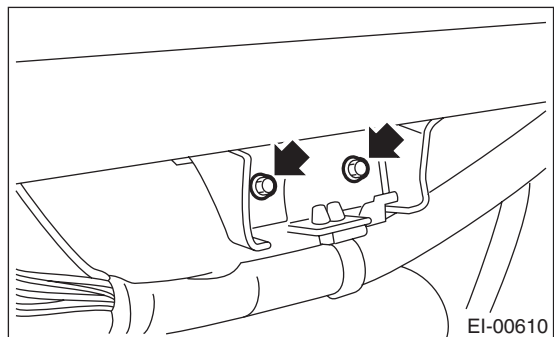
- 11) Remove the center air vent grille of the instrument panel. <Ref. to AC-46, CENTER GRILLE, REMOVAL, Air Vent Grille.>
- 12) Remove the screws.



- 13) Remove the screws at the side of the passenger's side instrument panel.



- 14) Remove the bolts securing the passenger's side airbag module to the steering support beam.



# Instrument Panel Assembly

## EXTERIOR/INTERIOR TRIM

15) Disconnect the connectors, and remove the instrument panel from vehicle body.

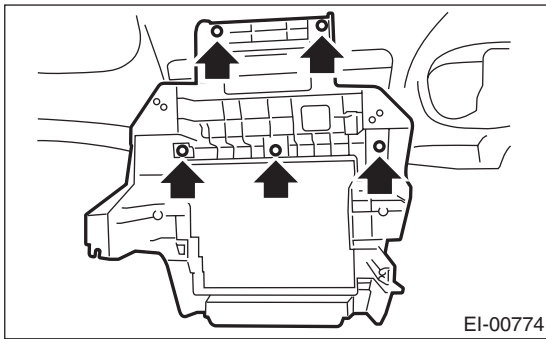
### NOTE:

- If necessary, make alignment marks for easy re-assembly.
- When storing the removed instrument panel, be sure to prepare a table or the like to place the instrument panel, in order to prevent scratches or other damage to the panel.

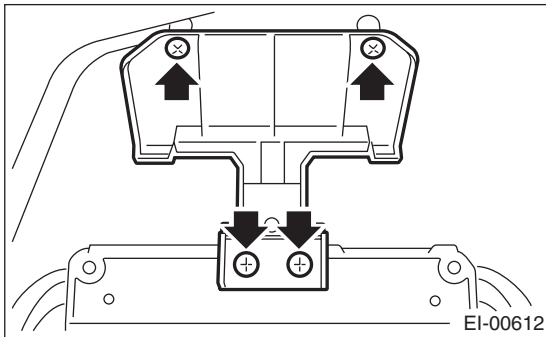
16) Remove the side air vent grille. <Ref. to AC-46, REMOVAL, Air Vent Grille.>

17) Remove the heater vent duct. <Ref. to AC-48, REMOVAL, Heater Vent Duct.>

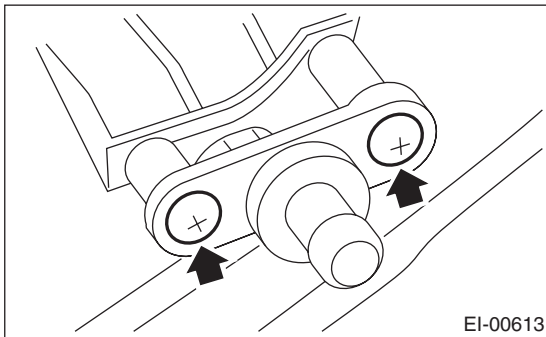
18) Loosen the screws to remove the center console frame.



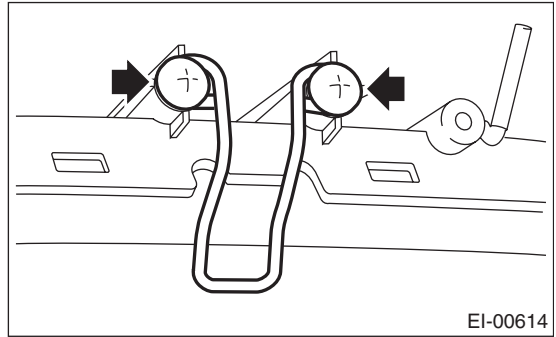
19) Loosen the screws to remove the meter bracket.



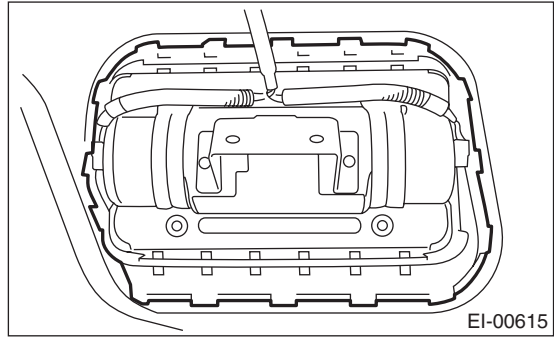
20) Loosen the screws to remove the instrument panel matching pins.



21) Loosen the screws to remove the glove box striker.



22) Remove the claw, and remove the passenger's airbag module.



## 2. STEERING SUPPORT BEAM

1) Remove the instrument panel. <Ref. to EI-57, INSTRUMENT PANEL (EXCLUDING STEERING SUPPORT BEAM), REMOVAL, Instrument Panel Assembly.>

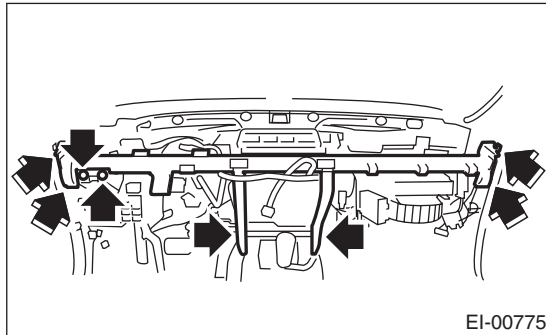
2) Remove the steering shaft assembly. <Ref. to PS-17, REMOVAL, Tilt Steering Column.>

3) Remove all harness clips, and remove the harness from the steering support beam.

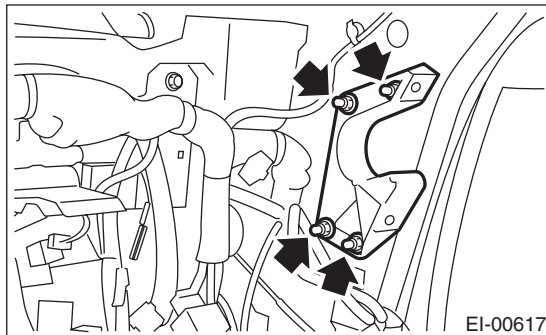
**NOTE:**

If necessary, make alignment marks for easy reassembly.

4) Remove the bolts and remove the steering support beam.



5) Remove the steering support beam bracket.



## 3. INSTRUMENT PANEL ASSEMBLY (INCLUDING STEERING SUPPORT BEAM)

**CAUTION:**

**Be careful not to damage the airbag system harness when servicing the instrument panel. Damage may cause the system to malfunction.**

1) Remove the front pillar upper trim. <Ref. to EI-62, REMOVAL, Upper Inner Trim.>

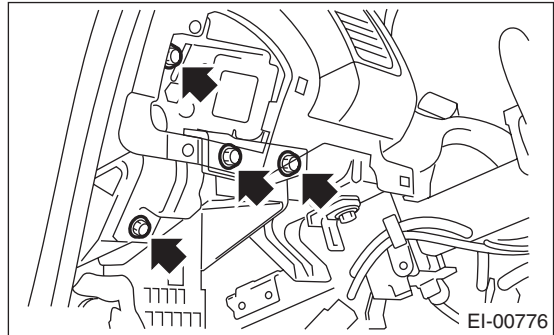
2) Remove the center console. <Ref. to EI-55, REMOVAL, Center Console.>

3) Remove the instrument panel lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.>

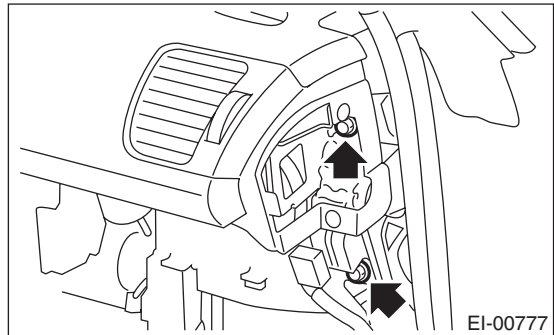
4) Remove the glove box. <Ref. to EI-52, REMOVAL, Glove Box.>

5) Remove the steering shaft assembly. <Ref. to PS-17, REMOVAL, Tilt Steering Column.>

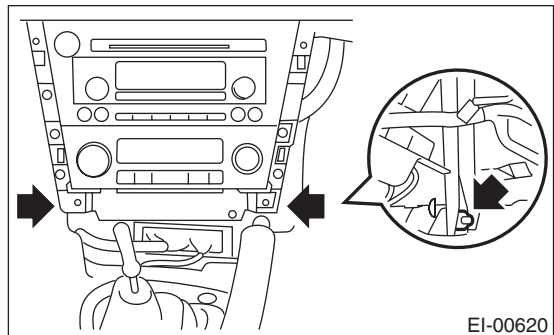
6) Remove the driver's side instrument panel side cover, and remove the bolts.



7) Remove the bolts at the side of the passenger's side instrument panel.



8) Loosen the bolts on the center console side.



9) Disconnect the connectors, and remove the instrument panel assembly.

**NOTE:**

If necessary, make alignment marks for easy reassembly.

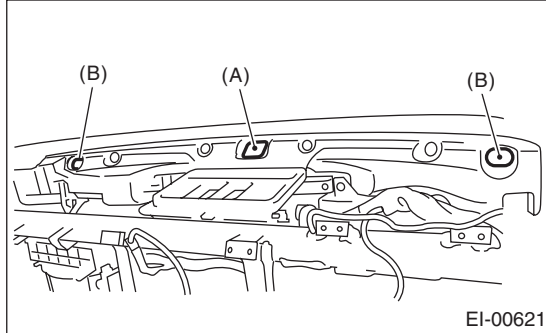
# Instrument Panel Assembly

EXTERIOR/INTERIOR TRIM

## B: INSTALLATION

### 1. INSTRUMENT PANEL (EXCLUDING STEERING SUPPORT BEAM)

1) Insert the matching pins (three places) on the instrument panel tip into the grommet (A) and (B) on the body panel side.



- 2) Check that the matching pins are inserted securely, and then route the harness.
- 3) Tighten the instrument panel with screws, and recheck the installation condition of instrument panel and harness routing.
- 4) Install in the reverse order of removal.

#### NOTE:

How to install insulator and pad;

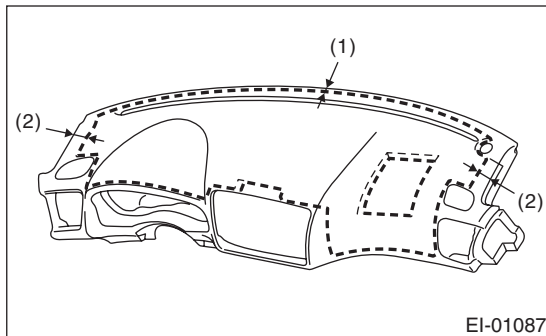
- Adhesive

Use polyurethane adhesive. When assembling the instrument panel assembly, wait until the adhesive has evaporated to prevent filling of the smell in the compartment.

- Double-sided tape

Use commercial double-sided tape. (Use strong double-sided adhesive tape.)

- Locations



(1) 10 mm

(2) 40 mm

Apply at a position spaced by 10 mm from the instrument panel front end, and 40 mm from the ends on both sides.

### 2. STEERING SUPPORT BEAM

- 1) Temporarily tighten the steering support beam with bolts, and then route the harness.
- 2) Make sure that there is no mutual interference in each pedal, and then tighten each bolt.

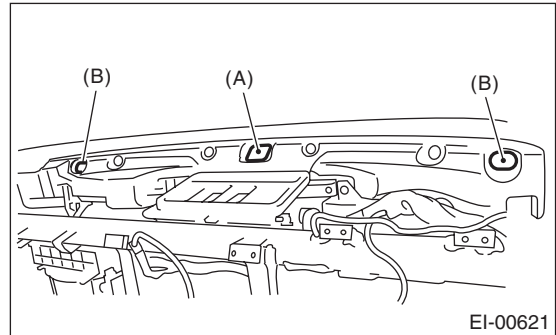
#### Tightening torque:

**25 N·m (25.5 kgf·m, 18 ft·lb)**

- 3) Install in the reverse order of removal.

### 3. INSTRUMENT PANEL ASSEMBLY (INCLUDING STEERING SUPPORT BEAM)

1) Insert the matching pins (three places) on the instrument panel tip into the grommet (A) and (B) on the body panel side.



- 2) Check that the matching pins are inserted securely, and then route the harness.
- 3) Temporarily tighten the steering support beam with bolts, and then route the harness.
- 4) Make sure that there is no mutual interference in each pedal, and then tighten each bolt.

#### Tightening torque:

**25 N·m (25.5 kgf·m, 18 ft·lb)**

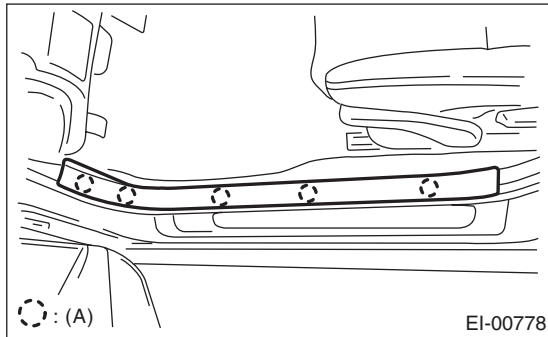
- 5) Install in the reverse order of removal.



## 23. Lower Inner Trim

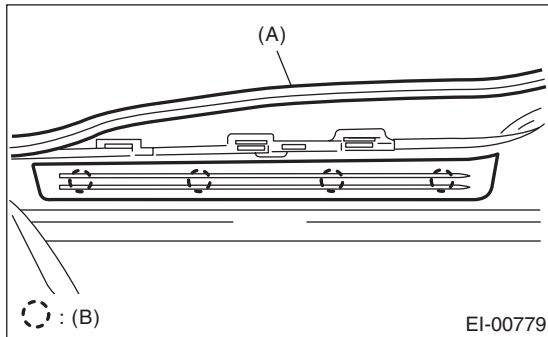
### A: REMOVAL

1) Remove the hook, and remove the inside scuff plate.



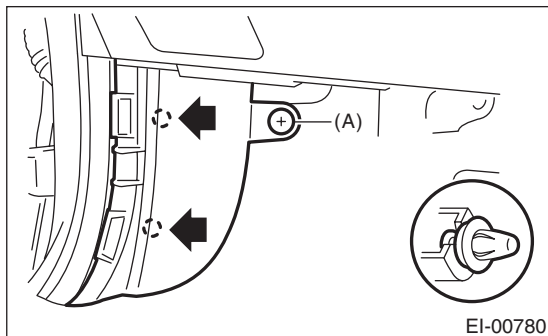
(A) Hook

2) Remove the door molding (A), and remove the outside scuff plate.



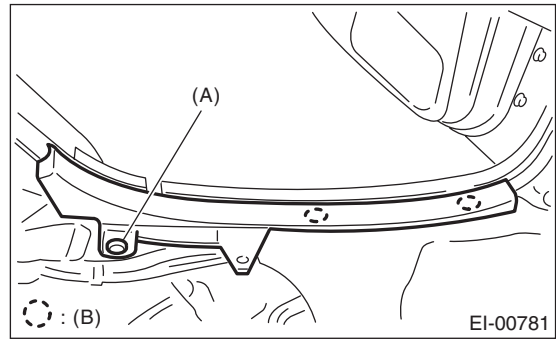
(B) Clip

3) Remove clip (A), and remove the front pillar lower trim.



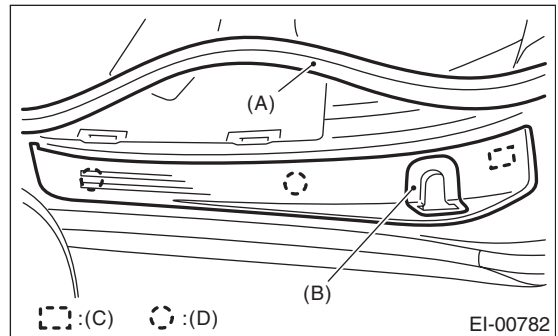
4) Remove the rear seat cushion. <Ref. to SE-17, REMOVAL, Rear Seat.>

5) Remove clip (A), and remove the inside scuff plate.



(B) Hook

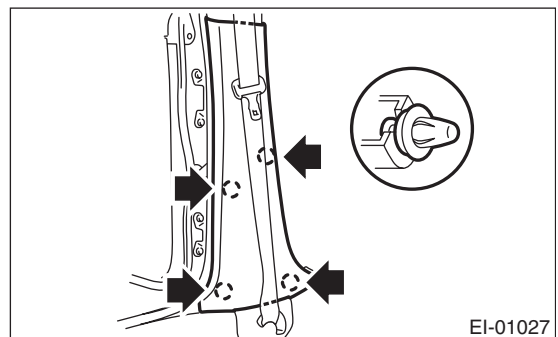
6) Remove door molding (A) and door catcher cover (B), then remove the outside scuff plate.



(C) Hook with plate clip

(D) Clip

7) Remove the clips of the center pillar lower trim.



### B: INSTALLATION

Install in the reverse order of removal.

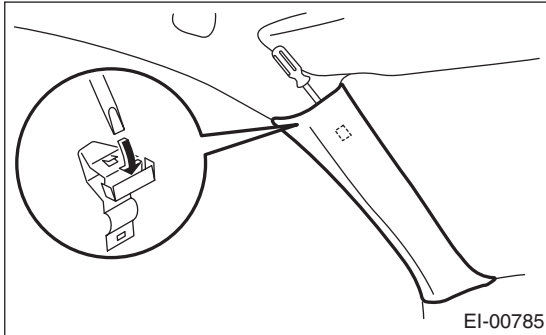
# Upper Inner Trim

EXTERIOR/INTERIOR TRIM

## 24. Upper Inner Trim

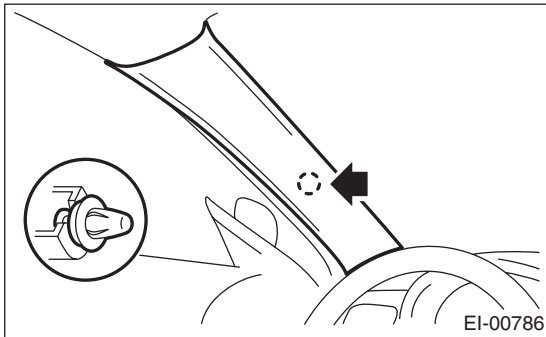
### A: REMOVAL

1) From the top side of the trim, remove the metal clip using a flat tip screwdriver.



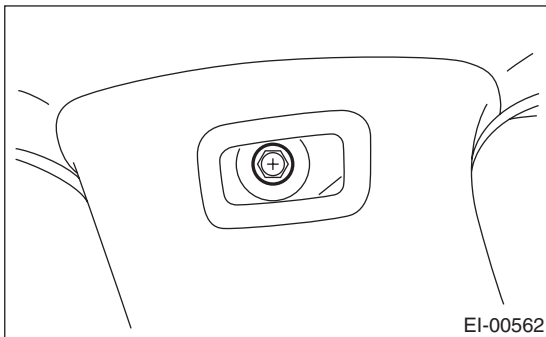
**CAUTION:**  
When the metal clip comes off or becomes damaged, replace both trim and metal clips with new parts.

2) Remove the front pillar upper trim.

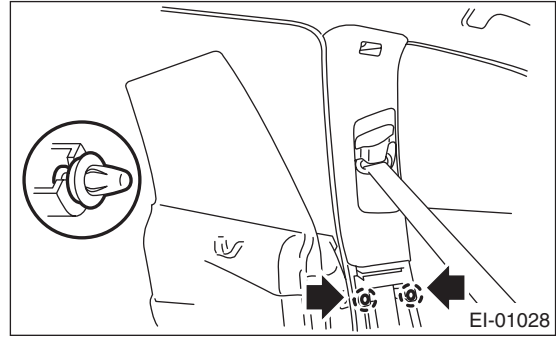


3) Remove the front inside scuff plate, rear inside scuff plate and center pillar lower trim. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>

4) Remove the cap on the upper side of the pillar trim, and remove the bolt inside.



5) Remove the center pillar upper trim.



6) Remove the seat belt lower anchor bolt at the center pillar lower port. (Driver's seat)

7) Refer to the removal procedure of "Front Seat Belt" for the passenger's seat. <Ref. to SB-13, OUTER SEAT BELT ASSEMBLY, REMOVAL, Front Seat Belt.>

### B: INSTALLATION

Install in the reverse order of removal.

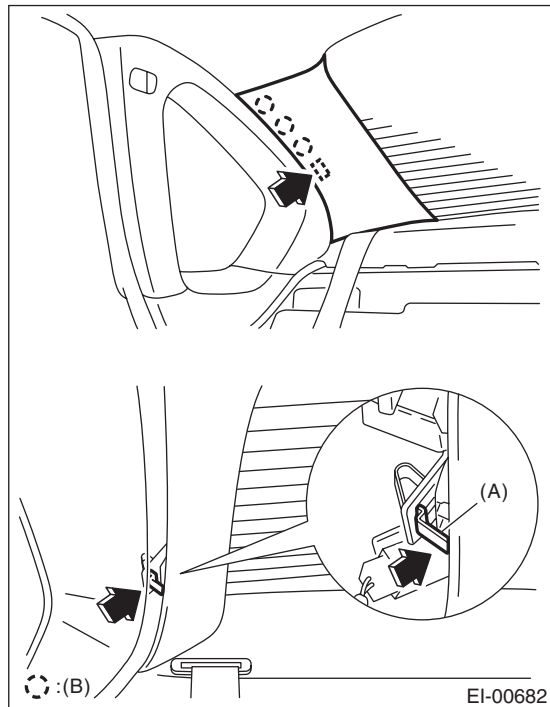
## 25.Rear Quarter Trim

### A: REMOVAL

#### 1. SEDAN MODEL

1) Remove the rear seat. <Ref. to SE-17, SEDAN MODEL, REMOVAL, Rear Seat.>

2) Turn over the trim, and remove the quarter trim rear by pressing the claw (A) of the metal clip using a flat screwdriver, etc.

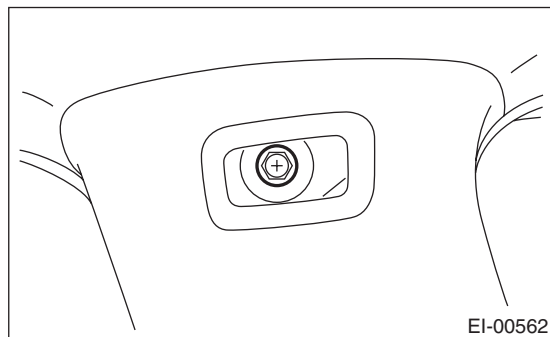


(B) Hook

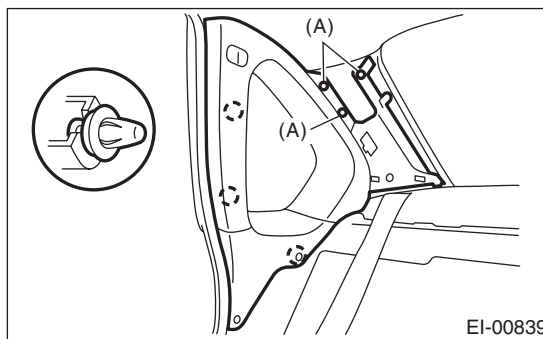
#### CAUTION:

**When the metal clip comes off or becomes damaged, replace both trim and metal clips with new parts.**

3) Remove the cap on the upper side of the trim, and remove the bolt inside.



4) Remove the bolts (A), and remove the quarter trim (front).



EI-00839

EI-00562

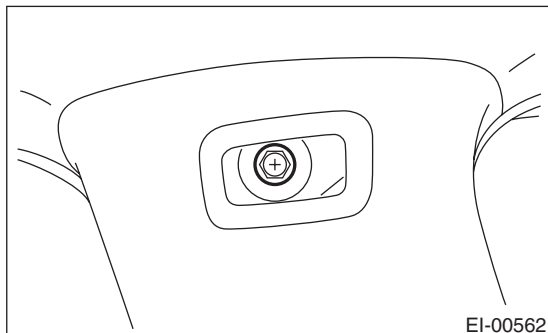
# Rear Quarter Trim

## EXTERIOR/INTERIOR TRIM

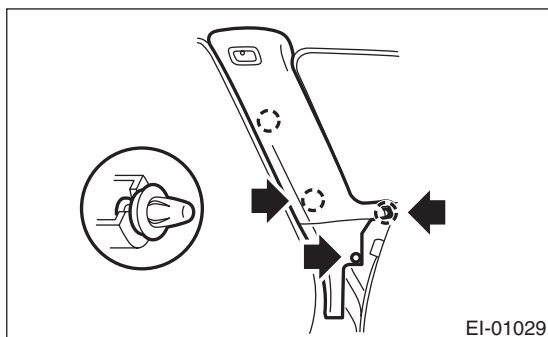
### 2. WAGON MODEL

1) Remove the rear seat cushion and backrest shoulder. <Ref. to SE-18, WAGON MODEL, REMOVAL, Rear Seat.>

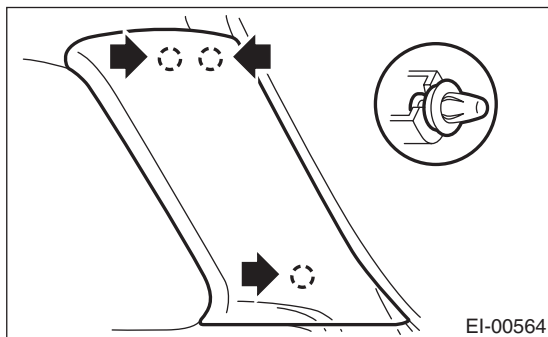
2) Remove the cap on the upper side of the pillar trim, and remove the bolt inside.



3) Remove the clip, and remove the quarter front pillar trim.

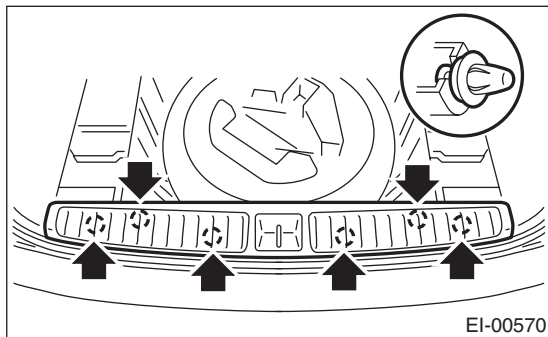


4) Remove the quarter rear pillar trim.

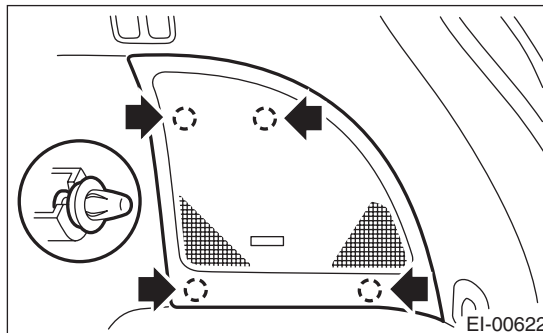


5) Remove the luggage floor box. <Ref. to EI-73, REMOVAL, Luggage Floor Box.>

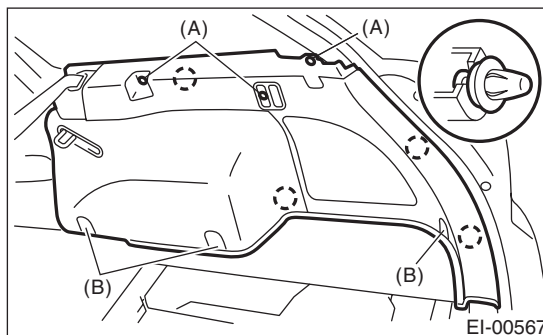
6) Remove the luggage floor end cover.



7) Remove the woofer cover. (Model with woofer)



8) Remove the screws (A) and bolts (B), and remove the quarter lower trim.



#### NOTE:

- Remove the screw cover on the tonneau cover installation area.
- Pull out the shopping bag hook, and remove the screw on the far end.

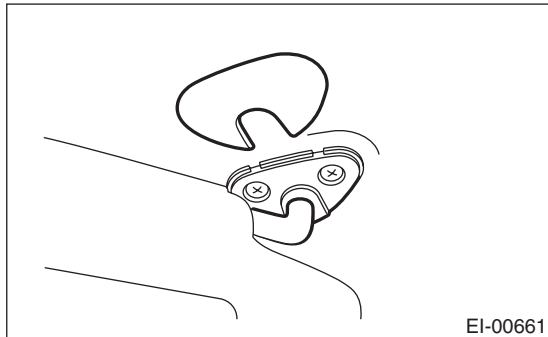
#### B: INSTALLATION

Install in the reverse order of removal.

## 26.Sun Visor

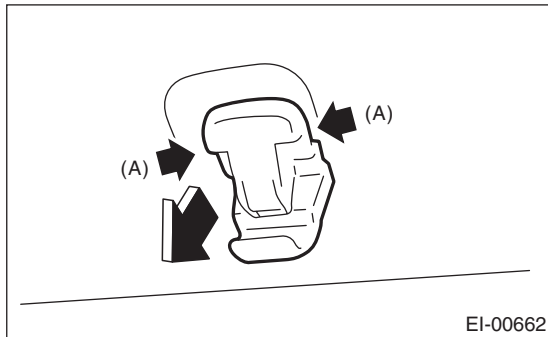
### A: REMOVAL

1) Remove the cover, loosen the mounting screws, and remove the sun visor.



2) Disconnect the connector. (Model with vanity mirror light)

3) While pressing the (A) on the both side using flat tip screwdriver, pull the sun visor hook to remove it.



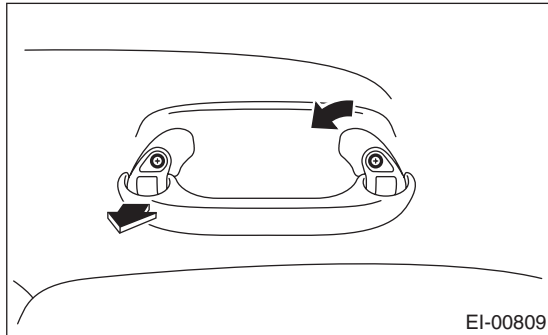
### B: INSTALLATION

Install in the reverse order of removal.

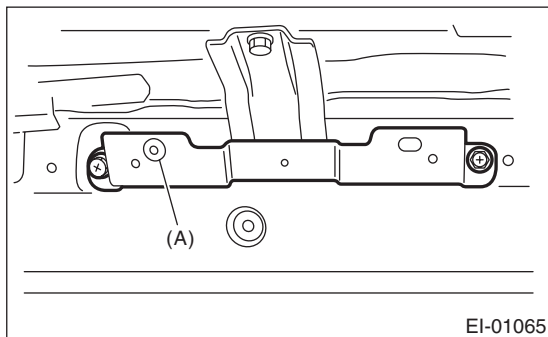
## 27. Assist Grip

### A: REMOVAL

- 1) Remove the screw cover, and remove the screw inside.
- 2) Pull the left side of assist grip, and rotate the right side of it counterclockwise to remove.



- 3) Remove the roof trim. <Ref. to EI-67, REMOVAL, Roof Trim.>
- 4) Remove the bolts, and remove the assist grip bracket.



(A) Grommet

### B: INSTALLATION

Install in the reverse order of removal.

#### CAUTION:

**Be sure to install the grommet to assist grip bracket.**

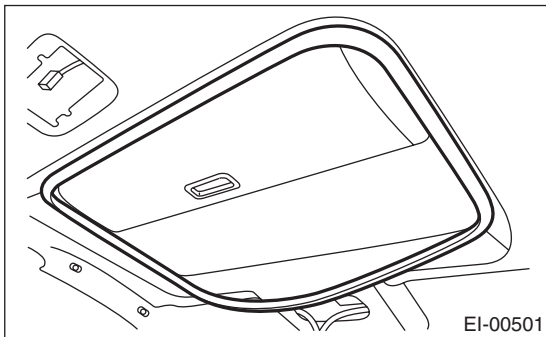
**When the assist grip is installed with no grommet, it will cause the grip to not return properly.**

## 28. Roof Trim

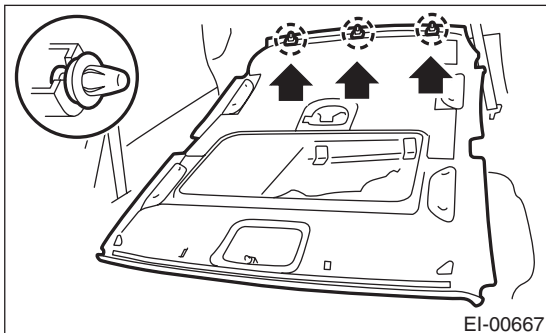
### A: REMOVAL

#### 1. SEDAN MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front seats. <Ref. to SE-9, REMOVAL, Front Seat.>
- 3) Remove the rear seat. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 4) Remove the console box. <Ref. to EI-54, REMOVAL, Console Box.>
- 5) Remove the center console. <Ref. to EI-55, REMOVAL, Center Console.>
- 6) Remove the select lever. (AT model) <Ref. to CS-23, REMOVAL, Select Lever.>
- 7) Remove the spot map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>
- 8) Remove the room light. <Ref. to LI-33, REMOVAL, Room Light.>
- 9) Remove the sun visor. <Ref. to EI-65, REMOVAL, Sun Visor.>
- 10) Remove the assist grip. <Ref. to EI-66, REMOVAL, Assist Grip.>
- 11) Remove the upper inner trim. <Ref. to EI-62, REMOVAL, Upper Inner Trim.>
- 12) Remove the rear quarter trim. <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 13) Remove the sunroof opening trim. (Model with sunroof)



- 14) Remove the clips and harnesses, and remove the roof trim.
- 15) Pull out the roof trim from the vehicle.



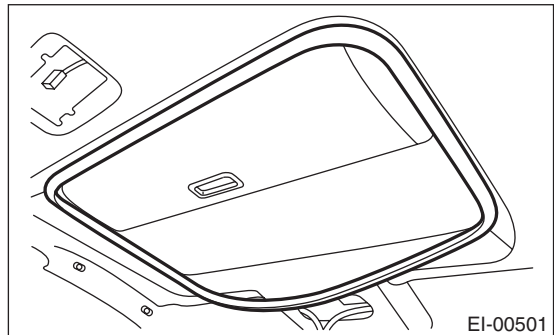
#### 2. WAGON MODEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the spot map light. <Ref. to LI-32, REMOVAL, Spot Map Light.>
- 3) Remove the room light. <Ref. to LI-33, REMOVAL, Room Light.>
- 4) Remove the luggage room light. <Ref. to LI-34, REMOVAL, Luggage Room Light.>
- 5) Remove the sun visor. <Ref. to EI-65, REMOVAL, Sun Visor.>
- 6) Remove the assist grip. <Ref. to EI-66, REMOVAL, Assist Grip.>
- 7) Remove the upper inner trim. <Ref. to EI-62, REMOVAL, Upper Inner Trim.>
- 8) Remove the rear quarter trim. <Ref. to EI-64, WAGON MODEL, REMOVAL, Rear Quarter Trim.>

#### CAUTION:

**Do not remove the roof end trim with excessive force. Otherwise the roof trim may become damaged. Roof trim and roof end trim are fastened by rivets.**

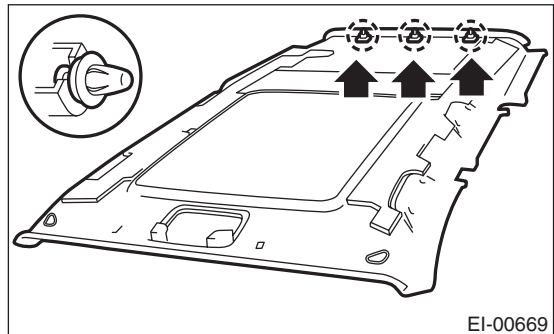
- 9) Remove the sunroof opening trim. (Model with sunroof)



- 10) Remove the clips and each harness, pull out the rear center seat belt, and remove the roof trim.

#### CAUTION:

**Do not remove the roof end trim with excessive force. Otherwise the roof trim may become damaged.**



### B: INSTALLATION

Install in the reverse order of removal.

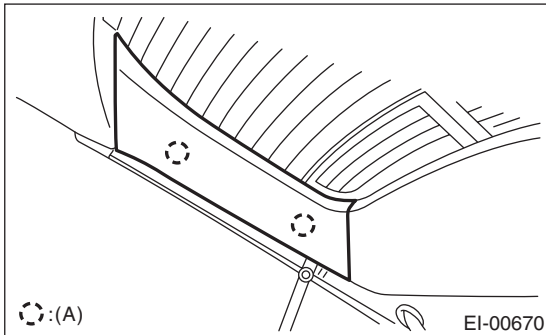
# Rear Gate Trim

EXTERIOR/INTERIOR TRIM

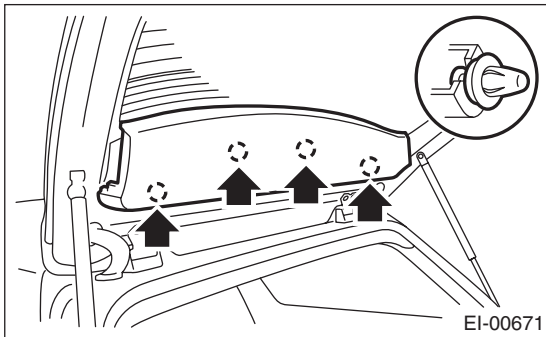
## 29. Rear Gate Trim

### A: REMOVAL

1) Remove clips (A), and remove the rear gate pillar trim.

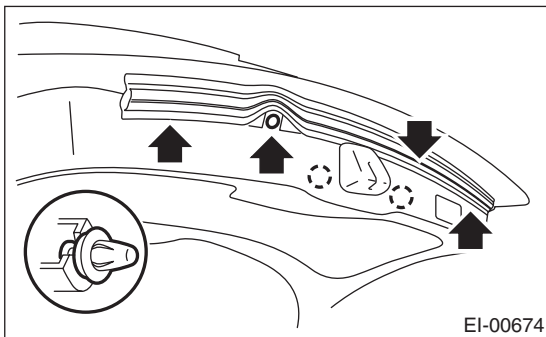


2) Remove the clips, and remove the rear gate upper trim.

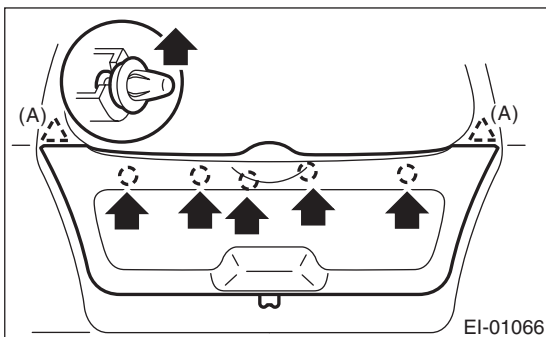


3) Remove the cover in the inner handle, and loosen the inside screw.

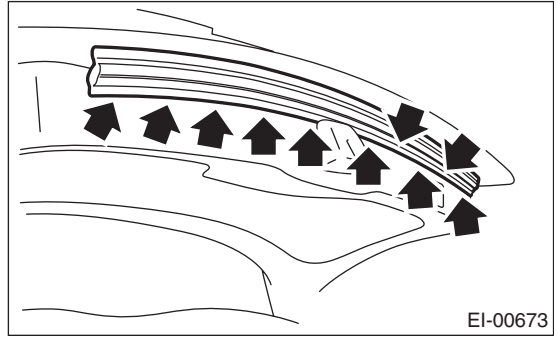
4) Turn over the weather strip, and remove the clips.



5) Remove the clips (A), and remove the rear gate lower trim.

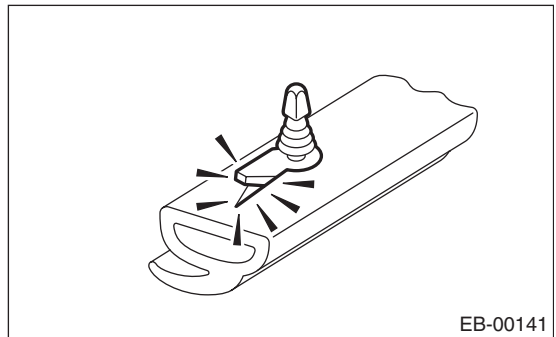


6) Remove the rear gate weather strip.



### NOTE:

If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use a clip remover to remove.



### B: INSTALLATION

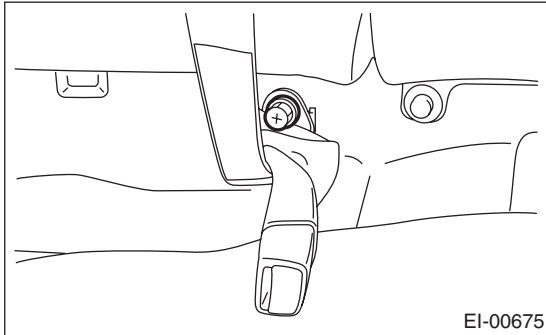
Install in the reverse order of removal.



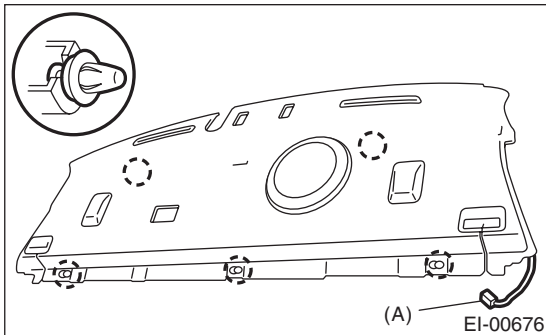
## 30.Rear Shelf Trim

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear quarter trim. <Ref. to EI-63, SEDAN MODEL, REMOVAL, Rear Quarter Trim.>
- 3) Remove the high-mounted stop light. <Ref. to LI-31, REMOVAL, High-mounted Stop Light.>
- 4) Remove the rear seat cushion. <Ref. to SE-18, WAGON MODEL, REMOVAL, Rear Seat.>
- 5) Remove the lower anchor bolt of the rear center seat belt.



- 6) After disconnecting the high-mounted stop light harness connector (A) and removing the five clips, remove the rear shelf trim by pulling it forward.

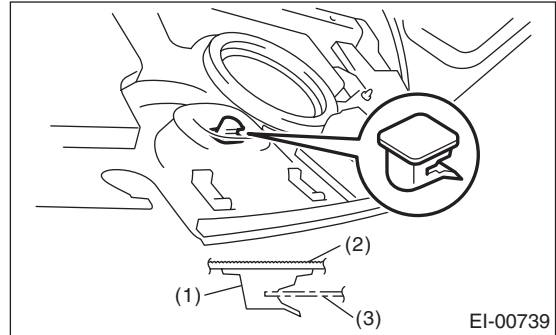


### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

Securely insert the vehicle body panel into the hook of the rear shelf trim center, and install the rear shelf trim.



- (1) Hook
- (2) Rear Shelf Trim
- (3) Vehicle body panel

# Trunk Room Trim

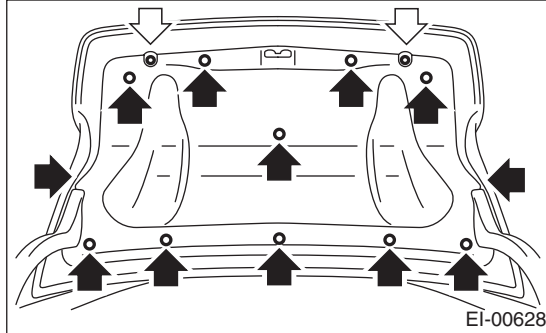
EXTERIOR/INTERIOR TRIM

## 31. Trunk Room Trim

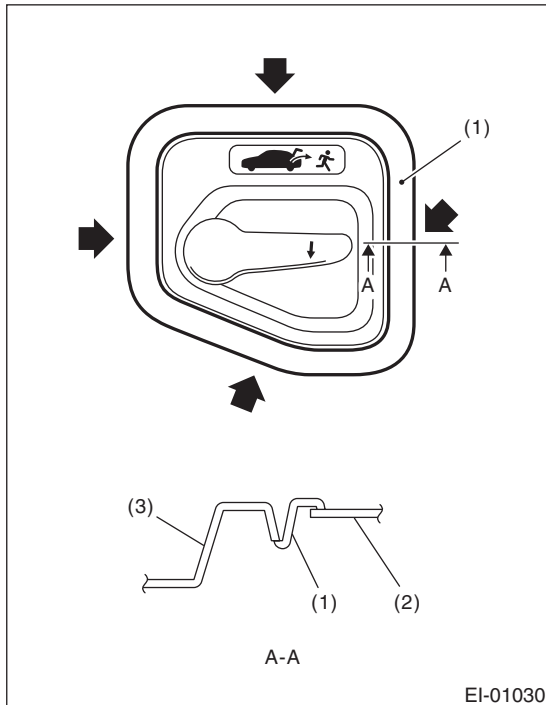
### A: REMOVAL

#### 1. TRUNK LID TRIM

1) Remove the trim clips and stopper rubber, and remove the trunk lid trim.

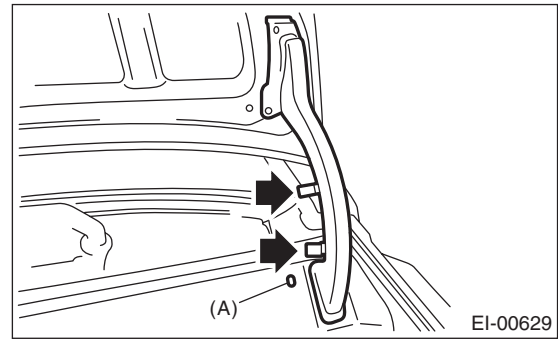


2) Remove the four claws, and remove the trunk handle cover (1).



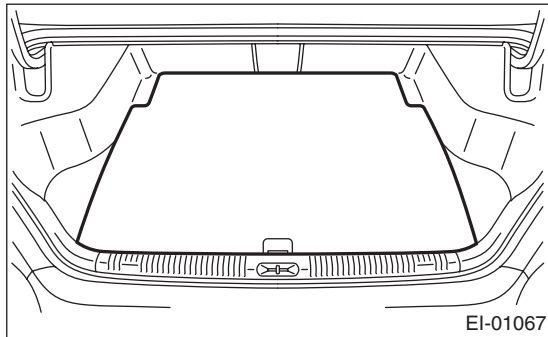
- (1) Trunk handle cover
- (2) Trunk lid trim
- (3) Trunk release handle

3) Remove clip (A) of the trunk side trim, and remove the trunk lid arm cover.

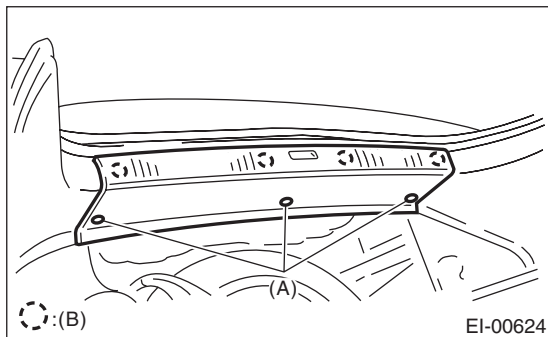


## 2. TRUNK ROOM TRIM

1) Remove the trunk room mat.

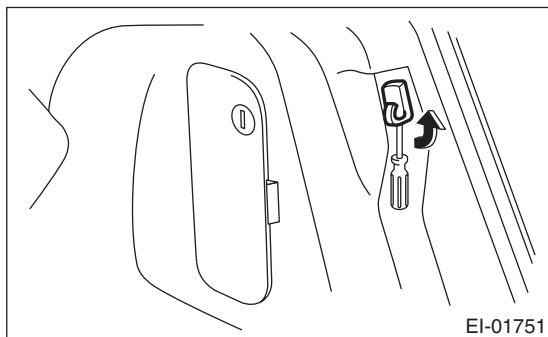


2) Remove the trim clips (A), and remove the trunk room end cover.

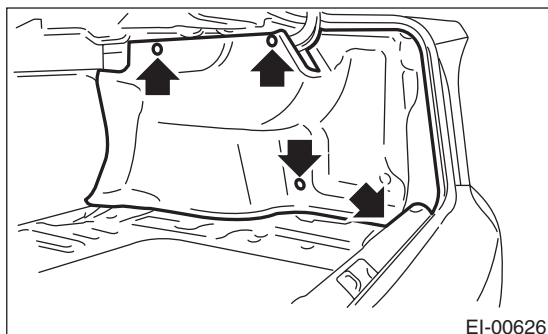


(B) Clip

3) Insert the flat tip screwdriver from the lower side of the trunk hook, and then remove the trunk hook by rotating it 90°.



4) Remove the trim clips, and remove the trunk side trim.



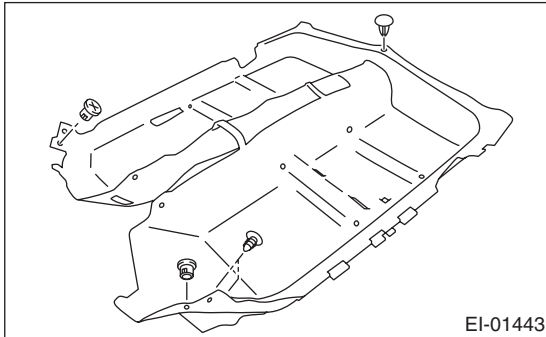
## B: INSTALLATION

Install in the reverse order of removal.

## 32.Floor Mat

### A: REMOVAL

- 1) Remove the front seats. <Ref. to SE-9, REMOVAL, Front Seat.>
- 2) Remove the rear seat cushion. <Ref. to SE-17, REMOVAL, Rear Seat.>
- 3) Remove the console box. <Ref. to EI-54, Console Box.>
- 4) Remove the console side panel. <Ref. to EI-55, REMOVAL, Center Console.>
- 5) Remove the lower inner trim. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>
- 6) Remove the clips from the floor mat.
- 7) Remove the mat hook on both sides.
- 8) Remove the mat from toe board area.
- 9) Remove the mat from rear heater duct.
- 10) Roll the mat, and then take it out of opened rear door.



### B: INSTALLATION

Install in the reverse order of removal.

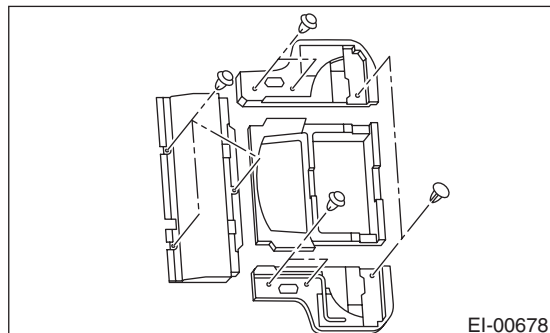
#### NOTE:

- Secure the mat firmly with hook and clip.
- Insert the mat edge firmly into the groove of side sill cover.

## 33.Luggage Floor Box

### A: REMOVAL

- 1) Remove the luggage floor mat.
- 2) Remove the clips, and remove the luggage floor box.



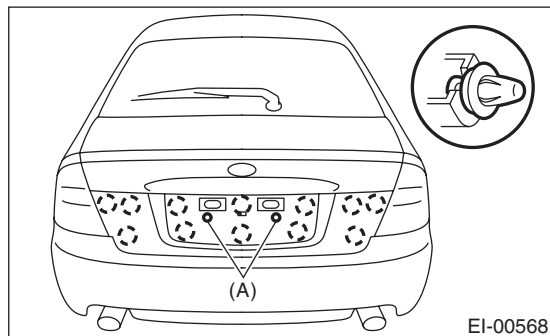
### B: INSTALLATION

Install in the reverse order of removal.

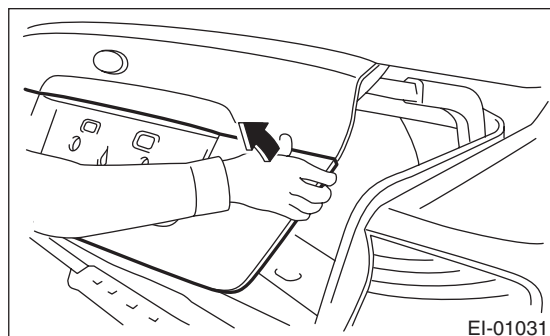
## 34. Trunk Lid Garnish

### A: REMOVAL

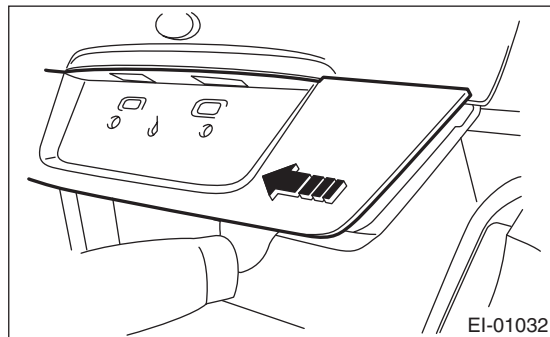
1) Remove the license plate, and loosen bolts (A).



2) Remove the clip in the upper corner of the trunk lid garnish.



3) Place your hands between the trunk lid garnish and the trunk lid panel, and remove the trunk lid garnish starting from the edge, in order.



### B: INSTALLATION

Install in the reverse order of removal.

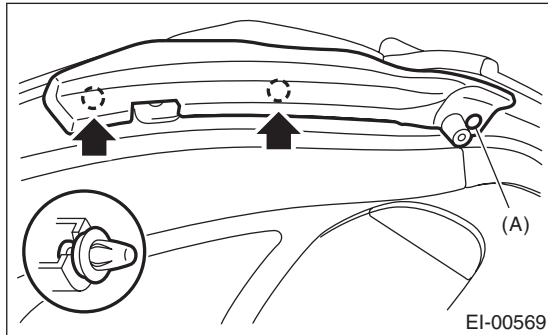
**Tightening torque:**

**7.5 N·m (0.77 kgf·m, 5.53 ft·lb)**

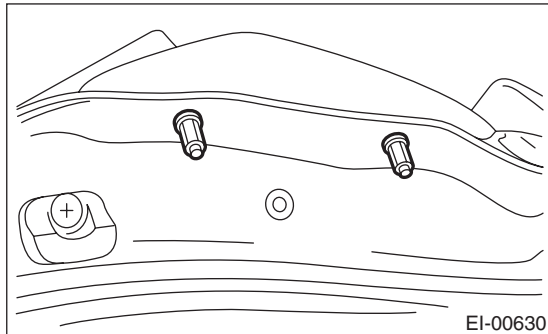
## 35.Rear Gate Garnish

### A: REMOVAL

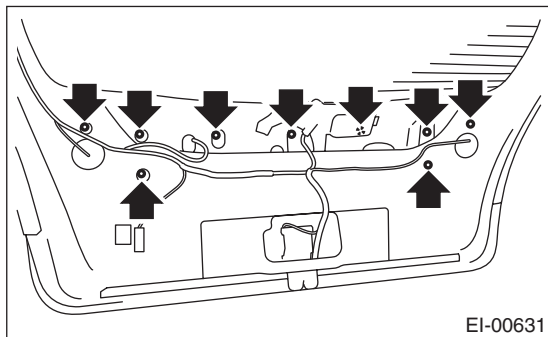
- 1) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 2) Remove clip (A), and remove the rear gate panel side cover.



- 3) Remove the hexagon cap nut.



- 4) Remove the nuts, disconnect connectors, and remove the rear gate garnish.



### B: INSTALLATION

Install in the reverse order of removal.

# Heat Shield Cover

EXTERIOR/INTERIOR TRIM

## 36.Heat Shield Cover

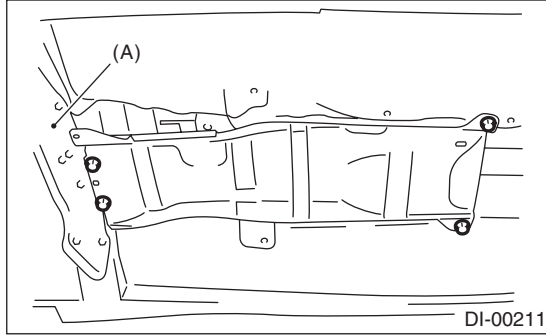
### A: REMOVAL

### B: INSTALLATION

Install in the reverse order of removal.

#### 1. FRONT HEAT SHIELD COVER

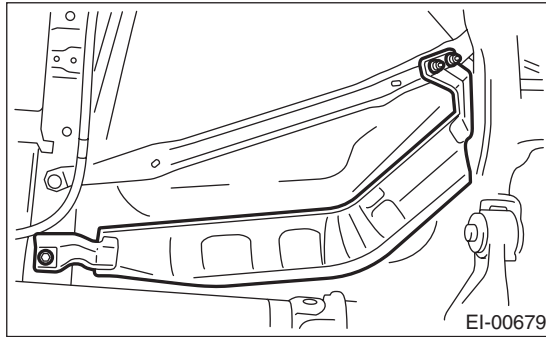
Remove the four bolts to remove the front heat shield cover.



(A) Transmission mount

#### 2. CENTER HEAT SHIELD COVER

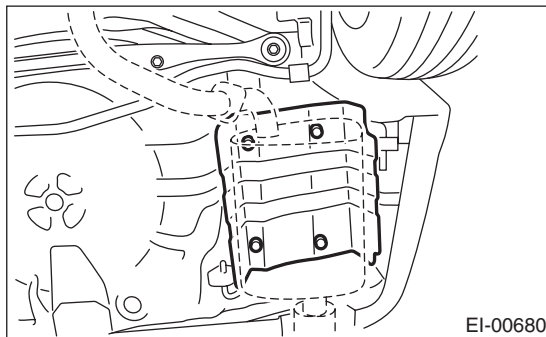
Remove the nut and bolt to remove center heat shield cover.



#### 3. REAR HEAT SHIELD COVER

1) Remove the muffler. <Ref. to EX(H4SO)-10, REMOVAL, Muffler.> <Ref. to EX(H4DOTC)-15, REMOVAL, Muffler.>

2) Remove the four bolts to remove the rear heat shield cover.





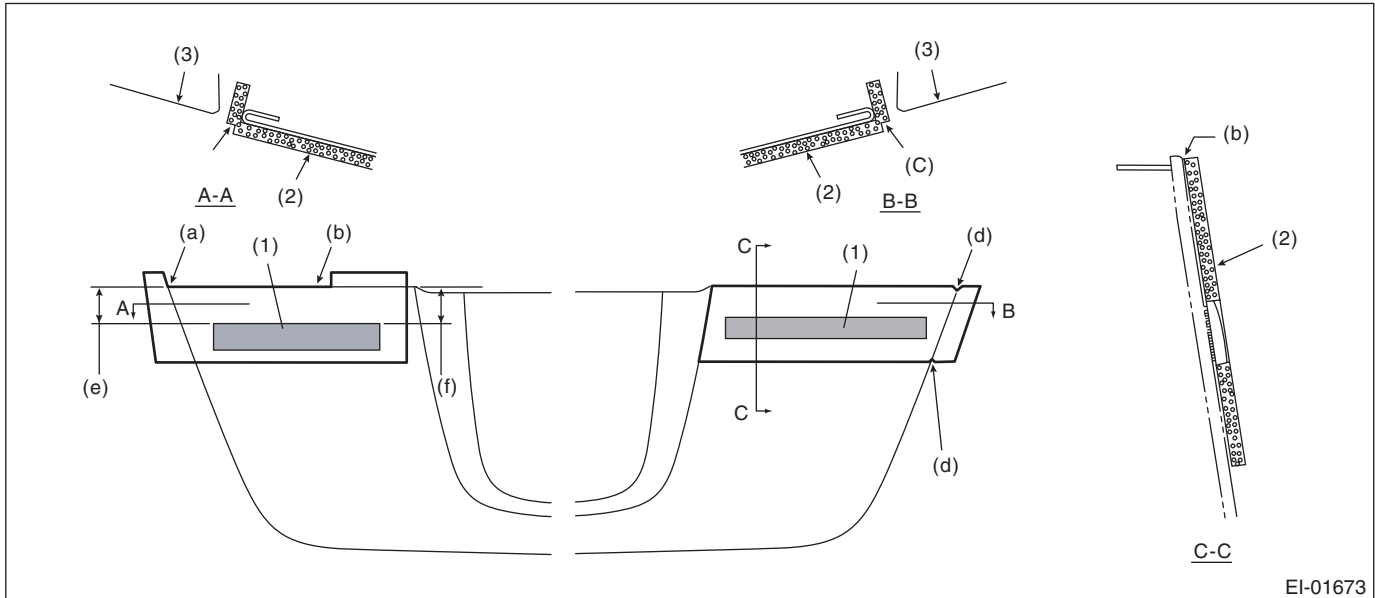
## 37.Ornament

### A: INSTALLATION

#### 1. LETTER MARK

Adhere the letter mark according to the following measurements.

- Sedan model



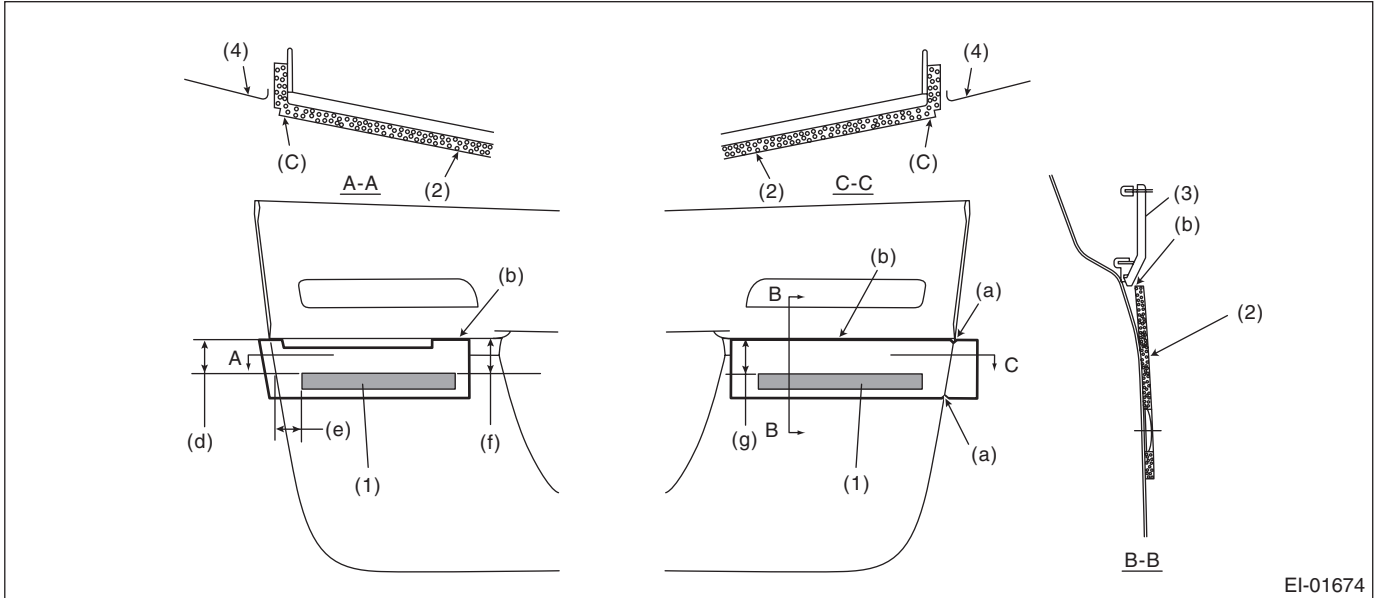
EI-01673

- |  |  |  |
|--|--|--|
| (a) Apply the edge of application tape by aligning with the end of the radius for the trunk lid garnish. | (b) Apply the application tape by aligning with the end of the radius, at the upper edge of the trunk lid garnish. | (c) Align the slit of the application tape to the panel end. |
| (d) Apply the application tape by aligning the cut out to the edge of the trunk lid garnish.             | (e) 33 mm (1.3 in)   | (f) 35 mm (1.38 in)  |
| (1) Letter mark  | (2) Application tape   | (3) Rear combination light                                   |

# Ornament

## EXTERIOR/INTERIOR TRIM

- Wagon model



(a) Apply the application tape by aligning the cut out to the edge of the rear gate panel.

(d) 44.5 mm (1.75 in)

(1) Letter mark

(2) Application tape

(b) Apply the application tape by aligning it with the outer bottom end of the rear gate garnish.

(e) 45 mm (1.77 in)

(3) Rear gate garnish

(c) Align the slit of the application tape to the panel end.

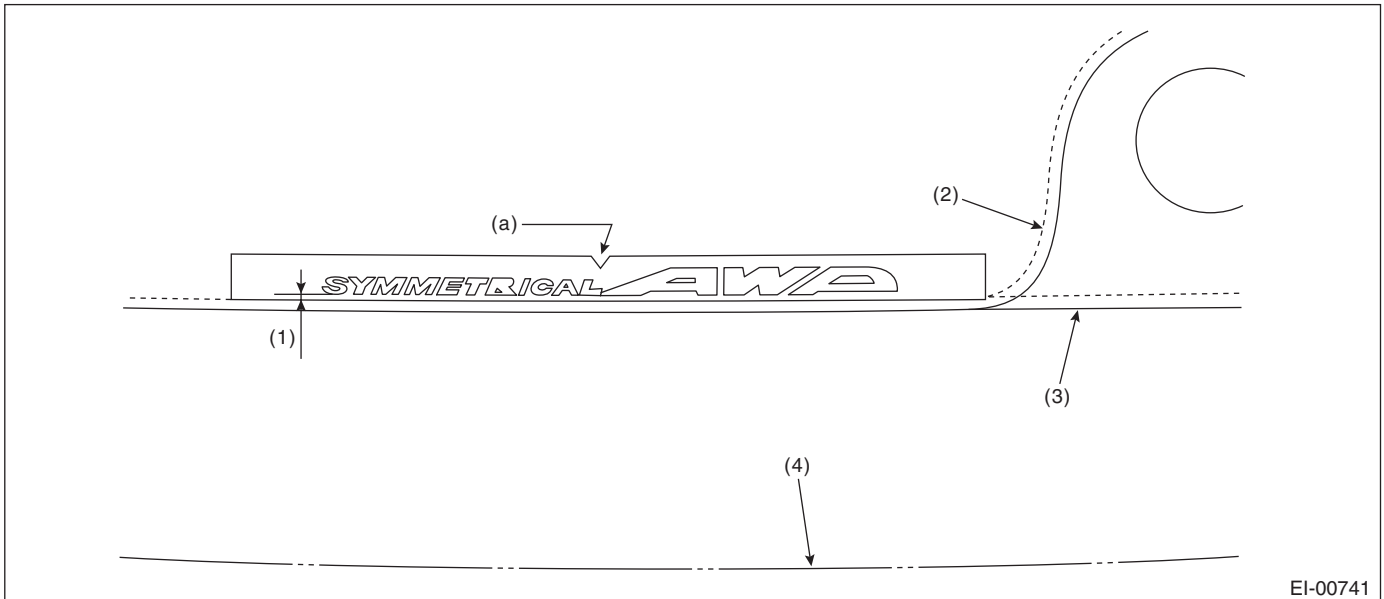
(f) 45.5 mm (1.79 in)

(4) Rear combination light

## 2. AWD STICKER

Apply the AWD sticker from inside of the glass according to the following dimensions.

- Sedan model

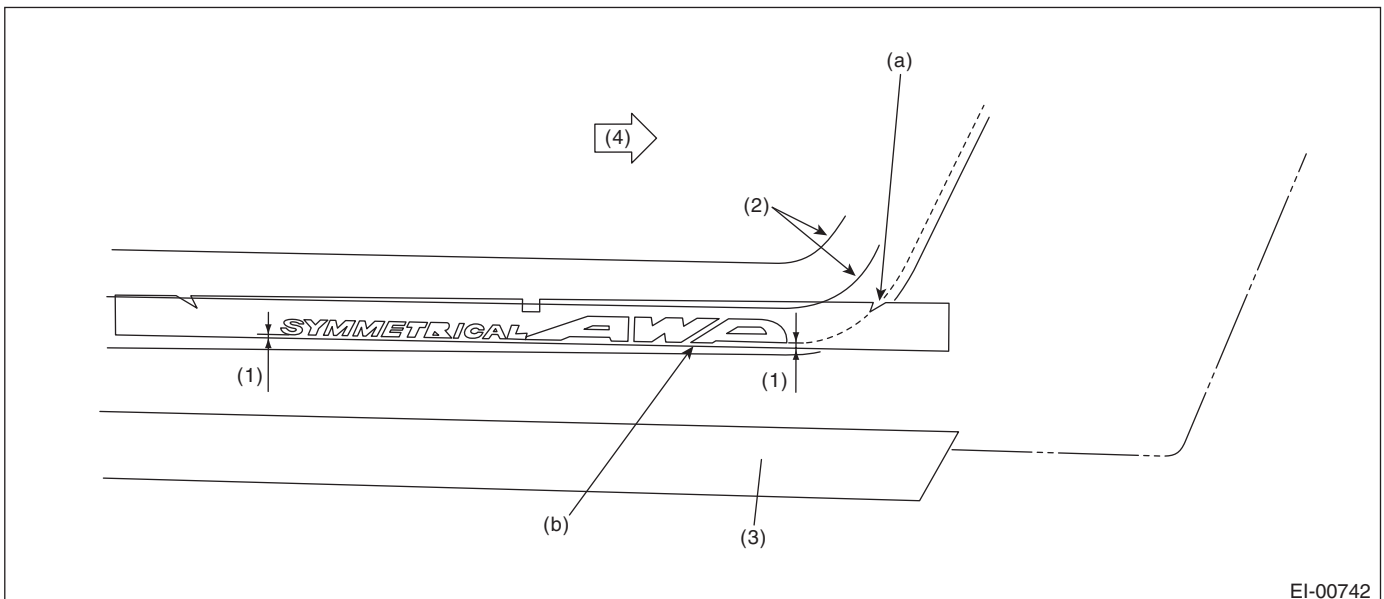


EI-00741

- (a) Apply the application tape by aligning the cut out to the edge of the rear glass center.

- |  |   |                       |
|--|---|-----------------------|
| (1) 1 mm (0.04 in)                                       | (3) Gradation end of the ceramic print (without rear wiper) | (4) End of rear glass |
| (2) Gradation end of the ceramic print (with rear wiper) |   |                       |

- Wagon model (RH side)

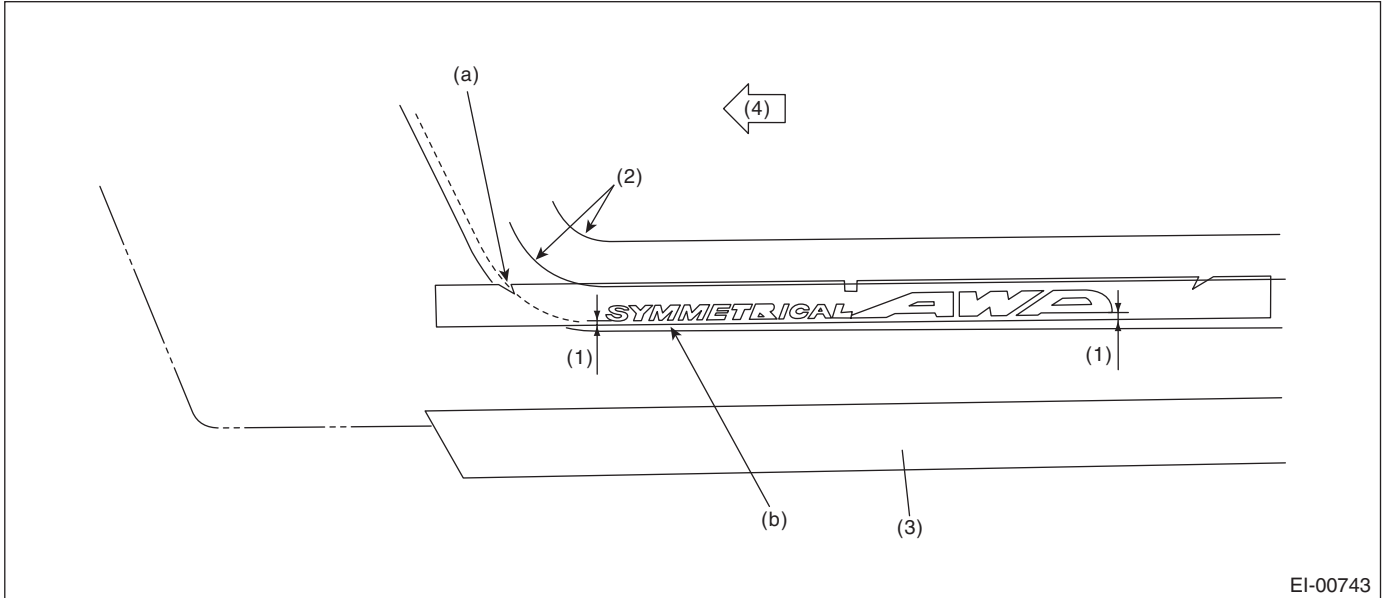


EI-00742

# Ornament

## EXTERIOR/INTERIOR TRIM

- Wagon model (LH side)



EI-00743

(a) Apply the application tape by aligning the cut out to the ceramic print.

(b) Gradation end of the ceramic print

(1) 1 mm (0.04 in)

(3) Molding

(4) Front side of vehicle

(2) Glass antenna wire

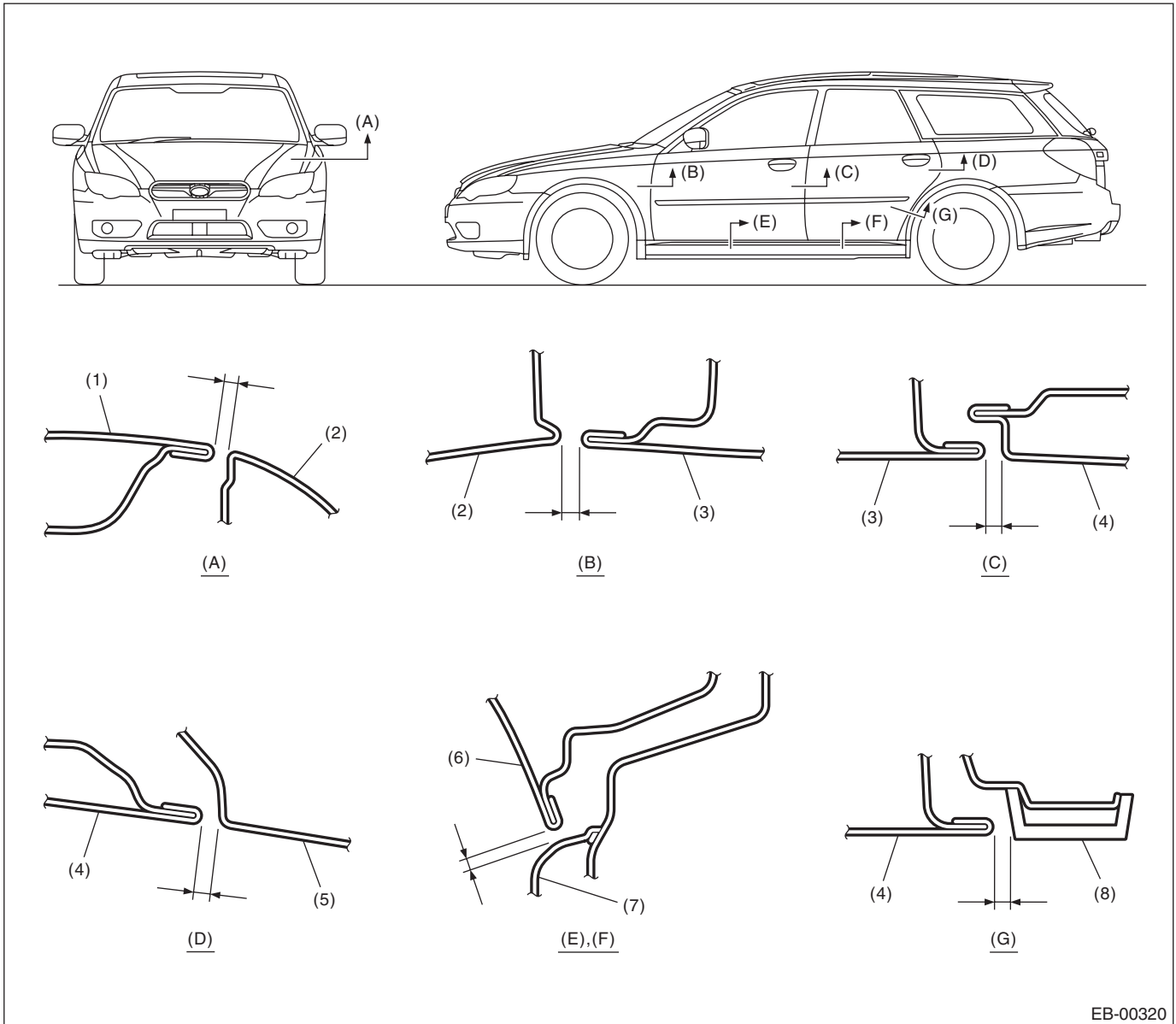
# General Description

## EXTERIOR BODY PANELS

### 1. General Description

#### A: SPECIFICATION

##### 1. SIDE

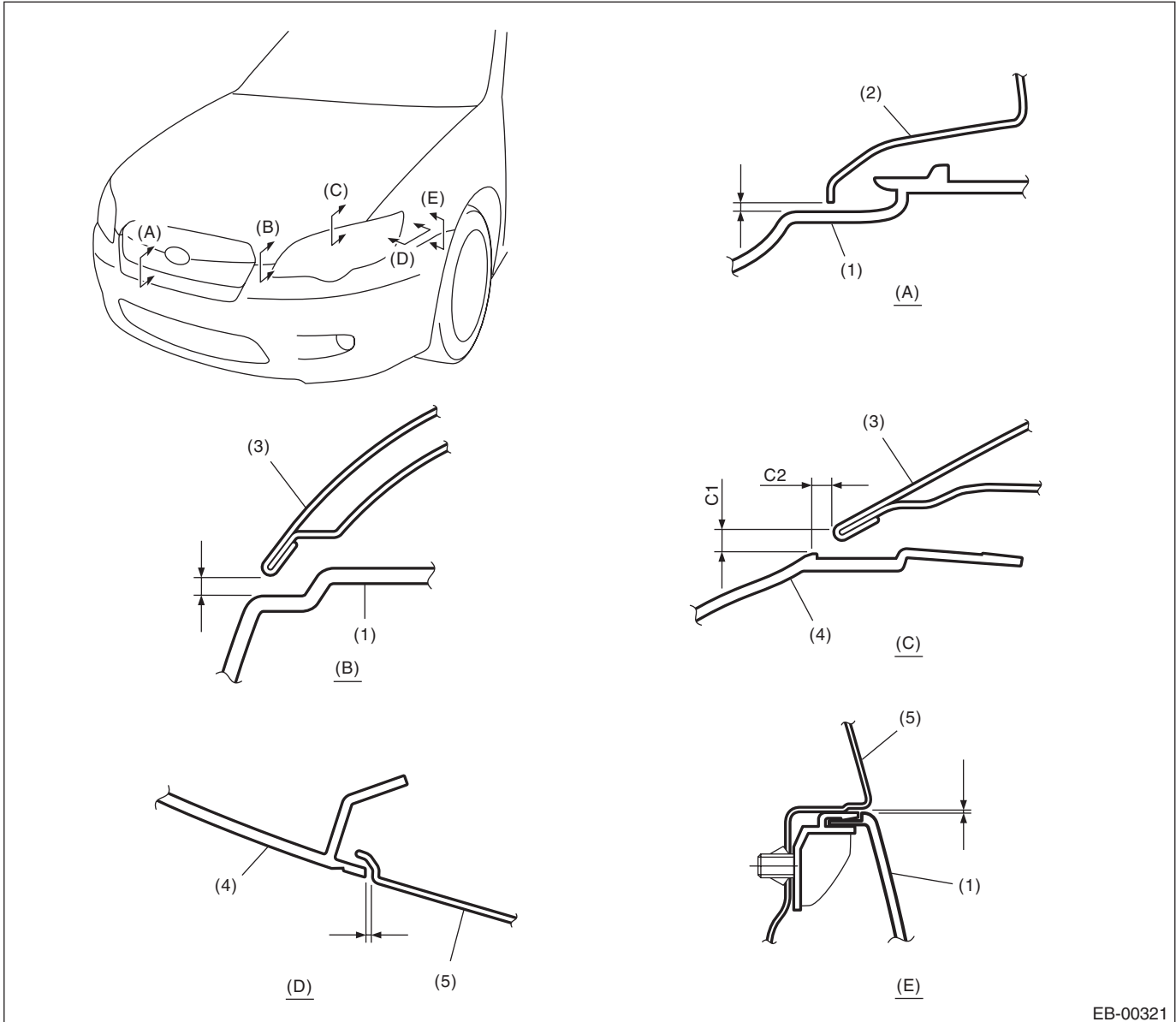


EB-00320

- |                        |                        |                                  |
|------------------------|------------------------|----------------------------------|
| (1) Front hood panel   | (4) Rear door panel    | (7) Side sill                    |
| (2) Front fender panel | (5) Rear quarter panel | (8) Rear quarter lower protector |
| (3) Front door panel   | (6) Door panel         |                                  |

Section	Part	Standard value
(A)	Front hood panel to Front fender panel	Sedan•Wagon model: 3.6±1.0 mm (0.14±0.04 in) OUTBACK model: 3.8±1.0 mm (0.15±0.04 in)
(B)	Front fender panel to Front door panel	4.7±1.0 mm (0.18±0.04 in)
(C)	Front door panel to Rear door panel	5.1±1.0 mm (0.20±0.04 in)
(D)	Rear door panel to Rear quarter panel	4.6±1.0 mm (0.18±0.04 in)
(E), (F)	Door panel to Side sill	6.0±1.0 mm (0.24±0.04 in)
(G)	Rear door panel to Rear quarter lower protector	4.8±1.0 mm (0.19±0.04 in)

### 2. FRONT



EB-00321

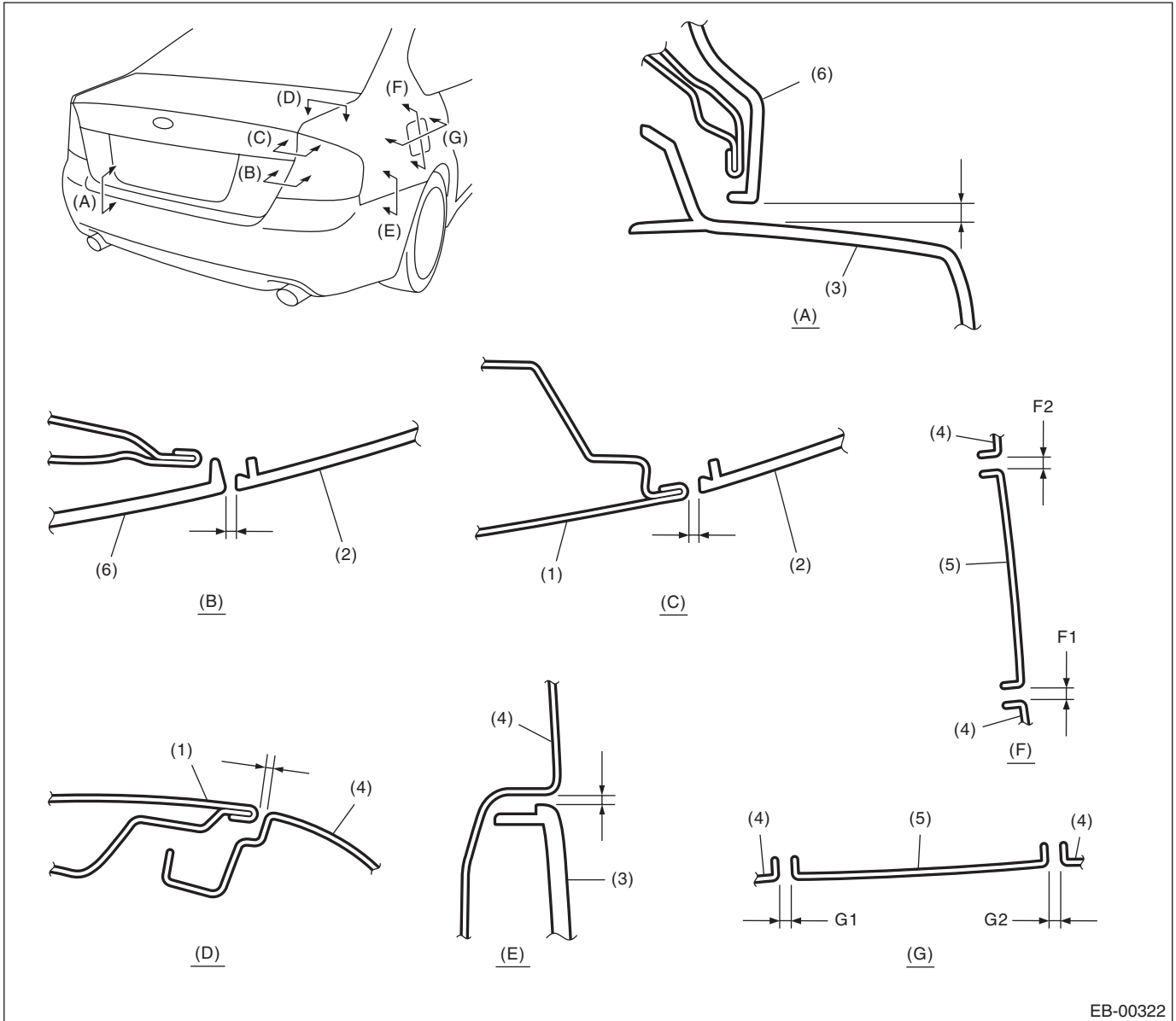
- |                  |                      |                        |
|------------------|----------------------|------------------------|
| (1) Front bumper | (3) Front hood panel | (5) Front fender panel |
| (2) Front grille | (4) Headlight        |                        |

Section	Part	Standard value
(A)	Front bumper to Front grille (longitudinal direction)	1.0±0.7 mm (0.04±0.03 in)
(B)	Front hood panel to Front bumper	4.0 — 6.0 mm (0.16 — 0.24 in)
(C)	Front hood panel to Headlight	C1: 6.0±1.0 mm (0.24±0.04 in) C2: 5.0±1.0 mm (0.20±0.04 in)
(D)	Front fender panel to Headlight	1.5±1.0 mm (0.06±0.04 in)
(E)	Front fender panel to Front bumper	1.0±0.7 mm (0.04±0.03 in)

# General Description

## EXTERIOR BODY PANELS

### 3. REAR (SEDAN MODEL)

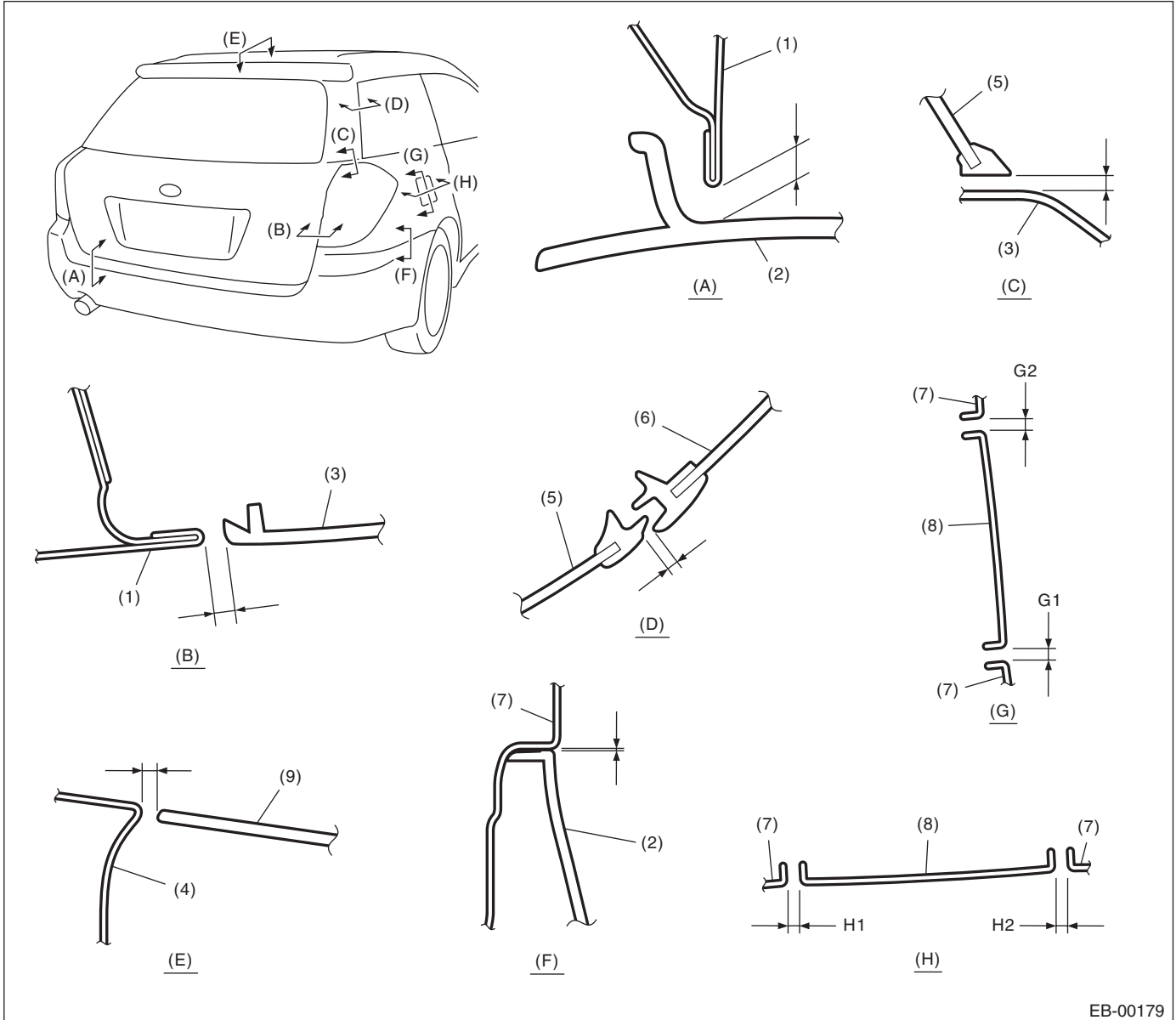


EB-00322

- |                            |                       |                          |
|----------------------------|-----------------------|--------------------------|
| (1) Trunk lid panel        | (3) Rear bumper       | (5) Fuel filler flap lid |
| (2) Rear combination light | (4) Rear fender panel | (6) Trunk lid garnish    |

Section	Part	Standard value
(A)	Trunk lid garnish to Rear bumper	7.0±1.0 mm (0.28±0.04 in)
(B)	Trunk lid garnish to Rear combination light	4.0±1.0 mm (0.16±0.04 in)
(C)	Trunk lid panel to Rear combination light	3.5±1.0 mm (0.14±0.04 in)
(D)	Trunk lid panel to Rear fender panel	3.5±1.0 mm (0.14±0.04 in)
(E)	Rear fender panel to Rear bumper	1.0±0.7 mm (0.04±0.03 in)
(F)	Rear fender panel to Fuel filler flap lid (longitudinal direction)	F1: 3.7±0.5 mm (0.15±0.02 in) F2: 3.4±0.5 mm (0.13±0.02 in)
(G)	Rear fender panel to Fuel filler flap lid (lateral direction)	G1, G2: 3.5±0.5 mm (0.14±0.02 in)

## 4. REAR (WAGON MODEL)



EB-00179

- |                            |                        |                          |
|----------------------------|------------------------|--------------------------|
| (1) Rear gate panel        | (4) Roof panel         | (7) Rear fender panel    |
| (2) Rear bumper            | (5) Rear gate glass    | (8) Fuel filler flap lid |
| (3) Rear combination light | (6) Rear quarter glass | (9) Roof spoiler         |

Section	Part	Standard value
(A)	Rear gate panel to Rear bumper	8.0±1.0 mm (0.31±0.04 in)
(B)	Rear gate panel to Rear combination light	5.0±1.0 mm (0.20±0.04 in)
(C)	Rear gate glass to Rear combination light	5.5±1.0 mm (0.22±0.04 in)
(D)	Rear gate glass to Rear quarter glass	4.0±1.5 mm (0.16±0.06 in)
(E)	Roof panel to Roof spoiler	5.0 — 6.5 mm (0.20 — 0.26 in)
(F)	Rear fender panel to Rear bumper	1.0±0.7 mm (0.04±0.03 in)
(G)	Rear fender panel to Fuel filler flap lid (longitudinal direction)	G1: 3.7±0.5 mm (0.15±0.02 in) G2: 3.4±0.5 mm (0.13±0.02 in)
(H)	Rear fender panel to Fuel filler flap lid (lateral direction)	H1, H2: 3.5±0.5 mm (0.14±0.02 in)

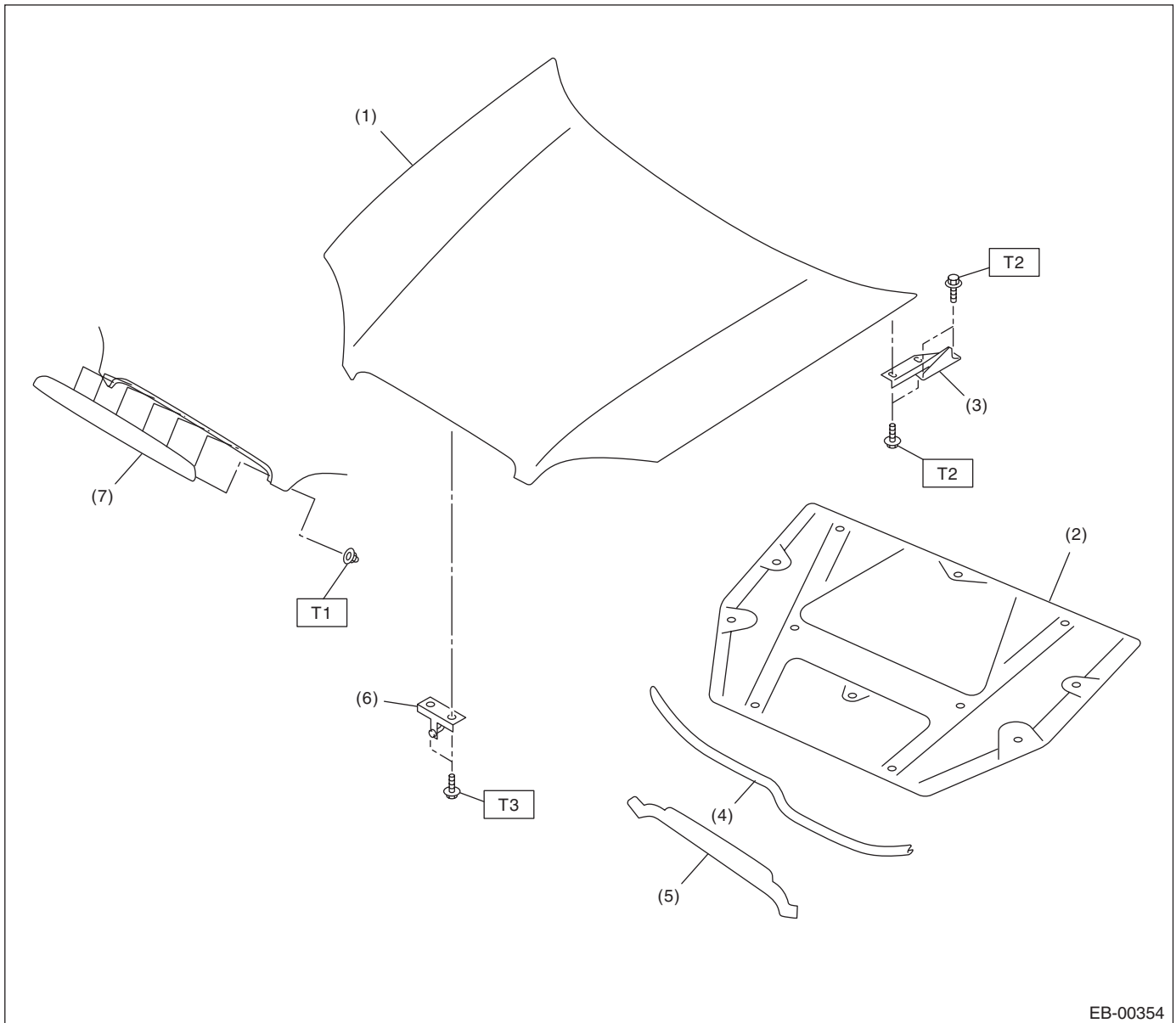


# General Description

## EXTERIOR BODY PANELS

### B: COMPONENT

#### 1. FRONT HOOD



- |                               |   |
|-------------------------------|---|
| (1) Front hood panel          | (5) Front hood weather strip              |
| (2) Front hood insulator      | (6) Front hood striker                    |
| (3) Front hood hinge          | (7) Front upper grille<br>(OUTBACK model) |
| (4) Intake duct weather strip |   |

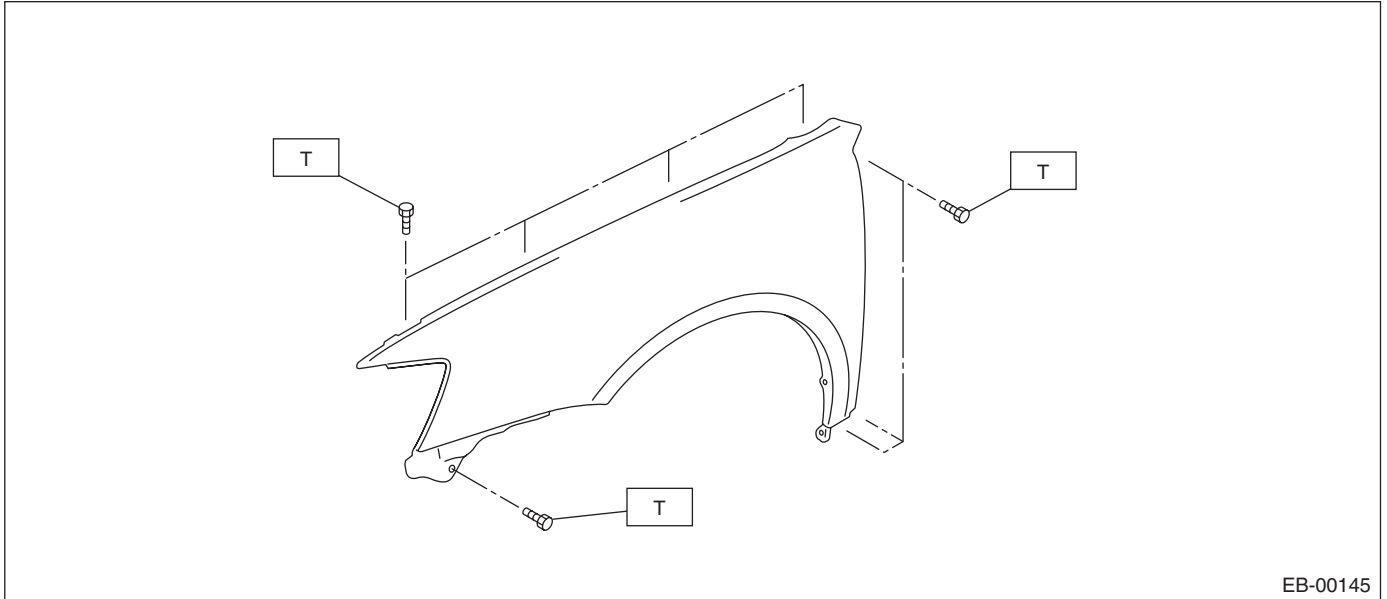
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 4.5 (0.46, 3.3)**

**T2: 24.5 (2.5, 18.1)**

**T3: 33 (3.4, 24.5)**

## 2. FRONT FENDER PANEL



EB-00145

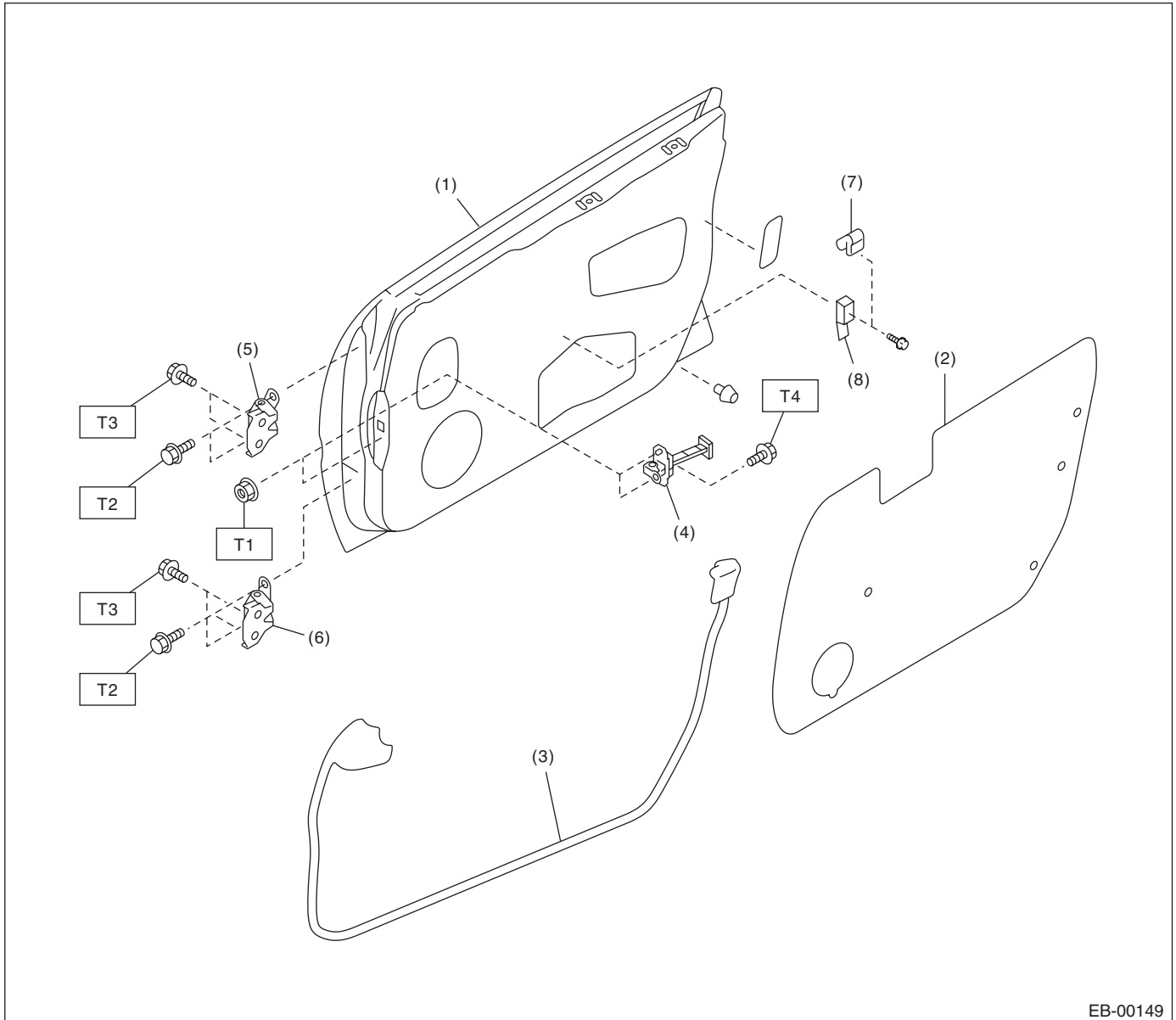
**Tightening torque: N-m (kgf-m, ft-lb)**

**T: 7.5 (0.76, 5.5)**

# General Description

## EXTERIOR BODY PANELS

### 3. FRONT DOOR PANEL



EB-00149

- |                              |                             |
|------------------------------|-----------------------------|
| (1) Front door panel         | (6) Lower hinge             |
| (2) Sealing cover            | (7) Door trim bracket upper |
| (3) Front door weather strip | (8) Door trim bracket lower |
| (4) Checker                  |                             |
| (5) Upper hinge              |                             |

**Tightening torque:N·m (kgf·m, ft·lb)**

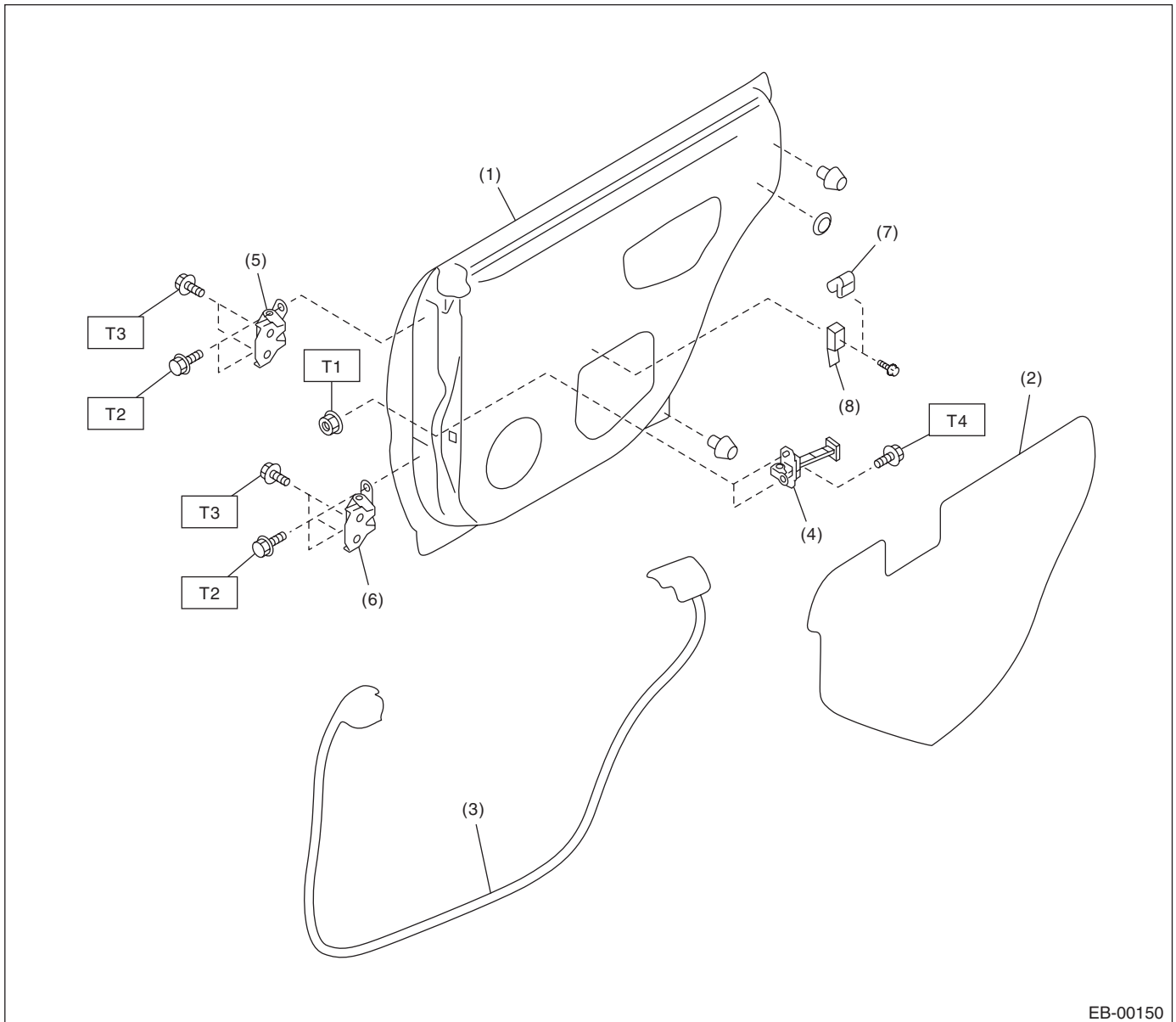
**T1: 7.4 (0.75, 5.5)**

**T2: 24.5 (2.5, 18.1)**

**T3: 29.4 (3.0, 21.7)**

**T4: 32.3 (3.3, 23.8)**

## 4. REAR DOOR PANEL



EB-00150

- |                             |                             |
|-----------------------------|-----------------------------|
| (1) Rear door panel         | (6) Lower hinge             |
| (2) Sealing cover           | (7) Door trim bracket upper |
| (3) Rear door weather strip | (8) Door trim bracket lower |
| (4) Checker                 |                             |
| (5) Upper hinge             |                             |

**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: 7.4 (0.75, 5.5)**

**T2: 24.5 (2.5, 18.1)**

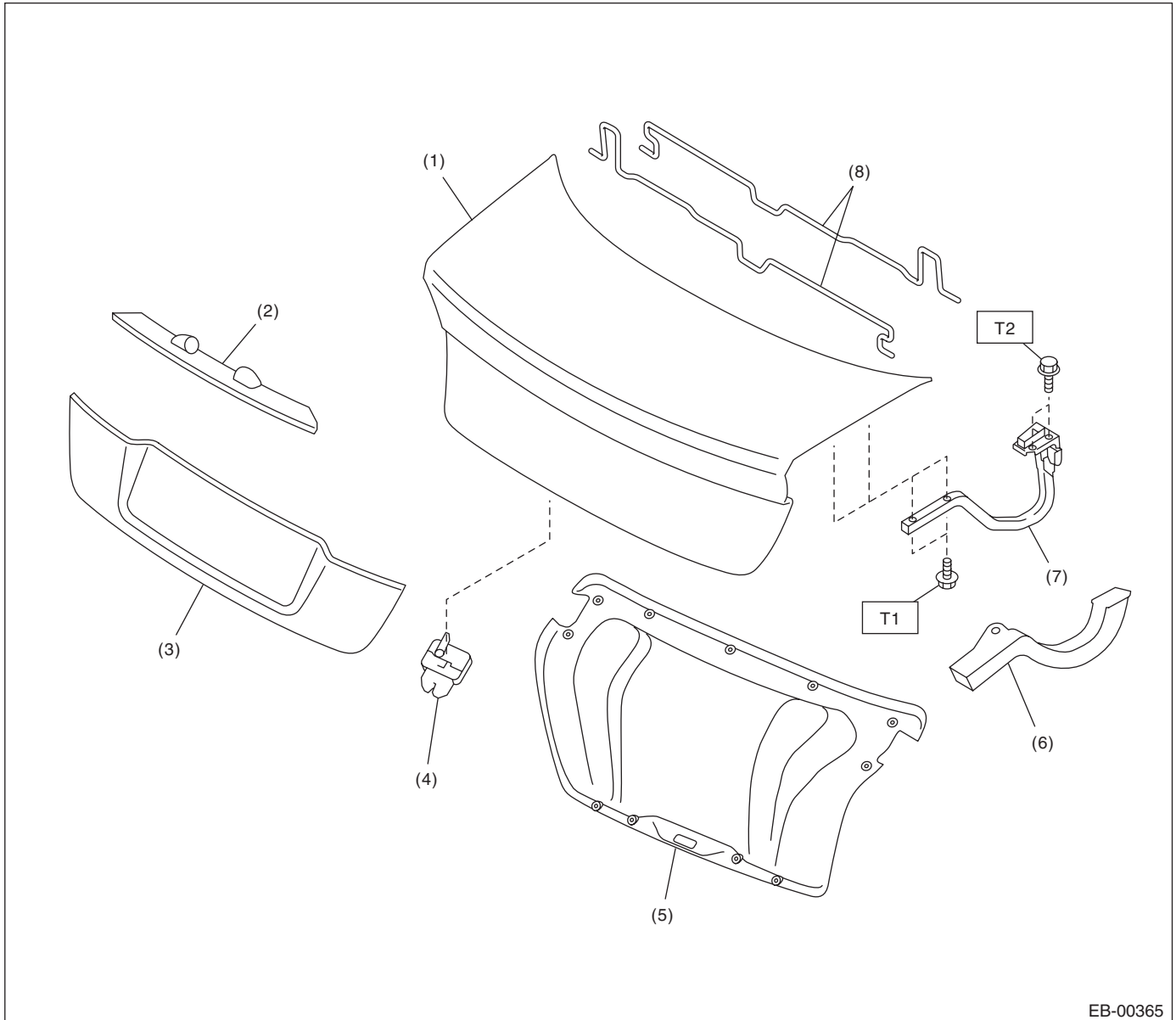
**T3: 29.4 (3.0, 21.7)**

**T4: 32.3 (3.3, 23.8)**

# General Description

## EXTERIOR BODY PANELS

### 5. TRUNK LID PANEL



EB-00365

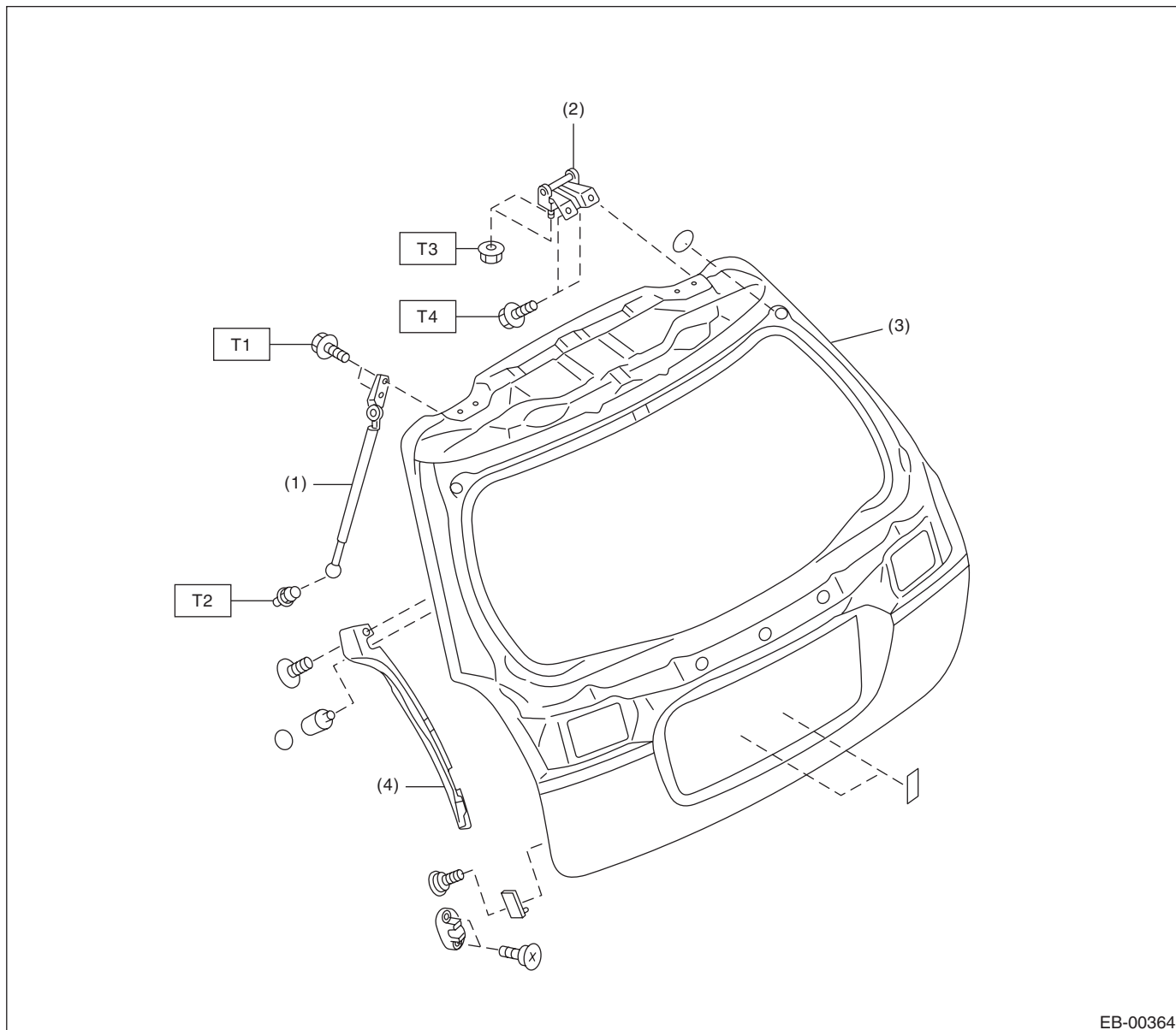
- |                               |                         |
|-------------------------------|-------------------------|
| (1) Trunk lid panel           | (5) Trunk lid trim      |
| (2) License plate light cover | (6) Trunk lid arm cover |
| (3) Trunk lid garnish         | (7) Trunk lid arm ASSY  |
| (4) Trunk lid lock ASSY       | (8) Torsion bar         |

**Tightening torque:N-m (kgf-m, ft-lb)**

**T1: 14 (1.43, 10.3)**

**T2: 18 (1.8, 12.9)**

## 6. REAR GATE PANEL



EB-00364

- (1) Rear gate damper stay
- (2) Hinge
- (3) Rear gate panel
- (4) Rear gate side panel cover

**Tightening torque:N·m (kgf·m, ft·lb)**

**T1: 7.5 (0.76, 5.5)**

**T2: 14 (1.43, 10.3)**

**T3: 25 (2.6, 18.4)**

**T4: 37 (3.7, 27.1)**

# General Description

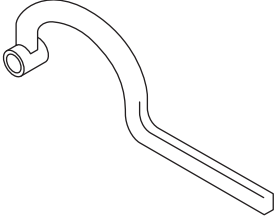
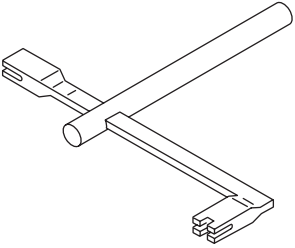
## EXTERIOR BODY PANELS

### C: CAUTION

- Exterior body panels are heavy. Do not drop and damage the panels. During removal and installation, do not damage the panel painting surface.
- While removing mounting bolts, using assistance devices such as a support jack will help support the panel.
- Be careful not to lose small parts.

### D: PREPARATION TOOL

#### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-925610000	925610000	WRENCH	Used for removing and installing door hinge.
 ST-927780000	927780000	REMOVER	Used for removing and installing the trunk torsion bar.

#### 2. GENERAL TOOL

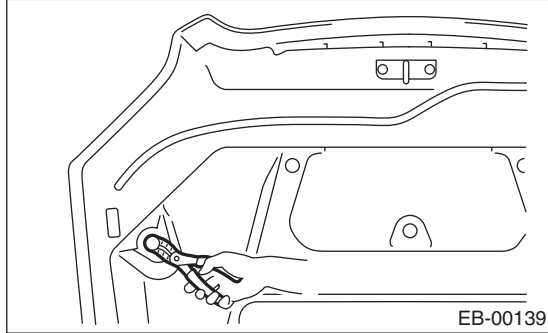
TOOL NAME	REMARKS
Support jack	Used for supporting door panel.
Clip remover	Used for removing various types of clips.

## 2. Front Hood

### A: REMOVAL

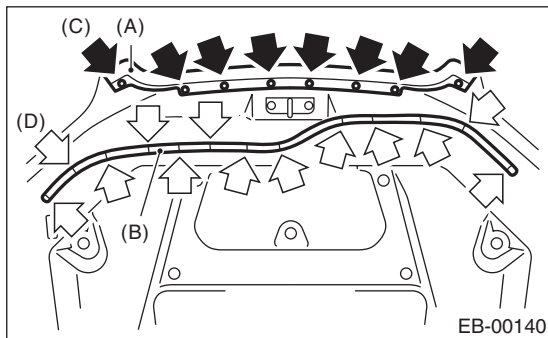
#### 1. FRONT HOOD INSULATOR

- 1) Open the front hood.
- 2) Release the clips to remove the front hood insulator.



#### 2. FRONT HOOD WEATHER STRIP

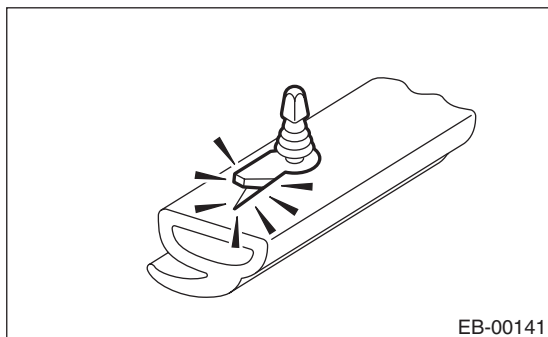
- 1) Open the front hood.
- 2) Remove the clips, and remove the front hood weather strip (A) and intake duct weather strip (B).



- (C) Clip
- (D) Weather strip clip

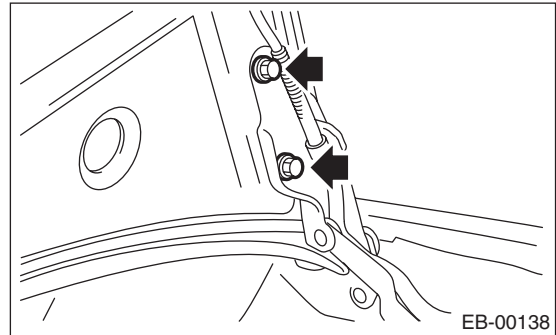
#### NOTE:

If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use clip remover to remove.

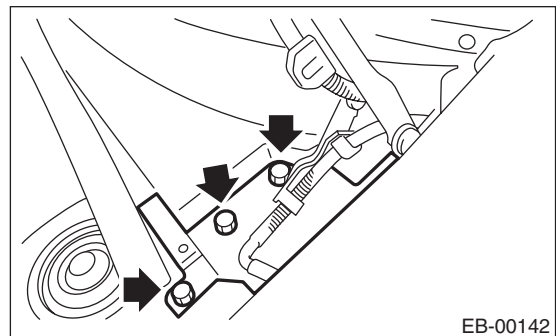


#### 3. FRONT HOOD HINGE

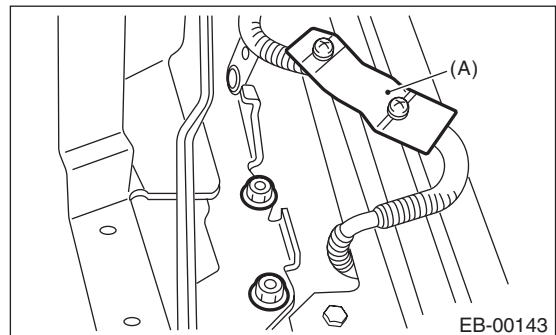
- 1) Remove the bolt, and remove the front hood panel. <Ref. to EB-14, FRONT HOOD PANEL, REMOVAL, Front Hood.>



- 2) Remove the clip, and remove the cowl side panel front.



- 3) Remove clamp (A) of the window washer hose, and remove the bolt of the hinge.



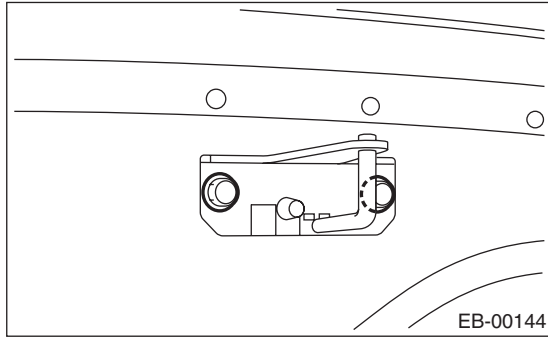


# Front Hood

## EXTERIOR BODY PANELS

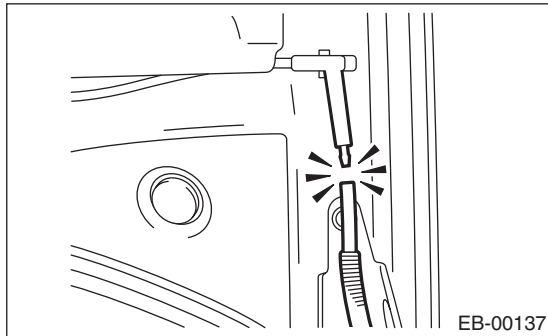
### 4. FRONT HOOD STRIKER

- 1) Open the front hood.
- 2) Remove the bolt, and remove the front hood striker.



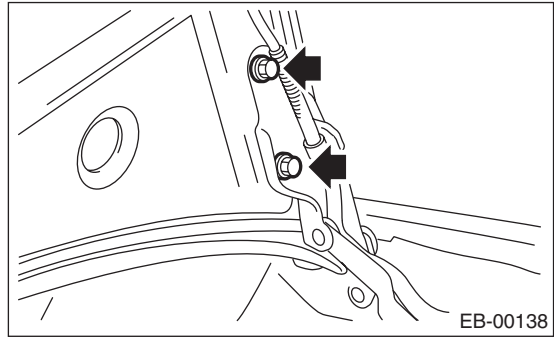
### 5. FRONT HOOD PANEL

- 1) Remove the upper grille of the front grille. (OUT-BACK model) <Ref. to EI-24, REMOVAL, Front Grille.>
- 2) Open the front hood to remove the window washer hose.



- 3) Remove the front hood insulator. <Ref. to EB-13, FRONT HOOD INSULATOR, REMOVAL, Front Hood.>
- 4) Remove the front hood weather strip. <Ref. to EB-13, FRONT HOOD WEATHER STRIP, REMOVAL, Front Hood.>
- 5) Remove the front hood striker. <Ref. to EB-14, FRONT HOOD STRIKER, REMOVAL, Front Hood.>
- 6) Remove the front hood duct. (Turbo model) <Ref. to EI-25, REMOVAL, Front Hood Grille.>
- 7) Remove the window washer hose and nozzle. <Ref. to WW-15, REMOVAL, Front Washer Nozzle.>

- 8) Remove the bolt, and remove the front hood panel from the front hood hinge.



### B: INSTALLATION

Install in the reverse order of removal.

#### NOTE:

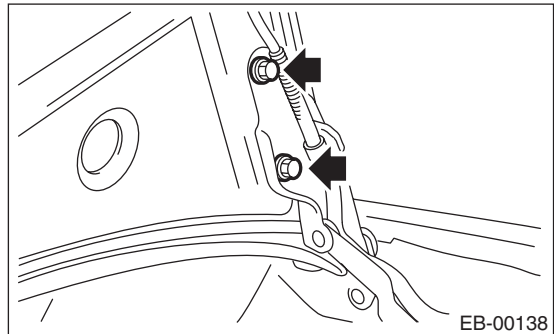
Be careful not to catch the window washer hose in when installing the front hood insulator.

#### Tightening torque:

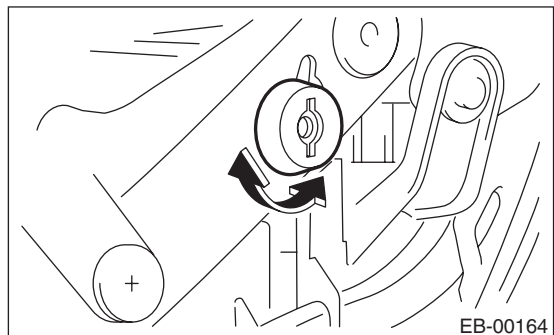
Refer to "COMPONENT" of "General Description". <Ref. to EB-6, FRONT HOOD, COMPONENT, General Description.>

### C: ADJUSTMENT

- 1) Adjust the clearance between front hood panel and front fender panel. Clearance must be equal at both sides. For the dimension of clearance, refer to "SPECIFICATION" in "General Description". <Ref. to EB-2, SPECIFICATION, General Description.>
- 2) Use the hinge mounting bolts to align the front hood longitudinal and lateral position.



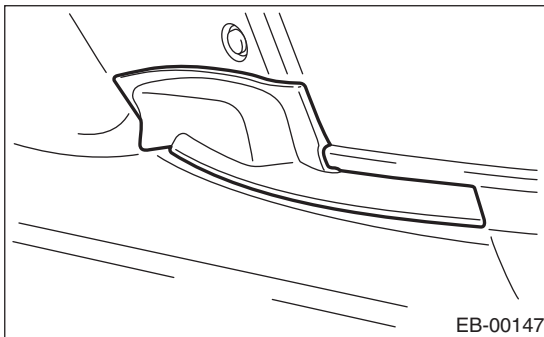
- 3) Adjust the height at the front end of hood. <Ref. to SL-45, ADJUSTMENT, Front Hood Lock Assembly.>
- 4) Rotate the hood buffer to adjust lateral height.



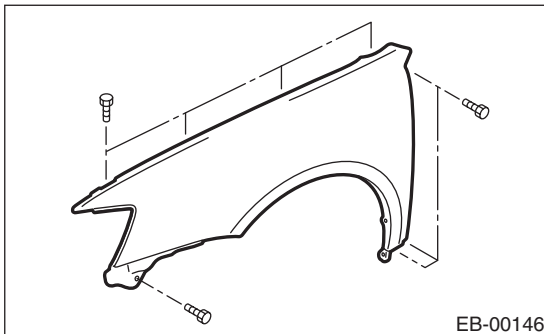
### 3. Front Fender

#### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the side sill spoilers. <Ref. to EI-42, REMOVAL, Side Sill Spoiler.>
- 3) Remove the front grille. <Ref. to EI-24, REMOVAL, Front Grille.>
- 4) Remove the front bumper face. <Ref. to EI-30, REMOVAL, Front Bumper.>
- 5) Remove the headlight assembly. <Ref. to LI-13, REMOVAL, Headlight Assembly.>
- 6) Remove the mud guard. <Ref. to EI-29, REMOVAL, Mud Guard.>
- 7) Remove the cowl panel side.



- 8) Remove the bolt, and remove the front fender panel.



#### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Install with attention to make uniform clearance between front fender panel and front hood panel. For the dimension of clearance, refer to "SPECIFICATION" in "General Description". <Ref. to EB-2, SPECIFICATION, General Description.>

#### ***Tightening torque:***

***7.5 N·m (0.76 kgf-m, 5.5 ft-lb)***

# Front Door

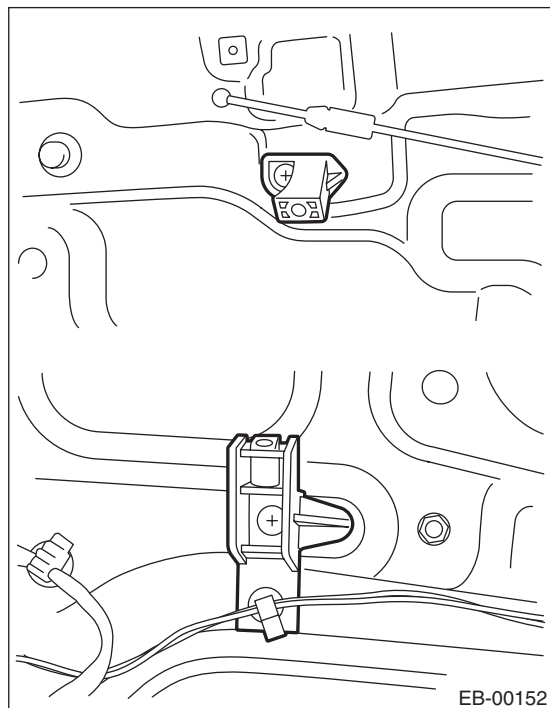
## EXTERIOR BODY PANELS

### 4. Front Door

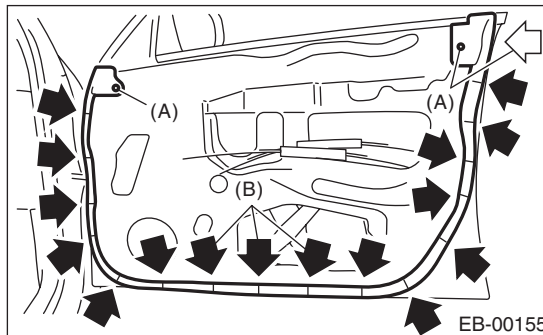
#### A: REMOVAL

##### 1. FRONT DOOR PANEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the outer mirror assembly. <Ref. to GW-19, REMOVAL, Outer Mirror Assembly.>
- 4) Remove the front door speaker. <Ref. to ET-7, REMOVAL, Front Speaker.>
- 5) Remove the sealing cover. <Ref. to EB-19, REMOVAL, Front Sealing Cover.>
- 6) Remove the gusset and front door glass. <Ref. to GW-11, REMOVAL, Front Door Glass.>
- 7) Remove the door sash, and remove the front door regulator and motor. <Ref. to GW-16, REMOVAL, Front Regulator and Motor Assembly.>
- 8) Remove the front door latch assembly. <Ref. to SL-35, REMOVAL, Front Door Latch and Door Lock Actuator Assembly.>
- 9) Remove the front outer handle. <Ref. to SL-34, REMOVAL, Front Outer Handle.>
- 10) Remove the screw to remove the door trim bracket.



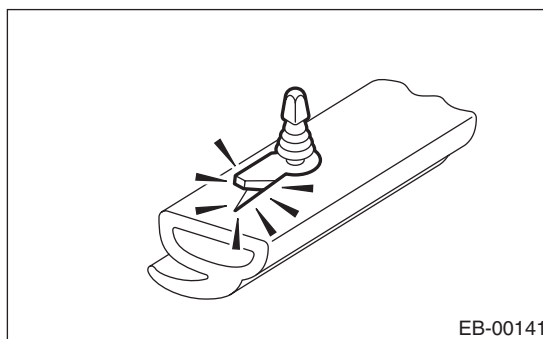
- 11) Remove the front door weather strip.



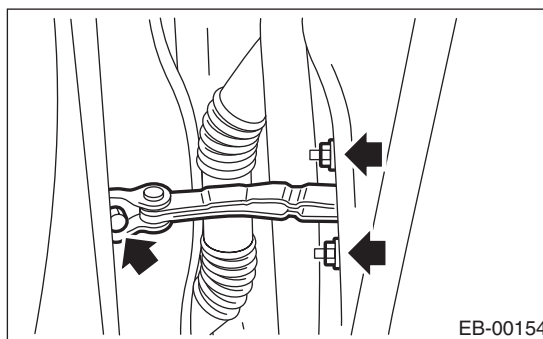
- (A) Pin clip  
(B) Weather strip clip

#### NOTE:

If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use clip remover to remove.



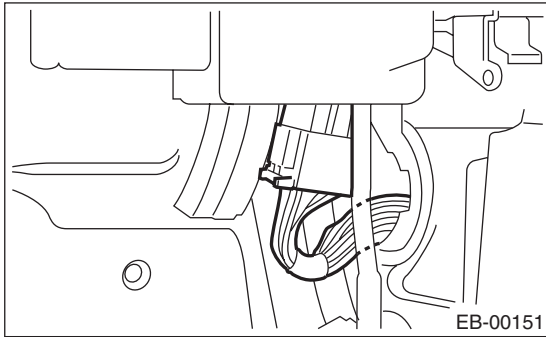
- 12) Remove the bolts and nuts to remove the door checker.



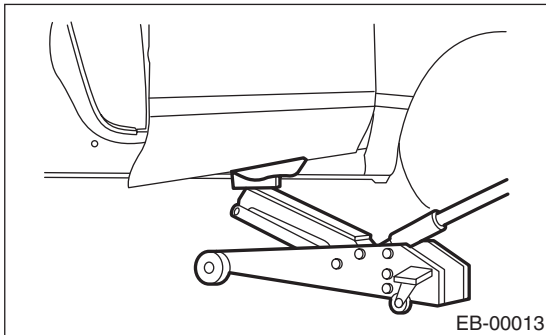
- 13) Remove the front door. <Ref. to EB-17, FRONT DOOR ASSEMBLY, REMOVAL, Front Door.>

## 2. FRONT DOOR ASSEMBLY

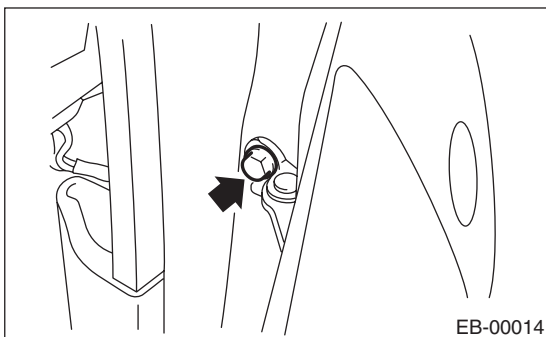
- 1) Disconnect the ground cable from the battery.
- 2) Remove the front pillar lower trim. <Ref. to EI-61, REMOVAL, Lower Inner Trim.>
- 3) Remove the instrument panel lower cover or glove box lower cover. <Ref. to EI-51, REMOVAL, Instrument Panel Lower Cover.> or <Ref. to EI-52, REMOVAL, Glove Box.>
- 4) Disconnect the connector of door harness from body harness.



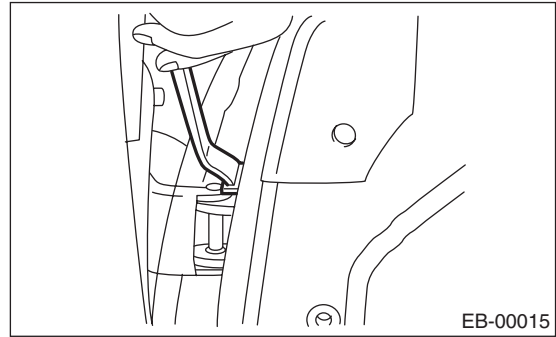
- 5) Put a wooden block on jack and place jack under the front door. Support the door with a jack to protect it from damage.



- 6) Remove the bolt from the door checker.



- 7) Remove the door-side bolts for upper and lower hinges to remove front door panel.



- 8) Remove the door hinge from vehicle.

## B: INSTALLATION

### 1. FRONT DOOR PANEL

Install in the reverse order of removal.

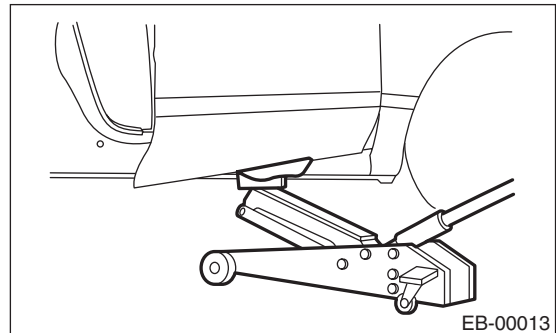
#### **Tightening torque:**

**Refer to "COMPONENT" of "General Description".**

**<Ref. to EB-8, FRONT DOOR PANEL, COMPONENT, General Description.>**

### 2. FRONT DOOR ASSEMBLY

- 1) Put a wooden block on jack and place the front door on that.



- 2) Apply grease to the sliding area of door hinges, and install the door hinge to vehicle.
- 3) Install the front door to upper hinge and lower hinge adjusting by jack.
- 4) Tighten bolt of door checker.
- 5) Connect door harness connector, and install the instrument panel lower cover.
- 6) Install the front pillar lower trim.

#### **Tightening torque:**

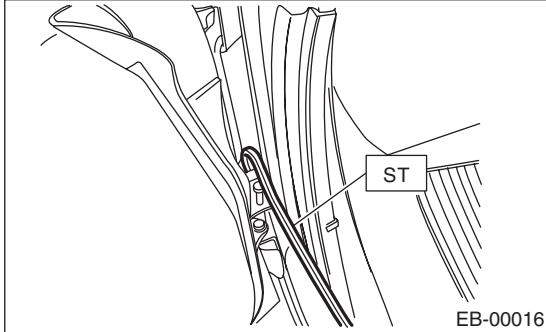
**Refer to "COMPONENT" of "General Description".**

**<Ref. to EB-8, FRONT DOOR PANEL, COMPONENT, General Description.>**

### C: ADJUSTMENT

1) Using the ST, loosen the body-side bolts of upper and lower hinges to align the position for vertical and horizontal direction of the front door panel.

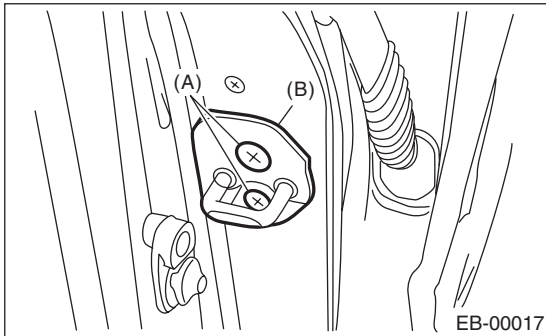
ST 925610000 DOOR HINGE WRENCH



2) Loosen the screw (A) and tap striker (B) using plastic hammer to adjust the gap between rear end surface of front door panel and front end surface of rear door.

#### CAUTION:

**Do not use an impact wrench. Welding area on the striker nut plate is easily broken.**



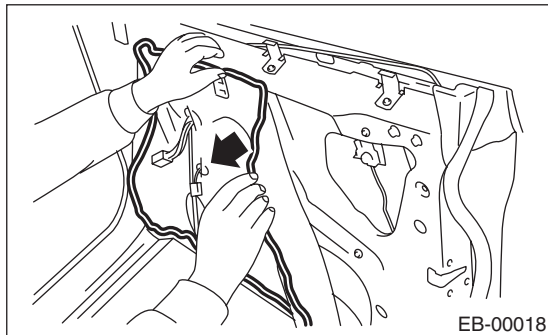
## 5. Front Sealing Cover

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the front door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the front speaker. <Ref. to ET-7, REMOVAL, Front Speaker.>
- 4) Remove the sealing cover.

#### NOTE:

- Carefully remove the butyl tape. Excessive force will easily break the cover.
- If cover gets broken, replace it with a new part.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) When replacing the sealing cover, use the butyl tape.
- 3) Press the butyl tape-applied area firmly to prevent any floating on surface.

#### **Butyl tape:**

**3M 8626 or equivalent**

#### NOTE:

- Apply a uniform bead of butyl tape.
- Attach the sealing cover, keeping it from becoming wrinkled.
- Breaks in the bead will allow water leakage and contamination.

### C: INSPECTION

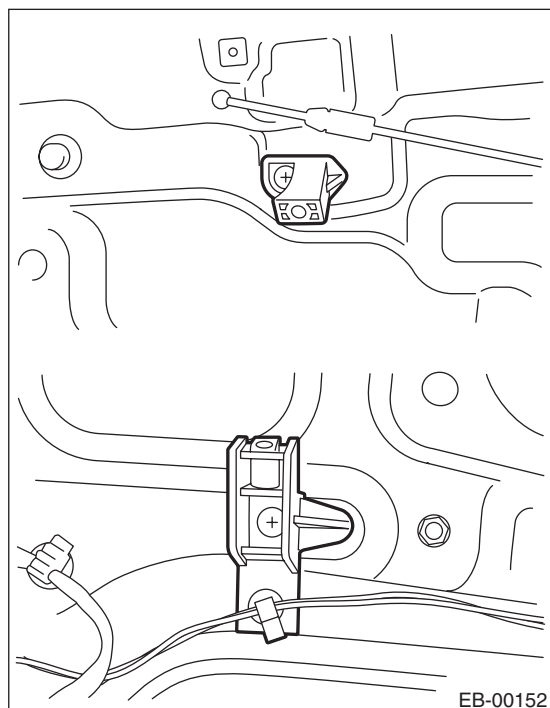
If the sealing cover gets damaged, replace it with a new part.

## 6. Rear Door

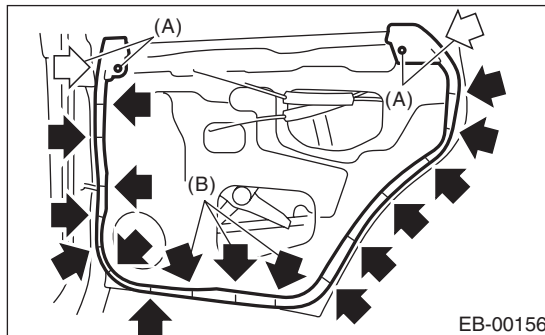
### A: REMOVAL

#### 1. REAR DOOR PANEL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the rear speaker. <Ref. to ET-9, REMOVAL, Rear Speaker.>
- 4) Remove the sealing cover. <Ref. to EB-23, REMOVAL, Rear Sealing Cover.>
- 5) Remove the rear door glass. <Ref. to GW-22, REMOVAL, Rear Door Glass.>
- 6) Remove the door sash and rear door regulator and motor assembly. <Ref. to GW-24, REMOVAL, Rear Regulator and Motor Assembly.>
- 7) Remove the rear door latch. <Ref. to SL-39, REMOVAL, Rear Door Latch and Door Lock Actuator Assembly.>
- 8) Remove the rear outer handle. <Ref. to SL-38, REMOVAL, Rear Outer Handle.>
- 9) Remove the screw to remove the door trim bracket.



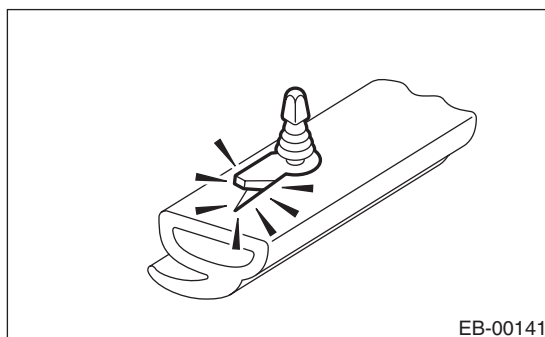
- 10) Remove the rear door inner weather strip.



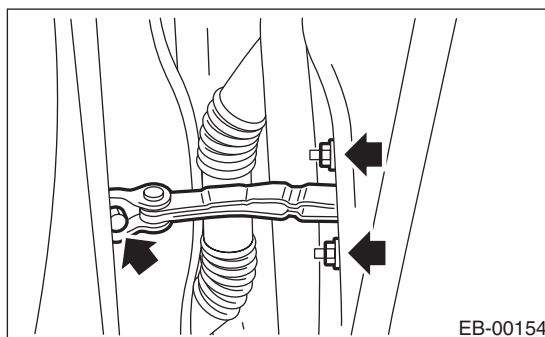
- (A) Pin clip  
(B) Weather strip clip

#### NOTE:

If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use clip remover to remove.



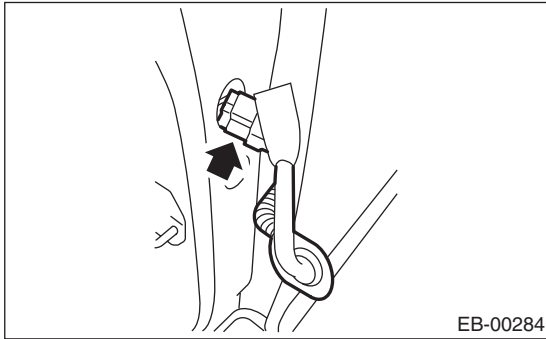
- 11) Remove the bolts and nuts to remove the door checker.



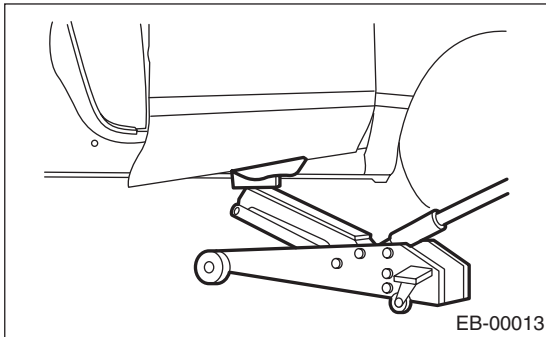
- 12) Remove the rear door. <Ref. to EB-21, REAR DOOR ASSEMBLY, REMOVAL, Rear Door.>

**2. REAR DOOR ASSEMBLY**

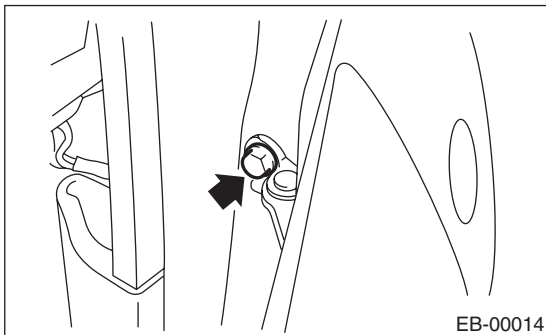
- 1) Disconnect the ground cable from the battery.
- 2) Pull the door harness connector inside the center pillar, then disconnect the connector.



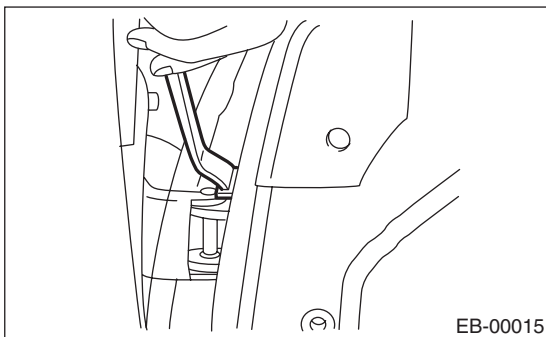
- 3) Put a wooden block on jack and place jack under the rear door. Support the rear door with the jack to protect it from damage.



- 4) Remove the bolt from the door checker.



- 5) Remove the door-side bolts for upper and lower hinges to remove the rear door panel.



- 6) Remove the door hinge from vehicle.

**B: INSTALLATION****1. REAR DOOR PANEL**

Install in the reverse order of removal.

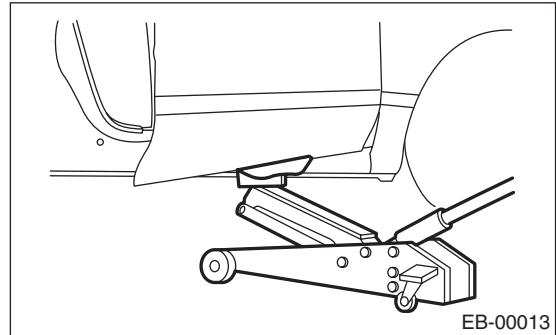
**Tightening torque:**

*Refer to "COMPONENT" of "General Description".*

*<Ref. to EB-9, REAR DOOR PANEL, COMPONENT, General Description.>*

**2. REAR DOOR ASSEMBLY**

- 1) Put a wooden block on jack and place the rear door on that.



- 2) Apply grease to the moving part of door hinges.
- 3) Install the rear door to upper hinge and lower hinge adjusting by jack.
- 4) Tighten bolt of door checker.
- 5) Connect the door harness connector, and install the center pillar inner protector.
- 6) Install the center pillar lower trim.

**Tightening torque:**

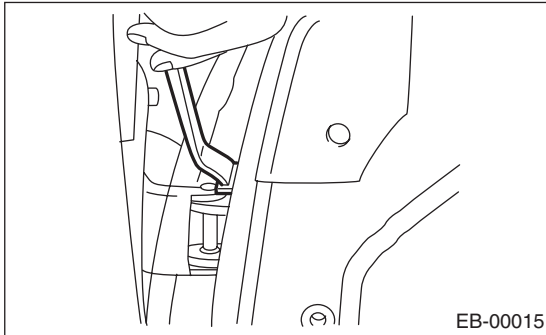
*Refer to "COMPONENT" of "General Description".*

*<Ref. to EB-9, REAR DOOR PANEL, COMPONENT, General Description.>*



### C: ADJUSTMENT

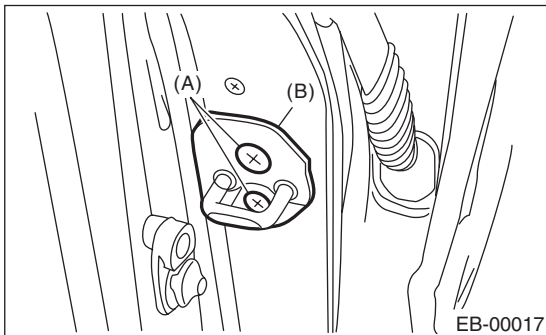
1) Open the rear door, loosen the door-side bolts of upper and lower hinges to align the position for vertical and horizontal direction of rear door panel.



2) Loosen the screw (A) and tap striker (B) using plastic hammer to adjust the gap between rear end surface of rear door panel and body surface.

#### **CAUTION:**

**Do not use an impact wrench. Welding area on the striker nut plate is easily broken.**



## 7. Rear Sealing Cover

### A: REMOVAL

- 1) Disconnect the ground cable from the battery.
- 2) Remove the rear door trim. <Ref. to EI-49, REMOVAL, Door Trim.>
- 3) Remove the sealing cover.

#### NOTE:

- Carefully remove the butyl tape. Excessive force will easily break the cover.
- If cover gets broken, replace it with a new part.



### B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) When replacing the sealing cover, use the butyl tape.
- 3) Press the butyl tape-applied area firmly to prevent any floating on surface.

#### **Butyl tape:**

**3M 8626 or equivalent**

#### NOTE:

- Apply a uniform bead of butyl tape.
- Attach the sealing cover, keeping it from becoming wrinkled.
- Breaks in the bead will allow water leakage and contamination.

### C: INSPECTION

If the sealing cover gets damaged, replace it with a new part.

# Trunk Lid

## EXTERIOR BODY PANELS

### 8. Trunk Lid

#### A: REMOVAL

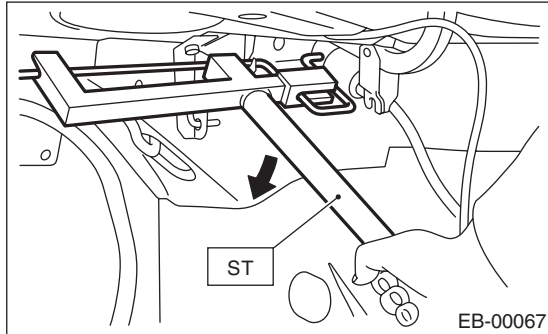
##### 1. TORSION BAR

- 1) Open the trunk lid.
- 2) Using the ST, remove the torsion bar from the hinge link.

ST 927780000 REMOVER

#### CAUTION:

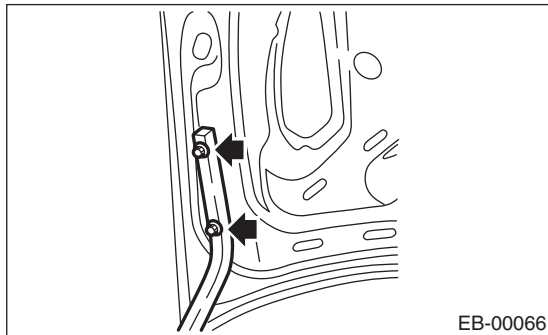
During removal and installation, handle the torsion bar carefully, because it will generate reactive force.



- 3) Remove the torsion bars RH/LH.

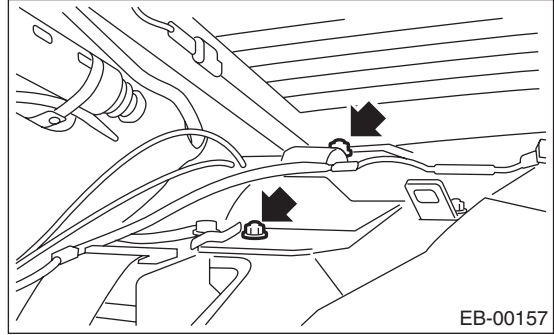
##### 2. TRUNK LID ARM

- 1) Disconnect the ground cable from the battery.
- 2) Open the trunk lid to remove the trunk lid trim, trunk lid arm cover and trunk room trim. <Ref. to EI-70, REMOVAL, Trunk Room Trim.>
- 3) Disconnect the trunk lid release cable. <Ref. to SL-43, REMOVAL, Trunk Lid Lock Assembly.>
- 4) Disconnect the connectors, and remove the harness clip, etc.
- 5) Remove the trunk lid mounting bolts, to remove the trunk lid panel from the trunk lid arm.



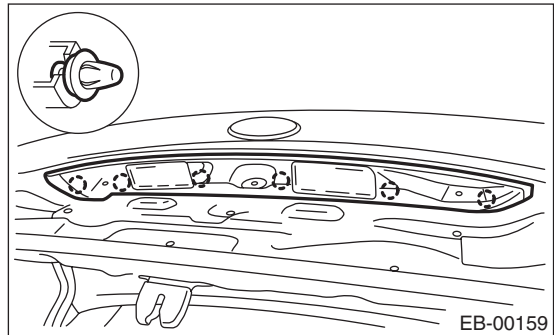
- 6) Remove the torsion bar from the trunk lid hinge link. <Ref. to EB-24, TORSION BAR, REMOVAL, Trunk Lid.>
- 7) Remove the rear shelf trim. <Ref. to EI-69, REMOVAL, Rear Shelf Trim.>

- 8) Remove the bolts, then remove the trunk lid arm.

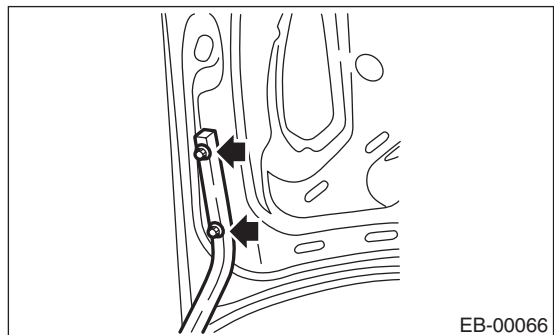


##### 3. TRUNK LID PANEL

- 1) Disconnect the ground cable from the battery.
- 2) Open the trunk lid to remove the trunk lid trim and trunk lid arm cover. <Ref. to EI-71, TRUNK ROOM TRIM, REMOVAL, Trunk Room Trim.>
- 3) Disconnect the connector to remove the trunk lid harness.
- 4) Remove the trunk lid lock assembly. <Ref. to SL-43, REMOVAL, Trunk Lid Lock Assembly.>
- 5) Remove the trunk lid garnish. <Ref. to EI-74, REMOVAL, Trunk Lid Garnish.>
- 6) Remove the license plate light cover.



- 7) Remove the bolts, then remove the trunk lid panel from the trunk lid arm.



## **B: INSTALLATION**

- 1) Install in the reverse order of removal.
- 2) Apply grease to the rotating area of hinges and the torsion bar.
- 3) Install while paying attention to make a uniform clearance around the trunk lid panel. For the dimension of clearance, refer to "SPECIFICATION" in "General Description". <Ref. to EB-2, SPECIFICATION, General Description.>

### ***Tightening torque:***

***Refer to "COMPONENT" of  
"General Description".***

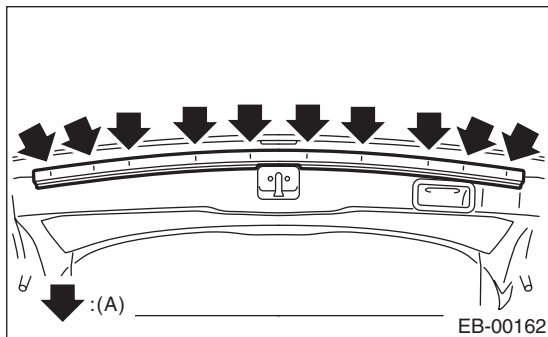
***<Ref. to EB-11, REAR GATE PANEL,  
COMPONENT, General Description.>***

## 9. Rear Gate

### A: REMOVAL

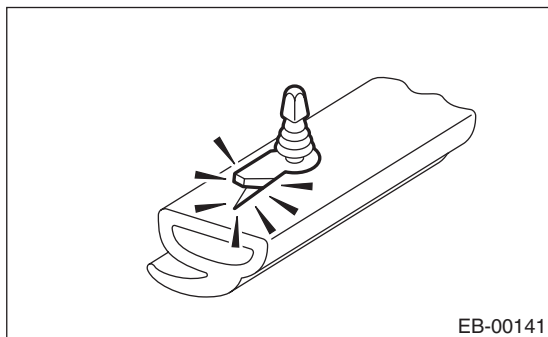
#### 1. REAR GATE PANEL

- 1) Disconnect the ground cable from the battery.
- 2) Open the rear gate.
- 3) Remove the rear gate trim. <Ref. to EI-68, REMOVAL, Rear Gate Trim.>
- 4) Remove the rear gate garnish. <Ref. to EI-75, REMOVAL, Rear Gate Garnish.>
- 5) Remove the rear wiper arm. <Ref. to WW-16, REMOVAL, Rear Wiper Arm.>
- 6) Remove the rear wiper motor. <Ref. to WW-17, REMOVAL, Rear Wiper Motor.>
- 7) Remove the rear gate outer handle. <Ref. to SL-41, REMOVAL, Rear Gate Outer Handle.>
- 8) Remove the rear gate latch assembly. <Ref. to SL-42, REMOVAL, Rear Gate Latch Assembly.>
- 9) Remove the roof spoiler. <Ref. to EI-41, REMOVAL, Roof Spoiler.>
- 10) Remove harness clip of each connector from the rear gate panel.
- 11) Remove the weather strip clip (A), and remove the rear gate panel weather strip.

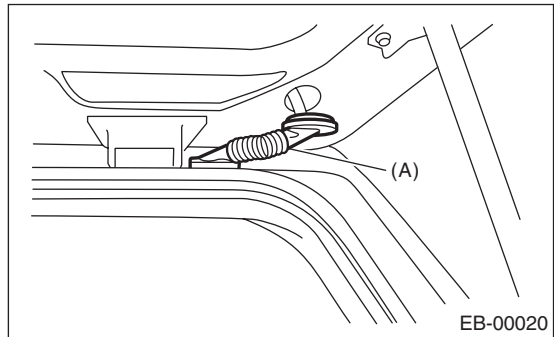


**NOTE:**

If the weather strip clip is removed with excessive force, the weather strip may be damaged. Be sure to use clip remover to remove.



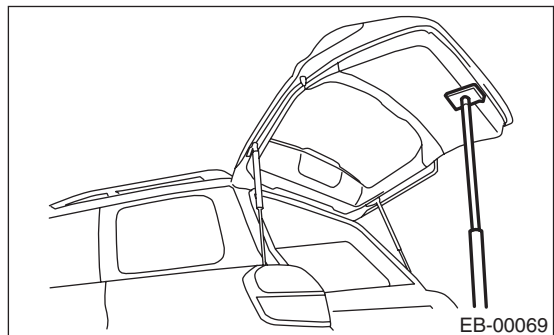
- 12) Remove the rubber duct (A) connection, and pull out the harness and washer hose from the rear gate.



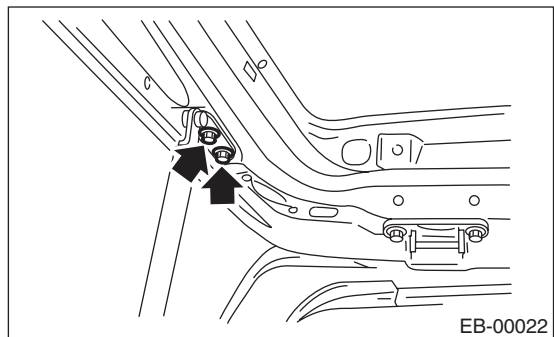
- 13) Before removing the rear gate damper stay, prevent the rear gate from closing using prop or the like.

**CAUTION:**

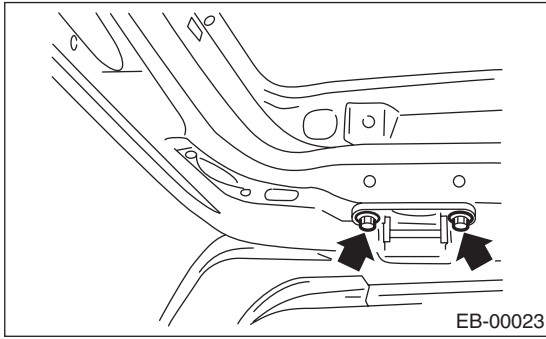
If the prop comes off, operators may get injured and vehicle may get damaged. Make sure to support the rear gate with secure material to prevent injury or damage.



- 14) Remove the mounting bolt of rear gate damper stay.



15) Remove the rear gate hinge bolt, and remove the rear gate panel.



16) Remove the rear gate hinge from the vehicle.

## 2. REAR GATE DAMPER STAY

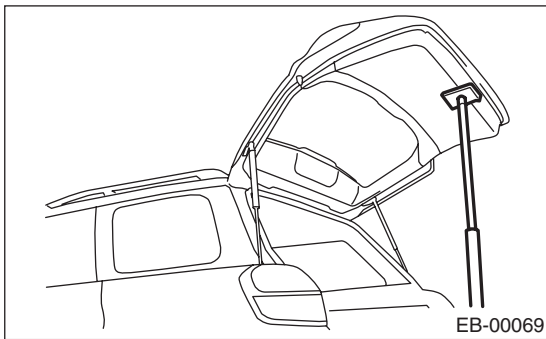
### CAUTION:

- Do not damage piston rods and oil seals.
- Never disassemble cylinders: They contain gas.

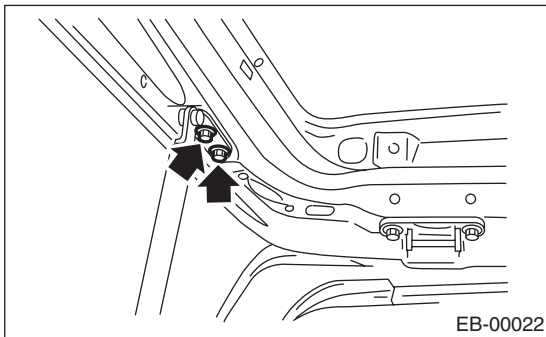
- 1) Open the rear gate.
- 2) Before removing the rear gate damper stay, prevent the rear gate from closing using prop or the like.

### CAUTION:

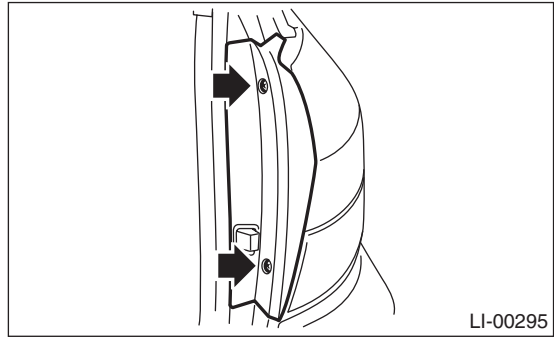
If the prop comes off, operators may get injured and vehicle may get damaged. Make sure to support the rear gate with secure material to prevent injury or damage.



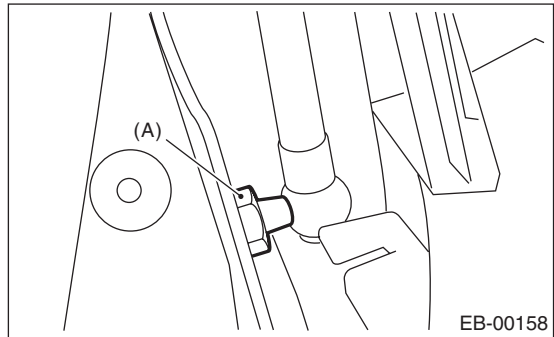
3) Remove the mounting bolt of rear gate damper stay.



4) Remove the clips and detach the rear combination light covers.



5) Remove mounting bolt (A), and remove the damper stay.



# Rear Gate

## EXTERIOR BODY PANELS

### B: INSTALLATION

#### 1. REAR GATE PANEL

- 1) Install in the reverse order of removal.
- 2) Install with attention to make uniform clearance between rear gate panel and body. For the dimension of clearance, refer to "SPECIFICATION" in "General Description". <Ref. to EB-2, SPECIFICATION, General Description.>

**Tightening torque:**

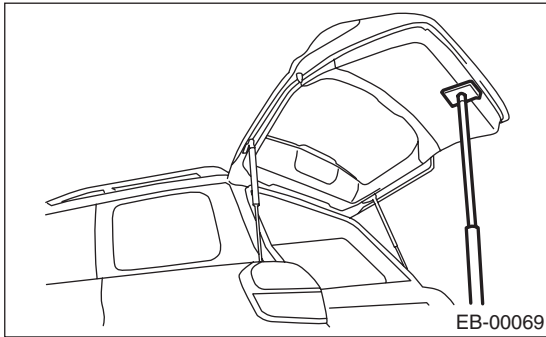
**25 N·m (2.6 kgf·m, 18.4 ft·lb)**

#### 2. REAR GATE DAMPER STAY

- 1) Prevent the rear gate from closing using prop or the like.

**CAUTION:**

**If the prop comes off, operators may get injured and vehicle may get damaged. Make sure to support the rear gate with secure material to prevent injury or damage.**



- 2) Install in the reverse order of removal.

**Tightening torque:**

**Refer to "COMPONENT" of "General Description".**

**<Ref. to EB-11, REAR GATE PANEL, COMPONENT, General Description.>**

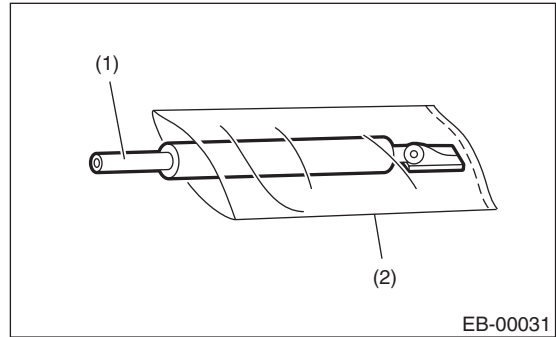
### C: DISPOSAL

#### 1. REAR GATE DAMPER STAY

**CAUTION:**

**Gas is colorless, odorless, and harmless. However, gas pressure may spray cutting powder or oil. Be sure to wear dust-resistant goggles.**

- 1) Cover with a vinyl sack as shown in the figure.



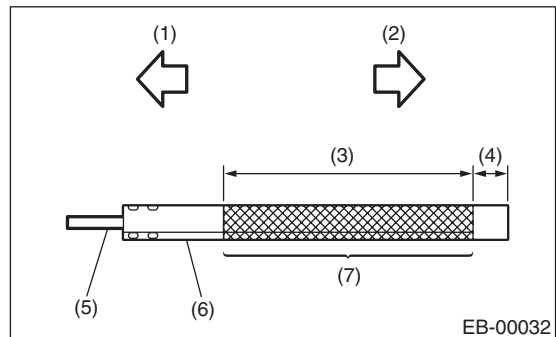
- (1) Rear gate damper stay
- (2) Vinyl sack

**NOTE:**

Prevent the vinyl sack from being caught by drill cutting edge.

2) Lift the body side slightly with piston rods fully extended, and secure the body side with vise.

Drill a hole in 2 to 3 mm (0.08 to 0.12 in) diameter at a point 10 to 200 mm (0.39 to 7.87 in) from door side, and bleed rear gate damper stay gas stay completely.



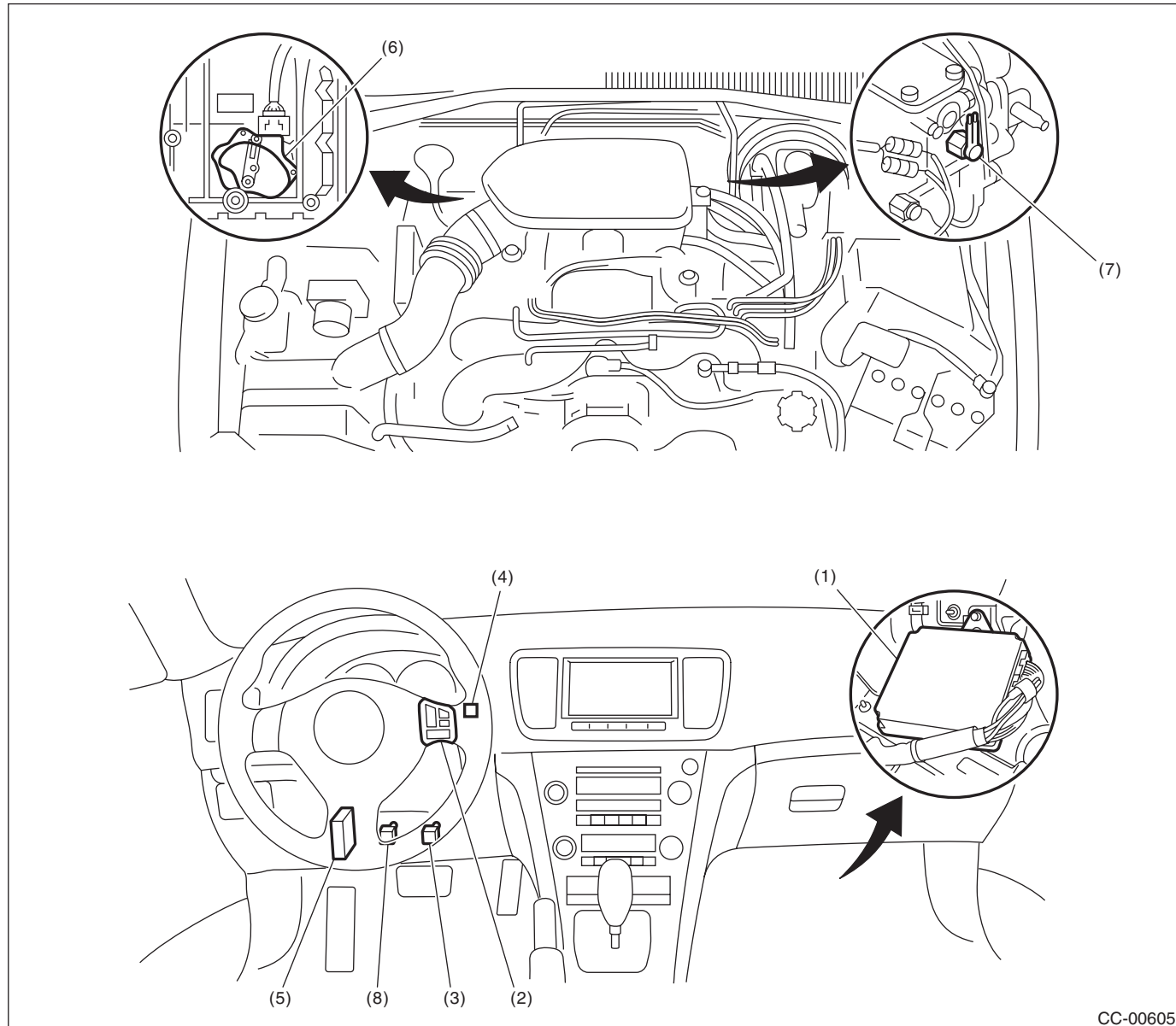
- (1) Body side
- (2) Door side
- (3) 190 mm (7.48 in)
- (4) 10 mm (0.39 in)
- (5) Piston rod
- (6) Cylinder
- (7) Portion to be drilled

# General Description

## CRUISE CONTROL SYSTEM

### 1. General Description

#### A: COMPONENT



CC-00605

- |   |  |  |
|---|--|--|
| (1) Engine control module (ECM)                           | (5) Transmission control module (TCM) (AT model) | (7) Neutral position switch (MT model) |
| (2) Cruise control command switch                         | (6) Inhibitor switch (AT model)                  | (8) Clutch switch (MT model)           |
| (3) Stop light & brake switch                             |  |  |
| (4) Cruise indicator light and cruise set indicator light |  |  |



## B: CAUTION

- Before disassembling or reassembling parts, always disconnect the battery ground cable from battery. When repairing the audio, control module, etc. which are provided with memory functions, record the memory contents before disconnecting the ground cable from battery. Otherwise, the memory will be cleared.
- Reassemble the parts in the reverse order of disassembly unless otherwise indicated.
- Adjust the parts to specifications specified in this manual.
- Connect the connectors securely during reassembly.
- After reassembly, ensure functional parts operate properly.

## C: PREPARATION TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.

## 2. Cruise Control Unit

### A: NOTE

The control of cruise control system is carried out in engine control module (ECM).

### B: REMOVAL

- 2.5 L non-turbo model <Ref. to FU(H4SO)-37, REMOVAL, Engine Control Module (ECM).>
- 2.5 L turbo model <Ref. to FU(H4DOTC)-45, REMOVAL, Engine Control Module (ECM).>
- 3.0 L model <Ref. to FU(H6DO)-37, REMOVAL, Engine Control Module (ECM).>

### C: INSTALLATION

- 2.5 L non-turbo model <Ref. to FU(H4SO)-37, INSTALLATION, Engine Control Module (ECM).>
- 2.5 L turbo model <Ref. to FU(H4DOTC)-45, INSTALLATION, Engine Control Module (ECM).>
- 3.0 L model <Ref. to FU(H6DO)-37, INSTALLATION, Engine Control Module (ECM).>

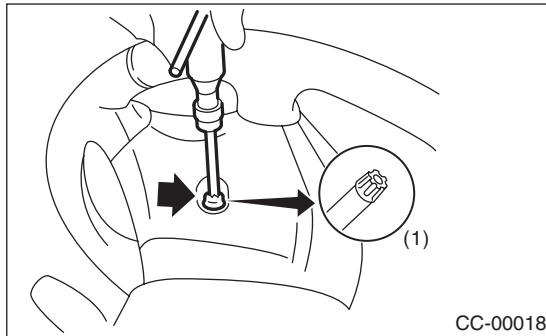
## 3. Cruise Control Command Switch

### A: REMOVAL

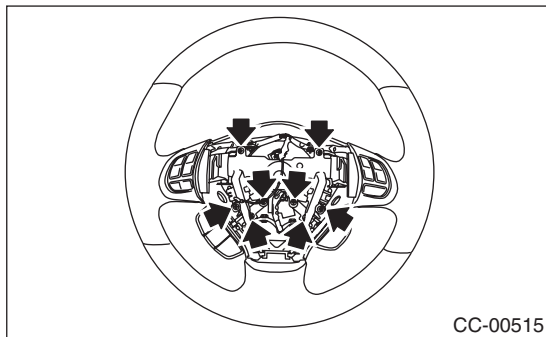
**CAUTION:**

Before servicing, be sure to read the notes in the “AB” section for proper handling of the driver’s airbag module. <Ref. to AB-4, CAUTION, General Description.>

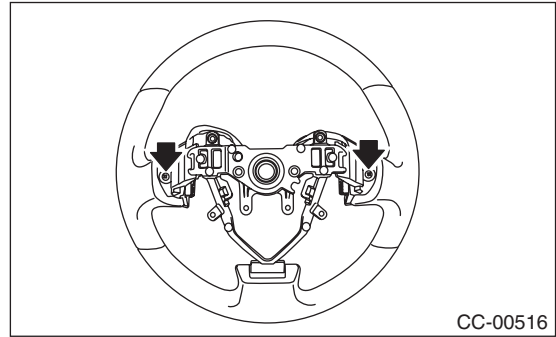
- 1) Set the front wheels in straight ahead position.
- 2) Turn the ignition switch to OFF.
- 3) Disconnect the ground cable from battery and wait for at least 20 seconds before starting work.
- 4) Using TORX® bit T30 (1), loosen two TORX® bolts which secure the driver’s airbag module.



- 5) Disconnect the airbag module connector on back of the airbag module.
- 6) Remove the steering wheel. <Ref. to PS-14, REMOVAL, Steering Wheel.>
- 7) Remove the eight screws to remove the lower cover from steering wheel.



- 8) Remove the screw on the backside of the steering wheel to remove the cruise control command switch.

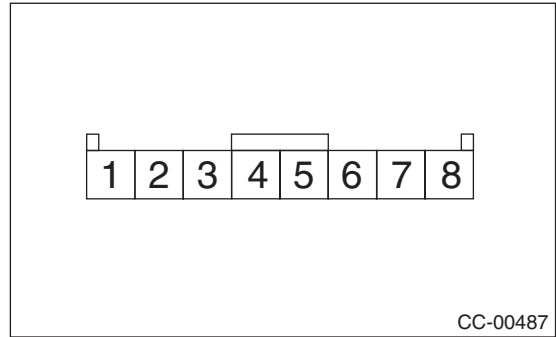


### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

Measure the cruise control command switch resistance.



Switch	Position	Terminal No.	Standard
CANCEL SET/COAST RESUME/ ACCEL	All OFF	7 and 6	Approx. 4 kΩ
CANCEL	ON	7 and 6	Less than 1 Ω
SET/COAST	ON	7 and 6	Approx. 250 Ω
RESUME/ ACCEL	ON	7 and 6	Approx. 1500 Ω
MAIN (CRUISE)	OFF	8 and 6	1 MΩ or more
	ON	8 and 6	Less than 1 Ω

If NG, replace the cruise control command switch.

## 4. Combination Meter

### A: NOTE

For the combination meter, refer to the IDI section.  
<Ref. to IDI-19, Combination Meter.>

## 5. Stop Light & Brake Switch

### A: NOTE

For the stop light & brake switch, refer to BR section. <Ref. to BR-44, INSPECTION, Stop Light Switch.>

### **6. Clutch Switch**

#### **A: NOTE**

For the clutch switch, refer to CL section. <Ref. to CL-35, Clutch Switch.>

## 7. Inhibitor Switch

### A: NOTE

#### 1. 4AT MODEL

For the inhibitor switch, refer to 4AT section. <Ref. to 4AT-47, INSPECTION, Inhibitor Switch.>

#### 2. 5AT MODEL

Inhibitor switch cannot be removed and checked, because the inhibitor switch is installed on control valve assembly.

When a malfunction occurs, refer to 5AT (diag) section. <Ref. to 5AT(diag)-34, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Transmission Control Module (TCM)

CRUISE CONTROL SYSTEM

---

## 8. Transmission Control Module (TCM)

### A: NOTE

For the transmission control module (TCM), refer to the following section.

- 4AT model <Ref. to 4AT-64, Transmission Control Module (TCM).>
- 5AT model <Ref. to 5AT-59, Transmission Control Module (TCM).>



## 9. Neutral Position Switch

### A: NOTE

For the neutral position switch, refer to the following section.

- 5MT model <Ref. to 5MT-35, Switches and Harness.>
- 6MT model <Ref. to 6MT-41, Neutral Position Switch.>

# Neutral Position Switch

CRUISE CONTROL SYSTEM

---

# Basic Diagnostic Procedure

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

### 1. Basic Diagnostic Procedure

#### A: PROCEDURE

	Step	Check	Yes	No
1	<b>CHECK MALFUNCTION INDICATOR LIGHT.</b> Make sure the malfunction indicator light illuminates.	Does the malfunction indicator light illuminate?	Go to step 5.	Go to step 2.
2	<b>CHECK CRUISE INDICATOR LIGHT.</b> Make sure the cruise indicator light blinks.	Does the cruise indicator light blink?	Go to step 5.	Go to step 3.
3	<b>CHECK CRUISE CONTROL MAIN SWITCH OPERATION.</b> Check cruise control main switch operation. (Ensure the cruise indicator light illuminates.)	Is the cruise control main switch turned on? (Does the cruise indicator light illuminate?)	Go to step 4.	Go to phenomenon 1. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
4	<b>CHECK CRUISE CONTROL SET OPERATION.</b> Check the cruise control setting operation.	Can the cruise control be set while driving at 40 km/h (25 MPH) or more?	Go to step 6.	Go to step 5.
5	<b>PERFORM CRUISE CONTROL CANCEL CONDITIONS DIAGNOSIS.</b> Perform the cruise cancel conditions diagnosis.	Is DTC displayed?	Go to "List of Diagnostic Trouble Code (DTC)". <Ref. to CC(diag)-12, List of Diagnostic Trouble Code (DTC).>	Go to phenomenon 2. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
6	<b>CHECK CRUISE SET INDICATOR LIGHT.</b> Make sure the cruise set indicator light illuminates.	Does the cruise set indicator light illuminate?	Go to step 7.	Go to phenomenon 3. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
7	<b>CHECK VEHICLE SPEED IS HELD WITHIN SET SPEED.</b> Make sure the vehicle speed is held within set speed.	Is the vehicle speed kept within setting speed $\pm 3$ km/h ( $\pm 2$ MPH) ? (Make sure that on a level road.)	Go to step 8.	Go to phenomenon 4. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
8	<b>CHECK RESUME/ACCEL OPERATION.</b> Check the RESUME/ACCEL switch operation.	Does the vehicle speed increase or return to set speed after RESUME/ACCEL switch has been pressed?	Go to step 9.	Go to phenomenon 5. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>

# Basic Diagnostic Procedure

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>9</b> <b>CHECK SET/COAST OPERATION.</b> Check the SET/COAST switch operation.	Does the vehicle speed decrease after SET/COAST switch has been pressed?	Go to step 10.	Go to phenomenon 6. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
<b>10</b> <b>CHECK CANCEL OPERATION.</b> Check the CANCEL switch operation.	Is the cruise control released after CANCEL switch has been pressed?	Go to step 11.	Go to phenomenon 7. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
<b>11</b> <b>CHECK CRUISE CONTROL RELEASE OPERATION.</b> Check the cruise control release operation.	Is the cruise control released after brake pedal has been depressed?	Go to step 12.	Go to phenomenon 8. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
<b>12</b> <b>CHECK CRUISE CONTROL RELEASE OPERATION.</b> Check the cruise control release operation.	Is the cruise control released after shifting to the neutral position?	Go to step 13.	Go to phenomenon 9. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>
<b>13</b> <b>CHECK CRUISE CONTROL RELEASE OPERATION.</b> Check the cruise control release operation.	Is the cruise control released after depressing the clutch pedal?	Finish the diagnosis.	Go to phenomenon 10. <Ref. to CC(diag)-9, DIAGNOSTIC PROCEDURE WITH PHENOMENON, Diagnostics with Phenomenon.>

# General Description

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

### 2. General Description

#### A: CAUTION

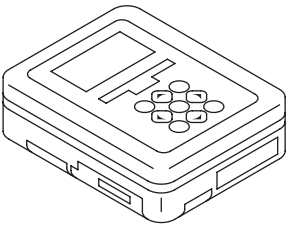
Airbag system wiring harness is routed near the cruise control command switch.

#### CAUTION:

- Airbag system wiring harnesses and connectors are yellow. Do not use electrical test equipment on these circuits.
- Be careful not to damage the airbag system wiring harness when servicing the cruise control command switch. Airbag system wiring harness is routed near the cruise control command switch.

#### B: PREPARATION TOOL

##### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

##### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

#### C: INSPECTION

Measure the battery voltage and specific gravity of electrolyte.

#### **Standard voltage:**

**12 V or more**

#### **Specific gravity:**

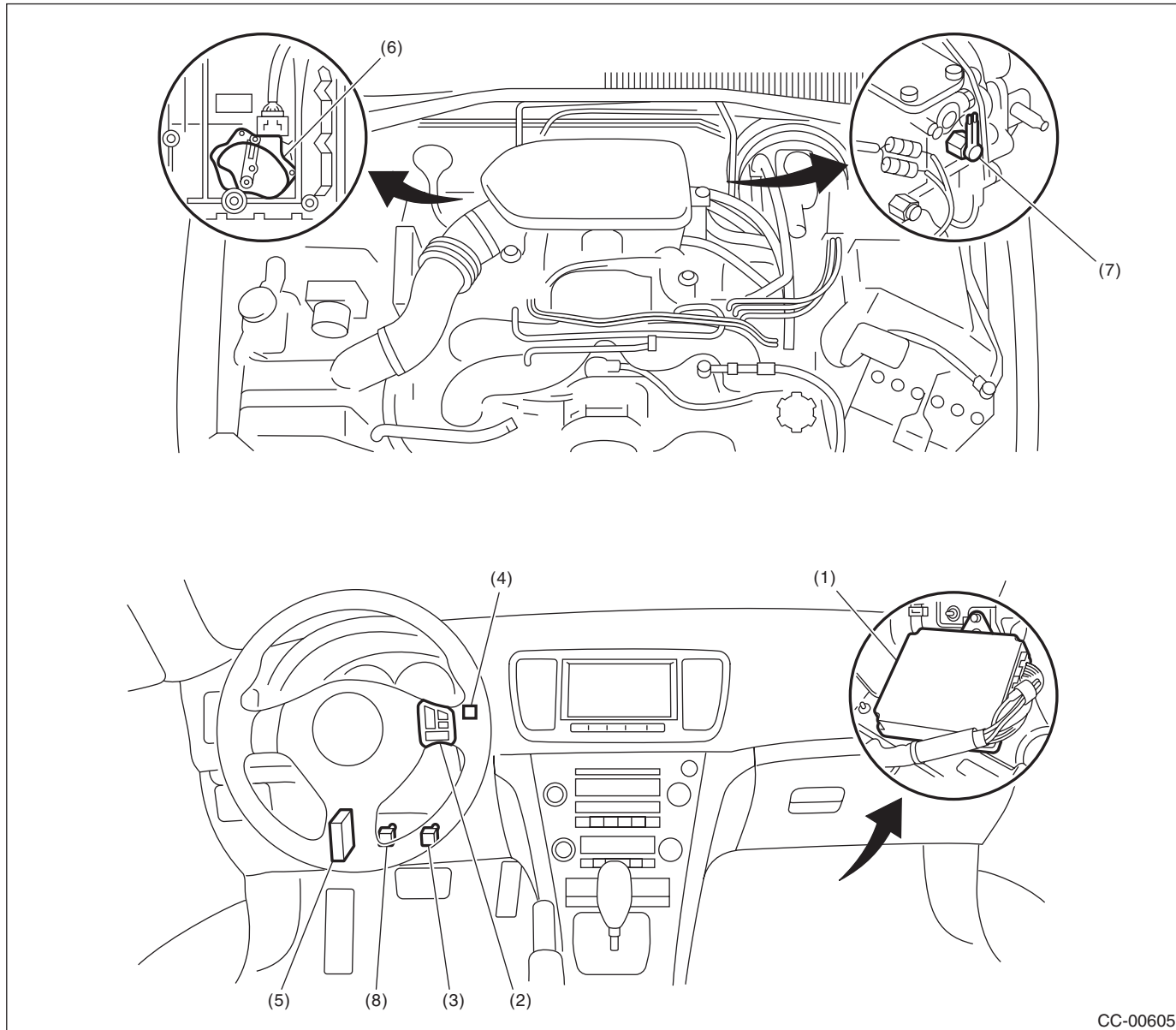
**1.260 or more**

# Electrical Component Location

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

## 3. Electrical Component Location

### A: LOCATION



CC-00605

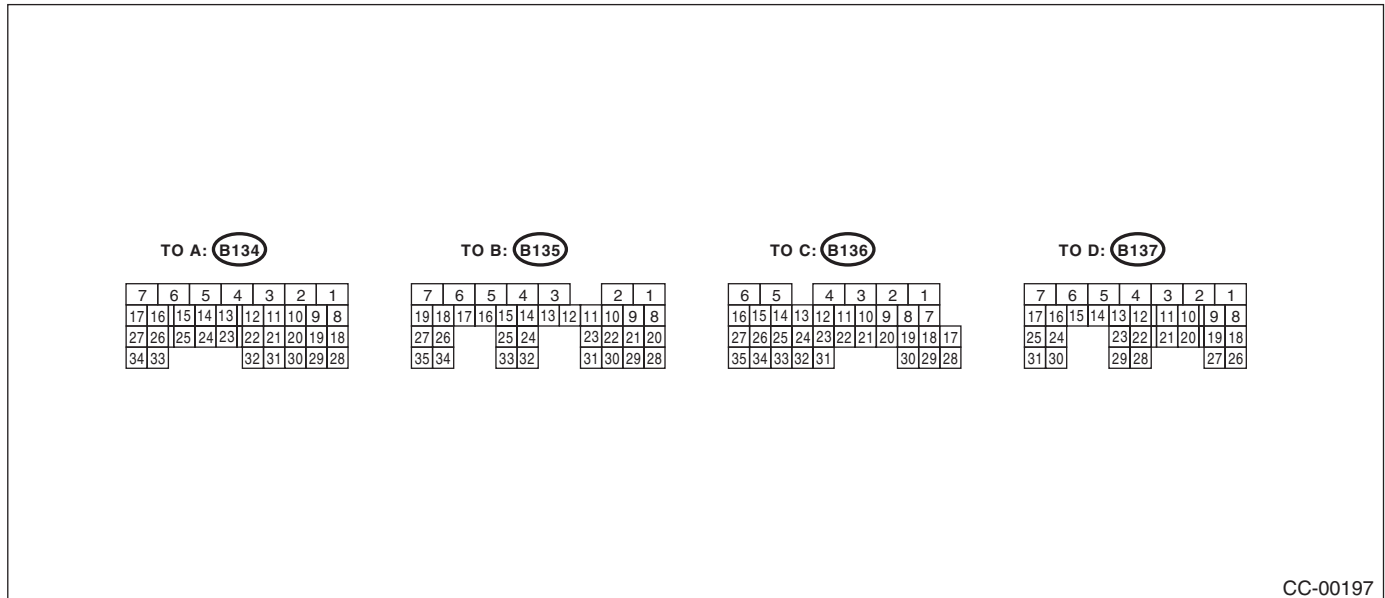
- |   |  |  |
|---|--|--|
| (1) Engine control module (ECM)                           | (5) Transmission control module (TCM) (AT model) | (7) Neutral position switch (MT model) |
| (2) Cruise control command switch                         | (6) Inhibitor switch (AT model)                  | (8) Clutch switch (MT model)           |
| (3) Stop light & brake switch                             |  |  |
| (4) Cruise indicator light and cruise set indicator light |  |  |

# Engine Control Module (ECM) I/O Signal

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

### 4. Engine Control Module (ECM) I/O Signal

#### A: ELECTRICAL SPECIFICATION



CC-00197

Contents		Terminal No.	Measurement condition and I/O signal (Idling with ignition ON: Except cruise set light)
Main power supply	VB (CONTROL 1) VB (CONTROL 2)	A7, B2	<ul style="list-style-type: none"> <li>Battery voltage is detected when the main power is turned ON.</li> <li>"0 V" is detected when the main power is turned OFF.</li> </ul>
Command switch		B24	<ul style="list-style-type: none"> <li>"0 V" is detected when the command switch is in CANCEL position.</li> <li>"Approx. 1 V" is present when the command switch is in SET/COAST position.</li> <li>"Approx. 3 V" is detected when the command switch is in RESUME/ACCEL position.</li> <li>"Approx. 4 V" is detected when the command switch is released.</li> </ul>
Brake switch 1 (Brake switch)		B20	<ul style="list-style-type: none"> <li>Battery voltage is detected when the brake pedal is released.</li> <li>"0 V" is present when brake pedal is depressed.</li> </ul>
Brake switch 2 (Stop light switch)		B28	<ul style="list-style-type: none"> <li>Battery voltage is present when brake pedal is depressed.</li> <li>"0 V" is detected when the brake pedal is released.</li> </ul>
Main switch		B12	<ul style="list-style-type: none"> <li>"0 V" is present while the main switch is pressed or turned on.</li> <li>Approx. "5 V" is detected when the main switch is OFF.</li> </ul>
Ground	GND (CONTROL 1) GND (CONTROL 2)	D2 D1	—
Ignition switch		B19	<ul style="list-style-type: none"> <li>Battery voltage is detected when the ignition switch is turned ON.</li> <li>"0 V" is detected when the ignition switch is turned OFF.</li> </ul>
Clutch switch (MT model)		C25	<ul style="list-style-type: none"> <li>"0 V" is present when brake pedal is depressed.</li> <li>Battery voltage is detected when the clutch pedal is released.</li> </ul>
Neutral position switch (MT model)		C31	<ul style="list-style-type: none"> <li>Battery voltage is present when the shift lever is set in any position other than neutral.</li> <li>"Approx. 0 V" is detected when the shift lever is in neutral position.</li> </ul>
Neutral signal (AT model)		C31	<ul style="list-style-type: none"> <li>"Approx. 5 V" (4AT model) or battery voltage (5AT model) is detected when the shift lever is set in any position except "P" or "N".</li> <li>"0 V" is detected when the shift lever is in "P" or "N" position.</li> </ul>

#### B: WIRING DIAGRAM

<Ref. to WI-220, WIRING DIAGRAM, Cruise Control System.>

### 5. Subaru Select Monitor

#### A: OPERATION

##### 1. GENERAL DESCRIPTION

The on-board diagnosis function of the cruise control system uses Subaru Select Monitor.

The on-board diagnosis function operates in two categories, which are used depending on the type of problems;

##### 1) Cruise Control Cancel Conditions Diagnosis:

(1) This category of diagnosis requires actual vehicle driving in order to determine the cause, as when cruise speed is cancelled during driving although cruise cancel condition is not entered.

(2) Cruise control memory in ECM stores the cancel condition (Code No.) which occurred during driving. When there are multiple cancel conditions (Code No.), they are shown on the Subaru Select Monitor.

#### CAUTION:

- The cruise control memory stores not only the cruise “cancel” which occurred (although “cancel” operation is not entered by the driver), but also the “cancel” condition input by the driver.

- The latest memory content (latest code) is cleared when ignition switch is turned OFF. However, the memory content by the diagnosis of faulty switches relating to the system and cruise control is retained as the fault history (memory code) after the ignition switch is turned OFF.

##### 2) Real-time Diagnosis:

Real-time diagnosis function is used to determine whether or not the input signal system is in good order, according to signal emitted from switches, sensors, etc.

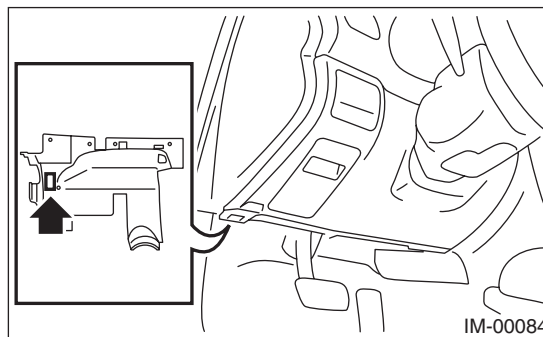
(1) Vehicle cannot be driven at cruise speed when the problem occurs in the cruise control system or relevant circuits.

(2) Monitor the signal conditions from switches and sensors.

##### 2. CRUISE CONTROL CANCEL CONDITIONS DIAGNOSIS

- 1) Prepare the Subaru Select Monitor kit.
- 2) Connect the diagnosis cable to the Subaru Select Monitor.
- 3) Connect the Subaru Select Monitor to the data link connector.

(1) Data link connector is located in the lower portion of the instrument panel (on the driver's side).



(2) Connect the diagnosis cable to the data link connector.

- 4) Start the engine and turn the cruise control main switch to ON.
- 5) Start up the Subaru Select Monitor.
- 6) Select {2. Each System Check} in «Main Menu». On the system selection display screen, select the {Engine Control System} and the [OK]. Select the [OK] after the information of engine type is displayed.
- 7) Drive vehicle at 40 km/h (25 MPH) or more and set the cruise control.

#### CAUTION:

- When performing diagnosis, observe the legal speed limit on the road.
- DTC will be also displayed when cruise control is cancelled by the driver's operation. Do not confuse them.
- Be sure to get an assistant to support the diagnosis while driving, and have him/her operate the select monitor.



# Subaru Select Monitor

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

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8) When the set speed is canceled by itself (without any cancel operations such as applying brake) or when the cruise control could not be set by performing the setting operation, selecting the {Check Cancel Code} on the engine malfunction diagnosis screen will display the DTC on the select monitor display.

### NOTE:

There are {Latest Code} and {Memorized Diagnostic Code(s)} in DTC. The latest code recognized during current test drive is displayed in {Latest Code}. DTCs by the diagnosis of faulty switches relating to the system and cruise control are displayed in {Memorized Diagnostic Code(s)}.

9) Perform Engine DTC Clear Memory operation.  
<Ref. to EN(H4SO)(diag)-54, OPERATION, Clear Memory Mode.>

<Ref. to EN(H4DOTC)(diag)-56, OPERATION, Clear Memory Mode.>

<Ref. to EN(H6DO)(diag)-57, OPERATION, Clear Memory Mode.>

DTCs of switches relating to the system and cruise control are deleted by clearing memory on the engine side.

### NOTE:

The latest code will be cleared by turning ignition switch to OFF.

## 3. REAL-TIME DIAGNOSIS

- 1) Connect the Subaru Select Monitor.
- 2) Turn the ignition switch and cruise control main switch to ON.
- 3) Start up the Subaru Select Monitor.
- 4) Select {2. Each System Check} in «Main Menu».
- 5) On the «System Selection» display screen, select the {Engine Control System}.
- 6) Select the [OK] after the information of engine type is displayed.
- 7) Select {Current Data Display & Save} in «Cruise Control Diagnosis» display screen.

8) Make sure that normal display is shown when operated as follows:

- Depress and release the brake pedal. (Stop light switch and brake switch are turned ON.)
- Turn the main switch to ON.
- Turn the “CANCEL” switch to ON.
- Turn the “SET/COAST” switch to ON.
- Turn the “RESUME/ACCEL” switch to ON.
- Depress or release the clutch pedal.
- Place the shift lever in any position other than neutral.

### NOTE:

- For details concerning operation procedures, refer to the “SUBARU SELECT MONITOR OPERATION MANUAL”.
- Refer to “List of Diagnostic Trouble Code (DTC)” for DTC. <Ref. to CC(diag)-12, List of Diagnostic Trouble Code (DTC).>

# Diagnostics with Phenomenon

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

## 6. Diagnostics with Phenomenon

### A: DIAGNOSTIC PROCEDURE WITH PHENOMENON

Phenomenon		Check item	Reference
1	Cruise control main switch is not turned to ON. (Cruise indicator light does not illuminate.)	(1) Check the cruise indicator light.	<Ref. to CC(diag)-11, CHECK CRUISE INDICATOR LIGHT AND CRUISE SET INDICATOR LIGHT, Diagnostics with Phenomenon.>
		(2) Check the cruise control command switch.	<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
2	Cruise control cannot be set.	(1) Check the cruise control command switch.	<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
		(2) Check stop light switch and brake switch.	<Ref. to CC(diag)-17, DTC 12, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 25, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 61, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
		(3) Check clutch switch.	<Ref. to CC(diag)-19, DTC 13, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
		(4) Check the neutral position switch.	<Ref. to CC(diag)-21, DTC 14, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 62, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
		(5) Check vehicle speed sensor.	<Ref. to CC(diag)-26, DTC 22, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 32, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 63, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
3	Cruise set indicator light does not illuminate.	Check the cruise set indicator light.	<Ref. to CC(diag)-11, CHECK CRUISE INDICATOR LIGHT AND CRUISE SET INDICATOR LIGHT, Diagnostics with Phenomenon.>
4	Vehicle speed is not held within set speed $\pm 3$ km/h ( $\pm 2$ MPH).	Check the vehicle speed sensor.	<Ref. to CC(diag)-26, DTC 22, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 32, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 63, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## Diagnostics with Phenomenon

### CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Phenomenon		Check item	Reference
5	Vehicle speed does not increase or does not return to set speed after RESUME/ACCEL switch has been pressed.	Check the RESUME/ACCEL switch.	<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
6	Vehicle speed does not decrease after SET/COAST switch has been pressed.	Check the SET/COAST switch.	<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
7	Cruise control is not released after CANCEL switch has been pressed.	Check the CANCEL switch.	<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
8	Cruise control is not released after brake pedal has been depressed.	Check the stop light switch and brake switch.	<Ref. to CC(diag)-17, DTC 12, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-26, DTC 25, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 61, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
9	Cruise control is not released after shifting to the neutral position.	Check the neutral position switch.	<Ref. to CC(diag)-21, DTC 14, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to CC(diag)-27, DTC 62, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
10	Cruise control is not released after clutch pedal has been depressed.	Check the clutch switch.	<Ref. to CC(diag)-19, DTC 13, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostics with Phenomenon

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

## B: CHECK CRUISE INDICATOR LIGHT AND CRUISE SET INDICATOR LIGHT

### TROUBLE SYMPTOM:

Cruise control can be set, but the cruise indicator light and cruise set indicator light do not illuminate.

Step	Check	Yes	No
<b>1</b> <b>CHECK CRUISE INDICATOR LIGHT AND CRUISE SET INDICATOR LIGHT.</b> 1) Perform self-diagnosis of the combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.> 2) Check the cruise indicator light and cruise set indicator light if they illuminate.	Do the cruise indicator light and cruise set indicator light illuminate?	Go to step 2.	Replace the meter case assembly. <Ref. to IDI-19, Combination Meter.>
<b>2</b> <b>CHECK DTC OF LAN COMMUNICATION CIRCUIT.</b> 1) Complete self-diagnosis, and turn the ignition switch to ON again. 2) Read the DTC of body integrated unit using Subaru Select Monitor.	Is DTC of Low-speed CAN displayed?	Check the LAN communication circuit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

## List of Diagnostic Trouble Code (DTC)

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

### 7. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Contents of diagnosis	Reference
11	Main switch	Main switch of cruise control command switch is turned to OFF, and then the cruise control is released.	This DTC is displayed without operating the main switch. <Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
12	Stop light & brake switch	Stop light switch or brake switch is turned to ON, and then the cruise control is released.	This DTC is displayed without depressing the brake pedal. <Ref. to CC(diag)-17, DTC 12, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
13	Clutch switch	Clutch switch is turned to ON, and then the cruise control is released.	This DTC is displayed without depressing the clutch pedal. <Ref. to CC(diag)-19, DTC 13, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
14	Neutral switch	Neutral position switch is turned to ON, and then the cruise control is released.	This DTC is displayed without shifting to neutral position. <Ref. to CC(diag)-21, DTC 14, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
15	Cancel switch	Cancel switch is turned to ON, and then the cruise control is released.	This DTC is displayed without operating the cancel switch. <Ref. to CC(diag)-24, DTC 15, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
16	Ignition switch	Ignition switch is turned to OFF, and then the cruise control is released.	This DTC is displayed without operating the ignition switch. <Ref. to CC(diag)-25, DTC 16, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	Cruise control switch malfunction when ignition switch is turned to ON	When the ignition switch is turned to ON, each switch of cruise control command switch is already turned to ON.	This DTC is displayed when the ignition switch is turned to ON without operating the cruise control command switch. <Ref. to CC(diag)-25, DTC 21, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	Vehicle Speed Variation Malfunction	Malfunction of vehicle speed signal variation is detected.	<Ref. to CC(diag)-26, DTC 22, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

DTC	Item	Contents of diagnosis	Reference
24	Cruise Control Related Switch Malfunction	Open circuit of cruise control switch is detected during cruise driving. (The system is judged as model without cruise control.)	This DTC is displayed with normal operation. <Ref. to CC(diag)-26, DTC 24, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	Brake Switch Input Circuit Malfunction	Malfunction of brake switch input circuit in ECM is detected.	<Ref. to CC(diag)-26, DTC 25, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
31	Engine speed signal	<ul style="list-style-type: none"> <li>Abnormal increase of engine speed is detected.</li> <li>Gear is placed in neutral, 1st or reverse position.</li> </ul>	Cruise in 2nd shift position or more. <Ref. to CC(diag)-26, DTC 31, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
32	Out of vehicle speed range of cruise control operation	<ul style="list-style-type: none"> <li>Controlled vehicle speed decreased under the limit during cruising.</li> <li>Set operation was performed at vehicle speed unavailable for setting.</li> <li>RESUME operation was performed without memorized vehicle speed.</li> </ul>	This DTC is displayed, though the vehicle speed is increased to the speed available for cruise set and set operation was performed again. <Ref. to CC(diag)-27, DTC 32, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
34	Prohibition when accelerator position is continued to be large	The vehicle has been driven at higher speed than set vehicle speed for an abnormally long time (approximately 10 minutes) during cruise driving.	This DTC is displayed when driving for a long period of time at higher speed than appropriate cruise set vehicle speed by operating accelerator pedal. In this case, the cruise setting is deactivated. <Ref. to CC(diag)-27, DTC 34, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
35	Prohibition when vehicle speed feedback is impossible	Set vehicle speed cannot be kept because of some reasons (steep uphill, parking brake, abnormal decrease of engine output, etc.) during cruise driving.	This DTC is displayed when driving condition is not suitable for cruise control. Perform cruise set operation again after clearing the possible cause. <Ref. to CC(diag)-27, DTC 35, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## List of Diagnostic Trouble Code (DTC)

### CRUISE CONTROL SYSTEM (DIAGNOSTICS)

DTC	Item	Contents of diagnosis	Reference
41	VDC/TCS operation	Vehicle dynamics control (VDC) or TCS is operated during cruise driving or cruise setting.	This DTC is displayed when driving condition is not suitable for cruise control. Perform cruise set operation again after clearing the possible cause. <Ref. to CC(diag)-27, DTC 41, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
43	ABS/VDC malfunction	ABS or Vehicle dynamics control (VDC) system malfunction is detected during cruise driving or cruise setting.	<Ref. to CC(diag)-27, DTC 43, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
44	Body integrated unit malfunction	Body integrated unit system malfunction is detected during cruise driving or cruise setting.	<Ref. to CC(diag)-27, DTC 44, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
45	Meter Failure	Combination meter malfunction is detected during cruise driving or cruise setting.	<Ref. to CC(diag)-27, DTC 45, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
61	Brake switch malfunction	Malfunction in the stop light & brake switch is detected.	<Ref. to CC(diag)-27, DTC 61, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
62	Neutral position switch malfunction	Neutral position switch malfunction is detected.	<Ref. to CC(diag)-27, DTC 62, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
63	Vehicle speed variation malfunction 1	Malfunction of vehicle speed signal variation is detected.	<Ref. to CC(diag)-28, DTC 63, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
64	Engine sensor related sensor malfunction 1	Malfunction related to engine is detected.	<Ref. to CC(diag)-28, DTC 64, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
65	Cruise control related switch malfunction 1	Cruise control command switch malfunction is detected. (While the switch is pressed ON for a long time (approximately two minutes), stuck ON condition is detected.)	<Ref. to CC(diag)-28, DTC 65, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
66	Cruise control computational malfunction	Cruise control calculation (microcomputer) malfunction is detected.	<Ref. to CC(diag)-28, DTC 66, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

## 8. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

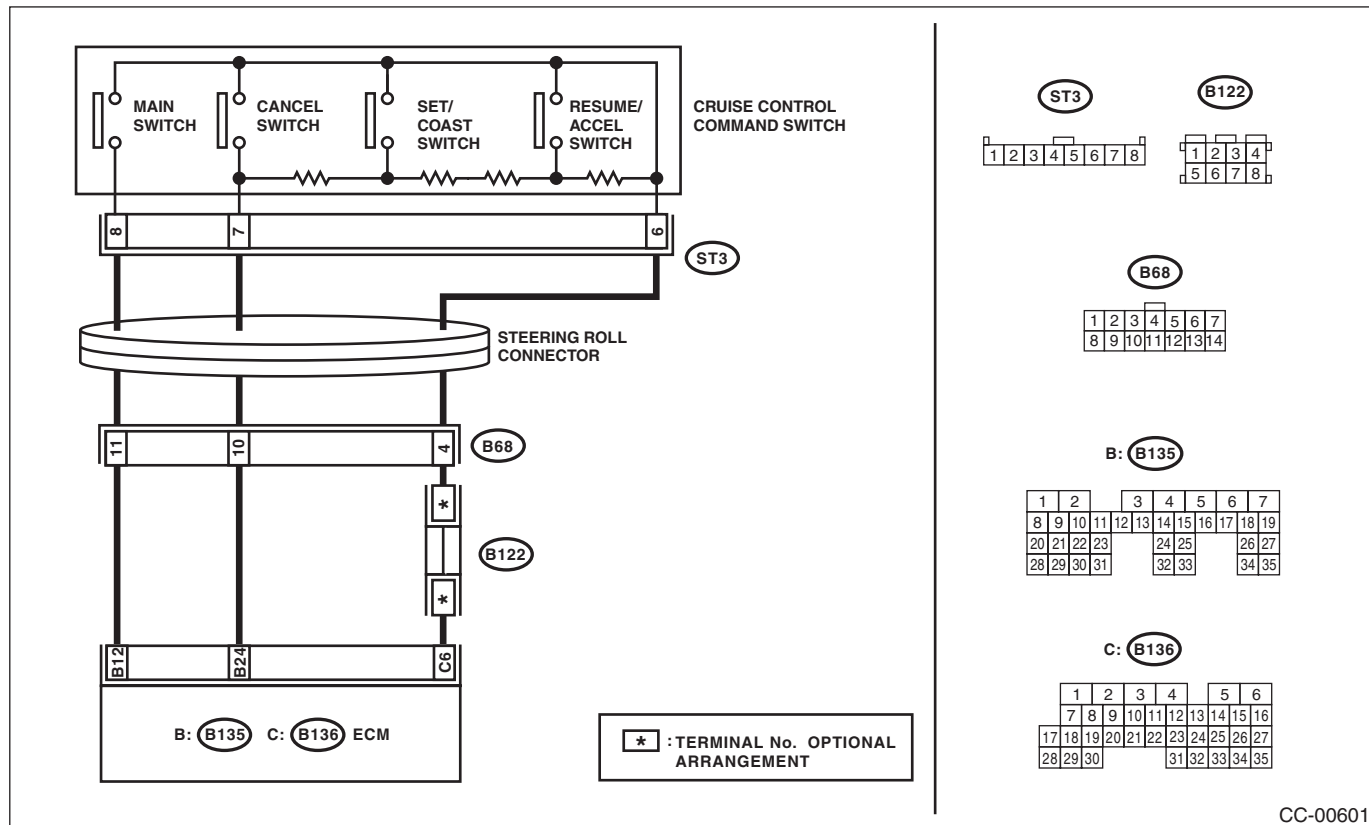
### A: DTC 11

The malfunction is detected when the main switch is pressed or problem relating to the main switch occurs.

#### TROUBLE SYMPTOM:

- Cruise control cannot be set. (Cancelled immediately.)
- Cruise control cannot be released.

#### WIRING DIAGRAM:



CC-00601



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK CRUISE CONTROL COMMAND SWITCH CIRCUIT.</b></p> <p>1) Remove the driver's airbag module. &lt;Ref. to AB-14, REMOVAL, Driver's Airbag Module.&gt;</p> <p>2) Disconnect the harness connector of cruise control command switch.</p> <p>3) Turn the ignition switch to ON.</p> <p>4) Measure the voltage between harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b>  <b>(ST3) No. 8 (+) — Chassis ground (-):</b>  <b>(ST3) No. 7 (+) — Chassis ground (-):</b></p>	Is the voltage 5 V or more?	Go to step 2.	Check the harness between cruise control command switch and ECM, and the steering roll connector for open or short circuit, or for poor contact.
<p><b>2 CHECK CRUISE CONTROL COMMAND SWITCH CIRCUIT.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Remove the cruise control command switch. &lt;Ref. to CC-5, REMOVAL, Cruise Control Command Switch.&gt;</p> <p>3) Measure the resistance between harness connector terminal and chassis ground.</p> <p><b>Connector terminal</b>  <b>(ST3) No. 6 — Chassis ground:</b></p>	Is the resistance less than 10 $\Omega$ ?	Go to step 3.	Check for open between cruise control command switch and ECM and chassis ground, and check the ECM.
<p><b>3 CHECK CRUISE CONTROL COMMAND SWITCH.</b></p> <p>Measure the resistance between switch terminals when the cruise control command switch is not being pressed.</p> <p><b>Terminals</b>  <b>No. 6 — No. 7:</b></p>	Is the resistance approx. 4 k $\Omega$ ?	Go to step 4.	Replace the cruise control command switch. <Ref. to CC-5, Cruise Control Command Switch.>
<p><b>4 CHECK CANCEL SWITCH.</b></p> <p>1) Turn the ignition switch to OFF.</p> <p>2) Remove the cruise control command switch. &lt;Ref. to CC-5, REMOVAL, Cruise Control Command Switch.&gt;</p> <p>3) Measure the resistance between switch terminals when the CANCEL switch is pressed.</p> <p><b>Terminals</b>  <b>No. 6 — No. 7:</b></p>	Is the resistance approx. less than 1 $\Omega$ when the CANCEL switch is pressed?	Go to step 5.	Replace the cruise control command switch. <Ref. to CC-5, Cruise Control Command Switch.>
<p><b>5 CHECK SET/COAST SWITCH.</b></p> <p>Measure the resistance between switch terminals when the SET/COAST switch is pressed.</p> <p><b>Terminals</b>  <b>No. 6 — No. 7:</b></p>	Is the resistance approx. 250 $\Omega$ when SET/COAST switch is pressed?	Go to step 6.	Replace the cruise control command switch. <Ref. to CC-5, Cruise Control Command Switch.>
<p><b>6 CHECK RESUME/ACCEL SWITCH CIRCUIT.</b></p> <p>Measure the resistance between switch terminals when the RESUME/ACCEL switch is pressed.</p> <p><b>Terminals</b>  <b>No. 6 — No. 7:</b></p>	Is the resistance approx. 1,500 $\Omega$ when RESUME/ACCEL switch is pressed?	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Replace the cruise control command switch. <Ref. to CC-5, Cruise Control Command Switch.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

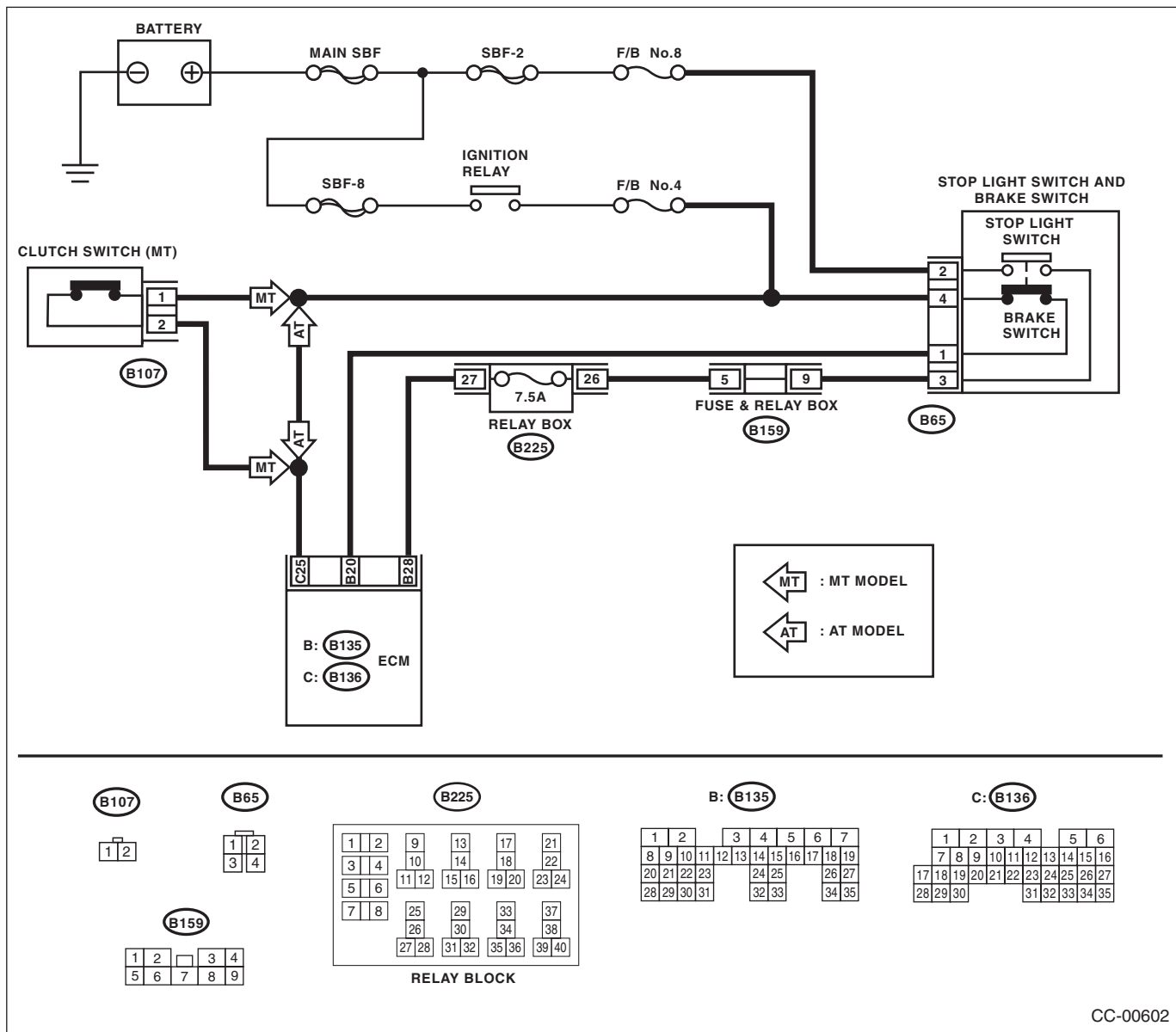
## B: DTC 12

The DTC is detected when the brake pedal is pressed or problem relating to stop light & brake switch occurs.

### TROUBLE SYMPTOM:

- Cruise control cannot be set.
- Cruise control cannot be released.

### WIRING DIAGRAM:



CC-00602

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK STOP LIGHT &amp; BRAKE SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the stop light & brake switch harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B65) No. 2 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	<ul style="list-style-type: none"> <li>• Check fuse No. 8 (in fuse &amp; relay box).</li> <li>• Check for open or short in the harness between stop light &amp; brake switch and fuse &amp; relay box.</li> </ul>
<b>2 CHECK STOP LIGHT &amp; BRAKE SWITCH CIRCUIT.</b> Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B65) No. 4 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 3.	<ul style="list-style-type: none"> <li>• Check fuse No. 4 (in fuse &amp; relay box).</li> <li>• Check for open or short in the harness between stop light &amp; brake switch and fuse &amp; relay box.</li> </ul>
<b>3 CHECK STOP LIGHT &amp; BRAKE SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of ECM. 3) Measure the resistance between ECM harness connector terminal and stop light & brake switch harness connector terminal. <b>Connector &amp; terminal</b> <b>(B135) No. 28 — (B65) No. 3:</b> <b>(B135) No. 20 — (B65) No. 1:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 4.	Repair the harness.
<b>4 CHECK STOP LIGHT &amp; BRAKE SWITCH CIRCUIT.</b> Remove and check the stop light & brake switch. <Ref. to CC-7, Stop Light & Brake Switch.>	Is the stop light & brake switch OK?	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Replace the stop light & brake switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

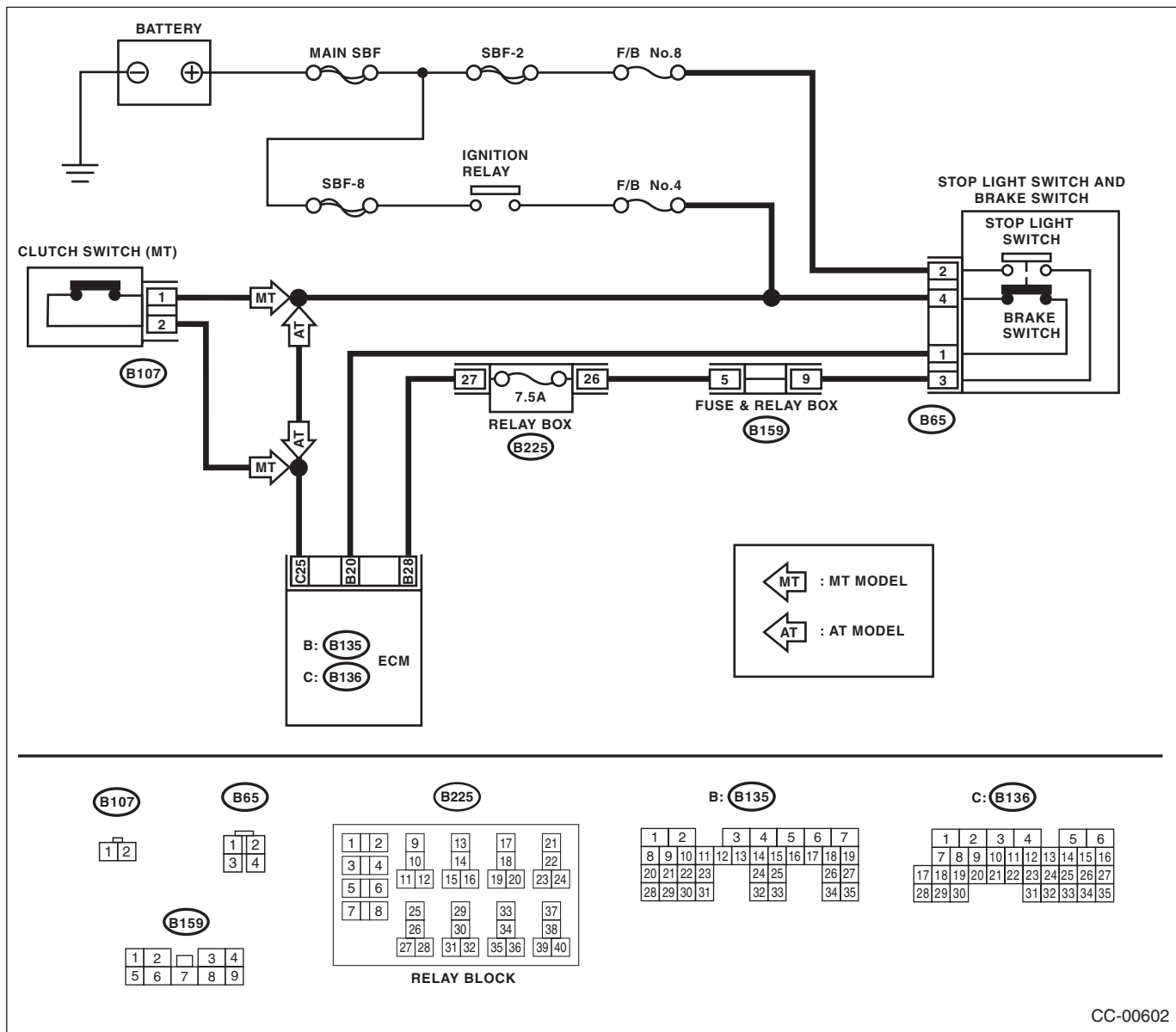
## C: DTC 13

The DTC is detected when the clutch pedal is depressed or problem relating to the clutch switch occurs.

### TROUBLE SYMPTOM:

- Cruise control cannot be set.
- Cruise control cannot be released.

### WIRING DIAGRAM:



CC-00602

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK CLUTCH SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the clutch switch harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B107) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	<ul style="list-style-type: none"> <li>• Check fuse No. 4 (in fuse &amp; relay box).</li> <li>• Check open or shorted circuit of harness between clutch switch and fuse &amp; relay box.</li> </ul>
<b>2</b> <b>CHECK CLUTCH SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector of ECM. 3) Measure the resistance between clutch switch harness connector terminal and ECM harness connector terminal. <b>Connector &amp; terminal</b> <b>(B107) No. 2 — (B136) No. 25:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 3.	Repair the harness.
<b>3</b> <b>CHECK CLUTCH SWITCH.</b> Remove and check the clutch switch. <Ref. to CC-8, Clutch Switch.>	Is clutch switch OK?	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>	Replace the clutch switch.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## D: DTC 14

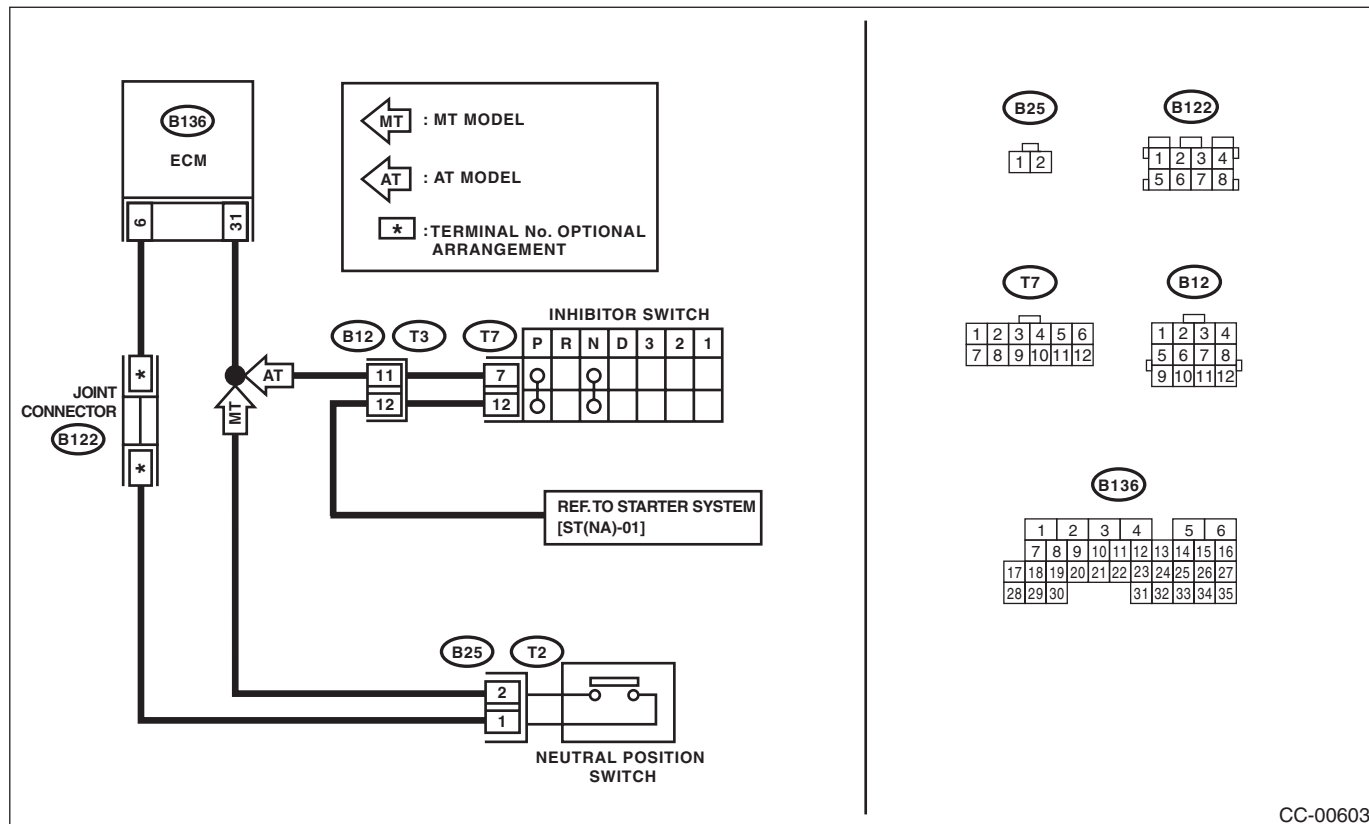
The DTC is detected when the select lever is placed in neutral position or problem relating to the neutral position switch occurs.

### TROUBLE SYMPTOM:

Cruise control cannot be set.

### WIRING DIAGRAM:

- H4 Non-turbo model

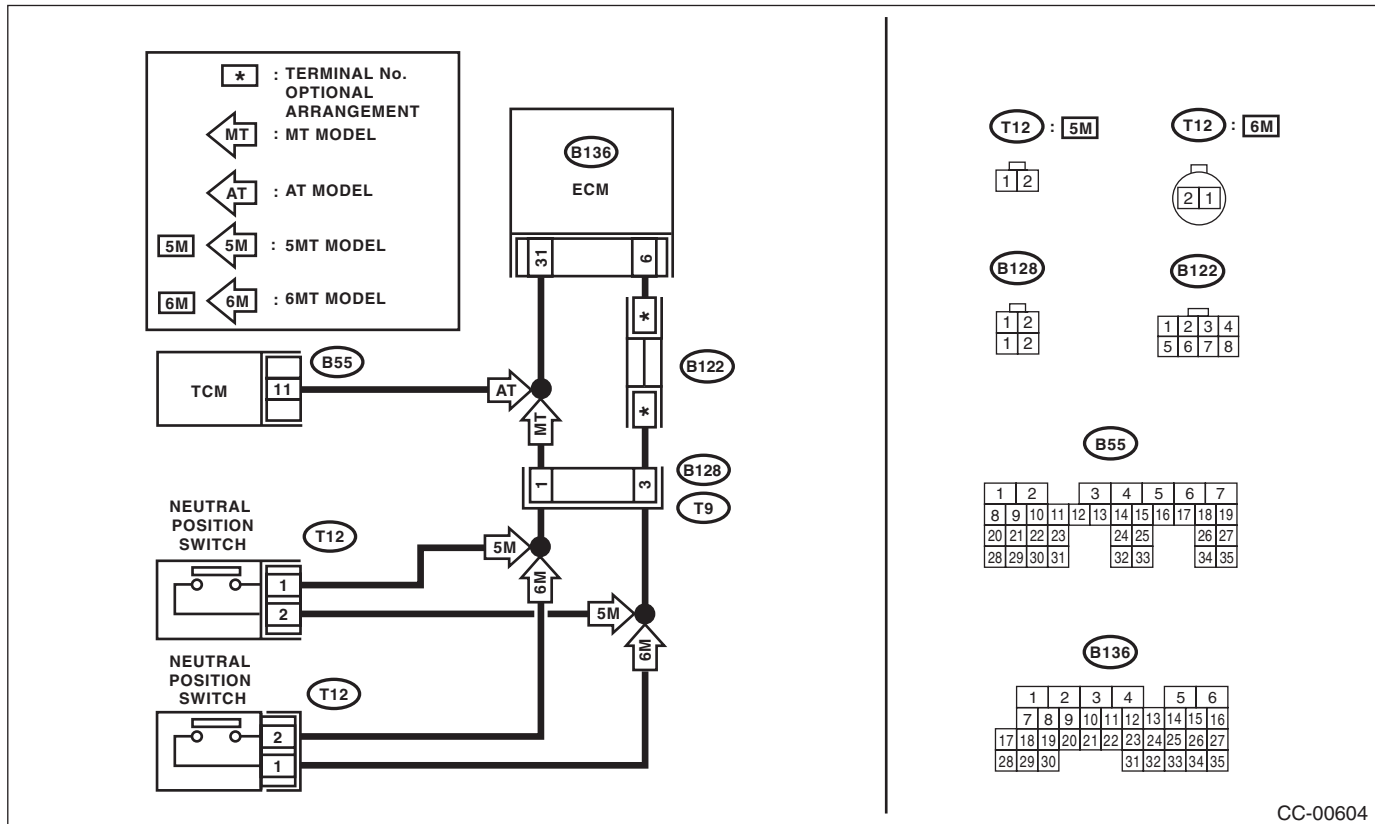


CC-00603

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

- H4 turbo model
- H6 model



CC-00604

Step	Check	Yes	No
1	<b>CHECK VEHICLE FOR SPECIFICATION.</b> Check the vehicle destination and specification.	Is the vehicle a 5AT model?	Go to step 2. / Go to step 5.
2	<b>CHECK NEUTRAL POSITION SWITCH.</b> 1) Connect the Subaru Select Monitor to the data link connector. 2) Turn the ignition switch to ON and start up the Subaru Select Monitor. 3) Select {Engine Control System} from the main menu. 4) Then, select {Current Data Display & Save}. 5) Check the neutral position switch signal by shifting the select lever to "P" or "N" range.	Is the Subaru Select Monitor ON when select lever is shifted into "P" or "N" range? Is Subaru Select Monitor OFF when select lever is shifted to a range other than the "P" or "N" range?	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> / Go to step 3. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
3	<b>CHECK TCM OUTPUT VOLTAGE.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between TCM harness connector terminal and chassis ground. <b>Connector &amp; terminal (B55) No. 11 (+) — Chassis ground (-):</b>	Is voltage 10 V or more when select lever is shifted to a range other than "P" or "N" range? Is voltage less than 1 V when select lever is shifted into "P" or "N" range?	Go to step 4. / Check the TCM. <Ref. to 5AT(diag)-2, Basic Diagnostic Procedure.>
4	<b>CHECK HARNESS BETWEEN TCM AND ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector from TCM and ECM. 3) Measure the resistance between TCM harness connector terminal and ECM harness connector terminal. <b>Connector &amp; terminal (B136) No. 31 — (B55) No. 19:</b>	Is the resistance less than 10 Ω?	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> / Repair the wiring harness. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>5</b>	<b>CHECK TRANSMISSION TYPE.</b>	Go to step 6.	MT model: Go to step 9.
<b>6</b>	<b>CHECK INHIBITOR SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the inhibitor switch harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(T7) No. 7 (+) — Chassis ground (-):</b>	Go to step 7.	Check for open or short in the harness between inhibitor switch and ECM.
<b>7</b>	<b>CHECK INHIBITOR SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the starter motor harness connector. 3) Measure the resistance between inhibitor switch harness connector terminal and starter motor. <b>Connector &amp; terminal</b> <b>(T7) No. 12 — Starter motor:</b>	Go to step 8.	Repair the harness.
<b>8</b>	<b>CHECK INHIBITOR SWITCH.</b> Remove and check the inhibitor switch. <Ref. to CC-9, Inhibitor Switch.>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).>	Replace the inhibitor switch.
<b>9</b>	<b>CHECK NEUTRAL POSITION SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the neutral position switch harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>5MT model:</b> <b>(B25) No. 1 (+) — Chassis ground (-):</b> <b>6MT model:</b> <b>(B128) No. 2 (+) — Chassis ground (-):</b>	Go to step 10.	Check for open or short in the harness between neutral position switch and ECM.
<b>10</b>	<b>CHECK NEUTRAL POSITION SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure resistance between harness connector terminal of neutral position switch and chassis ground. <b>Connector &amp; terminal</b> <b>5MT model:</b> <b>(B25) No. 2 — Chassis ground:</b> <b>6MT model:</b> <b>(B128) No. 1 — Chassis ground:</b>	Go to step 11.	Repair the harness.
<b>11</b>	<b>CHECK NEUTRAL POSITION SWITCH.</b> Remove and check the neutral position switch. <Ref. to CC-11, Neutral Position Switch.>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).>	Replace the neutral position switch.



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

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### **E: DTC 15**

This DTC is detected when the cancel switch is pressed or problem relating to the main switch occurs.

#### **TROUBLE SYMPTOM:**

- Cruise control cannot be set. (Cancelled immediately.)
- Cruise control cannot be released.

Refer to DTC 11 for diagnostic procedure.

<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

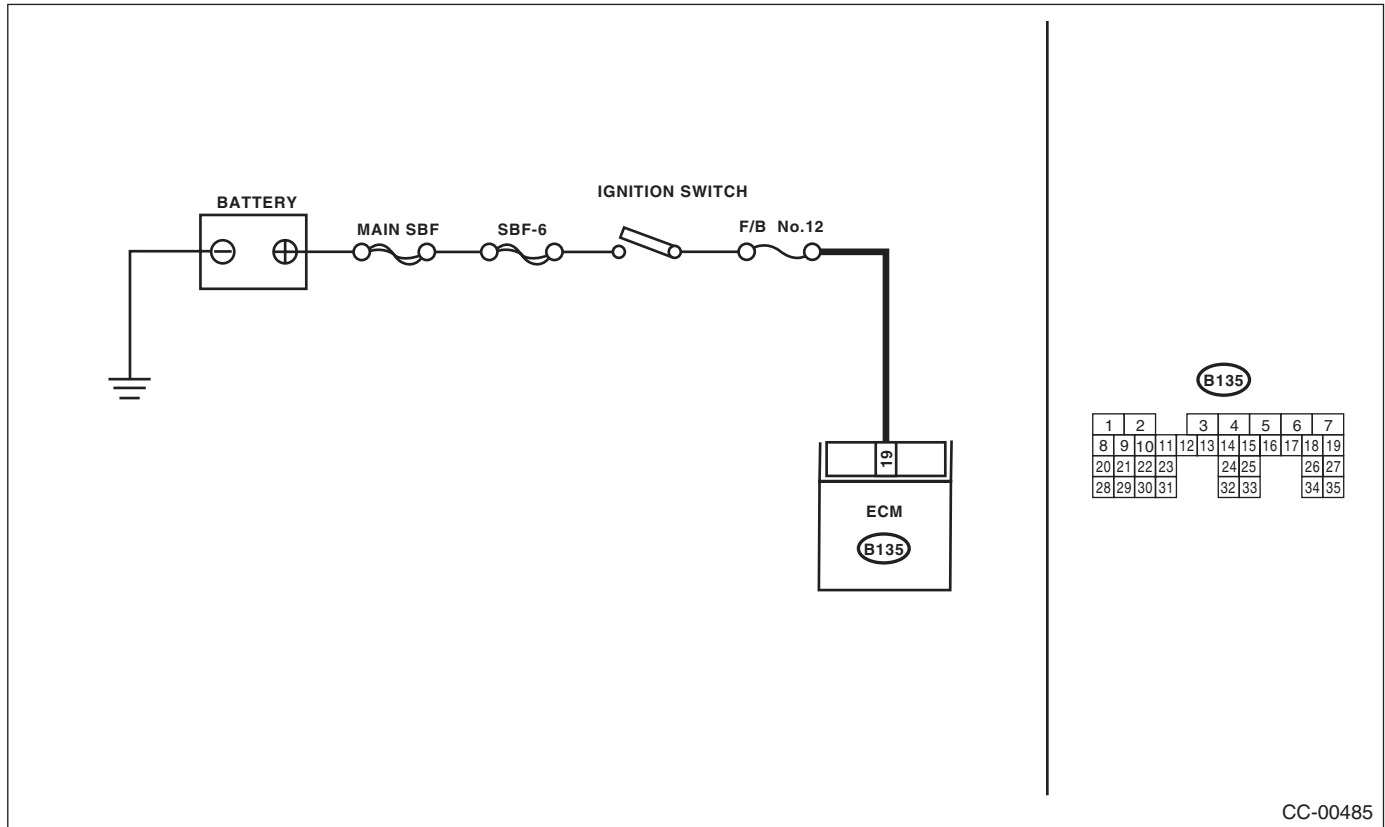
## F: DTC 16

This DTC is detected when the ignition switch is turned OFF or problem relating to the ignition switch occurs.

### TROUBLE SYMPTOM:

Cruise control cannot be set.

### WIRING DIAGRAM:



CC-00485

Step	Check	Yes	No
<b>1</b> <b>CHECK IGNITION SWITCH CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the ECM harness connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B135) No. 19 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Check for poor contact of the ECM connector.	<ul style="list-style-type: none"> <li>• Check fuse No. 12 (in fuse &amp; relay box).</li> <li>• Check the harness for open or short circuit between ignition switch and ECM.</li> </ul>

## G: DTC 21

Cruise control command switch malfunction is detected.

### TROUBLE SYMPTOM:

- Cruise control cannot be set. (Cancelled immediately.)
- Cruise control cannot be released.

Refer to DTC 11 for diagnostic procedure.

<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

### H: DTC 22

Malfunction related to vehicle speed sensor is detected.

#### DIAGNOSIS:

Open or shorted circuit in vehicle speed sensor system.

#### TROUBLE SYMPTOM:

Cruise control cannot be set. (Cancelled immediately.)

	Step	Check	Yes	No
1	<b>CHECK ABS OR VDC WARNING LIGHT.</b> 1) Turn the ignition switch to ON. 2) After the initial operation of combination meter is completed, check if ABS or VDC warning light continues to illuminate.	Does the warning light continue to illuminate?	Check ABSCM or VDCCM. <Ref. to ABS(diag)-2, Basic Diagnostic Procedure.> <Ref. to VDC(diag)-2, Basic Diagnostic Procedure.>	Go to step 2.
2	<b>CHECK DTC OF LAN COMMUNICATION CIRCUIT.</b> Read the DTC of body integrated unit using Subaru Select Monitor.	Is DTC of Low-speed CAN displayed?	Check the LAN communication circuit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Replace the ECM. <Ref. to FU(H4SO)-37, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

### I: DTC 24

Malfunction in cruise control-related switch is detected.

#### TROUBLE SYMPTOM:

- Cruise control cannot be set. (Cancelled immediately.)
- Cruise control cannot be released.

Refer to DTC 11 for diagnostic procedure.

<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### J: DTC 25

Malfunction of brake input circuit in ECM is detected.

Refer to the Engine Diagnostic Procedure for diagnostic procedure.

<Ref. to EN(H4SO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H6DO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

### K: DTC 31

Malfunction of the engine speed signal is detected.

Abnormal increase of engine speed is detected.

Gear is set to 1st or Reverse position.

After driving at the 2nd gear position or more, perform the cruise setting again. If the DTC is not detected, it is normal.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

CRUISE CONTROL SYSTEM (DIAGNOSTICS)

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## **L: DTC 32**

This DTC is detected out of vehicle speed range.

Increase vehicle speed high enough to allow the cruise control to function, and then perform setting operation again.

If the DTC is detected after performing the setting operation, perform DTC 22 diagnosis.

Refer to DTC 22 for diagnostic procedure.

<Ref. to CC(diag)-26, DTC 22, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **M: DTC 34**

The vehicle has been driven at a speed higher than set speed for a long time (approximately 10 minutes) during cruise driving.

DTC is detected when driving for a long period of time at higher speed than appropriate cruise speed by operating accelerator pedal.

Perform the cruise control setting operation again. If the DTC is not detected, it is normal.

## **N: DTC 35**

Detected when it is impossible to perform the vehicle speed feedback.

Set vehicle speed cannot be kept for some reasons (steep uphill, unreleased parking brake, etc.) during cruise driving.

DTC is detected when driving condition is not suitable for cruise control.

Perform cruise set operation again after clearing the possible cause.

## **O: DTC 41**

VDC/TCS has operated.

Vehicle dynamics control (VDC) or TCS is operated during cruise driving or cruise setting.

<Ref. to VDC(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

## **P: DTC 43**

ABS/VDC malfunction is detected.

VDC malfunction is detected during cruise driving or cruise setting.

<Ref. to VDC(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

## **Q: DTC 44**

Body integrated unit malfunction is detected.

Body integrated unit system malfunction is detected during cruise driving or cruise setting.

<Ref. to LAN(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

## **R: DTC 45**

Malfunction of the combination meter is detected.

Combination meter malfunction is detected during cruise driving or cruise setting.

<Ref. to LAN(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

## **S: DTC 61**

Malfunction in the stop light & brake switch is detected.

### **TROUBLE SYMPTOM:**

- Cruise control cannot be set.
- Cruise control cannot be released.

Refer to DTC 12 for diagnostic procedure.

<Ref. to CC(diag)-17, DTC 12, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

## **T: DTC 62**

Neutral position switch malfunction is detected.

### **TROUBLE SYMPTOM:**

Cruise control cannot be set.

Refer to DTC 14 for diagnostic procedure.

<Ref. to CC(diag)-21, DTC 14, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## CRUISE CONTROL SYSTEM (DIAGNOSTICS)

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### **U: DTC 63**

Malfunction of vehicle speed signal variation is detected.

#### **TROUBLE SYMPTOM:**

Cruise control cannot be set. (Cancelled immediately.)

Refer to DTC 22 for diagnostic procedure.

<Ref. to CC(diag)-26, DTC 22, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **V: DTC 64**

Malfunction related to engine is detected.

Refer to the Engine Diagnostic Procedure for diagnostic procedure.

<Ref. to EN(H4SO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H6DO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

### **W: DTC 65**

Cruise control command switch malfunction is detected.

While the command switch is pressed ON for a long time (approximately two minutes), stuck ON condition is detected.

#### **TROUBLE SYMPTOM:**

- Cruise control cannot be set. (Cancelled immediately.)

- Cruise control cannot be released.

Refer to DTC 11 for diagnostic procedure.

<Ref. to CC(diag)-15, DTC 11, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

### **X: DTC 66**

Cruise control calculation malfunction is detected.

Refer to the Engine Diagnostic Procedure for diagnostic procedure.

<Ref. to EN(H4SO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

<Ref. to EN(H6DO)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>

# Basic Diagnostic Procedure

IMMOBILIZER (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

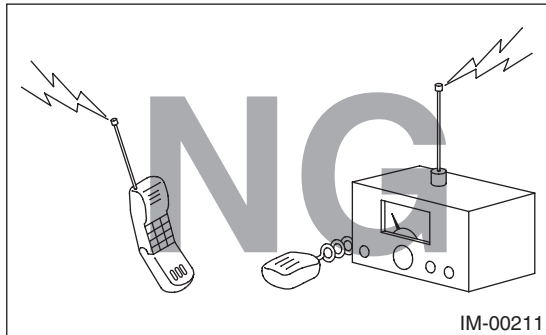
	Step	Check	Yes	No
1	<b>CHECK SECURITY INDICATOR LIGHT.</b> 1) Turn the ignition switch to "OFF" or "ACC". 2) Wait at least 60 seconds.	Does the security indicator light blink?	Go to step 2.	Check the security indicator light circuit. <Ref. to IM(diag)-10, CHECK SECURITY INDICATOR LIGHT CIRCUIT, INSPECTION, Diagnostics Chart for Security Indicator Light.>
2	<b>CHECK KEY SWITCH.</b> Remove the key from ignition switch.	Does the security indicator light blink within 1 second after removing the key?	Go to step 3.	Check the key switch circuit. <Ref. to IM(diag)-12, CHECK KEY SWITCH CIRCUIT, INSPECTION, Diagnostics Chart for Security Indicator Light.>
3	<b>CHECK SECURITY INDICATOR LIGHT.</b> Turn the ignition switch to ON.	Does the security indicator light go off?	Go to step 5.	Go to step 4.
4	<b>CHECK ENGINE START.</b> Turn the ignition switch to START.	Does the starter operate?	Check the LAN communication circuit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Check the DTC display (body integrated unit). Go to step 7.
5	<b>CHECK ENGINE START.</b> Turn the ignition switch to START.	Does the starter operate?	Go to step 6.	Check the LAN communication circuit. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>
6	<b>CHECK ENGINE START.</b> Turn the ignition switch to START.	Does the engine start?	Immobilizer system is normal.	Check the DTC display (ECM). Go to step 7.
7	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b> 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to the data link connector. <Ref. to IM(diag)-7, Subaru Select Monitor.> 3) Turn the ignition switch and Subaru Select Monitor switch to ON. 4) Read DTC's on the display.	Is the DTC displayed on screen?	Go to step 8.	Repair the related parts.
8	<b>PERFORM DIAGNOSIS.</b> 1) Inspect using the "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to IM(diag)-16, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> 2) Repair the trouble cause. 3) Perform the Clear Memory Mode. 4) Read DTC's again.	Is the DTC displayed on screen?	Inspect using the "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to IM(diag)-16, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

## 2. General Description

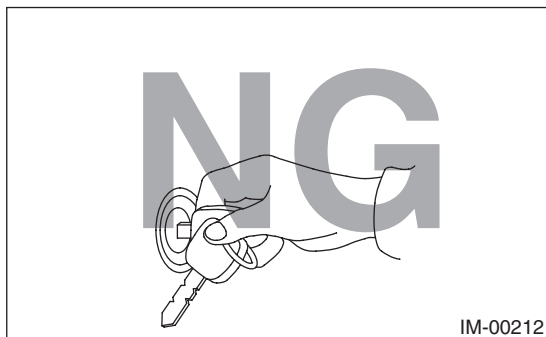
### A: CAUTION

**CAUTION:**

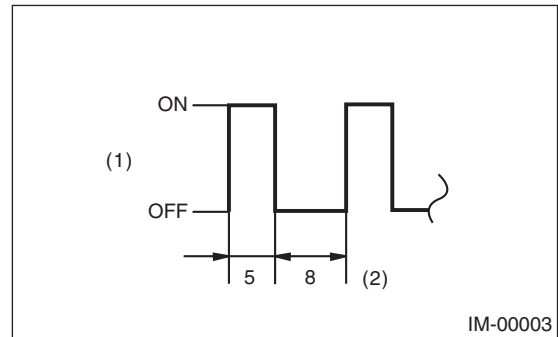
- Do not use the electrical test equipment on the airbag system wiring harnesses and connector circuits.
- Be careful not to damage the airbag system wiring harness.
- While diagnostic items are being checked, do not operate radios, portable telephones, etc. which emit electromagnetic waves near or inside the vehicle.



- When turning the ignition switch to ON or OFF while diagnostic items are being checked, do not allow keys with different ID codes close to the ignition switch. If the ignition key is on a key holder, remove it from the key holder before performing diagnoses.



- When repeatedly turning the ignition switch to ON or OFF while diagnostic items are being checked, it should be switched in cycles of "ON" for at least 5 seconds → "OFF" for at least 8 seconds.



- (1) Ignition switch position
- (2) Sec.

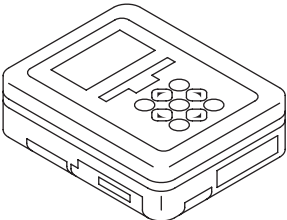
- If the engine fails to start with a registered ignition key, detach the ignition key from ignition switch and wait for approx. 1 second until security indicator light begins to flash. And then start the engine again.
- Before performing the diagnostics, obtain all keys for the vehicle from the owner.
- Do not install or register a body integrated unit already registered to another vehicle to diagnose failures or inspect functions.

# General Description

IMMOBILIZER (DIAGNOSTICS)

## B: PREPARATION TOOL

### 1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

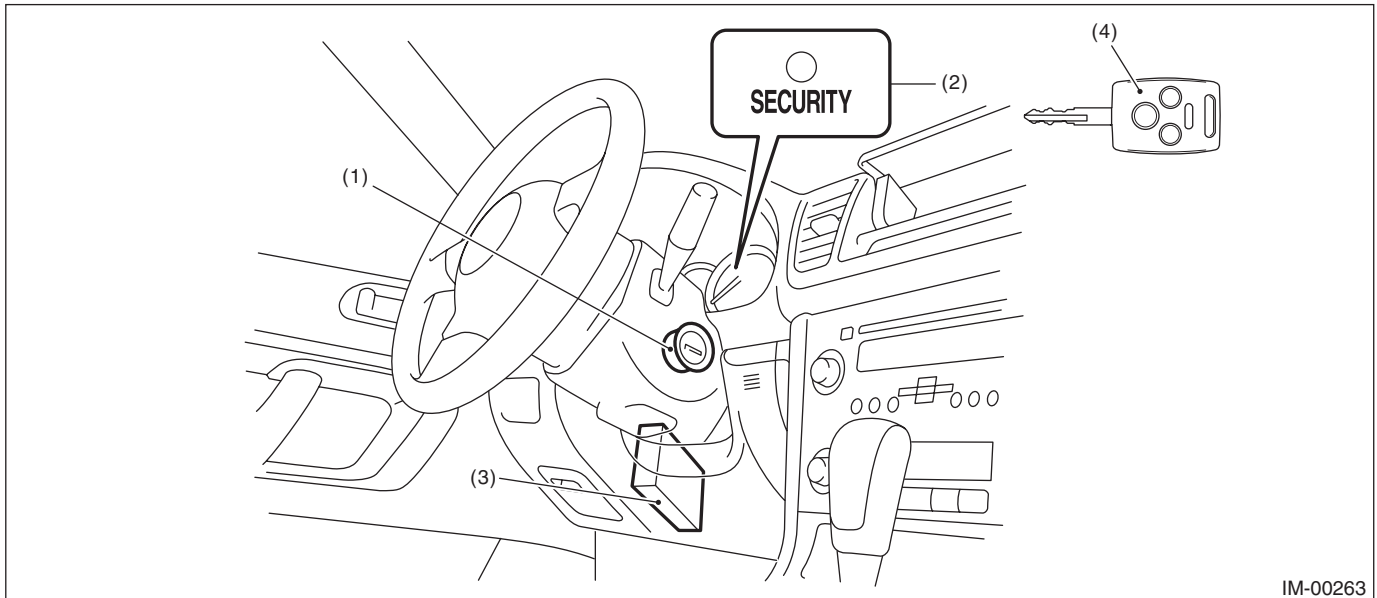
### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.



### 3. Electrical Component Location

#### A: LOCATION



IM-00263

(1) Antenna

(3) Body integrated unit

(4) Transponder

(2) Security indicator light (LED bulb)

# Immobilizer Control Module I/O Signal

IMMOBILIZER (DIAGNOSTICS)

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## 4. Immobilizer Control Module I/O Signal

### A: WIRING DIAGRAM

#### 1. IMMOBILIZER

<Ref. to WI-215, WIRING DIAGRAM, Immobilizer  
System.>

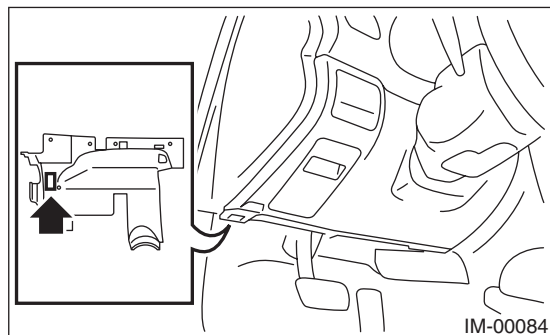
## 5. Subaru Select Monitor

### A: OPERATION

#### 1. HOW TO USE THE SUBARU SELECT MONITOR

- 1) Prepare the Subaru Select Monitor kit.
- 2) Connect the diagnosis cable to the Subaru Select Monitor.
- 3) Connect the Subaru Select Monitor to the data link connector.

(1) Data link connector is located in the lower portion of the instrument panel (on the driver's side).



(2) Connect the diagnosis cable to the data link connector.

#### CAUTION:

**Do not connect scan tools other than the Subaru Select Monitor.**

- 4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.
- 5) Using the Subaru Select Monitor, call up DTCs and various data, then record them.

#### 2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE AND BODY INTEGRATED UNIT

Refer to "Read Diagnostic Trouble Code" for information about how to indicate DTC. <Ref. to IM(diag)-8, Read Diagnostic Trouble Code (DTC).>

#### 3. COMMUNICATION LINE CHECK

##### NOTE:

The communication line between ECM and body integrated unit can be checked in "System Operation Check Mode". This is referred to as "Communication line check".

- 1) Connect the Subaru Select Monitor.
- 2) On the «Main Menu» display, select {Each System Check}.
- 3) On the «System Selection Menu» display, select {Engine}.
- 4) After engine type information is displayed, select [OK].
- 5) On the «Engine Diagnosis» display, select {System Operation Check Mode}.
- 6) On the «System operation check mode» display, select the {security system}.
- 7) Start the communication line check.
- 8) Is «OK» displayed on screen?  
If displayed, go to step 9).  
If not, go to step 10).

9) After diagnostic results, it is determined that the circuit is not shorted. Finish the communication line check.

10) If a problem is detected, repair the trouble cause. <Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# Read Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

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## 6. Read Diagnostic Trouble Code (DTC)

### A: OPERATION

#### 1. ECM

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Engine}.
- 3) After engine type information is displayed, select [OK].
- 4) On the «Engine Diagnosis», select {DTC Display}.
- 5) On the «DTC Display», select {Current Diagnostic Code(s)} or {History Diagnostic Code(s)}.

#### NOTE:

- For detailed operation procedure, refer to the “help on PC application for Subaru Select Monitor”.
- For detailed concerning DTC, refer to the List of Diagnostic Trouble Codes (DTC). <Ref. to IM(diag)-14, LIST, List of Diagnostic Trouble Code (DTC).>

#### 2. BODY INTEGRATED UNIT

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Integrated Unit}.
- 3) After {Integrated Unit} is displayed, select [OK].
- 4) On the «Integ. Unit mode failure diag», select {DTC Display}.

#### NOTE:

- For detailed operation procedure, refer to the “help on PC application for Subaru Select Monitor”.
- For detailed concerning DTC, refer to the List of Diagnostic Trouble Codes (DTC). <Ref. to IM(diag)-14, LIST, List of Diagnostic Trouble Code (DTC).>

## 7. Clear Memory Mode

### A: OPERATION

#### 1. ECM

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Engine}.
- 3) After engine type information is displayed, select [OK].
- 4) On the «Engine Diagnosis», select {Clear Memory}.
- 5) When “Done” is displayed on the display screen, end the Subaru Select Monitor and turn the ignition switch to OFF.

#### NOTE:

- After the memory has been cleared, the idle air control solenoid valve must be initialized. To execute this procedure, turn the ignition switch to ON. Wait 3 seconds before starting the engine.
- For detailed operation procedure, refer to the “help on PC application for Subaru Select Monitor”.

#### 2. BODY INTEGRATED UNIT

- 1) On the «Main Menu», select {Each System Check}.
- 2) On the «System Selection Menu», select {Integrated Unit}.
- 3) After {Integrated Unit} is displayed, select [OK].
- 4) On the «Integ. Unit mode», select {Clear Memory}.
- 5) When “Done” is displayed on the display screen, end the Subaru Select Monitor and turn the ignition switch to OFF.

#### NOTE:

For detailed operation procedure, refer to the “help on PC application for Subaru Select Monitor”.

# Diagnostics Chart for Security Indicator Light

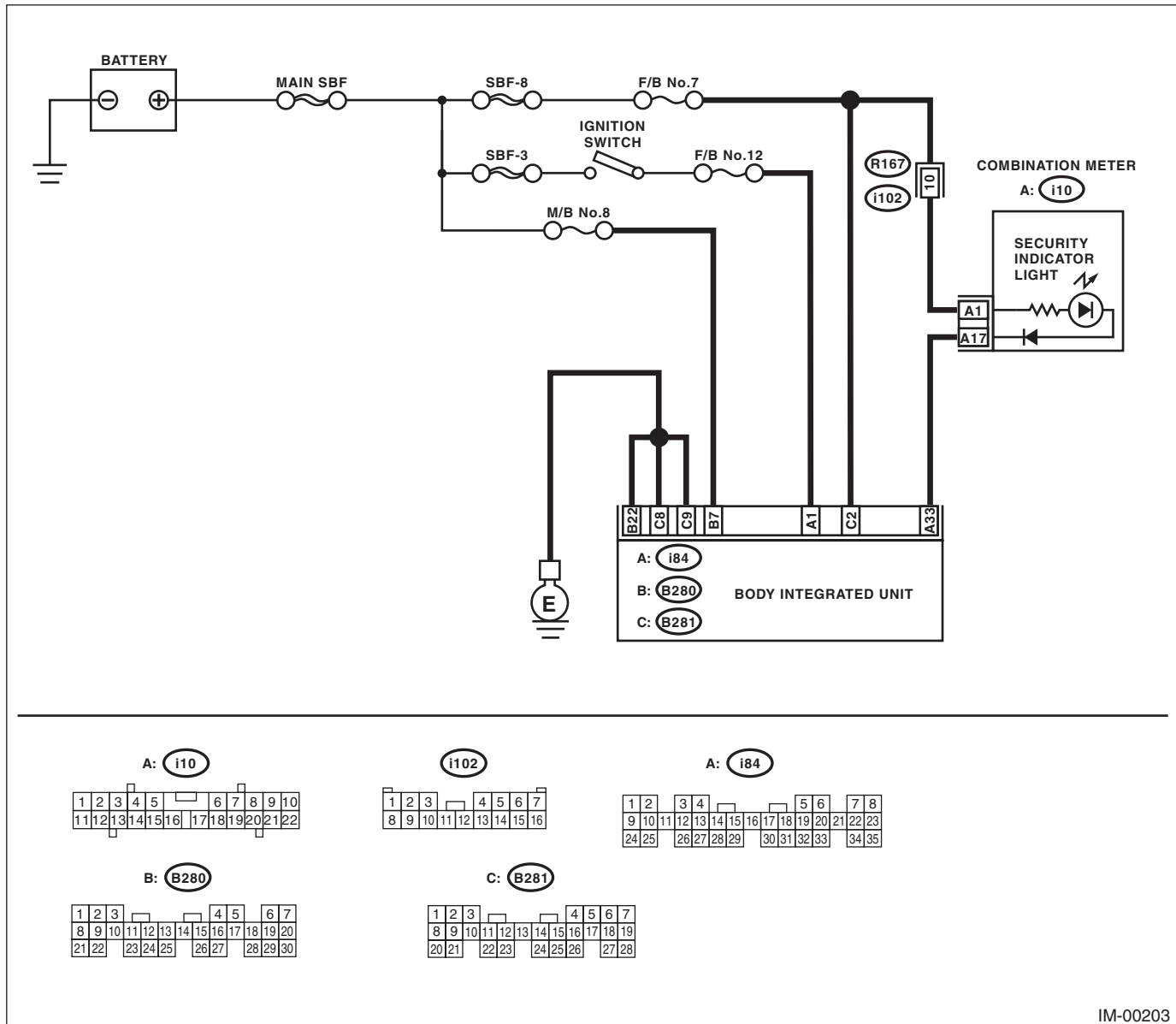
IMMOBILIZER (DIAGNOSTICS)

## 8. Diagnostics Chart for Security Indicator Light

### A: INSPECTION

#### 1. CHECK SECURITY INDICATOR LIGHT CIRCUIT

WIRING DIAGRAM:



# Diagnostics Chart for Security Indicator Light

IMMOBILIZER (DIAGNOSTICS)

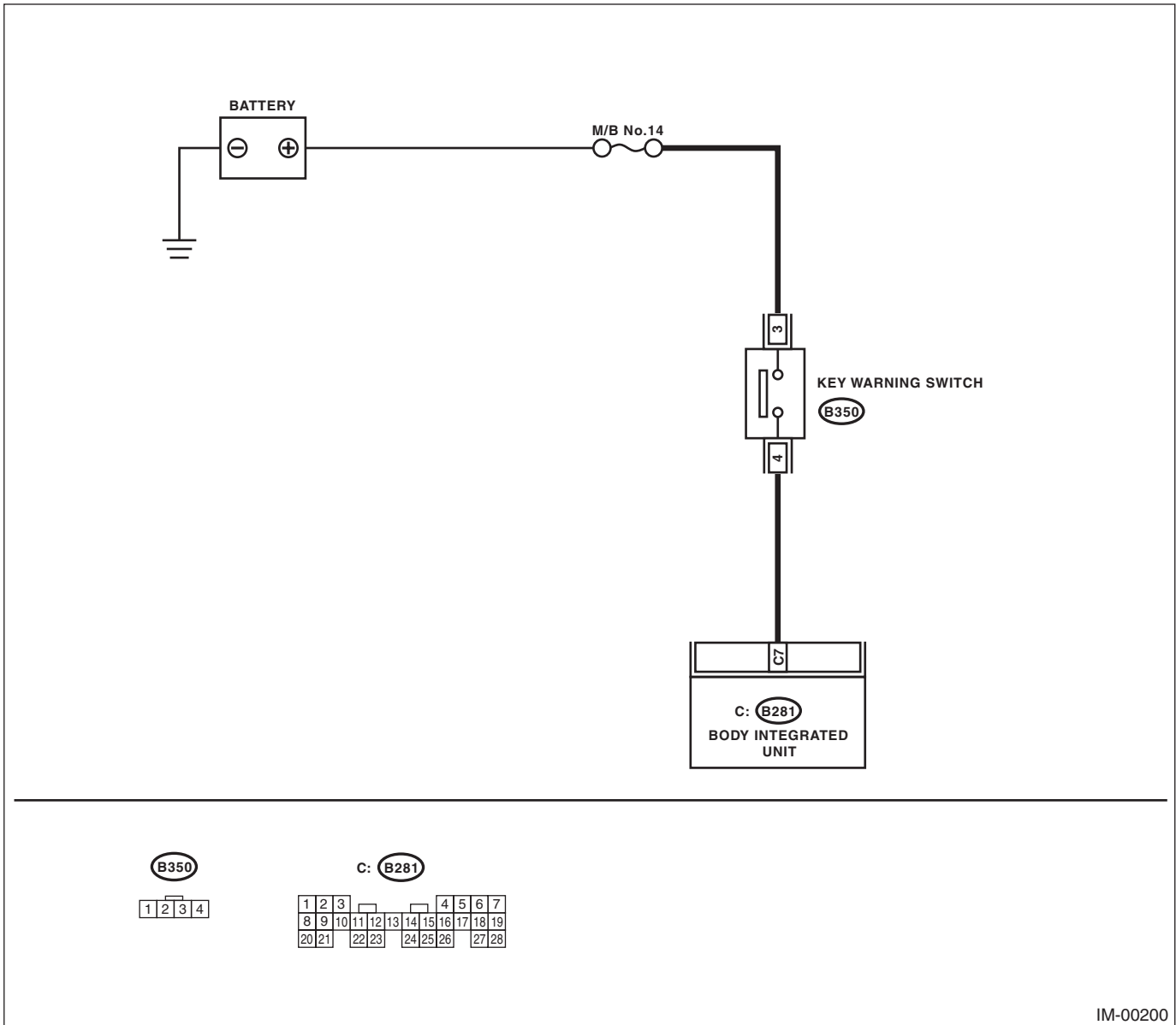
Step	Check	Yes	No
<b>1 CHECK SECURITY INDICATOR LIGHT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector from the body integrated unit. 3) Connect a resistor (100 Ω) between the body integrated unit harness connector terminal (i84) No. 33 and chassis ground.	Does the security indicator light illuminate?	Go to step 2.	Go to step 5.
<b>2 CHECK BODY INTEGRATED UNIT GROUND CIRCUIT.</b> Measure the resistance between the body integrated unit harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 22 — Chassis ground:</i> <i>(B281) No. 8 — Chassis ground:</i> <i>(B281) No. 9 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Go to step 3.	Repair the open circuit of the body integrated unit ground circuit.
<b>3 CHECK BODY INTEGRATED UNIT IGNITION CIRCUIT.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the voltage between the body integrated unit harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(i84) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Check the harness for open or short circuit between the body integrated unit and ignition switch.
<b>4 CHECK BODY INTEGRATED UNIT POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Measure the voltage between the body integrated unit harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 7 (+) — Chassis ground (-):</i> <i>(B281) No. 2 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Check the harness for open or short circuit between the body integrated unit and fuse.
<b>5 CHECK COMBINATION METER CIRCUIT.</b> 1) Remove the combination meter. <Ref. to IDI-19, Combination Meter.> 2) Measure the voltage between combination meter harness connector terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(i10) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 6.	Check for an open or short circuit in the harness between the combination meter and fuse.
<b>6 CHECK COMBINATION METER CIRCUIT.</b> Measure the resistance between the body integrated unit harness connector terminal and combination meter harness connector terminals. <i>Connector &amp; terminal</i> <i>(i84) No. 33 — (i10) No. 17:</i>	Is the resistance less than 10 Ω?	LED bulb is defective. Replace the combination meter case assembly. <Ref. to IDI-20, DISASSEMBLY, Combination Meter.>	Repair the harness or connector.

# Diagnostics Chart for Security Indicator Light

IMMOBILIZER (DIAGNOSTICS)

## 2. CHECK KEY SWITCH CIRCUIT

WIRING DIAGRAM:



IM-00200



# Diagnostics Chart for Security Indicator Light

IMMOBILIZER (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK POWER SUPPLY CIRCUIT.</b> 1) Disconnect the key warning switch harness connector. 2) Set the ignition switch to ACC or LOCK (with key inserted). 3) Measure the voltage between the key warning switch harness connector terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(B350) No. 3 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 2.	Check for an open or short circuit in the harness between the key warning switch and fuse.
<b>2</b> <b>CHECK KEY WARNING SWITCH.</b> 1) Insert the ignition key in the ignition switch. (OFF or ACC) 2) Measure the resistance between key warning switch connector terminals. <b>Connector &amp; terminal</b> <b>No. 3 — No. 4:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 3.	Replace the key warning switch.
<b>3</b> <b>CHECK KEY WARNING SWITCH.</b> 1) Remove the ignition key from the ignition switch. 2) Measure the resistance between key warning switch connector terminals. <b>Connector &amp; terminal</b> <b>No. 3 — No. 4:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 4.	Replace the key warning switch.
<b>4</b> <b>CHECK HARNESS BETWEEN KEY WARNING SWITCH AND BODY INTEGRATED UNIT.</b> 1) Disconnect the key warning switch harness connector. 2) Disconnect the harness connector from the body integrated unit. 3) Measure the resistance between the key warning switch harness connector and body integrated unit harness connector terminals. <b>Connector &amp; terminal</b> <b>(B350) No. 4 — (B281) No. 7:</b>	Is the resistance less than 10 $\Omega$ ?	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Repair the harness between the key warning switch and body integrated unit.

## List of Diagnostic Trouble Code (DTC)

### IMMOBILIZER (DIAGNOSTICS)

## 9. List of Diagnostic Trouble Code (DTC)

### A: LIST

#### 1. ECM

DTC	Item	Contents of diagnosis	Index No.
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	Faulty antenna	<Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM	<Ref. to IM(diag)-19, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	EGI — Immobilizer Communication (Excluding Antenna Circuit)	Communication failure between body integrated unit and ECM	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1574	Key — Immobilizer Communication	Communication failure between key and the body integrated unit	<Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	ECM malfunctioning	<Ref. to IM(diag)-23, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning	<Ref. to IM(diag)-23, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	Reference code incompatibility between body integrated unit and combination meter	<Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

#### NOTE:

Perform diagnosis of engine DTC when a DTC other than an immobilizer DTC is detected. <Ref. to EN(H4DOTC)(diag)-83, List of Diagnostic Trouble Code (DTC).> <Ref. to EN(H6DO)(diag)-84, List of Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

## 2. BODY INTEGRATED UNIT

DTC	Item	Contents of diagnosis	Index No.	Relation between ECM and DTC
B1401	M Collation NG	Reference code incompatibility between body integrated unit and combination meter	<Ref. to IM(diag)-24, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	P1578
B1402	Immobilizer Key Collation NG	<ul style="list-style-type: none"> <li>• Incorrect immobilizer key (Use of unregistered key in body integrated unit)</li> <li>• Faulty antenna</li> </ul>	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> or <Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	<ul style="list-style-type: none"> <li>• P0513</li> <li>• P1570</li> <li>• P1574</li> </ul>
B1403	E/G Request NG	Communication failure between body integrated unit and ECM	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	P1572

### NOTE:

- In immobilizer system, performing the starter relay control. When the body integrated unit detect the inconformity of reference code, immediately out put the starter relay cut signal to ECM, and then ECM stop the starter relay operation. In this case, engine does not start, and DTC is not recorded in ECM. Check that the engine does not start on the DTC of body integrated unit.
- DTC B1401 and B1402 are recorded as current malfunctions when the ignition is turned OFF. Because of this, if an engine is attempted to be started with an immobilizer key that is not registered, a DTC will not appear on the Subaru Select Monitor immediately. Turn the ignition switch to OFF once, then turn it back ON to check the DTC. At this time, (when turning the ignition switch back ON), note that even if a registered immobilizer key is used, the DTC will be displayed as a current malfunction.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

## 10. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: DTC P0513 INCORRECT IMMOBILIZER KEY

#### DTC DETECTING CONDITION:

Incorrect immobilizer key (Use of unregistered key in body integrated unit)

	Step	Check	Yes	No
1	<b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	END	Replace ignition keys (including transponder) which cannot be registered. Go to step 2.
2	<b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	END	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

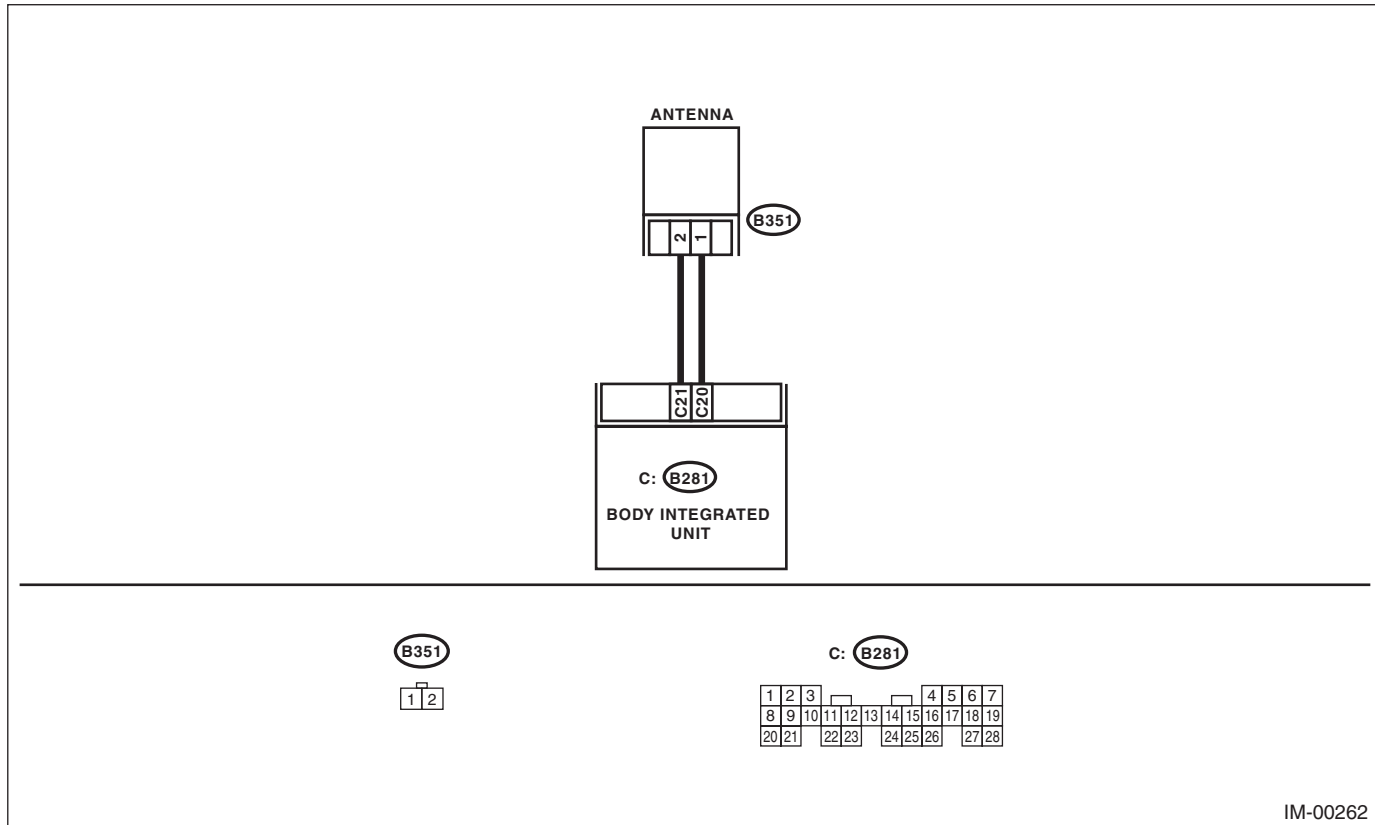
IMMOBILIZER (DIAGNOSTICS)

## B: DTC P1570 ANTENNA

### DTC DETECTING CONDITION:

Faulty antenna

### WIRING DIAGRAM:



IM-00262

Step	Check	Yes	No
<b>1</b> <b>CHECK THE ANTENNA CIRCUIT.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the harness connector from the antenna. <Ref. to SL-59, Immobilizer Antenna.> 3) Measure the resistance of the antenna circuit. <i>Connector &amp; terminal</i> <i>(B351) No. 1 — No. 2:</i>	Is the resistance less than 10 Ω?	Go to step 2.	Replace the antenna. <Ref. to SL-59, Immobilizer Antenna.>
<b>2</b> <b>CHECK THE ANTENNA CIRCUIT.</b> 1) Disconnect the harness connector from the body integrated unit. 2) Measure the resistance between harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B281) No. 21 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Repair the harness.	Go to step 3.
<b>3</b> <b>CHECK THE ANTENNA CIRCUIT.</b> Measure the resistance between harness connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B281) No. 20 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Repair the harness.	Go to step 4.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### IMMOBILIZER (DIAGNOSTICS)

Step	Check	Yes	No
<b>4 CHECK THE ANTENNA CIRCUIT.</b> 1) Turn the ignition switch to ON. (engine OFF) 2) Measure the voltage between harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 21 (+) — Chassis ground (-):</b>	Is the voltage 0 V?	Go to step 5.	Repair the harness.
<b>5 CHECK THE ANTENNA CIRCUIT.</b> Measure the voltage between harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B281) No. 20 (+) — Chassis ground (-):</b>	Is the voltage 0 V?	Go to step 6.	Because the battery voltage or ignition switch "ON" circuit is shorted, repair the harness between the body integrated unit and antenna.
<b>6 CHECK BODY INTEGRATED UNIT FUNCTION.</b> 1) Turn the ignition switch to OFF. 2) Connect the harness connector to the body integrated unit. 3) Insert the key into the ignition switch, then measure changes in voltage between the antenna harness connectors. <b>Connector &amp; terminal</b> <b>(B281) No. 20 (+) — No. 21 (-):</b>	Is the voltage -30 — 30 V? (Approx. 0.1 second after inserting the key) Is the voltage 0 V? (Approx. 1 second after inserting the key)	Go to step 7.	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".
<b>7 CHECK IGNITION KEY (TRANSPONDER).</b> 1) Remove the key from ignition switch. 2) Start the engine using other key which is already registered.	Does the engine start?	Replace the ignition key (including the transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

## C: DTC P1571 REFERENCE CODE INCOMPATIBILITY

### DTC DETECTING CONDITION:

Reference code incompatibility between body integrated unit and ECM

	Step	Check	Yes	No
1	<b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	END	Go to step 2.
2	<b>CHECK FOR ANY OTHER DTC ON DISPLAY.</b>	Is any other immobilizer DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to IM(diag)-14, List of Diagnostic Trouble Code (DTC).>Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

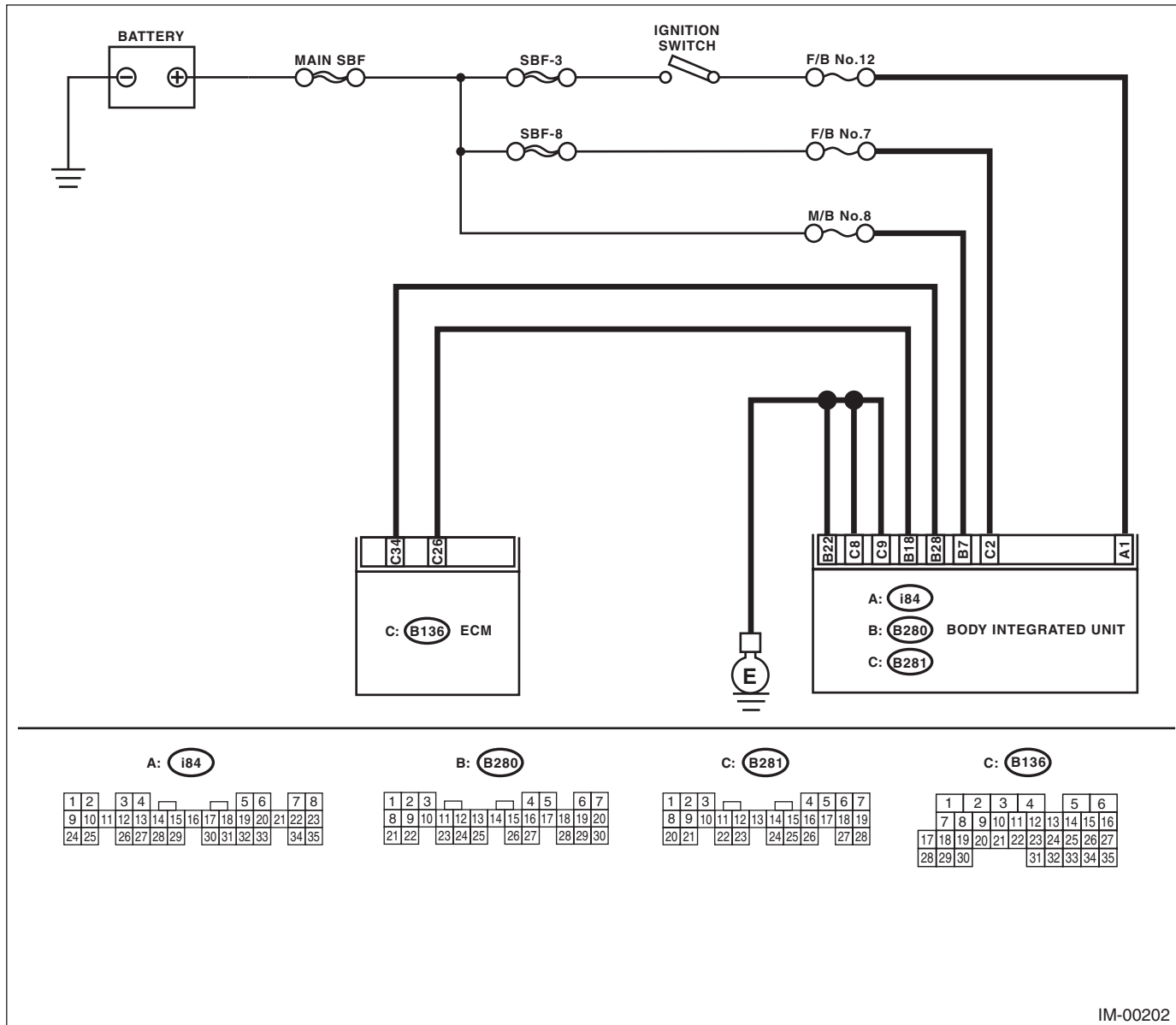
IMMOBILIZER (DIAGNOSTICS)

## D: DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

### DTC DETECTING CONDITION:

Communication failure between body integrated unit and ECM

### WIRING DIAGRAM:



IM-00202



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

Step	Check	Yes	No
<p><b>1 CHECK BODY INTEGRATED UNIT POWER SUPPLY CIRCUIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Disconnect the harness connector from the body integrated unit. 3) Measure the voltage between the body integrated unit harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B280) No. 7 (+) — Chassis ground (-):</b> <b>(B281) No. 2 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 2.	Check the harness for open or short circuit between the body integrated unit and fuse.
<p><b>2 CHECK BODY INTEGRATED UNIT POWER SUPPLY CIRCUIT.</b></p> <p>1) Turn the ignition switch to ON. (engine OFF) 2) Measure the voltage between the body integrated unit harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(i84) No. 1 (+) — Chassis ground (-):</b></p>	Is the voltage 10 V or more?	Go to step 3.	Check the harness for open or short circuit between the body integrated unit and ignition switch.
<p><b>3 CHECK BODY INTEGRATED UNIT GROUND CIRCUIT.</b></p> <p>1) Turn the ignition switch to OFF. 2) Measure the resistance between the body integrated unit harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B280) No. 22 — Chassis ground:</b> <b>(B281) No. 8 — Chassis ground:</b> <b>(B281) No. 9 — Chassis ground:</b></p>	Is the resistance less than 10 Ω?	Go to step 4.	Repair the open circuit of the body integrated unit ground circuit.
<p><b>4 CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND ECM.</b></p> <p>1) Disconnect the harness connector from the ECM and body integrated unit. 2) Measure the resistance between the body integrated unit harness connector and ECM harness connector terminals.</p> <p><b>Connector &amp; terminal</b> <b>(B280) No. 18 — (B136) No. 26:</b></p>	Is the resistance less than 10 Ω?	Go to step 5.	Repair the open circuit of the harness between the body integrated unit and ECM.
<p><b>5 CHECK HARNESS BETWEEN BODY INTEGRATED UNIT AND ECM.</b></p> <p>Measure the resistance between the body integrated unit harness connector and ECM harness connector terminals.</p> <p><b>Connector &amp; terminal</b> <b>(B280) No. 28 — (B136) No. 34:</b></p>	Is the resistance less than 10 Ω?	Go to step 6.	Repair the open circuit of the harness between the body integrated unit and ECM.
<p><b>6 CHECK COMMUNICATION CIRCUIT HARNESS.</b></p> <p>1) Turn the ignition switch to ON. (engine OFF) 2) Measure the voltage between the body integrated unit harness connector terminal and chassis ground.</p> <p><b>Connector &amp; terminal</b> <b>(B280) No. 18 (+) — Chassis ground (-):</b> <b>(B280) No. 28 (+) — Chassis ground (-):</b></p>	Is the voltage 0 V?	Go to step 7.	Because the battery voltage or ignition switch "ON" circuit is shorted, repair the harness between the body integrated unit and ECM.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## IMMOBILIZER (DIAGNOSTICS)

Step	Check	Yes	No
<b>7</b> <b>CHECK COMMUNICATION CIRCUIT HARNESS.</b> Measure the voltage between the ECM harness connector terminal and engine ground. <b>Connector &amp; terminal</b> <i>(B136) No. 26 (+) — Engine ground (-):</i> <i>(B136) No. 34 (+) — Engine ground (-):</i>	Is the voltage 0 V?	Go to step 8.	Because the battery voltage or ignition switch "ON" circuit is shorted, repair the harness between the body integrated unit and ECM.
<b>8</b> <b>CHECK ECM BY COMMUNICATION LINE CHECK.</b> 1) Connect the harness connector to the ECM. 2) Disconnect the harness connector from the body integrated unit. 3) Start the communication line short check. <Ref. to IM(diag)-7, COMMUNICATION LINE CHECK, OPERATION, Subaru Select Monitor.>	Is the communication line check OK?	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).> Next, execute the registration procedure. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".

## E: DTC P1574 KEY COMMUNICATION FAILURE

### DTC DETECTING CONDITION:

Communication failure between key and the body integrated unit

Step	Check	Yes	No
<b>1</b> <b>CHECK BODY INTEGRATED UNIT FUNCTION.</b> Insert the key into the ignition switch (LOCK position), then measure changes in voltage between the antenna connectors. <b>Connector &amp; terminal</b> <i>(B351) No. 1 (+) — No. 2 (-):</i>	Is the voltage -30 — 30 V? (Approx. 0.1 second after inserting the key) Is the voltage 0 V? (Approx. 1 second after inserting the key)	Go to step 2.	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".
<b>2</b> <b>CHECK IGNITION KEY (TRANSPONDER).</b> 1) Remove the key from ignition switch. 2) Start the engine using other key which is already registered.	Does the engine start?	Replace the ignition key (including the transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Replace the body integrated unit <Ref. to SL-55, Body Integrated Unit.> and replace all the ignition keys (including transponder). Execute the registration procedure next. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

## F: DTC P1576 EGI CONTROL MODULE EEPROM

### DTC DETECTING CONDITION:

- ECM malfunctioning
- Inaccessible ROM in ECM during key registration.

Step	Check	Yes	No
<b>1</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Go to step 2.
<b>2</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Go to step 3.
<b>3</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Replace the ECM. <Ref. to FU(H4DOTC)-45, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

## G: DTC P1577 IMM CONTROL MODULE EEPROM

### DTC DETECTING CONDITION:

- Body integrated unit malfunctioning
- Failed to access the ROM inside the body integrated unit.

Step	Check	Yes	No
<b>1</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Go to step 2.
<b>2</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Go to step 3.
<b>3</b> <b>PERFORM REGISTRATION ON IGNITION KEY.</b> Perform registration on all keys of the vehicle. Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".	Is registration for all keys complete?	Make sure it is possible to start the engine with all keys that have been taught. This completes the work.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

IMMOBILIZER (DIAGNOSTICS)

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## H: DTC P1578 METER FAILURE

### DTC DETECTING CONDITION:

Reference code incompatibility between combination meter and body integrated unit

### 1. CHECK LAN COMMUNICATION SYSTEM.

Inspect the LAN communication system in the following cases. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

- DTC U1300, U1301, U1302, B1100 or U1321 of the body integrated unit is displayed.
- “Er IU” or “Er LC” is displayed in combination meter odo/trip meter. (except for the meter with MID)

### 2. REPLACE COMBINATION METER.

Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>Next, perform the registration procedure for all immobilizer parts (combination meter and etc.). Refer to the “REGISTRATION MANUAL FOR IMMOBILIZER”.

### NOTE:

When the combination meter has been replaced, be sure to perform the registration procedure of immobilizer.

# Basic Diagnostic Procedure

LAN SYSTEM (DIAGNOSTICS)

## 1. Basic Diagnostic Procedure

### A: PROCEDURE

#### 1. WITH SUBARU SELECT MONITOR

##### CAUTION:

- Subaru Select Monitor is required for reading DTC, performing diagnosis and reading current data.
- Remove foreign matter (dust, water, oil, etc.) from the body integrated unit connector during removal and installation.
- For model with immobilizer, registration of immobilizer may be needed after the replacement of controller etc. For detailed procedure, refer to the REGISTRATION MANUAL FOR IMMOBILIZER.

##### NOTE:

- To check harness for open or short circuits, shake the suspected trouble spot or connector.
- Check List for Interview <Ref. to LAN(diag)-3, Check List for Interview.>

	Step	Check	Yes	No
1	<b>CHECK PRE-INSPECTION.</b> Ask the customer when and how the trouble occurred using the interview check list. <Ref. to LAN(diag)-3, Check List for Interview.>	Did you interview the customer?	Go to step 3.	Interview the customer and Go to step 2.
2	<b>BASIC INSPECTION.</b> Check components which might affect body control. <Ref. to LAN(diag)-5, INSPECTION, General Description.>	Is the component that might influence the body control problem normal?	Go to step 3.	Repair or replace each component.
3	<b>CHECK INDICATION OF DTC.</b> 1) Read the DTC. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> NOTE: If the communication function of the Subaru Select Monitor cannot be executed properly, check the communication circuit. <Ref. to LAN(diag)-31, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> 2) Record all DTC.	Is DTC displayed?	Go to step 5.	Go to step 4.
4	<b>PERFORM GENERAL DIAGNOSTICS.</b> Inspect using the "General Diagnostics Table". <Ref. to LAN(diag)-85, General Diagnostic Table.>	Is result of inspection OK?	LAN system is normal.	Go to step 5.
5	<b>PERFORM DIAGNOSIS.</b> 1) Correct the cause of trouble. 2) Perform Clear Memory Mode. <Ref. to LAN(diag)-20, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 3) Read the DTC. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC displayed?	Repeat step 5 until DTC is not shown.	Finish the diagnosis.

# Check List for Interview

LAN SYSTEM (DIAGNOSTICS)

## 2. Check List for Interview

### A: CHECK

Inspect the following item about the vehicle's state.

#### 1. DISPLAY OF COMMUNICATION ERROR

Communication error is displayed in odo/trip meter. (Except for meter with MID)	When and how often are they displayed? <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Only once  Which communication error is displayed? (Record them all) <input type="checkbox"/> Er IU (Fail in the body integrated unit) <input type="checkbox"/> Er HC (Fail of high-speed CAN) <input type="checkbox"/> Er LC (Fail of low-speed CAN) <input type="checkbox"/> Er — (Fails of both high-speed and low-speed CAN) <input type="checkbox"/> Er EG (Fail of EGI communication data) <input type="checkbox"/> Er TC (fail of TCM communication data) <input type="checkbox"/> Er Ab (Fail of vehicle dynamics control (VDC)/ABS communication data)
Ignition key position	<input type="checkbox"/> OFF <input type="checkbox"/> ACC <input type="checkbox"/> ON (before starting engine) <input type="checkbox"/> START <input type="checkbox"/> ON (after starting engine, engine is running) <input type="checkbox"/> ON (after starting engine, engine is at a standstill)
Timing	<input type="checkbox"/> Immediately after turning the ignition ON. <input type="checkbox"/> Immediately after turning the ignition to START.

#### 2. DISPLAY STATUS IN THE COMBINATION METER

Display status in the combination meter	a) Engine coolant temperature gauge display	<input type="checkbox"/> OK / <input type="checkbox"/> NG
	b) Fuel gauge display	<input type="checkbox"/> OK / <input type="checkbox"/> NG
Display of other indicators	c) Malfunction indicator light	<input type="checkbox"/> ON / <input type="checkbox"/> OFF
	d) SPORT indicator light (AT warning light)	<input type="checkbox"/> ON / <input type="checkbox"/> OFF
	e) ABS warning light/Vehicle dynamics control (VDC) warning light	<input type="checkbox"/> ON / <input type="checkbox"/> OFF
	f) Security indicator light	<input type="checkbox"/> ON / <input type="checkbox"/> Blink / <input type="checkbox"/> OFF
	g) Seat belt warning light (Driver's seat)	<input type="checkbox"/> ON / <input type="checkbox"/> OFF
	h) Seat belt warning light (Passenger's seat)	<input type="checkbox"/> ON / <input type="checkbox"/> OFF

#### 3. SYMPTOM

Vehicle condition	a) Lighting adjustment is not possible by the illumination volume control.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	b) Rear wiper does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	c) Wiper deicer does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	d) Rear defogger does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	e) Door lock does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	f) Trunk/rear gate lock does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	g) Drivers door lock does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	h) Shift lock does not operate.	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	i) Key illumination blinks.	<input type="checkbox"/> Yes / <input type="checkbox"/> No

## Check List for Interview

LAN SYSTEM (DIAGNOSTICS)

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### 4. CONDITIONS UNDER WHICH TROUBLE OCCURS

Driving condition	<input type="checkbox"/> At standstill (While idling) <input type="checkbox"/> When the vehicle is running      Vehicle speed km/h (MPH) <input type="checkbox"/> While accelerating      Acceleration    km/h (MPH) to    km/h (MPH) <input type="checkbox"/> Decelerating (With braking)      Deceleration    km/h (MPH) to    km/h (MPH) <input type="checkbox"/> Decelerating (Without braking)      Deceleration    km/h (MPH) to    km/h (MPH)
	<input type="checkbox"/> Flat road <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Gravel road <input type="checkbox"/> Bumpy road <input type="checkbox"/> Snowy road
	Does it occur when operating any part? Operated part: Trouble symptom:
	Are there any other troubles occurred? From where: Trouble symptom:

## 3. General Description

### A: CAUTION

#### 1. SUPPLEMENTAL RESTRAINT SYSTEM “AIRBAG”

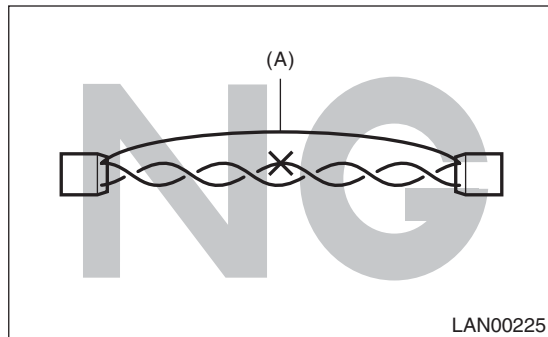
Airbag system wiring harness is routed near the body integrated unit and twisted pair line.

#### CAUTION:

- Do not use electrical test equipment on any airbag system wiring harness and connector circuit.
- Be careful not to damage the airbag system wiring harness when servicing the body integrated unit and LAN system.

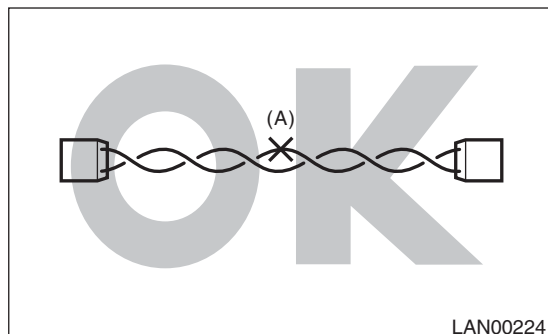
#### 2. LAN SYSTEM

- Bus line of LAN system is twisted pair line. Be careful not to bypass or partly unbind the twisted pair line.
- Do not make clearance between bus lines (CAN High, CAN Low).
- Difference of bus line length should be within 10 cm (3.94 in).
- Fray near the connector should be within 8 cm (3.14 in).



(A) Bypass wire connection

- If the characteristics of the twisted pair line are changed, it may extremely weaken against noise.
- When repairing the harness, connect the wires using soldering and protect it with insulating tape etc.



(A) Soldering and protection with insulating tape

### B: INSPECTION

Before performing diagnostics, check the following item which might affect body integrated unit malfunctions.

- 1) Measure the battery voltage and check electrolyte.

**Standard voltage: 12 V or more**

**Specific gravity: Above 1.260**

- 2) Check the fuse condition.  
Make sure that ampere of the fuse is setting value, and it is not blown out. While doing this, also check the backup fuse condition.
- 3) Check the connecting condition of harness and harness connector.
- 4) Confirm that a setting that does not match the vehicle equipment, is not set in the body integrated unit. <Ref. to LAN(diag)-18, REGISTRATION BODY INTEGRATED UNIT (EQUIPMENT SETTING), OPERATION, Subaru Select Monitor.>
- 5) Make sure that a setting that does not match the vehicle equipment, is not set in the function setting (ECM customizing) of the body integrated unit. <Ref. to LAN(diag)-21, FUNCTION SETTING (ECM CUSTOMIZING), OPERATION, Subaru Select Monitor.>
- 6) Confirm “Factory initial setting” of body integrated unit registrations is “Market”.
- 7) Confirm key illumination does not blink with ignition switch turned to ON.



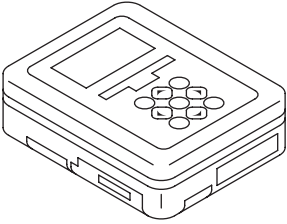
# General Description

LAN SYSTEM (DIAGNOSTICS)

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## C: PREPARATION TOOL

### 1. SPECIAL TOOL

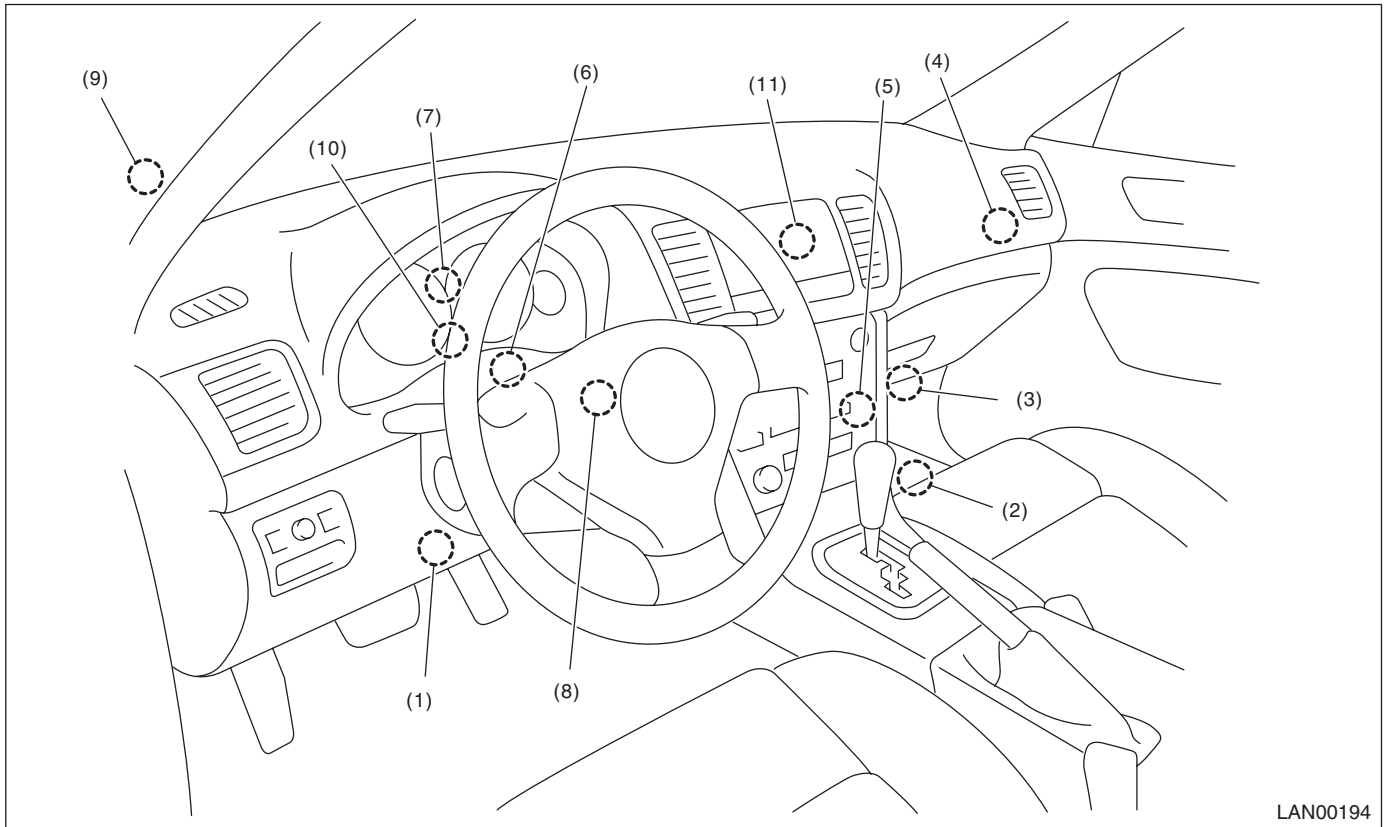
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B021XU0	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

### 2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

## 4. Electrical Component Location

### A: LOCATION

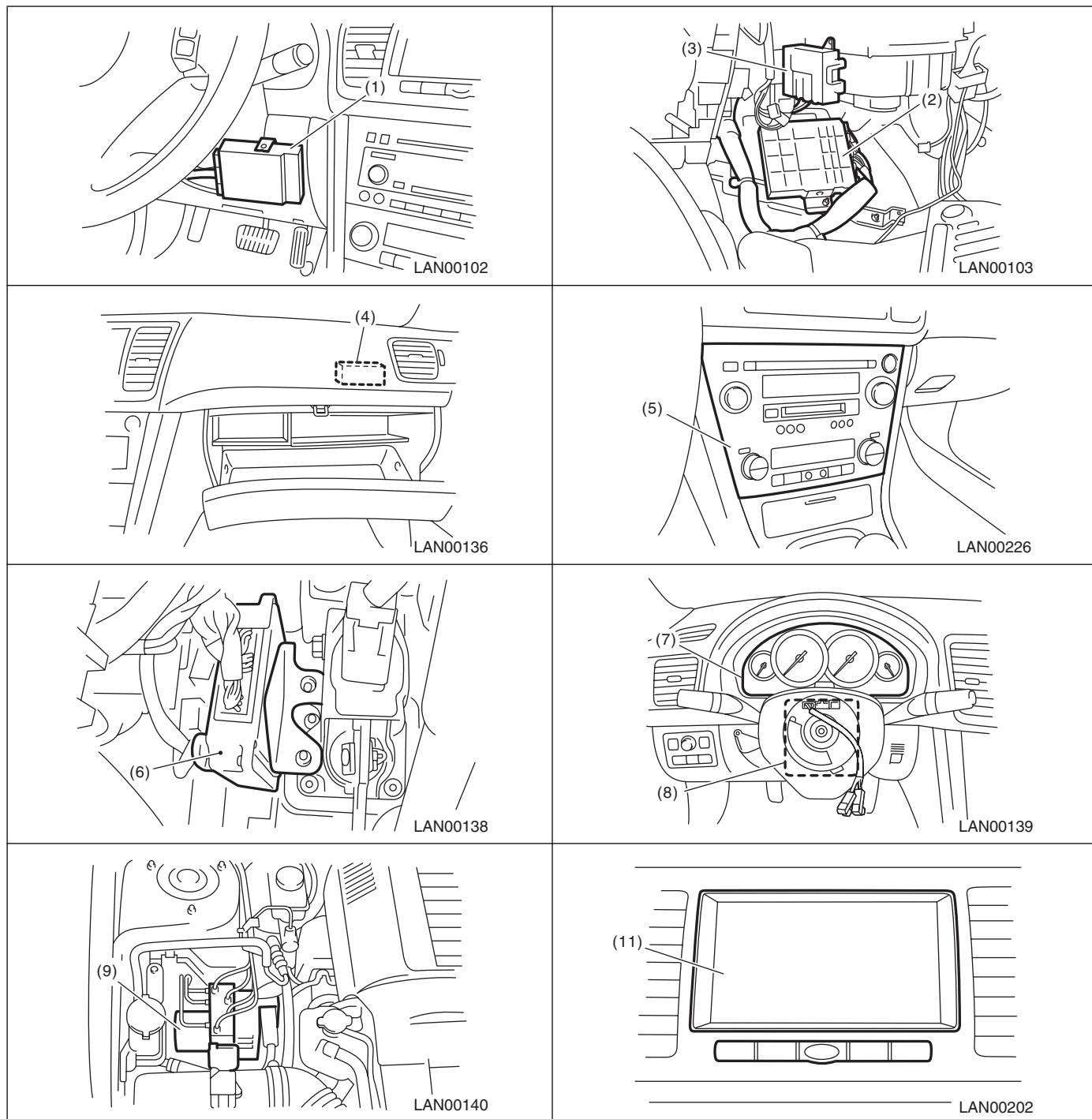


LAN00194

- |   |  |   |
|---|--|---|
| (1) Body integrated unit                      | (5) A/C control panel                    | (9) ABS CM&H/U or VDCCM&H/U<br>(inside engine room) |
| (2) Engine control module (ECM)               | (6) Transmission control module<br>(TCM) | (10) Odo/trip meter                                 |
| (3) Auto A/C control module                   | (7) Combination meter                    | (11) Center display                                 |
| (4) Keyless entry control module<br>(Antenna) | (8) Steering angle sensor                |   |

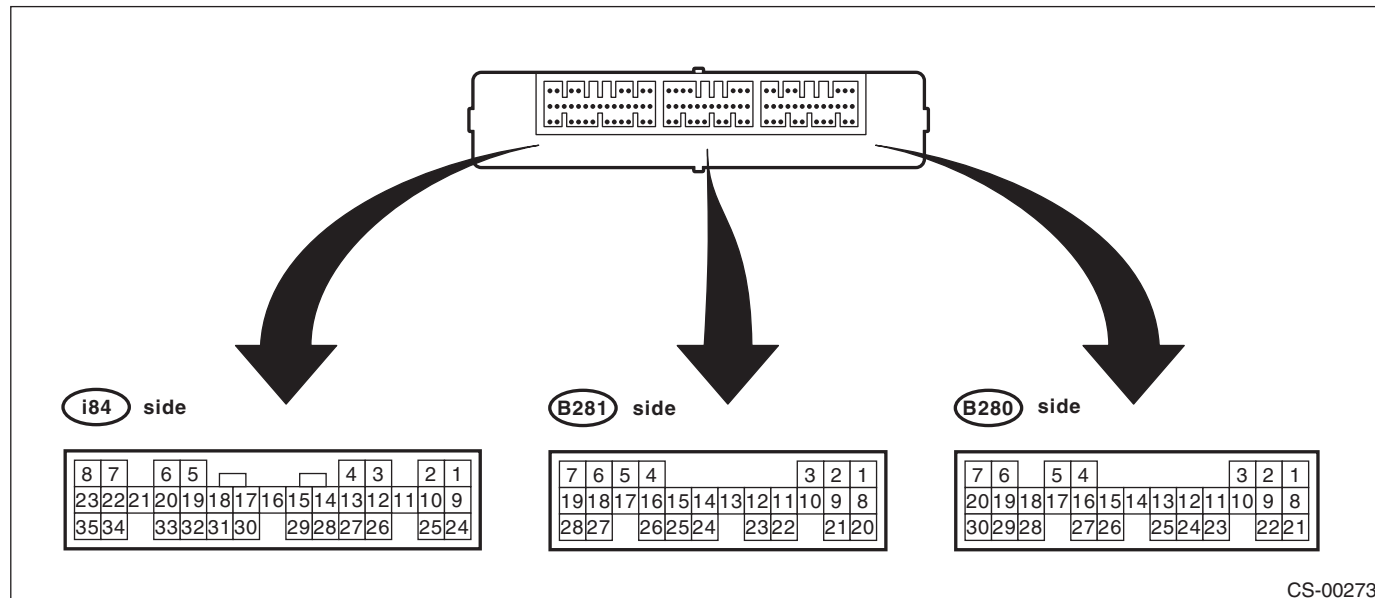
# Electrical Component Location

## LAN SYSTEM (DIAGNOSTICS)



## 5. Control Module I/O Signal

### A: ELECTRICAL SPECIFICATION



CS-00273

Contents	Connector No.	Terminal No.	Signal (V)	Note
			Ignition switch ON (engine OFF)	
System control power supply	B281	2	10 — 13 V	Always
Backup power supply	B280	7	10 — 13 V	When backup fuse is installed
Ignition power supply	i84	1	10 — 13 V	Ignition ON
ACC power supply	i84	24	10 — 13 V	ACC ON
Ground	i84	21	0 V	Always
	B281	9		
	B281	8		
	B280	22		
Key warning switch	B281	7	10 — 13 V	When ignition key inserted
Stop light switch	B281	23	10 — 13 V	When brake pedal depressed
Illumination control switch (Bright switch)	i84	30	10 — 13 V (at dimmer ON)	Cancel the extinction of the clock and audio illumination
Illumination volume (Vi1)	i84	10	4.5 — 5.5 V	Small light ON
Illumination volume (Vi2)	i84	2	0.5 — 4.5 V	Small light ON
Illumination volume (Vi3)	i84	25	0 V	Ground circuit
Illumination output	i84	5	Pulse signal	Small light ON
Front fog light SW input	B281	17	10 — 13 V	Front fog light ON
Door switch input Driver's seat	i84	19	Less than 1 V (10 — 13 V at OFF)	Driver's door open (ON)
Door switch input Passenger's seat	i84	32	Less than 1 V (10 — 13 V at OFF)	Passenger's door open (ON)
Door switch input Rear RH seat	i84	18	Less than 1 V (10 — 13 V at OFF)	Rear RH door open (ON)
Door switch input Rear LH seat	i84	31	Less than 1 V (10 — 13 V at OFF)	Rear LH door open (ON)
Door switch Trunk/Rear gate	i84	17	Less than 1 V (10 — 13 V at OFF)	Trunk/Rear gate open (ON)
Manual switch (LOCK)	i84	15	Less than 1 Ω	Door lock switch ON

## Control Module I/O Signal

### LAN SYSTEM (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)	Note
			Ignition switch ON (engine OFF)	
Manual switch (UNLOCK)	i84	29	Less than 1 Ω	Door unlock switch ON
Door lock power supply	i84	34	10 — 13 V	Always
All door lock output	i84	7	10 — 13 V	Manual lock switch, door key switch ON
Driver's door UNLOCK output	i84	23	10 — 13 V	Driver's seat unlock signal ON
All door UNLOCK output	i84	8	10 — 13 V	ALL door unlock signals ON
Rear gate UNLOCK output	i84	22	10 — 13 V	When the rear gate release switch is ON with all seats unlocked
Key/shift lock power supply	B281	1	10 — 13 V	Always
Shift lock output	B280	6	10 — 13 V	Ignition switch ON, shift position "P" range, foot brake ON (Only AT)
Key locking output	B280	5	10 — 13 V	Except P range, ignition key is inserted, ignition switch ON (AT model)
Wiper deicer switch	i84	14	Less than 1 Ω	Wiper deicer switch ON
Wiper deicer relay output	B280	14	1 V or less	Wiper deicer relay ON
Rear defogger switch	i84	28	Less than 1 Ω	Rear defogger switch ON
Rear defogger relay output	B281	16	1 V or less	Rear defogger relay ON
Shift switch (ON)	B281	26	Less than 1 Ω	At Manual mode
Shift switch (UP)	B281	15	Less than 1 Ω	At Manual mode UP
Shift switch (DOWN)	B281	25	Less than 1 Ω	At Manual mode DOWN
P range switch	B281	13	Less than 1 Ω	Shift range P position
Impact sensor	B281	5	8 V or more (pulse signal is usually used)	Impact sensor ON (Model with impact sensor)
Fuel level sensor	B281	19	0 — 102.3 Ω	Resistance differs according to the fuel level (displays resistance combining level gauge main and sub)
Ambient sensor	B281	3	0.5 — 4.5 V	SIG
	B281	10	0 V	GND
Seat belt switch (driver's seat)	i84	4	Less than 1 Ω	When driver's seat belt is not worn
Seat belt switch (Passenger's seat)	i84	13	Less than 1 Ω	When passenger's seat belt is not worn
Seat belt warning light (driver's seat)	i84	20	Less than 1 Ω	When driver's seat belt is worn
Seat belt warning light (Passenger's seat)	B281	27	Less than 1 Ω	When passenger's seat belt is worn
Rear wiper switch (ON)	B281	6	Less than 1 Ω	Rear wiper switch ON
Rear wiper switch (INT)	B281	18	Less than 1 Ω	Rear wiper switch ON
Rear washer switch	B281	27	Less than 1 Ω	Rear washer switch ON
Rear wiper power supply	B280	21	10 — 13 V	Ignition switch ON
Rear wiper ON output	B280	1	10 — 13 V	Rear wiper switch ON
Rear wiper return	B280	8	10 — 13 V	At wiper reversing
		1 — 8	10 — 13 V	

# Control Module I/O Signal

LAN SYSTEM (DIAGNOSTICS)

Contents	Connector No.	Terminal No.	Signal (V)	Note
			Ignition switch ON (engine OFF)	
Room light output	B280	3	1 V or less	When LOCK, UNLOCK with keyless entry
Key ring illumination output	B280	4	1 V or less	Ignition key removed, driver's door open
Turn hazard output	B280	12	1 V or less	When operating keyless entry answer back
Keyless Buzzer Output	i84	6	10 — 13 V	When operating keyless entry answer back
Security horn output	B280	11	1 V or less	When operating security horn
Security indicator light output	i84	33	Approx. 1 V	At ignition key removed, immobilizer operating
TPMS registration check signal input	B281	4	1 V or less	When inputting registration check signal
Keyless communication	i84	9	Serial communication	At keyless entry signal received
High speed CAN circuit	B280	20	Between B20 — B30 Serial communication	At communicating (sending and receiving)
High speed CAN circuit	B280	30		
Low-speed CAN circuit 1	i84	27	Between A26 — A27 Serial communication	At communicating (sending and receiving)
Low-speed CAN circuit 1	i84	26		
Low-speed CAN circuit 2	B280	26	Between B25 — B26 Serial communication	At communicating (sending and receiving) (Model with auto A/C)
Low-speed CAN circuit 2	B281	25		
Immobilizer antenna	B281	20 — 21	Serial communication	—
Immobilizer communication (Main)	B280	18 (Back-up 28)	Serial communication	—
Subaru Select Monitor communication	B280	19	Serial communication	—

## B: WIRING DIAGRAM

<Ref. to WI-229, WIRING DIAGRAM, CAN Communication System.> <Ref. to WI-143, AUTO A/C MODEL, WIRING DIAGRAM, Air Conditioning System.>

### 6. Subaru Select Monitor

#### A: OPERATION

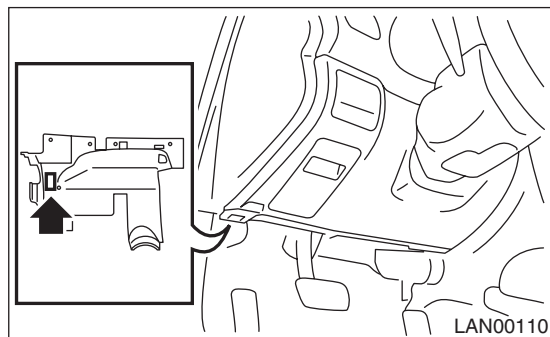
##### 1. READ DIAGNOSTIC TROUBLE CODE (DTC)

###### NOTE:

- DTC is displayed in the sequence of inputting. (When entering two DTCs or more simultaneously, they are displayed in the sequence of priority.)
- When more than two DTCs are displayed, perform the diagnosis of top one.

- 1) Prepare the Subaru Select Monitor kit.
- 2) Connect the diagnosis cable to the Subaru Select Monitor.
- 3) Connect the Subaru Select Monitor to the data link connector.

Data link connector is located in the lower portion of instrument panel (on the driver's side).



###### CAUTION:

**Do not connect the scan tools except for Subaru Select Monitor.**

- 4) Turn the ignition switch to ON (engine OFF) and run the Subaru Select Monitor.
- 5) On the «Main Menu» display screen, select the {Each System Check}.
- 6) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
- 7) On the «Integ. Unit mode» display screen, select the {Diagnostic Code(s) Display}.

###### NOTE:

- For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.
- For details concerning DTCs, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to LAN(diag)-28, List of Diagnostic Trouble Code (DTC).>

##### 2. READ CURRENT DATA

- 1) On the «Main Menu» display screen, select the {Each System Check}.
  - 2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
  - 3) On the «Integ. Unit mode failure diag» display screen, select the {Current Data Display & Save}.
  - 4) On the «Current Data Display & Save» display screen, select the {12 Data Display}.
  - 5) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- A support list contains both of analog and digital data, and they are shown in the following table.

## 3. DISPLAY OF ANALOG DATA

Items to be displayed	Unit of measure	Remarks	Note
BATT Voltage (Control)	10 — 15 V	Body integrated unit input value	Always
BATT Voltage (BACK UP)	10 — 15 V	Body integrated unit input value	Always
IG Power Supply Voltage	10 — 15 V	Body integrated unit input value	Ignition switch ON
ACC voltage	10 — 15 V	Body integrated unit input value	Ignition switch ACC
Illumination VR voltage	0 — 5 V	Body integrated unit output value	Illumination volume input value
Illumi. output d-ratio	0 — 100%	Body integrated unit input value	Small light ON Illumination volume is other than bright.
Ambient temp sensor V	0 — 5 V	Body integrated unit output value	Ignition switch ON
Ambient temperature	-40 — 87.5°C	Body integrated unit output value	Ignition switch ON
Fuel level voltage	0 — 8 V	Body integrated unit input value	Ignition switch ON
Fuel level resistance	0 — 102.3 Ω	Body integrated unit input value	Ignition switch ON
Key-lock solenoid V	6 — 12 V	Body integrated unit output value	Other than parking range Key warning switch ON
Number of regist.	0 — 4	Key No. to register	
Front Wheel Speed	km/h	CAN data input value	Reception from VDC module
VDC/ABS latest f-code	DTC display (Temporarily)	CAN data input value	It is normal when DTC is not been input even if this code is displayed. Reception from VDC
Blower fan steps	0 — 2 levels	CAN data input value	0: OFF, 1: Low, 2: 2 levels or more Reception from air conditioner ECM (AUTO A/C model)
Fuel level resistance2	0 — 102.3 Ω	CAN data output value	Reception from body integrated unit
Fuel consumption	cc/s	CAN data input value	Reception from ECM and transmission to center monitor
Engine coolant temperature	-40 — 130°C	CAN data input value	Reception from ECM
Vehicle lateral G	m/s <sup>2</sup>	CAN data input value	Reception from VDC unit
SPORT Shift Stages	0 — 7 levels	CAN data input value	(0: Light OFF; 1 — 5: Gear display; 6: Fail; 7: ATF temperature High/Low) Reception from TCM (AT model)
Shift Position	0 — 7 levels	CAN data input value	0: 1; 1: 2; 2: 3; 3: 4; 4: D; 5: N; 6: R; 7: P shift position (There is no 8 input.) Reception from TCM (AT model)
Off delay time	OFF, Short, Normal, Long	Body integrated unit setting items	Customize setting



# Subaru Select Monitor

## LAN SYSTEM (DIAGNOSTICS)

### 4. DISPLAY OF ON/OFF DATA

Items to be displayed	Unit of measure	Remarks	Note
key-lock warning SW	ON/OFF	Body integrated unit input value	ON when ignition key is inserted
Stop Light SW	ON/OFF	Body integrated unit input value	ON when brake pedal is depressed
Front fog light SW input	ON/OFF	Body integrated unit input value	ON when Front fog light is ON.
TPMS Input	ON/OFF	Body integrated unit input value	ON when TPMS registration completed
Door unlock SW input	ON/OFF	Body integrated unit input value	ON when door key cylinder is in UNLOCK
Driver's door SW input	ON/OFF	Body integrated unit input value	ON when driver's door is open
P-door SW input	ON/OFF	Body integrated unit input value	ON when passenger's door is open
Rear right door SW input	ON/OFF	Body integrated unit input value	ON when rear right door is open
Rear left door SW input	ON/OFF	Body integrated unit input value	ON when rear left door is open
R Gate SW input	ON/OFF	Body integrated unit input value	ON when trunk/rear gate is open
Manual lock SW input	ON/OFF	Body integrated unit input value	Manual lock switch ON
Manual unlock SW input	ON/OFF	Body integrated unit input value	Manual unlock switch ON
Bright SW input	ON/OFF	Body integrated unit input value	Except automatic A/C
Tiptronic Mode Switch	ON/OFF	Body integrated unit input value	SPORT shift mode ON
TIP UP SW input	ON/OFF	Body integrated unit input value	SPORT shift ON and ON at up operation
TIP DOWN SW input	ON/OFF	Body integrated unit input value	SPORT shift ON and ON at down operation
P SW	ON/OFF	Body integrated unit input value	ON when shift range is in parking
R wiper ON SW input	ON/OFF	Body integrated unit input value	Rear wiper switch ON
R wiper INT SW input	ON/OFF	Body integrated unit input value	ON when rear wiper switch is in INT
R washer SW input	ON/OFF	Body integrated unit input value	Rear washer switch ON
Wiper deicer SW input	ON/OFF	Body integrated unit input value	Wiper deicer switch ON
Rear defogger SW	ON/OFF	Body integrated unit input value	Rear defogger switch ON (manual A/C)
Driver's seat belt SW input	ON/OFF	Body integrated unit input value	Driver's seat buckle switch ON
P seatbelt SW input	ON/OFF	Body integrated unit input value	Passenger's seat buckle switch ON
Fr wiper input	ON/OFF	Body integrated unit input value	ON when front wiper is operating
Identification SW input	ON/OFF	Body integrated unit input value	ON with sedan
R defogger output	ON/OFF	Body integrated unit output value	ON when rear defogger relay is operating
Door lock actuator LOCK output	ON/OFF	Body integrated unit output value	ON when lock signal is output
All seat UNLOCK output	ON/OFF	Body integrated unit output value	ON when unlock signal is output
D-seat UNLOCK output	ON/OFF	Body integrated unit output value	ON when unlock signal is output
R gate/trunk UNLK output	ON/OFF	Body integrated unit output value	ON when rear gate/trunk unlock signal is output
R wiper output	ON/OFF	Body integrated unit output value	ON when rear wiper is operating
Shift lock solenoid	ON/OFF	Body integrated unit output value	ON when shift lock solenoid is operating (AT model)
Key locking output	ON/OFF	Body integrated unit output value	ON when key lock solenoid is operating (AT model)
Wiper deicer SW input	ON/OFF	Body integrated unit output value	ON when wiper deicer is operating
Starter cutting output	ON/OFF	Body integrated unit output value	
Hazard Output	ON/OFF	Body integrated unit output value	ON when keyless lock/unlock signal is received (when keyless switch connector is removed)
Keyless Buzzer Output	ON/OFF	Body integrated unit output value	ON when keyless lock/unlock signal is received (when keyless switch connector is removed)
Horn Output	ON/OFF	Body integrated unit output value	ON when security warning is operating

# Subaru Select Monitor

## LAN SYSTEM (DIAGNOSTICS)

Items to be displayed	Unit of measure	Remarks	Note
Siren Output	ON/OFF	Body integrated unit output value	ON when siren is installed, customize settings are enabled, and security warning is operating
D-belt warning light O/P	ON/OFF	Body integrated unit output value	ON when Ignition switch is turned to ON, and buckle switch is turned off
P-belt warning light O/P	ON/OFF	Body integrated unit output value	ON when Ignition switch is turned to ON, occupant is seated, and buckle switch is turned off
Illumination light O/P	ON/OFF	Body integrated unit output value	ON when illumination is illuminated
Room light output	ON/OFF	Body integrated unit output value	ON when keyless lock/unlock signal is received (when keyless switch connector is removed)
Key illumi. light o/p	ON/OFF	Body integrated unit output value	ON when key illumination light is illuminated
Immobilizer light output	ON/OFF	Body integrated unit output value	ON when immobilizer pilot light blinks
Keyless operation 1	Registration/Normal	Body integrated unit input value	Not supported by North American specifications
Keyless operation 2	Clear/Normal	Body integrated unit input value	Not supported by North American specifications
CC Main Light	On/Off	CAN data input value	Cruise control switch on Reception from ECM and transmission to combination meter
CC Set Light	On/Off	CAN data input value	On when cruise control vehicle speed is set Reception from ECM and transmission to combination meter
SPORT Light	On/Off	CAN data input value	SPORT mode switch ON Reception from TCM and transmission to combination meter (AT model)
SPORT Blink	Blink/Off	CAN data input value	TCM error signal reception ON Reception from TCM and transmission to combination meter (AT model)
ATF temperature light	On/Off	CAN data input value	ATF oil temperature rise ON Reception from TCM and transmission to combination meter (AT model)
ATF Blink	Blink/Off	CAN data input value	4AT model: During learning control and bleeding control valve air
Tire diameter abnormal 1	On/Off	CAN data input value	4AT model: When FWD fuse is installed
Tire diameter abnormal 2	Blink/Off	CAN data input value	ON when difference in rotation between front and rear wheels is 4% or more Reception from TCM and transmission to combination meter (AT model)
SPORT Shift (UP)	UP/OFF	CAN data input value	ON when shift-up operation available lamp in the combination meter lights (AT model)
SPORT Shift (DOWN)	DOWN/OFF	CAN data input value	ON when shift-down operation available lamp in the combination meter lights (AT model)
SPORT Shift (buzzer 1)	ON/OFF	CAN data input value	Reception from TCM and transmission to combination meter (AT model)
SPORT Shift (buzzer 2)	ON/OFF	CAN data input value	Not supported by North American specifications
ABS/VDC Judging	ABS/VDC	CAN data input value	Transmission from vehicle dynamic control (VDC) to high speed control module
Small light SW	ON/OFF	CAN data input value	ON when small light is illuminated

# Subaru Select Monitor

## LAN SYSTEM (DIAGNOSTICS)

Items to be displayed	Unit of measure	Remarks	Note
DRL	ON/OFF	CAN data input value	Headlight switch OFF, ignition switch ON (during DRL operation)
R defogger SW	ON/OFF	CAN data input value	Rear defogger switch ON
Australia Judging Flag	Australia/Others	CAN data output value	North American specifications have others
Large diameter tires	Large diameter/others	CAN data output value	Reception from combination meter
Number of cylinders	4 cylinders/6 cylinders	CAN data input value	—
E/G camshaft specification	SOHC/DOHC	CAN data input value	—
E/G Turbo	Turbo/Non-turbo	CAN data input value	—
E/G displacement (2.5 L)	2.5 L/ OFF	CAN data input value	—
E/G displacement (3.0 L)	3.0 L/ OFF	CAN data input value	—
AT/MT Model ID Signal	AT model / MT model	CAN data input value	—
Blower fan information	ON/OFF	CAN data input value	—
Keyless buzzer	ON/OFF	CAN data output value	ON when keyless answer-back buzzer operates (when keyless switch connector is removed)
Center display failure	OK/NG	CAN data input value	Reception from center display (NAVI monitor)
NAVI Failure	OK/NG	CAN data input value	Reception from Center Display
IE Bus failure	Can not use	CAN data input value	Reception from Center Display
Auto A/C failure	OK/NG	CAN data input value	Reception from auto A/C module
EBD Warning Light	OK/OFF	CAN data input value	Reception from VDC/ABS and transmission to combination meter
ABS Warning Light	OK/OFF	CAN data input value	Reception from VDC/ABS and transmission to combination meter
VDC OFF flag	ON/OFF	CAN data input value	Reception from VDC/ABS and transmission to combination meter
VDC/ABS OK B	OK/NG	CAN data input value	Reception from VDC/ABS (When an error is detected in either of the yaw rate, G sensor, steering sensor, or pressure sensor)

### NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 5. CONFIRMATION OF CURRENT SETTING

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
- 3) On the «Integ. Unit mode failure diag» display screen, select the {Current Data Display & Save}.
- 4) On the «Current Data Display & Save» display screen, select the {12 Data Display}.
- 5) Using the scroll key, scroll the display screen up or down until the desired data is shown.
- 6) Display the following item and record the settings.

Required items for new registration (Except for system not equipped)

Contents	Item to confirm				Remarks
	1	2	3	4	
Key No. to register	1	2	3	4	Registered ID type
Off delay	OFF	Long	Normal	Short	Setting for lighting off time
Outside Temp Offset	-2°C — +2°C (0.5°C increments)				Adjustment of outside temperature
Rr defogger op. mode	Normal		Continuous		Normal: OFF at 15 minutes of operation Continuous: Operations from switch ON to OFF
Wiper deicer op. mode	Normal		Continuous		Normal: OFF at 15 minutes of operation Continuous: Operations from switch ON to OFF, repeats ON for 15 minutes, OFF for 2 minutes
Security Alarm Setup	ON		OFF		ON: Warning device operation possible OFF: Warning device does not operate
Impact Sensor Setup	ON		OFF		ON: Impact sensor operation possible OFF: Impact sensor does not operate Turn OFF for vehicles not equipped with an Impact Sensor
Alarm monitor delay setting	ON		OFF		ON: Monitor after a fixed period of time from reception of the keyless lock signal OFF: Monitor after reception of the keyless lock signal
Lockout prevention	ON		OFF		ON: Lockout prevention operation OFF: Lockout prevention not operated
Impact Sensor	Yes		No		Yes: Impact sensor equipped No: Impact sensor not equipped Always set to no for vehicles not equipped with the impact sensor.
Answer-back buzzer setup	ON		OFF		ON: Answer-back buzzer operation possible OFF: Answer-back buzzer not operated
Hazard answer-back setup	ON		OFF		ON: Hazard answer-back buzzer operation possible OFF: Hazard answer-back buzzer not operated
Ans.-back Buzzer	Yes		No		Yes: Vehicle equipped with answer-back buzzer No: Vehicle not equipped with answer-back buzzer
Passive arming	ON		OFF		ON: Passive arming operation possible OFF: Passive arming not in operation
Belt warning Switch	ON		OFF		ON: All alarms except the first stage not in operation OFF: Belt alarm operation possible
Door open warning (prevention of battery run-out)	Yes		No		Yes: Door interlocked room light goes off when on for 10 minutes consecutively when door is open. No: Room light remains illuminated until door is closed.
A/C ECM setting	Yes		No		Set models with auto A/C to Yes.
Wiper deicer	Yes		No		Yes: Vehicle equipped with wiper deicer No: Vehicle not equipped with wiper deicer
Rear fog light setting	Yes		No		Not supported by North American specifications
Factory initial setting	Factory		Market		Do not change to the factory mode. Set to market when using normally.

### 6. REGISTRATION BODY INTEGRATED UNIT (EQUIPMENT SETTING)

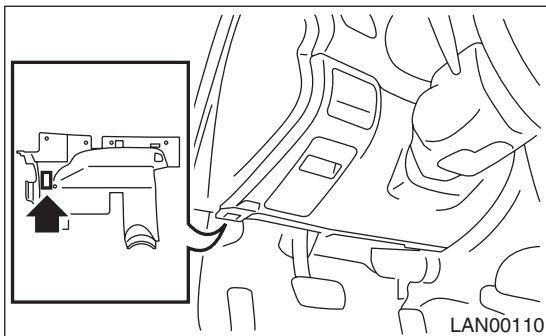
#### CAUTION:

Body integrated unit is core of LAN system, and also can select the function of all vehicle system control. It is possible to control the original functions of vehicle when registrations of body integrated unit and function setting are corresponded to vehicle equipment.

If registrations and function setting are different from vehicle equipment, vehicle system does not operate normally and diagnosis cannot be performed correctly. Pay attention to following item.

- Be sure to correspond registrations and function settings to vehicle equipment.
- Do not change the settings of vehicle improperly.
- Confirm key illumination does not blink or “Factory initial setting” of body integrated unit registrations is “Market”. If “Factory initial setting” is set to “Factory,” key illumination blinks when ignition key is turned ON, to notify that the settings are unconfirmed.
- Key illumination does not blink with ignition switch turned to ON and go off with door closed.
- Be sure to register immobilizer if body integrated unit is replaced with a new part. (models with immobilizer)
- Make a registration of immobilizer when the parts related to immobilizer have been replaced. Refer to the “REGISTRATION MANUAL FOR IMMOBILIZER”.

- 1) Turn the ignition switch to OFF.
- 2) Connect the Subaru Select Monitor to the data link connector.



- 3) Turn the ignition switch to ON and run the Subaru Select Monitor.
- 4) On the «Main Menu» display screen, select the {Each System Check}.
- 5) On the «Each System Check» display screen, select the {Integ. Unit mode} and then select the «ECM customizing».

6) Change the setting with UP/DOWN key and select the [OK].

List of body integrated unit registration item

**NOTE:**

Setting is different depending on the grade of vehicle.

Data	Initial setting	Registration	Remarks
A/C ECM setting	OFF	ON	Illumination control does not operate if A/C ECM setting is set to "OFF" in case of model with auto A/C.
		OFF	If A/C ECM setting is set to "ON" in case of model without auto A/C, illumination change to night illumination and it is difficult to be recognized.
P/W ECM setting	OFF	ON	Set to "OFF".
		OFF	
Wiper deicer setting	OFF	ON	ON signal does not output with operation of wiper deicer switch if wiper deicer is set to "OFF" in models with a wiper deicer.
		OFF	
Rear fog light setting	OFF	ON	Set to "OFF".
		OFF	
Factory initial setting (Reset of body integrated unit)	Factory	Factory (Reset)	If Factory initial setting is set to "Factory", registrations of items above is changed to "OFF". After setting, be sure to set to "Market".
		Market (Settlement)	

**CAUTION:**

- It is possible to control the original functions of vehicle when registrations of body integrated unit and function setting are corresponded to vehicle equipment.
- When body integrated unit is a new part or "Factory" mode, key illumination blinks to show equipment settings have not been completed.
- Be sure not to change Factory initial setting except installation of new body integrated unit.

**NOTE:**

"Factory" mode:

- Body integrated unit has not been set yet. It can be recognized by key illumination blinking with ignition switch turned to ON.
- All replacement body integrated units are set to Factory mode. When replacing a body integrated unit, be sure to perform the registration operation.

"Market" mode:

Each settings have been set. It can be recognized by key illumination coming on in concocting with room light and going off with ignition switch turned to ON.

# Subaru Select Monitor

## LAN SYSTEM (DIAGNOSTICS)

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7) Perform the Factory setting. On the «ECM customizing» display screen of Subaru Select Monitor, select the {Factory initial setting} and select the [OK].

8) Change the mode from Factory to Market.

9) Change to the immobilizer cartridge, and register the immobilizer key. (For models with immobilizer, perform the procedures according to “IMMOBILIZER TEACHING OPERATION MANUAL”.)

10) When key registration is completed, “Do you want to register remote engine start?” is displayed. Perform registration only for equipped models.

11) Perform the function setting (ECM customizing).

<Ref. to LAN(diag)-21, FUNCTION SETTING (ECM CUSTOMIZING), OPERATION, Subaru Select Monitor.>

### NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 7. CLEAR MEMORY MODE

1) On the «Main Menu» display screen, select the {2. Each System Check}.

2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.

3) Select the [OK] after the information of body integrated unit type is displayed.

4) On the «Integ. unit mode failure diag» display screen, select the {Clear Memory}.

Display	Contents to be monitored
Clear Memory?	Clear function of DTC and freeze frame data

5) When “Done” is shown on the display screen, turn the ignition switch to OFF.

### NOTE:

For details concerning the operation procedure, refer to the “PC application help for Subaru Select Monitor”.

## 8. FREEZE FRAME DATA

### NOTE:

- Data stored at the time of trouble occurrence is shown on the display.
- Freeze frame data will be memorized maximum to 20.
- If freeze frame data is not stored in memory correctly (caused by low power supply of body integrated unit), DTC will be displayed with “?” on the head of it in the Subaru Select Monitor display. This shows it may be an unreliable reading.

## 9. FUNCTION SETTING (ECM CUSTOMIZING)

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
- 3) On the «Integ. unit mode failure diag» display screen, select the {ECM customizing}.
- 4) Change the setting with UP/DOWN key and set with the [OK].

List of function setting item (ECM customizing)

Data	Initial setting value	Customize setting	Remarks	Destination Specifications
Off delay time	Normal		Delay time below can be selected by setting.	
			After door closed	After key unlock
		OFF	0 seconds	0 seconds
		Short	3 seconds	10 seconds
		Normal	5 seconds	20 seconds
		Long	8 seconds	30 seconds
Outside Temp Offset	0°C	-2 — +2 (increment of 0.5)	If it is set to +2.0°C at outside temperature of 12°, the displayed outside temperature will be 14°C.	
Rr defogger op. mode	15 min.	15 min.	Wiper deicer stops in 15 minutes automatically after switch is turned to ON.	
		Continuous	The wiper deicer activates for 15 minutes and turns inactive for 2 minutes repeatedly until the switch is turned OFF.	
Wiper deicer op. mode	15 min.	15 min.	Wiper deicer stops in 15 minutes automatically after switch is turned to ON.	
		Continuous	The wiper deicer activates for 15 minutes and turns inactive for 2 minutes repeatedly until the switch is turned OFF.	
Security Alarm Setup	ON	ON	Security alarm (hazard, horn or siren) in active condition	
		OFF	Security alarm in inactive condition	
Impact Sensor Setup	OFF	ON	Enabled when the Impact Sensor Setup is set to "ON". Impact sensor function becomes activated.	
		OFF	Impact sensor in inactive condition (Always set to OFF for vehicles not equipped with the sensor.)	
Alarm monitor delay setting	ON		After the keyless lock operation, the alarm monitor starts after the following delay time has passed.	
		ON	Delay time is 30 seconds.	
		OFF	Delay time is 0 seconds.	
Lockout prevention	ON	ON	Lockout prevention in inactive condition (The function does not operate if safety knob is locked by hand.)	
		OFF	Lockout prevention in inactive condition	
Impact Sensor	OFF	ON	Vehicle is controlled in impact sensor equipped mode. (Make sure to set to OFF for models without the impact sensor. When set to ON, hazard, the horn or siren will operate after doors are locked by the keyless entry system operation (Alarm monitor start).)	
		OFF	Vehicle is controlled in no impact sensor mode.	
Answer-back buzzer setup	ON	ON	Workable when answer-back buzzer setup is set to "ON". When lock/unlock is selected by keyless entry system operated, hazard answer-back buzzer operates.	
		OFF	When lock/unlock is selected by keyless entry system operated, answer-back buzzer does not sound.	



# Subaru Select Monitor

## LAN SYSTEM (DIAGNOSTICS)

Data	Initial setting value	Customize setting	Remarks	Destination Specifications
Hazard answer-back setup	ON	ON	Workable when hazard answer-back setup is set to "ON" When lock/unlock is selected by keyless entry system operated, hazard answer-back buzzer operates.	
		OFF	When lock/unlock is selected by keyless entry system operated, hazard answer-back does not operate.	
Ans.-back Buzzer	ON	ON	Vehicle is controlled in answer-back buzzer equipped mode.	
		OFF	Vehicle is controlled in answer-back buzzer non-equipped mode. (Always set to OFF for vehicles not equipped with the answer-back.)	
Initial Keyless Setting	—	—	—	
		Execution	Settings of keyless entry system are initialized. (Auto-lock time: 30 sec., Answer-back buzzer setup: ON, Hazard answer-back setup: ON, Automatic locking setup: ON, Ans.-back Buzzer: ON)	
Initial button setting	—	—	—	
		Execution	Settings of each function are initialized. (Off delay time: Normal, Rr defogger op. mode: 15 min., Wiper deicer op. mode: 15 min., Lockout prevention: ON)	
Passive arming	OFF	ON	Enabled when passive arming is set to "ON".	
		OFF		
Door open warning (prevention of battery run-out)	ON	ON	If detecting door open for 10 minutes, room light, key illumination and door warning light are turned off to prevent battery run-out.	
		OFF	Room light, key illumination and door warning light is not turned off.	
Belt warning Switch	OFF	ON	Alarm is set off with the indicator lit and buzzer beep from the first to third stage according to the vehicle speed and whether or not seat belts are worn.	
		OFF	Turns off the indicator and stops buzzer except for the first stage.	

5) After setting, make sure that vehicle equipment matches the changed settings in the {Current Data Display & Save}.

### CAUTION:

- The above settings most match the actual vehicle equipment for proper operation.
- Do not change settings other than the above while setting the functions.
- Be sure not to change Factory initial setting except installation of new body integrated unit.

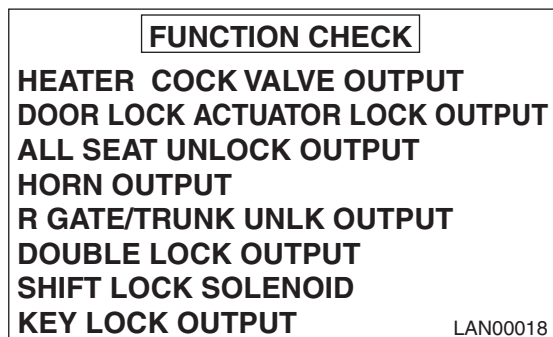
### NOTE:

For details concerning the operation procedure, refer to the "PC application help for Subaru Select Monitor".

## 10.FUNCTION CHECK

In order to check the body integrated unit function, inspect the body integrated unit and actuator using Subaru Select Monitor without operating switches.

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
- 3) On the «Integ. unit mode failure diag» display screen, select the {Function Check}.
- 4) Select the item to be operated on the «Function Check» display screen with «UP/Down key» and select the [OK].



- 5) Pressing [OK] starts, [NO] cancels the operation and [OK] returns to the System Operation Check Mode display screen.

### NOTE:

If not equipped (based on area or condition), process will not go on.

## Read Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

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### 7. Read Diagnostic Trouble Code (DTC)

#### A: OPERATION

##### 1. WITHOUT SUBARU SELECT MONITOR

NOTE:

Use the Subaru Select Monitor; DTCs cannot be read without it.

##### 2. WITH SUBARU SELECT MONITOR

For details concerning the DTC read procedure, refer to "Subaru Select Monitor". <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>

## 8. Clear Memory Mode

### A: OPERATION

#### 1. WITHOUT SUBARU SELECT MONITOR

**NOTE:**

Use the Subaru Select Monitor for the Clear Memory Mode.

#### 2. WITH SUBARU SELECT MONITOR

For details concerning DTC clear operation, refer to "Subaru Select Monitor". <Ref. to LAN(diag)-20, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.>

### 9. Read Current Data

#### A: OPERATION

- 1) On the «Main Menu» display screen, select the {Each System Check}.
- 2) On the «System Selection Menu» display screen, select the {Integ. Unit mode}.
- 3) On the «Integ. Unit mode failure diag» display screen, select the {Current Data Display & Save}.
- 4) On the «Data Display Menu» display screen, Select the {12 Data Display}.
- 5) Using the scroll key, scroll the display screen up or down until the desired data is shown.  
<Ref. to LAN(diag)-13, DISPLAY OF ANALOG DATA, OPERATION, Subaru Select Monitor.> <Ref. to LAN(diag)-14, DISPLAY OF ON/OFF DATA, OPERATION, Subaru Select Monitor.> <Ref. to LAN(diag)-17, CONFIRMATION OF CURRENT SETTING, OPERATION, Subaru Select Monitor.>

## 10. Function Setting (Customize)

### A: OPERATION

#### 1. WITH SUBARU SELECT MONITOR

For detailed procedures of function setting (ECM customizing), refer to "SUBARU SELECT MONITOR". <Ref. to LAN(diag)-21, FUNCTION SETTING (ECM CUSTOMIZING), OPERATION, Subaru Select Monitor.>

## List of Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

### 11. List of Diagnostic Trouble Code (DTC)

#### A: LIST

DTC	Item	Diagnosis content	Note
None	Communication for Initializing Impossible	Open or short in Subaru Select Monitor communication line	<Ref. to LAN(diag)-31, COMMUNICATION FOR INITIALIZING IMPOSSIBLE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
None	Diagnostic Trouble Code (DTC) is Not Stored	Internal error of combination meter	<Ref. to LAN(diag)-33, DIAGNOSTIC TROUBLE CODE (DTC) IS NOT STORED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1100	Integ. Unit System Error	Body integrated unit internal error	<Ref. to LAN(diag)-34, DTC B1100 INTEG. UNIT SYSTEM ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1101	BATT P/Supply Malfunction Cont.	Open or short in battery power supply control circuit	<Ref. to LAN(diag)-35, DTC B1101 BATT P/SUPPLY MALFUNCTION CONT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1102	BATT P/Supply Malfunction Cont.	Open or short of battery power supply backup circuit	<Ref. to LAN(diag)-37, DTC B1102 BATT P/SUPPLY MALFUNCTION CONT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1103	Ignition Power Failure	Open or short in IGN power supply circuit	<Ref. to LAN(diag)-39, DTC B1103 IGNITION POWER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1104	ACC Power Failure	Open or short in ACC power supply circuit	<Ref. to LAN(diag)-41, DTC B1104 ACC POWER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1105	Key Interlock Circuit Abnormal	Ground short of key interlock circuit	<Ref. to LAN(diag)-43, DTC B1105 KEY INTERLOCK CIRCUIT ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1106	Shift Lock Circuit Failure	Ground short of shift lock circuit	<Ref. to LAN(diag)-45, DTC B1106 SHIFT LOCK CIRCUIT FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1201	CAN-HS Counter Abnormal	Malfunction of high-speed CAN communication	<Ref. to LAN(diag)-47, DTC U1201 CAN-HS COUNTER ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1202	CAN-HS Bus Off	Any unit is cut communication.	<Ref. to LAN(diag)-52, DTC U1202 CAN-HS BUS OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1211	CAN-HS ECM Data Abnormal	Received error data from ECM.	<Ref. to LAN(diag)-57, DTC U1211 CAN-HS ECM DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1212	CAN-HS TCM Data Abnormal	Received error data from TCM.	<Ref. to LAN(diag)-59, DTC U1212 CAN-HS TCM DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1213	CAN-HS VDC/ABS Data Abnormal	Received error data from VDC/ABS unit.	<Ref. to LAN(diag)-61, DTC U1213 CAN-HS VDC/ABS DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1221	CAN-HS ECM No-Receive Data	Not received error data from ECM.	<Ref. to LAN(diag)-63, DTC U1221 CAN-HS ECM NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1222	CAN-HS TCM No-Receive Data	Not received error data from TCM.	<Ref. to LAN(diag)-65, DTC U1222 CAN-HS TCM NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

# List of Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

DTC	Item	Diagnosis content	Note
U1223	CAN-HS VDC/ABS No-Receive Data	Not received error data from VDC/ABS unit.	<Ref. to LAN(diag)-67, DTC U1223 CAN-HS VDC/ABS NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1300	CAN-LS Malfunction	Open or short in CAN-LS circuit, on each side or both sides.	<Ref. to LAN(diag)-69, DTC U1300 CAN-LS MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1301	CAN-LS Counter Abnormal	Malfunction of CAN-LS communication	<Ref. to LAN(diag)-72, DTC U1301 CAN-LS COUNTER ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1302	CAN-LS Bus Off	Any unit is cut communication.	<Ref. to LAN(diag)-75, DTC U1302 CAN-LS BUS OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1311	CAN-LS Meter Unit Data Abnormal	Received error data from meter.	<Ref. to LAN(diag)-78, DTC U1311 CAN-LS METER UNIT DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1313	CAN-LS Monitor Data Abnormal	Received error data from monitor.	<Ref. to LAN(diag)-80, DTC U1313 CAN-LS MONITOR DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U1321	CAN-LS Meter No-Receive Data	Not received error data from meter.	<Ref. to LAN(diag)-81, DTC U1321 CAN-LS METER NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1401	M Collation NG	Malfunction related immobilizer	<Ref. to IM(diag)-14, List of Diagnostic Trouble Code (DTC).>
B1402	Immobilizer Key Collation NG	Malfunction related immobilizer	<Ref. to IM(diag)-14, List of Diagnostic Trouble Code (DTC).>
B1403	E/G Request NG	Malfunction related immobilizer	<Ref. to IM(diag)-14, List of Diagnostic Trouble Code (DTC).>
B1500	Keyless UART com. Malfunction	Open or short circuit in keyless UART circuit	<Ref. to LAN(diag)-83, DTC B1500 KEYLESS UART COM. MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>



# List of Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

### 1. DTC TABLE

**NOTE:**

When more than two DTC codes are recorded, referring to their combination will make it easy to identify the possible cause. Refer to the list for typical examples.

DTC to Check	Diagnostic Code that was displayed.					Probable cause
	Body integrated unit	ECM	TCM	VDC/ABSCM	Combination meter display (except for meter with MID)	
B1100<Ref. to LAN(diag)-34, DTC B1100 INTEG. UNIT SYSTEM ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	B1100	—	—	—	Er IU	There could be a problem in the body integrated unit.
U1221<Ref. to LAN(diag)-63, DTC U1221 CAN-HS ECM NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	U1221	—	P1718	C0057	Er HC	It is possible that the ECM is faulty.
U1222<Ref. to LAN(diag)-65, DTC U1222 CAN-HS TCM NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	U1222	P0600	—	C0057	Er HC	It is possible that the TCM is faulty.
U1223<Ref. to LAN(diag)-67, DTC U1223 CAN-HS VDC/ABS NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	U1223	P0600	P1718	—	Er HC	It is possible that the VDC/ABSCM is faulty.
U1321<Ref. to LAN(diag)-81, DTC U1321 CAN-LS METER NO-RECEIVE DATA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	U1321	—	—	—	—	It is possible that the combination meter is faulty.
U1313<Ref. to LAN(diag)-80, DTC U1313 CAN-LS MONITOR DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	U1313	—	—	—	—	It is possible that the navigation monitor is faulty.
B1500<Ref. to LAN(diag)-83, DTC B1500 KEYLESS UART COM. MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	B1500	—	—	—	—	It is possible that the keyless entry module is faulty.

## 12. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

**NOTE:**

- DTC is displayed in the sequence of the amount of counter numbers.
- When more than two DTCs are displayed, perform the diagnosis of top one.

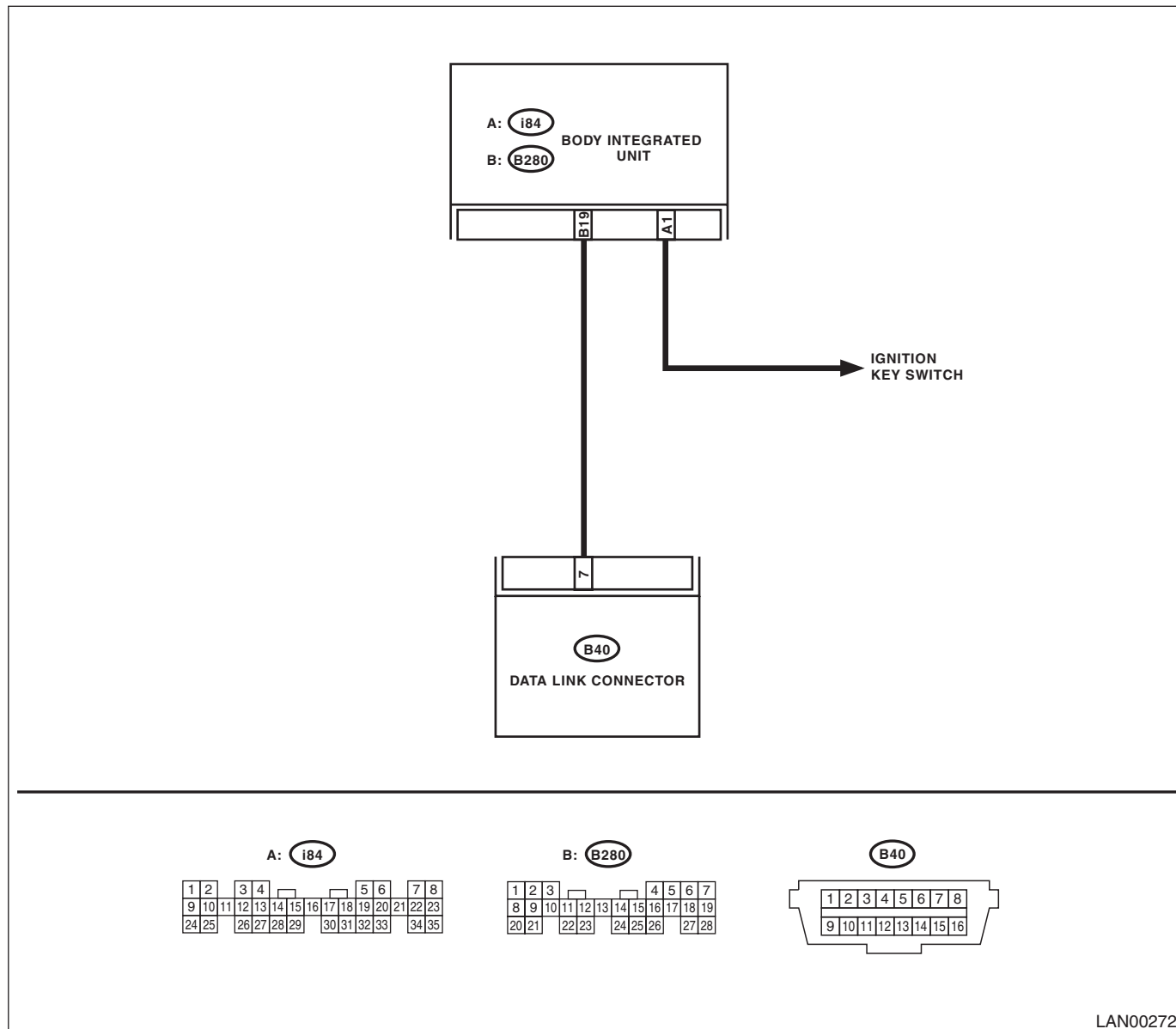
**DIAGNOSIS:**

Subaru Select Monitor communication line is open or shorted.

**TROUBLE SYMPTOM:**

Not communicable with Subaru Select Monitor.

**WIRING DIAGRAM:**



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No	
1	<b>CHECK IGNITION SWITCH.</b>	Is the ignition switch ON?	Go to step 2.	Turn the ignition switch to ON, and select Integ. Unit mode using Subaru Select Monitor.
2	<b>CHECK BATTERY.</b> 1) Turn the ignition switch to OFF. 2) Measure the battery voltage.	Is the voltage 11 V or more?	Go to step 3.	Charge or replace the battery.
3	<b>CHECK BATTERY TERMINAL.</b>	Is there poor contact at the battery terminal?	Repair or tighten the battery terminal.	Go to step 4.
4	<b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, check whether communication to other systems can be executed normally.	Is the system name displayed?	Go to step 7.	Go to step 5.
5	<b>CHECK COMMUNICATION OF SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the body integrated unit connector. 3) Turn the ignition switch to ON. 4) Check whether communication to other systems can be executed normally.	Is the system name displayed?	Go to step 7.	Go to step 6.
6	<b>CHECK HARNESS CONNECTOR BETWEEN EACH CONTROL UNIT AND SUBARU SELECT MONITOR.</b> 1) Turn the ignition switch to ON. 2) Disconnect the body integrated unit connector. 3) Measure the resistance between data link connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Go to step 7.	Repair the harness and connector between each control unit and Subaru Select Monitor.
7	<b>CHECK OUTPUT SIGNAL TO BODY INTEGRATED UNIT.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B40) No. 7 (+) — Chassis ground (-):</b>	Is the voltage less than 1 V?	Go to step 8.	Repair the harness and connector between each control unit and Subaru Select Monitor.
8	<b>CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND DATA LINK CONNECTOR.</b> Measure the resistance between body integrated unit and data link connector. <b>Connector &amp; terminal</b> <b>(B40) No. 7 — (B280) No. 19:</b>	Is the resistance less than 1 $\Omega$ ?	Go to step 9.	Repair the harness and connector between body integrated unit and Subaru Select Monitor.
9	<b>CHECK INSTALLATION OF BODY INTEGRATED UNIT CONNECTOR.</b> Turn the ignition switch to OFF.	Is the body integrated unit connector inserted into body integrated unit until the clamp locks onto it?	Go to step 10.	Insert the body integrated unit connector into body integrated unit.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK POWER SUPPLY CIRCUIT.</b> 1) Turn the ignition switch to ON (engine OFF). 2) Measure the ignition voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 10 V or more?	Go to step 11.	Repair the open circuit of harness between body integrated unit and battery.
<b>11 CHECK HARNESS CONNECTOR BETWEEN BODY INTEGRATED UNIT AND CHASSIS GROUND.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the connector from body integrated unit. 3) Measure the resistance of harness between the body integrated unit and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 19 — Chassis ground:</b>	Is the resistance 1 MΩ or more?	Go to step 12.	Repair the poor contact of harness between body integrated unit and ground.
<b>12 CHECK POOR CONTACT OF CONNECTORS.</b>	Is there poor contact at control unit ground and Subaru Select Monitor?	Repair the poor contact of connector.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

## CAUTION:

When replacing body integrated unit on the model with immobilizer system, refer to the “REGISTRATION MANUAL FOR IMMOBILIZER”.

## B: DIAGNOSTIC TROUBLE CODE (DTC) IS NOT STORED

### DIAGNOSIS:

Defective combination meter

### TROUBLE SYMPTOM:

- Communication error display in odo/trip meter is not cleared. (Except for meter with MID)
- “No trouble code” is displayed on Subaru Select Monitor.

### NOTE:

If DTC is not displayed on Subaru Select Monitor, LAN communication System should be OK.

Step	Check	Yes	No
<b>1 CHECK DTC.</b> Read the DTC of body integrated unit using Subaru Select Monitor.	Is DTC displayed?	Perform the diagnosis according to DTC.	Go to step 2.
<b>2 CHECK COMBINATION METER.</b> Perform the self-diagnosis of combination meter.	Is combination meter OK?	Go to step 3.	Replace the combination meter. <Ref. to IDI-19, Combination Meter.>
<b>3 CHECK BODY INTEGRATED UNIT.</b> 1) Display the current data of ECM using Subaru Select Monitor. 2) Check data of “body integrated unit data received”.	Is “Yes” displayed?	Go to step 4.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
<b>4 CHECK BODY INTEGRATED UNIT.</b> 1) Display the current data of ECM using Subaru Select Monitor. 2) Check data of “body Integrated unit counter update”.	Is “Yes” displayed?	Repair the poor contact of connector.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## C: DTC B1100 INTEG. UNIT SYSTEM ERROR

### DTC DETECTING CONDITION:

System error in body integrated unit

### TROUBLE SYMPTOM:

- Check light comes on in the combination meter, and displays communication error display “Er IU”. (Except for meter with MID)
- LAN communication immobilizer function may not be executed normally.

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of body integrated unit. Go to step 2.	Go to step 2.
2	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Go to step 4.	Go to step 3.
3	<b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 4.
4	<b>CHECK ALL DTCS.</b>	Is DTC concerning ECM displayed?	Go to step 5.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
5	<b>CHECK DTC CONCERNING ECM.</b>	Is output DTC on ECM concerning CAN communication failure?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Perform the diagnosis according to DTC concerning ECM.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## D: DTC B1101 BATT P/SUPPLY MALFUNCTION CONT

### DTC DETECTING CONDITION:

Battery power supply control circuit is open or shorted.

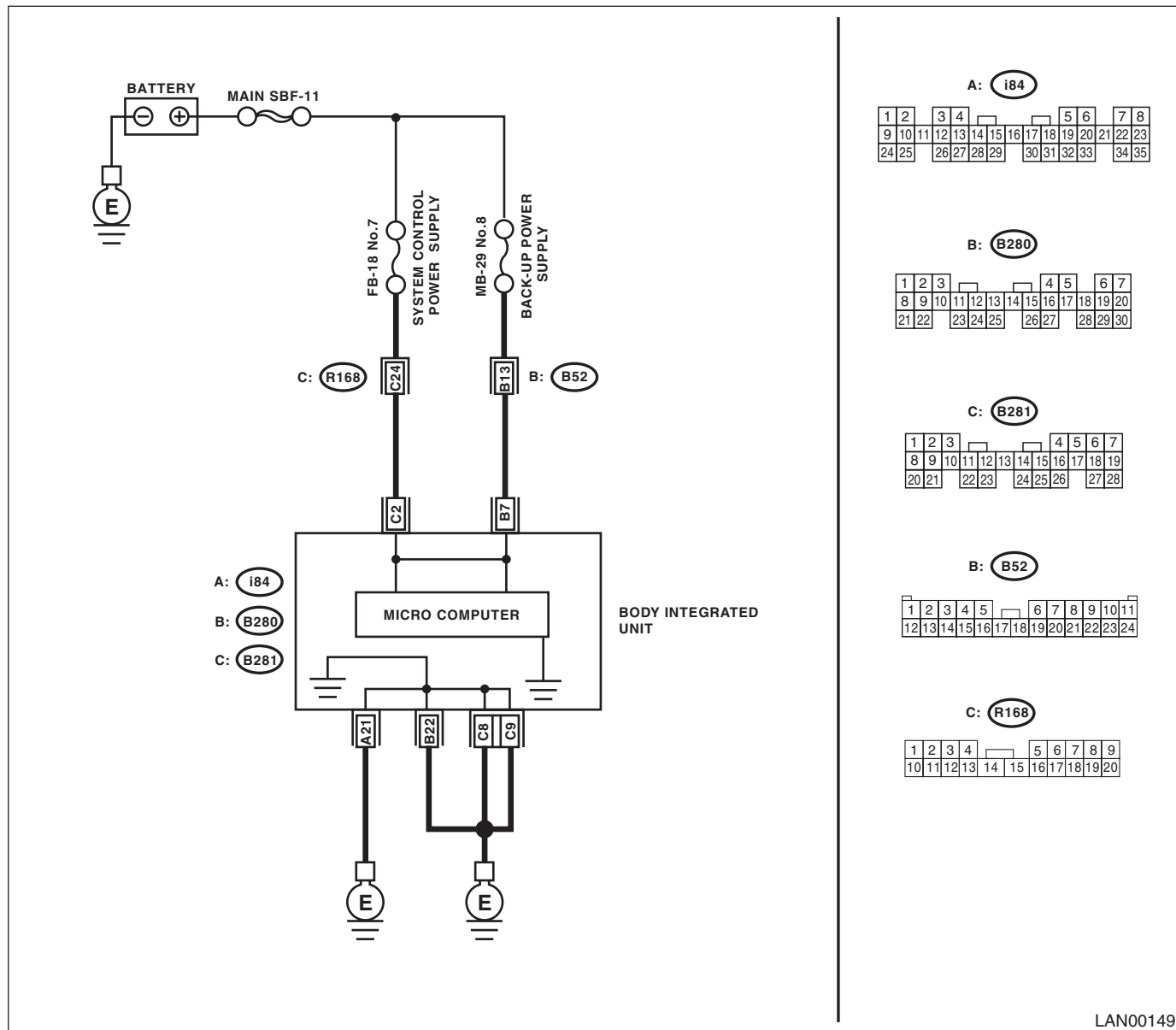
### TROUBLE SYMPTOM:

No malfunction occurs because the back-up power supply is activated.

### NOTE:

When B1102 BATT p/supply malfunction cont is output at the same time, all the function of body integrated unit may not operate.

### WIRING DIAGRAM:



LAN00149

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 7).	Is the fuse blown out?	Replace the fuse (No. 7). If the replaced fuse has blown out easily, repair the short circuit of harness between fuse (No. 7) and body integrated unit.	Go to step 2.
<b>2</b> <b>CONTINUITY CHECK OF WIRING HARNESS.</b> 1) Disconnect the connector (B281) from body integrated unit. 2) Measure the voltage between body integrated unit connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B281) No. 2 (+) — Chassis ground (-):</b></i>	Is the voltage 9 — 15 V?	Go to step 3.	Repair the harness for open or shorted circuit between body integrated unit and fuse.
<b>3</b> <b>CHECK POOR CONTACT OF CONNECTORS.</b>	Is there poor contact in body integrated unit connector?	Repair the poor contact of connector.	Go to step 4.
<b>4</b> <b>CHECK BODY INTEGRATED UNIT HARNESS.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Read DTC.	Is the same DTC displayed?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## E: DTC B1102 BATT P/SUPPLY MALFUNCTION CONT

### DTC DETECTING CONDITION:

Battery power supply backup circuit is open or shorted.

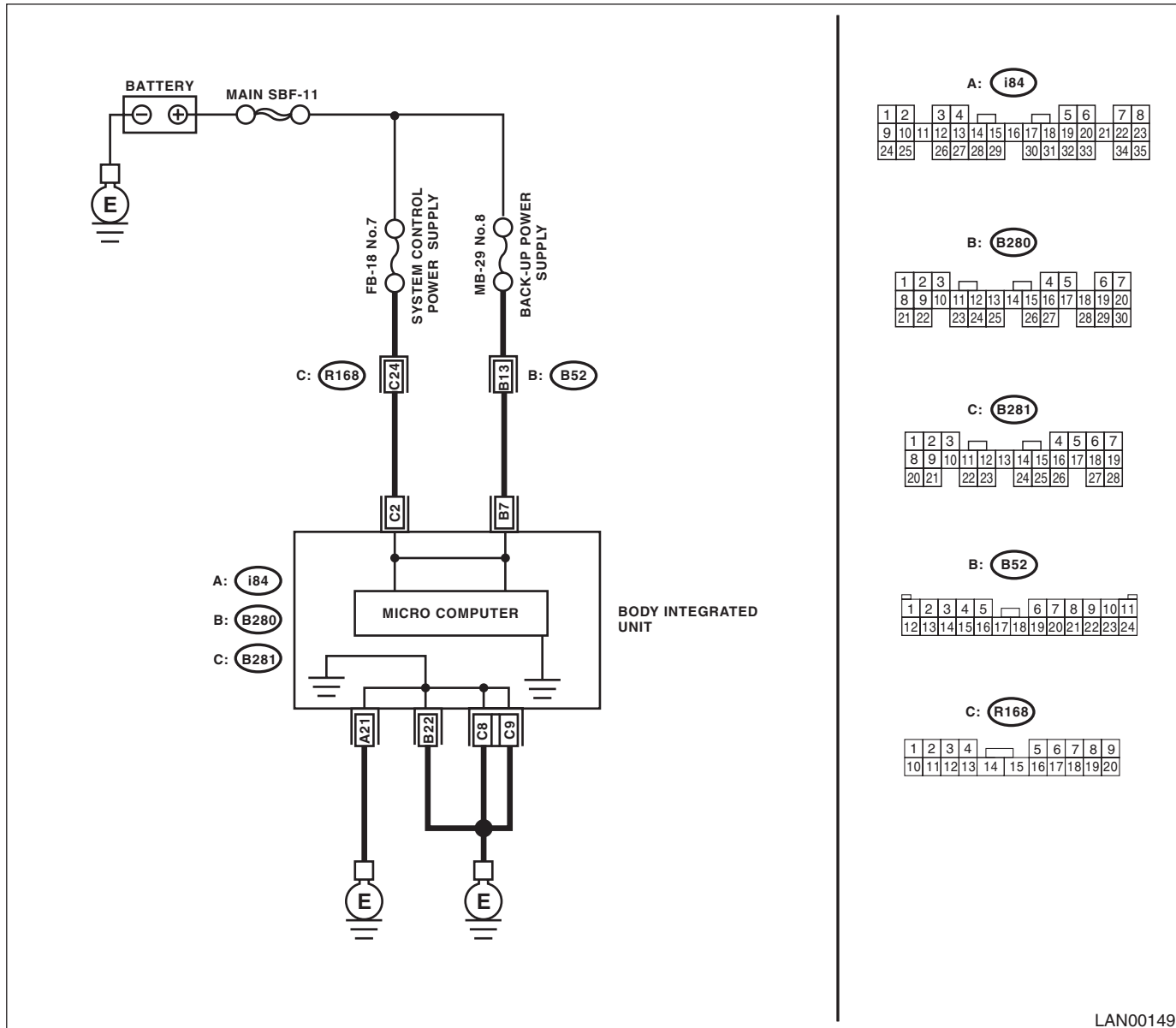
### TROUBLE SYMPTOM:

- Engine malfunction indicator light may illuminate.
- Keyless entry, room light and key illumination do not operate.
- "Er IU" may display in combination meter. (Except for meter with MID)

### NOTE:

When B1101 BATT p/supply malfunction cont is output at the same time, all function of body integrated unit may not function.

### WIRING DIAGRAM:





# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 8).	Is the fuse blown out?	Replace the fuse (No. 8). If the replaced fuse has blown out easily, repair the short circuit of harness between fuse (No. 8) and body integrated unit.	Go to step 2.
2	<b>CONTINUITY CHECK OF WIRING HARNESS.</b> 1) Disconnect the connector (B280) from body integrated unit. 2) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 7 (+) — Chassis ground (-):</b>	Is the voltage 9 — 15 V?	Go to step 3.	Repair the harness for open or shorted circuit between body integrated unit and fuse.
3	<b>CHECK POOR CONTACT OF CONNECTORS.</b>	Is there poor contact in body integrated unit connector?	Repair the poor contact of connector.	Go to step 4.
4	<b>CHECK BODY INTEGRATED UNIT HARNESS.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Read DTC.	Is the same DTC displayed?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## F: DTC B1103 IGNITION POWER FAILURE

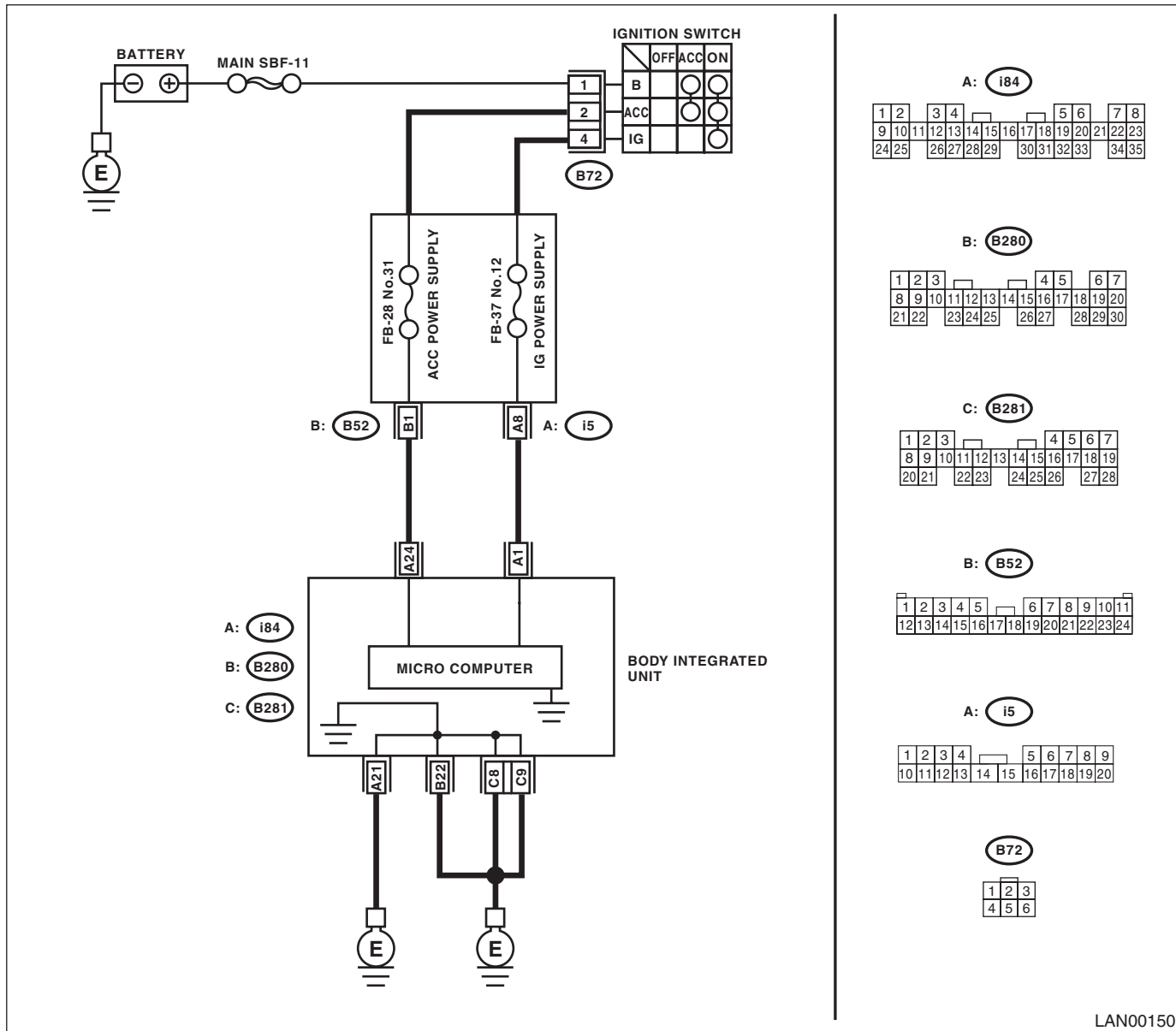
### DTC DETECTING CONDITION:

IGN power supply circuit is open or shorted.

### TROUBLE SYMPTOM:

Symptoms such as illuminating the malfunction indicator light or high speed CAN error display "Er HC" may occur. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00150

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 12).	Is the fuse blown out?	Replace the fuse (No. 12). If the replaced fuse has blown out easily, repair the short circuit of harness between fuse (No. 12) and body integrated unit.	Go to step 2.
2	<b>CONTINUITY CHECK OF WIRING HARNESS.</b> 1) Disconnect the connector (i84) from body integrated unit. 2) Turn the ignition switch to ON. 3) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal (i84) No. 1 (+) — Chassis ground (-):</b>	Is the voltage 9 — 15 V?	Go to step 3.	Repair the harness for open or shorted circuit between body integrated unit and fuse.
3	<b>CHECK POOR CONTACT OF CONNECTOR.</b>	Is there poor contact in body integrated unit connector?	Repair the poor contact of connector.	Go to step 4.
4	<b>CHECK BODY INTEGRATED UNIT HARNESS.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Read DTC.	Is the same DTC displayed?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Temporary poor contact occurs.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## G: DTC B1104 ACC POWER FAILURE

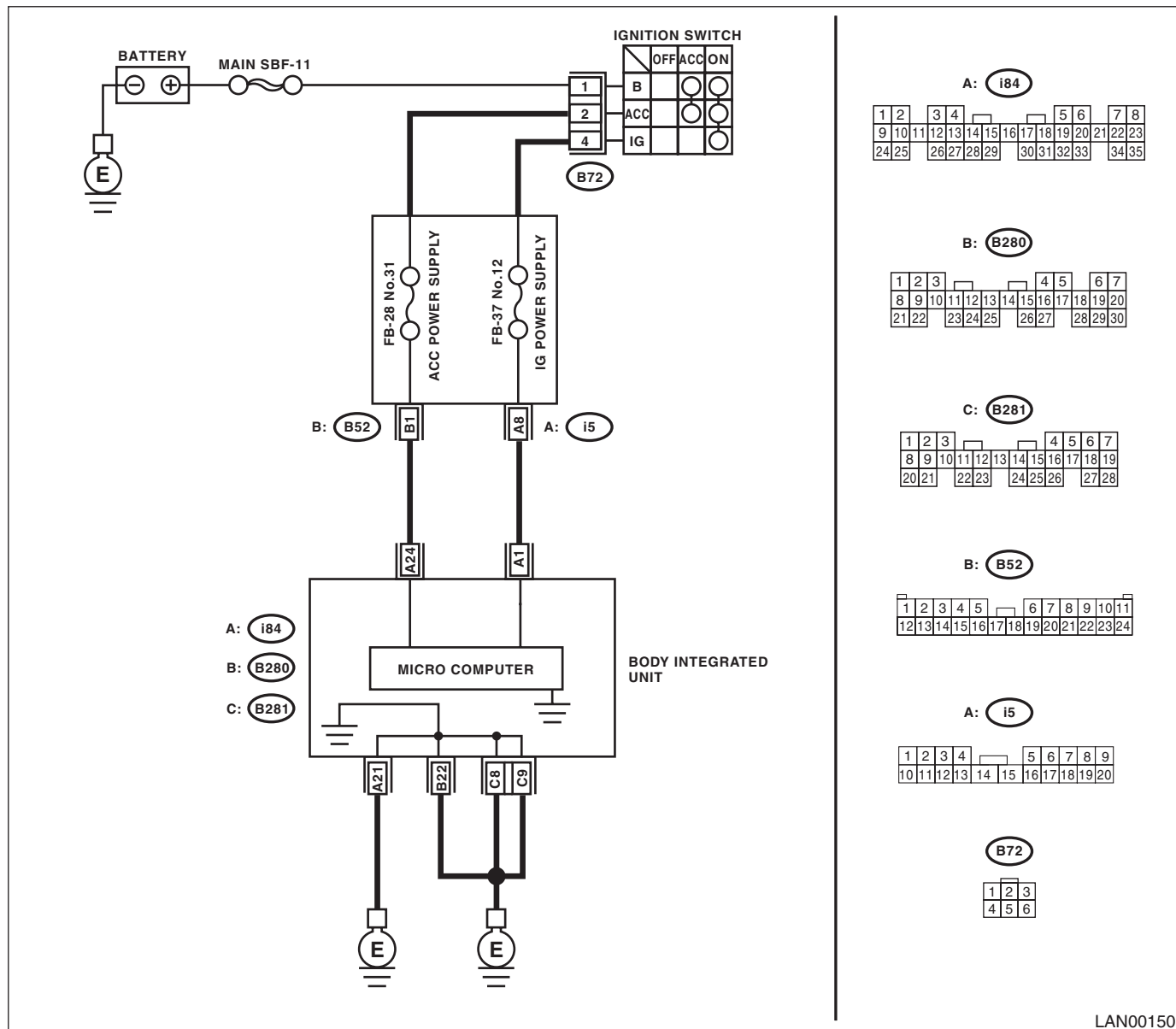
### DTC DETECTING CONDITION:

ACC power supply circuit is open or shorted.

### TROUBLE SYMPTOM:

Rear wiper may not operate at ACC position.

### WIRING DIAGRAM:



LAN00150

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse (No. 31).	Is the fuse blown out?	Replace the fuse (No. 31). If the replaced fuse has blown out easily, repair the short circuit of harness between fuse (No. 31) and body integrated unit.	Go to step 2.
2	<b>CONTINUITY CHECK OF WIRING HARNESS.</b> 1) Disconnect the connector (i84) from body integrated unit. 2) Turn the ignition switch to ON. 3) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal (i84) No. 24 (+) — Chassis ground (-):</b>	Is the voltage 9 — 15 V?	Go to step 3.	Repair the harness for open or shorted circuit between body integrated unit and fuse.
3	<b>CHECK POOR CONTACT OF CONNECTOR.</b>	Is there poor contact in body integrated unit connector?	Repair the poor contact of connector.	Go to step 4.
4	<b>CHECK BODY INTEGRATED UNIT HARNESS.</b> 1) Connect all connectors. 2) Perform the Clear Memory Mode. 3) Read DTC.	Is DTC displayed?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Temporary poor contact occurs.

## H: DTC B1105 KEY INTERLOCK CIRCUIT ABNORMAL

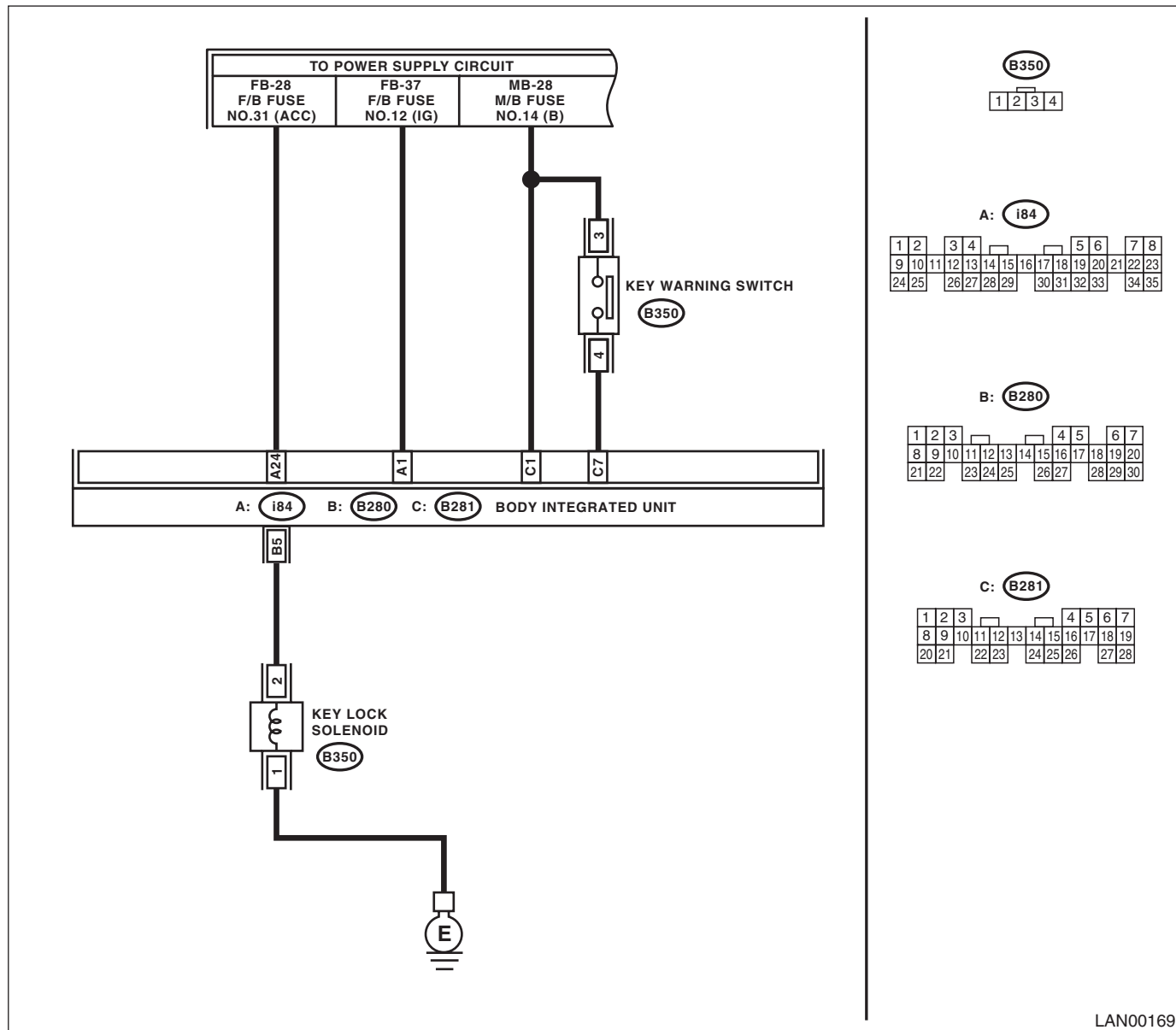
### DTC DETECTING CONDITION:

Key interlock circuit is shorted to ground.

### TROUBLE SYMPTOM:

- There is no key interlock power supply.
- Key interlock does not release or does not keep lock condition.

### WIRING DIAGRAM:



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK KEY LOCK SOLENOID.</b> 1) Disconnect the connector of key lock solenoid. 2) Measure the internal resistance of key lock solenoid. <i><b>Connector &amp; terminal</b></i> <i><b>(B350) No. 1 — No. 2:</b></i>	Is the resistance between 10 — 20 $\Omega$ ?	Go to step 2.	Replace the key lock solenoid.
<b>2 CHECK GROUND CIRCUIT.</b> 1) Disconnect the connector of key lock solenoid. 2) Measure the resistance between the key lock solenoid connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B350) No. 1 — Chassis ground:</b></i>	Is the resistance less than 10 $\Omega$ ?	Go to step 3.	Check the key lock solenoid ground circuit for short circuit and confirm the correct installation. Repair the ground circuit if defective.
<b>3 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and key lock solenoid connector (B350). 2) Measure the resistance between body integrated unit connector and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(B280) No. 5 — Chassis ground:</b></i>	Is the resistance 1 M $\Omega$ or more?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Repair the short circuit of harness or replace harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## I: DTC B1106 SHIFT LOCK CIRCUIT FAILURE

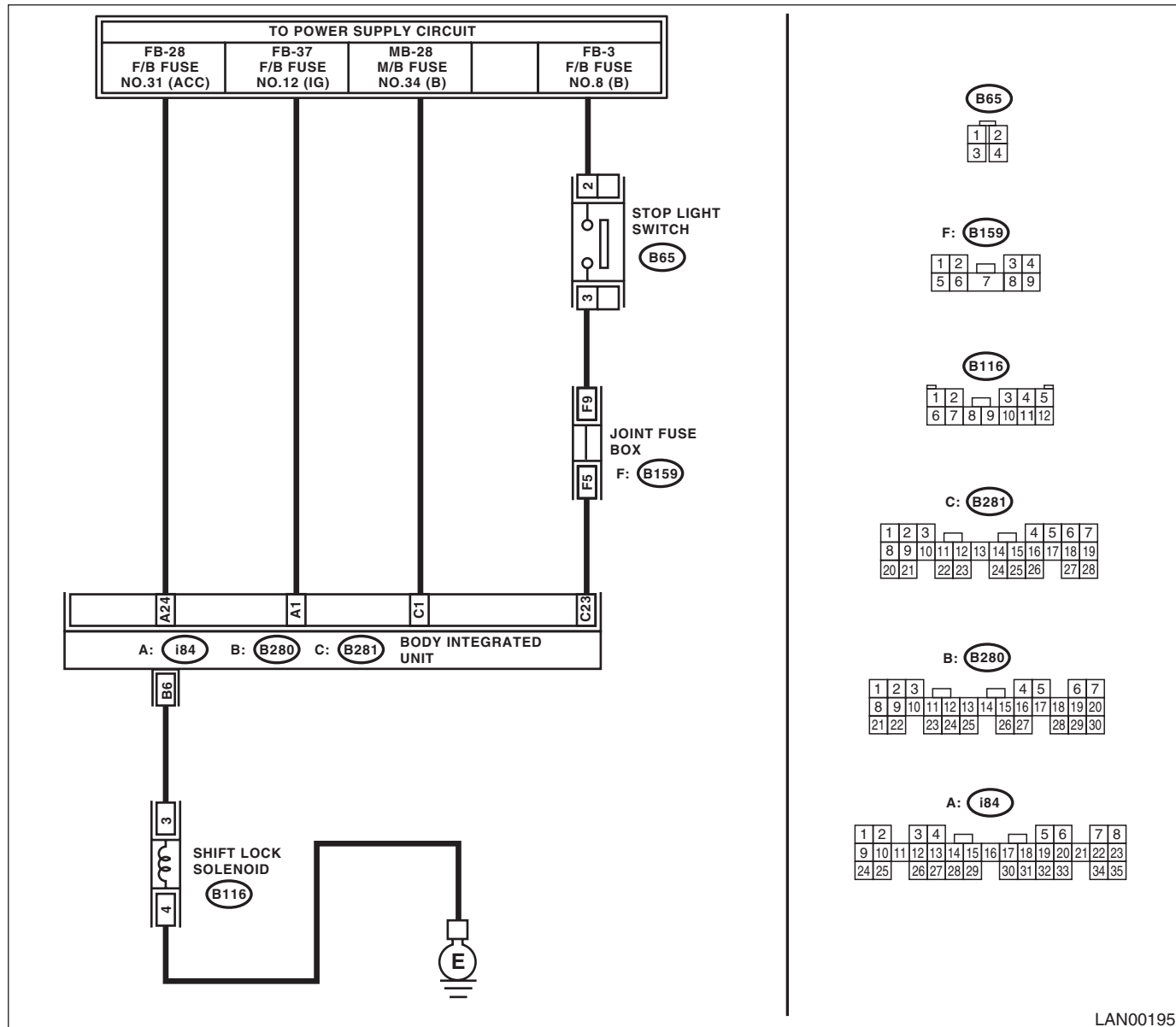
### DTC DETECTING CONDITION:

Shift lock circuit is shorted to ground.

### TROUBLE SYMPTOM:

Shift lock does not be released or remain locked.

### WIRING DIAGRAM:



LAN00195



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 6 — Chassis ground:</b>	Is the resistance between 20 — 30 $\Omega$ ?	Go to step 5.	Go to step 2.
2	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Disconnect the shift lock solenoid connector. 3) Measure the resistance between body integrated unit connector and shift lock solenoid connector. <b>Connector &amp; terminal</b> <b>(B280) No. 6 — (B116) No. 3:</b>	Is the resistance less than 10 $\Omega$ ?	Go to step 3.	Repair or replace the open or short circuit of harness.
3	<b>CHECK SHIFT LOCK SOLENOID.</b> 1) Disconnect the shift lock solenoid connector. 2) Measure the internal resistance of shift lock solenoid. <b>Connector &amp; terminal</b> <b>(B116) No. 3 — No. 4:</b>	Is the resistance between 20 — 30 $\Omega$ ?	Go to step 4.	Replace the shift lock solenoid.
4	<b>CHECK GROUND CIRCUIT.</b> 1) Disconnect the shift lock solenoid connector. 2) Measure the resistance between the shield connector and chassis ground. <b>Connector &amp; terminal</b> <b>(B116) No. 4 — Chassis ground:</b>	Is the resistance less than 10 $\Omega$ ?	Temporary poor contact occurs. Check the connection of each terminal and repair when necessary.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>
5	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and shift lock solenoid connector (B116). 2) Measure the resistance between body integrated unit connector (B280) and chassis ground. <b>Connector &amp; terminal</b> <b>(B280) No. 6 — Chassis ground:</b>	Is the resistance 1 M $\Omega$ or more?	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>	Repair the short circuit of harness or replace harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## J: DTC U1201 CAN-HS COUNTER ABNORMAL

### DTC DETECTING CONDITION:

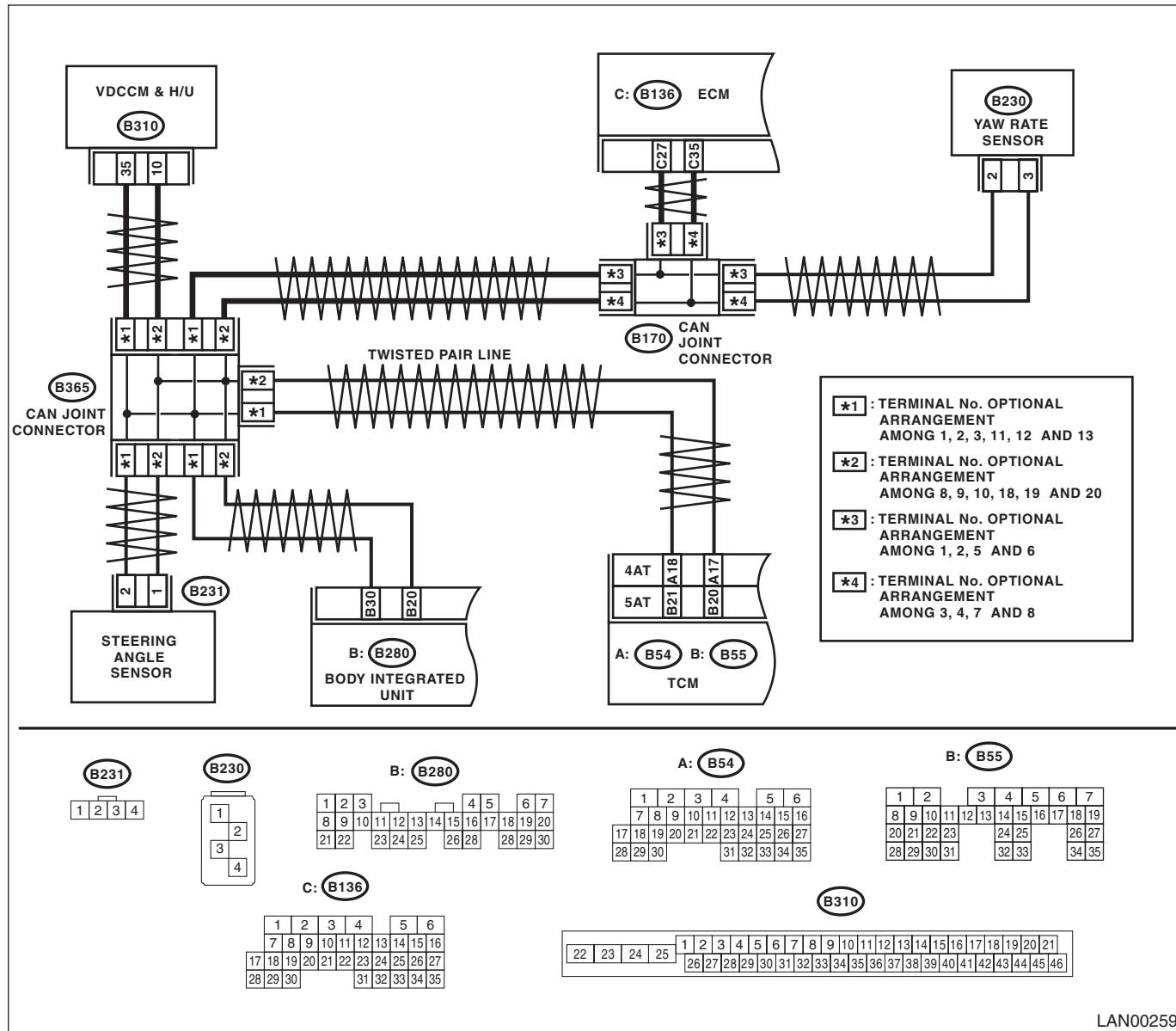
High speed CAN communication of body integrated unit which monitor the error data and non-received data are faulty.

### TROUBLE SYMPTOM:

- "Er HC" is displayed in odo/trip meter. (Except for meter with MID)
- Malfunction indicator light illuminates.

### WIRING DIAGRAM:

- VDC model:

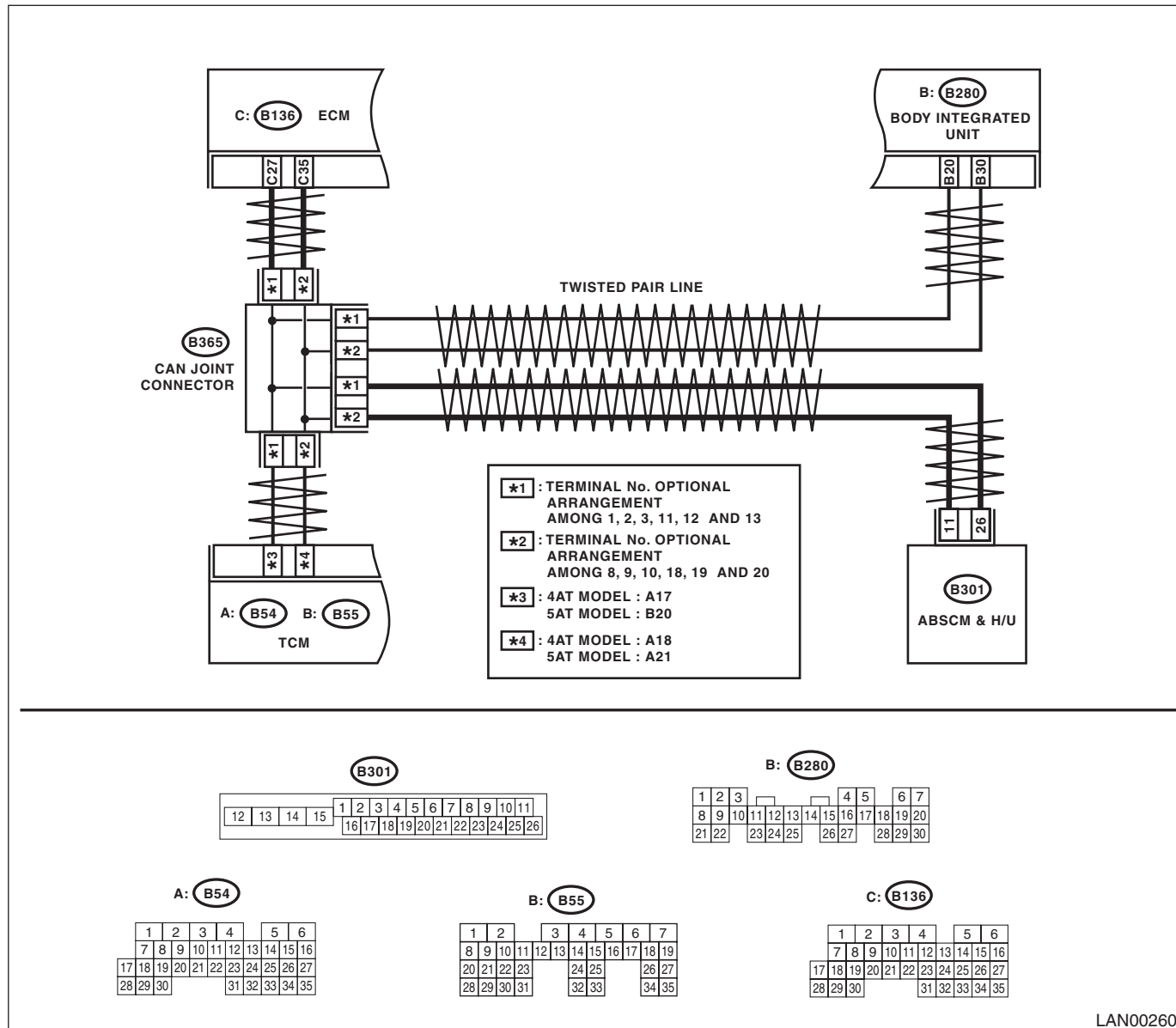


LAN00259

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

- ABS model:



LAN00260

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 4.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Go to step 5.	Go to step 4.
4	<b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
5	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Connect the tester to vehicle side connector, and measure the resistance. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 6.	Go to step 9.
6	<b>CHECK HARNESS.</b> 1) Disconnect the TCM connector (B54). 2) Connect the tester to vehicle side connector, and measure the resistance. <b>Connector &amp; terminal</b> <b>5AT model:</b> <b>(B54) No. 20 — No. 21:</b> <b>4AT model:</b> <b>(B54) No. 17 — No. 18:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 7.	Go to step 9.
7	<b>CHECK HARNESS.</b> NOTE: For ABS model, Go to step 12. 1) Disconnect the yaw rate sensor connector (B230). 2) Connect the tester to vehicle side connector, and measure the resistance. <b>Connector &amp; terminal</b> <b>(B230) No. 2 — No. 3:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 8.	Go to step 9.
8	<b>CHECK HARNESS.</b> 1) Disconnect the steering angle sensor connector (B231). 2) Connect the tester to vehicle side connector, and measure the resistance. <b>Connector &amp; terminal</b> <b>(B231) No. 1 — No. 2:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 12.	Go to step 9.
9	<b>CHECK HARNESS.</b>	Is the measured resistance 115 — 125 $\Omega$ when connecting the tester to vehicle side connector?	Go to step 12.	Go to step 10.
10	<b>CHECK HARNESS.</b>	Is the measured resistance less than 10 $\Omega$ when connecting the tester to vehicle side connector?	Repair or replace the short circuit of measured related harness.	Go to step 11.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>11</b> <b>CHECK HARNESS.</b>	Is the measured resistance 30 MΩ or more when connecting the tester to vehicle side connector?	Repair or replace the open circuit of measured related harness.	Go to step 12.
<b>12</b> <b>CHECK HARNESS.</b> 1) Disconnect the VDC/ABS CM connector. 2) Connect the tester to vehicle side harness, and measure the resistance. <b>Connector &amp; terminal</b> <b>VDC model:</b> <b>(B310) No. 10 — No. 35:</b> <b>ABS model:</b> <b>(B301) No. 11 — No. 26:</b>	Is the resistance between 115 — 125 Ω?	Go to step 13.	Go to step 14.
<b>13</b> <b>CHECK CONTROL MODULE.</b> 1) Connect the VDC/ABS CM connector. 2) Disconnect the connector from ECM. 3) Connect the tester to vehicle side harness, and measure the resistance between terminals. <b>Connector &amp; terminal</b> <b>(B136) No. 27 — No. 35:</b>	Is the resistance between 115 — 125 Ω?	Go to step 16.	Replace the VDC/ABS CM. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
<b>14</b> <b>CHECK HARNESS.</b> 1) Connect the VDC/ABS CM connector. 2) Disconnect the connector from ECM. 3) Connect the tester to vehicle side harness, and measure the resistance between terminals. <b>Connector &amp; terminal</b> <b>(B136) No. 27 — No. 35:</b>	Is the resistance between 115 — 125 Ω?	Go to step 15.	Repair or replace the open circuit of main wiring harness.
<b>15</b> <b>CHECK CONTROL MODULE.</b> Connect the tester to ECM terminal, and measure the resistance. <b>Connector &amp; terminal</b> <b>(B136) No. 27 — No. 35:</b>	Is the resistance between 115 — 125 Ω?	Go to step 16.	Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>16</b> <b>CHECK CONTROL MODULE.</b> 1) Connect all the control module connectors. 2) Connect the Subaru Select Monitor and perform the clear memory. 3) Disconnect the TCM connector (B54 or B55). 4) Turn the ignition switch to ON and read the DTC of body integrated unit. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC U1201 displayed?	Go to step 17.	Check the TCM. <Ref. to 5AT(diag)-17, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>
<b>17</b> <b>CHECK CONTROL MODULE.</b> 1) Connect the TCM control module connector. 2) Using the Subaru Select Monitor, perform the clear memory. 3) Disconnect the steering angle sensor connector (B231). 4) Turn the ignition switch to ON and read the DTC of the body integrated unit. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC U1201 displayed?	Go to step 18.	Check the steering angle sensor. <Ref. to VDC(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>18 CHECK CONTROL MODULE.</b> 1) Connect the steering angle sensor connector. 2) Using the Subaru Select Monitor, perform the clear memory. 3) Disconnect the yaw rate sensor connector (B230). 4) Turn the ignition switch to ON and read the DTC of the body integrated unit. <Ref. to LAN(diag)-12, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC U1201 displayed?	Go to step 19.	Check the yaw rate sensor. <Ref. to VDC(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>
<b>19 CHECK CONTROL MODULE.</b> 1) Connect all the control module connectors. 2) Check the data of "body integrated unit data received" on the current data display of ECM using Subaru Select Monitor.	Is the "Yes" displayed?	Go to step 20.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
<b>20 CHECK CONTROL MODULE.</b> Check the data of "body integrated unit counter update" on the data display of ECM.	Is the "Yes" displayed?	Inspect the ABS/VDC CM and ECM. <Ref. to ABS(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> <Ref. to VDC(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.> <Ref. to EN(H6DO)(diag)-44, Read Diagnostic Trouble Code (DTC).>	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

### K: DTC U1202 CAN-HS BUS OFF

#### DTC DETECTING CONDITION:

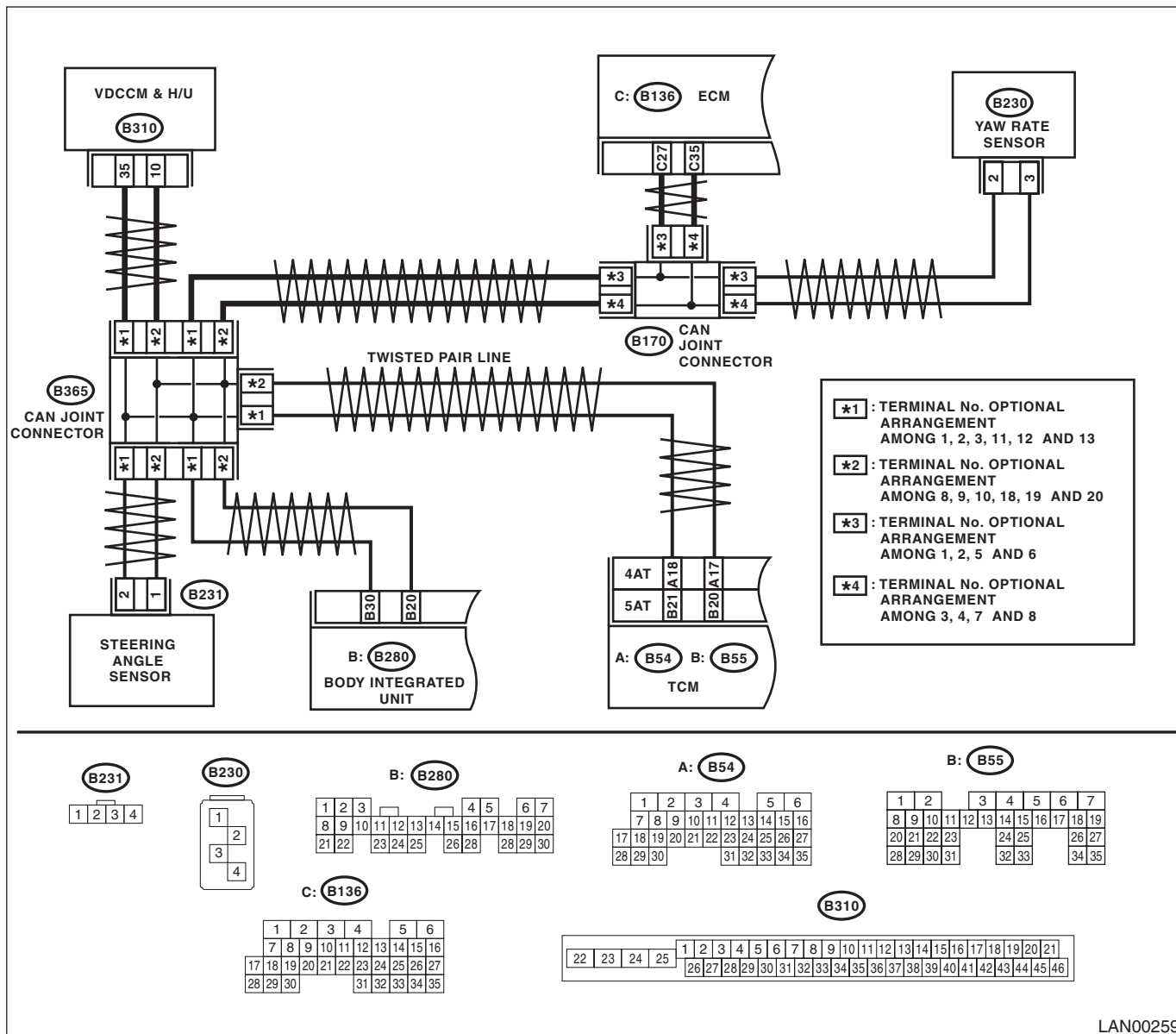
- Find the unit or CAN line in which trouble occurs, and repair and replace it.
- Not received data and error data may be detected at the same time.

#### TROUBLE SYMPTOM:

“Er HC” is displayed in odo/trip meter. (Except for meter with MID)

#### WIRING DIAGRAM:

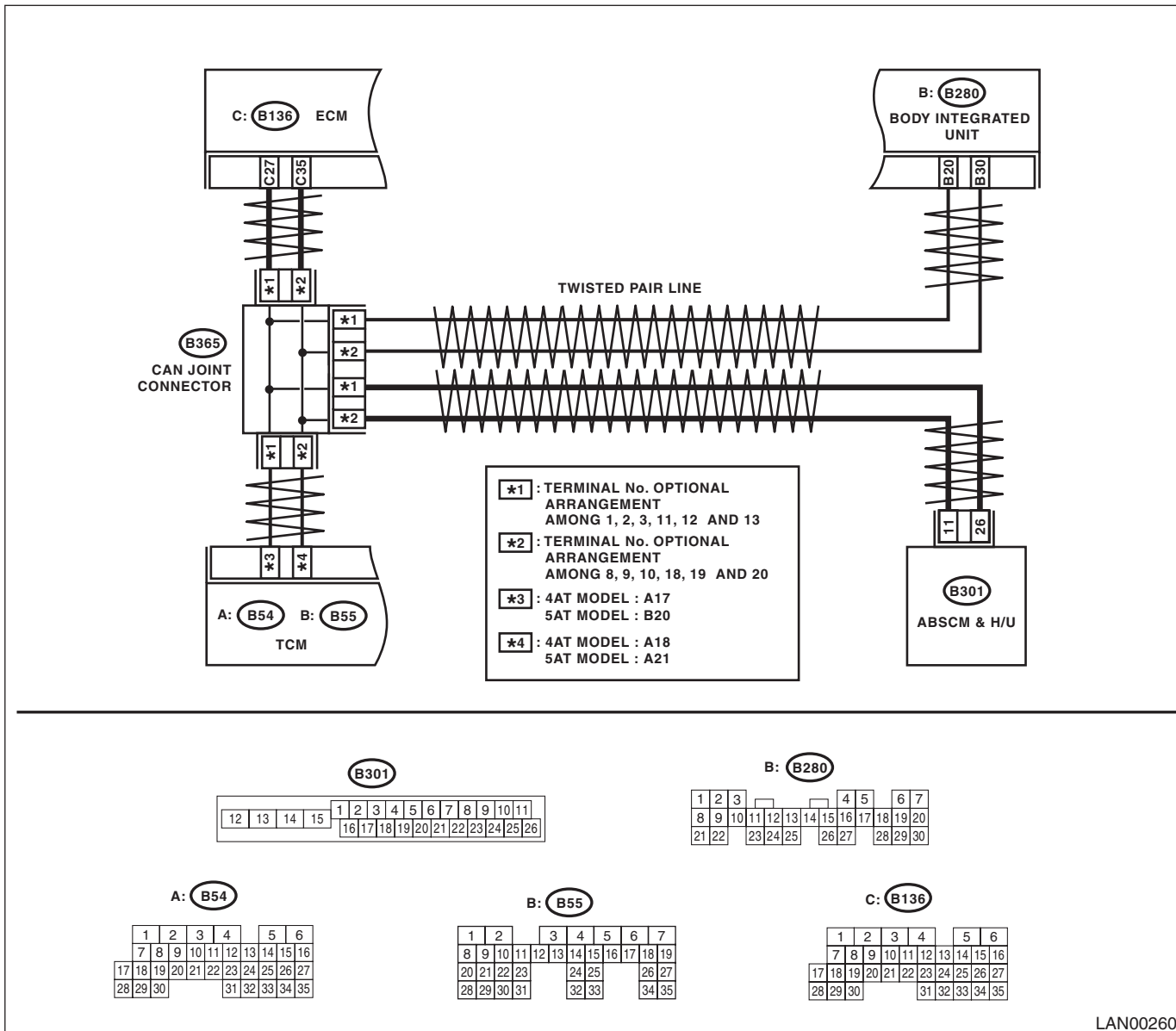
- VDC model:



LAN00259

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

- ABS model:



LAN00260



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 2.	Go to step 2.
<b>2 CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 4.	Go to step 3.
<b>3 CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 4.
<b>4 CHECK TCM.</b> 1) Disconnect the TCM connector (B54 or B55). 2) Perform the clear memory operation for the body integrated unit. <Ref. to LAN(diag)-20, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 3) Read DTC of the body integrated unit.	Is DTC (U1202) displayed?	Go to step 5.	Check the TCM. <Ref. to 5AT(diag)-17, Subaru Select Monitor.>
<b>5 CHECK STEERING ANGLE SENSOR.</b> 1) Disconnect the steering angle sensor connector (B231). 2) Perform Clear Memory Mode for the body integrated unit. <Ref. to LAN(diag)-20, CLEAR MEMORY MODE, OPERATION, Subaru Select Monitor.> 3) Read DTC of the body integrated unit.	Is DTC (U1202) displayed?	Go to step 6.	Replace the steering angle sensor. <Ref. to VDC-17, REPLACEMENT, Steering Angle Sensor.>
<b>6 CHECK YAW RATE SENSOR.</b> 1) Disconnect the yaw rate sensor connector (B230). 2) Perform Clear Memory Mode for the body integrated unit. 3) Read DTC of the body integrated unit.	Is DTC (U1202) displayed?	Go to step 7.	Check the yaw rate sensor. <Ref. to VDC(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>
<b>7 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 13.	Go to step 8.
<b>8 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance between 115 — 125 $\Omega$ ?	Go to step 10.	Go to step 9.
<b>9 CHECK HARNESS.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance 30 M $\Omega$ or more?	Open circuit in related line of body integrated unit. Repair the open circuit of harness or replace harness.	Go to step 10.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK HARNESS.</b> 1) Disconnect the VDC/ABS CM connector. 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>VDC model:</b> (B310) No. 10 — No. 35: <b>ABS model:</b> (B301) No. 11 — No. 26:	Is the resistance between 115 — 125 Ω?	Go to step 11.	Go to step 12.
<b>11 CHECK VDC/ABS CM.</b> 1) Disconnect the VDC/ABS CM connector. 2) Measure the resistance between VDC/ABS CM connector terminals. <b>Connector &amp; terminal</b> <b>VDC model:</b> (B310) No. 10 — No. 35: <b>ABS model:</b> (B301) No. 11 — No. 26:	Is the resistance between 115 — 125 Ω?	Go to step 12.	End resistance of VDC/ABS CM is open. Replace the VDC/ABS CM. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>
<b>12 CHECK ECM.</b> 1) Disconnect the ECM connector (B136). 2) Measure the resistance between ECM connector terminals. <b>Connector &amp; terminal</b> (B136) No. 27 — No. 35:	Is the resistance between 115 — 125 Ω?	Repair or replace the open circuit of the harness connector.	End resistance of ECM is open. Replace the ECM. <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>
<b>13 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> (B280) No. 20 — Chassis ground: (B280) No. 30 — Chassis ground:	Is the resistance less than 10 Ω?	Go to step 14.	Go to step 15.
<b>14 CHECK CONTROL MODULE.</b> 1) Turn the ignition switch to ON. 2) Disconnect each control module connector one by one with the tester connected to vehicle side harness. <b>Connector &amp; terminal</b> (B280) No. 20 — Chassis ground: (B280) No. 30 — Chassis ground:	Are there any modules whose resistance has become 10 Ω or more?	Replace modules whose resistance has become 10 Ω or more.	Repair or replace the short circuit of the harness.
<b>15 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the voltage between body integrated unit connector and chassis ground. <b>Connector &amp; terminal</b> (B280) No. 20 (+) — Chassis ground (-): (B280) No. 30 (+) — Chassis ground (-):	Is the voltage 6 V or more?	Go to step 16.	Go to step 17.
<b>16 CHECK CONTROL MODULE.</b> 1) Turn the ignition switch to ON. 2) Disconnect each control module connector one by one with the tester connected to vehicle side harness. <b>Connector &amp; terminal</b> (B280) No. 20 — Chassis ground: (B280) No. 30 — Chassis ground:	Is there any module for which the voltage has changed to 6 V or less?	Replace modules whose voltage has changed to 6 V or less.	Repair or replace the short circuit of the harness.

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>17</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor and read the Diagnostic Trouble Code (DTC) of ECM. <Ref. to EN(H6DO)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Go to step <b>18</b> .
<b>18</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor and read the Diagnostic Trouble Code (DTC) of VDC/ABS CM. <Ref. to VDC(diag)-14, READ DIAGNOSTIC TROUBLE CODE (DTC), OPERATION, Subaru Select Monitor.>	Is DTC other than "CAN communication" or "C0057" displayed?	Perform the diagnosis according to DTC.	Go to step <b>19</b> .
<b>19</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor and read the Diagnostic Trouble Code (DTC) of TCM. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## L: DTC U1211 CAN-HS ECM DATA ABNORMAL

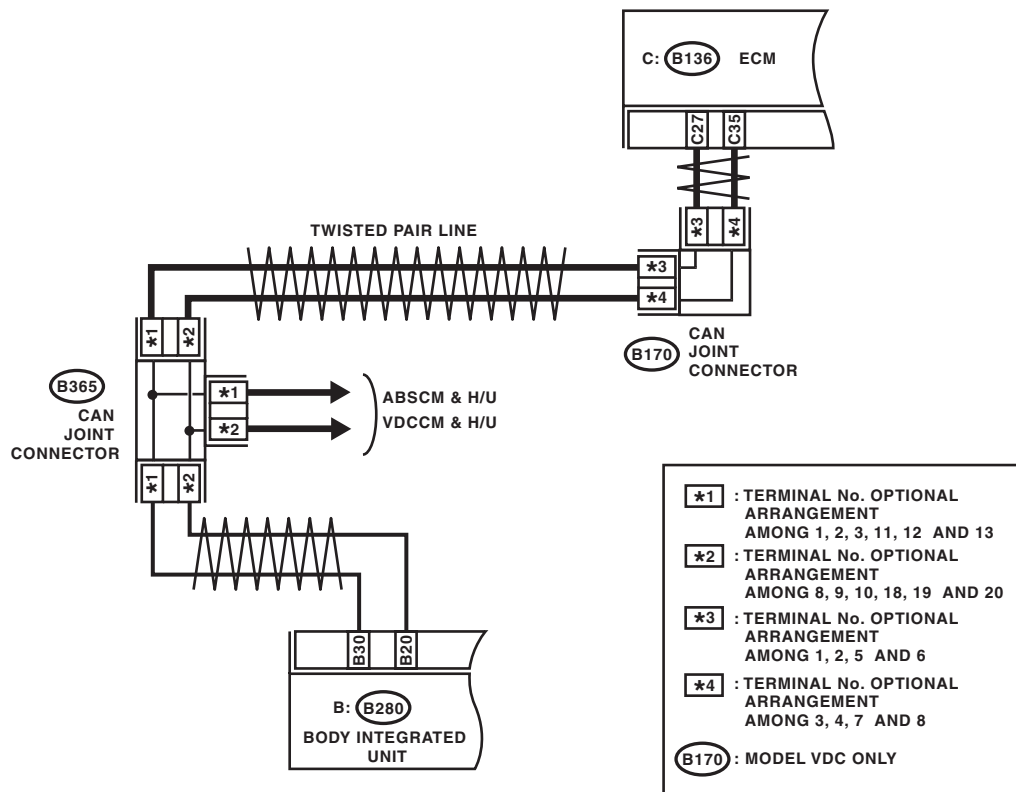
### DTC DETECTING CONDITION:

Defective data from ECM.

### TROUBLE SYMPTOM:

“Er HC” or “Er EG” is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



B: (B280)

1	2	3		4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30			

C: (B136)

1	2	3	4	5	6					
7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27
28	29	30		31	32	33	34	35		

LAN00261

## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units.	Go to step 2.
<b>2</b> <b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 4.
<b>3</b> <b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Replace the ECM. <Ref. to FU(H4DOTC)-45, REMOVAL, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, REMOVAL, Engine Control Module (ECM).> <Ref. to FU(H4SO)-37, REMOVAL, Engine Control Module (ECM).>	Go to step 4.
<b>4</b> <b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
<b>5</b> <b>CHECK ECM.</b> Read the DTC of ECM using the Subaru Select Monitor. <Ref. to EN(H6DO)(diag)-44, OPERATION, Read Diagnostic Trouble Code (DTC).>	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Replace the body integrated unit. <Ref. to SL-55, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## M: DTC U1212 CAN-HS TCM DATA ABNORMAL

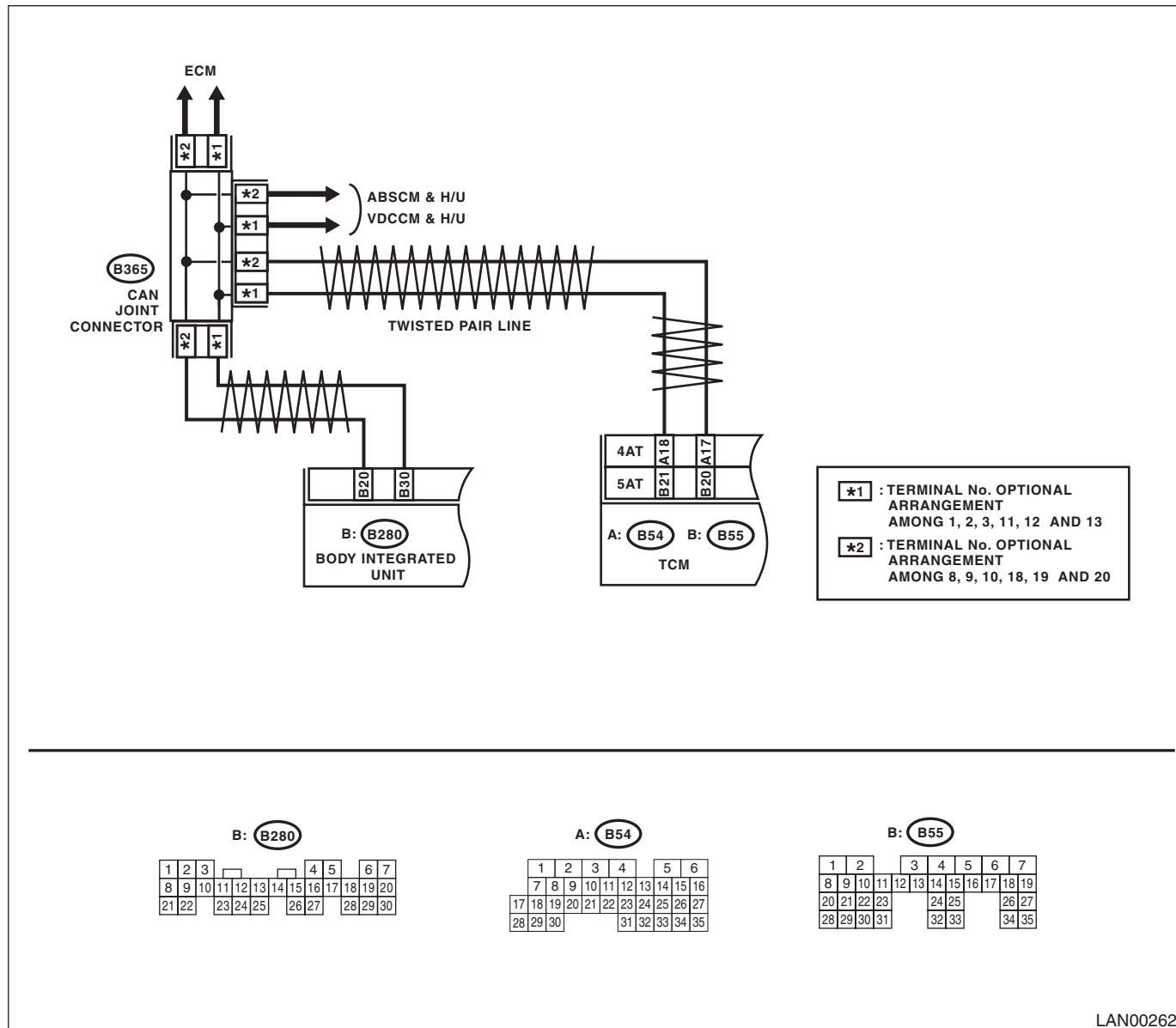
### DTC DETECTING CONDITION:

TCM has error, harness between the main harness splice and TCM is open or shorted, connectors are not connected securely, or the terminal has poor crimping.

### TROUBLE SYMPTOM:

- SPORT indicator light blinks.
- "Er HC" or "Er tC" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00262

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 4.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Replace the TCM. <Ref. to 5AT-59, Transmission Control Module (TCM).>	Go to step 4.
4	<b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
5	<b>CHECK TCM.</b> Read the DTC of the TCM using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## N: DTC U1213 CAN-HS VDC/ABS DATA ABNORMAL

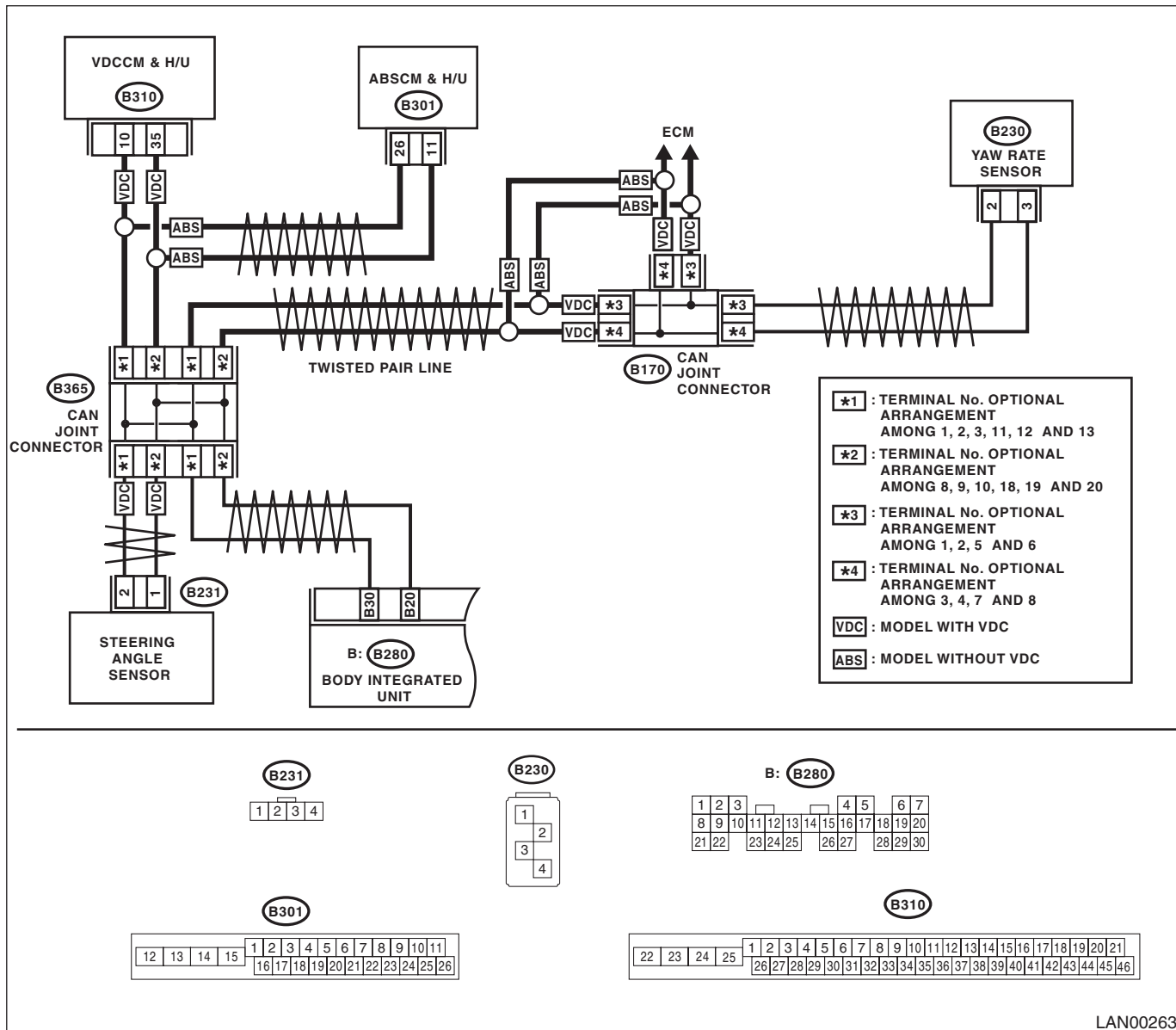
### DTC DETECTING CONDITION:

VDC/ABSCM itself is malfunctioning, the main harness is open or shorted, the connector is not connected properly, or the terminal is crimped poorly.

### TROUBLE SYMPTOM:

- ABS warning light and VDC warning light illuminates.
- "Er HC" or "Er Ab" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00263



## Diagnostic Procedure with Diagnostic Trouble Code (DTC)

### LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units.	Go to step 2.
<b>2</b> <b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 4.
<b>3</b> <b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Replace the VDC/ABS CM. <Ref. to VDC-7, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>	Go to step 4.
<b>4</b> <b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
<b>5</b> <b>CHECK VDC/ABS CM.</b> Read the DTC of VDCCM using the Subaru Select Monitor.	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## O: DTC U1221 CAN-HS ECM NO-RECEIVE DATA

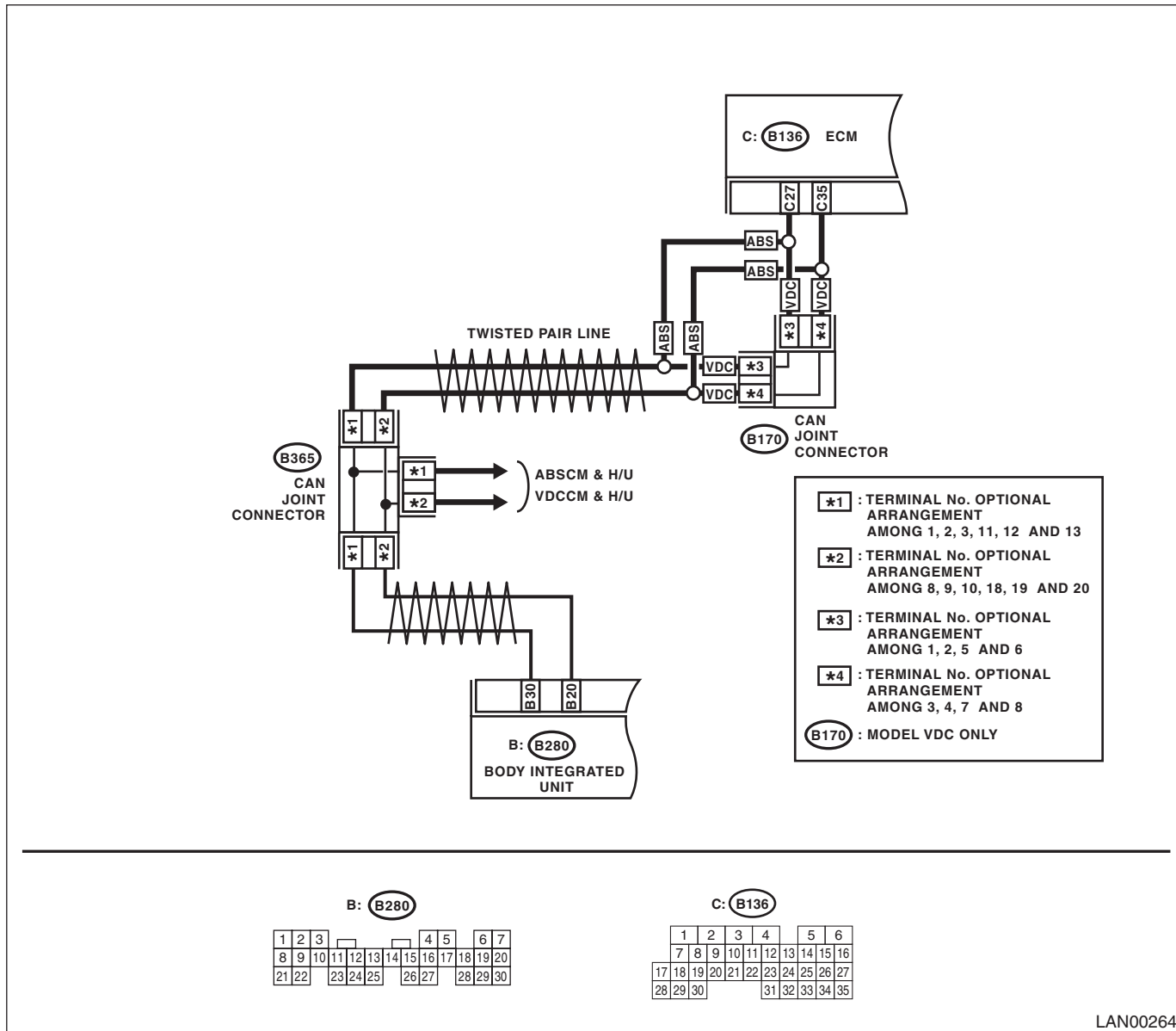
### DTC DETECTING CONDITION:

Defective ECM. (If error is in the main harness, DTC P0600 CAN communication link is input simultaneously.)

### TROUBLE SYMPTOM:

- Malfunction indicator light illuminates.
- "Er HC" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00264

Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units. Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3. Go to step 3.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Go to step 5.	Go to step 4.
4	<b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
5	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between harness connectors. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance 55 — 65 $\Omega$ ? (Standard value: 60 $\Omega$ )	Go to step 8.	Go to step 6.
6	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280). 2) Measure the resistance between harness connectors. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance 115 — 125 $\Omega$ ? (End resistance or main wiring harness is open.)	Go to step 7.	If the resistance is 1 M $\Omega$ or larger, a line related to the body integrated unit is open. Repair the open circuit of harness or replace harness.
7	<b>CHECK ECM.</b> Read the DTC of ECM using the Subaru Select Monitor. <Ref. to EN(H6DO)(diag)-35, READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>	Are there any DTCs other than one for "CAN communication"?	Perform the diagnosis according to DTC. <Ref. to EN(H6DO)(diag)-35, READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>	Go to step 8.
8	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Connect all the control module connectors. 2) Check the data of "body integrated unit data received" on the current data display of ECM using Subaru Select Monitor.	Is the "Yes" displayed?	Go to step 9.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
9	<b>CHECK BODY INTEGRATED UNIT.</b> Check the data of "body integrated unit counter update" on the data display of ECM.	Is the "Yes" displayed?	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>	Inspect the ECM. <Ref. to FU(H4SO)-37, REMOVAL, Engine Control Module (ECM).> <Ref. to FU(H4DOTC)-45, REMOVAL, Engine Control Module (ECM).> <Ref. to FU(H6DO)-37, Engine Control Module (ECM).>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## P: DTC U1222 CAN-HS TCM NO-RECEIVE DATA

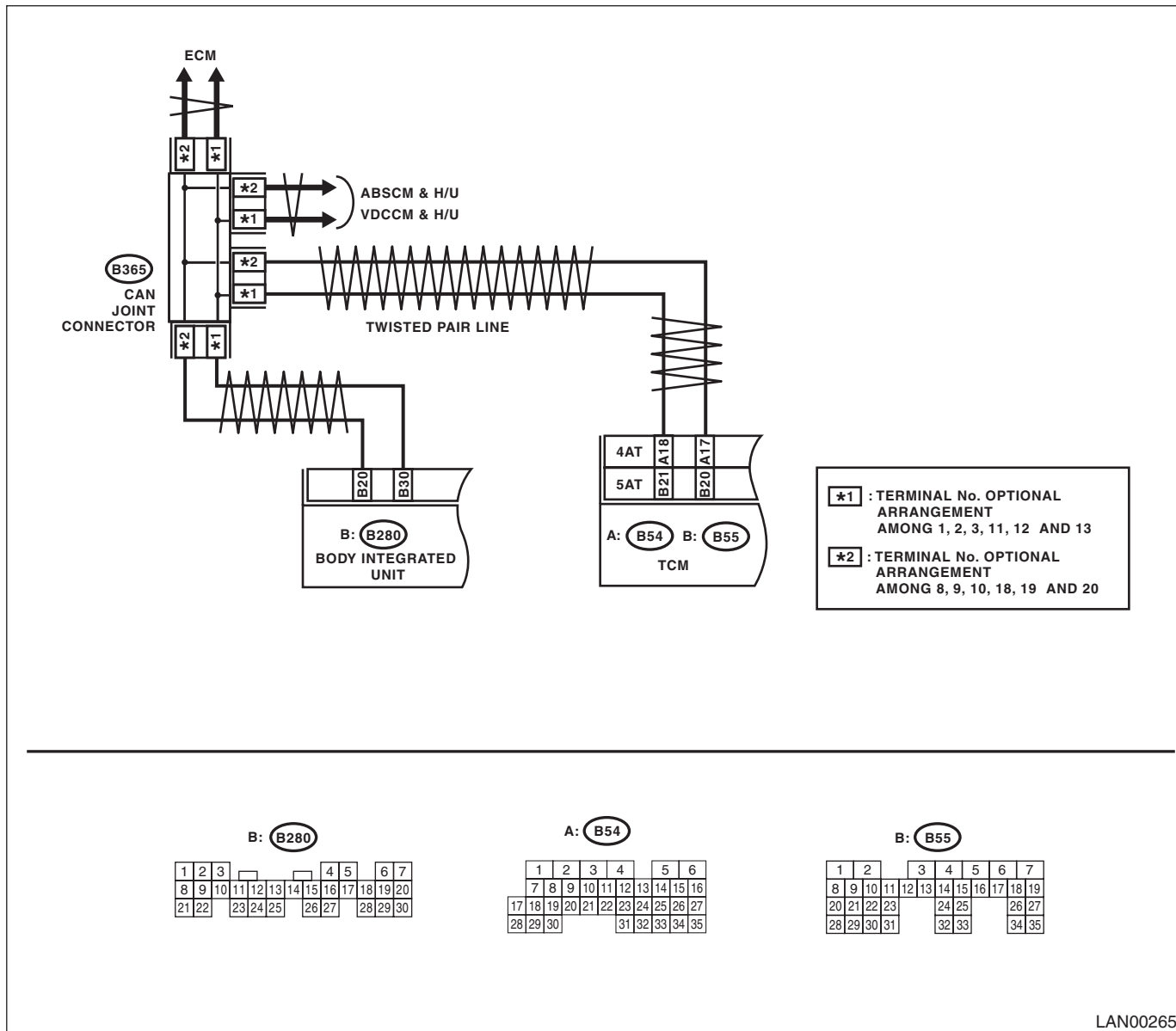
### DTC DETECTING CONDITION:

TCM has error, harness between the main harness splice and TCM is open or shorted, connectors are not connected securely, or the terminal has poor crimping.

### TROUBLE SYMPTOM:

- Malfunction indicator light illuminates.
- "Er HC" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00265

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1</b> <b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control units.	Go to step 2.
<b>2</b> <b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
<b>3</b> <b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Go to step 5.	Go to step 4.
<b>4</b> <b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
<b>5</b> <b>CHECK HARNESS.</b> 1) Disconnect the TCM connector (B54 or B55). 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>4AT model:</b> <b>(B54) No. 17 — No. 18:</b> <b>5AT model:</b> <b>(B55) No. 20 — No. 21:</b>	Is the resistance 1 MΩ or more?	Open circuit in related lines of TCM. Repair the open circuit of harness or replace harness.	Go to step 6.
<b>6</b> <b>CHECK TCM.</b> Read the DTC of the TCM using Subaru Select Monitor. <Ref. to 5AT(diag)-17, OPERATION, Subaru Select Monitor.>	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC.	Go to step 7.
<b>7</b> <b>CHECK BODY INTEGRATED UNIT.</b> 1) Connect all the control module connectors. 2) Check the data of "body integrated unit data received" on the current data display of ECM using Subaru Select Monitor.	Is the "Yes" displayed?	Go to step 8.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
<b>8</b> <b>CHECK BODY INTEGRATED UNIT.</b> Check the data of "body integrated unit counter update" on the data display of ECM.	Is the "Yes" displayed?	Replace the TCM. <Ref. to 4AT-64, REMOVAL, Transmission Control Module (TCM).> <Ref. to 5AT-59, REMOVAL, Transmission Control Module (TCM).>	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## Q: DTC U1223 CAN-HS VDC/ABS NO-RECEIVE DATA

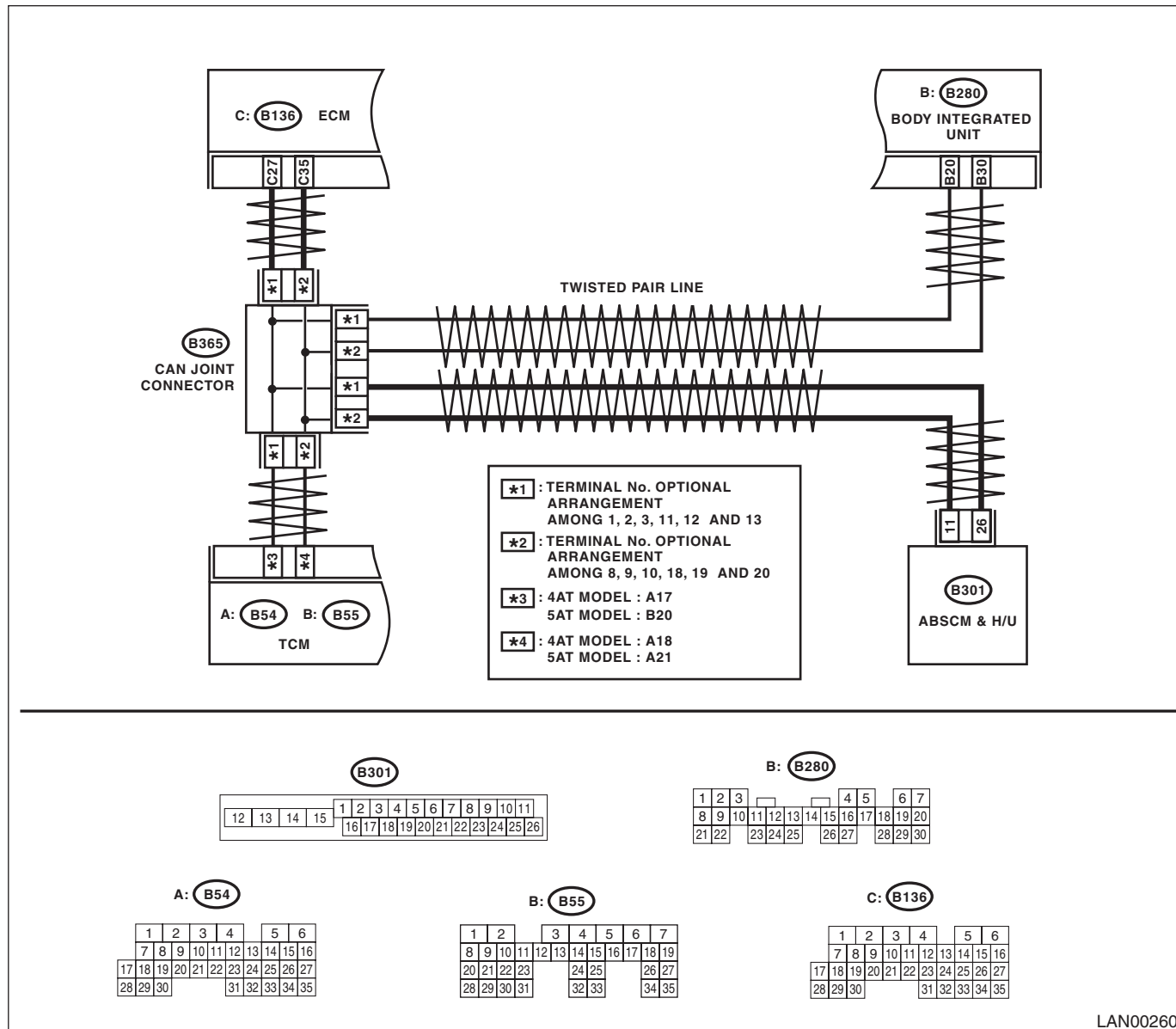
### DTC DETECTING CONDITION:

Defective VDC/ABSCM. (If error is in the main harness, DTC P0600 High-speed CAN circuit is input at the same time.)

### TROUBLE SYMPTOM:

- ABS warning light and VDC warning light illuminates.
- "Er HC" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00260

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read all DTCs.	Are there DTCs other than that of body integrated unit?	Perform the diagnosis according to DTCs for other control modules.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Does the displayed DTC indicate current malfunction?	Go to step 5.	Go to step 4.
4	<b>CHECK CURRENT DATA.</b> Using the Subaru Select Monitor, display engine speed and vehicle speed signal from ECM, TCM, VDC/ABS and body integrated unit under the same conditions and compare data.	Does each data match each other?	Temporary poor contact occurs. Perform the clear memory operation.	Go to step 5.
5	<b>CHECK HARNESS.</b> 1) Disconnect the harness connector of body integrated unit. 2) Measure the resistance between harness connector terminals. <b>Connector &amp; terminal</b> <b>(B280) No. 20 — No. 30:</b>	Is the resistance between 55 — 65 $\Omega$ ?	Go to step 6.	Open circuit in related line of body integrated unit. Repair the open circuit of harness or replace harness.
6	<b>CHECK VDC/ABS CM.</b> 1) Connect all connectors. 2) Read the DTC of VDC/ABS CM using the Subaru Select Monitor.	Is DTC other than "CAN communication" displayed?	Perform the diagnosis according to DTC of VDC/ABS CM.	Go to step 7.
7	<b>CHECK BODY INTEGRATED UNIT.</b> 1) Connect all the control module connectors. 2) Check the data of "body integrated unit data received" on the current data display of ECM using Subaru Select Monitor.	Is the "Yes" displayed?	Go to step 8.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
8	<b>CHECK BODY INTEGRATED UNIT.</b> Check the data of "body integrated unit counter update" on the data display of ECM.	Is the "Yes" displayed?	Replace the VDC/ABS CM. <Ref. to VDC-7, REMOVAL, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).> <Ref. to ABS-6, REMOVAL, ABS Control Module and Hydraulic Control Unit (ABSCM&H/U).>	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## R: DTC U1300 CAN-LS MALFUNCTION

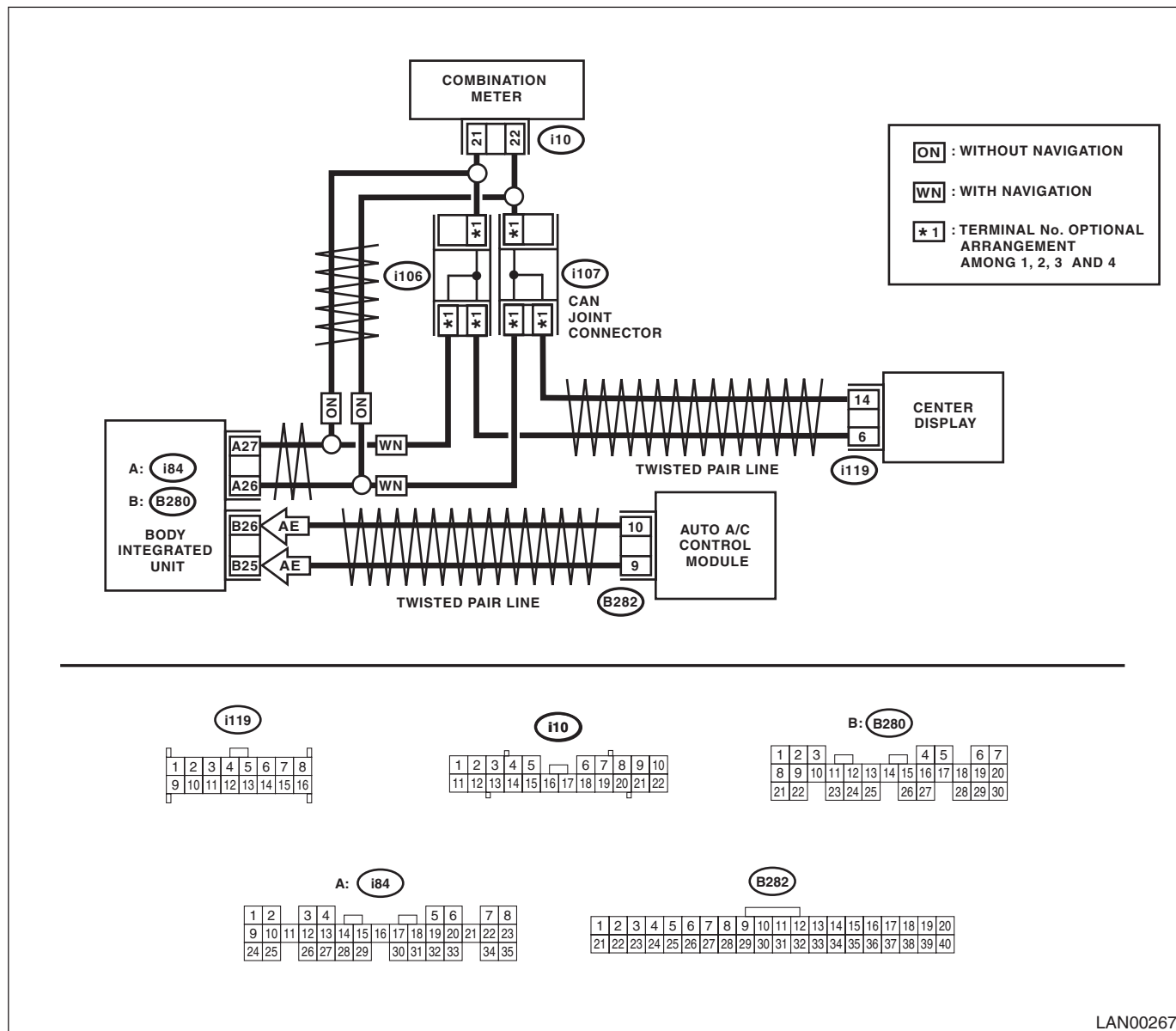
### DTC DETECTING CONDITION:

Either end of low-speed CAN communication line is open or shorted, the connector is not connected properly, or the terminal has poor crimping.

### TROUBLE SYMPTOM:

"Er LC" is displayed in odo/trip meter (except for meters with MID), but communicating function is normal.

### WIRING DIAGRAM:



LAN00267



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read DTC of body integrated unit.	Are there DTCs other than U1300?	Perform the diagnosis according to other DTCs.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Is U1300 current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Is U1300 current malfunction?	Go to step 4.	Temporary poor contact occurs.
4	<b>CHECK CURRENT DATA.</b> Display the current data (Auto A/C failure) of body integrated unit using the Subaru Select Monitor.	Is OK displayed?	Go to step 5.	Perform auto A/C self-diagnosis. <Ref. to AC(diag)-9, OPERATION, Diagnostic Chart for Self-diagnosis.>
5	<b>CHECK AUTO A/C ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the auto A/C ECM connector (B282). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1300 detected?	Go to step 6.	Go to step 7.
6	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and auto A/C control module connector (B282). 2) Check open or short conditions between body integrated unit connector and auto A/C control module connector. <b>Connector &amp; terminal</b> <b>(B282) No. 10 — (B280) No. 26:</b> <b>(B282) No. 9 — (B280) No. 25:</b>	Is harness normal?	Replace auto A/C ECM. <Ref. to AC-34, REMOVAL, Control Unit (Auto A/C Model).>	Repair or replace the open or short circuit of harness.
7	<b>CHECK CURRENT DATA.</b> Check current data (center display failure) of the body integrated unit.	Is OK displayed?	Go to step 8.	Repair or replace the center display. <Ref. to ET-15, REMOVAL, Navigation Display.>
8	<b>CHECK CENTER DISPLAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the center display connector (i119). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1300 detected?	Go to step 10.	Go to step 9.
9	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (i84) and center display connector (i119). 2) Check open or short conditions between body integrated unit connector and center display connector. <b>Connector &amp; terminal</b> <b>(i119) No. 14 — (i84) No. 26:</b> <b>(i119) No. 6 — (i84) No. 27:</b>	Is harness normal?	Replace the center display. <Ref. to ET-15, REMOVAL, Navigation Display.>	Repair or replace the open or short circuit of harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK CURRENT DATA.</b> Check current data (meter failure) of the body integrated unit.	Is OK displayed?	Go to step 11.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>11 CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the combination meter connector (i10). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1300 detected?	Go to step 12.	Go to step 13.
<b>12 CHECK HARNESS.</b> 1) Disconnect the combination meter connector (i10). 2) Check open or short conditions between body integrated unit connector and combination meter connector. <i>Connector &amp; terminal</i> <i>(i10) No. 21 — (i84) No. 27:</i> <i>(i10) No. 22 — (i84) No. 26:</i>	Is harness normal?	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>	Repair or replace the open or short circuit of harness.
<b>13 CHECK HARNESS.</b> 1) Disconnect connectors of A/C ECM (B282), center monitor (i119), combination meter (i10) and body integrated unit connector (i84). 2) Measure the resistance between connector terminals. <i>Connector &amp; terminal</i> <i>(i84) No. 27 — (i84) No. 26:</i>	Is the resistance 1 M $\Omega$ or more?	Go to step 14.	Repair the short circuit of harness or replace harness.
<b>14 CHECK HARNESS.</b> 1) Connect the disconnected connectors. 2) Measure the resistance between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 — Chassis ground:</i> <i>(B280) No. 26 — Chassis ground:</i> <i>(i84) No. 26 — Chassis ground:</i> <i>(i84) No. 27 — Chassis ground:</i>	Is the resistance less than 10 $\Omega$ ?	Repair the short circuit of harness or replace harness.	Go to step 15.
<b>15 CHECK HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 (+) — Chassis ground (-):</i> <i>(B280) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 27 (+) — Chassis ground (-):</i>	Is the voltage 6 V or more?	Repair the short circuit of harness or replace harness.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## S: DTC U1301 CAN-LS COUNTER ABNORMAL

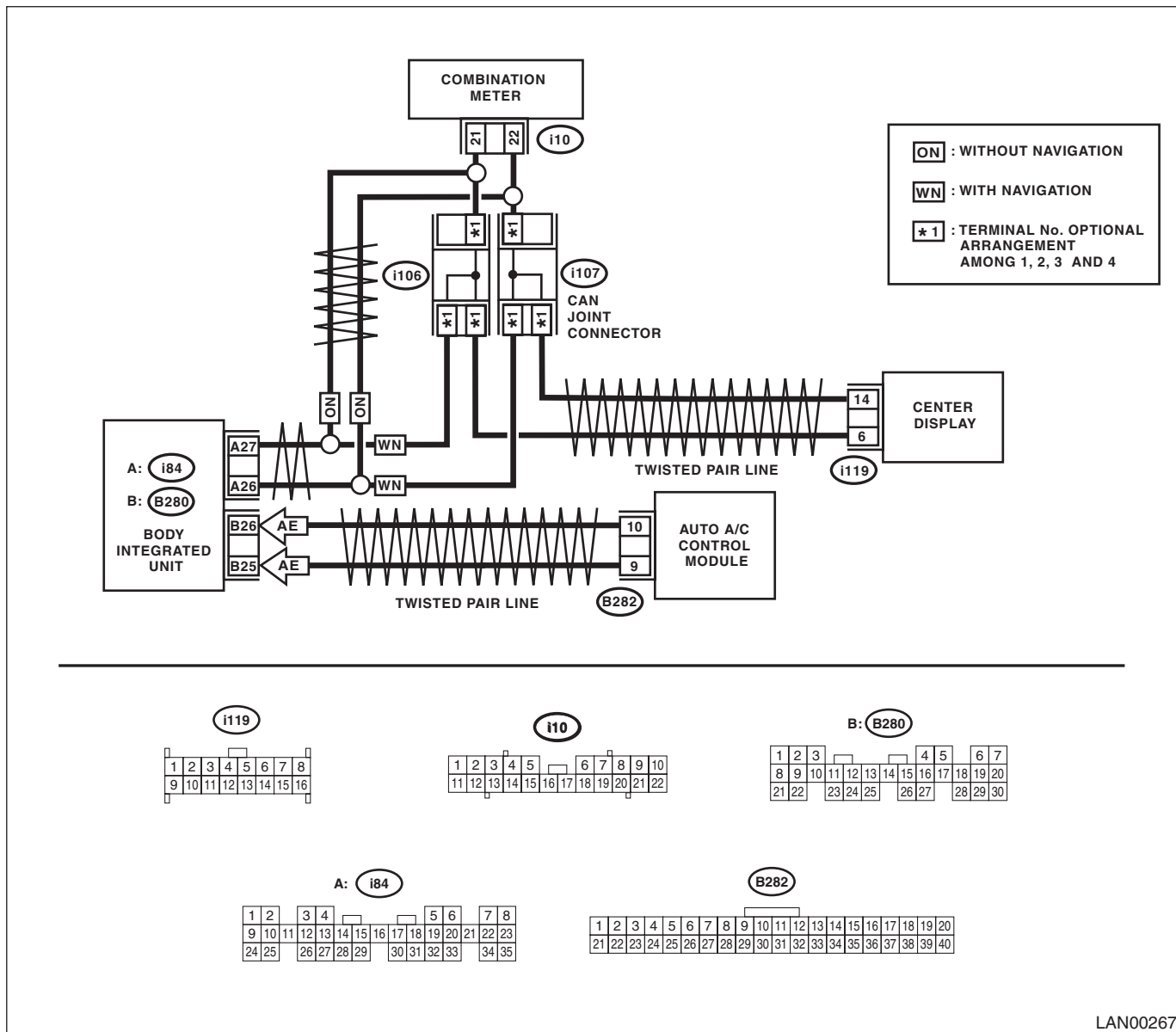
### DTC DETECTING CONDITION:

Find the unit in which trouble occurs and open or short CAN line, and repair and replace them.  
(Free running counter error may be detected at the same time from the unit in which the malfunction occurs.)

### TROUBLE SYMPTOM:

“Er LC” is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00267

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read DTC of body integrated unit.	Are there DTCs other than U1301?	Perform the diagnosis according to other DTCs.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Is U1301 current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Is U1301 current malfunction?	Go to step 4.	Temporary poor contact occurs.
4	<b>CHECK CURRENT DATA.</b> Display the current data (Auto A/C failure) of body integrated unit using the Subaru Select Monitor.	Is OK displayed?	Go to step 5.	Perform auto A/C self-diagnosis. <Ref. to AC(diag)-9, OPERATION, Diagnostic Chart for Self-diagnosis.>
5	<b>CHECK AUTO A/C ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the auto A/C ECM connector (B282). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1301 detected?	Go to step 7.	Go to step 6.
6	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and auto A/C control module connector (B282). 2) Check open or short conditions between body integrated unit connector and auto A/C control module connector. <b>Connector &amp; terminal</b> <b>(B282) No. 10 — (B280) No. 26:</b> <b>(B282) No. 9 — (B280) No. 25:</b>	Is harness normal?	Replace auto A/C ECM. <Ref. to AC-34, REMOVAL, Control Unit (Auto A/C Model).>	Repair or replace the open or short circuit of harness.
7	<b>CHECK CURRENT DATA.</b> Check current data (center display failure) of the body integrated unit.	Is OK displayed?	Go to step 8.	Repair or replace the center display. <Ref. to ET-15, REMOVAL, Navigation Display.>
8	<b>CHECK CENTER DISPLAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the center display connector (i119). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1301 detected?	Go to step 10.	Go to step 9.
9	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and center display connector (i119). 2) Check open or short conditions between body integrated unit connector and center display connector. <b>Connector &amp; terminal</b> <b>(i119) No. 14 — (i84) No. 26:</b> <b>(i119) No. 6 — (i84) No. 27:</b>	Is harness normal?	Replace the center display. <Ref. to AC-34, REMOVAL, Control Unit (Auto A/C Model).>	Repair or replace the open or short circuit of harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK CURRENT DATA.</b> Check current data (meter failure) of the body integrated unit.	Is OK displayed?	Go to step 11.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>11 CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the combination meter connector (i10). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1301 detected?	Go to step 13.	Go to step 12.
<b>12 CHECK HARNESS.</b> 1) Disconnect the combination meter connector (i10). 2) Check open or short conditions between body integrated unit connector and combination meter connector. <i>Connector &amp; terminal</i> <i>(i10) No. 21 — (i84) No. 27:</i> <i>(i10) No. 22 — (i84) No. 26:</i>	Is harness normal?	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>	Repair or replace the open or short circuit of harness.
<b>13 CHECK HARNESS.</b> 1) Disconnect connectors of A/C ECM (B282), center monitor (i119), combination meter (i10) and body integrated unit connector (i84). 2) Measure the resistance between connector terminals. <i>Connector &amp; terminal</i> <i>(i84) No. 27 — (i84) No. 26:</i>	Is the resistance 1 MΩ or more?	Go to step 14.	Repair the short circuit of harness or replace harness.
<b>14 CHECK HARNESS.</b> 1) Connect the disconnected connectors. 2) Measure the resistance between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 — Chassis ground:</i> <i>(B280) No. 26 — Chassis ground:</i> <i>(i84) No. 26 — Chassis ground:</i> <i>(i84) No. 27 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Repair the short circuit of harness or replace harness.	Go to step 15.
<b>15 CHECK HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 (+) — Chassis ground (-):</i> <i>(B280) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 27 (+) — Chassis ground (-):</i>	Is the voltage 6 V or more?	Repair the short circuit of harness or replace harness.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## T: DTC U1302 CAN-LS BUS OFF

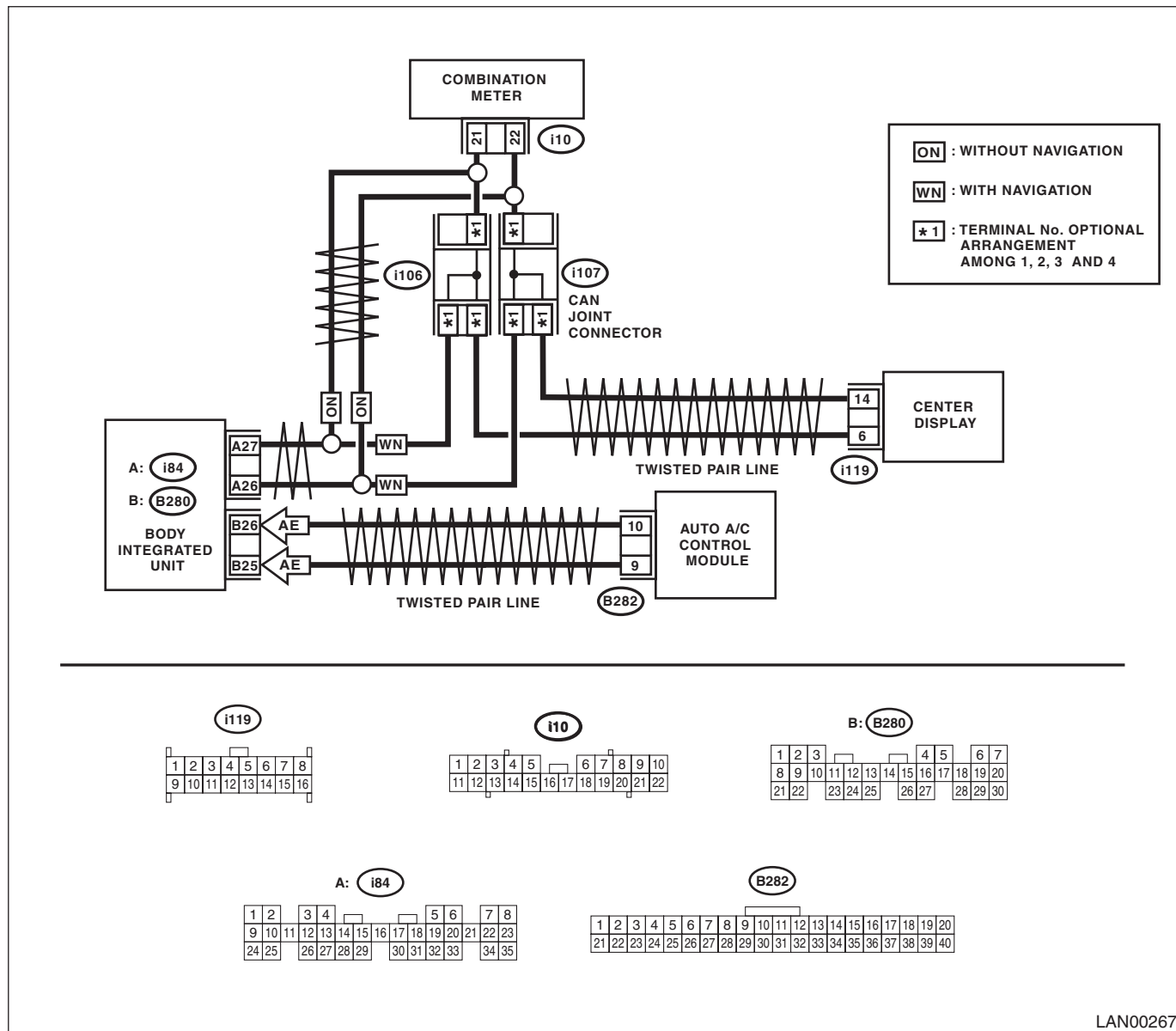
### DTC DETECTING CONDITION:

- Because of a lot of error data occurred, some units have been disconnected not to affect other units.
- Communication failure from the unit in which error is occurred is input at the same time.

### TROUBLE SYMPTOM:

“Er LC” is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00267

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>1 CHECK DTC.</b> Connect the Subaru Select Monitor to read DTC of body integrated unit.	Are there DTCs other than U1302?	Perform the diagnosis according to other DTCs.	Go to step 2.
<b>2 CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
<b>3 CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Is U1302 current malfunction?	Go to step 4.	Temporary poor contact occurs.
<b>4 CHECK CURRENT DATA.</b> Display the current data (Auto A/C failure) of body integrated unit using the Subaru Select Monitor.	Is OK displayed?	Go to step 5.	Perform auto A/C self-diagnosis. <Ref. to AC(diag)-9, OPERATION, Diagnostic Chart for Self-diagnosis.>
<b>5 CHECK AUTO A/C ECM.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the auto A/C ECM connector (B282). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1302 detected?	Go to step 7.	Go to step 6.
<b>6 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and auto A/C control module connector (B282). 2) Check open or short conditions between body integrated unit connector and auto A/C control module connector. <i>Connector &amp; terminal</i> <i>(B282) No. 10 — (B280) No. 26:</i> <i>(B282) No. 9 — (B280) No. 25:</i>	Is harness normal?	Replace auto A/C ECM. <Ref. to AC-34, REMOVAL, Control Unit (Auto A/C Model).>	Repair or replace the open or short circuit of harness.
<b>7 CHECK CURRENT DATA.</b> Check current data (center display failure) of the body integrated unit.	Is OK displayed?	Go to step 8.	Repair or replace the center display. <Ref. to ET-15, REMOVAL, Navigation Display.>
<b>8 CHECK CENTER DISPLAY.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the center display connector (i119). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1302 detected?	Go to step 10.	Go to step 9.
<b>9 CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (B280) and center display connector (i119). 2) Check open or short conditions between body integrated unit connector and center display connector. <i>Connector &amp; terminal</i> <i>(i119) No. 14 — (i84) No. 26:</i> <i>(i119) No. 6 — (i84) No. 27:</i>	Is harness normal?	Replace the center display. <Ref. to AC-34, REMOVAL, Control Unit (Auto A/C Model).>	Repair or replace the open or short circuit of harness.

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

Step	Check	Yes	No
<b>10 CHECK CURRENT DATA.</b> Check current data (meter failure) of the body integrated unit.	Is OK displayed?	Go to step 11.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>
<b>11 CHECK COMBINATION METER.</b> 1) Turn the ignition switch to OFF. 2) Disconnect the combination meter connector (i10). 3) Connect the Subaru Select Monitor and then turn the ignition switch to ON. 4) Perform the clear memory operation for the body integrated unit. 5) Read the DTC of the body integrated unit.	Is DTC U1302 detected?	Go to step 13.	Go to step 12.
<b>12 CHECK HARNESS.</b> 1) Disconnect the combination meter connector (i10). 2) Check open or short conditions between body integrated unit connector and combination meter connector. <i>Connector &amp; terminal</i> <i>(i10) No. 21 — (i84) No. 27:</i> <i>(i10) No. 22 — (i84) No. 26:</i>	Is harness normal?	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>	Repair or replace the open or short circuit of harness.
<b>13 CHECK HARNESS.</b> 1) Disconnect connectors of A/C ECM (B282), center monitor (i119), combination meter (i10) and body integrated unit connector (i84). 2) Measure the resistance between connector terminals. <i>Connector &amp; terminal</i> <i>(i84) No. 27 — (i84) No. 26:</i>	Is the resistance 1 MΩ or more?	Go to step 14.	Repair the short circuit of harness or replace harness.
<b>14 CHECK HARNESS.</b> 1) Connect the disconnected connectors. 2) Measure the resistance between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 — Chassis ground:</i> <i>(B280) No. 26 — Chassis ground:</i> <i>(i84) No. 26 — Chassis ground:</i> <i>(i84) No. 27 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Repair the short circuit of harness or replace harness.	Go to step 15.
<b>15 CHECK HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between body integrated unit connector and chassis ground. <i>Connector &amp; terminal</i> <i>(B280) No. 25 (+) — Chassis ground (-):</i> <i>(B280) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 26 (+) — Chassis ground (-):</i> <i>(i84) No. 27 (+) — Chassis ground (-):</i>	Is the voltage 6 V or more?	Repair the short circuit of harness or replace harness.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>



# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## U: DTC U1311 CAN-LS METER UNIT DATA ABNORMAL

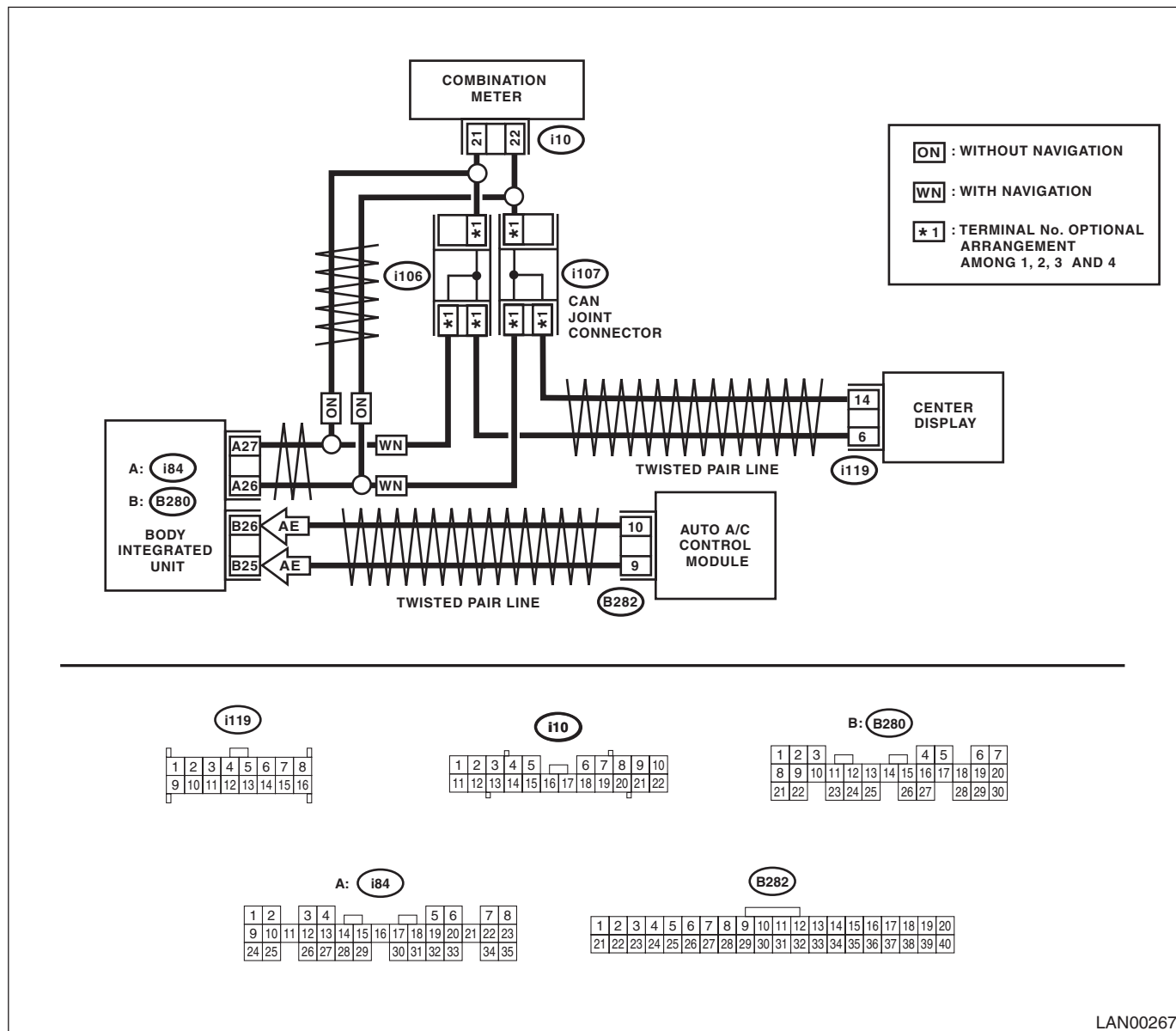
### DTC DETECTING CONDITION:

Combination meter has error, the harness between main harness splice and combination meter is open or shorted, the connector is not connected properly, or the terminal has poor crimping.

### TROUBLE SYMPTOM:

"Er Lc" is displayed in odo/trip meter. (Except for meter with MID)

### WIRING DIAGRAM:



LAN00267

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

	<b>Step</b>	<b>Check</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read DTC of body integrated unit.	Are there DTCs other than U1311?	Perform the diagnosis according to other DTCs.	Go to step 2.
<b>2</b>	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 3.
<b>3</b>	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Is U1311 current malfunction?	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>	Go to step 4.
<b>4</b>	<b>CHECK COMBINATION METER.</b> Perform self-diagnosis of the combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is the self-diagnosis OK?	Temporary poor contact occurs.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

### V: DTC U1313 CAN-LS MONITOR DATA ABNORMAL

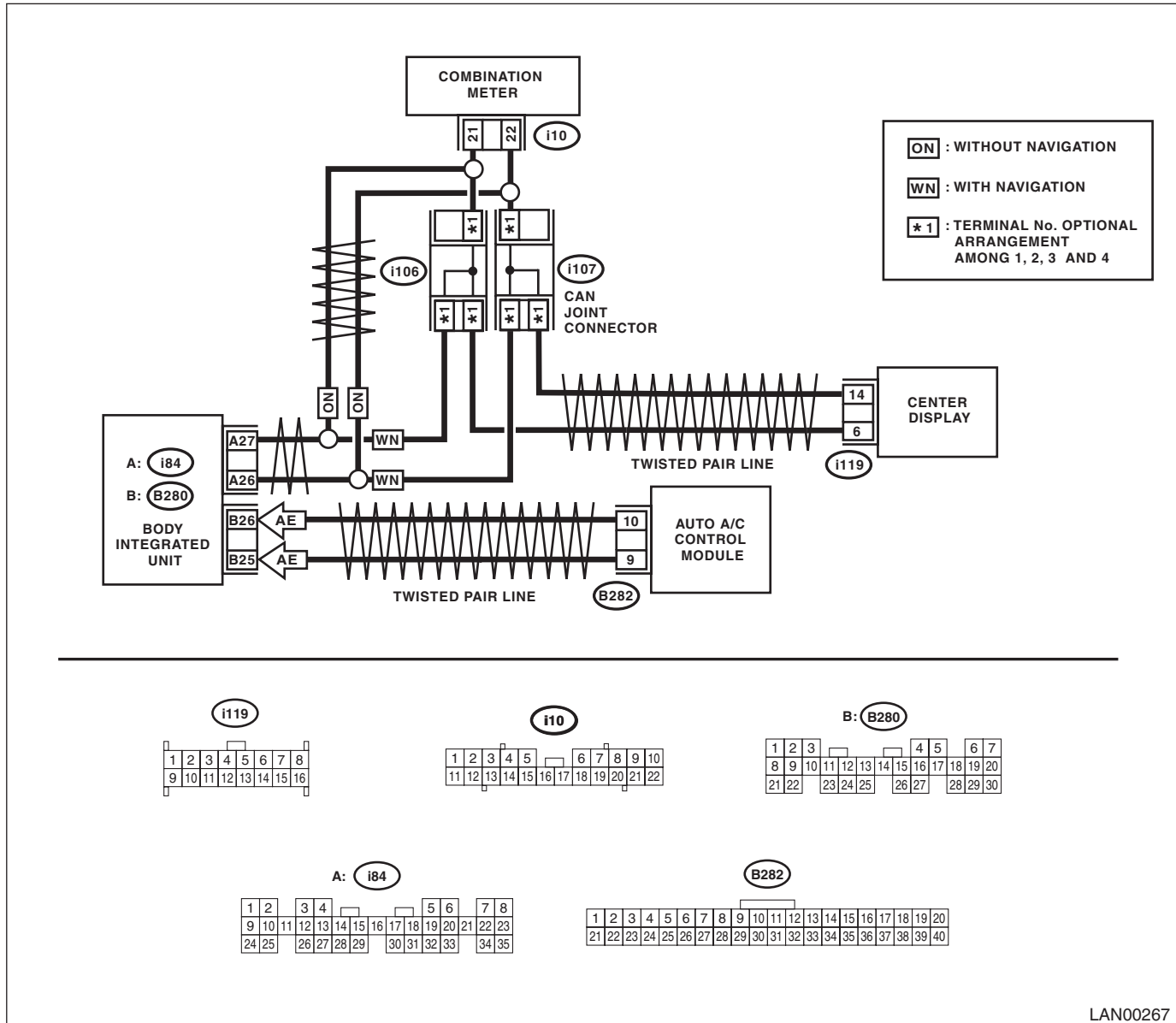
#### DTC DETECTING CONDITION:

Center display unit error, or harness between the main harness splice and center display unit is open or shorted, the connector is not connected securely and the terminal has poor crimping.

#### TROUBLE SYMPTOM:

“Er LC” is displayed in odo/trip meter. (Except for meter with MID)

#### WIRING DIAGRAM:



LAN00267

Step	Check	Yes	No
1	<b>CHECK CENTER MONITOR.</b> 1) Display the current data of body integrated unit using Subaru Select Monitor. 2) Display the center display failure.	Go to step 2.	Refer to the navigation display. <Ref. to ET-15, REMOVAL, Navigation Display.>
2	<b>CHECK NAVIGATION.</b> 1) Display the current data of body integrated unit using Subaru Select Monitor. 2) Display NAVI failure.	Refer to the navigation display. <Ref. to ET-15, REMOVAL, Navigation Display.>	Refer to the navigation unit. <Ref. to ET-17, REMOVAL, Navigation Body.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## W: DTC U1321 CAN-LS METER NO-RECEIVE DATA

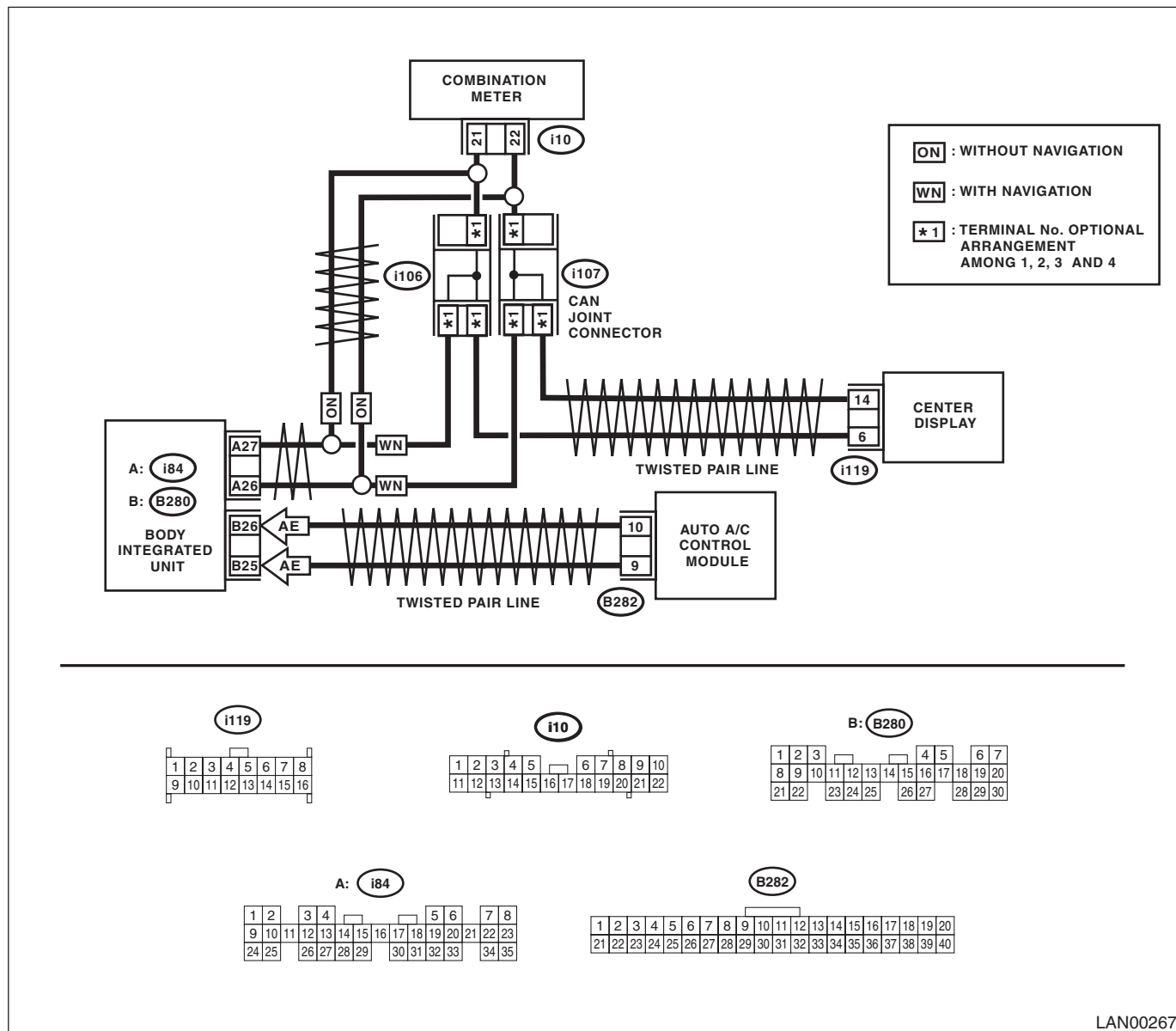
### DTC DETECTING CONDITION:

Combination meter unit error, or harness between the main harness splice and combination meter unit is open or shorted, the connector is not connected properly and the terminal has poor crimping.

### TROUBLE SYMPTOM:

Fail mode occurs because the data is not received from combination meter unit.

### WIRING DIAGRAM:



LAN00267

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK COMMUNICATION LINE.</b> 1) Warm up the engine. 2) Compare the data of body integrated unit and combination meter using Subaru Select Monitor. Check item: <ul style="list-style-type: none"> <li>• Engine speed</li> <li>• Shift range</li> </ul>	Is the data displayed same?	Go to step 2.	Perform self-diagnosis of the combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>
2	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit and combination meter connector. 2) Measure the resistance between harness connectors. <b>Connector &amp; terminal</b> <i>(i10) No. 21 — (i84) No. 27:</i> <i>(i10) No. 22 — (i84) No. 26:</i>	Is the resistance less than 10 Ω?	Go to step 4.	Go to step 3.
3	<b>CHECK HARNESS.</b> Measure the resistance between harness connector and chassis ground with the connector of the unit disconnected. <b>Connector &amp; terminal</b> <i>(i10) No. 21 — Chassis ground:</i> <i>(i10) No. 22 — Chassis ground:</i>	Is the resistance less than 10 Ω?	Go to step 4.	Repair or replace the open circuit of harness.
4	<b>CHECK COMBINATION METER.</b> Perform self-diagnosis of the combination meter. <Ref. to IDI-4, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Is the self-diagnosis OK?	Temporary poor contact occurs. Check the connection of each connector.	Replace the combination meter. <Ref. to IDI-19, REMOVAL, Combination Meter.>

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

LAN SYSTEM (DIAGNOSTICS)

## X: DTC B1500 KEYLESS UART COM. MALFUNCTION

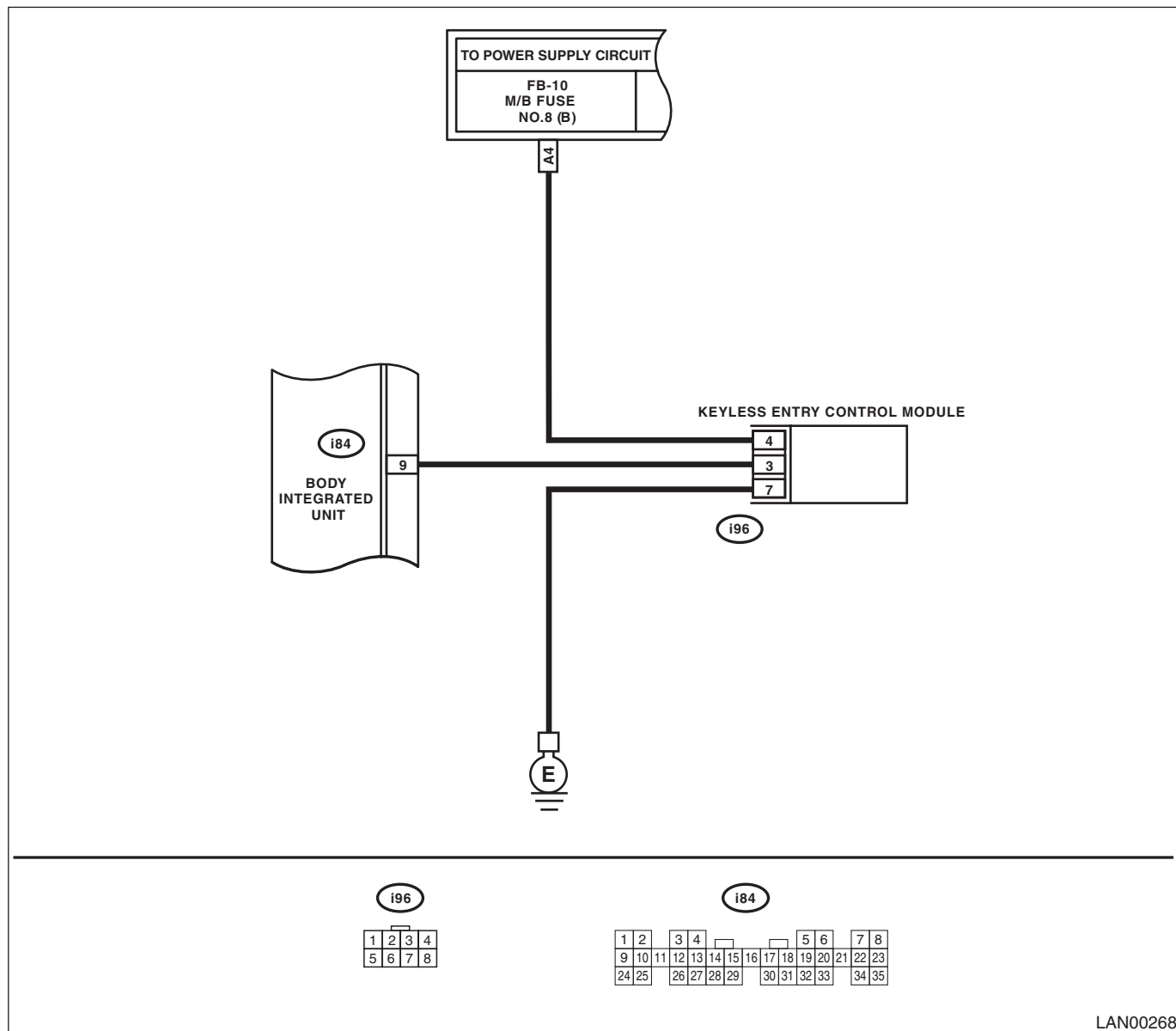
### DTC DETECTING CONDITION:

UART between keyless control unit and body integrated unit is open or shorted, the connector is not connected properly, or the terminal is crimped improperly.

### TROUBLE SYMPTOM:

Door lock does not operate with keyless.

### WIRING DIAGRAM:



LAN00268

# Diagnostic Procedure with Diagnostic Trouble Code (DTC)

## LAN SYSTEM (DIAGNOSTICS)

	Step	Check	Yes	No
1	<b>CHECK DTC.</b> Connect the Subaru Select Monitor to read DTC of body integrated unit.	Are there DTCs other than B1500?	Perform the diagnosis according to other DTCs.	Go to step 2.
2	<b>CHECK DTC.</b> Check DTC indicated by body integrated unit.	Does the displayed DTC indicate current malfunction?	Check the connection of harness connectors. Go to step 3.	Go to step 4.
3	<b>CHECK DTC.</b> Turn the ignition switch to OFF and read DTCs again.	Is B1500 current malfunction?	<Ref. to LAN(diag)-84, DTC B1500 KEY-LESS UART COM. MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	<Ref. to LAN(diag)-84, DTC B1500 KEY-LESS UART COM. MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
4	<b>CHECK HARNESS.</b> 1) Disconnect the body integrated unit connector (i84) and keyless entry control module connector (i96). 2) Measure the resistance between harnesses. <b>Connector &amp; terminal</b> <b>(i84) No. 9 — (i96) No. 3:</b>	Is the resistance less than 10 Ω?	Go to step 5.	Repair the open circuit of harness or replace harness.
5	<b>CHECK HARNESS.</b> Measure the resistance between harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 9 — Chassis ground:</b>	Is the resistance less than 1 MΩ?	Repair the short circuit of harness or replace harness.	Go to step 6.
6	<b>CHECK HARNESS.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between harness connector and chassis ground. <b>Connector &amp; terminal</b> <b>(i84) No. 9 (+) — Chassis ground (-):</b>	Is the voltage 6 V or more?	Repair the short circuit of harness or replace harness.	Go to step 7.
7	<b>CHECK OPERATION.</b> Check the door lock operation when the doors LOCK/UNLOCK using manual LOCK switch.	Does it operate on switch operation?	Go to step 8.	Replace the body integrated unit. <Ref. to SL-55, REMOVAL, Body Integrated Unit.>
8	<b>CHECK OPERATION.</b> 1) Remove the ignition key. 2) Close all the doors, and then perform the LOCK/UNLOCK operation on keyless entry operation.	Does it operate?	Temporary poor contact occurs.	Replace the keyless entry control module. <Ref. to SL-53, REMOVAL, Keyless Entry Control Module.>

## 13. General Diagnostic Table

### A: INSPECTION

Read the DTC or inspect and diagnose the following data in the current data display using Subaru Select Monitor.

#### 1. LAN SYSTEM

Item	Operation	Specifications		Note
		YES	NO	
Diagnostic code	DTC is not displayed when inspecting all DTCs.	DTC is not displayed.	Perform the diagnosis according to DTC.	—
Engine coolant temperature	Check the current data display of ECM, TCM and body integrated unit. Three data value are the same.	Same values	Inspect LAN system.	If engine coolant temperature sensor is not OK, inspect the sensor circuit.
R defogger SW	It turns to ON when pressing switch. (Low-speed CAN is OK)	Turns to ON.	Inspect rear defogger switch.	Rear defogger switch is connected with Low-speed CAN.
R defogger output	When switch input, it is output.	Output	Check the body integrated unit.	If not operating with output, check the rear defogger relay.
Door lock SW	When locked with door lock switch, it turns to ON.	Turns to ON.	Inspect door lock switch.	The door lock switch is connected to the Low-speed CAN.
Door lock actuator	When locked with door lock switch, it is output.	Output	Check the body integrated unit.	—



## General Diagnostic Table

LAN SYSTEM (DIAGNOSTICS)

### 2. BODY INTEGRATED UNIT

Item	Operation	Specifications		Note
		YES	NO	
Illumination VR power supply	Operate the illumination volume, illumination light is controlled according to the change of voltage on data display.	Illumination light is controlled with changing of data.	Inspect the illumination volume.	—
Fuel level resistance	Check the fuel level resistance and fuel level resistance 2. Both resistances are same.	Same values	Inspect the body integrated unit.	Compare the input and output values of body integrated unit.
R wiper SW input	When rear wiper SW to ON, data display turns to ON.	Turns to ON.	Inspect the rear wiper switch.	—
R wiper output	When rear wiper switch to ON, output signal turns to ON.	Turns to ON.	Check the body integrated unit.	If not operate with output turned to ON, check the rear wiper motor.
Keyless Entry	Keyless entry LOCK/UNLOCK the doors.	Operate	Inspect the keyless antenna.	If the antenna is OK, replace the body integrated unit.
Brake Switch	When brake pedal is depressed, it turns to ON.	Turns to ON.	Inspect the brake switch.	—
Shift lock solenoid	The shift lock releases when depressing the brake pedal.	Released	Inspect the shift lock.	—
Body integrated unit registration function setting	Does Vehicle equipment correspond to setting values?	Correspondence	Reconfigure the values according to vehicle equipment.	—
Customize	When changing customize setting, the registration completes correctly.	Registered	Inspect the body integrated unit.	—
Manual mode	Switch the shift (UP/DOWN) on Manual mode. Indicator is changed in 1 — 2.	Change	Inspect the shift lever.	—
Function check	Each checking item operate correctly. (Except for not equipped)	Operate	Inspect for non-functional actuator.	—
Security	After locking with keyless entry system and open the door, the security system operates and the horn sounds.	Horn sounds. (Security system operates.)	Inspect the security system.	—

## 1. Basic Diagnostic Procedure

### A: BASIC PROCEDURES

#### 1. GENERAL DESCRIPTION

The most important purpose of diagnostics is to quickly determine which part is malfunctioning, to save time and labor.

#### 2. IDENTIFICATION OF TROUBLE SYMPTOM

Determine what the problem is based on the symptom.

#### 3. PROBABLE CAUSE OF TROUBLE

Look at the wiring diagram and check the system's circuit. Then check the switch, relay, fuse, ground, etc.

#### 4. LOCATION AND REPAIR OF TROUBLE

- 1) Using the diagnostics, narrow down the causes.
- 2) If necessary, use a voltmeter, ohmmeter, etc.
- 3) Before replacing certain component parts (switch, relay, etc.), check the power supply, ground, for open wiring harness, poor connectors, etc. If no problem is encountered, check the component parts.

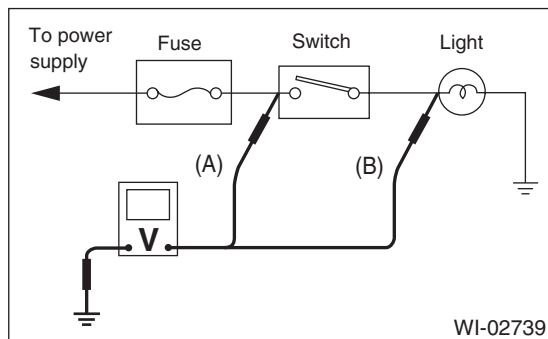
#### 5. SYSTEM OPERATION CHECK

After repairing, ensure that the system operates properly.

### B: BASIC INSPECTION

#### 1. VOLTAGE MEASUREMENT

- 1) Using a voltmeter, connect the negative lead to a good ground point or negative battery terminal and the positive lead to the connector or component terminal.
- 2) Contact the positive lead of the voltmeter on connector (A). The voltmeter will indicate a voltage.
- 3) Shift the positive lead to connector (B). The voltmeter will indicate no voltage.



- 4) With the test set-up held as it is, turn the switch to ON. The voltmeter will indicate a voltage and, at the same time, the light will illuminate.

- 5) The circuit is in good order. If a problem such as a light failing to illuminate occurs, use the procedures outlined above to track down the malfunction.

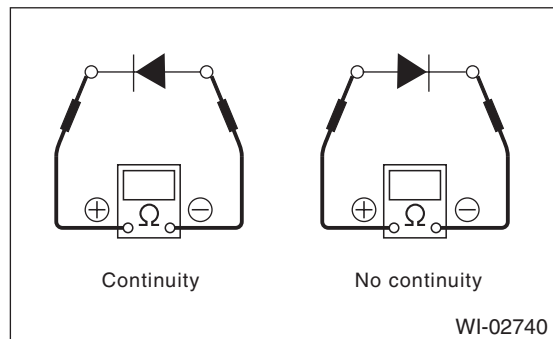
#### 2. CIRCUIT CONTINUITY CHECKS

- 1) Disconnect the battery terminal or connector so there is no voltage between the check points. Contact the two leads of an ohmmeter to each of the check points.

If the circuit has diodes, reverse the two leads and check again.

- 2) Use an ohmmeter to check for diode continuity. When contacting the negative lead to the diode positive side and the positive lead to the negative side, there should be continuity.

When contacting the two leads in reverse, there should be no continuity.



- 3) The symbol "○ — ○" indicates that continuity exists between two points or terminals. For example, when a switch position is at "3", continuity exists among terminals 1, 3 and 6, as shown in the table below.

Terminal	Switch Position					
Switch Position	1	2	3	4	5	6
OFF						
1	○	—			○	○
2	○	—		○		○
3	○		○			○
4	○	○				○

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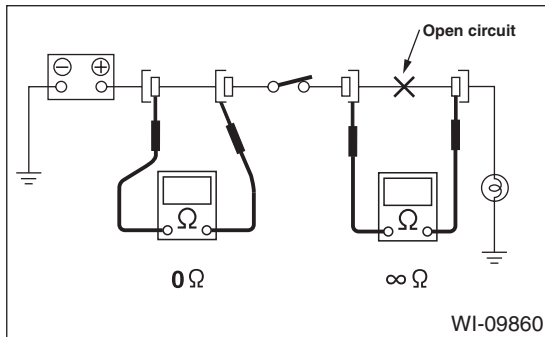
# Basic Diagnostic Procedure

## WIRING SYSTEM

### 3. HOW TO DETERMINE AN OPEN CIRCUIT

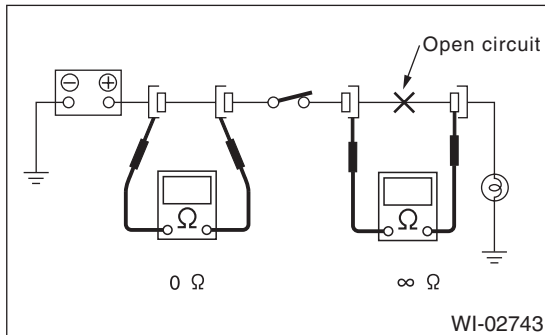
#### 1) WITH VOLTMETER:

An open circuit is determined by measuring the voltage between respective connectors and ground using a voltmeter, starting with the connector closest to the power supply. The power supply must be turned ON so that current flows in the circuit. If voltage is not present between a particular connector and ground, the circuit between that connector and the previous connector is open.



#### 2) WITH OHMMETER:

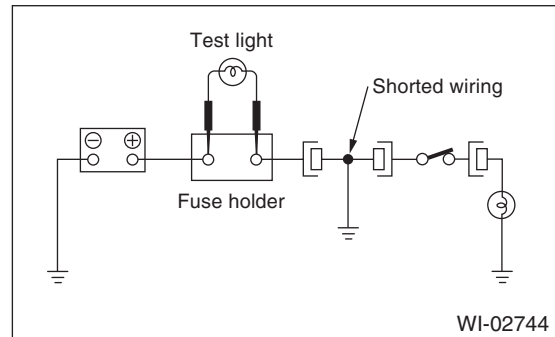
Disconnect all connectors affected, and check continuity in the wiring between adjacent connectors. When the ohmmeter indicates “infinite”, the wiring is open.



### 4. HOW TO DETERMINE A SHORT CIRCUIT

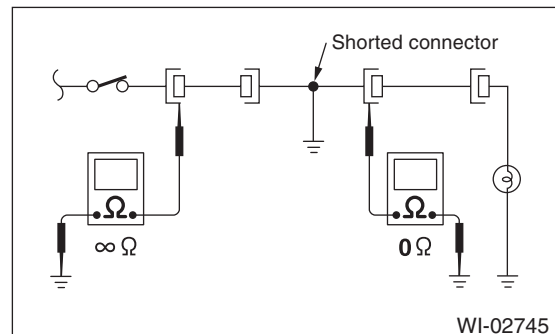
#### 1) WITH TEST LIGHT:

Connect a test light (rated at approx. 3 watts) in place of the blown fuse and allow current to flow through the circuit. Disconnect one connector at a time from the circuit. Starting with the one located farthest from the power supply. If the test light goes out when a connector is disconnected, the wiring between that connector and the next connector (farther from the power supply) is shorted.



#### 2) WITH OHMMETER:

Disconnect all affected connectors, and check continuity between each connector and ground. When the ohmmeter indicates continuity between a particular connector and a ground, that connector is shorted.



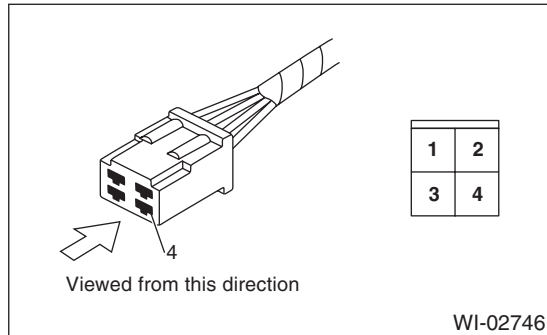
## C: HOW TO READ WIRING DIAGRAMS

### 1. WIRING DIAGRAM

The wiring diagram of each system is illustrated so that you can understand the path through which the electric current flows from the battery.

Sketches and codes are used in the diagrams. They should read as follows:

- Each connector and its terminal position are indicated by a sketch of the connector in a disconnected state which is viewed from the front.



- The number of poles or pins, presence of a lock are indicated in the sketch of each connector. In the sketch, the highest pole number refers to the number of poles which the connector has. For example, the sketch of the connector shown in figure indicates the connector has 9 poles.

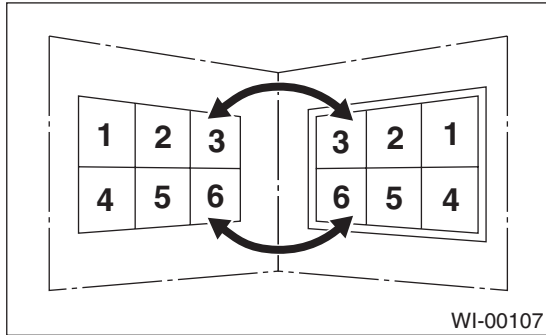
Connector used in vehicle	Connector shown in wiring diagram		
	Sketch	Symbol	Number of poles
	<p>Double frames</p> <p>Indicates a lock is included.</p> <p>Indicates the number of poles.</p>		<p>Numbered in order from upper right to lower left</p>
	<p>Indicates a lock is included.</p> <p>Single frame</p>		<p>Numbered in order from upper left to lower right</p>

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# Basic Diagnostic Procedure

## WIRING SYSTEM

- When one set of connectors is viewed from the front side, the pole numbers of one connector are symmetrical to those of the other. When these two connectors are connected as a unit, the poles which have the same number are joined.



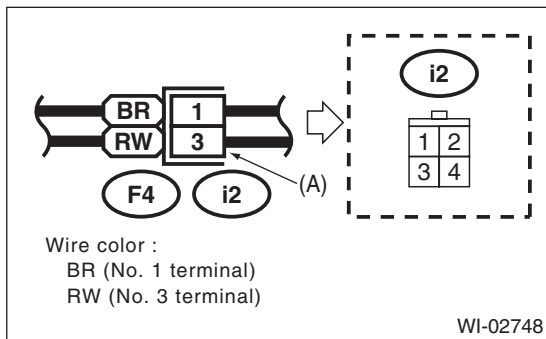
### • WIRING DIAGRAM:

The connectors are numbered along with the number of poles, external colors, and mating connections in the accompanying list.

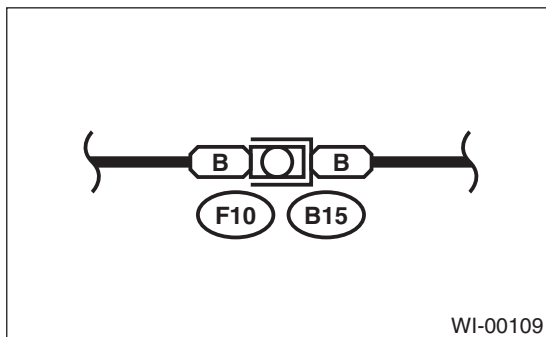
- The sketch of each connector in the wiring diagram usually shows the (A) side of the connector. The relationship between the wire color, terminal number and connector is described in the figure.

### NOTE:

A wire which runs in one direction from a connector terminal sometimes may have a different color from that which runs in the other direction from that terminal.

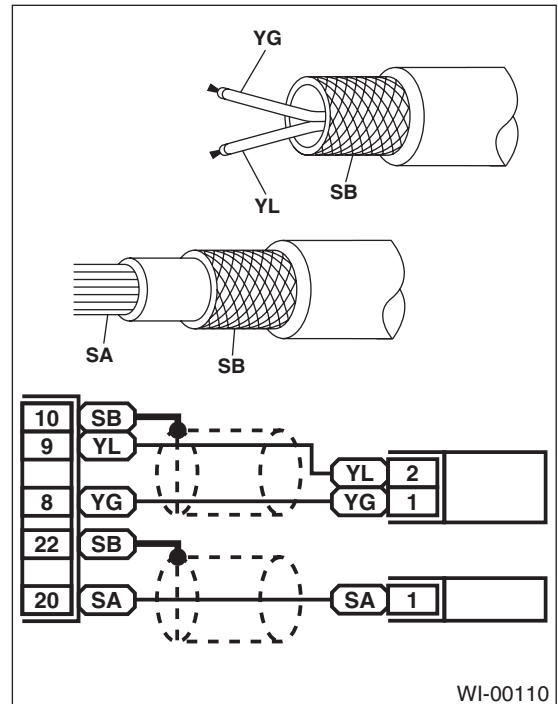


- In the wiring diagram, connectors which have no terminal number refer to one-pole types. Sketches of these connectors are omitted intentionally.

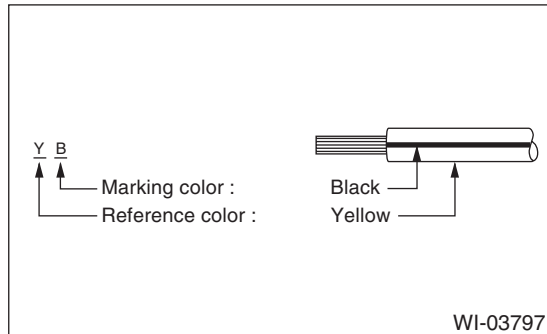


- The following color codes are used to indicate the colors of the wires.

Color code	Color
L	Blue
B	Black
Y	Yellow
G	Green
R	Red
W	White
Br	Brown
Lg	Light green
Gr	Gray
P	Pink
Or	Orange
Sb	Light blue
V	Violet
SA	Sealed (Inner)
SB	Sealed (Outer)



- The wire color code, which consists of two letters (or three letters including Br or Lg), indicates the standard color (base color of the wire covering) by its first letter and the stripe marking by its second letter.



- The table lists the nominal sectional areas and allowable currents of the wires.

### CAUTION:

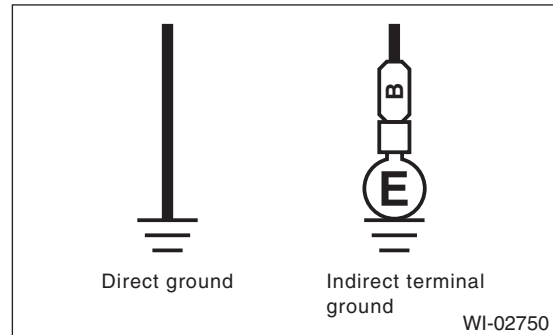
**When replacing or repairing a wire, be sure to use the same size and type of the wire which was originally used.**

### NOTE:

- The allowable current in the table indicates the tolerable amperage of each wire at an ambient temperature of 40°C (104°F).
- The allowable current changes with ambient temperature. Also, it changes if a bundle of more than two wires is used.

Nominal sectional area mm <sup>2</sup>	No. of strands/ strand diameter	Outside diameter of wiring mm	Allowable current Amps/ 40°C (104°F)
0.3	7/0.26	1.8	7
0.5	7/0.32	2.2 (or 2.0)	12
0.75	30/0.18	2.6 (or 2.4)	16
0.85	11/0.32	2.4 (or 2.2)	16
1.25	16/0.32	2.7 (or 2.5)	21
2	26/0.32	3.1 (or 2.9)	28
3	41/0.32	3.8 (or 3.6)	38
5	65/0.32	4.6 (or 4.4)	51
8	50/0.45	5.5	67

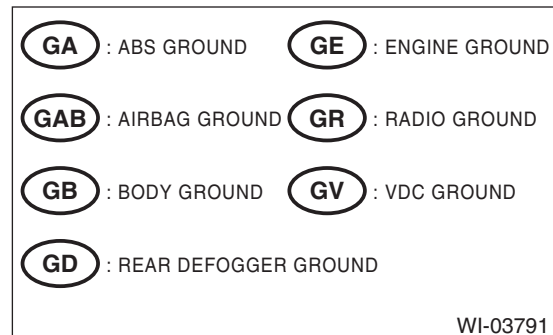
- Each unit is either directly grounded to the body or indirectly grounds through a harness ground terminal. Different symbols are used in the wiring diagram to identify the two grounding systems.



- The ground points shown in the wiring diagram refer to the following:

### NOTE:

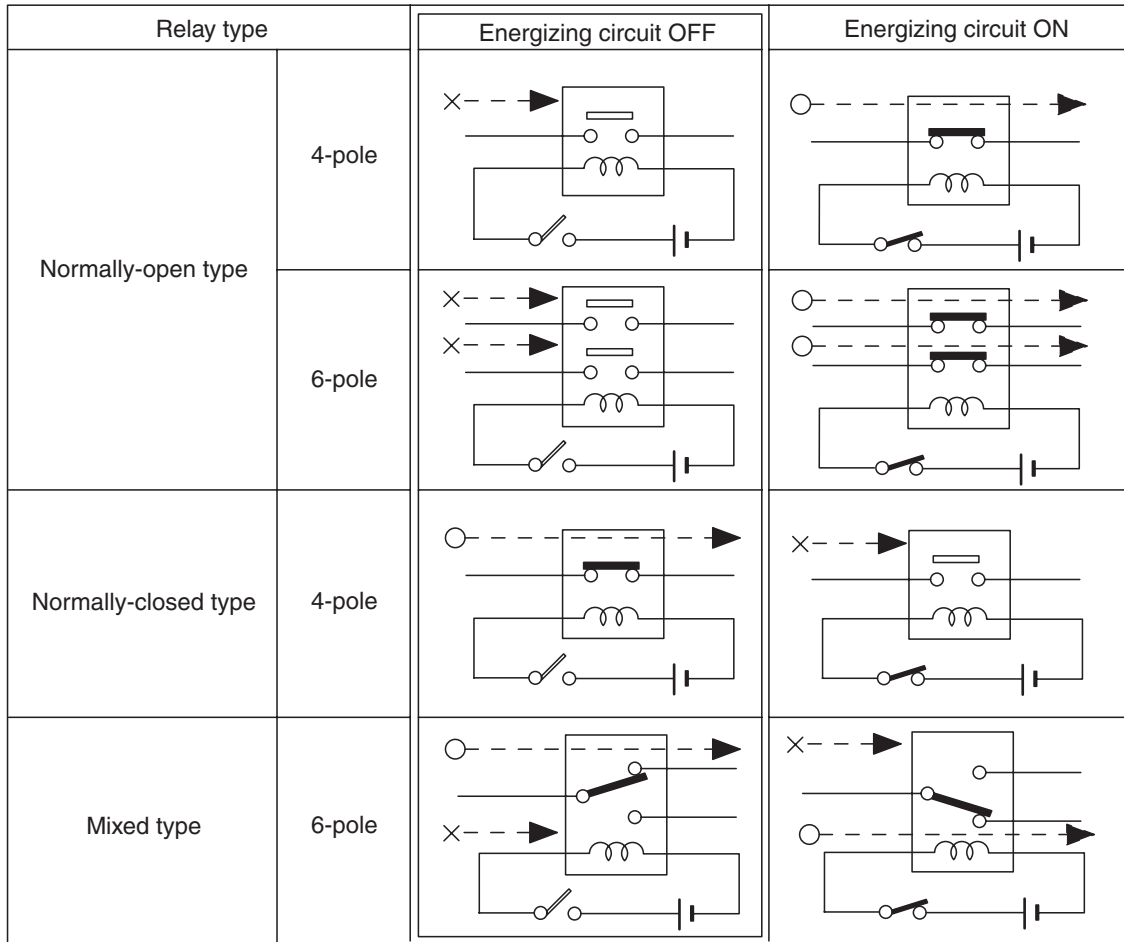
All wiring harnesses are provided with a ground point which should be securely connected.



# Basic Diagnostic Procedure

## WIRING SYSTEM

- Relays are classified as normally-open or normally-closed.
- The normally-closed relay has one or more contacts. The wiring diagram shows the relay mode when the energizing circuit is OFF.



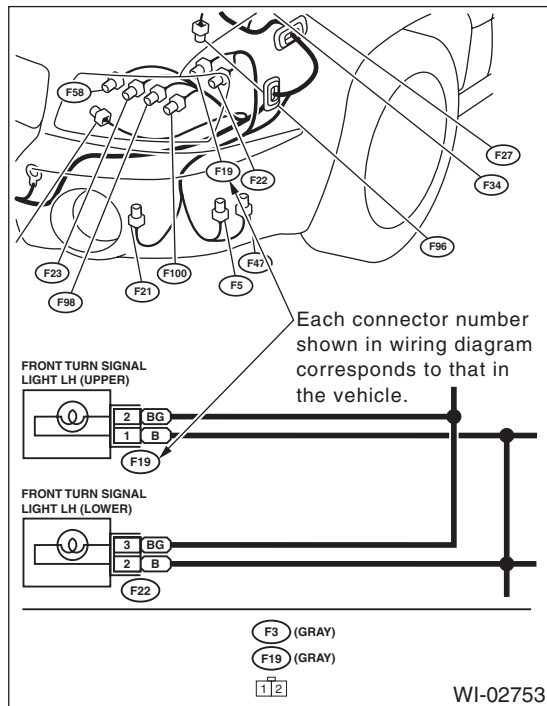
Key to symbols:

- —▶ : Current flows.
- × —▶ : Current does not flow.

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- Each connector number shown in the wiring diagram corresponds to that in the wiring harness. The location of each connector in the actual vehicle is determined by reading the first character of the connector (for example, a "F" for F8, "i" for i16, etc.) and the type of wiring harness. The first character of each connector number corresponds to the area or system of the vehicle.

Symbol	Wiring harness and cord
F	Front wiring harness
B	Bulkhead wiring harness
E	Engine wiring harness
T	Transmission cord
D	Door cord LH & RH, Rear gate cord Rear door cord LH & RH, Rear defogger cord
i	Instrument panel wiring harness
R	Rear wiring harness, Fuel tank cord, Roof cord, Rear gate cord, Rear defogger ground cord (Sedan model)
AB	Airbag wiring harness



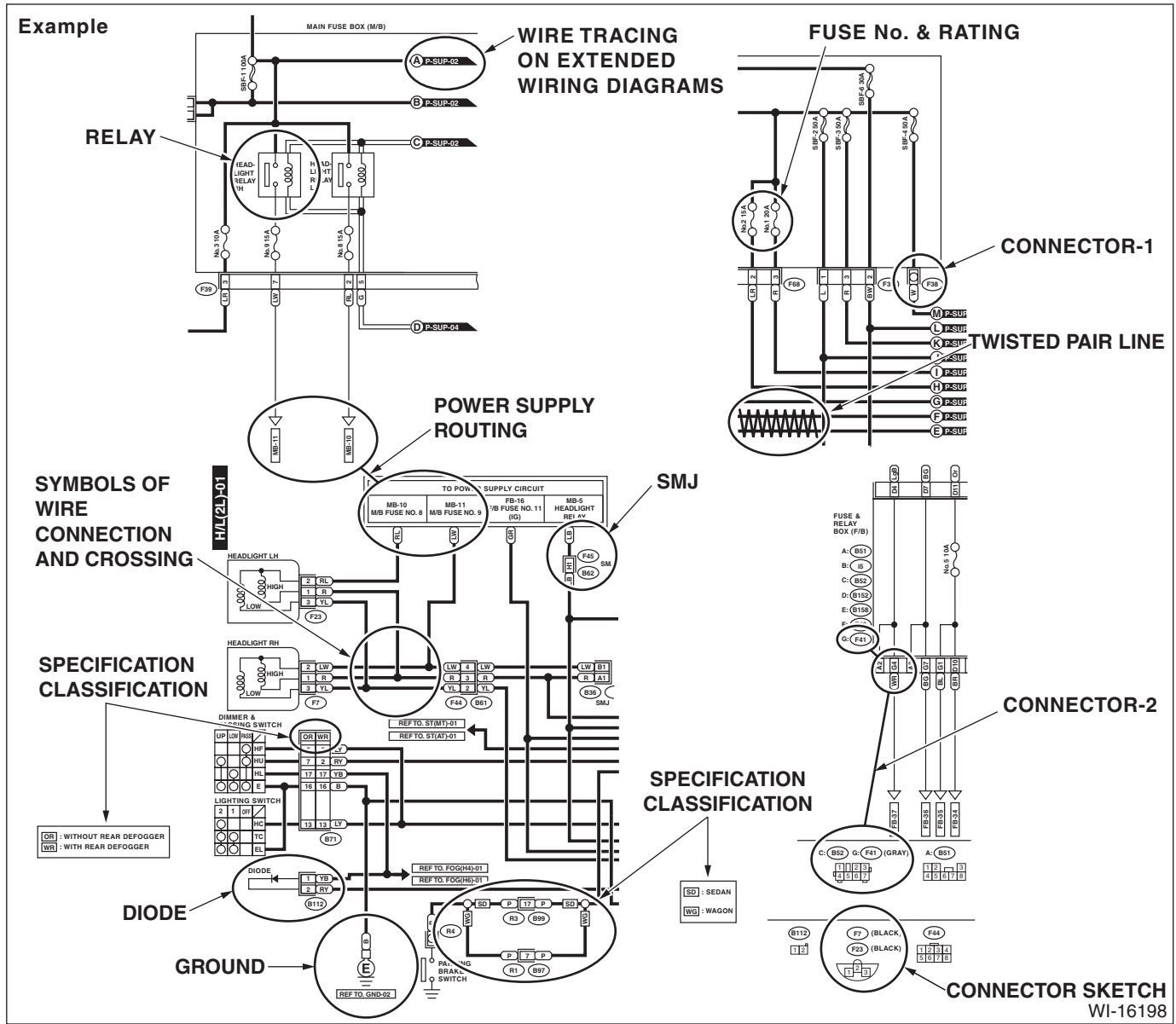


# Basic Diagnostic Procedure

## WIRING SYSTEM

### D: SYMBOLS IN WIRING DIAGRAMS

A number of symbols are used in each wiring diagram to easily identify parts or circuits.



## 1. RELAY

A symbol used to indicate a relay.

## 2. CONNECTOR 1

The sketch of the connector indicates the one-pole types.

## 3. WIRING CONNECTION

Some wiring diagrams are indicated in foldouts for convenience. Wiring destinations are indicated where necessary by corresponding symbols. (When two pages are needed for clear indication)

## 4. FUSE NO. & RATING

The "FUSE No. & RATING" corresponds with that used in the fuse box (main fuse box, fuse and joint box).

## 5. CONNECTOR 2

- Each connector is indicated by a symbol.
- Each terminal number is indicated in the corresponding wiring diagram in an abbreviated form.
- For example, terminal number "G4" refers to No. 4 terminal of connector (G: F41) shown in the connector sketch.

## 6. CONNECTOR SKETCH

- Each connector sketch clearly identifies the shape and color of a connector as well as terminal locations. Non-colored connectors are indicated in white or natural color.
- When more than two types of connector number are indicated in a connector sketch, it means that the same type connectors are used.

## 7. GROUND

Each grounding point can be located easily by referring to the corresponding wiring harness.

## 8. DIODE

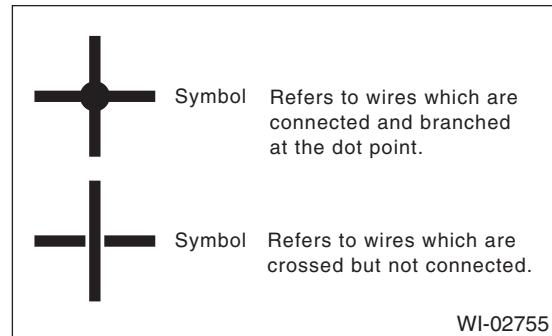
A symbol is used to indicate a diode.

## 9. WIRE TRACING ON EXTENDED WIRING DIAGRAMS

For a wiring diagram extending over at least two pages, a symbol (consisting of the same characters with arrows), facilitates wire tracing from one page to the next.

A ↔ A, B ↔ B

## 10. SYMBOLS OF WIRE CONNECTION AND CROSSING



## 11. POWER SUPPLY CIRCUIT

A symbol is used to indicate the power supply in each wiring diagram.

"MB-5", "MB-6", etc., which are used as power-supply symbols throughout the text, correspond with those shown in the "DC POWER SUPPLY CIRCUIT" in the wiring diagram.

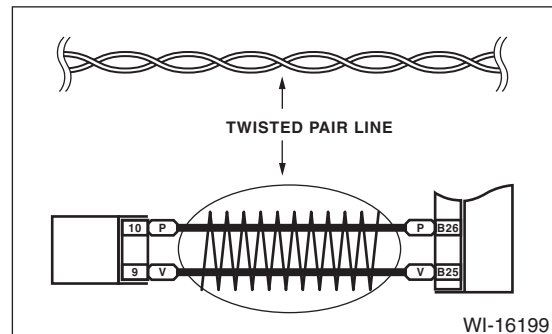
Accordingly, using the "DC POWER SUPPLY CIRCUIT" and wiring diagrams permits service personnel to understand the entire electrical arrangement of a system.

## 12. CLASSIFICATION BY SPECIFICATION

When the wiring diagram differ according to vehicle specifications, the specification difference is described by using abbreviations.

## 13. TWISTED PAIR LINE

The twisted pair line is indicated by a symbol in the wiring diagrams.



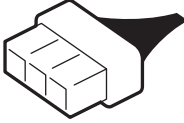


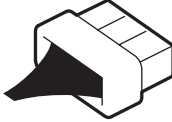
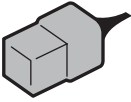
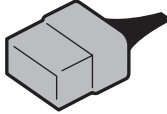
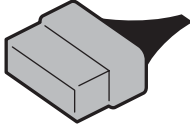
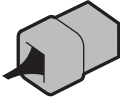

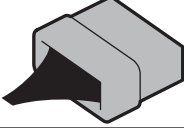











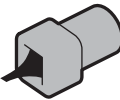


# Basic Diagnostic Procedure

## WIRING SYSTEM

### E: CONNECTOR SYMBOL IN WIRING HARNESS

A number of connector symbols are used in each wiring diagram to easily identify the wiring harness connectors.

Standard type: Female		
Pole: From 1 to 8	Pole: From 9 to 20	Pole: More than 21
		
		
Standard type: Male		
		
		

Water proof type: Female		
Pole: From 1 to 8	Pole: From 9 to 20	Pole: More than 21
		
		
Water proof type: Male		
		
		

WI-02756

## F: ABBREVIATION IN WIRING DIAGRAMS

Abbr.	Full name
A/B	Airbag
A/C	Air Conditioner
A/F	Air/Fuel (Air fuel ratio sensor)
ABS	Anti-lock Brake System
ACC	Accessory
ALT	Generator
ASSY	Assembly
AT	Automatic Transmission
ATF	Automatic Transmission Fluid
AWD	All Wheel Drive
B, BAT	Battery
CAN	Communication Area Network
CPU	Central Processing Unit
D	Drive Range
D, DN	Down
E	Ground
ECO	Economy
ECM	Engine Control Module
EGR	Exhaust Gas Recirculation
F/B	Fuse & Relay Box
FL	Front Left Hand
FR	Front Right Hand
FWD	Front Wheel Drive
G	Gravity (G sensor)
H/L	Headlight
HI	High
HID	High Intensity Discharge
I/F	Interface
IG	Ignition
Illumi.	Illumination
INT	Intermittent
LCD	Liquid Crystal Display
LH	Left Hand
Lo	Low
M	Motor
M/B	Main Fuse Box
MG	Magnet
Mi	Middle
MT	Manual Transmission
MID	Multi Information Display
MIST	Wiper mist (One-touch)
MT	Manual Transmission
N	Neutral Range
NA	Natural Aspiration
NAVI	Navigation
OP	Optional Parts or Open
P	Parking Range

Abbr.	Full name
PASS	Passing
PCV	Positive Crankcase Ventilation Valve
R	Reverse Range
R, RH	Right Hand
RL	Rear Left
RR	Rear Right
SBF	Slow Blow Fuse
SI-DRIVE	Subaru Intelligent Drive
S/S	SPORT Shift
ST	Starter
SW	Switch
TB	Turbo
TCM	AT Control Module
TPM	Tire Pressure Monitor
TPMS	Tire Pressure Monitor System
TV	Television
U, UP	Up
VDC	Vehicle Dynamics Control
VICS	Vehicle Information and Communication System
WASH	Washer

# Working Precautions

## WIRING SYSTEM

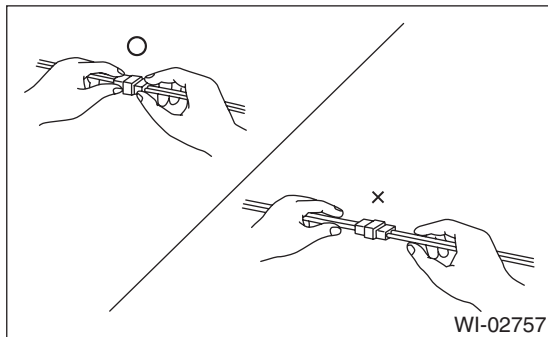
### 2. Working Precautions

#### A: PRECAUTIONS WHEN WORKING WITH THE PARTS MOUNTED ON THE VEHICLE

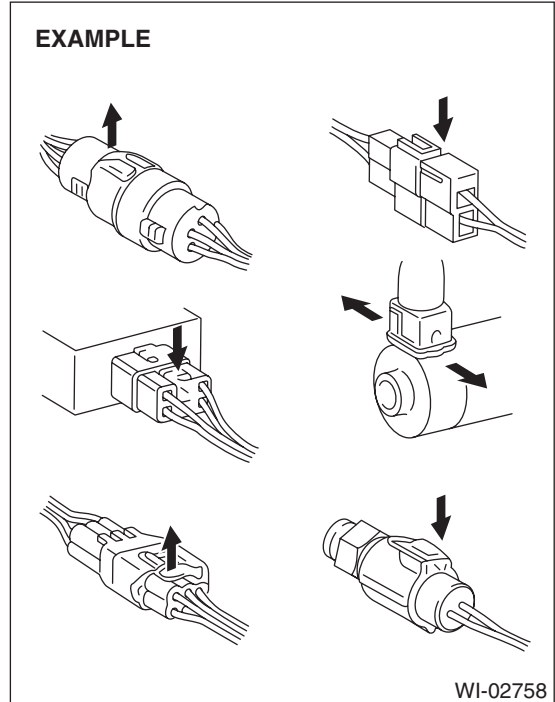
- 1) When working under a vehicle which is jacked-up, always be sure to use rigid rack.
- 2) The parking brake must always be applied during working. Also, in automatic transmission vehicles, keep the select lever set to the P (Parking) range.
- 3) Be sure the workshop is properly ventilated when running the engine. Further, be careful not to touch the belt or fan while the engine is operating.
- 4) Be careful not to touch hot metal parts, especially the radiator and exhaust system immediately after the engine has been turned off.

#### B: PRECAUTIONS IN TROUBLE DIAGNOSIS AND REPAIR OF ELECTRIC PARTS

- 1) The battery cable must be disconnected from the battery's (-) terminal, and the ignition switch must be set to the OFF position, unless otherwise required by the diagnostics.
- 2) Securely fasten the wiring harness with clamps and clips so that the harness does not interfere with the body end parts or edges and bolts or screws.
- 3) When installing parts, be careful not to catch them on the wiring harness.
- 4) When disconnecting a connector, do not pull the wires, but pull while holding the connector body.

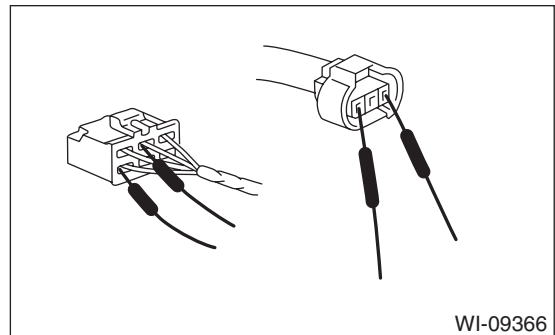


- 5) Some connectors are provided with a lock. One type of such a connector is disconnected by pushing the lock, and the other, by moving the lock up. In either type the lock shape must be identified before attempting to disconnect the connector. To connect, insert the connector until it snaps and confirm that it is connected securely.



- 6) When checking continuity between connector terminals, or measuring voltage across the terminal and ground, always contact tester probe(s) on terminals from the wiring connection side. If the probe is too thick to gain access to the terminal, use "mini" test leads.

To check water-proof connectors (which are not measurable from the wiring side), contact test probes on the terminal side. Be careful not to bend or damage the terminals.



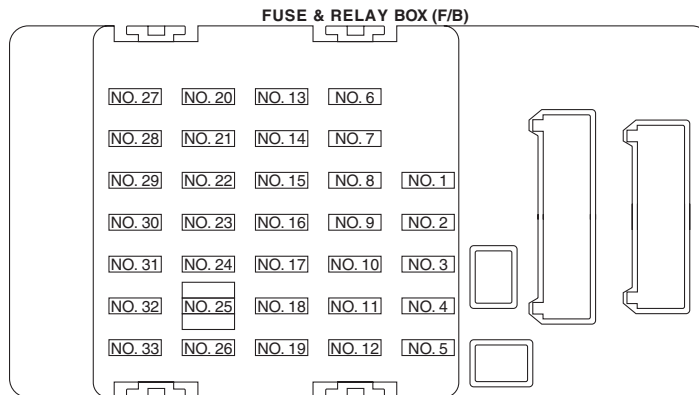
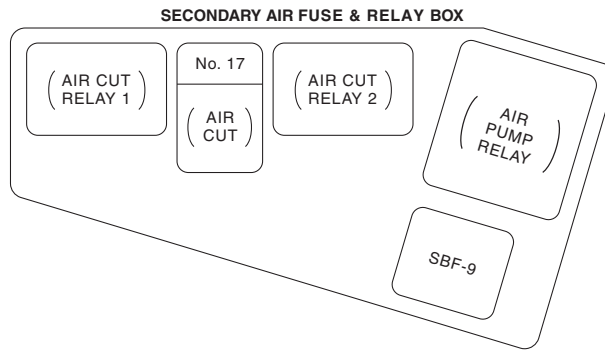
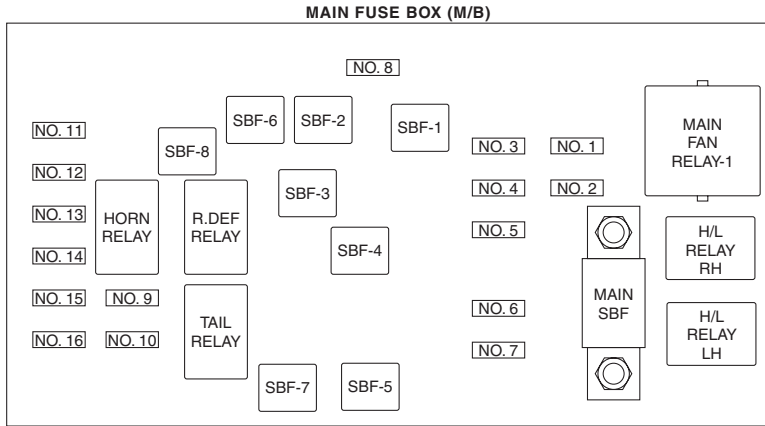
- 7) Sensors, relays, electrical unit, etc., are sensitive to strong impacts. Handle them with care so that they are not dropped or mishandled.

## 3. Power Supply Circuit

### A: WIRING DIAGRAM

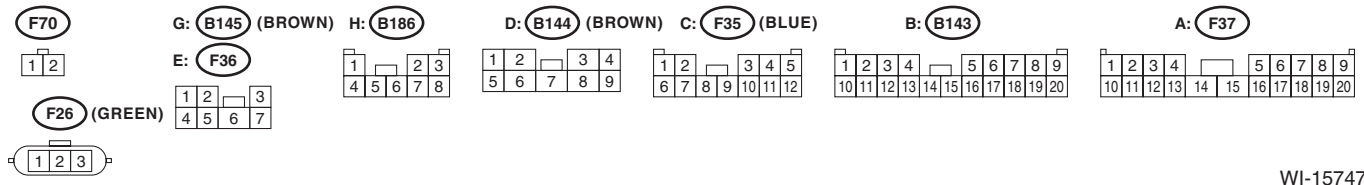
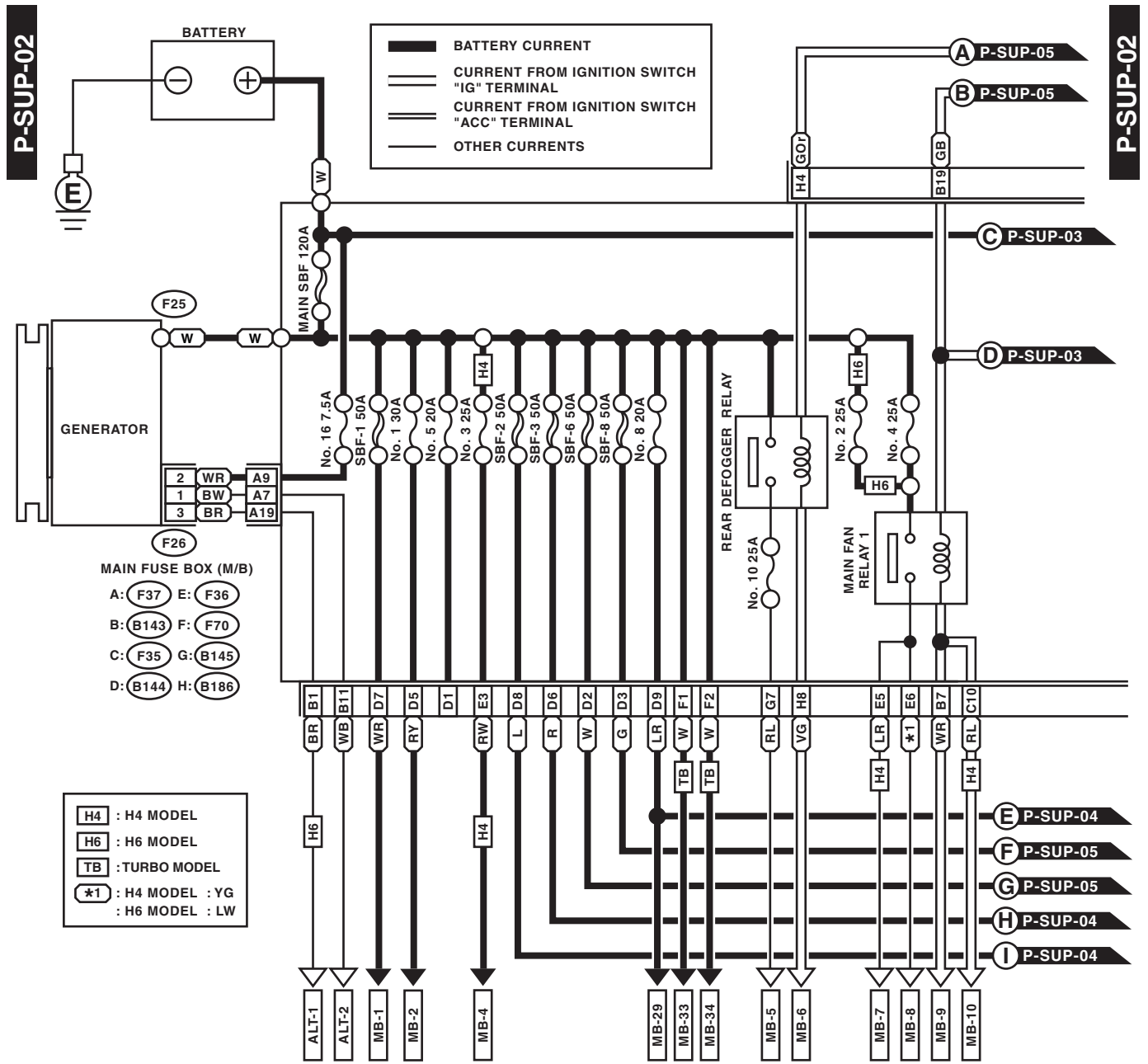
P-SUP-01

P-SUP-01



# Power Supply Circuit

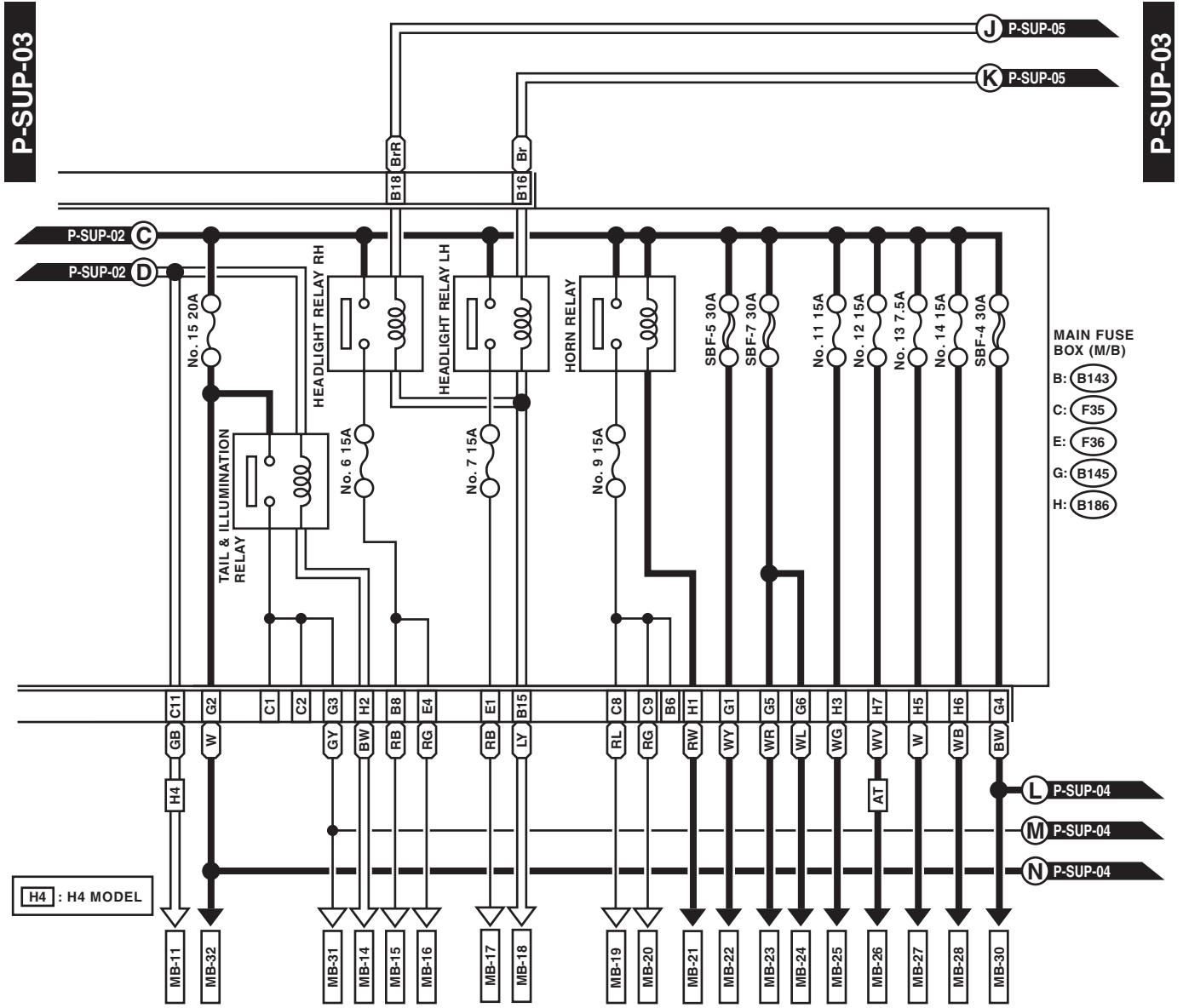
## WIRING SYSTEM



WI-15747

# Power Supply Circuit

WIRING SYSTEM



H4 : H4 MODEL

MAIN FUSE BOX (M/B)  
 B: (B143)  
 C: (F35)  
 E: (F36)  
 G: (B145)  
 H: (B186)

G: (B145) (BROWN)  
 E: (F36)

1	2	3
4	5	6
7		

H: (B186)

1	2	3
4	5	6
7	8	

C: (F35) (BLUE)

1	2	3	4	5
6	7	8	9	10
11	12			

B: (B143)

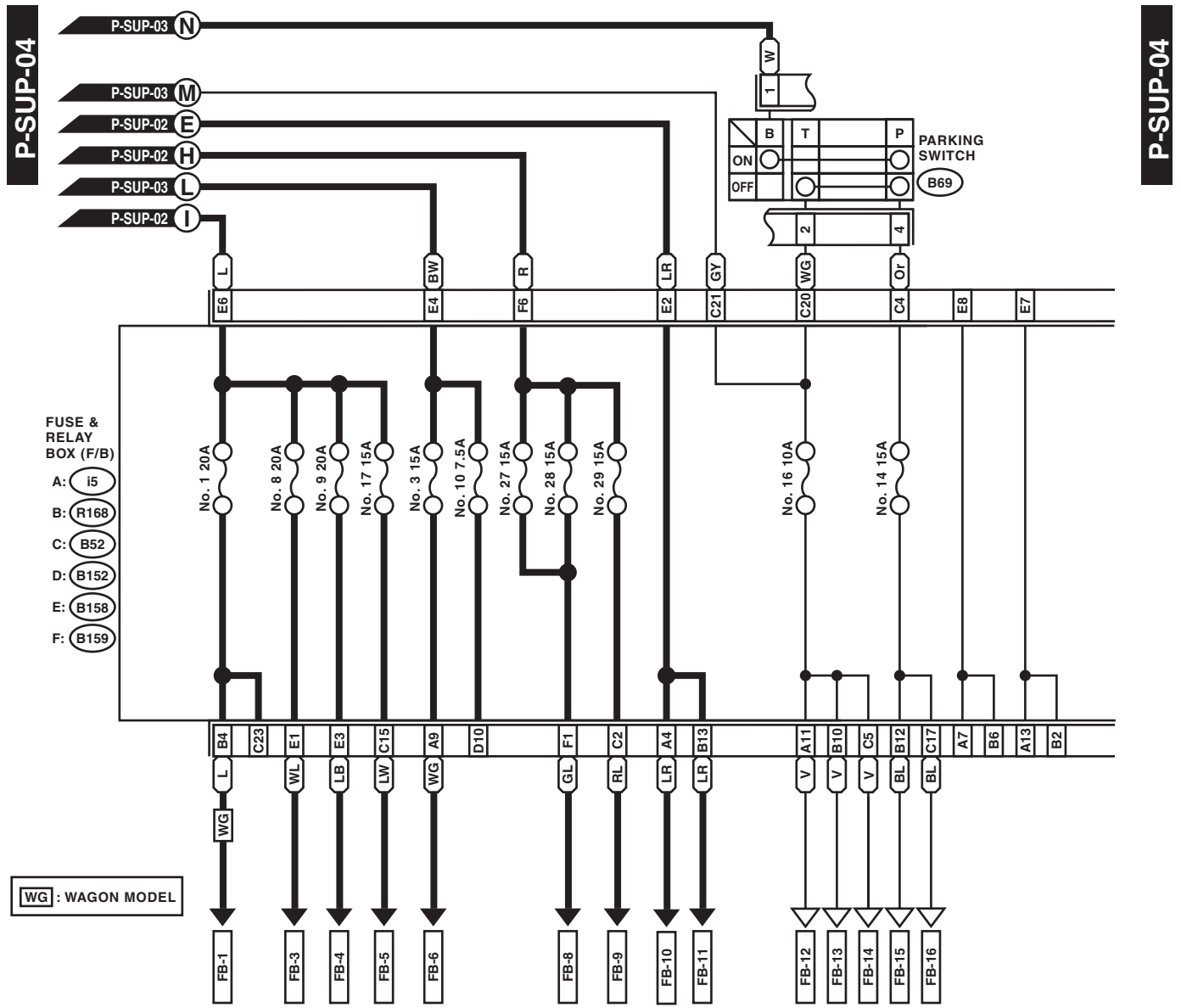
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20							

WI-15748



# Power Supply Circuit

WIRING SYSTEM



B69

1	2
3	4

E: B158

1	2	3	4
5	6	7	8

F: B159 (BROWN)

1	2	3	4
5	6	7	8

D: B152 (GRAY)

1	2	3	4
5	6	7	8
9	10		

A: i5

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20							

B: R168

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20							

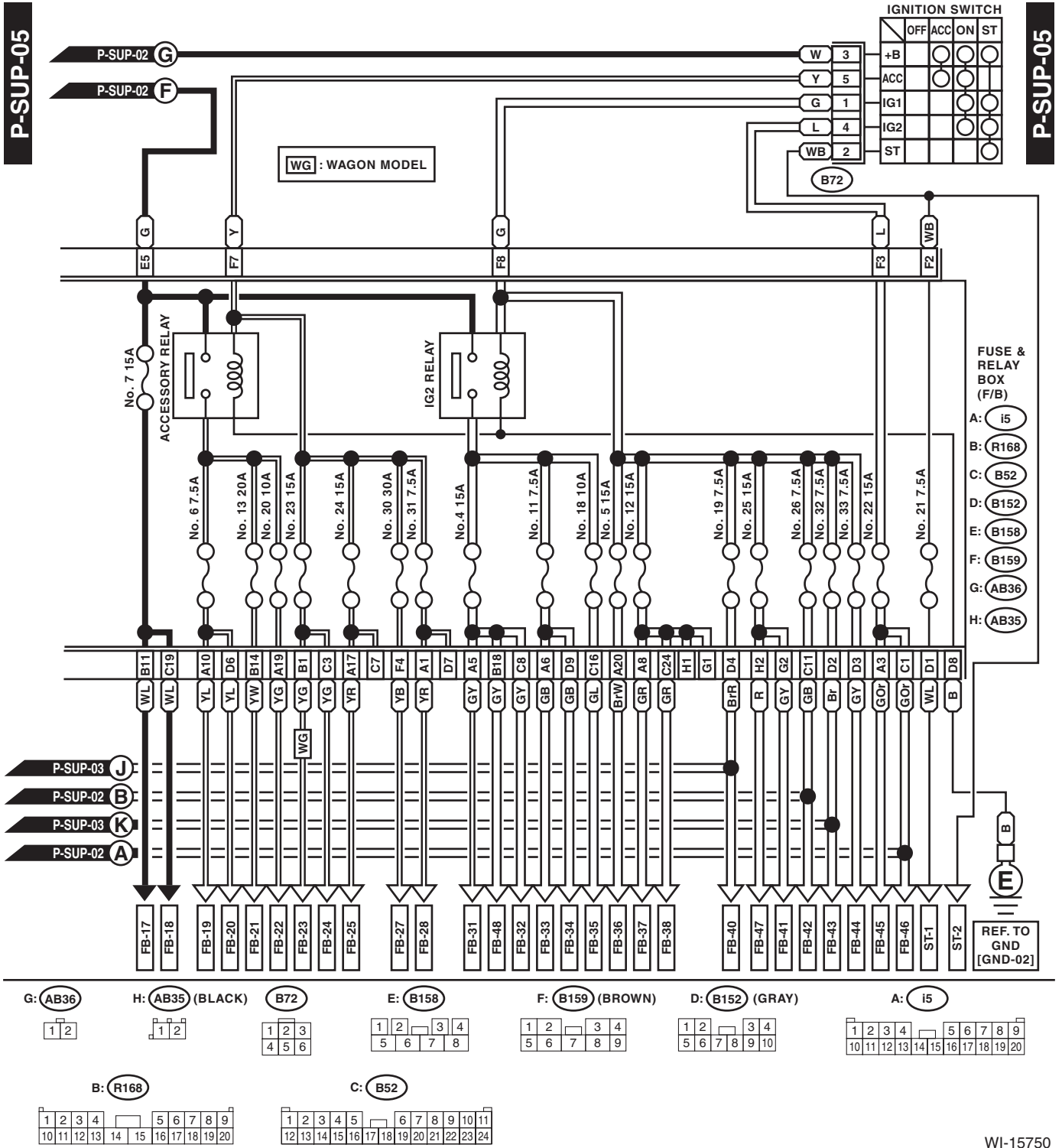
C: B52

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24									

WI-15749

# Power Supply Circuit

WIRING SYSTEM



WI-15750

# Power Supply Circuit

## WIRING SYSTEM

No.	Load
MB-1	ABS control module
	VDC control module
MB-2	ABS control module
	VDC control module
MB-4	Sub fan relay
MB-5	Mirror heater relay (with mirror heater)
	Rear defogger
	A/C control panel (rear defogger switch)
MB-6	Body integrated unit
MB-7	Main fan relay 2
MB-8	Radiator fan control unit
	Main fan motor
MB-9	ECM
MB-10	Main fan relay 2
MB-11	Main fan relay 2
MB-14	Lighting switch
MB-15	Combination meter
MB-16	Headlight RH
MB-17	Headlight LH
MB-18	Diode (Headlight)
	Daytime running light control module
MB-19	Horn
MB-20	Horn
MB-21	Horn switch
	Body integrated unit
	Remote engine start control module
MB-22	A/F, O <sub>2</sub> Sensor relay
	Main relay
MB-23	Main relay
	A/F, O <sub>2</sub> Sensor relay
MB-24	Electronic throttle control relay
MB-25	Fuel pump relay
MB-26	TCM
MB-27	ECM
	Data link connector
MB-28	Ignition switch illumination
	Key warning switch
	Turn signal and hazard unit
	Body integrated unit
MB-29	Spot map light
	Home link
	Body integrated unit
	Room light
MB-30	Power window circuit breaker
MB-31	F/B fuse No. 16
MB-32	Parking switch
MB-33	Secondary air fuse
	Secondary air pump relay
MB-34	Secondary air fuse
	Secondary air combination valve relay

No.	Load
FB-1	Trailer connector (Wagon model)
FB-3	Stop light & brake switch
FB-4	Wiper deicer relay
	Mirror heater relay (with mirror heater)
FB-5	Seat heater relay
FB-6	Body integrated unit
FB-8	Blower motor relay
FB-9	Front fog light relay
FB-10	Audio
	Keyless entry control module
	Door step light LH
	Door step light RH
	Clock
FB-11	TV monitor
	Trunk room light (Sedan model)
	Luggage room light (Wagon model)
	Navigation control module
FB-12	Clock
	TV monitor
FB-13	Seat heater switch
	Navigation control module
FB-14	Satellite switch
FB-17	TPM control module
	Impact sensor
	Combination meter
FB-18	Body integrated unit
	Auto A/C control module
FB-19	Remote control mirror switch
FB-20	Seat heater relay
	Vanity mirror illumination LH (Without home link)
	Vanity mirror illumination RH
	Home link
FB-21	Shade mirror
	Rear accessory power supply socket (Console box)
	Rear accessory power supply socket (Luggage room)
FB-22	Front accessory power supply socket
FB-23	Rear wiper motor
FB-24	Body integrated unit
	Rear washer motor
FB-25	Audio
	Clock
	Navigation control module
	TV monitor
FB-27	Front washer motor
	Front wiper motor
	Combination switch
FB-28	Body integrated unit

# Power Supply Circuit

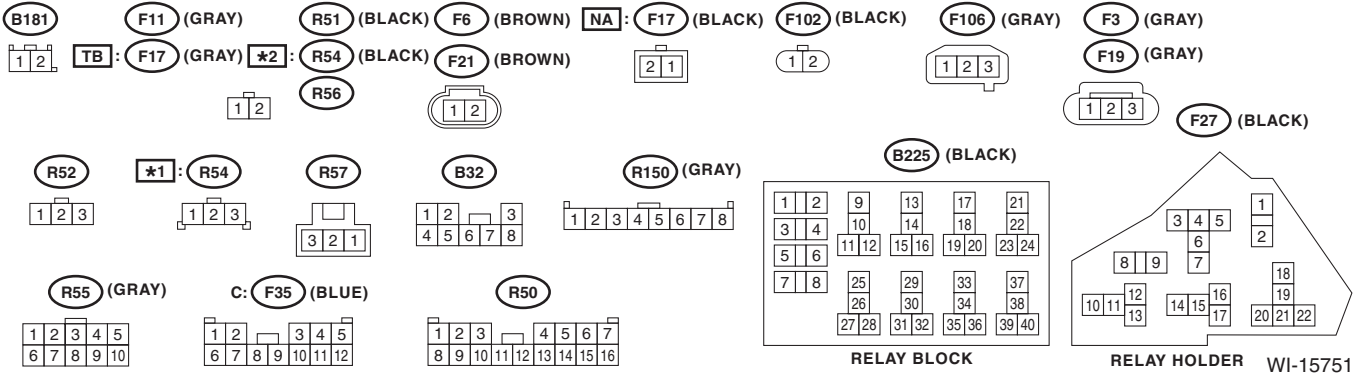
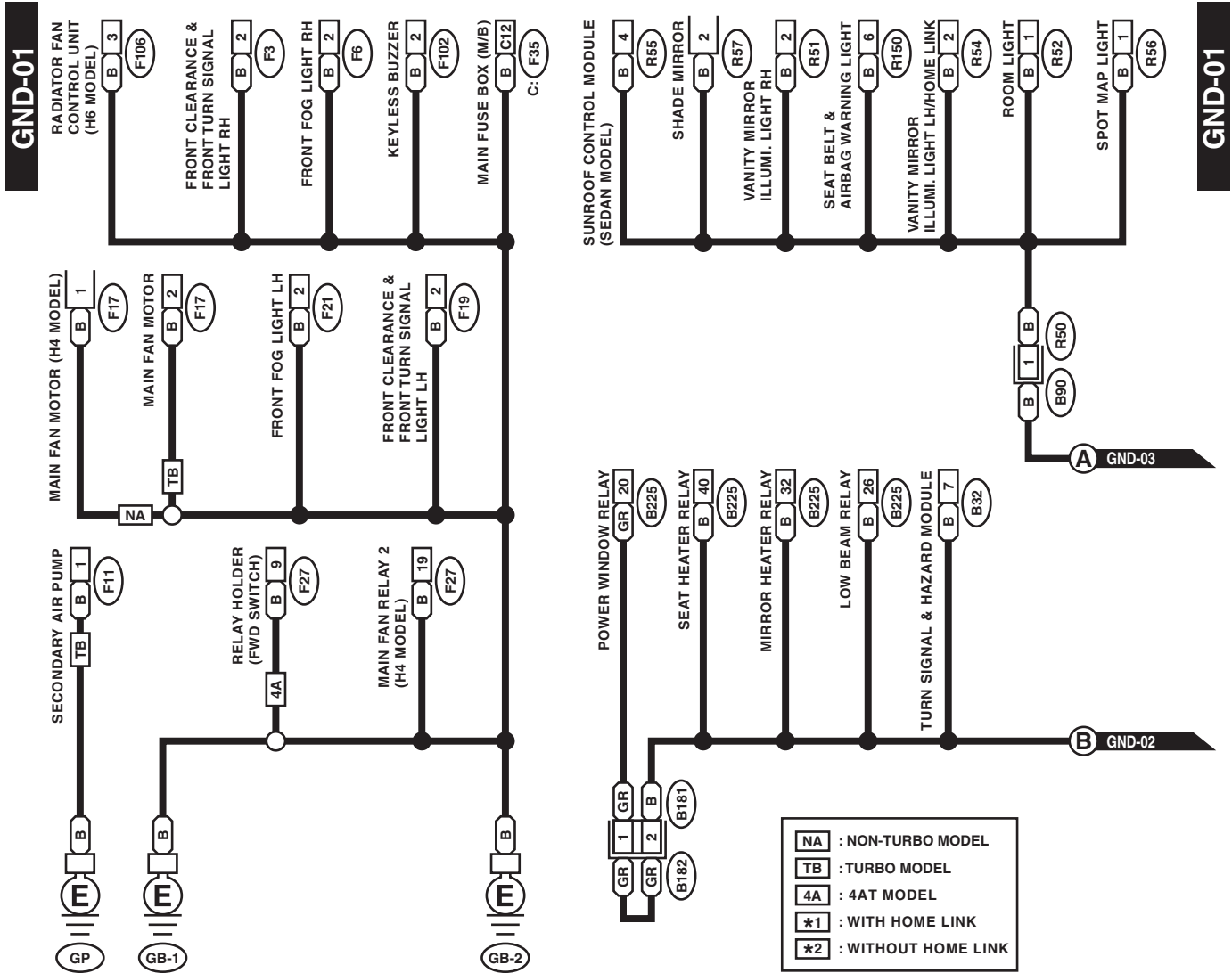
WIRING SYSTEM

No.	Load
FB-31	TV monitor
FB-32	ECM
	Clutch switch (MT model)
	Sunroof motor ASSY
	Seat belt & airbag warning light
	Wiper deicer relay
	Stop light & brake switch
	Sunroof switch
	Sunroof tilt switch
	Data link connector
FB-33	Clock
FB-34	Turn signal and hazard unit
FB-35	Inhibitor switch (4AT model)
	Daytime running light control module
	Back-up light switch
	Back-up light relay (5AT model)
	Daytime running light relay
FB-36	Combination meter
FB-37	Body integrated unit
FB-38	ECM
	TCM
	Ignition coil
	Fuel pump relay
FB-41	Airbag control module
FB-42	Power window relay
FB-44	ABS control module
	VDC control module
	Steering angle sensor
	Yaw rate sensor
FB-45	A/C control panel
FB-46	A/C relay
	Pressure switch
	Auto A/C control module
	Intake door actuator
	Sub fan relay
	Blower motor relay
	Mode door actuator
FB-47	Occupant detection control module
FB-48	TPM control module
	Power seat LH (with seat position memory)
	Impact sensor
ALT-1	ECM
ST-1	ECM
	Starter relay
	Clutch switch (MT model)
	Inhibitor relay (AT model)
ST-2	Starter relay

# Ground Circuit

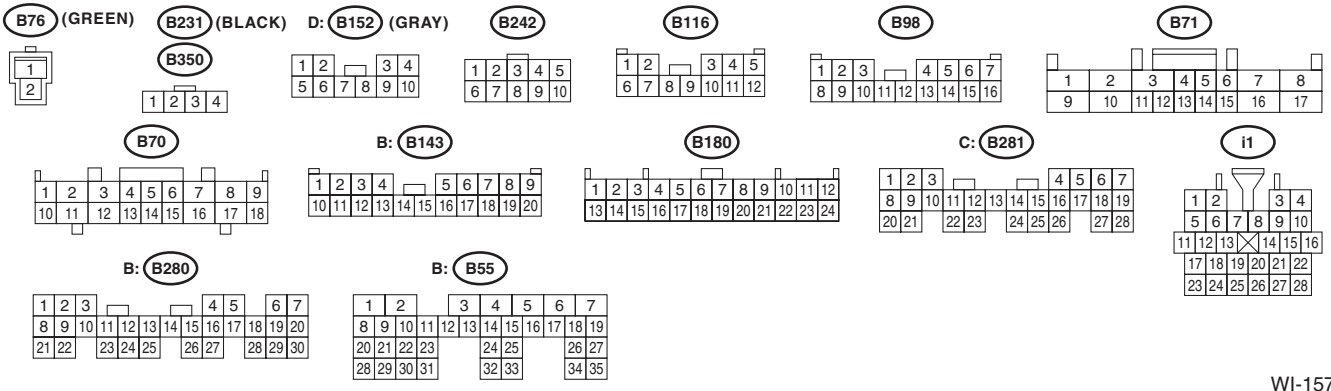
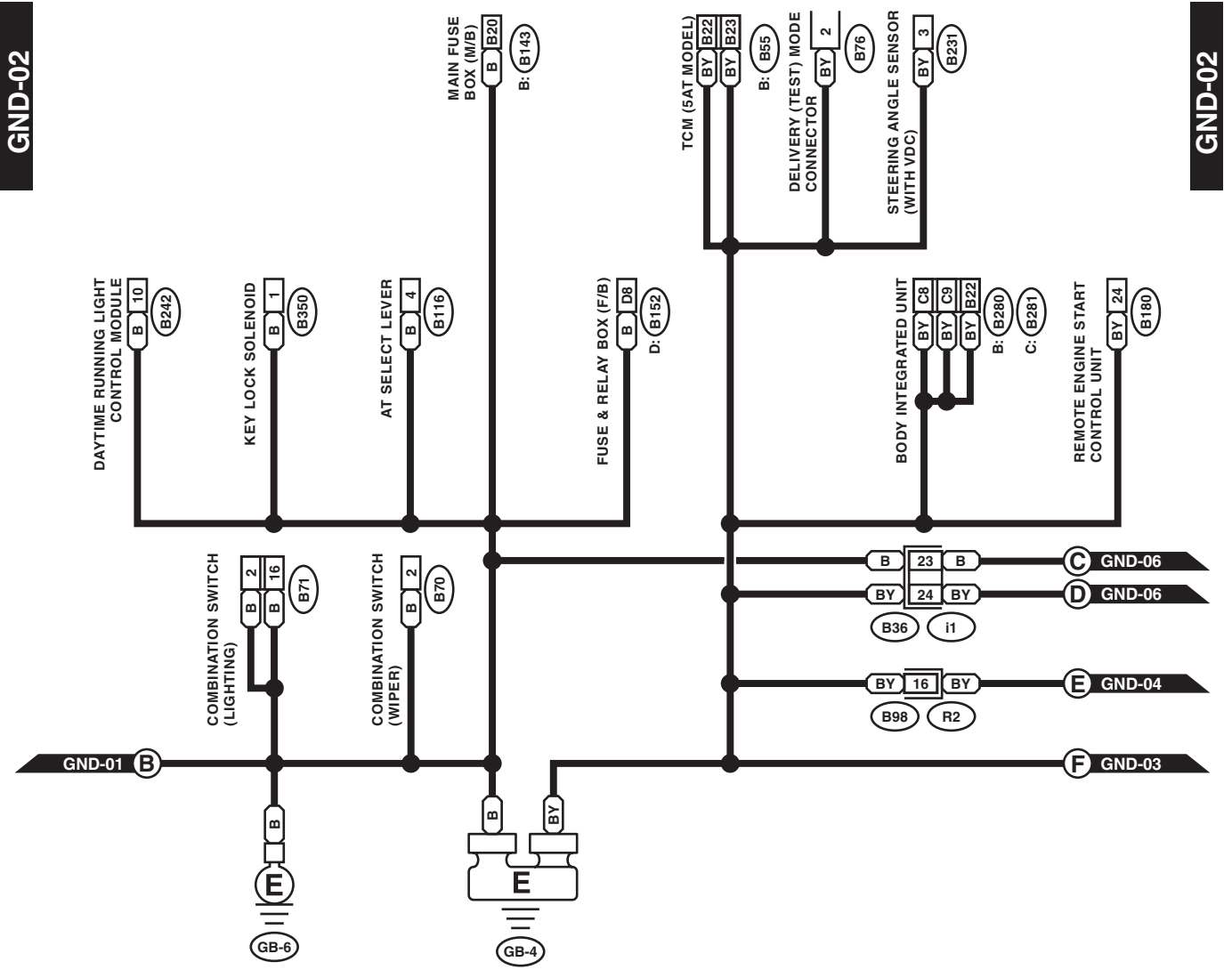
## WIRING SYSTEM

### 4. Ground Circuit A: WIRING DIAGRAM 1. BODY GROUND



# Ground Circuit

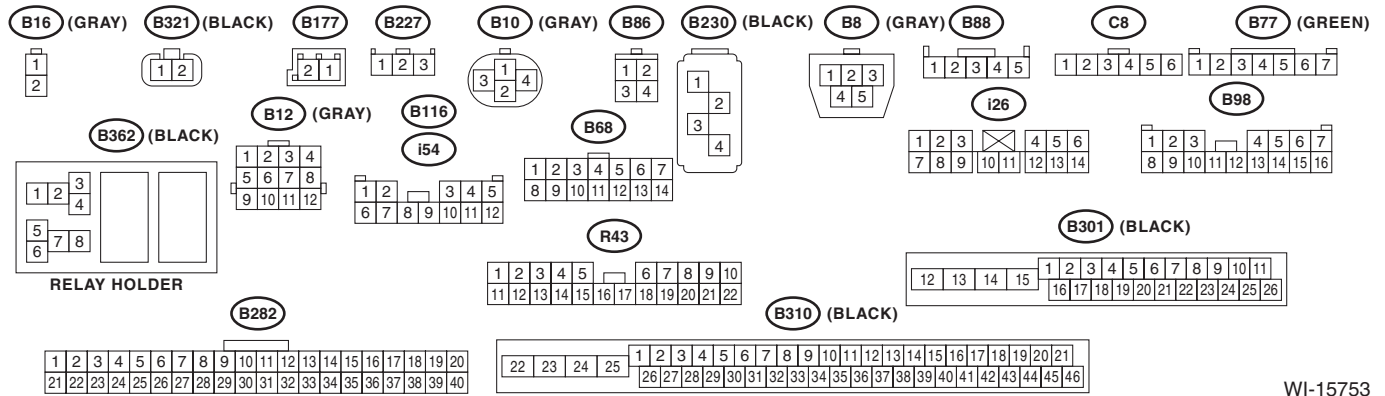
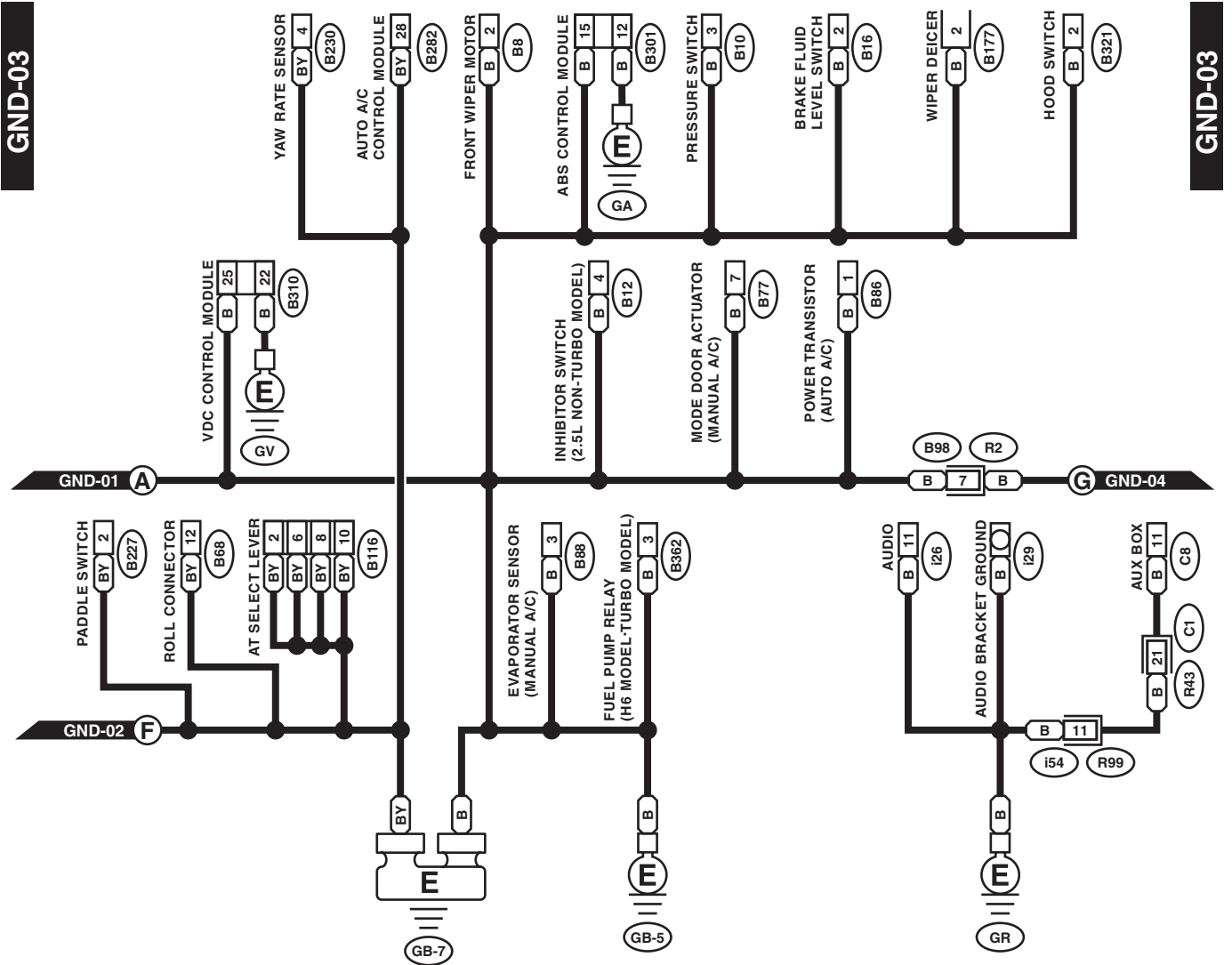
WIRING SYSTEM



WI-15752

# Ground Circuit

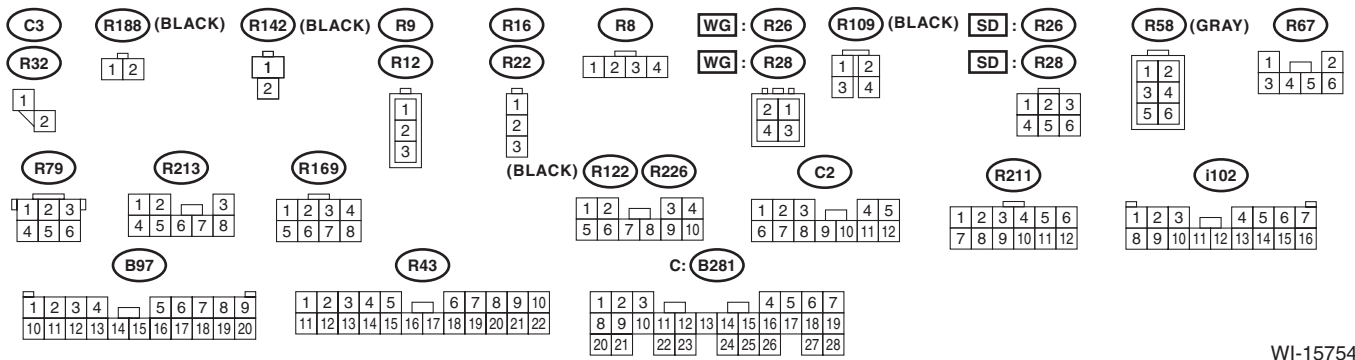
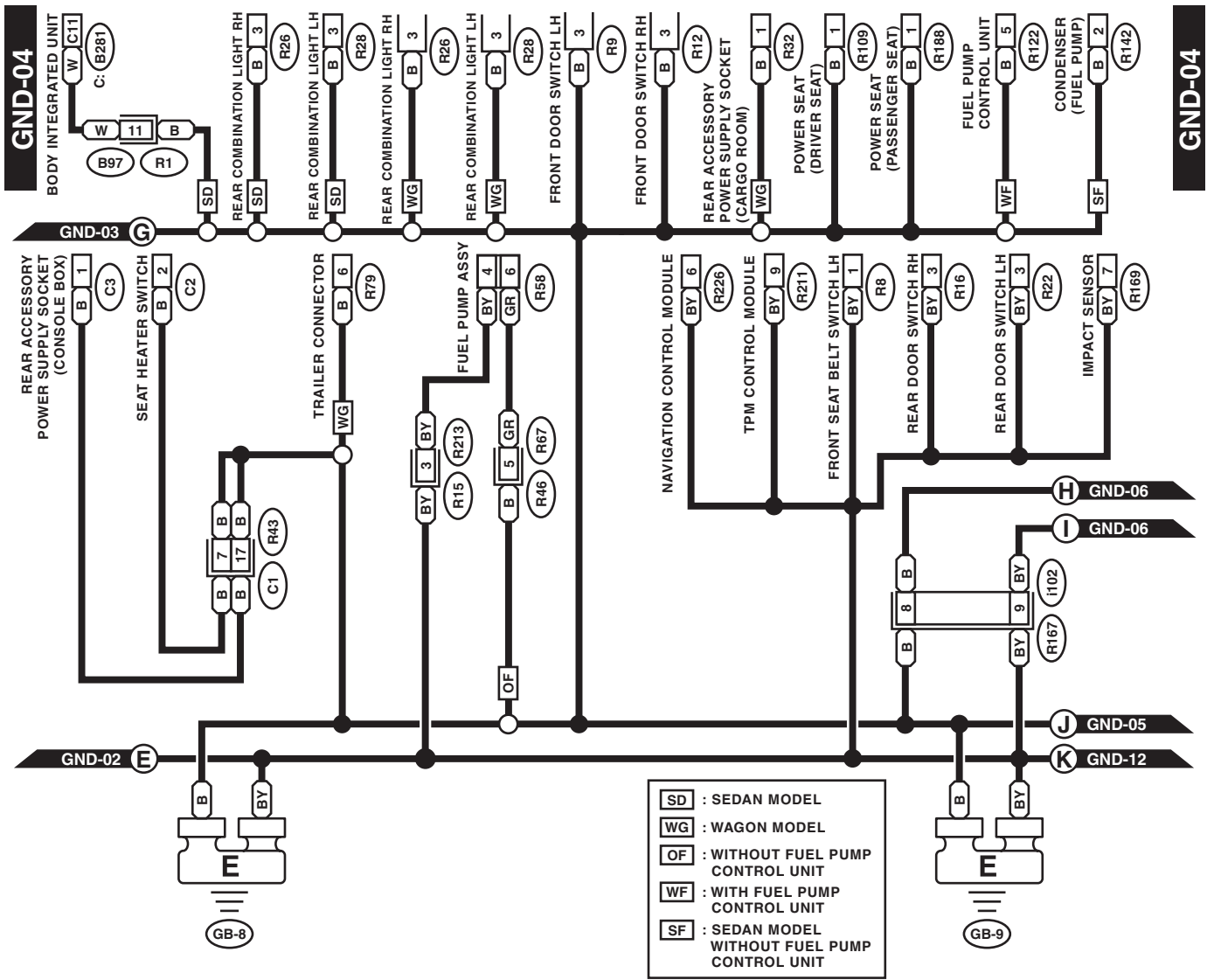
WIRING SYSTEM



WI-15753

# Ground Circuit

WIRING SYSTEM

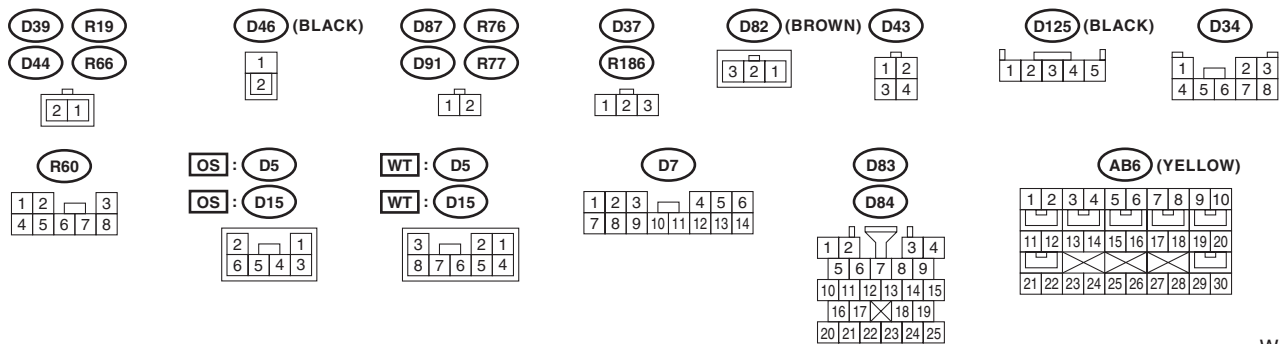
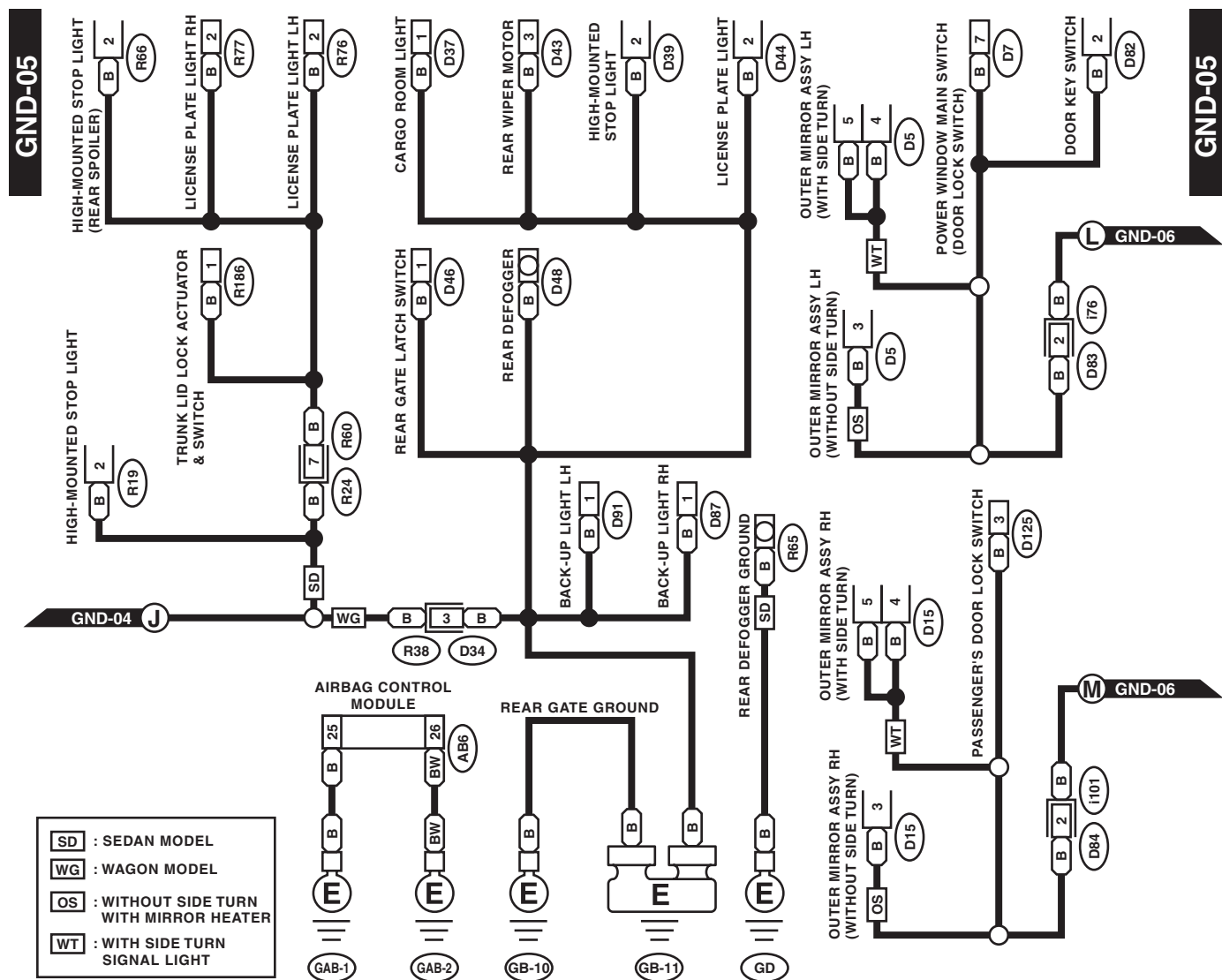


WI-15754



# Ground Circuit

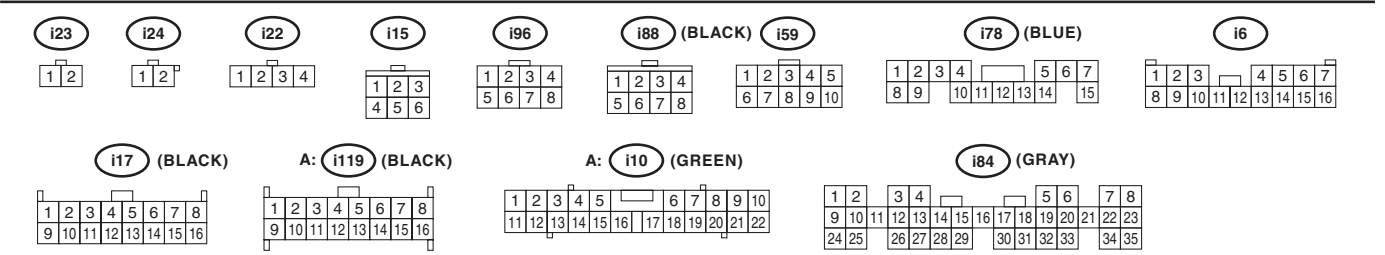
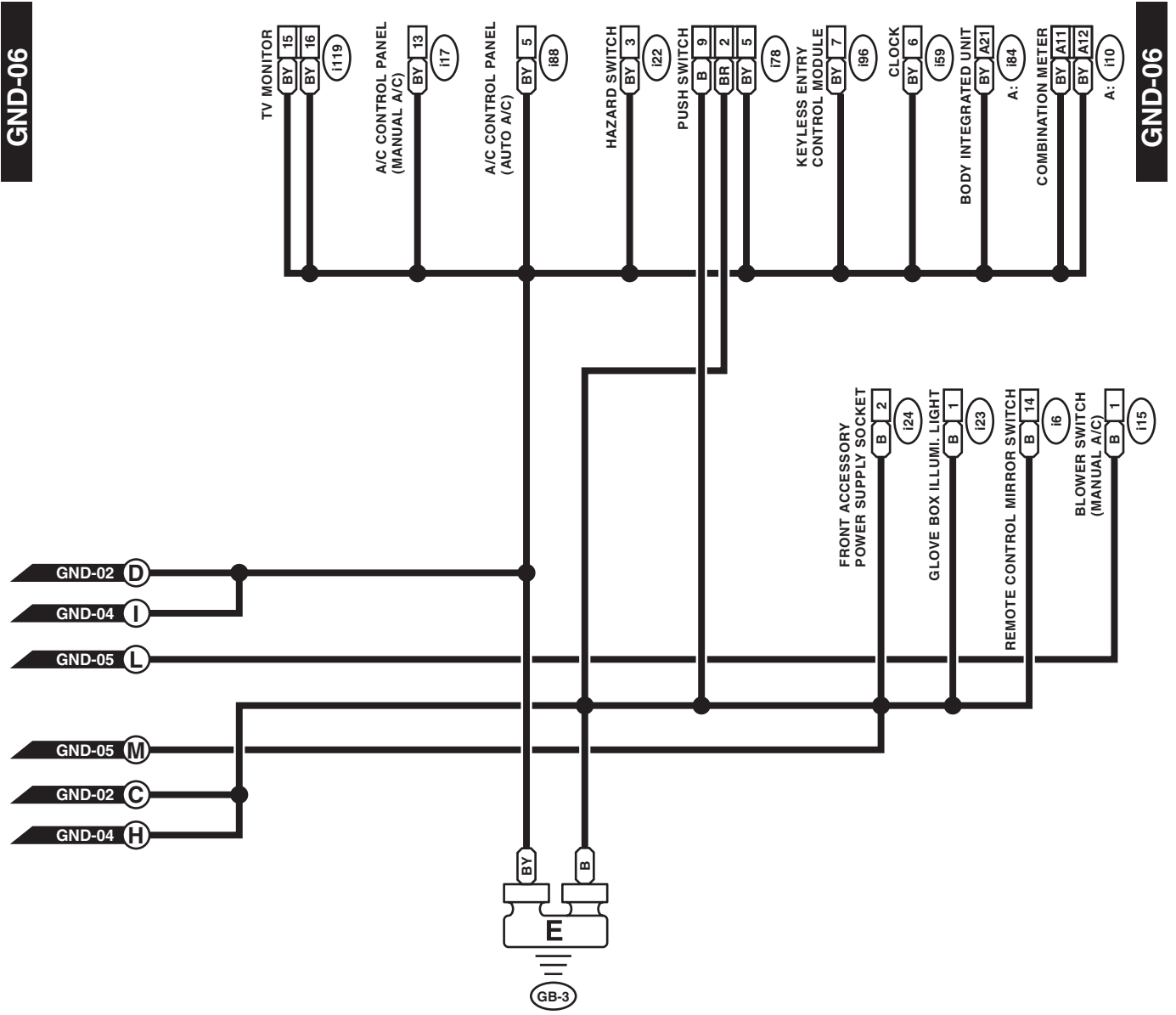
## WIRING SYSTEM



WI-15755

# Ground Circuit

WIRING SYSTEM

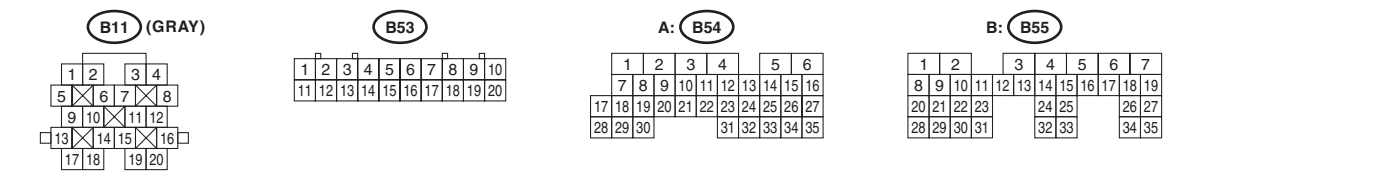
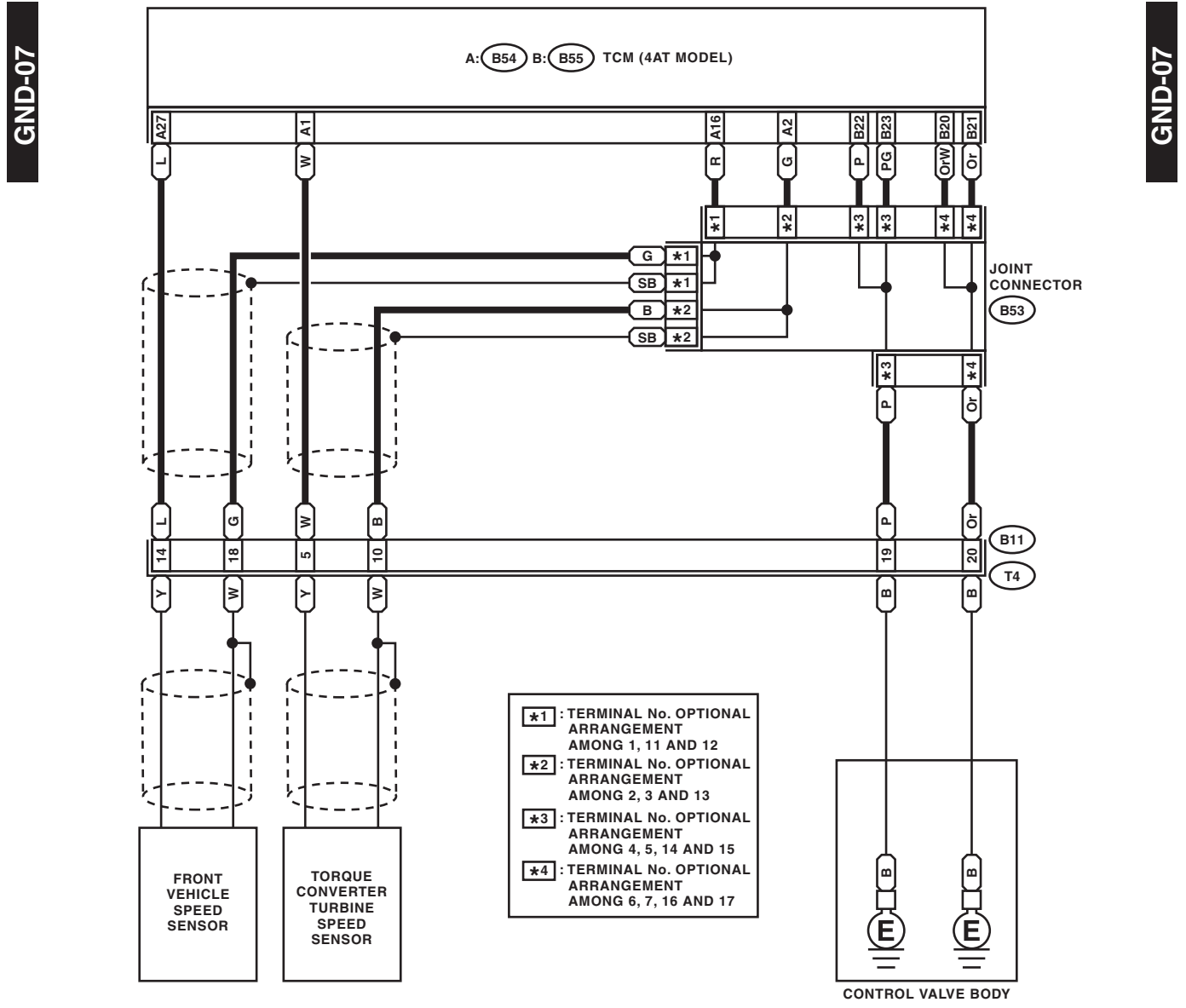


WI-15756

# Ground Circuit

WIRING SYSTEM

## 2. AT TRANSMISSION GROUND (4AT MODEL)

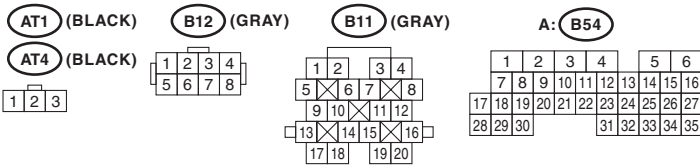
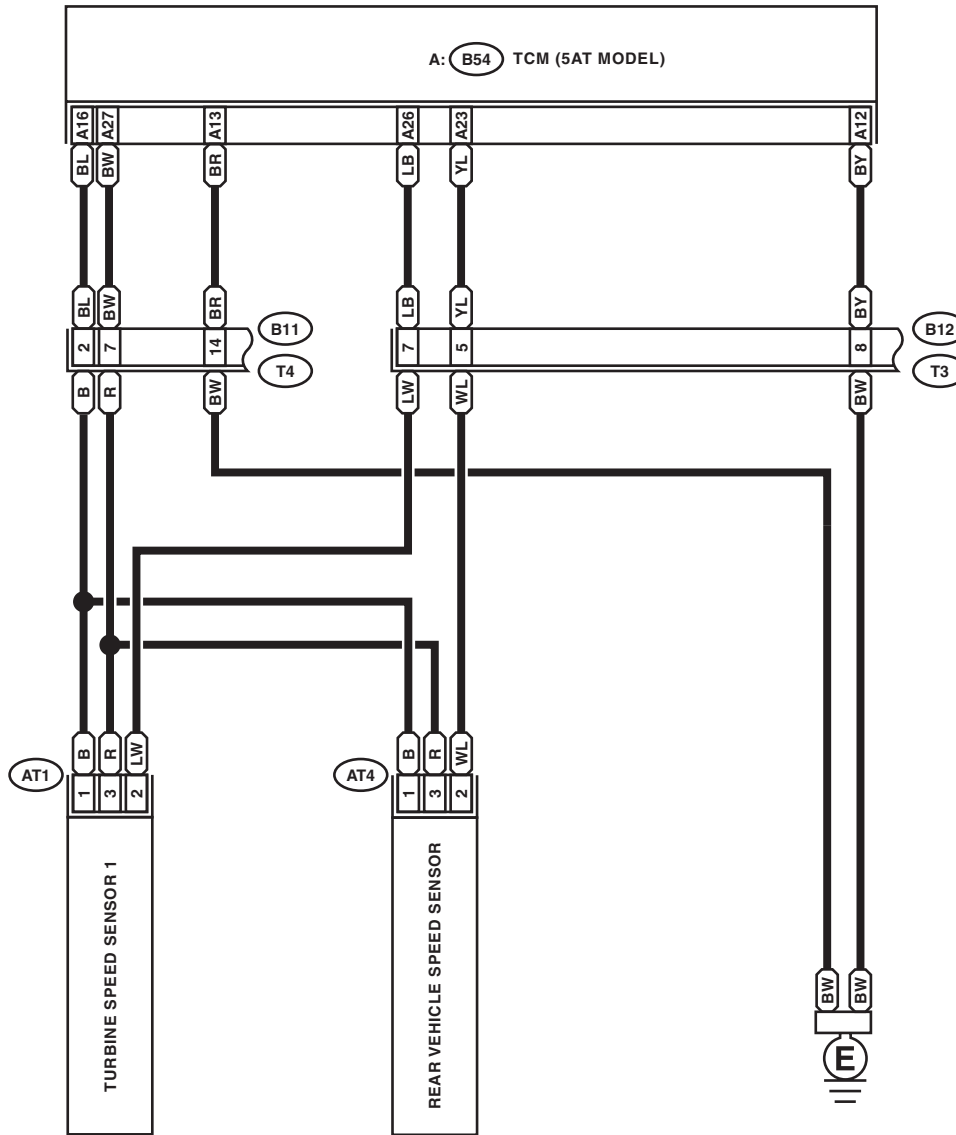


WI-15757

## 3. AT TRANSMISSION GROUND (5AT MODEL)

GND-08

GND-08



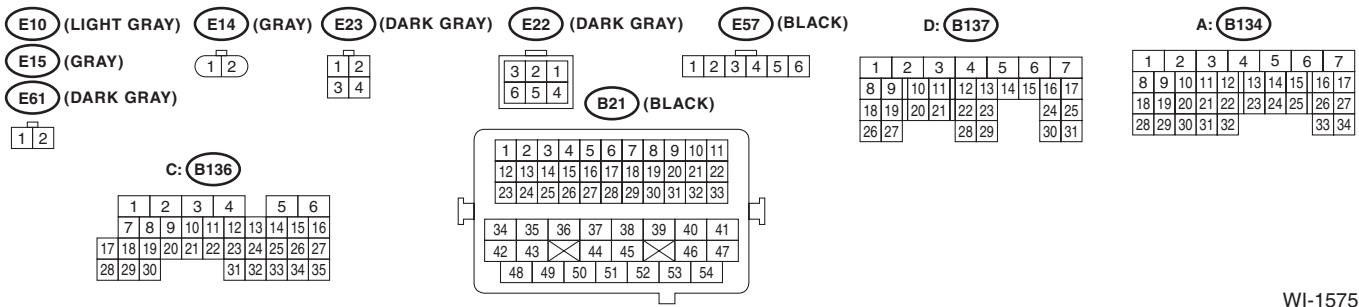
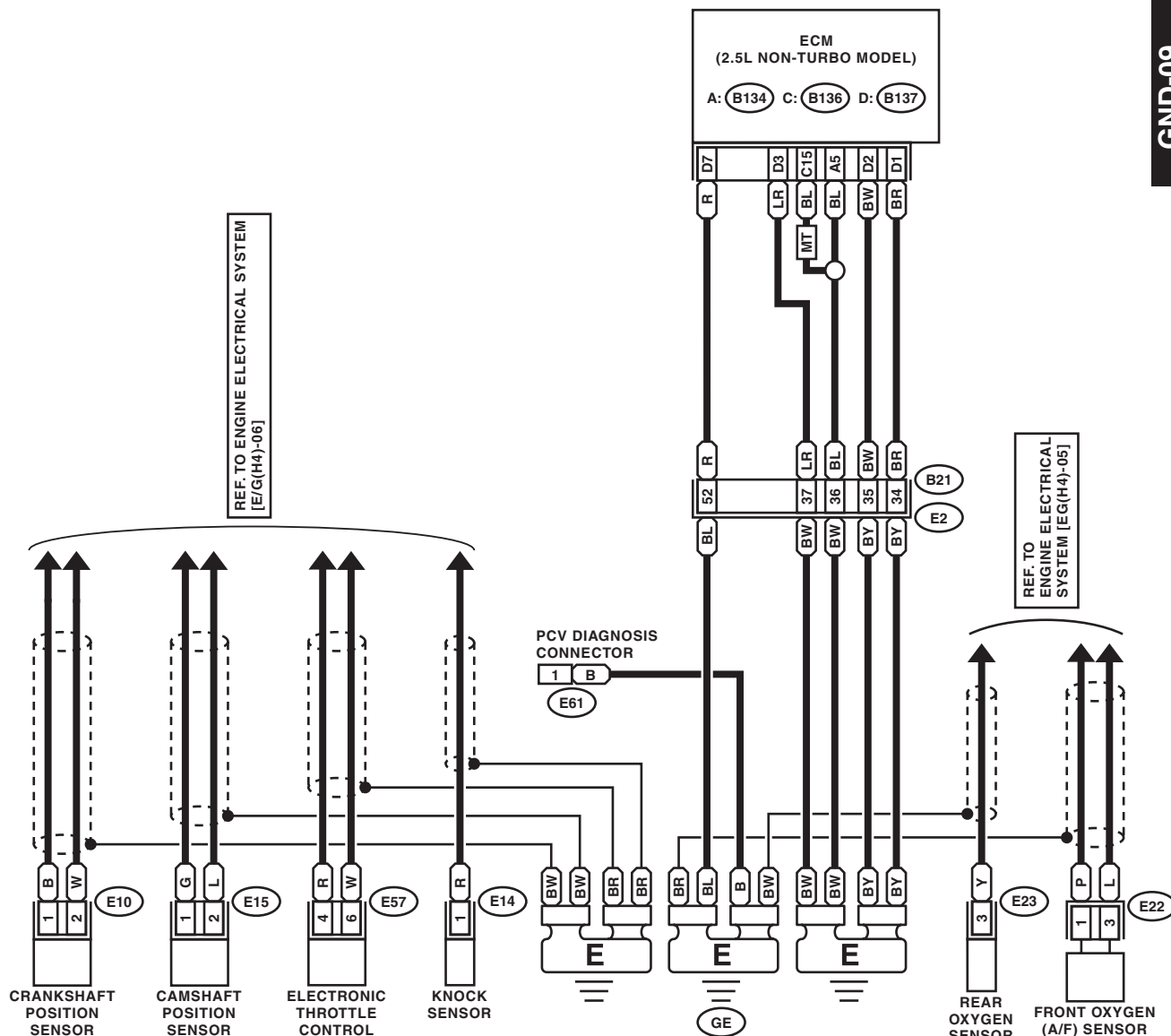
# Ground Circuit

WIRING SYSTEM

## 4. ENGINE GROUND (2.5 L NON-TURBO MODEL)

GND-09

GND-09

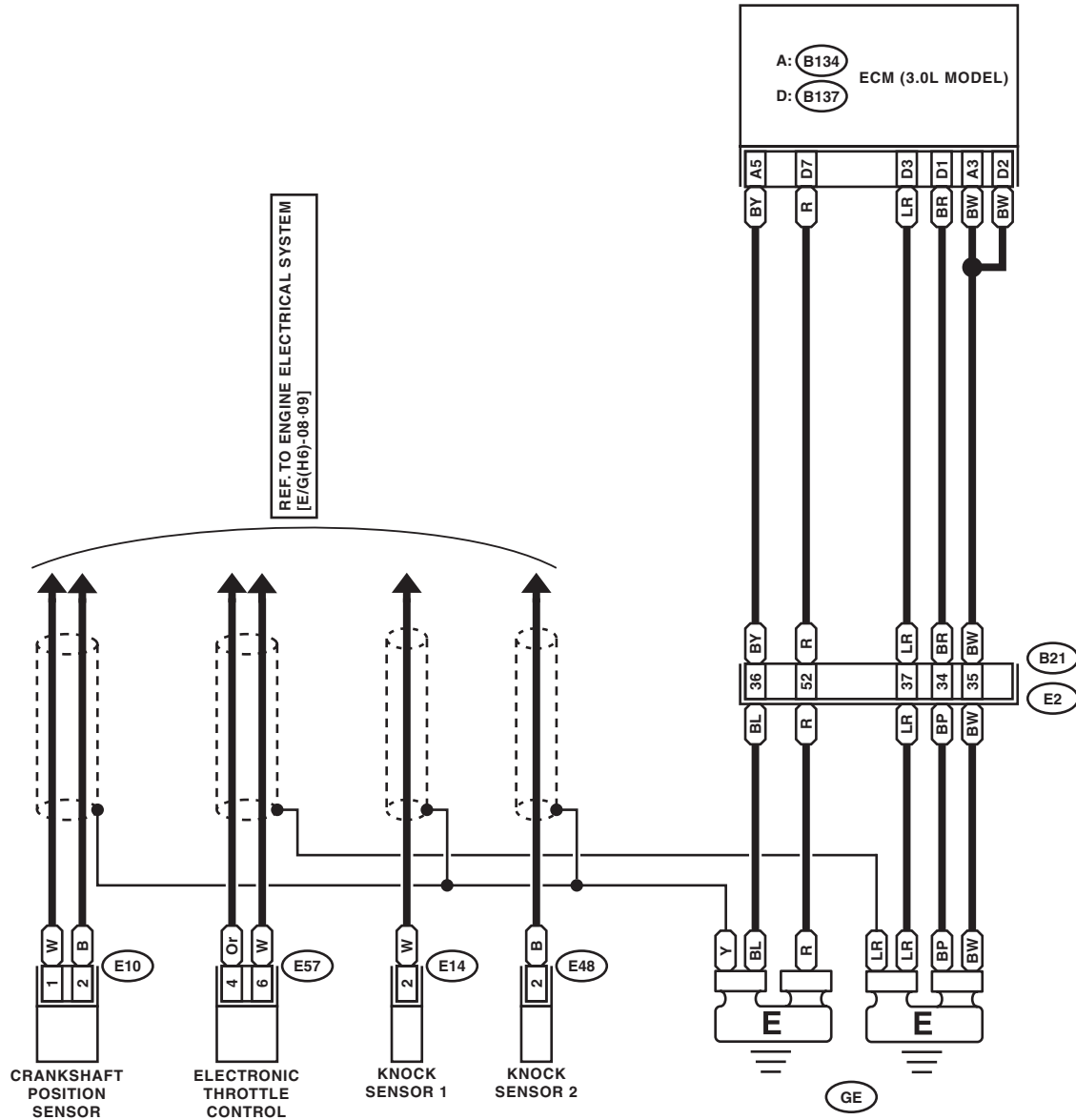


WI-15759

## 5. ENGINE GROUND (3.0 L MODEL)

GND-10

GND-10



E10 (DARK GRAY)

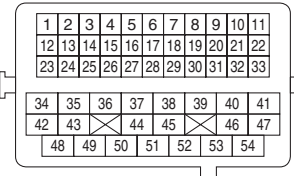
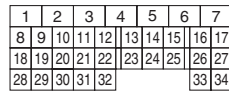
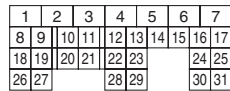
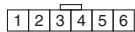
E57 (BLACK)

D: B137

A: B134

B21 (BLACK)

E14 (BLUE)



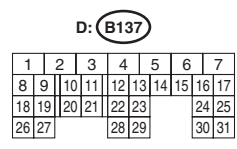
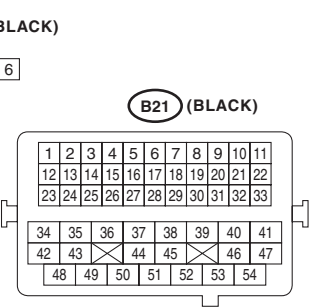
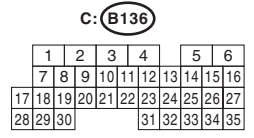
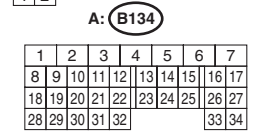
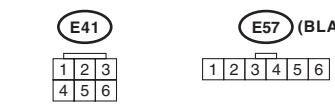
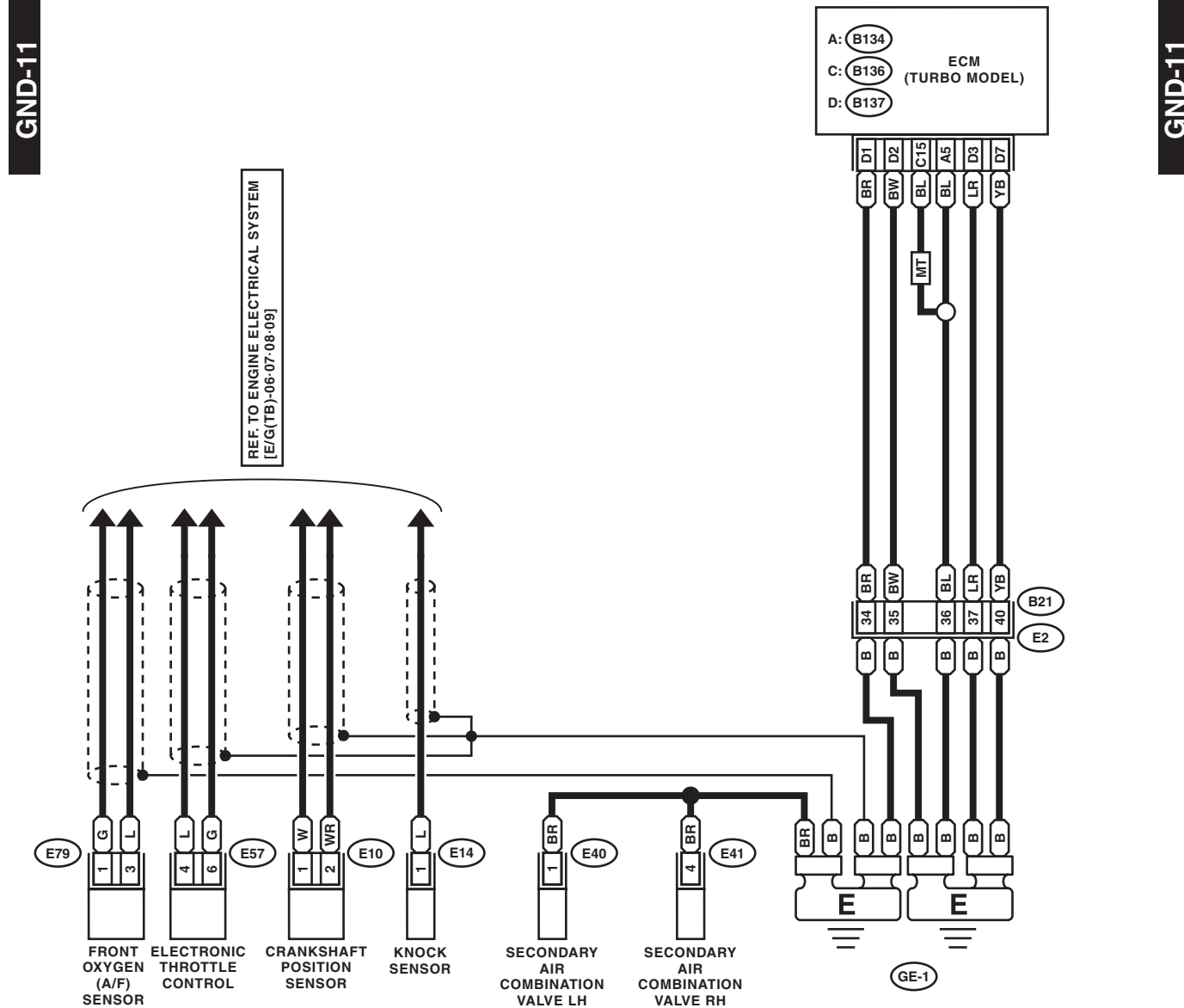
# Ground Circuit

WIRING SYSTEM

## 6. ENGINE GROUND (2.5 L TURBO MODEL)

GND-11

GND-11

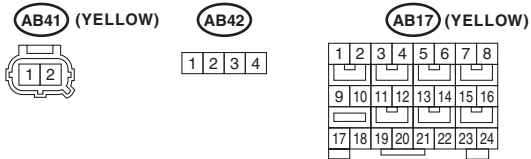
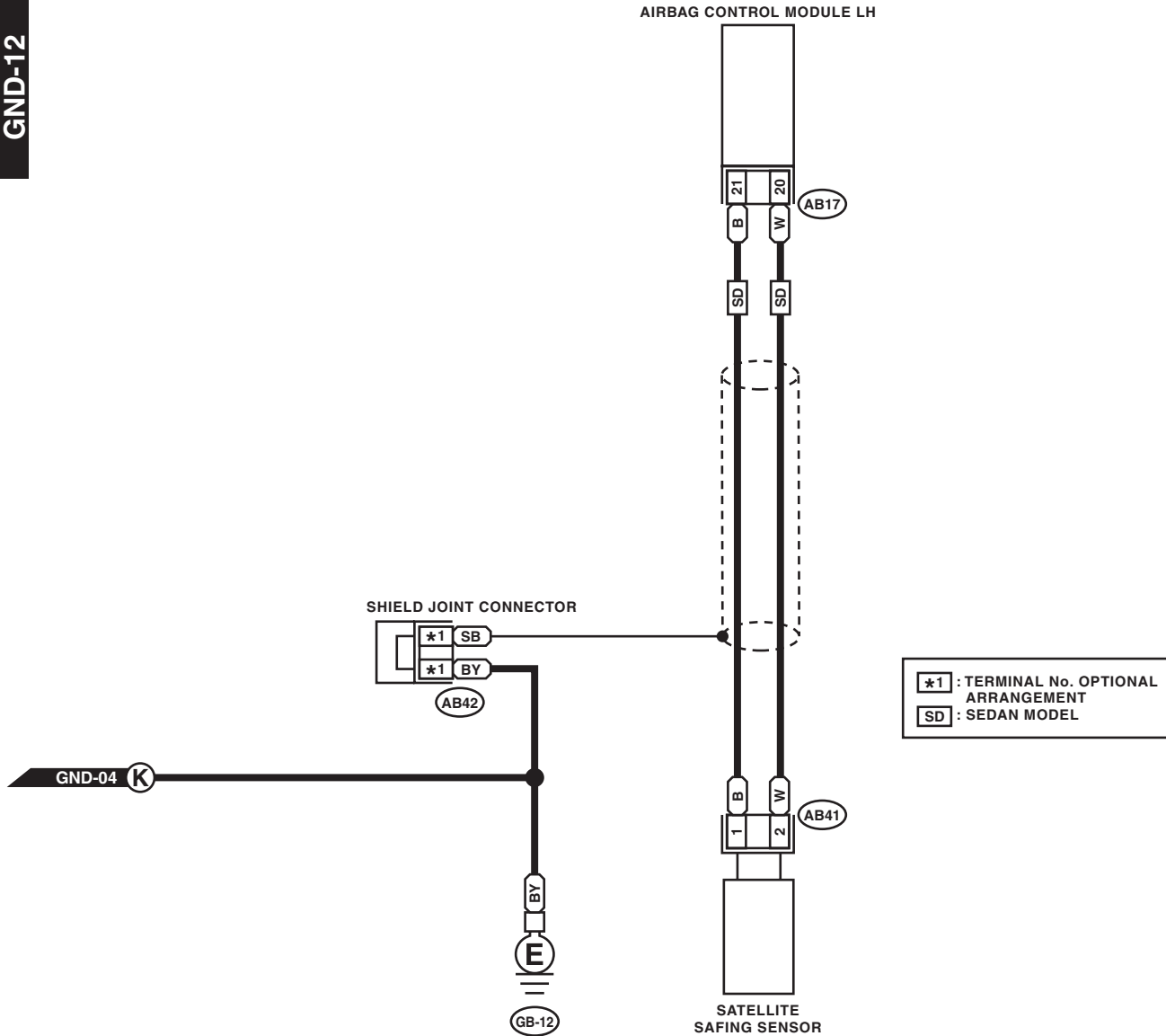


WI-15761

## 7. AIRBAG GROUND

GND-12

GND-12



WI-15762



# Engine Electrical System

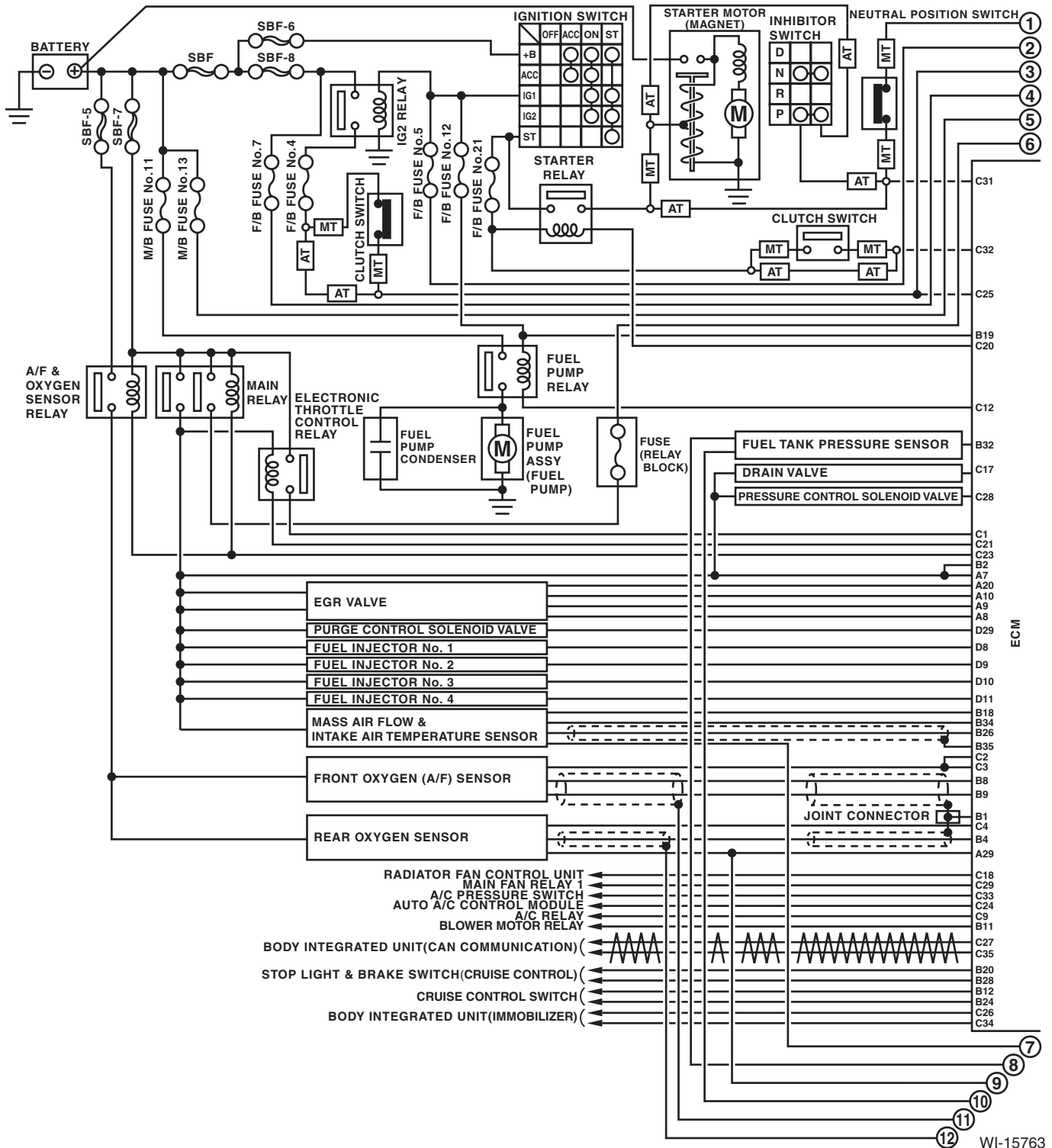
## WIRING SYSTEM

### 5. Engine Electrical System

#### A: WIRING DIAGRAM

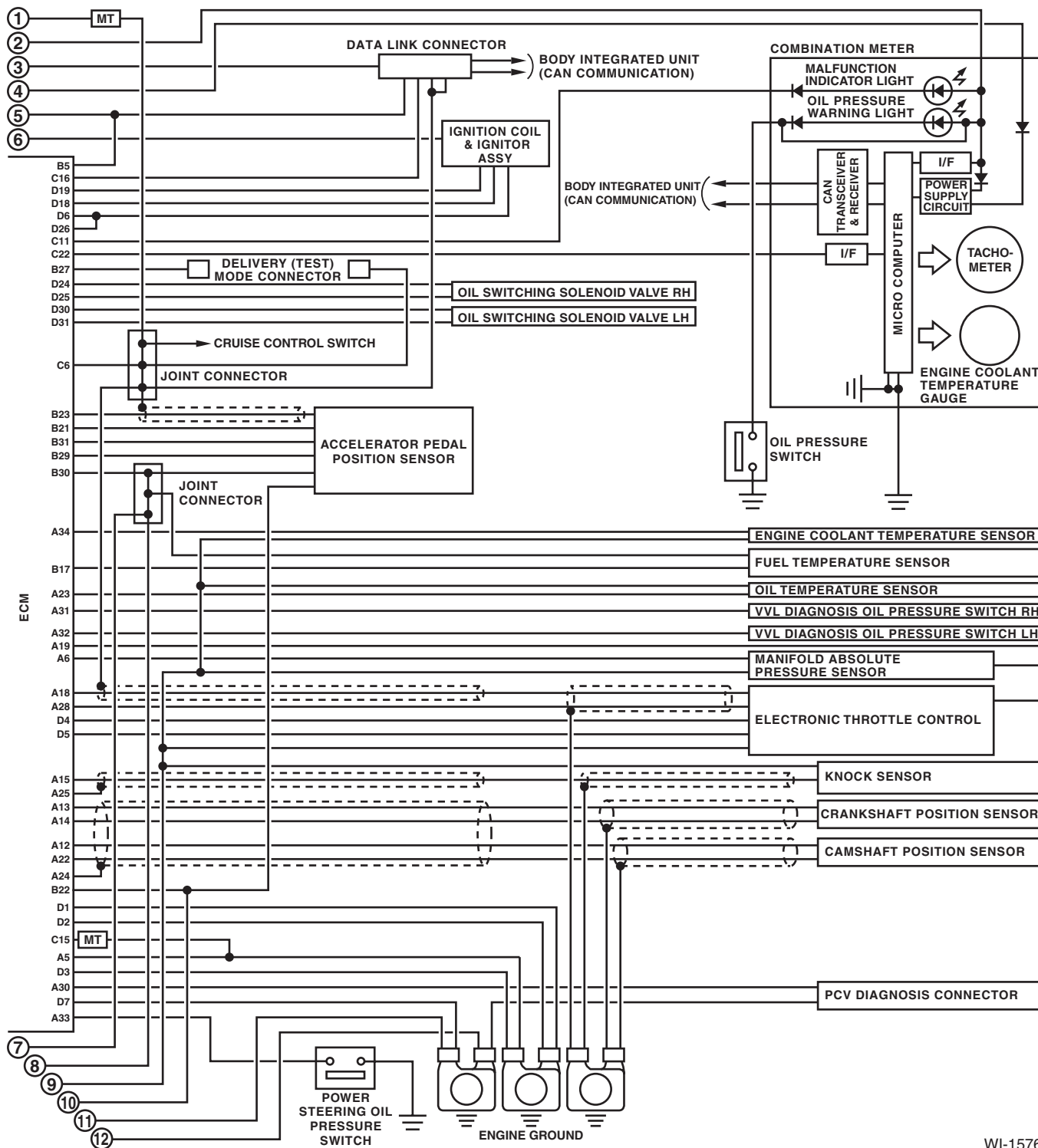
##### 1. 2.5 L NON-TURBO MODEL

- Transmission serial No. 4078112 or earlier



# Engine Electrical System

WIRING SYSTEM



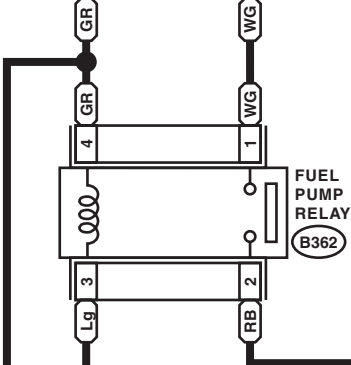
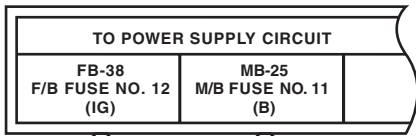
WI-15764

# Engine Electrical System

## WIRING SYSTEM

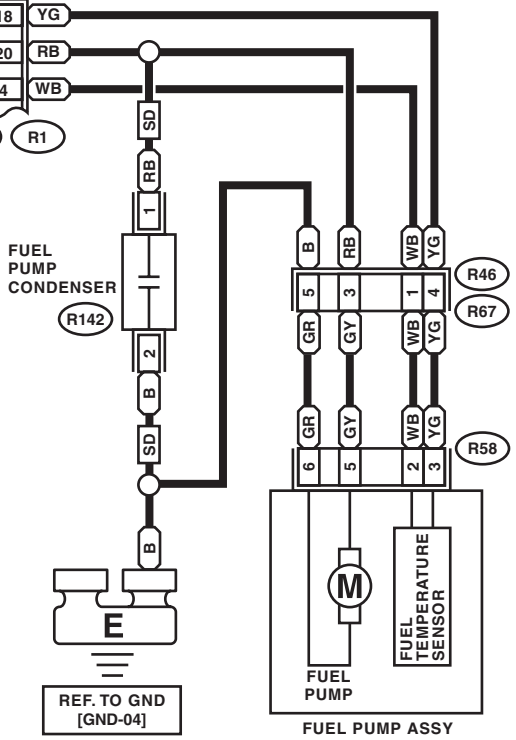
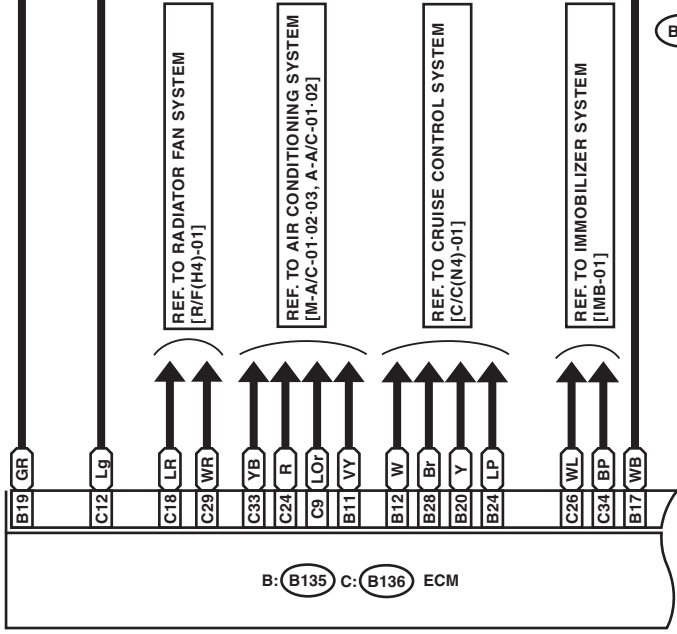
E/G(H4)-01

E/G(H4)-01



SD : SEDAN MODEL

A E/G(H4)-08



SD : R142 (BLACK)

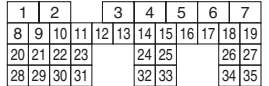
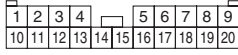
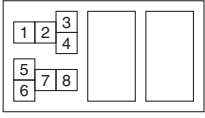
R58 (GRAY)

R67

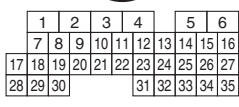
B362 (BLACK)

B97

B: B135



C: B136



RELAY HOLDER

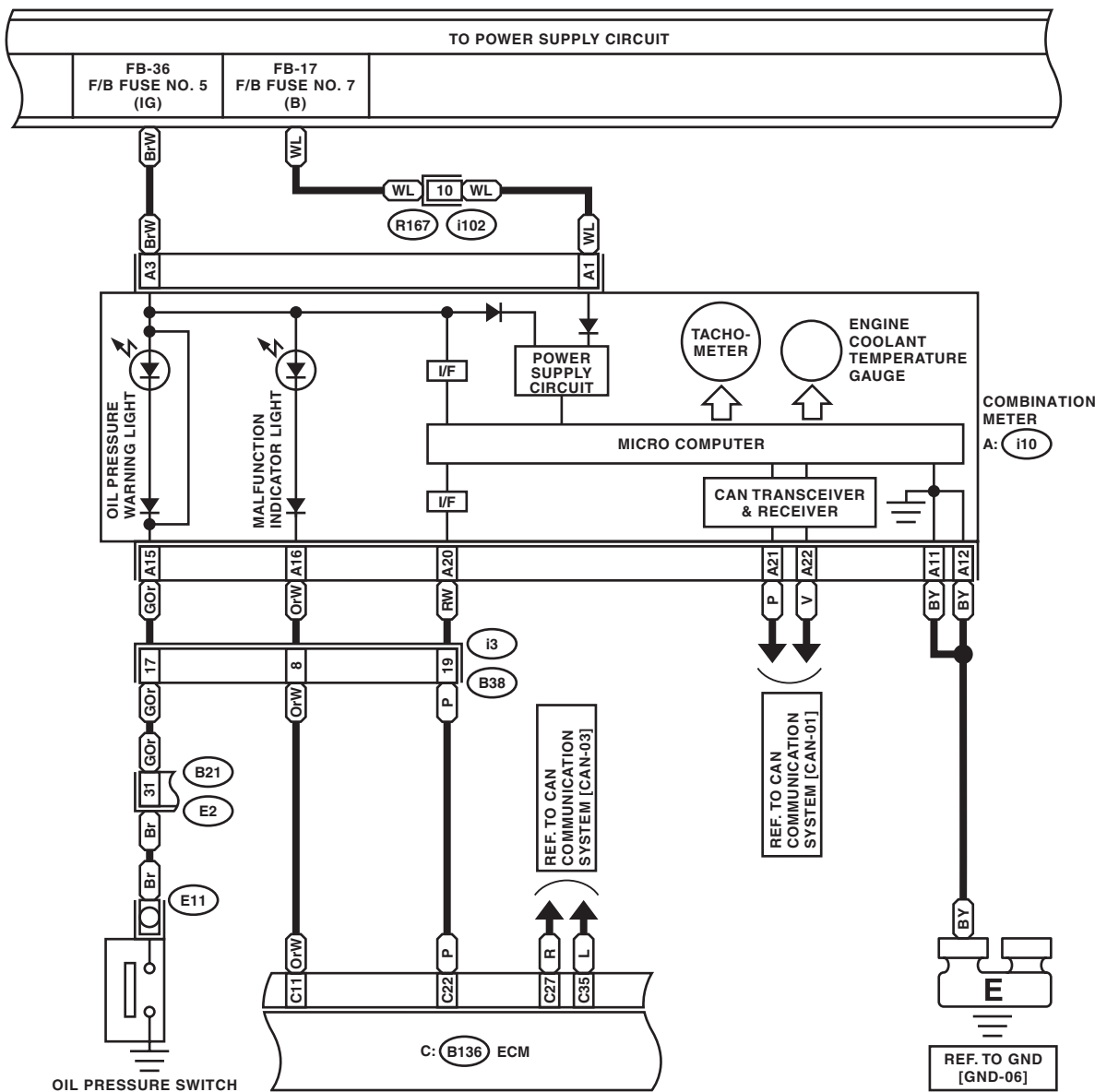
WI-15765

# Engine Electrical System

WIRING SYSTEM

E/G(H4)-02

E/G(H4)-02



i102

1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15	16

B38

1	2	3	4	5	6	7	8	9		
10	11	12	13	14	15	16	17	18	19	20

B21 (BLACK)

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

A: i10 (GREEN)

1	2	3	4	5	6	7	8	9	10		
11	12	13	14	15	16	17	18	19	20	21	22

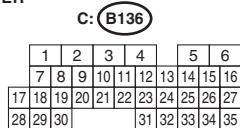
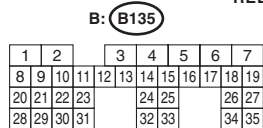
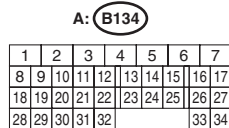
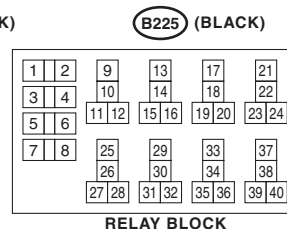
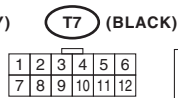
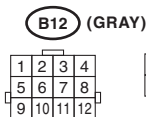
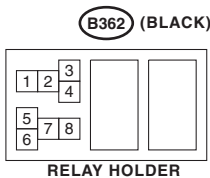
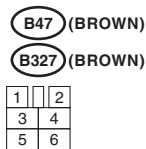
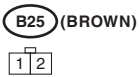
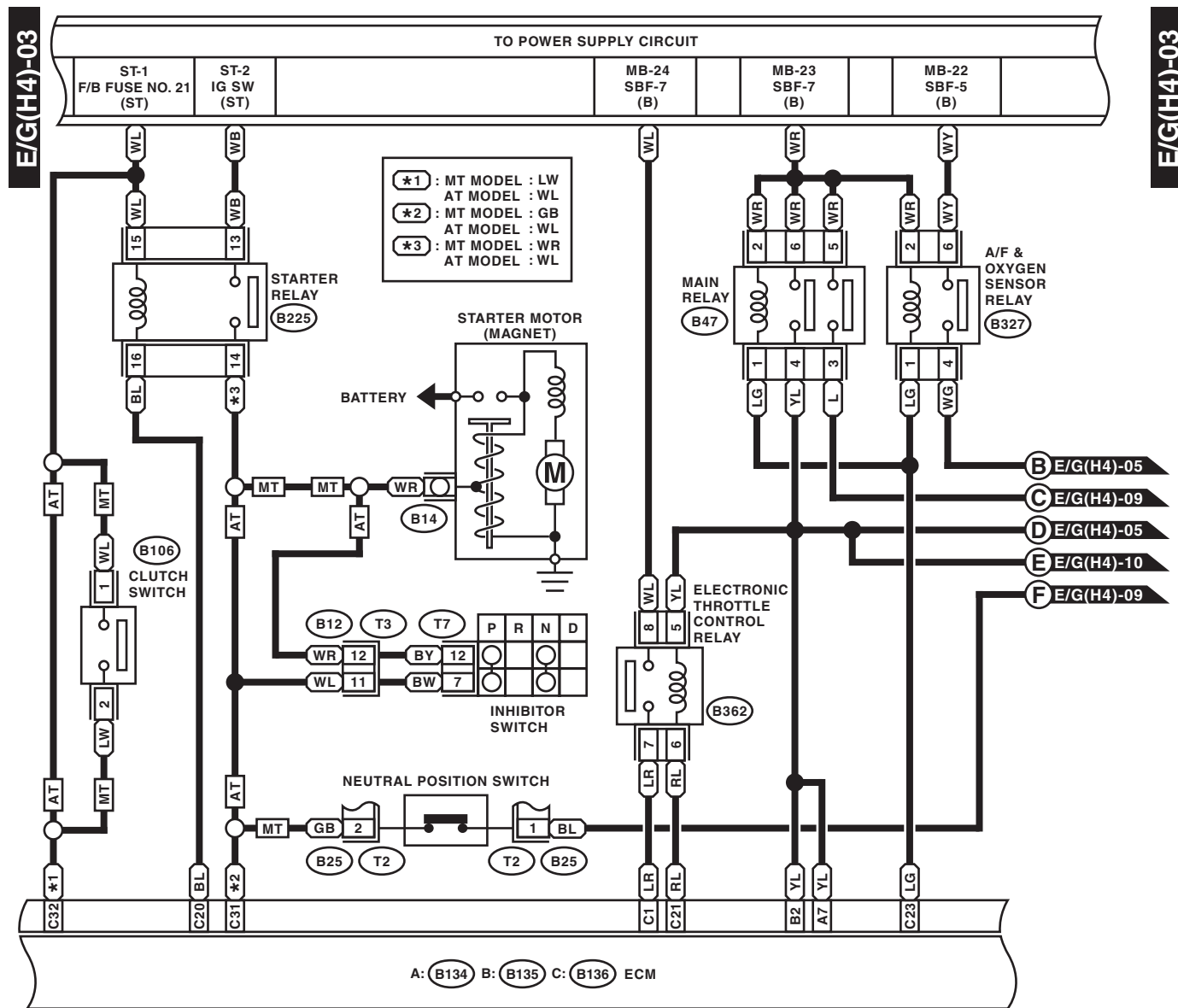
C: B136

1	2	3	4	5	6					
7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35			

WI-15766

# Engine Electrical System

## WIRING SYSTEM



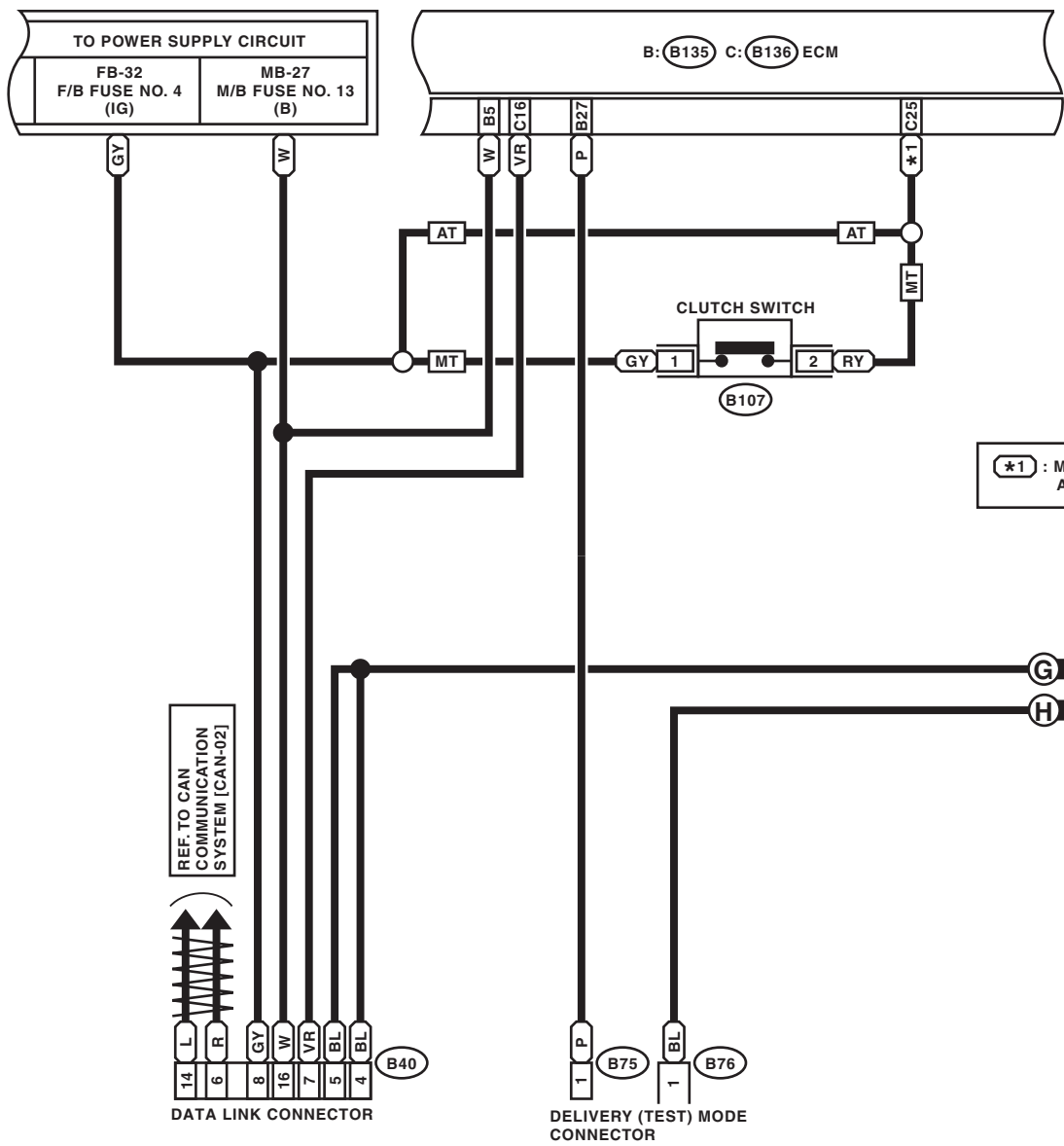
WI-15767

# Engine Electrical System

WIRING SYSTEM

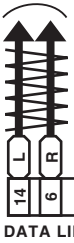
E/G(H4)-04

E/G(H4)-04

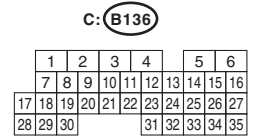
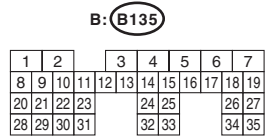
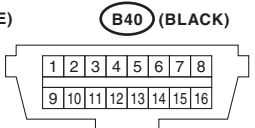
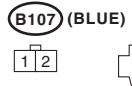
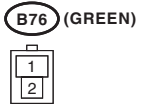
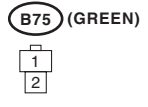


\*1 : MT MODEL : RY  
AT MODEL : GY

REF. TO CAN COMMUNICATION SYSTEM [CAN-02]



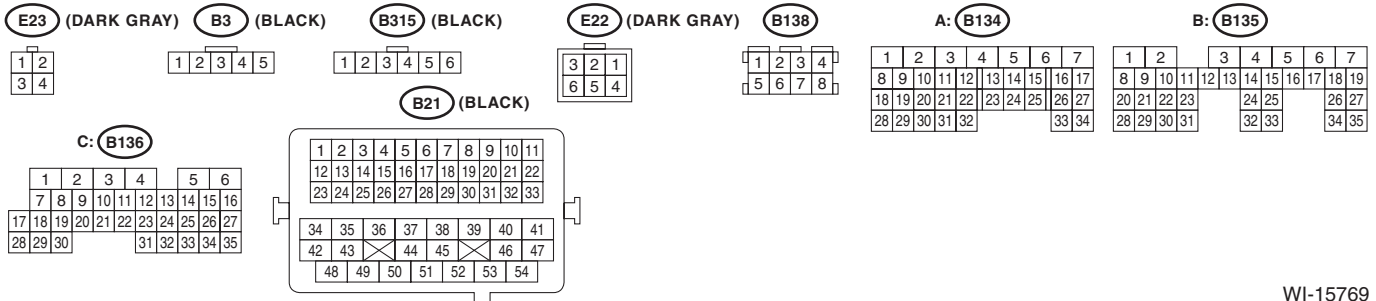
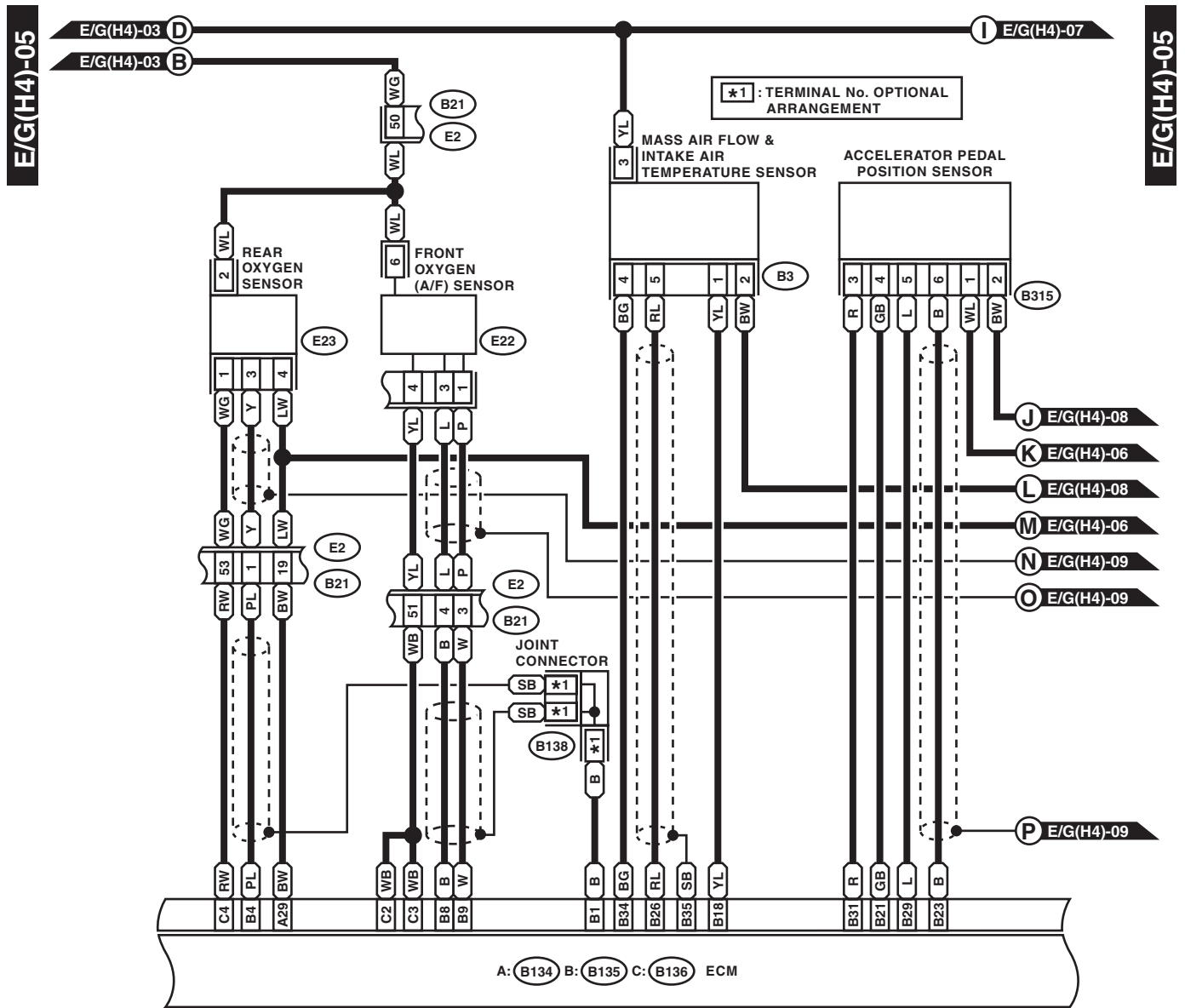
DELIVERY (TEST) MODE CONNECTOR



WI-15768

# Engine Electrical System

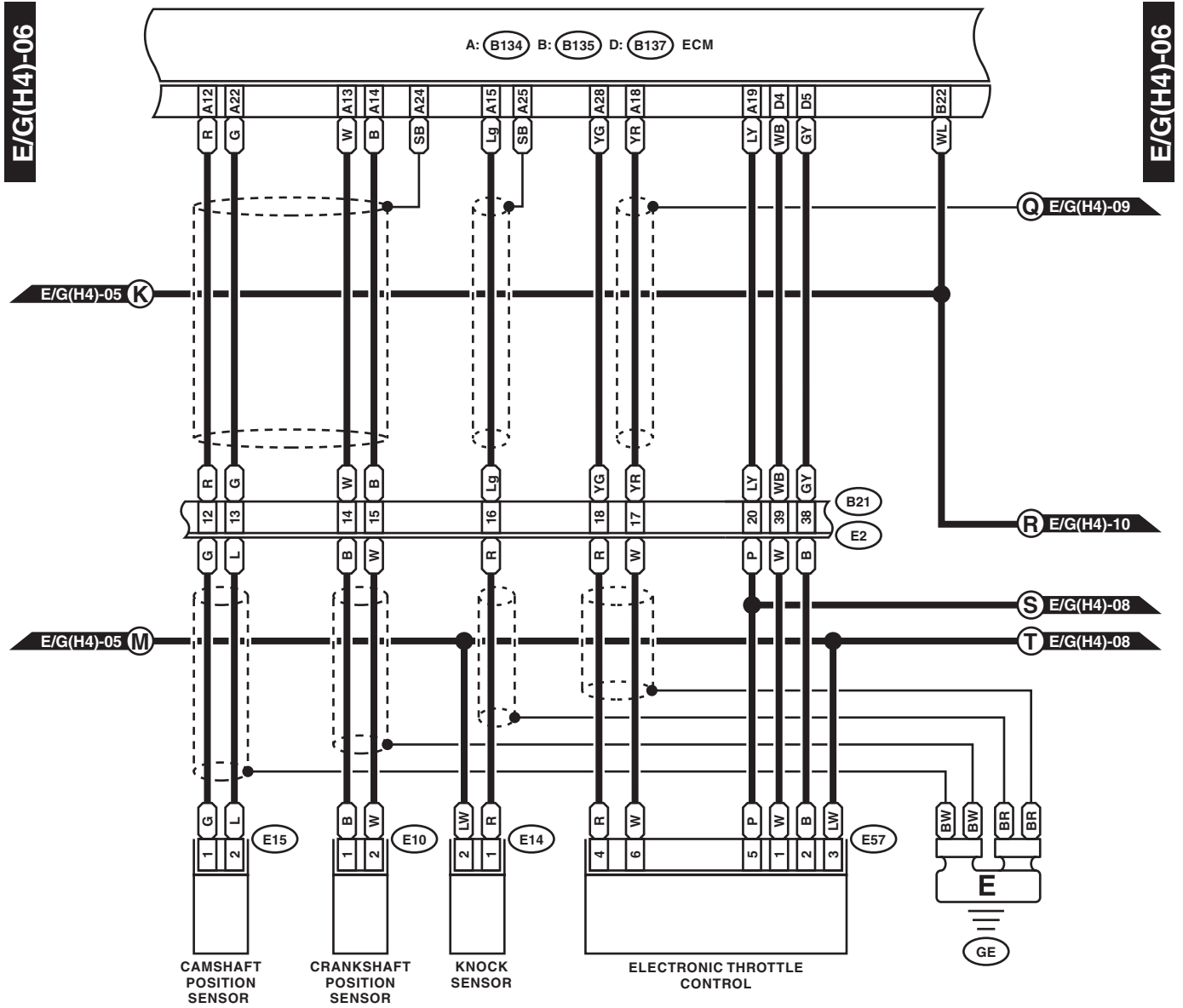
## WIRING SYSTEM



WI-15769

# Engine Electrical System

WIRING SYSTEM



E10 (LIGHT GRAY)

E14 (GRAY)

E57 (BLACK)

D: B137

E15 (GRAY)

1 2

1 2 3 4 5 6

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

B21 (BLACK)

A: B134

B: B135

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

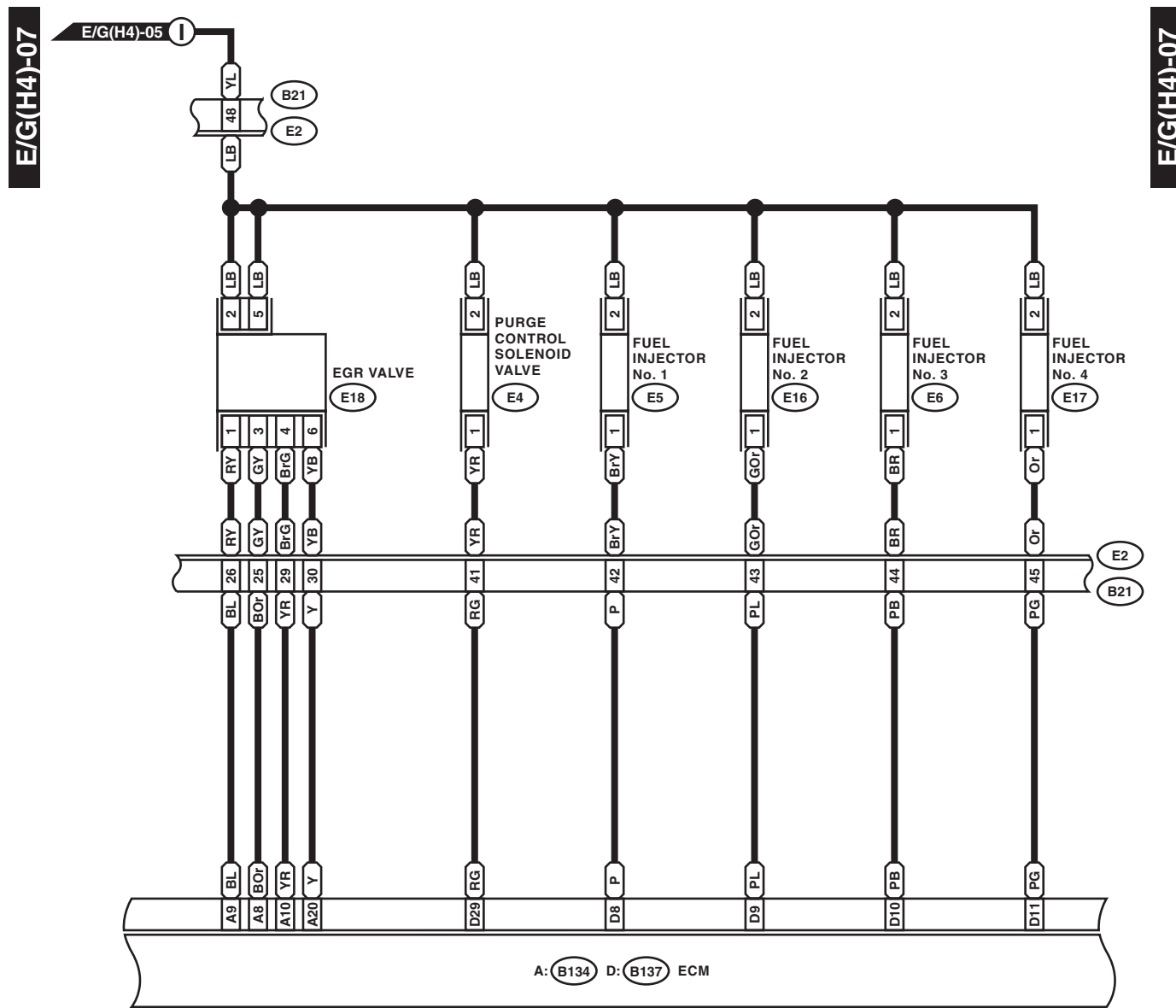
1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55

WI-15770



# Engine Electrical System

WIRING SYSTEM



**E4 (BLACK)**  

1	2
---	---

**E18 (DARK GRAY)**  

1	2	3
4	5	6

**D: B137**  

1	2	3	4	5	6	7			
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31						

**A: B134**  

1	2	3	4	5	6	7			
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31	32				33	34

**B21 (BLACK)**  

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

**(LIGHT GRAY) E5 (LIGHT GRAY)**  

1	2
---	---

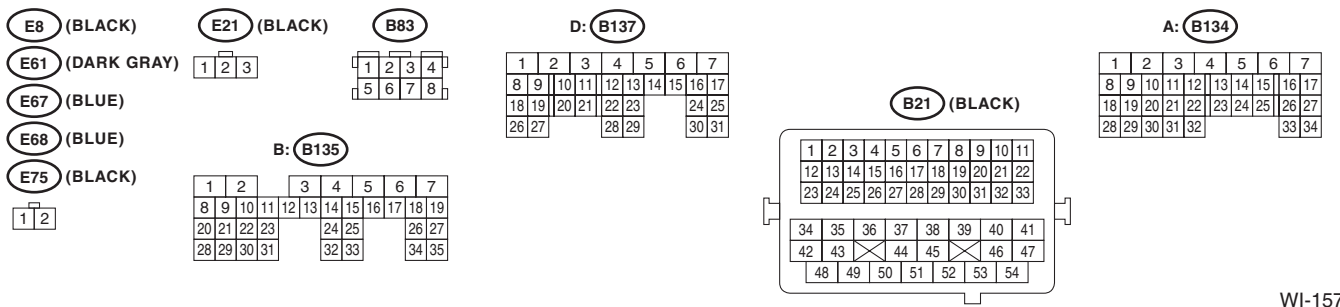
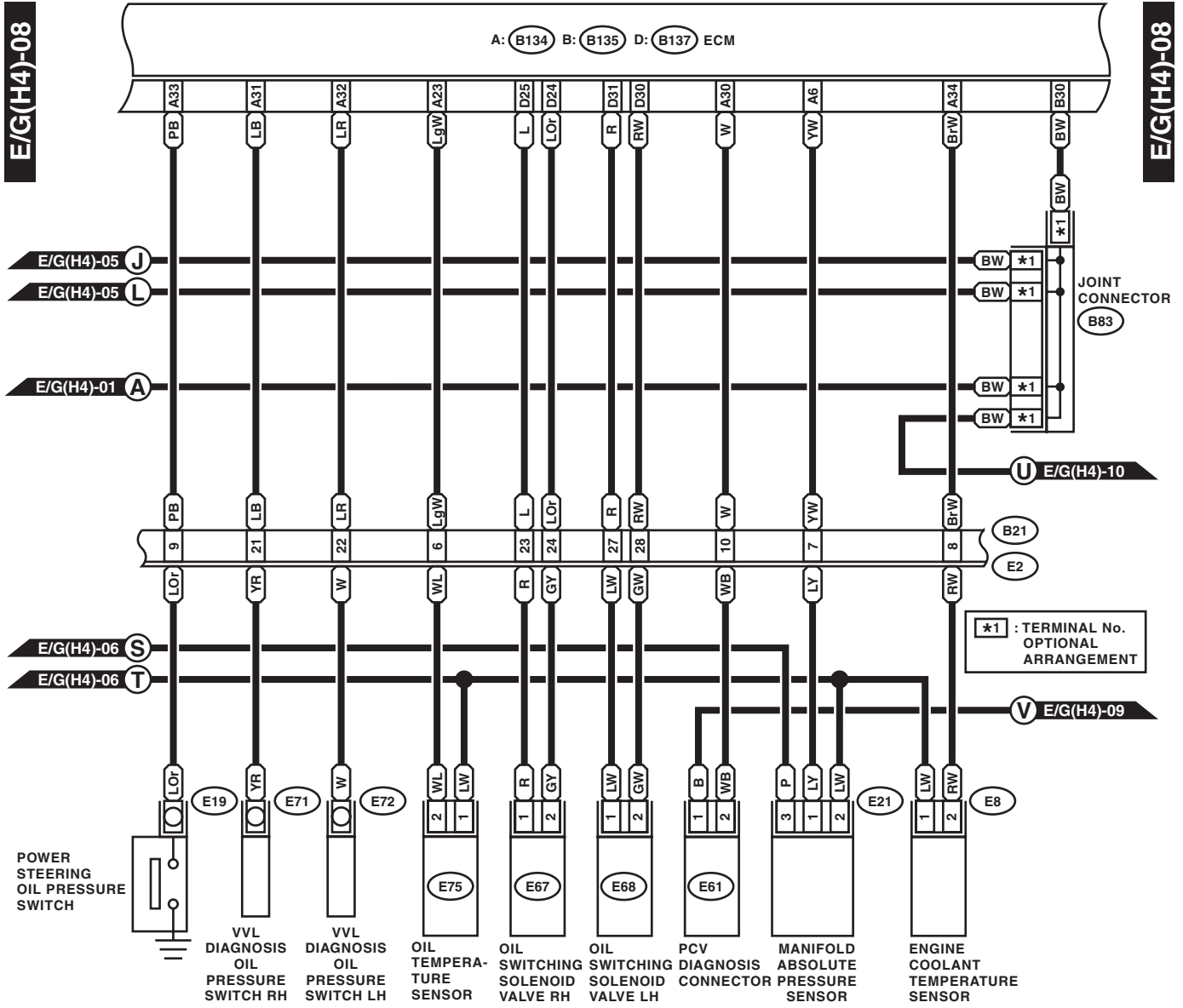
**(LIGHT GRAY) E6 (LIGHT GRAY)**  

1	2
---	---

WI-16200

# Engine Electrical System

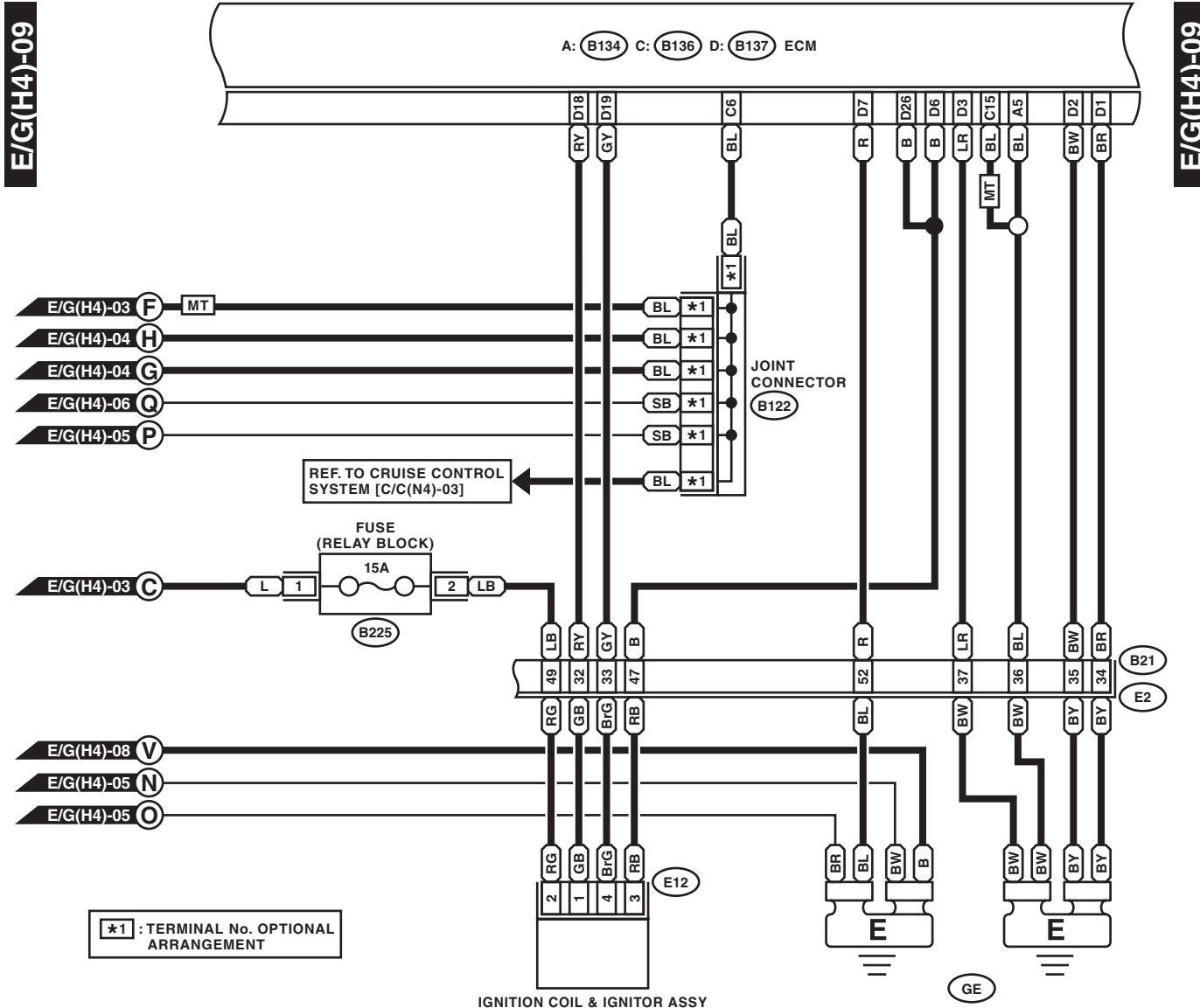
WIRING SYSTEM



WI-15771

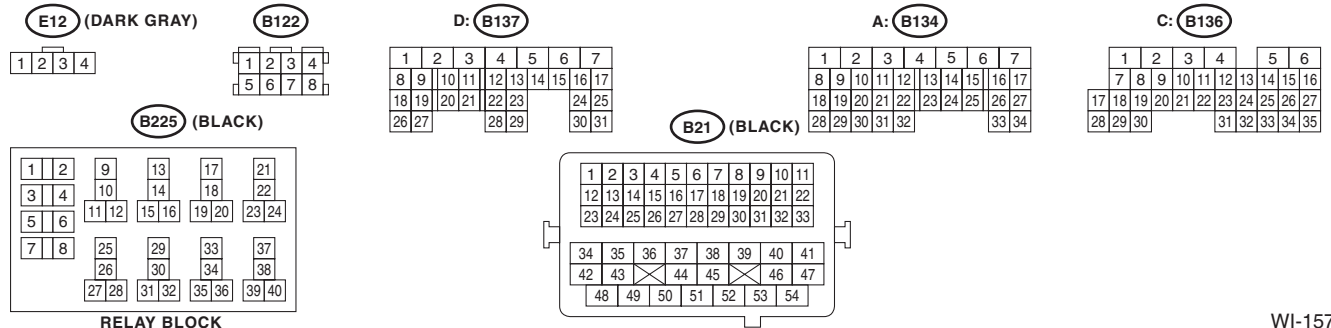
# Engine Electrical System

## WIRING SYSTEM



\*1 : TERMINAL No. OPTIONAL ARRANGEMENT

IGNITION COIL & IGNITOR ASSY



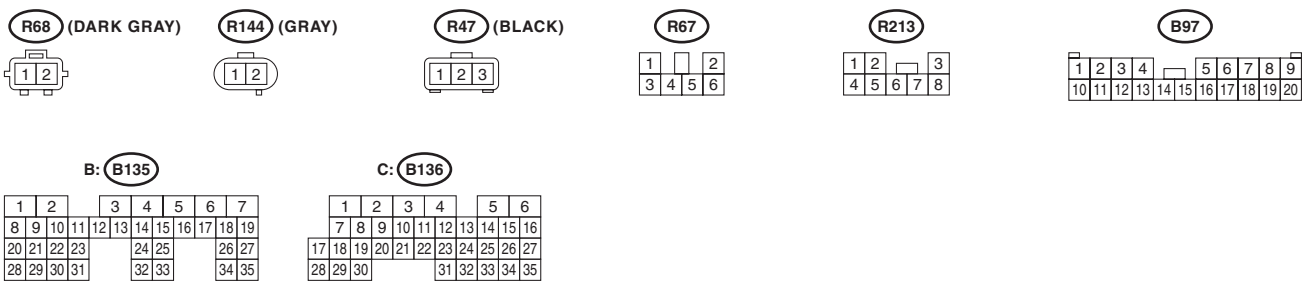
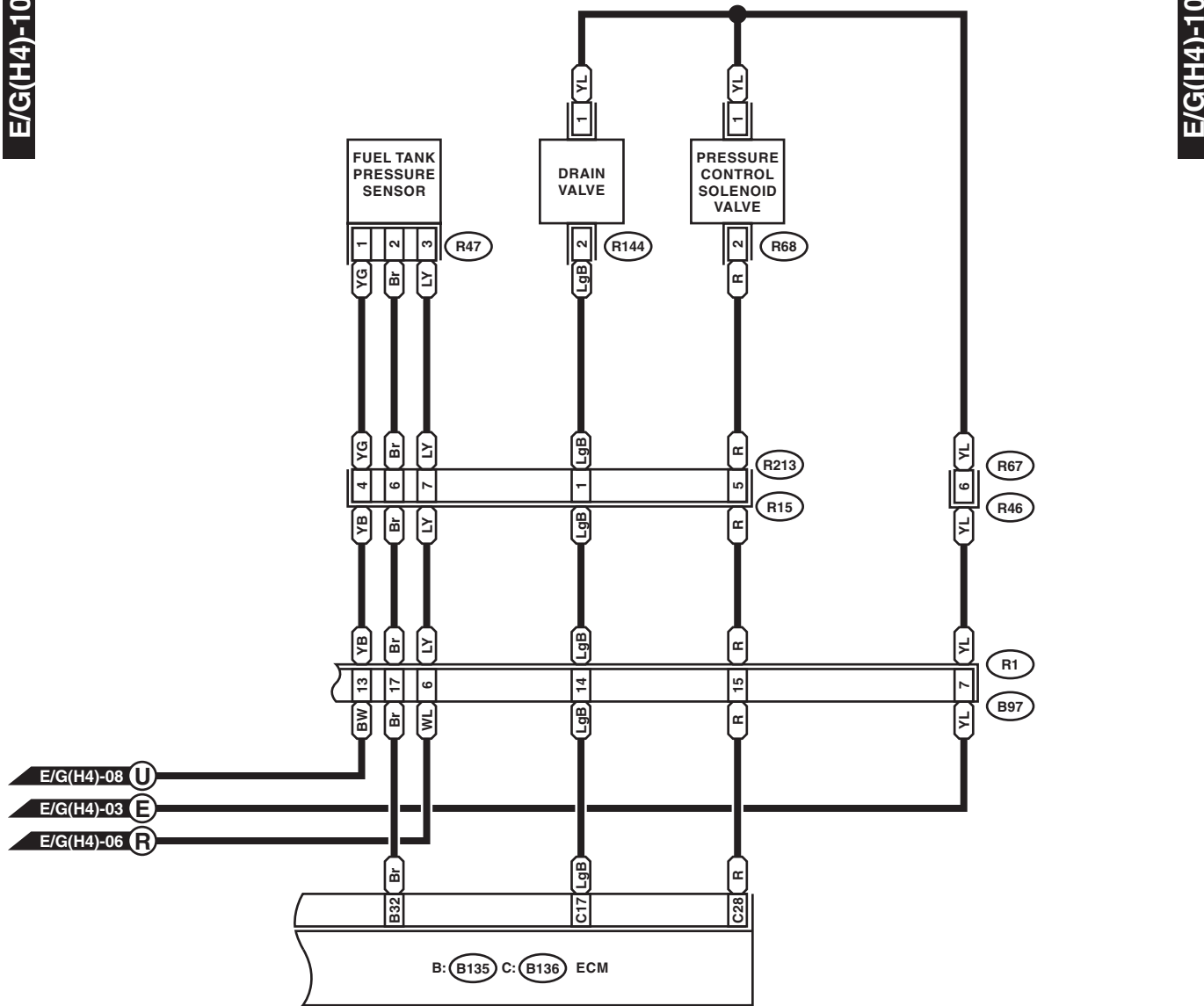
WI-15772

# Engine Electrical System

WIRING SYSTEM

E/G(H4)-10

E/G(H4)-10

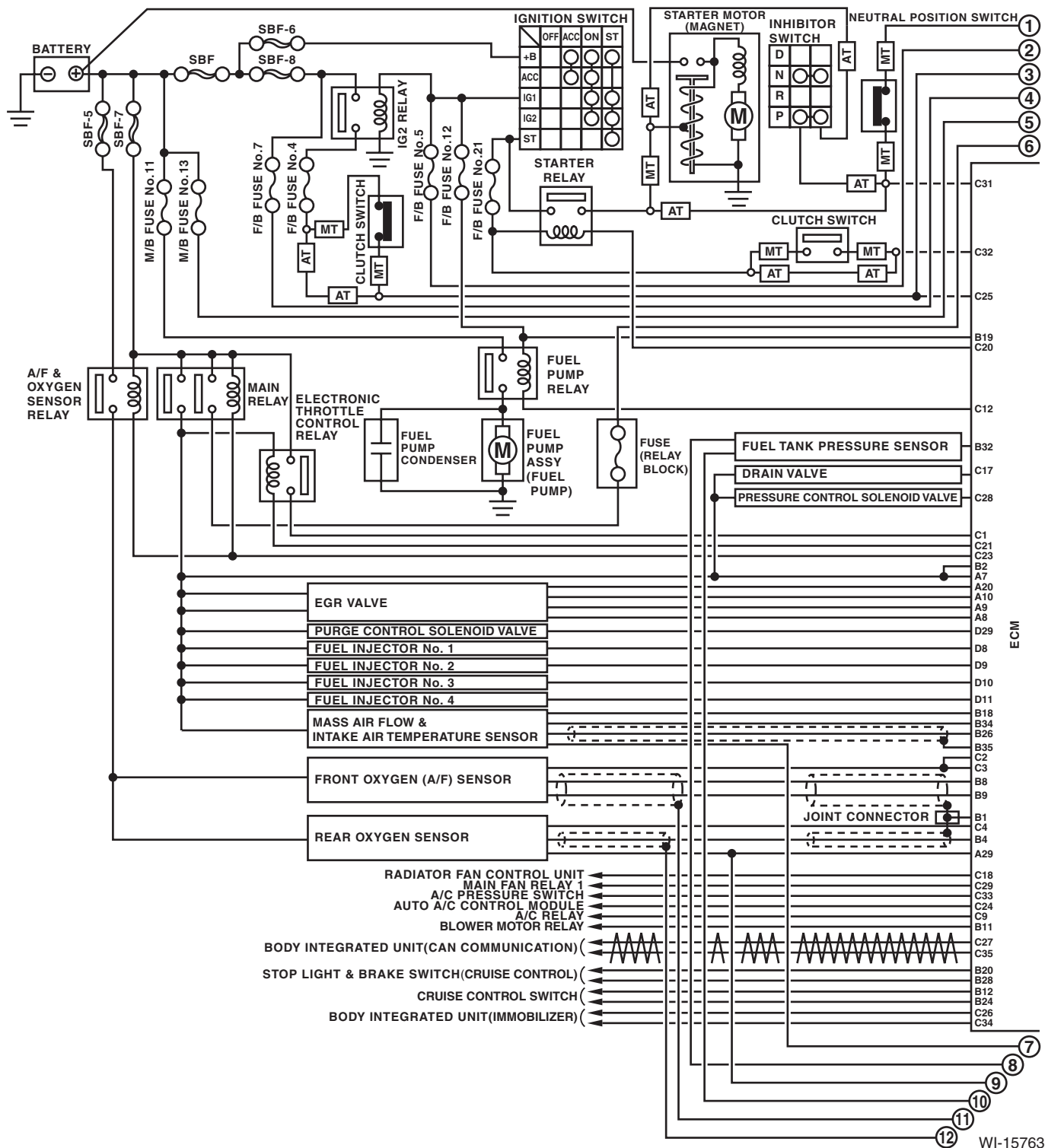


WI-15773

# Engine Electrical System

## WIRING SYSTEM

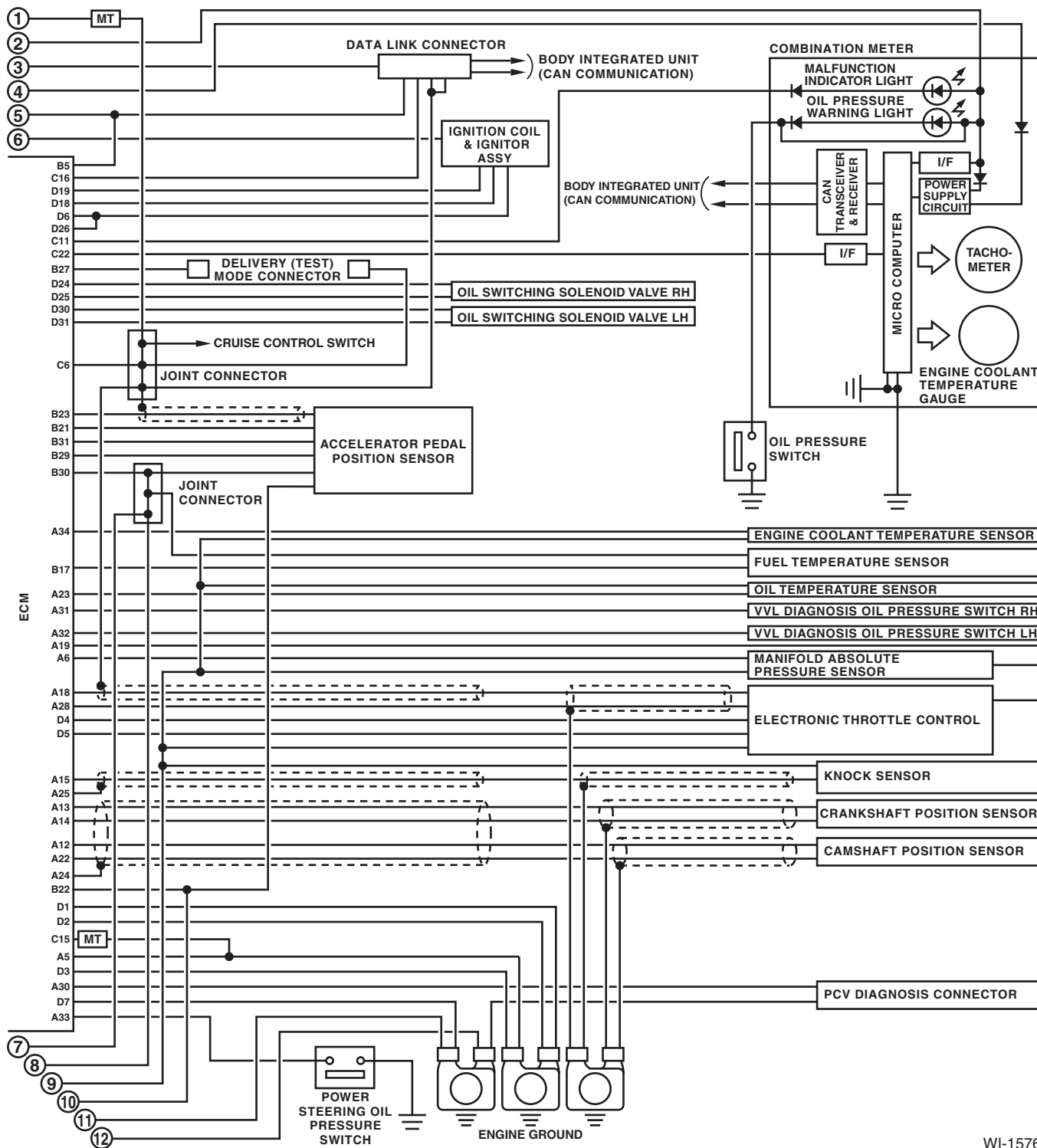
- Transmission serial No. 4078113 or later



WI-15763

# Engine Electrical System

WIRING SYSTEM



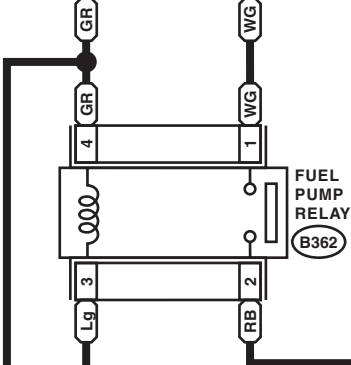
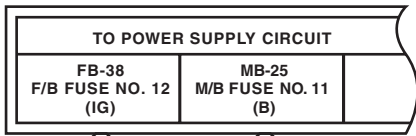
WI-15764

# Engine Electrical System

## WIRING SYSTEM

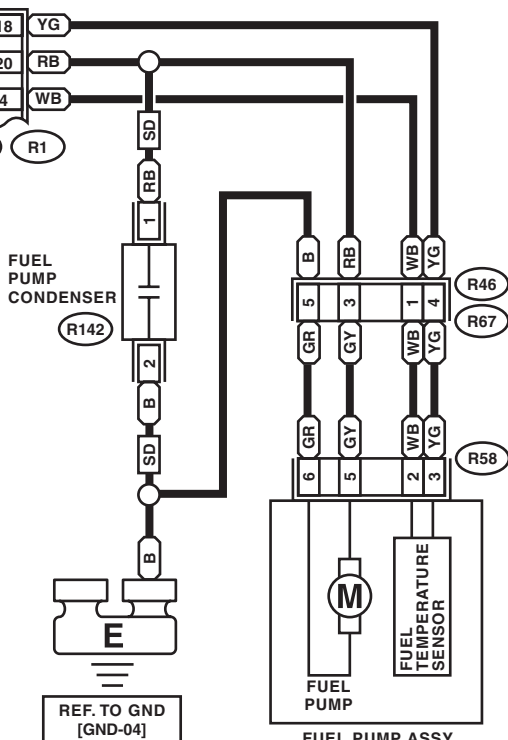
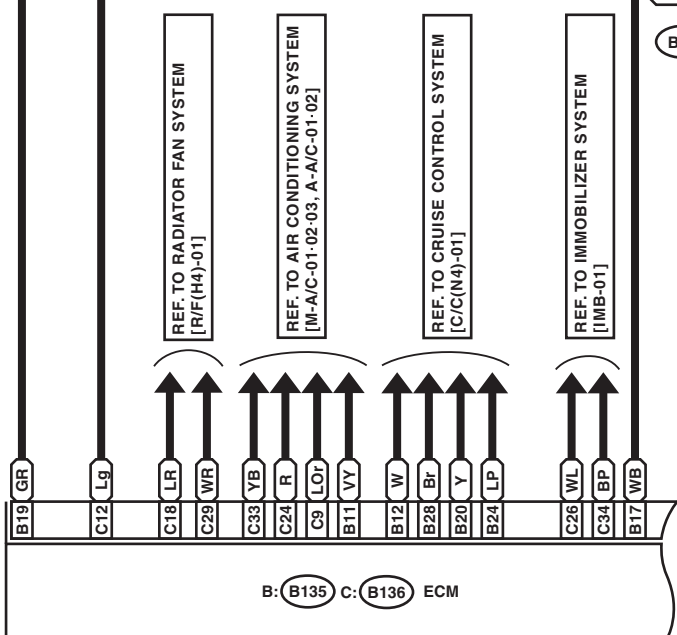
E/G(H4)-01

E/G(H4)-01



SD : SEDAN MODEL

A E/G(H4)-08



SD : R142 (BLACK)

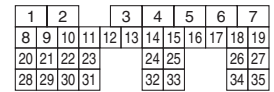
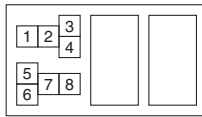
R58 (GRAY)

R67

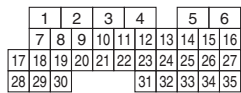
B362 (BLACK)

B97

B: B135



C: B136



RELAY HOLDER

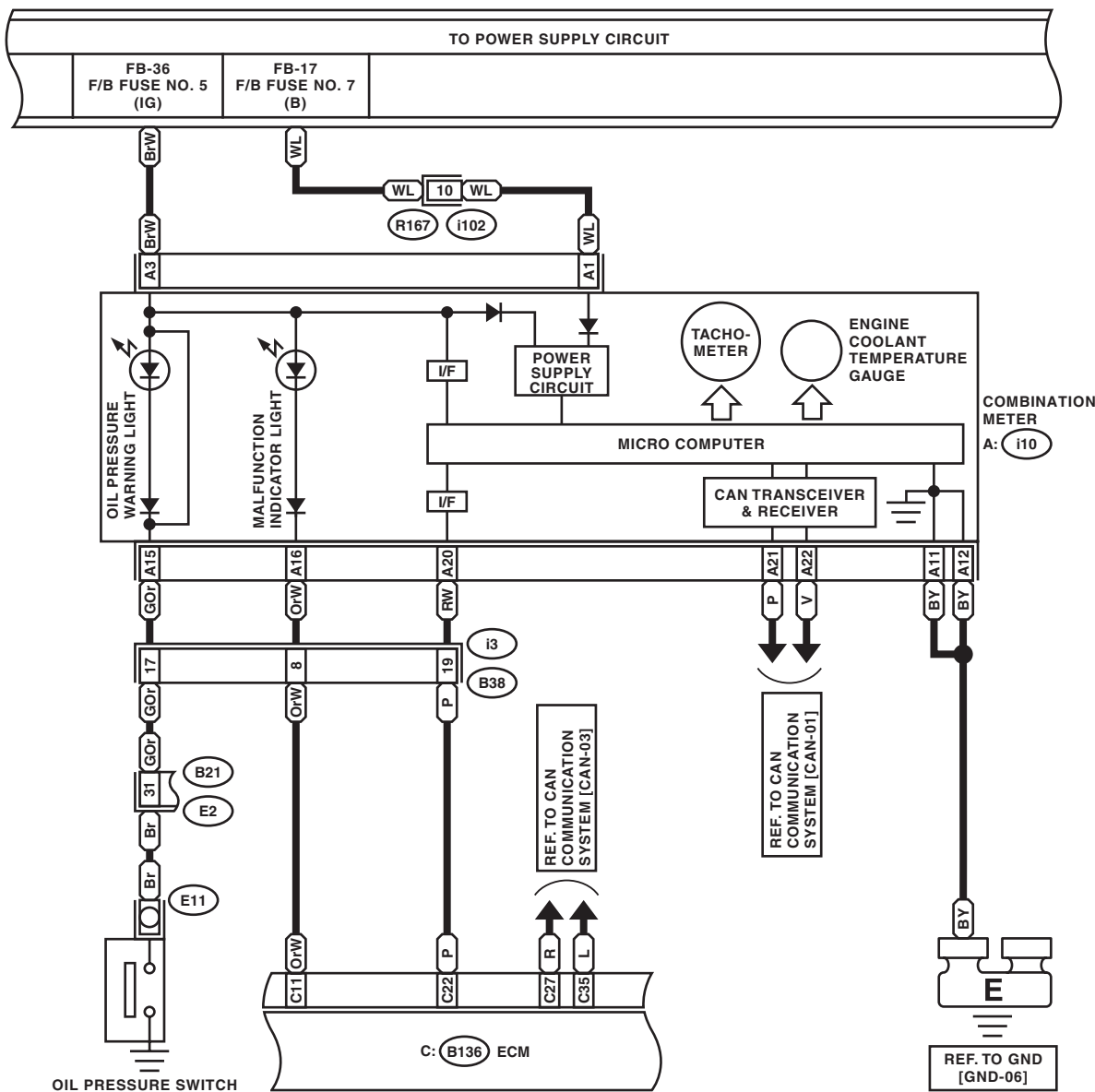
WI-15765

# Engine Electrical System

WIRING SYSTEM

E/G(H4)-02

E/G(H4)-02



i102

1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15	16

B38

1	2	3	4	5	6	7	8	9		
10	11	12	13	14	15	16	17	18	19	20

B21 (BLACK)

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

A: i10 (GREEN)

1	2	3	4	5	6	7	8	9	10		
11	12	13	14	15	16	17	18	19	20	21	22

C: B136

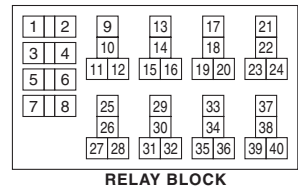
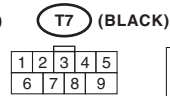
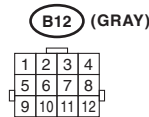
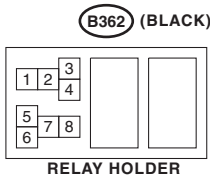
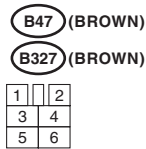
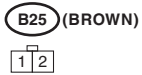
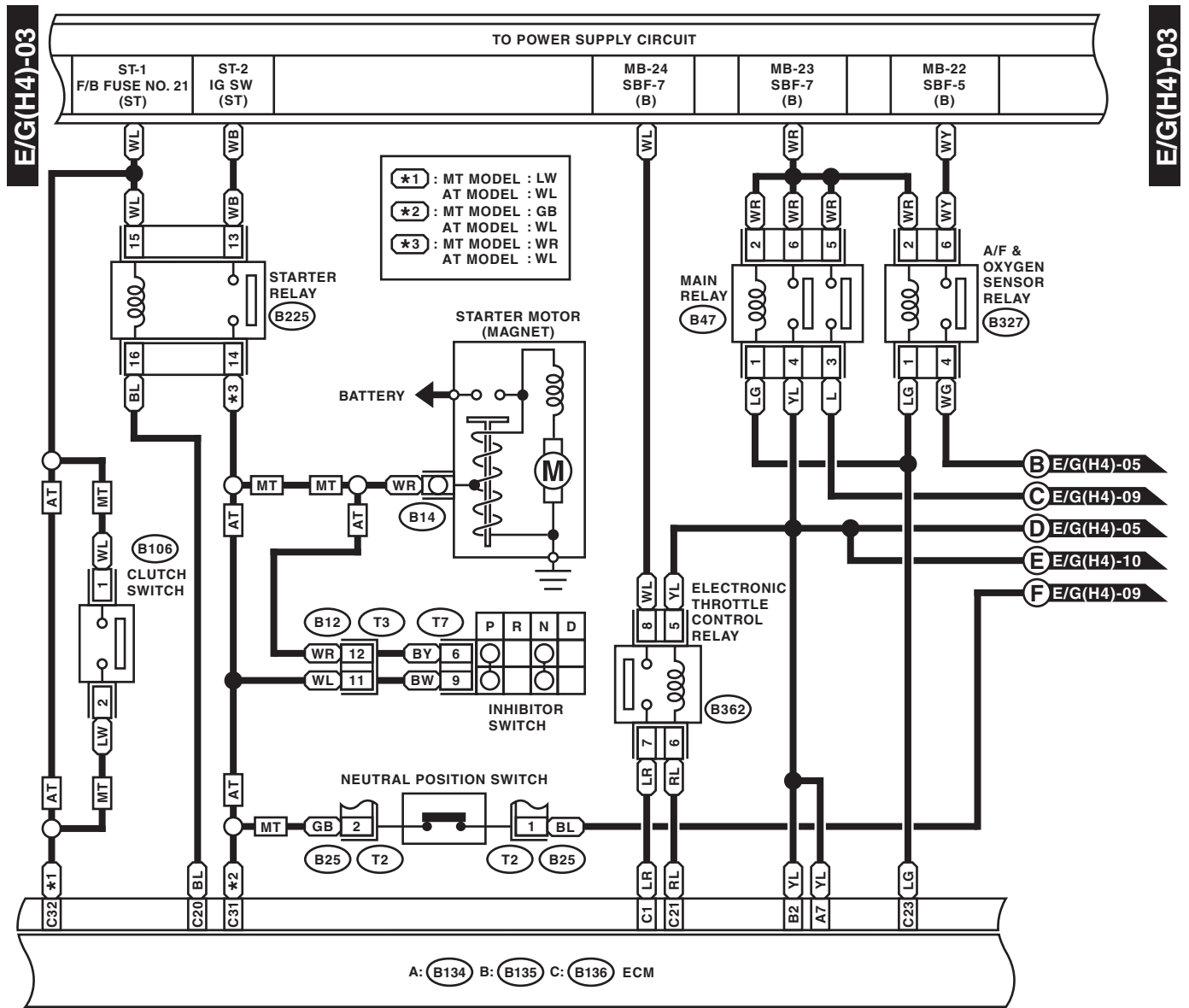
1	2	3	4	5	6					
7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35			

WI-15766

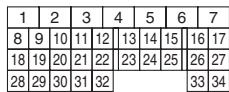


# Engine Electrical System

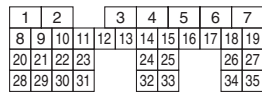
## WIRING SYSTEM



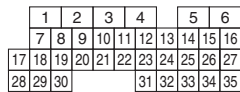
**A: (B134)**



**B: (B135)**



**C: (B136)**



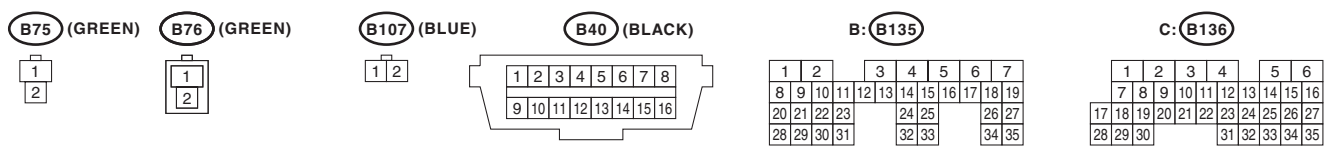
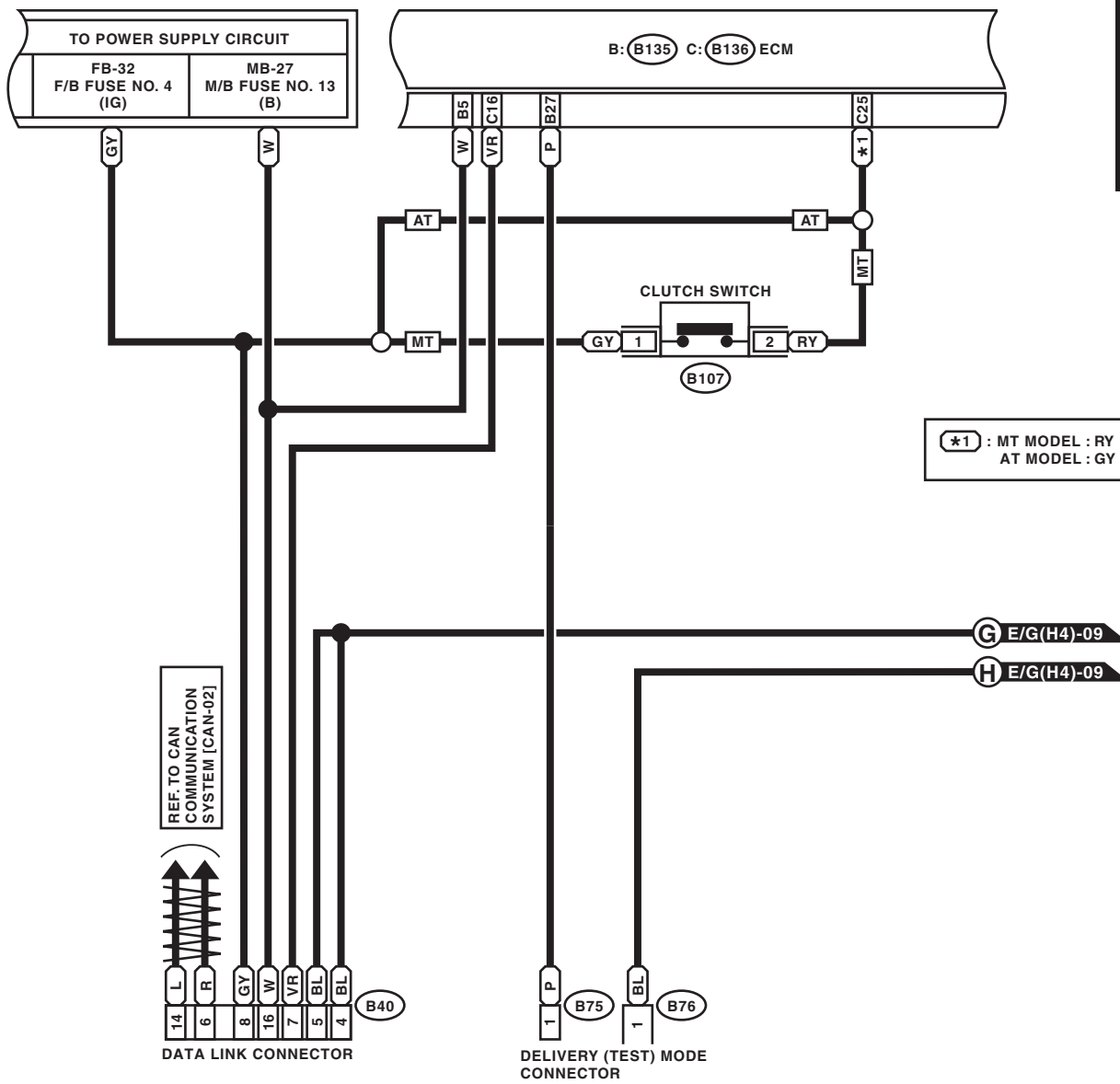
WI-21065

# Engine Electrical System

WIRING SYSTEM

E/G(H4)-04

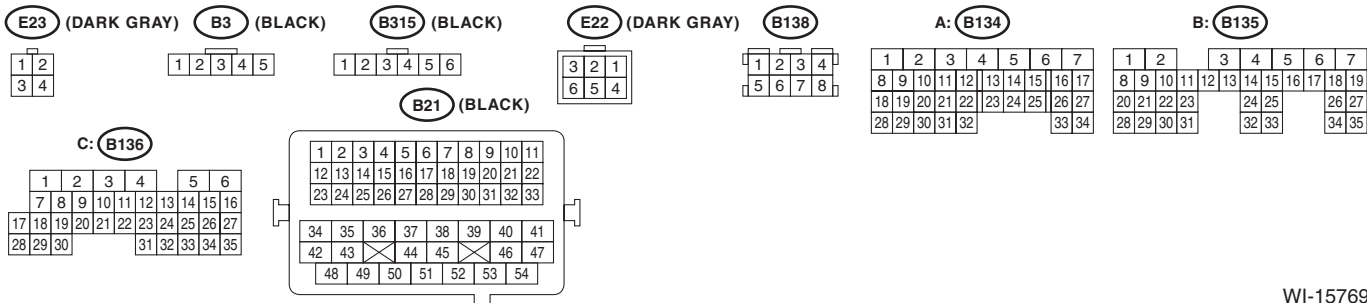
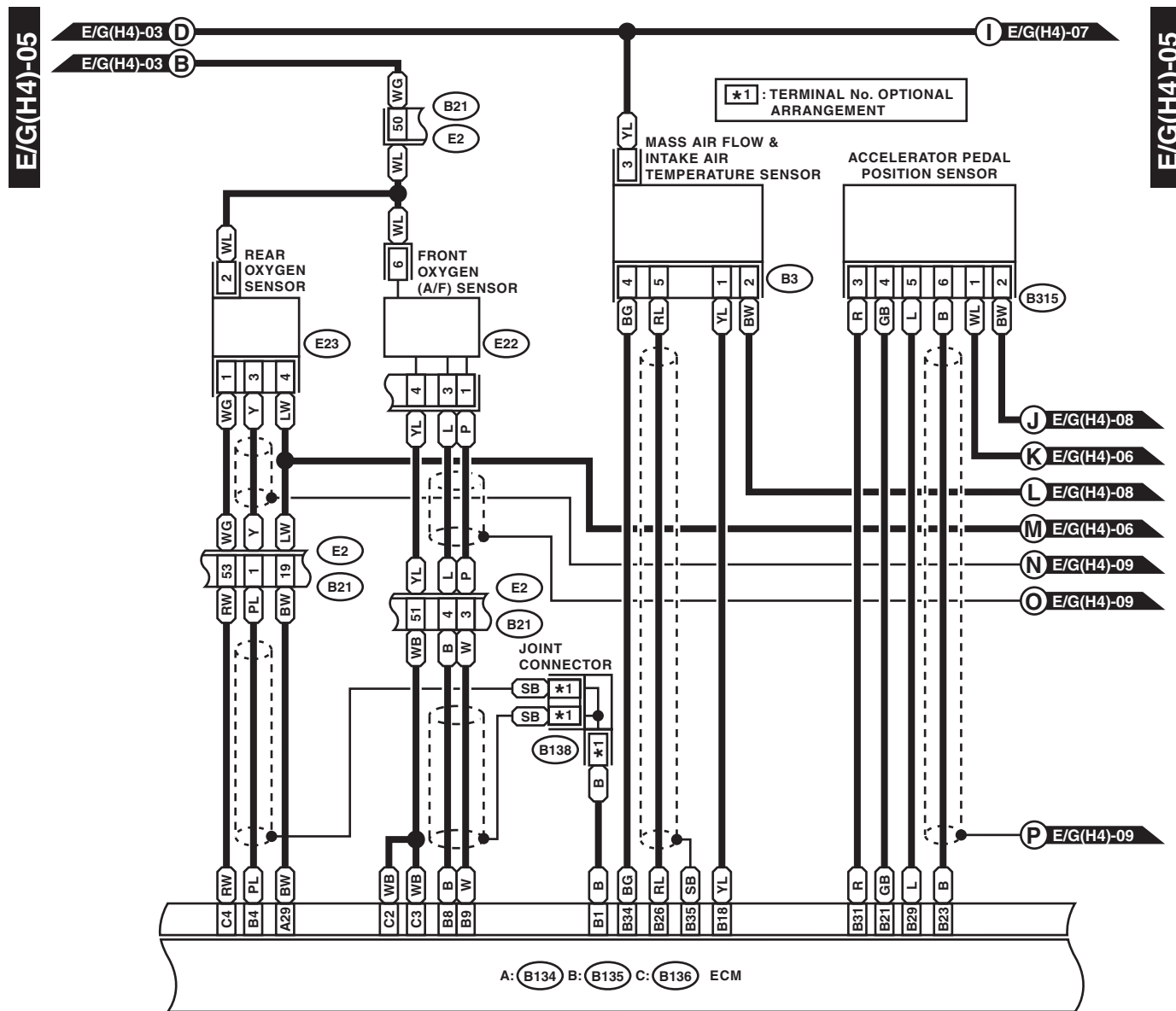
E/G(H4)-04



WI-15768

# Engine Electrical System

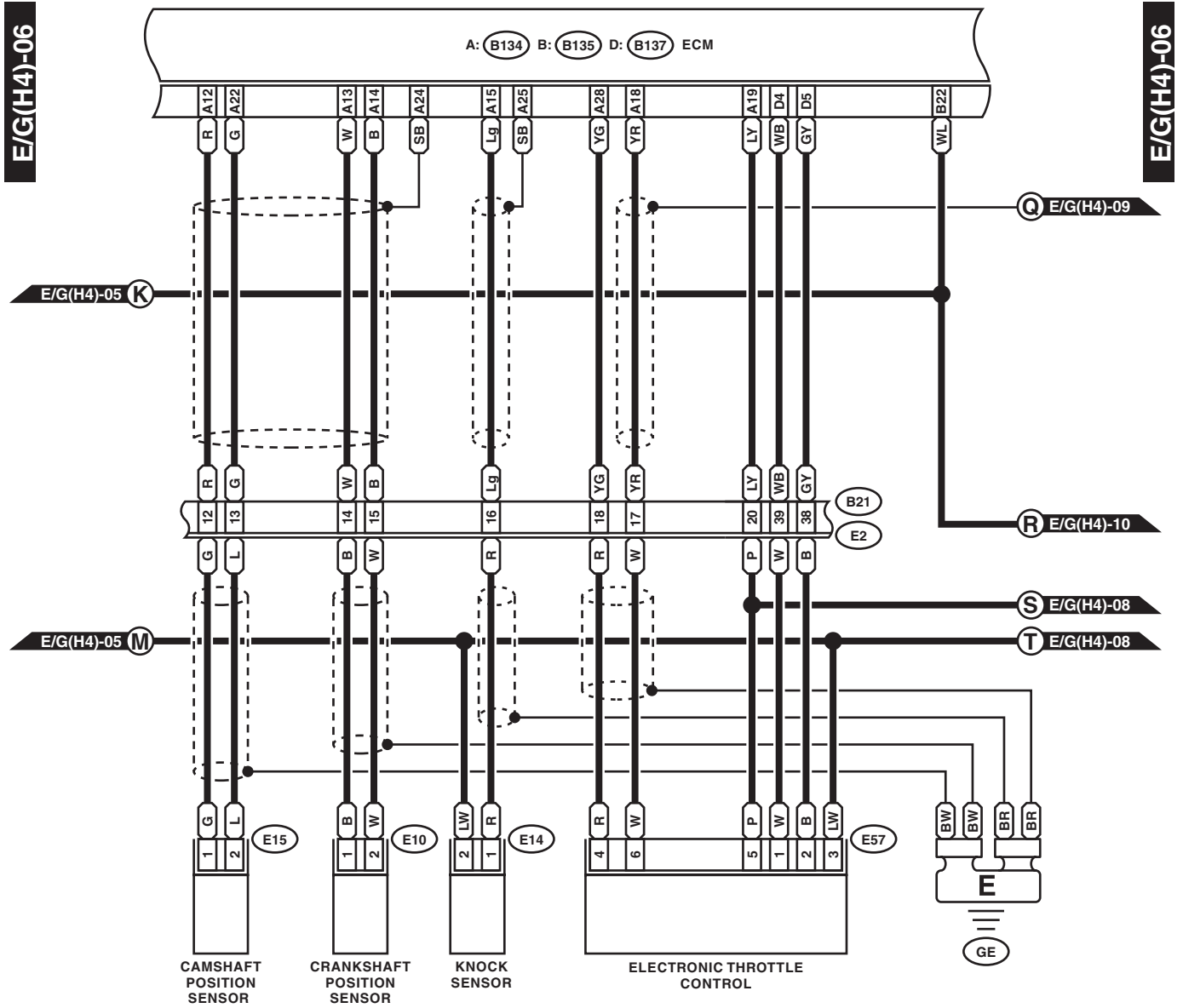
## WIRING SYSTEM



WI-15769

# Engine Electrical System

WIRING SYSTEM



**E10** (LIGHT GRAY)

**E14** (GRAY)

**E57** (BLACK)

**D: B137**

**B21** (BLACK)

**E15** (GRAY)

1 2

1 2 3 4 5 6

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55

**A: B134**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

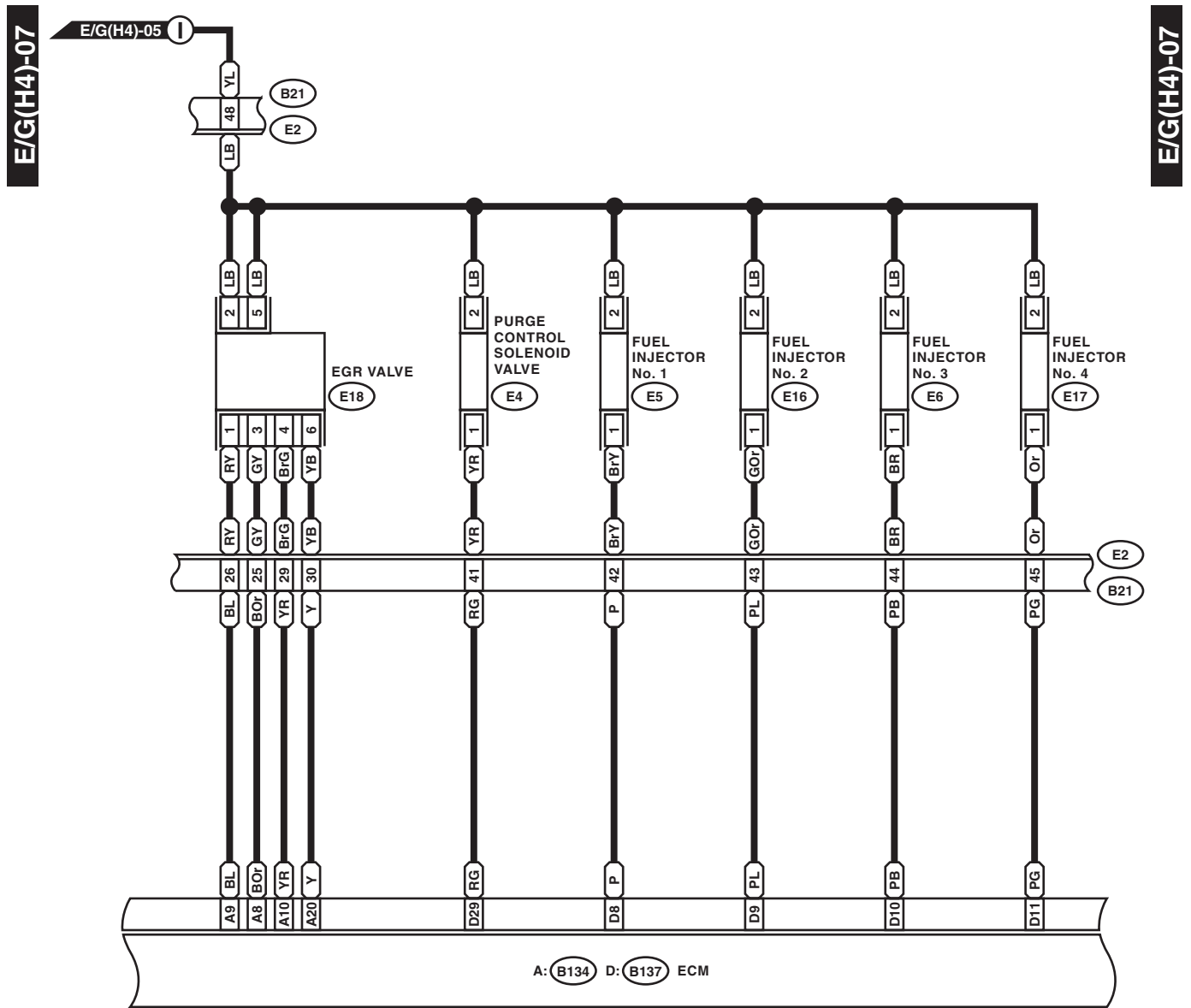
**B: B135**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

WI-15770

# Engine Electrical System

WIRING SYSTEM



E4 (BLACK)



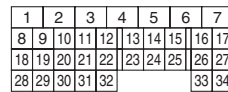
E18 (DARK GRAY)



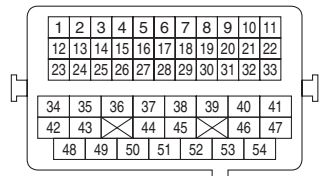
D: (B137)



A: (B134)



B21 (BLACK)



(LIGHT GRAY) E5 (LIGHT GRAY) E16 (LIGHT GRAY)

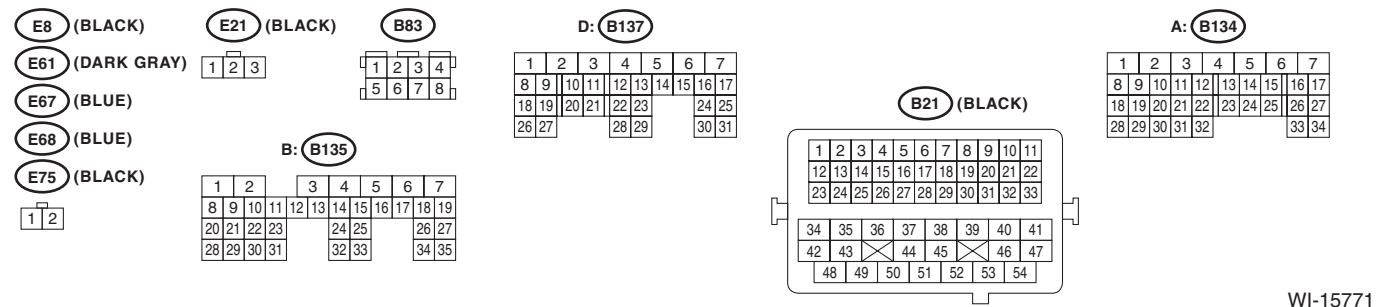
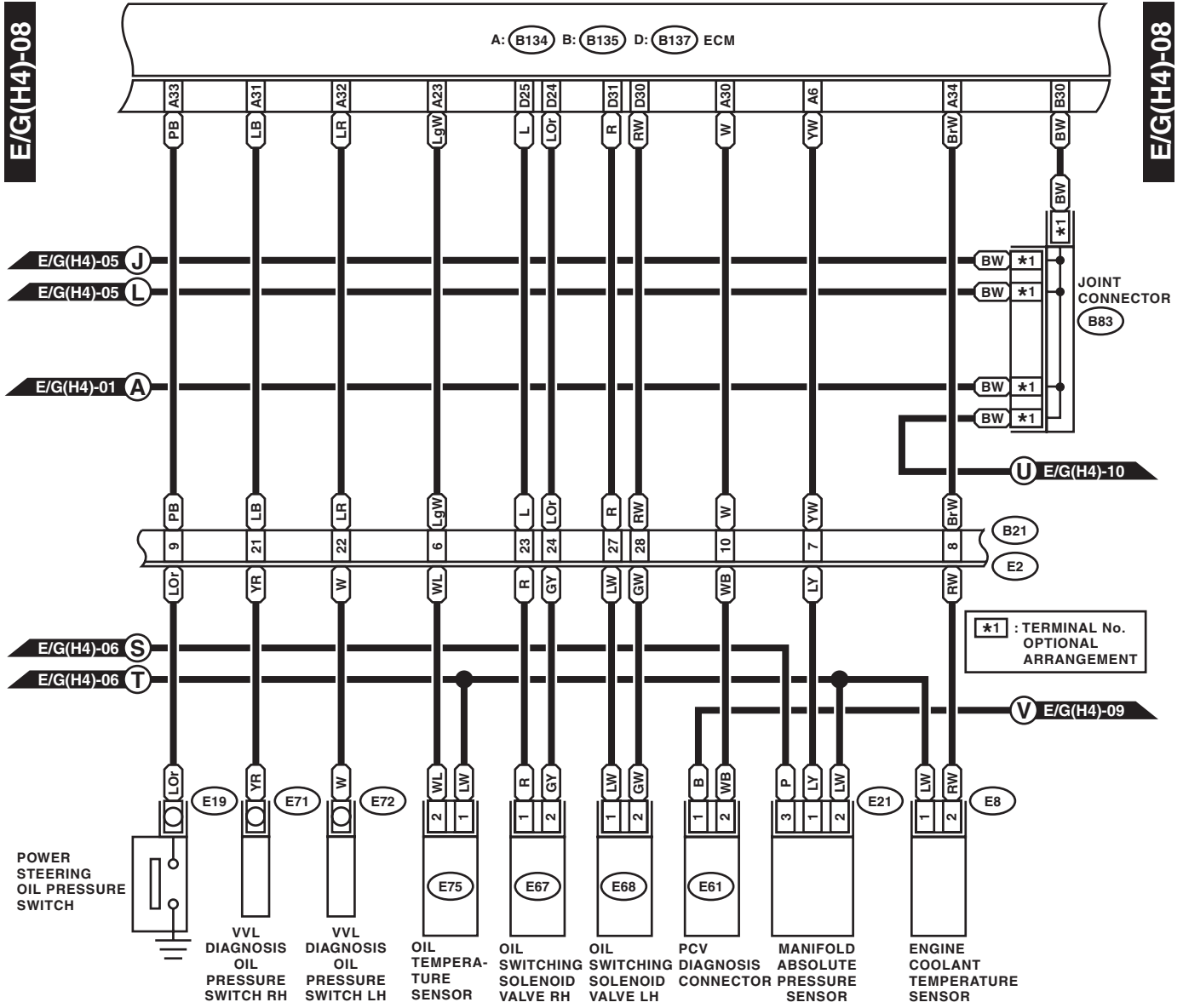
(LIGHT GRAY) E6 (LIGHT GRAY) E17 (LIGHT GRAY)



WI-16200

# Engine Electrical System

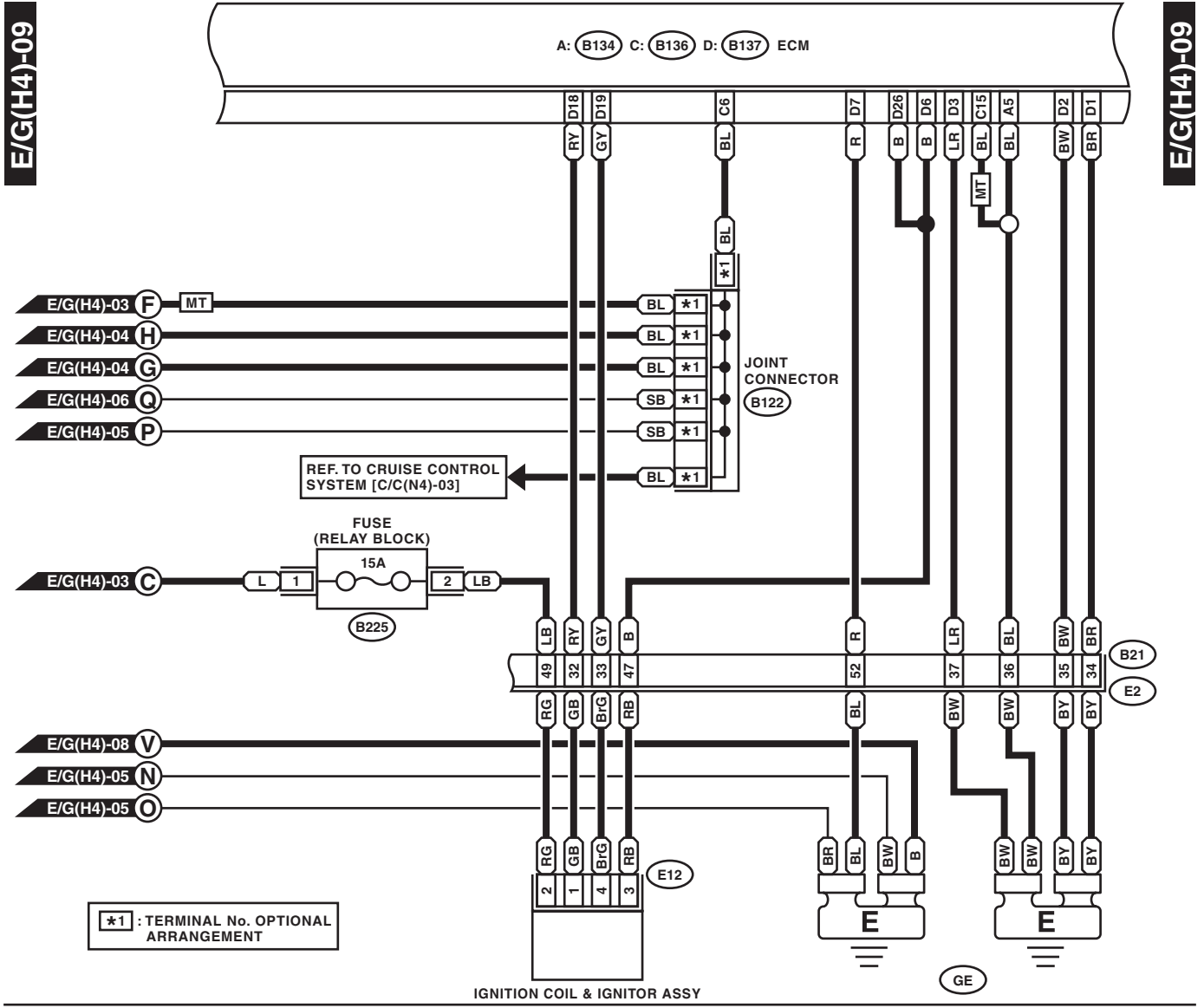
WIRING SYSTEM



WI-15771

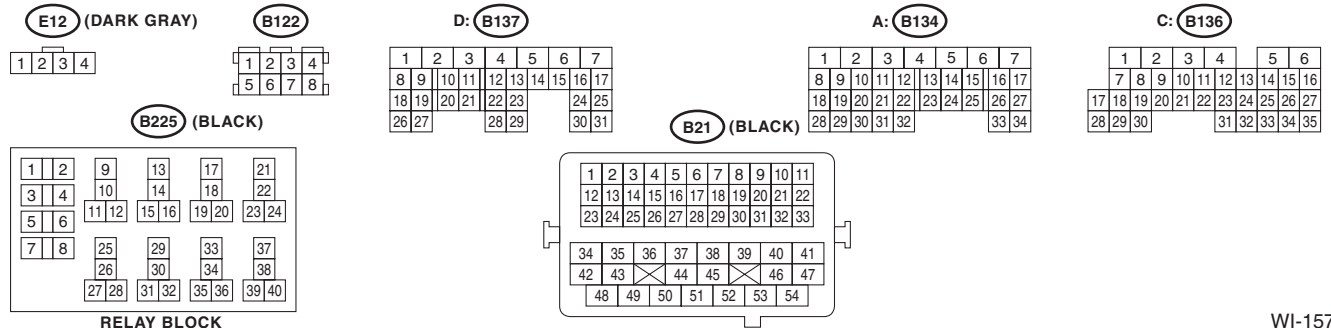
# Engine Electrical System

## WIRING SYSTEM



\*1 : TERMINAL No. OPTIONAL ARRANGEMENT

IGNITION COIL & IGNITOR ASSY



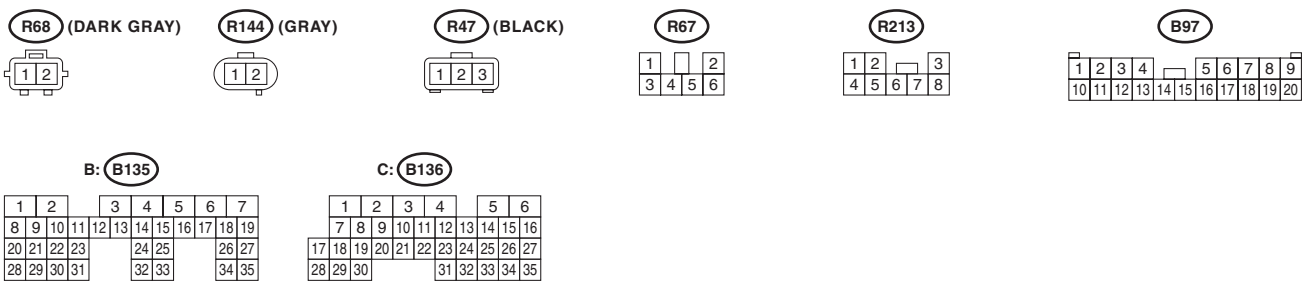
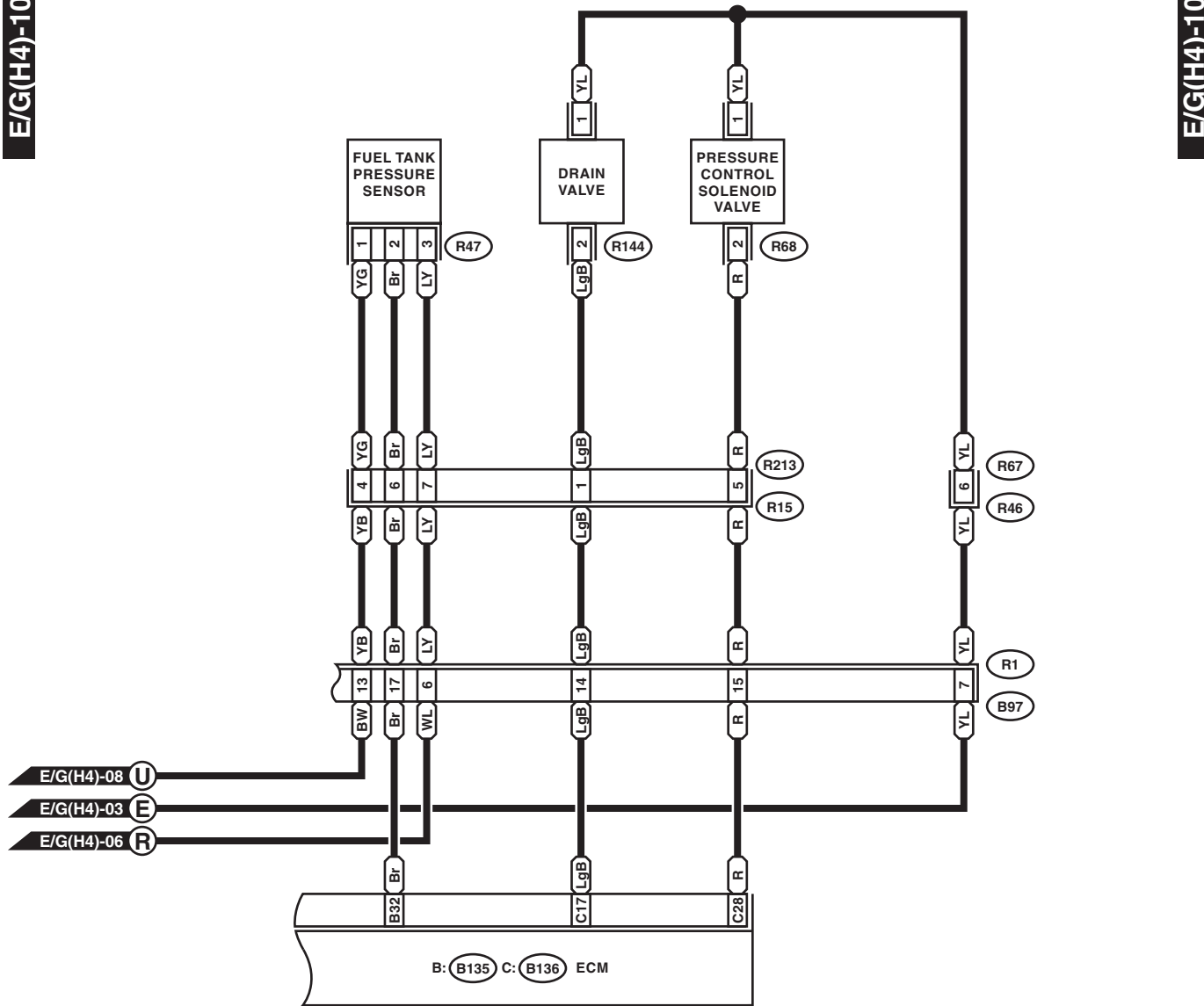
WI-15772

# Engine Electrical System

WIRING SYSTEM

E/G(H4)-10

E/G(H4)-10



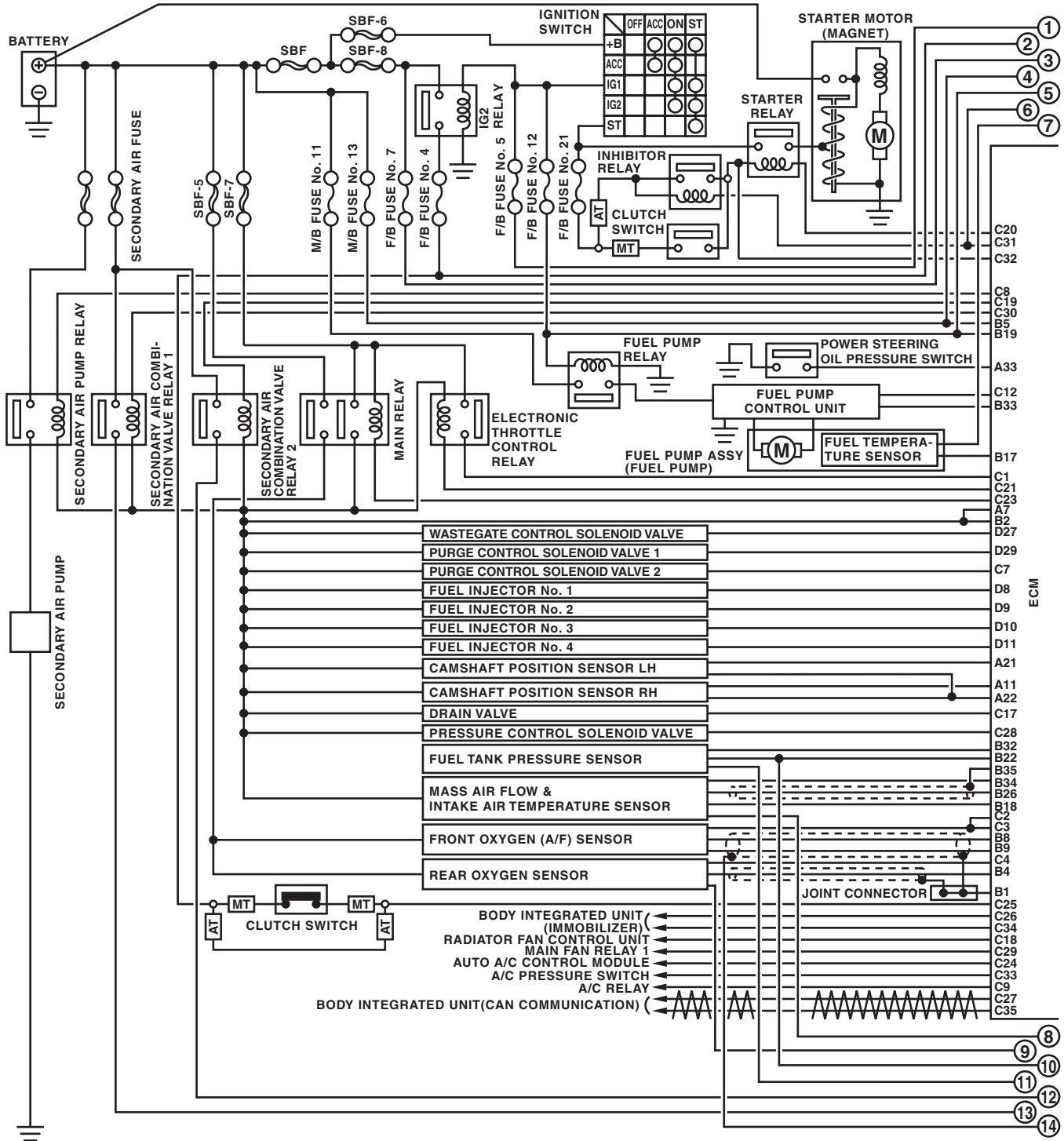
WI-15773



# Engine Electrical System

## WIRING SYSTEM

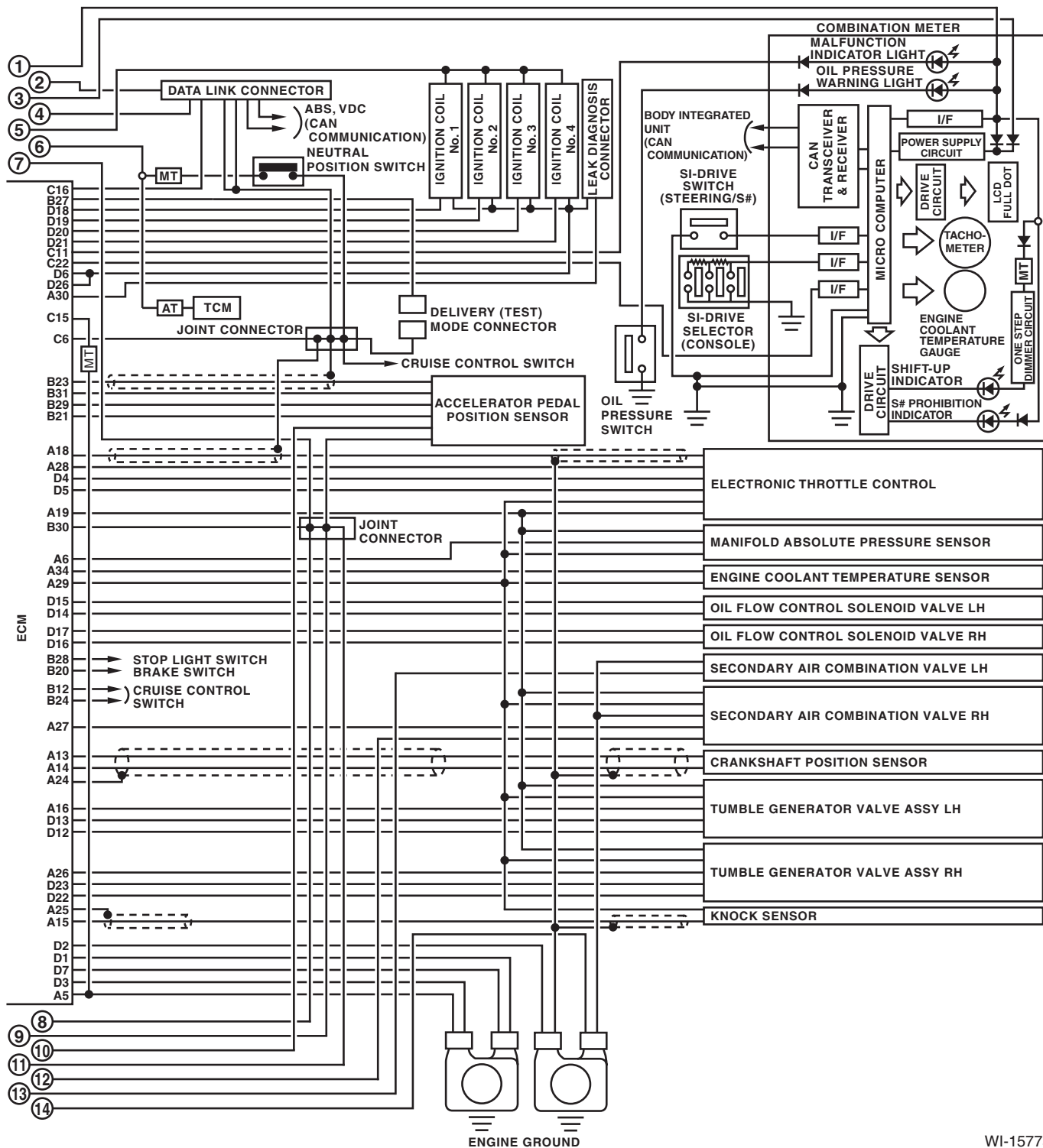
### 2. 2.5 L TURBO MODEL



WI-15774

# Engine Electrical System

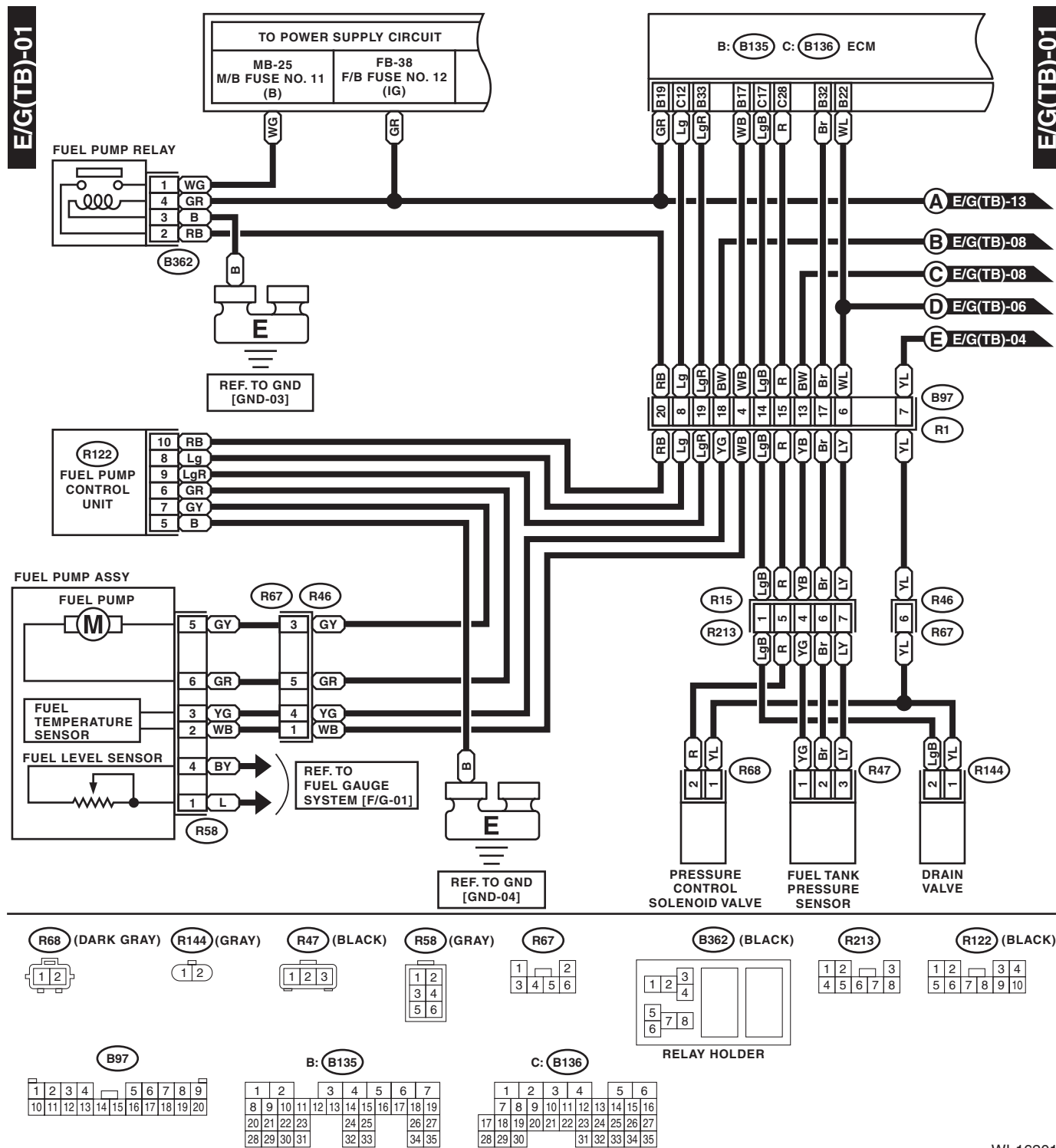
WIRING SYSTEM



WI-15775

# Engine Electrical System

## WIRING SYSTEM

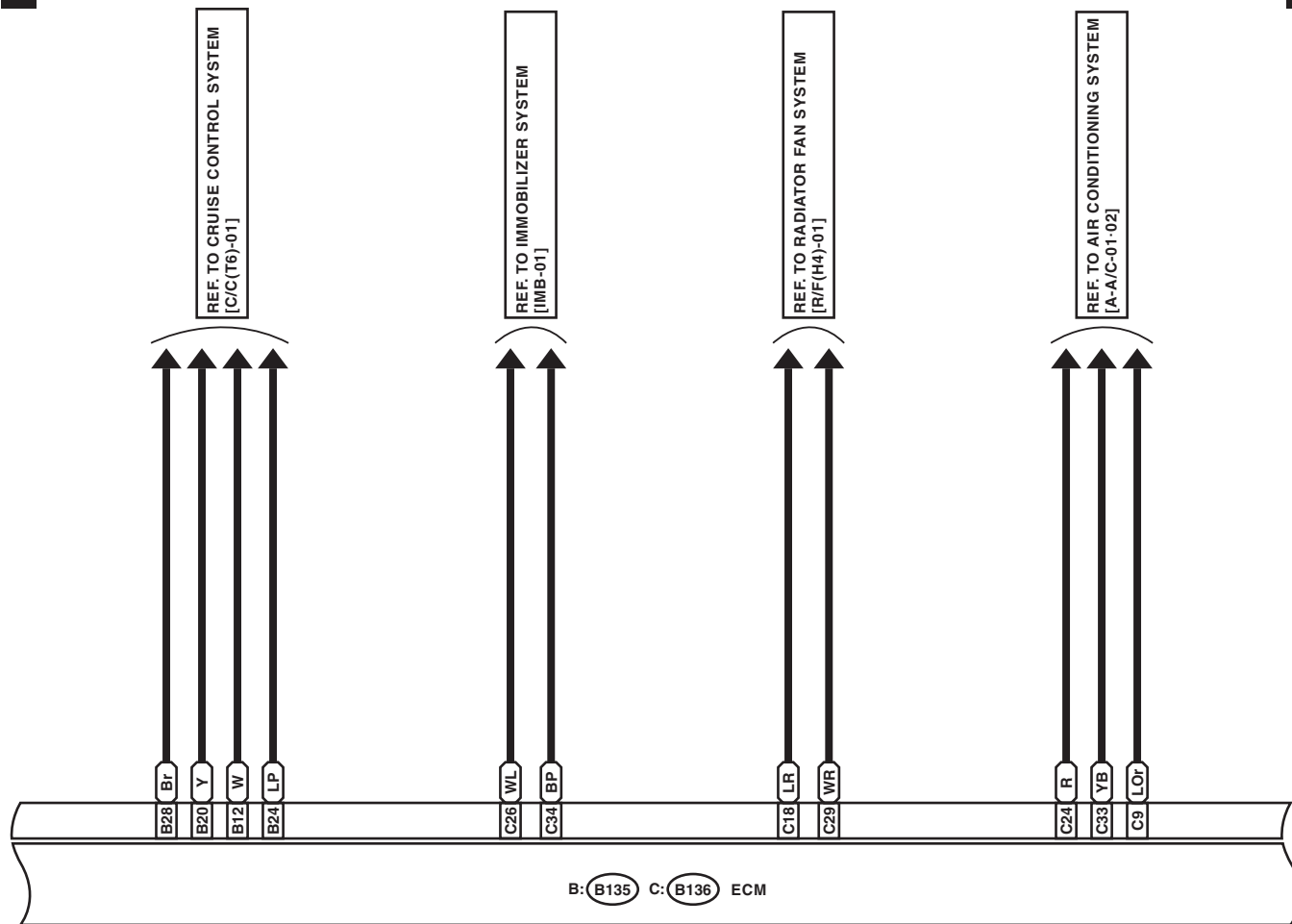


**E/G(TB)-01**

WI-16201

E/G(TB)-02

E/G(TB)-02



B: (B135)

1	2		3	4	5	6	7				
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23		24	25		26	27		
28	29	30	31		32	33		34	35		

C: (B136)

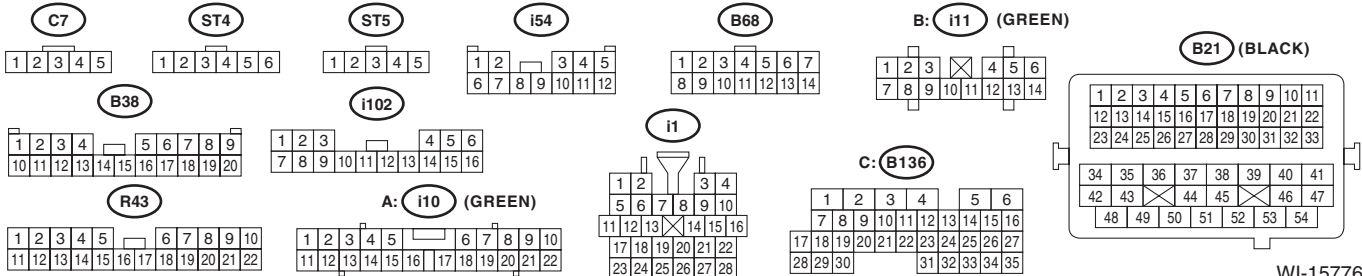
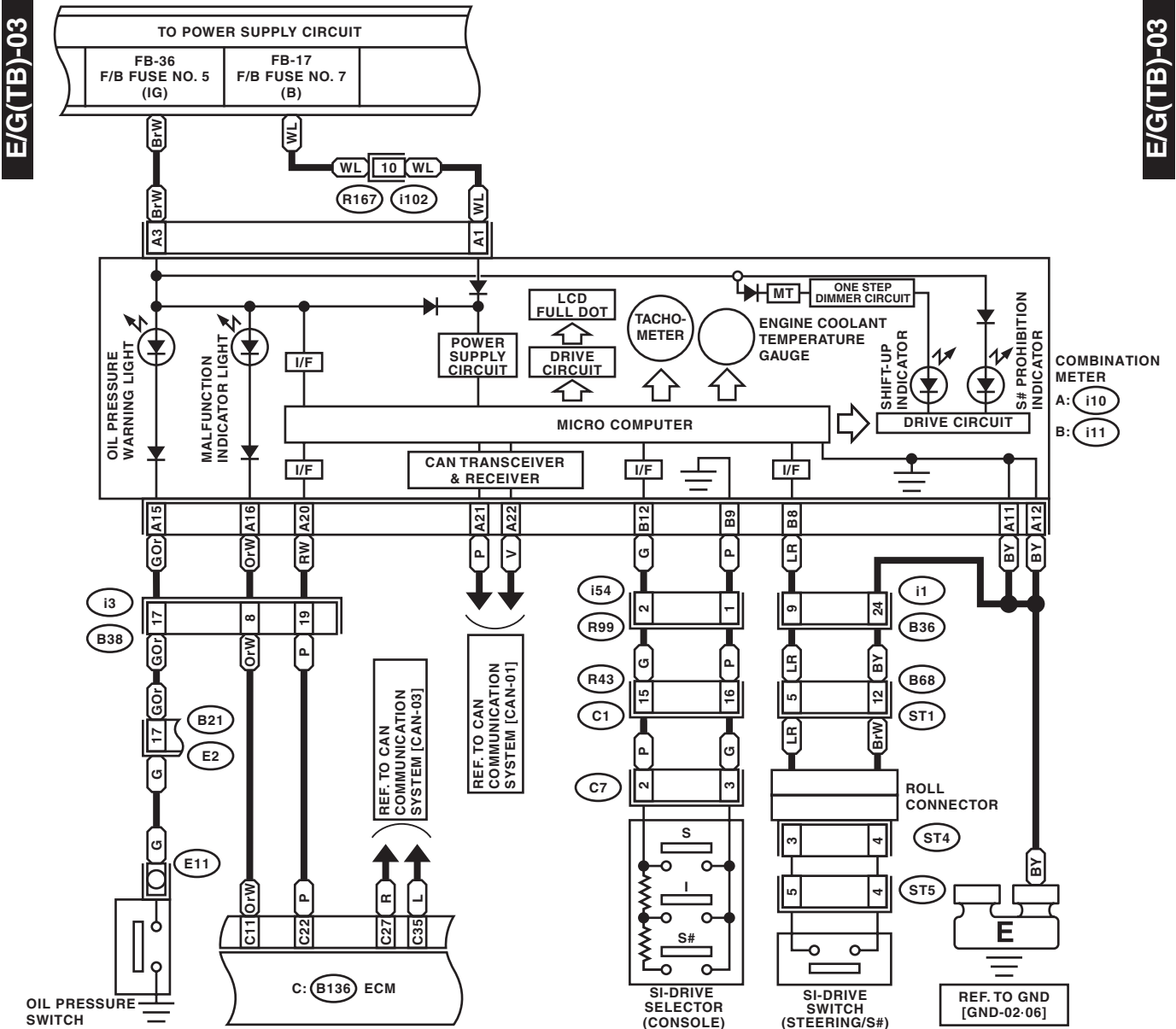
	1	2	3	4		5	6			
	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27
28	29	30			31	32	33	34	35	

# Engine Electrical System

## WIRING SYSTEM

E/G(TB)-03

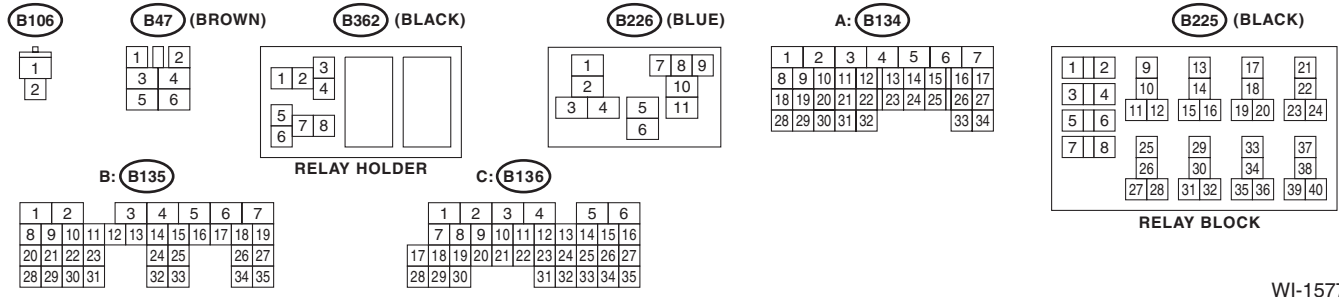
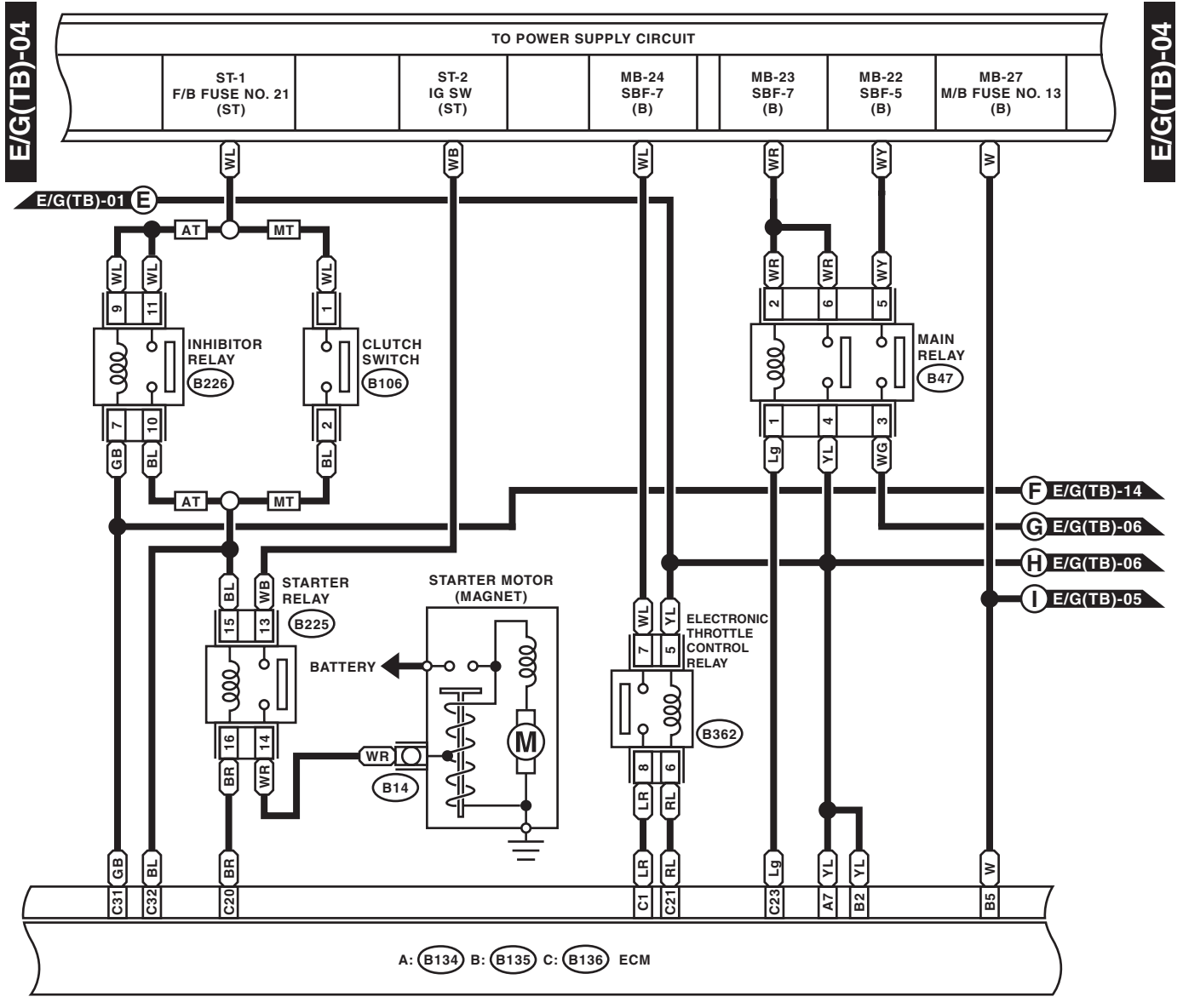
E/G(TB)-03



WI-15776

# Engine Electrical System

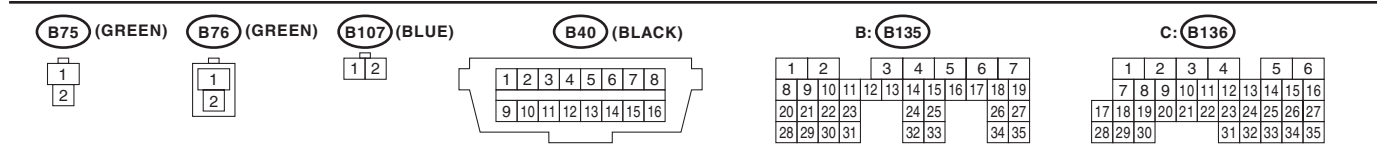
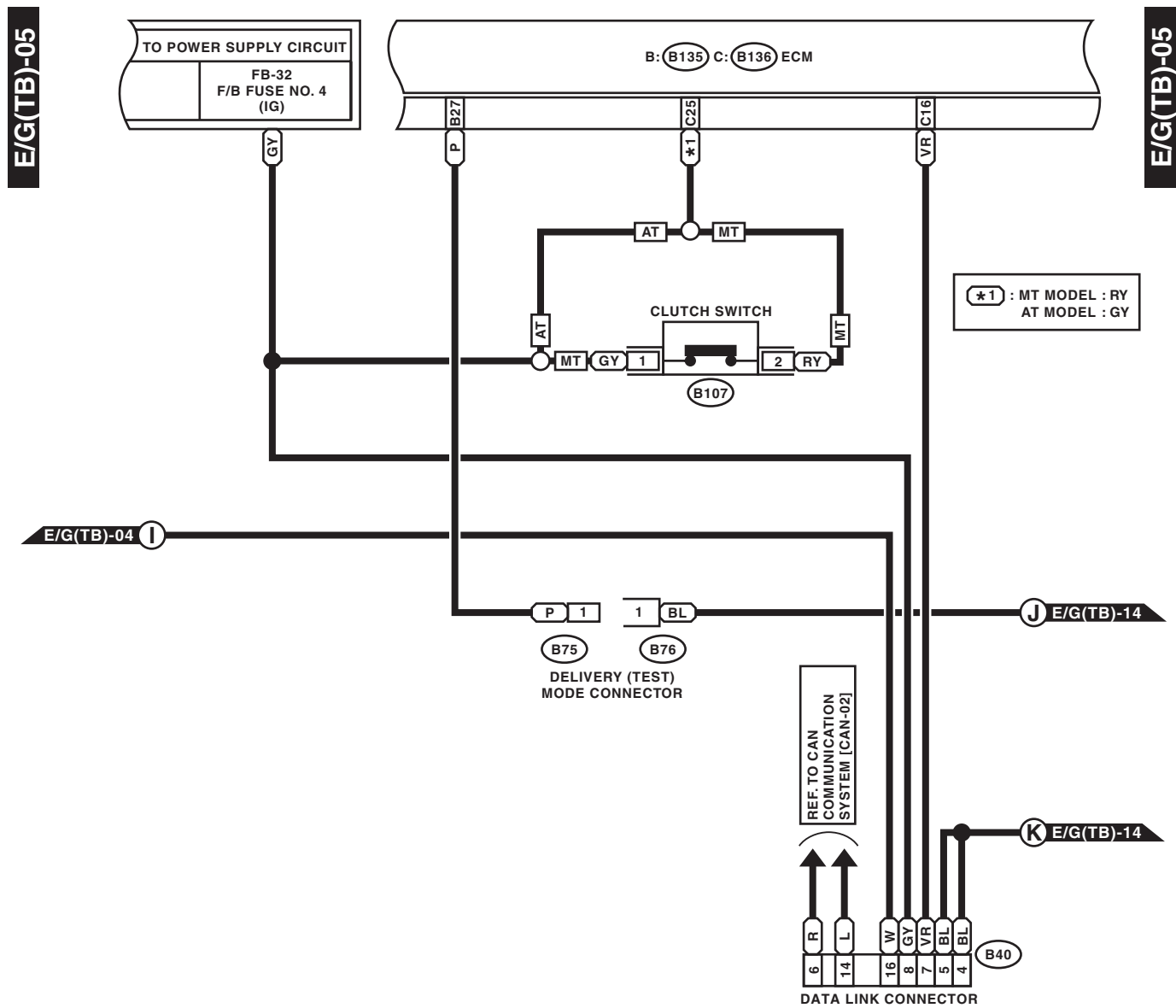
WIRING SYSTEM



WI-15777

# Engine Electrical System

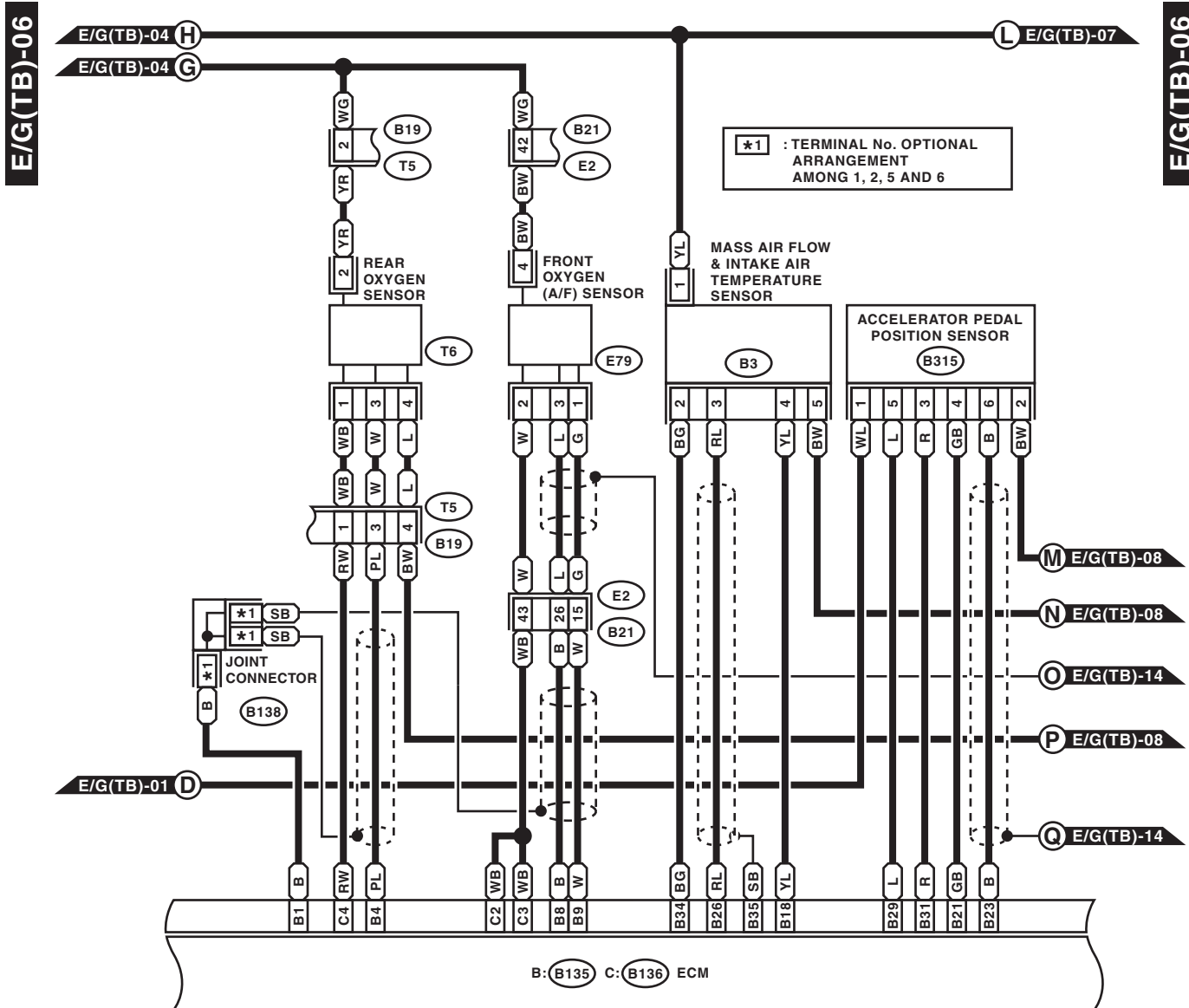
WIRING SYSTEM



WI-15778

# Engine Electrical System

WIRING SYSTEM



**B19** (GREEN) : 5AT,5MT  
(GRAY) : 6MT

**E79**

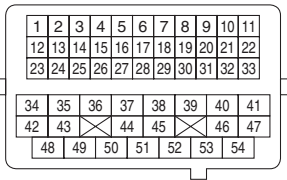
**T6** (DARK GRAY)

1	2
3	4

**B3** (BLACK)

1	2	3	4	5
---	---	---	---	---

**B21** (BLACK)



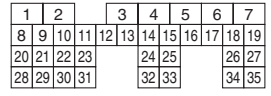
**B138**

1	2	3	4
5	6	7	8

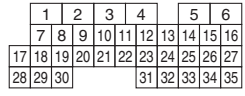
**B315** (BLACK)

1	2	3	4	5	6
---	---	---	---	---	---

**B: B135**



**C: B136**

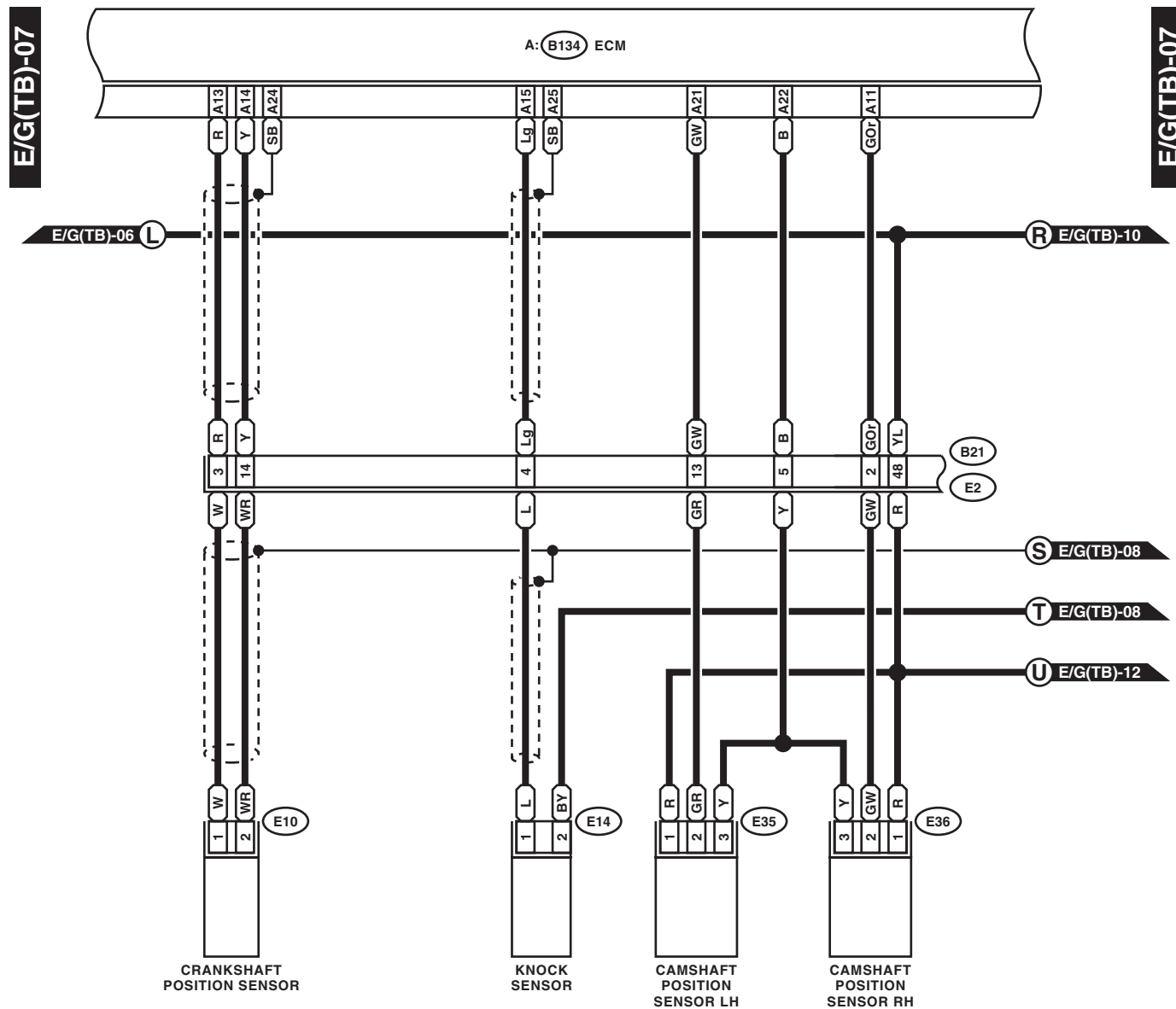


WI-15779



# Engine Electrical System

## WIRING SYSTEM



**E10** (LIGHT GRAY)

**E35** (LIGHT GRAY)

**A: B134**

**B21** (BLACK)

**E14** (LIGHT GRAY)

**E36** (LIGHT GRAY)

1	2
---	---

1	2	3
---	---	---

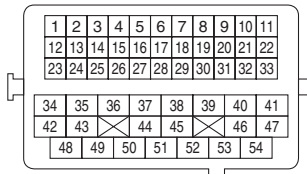
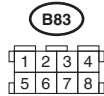
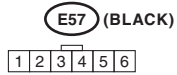
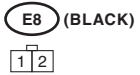
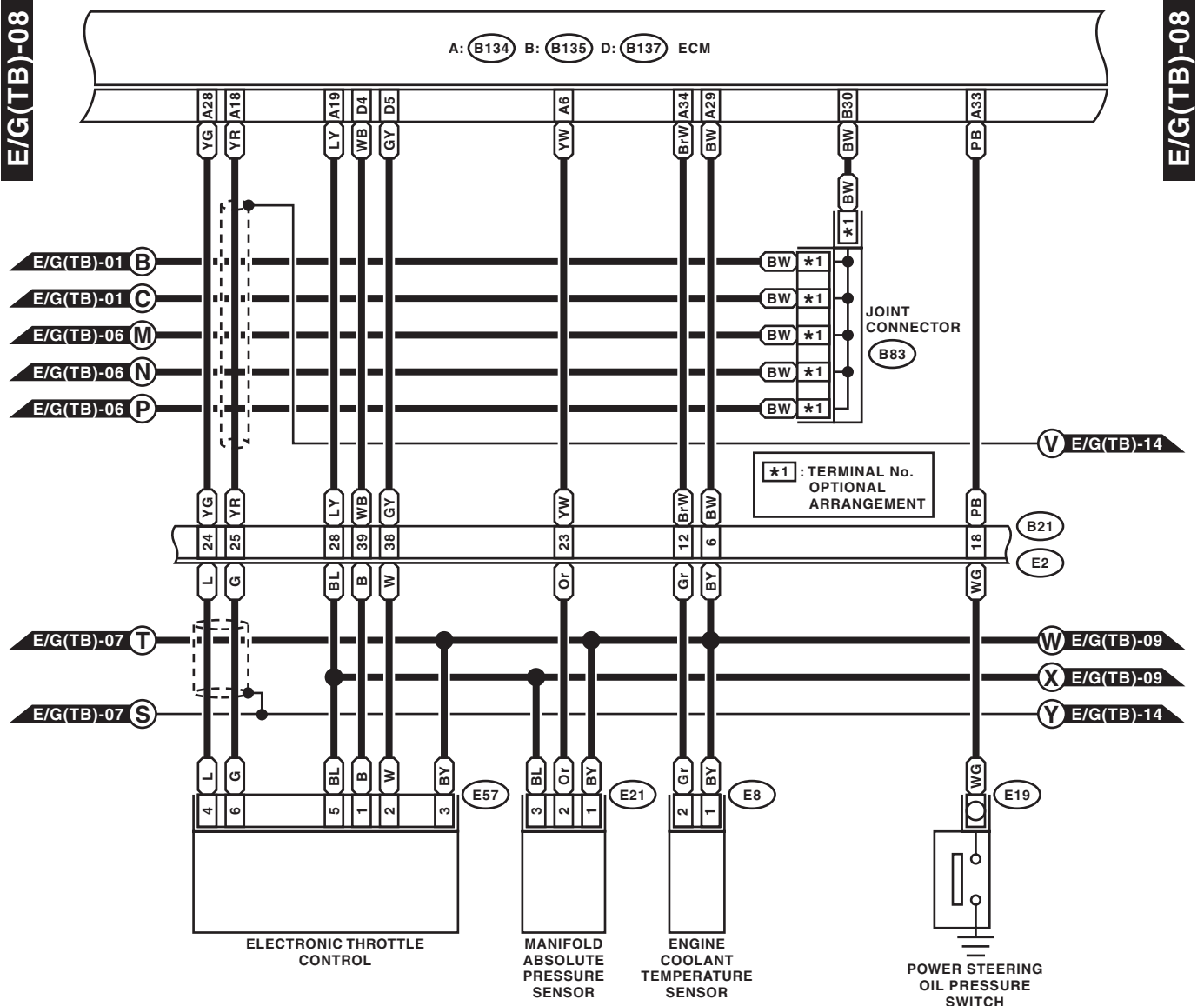
1	2	3	4	5	6	7			
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31	32				33	34

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

WI-15780

# Engine Electrical System

WIRING SYSTEM



D: B137

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

A: B134

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	

B: B135

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

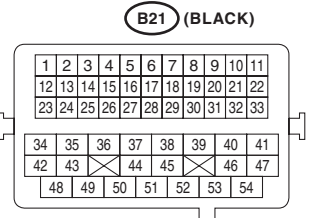
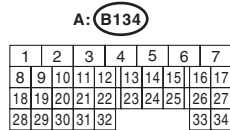
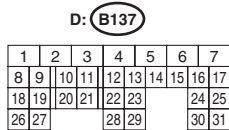
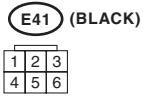
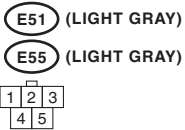
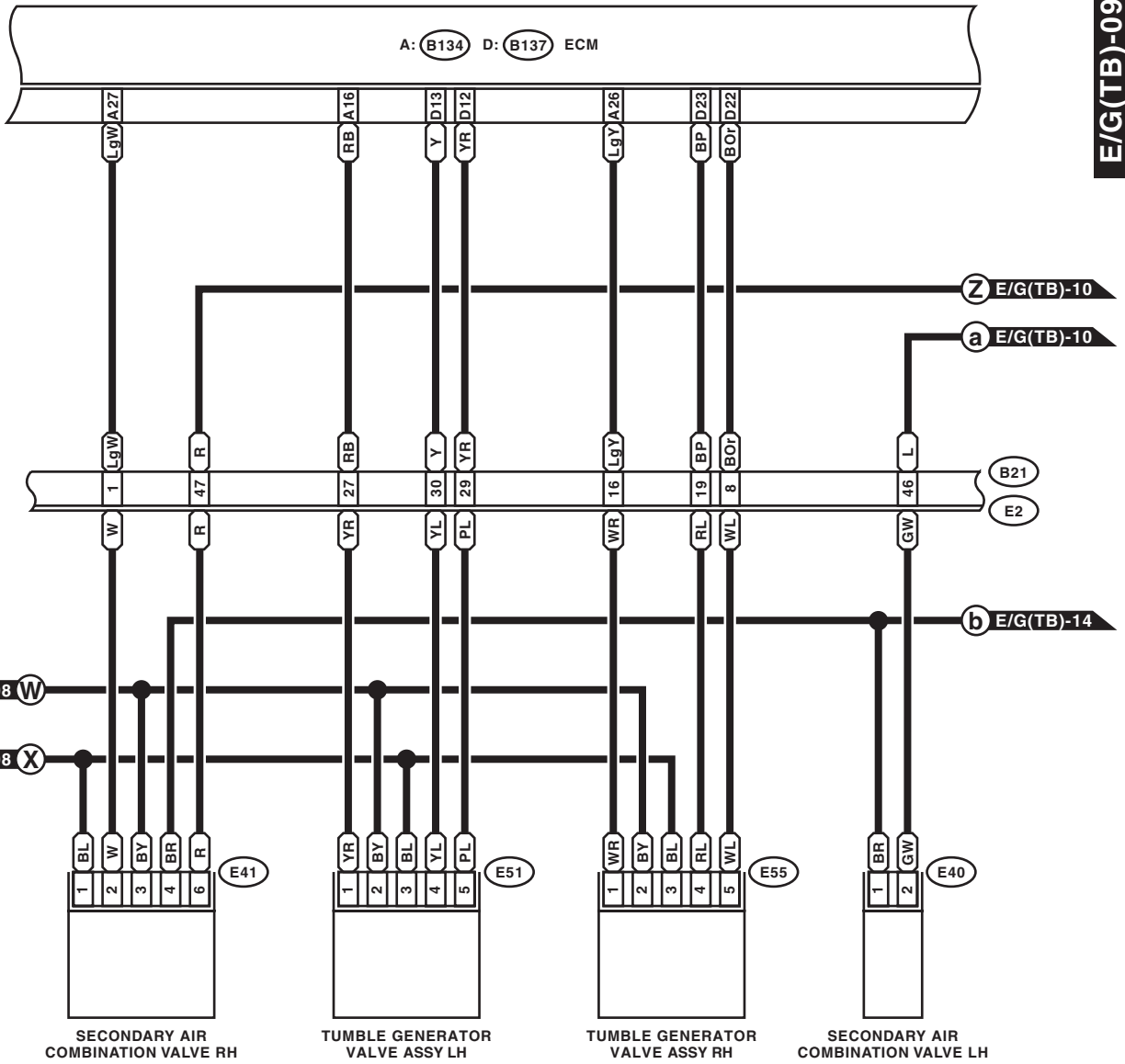
WI-15781

# Engine Electrical System

WIRING SYSTEM

E/G(TB)-09

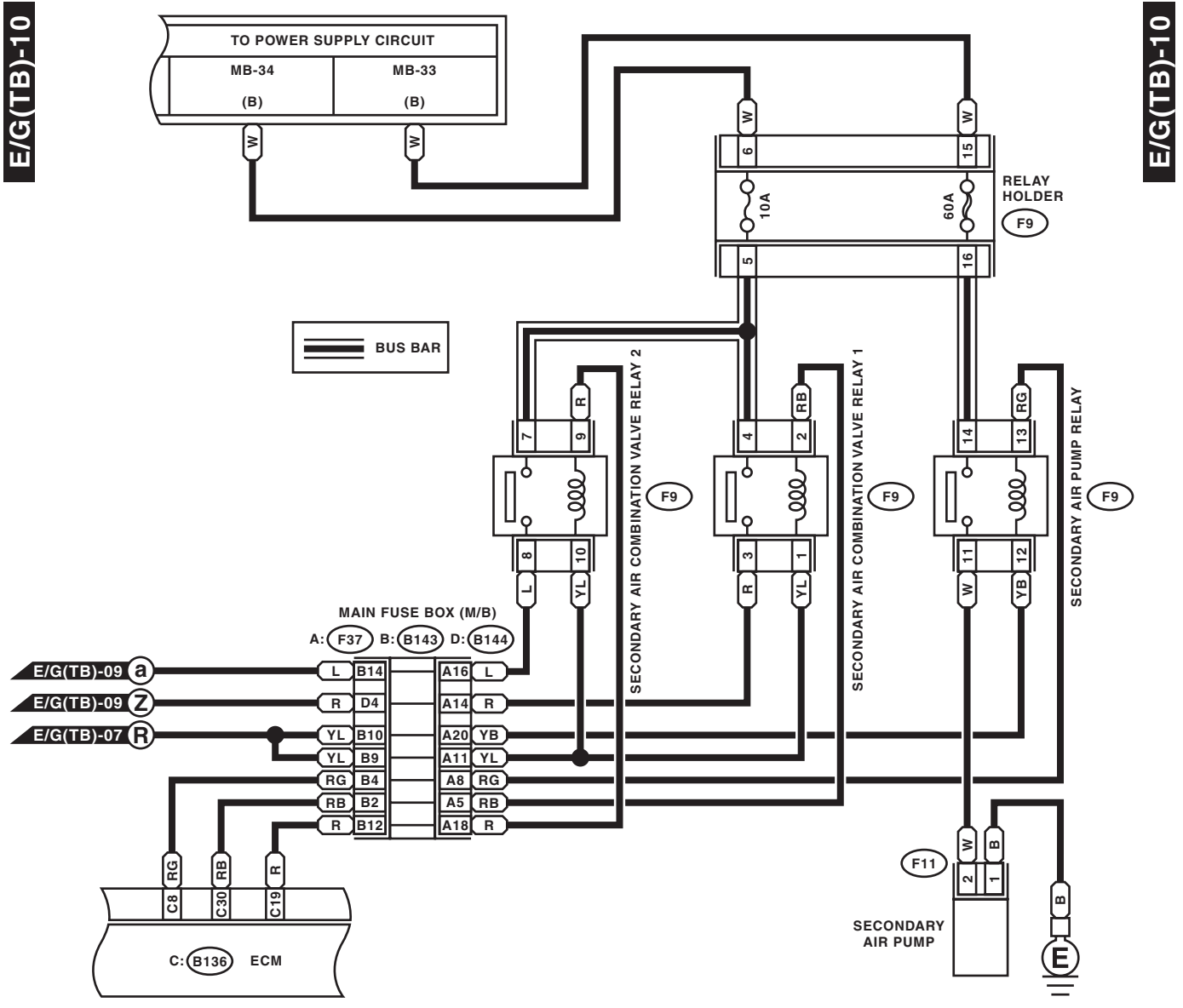
E/G(TB)-09



WI-15782

# Engine Electrical System

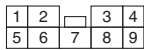
WIRING SYSTEM



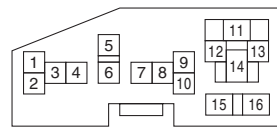
F11 (GRAY)



D: B144 (BROWN)



F9 (BLACK)



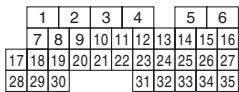
B: B143



A: F37



C: B136



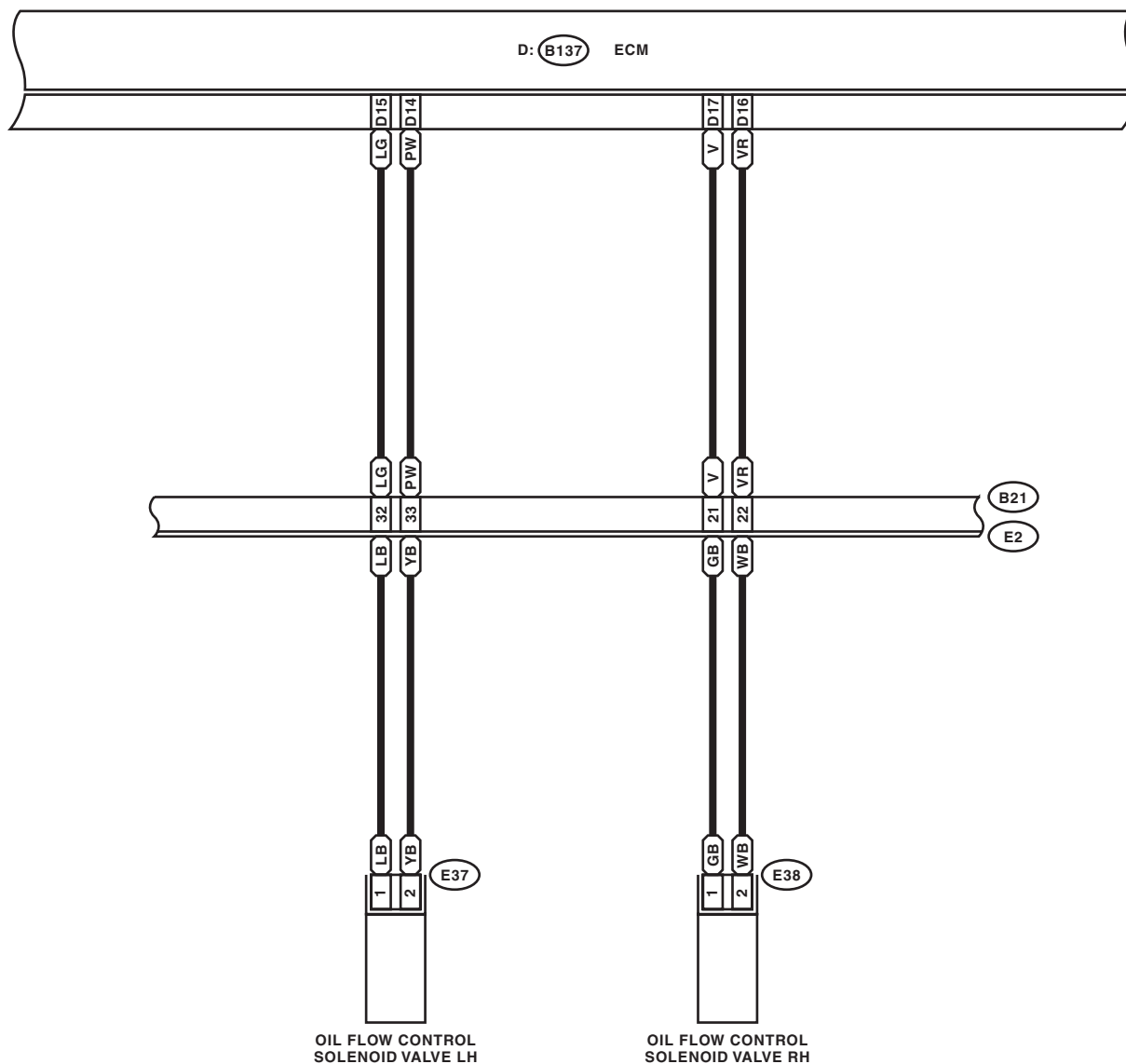
WI-15783

# Engine Electrical System

WIRING SYSTEM

E/G(TB)-11

E/G(TB)-11



E37 (BLUE)

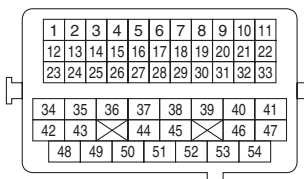
E38 (BLUE)



D: B137



B21 (BLACK)



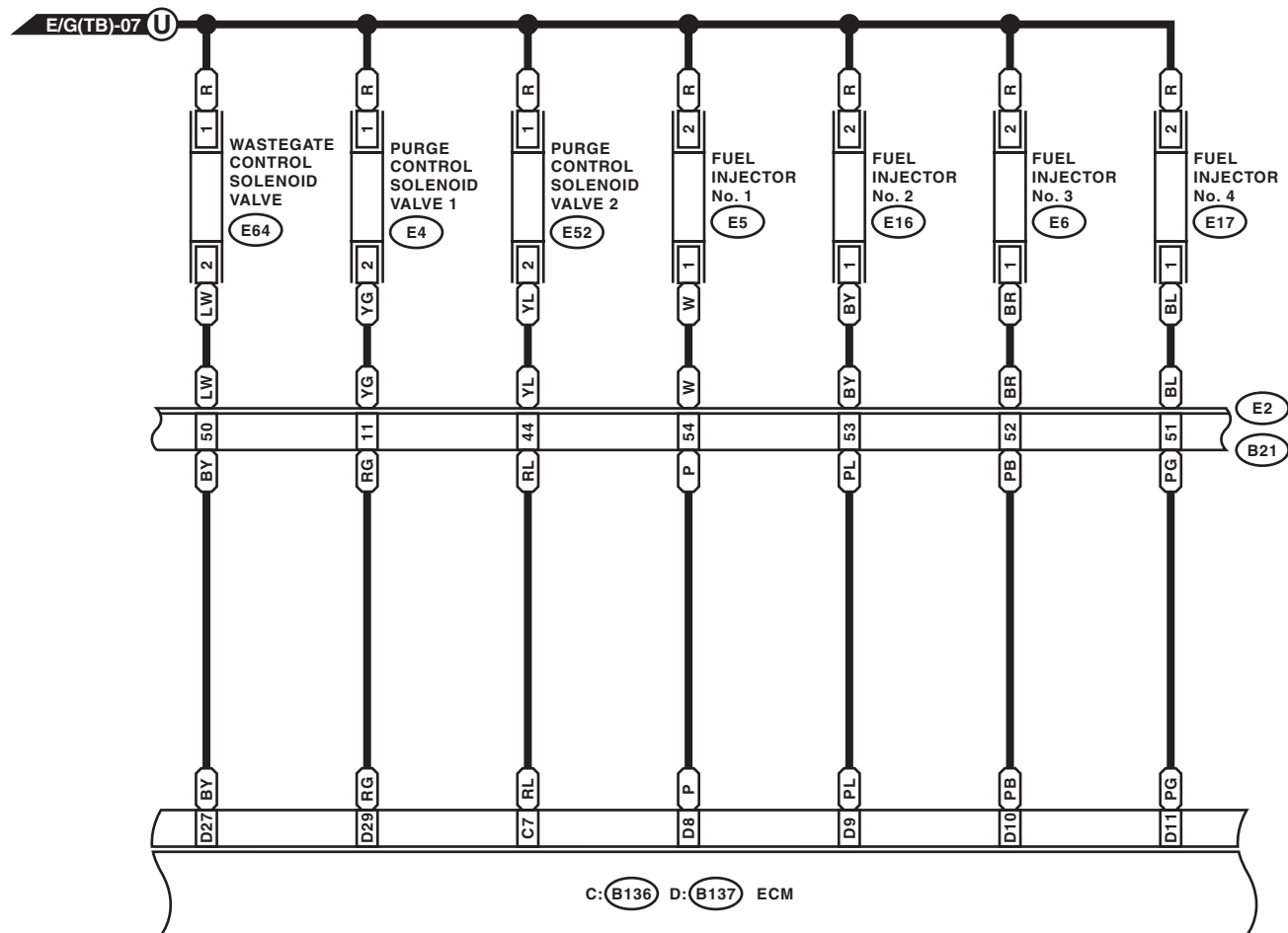
WI-15784

# Engine Electrical System

WIRING SYSTEM

E/G(TB)-12

E/G(TB)-12



E4 (BLACK)

E5 (DARK GRAY)

D: B137

C: B136

B21 (BLACK)

E52 (BLACK)

E6 (DARK GRAY)

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	



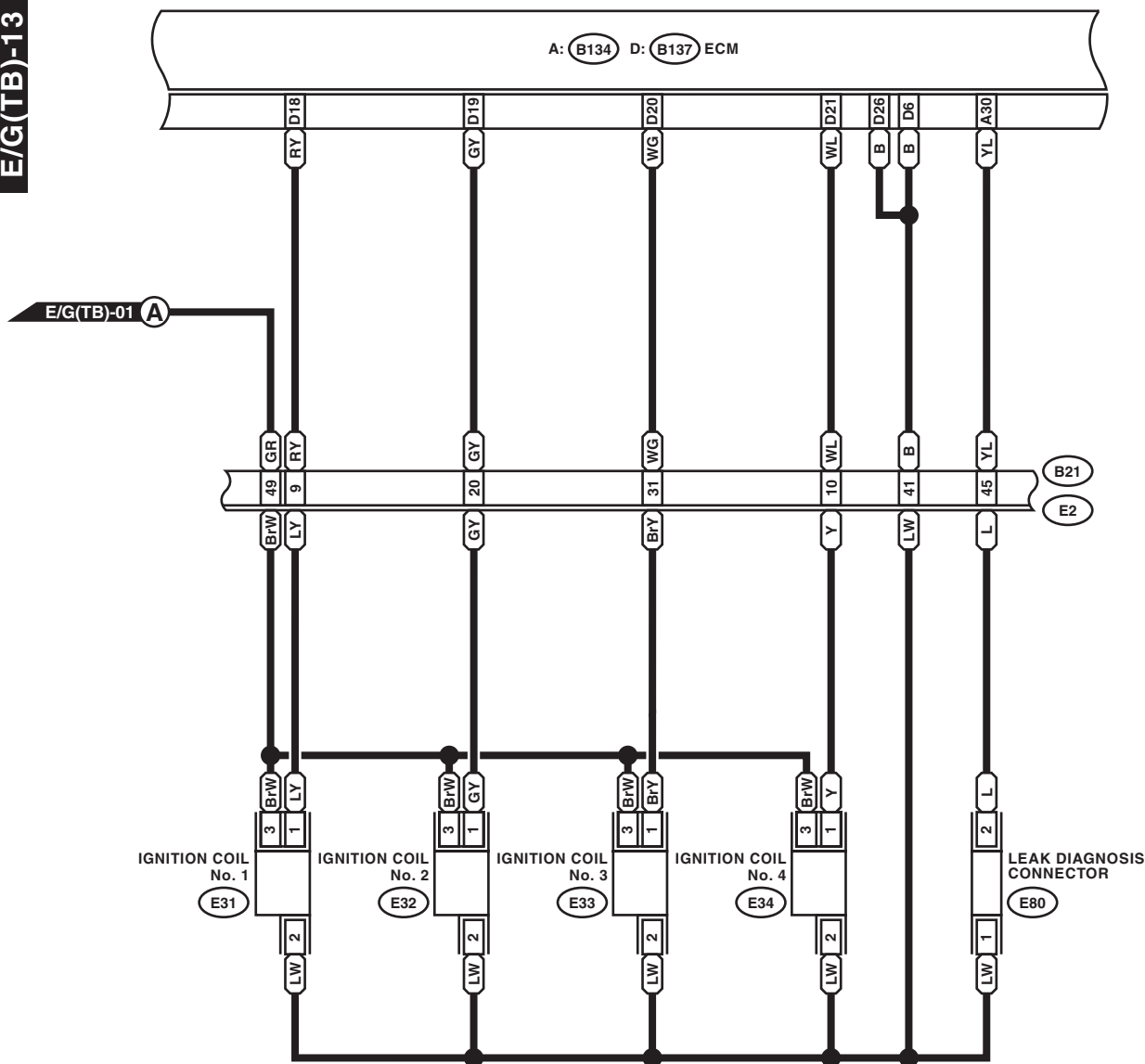
WI-15785

# Engine Electrical System

WIRING SYSTEM

E/G(TB)-13

E/G(TB)-13



E80 (DARK GRAY)



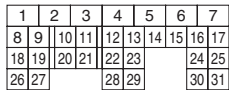
E31 E33 (BLACK)



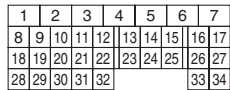
E32 E34 (BLACK)



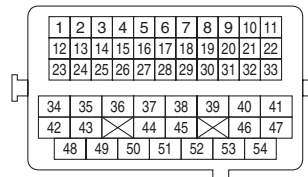
D: (B137)



A: (B134)



B21 (BLACK)



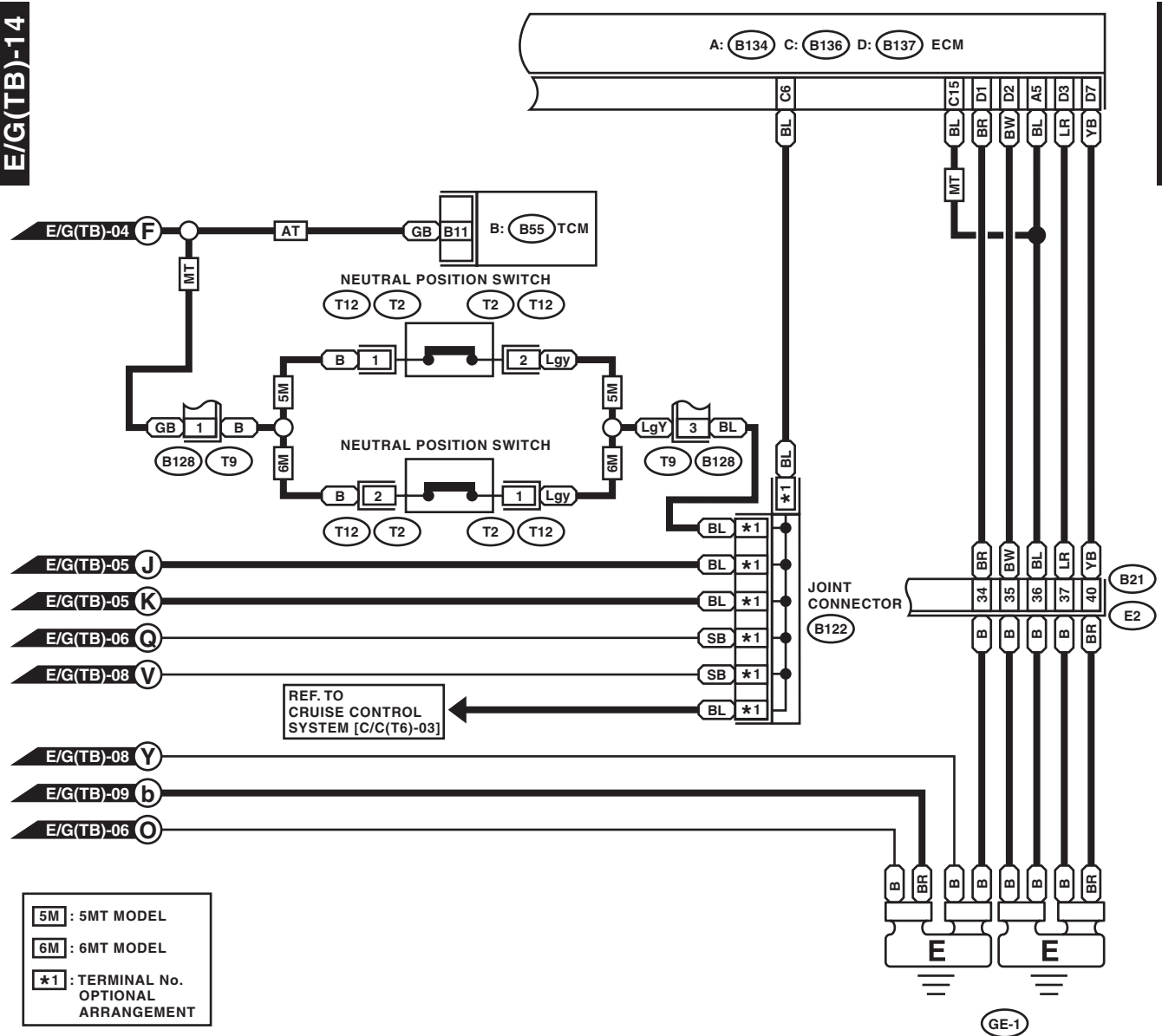
WI-15786

# Engine Electrical System

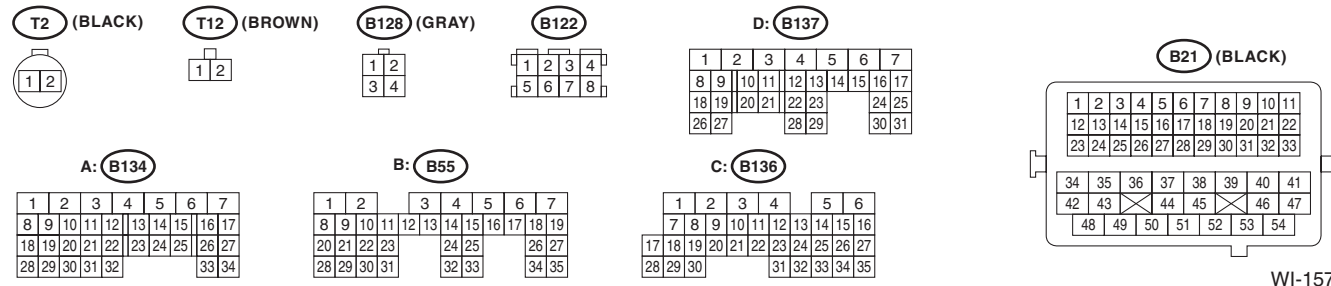
WIRING SYSTEM

E/G(TB)-14

E/G(TB)-14



**5M** : 5MT MODEL  
**6M** : 6MT MODEL  
**\*1** : TERMINAL No. OPTIONAL ARRANGEMENT



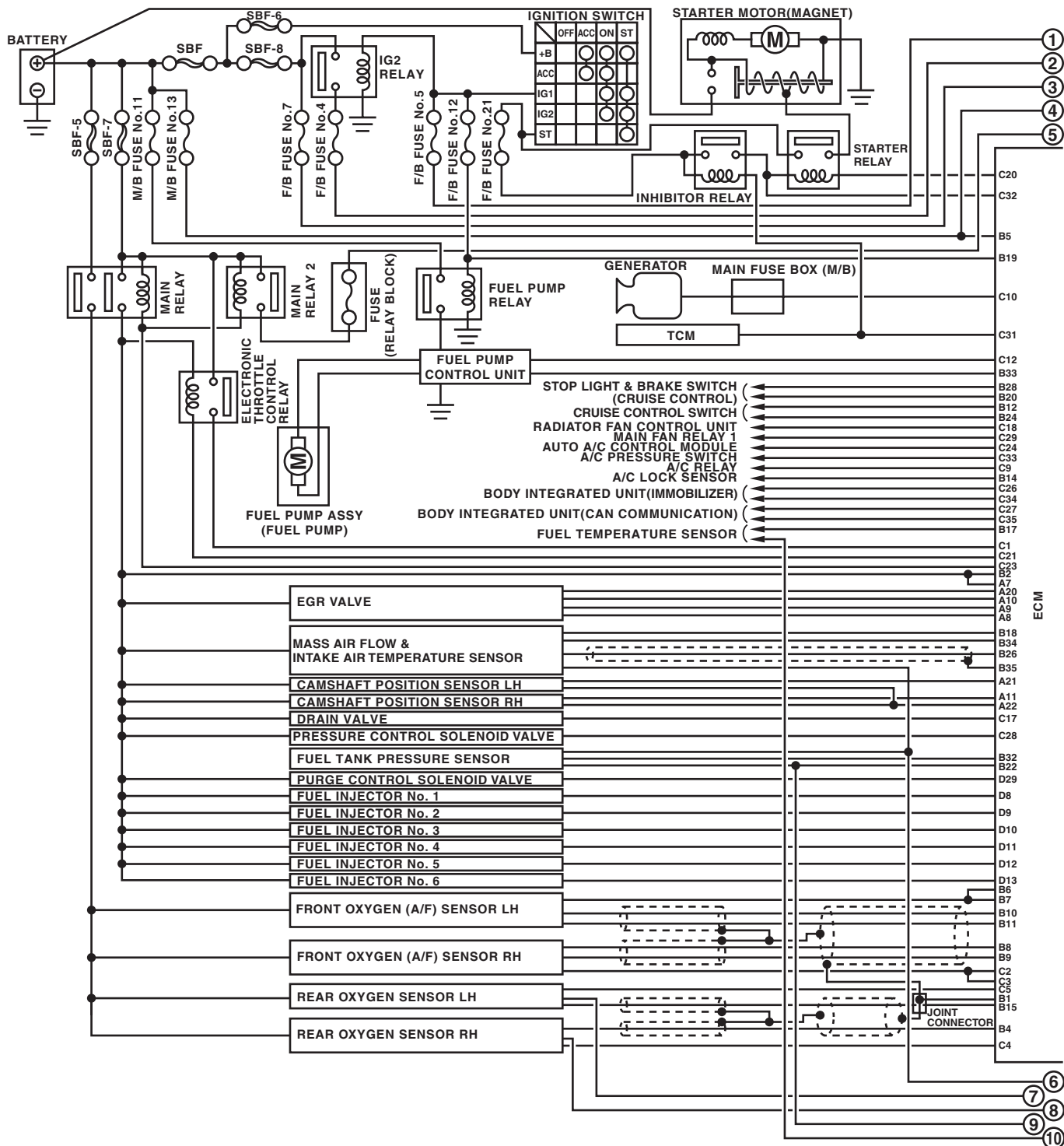
WI-15787



# Engine Electrical System

## WIRING SYSTEM

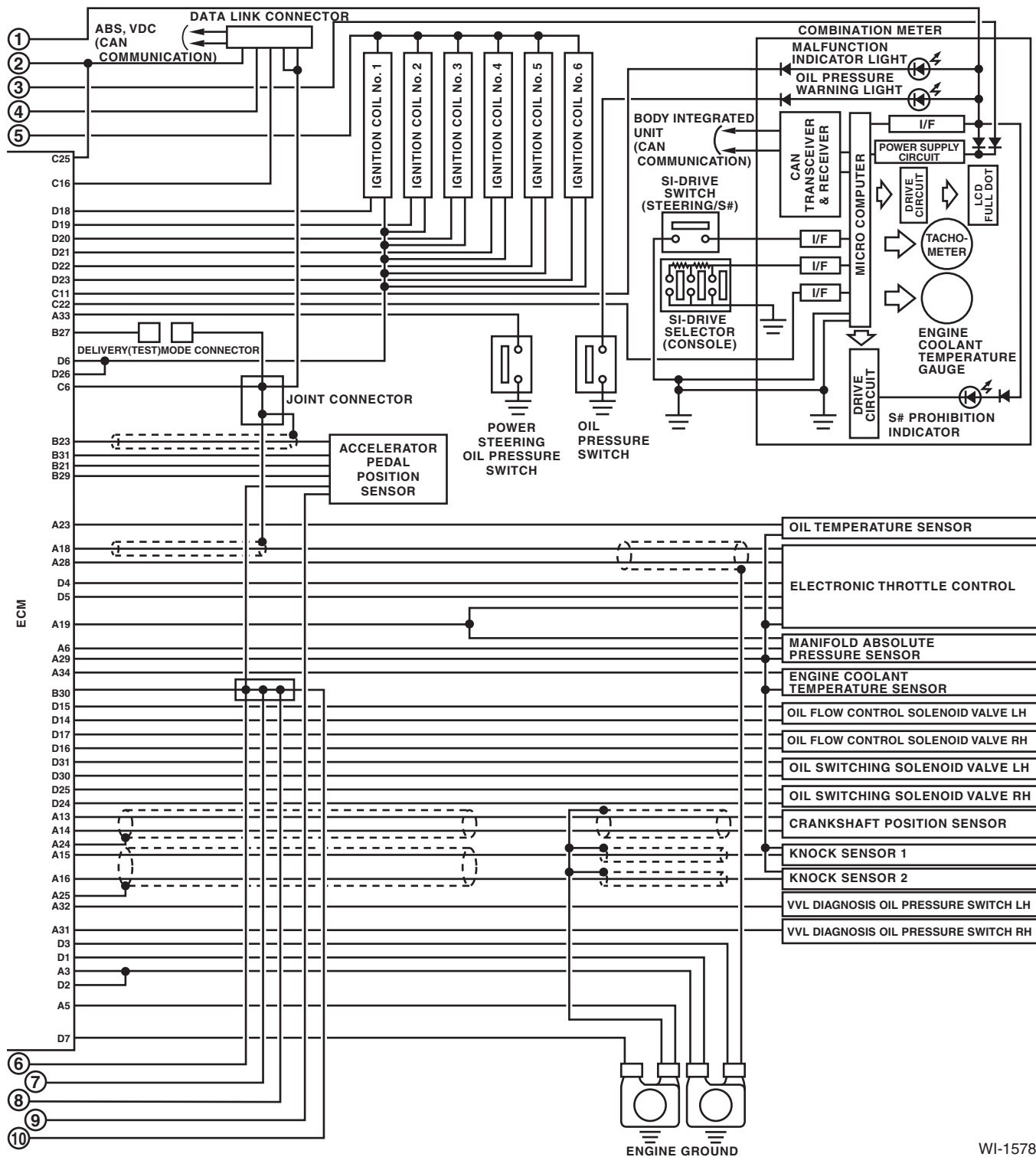
### 3. 3.0 L MODEL



WI-15788

# Engine Electrical System

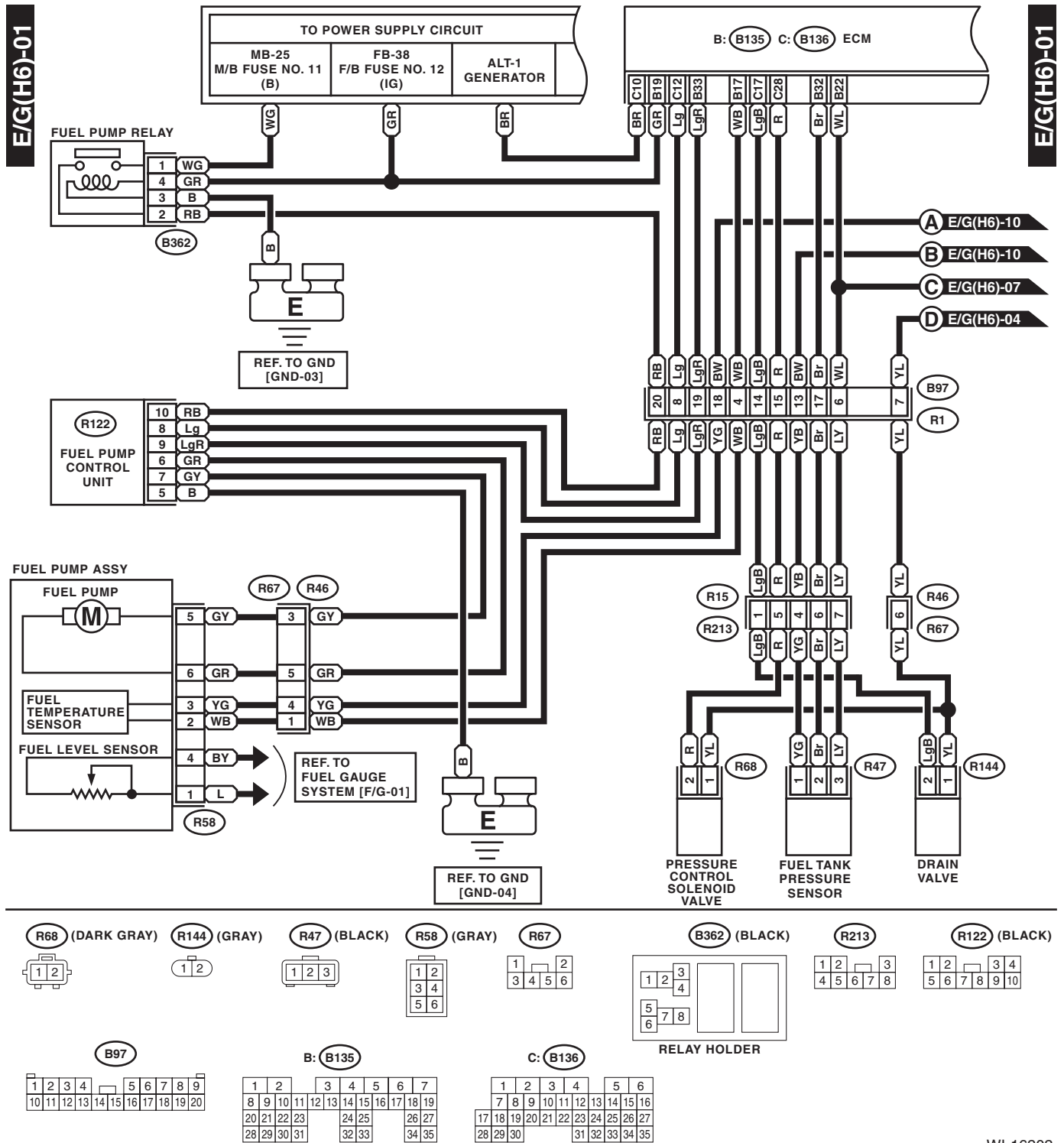
WIRING SYSTEM



WI-15789

# Engine Electrical System

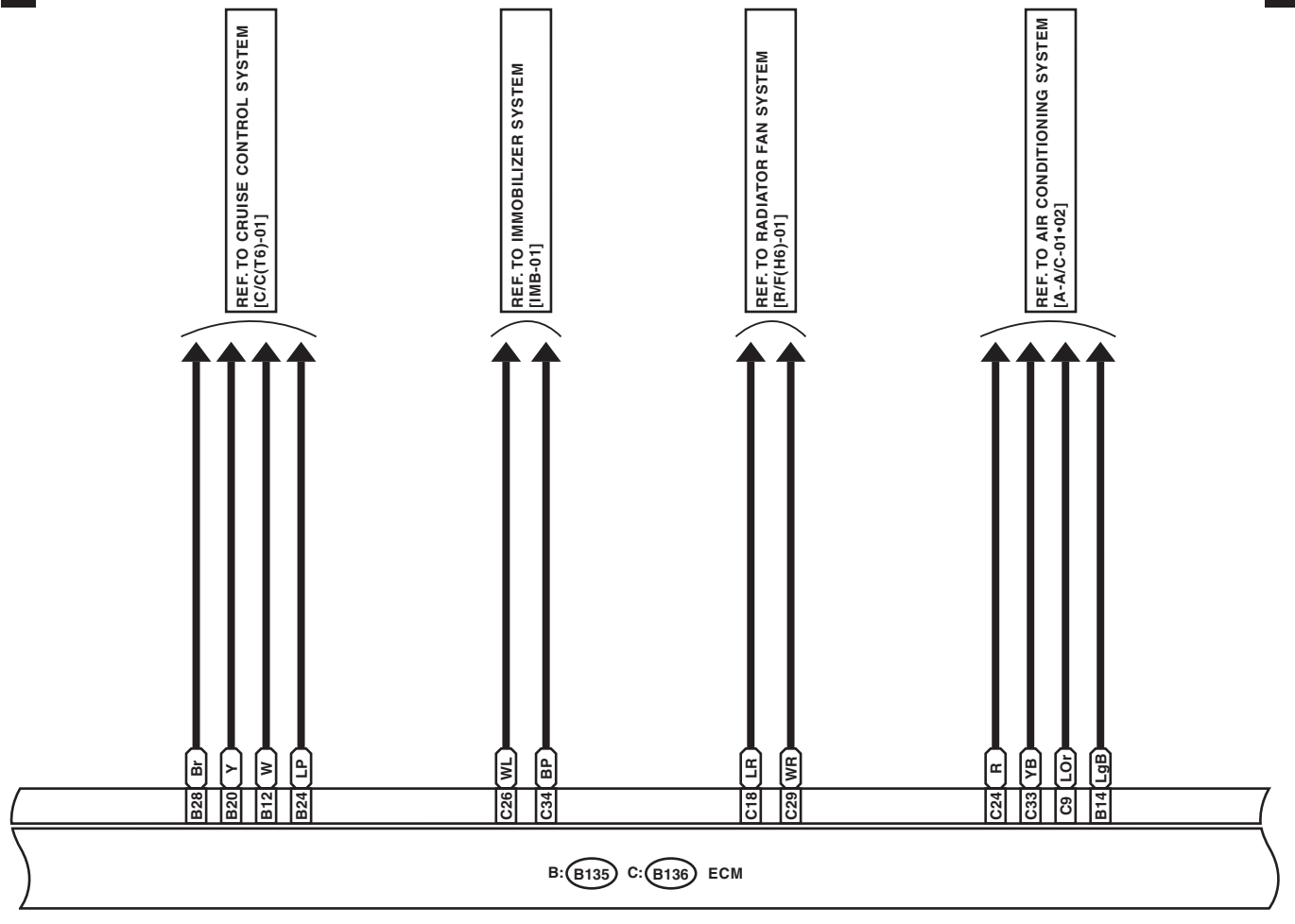
## WIRING SYSTEM



WI-16202

E/G(H6)-02

E/G(H6)-02



B: **B135**

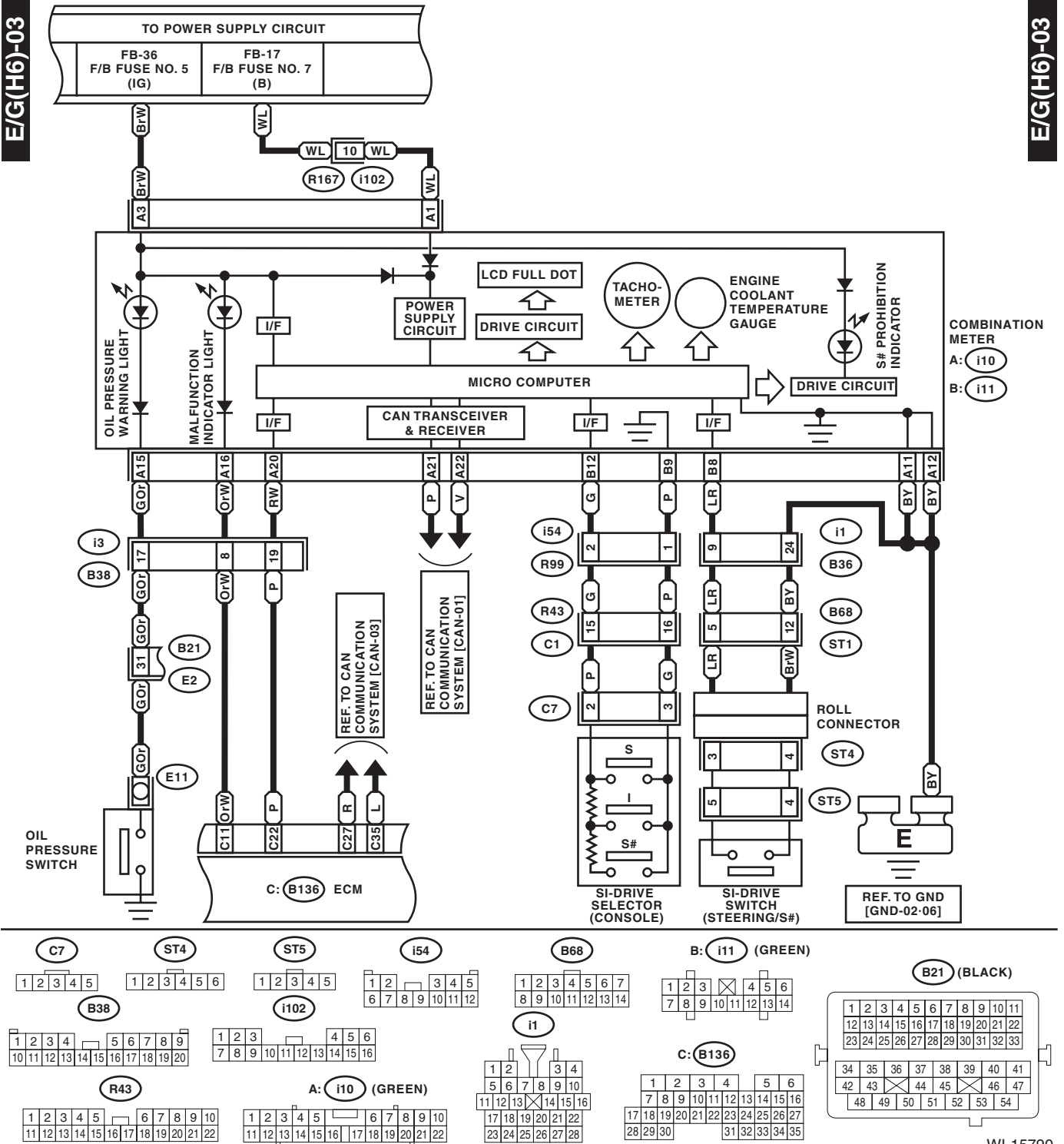
1	2		3	4	5	6	7				
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23		24	25		26	27		
28	29	30	31		32	33		34	35		

C: **B136**

			1	2	3	4		5	6			
			7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27		
28	29	30				31	32	33	34	35		

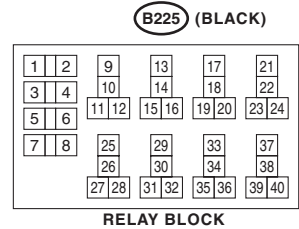
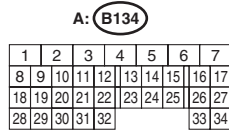
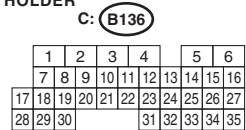
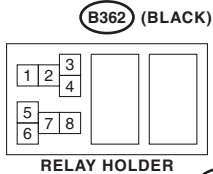
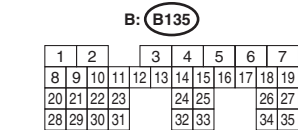
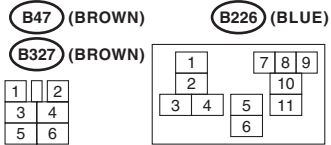
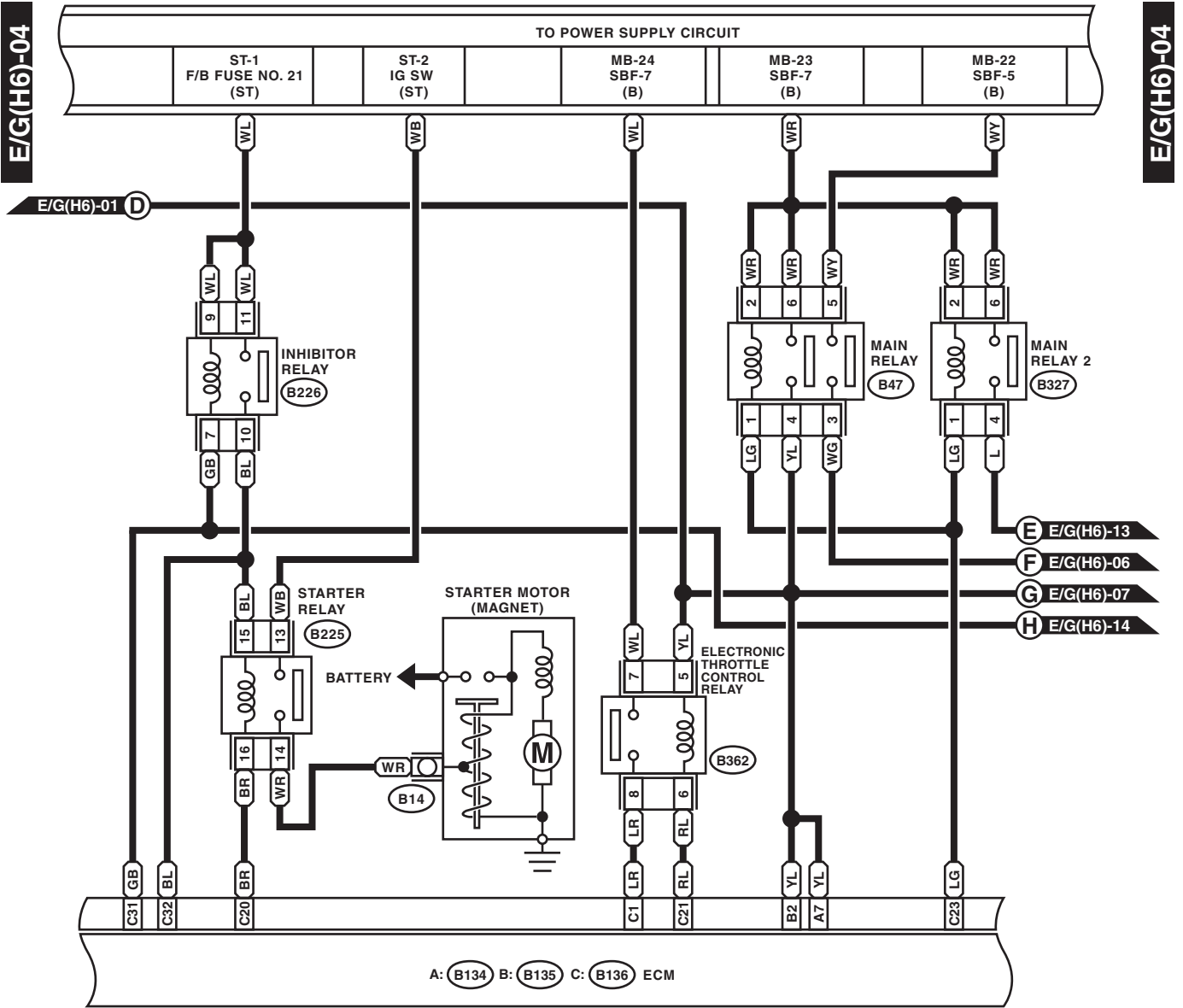
# Engine Electrical System

## WIRING SYSTEM



# Engine Electrical System

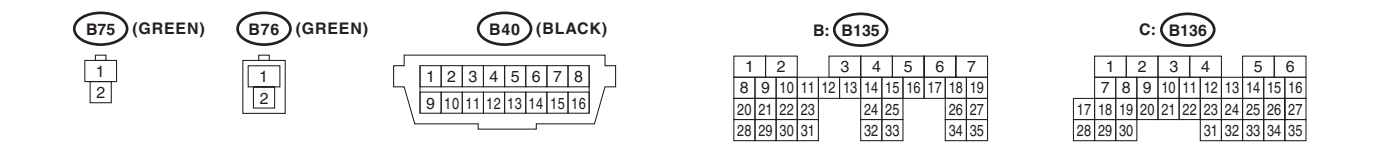
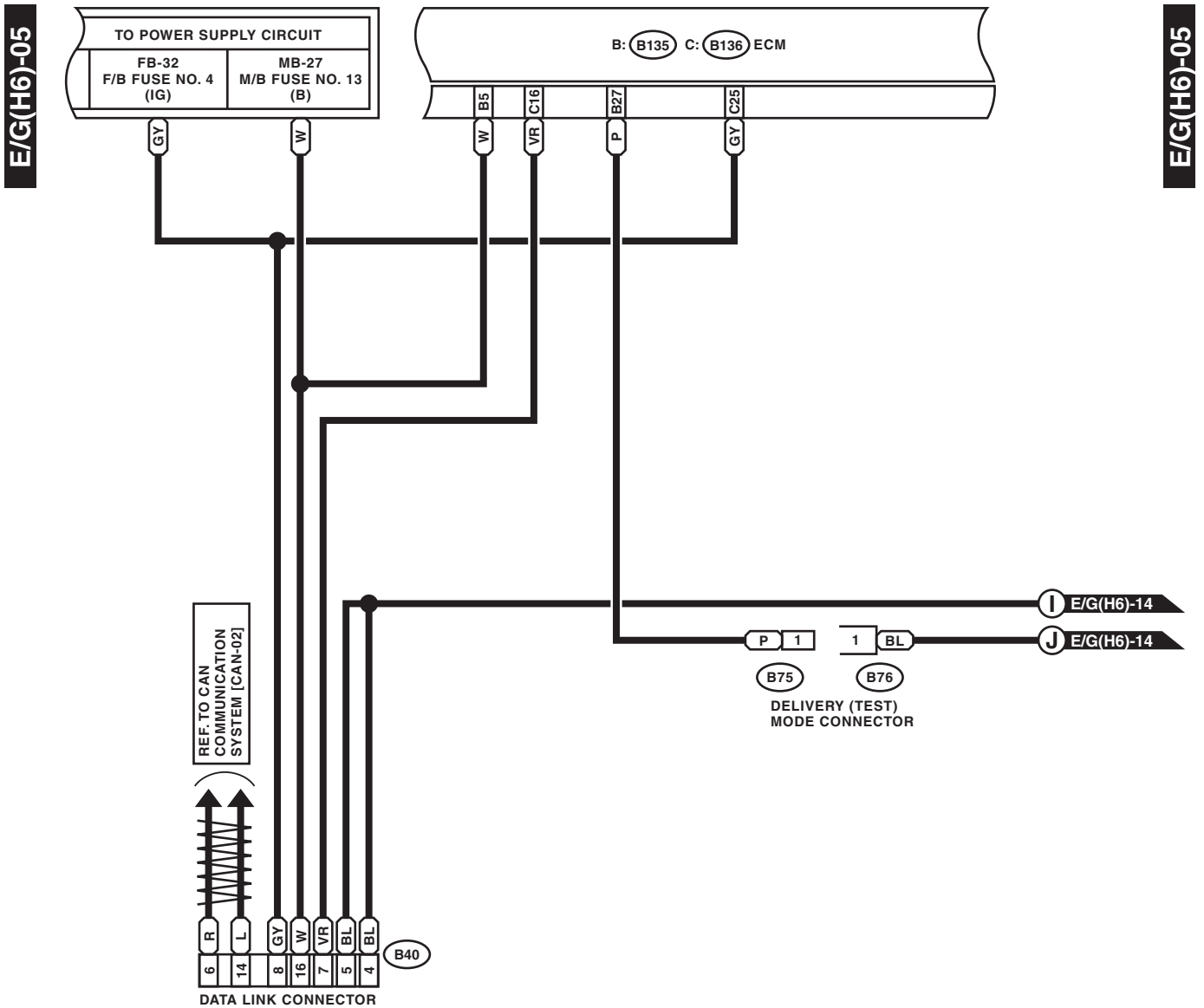
WIRING SYSTEM



WI-15791

# Engine Electrical System

## WIRING SYSTEM



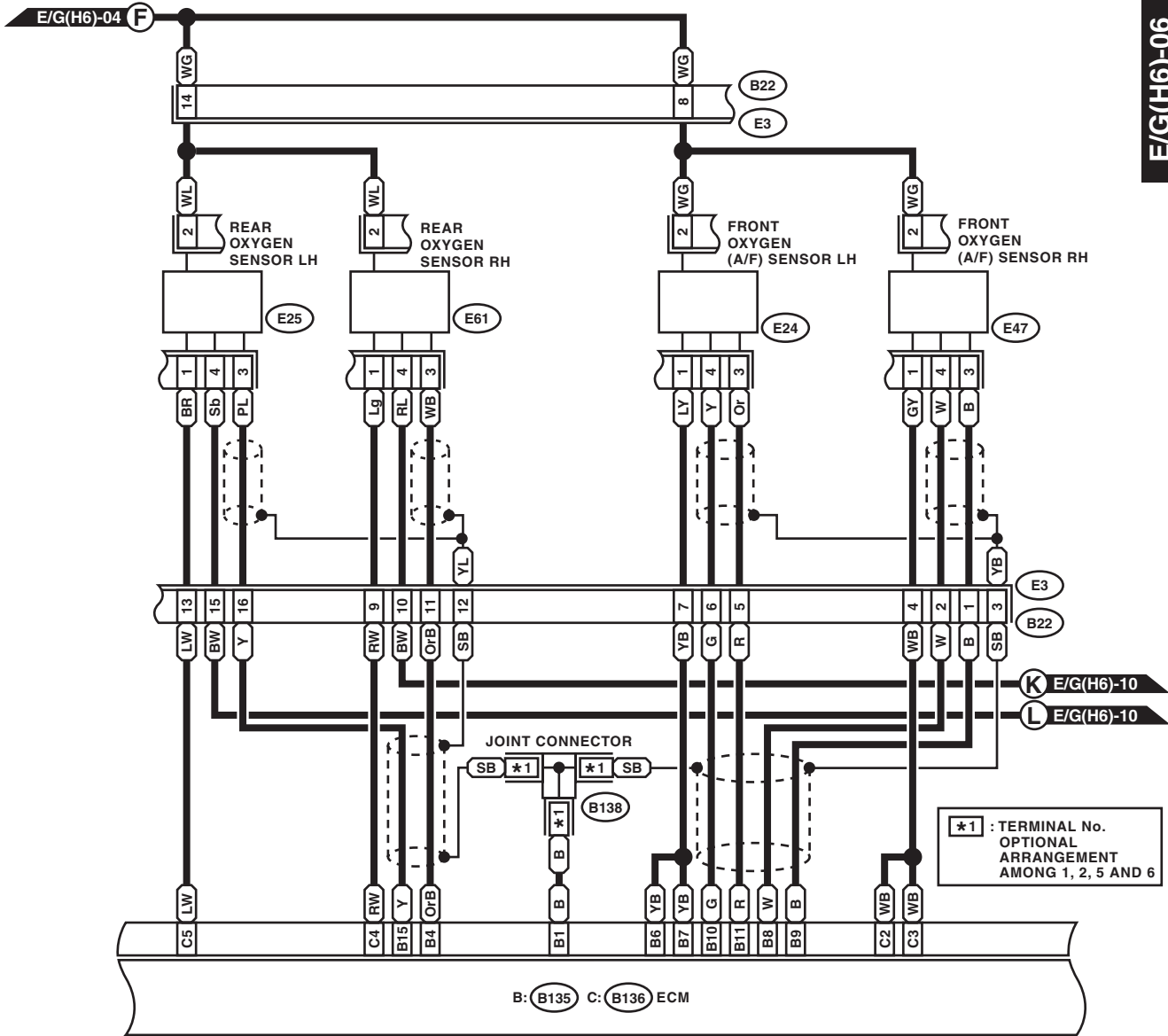
WI-15792

# Engine Electrical System

WIRING SYSTEM

E/G(H6)-06

E/G(H6)-06



E24 (LIGHT GRAY)

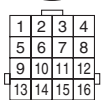
B138

E25 (DARK GRAY)



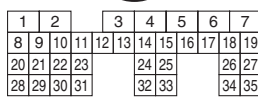
E47 (LIGHT GRAY)

B22 (BROWN)

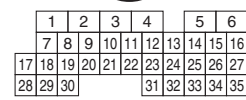


E61 (DARK GRAY)

B: B135



C: B136

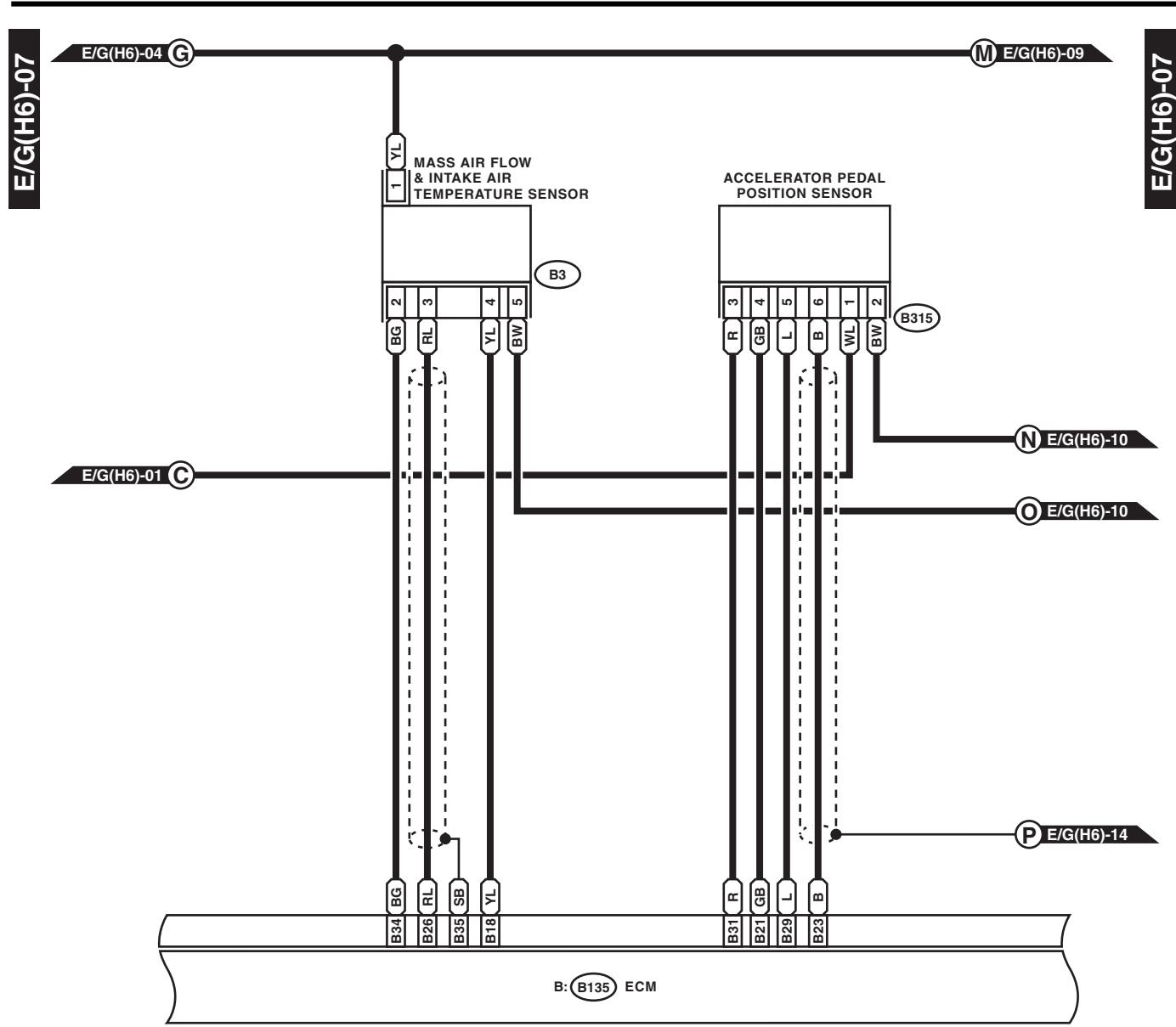


WI-15793



# Engine Electrical System

## WIRING SYSTEM



B3 (BLACK)

B315 (BLACK)

B: B135

1	2	3	4	5
---	---	---	---	---

1	2	3	4	5	6
---	---	---	---	---	---

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

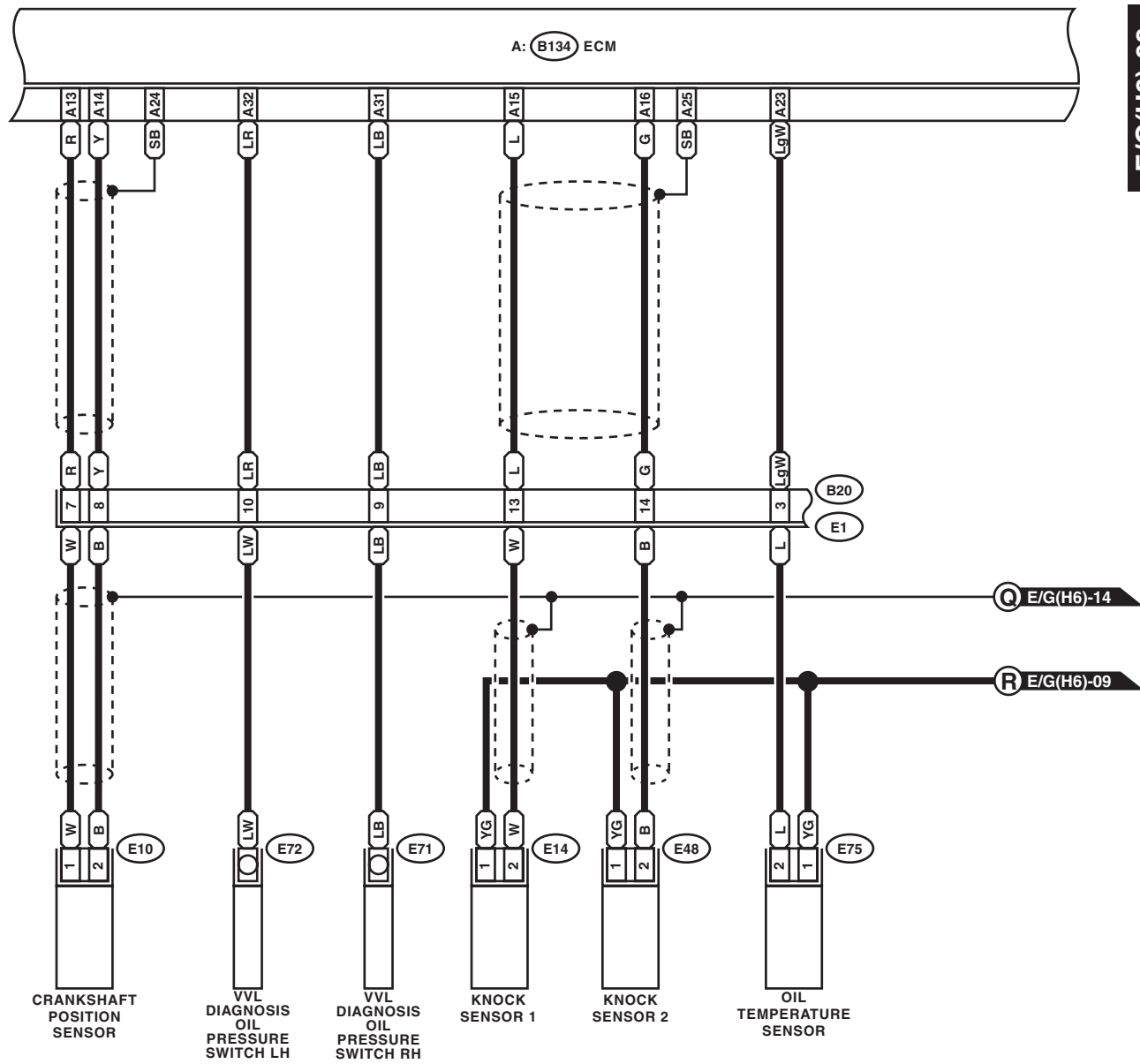
WI-15794

# Engine Electrical System

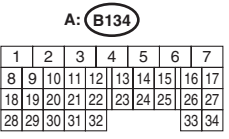
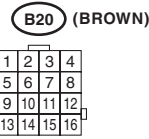
WIRING SYSTEM

E/G(H6)-08

E/G(H6)-08



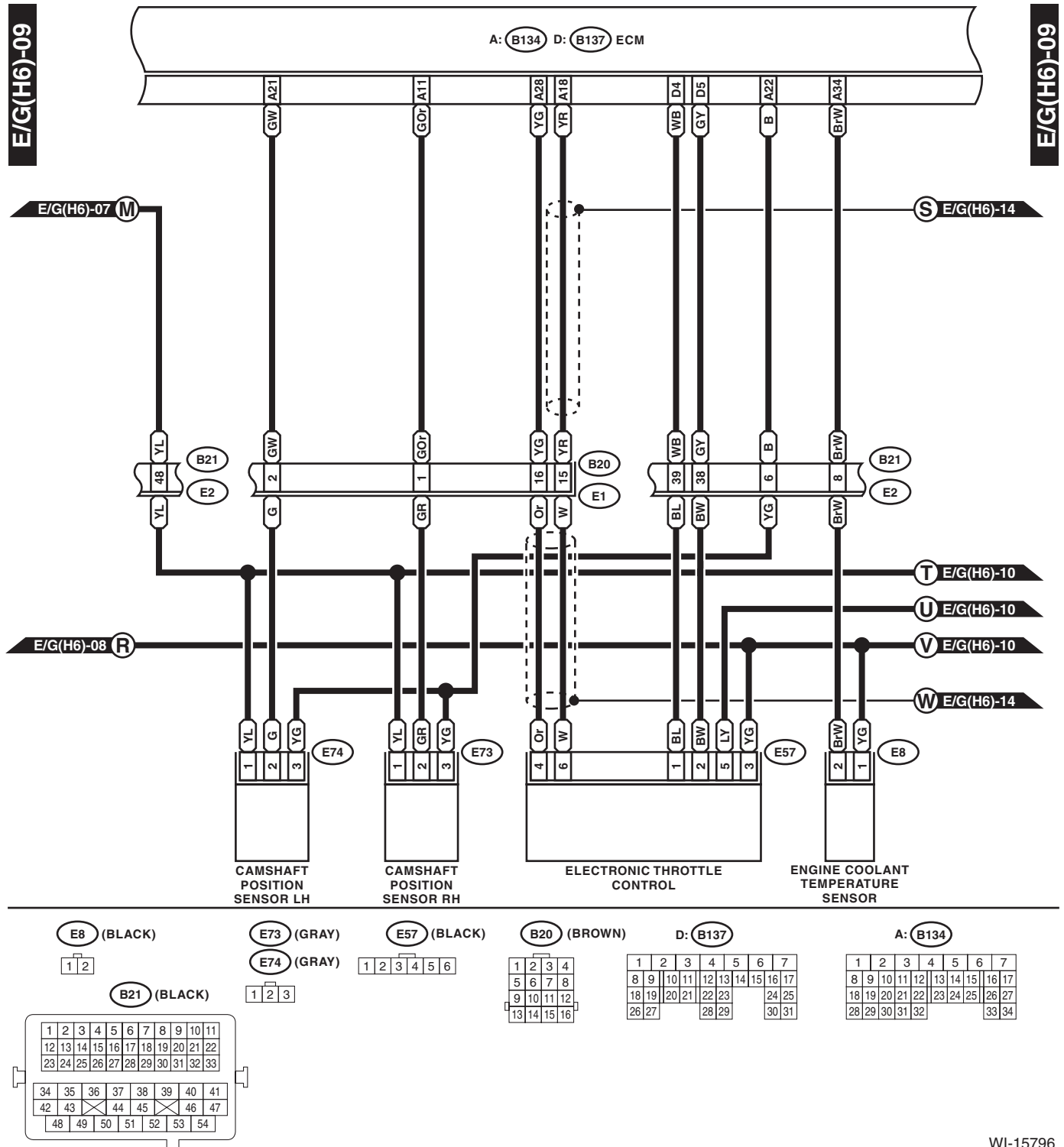
- E10 (LIGHT GRAY)
- E14 (BLUE)
- E48 (BLUE)
- E75 (BLACK)



WI-15795

# Engine Electrical System

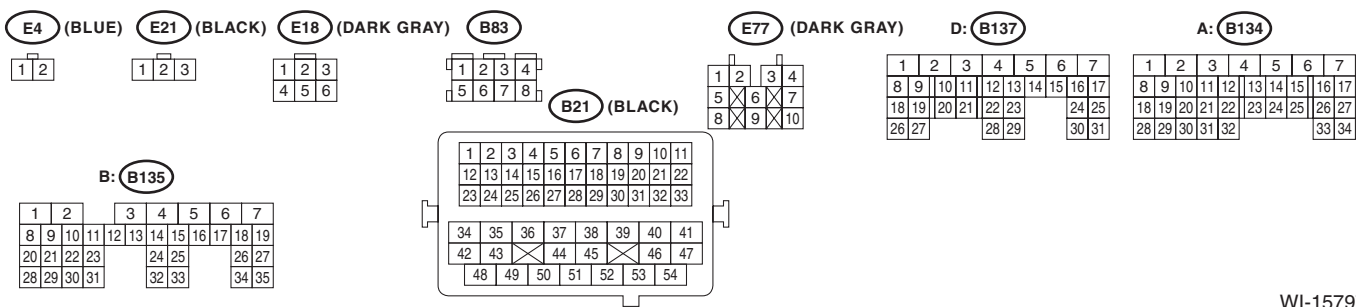
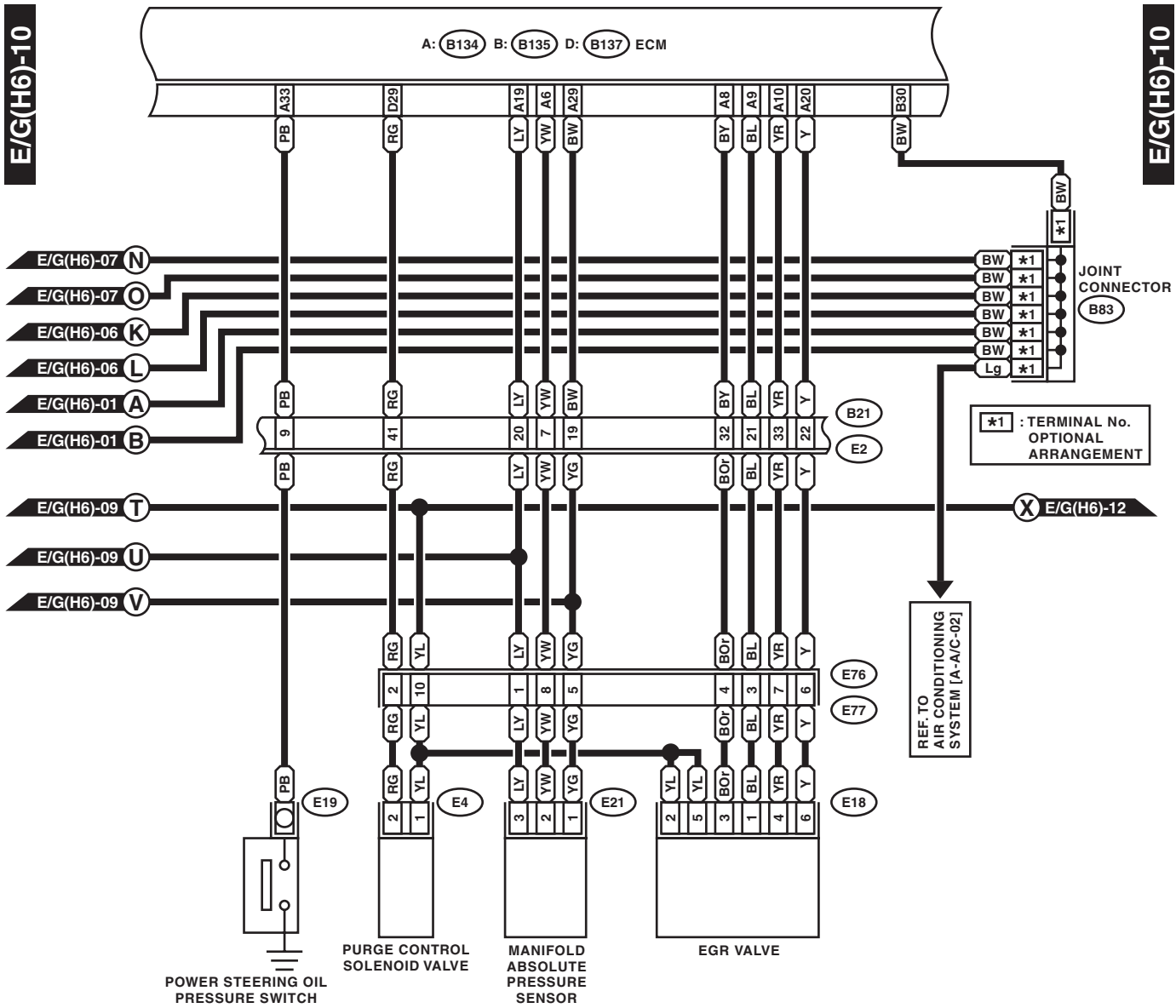
## WIRING SYSTEM



WI-15796

# Engine Electrical System

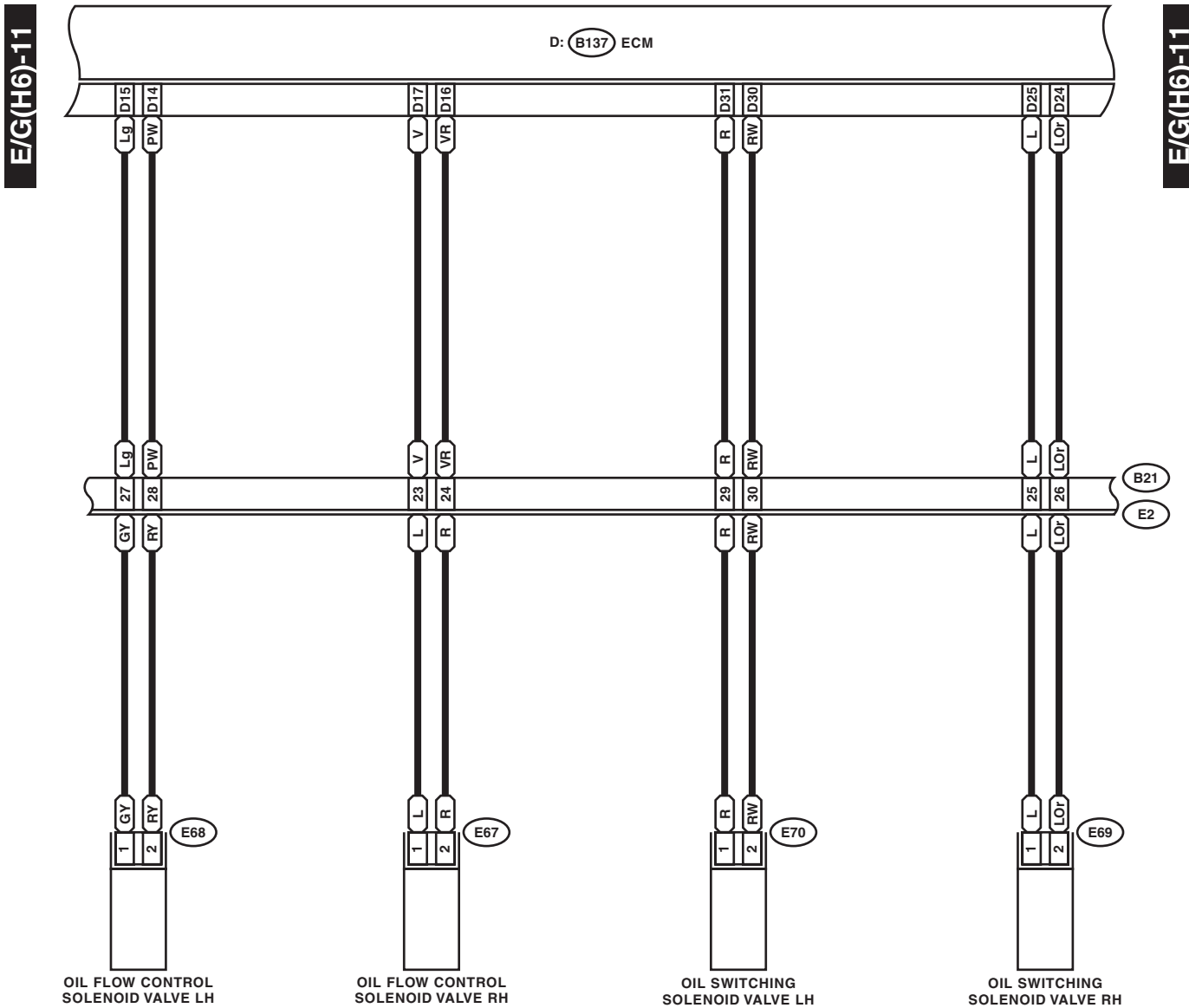
WIRING SYSTEM



WI-15797

# Engine Electrical System

## WIRING SYSTEM



- (E67) (BLACK)
- (E68) (BLACK)
- (E69) (BLUE)
- (E70) (BLUE)

D: (B137)

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

(B21) (BLACK)

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

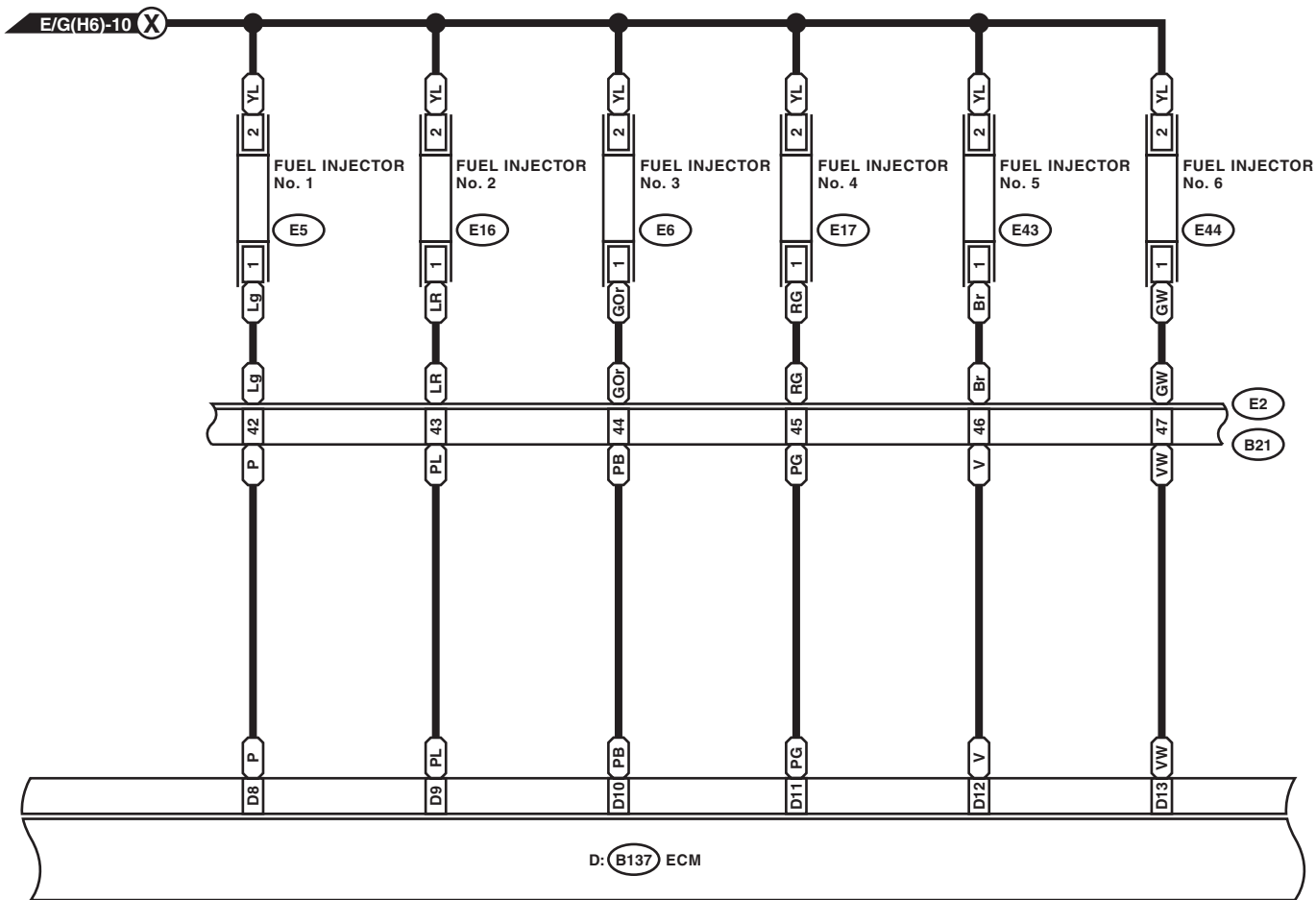
WI-15798

# Engine Electrical System

WIRING SYSTEM

E/G(H6)-12

E/G(H6)-12



- (DARK GRAY) E5 (DARK GRAY) E17 (DARK GRAY)
- (DARK GRAY) E6 (DARK GRAY) E43 (DARK GRAY)
- (DARK GRAY) E16 (DARK GRAY) E44 (DARK GRAY)



D: B137

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

B21 (BLACK)

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41			
42	43	44	45	46	47					
48	49	50	51	52	53	54				

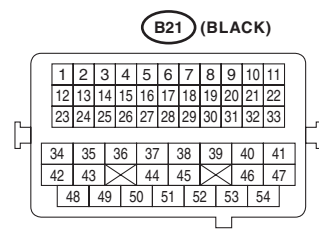
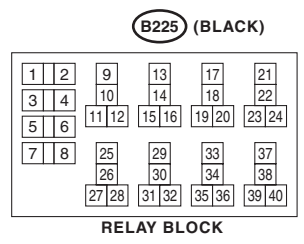
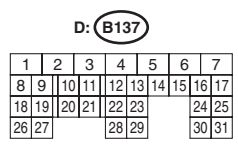
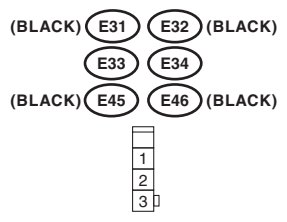
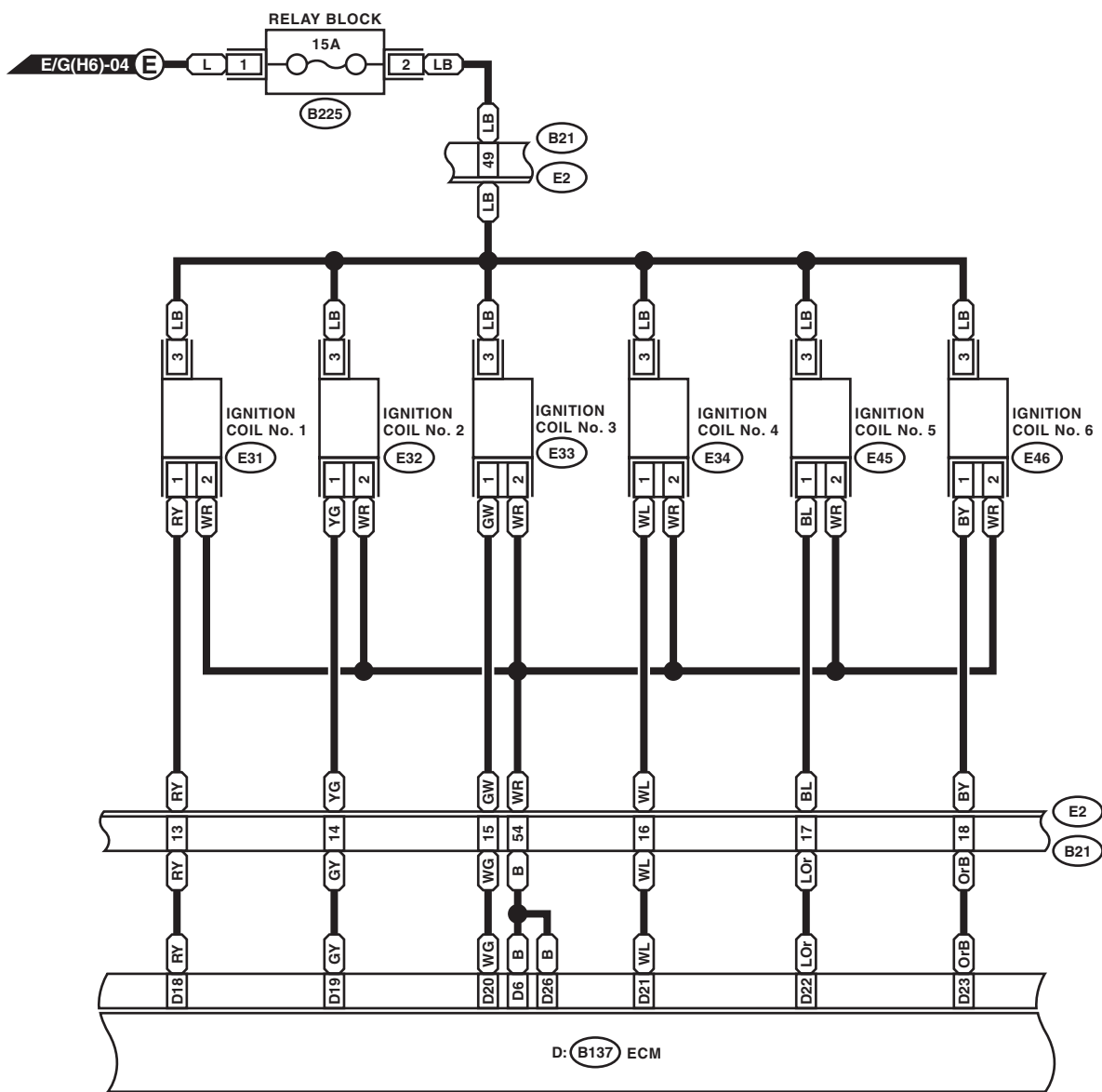
WI-15799

# Engine Electrical System

WIRING SYSTEM

E/G(H6)-13

E/G(H6)-13



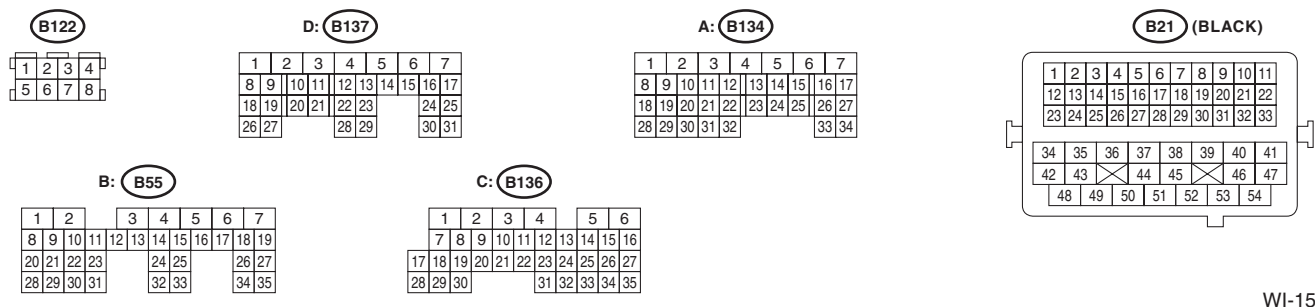
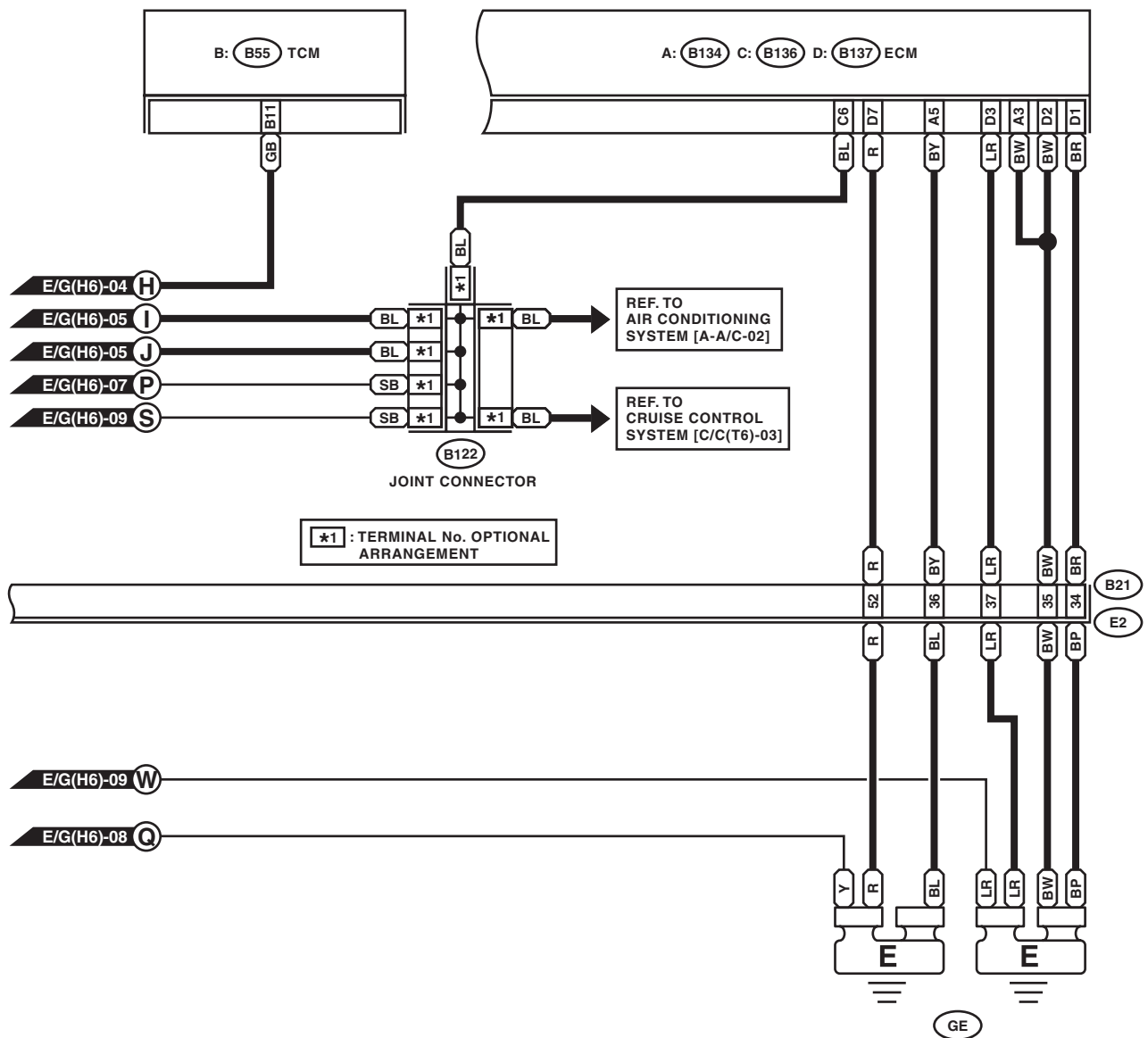
WI-15800

# Engine Electrical System

WIRING SYSTEM

E/G(H6)-14

E/G(H6)-14



WI-15801



# Radiator Fan System

WIRING SYSTEM

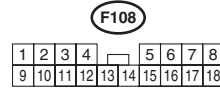
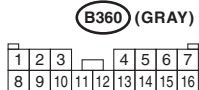
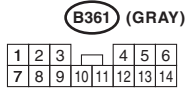
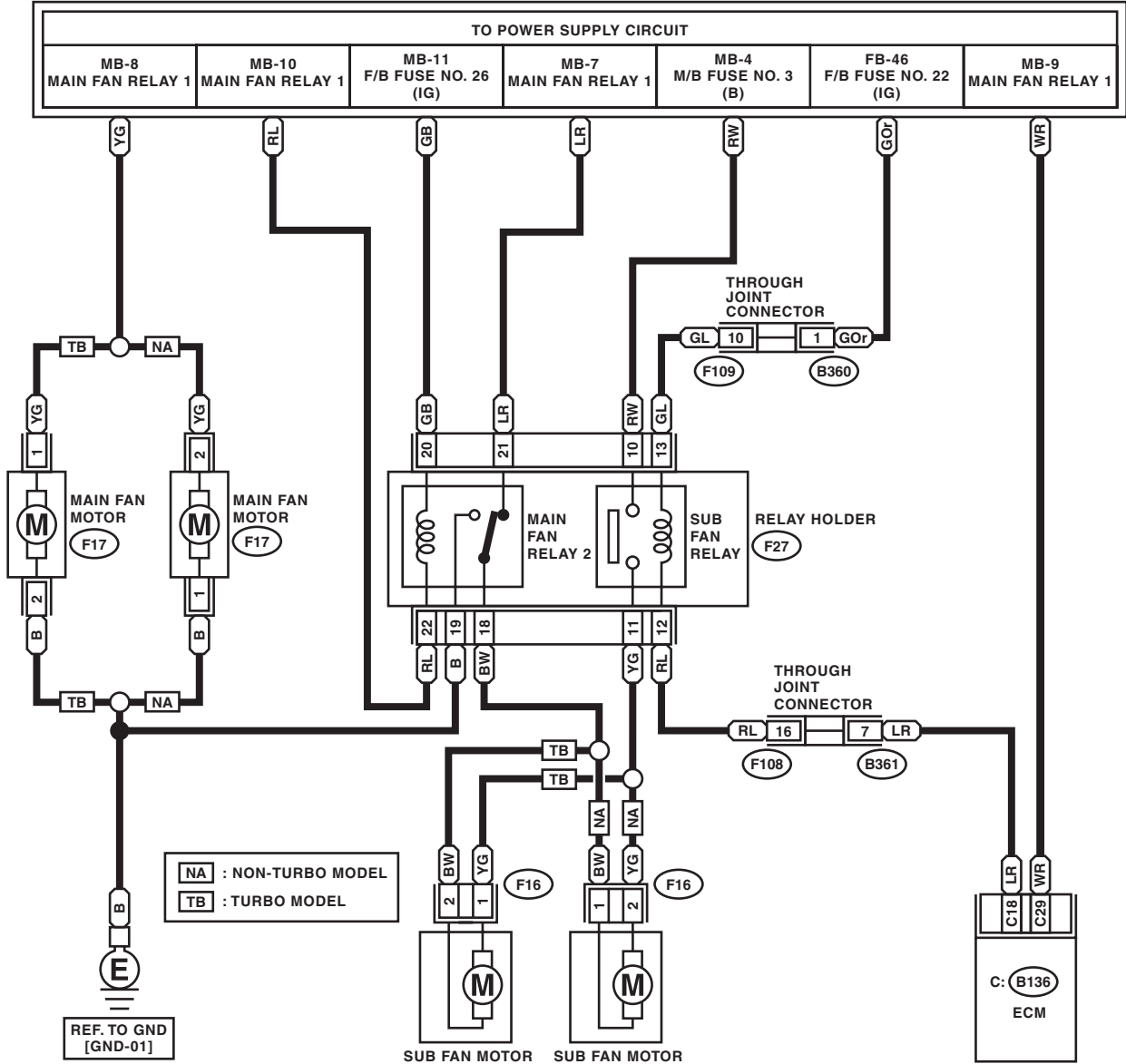
## 6. Radiator Fan System

### A: WIRING DIAGRAM

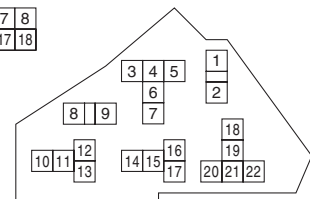
#### 1. 2.5 L MODEL

R/F(H4)-01

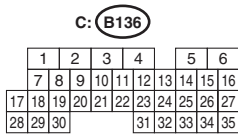
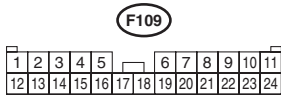
R/F(H4)-01



F27 (BLACK)



RELAY HOLDER



WI-13178

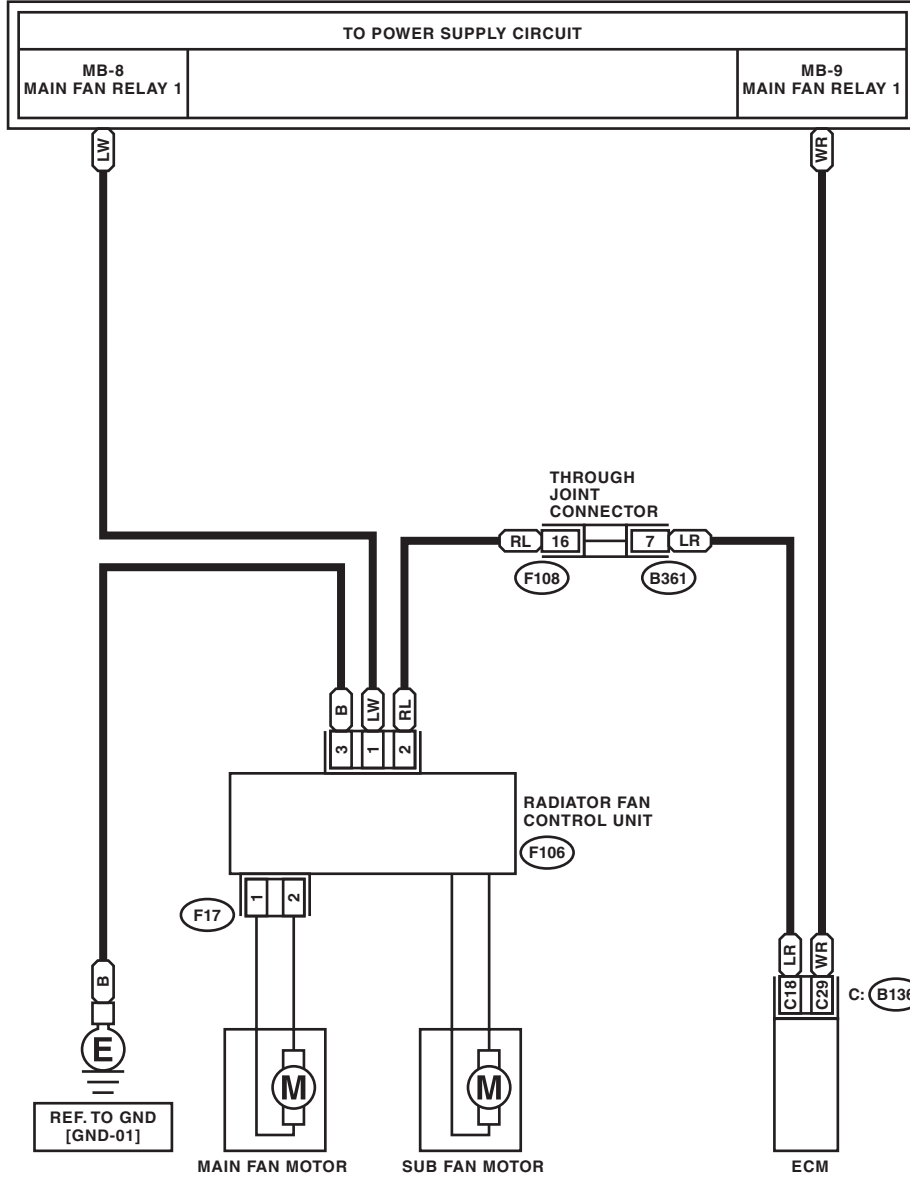
# Radiator Fan System

WIRING SYSTEM

## 2. 3.0 L MODEL

R/F(H6)-01

R/F(H6)-01



F17



F106 (GRAY)



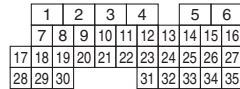
B361 (GRAY)



F108



C: B136



WI-15802

# Charging System

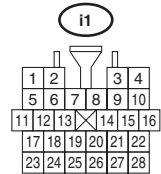
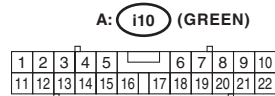
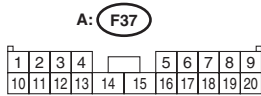
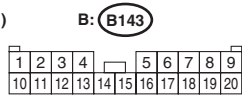
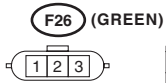
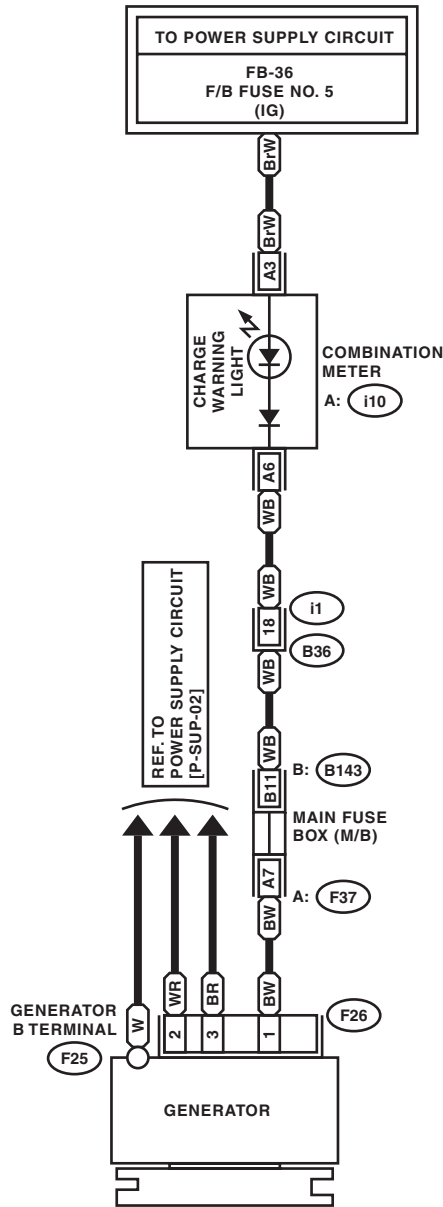
WIRING SYSTEM

## 7. Charging System

### A: WIRING DIAGRAM

CHG-01

CHG-01



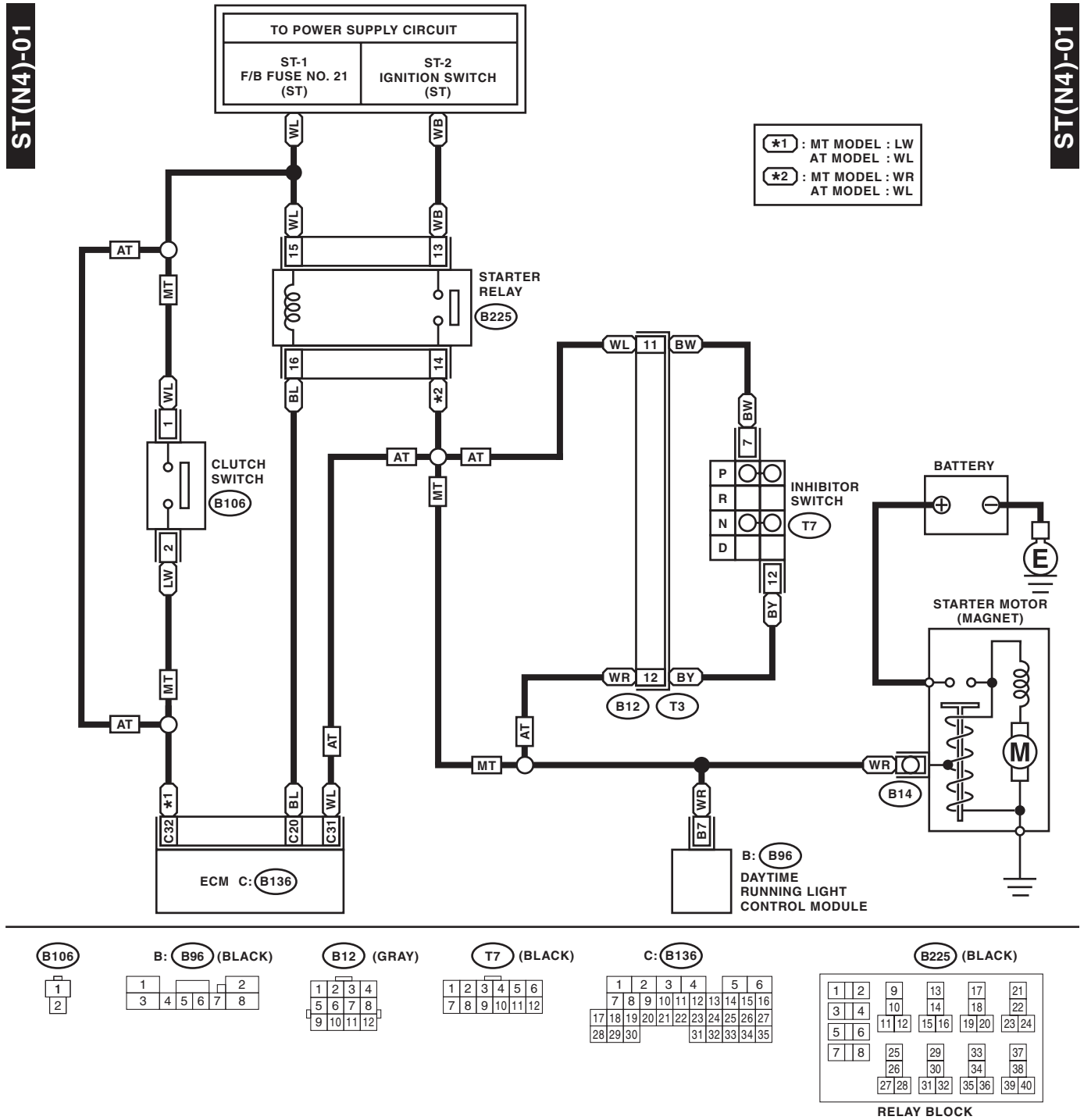
WI-15803

## 8. Starter System

### A: WIRING DIAGRAM

#### 1. 2.5 L NON-TURBO MODEL

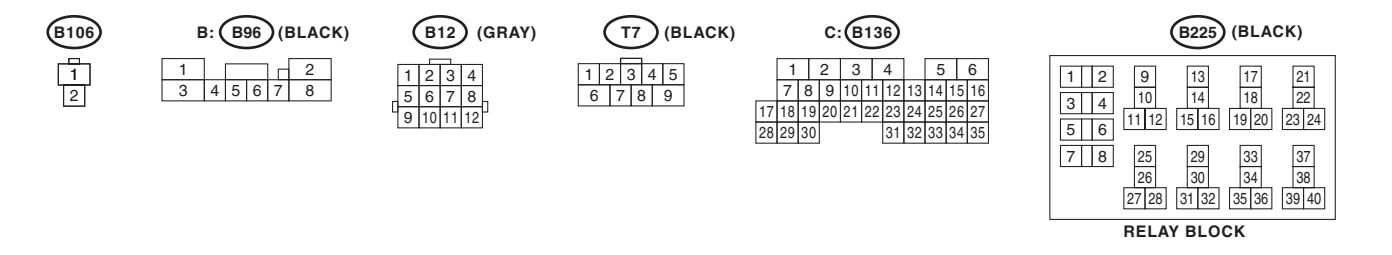
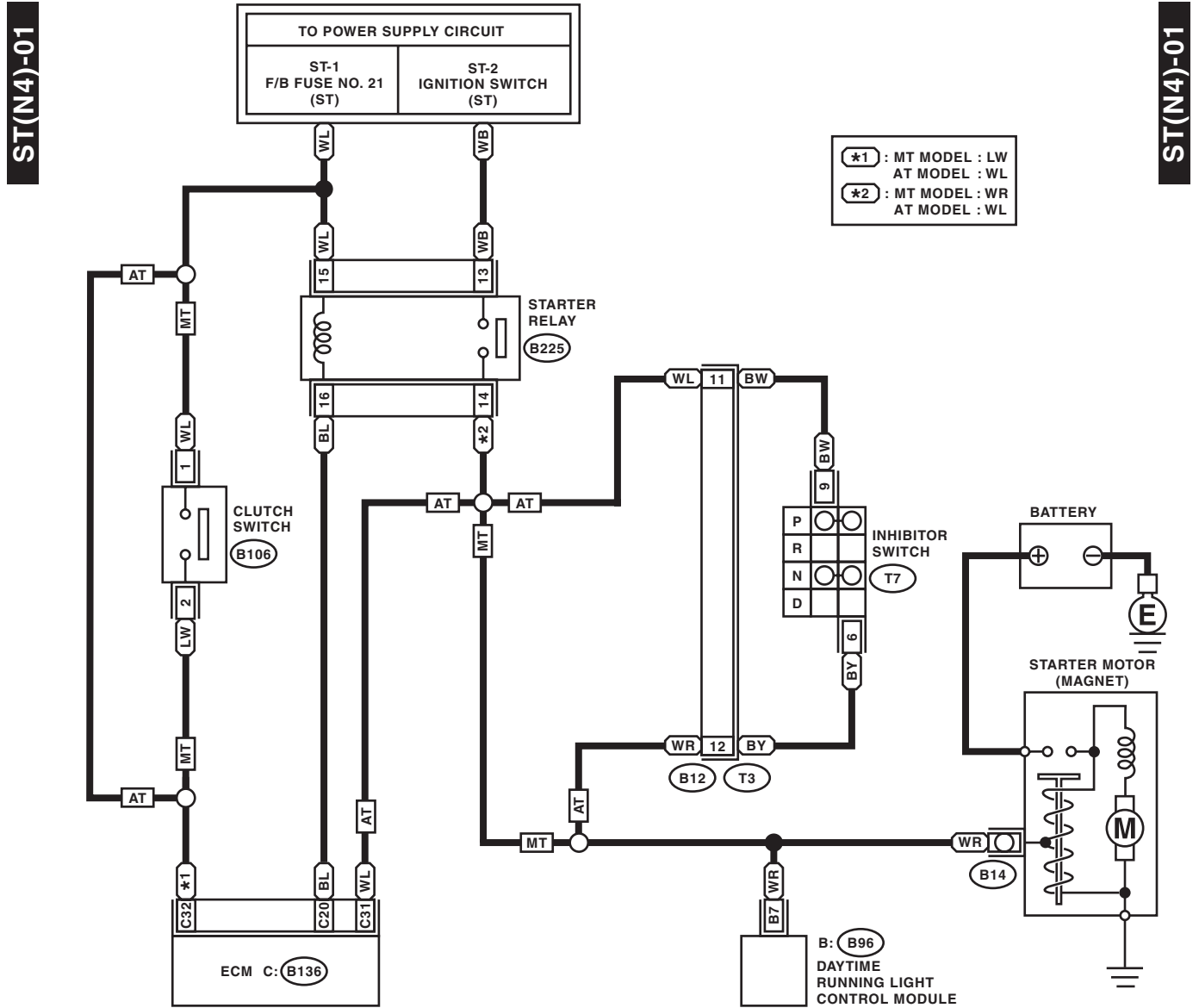
- Transmission serial No. 4078112 or earlier



# Starter System

## WIRING SYSTEM

- Transmission serial No. 4078113 or later



WI-21066

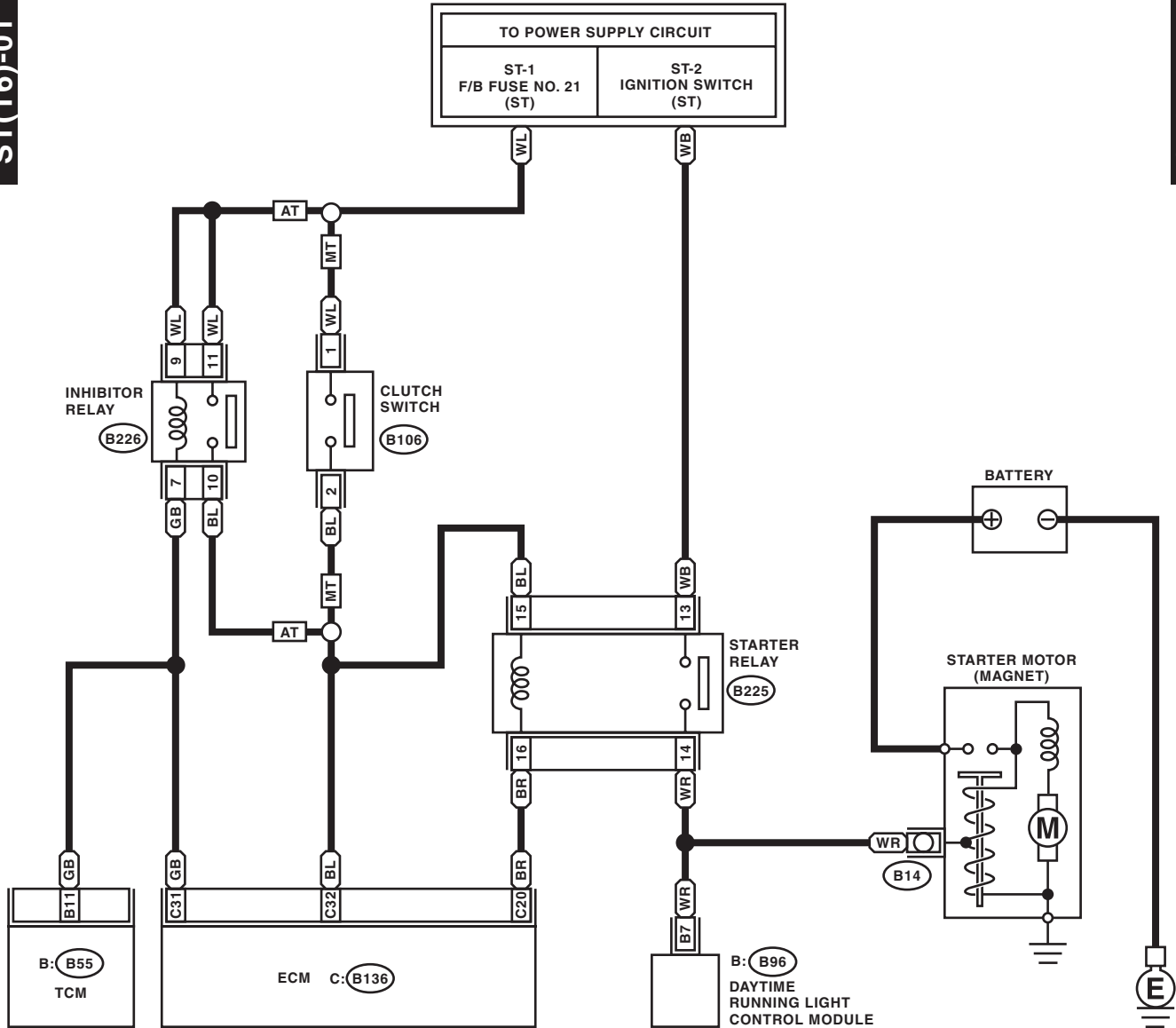
# Starter System

WIRING SYSTEM

## 2. 2.5L TURBO MODEL AND 3.0 L MODEL

ST(T6)-01

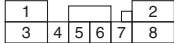
ST(T6)-01



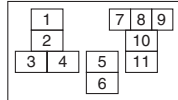
B106



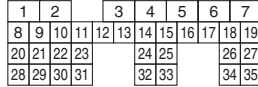
B: B96 (BLACK)



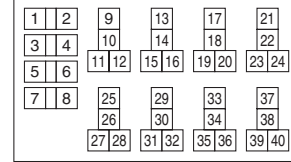
B226 (BLUE)



B: B55

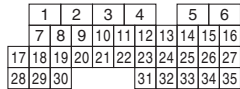


B225 (BLACK)



RELAY BLOCK

C: B136



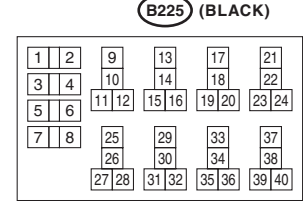
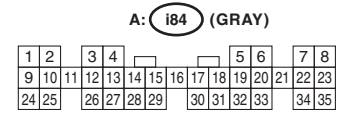
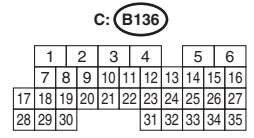
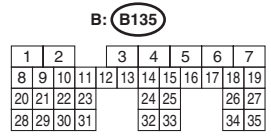
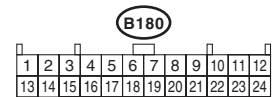
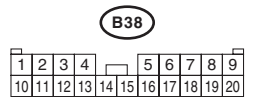
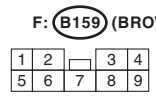
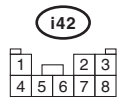
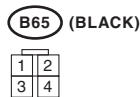
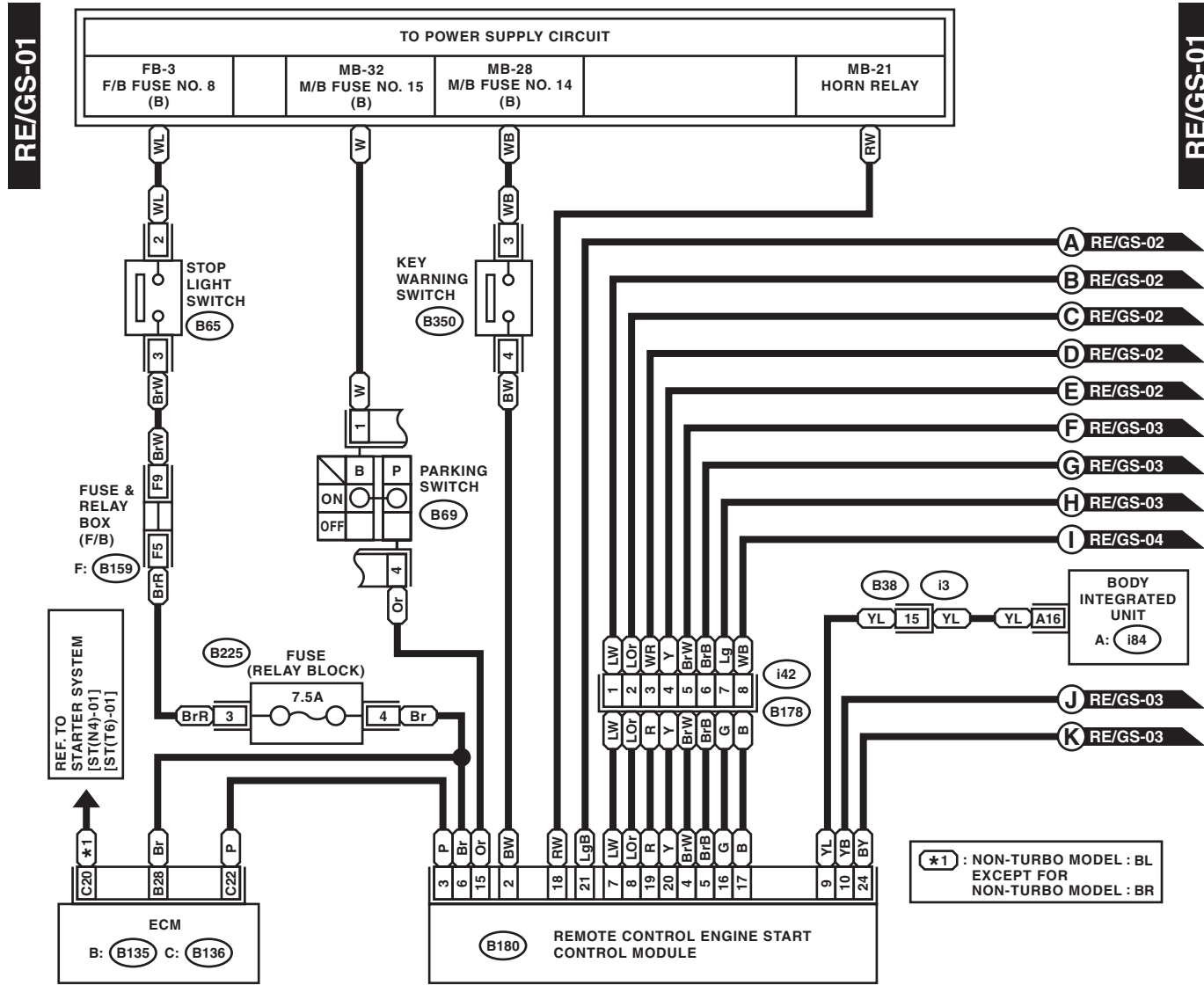
WI-15805

# Remote Engine Start System

WIRING SYSTEM

## 9. Remote Engine Start System

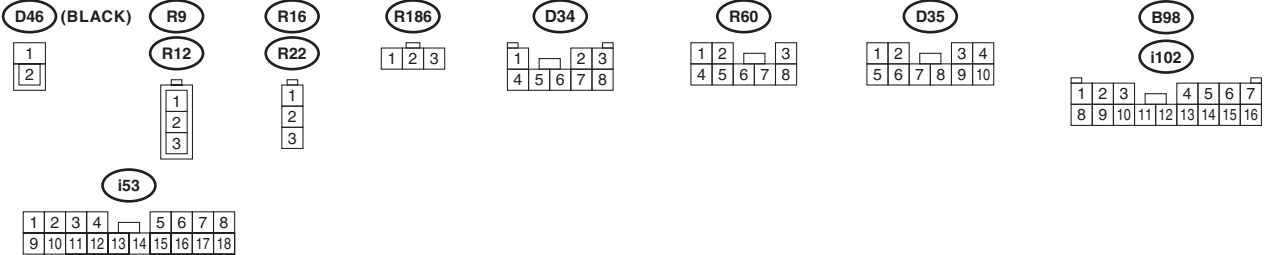
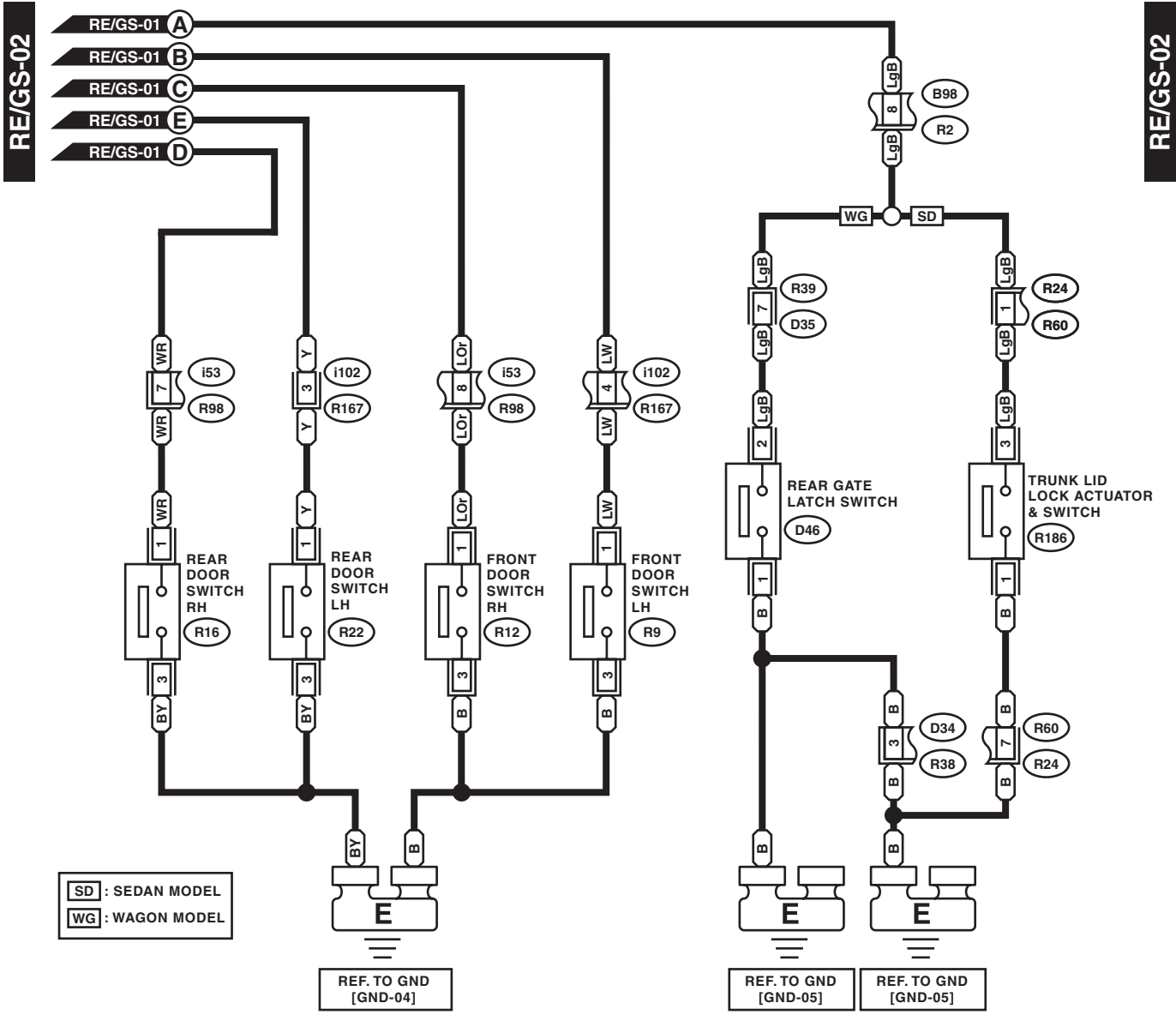
### A: WIRING DIAGRAM



RELAY BLOCK WI-15806

# Remote Engine Start System

WIRING SYSTEM

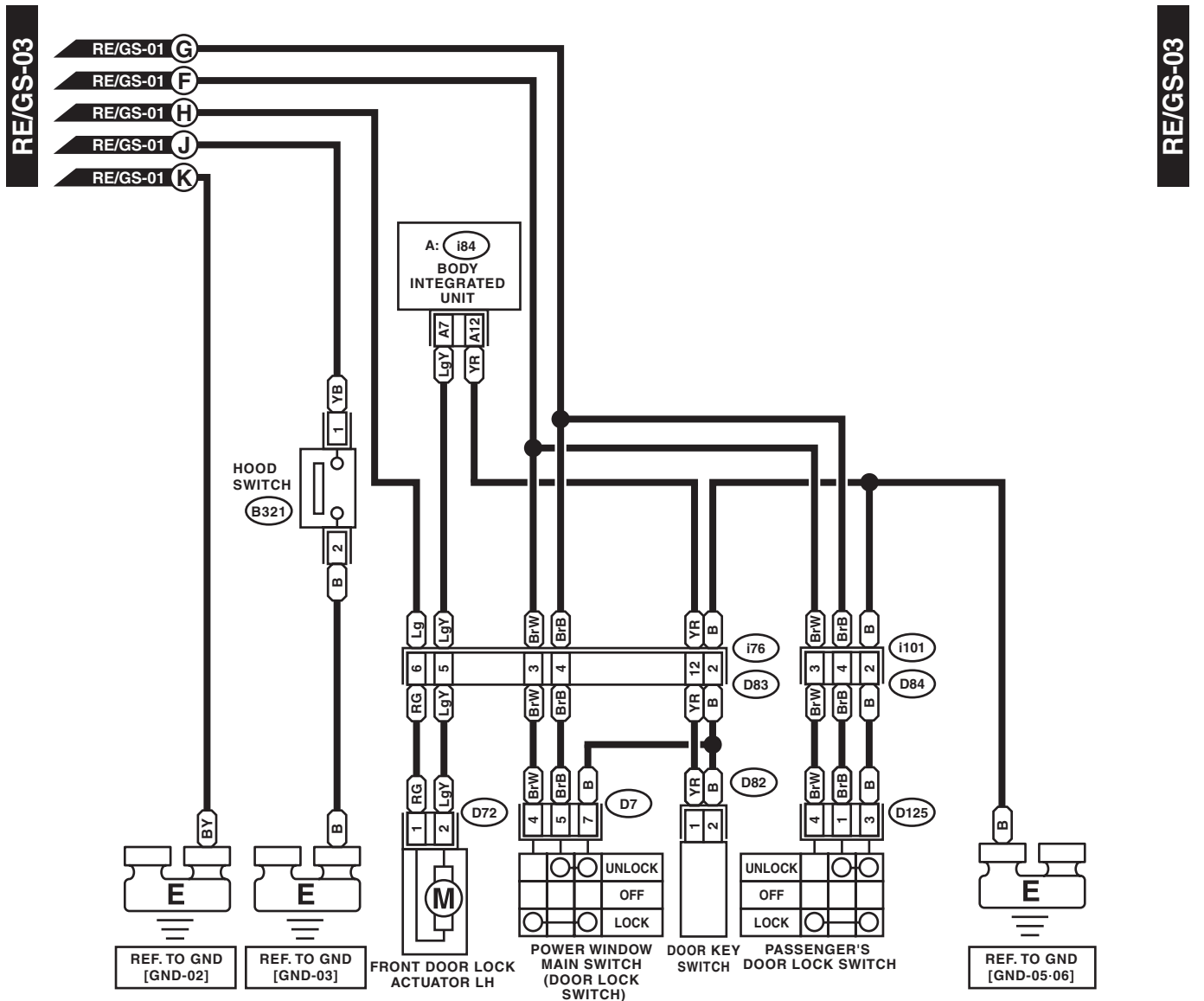


WI-15807



# Remote Engine Start System

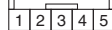
## WIRING SYSTEM



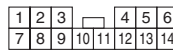
B321 (BLACK) D72 (GRAY)



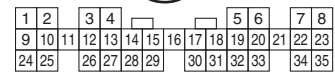
D82 (BROWN) D125 (BLACK)



D7

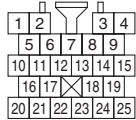


A: i84



D83

D84



WI-15808

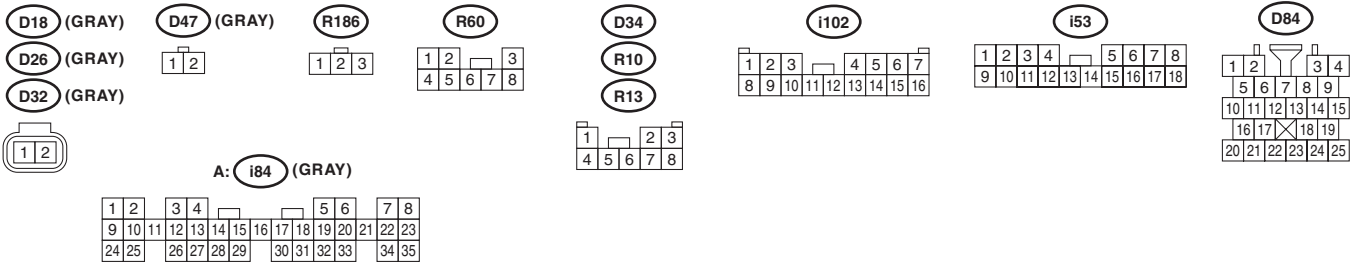
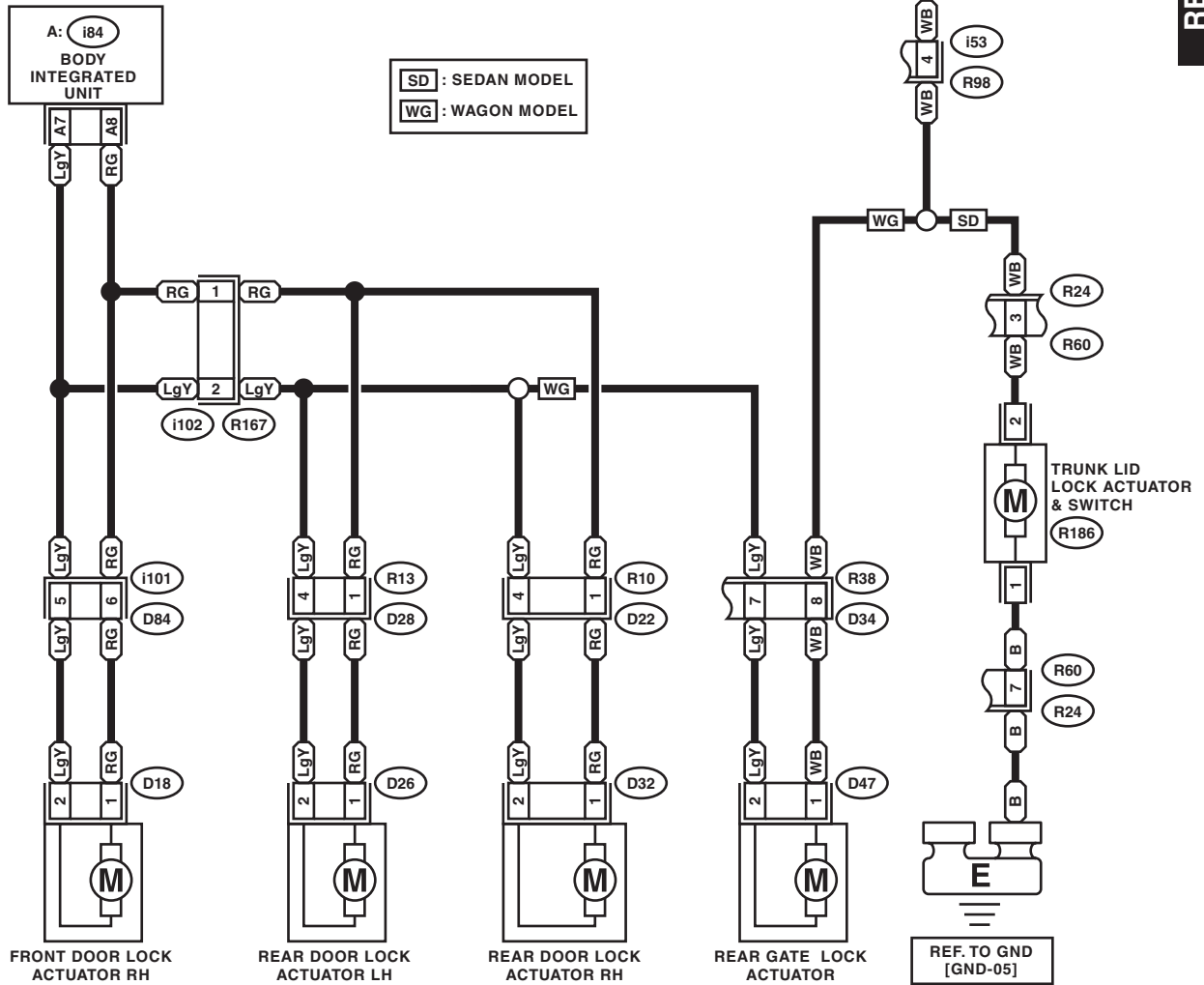
# Remote Engine Start System

WIRING SYSTEM

RE/GS-04

RE/GS-04

RE/GS-01



WI-15809

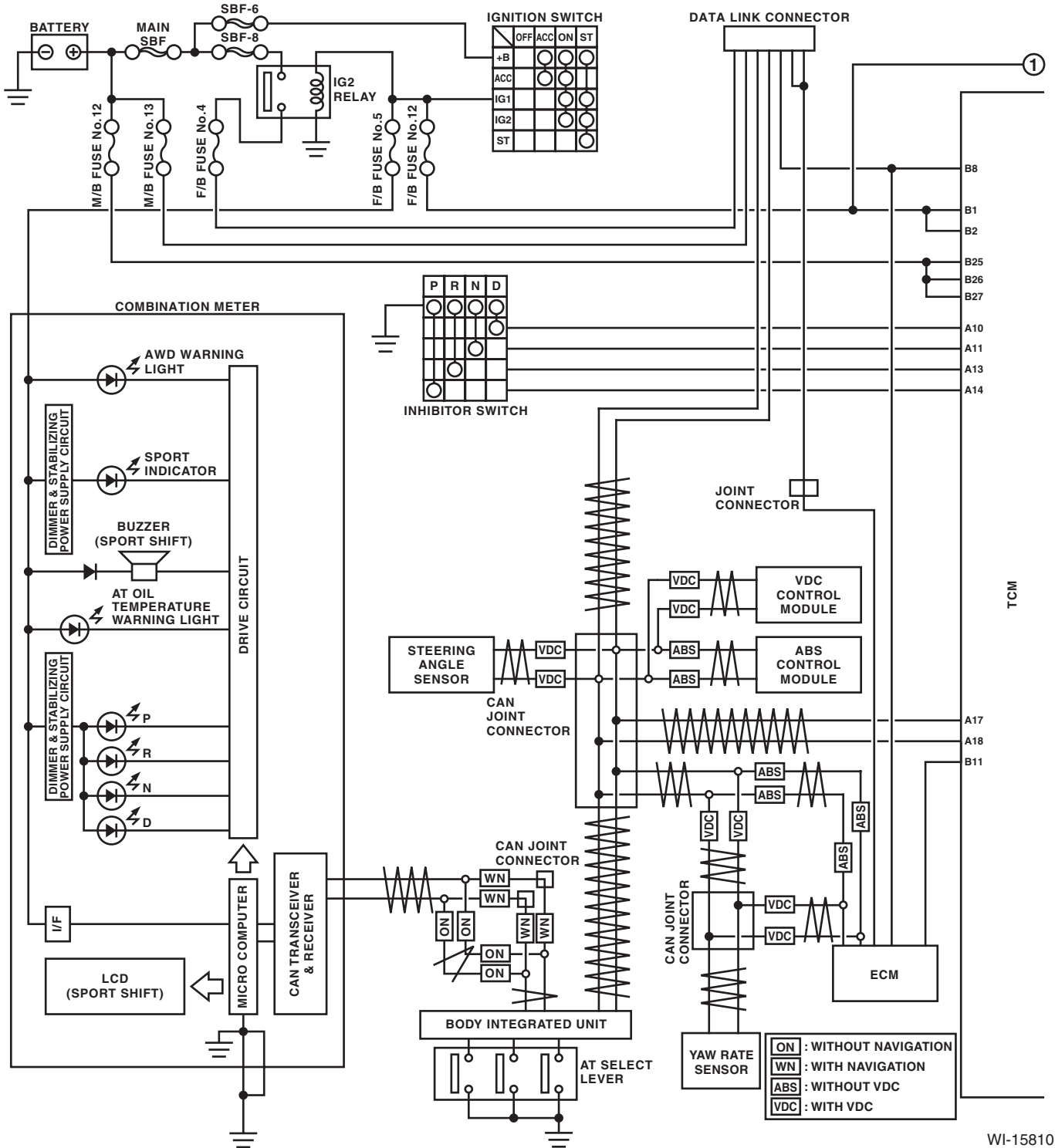
# AT Control System

## WIRING SYSTEM

### 10. AT Control System

#### A: WIRING DIAGRAM

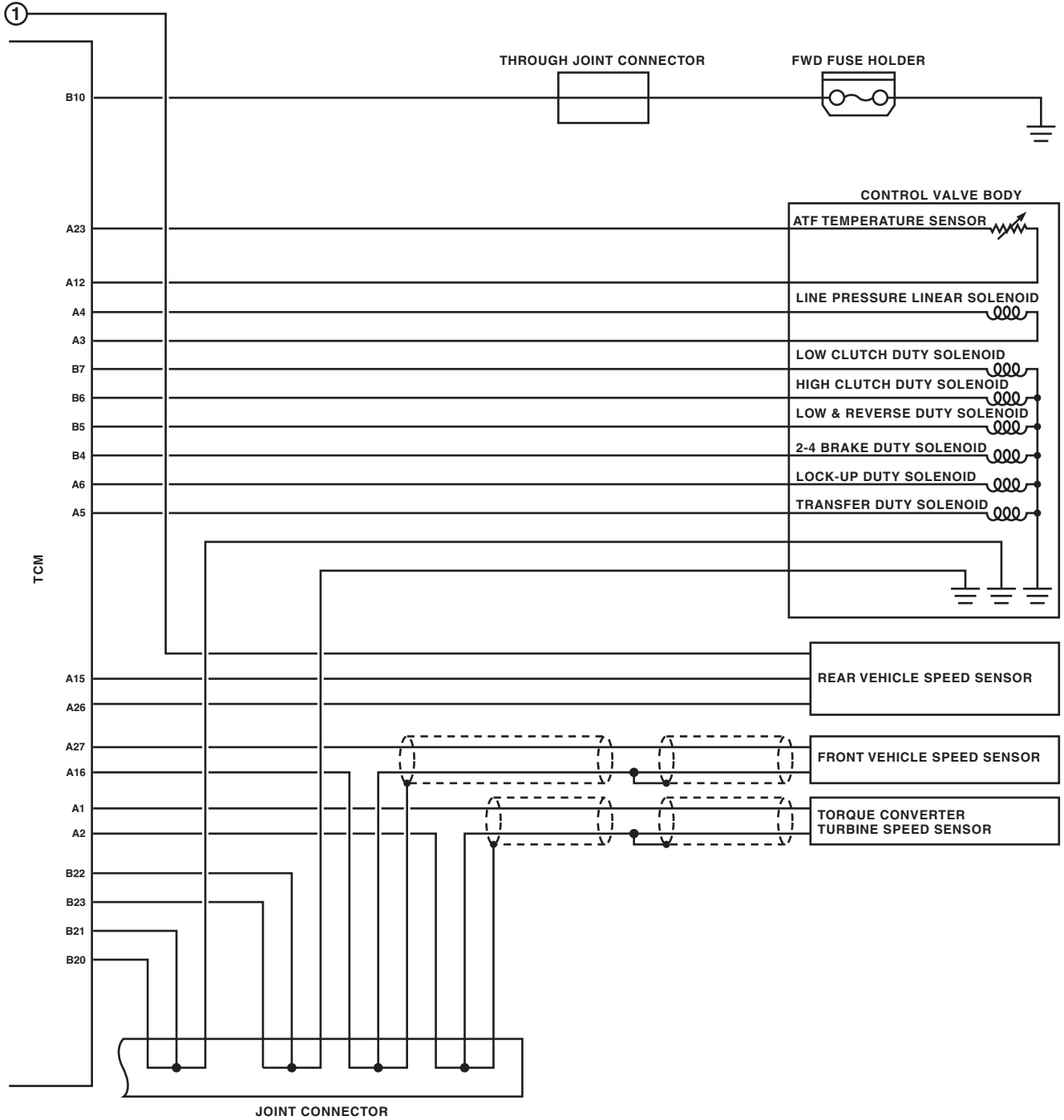
##### 1. 4AT MODEL (TRANSMISSION SERIAL NO. 3966774 OR EARLIER)



WI-15810

# AT Control System

## WIRING SYSTEM



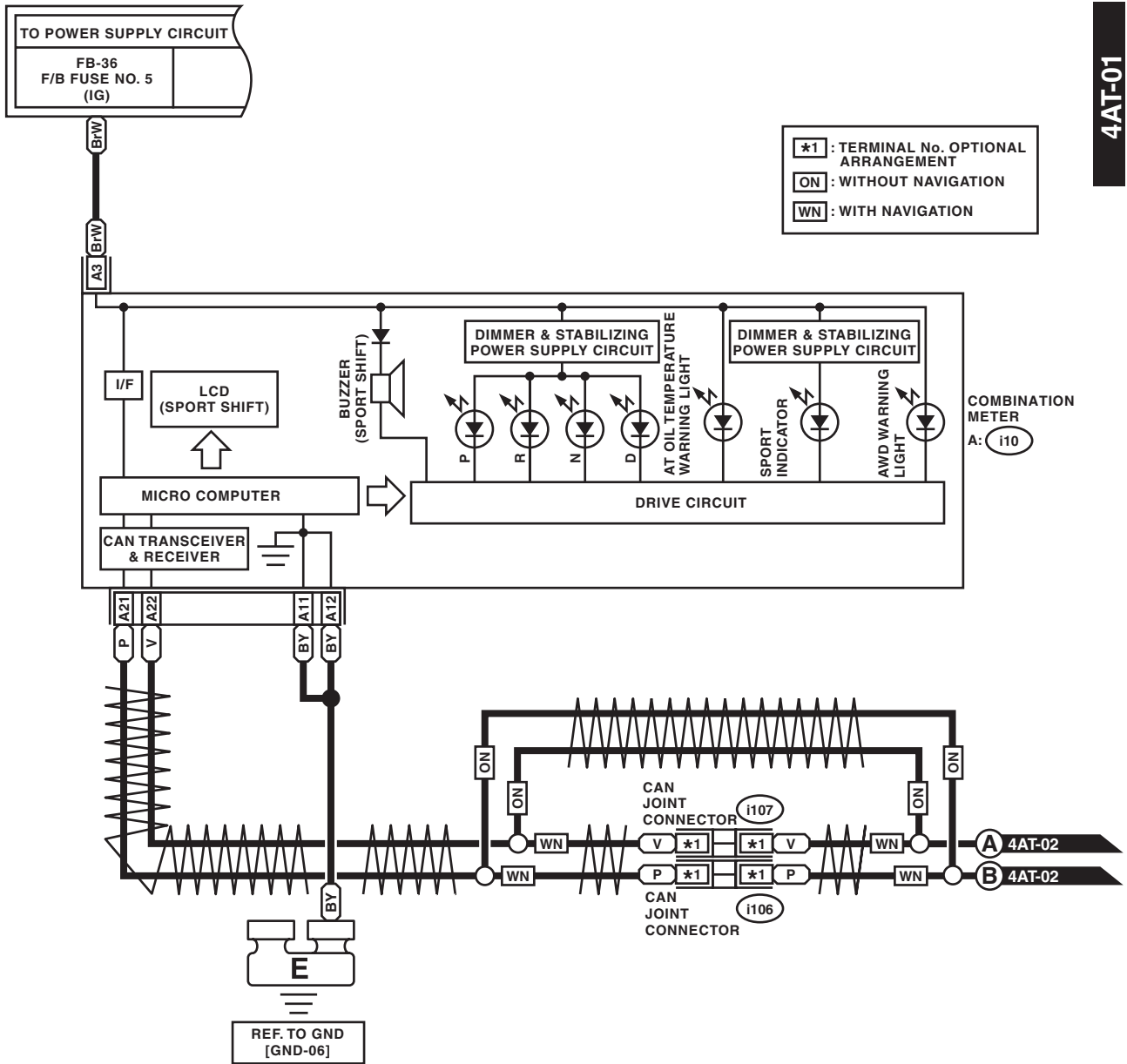
WI-15811

# AT Control System

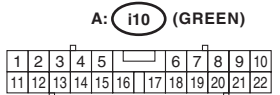
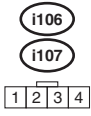
## WIRING SYSTEM

4AT-01

4AT-01



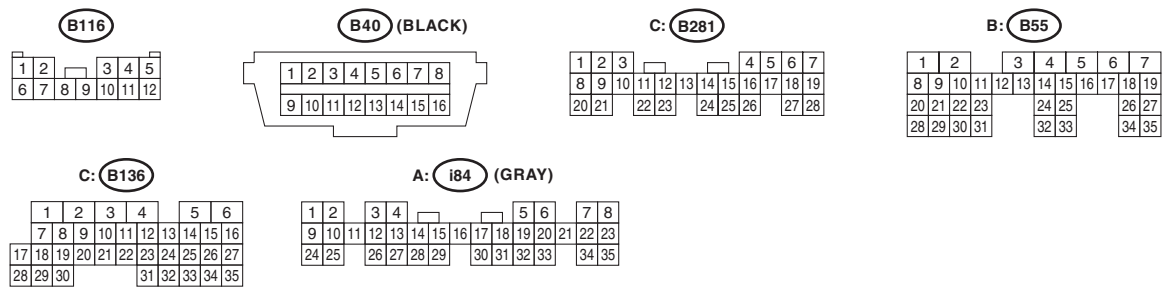
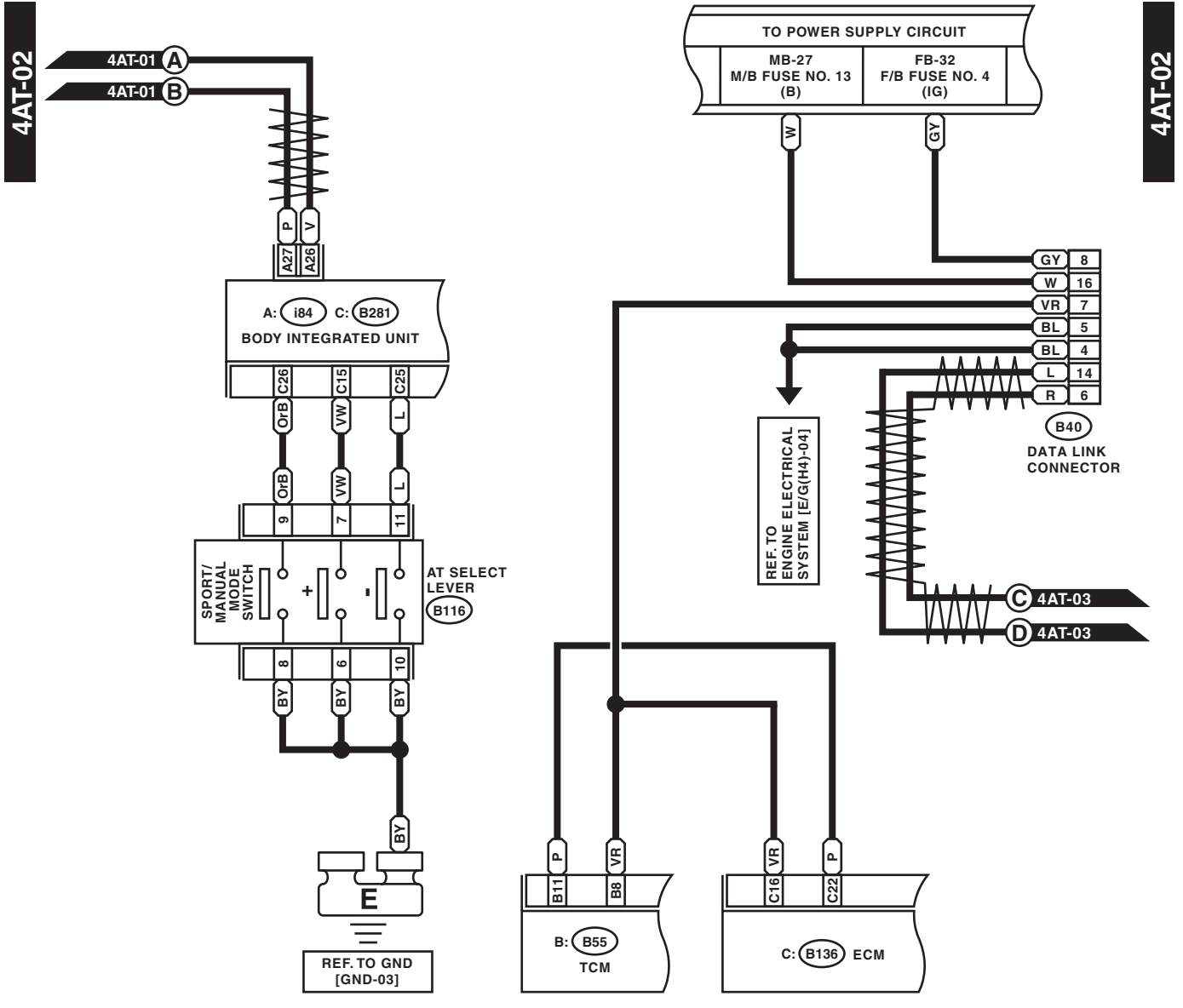
\*1 : TERMINAL No. OPTIONAL ARRANGEMENT  
 ON : WITHOUT NAVIGATION  
 WN : WITH NAVIGATION



WI-15812

# AT Control System

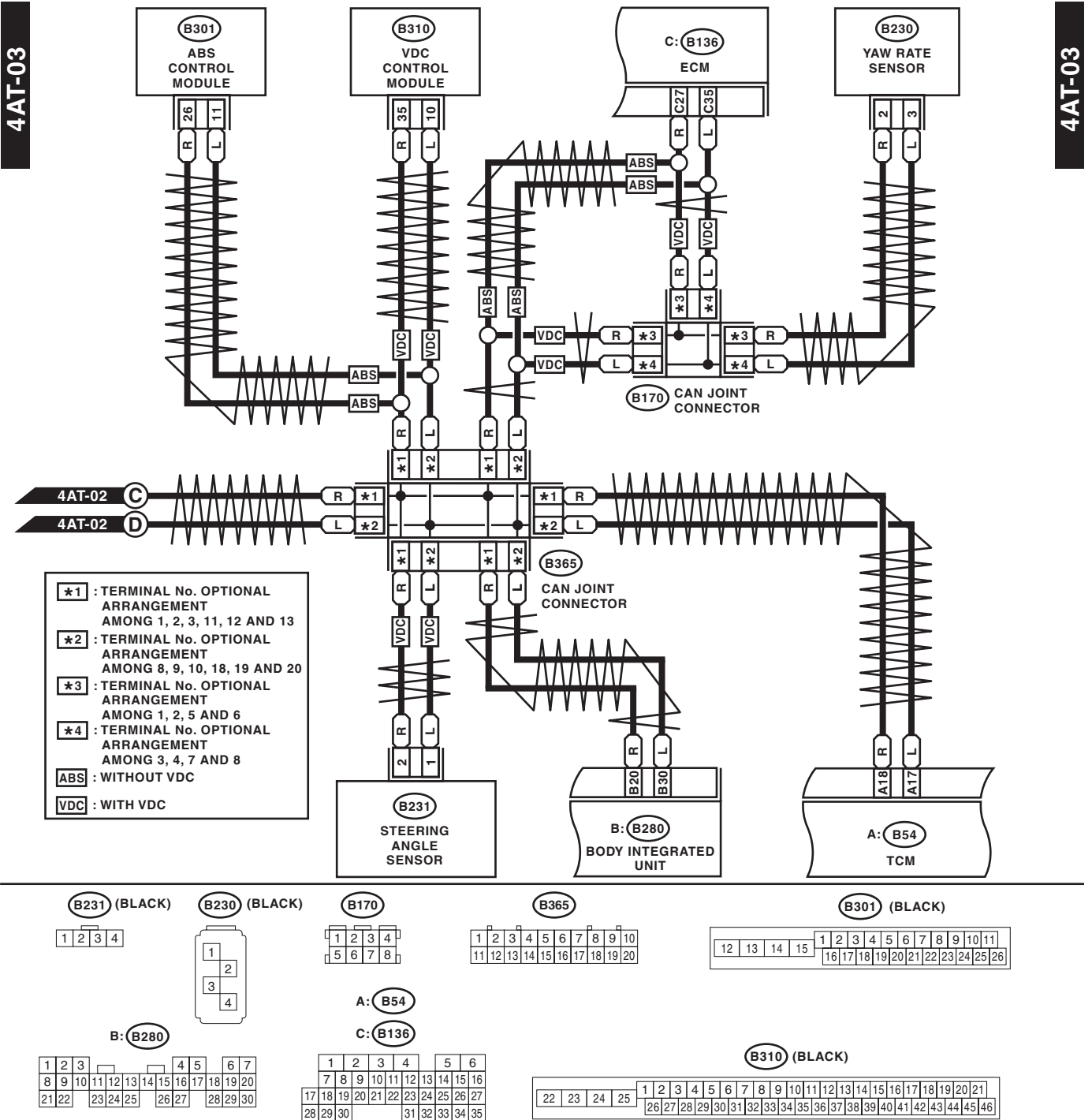
## WIRING SYSTEM



WI-17955

# AT Control System

## WIRING SYSTEM



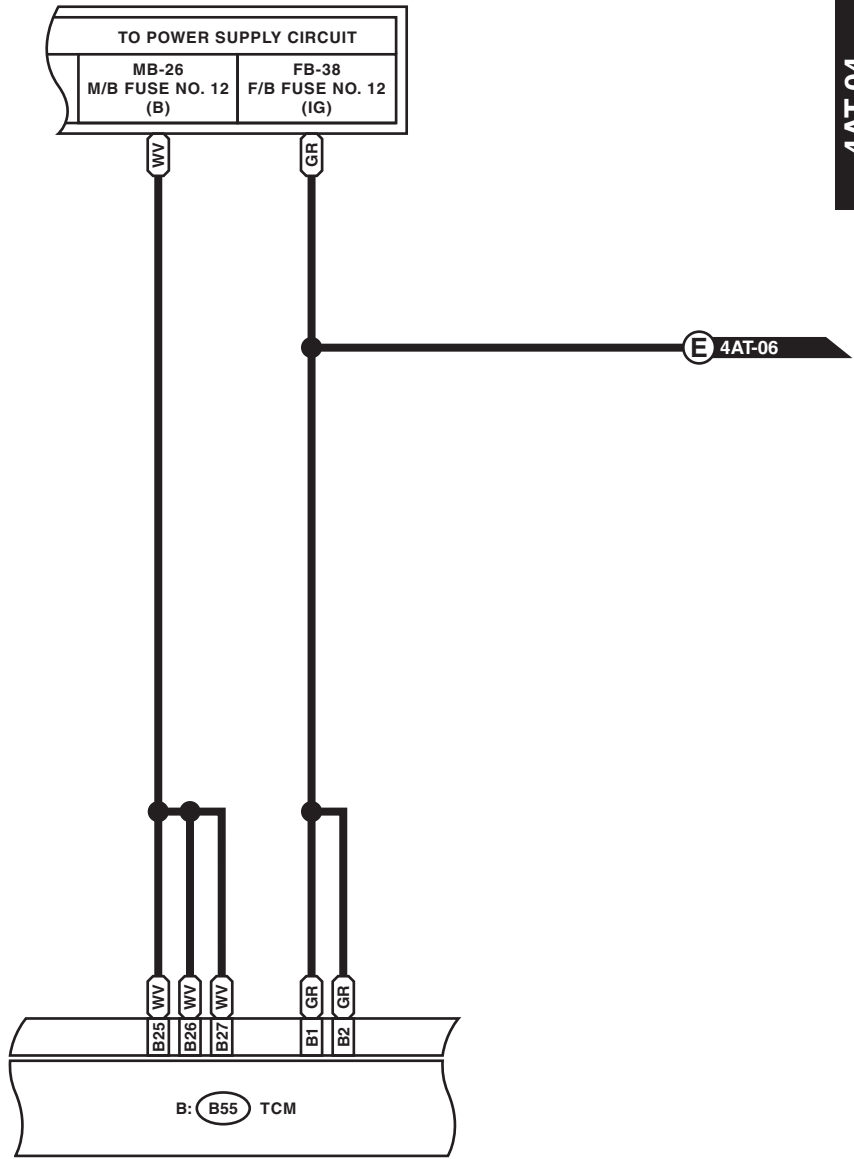
WI-15814

# AT Control System

WIRING SYSTEM

4AT-04

4AT-04



B: B55

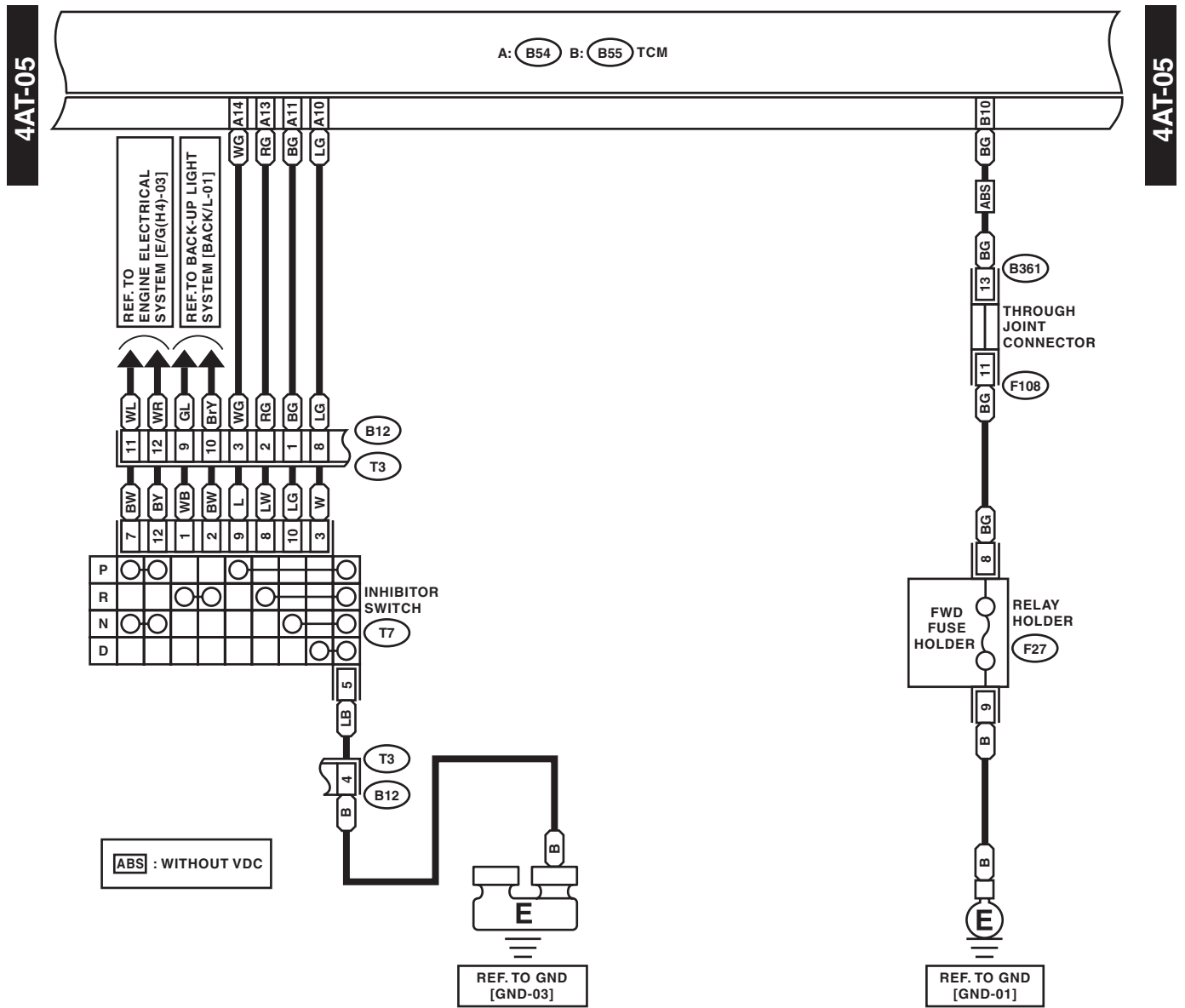
1	2	3	4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27				
28	29	30	31	32	33	34	35				

WI-15815

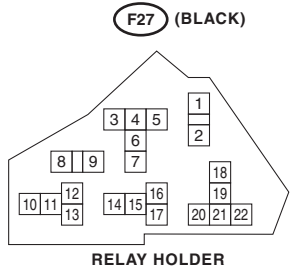
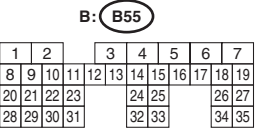
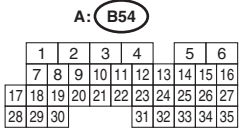
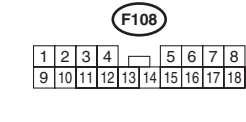
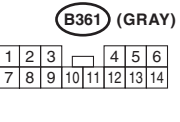
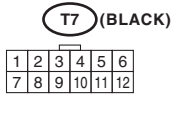
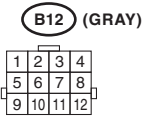


# AT Control System

## WIRING SYSTEM



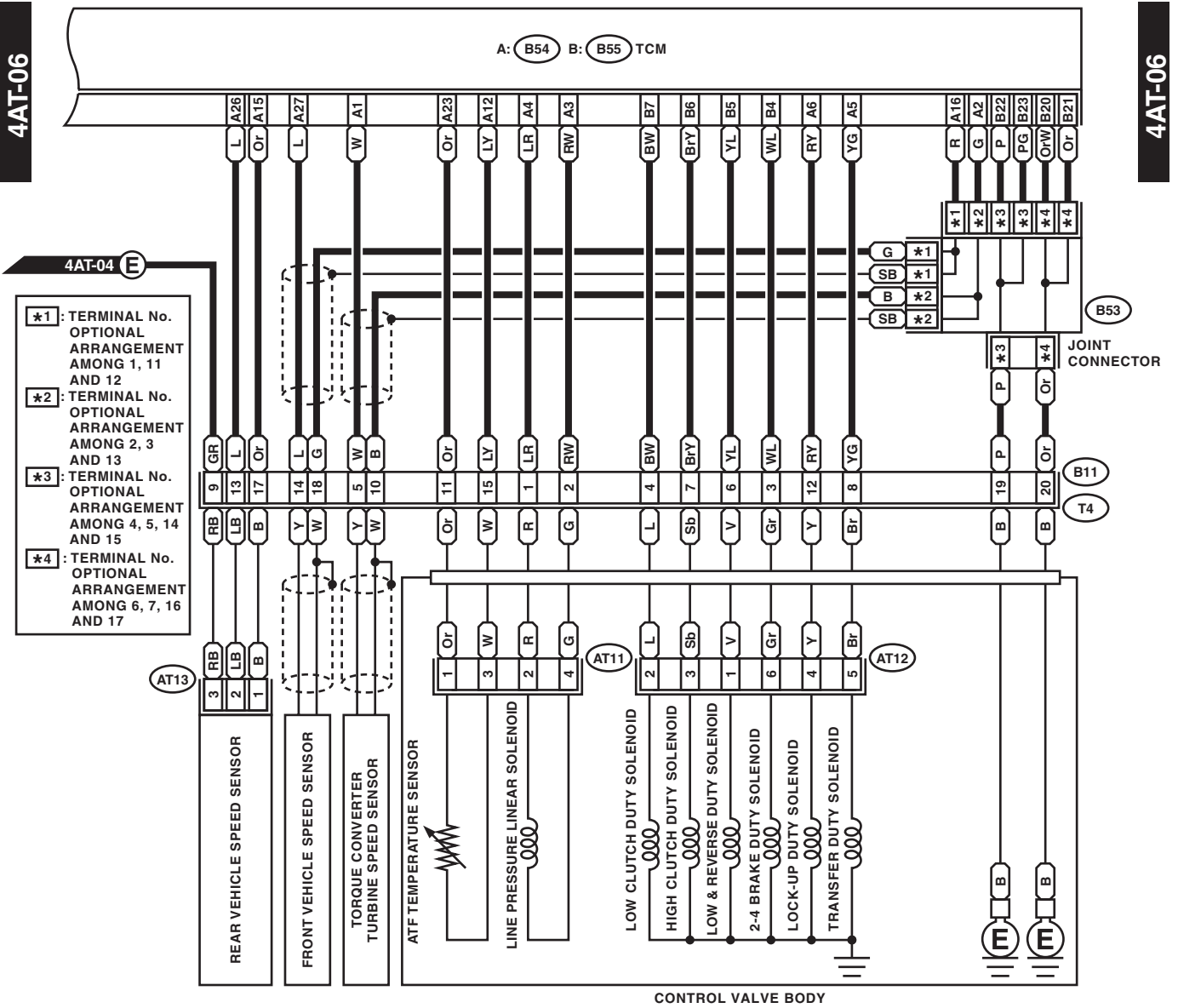
ABS : WITHOUT VDC



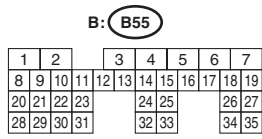
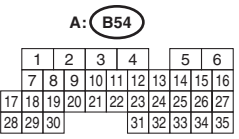
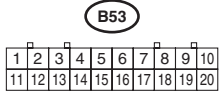
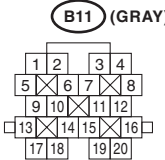
WI-15816

# AT Control System

WIRING SYSTEM



- \*1: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 1, 11 AND 12
- \*2: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 2, 3 AND 13
- \*3: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 4, 5, 14 AND 15
- \*4: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 6, 7, 16 AND 17

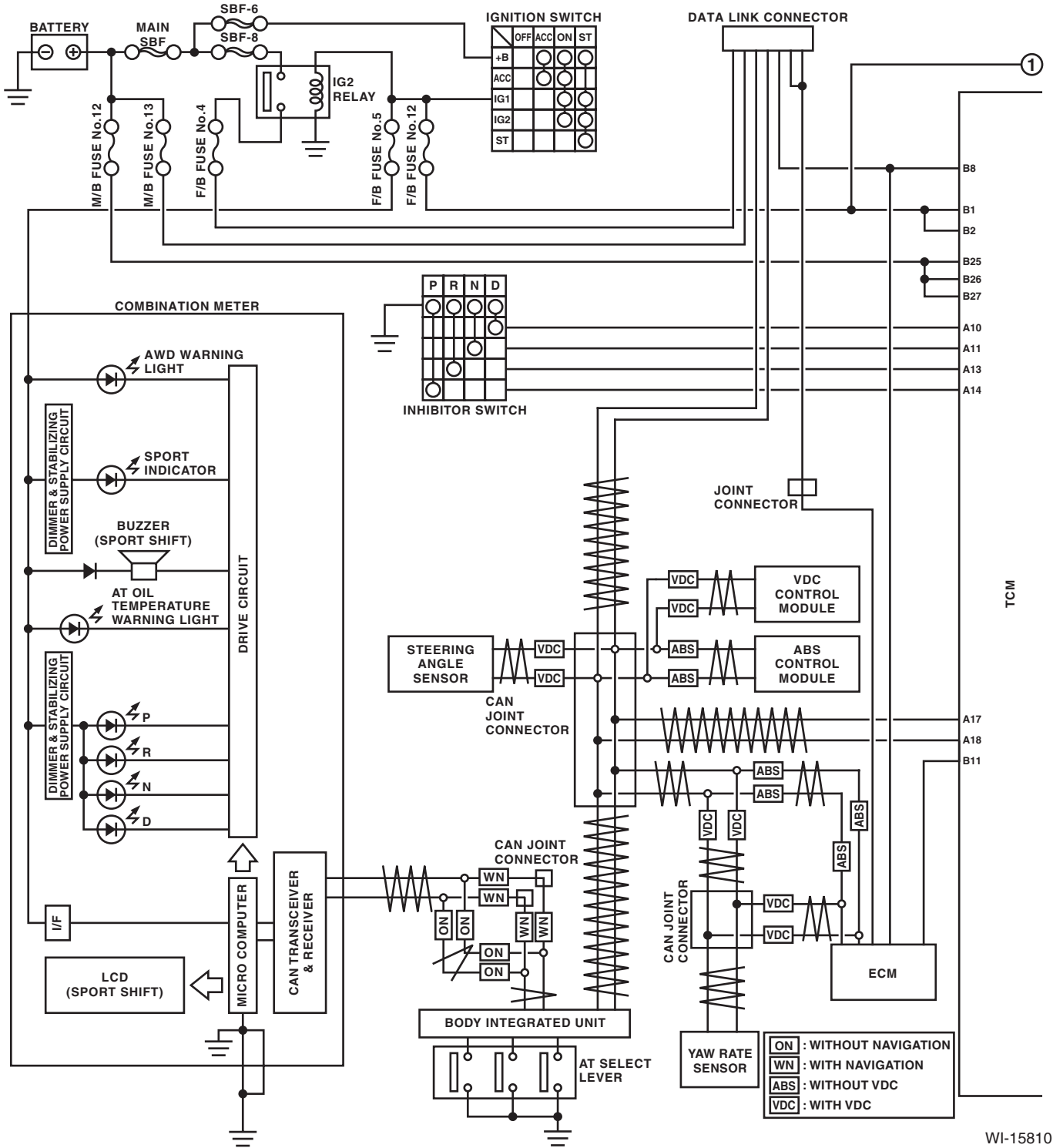


WI-15817

# AT Control System

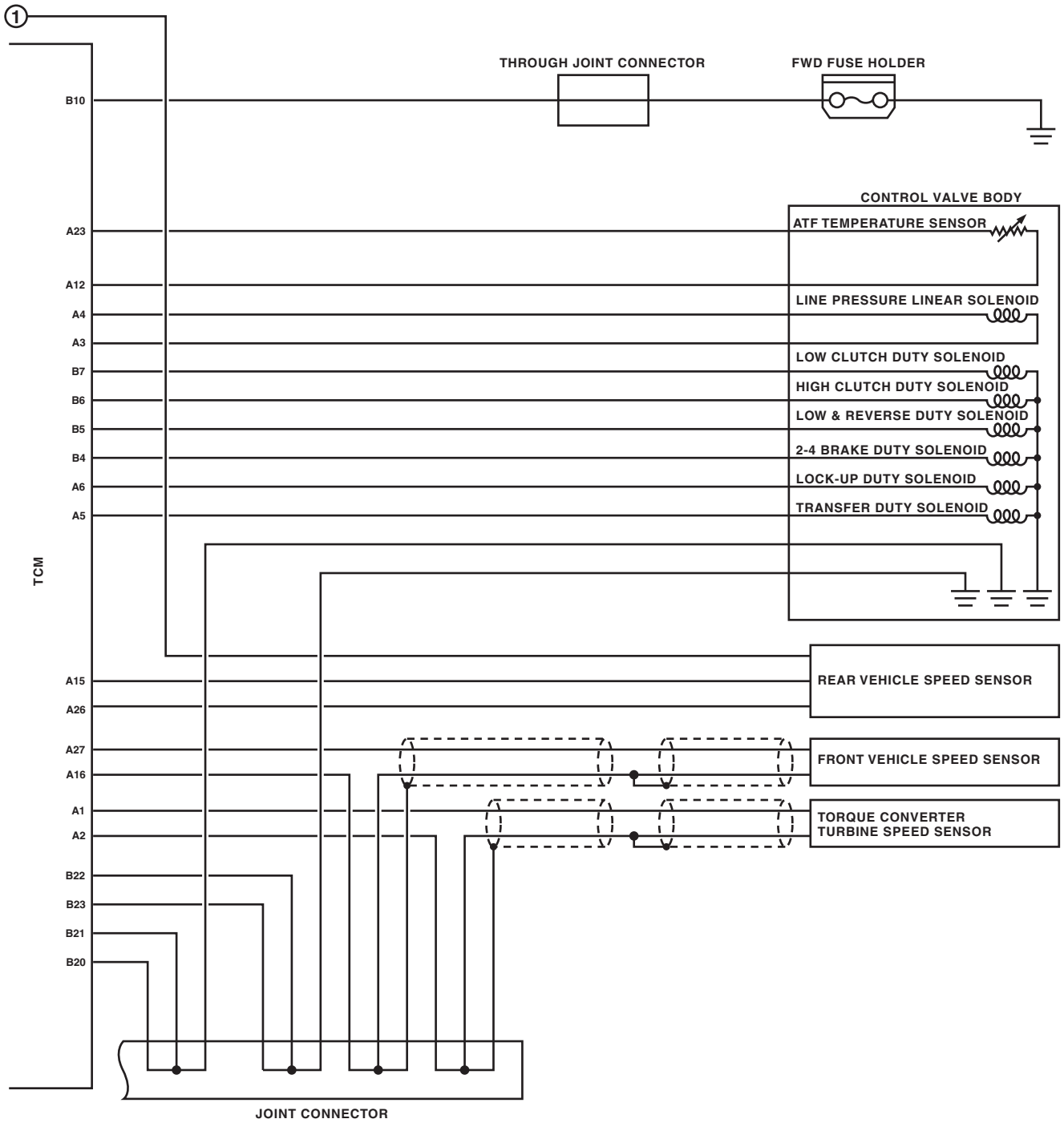
## WIRING SYSTEM

### 2. 4AT MODEL (TRANSMISSION SERIAL NO. 3966775 OR LATER)



# AT Control System

## WIRING SYSTEM



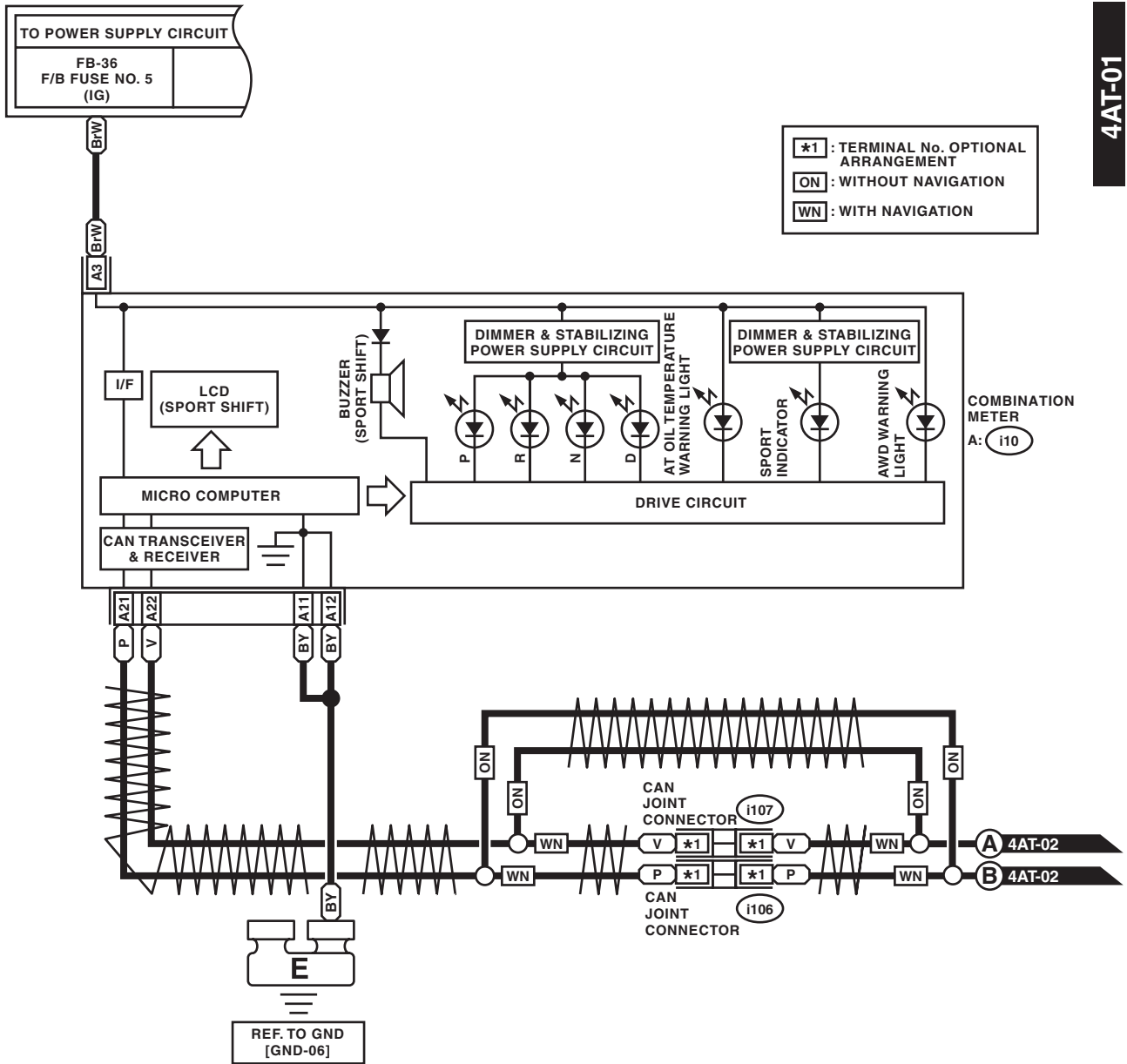
WI-15811

# AT Control System

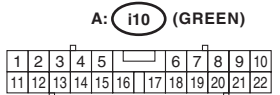
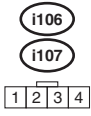
## WIRING SYSTEM

4AT-01

4AT-01



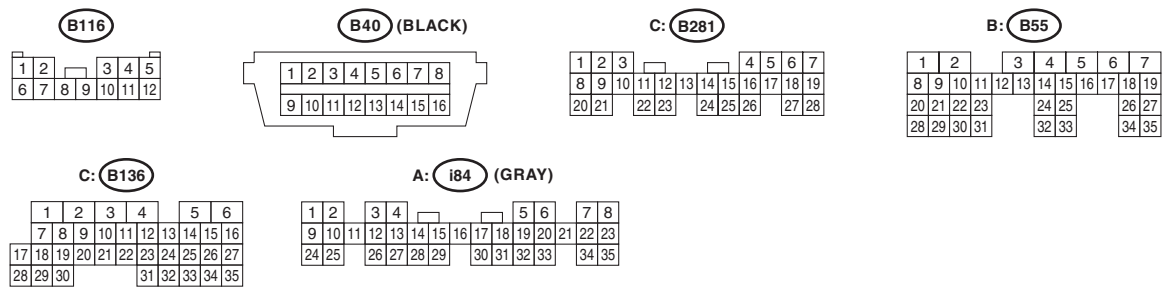
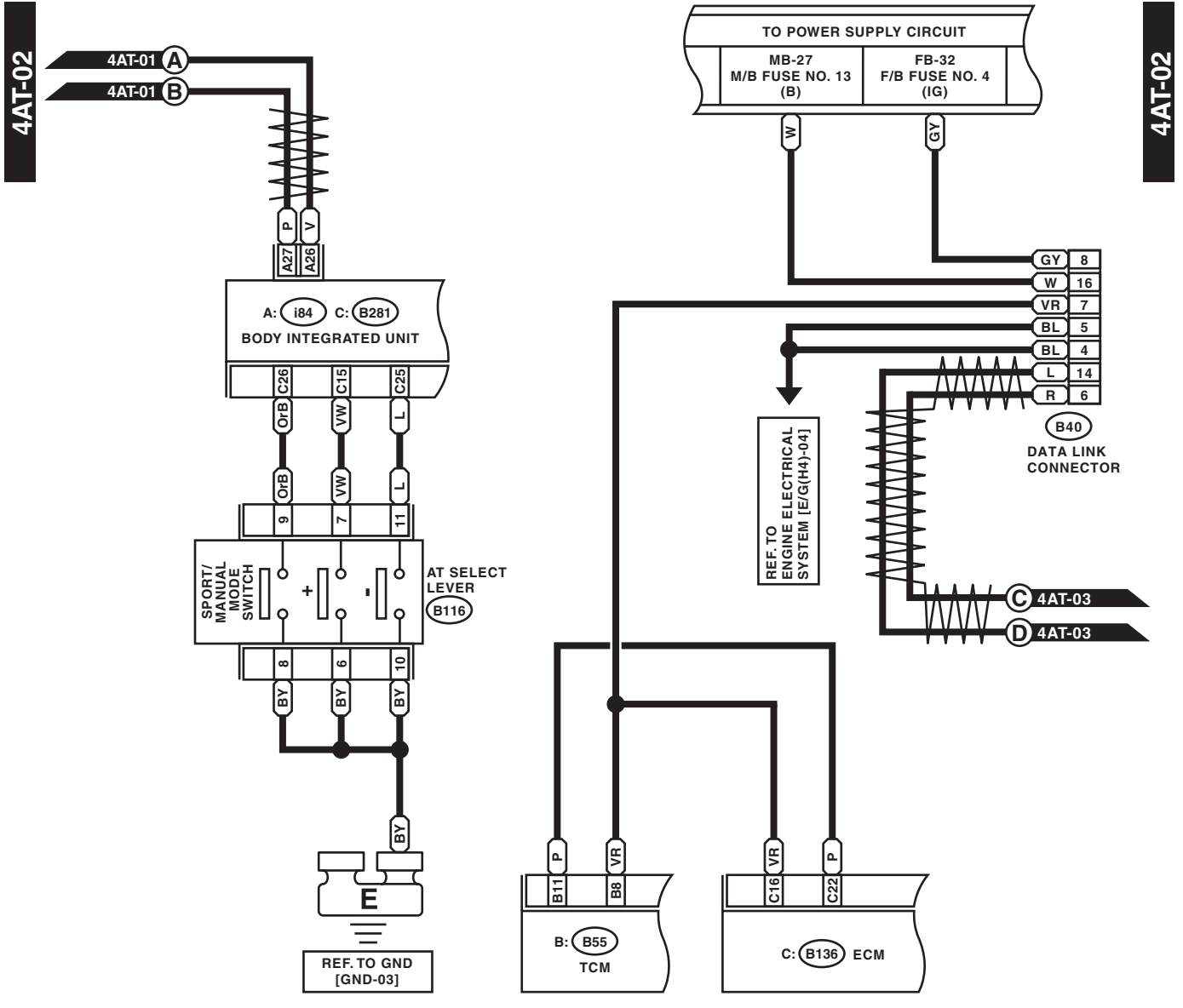
\*1 : TERMINAL No. OPTIONAL ARRANGEMENT  
 ON : WITHOUT NAVIGATION  
 WN : WITH NAVIGATION



WI-15812

# AT Control System

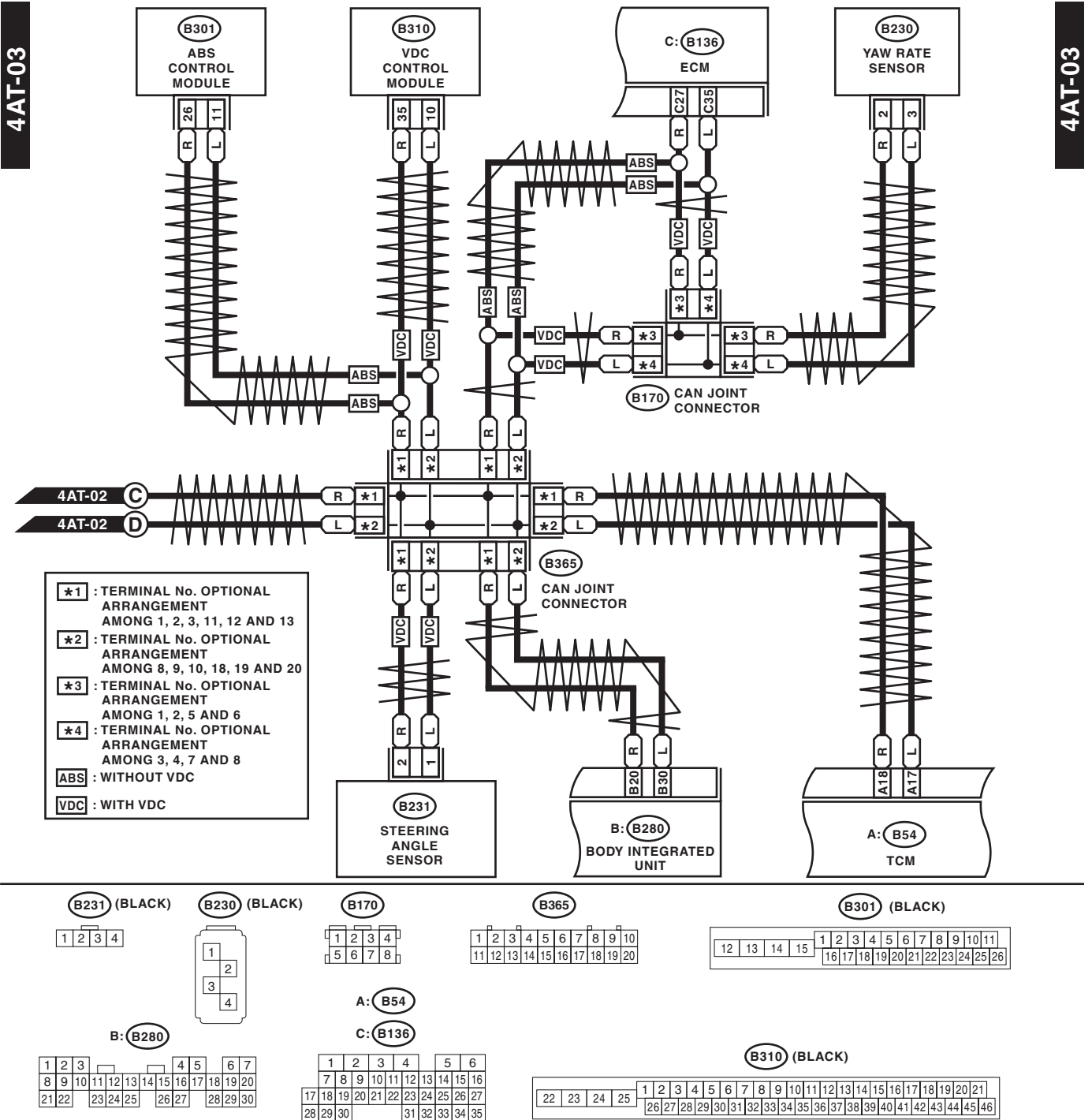
## WIRING SYSTEM



WI-17955

# AT Control System

## WIRING SYSTEM



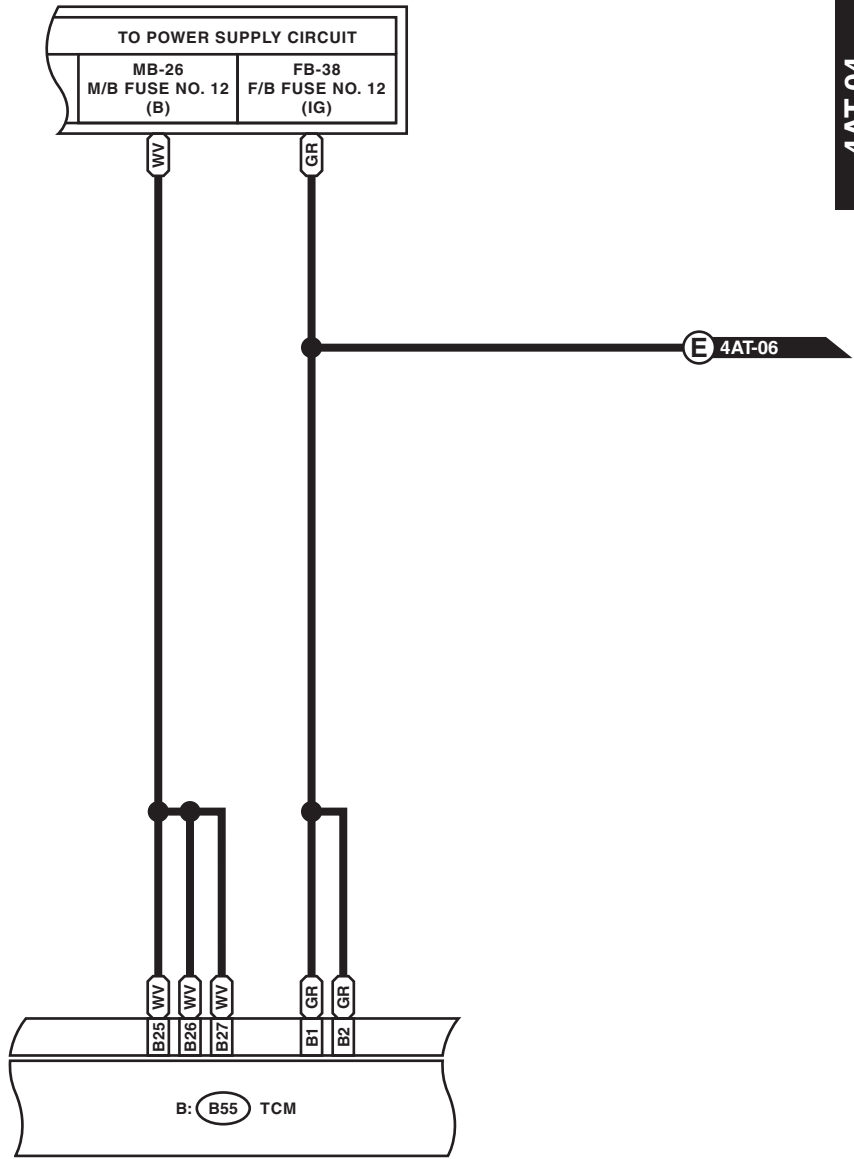
WI-15814

# AT Control System

WIRING SYSTEM

4AT-04

4AT-04



B: B55

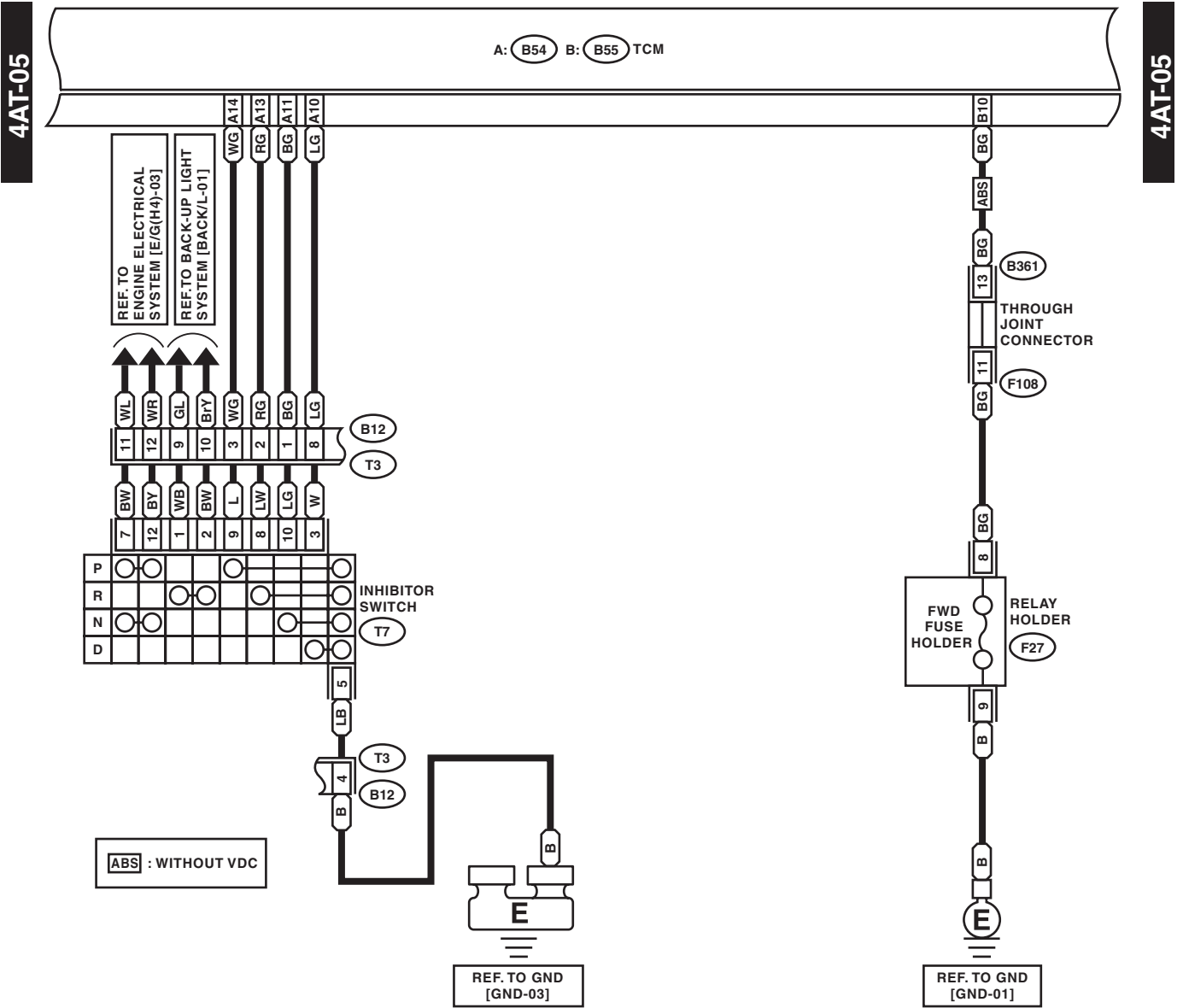
1	2	3	4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27				
28	29	30	31	32	33	34	35				

WI-15815

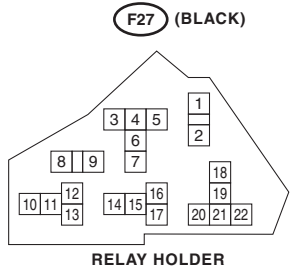
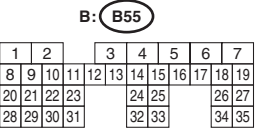
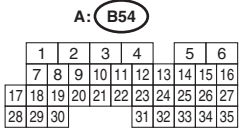
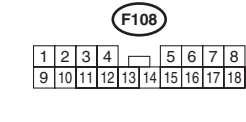
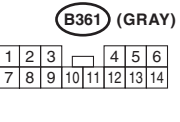
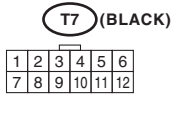
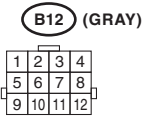


# AT Control System

## WIRING SYSTEM



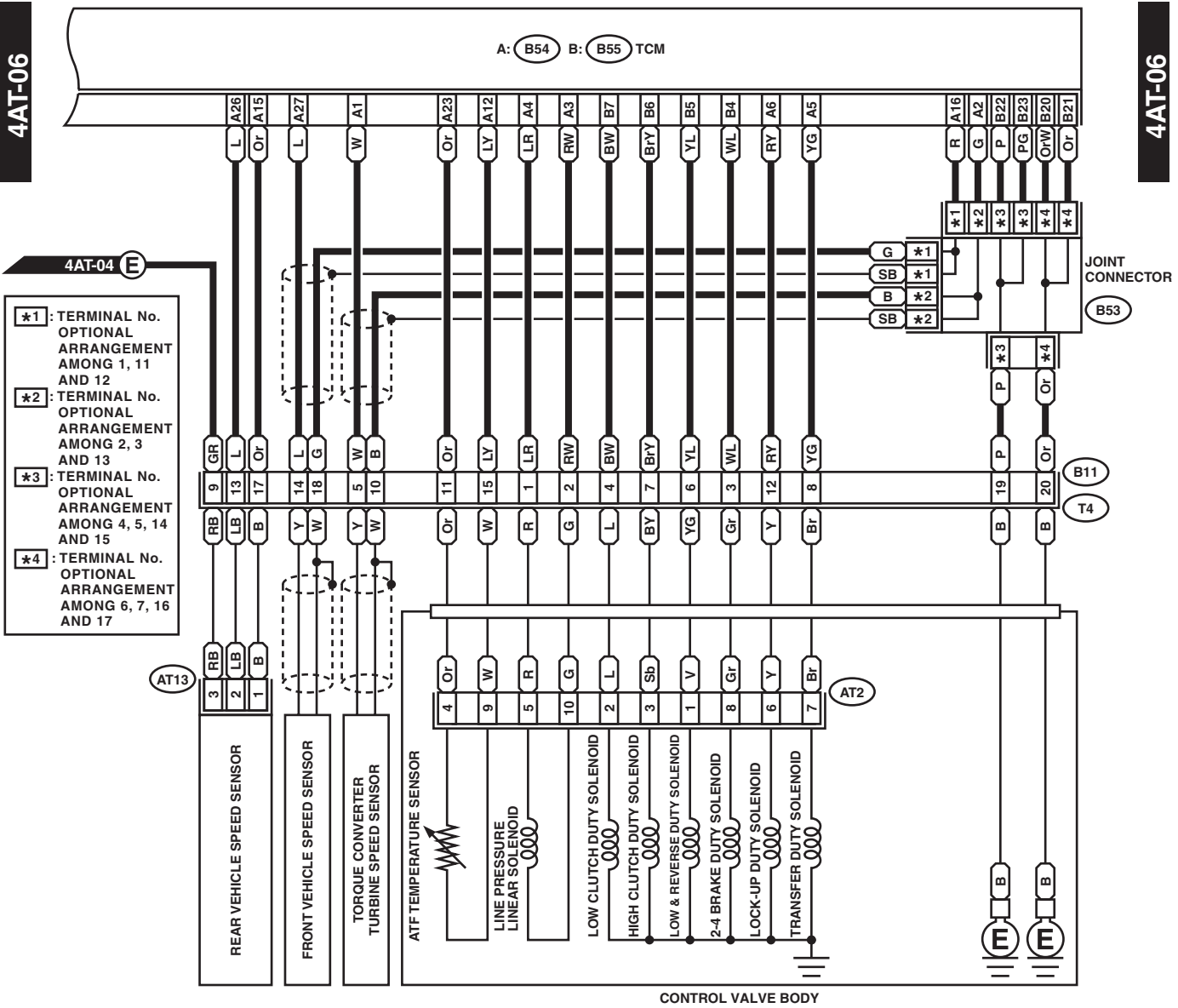
ABS : WITHOUT VDC



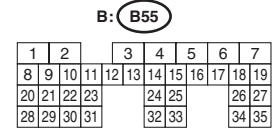
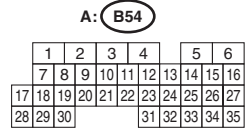
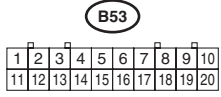
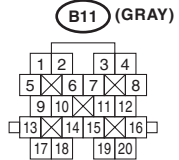
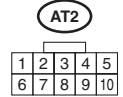
WI-15816

# AT Control System

## WIRING SYSTEM



- \*1: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 1, 11 AND 12
- \*2: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 2, 3 AND 13
- \*3: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 4, 5, 14 AND 15
- \*4: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 6, 7, 16 AND 17

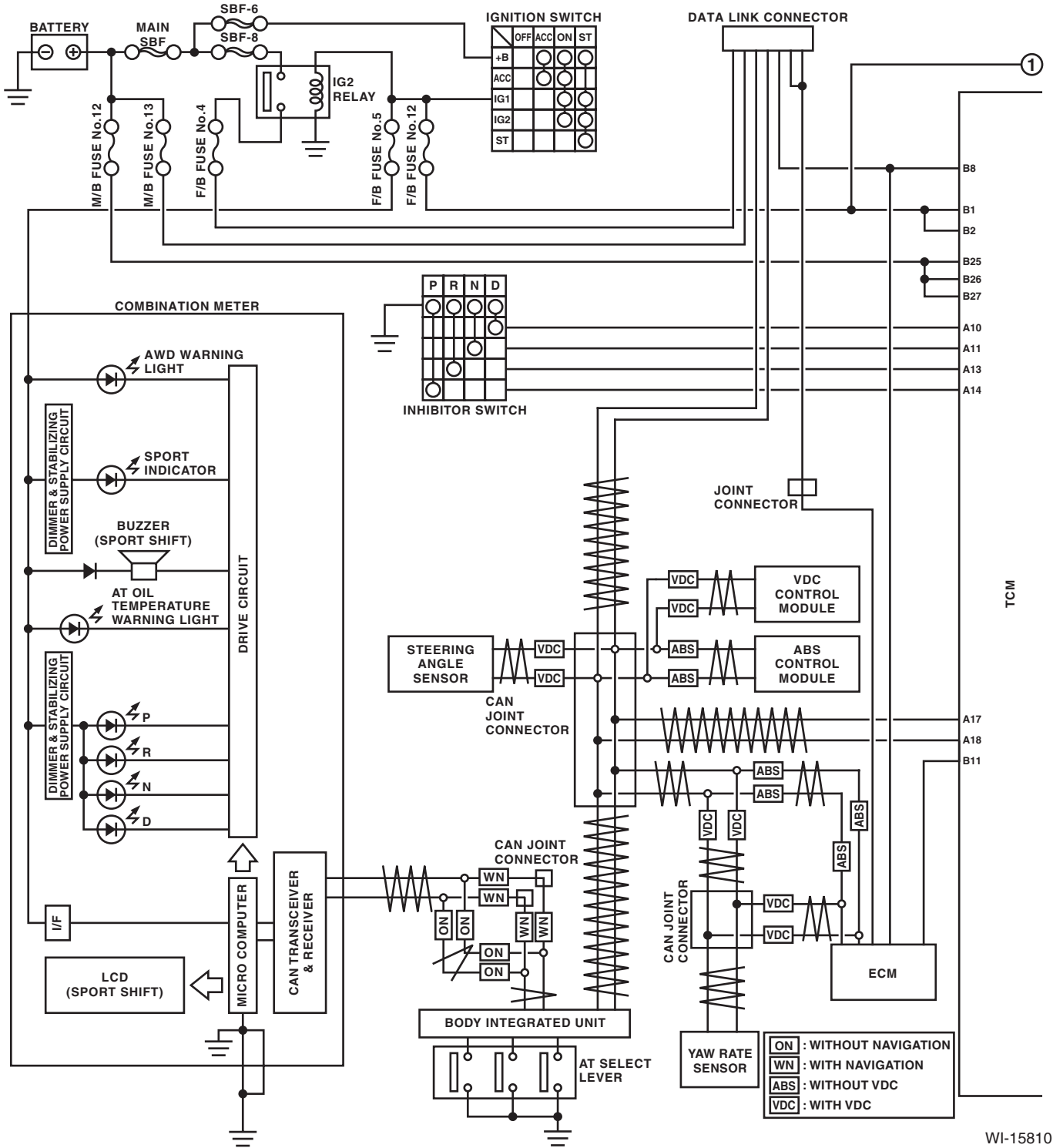


WI-19674

# AT Control System

## WIRING SYSTEM

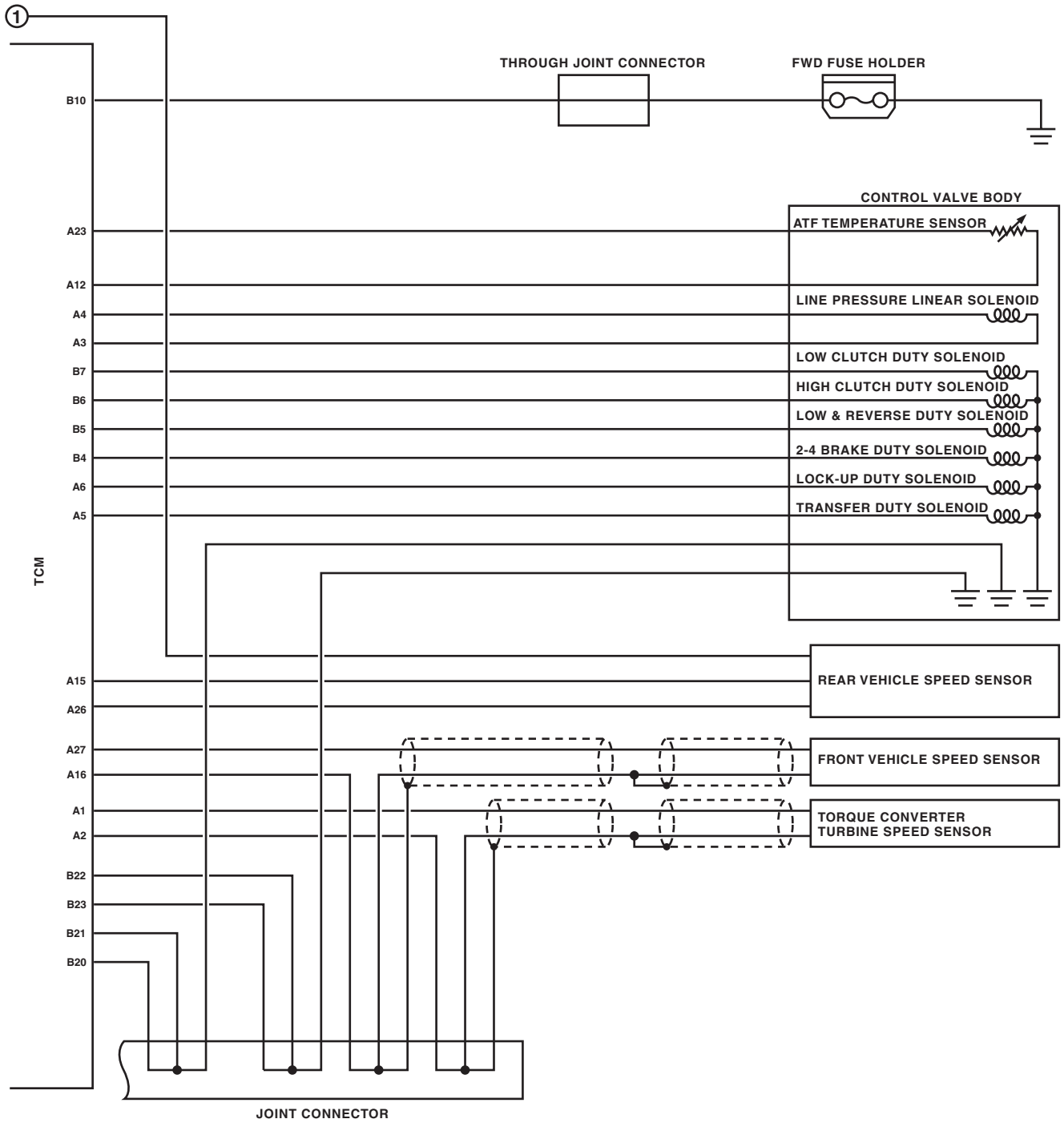
### 3. 4AT MODEL (TRANSMISSION SERIAL NO. 4078113 OR LATER)



WI-15810

# AT Control System

## WIRING SYSTEM



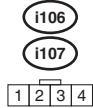
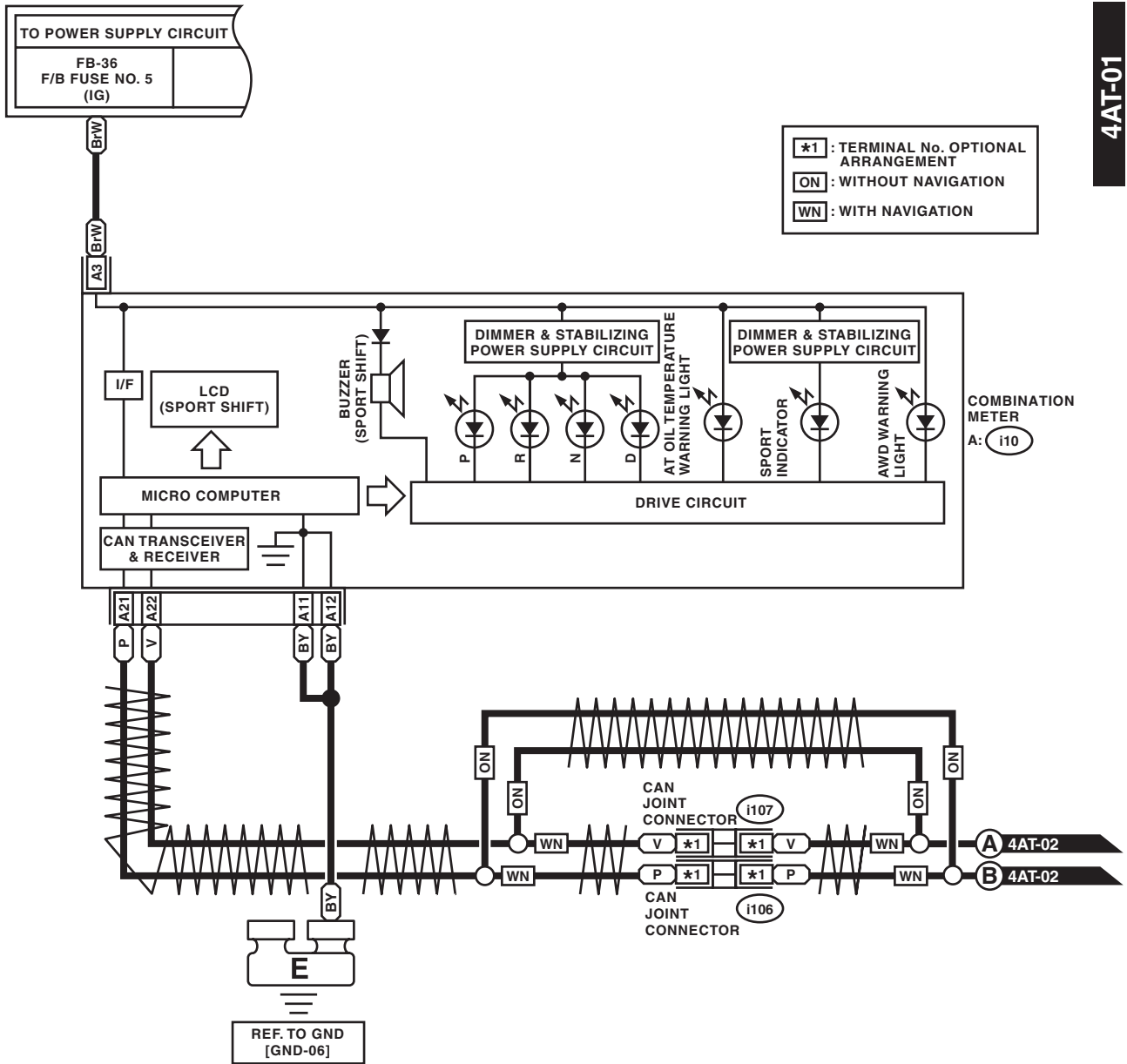
WI-15811

# AT Control System

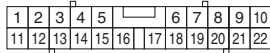
## WIRING SYSTEM

4AT-01

4AT-01



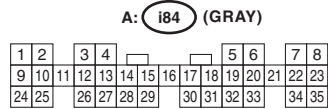
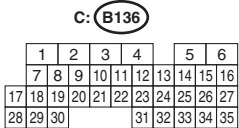
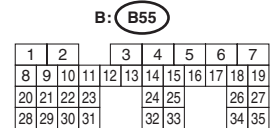
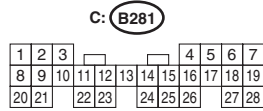
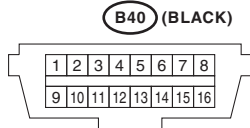
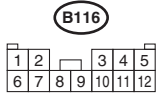
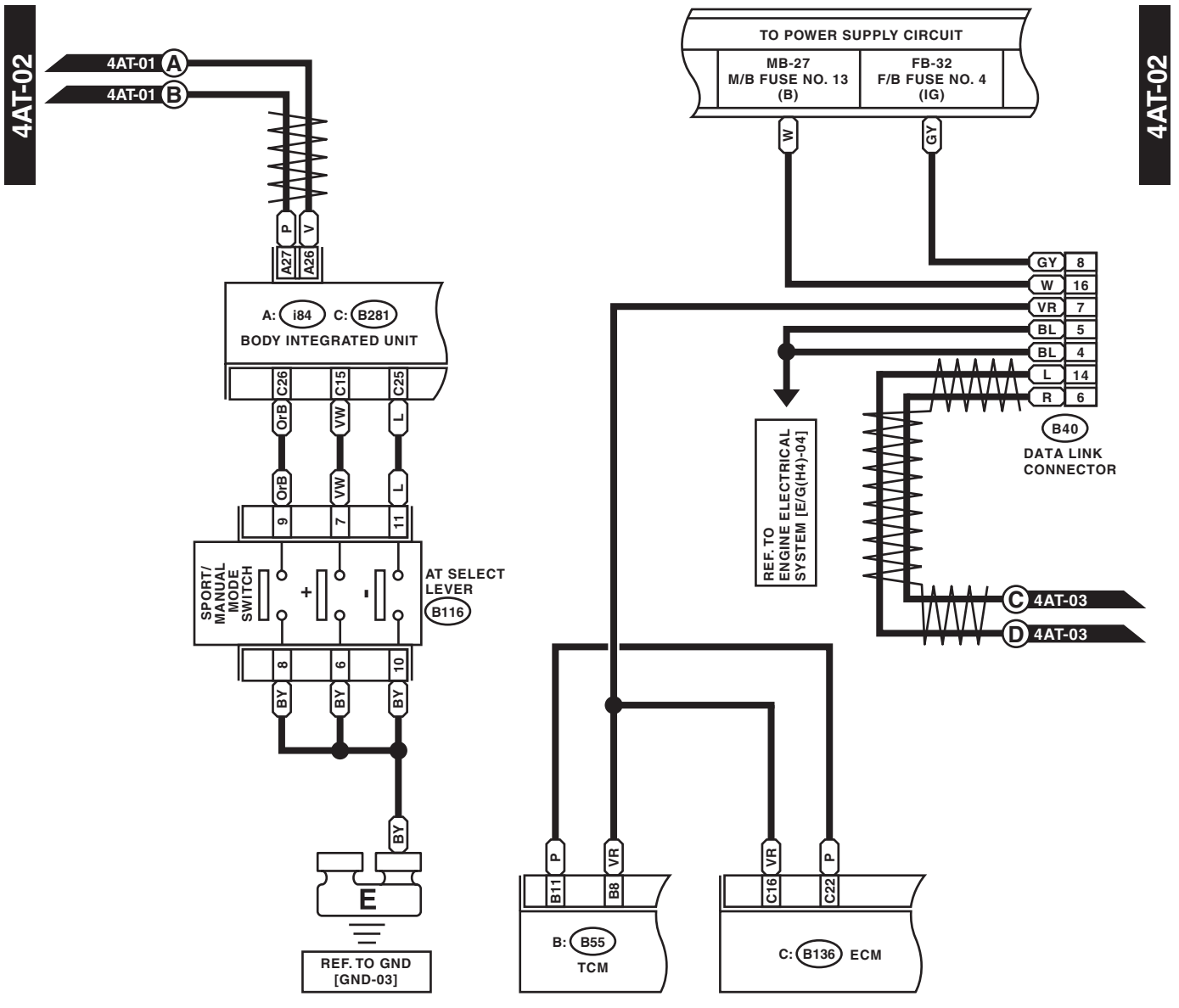
A: i10 (GREEN)



WI-15812

# AT Control System

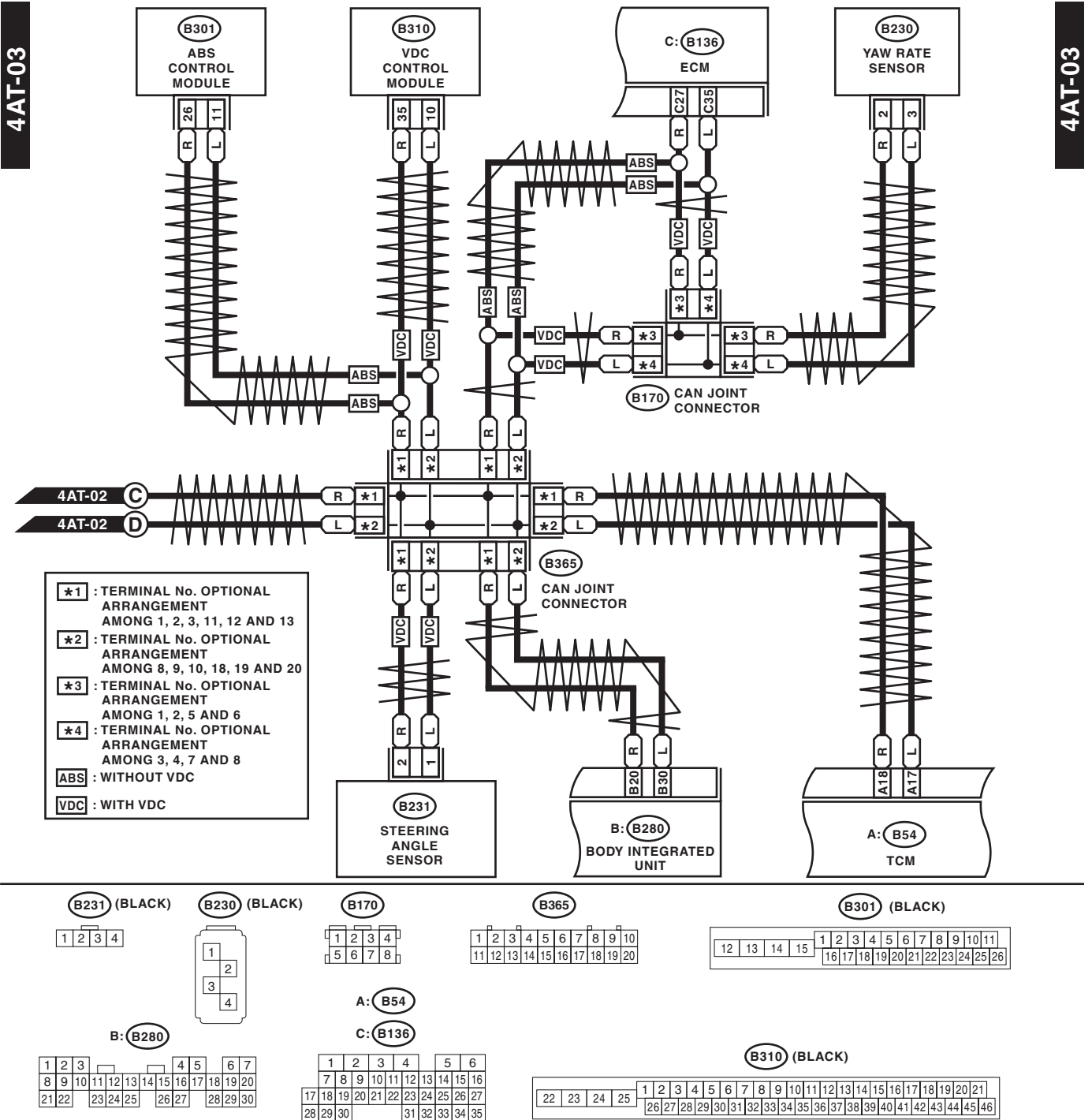
## WIRING SYSTEM



WI-17955

# AT Control System

## WIRING SYSTEM



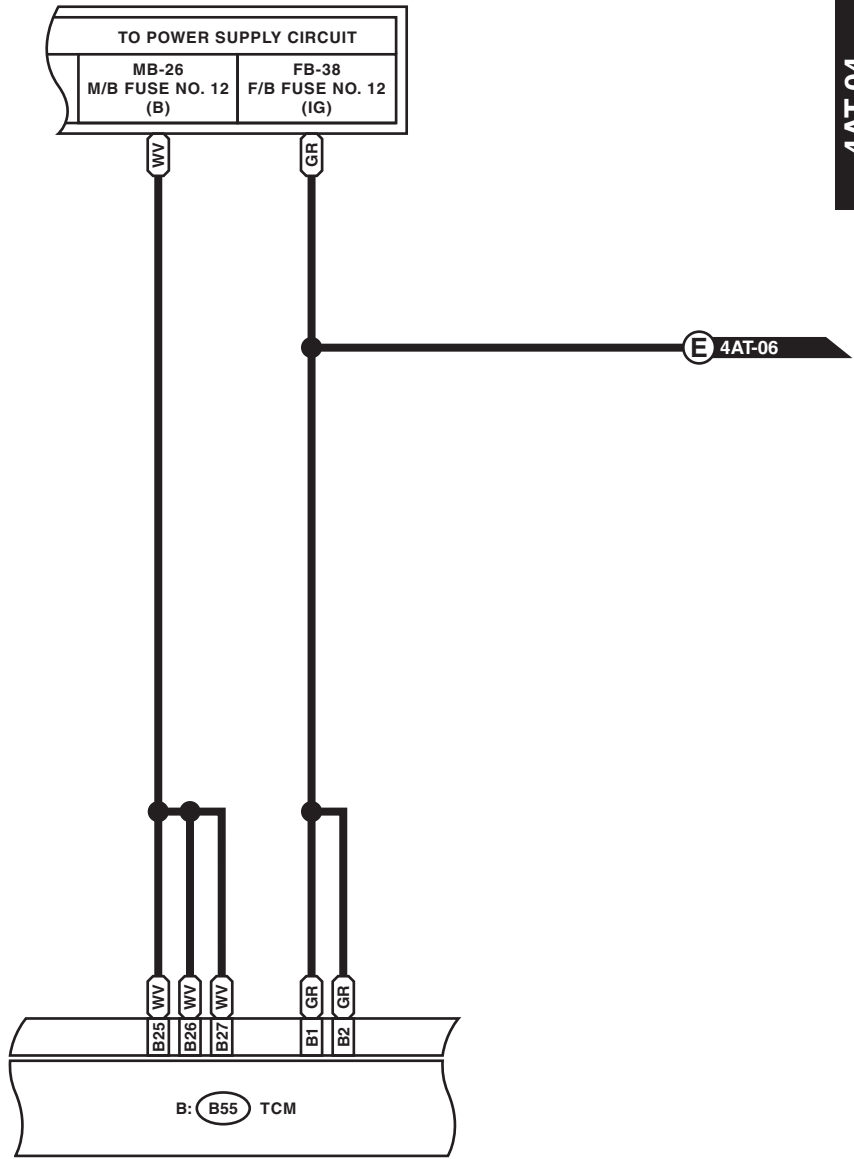
WI-15814

# AT Control System

WIRING SYSTEM

4AT-04

4AT-04



B: B55

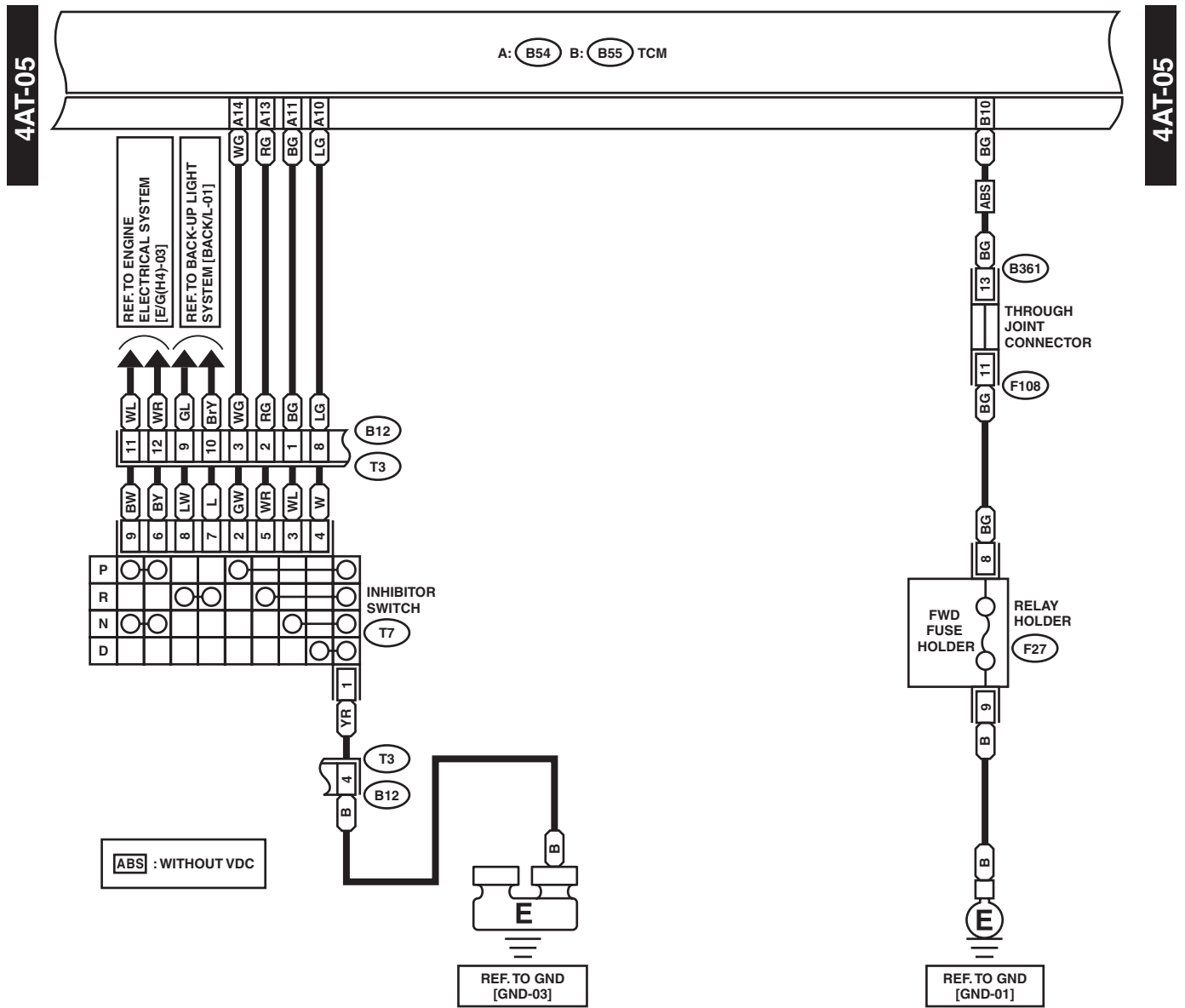
1	2	3	4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27				
28	29	30	31	32	33	34	35				

WI-15815

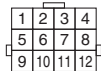


# AT Control System

## WIRING SYSTEM



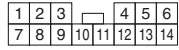
B12 (GRAY)



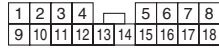
T7 (BLACK)



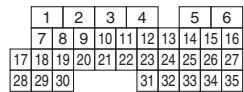
B361 (GRAY)



F108



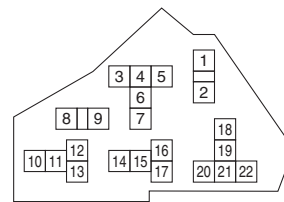
A: B54



B: B55



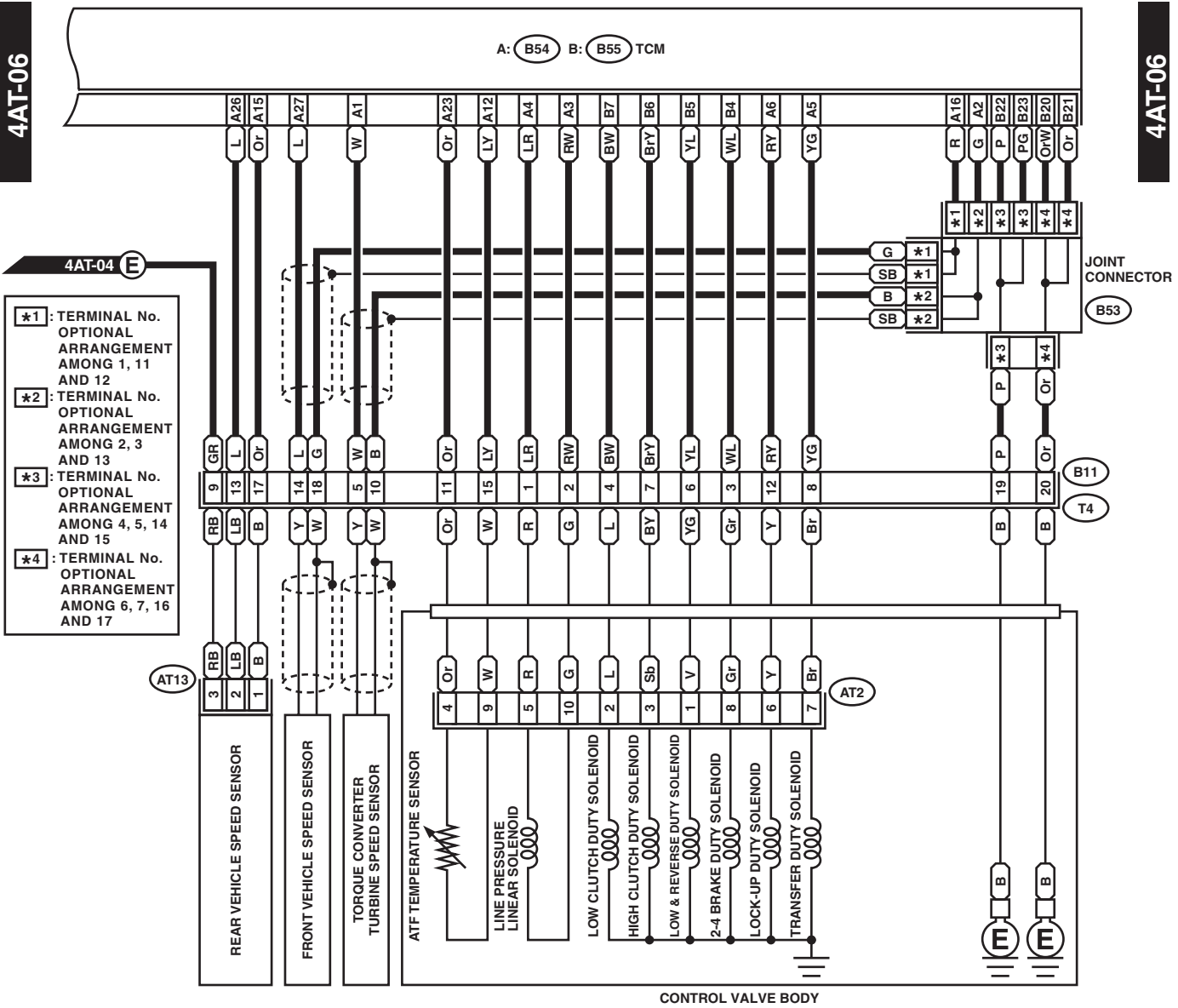
F27 (BLACK)



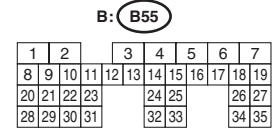
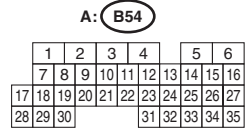
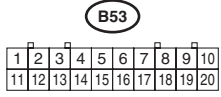
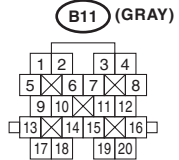
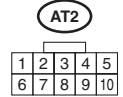
WI-21067

# AT Control System

WIRING SYSTEM



- \*1: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 1, 11 AND 12
- \*2: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 2, 3 AND 13
- \*3: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 4, 5, 14 AND 15
- \*4: TERMINAL No. OPTIONAL ARRANGEMENT AMONG 6, 7, 16 AND 17

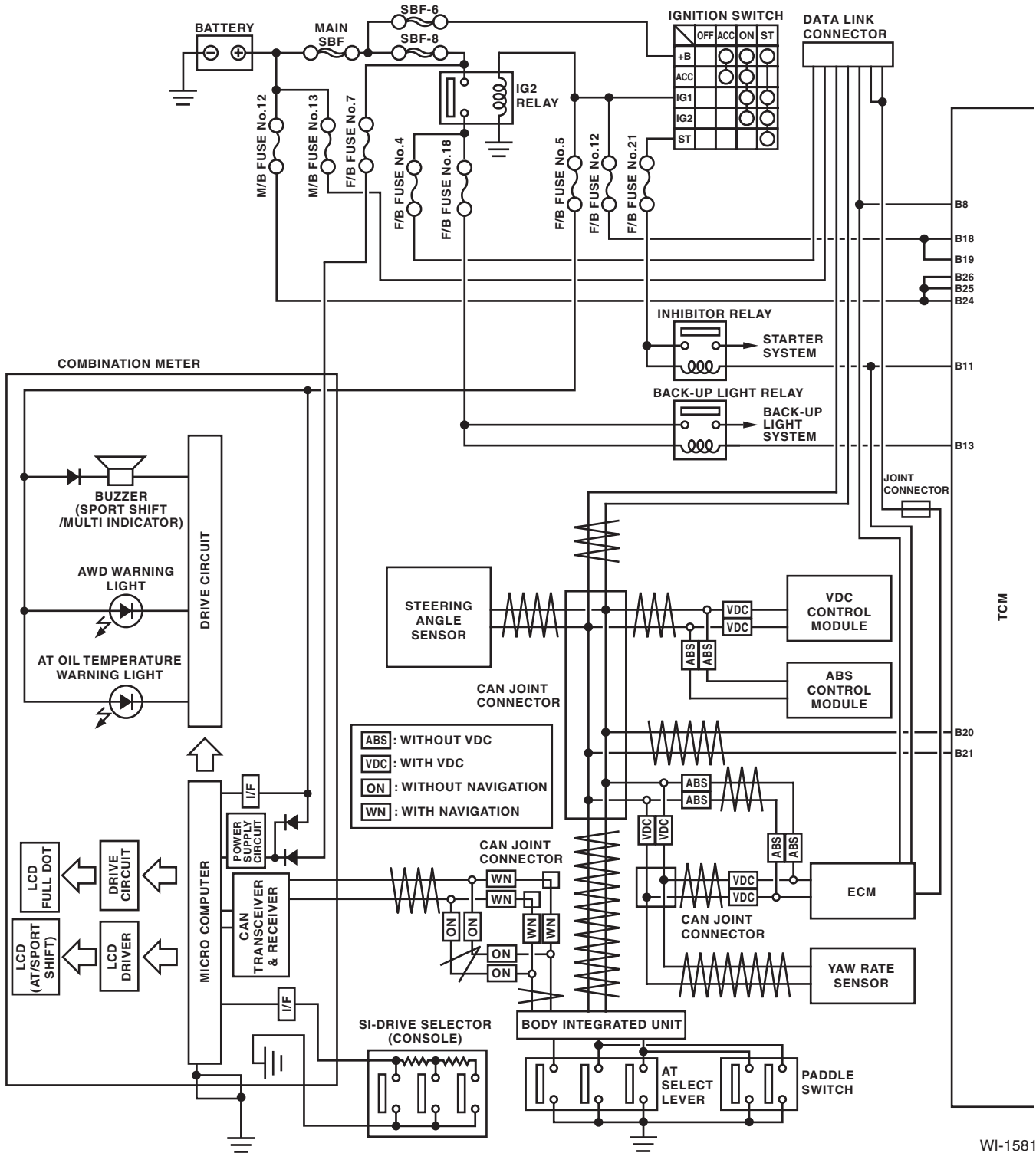


WI-19674

# AT Control System

## WIRING SYSTEM

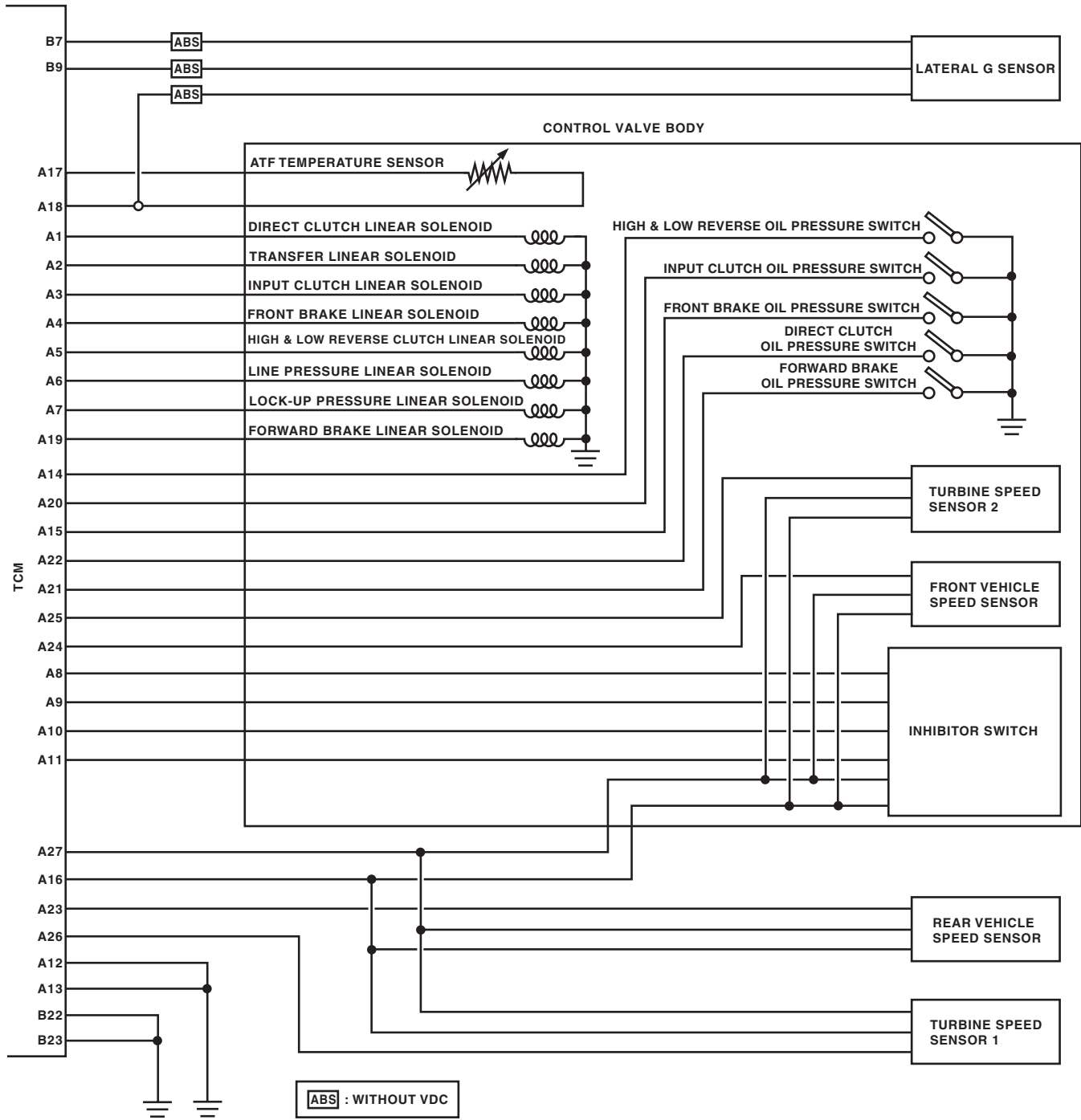
### 4. 5AT MODEL



WI-15818

# AT Control System

## WIRING SYSTEM



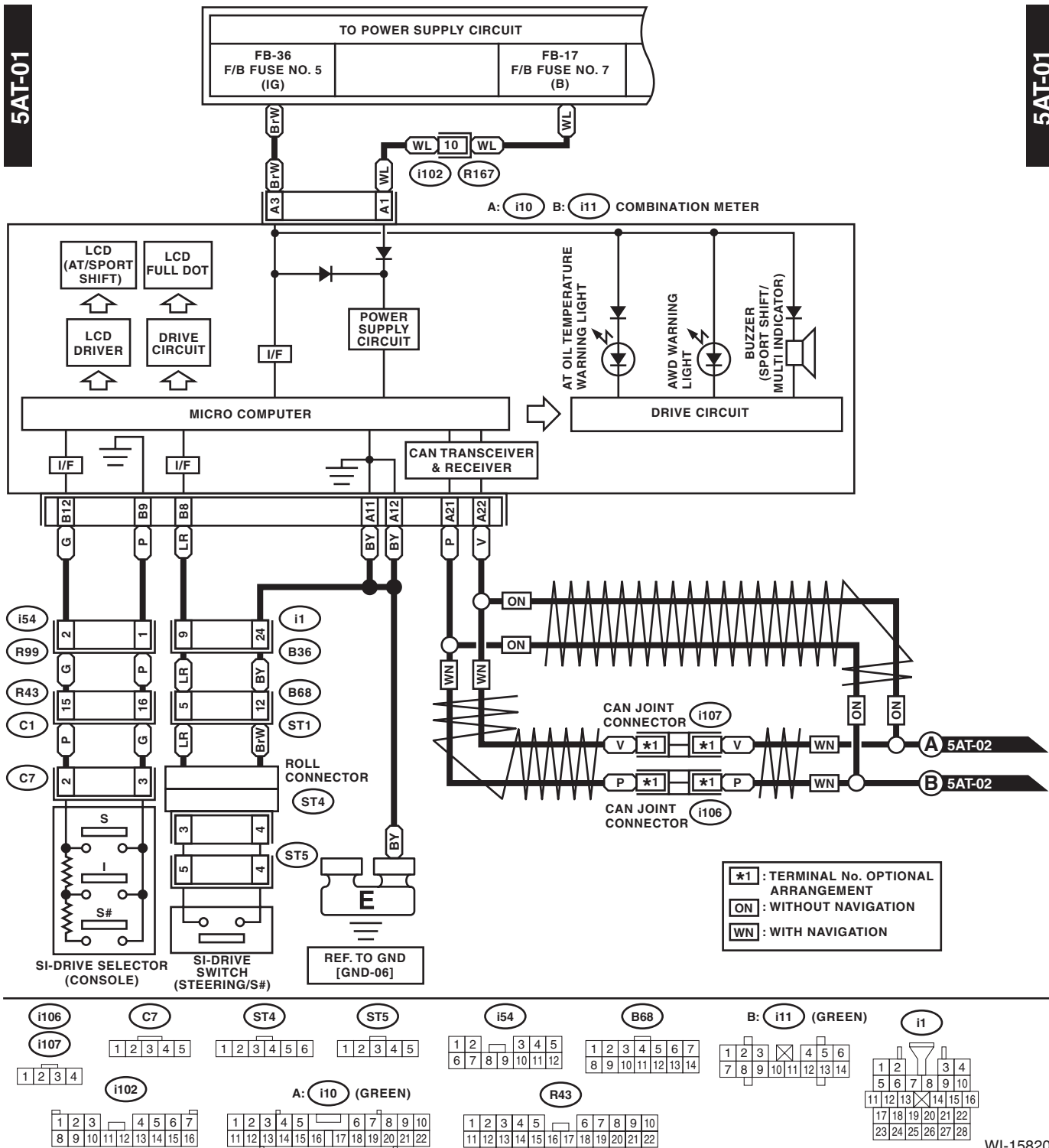
WI-15819

# AT Control System

## WIRING SYSTEM

5AT-01

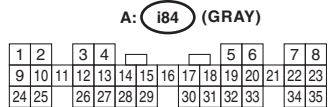
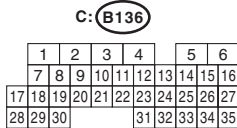
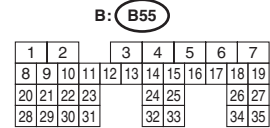
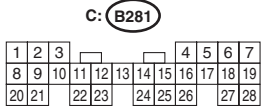
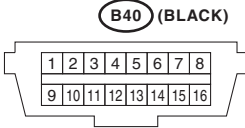
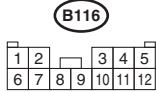
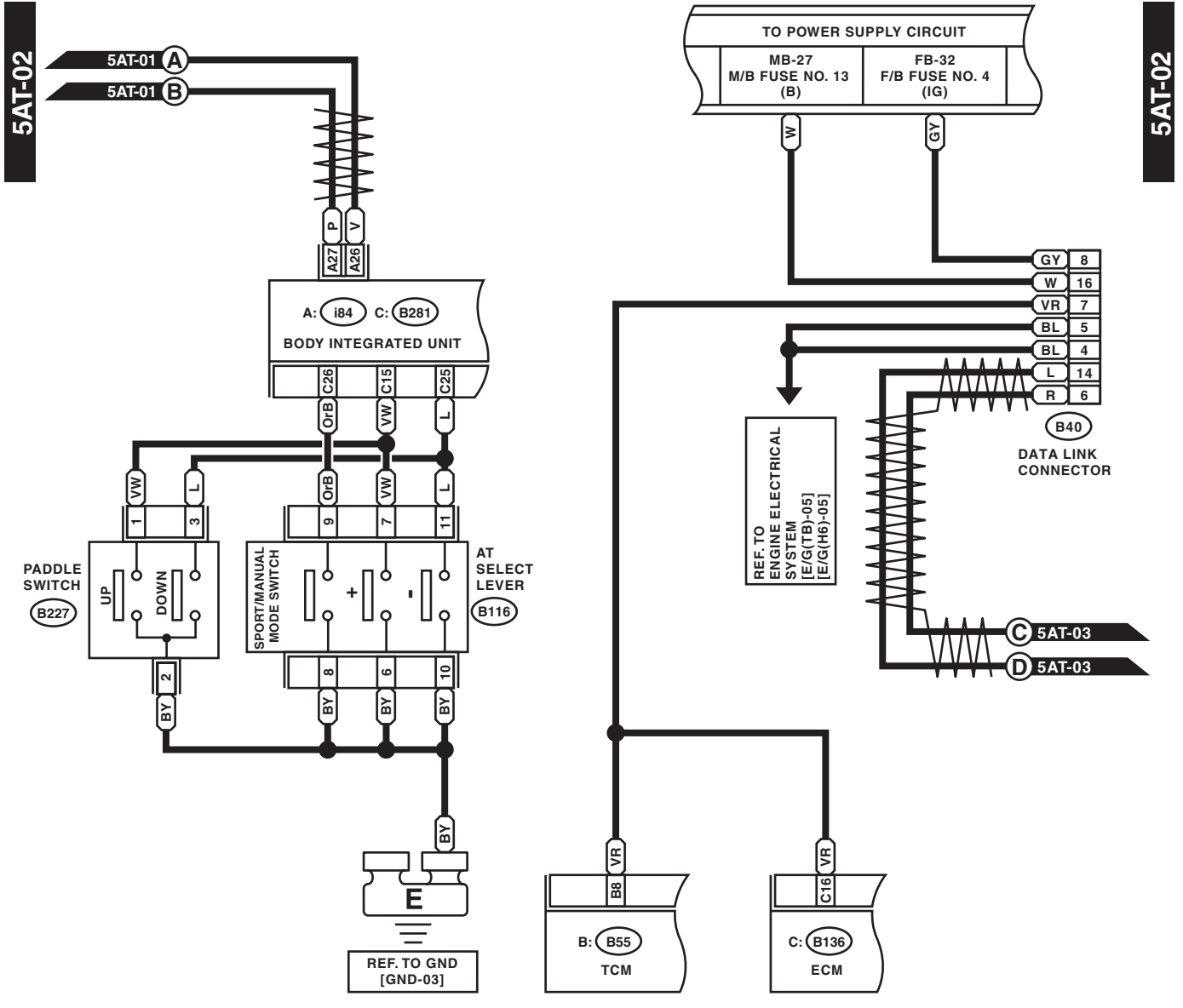
5AT-01



WI-15820

# AT Control System

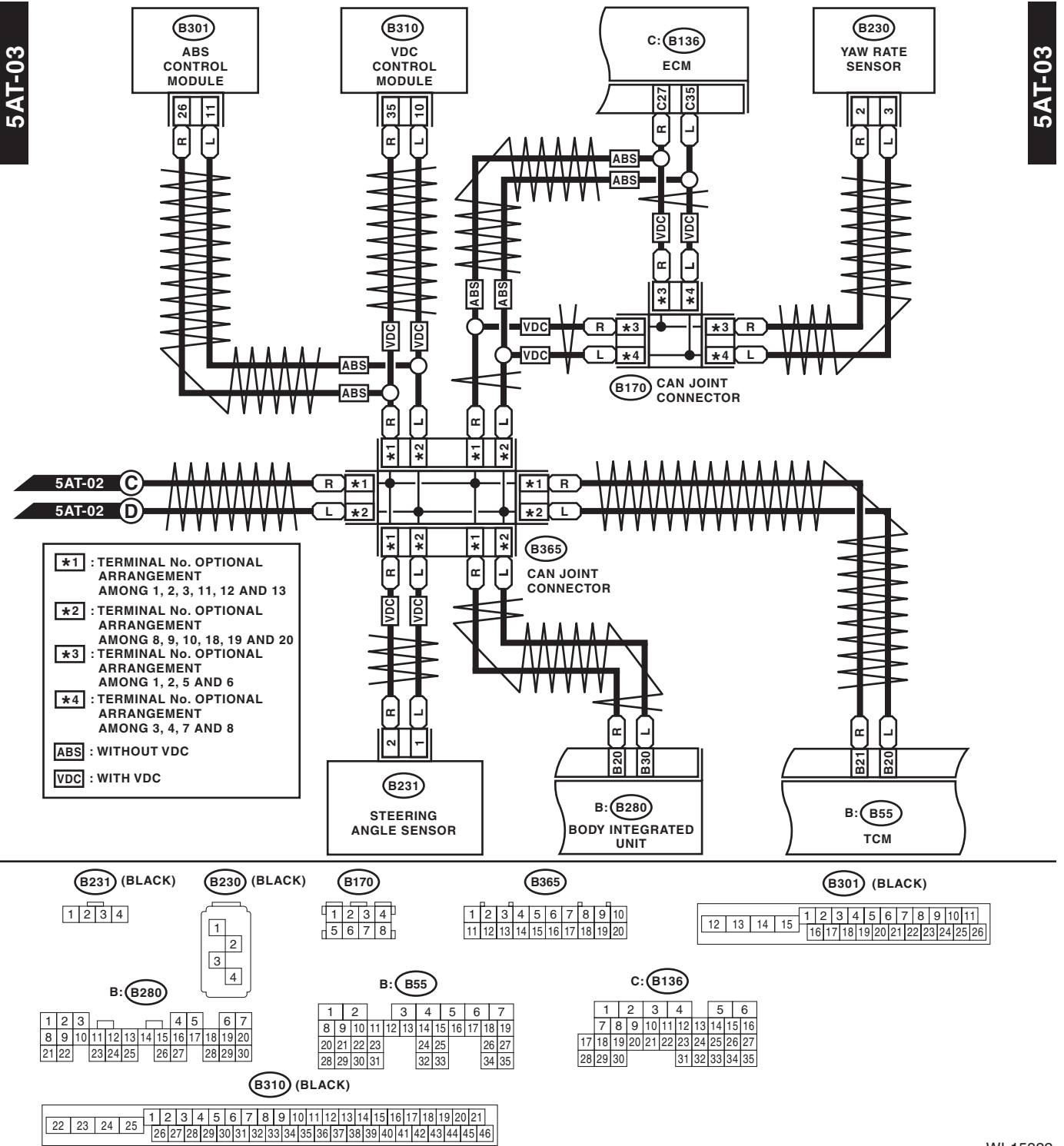
WIRING SYSTEM



WI-17956

# AT Control System

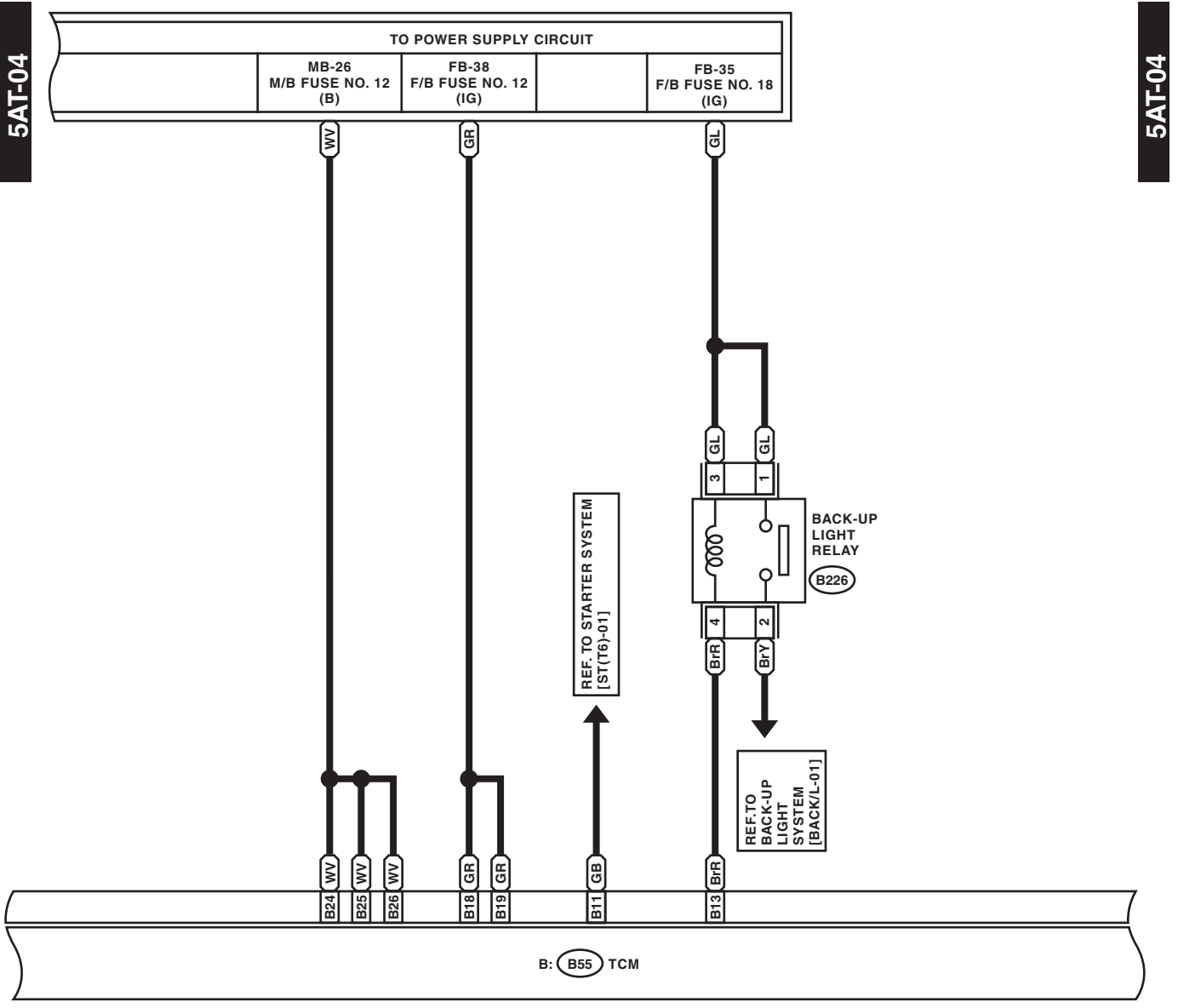
## WIRING SYSTEM



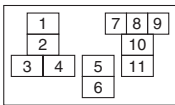
WI-15822

# AT Control System

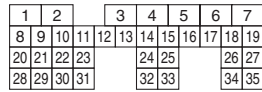
WIRING SYSTEM



(B226) (BLUE)



B: (B55)



WI-15823

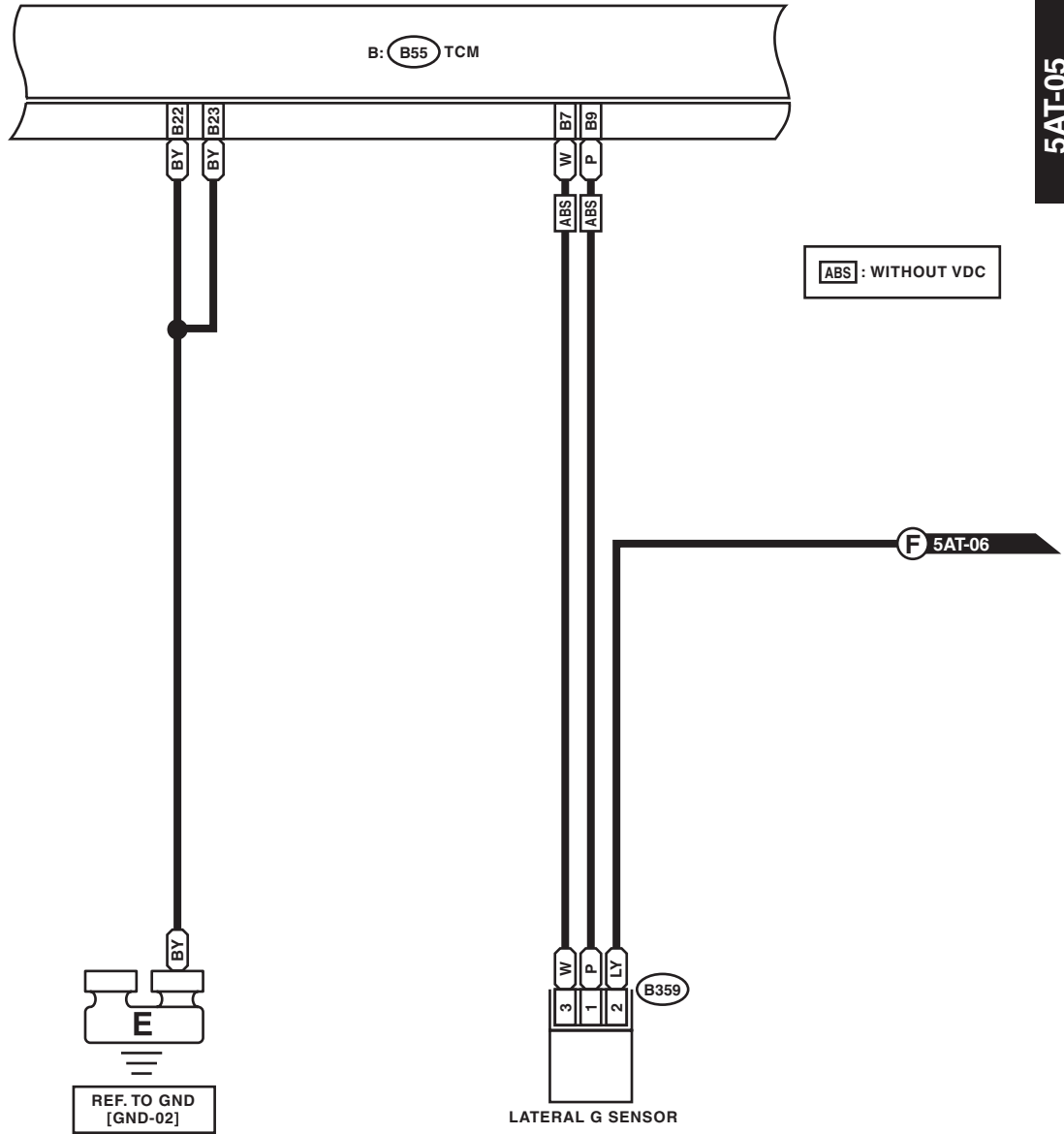


# AT Control System

## WIRING SYSTEM

5AT-05

5AT-05



**B359** (BLACK)

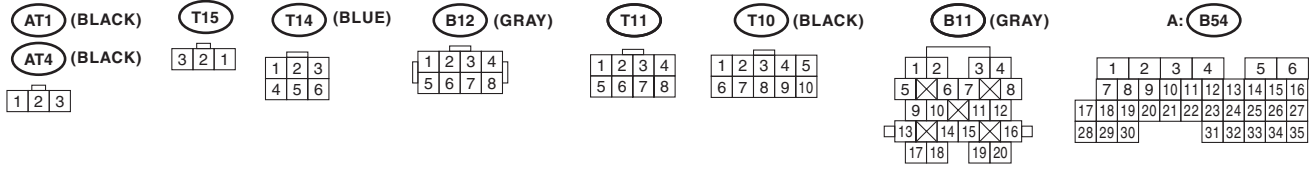
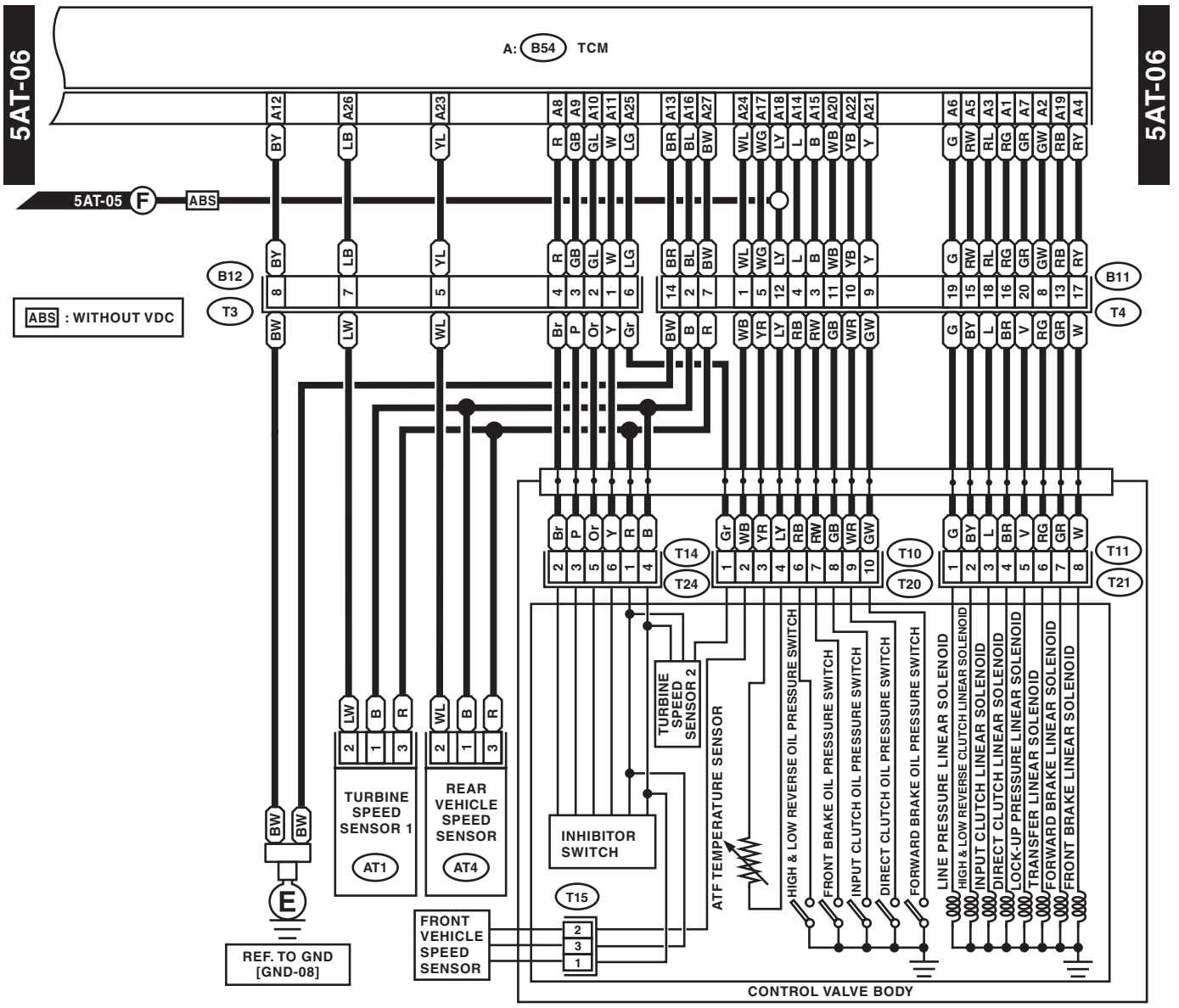
1	2	3
---	---	---

B: **B55**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
14	15	16	17	18	19	
20	21	22	23	24	25	26
26	27			28	29	30
				31	32	33
						34
						35

# AT Control System

## WIRING SYSTEM



WI-15825

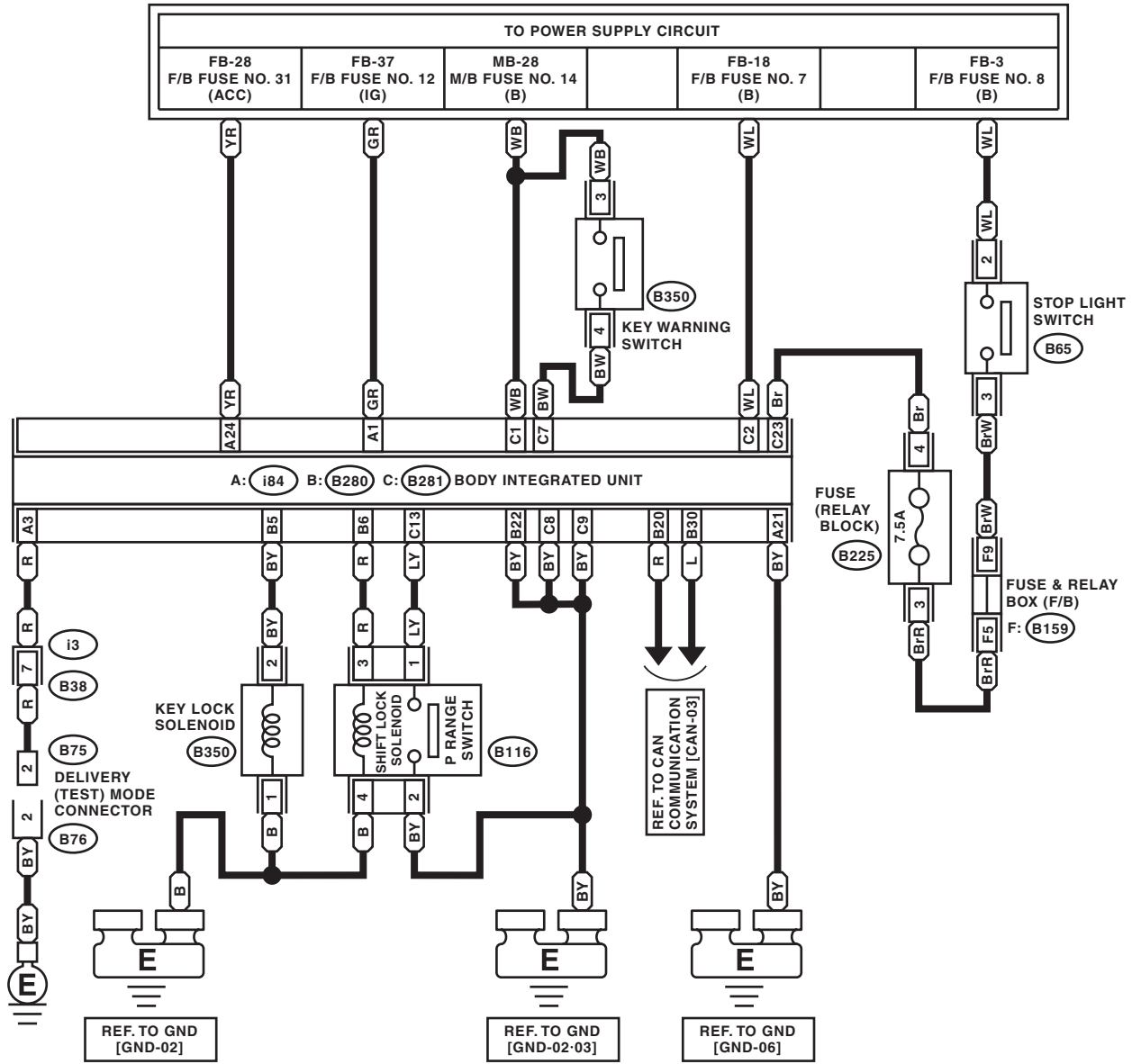
# AT Shift Lock Control System

WIRING SYSTEM

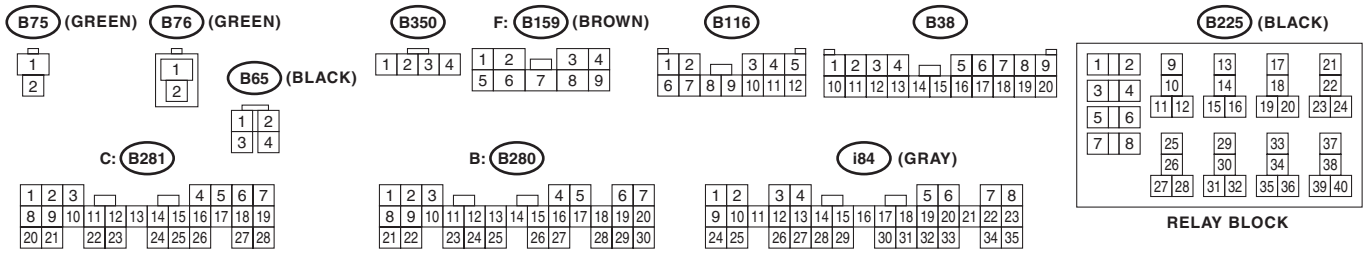
## 11. AT Shift Lock Control System

### A: WIRING DIAGRAM

ATSL-01



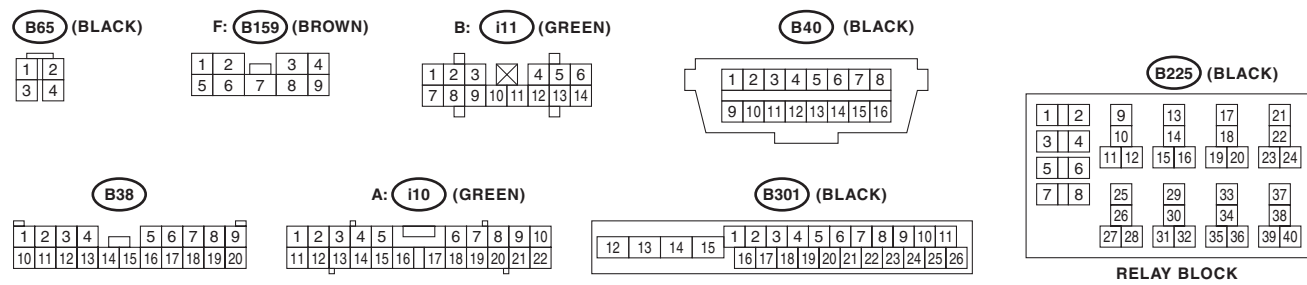
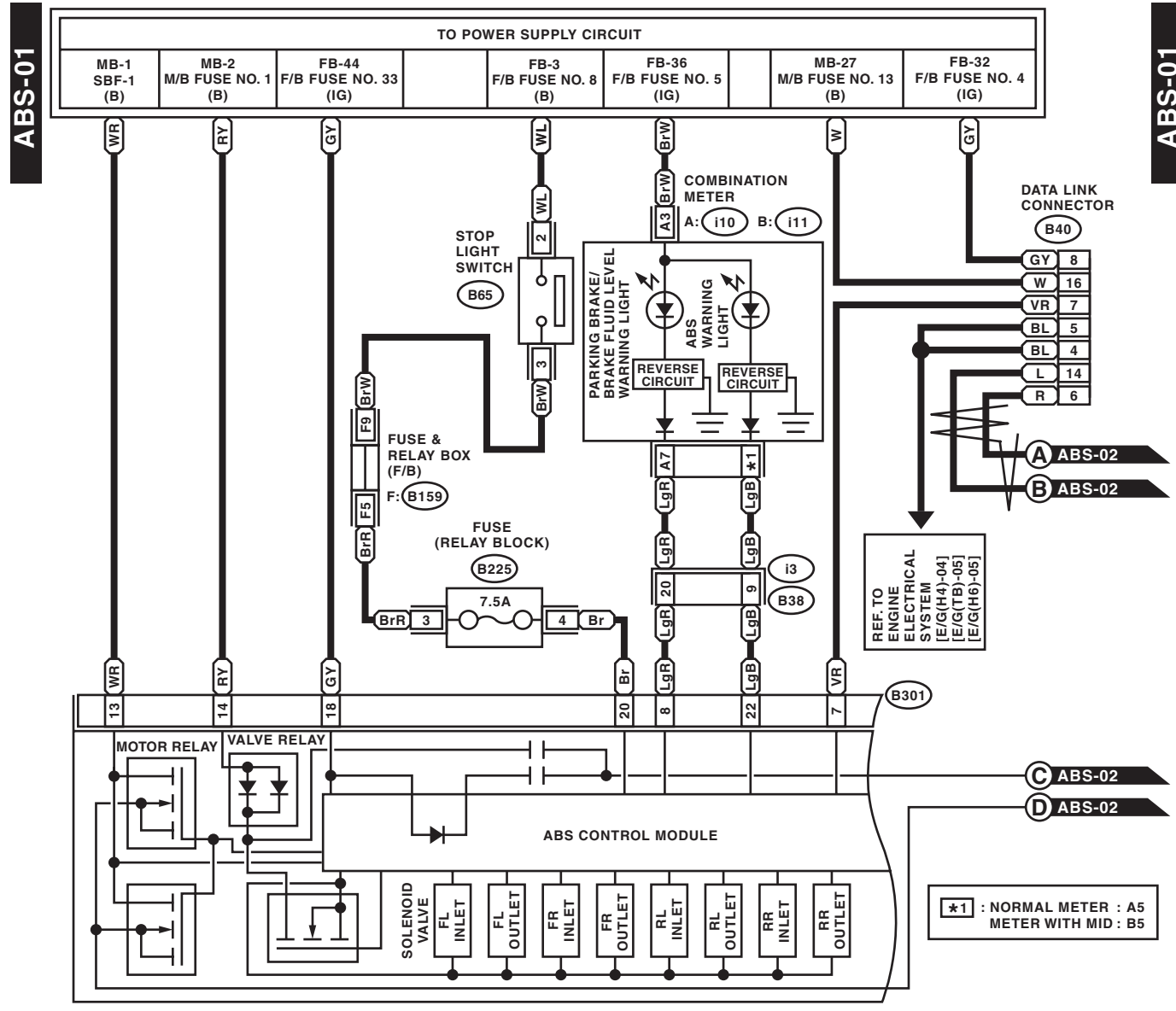
ATSL-01



WI-15827

## 12. Anti-lock Brake System

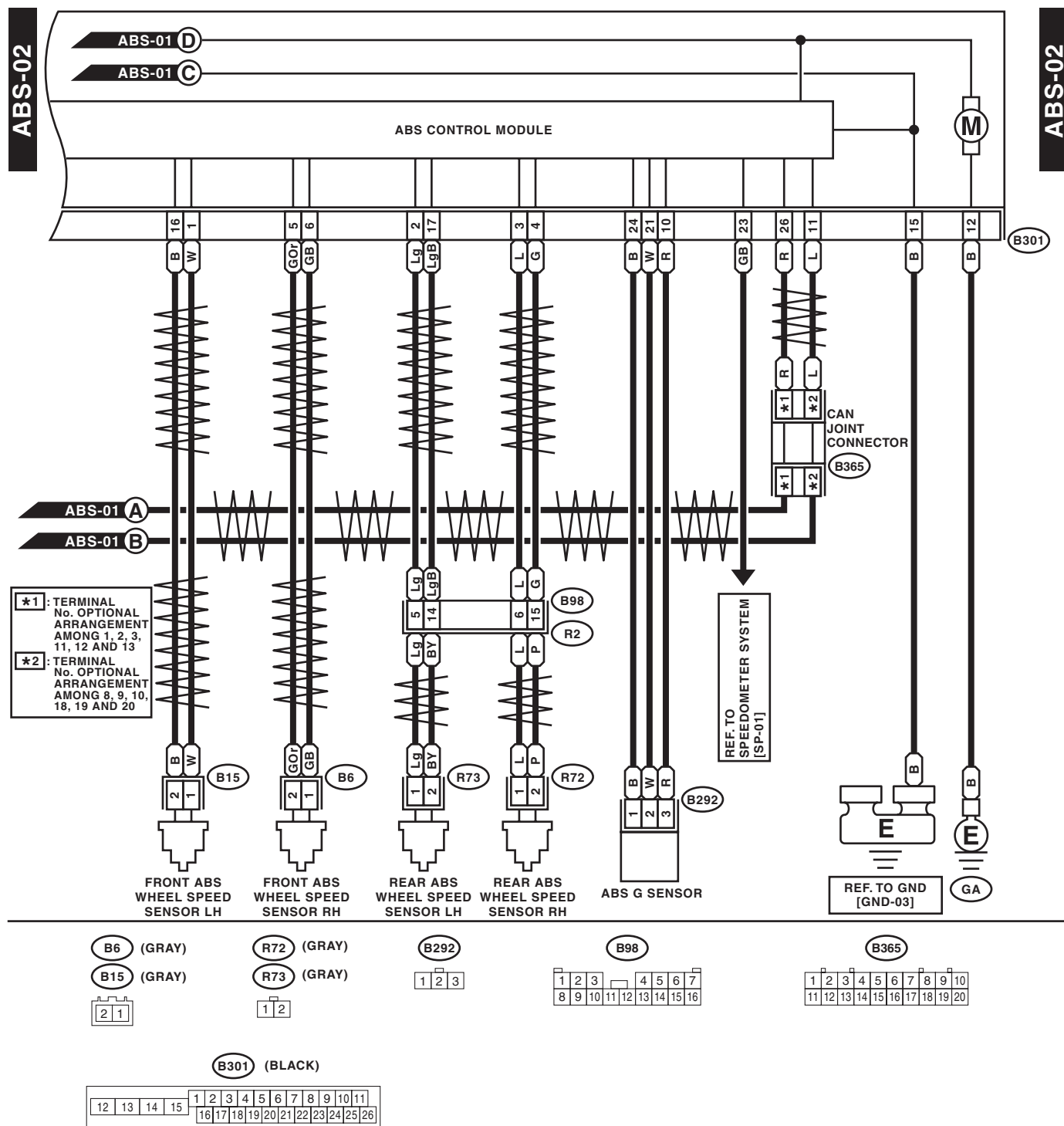
### A: WIRING DIAGRAM



\*1 : NORMAL METER : A5  
METER WITH MID : B5

# Anti-lock Brake System

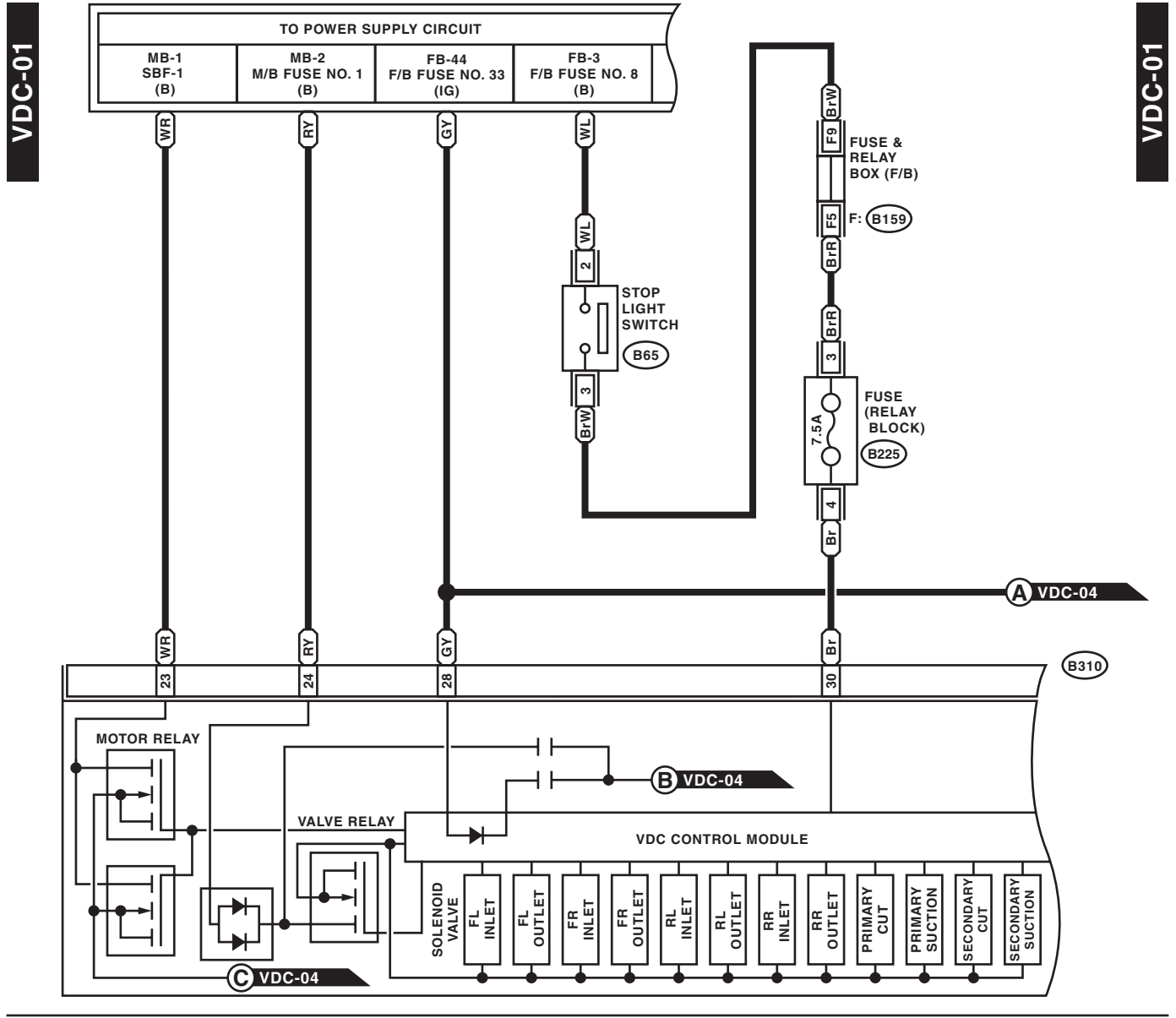
## WIRING SYSTEM



WI-15829

## 13. Vehicle Dynamics Control System

### A: WIRING DIAGRAM



(B65) (BLACK)

1	2
3	4

F: (B159) (BROWN)

1	2	3	4
5	6	7	8

(B310) (BLACK)

22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
				26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

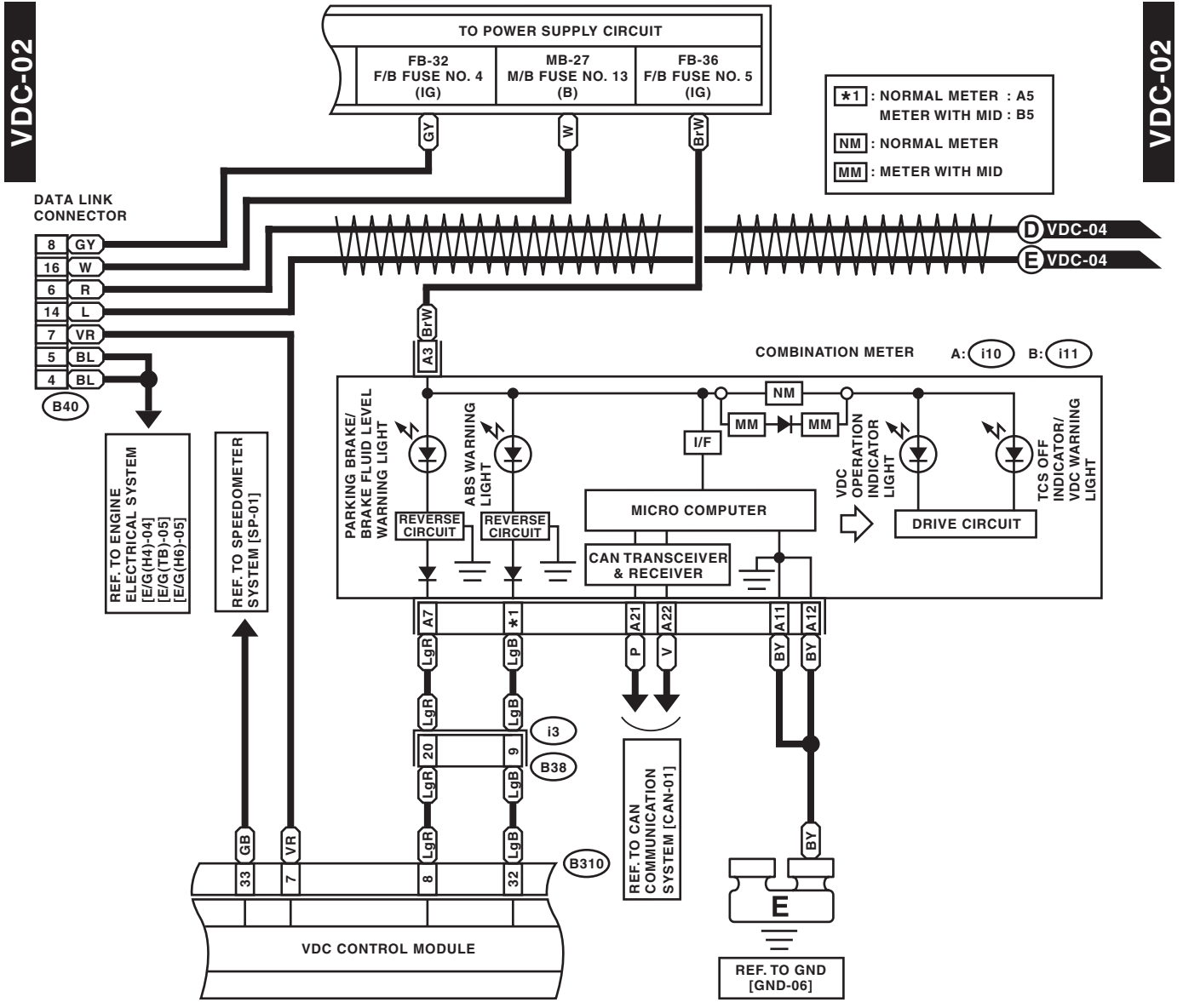
(B225) (BLACK)

1	2	9	13	17	21				
3	4	10	14	18	22				
5	6	11	15	19	20	23	24		
7	8	25	29	33	37				
		26	30	34	38				
		27	28	31	32	35	36	39	40

RELAY BLOCK

# Vehicle Dynamics Control System

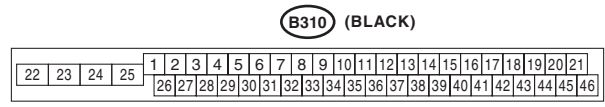
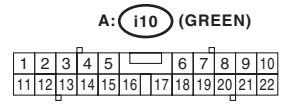
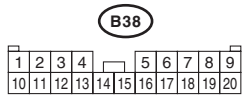
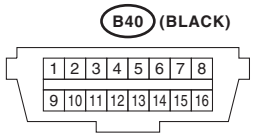
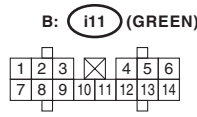
## WIRING SYSTEM



**VDC-02**

**VDC-02**

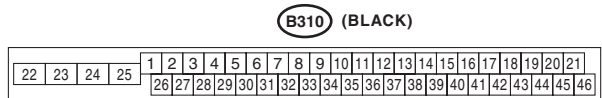
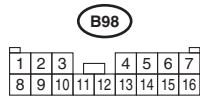
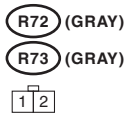
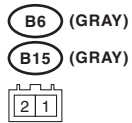
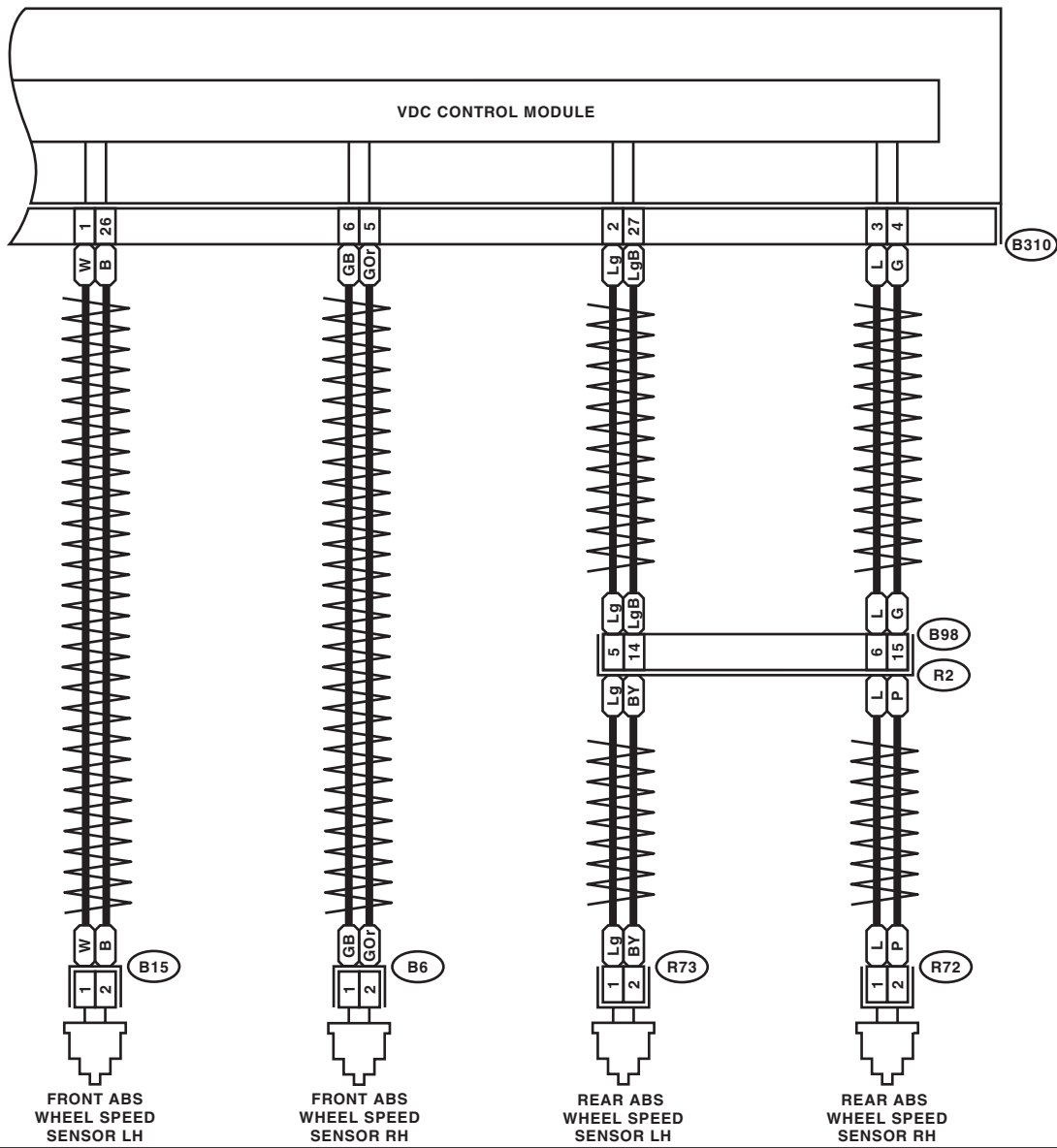
★1 : NORMAL METER : A5  
 METER WITH MID : B5  
 NM : NORMAL METER  
 MM : METER WITH MID



WI-15831

VDC-03

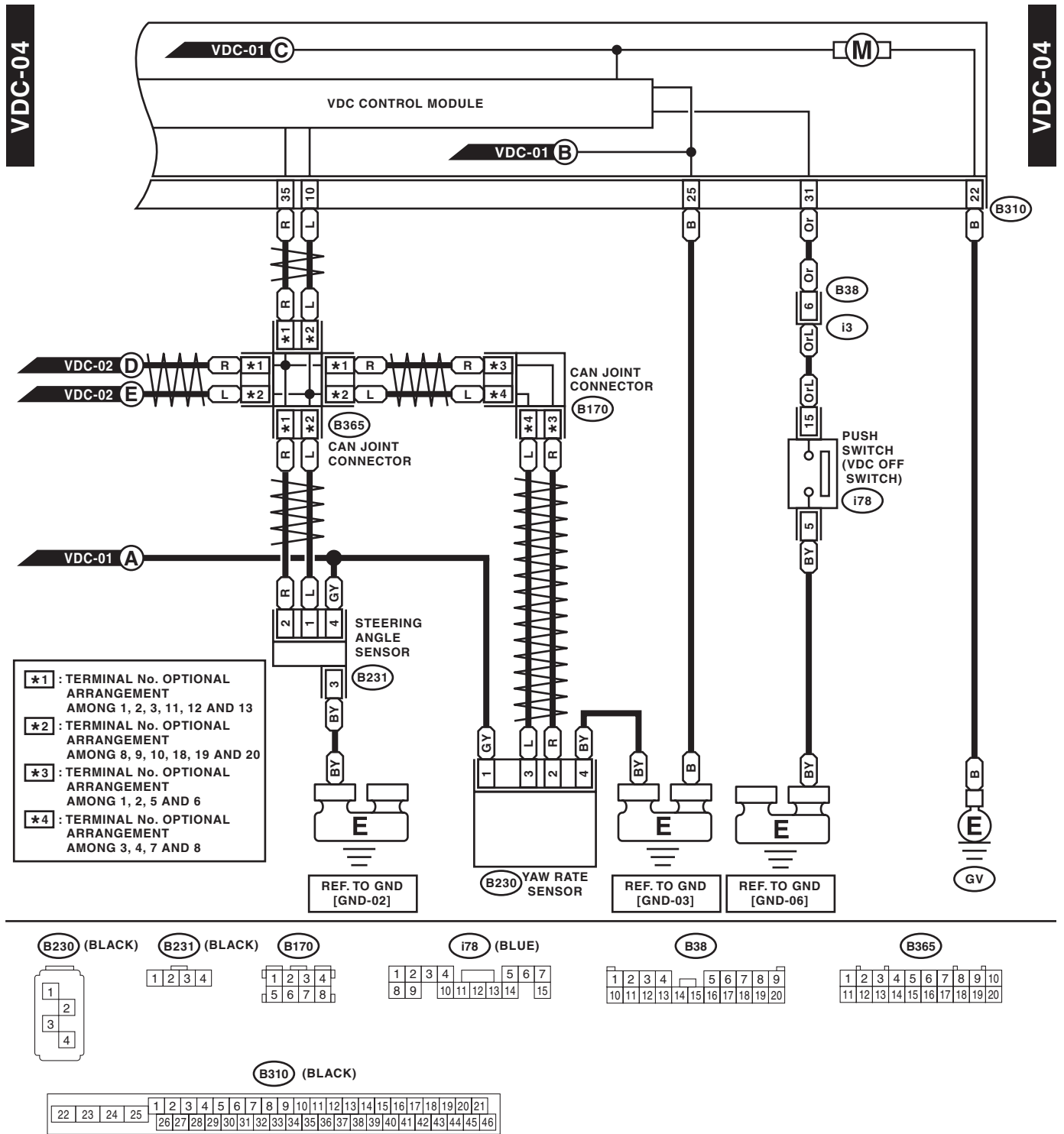
VDC-03





# Vehicle Dynamics Control System

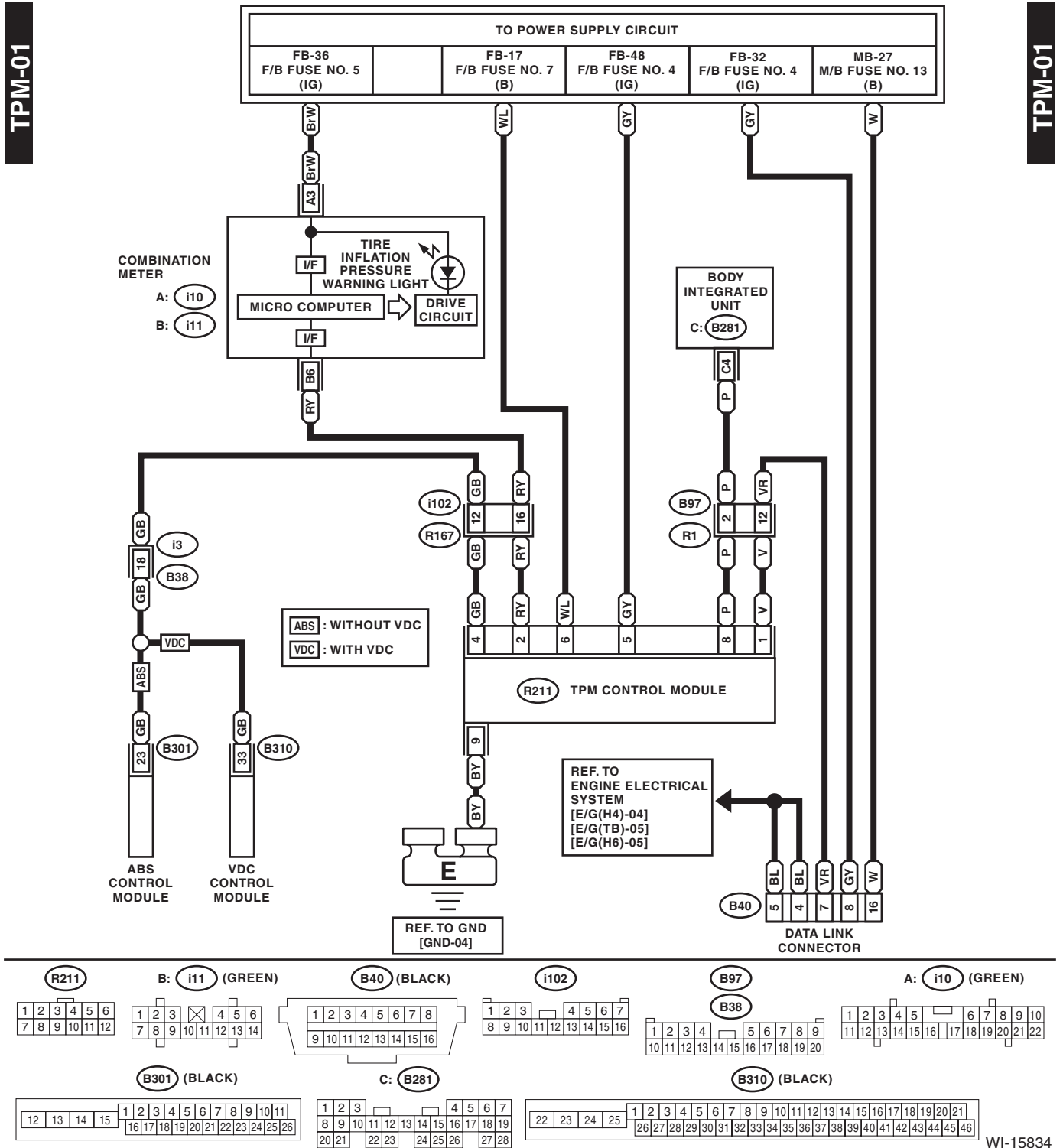
## WIRING SYSTEM



WI-15833

## 14. Tire Pressure Monitoring System

### A: WIRING DIAGRAM



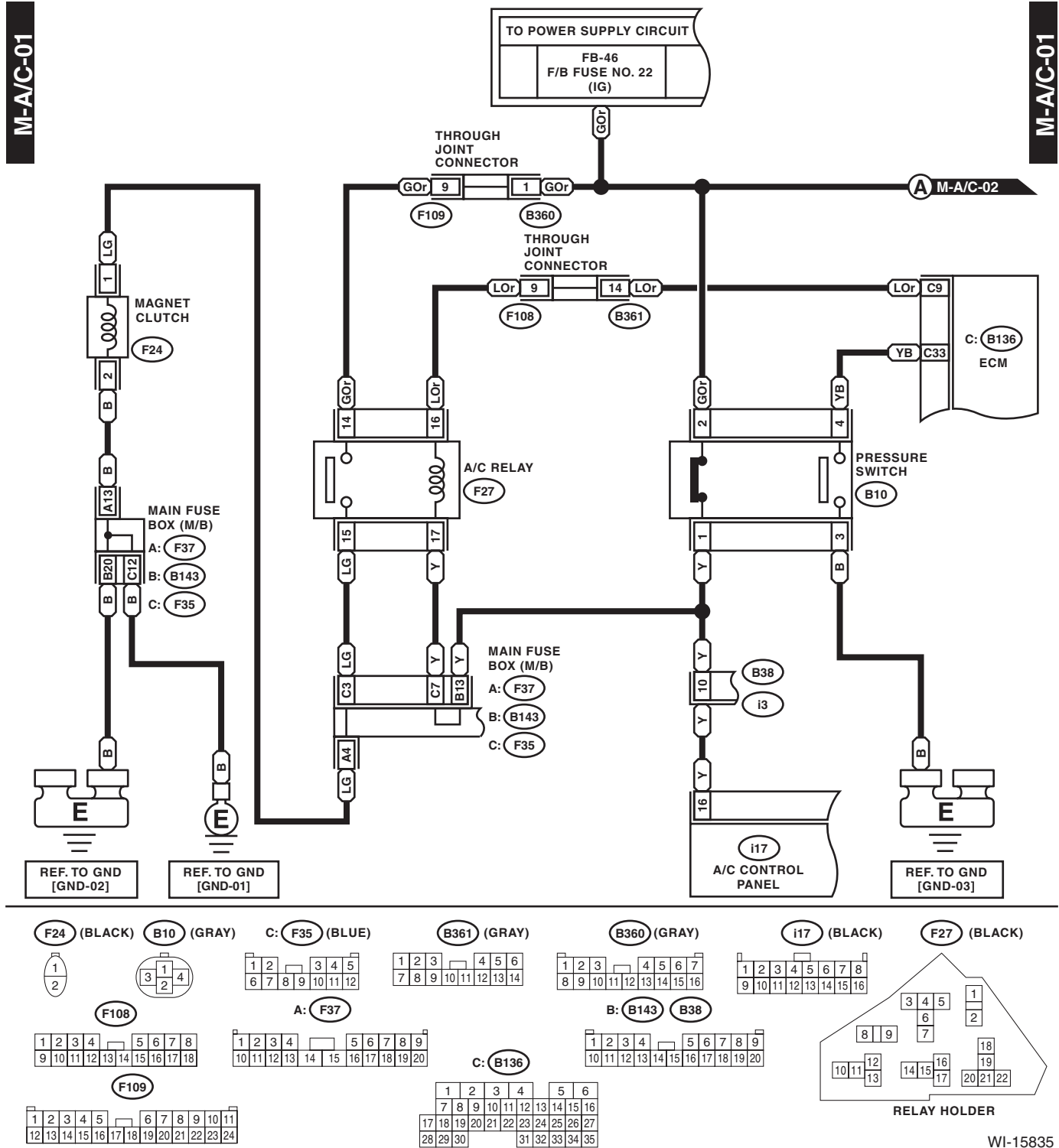
# Air Conditioning System

WIRING SYSTEM

## 15. Air Conditioning System

### A: WIRING DIAGRAM

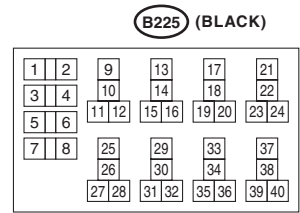
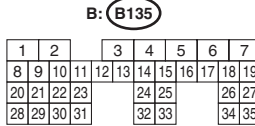
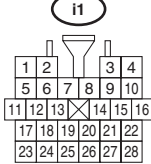
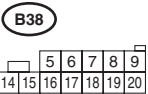
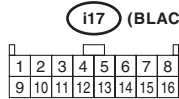
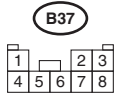
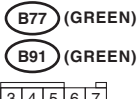
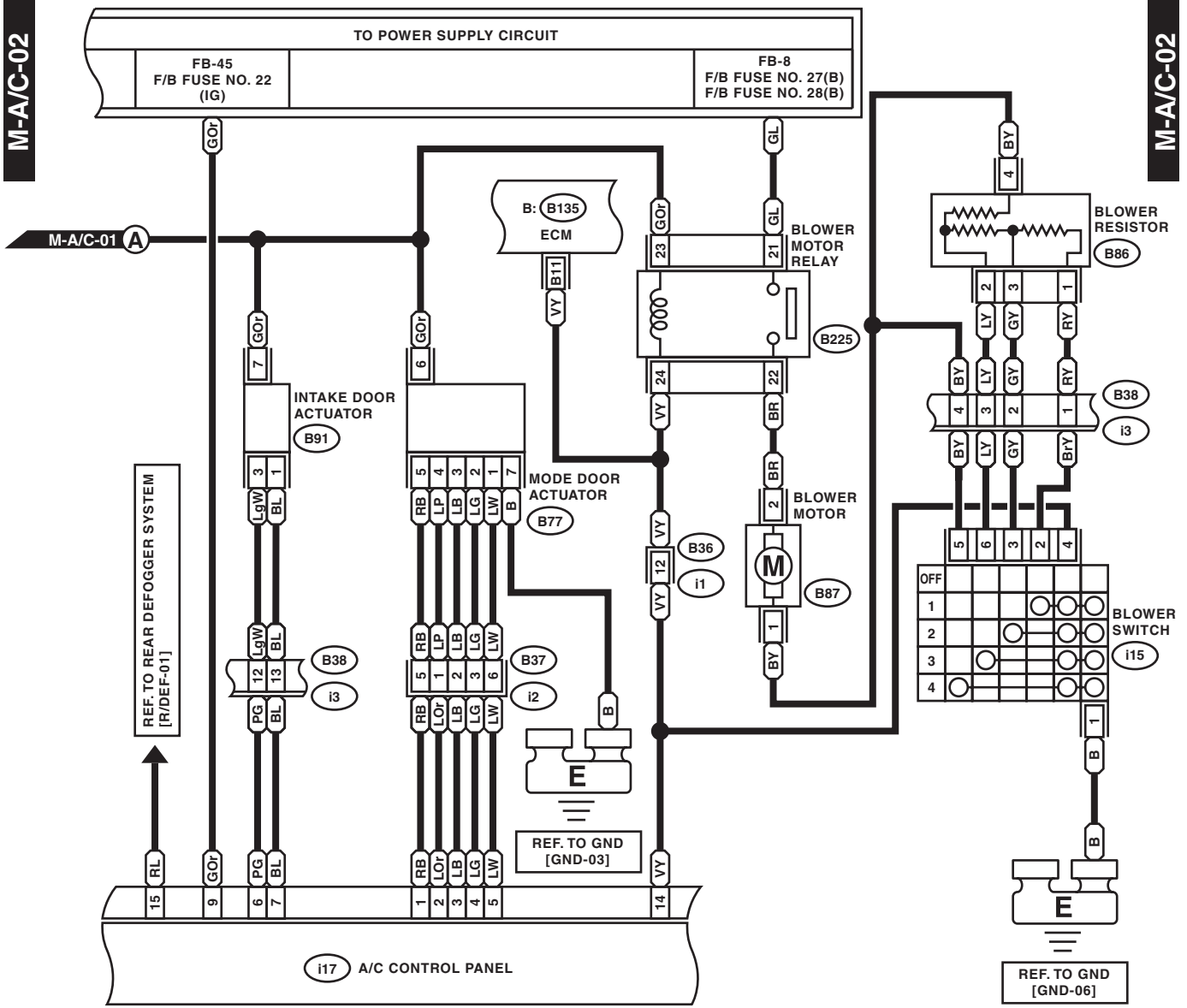
#### 1. MANUAL A/C MODEL



WI-15835

# Air Conditioning System

## WIRING SYSTEM



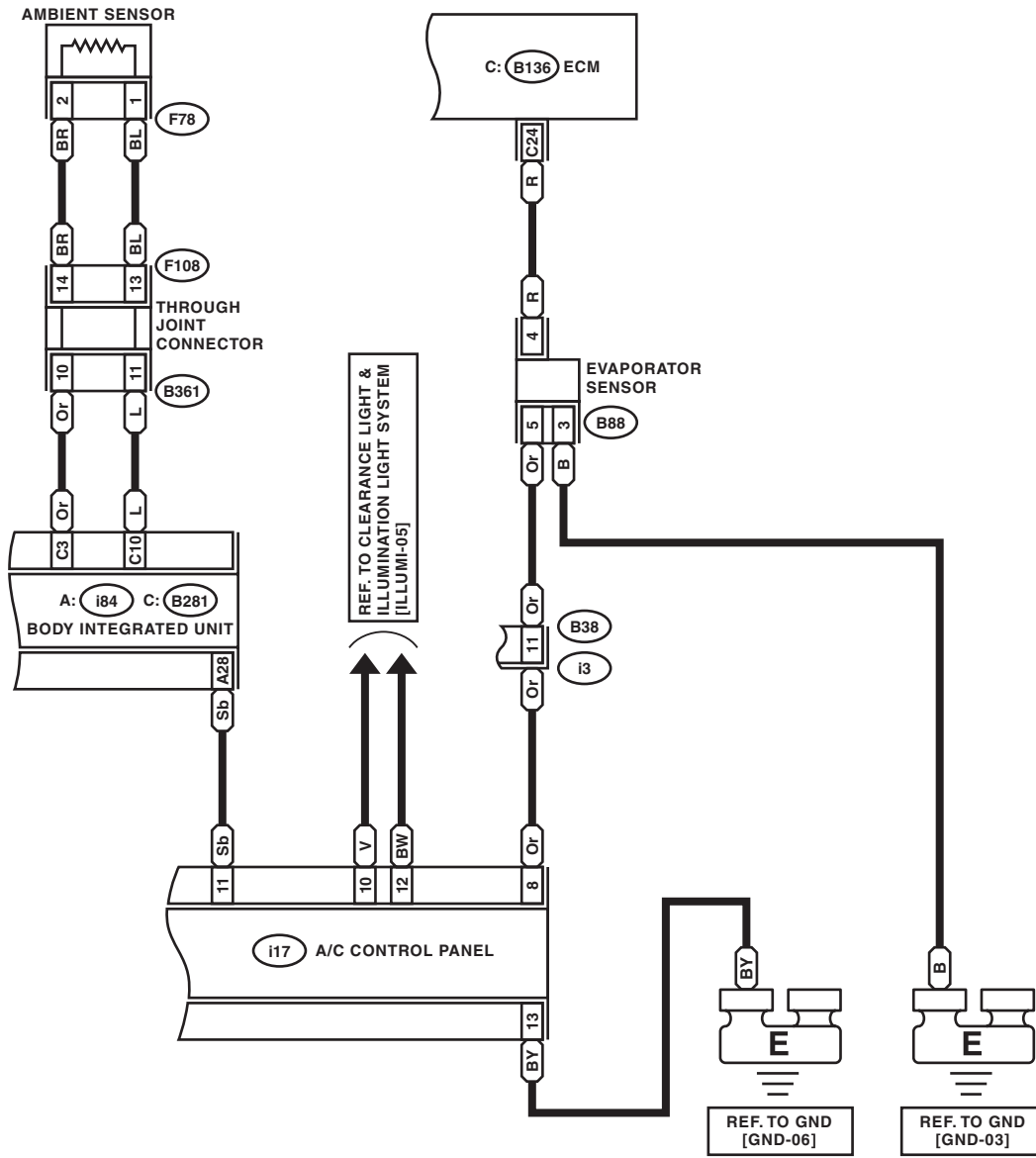
WI-15836

# Air Conditioning System

## WIRING SYSTEM

M-A/C-03

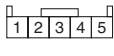
M-A/C-03



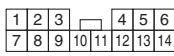
F78 (BLACK)



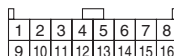
B88



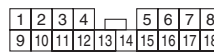
B361 (GRAY)



i17 (BLACK)



F108



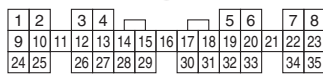
B38



C: B281



A: i84 (GRAY)



C: B136



WI-15837

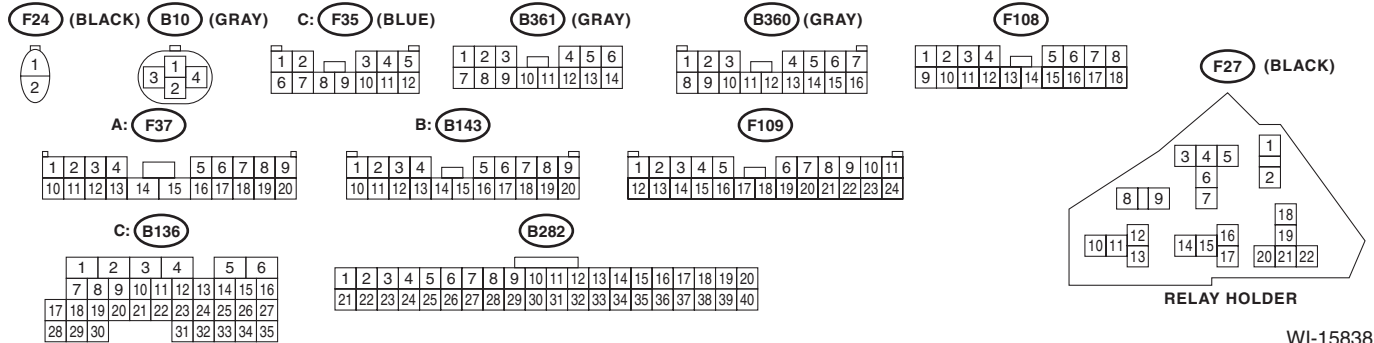
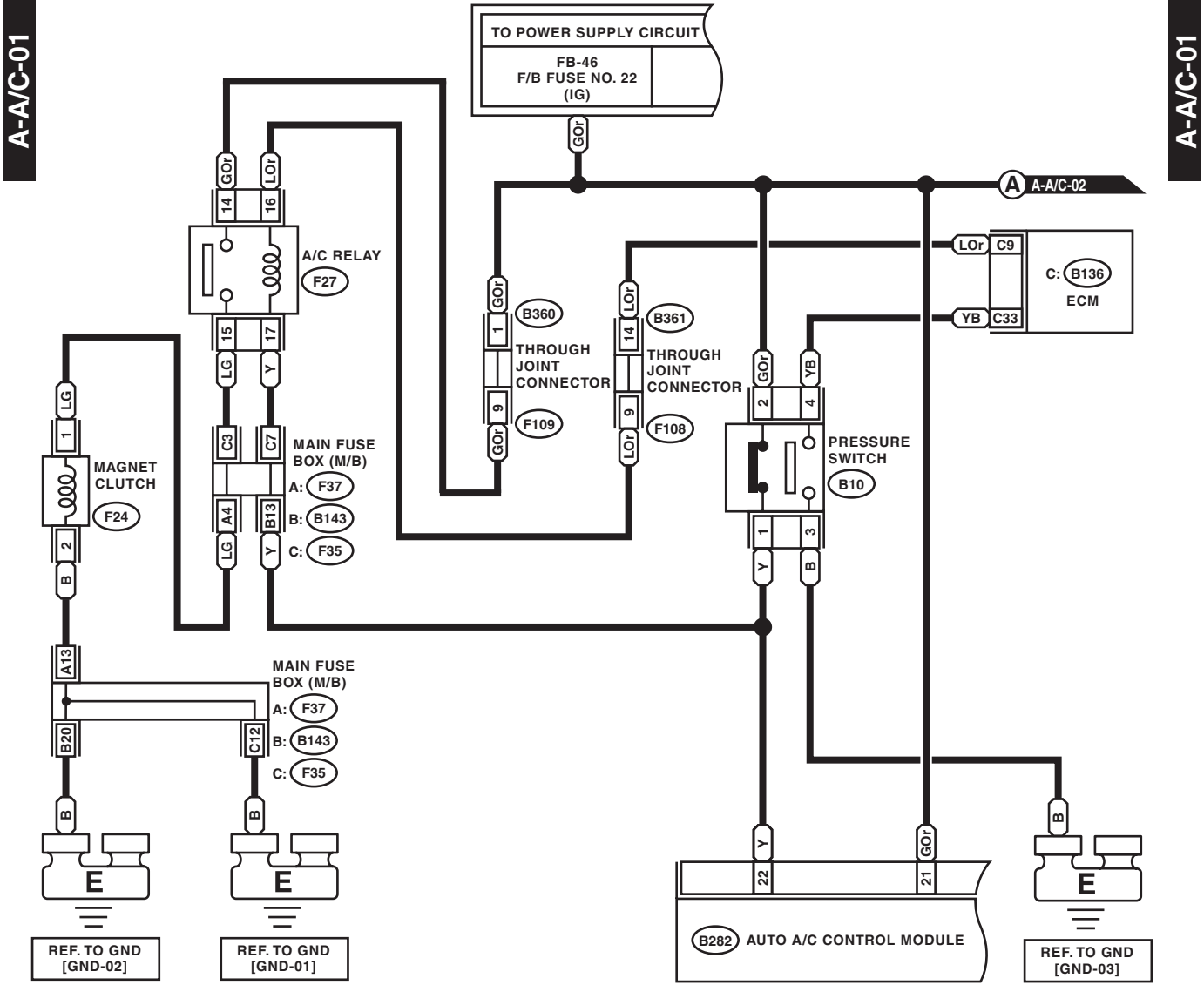
# Air Conditioning System

WIRING SYSTEM

## 2. AUTO A/C MODEL

A-A/C-01

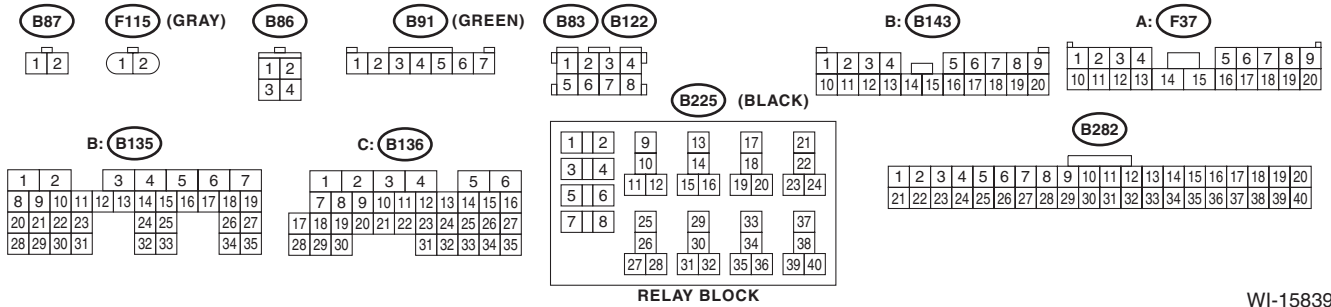
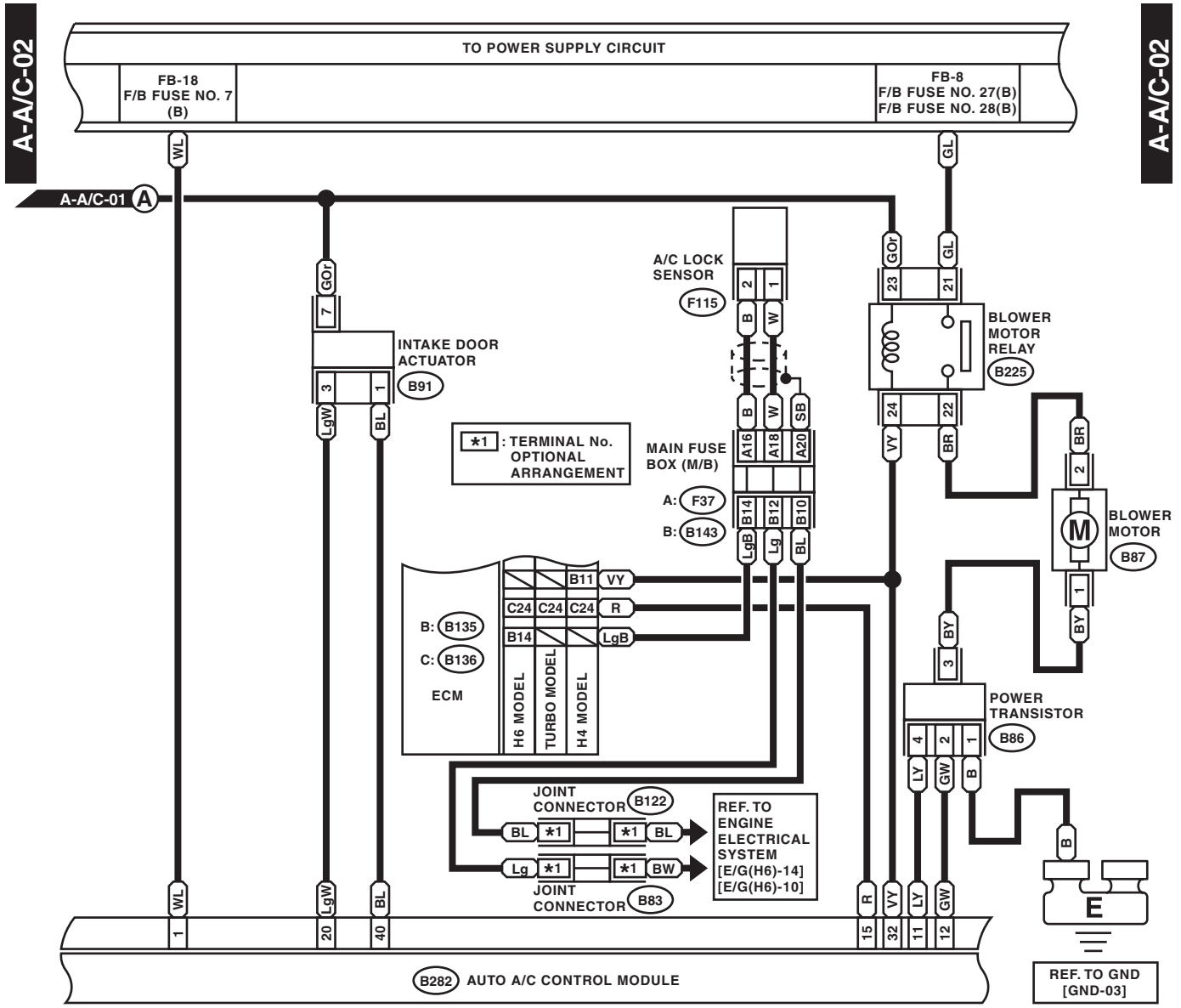
A-A/C-01



WI-15838

# Air Conditioning System

WIRING SYSTEM



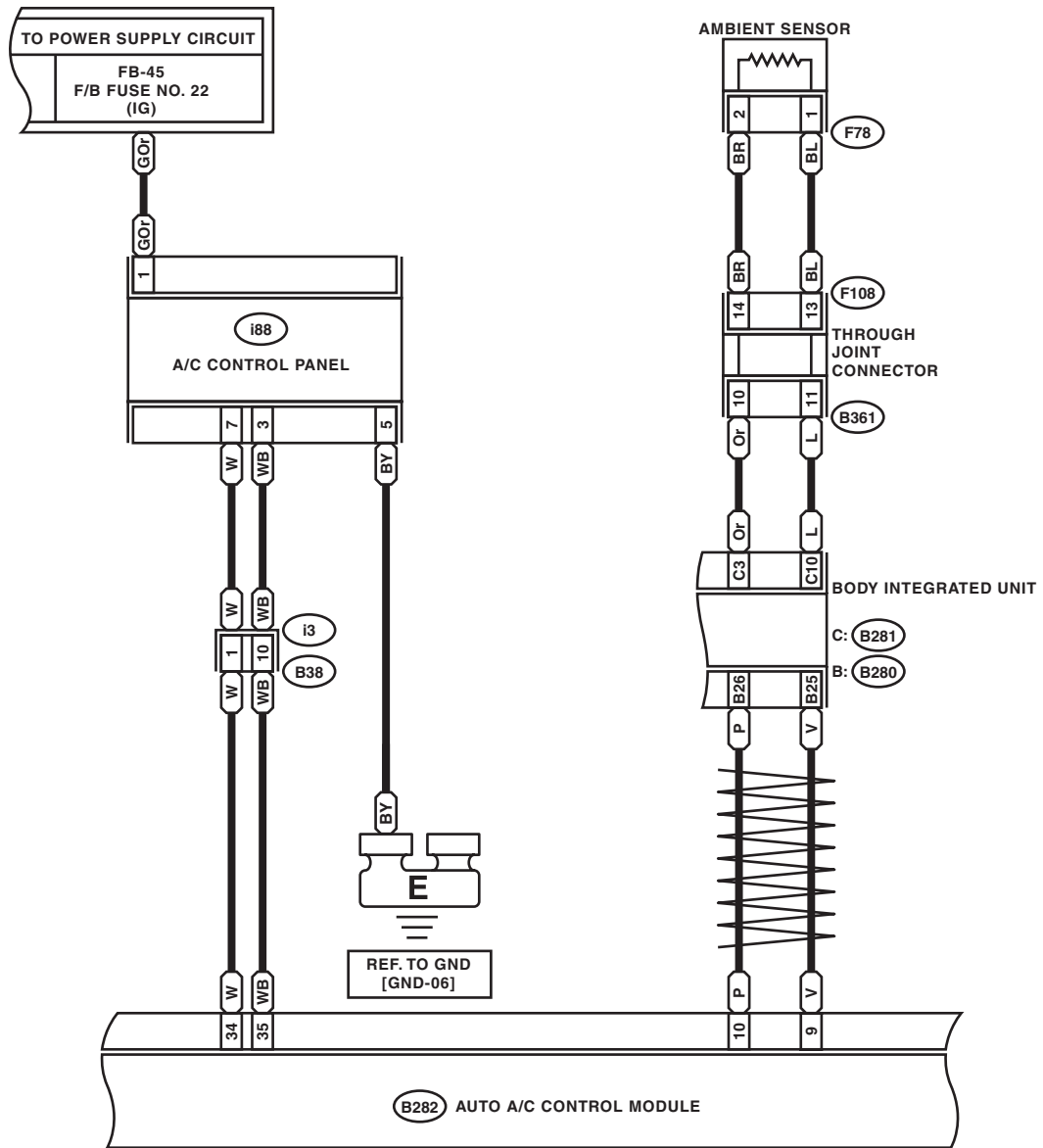
WI-15839

# Air Conditioning System

WIRING SYSTEM

A-A/C-03

A-A/C-03



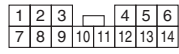
F78 (BLACK)



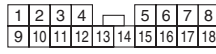
i88 (BLACK)



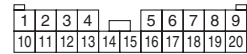
B361 (GRAY)



F108



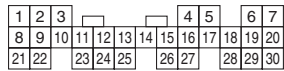
B38



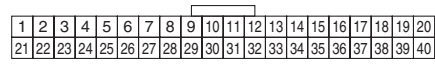
C: B281



B: B280



B282

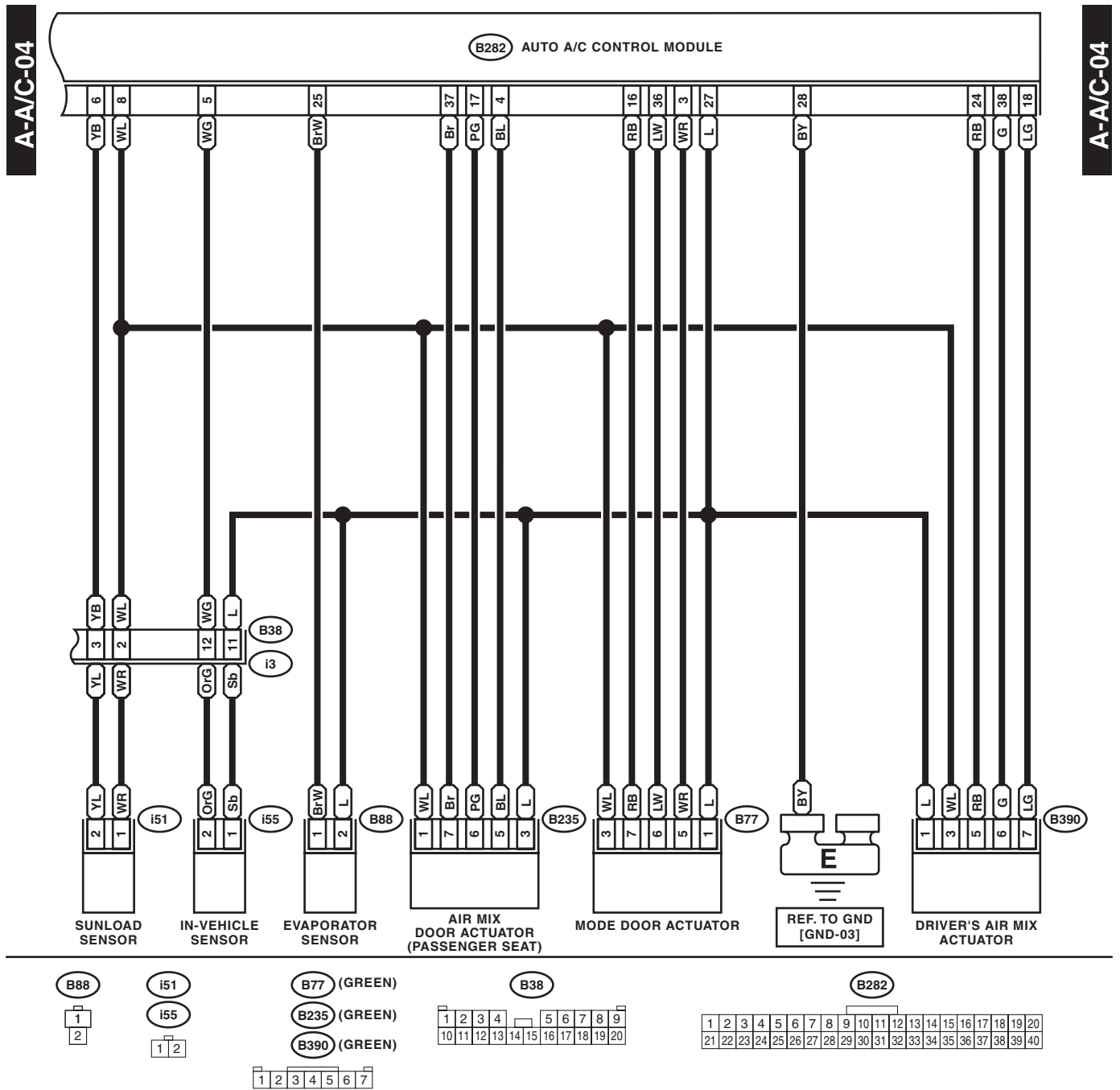


WI-15840



# Air Conditioning System

## WIRING SYSTEM



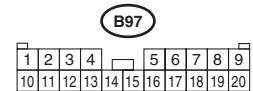
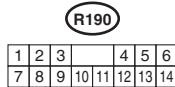
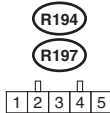
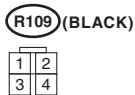
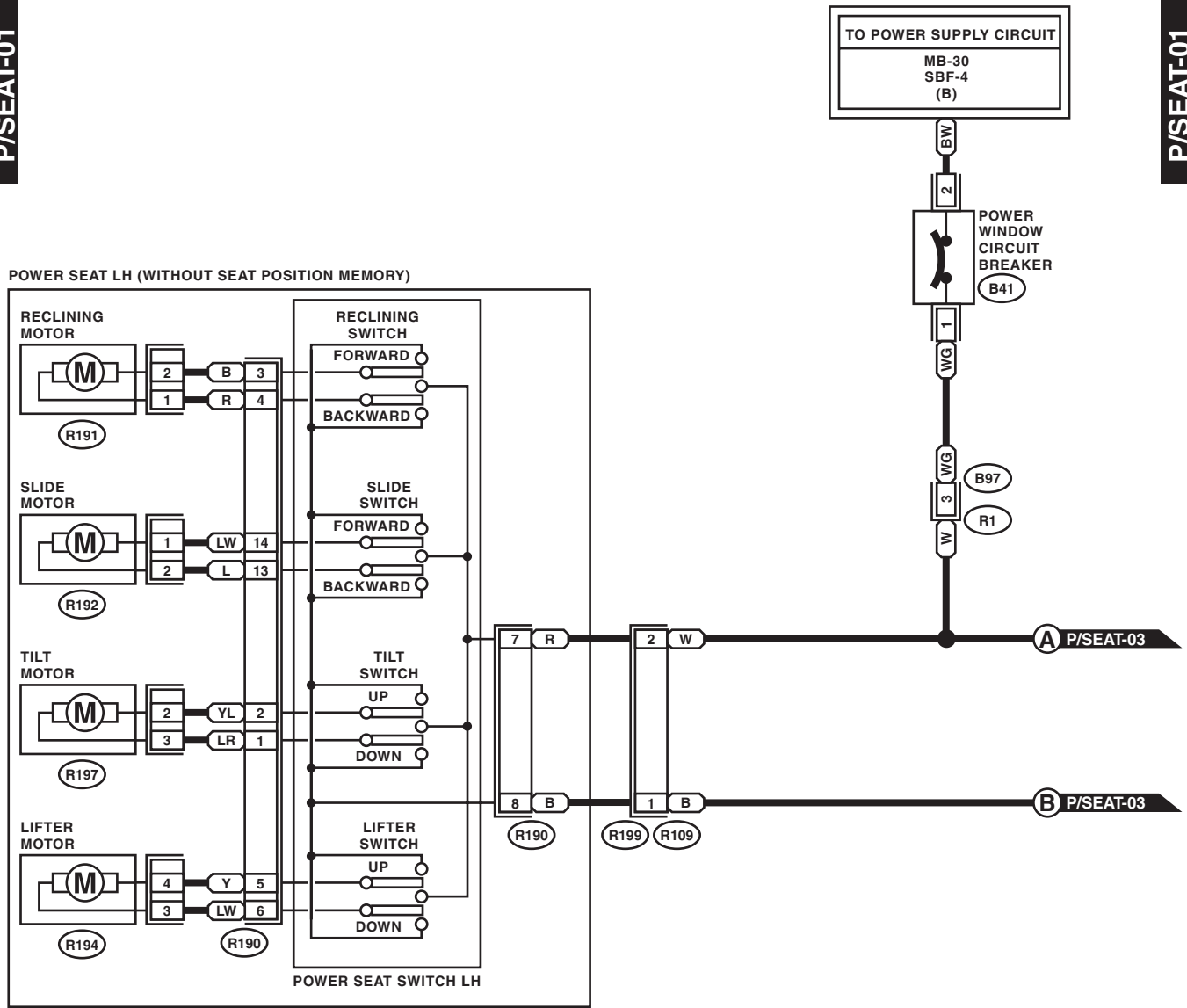
WI-15841

## 16. Power Seat System

### A: WIRING DIAGRAM

P/SEAT-01

P/SEAT-01



# Power Seat System

## WIRING SYSTEM

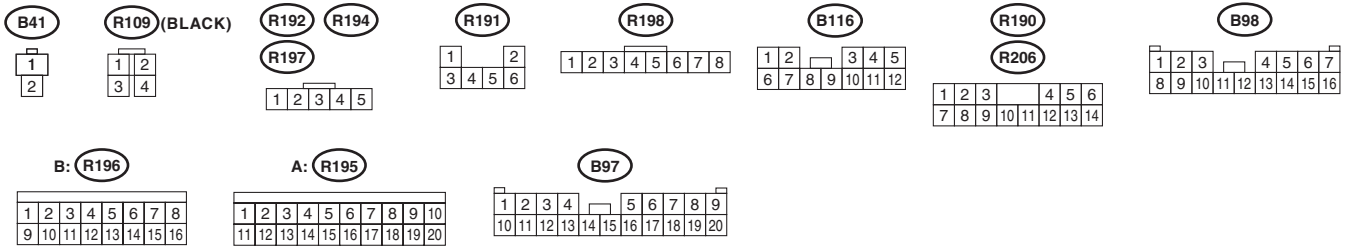
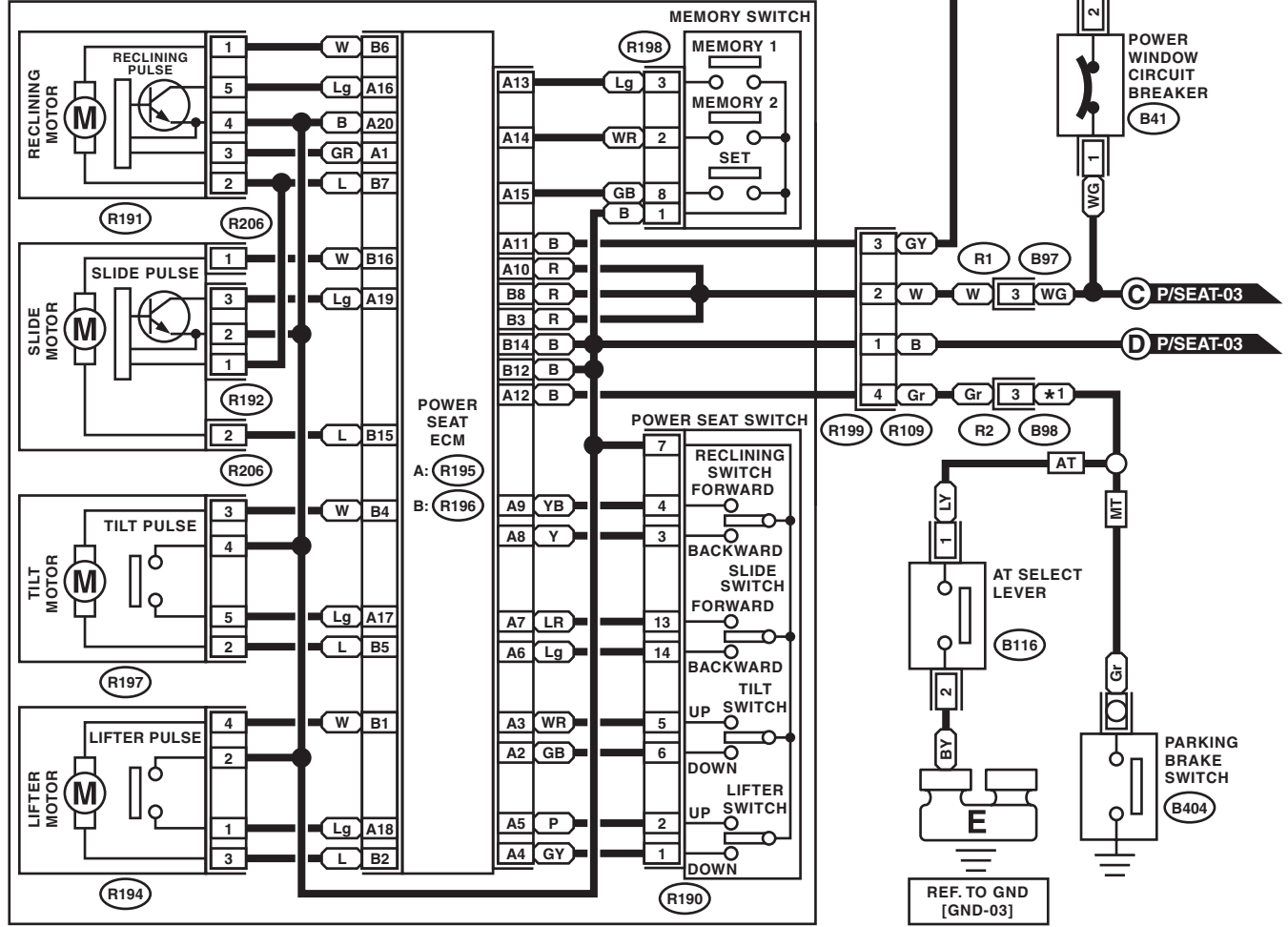
P/SEAT-02

P/SEAT-02

\*1 : MT MODEL : GY  
AT MODEL : LY

TO POWER SUPPLY CIRCUIT  
FB-48 F/B FUSE NO. 4 (IG)      MB-30 SBF-4 (B)

### POWER SEAT LH (WITH SEAT POSITION MEMORY)



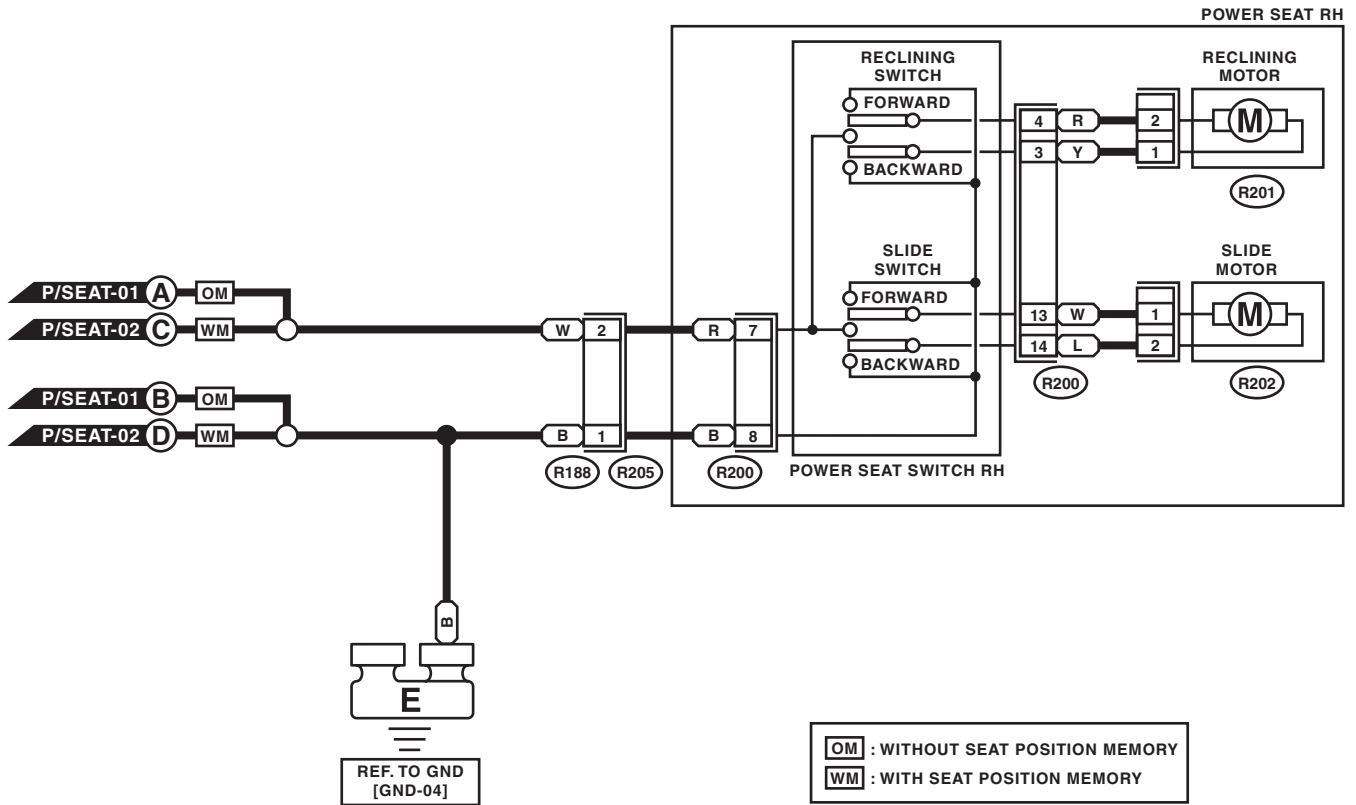
WI-15843

# Power Seat System

WIRING SYSTEM

P/SEAT-03

P/SEAT-03



R188 (BLACK)

R200

1	2
---	---

1	2	3	4	5	6
7	8	9	10	11	12
13	14				

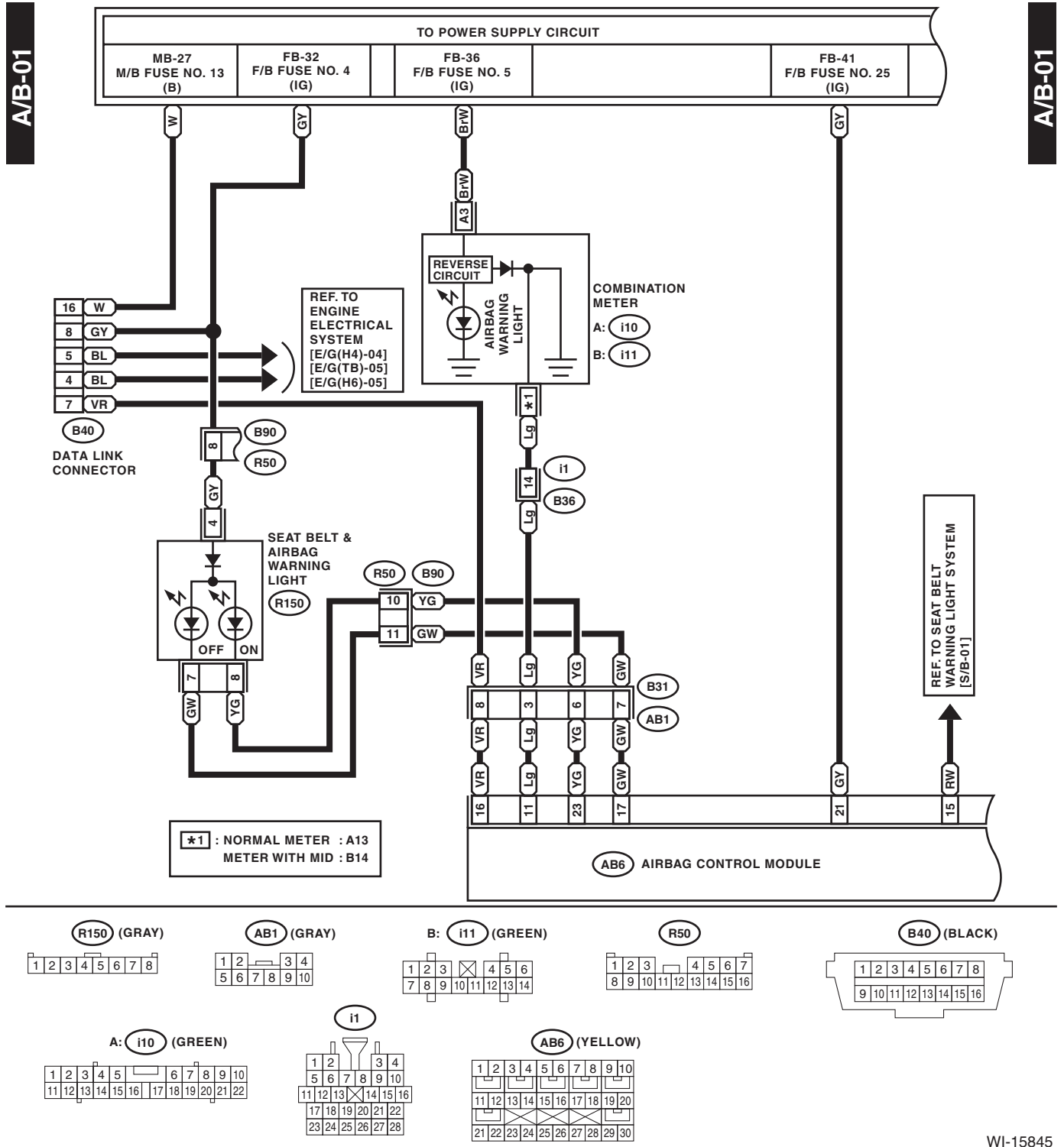
WI-15844

# Airbag System

WIRING SYSTEM

## 17. Airbag System

### A: WIRING DIAGRAM



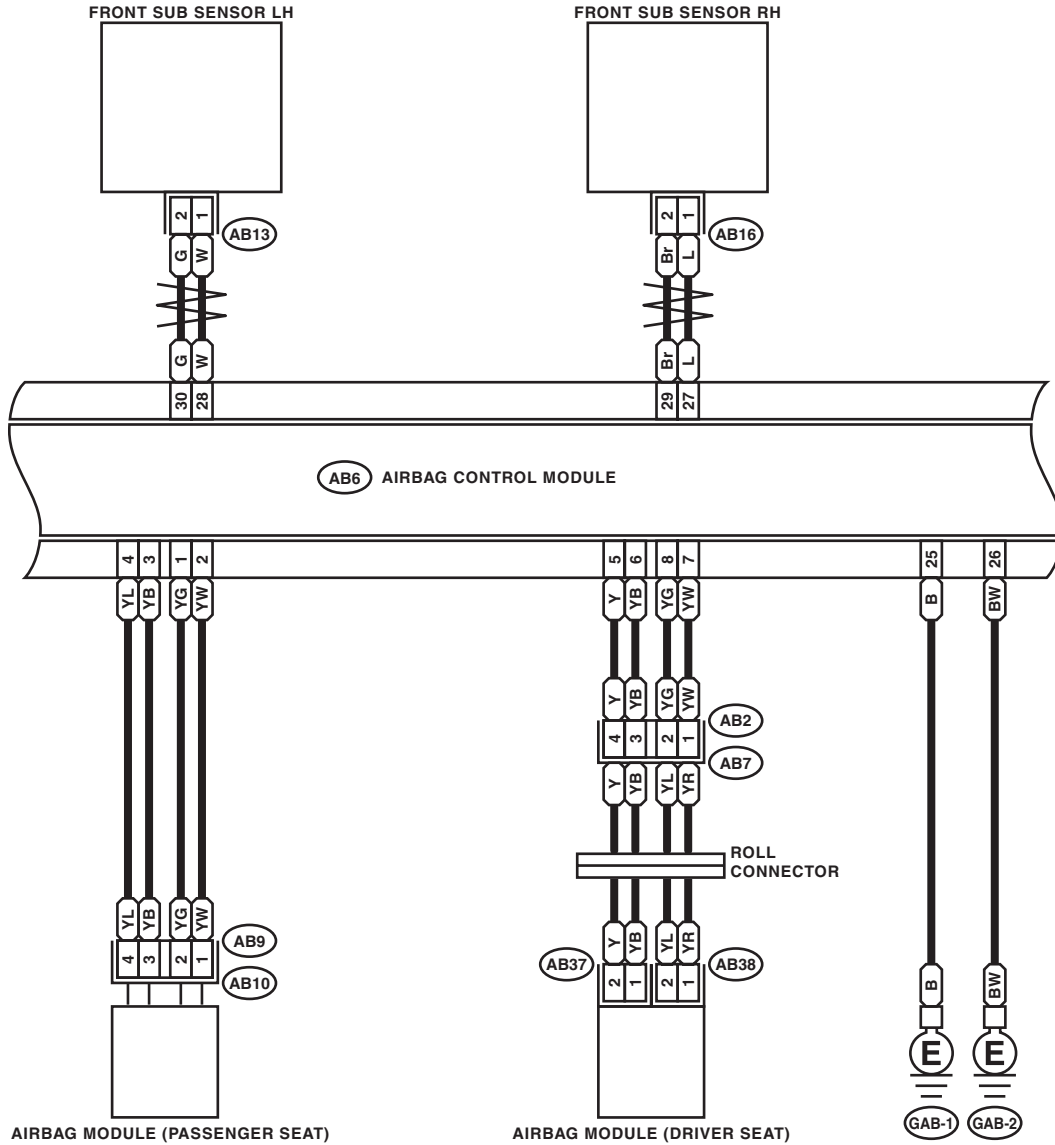
WI-15845

# Airbag System

WIRING SYSTEM

A/B-02

A/B-02



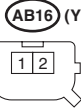
AB37 (ORANGE)



AB38 (BLACK)



AB13 (YELLOW)



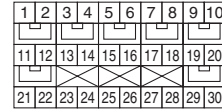
AB16 (YELLOW)

AB2 (YELLOW)



AB9 (YELLOW)

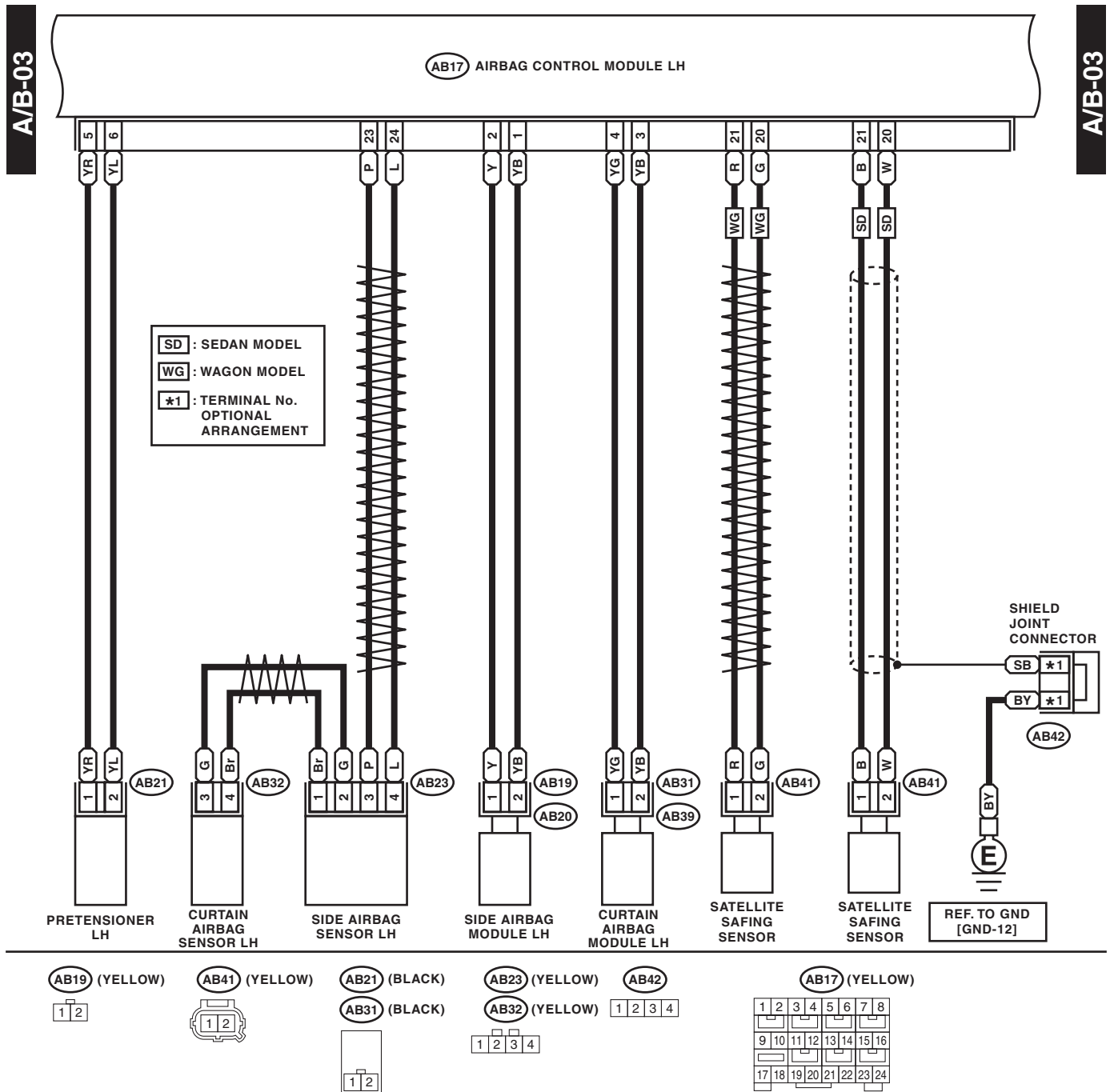
AB6 (YELLOW)



WI-15846

# Airbag System

## WIRING SYSTEM



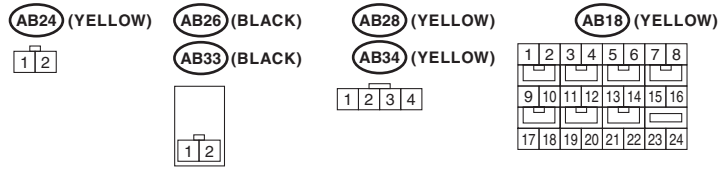
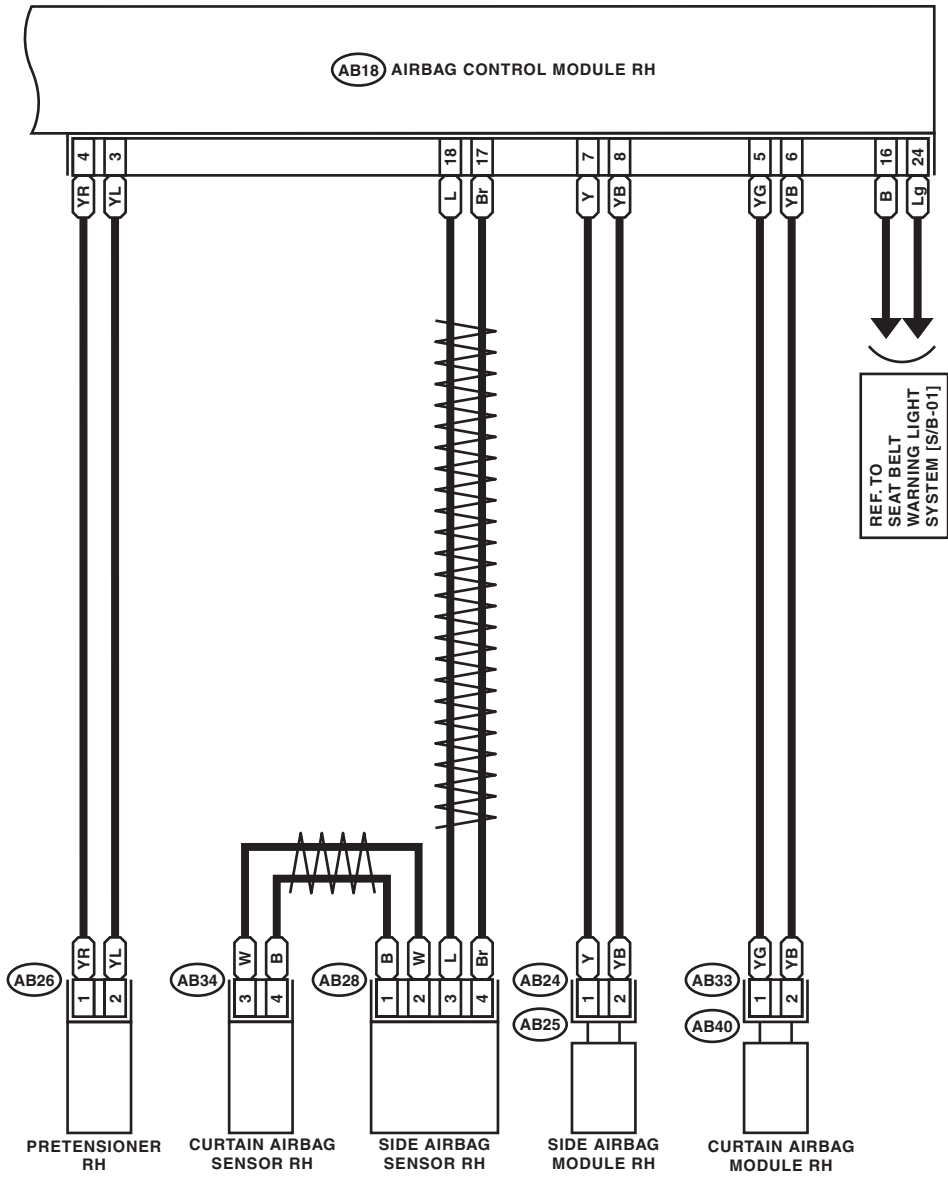
WI-15847

# Airbag System

WIRING SYSTEM

A/B-04

A/B-04



WI-15848

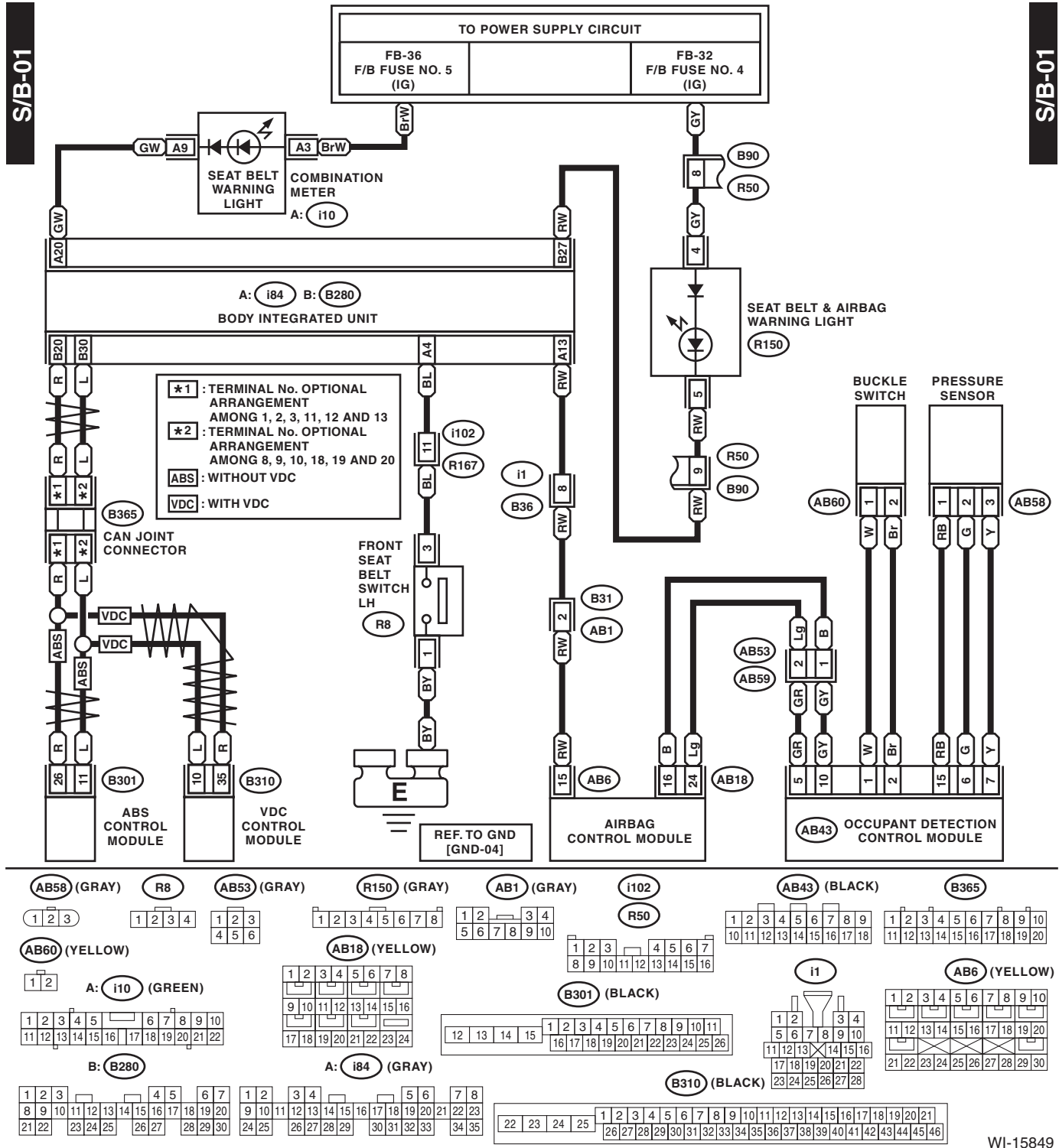


# Seat Belt Warning System

WIRING SYSTEM

## 18. Seat Belt Warning System

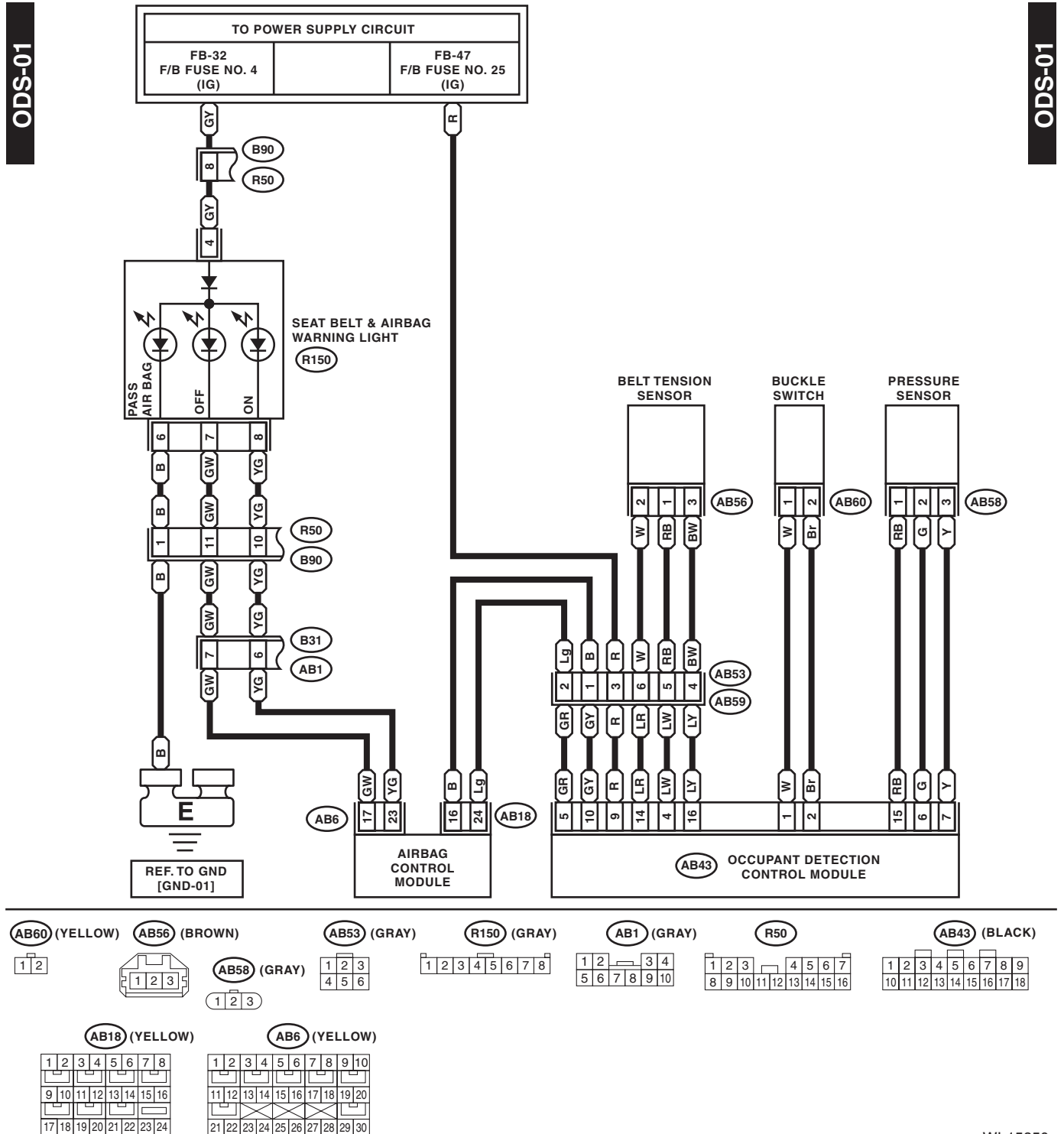
### A: WIRING DIAGRAM



WI-15849

## 19. Occupant Detection System

### A: WIRING DIAGRAM



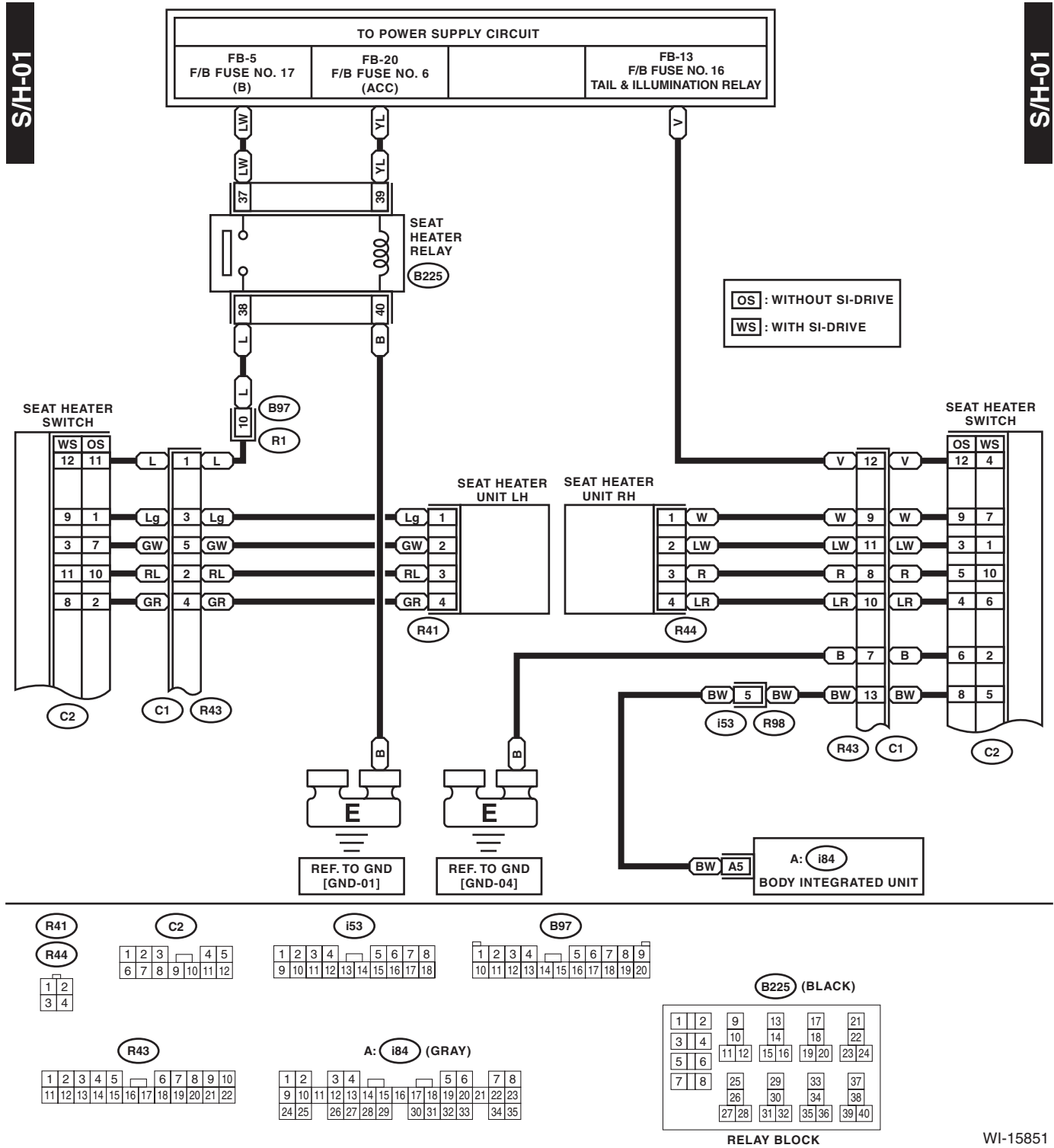
WI-15850

# Seat Heater System

WIRING SYSTEM

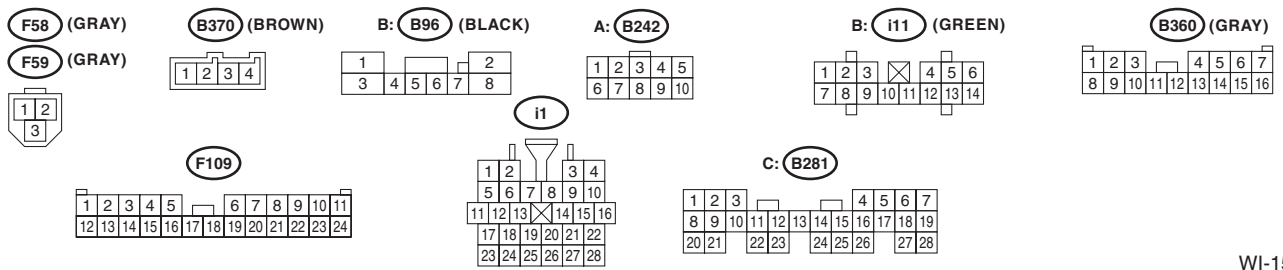
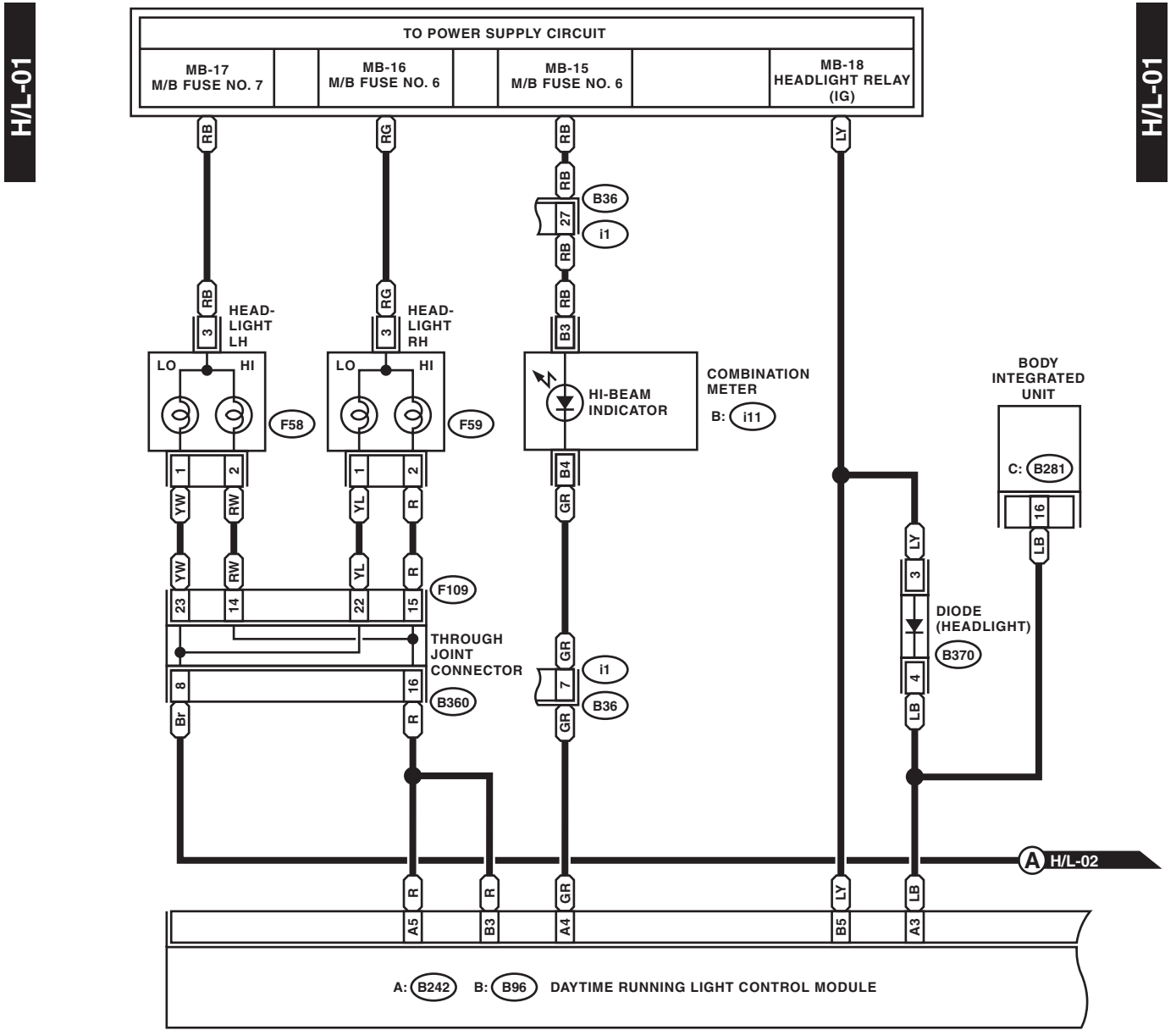
## 20. Seat Heater System

### A: WIRING DIAGRAM



## 21. Headlight System

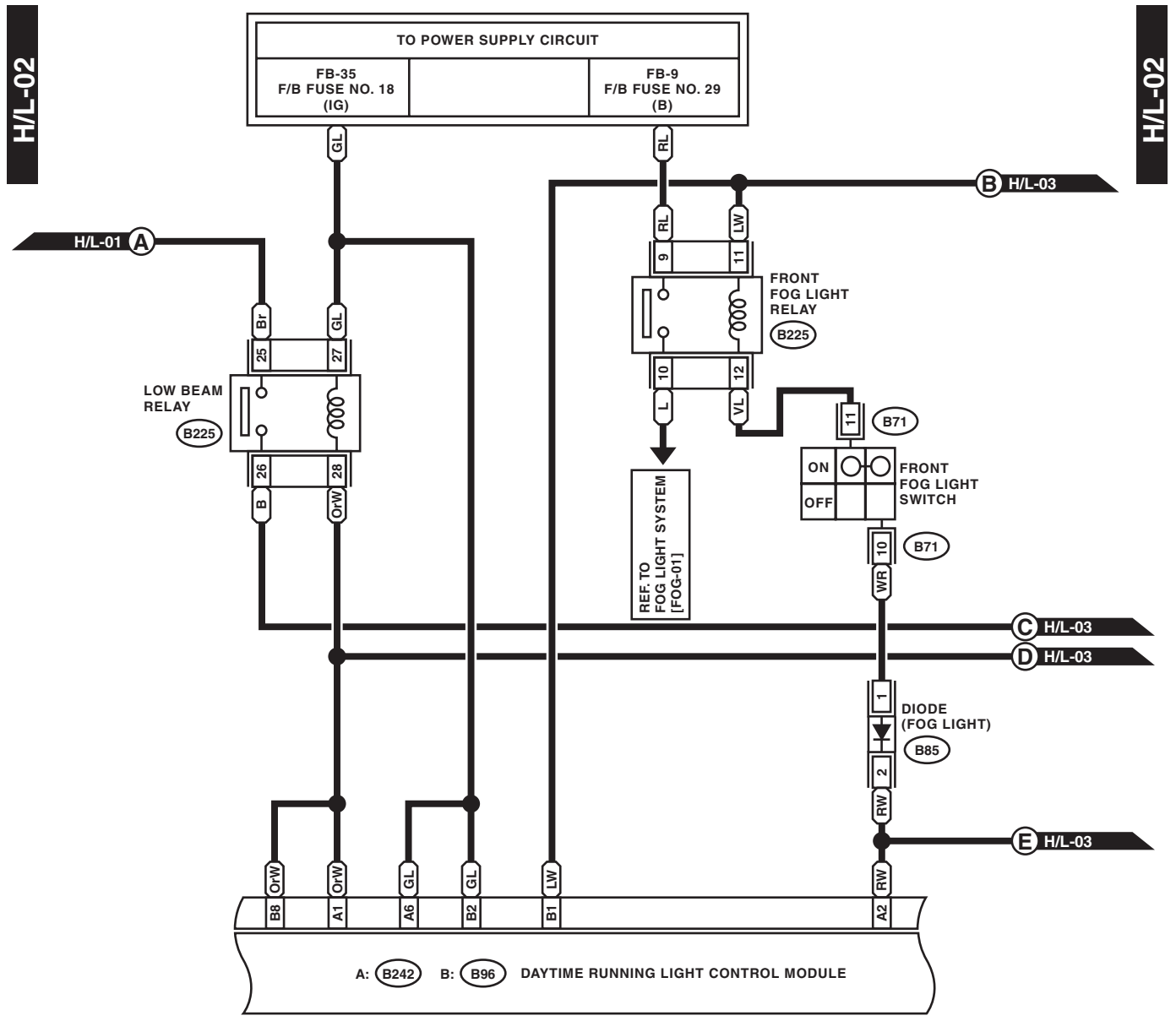
### A: WIRING DIAGRAM



WI-15852

# Headlight System

## WIRING SYSTEM



B85 (BLACK)

B: B96 (BLACK)

A: B242

B71

B225 (BLACK)

1	2
---	---

1	2	3	4	5	6	7	8
3	4	5	6	7	8		

1	2	3	4	5
6	7	8	9	10

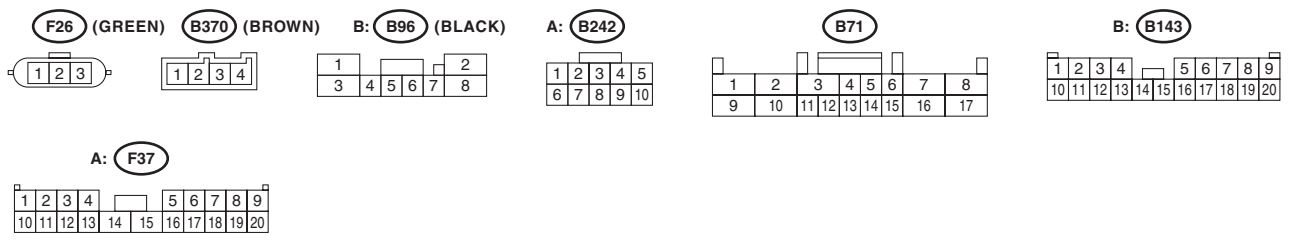
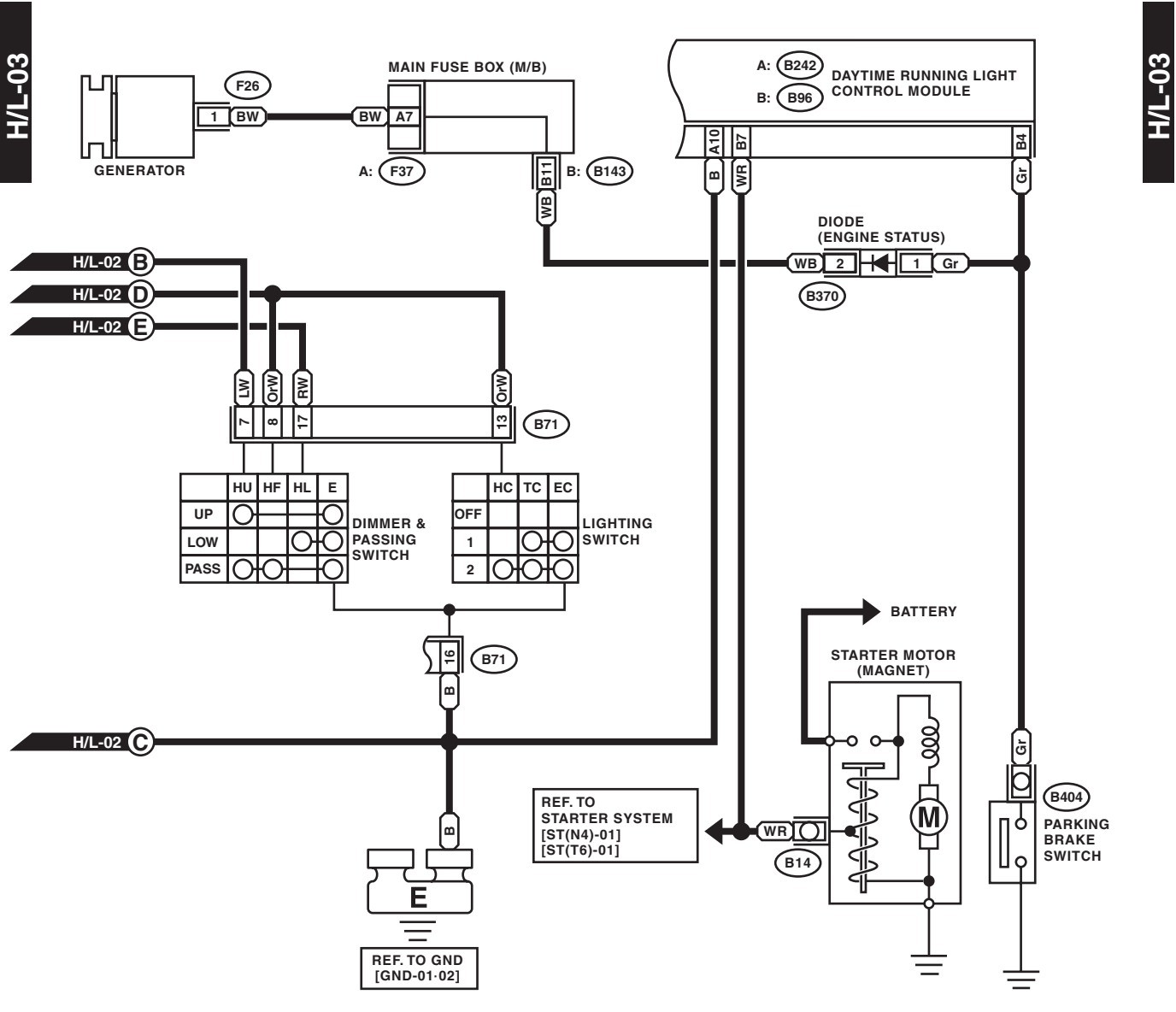
1	2	3	4	5	6	7	8	
9	10	11	12	13	14	15	16	17

1	2	9	13	17	21				
3	4	10	14	18	22				
5	6	11	15	19	23	24			
7	8	25	29	33	37				
		26	30	34	38				
		27	28	31	32	35	36	39	40

RELAY BLOCK

# Headlight System

WIRING SYSTEM



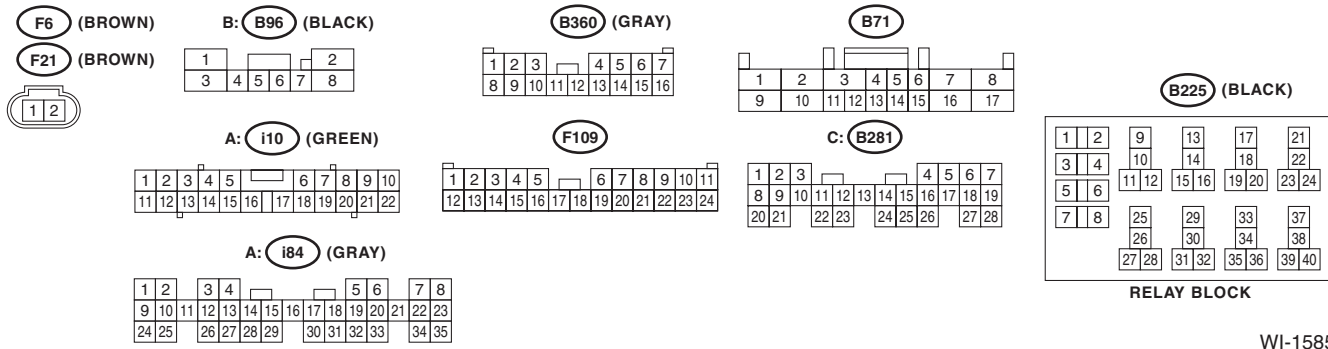
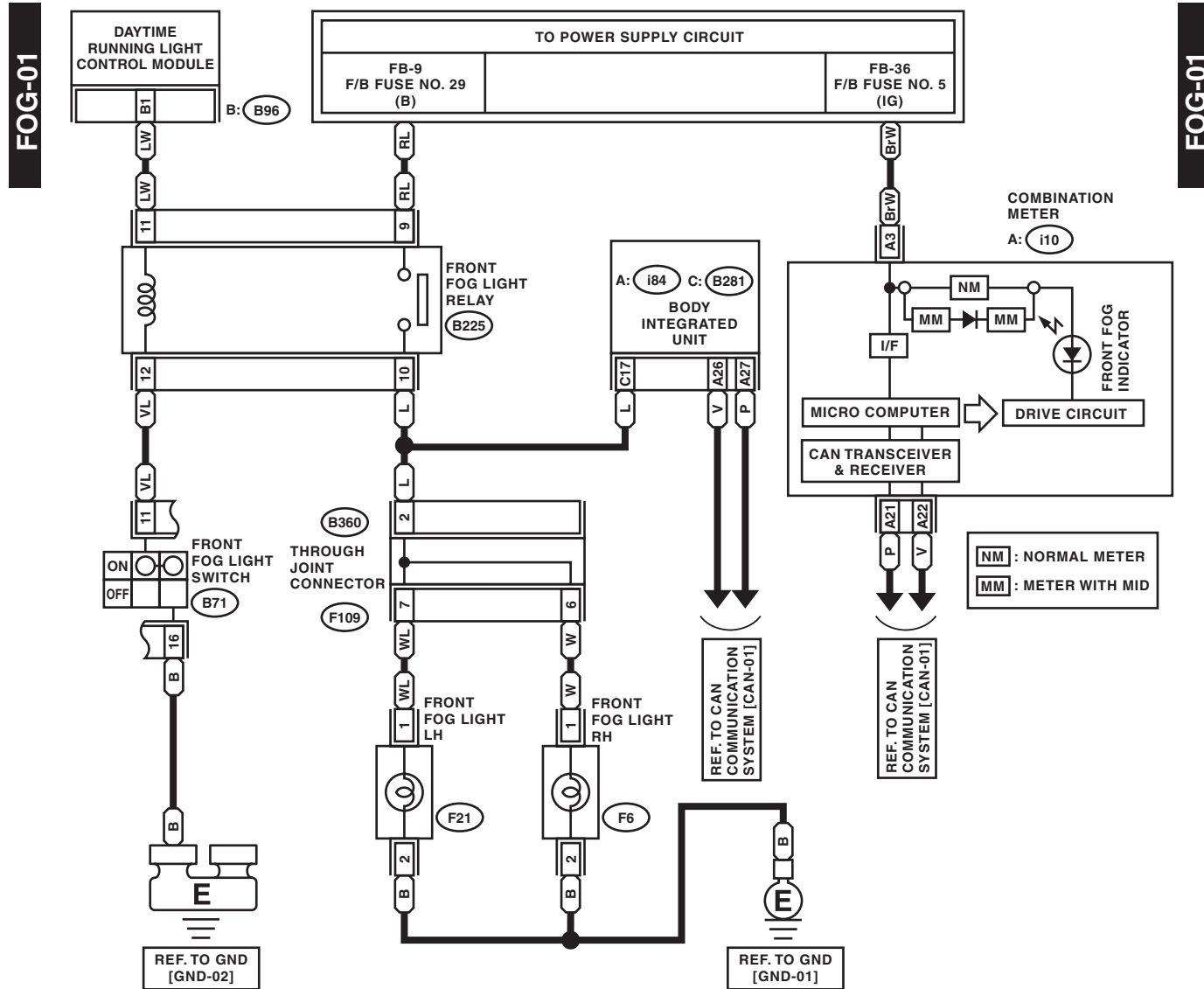
WI-15853

# Front Fog Light System

WIRING SYSTEM

## 22. Front Fog Light System

### A: WIRING DIAGRAM

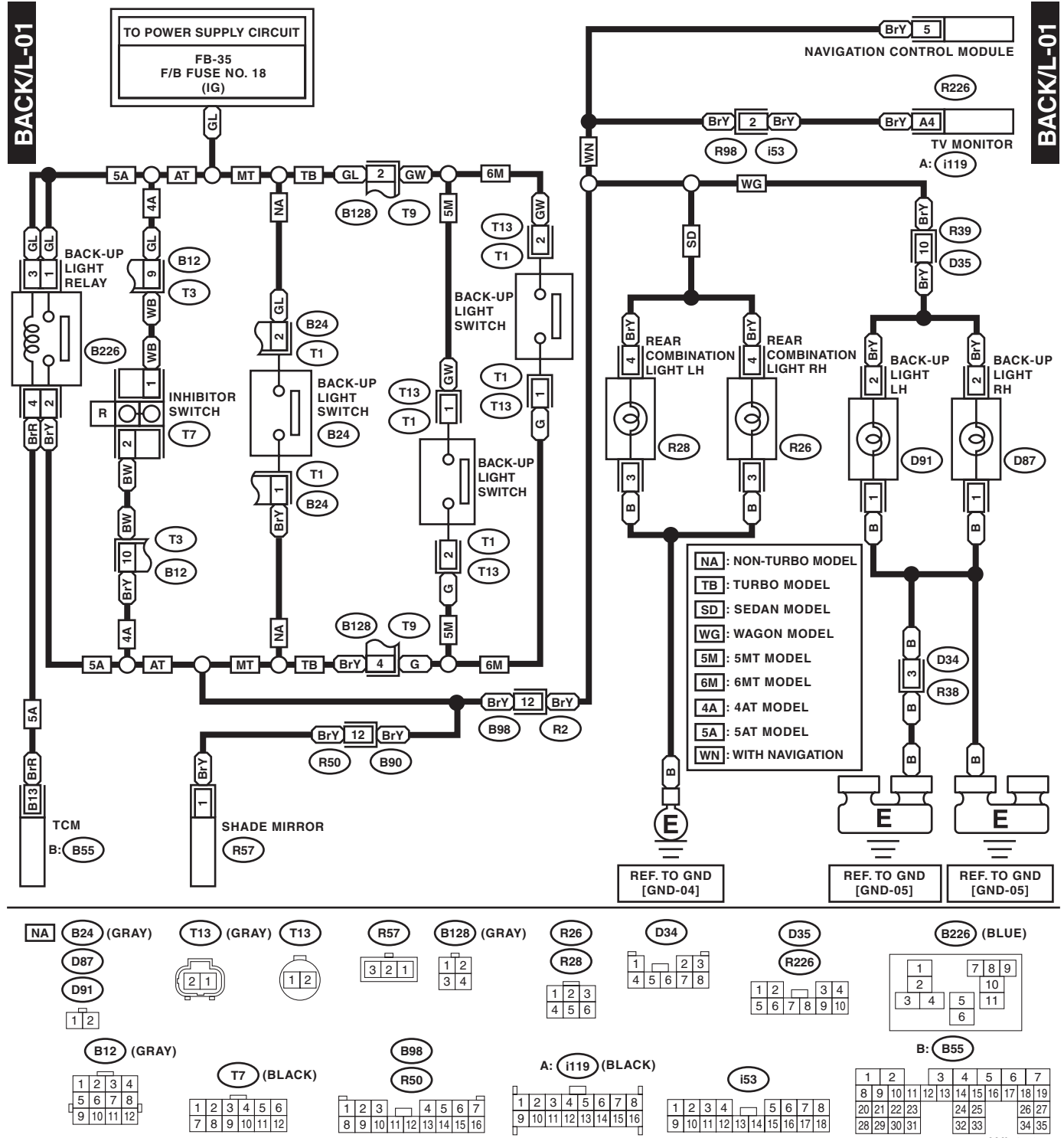


WI-15854

## 23. Back-up Light System

### A: WIRING DIAGRAM

#### 1. TRANSMISSION SERIAL NO. 4078112 OR EARLIER



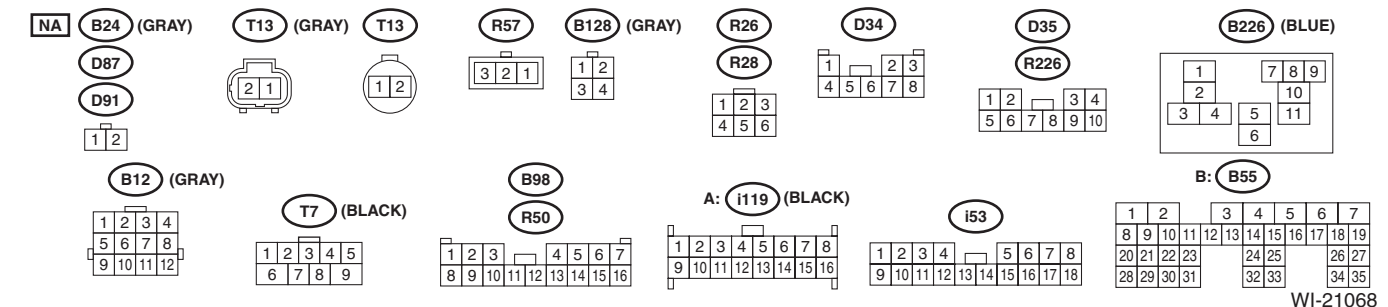
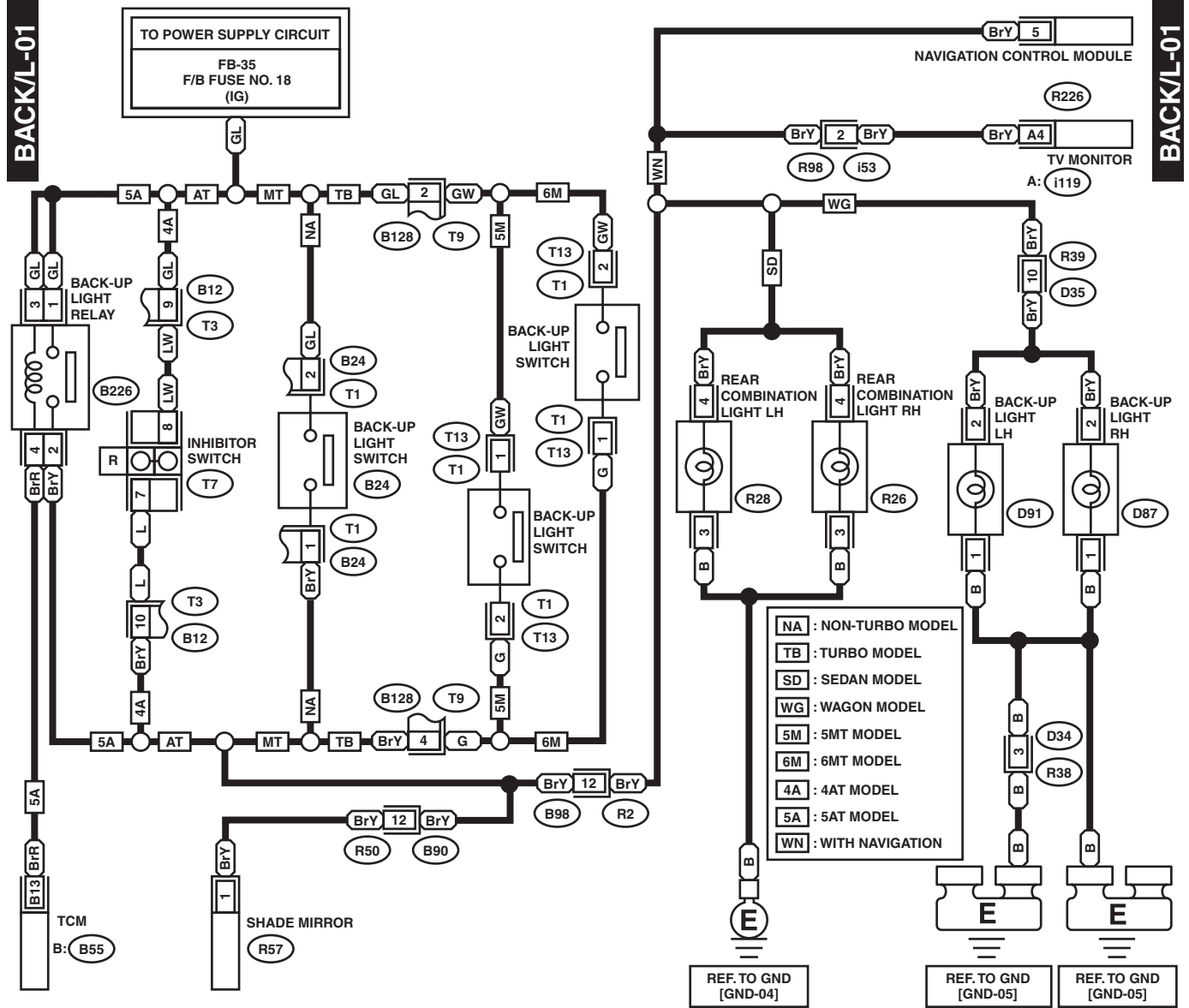
WI-15855



# Back-up Light System

WIRING SYSTEM

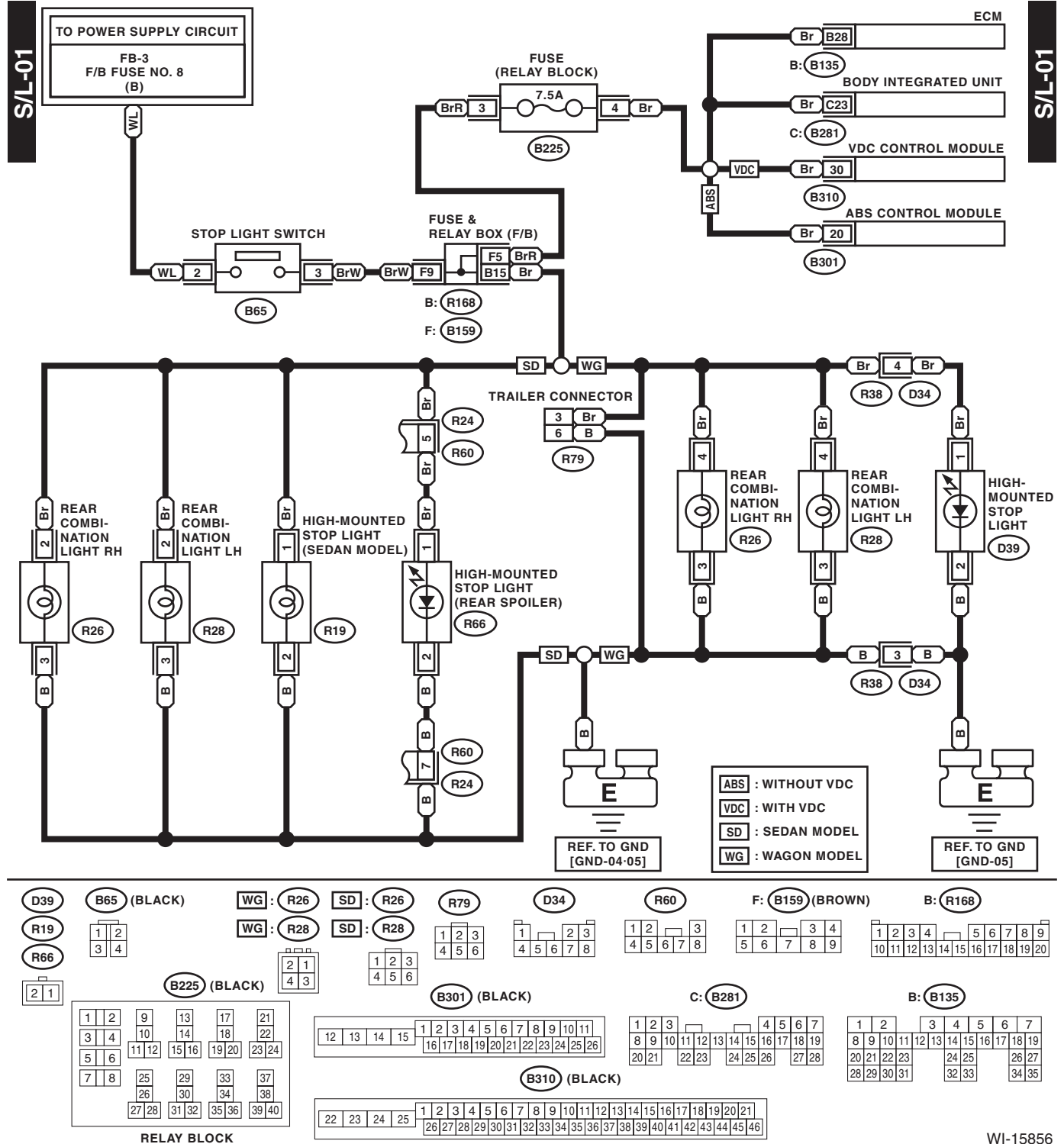
## 2. TRANSMISSION SERIAL NO. 4078113 OR LATER



WI-21068

## 24. Stop Light System

### A: WIRING DIAGRAM



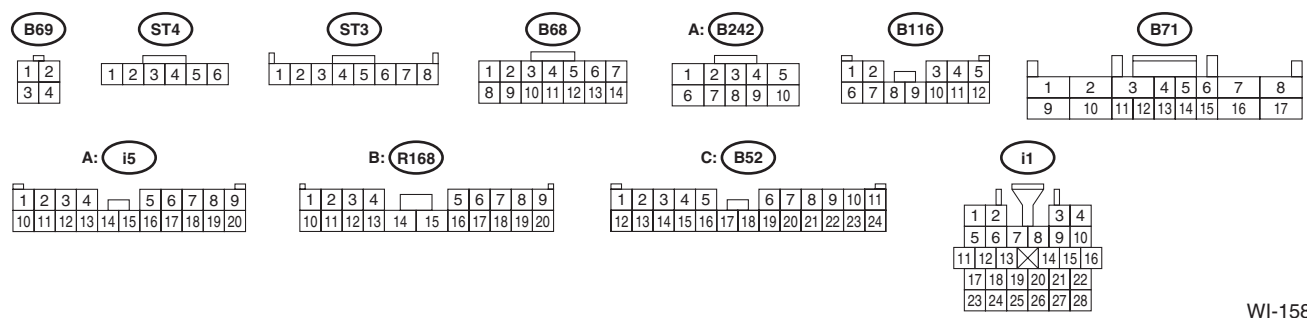
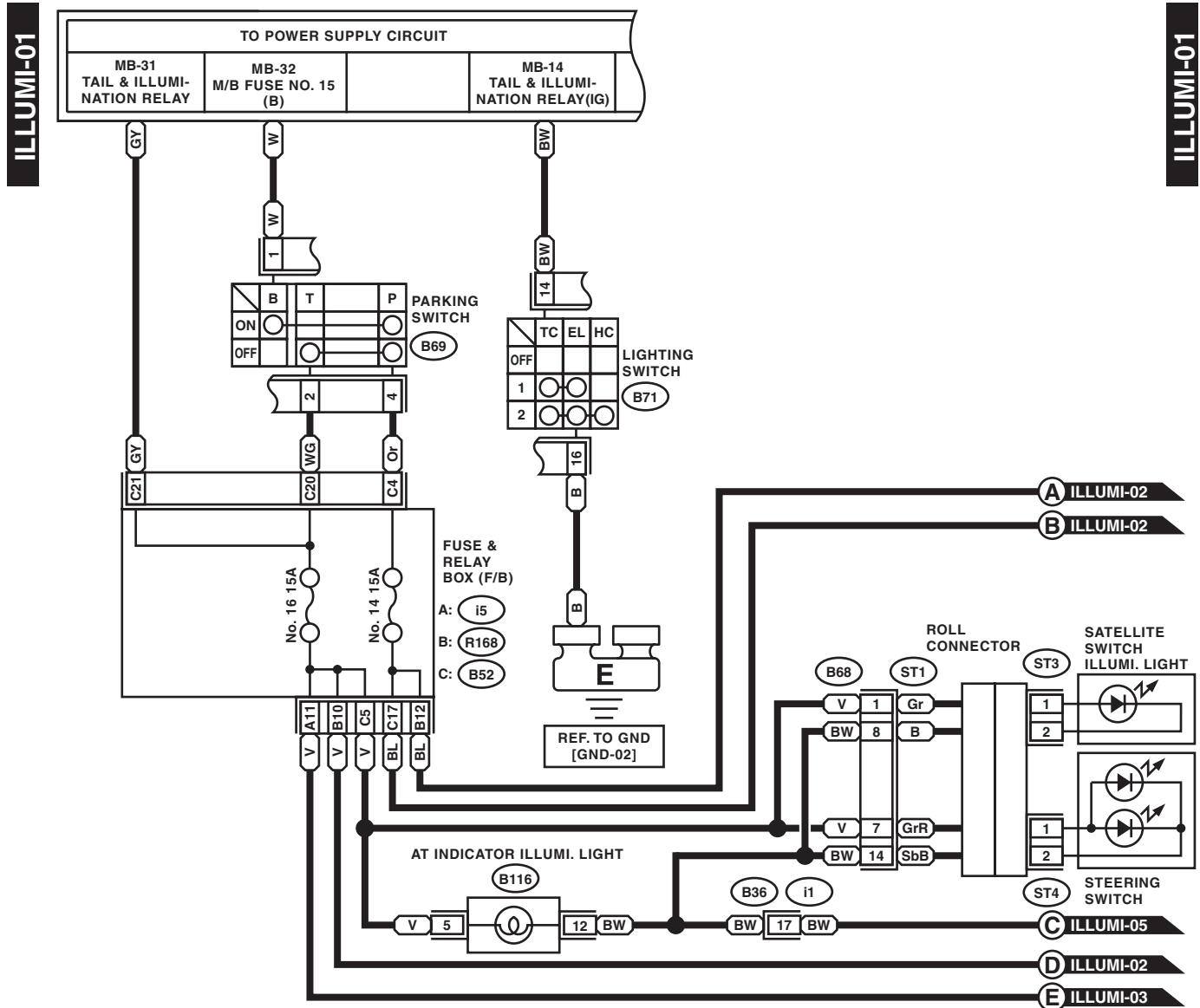
WI-15856

# Clearance Light and Illumination Light System

WIRING SYSTEM

## 25. Clearance Light and Illumination Light System

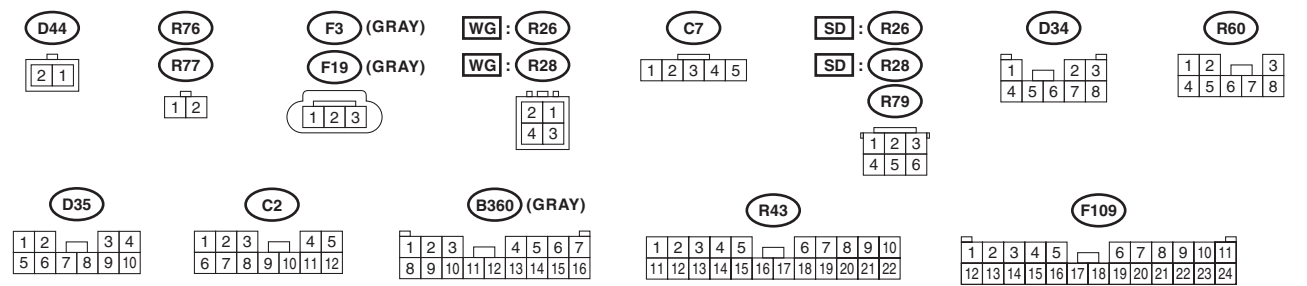
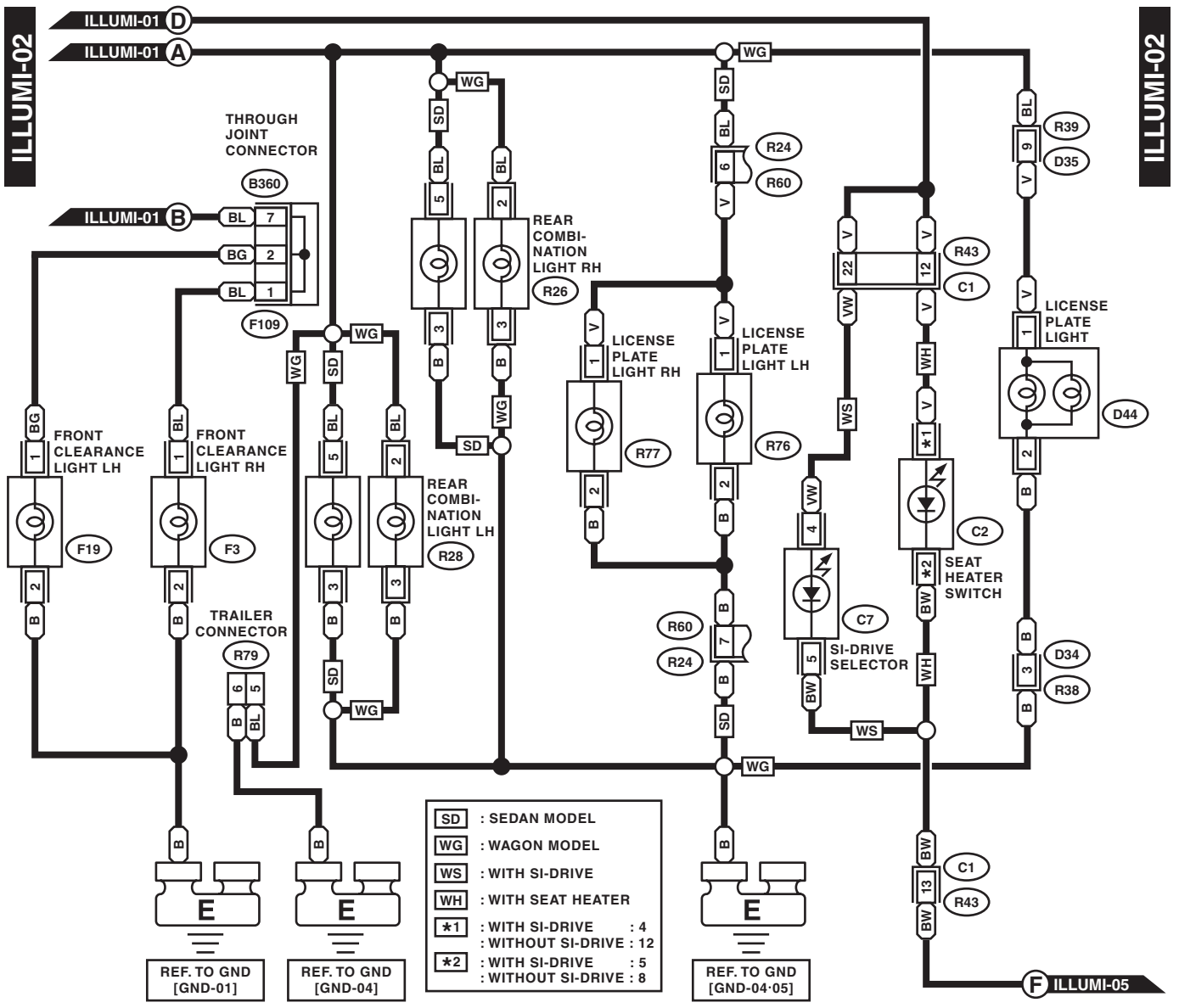
### A: WIRING DIAGRAM



WI-15857

# Clearance Light and Illumination Light System

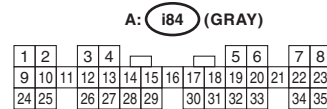
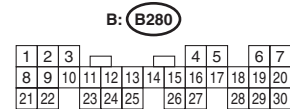
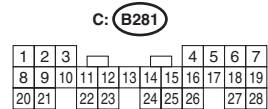
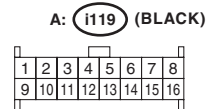
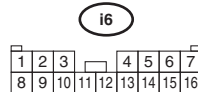
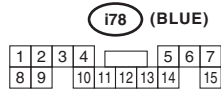
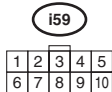
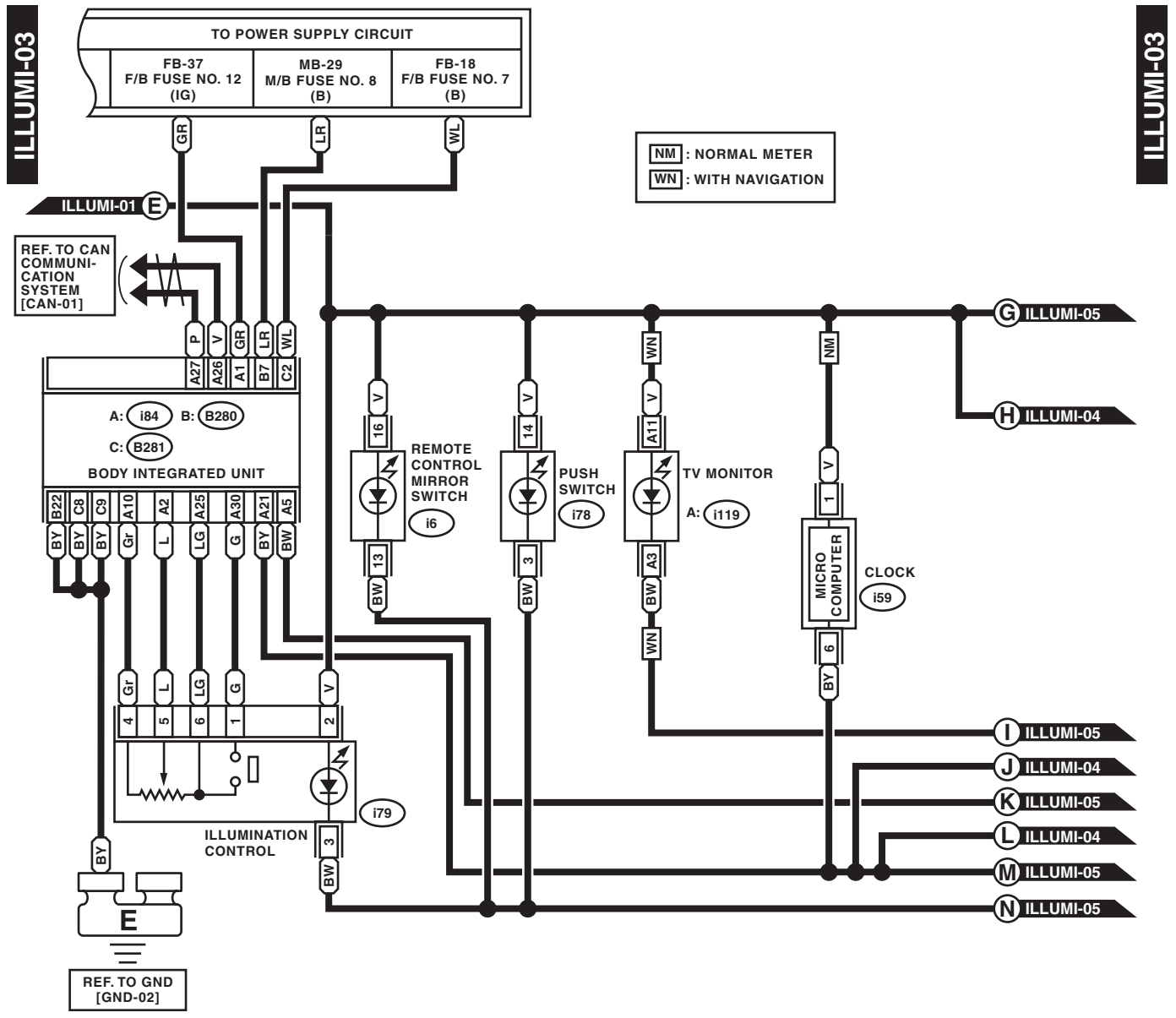
WIRING SYSTEM



WI-15858

# Clearance Light and Illumination Light System

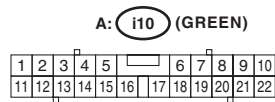
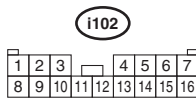
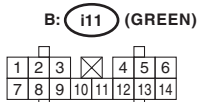
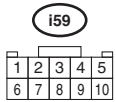
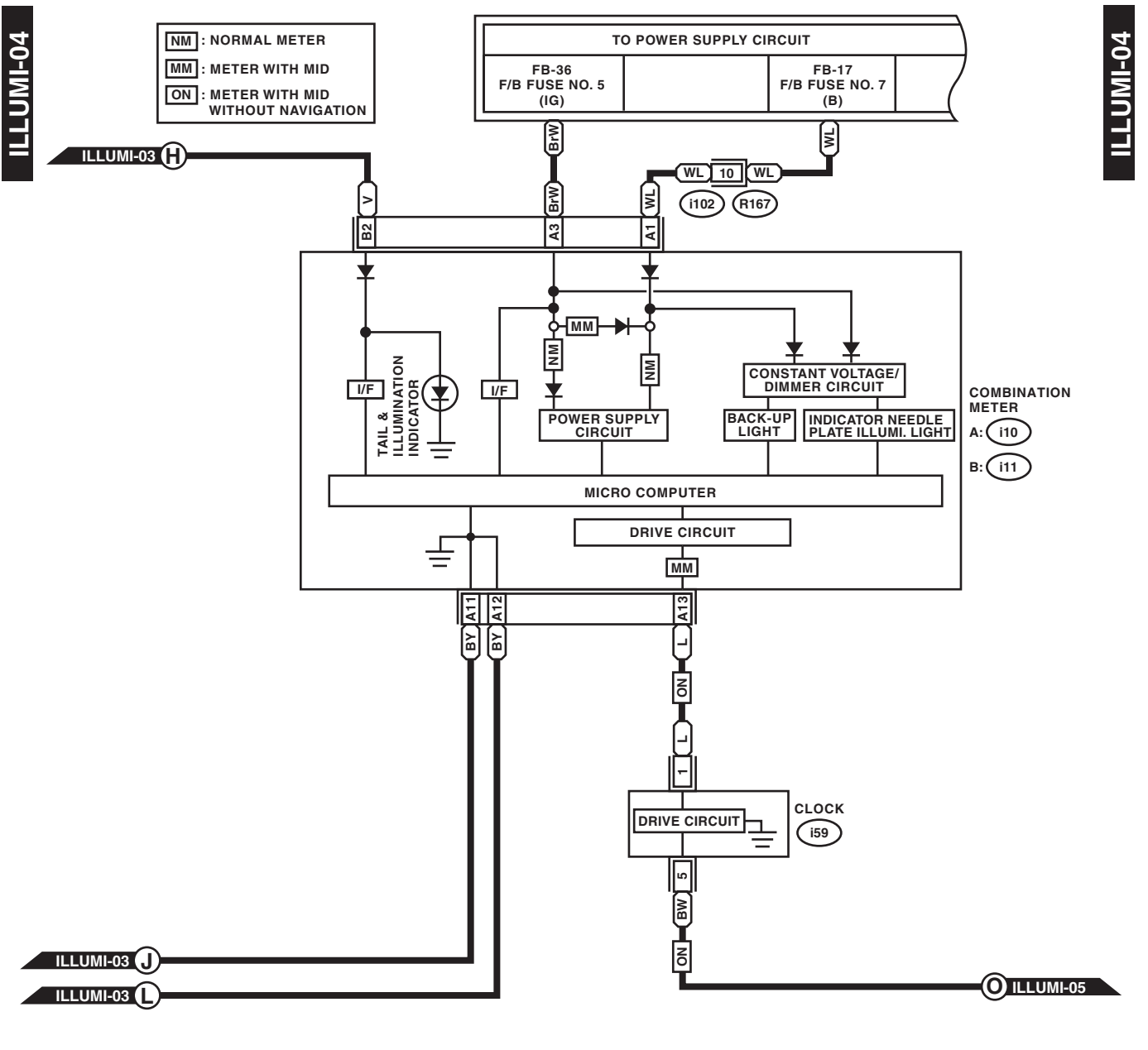
## WIRING SYSTEM



WI-15859

# Clearance Light and Illumination Light System

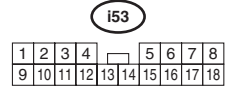
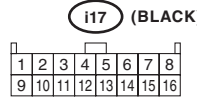
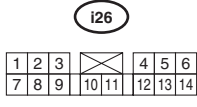
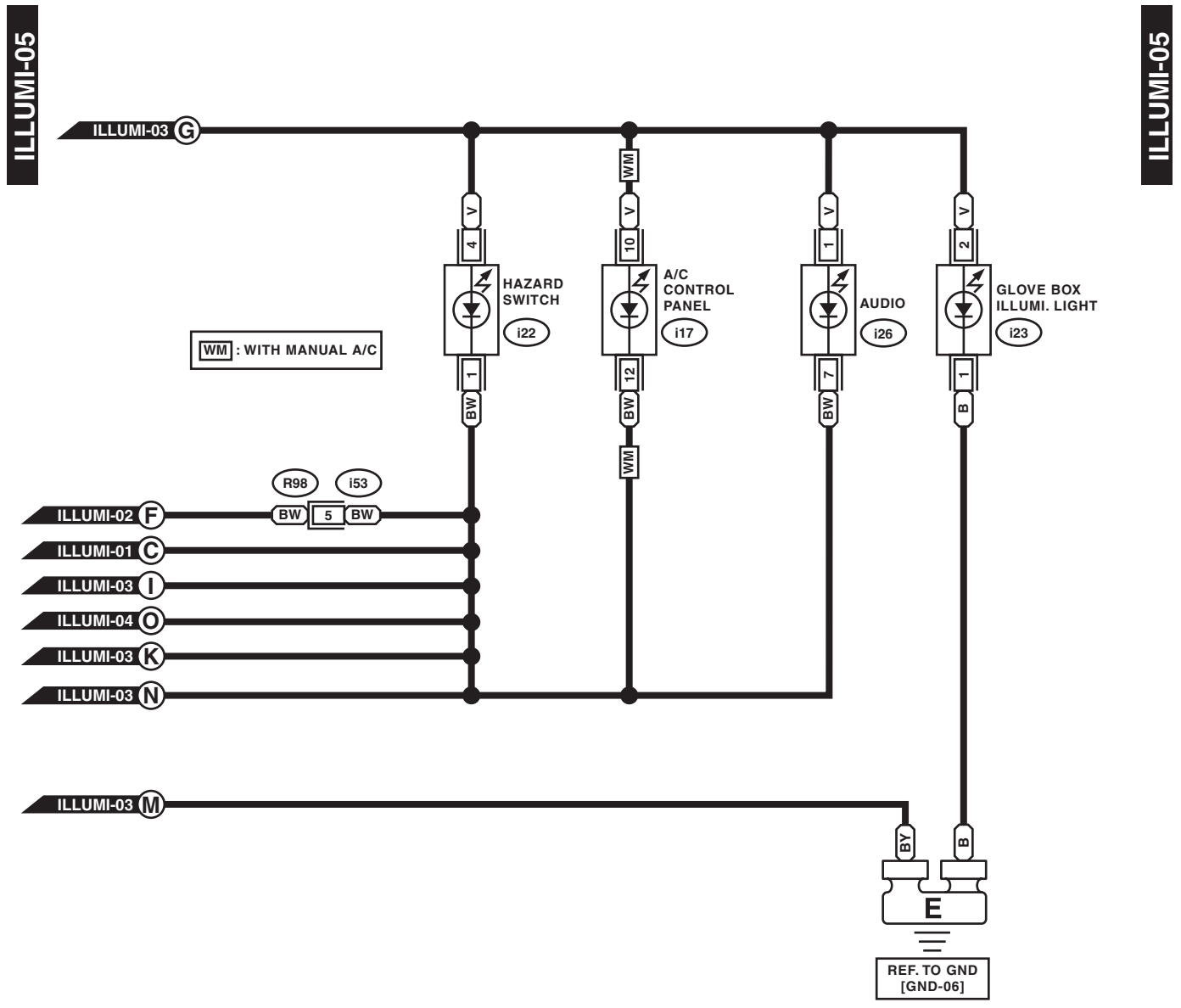
WIRING SYSTEM



WI-15860

# Clearance Light and Illumination Light System

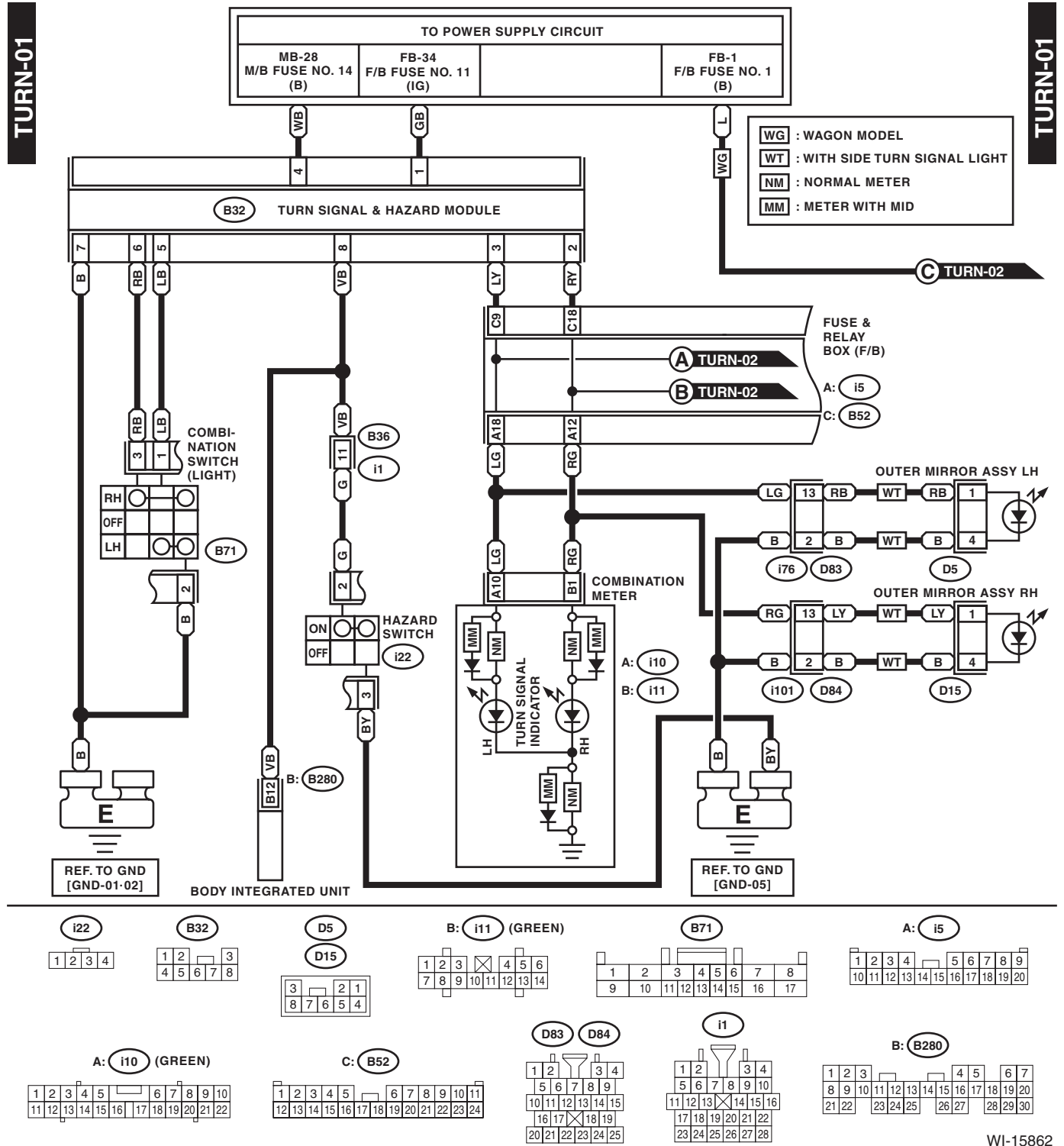
WIRING SYSTEM



WI-15861

## 26. Turn Signal Light and Hazard Light System

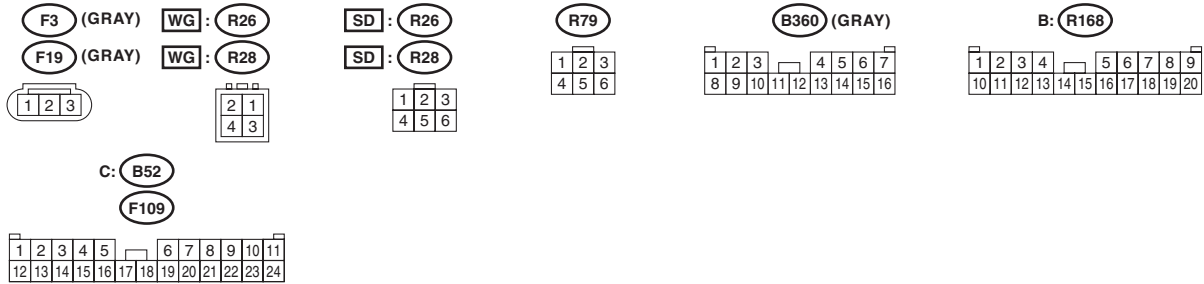
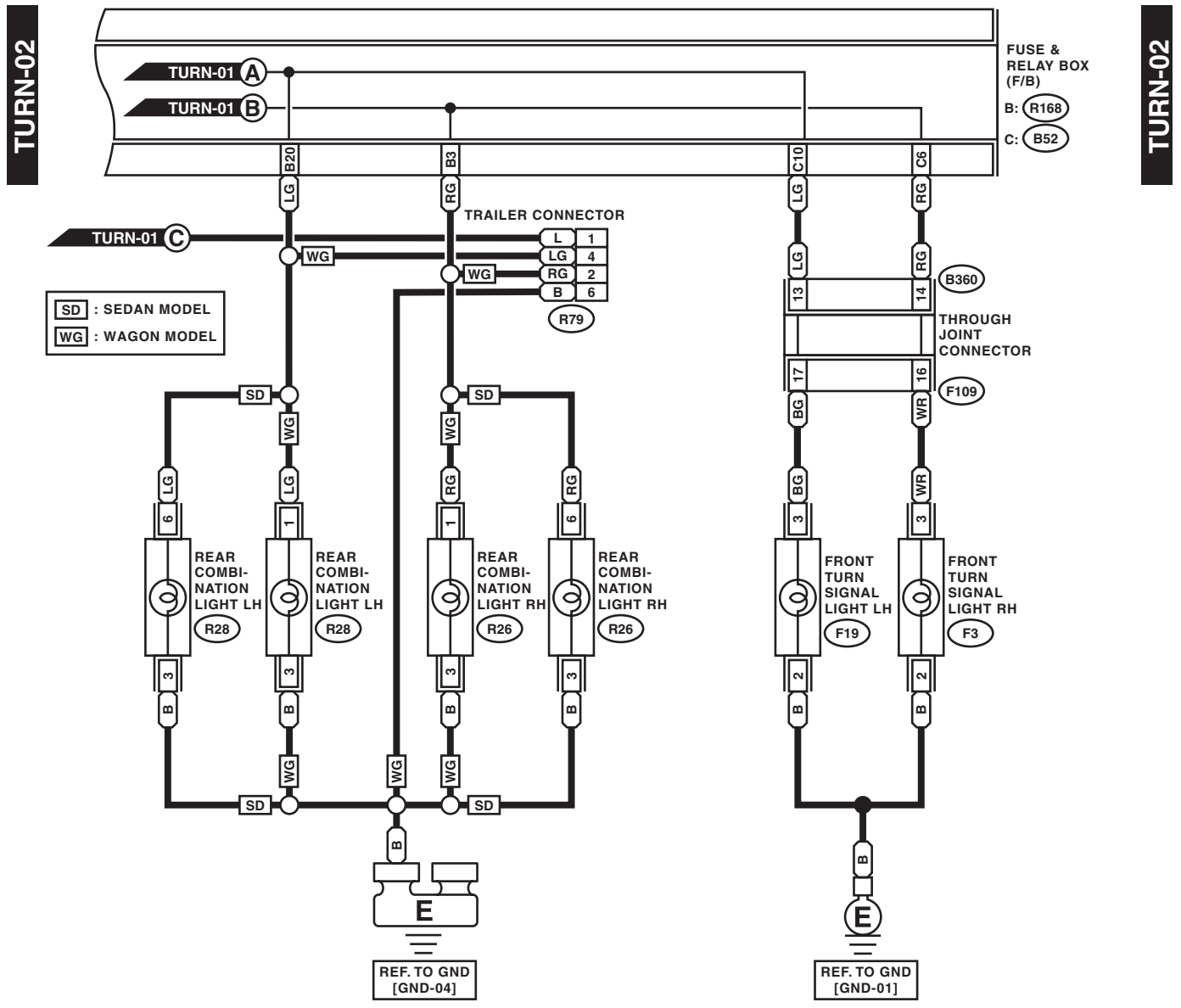
### A: WIRING DIAGRAM





# Turn Signal Light and Hazard Light System

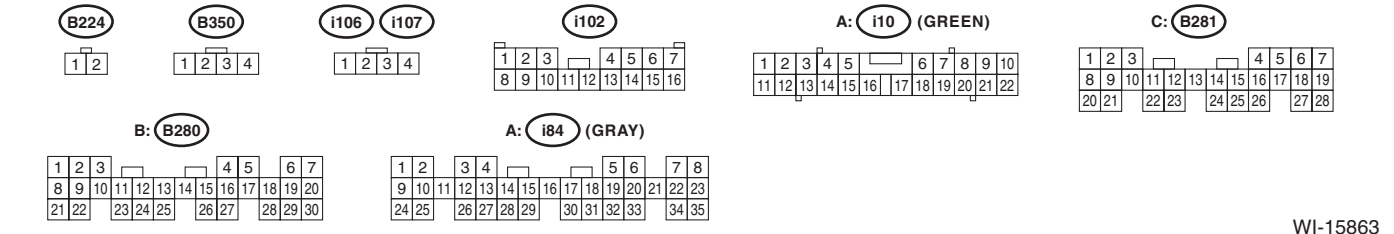
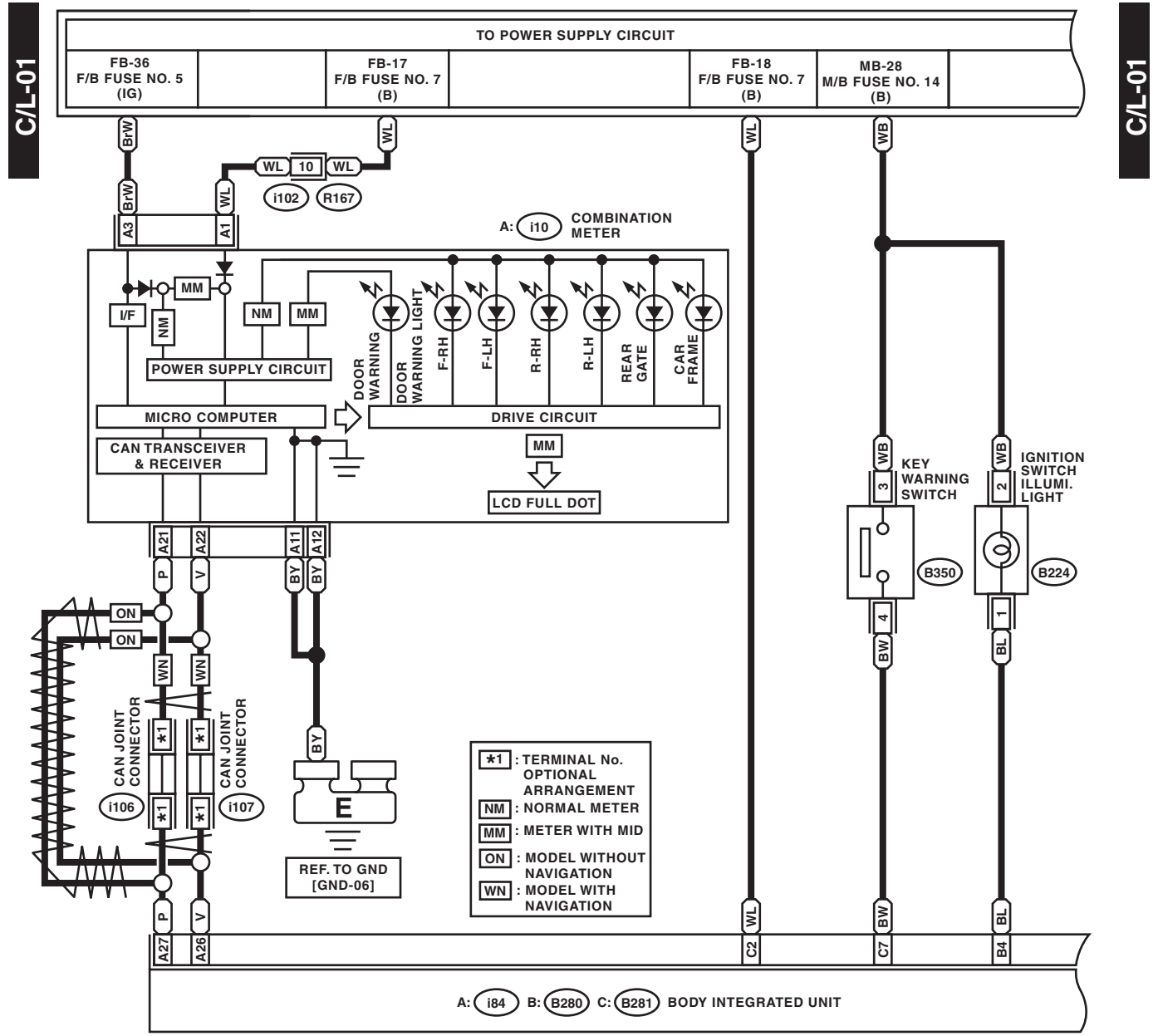
WIRING SYSTEM



WI-13242

## 27. Interior Light System

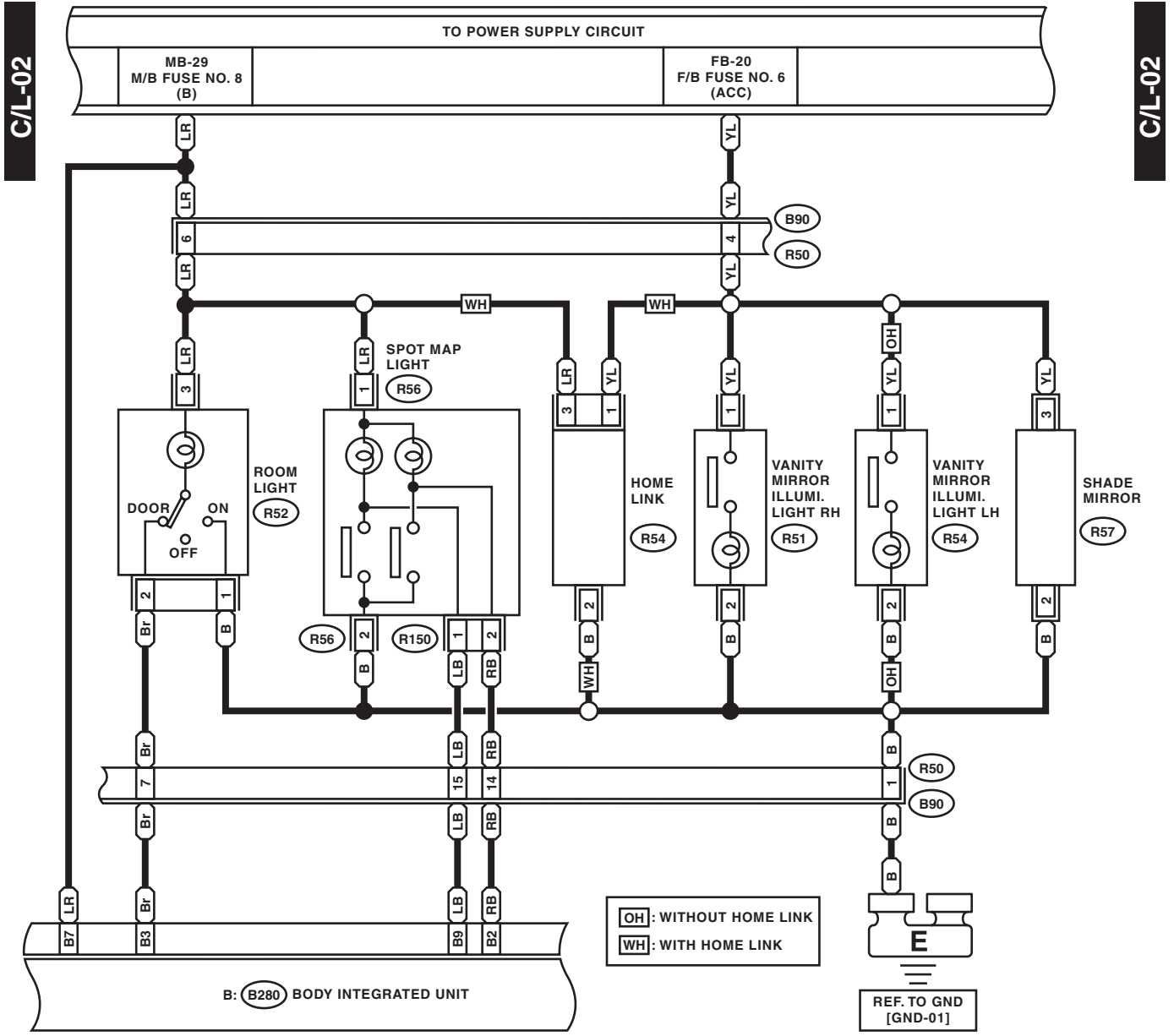
### A: WIRING DIAGRAM



WI-15863

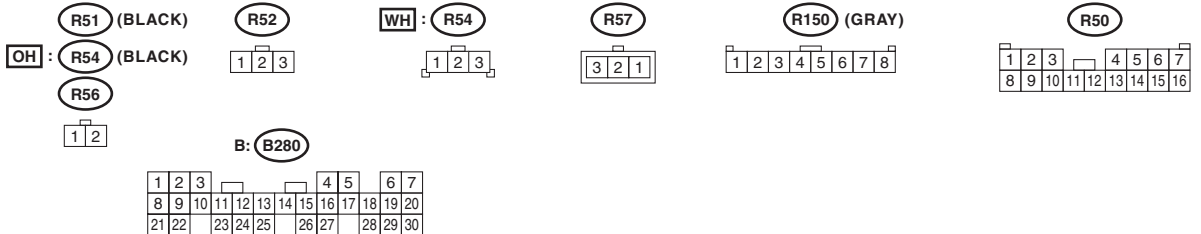
# Interior Light System

WIRING SYSTEM



C/L-02

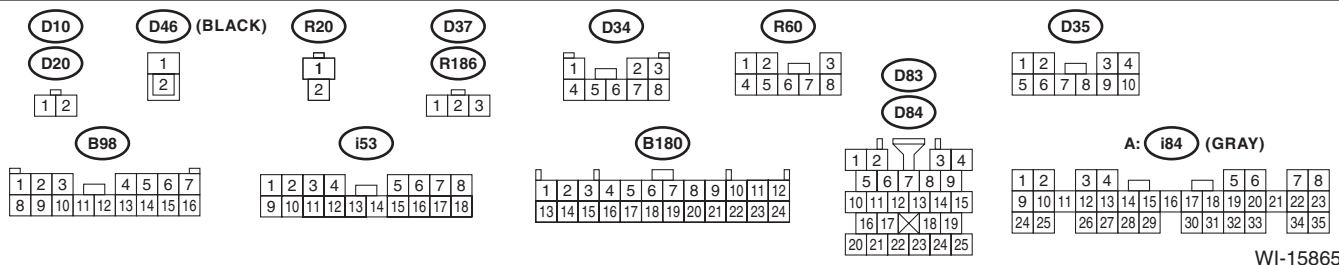
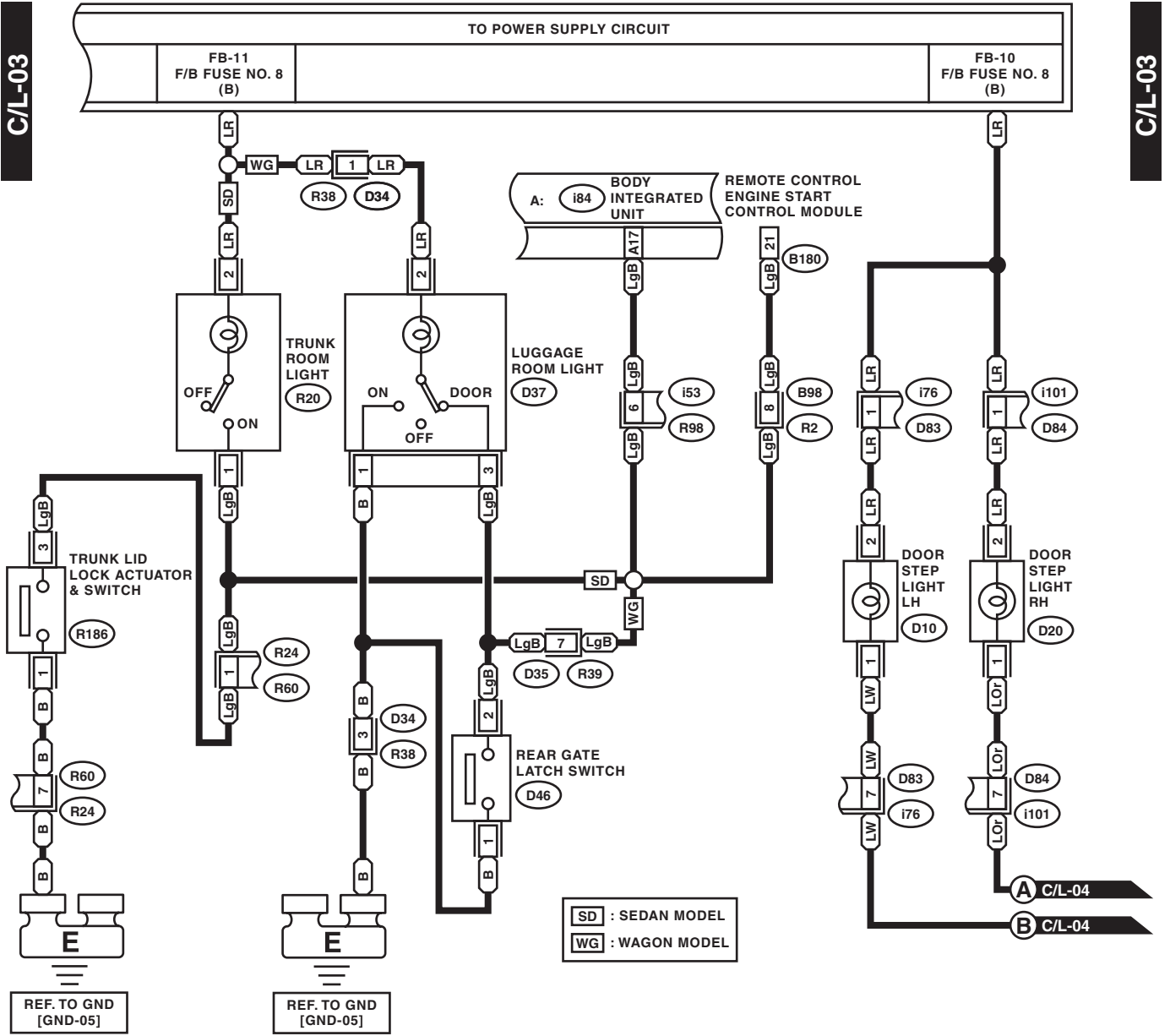
C/L-02



WI-15864

# Interior Light System

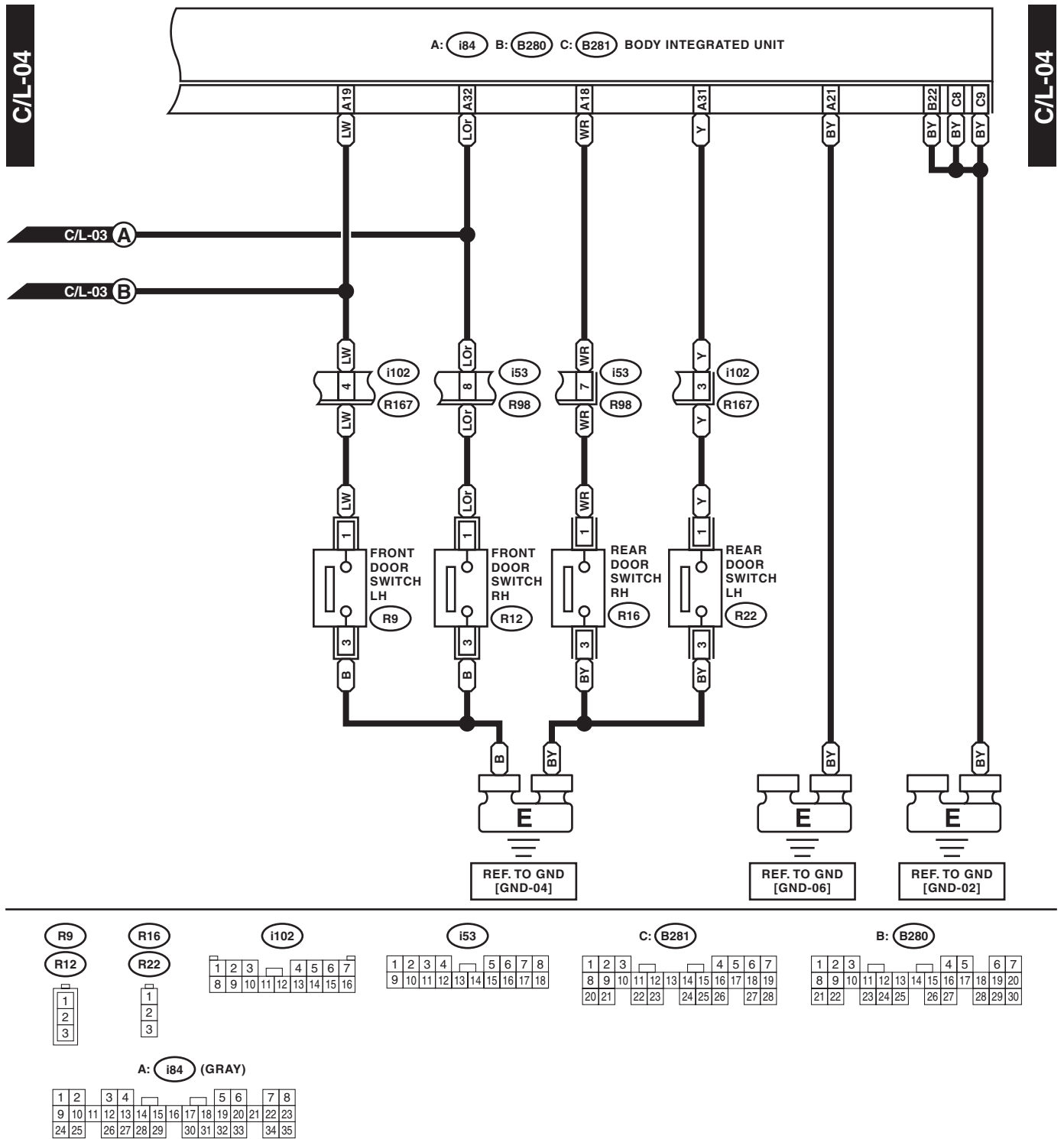
WIRING SYSTEM



WI-15865

# Interior Light System

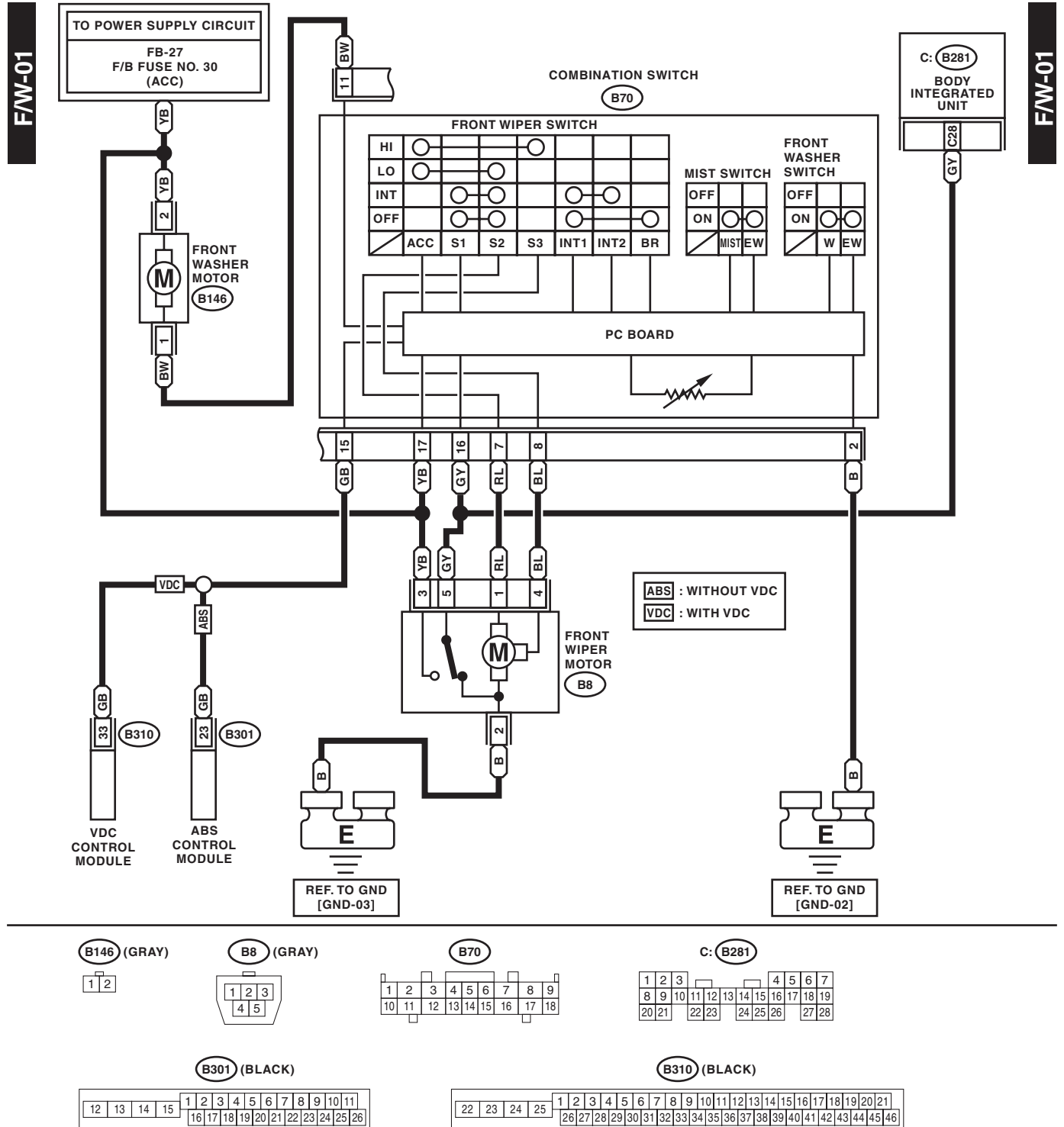
WIRING SYSTEM



WI-15866

## 28. Front Wiper and Washer System

### A: WIRING DIAGRAM

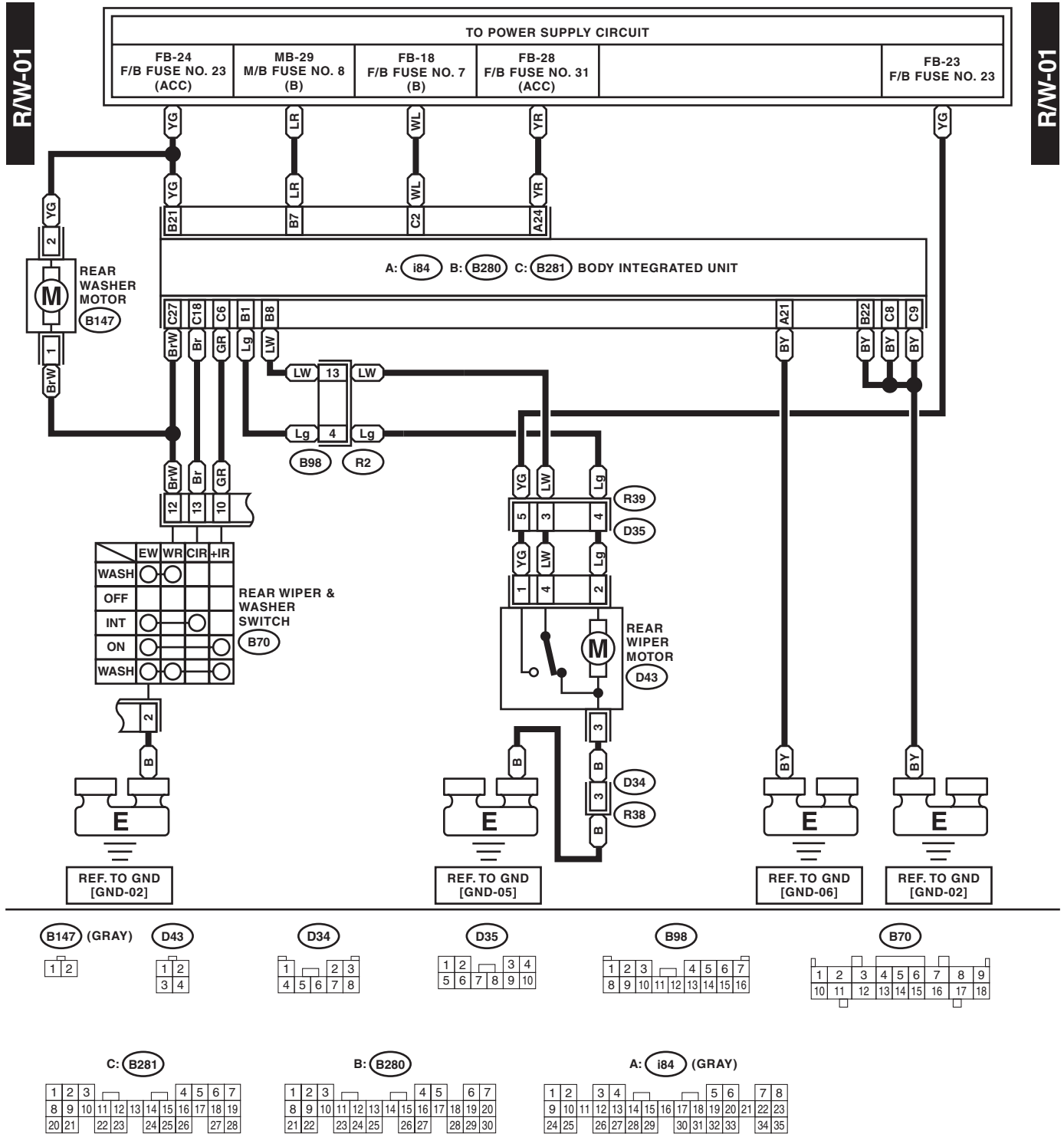


# Rear Wiper and Washer System

WIRING SYSTEM

## 29. Rear Wiper and Washer System

### A: WIRING DIAGRAM



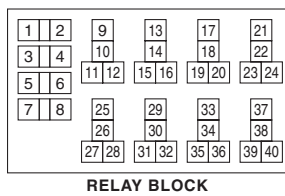
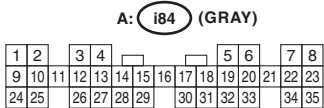
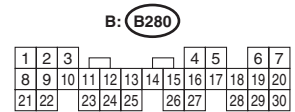
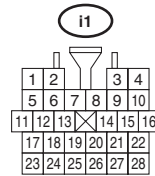
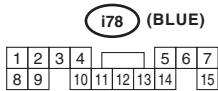
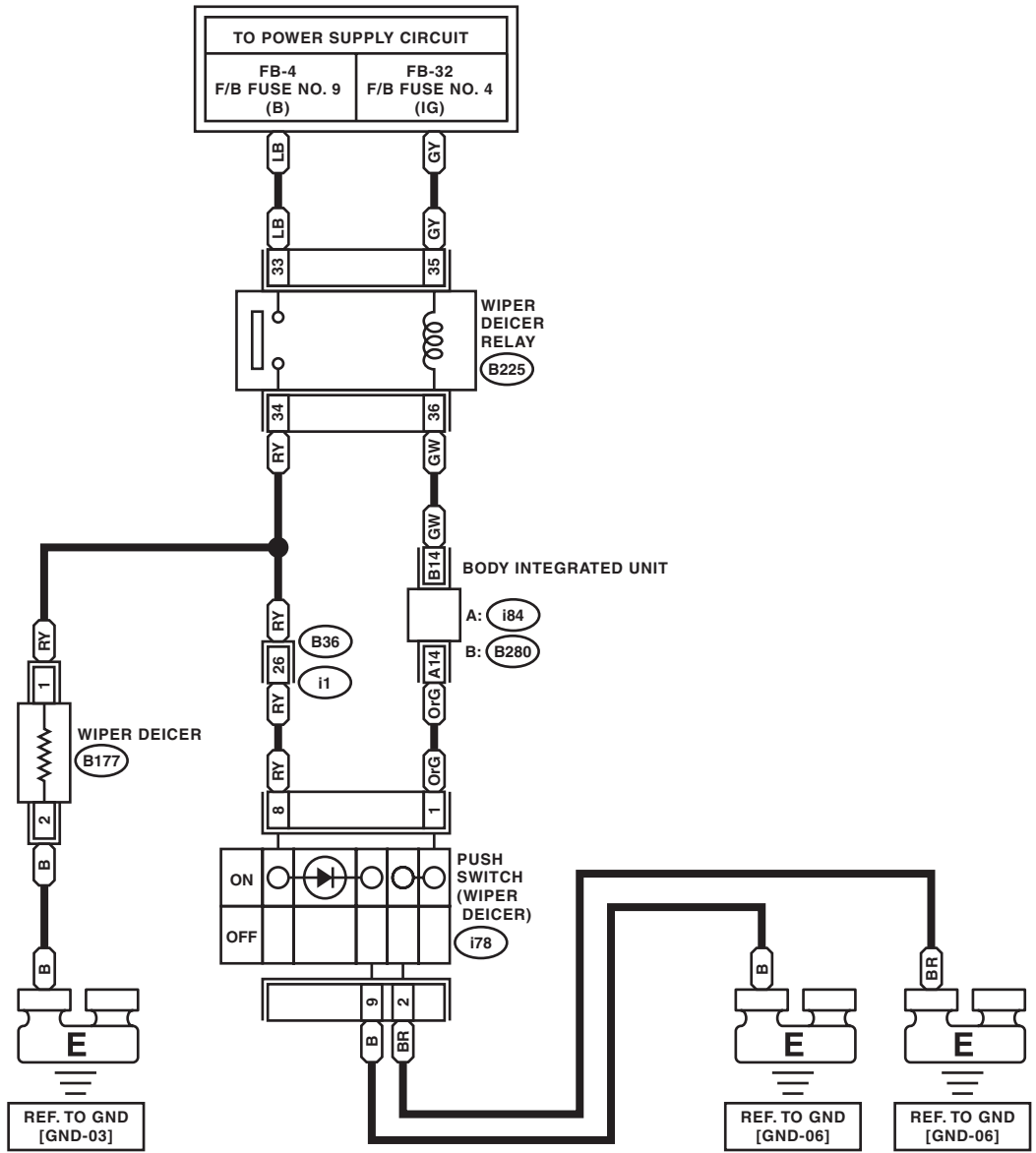
WI-15868

## 30. Wiper Deicer System

### A: WIRING DIAGRAM

W/D-01

W/D-01



WI-15869

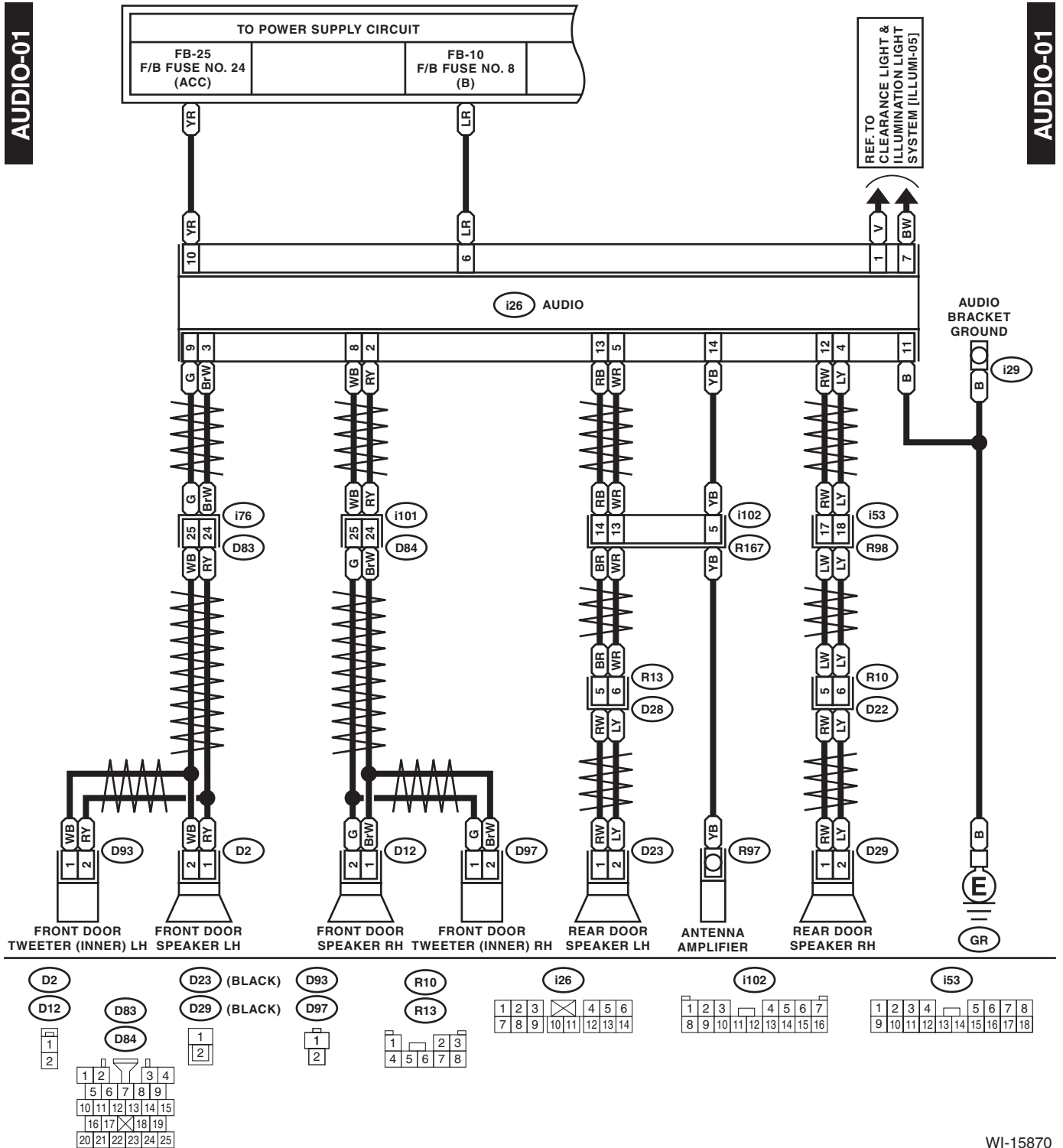


# Audio System

## WIRING SYSTEM

### 31. Audio System

#### A: WIRING DIAGRAM



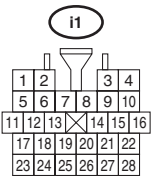
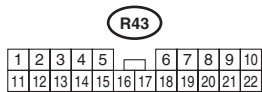
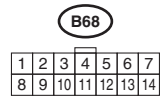
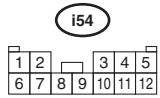
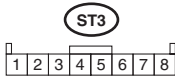
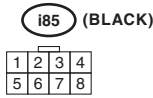
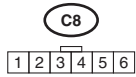
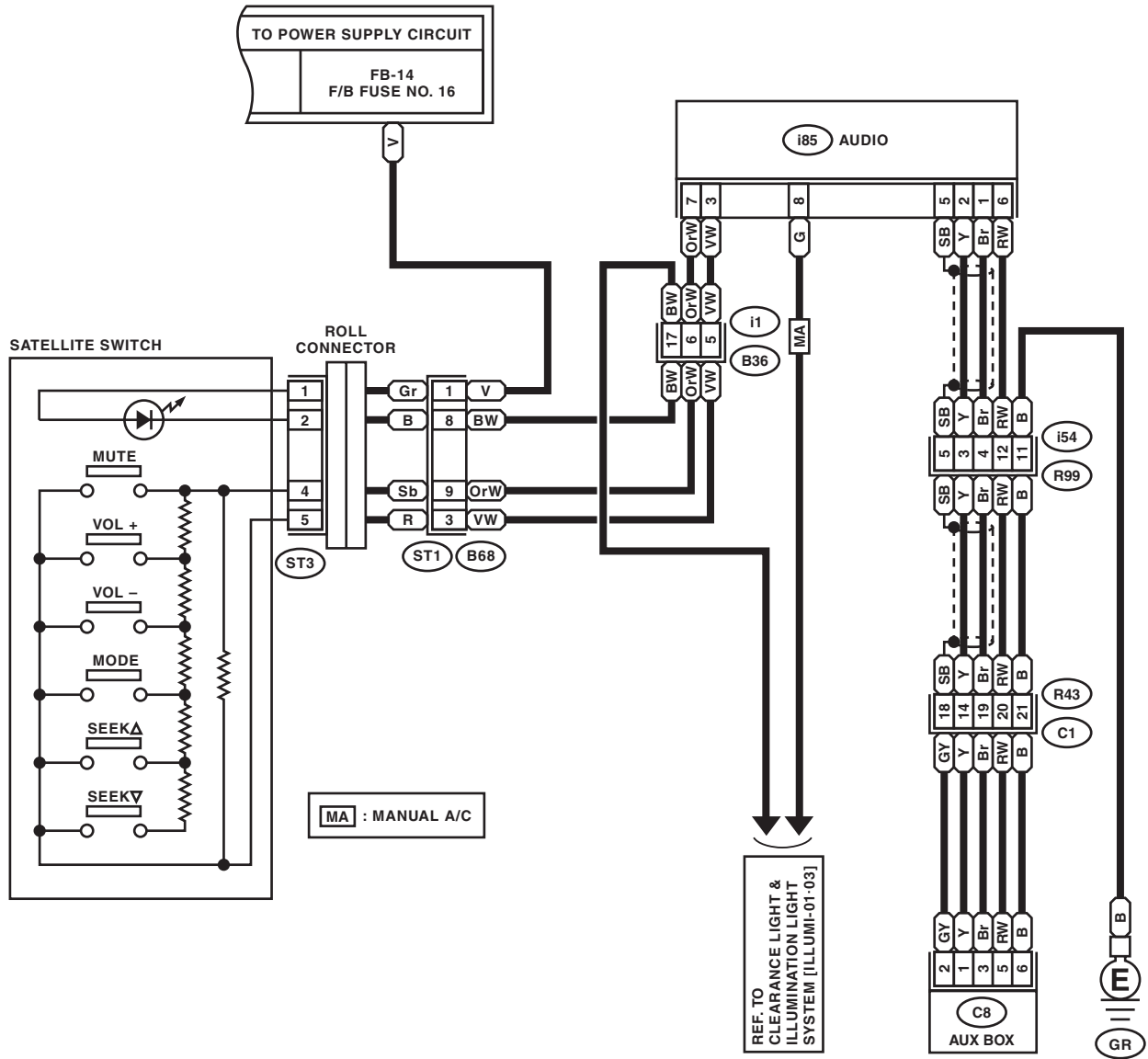
WI-15870

# Audio System

WIRING SYSTEM

AUDIO-02

AUDIO-02



WI-15871

# Front Accessory Power Supply Socket System

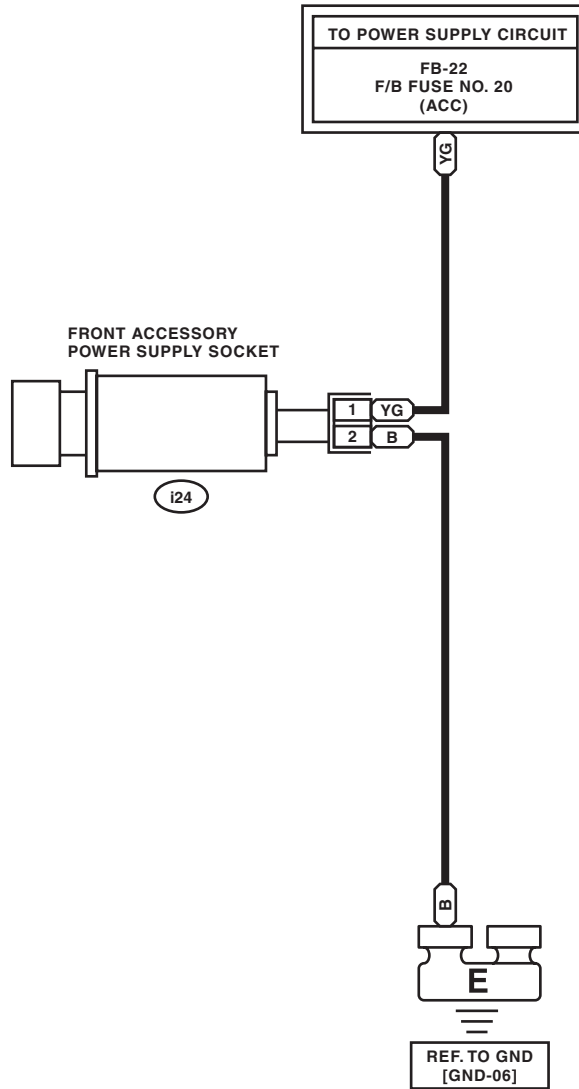
WIRING SYSTEM

## 32. Front Accessory Power Supply Socket System

### A: WIRING DIAGRAM

FAPS-01

FAPS-01



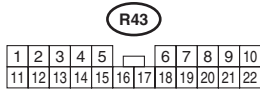
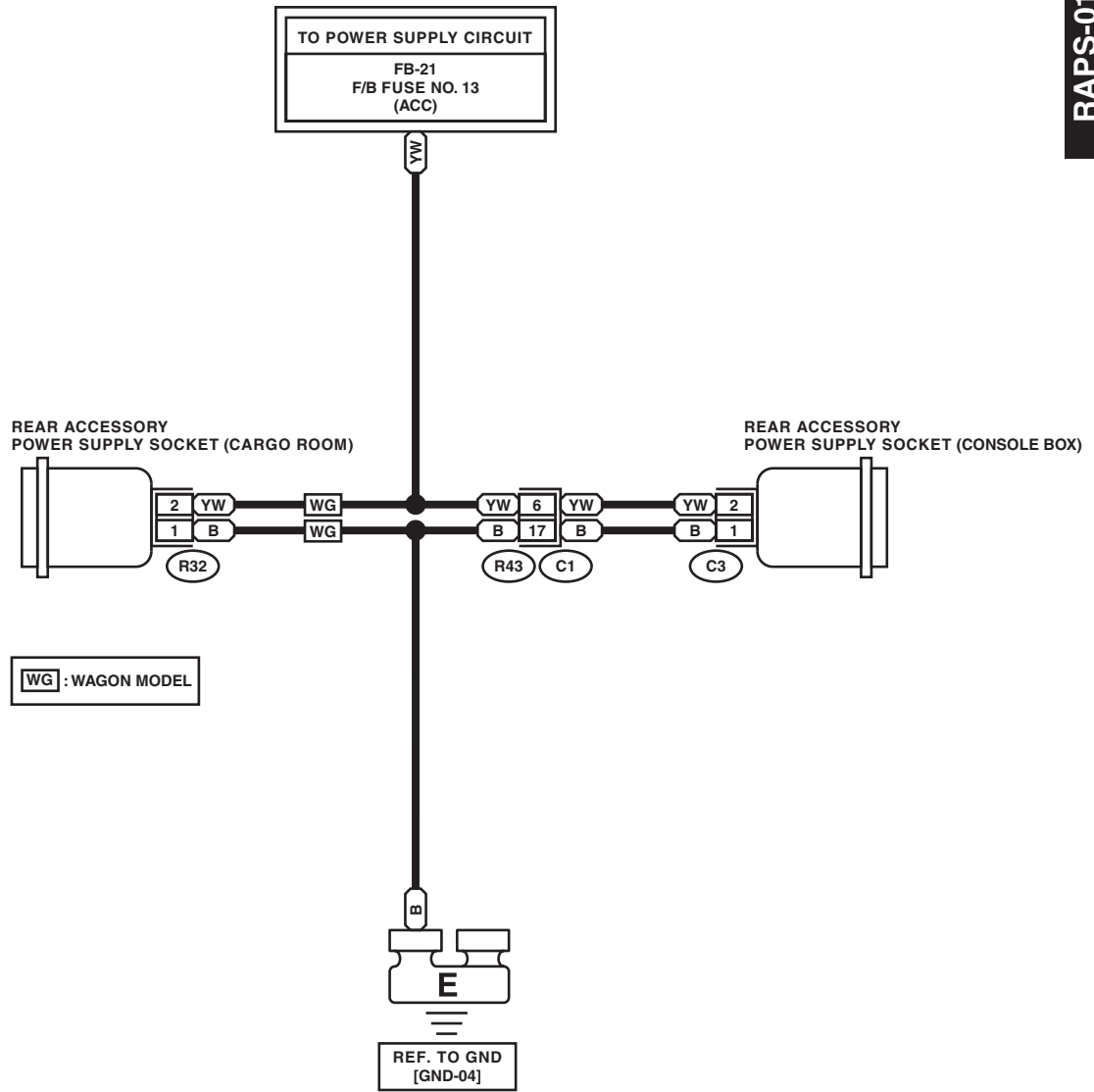
WI-15872

## 33.Rear Accessory Power Supply Socket System

### A: WIRING DIAGRAM

RAPS-01

RAPS-01

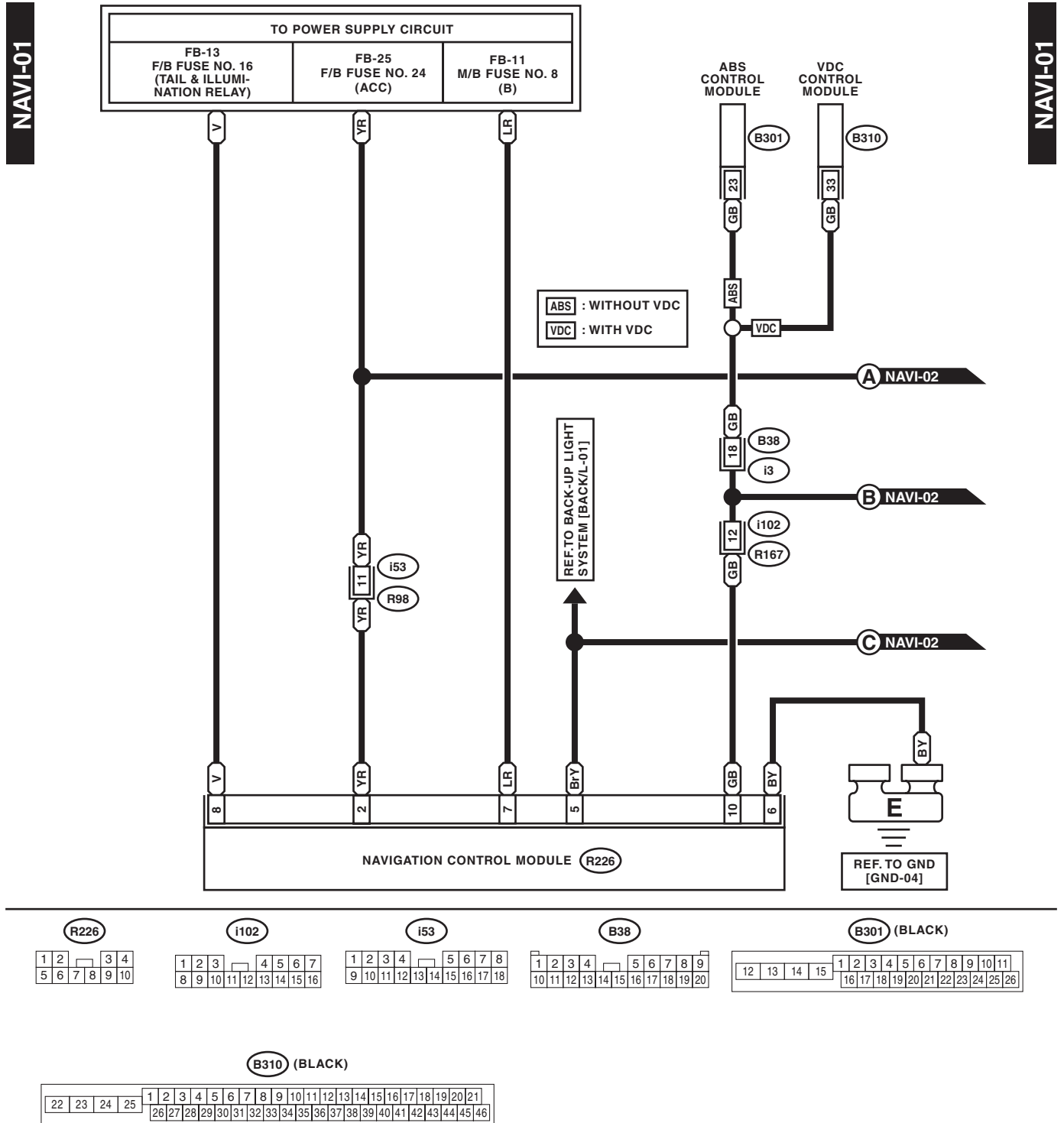


# Navigation System

WIRING SYSTEM

## 34. Navigation System

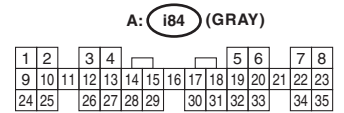
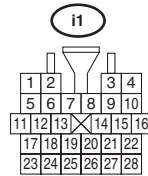
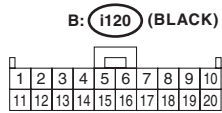
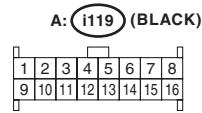
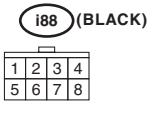
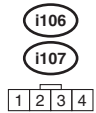
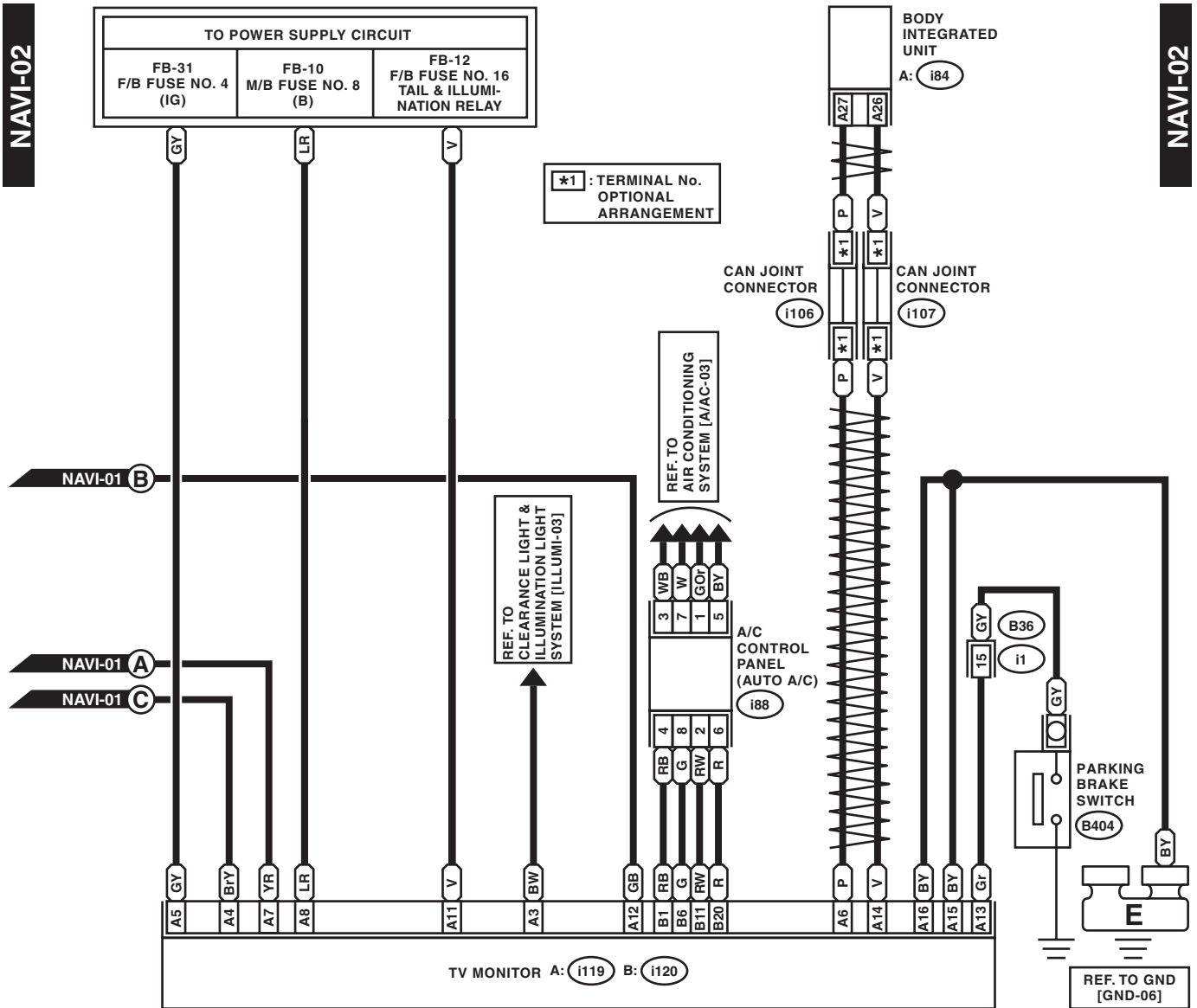
### A: WIRING DIAGRAM



WI-15873

# Navigation System

WIRING SYSTEM



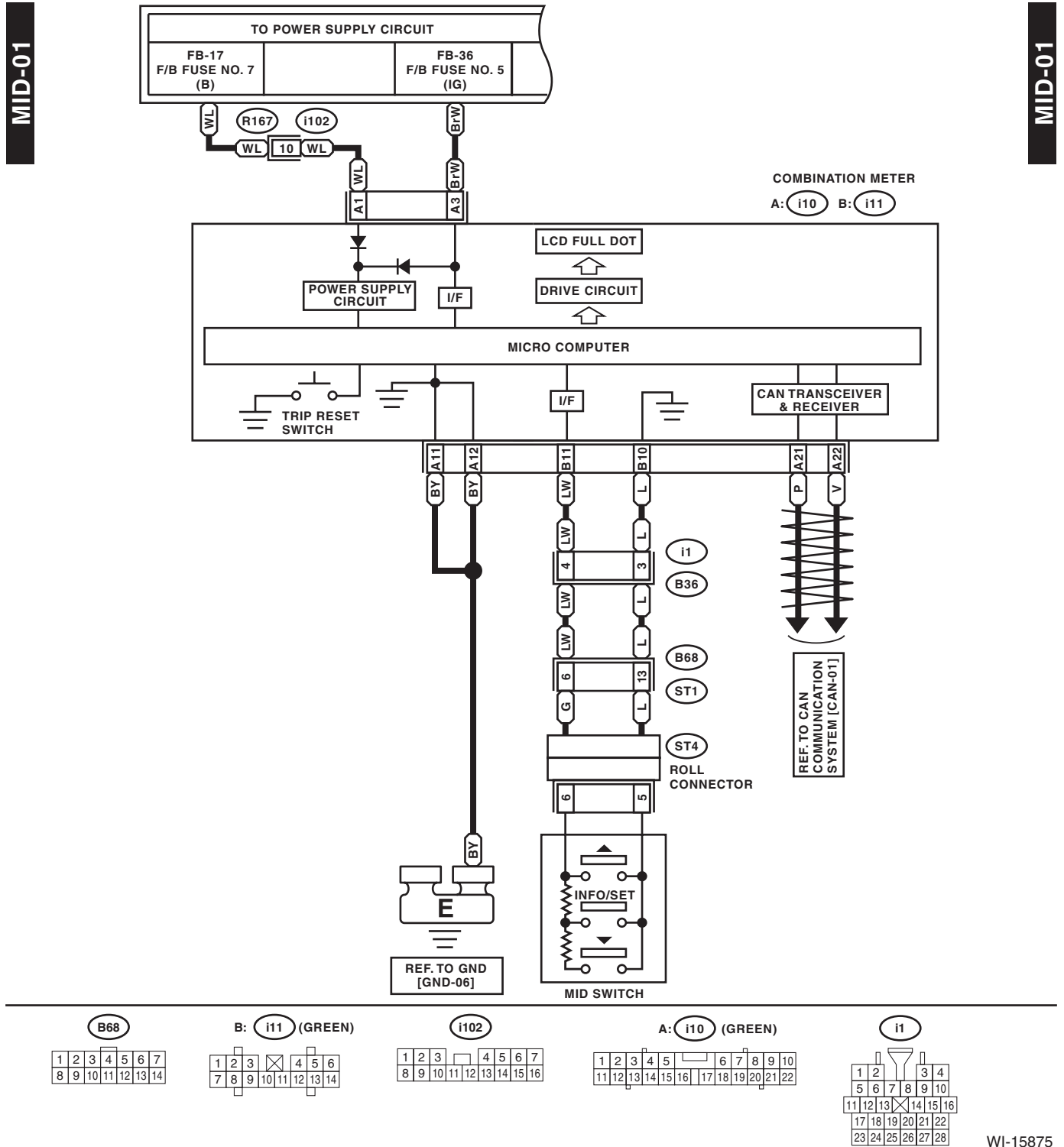
WI-15874

# Multi-information Display (MID) System

WIRING SYSTEM

## 35. Multi-information Display (MID) System

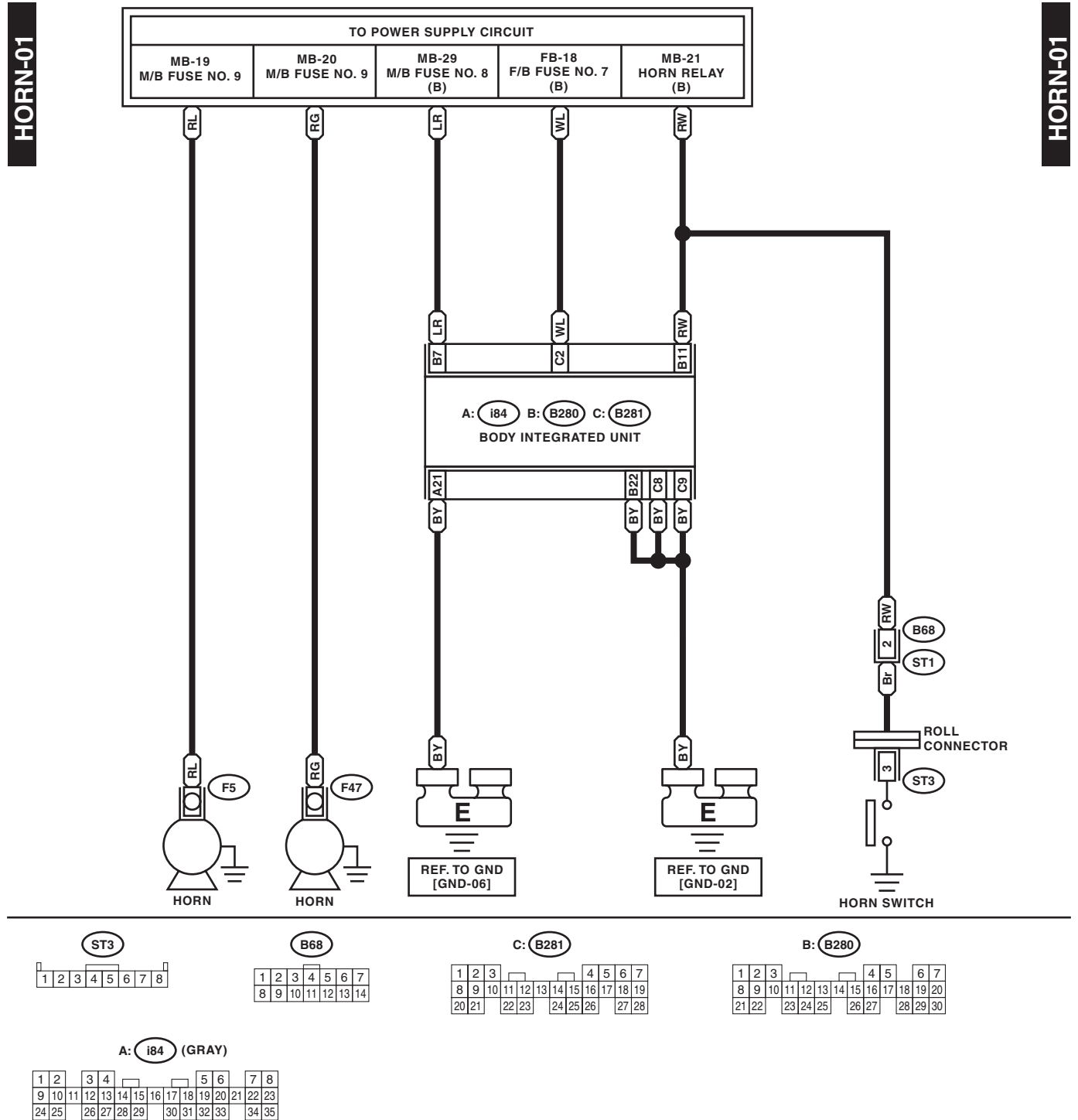
### A: WIRING DIAGRAM



WI-15875

## 36.Horn System

### A: WIRING DIAGRAM



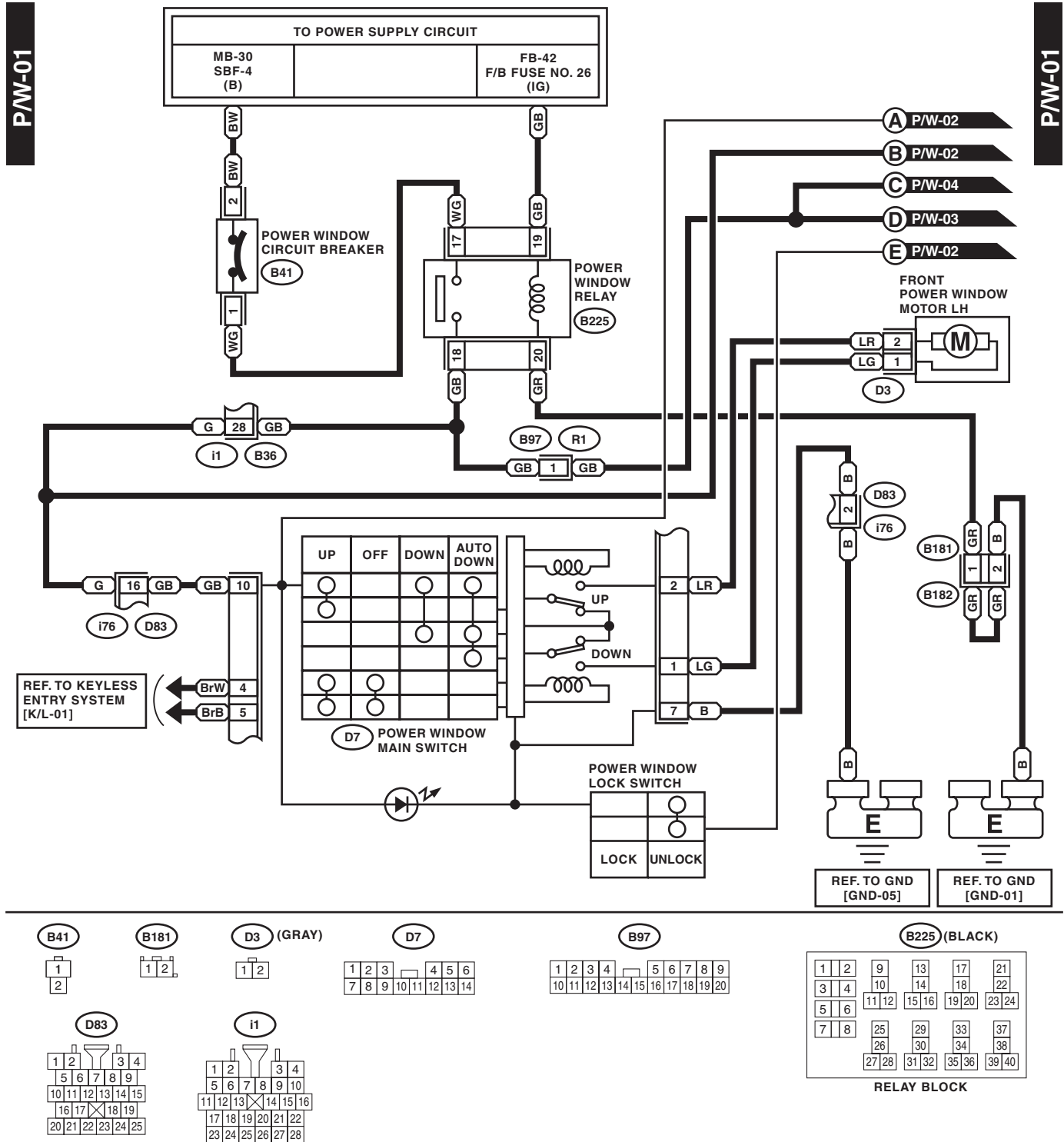


# Power Window System

WIRING SYSTEM

## 37. Power Window System

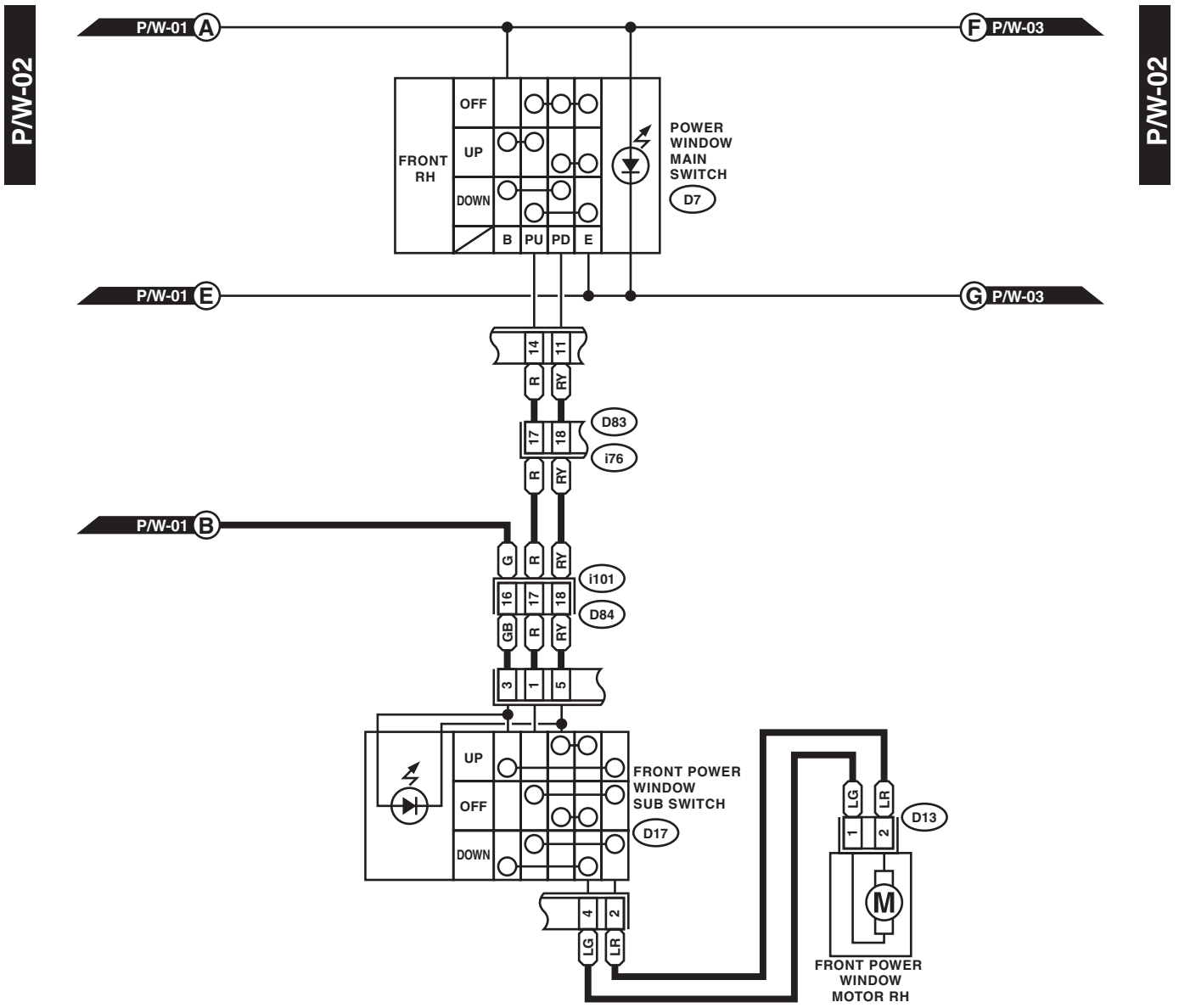
### A: WIRING DIAGRAM



WI-15877

# Power Window System

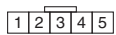
WIRING SYSTEM



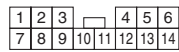
D13 (GRAY)



D17

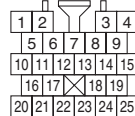


D7



D83

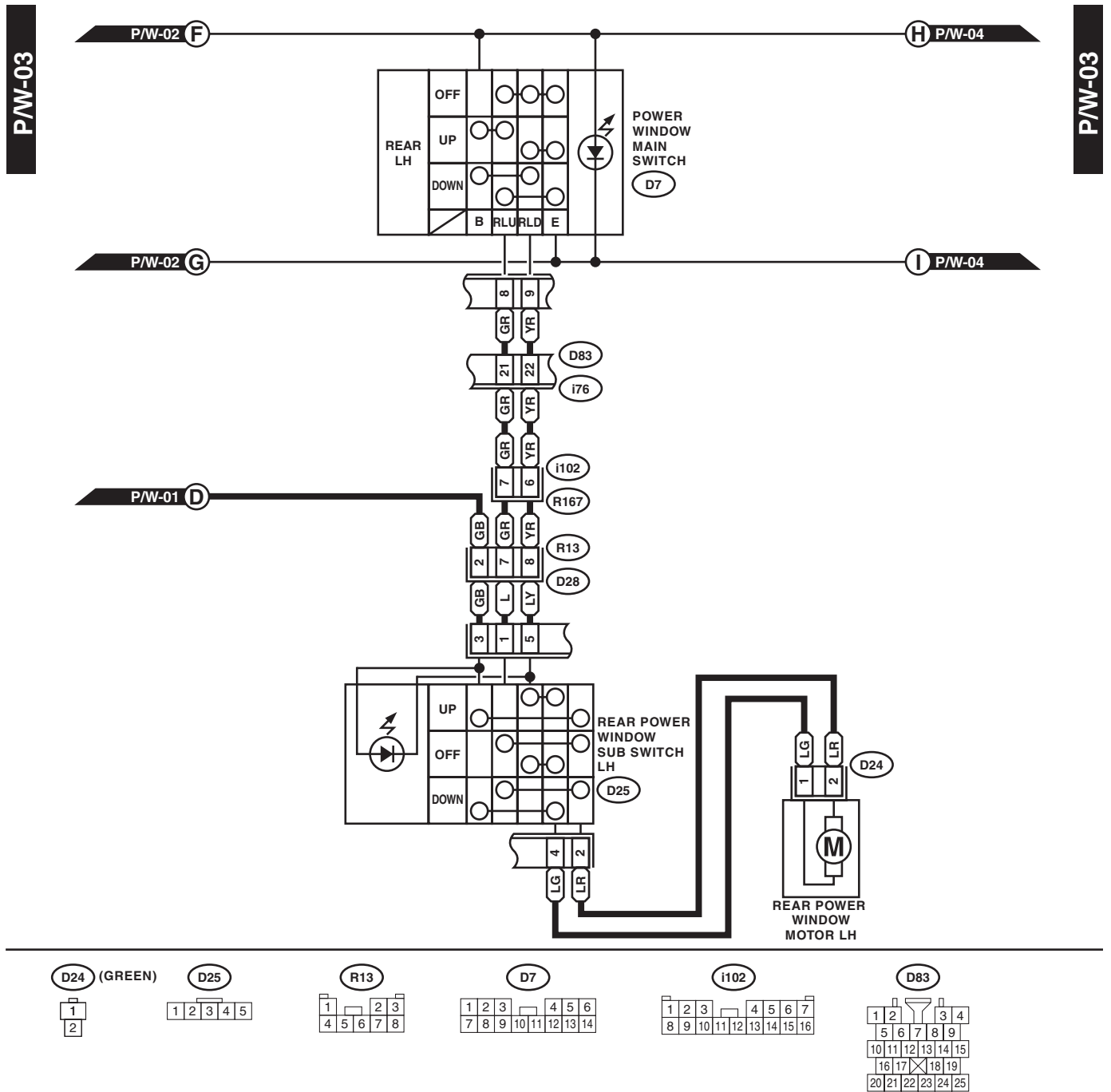
D84



WI-13259

# Power Window System

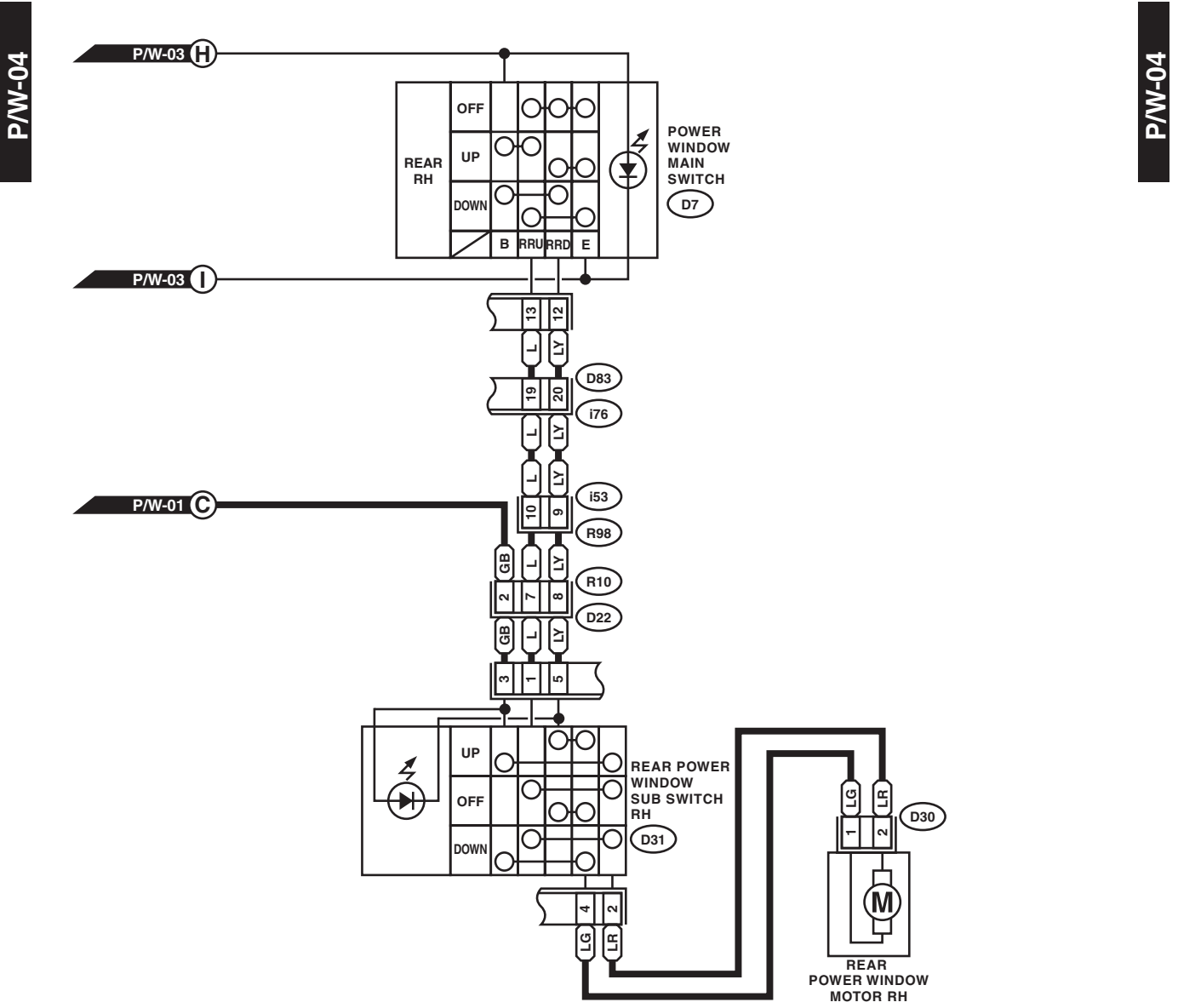
## WIRING SYSTEM



WI-13260

# Power Window System

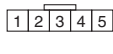
WIRING SYSTEM



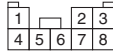
D30 (GREEN)



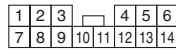
D31



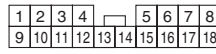
R10



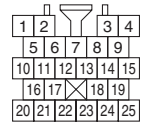
D7



i53



D83



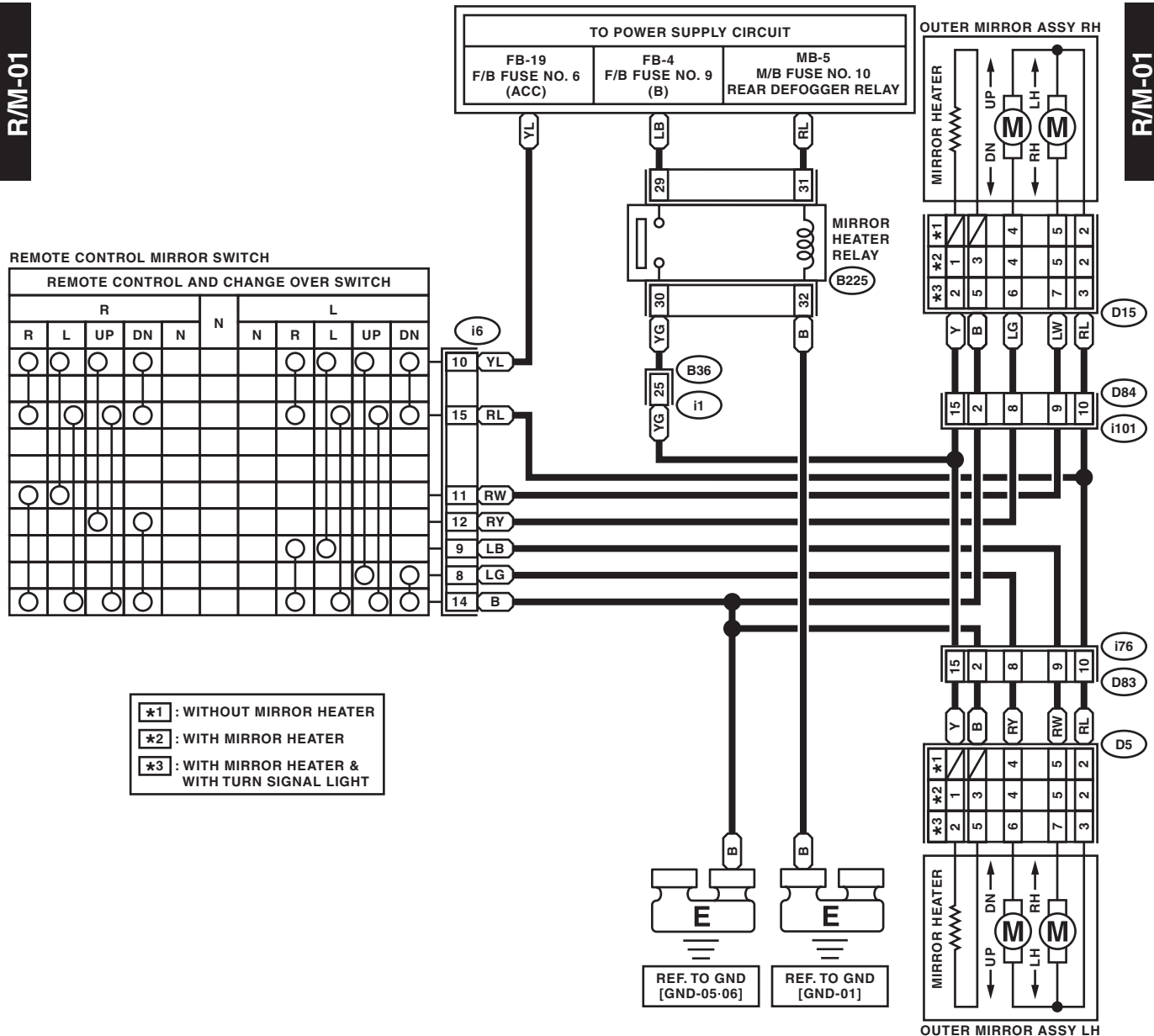
WI-13261

# Remote Control Mirror System

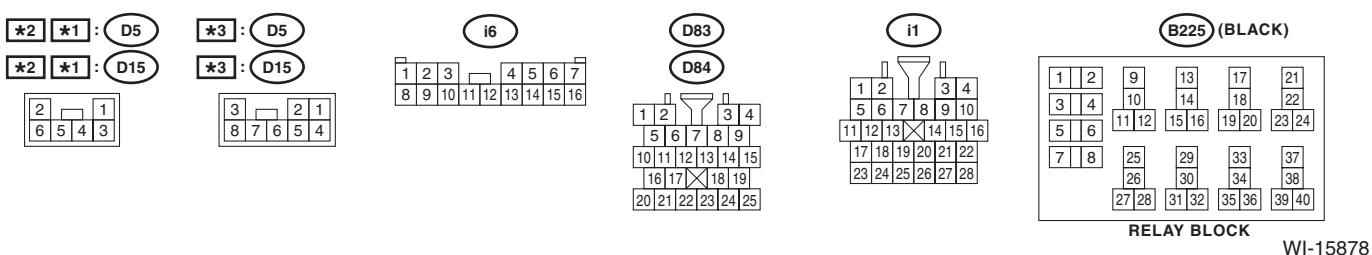
WIRING SYSTEM

## 38. Remote Control Mirror System

### A: WIRING DIAGRAM



\*1 : WITHOUT MIRROR HEATER  
 \*2 : WITH MIRROR HEATER  
 \*3 : WITH MIRROR HEATER & WITH TURN SIGNAL LIGHT



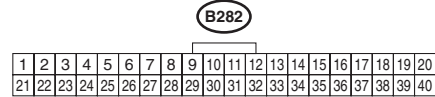
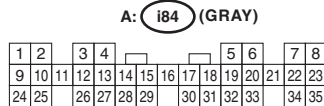
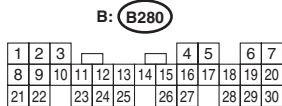
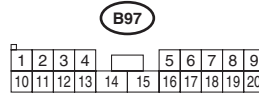
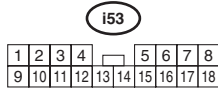
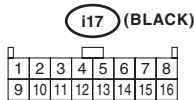
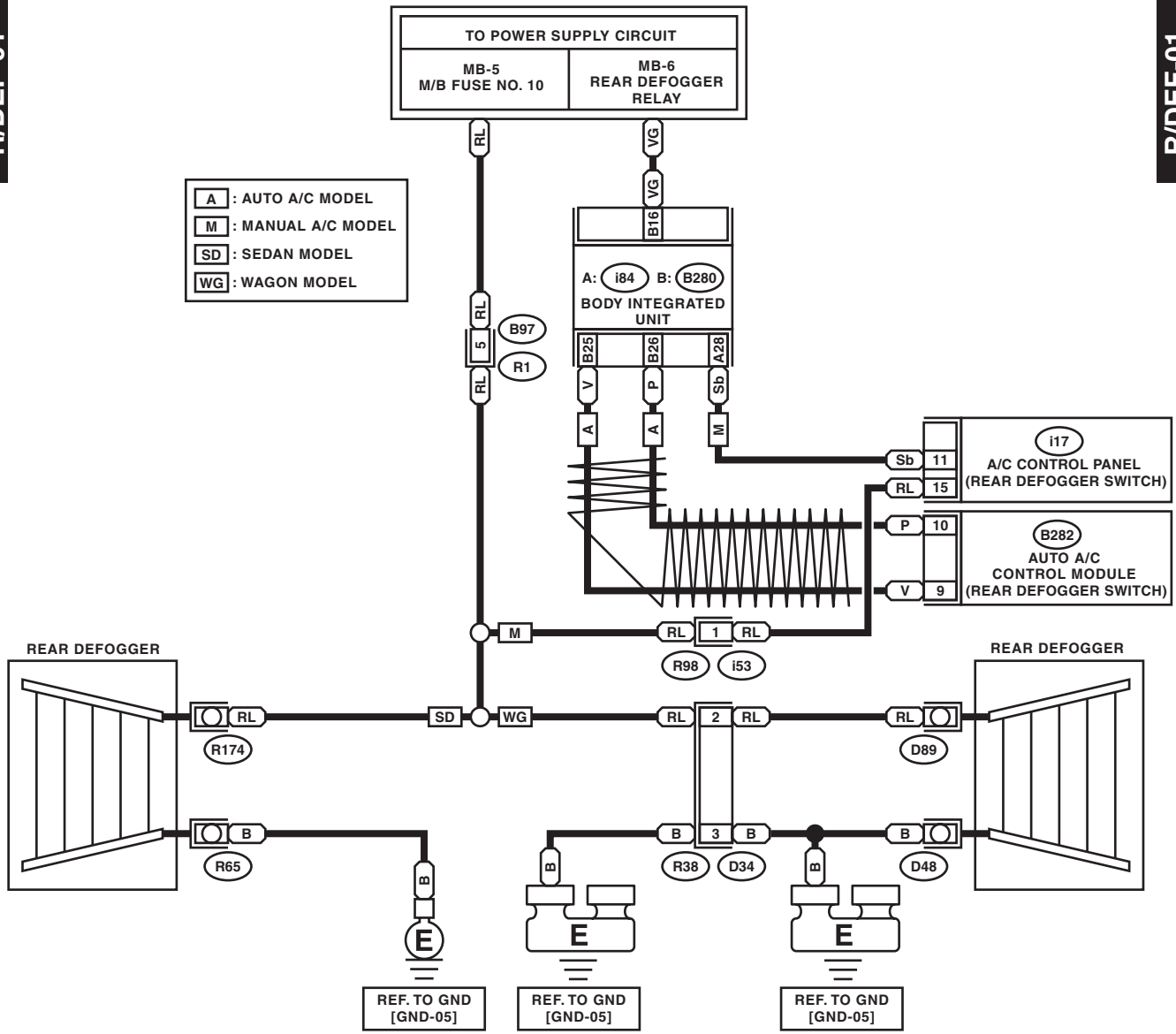
WI-15878

## 39.Rear Defogger System

### A: WIRING DIAGRAM

R/DEF-01

R/DEF-01



WI-15879

# Combination Meter System

WIRING SYSTEM

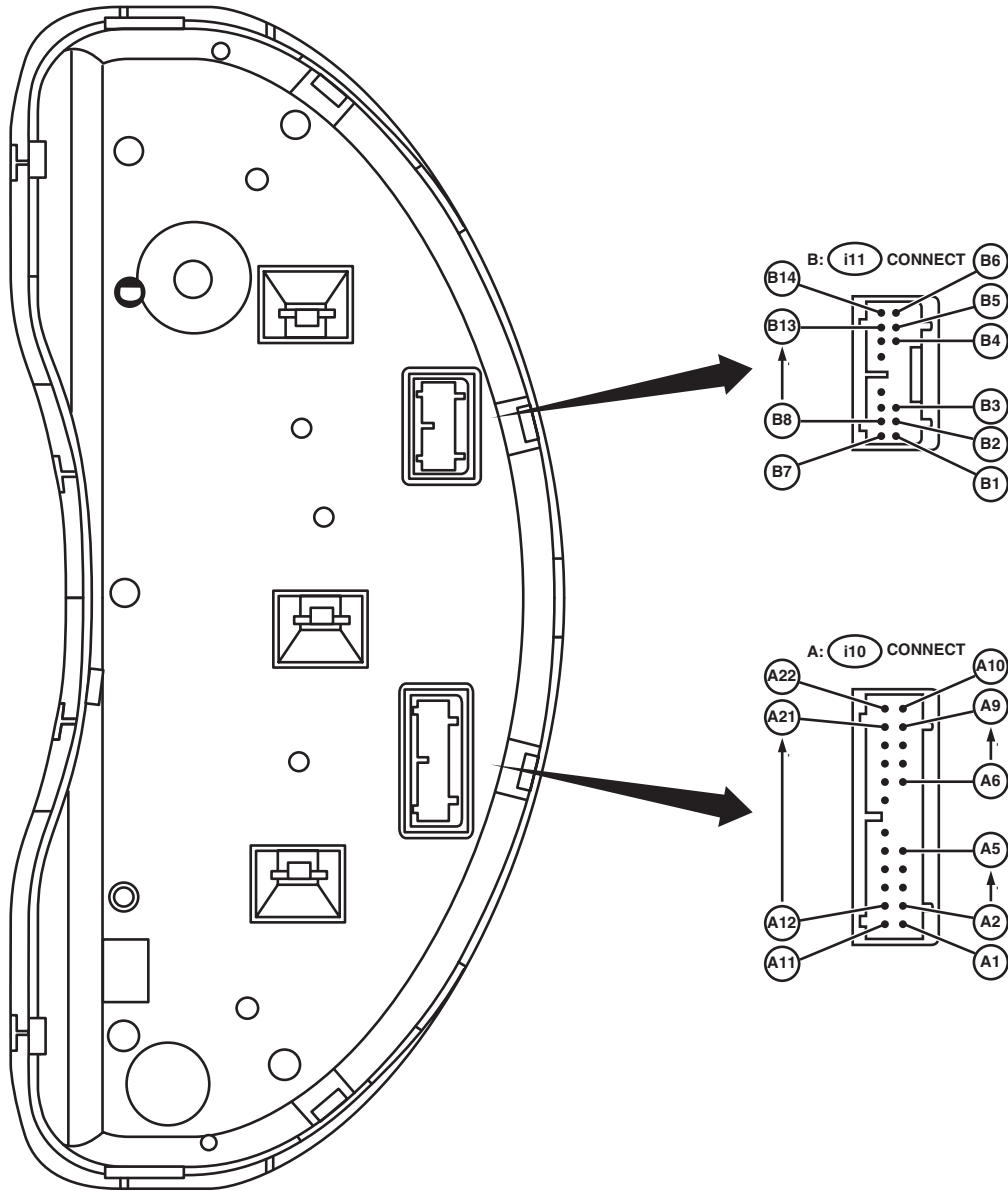
## 40. Combination Meter System

### A: WIRING DIAGRAM

#### 1. NORMAL METER

C/M(NM)-01

C/M(NM)-01



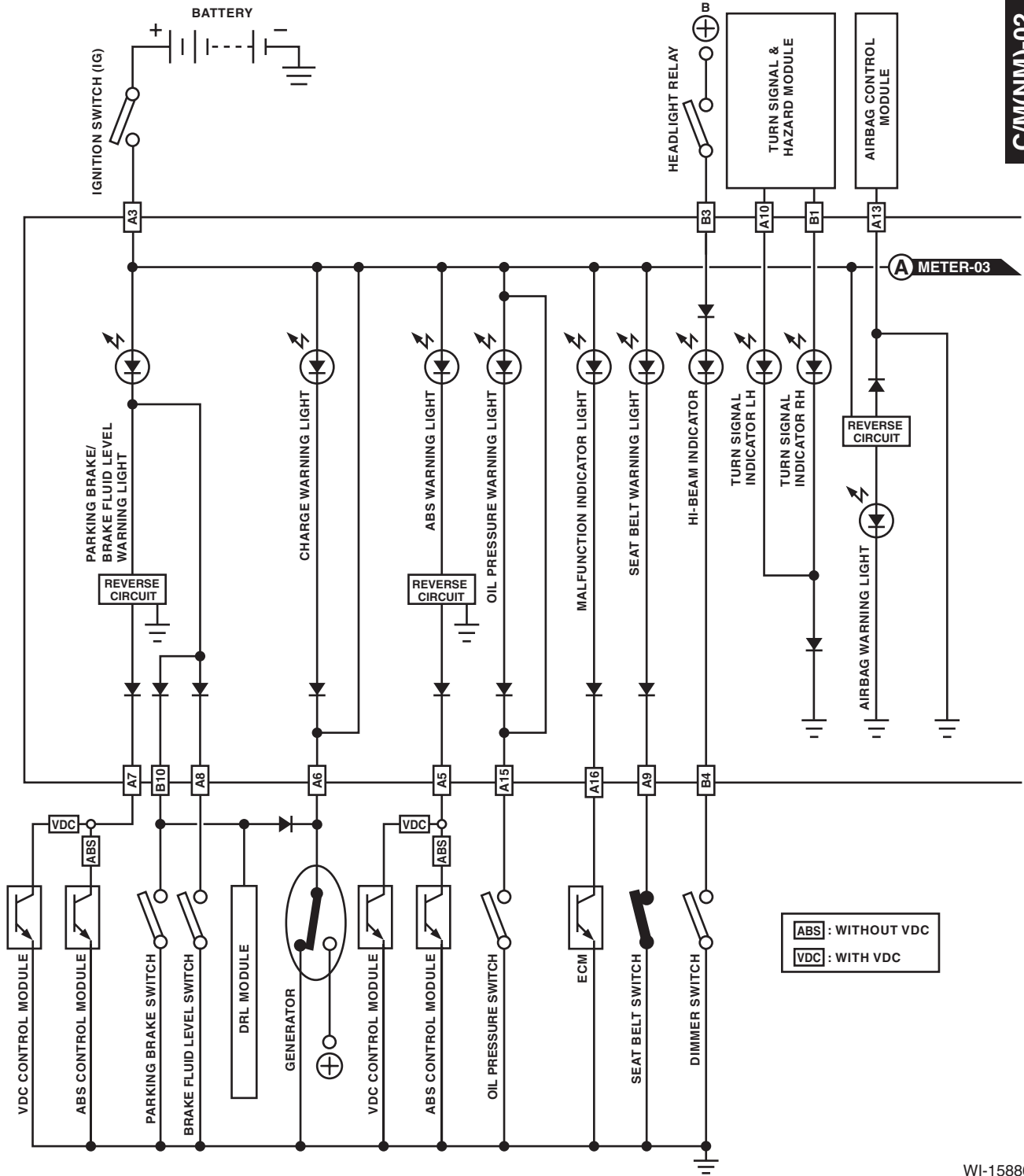
WI-16204

# Combination Meter System

WIRING SYSTEM

C/M(NM)-02

C/M(NM)-02

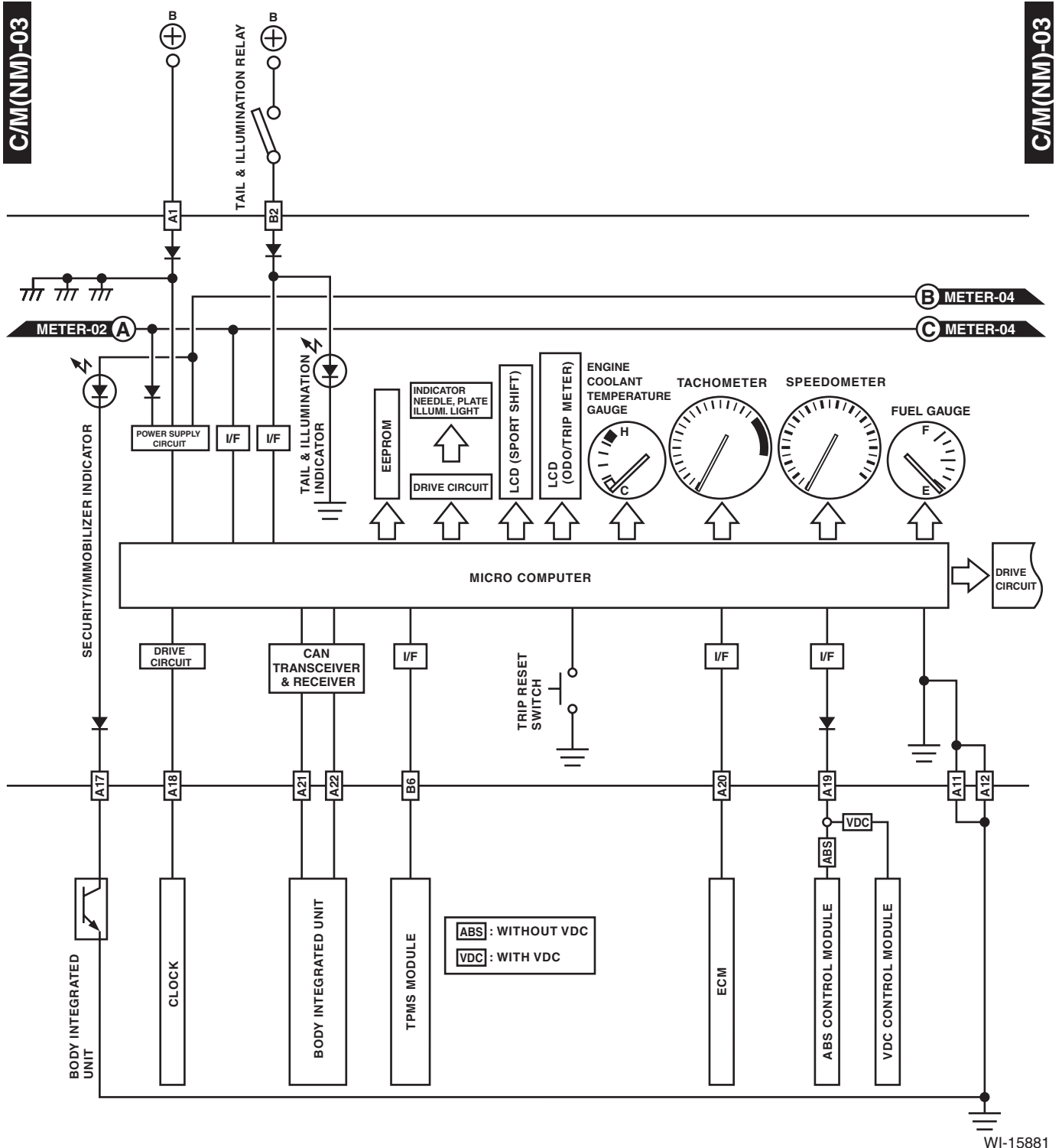


WI-15880



# Combination Meter System

WIRING SYSTEM

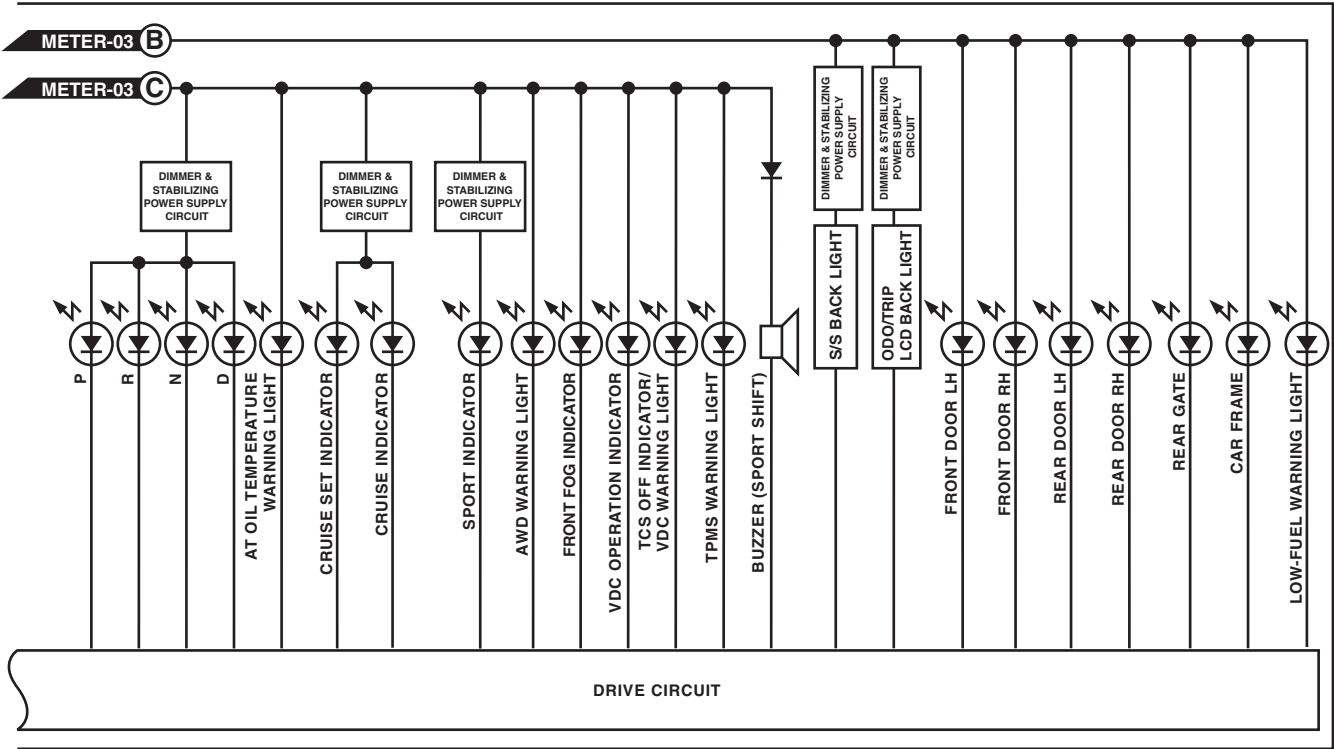


# Combination Meter System

WIRING SYSTEM

C/M(NM)-04

C/M(NM)-04



WI-15882

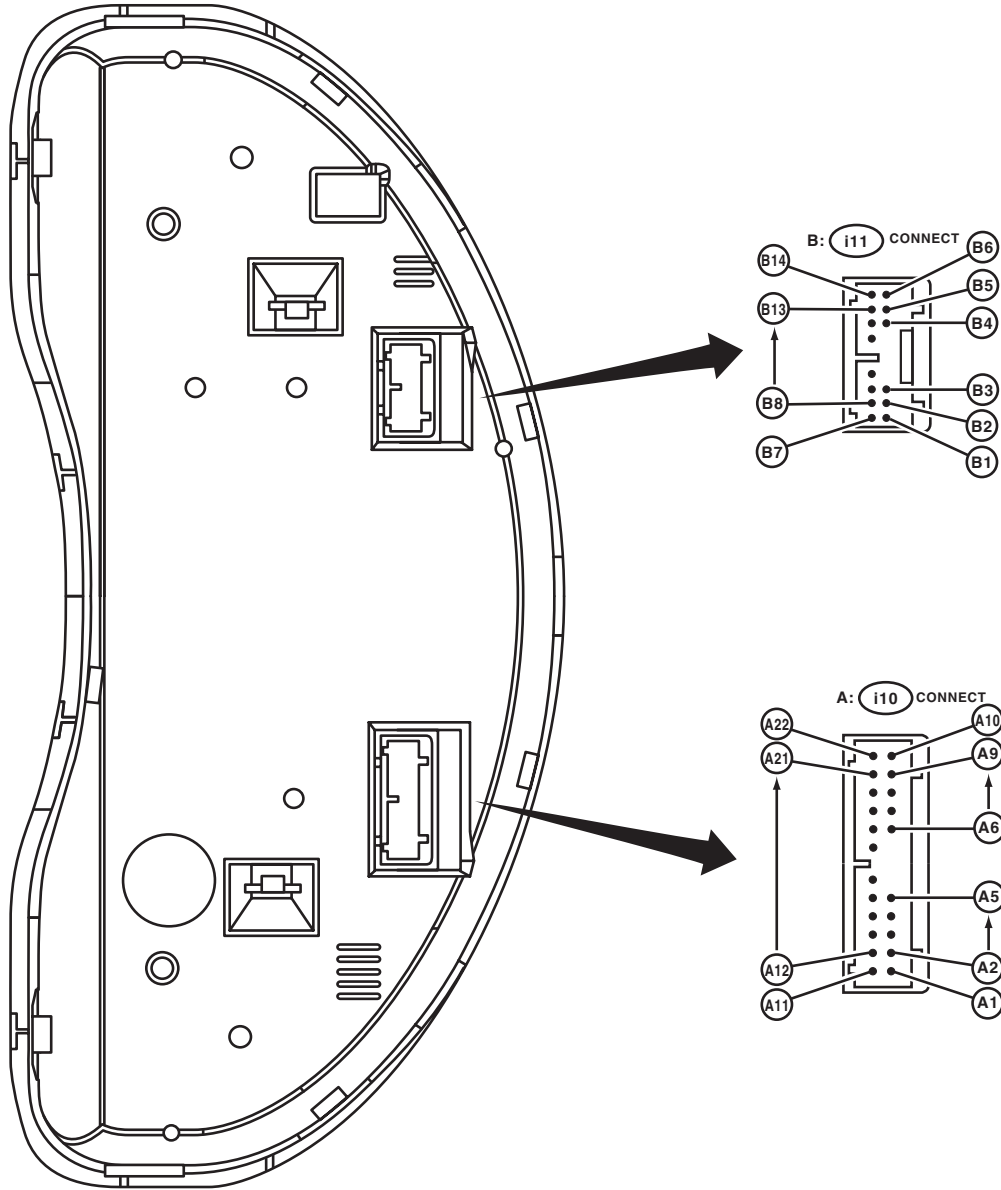
# Combination Meter System

WIRING SYSTEM

## 2. MULTI METER

C/M(MM)-01

C/M(MM)-01



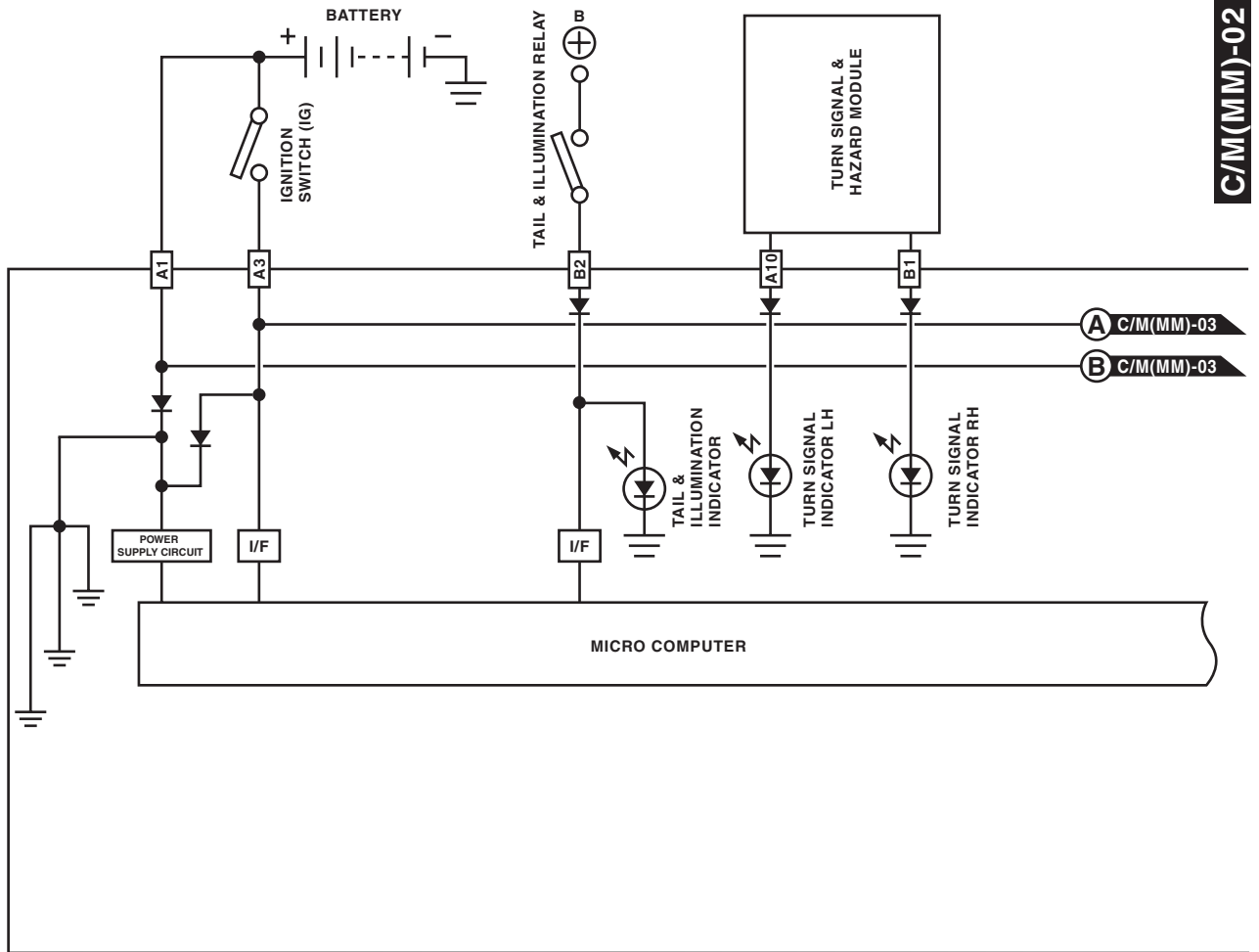
WI-13268

# Combination Meter System

WIRING SYSTEM

C/M(MM)-02

C/M(MM)-02



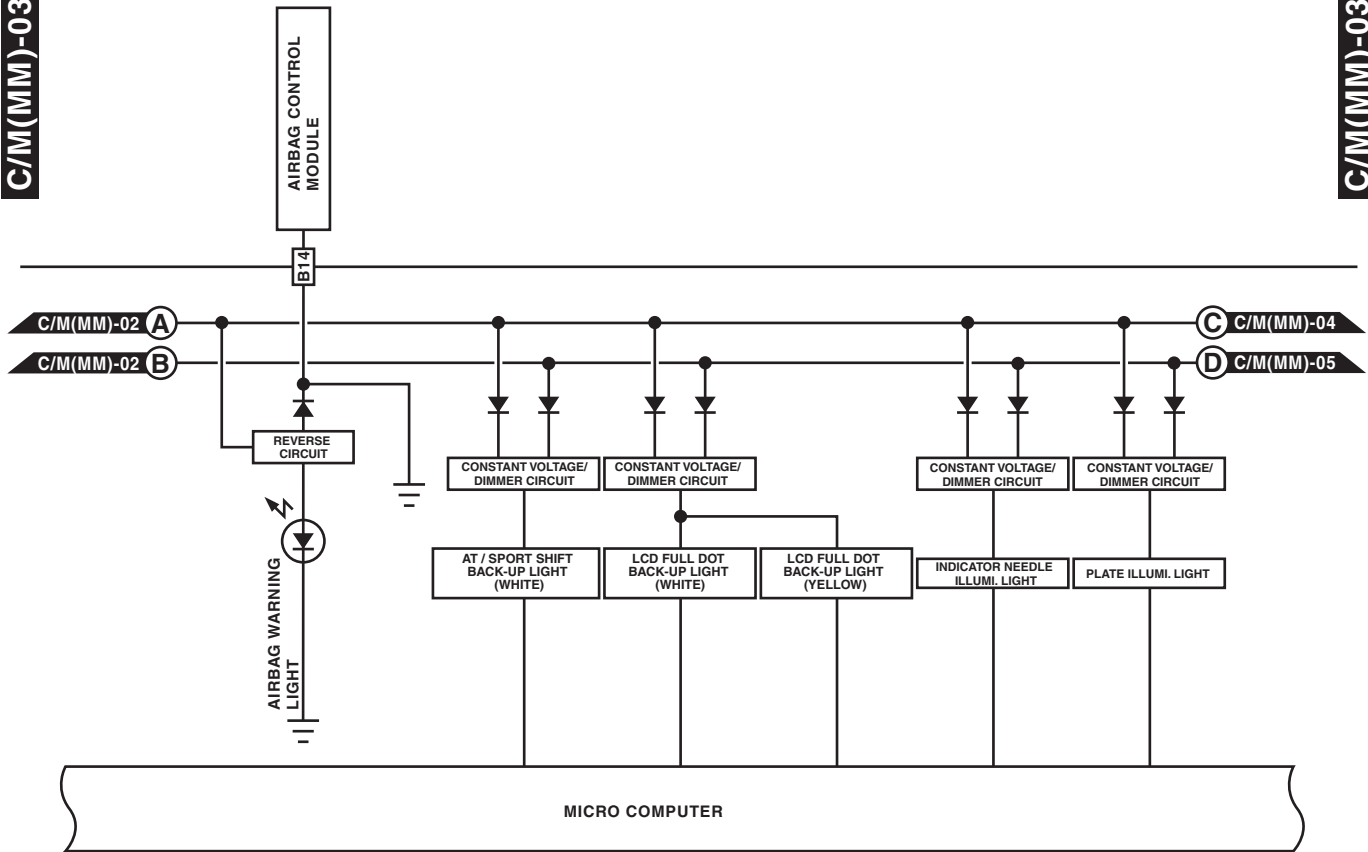
WI-15883

# Combination Meter System

WIRING SYSTEM

C/M(MM)-03

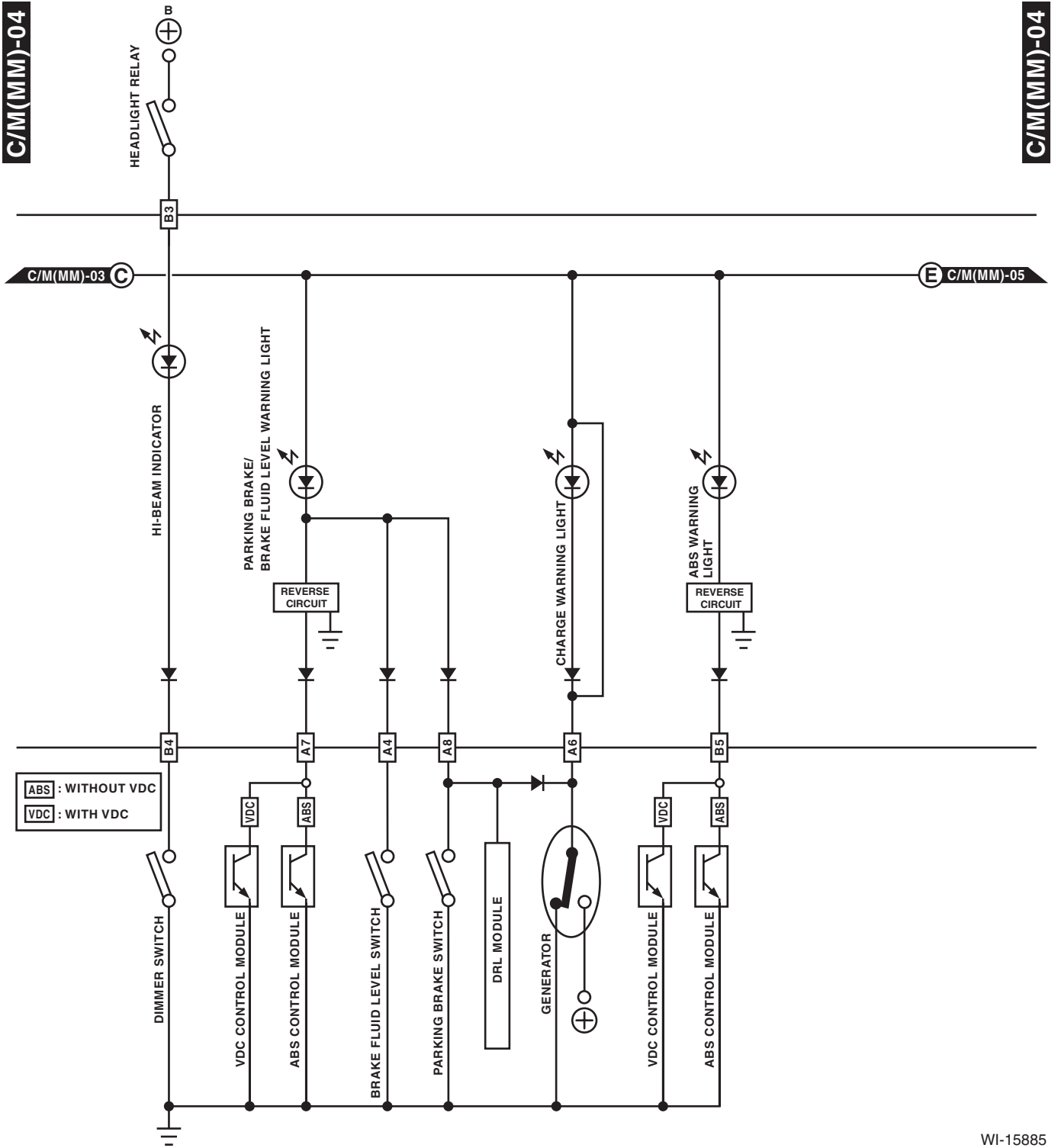
C/M(MM)-03



WI-15884

# Combination Meter System

WIRING SYSTEM



C/M(MM)-04

C/M(MM)-04

C/M(MM)-03

C/M(MM)-05

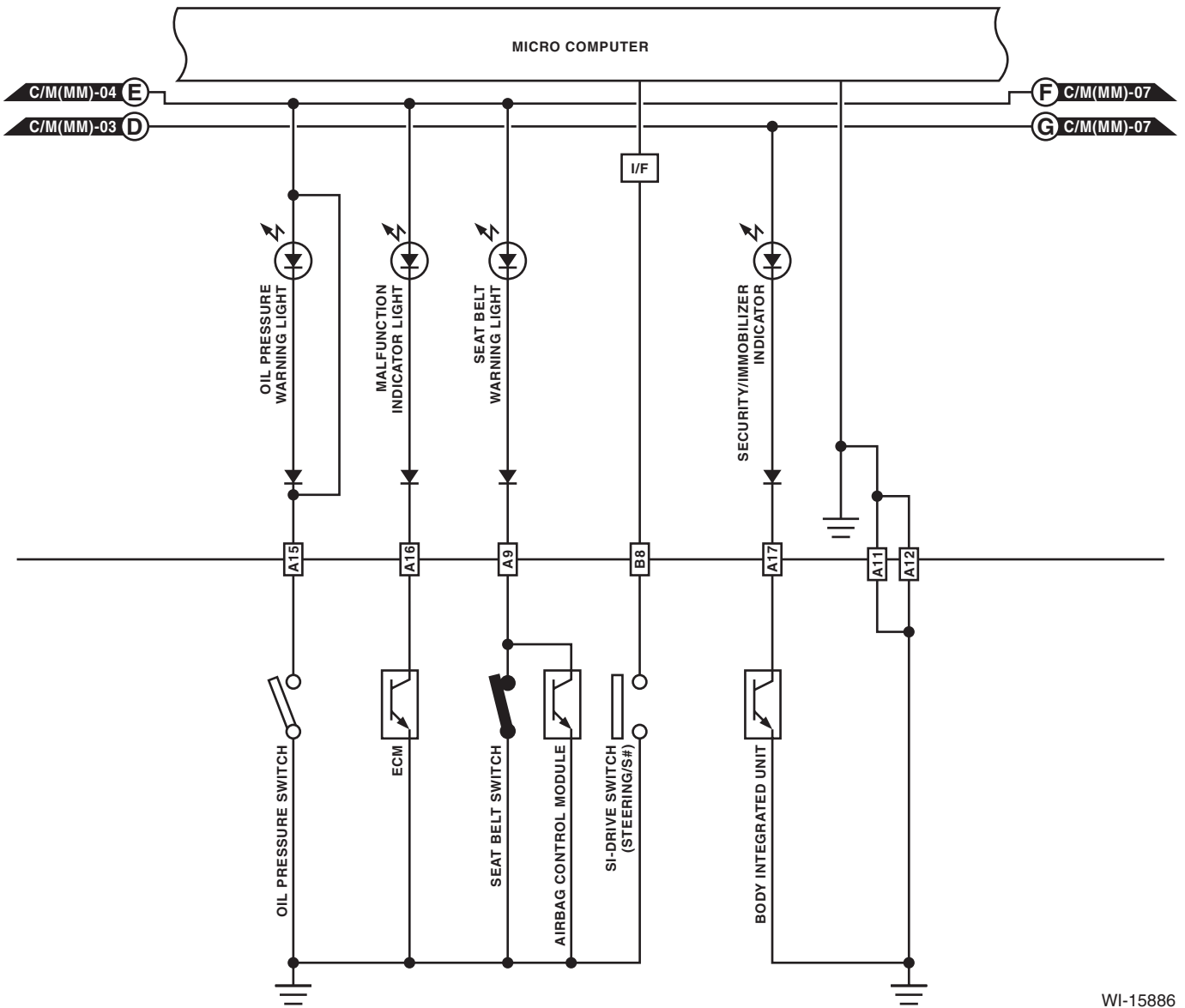
WI-15885

# Combination Meter System

WIRING SYSTEM

C/M(MM)-05

C/M(MM)-05



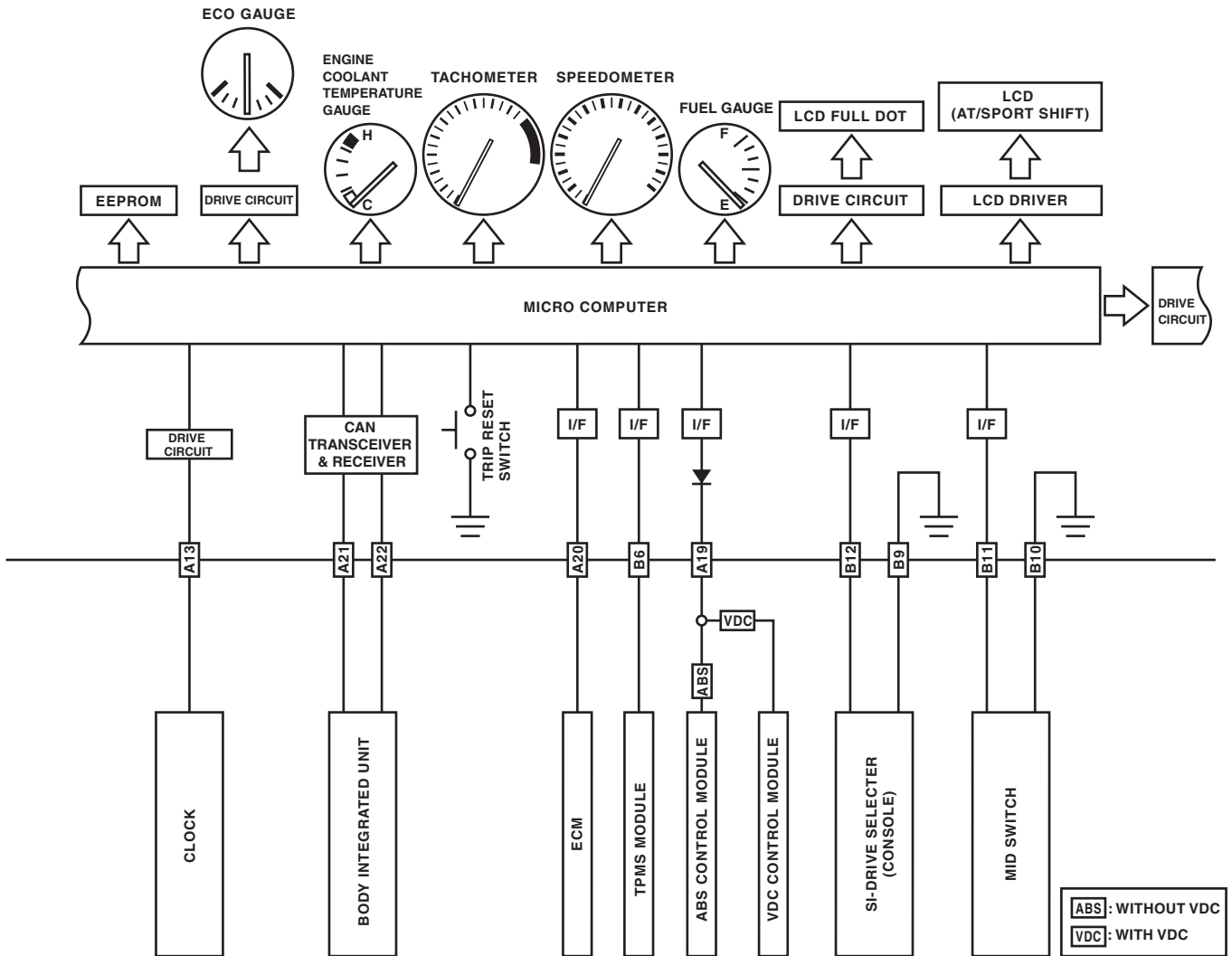
WI-15886

# Combination Meter System

WIRING SYSTEM

C/M(MM)-06

C/M(MM)-06



WI-15887

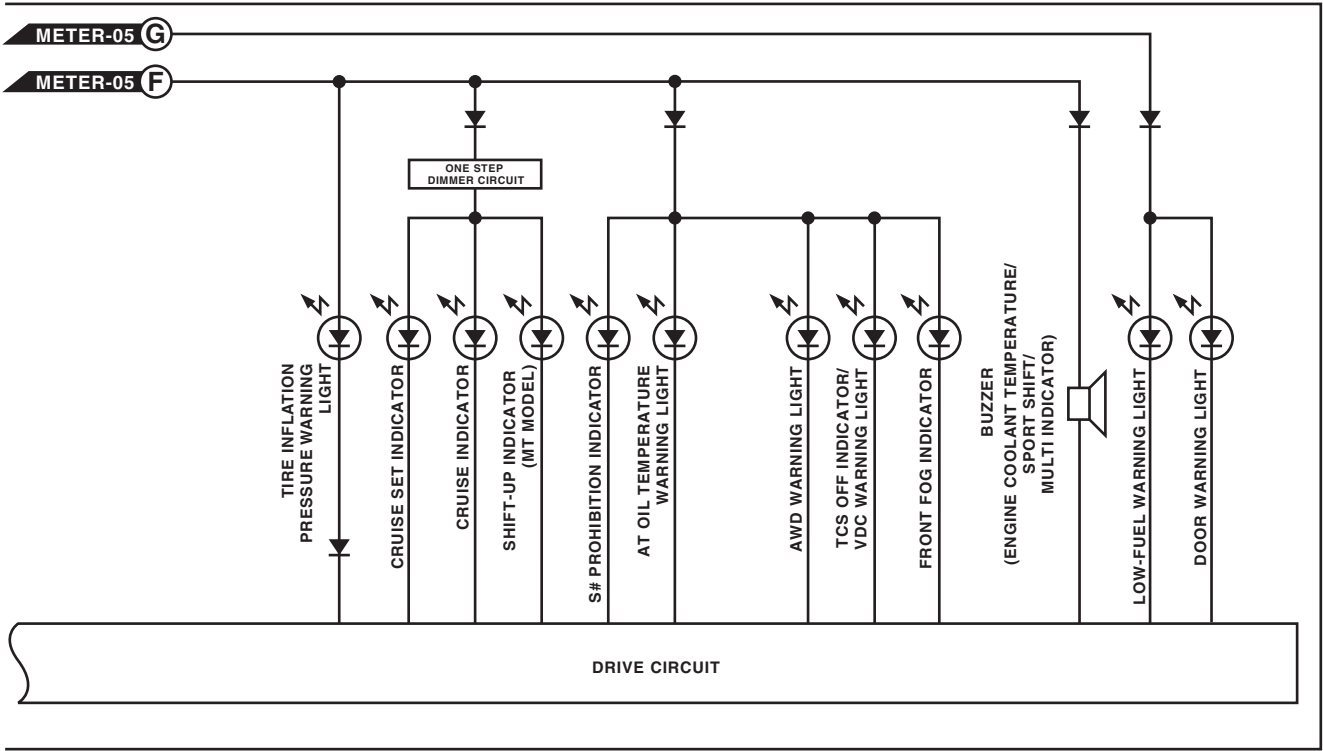


# Combination Meter System

WIRING SYSTEM

C/M(MM)-07

C/M(MM)-07



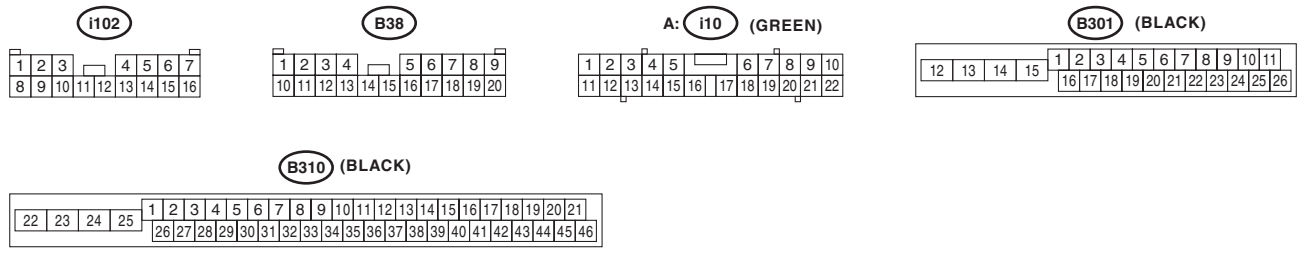
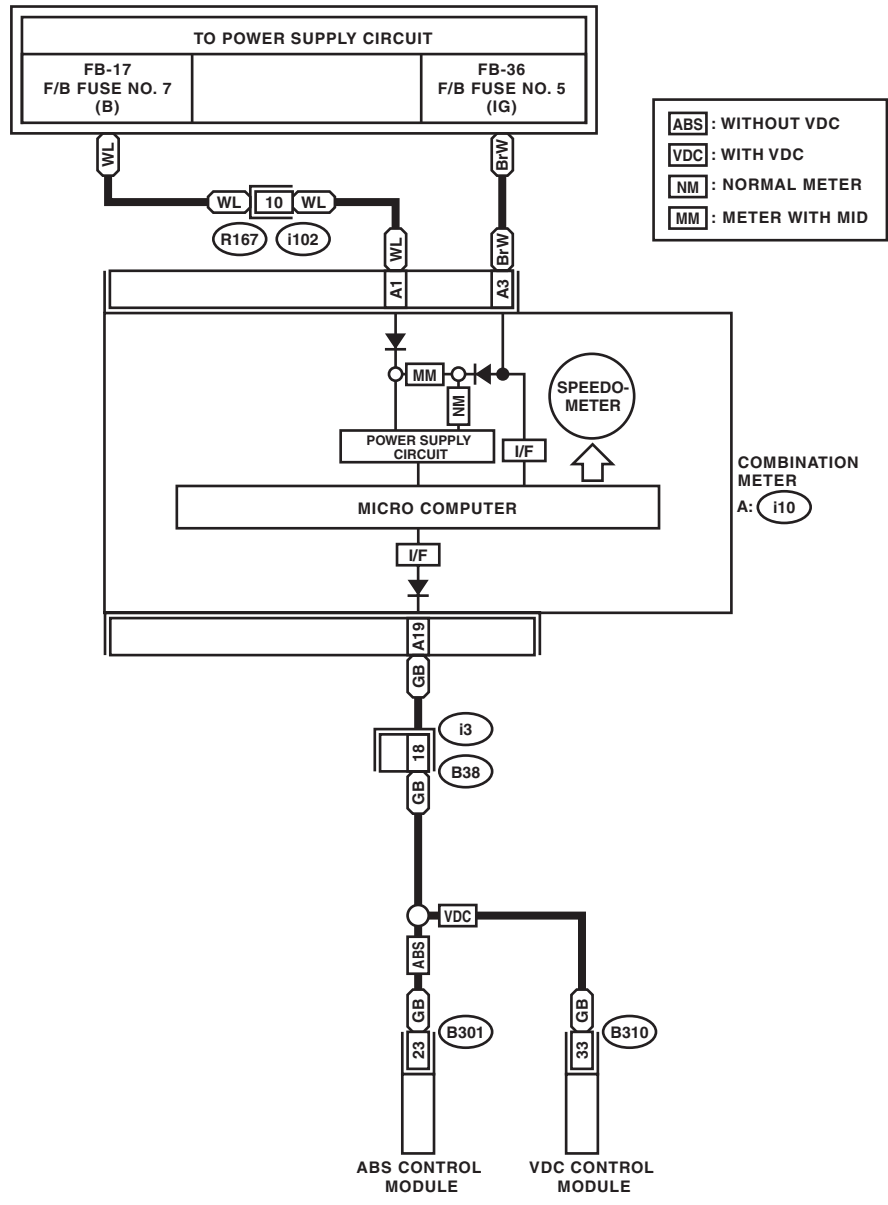
WI-15888

## 41.Speedometer System

### A: WIRING DIAGRAM

SP-01

SP-01



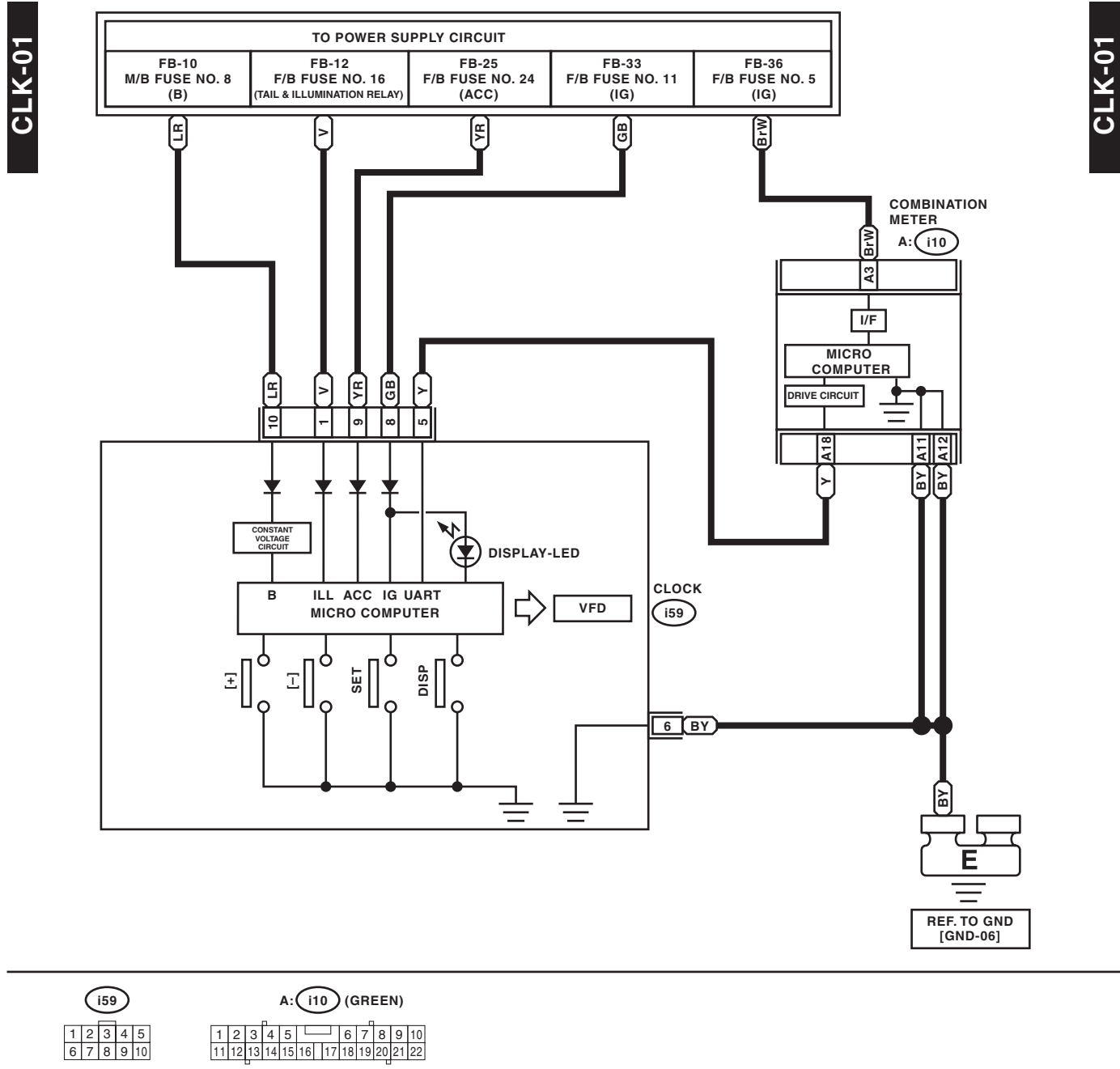
# Clock System

WIRING SYSTEM

## 42.Clock System

### A: WIRING DIAGRAM

#### 1. WITH FUEL GAUGE AMBIENT AIR TEMPERATURE RESIDUAL DRIVEN DISPLAY



WI-15890

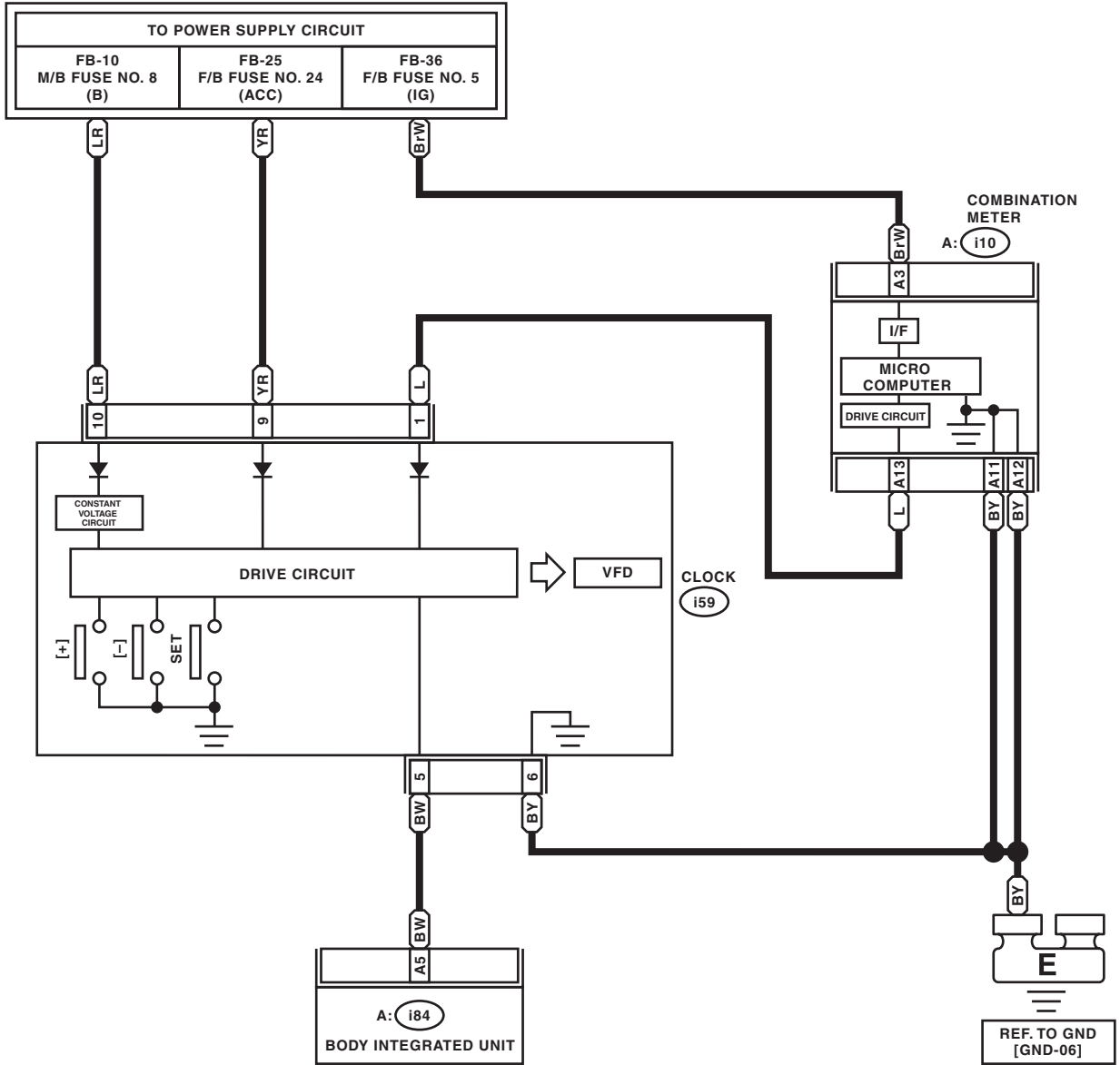
# Clock System

WIRING SYSTEM

## 2. ONLY CLOCK DISPLAY (WITH ILLUMINATION CONTROL)

CLK(IL)-01

CLK(IL)-01



i59

1	2	3	4	5
6	7	8	9	10

A: i10 (GREEN)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35					

A: i84 (GRAY)

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35					

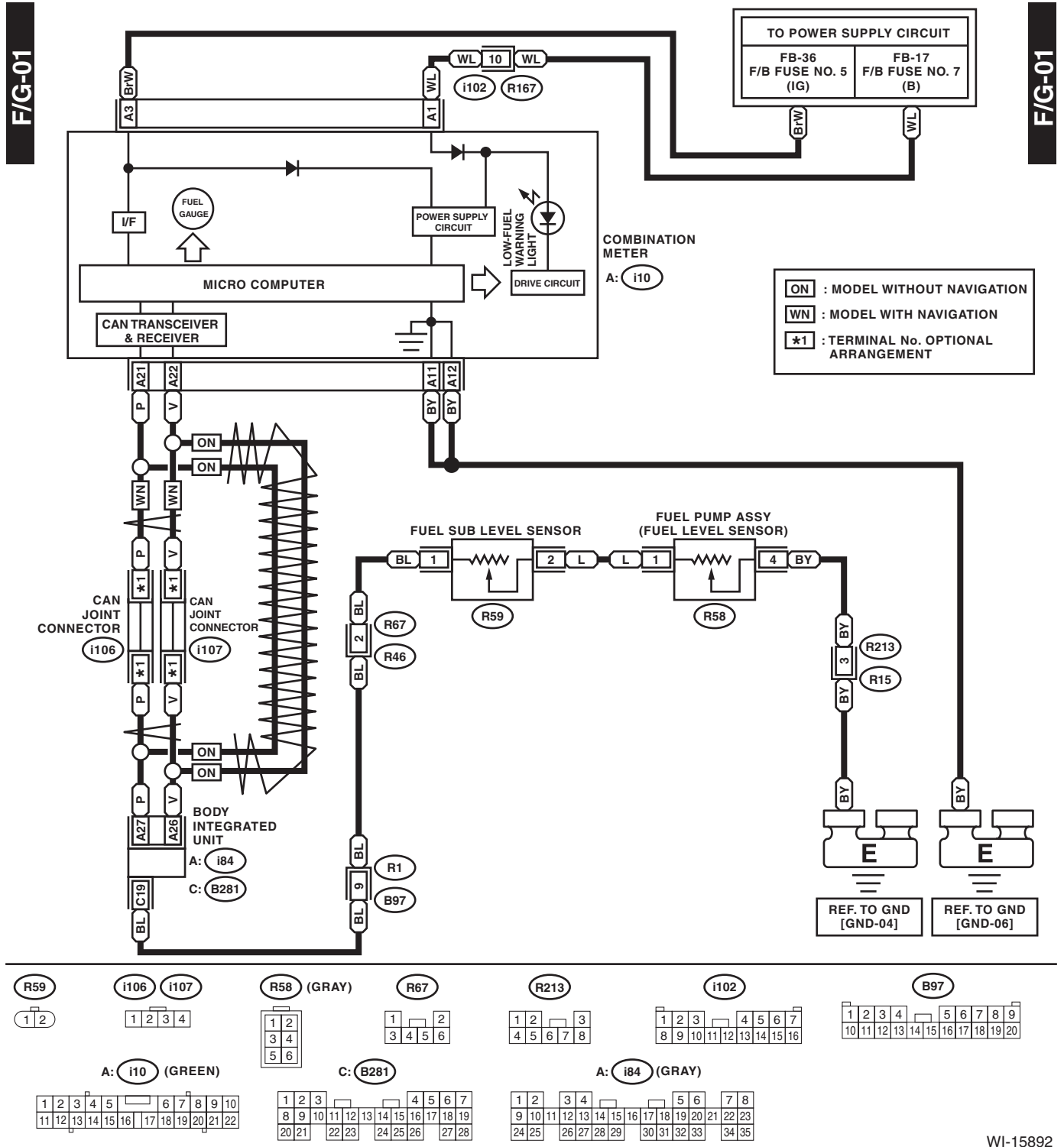
WI-15891

# Fuel Gauge System

WIRING SYSTEM

## 43. Fuel Gauge System

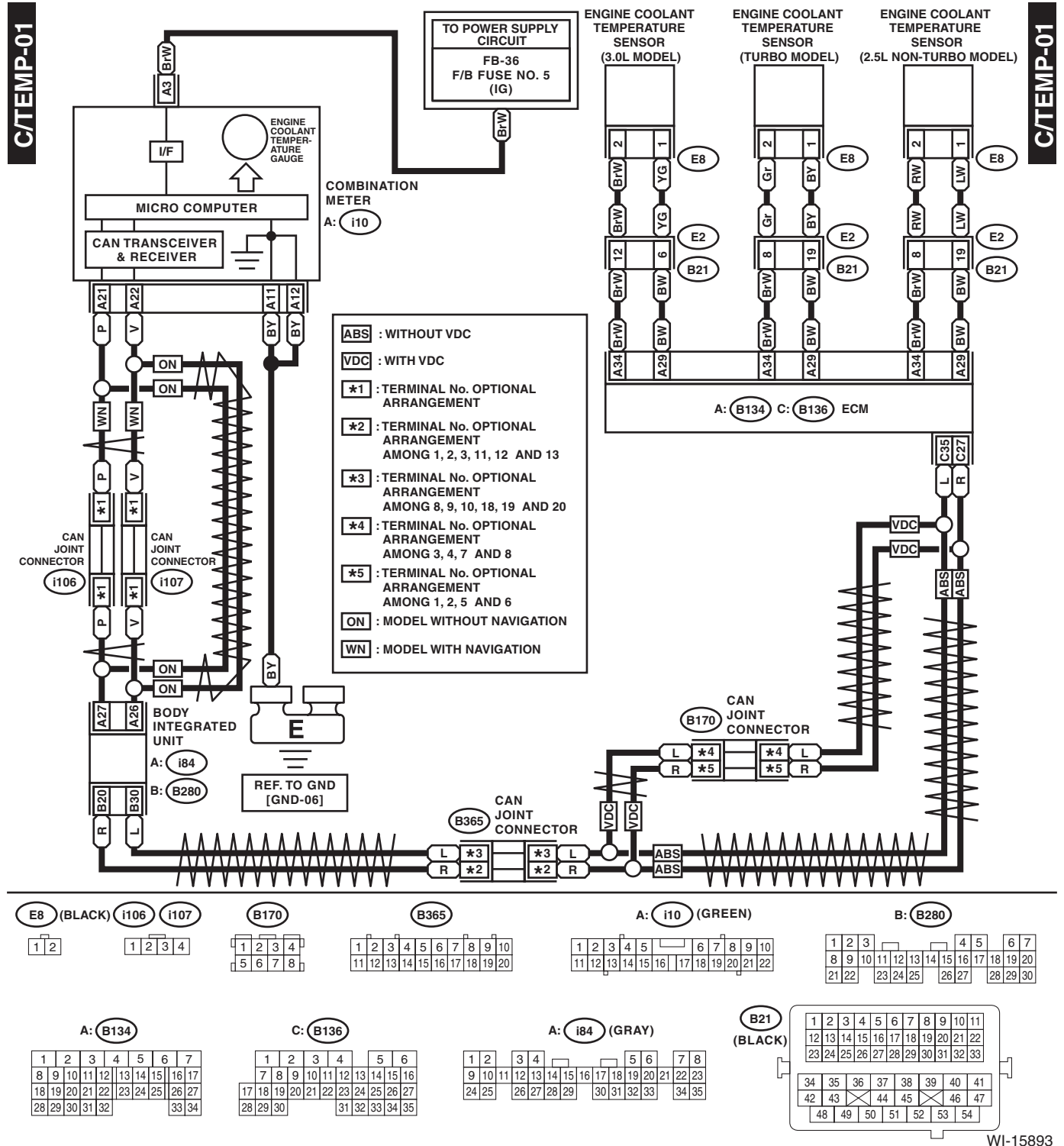
### A: WIRING DIAGRAM



WI-15892

## 44. Coolant Temperature System

### A: WIRING DIAGRAM



# Oil Pressure Warning Light System

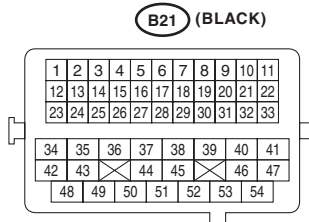
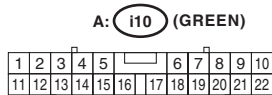
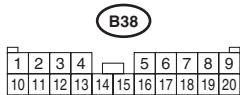
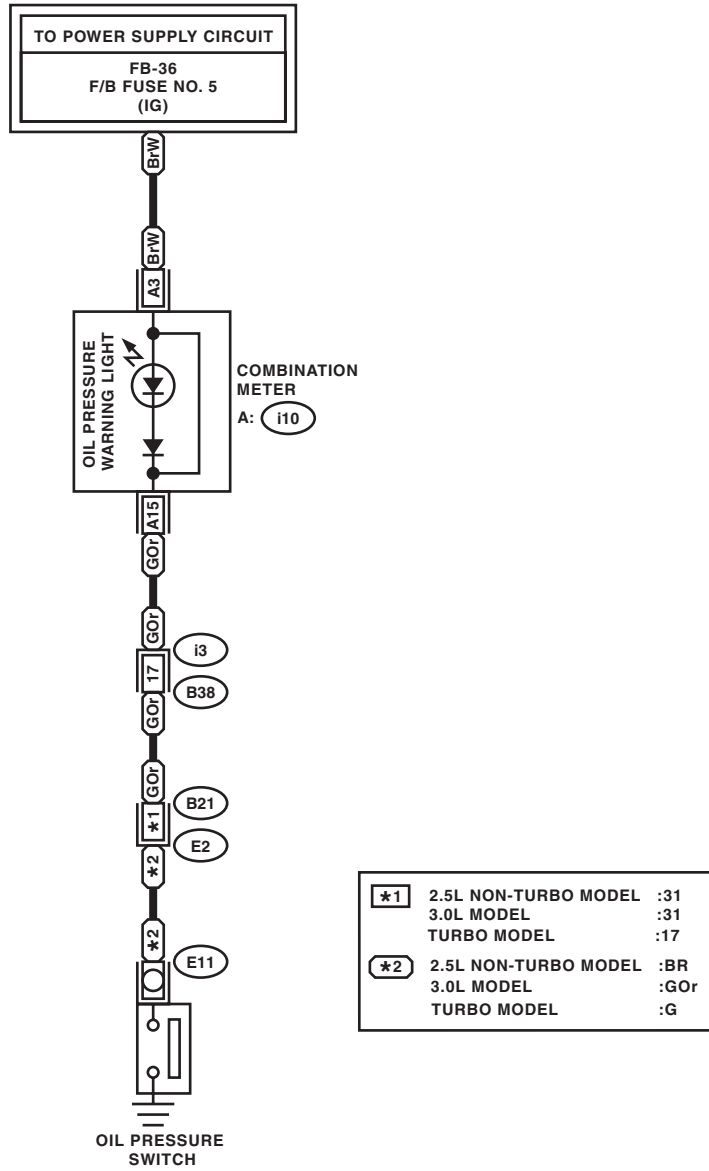
WIRING SYSTEM

## 45.Oil Pressure Warning Light System

### A: WIRING DIAGRAM

OIL/P-01

OIL/P-01



WI-15894

# Parking Brake / Brake Fluid Level Warning Light System

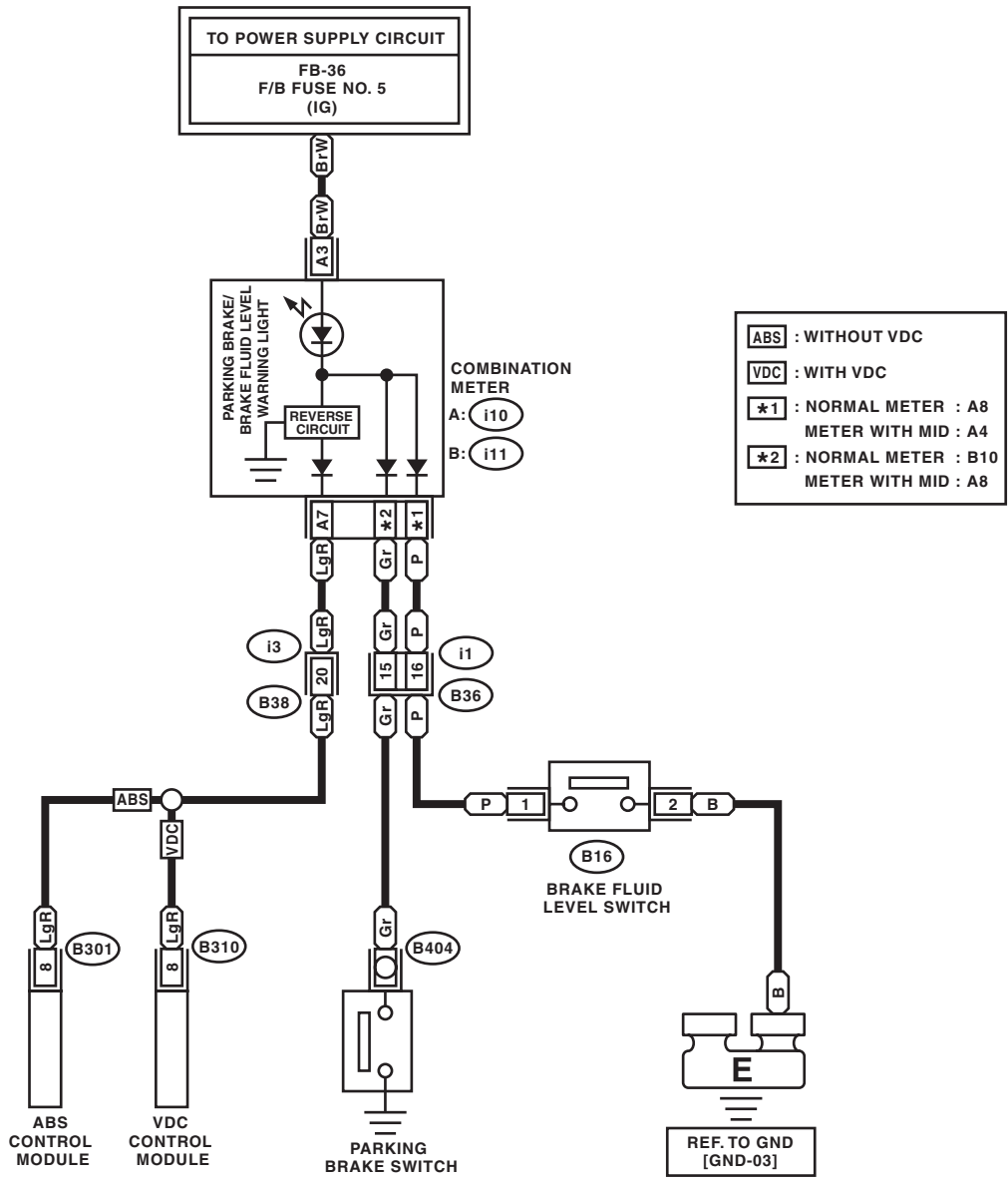
WIRING SYSTEM

## 46. Parking Brake / Brake Fluid Level Warning Light System

### A: WIRING DIAGRAM

BR/W-01

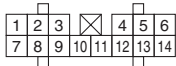
BR/W-01



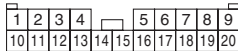
B16 (GRAY)



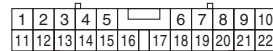
B: i11 (GREEN)



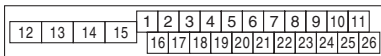
B38



A: i10 (GREEN)



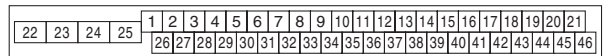
B301 (BLACK)



i11



B310 (BLACK)



WI-15895



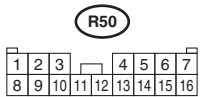
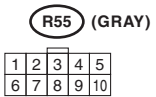
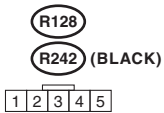
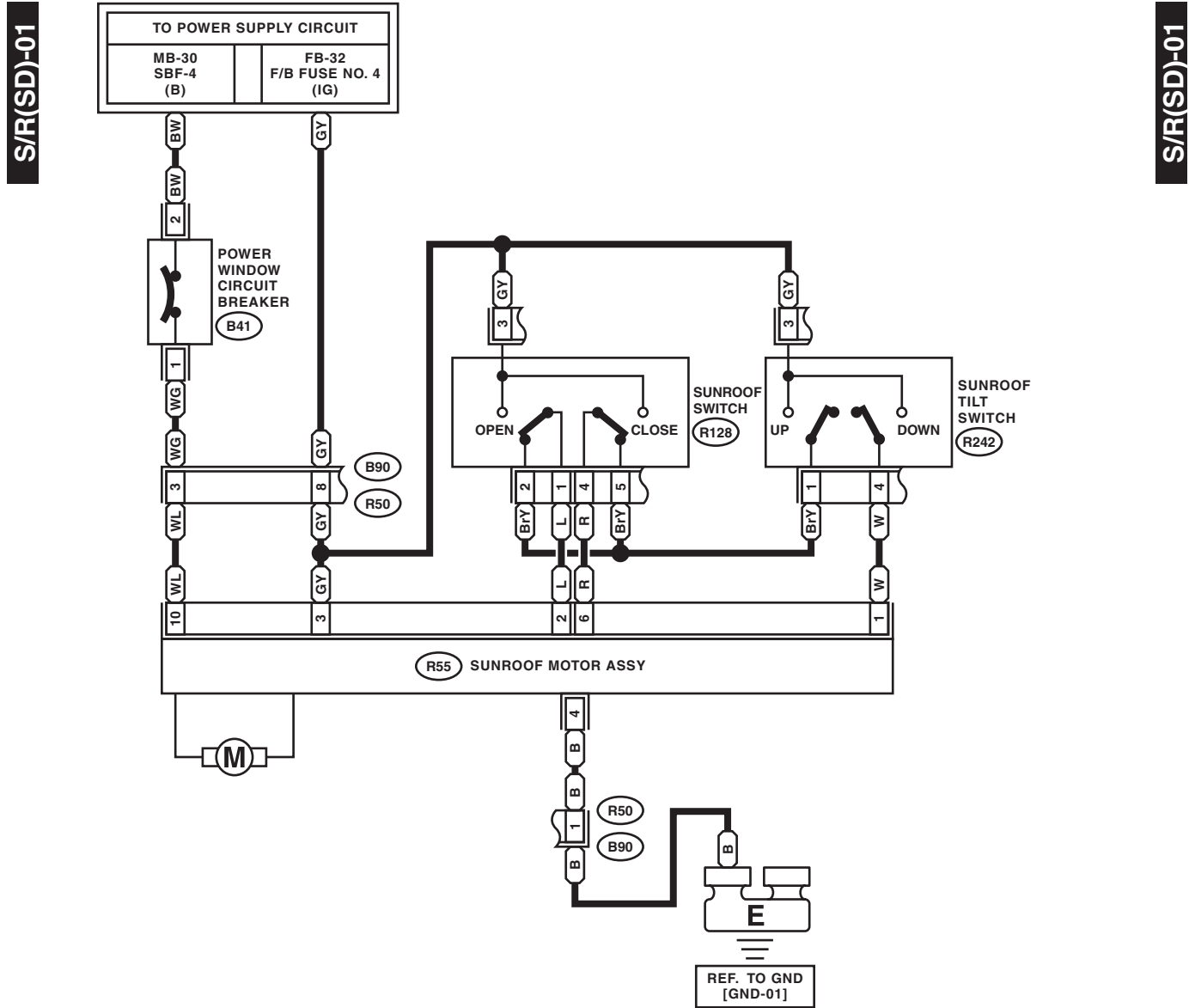
# Sunroof Control System

WIRING SYSTEM

## 47. Sunroof Control System

### A: WIRING DIAGRAM

#### 1. SEDAN MODEL



WI-15896

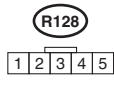
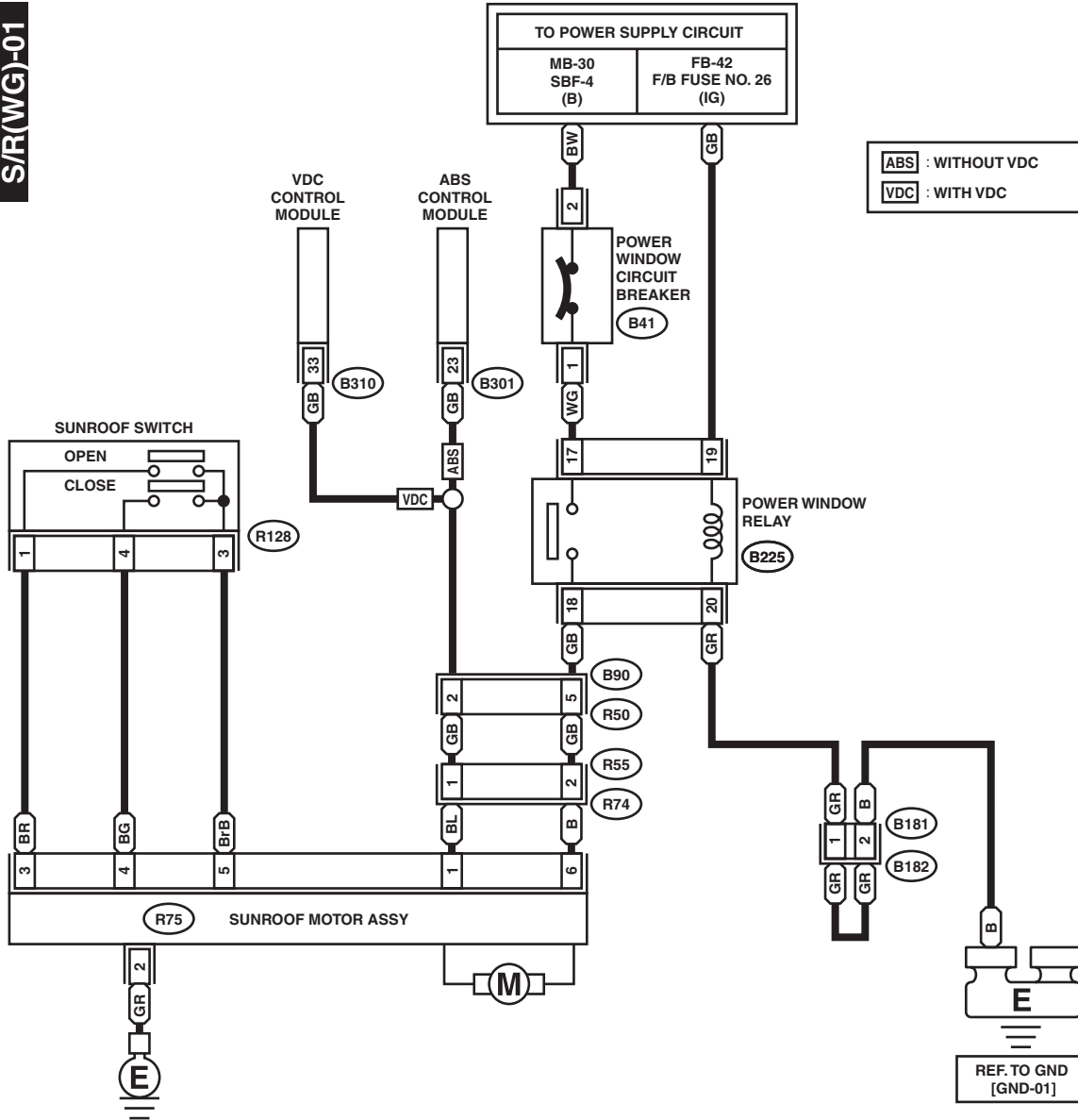
# Sunroof Control System

WIRING SYSTEM

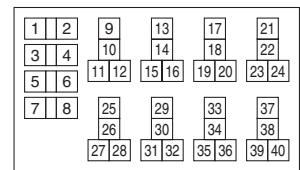
## 2. WAGON MODEL

S/R(WG)-01

S/R(WG)-01

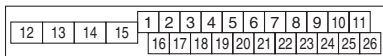


B225 (BLACK)

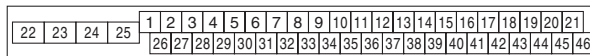


RELAY BLOCK

B301 (BLACK)



B310 (BLACK)



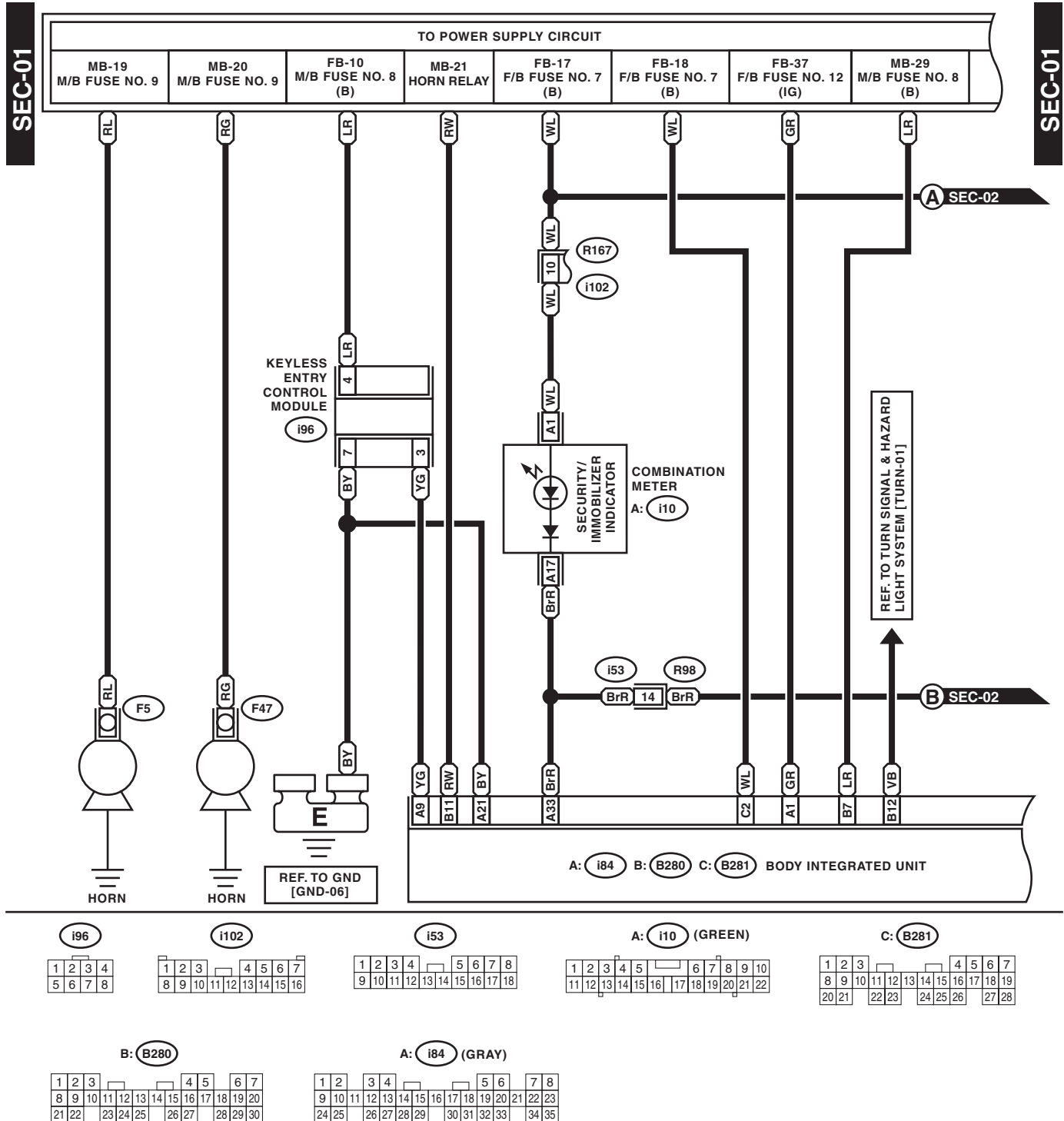
WI-18657

# Security System

WIRING SYSTEM

## 48. Security System

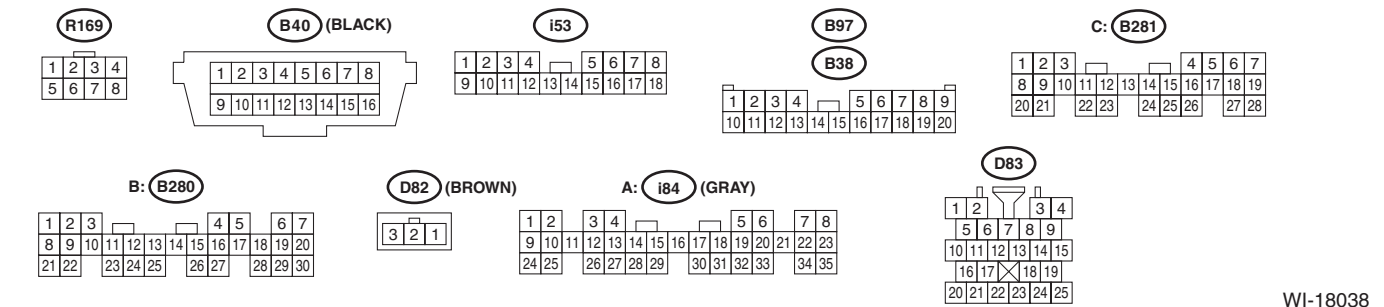
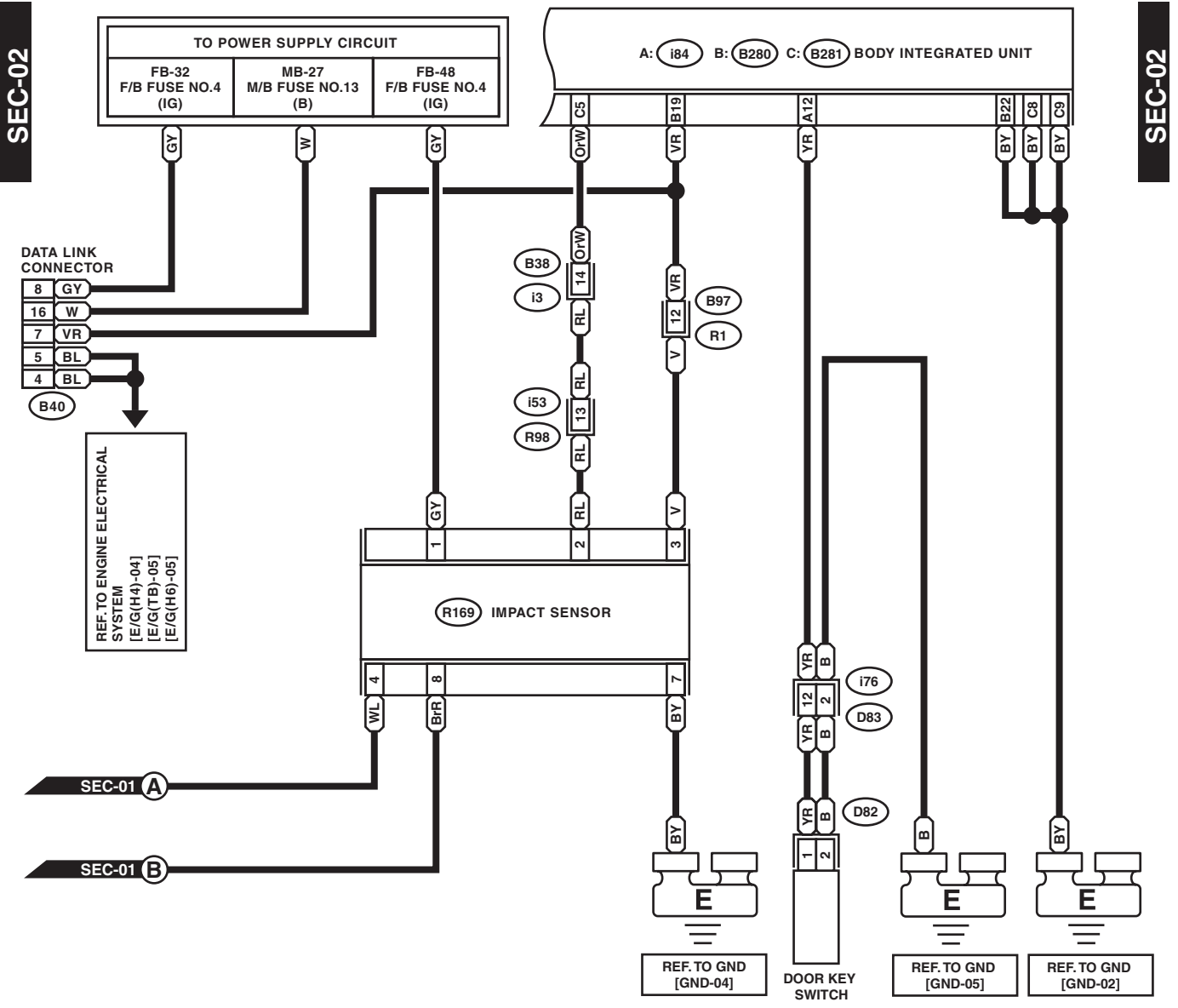
### A: WIRING DIAGRAM



WI-15898

# Security System

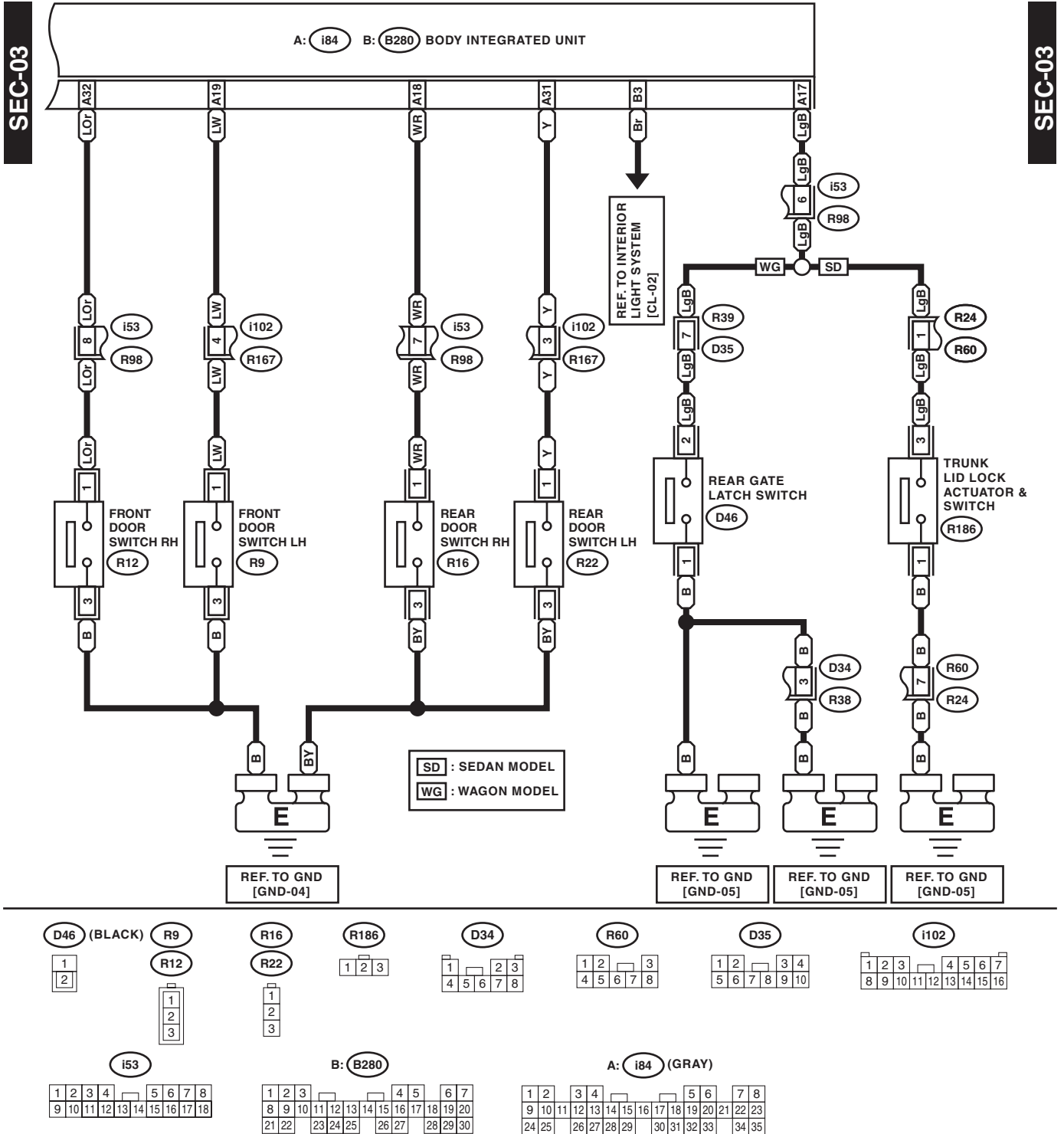
WIRING SYSTEM



WI-18038

# Security System

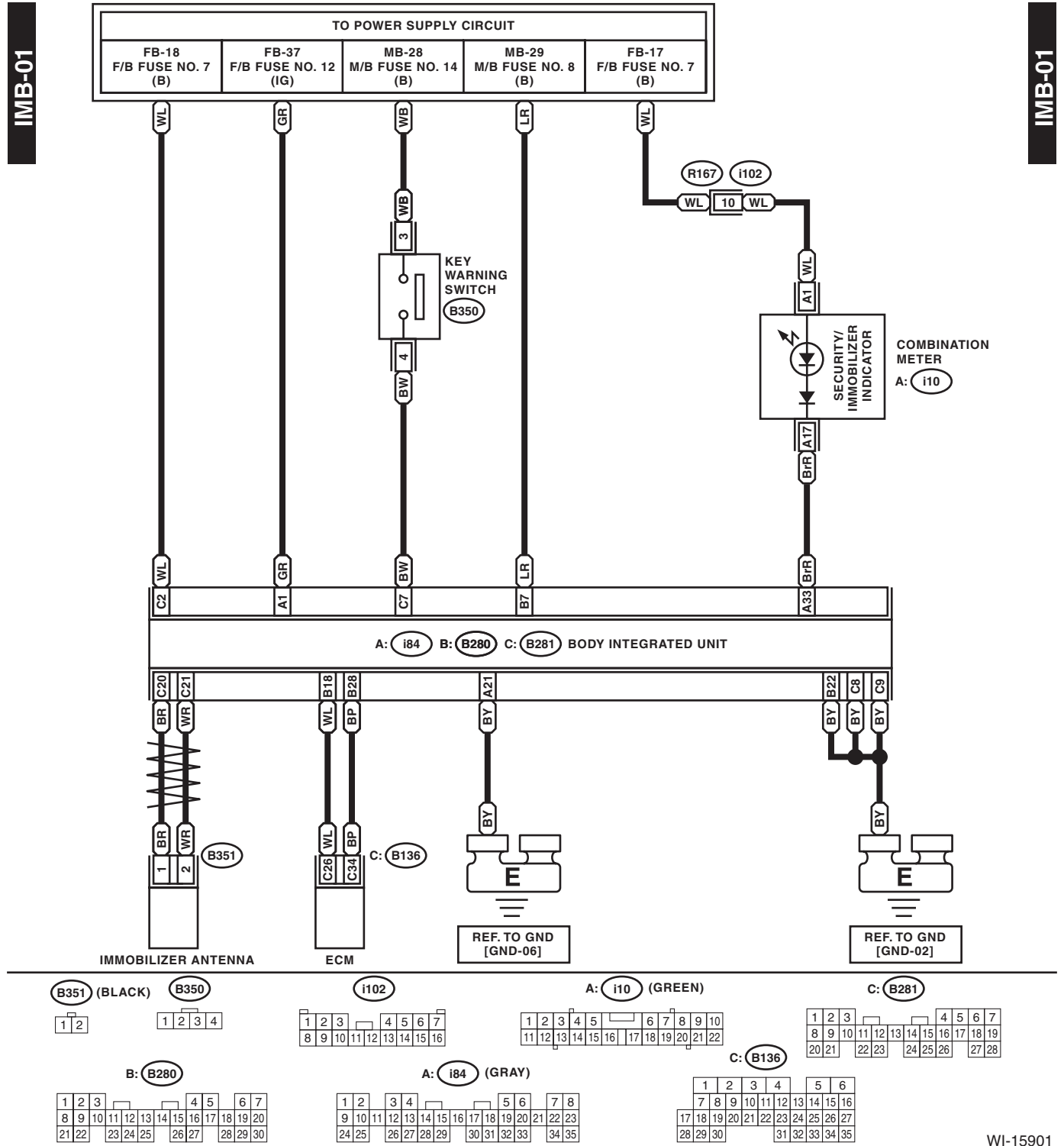
## WIRING SYSTEM



WI-15900

## 49. Immobilizer System

### A: WIRING DIAGRAM

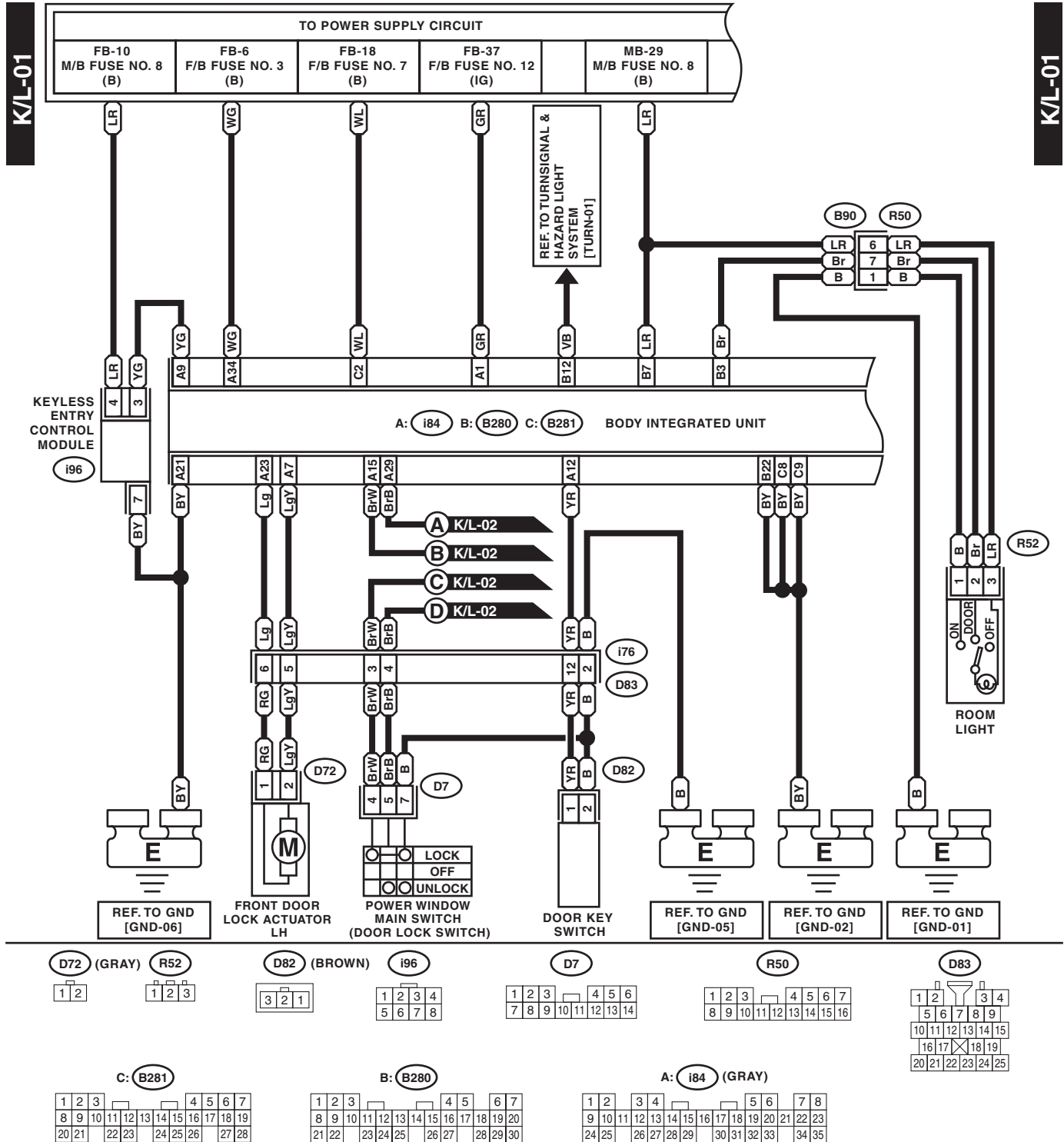


# Keyless Entry System

WIRING SYSTEM

## 50. Keyless Entry System

### A: WIRING DIAGRAM



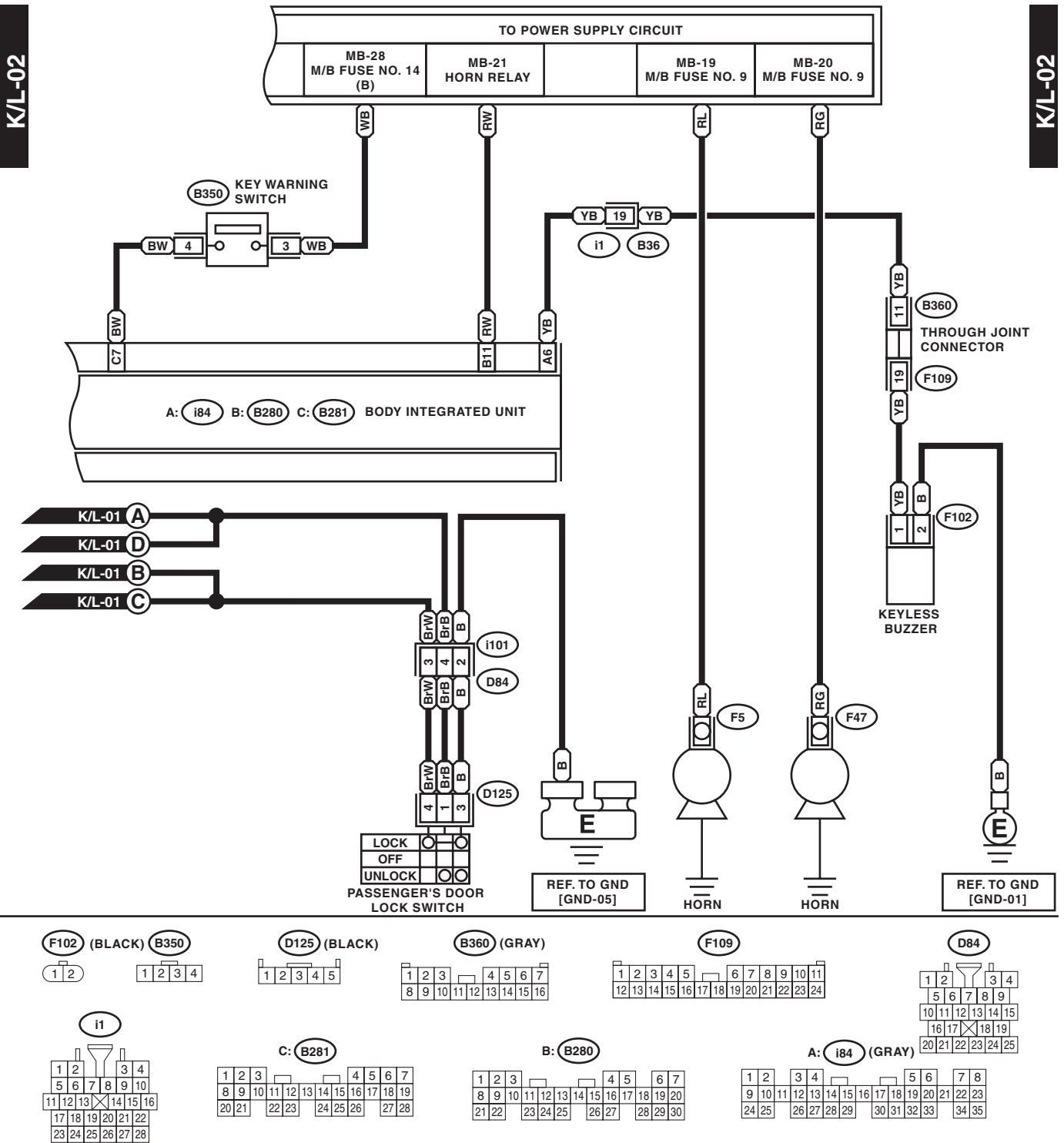
WI-15902

# Keyless Entry System

WIRING SYSTEM

K/L-02

K/L-02

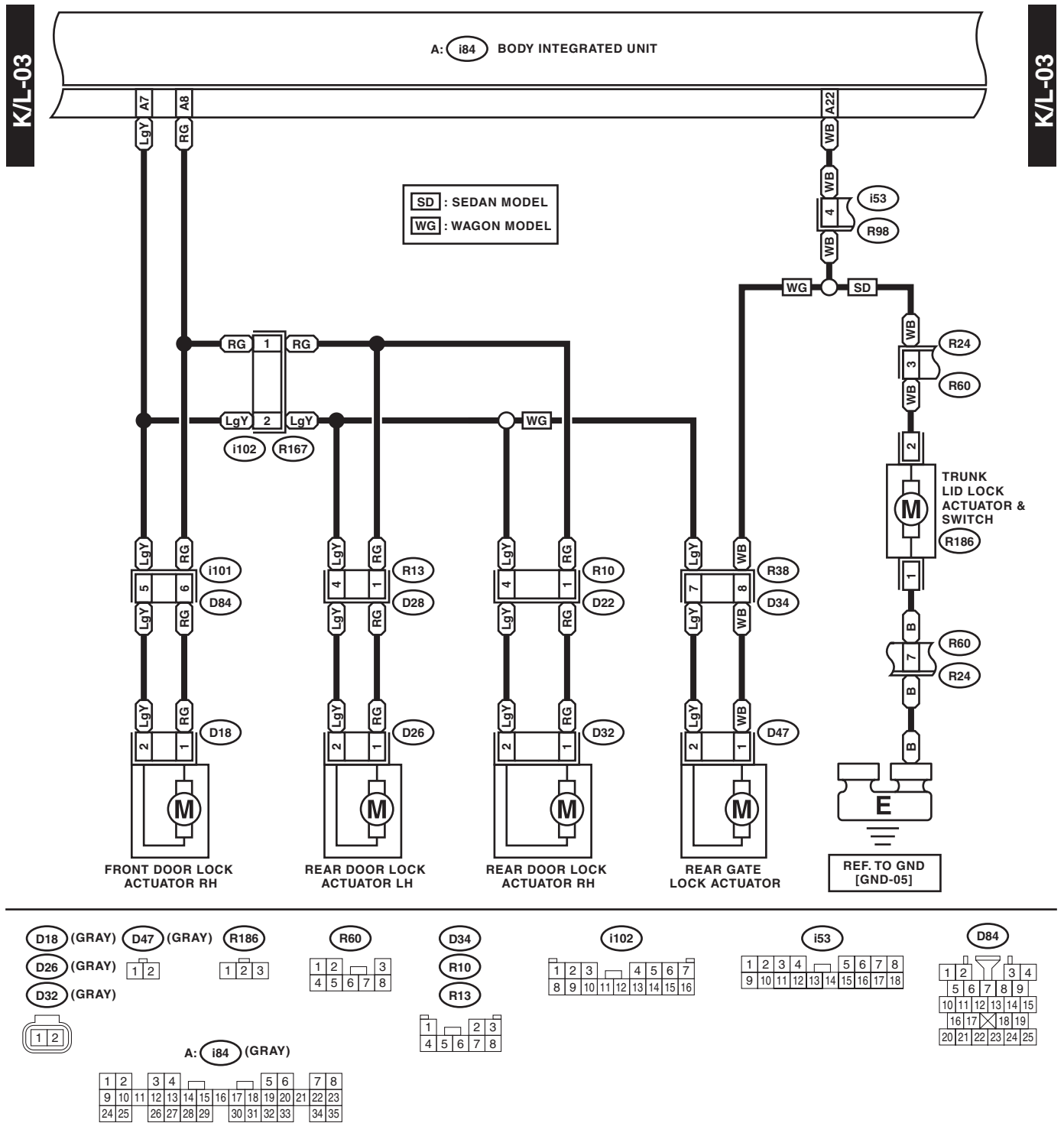


WI-15903



# Keyless Entry System

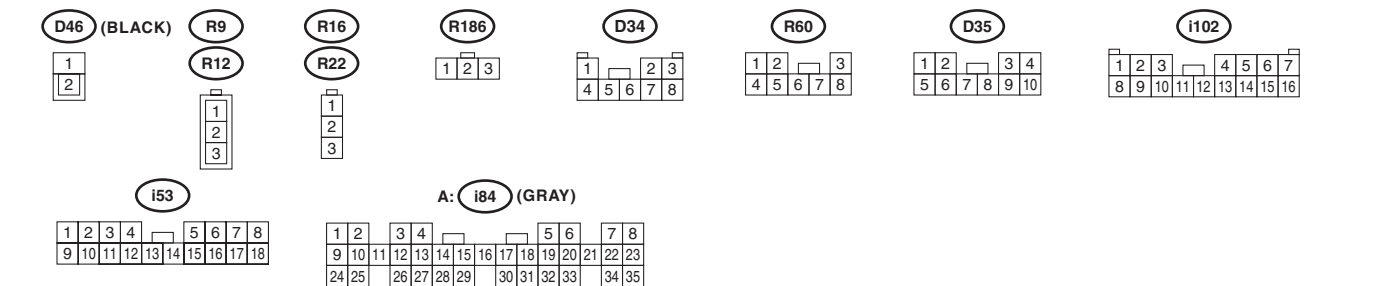
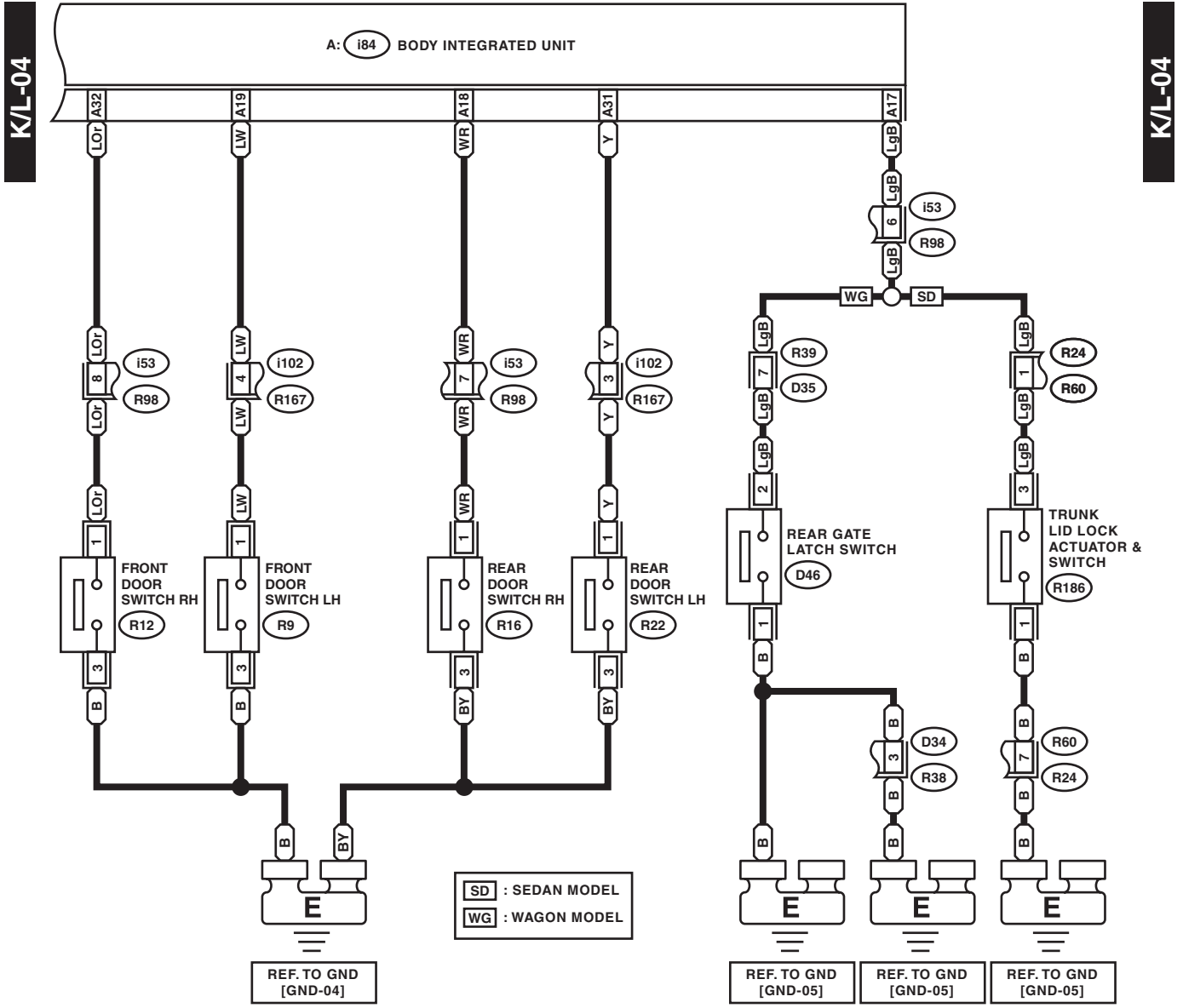
## WIRING SYSTEM



WI-15904

# Keyless Entry System

WIRING SYSTEM



WI-15905

# Cruise Control System

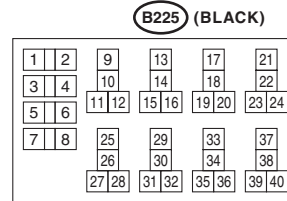
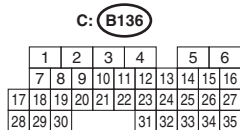
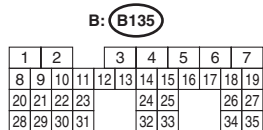
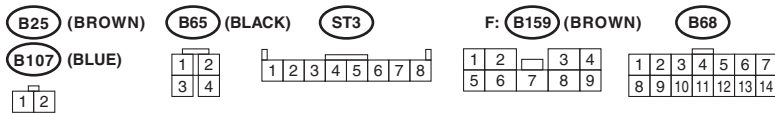
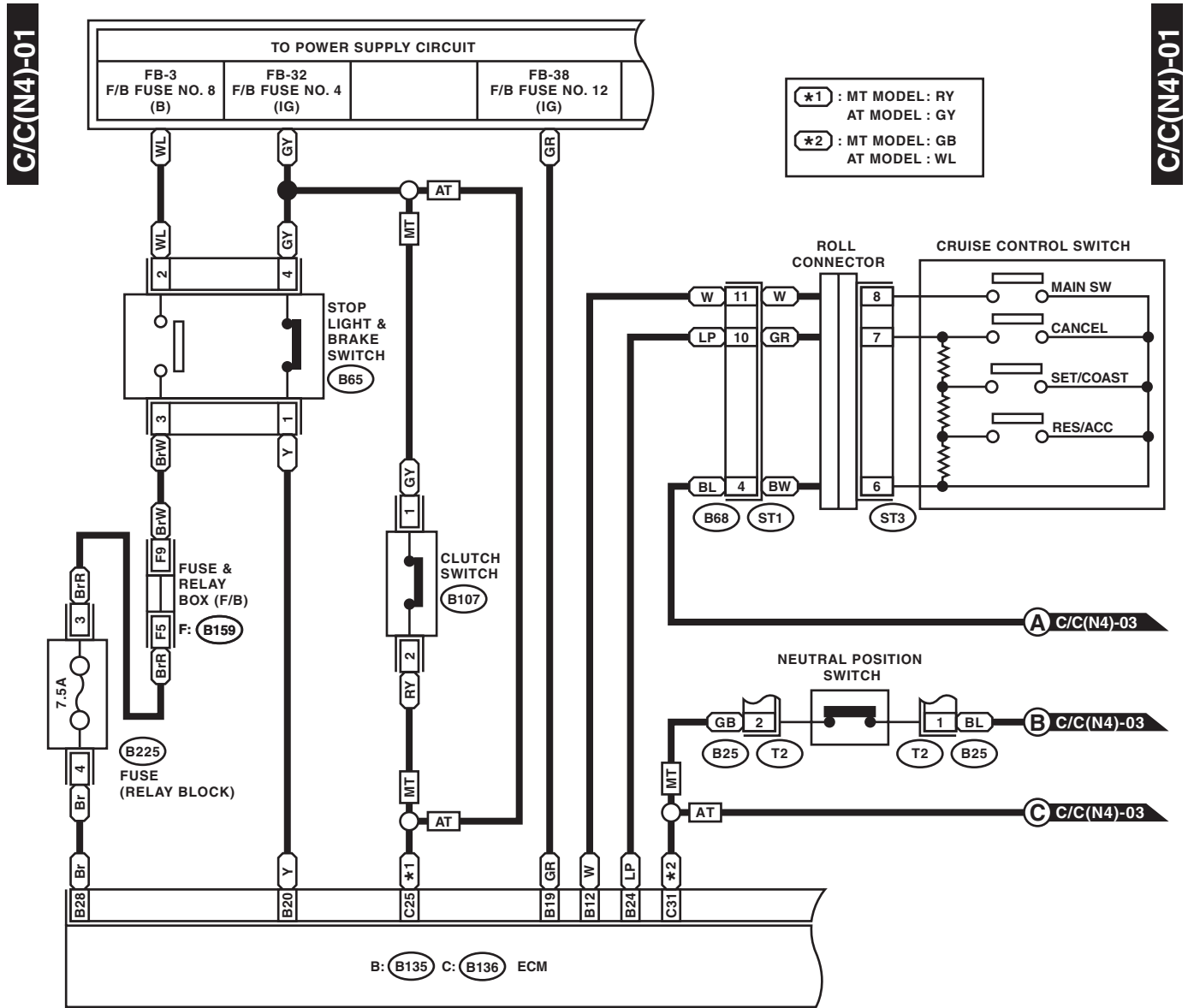
WIRING SYSTEM

## 51. Cruise Control System

### A: WIRING DIAGRAM

#### 1. 2.5 L NON-TURBO MODEL

- Transmission serial No. 4078112 or earlier



RELAY BLOCK

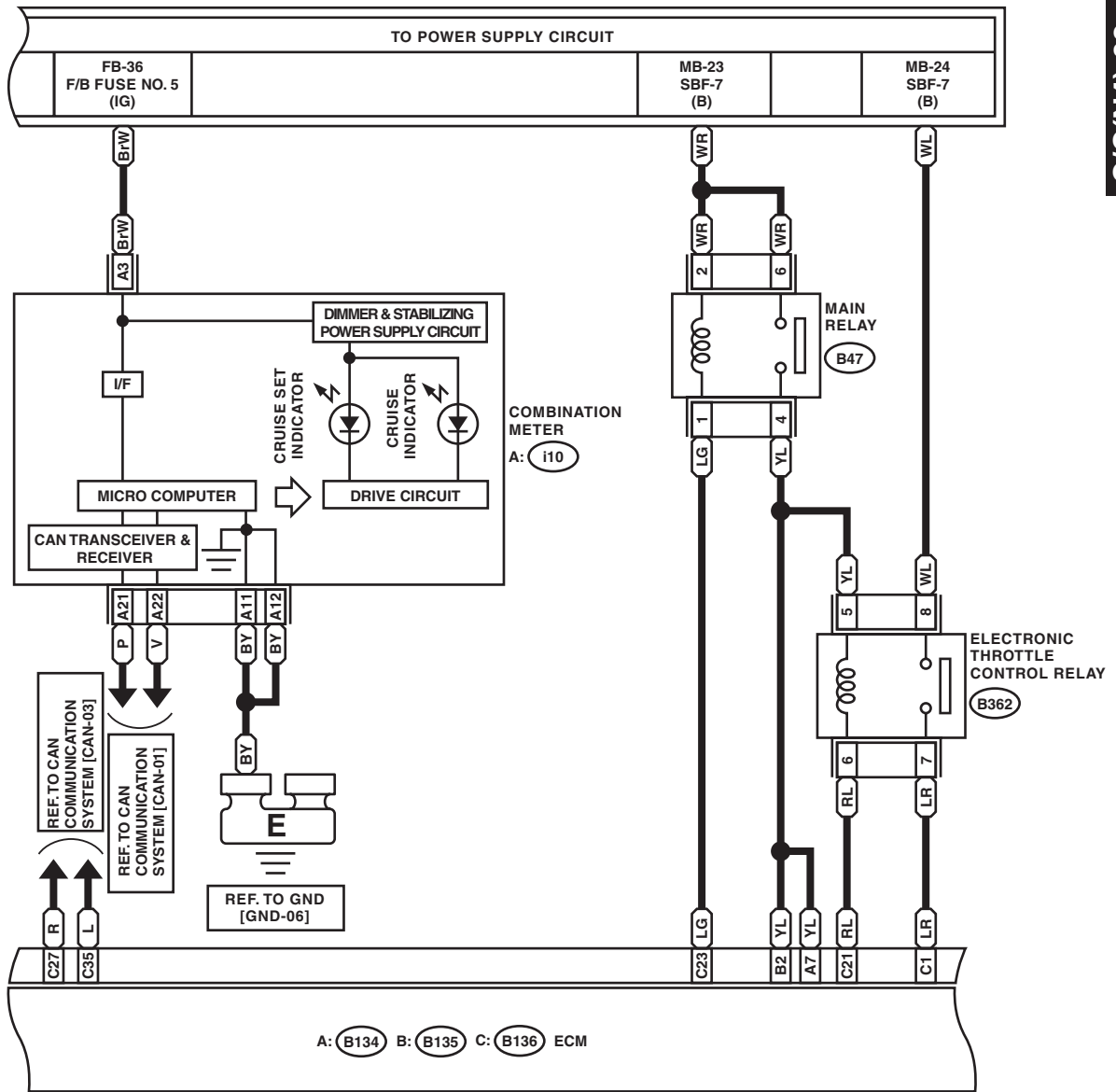
WI-15906

# Cruise Control System

WIRING SYSTEM

C/C(N4)-02

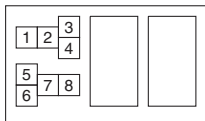
C/C(N4)-02



**B47** (BROWN)

1	2
3	4
5	6

**B362** (BLACK)



A: **i10** (GREEN)

1	2	3	4	5	6	7	8	9	10		
11	12	13	14	15	16	17	18	19	20	21	22

A: **B134**

1	2	3	4	5	6	7			
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31	32				33	34

B: **B135**

1	2	3	4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27				
28	29	30	31	32	33	34	35				

RELAY HOLDER

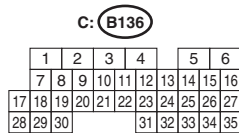
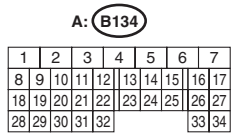
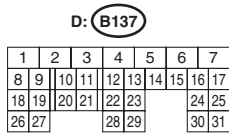
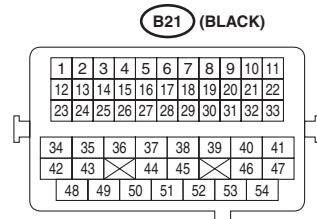
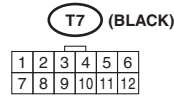
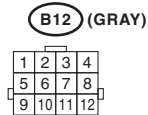
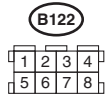
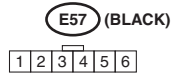
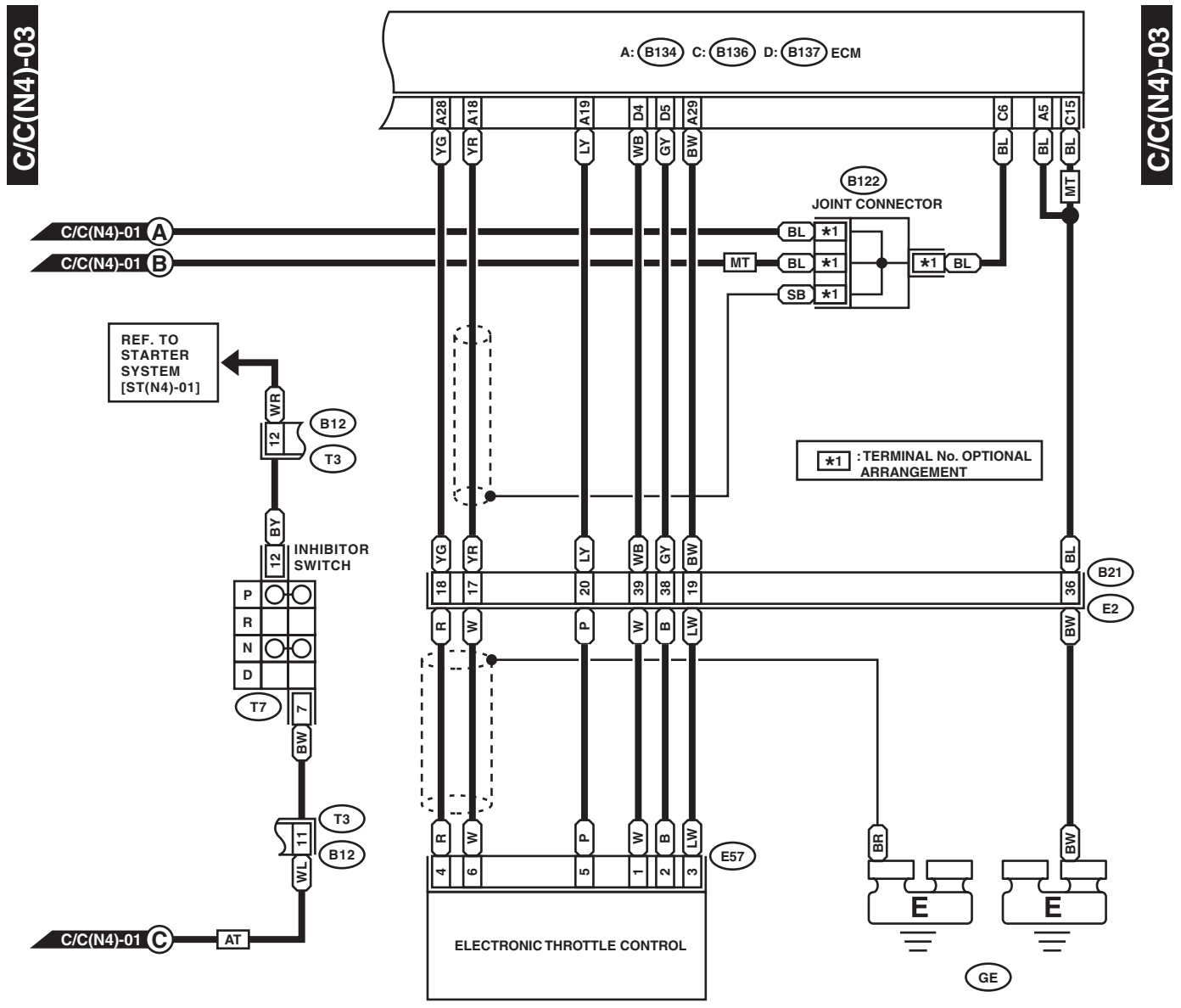
C: **B136**

1	2	3	4	5	6					
7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27
28	29	30				31	32	33	34	35

WI-15907

# Cruise Control System

WIRING SYSTEM

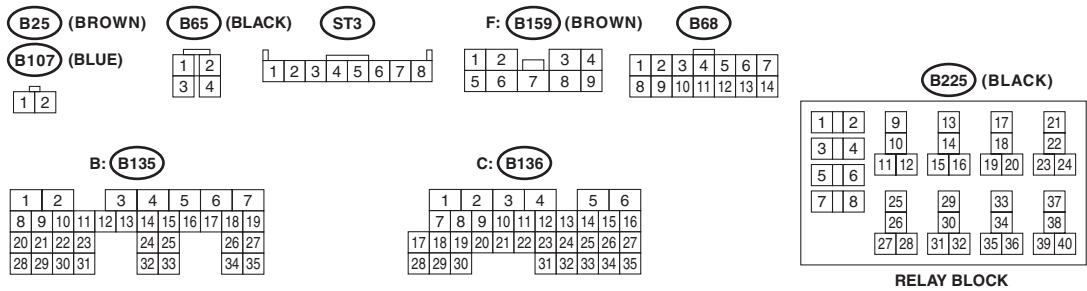
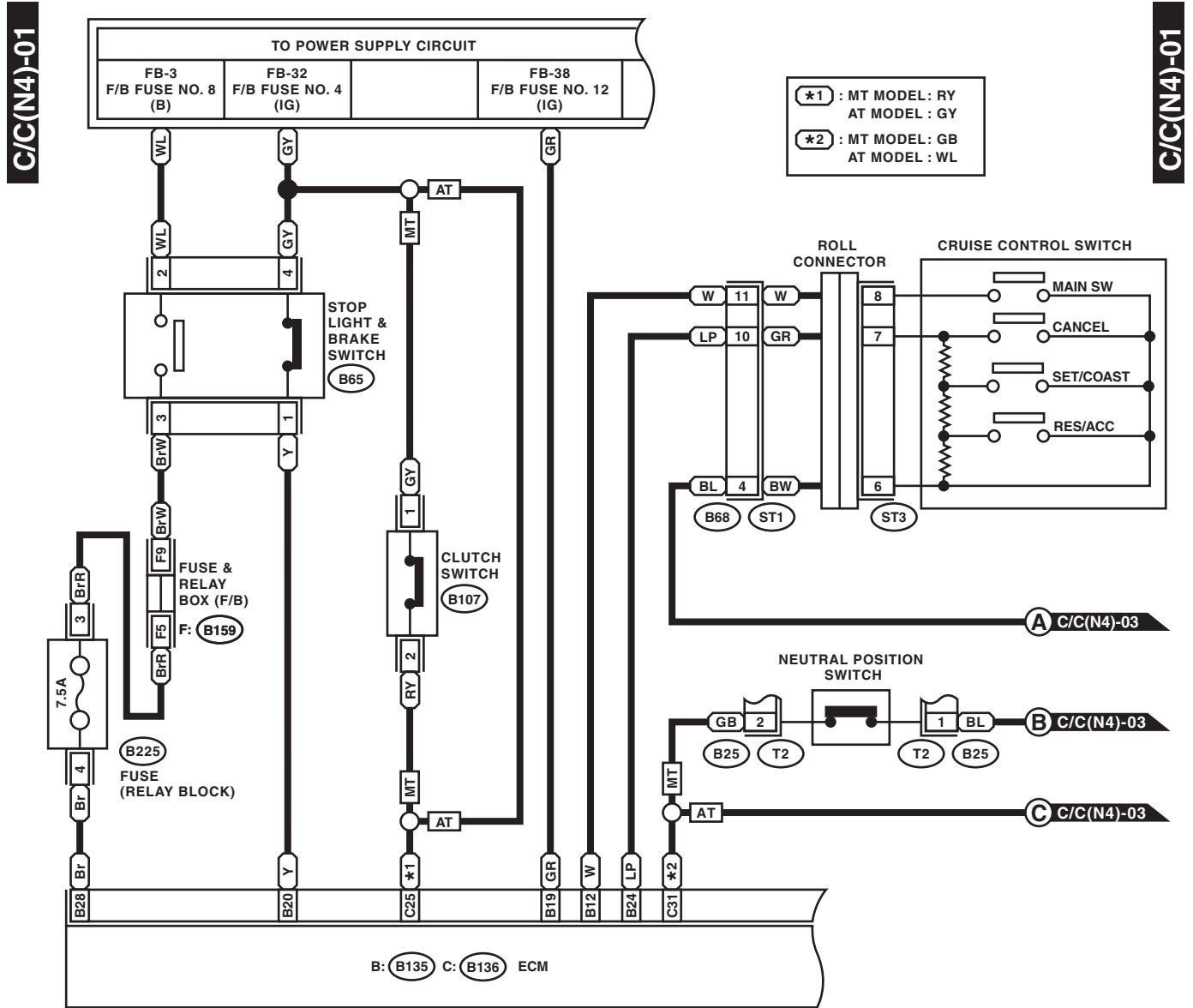


WI-13294

# Cruise Control System

WIRING SYSTEM

• Transmission serial No. 4078113 or later



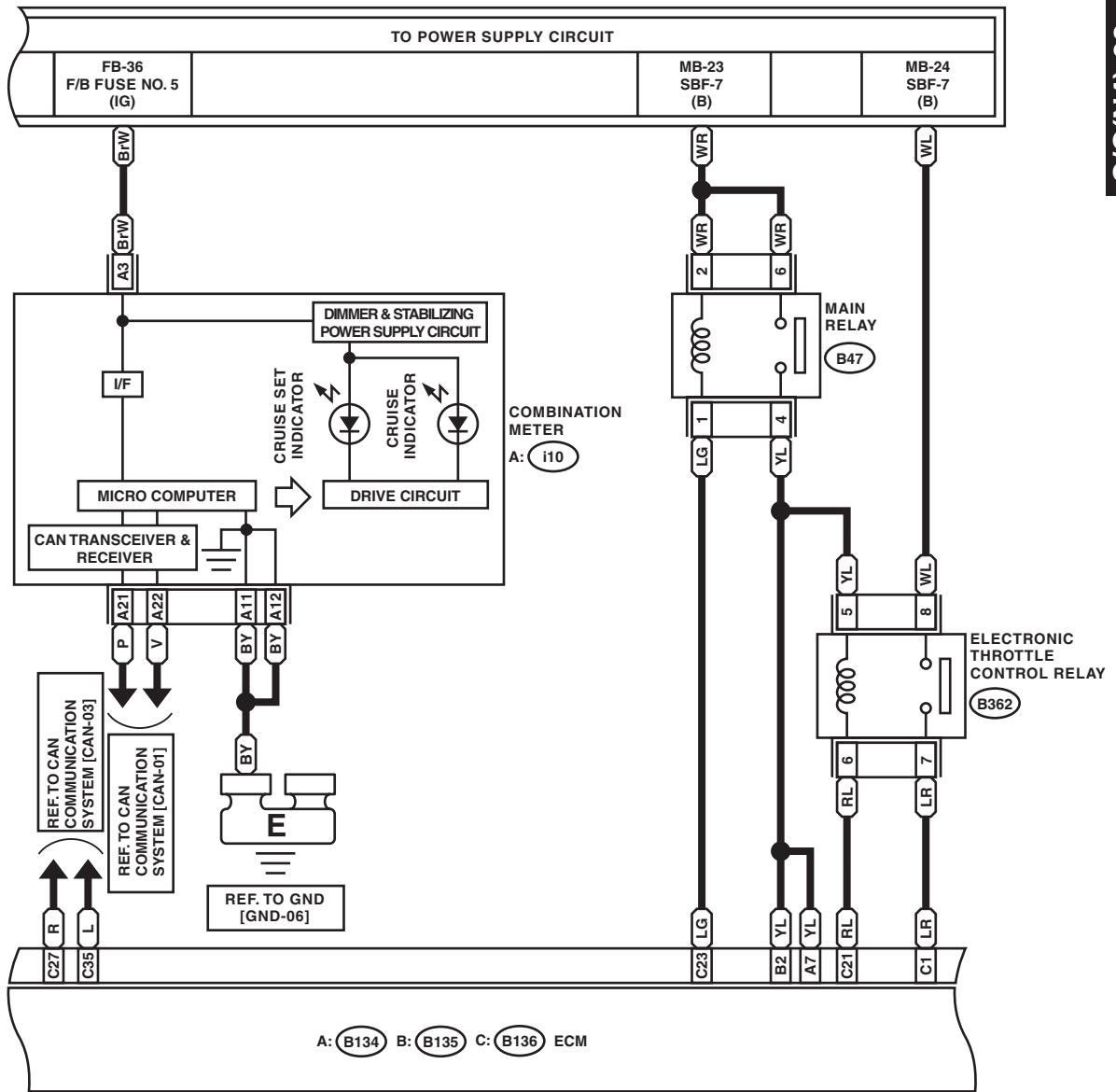
WI-15906

# Cruise Control System

## WIRING SYSTEM

C/C(N4)-02

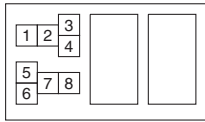
C/C(N4)-02



(B47) (BROWN)

1	2
3	4
5	6

(B362) (BLACK)



A: (i10) (GREEN)

1	2	3	4	5	6	7	8	9	10		
11	12	13	14	15	16	17	18	19	20	21	22

A: (B134)

1	2	3	4	5	6	7			
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31	32			33	34	

B: (B135)

1	2	3	4	5	6	7					
8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27				
28	29	30	31	32	33	34	35				

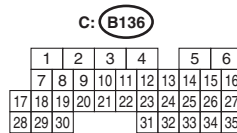
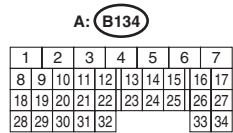
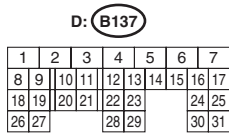
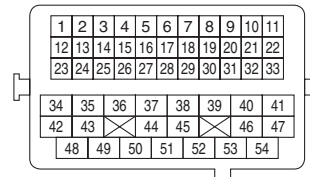
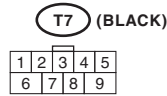
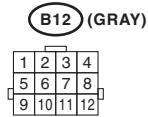
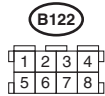
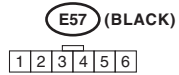
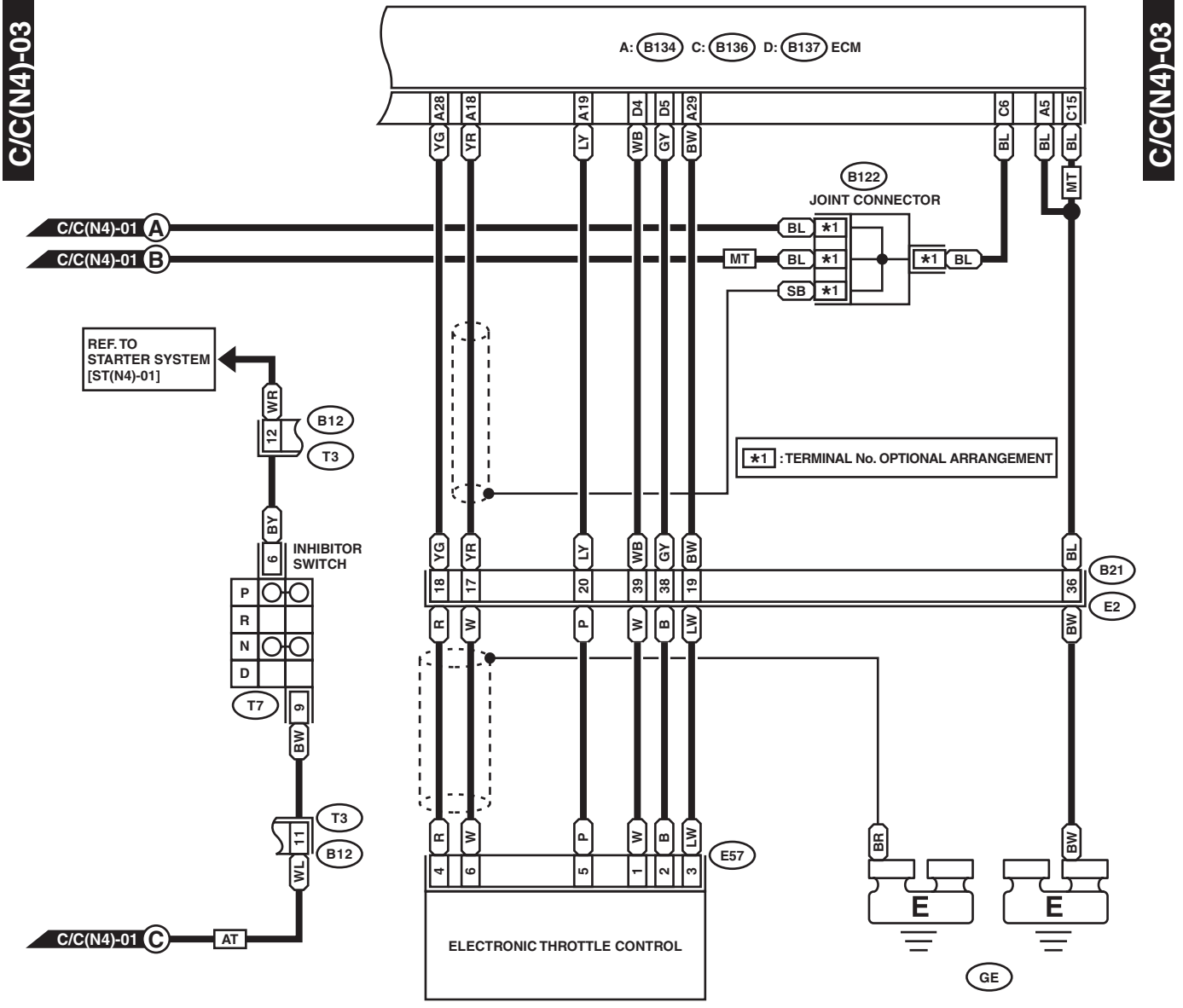
C: (B136)

1	2	3	4	5	6					
7	8	9	10	11	12	13	14	15	16	
17	18	19	20	21	22	23	24	25	26	27
28	29	30				31	32	33	34	35

WI-15907

# Cruise Control System

WIRING SYSTEM



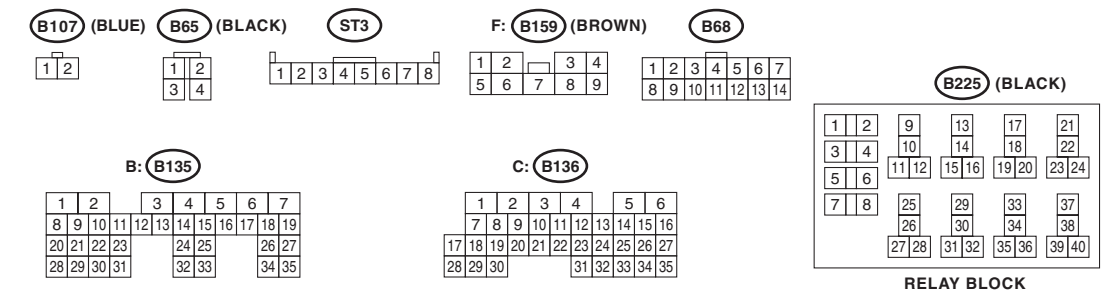
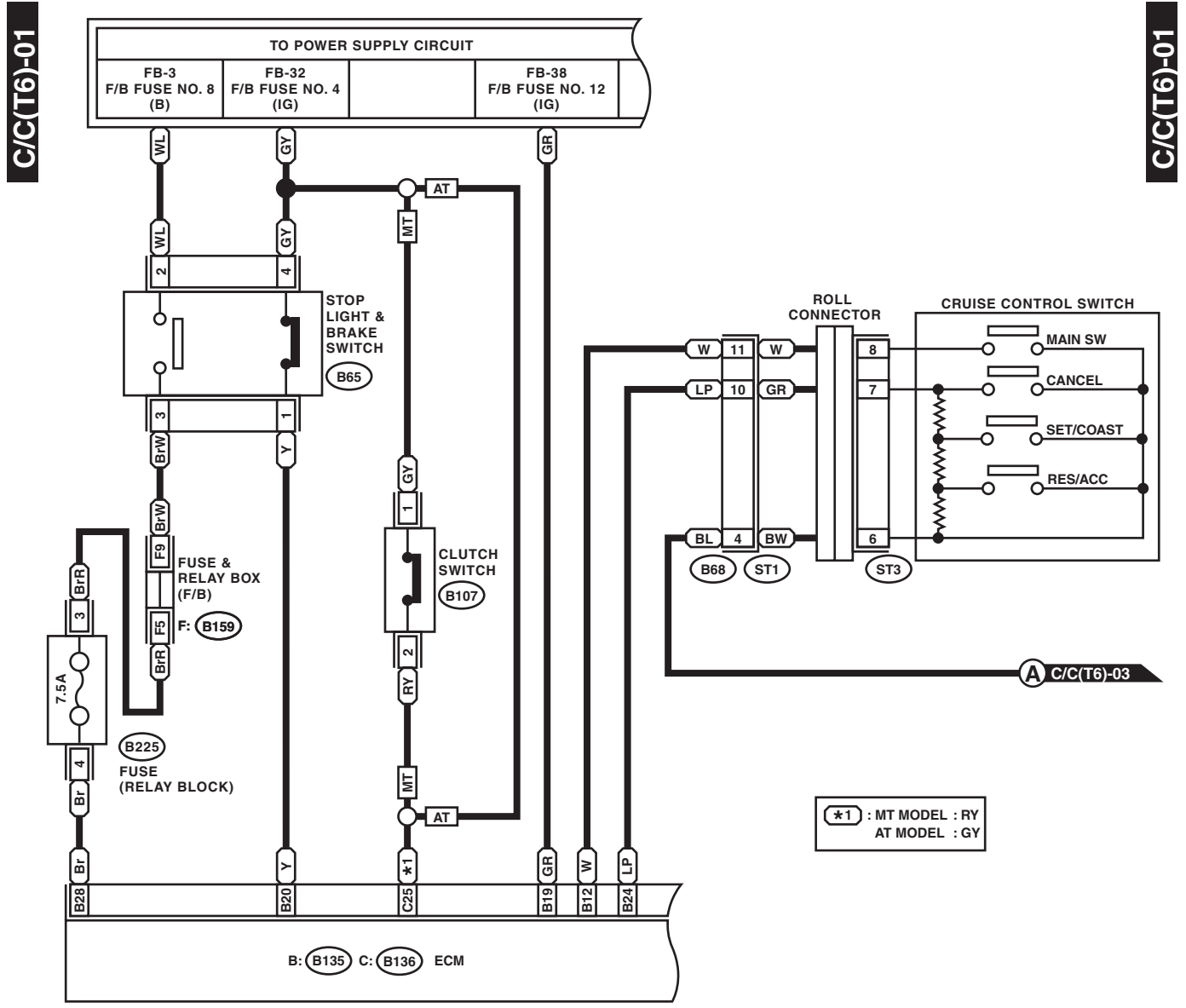
WI-21069



# Cruise Control System

## WIRING SYSTEM

### 2. 2.5L TURBO MODEL AND 3.0 L MODEL



RELAY BLOCK

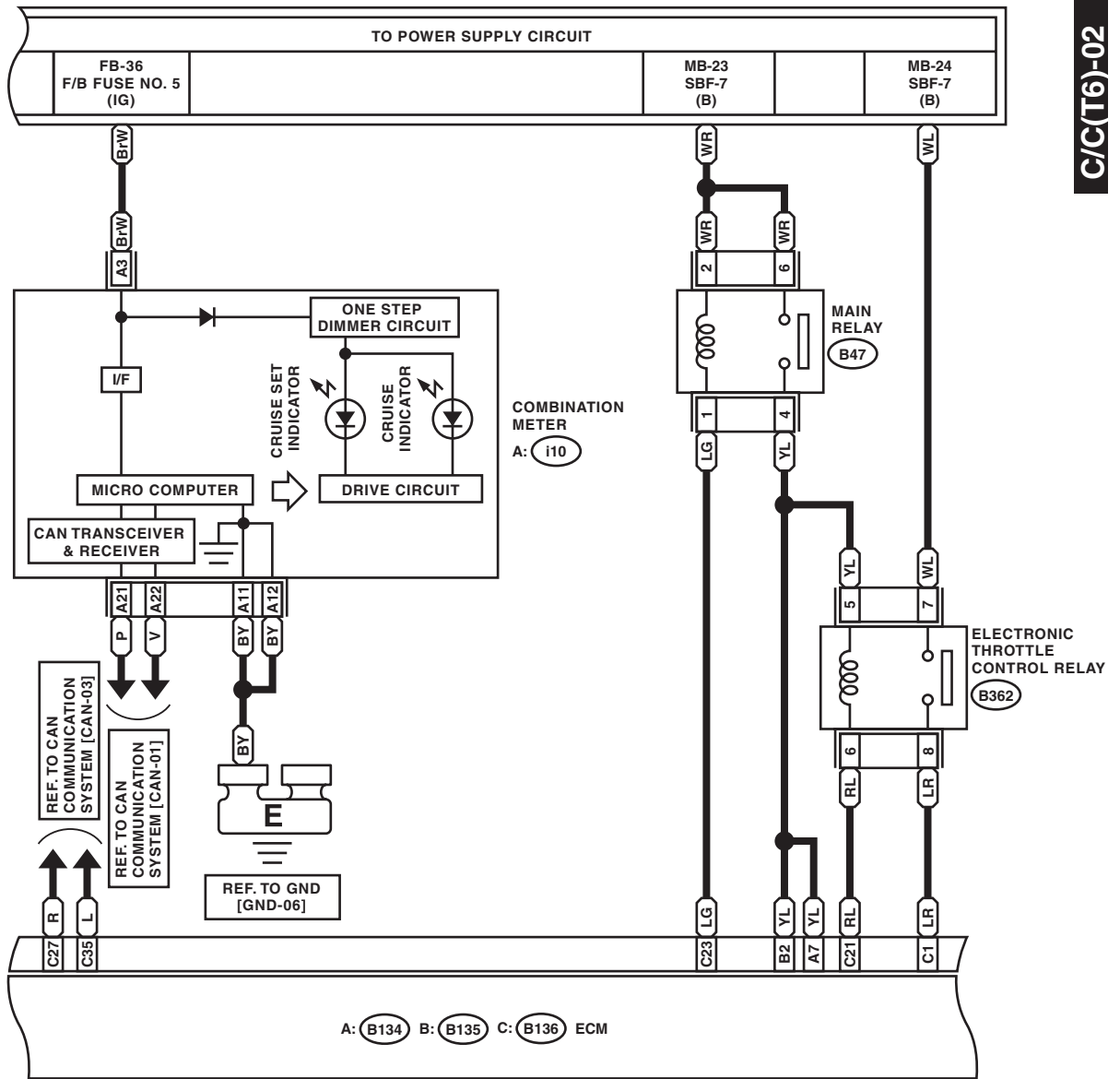
WI-15908

# Cruise Control System

WIRING SYSTEM

C/C(T6)-02

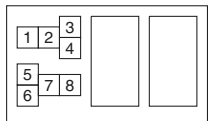
C/C(T6)-02



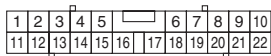
B47 (BROWN)



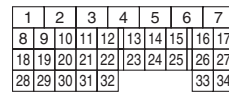
B362 (BLACK)



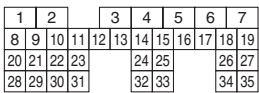
A: i10 (GREEN)



A: B134

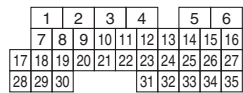


B: B135



RELAY HOLDER

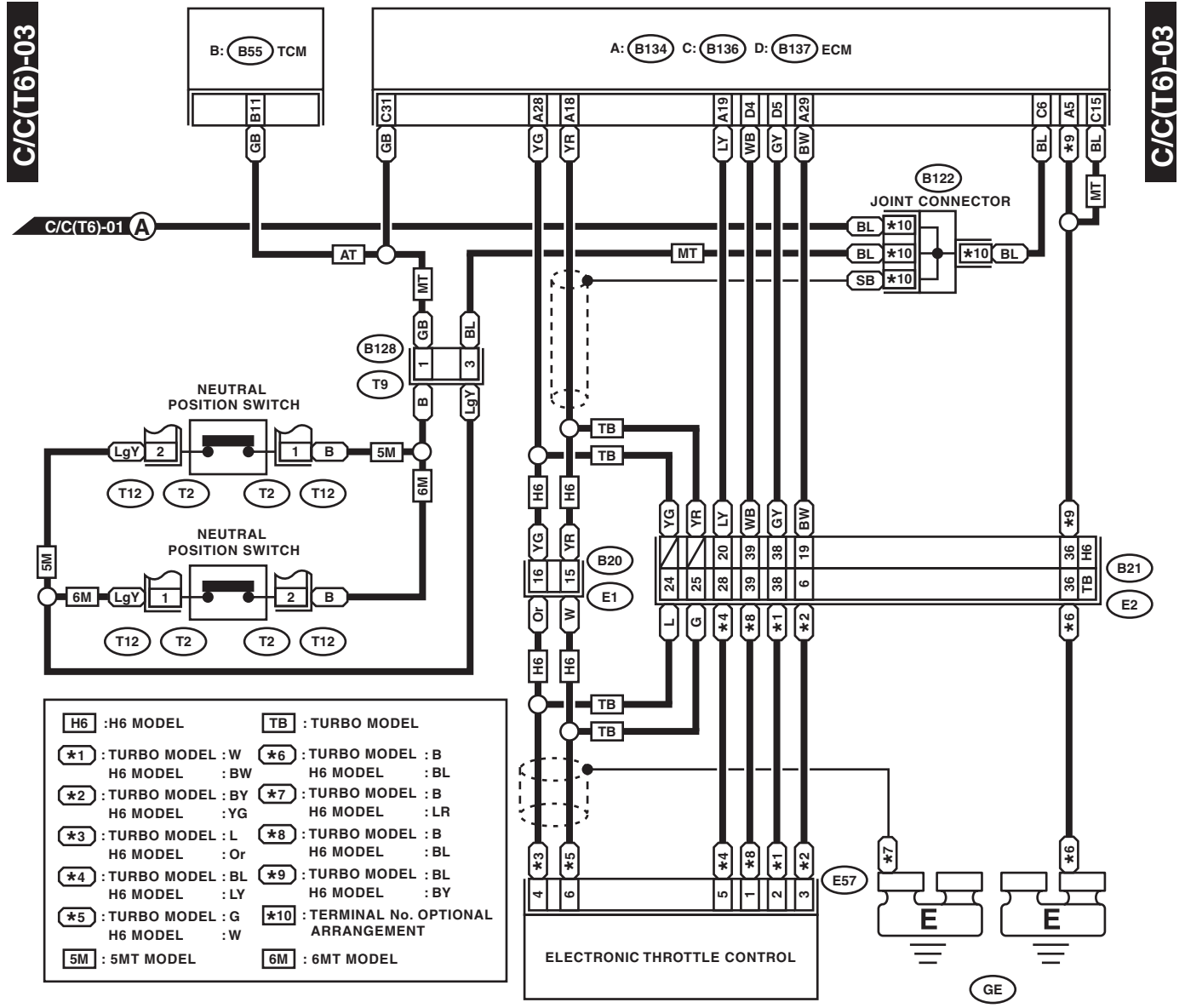
C: B136



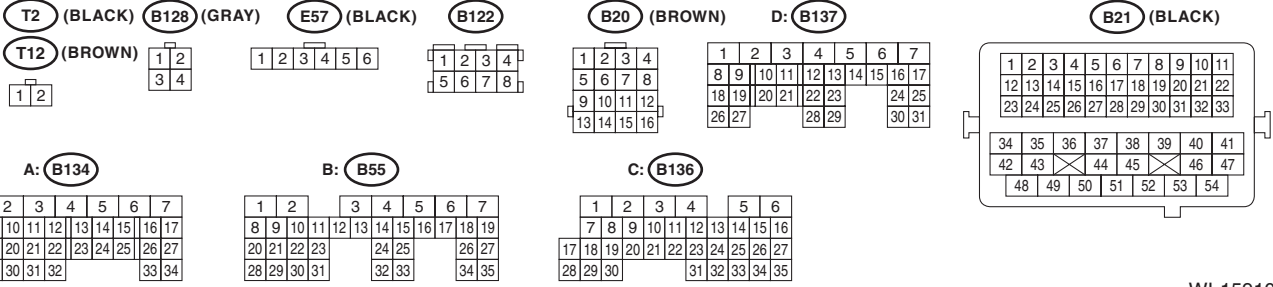
WI-15909

# Cruise Control System

## WIRING SYSTEM



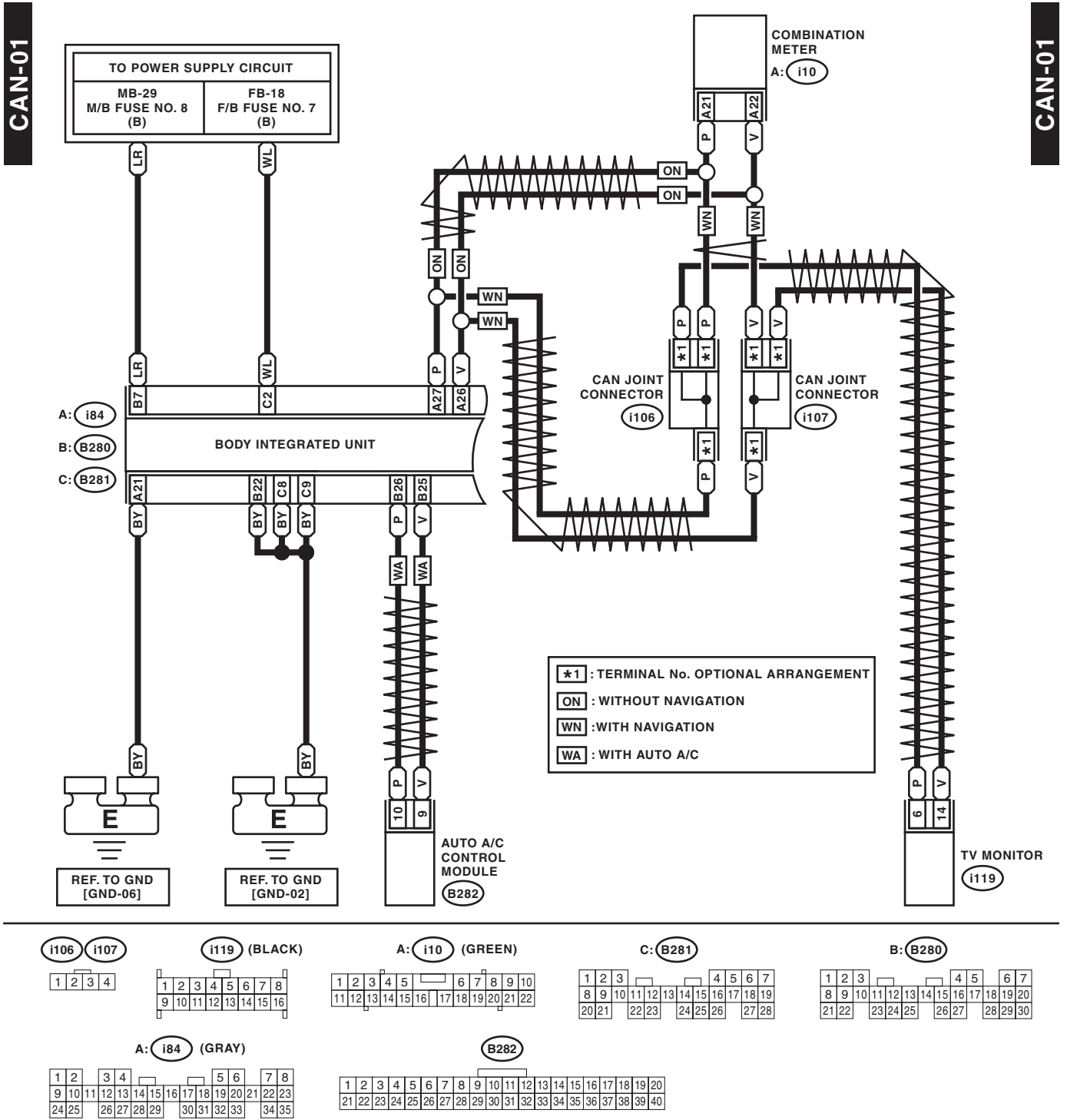
- Legend:**
- H6** : H6 MODEL
  - TB** : TURBO MODEL
  - \*1** : TURBO MODEL : W
  - \*6** : TURBO MODEL : B
  - \*2** : TURBO MODEL : BY
  - \*7** : TURBO MODEL : B
  - \*3** : TURBO MODEL : L
  - \*8** : TURBO MODEL : B
  - \*4** : TURBO MODEL : BL
  - \*9** : TURBO MODEL : BL
  - \*5** : TURBO MODEL : G
  - \*10** : TERMINAL No. OPTIONAL ARRANGEMENT
  - 5M** : 5MT MODEL
  - 6M** : 6MT MODEL



WI-15910

## 52.CAN Communication System

### A: WIRING DIAGRAM

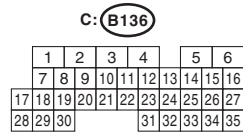
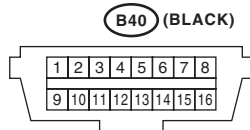
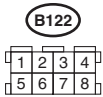
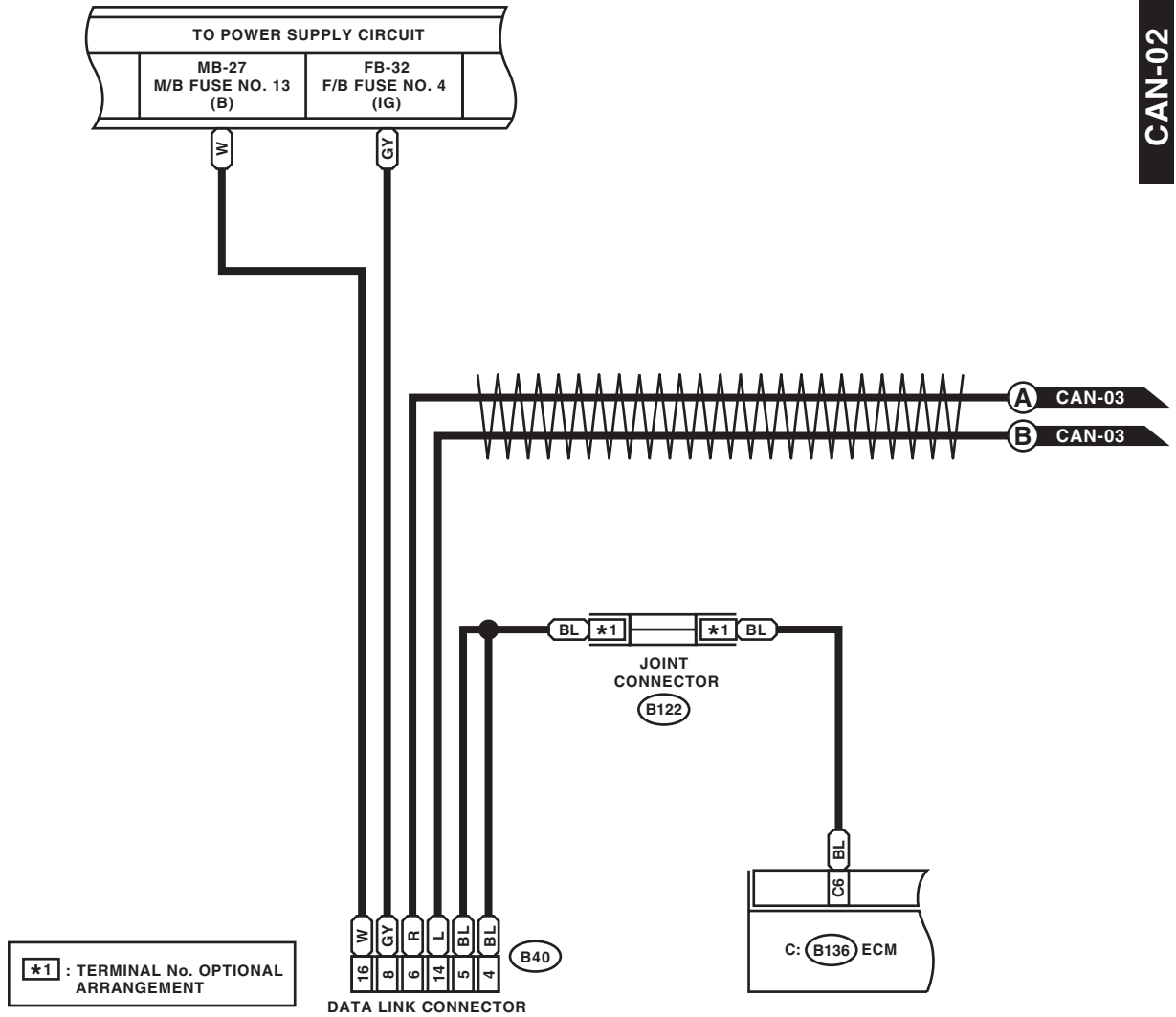


# CAN Communication System

WIRING SYSTEM

CAN-02

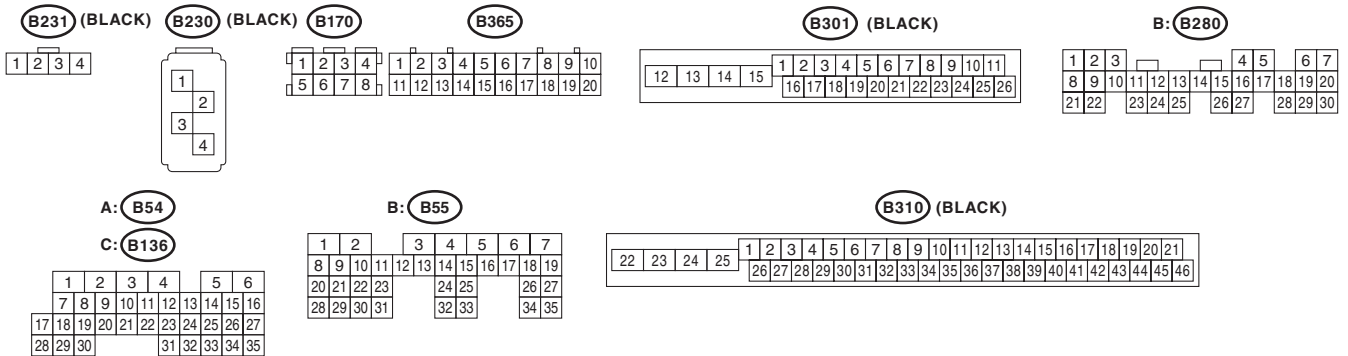
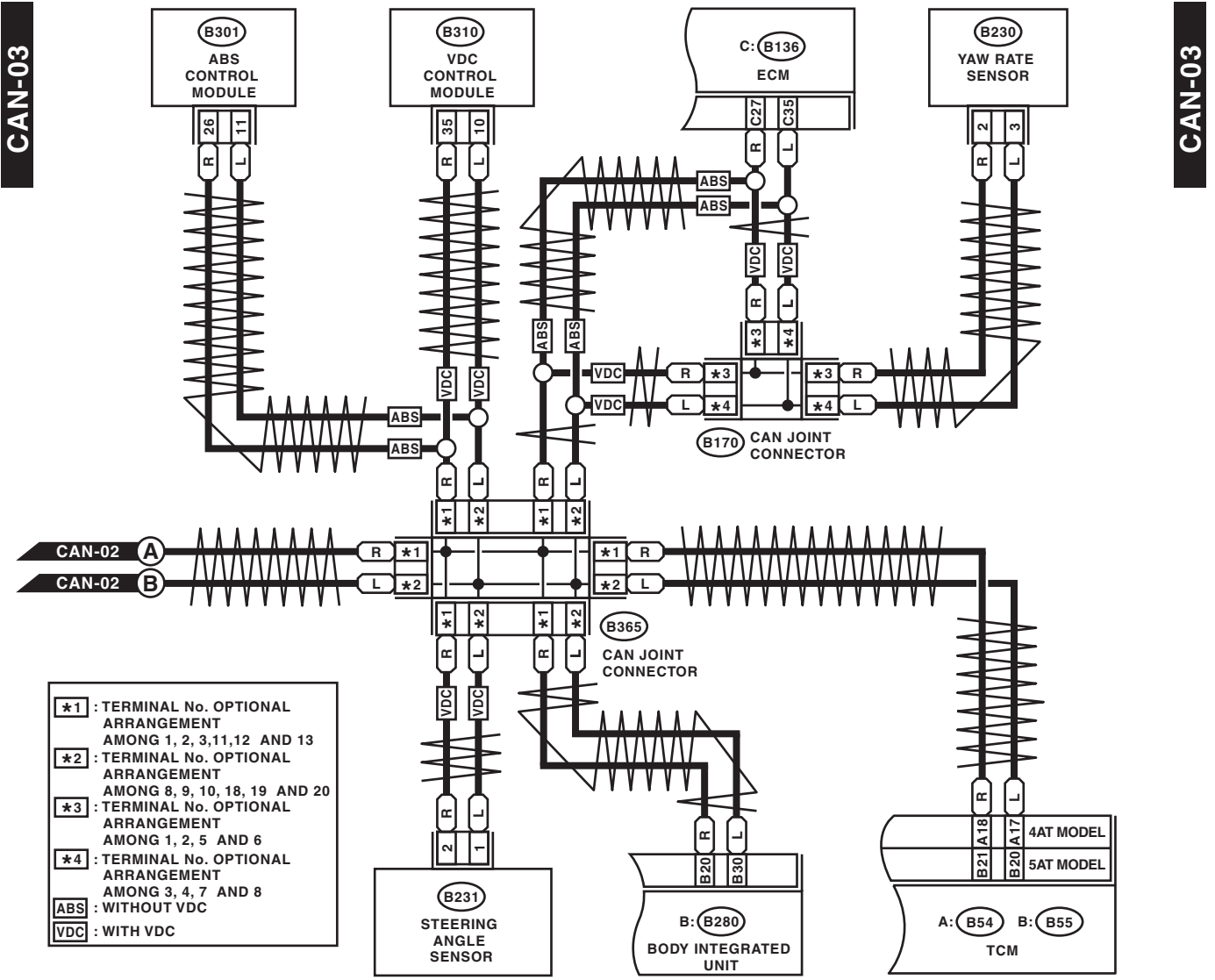
CAN-02



WI-15912

# CAN Communication System

WIRING SYSTEM



WI-15913

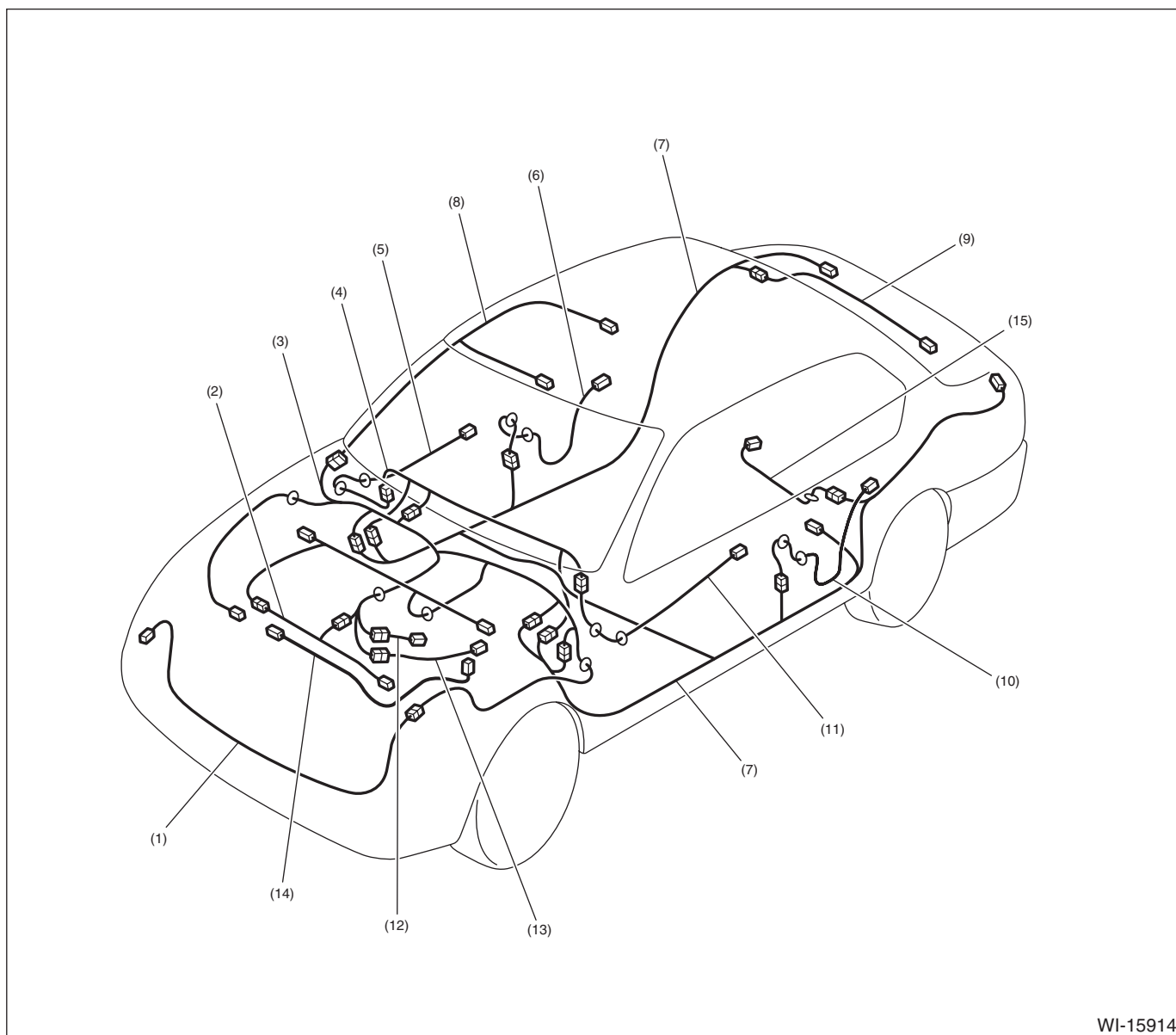
# Harness Components Location

WIRING SYSTEM

## 53. Harness Components Location

### A: LOCATION

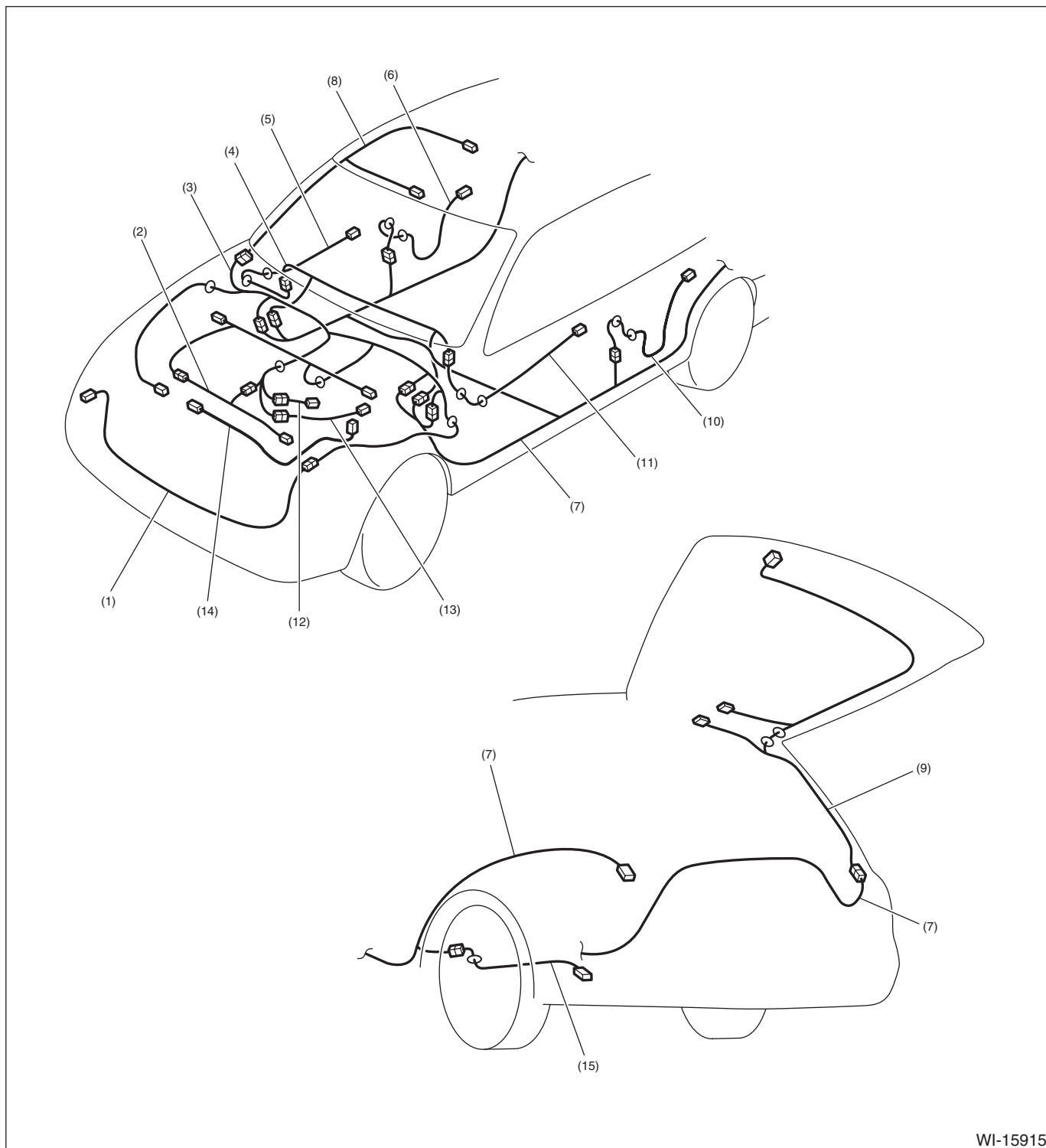
#### 1. SEDAN MODEL



WI-15914

- |                                     |                         |                              |
|-------------------------------------|-------------------------|------------------------------|
| (1) Front wiring harness            | (6) Rear door cord RH   | (11) Front door cord LH      |
| (2) Engine wiring harness           | (7) Rear wiring harness | (12) Transmission cord       |
| (3) Bulkhead wiring harness         | (8) Roof cord           | (13) Rear oxygen sensor cord |
| (4) Instrument panel wiring harness | (9) Trunk lid cord      | (14) Generator cord          |
| (5) Front door cord RH              | (10) Rear door cord LH  | (15) Fuel cord               |

## 2. WAGON MODEL



WI-15915

- |                                     |                         |                              |
|-------------------------------------|-------------------------|------------------------------|
| (1) Front wiring harness            | (6) Rear door cord RH   | (11) Front door cord LH      |
| (2) Engine wiring harness           | (7) Rear wiring harness | (12) Transmission cord       |
| (3) Bulkhead wiring harness         | (8) Roof cord           | (13) Rear oxygen sensor cord |
| (4) Instrument panel wiring harness | (9) Rear gate cord      | (14) Generator cord          |
| (5) Front door cord RH              | (10) Rear door cord LH  | (15) Fuel cord               |



# Front Wiring Harness

## WIRING SYSTEM

### 54. Front Wiring Harness

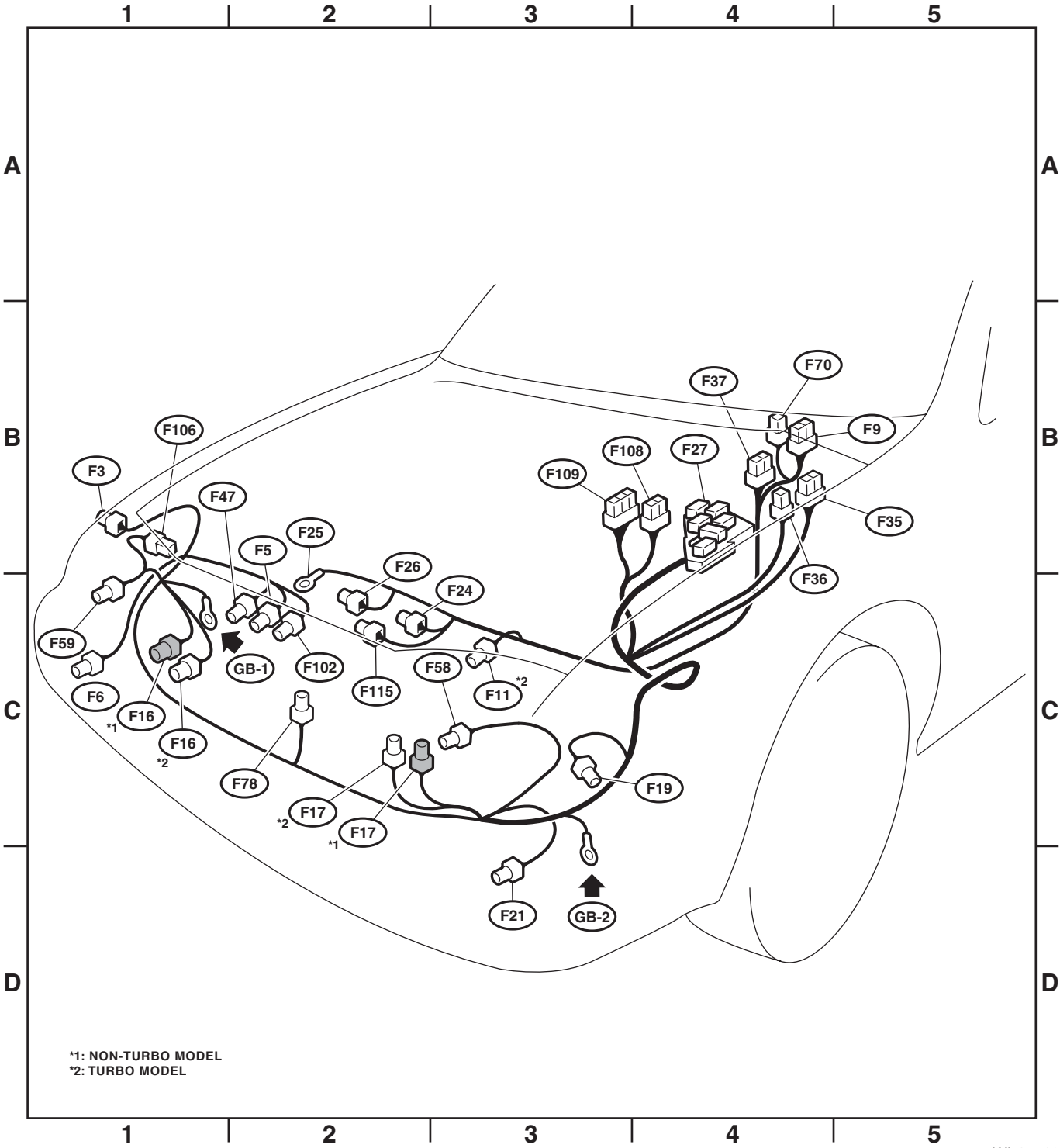
#### A: LOCATION

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
F3	3	Gray	B-1		Front clearance and front turn signal light RH
F5	1	Black	C-2		Horn
F6	2	Brown	C-1		Front fog light RH
F9	16	Black	B-4		Secondary air relay holder
F11	2	Gray	C-3		Secondary air pump
F16	2	Gray	C-1		Sub fan motor (H4 Turbo model)
		Black	C-1		Sub fan motor (H4 Non-turbo model)
F17	2	Gray	C-2		Main fan motor (H4 Turbo model)
		Black	C-2		Main fan motor (H4 Non-turbo model)
F19	3	Gray	C-3		Front clearance and front turn signal light LH
F21	2	Brown	D-3		Front fog light LH
F24	2	Black	C-2		Magnet clutch
F25	1	★	C-2		Generator terminal B
F26	3	Green	C-2		Generator
F27	22	Black	B-4		Relay holder
F35	12	Blue	B-4		Main fuse box (M/B)
F36	7	★	B-4		
F37	20	★	B-4		
F47	1	Black	C-2		Horn
F58	3	Gray	C-3		Headlight LH
F59	3	Gray	C-1		Headlight RH
F70	2	★	B-4		Main fuse box (M/B)
F78	2	Black	C-2		Ambient sensor
F102	2	Black	C-2		Keyless buzzer
F106	3	Gray	B-1		Radiator fan control unit (H6 model)
F108	18	★	B-4	B361	Through joint connector
F109	24	★	B-3	B360	
F115	2	Gray	C-2		A/C lock sensor (H6 model)

★ : White or natural color

# Front Wiring Harness

WIRING SYSTEM



\*1: NON-TURBO MODEL  
\*2: TURBO MODEL

# Bulkhead Wiring Harness (In Engine Compartment)

## WIRING SYSTEM

### 55. Bulkhead Wiring Harness (In Engine Compartment)

#### A: LOCATION

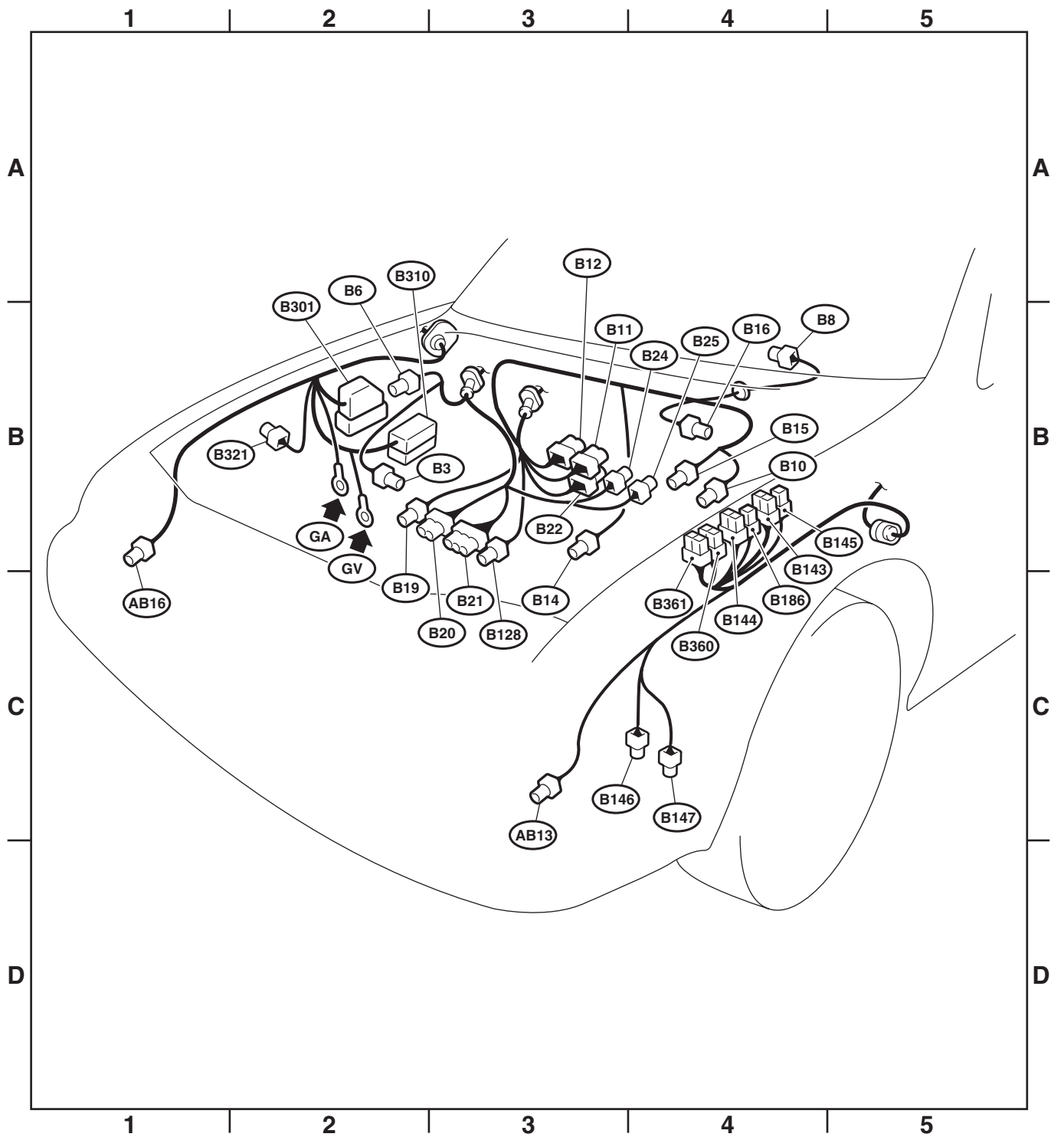
Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
B3	5	Black	B-2		Mass air flow and intake air temperature sensor
B6	2	Gray	B-2		Front ABS wheel speed sensor RH
B8	5	Gray	B-4		Front wiper motor
B10	4	Gray	B-4		Pressure switch
B11	20	Gray	B-3	T4	Transmission (AT model)
B12	8	Gray	B-3	T3	Transmission (Turbo, H6 model)
	12	Gray	B-3	T3	Transmission (SOHC model)
B14	1	Black	B-3		Starter motor (Magnet)
B15	2	Gray	B-4		Front ABS wheel speed sensor LH
B16	2	Gray	B-4		Brake fluid level switch
B19	4	Green	B-2	T5	Rear oxygen sensor sensor code (Turbo, 5AT, 5MT model)
		Gray	B-2	T5	Rear oxygen sensor cord (Turbo, 6MT model)
B20	16	Brown	B-3	E1	Engine wiring harness (H6 model)
B21	54	Black	B-3	E2	Engine wiring harness
B22	16	Brown	B-3	E3	Engine wiring harness (H6 model)
B24	2	Gray	B-3	T1	Back-up light switch (H4 Non-turbo model)
B25	2	Brown	B-4	T2	Neutral position switch (H4 Non-turbo model)
B128	4	Gray	B-3	T9	Transmission harness (Turbo model)
B143	20	★	B-4		Main fuse box (M/B)
B144	9	Brown	B-4		
B145	7	Brown	B-4		
B146	2	Gray	C-4		Front washer motor
B147	2	Gray	C-4		Rear washer motor
B186	8	★	B-4		Main fuse box (M/B)
B301	26	Black	B-2		ABS control module
B310	46	Black	B-2		VDC control module
B321	2	Black	B-2		Hood switch
B360	16	Gray	B-4	F109	Through joint connector
B361	14	Gray	B-4	F108	

★ : White or natural color

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB13	2	Yellow	C-3		Front sub sensor LH
AB16	2	Yellow	B-1		Front sub sensor RH

# Bulkhead Wiring Harness (In Engine Compartment)

WIRING SYSTEM



WI-15917

## Bulkhead Wiring Harness (In Compartment)

WIRING SYSTEM

### 56. Bulkhead Wiring Harness (In Compartment)

#### A: LOCATION

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
B31	10	Yellow	C-4	AB1	Airbag wiring harness
B32	8	★	C-2		Turn signal & hazard unit
B36	28	★	B-2	i1	Instrument panel wiring harness
B37	8	★	C-5	i2	Instrument panel wiring harness (Manual A/C)
B38	20	★	B-5	i3	Instrument panel wiring harness
B40	16	Black	C-2		Data link connector
B41	2	★	B-2		Power window circuit breaker
B47	6	Brown	B-5		Main relay
B52	24	★	C-2		Fuse & relay box (F/B)
B53	20	★	C-3		Joint connector (4AT model)
B54	35	★	C-3		TCM
B55	35	★	C-3		
B65	4	Black	B-3		Stop light & brake switch
B68	14	★	B-4		Roll connector
B69	4	★	C-4		Parking switch
B70	18	★	B-4		Combination switch
B71	17	★	C-3		
B72	6	★	B-4		Ignition switch
B75	2	Green	B-4	B76	Delivery (test) mode connector
B76	2	Green	B-4	B75	
B77	7	Green	B-4		Mode door actuator
B83	8	★	C-5		Joint connector
B85	2	Black	B-2		Diode (Fog light)
B86	4	★	B-4		Power transistor (Auto A/C Model)
B86	4	★	B-4		Blower resistor
B87	2	★	C-4		Blower fan motor
B88	5	★	B-4		Evaporator sensor (Manual A/C)
	2	★	B-4		Evaporator sensor (Auto A/C)
B90	16	★	B-5	R50	Roof cord
B91	7	Green	B-4		Intake door actuator
B96	8	Black	B-1		Daytime running light control module
B97	20	★	C-1	R1	Rear wiring harness
B98	16	★	B-5	R2	
B106	2	★	B-2		Clutch switch
B107	2	Blue	B-2		Clutch switch (model with cruise control)
B116	12	★	D-4		AT select lever
B122	8	★	C-5		Joint connector (E/G)
B134	34	★	C-4		ECM
B135	35	★	C-4		
B136	35	★	C-4		
B137	31	★	C-4		
B138	8	★	C-4		Joint connector
B152	10	Gray	C-2		Fuse & relay box (F/B)
B158	8	★	C-2		
B159	9	Brown	C-2		
B170	8	★	D-5		CAN joint connector

# Bulkhead Wiring Harness (In Compartment)

WIRING SYSTEM

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
B177	2	★	B-4		Wiper deicer
B178	8	Brown	B-2	i42	Instrument panel wiring harness
B180	24	★	C-2		Remote engine start control module
B181	2	★	C-2		Short connector
B182	2	★	C-2		
B224	2	★	B-4		Ignition switch illumination
B225	40	Black	C-2		Fuse (Relay block)
					Mirror heater relay
					Starter relay
					Front fog light relay
					Power window relay
					Blower motor relay
					Low beam relay
					Wiper deicer relay
		Seat heater relay			
B226	11	Blue	B-2		Inhibitor relay (Turbo, H6 model)
B227	4	★	C-4		Paddle switch
B230	4	Black	D-5		Yaw rate sensor (VDC)
B231	4	Black	B-4		Steering angle sensor (VDC)
B235	7	Green	B-4		Passenger seat air mix actuator (Auto A/C)
B242	10	★	B-1		Daytime running light control module
B280	30	★	C-3		Body integrated unit
B281	28	★	C-3		
B282	40	★	B-4		
B292	3	★	D-4		ABS G sensor
B315	6	Black	B-3		Acceleration pedal position sensor
B327	6	Brown	B-5		A/F, O <sub>2</sub> Sensor relay
B350	4	★	B-3		Key warning switch & key lock solenoid
B351	2	Black	B-4		Antenna
B359	3	Black	D-5		Lateral G sensor (5AT model)
B362	8	Black	B-5		Relay holder
B365	20	★	B-3		CAN joint connector
B370	4	Brown	C-1		Diode (Engine status)
B390	7	Green	B-3		Driver seat air mix actuator (Auto A/C)
B404	1	Black	D-5		Parking brake switch

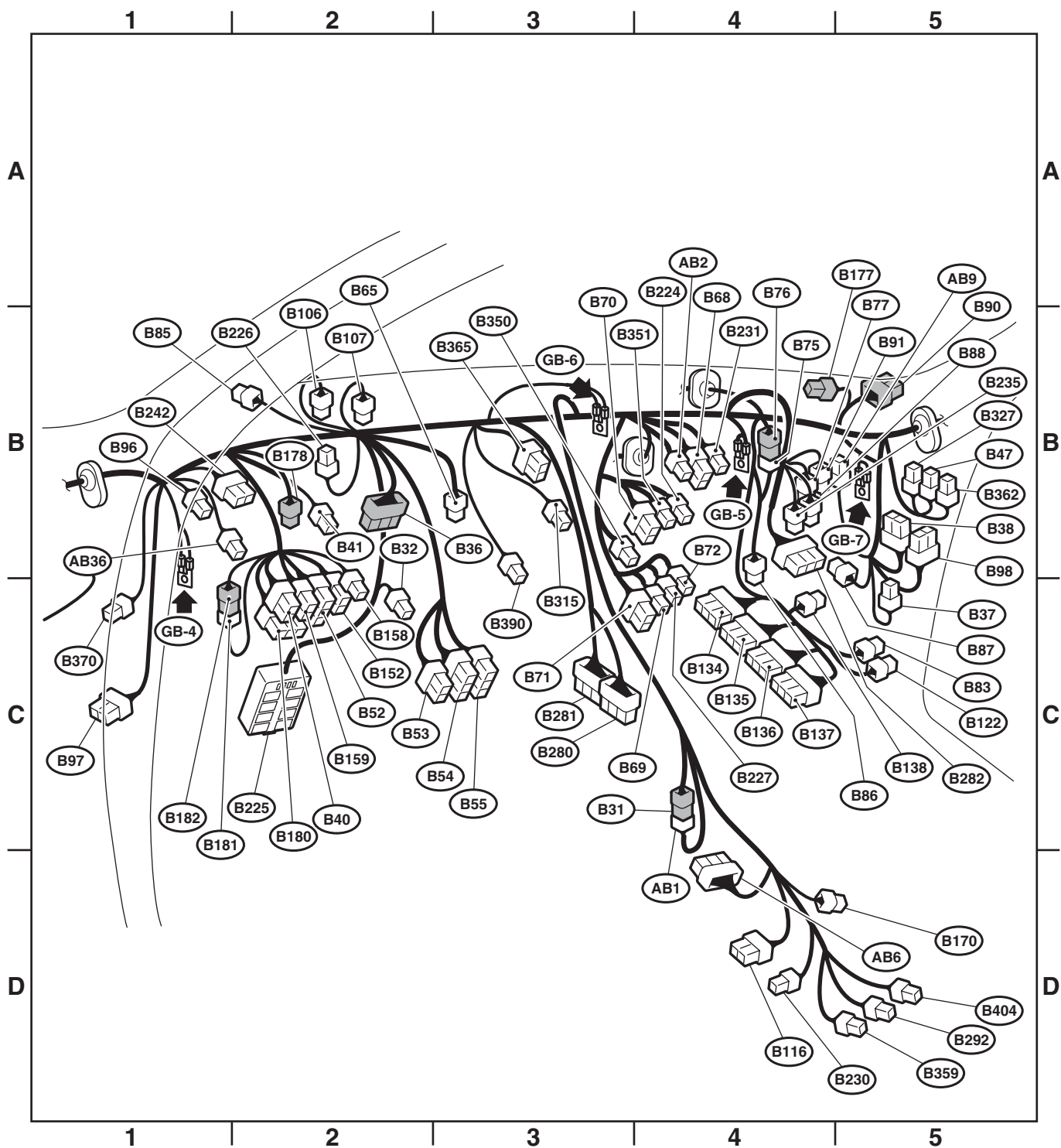
★ : White or natural color

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB1	10	Yellow	D-4	B31	Airbag wiring harness
AB2	4	Gray	B-4	AB7	Driver's airbag module
AB6	30	Yellow	C-4		Airbag control module
AB9	4	Yellow	B-5	AB10	Passenger's airbag module
AB36	2	★	B-1		Fuse & relay box (F/B)

★ : White or natural color

# Bulkhead Wiring Harness (In Compartment)

WIRING SYSTEM



WI-15918

## 57.Engine Wiring Harness and Transmission Cord

### A: LOCATION

#### 1. 2.5 L NON-TURBO MODEL

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
E2	54	Black	A-3	B21	Bulkhead wiring harness
E4	2	Black	A-2		Purge control solenoid valve
E5	2	Light gray	B-1		Fuel injector No. 1
E6	2	Light gray	A-2		Fuel injector No. 3
E8	2	Black	B-2		Engine coolant temperature sensor
E10	2	Light gray	B-3		Crankshaft position sensor
E11	1	—	B-2		Oil pressure switch
E12	4	Dark gray	A-2		Ignition coil & ignitor assembly
E14	2	Gray	B-4		Knock sensor
E15	2	Gray	B-4		Camshaft position sensor
E16	2	Light gray	B-4		Fuel injector No. 2
E17	2	Light gray	B-4		Fuel injector No. 4
E18	6	Dark gray	B-4		EGR valve
E19	1	★	B-2		Power steering oil pressure switch
E21	3	Black	A-3		Manifold absolute pressure sensor
E22	6	Dark gray	A-1		Front oxygen (A/F) sensor
E23	4	Dark gray	A-1		Rear oxygen sensor
E57	6	Black	A-3		Electronic throttle control
E61	2	Dark gray	A-4		PCV diagnosis connector
E67	2	Blue	A-2		Oil switching solenoid valve RH
E68	2	Blue	B-5		Oil switching solenoid valve LH
E71	1	Gray	A-3		Variable valve lift diagnosis oil pressure switch RH
E72	1	Gray	B-5		Variable valve lift diagnosis oil pressure switch LH
E75	2	Black	A-3		Oil temperature sensor

★ : White or natural color

#### MT model

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
T1	2	Gray	D-2	B24	Bulkhead wiring harness
T2	2	Brown	D-2	B25	

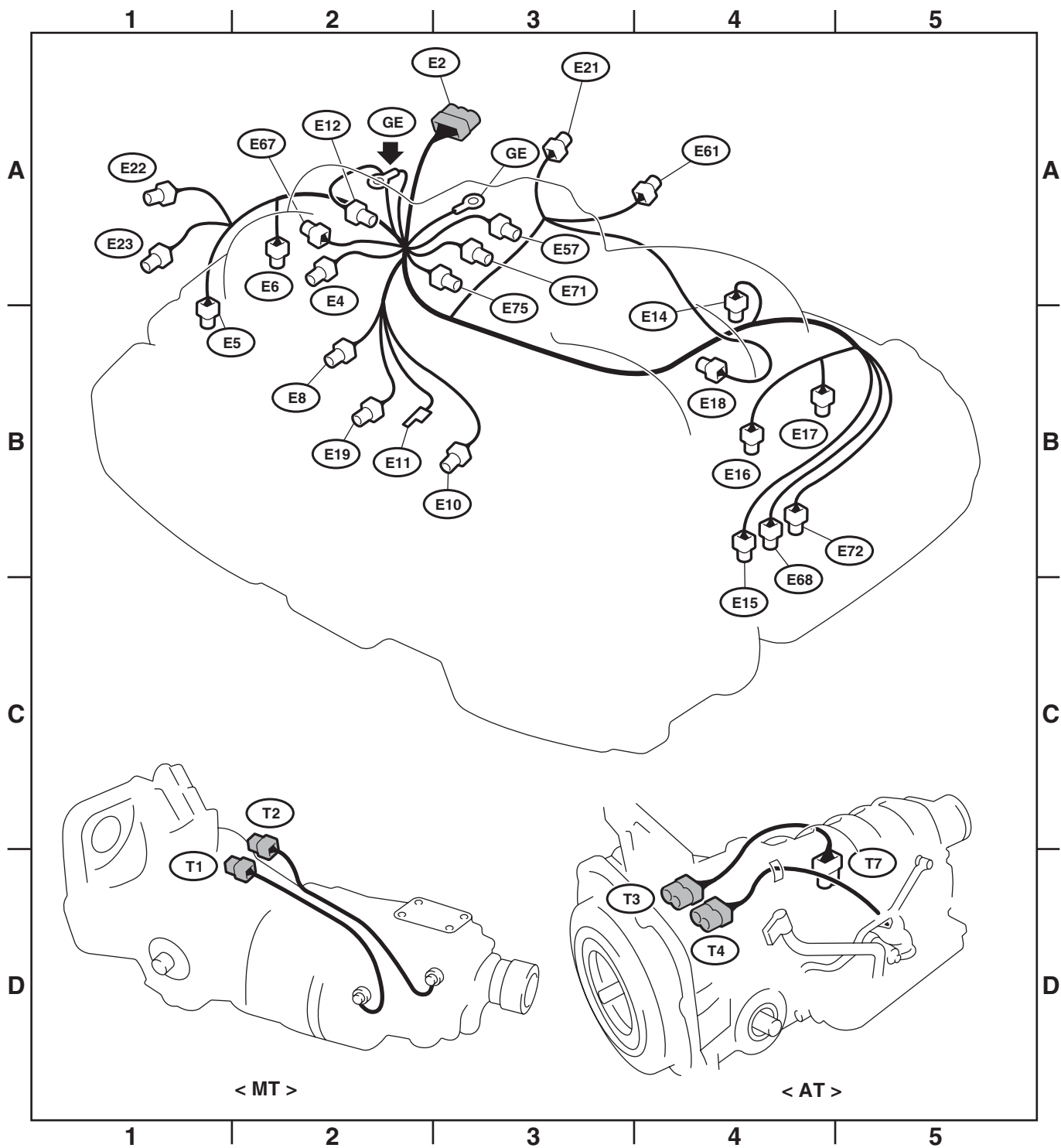
#### AT model

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
T3	12	Black	D-4	B12	Bulkhead wiring harness
T4	20	Gray	D-4	B11	
T7	12	Black	D-5		Inhibitor switch (transmission serial No. 4078112 or earlier)
	9	Black	D-5		Inhibitor switch (transmission serial No. 4078113 or later)



# Engine Wiring Harness and Transmission Cord

WIRING SYSTEM



WI-13305

# Engine Wiring Harness and Transmission Cord

WIRING SYSTEM

## 2. TURBO MODEL

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
E2	54	Black	A-2	B21	Bulkhead wiring harness
E4	2	Black	B-2		Purge control solenoid valve 1
E5	2	Dark gray	B-2		Fuel injector No. 1
E6	2	Dark gray	B-1		Fuel injector No. 3
E8	2	Black	B-2		Engine coolant temperature sensor
E10	2	Light gray	B-3		Crankshaft position sensor
E11	1	—	B-2		Oil pressure switch
E14	2	Light gray	B-3		Knock sensor
E16	2	Dark gray	B-4		Fuel injector No. 2
E17	2	Dark gray	B-5		Fuel injector No. 4
E19	1	★	B-2		Power steering oil pressure switch
E21	3	Black	A-3		Manifold absolute pressure sensor
E31	3	★	B-2		Ignition coil No. 1
E32	3	★	B-4		Ignition coil No. 2
E33	3	Black	A-2		Ignition coil No. 3
E34	3	Black	B-4		Ignition coil No. 4
E35	3	Light gray	A-4		Camshaft position sensor LH
E36	3	Light gray	A-2		Camshaft position sensor RH
E37	2	Blue	B-3		Oil flow control solenoid valve LH
E38	2	Blue	B-1		Oil flow control solenoid valve RH
E40	2	Black	B-4		Secondary air combination valve LH
E41	6	Black	B-2		Secondary air combination valve RH
E51	5	Light gray	B-4		Tumble generator valve ASSY LH
E52	2	Black	A-3		Purge control solenoid valve 2
E55	5	Light gray	A-1		Tumble generator valve ASSY RH
E57	6	Black	A-3		Electronic throttle control
E64	2	Blue	A-3		Wastegate control solenoid valve
E79	4	★	B-2		Front oxygen (A/F) sensor
E80	2	Dark gray	B-2		Leak diagnosis connector

★ : White or natural color

## MT model

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
T1	2	Gray	D-2	T13	Transmission harness (5MT model)
		★	D-2	T13	Transmission harness (6MT model)
T2	2	Brown	D-2	T12	Transmission harness (5MT model)
		Black	D-2	T12	Transmission harness (6MT model)
T5	4	Green	C-1	B19	Bulkhead wiring harness
T6	4	Dark gray	D-2		Rear oxygen sensor
T9	4	Gray	C-1	B128	Bulkhead wiring harness
T12	2	Brown	D-2		Neutral position switch (5MT model)
		Black			Neutral position switch (6MT model)
T13	2	Gray	D-2		Back-up light switch (5MT model)
		★			Back-up light switch (6MT model)

★ : White or natural color

# Engine Wiring Harness and Transmission Cord

## WIRING SYSTEM

---

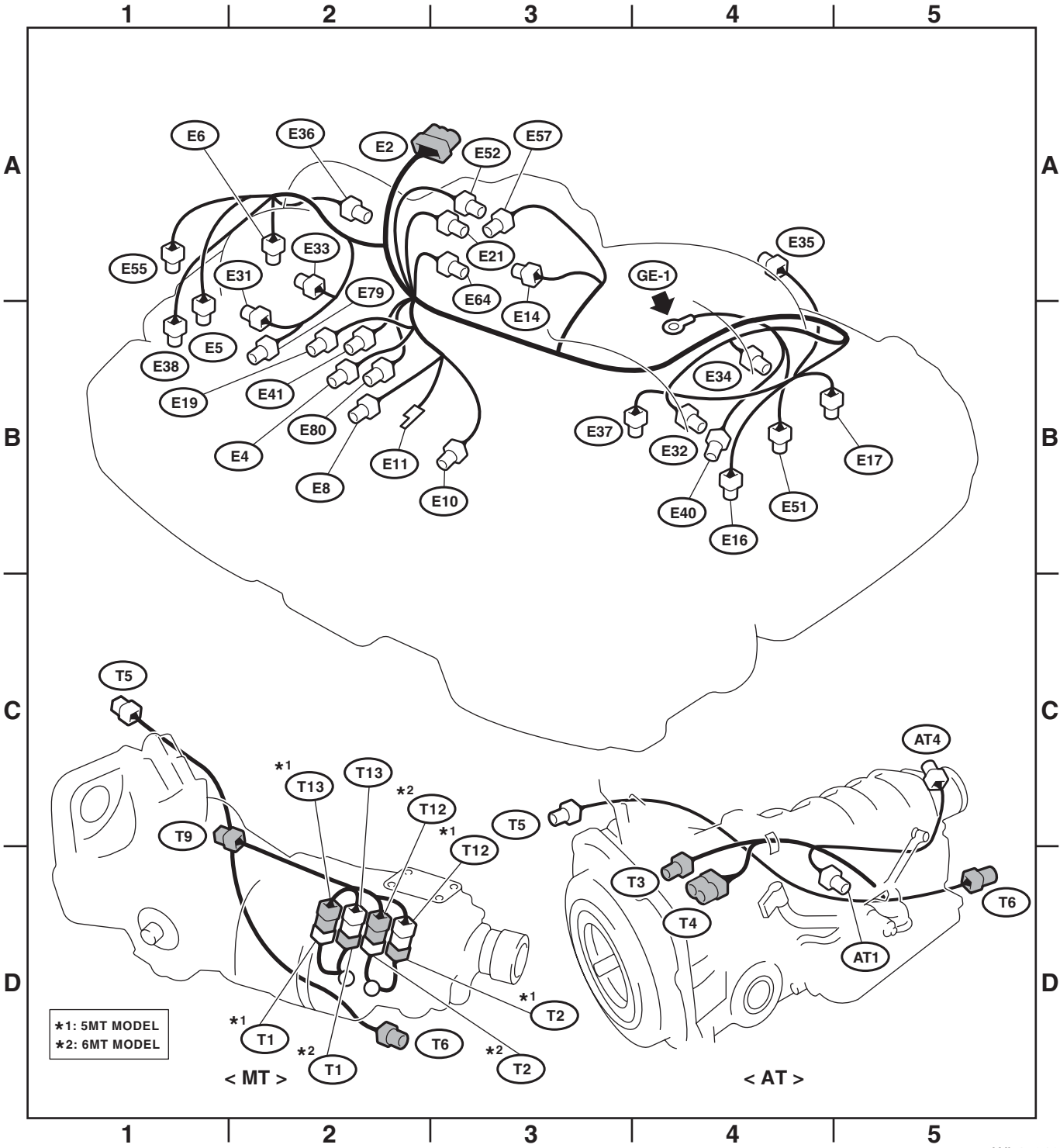
### AT model

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
T3	8	Black	D-4	B12	Bulkhead wiring harness
T4	20	Gray	D-4	B11	
T5	4	Green	C-3	B19	
T6	4	Dark gray	D-5		Rear oxygen sensor

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AT1	3	Black	D-5		Turbine speed sensor 1
AT4	3	Black	C-5		Rear vehicle speed sensor

# Engine Wiring Harness and Transmission Cord

WIRING SYSTEM



\*1: 5MT MODEL  
\*2: 6MT MODEL

< MT >

< AT >

WI-15919

# Engine Wiring Harness and Transmission Cord

## WIRING SYSTEM

### 3. 3.0 L MODEL

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
E1	16	Brown	A-3	B20	Bulkhead wiring harness
E2	54	Black	A-3	B21	
E3	16	Brown	D-3	B22	
E4	2	Blue	A-2		Purge control solenoid valve
E5	2	Dark gray	A-2		Fuel injector No. 1
E6	2	Dark gray	A-2		Fuel injector No. 3
E8	2	Black	B-4		Engine coolant temperature sensor
E10	2	Dark gray	B-4		Crankshaft position sensor
E11	1	—	B-1		Oil pressure switch
E14	2	Blue	A-3		Knock sensor 1
E16	2	Dark gray	B-4		Fuel injector No. 2
E17	2	Dark gray	B-4		Fuel injector No. 4
E18	6	Dark gray	A-3		EGR valve
E19	1	★	B-3		Power steering oil pressure switch
E21	3	Black	A-3		Manifold absolute pressure sensor
E24	4	Light gray	D-3		Front oxygen (A/F) sensor LH
E25	4	Dark gray	D-3		Rear oxygen sensor LH
E31	3	Black	B-1		Ignition coil No. 1
E32	3	Black	C-4		Ignition coil No. 2
E33	3	★	B-2		Ignition coil No. 3
E34	3	★	B-4		Ignition coil No. 4
E43	2	Dark gray	A-2		Fuel injector No. 5
E44	2	Dark gray	B-5		Fuel injector No. 6
E45	3	Black	B-2		Ignition coil No. 5
E46	3	Black	B-5		Ignition coil No. 6
E47	4	Light gray	D-2		Front oxygen (A/F) sensor RH
E48	2	Blue	A-4		Knock sensor 2
E57	6	Black	A-4		Electronic throttle control
E61	4	Dark gray	C-2		Rear oxygen sensor RH
E67	2	Black	B-1		Oil flow control solenoid valve RH
E68	2	Black	C-4		Oil flow control solenoid valve LH
E69	2	Blue	A-2		Oil switching solenoid valve RH
E70	2	Blue	B-5		Oil switching solenoid valve LH
E71	1	★	A-3		Variable valve lift diagnosis oil pressure switch RH
E72	1	★	B-5		Variable valve lift diagnosis oil pressure switch LH
E73	3	Gray	A-2		Camshaft position sensor RH
E74	3	Gray	B-5		Camshaft position sensor LH
E75	2	Black	B-5		Oil temperature sensor
E76	10	Dark gray	A-3	E77	Engine wiring harness
E77	10	Dark gray	A-3	E76	

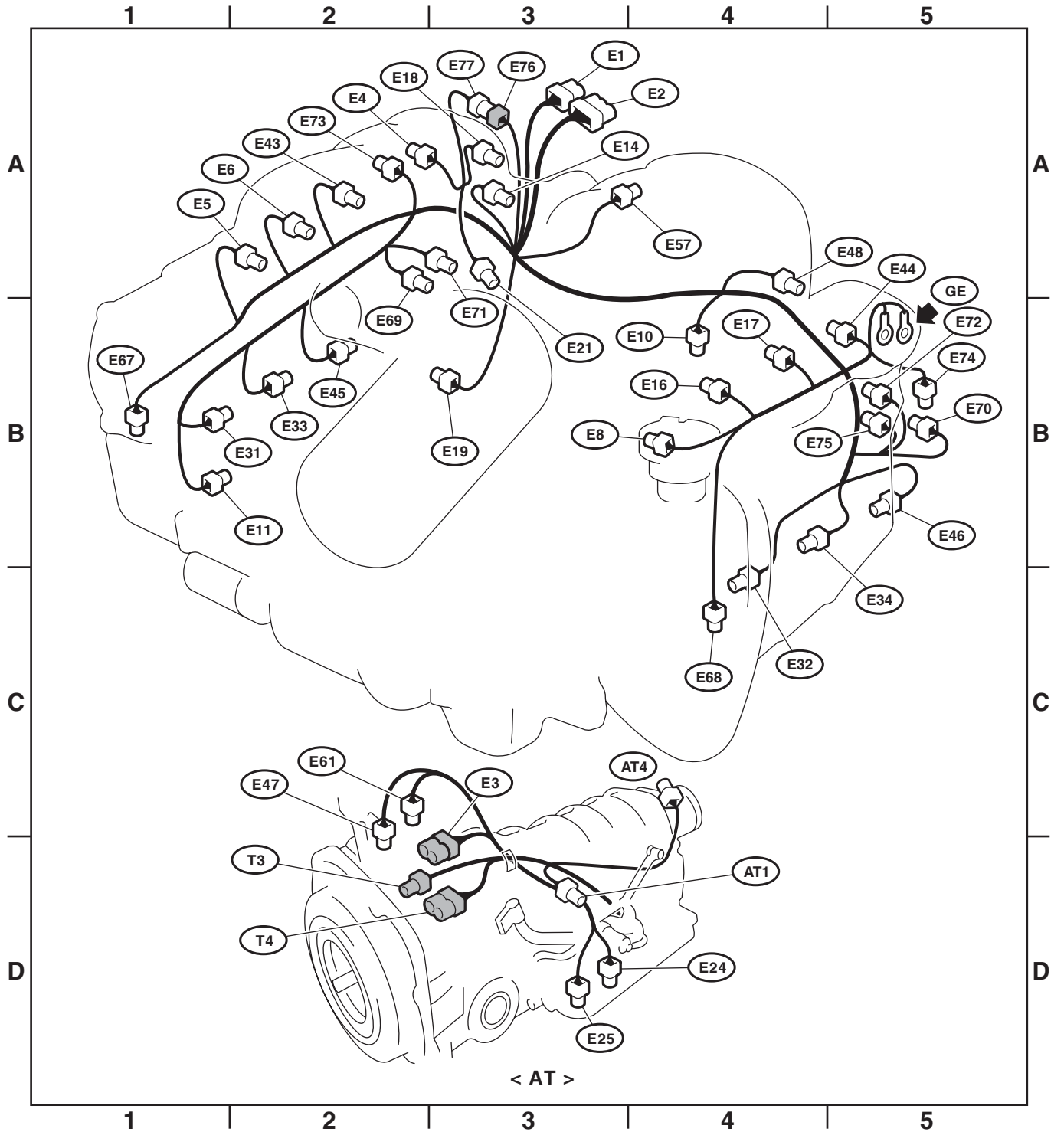
★ : White or natural color

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
T3	8	Brown	D-2	B12	Bulkhead wiring harness
T4	20	Gray	D-3	B11	

# Engine Wiring Harness and Transmission Cord

WIRING SYSTEM

Connector				Connecting to	
No.	Pole	Color	Area	No.	TOOL NAME
AT1	3	Black	D-3		Turbine speed sensor 1
AT4	3	Black	C-4		Rear vehicle speed sensor



WI-15920

# Instrument Panel Wiring Harness

WIRING SYSTEM

## 58. Instrument Panel Wiring Harness

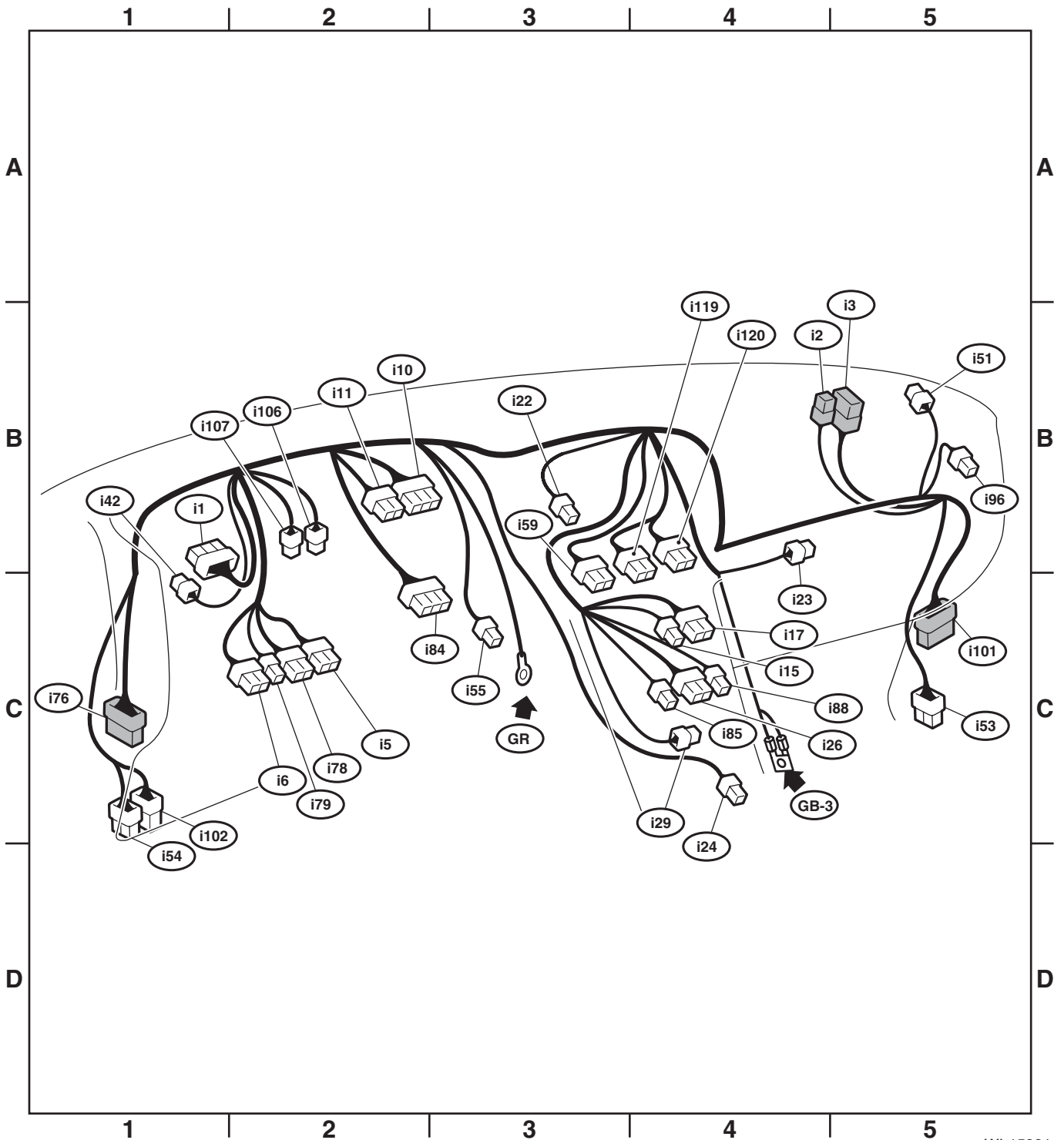
### A: LOCATION

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
i1	28	★	B-1	B36	Bulkhead wiring harness
i2	8	★	B-4	B37	
i3	20	★	B-5	B38	
i5	20	★	C-2		Fuse & relay box (F/B)
i6	16	★	C-2		Remote control mirror switch
i10	22	Green	B-2		Combination meter
i11	14	Green	B-2		
i15	6	★	C-4		Blower switch (Manual A/C)
i17	16	Black	C-4		A/C control panel
i22	4	★	B-3		Hazard switch
i23	2	★	B-4		Glove box light
i24	2	★	C-4		Front accessory power supply socket
i26	14	★	C-4		Audio
i29	1	Black	C-4		Audio bracket earth
i42	8	★	C-1	B178	Bulkhead wiring harness
i51	2	★	B-5		Sunload sensor
i53	18	★	C-5	R98	Rear wiring harness
i54	12	★	C-1	R99	
i55	2	★	C-3		In-vehicle sensor
i59	10	★	B-3		Clock
i76	25	★	C-1	D83	Front door cord LH
i78	15	Blue	C-2		Push switch
i79	6	★	C-2		Illumination control
i84	35	Gray	C-3		Body integrated unit
i85	8	Black	C-4		Audio
i88	8	★	C-4		A/C control pane (Auto A/C)
i96	8	Black	B-5		Keyless entry control module
i101	25	★	C-5	D84	Front door cord RH
i102	16	★	C-1	R167	Rear wiring harness
i106	4	★	B-2		CAN joint connector
i107	4	★	B-2		
i119	16	Black	B-4		TV monitor
i120	20	Black	B-4		

★ : White or natural color

# Instrument Panel Wiring Harness

WIRING SYSTEM



WI-15921



# Rear Wiring Harness

WIRING SYSTEM

## 59.Rear Wiring Harness

### A: LOCATION

#### 1. SEDAN MODEL

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
R1	20	★	C-3	B97	Bulkhead wiring harness
R2	16	★	B-2	B98	
R8	4	★	C-3		Front seat belt switch LH
R9	3	★	C-4		Front door switch LH
R10	8	★	B-3	D22	Rear door cord RH
R12	3	★	B-3		Front door switch RH
R13	8	★	C-4	D28	Rear door cord LH
R15	8	★	B-4	R213	Fuel cord
R16	3	★	B-4		Rear door switch RH
R41	4	★	C-4		Seat heater unit LH
R43	22	★	C-3		Adapter code (Console)
R44	4	★	C-2		Seat heater unit RH
R46	6	★	B-4	R67	Fuel cord
R50	16	★	B-2	B90	Bulkhead wiring harness
R51	2	Black	B-3		Vanity mirror illumination RH
R52	3	★	B-3		Room light
R54	2	Black	B-4		Vanity mirror illumination LH
R55	10	Gray	A-3		Sunroof control unit
R56	2	★	A-3		Spot map light
R57	3	★	B-3		Shade mirror
R72	2	Gray	B-4		Rear ABS wheel speed sensor RH
R73	2	Gray	B-4		Rear ABS wheel speed sensor LH
R98	18	★	B-1	i53	Instrument panel wiring harness
R99	12	★	C-4	i54	
R109	4	Black	C-3		Driver's power seat
R128	5	★	B-3		Sunroof switch
R142	2	Black	C-4		Condenser (Fuel pump)
R150	8	Gray	B-3		Seat belt & airbag warning light & spot map light
R167	16	★	C-3	i102	Instrument panel wiring harness
R168	20	★	C-3		Fuse & relay box (F/B)
R169	8	★	B-3		Impact sensor
R188	2	Black	C-3		Passenger's power seat
R211	12	★	C-4		TPM control module
R226	10	★	C-4		Navigation control module
R242	5	Black	B-3		Sunroof tilt switch

★ : White or natural color

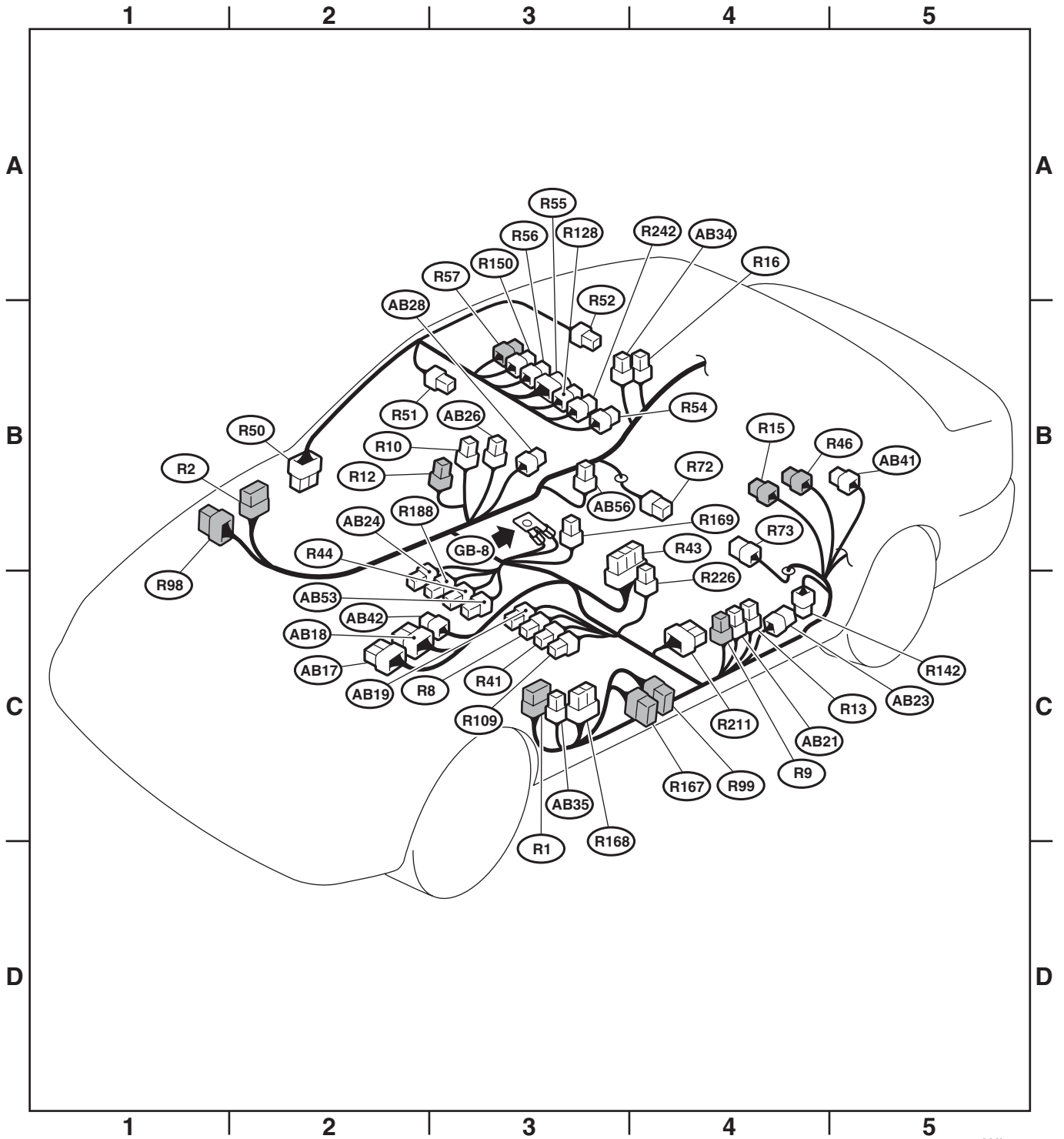
# Rear Wiring Harness

WIRING SYSTEM

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB17	24	Yellow	C-2		Airbag control module LH
AB18	24	Yellow	C-2		Airbag control module RH
AB19	2	Yellow	C-3	AB20	Side airbag module LH
AB21	2	Black	C-4		Pretensioner LH
AB23	4	Yellow	C-4		Side airbag sensor LH
AB24	2	Yellow	B-3	AB25	Side airbag module RH
AB26	2	Black	B-3		Pretensioner RH
AB28	4	Yellow	B-3		Side airbag sensor RH
AB34	4	Yellow	B-3		Curtain airbag sensor RH
AB35	2	Black	C-3		Fuse & relay box (F/B)
AB41	2	Yellow	B-5		Satellite safing sensor
AB42	4	★	C-2		Shield joint connector
AB53	6	Gray	C-3		Occupant detection control module
AB56	3	Brown	B-3		Belt tensioner sensor

# Rear Wiring Harness

WIRING SYSTEM



WI-15922

# Rear Wiring Harness

WIRING SYSTEM

## 2. WAGON MODEL

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
R1	20	★	C-3	B97	Bulkhead wiring harness
R2	16	★	B-1	B98	
R8	4	★	C-3		Front seat belt switch LH
R9	3	★	C-4		Front door switch LH
R10	8	★	B-2	D22	Rear door cord RH
R12	3	★	B-2		Front door switch RH
R13	8	★	C-4	D28	Rear door cord LH
R15	8	★	B-4	R213	Fuel cord
R16	3	★	A-3		Rear door switch RH
R41	4	★	C-3		Seat heater unit LH
R43	22	★	C-3		Adapter code (Console)
R44	4	★	B-3		Seat heater unit RH
R46	6	★	B-5	R67	Fuel cord
R50	16	★	B-1	B90	Bulkhead wiring harness
R51	2	Black	A-2		Vanity mirror illumination RH
R52	3	★	A-3		Room light
R54	2	Black	B-3		Vanity mirror illumination LH (Without home link)
	3	★	B-3		Vanity mirror illumination LH (With home link)
R55	2	★	B-3		Sunroof cord
R56	2	★	B-3		Spot map light
R57	3	★	B-3		Shade mirror
R72	2	Gray	B-4		Rear ABS wheel speed sensor RH
R73	2	Gray	B-4		Rear ABS wheel speed sensor LH
R74	2	★	B-3	R55	Roof cord
R75	6	★	A-4		Sunroof motor assembly
R98	18	★	B-1	i53	Instrument panel wiring harness
R99	12	★	C-3	i54	
R109	4	Black	C-3		Driver's power seat
R150	8	Gray	B-3		Seat belt & airbag warning light & spot map light
R167	16	★	C-3	i102	Instrument panel wiring harness
R168	20	★	C-3		Fuse & relay box (F/B)
R169	8	★	B-2		Impact sensor
R188	2	Black	B-3		Passenger's power seat
R211	12	★	C-4		TPM control module
R226	10	★	C-3		Navigation control module

★ : White or natural color

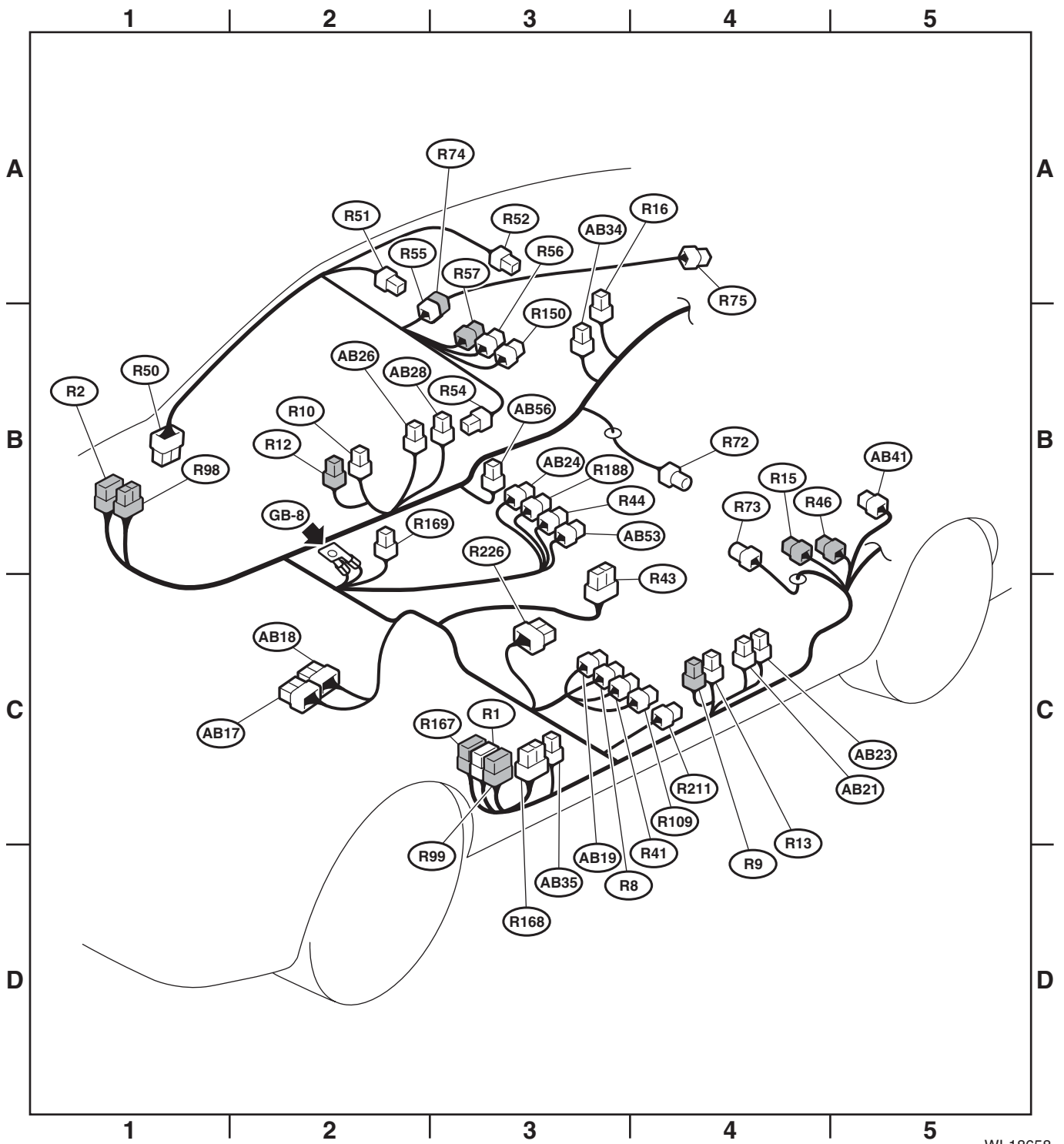
## Rear Wiring Harness

### WIRING SYSTEM

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB17	24	Yellow	C-2		Airbag control module LH
AB18	24	Yellow	C-2		Airbag control module RH
AB19	2	Yellow	C-3	AB20	Side airbag module LH
AB21	2	Black	C-4		Pretensioner LH
AB23	4	Yellow	C-4		Side airbag sensor LH
AB24	2	Yellow	B-3	AB25	Side airbag module RH
AB26	2	Black	B-2		Pretensioner RH
AB28	4	Yellow	B-3		Side airbag sensor RH
AB34	4	Yellow	B-3		Curtain airbag sensor RH
AB35	2	Black	C-3		Fuse & relay box (F/B)
AB41	2	Yellow	B-5		Satellite safing sensor
AB53	6	Gray	B-3		Occupant detection control module
AB56	3	Brown	B-3		Belt tensioner sensor

# Rear Wiring Harness

WIRING SYSTEM



WI-18658

# Door Cord

WIRING SYSTEM

## 60. Door Cord

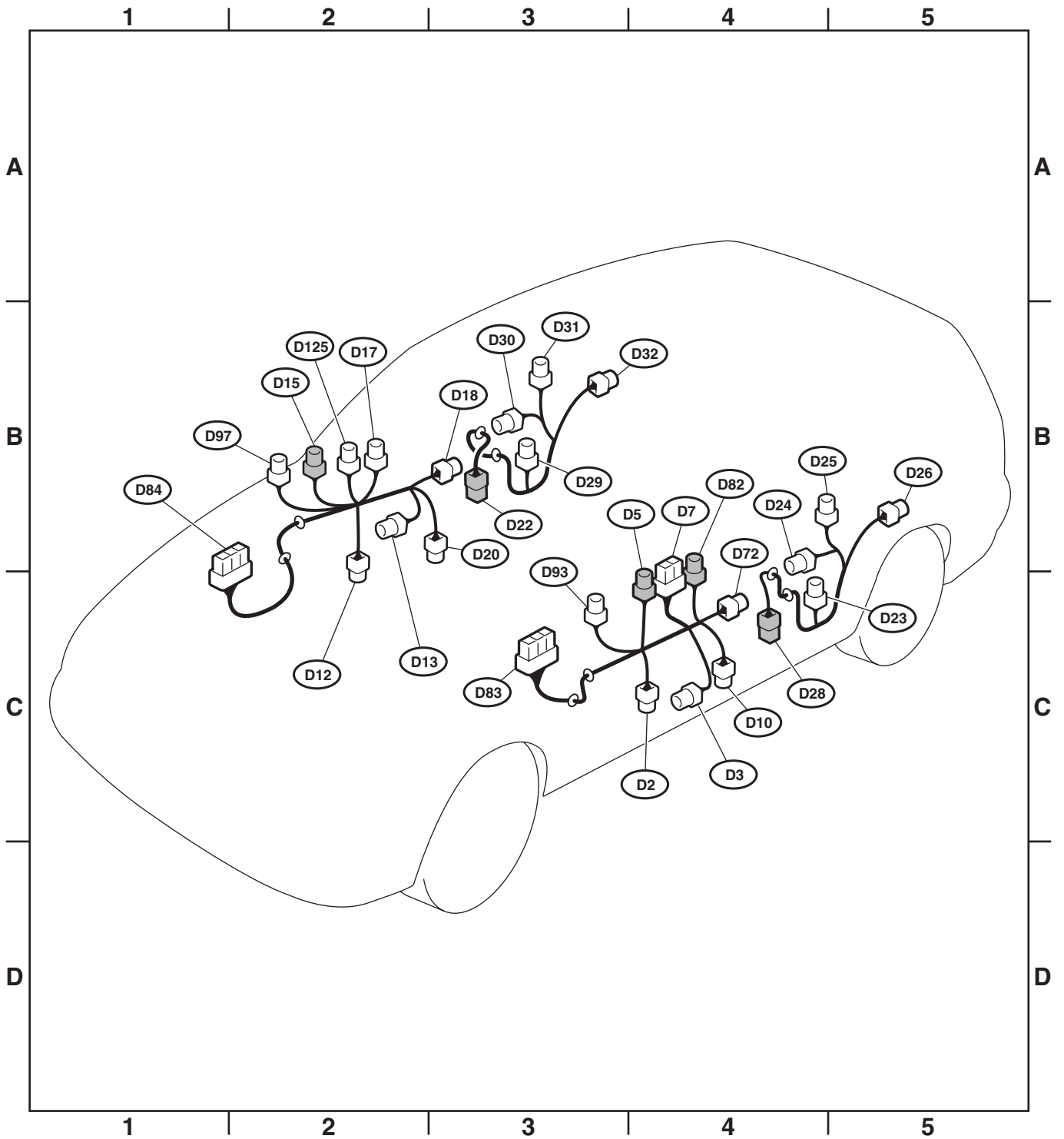
### A: LOCATION

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
D2	2	★	C-4		Front door speaker LH
D3	2	Gray	C-4		Front power window motor LH
D5	6	★	C-4		Outer mirror assembly LH (Without turn signal light)
	8	★	C-4		Outer mirror assembly LH (With turn signal light)
D7	14	★	C-4		Power window main switch
D10	2	★	C-4		Door step light LH
D12	2	★	C-2		Front door speaker RH
D13	2	Gray	B-2		Front power window motor RH
D15	6	★	B-2		Outer mirror assembly RH (Without turn signal light)
	8	★	B-2		Outer mirror assembly RH (With turn signal light)
D17	5	★	B-2		Front power window sub-switch
D18	2	Gray	B-3		Front door lock actuator RH
D20	2	★	B-3		Door step light RH
D22	8	★	B-3	R10	Rear wiring harness RH
D23	2	Black	C-4		Rear door speaker LH
D24	2	Green	B-4		Rear power window motor LH
D25	5	★	B-5		Rear power window sub-switch LH
D26	2	Gray	B-5		Rear door lock actuator LH
D28	8	★	C-4	R13	Rear wiring harness LH
D29	2	Black	B-3		Rear door speaker RH
D30	2	Green	B-3		Rear power window motor RH
D31	5	★	B-3		Rear power window sub-switch RH
D32	2	Gray	B-4		Rear door lock actuator RH
D72	2	Gray	C-4		Front door lock actuator LH
D82	3	Brown	C-4		Door key switch
D83	25	★	C-3	i76	Instrument panel wiring harness
D84	25	★	B-1	i101	
D93	2	★	C-3		Front door tweeter (Inner) LH
D97	2	★	B-2		Front door tweeter (Inner) RH
D125	5	Black	B-2		Passenger's seat door lock switch

★ : White or natural color

# Door Cord

WIRING SYSTEM



WI-09856



## Rear Wiring Harness and Trunk Lid Cord

### WIRING SYSTEM

## 61.Rear Wiring Harness and Trunk Lid Cord

### A: LOCATION

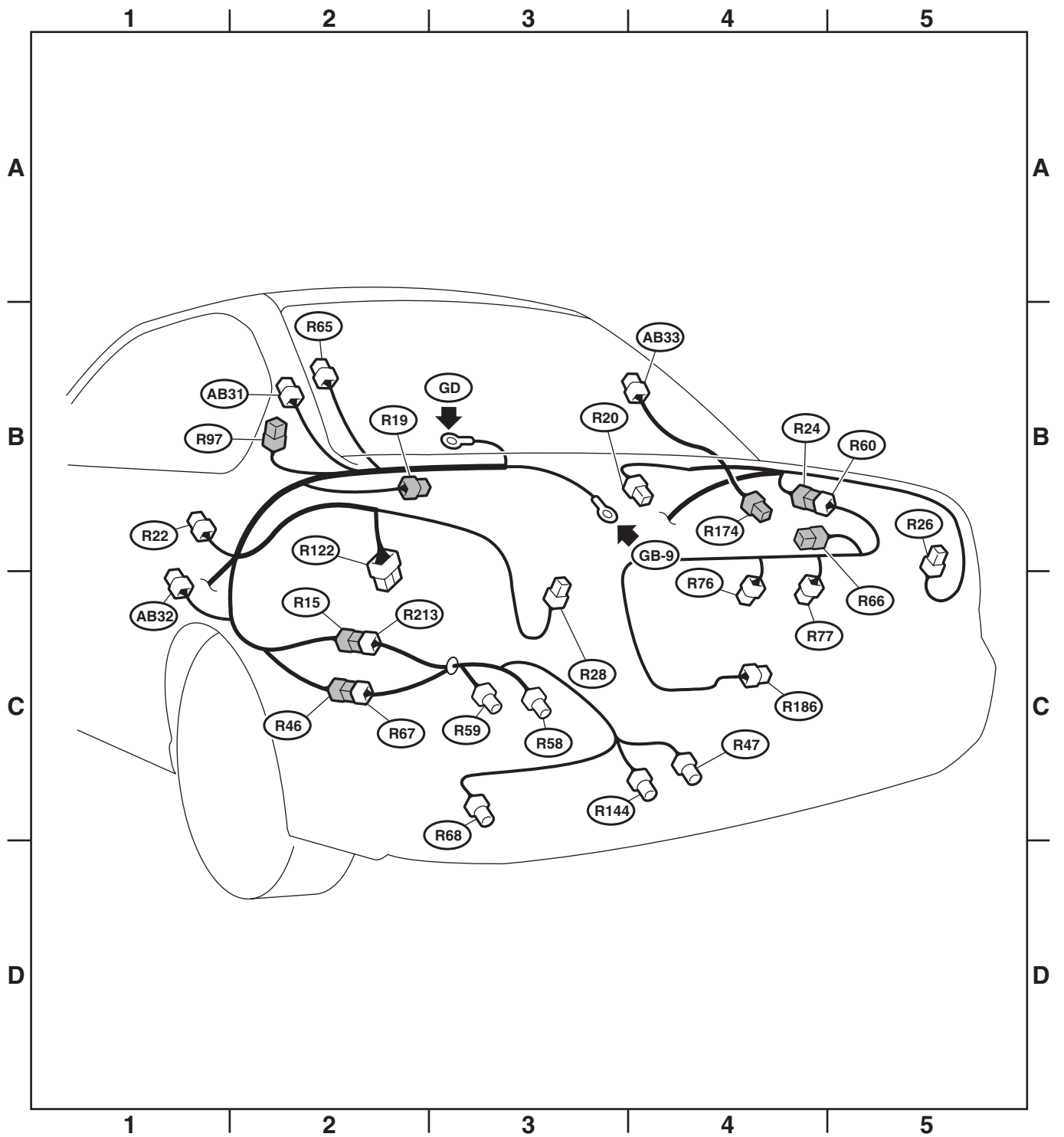
Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
R15	8	★	C-2	R213	Fuel cord
R19	2	★	B-2		High-mounted stop light
R20	2	★	B-4		Trunk room light
R22	3	★	B-1		Rear door switch LH
R24	8	★	B-4	R60	Trunk lid cord
R26	6	★	B-5		Rear combination light RH
R28	6	★	C-3		Rear combination light LH
R46	6	★	C-2	R67	Fuel cord
R47	3	Black	C-4		Fuel tank pressure sensor
R58	6	Gray	C-3		Fuel pump assembly
R59	2	★	C-3		Fuel sub level sensor
R60	8	★	B-4	R24	Rear wiring harness
R65	1	★	B-2		Rear defogger
R66	2	★	B-4		High-mounted stop light (Rear spoiler)
R67	6	★	C-2	R46	Rear wiring harness
R68	2	Dark gray	C-3		Pressure control solenoid valve
R76	2	★	C-4		License plate light LH
R77	2	★	C-4		License plate light RH
R97	1	★	B-2		Antenna amplifier
R122	10	Black	C-2		Fuel pump control unit
R144	2	Gray	C-4		Drain valve
R174	1	★	B-4		Rear defogger
R186	3	★	C-4		Trunk lid lock actuator & switch
R213	8	★	C-2	R15	Rear wiring harness

★ : White or natural color

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB31	2	Black	B-2	AB39	Curtain airbag module LH
AB32	4	Yellow	C-1		Curtain airbag sensor LH
AB33	2	Black	B-4	AB40	Curtain airbag module RH

# Rear Wiring Harness and Trunk Lid Cord

WIRING SYSTEM



WI-13309

## Rear Wiring Harness and Rear Gate Cord

### WIRING SYSTEM

## 62.Rear Wiring Harness and Rear Gate Cord

### A: LOCATION

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
R15	8	★	C-1	R213	Fuel cord
R22	3	★	C-1		Rear door switch LH
R26	4	★	C-5		Rear combination light RH
R28	4	★	C-3		Rear combination light LH
R32	2	★	C-2		Rear accessory power supply socket (Luggage room)
R38	8	★	C-4	D34	Rear gate cord
R39	10	★	C-4	D35	
R46	6	★	D-1	R67	Fuel cord
R47	3	Black	D-4		Fuel tank pressure sensor
R58	6	Gray	D-2		Fuel pump assembly
R59	2	★	D-2		Fuel sub level sensor
R67	6	★	D-2	R46	Rear wiring harness
R68	2	Dark gray	D-3		Pressure control solenoid valve
R79	6	★	C-2		Trailer connector
R97	1	★	C-2		Antenna amplifier
R122	10	Black	C-2		Fuel pump control unit
R144	2	Gray	D-3		Drain valve
R213	8	★	C-1	R15	Rear wiring harness

★ : White or natural color

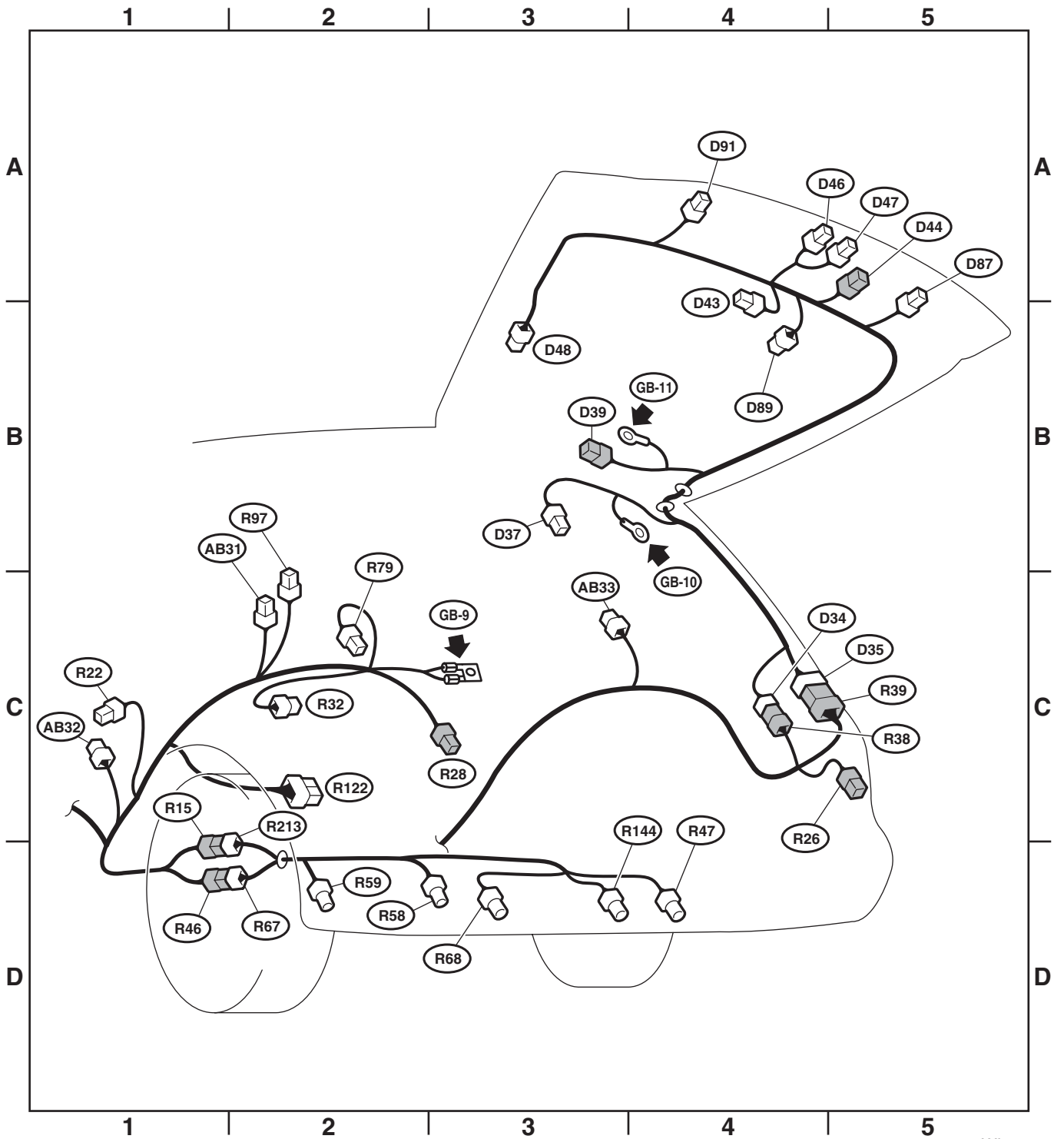
Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
D34	8	★	C-4	R38	Rear wiring harness
D35	10	★	C-4	R39	
D37	3	★	B-3		Luggage room light
D39	2	★	B-3		High-mounted stop light
D43	4	★	B-4		Rear wiper motor
D44	2	★	A-5		License plate light
D46	2	Black	A-4		Rear gate latch switch
D47	2	Gray	A-5		Rear gate lock actuator
D48	1	Black	B-3		Rear defogger
D87	2	Gray	A-5		Back-up light RH
D89	1	★	B-4		Rear defogger
D91	2	Gray	A-4		Back-up light LH

★ : White or natural color

Connector				Connecting to	
No.	Pole	Color	Area	No.	Description
AB31	2	Black	C-2	AB39	Curtain airbag module LH
AB32	4	Yellow	C-1		Curtain airbag sensor LH
AB33	2	Black	C-3	AB40	Curtain airbag module RH

# Rear Wiring Harness and Rear Gate Cord

WIRING SYSTEM



WI-13310

# Rear Wiring Harness and Rear Gate Cord

WIRING SYSTEM

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# GENERAL

## FUEL INJECTION (FUEL SYSTEM)

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### 1. General

- The Multipoint Fuel Injection (MFI) system supplies optimum air-fuel mixture under every engine operating condition through the use of the latest electronic control technology.

This system pressurizes the fuel to a constant pressure and injects it into each intake air port in the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where an electro-magnetic injection valve or injector opens for a short period that is precisely controlled depending on the quantity of air appropriate for each condition of operation. In actual control, an optimum fuel injection quantity is achieved by varying the duration of an electric pulse applied to the injector. This way of control enables simple, yet highly precise metering of the fuel.

- The engine control module (ECM) that controls the fuel injection system corrects the fuel injection amount depending on the vehicle speed, throttle opening, coolant temperature and other vehicle-operation-related information. The ECM receives the information in the form of electric signals from the corresponding sensors and switches.

The MFI system also has the following features:

- Reduced exhaust emissions
- Improves fuel efficiency
- Increased engine output
- Quick response to accelerator and brake pedal operation
- Superior start ability and warm-up performance in cold weather due to corrective controls made according to coolant and intake air temperatures

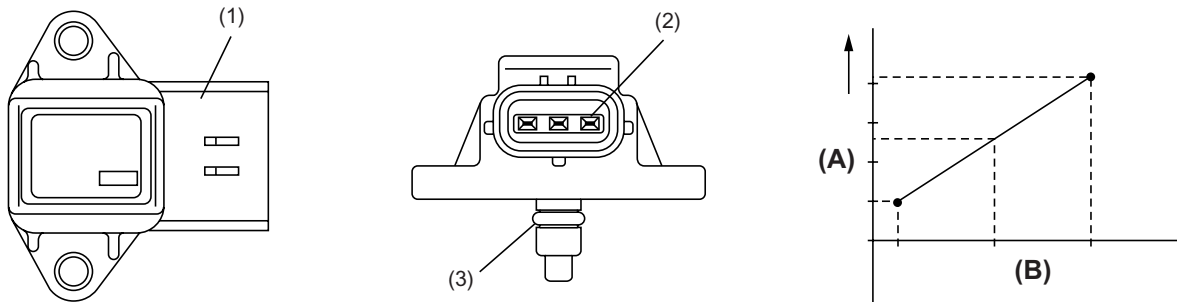
## 2. Air Line

### A: GENERAL

The air filtered by the air cleaner enters the throttle body where it is regulated in the volume by the throttle valve and then enters the intake manifold. It is then distributed to each cylinder where the air is mixed with fuel injected by the injector.

### B: MANIFOLD ABSOLUTE PRESSURE SENSOR

The manifold absolute pressure sensor is attached to the top of the throttle body, and continuously sends to the engine control module (ECM) voltage signals that are proportional to intake manifold absolute pressures. The ECM controls the fuel injection and ignition timing based on the intake manifold absolute pressure signals in addition to other signals from many sensors and other control modules.



FU-02010

- (1) Connector
- (2) Terminal
- (3) O-ring

- (A) Output voltage
- (B) Absolute pressure

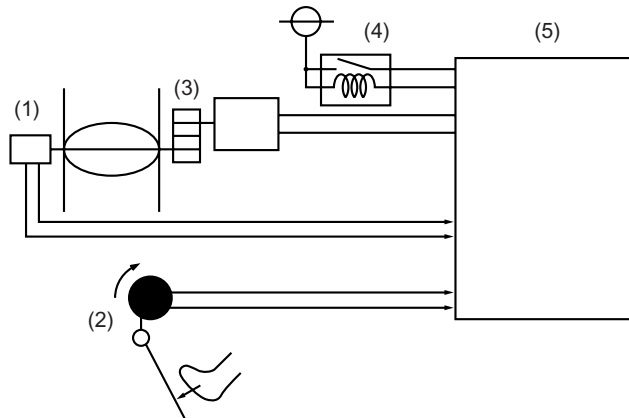
## AIR LINE

### FUEL INJECTION (FUEL SYSTEM)

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#### C: ELECTRONIC CONTROL THROTTLE SYSTEM

- The electronic control throttle system consists of an accelerator pedal position sensor mounted on the accelerator pedal, a throttle position sensor and a throttle motor mounted on the throttle body, and the ECM, which controls these devices.
- The movement of the accelerator pedal is converted into electrical signals by the accelerator pedal position sensor and sent to the ECM. Based on these signals the ECM controls the throttle motor to open and close the throttle valve.
- Idling control is now performed by the electronic control throttle system in place of the idle air control solenoid valve.



FU-01230

- |  |                                       |
|--|---------------------------------------|
| (1) Throttle position sensor             | (4) Electronic control throttle relay |
| (2) Accelerator pedal position sensor    | (5) ECM                               |
| (3) Electronic control throttle assembly |                                       |



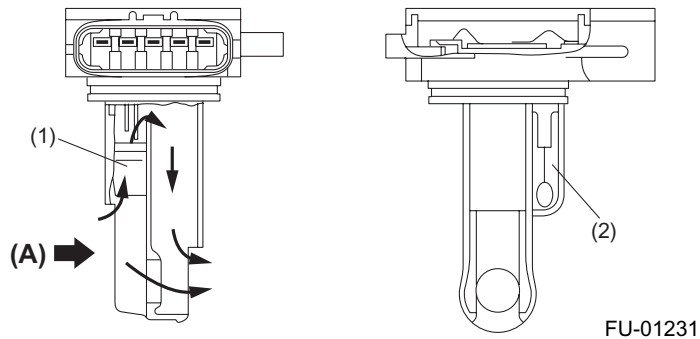
## D: MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR

**NOTE:**

Not installed on some models.

The mass air flow and the intake air temperature sensors are integrated into a single unit. The unit is mounted on the air cleaner case and measures the amount as well as the temperature of the intake air.

The measured amount and temperature are converted into electrical signals and sent to the ECM. The ECM uses these signals to control injection and ignition timing as well as the fuel injection amount.



- (1) Mass air flow sensor
- (2) Intake air temperature sensor

(A) Air

FU-01231

# AIR LINE

## FUEL INJECTION (FUEL SYSTEM)

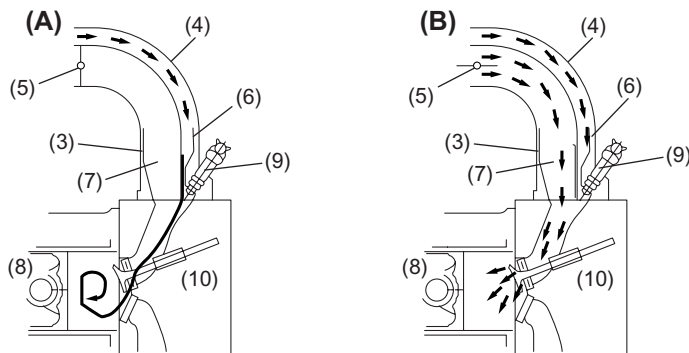
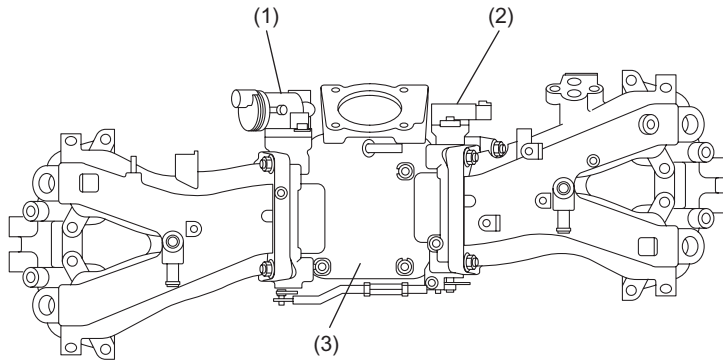
### E: TUMBLE GENERATOR VALVE

#### NOTE:

This is not installed on some models.

- A tumble generator valve is provided on the intake manifold of each engine bank. The right bank tumble generator valve has butterfly valves for the #1 and #3 cylinders and the left bank tumble generator valve has those for the #2 and #4 cylinders. The two butterfly valves in each tumble generator valve are fitted on a single shaft that is driven by an actuator.

- The tumble generator valves are controlled by the ECM according to the coolant temperature and the time elapsed after start of the engine. When the engine is started, the butterfly valves are moved to the closing ends. In this state, the intake air flows at very high speeds passing through narrowed passages in the directions determined by the individual intake air ports in the cylinder head. This creates tumbling air motions in the cylinders, which enables lean mixtures to be ignited and thus harmful exhaust emissions to be reduced during engine start. The tumble generator valves are fully open when the engine is operating at an ordinary driving speed, allowing intake air to flow without being changed in direction and velocity.



FU-01316

**(A)** Activated

**(B)** Not activated

(1) Actuator

(2) Tumble generator valve position sensor

(3) Tumble generator housing

(4) Intake manifold

(5) Tumble generator valve

(6) Tumble generating air passage

(7) Main intake air passage

(8) Piston

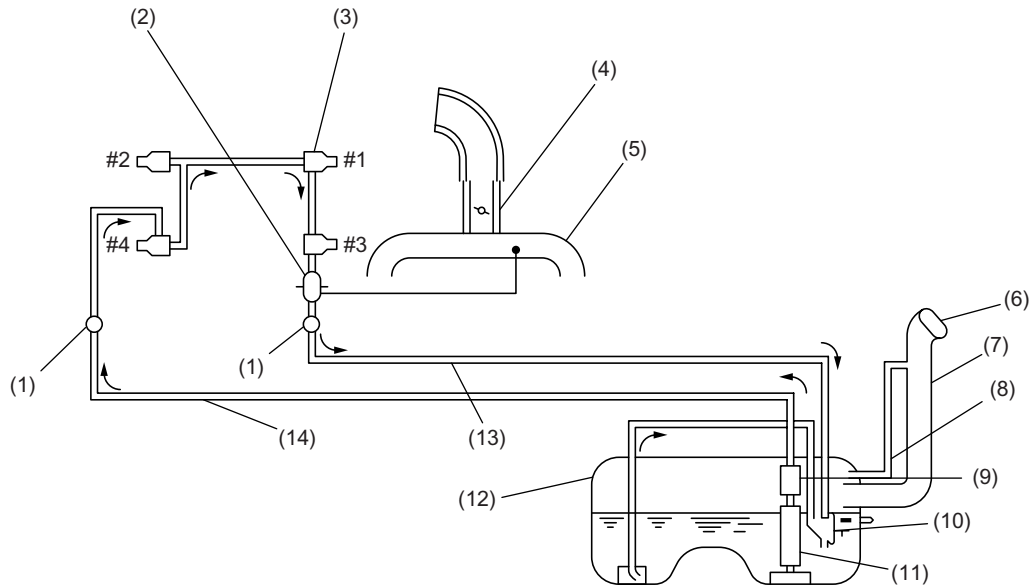
(9) Injector

(10) Cylinder head

### 3. Fuel System

#### A: GENERAL

- The fuel pressurized by the fuel tank inside pump is delivered to each fuel injector through the fuel filter. Fuel injection pressure is regulated to an optimum level by the pressure regulator.
- Each injector injects fuel into the intake port of the corresponding cylinder where the fuel is mixed with air. The mixture then enters the cylinder. Fuel injection amount and timing are regulated by the ECM.



FU-02409

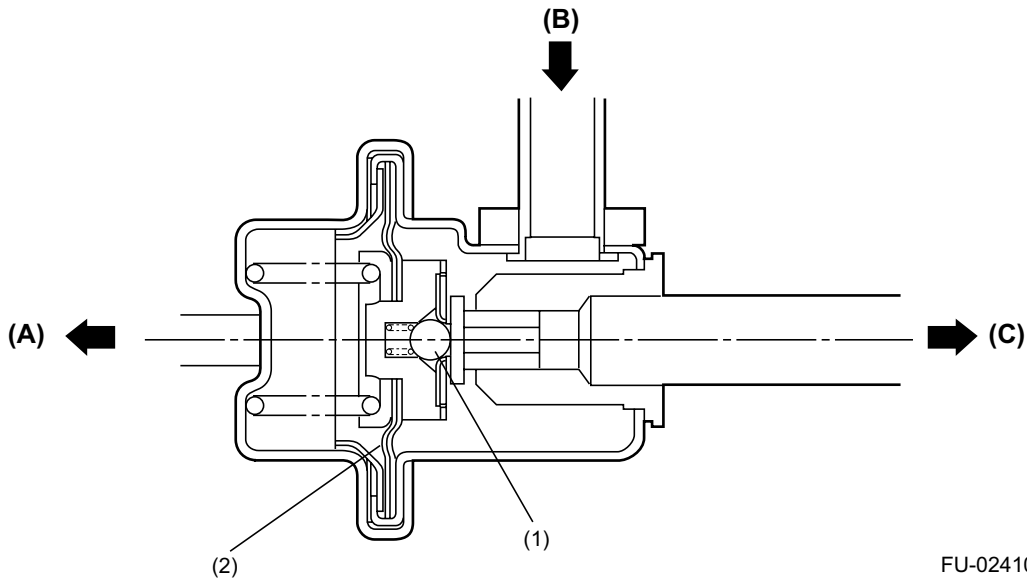
- |                        |                         |
|------------------------|-------------------------|
| (1) Fuel damper valve  | (8) Air vent pipe       |
| (2) Pressure regulator | (9) Fuel filter         |
| (3) Fuel injector      | (10) Jet pump           |
| (4) Throttle body      | (11) Fuel pump          |
| (5) Intake manifold    | (12) Fuel tank          |
| (6) Filler cap         | (13) Fuel return line   |
| (7) Filler pipe        | (14) Fuel delivery line |

# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### B: PRESSURE REGULATOR

The pressure regulator is installed at the injector end of the fuel supply line. It has a fuel chamber and spring chamber separated by a diaphragm. The fuel chamber is connected to the fuel supply line and the spring chamber is connected to the intake manifold. Fuel chamber also has a relief valve connected to the fuel return line through which fuel returns to the fuel tank. When the intake manifold vacuum increases, the diaphragm is pulled and the relief valve opens to decrease the fuel supply line pressure (or fuel injection pressure). When the intake manifold vacuum decreases, the diaphragm is pushed by the spring to increase the fuel supply line pressure. Thus, the difference between the fuel injection pressure and the intake manifold vacuum is kept at a constant level to precisely control the amount of injected fuel.



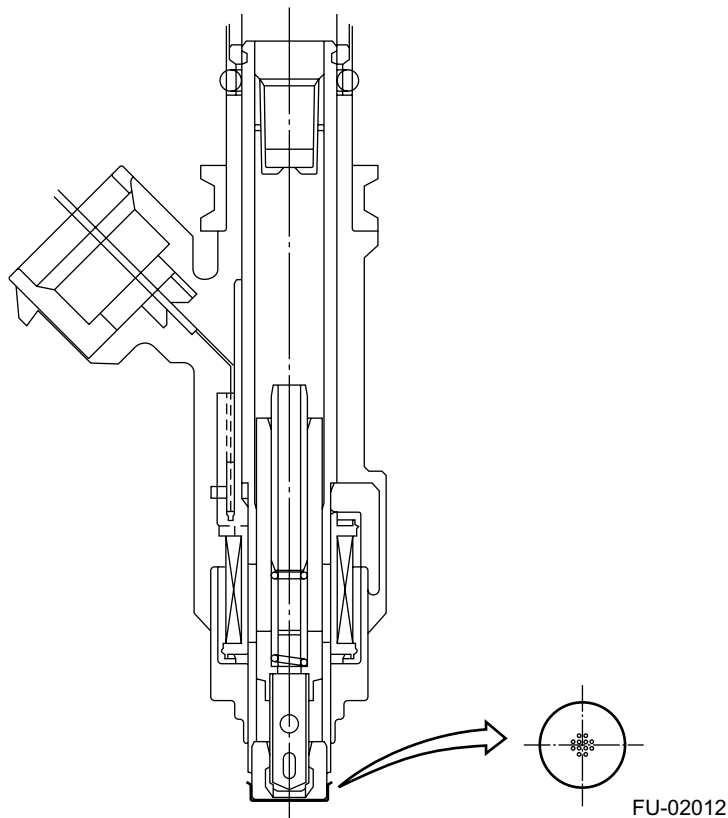
FU-02410

- (1) Relief valve
- (2) Diaphragm

- (A) To intake manifold
- (B) Fuel IN
- (C) Fuel OUT

### C: FUEL INJECTOR

- The MFI system employs top feed type fuel injectors.
- Each injector is installed in the fuel pipe in such a way that the injector is cooled by fuel.
- The features of this type of fuel injector are as follows:
  - 1) High heat resistance
  - 2) Low driving noise
  - 3) Easy to service
  - 4) Small size
- The injector injects fuel according to the valve open signal from the ECM. The needle valve is lifted by the solenoid, which is energized on arrival of the valve open signal.
- Since the injector's nozzle hole area, the lift of valve and the fuel pressure are kept constant, the amount of fuel injected is controlled only by varying the duration of the valve open signal from the ECM.
- The multi-hole nozzle makes it possible for the injector to produce fine fuel particles, which enhances the combustion efficiency and output performance of the engine.



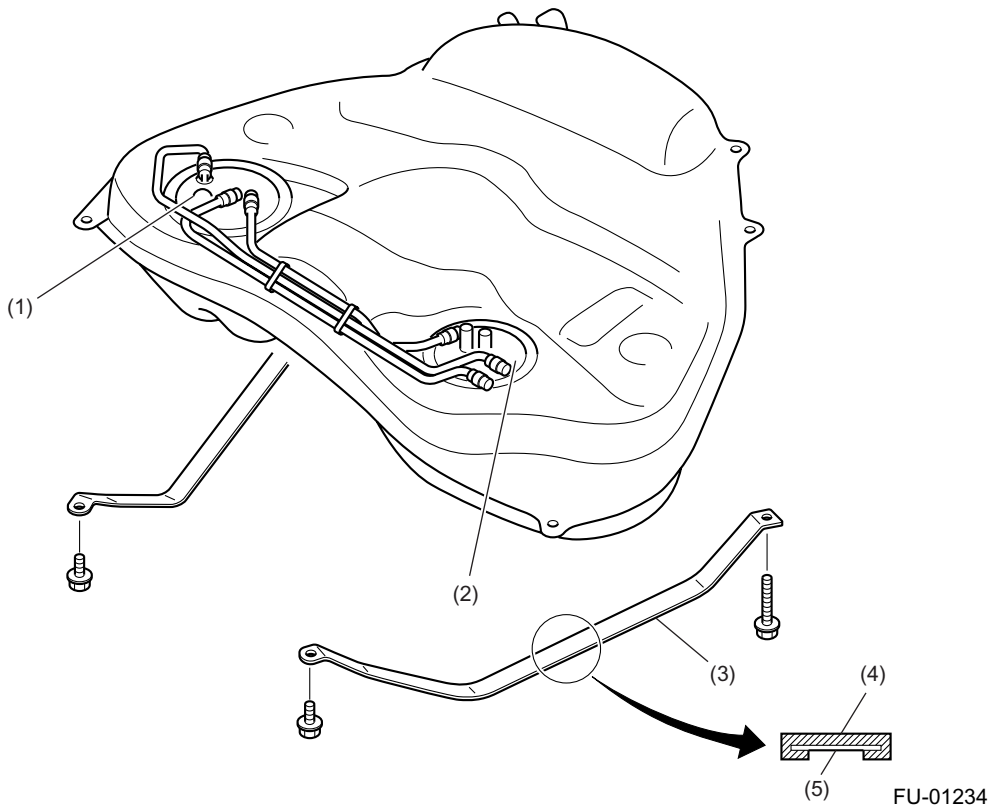
# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### D: FUEL TANK

The fuel tank utilizes a two-compartment design to ensure sufficient capacity without interfering with the rear differential. It is provided with a suction jet pump (included in the fuel pump and fuel level sensor assembly) which transfers fuel from one compartment to the other.

Each compartment has an individual fuel level sensor. The fuel tank is located under the rear seat and secured with hold-down bands.



- (1) Fuel pump and fuel level sensor assembly
- (2) Fuel sub level sensor
- (3) Band

- (4) Cushion
- (5) Steel

### E: FUEL PUMP AND FUEL LEVEL SENSOR ASSEMBLY

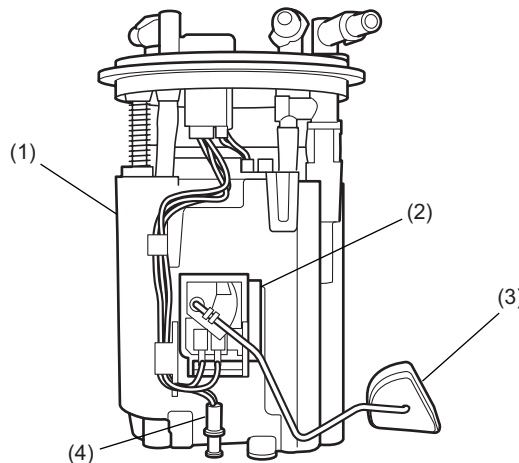
#### 1. FUEL PUMP

The fuel pump consists of a motor, impeller, pump casing, pump cover, check valve and filter. It is located in the fuel tank and combined with the fuel level sensor into a single unit. The operation of this impeller type pump is very quiet.

- When the ignition switch is turned ON, fuel pump relay is activated. Then the motor operates to rotate the impeller.
- As the impeller rotates, fuel in a vane groove of the impeller flows along the fuel passage into the next vane groove by centrifugal force. When fuel flows from one groove to the next, a pressure difference occurs due to friction. This creates a pumping effect.
- The fuel pushed up by rotation of the impeller then passes through the clearance between the armature and the magnet of the motor and is discharged through the check valve.
- When the fuel discharge pressure reaches the specified level, the relief valve opens and excess fuel is released into the fuel tank. In this manner, the relief valve prevents an abnormal increase in fuel pressure.
- When the engine and the fuel pump stop, check valve operates to close the discharge port, so that the fuel pressure in the fuel delivery line is retained.

#### 2. FUEL LEVEL SENSOR

The fuel level sensor is integrated with the fuel pump, which is located in the fuel tank. The sensor outputs an electric resistance signal that varies with movement of its float to indicate the level of the fuel remaining in the tank.



FU-02519

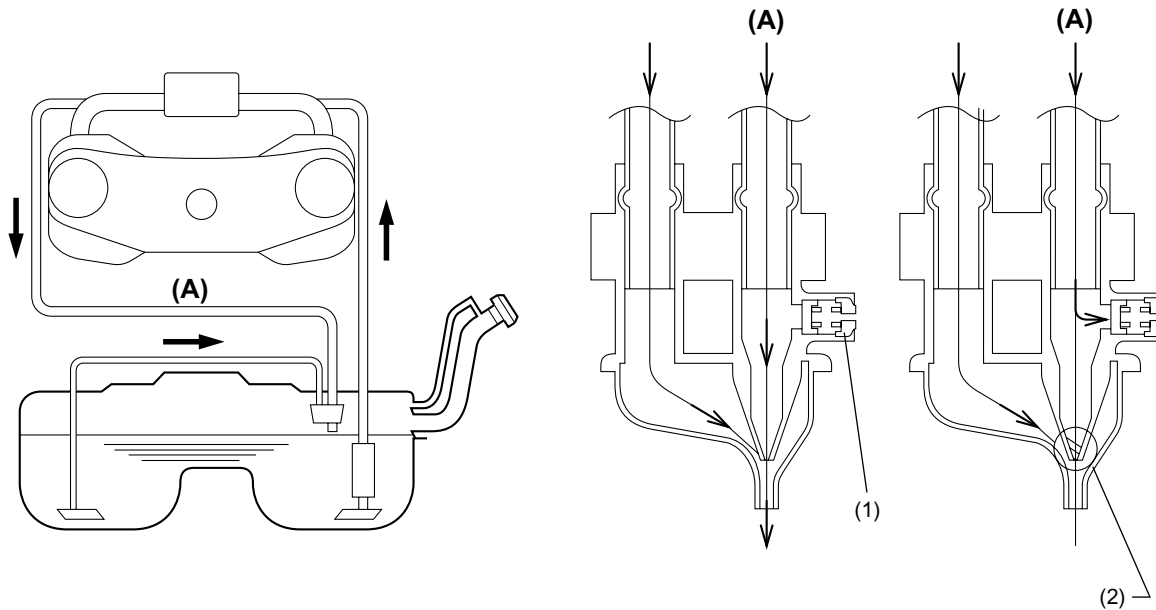
- (1) Fuel pump assembly
- (2) Fuel level sensor
- (3) Float
- (4) Fuel temperature sensor

# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### 3. JET PUMP

- The jet pump utilizes the velocity of fuel returning from the engine to produce vacuum in it.
- Using the pumping effect produced by the vacuum, the jet pump transfers fuel from the sub-compartment and main compartment of the fuel tank to the fuel pump.
- When the return line nozzle is clogged, the fuel sent back through the return line flows back into the fuel tank via the relief valve.



FU-00226

- (1) Relief valve
- (2) Nozzle

(A) Return line

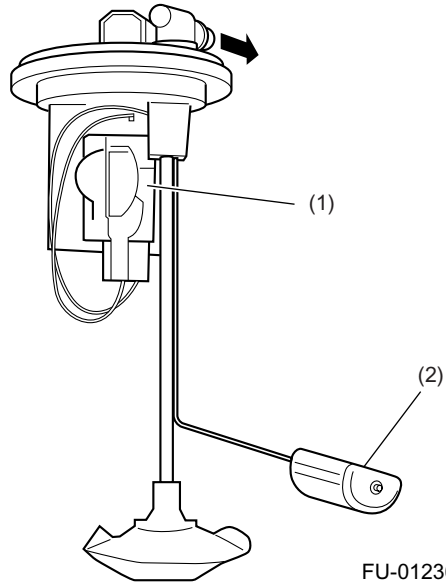
### 4. FUEL FILTER

The fuel filter is integrated with the fuel pump assembly, which is located in the fuel tank.



### F: SUB-COMPARTMENT FUEL LEVEL SENSOR

This sensor detects the level of the fuel in the sub side (the side without a fuel pump) of the fuel tank. Also, when the jet pump is operating, fuel in the sub side is drawn up and transferred to the fuel pump.



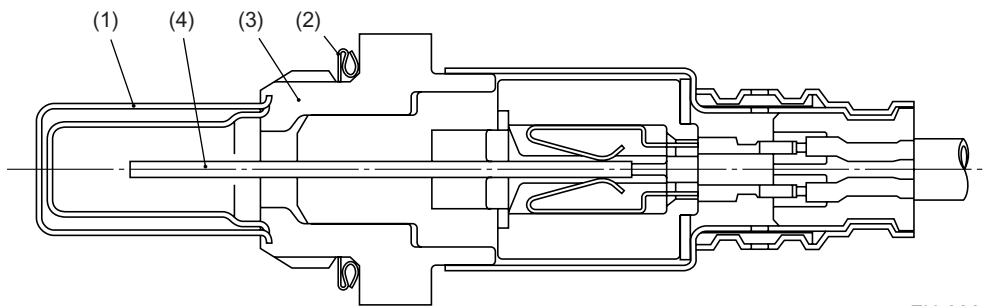
- (1) Fuel level sensor
- (2) Float

**(A)** To jet pump

### 4. Sensors and Switches

#### A: FRONT OXYGEN (A/F) SENSOR

- The front oxygen sensor uses zirconium oxide ( $ZrO_2$ ), which is a solid electrolyte, at portions exposed to exhaust gas.
  - The zirconium oxide has the property of generating electromotive force when its both sides are exposed to oxygen ions of different concentration and the magnitude of this electromotive force depends on how much the difference is.
- The front oxygen (A/F) sensor detects the amount of oxygen in exhaust gases by making use of this property of the zirconium oxide material.
- The sensor incorporates a ceramic heater to improve its performance at low temperatures.



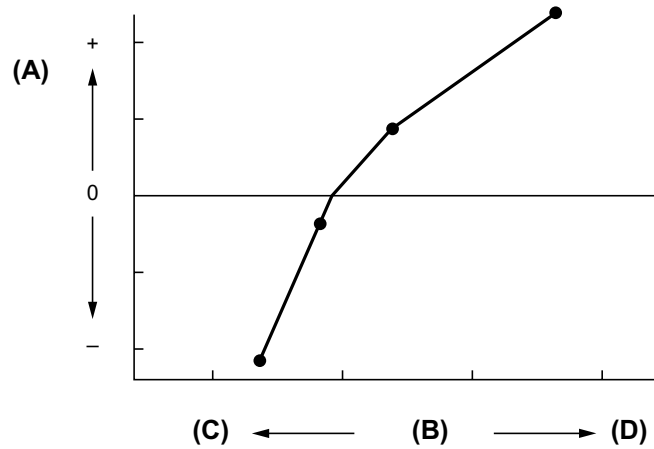
FU-02014

- (1) Protection tube
- (2) Gasket
- (3) Sensor housing
- (4) Ceramic heater

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconium tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The front oxygen (A/F) sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 700°C (1,292°F).



FU-02015

- (A) Current
- (B) Air/fuel ratio
- (C) Rich
- (D) Lean

# SENSORS AND SWITCHES

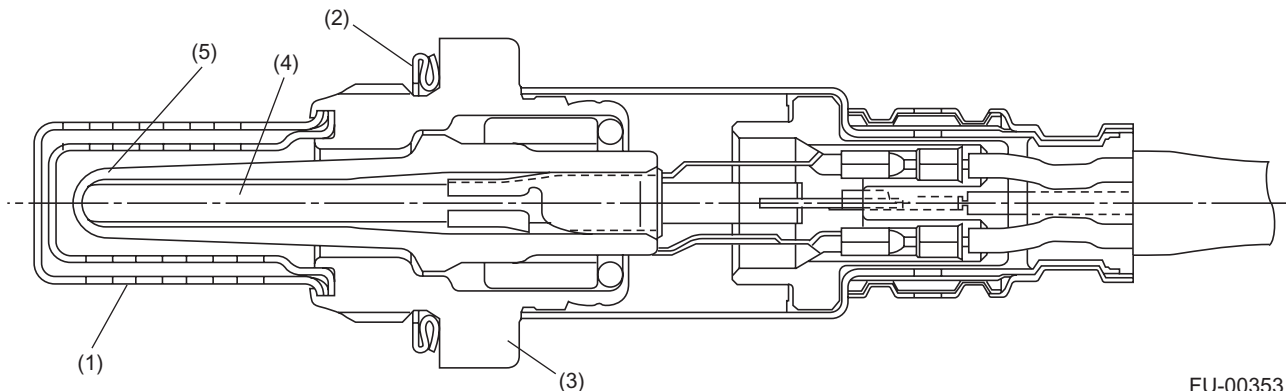
## FUEL INJECTION (FUEL SYSTEM)

### B: FRONT OXYGEN SENSOR AND REAR OXYGEN SENSOR

#### NOTE:

The front oxygen sensor is not installed on some models.

- The front oxygen sensor and rear oxygen sensor are used to sense oxygen concentration in the exhaust gas. If the air-fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e., excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains almost no oxygen.
- Detecting the oxygen concentration in exhaust gas using the front oxygen sensor and rear oxygen sensor makes it possible to determine whether the air-fuel ratio is leaner or richer than the stoichiometric ratio.
- The front oxygen sensor and the rear oxygen sensor have a zirconium tube (ceramic), which generates voltage if there is a difference in oxygen ion concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconium tube as a catalysis and electrode material. The sensor housing is grounded to the exhaust pipe and the inside is connected to the ECM through the harness.
- A ceramic heater is employed to improve performance at low temperatures.



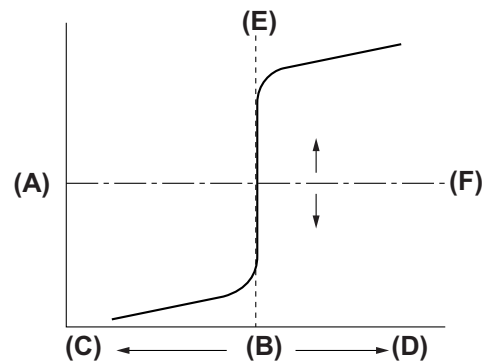
FU-00353

- |                     |                    |
|---------------------|--------------------|
| (1) Protection tube | (4) Ceramic heater |
| (2) Gasket          | (5) Zirconium tube |
| (3) Sensor housing  |                    |

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconium tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The rear oxygen sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 300 to 400°C (572 to 752°F).



FU-02016

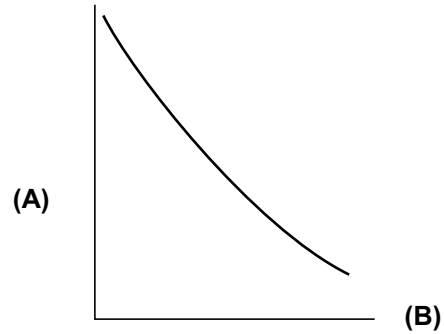
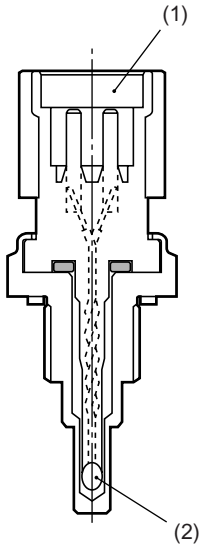
- (A) Electromotive force
- (B) Air/fuel ratio
- (C) Lean
- (D) Rich
- (E) Stoichiometric ratio
- (F) Comparison voltage

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

### C: ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor is located on the engine coolant pipe. The sensor uses a thermistor whose resistance changes inversely with temperature. Resistance signals as engine coolant temperature information are transmitted to the ECM to make fuel injection, ignition timing, purge control solenoid valve and other controls.



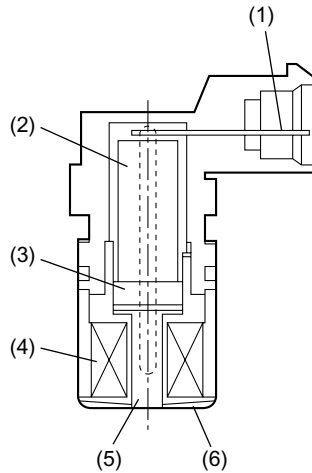
FU-02017

- (1) Connector
- (2) Thermistor element

- (A) Resistance ( $k\Omega$ )
- (B) Temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )

### D: CRANKSHAFT POSITION SENSOR

- The crankshaft position sensor is installed on the oil pump, which is located in the front center portion of the cylinder block. The sensor generates a pulse when one of the teeth on the perimeter of the crankshaft sprocket (rotating together with the crankshaft) passes in front of it. The ECM determines the crankshaft angular position by counting the number of pulses.
- The crankshaft position sensor is a molded type, which consists of a magnet, core, coil, terminals and other components as illustrated below.



FU-00234

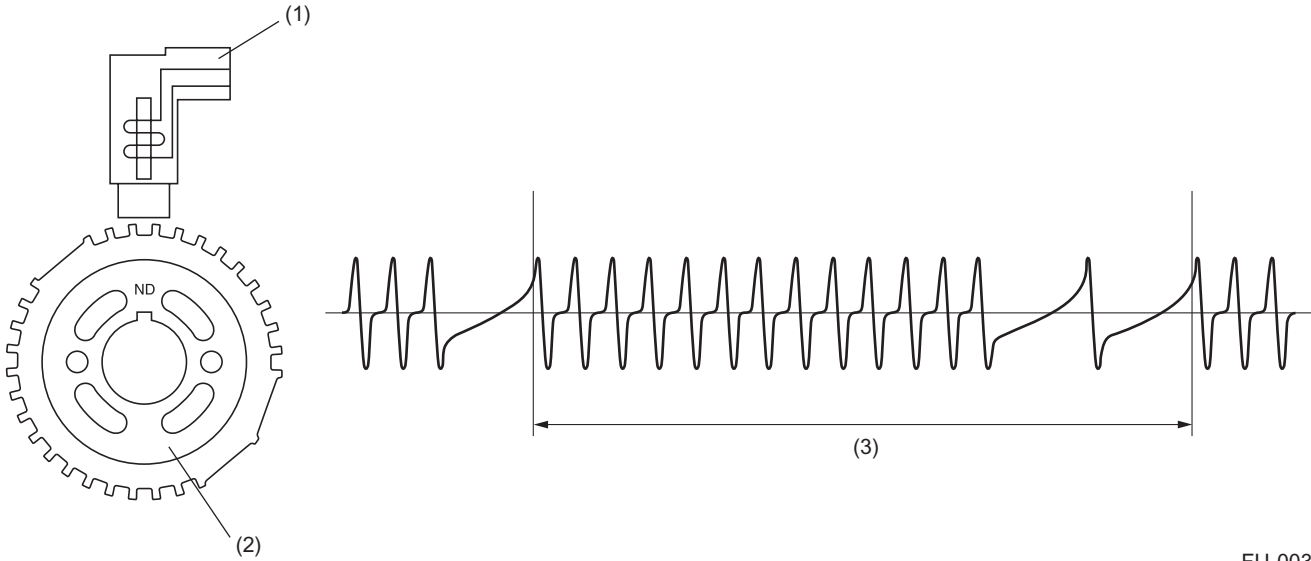
- (1) Terminal
- (2) Yoke core
- (3) Magnet

- (4) Coil
- (5) Core
- (6) Cover

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- As the crankshaft rotates, each tooth aligns with the crankshaft position sensor. At that time, the magnetic flux in the sensor's coil changes since the air gap between the sensor pickup and the sprocket changes. This change in magnetic flux induces a voltage pulse in the sensor and the pulse is transmitted to the ECM.



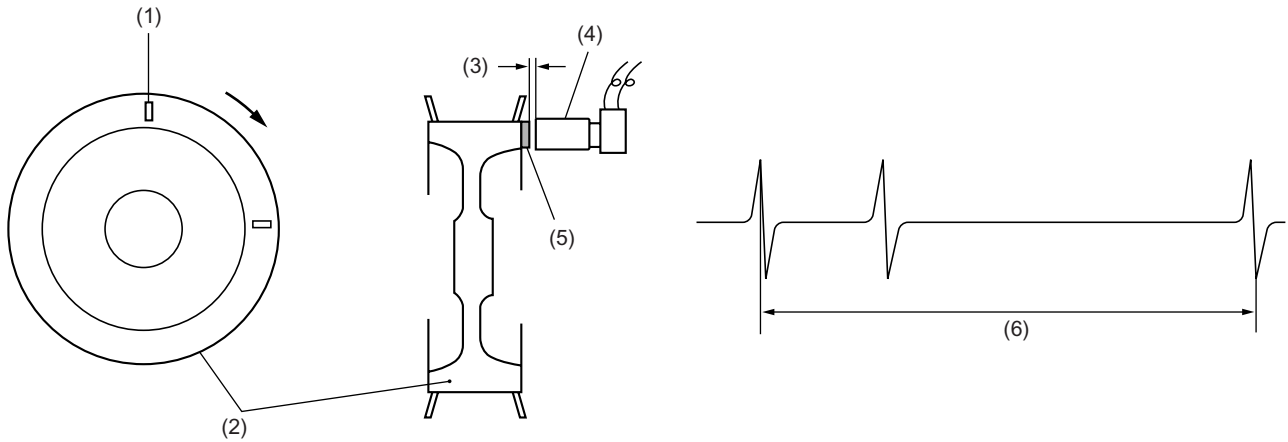
FU-00354

- (1) Crankshaft position sensor
- (2) Crankshaft sprocket
- (3) Crankshaft half rotation



### E: CAMSHAFT POSITION SENSOR

- The camshaft position sensor is located on the left-hand camshaft support. This sensor detects the combustion cylinder at any given moment.
  - The sensor generates a pulse when one of the bosses on the back of the left-hand camshaft drive sprocket passes in front of the sensor. The ECM determines the camshaft angular position by counting the number of pulses.
- Internal construction and the basic operating principle of the camshaft position sensor are similar to those of the crankshaft position sensor.



FU-02018

- (1) Boss
- (2) Cam sprocket
- (3) Air gap

- (4) Camshaft position sensor
- (5) Boss
- (6) Camshaft one rotation (crankshaft two rotations)

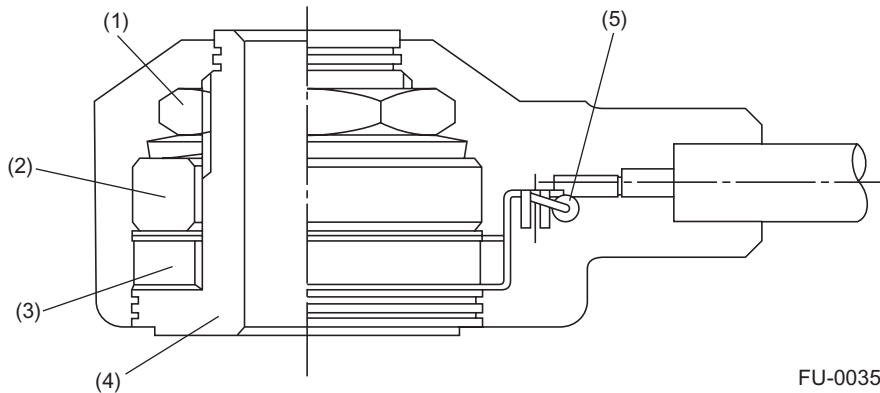
# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

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### F: KNOCK SENSOR

- The knock sensor is installed on the cylinder block, and senses knocking that occur in the engine.
- The sensor is a piezo-electric type, which converts vibration resulting from knocking into electric signals.
- In addition to a piezo-electric element, the sensor has a weight and case as its components. If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.
- The knock sensor harness is connected to the engine harness.



FU-00356

- (1) Nut
- (2) Weight
- (3) Piezo-electric element
- (4) Housing
- (5) Resistance

### G: VEHICLE SPEED SENSOR

Vehicle speed signals are sent from the vehicle speed sensor to the ABS and VDC control modules. The signals are sent to the ECM via CAN communication. (For details, refer to the LAN section.)  
<Ref. to LAN section.>

## 5. Control System

### A: GENERAL

The ECM receives signals from various sensors, switches, and other control modules. Using these signals, it determines the engine operating conditions and if necessary, emits signals to one or more systems to control them for optimum operation.

Major control items of the ECM are as follows:

- Fuel injection control
- Ignition control
- Idle air control
- Fuel pump control
- Canister purge control\*<sup>1</sup>
- Radiator fan control\*<sup>2</sup>
- On-board diagnosis function

\*1: Canister purge control is described under EC(H4SO) — Evaporative Emission Control System. <Ref. to EC(H4SO) section.>

\*2: Radiator fan control is described under CO(H4SO). <Ref. to CO(H4SO) section.>

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### B: INPUT AND OUTPUT SIGNALS

Signal	Unit	Function
Input signals	Manifold absolute pressure sensor	Detects the pressure of intake air (measures the absolute pressure).
	Mass air flow and intake air temperature sensor	Detects the temperature and amount of intake air.
	Throttle position sensor	Detects the throttle valve position.
	Front oxygen (A/F) sensor	Detects the density of oxygen in exhaust gases at the upstream of the front catalytic converter.
	Front oxygen sensor Rear oxygen sensor	Detects the density of oxygen in exhaust gases at the downstream of the front catalytic converter.
	Crankshaft position sensor	Detects the crankshaft angular position.
	Camshaft position sensor	Detects the combustion cylinder.
	Engine coolant temperature sensor	Detects the engine coolant temperature.
	Knock sensor	Detects engine knocking.
	Accelerator pedal position sensor	Indicates the accelerator pedal position.
	Ignition switch	Detects operation of the ignition switch.
	Starter switch	Detects the condition of engine cranking.
	Neutral position switch (MT)	Detects that the gear is in neutral.
	Inhibitor switch (AT)	Detects shift positions.
	A/C switch	Detects ON-OFF operation of the A/C switch.
	Fuel temperature sensor	Detects the temperature of the fuel in the fuel tank.
	Fuel level sensor	Detects the level of the fuel in the fuel tank.
	Fuel tank pressure sensor	Detects the evaporation gas pressure in the fuel tank.
	A/C mid pressure switch	Detects operation of the A/C mid pressure switch.
	Wiper switch	Detects ON-OFF operation of the wiper switch.
	Power steering switch	Detects operation of the power steering switch.
	Small light switch	Detects ON-OFF operation of the small light switch.
Blower fan switch	Detects ON-OFF operation of the blower fan switch.	
Rear defogger switch	Detects ON-OFF operation of the rear defogger switch.	

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

Signal	Unit	Function
Output signals	Fuel injector	Activates an injector.
	Ignition signal	Turns the primary current to the ignition coil ON or OFF.
	Electronic control throttle	Controls motor output for the electronic control throttle.
	Fuel pump relay	Turns ON or OFF the fuel pump relay.
	A/C control relay	Turns ON or OFF the A/C control relay.
	Radiator fan control relay	Turns ON or OFF the radiator fan control relay.
	Tumble generator valve actuator	Operates the tumble generator valve.
	Engine warning light	Indicates existence of abnormality.
	Purge control solenoid valve	Controls purge of evaporative gas absorbed by the canister.
	EGR valve	Adjusts the exhaust gas circulating flow to the intake pipe.
	Heater circuit of front and rear oxygen sensors	Controls heater of front and rear oxygen sensors.
	Pressure control solenoid valve	Controls evaporation pressure in the fuel tank.
	Drain valve	Closes the evaporation line between the fuel tank and canister to detect leakage of evaporation gas.
	Power supply	Controls ON/OFF of the main power supply relay.

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### C: FUEL INJECTION CONTROL

- The ECM receives signals from various sensors and based on them, it determines the amount of fuel injected and the fuel injection timing. It performs the sequential fuel injection control over the entire engine operating range except during start-up of the engine.
- The amount of fuel injected depends upon the length of time the injector stays open. The fuel injection duration is determined according to varying operating condition of the engine. For the purpose of achieving highly responsive and accurate fuel injection duration control, the ECM performs a new feedback control that incorporates a learning feature as detailed later.
- The sequential fuel injection control is performed such that fuel is injected accurately at the time when the maximum air intake efficiency can be achieved for each cylinder (i.e., fuel injection is completed just before the intake valve begins to open).

#### 1. FUEL INJECTION DURATION

Fuel injection duration is basically determined as indicated below:

- While cranking the engine:

The duration defined below is used.

- Duration of fuel injection during engine start-up ..... Determined according to the engine coolant temperature detected by the engine coolant temperature sensor.

- During normal operation:

The duration is determined as follows:

Basic duration of fuel injection  $\times$  Correction factors + Voltage correction time

- Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors — the amount of intake air detected by the air flow sensor and the engine speed monitored by the crankshaft position sensor.
- Correction factors ..... See the next section.
- Voltage correction time ..... This is added to compensate for the time lag before operation of injector that results from variation in the battery voltage.

#### 2. CORRECTION FACTORS

The following factors are used to correct the basic duration of fuel injection in order to make the air-fuel ratio meet the requirements of varying engine operating conditions:

- Air-fuel ratio feedback factor:

This factor is used to correct the basic duration of fuel injection in relation to the actual engine speed. (See the next section for more details.)

- Start increment factor:

This factor is used to increase the fuel injection duration only while the engine is being cranked to improve its start ability.

- Coolant-temperature-dependent increment factor:

This factor is used to increase the fuel injection duration depending on engine coolant temperature signals to facilitate cold starting. The lower the coolant temperature, the greater becomes the increment.

- After-start increment factor:

- This factor is used to increase the fuel injection duration for a certain period immediately after start of the engine to stabilize engine operation.
- The increment depends on the coolant temperature at the start of the engine.

- **Wide-open-throttle increment factor:**

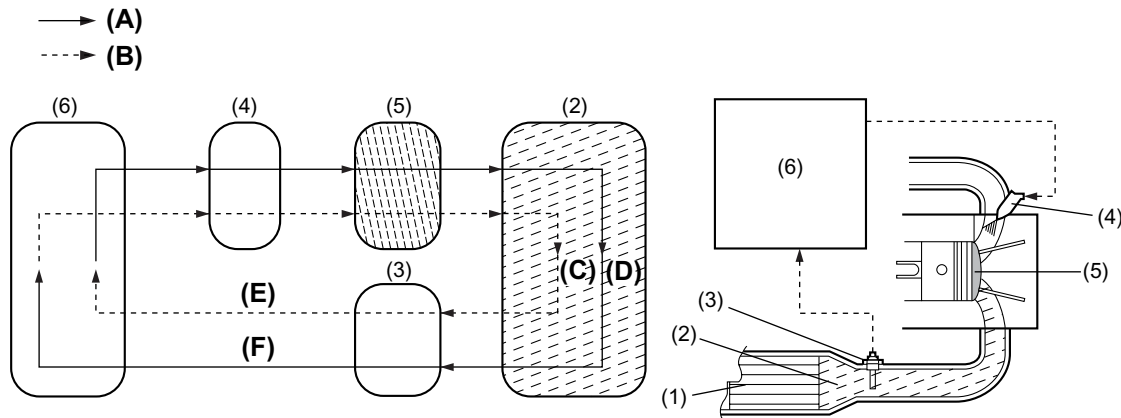
This factor is used to increase the fuel injection duration depending on the relationship between the throttle position sensor signal and air flow sensor signal.

- **Acceleration increment factor:**

This factor is used to increase the fuel injection duration to compensate for a time lag between air flow measurement and fuel injection control for better engine response to driver's pedal operation during acceleration.

### 3. AIR-FUEL RATIO FEEDBACK FACTOR

The ECM creates this factor utilizing the front oxygen (A/F) sensor signal. When the signal is high, the air-fuel ratio is leaner than the stoichiometric ratio. The ECM then makes the fuel injection duration longer by modifying the factor. When the signal is low showing that the mixture is rich, the ECM modifies the factor to make the injection duration shorter. In this way, the air-fuel ratio is maintained at a level close to the stoichiometric ratio at which the three-way catalytic converter acts most effectively.



FU-00240

- (1) Front catalytic converter
- (2) Exhaust gases
- (3) Front oxygen (A/F) sensor
- (4) Fuel injector
- (5) Combustion chamber
- (6) ECM

- (A) Injection duration increment signal
- (B) Injection duration decrement signal
- (C) High oxygen density
- (D) Low oxygen density
- (E) Lean signal
- (F) Rich signal

### 4. LEARNING FEATURE

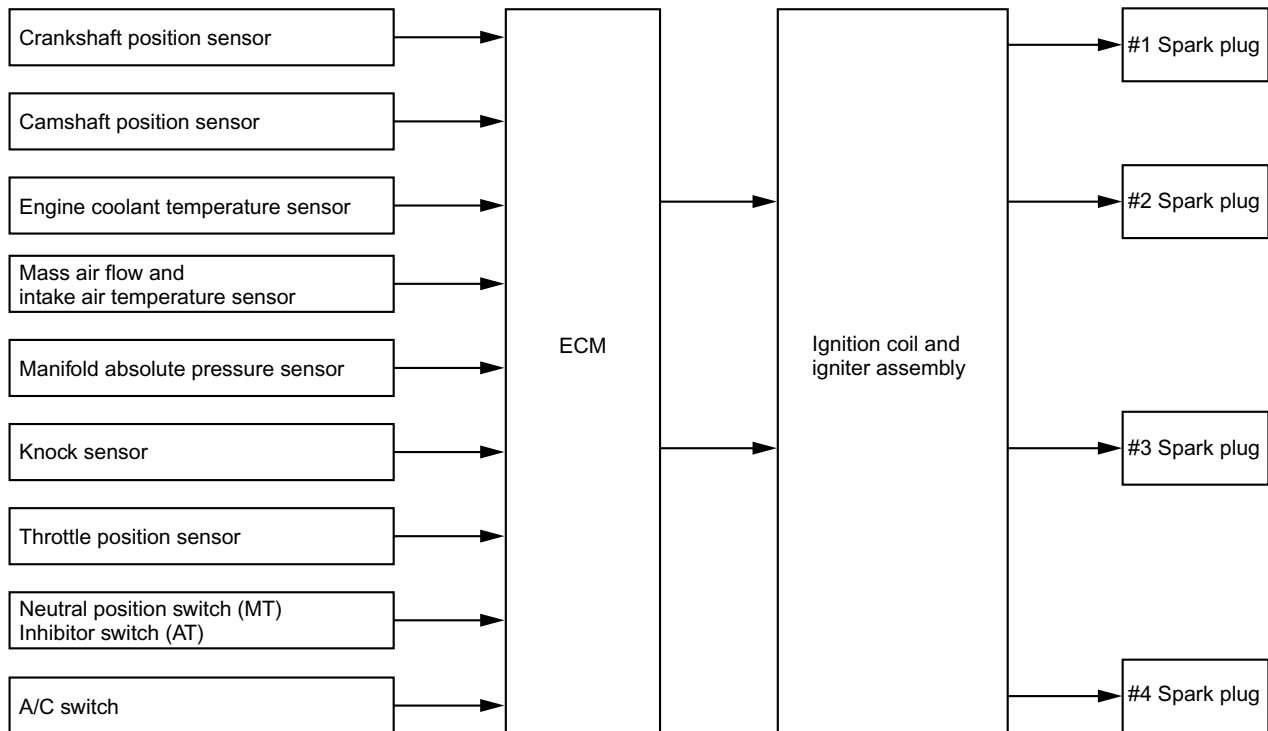
The air-fuel ratio feedback control includes a learning feature, which contributes to more accurate and responsive control.

- In the air-fuel ratio feedback control, the ECM calculates the necessary amount of correction based on data from the front oxygen (A/F) sensor and adds the result to the basic duration (which is stored in the ECM's memory for each condition defined by the engine speed and various loads.)
- Without a learning feature, the ECM carries out the above-mentioned process every time. This means that if the amount of necessary correction is large, the air-fuel ratio feedback control becomes less responsive and less accurate.
- The learning feature enables the ECM to store the amount of correction into memory, and takes it into account with the basic fuel injection duration to create a new reference fuel injection duration. Using the reference duration as the basic duration for the injection a few times later, the ECM can reduce the amount of correction and thus make its feedback control more accurate and responsive to changes in the air-fuel ratio due to difference in driving condition and sensor/actuator characteristics that may result from unit-to-unit variation or aging over time.



## D: IGNITION CONTROL

- The ECM determines operating condition of the engine based on signals from the manifold absolute pressure sensor, engine coolant temperature sensor, intake air temperature sensor, crankshaft position sensor and other sources. The ECM then selects the ignition timing most appropriate for the condition thus determined from those stored in its memory and outputs at that timing a primary current OFF signal to the igniter to initiate ignition.
- This control uses a quick-to-response learning feature by which the data stored in the ECM memory is processed in comparison with information from various sensors and switches.
- Thus, the ECM can always perform optimum ignition timing taking into account the output, fuel efficiency, exhaust gas, and other factors for every engine operating condition.
- Ignition control during start-up  
 Engine speed fluctuates during start of the engine, so the ECM cannot control the ignition timing. During that period, the ignition timing is fixed at 10° BTDC by using the 10° signal from the crankshaft position sensor.



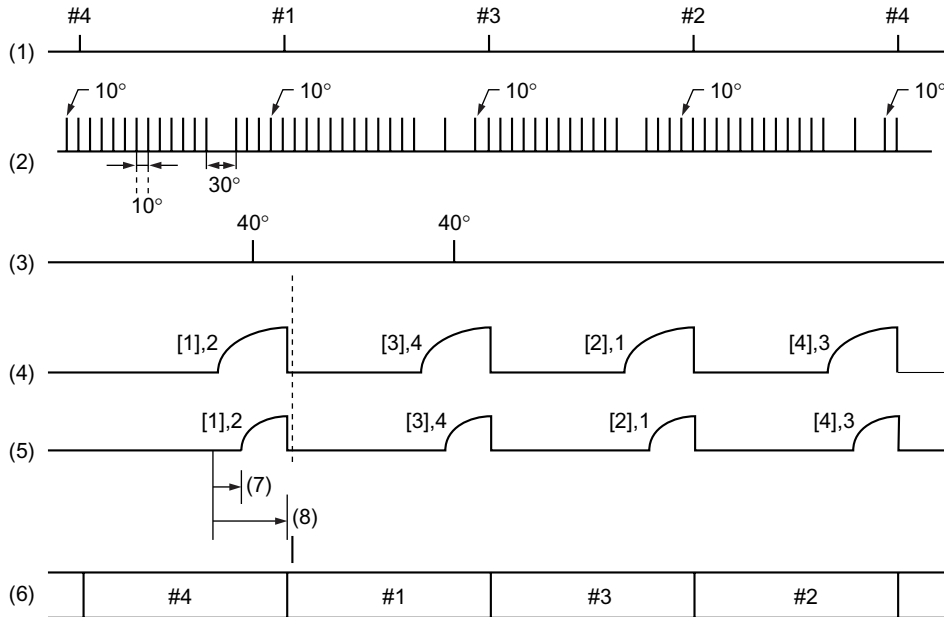
FU-02412

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### ● Ignition control after start of engine

From the time to receive crank angle signals indicating  $180^\circ$  of a turn, the ECM measures the engine speed, and by using this data it decides the dwell set timing and ignition timing according to the engine condition.

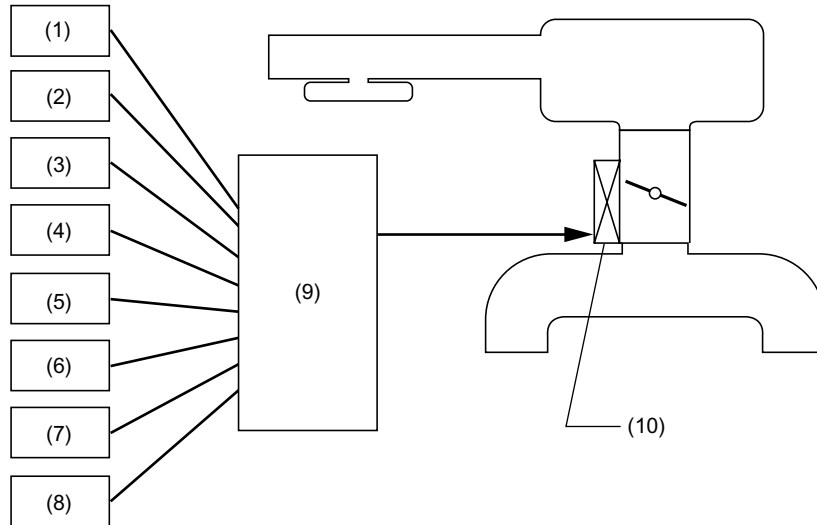


FU-02019

- |                                 |   |
|---------------------------------|---|
| (1) Cylinder number             | (5) Ignition timing under normal conditions |
| (2) Crank angle pulse (BTDC)    | (6) Cylinder at combustion                  |
| (3) Cam angle pulses (BTDC)     | (7) Dwell set                               |
| (4) Ignition timing at starting | (8) Ignition                                |

## E: IDLE AIR CONTROL

- The ECM controls the electronic control throttle based on signals from the crankshaft position sensor, engine coolant temperature sensor, manifold absolute pressure sensor and A/C switch so that the proper idle speed for each engine load is achieved.



FU-01238

- |                                       |   |
|---------------------------------------|---|
| (1) Crankshaft position sensor        | (6) Ignition switch                                     |
| (2) Camshaft position sensor          | (7) A/C switch  |
| (3) Throttle position sensor          | (8) Neutral position switch (MT), inhibitor switch (AT) |
| (4) Engine coolant temperature sensor | (9) ECM   |
| (5) Manifold absolute pressure sensor | (10) Electronic control throttle                        |

## F: FUEL PUMP CONTROL

Using the signal from the crankshaft position sensor, the ECM controls operation of the fuel pump by turning its relay ON or OFF. To improve safety, the fuel pump is stopped if the engine stalls with the ignition switch ON.

Ignition switch ON	Fuel pump relay	Fuel pump
A certain period of time after ignition switch is turned ON	ON	Operates
While cranking the engine	ON	Operates
While engine is operating	ON	Operates
When engine stops	OFF	Does not operate

# ON-BOARD DIAGNOSIS SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### 6. On-board Diagnosis System

#### A: GENERAL

- The on-board diagnosis system detects and indicates a fault by generating a code corresponding to each fault location. The malfunction indicator light on the combination meter indicates occurrence of a fault or abnormality.
- When the malfunction indicator light comes on as a result of detection of a fault by the ECM, the corresponding diagnostic trouble code (DTC) and freeze frame engine condition are stored in the ECM.
- On the OBD-II conformable car, it is necessary to connect the SUBARU Select Monitor (SSM) or General Scan Tool (GST) to the data link connector in order to check the DTC.
- The SSM and GST can be used for erasing DTCs. These can also read freeze frame data in addition to other pieces of engine data.
- If there is a failure involving sensors, which may affect drive control of the vehicle, the fail-safe function ensures minimum level of drivability.

#### B: FAIL-SAFE FUNCTION

For a sensor or switch that has been judged to be faulty by the on-board diagnosis, the ECM generates a pseudo signal to keep the vehicle operational. (The control becomes degraded.)

# SYSTEM OVERVIEW

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 1. System Overview

There are three emission control systems, which are as follows:

- Crankcase emission control system
- Exhaust emission control system
  - Catalytic converter
  - Air/fuel (A/F) control system
  - Ignition control system
  - Exhaust gas recirculation system
- Evaporative emission control system
  - On-board refueling vapor recovery (ORVR) system

# SYSTEM OVERVIEW

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

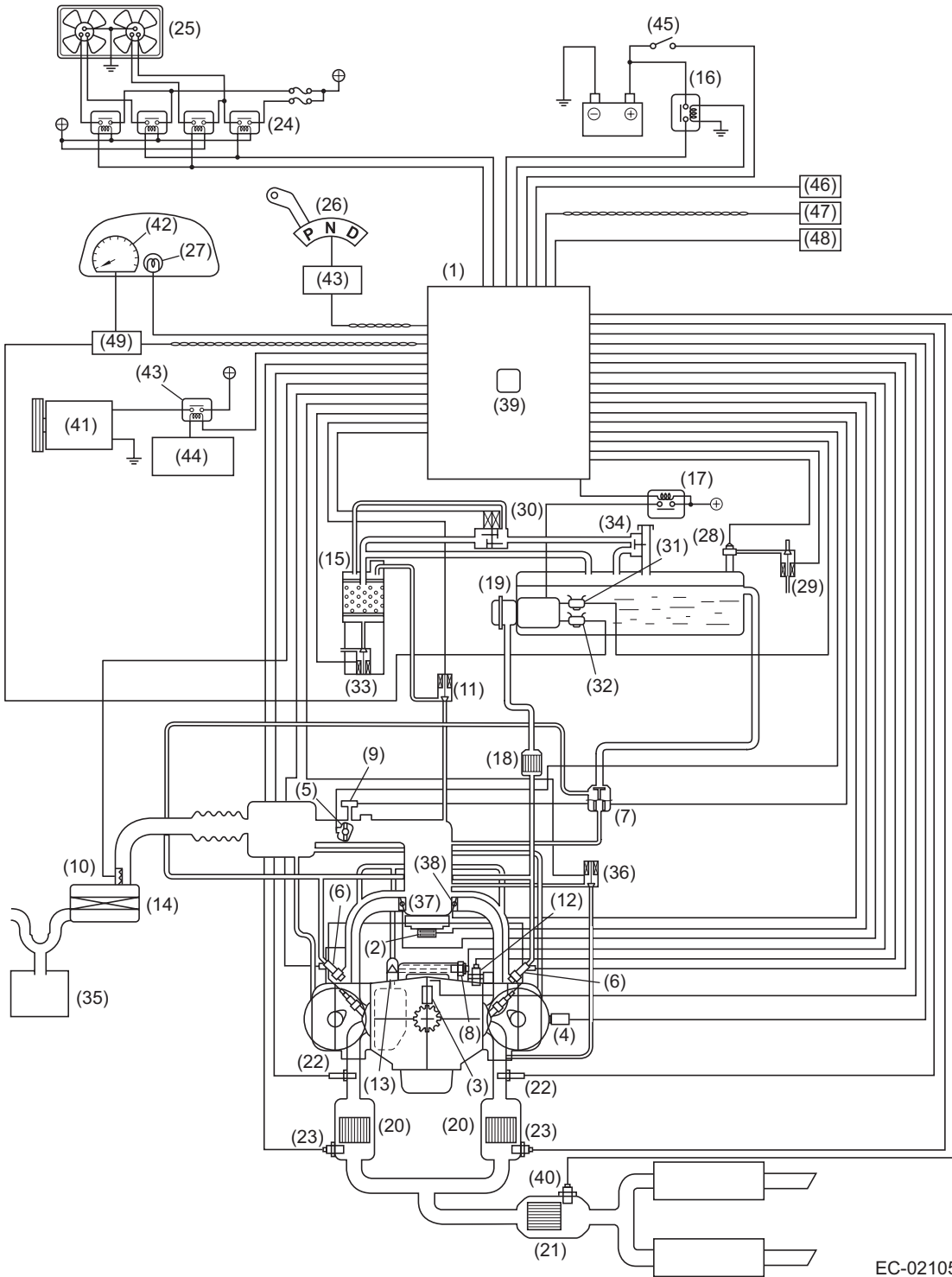
Item		Main components	Function
Crankcase emission control system		Positive crankcase ventilation (PCV) valve	Draws blow-by gas into intake manifold from crankcase and burn it together with air-fuel mixture. Amount of blow-by gas to be drawn in is controlled by intake manifold pressure.
Exhaust emission control system	Catalytic converter	Front	Oxidizes HC and CO contained in exhaust gases as well as reducing NOx.
		Rear	
	Air/fuel (A/F) control system	Engine control module (ECM)	Receives input signals from various sensors, compares signals with stored data, and emits a signal for optimal control of air-fuel mixture ratio.
		Front oxygen (A/F) sensor	Detects density of oxygen contained exhaust gases.
		Front oxygen sensor Rear oxygen sensor	Detects density of oxygen contained in exhaust gases.
		Throttle position sensor	Detects throttle opening.
		Manifold absolute pressure sensor	Detects absolute pressure of intake manifold.
		Mass air flow and intake air temperature sensor	Detects amount of intake air. Detects intake air temperature at air cleaner case.
	Ignition control system	ECM	Receives various signals, compares signals with basic data stored in memory, and emits a signal for optimal control of ignition timing.
		Crankshaft position sensor	Detects engine speed (revolution).
		Camshaft position sensor	Detects reference signal for combustion cylinder discrimination.
		Engine coolant temperature sensor	Detects coolant temperature.
	Exhaust gas recirculation system	Knock sensor	Detects engine knocking.
		EGR valve	Adjusts the amount of exhaust gas flowing back to the intake pipe.
Evaporative emission control system	Canister	Absorbs evaporative gas that accumulates in fuel tank when engine stops, and releases it to combustion chambers for a complete burn when the engine is started. This prevents HC from being discharged into atmosphere.	
	Purge control solenoid valve	Receives a signal from ECM and controls purge of evaporative gas absorbed by canister.	
	Pressure control solenoid valve	Receives a signal from ECM and controls evaporative gas pressure in fuel tank.	
ORVR system	Vent valve	Controls evaporation pressure in the fuel tank.	
	Drain valve	Closes the evaporation line by receiving a signal from ECM to check the evaporation gas leak.	

# SCHEMATIC DIAGRAMS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. Schematic Diagrams

- Type 1



EC-02105

EC(H4SO)-4

# **SCHEMATIC DIAGRAMS**

## **EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)**

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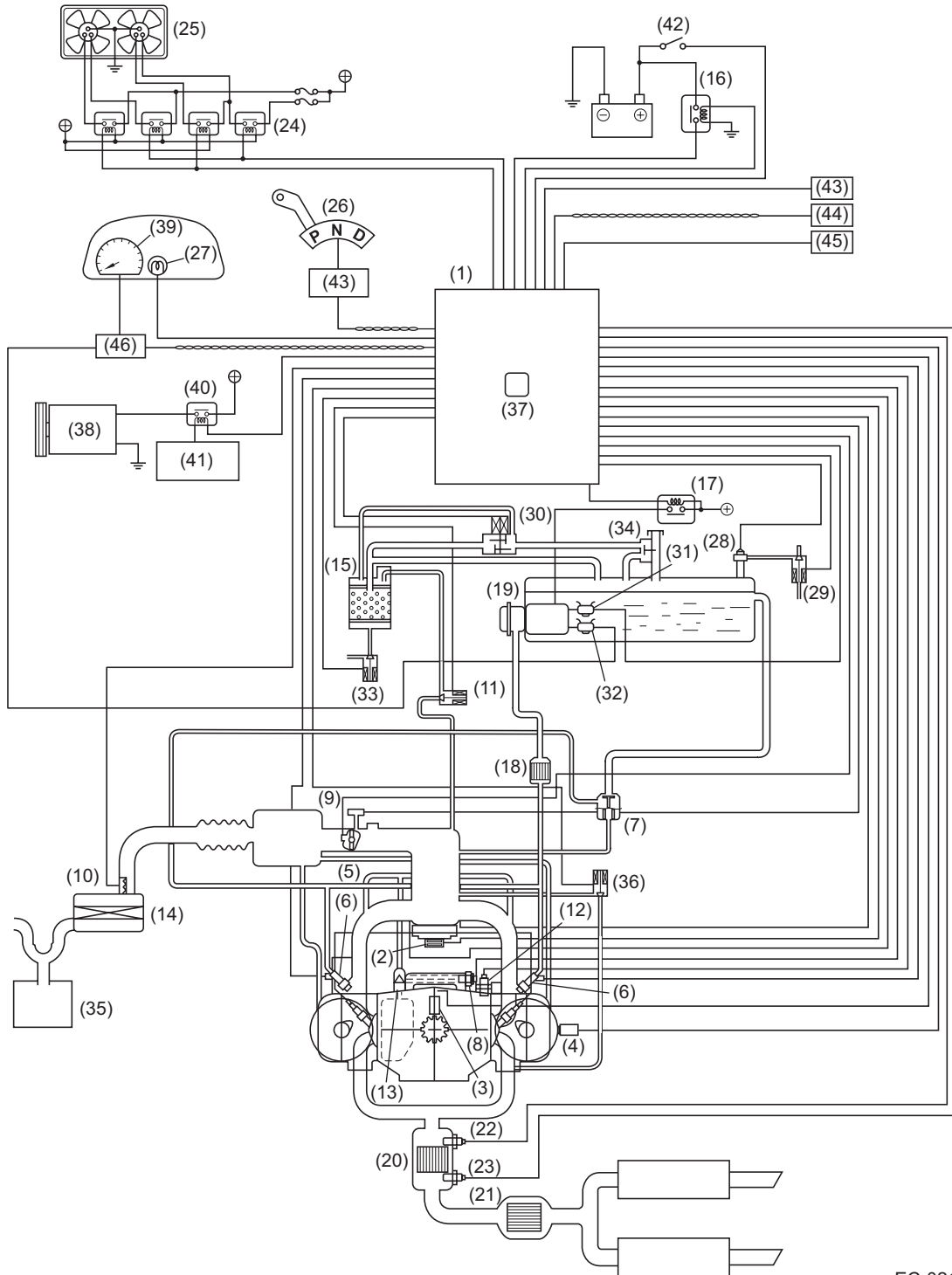
- |  |  |   |
|--|--|---|
| (1) Engine control module (ECM)                      | (18) Fuel filter                       | (35) Resonator chamber                                  |
| (2) Ignition coil and igniter assembly               | (19) Fuel pump                         | (36) EGR valve  |
| (3) Crankshaft position sensor                       | (20) Front catalytic converter         | (37) Tumble generator valve actuator                    |
| (4) Camshaft position sensor                         | (21) Rear catalytic converter          | (38) Tumble generator valve position sensor             |
| (5) Electronic control throttle                      | (22) Front oxygen (A/F) sensor         | (39) Atmospheric pressure sensor                        |
| (6) Fuel injector                                    | (23) Front oxygen sensor               | (40) Rear oxygen sensor                                 |
| (7) Pressure regulator                               | (24) Radiator fan relay                | (41) A/C compressor                                     |
| (8) Engine coolant temperature sensor                | (25) Radiator fan                      | (42) Tachometer   |
| (9) Manifold absolute pressure sensor                | (26) Inhibitor switch (AT models only) | (43) A/C relay  |
| (10) Mass air flow and intake air temperature sensor | (27) Engine warning light              | (44) A/C control module                                 |
| (11) Purge control solenoid valve                    | (28) Fuel tank pressure sensor         | (45) Ignition switch                                    |
| (12) Knock sensor                                    | (29) Fuel tank sensor control valve    | (46) Transmission control module (TCM) (AT models only) |
| (13) PCV valve                                       | (30) Pressure control solenoid valve   | (47) ABS control module (ABSCM)                         |
| (14) Air cleaner element                             | (31) Fuel temperature sensor           | (48) Data link connector                                |
| (15) Canister  | (32) Fuel level sensor                 | (49) Body integrated unit                               |
| (16) Main relay                                      | (33) Drain valve                       |   |
| (17) Fuel pump relay                                 | (34) Shut-off valve                    |   |



# SCHEMATIC DIAGRAMS

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

- Type 2



EC-02106

# **SCHEMATIC DIAGRAMS**

## **EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)**

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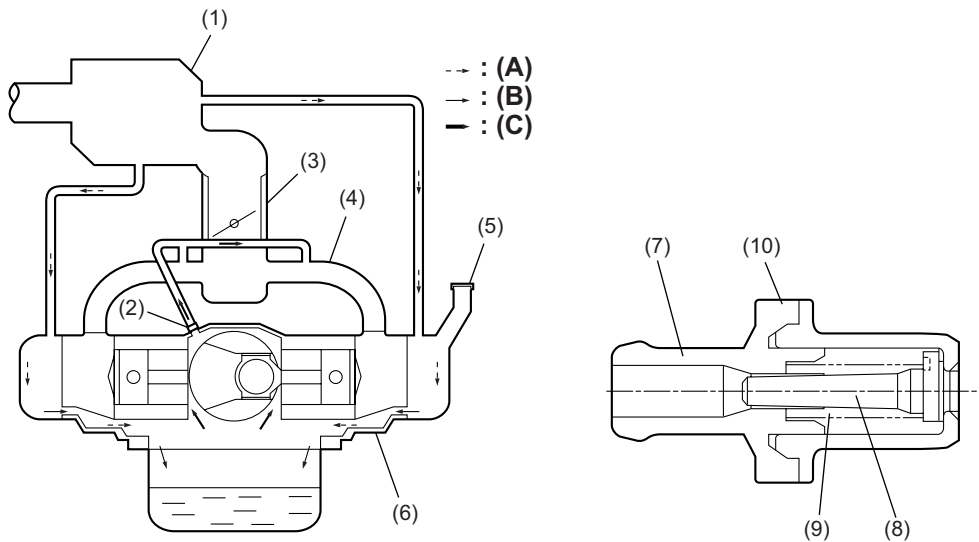
- |  |  |   |
|--|--|---|
| (1) Engine control module (ECM)                      | (17) Fuel pump relay                   | (33) Drain valve  |
| (2) Ignition coil and igniter assembly               | (18) Fuel filter                       | (34) Shut-off valve                                     |
| (3) Crankshaft position sensor                       | (19) Fuel pump                         | (35) Resonator chamber                                  |
| (4) Camshaft position sensor                         | (20) Front catalytic converter         | (36) EGR valve  |
| (5) Electronic control throttle                      | (21) Rear catalytic converter          | (37) Atmospheric pressure sensor                        |
| (6) Fuel injector                                    | (22) Front oxygen (A/F) sensor         | (38) A/C compressor                                     |
| (7) Pressure regulator                               | (23) Rear oxygen sensor                | (39) Tachometer   |
| (8) Engine coolant temperature sensor                | (24) Radiator fan relay                | (40) A/C relay  |
| (9) Manifold absolute pressure sensor                | (25) Radiator fan                      | (41) A/C control module                                 |
| (10) Mass air flow and intake air temperature sensor | (26) Inhibitor switch (AT models only) | (42) Ignition switch                                    |
| (11) Purge control solenoid valve                    | (27) Engine warning light              | (43) Transmission control module (TCM) (AT models only) |
| (12) Knock sensor                                    | (28) Fuel tank pressure sensor         | (44) ABS control module (ABSCM)                         |
| (13) PCV valve                                       | (29) Fuel tank sensor control valve    | (45) Data link connector                                |
| (14) Air cleaner element                             | (30) Pressure control solenoid valve   | (46) Body integrated unit                               |
| (15) Canister  | (31) Fuel temperature sensor           |   |
| (16) Main relay                                      | (32) Fuel level sensor                 |   |

# CRANKCASE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 3. Crankcase Emission Control System

- The positive crankcase ventilation (PCV) system prevents air pollution that will be caused by blow-by gas being emitted from the crankcase. The system consists of a sealed oil filler cap, rocker covers with fresh air inlet, connecting hoses, a PCV valve and an air intake duct.
- In a part-throttle condition, the blow-by gas in the crankcase flows into the intake manifold through the connecting hose of crankcase and PCV valve by the strong vacuum created in the intake manifold. Under this condition, fresh air is introduced into the crankcase through the connecting hose of the rocker cover.
- In a wide-open-throttle condition, a part of blow-by gas flows into the air intake duct through the connecting hose and is drawn into the throttle chamber, because under this is condition, the intake manifold vacuum is not strong enough to introduce through the PCV valve all blow-by gases that increase in the amount with engine speed.



EC-02107

- |                        |                |                                    |
|------------------------|----------------|------------------------------------|
| (1) Air intake chamber | (6) Crankcase  | (A) Outside air                    |
| (2) PCV valve          | (7) Case       | (B) Mixture of air and blow-by gas |
| (3) Throttle body      | (8) Valve      | (C) Blow-by gas                    |
| (4) Intake manifold    | (9) Spring     |                                    |
| (5) Oil filler cap     | (10) PCV valve |                                    |

## 4. Catalytic Converter

- The basic materials of the three-way catalytic converter are platinum (Pt), rhodium (Rh) and palladium (Pd), and a thin coat of their mixture is applied onto a honeycomb or porous ceramic (carrier). To avoid damaging the catalytic converter, only unleaded gasoline should be used.
- The catalytic converter reduces HC, CO and NO<sub>x</sub> in exhaust gases through chemical reactions (oxidation and reduction). These harmful components are reduced most efficiently when their concentrations are in a certain balance. These concentrations vary with the air-fuel ratio. The ideal air-fuel ratio for reduction of these components is the stoichiometric ratio.
- Therefore, the air-fuel ratio needs to be controlled to around the stoichiometric ratio to purify the exhaust gases most efficiently.

## **AIR/FUEL (A/F) CONTROL SYSTEM**

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

### **5. Air/fuel (A/F) Control System**

- The air/fuel (A/F) control system makes a correction to the basic fuel injection duration in accordance with the signals from the front oxygen (A/F) sensor and the rear oxygen sensor so that the stoichiometric ratio is maintained, thus ensuring most effective exhaust gas purification by the three-way catalytic converter. Different basic fuel injection durations are preset for various engine speeds and loads, as well as the amount of intake air.
- This system also has a learning control function which stores the corrected data in relation to the basic fuel injection in the memory map. This allows an appropriate air-fuel ratio correction to be added automatically in quick response to any situation that requires such an effect. Thus, the air-fuel ratio is optimally maintained under various conditions while purifying exhaust gases most effectively, improving driving performance and compensating for changes in sensors' performance over time.

# **AIR/FUEL (A/F) CONTROL SYSTEM**

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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**MEMO**

# IGNITION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

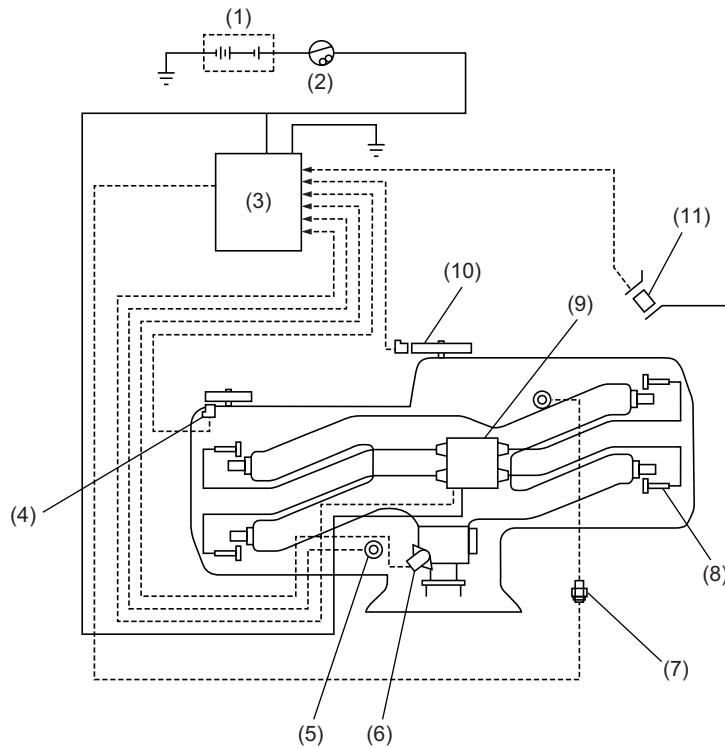
## 6. Ignition Control System

- The ignition system is controlled by the ECM.

The ECM monitors the operating condition of the engine using the signals from the sensors and switches shown below and determines the ignition timing most appropriate for each engine operating condition. Then it sends a signal to the igniter, commanding generation of a spark at that timing.

- The ECM uses a preprogrammed map for a “closed-loop” control which provides its ignition timing control with excellent transient characteristics, i.e., highly responsive ignition timing control.

- Type 1



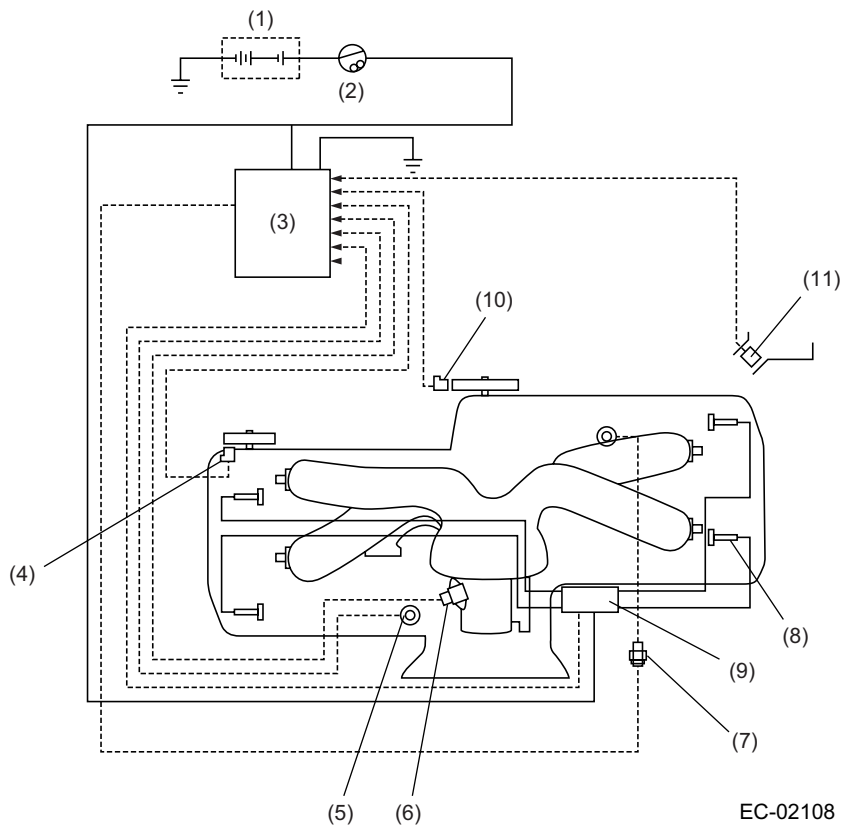
EC-02091

- |                                       |  |
|---------------------------------------|--|
| (1) Battery                           | (7) Engine coolant temperature sensor                |
| (2) Ignition switch                   | (8) Spark plug                                       |
| (3) ECM                               | (9) Ignition coil and igniter assembly               |
| (4) Camshaft position sensor          | (10) Crankshaft position sensor                      |
| (5) Knock sensor                      | (11) Mass air flow and intake air temperature sensor |
| (6) Manifold absolute pressure sensor |  |

# IGNITION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

- Type 2



- |                                       |  |
|---------------------------------------|--|
| (1) Battery                           | (7) Engine coolant temperature sensor                |
| (2) Ignition switch                   | (8) Spark plug                                       |
| (3) ECM                               | (9) Ignition coil and igniter assembly               |
| (4) Camshaft position sensor          | (10) Crankshaft position sensor                      |
| (5) Knock sensor                      | (11) Mass air flow and intake air temperature sensor |
| (6) Manifold absolute pressure sensor |  |



# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

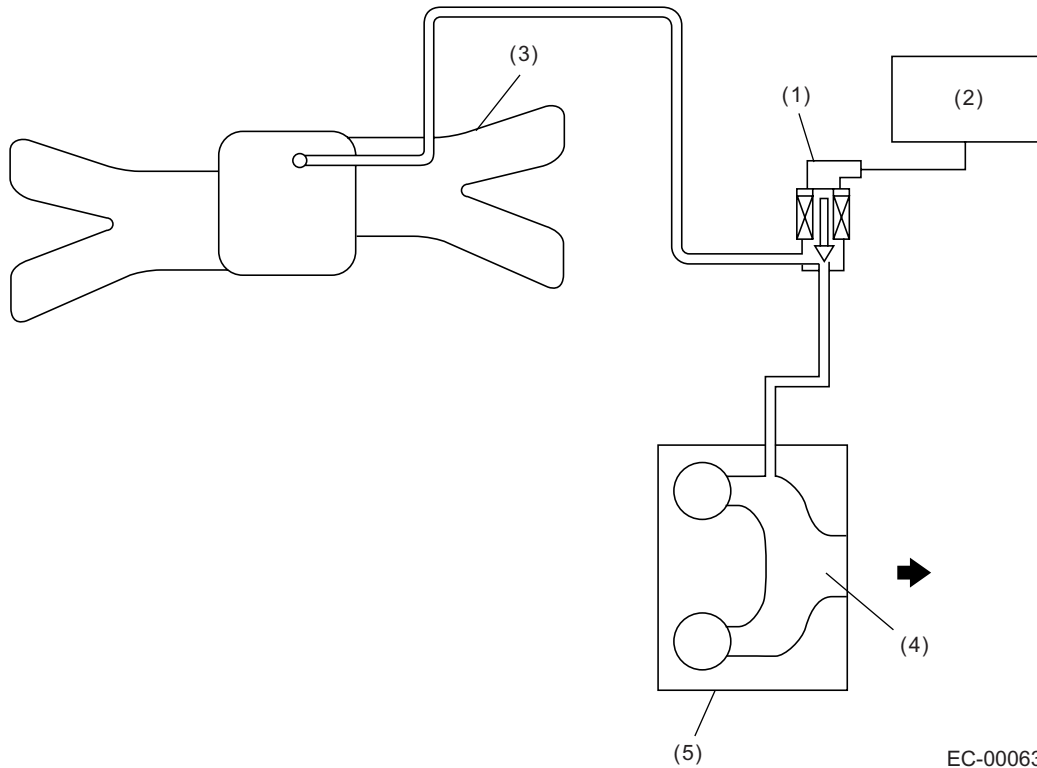
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 7. Exhaust Gas Recirculation (EGR) System

### 1. GENERAL

- The EGR system aims at reduction of NO<sub>x</sub> by lowering the combustion temperature through re-circulation of a part of exhaust gas into cylinders via the intake manifold.
- The EGR valve is controlled by the ECM according to the engine operating condition.



EC-00063

- (1) EGR valve
- (2) ECM
- (3) Intake manifold

- (4) Exhaust port
- (5) Cylinder head LH

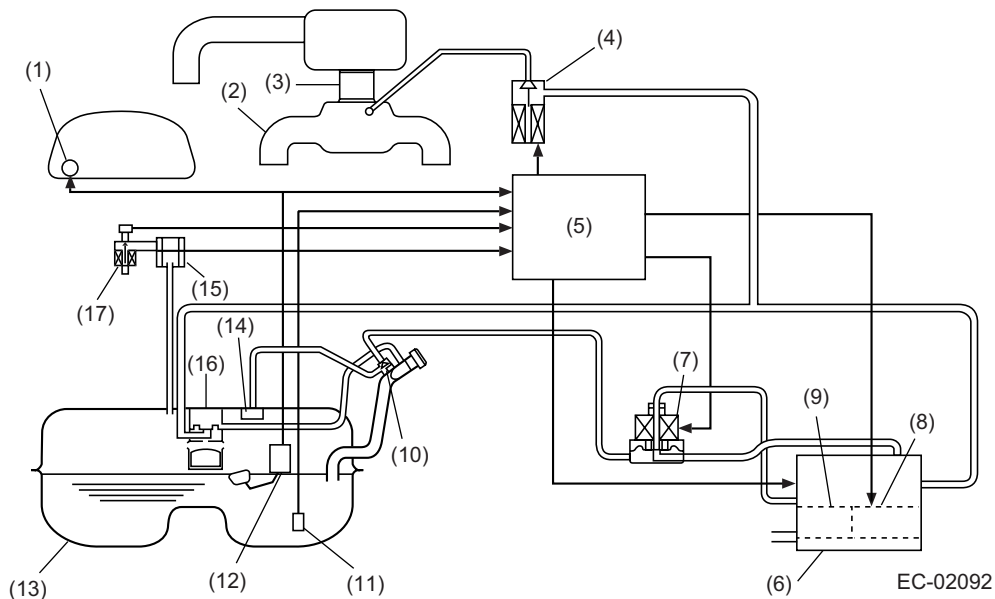
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 8. Evaporative Emission Control System

### A: GENERAL

- The evaporative emission control system prevents fuel vapors from escaping into atmosphere. This system includes a canister, purge control solenoid valve, fuel cut valve, and the lines connecting them.
- Fuel vapor in the fuel tank is introduced into the canister through the evaporation line, and are absorbed by activated carbon in it. The fuel cut valve is also incorporated in the fuel tank line.
- The purge control solenoid valve is controlled optimally by the ECM according to the engine condition.
- The pressure control solenoid valve incorporated in the fuel tank evaporation line regulates the pressure/vacuum in the fuel tank under the control of the ECM which uses the signal from the fuel tank pressure sensor.



- |                                  |                                     |                                     |
|----------------------------------|-------------------------------------|-------------------------------------|
| (1) Fuel gauge                   | (7) Pressure control solenoid valve | (13) Fuel tank                      |
| (2) Intake manifold              | (8) Drain valve                     | (14) Fuel cut valve                 |
| (3) Throttle body                | (9) Drain filter                    | (15) Fuel tank pressure sensor      |
| (4) Purge control solenoid valve | (10) Shut-off valve                 | (16) Vent valve                     |
| (5) Engine control module (ECM)  | (11) Fuel temperature sensor        | (17) Fuel tank sensor control valve |
| (6) Canister                     | (12) Fuel level sensor              |                                     |

### B: FUEL CUT VALVE

The fuel cut valve is incorporated in the fuel tank. The rising level of the fuel in the fuel tank causes the float to move up and close the cap hole so that no fuel can flow to the evaporation line.

# EVAPORATIVE EMISSION CONTROL SYSTEM

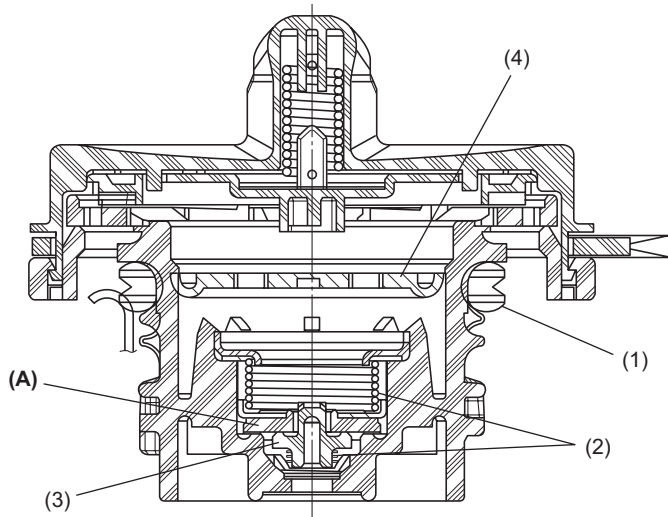
## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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### C: FUEL TANK CAP

- The fuel tank cap is of a quick lock type and can be opened or closed in 1/4 of a full turn.
- The fuel tank cap has a relief valve, which prevents development of vacuum in the fuel tank in the event of a problem with the fuel vapor line.

When there is no problem with the fuel vapor line, the filler pipe is sealed at the portion (A) and by the seal pressed against the filler pipe end. If vacuum develops in the fuel tank, the atmospheric pressure forces the spring down to open the valve; consequently outside air flows into the fuel tank, thus controlling the inside pressure.



EC-02109

- (1) Seal
- (2) Spring
- (3) Valve
- (4) Filter

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

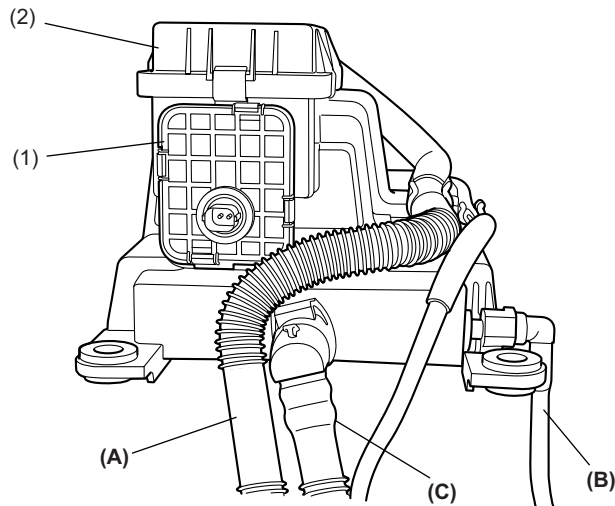
## D: CANISTER

The canister incorporates a drain valve and a drain filter.

The charcoal filled in the canister temporarily stores fuel vapors. When the purge control solenoid valve is opened by a signal from the ECM, the external fresh air entering the canister carries the fuel vapors into the collector chamber.

The drain filter is installed at the air inlet port of the drain valve. It cleans the air taken in the canister through the drain valve.

The drain valve is located just below the drain filter.



EC-02093

- (1) Drain valve
- (2) Drain filter

- (A) Air
- (B) To pressure control solenoid valve
- (C) From fuel tank

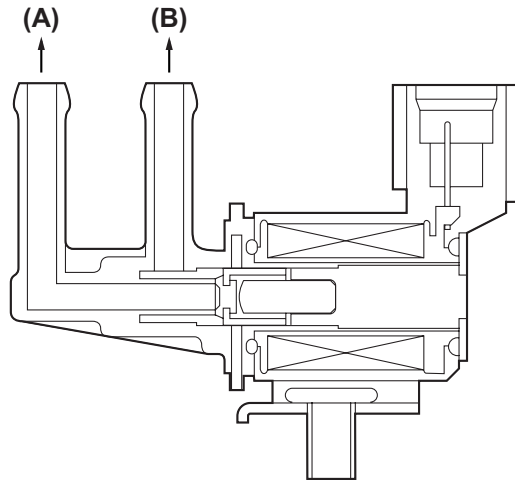
# EVAPORATIVE EMISSION CONTROL SYSTEM

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

### E: PURGE CONTROL SOLENOID VALVE

The purge control solenoid valve is on the evaporation line between the canister and intake manifold. The valve is installed under the intake manifold.



EC-00237

- (A) To intake manifold
- (B) To canister

# EVAPORATIVE EMISSION CONTROL SYSTEM

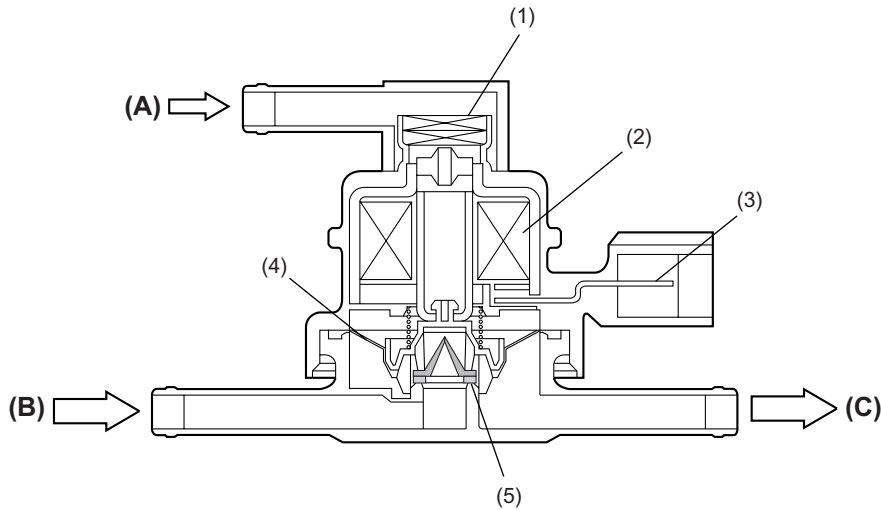
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## F: PRESSURE CONTROL SOLENOID VALVE

The fuel tank pressure control solenoid valve is located in the evaporation line between the canister and the fuel tank.

When the tank inside pressure becomes higher than the atmospheric pressure, the valve is opened allowing fuel vapors to be introduced into the canister.

On the other hand, when the tank inside pressure becomes lower than the atmospheric pressure, external air is taken from the drain valve into the canister.



EC-00026

- |                        |                          |
|------------------------|--------------------------|
| (1) Filter             | (A) Atmospheric pressure |
| (2) Coil               | (B) Shut-off valve       |
| (3) Connector terminal | (C) To fuel tank         |
| (4) Diaphragm          |                          |
| (5) Valve              |                          |

## G: VENT VALVE

The vent valve is incorporated in the fuel tank. During filling the fuel tank, fuel vapors are introduced into the canister through the vent valve.

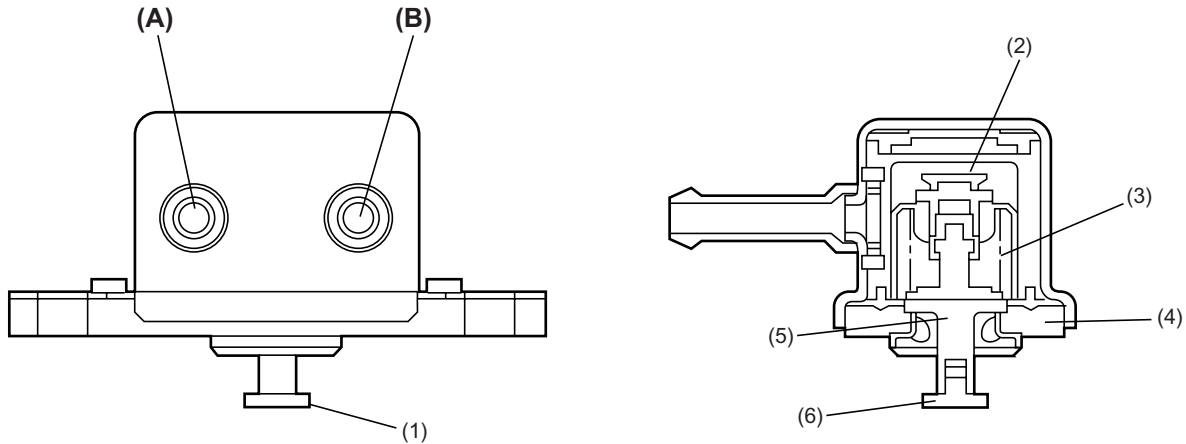
When the fuel vapor pressure becomes higher than the atmospheric pressure and overcomes the spring force which is applied to the back side of the diaphragm, the port toward the canister is opened. The vent valve also has a float which rises and block the port toward the canister when the fuel is full.

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## H: SHUT-OFF VALVE

The shut-off valve is located at the top of the fuel filler pipe. When a filler gun is inserted into the filler pipe, the shut-off valve closes the evaporation line.

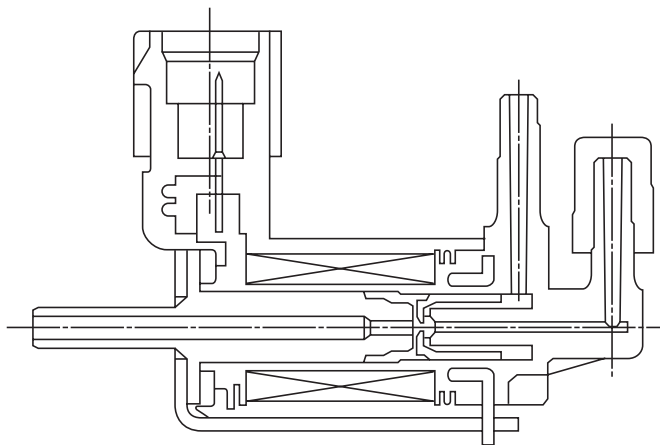


EC-00029

- (1) Pin
- (2) Valve
- (3) Spring
- (4) Plate
- (5) Shaft
- (6) Pin
- (A) To canister
- (B) To fuel tank

## I: FUEL TANK SENSOR CONTROL VALVE

The fuel tank sensor control valve is installed on the top of the fuel tank and its one end is connected to the fuel tank pressure sensor while its other end is open to the atmosphere.



EC-00031

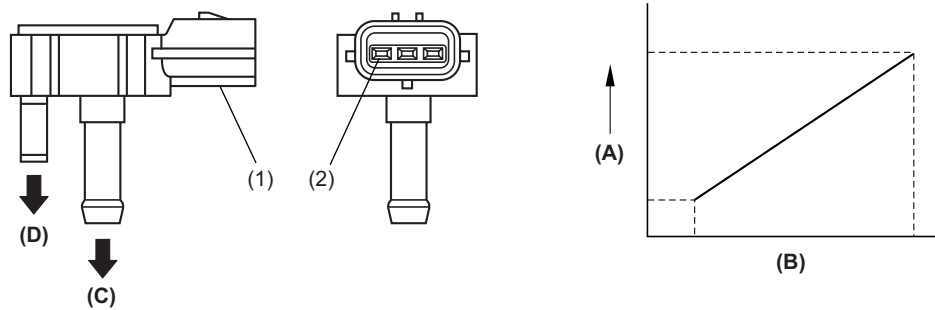
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## J: FUEL TANK PRESSURE SENSOR

The fuel tank pressure sensor is installed on the top of the fuel tank and measures the pressure in the fuel tank.

The measured pressure is converted into an electrical signal and sent to the ECM for diagnosis of the evaporative emission control system.



EC-02110

- (1) Connector
- (2) Terminal

- (A) Output voltage
- (B) Input pressure
- (C) To fuel tank
- (D) To fuel tank sensor control valve



# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 9. On-board Refueling Vapor Recovery (ORVR) System

### A: GENERAL

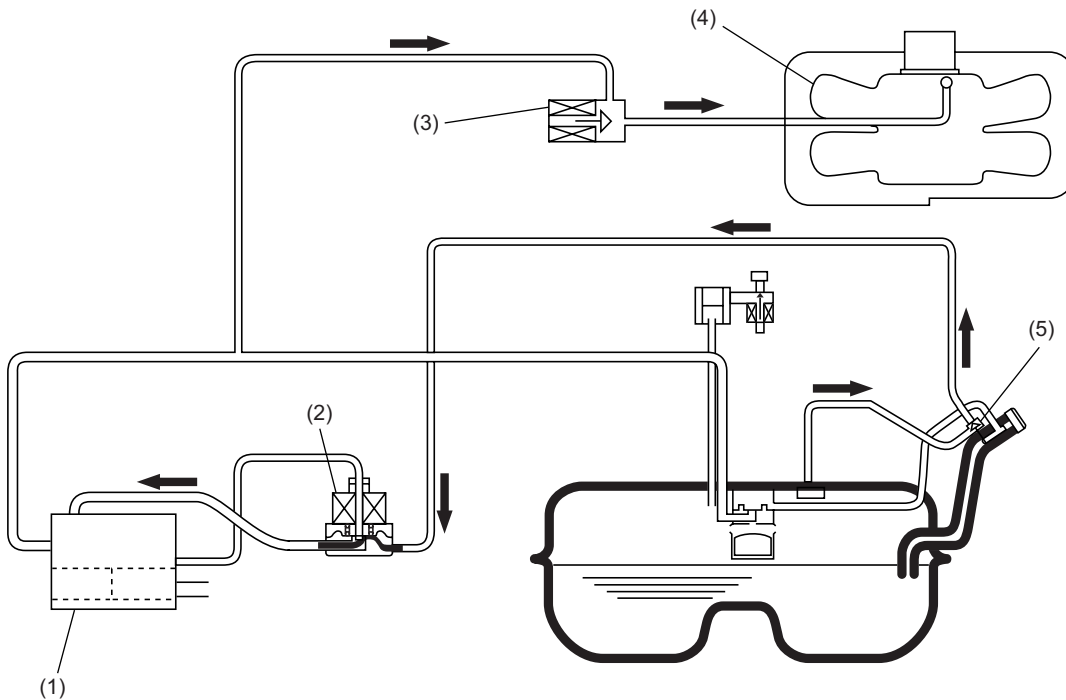
The on-board refueling vapor recovery system allows the fuel vapors in the fuel tank to be introduced directly into the canister through the vent valve when the fuel tank inside pressure increases as a result of refueling.

The diagnosis of the system is performed by monitoring the fuel tank inside pressure data from the fuel tank pressure sensor while forcibly closing the drain valve.

### B: OPERATION

- While driving

Since the back side of the diaphragm in the pressure control solenoid valve is open to the atmosphere, the diaphragm is held pressed by the atmospheric pressure in the position where only the external air is introduced into the canister. When the fuel vapor pressure acting on the other side of the diaphragm increases and overcomes the atmospheric pressure, it pushes the diaphragm and opens the port through which the fuel vapors make their way to the canister.



EC-02094

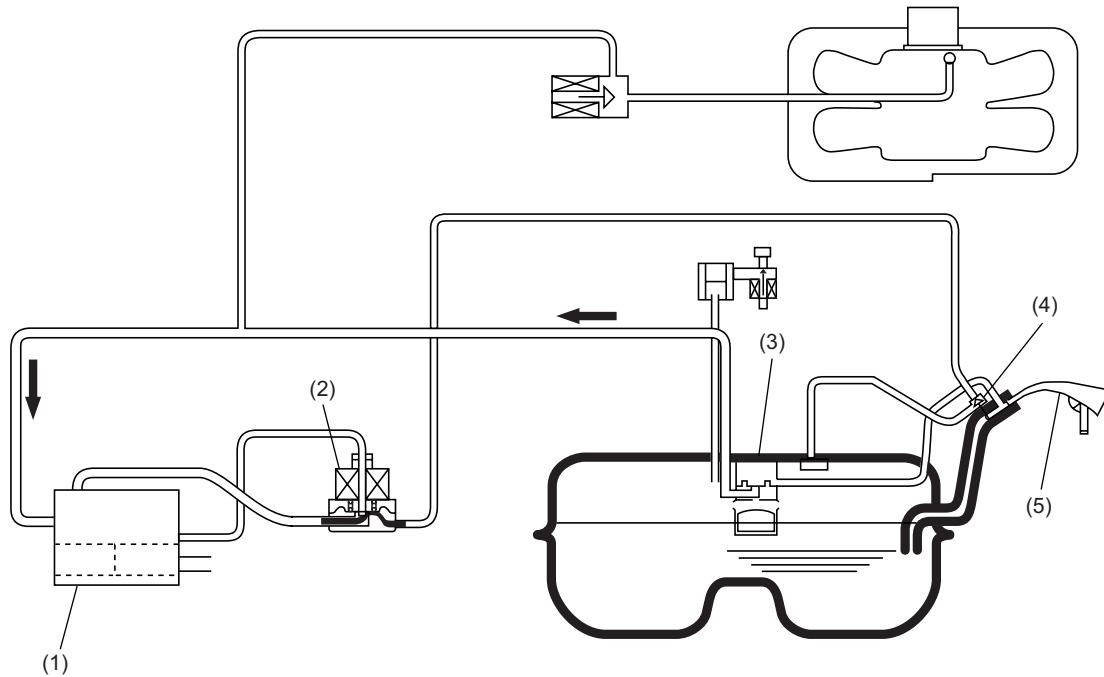
- |                                     |                          |
|-------------------------------------|--------------------------|
| (1) Canister                        | (4) Intake manifold      |
| (2) Pressure control solenoid valve | (5) Shut-off valve: open |
| (3) Purge control solenoid valve    |                          |

# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

- While refueling

As the fuel enters the fuel tank, the tank inside pressure increases. When the inside pressure becomes higher than the atmospheric pressure, the port of the vent valve opens, allowing the fuel vapors to be introduced into the canister through the vent line. The fuel vapors are absorbed by charcoal in the canister, so the air discharged from the drain valve contains no fuel. When a filler gun is inserted, the shut-off valve closes the evaporation line.



EC-02095

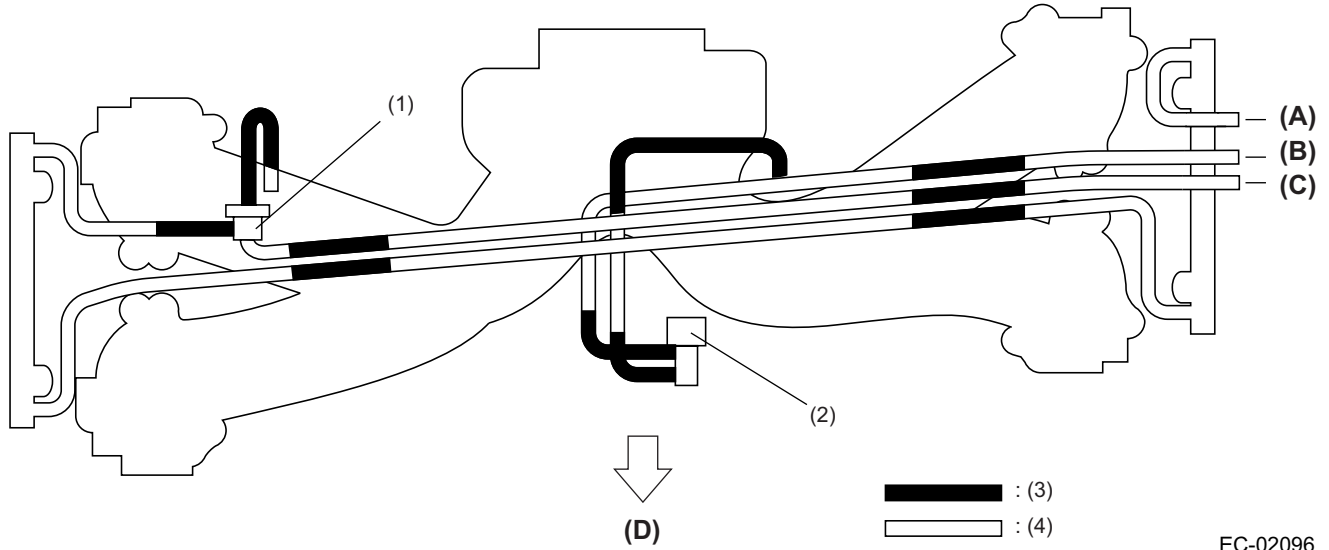
- (1) Canister
- (2) Pressure control solenoid valve
- (3) Vent valve
- (4) Shut-off valve: closed
- (5) Filler gun

# VACUUM CONNECTIONS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 10. Vacuum Connections

The hose and pipe connections of the intake manifold and other related parts are as shown in the illustration.



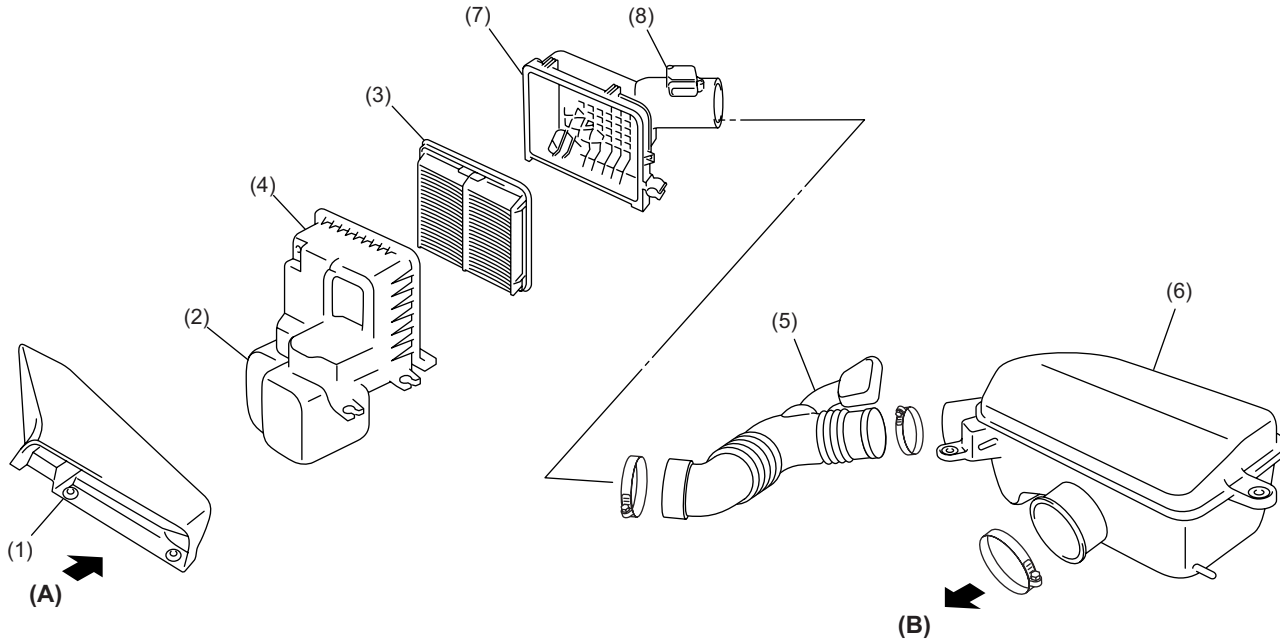
EC-02096

# GENERAL

## INTAKE (INDUCTION)

### 1. General

The intake system consists of an intake duct, a resonator chamber, and an air cleaner element housed in its case. The resonator chamber effectively reduces the intake noise level.



IN-02086

- (1) Air intake duct
  - (2) Resonator
  - (3) Air cleaner element
  - (4) Air cleaner case (front)
  - (5) Intake duct
  - (6) Air intake chamber
  - (7) Air cleaner case (rear)
  - (8) Mass air flow and intake air temperature sensor
- (A) Outside air
  - (B) To throttle body

# GENERAL

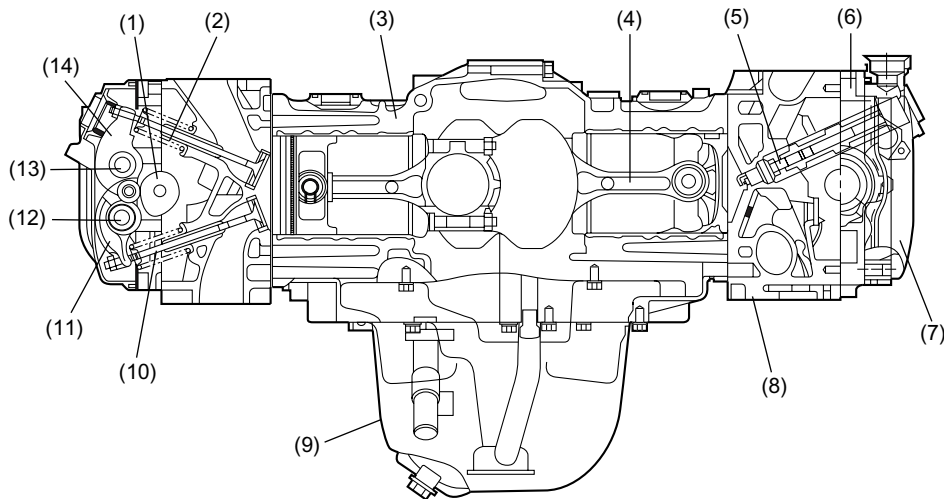
## MECHANICAL

### 1. General

The engine used in this vehicle is of a horizontally opposed, four-cylinder design. This four-stroke-cycle, water-cooled, SOHC engine uses a total of 16 valves and its main components are made of aluminum alloy. It is fueled by a multiple fuel injection system.

The engine's major structural and functional features are as follows:

- The cylinder head forms pent roof combustion chambers, each having a spark plug located at its center and two each of intake and exhaust valves (four valves per cylinder). The intake and exhaust ports are located in a cross-flow arrangement.
- There are a screw and nut at the valve end of each rocker arm. They are used for adjusting the valve clearance.
- A single timing belt drives two camshafts on the left and right banks and the water pump on the left bank. A belt tension adjuster automatically adjusts the belt tension and eliminates the need for manual adjustments.
- The crankshaft is supported at five journals with high rigidity and strength.
- The cylinder block is made of aluminum die-casting, and cast iron cylinder liners are cast in.

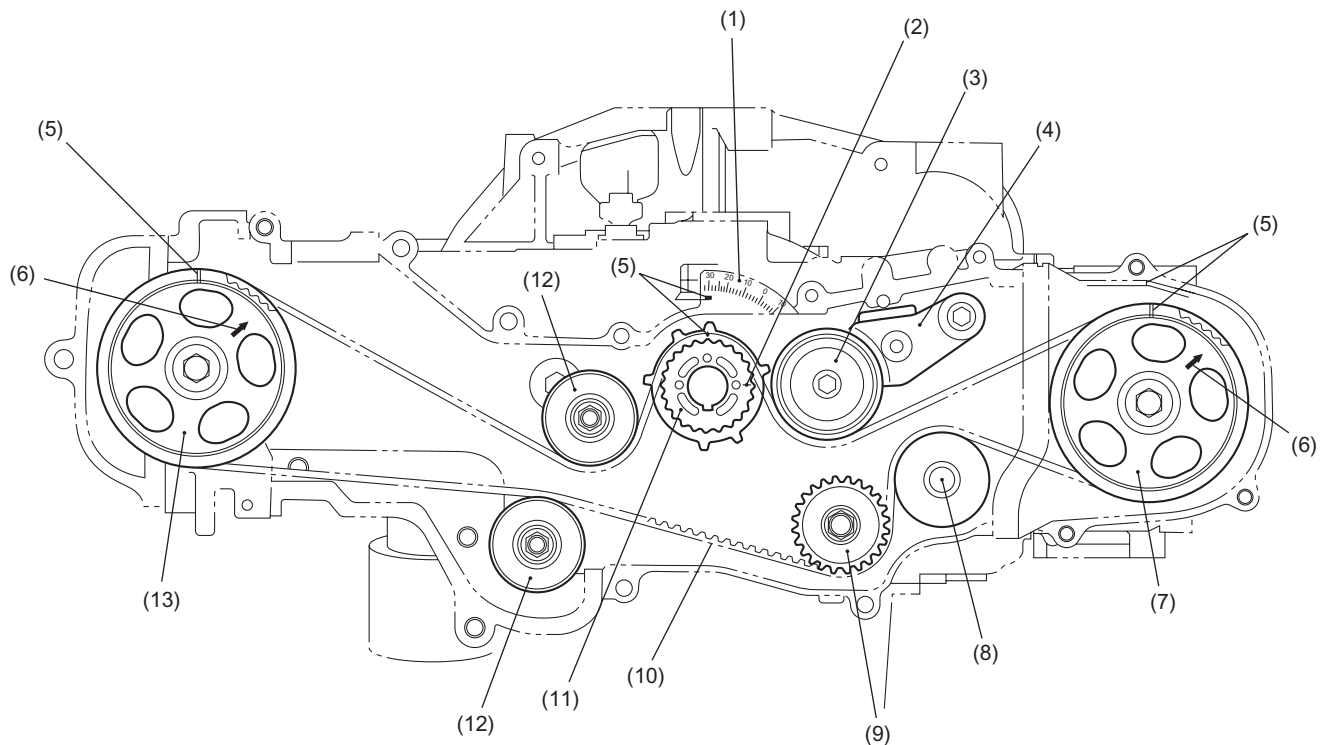


ME-00312

- |                    |                        |                           |
|--------------------|------------------------|---------------------------|
| (1) Camshaft       | (6) Camshaft cap       | (11) Exhaust rocker arm   |
| (2) Intake valve   | (7) Valve rocker cover | (12) Exhaust rocker shaft |
| (3) Cylinder block | (8) Cylinder head      | (13) Intake rocker shaft  |
| (4) Connecting rod | (9) Oil pan            | (14) Intake rocker arm    |
| (5) Spark plug     | (10) Exhaust valve     |                           |

## 2. Timing Belt

- A single timing belt drives two camshafts (one in the left bank and one in the right bank). The belt also drives the water pump by its non-toothed side.
- The timing belt teeth have a specially designed round profile, which contributes to quiet operation. The timing belt is made of strong and inflexible core cords, wear-resistant canvas and heat-resistant rubber material.
- A hydraulic automatic belt tension adjuster always keeps the belt taut to the specified tension. Any manual belt tension adjustment is unnecessary.



ME-00431

- |   |                           |
|---|---------------------------|
| (1) Timing indicator (for timing mark of crankshaft pulley) | (8) Water pump pulley     |
| (2) *Piston position mark                                   | (9) Idler No. 2           |
| (3) Belt tension pulley                                     | (10) Timing belt          |
| (4) Automatic belt tension adjuster                         | (11) Crankshaft sprocket  |
| (5) Alignment mark  | (12) Idler                |
| (6) **Piston position mark                                  | (13) Camshaft sprocket RH |
| (7) Camshaft sprocket LH                                    |                           |

### NOTE:

\*: The #1 piston is at TDC when the piston position mark on the crankshaft sprocket is aligned with the timing mark on the cylinder block.

\*\* : The #1 piston is at TDC on the compression stroke when the piston position mark on the camshaft sprocket is aligned with the timing mark on the belt cover.

# AUTOMATIC BELT TENSION ADJUSTER

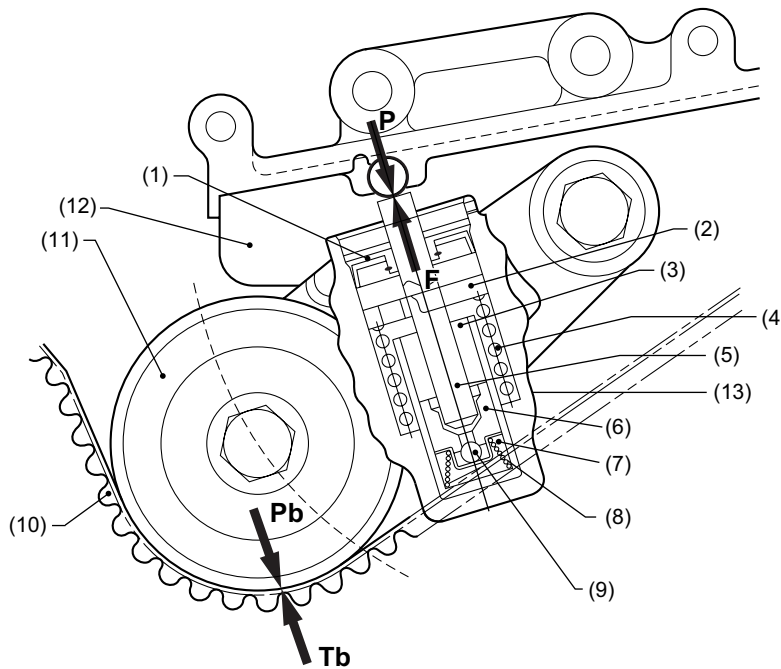
MECHANICAL

## 3. Automatic Belt Tension Adjuster

The automatic belt tension adjuster consists of a tensioner unit and a bracket. It maintains the timing belt tension automatically at a specified level to enable the belt to transmit power correctly, reduce operating noise and increase the life of the belt.

The cylinder of the tensioner unit incorporates an adjuster rod, wear ring, plunger spring, return spring, check ball and silicone oil.

The automatic belt tension adjuster gives tension to the belt by a levering action which is produced by the push force of the tensioner unit's adjuster rod. It operates in the process detailed below.



ME-00314

- |                           |                          |
|---------------------------|--------------------------|
| (1) Oil seal              | (8) Plunger spring       |
| (2) Wear ring             | (9) Check ball           |
| (3) Oil reservoir chamber | (10) Timing belt         |
| (4) Return spring         | (11) Belt tension pulley |
| (5) Adjuster rod          | (12) Tensioner bracket   |
| (6) Plunger               | (13) Cylinder            |
| (7) Oil pressure chamber  |                          |

# AUTOMATIC BELT TENSION ADJUSTER

MECHANICAL

---

- Timing belt tensioning action

When the belt becomes slack, the adjuster rod is pushed upward by the return spring. The oil in the reservoir chamber, which is pressurized by the plunger spring to a certain level, pushes open the check ball and flows into the oil pressure chamber to keep the pressure constant. The thrust force  $F$  resulting from extension of the adjuster rod applies a counterclockwise torque to the tensioner bracket, which causes the belt tension pulley at its end to turn in the same direction. This applies tensioning pressure  $P_b$  to the timing belt.

- Timing belt tension balancing action

When the belt tension pulley is pushed against the timing belt with pressure  $P_b$ , reaction force  $T_b$  of the timing belt generates the reaction force  $P$  at the point on which the adjuster rod force is acting. This force  $P$  pushes the adjuster rod until it balances with the sum of the thrust force  $F$  and the pressure of the oil in the oil pressure chamber. Therefore, the timing belt tension is kept constant.

- Over-tension correction action

If the tension of the timing belt increases excessively, the force  $P$  becomes larger than the thrust force  $F$  and silicone oil is returned from the oil pressure chamber to the reservoir chamber little by little until the force  $P$  balances again with the thrust force  $F$ . Thus the timing belt tension is maintained at the specified level at all times.

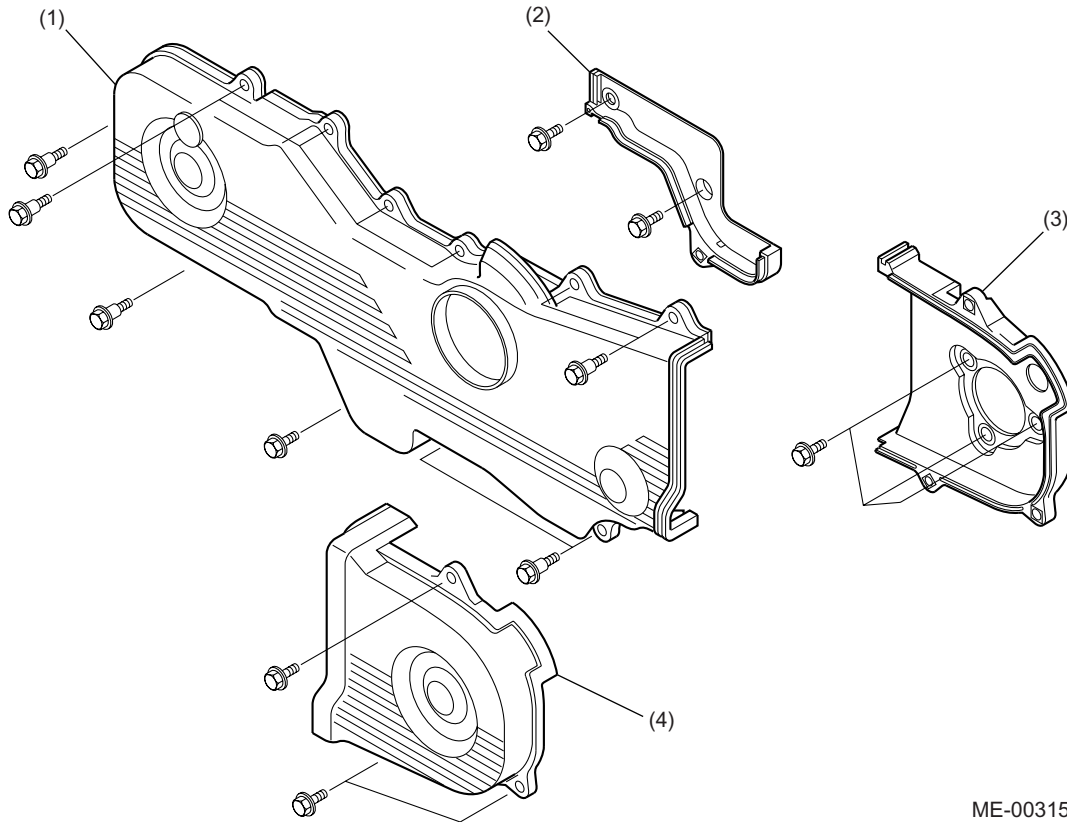


# BELT COVER

MECHANICAL

## 4. Belt Cover

- The belt cover is made of lightweight, heat resistant synthetic resin molding. It constitutes a totally enclosed housing with its cylinder block mating edges sealed with rubber gaskets. This effectively protects the inside components from dust and liquid.
- Rubber seals used between the cylinder block and the belt cover effectively reduces transmission of noise and vibration.
- The front belt cover has a line mark for ignition-timing checking.

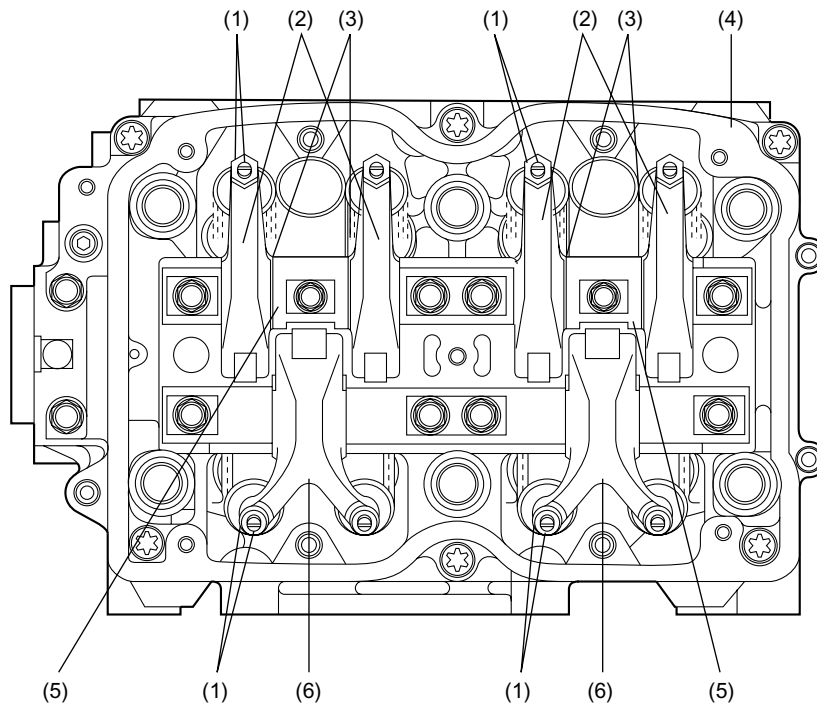


ME-00315

- (1) Front belt cover
- (2) Belt cover No. 2 (RH)
- (3) Belt cover No. 2 (LH)
- (4) Belt cover (LH)

## 5. Valve Rocker Assembly (Until '05MY)

- The intake valve rocker arms and the exhaust valve rocker arms are installed on their own rocker shafts both of which are retained by the camshaft caps.
- The valve end of each rocker arm is provided with valve rocker adjusting screw and nut. Turning of this screw adjusts the valve clearance.
- The exhaust valve rocker arms are Y-shaped, and each arm operates two exhaust valves simultaneously.
- Each rocker shaft has an oil passage in it.



ME-00316

- |  |                              |
|--|------------------------------|
| (1) Valve rocker adjusting screw and nut | (4) Camshaft cap             |
| (2) Intake valve rocker arm              | (5) Supporter                |
| (3) Wave washer                          | (6) Exhaust valve rocker arm |

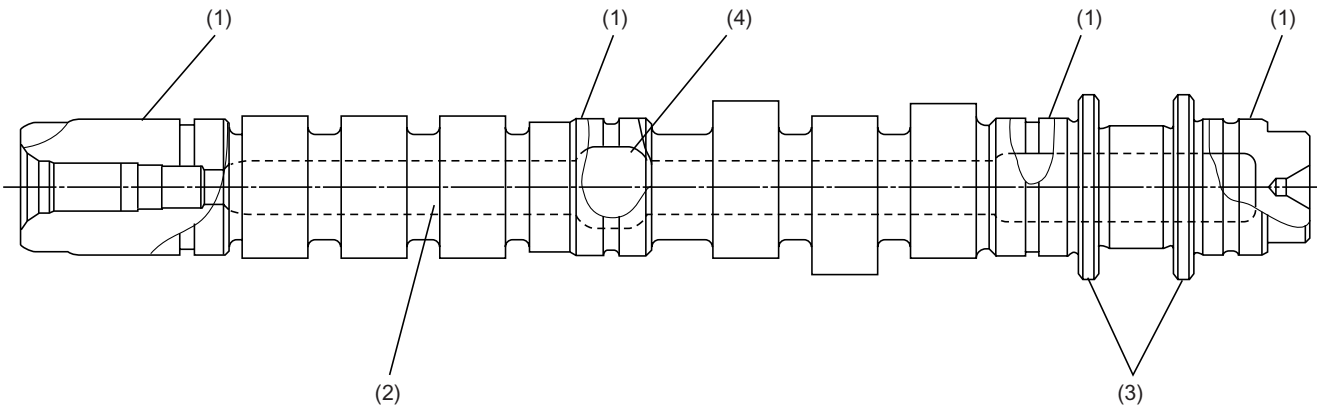
# CAMSHAFT (UNTIL '05MY)

MECHANICAL

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## 6. Camshaft (Until '05MY)

- The camshaft is supported inside the cylinder head at four journals.
- The two flanges on each camshaft supports thrust forces to limit the end play of the camshaft within the tolerance.
- Each camshaft has an oil passage in it. The oil passage is formed by casting (hollowed in varying inner diameter) to reduce the weight.



ME-02102

- (1) Journal
- (2) Oil passage
- (3) Shaft flange
- (4) Hollowed in varying inner diameter

## 7. Variable Valve Lift System (From '06MY)

### A: GENERAL

Variable valve lift system of SOHC engine is the system that aims at the improvement of fuel efficiency, the improvement of engine output, and the decrease of toxic substances in exhaust gas, etc.

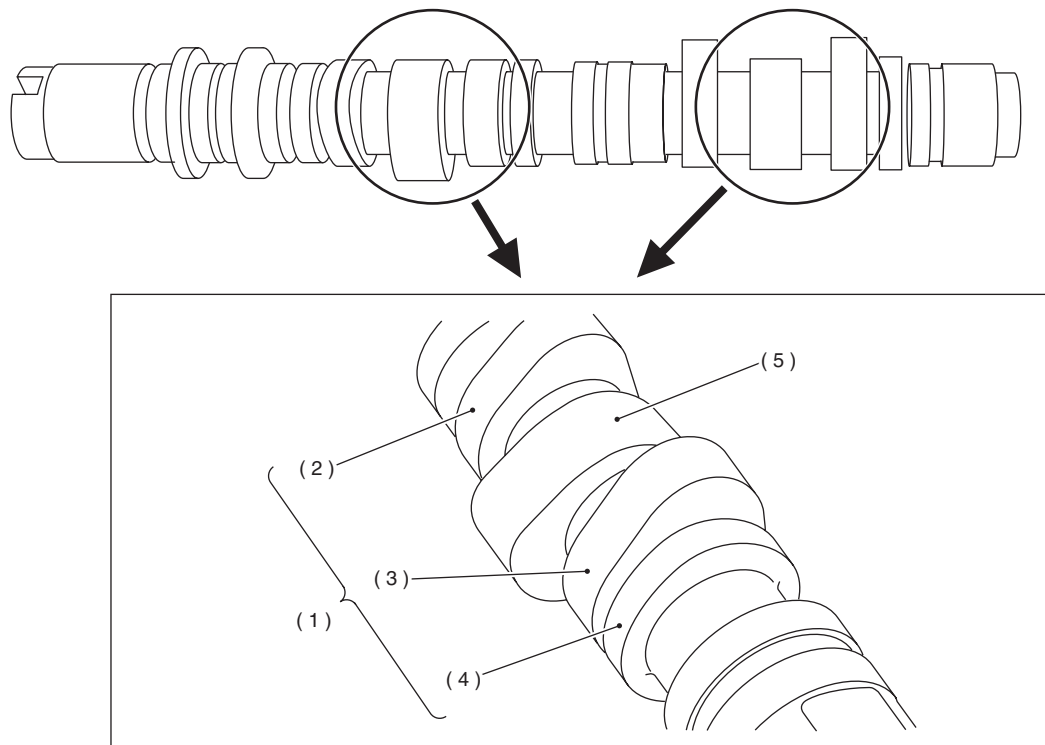
It changes the lift amount of intake valve to low-lift or high-lift according to the engine driving status. Then, the combustion status of air-fuel mixture has been improved in the medium-low speed area. In the high-speed area, the intake air efficiency has been improved. As a result, the engine output improves, and at the same time the fuel efficiency improves.

### B: STRUCTURE

The variable valve lift mechanism that is provided to intake valve rocker assembly changes the lift amount of one side intake valves to high-lift or low-lift according to the engine speed and engine load. The variable valve lift mechanism is operated by the engine oil pressure that is controlled by the oil switching valve (OSV).

#### 1. CAMSHAFT

3 cams are provided to each cylinder: the fixed lift cam, the variable high lift cam, and the variable low lift cam.



ME-02786

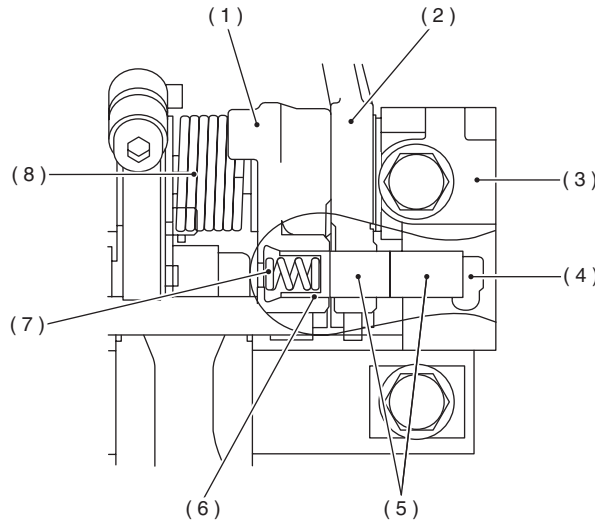
- |                            |                           |
|----------------------------|---------------------------|
| (1) Intake cams            | (4) Variable low lift cam |
| (2) Normal lift cam        | (5) Exhaust cam           |
| (3) Variable high lift cam |                           |

# VARIABLE VALVE LIFT SYSTEM (FROM '06MY)

MECHANICAL

## 2. VARIABLE VALVE LIFT MECHANISM

The variable valve lift mechanism consists of a low lift arm, high lift arm, torsion spring, and a small cylinder that includes 2 locking pins and a spring. The engine oil pressure is led from OSV to the oil chamber of support.



ME-02787

- |                   |                    |
|-------------------|--------------------|
| (1) High lift arm | (5) Locking pin    |
| (2) Low lift arm  | (6) Small cylinder |
| (3) Support       | (7) Spring         |
| (4) Oil chamber   | (8) Torsion spring |

## C: OPERATION

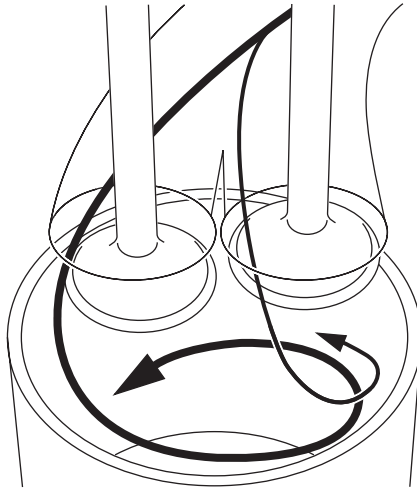
### 1. LOW LIFT

When the low lift arm and the high lift arm are pushed up by the camshaft rotation, the locking pin is in the unlock position. Therefore, the high lift arm is separated from the low lift rocker arm and can operate freely. The valve lift may be small in this condition because the valve is opened or closed being linked with the low lift cam via the low lift arm.

At this time, the high lift arm is pushed against the high lift cam with the torsion spring.

In the cylinder at intake air process, the swirl occurs because the flow velocity is sped up by the air-fuel mixture sucked from one side valve. The flow velocity of air-fuel mixture in the combustion chamber is further sped up around TDC on its compression stroke because of the piston head and the squish area of the combustion chamber.

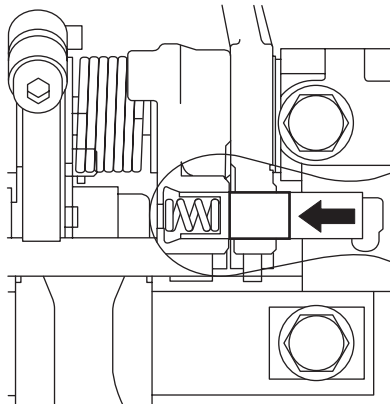
Then, the rich A/F area is made around the ignition area of spark plug and the combustion of the air-fuel mixture is improved. As a result, the generated torque improves, and at the same time it is possible to drive with the lean A/F, and toxic substances in exhaust gas are decreased.



ME-02788

- Operation change from low lift to high lift

When the oil pressure provided from OSV to the oil chamber increases, the locking pin is pushed against the high lift arm side. Then, the return spring of small cylinder is compressed, and then the locking pin of low lift arm is pressed into the locking hole of high lift arm. By a series of these operations, the low lift arm is integrated to the high lift arm.



ME-02789

# VARIABLE VALVE LIFT SYSTEM (FROM '06MY)

MECHANICAL

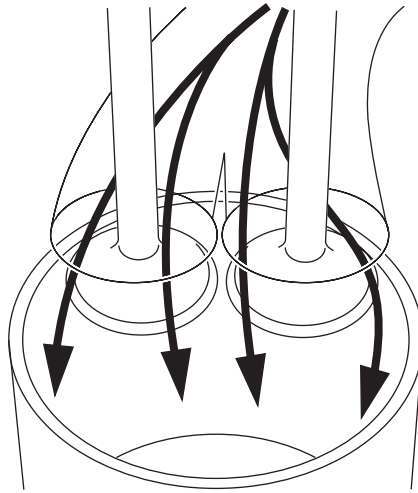
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## 2. HIGH LIFT

As the valve is pushed up to the high lift cam by the high lift arm and low lift arm that were integrated, the valve lift becomes larger.

When the low lift arm operates upward or downward, the connecting position between the locking pin of low lift arm and the locking pin of support may change. But the low lift arm keeps integrating with the high lift arm because the locking pin of the low lift arm keeps being pushed.

By opening the 2 intake valves, the air flow resistance of valves is decreased and the valve overlap in TDC on its exhaust stroke is increased (because the valve opening angle of high lift cam is wider than the fixed lift cam). Then, in the high-speed area that the throttle valve opens greatly, the intake and exhaust inertia effect can be used. As a result, a lot of air is sucked in the cylinder and the engine output may be improved.



ME-02790

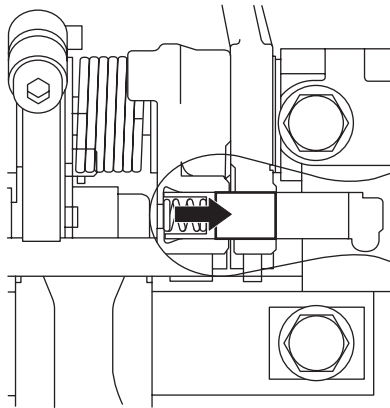
## VARIABLE VALVE LIFT SYSTEM (FROM '06MY)

MECHANICAL

- Operation change from high lift to low lift

When the oil pressure from OSV to oil chamber is decreased, the return spring of small cylinder pushes back the locking pin of low lift arm and the locking pin of rocker shaft holder to the unlock position.

As a result, the low lift arm separates from the high lift arm, and then the variable valve lift mechanism becomes the low lift operation.



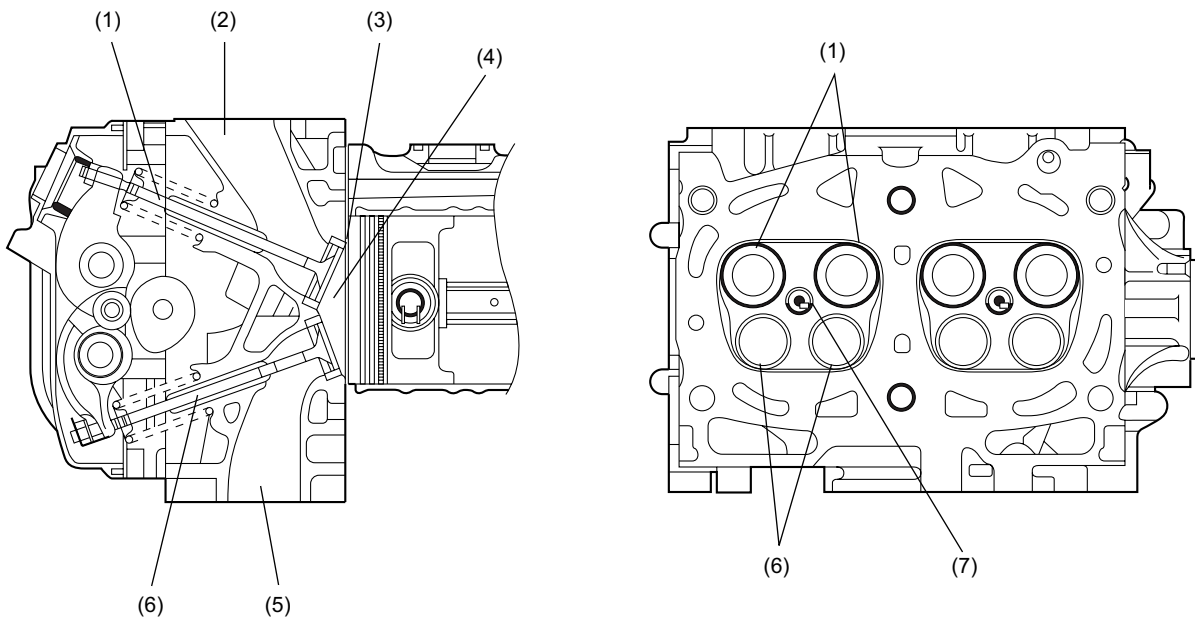
ME-02791



# CYLINDER HEAD

## 8. Cylinder Head

- The cylinder head is made of low pressure cast aluminum.
- Each combustion chamber in the cylinder head is a compact, pent roof design. The spark plug is located at the center of the combustion chamber, which contributes to creation of a wide “squish area” for increased combustion efficiency.
- The two intake and two exhaust valves are arranged on opposite sides for a cross-flow feature.
- As a design feature, the exhaust port of adjacent cylinders are joined to a single port, aiming at decreasing heat dissipation and accelerate activation of the catalytic converter.
- The cylinder head gasket is a metallic gasket. The gasket is highly resistant to heat and maintains high level of sealing performance for a long period.



ME-00318

- (1) Intake valve
- (2) Intake port
- (3) Squish area
- (4) Combustion chamber

- (5) Exhaust port
- (6) Exhaust valve
- (7) Spark plug

## 9. Cylinder Block

- The cylinder block is made of aluminum die casting. Its open-deck design provides it with such advantageous features as relatively small weight, high rigidity and excellent cooling efficiency.
- The cylinder liners are made of cast iron. As they are of a dry type, their outer surfaces are entirely in contact with the cylinder block.
- The cylinder block supports the crankshaft at its five journals. The journal supporting portions are designed such that sufficient stiffness and quiet operation are ensured.
- Sintered material is fit in the casting at the #5 journal to achieve further quietness.
- The oil pump is located in the front center of the cylinder block and the water pump is located at the front of the left-cylinder bank. At the rear of the right-cylinder bank is an oil separator which removes oil mist contained in blow-by gas.

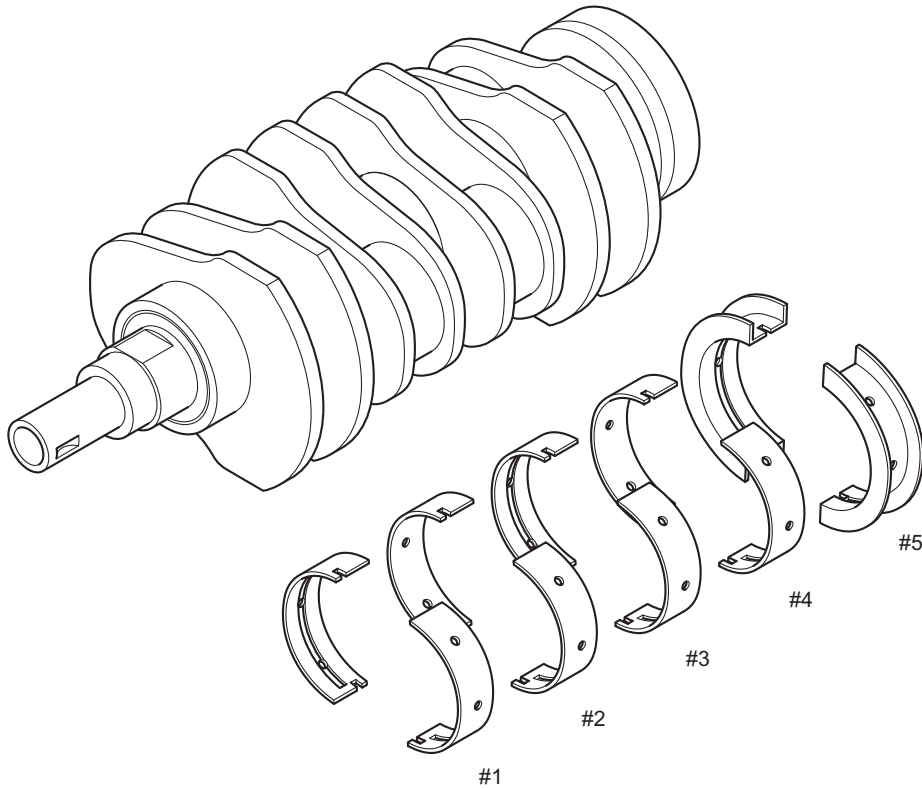
# CRANKSHAFT

MECHANICAL

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## 10.Crankshaft

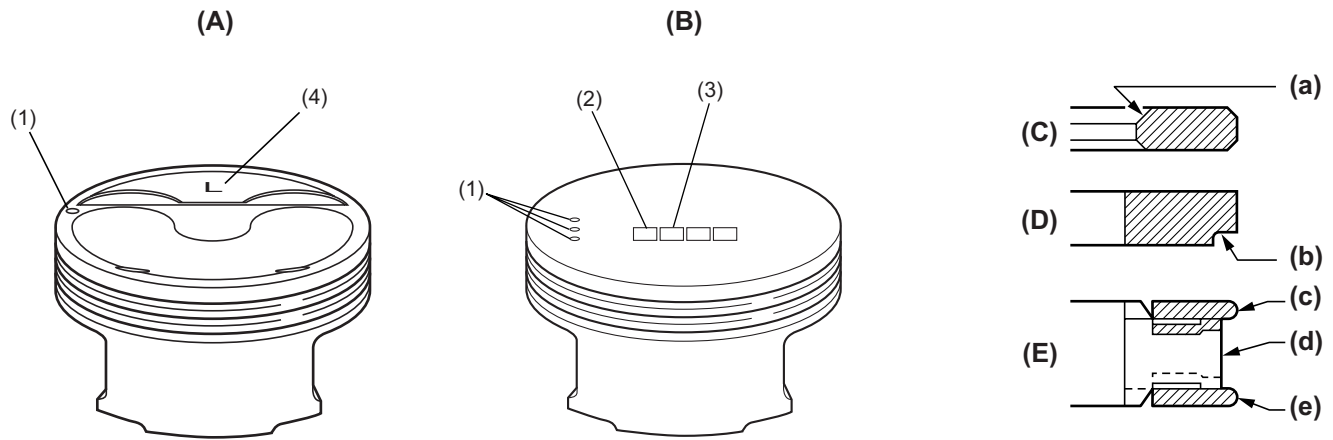
The crankshaft is supported in the cylinder block at five journals. Each corner formed by a journal or pin and a web is finished by fillet-rolling method which increases strength of that area. The five crankshaft bearings are made of aluminum alloy and the No. 5 bearing is provided with a flanged metal to support thrust forces.



ME-00319

## 11. Piston

- The pistons are of a slipper skirt design for reduced weight and friction. The piston is also a thermal flow type whose oil control ring groove is provided with round oil drain holes.
- The piston pin is offset toward the thrust side (No. 1 and No. 3 pistons downwards, No. 2 and No. 4 pistons upwards) to reduce piston slap noises.
- The piston head has recesses to prevent interference with the intake and exhaust valves. It also has engraved marks to identify the piston size and the direction of installation. On type I models, the piston heads are concaved at the entire exhaust side to gather the tumble flow around the spark plug and improve combustion. Only on the type I models the pistons are distinguished left or right.
- Three piston rings are used for each piston; two compression rings and one oil control ring. The top piston ring has inner bevels and the second piston ring has an interrupt (cut) on the bottom outside to reduce oil consumption.



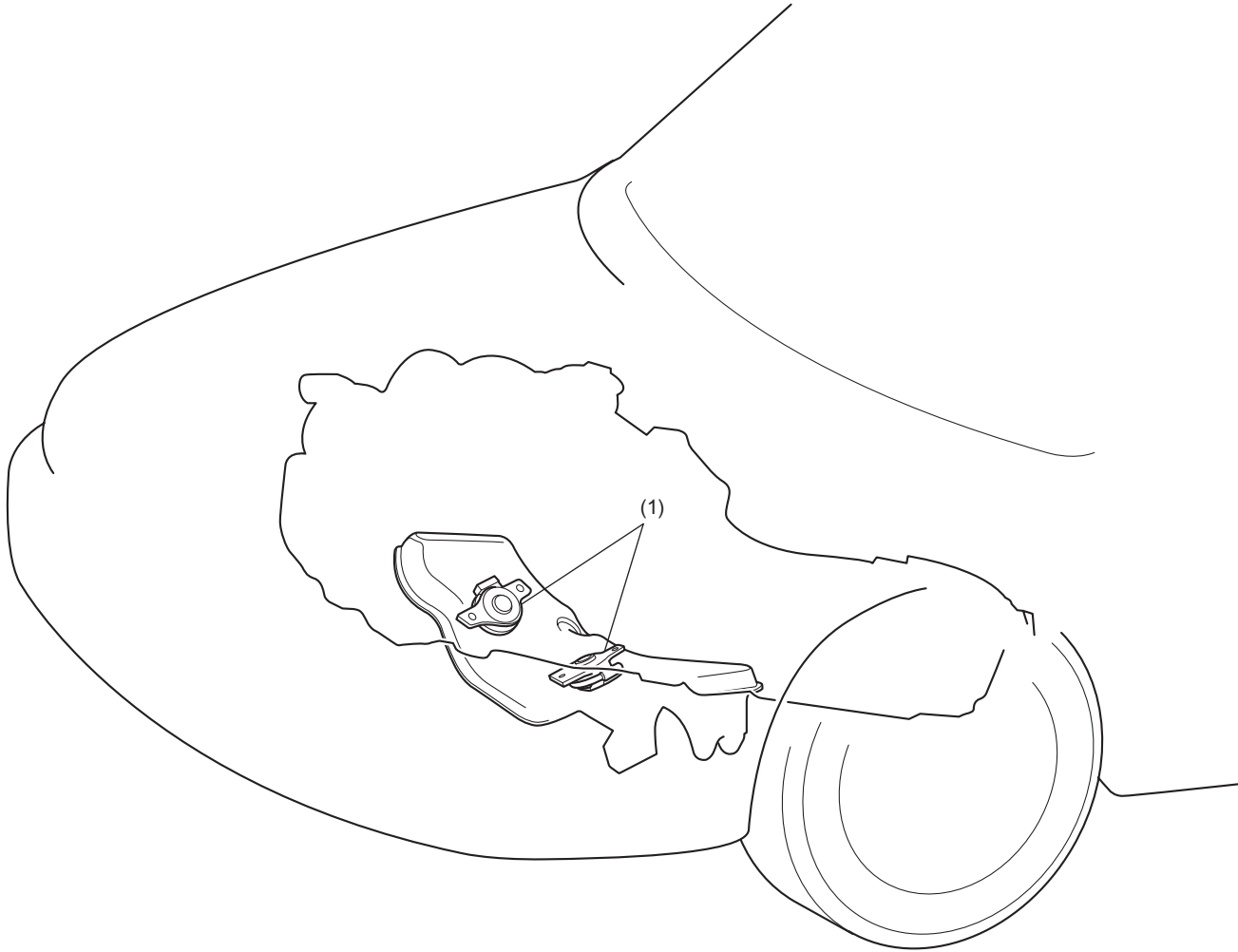
ME-02393

- (1) Location mark (engine front side)
- (2) Identification mark (piston size)
- (3) Engine displacement
- (4) Identification mark (left or right)

- (A)** Type I models
- (B)** Type II models
- (C)** Top ring
- (D)** Second ring
- (E)** Oil ring

- (a)** Inner-bevel
- (b)** Cut
- (c)** Upper rail
- (d)** Expander
- (e)** Lower rail

## 12.Engine Mounting



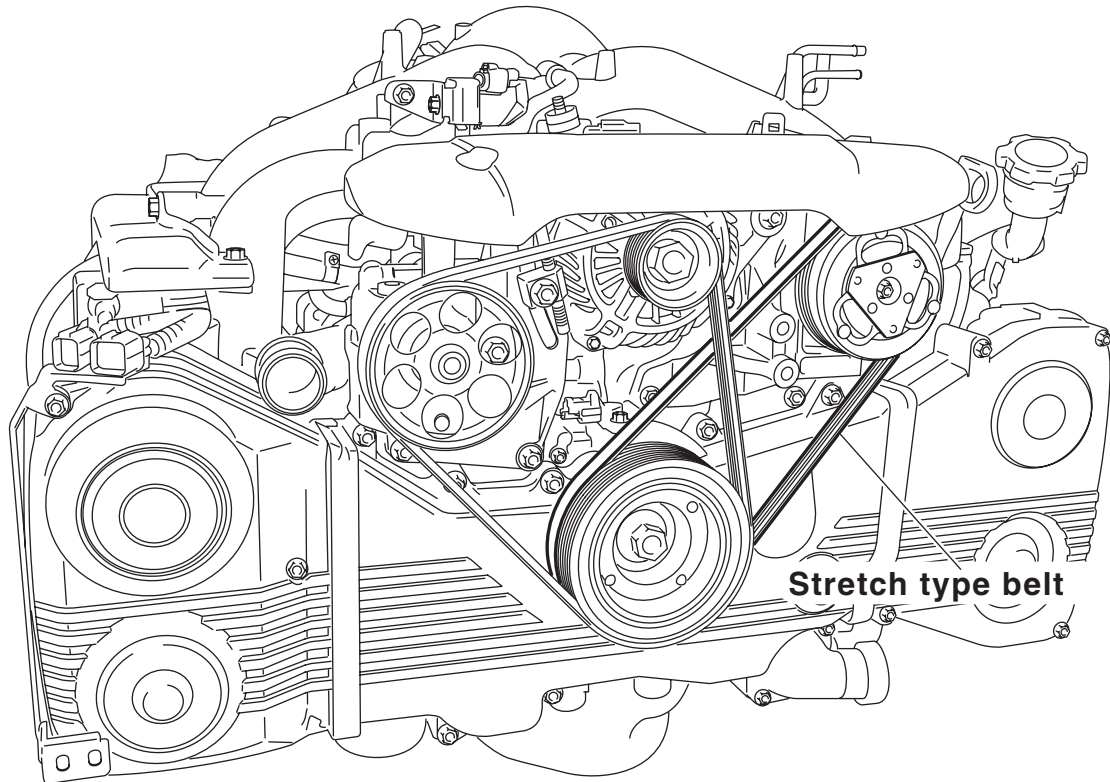
ME-00434

(1) Cushion rubber

## 13.Stretch Type Belt (From '08MY)

### A: GENERAL

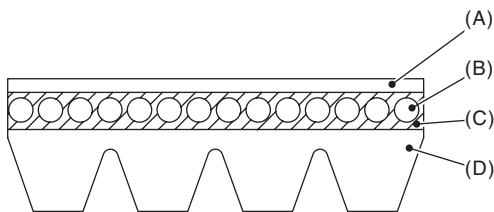
- Stretch type belt uses elastic material in its core, resulting in eliminating a tensioner pulley and in a weight reduction.
- The stretch type belt eliminates the need to adjust tension of the belt.



ME-03635

### B: STRUCTURE

The stretch type belt is built as shown in the following figure providing the elastic feature.



ME-03636

- (A) Upper cloth (nylon)
- (B) Core (nylon)
- (C) Adhesive rubber
- (D) Rib rubber

## GENERAL

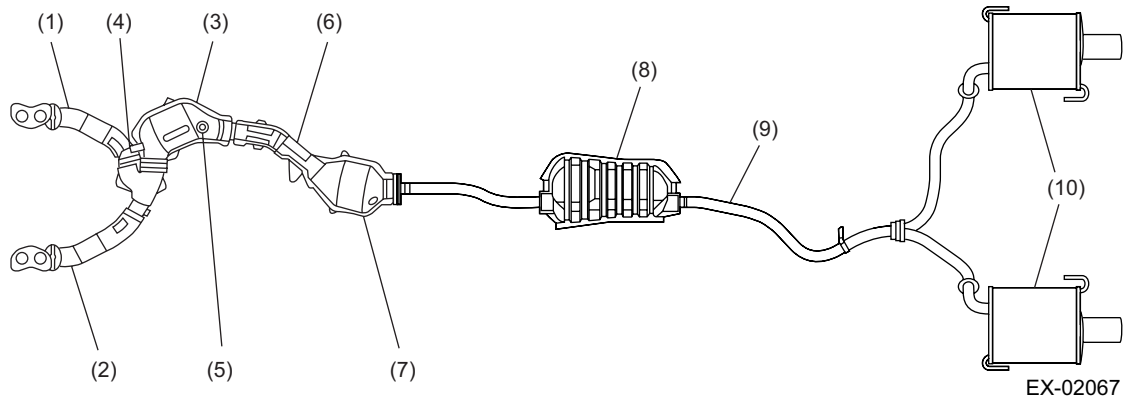
### EXHAUST

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#### 1. General

- The exhaust system consists of front exhaust pipes, three-way catalytic converters, a center exhaust pipe, a rear exhaust pipe and a muffler. The front catalytic converter and rear catalytic converter are incorporated in the center exhaust pipe.
- The exhaust system features an improved sound suppression design and has a chamber in addition to the muffler. Also, a twin-muffler system is used to reduce gas flow resistance.

### 2. Construction



- |                               |                              |
|-------------------------------|------------------------------|
| (1) Front exhaust pipe (RH)   | (6) Center exhaust pipe      |
| (2) Front exhaust pipe (LH)   | (7) Rear catalytic converter |
| (3) Front catalytic converter | (8) Chamber                  |
| (4) Front oxygen (A/F) sensor | (9) Rear exhaust pipe        |
| (5) Rear oxygen sensor        | (10) Muffler                 |



# CONSTRUCTION

EXHAUST

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**MEMO**

**EX(H4SO)-4**

### 1. General

- The engine cooling system consists of a down-flow radiator featuring high heat-dissipation performance, an electric-motor-driven fan, a water pump, a thermostat, and an engine coolant temperature sensor.
- The reservoir tank is made of translucent resin and enables easy confirmation of the coolant level. Also, coolant should be added to the reservoir tank when replenishment is necessary.
- The ECM controls the operation of the radiator main fan and sub fan depending on the signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch.

## 2. Cooling Circuits

The cooling system operates in three different phases depending on the temperature of the engine coolant.

- 1st phase (thermostat closed)

When the engine coolant temperature is lower than the preset value, the thermostat remains closed. The coolant flows through the heater circuit. This permits the engine to warm up quickly.

- 2nd phase (thermostat open)

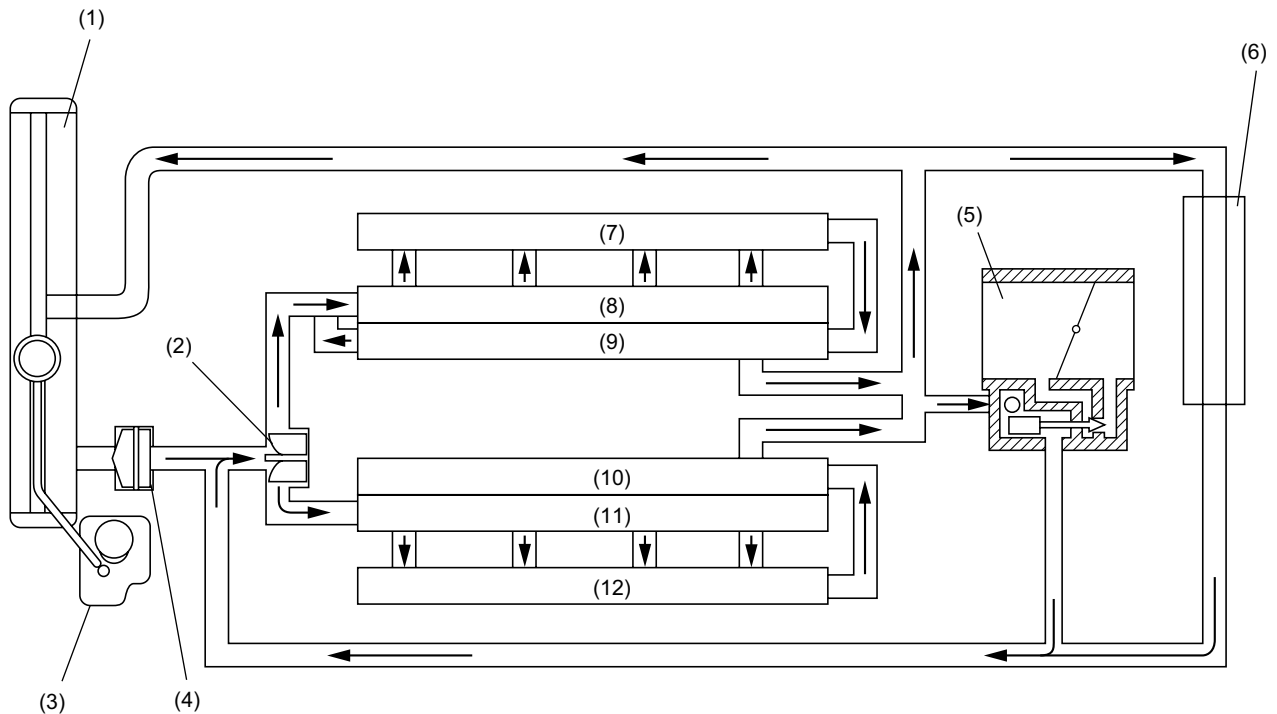
When the engine coolant temperature reaches the preset value, the thermostat opens. The coolant flows through the radiator where it is cooled.

- 3rd phase (thermostat open and radiator fan operating)

When the engine coolant temperature becomes higher than the preset value, the ECM receives a signal from the engine coolant temperature sensor and causes the radiator fan(s) to operate.

**NOTE:**

Refer to the Service Manual for preset engine coolant temperature values for each stage.



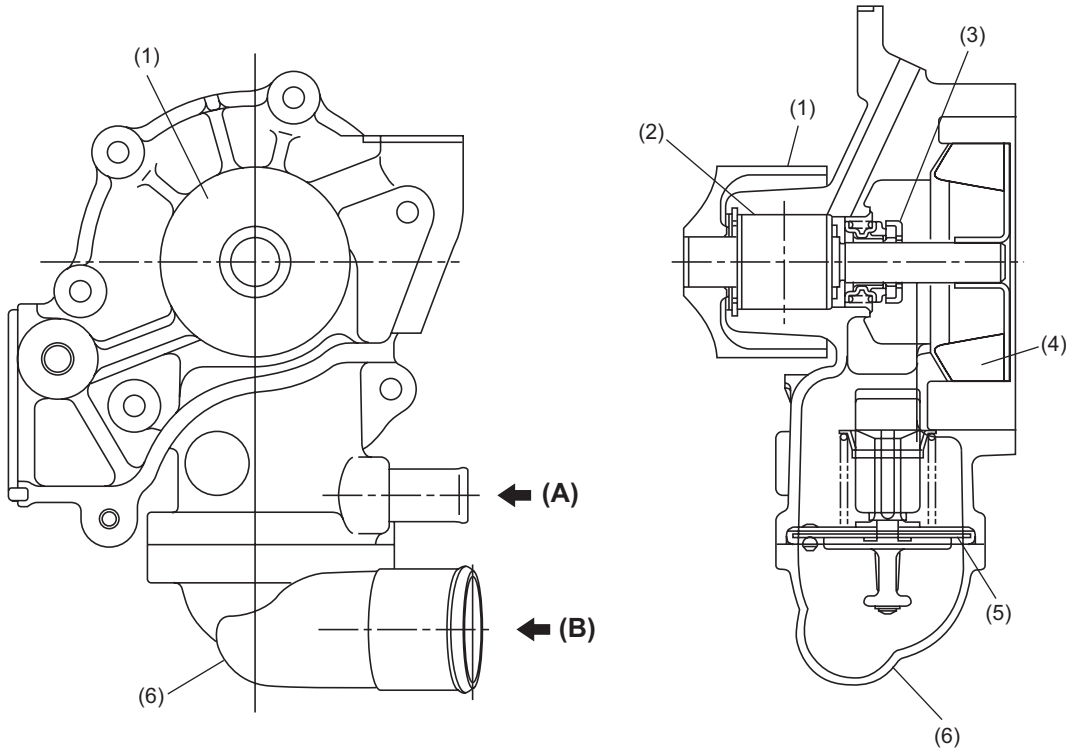
CO-02110

- |                                   |                         |
|-----------------------------------|-------------------------|
| (1) Radiator                      | (7) Cylinder head RH    |
| (2) Water pump                    | (8) Cylinder jacket RH  |
| (3) Engine coolant reservoir tank | (9) Cylinder block RH   |
| (4) Thermostat                    | (10) Cylinder block LH  |
| (5) Throttle body                 | (11) Cylinder jacket LH |
| (6) Heater core                   | (12) Cylinder head LH   |

# WATER PUMP

COOLING

## 3. Water Pump



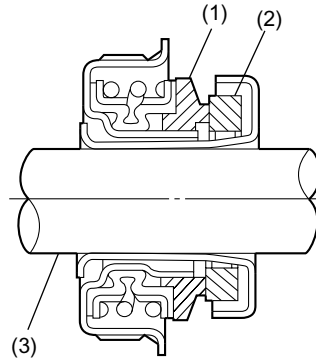
CO-02119

- (A) From heater circuit
- (B) From radiator

- (1) Pulley
- (2) Ball bearing
- (3) Mechanical seal
- (4) Impeller
- (5) Thermostat
- (6) Thermostat cover

## 4. Mechanical Seal

The mechanical seal has its seat tightly fitted on the water pump shaft. Since it is a hermetic seal forming an integral part of the water pump, the water pump cannot be disassembled.



CO-00058

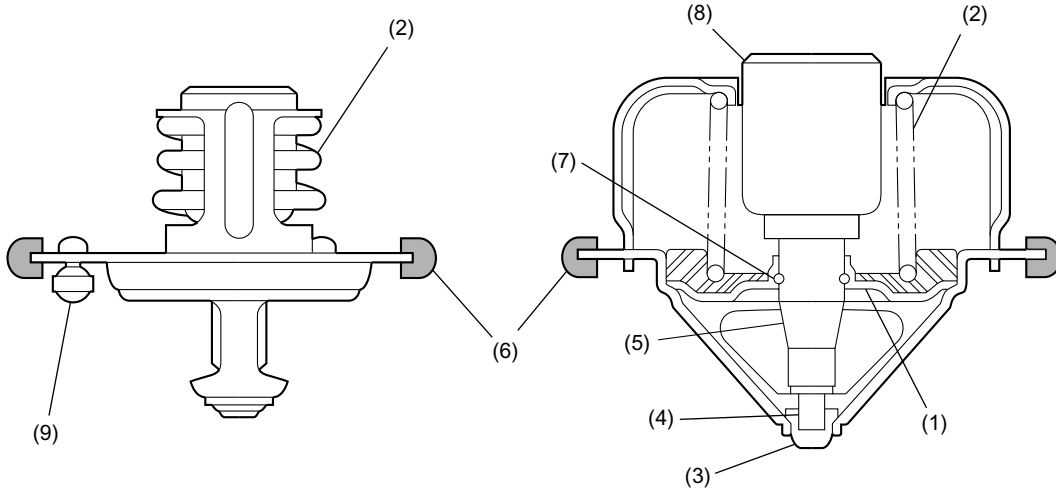
- (1) Carbon seal
- (2) Ceramics seat
- (3) Water pump shaft

# THERMOSTAT

COOLING

## 5. Thermostat

The thermostat has a totally enclosed wax pellet, which expands as the coolant temperature increases. It opens and closes accurately at the preset temperatures and features high durability.



CO-00059

- (1) Valve
- (2) Spring
- (3) Stopper

- (4) Piston
- (5) Guide
- (6) Rubber packing

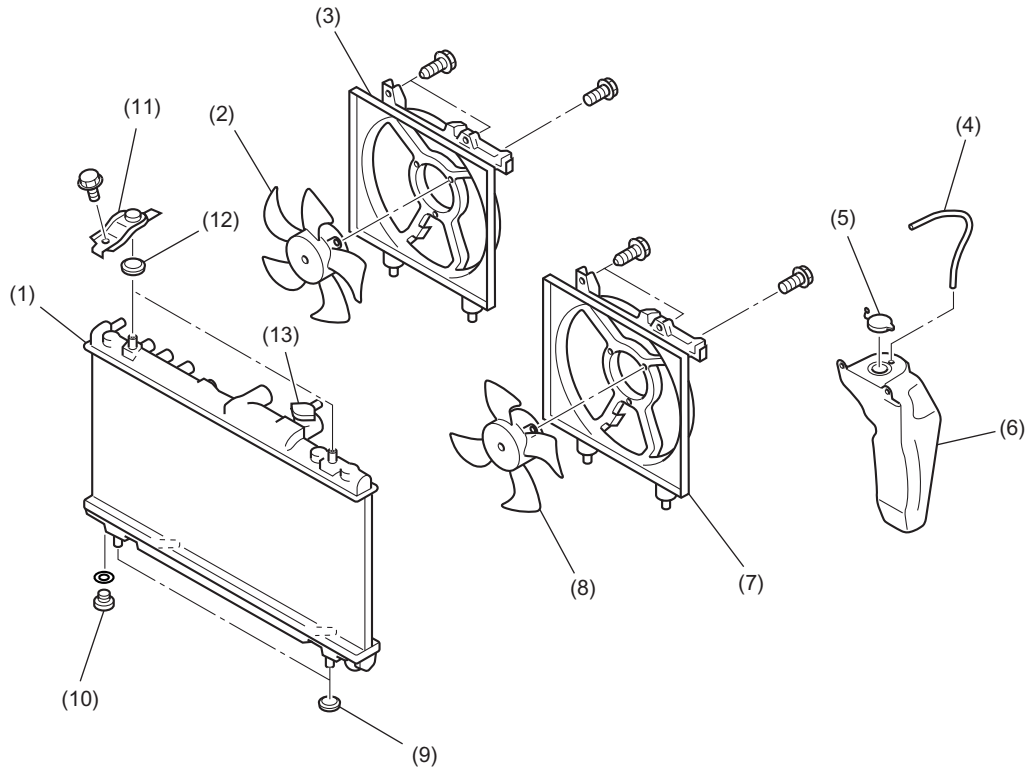
- (7) Stop ring
- (8) Wax element
- (9) Jiggle valve

CO(H4SO)-6

## 6. Radiator Fan

### A: DESCRIPTION

Each radiator fan is made of plastic. It is driven by an electric motor, which is retained on a shroud.



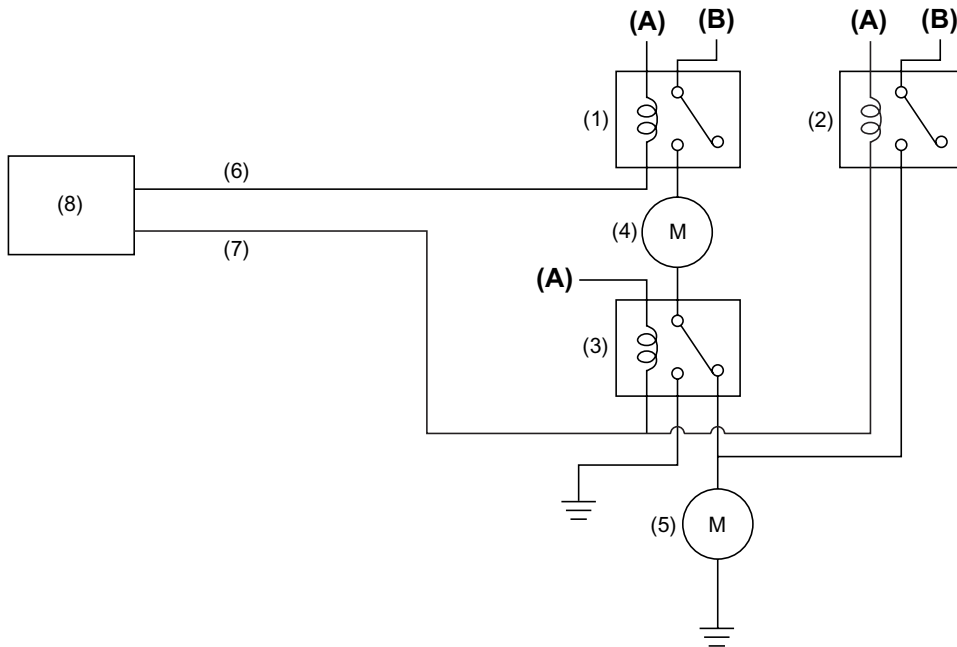
CO-00282

- |   |   |
|---|---|
| (1) Radiator                                    | (8) Radiator main fan and main fan motor assembly |
| (2) Radiator sub fan and sub fan motor assembly | (9) Lower cushion                                 |
| (3) Radiator sub fan shroud (models with A/C)   | (10) Drain plug                                   |
| (4) Overflow hose                               | (11) Upper bracket                                |
| (5) Reservoir tank cap                          | (12) Upper cushion                                |
| (6) Reservoir tank                              | (13) Radiator cap                                 |
| (7) Radiator main fan shroud                    |   |

# RADIATOR FAN

## COOLING

To reduce fan noise, the fan output is two-stepped and can be switched to Low or High according to the load on A/C, coolant temperature, and vehicle speed. This control is accomplished by a circuit as shown below; the output is changed by switching the connection of two motors between serial and parallel instead of using components such as resistors.



CO-00060

- |                      |                          |
|----------------------|--------------------------|
| (1) Sub fan relay    | (6) Low speed signal     |
| (2) Main fan relay 1 | (7) High speed signal    |
| (3) Main fan relay 2 | (8) ECM                  |
| (4) Sub fan motor    | (A) From ignition switch |
| (5) Main fan motor   | (B) From battery         |



# RADIATOR FAN

COOLING

## B: FUNCTION

On models equipped with an air conditioning system, the ECM receives signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch, and based on these signals, the ECU controls the fan speed to Hi or Low.

### NOTE:

Refer to the Service Manual for operation of each model.

Operation examples:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Rising: below 95°C (203°F) Lowering: below 92°C (198°F)	Rising: between 96 and 99°C (205 and 210°F) Lowering: between 93 and 94°C (199 and 201°F)	Rising: over 100°C (212°F) Lowering: over 95°C (203°F)
		Operation of radiator fans	Operation of radiator fans	Operation of radiator fans
When accelerating: below 19 km/h (12 MPH) When decelerating: below 10 km/h (6 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 20 and 69 km/h (12 and 43 MPH) When decelerating: between 11 and 64 km/h (7 and 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 70 and 105 km/h (43 and 65 MPH) When decelerating: between 65 and 103 km/h (40 and 64 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
When accelerating: over 106 km/h (66 MPH) When decelerating: over 104 km/h (64.6 MPH)	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

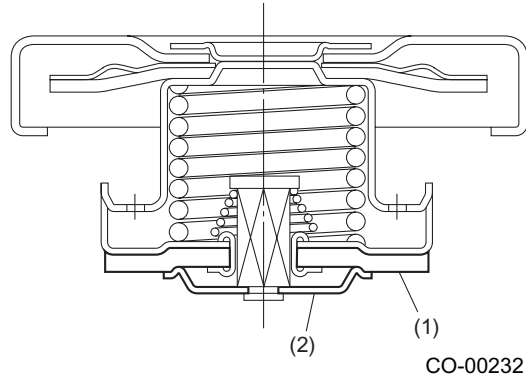
# RADIATOR CAP

COOLING

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## 7. Radiator Cap

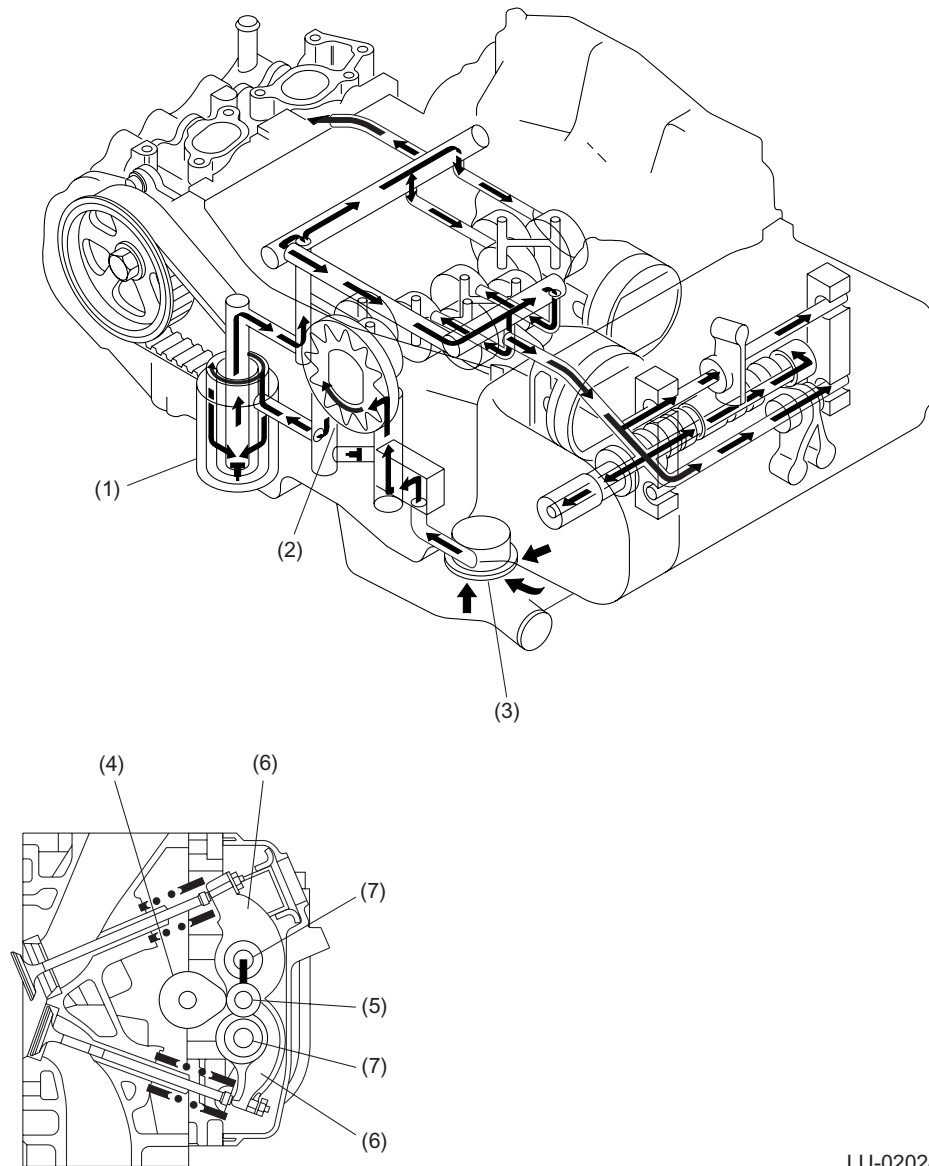
The radiator cap has a pressure valve and a vacuum valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. Also, when the radiator inner pressure becomes lower than the atmospheric pressure during the cooling down phase, the vacuum valve opens to send back coolant from the reservoir tank to the radiator. These functions prevent damage to the radiator components.



- (1) Pressure valve
- (2) Vacuum valve

### 1. General

- The lubrication system forcibly circulates engine oil throughout the engine using an oil pump. The oil pressure is regulated by the relief valve built into the oil pump.
- The oil pump is a thin, large-diameter trochoid rotor type which can accommodate the engine's high output. The pump is directly driven by the crankshaft.
- The engine oil is cleaned by a full-flow, paper element type oil filter. The filter has a bypass valve, which allows the engine oil to flow bypassing the filter if it is clogged.
- The inside of the oil pan is fitted with a baffle plate, which reduces changes in the oil level due to movement of the vehicle, thus ensuring uninterrupted suction of oil.
- The engine oil discharged from the oil pump is delivered to the journal bearings, connecting rod bearings, and other parts requiring lubrication and cooling through the oil filter, vertical passage in the right bank of the cylinder block, and the oil galleries in the right and left banks of the cylinder block.
- The engine oil is also distributed to each cylinder head valve mechanism at a proper flow rate achieved by metering by the orifice provided in each oil gallery.



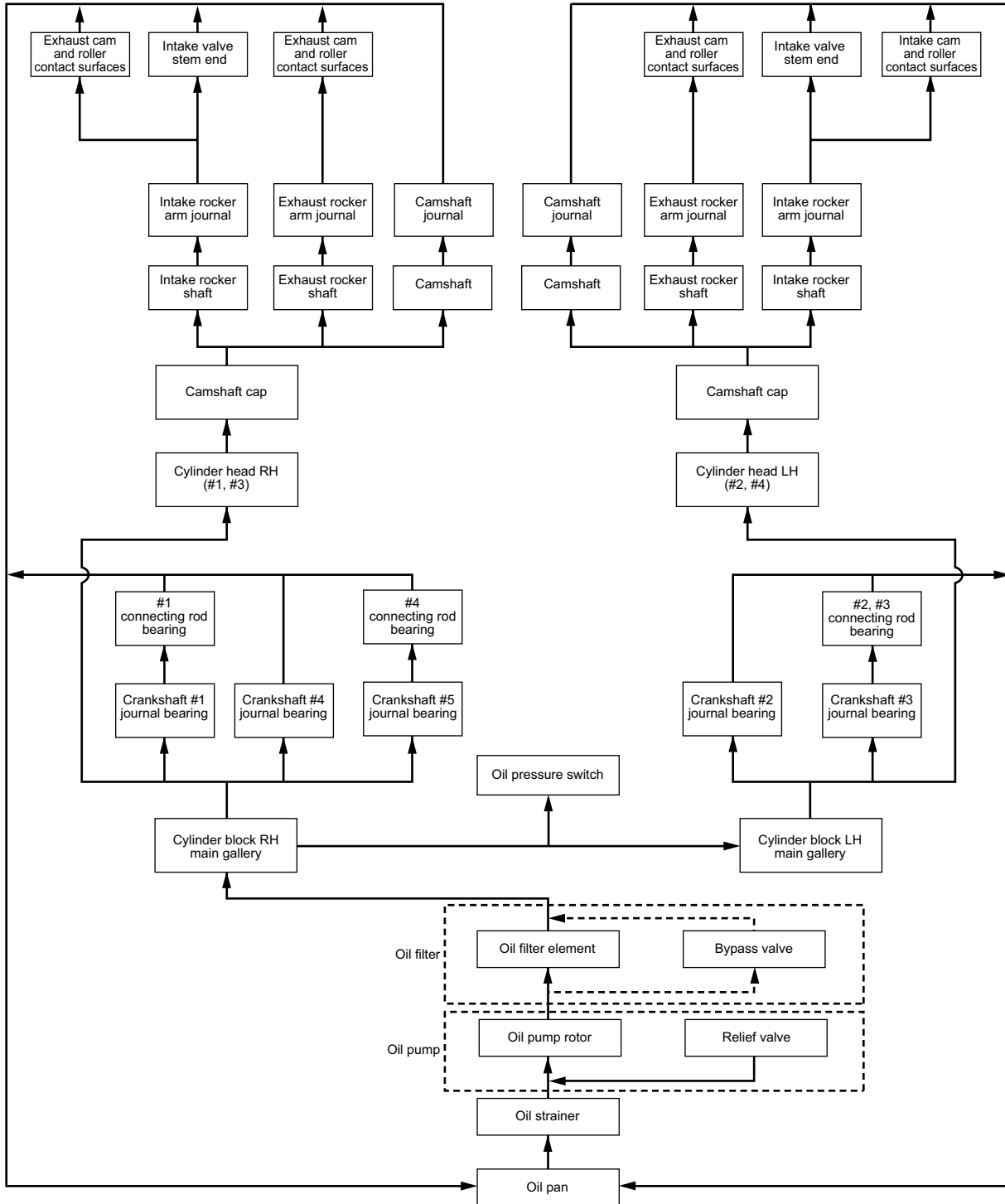
LU-02024

- |                  |                  |
|------------------|------------------|
| (1) Oil filter   | (5) Roller       |
| (2) Oil pump     | (6) Rocker arm   |
| (3) Oil strainer | (7) Rocker shaft |
| (4) Camshaft     |                  |

# ENGINE OIL FLOW

LUBRICATION

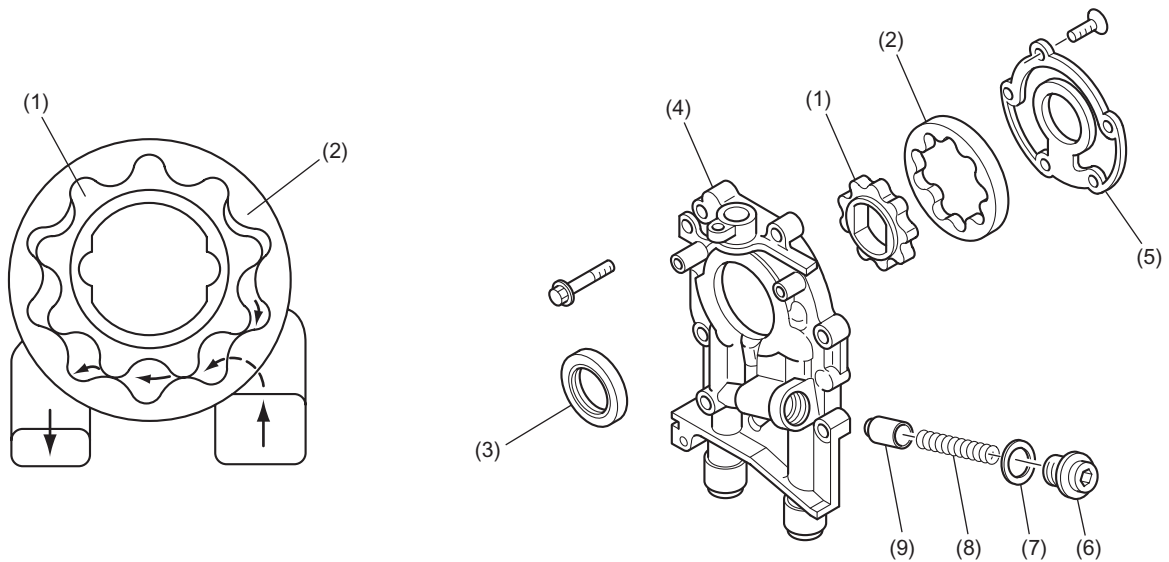
## 2. Engine Oil Flow



LU-02109

## 3. Oil Pump

- The oil pump is a trochoid rotor type consisting of an inner rotor and outer rotor assembled with each other in a pump body. When the inner rotor is driven by the crankshaft, the outer rotor is rotated, changing the space between it and the inner rotor. The change in the space occurs because of the difference in the number of teeth between the rotors.
- Engine oil is carried from the inlet port to the discharge port. As the pump rotates, the space carrying the oil becomes smaller, thus the oil is pressurized and discharged from the discharge port. A relief valve is built in the oil pump at its discharge side. When the oil pressure becomes higher than the preset value, the relief valve regulates the pressure by sending excessive oil back to the inlet side.



LU-00058

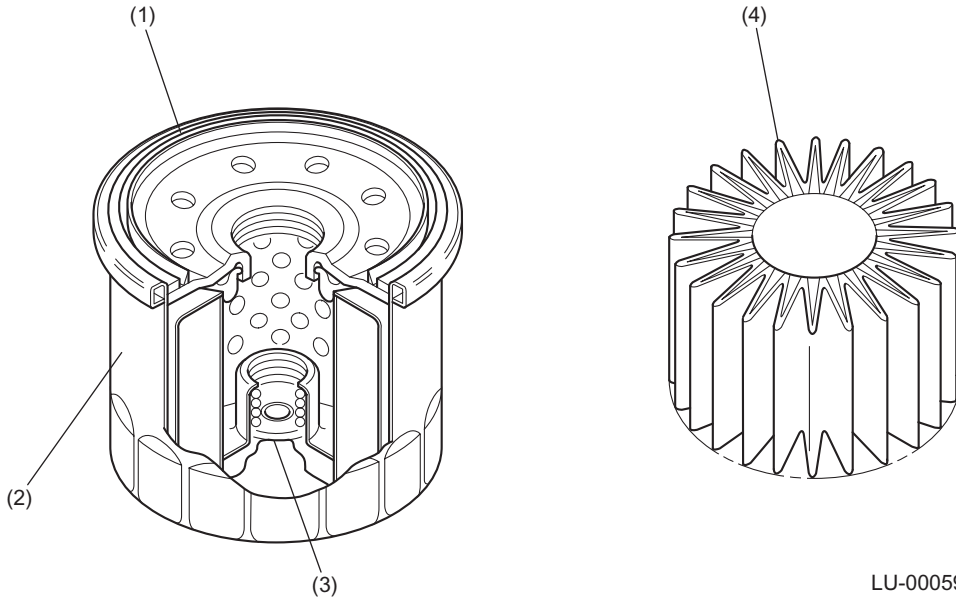
- (1) Inner rotor
- (2) Outer rotor
- (3) Oil seal
- (4) Oil pump case
- (5) Oil pump cover

- (6) Plug
- (7) Gasket
- (8) Relief valve spring
- (9) Relief valve

# OIL FILTER

## 4. Oil Filter

The oil filter is a full-flow filtering, cartridge type that utilizes a paper element. It also has a built-in bypass valve. If the filter gets clogged causing the oil pressure to exceed the preset value, the bypass valve opens and detours the engine oil to flow around the filter. The filter element has a special pleat design to increase the effective filtering area.

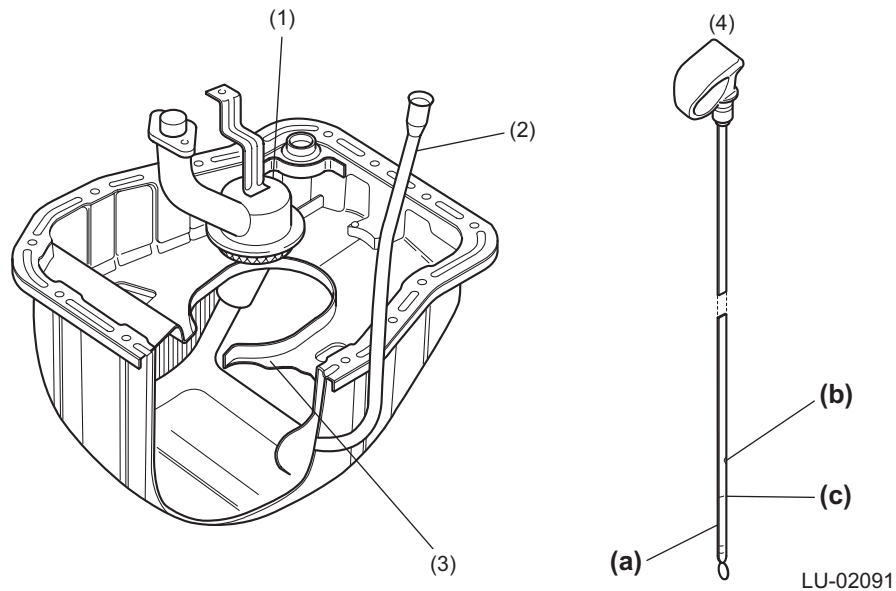


LU-00059

- (1) Oil seal
- (2) Filter body
- (3) Bypass valve
- (4) Pleated element

## 5. Oil Pan and Oil Strainer

- The oil pan is attached to the cylinder block using liquid gasket for sealing. The oil strainer is a metal net type and removes large foreign particles from the engine oil. It is located in the middle of the oil pan. The pipe from the strainer is connected to the suction port of the oil pump in the left bank of the cylinder block.
- There is a baffle plate inside the oil pan. It stabilizes the oil level and reinforces the oil pan.



- (1) Oil strainer
- (2) Level gauge guide
- (3) Baffle plate
- (4) Oil level gauge

- (a) LOW level
- (b) FULL level (engine hot condition)
- (c) FULL level (engine cold condition)

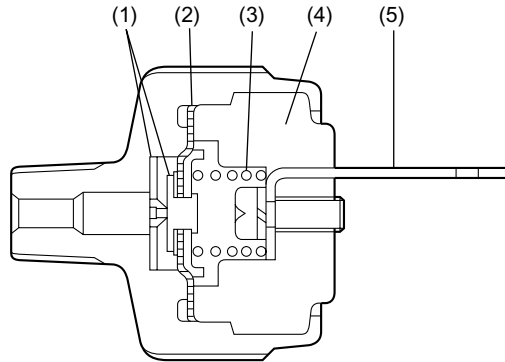


# OIL PRESSURE SWITCH

LUBRICATION

## 6. Oil Pressure Switch

The oil pressure switch is located in the front upper portion of the right cylinder block bank. The purpose of this switch is to monitor the operation of the oil pump as well as the lubricating oil pressure when the engine is running.



LU-00061

- |               |                    |
|---------------|--------------------|
| (1) Contact   | (4) Molded portion |
| (2) Diaphragm | (5) Terminal       |
| (3) Spring    |                    |

1) When oil pressure does not build up (immediately after ignition switch is turned ON):  
The diaphragm is pushed toward the cylinder block by the spring force (a force equivalent to the specified oil pressure). This closes the contact points, causing the oil pressure warning light in the combination meter to illuminate.

2) When oil pressure reaches the specified value (after engine starts):  
After reaching the specified value, the oil pressure pushes the diaphragm against the spring force. This opens the contact points and the oil pressure warning light goes out.

# GENERAL

## SPEED CONTROL SYSTEM

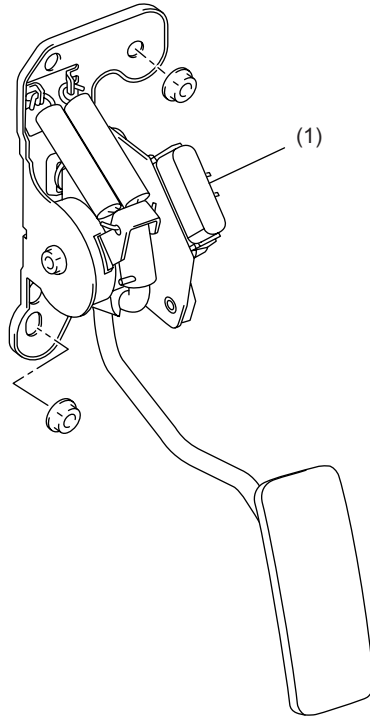
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### 1. General

An electronically controlled throttle is adopted.

The movement of the accelerator pedal is converted into electrical signals by the accelerator pedal position sensor and these signals are sent to the ECM.

The ECM controls the operation of the throttle body based on the signals from the accelerator pedal position sensor and on other driving conditions.



SP-02029

(1) Accelerator pedal position sensor

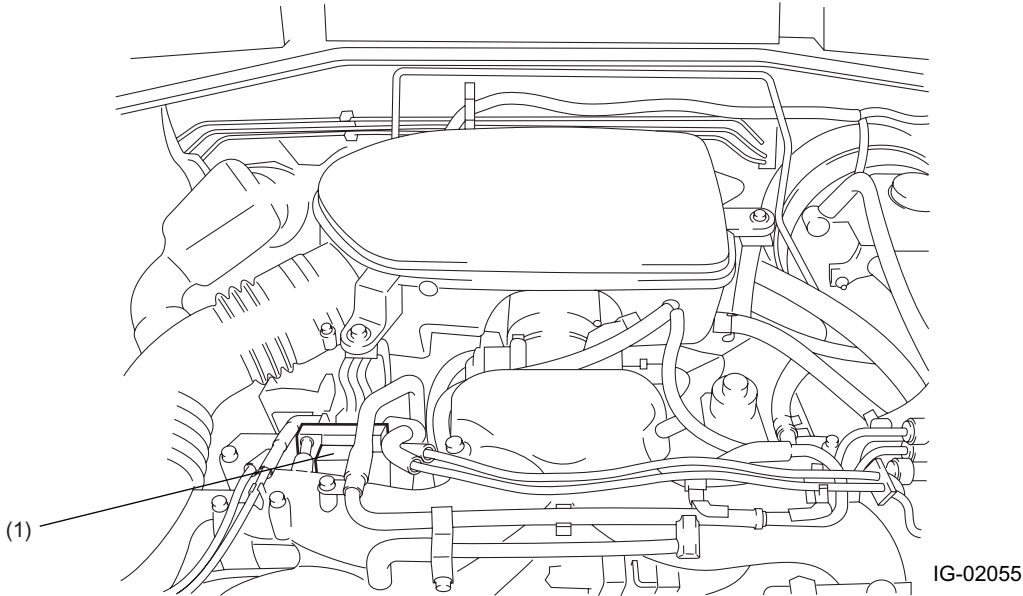
# IGNITION COIL

## IGNITION

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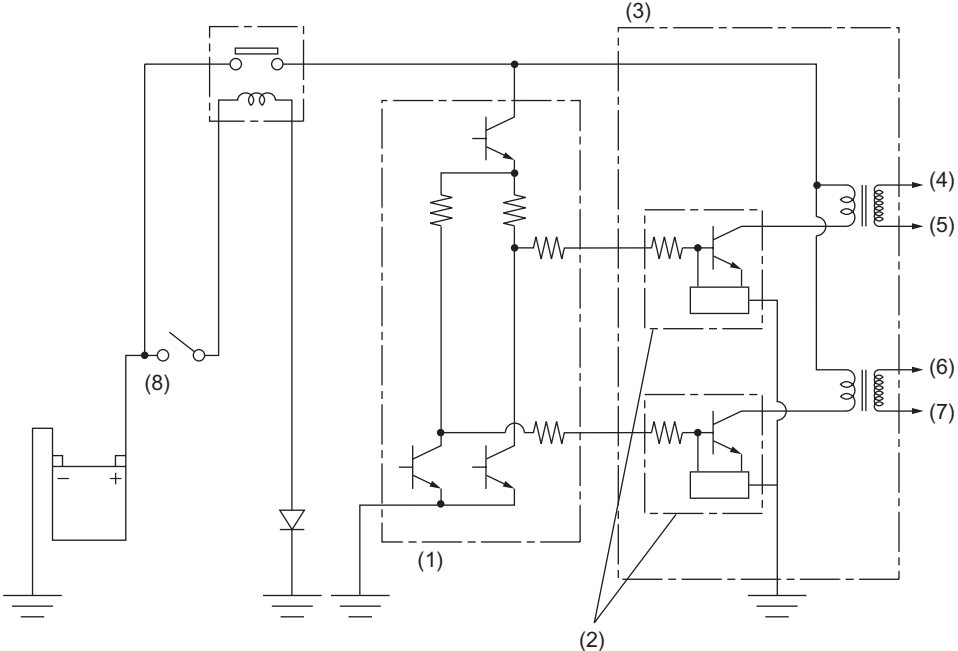
### 1. Ignition Coil

Ignition coils are made integral with an igniter. The ignition system is of a dual-ignition-coil design, each coil causing two plugs to generate sparks simultaneously. In response to the signal from the ECM, the igniter supplies current to an ignition coil and the ignition coil supplies high-voltage current to a pair of spark plugs (#1 and #2 or #3 and #4) simultaneously.



(1) Ignition coil and igniter assembly

# IGNITION COIL



IG-00103

- (1) ECM
- (2) Igniter
- (3) Ignition coil
- (4) Spark plug #1
- (5) Spark plug #2
- (6) Spark plug #3
- (7) Spark plug #4
- (8) Ignition switch

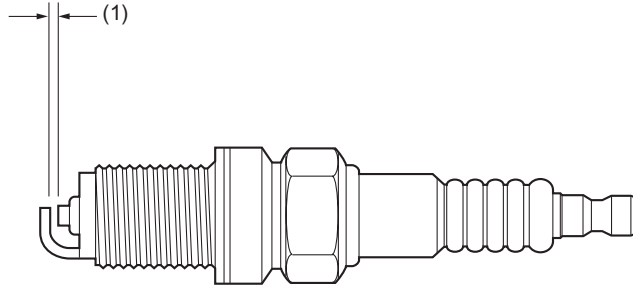
# SPARK PLUG

IGNITION

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## 2. Spark Plug

The spark plug's thread diameter is 14 mm (0.551 in) and the gap is controlled to a value between 1.0 and 1.1 mm (0.039 and 0.043 in).



IG-00035

(1) Gap: 1.0 — 1.1 mm (0.039 — 0.043 in)

**IG(H4SO)-4**

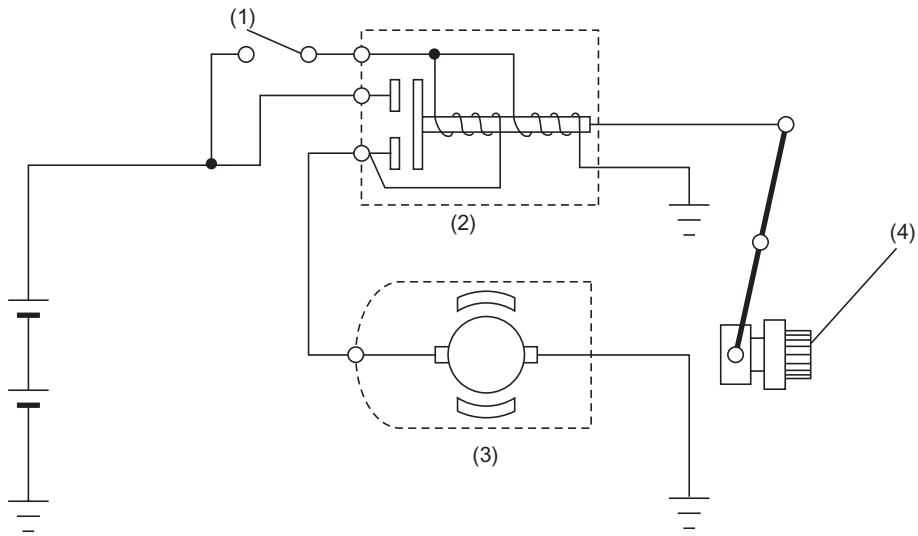
# STARTER

STARTING/CHARGING

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## 1. Starter

The starter is of a reduction type.



SC-02008

- (1) Starter switch
- (2) Magnet switch
- (3) Starter
- (4) Pinion

## 2. Generator

The generator has a built-in regulator which provides diagnostic functions in addition to a voltage regulating function as follows:

1) Voltage regulation

The on-off operation of transistor connects and disconnects the field current circuit, providing a constant level of output voltage.

2) Diagnosis warning

When any of the following problems occur, the charge light illuminates.

(1) No voltage generation

Brush wear exceeds specified wear limits, field coil circuit is broken, etc.

(2) Excessive output

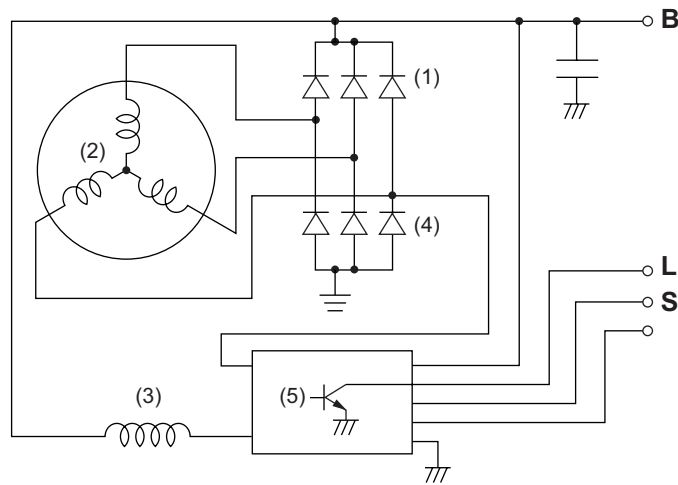
Output voltage is greater than 16 volts (approx.)

(3) Terminal B disconnection

Harness is disconnected from generator terminal B.

(4) Terminal S disconnection

Harness is disconnected from generator terminal S. In this case, voltage is slightly greater than specified regulated voltage; however, voltage regulation is still controlled and the battery is prevented from becoming overcharged.



SC-02093

(1) Positive side diodes (3 pcs.)

(4) Negative side diodes (3 pcs.)

(2) Stator coil

(5) IC regulator

(3) Field coil

# BATTERY

STARTING/CHARGING

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## **3. Battery**

The battery is located in the left front part of the engine compartment. It is held on a tray by the battery holder.



# GENERAL

## FUEL INJECTION (FUEL SYSTEM)

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### 1. General

- The Multipoint Fuel Injection (MFI) system supplies optimum air-fuel mixture under every engine operating condition through the use of the latest electronic control technology.

This system pressurizes the fuel to a constant pressure and injects it into each intake air port in the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where an electro-magnetic injection valve or injector opens for a short period that is precisely controlled depending on the quantity of air appropriate for each condition of operation. In actual control, an optimum fuel injection quantity is achieved by varying the duration of an electric pulse applied to the injector. This way of control enables simple, yet highly precise metering of the fuel.

- The engine control module (ECM) that controls the fuel injection system corrects the fuel injection amount depending on the vehicle speed, throttle opening, coolant temperature and other vehicle-operation-related information. The ECM receives the information in the form of electric signals from the corresponding sensors and switches.

The MFI system also has the following features:

- Reduced exhaust emissions
- Reduced fuel consumption
- Increased engine output
- Quick response to accelerator and brake pedal operation
- Superior startability and warm-up performance in cold weather due to corrective controls made according to coolant and intake air temperatures

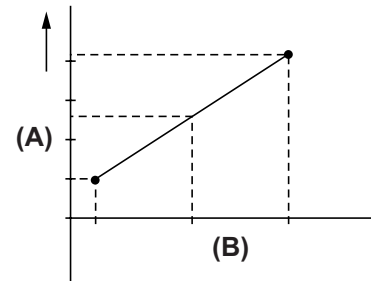
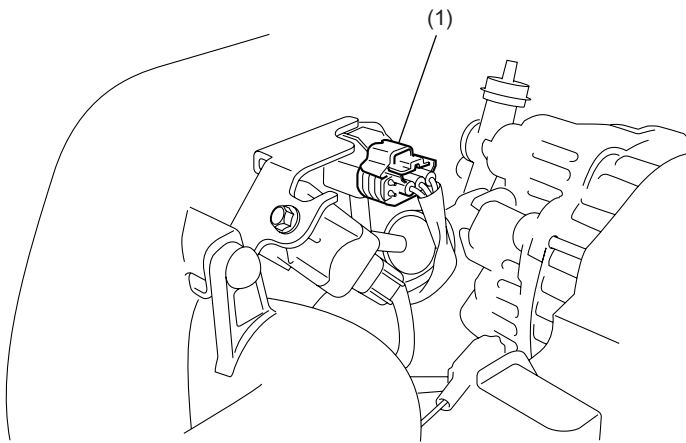
## 2. Air Line

### A: GENERAL

The air filtered by the air cleaner enters the throttle body where it is regulated in the volume by the throttle valve and then enters the intake manifold. It is then distributed to each cylinder where the air is mixed with fuel injected by the injector.

### B: MANIFOLD ABSOLUTE PRESSURE SENSOR

The manifold absolute pressure sensor is attached to the intake manifold, and continuously sends to the engine control module (ECM) voltage signals that are proportional to intake manifold absolute pressures. The ECM controls the fuel injection and ignition timing based on the intake manifold absolute pressure signals in addition to other signals from many sensors and other control modules.



FU-01239

(1) Manifold absolute pressure sensor

(A) Output voltage

(B) Absolute pressure

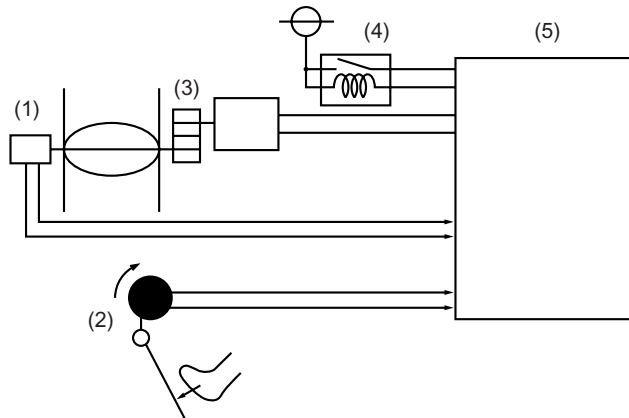
# AIR LINE

## FUEL INJECTION (FUEL SYSTEM)

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### C: ELECTRONIC CONTROL THROTTLE SYSTEM

- The electronic control throttle system consists of an accelerator pedal position sensor mounted on the accelerator pedal, a throttle position sensor and a throttle motor mounted on the throttle body, and the ECM which controls these devices.
- The movement of the accelerator pedal is converted into electrical signals by the accelerator pedal position sensor and sent to the ECM. Based on these signals the ECM controls the throttle motor to open and close the throttle valve.
- Idling control is now performed by the electronic control throttle system in place of the idle air control solenoid valve.



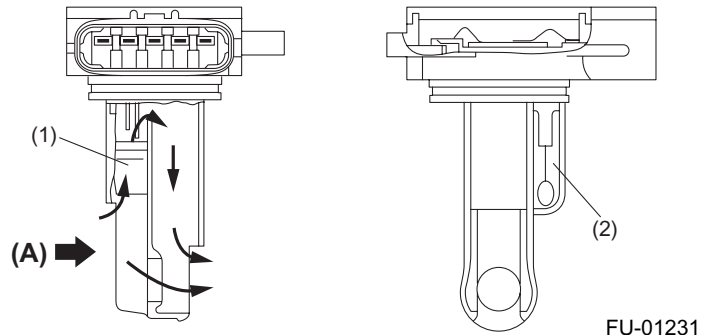
FU-01230

- |  |                                       |
|--|---------------------------------------|
| (1) Throttle position sensor             | (4) Electronic control throttle relay |
| (2) Accelerator pedal position sensor    | (5) ECM                               |
| (3) Electronic control throttle assembly |                                       |

## D: MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR

The mass air flow and the intake air temperature sensors are integrated into a single unit. The unit is mounted on the air cleaner case and measures the amount as well as the temperature of the intake air.

The measured amount and temperature are converted into electrical signals and sent to the ECM. The ECM uses these signals to control injection and ignition timing as well as the fuel injection amount.



- (1) Mass air flow sensor
- (2) Intake air temperature sensor

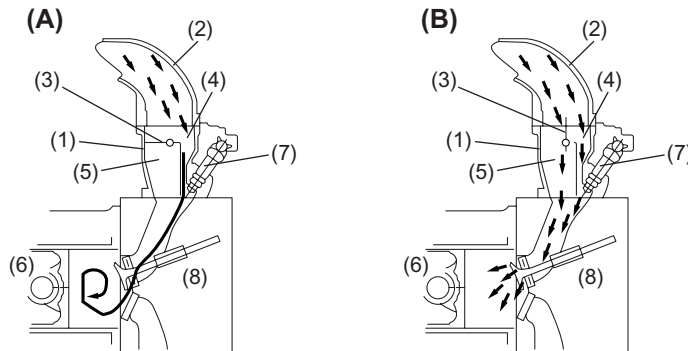
(A) Air

# AIR LINE

## FUEL INJECTION (FUEL SYSTEM)

### E: TUMBLE GENERATOR VALVE

- A tumble generator valve is provided on each engine bank, between the intake manifold and intake air ports. The right bank tumble generator valve has butterfly valves for the #1 and #3 cylinders and the left bank tumble generator valve has those for the #2 and #4 cylinders. The two butterfly valves in each tumble generator valve are fitted on a single shaft that is driven by an actuator.
- The tumble generator valves are controlled by the ECM according to the coolant temperature and the time elapsed after start of the engine. When the engine is started, the butterfly valves are moved to the closing ends. In this state, the intake air flows at very high speeds passing through narrowed passages in the directions determined by the individual intake air ports in the cylinder head. This creates tumbling air motions in the cylinders, which enables lean mixtures to be ignited and thus harmful exhaust emissions to be reduced during engine start. The tumble generator valves are fully open when the engine is operating at an ordinary driving speed, allowing intake air to flow without being changed in direction and velocity.



FU-01232

**(A)** When closed

**(B)** When wide open

(1) Tumble generator housing

(2) Intake manifold

(3) Tumble generator valve

(4) Tumble generating air passage

(5) Intake main air passage

(6) Piston

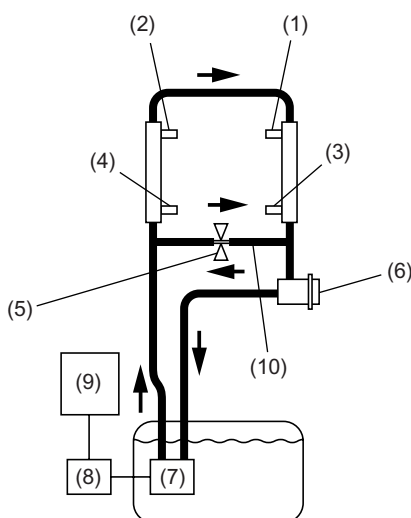
(7) Injector

(8) Cylinder head

## 3. Fuel System

### A: GENERAL

- The fuel pressurized by the fuel tank inside pump is delivered to each fuel injector by way of the fuel pipe and fuel filter. Fuel injection pressure is regulated to an optimum level by the pressure regulator.
- Each injector injects fuel into the intake port of the corresponding cylinder where the fuel is mixed with air. The mixture then enters the cylinder. Fuel injection amount and timing are regulated by the ECM.
- On some models, the fuel bypass return passage connected between the fuel pump and engine prevents excessive fuel to be supplied to the engine and lowers the fuel temperature after return, to reduce the generation of evaporative gas.



FU-02027

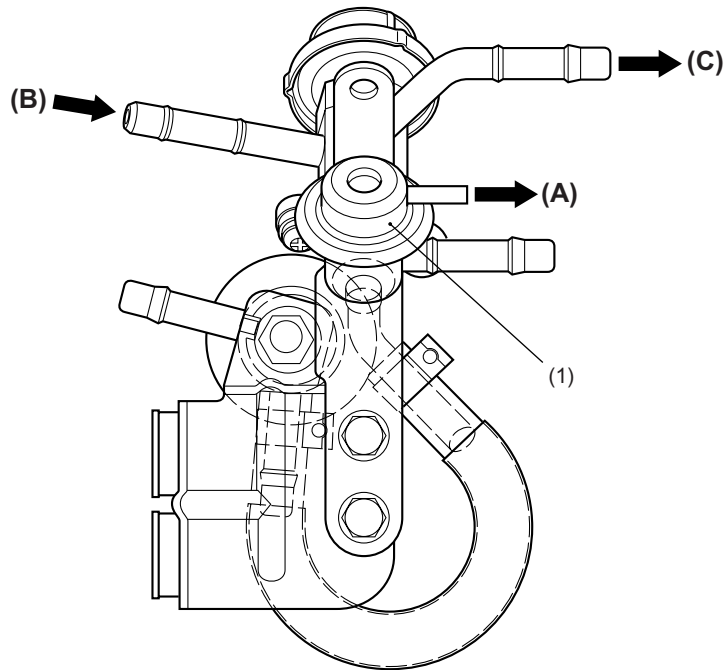
- |                      |                            |
|----------------------|----------------------------|
| (1) #1 fuel injector | (6) Pressure regulator     |
| (2) #2 fuel injector | (7) Fuel pump              |
| (3) #3 fuel injector | (8) Fuel pump control unit |
| (4) #4 fuel injector | (9) ECM                    |
| (5) Orifice          | (10) Fuel return passage   |

# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### B: PRESSURE REGULATOR

The pressure regulator is installed in the fuel supply line. It has a fuel chamber and spring chamber separated by a diaphragm. The fuel chamber is connected to the fuel supply line and the spring chamber is connected to the intake manifold. Fuel chamber also has a relief valve connected to the fuel return line through which fuel returns to the fuel tank. When the intake manifold vacuum increases, the diaphragm is pulled and the relief valve opens to decrease the fuel supply line pressure (or fuel injection pressure). When the intake manifold vacuum decreases, the diaphragm is pushed by the spring to increase the fuel supply line pressure. Thus, the difference between the fuel injection pressure and the intake manifold vacuum is kept at a constant level to precisely control the amount of injected fuel.

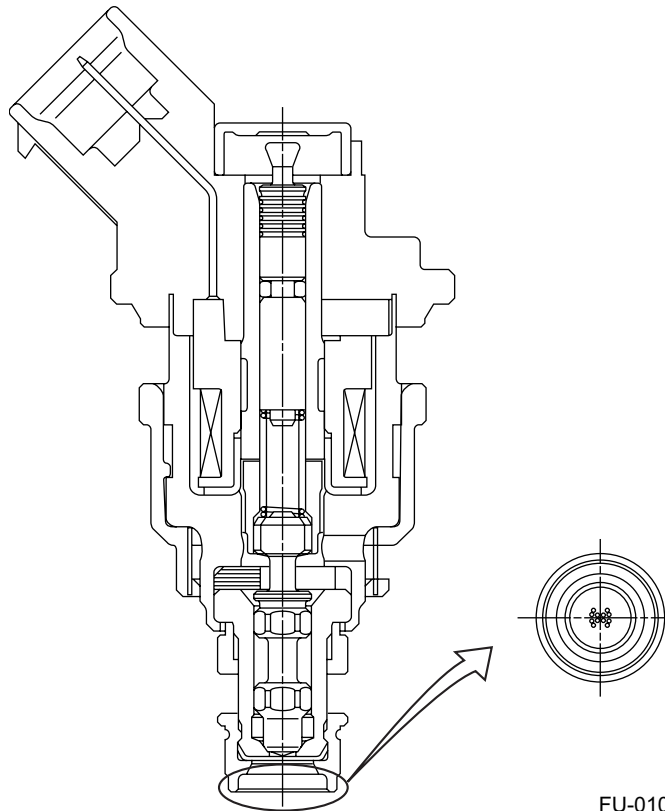


FU-02028

- (1) Pressure regulator
- (A) To intake manifold
- (B) Fuel IN
- (C) Fuel OUT

### C: FUEL INJECTOR

- The MFI system employs side feed type fuel injectors.
- Each injector is installed in the fuel pipe in such a way that the injector is cooled by fuel.
- The features of this type of fuel injector are as follows:
  - 1) High heat resistance
  - 2) Low driving noise
  - 3) Easy to service
  - 4) Small size
- The injector injects fuel according to the valve open signal from the ECM. The needle valve is lifted by the solenoid which is energized on arrival of the valve open signal.
- Since the injector's nozzle hole area, the lift of valve and the fuel pressure are kept constant, the amount of fuel injected is controlled only by varying the duration of the valve open signal from the ECM.
- The multi-hole nozzle makes it possible for the injector to produce fine fuel particles, which enhances the combustion efficiency and output performance of the engine.





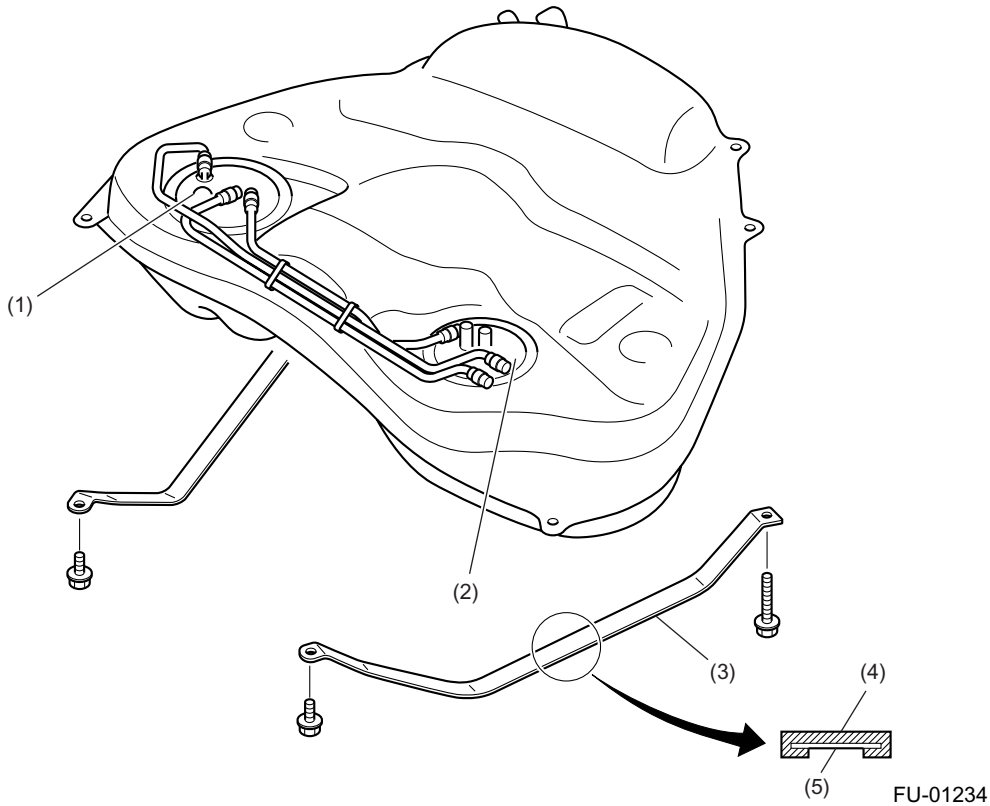
# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### D: FUEL TANK

The fuel tank utilizes a two-compartment design to ensure sufficient capacity without interfering with the rear differential. It is provided with a suction jet pump (included in the fuel pump and fuel level sensor assembly) which transfers fuel from one compartment to the other.

Each compartment has an individual fuel level sensor. The fuel tank is located under the rear seat and secured with hold-down bands.



- (1) Fuel pump and fuel level sensor assembly
- (2) Fuel sub level sensor
- (3) Band

- (4) Cushion
- (5) Steel

### E: FUEL PUMP AND FUEL LEVEL SENSOR ASSEMBLY

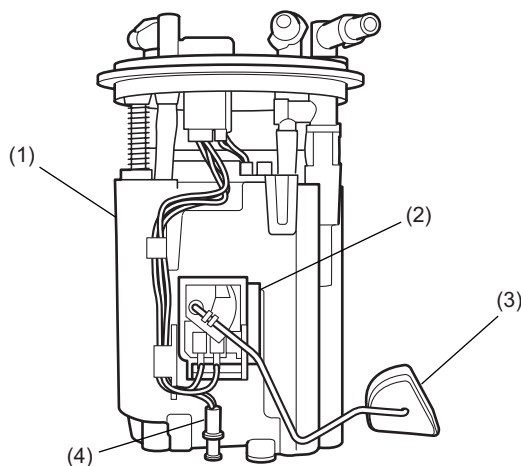
#### 1. FUEL PUMP

The fuel pump consists of a motor, impeller, pump casing, pump cover, check valve and filter. It is located in the fuel tank and combined with the fuel level sensor into a single unit. The operation of this impeller type pump is very quiet.

- When the ignition switch is turned ON, fuel pump relay is activated. Then the motor operates to rotate the impeller.
- As the impeller rotates, fuel in a vane groove of the impeller flows along the fuel passage into the next vane groove by centrifugal force. When fuel flows from one groove to the next, a pressure difference occurs due to friction. This creates a pumping effect.
- The fuel pushed up by rotation of the impeller then passes through the clearance between the armature and the magnet of the motor and is discharged through the check valve.
- When the fuel discharge pressure reaches the specified level, the relief valve opens and excess fuel is released into the fuel tank. In this manner, the relief valve prevents an abnormal increase in fuel pressure.
- When the engine and the fuel pump stop, the check valve closes the discharge port, so that the fuel pressure in the fuel delivery line is retained.

#### 2. FUEL LEVEL SENSOR

The fuel level sensor is integrated with the fuel pump which is located in the fuel tank. The sensor outputs an electric resistance signal that varies with movement of its float to indicate the level of the fuel remaining in the tank.



FU-02519

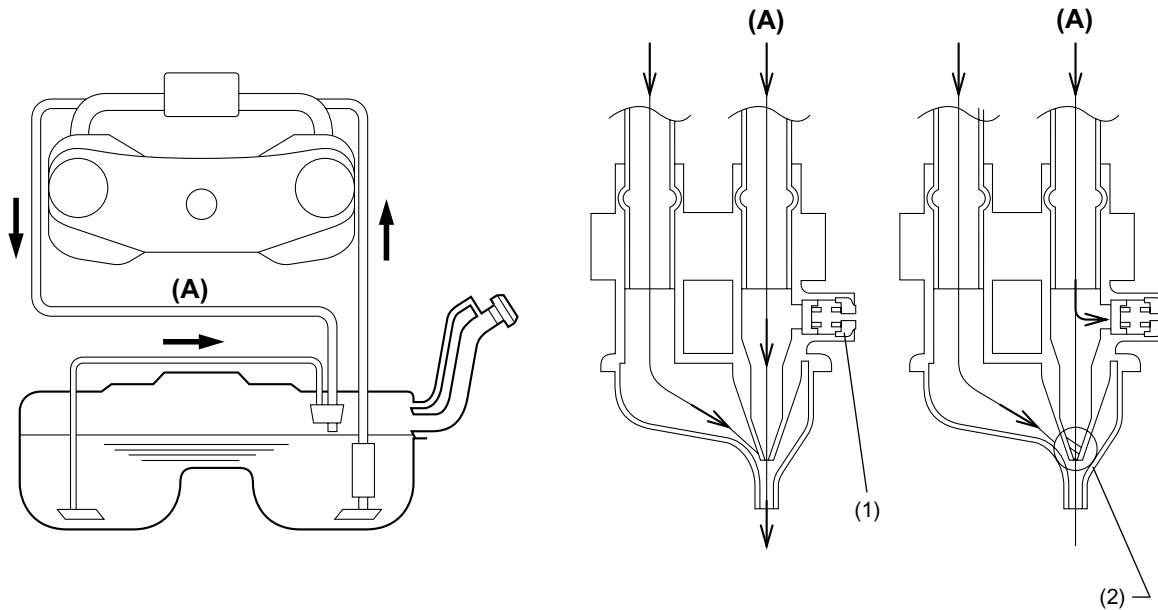
- (1) Fuel pump assembly
- (2) Fuel level sensor
- (3) Float
- (4) Fuel temperature sensor

# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### 3. JET PUMP

- The jet pump utilizes the velocity of fuel returning from the engine to produce vacuum in it.
- Using the pumping effect produced by the vacuum, the jet pump transfers fuel from the sub side and main side of the fuel tank to the fuel pump.
- When the return line nozzle is clogged, the fuel sent back through the return line flows back into the fuel tank via the relief valve.



FU-00226

- (1) Relief valve
- (2) Nozzle

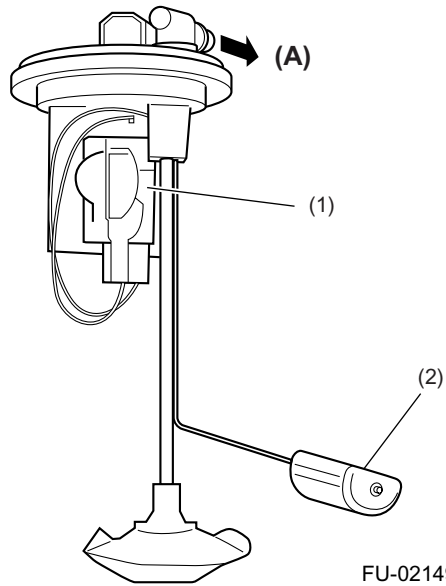
(A) Return line

### 4. FUEL FILTER

The fuel filter is integrated with the fuel pump assembly which is located in the fuel tank.

### F: SUB-COMPARTMENT FUEL LEVEL SENSOR

This sensor detects the level of the fuel in the sub side (the side in which the fuel pump is not located) of the fuel tank. Also, when the jet pump is operating, fuel in the sub side is drawn up and transferred to the fuel pump.



- (1) Fuel level sensor
- (2) Float

(A) To jet pump

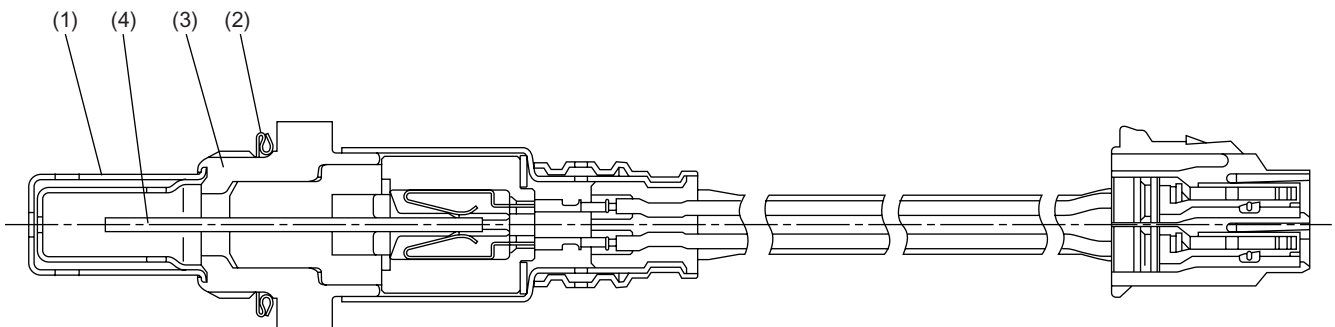
# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

### 4. Sensors and Switches

#### A: FRONT OXYGEN (A/F) SENSOR

- The front oxygen sensor uses zirconium oxide ( $ZrO_2$ ) which is a solid electrolyte, at portions exposed to exhaust gas.
- The zirconium oxide has the property of generating electromotive force when its both sides are exposed to oxygen ions of different concentration and the magnitude of this electromotive force depends on how much the difference is.  
The front oxygen (A/F) sensor detects the amount of oxygen in exhaust gases by making use of this property of the zirconium oxide material.
- The zirconium oxide material is formed into a closed end tube and its external surface is exposed to exhaust gases with smaller oxygen ion concentration, whereas its internal surface is exposed to atmospheric air. The external surface has a porous platinum coating. The sensor housing is grounded to the exhaust pipe and the inside is connected to the ECM through the harness to be able to use the current output from the sensor.
- The sensor incorporates a ceramic heater to improve its performance at low temperatures.



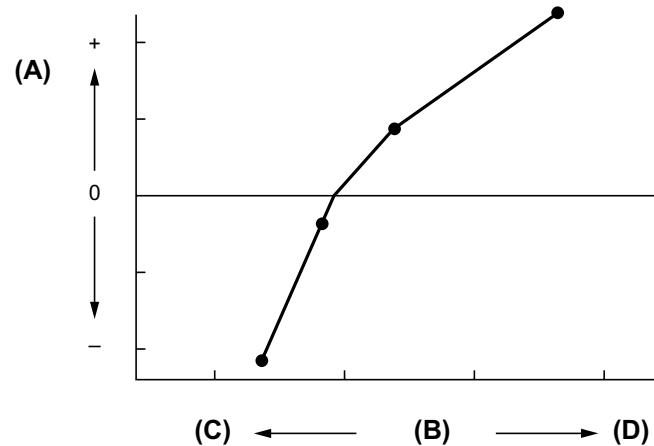
FU-02163

- (1) Protection tube
- (2) Gasket
- (3) Sensor housing
- (4) Ceramic heater

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconia tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The front oxygen (A/F) sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 700°C (1,292°F).



FU-02015

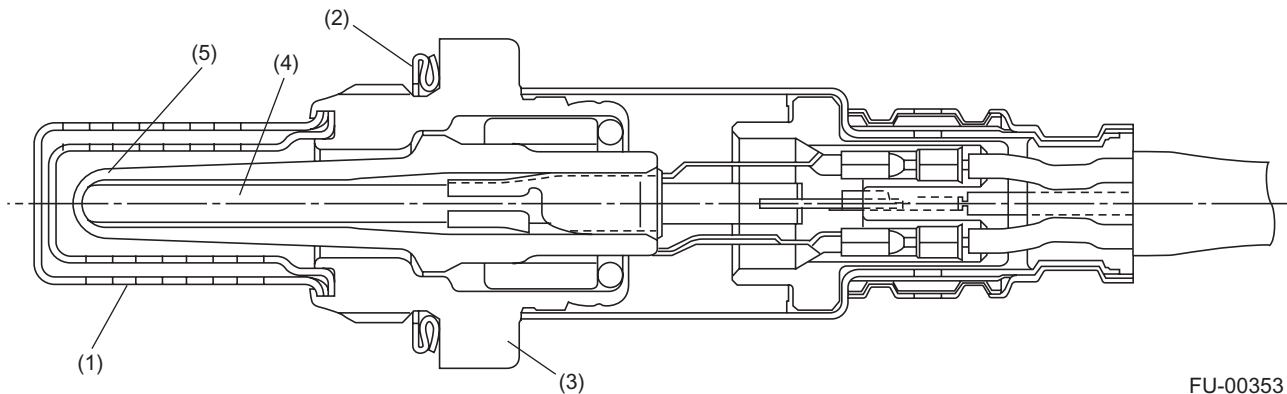
- (A) Current
- (B) Air/fuel ratio
- (C) Rich
- (D) Lean

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

### B: REAR OXYGEN SENSOR

- The rear oxygen sensor is used to sense oxygen concentration in the exhaust gas. If the air-fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e., excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains almost no oxygen.
- By detecting the oxygen concentration in the exhaust gas using the oxygen sensor makes it possible to determine whether the air-fuel ratio is leaner or richer than the stoichiometric ratio.
- The rear oxygen sensor has a zirconia tube (ceramic) which generates voltage if there is a difference in oxygen ion concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconia tube as a catalysis and electrode material. The sensor housing is grounded to the exhaust pipe and the inside is connected to the ECM through the harness.
- A ceramic heater is employed to improve performance at low temperatures.



FU-00353

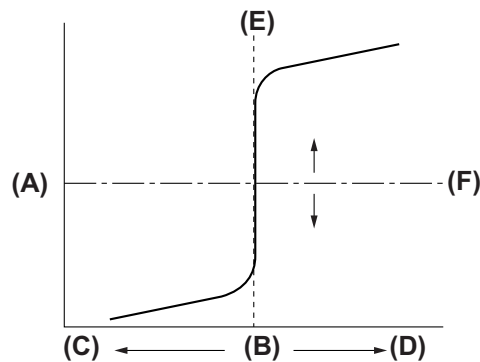
- (1) Protection tube
- (2) Gasket
- (3) Sensor housing

- (4) Ceramic heater
- (5) Zirconia tube

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconia tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The rear oxygen sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 300 to 400°C (572 to 752°F).



FU-02016

- (A) Electromotive force
- (B) Air/fuel ratio
- (C) Lean
- (D) Rich
- (E) Stoichiometric ratio
- (F) Comparison voltage



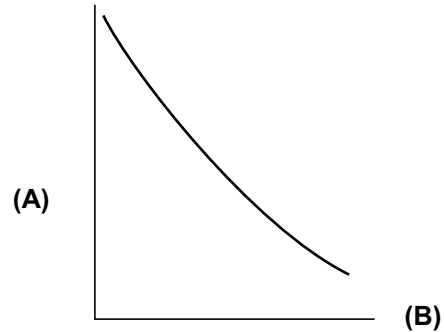
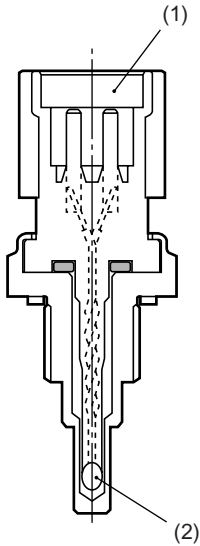
# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

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### C: ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor is located on the engine coolant pipe. The sensor uses a thermistor whose resistance changes inversely with temperature. Resistance signals as engine coolant temperature information are transmitted to the ECM to make fuel injection, ignition timing, purge control solenoid valve and other controls.



FU-02017

- (1) Connector
- (2) Thermistor element

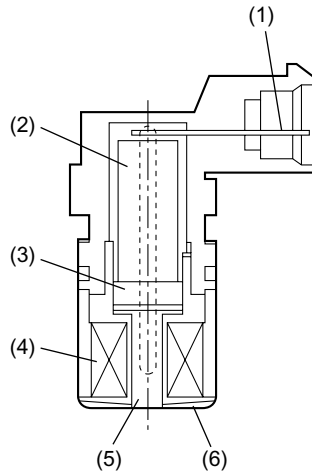
- (A) Resistance (kΩ)
- (B) Temperature °C (°F)

### D: EXHAUST GAS TEMPERATURE SENSOR

The exhaust gas temperature sensor is located on the joint pipe and used to monitor the condition of the pre-catalytic converter.

## E: CRANKSHAFT POSITION SENSOR

- The crankshaft position sensor is installed on the oil pump which is located in the front center portion of the cylinder block. The sensor generates a pulse when one of the teeth on the perimeter of the crankshaft sprocket (rotating together with the crankshaft) passes in front of it. The ECM determines the crankshaft angular position by counting the number of pulses.
- The crankshaft position sensor is a magnet pickup type and is molded with components such as a magnet, core, coil, and terminal, etc.



FU-00234

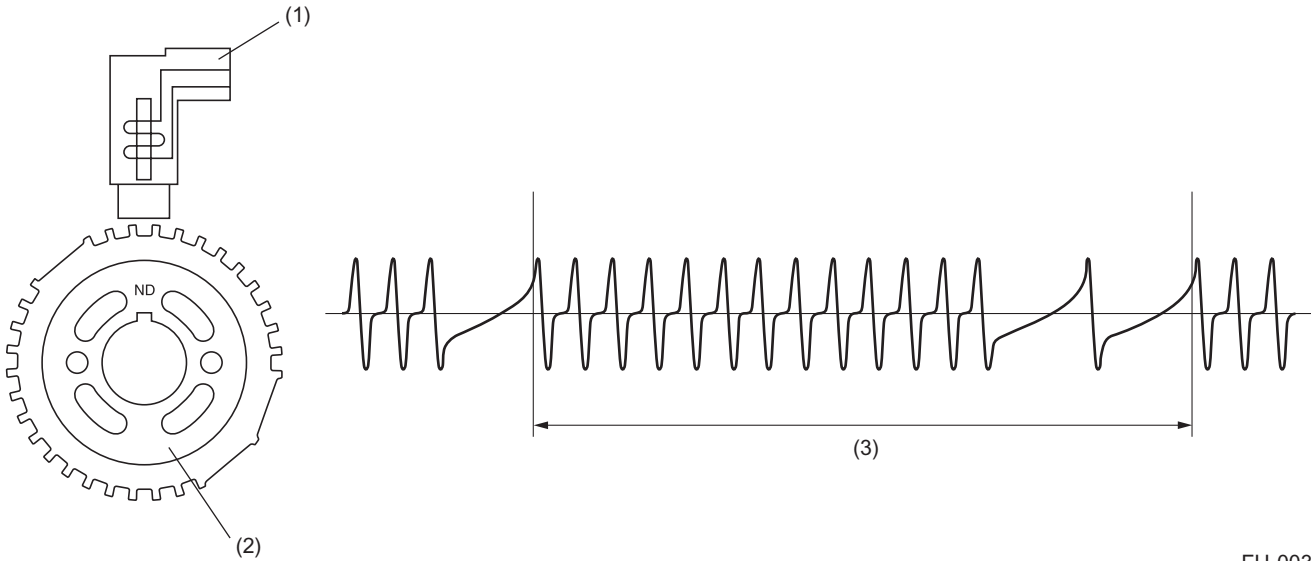
- (1) Terminal
- (2) Yoke core
- (3) Magnet

- (4) Coil
- (5) Core
- (6) Cover

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- As the crankshaft rotates, each tooth aligns with the crankshaft position sensor. At that time, the magnetic flux in the sensor's coil changes since the air gap between the sensor pickup and the sprocket changes. This change in magnetic flux induces a voltage pulse in the sensor and the pulse is transmitted to the ECM.

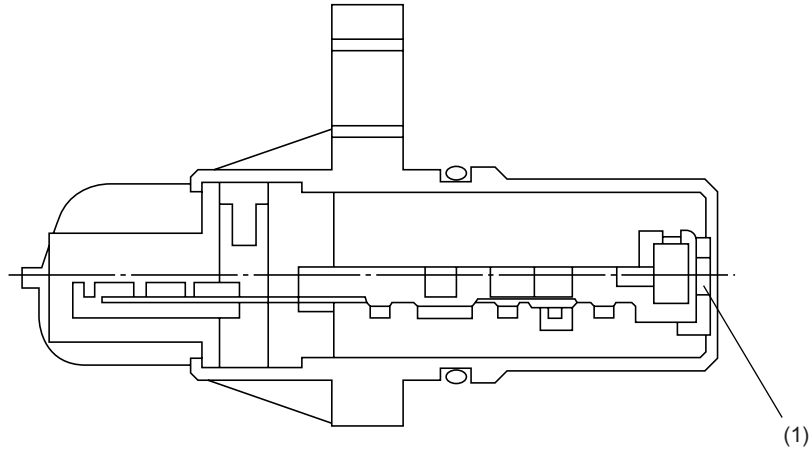


FU-00354

- (1) Crankshaft position sensor
- (2) Crankshaft sprocket
- (3) Crankshaft half rotation

## F: CAMSHAFT POSITION SENSOR

- The camshaft position sensor is located on the cylinder head.
- A hall element is used in this sensor and its construction is as shown below.



FU-02029

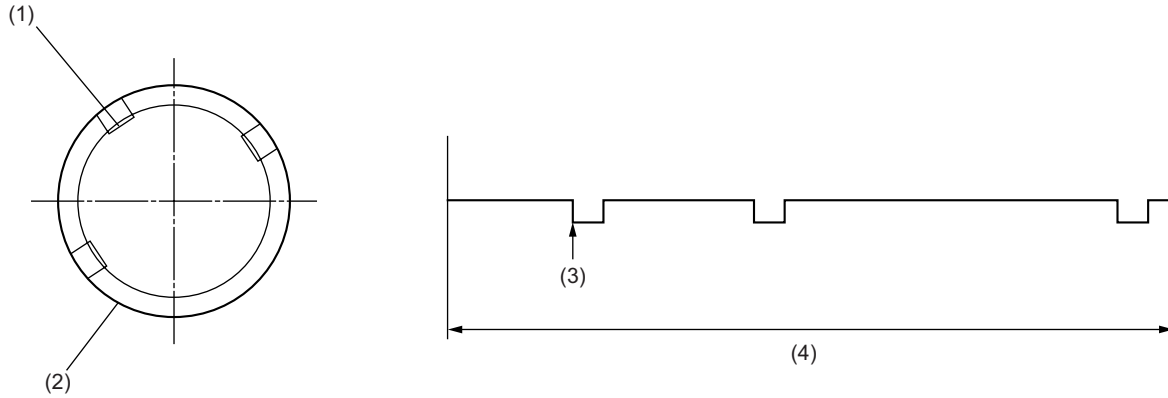
(1) Hall element

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

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- The sensor generates a pulse when one of the slots in the camshaft passes in front of the sensor. The ECM detects the camshaft position by measuring the pulse. Three slots are provided on the camshaft as shown below.

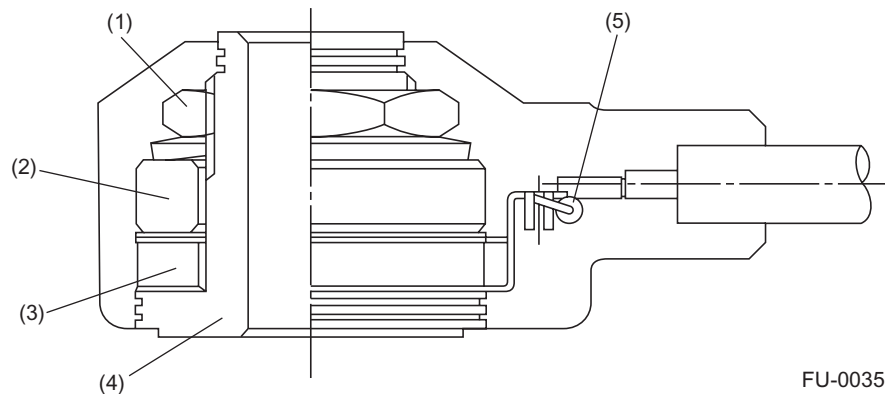


FU-01151

- (1) Slot
- (2) Camshaft
- (3) Detection point
- (4) Camshaft one rotation (crankshaft two rotations)

## G: KNOCK SENSOR

- The knock sensor is installed on the cylinder block, and senses knocking that occurs in the engine.
- The sensor is a piezo-electric type which converts vibration resulting from knocking into electric signals.
- In addition to a piezo-electric element, the sensor has a weight and case as its components. If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.
- The knock sensor harness is connected to the engine harness.



FU-00356

- (1) Nut
- (2) Weight
- (3) Piezo-electric element
- (4) Housing
- (5) Resistance

## H: VEHICLE SPEED SENSOR

Vehicle speed signals are sent from the vehicle speed sensor to the ABS and VDC control modules. The signals are sent to the ECM via CAN communication. For details, refer to the LAN section. <Ref. to LAN section.>

### 5. Control System

#### A: GENERAL

The ECM receives signals from various sensors, switches, and other control modules. Using these signals, it determines the engine operating conditions and if necessary, emits signals to one or more systems to control them for optimum operation.

Major control items of the ECM are as follow:

- Fuel injection control
- Ignition control
- Idle air control
- Fuel pump control
- Canister purge control\*<sup>1</sup>
- Radiator fan control\*<sup>2</sup>
- On-board diagnosis function

\*1: Canister purge control is described under EC(H4DOTC) — Emission Control (Aux. Emission Control Devices) Evaporative Emission Control System. <Ref. to EC(H4DOTC) section, Evaporative Emission Control System.>

\*2: Radiator fan control is described under CO(H4DOTC) — COOLING. <Ref. to CO(H4DOTC) section.>

# CONTROL SYSTEM

FUEL INJECTION (FUEL SYSTEM)

## B: INPUT AND OUTPUT SIGNALS

Signal	Unit	Function
Input signals	Manifold absolute pressure sensor	Detects the pressure (measures the absolute pressure) of intake air .
	Mass air flow and intake air temperature sensor	Detects the temperature and amount of intake air.
	Throttle position sensor	Detects the throttle valve position.
	Front oxygen (A/F) sensor	Detects the density of oxygen in exhaust gases at the upstream of the front catalytic converter.
	Rear oxygen sensor	Detects the density of oxygen in exhaust gases at the downstream of the front catalytic converter.
	Crankshaft position sensor	Detects the crankshaft angular position.
	Camshaft position sensor	Detects the combustion cylinder.
	Engine coolant temperature sensor	Detects the engine coolant temperature.
	Knock sensor	Detects engine knocking.
	Accelerator position sensor	Detects the position of the accelerator pedal.
	Exhaust gas temperature sensor	Detects the exhaust gas temperature.
	Fuel temperature sensor	Detects the temperature of the fuel in the fuel tank.
	Fuel tank pressure sensor	Detects the evaporation gas pressure in the fuel tank.
	Ignition switch	Detects operation of the ignition switch.
	Starter switch	Detects the condition of engine cranking.
	Neutral position switch (MT)	Detects that the gear is in neutral.
	Inhibitor switch (AT)	Detects shift positions.
	A/C switch	Detects ON-OFF operation of the A/C switch.
	Power steering switch	Detects the steering condition.
	Output signals	Fuel injector
Ignition signal		Turns the primary ignition current ON or OFF.
Electronic control throttle		Controls motor output to the electronic control throttle.
Oil flow control solenoid valve		Controls oil pressure for oil flow control solenoid valve.
Fuel pump control unit		Controls the fuel pump.
A/C control relay		Turns ON or OFF the A/C control relay.
Radiator fan control relay		Turns ON or OFF the radiator fan control relay.
Wastegate control solenoid valve		Controls supercharging pressure
Engine malfunction indicator light (MIL)		Indicates existence of abnormality.
Purge control solenoid valve		Controls purge of evaporative gas absorbed by the canister.
Tumble generator valve actuator		Operates the tumble generator valve.
Pressure control solenoid valve		Controls evaporation pressure in fuel tank.
Drain valve		Closes the evaporation line between the fuel tank and canister to detect leakage of evaporation gases.
Oil flow control solenoid valve		Controls advance and retard angles of the intake valves.
Heater circuit of front and rear oxygen sensors		Controls the heater of the front and rear oxygen sensors.
Electronic control throttle motor cut relay		Turns ON-OFF the electronic control throttle motor relay.
Power supply		Controls ON/OFF of the main power supply relay.



# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### C: FUEL INJECTION CONTROL

- The ECM receives signals from various sensors and based on them, it determines the amount of fuel injected and the fuel injection timing. It performs the sequential fuel injection control over the entire engine operating range except during start-up of the engine.
- The amount of fuel injected depends upon the length of time the injector stays open. The fuel injection duration is determined according to varying operating condition of the engine. For the purpose of achieving highly responsive and accurate fuel injection duration control, the ECM performs a new feedback control that incorporates a learning feature as detailed later.
- The fuel injection control is performed such that fuel is injected accurately at the time when the maximum efficiency can be achieved for each cylinder.

#### 1. FUEL INJECTION DURATION

Fuel injection duration is basically determined as indicated below:

- While cranking the engine:

The duration defined below is used.

- Duration of fuel injection during engine start-up ..... Determined according to the engine coolant temperature detected by the engine coolant temperature sensor.

- During normal operation:

The duration is determined as follows:

Basic duration of fuel injection × Correction factors + Voltage correction time

- Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors — the amount of intake air detected by the air flow sensor and the engine speed monitored by the crankshaft position sensor.
- Correction factors ..... See the next section.
- Voltage correction time ..... This is added to compensate for the time lag before operation of injector that results from variation in the battery voltage.

### 2. CORRECTION FACTORS

The following factors are used to correct the basic duration of fuel injection in order to make the air-fuel ratio meet the requirements of varying engine operating conditions:

- **Air-fuel ratio feedback factor:**

This factor is used to correct the basic duration of fuel injection in relation to the actual engine speed. (See the next section for more details.)

- **Start increment factor:**

This factor is used to increase the fuel injection duration only while the engine is being cranked to improve its startability.

- **Coolant-temperature-dependent increment factor:**

This factor is used to increase the fuel injection duration depending on engine coolant temperature signals to facilitate cold starting. The lower the coolant temperature, the greater the increment.

- **After-start increment factor:**

- This factor is used to increase the fuel injection duration for a certain period immediately after start of the engine to stabilize engine operation.
- The increment depends on the coolant temperature at the start of the engine.

- **Wide-open-throttle increment factor:**

This factor is used to increase the fuel injection duration depending on the relationship between the throttle position sensor signal and air flow sensor signal.

- **Acceleration increment factor:**

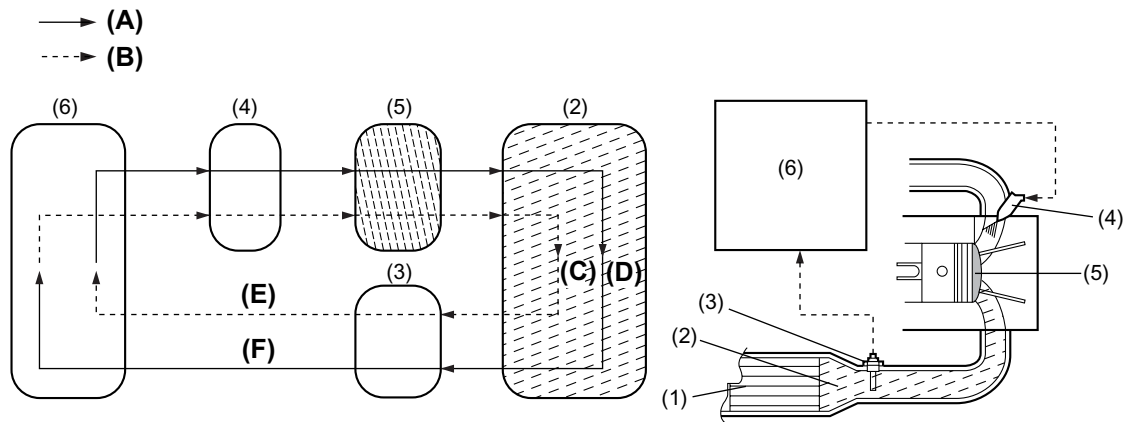
This factor is used to increase the fuel injection duration to compensate for a time lag between air flow measurement and fuel injection control for better engine response to driver's pedal operation during acceleration.

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### 3. AIR-FUEL RATIO FEEDBACK FACTOR

The ECM creates this factor utilizing the front oxygen (A/F) sensor signal. When the signal is high, the air-fuel ratio is leaner than the stoichiometric ratio. The ECM then makes the fuel injection duration longer by modifying the factor. When the signal is low showing that the mixture is rich, the ECM modifies the factor to make the injection duration shorter. In this way, the air-fuel ratio is maintained at a level close to the stoichiometric ratio at which the three-way catalytic converter acts most effectively.



FU-00240

- (1) Front catalytic converter
- (2) Exhaust gases
- (3) Front oxygen (A/F) sensor
- (4) Fuel injector
- (5) Combustion chamber
- (6) ECM

- (A) Injection duration increment signal
- (B) Injection duration decrement signal
- (C) High oxygen density
- (D) Low oxygen density
- (E) Lean signal
- (F) Rich signal

### 4. LEARNING FEATURE

The air-fuel ratio feedback control includes a learning feature which contributes to more accurate and responsive control.

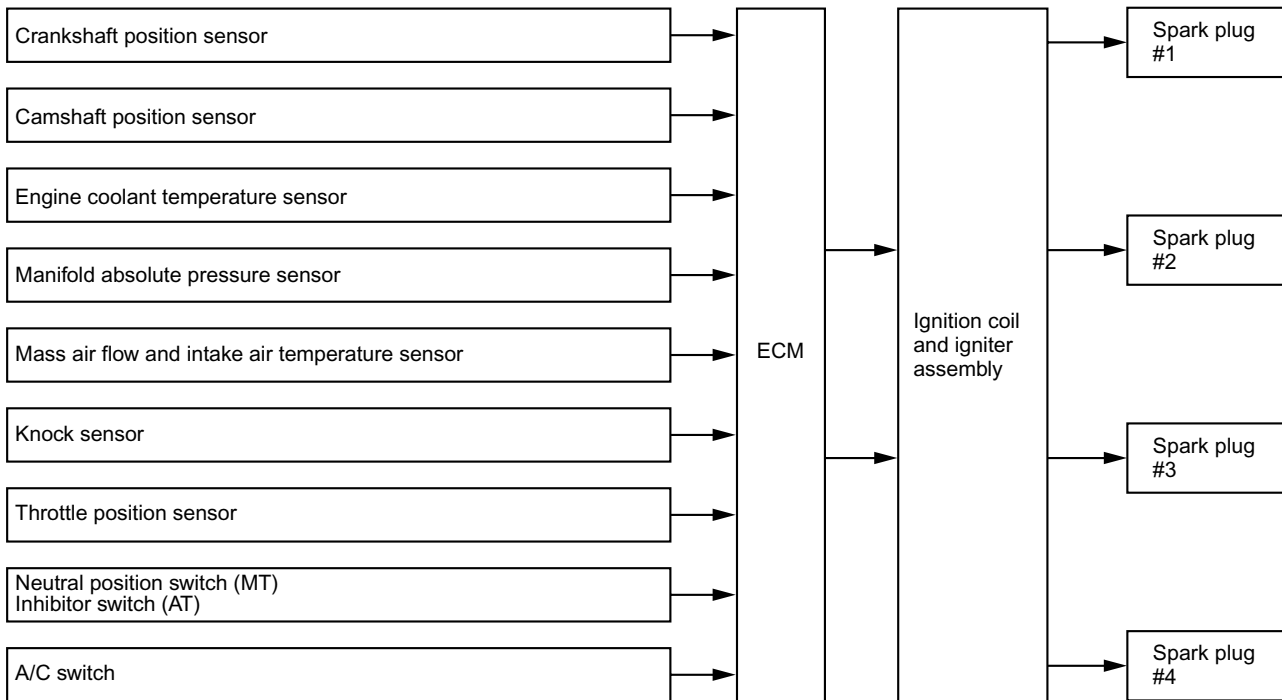
- In the air-fuel ratio feedback control, the ECM calculates the necessary amount of correction based on data from the front oxygen (A/F) sensor and adds the result to the basic duration (which is stored in the ECMs memory for each condition defined by the engine speed and various loads.)
- Without a learning feature, the ECM carries out the above-mentioned process every time. This means that if the amount of necessary correction is large, the air-fuel ratio feedback control becomes less responsive and less accurate.
- The learning feature enables the ECM to store the amount of correction into memory and add it to the basic fuel injection duration to create a new reference fuel injection duration. Using the reference duration as the basic duration for the injection a few times later, the ECM can reduce the amount of correction and thus make its feedback control more accurate and responsive to changes in the air-fuel ratio due to difference in driving condition and sensor/actuator characteristics that may result from unit-to-unit variation or aging over time.

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

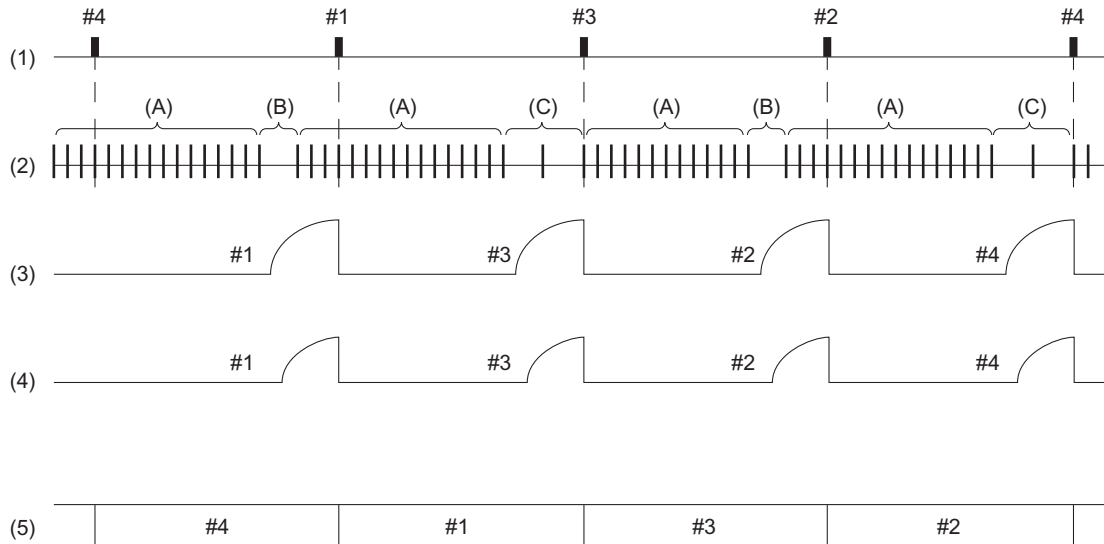
### D: IGNITION CONTROL

- The ECM determines operating condition of the engine based on signals from the manifold absolute pressure sensor, engine coolant temperature sensor, intake air temperature sensor, crankshaft position sensor and other sources. The ECM then selects the ignition timing most appropriate for the condition thus determined from those stored in its memory and outputs at that timing a primary current OFF signal to the igniter to initiate ignition.
- This control uses a quick-to-response learning feature by which the data stored in the ECM memory is processed in comparison with information from various sensors and switches.
- Thus, the ECM can always perform optimum ignition timing taking into account the output, fuel consumption, exhaust gas, and other factors for every engine operating condition.
- Ignition control during start-up  
Engine speed fluctuates during start of the engine, so the ECM cannot control the ignition timing. During that period, the ignition timing is fixed at  $10^\circ$  BTDC by using the  $10^\circ$  signal from the crankshaft position sensor.



FU-02164

- The ECM identifies cylinders at TDC and determines ignition timing as follows:
  - Within the range (A), the crank angle signal is input every 10° rotation of the crankshaft.
  - The ECM discriminates a TDC cylinder group from the other by detecting the ranges (B) and (C) where no signals are input.
  - The ECM judges that the No. 1 and No. 2 cylinders are at TDC when it detects the range (B), and that the No. 3 and No. 4 cylinders are at TDC when it detects the range (C).



FU-00358

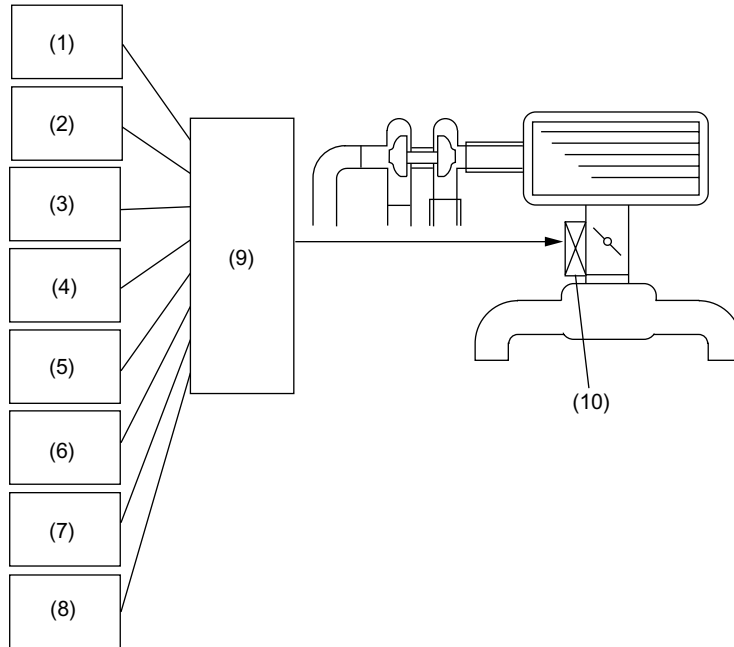
- (1) Cylinder number (TDC)
- (2) Crank angle pulse
- (3) Ignition timing at starting
- (4) Ignition timing at normal condition
- (5) Cylinder at combustion

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### E: IDLE AIR CONTROL

• The ECM controls the electronic control throttle based on signals from the crankshaft position sensor, engine coolant temperature sensor, air flow sensor, manifold absolute pressure sensor and A/C switch so that the proper idle speed for each engine load is achieved.



FU-00359

- |                                       |                                  |
|---------------------------------------|----------------------------------|
| (1) Crankshaft position sensor        | (6) Ignition switch              |
| (2) Camshaft position sensor          | (7) A/C switch                   |
| (3) Throttle position sensor          | (8) Neutral position switch      |
| (4) Engine coolant temperature sensor | (9) ECM                          |
| (5) Vehicle speed sensor              | (10) Electronic control throttle |

### F: FUEL PUMP CONTROL

The ECM controls the operation of the fuel pump through the fuel pump control unit, based on signals from the crankshaft position sensor. To improve safety, a “fuel pump stop signal” is sent from the ECM to the fuel pump control unit to stop the fuel pump if the engine stalls while the ignition switch is ON.

Ignition switch ON	Fuel pump
A certain period of time after ignition switch is turned ON	Operates
While cranking the engine	Operates
While engine is operating	Operates
When engine stops	Does not operate

## 6. On-board Diagnosis System

### A: GENERAL

- The on-board diagnosis system detects and indicates a fault by generating a code corresponding to each fault location. The engine malfunction indicator light on the combination meter indicates occurrence of a fault or abnormality.
- When the malfunction indicator light comes on as a result of detection of a fault by the ECM, the corresponding diagnostic trouble code (DTC) and freeze frame data indicating the engine condition are stored in the ECM.
- On the OBD-II conformable car, it is necessary to connect the SUBARU Select Monitor (SSM) or General Scan Tool (GST) to the data link connector in order to check for DTCs.
- The SSM and GST can be used for erasing DTCs. These can also read freeze frame data in addition to other pieces of engine data.
- If there is a failure involving sensors, which may affect drive control of the vehicle, the fail-safe function ensures minimum level of drivability.

### B: FAIL-SAFE FUNCTION

For a sensor or switch which has been judged faulty in the on-board diagnosis, the ECM, if appropriate, generates an associated pseudo signal to keep the vehicle operational. (The control becomes degraded.)



# SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)

## FUEL INJECTION (FUEL SYSTEM)

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### 7. SUBARU Intelligent Drive System (From '07MY)

#### A: GENERAL

The SI-DRIVE (SUBARU Intelligent Drive) system is a system that allows selection of the vehicle driving mode, from the I (intelligent mode), S (sport mode), and S# (sport sharp mode). The mode is changed using the SI-DRIVE selector on the console.

- I (intelligent mode)

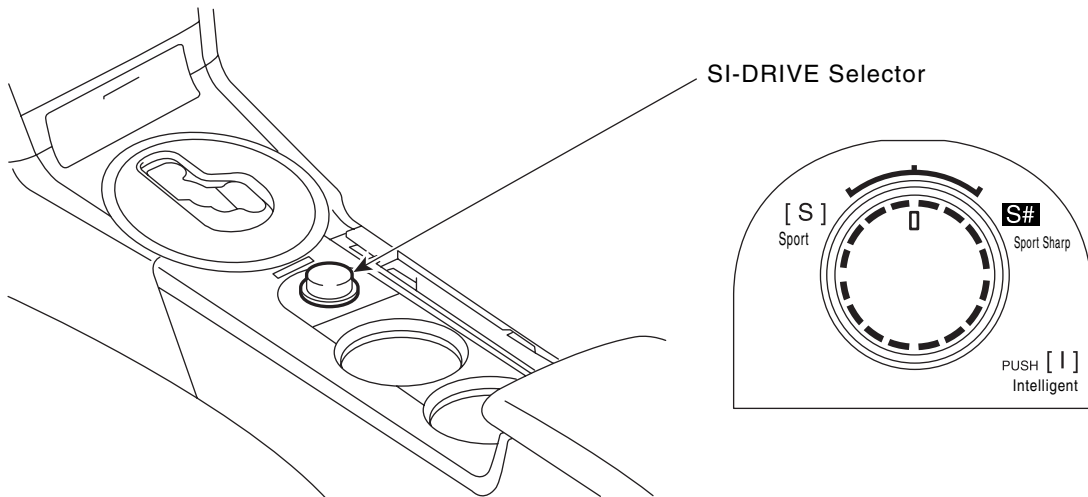
This is a mode that balances stress-free driving and fuel economy. This mode is optimal for driving in city areas where maximum power output is not required.

- S (sport mode)

This is an all-round driving mode that can be used anywhere. This mode is suited for driving on highways and open country roads.

- S# (sport sharp mode)

This is a driving mode for acceleration, etc, where more engine output is required. This mode is suited for driving in mountainous areas, when merging with traffic on highways, and for accelerating to overtake other cars.

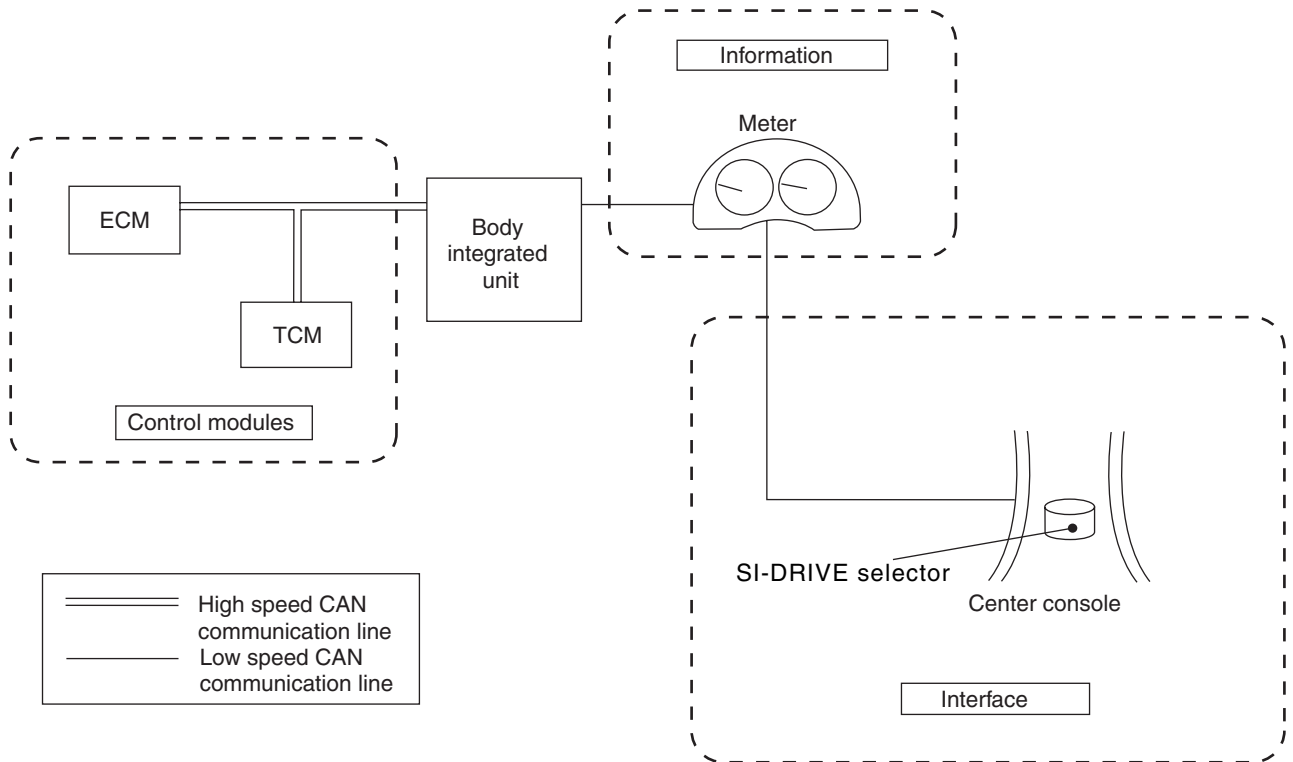


FU-03200

# SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)

FUEL INJECTION (FUEL SYSTEM)

The SI-DRIVE operation will be detected by the meter, and the ECM will be notified that the mode has changed by CAN communication through the integrated unit. The ECM will change the driving modes and display data on the meter.



FU-03201

# SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)

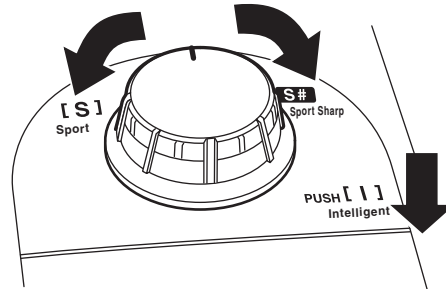
## FUEL INJECTION (FUEL SYSTEM)

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### B: OPERATION

#### SI-DRIVE SELECTOR

It is possible to change modes by turning the knob on the console. Turn the knob counterclockwise for S (sport mode), turn clockwise for S# (sport sharp mode) and push the knob for I (intelligent mode). After turning the knob, it will return to its original position.



FU-03195

## C: MULTI-INFORMATION DISPLAY

- Meter interrupt screen

When a mode change is performed, a mode change screen will be displayed for approximately 3 seconds, indicating which mode was selected. When displaying, a buzzer (blip) will sound.



Displayed for 3 seconds

FU-03191

- SI-DRIVE screen

By operating the control switch on the steering wheel, it is possible to display the SI-DRIVE screen. The SI-DRIVE screen will display a graph that changes according to the drive mode and accelerator opening.

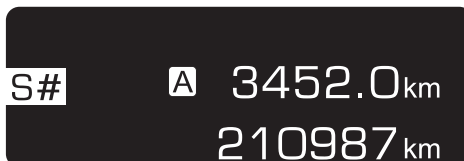


SI-DRIVE display

FU-03192

- Mode display in screens other than SI-DRIVE

The driving mode will be displayed on the left side in screens other than SI-DRIVE.

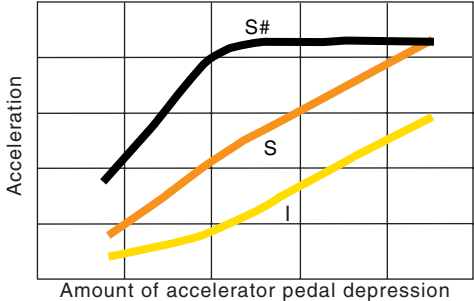


FU-03193

# SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)

## FUEL INJECTION (FUEL SYSTEM)

### D: CONTROLS

	Item	I	S	S#	Content	Remarks
Engine	ETC (electronic throttle control) opening characteristics change	○	○	○	<p>The ECM controls the ETC opening characteristics to match the 3 modes.</p> <ul style="list-style-type: none"> <li>• I (intelligent mode) Milder in characteristics than the S (sport mode) (Maximum torque is restrained).</li> <li>• S (sport mode) Normal throttle characteristics</li> <li>• S# (sport sharp mode) More responsive than the S (sport mode)</li> </ul> <div style="text-align: center;">  <p style="font-size: small;">FU-03190</p> </div>	—
	When restarting	—	—	○	When restarting, the S# (sport sharp mode) will return to the S (sport mode).	—
	When the engine is cold	—	—	○	Until the coolant temperature rises, changing to S# (sport sharp mode) is prohibited. (When change to S# is attempted when S# is prohibited, a buzzer (two blips) will sound.)	—
	Driving mode change prohibited	○	○	○	<ul style="list-style-type: none"> <li>• If the engine warning light becomes lit while the engine is running, the mode will switch to S (sport mode) from whichever mode it is in. In this case, it will not be possible to change to the S# (sport sharp) or I (intelligent) mode.</li> <li>• If the coolant temperature is high and there is a possibility of overheating, it will not be possible to change to S# (sport sharp mode). While driving in the S# (sport sharp mode), it will switch automatically to the S (sport mode).</li> </ul>	While driving mode switching is prohibited, the driving mode display on the meter will flash.
	When in reverse [R]	○	○	○	<ul style="list-style-type: none"> <li>• MT vehicles Individual mode characteristics</li> <li>• AT vehicles Change to S (sport) mode characteristic. (However, the meter display remains in S# (sport sharp mode) set before shifting to [R].)</li> </ul>	—
	ECO mode control (idle speed change, etc.)	○	—	—	—	—

# SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)

## FUEL INJECTION (FUEL SYSTEM)

	Item	I	S	S#	Content	Remarks	
Transmission	Shifting characteristics (AT)	○	○	○	<p>The TCM controls the shifting characteristics to match the 3 modes.</p> <ul style="list-style-type: none"> <li>• I (intelligent mode) Shifting is performed at the optimum point for fuel economy, matching the engine characteristics of the I (intelligent mode). Also, the slip lock-up control operates in 3rd and 4th gear, and the 5th gear full lock up speed is set lower in comparison to the S (sport) and S# (Sport sharp) modes.</li> <li>• S (sport mode) Matching the engine characteristics of the S (sport mode), the shifting characteristics will be set so that constant acceleration is gained from any speed range.</li> <li>• S# (sport sharp mode) Matching the engine characteristics of the S# (sport sharp mode), the shift timing will be set at a higher engine speed in comparison to the S (sport mode), fully utilizing the engine performance and providing an enjoyable, responsive driving characteristic.</li> </ul>	—	
	Manual shift (AT)	○	○	○	In all driving modes, it is possible to change to the manual mode by moving the select lever towards the driver's side.	—	
	Adaptive control	Shift pattern automatic switching control	○	○	○	Automatically switches to a shifting pattern that avoids frequent shift changes, by restricting upshifting while climbing uphill or going downhill.	—
		Rapid accelerator pedal depression control	○	○	○	When the speed of accelerator pedal depression is very rapid, the transmission will shift down quickly to secure adequate driving force.	—
		Rapid accelerator pedal return control	—	—	○	If the return speed of the accelerator pedal is rapid, upshifting is temporarily prohibited to hold the gear in the current gear, to supply engine braking.	—
		Control while brake light is ON	—	—	○	During braking, downshifting is performed according to the amount of braking strength (amount of speed reduction), in order to supply engine braking and also to provide driving force at acceleration.	—
Control during cornering		—	—	○	While cornering, unexpected upshifting is prohibited to secure driving force and turning characteristics.	—	
Meter Display	Shift up indicator light (MT)	○	—	—	At the shift up timing that provides good fuel economy, the shift up indicator flashes for approximately 2 seconds.	The shift up indicator will flash to indicate the shift up timing that provides good fuel economy.	
	ECO gauge	○	○	○	Shows the good/bad of the instantaneous fuel economy in relation to the average fuel economy from the last time that the trip meter was reset.	—	
Other	Cruise control	○	○	○	The cruise control management has priority over each mode. However, when the accelerator pedal is stepped on, the control will be according to each mode.	—	

# **SUBARU INTELLIGENT DRIVE SYSTEM (FROM '07MY)**

FUEL INJECTION (FUEL SYSTEM)

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**MEMO**

# SYSTEM OVERVIEW

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 1. System Overview

There are three emission control systems, which are as follows:

- Crankcase emission control system
- Exhaust emission control system
  - Catalytic converter
  - Air/fuel (A/F) control system
  - Ignition control system
- Evaporative emission control system
  - On-board refueling vapor recovery (ORVR) system



# SYSTEM OVERVIEW

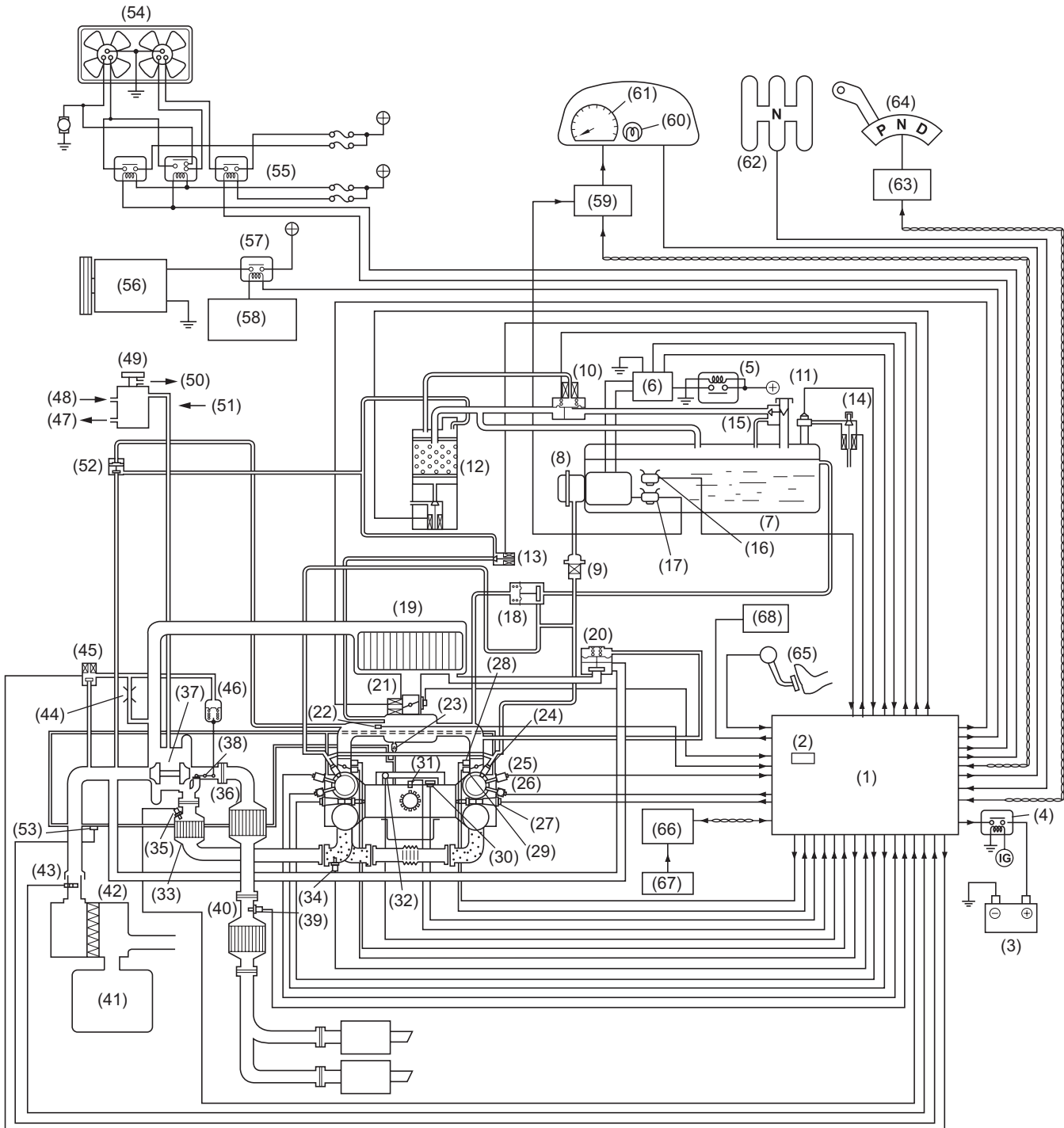
## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

Item			Main components	Function
Crankcase emission control system			Positive crankcase ventilation (PCV) valve	Draws blow-by gas into intake manifold from crankcase and burn it together with air-fuel mixture. Amount of blow-by gas to be drawn in is controlled by intake manifold pressure.
Exhaust emission control system	Catalytic converter	Pre	Catalytic converter	Oxidizes HC and CO contained in exhaust gases as well as reducing NOx.
		Front		
		Rear		
	Air/fuel (A/F) control system		Engine control module (ECM)	Receives input signals from various sensors, compares signals with stored data, and emits a signal for optimal control of air-fuel mixture ratio.
			Front oxygen (A/F) sensor	Detects density of oxygen contained exhaust gases.
			Rear oxygen sensor	Detects density of oxygen contained in exhaust gases.
			Throttle position sensor	Detects throttle opening.
			Manifold absolute pressure sensor	Detects absolute pressure of intake manifold.
			Mass air flow and intake air temperature sensor	Detects amount of intake air.
				Detects intake air temperature at air cleaner case.
	Ignition control system		ECM	Receives various signals, compares signals with basic data stored in memory, and emits a signal for optimal control of ignition timing.
			Crankshaft position sensor	Detects engine speed (revolution).
		Camshaft position sensor	Detects reference signal for combustion cylinder discrimination.	
		Engine coolant temperature sensor	Detects coolant temperature.	
		Knock sensor	Detects engine knocking.	
Evaporative emission control system			Canister	Absorbs evaporative gas that accumulates in fuel tank when engine stops, and releases it to combustion chambers for a complete burn when the engine is started. This prevents HC from being discharged into atmosphere.
			Purge control solenoid valve	Receives a signal from ECM and controls purge of evaporative gas absorbed by canister.
			Pressure control solenoid valve	Receives a signal from ECM and controls evaporative gas pressure in fuel tank.
ORVR system			Vent valve	Closes the port to the canister when the fuel tank is full of fuel.
			Drain valve	Closes the evaporation line by receiving a signal from ECM to check the evaporation gas leak.

# SCHEMATIC DIAGRAMS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. Schematic Diagrams



EC-02111

# SCHEMATIC DIAGRAMS

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

- |   |  |
|---|--|
| (1) Engine control module (ECM)             | (35) Exhaust temperature sensor                      |
| (2) Atmospheric pressure sensor             | (36) Pre-catalytic converter                         |
| (3) Battery                                 | (37) Turbocharger                                    |
| (4) Ignition relay                          | (38) Wastegate valve                                 |
| (5) Fuel pump relay                         | (39) Rear oxygen sensor                              |
| (6) Fuel pump control unit                  | (40) Rear catalytic converter                        |
| (7) Fuel tank                               | (41) Chamber   |
| (8) Fuel pump                               | (42) Air cleaner element                             |
| (9) Fuel filter                             | (43) Mass air flow and intake air temperature sensor |
| (10) Pressure control solenoid valve        | (44) Orifice   |
| (11) Fuel tank pressure sensor              | (45) Wastegate control solenoid valve                |
| (12) Canister                               | (46) Wastegate actuator                              |
| (13) Purge control solenoid valve           | (47) To water pump                                   |
| (14) Fuel tank sensor control valve         | (48) From radiator                                   |
| (15) Shut-off valve                         | (49) Engine coolant filler tank                      |
| (16) Fuel temperature sensor                | (50) To reservoir tank                               |
| (17) Fuel level sensor                      | (51) From turbocharger                               |
| (18) Pressure regulator                     | (52) Purge valve                                     |
| (19) Intercooler                            | (53) PCV hose assembly                               |
| (20) Air bypass valve                       | (54) Radiator fan                                    |
| (21) Electronic control throttle            | (55) Fan control relay                               |
| (22) Manifold absolute pressure sensor      | (56) A/C compressor                                  |
| (23) PCV valve                              | (57) A/C relay                                       |
| (24) Fuel injector                          | (58) A/C control module                              |
| (25) Intake camshaft position sensor        | (59) Body integrated unit                            |
| (26) Intake oil flow control solenoid valve | (60) Engine warning light                            |
| (27) Ignition coil and igniter assembly     | (61) Tachometer                                      |
| (28) Tumble generator valve position sensor | (62) Neutral switch (MT models)                      |
| (29) Tumble generator valve actuator        | (63) Transmission control module (AT models)         |
| (30) Knock sensor                           | (64) Neutral switch (AT models)                      |
| (31) Crankshaft position sensor             | (65) Accelerator pedal position sensor               |
| (32) Engine coolant temperature sensor      | (66) ABS/VDC control module                          |
| (33) Front catalytic converter              | (67) Vehicle speed signal                            |
| (34) Front oxygen (A/F) sensor              | (68) Data link connector                             |

# CRANKCASE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 3. Crankcase Emission Control System

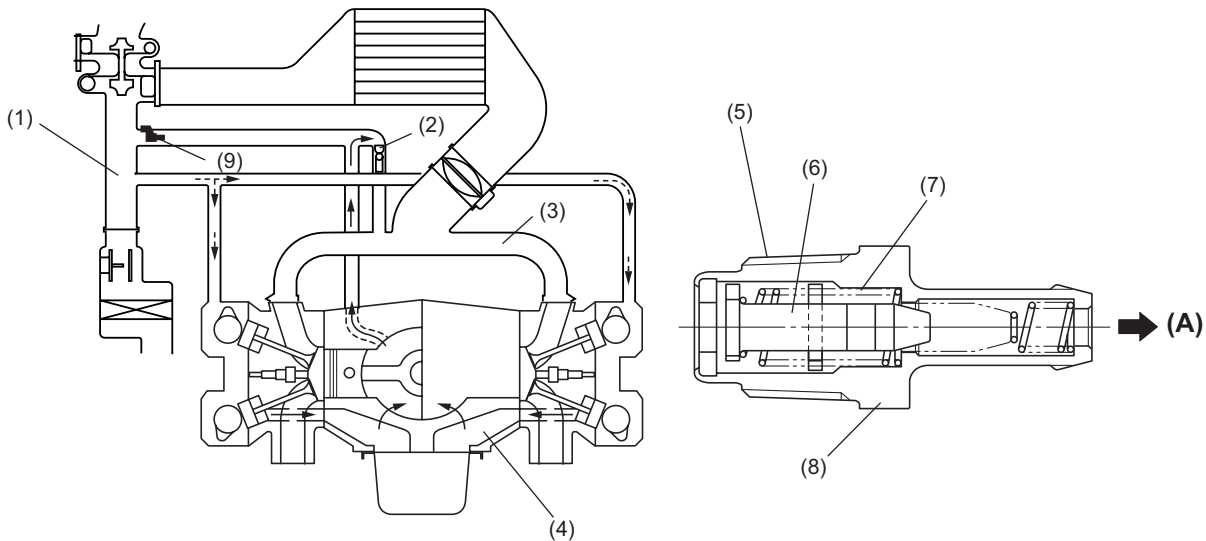
- The positive crankcase ventilation (PCV) system prevents air pollution that will be caused by blow-by gas being emitted from the crankcase.

The system consists of a sealed oil filler cap, rocker covers with fresh air inlet, connecting hoses, a PCV valve and an air intake duct.

- In a part-throttle condition, the blow-by gas in the crankcase flows into the intake manifold through the connecting hose of crankcase and PCV valve by the strong vacuum created in the intake manifold. Under this condition, fresh air is introduced into the crankcase through the connecting hose of the rocker cover.

- In a wide-open-throttle condition, a part of blow-by gas flows into the air intake duct through the connecting hose and is drawn into the throttle chamber, because under this is condition, the intake manifold vacuum is not strong enough to introduce through the PCV valve all blow-by gases that increase in the amount with engine speed.

- The PCV hose is provided with a leak detection function.



EC-02112

- |                     |                       |                        |
|---------------------|-----------------------|------------------------|
| (1) Intake duct     | (6) Valve             | (A) To intake manifold |
| (2) PCV valve       | (7) Spring            |                        |
| (3) Intake manifold | (8) PCV valve         |                        |
| (4) Crankcase       | (9) PCV hose assembly |                        |
| (5) Case            |                       |                        |

## 4. Catalytic Converter

- The basic materials of the three-way catalytic converter are platinum (Pt), rhodium (Rh) and palladium (Pd), and a thin coat of their mixture is applied onto a honeycomb or porous ceramic (carrier). To avoid damaging the catalytic converter, only unleaded gasoline should be used.
- The catalytic converter reduces HC, CO and NO<sub>x</sub> in exhaust gases through chemical reactions (oxidation and reduction). These harmful components are reduced most efficiently when their concentrations are in a certain balance. These concentrations vary with the air-fuel ratio. The ideal air-fuel ratio for reduction of these components is the stoichiometric ratio.
- Therefore, the air-fuel ratio needs to be controlled to around the stoichiometric ratio to purify the exhaust gases most efficiently.

# AIR/FUEL (A/F) CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 5. Air/fuel (A/F) Control System

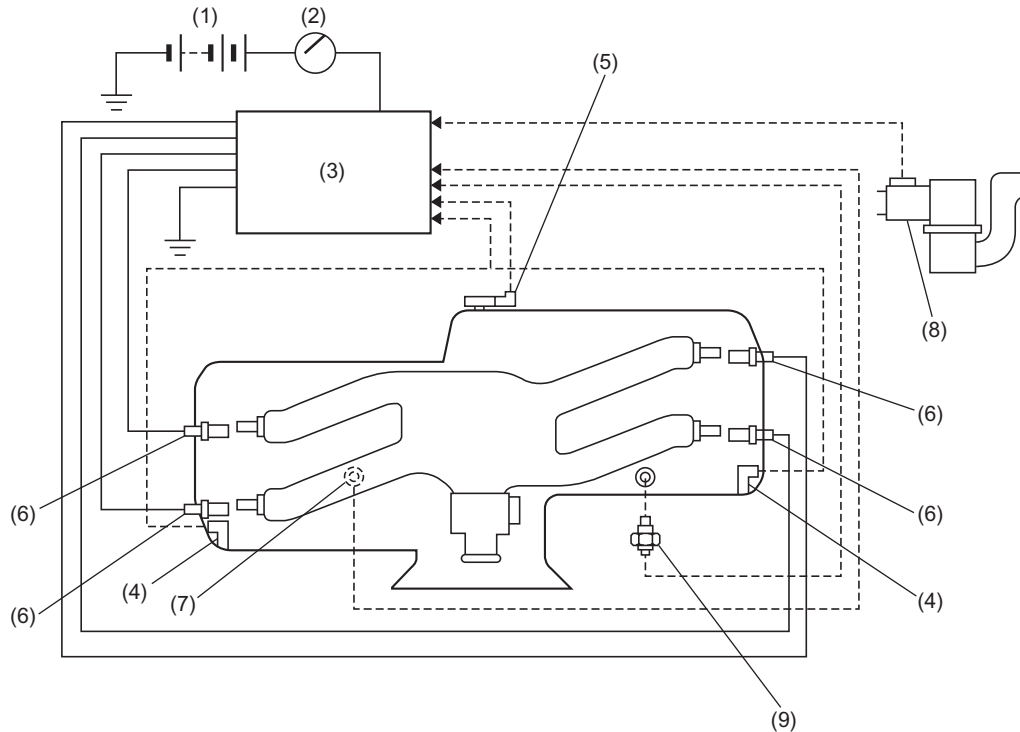
- The air/fuel (A/F) control system makes a correction to the basic fuel injection duration in accordance with the signals from the front oxygen (A/F) sensor and the rear oxygen sensor so that the stoichiometric ratio is maintained, thus ensuring most effective exhaust gas purification by the three-way catalytic converter. Different basic fuel injection durations are preset for various engine speeds and loads, as well as the amount of intake air.
- This system also has a learning control function which stores the corrected data in relation to the basic fuel injection in the memory map. This allows an appropriate air-fuel ratio correction to be added automatically in quick response to any situation that requires such an effect. Thus, the air-fuel ratio is optimally maintained under various conditions while purifying exhaust gases most effectively, improving driving performance and compensating for changes in sensors' performance over time.

# IGNITION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 6. Ignition Control System

- The ignition system is controlled by the ECM.  
The ECM monitors the operating condition of the engine using the signals from the sensors and switches shown below and determines the ignition timing most appropriate for each engine operating condition. Then it sends a signal to the igniter, commanding generation of a spark at that timing.
- The ECM uses a preprogrammed map for a “closed-loop” control which provides its ignition timing control with excellent transient characteristics, i.e., highly responsive ignition timing control.



EC-00247

- |                                |   |
|--------------------------------|---|
| (1) Battery                    | (6) Ignition coil and igniter assembly              |
| (2) Ignition switch            | (7) Knock sensor                                    |
| (3) ECM                        | (8) Mass air flow and intake air temperature sensor |
| (4) Camshaft position sensor   | (9) Engine coolant temperature sensor               |
| (5) Crankshaft position sensor |   |

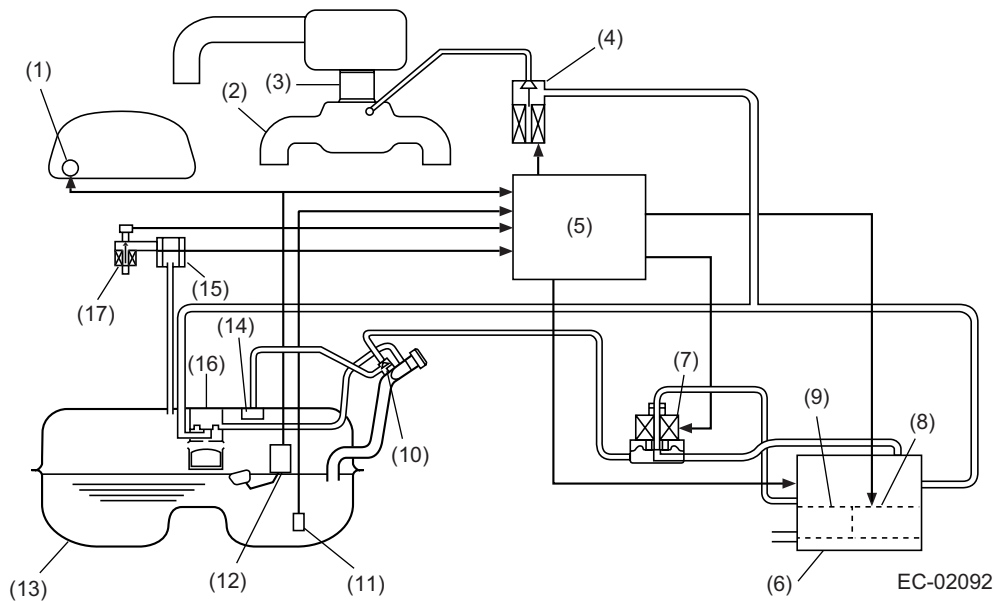
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 7. Evaporative Emission Control System

### A: GENERAL

- The evaporative emission control system prevents fuel vapors from escaping into atmosphere. This system includes a canister, purge control solenoid valve, fuel cut valve, and the lines connecting them.
- Fuel vapors in the fuel tank are introduced into the canister through the evaporation line, and are absorbed by activated carbon in it. The fuel cut valve is also incorporated in the fuel tank line.
- The purge control solenoid valve is controlled optimally by the ECM according to the engine condition.
- The pressure control solenoid valve incorporated in the fuel tank evaporation line regulates the pressure/vacuum in the fuel tank under the control of the ECM which uses the signal from the fuel tank pressure sensor.



- |                                  |                                     |                                     |
|----------------------------------|-------------------------------------|-------------------------------------|
| (1) Fuel gauge                   | (7) Pressure control solenoid valve | (13) Fuel tank                      |
| (2) Intake manifold              | (8) Drain valve                     | (14) Fuel cut valve                 |
| (3) Throttle body                | (9) Drain filter                    | (15) Fuel tank pressure sensor      |
| (4) Purge control solenoid valve | (10) Shut-off valve                 | (16) Vent valve                     |
| (5) ECM                          | (11) Fuel temperature sensor        | (17) Fuel tank sensor control valve |
| (6) Canister                     | (12) Fuel level sensor              |                                     |

### B: FUEL CUT VALVE

The fuel cut valve is incorporated in the fuel tank. The rising level of the fuel in the fuel tank causes the float to move up and close the cap hole so that no fuel can enter the evaporation line.



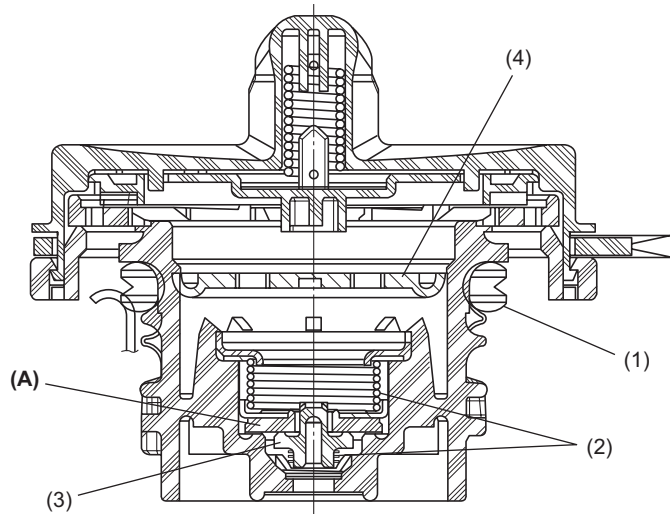
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## C: FUEL TANK CAP

- The fuel tank cap is of a quick lock type and can be opened or closed in 1/4 of a full turn.
- The fuel tank cap has a relief valve, which prevents development of vacuum in the fuel tank in the event of a problem with the fuel vapor line.

When there is no problem with the fuel vapor line, the filler pipe is sealed at the portion (A) and by the seal pressed against the filler pipe end. If vacuum develops in the fuel tank, the atmospheric pressure forces the spring down to open the valve; consequently outside air flows into the fuel tank, thus controlling the inside pressure.



EC-02109

- (1) Seal
- (2) Spring
- (3) Valve
- (4) Filter

# EVAPORATIVE EMISSION CONTROL SYSTEM

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

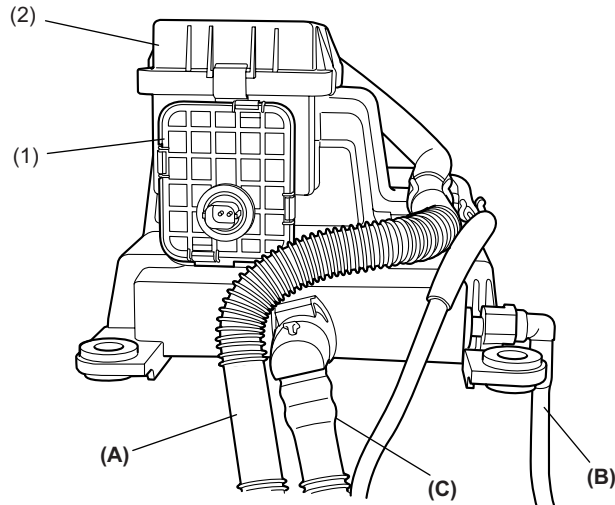
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### D: CANISTER

The canister incorporates a drain valve and a drain filter.

The charcoal filled in the canister temporarily stores fuel vapors. When the purge control solenoid valve is opened by a signal from the ECM, the external fresh air entering the canister carries the fuel vapors into the collector chamber.

The drain filter is installed at the air inlet port of the drain valve. It cleans the air taken in the canister through the drain valve.



EC-02093

- (1) Drain valve
- (2) Drain filter

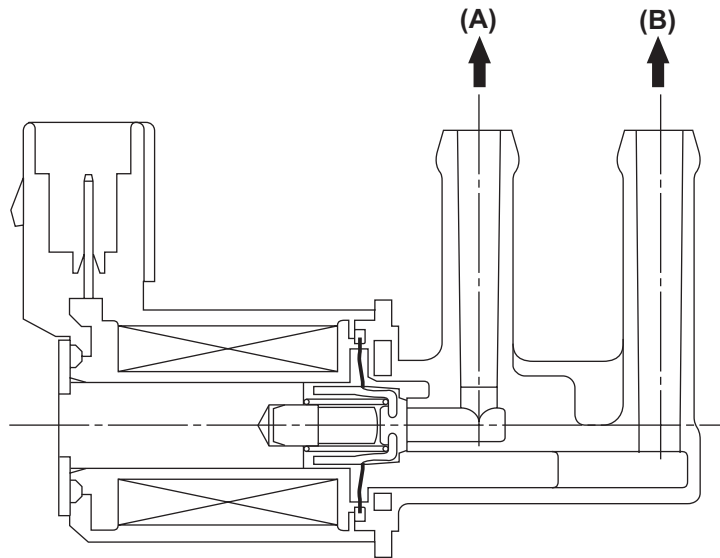
- (A) Air
- (B) To pressure control solenoid valve
- (C) From fuel tank

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## E: PURGE CONTROL SOLENOID VALVE (Until '05MY)

The purge control solenoid valve is on the evaporation line between the canister and intake manifold. The valve is installed under the intake manifold and lets the evaporative gas absorbed by the canister be drawn into the intake manifold.



EC-02001

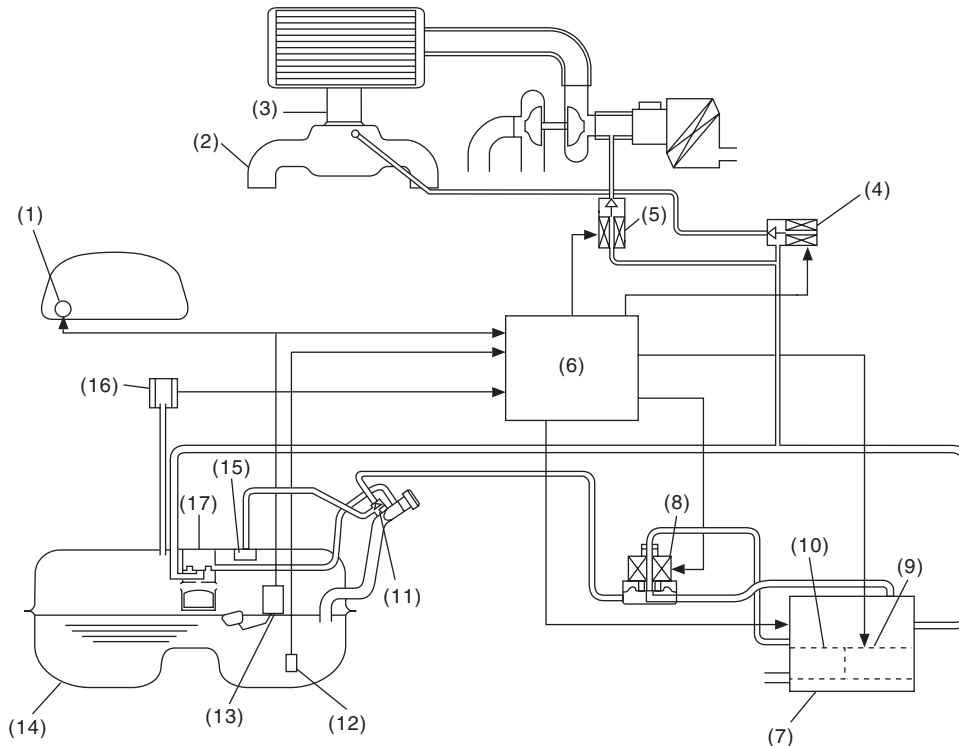
- (A) To canister
- (B) To intake manifold

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## F: PURGE CONTROL SOLENOID VALVE (FROM '06MY)

The purge control solenoid valve is a part of the fuel evaporation gas emission control device, and is configured as follows.



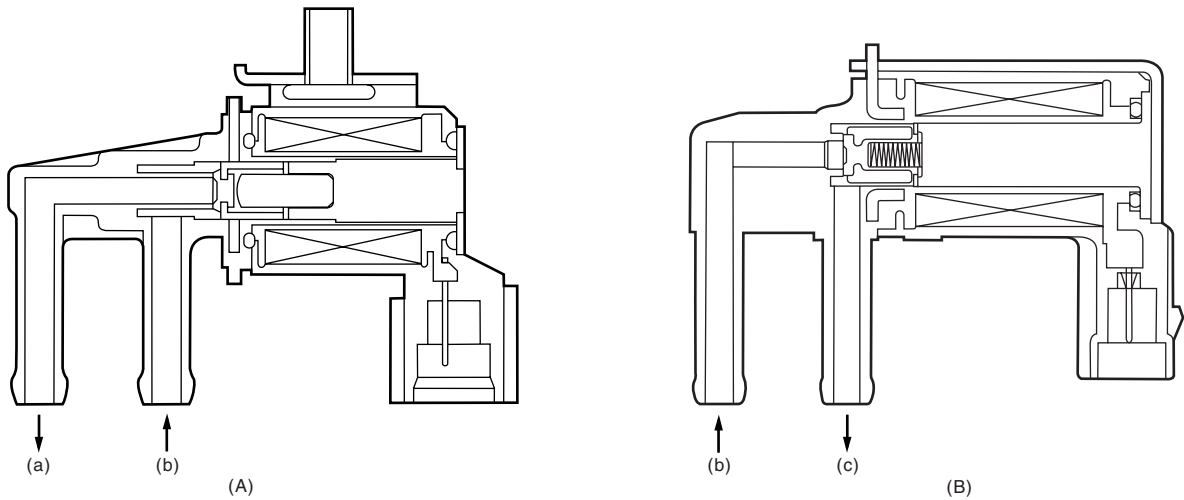
EC-02226

- |                                    |                                     |                                |
|------------------------------------|-------------------------------------|--------------------------------|
| (1) Fuel gauge                     | (7) Canister                        | (13) Fuel level sensor         |
| (2) Intake manifold                | (8) Pressure control solenoid valve | (14) Fuel tank                 |
| (3) Throttle body                  | (9) Drain valve                     | (15) Fuel cut valve            |
| (4) Purge control solenoid valve 1 | (10) Drain filter                   | (16) Fuel tank pressure sensor |
| (5) Purge control solenoid valve 2 | (11) Shut off valve                 | (17) Vent valve                |
| (6) Engine control module (ECM)    | (12) Fuel temperature sensor        |                                |

# EVAPORATIVE EMISSION CONTROL SYSTEM

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

The purge control solenoid valve 1 and purge control solenoid valve 2 are optimally controlled by the ECM according to the engine status.



EC-02227

(A) Purge control solenoid valve 2

(B) Purge control solenoid valve 1

(a) To intake duct

(b) From fuel pipe

(c) To intake manifold

### PURGE CONTROL SOLENOID VALVE OPERATION

	Intake manifold pressure	
	During vacuum	At pressure (pressurized)
Purge control solenoid valve 1	Operating	Not operating
Purge control solenoid valve 2	Not operating	Operating

# EVAPORATIVE EMISSION CONTROL SYSTEM

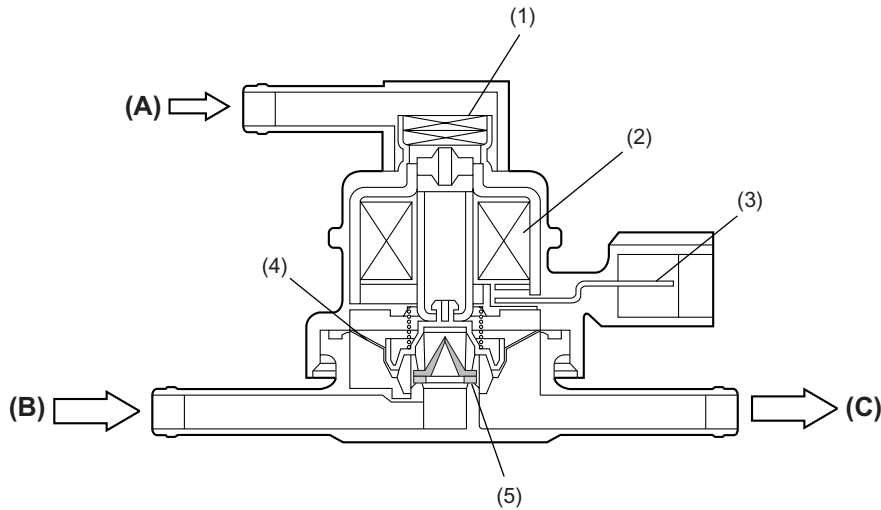
## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

### G: PRESSURE CONTROL SOLENOID VALVE

The fuel tank pressure control solenoid valve is located in the evaporation line between the canister and the fuel tank. It adjusts the fuel tank inside pressure under the control of the ECM.

When the tank inside pressure becomes higher than the atmospheric pressure, the valve is opened allowing fuel vapors to be introduced into the canister.

On the other hand, when the tank inside pressure becomes lower than the atmospheric pressure, external air is taken from the drain valve into the canister.



EC-00026

- |                        |                          |
|------------------------|--------------------------|
| (1) Filter             | (A) Atmospheric pressure |
| (2) Coil               | (B) Shut-off valve       |
| (3) Connector terminal | (C) To fuel tank         |
| (4) Diaphragm          |                          |
| (5) Valve              |                          |

### H: VENT VALVE

The vent valve is located inside of the fuel tank. During filling the fuel tank, fuel vapors are introduced into the canister through the vent valve.

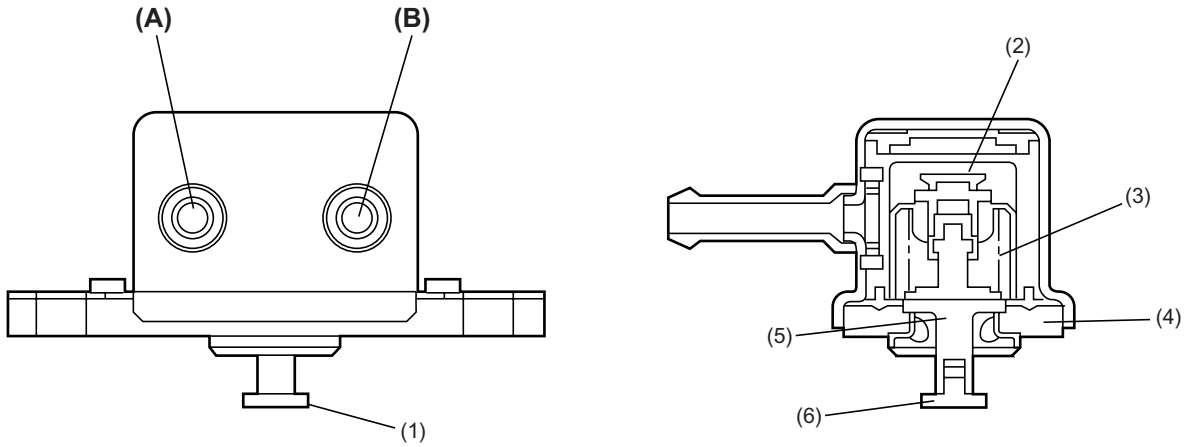
When the fuel vapor pressure becomes higher than the atmospheric pressure and overcomes the spring force which is applied to the back side of the diaphragm, the port toward the canister is opened. The vent valve also has a float which rises and block the port toward the canister when the fuel is full.

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## I: SHUT-OFF VALVE

The shut-off valve is located at the top of the fuel filler pipe. When a filler gun is inserted into the filler pipe, the shut-off valve closes the evaporation line.



EC-00029

- (1) Pin
- (2) Valve
- (3) Spring
- (4) Plate
- (5) Shaft
- (6) Pin

- (A) To canister
- (B) To fuel tank

# EVAPORATIVE EMISSION CONTROL SYSTEM

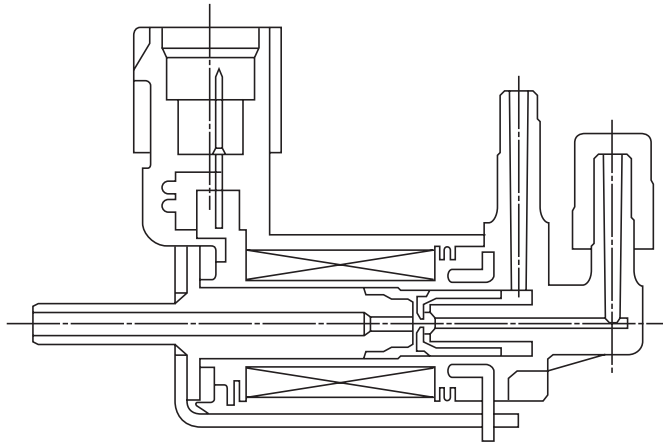
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## J: FUEL TANK SENSOR CONTROL VALVE

The fuel tank sensor control valve is installed on the top of the fuel tank and its one end is connected to the fuel tank pressure sensor while its other end is open to the atmosphere.

Normally the passage to the fuel tank pressure sensor is open to the atmosphere, however, the passage is closed when the ECM sends a signal to make a diagnosis of the evaporative emission control system.



EC-00031



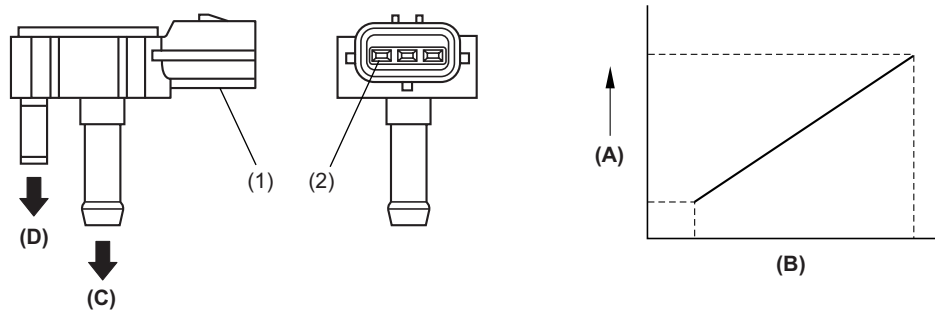
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## K: FUEL TANK PRESSURE SENSOR

The fuel tank pressure sensor is installed on the top of the fuel tank and measures the pressure in the fuel tank.

The measured pressure is converted into an electrical signal and sent to the ECM for diagnosis of the evaporative emission control system.



EC-02110

- (1) Connector
- (2) Terminal

- (A) Output voltage
- (B) Input pressure
- (C) To fuel tank
- (D) To fuel tank sensor control valve

# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 8. On-board Refueling Vapor Recovery (ORVR) System

### A: GENERAL

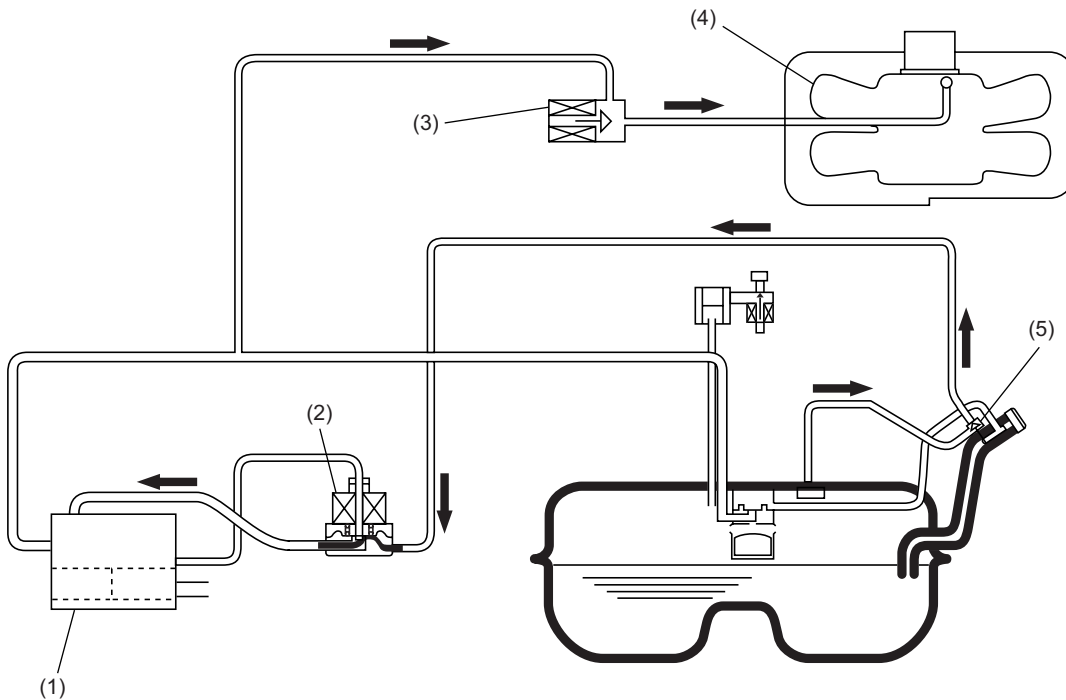
The on-board refueling vapor recovery system allows the fuel vapors in the fuel tank to be introduced directly into the canister through the vent valve when the fuel tank inside pressure increases as a result of refueling.

The diagnosis of the system is performed by monitoring the fuel tank inside pressure data from the fuel tank pressure sensor while forcibly closing the drain valve.

### B: OPERATION

- While driving

Since the back side of the diaphragm in the pressure control solenoid valve is open to the atmosphere, the diaphragm is held pressed by the atmospheric pressure in the position where only the external air is introduced into the canister. When the fuel vapor pressure acting on the other side of the diaphragm increases and overcomes the atmospheric pressure, it pushes the diaphragm and opens the port through which the fuel vapors make their way to the canister.



EC-02094

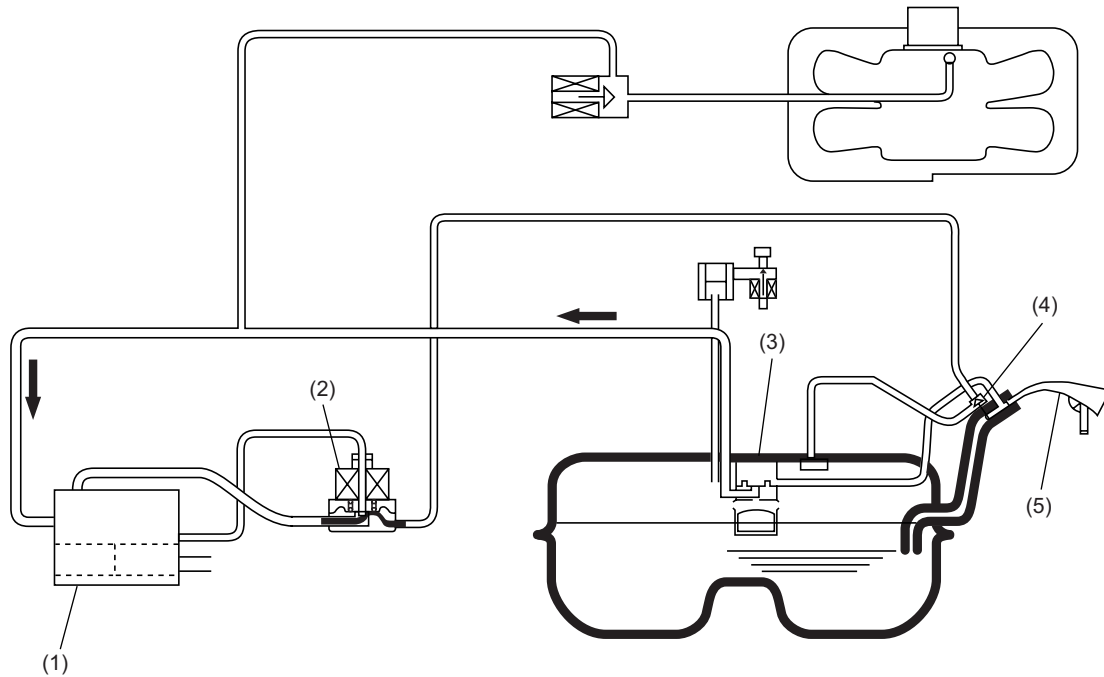
- |                                     |                          |
|-------------------------------------|--------------------------|
| (1) Canister                        | (4) Intake manifold      |
| (2) Pressure control solenoid valve | (5) Shut-off valve: open |
| (3) Purge control solenoid valve    |                          |

# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

- While refueling

As the fuel enters the fuel tank, the tank inside pressure increases. When the inside pressure becomes higher than the atmospheric pressure, the port of the vent valve opens, allowing the fuel vapors to be introduced into the canister through the vent line. The fuel vapors are absorbed by charcoal in the canister, so the air discharged from the drain valve contains no fuel. When a filler gun is inserted, the shut-off valve closes the evaporation line.



EC-02095

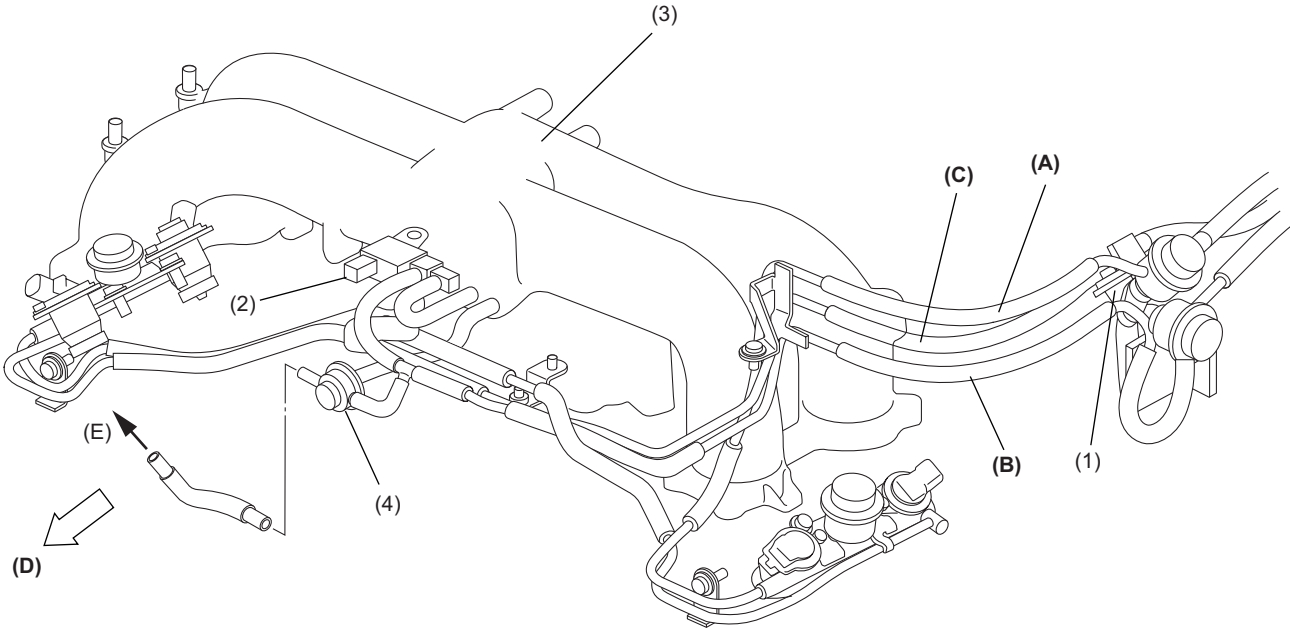
- |                                     |                            |
|-------------------------------------|----------------------------|
| (1) Canister                        | (4) Shut-off valve: closed |
| (2) Pressure control solenoid valve | (5) Filler gun             |
| (3) Vent valve                      |                            |

# VACUUM CONNECTIONS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 9. Vacuum Connections

The hose and pipe connections of the intake manifold, throttle body and other related parts are as shown in the illustration.



EC-02113

- (1) Pressure regulator
- (2) Purge control solenoid valve
- (3) Intake manifold
- (4) Purge valve

- (A) Delivery pipe
- (B) Return pipe
- (C) Evaporation pipe
- (D) Front of vehicle
- (E) To intake duct

## SECONDARY AIR SYSTEM (FROM '06MY)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

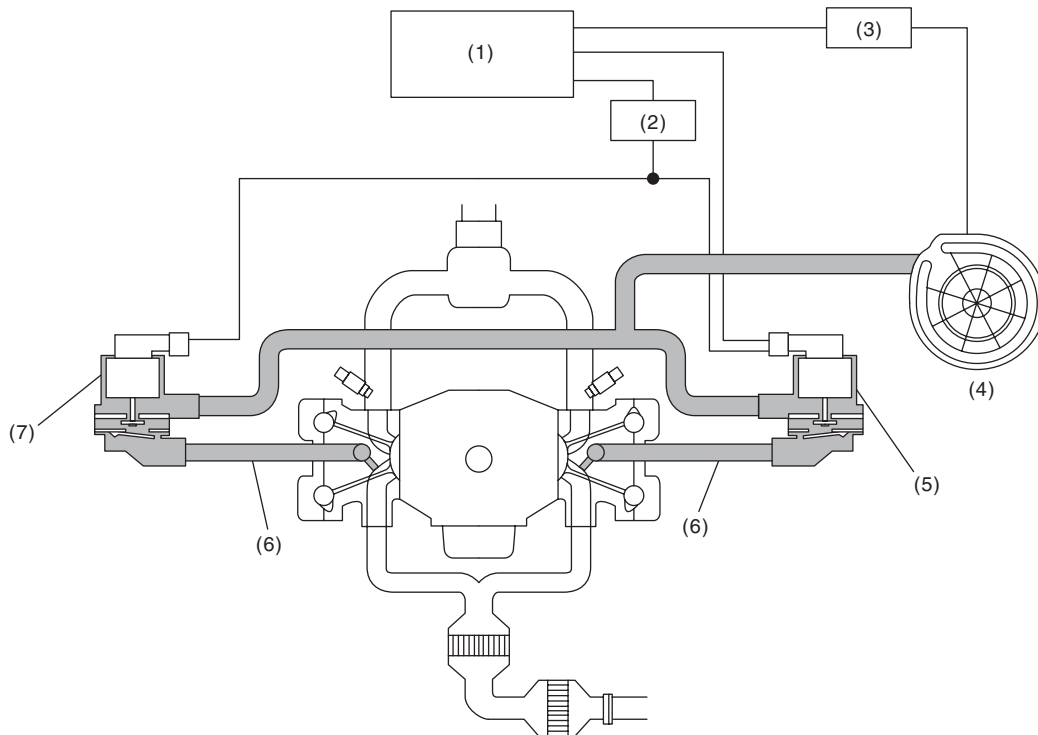
### 10.Secondary Air System (From '06MY)

#### A: GENERAL

The secondary air system reduces harmful emissions by initiating the actuation of the catalyzer early by supplying air to the exhaust port of the cylinder head when the engine is cold started to reburn unburned gas.

#### B: COMPONENT

The secondary air system consists of the two secondary air combination valves (depending on the specification, there are vehicles with only one air combination valve.), pipes and air passages running through the cylinder head. The secondary air pump and the secondary air combination valves are controlled by the ECM which judges the startup conditions of the engine.



EC-02224

- |   |   |                                     |
|---|---|-------------------------------------|
| (1) ECM                                   | (4) Secondary air pump  | (6) Pipe                            |
| (2) Secondary air combination valve relay | (5) Secondary air combination valve (with built-in pressure sensor) | (7) Secondary air combination valve |
| (3) Secondary air pump relay              |   |                                     |

# SECONDARY AIR SYSTEM (FROM '06MY)

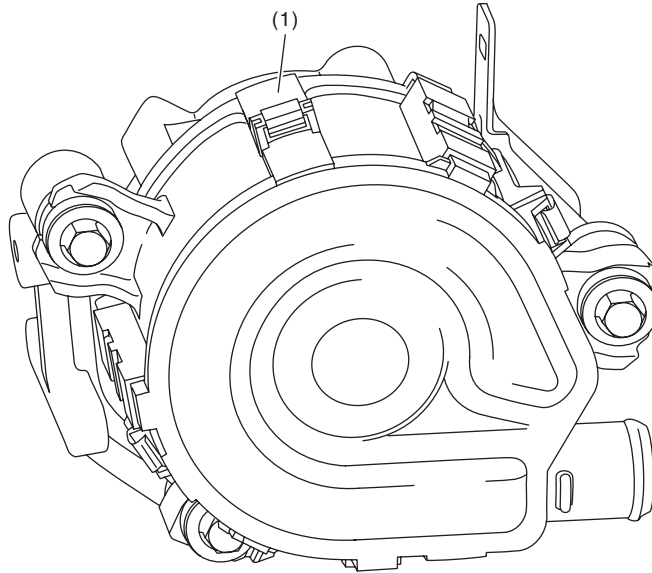
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## C: OPERATION

### 1. SECONDARY AIR PUMP

The secondary air pump compresses the air drawn in by the DC motor, and supplies this compressed air to the secondary air combination valve. There is a filter at the inlet of the secondary air pump to prevent drawing in dust and foreign objects.



EC-02231

(1) Secondary air pump

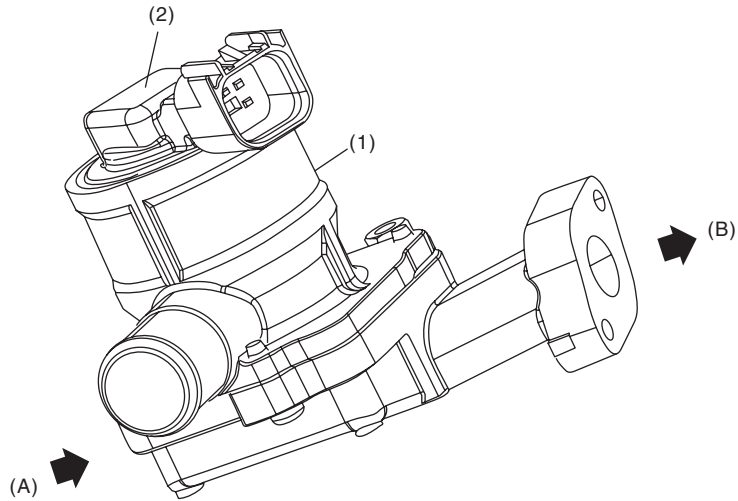
# SECONDARY AIR SYSTEM (FROM '06MY)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. SECONDARY AIR COMBINATION VALVE

The secondary air combination valve consists of an air valve, a reed valve that prevents the reverse flow of exhaust gas, and a solenoid for opening/closing the air valve. Compressed air whose flow is controlled by the secondary air combination valve is supplied to the cylinder head through a pipe.

One of the secondary air combination valves is equipped with a pressure sensor for malfunction diagnosis.



EC-02232

- |     |                                 |     |                  |
|-----|---------------------------------|-----|------------------|
| (A) | Secondary air pump              | (B) | To cylinder head |
| (1) | Secondary air combination valve | (2) | Pressure sensor  |

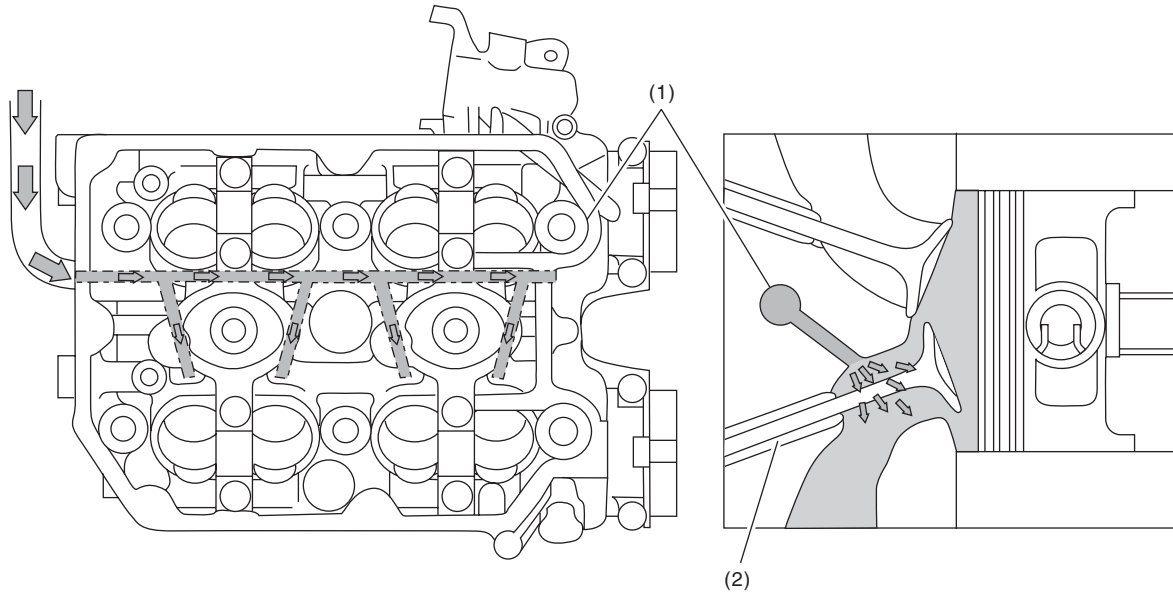
# SECONDARY AIR SYSTEM (FROM '06MY)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 3. CYLINDER HEAD

Inside the cylinder head are air passages as shown in the diagram. The compressed air supplied from the secondary air combination valve travels through these air passages to be sprayed on the back face of the exhaust valve.



EC-02225

(1) Air passage

(2) Exhaust valve



# INTAKE SYSTEM

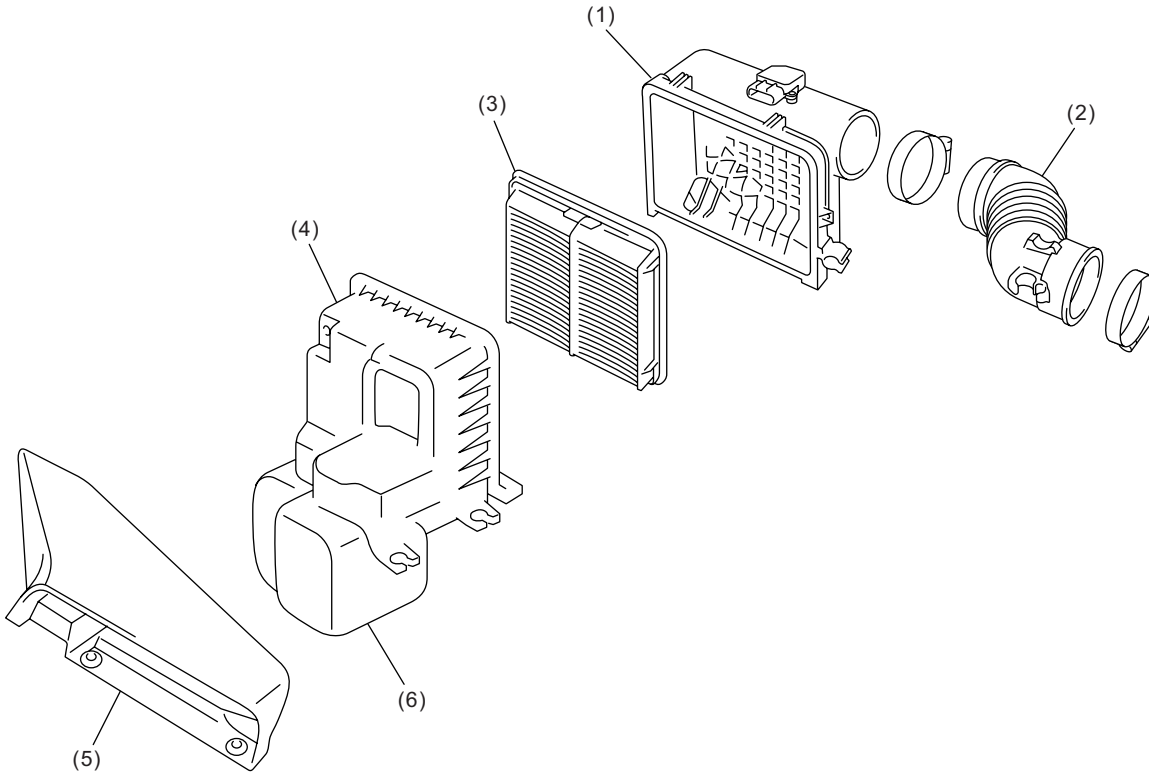
INTAKE (INDUCTION)

---

## 1. Intake System

### A: GENERAL

The intake system consists of an intake duct, a resonator integrated with the air cleaner case, and an air cleaner element housed in the air cleaner case. The resonator, located upstream of the air cleaner case, effectively reduces the intake noise level.



IN-02098

(1) Air cleaner rear case

(2) Air intake boot

(3) Air cleaner element

(4) Air cleaner front case

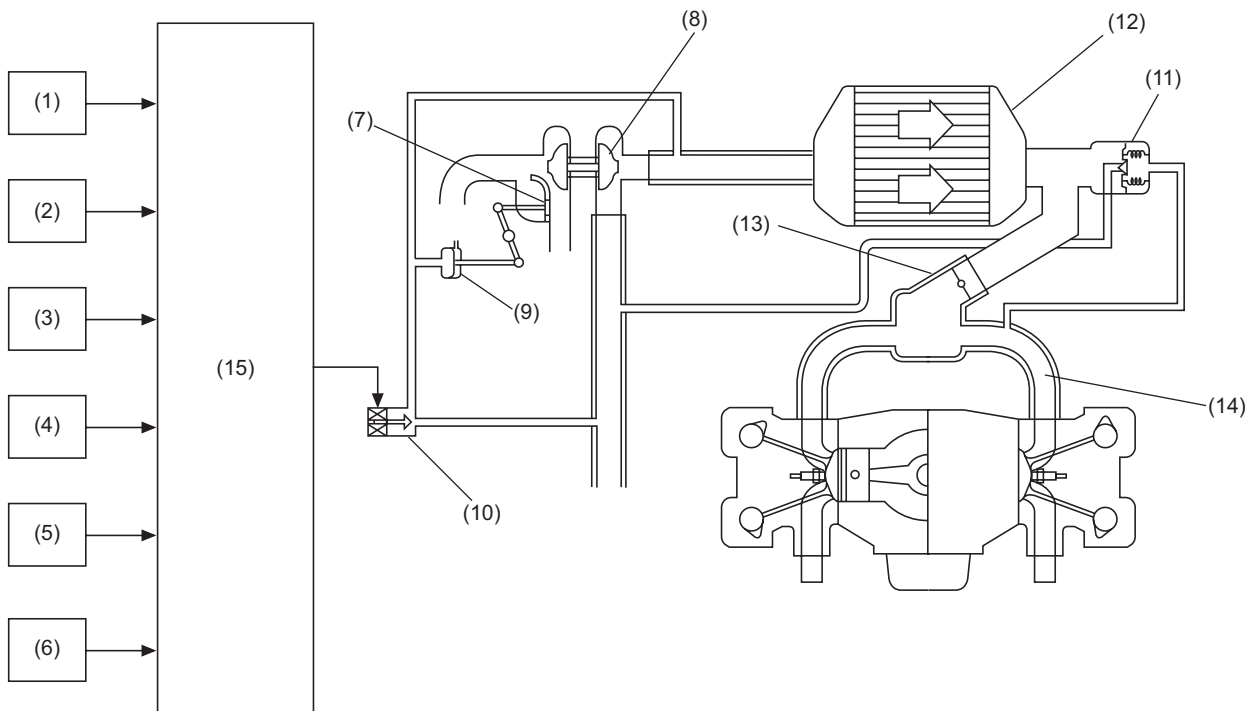
(5) Air intake duct

(6) Resonator chamber

## 2. Turbocharger System

### A: GENERAL

- The turbocharger system consists of a water-cooled turbocharger, air-cooled intercooler, wastegate control solenoid valve, etc.
- The turbine rotated by exhaust gas pressure rotates the compressor.
- As a result, the intake air is compressed by the compressor before it is delivered to the intake manifold.
- This turbocharger system controls the supercharging pressure according to changes in the atmospheric pressure. Even at a high altitude, therefore, the system offers stable performance without being affected by variations in atmospheric pressure.



IN-00234

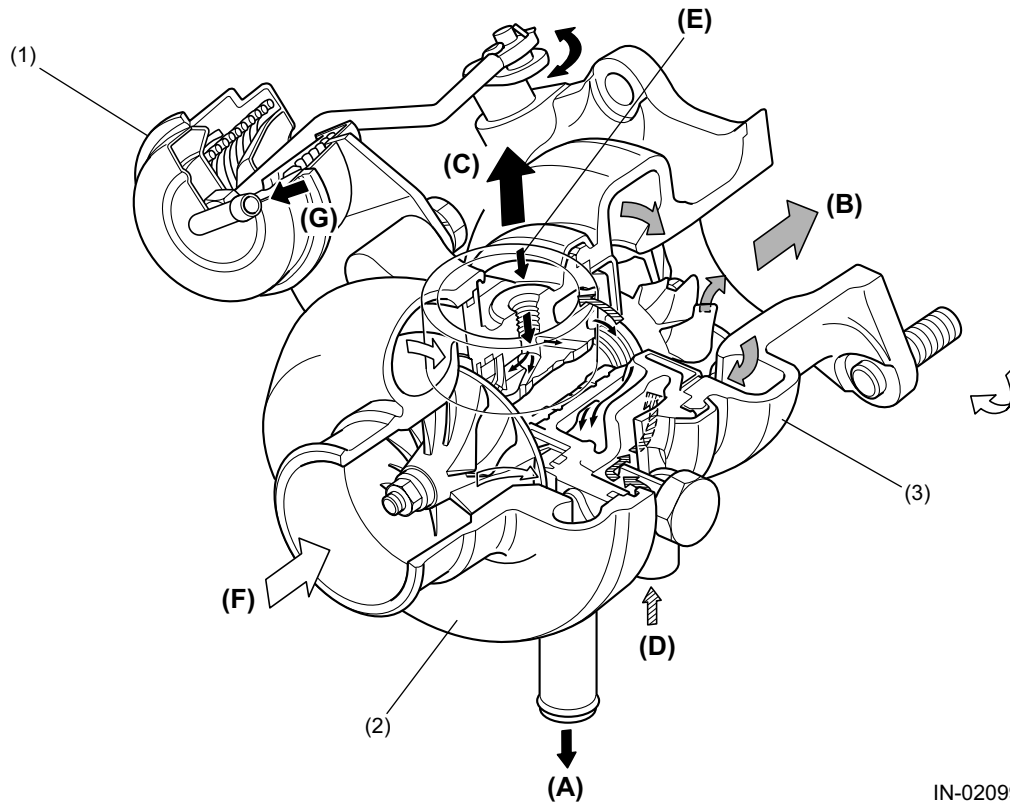
- |   |  |
|---|--|
| (1) Manifold absolute pressure sensor               | (9) Wastegate controller                             |
| (2) Crankshaft position sensor                      | (10) Wastegate control solenoid valve                |
| (3) Camshaft position sensor                        | (11) Air bypass valve                                |
| (4) Throttle position sensor                        | (12) Intercooler                                     |
| (5) Engine coolant temperature sensor               | (13) Throttle body                                   |
| (6) Mass air flow and intake air temperature sensor | (14) Intake manifold                                 |
| (7) Wastegate valve                                 | (15) ECM (with built-in atmospheric pressure sensor) |
| (8) Turbocharger unit                               |  |

# TURBOCHARGER SYSTEM

## INTAKE (INDUCTION)

### B: TURBOCHARGER UNIT

The turbocharger is water-cooled. It utilizes a wastegate valve to adjust its supercharging pressure to an optimum level. The turbine is housed in a lightweight, thin-wall, heat-resistant casting. The compressor housing is made of thin-wall, aluminum alloy casting. The shaft for turbine and compressor is supported by a full-floating metal bearing system.



IN-02099

- (1) Wastegate controller
- (2) Compressor housing
- (3) Turbine housing

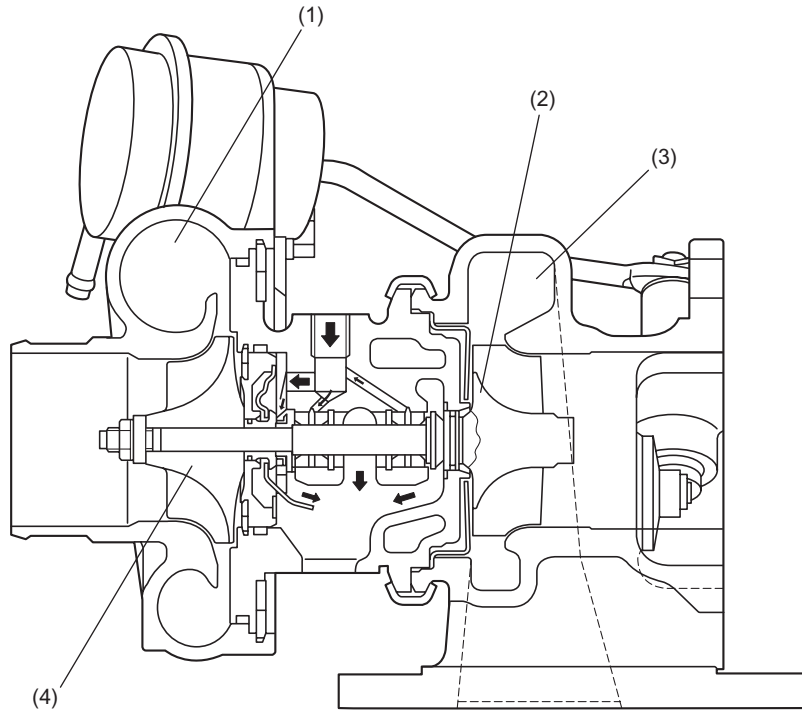
- (A) Lubricating oil outlet
- (B) Exhaust gas outlet
- (C) Air outlet port
- (D) Coolant inlet

- (E) Lubricating oil inlet
- (F) Air inlet
- (G) Wastegate valve operation pressure

## C: LUBRICATION OF TURBOCHARGER

The turbocharger is lubricated by engine oil branched out from the oil pump. To cope with very high speed of the turbocharger turbine and the compressor shaft which may reach a maximum of several hundred thousands of rpm, full-floating type bearings are used which can form adequate oil films on their inside and outside during running.

Further the oil supplied to the turbocharger also plays a role of cooling the turbine so that heat from exhaust gas does not transmitted to the bearings.



IN-00048

- (1) Compressor housing
- (2) Turbine wheel

- (3) Turbine housing
- (4) Compressor impeller

## D: COOLING OF TURBOCHARGER

The turbocharger unit is cooled by engine coolant, which enhances the reliability and durability of the unit. The engine coolant from the coolant drain hose located under the cylinder head is led by a pipe to the coolant passage provided in the turbocharger bearing housing. After cooling the bearing housing, the engine coolant is led into the coolant filler tank through a pipe.

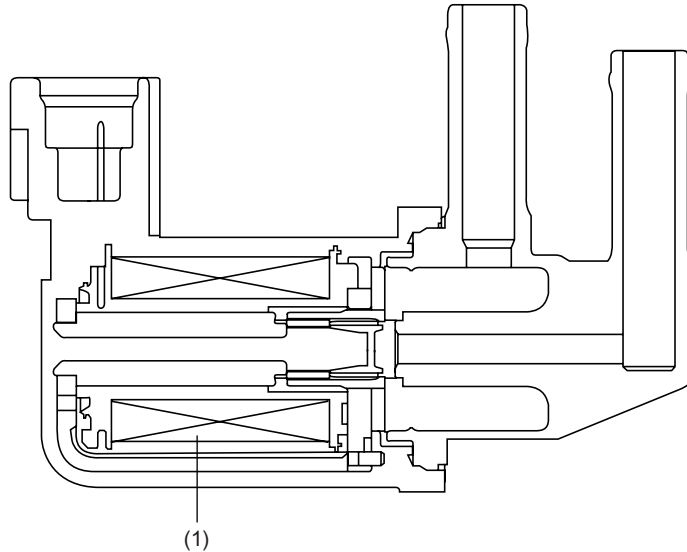
# TURBOCHARGER SYSTEM

INTAKE (INDUCTION)

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## E: WASTEGATE CONTROL SOLENOID VALVE

The wastegate control solenoid valve switches the intake air pressure passages to the wastegate controller in response to signals from the ECM. When the solenoid valve opens, the intake air pressure upstream of the turbocharger unit is applied to the wastegate controller. When the solenoid valve closes, the intake air pressure downstream of the turbocharger unit (supercharged air pressure) is applied to the wastegate controller.



IN-02001

(1) Coil

**MEMO**

# TURBOCHARGER SYSTEM

INTAKE (INDUCTION)

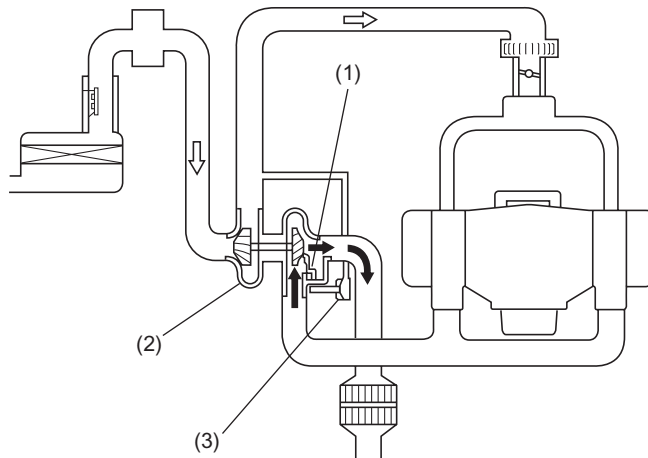
---

## F: REGULATION OF SUPERCHARGING PRESSURE

### 1. BASIC FUNCTION OF THE WASTEGATE VALVE

When the engine speed increases as the throttle valve opens, the amount of exhaust gas increases. This increases the speed of the turbine (approx. 20,000 to 150,000 rpm), the supercharging pressure and the engine output.

If the resultant supercharging pressure is extremely high, however, it may cause knocking and an excessively high thermal load on such engine components as pistons. In the worst case, the engine may be damaged or broken. To prevent this, the waste gate valve and its controller are provided. By sensing the supercharging pressure, the waste gate valve controller controls the operation of the waste gate valve to maintain the supercharging pressure at a predetermined level.

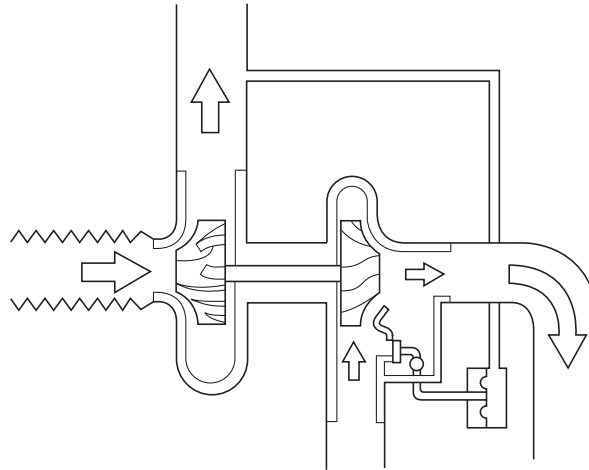


IN-00049

- (1) Wastegate valve
- (2) Turbocharger
- (3) Wastegate valve controller

# TURBOCHARGER SYSTEM

While the supercharging pressure is lower than the predetermined level, the wastegate valve is closed so that entire exhaust gas is directed to the turbine.



IN-00050

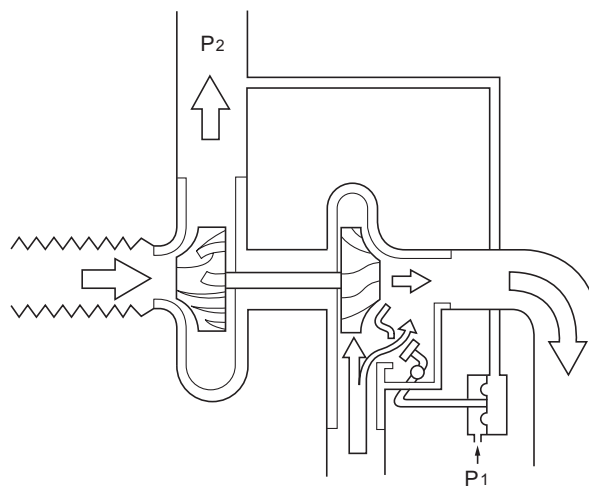
When the supercharging pressure reaches the predetermined level, the wastegate controller lets the supercharging pressure press the diaphragm. This causes the wastegate valve to open through a linkage. With the wastegate valve open, part of the exhaust gas is allowed to flow into the exhaust gas pipe that bypasses the passage to the turbine.

This decreases the exhaust gas pressure that rotates the turbine and keeps the supercharging pressure constant.

- It means  $P_2 - P_1 = \text{constant}$ .

$P_1$ : Atmospheric pressure

$P_2$ : Supercharging pressure



IN-00051



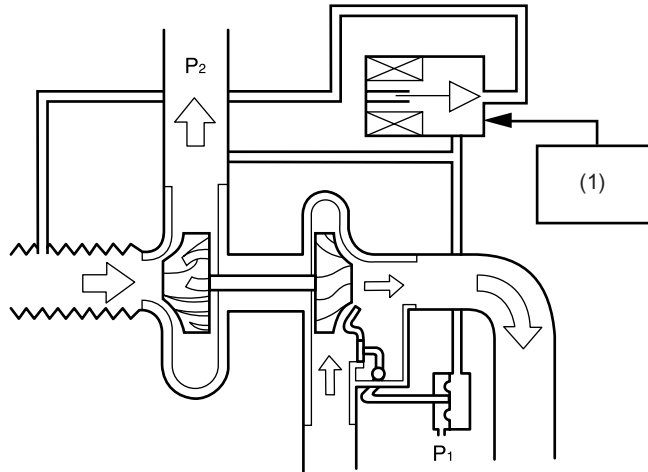
# TURBOCHARGER SYSTEM

INTAKE (INDUCTION)

---

## 2. CONCEPT OF THE WASTEGATE VALVE CONTROL

At high altitudes, the atmospheric pressure ( $P_1$ ) is low, so that the supercharging pressure ( $P_2$ ) is also low in a conventional system. The wastegate solenoid valve operates in such a way that a constant supercharging pressure ( $P_2$ ) is maintained by acting in response to change in the atmospheric pressure.

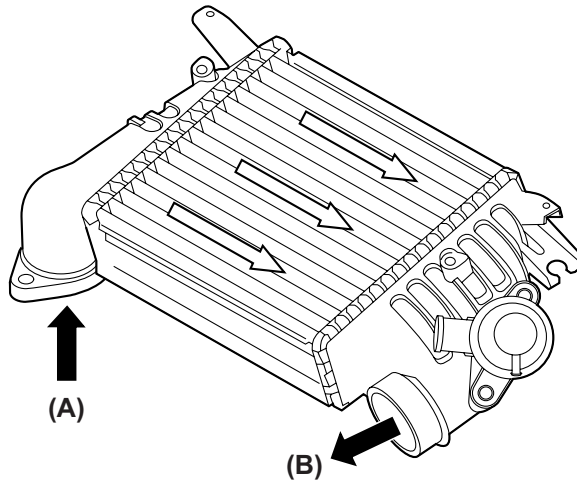


IN-02002

(1) ECU

## G: INTERCOOLER

- Since the intake air having passed through the turbocharger unit is heated to a very high temperature, the air itself expands, resulting in a lower supercharging efficiency. The intercooler is provided just before the throttle body to cool down the intake air and improve the boosting efficiency.
- The intercooler is an air cooled type. The air delivered from the air intake duct provided at the engine hood flows through the core and cools the intake air passing through the intercooler.



IN-02100

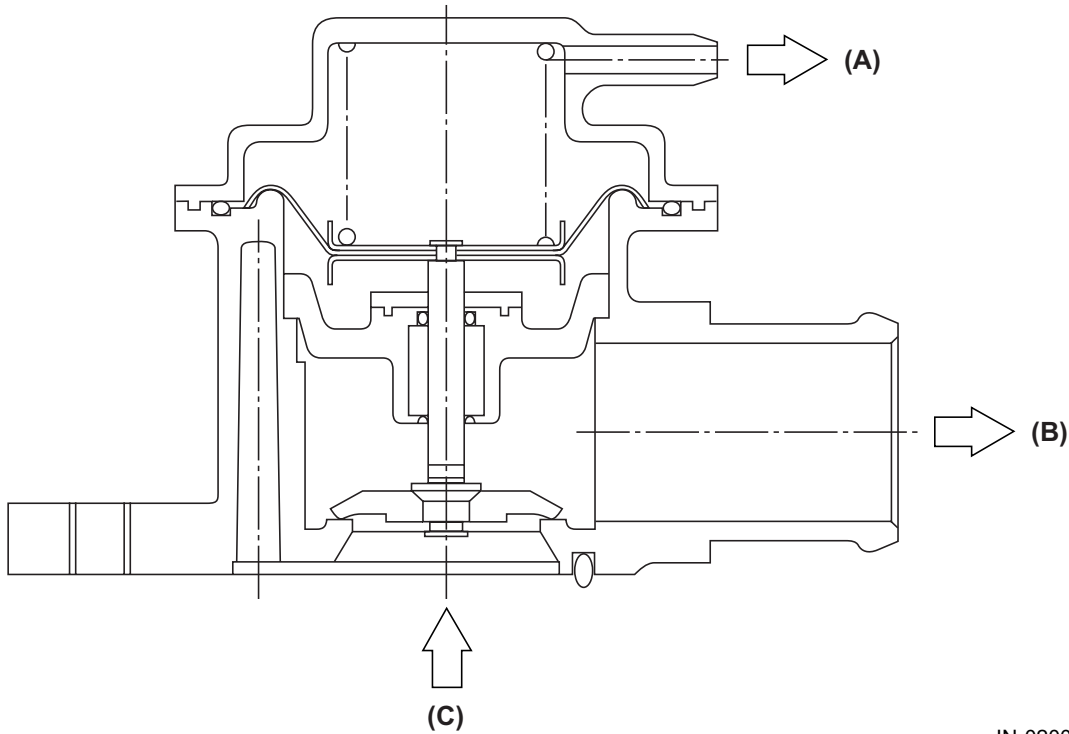
- (A) From turbocharger
- (B) To throttle body

# TURBOCHARGER SYSTEM

## INTAKE (INDUCTION)

### H: AIR BYPASS VALVE

When a throttle valve is suddenly closed, a surge may occur due to a sudden rise of the air pressure in the passage between the turbocharger and throttle body. To prevent this, an air bypass valve and air passage are provided. The air bypass valve, actuated by the vacuum created by a sudden closure of the throttle valve, allows the suction air to bypass the turbocharger and flow directly upstream, thus lowering the pressure in the air passage.



IN-02003

- (A) To intake manifold
- (B) To turbocharger inlet duct
- (C) From intercooler

# GENERAL

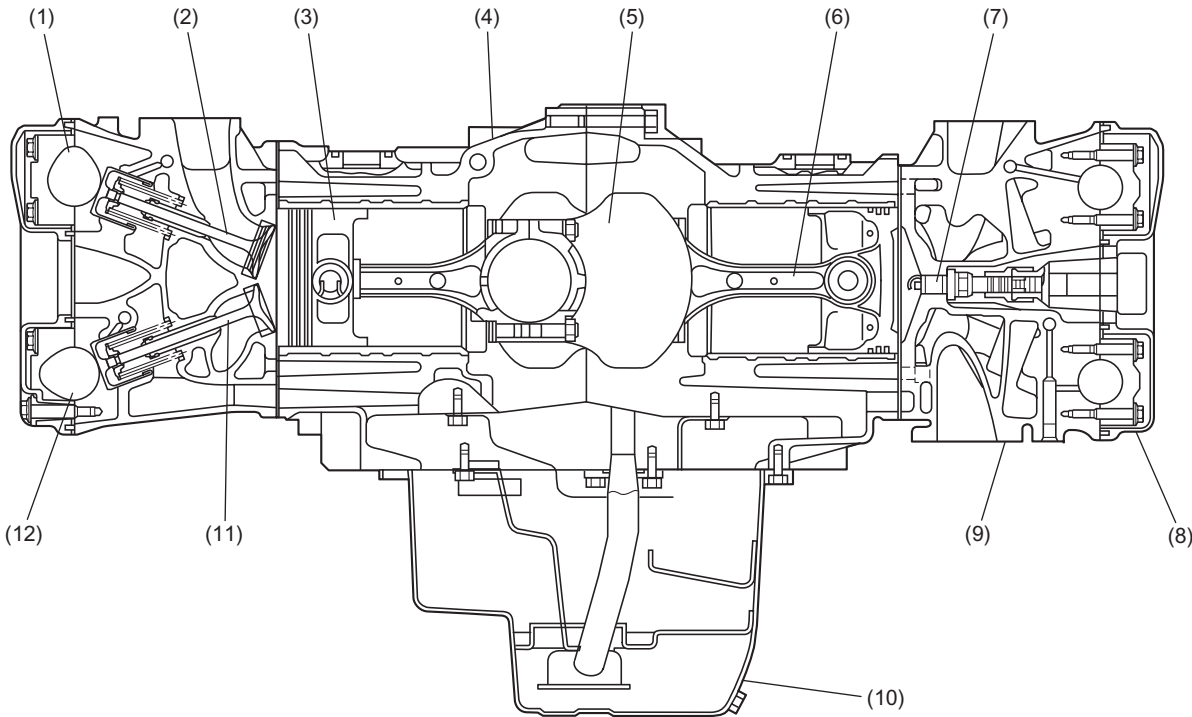
## MECHANICAL

### 1. General

The engine used in this vehicle is of a horizontally opposed, four-cylinder design. This four-stroke-cycle, water-cooled, DOHC turbocharged engine uses a total of 16 valves and its main components are made of aluminum alloy. It is fueled by a multiple fuel injection system.

The engine's major structural and functional features are as follows:

- The cylinder head forms pent roof combustion chambers, each having a spark plug located at its center and two each of intake and exhaust valves (four valves per cylinder). The intake and exhaust ports are located in a cross-flow arrangement.
- A single timing belt drives four camshafts on the left and right banks and the water pump on the left bank. Belt tension is automatically adjusted by a belt tension adjuster, eliminating need for manual adjustment.
- The crankshaft is supported at five journals with high rigidity and strength.
- The cylinder block is made of cast aluminum, and cast iron cylinder liners are cast in.

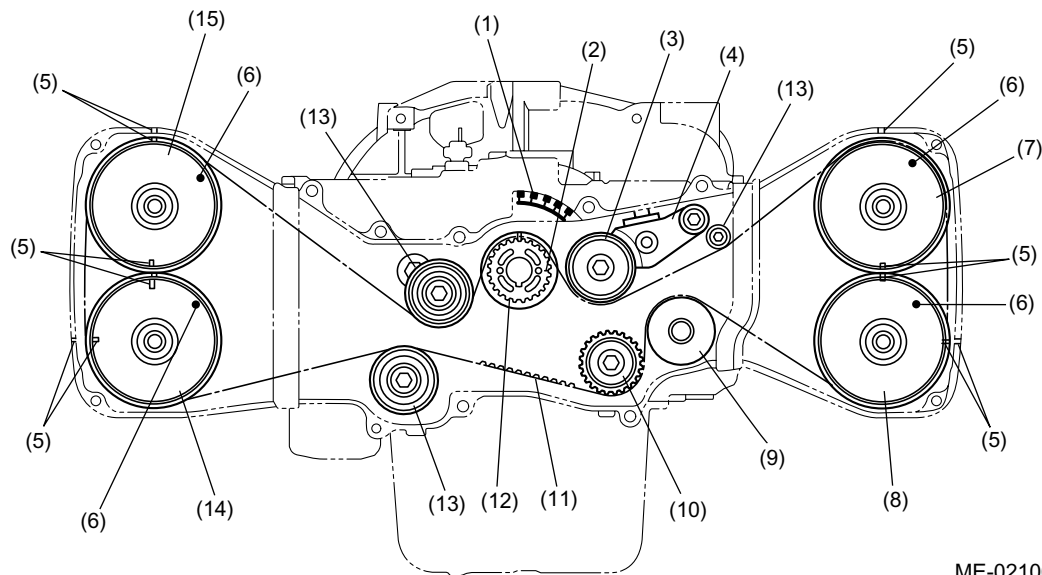


ME-00828

- |                     |                        |                       |
|---------------------|------------------------|-----------------------|
| (1) Intake camshaft | (5) Crankshaft         | (9) Cylinder head     |
| (2) Intake valve    | (6) Connecting rod     | (10) Oil pan          |
| (3) Piston          | (7) Spark plug         | (11) Exhaust valve    |
| (4) Cylinder block  | (8) Valve rocker cover | (12) Exhaust camshaft |

## 2. Timing Belt

- A single timing belt drives four camshafts (intake and exhaust camshafts on each bank). The belt also drives the water pump by its non-toothed side.
- The timing belt teeth have a specially designed round profile which contributes to quiet operation. The timing belt is made of strong and inflexible core cords, wear-resistant canvas and heat-resistant rubber material.
- A hydraulic automatic belt tension adjuster always keeps the belt taut to the specified tension. Any manual belt tension adjustment is unnecessary.



ME-02106

- |   |                                   |
|---|-----------------------------------|
| (1) Timing indicator (for timing mark of crankshaft pulley) | (9) Water pump pulley             |
| (2) *Piston position mark                                   | (10) Idler No. 2                  |
| (3) Belt tension pulley                                     | (11) Timing belt                  |
| (4) Automatic belt tension adjuster assembly                | (12) Crankshaft sprocket          |
| (5) Alignment mark  | (13) Idler                        |
| (6) **Piston position mark                                  | (14) Exhaust camshaft sprocket RH |
| (7) Intake camshaft sprocket LH                             | (15) Intake camshaft sprocket RH  |
| (8) Exhaust camshaft sprocket LH                            |                                   |

### NOTE:

\*: The #1 piston is set at the top dead center (TDC) when the piston-position mark on the crankshaft sprocket is aligned with the mark on cylinder block.

\*\* : The #1 piston is set at TDC on the compression stroke when the piston-position mark on the camshaft sprocket is facing directly upward.

# AUTOMATIC BELT TENSION ADJUSTER

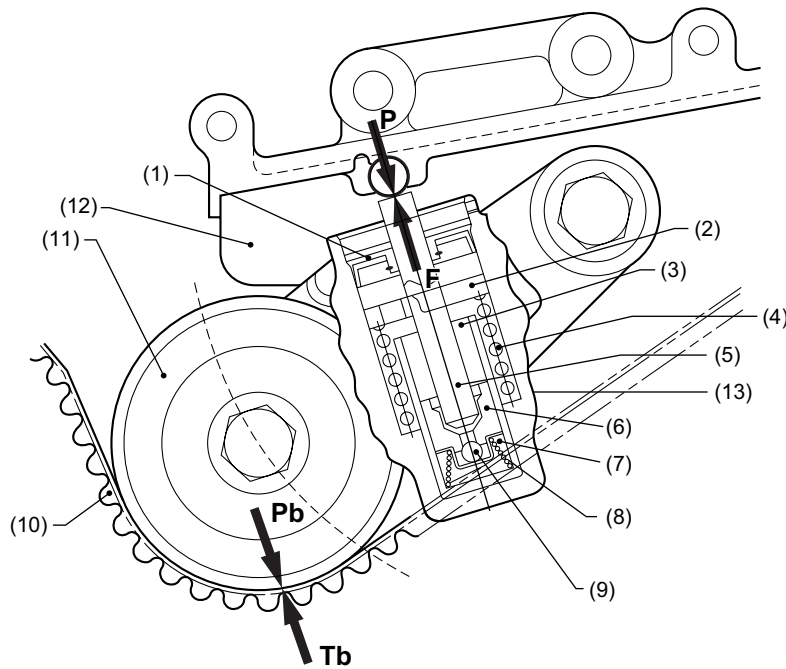
MECHANICAL

## 3. Automatic Belt Tension Adjuster

The automatic belt tension adjuster consists of a tensioner unit and a bracket. It maintains the timing belt tension automatically at a specified level to enable the belt to transmit power correctly, reduce operating noise and increase the life of the belt.

The cylinder of the tensioner unit incorporates an adjuster rod, wear ring, plunger spring, return spring, check ball and silicone oil.

The automatic belt tension adjuster gives tension to the belt by a levering action which is produced by the push force of the tensioner unit's adjuster rod. It operates in the process detailed below.



ME-00314

- |                           |                          |
|---------------------------|--------------------------|
| (1) Oil seal              | (8) Plunger spring       |
| (2) Wear ring             | (9) Check ball           |
| (3) Oil reservoir chamber | (10) Timing belt         |
| (4) Return spring         | (11) Belt tension pulley |
| (5) Adjuster rod          | (12) Tensioner bracket   |
| (6) Plunger               | (13) Cylinder            |
| (7) Oil pressure chamber  |                          |

# AUTOMATIC BELT TENSION ADJUSTER

MECHANICAL

---

- Timing belt tensioning action

When the belt becomes slack, the adjuster rod is pushed upward by the return spring. The oil in the reservoir chamber, which is pressurized by the plunger spring to a certain level, pushes open the check ball and flows into the oil pressure chamber to keep the pressure constant.

The thrust force  $F$  resulting from extension of the adjuster rod applies a counterclockwise torque to the tensioner bracket, which causes the belt tension pulley at its end to turn in the same direction. This applies tensioning pressure  $P_b$  to the timing belt.

- Timing belt tension balancing action

When the belt tension pulley is pushed against the timing belt with pressure  $P_b$ , reaction force  $T_b$  of the timing belt generates the reaction force  $P$  at the point on which the adjuster rod force is acting. This force  $P$  pushes the adjuster rod until it balances with the sum of the thrust force  $F$  and the pressure of the oil in the oil pressure chamber. Therefore, the timing belt tension is kept constant.

- Over-tension correction action

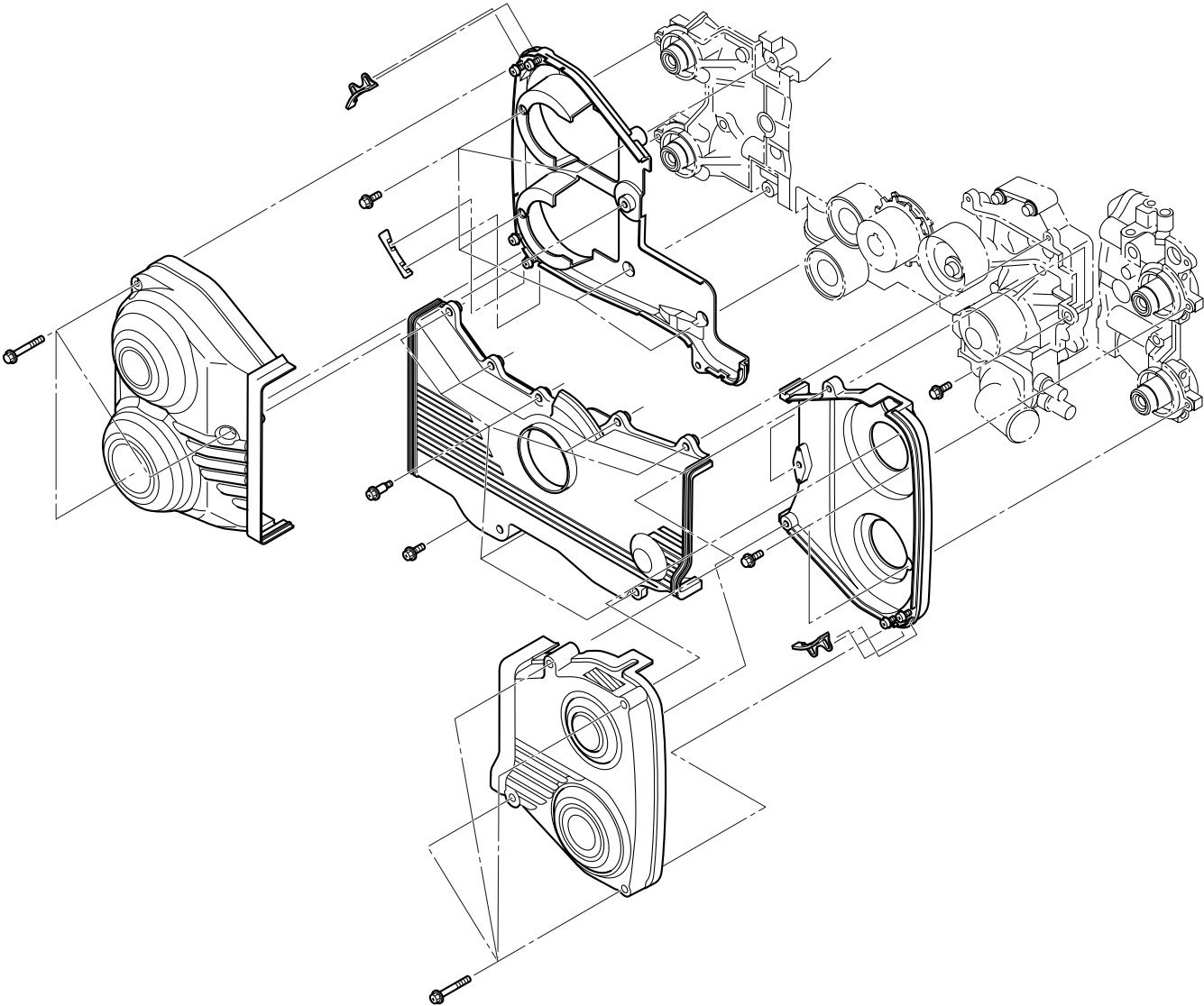
If the tension of the timing belt increases excessively, the force  $P$  becomes larger than the thrust force  $F$  and silicone oil is returned from the oil pressure chamber to the reservoir chamber little by little until the force  $P$  balances again with the thrust force  $F$ . Thus the timing belt tension is maintained at the specified level at all times.

# BELT COVER

MECHANICAL

## 4. Belt Cover

- The belt cover is made of lightweight, heat resistant synthetic resin molding. It constitutes a totally enclosed housing with its cylinder block mating edges sealed with rubber gaskets. This effectively protects the inside components from dust and liquid.
- Rubber seals used between the cylinder block and the belt cover effectively reduces transmission of noise and vibration.
- The front belt cover has a line mark for ignition-timing checking.



ME-00823



## 5. Camshaft

The DOHC engine uses four camshafts in all; intake and exhaust camshafts on each of the right and left banks.

The camshafts are of a composite material type using sintered steel for cam lobes and carbon steel for pipe part.

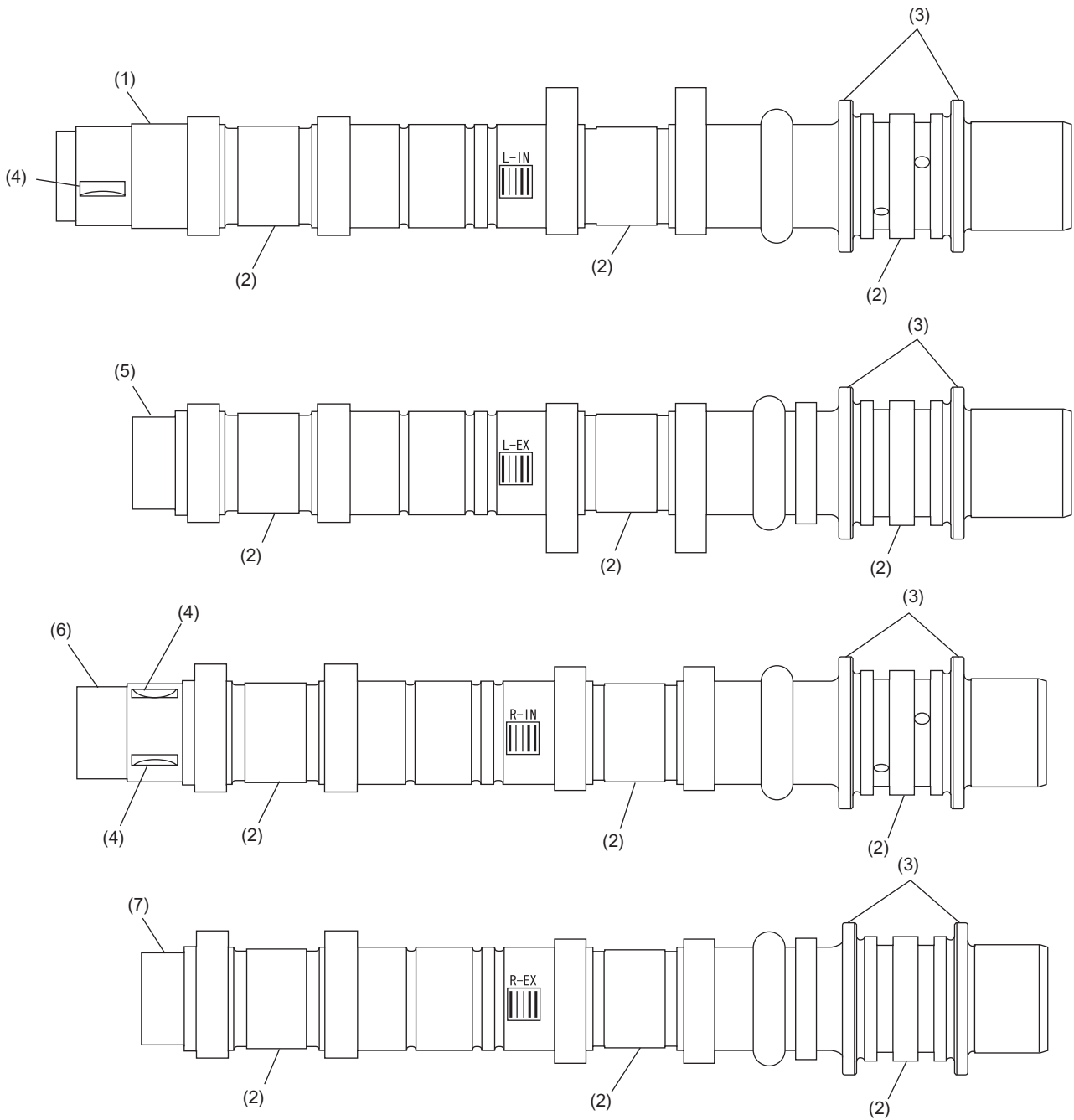
The sintered steel cams are very high in the resistance to wear, which enables the cam lift to be increased. In addition, use of a hollow pipe material contributes to reduction in weight.

Each camshaft is supported at its three journals and held in position by three camshaft caps. The two flanges on each camshaft supports thrust forces to limit the end play of the camshaft within the tolerance.

For DOHC turbo model engines, slots (notches) for variable valve timing position sensors are provided at the intake side.

# CAMSHAFT

MECHANICAL



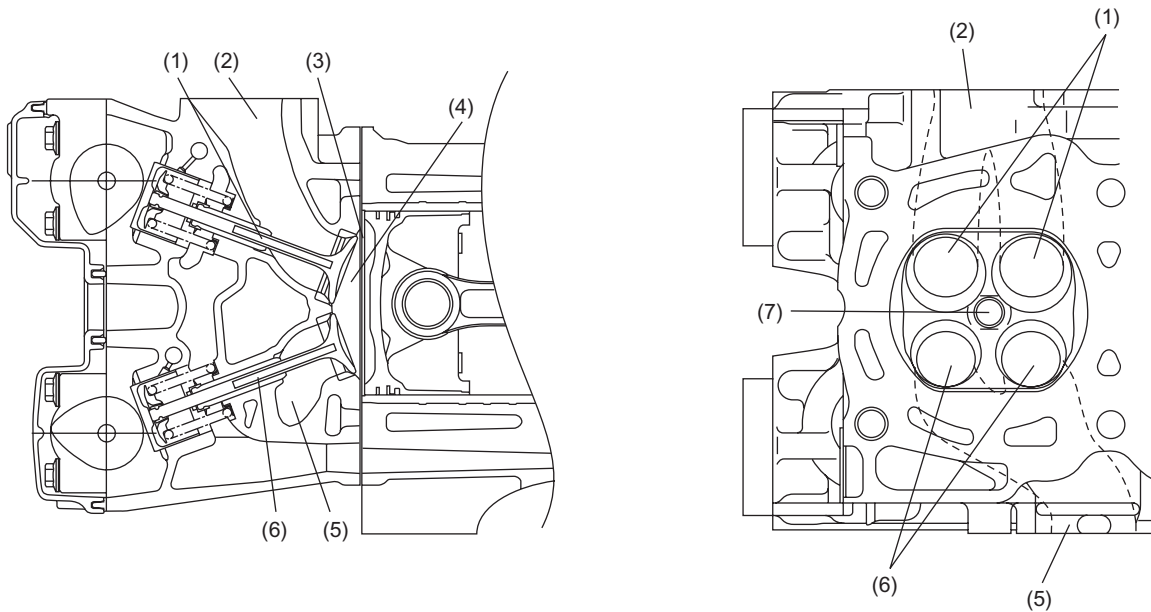
ME-00790

- |  |                         |
|--|-------------------------|
| (1) Intake camshaft LH                               | (5) Exhaust camshaft LH |
| (2) Journal  | (6) Intake camshaft RH  |
| (3) Flange   | (7) Exhaust camshaft RH |
| (4) Slot (notch) for variable timing position sensor |                         |

**ME(H4DOTC)-8**

## 6. Cylinder Head

- The cylinder head is made of low pressure cast aluminum.
- Each combustion chamber in the cylinder head is a compact, pent roof design. The spark plug is located at the center of the combustion chamber, which contributes to creation of a wide “squish area” for increased combustion efficiency.
- The two intake and two exhaust valves are arranged on opposite sides for a cross-flow feature.
- The cylinder head gasket is a metallic gasket consisting of three layers of the stainless steel sheets. The gasket is highly resistant to heat and maintains high level of sealing performance for a long period.



ME-00793

- (1) Intake valve
- (2) Intake port
- (3) Squish area
- (4) Combustion chamber

- (5) Exhaust port
- (6) Exhaust valve
- (7) Spark plug

# CYLINDER BLOCK

MECHANICAL

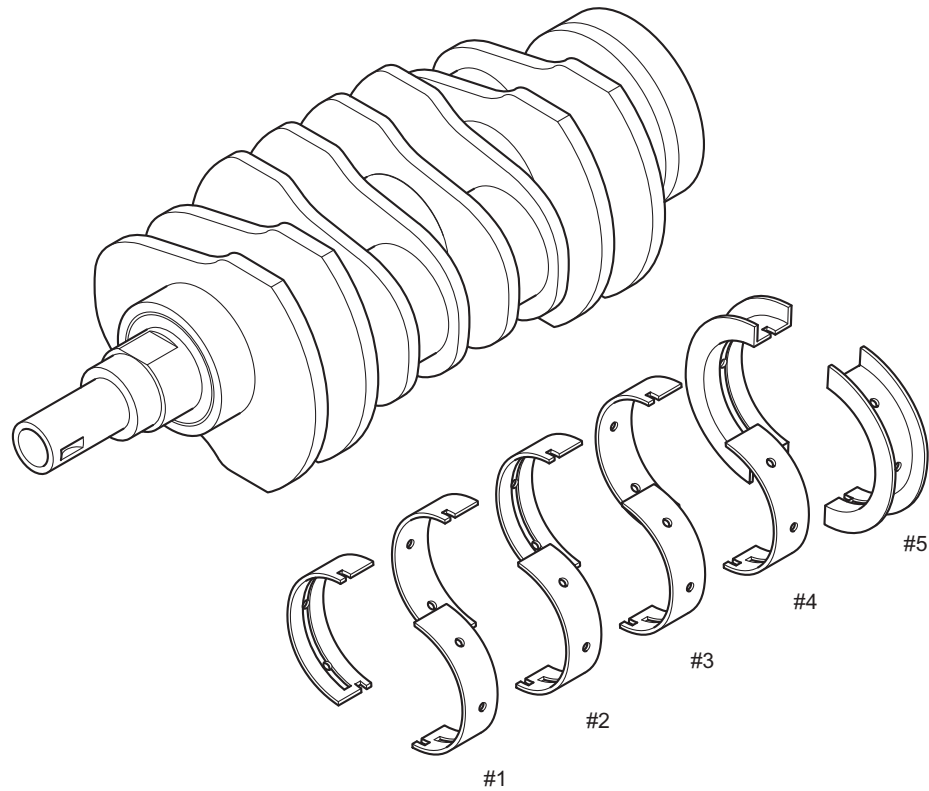
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## 7. Cylinder Block

- The cylinder block is made of aluminum die casting. A semi-closed deck structure is used to obtain a higher rigidity to hold the cylinder liners.
- The cylinder liners are made of cast iron. As they are of a dry type, their outer surfaces are entirely in contact with the cylinder block.
- The cylinder block supports the crankshaft at its five journals. The journal supporting portions are designed such that sufficient stiffness and quiet operation are ensured.
- Sintered material is fit in the casting at the #5 journal to achieve further quietness.
- The oil pump is located in the front center of the cylinder block and the water pump is located at the front of the left-cylinder bank. At the rear of the right-cylinder bank is an oil separator which removes oil mist contained in blow-by gas.

## 8. Crankshaft

The crankshaft is supported in the cylinder block at five journals. Each corner formed by a journal or pin and a web is finished by fillet-rolling method, which increases strength of that area. The five crankshaft bearings are made of aluminum alloy and the No. 5 bearing is provided with a flanged metal to support thrust forces.



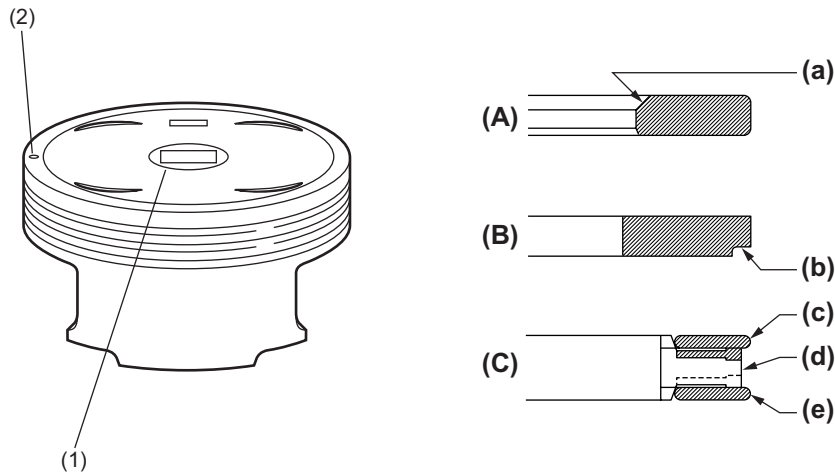
ME-00319

# PISTON

MECHANICAL

## 9. Piston

- The pistons are of a slipper skirt design for reduced weight and friction. The piston is also a thermal flow type whose oil control ring groove is provided with round oil drain holes.
- The piston pin is offset toward the thrust side (No. 1 and No. 3 downwards, No. 2 and No. 4 upwards) to reduce piston slap noises.
- The piston head has recesses to prevent interference with the intake and exhaust valves. It also has engraved marks to identify the piston size and the direction of installation. All the pistons are common in their design.
- Three piston rings are used for each piston; two compression rings and one oil control ring. The top piston ring has inner bevels and the second piston ring has a cut on the bottom outside to reduce oil consumption.



ME-00791

- (1) Identification mark
- (2) Location mark (engine front side)

- (A) Top ring
- (B) Second ring
- (C) Oil ring

- (a) Inner-bevel
- (b) Cut
- (c) Upper rail
- (d) Spacer
- (e) Lower rail

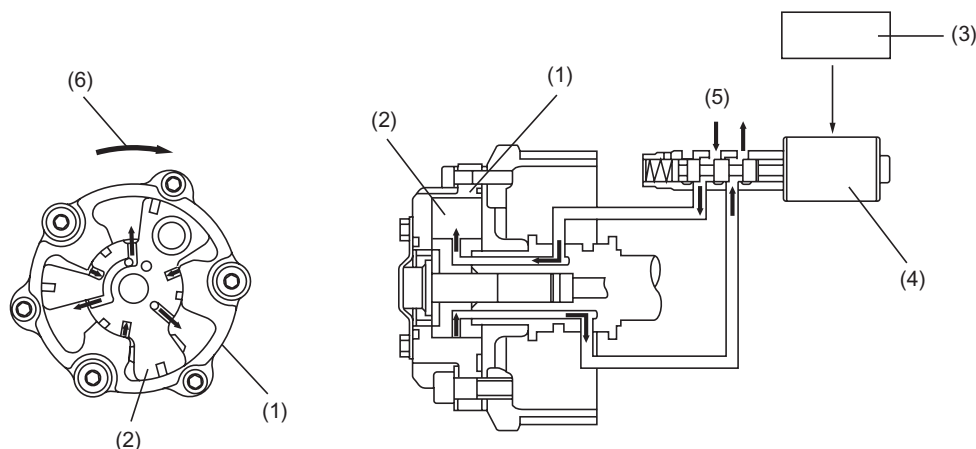
## 10. Variable Valve Timing System

This engine has a variable valve timing system, which adjusts the opening and closing timings of the valves optimally by continuously changing the phase angle of the camshaft sprocket relative to the camshaft.

- The ECM determines the optimal cam angle relative to the crank angle by making reference to the engine speed, vehicle speed, throttle opening and other relevant parameters.
- Under the control of the ECM, the oil flow control solenoid valve moves its spool to switch the hydraulic passage to/from the advance and retard chambers that are formed in the camshaft sprocket to change continuously the phase angle between the camshaft sprocket and camshaft.

### A: PHASE ANGLE ADVANCES

In response to an advance signal from the ECM, the oil flow control solenoid valve moves its spool such that hydraulic pressure is applied to the advance chamber in the camshaft sprocket. The sprocket is then turned in the direction in which its phase angle advances relative to the camshaft.



ME-00825

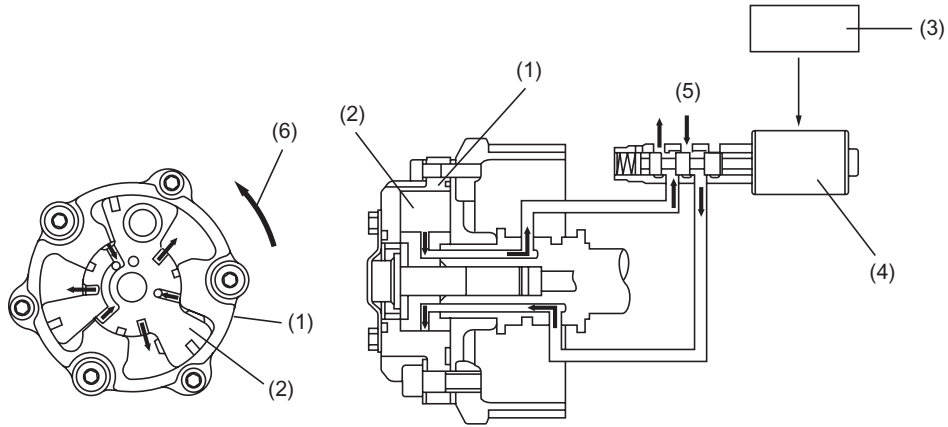
- (1) Variable valve timing controller (attached to camshaft sprocket)
- (2) Vane (attached to camshaft)
- (3) ECM
- (4) Oil flow control solenoid valve
- (5) Oil pressure
- (6) Turns in advance direction

# VARIABLE VALVE TIMING SYSTEM

MECHANICAL

## B: PHASE ANGLE RETARDS

In response to a retard signal from the ECM, the oil flow control solenoid valve moves its spool such that hydraulic pressure is applied to the retard chamber in the camshaft sprocket. The sprocket is then turned in the direction in which its phase angle retards relative to the camshaft.



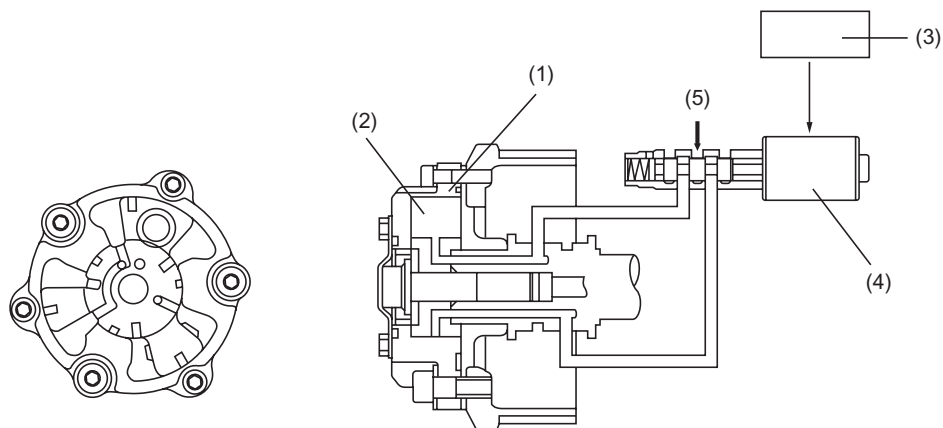
ME-00826

- (1) Variable valve timing controller (attached to camshaft sprocket)
- (2) Vane (attached to camshaft)
- (3) ECM
- (4) Oil flow control solenoid valve
- (5) Oil pressure
- (6) Turns in retard direction



## C: A CERTAIN PHASE ANGLE IS RETAINED

When the ECM issues a signal to keep the phase angle unchanged, the oil flow control solenoid valve moves its spool to the position at which the hydraulic pressures to/from both the chambers are blocked. The pressures in the chambers are thus maintained, so the phase angle does not change and the intake valves' opening and closing timings also remain unchanged.



ME-00827

- (1) Variable valve timing controller (attached to camshaft sprocket)
- (2) Vane (attached to camshaft)
- (3) ECM
- (4) Oil flow control solenoid valve
- (5) Oil pressure

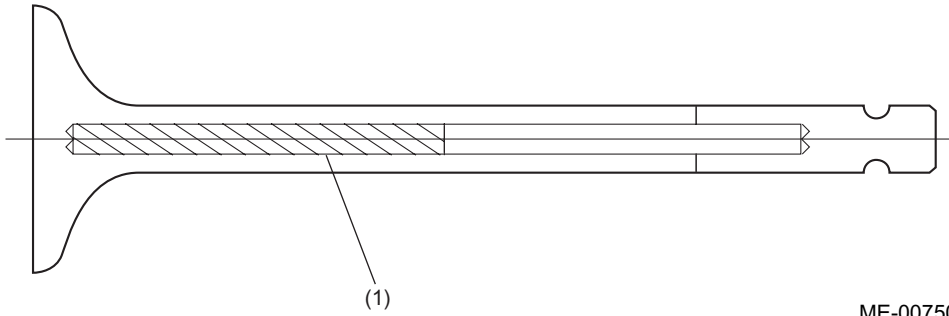
# SODIUM-FILLED EXHAUST VALVES

MECHANICAL

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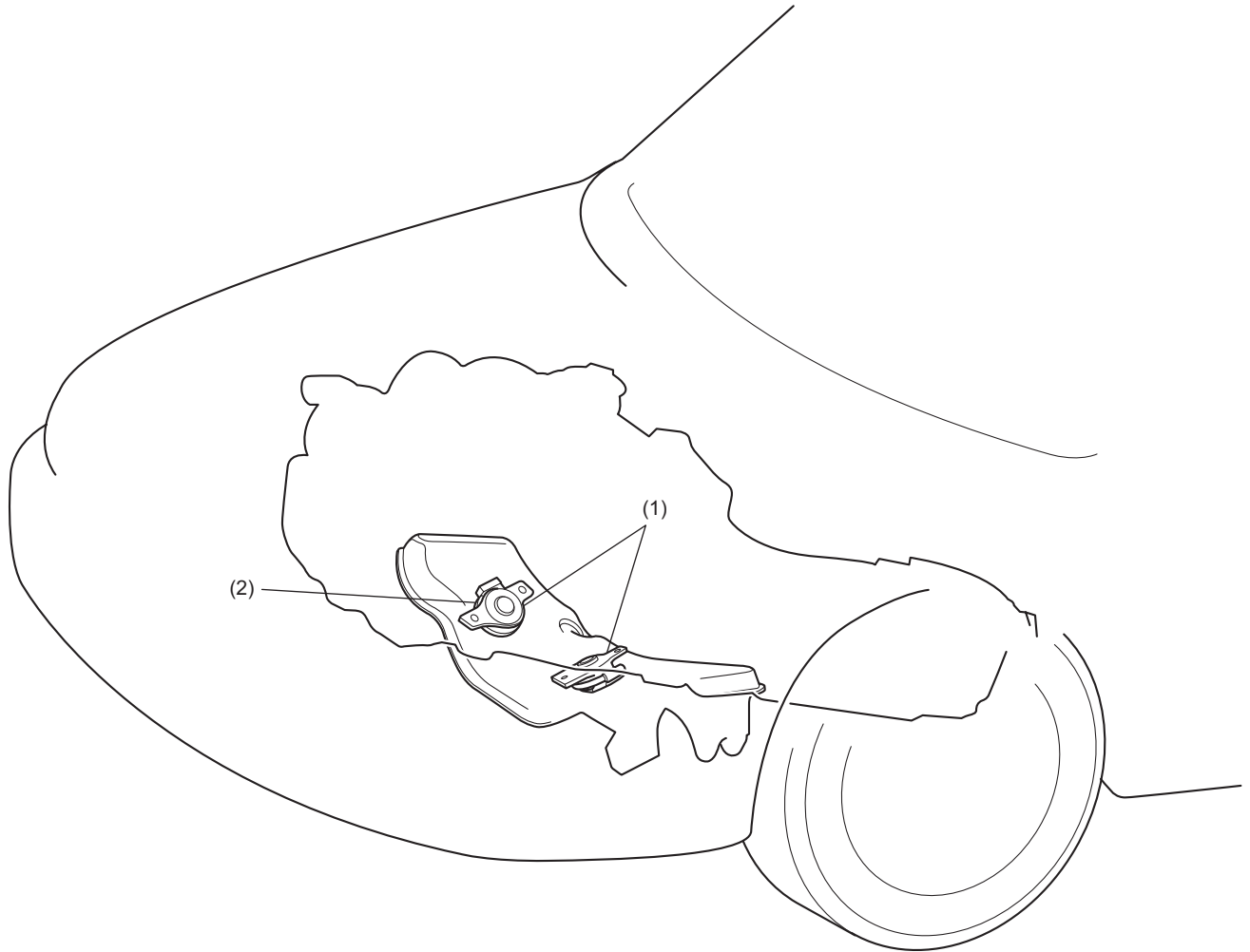
## 11.Sodium-filled Exhaust Valves

Each exhaust valve contains pure sodium in its hollow stem. Sodium has high thermal conductivity. The entrapped sodium will liquefy at high temperatures and move inside the stem as the valve is operated. Thus the sodium will effectively transfer heat from the valve head to the valve stem, contributing to cooling down the valve head faster.



(1) Pure sodium

## 12.Engine Mounting



ME-02441

- (1) Cushion rubber
- (2) Engine mounting cover

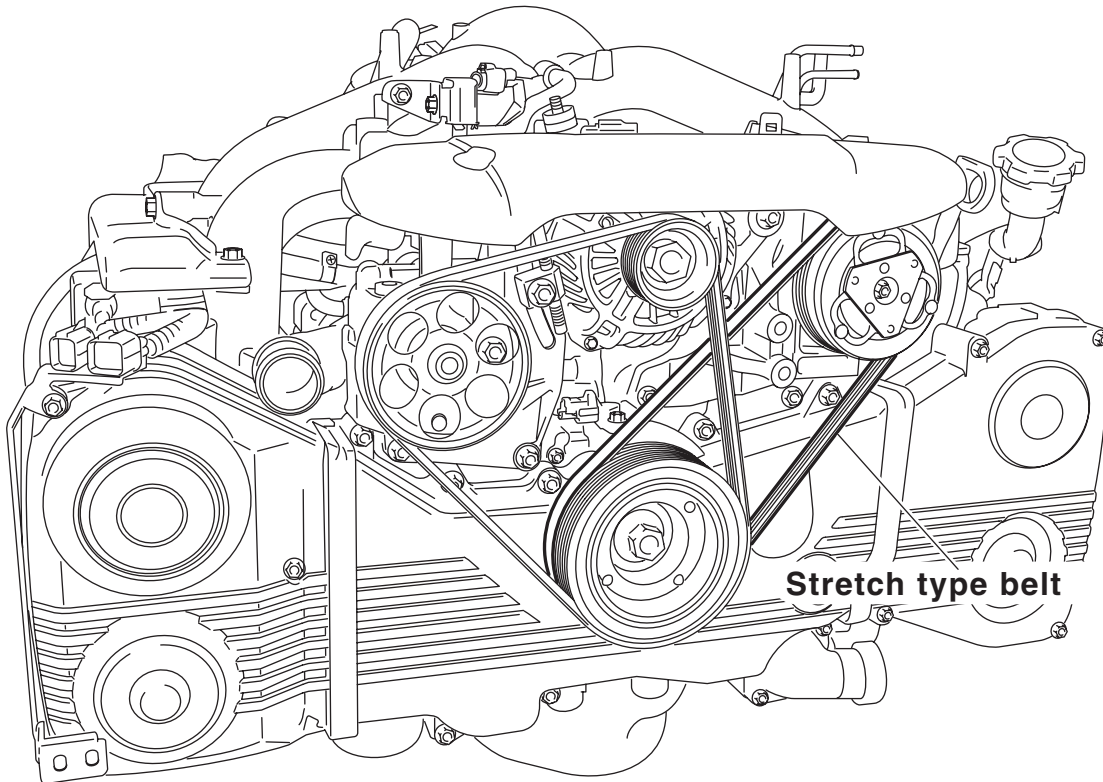
# STRETCH TYPE BELT (FROM '08MY)

MECHANICAL

## 13.Stretch Type Belt (From '08MY)

### A: GENERAL

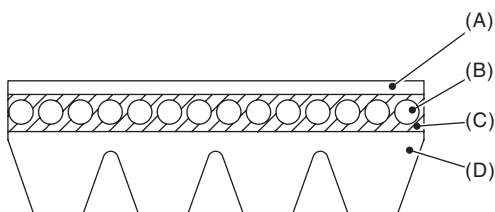
- Stretch type belt uses elastic material in its core, resulting in eliminating a tensioner pulley and in a weight reduction.
- The stretch type belt eliminates the need to adjust tension of the belt.



ME-03635

### B: STRUCTURE

The stretch type belt is built as shown in the following figure providing the elastic feature.



ME-03636

- (A) Upper cloth (nylon)
- (B) Core (nylon)
- (C) Adhesive rubber
- (D) Rib rubber

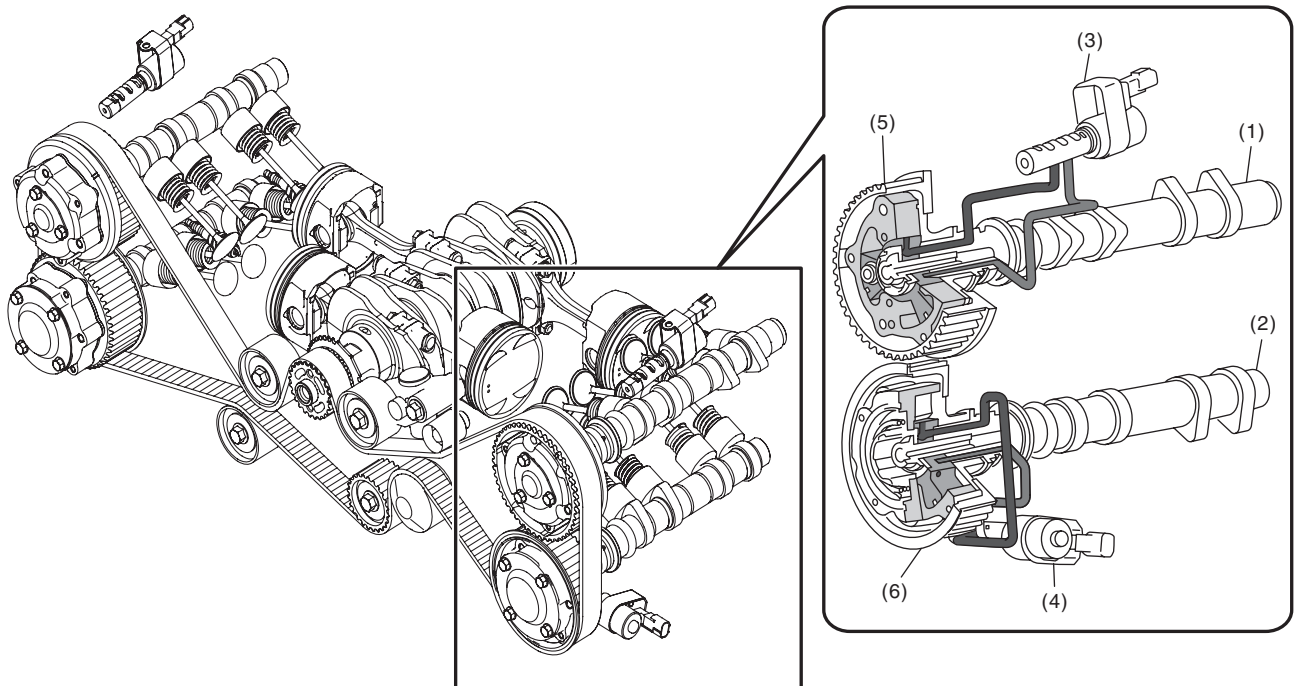
## 14. Dual AVCS (Active Valve Control System) (From '08MY)

### A: GENERAL

The dual AVCS (Active Valve Control System) changes the camshaft phase angle in relation to the camshaft sprocket to optimize valve timing of the intake and exhaust valves, improving torque in a low and medium speed range, output performance in a high speed range, emission performance, and fuel efficiency.

- The ECM determines the best camshaft angle in relation to the crankshaft angle based on engine speed, vehicle speed, throttle angle, and other relevant parameters.
- Under the control of the ECM, the oil flow control solenoid valve moves its spool to change the phase angle between the camshaft sprocket and camshaft successively by switching the oil path designed between the advance angle chamber and the retard angle chamber.

### B: COMPONENT



ME-03631

- |                                   |   |  |
|-----------------------------------|---|--|
| (1) Intake camshaft               | (4) Exhaust oil flow control valve          | (6) Exhaust variable valve timing controller |
| (2) Exhaust camshaft              | (5) Intake variable valve timing controller |  |
| (3) Intake oil flow control valve |   |  |

# DUAL AVCS (ACTIVE VALVE CONTROL SYSTEM) (FROM '08MY)

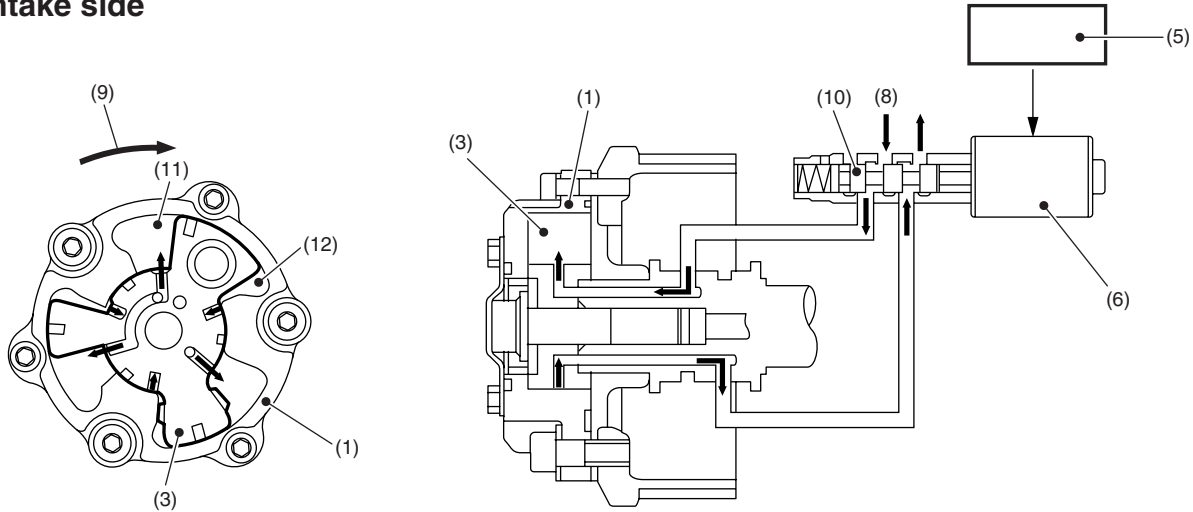
MECHANICAL

## C: OPERATION

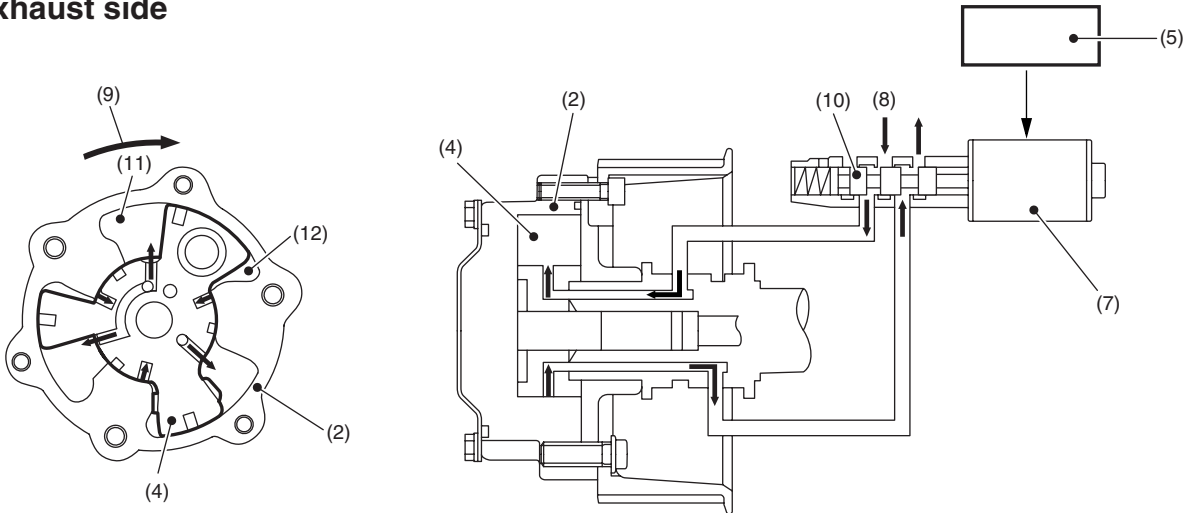
### 1. ADVANCEMENT IN PHASE ANGLE

The oil flow control solenoid valve applies oil pressure to the advance angle chamber of the camshaft sprocket by moving its spool in response to an advance angle signal from the ECM. As the pressure is applied, the camshaft that is attached to the vanes rotates in the phase angle advance direction in relation to the camshaft sprocket.

#### Intake side



#### Exhaust side



ME-03632

- |  |   |   |
|--|---|---|
| (1) Intake variable valve timing controller (attached to the intake camshaft sprocket)   | (3) Vane (attached to intake camshaft)      | (8) Oil pressure                          |
| (2) Exhaust variable valve timing controller (attached to the exhaust camshaft sprocket) | (4) Vane (attached to exhaust camshaft)     | (9) Rotates in direction of advance angle |
|  | (5) ECM                                     | (10) Spool                                |
|  | (6) Intake oil flow control solenoid valve  | (11) Advance angle chamber                |
|  | (7) Exhaust oil flow control solenoid valve | (12) Retard angle chamber                 |

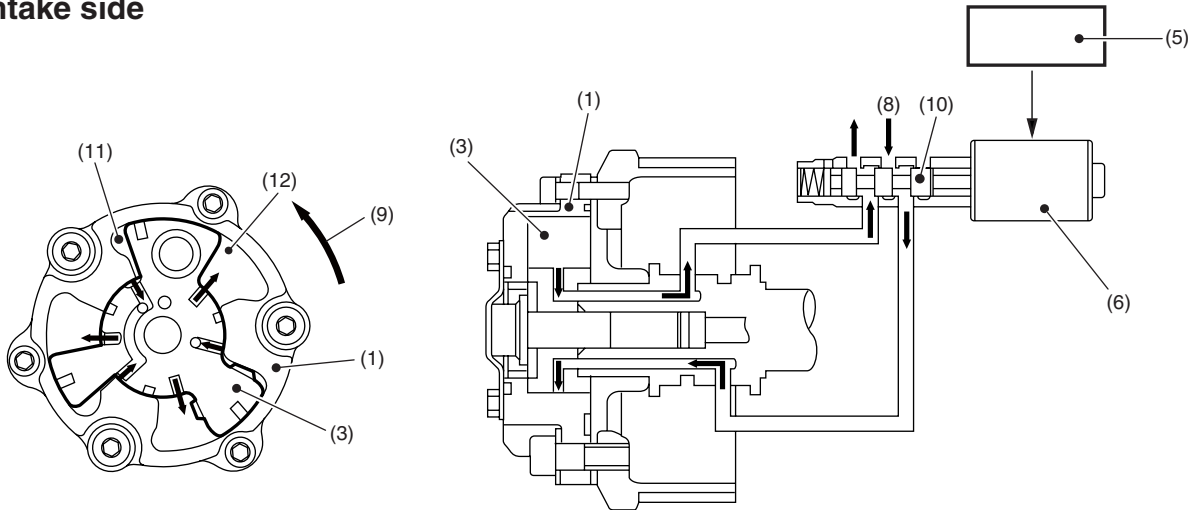
# DUAL AVCS (ACTIVE VALVE CONTROL SYSTEM) (FROM '08MY)

MECHANICAL

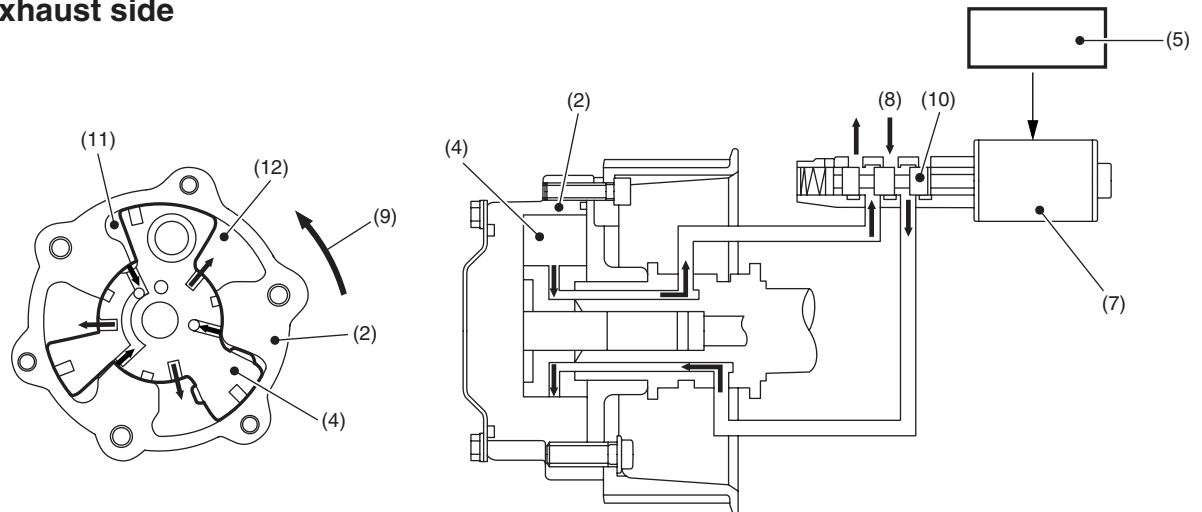
## 2. RETARD IN PHASE ANGLE

The exhaust oil flow control solenoid valve applies oil pressure to the retard angle chamber of the camshaft sprocket by moving its spool in response to a retard angle signal from the ECM. As the pressure is applied, the camshaft that is attached to the vanes rotates in the phase angle retard direction in relation to the camshaft sprocket.

### Intake side



### Exhaust side



ME-03633

- |  |   |  |
|--|---|--|
| (1) Intake variable valve timing controller (attached to the intake camshaft sprocket)   | (3) Vane (attached to intake camshaft)      | (8) Oil pressure                         |
| (2) Exhaust variable valve timing controller (attached to the exhaust camshaft sprocket) | (4) Vane (attached to exhaust camshaft)     | (9) Rotates in direction of retard angle |
|  | (5) ECM                                     | (10) Spool                               |
|  | (6) Intake oil flow control solenoid valve  | (11) Advance angle chamber               |
|  | (7) Exhaust oil flow control solenoid valve | (12) Retard angle chamber                |

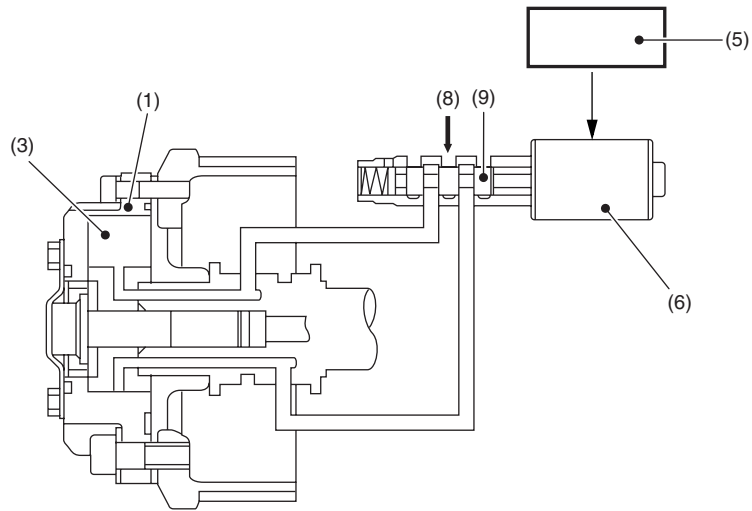
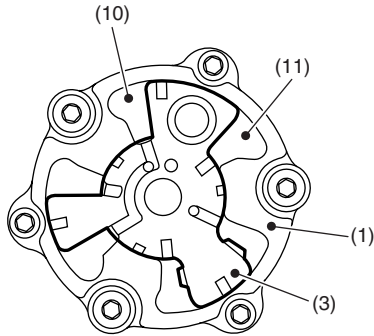
# DUAL AVCS (ACTIVE VALVE CONTROL SYSTEM) (FROM '08MY)

MECHANICAL

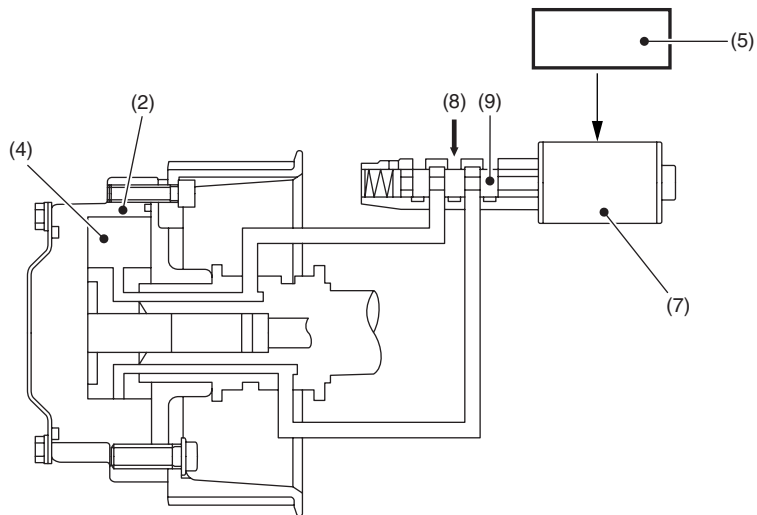
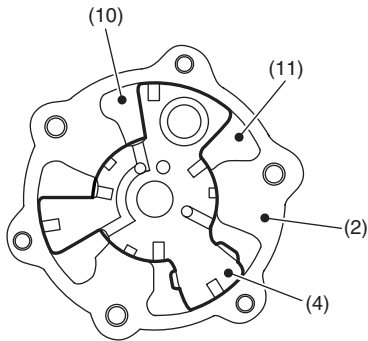
## 3. CONSISTENT PHASE ANGLE IS RETAINED

When the ECM commands a signal preventing a change in phase angle, the oil flow control solenoid valve move its spool to block oil pressure that is applied to both chambers. Therefore the oil pressure in the chambers are held and the phase angle is retained.

### Intake side



### Exhaust side



ME-03634

- |  |   |                            |
|--|---|----------------------------|
| (1) Intake variable valve timing controller (attached to the intake camshaft sprocket)   | (3) Vane (attached to intake camshaft)      | (8) Oil pressure           |
| (2) Exhaust variable valve timing controller (attached to the exhaust camshaft sprocket) | (4) Vane (attached to exhaust camshaft)     | (9) Spool                  |
|  | (5) ECM                                     | (10) Advance angle chamber |
|  | (6) Intake oil flow control solenoid valve  | (11) Retard angle chamber  |
|  | (7) Exhaust oil flow control solenoid valve |                            |



## GENERAL

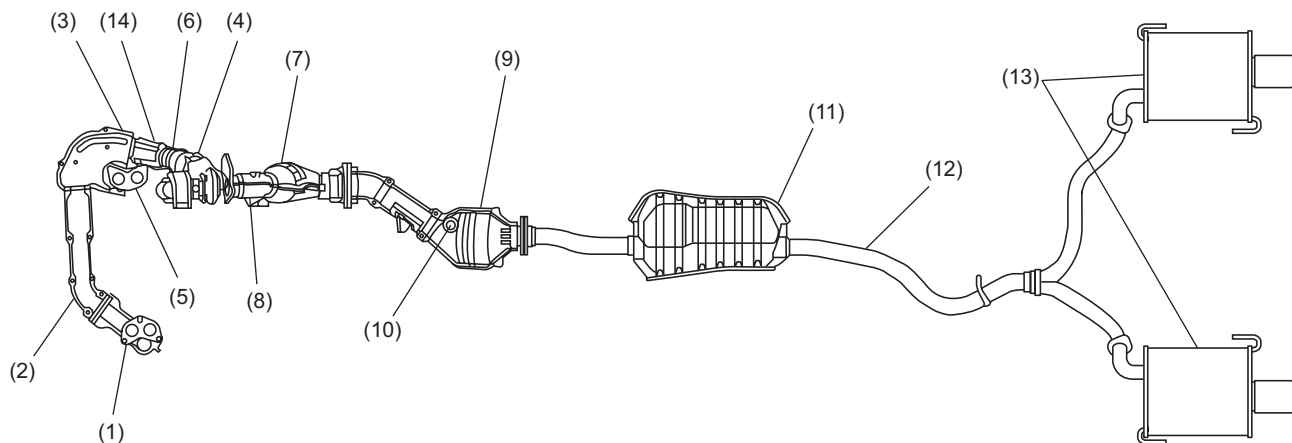
### EXHAUST

---

#### 1. General

- The exhaust system consists of left and right exhaust manifolds, a front joint pipe, a turbocharger joint pipe, a center exhaust pipe, a rear exhaust pipe and a muffler. The pre catalytic converter is incorporated in the turbocharger joint pipe, the front catalytic converter is incorporated in the center exhaust pipe, and the rear catalytic converter is incorporated in the rear exhaust pipe.
- The exhaust system features an excellent sound suppression design; the rear exhaust pipe has a chamber in addition to a large capacity muffler.

## 2. Construction



EX-02079

- |                                |                              |
|--------------------------------|------------------------------|
| (1) Exhaust manifold (LH)      | (8) Center exhaust pipe      |
| (2) Front joint pipe           | (9) Rear catalytic converter |
| (3) Front oxygen (A/F) sensor  | (10) Rear oxygen sensor      |
| (4) Exhaust temperature sensor | (11) Chamber                 |
| (5) Exhaust manifold (RH)      | (12) Rear exhaust pipe       |
| (6) Pre-catalytic converter    | (13) Muffler                 |
| (7) Front catalytic converter  | (14) Turbocharger joint pipe |

# CONSTRUCTION

EXHAUST

---

**MEMO**

### 1. General

- The engine cooling system consists of a down-flow radiator which features high heat-dissipation performance, an electric-motor-driven fan, a water pump, a thermostat, and an engine coolant temperature sensor.
- The reservoir tank is made of translucent resin and enables easy confirmation of the coolant level. Also, coolant should be added to the reservoir tank when replenishment is necessary.
- The ECM controls the operation of the radiator main fan and sub fan depending on the signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch.

## 2. Cooling Circuits

The cooling system operates in three different phases depending on the temperature of the engine coolant.

- 1st phase (thermostat closed)

When the engine coolant temperature is below the preset temperature, the thermostat remains closed. The coolant flows through the heater circuit. This permits the engine to warm up quickly.

- 2nd phase (thermostat open)

When the engine coolant temperature becomes higher than the preset temperature, the thermostat opens. The coolant flows through the radiator where it is cooled.

- 3rd phase (thermostat open and radiator fan operating)

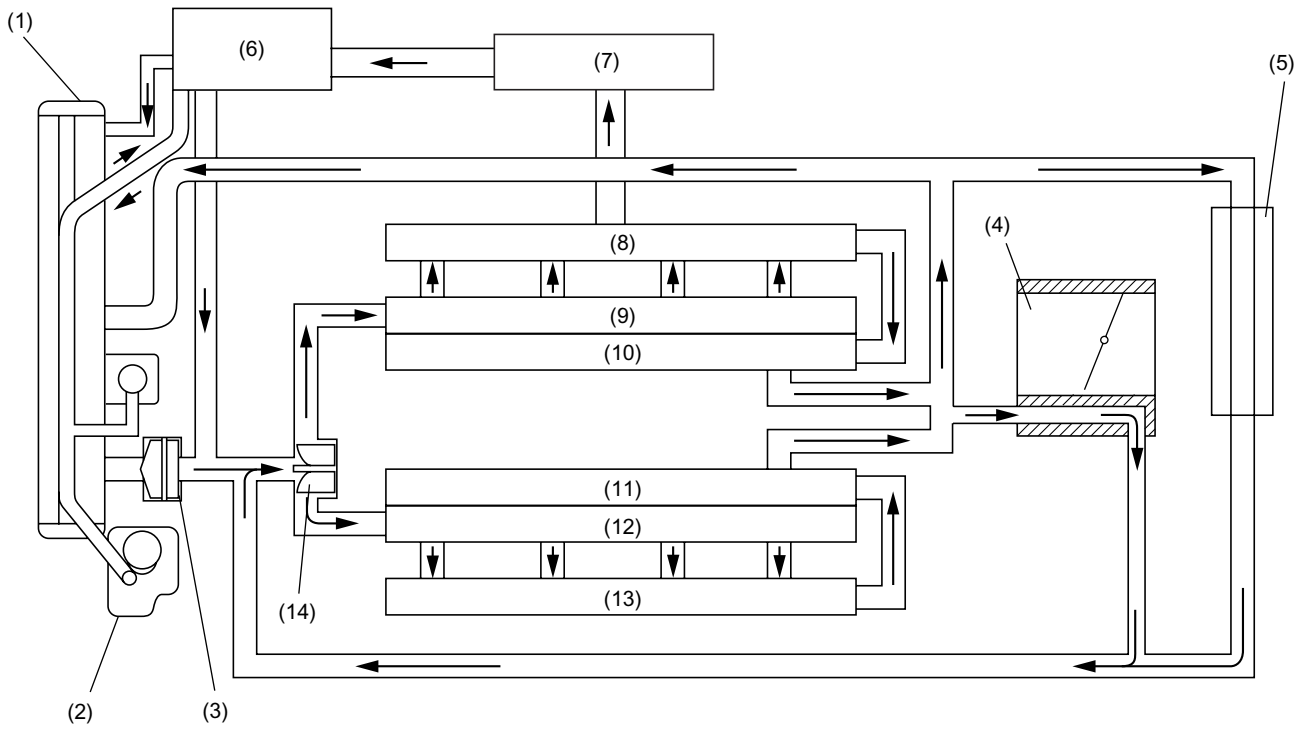
When the engine coolant temperature sensor becomes hotter than the preset value, the ECM receives signals from the engine coolant temperature sensor and causes the radiator fan(s) to operate. When the engine is stopped after high-speed operation, vapor produced in the turbocharger cooling section flows from the coolant filler tank to the reservoir tank where it condenses back into water. Water is then absorbed by the coolant filler tank as the engine cools down.

**NOTE:**

Refer to the Service Manual for preset engine coolant temperature values for each stage.

# COOLING CIRCUITS

## COOLING

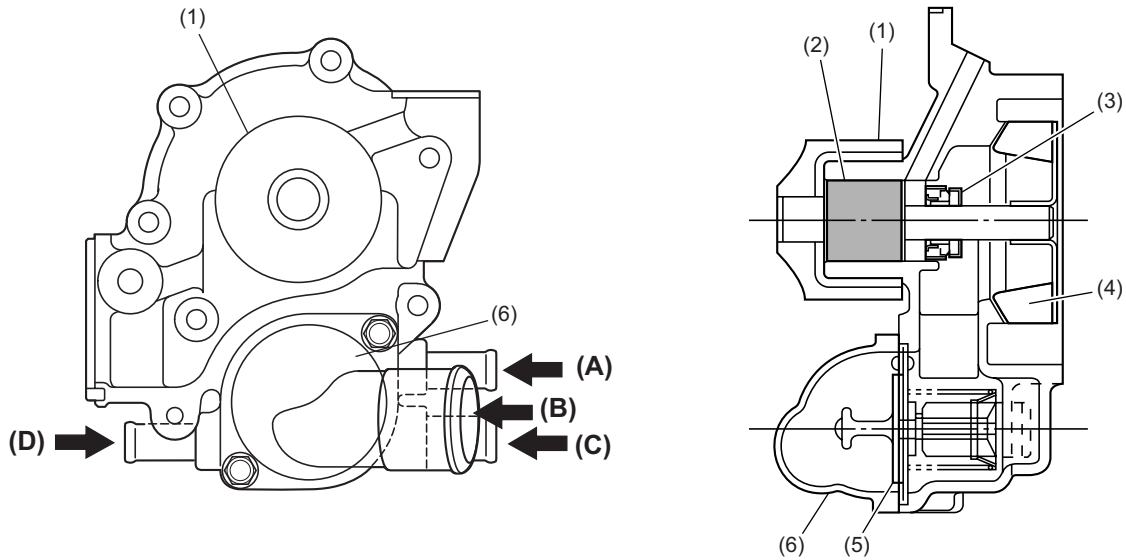


CO-02023

- |                                   |                         |
|-----------------------------------|-------------------------|
| (1) Radiator                      | (8) Cylinder head RH    |
| (2) Engine coolant reservoir tank | (9) Cylinder jacket RH  |
| (3) Thermostat                    | (10) Cylinder block RH  |
| (4) Throttle body                 | (11) Cylinder block LH  |
| (5) Heater core                   | (12) Cylinder jacket LH |
| (6) Coolant filler tank           | (13) Cylinder head LH   |
| (7) Turbocharger                  | (14) Water pump         |

## 3. Water Pump

The water pump is located in the front portion of the left bank cylinder block and is driven by the engine through the timing belt. The thermostat is fitted into the coolant inlet at the bottom of the water pump. When the pump's impeller rotates, the coolant is drawn into the pump from the lower pipe (which is connected to the radiator hose) via the thermostat. It then flows along the perimeter of the impeller and then is discharged for circulation through a circuit depending on the coolant temperature.



CO-02117

- (A) From water tank
- (B) From radiator
- (C) From heater
- (D) From engine oil cooler

- (1) Pulley
- (2) Ball bearing
- (3) Mechanical seal
- (4) Impeller
- (5) Thermostat
- (6) Thermostat cover

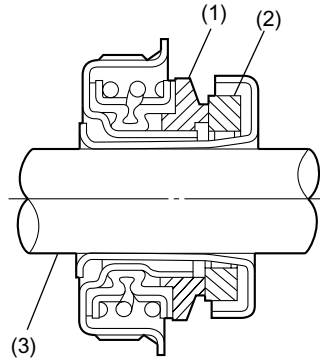
# MECHANICAL SEAL

COOLING

---

## 4. Mechanical Seal

The mechanical seal has its seat tightly fitted on the water pump shaft. Since it is a hermetic seal forming an integral part of the water pump, the water pump cannot be disassembled.



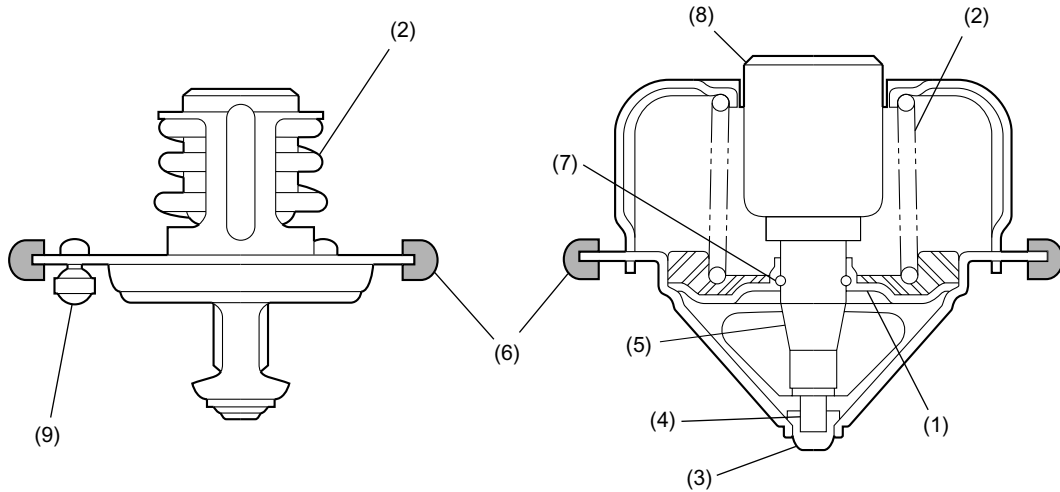
CO-00058

- (1) Carbon seal
- (2) Ceramics seat
- (3) Water pump shaft



## 5. Thermostat

The thermostat has a totally-enclosed wax pellet which expands as the coolant temperature increases. It opens and closes accurately at the preset temperatures and features high durability.



CO-00059

- (1) Valve
- (2) Spring
- (3) Stopper

- (4) Piston
- (5) Guide
- (6) Rubber packing

- (7) Stop ring
- (8) Wax element
- (9) Jiggle valve

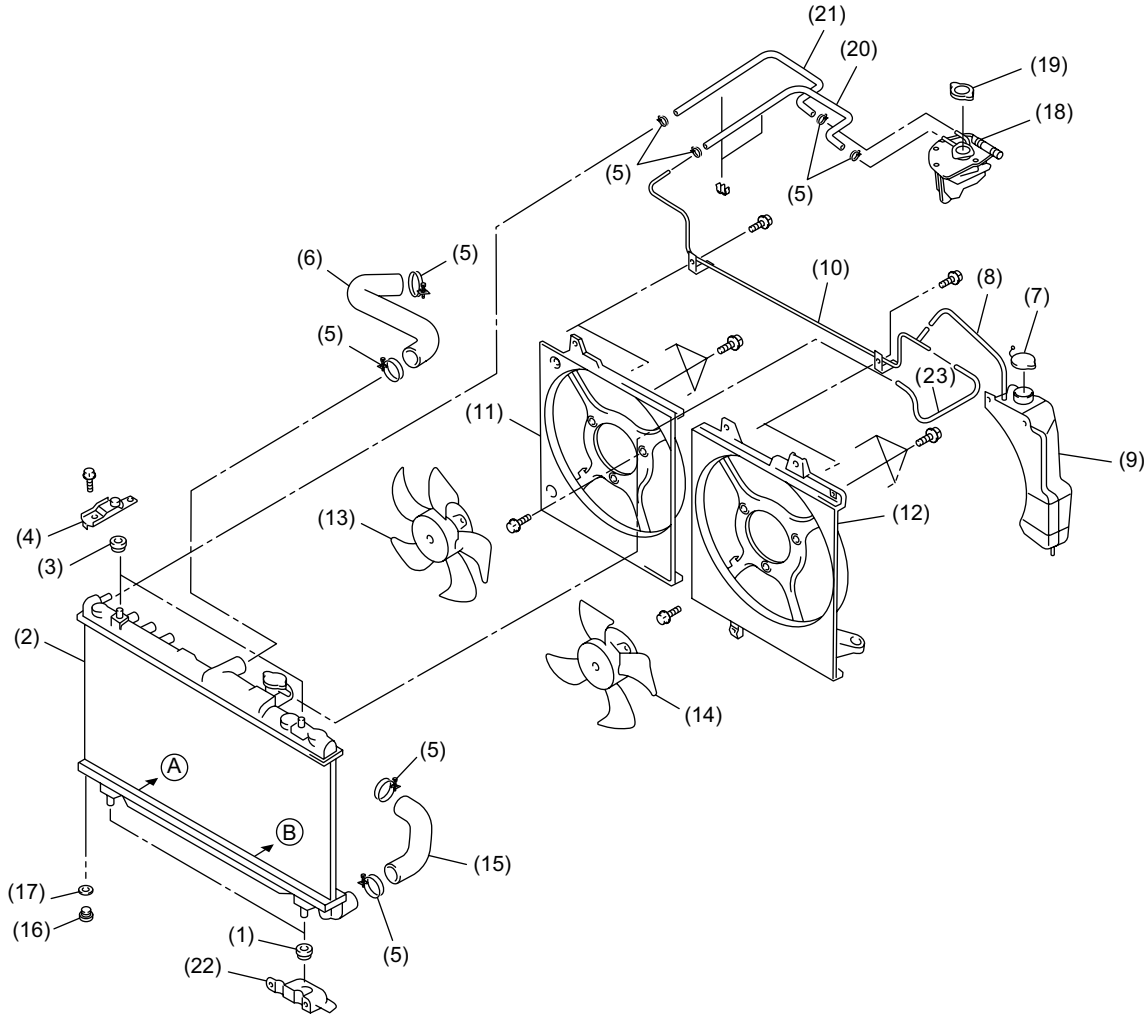
# RADIATOR FAN

COOLING

## 6. Radiator Fan

### A: DESCRIPTION

Each radiator fan is made of plastic. It is driven by an electric motor which is retained on a shroud.



CO-02118

# RADIATOR FAN

COOLING

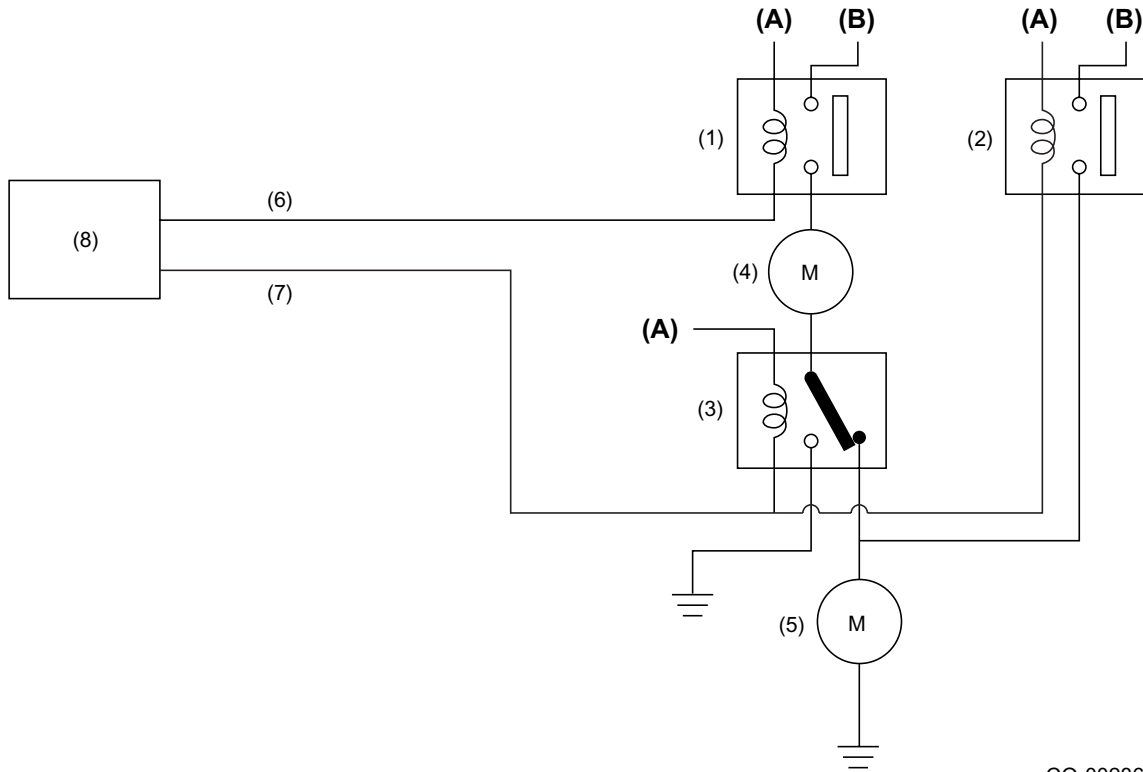
---

- |                                       |  |
|---------------------------------------|--|
| (1) Radiator lower cushion            | (13) Radiator main fan assembly                    |
| (2) Radiator                          | (14) Radiator sub fan assembly                     |
| (3) Radiator upper cushion            | (15) Radiator hose B                               |
| (4) Radiator upper bracket            | (16) Radiator drain plug                           |
| (5) Clamp                             | (17) O-ring  |
| (6) Radiator hose A                   | (18) Engine coolant filler tank                    |
| (7) Engine coolant reservoir tank cap | (19) Radiator cap (engine coolant filler tank cap) |
| (8) Overflow hose A                   | (20) Engine overflow hose                          |
| (9) Engine coolant reservoir tank     | (21) Engine air breather hose                      |
| (10) Overflow pipe                    | (22) Radiator lower bracket                        |
| (11) Radiator main fan shroud         | (23) Overflow hose B                               |
| (12) Radiator sub fan shroud          |  |

# RADIATOR FAN

## COOLING

To reduce fan noise, the fan output is two-stepped and can be switched to Low or High according to the load on A/C, coolant temperature, and vehicle speed. This control is accomplished by a circuit as shown below; the output is changed by switching the connection of two motors between serial and parallel instead of using components such as resistors.



CO-00286

- |                      |                          |
|----------------------|--------------------------|
| (1) Sub fan relay    | (6) Low speed signal     |
| (2) Main fan relay 1 | (7) High speed signal    |
| (3) Main fan relay 2 | (8) ECM                  |
| (4) Sub fan motor    | (A) From ignition switch |
| (5) Main fan motor   | (B) From battery         |

# RADIATOR FAN

COOLING

## B: FUNCTION

The ECM receives signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch, and based on these signals, the ECM controls the radiator fan speed to high or low.

### NOTE:

Refer to the Service Manual for operation of each model.

### Operation example:

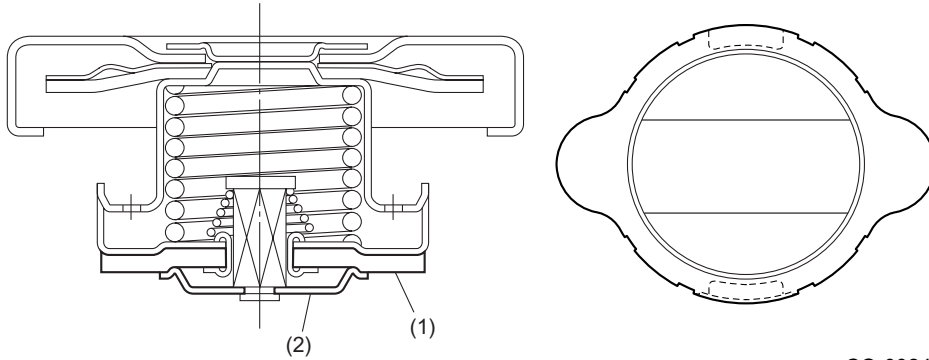
Vehicle speed	A/C compressor load	Engine coolant temperature		
		Rising: below 94°C (201°F) Lowering: below 91°C (196°F)	Rising: between 95 and 96°C (203 and 205°F) Lowering: between 92 and 94°C (198 and 201°F)	Rising: over 97°C (207°F) Lowering: over 95°C (203°F)
		Operation of radiator fans	Operation of radiator fans	Operation of radiator fans
When accelerating: below 19 km/h (12 MPH) When decelerating: below 10 km/h (6 MPH)	OFF	OFF	Low-speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 20 and 69 km/h (12 and 43 MPH) When decelerating: between 11 and 64 km/h (7 and 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 70 and 105 km/h (43 and 65 MPH) When decelerating: between 65 and 100 km/h (40 and 62 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: over 106 km/h (66 MPH) When decelerating: over 101 km/h (63 MPH)	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed

# RADIATOR CAP

COOLING

## 7. Radiator Cap

The radiator cap at the coolant filler tank side has a pressure valve and a vacuum valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. Also, when the radiator inner pressure becomes lower than the atmospheric pressure during the cooling down phase, the vacuum valve opens to send back coolant from the reservoir tank to the radiator. These functions prevent damage to the radiator components.



CO-00245

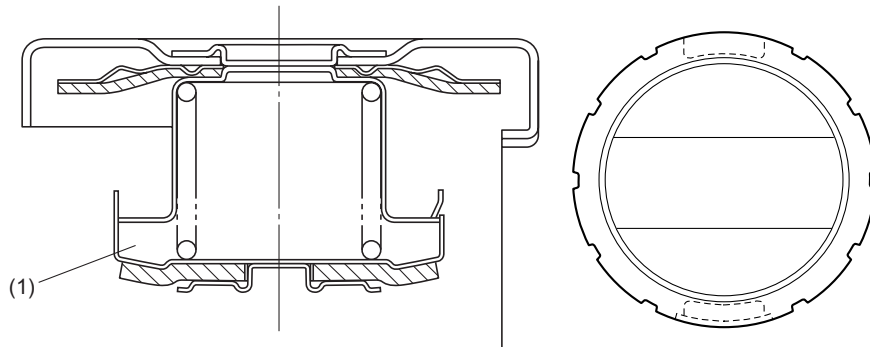
- (1) Pressure valve
- (2) Vacuum valve

## 8. Relief Valve Cap

The relief valve cap at the radiator side has a pressure valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. This function prevents damage to the radiator components.

**CAUTION:**

Due to the difference in construction, the relief valve cap cannot be used in place of the radiator cap at the coolant filler tank side. If the relief valve cap is fit on the coolant filler tank, overheating may occur.



CO-00246

(1) Pressure valve

# RELIEF VALVE CAP

COOLING

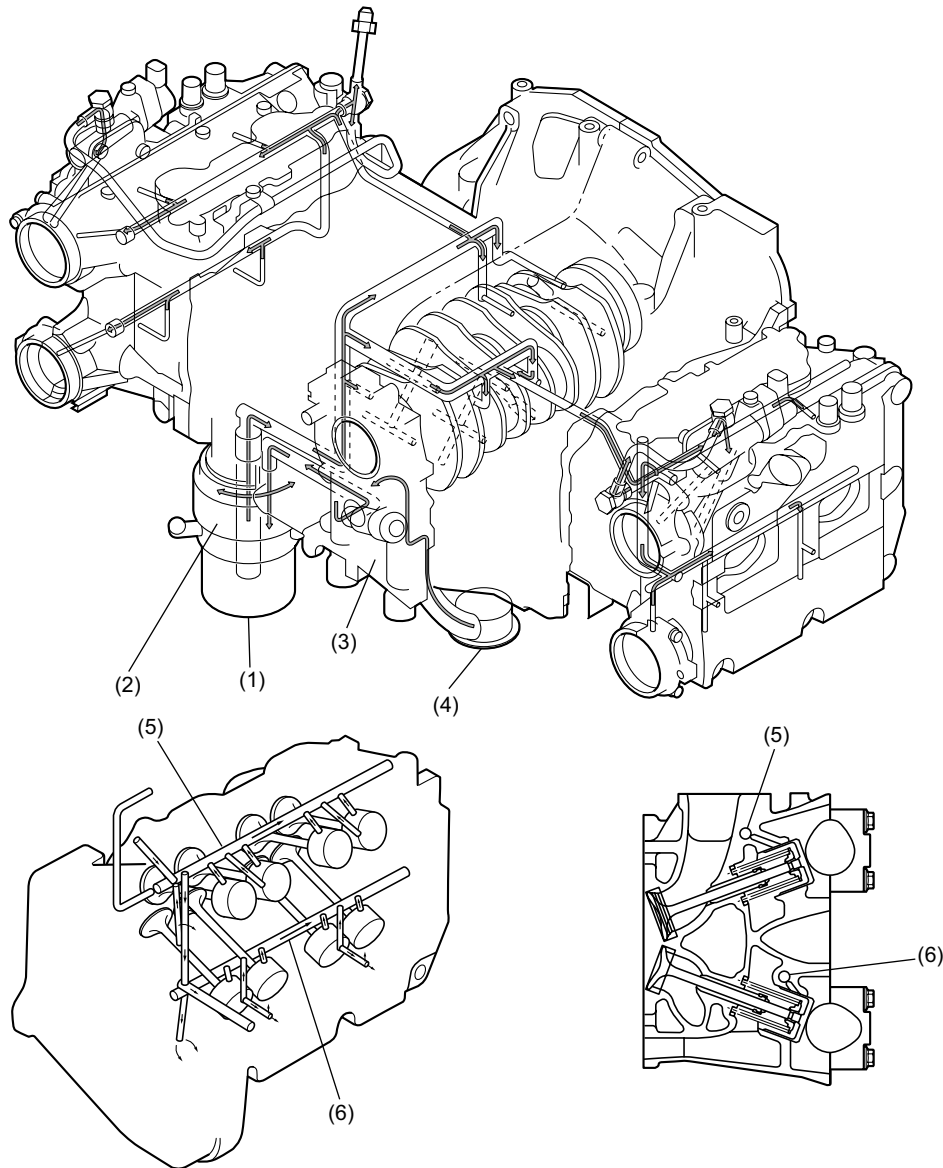
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**MEMO**



### 1. General

- The lubrication system force-circulates engine oil throughout the engine using an oil pump. The oil pressure is regulated by the relief valve built into the oil pump.
- The oil pump is a thin, large-diameter trochoid rotor type which can accommodate the engine's high output. The pump is directly driven by the crankshaft.
- The engine oil is cleaned by a full-flow, paper element type oil filter. The filter has a bypass valve which allows the engine oil to flow bypassing the filter if it is clogged.
- The inside of the oil pan is fitted with a baffle plate which reduces changes in the oil level due to movement of the vehicle, thus ensuring uninterrupted suction of oil.
- The engine oil discharged from the oil pump is delivered to the journal bearings, connecting rod bearings, and other parts requiring lubrication and cooling via the vertical passage in the right bank of the cylinder block, the oil filter, and the oil galleries in the right and left banks of the cylinder block.
- The engine oil is also distributed to each cylinder head valve mechanism at a proper flow rate achieved by metering by the orifice provided in each oil gallery.
- An oil cooler is installed to keep the engine oil in an optimum temperature range and prevent degradation of lubrication performance.



LU-00212

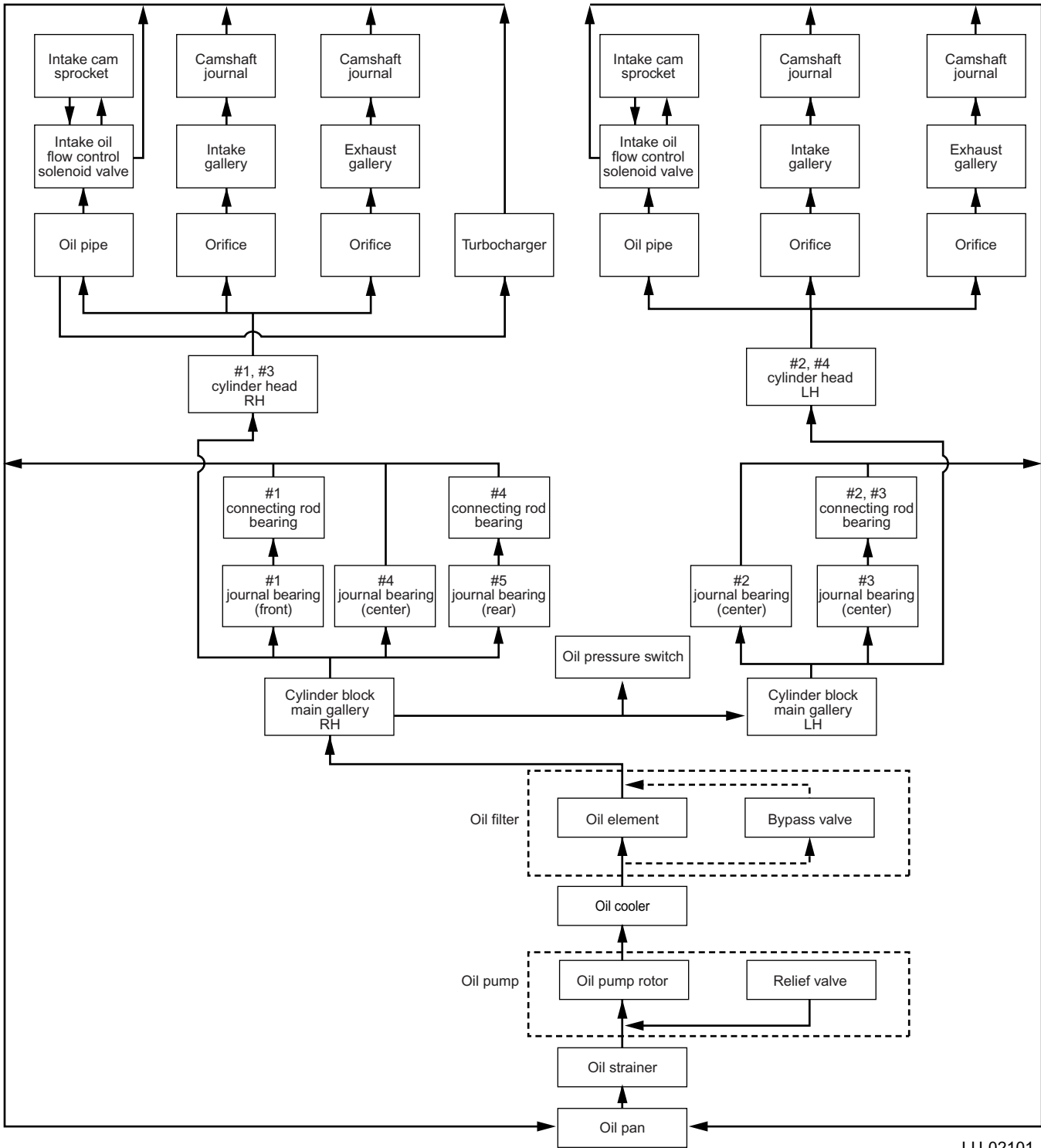
- (1) Oil filter
- (2) Oil cooler (water cooled)
- (3) Oil pump

- (4) Oil strainer
- (5) Intake gallery
- (6) Exhaust gallery

# ENGINE OIL FLOW

LUBRICATION

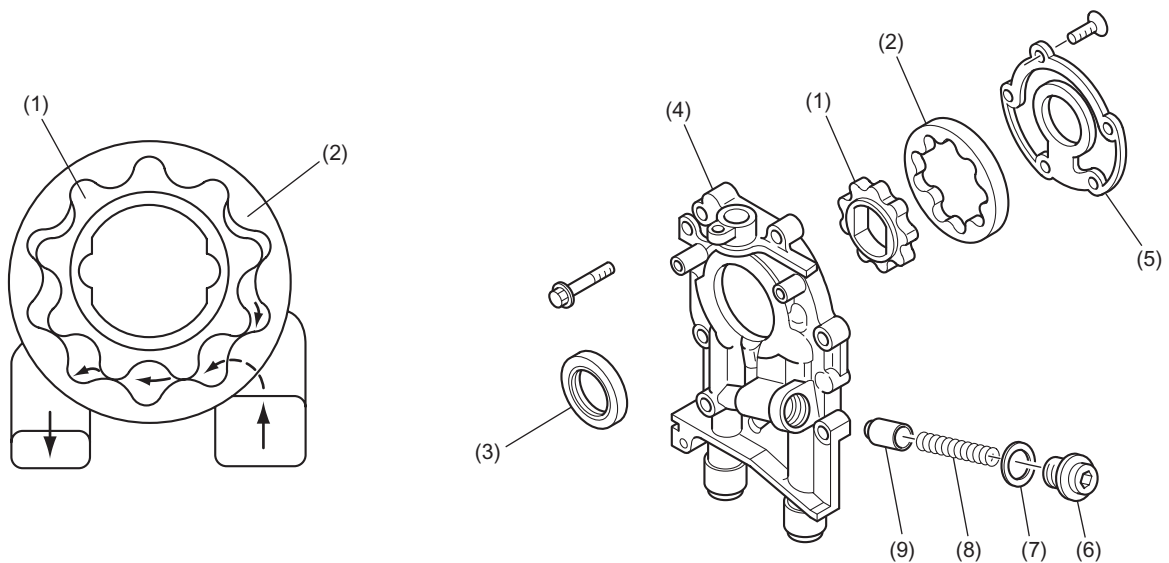
## 2. Engine Oil Flow



LU-02101

## 3. Oil Pump

- The oil pump is a trochoid rotor type consisting of an inner rotor and outer rotor assembled with each other in a pump body. When the inner rotor is driven by the crankshaft, the outer rotor is rotated, changing the space between it and the inner rotor. The change in the space occurs because of the difference in the number of teeth between the rotors.
- Engine oil is carried from the inlet port to the discharge port. As the pump rotates, the space carrying the oil becomes smaller, thus the oil is pressurized and discharged from the outlet port.
- A relief valve is built in the oil pump at its discharge side. When the oil pressure becomes higher than the preset value, the relief valve regulates the pressure by sending excessive oil back to the inlet side.



LU-00058

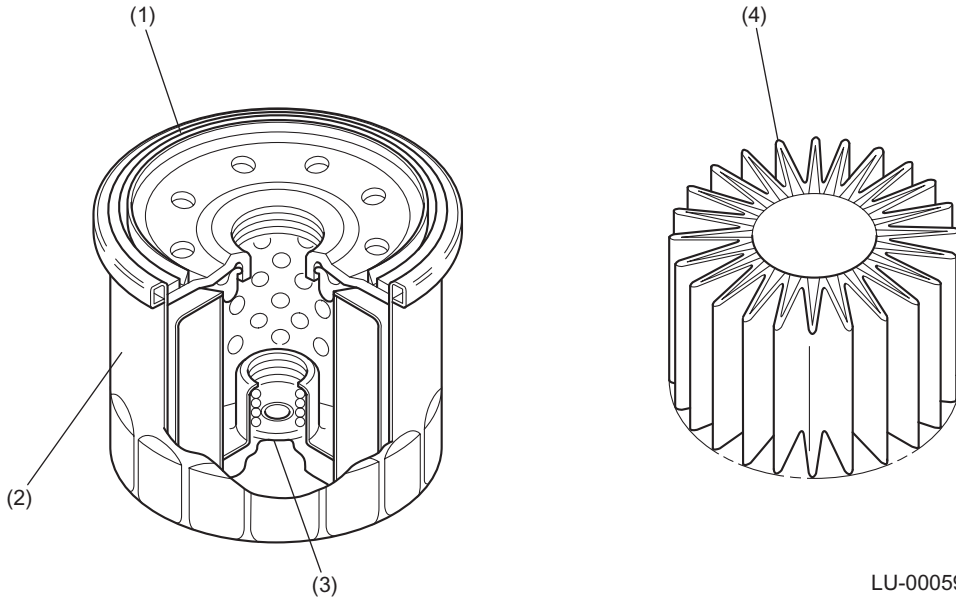
- (1) Inner rotor
- (2) Outer rotor
- (3) Oil seal
- (4) Oil pump case
- (5) Oil pump cover

- (6) Plug
- (7) Gasket
- (8) Relief valve spring
- (9) Relief valve

# OIL FILTER

## 4. Oil Filter

The oil filter is a full-flow filtering, cartridge type that utilizes a paper element. It also has a built-in bypass valve. If the filter gets clogged causing the oil pressure to exceed the preset value, the bypass valve opens and detours the engine oil to flow around the filter. The filter element has a special pleat design to increase the effective filtering area.

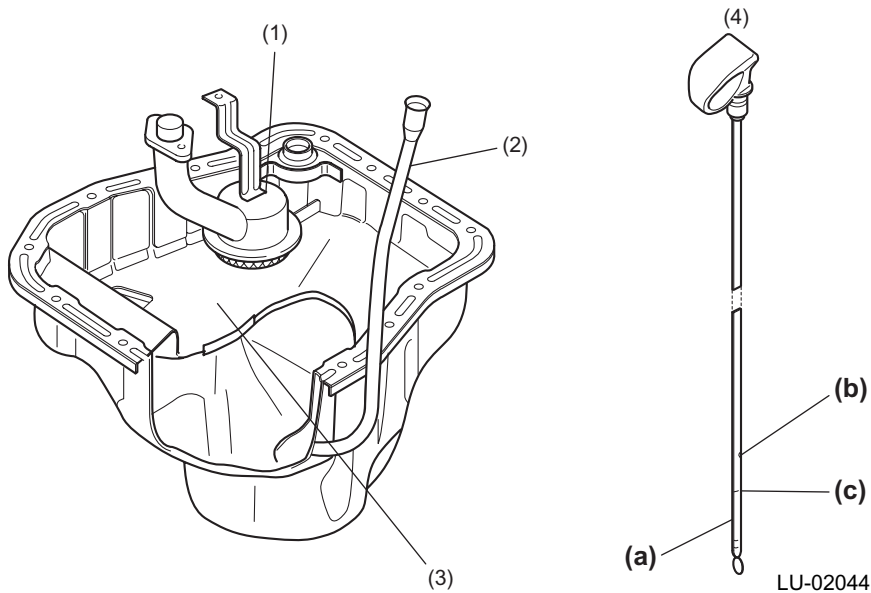


LU-00059

- (1) Oil seal
- (2) Filter body
- (3) Bypass valve
- (4) Pleated element

## 5. Oil Pan and Oil Strainer

- The oil pan is attached to the cylinder block using liquid gasket for sealing. The oil strainer is a metal net type and removes large foreign particles from the engine oil. It is located in the middle of the oil pan. The pipe from the strainer is connected to the suction port of the oil pump in the left bank of the cylinder block.
- There is a baffle plate inside the oil pan. It stabilizes the oil level and reinforces the oil pan.



- (1) Oil strainer
- (2) Level gauge guide
- (3) Baffle plate
- (4) Oil level gauge

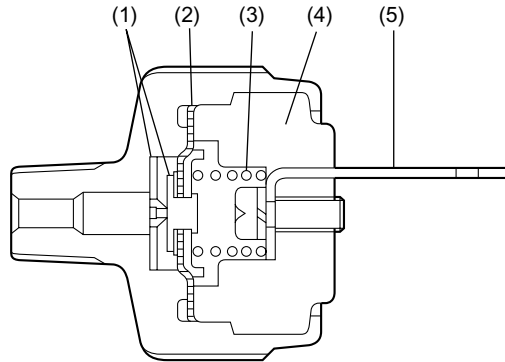
- (a) LOW level
- (b) FULL level (engine hot condition)
- (c) FULL level (engine cold condition)

# OIL PRESSURE SWITCH

LUBRICATION

## 6. Oil Pressure Switch

The oil pressure switch is located in the front upper portion of the right cylinder block bank. The purpose of this switch is to monitor the operation of the oil pump as well as the lubricating oil pressure when the engine is running.



LU-00061

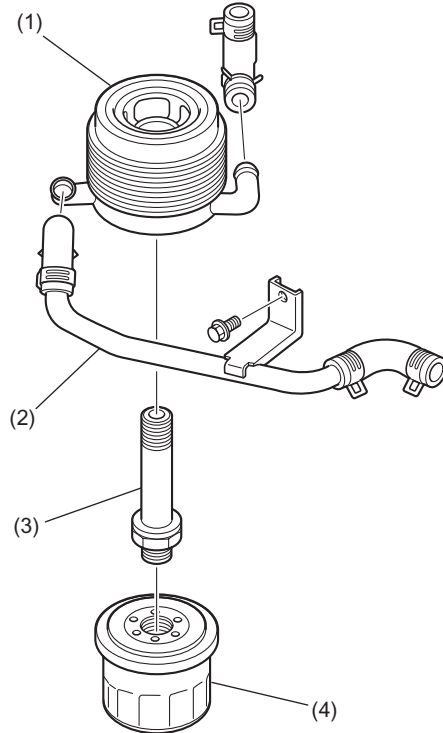
- |               |                    |
|---------------|--------------------|
| (1) Contact   | (4) Molded portion |
| (2) Diaphragm | (5) Terminal       |
| (3) Spring    |                    |

1) When oil pressure does not build up (immediately after ignition switch is turned ON):  
The diaphragm is pushed toward the cylinder block by the spring force (a force equivalent to the specified oil pressure). This closes the contact points, causing the oil pressure warning light in the combination meter to illuminate.

2) When oil pressure reaches the specified value (after engine starts):  
After reaching the specified value, the oil pressure pushes the diaphragm against the spring force. This opens the contact points and the oil pressure warning light goes out.

## 7. Oil Cooler

The oil cooler used in turbo models is of a water cooled type. It serves to maintain engine oil in proper temperature range and so prevent degradation of lubricating oil performance.



LU-00067

- (1) Oil cooler
- (2) Water pipe

- (3) Connector
- (4) Oil filter



# OIL COOLER

LUBRICATION

---

**MEMO**

**LU(H4DOTC)-10**

# GENERAL

SPEED CONTROL SYSTEM

---

## 1. General

Specifications for DOHC turbo models are the same as those for SOHC models. <Ref. to SP(H4SO) section.>

# IGNITION COIL

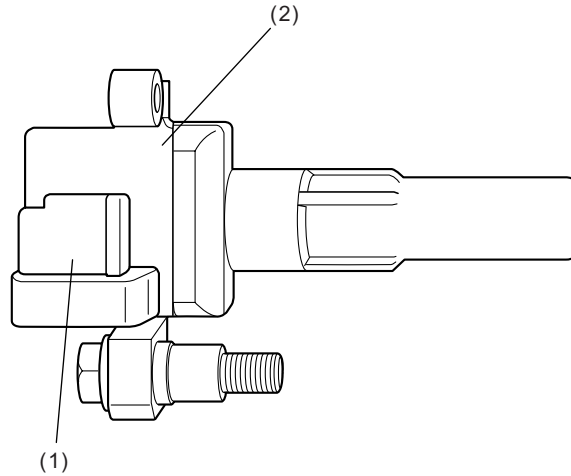
## IGNITION

---

### 1. Ignition Coil

The engine uses a direct ignition system with one ignition coil mounted for each cylinder.

The secondary terminal of the ignition coil is in contact with the spark plug terminal. Since no spark plug cable is used, secondary voltage drop, short circuit at connections, or other problems that are inherent in a system using spark plug cables do not occur. The result is high reliability.



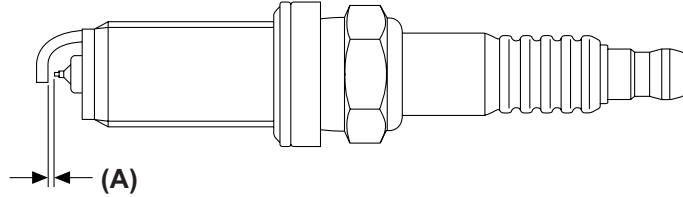
IG-00040

(1) Connector

(2) Ignition coil

## 2. Spark Plug

The spark plug has an iridium tipped electrode. The thread diameter is 14 mm (0.551 in) and the gap is controlled to a value between 0.7 and 0.8 mm (0.028 and 0.031 in).



IG-02008

(A) Gap: 0.7 — 0.8 mm (0.028 — 0.031 in)

# SPARK PLUG

IGNITION

---

**MEMO**

# GENERAL

STARTING/CHARGING

---

## 1. General

Specifications for DOHC turbo models are the same as those for SOHC models. <Ref. to SC(H4SO) section.>

# GENERAL

## FUEL INJECTION (FUEL SYSTEM)

---

### 1. General

- The Multipoint Fuel Injection (MFI) system supplies optimum air-fuel mixture under every engine operating condition through the use of the latest electronic control technology.

This system pressurizes the fuel to a constant pressure and injects it into each intake air port in the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where an electro-magnetic injection valve or injector opens for a short period that is precisely controlled depending on the quantity of air appropriate for each condition of operation. In actual control, an optimum fuel injection quantity is achieved by varying the duration of an electric pulse applied to the injector. This way of control enables simple, yet highly precise metering of the fuel.

- The engine control module (ECM) that controls the fuel injection system corrects the fuel injection amount depending on the vehicle speed, throttle opening, coolant temperature and other vehicle-operation-related information. The ECM receives the information in the form of electric signals from the corresponding sensors and switches.

The MFI system also has the following features:

- Reduced exhaust emissions
- Improves fuel efficiency
- Increased engine output
- Quick response to accelerator and brake pedal operation
- Superior start ability and warm-up performance in cold weather due to corrective controls made according to coolant and intake air temperatures

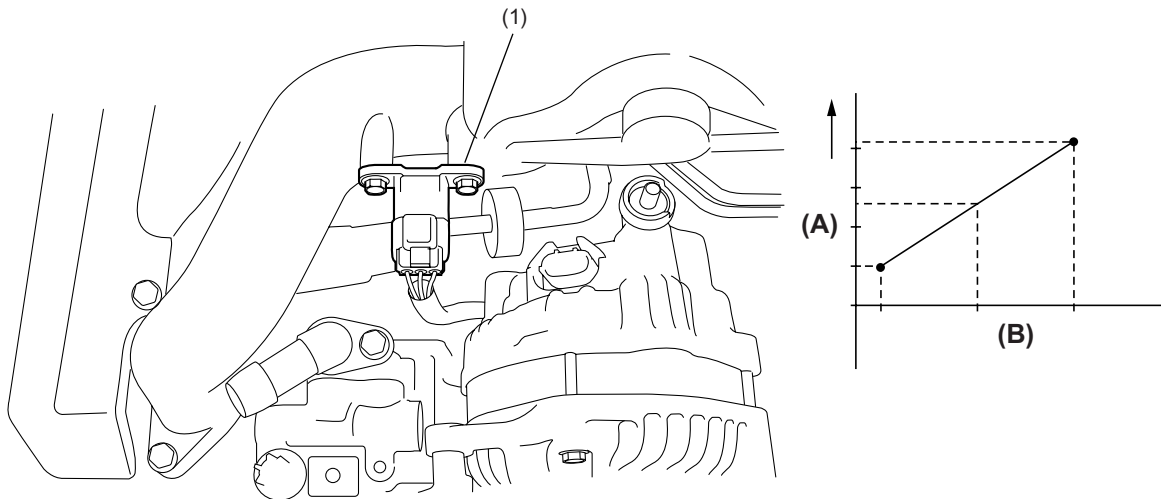
## 2. Air Line

### A: GENERAL

The air filtered by the air cleaner enters the throttle body where it is regulated in the volume by the throttle valve and then enters the intake manifold. It is then distributed to each cylinder where the air is mixed with fuel injected by the injector.

### B: MANIFOLD ABSOLUTE PRESSURE SENSOR

The manifold absolute pressure sensor is attached to the top of the throttle body, and continuously sends to the engine control module (ECM) voltage signals that are proportional to intake manifold absolute pressures. The ECM controls the fuel injection and ignition timing based on the intake manifold absolute pressure signals in addition to other signals from many sensors and other control modules.



FU-02152

(1) Manifold absolute pressure sensor

(A) Output voltage

(B) Absolute pressure



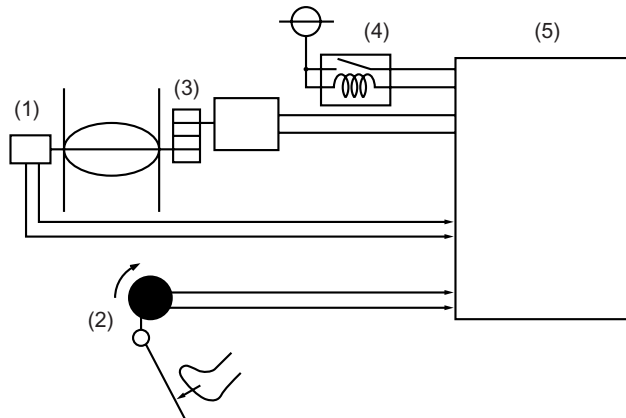
## AIR LINE

### FUEL INJECTION (FUEL SYSTEM)

---

#### C: ELECTRONIC CONTROL THROTTLE SYSTEM

- The electronic control throttle system consists of an accelerator pedal position sensor mounted on the accelerator pedal, a throttle position sensor and a throttle motor mounted on the throttle body, and the ECM, which controls these devices.
- The movement of the accelerator pedal is converted into electrical signals by the accelerator pedal position sensor and sent to the ECM. Based on these signals the ECM controls the throttle motor to open and close the throttle valve.
- Idling control is now performed by the electronic control throttle system in place of the idle air control solenoid valve.



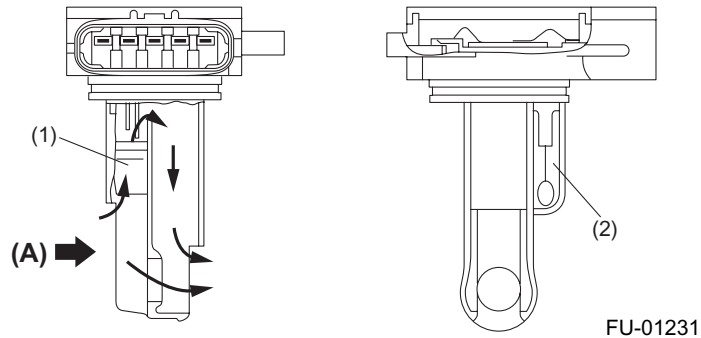
FU-01230

- |  |                                       |
|--|---------------------------------------|
| (1) Throttle position sensor             | (4) Electronic control throttle relay |
| (2) Accelerator pedal position sensor    | (5) ECM                               |
| (3) Electronic control throttle assembly |                                       |

## D: MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR

The mass air flow and the intake air temperature sensors are integrated into a single unit. The unit is mounted on the air cleaner case and measures the amount as well as the temperature of the intake air.

The measured amount and temperature are converted into electrical signals and sent to the ECM. The ECM uses these signals to control injection and ignition timing as well as the fuel injection amount.



- (1) Mass air flow sensor
- (2) Intake air temperature sensor

(A) Air

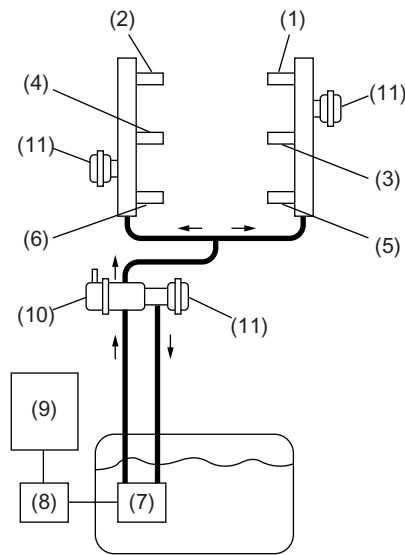
# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### 3. Fuel System

#### A: GENERAL

- The fuel pressurized by the fuel tank inside pump is delivered to each fuel injector by way of the fuel pipe and fuel filter. Fuel injection pressure is regulated to an optimum level by the pressure regulator.
- Each injector injects fuel into the intake port of the corresponding cylinder where the fuel is mixed with air. The mixture then enters the cylinder. Fuel injection amount and timing are regulated by the ECM.



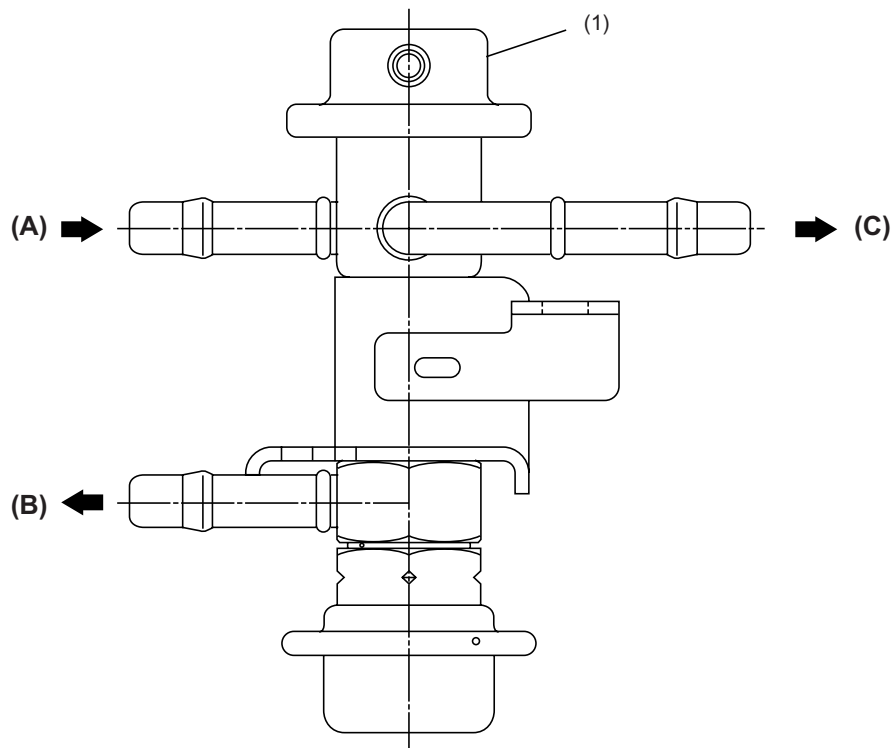
FU-02153

- (1) #1 fuel injector
- (2) #2 fuel injector
- (3) #3 fuel injector
- (4) #4 fuel injector
- (5) #5 fuel injector
- (6) #6 fuel injector

- (7) Fuel pump
- (8) Fuel pump control unit
- (9) ECM
- (10) Pressure regulator
- (11) Pulsation damper

### B: PRESSURE REGULATOR

The pressure regulator is installed at the injector end of the fuel supply line. It has a fuel chamber and spring chamber separated by a diaphragm. The fuel chamber is connected to the fuel supply line and the spring chamber is connected to the intake manifold. Fuel chamber also has a relief valve connected to the fuel return line through which fuel returns to the fuel tank. When the intake manifold vacuum increases, the diaphragm is pulled and the relief valve opens to decrease the fuel supply line pressure (or fuel injection pressure). When the intake manifold vacuum decreases, the diaphragm is pushed by the spring to increase the fuel supply line pressure. Thus, the difference between the fuel injection pressure and the intake manifold vacuum is kept at a constant level of 343 kPa (3.50 kgf/cm<sup>2</sup>, 49.7 psi) to precisely control the amount of injected fuel.



FU-02174

- (1) Pressure regulator
- (A) From fuel tank
- (B) To fuel tank
- (C) To engine

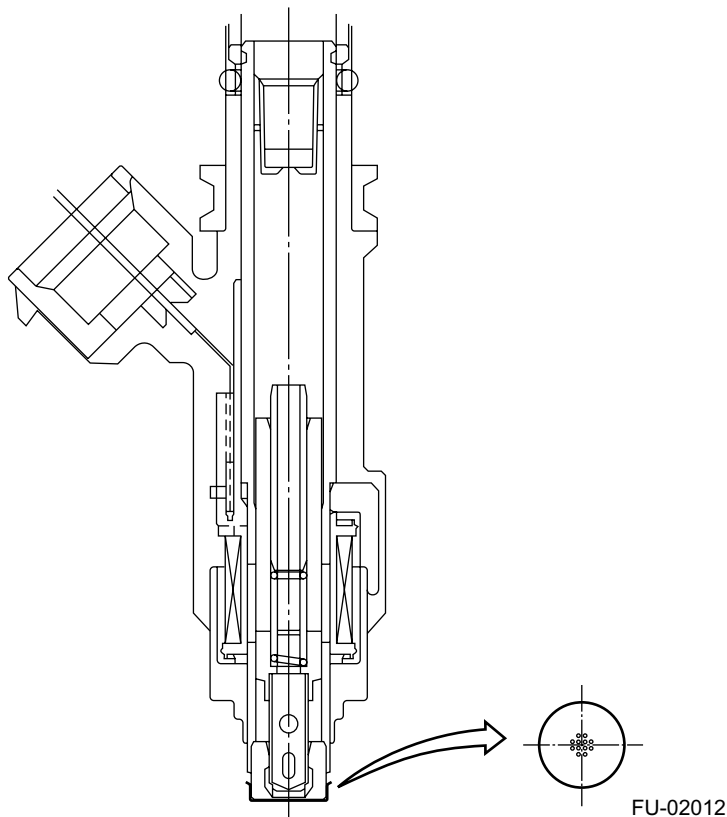
# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### C: FUEL INJECTOR

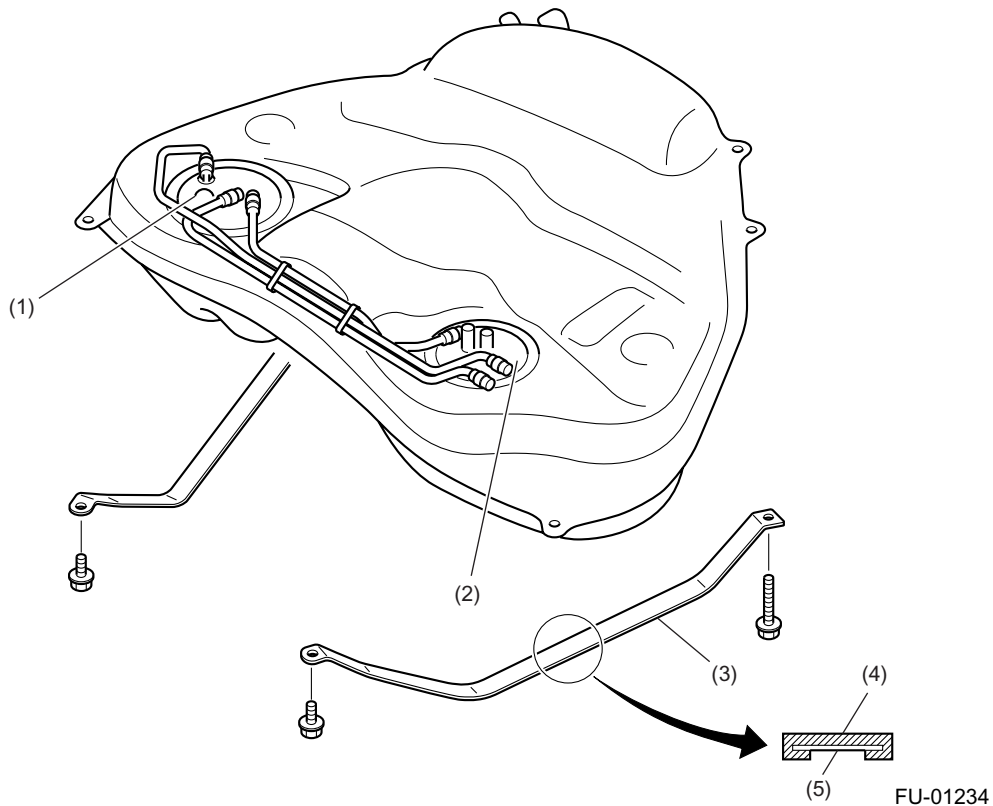
- The MFI system employs top feed type fuel injectors.
- Each injector is installed in the fuel pipe in such a way that the injector is cooled by fuel.
- The features of this type of fuel injector are as follows:
  - 1) High heat resistance
  - 2) Low driving noise
  - 3) Easy to service
  - 4) Small size
- The injector injects fuel according to the valve open signal from the ECM. The needle valve is lifted by the solenoid, which is energized on arrival of the valve open signal.
- Since the injector's nozzle hole area, the lift of valve and the fuel pressure are kept constant, the amount of fuel injected is controlled only by varying the duration of the valve open signal from the ECM.
- The multi-hole nozzle makes it possible for the injector to produce fine fuel particles, which enhances the combustion efficiency and output performance of the engine.



### D: FUEL TANK

The fuel tank utilizes a two-compartment design to ensure sufficient capacity without interfering with the rear differential. It is provided with a suction jet pump (included in the fuel pump and fuel level sensor assembly) which transfers fuel from one compartment to the other.

Each compartment has an individual fuel level sensor. The fuel tank is located under the rear seat and secured with hold-down bands.



- (1) Fuel pump and fuel level sensor assembly
- (2) Fuel sub level sensor
- (3) Band

- (4) Cushion
- (5) Steel

FU-01234

# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### E: FUEL PUMP AND FUEL LEVEL SENSOR ASSEMBLY

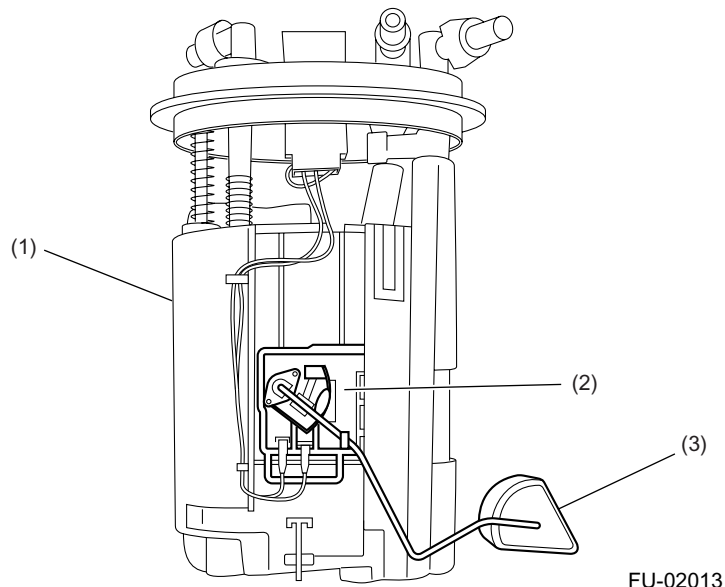
#### 1. FUEL PUMP

The fuel pump consists of a motor, impeller, pump casing, pump cover, check valve and filter. It is located in the fuel tank and combined with the fuel level sensor and fuel temperature sensor into a single unit. The operation of this impeller type pump is very quiet.

- When the ignition switch is turned ON, fuel pump relay is activated. Then the motor operates to rotate the impeller.
- As the impeller rotates, fuel in a vane groove of the impeller flows along the fuel passage into the next vane groove by centrifugal force. When fuel flows from one groove to the next, a pressure difference occurs due to friction. This creates a pumping effect.
- The fuel pushed up by rotation of the impeller then passes through the clearance between the armature and the magnet of the motor and is discharged through the check valve.
- When the fuel discharge pressure reaches the specified level, the relief valve opens and excess fuel is released into the fuel tank. In this manner, the relief valve prevents an abnormal increase in fuel pressure.
- When the engine and the fuel pump stop, the check valve operates to close the discharge port, so that the fuel pressure in the fuel delivery line is retained.

#### 2. FUEL LEVEL SENSOR

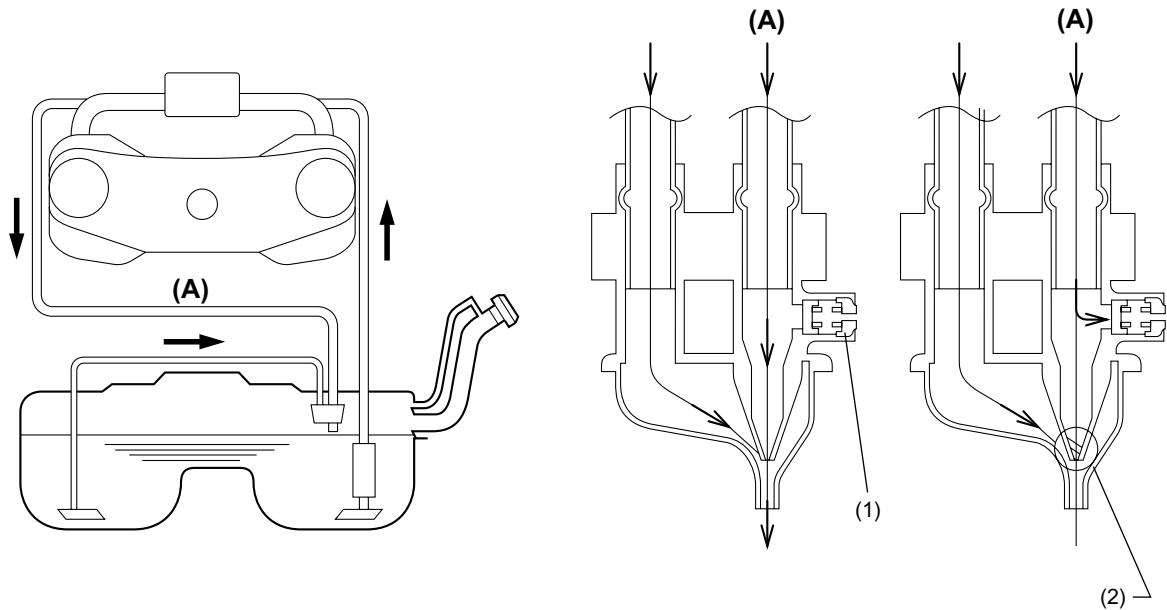
The fuel level sensor is integrated with the fuel pump, which is located in the fuel tank. The sensor outputs an electric resistance signal that varies with movement of its float to indicate the level of the fuel remaining in the tank.



- (1) Fuel pump assembly
- (2) Fuel level sensor
- (3) Float

### 3. JET PUMP

- The jet pump utilizes the velocity of fuel returning from the engine to produce vacuum in it.
- Using the pumping effect produced by the vacuum, the jet pump transfers fuel from the sub-compartment and main compartment of the fuel tank to the fuel pump.
- When the return line nozzle is clogged, the fuel sent back through the return line flows back into the fuel tank via the relief valve.



FU-00226

- (1) Relief valve
- (2) Nozzle

(A) Return line

### 4. FUEL FILTER

The fuel filter is integrated with the fuel pump assembly, which is located in the fuel tank.



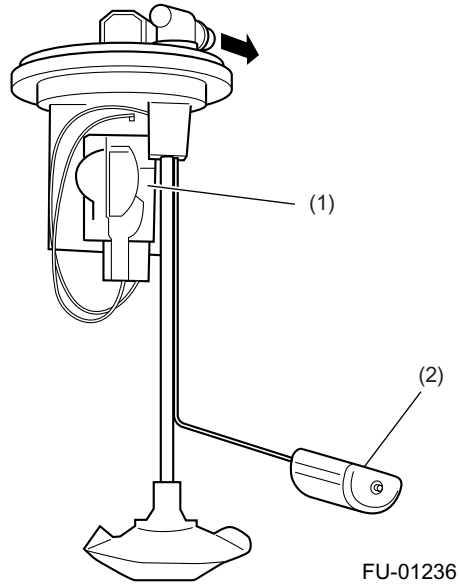
# FUEL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### F: SUB-COMPARTMENT FUEL LEVEL SENSOR

This sensor detects the level of the fuel in the sub side (the side without a fuel pump) of the fuel tank. Also, when the jet pump is operating, fuel in the sub side is drawn up and transferred to the fuel pump.



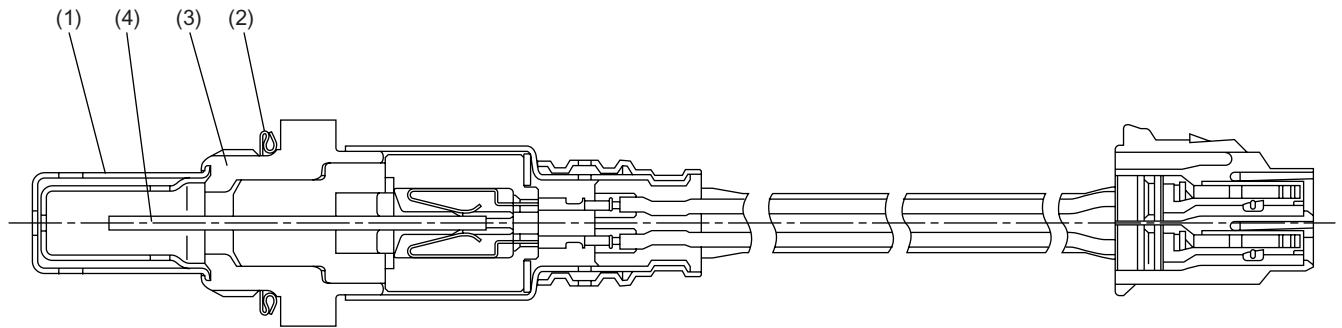
- (1) Fuel level sensor
- (2) Float

(A) Jet pump

## 4. Sensors and Switches

### A: FRONT OXYGEN (A/F) SENSOR

- The front oxygen (A/F) sensor uses zirconium oxide ( $ZrO_2$ ), which is a solid electrolyte, at portions exposed to exhaust gas.
- The zirconium oxide has the property of generating electromotive force when its both sides are exposed to oxygen ions of different concentration and the magnitude of this electromotive force depends on how much the difference is.  
The front oxygen (A/F) sensor detects the amount of oxygen in exhaust gases by making use of this property of the zirconium oxide material.
- The zirconium oxide material is formed into a closed end tube and its external surface is exposed to exhaust gases with smaller oxygen ion concentration, whereas its internal surface is exposed to atmospheric air. The external surface has a porous platinum coating. The sensor's inside is connected to the ECM through a harness to send the current output from the sensor.
- The sensor incorporates a ceramic heater to improve its performance at low temperatures.



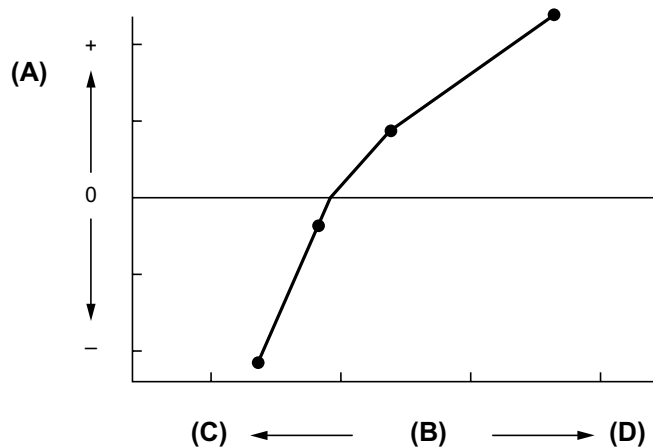
FU-02163

- (1) Protection tube
- (2) Gasket
- (3) Sensor housing
- (4) Ceramic heater

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconium tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The front oxygen (A/F) sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 700°C (1,292°F).

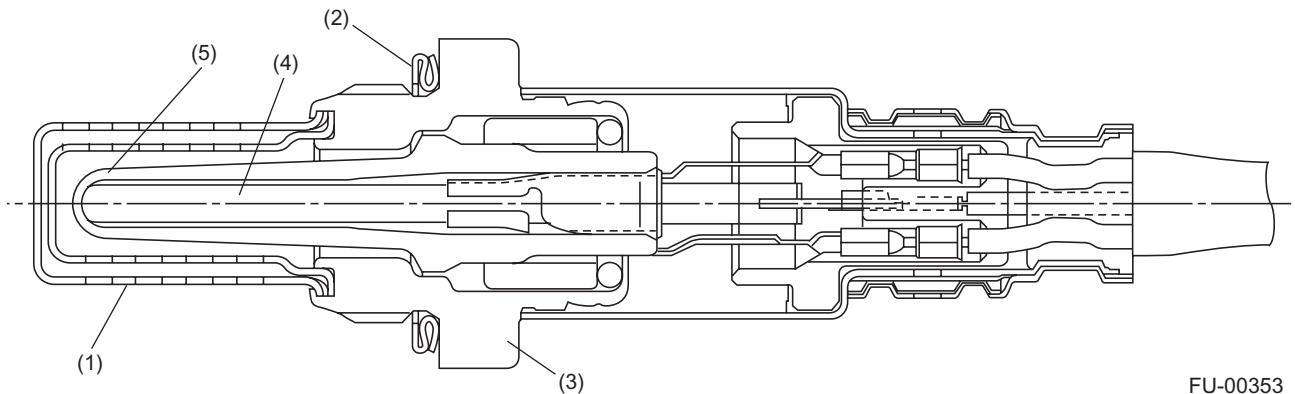


FU-02015

- (A) Current
- (B) Air/fuel ratio
- (C) Rich
- (D) Lean

## B: REAR OXYGEN SENSOR

- The rear oxygen sensor is used to sense oxygen concentration in the exhaust gas. If the air-fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e., excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains almost no oxygen.
- By detecting the oxygen concentration in the exhaust gas using the oxygen sensor makes it possible to determine whether the air-fuel ratio is leaner or richer than the stoichiometric ratio.
- The rear oxygen sensor has a zirconium tube (ceramic), which generates voltage if there is a difference in oxygen ion concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconium tube as a catalysis and electrode material. The sensor's inside is connected to the ECM through a harness.
- A ceramic heater is employed to improve performance at low temperatures.



FU-00353

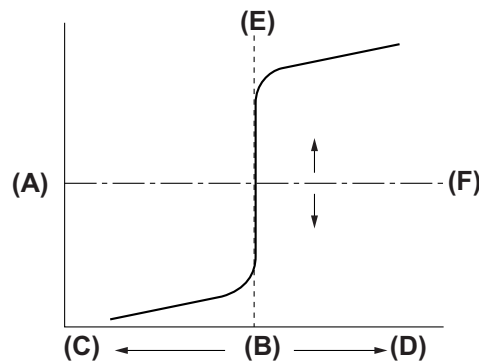
- (1) Protection tube
- (2) Gasket
- (3) Sensor housing

- (4) Ceramic heater
- (5) Zirconium tube

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

- When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases is almost completely used in the catalytic reaction by the platinum coating on the external surface of the zirconium tube. This results in a very large difference in the oxygen ion concentration between the inside and outside of the tube, and the electromotive force generated is large.
- When a lean air-fuel mixture is burnt in the cylinder, relatively large amount of oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen ion concentration between the tube's internal and external surfaces. The electromotive force in this case is very small.
- The difference in oxygen concentration changes drastically in the vicinity of the stoichiometric air-fuel ratio, and hence the change in the electromotive force is also large. By using this information, the ECM can determine the air-fuel ratio of the supplied mixture easily. The rear oxygen sensor does not generate much electromotive force when the temperature is low. The output characteristics of the sensor stabilize at a temperature of approximately 300 to 400°C (572 to 752°F).

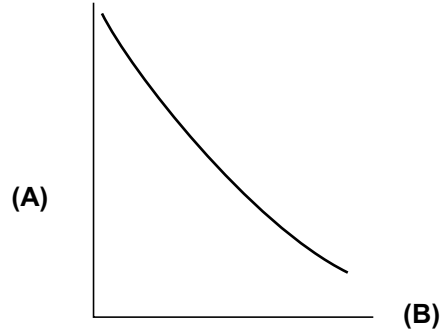
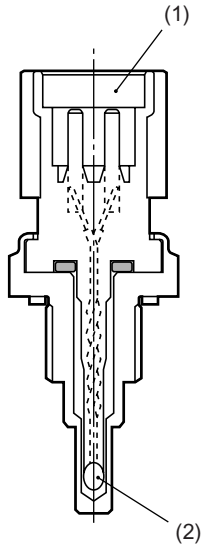


FU-02016

- (A) Electromotive force
- (B) Air/fuel ratio
- (C) Lean
- (D) Rich
- (E) Stoichiometric ratio
- (F) Comparison voltage

## C: ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor is located in the engine coolant passage. The sensor uses a thermistor whose resistance changes inversely with temperature. Resistance signals as engine coolant temperature information are transmitted to the ECM to make fuel injection, ignition timing, purge control solenoid valve and other controls.



- (1) Connector
- (2) Thermistor element

- (A) Resistance (k $\Omega$ )
- (B) Temperature  $^{\circ}\text{C}$  ( $^{\circ}\text{F}$ )

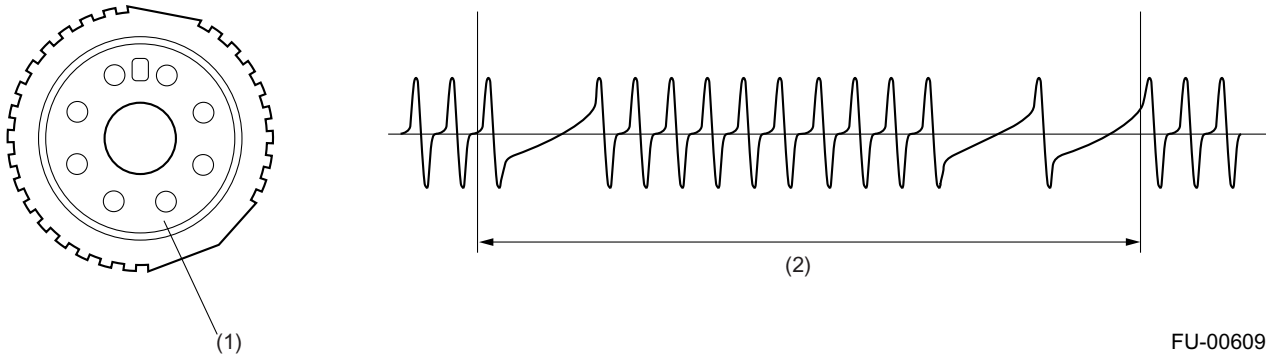
FU-02017

# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

### D: CRANKSHAFT POSITION SENSOR

- The crankshaft position sensor is installed on the rear end of the cylinder block. The sensor generates a pulse when one of the teeth on the perimeter of the crankshaft plate (rotating together with the crankshaft) passes in front of it. The ECM determines the crankshaft angular position by counting the number of pulses.
- As the crankshaft rotates, each tooth of the crankshaft plate aligns with the crankshaft position sensor so that the magnetic flux in the sensor's coil changes since the air gap between the sensor pickup and the crankshaft plate changes. This change in magnetic flux induces a voltage pulse in the sensor and the pulse is transmitted to the ECM.

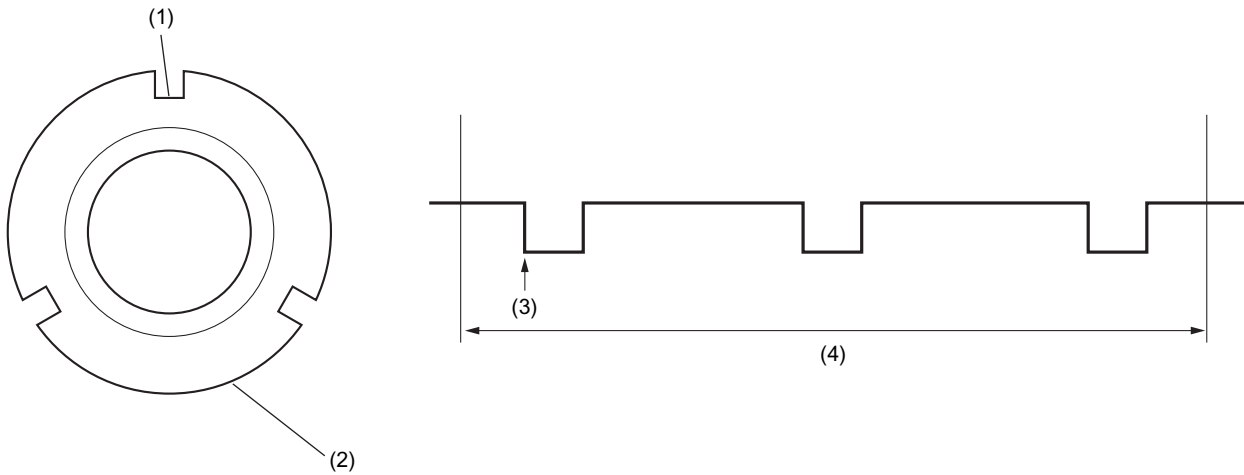


FU-00609

- (1) Crankshaft plate
- (2) Crankshaft half rotation

## E: CAMSHAFT POSITION SENSOR

- The camshaft position sensor is located on the cylinder head. It detects the combustion cylinder at any given moment.
  - The sensor generates a pulse when one of the slots in the camshaft plate passes in front of the sensor. The ECM detects the camshaft position by measuring the pulse. Three slots are provided on the plate as shown below.
- Three slots are provided on the plate as shown below.



FU-00610

- (1) Slot
- (2) Camshaft plate
- (3) Detection point
- (4) Camshaft one rotation (crankshaft two rotations)

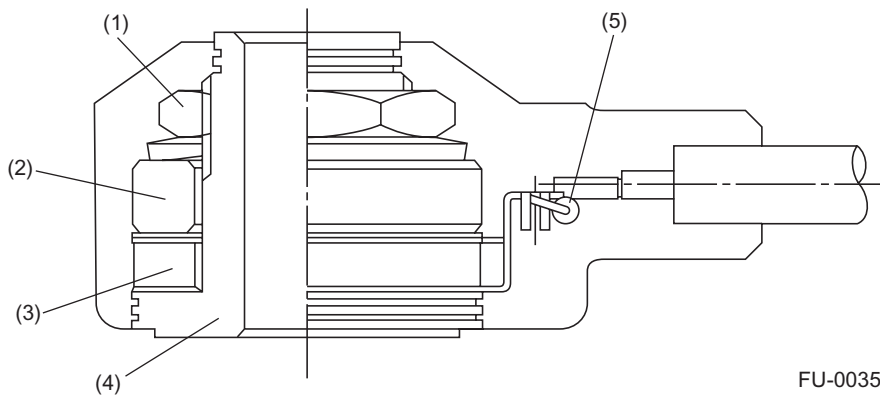


# SENSORS AND SWITCHES

## FUEL INJECTION (FUEL SYSTEM)

### F: KNOCK SENSOR

- The knock sensor is installed on the cylinder block, and senses knocking that occur in the engine.
- The sensor is a piezo-electric type, which converts vibration resulting from knocking into electric signals.
- In addition to a piezo-electric element, the sensor has a weight and case as its components. If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.
- The knock sensor harness is connected to the engine harness.



FU-00356

- (1) Nut
- (2) Weight
- (3) Piezo-electric element
- (4) Housing
- (5) Resistance

### G: VEHICLE SPEED SENSOR

Vehicle speed signals are sent from the vehicle speed sensor to the ABS control module or the vehicle dynamics control (VDC) control module.

The signals are sent to the ECM via CAN communication.<Ref. to LAN section.>

## 5. Control System

### A: GENERAL

The ECM receives signals from various sensors, switches, and other control modules. Using these signals, it determines the engine operating conditions and if necessary, emits signals to one or more systems to control them for optimum operation.

Major control items of the ECM are as follows:

- Fuel injection control
- Ignition control
- Idle air control
- Fuel pump control
- Canister purge control\*<sup>1</sup>
- Radiator fan control\*<sup>2</sup>
- On-board diagnosis function

\*1: Canister purge control is described under EC (H6DO) section. <Ref. to EC(H6DO) section.>

\*2: Radiator fan control is described under CO (H6DO) section. <Ref. to CO(H6DO) section.>

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

### B: INPUT AND OUTPUT SIGNALS

Signal	Unit	Function
Input signals	Manifold absolute pressure sensor	Detects the amount (measures the absolute pressure) of intake air.
	Mass air flow and intake air temperature sensor	Detects the temperature and amount of intake air.
	Throttle position sensor	Detects the throttle valve position.
	Front oxygen (A/F) sensor	Detects the density of oxygen in exhaust gases at the upstream of the front catalytic converter.
	Rear oxygen sensor	Detects the density of oxygen in exhaust gases at the downstream of the rear catalytic converter.
	Crankshaft position sensor	Detects the crankshaft angular position.
	Camshaft position sensor	Detects the combustion cylinder.
	Engine coolant temperature sensor	Detects the engine coolant temperature.
	Knock sensor	Detects engine knocking.
	Accelerator pedal position sensor	Indicates the accelerator pedal position.
	Variable valve lift diagnosis oil pressure switch	Detects the oil pressure in the variable valve lift circuit.
	Oil temperature sensor	Detects the oil temperature in the variable valve lift circuit.
	Ignition switch	Detects operation of the ignition switch.
	Starter switch	Detects the condition of engine cranking.
	Power steering switch	Detects the steering condition.
	A/C mid pressure switch	Detects the A/C refrigerant pressure through an ON-OFF switch.
	Inhibitor switch	Detects shift positions.
	A/C switch	Detects ON-OFF operation of the A/C switch.
	Fuel temperature sensor	Detects the temperature of the fuel in the fuel tank.
	Fuel tank pressure sensor	Detects the pressure in the fuel tank.
Output signals	Fuel injector	Activates an injector.
	Ignition signal	Turns the primary ignition current ON or OFF.
	Electronic control throttle	Controls motor output for the electronic control throttle.
	Electronic control throttle motor cut relay	Turns ON-OFF the electronic control throttle motor relay.
	Oil flow control solenoid valve	Controls oil pressure for AVCS.
	Oil switching solenoid valve	Controls oil pressure for variable valve lift.
	Fuel pump control unit	Controls the fuel pump.
	A/C control relay	Turns ON or OFF the A/C control relay.
	Radiator fan control signal	Controls operation of radiator fans.
	Malfunction indicator light (MIL)	Indicates existence of abnormality.
	Pressure control solenoid valve	Controls evaporation pressure in the fuel tank.
	Drain valve	Closes the evaporation line between the fuel tank and canister to detect leakage of evaporation gas.
	Purge control solenoid valve	Controls purge of evaporative gas absorbed by the canister.
	Heater circuit of front and rear oxygen sensors	Controls heater of front and rear oxygen sensors.
	Power supply	Controls ON/OFF of the main power supply relay.

### **C: FUEL INJECTION CONTROL**

- The ECM receives signals from various sensors and based on them, it determines the amount of fuel injected and the fuel injection timing. It performs the sequential fuel injection control over the entire engine operating range except during start-up of the engine.
- The amount of fuel injected depends upon the length of time the injector stays open. The fuel injection duration is determined according to varying operating condition of the engine. For the purpose of achieving highly responsive and accurate fuel injection duration control, the ECM performs a new feedback control that incorporates a learning feature as detailed later.
- Fuel injection control is performed in a way that fuel is injected accurately at the time when the maximum air intake efficiency can be achieved for each cylinder.

#### **1. FUEL INJECTION DURATION**

Fuel injection duration is basically determined as indicated below:

- While cranking the engine:

The duration defined below is used.

- Duration of fuel injection during engine start-up ..... Determined according to the engine coolant temperature detected by the engine coolant temperature sensor.

- During normal operation:

The duration is determined as follows:

Basic duration of fuel injection × Correction factors + Voltage correction time

- Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors — the amount of intake air detected by the air flow sensor and the engine speed monitored by the crankshaft position sensor.
- Correction factors ..... See the next section.
- Voltage correction time ..... This is added to compensate for the time lag before operation of injector that results from variation in the battery voltage.

# CONTROL SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

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### 2. CORRECTION FACTORS

The following factors are used to correct the basic duration of fuel injection in order to make the air-fuel ratio meet the requirements of varying engine operating conditions:

- **Air-fuel ratio feedback factor:**

This factor is used to correct the basic duration of fuel injection in relation to the actual engine speed. (See the next section for more details.)

- **Start increment factor:**

This factor is used to increase the fuel injection duration only while the engine is being cranked to improve its start ability.

- **Coolant-temperature-dependent increment factor:**

This factor is used to increase the fuel injection duration depending on engine coolant temperature signals to facilitate cold starting. The lower the coolant temperature, the greater becomes the increment.

- **After-start increment factor:**

- This factor is used to increase the fuel injection duration for a certain period immediately after start of the engine to stabilize engine operation.
- The increment depends on the coolant temperature at the start of the engine.

- **Wide-open-throttle increment factor:**

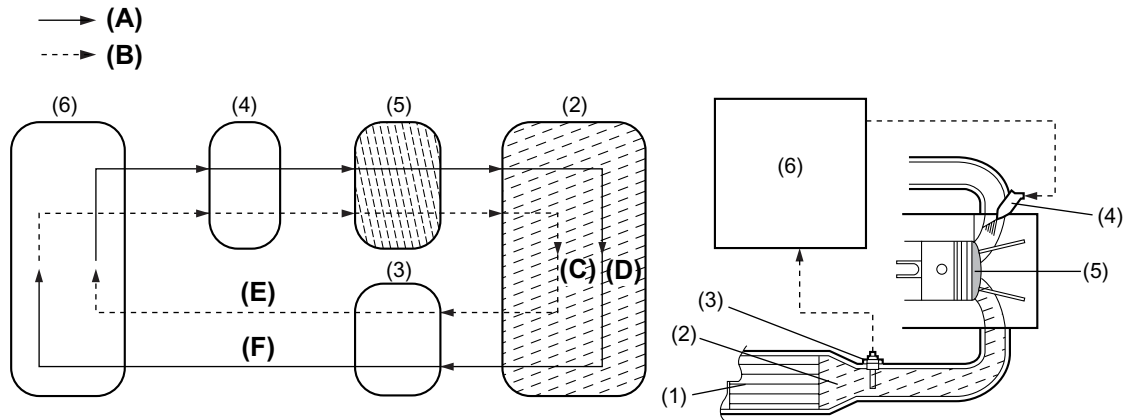
This factor is used to increase the fuel injection duration depending on the relationship between the throttle position sensor signal and air flow sensor signal.

- **Acceleration increment factor:**

This factor is used to increase the fuel injection duration to compensate for a time lag between air flow measurement and fuel injection control for better engine response to driver's pedal operation during acceleration.

### 3. AIR-FUEL RATIO FEEDBACK FACTOR

The ECM creates this factor utilizing the front oxygen (A/F) sensor signal. When the signal is high, the air-fuel ratio is leaner than the stoichiometric ratio. The ECM then makes the fuel injection duration longer by modifying the factor. When the signal is low showing that the mixture is rich, the ECM modifies the factor to make the injection duration longer. In this way, the air-fuel ratio is maintained at a level close to the stoichiometric ratio at which the three-way catalytic converter acts most effectively.



FU-00240

- (1) Front catalytic converter
- (2) Exhaust gases
- (3) Front oxygen (A/F) sensor
- (4) Fuel injector
- (5) Combustion chamber
- (6) ECM

- (A) Injection duration increment signal
- (B) Injection duration decrement signal
- (C) High oxygen density
- (D) Low oxygen density
- (E) Lean signal
- (F) Rich signal

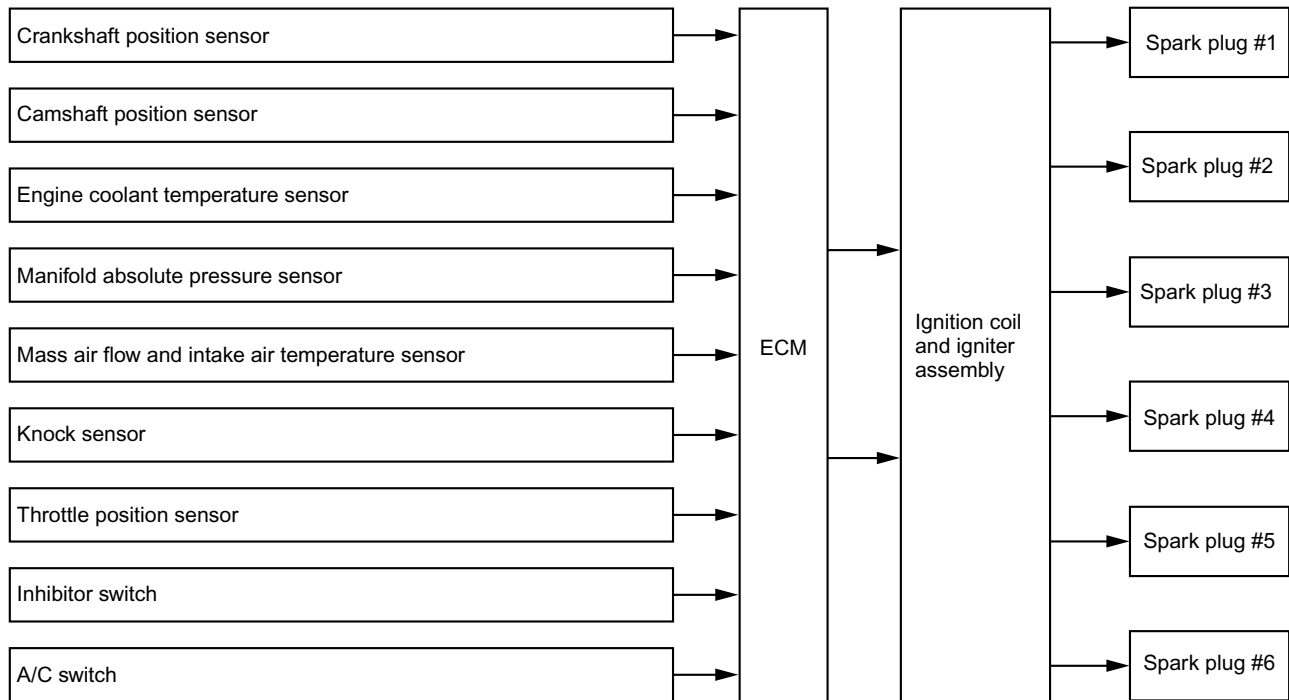
### 4. LEARNING FEATURE

The air-fuel ratio feedback control includes a learning feature, which contributes to more accurate and responsive control.

- In the air-fuel ratio feedback control, the ECM calculates the necessary amount of correction based on data from the front oxygen (A/F) sensor and adds the result to the basic duration (which is stored in the ECM's memory for each condition defined by the engine speed and various loads.)
- Without a learning feature, the ECM carries out the above-mentioned process every time. This means that if the amount of necessary correction is large, the air-fuel ratio feedback control becomes less responsive and less accurate.
- The learning feature enables the ECM to store the amount of correction into memory and add it to the basic fuel injection duration to create a new reference fuel injection duration. Using the reference duration as the basic duration for the injection a few times later, the ECM can reduce the amount of correction and thus make its feedback control more accurate and responsive to changes in the air-fuel ratio due to difference in driving condition and sensor/actuator characteristics that may result from unit-to-unit variation or aging over time.

## D: IGNITION CONTROL

- The ECM determines operating condition of the engine based on signals from the mass air flow and intake air temperature sensor, manifold absolute pressure sensor, engine coolant temperature sensor, crankshaft position sensor and other sources. The ECM then selects the ignition timing most appropriate for the condition thus determined from those stored in its memory and outputs at that timing a primary current OFF signal to the igniter to initiate ignition.
- This control uses a quick-to-response learning feature by which the data stored in the ECM memory is processed in comparison with information from various sensors and switches.
- Thus, the ECM can always perform optimum ignition timing taking into account the output, fuel efficiency, exhaust gas, and other factors for every engine operating condition.
- Ignition control during start-up  
 Engine speed fluctuates during start of the engine, so the ECM cannot control the ignition timing. During that period, the ignition timing is fixed at 10° BTDC by using the 10° signal from the crankshaft position sensor.



FU-02175



# CONTROL SYSTEM

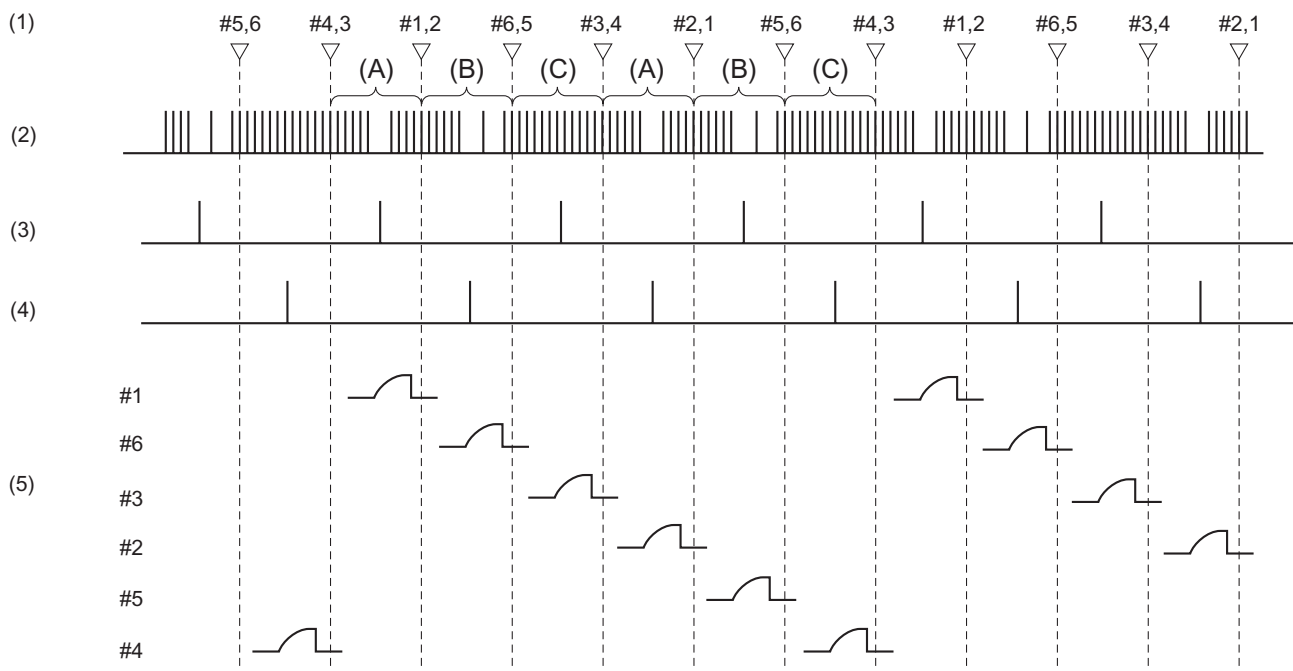
## FUEL INJECTION (FUEL SYSTEM)

● On the sensor plate at the rear end of the crankshaft, there are projections placed at 10° and 30° intervals. The ECM receives crankshaft angle pulse signals that are generated when the crankshaft position sensor passes these projections.

Using crankshaft position sensor signals and camshaft position sensor pulse signals, the ECM determines the position of each piston as follows:

The ECM interprets the pulses of range (A) shown below as the No. 1 and No. 2 cylinder pistons being at TDC, the pulses of range (B) as the No. 5 and No. 6 cylinder pistons being at TDC, and the pulses of range (C) as the No. 3 and No. 4 cylinder pistons being at TDC.

● The ECM outputs an ignition signal for the No. 1, No. 3 or No. 5 cylinder when it receives a cam angle pulse (RH) before a TDC signal and for the No. 2, No. 4 or No. 6 cylinder when it receives a cam angle pulse (LH) before a TDC signal.

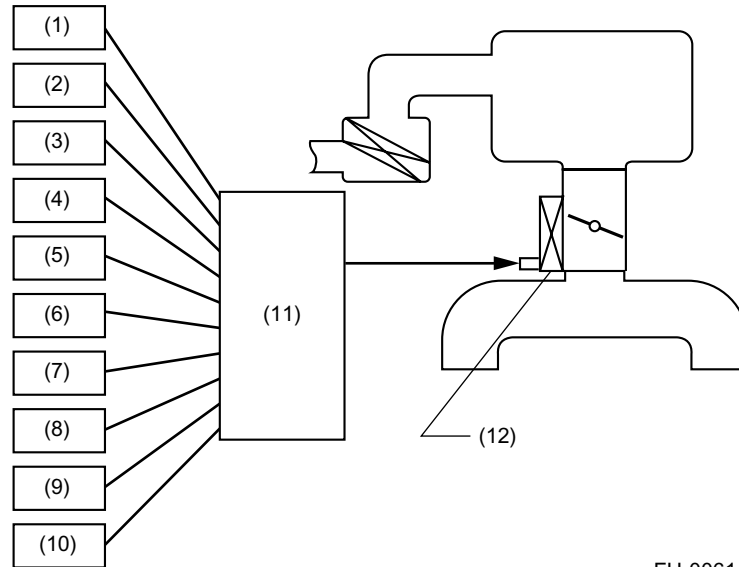


FU-02492

- (1) Cylinder number (TDC)
- (2) Crank angle pulse
- (3) Cam angle pulse (RH)
- (4) Cam angle pulse (LH)
- (5) Ignition timing

## E: IDLE AIR CONTROL

• The ECM controls the electronic control throttle based on signals from the crankshaft position sensor, engine coolant temperature sensor, air flow and intake air temperature sensor, and A/C switch etc. so that the proper idle speed for each engine load is achieved.



FU-00614

- |   |                                  |
|---|----------------------------------|
| (1) Manifold absolute pressure sensor               | (7) Vehicle speed sensor         |
| (2) Mass air flow and intake air temperature sensor | (8) Ignition switch              |
| (3) Crankshaft position sensor                      | (9) A/C switch                   |
| (4) Camshaft position sensor                        | (10) Inhibitor switch            |
| (5) Throttle position sensor                        | (11) ECM                         |
| (6) Engine coolant temperature sensor               | (12) Electronic control throttle |

## F: FUEL PUMP CONTROL

The ECM controls the operation of the fuel pump through the fuel pump control unit, based on signals from the crankshaft position sensor. To improve safety, a “fuel pump stop signal” is sent from the ECM to the fuel pump control unit to stop the fuel pump if the engine stalls while the ignition switch is ON.

Ignition switch ON	Fuel pump relay	Fuel pump
A certain period of time after ignition switch is turned ON	ON	Operates
While cranking the engine	ON	Operates
While engine is operating	ON	Operates
When engine stops	OFF	Does not operate

# ON-BOARD DIAGNOSIS SYSTEM

## FUEL INJECTION (FUEL SYSTEM)

---

### 6. On-board Diagnosis System

#### A: GENERAL

- The on-board diagnosis system detects and indicates a fault by generating a code corresponding to each fault location. The engine malfunction indicator light on the combination meter indicates occurrence of a fault or abnormality.
- When the malfunction indicator light comes on as a result of detection of a fault by the ECM, the corresponding diagnostic trouble code (DTC) and freeze frame data indicating the engine condition are stored in the ECM.
- On the OBD-II conformable car, it is necessary to connect the SUBARU Select Monitor (SSM) or General Scan Tool (GST) to the data link connector in order to check for DTCs.
- The SSM and GST can be used for erasing DTCs. These can also read freeze frame data in addition to other pieces of engine data.
- If there is a failure involving sensors, which may affect drive control of the vehicle, the fail-safe function ensures minimum level of drivability.

#### B: FAIL-SAFE FUNCTION

For a sensor or switch which has been judged faulty in the on-board diagnosis, the ECM, if appropriate, generates an associated pseudo signal to keep the vehicle operational. (The control becomes degraded.)

# SYSTEM OVERVIEW

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

## 1. System Overview

There are three emission control systems, which are as follows:

- Crankcase emission control system
- Exhaust emission control system
  - Catalytic converter
  - Air/fuel (A/F) control system
  - Ignition control system
- Evaporative emission control system
  - On-board refueling vapor recovery (ORVR) system

# SYSTEM OVERVIEW

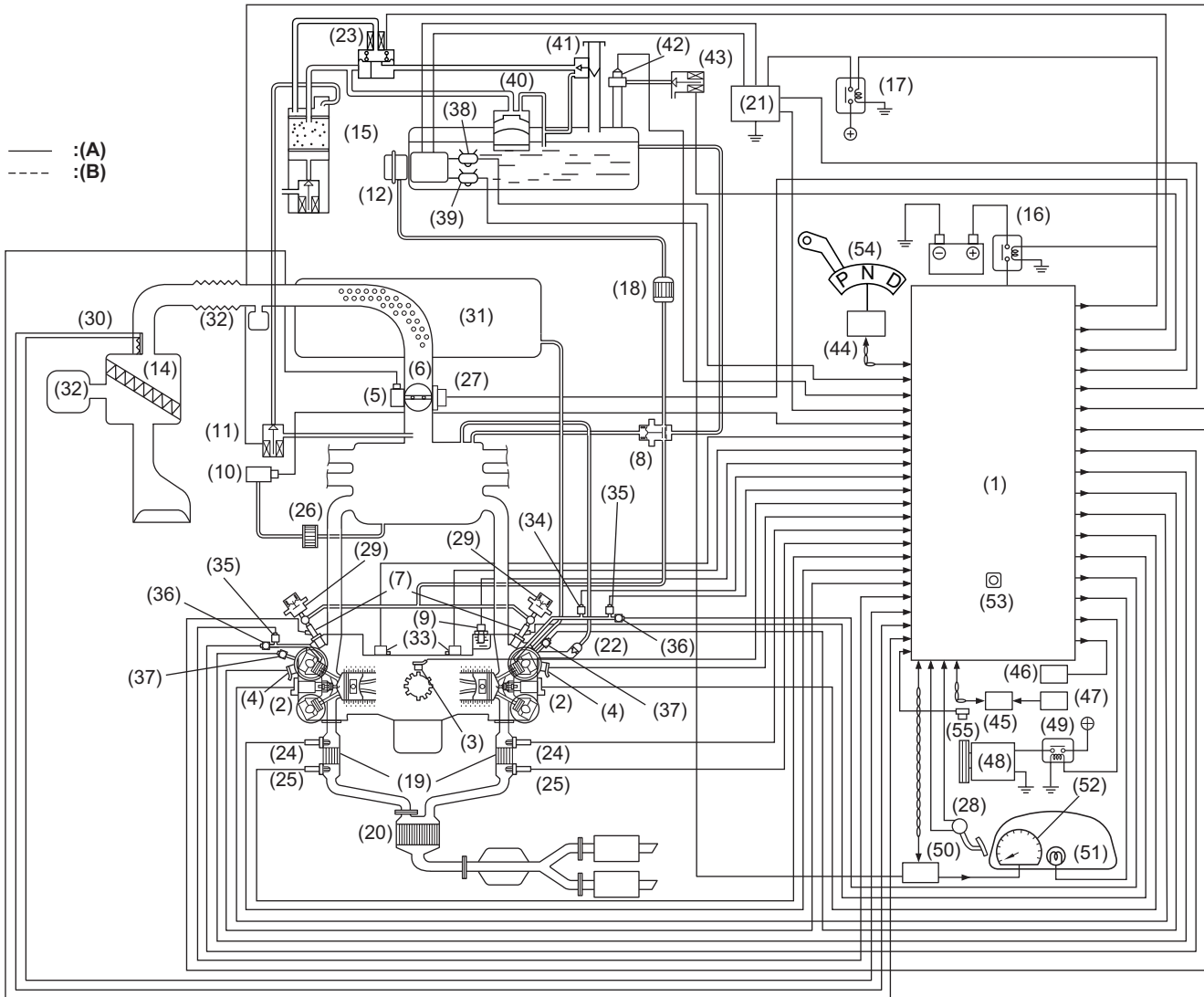
## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

Item		Main components	Function
Crankcase emission control system		Positive crankcase ventilation (PCV) valve	Draws blow-by gas into intake manifold from crankcase and burn it together with air-fuel mixture. Amount of blow-by gas to be drawn in is controlled by intake manifold pressure.
Exhaust emission control system	Catalytic converter	Front	Oxidizes HC and CO contained in exhaust gases as well as reducing NOx.
		Rear	
	Air/fuel (A/F) control system	Engine control module (ECM)	Receives input signals from various sensors, compares signals with stored data, and emits a signal for optimal control of air-fuel mixture ratio.
		Front oxygen (A/F) sensor	Detects density of oxygen contained exhaust gases.
		Rear oxygen sensor	Detects density of oxygen contained in exhaust gases.
		Throttle position sensor	Detects throttle opening.
		Manifold absolute pressure sensor	Detects absolute pressure of intake manifold.
		Mass air flow and intake air temperature sensor	Detects amount of intake air. Detects the amount of intake air temperature inside the air cleaner case.
	Ignition control system	ECM	Receives various signals, compares signals with basic data stored in memory, and emits a signal for optimal control of ignition timing.
		Crankshaft position sensor	Detects engine speed (revolution).
		Camshaft position sensor	Detects reference signal for combustion cylinder discrimination.
		Engine coolant temperature sensor	Detects coolant temperature.
Evaporative emission control system	Canister	Absorbs evaporative gas that accumulates in fuel tank when engine stops, and releases it to combustion chambers for a complete burn when the engine is started. This prevents HC from being discharged into atmosphere.	
	Purge control solenoid valve	Receives a signal from ECM and controls purge of evaporative gas absorbed by canister.	
	Pressure control solenoid valve	Receives a signal from ECM and controls evaporative gas pressure in fuel tank.	
On-board refueling vapor recovery (ORVR) system	Vent valve	Opens a valve during refueling to let fuel vapor in the fuel tank flow to the canister. The system also closes the port to the canister when the fuel tank is full of fuel.	
	Drain valve	Closes the evaporation line by receiving a signal from ECM to check the evaporation gas leak.	

# SCHEMATIC DIAGRAMS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 2. Schematic Diagrams



EC-02102

# SCHEMATIC DIAGRAMS

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

---

- |  |  |                                     |
|--|--|-------------------------------------|
| (1) Engine control module (ECM)        | (20) Rear catalytic converter                          | (39) Fuel level sensor              |
| (2) Ignition coil and igniter assembly | (21) Fuel pump controller                              | (40) Vent valve                     |
| (3) Crankshaft position sensor         | (22) PCV valve   | (41) Shut-off valve                 |
| (4) Camshaft position sensor           | (23) Pressure control solenoid valve                   | (42) Fuel tank pressure sensor      |
| (5) Throttle position sensor           | (24) Front oxygen (A/F) sensor                         | (43) Fuel tank sensor control valve |
| (6) Electronic control throttle        | (25) Rear oxygen sensor                                | (44) Transmission control module    |
| (7) Fuel injector                      | (26) Air filter  | (45) ABS/VDC control module         |
| (8) Pressure regulator                 | (27) Electronic control throttle motor                 | (46) Data link connector            |
| (9) Engine coolant temperature sensor  | (28) Accelerator pedal position sensor                 | (47) Vehicle speed signal           |
| (10) Manifold absolute pressure sensor | (29) Fuel damper                                       | (48) A/C compressor                 |
| (11) Purge control solenoid valve      | (30) Mass air flow and intake air temperature sensor   | (49) A/C relay                      |
| (12) Fuel pump                         | (31) Air intake chamber                                | (50) Body integrated unit           |
| (13) Fuel tank                         | (32) Resonator   | (51) Malfunction indicator light    |
| (14) Air cleaner element               | (33) Knock sensor                                      | (52) Tachometer                     |
| (15) Canister                          | (34) Oil temperature sensor                            | (53) Atmospheric pressure sensor    |
| (16) Ignition relay                    | (35) Variable valve lift diagnosis oil pressure switch | (54) Neutral switch                 |
| (17) Fuel pump relay                   | (36) Oil switching solenoid valve                      | (55) A/C rotation lock sensor       |
| (18) Fuel filter                       | (37) Oil flow control solenoid valve                   | <b>(A)</b> Electrical wiring        |
| (19) Front catalytic converter         | (38) Fuel temperature sensor                           | <b>(B)</b> Control piping           |

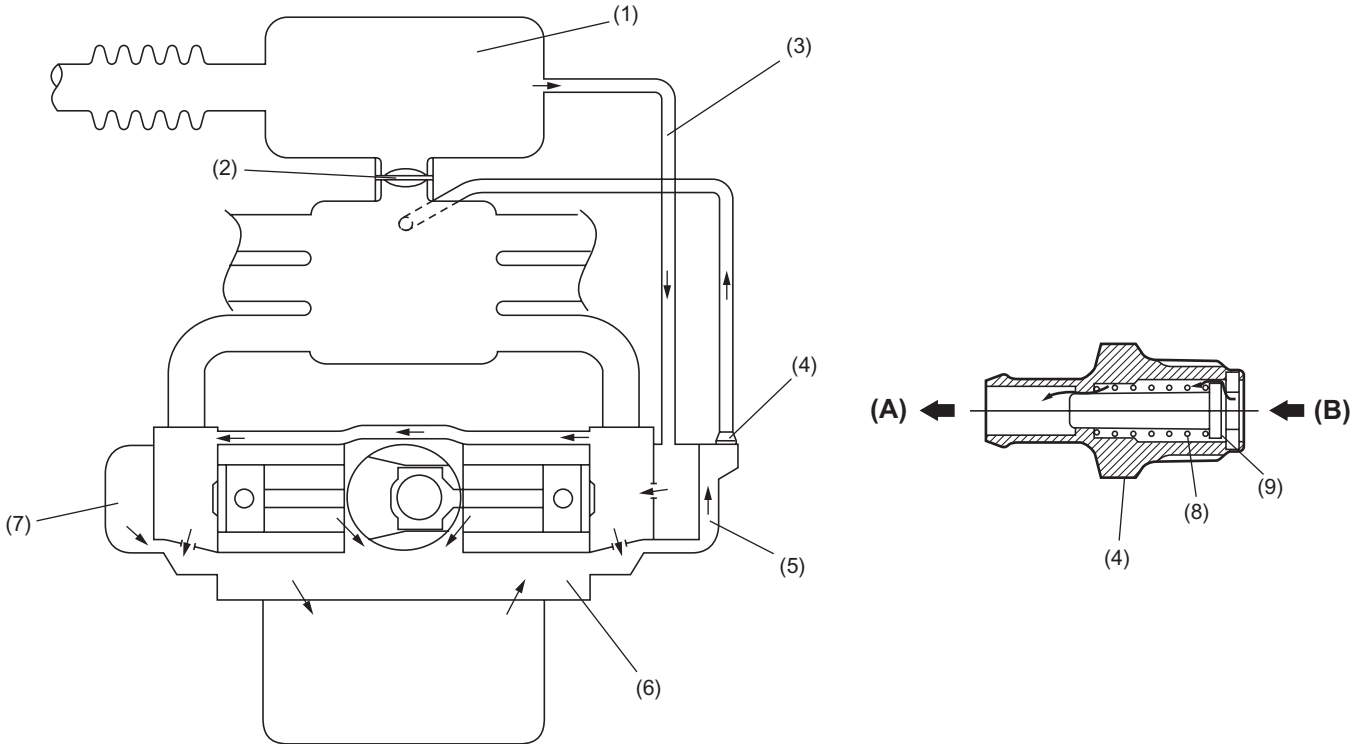
# CRANKCASE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 3. Crankcase Emission Control System

The positive crankcase ventilation (PCV) system prevents air pollution that will be caused by blow-by gas being emitted from the crankcase.

The system consists of rocker covers with fresh air inlet, connecting hoses, a PCV valve and a chamber.



EC-02036

- (1) Air intake chamber
- (2) Electronic control throttle
- (3) Connecting hose
- (4) PCV valve
- (5) Rocker cover LH

- (6) Crankcase
- (7) Rocker cover RH
- (8) Spring
- (9) Valve

- (A) To intake manifold
- (B) Blow-by gas



## 4. Catalytic Converter

- The basic materials of the three-way catalytic converter are platinum (Pt), rhodium (Rh) and palladium (Pd), and a thin coat of their mixture is applied onto honeycomb or porous ceramics of an oval or round shape (carrier). To avoid damaging the catalytic converter, only unleaded gasoline should be used.
- The catalytic converter reduces HC, CO and NO<sub>x</sub> in exhaust gases through chemical reactions (oxidation and reduction). These harmful components are reduced most efficiently when their concentrations are in a certain balance. These concentrations vary with the air-fuel ratio. The ideal air-fuel ratio for reduction of these components is the stoichiometric ratio.
- Therefore, the air-fuel ratio needs to be controlled to around the stoichiometric ratio to purify the exhaust gases most efficiently.

# AIR/FUEL (A/F) CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 5. Air/fuel (A/F) Control System

- The air/fuel (A/F) control system makes a correction to the basic fuel injection duration in accordance with the signals from the front oxygen (A/F) sensor so that the stoichiometric ratio is maintained, thus ensuring most effective exhaust gas purification by the three-way catalytic converter. Different basic fuel injection durations are preset for various engine speeds and loads, as well as the amount of intake air.
- This system also has a learning control function which stores the corrected data in relation to the basic fuel injection in the memory map. This allows an appropriate air-fuel ratio correction to be added automatically in quick response to any situation that requires such an effect. Thus, the air-fuel ratio is optimally maintained under various conditions while purifying exhaust gases most effectively, improving driving performance and compensating for changes in sensors' performance over time.

# AIR/FUEL (A/F) CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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**MEMO**

**EC(H6DO)-9**

# IGNITION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## 6. Ignition Control System

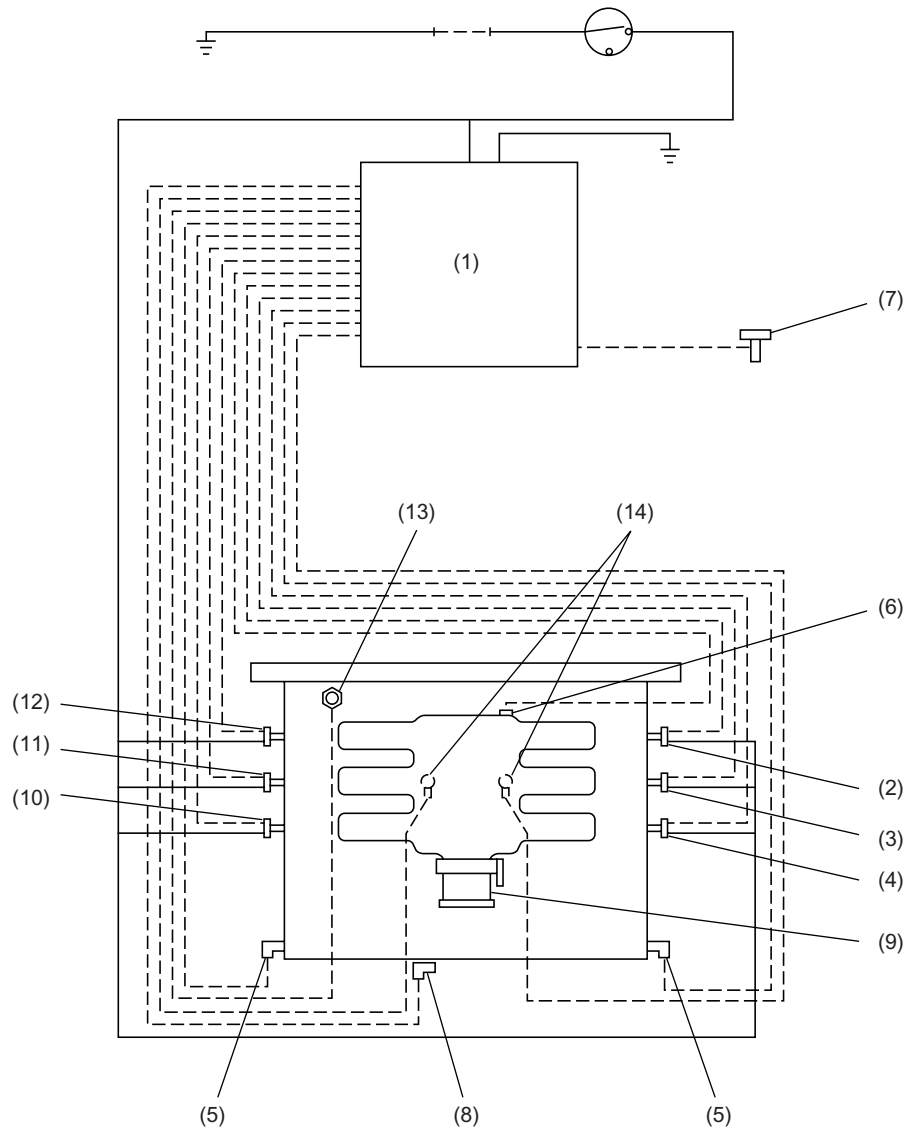
- The ignition system is controlled by the ECM.

The ECM monitors the operating condition of the engine using the signals from the sensors and switches shown below and determines the ignition timing most appropriate for each engine operating condition. Then it sends a signal to the igniter, commanding generation of a spark at that timing.

- The ECM uses a preprogrammed map for a “closed-loop” control which provides its ignition timing control with excellent transient characteristics, i.e., highly responsive ignition timing control.

# IGNITION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)



EC-02037

- |   |  |
|---|--|
| (1) ECM   | (8) Crankshaft position sensor         |
| (2) #1 ignition coil                                | (9) Electronic control throttle        |
| (3) #3 ignition coil                                | (10) #6 ignition coil                  |
| (4) #5 ignition coil                                | (11) #4 ignition coil                  |
| (5) Camshaft position sensor                        | (12) #2 ignition coil                  |
| (6) Manifold absolute pressure sensor               | (13) Engine coolant temperature sensor |
| (7) Mass air flow and intake air temperature sensor | (14) Knock sensor                      |

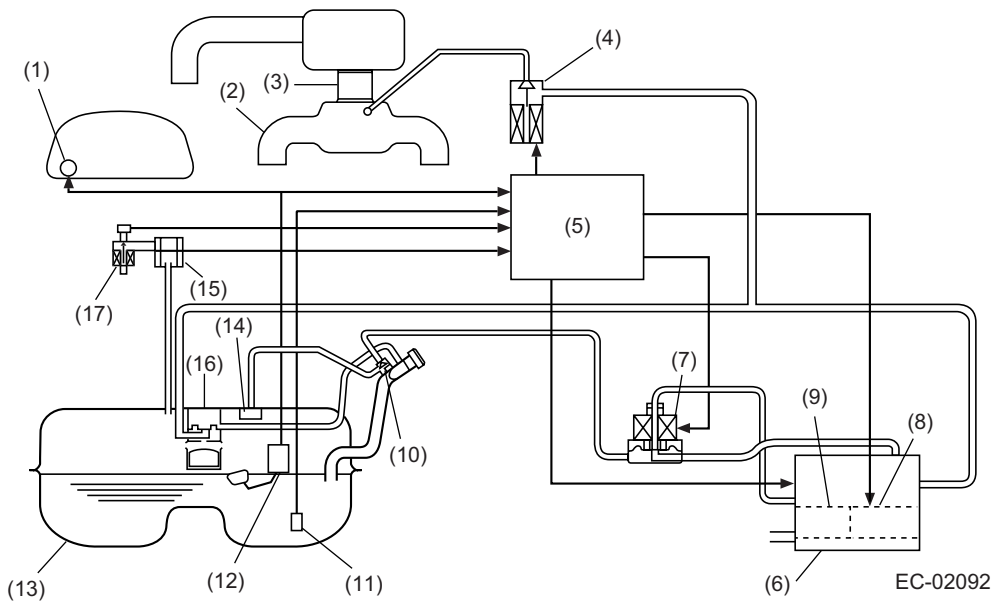
# EVAPORATIVE EMISSION CONTROL SYSTEM

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

### 7. Evaporative Emission Control System

#### A: GENERAL

- The evaporative emission control system prevents fuel vapors from escaping into atmosphere. This system includes a canister, purge control solenoid valve, fuel cut valve, and the lines connecting them.
- Fuel vapor in the fuel tank is introduced into the canister through the evaporation line, and are absorbed by activated carbon in it. The fuel cut valve is also incorporated in the fuel tank line.
- The purge control solenoid valve is controlled optimally by the ECM according to the engine condition.
- The pressure control solenoid valve incorporated in the fuel tank evaporation line regulates the pressure/vacuum in the fuel tank under the control of the ECM which uses the signal from the fuel tank pressure sensor.



- |                                  |                                     |                                     |
|----------------------------------|-------------------------------------|-------------------------------------|
| (1) Fuel gauge                   | (7) Pressure control solenoid valve | (13) Fuel tank                      |
| (2) Intake manifold              | (8) Drain valve                     | (14) Fuel cut valve                 |
| (3) Throttle body                | (9) Drain filter                    | (15) Fuel tank pressure sensor      |
| (4) Purge control solenoid valve | (10) Shut-off valve                 | (16) Vent valve                     |
| (5) Engine control module (ECM)  | (11) Fuel temperature sensor        | (17) Fuel tank sensor control valve |
| (6) Canister                     | (12) Fuel level sensor              |                                     |

#### B: FUEL CUT VALVE

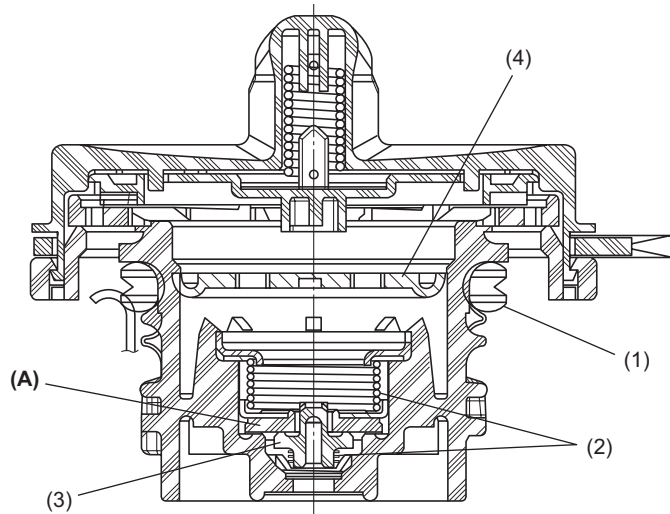
The fuel cut valve is incorporated in the fuel tank. The rising level of the fuel in the fuel tank causes the float to move up and close the cap hole so that no fuel can enter the evaporation line.

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## C: FUEL TANK CAP

- The fuel tank cap is of a quick lock type and can be opened or closed in 1/4 of a full turn.
- The fuel tank cap has a relief valve, which prevents development of vacuum in the fuel tank in the event of a problem with the fuel vapor line.
- When there is no problem with the fuel vapor line, the filler pipe is sealed at the portion (A) and by the seal pressed against the filler pipe end. If vacuum develops in the fuel tank, the atmospheric pressure forces the spring down to open the valve; consequently outside air flows into the fuel tank, thus controlling the inside pressure.



EC-02109

- (1) Seal
- (2) Spring

- (3) Valve
- (4) Filter

# EVAPORATIVE EMISSION CONTROL SYSTEM

## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

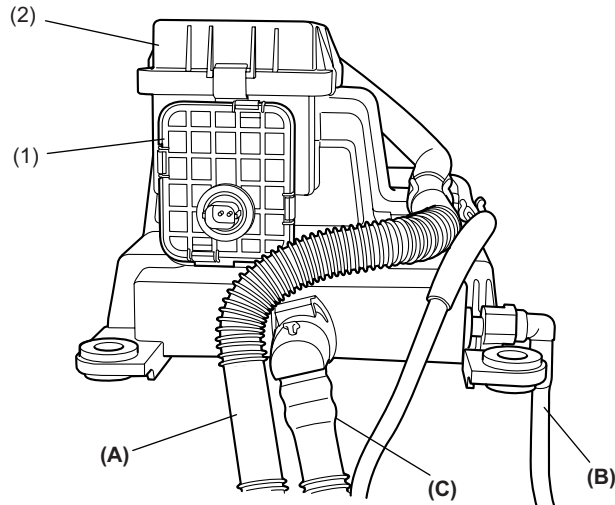
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### D: CANISTER

The canister incorporates a drain valve and a drain filter.

The charcoal filled in the canister temporarily stores fuel vapors. When the purge control solenoid valve is opened by a signal from the ECM, the external fresh air entering the canister carries the fuel vapors into the collector chamber.

The drain filter is installed at the air inlet port of the drain valve. It cleans the air taken in the canister through the drain valve.



EC-02093

- (1) Drain valve
- (2) Drain filter

- (A) Air
- (B) To pressure control solenoid valve
- (C) From fuel tank



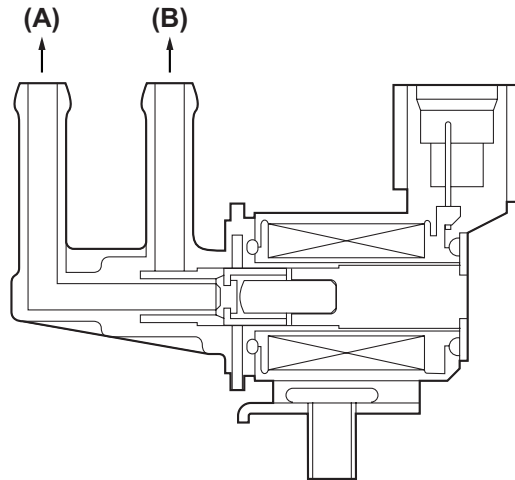
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## E: PURGE CONTROL SOLENOID VALVE

The purge control solenoid valve is on the evaporation line between the canister and intake manifold. It is installed at the underside of intake manifold.



EC-00237

- (A) To canister
- (B) To intake manifold

# EVAPORATIVE EMISSION CONTROL SYSTEM

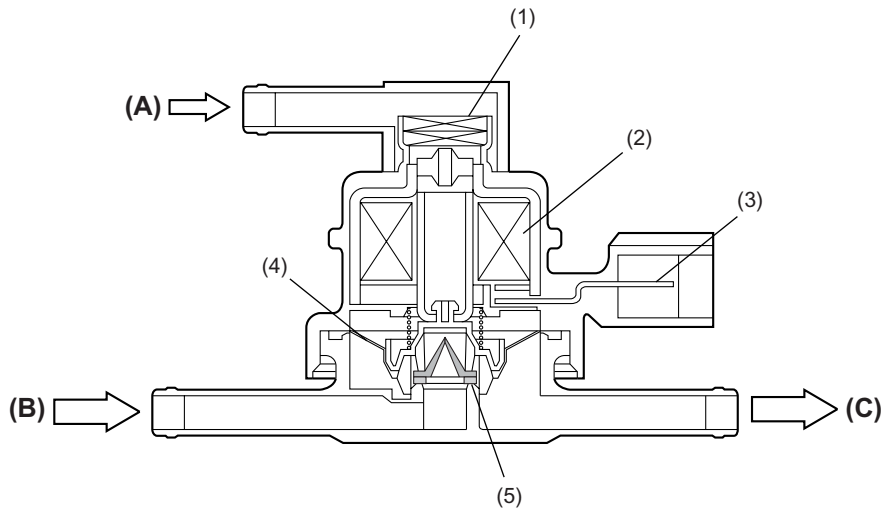
## EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

### F: PRESSURE CONTROL SOLENOID VALVE

The fuel tank pressure control solenoid valve is located in the evaporation line between the shut-off valve on fuel filler pipe and the fuel tank. It adjusts the fuel tank inside pressure under the control of the ECM.

When the tank inside pressure becomes higher than the atmospheric pressure, the valve is opened allowing fuel vapors to be introduced into the canister.

On the other hand, when the tank inside pressure becomes lower than the atmospheric pressure, external air is taken from the drain valve into the canister.



EC-00026

- |                        |                          |
|------------------------|--------------------------|
| (1) Filter             | (A) Atmospheric pressure |
| (2) Coil               | (B) From shut-off valve  |
| (3) Connector terminal | (C) To fuel tank         |
| (4) Diaphragm          |                          |
| (5) Valve              |                          |

### G: VENT VALVE

The vent valve is located inside of the fuel tank. During filling the fuel tank, fuel vapors are introduced into the canister through the vent valve.

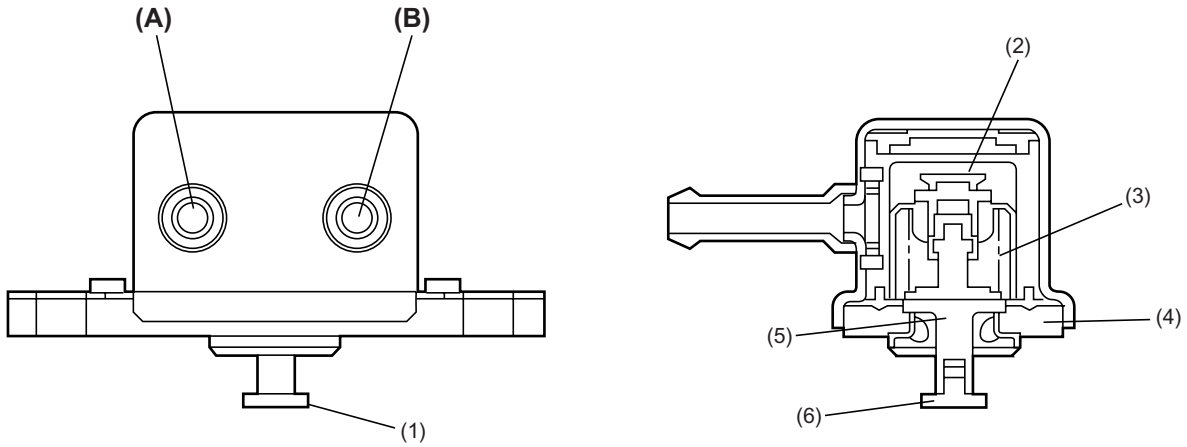
When the fuel vapor pressure becomes higher than the atmospheric pressure and overcomes the spring force which is applied to the back side of the diaphragm, the port toward the canister is opened. The vent valve also has a float which rises and block the port toward the canister when the fuel is full.

# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## H: SHUT-OFF VALVE

The shut-off valve is located at the top of the fuel filler pipe. When a filler gun is inserted into the filler pipe, the shut-off valve closes the evaporation line.



EC-00029

- (1) Pin
- (2) Valve
- (3) Spring
- (4) Plate
- (5) Shaft
- (6) Pin

- (A) To canister
- (B) To fuel tank

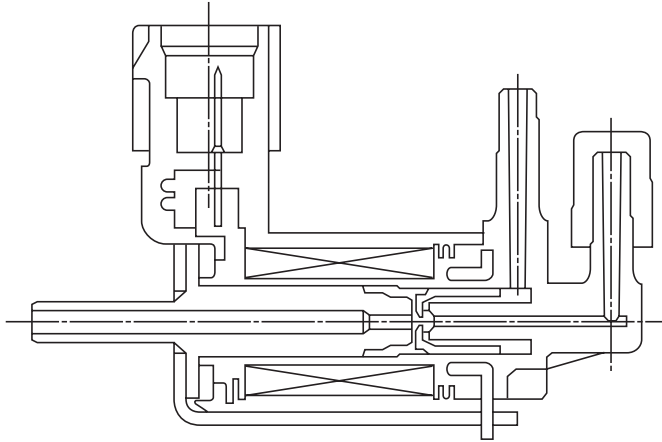
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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## I: FUEL TANK SENSOR CONTROL VALVE

The fuel tank sensor control valve is installed on the top of the fuel tank and its one end is connected to the fuel tank pressure sensor while its other end is open to the atmosphere.



EC-00031

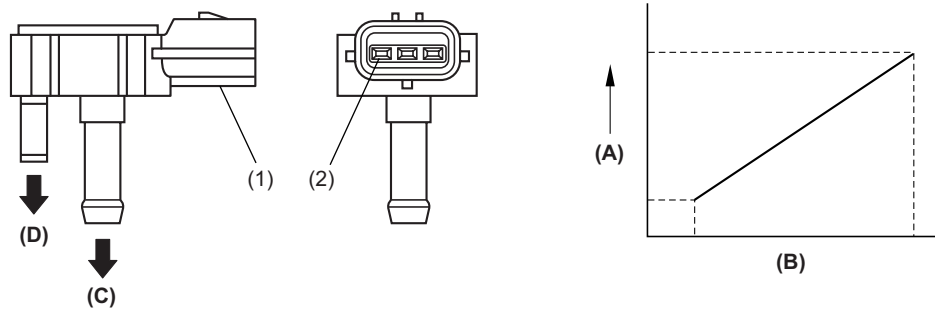
# EVAPORATIVE EMISSION CONTROL SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## J: FUEL TANK PRESSURE SENSOR

The fuel tank pressure sensor is installed on the top of the fuel tank and measures the pressure in the fuel tank.

The measured pressure is converted into an electrical signal and sent to the ECM for diagnosis of the evaporative emission control system.



EC-02110

- (1) Connector
- (2) Terminal

- (A) Output voltage
- (B) Input pressure
- (C) To fuel tank
- (D) To fuel tank sensor control valve

# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 8. On-board Refueling Vapor Recovery (ORVR) System

### A: GENERAL

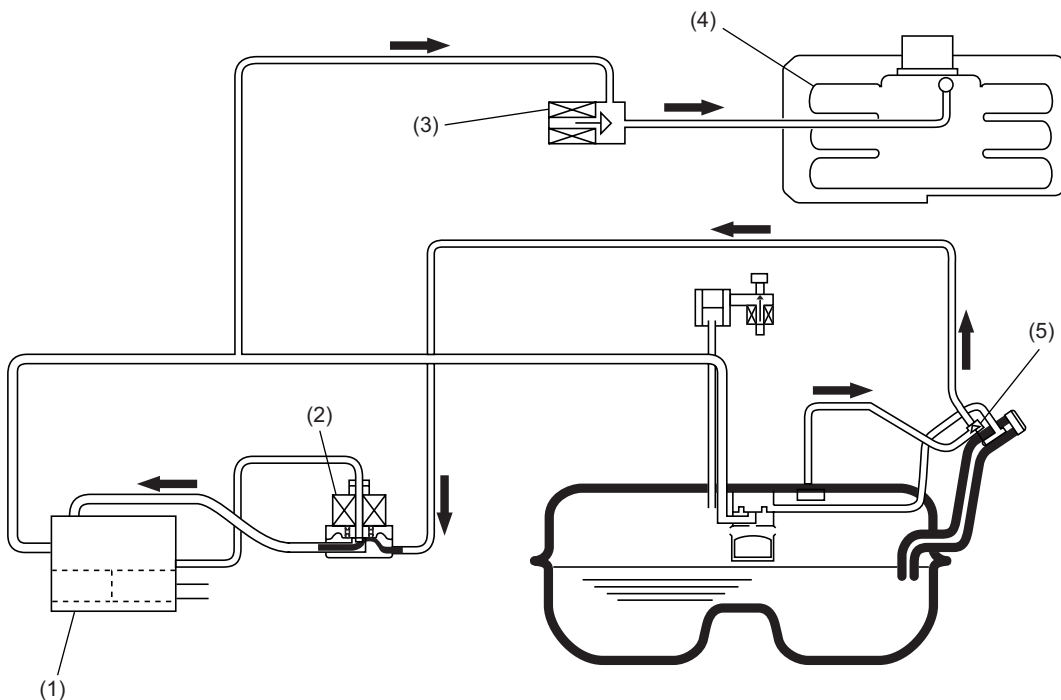
The on-board refueling vapor recovery system allows the fuel vapors in the fuel tank to be introduced directly into the canister through the vent valve when the fuel tank inside pressure increases as a result of refueling.

The diagnosis of the system is performed by monitoring the fuel tank inside pressure data from the fuel tank pressure sensor while forcibly closing the drain valve.

### B: OPERATION

- While driving

Since the back side of the diaphragm in the pressure control solenoid valve is open to the atmosphere, the diaphragm is held pressed by the atmospheric pressure in the position where only the external air is introduced into the canister. When the fuel vapor pressure acting on the other side of the diaphragm increases and overcomes the atmospheric pressure, it pushes the diaphragm and opens the port through which the fuel vapors make their way to the canister.



EC-02103

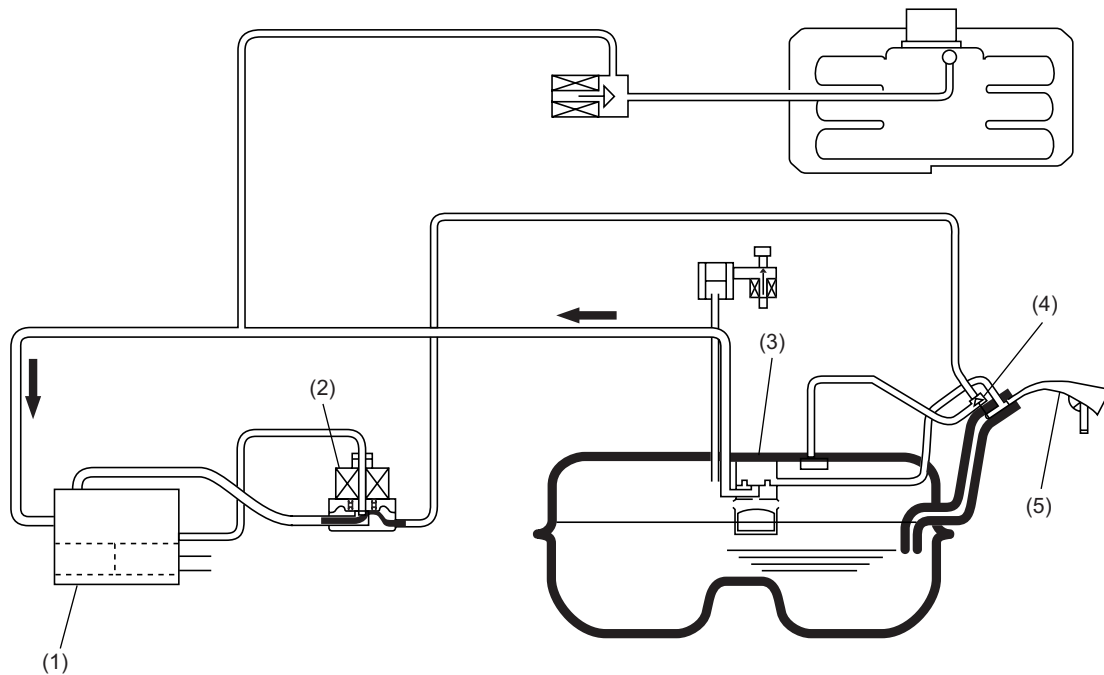
- |                                     |                          |
|-------------------------------------|--------------------------|
| (1) Canister                        | (4) Intake manifold      |
| (2) Pressure control solenoid valve | (5) Shut-off valve: Open |
| (3) Purge control solenoid valve    |                          |

# ON-BOARD REFUELING VAPOR RECOVERY (ORVR) SYSTEM

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

- While refueling

As the fuel enters the fuel tank, the tank inside pressure increases. When the inside pressure becomes higher than the atmospheric pressure, the port of the vent valve opens, allowing the fuel vapors to be introduced into the canister through the vent line. The fuel vapors are absorbed by charcoal in the canister, so the air discharged from the drain valve contains no fuel. When a filler gun is inserted, the shut-off valve closes the evaporation line.



EC-02104

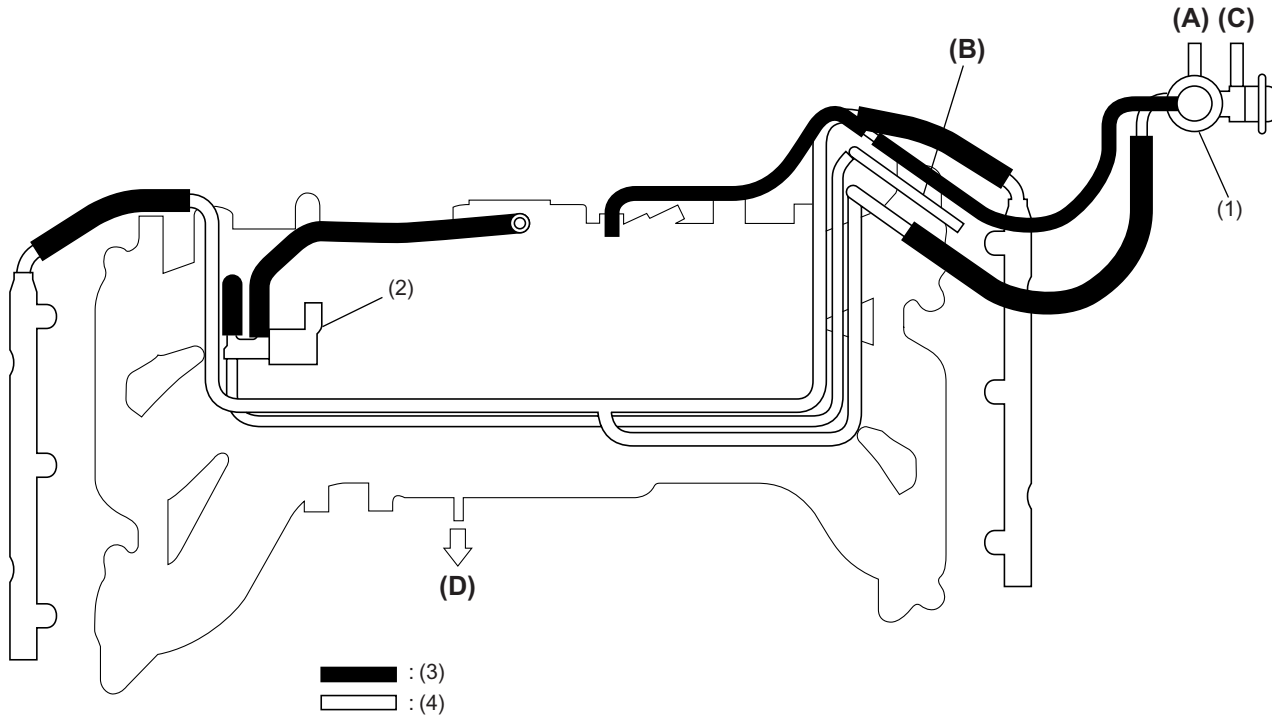
- |                                     |                            |
|-------------------------------------|----------------------------|
| (1) Canister                        | (4) Shut-off valve: Closed |
| (2) Pressure control solenoid valve | (5) Filler gun             |
| (3) Vent valve                      |                            |

# VACUUM CONNECTIONS

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

## 9. Vacuum Connections

The hose and pipe connections of the intake manifold and other related parts are as shown in the illustration.



EC-02039

- (1) Pressure regulator
- (2) Purge control solenoid valve
- (3) Hose
- (4) Pipe

- (A) Delivery line
- (B) Fuel evaporation line
- (C) Return line
- (D) Front of vehicle

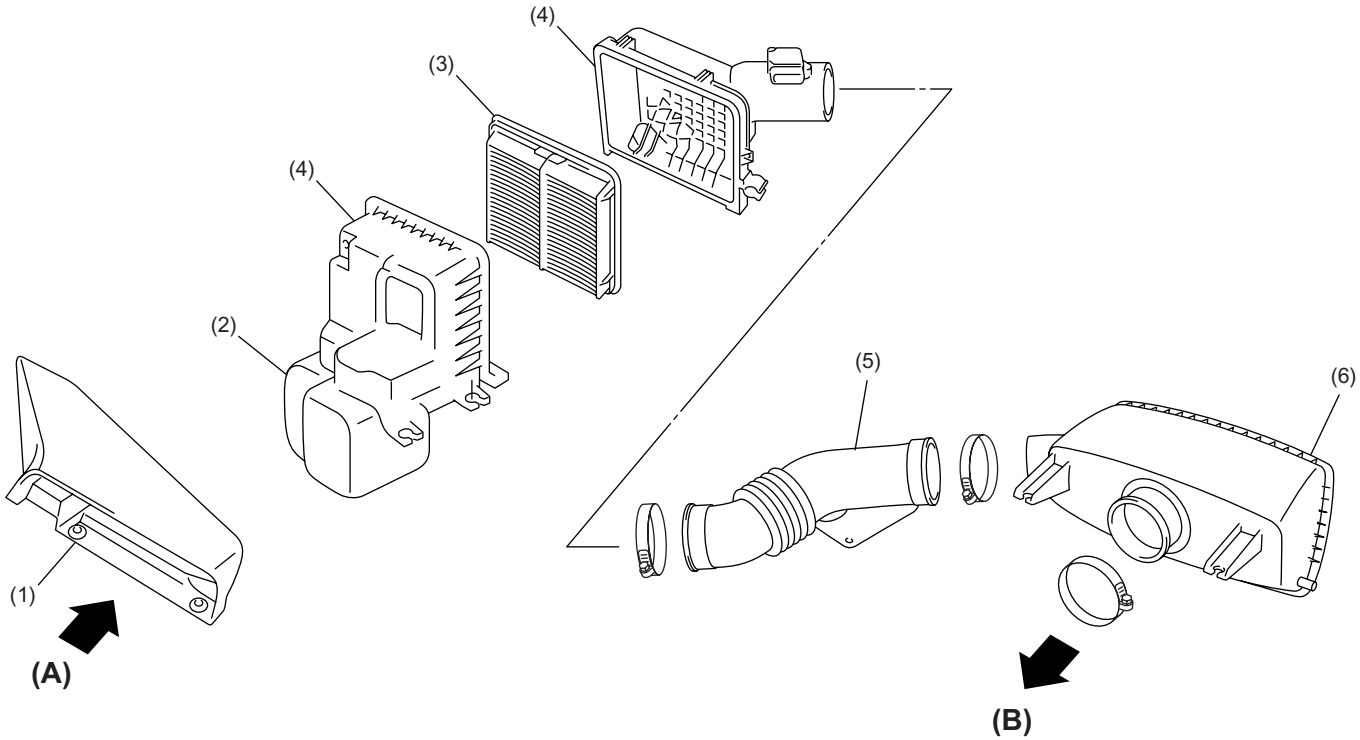


# GENERAL

## INTAKE (INDUCTION)

### 1. General

The intake system consists of an intake duct, a resonator chamber, and an air cleaner element housed in its case. The resonator chamber effectively reduces the intake noise level.



IN-02015

- (1) Intake duct
- (2) Resonator chamber
- (3) Air cleaner element
- (4) Air cleaner case
- (5) Intake duct
- (6) Air intake chamber

- (A) Outside air
- (B) To throttle body

# GENERAL

## MECHANICAL

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### 1. General

The H6 engine is of a horizontally opposed, six-cylinder design. This four-stroke-cycle, water-cooled, DOHC engine uses a total of 24 valves and its main components are made of aluminum alloy. It is fueled by a multiple fuel injection system.

The engine's major structural and functional features are as follows:

- A maintenance-free, chain-and-sprocket type camshaft drive mechanism is used which also contributes to reduction in the overall length of the engine.
- The cylinder block is an aluminum die-casting fitted with iron die-cast cylinder liners.
- Lightweight and compact design.

The cylinder bore pitch is 98.4 mm (3.874 in), which is much shorter than 113 mm (4.45 in) of the H4 engine.

The cylinder bore and piston stroke dimensions have been selected optimally for sufficient output and reduced size of the engine; they are 89.2 mm (3.512 in) and 80.0 mm (3.150 in) in contrast to 92.0 mm (3.622 in) and 75.0 mm (2.953 in) of the H4 engine.

The cylinder block is of a "siamese-triplet" design with the three cylinders of each bank cast without coolant passages between cylinders, while ensuring adequate cooling by employing an open-deck design.

The right bank camshafts and the left bank camshafts are driven by different timing chains, whereas the accessories are driven through their own pulleys by a single serpentine belt (two belts were used in the previous model's engine).

- Quiet operation

Unlike V6 engines, horizontally opposed six-cylinder engines do not generate secondary vibration (which is caused by primary operational vibration in a V6 engine and has a frequency twice as large as that of the primary vibration) although V6 engines have space saving merit. In addition to this inherent quietness provided by complete dynamic balance, the H6 engine incorporates the following quietly operating considerations:

The crankshaft is supported by seven bearings.

The chains driving the camshafts are provided with hydraulic tension adjusters and covered by a chain cover at the front of the engine.

An aluminum die-cast oil pan upper reinforces the joint of the right and left cylinder block banks, while giving additional rigidity to the crankshaft bearing areas.

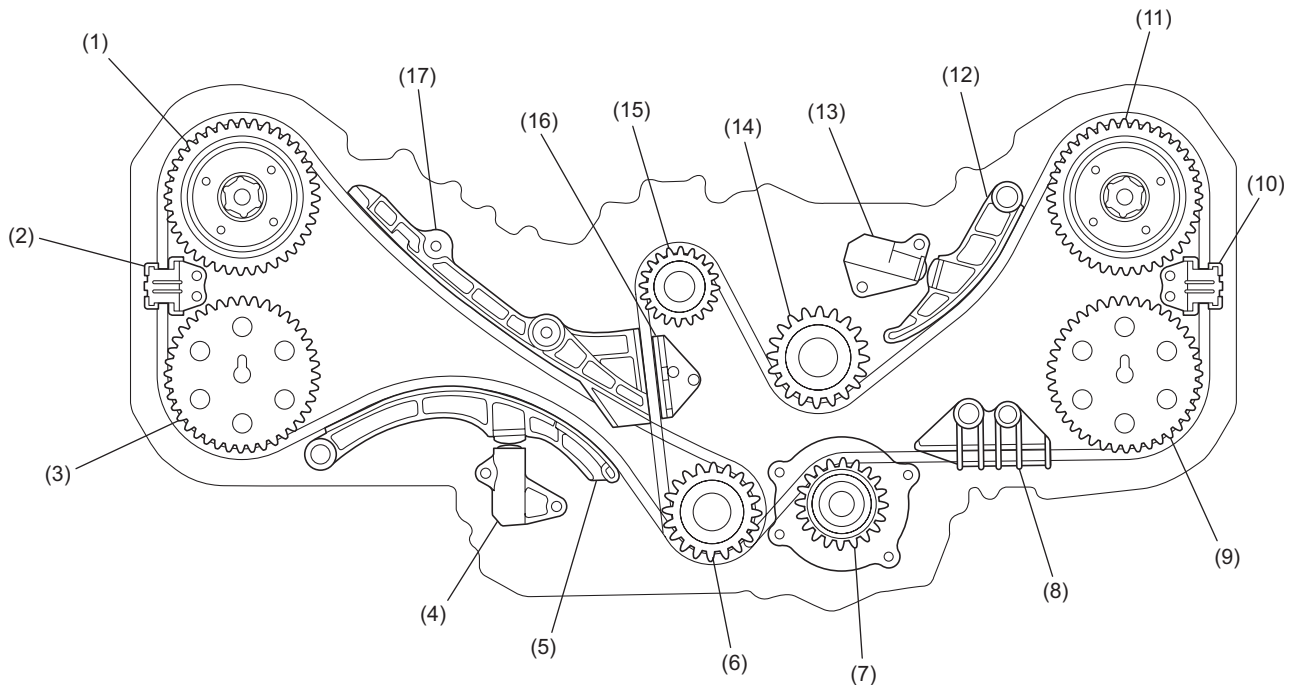
The engine is connected to the transmission more rigidity than with the H4 engine by using 11 bolts (eight bolts in the H4 engine).

## 2. Timing Chains

• Two timing chains are used to drive the camshafts, one each for driving the two camshafts on each bank. Every camshaft is fitted with a sprocket through which it is driven by the corresponding timing chain. The left bank timing chain transmits the power from the crankshaft sprocket directly to the left bank camshaft sprockets, whereas the right bank timing chain transmits the crankshaft power via the lower idler sprocket which is driven by the left bank timing chain. (The lower idler gear has two tooth rows; the left bank timing chain engages with the inner row teeth and the right bank chain engages with the outer row teeth.) By this way, the right and left bank camshafts rotate in synchronization with each other.

The left bank timing chain also drives the water pump.

• The hydro-mechanical automatic chain tension adjuster provided for each chain constantly maintains the specified chain tension necessary to properly drive the camshafts, as well as to provide this chain and sprocket camshaft drive mechanism with a “maintenance-free” feature.



ME-02431

- |                                     |                                      |                                |
|-------------------------------------|--------------------------------------|--------------------------------|
| (1) Intake camshaft sprocket RH     | (7) Water pump sprocket              | (13) Chain tension adjuster LH |
| (2) No. 1 chain guide RH            | (8) No. 2 chain guide LH             | (14) Upper idler sprocket      |
| (3) Exhaust camshaft sprocket RH    | (9) Exhaust camshaft sprocket LH     | (15) Crankshaft sprocket       |
| (4) Chain tension adjuster RH       | (10) No. 1 chain guide LH            | (16) Center chain guide        |
| (5) Chain tension adjuster lever RH | (11) Intake camshaft sprocket LH     | (17) No. 2 chain guide RH      |
| (6) Lower idler sprocket            | (12) Chain tension adjuster lever LH |                                |

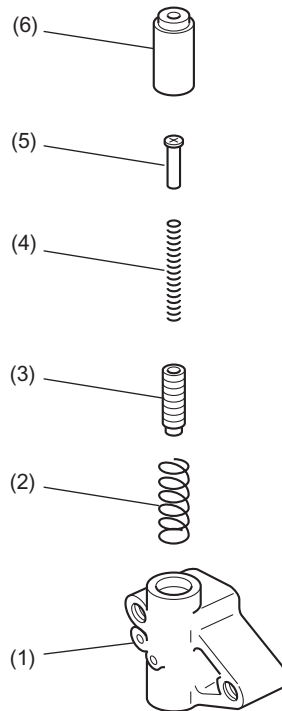
# AUTOMATIC CHAIN TENSION ADJUSTER

MECHANICAL

## 3. Automatic Chain Tension Adjuster

The right and left bank timing chains are provided with their own tensioners. The tensioners are of a hydro-mechanical type that utilizes the engine oil pressure and can automatically keep the tension of the chains at a proper level without need for manual adjustments.

The tensioner case has an oil port that aligns with the oil port in the cylinder block when it is installed in position. The inside of the tensioner case is a high-pressure hydraulic chamber with a check ball. The pressure of the oil in the chamber is adjusted by the relief valve. Featuring a plunger with external screw threads, the tensioner can keep the chain taut constantly even when the engine is stationary.



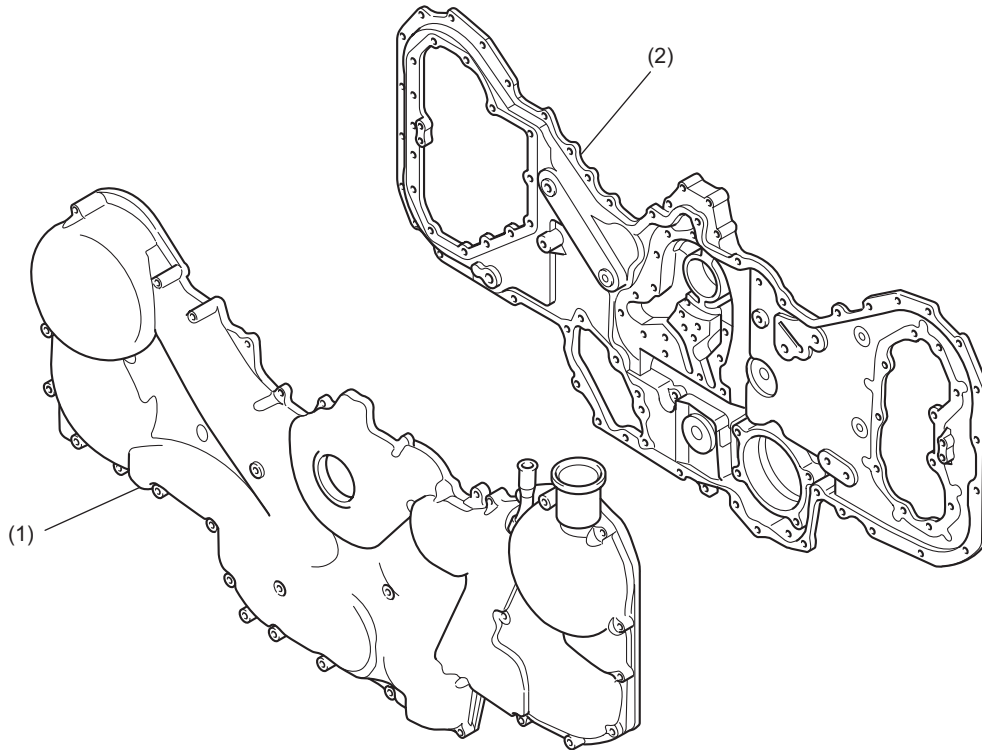
ME-00609

- (1) Tensioner case
- (2) Spring
- (3) Plunger

- (4) Spring
- (5) Adjuster rod
- (6) Plunger case

## 4. Timing Chain Case

- The timing chain case is formed by the front chain cover and rear chain cover, both made of aluminum die-casting. This two-piece chain case design helps reduce noise.
- Sealing materials used between the engine block and rear chain cover are an O-ring, metal gasket, and liquid gasket. Between the front and rear chain covers, liquid gasket is used to prevent oil from leaking out.
- A fluorocarbon resin oil seal is used at the crankshaft opening in the front chain cover.



ME-02080

- (1) Front chain cover
- (2) Rear chain cover

## 5. Camshaft

- The camshafts are of a composite material type using sintered steel for cam lobes and carbon steel for pipe part.

The sintered steel cams are very high in the resistance to wear, which enables the cam lift to be increased. In addition, use of the sintered steel cams contributes to reduction in weight.

- Each camshaft is supported at its four journals by the corresponding bearings. The front-most bearing has flanges on its both ends to receive thrust loads that are generated during movement of the camshaft.

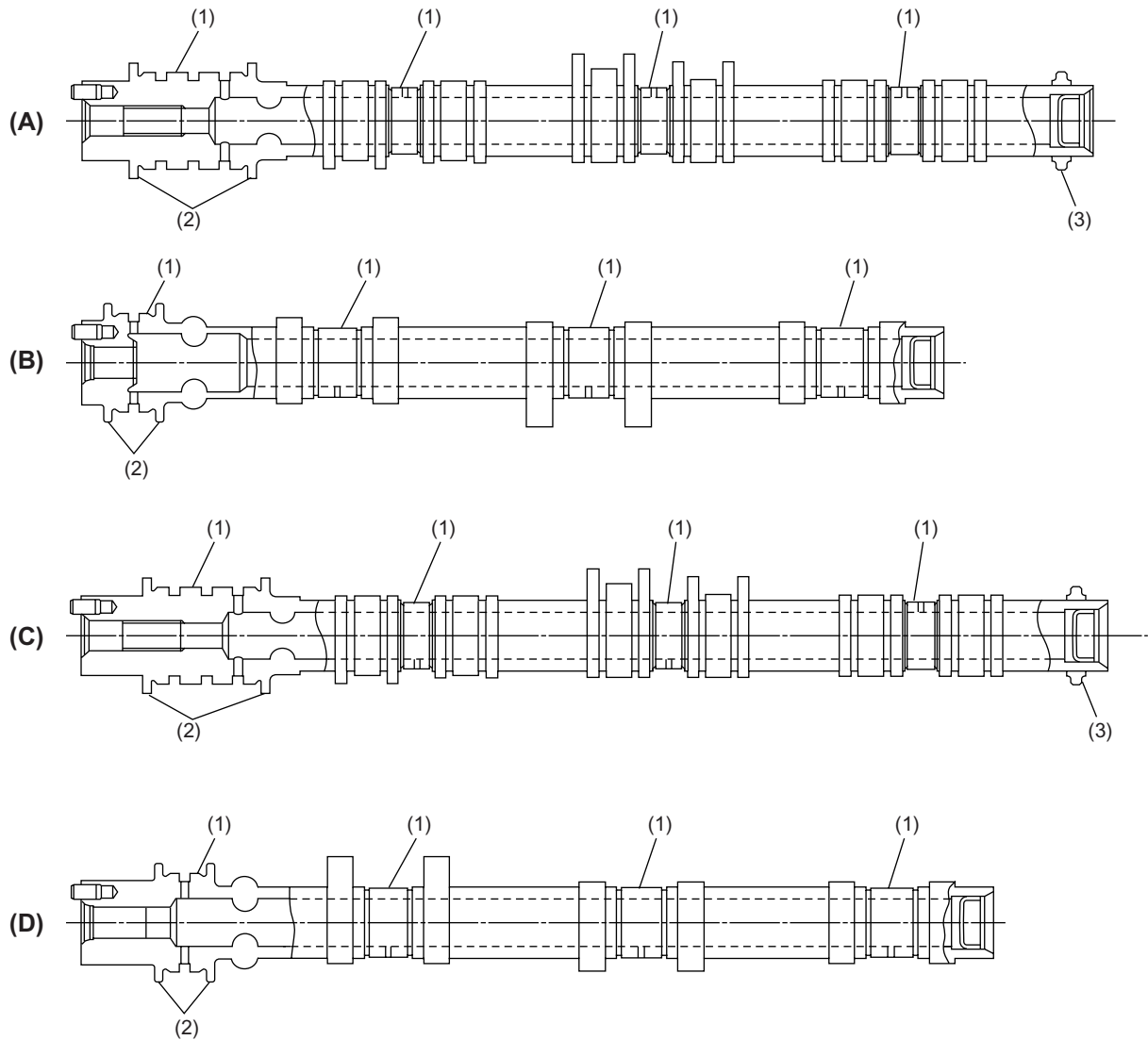
- The bearings are lubricated by the oil that enters the passage in each camshaft from the port at the front-end journal and flows out through the hole in each journal.

- The intake camshaft has at its rear end a flange, which is used as an angle sensing wheel by the camshaft position sensor.

- As the engine is equipped with a variable valve lift system, each of the intake camshafts have high-lift cams and low-lift cams.

# CAMSHAFT

MECHANICAL



ME-02103

- (1) Journal
- (2) Shaft flange
- (3) Camshaft position sensor flange

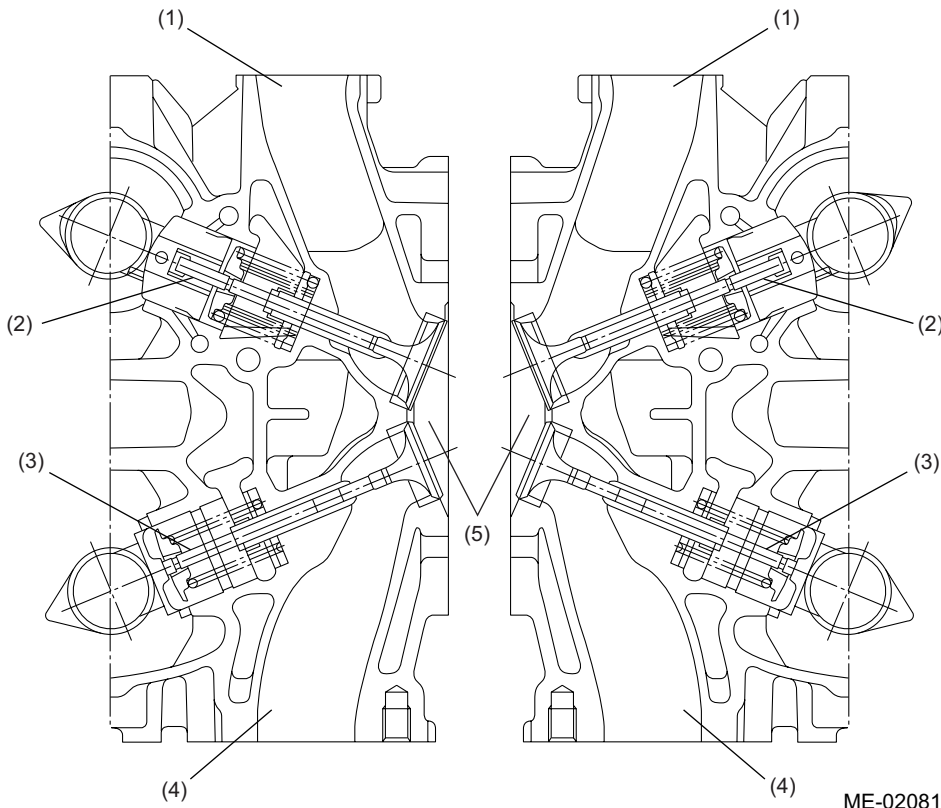
- (A) Intake camshaft RH
- (B) Exhaust camshaft RH
- (C) Intake camshaft LH
- (D) Exhaust camshaft LH

# CYLINDER HEAD

MECHANICAL

## 6. Cylinder Head

- The cylinder heads are made of aluminum alloy, which features light weight and high cooling efficiency.
- Each cylinder head incorporates a DOHC mechanism, which is adapted to the four valves per cylinder arrangement. A variable valve lift system is used at the intake port. The exhaust ports are formed in three independent ports. These design features contribute together to higher output.
- The combustion chamber is of a compact pent roof design with the spark plug located at its top center. The squish area formed between the piston top surface and combustion chamber helps improve mixing of air and fuel and thus combustion efficiency.
- Coolant flows from the rear to the front of the cylinder head of each bank. This serial-flow coolant line arrangement ensures highly efficient cooling of the engine.
- A metal gasket is used between the cylinder head and cylinder block. Tightening the cylinder head bolts by the angle-tightening method ensures invariable sealing performance of this gasket.



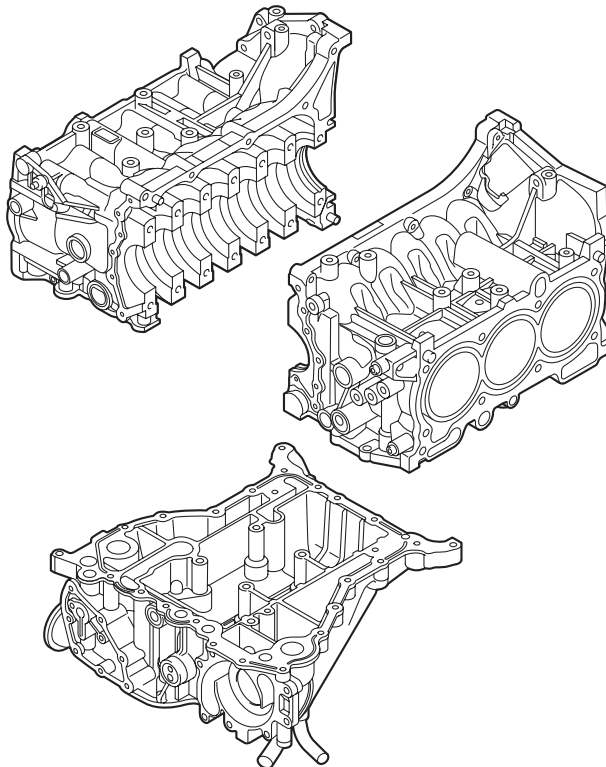
- (1) Intake port
- (2) Intake valve
- (3) Exhaust valve

- (4) Exhaust port
- (5) Combustion chamber



## 7. Cylinder Block

- The cylinder block of this horizontally-opposed-cylinder engine is made of aluminum die-casting. It is split into right and left halves at its center where the crankshaft is supported. The cylinder liners are made of cast iron and are embedded as integral part of the cylinder block body during the casting process.
- The coolant passages of the right and left banks are independent of each other (parallel-flow type). The water jackets around the cylinder liners are open at the cylinder head side end of each bank (open-deck design).
- The cylinder block supports the crankshafts journals through seven main bearings rigidly and quietly. The #7 bearing is a flanged thrust bearing which controls the crankshafts end play.
- Rigid engine-to-transmission connection is ensured by 11 bolts (three more bolts than with the H4 engine).
- The aluminum die-cast oil pan upper located below the cylinder block reinforces connection between the cylinder block banks and its special form provides a baffle effect to suppress large fluctuation of oil level. In addition, the oil pan upper constitutes part of the oil and cooling circuits as well as the water pump volute chamber and thermostat chamber.



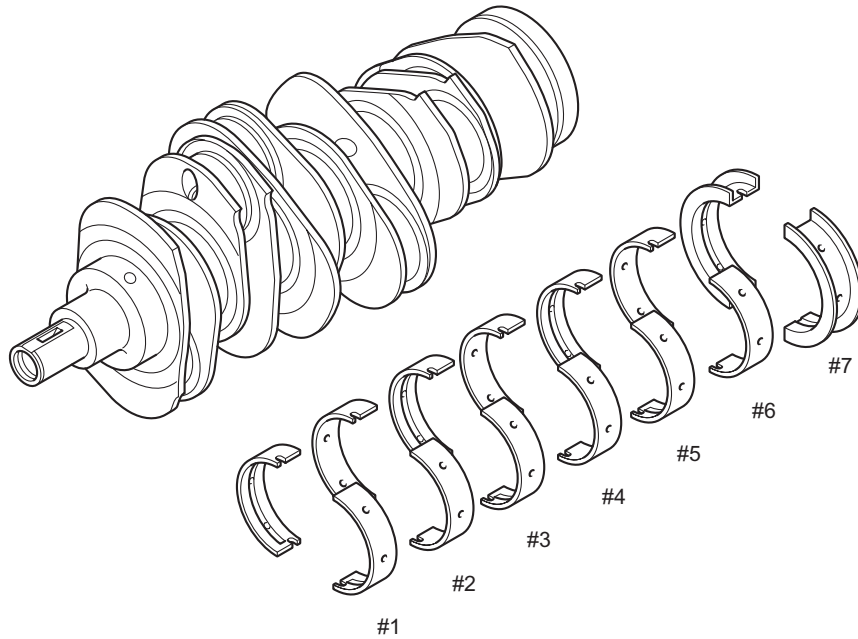
ME-02082

# CRANKSHAFT

MECHANICAL

## 8. Crankshaft

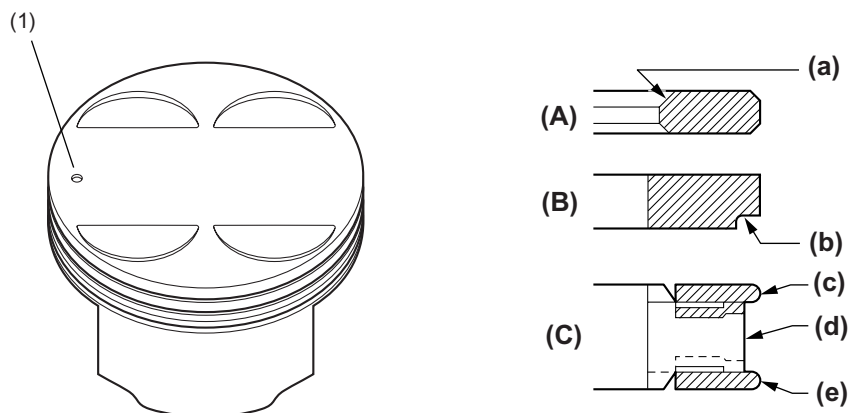
The crankshaft is supported in the cylinder block by seven bearings. Each corner formed by a journal or pin and a web is finished by fillet-rolling method, which increases strength of that area. The seven crankshaft bearings are made of aluminum alloy and the No. 7 bearing is provided with a flanged metal to support thrust forces.



ME-00614

## 9. Piston

- The pistons are of a slipper skirt design for reduced weight and friction. The oil control ring groove utilizes a thermal design.
- The piston pin is offset either downward (Nos. 1, 3 and 5 pistons) or upward (Nos. 2, 4 and 6 pistons).
- Recesses are provided in the piston to maintain clearance between the piston and valve heads. All the right and left bank pistons are the same in shape. Each piston has a location mark (mark indicating the front of engine) on its top.
- Three piston rings are used for each piston; two compression rings and one oil control ring. The top piston ring has inner bevels and the second piston ring has an interrupt (cut) on the bottom outside to reduce oil consumption.



ME-02083

(1) Location mark (engine front side)

(A) Top ring

(B) Second ring

(C) Oil ring

(a) Inner-bevel

(b) Cut

(c) Upper rail

(d) Expander

(e) Lower rail

# VARIABLE VALVE TIMING SYSTEM

MECHANICAL

---

## 10. Variable Valve Timing System

Regarding the construction and operation of the variable valve timing system, refer to ME (H4DOTC) section, Variable Valve Timing System. <Ref. to ME(H4DOTC) section, Variable Valve Timing System.>

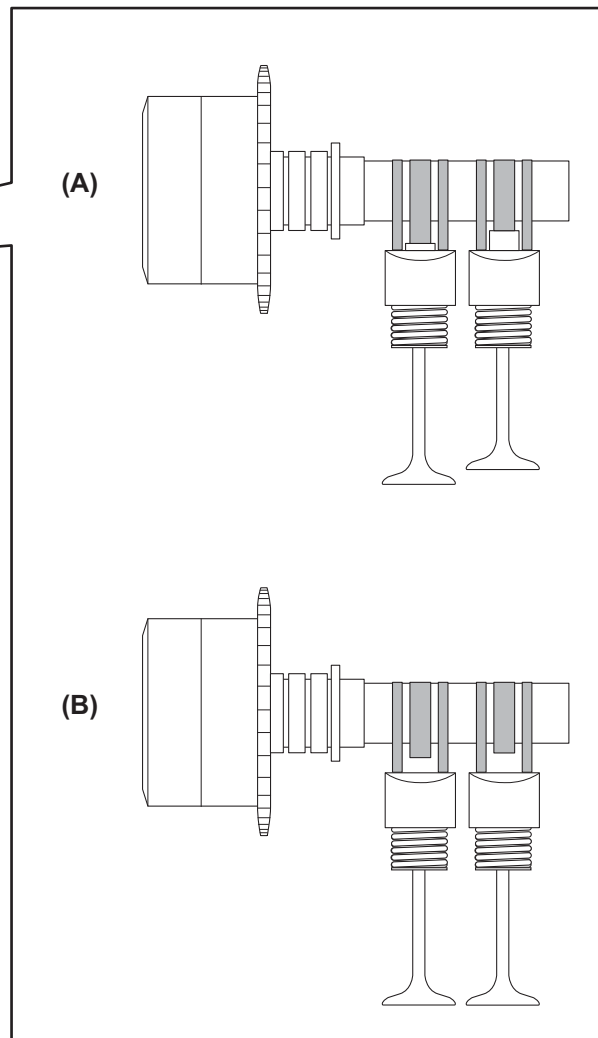
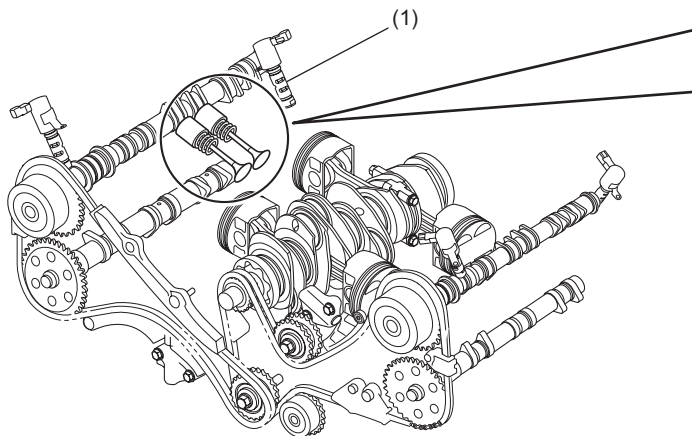
## 11.Variable Valve Lift System

The engine is provided with a variable valve lift system. The variable valve lift system optimizes the intake valve lift by switching to use low lift cams or high lift cams in accordance with engine speed.

- In response to the signals from the ECM, the oil switching solenoid valve operates to switch the valve lift.
- At low engine speeds, the lift is reduced to increase intake air speed and to obtain effective combustion and higher torque output. The lift of the two valves are different from each other. By differentiating the intake air volume in this way, a swirl occurs in the combustion chamber and combustion is improved.
- At high engine speeds, the lift is increased to reduce intake resistance and to obtain higher power.
- To protect the engine, the system does not allow racing up the engine to high speeds in P or N range.

# VARIABLE VALVE LIFT SYSTEM

MECHANICAL



ME-02104

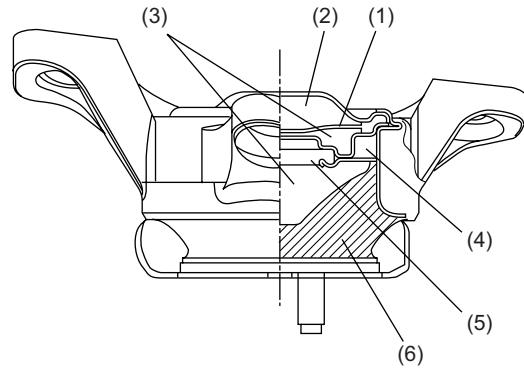
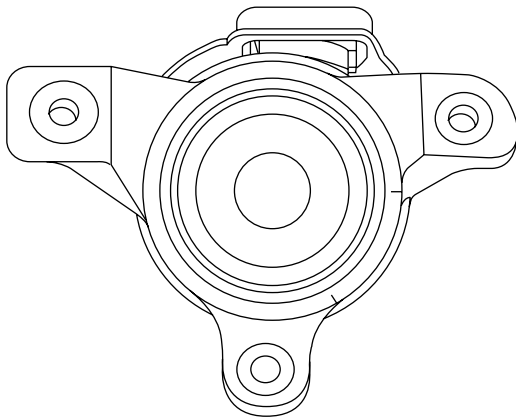
(1) Oil switching solenoid valve

(A) During low speed operation

(B) During high speed operation

## 12.Engine Mounting

The front cushion rubber for H6 engines hold the engine at three points to increase rigidity. The cushion has an upper and lower liquid chambers inside, and an orifice connects the upper and lower liquid chambers while a diaphragm separates the upper liquid chamber and air chamber. A rubber membrane is also added, and vibration and noise are reduced by optimally tuning its spring constant.



ME-02105

- (1) Diaphragm
- (2) Air chamber
- (3) Liquid chamber

- (4) Orifice
- (5) Membrane (rubber)
- (6) Rubber

# ENGINE MOUNTING

MECHANICAL

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**MEMO**

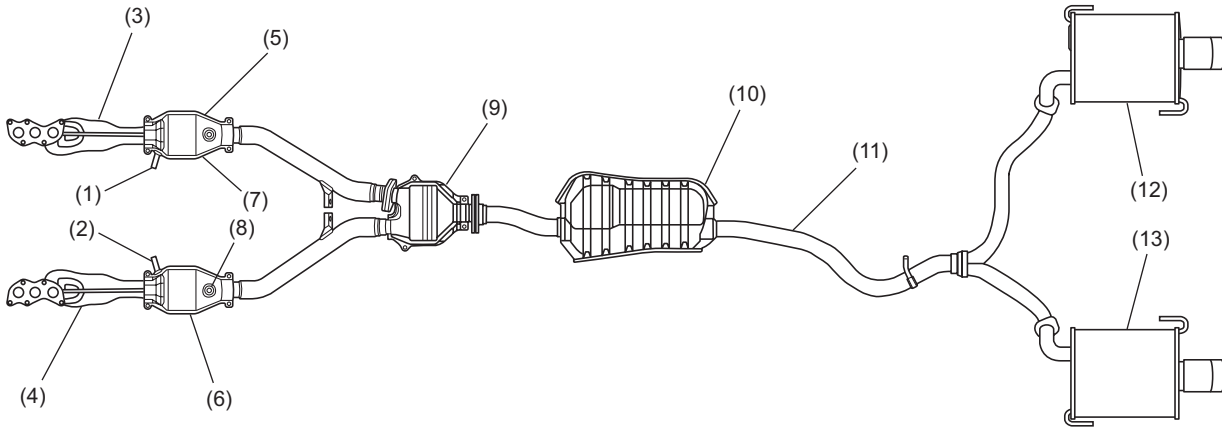


# GENERAL

## EXHAUST

### 1. General

- The exhaust system consists of a front exhaust pipe assembly, a rear exhaust pipe with a resonance chamber, and a muffler.
- The front exhaust pipe assembly consists of right and left exhaust pipes each incorporating a front catalytic converter, and a rear catalytic converter that is located at the joint of the two pipes.
- The exhaust system features an excellent sound suppression design; the rear exhaust pipes have a large capacity chamber and twin mufflers.



EX-02076

- |                                  |                              |
|----------------------------------|------------------------------|
| (1) Front oxygen (A/F) sensor RH | (8) Rear oxygen sensor LH    |
| (2) Front oxygen (A/F) sensor LH | (9) Rear catalytic converter |
| (3) Front exhaust pipe RH        | (10) Chamber                 |
| (4) Front exhaust pipe LH        | (11) Rear exhaust pipe       |
| (5) Front catalytic converter RH | (12) Muffler RH              |
| (6) Front catalytic converter LH | (13) Muffler LH              |
| (7) Rear oxygen sensor RH        |                              |

### 1. General

- The engine cooling system consists of a down-flow radiator featuring high heat-dissipation performance, an electric-motor-driven fan, a water pump, a thermostat, and an engine coolant temperature sensor.
- The reservoir tank is designed to eliminate the need for replenishing coolant.
- The ECM controls the operation of the radiator main fan and sub fan depending on the signals from the engine coolant temperature sensor, vehicle speed sensor, A/C switch and A/C mid pressure switch.

## 2. Cooling Circuits

The cooling system operates in three different phases depending on the temperature of the engine coolant.

- 1st phase (thermostat closed)

When the engine coolant temperature is below 80°C (176°F), the thermostat remains closed. The coolant flows through the bypass and heater circuits.

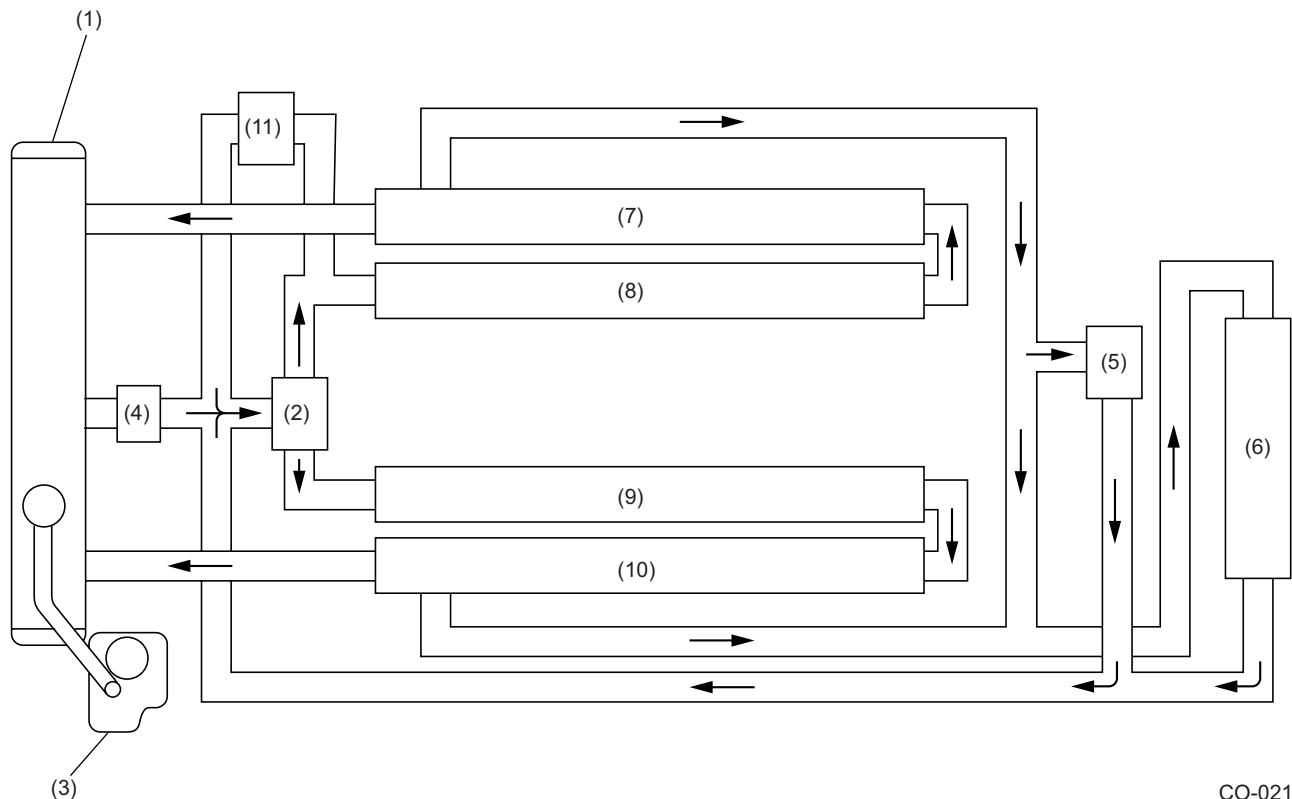
This permits the engine to warm up quickly.

- 2nd phase (thermostat open)

When the engine coolant temperature is above 80 — 84°C (176 — 183.2°F), the thermostat opens. The coolant flows through the radiator where it is cooled.

- 3rd phase (thermostat open and radiator fan operating)

When the engine coolant temperature sensor sends a signal indicating a temperature above 91°C (196°F) to the ECM, it causes the radiator fan (or fans) to operate.



CO-02106

- |                                   |                       |
|-----------------------------------|-----------------------|
| (1) Radiator                      | (7) Cylinder head RH  |
| (2) Water pump                    | (8) Cylinder block RH |
| (3) Engine coolant reservoir tank | (9) Cylinder block LH |
| (4) Thermostat                    | (10) Cylinder head LH |
| (5) Throttle body                 | (11) Oil cooler       |
| (6) Heater core                   |                       |

# WATER PUMP

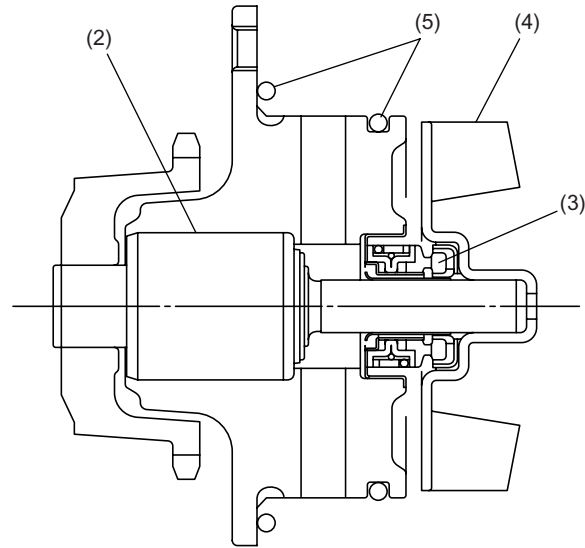
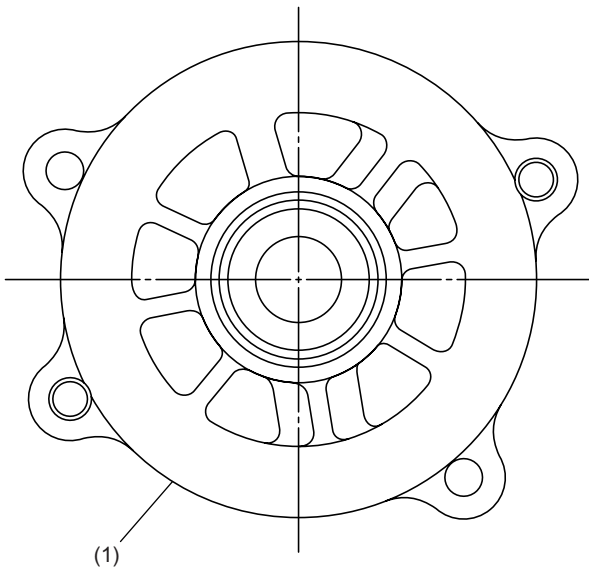
COOLING

## 3. Water Pump

The water pump is fitted in a housing formed in the rear chain cover using an O-ring as a seal between the pump case and the housing. The pump is driven by the timing chain through a sprocket and rotation of the impeller in a volute chamber creates flow of coolant toward the cylinder block.

The pump case is made of aluminum die-casting and the impeller is made of steel sheet. The impeller shaft is supported by a ball bearing and a roller bearing. Its end exposed to coolant is sealed by a mechanical seal and the other end exposed to engine oil is sealed by an oil seal.

The volute chamber is formed by the rear chain cover and the oil pan upper. A metal gasket is used at the joint between the chain cover and oil pan upper.



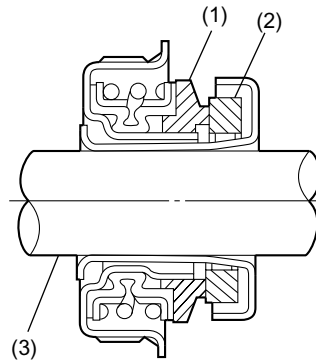
CO-02040

- (1) Pump case
- (2) Bearing
- (3) Mechanical seal

- (4) Impeller
- (5) O-ring

## 4. Mechanical Seal

The mechanical seal has its seat tightly fitted on the water pump shaft. Since it is a hermetic seal forming an integral part of the water pump, the water pump cannot be disassembled.



CO-00058

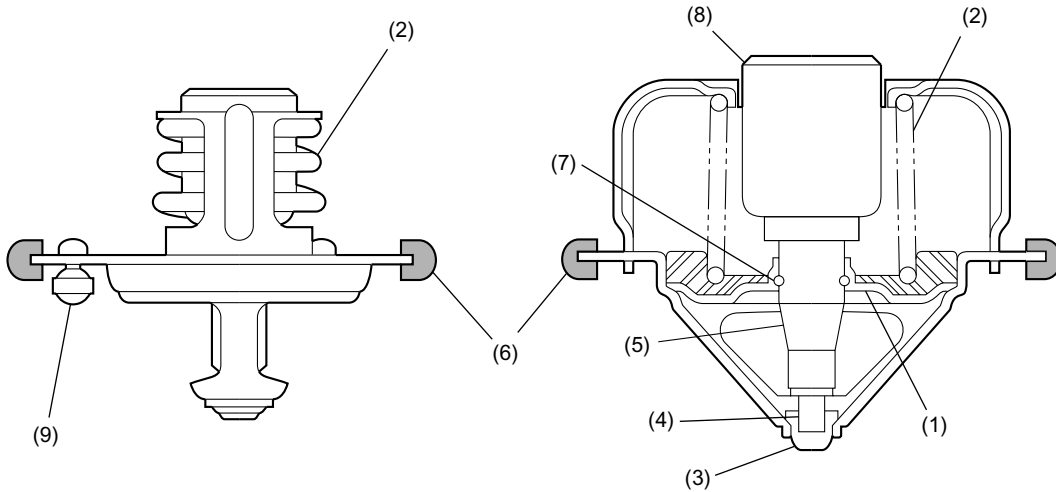
- (1) Carbon seal
- (2) Ceramics seat
- (3) Water pump shaft

# THERMOSTAT

COOLING

## 5. Thermostat

The thermostat has a totally enclosed wax pellet, which expands as the coolant temperature increases. It opens and closes accurately at the preset temperatures and features high durability.



CO-00059

- (1) Valve
- (2) Spring
- (3) Stopper

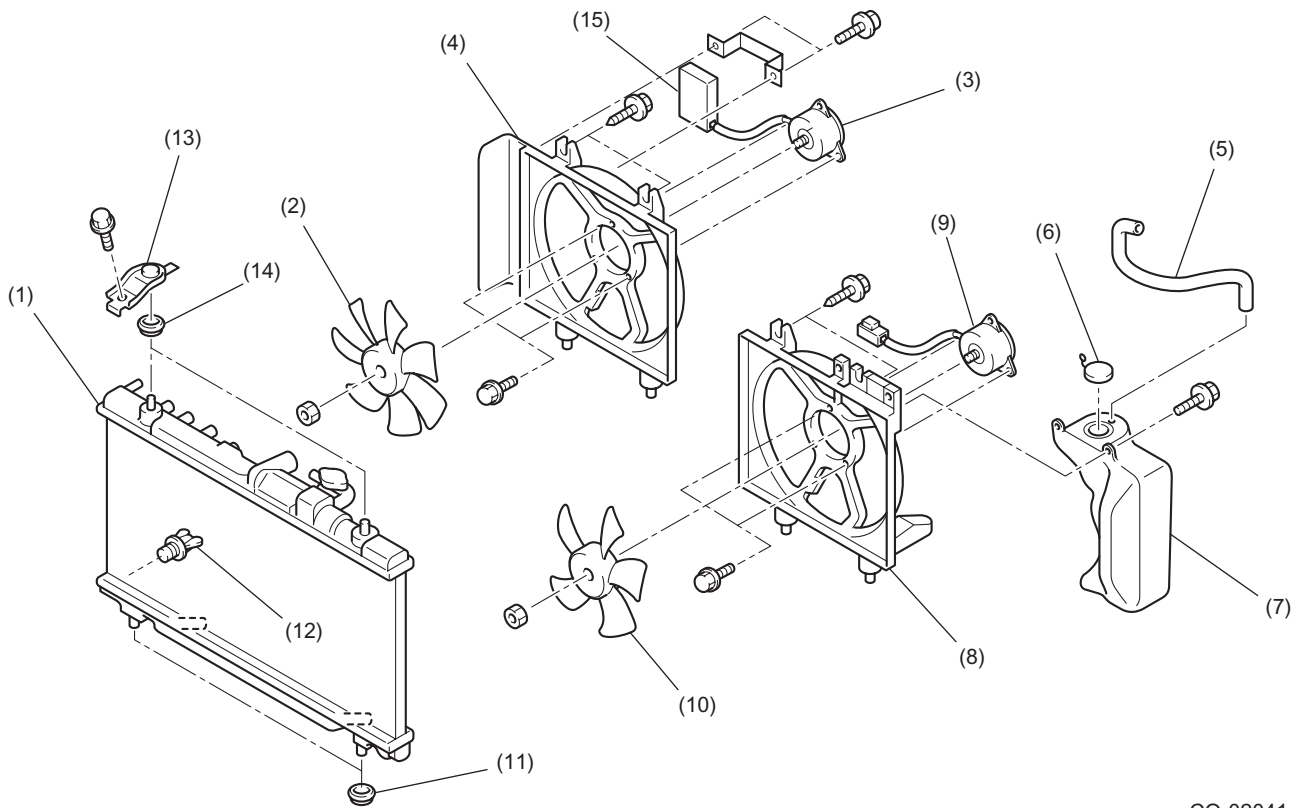
- (4) Piston
- (5) Guide
- (6) Rubber packing

- (7) Stop ring
- (8) Wax element
- (9) Jiggle valve

## 6. Radiator Fan

### A: DESCRIPTION

Each radiator fan is made of plastic. It is driven by an electric motor, which is retained on a shroud.



CO-02041

- |                             |                                |
|-----------------------------|--------------------------------|
| (1) Radiator                | (8) Radiator main fan shroud   |
| (2) Radiator sub fan        | (9) Radiator main fan motor    |
| (3) Radiator sub fan motor  | (10) Radiator main fan         |
| (4) Radiator sub fan shroud | (11) Lower cushion             |
| (5) Overflow hose           | (12) Drain plug                |
| (6) Reservoir tank cap      | (13) Upper bracket             |
| (7) Reservoir tank          | (14) Upper cushion             |
|                             | (15) Radiator fan control unit |

# RADIATOR FAN

## COOLING

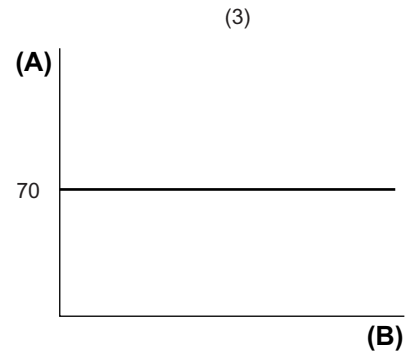
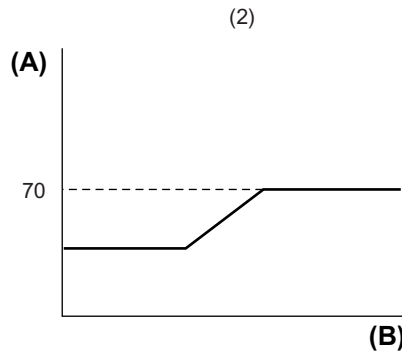
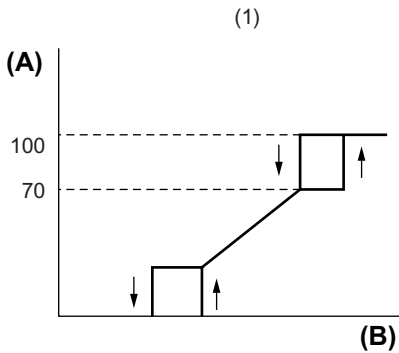
### B: FUNCTION

The operation of the radiator fan is controlled by the ECM, depending on the signals from the engine coolant temperature sensor, vehicle speed sensor, A/C switch, and A/C mid pressure switch.

**NOTE:**

Refer to the Service Manual for operation of each model.

A/C compressor	A/C mid pressure switch	Engine coolant temperature		
		Rising: below 95°C (203°F) Lowering: below 93°C (199°F)	Rising: between 95 and 101°C (203 and 214°F) Lowering: between 93 and 99°C (199 and 210°F)	Rising: over 102°C (216°F) Lowering: over 100°C (212°F)
OFF	OFF	0%	See figure (1)	100%
ON	OFF	See figure (2)		100%
	ON	See figure (3)		100%



CO-02042

(1) A/C OFF control

(2) A/C ON control (A/C mid pressure switch OFF)

(3) A/C ON control (A/C mid pressure switch ON)

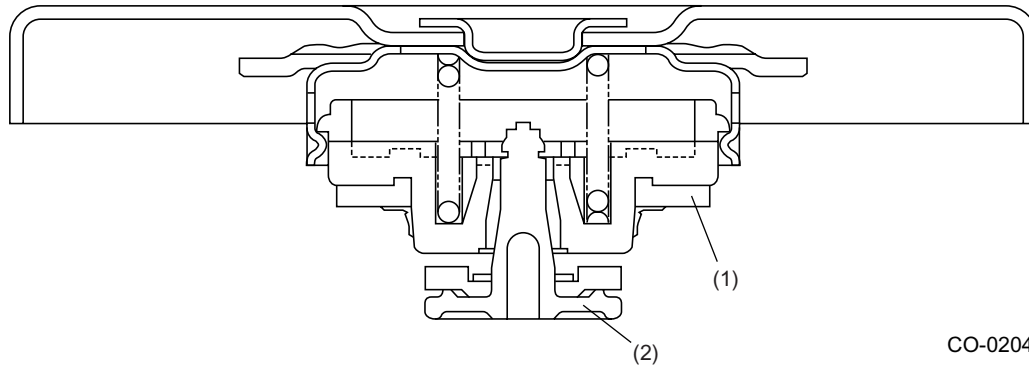
(A) Fan speed (%)

(B) Coolant temperature



## 7. Radiator Cap

The radiator cap has a pressure valve and a vacuum valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. Also, when the radiator inner pressure becomes lower than the atmospheric pressure during the cooling down phase, the vacuum valve opens to send back coolant from the reservoir tank to the radiator. These functions prevent damage to the radiator components.



CO-02043

- (1) Pressure valve
- (2) Vacuum valve

# RADIATOR CAP

COOLING

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**MEMO**

**CO(H6DO)-10**

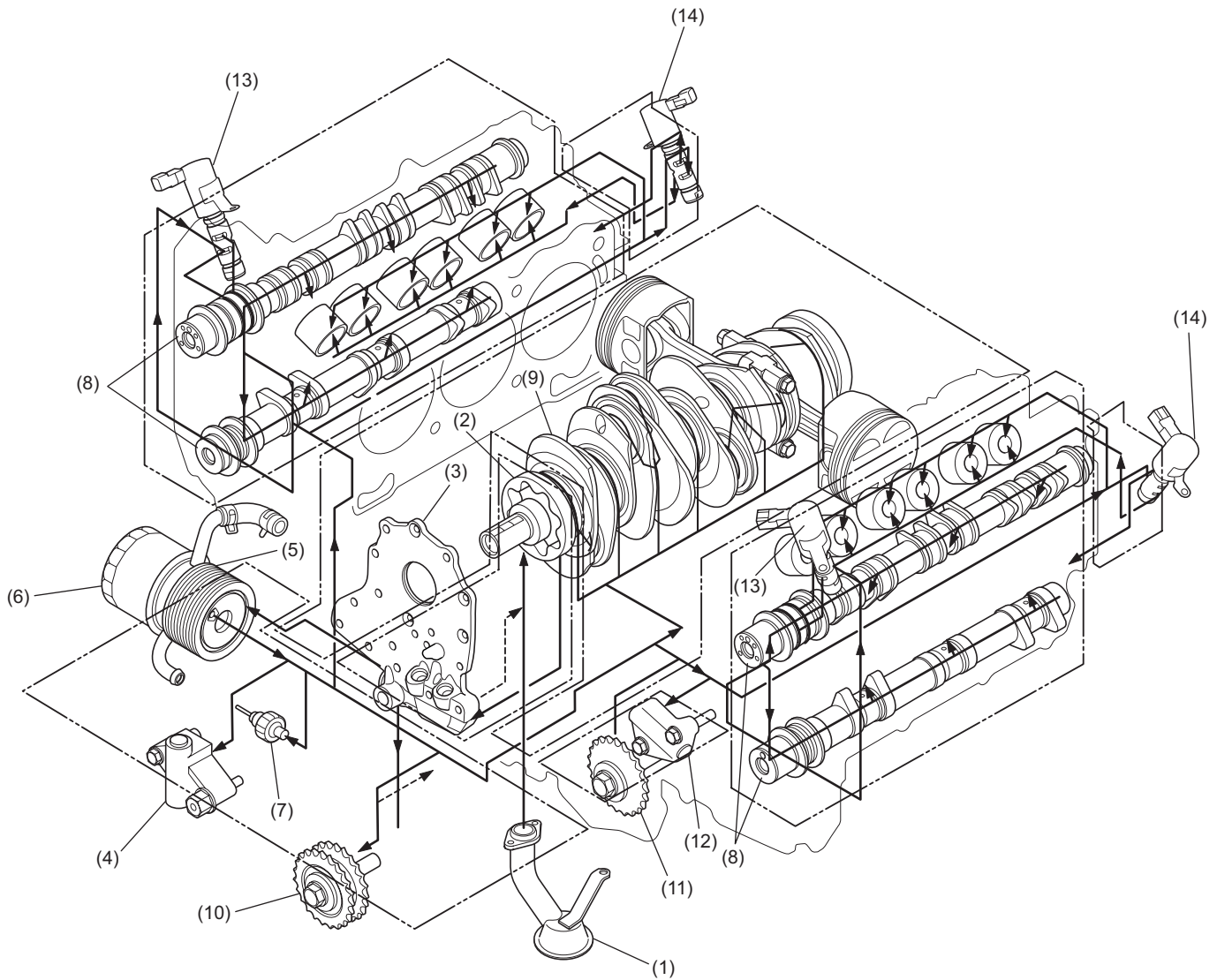
# GENERAL

## LUBRICATION

---

### 1. General

- The lubrication system forcibly circulates engine oil throughout the engine using an oil pump. The oil pressure is regulated by the relief valve.
- The oil pump is a thin, large-diameter trochoid rotor type which can accommodate the engine's high output. The pump is directly driven by the crankshaft.
- The engine oil is cleaned by a full-flow, paper element type oil filter. The filter has a bypass valve, which allows the engine oil to flow bypassing the filter if it is clogged.
- The engine oil discharged from the oil pump is delivered to the journal bearings, connecting rod bearings, and other parts requiring lubrication and cooling via an oil passage, oil filter, and oil galleries.
- The engine oil is also distributed to each cylinder head valve mechanism at a proper flow rate achieved by metering by the orifice provided in each cylinder head oil gallery.



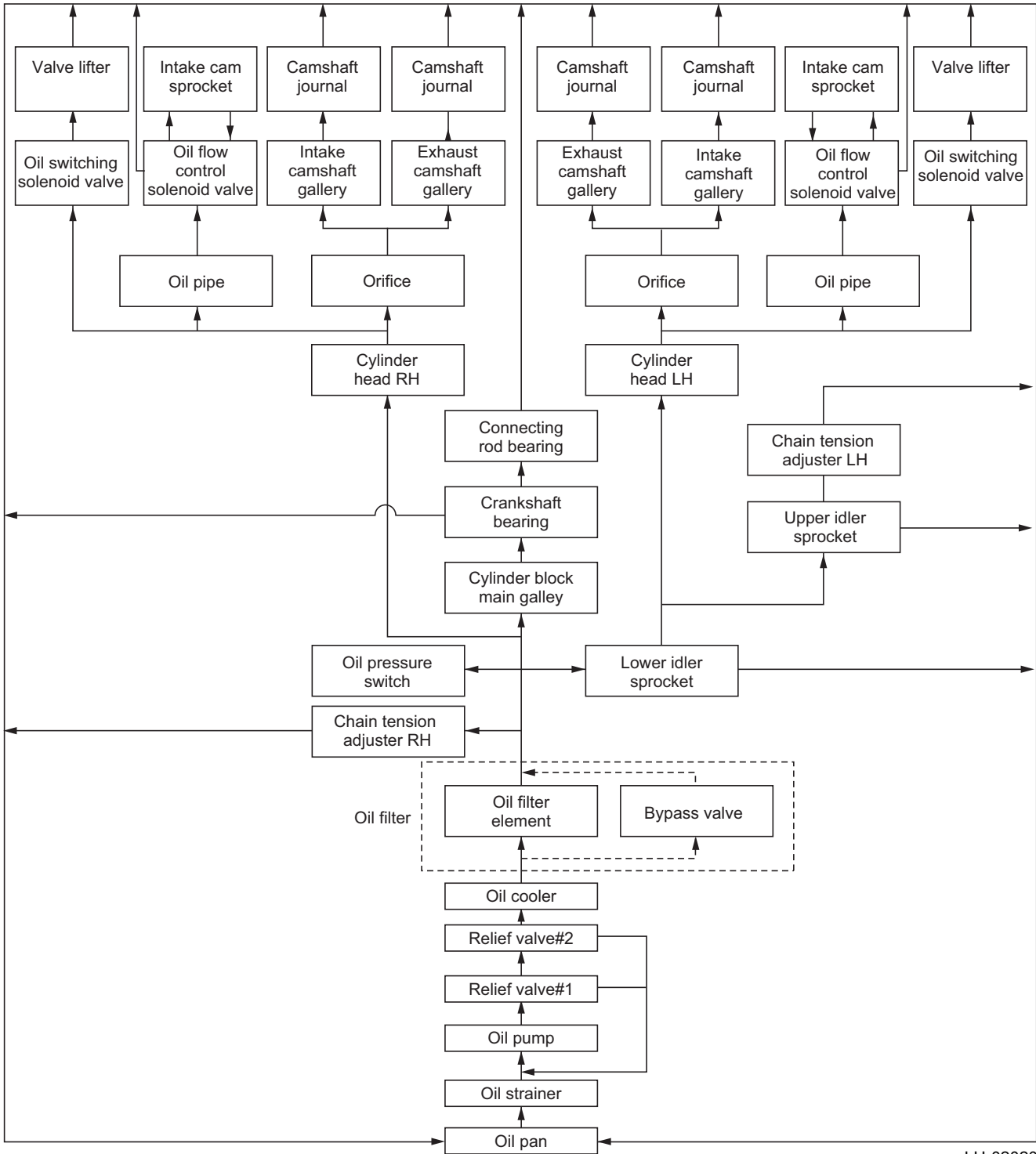
LU-02107

- |                               |                                      |
|-------------------------------|--------------------------------------|
| (1) Oil strainer              | (8) Camshaft                         |
| (2) Oil pump                  | (9) Crankshaft                       |
| (3) Oil pump cover            | (10) Lower idler sprocket            |
| (4) Chain tension adjuster RH | (11) Upper idler sprocket            |
| (5) Oil cooler                | (12) Chain tension adjuster LH       |
| (6) Oil filter                | (13) Oil flow control solenoid valve |
| (7) Oil pressure switch       | (14) Oil switching solenoid valve    |

# ENGINE OIL FLOW

LUBRICATION

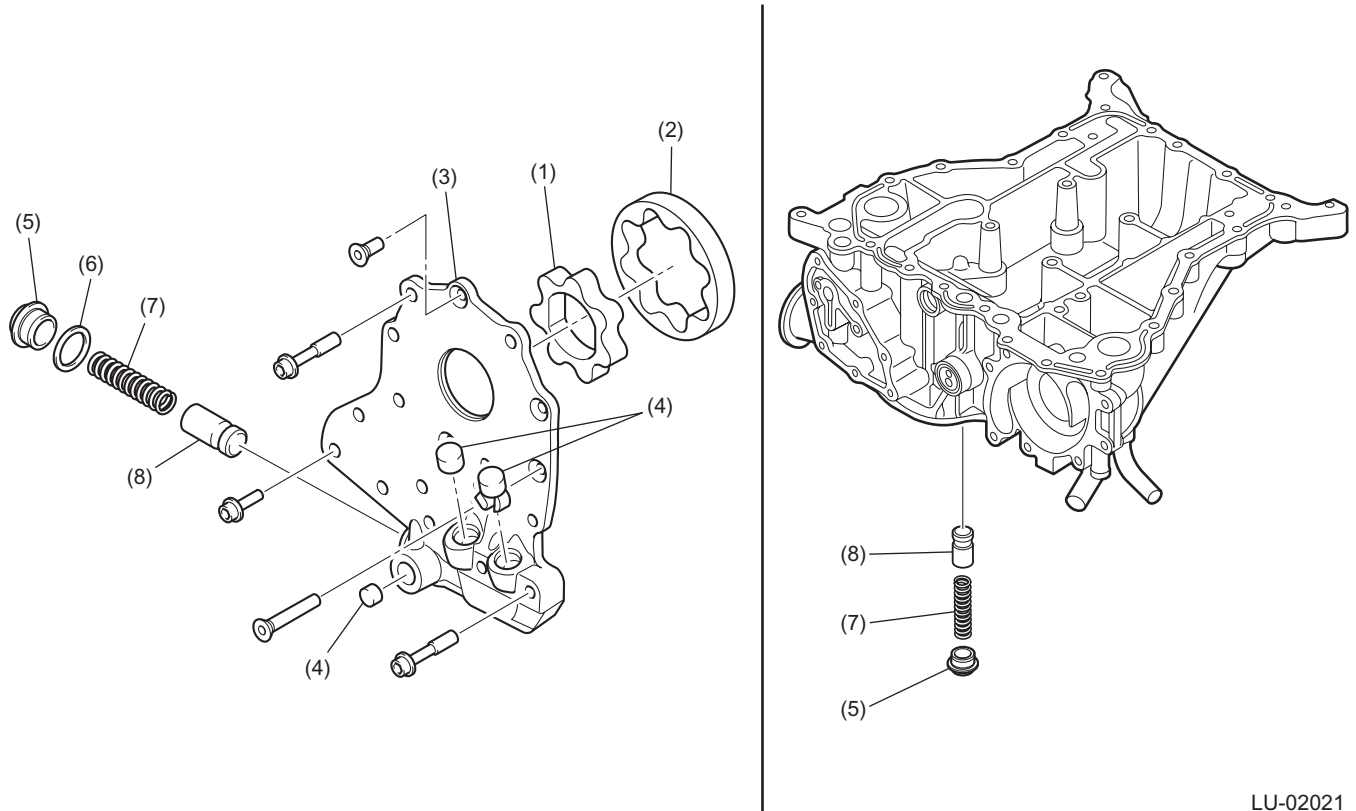
## 2. Engine Oil Flow



LU-02020

## 3. Oil Pump and Relief Valve

- The oil pump is a thin, large-diameter trochoid roller pump directly driven by the crankshaft. Its outer rotor and inner rotor are assembled with each other inside the rotor housing which is formed in the rear chain cover. The rotor housing is closed by the oil pump cover. The oil pump cover is made of aluminum die-casting and the outer rotor and inner rotor are made of sintered metal.
- When the pump discharge pressure exceeds a certain level, the relief valve opens and allows excess oil to return to the inlet of the pump. Two relief valves are installed; one in the oil pump cover and one in the oil pan upper.



- (1) Inner rotor
- (2) Outer rotor
- (3) Oil pump cover
- (4) Plug

- (5) Plug
- (6) Gasket
- (7) Relief valve spring
- (8) Relief valve

LU-02021

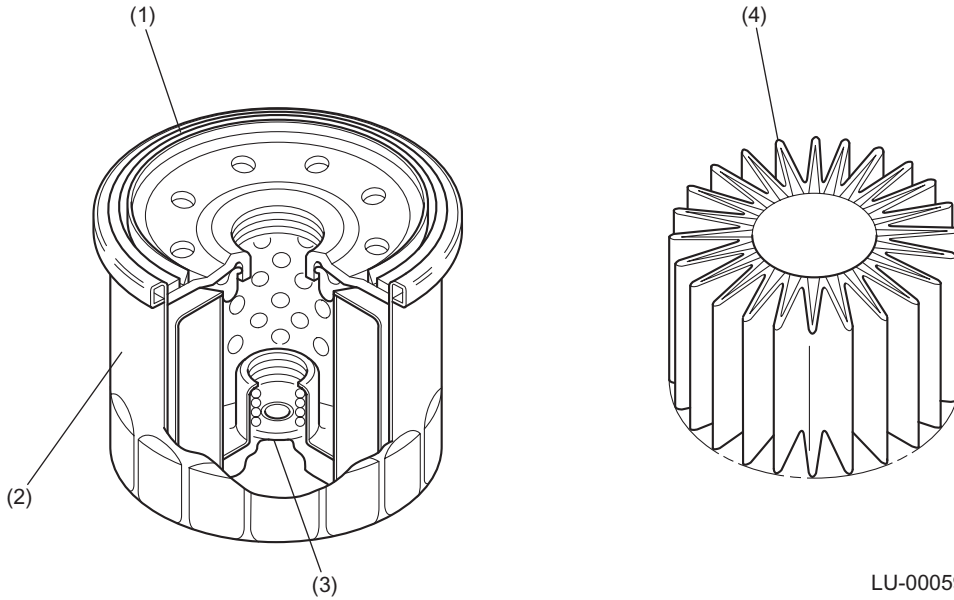
# OIL FILTER

LUBRICATION

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## 4. Oil Filter

The oil filter is a full-flow filtering, cartridge type that utilizes a paper element. It also has a built-in bypass valve. The filter element has a special pleat design to increase the effective filtering area.

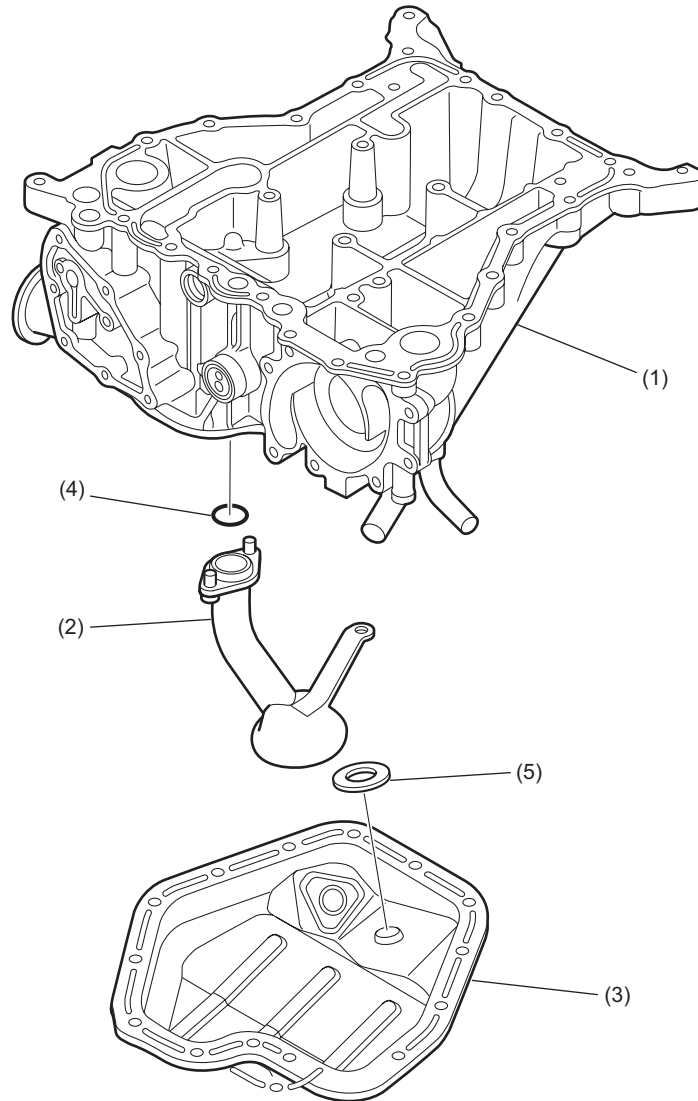


LU-00059

- (1) Oil seal
- (2) Filter body
- (3) Bypass valve
- (4) Pleated element

## 5. Oil Pan and Oil Strainer

- The oil pan consists of an upper oil pan (aluminum die-casting) and a lower oil pan (formed steel plate). The upper oil pan has an integrally mold baffle plate to improve stability of the oil level.
- The oil strainer has a stay whose end is attached to the upper oil pan. The strainer pipe is connected to the upper oil pan using an O-ring. The upper oil pan forms a passage together with the block and liquid gasket, and the passage leads from the block through an O-ring to the rear chain cover, which is connected to the oil pump. The strainer is located close to the bottom at the center of the oil pan where the oil level changes the least.



LU-02043

- (1) Upper oil pan
- (2) Strainer
- (3) Oil pan lower

- (4) O-ring
- (5) Magnet

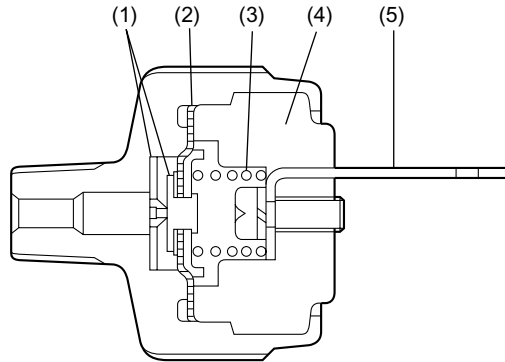


# OIL PRESSURE SWITCH

LUBRICATION

## 6. Oil Pressure Switch

The oil pressure switch is located at the right of the oil pan upper. The purpose of this switch is to monitor the operation of the oil pump as well as the lubricating oil pressure when the engine is running.



LU-00061

- |               |                    |
|---------------|--------------------|
| (1) Contact   | (4) Molded portion |
| (2) Diaphragm | (5) Terminal       |
| (3) Spring    |                    |

1) When oil pressure does not build up (immediately after ignition switch is turned ON):  
The diaphragm is pushed toward the oil pan upper by the spring force (a force equivalent to the specified oil pressure). This closes the contact points, causing the oil pressure warning light in the combination meter to illuminate.

2) When oil pressure reaches the specified value (after engine starts):  
After reaching the specified value of 14.7 kPa (0.15 kgf/cm<sup>2</sup>, 2.1 psi), the oil pressure pushes the diaphragm against the spring force. This opens the contact points and the oil pressure warning light goes out.

# GENERAL

SPEED CONTROL SYSTEM

---

## 1. General

Specifications for 3.0 L DOHC non-turbo models are the same as those for SOHC models. <Ref. to SP(H4SO) section.>

# GENERAL

IGNITION

---

## 1. General

Specifications for 3.0 L DOHC non-turbo models are the same as those for 2.5 L DOHC turbo models. <Ref. to IG(H4DOTC) section.>

# GENERAL

STARTING/CHARGING

---

## 1. General

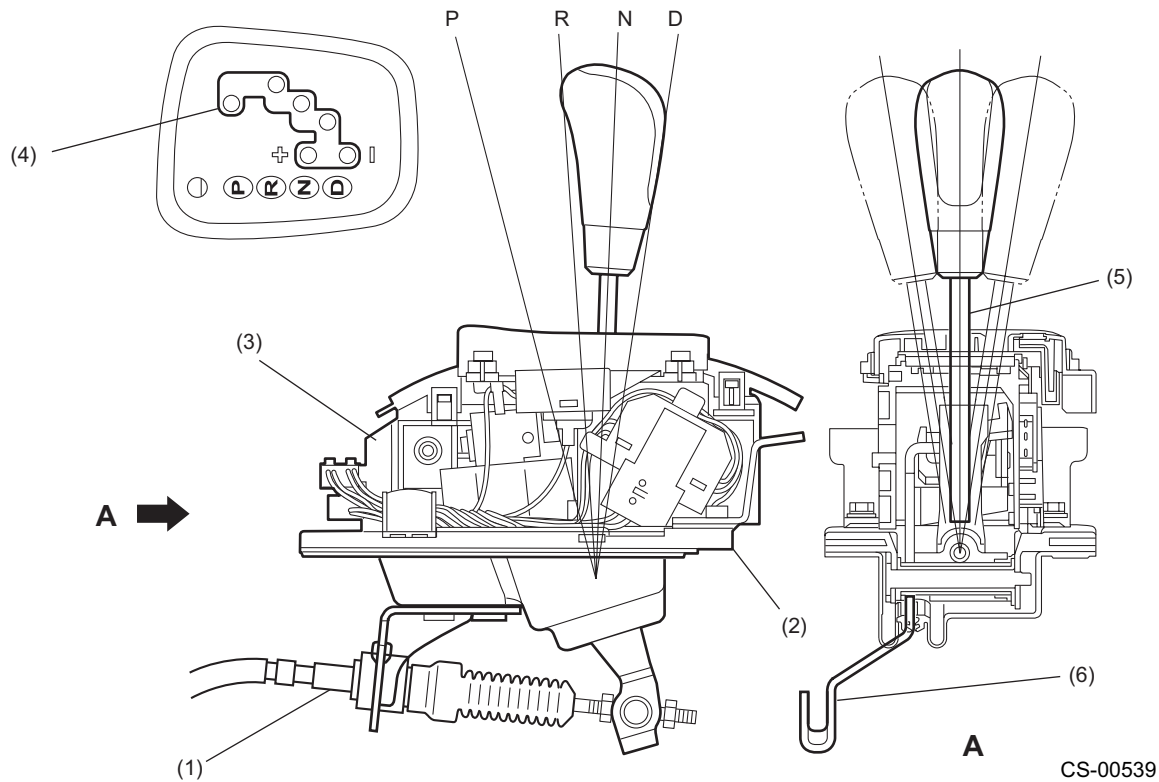
Specifications for 3.0 L DOHC non-turbo models are the same as those for SOHC models. <Ref. to SC(H4SO) section.>

# SELECT LEVER

## CONTROL SYSTEM

### 1. Select Lever

- The automatic transmission select lever can be moved to any of the 4 ranges and the transmission enters sports mode when the lever is moved laterally from D range, and further switches to sports shift mode (manual mode) when the lever is moved forward (“+” direction) or rearward (“-” direction).
- The select lever makes shift direction (longitudinal) movements as well as select direction (lateral) movements. The select lever is guided by a gate to make these movements.
- In the sports shift mode, the transmission upshifts when the selector lever is moved forward (“+” direction) and downshifts when the lever is moved rearward (“-” direction).
- To transmit movements of the select lever to the transmission, a select cable is used.
- The select lever mechanism has a detent spring. It ensures more precise positioning of the select lever.



- (1) Select cable
- (2) Base plate, lower
- (3) Base plate, upper
- (4) Gate

- (5) Select lever
- (6) Arm
- (A) View A

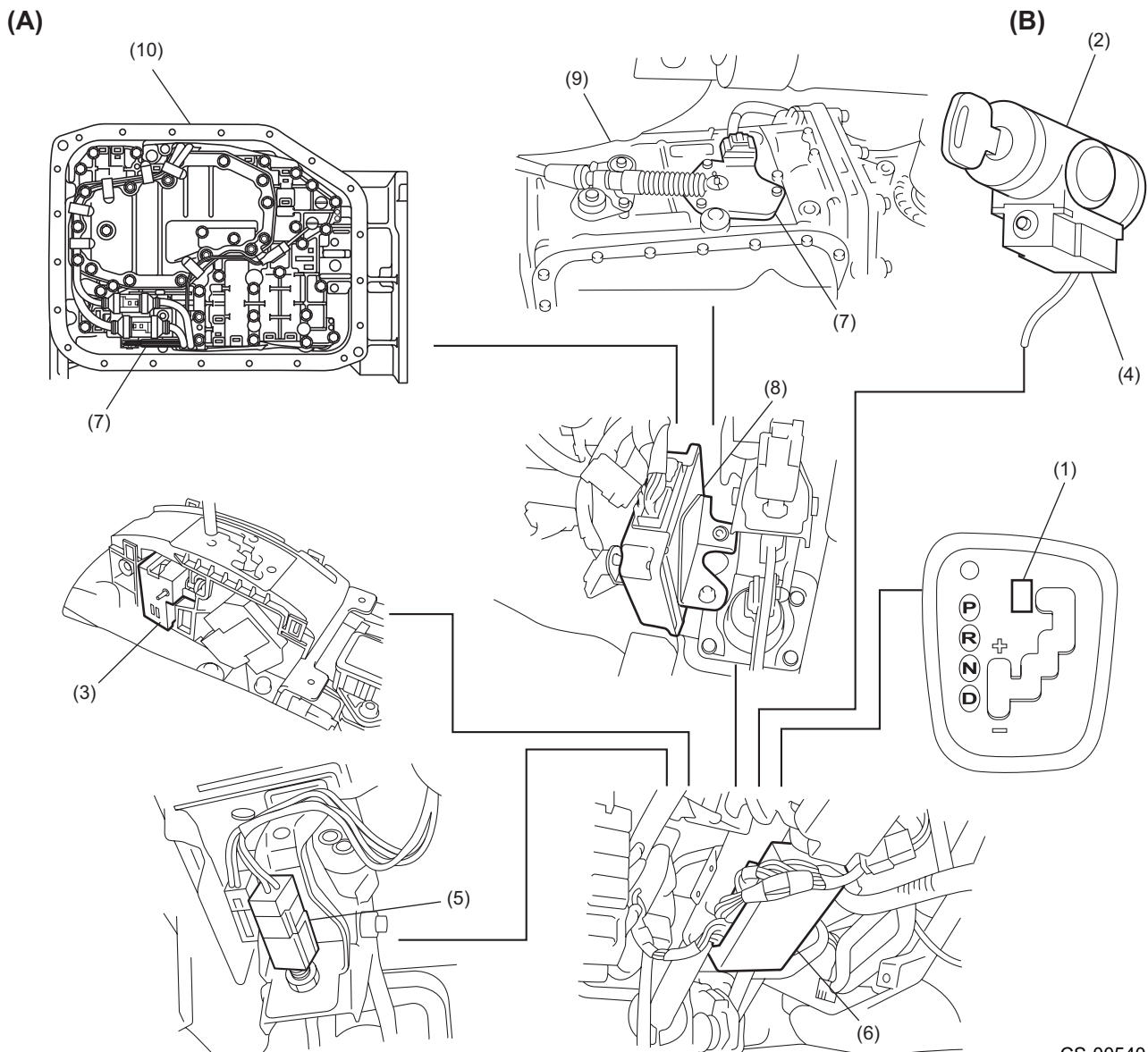
## 2. Shift Lock and Key Interlock System

### A: GENERAL

To increase safety during standing start, the shift lock system prevents movement of the select lever from the “P” position to any other position unless the brake pedal is depressed. This system is also provided with a key interlock function which prevents removal of the ignition key from the key cylinder unless the selector lever is placed in the “P” position.

# SHIFT LOCK AND KEY INTERLOCK SYSTEM

## CONTROL SYSTEM



CS-00540

**(A)** Shift lock system

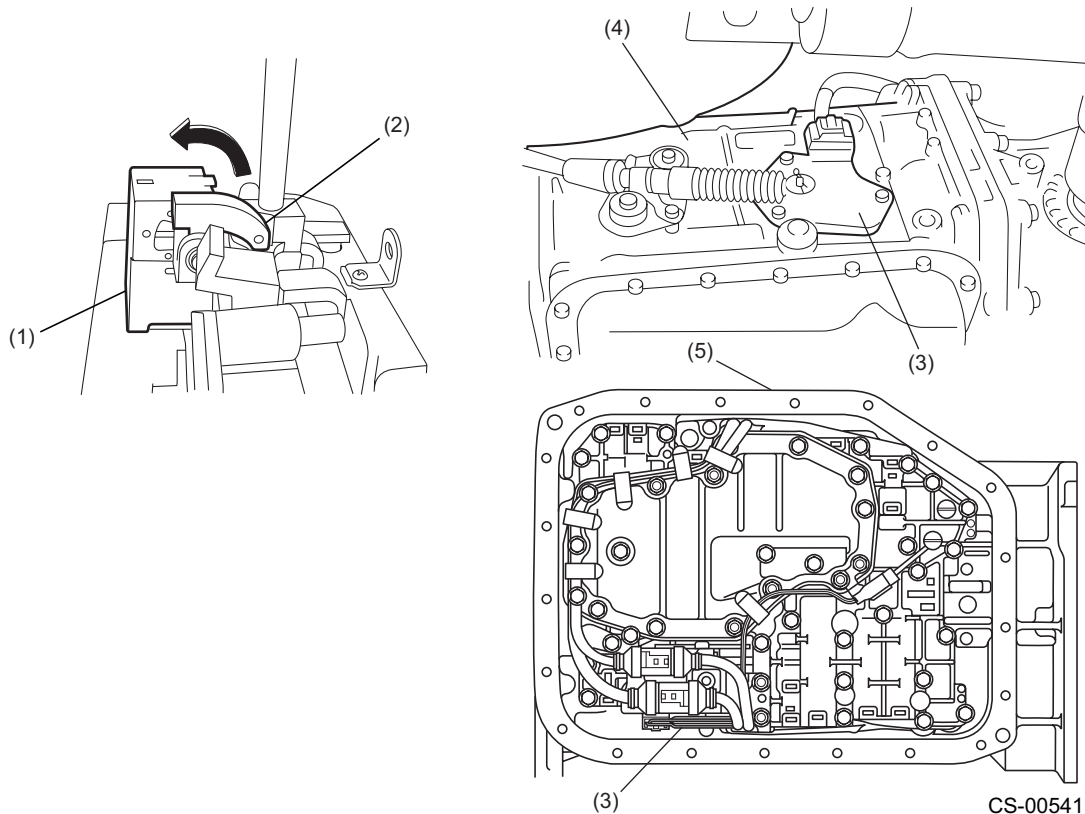
- (1) "P" position switch
- (2) Key cylinder
- (3) Shift lock solenoid
- (4) Key lock solenoid
- (5) Brake pedal switch

**(B)** Key interlock system

- (6) Body integrated unit
- (7) Inhibitor switch
- (8) TCM
- (9) 4AT
- (10) 5AT

## B: SHIFT LOCK SYSTEM OPERATION

The shift lock system has a solenoid-operated plunger (1). With the select lever in the P position, the plunger remains extended, holding the lock arm (2) in its pushed out (locking) position. When the brake pedal is depressed with the ignition switch in either the ON or START position, the solenoid is energized and the plunger is retracted. This causes the lock arm to lift to the select lever release position. The select lever now can be moved to any other position. The P position of the select lever is detected by the inhibitor switch (3).



- (1) Solenoid
- (2) Lock arm
- (3) Inhibitor switch
- (4) 4AT
- (5) 5AT

CS-00541

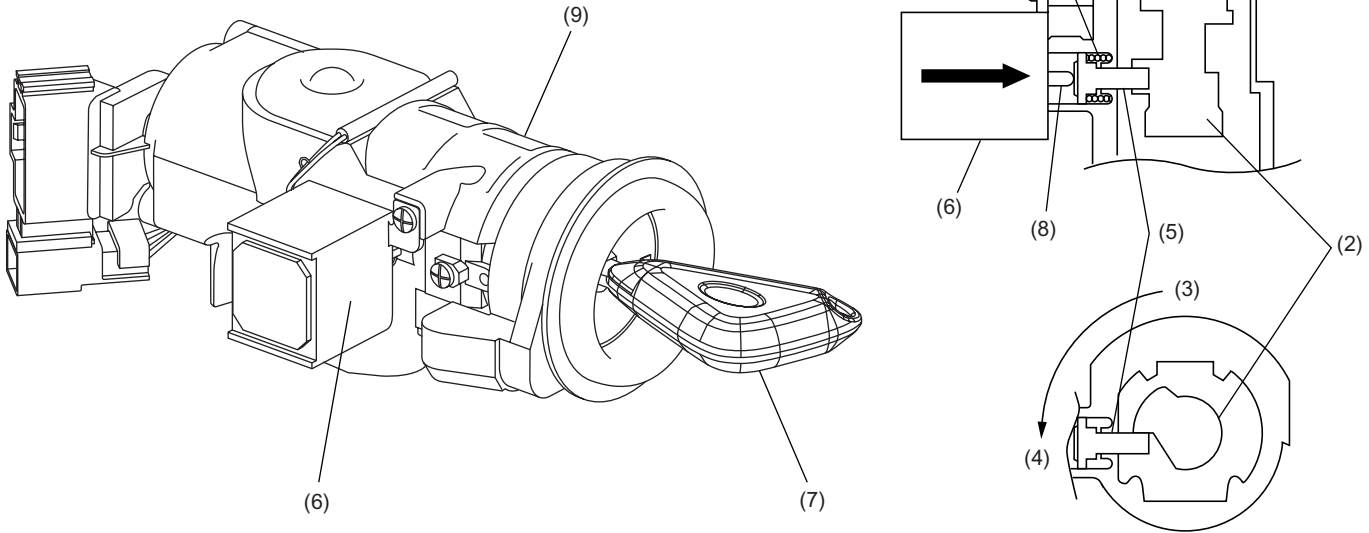


# SHIFT LOCK AND KEY INTERLOCK SYSTEM

## CONTROL SYSTEM

### C: KEY INTERLOCK FUNCTION

● When the select lever is at any position other than P, the solenoid is energized and its guide pin extends to hold the lock pin in its pushed out position. Held in its extended position, the lock pin interferes with the stopper portion of the rotator which turns together with the ignition key. Thus, the ignition key cannot be rotated to the “LOCK” position.



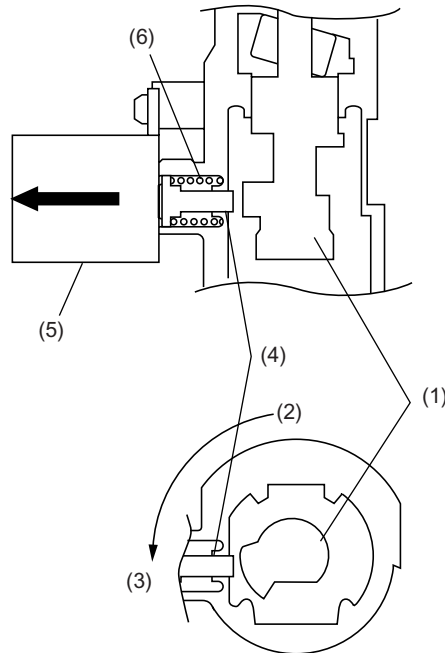
CS-00360

- |                    |                  |
|--------------------|------------------|
| (1) Return spring  | (6) Solenoid     |
| (2) Rotator        | (7) Key          |
| (3) START position | (8) Guide pin    |
| (4) LOCK position  | (9) Key cylinder |
| (5) Lock pin       |                  |

# SHIFT LOCK AND KEY INTERLOCK SYSTEM

CONTROL SYSTEM

- When the select lever is moved to “P”, the “P” position switch in the select lever assembly operates, deenergizing the solenoid. As the push force of the guide pin is removed, the return spring moves the lock pin toward the solenoid and the lock pin becomes clear of the rotator stopper. Then the key can be rotated to the LOCK position and removed from the ignition switch.



CS-00361

- (1) Rotator
- (2) START position
- (3) LOCK position
- (4) Lock pin
- (5) Solenoid
- (6) Return spring

# SHIFT LOCK AND KEY INTERLOCK SYSTEM

CONTROL SYSTEM

---

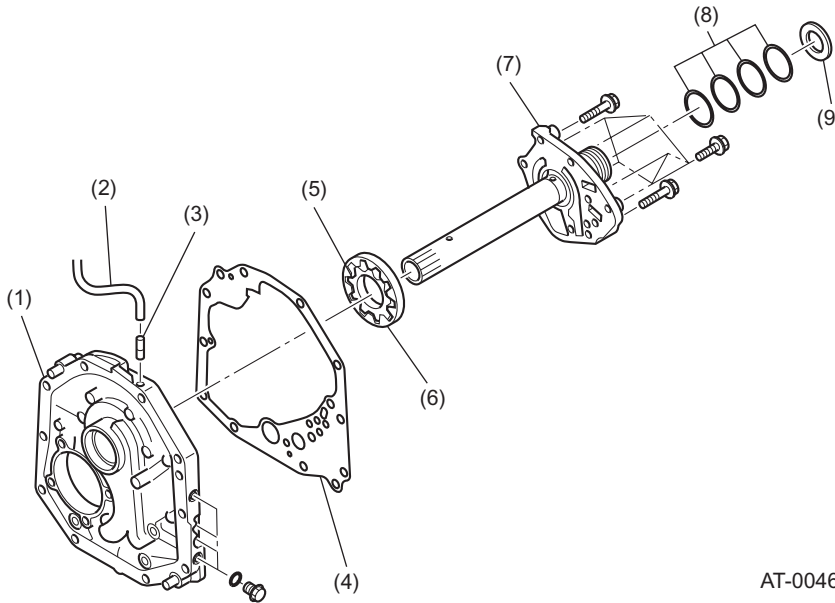
**MEMO**

# OIL PUMP

## 1. Oil Pump

### A: CONSTRUCTION

The pump consists of a parachoid rotor pair, a housing and a cover. The inner rotor has nine teeth and the outer rotor has ten teeth.



AT-00461

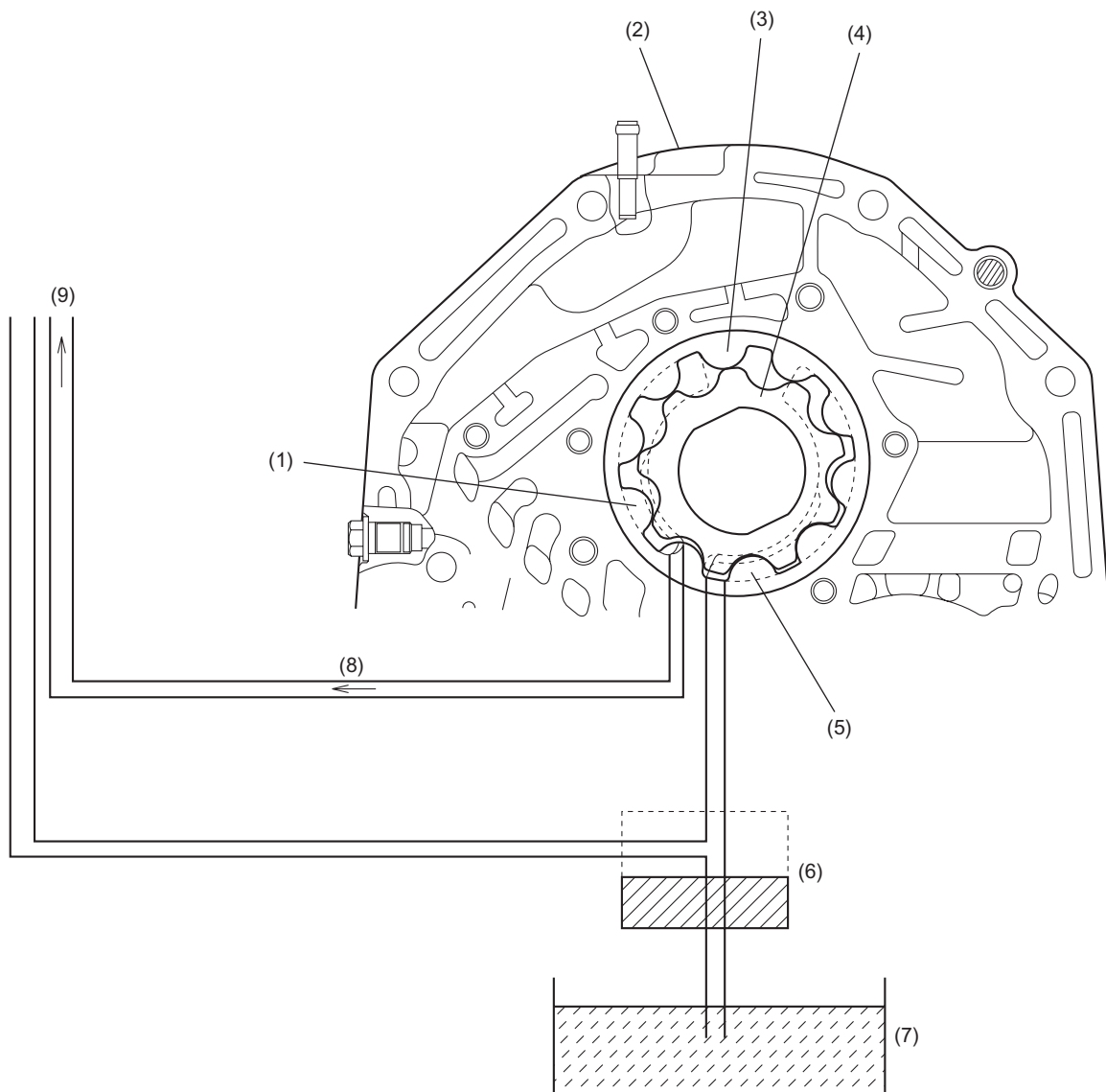
- |                      |                 |                    |
|----------------------|-----------------|--------------------|
| (1) Oil pump housing | (4) Gasket      | (7) Oil pump cover |
| (2) Hose             | (5) Inner rotor | (8) Seal ring      |
| (3) Nipple           | (6) Outer rotor | (9) Thrust bearing |

### B: FUNCTION

- The pump draws automatic transmission fluid (ATF) from the oil pan through the oil strainer located under the control valve assembly. The ATF then flows through a passage in the transmission case, and after passing through the oil pump housing and oil pump cover, it enters the suction port.
- As the inner rotor rotates, the outer rotor also rotates. This motion causes the ATF to be sucked up through the suction port and discharged from the discharge port.
- The discharged ATF flows through a passage in the oil pump cover and then a passage in the oil pump housing. It then goes through a passage in the transmission case to the control valve assembly, from which the ATF is directed to various clutches, brakes, and torque converter lockup clutch for acting as hydraulic fluid and lubricating oil. Part of the ATF also flows to the manual valve, from where it is distributed to the circuit corresponding to the range selected by the selector lever.
- As engine speed increases, the delivery rate of the oil pump also increases.

# OIL PUMP

AUTOMATIC TRANSMISSION



AT-01774

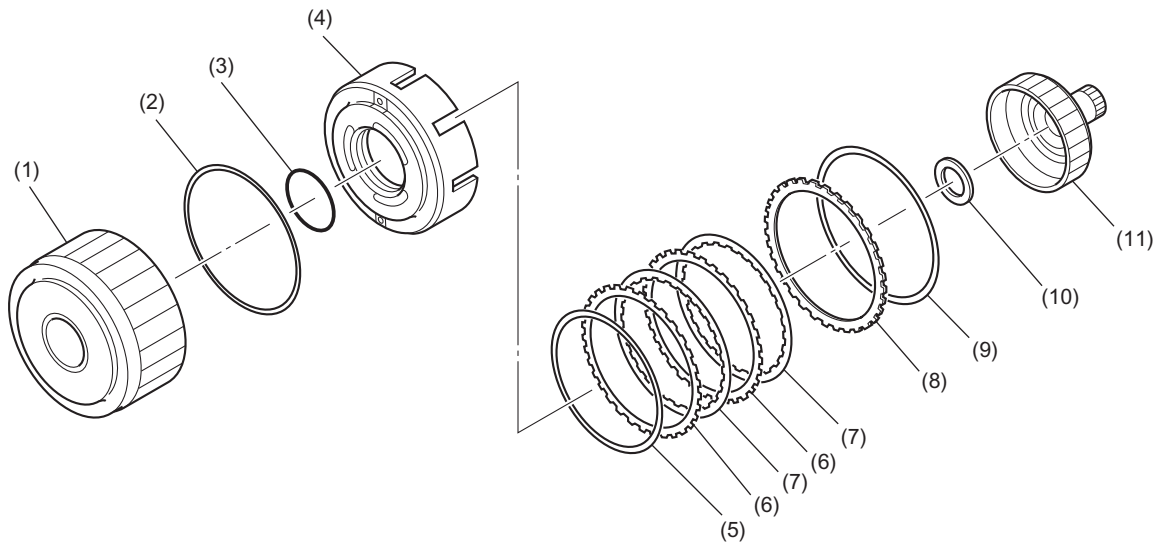
- |                      |                      |
|----------------------|----------------------|
| (1) Delivery port    | (6) Oil strainer     |
| (2) Oil pump housing | (7) Oil pan          |
| (3) Outer rotor      | (8) Line pressure    |
| (4) Inner rotor      | (9) To control valve |
| (5) Suction port     |                      |

# REVERSE CLUTCH

AUTOMATIC TRANSMISSION

## 2. Reverse Clutch

### A: CONSTRUCTION



AT-00463

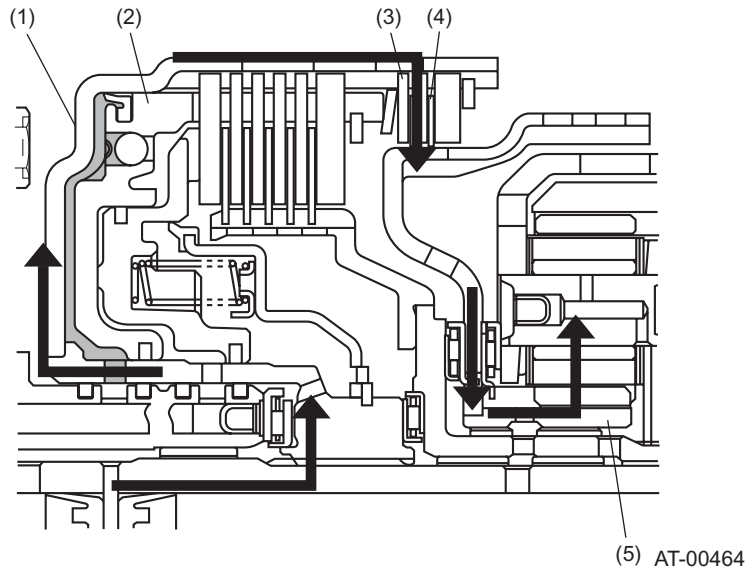
- (1) High clutch drum
- (2) Lip seal
- (3) D-ring
- (4) Reverse clutch piston
- (5) Dish plate
- (6) Driven plate

- (7) Drive plate
- (8) Retaining plate
- (9) Snap ring
- (10) Thrust needle bearing
- (11) High clutch hub

## B: FUNCTION

### 1. WHEN REVERSE IS SELECTED

Hydraulic pressure from the control valve is applied to the reverse clutch piston when a shift is made into the reverse. The drive and driven plates are pressed together by this pressure, so that the engine torque from the high clutch drum is transmitted to the front sun gear through the 2-4 brake hub.



- |                           |                    |
|---------------------------|--------------------|
| (1) High clutch drum      | (4) Drive plate    |
| (2) Reverse clutch piston | (5) Front sun gear |
| (3) Driven plate          |                    |

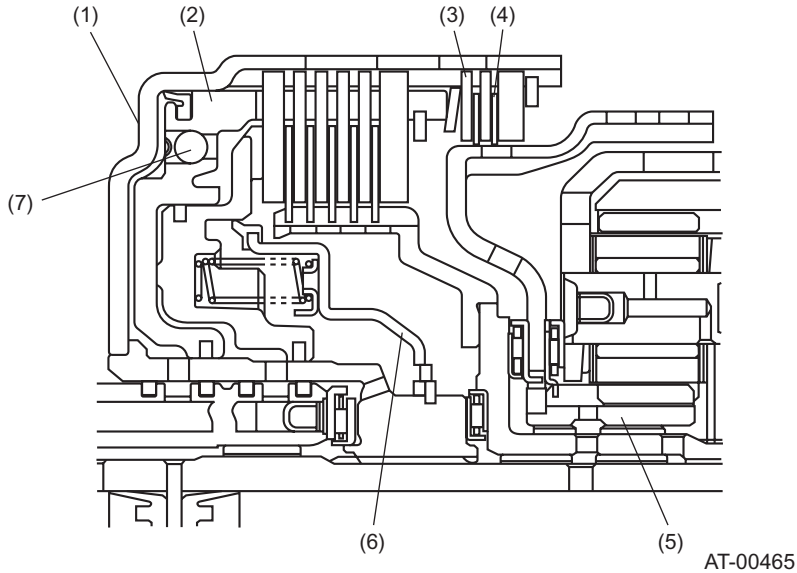
# REVERSE CLUTCH

## AUTOMATIC TRANSMISSION

### 2. WHEN REVERSE IS NOT SELECTED

When the select lever is in any position other than reverse, no pressure is applied to the reverse clutch piston. Hence the drive and driven plates are separated from each other, transmitting no power to any element beyond them.

A check ball is built into the clutch piston. This check ball has a function of releasing the pressure which may build up in the fluid remaining behind the piston by centrifugal force generated by the idly rotating high clutch drum, thereby avoiding a half-engaged state of the clutch.



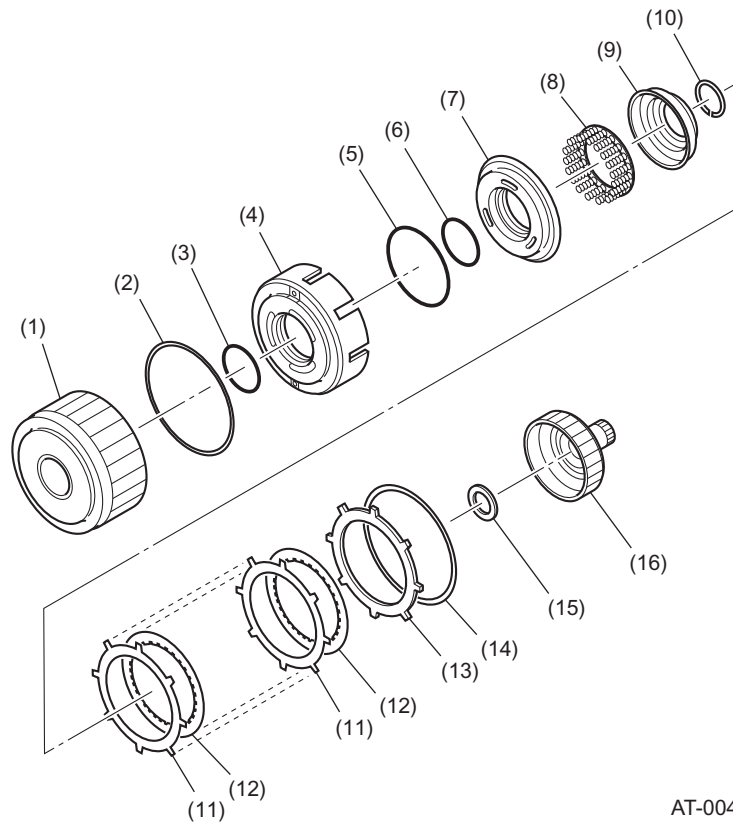
- |                           |                    |
|---------------------------|--------------------|
| (1) High clutch drum      | (5) Front sun gear |
| (2) Reverse clutch piston | (6) Cover          |
| (3) Driven plate          | (7) Check ball     |
| (4) Drive plate           |                    |



## 3. High Clutch

When the 3rd or 4th gear is selected, hydraulic pressure is applied to the high clutch from the shift valve and pressure regulator valve. The clutch drive and driven plates are pressed together, thus transmitting the engine power from the input shaft to the front planetary carrier through the high clutch hub.

A cover is placed inside the piston, and the space between the piston and the cover is filled with ATF. When the high clutch is not in engagement, the centrifugal force generated in the ATF inside the cover cancels out the centrifugal force generated in the ATF remaining behind the high clutch piston, thus preventing incomplete disengagement of the clutch.



AT-00466

- |                           |                        |                            |
|---------------------------|------------------------|----------------------------|
| (1) High clutch drum      | (7) High clutch piston | (13) Retaining plate       |
| (2) Lip seal              | (8) Return spring      | (14) Snap ring             |
| (3) D-ring                | (9) Cover              | (15) Thrust needle bearing |
| (4) Reverse clutch piston | (10) Snap ring         | (16) High clutch hub       |
| (5) D-ring (outer)        | (11) Driven plate      |                            |
| (6) D-ring (inner)        | (12) Drive plate       |                            |

## 2-4 BRAKE

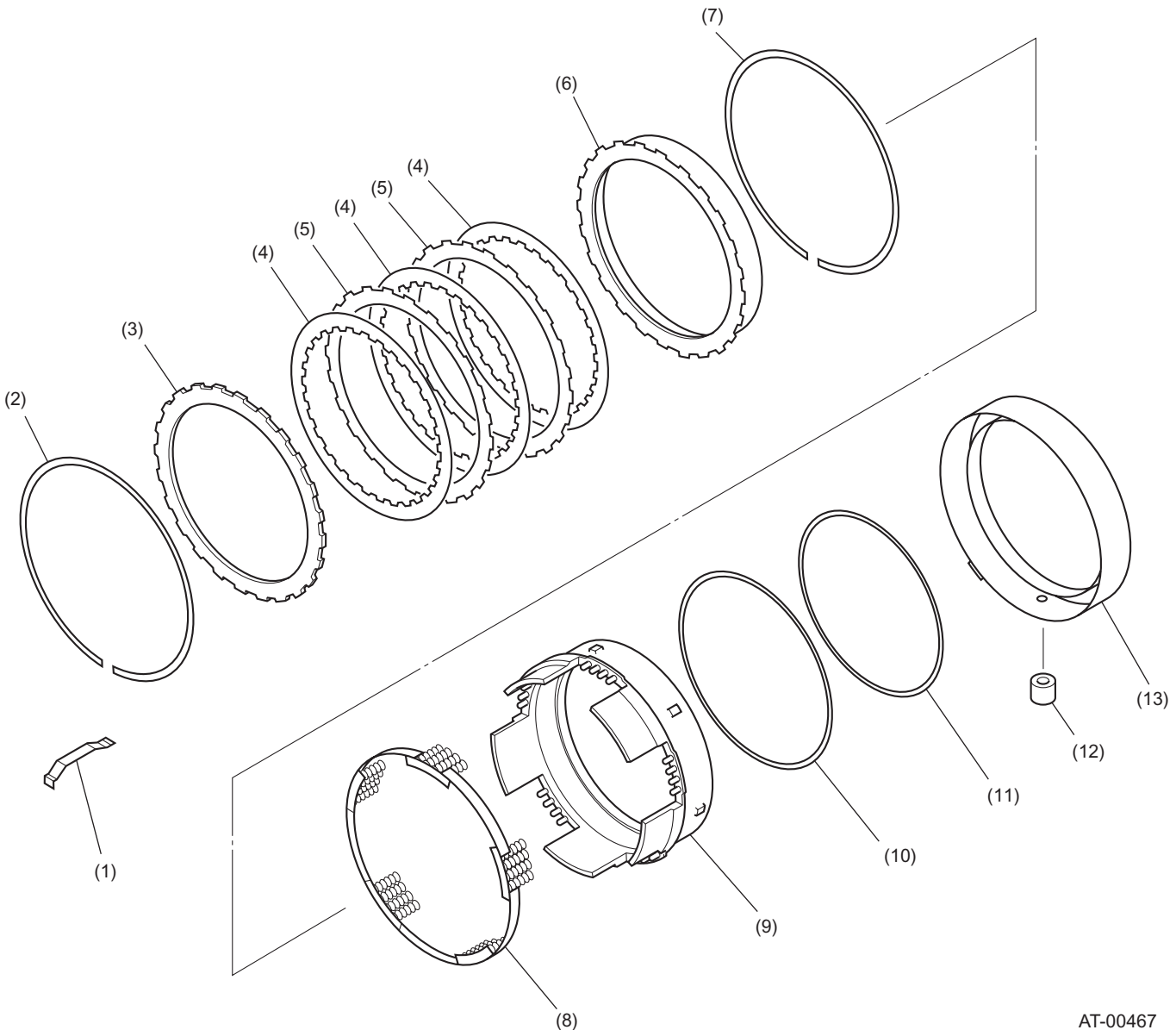
### AUTOMATIC TRANSMISSION

#### 4. 2-4 Brake

##### A: CONSTRUCTION

The 2-4 brake consists of a 2-4 brake piston retainer, 2-4 brake piston, return spring, pressure plate, drive plates, driven plates, and a snap ring that fits in a housing formed in the transmission case.

This brake is engaged by the hydraulic pressure from the control valve and locks the front sun gear when the 2nd or 4th gear is selected.



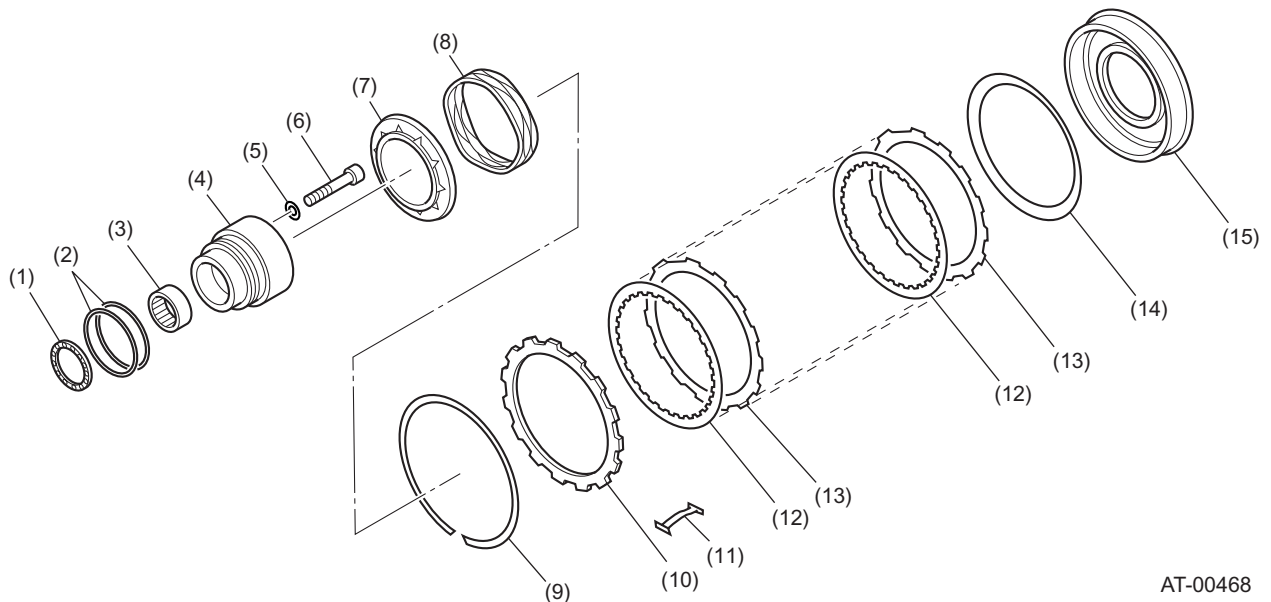
AT-00467

- |                     |                         |                                |
|---------------------|-------------------------|--------------------------------|
| (1) Leaf spring     | (6) Pressure rear plate | (10) D-ring                    |
| (2) Snap ring       | (7) Snap ring           | (11) D-ring                    |
| (3) Retaining plate | (8) Return spring       | (12) 2-4 brake piston seal     |
| (4) Drive plate     | (9) 2-4 brake piston    | (13) 2-4 brake piston retainer |
| (5) Driven plate    |                         |                                |

## 5. Low & Reverse Brake

### A: CONSTRUCTION

The low & reverse brake consists of a piston, a dish plate, drive plates, driven plates, a retaining plate and a snap ring that fits in a housing formed in the transmission case.



AT-00468

- |                               |                      |                                 |
|-------------------------------|----------------------|---------------------------------|
| (1) Thrust bearing            | (6) Bolt             | (11) Leaf spring                |
| (2) Seal ring                 | (7) Spring retainer  | (12) Drive plate                |
| (3) Needle bearing            | (8) Return spring    | (13) Driven plate               |
| (4) One-way clutch inner race | (9) Snap ring        | (14) Dish plate                 |
| (5) Washer                    | (10) Retaining plate | (15) Low & reverse brake piston |

### B: FUNCTION

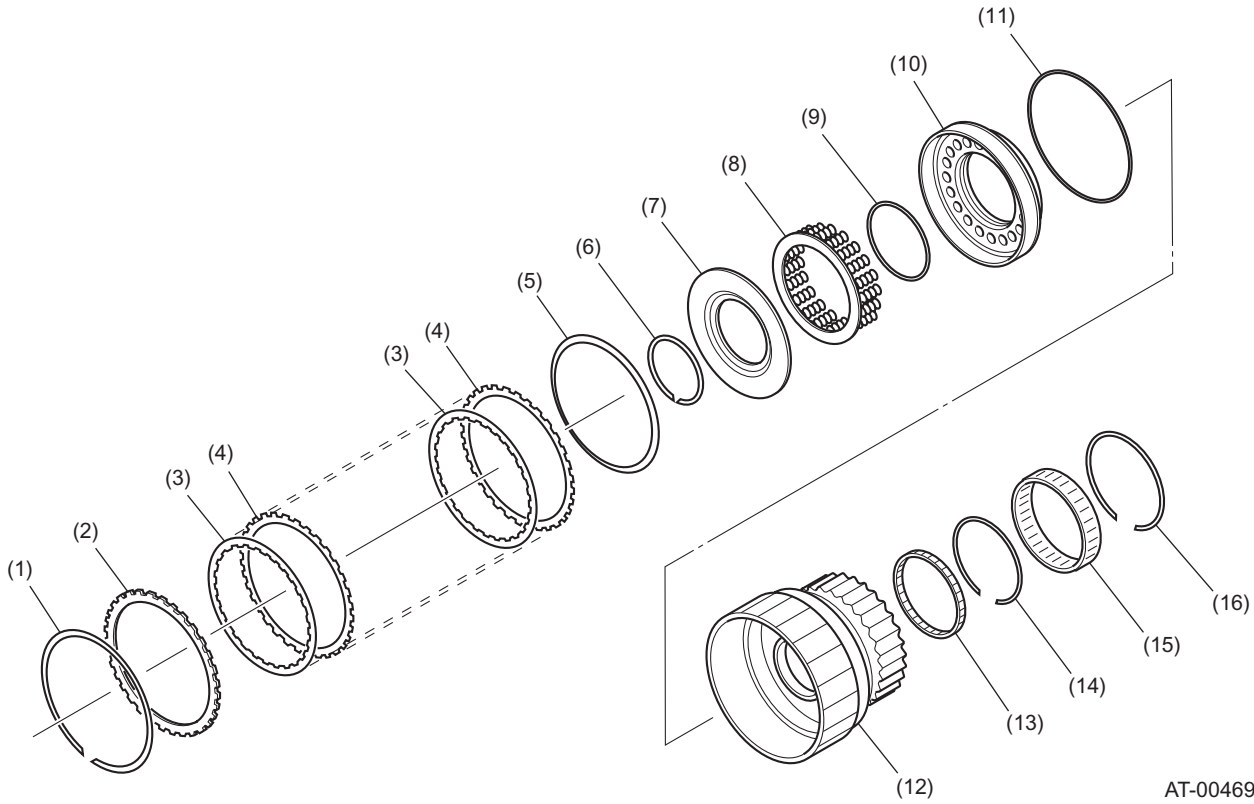
When the 1st gear of manual mode or reverse is selected, the pressure from the control valve is applied to the low & reverse brake piston. The piston then presses the drive and driven plates together and causes the low clutch drum to lock.

# LOW CLUTCH

## 6. Low Clutch

### A: CONSTRUCTION

The low clutch consists of a drum, piston, return springs, cover, drive plates, driven plates, one-way clutch, and the retaining plate.



AT-00469

- (1) Snap ring
- (2) Retaining plate
- (3) Drive plate
- (4) Driven plate
- (5) Dish plate
- (6) Snap ring

- (7) Cover
- (8) Return spring
- (9) D-ring
- (10) Low clutch piston
- (11) D-ring
- (12) Low clutch drum

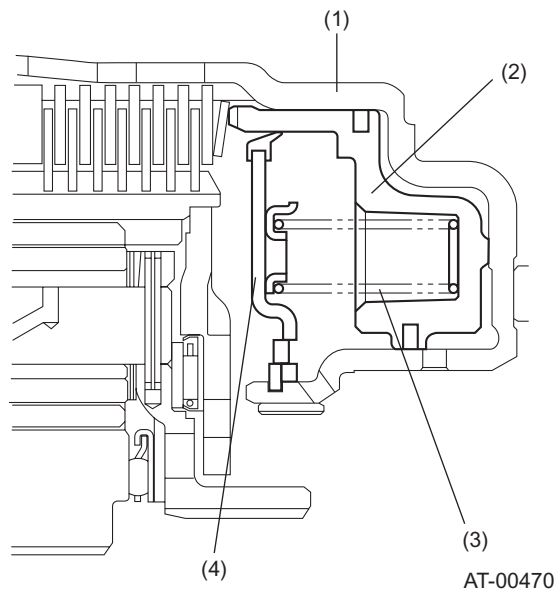
- (13) Needle bearing
- (14) Snap ring
- (15) One-way clutch
- (16) Snap ring

## B: FUNCTION

The low clutch operates in the 1st, 2nd and 3rd speed gears.

This clutch engages when hydraulic pressure from the control valve is applied to the low clutch piston, transmitting power through the rear planetary carrier to the reduction drive shaft.

A cover is placed inside the piston, and the space between the piston and the cover is filled with ATF. When the low clutch is not in engagement, the centrifugal force generated in the ATF inside the cover cancels out the centrifugal force generated in the ATF remaining behind the low clutch piston, thus preventing incomplete disengagement of the clutch.



- (1) Low clutch drum
- (2) Low clutch piston

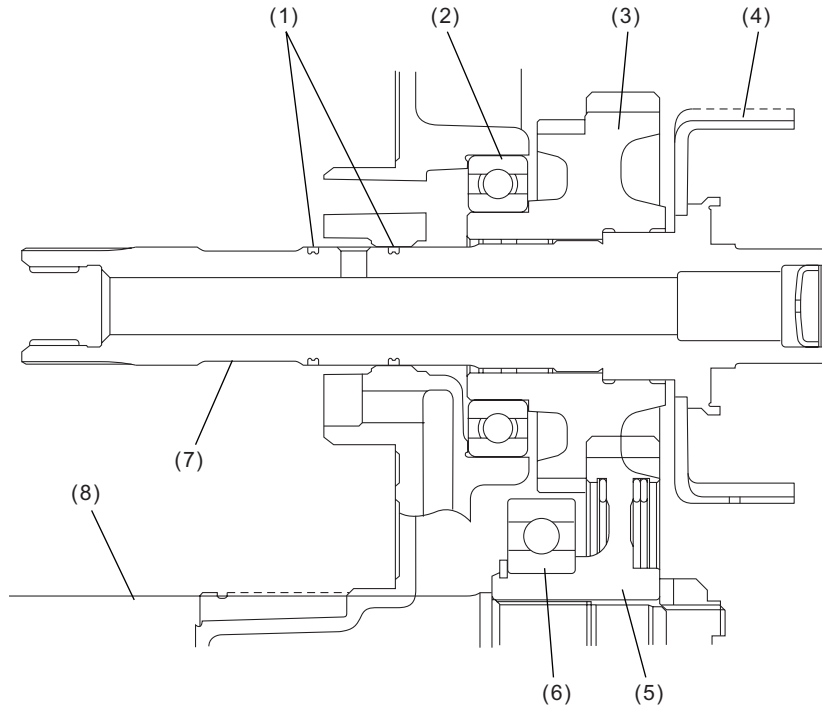
- (3) Return spring
- (4) Cover

# REDUCTION GEAR

## 7. Reduction Gear

### A: GENERAL

Engine output is transmitted from the rear planetary carrier to the reduction drive shaft and the reduction drive gear. Power to the front wheels is then transmitted through the reduction driven gear and drive pinion to the front final gears and front wheels. Power to the rear wheels is transmitted sequentially from the transfer clutch hub through the transfer clutch, rear drive shaft, propeller shaft, and rear differential to the rear wheels.



AT-02183

- |                          |                           |                           |
|--------------------------|---------------------------|---------------------------|
| (1) Seal ring            | (4) Transfer clutch hub   | (7) Reduction drive shaft |
| (2) Ball bearing         | (5) Reduction driven gear | (8) Drive pinion shaft    |
| (3) Reduction drive gear | (6) Ball bearing          |                           |

## **8. Control Valve**

The hydraulic control system of the automatic transmission consists of an oil pump, valve bodies containing valves, clutches, fluid passages and pipes. The operation of the system is controlled by driver's manual inputs and electrical inputs from the TCM.

### **A: CONSTRUCTION**

The structure of the control valve is simplified by disusing the accumulator and decreasing the number of mechanical valves. This allowed a two-layered body structure, which contributes to minimizing the size and weight. Also, the transfer hydraulic control mechanism is contained in the control valve.

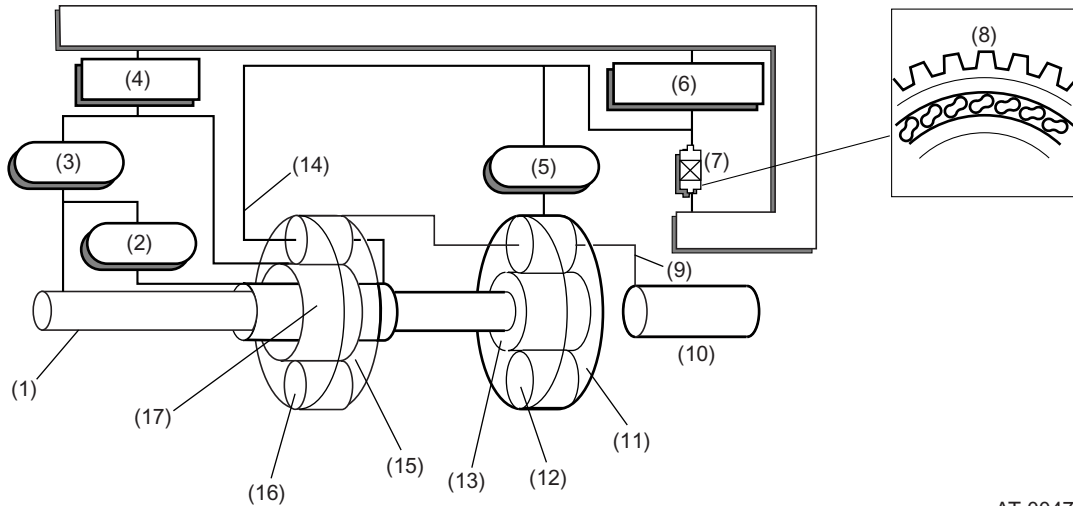
Oil pressure from the duty solenoid for each clutch will be directly applied to the clutch/brake without flowing through an accumulator, therefore the engagement/disengagement control range is widened and the response during gear shift is improved.

# GEAR TRAIN

## 9. Gear Train

### A: CONSTRUCTION

The gear train consists of two sets of planetary gears, three sets of multi-plate clutches, two sets of multi-plate brakes and one set of one-way clutch.



AT-00474

- |                         |                            |                              |
|-------------------------|----------------------------|------------------------------|
| (1) Input shaft         | (7) One-way clutch         | (13) Rear sun gear           |
| (2) High clutch         | (8) Free/locked            | (14) Front planetary carrier |
| (3) Reverse clutch      | (9) Rear planetary carrier | (15) Front internal gear     |
| (4) 2-4 brake           | (10) Reduction drive shaft | (16) Front pinion gear       |
| (5) Low clutch          | (11) Rear internal gear    | (17) Front sun gear          |
| (6) Low & reverse brake | (12) Rear pinion gear      |                              |



# GEAR TRAIN

AUTOMATIC TRANSMISSION

## B: OPERATION

### 1. OPERATION TABLE

		Reverse clutch	2-4 brake	High clutch	Low clutch	Low & reverse brake	One-way clutch	
Select lever position	(P)							
	(R)	○				○		
	(N)							
	(D)	1st ↑↓				○		○
		2nd ↑↓		○		○		
		3rd ↑↓			○	○		
		4th ↑↓		○	○			
	Manual mode	1st ↑↓ Above preset speed				○	○	
		Below preset speed				○		○
		2nd ↑↓		○		○		
		3rd ↑↓			○	○		
		4th ↑↓		○	○			

AT-02305

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 2. N RANGE

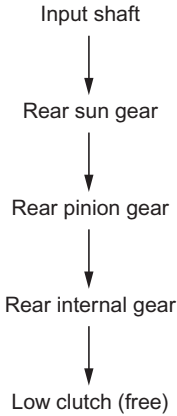
Since the rear sun gear and the high clutch drum are in mesh with the input shaft, they rotate together with the input shaft.

The high clutch drum does not transmit the torque to the planetary unit since the reverse clutch and the high clutch are not engaged.

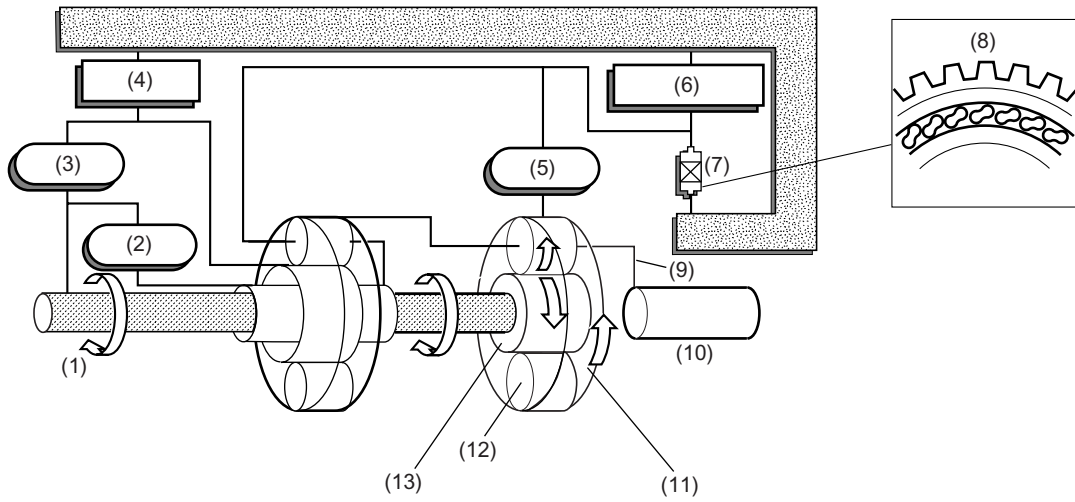
The torque of the rear sun gear is transmitted to the rear internal gear through the pinion gear.

However, the torque of the rear sun gear is not transmitted to the rear planetary carrier since the low clutch is disengaged and, therefore, the rear internal gear is freewheeling.

As a result, the torque of the input shaft is not transmitted to the reduction drive shaft.

Operating condition of components	Power flow (in acceleration)
All clutches and brakes : disengaged	 <pre>graph TD; A[Input shaft] --&gt; B[Rear sun gear]; B --&gt; C[Rear pinion gear]; C --&gt; D[Rear internal gear]; D --&gt; E[Low clutch (free)];</pre> <p>AT-00476</p>

# GEAR TRAIN



- : (14)
- : (15)
- : (16)
- : (17)

AT-00477

- |                         |                            |   |
|-------------------------|----------------------------|---|
| (1) Input shaft         | (7) One-way clutch         | (13) Rear sun gear  |
| (2) High clutch         | (8) No effect              | (14) Input  |
| (3) Reverse clutch      | (9) Rear planetary carrier | (15) Output   |
| (4) 2-4 brake           | (10) Reduction drive shaft | (16) Locked   |
| (5) Low clutch          | (11) Rear internal gear    | (17) Planetary gear components involved in power transmission |
| (6) Low & reverse brake | (12) Rear pinion gear      |   |

# GEAR TRAIN

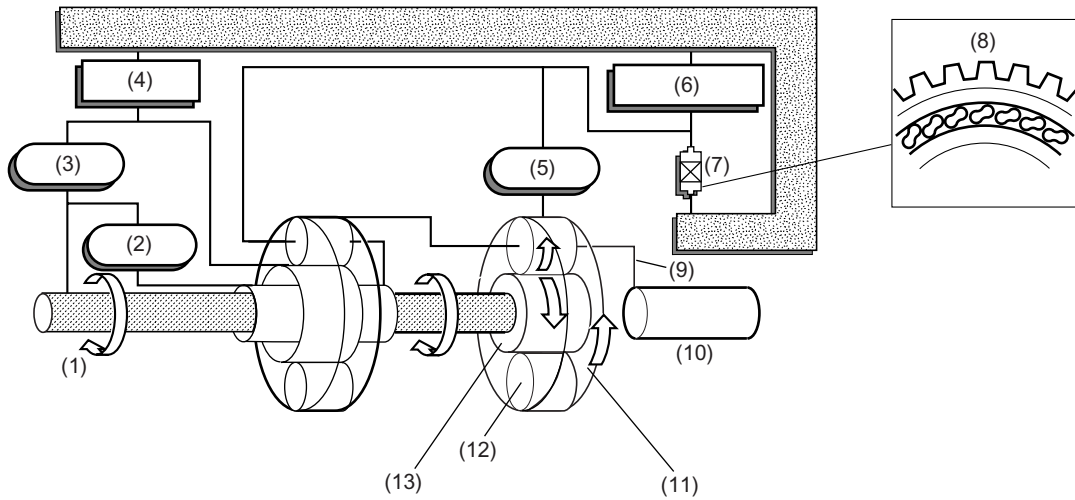
## AUTOMATIC TRANSMISSION





### 3. P RANGE

All the clutches and brakes are free, just as in the N range. The parking pawl engages with the parking gear, which forms an integral part of the reduction drive gear, preventing the gear from rotating.

Operating condition of components	Power flow (in acceleration)
All clutches and brakes: disengaged	<pre>graph TD; A[Input shaft] --&gt; B[Rear sun gear]; B --&gt; C[Rear pinion gear]; C --&gt; D[Rear internal gear]; D --&gt; E[Low clutch (free)];</pre> <p>AT-00476</p>

# GEAR TRAIN



-  : (14)
-  : (15)
-  : (16)
-  : (17)

AT-00477

- |                         |                            |   |
|-------------------------|----------------------------|---|
| (1) Input shaft         | (7) One-way clutch         | (13) Rear sun gear  |
| (2) High clutch         | (8) No effect              | (14) Input  |
| (3) Reverse clutch      | (9) Rear planetary carrier | (15) Output   |
| (4) 2-4 brake           | (10) Reduction drive shaft | (16) Locked   |
| (5) Low clutch          | (11) Rear internal gear    | (17) Planetary gear components involved in power transmission |
| (6) Low & reverse brake | (12) Rear pinion gear      |   |

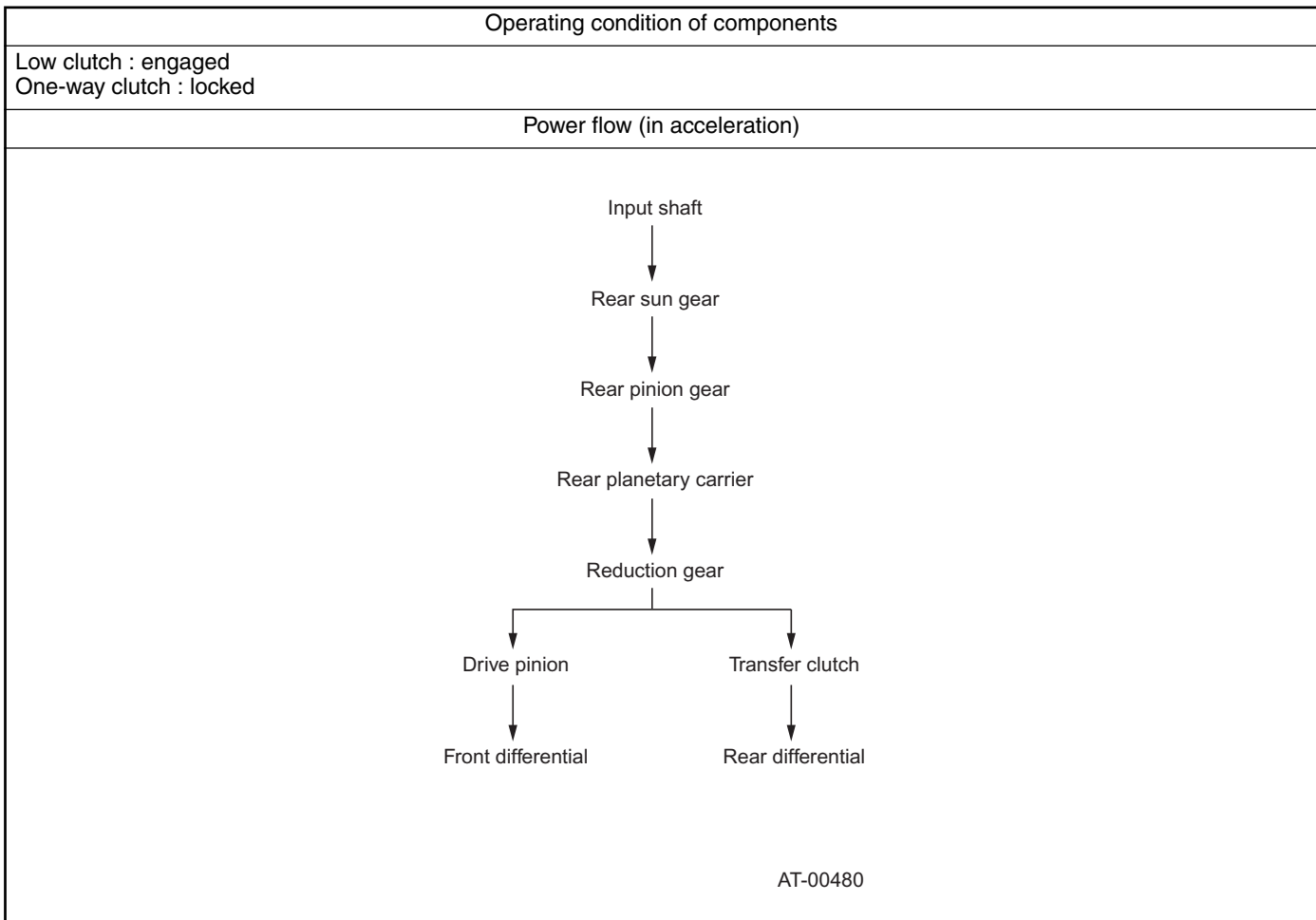
# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 4. 1st GEAR OF D RANGE OR MANUAL MODE (BELOW SET SPEED) ( $D_1$ )

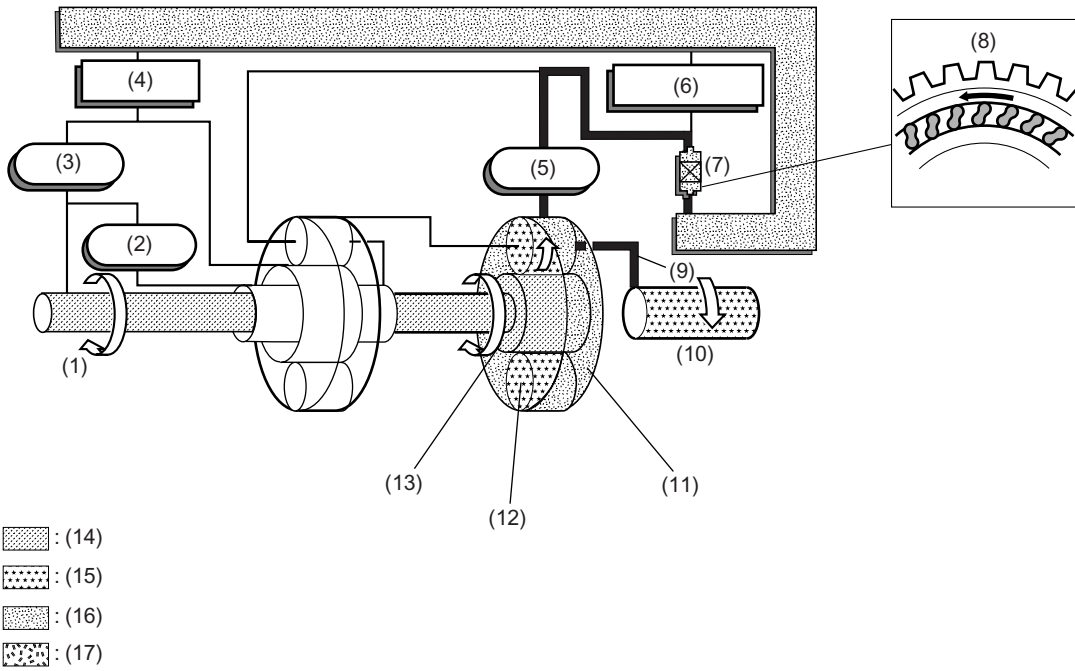
When the 1st gear is selected in the D range or in manual mode (below set speed), only the low clutch is engaged. In this state, the rear internal gear attempts to rotate counterclockwise but it is impossible by the action of the one-way clutch which locks the internal gear to the transmission case. As a result, rotation of the rear sun gear causes the pinion gears to rotate around the sun gear. This causes the planetary carrier to rotate. In this way, rotation of the input shaft is transmitted to the reduction drive shaft, after being subjected to speed reduction by the planetary gear train.

On the other hand, the rear internal gear rotates clockwise if the reverse driving force is applied to it by the reduction drive shaft during coasting. This clockwise rotation of the internal gear causes the one-way clutch to freewheel. Since the power path between the reduction drive shaft and the input shaft is lost as a result, no engine braking effect is available.



# GEAR TRAIN

AUTOMATIC TRANSMISSION



AT-00481

- |                         |                            |   |
|-------------------------|----------------------------|---|
| (1) Input shaft         | (7) One-way clutch         | (13) Rear sun gear  |
| (2) High clutch         | (8) Locked                 | (14) Input  |
| (3) Reverse clutch      | (9) Rear planetary carrier | (15) Output   |
| (4) 2-4 brake           | (10) Reduction drive shaft | (16) Locked   |
| (5) Low clutch          | (11) Rear pinion gear      | (17) Planetary gear components involved in power transmission |
| (6) Low & reverse brake | (12) Rear pinion gear      |   |

# GEAR TRAIN

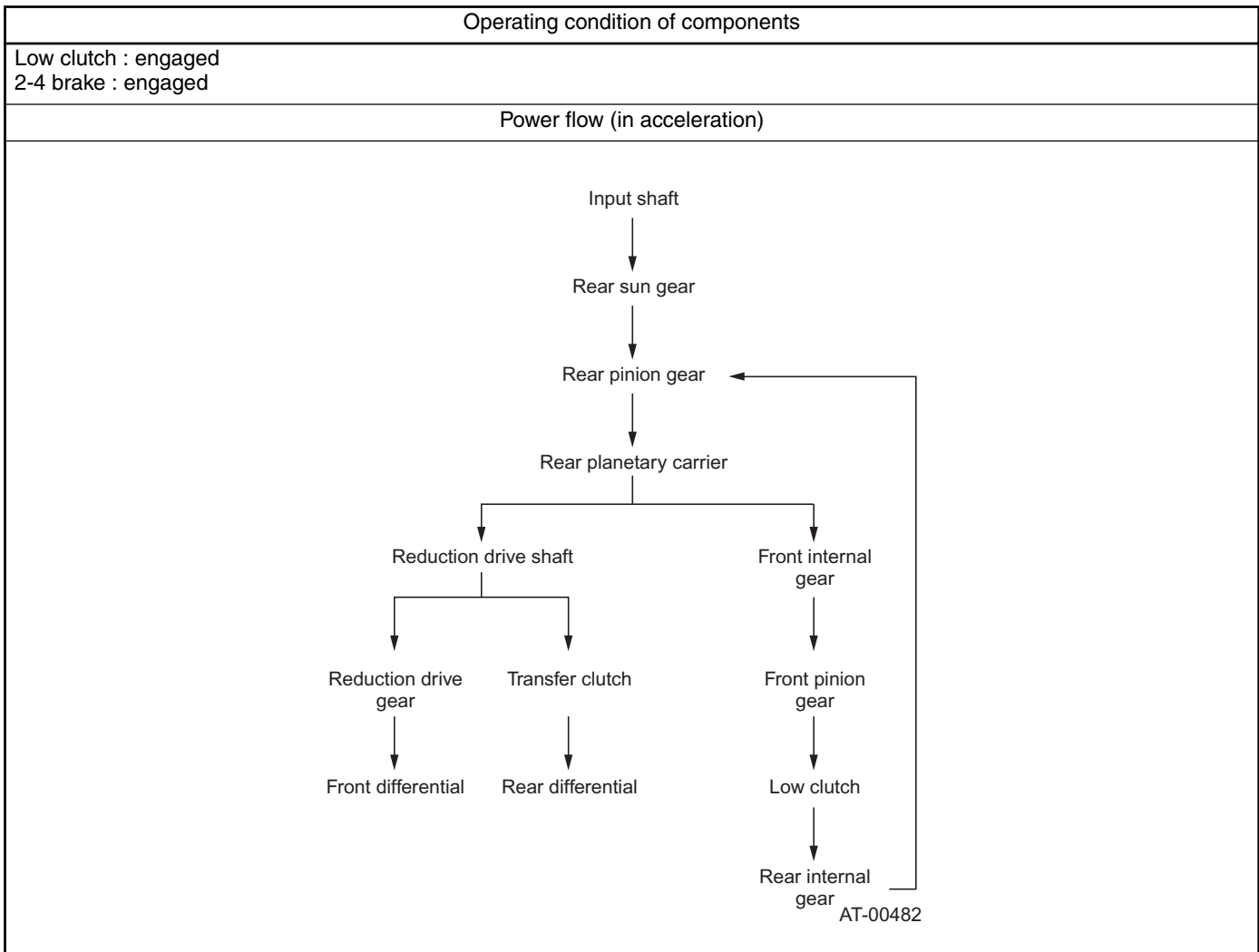
## AUTOMATIC TRANSMISSION

### 5. 2nd GEAR

When the 2nd gear is selected, the 2-4 brake and the low clutch are engaged. The front sun gear is now locked to the transmission case due to engagement of the 2-4 brake. In this state, the torque of the rear sun gear is transmitted to the rear internal gear through the path of the front internal gear, front pinion gears, low clutch drum and low clutch. At this time, the one-way clutch is freewheeling since the low clutch drum is rotating clockwise.

In this power flow configuration, the rear pinion gears are rotated by the rear internal gear at a speed faster than that available from the configuration for the 1st gear, so the rotation speed of the reduction drive shaft is higher than that of the 1st gear.

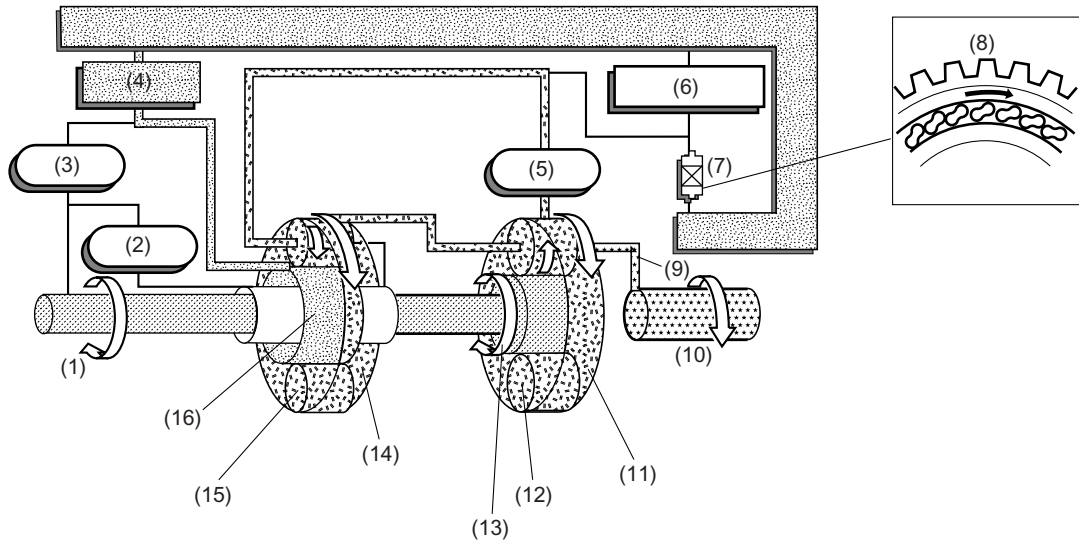
Since the drive power is transmitted without passing through the one-way clutch in the 2nd gear, the backward driving force from the wheels is transmitted through the reduction drive shaft to the input shaft; this makes the engine braking effect available.









# GEAR TRAIN

AUTOMATIC TRANSMISSION



-  : (17)
-  : (18)
-  : (19)
-  : (20)

AT-00483

- |                            |                            |   |
|----------------------------|----------------------------|---|
| (1) Input shaft            | (8) Free                   | (15) Front pinion gear  |
| (2) High clutch            | (9) Rear planetary carrier | (16) Front sun gear   |
| (3) Reverse clutch         | (10) Reduction drive shaft | (17) Input  |
| (4) 2-4 brake              | (11) Rear internal gear    | (18) Output   |
| (5) Low clutch             | (12) Rear pinion gear      | (19) Locked   |
| (6) Low and reverse clutch | (13) Rear sun gear         | (20) Planetary gear components involved in power transmission |
| (7) One-way clutch         | (14) Front internal gear   |   |

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

---

### 6. 3rd GEAR

When the 3rd gear is selected, the low clutch and the high clutch are engaged. The engaged high clutch rotates through its drum the front planetary carrier, and rotation of the carrier is transmitted to the rear internal gear through the engaged low clutch. In this power flow configuration, the rear sun gear and the rear internal gear rotate at the same speed since the rear pinion gears are solid on their axes and the whole planetary gear train rotates as a unit at the same speed as its sun gear. As a result, the input shaft and the reduction drive shaft rotate at the same speed.

In the 3rd gear, the one-way clutch is freewheeling because the low clutch is rotating clockwise. Since the drive power is transmitted without passing through the one-way clutch, the backward driving force from the wheels is transmitted through the reduction drive shaft to the input shaft; this makes the engine braking effect available.

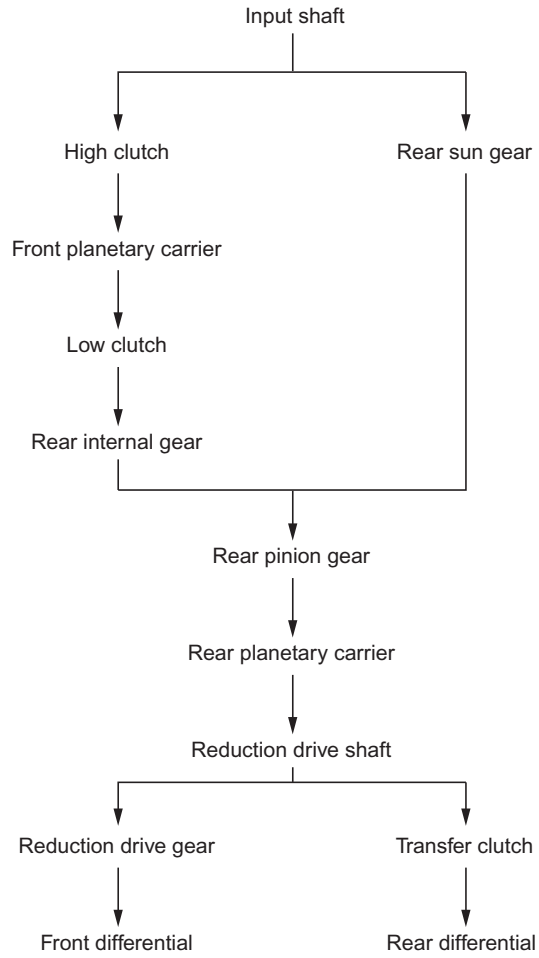
# GEAR TRAIN

AUTOMATIC TRANSMISSION

Operating condition of components

High clutch : engaged  
Low clutch : engaged

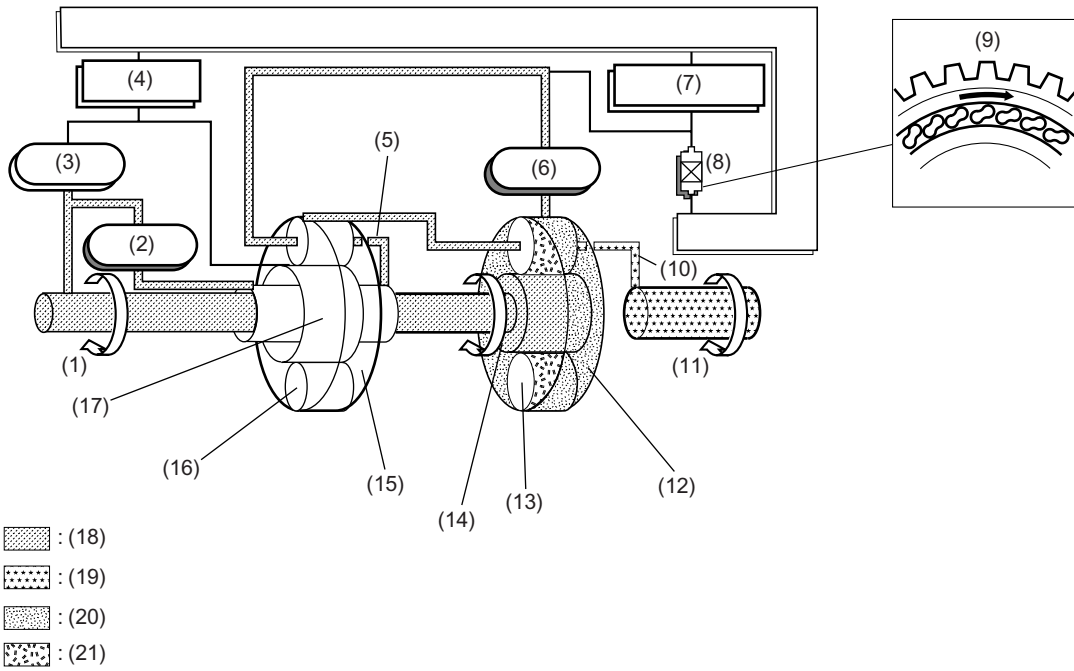
Power flow (in acceleration)



AT-00484

# GEAR TRAIN

AUTOMATIC TRANSMISSION



AT-00485

- |                             |                             |   |
|-----------------------------|-----------------------------|---|
| (1) Input shaft             | (8) One-way clutch          | (15) Front internal gear                                      |
| (2) High clutch             | (9) Free                    | (16) Front pinion gear  |
| (3) Reverse clutch          | (10) Rear planetary carrier | (17) Front sun gear   |
| (4) 2-4 brake               | (11) Reduction drive shaft  | (18) Input  |
| (5) Front planetary carrier | (12) Rear internal gear     | (19) Output   |
| (6) Low clutch              | (13) Rear pinion gear       | (20) Locked   |
| (7) Low & reverse brake     | (14) Rear sun gear          | (21) Planetary gear components involved in power transmission |

**MEMO**

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

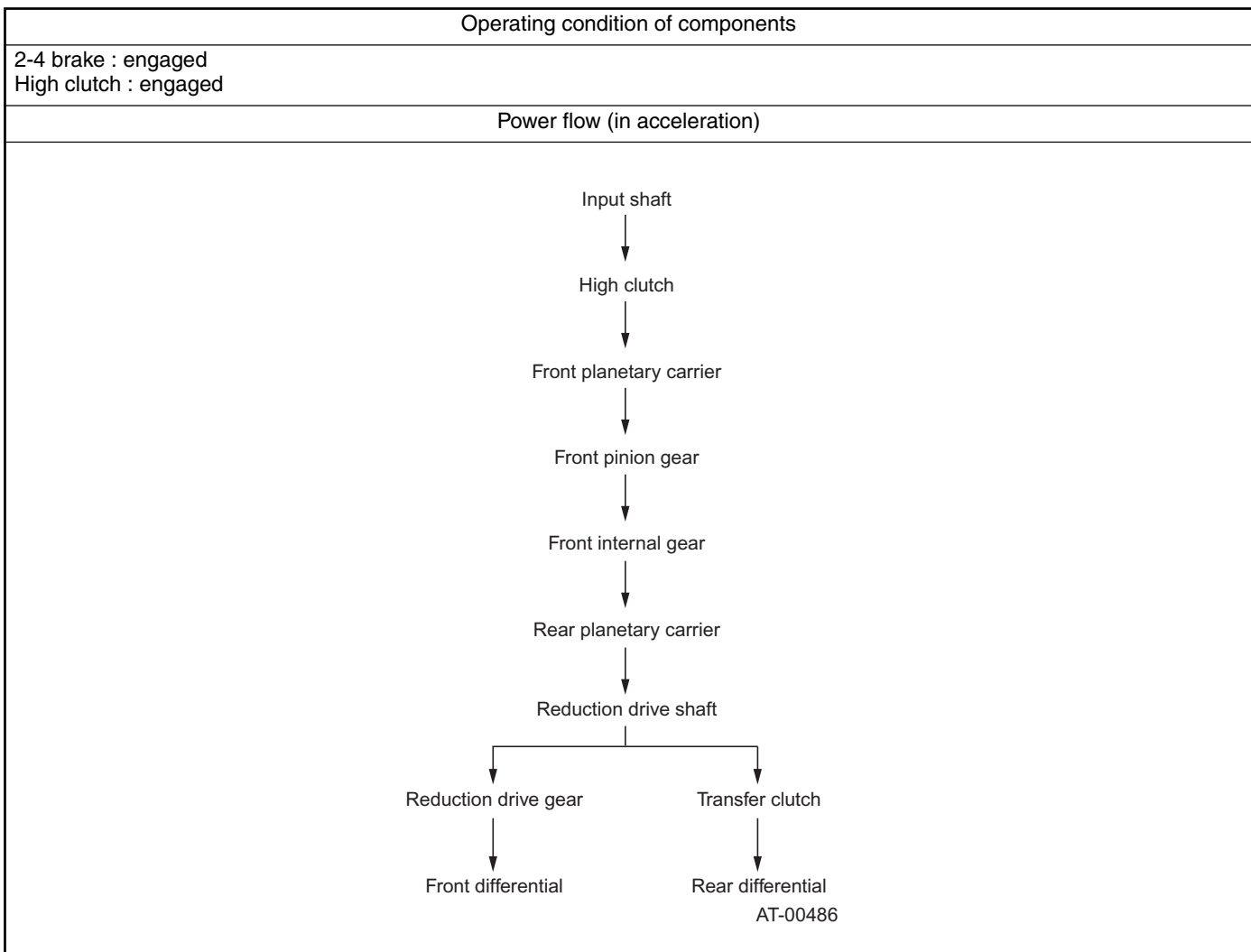
### 7. 4th GEAR

When the 4th gear is selected, the high clutch and the 2-4 brake are engaged. The engaged high clutch causes the front planetary carrier to rotate, whereas the engaged 2-4 brake causes the front sun gear to be locked to the transmission case.

The front planetary carrier rotates at the same speed as the input shaft. The rotation of the front planetary carrier causes the front pinion gears to revolve around the stationary front sun gear, which causes the front internal gear to rotate faster than the input shaft.

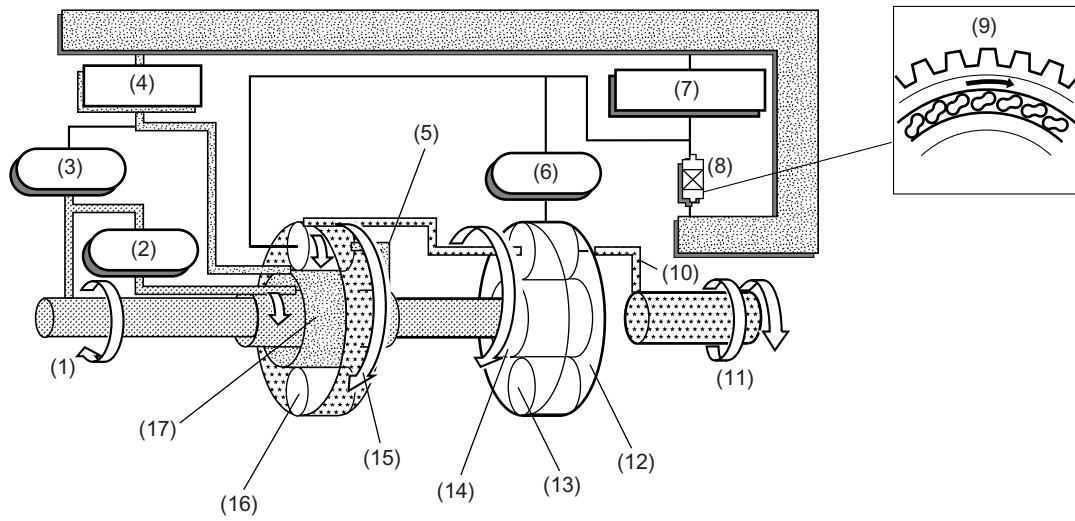
As a result, the reduction drive shaft is driven at a higher speed than the input shaft.





In the 4th gear, the one-way clutch is freewheeling because the low clutch is rotating clockwise. Since the drive power is transmitted without passing through the one-way clutch, the backward driving force from the wheels is transmitted through the reduction drive shaft to the input shaft; this makes the engine braking effect available.



# GEAR TRAIN

AUTOMATIC TRANSMISSION



-  : (18)
-  : (19)
-  : (20)
-  : (21)

AT-00487

- |                             |                             |   |
|-----------------------------|-----------------------------|---|
| (1) Input shaft             | (8) One-way clutch          | (15) Front internal gear                                      |
| (2) High clutch             | (9) Free                    | (16) Front pinion gear  |
| (3) Reverse clutch          | (10) Rear planetary carrier | (17) Front sun gear   |
| (4) 2-4 brake               | (11) Reduction drive shaft  | (18) Input  |
| (5) Front planetary carrier | (12) Rear internal gear     | (19) Output   |
| (6) Low clutch              | (13) Rear pinion gear       | (20) Locked   |
| (7) Low & reverse brake     | (14) Rear sun gear          | (21) Planetary gear components involved in power transmission |

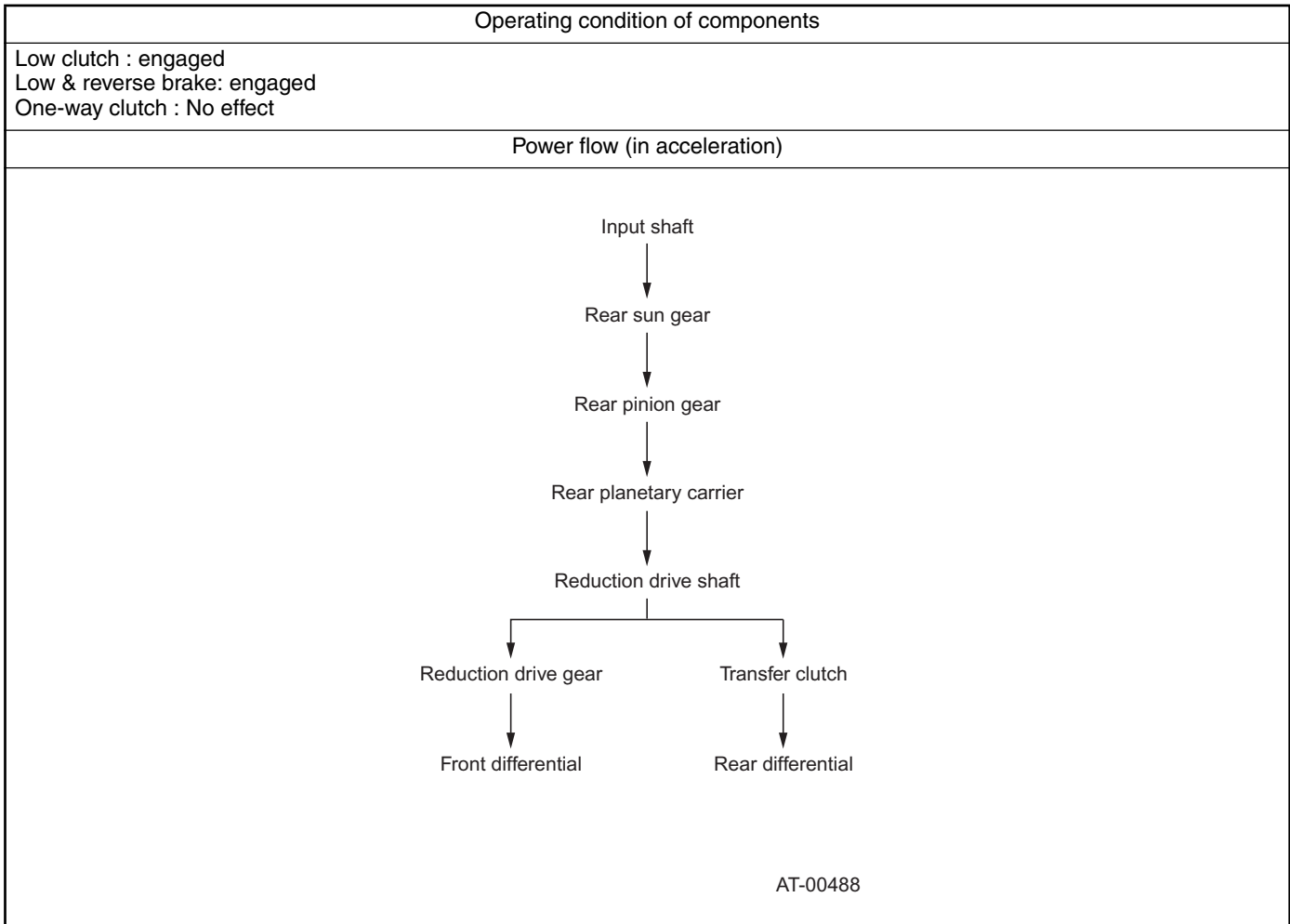
# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 8. 1st SPEED GEAR OF MANUAL MODE (OVER SET SPEED)

When the 1st gear is selected in manual mode (over set speed), both the low clutch and the low & reverse brake are engaged. Although the power flow configuration is the same as that with the 1st gear in the D range, the one-way clutch produces no freewheeling effect because the low & reverse brake is locking the rear internal gear always to the transmission case.

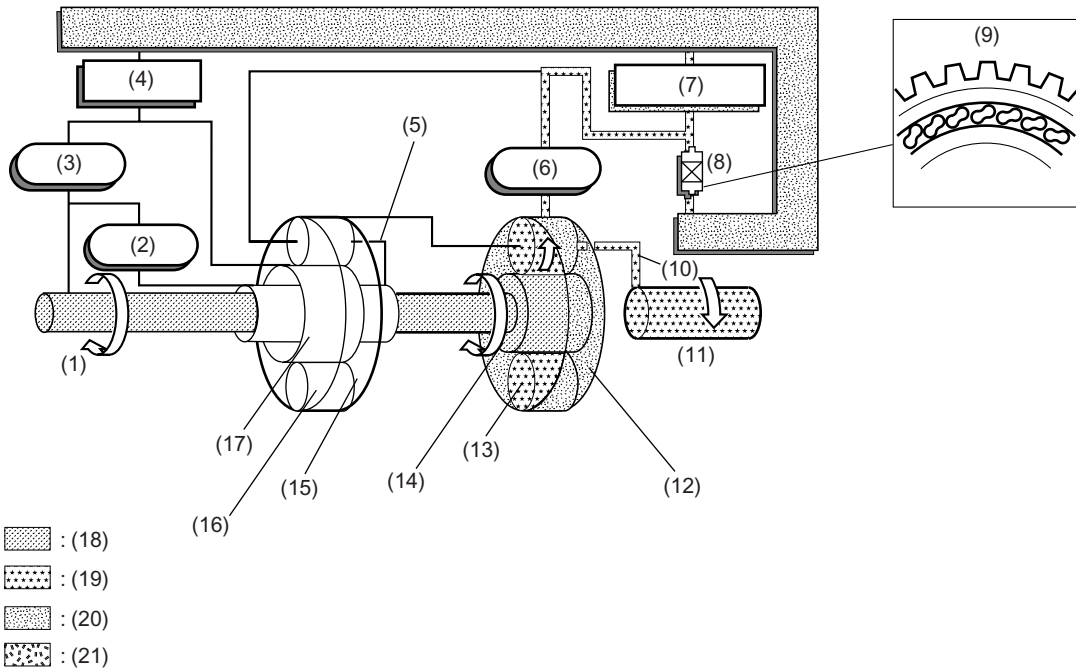
During coasting, therefore, the backward driving force from the wheels is transmitted through the reduction drive gear to the input shaft. This means, unlike the 1st gear in D range, that the engine braking effect is available in this range.





# GEAR TRAIN

AUTOMATIC TRANSMISSION



AT-00489

- |                             |                             |   |
|-----------------------------|-----------------------------|---|
| (1) Input shaft             | (8) One-way clutch          | (15) Front internal gear                                      |
| (2) High clutch             | (9) No effect               | (16) Front pinion gear  |
| (3) Reverse clutch          | (10) Rear planetary carrier | (17) Front sun gear   |
| (4) 2-4 brake               | (11) Reduction drive shaft  | (18) Input  |
| (5) Front planetary carrier | (12) Rear internal gear     | (19) Output   |
| (6) Low clutch              | (13) Rear pinion gear       | (20) Locked   |
| (7) Low & reverse brake     | (14) Rear sun gear          | (21) Planetary gear components involved in power transmission |

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 9. R RANGE

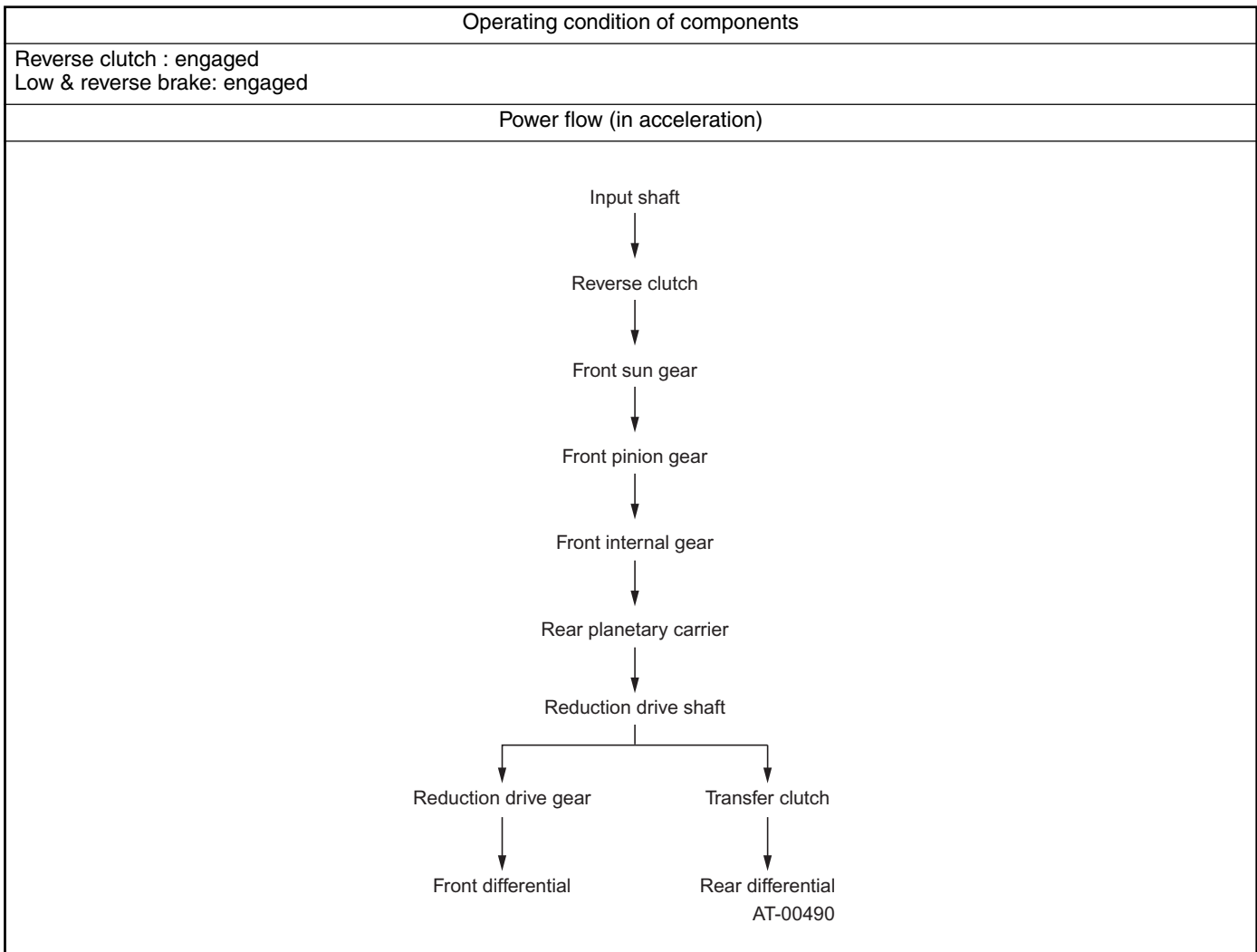
When the select lever is placed in the R position, the reverse clutch and the low & reverse brake are engaged. The reverse clutch allows the input shaft torque to be transmitted to the front sun gear, while the low & reverse brake allows the low clutch drum to be interlocked with the transmission case.

The rotation of the front sun gear causes the front pinion gear to rotate in the opposite direction and therefore the front internal gear rotates in the same direction.

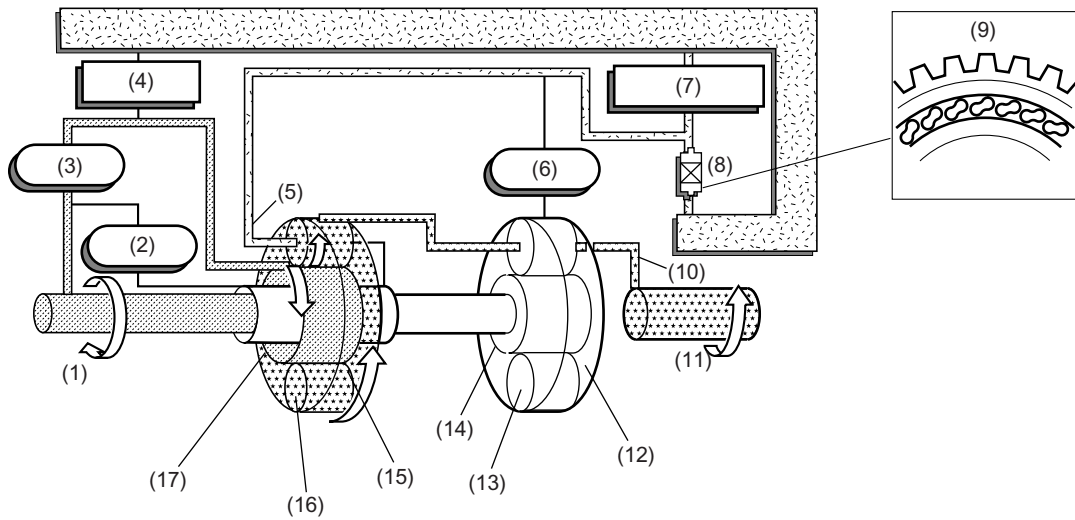
At this time, the rotation speed transmitted to the front internal gear is reduced through gearing between the front sun gear and the front pinion gears.





The one-way clutch produces no freewheeling effect because the low & reverse brake is in engagement.

In this range, since the power transmission is made without passing through the one-way clutch, the driving force from the wheels is transmitted through the reduction drive shaft to the input shaft; this makes the engine braking effect available.



# GEAR TRAIN



-  : (18)
-  : (19)
-  : (20)
-  : (21)

AT-00491

- |                             |                             |   |
|-----------------------------|-----------------------------|---|
| (1) Input shaft             | (8) One-way clutch          | (15) Front internal gear                                      |
| (2) High clutch             | (9) No effect               | (16) Front pinion gear  |
| (3) Reverse clutch          | (10) Rear planetary carrier | (17) Front sun gear   |
| (4) 2-4 brake               | (11) Reduction drive shaft  | (18) Input  |
| (5) Front planetary carrier | (12) Rear internal gear     | (19) Output   |
| (6) Low clutch              | (13) Rear pinion gear       | (20) Locked   |
| (7) Low & reverse brake     | (14) Rear sun gear          | (21) Planetary gear components involved in power transmission |

# AWD TRANSFER SYSTEM

AUTOMATIC TRANSMISSION

## 10.AWD Transfer System

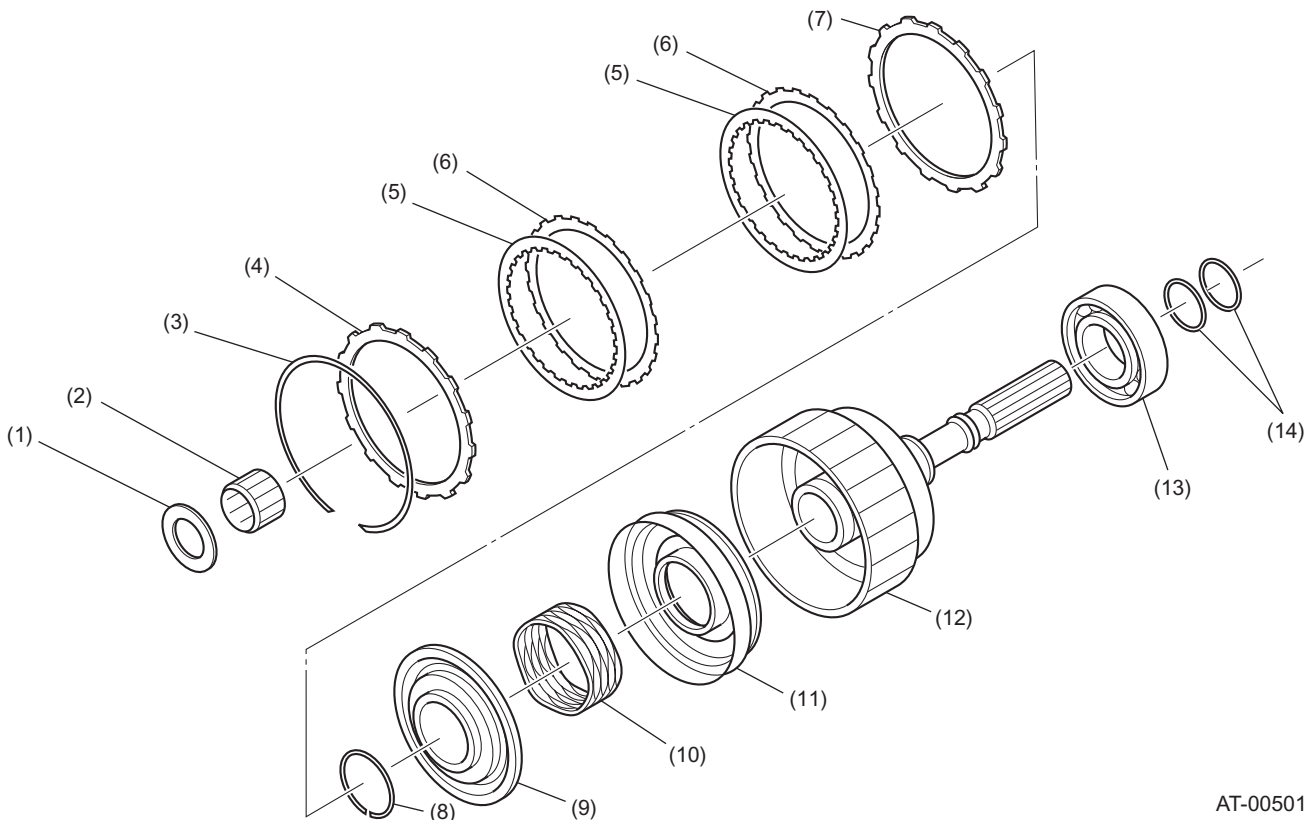
### A: GENERAL

This all-wheel-drive (AWD) transfer system uses a hydraulic multi-plate type clutch. The clutch is controlled by the TCM through a control valve.

The TCM has in its memory a set of duty ratio data, each defining at what ratio the transfer clutch should transmit the torque for a particular driving condition. Based on the driving condition information it receives from the corresponding sensors (engine torque, vehicle speed, throttle opening, gear range, slip of wheels, etc.), the TCM selects an appropriate duty ratio from the memory and uses it to control the solenoid valve. The solenoid valve then regulates the pilot pressure of the transfer control valve, which creates the pressure to the clutch from the line pressure. The clutch is engaged to a degree determined by the transfer clutch pressure thus created. Through this process, the torque from the engine is distributed to the rear wheels optimally according to driving conditions.

### B: CONSTRUCTION

The transfer clutch drum and rear drive shaft are joined to each other by welding. The rear drive shaft is provided with oil passages for transfer clutch control.



AT-00501

- |                    |                          |                             |
|--------------------|--------------------------|-----------------------------|
| (1) Thrust bearing | (6) Driven plate         | (11) Transfer clutch piston |
| (2) Needle bearing | (7) Pressure plate       | (12) Rear drive shaft       |
| (3) Snap ring      | (8) Snap ring            | (13) Ball bearing           |
| (4) Pressure plate | (9) Transfer piston seal | (14) Seal ring              |
| (5) Drive plate    | (10) Return spring       |                             |

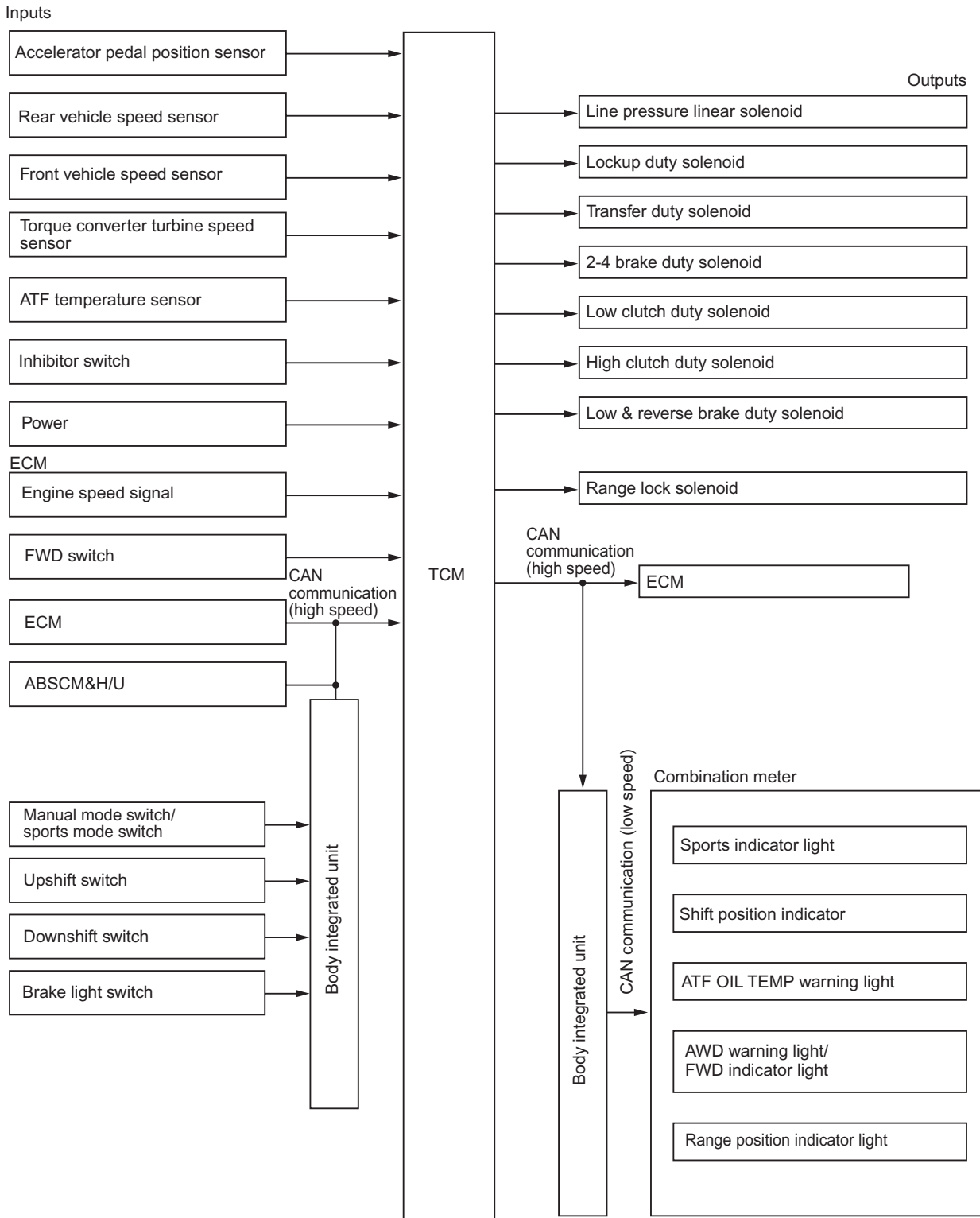
## 11. Electro-hydraulic Control System

### A: GENERAL

The electro-hydraulic control system for the transmission and transfer consists of various sensors and switches, a transmission control module (TCM) and the control valves including solenoid valves. The system controls the automatic transmission operation, including gear shifting, lockup clutch operation, line pressure, pattern selection (NORMAL and SPORTS), and gear-shift timing. It also controls the operation of the transfer clutch. The TCM determines the vehicle's operating conditions from various input signals and controls a total of seven solenoids (line pressure linear solenoid, lockup duty solenoid, 2-4 brake duty solenoid, low clutch duty solenoid, high clutch duty solenoid, low & reverse duty solenoid, and transfer duty solenoid) by sending appropriate signals to them.

# ELECTRO-HYDRAULIC CONTROL SYSTEM

## AUTOMATIC TRANSMISSION



AT-02934

# ELECTRO-HYDRAULIC CONTROL SYSTEM

AUTOMATIC TRANSMISSION

## B: INPUT SIGNALS

Signal name	Major function
Accelerator pedal position sensor	Indicates the throttle opening. This signal is used to determine shift point, line pressure, and lockup engaging vehicle speed, which vary with engine load.
Front vehicle speed sensor (located on transmission case)	Indicates the vehicle speed. This signal is used for control of gear shifting, lockup engaging, line pressure, and transfer clutch operation.
Rear vehicle speed sensor (located on extension case)	Used to control transfer clutch, and also as backup signal in case of failure of front vehicle speed sensor.
Engine speed signal	Indicates the engine speed. This signal is used for control of lockup clutch to ensure smooth engagement.
Inhibitor switch	Used to determine gears and line pressures in each of ranges P, R, N, and D.
ATF temperature sensor	Indicates the ATF temperature. This signal is used for inhibition of lockup, release of OD and determination of ATF temperature.
FWD switch	Used for changing the mode from AWD to FWD. Also used for adapting the vehicle to FWD tester roller. Changeover from AWD to FWD can be made by inserting a fuse into the fuse holder.
Torque converter turbine speed sensor	Tells the rotation speed of the input shaft. The proportion of this speed to the vehicle speed determines whether shifting should be made or not.
CAN communication signals	Receives information from ECM, ABSCM and body integrated unit to control the transmission.

## C: OUTPUT SIGNALS

Signal name	Function
Line pressure linear solenoid	Regulates the line pressure according to driving conditions.
Lockup duty solenoid	Regulates the hydraulic pressure of the lockup clutch to operate it in three modes (open, smooth and lockup).
Transfer duty solenoid	Regulates the hydraulic pressure of the transfer clutch to control the driving force to the rear drive shaft.
2-4 brake duty solenoid	Regulates 2-4 brake operating pressure to reduce shifting shocks.
High clutch duty solenoid	Regulates high clutch operating pressure to reduce shifting shocks.
Low clutch duty solenoid	Regulates low clutch operating pressure to reduce shifting shocks.
Low & reverse duty solenoid	Regulates low & reverse brake operating pressure to reduce shifting shocks.
Shift lock solenoid	Controls the shift lock solenoid during range lock control.
CAN communication signals	Outputs transmission information to control modules and the body integrated unit.

# ELECTRO-HYDRAULIC CONTROL SYSTEM

## AUTOMATIC TRANSMISSION

### D: CONTROL ITEMS

Control items		Description of control	
Transmission control	Shifting control	Base shift control	Upshifting and downshifting are set for each range, gear and pattern according to the accelerator pedal position and vehicle speed.
		ABS-in-operation control	Gear speed is determined according to vehicle speed when ABS signal and brake signal is input.
		ATF low temperature control	Shifting into 4th gear is prevented when ATF temperature is below the preset value.
		Sports pattern control (SPORTS light ON)	Sports pattern is selected when the select lever is moved to the manual mode position.
		Base pattern control (SPORTS light OFF)	Base pattern is selected when the select lever is in D range.
	Lockup control	Base lockup control	Lockup control is performed according to throttle position and vehicle speed. (Basically lockup is OFF during gear shifting.)
		Smooth control	Smooth lockup is performed when lockup is switched on.
	Line pressure control	Ordinary control	Line pressure is regulated according to the accelerator pedal position and vehicle speed signals.
	Shift timing control	Gear speed control	Controls each solenoid.
		Lockup control	When shifting, the lockup clutch is temporarily released.
	Adaptive control	Accelerator pedal quick return control	When the accelerator pedal is quickly released from a depressed condition, the gear is held in the current speed.
		Accelerator pedal quick depressing control	When the accelerator pedal is quickly depressed, the transmission down shifts immediately.
		Map switch control	Switches the shift point setting according to the driving condition.
		Braking control	To ensure engine braking effect during braking and improve the re-acceleration performance, the transmission is downshifted in accordance with the deceleration.
CAN communication signals control		Sends and receives vehicle information between control modules and controls each module.	
AWD transfer clutch control	Ordinary transfer control	Transfer clutch pressure is regulated according to the throttle valve angle, vehicle speed, and engine torque.	
	Slip control	Regulates transfer clutch pressure in accordance with the amount of slip.	
	Turning control	Transfer clutch pressure is reduced after detecting a turn.	
	ABS-in-operation control	Transfer clutch pressure is adjusted to a set level immediately after reception of ABS signal.	



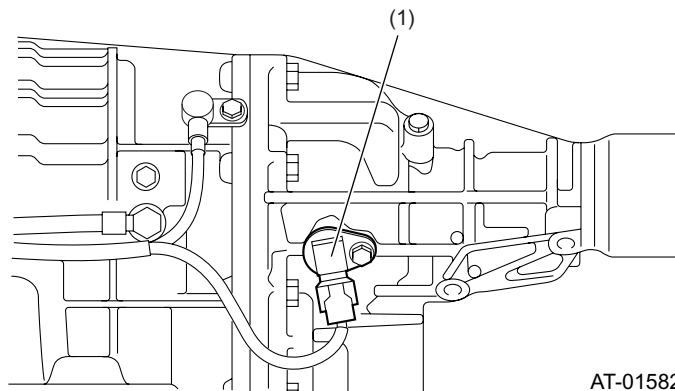
## 12.Sensor Systems

### A: ACCELERATOR PEDAL POSITION SENSOR

The accelerator pedal position sensor provides electrical signals corresponding to accelerator pedal position. The throttle valve angular position and accelerator depressing speed are detected by this accelerator pedal position sensor.

### B: REAR VEHICLE SPEED SENSOR

This vehicle speed sensor (output shaft speed sensor) is a Hall element type sensor and is externally mounted on the extension case. It detects the rear drive shaft speed in terms of the peripheral speed of the transfer clutch drum and sends pulse signals (30 pulses per rotation) to the TCM.

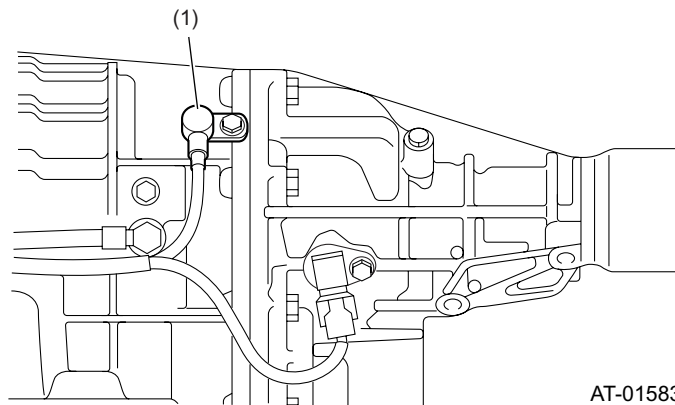


AT-01582

(1) Rear vehicle speed sensor

### C: FRONT VEHICLE SPEED SENSOR

This vehicle speed sensor (output shaft speed sensor) is externally mounted on the transmission case. It detects the front drive pinion shaft speed and sends sine wave signals (16 pulses per rotation) to the TCM.



AT-01583

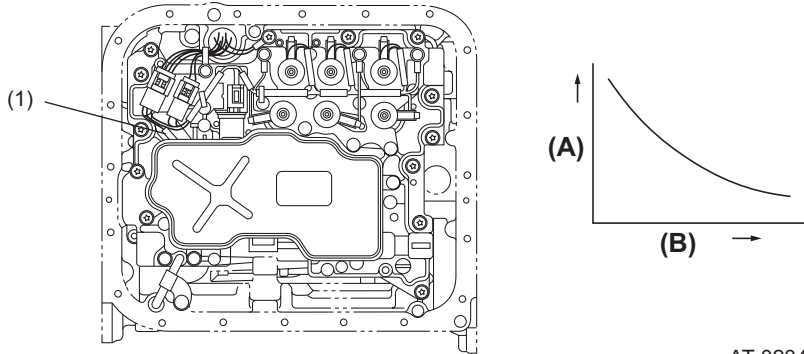
(1) Front vehicle speed sensor

# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

### D: ATF TEMPERATURE SENSOR

This sensor is integrated with the transmission harness and is mounted on the transmission control valve body. Its resistance varies in accordance with the ATF temperature. The characteristics of the sensor are as shown below.



AT-02348

(1) ATF temperature sensor

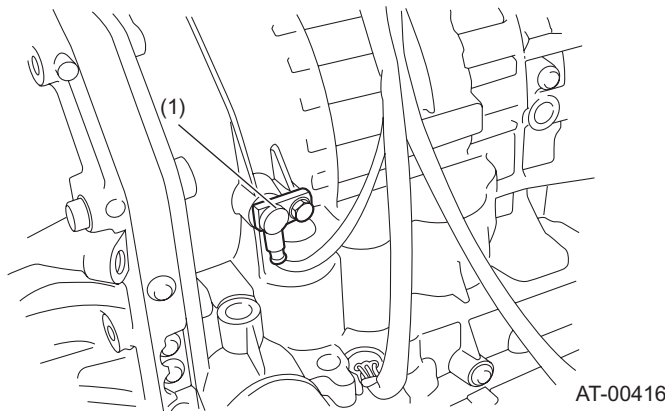
(A) Resistance

(B) Temperature

### E: TORQUE CONVERTER TURBINE SPEED SENSOR

The torque converter turbine speed sensor (output shaft speed sensor) is externally mounted on the transmission case.

The sensor detects the torque converter turbine speed in terms of the rotation speed of the periphery of the high clutch drum coupled to the input shaft, and sends sine wave signals (32 pulses per rotation) to the TCM. The TCM converts this signal into turbine speed to use it for shifting control.



AT-00416

(1) Torque converter turbine speed sensor

## F: INHIBITOR SWITCH

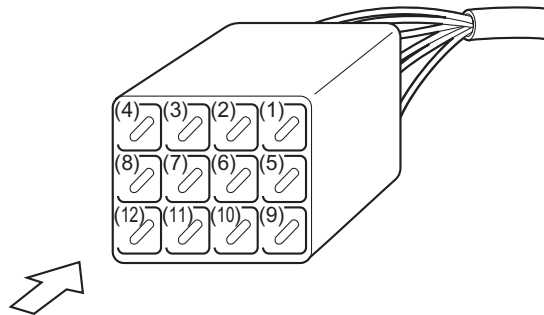
The inhibitor switch assures safety when starting the engine. This switch is mounted on the right side of the transmission case, and is operated by the selector lever.

When the selector lever is set to P or N, the electrical circuit in the inhibitor switch is connected to the starter circuit to enable cranking of the engine.

When the selector lever is in the R or D range, the electrical circuit in the inhibitor switch is disconnected. Hence engine cranking is disabled. In the R range, the backup light circuit is completed in the switch, and the backup lights come on.

In addition to the above function, the inhibitor switch incorporates a circuit for detecting the selected range position and sending the range signal to the TCM.

### Inhibitor switch side connector



AT-00417

Range position	Pin No.
P	(4) — (3) (12) — (11)
R	(4) — (2) (10) — (9)
N	(4) — (1) (12) — (11)
D	(4) — (8)

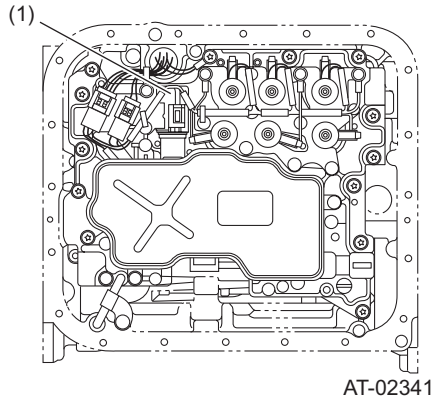
# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

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### G: LINE PRESSURE LINEAR SOLENOID

This solenoid is mounted on the transmission control valve. This adjusts the line pressure in response to electrical current instructions from the TCM. The line pressure is regulated to an optimum level according to the driving condition.

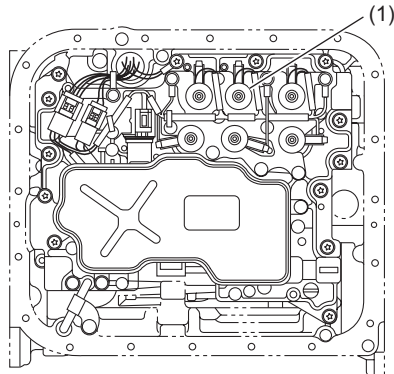


AT-02341

(1) Line pressure linear solenoid 2

### H: 2-4 BRAKE DUTY SOLENOID

This solenoid is mounted on the transmission control valve. This adjusts the pressure applied to the 2-4 brake in response to the duty instructions from the TCM. The engaging force of the 2-4 brake during shifting is properly controlled and shift shocks are reduced.

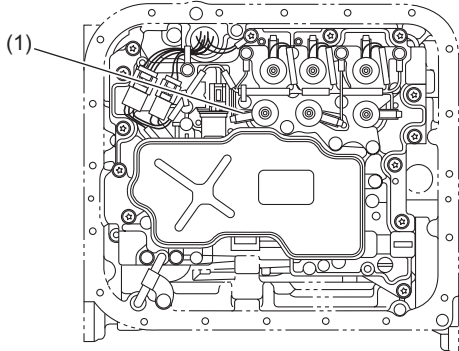


AT-02342

(1) 2-4 brake duty solenoid

### I: LOCKUP DUTY SOLENOID

This solenoid is mounted on the transmission control valve. Its duty ratio is controlled by signals from the TCM. The solenoid provides smooth engagement and disengagement of the lockup clutch.

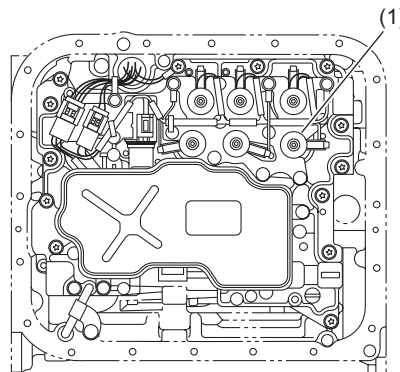


AT-02343

(1) Lockup duty solenoid

### J: LOW CLUTCH DUTY SOLENOID

This solenoid is mounted on the transmission control valve. This adjusts the pressure applied to the low clutch in response to the duty instructions from the TCM. The engaging force of the low clutch during shifting is properly controlled and shift shocks are reduced.



AT-02344

(1) Low clutch duty solenoid

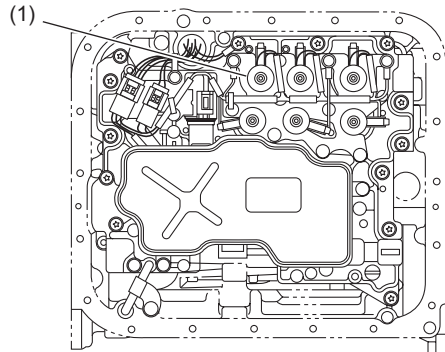
# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

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### **K: HIGH CLUTCH DUTY SOLENOID**

This solenoid is mounted on the transmission control valve. This adjusts the pressure applied to the high clutch in response to the duty instructions from the TCM. The engaging force of the high clutch during shifting is properly controlled and shift shocks are reduced.

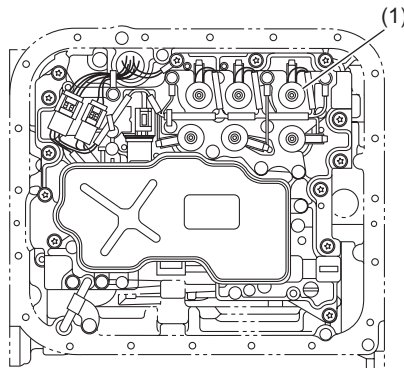


AT-02345

(1) High clutch duty solenoid

### **L: LOW & REVERSE BRAKE DUTY SOLENOID**

This solenoid is mounted on the transmission control valve. This adjusts the pressure applied to the low & reverse brake in response to the duty instructions from the TCM. The engaging force of the low & reverse brake during shifting is properly controlled and shift shocks are reduced.

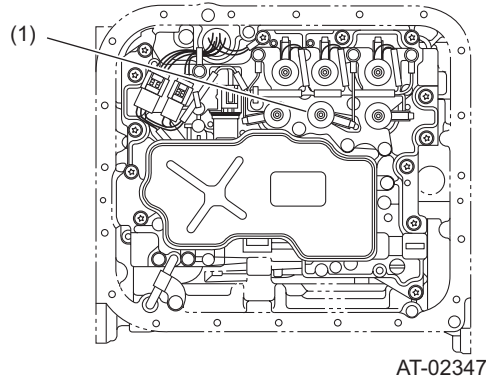


AT-02346

(1) Low & reverse brake duty solenoid

### M: TRANSFER DUTY SOLENOID

This solenoid is mounted on the transmission control valve. This adjusts the pressure applied to the transfer in response to the duty instructions from the TCM. Torque distribution to the front and rear is controlled by properly controlling the engagement force of the transfer clutch.



AT-02347

(1) Transfer duty solenoid

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## 13. Transmission Control Module (TCM)

The TCM receives various sensor signals and determines the running conditions of the vehicle. It then sends control signals to each solenoid according to the preset gearshift characteristic data, lockup operation data, and transfer clutch torque data (duty ratios).

### A: CONTROL SYSTEM

Control items		Input signals
Shifting control	Ordinary shift control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed signal Range signal
	ABS-in-operation control	ABS signal Rear vehicle speed signal Front vehicle speed signal Brake switch signal
	Shift pattern select control	Cruise control signal ATF temperature signal Accelerator pedal position signal Manual mode switch signal
	Grade control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Brake switch signal Range signal Engine speed signal Engine torque signal
	Sports shift control	CAN communication signals (sports mode switch, upshift switch, downshift switch) Front vehicle speed signal Rear vehicle speed signal Engine speed signal ATF temperature signal Range signal
	Adaptive control	Accelerator pedal position signal Front vehicle speed signal Rear vehicle speed signal Engine speed signal ATF temperature signal Brake switch signal Torque converter turbine speed signal
Lockup control	Ordinary lockup control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed signal Range signal
	Hydraulic oil temperature control	ATF temperature sensor



# TRANSMISSION CONTROL MODULE (TCM)

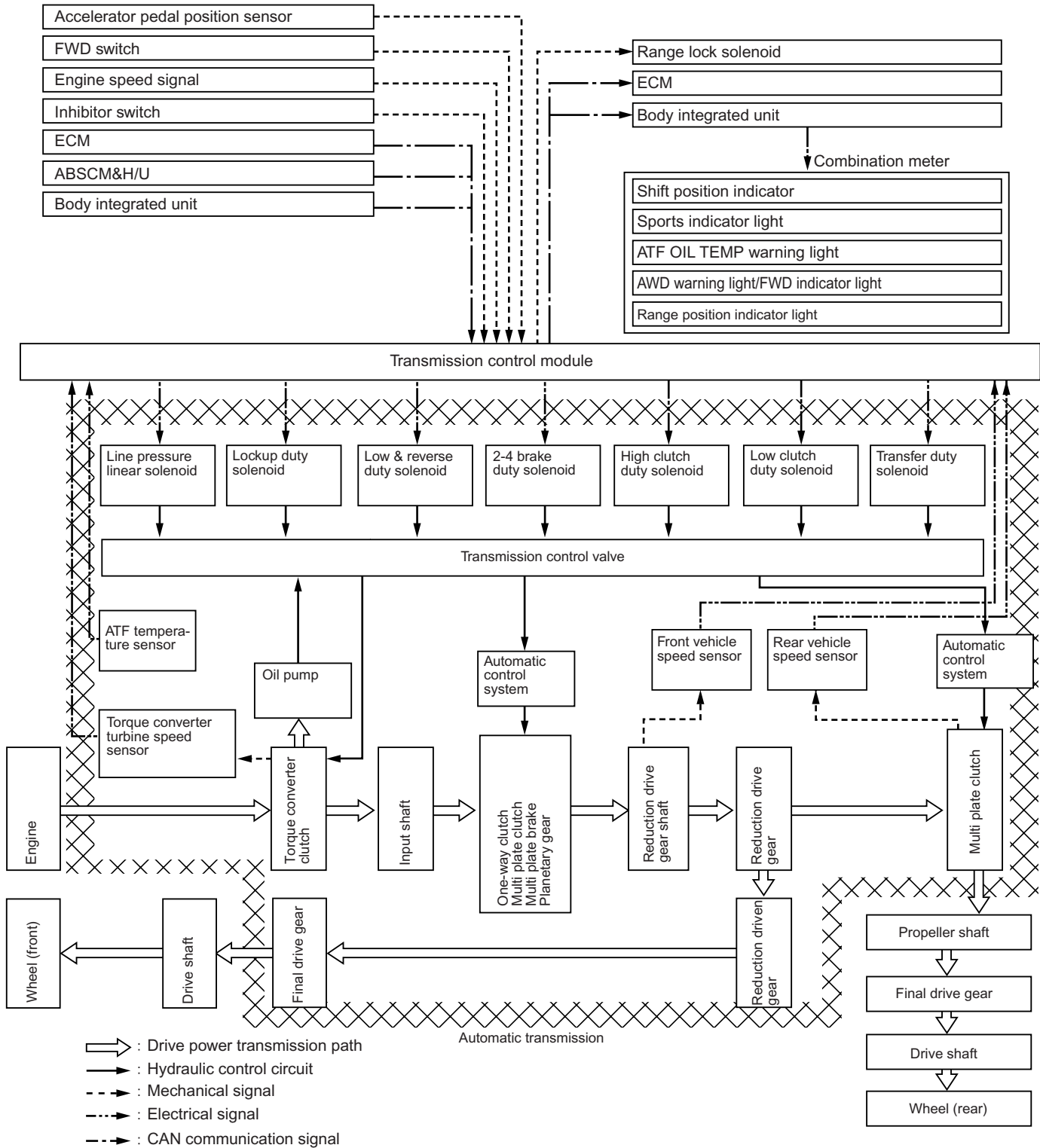
AUTOMATIC TRANSMISSION

Control items		Input signals
Oil pressure control	Ordinary pressure control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed signal Inhibitor switch signal ATF temperature signal
	Shifting control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed signal Torque converter turbine speed signal Range signal ATF temperature signal
AWD transfer clutch control	Ordinary transfer control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Range signal ATF temperature signal FWD switch signal
	Slip detection control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal
	Steering control	Throttle position signal Rear vehicle speed signal Front vehicle speed signal
	ABS-in-operation control	ABS signal Rear vehicle speed signal Front vehicle speed signal Brake switch signal
Range lock control		Front vehicle speed signal Rear vehicle speed signal Range signal

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## B: SCHEMATIC DIAGRAM



AT-02935

## **C: SHIFTING CONTROL**

### **1. ORDINARY SHIFT CONTROL**

The TCM controls each solenoid based on input signal information such as inhibitor switch signals, vehicle speed signals and accelerator pedal position signals, to automatically select the optimum gear position from the shifting map.

### **2. ENGINE COOPERATIVE CONTROL**

During shifting, the TCM outputs a torque-down requirement signal, and the ECM receives this to retard the ignition timing of each cylinder to temporarily decrease the output torque from the engine. Simultaneously with this control, the TCM constantly monitors the shift sequence through vehicle speed sensors and the turbine speed sensor to perform feedback control and optimize gear shifts. Because of this control, a smooth and comfortable gear shifting is ensured under all conditions.

### **3. ABS COOPERATIVE CONTROL**

When the ABS is operating, the optimum gear speed for the vehicle speed is selected by cooperative operation with the ABSCM to prevent degrading the operation of the ABS.

### **4. CONTROL AT HIGH OIL TEMPERATURES**

If the ATF temperature becomes extremely high, shifting control is performed by automatically switching to a shifting map that is less likely to cause temperature rise.

### **5. CONTROL WHEN ATF OR ENGINE COOLANT TEMPERATURE IS LOW**

When the ATF temperature or engine coolant temperature is extremely low at engine start, etc., shifting control is performed by automatically switching to a shifting map that causes temperature rise easier.

### **6. CONTROL WHEN CRUISE CONTROL IN OPERATION**

When the cruise control is operating, shifting control is performed by automatically switching to a shifting map that is suitable for cruise control.

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

---

### **D: LOCKUP CONTROL**

- The TCM has pre-programmed lockup clutch engagement and disengagement conditions for each gear and shift pattern. The engagement and disengagement conditions are defined in terms of the accelerator pedal position and vehicle speed.
- The TCM controls lockup clutch operation through duty solenoids.

#### **1. NON-LOCKUP OPERATION**

The duty solenoid allows the pilot pressure to be applied to the disengaging end of the valve in the control valve body. The valve then opens the clutch disengaging circuit port to add the lockup operating pressure (torque converter clutch regulating pressure) to the disengaging circuit. Moreover, the valve opens the lockup clutch engaging circuit port and allows the hydraulic fluid in the circuit to flow to the ATF cooler, thus lowering the pressure in the circuit. As a result, the lockup clutch is disengaged due to difference in pressure between both circuits.

This control is performed in all gear positions.

#### **2. LOCKUP OPERATION**

The duty solenoid allows the pilot pressure to be applied to the engaging end of the valve in the control valve body. The valve then opens the clutch engaging circuit port that communicates to the torque converters impeller chamber, allowing high pressure fluid to flow to the lockup clutch. The clutch then engages.

- The TCM controls the current to the duty solenoid by gradually changing the current. As a result, the valve also moves gradually, so the clutch engagement pressure increases smoothly. This causes the lockup clutch to become initially in a half-engaged state and then in a fully engaged state, thus preventing shock during engagement.

This control is performed in all gear positions.

### **E: LINE PRESSURE CONTROL**

The oil pump discharge pressure (line pressure) is controlled by the line pressure linear solenoid and the line pressure is regulated to an optimum level corresponding to the vehicle's running conditions.

#### **1. LINE-PRESSURE CONTROL DURING SHIFTING**

The line pressure is controlled by the TCM as follows to meet varying operating conditions.

- The TCM receives throttle angle signals, and the TCM sends a control signal to the line pressure linear solenoid. The pressure from the line pressure linear solenoid is sent to the valve where the line pressure is regulated. The valve adjusts the oil-pump-generated line pressure to make the line pressure matched to the driving condition.

## F: SHIFT PATTERN SELECTION CONTROL

### 1. ADAPTIVE CONTROL

This control is performed to improve the drivability of the vehicle by optimizing gear shifts in accordance with the driver's intention to accelerate or decelerate, and driving conditions such as hill climbing and descending, etc.

- Shift pattern automatic switching control

This control enables selection of the optimum gear speed by automatically switching the shift pattern by estimating driver's intentions and driving conditions through sensor information such as driving resistance, engine speed, acceleration, vehicle speed, and also from calculated values.

Any of the three patterns NORMAL, SPORTS, and SLOPE are continuously and automatically selected under the following conditions.

D range

NORMAL ↔ SPORTS ↔ SLOPE

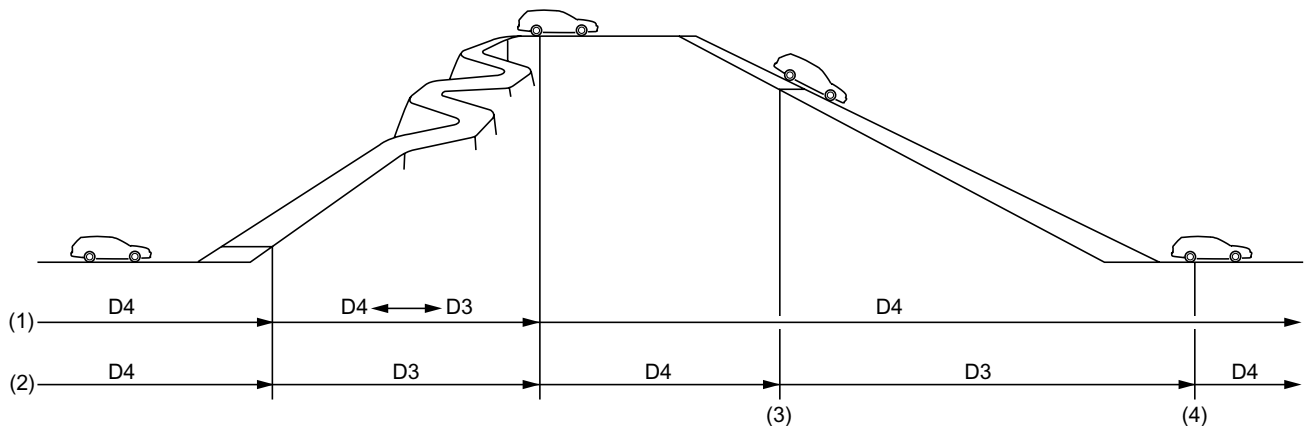
D range, in sports mode

SPORTS ↔ SLOPE

Normal pattern: covers a wide range from normal driving to high speed driving.

Sports pattern: a shift pattern suitable for driving conditions requiring deep accelerator pedal positions, such as winding road driving.

Slope pattern: this shift pattern controls upshifting to prevent too frequent gear shifting during climbing or descending hills. By combining braking control (in sports mode only) (explained later), engine braking will be positively used when descending hills.



AT-00431

(1) Without climbing and descending control

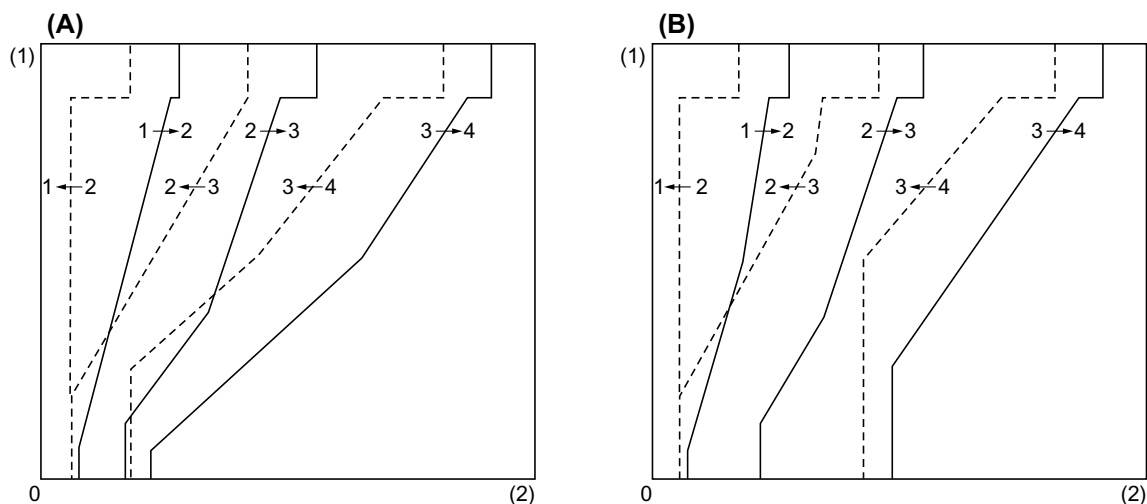
(3) Brake pedal ON

(2) With climbing and descending control

(4) Re-acceleration

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION



AT-00432

**(A)** Base pattern  
(1) Accelerator pedal position

**(B)** Grade control pattern  
(2) Vehicle speed

- Accelerator pedal quick depressing control

When the accelerator pedal is quickly depressed, the TCM interprets this as acceleration is required, and the transmission is downshifted earlier to obtain a greater drive force.

- Accelerator pedal quick return control

When the accelerator pedal is quickly released, the TCM interprets this as deceleration is required, and upshift is prohibited in order to hold the transmission in the current gear speed to prevent frequent shifting and to maintain engine braking effect (operates in sports mode only).

- Braking control

According to the braking force (deceleration) during braking, downshifts are hastened to ensure engine braking effect and obtain a larger driving power for accelerating after braking (operates in sports mode only).

## 2. SPORTS MODE CONTROL

When the shift lever is moved toward the manual gate side in D range, the SPORT light in the combination meter illuminates and the system enters the Sports mode. Gearshift timings are set at higher vehicle and engine speeds to make more use of low speed gears. The full lockup vehicle speed in 4th is also set higher than in the normal mode.

## 3. MANUAL MODE CONTROL

By operating the “+” or “-” switch on the select lever in D range with the sports shift switch ON (in sports mode), the system switches to manual mode. In this state, operating the “+” switch causes upshifting while operating the “-” switch causes downshifting; manual shifting is enabled and the selected gear position is held while driving.

However, at certain vehicle speeds or ATF temperatures, the following inhibiting control is performed.

- Upshift inhibiting and auto downshift control

The gear upshifts each time the “+” switch is operated, however, when the vehicle speed is too low

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

for the selected gear speed, the TCM inhibits further upshifting. If the vehicle speed becomes too slow for the current gear speed, a downshift will be made automatically to prevent engine stall. When the vehicle comes to a stop, the transmission will always be controlled to shift to 1st speed unless the vehicle was in Manual mode 2nd hold control.

- Downshift inhibiting control

The gear downshifts each time the “-” switch is operated, however, when the vehicle speed is too low for the selected gear speed, the TCM inhibits further shifting. A manual shifting inhibiting buzzer will sound to warn the driver.

- Engine over speed prevention control

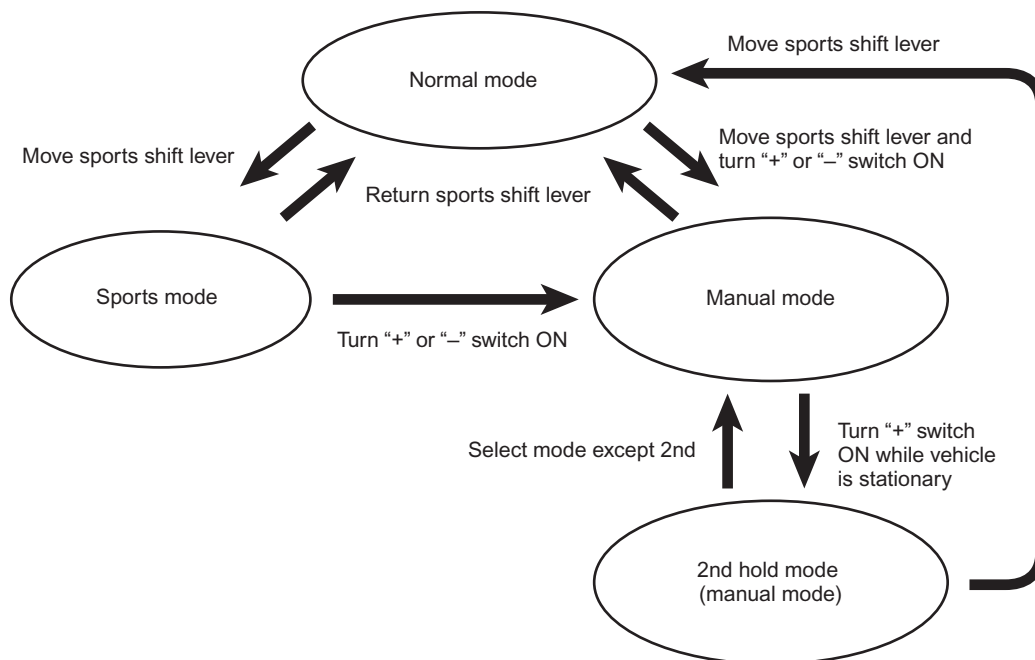
If the engine speed exceeds the preset value during accelerating, the fuel supply is cut to prevent over-revving of the engine.

- Control when the temperature is low or hot

When the ATF temperature is low as in cases such as immediately after start in winter, upshifting to 4th is inhibited to quicken warm up. Upshifting to 4th is also inhibited if the ATF temperature becomes extremely high after severe driving, to prevent further temperature rise.

## 4. 2nd HOLD CONTROL (IN MANUAL MODE)

When the “+” switch is operated when the vehicle is in Manual mode and not moving, the transmission shifts to 2nd speed enabling start in 2nd. This status is held unless the manual mode is canceled, or a speed other than 2nd is selected with the “-” switch. Also, the transmission is held in 2nd when the vehicle is stopped.



AT-02340

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

### 5. ILLUMINATION CONTROL OF VARIOUS INDICATORS

Illuminations of the various indicators on the combination meter are controlled in accordance with the shift pattern selection as shown below.

Status \ Indicator	D ●	SPORT	▲ ▼	1	Operation mode
Normal D range	D ●	SPORT	△ ▽	(extinguished)	Normal mode
In sports mode	D ●	SPORT	△ ▽	(extinguished)	Sports mode
Manual shift mode	D ○	SPORT	▲ ▼	1 — 4	Manual mode

NOTE:  
Indicators printed in solid black show their illuminated status.

AT-02881



## **G: LEARNING CONTROL OF SHIFTING HYDRAULIC PRESSURES**

To constantly ensure excellent shift quality regardless of the variance between friction material and aging, learning control of shifting hydraulic pressures is used.

Learning takes place for every normal shifting under certain conditions, and the learned values are not lost even when the power is turned OFF (or battery's negative terminal disconnected).

## **H: RANGE LOCK CONTROL**

This control prevents the select lever from being moved to the R position when the vehicle is running. Thus damage to components such as the reverse clutch is prevented.

When the specified speed is exceeded the TCM turns off the shift lock solenoid for the select lever. Therefore the range lock control works to inhibit operation from N range to R range, preventing the transmission from put into reverse.

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

### I: CAN COMMUNICATION SIGNALS CONTROL

By interchanging information between control modules such as the TCM, ECM, ABSCM & H/U, etc., the modules are controlled in accordance with the vehicle's driving conditions.

In CAN (Controller Area Network) communication, each control module is connected with 2 lines and a large amount of information is interchanged through such a small number of wiring. Each control module sends and receives information and reads only the necessary information for its own purpose.

#### Main signals sent and received for transmission control

	TCM	ECM	ABSCM&H/U	Body integrated unit	Combination meter
Sports mode switch-cum-manual mode switch signal	IN			OUT	
Upshift signal (manual mode)	IN			OUT	
Downshift signal (manual mode)	IN			OUT	
Brake switch signal	IN			OUT	
ABS signal	IN		OUT		
ENG AT cooperation signal	IN	OUT			
	OUT	IN			
Range position signal	OUT	IN		IN/OUT	IN
AT warning light signal (SPORT indicator light)	OUT			IN/OUT	IN
Sports shift warning buzzer signal	OUT			IN/OUT	IN
AWD warning light signal Also used as FWD indicator light signal	OUT			IN/OUT	IN

IN: received

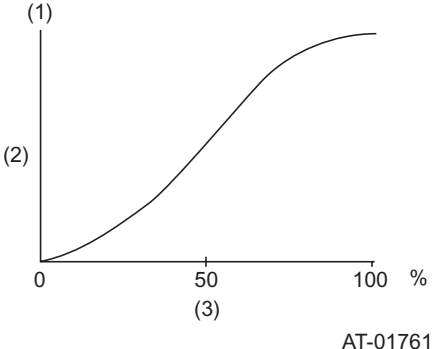
OUT: sent

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## J: AWD TRANSFER CLUTCH CONTROL

### ● Basic control

Type of control	Regulates transfer clutch pressure in response to engine torque, throttle position and vehicle speed.
Gear position	1st thru 4th and reverse
Remarks	<div style="text-align: center;">  <p>AT-01761</p> <p>(1) Ordinary control (2) Transfer clutch capacity (3) Duty-ratio</p> </div>

### ● Slip control

Type of control	Regulates transfer clutch pressure in accordance with the amount of slip.
Gear position	1st thru 4th and reverse
Remarks	Release: Released when the amount of slip becomes smaller than the specified value.

### ● Turning control

Type of control	Decreases transfer clutch pressure upon detection of a turn.
Gear position	1st thru 4th and reverse
Remarks	—

### ● ABS control

Type of control	Regulates to the specified transfer clutch pressure quickly when the ABS signal is input.
Gear position	1st thru 4th and reverse
Remarks	—

### ● P and N range control

Type of control	Regulates to the specified transfer clutch pressure immediately after a P or N range signal is input.
Gear position	P and N
Remarks	—

# ON-BOARD DIAGNOSTICS SYSTEM

## AUTOMATIC TRANSMISSION

### 14. On-board Diagnostics System

#### A: FUNCTION

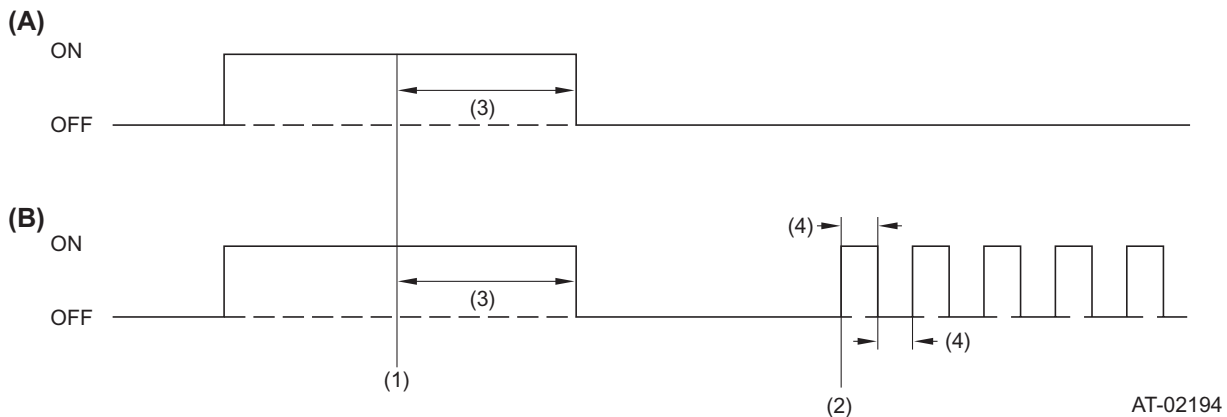
The on-board diagnostics system detects and stores in the form of a code a fault that has occurred in any of the following input and output signal systems.

Rear vehicle speed sensor	High clutch duty solenoid	Sports shift switch
Front vehicle speed sensor	Low & reverse duty solenoid	Engine speed signal
Throttle position sensor	Transfer duty solenoid	Lockup clutch
Line pressure linear solenoid	ATF temperature sensor	Torque converter turbine speed sensor
2-4 brake duty solenoid	CAN communication signal circuit	1, 2, 3, 4, R gear ratios
Lockup duty solenoid	Inhibitor switch	Shift lock solenoid
Low clutch duty solenoid	Brake switch	

If a fault has been detected, the system tells the fault by causing the SPORT indicator light to blink.

#### B: OPERATION OF SPORT INDICATOR LIGHT

On starting the engine, the SPORT indicator light illuminates and then goes out as shown in the Normal diagram below. If any problem exists, the light continues flashing as shown in the Abnormal diagram below.



AT-02194

- (A) When normal
- (B) When abnormal

- (1) Engine cranking
- (2) After abnormality is detected
- (3) 2 seconds
- (4) 0.25 seconds

## 15.Fail-safe Function

The failsafe control function ensures minimum level of drivability even if a fault should occur in the vehicle speed sensors, accelerator pedal position sensor, inhibitor switch, or any of the solenoids.

- Front and rear vehicle speed sensors

A dual speed-sensing system is used. The speed signal is taken from the transmission (by the output shaft speed sensor). Even if one sensor system fails, the vehicle can be controlled normally with the other normally operating sensor system.

- Accelerator pedal position sensor

If the accelerator position sensor becomes faulty, control will be maintained by assuming that the accelerator pedal position is at a certain angle.

- Inhibitor switch

If the TCM receives different signals simultaneously from a faulty inhibitor switch, it selects a range in the following priority:

D > R > N > P

- Line pressure linear solenoid

If the line pressure linear solenoid system fails, the solenoid is de-energized and the line pressure is raised to the maximum to enable the vehicle to operate.

- Lockup duty solenoid

If the lockup duty solenoid system fails, the solenoid is de-energized and the lockup clutch is disengaged.

- Transfer duty solenoid

When the transfer duty solenoid system becomes faulty, it is de-energized. This causes oil pressure to the transfer clutch to be interrupted and no power is transmitted to the rear axle. (FWD state)

- 2-4 brake duty solenoid

If a fault occurs in the 2-4 brake duty solenoid system, the solenoid is de-energized and the gears are limited to the 2nd or 3rd.

- Low clutch duty solenoid

If a fault occurs in the low clutch duty solenoid system, the solenoid is de-energized and the gears are limited to the 3rd or 4th.

- High clutch duty solenoid

If a fault occurs in the high clutch duty solenoid system, the solenoid is de-energized and the gears are limited to the 2nd or 3rd.

- Torque converter turbine speed sensor

If a fault occurs in the torque converter turbine speed sensor, the gears are limited to the 3rd speed.

- Low & reverse duty solenoid

If a fault occurs in the low and reverse duty solenoid system, the solenoid is de-energized and the gears are limited to the 1st.

# TRANSMISSION MOUNTING

AUTOMATIC TRANSMISSION

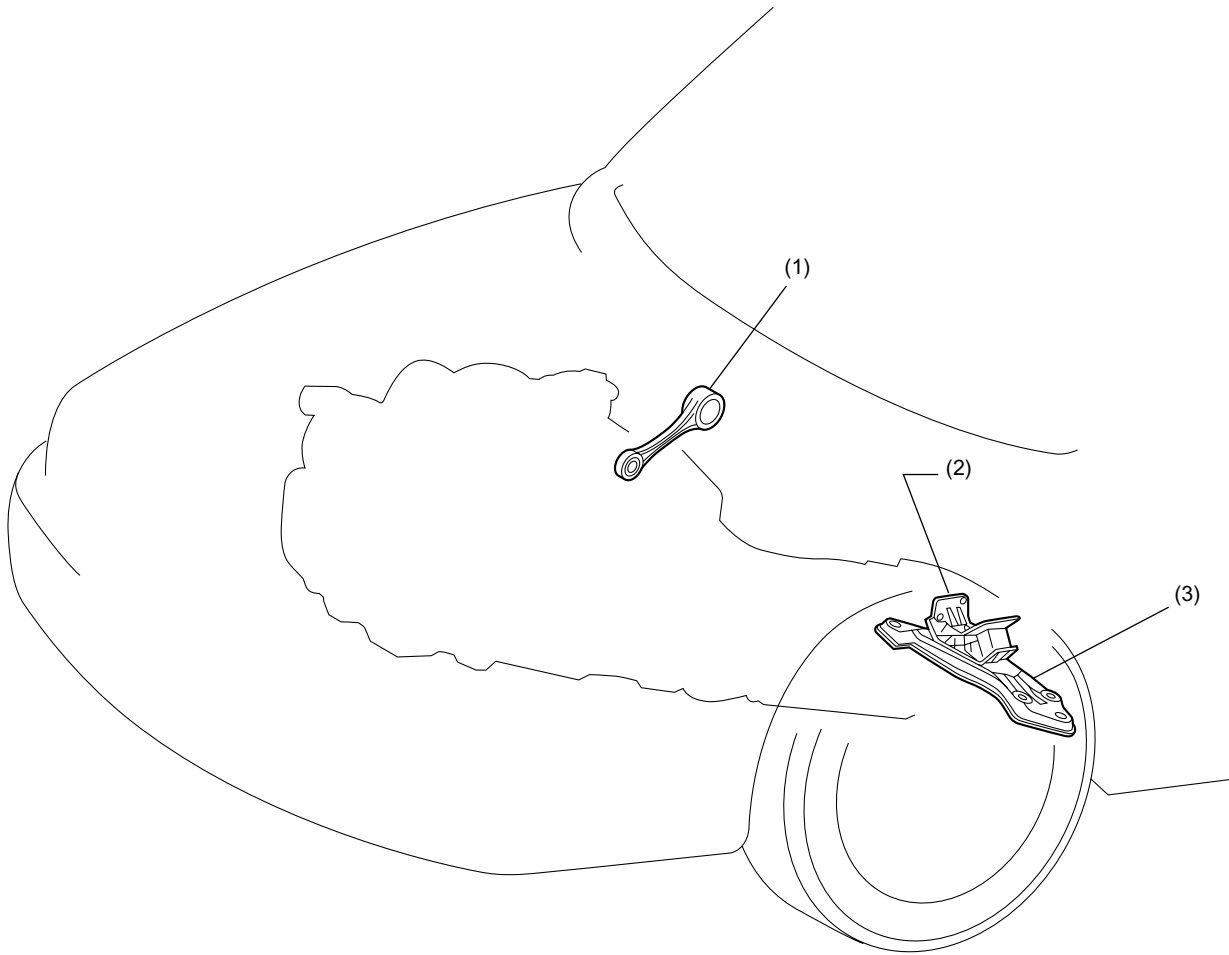
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## 16. Transmission Mounting

### A: GENERAL

The transmission mounting consists of a pitching stopper, cushion rubber, and a cross member.

In addition to support the transmission, these components absorb noise and vibration caused by the transmission.



AT-00438

- (1) Pitching stopper
- (2) Cushion rubber
- (3) Cross member

### 1. General

To improve the dynamic performance and fuel efficiency of the vehicle, a new 5-speed automatic transmission is developed. The features of this new automatic transmission are as follows:

#### A: NEW CONSTRUCTION

- The planetary gears layout has been changed from the conventional 2-planetary to a 3-planetary arrangement.
- The construction of the torque converter has been changed to achieve a higher efficiency.
- The layout of the oil pump has been changed to reduce friction.
- The drive pinion gear has been changed.
- Major components are made of aluminum.

#### B: CHANGES FOR BETTER DRIVING PERFORMANCE

##### 1. IMPROVED SHIFTING PERFORMANCE

- By using a wide ranged and crossed ratio gears, a high driving power is ensured at a wide vehicle speed range, and the torque differential between before and after shifting is minimized.
- By using a system that controls the clutch pressure directly and electronically (direct hydraulic control), an accurate and highly responsive control is achieved.
- By using a one-way clutch, smooth shifting without torque interruption is realized.
- By using a new adaptive control, the shifting map is automatically switched and a more active shifting control is performed in the manual mode.
- The control enables manual shifting by operating the steering switch to UP or DOWN while driving in D range, and returns to normal automatic shifting when certain conditions are met.
- To reduce gear noise from the reduction driven gear and prevent the bending moment of the drive pinion shaft from affecting the engagement of reduction gears, the front and rear ends are supported with bearings.
- To reduce driving noise, the drive shafts and joints are integrated and the transmission side drive axle shaft is abolished.

## **C: MODIFICATION MADE FOR BETTER FUEL EFFICIENCY**

### **1. OPTIMIZED GEAR RATIO**

- The wider gear ratio range obtained by five speeds contribute to better dynamic performance, while improving fuel efficiency at constant speed cruising by enabling use of lower engine speeds.

### **2. IMPROVED EFFICIENCY**

- The efficiency of the torque converter has been increased.
- Friction in the oil pump and gear train are reduced.
- Drive pinion gear teeth are changed to uniform height teeth, and their offset amount is reduced.
- Ranges in which the transmission operates in slipping lockup and full lockup states are widened.

### **3. WEIGHT REDUCTION**

- An aluminum bearing plate is used.
- The planetary carrier, clutch drum and the hub are made of aluminum.
- The wall thickness of the transmission case is reduced.

## **D: CONVENTIONAL MECHANISMS**

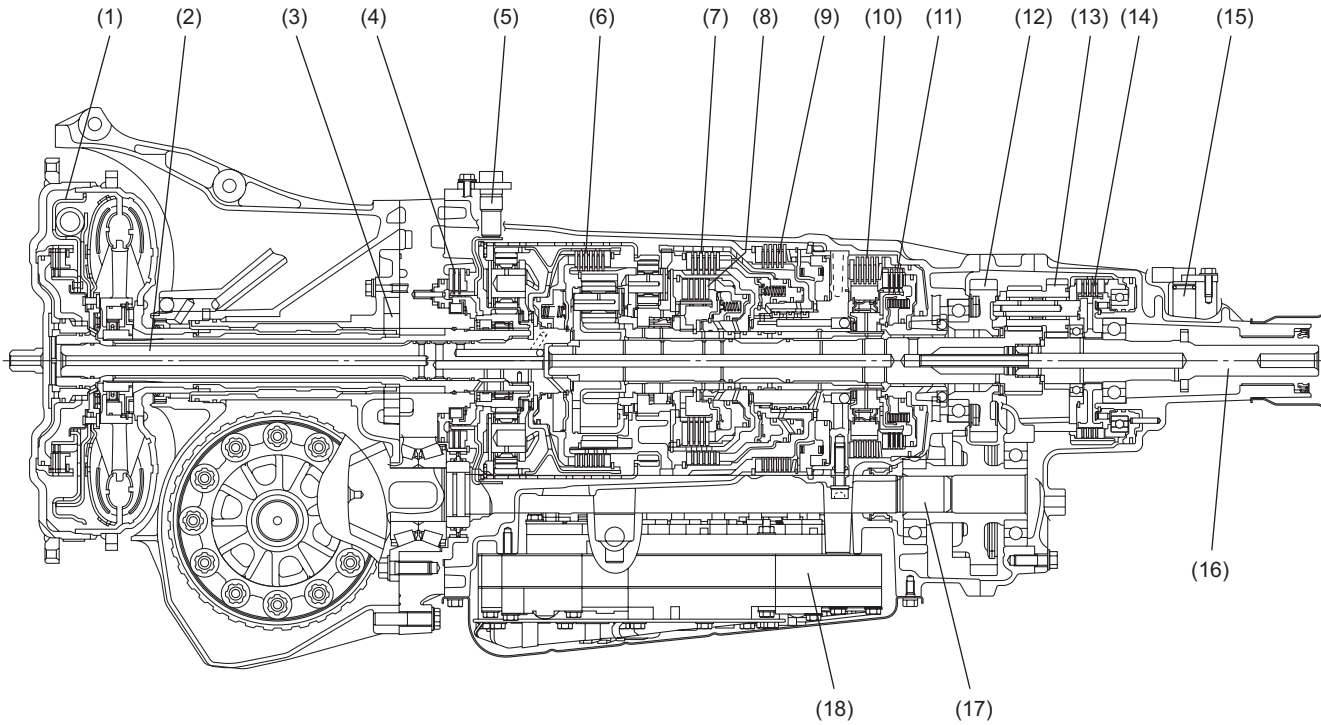
- The transfer is provided with a VTD (Variable Torque Distribution) system which consists of a planetary gear type center differential and a hydraulic multi-plated LSD, to electronically control the differential operation and improve safety and drivability.



# CROSS SECTIONAL VIEW

## AUTOMATIC TRANSMISSION

### 2. Cross Sectional View



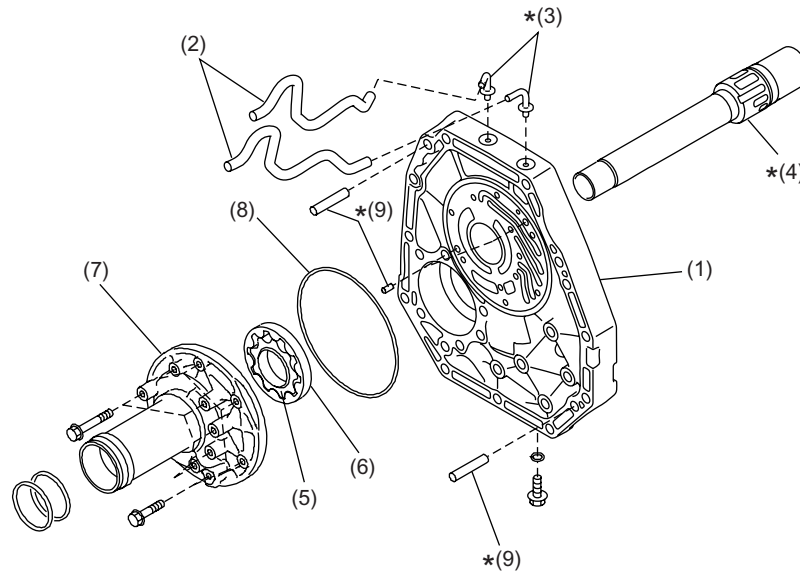
AT-02812

- |                                 |   |
|---------------------------------|---|
| (1) Torque converter assembly   | (10) Forward brake                      |
| (2) Input shaft                 | (11) Low coast brake                    |
| (3) Oil pump                    | (12) Reduction gear                     |
| (4) Front brake                 | (13) Variable torque distribution (VTD) |
| (5) Turbine speed sensor 1      | (14) Transfer clutch                    |
| (6) Input clutch                | (15) Rear vehicle speed sensor          |
| (7) Direct clutch               | (16) Rear drive shaft                   |
| (8) High and low reverse clutch | (17) Drive pinion shaft                 |
| (9) Reverse brake               | (18) Control valve                      |

## 3. Oil Pump

### A: CONSTRUCTION

The pump consists of a inner-teeth type rotor, oil pump housing, and an oil pump cover. The inner rotor has nine teeth and the outer rotor has ten teeth.



AT-02066

- |                       |                                       |
|-----------------------|---------------------------------------|
| (1) Oil pump cover    | (6) Outer rotor                       |
| (2) Air breather hose | (7) Oil pump housing                  |
| (3) Nipple            | (8) O-ring                            |
| (4) Stator shaft      | (9) Straight pin                      |
| (5) Inner rotor       | * : Parts that cannot be disassembled |

### B: OPERATION

The inner rotor is connected to the engine crankshaft via a oil pump shaft, impeller side of the torque converter, and drive plate; when the inner rotor turns the outer rotor also turns.

Since the number of teeth on the inner rotor and outer rotor are not the same, a space is formed between the inner rotor and outer rotor and its capacity changes as the rotors turn. Oil is drawn in when the capacity is large and is compressed and discharged when the capacity becomes smaller.

# FRONT BRAKE

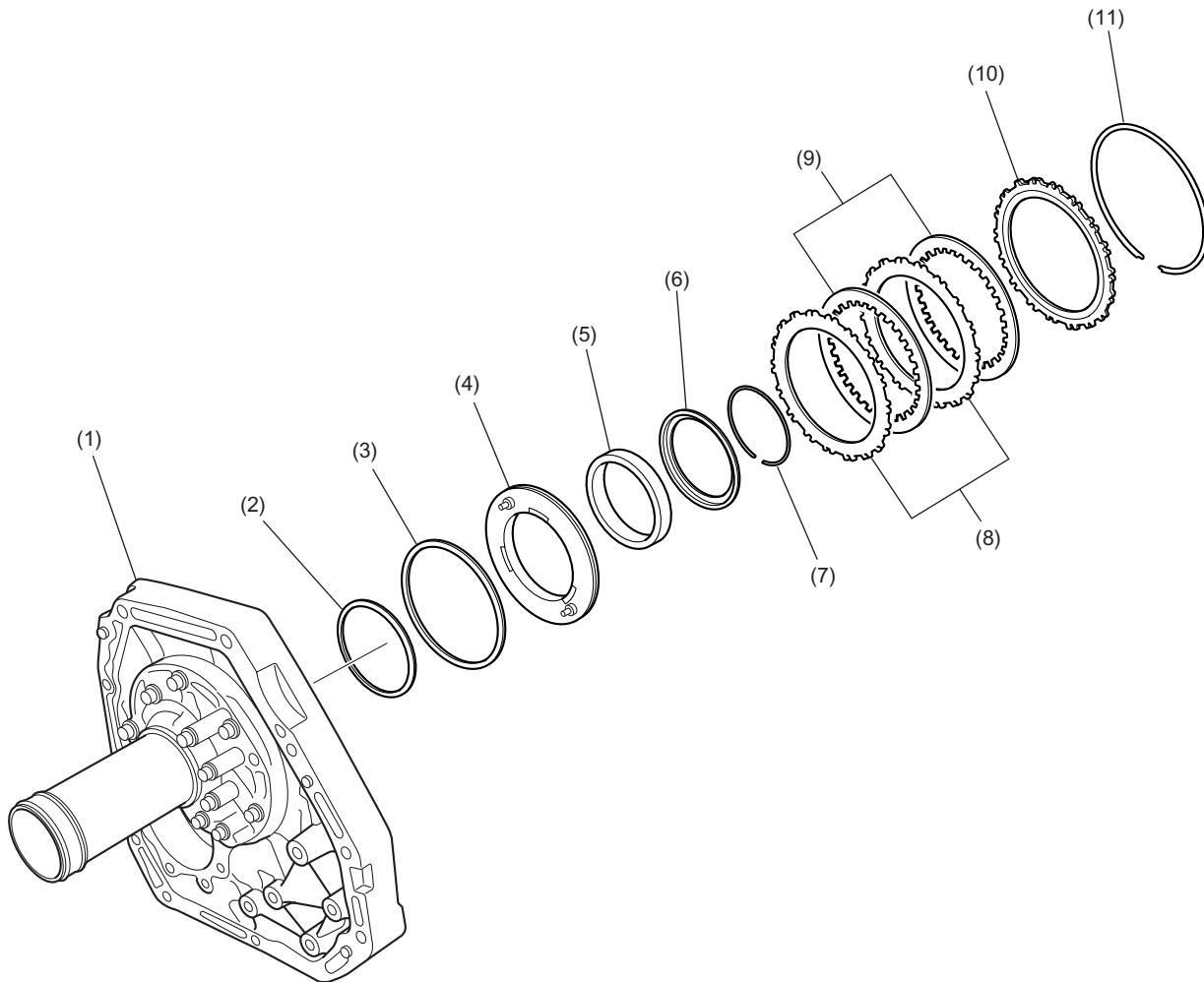
AUTOMATIC TRANSMISSION

## 4. Front Brake

### A: CONSTRUCTION

The front brake consists of a front brake piston, return spring, drive plates, driven plates, and a retaining plate.

This brake engages to lock the front sun gear when engine braking is used in the 1st, 2nd and 3rd speeds and in the 5th speed and reverse range.



AT-01560

- (1) Oil pump housing
- (2) D-ring (inner)
- (3) D-ring (outer)
- (4) Front brake piston

- (5) Return spring
- (6) Retainer
- (7) Snap ring
- (8) Driven plate

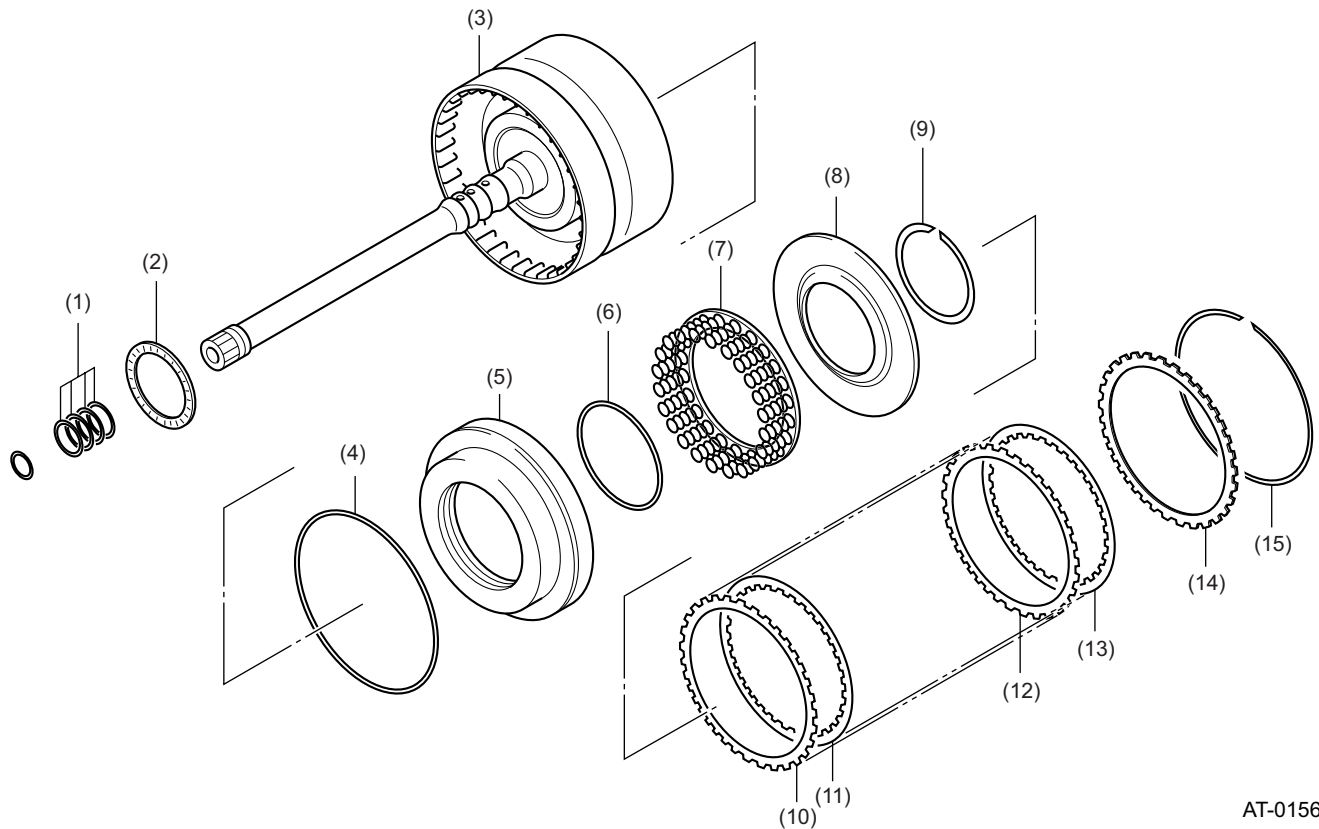
- (9) Drive plate
- (10) Retaining plate
- (11) Snap ring

## 5. Input Clutch

### A: CONSTRUCTION

The input clutch consists of an input clutch piston, retainer spring, drive plates, driven plates, and a retaining plate.

This clutch engages to connect the front internal gear and mid internal gear in the 4th and 5th speeds.



AT-01561

- |                         |                    |                      |
|-------------------------|--------------------|----------------------|
| (1) Seal ring           | (6) D-ring (inner) | (11) Drive plate     |
| (2) Thrust bearing      | (7) Return spring  | (12) Driven plate    |
| (3) Input clutch drum   | (8) Cover          | (13) Drive plate     |
| (4) D-ring (outer)      | (9) Snap ring      | (14) Retaining plate |
| (5) Input clutch piston | (10) Driven plate  | (15) Snap ring       |

# DIRECT CLUTCH

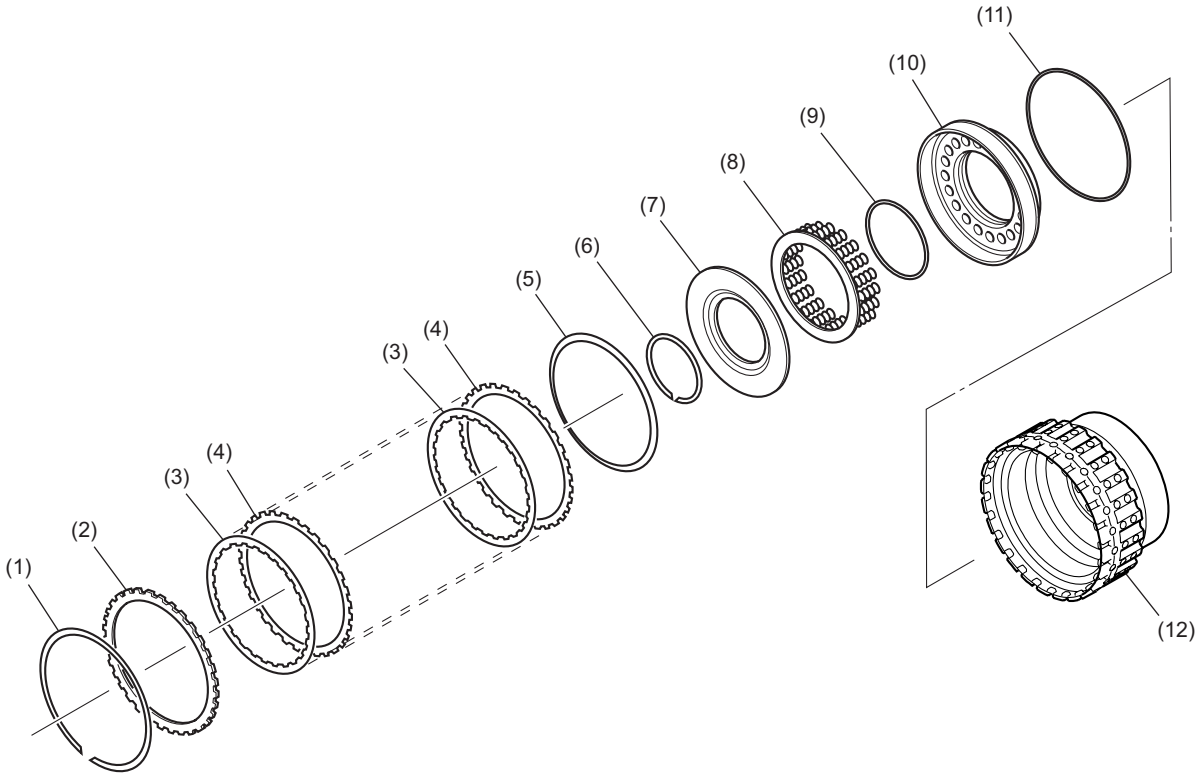
## 6. Direct Clutch

### A: CONSTRUCTION

The direct clutch consists of a direct clutch piston, retainer spring, drive plates, driven plates, and a retaining plate.

This clutch engages to connect the rear carrier and rear sun gear in the 2nd, 3rd and 4th speeds.

(The direct clutch cannot be disassembled.)



AT-01562

- (1) Snap ring
- (2) Retaining plate
- (3) Drive plate
- (4) Driven plate

- (5) Dish plate
- (6) Snap ring
- (7) Cover
- (8) Return spring

- (9) D-ring (inner)
- (10) Direct clutch piston
- (11) D-ring (outer)
- (12) Direct clutch drum

## 7. High and Low Reverse Clutch

### A: CONSTRUCTION

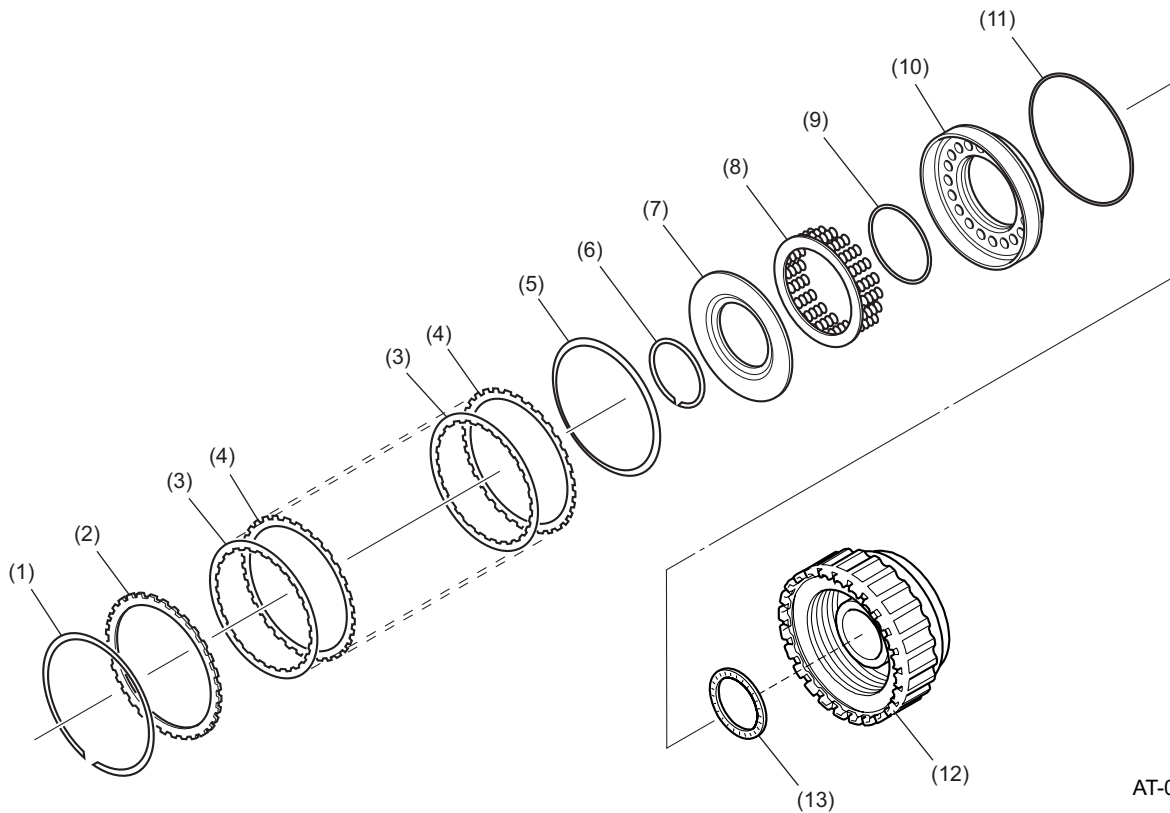
The high and low reverse clutch consists of a high and low reverse clutch piston, retainer spring, drive plate, driven plate, and a retaining plate.

This clutch engages to fix the mid sun gear with the rear sun gear in the 3rd, 4th and 5th speeds.

It also fix the mid sun gear and rear sun gear when engine braking is used in 1st speed.

In reverse, the mid sun gear and rear sun gear are connected.

(The high & low reverse clutch cannot be disassembled.)



AT-01563

- (1) Snap ring
- (2) Retaining plate
- (3) Drive plate
- (4) Driven plate
- (5) Dish plate

- (6) Snap ring
- (7) Cover
- (8) Return spring
- (9) D-ring (inner)
- (10) High and low clutch piston

- (11) D-ring (outer)
- (12) High and low clutch drum
- (13) Thrust bearing

# REVERSE BRAKE

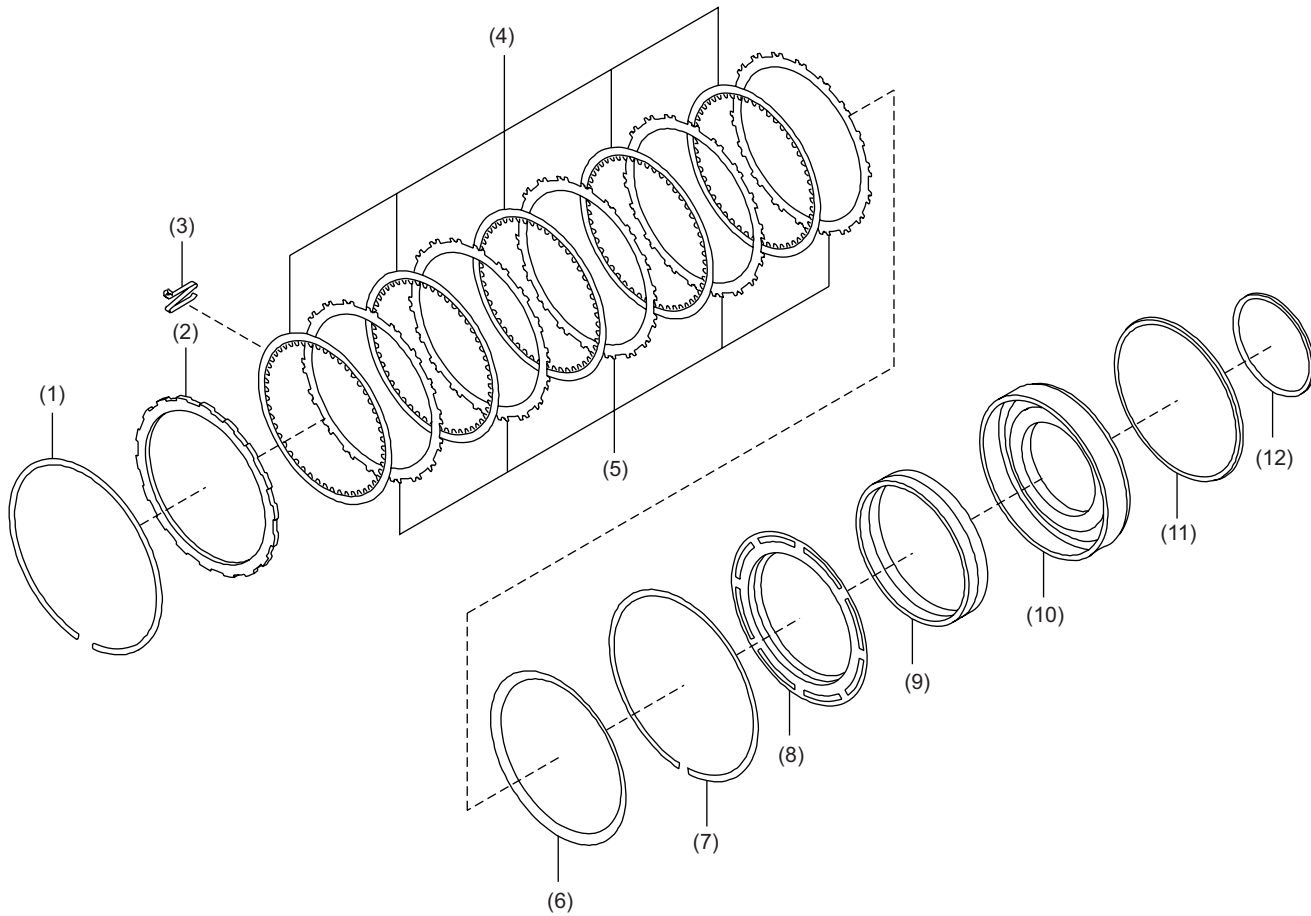
## AUTOMATIC TRANSMISSION

### 8. Reverse Brake

#### A: CONSTRUCTION

The reverse brake which consists of a reverse brake piston, return spring, dish plate, drive plates, driven plates and retaining plate, is placed in a housing formed in the transmission case.

This brake fixes the rear carrier in reverse range.



AT-01564

- (1) Snap ring
- (2) Retainer plate
- (3) Leaf spring
- (4) Drive plate

- (5) Driven plate
- (6) Dish plate
- (7) Snap ring
- (8) Retainer

- (9) Return spring
- (10) Reverse brake piston
- (11) D-ring (outer)
- (12) D-ring (inner)

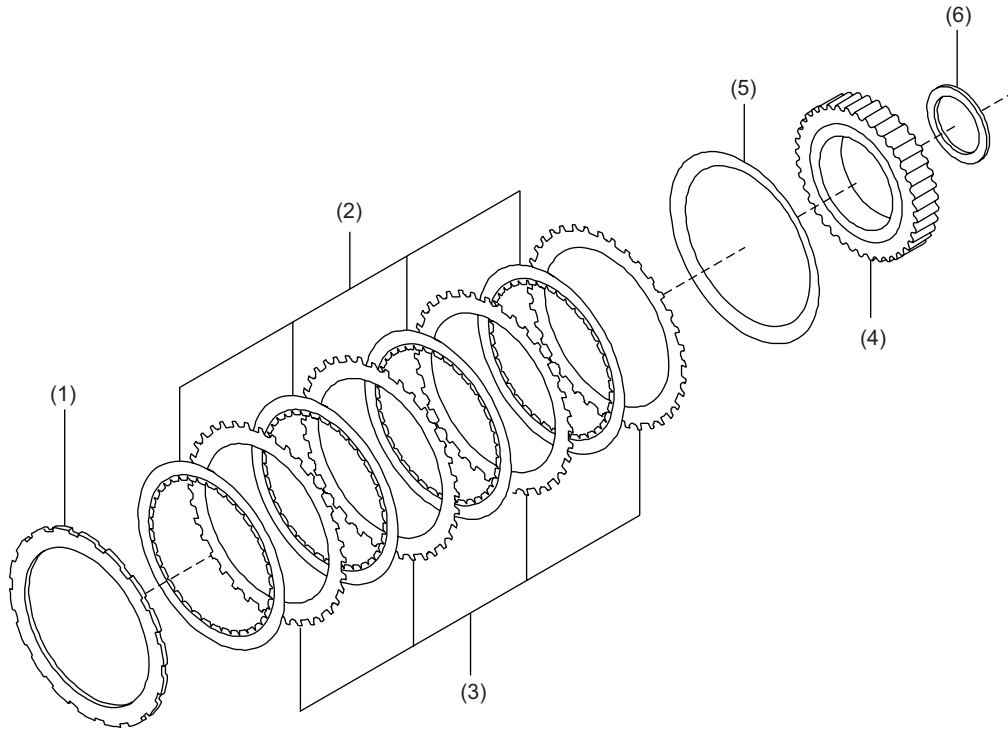
## 9. Forward Brake

### A: CONSTRUCTION

The forward brake consists of a forward brake hub, forward brake piston, dish plate, drive plates, driven plates, and a retaining plate.

The forward brake restricts the reverse rotation of the mid sun gear in 1st and 2nd speeds.

(The forward brake cannot be disassembled.)



AT-01565

- (1) Retainer plate
- (2) Drive plate
- (3) Driven plate

- (4) Forward brake hub
- (5) Dish plate
- (6) Thrust bearing



### **10.Low Coast Brake**

#### **A: CONSTRUCTION**

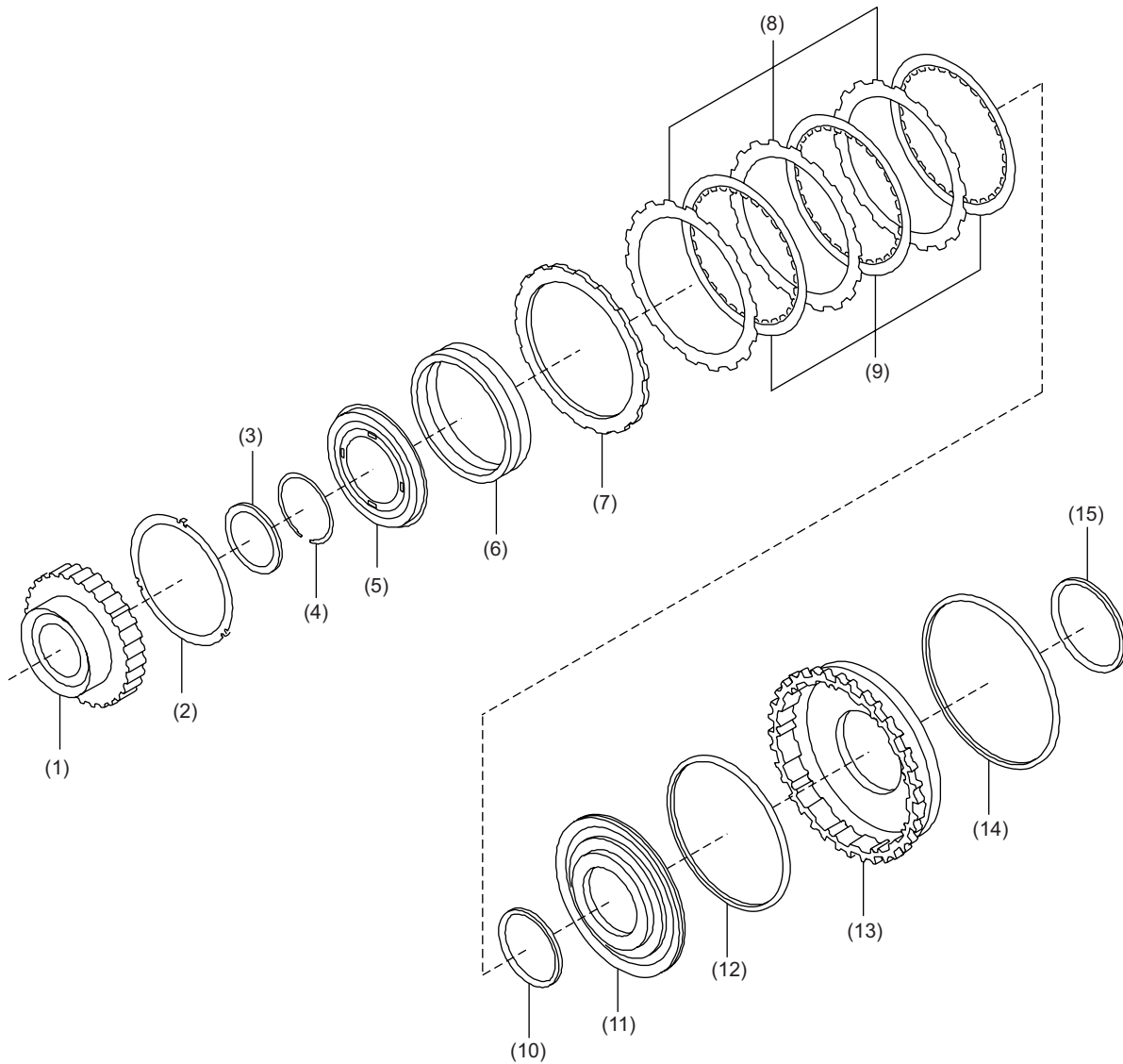
The low coast brake consists of a low coast brake hub, low coast piston, drive plates, driven plates, and a retaining plate.

The low coast brake restricts the reverse rotation of the mid sun gear when engine braking is used in 1st and 2nd speeds of the manual mode.

(The low coast brake cannot be disassembled.)

# LOW COAST BRAKE

AUTOMATIC TRANSMISSION



AT-01566

- (1) Low coast brake hub
- (2) Washer
- (3) Thrust bearing
- (4) Snap ring
- (5) Retainer

- (6) Return spring
- (7) Retainer plate
- (8) Driven plate
- (9) Drive plate
- (10) D-ring (inner)

- (11) Low coast brake piston
- (12) D-ring (outer)
- (13) Forward brake piston
- (14) D-ring (outer)
- (15) D-ring (inner)

# CONTROL VALVE

## AUTOMATIC TRANSMISSION

### 11. Control Valve

The control system of the automatic transmission consists of an oil pump, valve bodies containing valves, clutches, and fluid passages. The operation of the system is controlled by driver's manual inputs and electrical inputs from the TCM.

#### A: FUNCTION

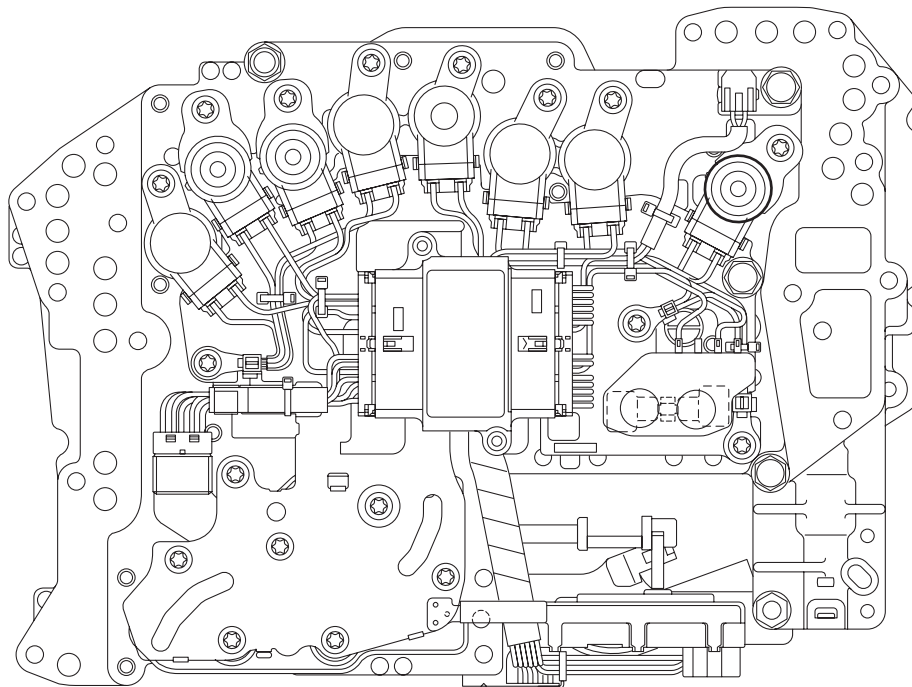
Name	Function
<ul style="list-style-type: none"> <li>• Torque converter regulator valve</li> </ul>	Regulates the line pressure to an optimum level (torque converter operating pressure) to prevent excessive torque converter supply pressure.
<ul style="list-style-type: none"> <li>• Pressure regulator valve</li> <li>• Pressure regulator plug</li> <li>• Pressure regulator sleeve</li> </ul>	Regulates the pressure of oil discharged from the oil pump to an optimum level (line pressure) which is suitable for the vehicle's running condition.
<ul style="list-style-type: none"> <li>• Front brake control valve</li> </ul>	Regulates the line pressure to an optimum level (front brake pressure) when the front brake is engaged, and supplies this pressure to the front brake. (regulates clutch pressure in 1st, 2nd, 3rd and 5th speeds)
<ul style="list-style-type: none"> <li>• Accumulator control valve</li> </ul>	Regulates the pressure to the accumulator piston and low coast reducing valve (accumulator control pressure) in accordance with the vehicle's running condition.
<ul style="list-style-type: none"> <li>• Pilot valve A</li> </ul>	Regulates the line pressure to create a constant pressure (pilot pressure) necessary for line pressure control, gear shift control, and lockup control.
<ul style="list-style-type: none"> <li>• Pilot valve B</li> </ul>	Regulates the line pressure to create a constant pressure (pilot pressure) necessary for gear shift control.
<ul style="list-style-type: none"> <li>• Low coast brake switch valve</li> </ul>	Supplies line pressure to the low coast brake reducing valve when engine braking is used.
<ul style="list-style-type: none"> <li>• Low coast brake reducing valve</li> </ul>	Regulates the line pressure to an optimum level (low coast brake pressure) when the low coast brake is engaged, and supplies this pressure to the low coast brake.
<ul style="list-style-type: none"> <li>• N-R accumulator</li> </ul>	Builds a shelf-pressure when N-R is selected.
<ul style="list-style-type: none"> <li>• Direct clutch piston switching valve</li> </ul>	Operates in 4th speed and switches the engaging capacity of the direct clutch.
<ul style="list-style-type: none"> <li>• High and low reverse clutch control valve</li> </ul>	Regulates the line pressure to an optimum level (high and low reverse clutch pressure) when the high and low reverse clutch is engaged, and supplies this pressure to the high and low reverse clutch. (regulates clutch pressure in 1st, 2nd, 4th and 5th speeds)
<ul style="list-style-type: none"> <li>• Input clutch control valve</li> </ul>	Regulates the line pressure to an optimum level (input clutch pressure) when the input clutch is engaged, and supplies this pressure to the input clutch. (regulates clutch pressure in 4th and 5th speeds)
<ul style="list-style-type: none"> <li>• Direct clutch control valve</li> </ul>	Regulates the line pressure to an optimum level (direct clutch pressure) when the direct clutch is engaged, and supplies this pressure to the direct clutch. (regulates clutch pressure in 2nd, 3rd and 4th speeds)
<ul style="list-style-type: none"> <li>• Lockup control valve</li> <li>• Lockup control plug</li> <li>• Lockup control sleeve</li> </ul>	Engages or releases lockup. It also provides a smooth lockup by performing lockup gradually.
<ul style="list-style-type: none"> <li>• Torque converter lubrication valve</li> </ul>	Operates when lockup is engaged and switches the oil passages of the torque converter, cooling and lubrication systems.
<ul style="list-style-type: none"> <li>• Cooler bypass valve</li> </ul>	Detours excessive cooler circuit oil.
<ul style="list-style-type: none"> <li>• Line pressure relief valve</li> </ul>	Drains excessive line pressure circuit oil.
<ul style="list-style-type: none"> <li>• N-D accumulator</li> </ul>	Builds a shelf-pressure when N-D is selected.
<ul style="list-style-type: none"> <li>• Manual valve</li> </ul>	Delivers line pressure to the circuits according to the selected position. Circuits, which are not delivered with line pressure becomes drain.

# CONTROL VALVE

AUTOMATIC TRANSMISSION

Name	Function
• Front brake hydraulic switch	Monitors front brake oil pressure and lets the system enter the fail safe mode if abnormality is found.
• Low coast brake hydraulic switch	Monitors low coast brake oil pressure and lets the system enter the fail safe mode if abnormality is found.
• Input clutch hydraulic switch	Monitors input clutch oil pressure and lets the system enter the fail safe mode if abnormality is found.
• Direct clutch hydraulic switch	Monitors direct clutch oil pressure and lets the system enter the fail safe mode if abnormality is found.
• High and low reverse clutch hydraulic switch	Monitors high and low reverse clutch oil pressure and let the system enter the fail safe mode if abnormality is found.

## B: ARRANGEMENT



AT-01551

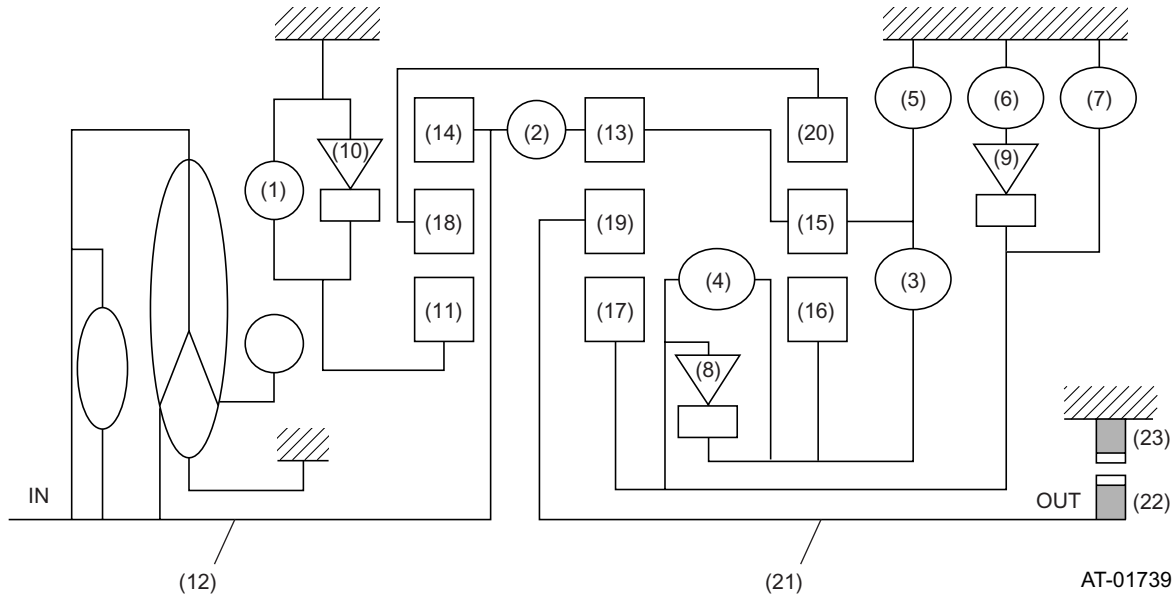
# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 12.Gear Train

#### A: CONSTRUCTION

The gear train consists of three sets of planetary gears, three sets of multi-plate clutches, four sets of multi-plate brakes and three set of one-way clutches.



- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## B: OPERATION

### 1. OPERATION TABLE

		Input clutch	High & low reverse clutch	Direct clutch	Reverse brake	Front brake	Low coast brake	Forward brake	1st one-way clutch	Forward one-way clutch	3rd one-way clutch	
Select lever position	P		△			△						
	R		○		○	○			◎		◎	
	N		△				△					
	D	1st		△*			△	△*◇*	○	◎	◎	◎
		↑↓ 2nd			○		△	◇*	○		◎	◎
		↑↓ 3rd		○	○		○		△	◇		◎
		↑↓ 4th	○	○	○				△	◇		
↑↓ 5th		○	○			○		△	◇		◇	

- : Engaged
- ◎ : Participates in torque transmission only when driven
- ◇ : Participates in torque transmission only when coasting
- ◇\* : Engaged in sports mode
- △ : Engaged but no effect to output
- △\* : Engaged when vehicle speed is within certain range

AT-02094

### 2. N RANGE

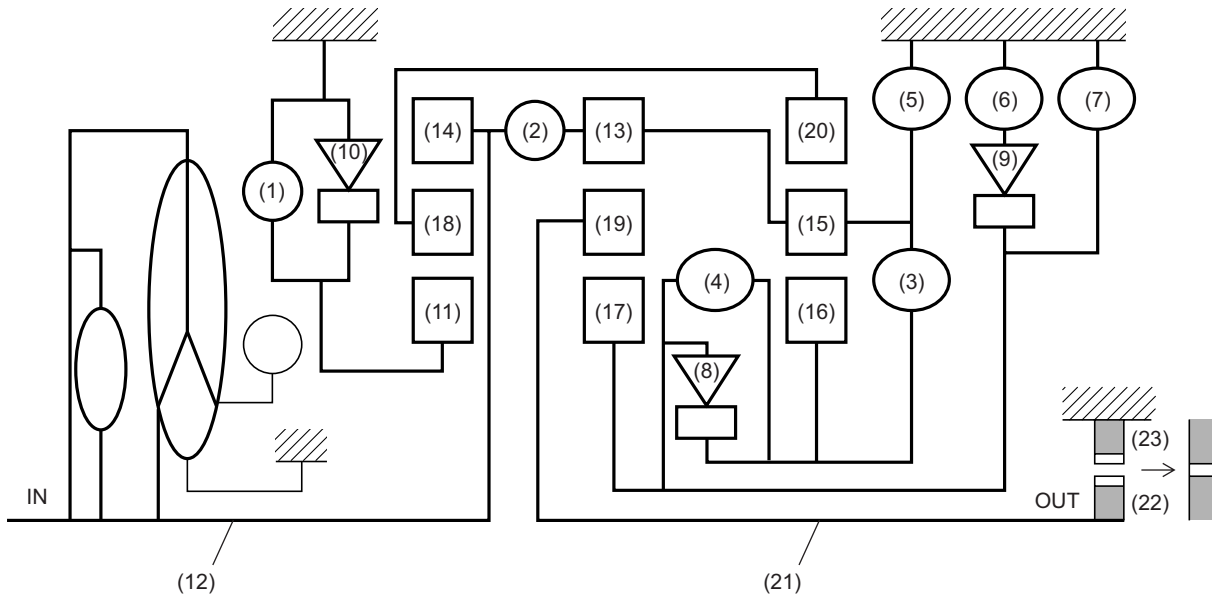
Since the forward and reverse brakes are disengaged, driving power from the input shaft is not transmitted to the output shaft.

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 3. P RANGE

- Since the forward and reverse brakes are disengaged as in the N range, driving power from the input shaft is not transmitted to the output shaft.
- The parking pawl, which is linked with the selector lever engages with the parking gear and mechanically holds the output shaft.

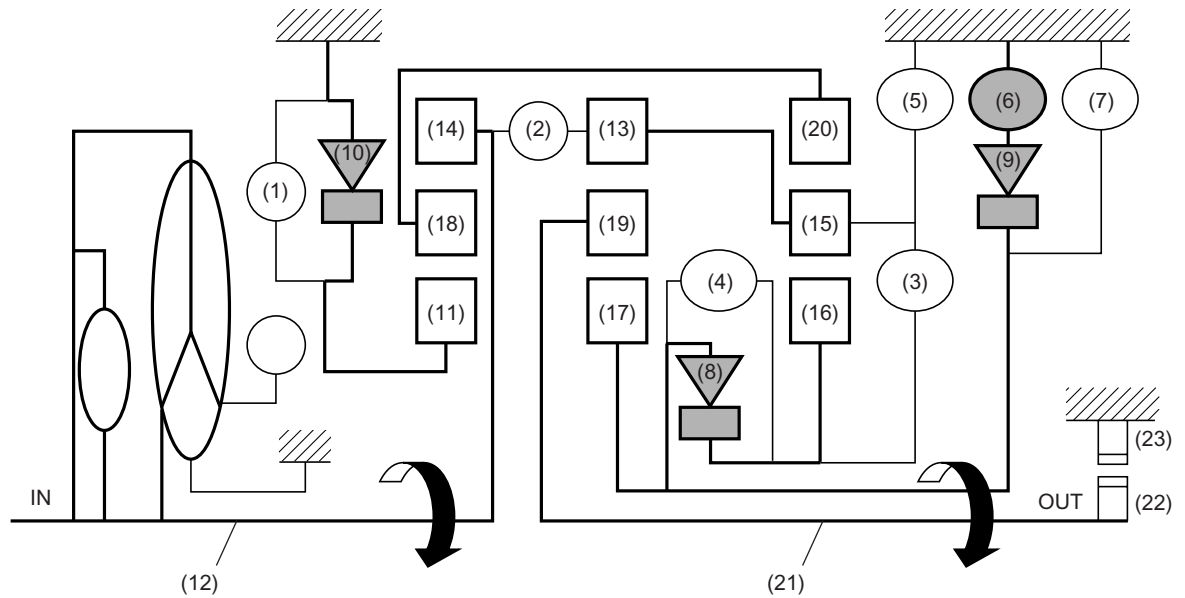


AT-01741

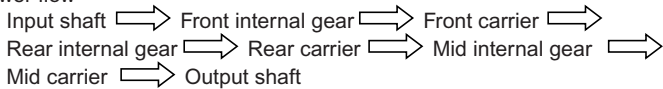
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## 4. 1st SPEED GEAR OF D RANGE

- The forward brake and forward one-way clutch operates to control the reverse rotation of the mid sun gear.
- The 1st one-way clutch operates to control the reverse rotation of the rear sun gear.
- The 3rd one-way clutch operates to control the reverse rotation of the front sun gear.
- As the mid sun gear spins during deceleration, the forward one-way clutch spins and engine braking effect will not be available.



Power flow



AT-01929

- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

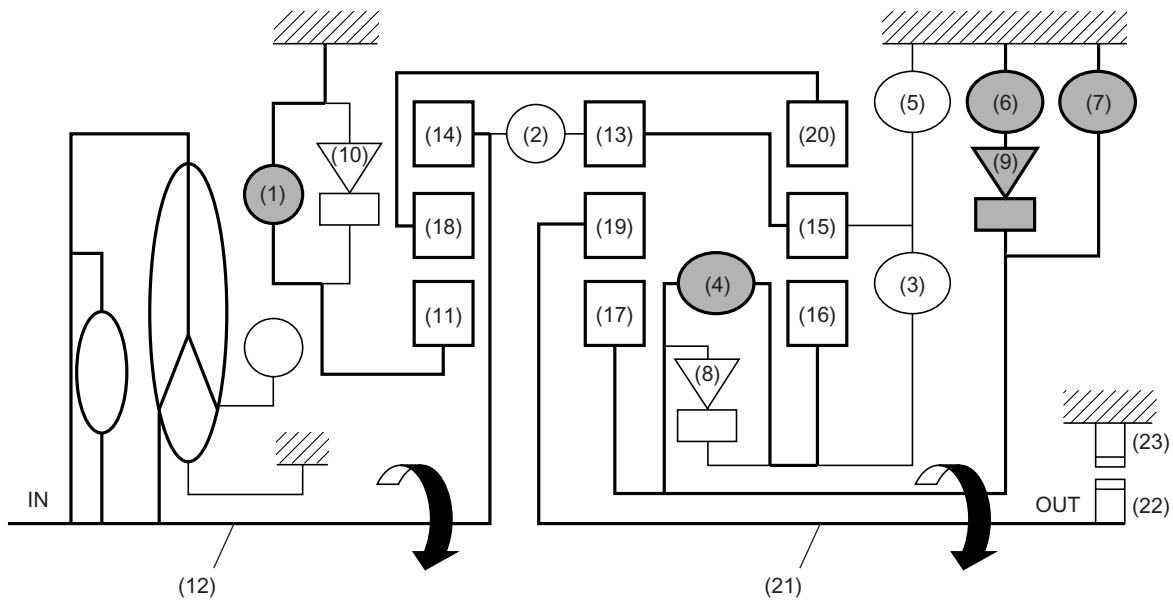


# GEAR TRAIN

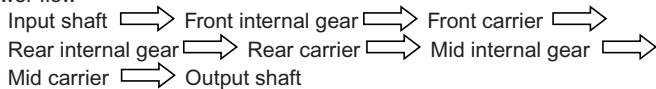
## AUTOMATIC TRANSMISSION

### 5. 1st SPEED GEAR OF MANUAL MODE

- The front brake operates to hold the front sun gear.
- The forward brake and forward one-way clutch operates to control the reverse rotation of the mid sun gear.
- The high and low reverse clutch operates to engage the rear sun gear and the mid sun gear.
- The low coast brake operates to hold the mid sun gear.
- During deceleration, the low coast brake controls the reverse rotation of the mid sun gear and engine braking effect will be available.



#### Power flow

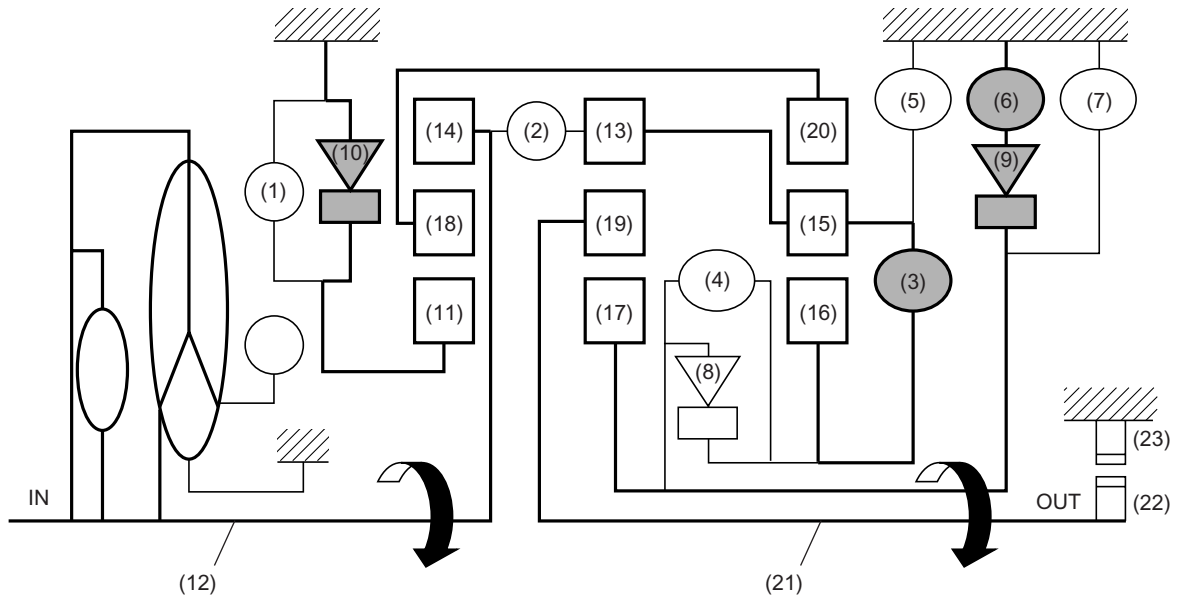


AT-01934

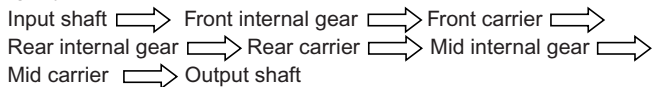
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## 6. 2nd SPEED GEAR OF D RANGE

- The forward brake and forward one-way clutch operates to control the reverse rotation of the mid sun gear.
- The 3rd one-way clutch operates to control the reverse rotation of the front sun gear.
- The direct clutch engages to connect the rear carrier and rear sun gear.
- As the mid sun gear spins during deceleration, the forward one-way clutch spins and engine braking effect will not be available.



Power flow



AT-01939

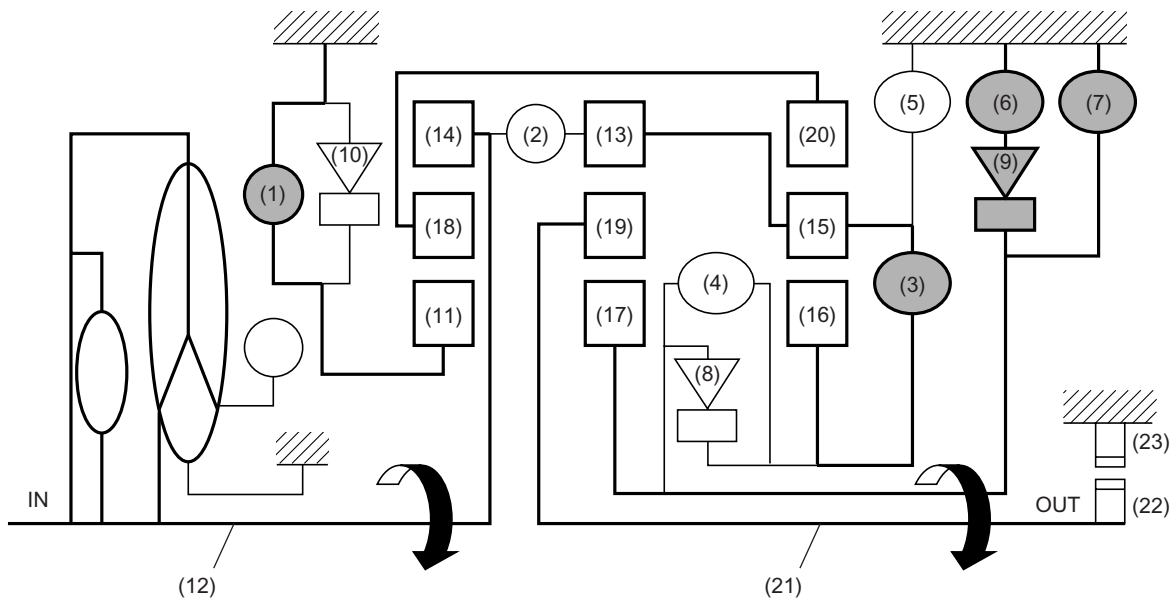
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

# GEAR TRAIN

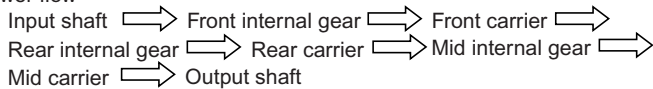
## AUTOMATIC TRANSMISSION

### 7. 2nd SPEED GEAR OF MANUAL MODE

- The front brake operates to hold the front sun gear.
- The forward brake and forward one-way clutch operates to control the reverse rotation of the mid sun gear.
- The direct clutch engages to connect the rear carrier and rear sun gear.
- The low coast brake operates to hold the mid sun gear.
- During deceleration, the low coast brake controls the reverse rotation of the mid sun gear and engine braking effect will be available.



#### Power flow

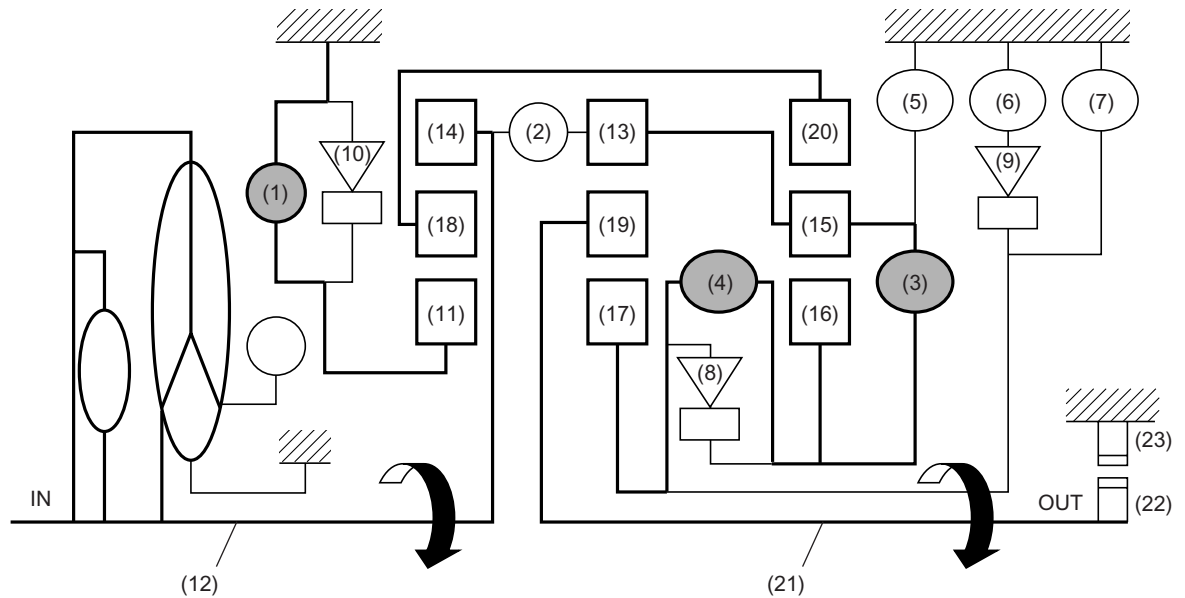


AT-01944

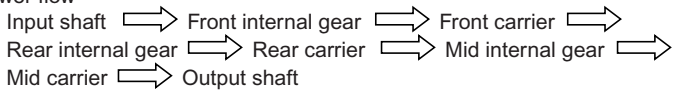
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## 8. 3rd SPEED GEAR OF D RANGE OR MANUAL MODE

- The front brake operates to hold the front sun gear.
- The direct clutch engages to connect the rear carrier and rear sun gear.
- The high and low reverse clutch engages to connect the mid sun gear and rear sun gear.



Power flow



AT-01949

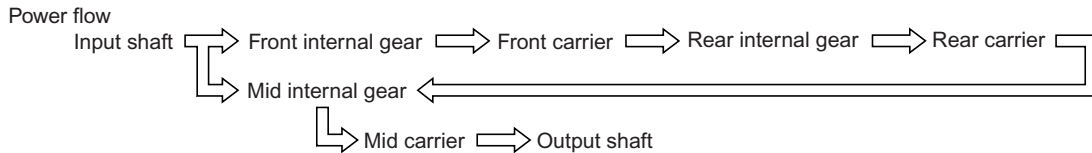
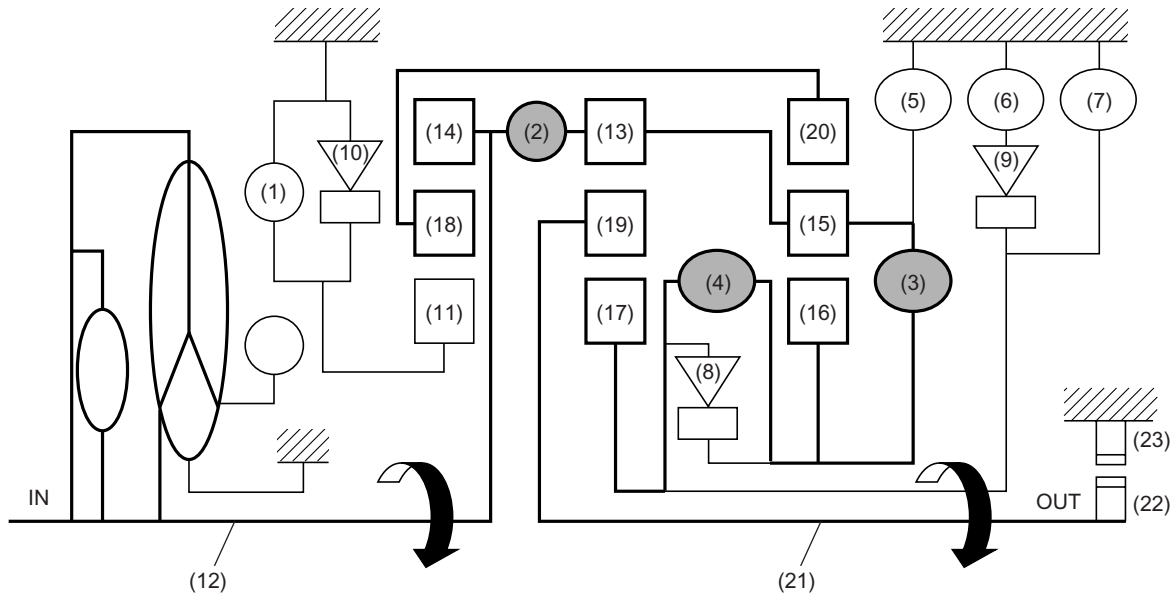
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 9. 4th SPEED GEAR OF D RANGE OR MANUAL MODE

- The direct clutch engages to connect the rear carrier and rear sun gear.
- The high and low reverse clutch engages to connect the mid sun gear and rear sun gear.
- The input clutch engages to connect the front internal gear and mid internal gear.
- Drive power is transmitted to the front internal gear, mid internal gear and rear carrier; the three planetary gears turn together as a unit in the normal direction.

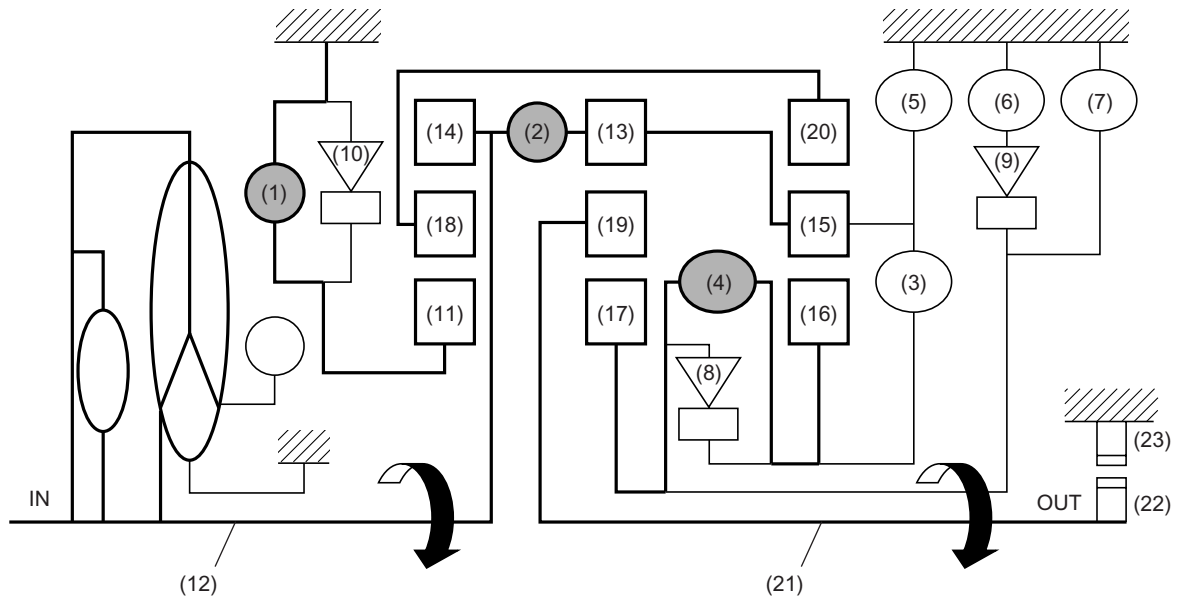


AT-02231

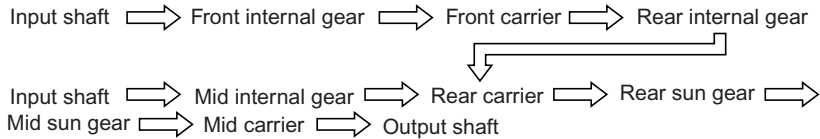
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## 10. 5th SPEED GEAR OF D RANGE OR MANUAL MODE

- The front brake operates to hold the front sun gear.
- The input clutch engages to connect the front internal gear and mid internal gear.
- The high and low reverse clutch engages to connect the mid sun gear and rear sun gear.



Power flow



AT-02236

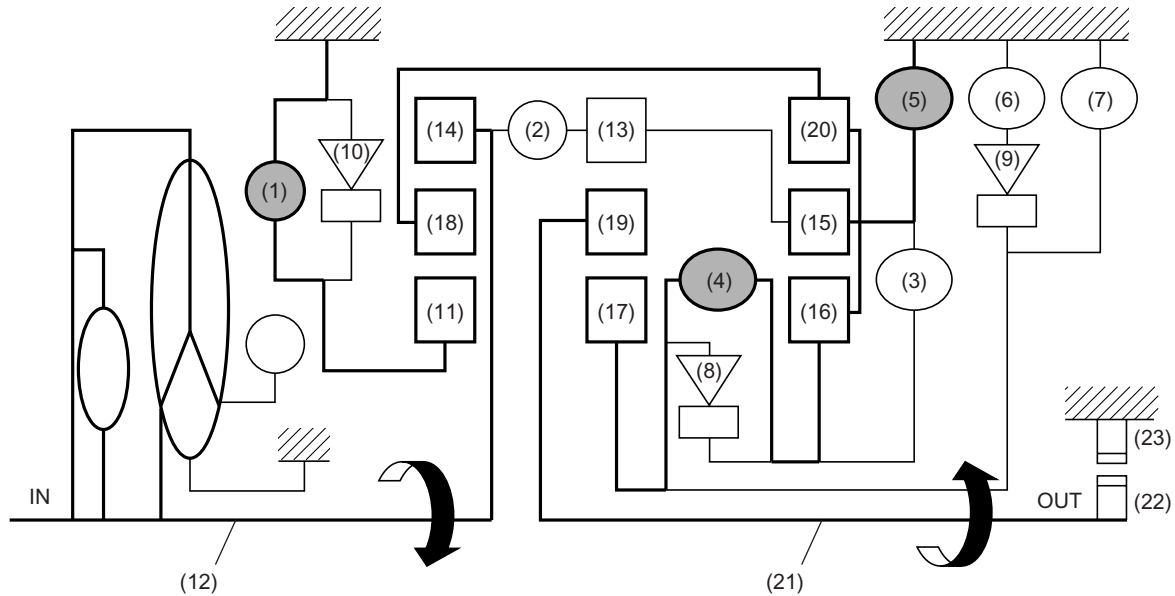
- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

# GEAR TRAIN

## AUTOMATIC TRANSMISSION

### 11. R RANGE

- The front brake operates to hold the front sun gear.
- The high and low reverse clutch engages to connect the mid sun gear and rear sun gear.
- The reverse brake operates to hold the rear carrier.



Power flow

Input shaft → Front internal gear → Front carrier → Rear internal gear →  
 Rear sun gear → Mid sun gear → Mid carrier → Output shaft

AT-02241

- |                                 |                            |                         |
|---------------------------------|----------------------------|-------------------------|
| (1) Front brake                 | (9) Forward one-way clutch | (17) Mid sun gear       |
| (2) Input clutch                | (10) 3rd one-way clutch    | (18) Front carrier      |
| (3) Direct clutch               | (11) Front sun gear        | (19) Mid carrier        |
| (4) High and low reverse clutch | (12) Input shaft           | (20) Rear internal gear |
| (5) Reverse brake               | (13) Mid internal gear     | (21) Output shaft       |
| (6) Forward brake               | (14) Front internal gear   | (22) Parking gear       |
| (7) Low coast brake             | (15) Rear carrier          | (23) Parking pawl       |
| (8) 1st one-way clutch          | (16) Rear sun gear         |                         |

## **13.AWD Transfer System**

### **A: GENERAL**

Used in the transfer is the VTD (Variable Torque Distribution) system which combines a compound planetary gear type center differential installed in the transfer case behind the transmission and a hydraulically operated multi-plate differential action limiting device (LSD) located between the output shafts of the center differential. Differential action limiting control is performed by the TCM according to driving and road surface conditions.

The input torque is transmitted to the 1st sun gear of the center differential through the intermediate shaft. From the 1st sun gear, the torque is transmitted through the 1st pinion to the output carrier in the front wheel output shaft, and through the 2nd pinion to the 2nd sun gear in the rear wheel output shaft.

The center differential performs the differential functions of absorbing the speed difference between the front and rear wheels and also distributes drive forces to the front and rear wheels at a predetermined ratio. In normal conditions (when pressure is not applied to the multi-plate clutch), the drive force distribution ratio is 45.7 % to the front wheels and 54.3 % to the rear wheels. The hydraulic multi-plate clutch connected in parallel with the center differential between the carrier and 2nd sun gear functions as a differential action limiting device (LSD) and also as a device that controls torque distribution according to driving conditions.

Differential action limiting control is performed as a “torque responsive control”, where control is based on the input torque to the transfer as calculated from the engine torque, torque converter characteristics, gear ratio, etc. The LSD clutch is controlled by the hydraulic pressure regulated by the transfer valve in the transmission hydraulic control valve assembly, as a result of the TCM directly controlling the linear solenoid. The torque distribution ratio to front and rear wheels changes from 45.7:54.3 to direct connection, in accordance with the hydraulic pressure acting on the piston.

The speed of the front and rear wheels determine the basic signals for the differential action limiting control. The rear wheel speed is detected by the sensor installed above the rear drive shaft, and the front wheel speed is detected by the sensor on the parking gear above the reduction gear.



# AWD TRANSFER SYSTEM

## AUTOMATIC TRANSMISSION

### B: OPERATION

The front-rear torque distribution ratio is determined by the of center differential's compound planetary gears and is varied by changing the degree of engagement of the hydraulically operated multi-plate clutch that connects the center differential output elements according to driving conditions and road surface conditions. The torque distribution ratio is calculated using the following equations, which include torque distribution coefficients (determined by number of gear teeth), input torque to the center differential, and torque capacity of the multi-plate clutch as factors.

1) When the front wheel speed is higher than the rear wheel speed:

$$T_R = 0.543 \times T_i + T_C$$

$$T_F = 0.457 \times T_i - T_C$$

where

$T_R$ : Rear wheel output torque

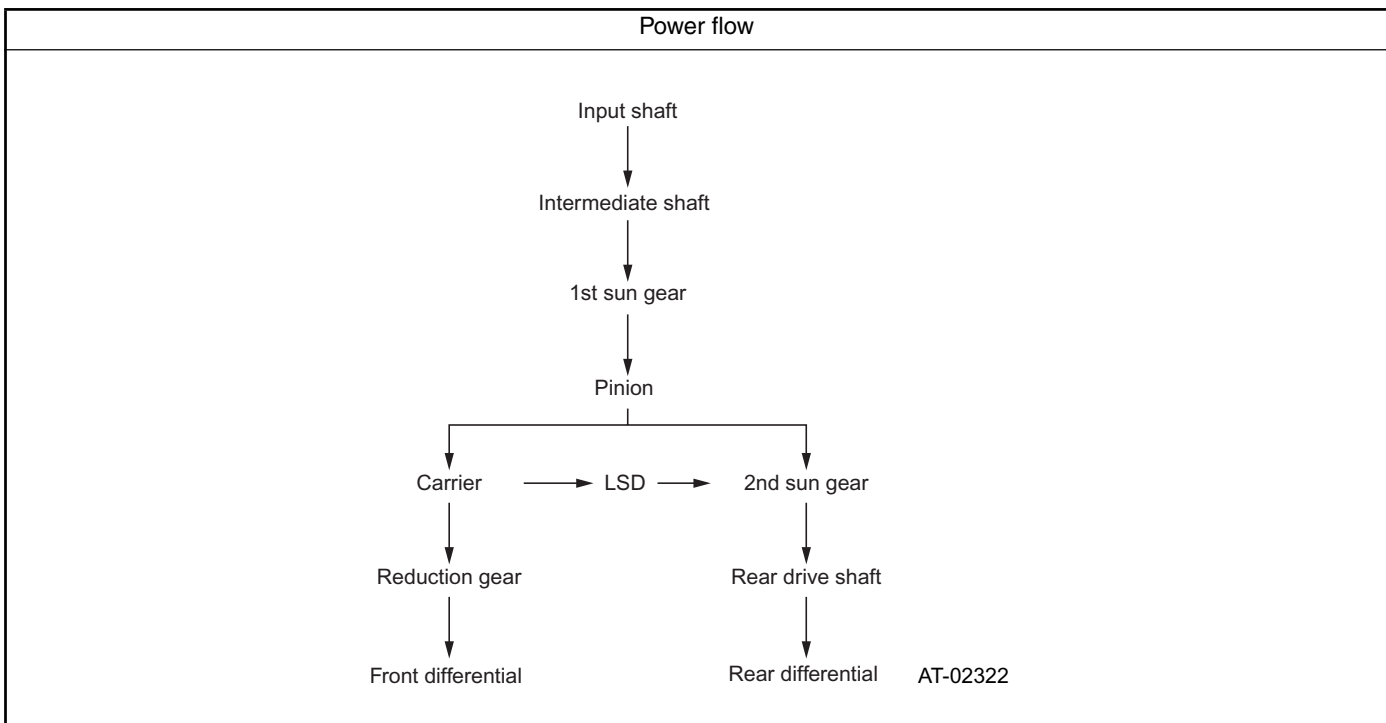
$T_i$ : Input torque to center differential

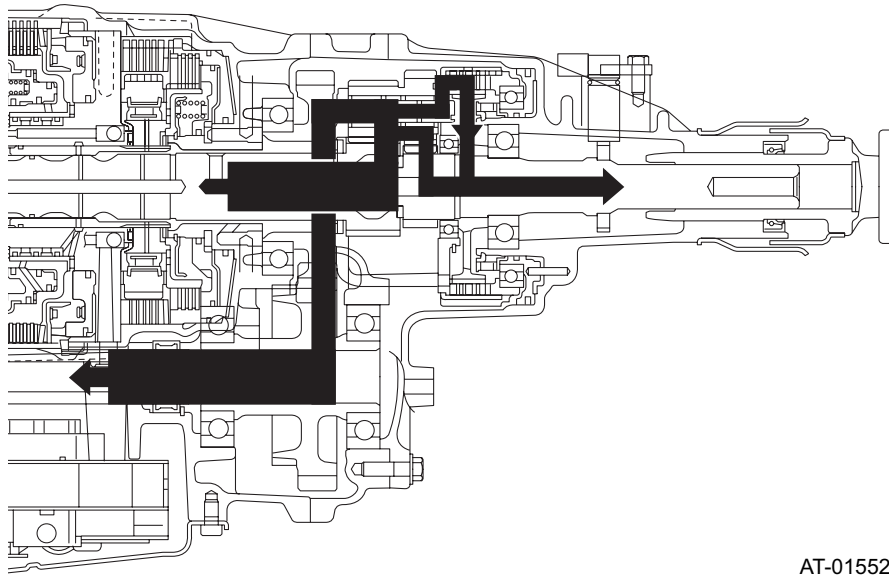
$T_C$ : Torque capacity of multi-plate clutch

$T_F$ : Front wheel output torque

0.543: Coefficient of rear wheel torque determined by number of gear teeth

0.457: Coefficient of front wheel torque determined by number of gear teeth



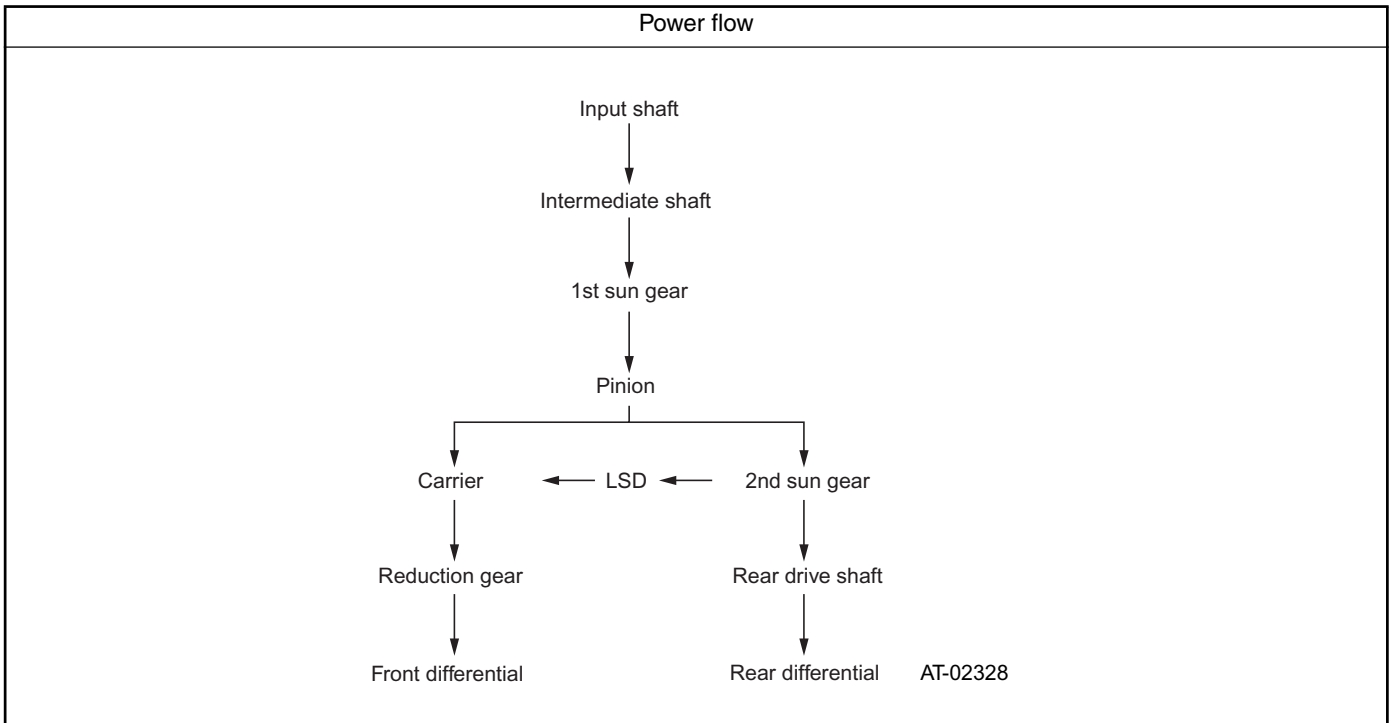


AT-01552

2) When the rear wheel speed is higher than the front wheel speed:

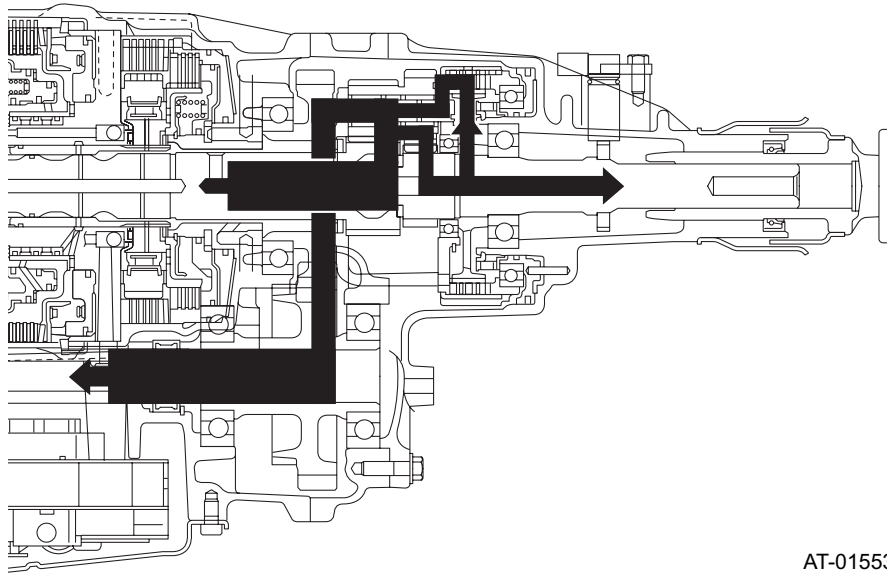
$$T_R = 0.543 \times T_i - T_C$$

$$T_F = 0.457 \times T_i + T_C$$



# AWD TRANSFER SYSTEM

AUTOMATIC TRANSMISSION



AT-01553

## <Calculation of front and rear wheel torques>

If the frictional resistance resulting from meshing of the planetary gears and sliding of rotational components are ignored, the torques distributed to the front and rear wheels are expressed by the following equations:

$$T_R = [(Z_{P1} \times Z_{S2}) \div (Z_{S1} \times Z_{P2})] \times T_i$$

$$T_F = [1 - (Z_{P1} \times Z_{S2}) \div (Z_{S1} \times Z_{P2})] \times T_i$$

where

$Z_{P1}$ : Number of teeth of 1st planetary gear

$Z_{P2}$ : Number of teeth of 2nd planetary gear

$Z_{S1}$ : Number of teeth of 1st sun gear

$Z_{S2}$ : Number of teeth of 2nd sun gear

$T_i$ : Input torque

If the number of teeth in each component is the same as that assumed in the equations on the previous page, the following ratios are the calculation results of the equations shown above.

$$T_R = 0.543 \times T_i$$

$$T_F = 0.457 \times T_i$$

As a result, the front-rear torque distribution ratio of the compound planetary gear set without an adjustment by the multi-plate clutch is 45.7 : 54.3.

## **C: CONSTRUCTION**

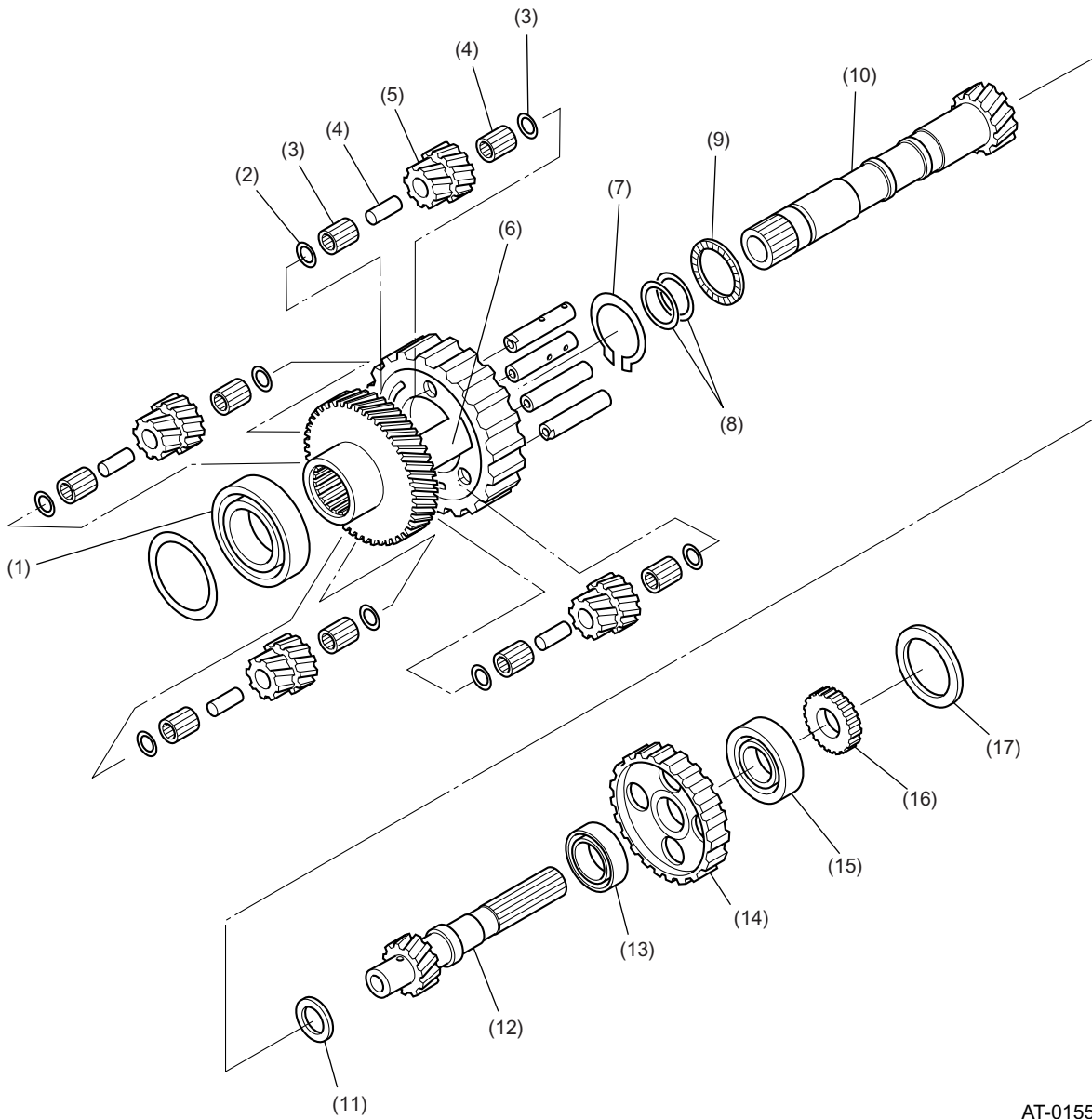
### **1. CENTER DIFFERENTIAL ASSEMBLY**

The center differential is a compound planetary gear set without internally-toothed gears. Input torque is transmitted to the 1st sun gear of the center differential, and from the 1st sun gear the torque is distributed through the 1st pinion to the carrier (output element of front wheel side), and to the 2nd sun gear (output element of rear wheel side) at a certain ratio.

The compound planetary gears use helical gears for quiet operation and strength. The four pinions are arranged to ensure the best motion balance during operation.

# AWD TRANSFER SYSTEM

AUTOMATIC TRANSMISSION



AT-01554

- |                    |                           |                             |
|--------------------|---------------------------|-----------------------------|
| (1) Ball bearing   | (7) Snap ring             | (13) Ball bearing           |
| (2) Washer         | (8) Seal ring             | (14) Multi-plate clutch hub |
| (3) Needle bearing | (9) Thrust needle bearing | (15) Ball bearing           |
| (4) Collar         | (10) Intermediate shaft   | (16) Revolution gear        |
| (5) Pinion gear    | (11) Thrust washer        | (17) Rear drive shaft shim  |
| (6) Carrier        | (12) Rear drive shaft     |                             |

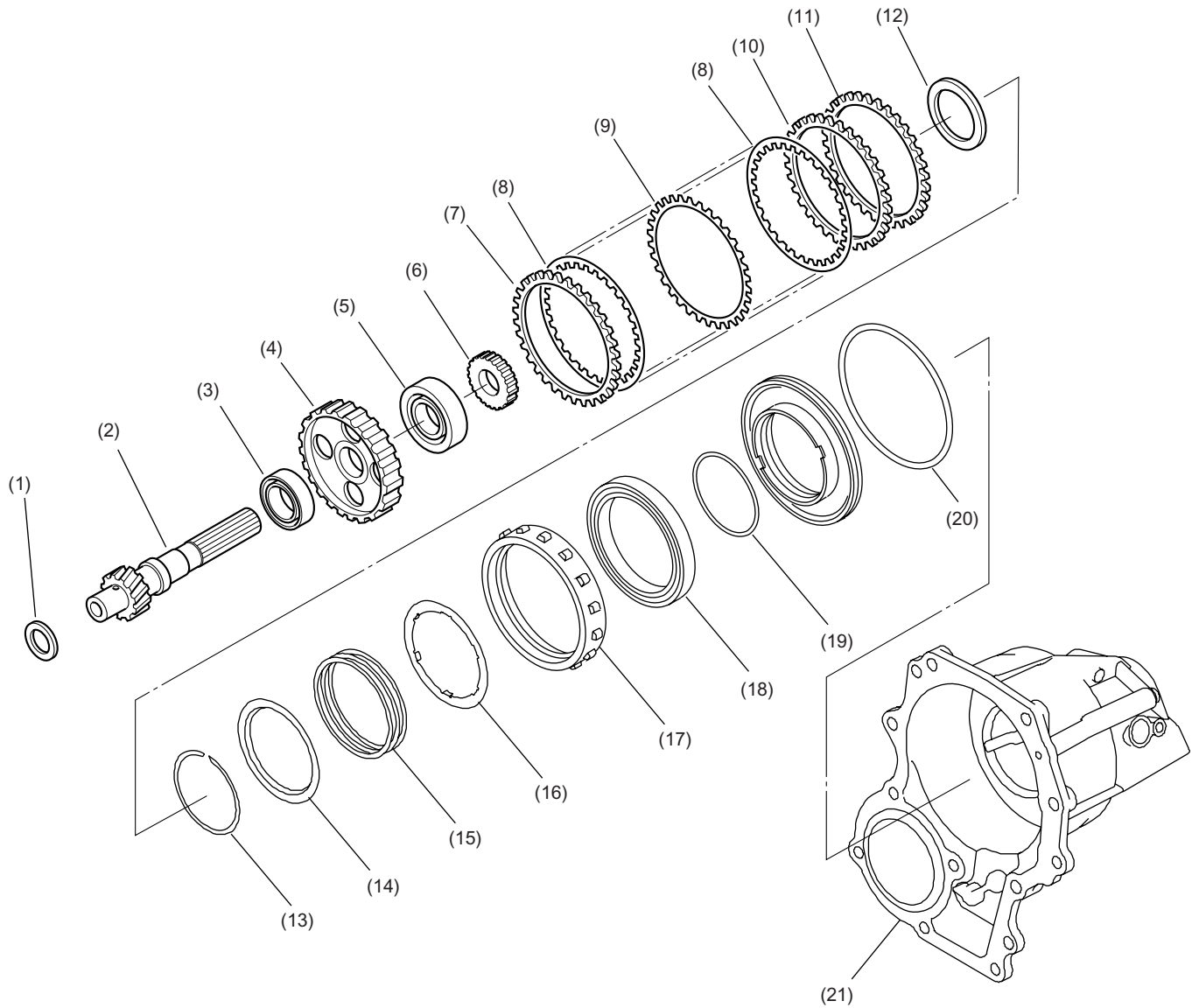
## 2. MULTI-PLATE CLUTCH (LSD)

The transfer's differential action limiting device (LSD) consists of a piston that press together the wet multi-plate clutch to generate differential action limiting force.

The rear drive shaft has drilled oil passages for lubrication of multi-plate clutch and extension bushing and ball bearing in it.

# AWD TRANSFER SYSTEM

AUTOMATIC TRANSMISSION



AT-01716

- |                            |                             |                             |
|----------------------------|-----------------------------|-----------------------------|
| (1) Thrust washer          | (8) Drive plate             | (15) Return spring          |
| (2) Rear drive shaft       | (9) Driven plate (thin)     | (16) Clutch spring retainer |
| (3) Ball bearing           | (10) Driven plate (thick)   | (17) Pressure plate         |
| (4) Multi-plate clutch hub | (11) Adjust plate           | (18) Ball bearing           |
| (5) Ball bearing           | (12) Rear drive shaft shim  | (19) O-ring                 |
| (6) Revolution gear        | (13) Snap ring              | (20) C-ring                 |
| (7) Driven plate (thick)   | (14) Clutch spring retainer | (21) Extension case         |

### 3. TRANSFER HYDRAULIC PRESSURE CONTROL UNIT

The transfer hydraulic control unit consists of the transfer linear solenoid installed in the transmission hydraulic control valve assembly and the transmission hydraulic control valve.

The transfer linear solenoid controls the transfer pilot pressure in accordance with the differential action limiting force determined by the TCM based on driving and road conditions, and the transfer hydraulic control valve regulates the line pressure into transfer pressure in accordance with the transfer pilot pressure.

The transfer pressure is sent through the passages formed in the transmission case and extension case to the clutch piston chamber.



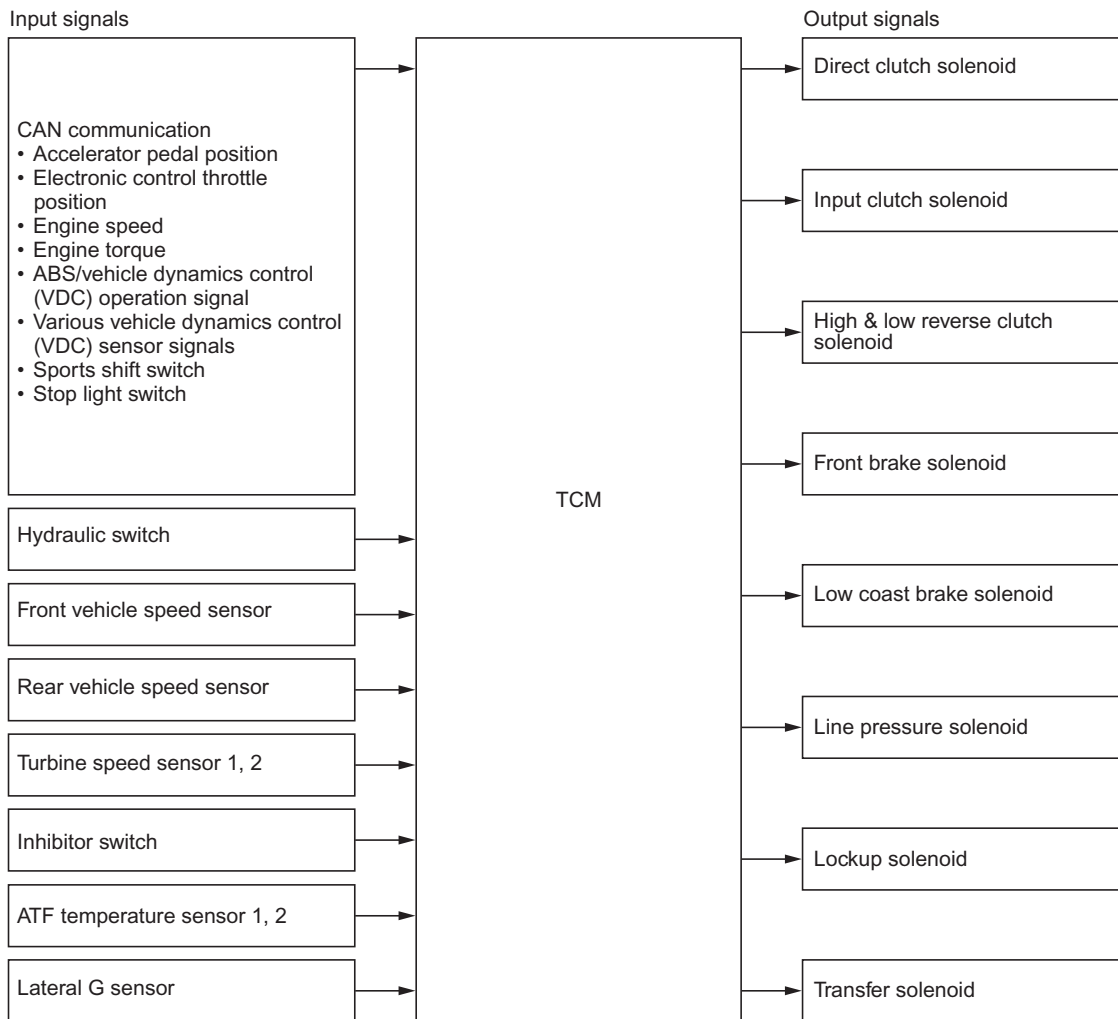
# ELECTRO-HYDRAULIC CONTROL SYSTEM

AUTOMATIC TRANSMISSION

## 14. Electro-hydraulic Control System

### A: DESCRIPTION

The electro-hydraulic control system for the transmission and transfer consists of various sensors and switches, TCM, and the control valves including solenoid valves. The system controls the automatic transmission operation, including gear shifting, lockup clutch operation, line pressure, pilot pressure, and gear-shift timing. It also controls the operation of the transfer clutch. The TCM determines vehicle operating conditions from various input signals and controls a total of eight solenoids (front brake solenoid, low coast brake solenoid, input clutch solenoid, high and low reverse clutch solenoid, direct clutch solenoid, lockup solenoid, line pressure solenoid, and transfer solenoid) by sending appropriate signals to them.



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# ELECTRO-HYDRAULIC CONTROL SYSTEM

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## B: CONTROL ITEMS

Control items		Description of control	
Transmission hydraulic control	Shifting control	Shift pattern selection	Upshift points and downshift points are set for each range and shift pattern selected by switch operation, according to throttle position and vehicle speed. <Ref. to 5AT section, Transmission Control Module (TCM).>
		Control of linear solenoid for each shift clutch	The linear solenoid for each shift clutch is directly controlled in accordance with the target gear speed. Supported by the learning control and real time feedback functions, control values are corrected any time when necessary to improve shift quality and eliminate errors due to aging.
		Engine braking control	In manual mode, the low coast brake ON-OFF solenoid is controlled to make engine braking available in 1st and 2nd speeds.
	Lockup control	Base lockup control	Lockup engagement and disengagement points are set for each range and shift pattern selected by switch operation, according to throttle position and vehicle speed, and the lockup solenoid is controlled in accordance with these points to engage or disengage the lockup clutch inside the torque converter.
		Smooth control	When the lockup clutch is engaged, the pressure is gradually changed to ensure a smooth engagement.
	Line pressure control	Ordinary control	Line pressure is properly regulated according to information such as the electronic control throttle position, engine torque value, engine speed, vehicle speed, and range position.
		Control during engine braking	Line pressure is regulated in accordance with the vehicle speed while engine braking is used.
		Line pressure control in during shifting	Line pressure is regulated to the necessary value during gear shifting.
		Line pressure control when ATF temperature is low	Hydraulic pressure is controlled to a higher value than normal when the ATF temperature is low.
	AWD center differential control	Ordinary transfer control	
Start control		LSD pressure is regulated according to the torque input to the transfer. Compared to normal control, the control pressure is raised to prevent slip.	
Turning control		When the front and rear wheel speed ratio is less than the set value for a vehicle speed, the LSD pressure is decreased.	
Slip control		When a front or rear wheel starts slipping, the LSD pressure is increased.	
Control while ABS/vehicle dynamics control (VDC) in operation		When ABS/vehicle dynamics control (VDC) operation signal is received, the LSD pressure is adjusted to the set level.	
Base brake control		When the brake switch is ON and throttle valve is fully closed, the LSD pressure is lowered.	

# ELECTRO-HYDRAULIC CONTROL SYSTEM

## AUTOMATIC TRANSMISSION

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### C: CONTROL OF HYDRAULIC PRESSURE FOR SHIFTS

- Control of linear solenoid for each shift clutch

The linear solenoid for each shift clutch is directly controlled by means of electrical current in accordance with the target gear speed. The control current value is corrected any time when necessary by the learning control and real time feedback functions to improve shift quality and eliminate errors due to aging.

- Engine braking control

In manual mode, the low coast brake solenoid is controlled to make engine braking available in 1st and 2nd speeds.

### D: LOCKUP CONTROL

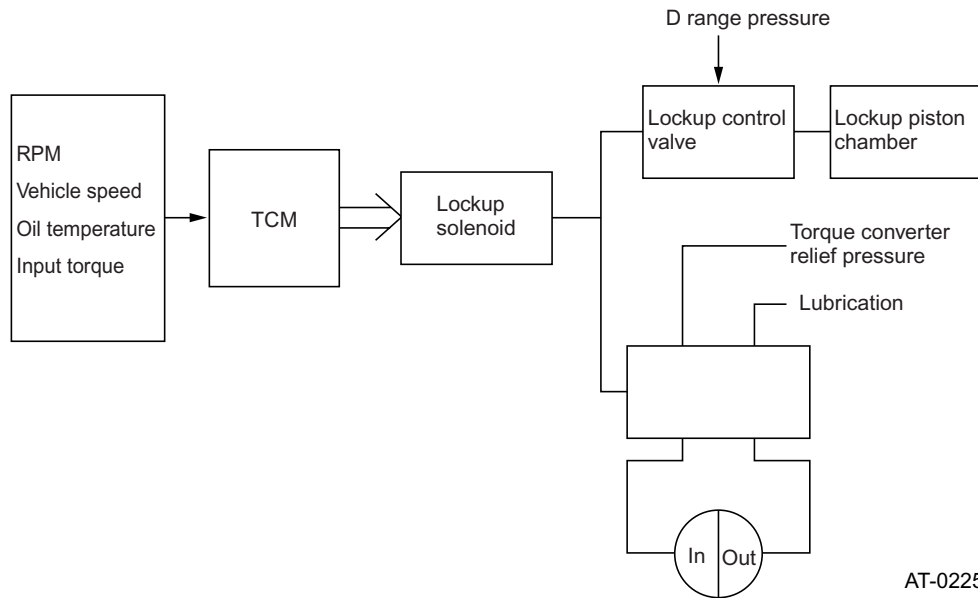
- By engaging the lockup clutch in the torque converter, the slip in the torque converter is eliminated and power is transmitted more effectively.

- Based on signals from the TCM, the lockup solenoid is controlled in order to let the lockup control valve operate and adjust apply pressure/release pressure, to consequently vary the lockup clutch engagement force.

Lockup operation conditions

Select lever	Gear position	Full lockup
D range	3	Δ
	4	Δ
	5	○
Manual mode	3	○
	4	○
	5	○

Δ: When the hill climbing mode is selected according to driving conditions, or when high ATF temperature is detected.



## 1. LOCKUP DISENGAGED STATE

When lockup is disengaged, the lockup solenoid causes the lockup control valve to open the clutch disengaging port, and the lockup operating pressure is added to the disengaging circuit. In the meantime, the lockup clutch control valve opens the lockup clutch engaging port and allows the hydraulic fluid in the circuit to flow to the ATF cooler, thus lowering the pressure in the engaging circuit. As a result, the lockup clutch is disengaged due to difference in pressure between both circuits. This operation is performed in all speed gears.

## 2. LOCKUP ENGAGED STATE

When lockup is engaged, the lockup solenoid puts the lockup control valve in the lockup state and builds up lockup operating pressure.

The lockup control valve then opens the clutch engaging circuit's port that communicates to the torque converter's impeller chamber, allowing high pressure fluid to flow to the lockup clutch and the clutch is engaged.

This operation is performed in all speed gears, and the lockup engages in response to the vehicle speed when the 5th gear is selected in the D range.

## 3. SMOOTH LOCKUP CONTROL

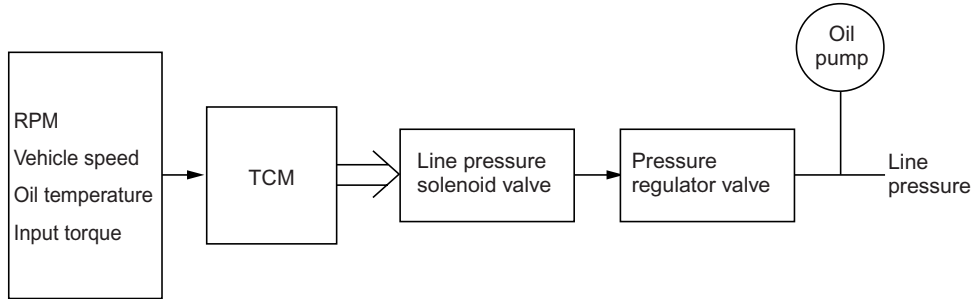
During the transition period from the lockup (disengaged) state to the lockup engaged state, the TCM controls the current output to the lockup solenoid. By changing the current output to the lockup solenoid and gradually raising the lockup clutch pressure, the lockup clutch piston is first put in a partially engaged state and its pressure is gradually increased to reduce shock.

# ELECTRO-HYDRAULIC CONTROL SYSTEM

## AUTOMATIC TRANSMISSION

### E: LINE PRESSURE CONTROL

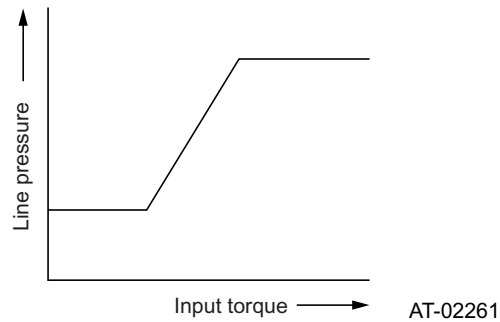
When torque signals corresponding to the engine drive power is sent from the ECM to the TCM, the TCM controls the line pressure solenoid. Using the line pressure solenoid pressure as a signal pressure, the pressure regulator valve is controlled, and the ATF discharged from the oil pump is regulated to an optimum level corresponding to the vehicle's running conditions.



AT-02256

#### 1. LINE PRESSURE CONTROL IN NORMAL CONDITIONS

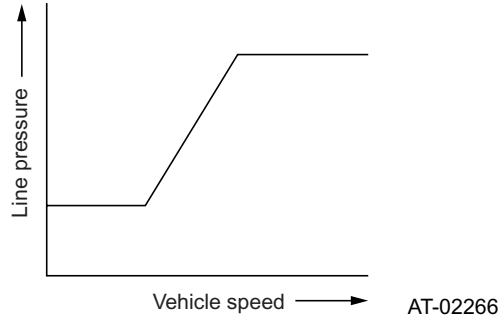
The line pressure which engages shift clutches to create 1st to 4th speeds, is regulated to a pressure required at each clutch according to the input torque.



AT-02261

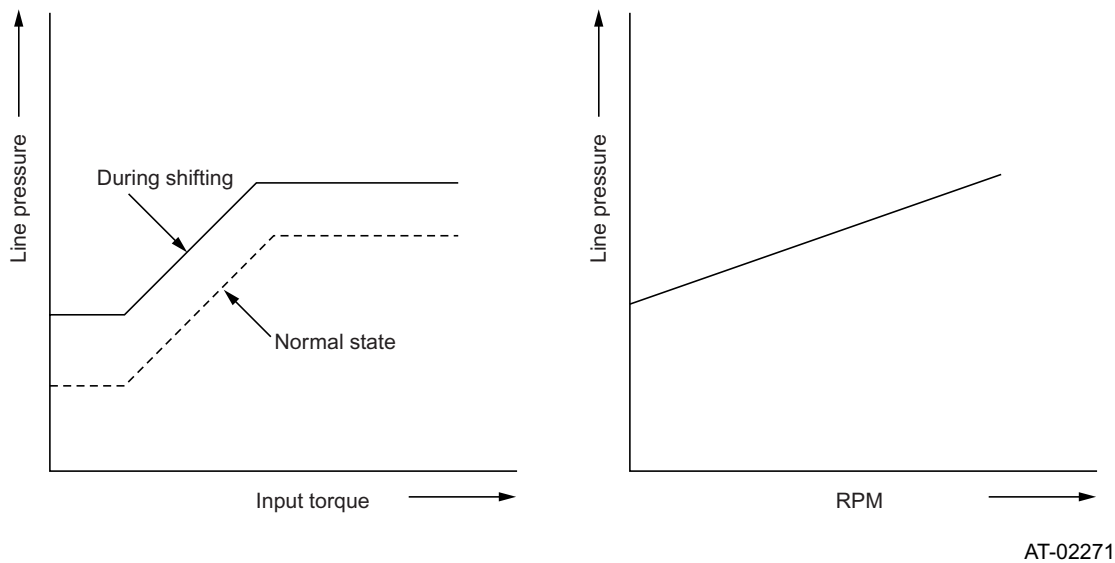
## 2. LINE-PRESSURE CONTROL DURING ENGINE BRAKING IN SPORTS MODE

When engine braking is used to let the transmission downshift, the line pressure is regulated in accordance with the vehicle speed.



## 3. LINE-PRESSURE CONTROL DURING SHIFTING

During shifting, the line pressure is set to a level suitable for the input speed, input torque and the difference between the required and current gear speed.



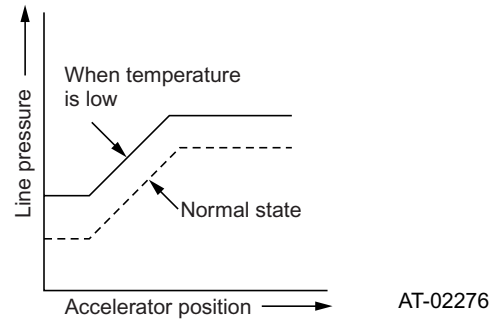
# ELECTRO-HYDRAULIC CONTROL SYSTEM

## AUTOMATIC TRANSMISSION

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### 4. LINE PRESSURE CONTROL WHEN ATF TEMPERATURE IS LOW

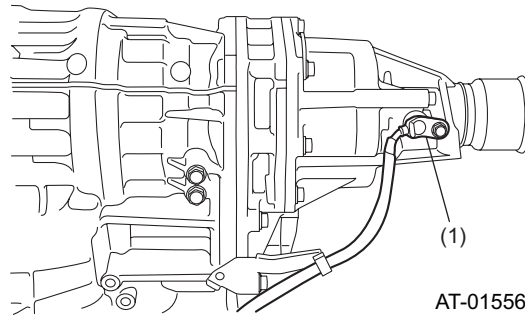
When the ATF temperature is low, the line pressure control characteristics is set higher than normal so that the clutches and brakes will operate at an earlier stage.



## 15.Sensor Systems

### A: REAR VEHICLE SPEED SENSOR

This vehicle speed sensor is a Hall element type sensor and is externally mounted on the extension case. It detects the rear wheel speed in terms of the peripheral speed of the rear drive shaft and sends pulse signals (22 pulses per rotation) to the TCM.

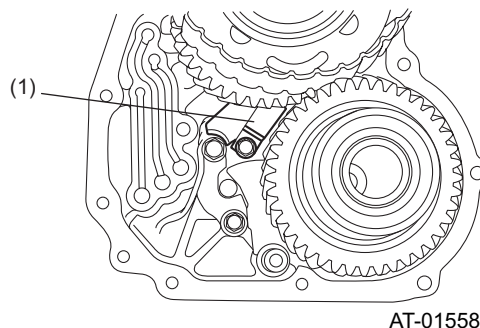


(1) Rear vehicle speed sensor

### B: FRONT VEHICLE SPEED SENSOR

This vehicle speed sensor is a Hall element type sensor and is mounted on the inside of the transmission case. It detects the drive pinion shaft speed and sends pulse signals (16 pulses per rotation) to the TCM.

Signals from the front and rear vehicle speed sensors are used to calculate controlling vehicle speed, which is in turn used for gear shift control.



(1) Front vehicle speed sensor



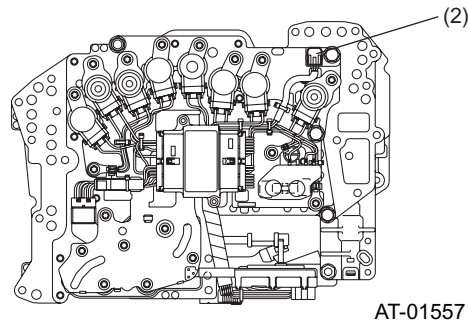
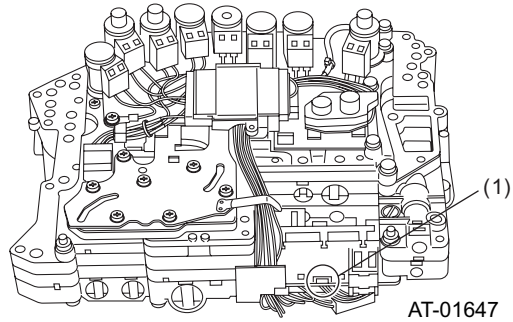
# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

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### C: ATF TEMPERATURE SENSOR 1, 2

These temperature sensors are thermistors and each of them is mounted on the control valve body. ATF temperature sensor 1 detects the ATF temperature in the oil pan, and ATF temperature sensor 2 detects the ATF temperature at the torque converter outlet; each sensor outputs electrical resistance signals.

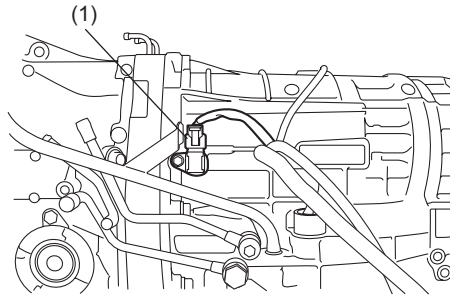


(1) ATF temperature sensor 1

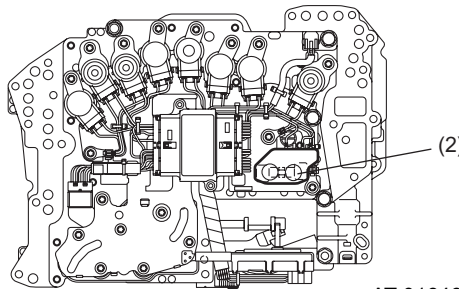
(2) ATF temperature sensor 2

### D: TURBINE SPEED SENSOR 1, 2

Wheel speed sensors are hall element type sensors. Turbine speed sensor 1 detects the speed of the front sun gear, and turbine sensor 2 detects the speed of the front carrier. Each sensor sends pulse signals (60 pulses per rotation) to the TCM. From these two speed values, the TCM calculates the turbine speed and uses it for shifting control.



AT-01559



AT-01646

(1) Turbine speed sensor 1

(2) Turbine speed sensor 2

# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

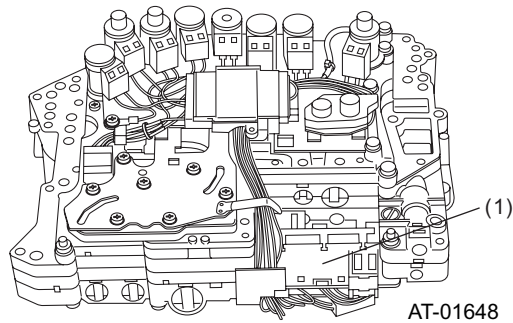
### E: INHIBITOR SWITCH

The inhibitor switch is installed in the control valve and is connected to the TCM with 4 signal lines. The TCM uses this signal to detect range positions and to perform various controls. Relation between signals from the 4 lines (INH1 to 4) and range positions are as shown below:

	INH1	INH2	INH3	INH4
P				
R	○			○
N	○	○		
D	○	○	○	○

When the range position is detected as P or N as shown above, the TCM sends a signal (PN signal) allowing operation of the starter. On the other hand, in R or D range, starter operation is inhibited to ensure safety.

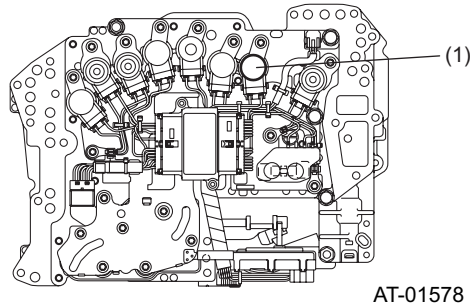
Additionally, when the range position is detected as R, the TCM turns the backup light relay output to ON and lets the backup lights illuminate.



(1) Inhibitor switch

### F: LINE PRESSURE SOLENOID

The line pressure solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This controls the pressure modifier valve and accumulator control valve A to adjust the line pressure to an optimum pressure level suitable for operating conditions.

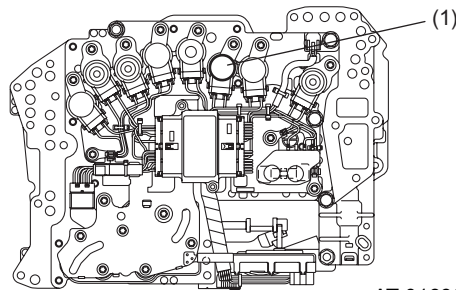


AT-01578

(1) Line pressure solenoid

### G: LOCKUP SOLENOID

The lockup solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. It then controls the lockup control valve to provide smooth engagement and disengagement. It also enables stable slip lockup control while supported by learning control and real time feedback functions.



AT-01636

(1) Lockup solenoid

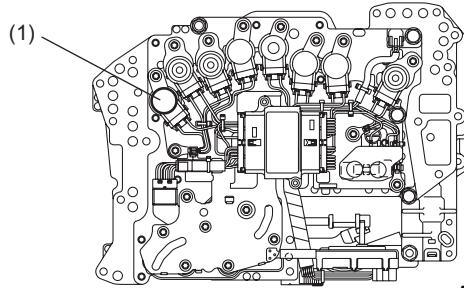
# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

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### H: FRONT BRAKE SOLENOID

The front brake solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This solenoid is activated when the front brake is to be engaged. Control values are corrected any time when necessary by the learning control and real time feedback functions to improve shift quality and eliminate errors due to aging.

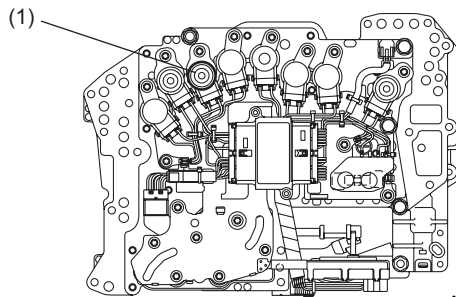


AT-01579

(1) Front brake solenoid

### I: INPUT CLUTCH SOLENOID

The input clutch solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This solenoid is activated when the input clutch is to be engaged. Control values are corrected any time when necessary by the learning control and real time feedback functions to improve shift quality and eliminate errors due to aging.



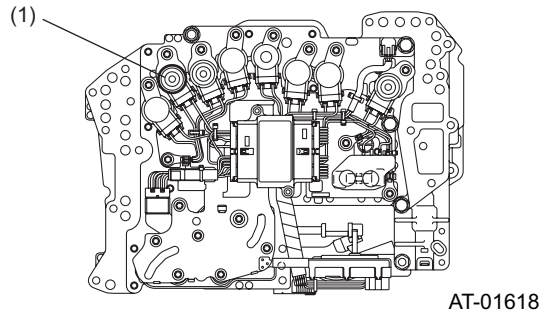
AT-01617

(1) Input clutch solenoid

### J: DIRECT CLUTCH SOLENOID

The direct clutch solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This solenoid is activated when the direct clutch is to be engaged. Control values are corrected any time when necessary by the learning control and real time feedback functions to improve shift quality and eliminate errors due to aging.

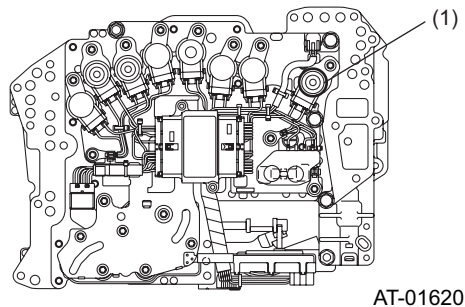
The direct clutch pressure can be switched to two range pressures with the direct clutch piston switch valve.



(1) Direct clutch solenoid

### K: HIGH AND LOW REVERSE CLUTCH SOLENOID

The high and low reverse clutch solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This solenoid is activated when the high and low reverse clutch is to be engaged. Control values are corrected any time when necessary by the learning control and real time feedback functions to improve shift quality and eliminate errors due to aging.



(1) High and low reverse clutch solenoid

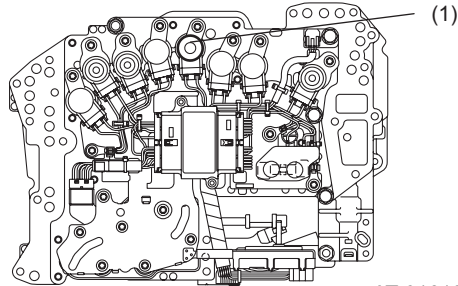
# SENSOR SYSTEMS

## AUTOMATIC TRANSMISSION

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### **L: LOW COAST BRAKE SOLENOID**

The low coast brake solenoid is mounted on the control valve and is directly controlled by ON/OFF instructions from the TCM. This solenoid is activated when the low coast brake is to be engaged during usage of engine braking in 1st or 2nd speed in manual mode.

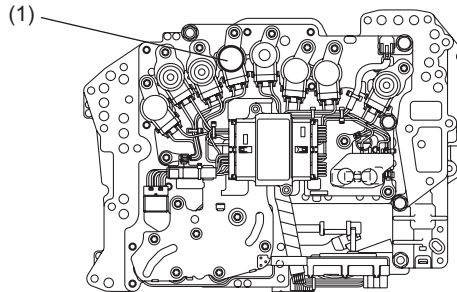


AT-01619

(1) Low coast brake solenoid

### **M: TRANSFER SOLENOID**

The transfer solenoid is mounted on the control valve and is directly controlled by electrical current instructions from the TCM. This ensures optimum AWD control in accordance with the varying road conditions by engaging/releasing the transfer clutch.

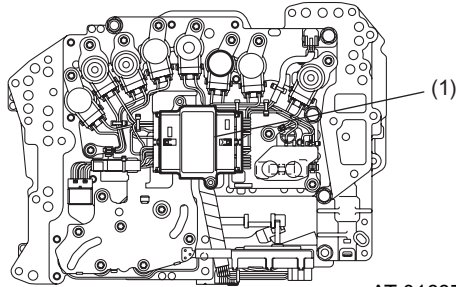


AT-01615

(1) Transfer solenoid

## N: MEMORY BOX

The memory box is mounted on the control valve and stores hydraulic correction values and learned values for the initial shifting pressures for each solenoid, based on its hydraulic characteristics at the time delivered from the factory. The TCM acquires data from this memory box and performs correction based on these data to control each solenoid. This ensures high quality shifting from the time the vehicle was delivered from the factory.



AT-01637

(1) Memory box



# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## 16. Transmission Control Module (TCM)

The TCM receives various sensor signals and determines the running conditions of the vehicle. It then sends control signals to each solenoid according to the preset gearshift characteristic data, lockup operation data, and transfer clutch torque data.

### A: CONTROL SYSTEM

Control items		Input signals
Shifting control	Ordinary shift control	Accelerator pedal position signal Engine torque signal Engine speed Front vehicle speed signal Rear vehicle speed signal Turbine sensor 1, 2 signal Range signal
	Engine cooperative control	Front vehicle speed signal Rear vehicle speed signal Various engine information
	ABS cooperative control	Front vehicle speed signal Rear vehicle speed signal ABS operating signal Brake switch signal
	Control at high oil temperatures	ATF temperature sensor 1 signal ATF temperature sensor 2 signal
	Control when ATF or coolant temperature is low	ATF temperature sensor 1 signal ATF temperature sensor 2 signal Coolant temperature information
	Control when cruise control in operation	Cruise control switch signal Cruise control set signal

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

Control items		Input signals
Shift pattern selection control	Adaptive control	Shift pattern automatic switching control
		Accelerator pedal position signal Engine speed Engine torque signal Front vehicle speed signal Rear vehicle speed signal Range signal Lateral G sensor signal Sports mode switch signal
		Accelerator pedal quick depressing control
		Accelerator pedal position signal Front vehicle speed signal Rear vehicle speed signal Range signal
		Accelerator pedal quick return control
		Accelerator pedal position signal Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal
	Braking control	Accelerator pedal position signal Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal Brake switch signal
	Control during cornering	Accelerator pedal position signal Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal Lateral G sensor signal
	Sports mode control	Accelerator pedal position signal Engine torque signal Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal
	Manual mode control	Engine speed Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal Upshift switch signal Downshift switch signal ATF temperature sensor 1 signal ATF temperature sensor 2 signal
Shift pattern selection control	2nd hold control (in Manual mode)	Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal Upshift switch signal Downshift switch signal
	Steering sports shift control	Engine speed Front vehicle speed signal Rear vehicle speed signal Range signal Sports mode switch signal Upshift switch signal Downshift switch signal ATF temperature sensor 1 signal ATF temperature sensor 2 signal Lateral G sensor signal

# TRANSMISSION CONTROL MODULE (TCM)

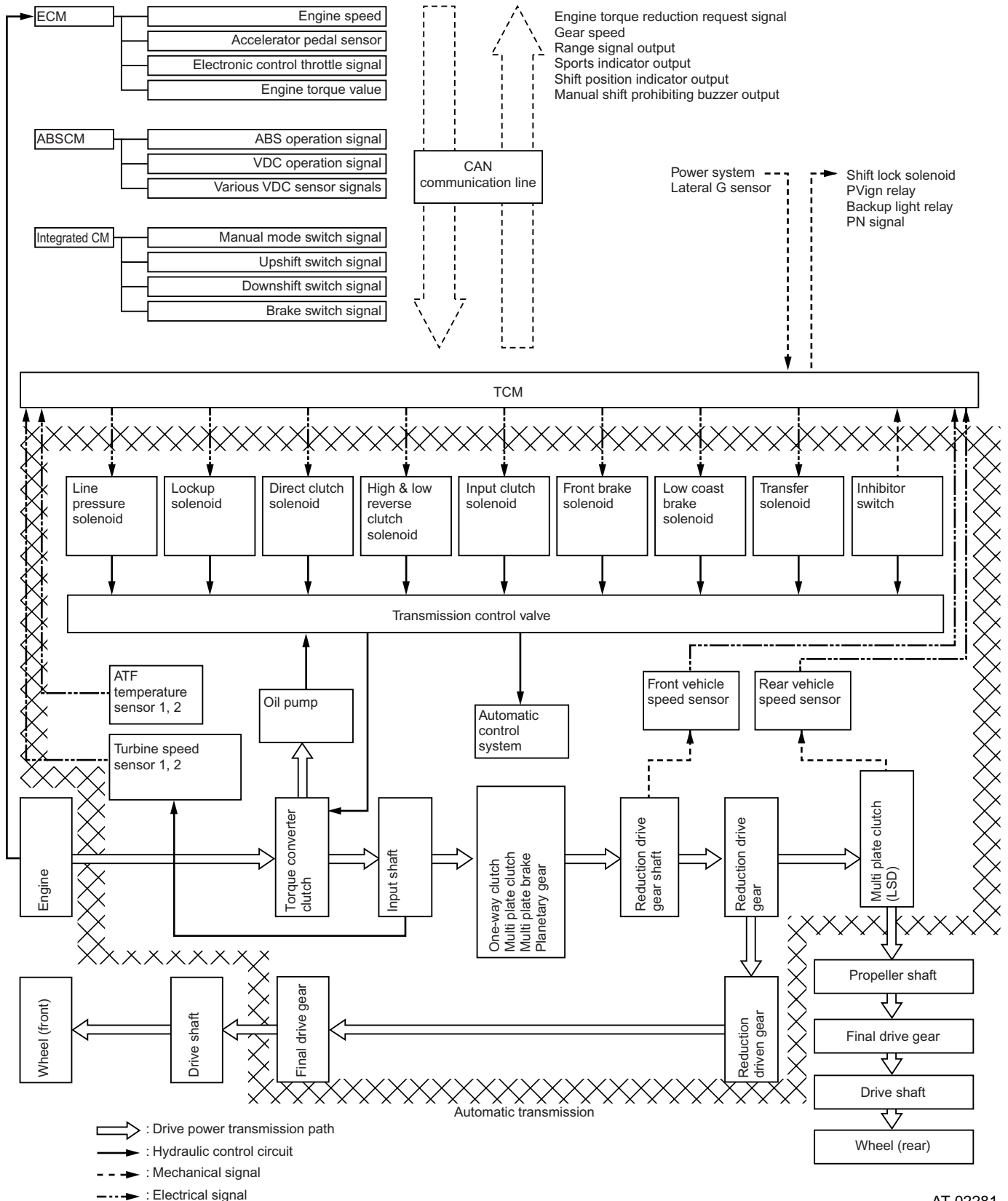
## AUTOMATIC TRANSMISSION

Control items		Input signals
Lockup control	Ordinary lockup control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed Range signal ATF temperature signal
	Slip lockup control	Front vehicle speed signal Rear vehicle speed signal Range signal Engine speed Turbine speed signal ATF temperature signal
Oil pressure control	Ordinary pressure control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed Range signal ATF temperature signal
	Shifting control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Engine speed Turbine speed signal Range signal ATF temperature signal
AWD center differential	Ordinary transfer control	Throttle position signal Rear vehicle speed signal Front vehicle speed signal Inhibitor switch ATF temperature signal Turbine speed signal Engine torque signal
	Slip detection control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Brake switch
	Steering control	Accelerator pedal position signal Rear vehicle speed signal Front vehicle speed signal Steering angle signal
	Control while ABS/vehicle dynamic control (VDC) in operation	ABS operating signal Vehicle dynamic control (VDC) operating signal Rear vehicle speed signal Front vehicle speed signal Brake switch
	Braking control	Accelerator pedal position signal Front vehicle speed signal Brake switch
	Start control	Engine torque signal Rear vehicle speed signal Front vehicle speed signal Turbine speed signal

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## B: SCHEMATIC DIAGRAM



AT-02281

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

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### **C: SHIFTING CONTROL**

#### **1. ORDINARY SHIFT CONTROL**

The TCM controls each solenoid based on input signal information such as inhibitor switch signals, vehicle speed signals and accelerator pedal position signals, to automatically select the optimum gear position from the shifting map.

#### **2. ENGINE COOPERATIVE CONTROL**

During shifting, the TCM outputs a torque-down requirement signal, and the ECM receives this to retard the ignition timing of each cylinder to temporarily decrease the output torque from the engine. Simultaneously with this control, the TCM constantly monitors the shift sequence through vehicle speed sensors and the turbine speed sensor to perform feedback control and optimize gear shifts. Because of this control, a smooth and comfortable gear shifting is ensured under all conditions.

#### **3. ABS COOPERATIVE CONTROL**

When the ABS is operating, the optimum gear speed for the vehicle speed is selected by cooperative operation with the ABS/CM to prevent degrading the operation of the ABS.

#### **4. CONTROL AT HIGH OIL TEMPERATURES**

If the ATF temperature becomes extremely high, shifting control is performed by automatically switching to a shifting map that is less likely to cause temperature rise.

#### **5. CONTROL WHEN ATF OR ENGINE COOLANT TEMPERATURE IS LOW**

When the ATF temperature or engine coolant temperature is extremely low at engine start, etc., shifting control is performed by automatically switching to a shifting map that causes temperature rise easier.

#### **6. CONTROL WHEN CRUISE CONTROL IN OPERATION**

When the cruise control is operating, shifting control is performed by automatically switching to a shifting map that is suitable for cruise control.

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

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**MEMO**

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

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### D: SHIFT PATTERN SELECTION

#### 1. ADAPTIVE CONTROL

This control is performed to improve the drivability of the vehicle by optimizing gear shifts in accordance with the driver's intention to accelerate or decelerate, and driving conditions such as hill climbing, winding road driving, etc.

- Shift pattern automatic switching control

This control enables selection of the optimum gear speed by automatically switching the shift pattern by estimating driver's intentions and driving conditions through sensor information such as driving resistance, engine speed, acceleration, vehicle speed, and also from calculated values.

Any of the three patterns NORMAL, SPORTS, and SLOPE are continuously and automatically selected under the following conditions.

D range

NORMAL↔SPORTS↔SLOPE

D range, in sports mode

SPORTS↔SLOPE

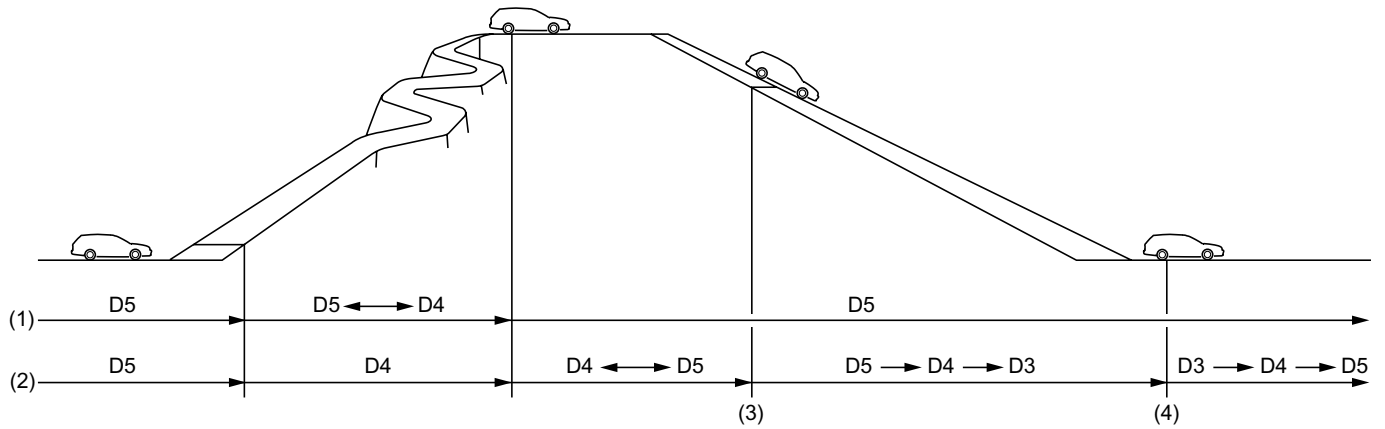
Normal pattern: covers a wide range from normal driving to high speed driving.

Sports pattern: a shift pattern suitable for driving conditions requiring deep accelerator pedal positions, such as winding road driving.

Slope pattern: this shift pattern controls upshifting to prevent too frequent gear shifting during climbing or descending hills. By combining braking control (in sports mode only) (explained later), automatic engine braking will be available when descending hills.

# TRANSMISSION CONTROL MODULE (TCM)

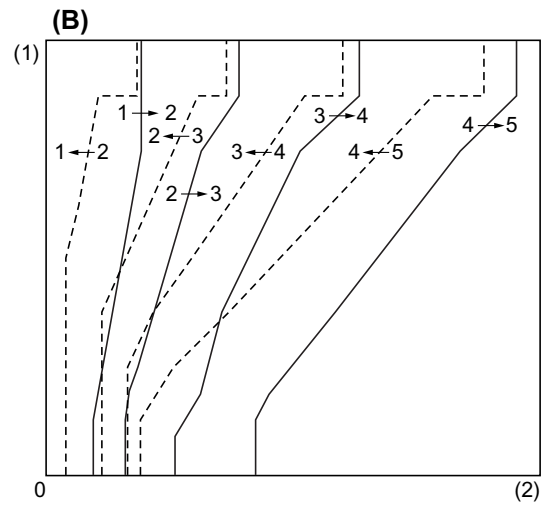
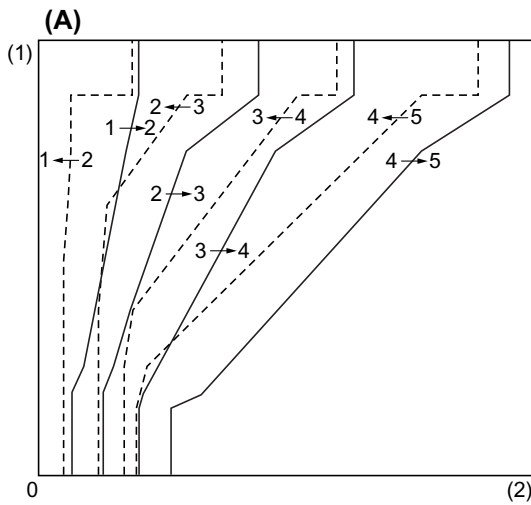
AUTOMATIC TRANSMISSION



AT-01731

- (1) Without climb/descend control
- (2) With climb/descend control

- (3) Brake pedal ON
- (4) Re-acceleration



AT-01730

- (A)** Base pattern
- (1) Accelerator pedal position

- (B)** Grade control pattern
- (2) Vehicle speed



# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

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- Accelerator pedal quick depressing control

When the accelerator pedal is quickly depressed, the TCM interprets this as acceleration is required, and the transmission is downshifted earlier to obtain a greater drive force.

- Accelerator pedal quick return control

When the accelerator pedal is quickly released, the TCM interprets this as deceleration is required, and upshift is prohibited in order to hold the transmission in the current gear speed to prevent frequent shifting and to maintain engine braking effect (operates in sports mode only).

- Braking control

According to the braking force (deceleration) during braking, downshifts are hastened to ensure engine braking effect and obtain a larger driving power for accelerating after braking (operates in sports mode only).

- Control during cornering

When the system interprets that the vehicle is turning a corner by the lateral acceleration and the change rate in vehicle speed, it prevents unwanted upshifts to maintain a stable drive force and cornering performance.

## 2. SPORTS MODE CONTROL

When the shift lever is moved toward the manual gate side in D range, the SPORT light in the combination meter illuminates and the system enters the Sports mode. Gearshift timings are set at higher vehicle and engine speeds to make more use of low speed gears. The full lockup vehicle speed in 5th is also set higher than in the normal mode.

### 3. MANUAL MODE CONTROL

By operating the “+” or “-” switch on the select lever or steering wheel in D range with the sports mode switch ON (in sports mode), the system switches to manual mode. In this mode, operating the “+” switch causes upshifting while operating the “-” switch causes downshifting; manual shifting is enabled and the selected gear position is held while driving.

However, at certain vehicle speeds or ATF temperatures, the following inhibiting control is performed.

- Upshift inhibiting and auto downshift control

The gear upshifts each time the “+” switch is operated, however, when the vehicle speed is too low for the selected gear speed, the TCM inhibits further upshifting. If the vehicle speed becomes too slow for the current gear speed, a downshift will be made automatically to prevent engine stall. When the vehicle comes to a stop, the transmission will always be controlled to shift to 1st speed unless the vehicle was in manual 2nd hold control.

- Downshift inhibiting control

The gear downshifts each time the “-” switch is operated, however, when the vehicle speed is too low for the selected gear speed, the TCM inhibits further shifting. A manual shifting inhibiting buzzer will sound to warn the driver.

- Control when oil temperature is low

When the ATF temperature is low as in cases such as immediately after start in winter, upshifting to 5th is inhibited to quicken warm up.

- Engine over speed prevention control

If the engine speed exceeds the preset value during accelerating, the fuel supply is cut to prevent over-revving of the engine.

### 4. 2nd HOLD CONTROL (IN MANUAL MODE)

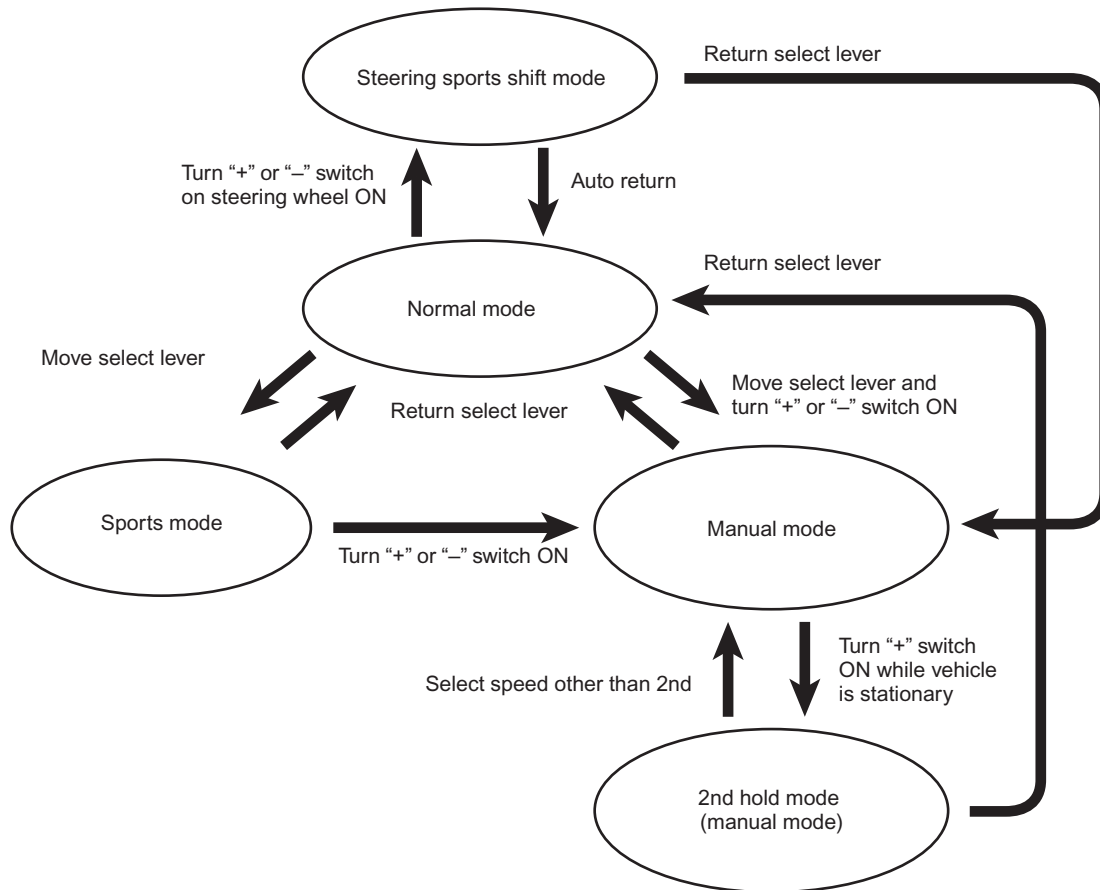
When the “+” switch is operated when the vehicle is in manual mode and not moving, the transmission shifts to 2nd speed enabling start in 2nd. This status is held unless the manual mode is canceled, or a speed other than 2nd is selected with the “-” switch. Also, the transmission is held in 2nd when the vehicle is stopped.

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

### 5. STEERING SPORTS SHIFT CONTROL

By operating the “+” or “-” switch on the steering wheel in D range during Normal mode, the system can be temporary switched to manual mode to perform manual shift operations. In this mode, the mode automatically returns to the previous mode when the next operation is not performed within a specified time or when the vehicle is put in the straight forward accelerating state.



AT-02970

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION

## 6. ILLUMINATION CONTROL OF VARIOUS INDICATORS

Illuminations of the various indicators on the combination meter are controlled in accordance with the shift pattern selection as shown below.

Status \ Indicator	D ●	SPORT	▲ ▼	1	Operation mode
Normal D range	D ●	SPORT	△ ▽	(extinguished)	Normal mode
In sports mode	D ●	SPORT	△ ▽	(extinguished)	Sports mode
Manual mode	D ○	SPORT	▲ ▼	1 — 5	Manual mode
When engine oil temperature is high and high engine speed is maintained	D ○	SPORT	△ ▽	—	Manual mode (at high oil temperature)
In steering sports shift	D ○	SPORT	▲ ▼	1 — 5	Semi sports shift mode
When engine oil temperature is high and high engine speed is maintained (upper row: first 2 seconds, lower row: thereafter)	D ●	SPORT	△ ▽	—	Normal mode (at high oil temperature)
	D ●	SPORT	△ ▽	(extinguished)	Normal mode (at high oil temperature)

**NOTE:**

- Indicators printed in solid black show their illuminated status.
- ATF TEMP indicator illuminates to inform of high ATF temperature.

AT-02882

# TRANSMISSION CONTROL MODULE (TCM)

## AUTOMATIC TRANSMISSION

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### **E: CONTROL VALVE HYDRAULIC PRESSURE CORRECTION CONTROL AND LEARNING CONTROL**

- Control valve hydraulic pressure correction control

During this control, the TCM acquires the hydraulic pressure correction data stored for each control valve in the memory box installed on the control valves, and then correctively controls the instruction current to each solenoid based on the data. This ensures stable shifting quality irrespective of variance between units.

- Learning control of shifting hydraulic pressures

To constantly ensure excellent shift quality regardless of the variance between friction material and aging, learning control of shifting hydraulic pressures is used.

Learning takes place for every normal shifting under certain conditions, and the learned values are saved in the flash ROM of the TCM. The values are not cleared even when the power is turned OFF (or the battery's negative terminal disconnected).

### **F: AWD CENTER DIFFERENTIAL CONTROL**

#### **1. CONTROL DESCRIPTION**

Engagement of the multi-plate clutch (LSD) in the center differential is controlled according to the torque input to the transfer. It selects a map according to driving conditions and use it as the control basis.

#### **2. NORMAL CONTROL**

The input torque to the multi-plate clutch is calculated according to various factors such as engine torque signals, torque converter turbine speed and selected gear position. Based on the calculation result, the basic coupling force of the clutch is determined.

#### **3. START CONTROL**

When the vehicle speed is 0 km/h (0 MPH), the TCM increases the engaging force of the multi-plate clutch to a higher level compared to that of normal control.

This enables the vehicle to start smoothly without swerving even on a slippery road.

#### **4. TURNING CONTROL**

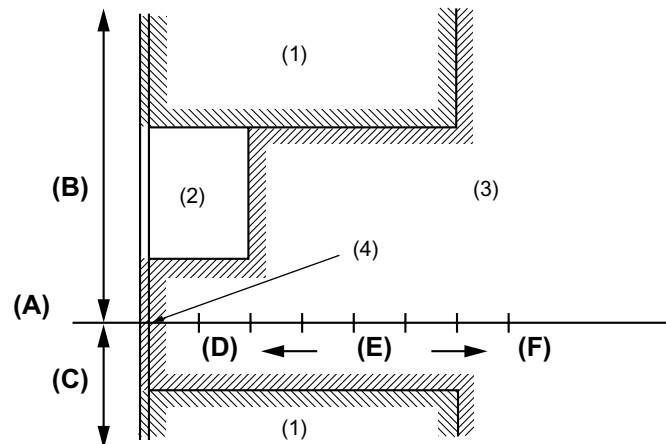
The TCM makes a correction such that the engagement force of the multi-plate clutch is reduced as the steering angle increases.

This function is performed to improve turning performance at certain vehicle speed range.

## 5. SLIP CONTROL

When front or rear wheels start slipping with the vehicle running slower than the predetermined speed, the TCM makes control to increase the differential action limiting torque.

This function maintains traction and improves driving stability.



AT-00737

- |                                      |                     |
|--------------------------------------|---------------------|
| (A) Front and rear wheel speed ratio | (1) Slip control    |
| (B) Front wheel slip                 | (2) Turning control |
| (C) Rear wheel slip                  | (3) Normal control  |
| (D) Low                              | (4) Start control   |
| (E) Vehicle speed                    |                     |
| (F) High                             |                     |

## 6. ABS CONTROL

When the TCM receives an ABS operation signal from the ABSCM, it adjusts the differential action limiting torque to the predetermined level.

This function improves ABS control.

## 7. BASE BRAKE CONTROL

When the brake switch is ON and the throttle valve is fully closed, the TCM makes control to decrease the differential action limiting torque. The ABS control has priority over this control.

This function improves stability during braking.

## G: RANGE LOCK CONTROL

This control prevents the select lever from being moved to the R position when the vehicle is running. Thus damage to components such as the reverse clutch is prevented.

When the specified speed is exceeded the TCM turns off the shift lock solenoid for the select lever. Therefore the range lock control works to inhibit operation from N range to R range, preventing the transmission from put into reverse.

# ON-BOARD DIAGNOSTICS SYSTEM

## AUTOMATIC TRANSMISSION

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### 17. On-board Diagnostics System

#### A: FUNCTION

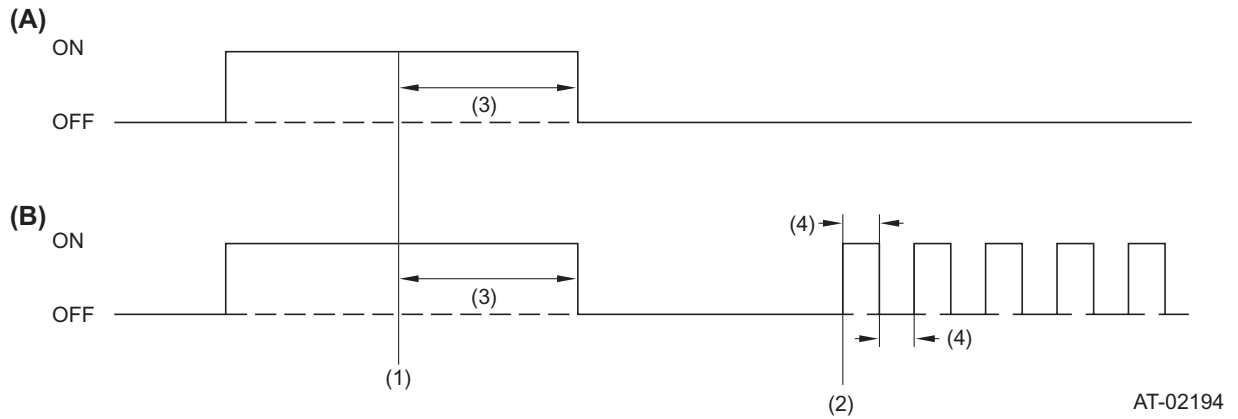
- The on-board diagnosis system detects and indicates a fault by generating a code corresponding to each fault location. The engine malfunction indicator light (SPORTS indicator light) on the combination meter indicates occurrence of a fault or abnormality.
- When the engine malfunction indicator light comes on as a result of detection of a fault by the TCM, the corresponding diagnostic trouble code (DTC) is stored in the TCM.
- On OBD-II available vehicles, it is necessary to connect the SUBARU Select Monitor (SSM) to the data link connector in order to check the DTC.
- To provide various functions and to facilitate fault isolation, a diagnosis system compatible with the SSM is used.
- The on-board diagnostics system detects the following electrical system faults or abnormalities in the system.

ATF temperature sensor 1, 2	Inhibitor switch
Turbine speed sensor 1, 2	CAN communication system
Front and rear wheel speed sensors	Interlock decision
Lockup solenoid (circuit, function)	1st engine brake abnormal
Line pressure solenoid (circuit)	Range lock solenoid (circuit)
Front brake solenoid (circuit, function)	PN signal output
Input clutch solenoid (circuit, function)	PVign power circuit (PVign relay)
High and low reverse clutch solenoid (circuit, function)	Backup light relay output circuit
Direct clutch solenoid (circuit, function)	TCM data communication abnormal
Low coast brake solenoid (circuit, function)	Lateral G sensor
Transfer solenoid (circuit)	Brake switch
Front brake hydraulic switch	Sports mode switch
Input clutch hydraulic switch	Engine speed signal
High and low reverse clutch hydraulic switch	1, 2, 3, 4, 5, R gear ratios
Direct clutch hydraulic switch	

If a fault is detected, the system tells the fault by causing the SPORTS indicator light to blink.

## B: OPERATION OF SPORTS INDICATOR LIGHT

On starting the engine, the SPORTS indicator light illuminates for bulb check and then goes out as shown in the Normal diagram below. If any problem exists, the light continues flashing as shown in the Abnormal diagram below.



(A) When normal

(B) Abnormal

(1) Engine cranking

(2) Abnormality detected

(3) 2 seconds

(4) 0.25 seconds

AT-02194



### 18.Fail-safe Function

- Front and rear vehicle speed sensors, rear wheel speed sensor abnormal

If a fault is detected in either or both of the front vehicle speed sensor and rear vehicle speed sensor, the vehicle speed information received from the ABS unit via CAN communication is substituted for control. This enables normal quality shifting.

- Inhibitor switch abnormal

If an input of other than the specified pattern is entered to the TCM, the select position indicator lights in the combination meter are turned off, the starter is disabled, the reverse light is disabled, the transmission is fixed in D range, and manual mode is inhibited.

- PN signal abnormal

The output is turned OFF (starter inhibited) if an abnormality is detected in the PN signal output. However, if the ECM is receiving range signals through the backup of CAN communication, the starter can be used in P and N ranges.

- AT interlock decision

If an AT interlock decision is made, the vehicle's minimum mobility is maintained by fixing the transmission in 2nd, 4th or 5th speeds in accordance with the engaging pattern detected by the hydraulic switch. Relation between the hydraulic switch detection pattern and fixed gear speeds are as shown in the following table.

- Engine braking in 1st abnormal decision

If 1st engine braking abnormal decision is made, the low coast brake solenoid is deactivated to cancel the engine braking effect.

- Line pressure solenoid abnormal

The solenoid is deactivated and the line pressure set at maximum, 5th speed is inhibited. Except for this, the system is controlled normally.

- Lockup solenoid abnormal

The solenoid is deactivated and lockup is inhibited.

- Low coast brake solenoid abnormal

If the solenoid is failed and stuck in its ON state (electrically or mechanically) the transmission is fixed in 2nd speed, and when the solenoid is failed and stuck in its OFF state (electrically or mechanically) the solenoid is constantly turned OFF. (Engine braking is made not available in 1st and 2nd speeds.)

- Input clutch solenoid abnormal

If the solenoid is failed and stuck in its ON or OFF state (electrically or mechanically) the transmission is fixed in 4th speed to maintain mobility.

- Direct clutch solenoid abnormal

If the solenoid is failed and stuck in its ON or OFF state (electrically or mechanically) the transmission is fixed in 4th speed to maintain mobility.

- Front brake solenoid abnormal

If the solenoid is failed and stuck in its ON state (electrically or mechanically) the transmission is fixed in 5th speed, and when the solenoid is failed and stuck in its OFF state (electrically or mechanically) the transmission is fixed in 4th speed to maintain mobility.

- High and low reverse clutch solenoid abnormal

If the solenoid is failed and stuck in its ON or OFF state (electrically or mechanically) the transmission is fixed in 4th speed to maintain mobility.

# FAIL-SAFE FUNCTION

AUTOMATIC TRANSMISSION

- Transfer clutch solenoid abnormal

If the solenoid is failed and stuck in its ON or OFF state, the transfer solenoid output is constantly turned OFF.

- Turbine sensor 1, 2 abnormal

Shifting control is performed without using turbine sensor values to maintain minimum mobility. 5th speed and manual mode are inhibited.

- TCM data communication abnormal

If communication with the memory box on the control valves fails, backup values stored in the TCM are used for controlling the solenoids.

- CAN communication abnormal

If an abnormality occurs in CAN communication, data received via CAN communication are fixed to preset values to perform shift control and maintain minimum mobility. Lockup and manual mode are inhibited.

Gear position	Oil pressure switch output					Fail safe	Clutch pressure output pattern in failsafe mode							
	Input clutch switch	High& low reverse clutch switch	Direct clutch switch	Front brake switch	Low coast brake switch		Input clutch solenoid	High & low reverse clutch solenoid	Direct clutch solenoid	Front brake solenoid	Low coast brake solenoid	Lockup solenoid	Transfer solenoid	
Interlock engaging pattern	1	x	○	—	○	○	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON
		—	○	x	—	○	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON
	2	—	x	○	—	○	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON
		x	—	○	○	—	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON
	3	—	○	○	—	x	Fixed in 2nd	OFF	OFF	ON	OFF	OFF	OFF	ON
		x	—	○	○	—	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON
	4	—	○	○	—	x	Fixed in 2nd	OFF	OFF	ON	OFF	OFF	OFF	ON
		○	—	○	x	—	Fixed in 5th	ON	ON	OFF	ON	OFF	OFF	ON
	5	○	○	—	○	x	Fixed in 2nd	OFF	OFF	ON	OFF	OFF	OFF	ON
		○	—	x	○	—	Fixed in 4th	ON	ON	ON	OFF	OFF	OFF	ON

x : Abnormal

○ : Normal

AT-02300

# TRANSMISSION MOUNTING

AUTOMATIC TRANSMISSION

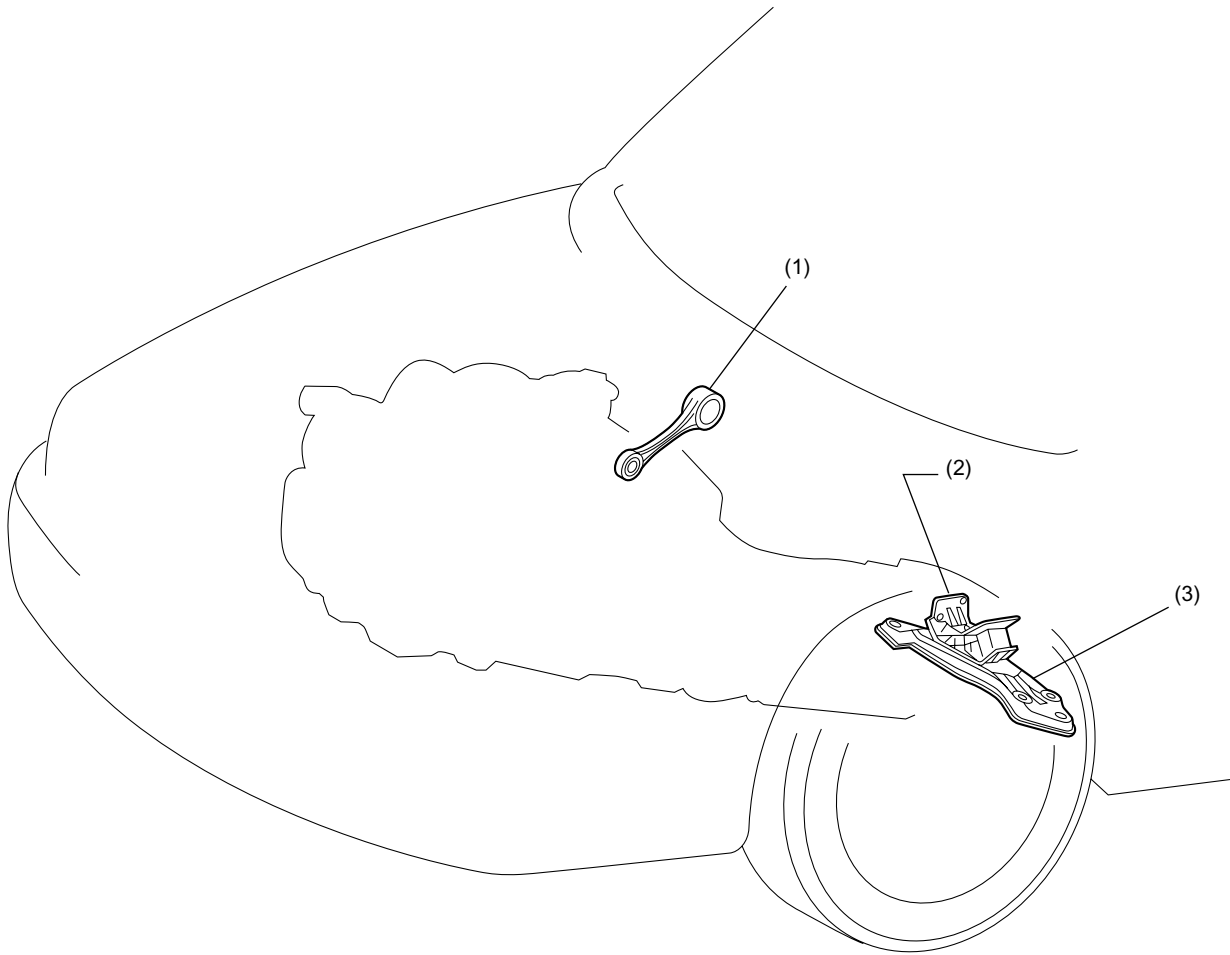
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## 19. Transmission Mounting

### A: GENERAL

The transmission mounting consists of a pitching stopper, cushion rubber, and a cross member.

In addition to support the transmission, these components absorb noise and vibration caused by the transmission.



AT-00438

- (1) Pitching stopper
- (2) Cushion rubber
- (3) Cross member

# GENERAL

AUTOMATIC TRANSMISSION (FROM '08MY)

---

## 1. General

### A: GENERAL

In purpose of improving shifting quality, driving performance and fuel efficiency, we have developed 5-speed automatic transmission mainly with new hydraulic control and electronic control systems. This automatic transmission features the following:

### B: NEW STRUCTURE

- Low coast brake and forward one-way clutch are eliminated to reduce friction torque.
- Torque converter structure is modified to improve acceleration performance for more linearity.
- Control valve structure is modified to reduce drive torque and weight.

### C: MODIFICATIONS FOR DRIVING PERFORMANCE IMPROVEMENT

#### 1. SHIFTING PERFORMANCE IMPROVEMENT

- Structure change of control valve has realized highly accurate and responsive control system.
- Blipping control is employed to provide automatic switching of shift schedule and active shifting control in manual mode.
- A new control system is applied so that operating the paddle switch up ⇔ down while driving in D range enables manual shifting and automatically returns to normal automatic shifting under certain conditions. (models with paddle switch)

### D: MODIFICATIONS FOR FUEL EFFICIENCY IMPROVEMENT

#### 1. EFFICIENCY IMPROVEMENT

- Low coast brake and forward one-way clutch are eliminated to reduce friction on gear train.
- Slip lock-up range is expanded.

#### 2. WEIGHT SAVING

- Low coast brake and forward one-way clutch are eliminated.
- Control valve is changed to two-layer type.

### E: UNCHANGED MECHANISM

The following mechanisms are unchanged from the former systems:

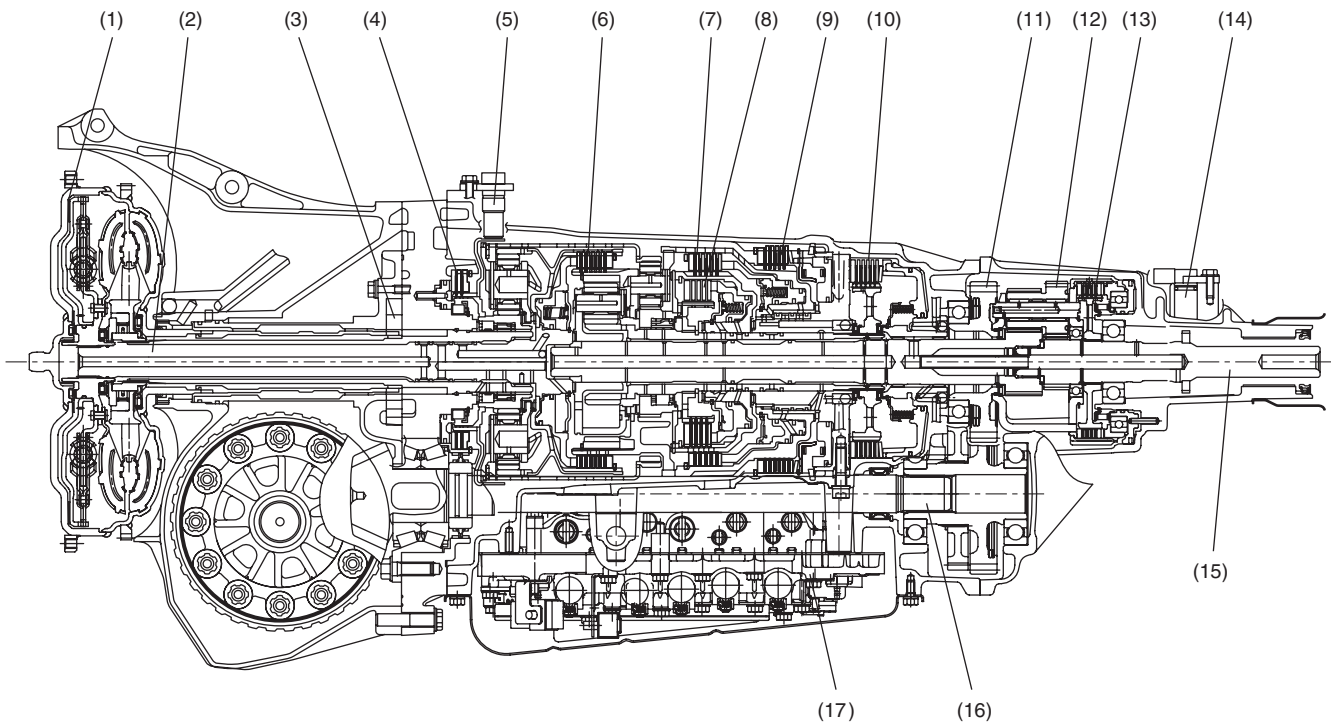
- Oil pump
- Front brake
- Input clutch
- Direct clutch
- High & low reverse clutch
- Reverse brake
- AWD transfer system
- Transmission mount
- Transfer

# CROSS-SECTION

AUTOMATIC TRANSMISSION (FROM '08MY)

## 2. Cross-section

### A: CROSS-SECTION



AT-04714

- |                            |   |                                |
|----------------------------|---|--------------------------------|
| (1) Torque converter ASSY  | (7) Direct clutch                       | (13) Transfer clutch           |
| (2) Input shaft            | (8) High & low reverse clutch           | (14) Rear vehicle speed sensor |
| (3) Oil pump               | (9) Reverse brake                       | (15) Rear drive shaft          |
| (4) Front brake            | (10) Forward brake                      | (16) Drive pinion shaft        |
| (5) Turbine speed sensor 1 | (11) Reduction gear                     | (17) Control valve             |
| (6) Input clutch           | (12) Variable torque distribution (VTD) |                                |

# OIL PUMP

AUTOMATIC TRANSMISSION (FROM '08MY)

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## **3. Oil Pump**

### **A: GENERAL**

Same mechanism as the existing model.

## 4. Front Brake

### A: GENERAL

Same mechanism as the existing model.

# INPUT CLUTCH

AUTOMATIC TRANSMISSION (FROM '08MY)

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## 5. Input Clutch

### A: GENERAL

Same mechanism as the existing model.



## 6. Direct Clutch

### A: GENERAL

Same mechanism as the existing model.

# HIGH & LOW REVERSE CLUTCH

AUTOMATIC TRANSMISSION (FROM '08MY)

---

## 7. High & Low Reverse Clutch

### A: GENERAL

Same mechanism as the existing model.

## 8. Reverse Brake

### A: GENERAL

Same mechanism as the existing model.

# FORWARD BRAKE

AUTOMATIC TRANSMISSION (FROM '08MY)

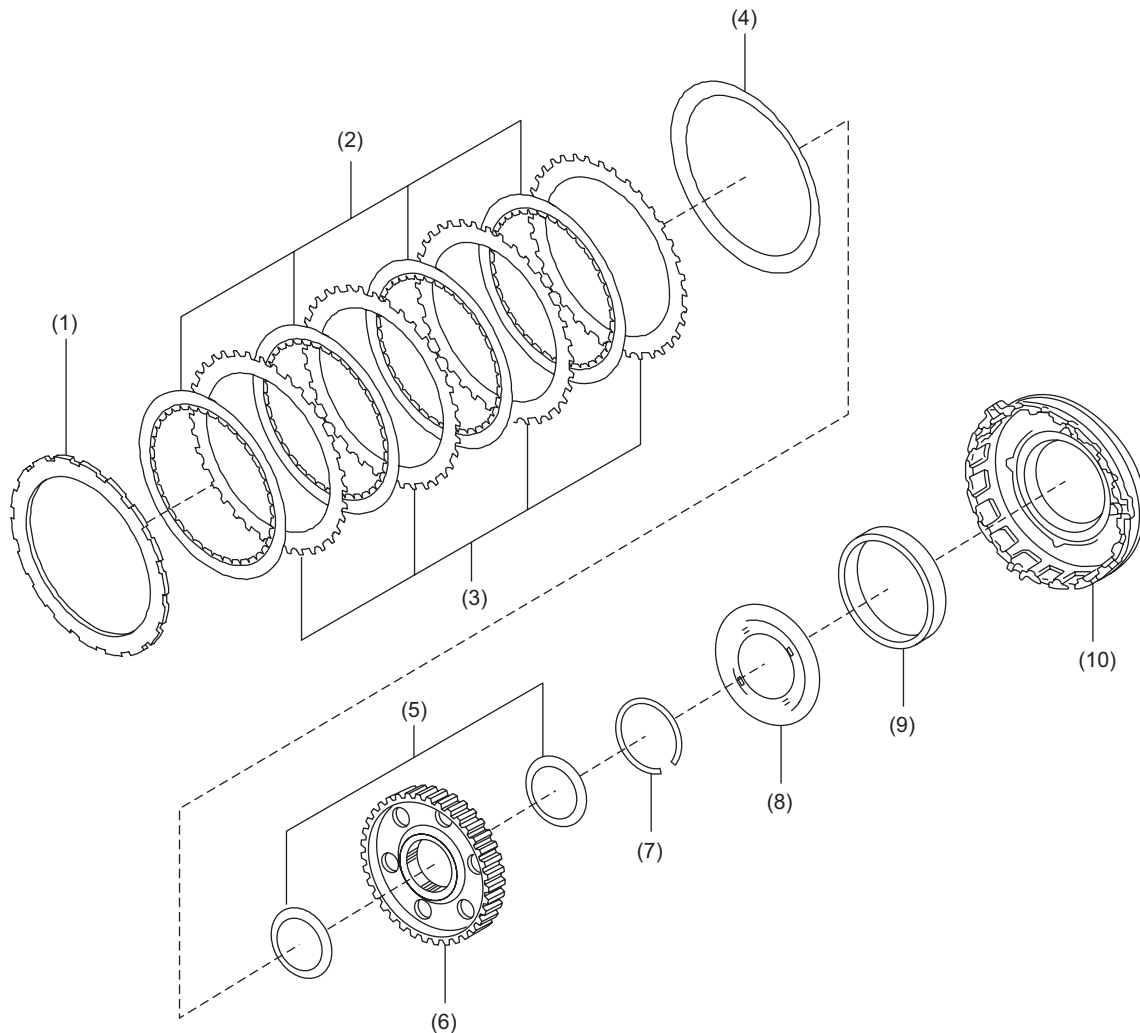
## 9. Forward Brake

### A: COMPONENT

The forward brake consists of forward brake hub, forward brake piston, return spring, dish plate, drive plates, driven plates and retaining plate.

The forward brake restrains reverse rotation of mid sun gear at 1st and 2nd speed.

(Forward brake cannot be disassembled.)



AT-04715

- (1) Retaining plate
- (2) Drive plate
- (3) Driven plate
- (4) Dish plate

- (5) Thrust bearing
- (6) Forward brake hub
- (7) Snap ring

- (8) Retainer
- (9) Return spring
- (10) Forward brake piston

# CONTROL VALVE

AUTOMATIC TRANSMISSION (FROM '08MY)

## 10. Control Valve

### A: GENERAL

The control system of automatic transmission consists of oil pump, valve body containing valves, clutches and fluid passages. The system is operated by both driver's input and electrical input from TCM.

### B: FUNCTION

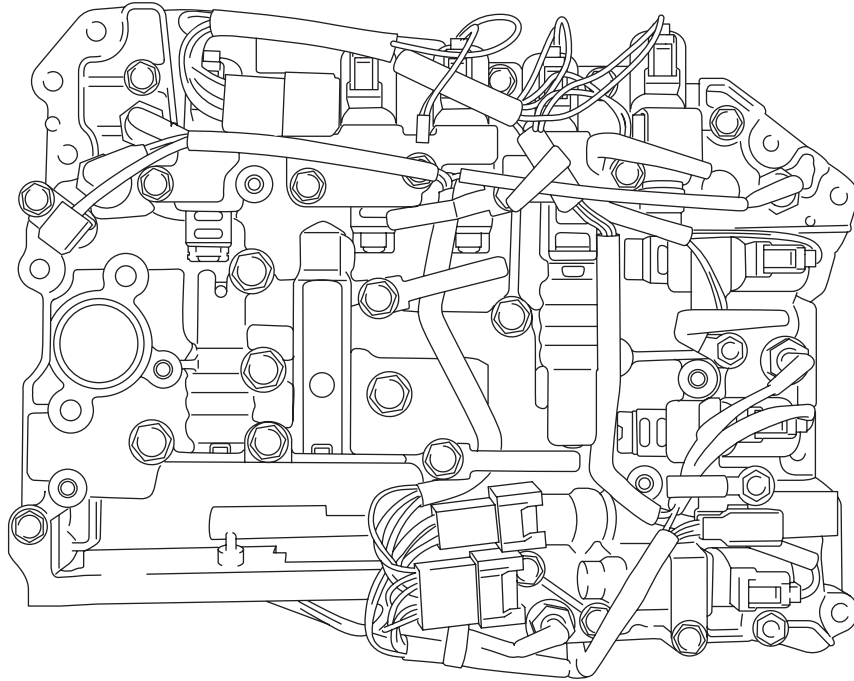
Name	Function
Primary regulator valve	Regulates the pressure of oil discharged from the oil pump to the optimum pressure (line pressure) depending on the driving condition.
Front brake control valve	During front brake engagement, regulates the line pressure to the optimum level (front brake pressure) and supplies to front brake. (Regulates the clutch pressure at 1st, 2nd, 3rd and 5th speed)
Modulator valve 1	Regulates the line pressure to create a certain pressure (pilot pressure) required for line pressure control, shifting control and lock-up control.
Modulator valve 2	Regulates the line pressure to create a certain pressure (pilot pressure) required for shifting control.
Forward brake control valve	During forward brake engagement, regulates the line pressure to the optimum level (forward brake pressure) and supplies to forward brake.
High & low reverse clutch control valve	During high & low reverse clutch engagement, regulates the line pressure to the optimum level (high & low reverse clutch) and supplies to high & low reverse clutch. (Regulates the clutch pressure at 1st, 3rd, 4th and 5th speed)
Input clutch control valve	During input clutch engagement, regulates the line pressure to the optimum level (input clutch pressure) and supplies to input clutch. (Regulates the clutch pressure at 4th and 5th speed)
Direct clutch control valve	During direct clutch engagement, regulates the line pressure to the optimum level (direct clutch pressure) and supplies to direct clutch. (Regulates the clutch pressure at 2nd, 3rd and 4th speed)
Transfer clutch control valve	Regulates the line pressure to the optimum level (transfer clutch pressure) and supplies to transfer clutch.
Lock-up control valve	Switches lock-up function between operation and release. Also provides smooth lock-up by continuously performing the lock-up operation.
Oil cooler bypass valve	Bypasses redundant oil of the cooler circuit without sending it.
Line pressure relief valve	Discharges redundant oil of the line pressure circuit.
Manual valve	Distributes the line pressure to each circuit in accordance with each selector position. For the circuits where no line pressure is distributed, drain occurs.
Front brake oil pressure switch	Detects problems in front brake oil pressure and switches to the fail safe mode if a problem is detected.
Forward brake oil pressure switch	Detects problems in forward brake oil pressure and switches to the fail safe mode if a problem is detected.
Input clutch oil pressure switch	Detects problems in input clutch oil pressure and switches to the fail safe mode if a problem is detected.
Direct clutch oil pressure switch	Detects problems in direct clutch oil pressure and switches to the fail safe mode if a problem is detected.
High & low reverse clutch oil pressure switch	Detects problems in high & low reverse clutch oil pressure and switches to the fail safe mode if a problem is detected.

# CONTROL VALVE

AUTOMATIC TRANSMISSION (FROM '08MY)

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## C: ARRANGEMENT

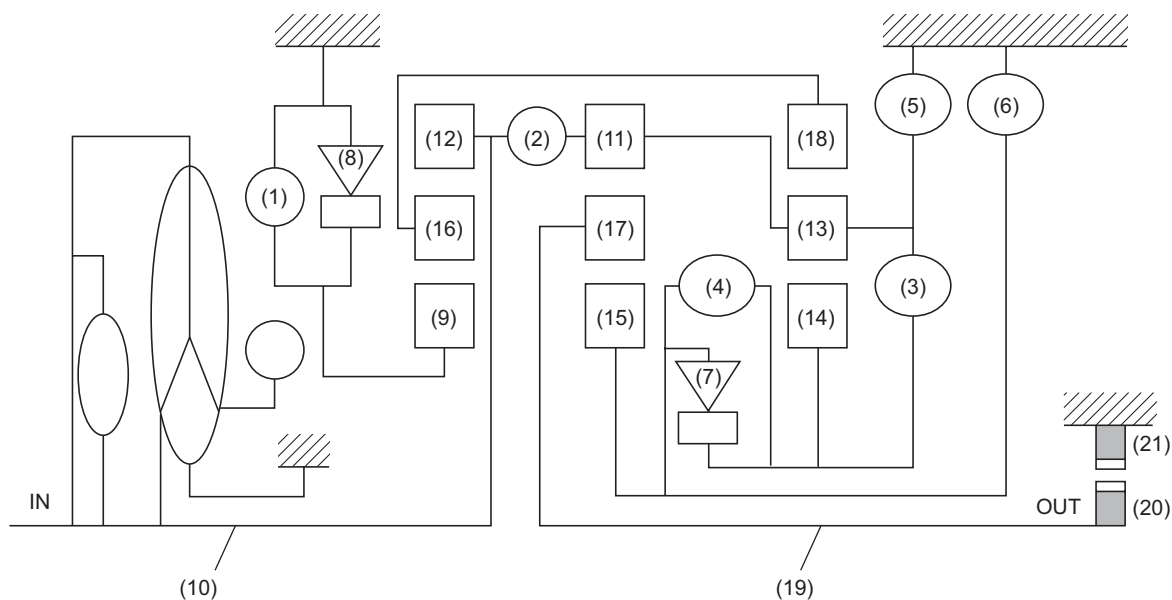


AT-04741

## 11. Gear Train

### A: STRUCTURE

The gear train consists of three sets of planetary gears, three sets of multi-plate clutches, three sets of multi-plate brakes and two sets of one-way clutches.



AT-04717

- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

AUTOMATIC TRANSMISSION (FROM '08MY)

## B: OPERATION

### 1. OPERATION TABLE

		Input clutch	High & low reverse clutch	Direct clutch	Reverse brake	Front brake	Forward brake	1st one-way clutch	3rd one-way clutch	
Selector lever selection	(P)		△			△				
	(R)		◇		○	◇		◎	◎	
	(N)		△			△				
	(D)	1st ↑↓		◇*			◇	○	◎	◎
		2nd ↑↓			○		◇	○		◎
		3rd ↑↓		○	○		◇		◇	◎
4th ↑↓		○	○	○				◇		
5th ↑↓		○	○			○		◇	◇	

- : Engaged
- ◎ : Torque is transmitted only when vehicle is driven
- ◇ : Torque is transmitted only when vehicle is coasting
- ◇\* : When SPORT mode is engaged
- △ : Engaged but no influence for output

AT-04716

### 2. N RANGE

Since both forward brake and reverse brake are in the release status, driving force of input shaft is not transmitted to output shaft.

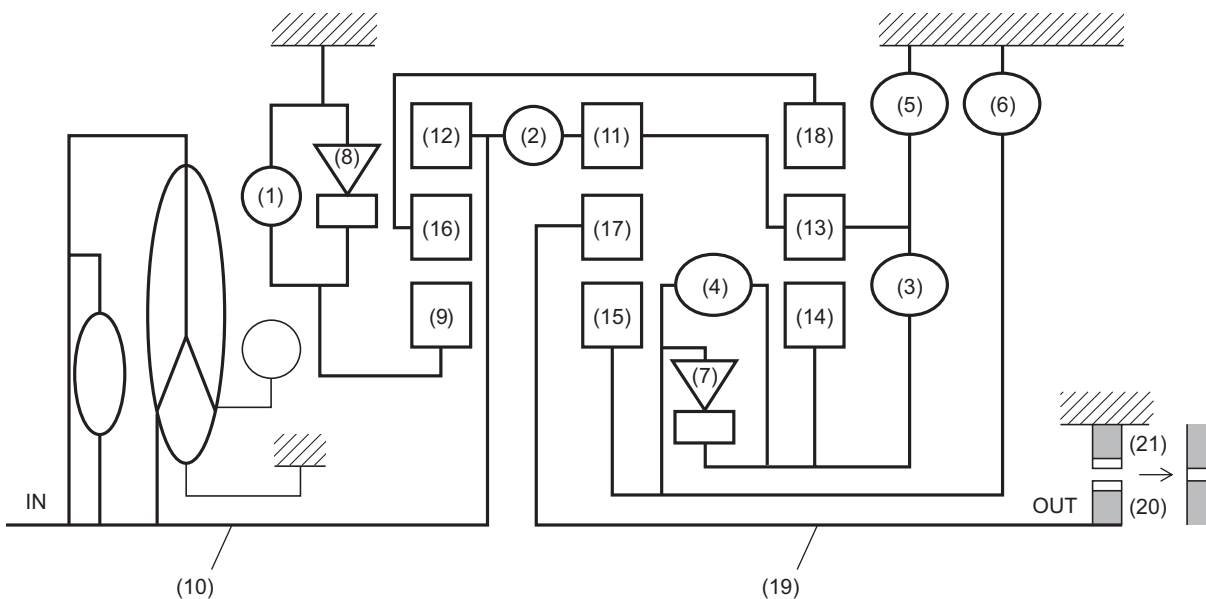


# GEAR TRAIN

AUTOMATIC TRANSMISSION (FROM '08MY)

## 3. P RANGE

- As with N range, since both forward brake and reverse brake are in the release status, driving force of input shaft is not transmitted to output shaft.
- The parking pawl that operates in conjunction with the select lever engages with the parking gear and mechanically fixes the output shaft.



AT-04718

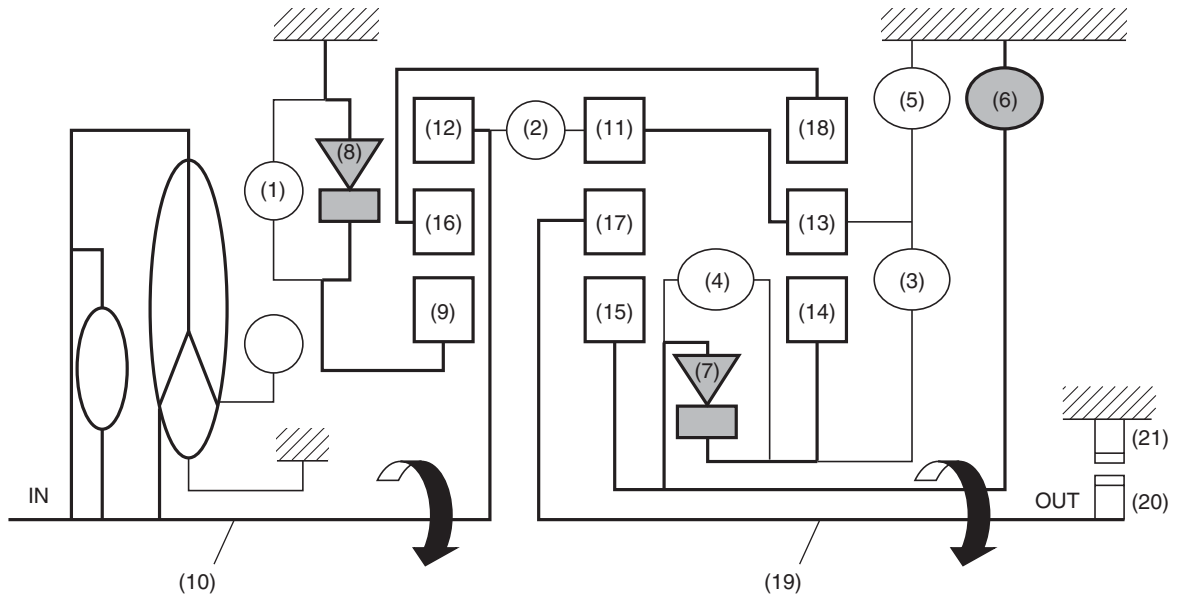
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

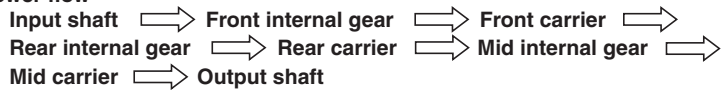
AUTOMATIC TRANSMISSION (FROM '08MY)

## 4. 1st GEAR IN D RANGE

- Forward brake operates to fix the mid sun gear.
- 1st one-way clutch operates to restrain reverse rotation of rear sun gear.
- 3rd one-way clutch operates to restrain reverse rotation of front sun gear.
- During deceleration, because the rear sun gear rotates in normal direction, 1st one-way clutch slips and engine brake does not work.



### Power flow



AT-04719

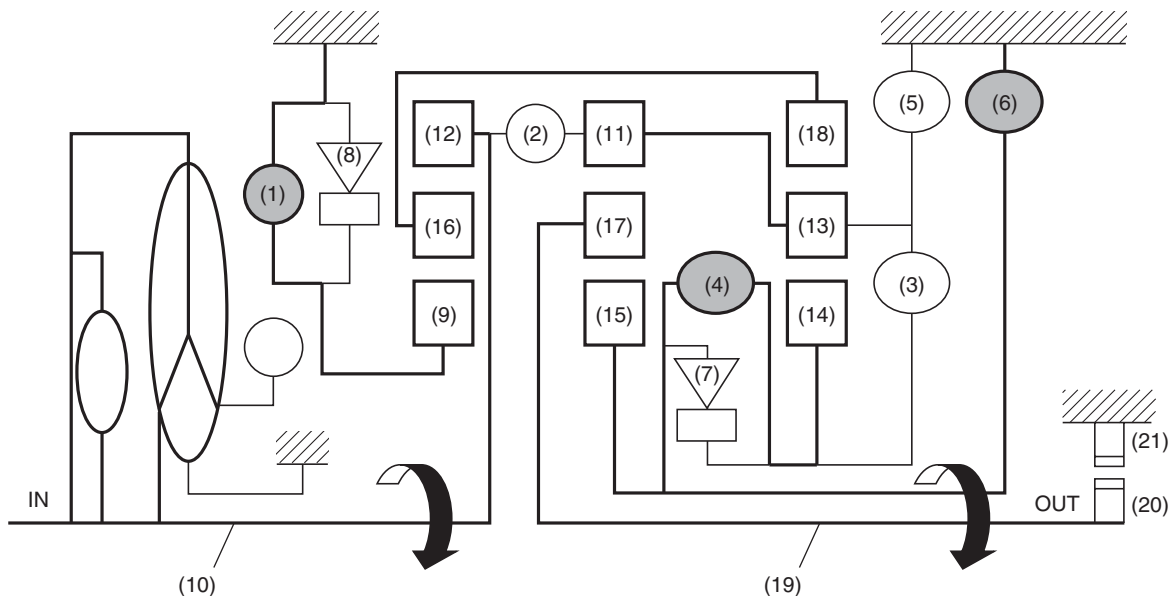
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

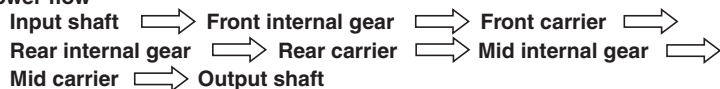
AUTOMATIC TRANSMISSION (FROM '08MY)

## 5. 1st GEAR IN MANUAL MODE

- Front brake operates to fix the front sun gear.
- Forward brake operates to fix the mid sun gear.
- High & low reverse clutch operates to engage rear sun gear and mid sun gear.
- Forward brake operates to fix the mid sun gear.
- During deceleration, high & low reverse clutch restrains normal rotation of rear sun gear and engine brake works.



### Power flow



AT-04720

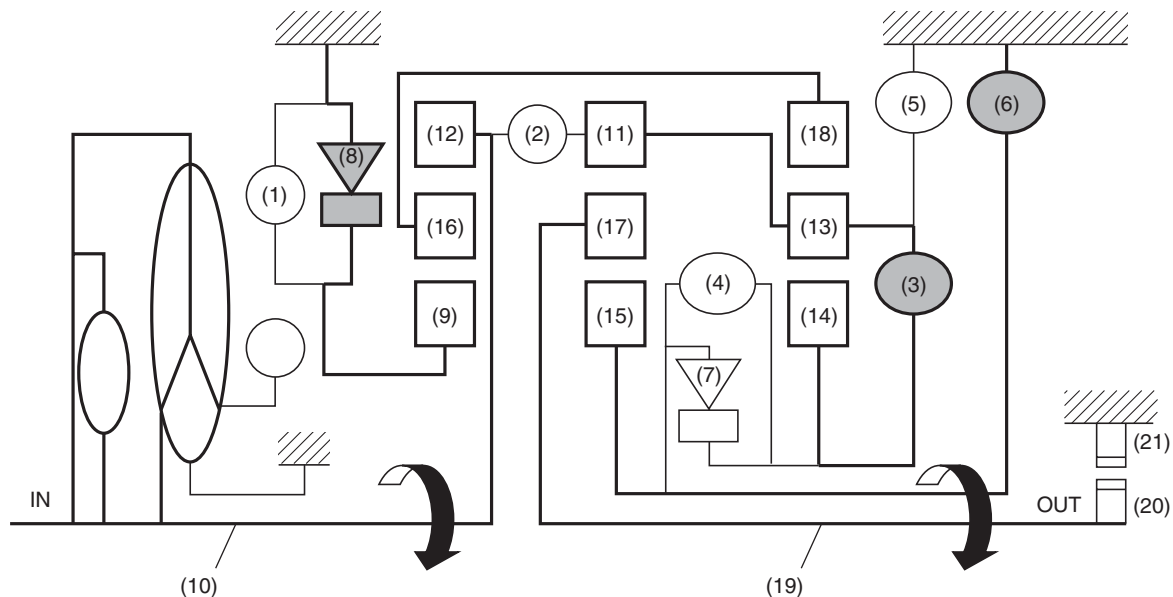
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

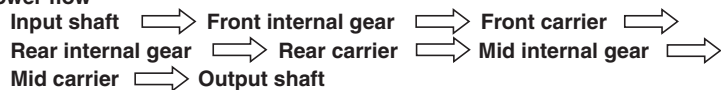
AUTOMATIC TRANSMISSION (FROM '08MY)

## 6. 2nd GEAR IN D RANGE

- Forward brake operates to fix the mid sun gear.
- 3rd one-way clutch operates to restrain reverse rotation of front sun gear.
- Direct clutch engages and connects rear carrier and rear sun gear.
- Engine brake works during deceleration.



### Power flow



AT-04721

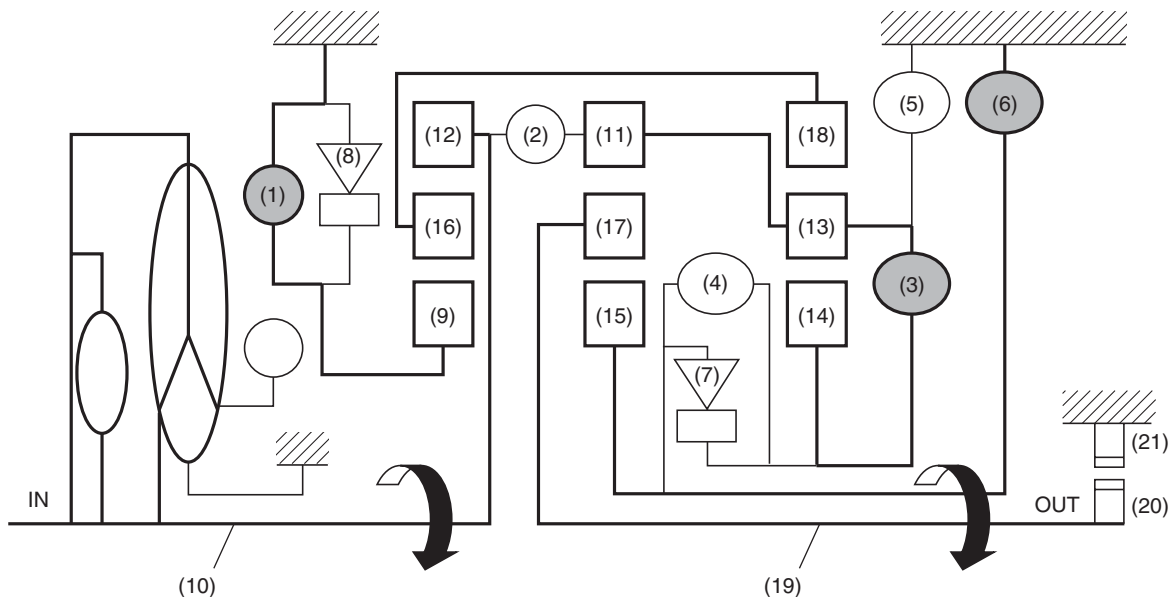
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

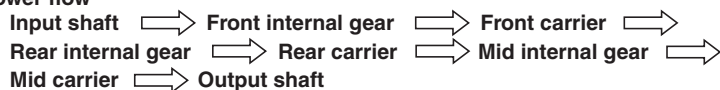
AUTOMATIC TRANSMISSION (FROM '08MY)

## 7. 2nd GEAR IN MANUAL MODE

- Forward brake engages and fixes the mid sun gear.
- Front brake operates to fix the front sun gear.
- Direct clutch engages and connects rear carrier and rear sun gear.
- Engine brake works during deceleration.



### Power flow



AT-04722

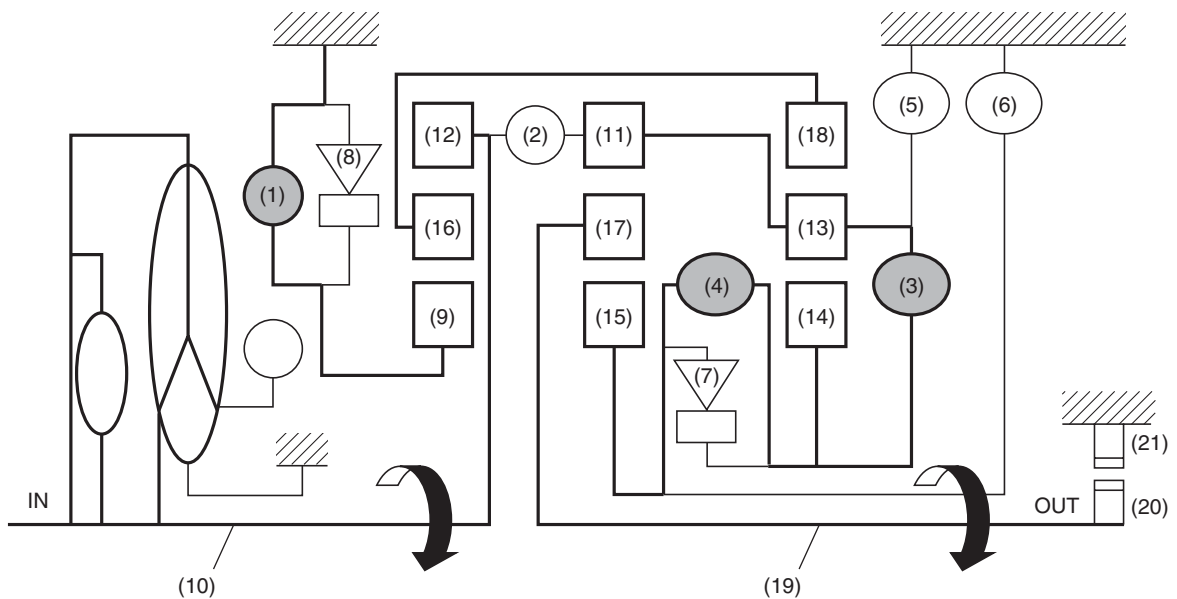
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

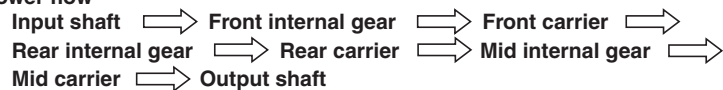
AUTOMATIC TRANSMISSION (FROM '08MY)

## 8. 3rd GEAR IN D RANGE OR MANUAL MODE

- Front brake operates to fix the front sun gear.
- Direct clutch engages and connects rear carrier and rear sun gear.
- High & low reverse clutch engages and connects mid sun gear and rear sun gear.



### Power flow



AT-04723

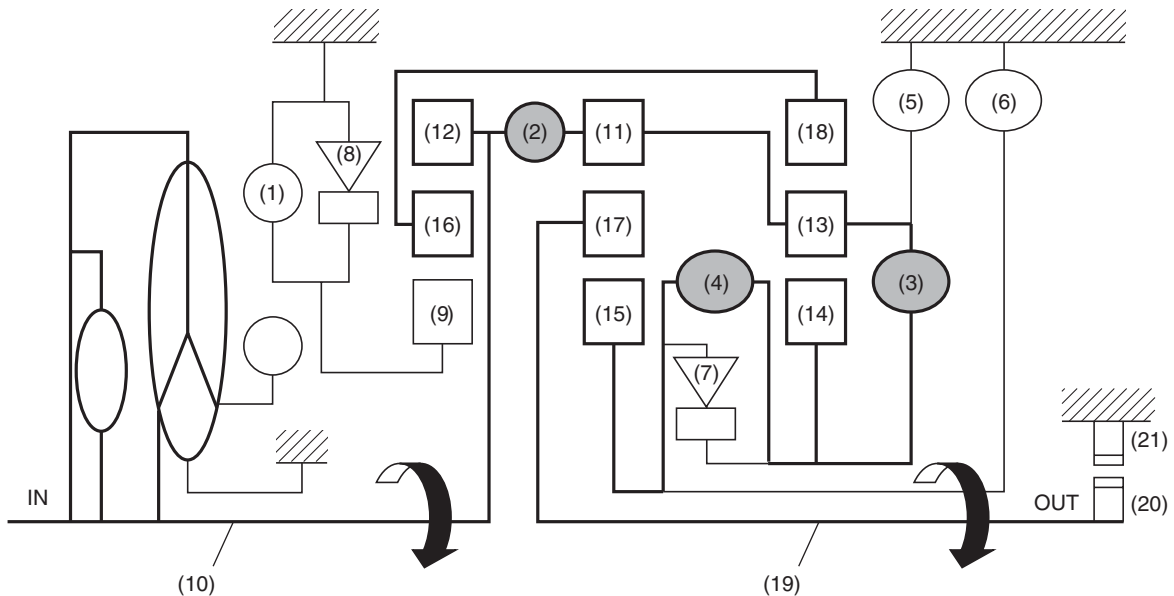
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

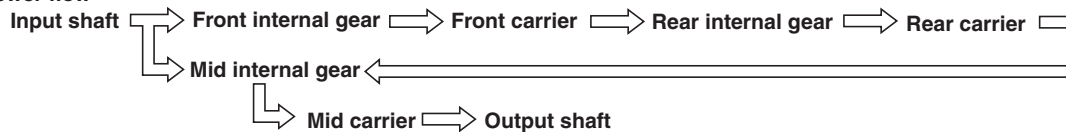
AUTOMATIC TRANSMISSION (FROM '08MY)

## 9. 4th GEAR IN D RANGE OR MANUAL MODE

- Direct clutch engages and connects rear carrier and rear sun gear.
- High & low reverse clutch engages and connects mid sun gear and rear sun gear.
- Input clutch engages and connects front internal gear and mid internal gear.
- Driving force is transmitted to front internal gear, mid internal gear and rear carrier, and the three planetary gears rotate in normal direction as a unit.



### Power flow



AT-04724

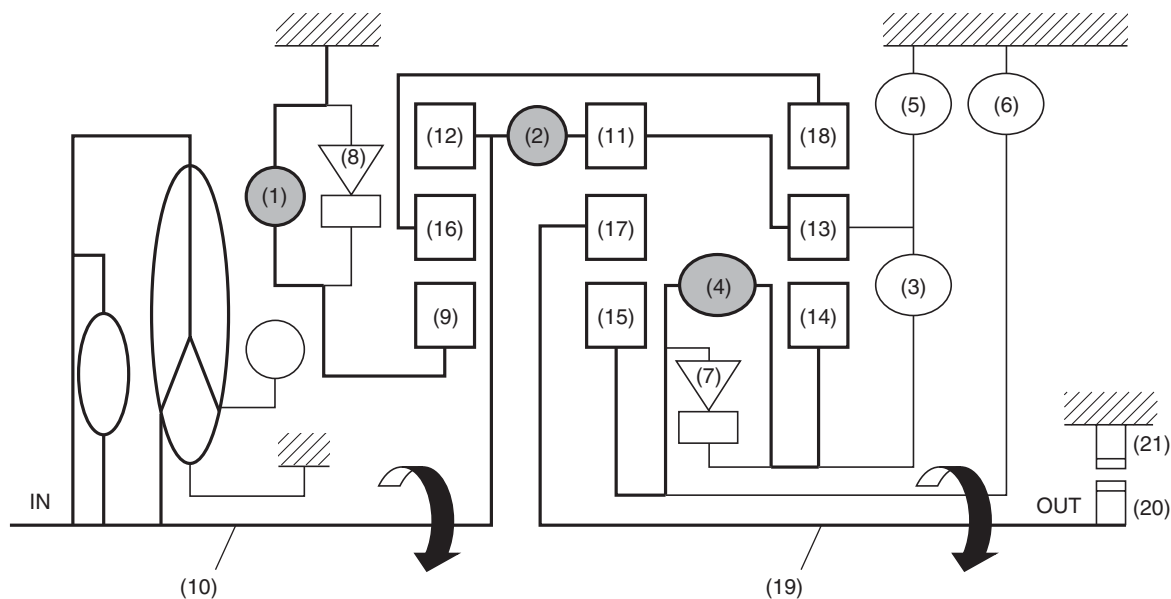
- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# GEAR TRAIN

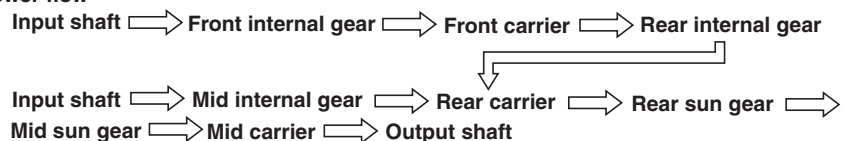
AUTOMATIC TRANSMISSION (FROM '08MY)

## 10.5th GEAR IN D RANGE OR MANUAL MODE

- Front brake operates to fix the front sun gear.
- Input clutch engages and connects front internal gear and mid internal gear.
- High & low reverse clutch engages and connects mid sun gear and rear sun gear.



### Power flow



AT-04725

- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

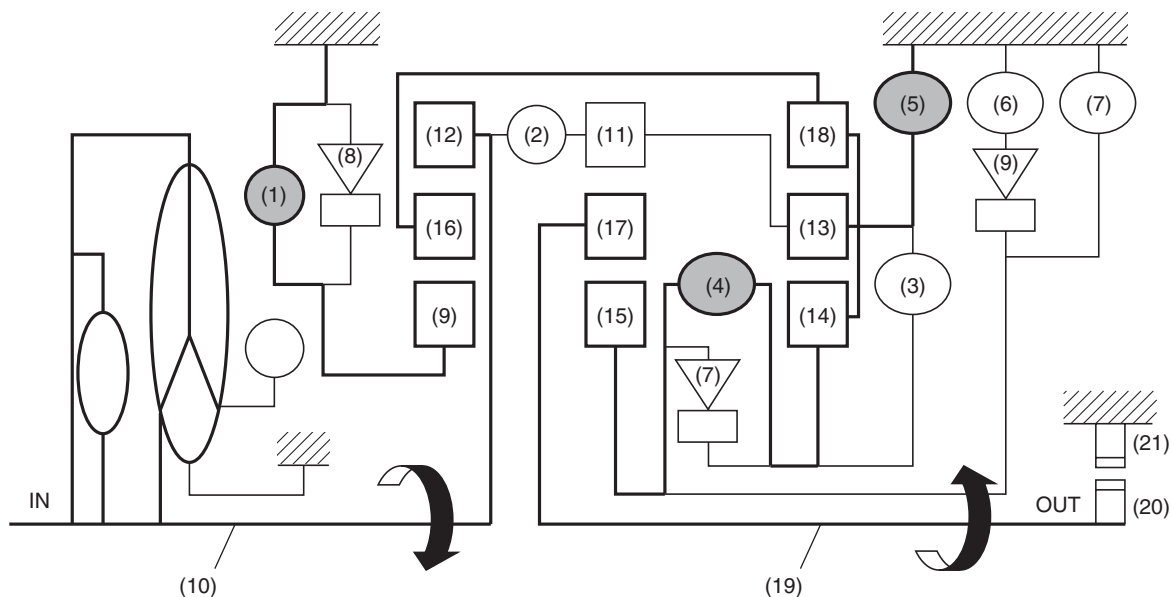


# GEAR TRAIN

AUTOMATIC TRANSMISSION (FROM '08MY)

## 11.R RANGE

- Front brake operates to fix the front sun gear.
- High & low reverse clutch engages and connects mid sun gear and rear sun gear.
- Reverse brake operates to fix the rear carrier.



### Power flow

Input shaft → Front internal gear → Front carrier → Rear internal gear →  
 Rear sun gear → Mid sun gear → Mid carrier → Output shaft

AT-04726

- |                               |                          |                         |
|-------------------------------|--------------------------|-------------------------|
| (1) Front brake               | (8) 3rd one-way clutch   | (15) Mid sun gear       |
| (2) Input clutch              | (9) Front sun gear       | (16) Front carrier      |
| (3) Direct clutch             | (10) Input shaft         | (17) Mid carrier        |
| (4) High & low reverse clutch | (11) Mid internal gear   | (18) Rear internal gear |
| (5) Reverse brake             | (12) Front internal gear | (19) Output shaft       |
| (6) Forward brake             | (13) Rear carrier        | (20) Parking gear       |
| (7) 1st one-way clutch        | (14) Rear sun gear       | (21) Parking pawl       |

# **AWD TRANSFER SYSTEM**

AUTOMATIC TRANSMISSION (FROM '08MY)

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## **12.AWD Transfer System**

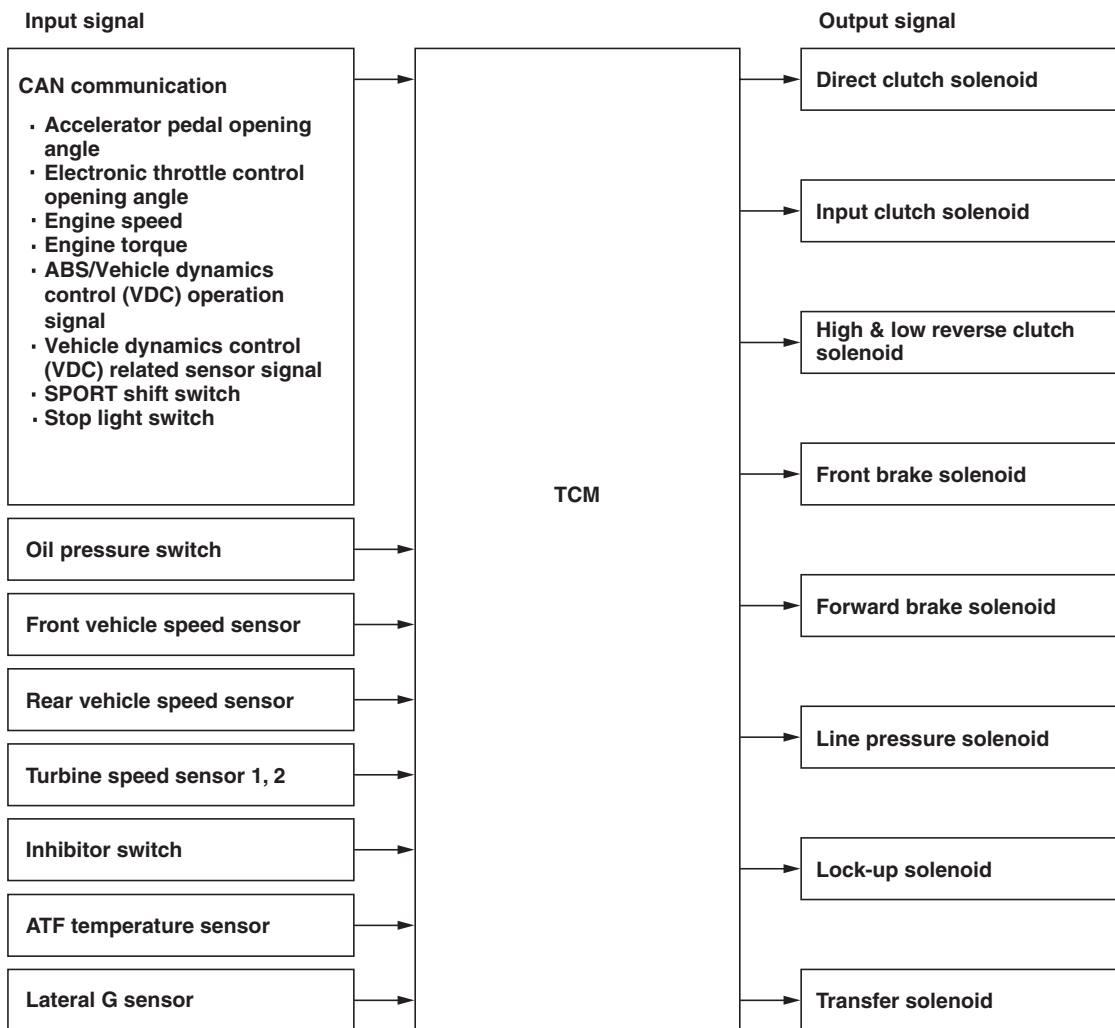
### **A: GENERAL**

Same mechanism as the existing model.

## 13. Electronic Hydraulic Control System

### A: GENERAL

The electronic hydraulic control system for transmission and transfer consists of various sensors, switches, TCM and control valve containing solenoid valves. This system controls shifting, lock-up clutch operation, line pressure and automatic transmission operation including shift timing. This also controls transfer clutch operation. TCM judges vehicle driving status based on various types of input signals and controls a total of eight solenoids (front brake solenoid, forward brake solenoid, input clutch solenoid, high & low reverse clutch solenoid, direct clutch solenoid, lock-up solenoid, line pressure solenoid and transfer solenoid) by sending appropriate signals.



AT-04727

# ELECTRONIC HYDRAULIC CONTROL SYSTEM

AUTOMATIC TRANSMISSION (FROM '08MY)

## B: CONTROL ITEMS

Control items		Control details	
Transmission hydraulic control	Shifting control	Shift pattern selection	Based on the shift pattern selected by input from switches in each range, upshift and downshift points are set according to accelerator pedal opening angle and vehicle speed. (Refer to "Transmission Control Module (TCM)" in <Ref. to 5AT-33, Transmission Control Module (TCM).>.)
		Linear solenoid control for each shift clutch	Directly controls the linear solenoid for each shift clutch according to target gear range. The control values are constantly corrected by learning control and real-time feedback, contributing shifting quality improvement and prevention of quality aging.
		Engine brake control	In manual mode, controls high & low reverse clutch solenoid so that engine brake is applied at 1st speed.
	Lock-up control	Basic lock-up control	Based on the shift pattern selected by input from switches in each range, lock-up engagement and release points are set according to accelerator pedal opening angle and vehicle speed. In accordance with these points, the lock-up solenoid is controlled to engage and release the lock-up clutch in torque converter.
		Smooth control	In lock-up clutch engagement, gradually changes pressure to provide smooth engagement.
	Line pressure control		Controls the line pressure in accordance with the input torque, front vehicle speed signal, rear vehicle speed signal and gear range.
AWD center differential control	Normal transfer control	Torque sensitive control	Adjusts the multi-plate clutch (LSD) pressure according to torque input to the transfer.
		Control for turning	Adjusts the LSD pressure based on the steering angle and vehicle speed.
		Slip control	LSD pressure increases if front or rear wheels start to slip.
	Cooperation control	Control during ABS operation	LSD pressure is adjusted to the set value during ABS operation.
		Control during braking	LSD pressure is adjusted to the set value while the brake switch is ON with the throttle valve fully closed.
		Control during VDC and TCS operation	LSD pressure is adjusted to the set value during VDC and TCS operation.

# ELECTRONIC HYDRAULIC CONTROL SYSTEM

AUTOMATIC TRANSMISSION (FROM '08MY)

## C: TRANSMISSION SHIFTING HYDRAULIC CONTROL

- Linear solenoid control for each shift clutch

Directly controls the linear solenoid for each shift clutch with electric current according to target gear range. The control current values are constantly corrected by learning control and real-time feedback control, contributing shifting quality improvement and prevention of quality aging.

- Engine brake control

In manual mode, controls high & low reverse clutch solenoid so that engine brake is applied at 1st speed.

## D: LOCK-UP CONTROL

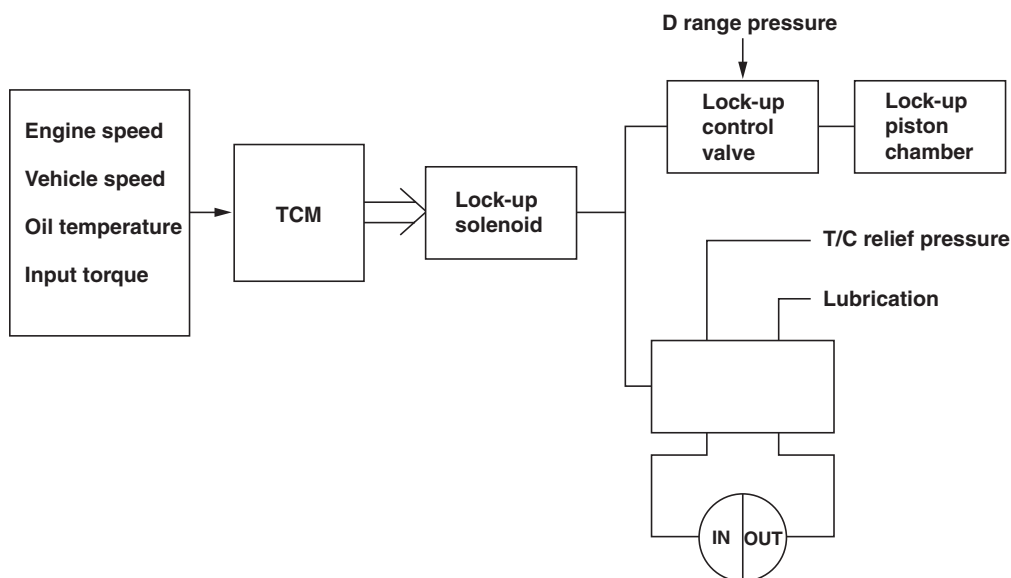
- Engages lock-up clutch in torque converter to prevent torque converter slippage and improve transmission efficiency.

- Upon receipt of signals from TCM, controls lock-up solenoid to operate lock-up control valve, adjusts the application pressure and release pressure, and changes the engaging force of lock-up clutch.

### Lock-up operation conditions

Select lever	Gear position	Slip lock-up	Full lock-up
D range Manual mode	2	○	△
	3	○	△
	4	○	○
	5	○	○

△: Full lock-up occurs when high ATF oil temperature is determined.



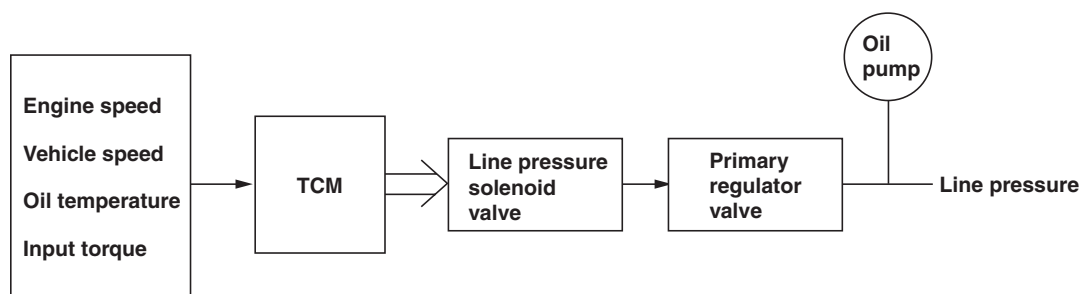
AT-01623

# ELECTRONIC HYDRAULIC CONTROL SYSTEM

AUTOMATIC TRANSMISSION (FROM '08MY)

## E: LINE PRESSURE CONTROL

When torque signal equivalent to engine driving force is sent from ECM to TCM, TCM controls the line pressure solenoid. By using the line pressure solenoid pressure as the signal pressure, controls the primary regulator valve and adjusts the pressure of ATF discharged from oil pump to the optimum level depending on the driving condition.



AT-01624

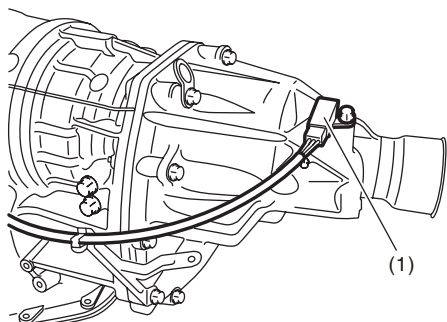
Maximum value of the calculated four values of required line pressure is set as the line pressure.

No.	Control details
1. Required line pressure for lubrication	The line pressure is calculated based on the input torque and gear range.
2. Required line pressure for shift clutch	The line pressure is calculated based on the input torque, front vehicle speed signal, rear vehicle speed signal and gear range.
3. Required line pressure for multi-plate clutch controlled by AWD	The line pressure required for the multi-plate clutch (LSD) is calculated.
4. Required line pressure for lock-up clutch	The line pressure required for the lock-up clutch is calculated.

## 14.Sensors

### A: REAR VEHICLE SPEED SENSOR

This vehicle speed sensor uses the hall element type sensor and is installed on the outside of extension case. This sensor detects the rear wheel speed based on the circumferential speed of rear drive shaft and sends pulse signal (22 pulses per one turn) to TCM.



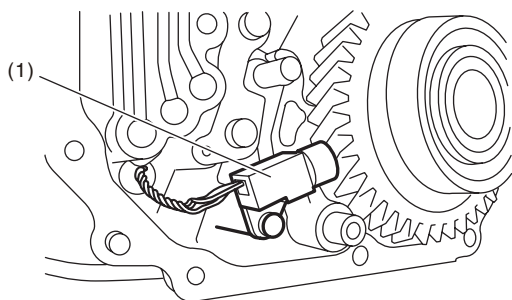
AT-04734

(1) Rear vehicle speed sensor

### B: FRONT VEHICLE SPEED SENSOR

This vehicle speed sensor uses the hall element type sensor and is installed on the inside of transmission case. This sensor detects the drive pinion shaft speed and sends pulse signal (41 pulses per one turn) to TCM.

The vehicle speed for control is calculated from the signals of front vehicle speed sensor and rear speed vehicle sensor and is used for shifting control.

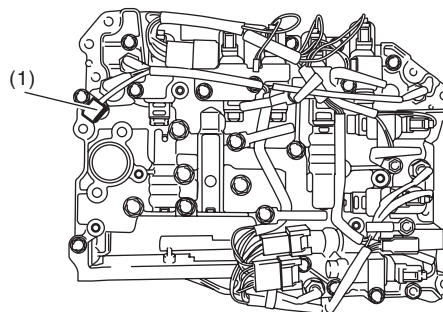


AT-04733

(1) Front vehicle speed sensor

### C: ATF TEMPERATURE SENSOR

This temperature sensor uses thermistor and is installed on the control valve body. The ATF temperature sensor detects the ATF temperature and outputs it as electrical resistance signal.

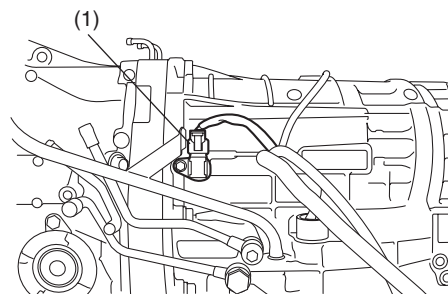


AT-04735

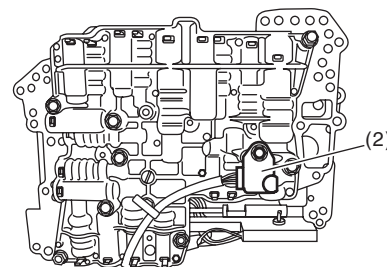
(1) ATF temperature sensor

### D: TURBINE SPEED SENSOR 1 AND 2

This speed sensor uses the hall element type sensor. The turbine speed sensor 1 detects the front sun gear speed, the turbine speed sensor 2 detects the front carrier speed, and then both send pulse signal (60 pulses per one turn) to TCM. From these two speed values, turbine speed is calculated and is used for shifting control.



AT-01559



AT-04736

(1) Turbine speed sensor 1  
(2) Turbine speed sensor 2

# SENSORS

## AUTOMATIC TRANSMISSION (FROM '08MY)

### E: INHIBITOR SWITCH

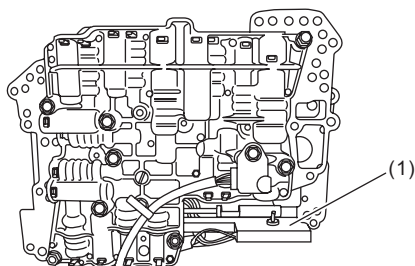
The inhibitor switch is installed in the control valve. TCM detects the range position based on the ON/OFF signal of each range output by the inhibitor switch, and performs various controls. The following list shows the inhibitor switch signal (INH1 — 4) and range position patterns.

	INH1	INH2	INH3	INH4
P	○			○
R		○		
N			○	○
D	○	○	○	

○ : Inhibitor switch ON

If the range position is judged as P or N, TCM outputs the signal (PN signal) to permit starter drive. In R or D range, starter drive is inhibited to ensure safety.

In addition, if the position is judged as R range, TCM turns back lamp relay output to ON and turns the back lamp on.

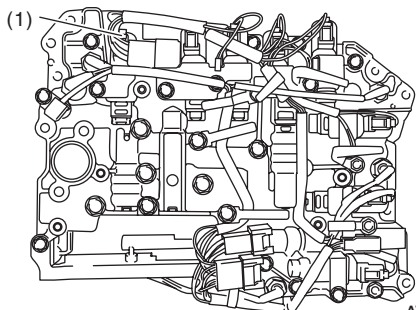


AT-04737

(1) Inhibitor switch

### F: LINE PRESSURE SOLENOID

The line pressure solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This controls the pressure modifier valve and accumulator control valve A and adjusts the line pressure to the optimum level in accordance with the driving condition.



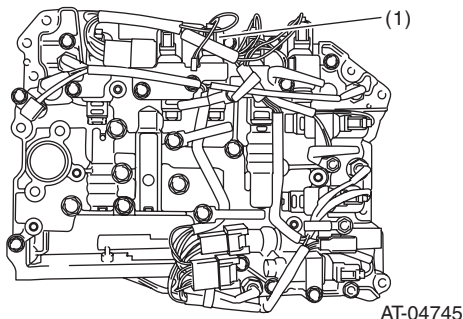
AT-04744

(1) Line pressure solenoid



### G: LOCK-UP SOLENOID

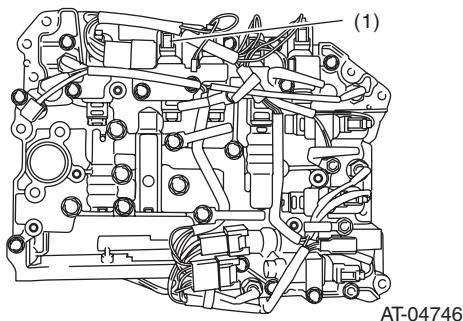
The lock-up solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This controls lock-up control valve, enabling smooth engagement and release. Real-time feedback enables stable control of slip lock-up.



(1) Lock-up solenoid

### H: FRONT BRAKE SOLENOID

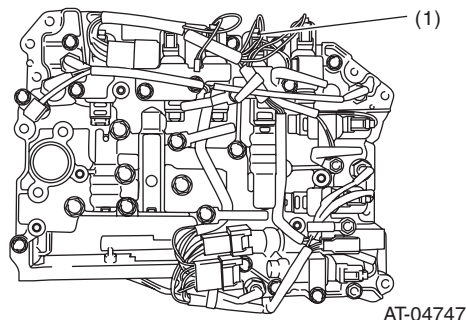
The front brake solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This solenoid is driven when the front brake is operated. The indicator current values are constantly corrected by learning control and real-time feedback, contributing shifting quality improvement and prevention of quality aging.



(1) Front brake solenoid

### I: INPUT CLUTCH SOLENOID

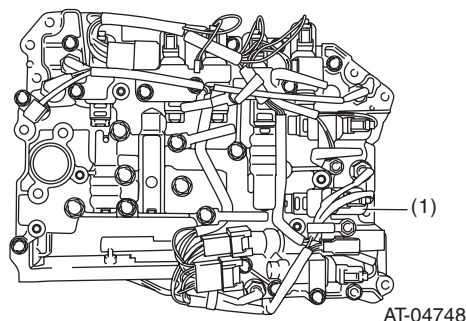
The input clutch solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This solenoid is driven when the input clutch is operated. The indicator current values are constantly corrected by learning control and real-time feedback, contributing shifting quality improvement and prevention of quality aging.



(1) Input clutch solenoid

### J: DIRECT CLUTCH SOLENOID

The direct clutch solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This solenoid is driven when the direct clutch is operated. The indicator current values are constantly corrected by learning control and real-time feedback, contributing shifting quality improvement and prevention of quality aging. Direct clutch pressure can be switched between two types of range pressure with the direct clutch piston switch valve.



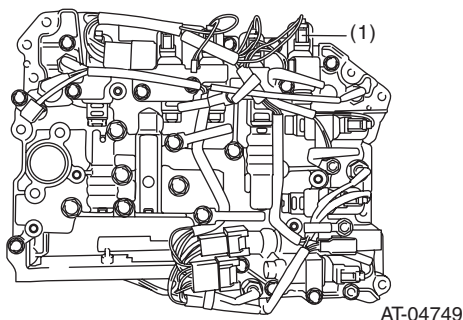
(1) Direct clutch solenoid

# SENSORS

AUTOMATIC TRANSMISSION (FROM '08MY)

## K: HIGH & LOW REVERSE CLUTCH SOLENOID

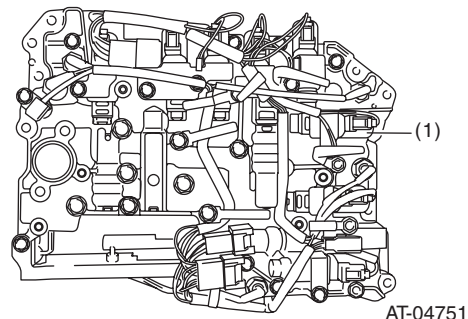
The high & low reverse clutch solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This solenoid is driven when the high & low reverse clutch is operated. The indicator current values are constantly corrected by learning control and real-time feedback, contributing shifting quality improvement and prevention of quality aging.



(1) High & low reverse clutch solenoid

## M: TRANSFER SOLENOID

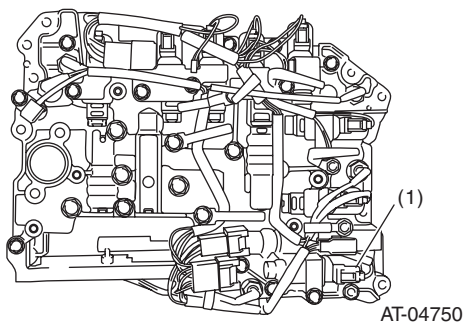
The transfer solenoid is installed on the control valve and is directly controlled by indicator current from TCM. This engages/releases the transfer clutch, enabling optimum AWD control depending on changes in road surface.



(1) Transfer solenoid

## L: FORWARD BRAKE SOLENOID

The forward brake solenoid is installed on the control valve and is operated by ON/OFF instructions from TCM. This solenoid is driven when the forward brake is engaged during engine brake operation at 1st or 2nd speed in manual mode.



(1) Forward brake solenoid

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## 15. Transmission Control Module (TCM)

### A: GENERAL

TCM receives signal from various sensors and judges the vehicle driving status. TCM then sends control signal to each solenoid according to preset shifting characteristics data, lock-up operation data and transfer clutch torque data.

### B: CONTROL ITEMS

Control items		Control details
Shifting control	Normal shifting control	Accelerator position signal Engine torque signal Front vehicle speed signal Rear vehicle speed signal Turbine sensor 1 and 2 signal Range signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
	Engine cooperation control	Front vehicle speed signal Rear vehicle speed signal Various engine information
	Control at high oil temperature	ATF oil temperature sensor signal
	Control at low ATF oil temperature or low water temperature	ATF oil temperature sensor signal Engine coolant temperature information
	Control during cruise control operation	Cruise control switch signal Cruise control SET signal

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

Control items			Control details
Shift pattern selection control	Adaptive control	Uphill control	Accelerator position signal Engine torque signal Front vehicle speed signal Rear vehicle speed signal Range signal Turbine sensor 1 and 2 signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
		Control during sudden depression of accelerator pedal	Accelerator position signal Front vehicle speed signal Rear vehicle speed signal Range signal
		Control during sudden release of accelerator pedal	Accelerator position signal Front vehicle speed signal Rear vehicle speed signal Turbine sensor 1 and 2 signal Range signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
		Control during braking	Accelerator position signal Front vehicle speed signal Rear vehicle speed signal Range signal Turbine sensor 1 and 2 signal Lateral G sensor signal Brake switch signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
		Control during cornering	Accelerator position signal Front vehicle speed signal Rear vehicle speed signal Range signal Turbine sensor 1 and 2 signal Lateral G sensor signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
	Manual mode control		Engine speed Front vehicle speed signal Rear vehicle speed signal Range signal Up shift switch signal Down shift switch signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
SI-DRIVE control (models with SI-DRIVE)		SI-DRIVE switch signal Accelerator position signal Engine speed Engine torque signal Front vehicle speed signal Rear vehicle speed signal Range signal	

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

Control items		Control details
Shift pattern selection control	2nd hold control (in manual mode)	Front vehicle speed signal Rear vehicle speed signal Range signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
	Semi SPORT shift control (models with paddle shift)	Engine speed Front vehicle speed signal Rear vehicle speed signal Range signal Up shift switch signal Down shift switch signal ATF oil temperature sensor signal Lateral G sensor signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
Lock-up control	Lock-up control	Turbine sensor 1 and 2 signal Rear vehicle speed signal Front vehicle speed signal Engine speed Range signal ATF temperature signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
	Slip lock-up control	Front vehicle speed signal Rear vehicle speed signal Range signal Engine speed Turbine sensor 1 and 2 signal ATF temperature signal SI-DRIVE switch signal (models with SI-DRIVE) Manual mode switch signal (models with manual mode)
Hydraulic control	Normal hydraulic control	Accelerator position signal Rear vehicle speed signal Front vehicle speed signal Engine speed Range signal ATF temperature signal
	Transmission shifting hydraulic control	Accelerator position signal Rear vehicle speed signal Front vehicle speed signal Engine speed Range signal ATF temperature signal

# TRANSMISSION CONTROL MODULE (TCM)

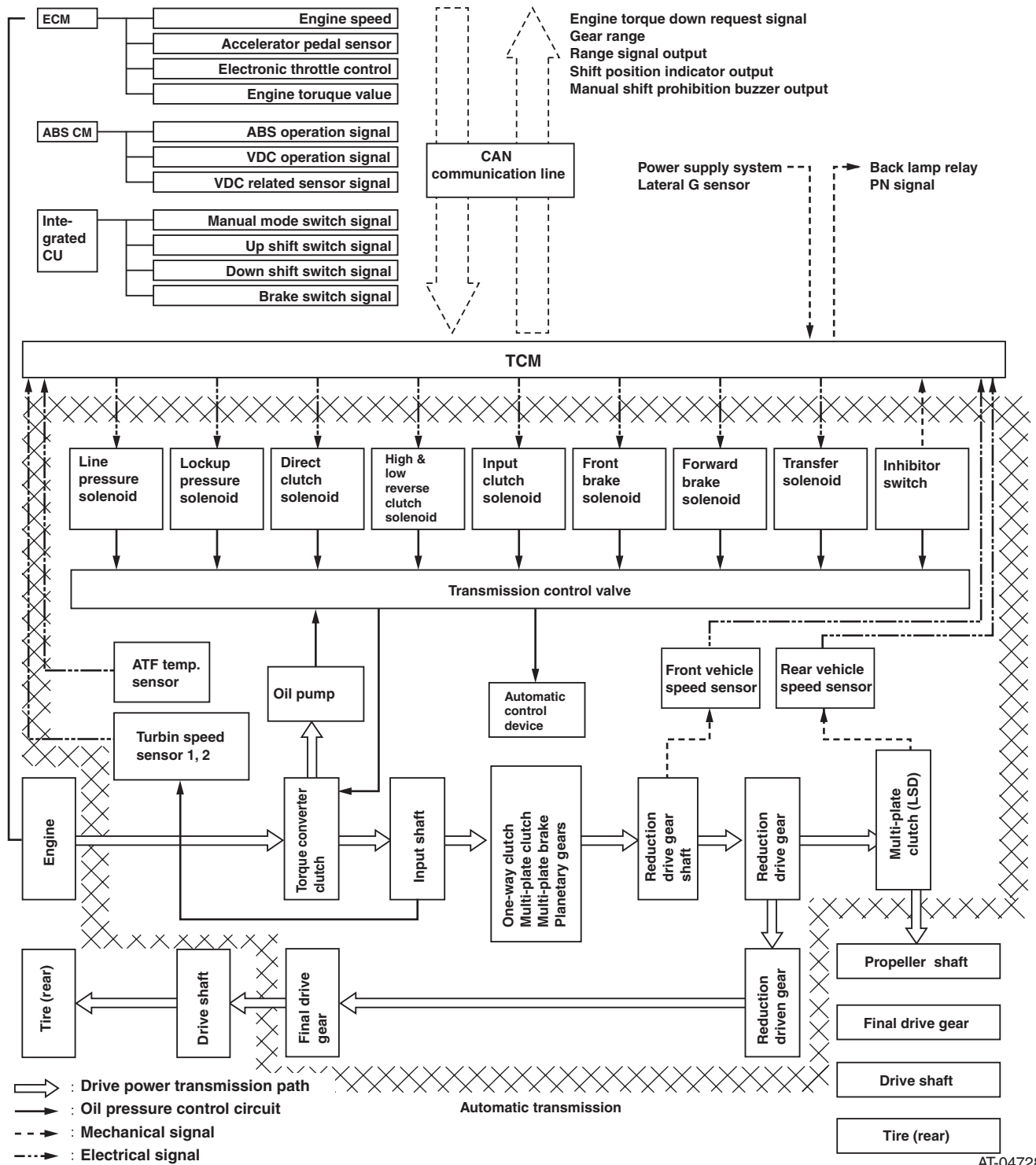
AUTOMATIC TRANSMISSION (FROM '08MY)

Control items			Control details
AWD center differential control	Normal transfer control	Torque sensitive control	Engine torque signal Front vehicle speed signal Rear vehicle speed signal ATF temperature signal Inhibitor switch signal
		Control for turning	Steering angle signal Front vehicle speed signal Rear vehicle speed signal
		Control for slip	Brake switch signal 4-wheel speed signal
	Cooperation control	Control during ABS operation	ABS operation signal
		Control during braking	Brake switch signal Front vehicle speed signal Rear vehicle speed signal
		Control during VDC and TCS operation	VDC and TCS operation signal Brake switch signal

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## C: SCHEMATIC DIAGRAM



# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

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## **D: SHIFTING CONTROL**

### **1. NORMAL SHIFTING CONTROL**

Based on the input signal information such as inhibitor switch, vehicle speed and accelerator pedal opening angle, TCM controls each solenoid and automatically shifts to an appropriate gear position according to the shift schedule.

### **2. ENGINE COOPERATION CONTROL**

When shifting, TCM outputs torque down request signal. Receiving the signal, ECM retards the ignition timing of each cylinder to temporarily reduce the torque developed by the engine. In synchronization with this control, TCM constantly monitors the shifting status using the vehicle speed sensor and turbine sensor, and performs feedback control to obtain optimum shifting. This control enables smooth and comfortable shifting under any conditions.

### **3. CONTROL AT HIGH OIL TEMPERATURE**

When ATF oil temperature is extremely high, the shift schedule is automatically changed so that temperature rise is minimized.

### **4. CONTROL AT LOW ATF OIL TEMPERATURE OR LOW ENGINE COOLANT TEMPERATURE**

When ATF oil temperature or engine coolant temperature is extremely low, at engine start for example, the shift schedule is automatically changed to actively raise the oil temperature.



## E: SHIFT PATTERN SELECTION

### 1. SI-DRIVE CONTROL

By changing the SI-DRIVE mode switch while driving in D range, shift control can be switched among three types according to each engine characteristics.

#### 1. I mode

When I mode engine characteristics is employed, shifting is performed at the optimum point to realize low fuel consumption. Compared to S and S# mode, slip lock-up range and full lock-up range are expanded.

#### 2. S mode

When S mode engine characteristics is employed, shifting characteristics is applied so that linear acceleration can be obtained and the acceleration is even in any vehicle speed range.

#### 3. S# mode

When S# mode engine characteristics is employed, shift timing is intended for higher speed than that of S mode and is set so that full engine performance can be obtained to provide driving with great response. In addition, adaptive control is operated more actively compared to I mode or S mode to realize sportier driving performance.

### 2. MANUAL MODE CONTROL

By operating the manual mode switch to ON (tilting the shift lever to the left) in D range, the mode shifts to the manual mode and the combination meter indicates the current gear range and permission for upshift and downshift.

[+] operation of shift lever or paddle causes upshift and [-] operation causes downshift; and the shift is held in the selected gear range while driving.

- Upshift prohibition and auto downshift control

“▲” mark next to the SPORT indicator indicates permission for upshift, with which upshift occurs by each [+] operation. However, when the current vehicle speed is too low for higher gear range, “▲” mark lights off, prohibiting further upshift.

If the vehicle speed level becomes too low for the current gear range, the gear automatically shifts down to prevent engine stall. When the vehicle stops, the gear always downshifts to 1st except when the vehicle is in the 2nd hold control mode.

- Downshift prohibition control

“▼” mark next to the SPORT indicator indicates permission for downshift, with which downshift occurs by each [-] operation. However, when the current vehicle speed is too high for lower gear range, “▼” mark lights off, prohibiting further downshift. In this case, if downshift operation occurs, the alarm beeps to warn the driver.

When ATF oil temperature is extremely low, for instance, immediately after engine start in winter, upshift to 5th is prohibited to promote warm-up.

- Engine over speed preventive control

If the engine speed exceeds the specified level during acceleration in manual mode, the gear automatically shifts up to prevent engine over speed.

### 3. 2nd HOLD CONTROL (IN MANUAL MODE)

Starting vehicle with 2nd gear on slippery road surface has been enabled.

This condition continues unless

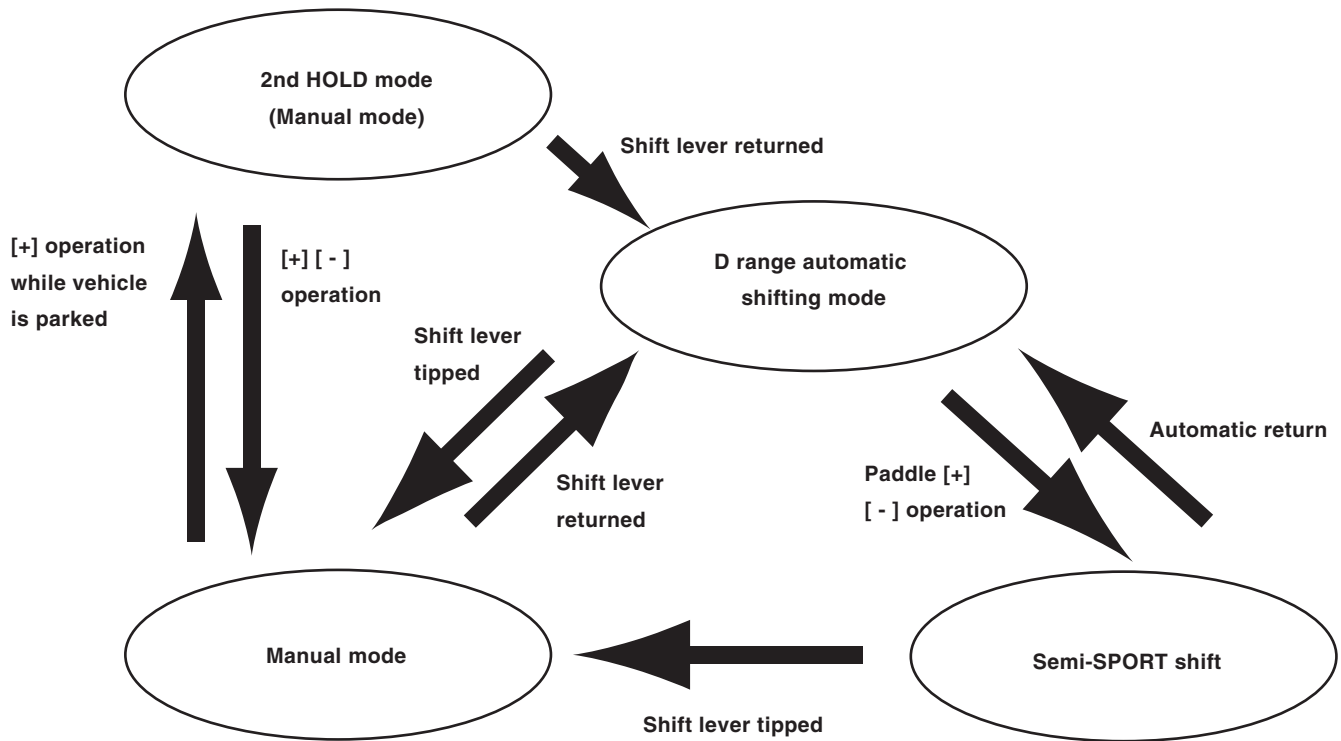
- 1) the manual mode is off,
  - 2) [+] or [-] switch is operated again, or
  - 3) engine over speed preventive control is operated,
- and 2nd gear is maintained while vehicle is stopped.

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## 4. SEMI SPORT SHIFT CONTROL (MODELS WITH PADDLE SHIFT)

Operation of [+] and [-] switches on the paddle in D range can temporarily shift the mode to manual mode, enabling gear shifting with manual operation using paddles. This mode is cancelled under the specified conditions such as linear acceleration status, and the vehicle is automatically returns to D range automatic shifting mode. When ATF oil temperature is extremely high, the semi manual mode is prohibited.



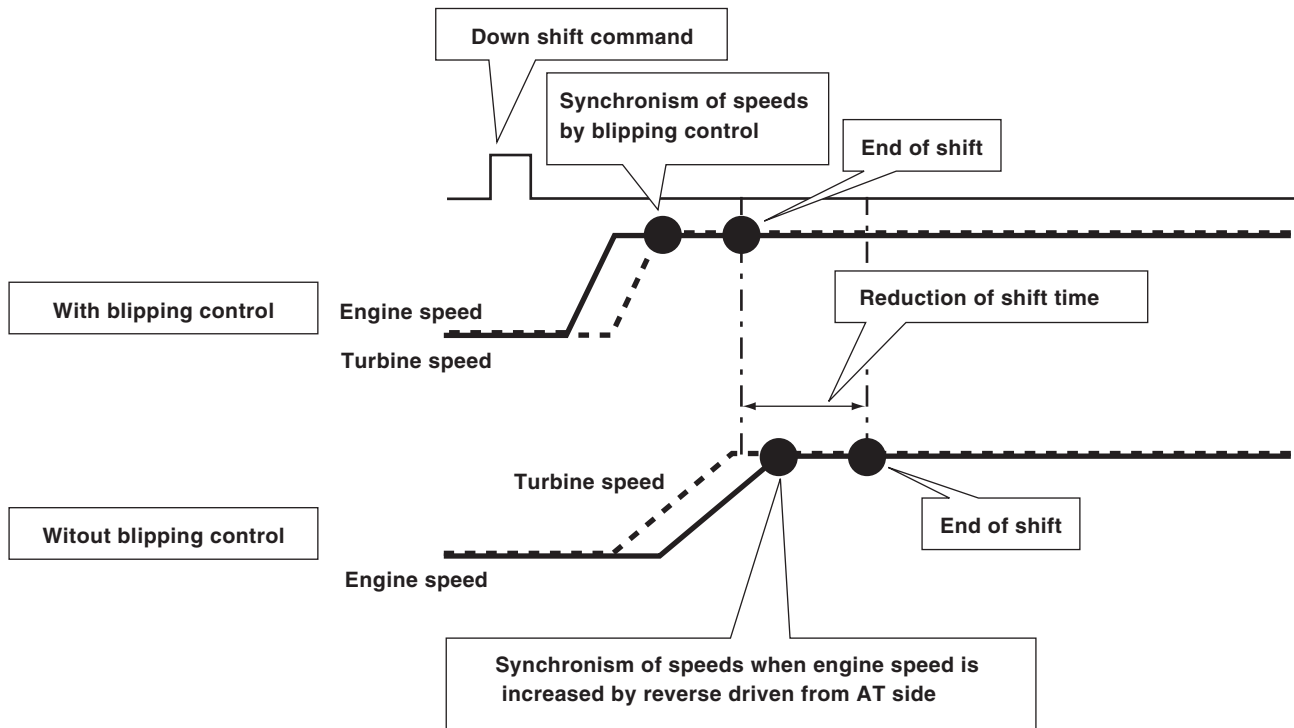
AT-04729

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## 5. BLIPPING CONTROL

Under the manual mode or semi SPORT shift mode control, if the gear is shifted down manually at a certain vehicle speed or higher with fully closed accelerator, engine speed automatically increases to be close to the level after shifting, which improves shifting response and shifting quality.



AT-04731

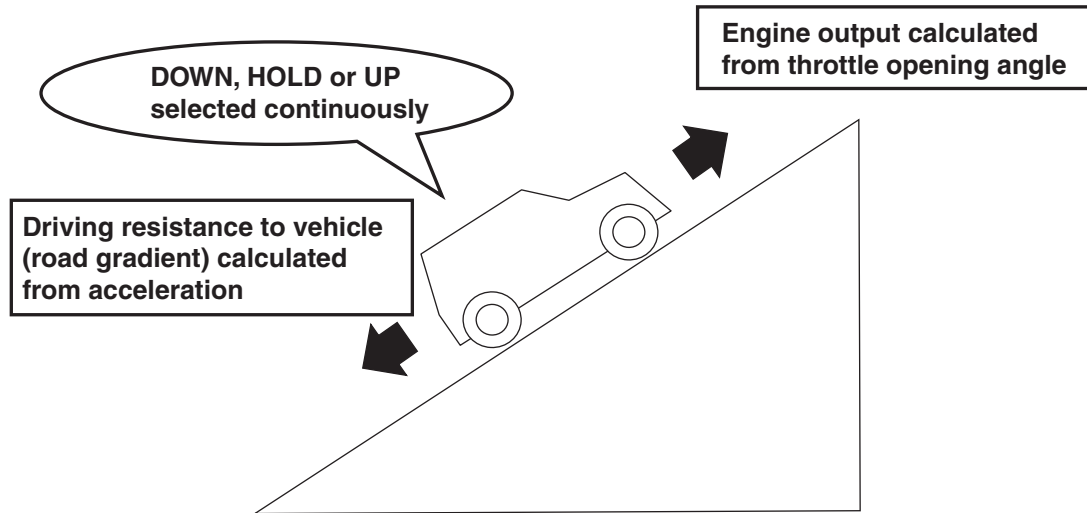
# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## 6. ADAPTIVE CONTROL

- Uphill/downhill control

Based on the vehicle speed and accelerator opening angle, excess driving force is judged from engine output and acceleration while the road gradient is estimated, in order to select optimum gear range as needed and reduce unnecessary shifting.



AT-04850

- Control during sudden release of accelerator pedal

When accelerator pedal is suddenly released, TCM judges the driver's intention for deceleration and temporarily prohibits shift-up to hold the current gear position in order to ensure engine brake operation.

- Control during braking

Operation frequency of this function in S# mode is higher than that in S mode.

The gear range is held (restraining upshift) or shifted down depending on the driving condition and braking force (deceleration), in order to ensure engine brake operation and driving force for re-acceleration.

- Control during cornering

Operation frequency of this function is as follows: S# > S > I.

Based on the cornering driving judgement from the driving condition and vehicle acceleration (longitudinal and lateral acceleration), unnecessary shift-up is restrained to ensure stable driving force and turning performance.






Control items	Mode	Supporting model
Control during sudden release of accelerator pedal	SI-DRIVE S# mode	Models with SI-DRIVE
	Normal mode	Models with manual mode
	Manual mode	Models with manual mode
Control during braking	SI-DRIVE S# mode	Models with SI-DRIVE
	Normal mode	Models with manual mode
	Manual mode	Models with manual mode
Control during cornering	All modes	Models with SI-DRIVE
		Models with manual mode

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

## 7. VARIOUS INDICATORS ILLUMINATION CONTROL

Illumination of indicators on the combination meter are controlled as shown below according to shift pattern change.

Condition	Display	
	Arrow mark	7-segment
P, R, N range		P, R, N
Normal D range		D
Manual mode Semi SPORT shift		1 — 5
Engine oil high temperature & engine high speed key		—
At transmission failure		—

▲ and ▼ indicate illumination.

ATF high temperature is informed by illuminating “ATF TEMP”.

# TRANSMISSION CONTROL MODULE (TCM)

AUTOMATIC TRANSMISSION (FROM '08MY)

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## F: LEARNING CONTROL

- Transmission shifting hydraulic learning control

Online learning control performance has been improved to absorb variation from vehicle to vehicle and quality aging and to ensure constant high shifting quality.

Learning occurs at each normal shifting under certain conditions, and learned values are saved in the flash ROM. The learned values are not deleted even if power is turned to OFF (even if the battery ground terminal is disconnected).

- Initial learning

The system in which measured data of predetermined driving operations for learning is set to TCM as the initial value is employed to assure high shifting quality from immediately after completion of vehicle. This system does not require the memory box that has been located on the control valve, contributing to cost reduction.

## G: AWD CENTER DIFFERENTIAL CONTROL

Control overview

Connection of multi-plate clutch (LSD) of center differential is controlled according to torque input to the transfer.

### 1. NORMAL CONTROL

During normal driving, connecting force of multi-plate clutch (LSD) is determined from the calculation results of the following controls:

- Torque sensitive control

Calculates connecting force of LSD according to torque input to the transfer.

- Control for turning

Calculates reduction in connecting force of LSD based on the steering angle and vehicle speed.

This function improves turning performance within the specific vehicle speed range.

- Control for slip

When the front or rear tires begin to slip, calculates the increase in connecting force of LSD according to the amount and time of the slip.

This function maintains road contact, improving drivability.

### 2. COOPERATION CONTROL

In this control, connecting force of LSD is determined in prior to normal control.

A. Control during ABS operation

During ABS operation, adjusts connecting force of LSD to the specified level. This function improves ABS control.

B. Control during braking

Adjusts connecting force of LSD to the specified level while the brake switch is ON with the throttle valve fully closed. This function improves stability during braking.

C. Control during VDC and TCS operation

During VDC and TCS operation, adjusts connecting force of LSD to the specified level. This function improves VDC and TCS control.

The priority is as follows: A > B > C.

# ON-BOARD DIAGNOSTIC SYSTEM

AUTOMATIC TRANSMISSION (FROM '08MY)

## 16. On-board Diagnostic System

### A: FUNCTION

- The on-board diagnostic system detects malfunction and generates and displays the codes corresponding to the location of each malfunction. The malfunction indicator light (AT OIL TEMP light) on the combination meter blinks to indicate occurrence of a failure or error.
- If the malfunction indicator light lights up as a result of TCM detecting a malfunction, the diagnostic trouble code (DTC) corresponding to the malfunction is stored in TCM.
- When checking DTC on the models supporting OBD-II, it is required to connect Subaru Select Monitor (SSM) to data link connector.
- To facilitate each function and failure diagnosis, a diagnostic system that supports SSM is used.
- The on-board diagnostic system detects electrical failures or system errors as shown below.

Front brake oil pressure switch	Front and rear wheel speed sensor
Input clutch oil pressure switch	Turbine speed sensor 1 and 2
Forward brake oil pressure switch	Brake signal
Direct clutch oil pressure switch	ATF temperature sensor
High & low reverse clutch oil pressure switch	Lateral G sensor
Line pressure solenoid (circuit)	CAN communication system
Transfer solenoid (circuit)	SPORT shift mode switch
Lock-up solenoid (circuit, function)	Range switch system
Front brake solenoid (circuit, function)	Back lamp relay output circuit
Input clutch solenoid (circuit, function)	PN signal output circuit
Forward brake solenoid (circuit, function)	Reverse inhibitor circuit
Direct clutch solenoid (circuit, function)	1, 2, 3, 4, 5, R gear ratio
High & low reverse clutch solenoid (circuit, function)	

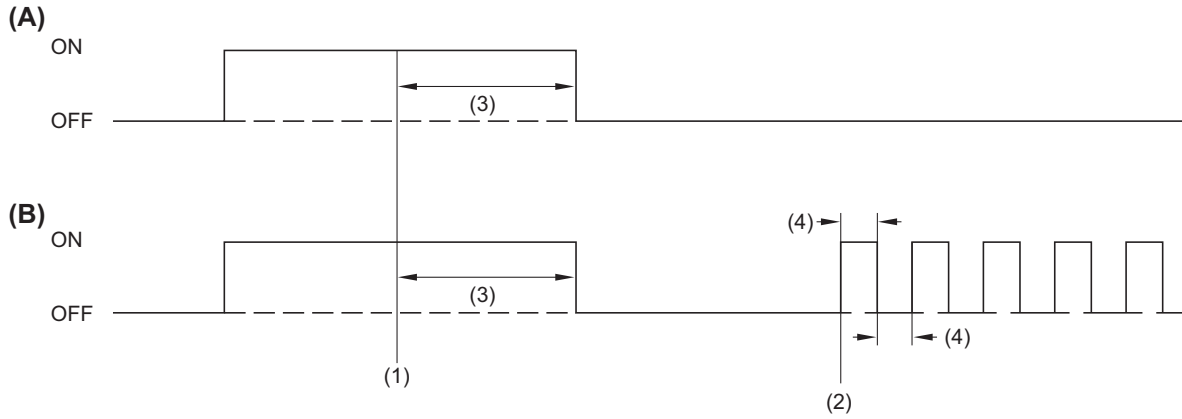
If a malfunction is detected, the system notifies the malfunction by blinking the AT OIL TEMP light.

# ON-BOARD DIAGNOSTIC SYSTEM

AUTOMATIC TRANSMISSION (FROM '08MY)

## B: OPERATION OF AT OIL TEMP LIGHT

At engine start, the AT OIL TEMP light illuminates to prove out and then turns off, as shown in “Normal operation” in the figure below. If some malfunction has occurred, the light keeps blinking as shown in “Abnormal operation” in the figure below.



AT-02194

(A) Normal operation

(B) Abnormal operation

(1) Engine start

(3) 2 seconds

(4) 0.25 seconds

(2) Malfunction detected



# FAIL-SAFE FUNCTION

AUTOMATIC TRANSMISSION (FROM '08MY)

## 17.Fail-safe Function

### A: SENSOR FAILURE

If a failure is detected on either or both of turbine speed sensor 1 and 2 installed on the transmission, the gear is fixed in 4th to ensure minimum drivability.

### B: FRONT SUN GEAR OVER-SPEED FAILURE

If an over-speed failure is detected on the front sun gear in the transmission, the gear is shifted to neutral and the vehicle stops. Then the gear is fixed in 2nd from vehicle start.

### C: SOLENOID ELECTRICAL FAILURE

If the solenoid status is fixed to constantly energized or de-energized status due to an electrical failure, the gear is shifted depending on the failed solenoid and its status, and then the gear range is fixed. The table below shows the relation of faulty parts and fixed gear range.

Faulty part	Failure status	Gear range at failure occurrence	Fail-safe gear range	
Front brake	Constantly energized	3rd or lower	3rd	
		4th	N → 3rd	
		5th	Temp 5th → 3rd	
	Constantly de-energized	4th or lower	4th	
		5th	N → 4th	
Input clutch	Constantly energized	3rd or lower	3rd	
		4th or upper	N → 3rd	
	Constantly de-energized	4th or lower	4th	
		5th	N → 4th	
High & low reverse clutch	Constantly energized	2nd or lower	2nd	
		3rd or upper	N → 2nd	
	Constantly de-energized	4th or lower	4th	
		5th	N → 4th	
Direct clutch	Constantly energized	All	5th	
	Constantly de-energized	4th or lower	4th	
		5th	N → 4th	
Forward brake	Constantly energized	2nd or lower	2nd	
		3rd or upper	N → 2nd	
	Constantly de-energized	4th or lower	4th	
		5th	N → 4th	

#### NOTE:

- “→” indicates the gear range after vehicle stop.
- “Temp 5th” refers to keeping 5th until vehicle stop.

# FAIL-SAFE FUNCTION

AUTOMATIC TRANSMISSION (FROM '08MY)

## D: HYDRAULIC FUNCTIONAL FAILURE

When a hydraulic functional failure is detected, the gear is shifted depending on the relation of faulty part and gear position at failure detection in order to ensure minimum drivability. The table below shows the relation of faulty parts and fixed gear range.

		Gear position at failure detection				
		1st	2nd	3rd	4th	5th
Faulty part	Front brake	1	N → 1	N → 1	N → 1	N → 1
	Input clutch	4	4	4	N → 1	N → 1
	High & low reverse clutch	1	N → 1	N → 1	N → 1	N → 1
	Direct clutch	2	N → 1	N → 1	N → 1	N → 4
	Forward brake	4	3	N → 2	N → 2	N → 2

NOTE:

“→” indicates the gear range after vehicle stop.

## E: RANGE SW ERROR

When a range SW error is detected, the gear is shifted to any of 1st, 3rd and 5th depending on the gear range before failure. If ignition is turned to OFF while a range SW error is detected, hydraulic control is electrically set to neutral after engine start until a range is selected.

## F: LINE PRESSURE SOLENOID ERROR

When the line pressure solenoid has an error, the solenoid is turned to OFF to maximize the line pressure. Otherwise, normal control is performed.

## G: LOCK-UP SOLENOID ERROR

When the lock-up solenoid has an error, the lock-up solenoid is constantly set to OFF (lock-up released).

## H: TRANSFER CLUTCH SOLENOID ERROR

When a solenoid ON/OFF error is detected, the transfer solenoid is constantly set to OFF (LSD released).

## I: CAN COMMUNICATION ERROR

When CAN communication has an error, the data received by CAN is fixed to the specified value to perform shifting control and to ensure minimum drivability.

## 18. Transmission Mount

### A: GENERAL

Same mechanism as the existing model.

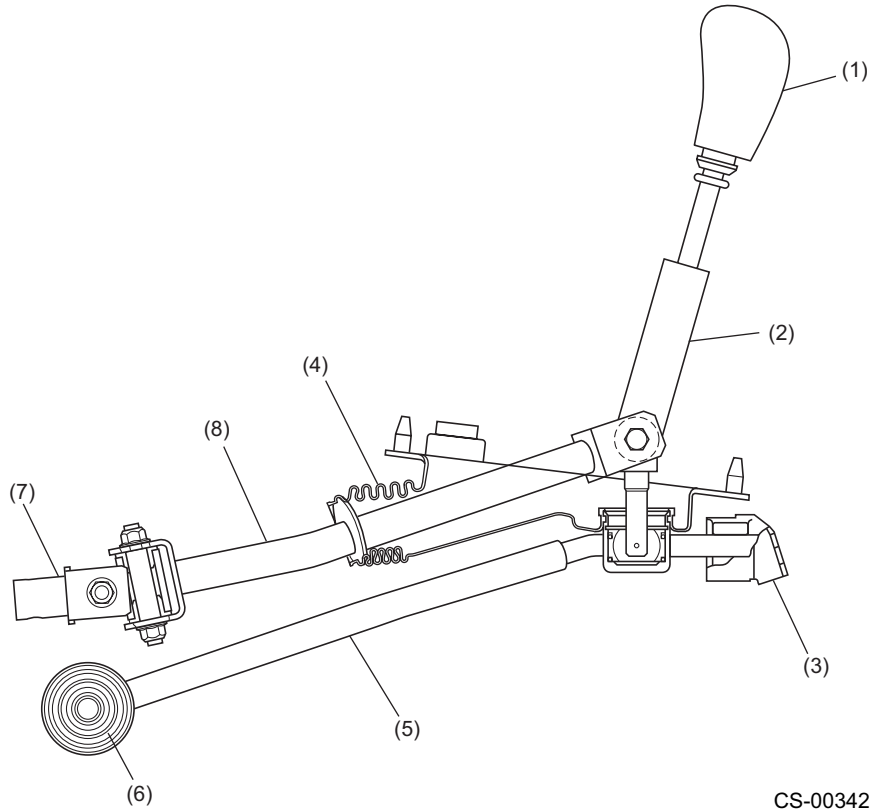
# 5MT GEAR SHIFT LEVER

CONTROL SYSTEM

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## 1. 5MT Gear Shift Lever

The manual transmission's gear shift lever system is a parallel link type whose stay is mounted through a cushion rubber.



CS-00342

- |                    |               |
|--------------------|---------------|
| (1) Knob           | (5) Stay      |
| (2) Lever          | (6) Bushing B |
| (3) Cushion rubber | (7) Joint     |
| (4) Boot           | (8) Rod       |

### 1. General

The manual transmission is of a full-time all-wheel-drive design integrating a transmission assembly, front differential, and transfer gear assembly with center differential into a single unit. The transmission has five forward speeds and one reverse speed, and all gears are provided with inertia lock type synchronizers.

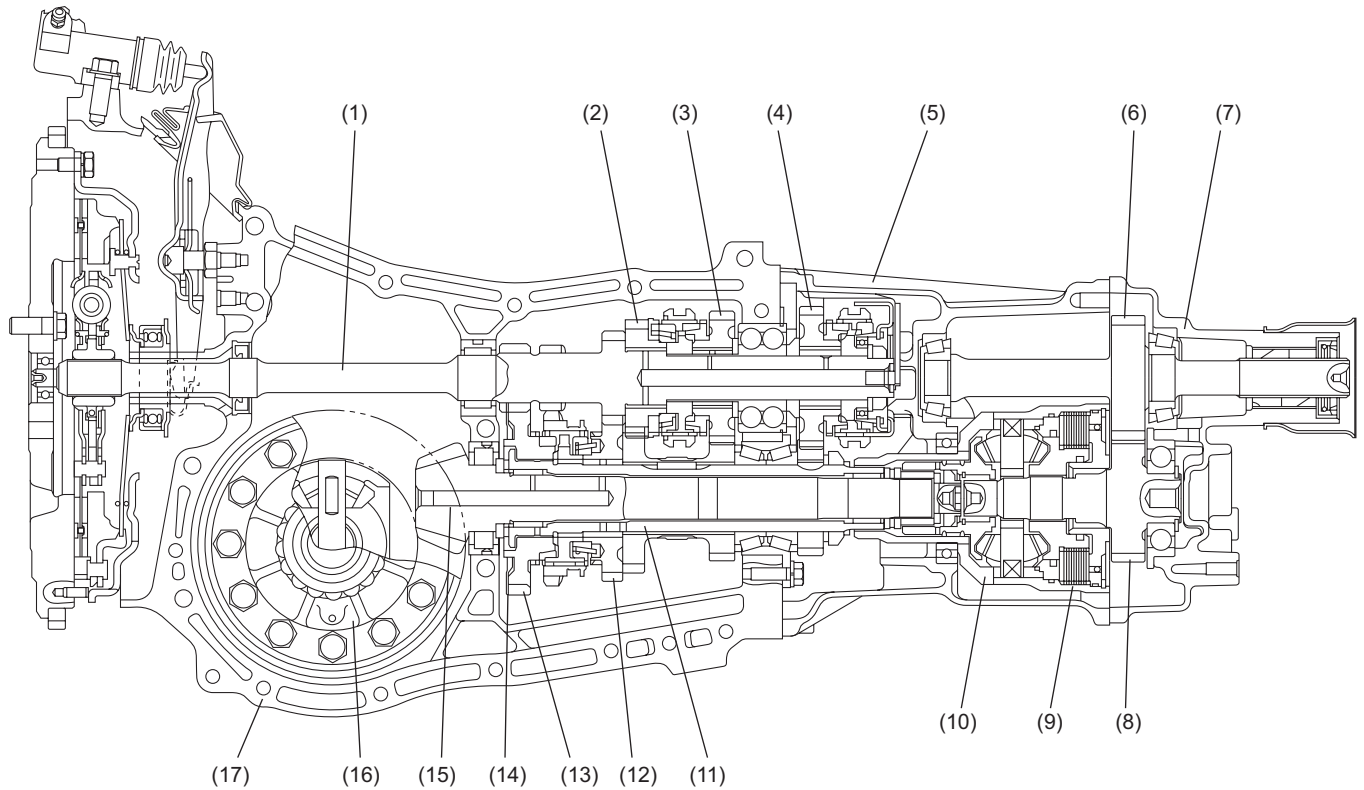
The transmission and front differential are housed in an aluminum case, which is split into right and left halves and constitutes also a clutch housing. Located at the rear and joined each other are the transfer case and extension case which house the transfer gears and center differential as well as part of the transmission assembly.

The major features of the transmission are as follows:

- The forward speed gears are helical gears featuring high tooth face strength, large tooth contact areas, and quiet operation.
- Reversing rotation is achieved by making a slidable reverse idler gear engage with both the reverse drive gear on the main shaft and the reverse driven gear integral with the 1st-2nd synchronizer hub on the drive pinion shaft.
- The center differential compensates for the difference in front and rear axle speeds. It consists of a bevel gear set and a viscous coupling located at its rear end, which are housed in a single case. The center differential, together with a pair of transfer gears, transmits the power from the transmission to the drive pinion shaft (front wheel drive shaft) and the propeller shaft. The viscous coupling functions as a differential-action-limiting element.

# GENERAL

## MANUAL TRANSMISSION AND DIFFERENTIAL



MT-01225

- |                          |                                   |  |
|--------------------------|-----------------------------------|--|
| (1) Main shaft           | (7) Extension case                | (13) 1st driven gear   |
| (2) 3rd drive gear       | (8) Transfer drive gear           | (14) 1st driven sub gear (except models with dual mass flywheel) |
| (3) 4th drive gear       | (9) Viscous coupling              | (15) Drive pinion shaft  |
| (4) 5th drive gear       | (10) Center differential assembly | (16) Front differential assembly                                 |
| (5) Transfer case        | (11) Driven shaft (countershaft)  | (17) Main case   |
| (6) Transfer driven gear | (12) 2nd driven gear              |  |

# GEARSHIFT MECHANISM

## MANUAL TRANSMISSION AND DIFFERENTIAL

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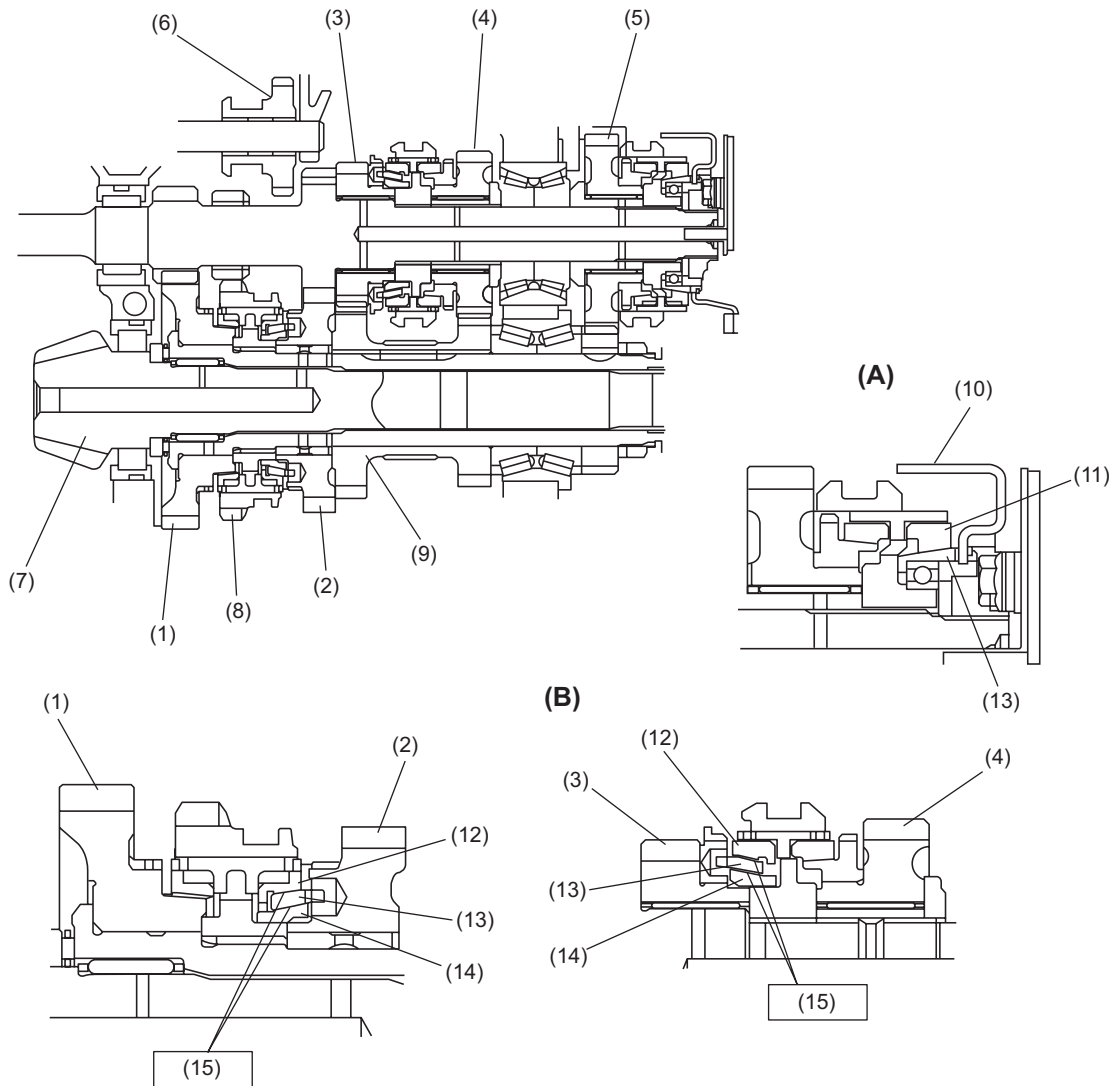
### 2. Gearshift Mechanism

#### A: CONSTRUCTION

- Helical gears are used for forward speed gears. Reverse speed is achieved by making the drive gear to mesh with the main shaft while making the driven gear and reverse idler gear to mesh with the 1st-2nd synchronizer sleeve of the drive pinion, in order to reverse the rotating direction.
- The synchromesh mechanism for 1st and 2nd speeds are placed at the drive pinion side, while the mechanism for 3rd, 4th, 5th and reverse speeds are placed at the main shaft side.
- On non-turbo models, a double cone synchromesh mechanism is used for 2nd and 3rd speed gears.
- On turbo models, a double cone synchromesh mechanism is used for 1st, 2nd and 3rd speed gears.

# GEARSHIFT MECHANISM

MANUAL TRANSMISSION AND DIFFERENTIAL



MT-01034

- |                        |                         |  |
|------------------------|-------------------------|--|
| (1) 1st gear           | (9) 3rd-4th driven gear | <b>(A)</b> <Reverse synchronizer>                        |
| (2) 2nd gear           | (10) Stopper            | <b>(B)</b> Torque <2nd and 3rd double-cone synchronizer> |
| (3) 3rd gear           | (11) Balk ring          |  |
| (4) 4th gear           | (12) Outer balk ring    |  |
| (5) 5th gear           | (13) Synchronizer cone  |  |
| (6) Reverse idler gear | (14) Inner balk ring    |  |
| (7) Drive pinion shaft | (15) Cone surface       |  |
| (8) Reverse gear       |                         |  |



# REVERSE CHECK MECHANISM

## MANUAL TRANSMISSION AND DIFFERENTIAL

---

### 3. Reverse Check Mechanism

Located in the transfer case, the reverse check mechanism prevents a direct 5th-to-reverse shift by using a selector arm and cam combination, which allows the gear to be shifted into the reverse only after it has been returned once to neutral.

#### A: CONSTRUCTION

The construction of the reverse check mechanism is as shown in the drawing on the opposing page. The reverse check sleeve is bolted to the transfer case and houses the mechanism main components.

The reverse accent shaft is slidable inside the reverse check sleeve and its smaller-diameter end is fitted with the reverse check cam. The cam can rotate and move axially on the shaft but its leftward movement is restricted by a step formed on the sleeve inner wall.

The reverse accent shaft has hollows in both ends. In the left end hollow are the 1st return spring and its cap and in the right end hollow is the reverse return spring, which pushes the shaft leftward.

Around the check cam is the reverse check spring whose left end applies simultaneous leftward and rotational forces to the cam.

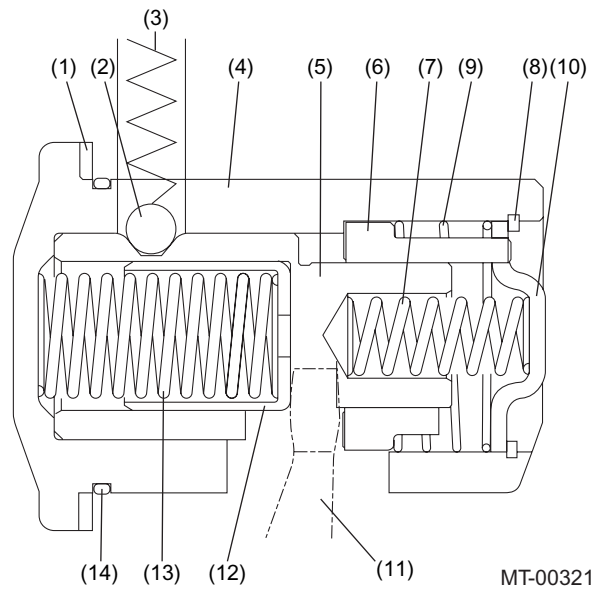
Both the reverse check spring and reverse return spring are retained at their right ends by the reverse check plate which is held in place by the snap ring.

The reverse accent shaft has a V-groove in which the detent ball is pressed by the reverse accent spring fitted through the hole in the reverse check sleeve.

The reverse check sleeve and reverse accent shaft have a slot and a notch at their bottoms, respectively, and the selector arm is inserted in the notch through the slot.

# REVERSE CHECK MECHANISM

MANUAL TRANSMISSION AND DIFFERENTIAL



- |                           |                           |                        |
|---------------------------|---------------------------|------------------------|
| (1) Select adjust shim    | (6) Reverse check cam     | (11) Selector arm      |
| (2) Detent ball           | (7) Reverse return spring | (12) Spring cap        |
| (3) Reverse accent spring | (8) Snap ring             | (13) 1st return spring |
| (4) Reverse check sleeve  | (9) Reverse check spring  | (14) O-ring            |
| (5) Reverse accent shaft  | (10) Reverse check plate  |                        |

# REVERSE CHECK MECHANISM

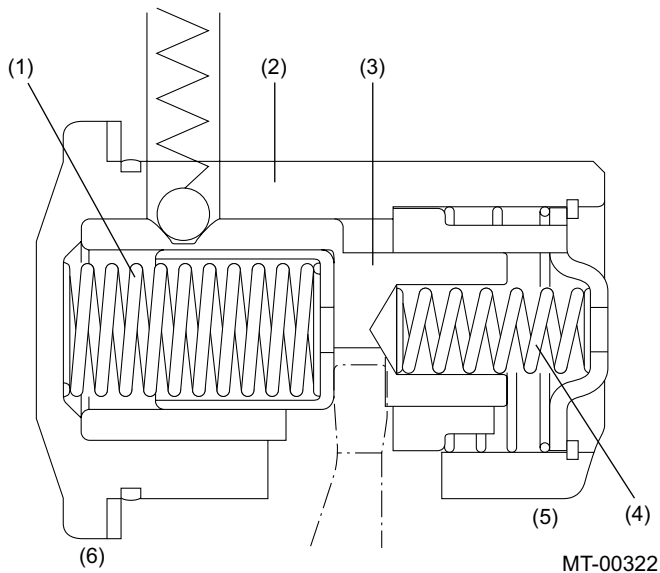
## MANUAL TRANSMISSION AND DIFFERENTIAL

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### B: OPERATION

The drawing below shows the state of the reverse check mechanism when the selector arm is in the neutral position. The 1st and 2nd gears will be selected if the selector arm is moved leftward from this point to a stop and then turned in either way. A rightward movement of the arm to a stop will enable selection of the 5th and reverse gears. In the neutral position, the selector arm receives a rightward force (force toward the 5th and reverse gear side) from the 1st return spring and a leftward force (force toward the 1st and 2nd gear side) from the reverse return spring to stay in that position.

The following explanation describes how the selector arm and reverse check mechanism operate when the driver selects the 5th gear and then selects the reverse gear.



- (1) 1st return spring
- (2) Reverse check sleeve

- (3) Reverse accent shaft
- (4) Reverse return spring

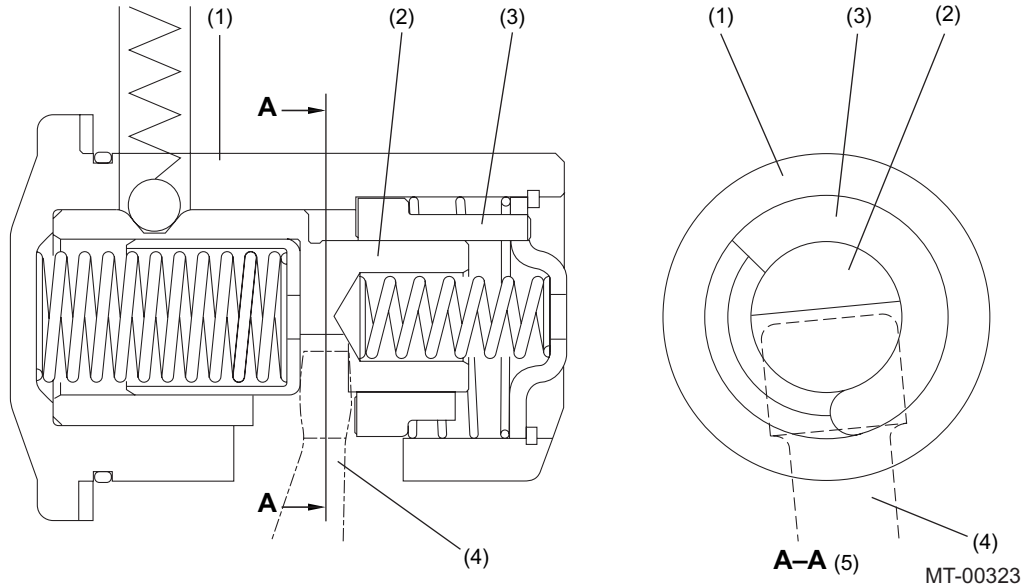
- (5) 5th and reverse gear side
- (6) 1st and 2nd gear side

# REVERSE CHECK MECHANISM

MANUAL TRANSMISSION AND DIFFERENTIAL

## 1. WHEN SELECTOR ARM IS MOVED TOWARD 5TH AND REVERSE GEAR SIDE

The selector arm moves rightward while pushing both the reverse accent shaft and reverse check cam simultaneously.



(1) Reverse check sleeve

(2) Reverse accent shaft

(3) Reverse check cam

(4) Selector arm

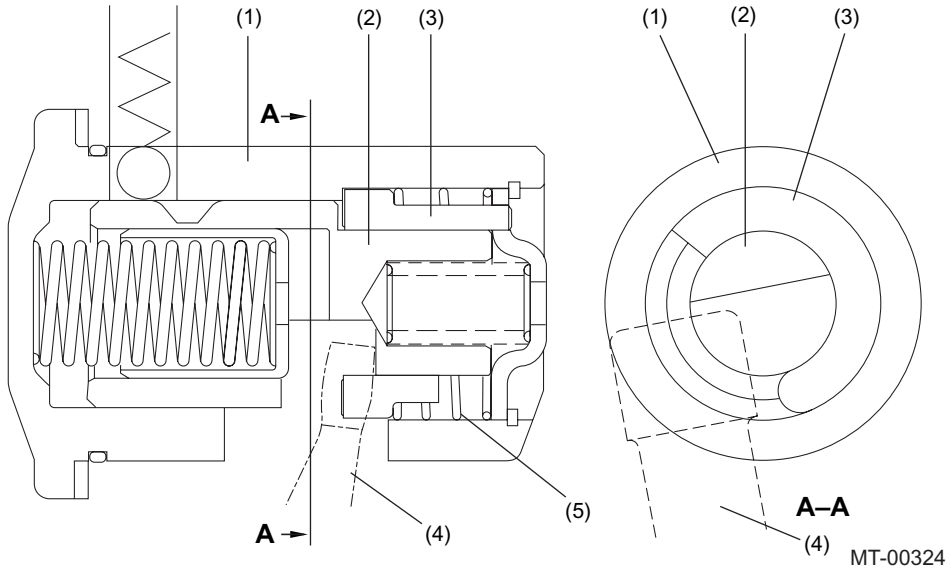
(5) Neutral position

# REVERSE CHECK MECHANISM

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 2. WHEN SHIFT IS MADE TO 5TH GEAR

The selector arm is turned toward the 5th gear selection direction. When the arm clears the edge of the reverse check cam as it turns, the cam becomes free of the selector arm pressure and returns to its original position by the force of the reverse check spring.



- (1) Reverse check sleeve
- (2) Reverse accent shaft

- (3) Reverse check cam
- (4) Selector arm

- (5) Reverse check spring

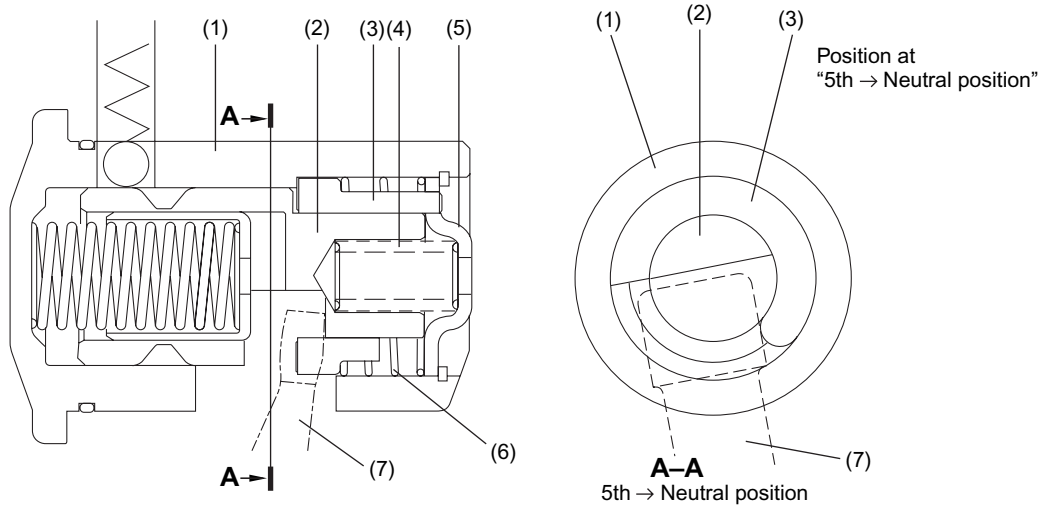
# REVERSE CHECK MECHANISM

MANUAL TRANSMISSION AND DIFFERENTIAL

## 3. WHEN A SHIFT FROM 5TH TO REVERSE IS ATTEMPTED

The selector arm turns toward the reverse gear while pushing the reverse accent shaft rightward and the reverse check cam counterclockwise (as viewed in the direction of arrows A).

The reverse check cam, however, stops to rotate at a point where its stopper hits against the reverse check plate (this point corresponds to the neutral position in terms of the angle) and prevents the selector arm from moving toward the reverse gear selection direction. The selector arm is then axially pushed to the neutral position by the reverse accent shaft, which is given a leftward force by the reverse return spring.



MT-00325

- (1) Reverse check sleeve
- (2) Reverse accent shaft
- (3) Reverse check cam
- (4) Reverse return spring

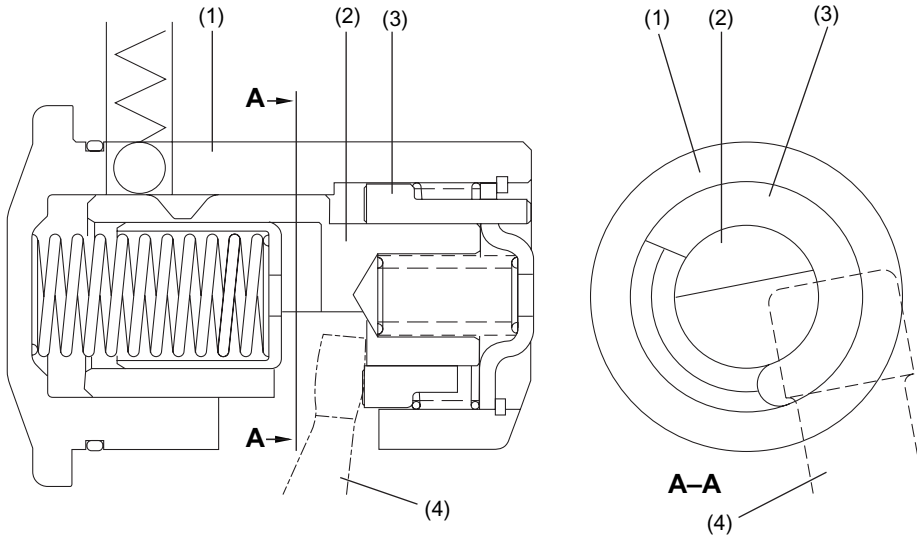
- (5) Reverse check plate
- (6) Reverse check spring
- (7) Selector arm

# REVERSE CHECK MECHANISM

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 4. WHEN A SHIFT TO REVERSE IS MADE AFTER RETURN OF SELECTOR ARM TO NEUTRAL

As the ends of the reverse accent shaft and the reverse check cam are on the same plane, the selector arm now can turn toward the reverse gear selection direction after pushing leftward both the shaft and cam simultaneously.



MT-00326

- (1) Reverse check sleeve
- (2) Reverse accent shaft

- (3) Reverse check cam
- (4) Selector arm

# CENTER DIFFERENTIAL

## 4. Center Differential

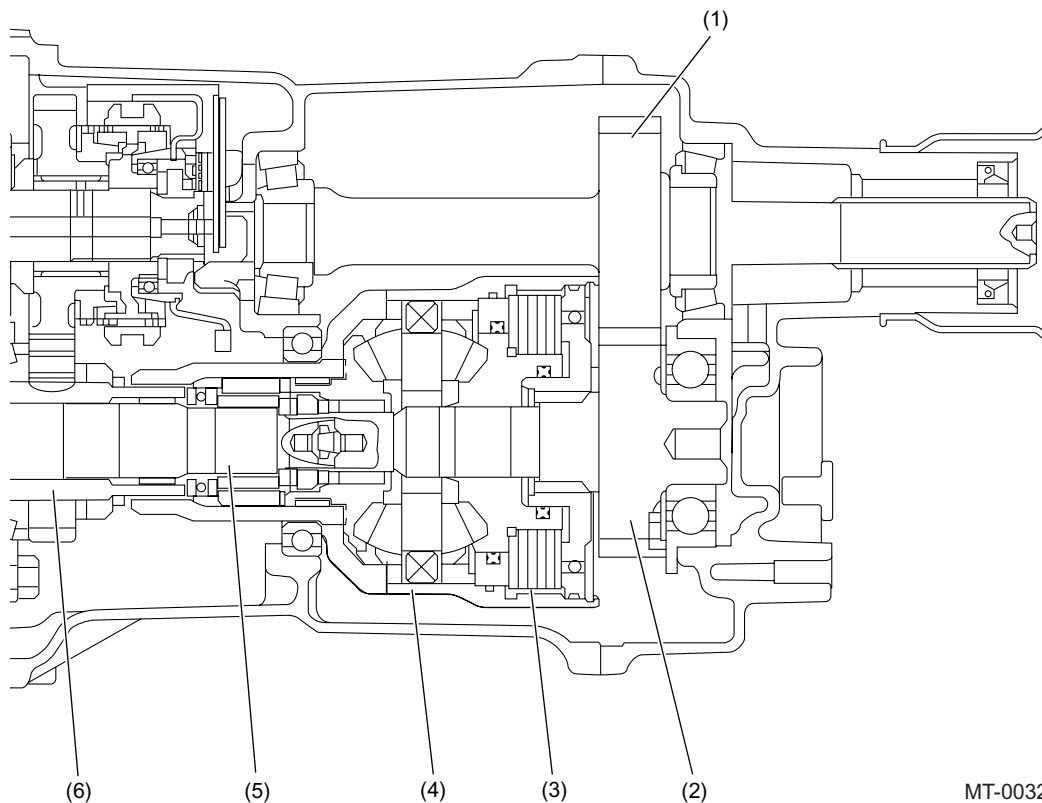
### A: CONSTRUCTION

The center differential consists of a set of bevel gears and a viscous coupling.

The center differential has the following two functions: distributing the engine torque to the front and rear wheel drive shafts and absorbing the difference in rotating speed between the front and rear wheels.

The engine torque enters the center differential case from the transmission's driven shaft. The engine torque is then distributed through the bevel gear set directly to the drive pinion shaft and via the transfer drive and driven gears to the rear drive shaft.

The viscous coupling limits the differential action of the bevel gear set when either front or rear wheels spin so that adequate torques are transmitted to the front and rear wheels and proper traction is obtained.



MT-00327

- |                          |   |
|--------------------------|---|
| (1) Transfer driven gear | (4) Center differential (with viscous coupling) |
| (2) Transfer drive gear  | (5) Drive pinion shaft                          |
| (3) Viscous coupling     | (6) Drive shaft                                 |

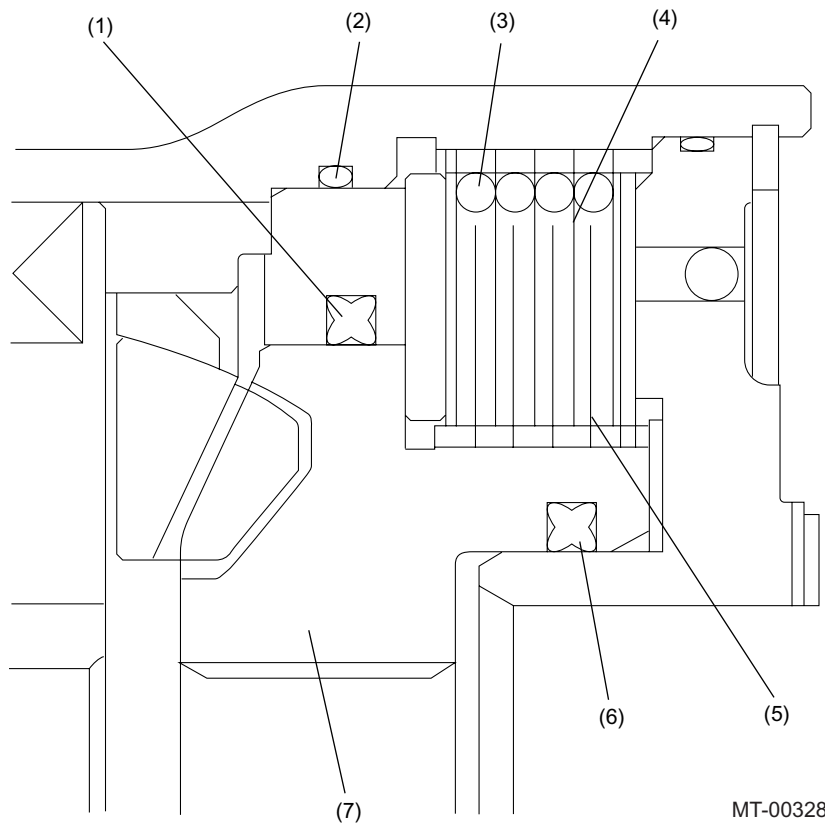


# CENTER DIFFERENTIAL

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: MECHANISM OF VISCOUS COUPLING

The viscous coupling consists of a number of alternately arranged inner and outer plates and air-and-silicone oil mixture filled into a sealed space that is formed by the center differential case and the rear side gear of the differential gear set. The inner plates have their inner perimeters splined to the side gear and the outer plates have their outer perimeters splined to the center differential case. The outer plates are held apart by spacer rings. There are no spacer rings between the inner rings, so the inner rings are movable slightly in axial directions. X-section rings are used to prevent leakage of silicone oil, which would otherwise occur if the oil is pressurized due to large difference in front and rear axle speeds.



MT-00328

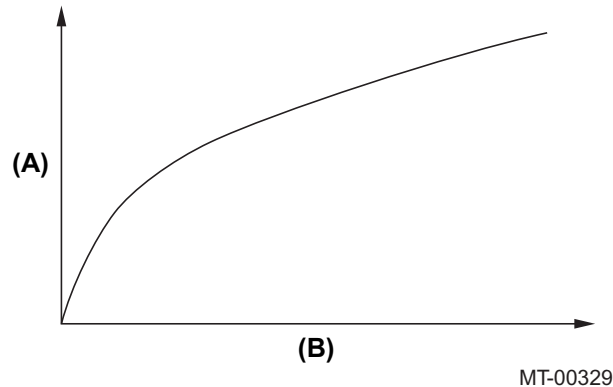
- (1) X-section ring
- (2) O-ring
- (3) Spacer ring
- (4) Outer plate

- (5) Inner plate
- (6) X-section ring
- (7) Side gear (rear)

## 1. TORQUE CHARACTERISTICS

When a speed difference occurs between the center differential case and the rear side gear, a shear force is generated in the silicone oil placed between the outer and inner plates. The torque is then transmitted by the silicone oil between the center differential case and the rear side gear.

The greater the speed difference, the greater the shear force generated in the silicone oil. The relationship between the torque transmission and the speed difference is shown in the figure below. As can be seen from the figure, the smaller the speed difference, the smaller the torque transmission and the differential action.



- (A) Driving torque
- (B) Speed difference

## 2. HUMP PHENOMENON

Silicone oil is heated and expanded as differential action continues. The oil in the viscous coupling expands and compresses the inside air to cause direct plate-to-plate contact or a non-viscous operation to occur; this phenomenon is called hump.

The hump eliminates the rotating speed difference between the center differential case and the rear side gear (or locks the differential), so soon after it has occurred, the internal pressure and temperature drop. The viscous coupling then returns to the normal shear torque transmitting operation. (The hump phenomenon does not occur under normal operating conditions.)

# CENTER DIFFERENTIAL

## MANUAL TRANSMISSION AND DIFFERENTIAL

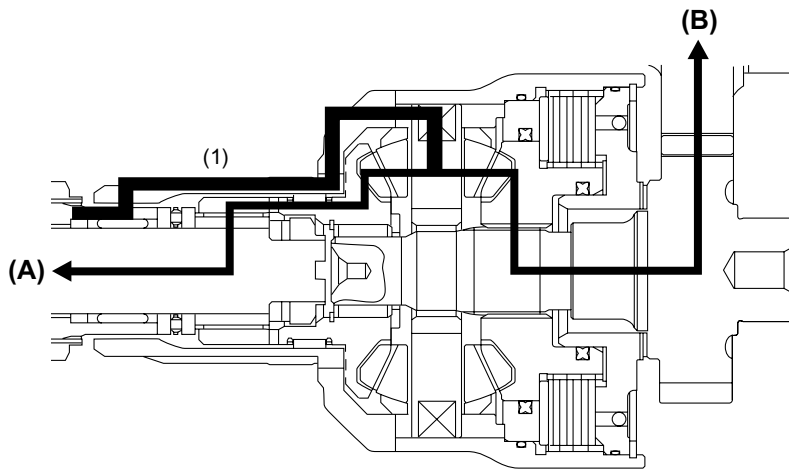
### C: FUNCTION

When there is no speed difference between the front and rear wheels, the center differential delivers the engine torque to the front and rear wheels at a ratio of 50:50.

When a rotating speed difference occurs between the front and rear wheels, the center differential operates to absorb it in a controlled way by the function of the viscous coupling.

#### 1. DURING NORMAL DRIVING

During straight-line driving on a flat road at a constant speed, all the four wheels rotate at the same speed. The center differential delivers engine torque evenly to the front and rear wheels. The viscous coupling does not generate shear torque because there is no relative movements between the inner and outer plates.



MT-00330

(1) Engine torque

(A) To front differential

(B) To rear differential

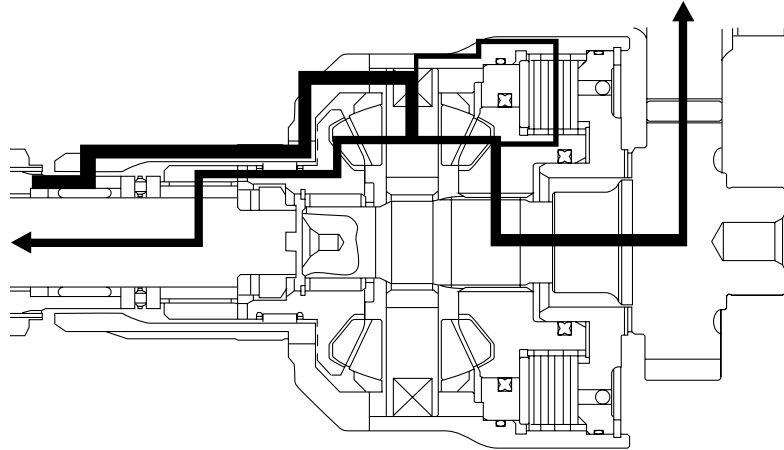
# CENTER DIFFERENTIAL

MANUAL TRANSMISSION AND DIFFERENTIAL

## 2. DURING TURNS AT LOW SPEEDS

During turns at low speeds, rotating speed difference occurs between the front and rear wheels, as well as between the left and right wheels. More particularly, the front wheels rotate faster than the rear wheels. The center differential then acts to absorb the speed difference to enable smooth driving.

Although the speed difference is small under this condition, operation of the viscous coupling causes more torque to be transmitted to the rear than to the front.



MT-00331

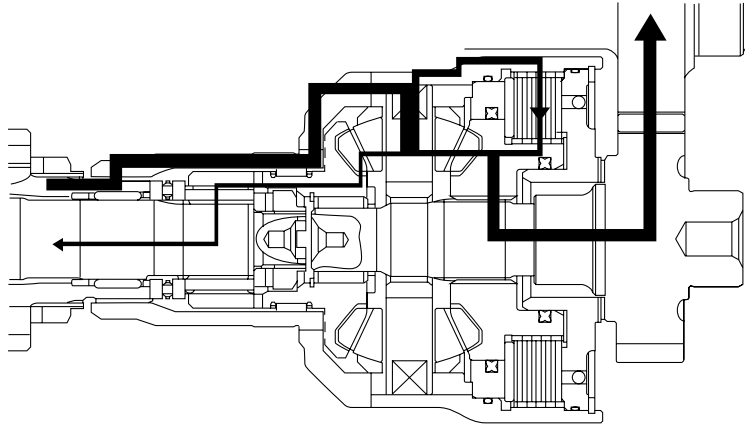
# CENTER DIFFERENTIAL

## MANUAL TRANSMISSION AND DIFFERENTIAL

### 3. DRIVING ON ROUGH OR SLIPPERY ROADS

- When front wheels are on a slippery surface

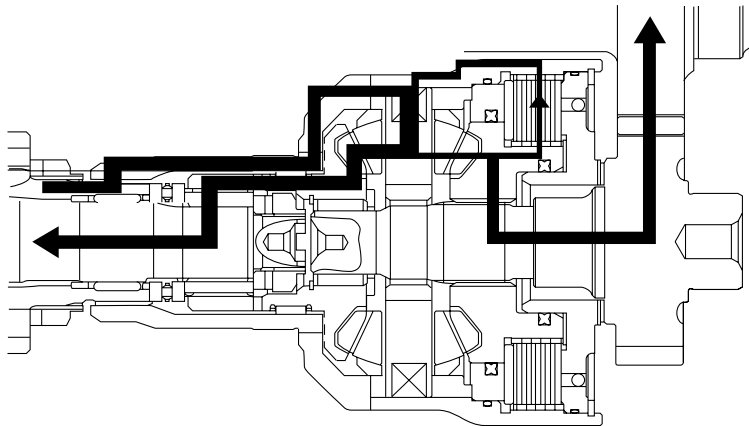
When the front wheels begin to spin, the resulting speed difference between the front and rear drive shafts causes the viscous coupling to generate significant amount of shear torque. As a result, the torque distributed to the rear wheels becomes much larger than that distributed to the spinning front wheels. The traction and driving stability are thus ensured on a rough or slippery road.



MT-00332

- When rear wheels are on a slippery surface

When the vehicle is accelerated quickly from a standing start with the rear wheels on a slippery surface, the distribution of the vehicle weight on the front and rear wheels changes and the rear wheels start spinning. Due to the resulting speed difference between the front and rear drive shafts, the viscous coupling generates a significant amount of shear torque, now in the direction opposite to that generated when the front wheels are on a slippery surface. As a result, the torque distributed to the front wheels becomes much larger than that distributed to the rear wheels.

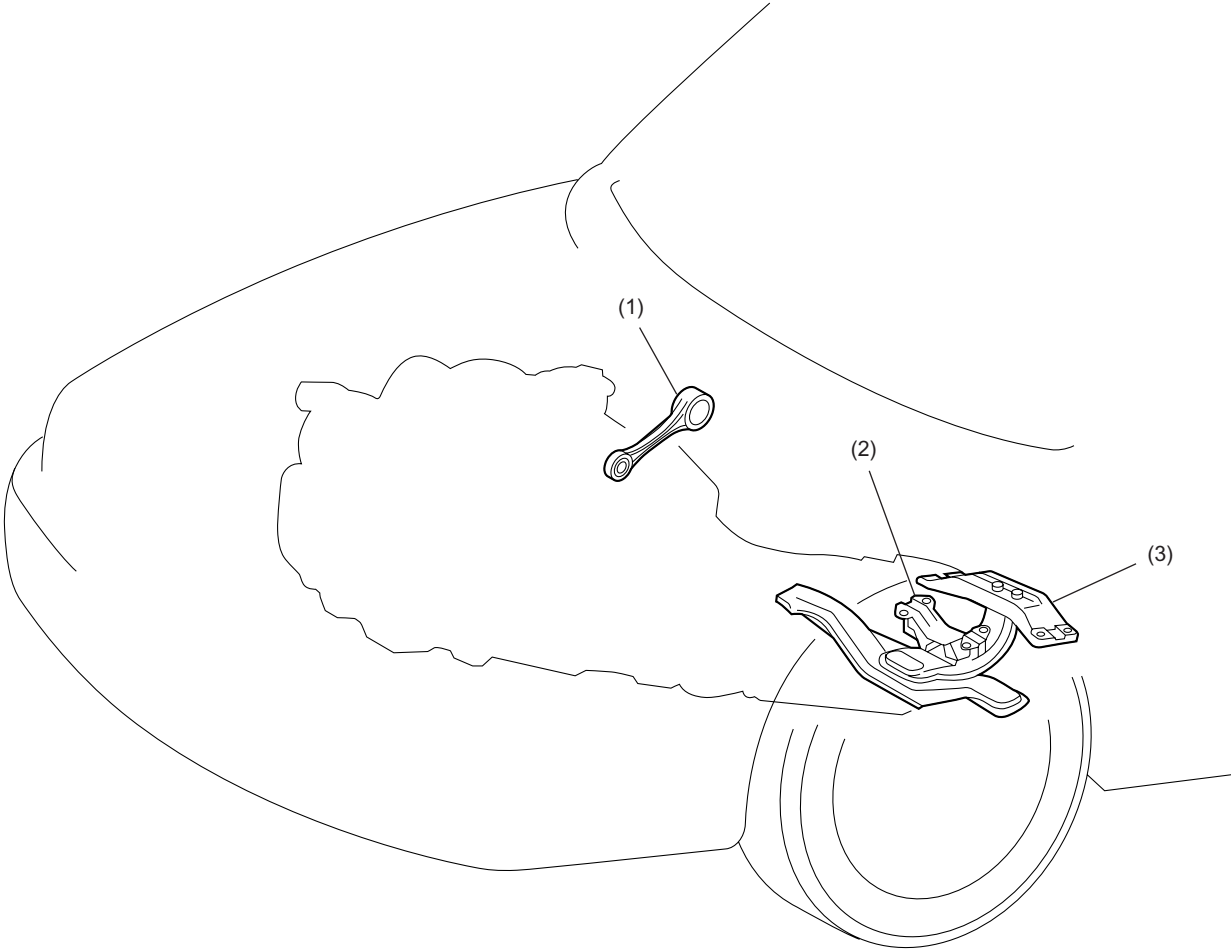


MT-00333

# TRANSMISSION MOUNTING

MANUAL TRANSMISSION AND DIFFERENTIAL

## 5. Transmission Mounting



MT-00334

(1) Pitching stopper

(2) Cushion rubber

(3) Cross member

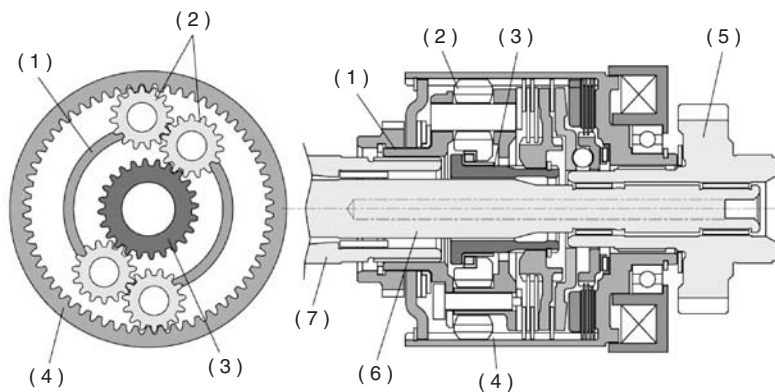
## 1. Driver's Control Center Differential System (From '06MY)

### A: GENERAL

The Driver's Control Center Differential (DCCD) system consists of the sensors and switches such as steering angle sensor, yaw rate and lateral G sensor, or stop light switch, the planetary gear type center differential (with built-in the LSD clutch), and the DCCD control module.

The center differential of double pinion gear type planetary unit distributes the engine torque to the front wheels and rear wheels at the torque ratio of 41:59.

(In the actual planetary gear unit, 3 sets of double pinion gears are used. But the figure shows only 2 sets of double pinion gears for simplification.)



MT-01432

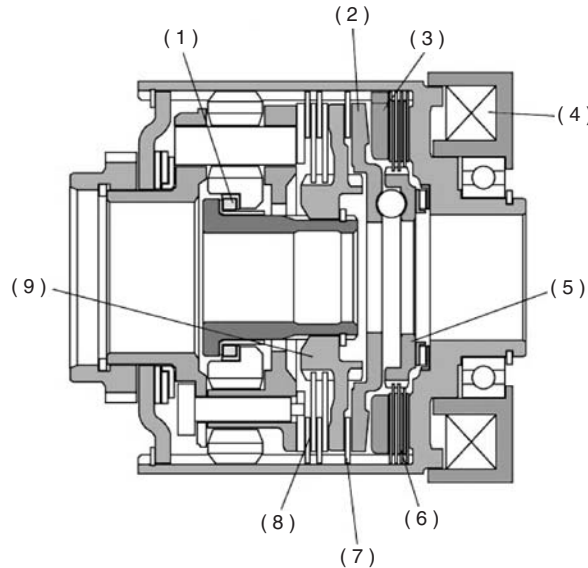
- |                   |                         |
|-------------------|-------------------------|
| (1) Carrier       | (5) Transfer drive gear |
| (2) Pinion gears  | (6) Drive pinion shaft  |
| (3) Sun gear      | (7) Driven shaft        |
| (4) Internal gear |                         |

# DRIVER'S CONTROL CENTER DIFFERENTIAL SYSTEM (FROM '06MY)

## MANUAL TRANSMISSION AND DIFFERENTIAL

- The LSD mechanism improves the initial steering operation response further by combining and using the conventional solenoid clutch LSD mechanism and the torque sensing mechanical LSD mechanism.

When the solenoid clutch LSD is in the free condition, the mechanical LSD mechanism performs the differential control of 0 — 30%. The other 30 — 100% differential control can be performed by activating the solenoid clutch LSD.



MT-01433

- |  |                         |
|--|-------------------------|
| (1) Torque cam                         | (5) Pilot clutch hub    |
| (2) Intermediate clutch pressure plate | (6) Pilot clutch        |
| (3) Armature                           | (7) Intermediate clutch |
| (4) Coil                               | (8) Main clutch         |
|  | (9) Main clutch hub     |

- The drivability and stability during cornering were made compatible by using the yaw rate and lateral G sensor and the newly adapted steering angle sensor. With this, the quick steering characteristics and the improvement of cornering ability are achieved, and the tight cornering symptom may also be decreased.

- In manual mode, the engagement power of solenoid clutch LSD can be adjusted within the range of 30 to 100%.

- When a malfunction occurs in the system, the fail-safe control may be performed that releases the solenoid clutch LSD so as to maintain safe conditions. At this time, the Subaru Select Monitor can be used for the system diagnosis.



# DRIVER'S CONTROL CENTER DIFFERENTIAL SYSTEM (FROM '06MY)

## MANUAL TRANSMISSION AND DIFFERENTIAL

### B: OPERATION

The DCCD system has the following 2 modes: "MANUAL MODE" and "AUTO MODE". In MANUAL MODE, as the operation amount of DCCD control dial (driver's will) is prioritized, the control that increases/decreases the engagement power of solenoid clutch LSD is performed. In AUTO MODE, the control that automatically adjusts the engagement power of solenoid clutch LSD corresponding to the input signals of steering angle sensor or yaw rate and lateral G sensor is performed.

#### NOTE:

The solenoid clutch LSD controls the differential control within the range of 30 to 100% [which excludes the differential control (0 — 30%) of the mechanical LSD].

#### Control of DCCD control module

Throttle sensing engagement power	Increases or decreases the engagement power of solenoid clutch LSD based on the amount of accelerator pedal depression by the driver.
ABS operation signal input	Decreases the engagement power of solenoid clutch LSD when the ABS operation signal is input from ABSCM&H/U to DCCD CM.
Brake switch signal input	Decreases the engagement power of solenoid clutch LSD when the brake switch signal is input to DCCD CM.
Parking brake signal input	Releases the solenoid clutch LSD when the parking brake signal to DCCD CM is input.
Tight cornering	Decreases the engagement power of solenoid clutch LSD by judging the vehicle condition from the steering angle sensor signal so as to prevent the tight cornering symptom.
Slip	Calculates the slip amount of each wheel based on the wheel sensor signal, and then corrects the engagement power of solenoid clutch LSD corresponding to the slip amount of wheel.
Cornering	Judges the vehicle cornering condition based on the signals of the steering angle sensor and the yaw rate and lateral G sensor so as to manage both drivability and stability of the vehicle during cornering.
DCCD control dial	Decreases or increases the engagement power of solenoid clutch LSD with the operation amount of the DCCD control dial of the driver.
Fail-safe	DCCD CM indicates the malfunction to the driver by blinking the light on the bottom of DCCD indicator when some malfunctions of system have been detected. When there is a serious malfunction in the DCCD coil, DCCD CM turns the DCCD coil OFF and releases the solenoid clutch LSD completely. If the malfunction is not a serious malfunction, such as the malfunctions of some sensors, DCCD CM performs the control that maintains the system operation as much as possible.
Rear differential oil temperature	When the rear differential oil temperature rises excessively [approximately 150°C (302°F) ] for some reasons such as repetitive hard driving, the rear differential oil temperature switch turns ON and the rear differential oil temperature warning light of the combination meter illuminates. At the same time, DCCD CM performs the control that decreases the engagement power of solenoid clutch LSD. (If the oil temperature drops, the system returns to the normal control automatically.)

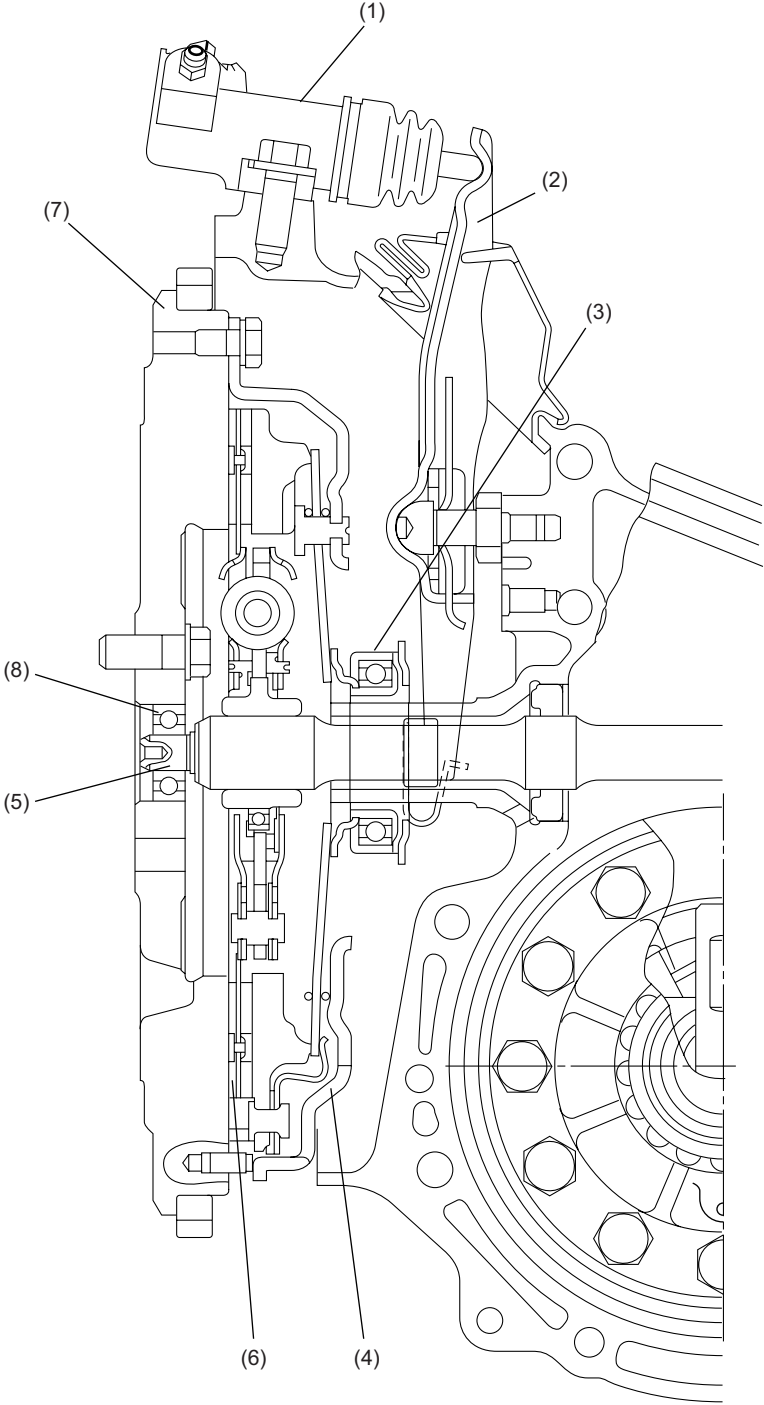
## 2. Clutch

- The clutch is a push type clutch. When the pedal is depressed, the self-aligning release bearing is caused to slide on a guide pressing the center of the diaphragm spring. The diaphragm spring is warped and the force having pressed the pressure plate is released, causing the flywheel, clutch disk and pressure plate to be disengaged from each other, and the transmission of drive force is interrupted. The action point of the clutch is located at the tip of each diaphragm spring fingers, which press the pressure plate against the clutch disc.
- A clutch using a diaphragm spring has the advantage of little variation in push load even when the clutch disc is worn. The diaphragm spring is located inside the clutch cover.
- The clutch disk for both of the non-turbo and turbo models has damper springs and is placed in between the flywheel and the pressure plate.
- Inside the clutch cover, the diaphragm spring and pressure plate are combined with each other by means of strap plates, which also serve to prevent the pressure plate from relatively turning.
- The clutch control is hydraulic and the master cylinder is of the conventional type. The cylinder diameter of the master cylinder for turbo models are made larger. Also, on both the non-turbo and turbo models, the pedal depressing effort is optimized and a damper is attached to reduce vibration of the clutch pedal.

# CLUTCH

CLUTCH

## A: NON-TURBO MODELS



CL-00347

# CLUTCH

CLUTCH

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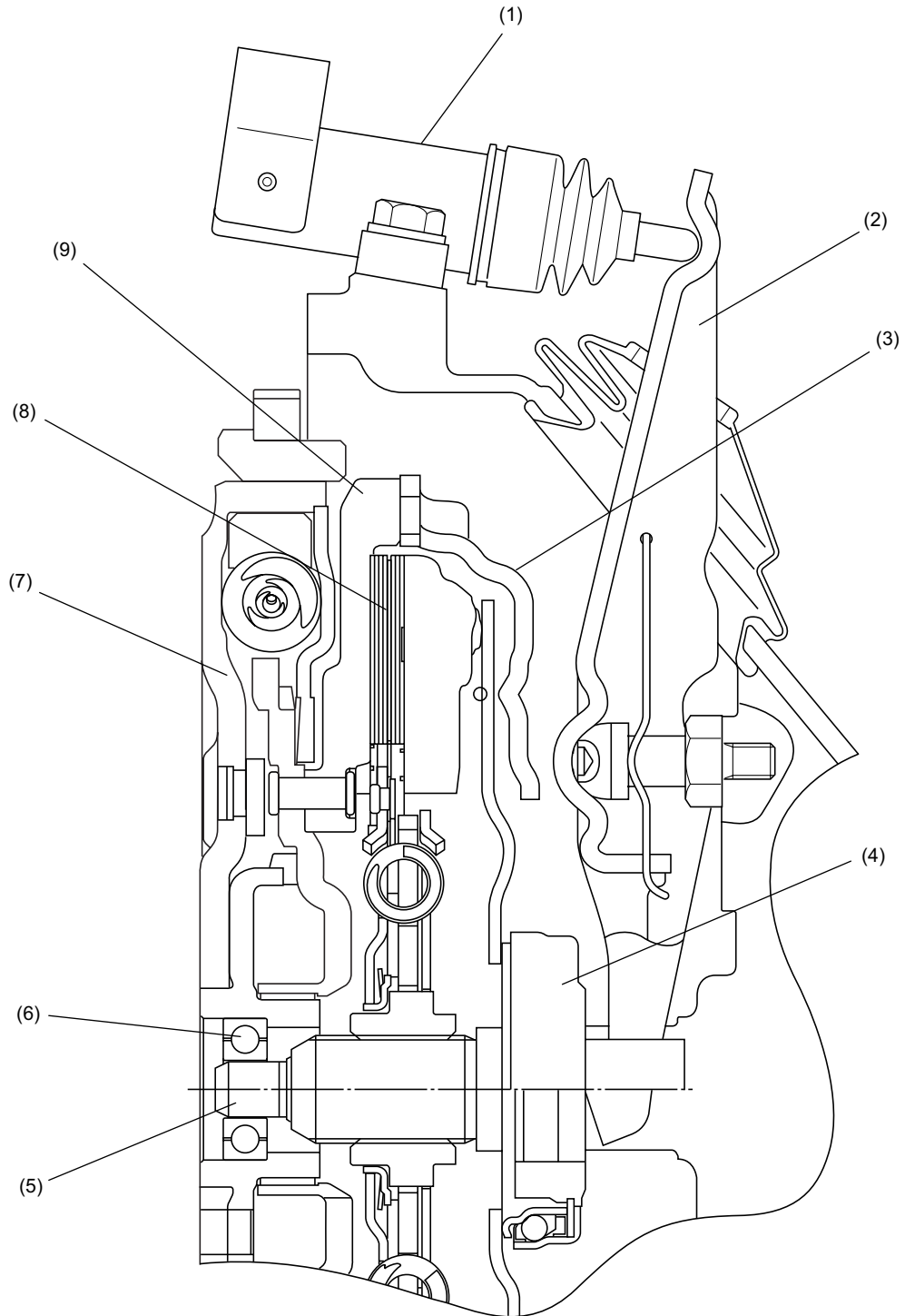
- (1) Operating cylinder
- (2) Release lever
- (3) Release bearing
- (4) Clutch cover

- (5) Main shaft
- (6) Clutch disc
- (7) Flywheel
- (8) Pilot bearing

# CLUTCH

CLUTCH

## B: TURBO MODELS



CL-00263

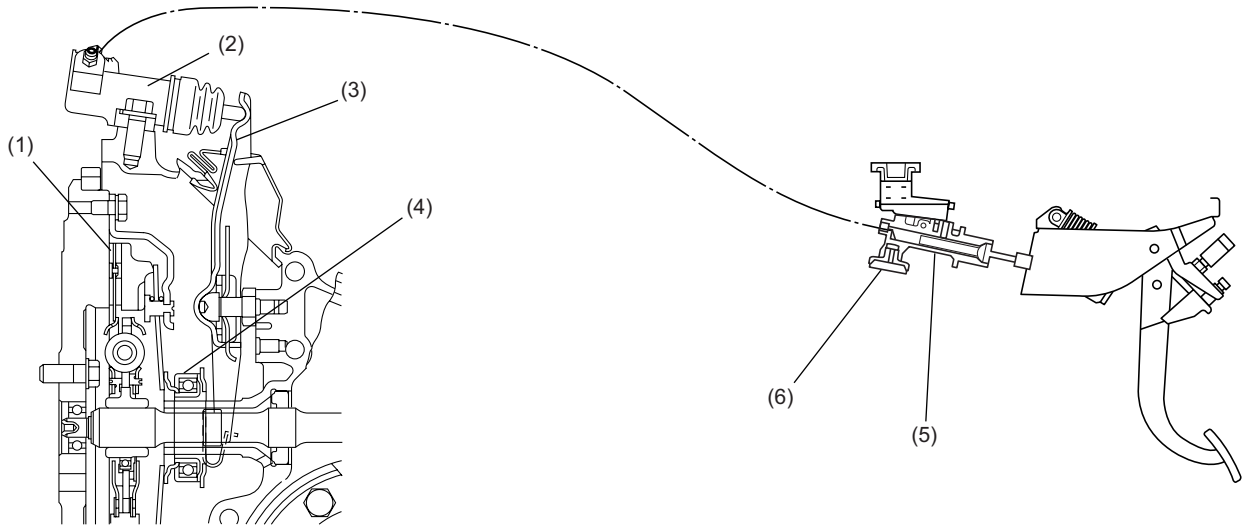
- (1) Operating cylinder
- (2) Release lever
- (3) Clutch cover

- (4) Release bearing
- (5) Main shaft
- (6) Pilot bearing

- (7) Primary flywheel
- (8) Clutch disc
- (9) Secondary flywheel

## C: CLUTCH CONTROL SYSTEM

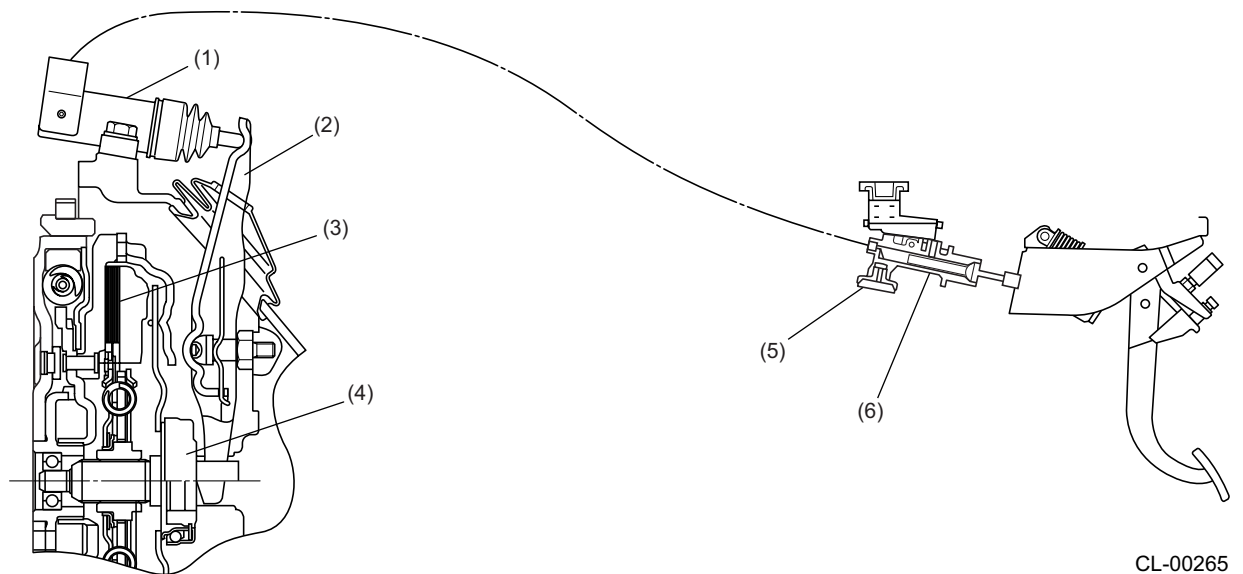
- Non-turbo models



CL-00348

- |                        |                            |
|------------------------|----------------------------|
| (1) Clutch disc        | (4) Release bearing        |
| (2) Operating cylinder | (5) Clutch master cylinder |
| (3) Release lever      | (6) Damper                 |

- Turbo models



CL-00265

- |                        |                            |
|------------------------|----------------------------|
| (1) Operating cylinder | (4) Release bearing        |
| (2) Release lever      | (5) Damper                 |
| (3) Clutch disc        | (6) Clutch master cylinder |

### 1. General

- The clutch is of a dry, single plate type with a diaphragm spring.
- The clutch is a push type clutch. When the pedal is depressed, the release bearing will press the center of the diaphragm spring to disengage the contact between the pressure plate and clutch.
- The clutch control is hydraulic and operates the release lever using the hydraulic pressure generated in the master cylinder when the pedal is depressed.
- A conventional type flywheel is used on non-turbo models, while a dual mass type flywheel is used on turbo models.
- The clutch start system enables the driver to start the engine only when the clutch pedal is fully depressed.

## 3. Flywheel

### A: GENERAL

#### 1. NON-TURBO MODELS

The flywheel is directly connected to the crankshaft. The mass of the flywheel absorbs the fluctuations in crankshaft rotation, and the flywheel transmits the engine torque to the clutch disc.

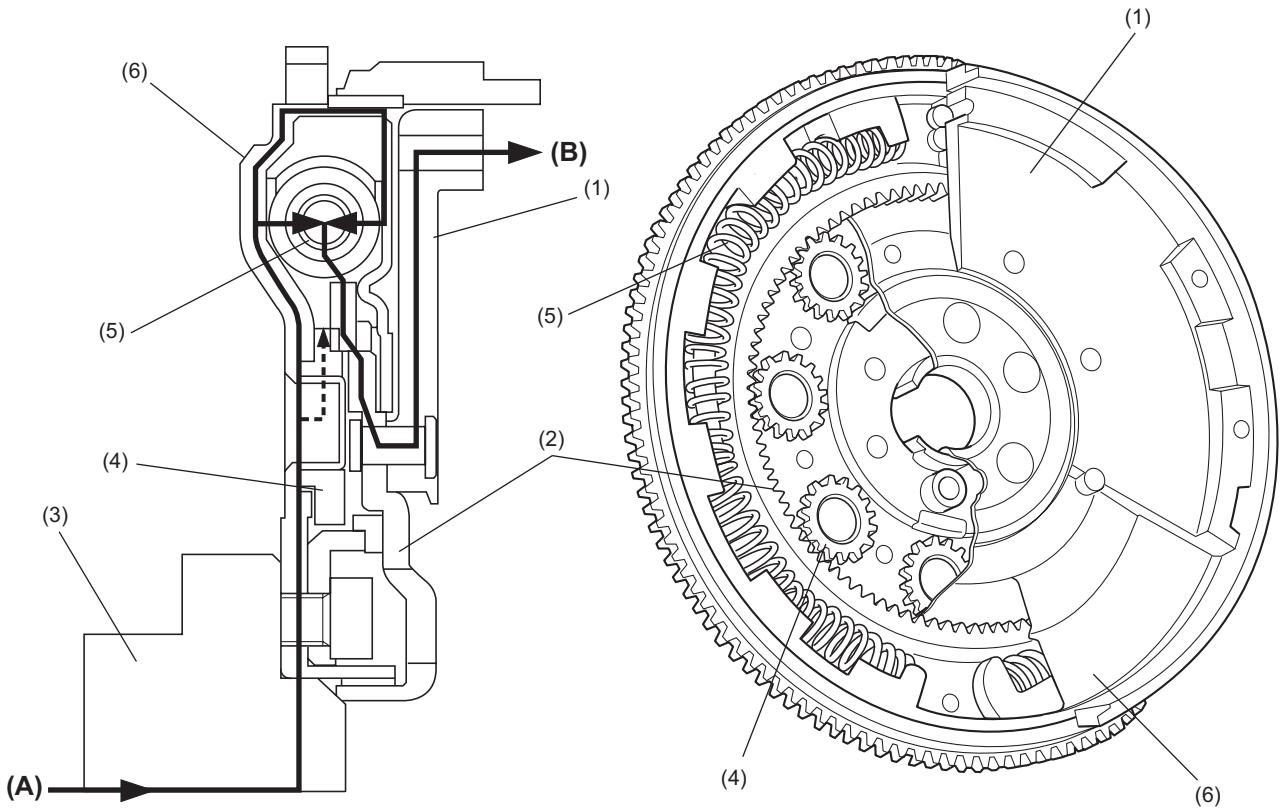
#### 2. TURBO MODELS

- The flywheel is of a dual mass type, which consists of a primary flywheel, damper spring, ring gear, planetary gears, and a secondary flywheel.
- The damper spring is attached to the periphery of the primary flywheel.
- The engine power flows from the primary flywheel through the damper spring, ring gear and planetary gears to the secondary flywheel, and then is transmitted to the transmission via the clutch. Torque fluctuation in this power train is dampened by lowering the rigidity of the power train using a two piece flywheel with a damper spring, ring gear and planetary gears in between, which helps reduce vibration and noise from the power unit.



## B: CROSS SECTIONAL VIEW AND TORQUE FLOW

- Turbo models



CL-00266

- (1) Secondary flywheel
- (2) Ring gear
- (3) Crankshaft
- (4) Planetary gear

- (5) Damper spring
- (6) Primary flywheel
- (A) Input
- (B) Output

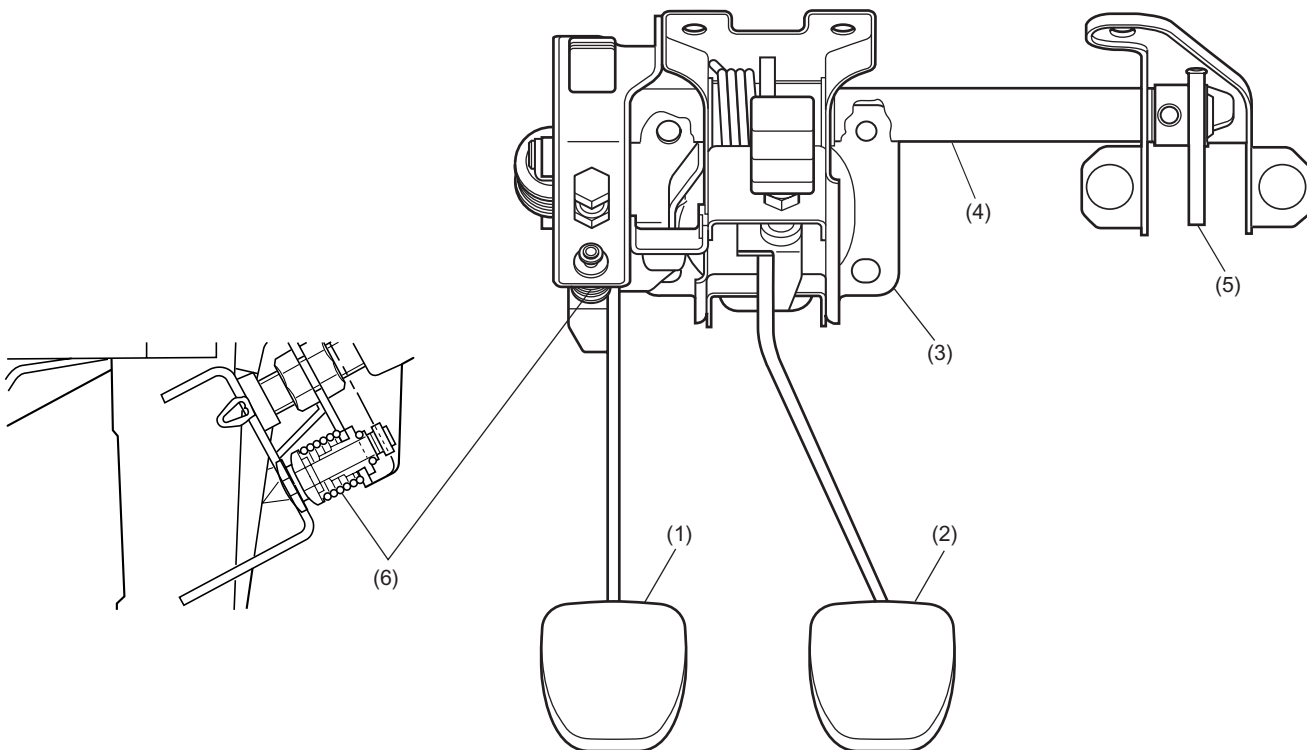
# HYDRAULIC CLUTCH PEDAL SYSTEM

CLUTCH

## 4. Hydraulic Clutch Pedal System

### A: CONSTRUCTION

- The hydraulic clutch pedal is connected to the master cylinder via a rod.
- The clutch pedal and brake pedal are mounted on the same bracket.
- The clutch pedal has a mechanism that reduces (assists) the force required to depress the clutch pedal and reduce the initial pedal depressing force.
- A starter interlock mechanism is provided to prevent the engine from starting unless the clutch pedal is pressed.



CL-00272

(1) Clutch pedal

(2) Brake pedal

(3) Brake and clutch pedal bracket

(4) Rod

(5) Lever

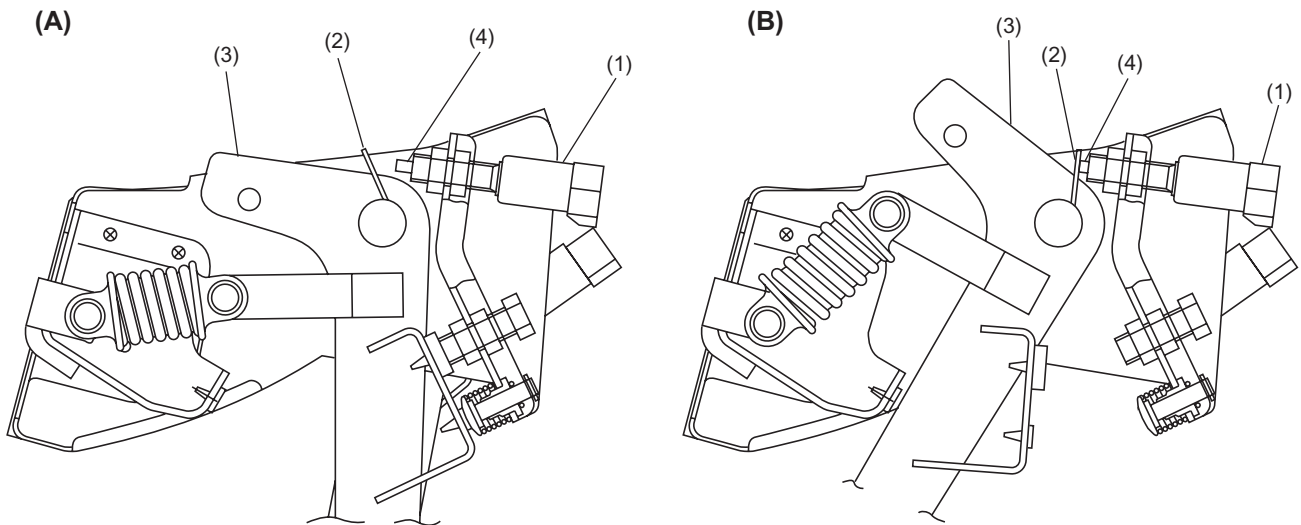
(6) Initial pedal effort reducing mechanism

## B: OPERATION

### 1. STARTER INTERLOCK MECHANISM

When the clutch pedal is fully depressed, the stopper on the pedal pushes the clutch switch pushrod inwards.

When the pushrod is pressed in, the switch turns ON and connects the ignition switch to the starter circuit enabling engine start.



CL-00138

**(A)** When clutch switch is OFF

- (1) Clutch switch
- (2) Stopper

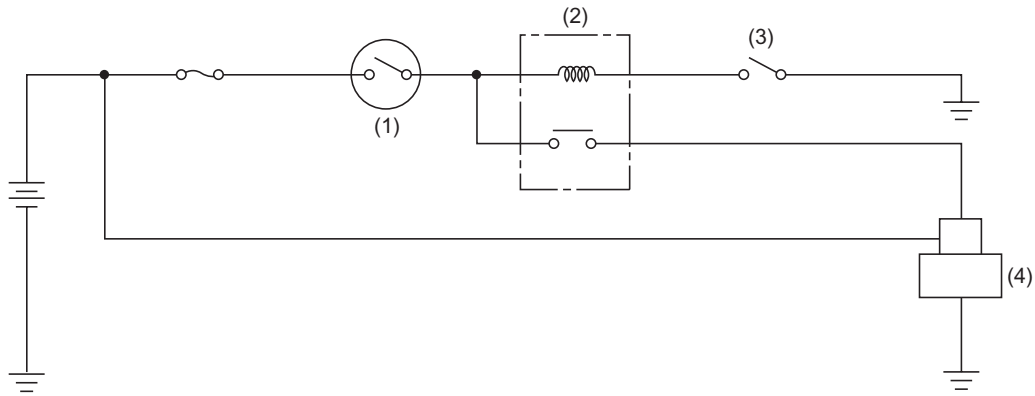
**(B)** When clutch switch is ON

- (3) Clutch pedal
- (4) Pushrod

# HYDRAULIC CLUTCH PEDAL SYSTEM

## CLUTCH

- Schematic drawings



CL-00137

- (1) Ignition switch
- (2) Starter relay

- (3) Clutch switch
- (4) Starter motor

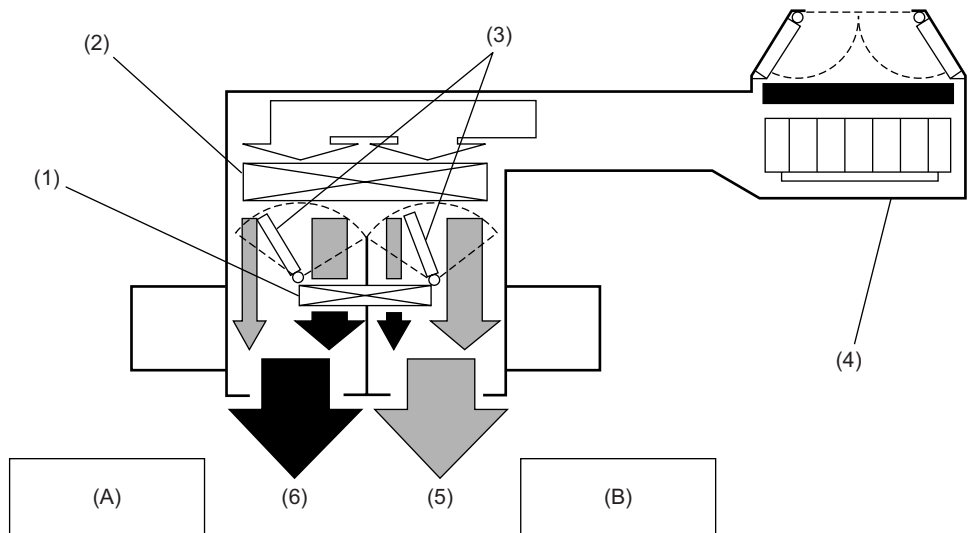
# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 1. Heater System

### A: GENERAL

- A semi-center type integrated air conditioning unit is used, where a high performance heater core and an evaporator core are placed in front and rear of the unit. While ensuring sufficient leg space at the front passenger's seat, resistance to air flow in the air passage is reduced, and the air conditioning system offers a low noise and comfortable environment in all seasons through its functions such as heating, air conditioning, ventilating and defrosting.
- On models with automatic air conditioning, a left/right independent temperature control system is introduced to enable the driver and passenger choose a desirable temperature setting individually.



AC-01171

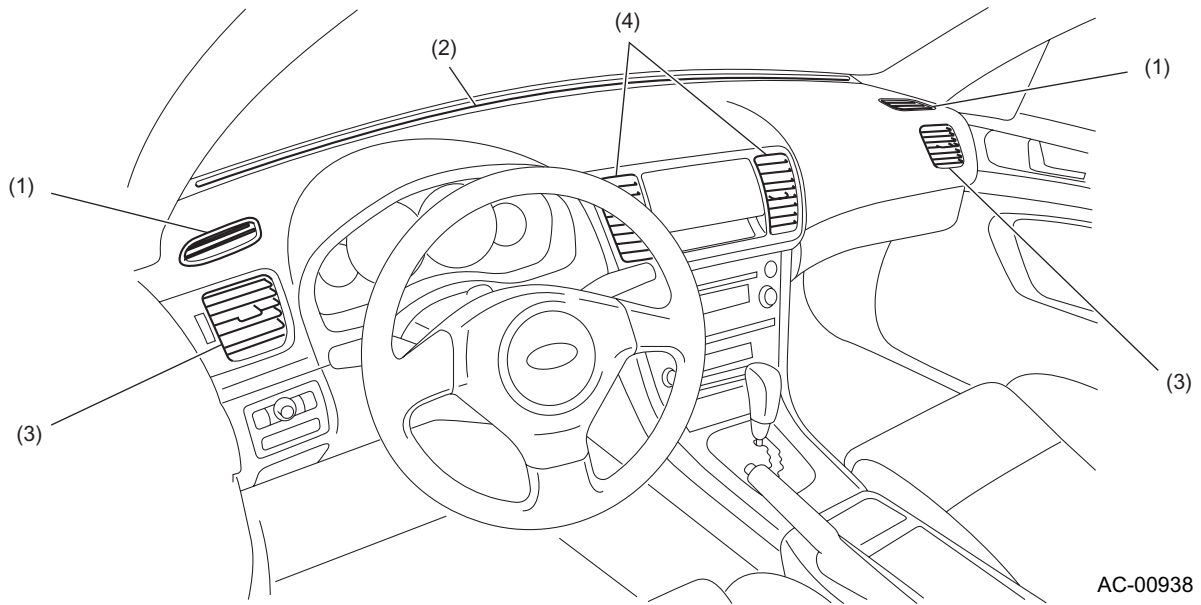
- (A) Driver's seat
- (B) Passenger's seat
- (1) Heater core
- (2) Evaporator
- (3) Air mix door

- (4) Blower unit
- (5) Cool air
- (6) Warm air

- There are four ventilation grilles in the dashboard; two large size grilles at the center and a side grille at each side. To improve the defrosting performance, air is always sent out from the side grilles.

# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)



(1) Side defroster

(2) Front defroster

(3) Side ventilation grille

(4) Center ventilation grille

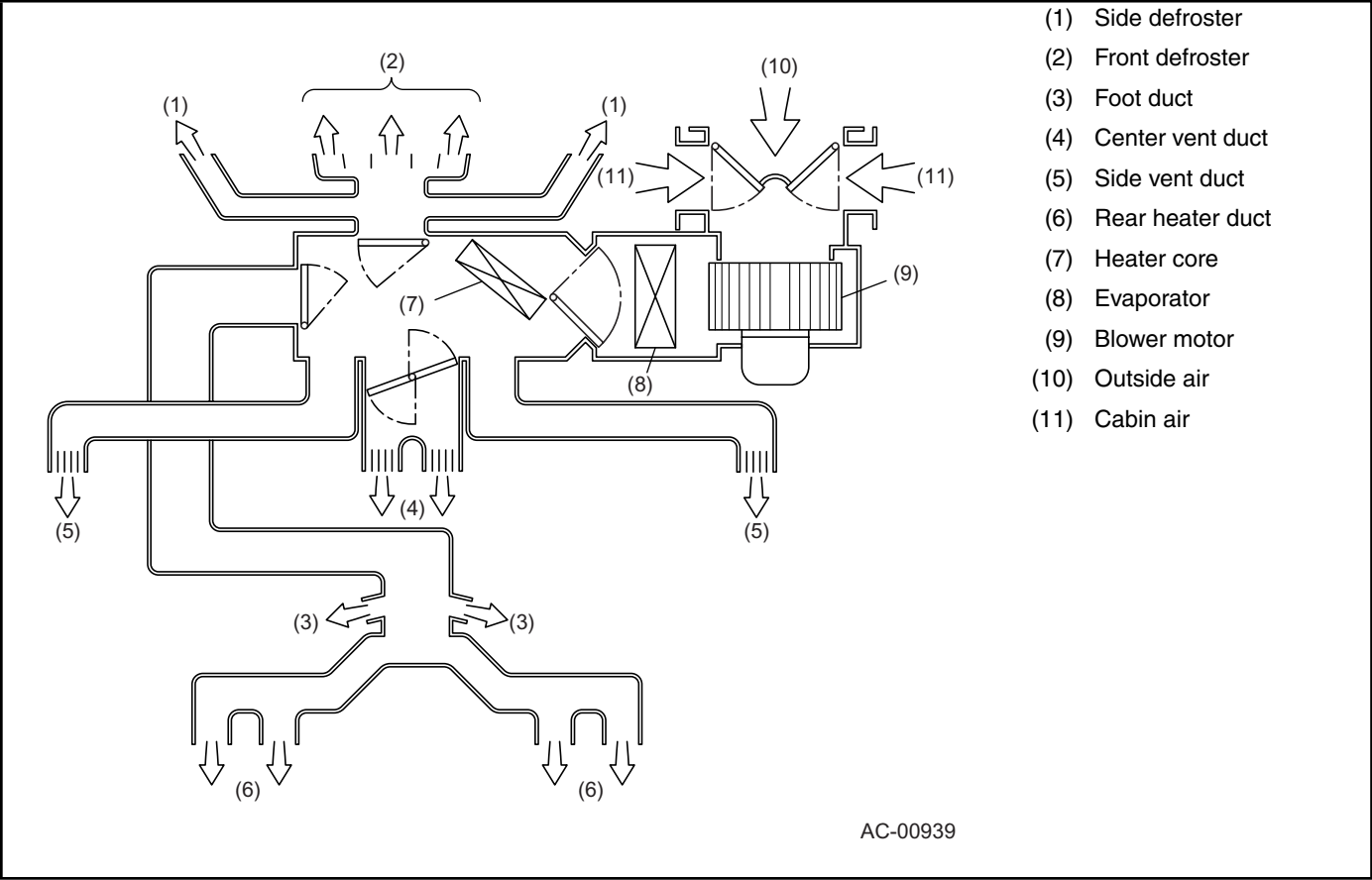
## 1. SPECIFICATIONS

Heating type	Heating performance (W)	Blower power consumption (W)	Maximum blower capacity (m <sup>3</sup> /h)		
			VENT	HEAT	DEF
Outside air mixing type ("full-air-mix" type)	5200	220 or less	460	320	300

# HEATER SYSTEM


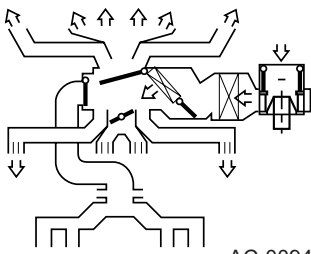

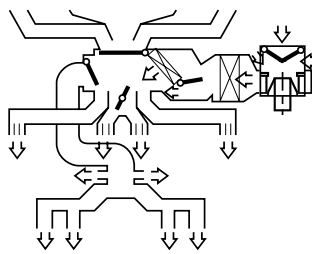

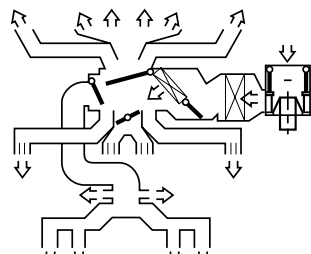

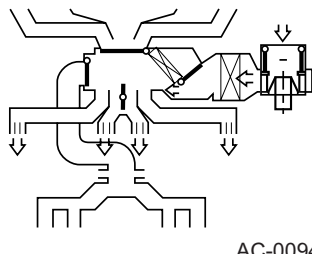

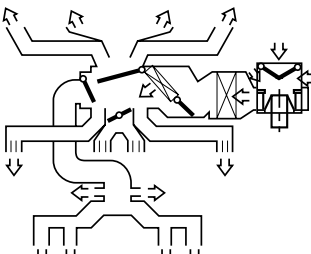

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## B: AIR FLOW MODES



# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

Switch position		Heater unit door operation		Switch position		Heater unit door operation	
Air flow control	 <b>DEF</b> AC-00119	 AC-00940	Air flow control	 <b>BILEVEL</b> AC-00122	 AC-00943		
	 <b>DEF/FOOT</b> AC-00837	 AC-00941		 <b>FACE</b> AC-00839	 AC-00944		
	 <b>FOOT</b> AC-00838	 AC-00942		 <b>FRESH/RECIRC switching</b> AC-00124	<p>This switch allows selecting either of cabin-air-recirculation or fresh-air-introduction modes.                      FRESH/RECIRC is changed each time the switch is pressed.                      Indicator ON: cabin air recirculation                      Indicator OFF: fresh air introduction</p>		



# HEATER SYSTEM

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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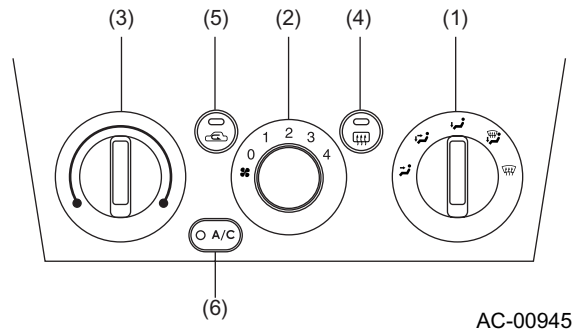
### C: CONTROL PANEL

- The control panel is incorporated into the center panel. To improve the appearance of the interior, the panel is integrated with the audio panel except for models with some audio equipment variations.

- A rear window defogger switch is located in the control panel.

#### 1. MODELS WITH MANUAL AIR CONDITIONING

- The control panel uses three large-diameter, dial type switches for easy operation and good visual recognition.



- (1) Air flow control dial:  
This switch allows selecting any of the five air flow modes.



AC-00127

- (2) Fan speed control dial:  
This switch allows turning on/off the blower and selecting any of the four blower speeds.

# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

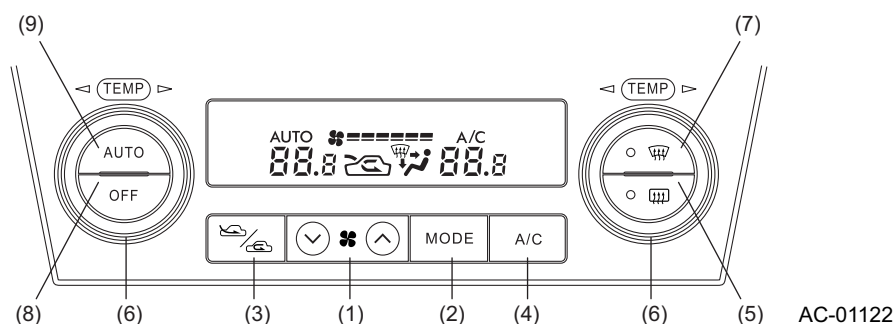
# 0 1 2 3 4

AC-00126

- (3) Temperature control dial:  
This switch allows step-less adjusting of the temperature of air delivered through ventilators.
- (4) Rear window defogger switch:  
This switch activates the rear defogger. When the switch is left on, a timer keeps the defogger activated for 15 minutes and then turns it off automatically.
- (5) FRESH/RECIRC switch:  
This switch allows selecting either cabin-air-recirculation or fresh-air-introduction.
- (6) Air conditioning switch:  
This switch turns on or off the air conditioning compressor.

## 2. MODELS WITH AUTOMATIC AIR CONDITIONING

- A motor driven actuator is used for air outlet switching, driver and passenger side temperature control, and FRESH/RECIRC switching.
- A large sized LCD panel which excels in visibility is used for the control panel.
- To eliminate errors due to heat, the cabin temperature sensor is moved from the control panel to the console side panel.



- (1) Fan speed control switch:  
In automatic air conditioning mode, the system controls the blower speed automatically in accordance with sensor signals.  
In manual air conditioning mode, this switch allows selecting any of the six blower speeds.
- (2) Air flow control switch:  
This switch allows selecting any of the four air flow modes.

# HEATER SYSTEM

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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AC-00130

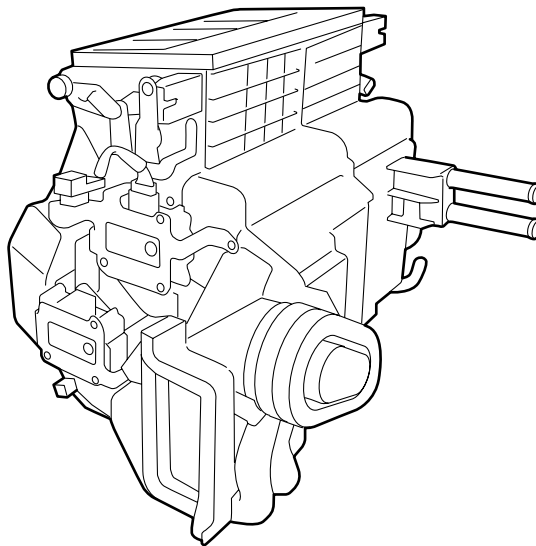
- (3) FRESH/RECIRC switch:  
This switch allows selecting either cabin-air-recirculation or fresh-air-introduction.
- (4) A/C switch:  
This switch turns on or off the air conditioning compressor.
- (5) Rear window defogger switch:  
This switch activates the rear defogger. When the switch is left on, a timer keeps the defogger activated for 15 minutes and then turns it off automatically.
- (6) Temperature control dial (left: driver's seat, right: passenger's seat):  
By turning the left or right dial the temperature of air delivered through ventilators can be adjusted individually at the driver's side and passenger's side. When the dial is turned clockwise the temperature setting rises, and when the dial is turned counterclockwise the setting becomes lower. Temperature setting can be changed in a range between 18 and 32°C in 0.5°C steps.
- (7) Defroster switch:  
When this switch is turned ON the system enters the defroster mode.
- (8) OFF switch:  
All functions are disabled.
- (9) AUTO switch:  
When this switch is turned ON the system enters auto air conditioning mode and automatically controls the blower fan speed, air outlet, fresh/recirculation switching, and compressor operation.

# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## D: HEATER AND COOLING UNIT

- Having an evaporator core at the front and a heater core at the rear, this single unit combines both heating and cooling functions.
- The heater and cooling unit incorporates mode doors for creating different air flow modes and an air mix door for mixing heated air and outside air.
- On models with automatic air conditioning, the inside of the heater and cooling unit is separated into left and right parts so that the driver and passenger can individually control the temperature.
- In models with an automatic air conditioning, the mode doors and air mixing door are moved by electric-motor-driven actuators.  
In models with a manual air conditioning system, the air mix door is moved by a linkage cable.



AC-00947

## 1. SPECIFICATIONS

Heater core size	Heat output
264 × 110 × 27	5200 W

# HEATER SYSTEM

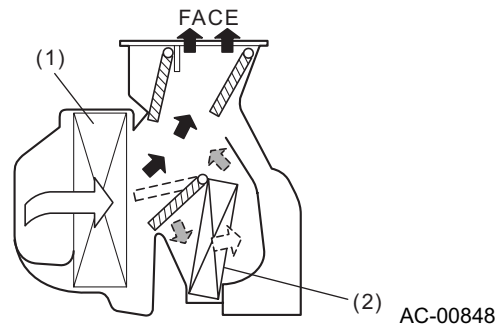
## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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### 2. DESIGN FEATURES FOR EACH AIR FLOW MODE

#### 1) Ventilation (FACE) mode

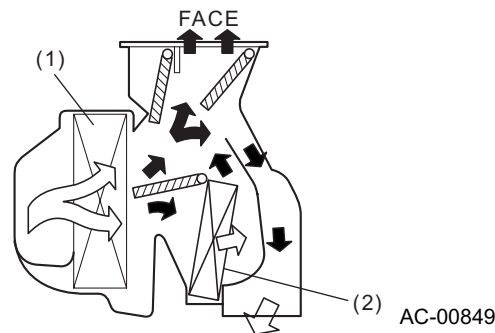
- The passage leading air from the evaporator to the ventilation duct is made straight to reduce air flow resistance.
- When the air temperature is necessary to be adjusted, heated air is blown at right angles against the flow of cool air from the evaporator. This allows the airs to mix thoroughly.



- (1) Evaporator
- (2) Heater core

#### 2) Foot/face (BILEVEL) mode

- The air that has flown through the evaporator is divided into two directions. Part of this air flows through the heater core and becomes warm air. The rest of the air goes to the outlet as cool air, however, this is mixed with the warm air from the heater core. The mixed air then flows to the ventilation and heater ducts.



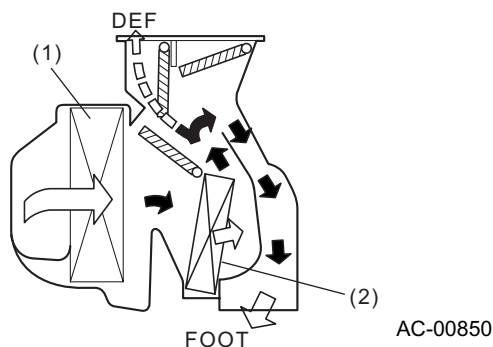
- (1) Evaporator
- (2) Heater core

# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 3) Heating (FOOT) mode

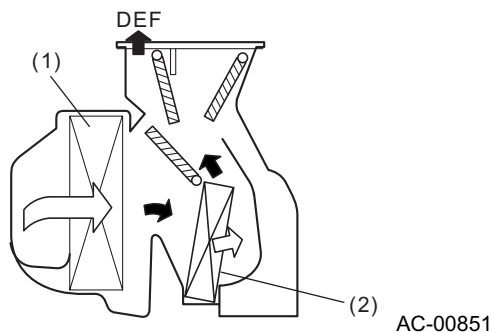
- The air that has flown through the evaporator is heated at the heater core and then flows to the heater ducts.
- To defog the windshield, the defroster door is slightly open and warm air is also sent to the defroster (DEF) duct.
- The side ventilation grills ventilate air always.



- (1) Evaporator
- (2) Heater core

## 4) Defroster (DEF) mode

- Air passages are designed in such a way that air flow resistance is minimized and defrosting performance is maximized.
- The air passages toward the defroster (DEF) outlet is long enough to ensure a same airflow rate at all defroster outlets.
- The side ventilation grills ventilate air always.



- (1) Evaporator
- (2) Heater core

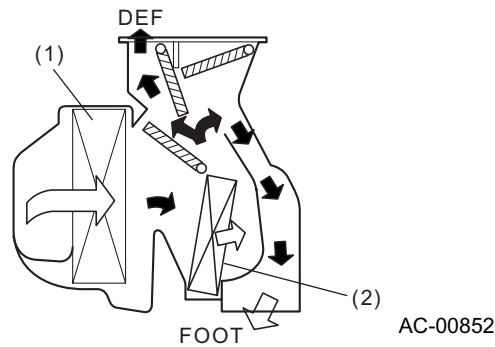
# HEATER SYSTEM

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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### 5) Defroster (DEF) /Heating (FOOT) mode

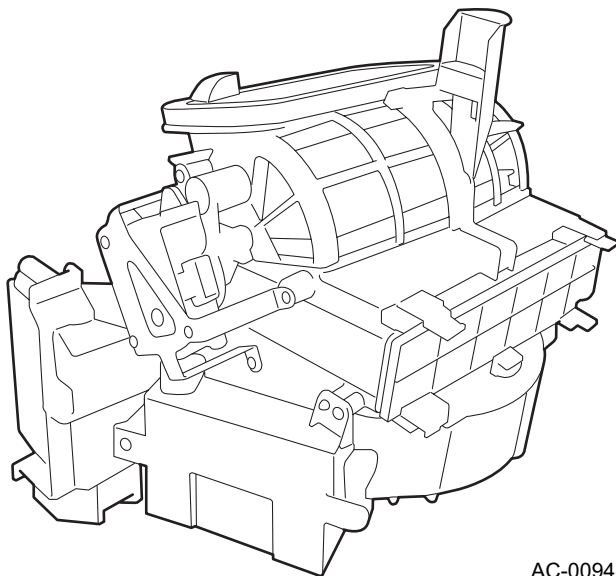
- The air from the evaporator flows through the heater core and the warmed air flows to the defroster (DEF) duct and foot duct to defog the windshield while sending warm air to the legs.
- The air directed to the defroster duct flows out from the front and side defroster ducts to defog the windows.
- The side ventilation grills ventilate air always.



- (1) Evaporator
- (2) Heater core

### E: BLOWER UNIT

- The blower unit uses a low-noise-type motor.

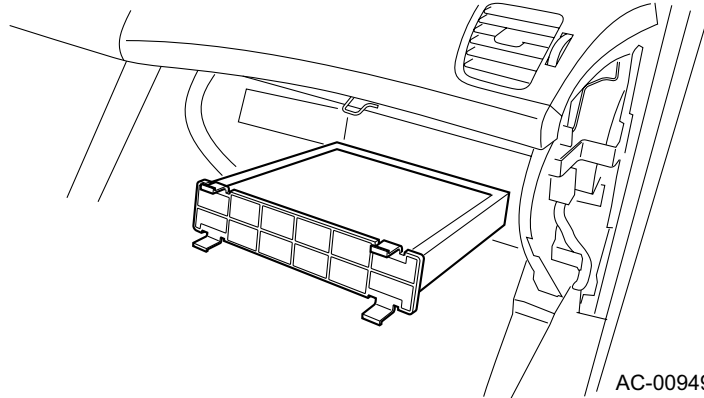


# HEATER SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

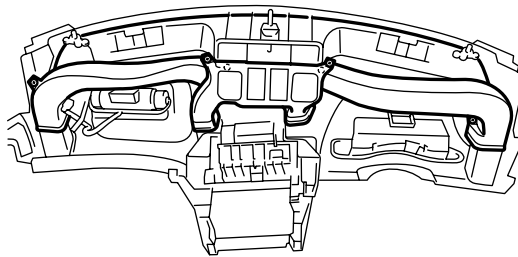
## F: FILTER

- Clean air filters are available for all models as dealer option. They can remove dust, cigarette smoke particles and other similar impurities in the air.



## G: DUCT

- The ventilation duct and defroster duct are located behind the instrument panel. Both the ducts have been modified in the shape to reduce air flow resistance.
- Defrosting air flow is divided at the center, so that air can flow out evenly through a wide center defroster as well as right and left side defrosters.



AC-00950



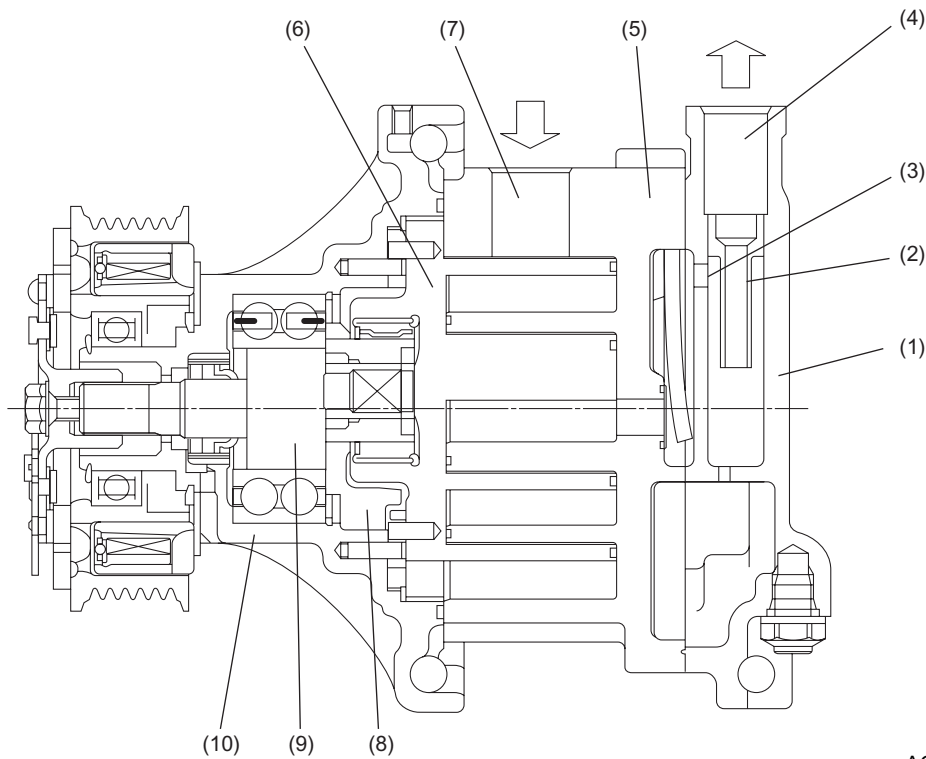
# COOLING SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 2. Cooling System

### A: COMPRESSOR

As two scrolls (one movable and other fixed) are engaged, a crescent chamber is formed between multiple contact points. The movable scroll cannot rotate on its own axis but orbits instead, so the operating chamber moves inwards while its capacity is reduced. Intake, compression and discharge take place simultaneously at multiple operation chambers, and compressed refrigerant is sent from the discharge hole at the center to the oil separator and then separated in to refrigerant gas and oil before it is output from the discharge port.



AC-00874

- |                         |                           |
|-------------------------|---------------------------|
| (1) Rear housing        | (6) Rotor: movable scroll |
| (2) Oil separator       | (7) Suction port          |
| (3) Discharge hole      | (8) Balancer              |
| (4) Discharge port      | (9) Shaft                 |
| (5) Shell: fixed scroll | (10) Front housing        |

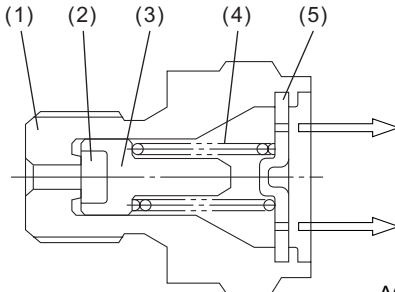
# COOLING SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 1. PRESSURE RELIEF VALVE

This valve opens if the pressure of the high-pressure refrigerant gas rises to a dangerously high level to release part of refrigerant into the atmosphere, thus protecting the compressor. The valve is designed to limit the amount of released gas to the necessary minimum.

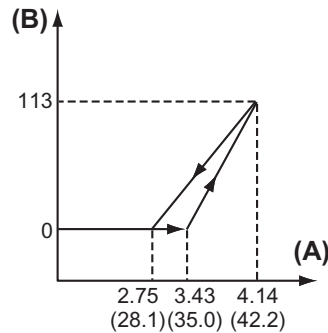
- Valve opening pressure: above 3.43 MPa (35.0 kgf/cm<sup>2</sup>)
- Valve closing pressure: above 2.75 MPa (28.1 kgf/cm<sup>2</sup>)
- Valve wide open pressure: below 4.14 MPa (42.2 kgf/cm<sup>2</sup>)



AC-00875

- |             |            |
|-------------|------------|
| (1) Housing | (4) Spring |
| (2) Valve   | (5) Plate  |
| (3) Holder  |            |

## Operating characteristics



AC-00876

- (A) Pressure MPa (kgf/cm<sup>2</sup>)  
(B) Leakage l/min

# COOLING SYSTEM

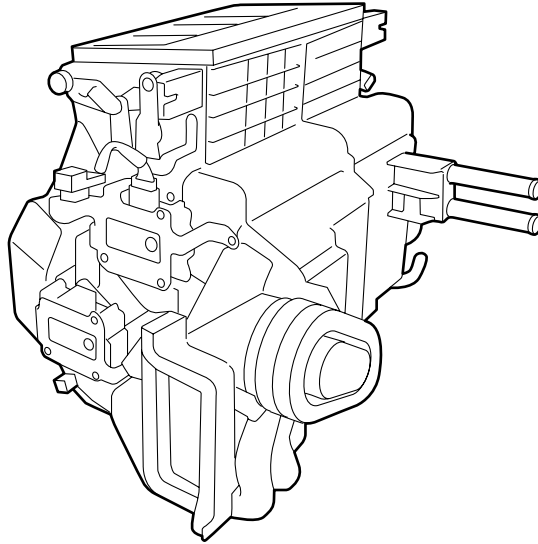
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## B: COOLING UNIT

The heater unit and cooling unit are integrated into a single heater and cooling unit.

The cooling section components of this unit include an evaporator, expansion valve, and case.



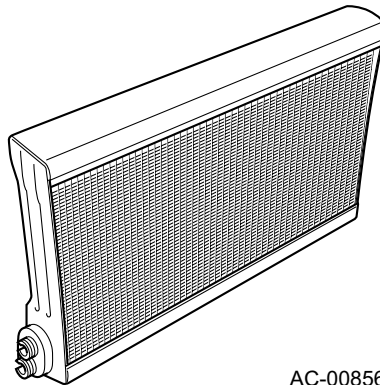
AC-00947

### 1. EVAPORATOR

The evaporator is a laminated type.

When a low-pressure, low-temperature refrigerant is sprayed by the expansion valve into the evaporator, it evaporates and cools the evaporator surfaces.

The cabin air is drawn by the blower and cooled down as it flows over the evaporator. The cooled air then flows passing through the heater unit and delivered into the cabin through vent outlets.



AC-00856

# COOLING SYSTEM

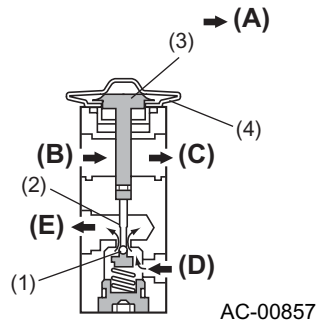
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 2. EXPANSION VALVE

The expansion valve regulates the flow of refrigerant such that heat exchange takes place optimally.

The expansion valve performs two functions; it sprays the high-pressure refrigerant from the condenser using a throttle valve, and it regulates the amount of the spray by changing opening of the throttle valve.

The expansion valve consists of such main components as a heat sensing cylinder, diaphragm, ball valve, spring, and adjusting screw.



- |                           |   |
|---------------------------|---|
| (1) Ball valve            | (A) Refrigerant flow                    |
| (2) Shaft                 | (B) From evaporator (low-pressure side) |
| (3) Heat sensing cylinder | (C) To compressor                       |
| (4) Diaphragm             | (D) To liquid tank                      |
|                           | (E) To evaporator (high-pressure side)  |

The heat (temperature) sensing cylinder is held in contact with the evaporator outlet pipe so that a pressure corresponding to the sensed temperature may be applied to the chamber above the diaphragm. There is a pressure equalizing hole which communicates with the chamber below the diaphragm to transmit changes in the refrigerant pressure to the chamber. The ball valve is linked with the diaphragm and moves according to changes in the balance between the force applied to the diaphragm and the tension of the spring.

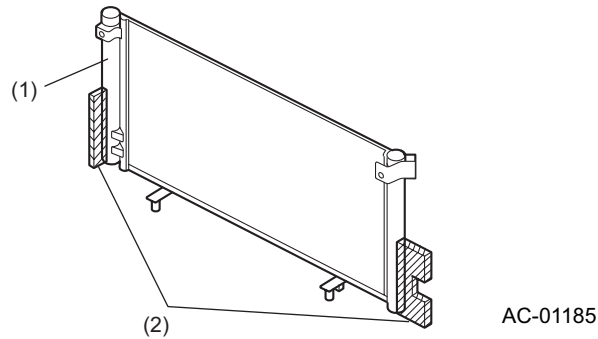
# COOLING SYSTEM

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## C: CONDENSER

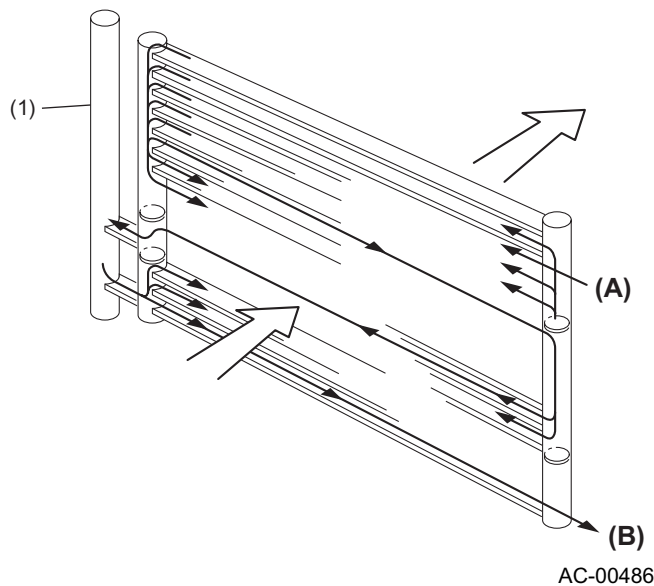
The condenser is a newly developed subcooling condenser that integrates a multi-flow type condenser and a modulator (gas-liquid separator) into a single unit. The condenser has a high heat-exchange efficiency.



- (1) Liquid tank
- (2) Urethane

## 1. SUBCOOLING CONDENSER

The new subcooling condenser has a subcooling section where part of the refrigerant that remains in gas form is cooled and reduced into liquid form. This enables almost 100% of the refrigerant to be re-liquefied.



- (1) Liquid tank

- (A) Suction
- (B) Discharge

# COOLING SYSTEM

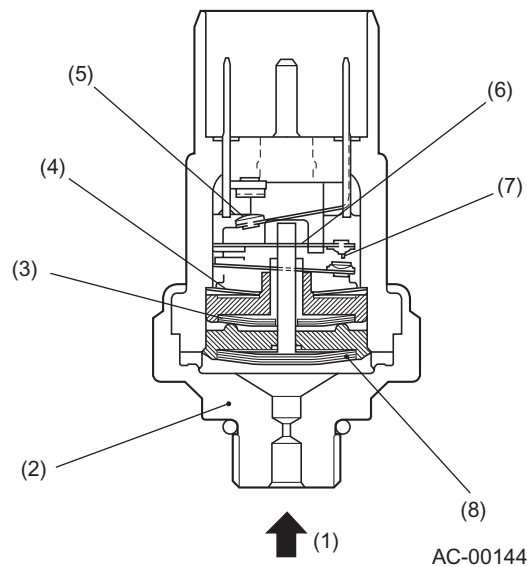
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## D: PRESSURE SWITCH

The pressure switch is a high-pressure side component of the refrigeration cycle (cooling cycle). It consists of a diaphragm that receives refrigerant gas pressure, a snap plate, a rod, contacts that open both when the gas pressure is too low and when it is too high, and a switch that operates at mid-pressure.

The pressure switch plays the following roles:

- Prevents “no-gas” operation due to leakage (when gas pressure is too low)
- Protects the system against abnormally high refrigerant pressure (when gas pressure is too high)
- Detects compressor load (mid pressure contact: electric cooling fan output control)



(1) Pressure

(2) Housing

(3) Diaphragm (high pressure)

(4) Diaphragm (low pressure)

(5) Mid-pressure switch

(6) Lever (high-pressure)

(7) High and low pressure switch

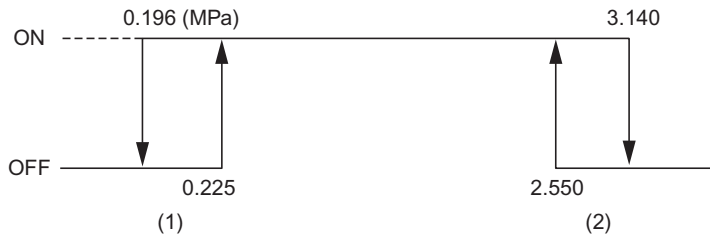
(8) Diaphragm (mid pressure)

# COOLING SYSTEM

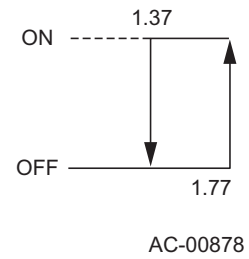
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## ON-OFF pressures

(A)



(B)



AC-00878

(A) High and low pressure switch

(B) Mid-pressure switch

(1) Low pressure

(2) High pressure

## 1. SPECIFICATIONS

### High/low pressure switch (compressor ON/OFF control)

Low pressure switch	ON→OFF	0.196 MPa (2.00 kgf/cm <sup>2</sup> )
	OFF→ON	0.255 MPa (2.60 kgf/cm <sup>2</sup> )
High pressure switch	ON→OFF	3.140 MPa (32.0 kgf/cm <sup>2</sup> )
	OFF→ON	2.550 MPa (26.0 kgf/cm <sup>2</sup> )

### Mid pressure switch (electric cooling fan output control)

Compressor at low load	ON→OFF	1.37 MPa (13.9 kgf/cm <sup>2</sup> )
Compressor at high load	OFF→ON	1.77 MPa (18.0 kgf/cm <sup>2</sup> )

# MANUAL AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 3. Manual Air Conditioning

### A: GENERAL

#### 1. SPECIFICATIONS

Item	Specifications		Remarks	
Air conditioning	"Full-air-mix" type			
Cooling performance	Cooling capacity (W)	5300		
	Air flow rate (m <sup>3</sup> /h)	460		
Refrigerant quantity	HFC-134a (g)	400±30		
Compressor	Type	Scroll	Denso SCSA08C	
	Capacity (cm <sup>3</sup> /rev)	74.5		
	Maximum permissible speed (rpm)	9000		
	Lubricant (amount contained in compressor in g)	Denso oil 8 (70)		
Magnetic clutch	Type	Dry, single disc		
	Power consumption (W)	35		
	Pulley ratio	1:1.43 (crankshaft pulley diameter: 133 mm; compressor pulley diameter: 125 mm)		
	Belt	Polyurethane V-belt with four ribs		
Condenser	Type	Multi-flow type (with built-in liquid tank for subcooling)		
	Fan	Type		Electric-motor-driven axial flow fan
		Fan diameter		300 mm (7+5 blades)
		Power consumption (W)		90 × 2
Evaporator	Type	Laminated		
	Expansion valve	External pressure equalizing type		
	Temperature control	Thermo AMP (amplifier)		
Other controls	Fast idle control system	Engine control module (ECM)		
	High and low pressure limit control	Low pressure switch: Turns off compressor at a pressure lower than 0.196 MPa High-pressure switch: Turns off compressor at a pressure higher than 3.140 MPa		
	High-speed limit control	Performed by ECM		
	Radiator and condenser fan control	Performed by ECM		

#### 2. CONTROL PANEL

<Ref. to AC-6, MODELS WITH MANUAL AIR CONDITIONING, CONTROL PANEL, Heater System.>

#### 3. THERMO AMP (AMPLIFIER)

The thermo AMP detects the temperature at the evaporator outlet to turn off the magnetic clutch circuit when the evaporator temperature drops to a certain level in order to prevent frost from forming on the evaporator.



# **AUTOMATIC AIR CONDITIONING**

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

---

## **4. Automatic Air Conditioning**

### **A: GENERAL**

When the AUTO mode is selected, the automatic air conditioner controls the air temperature and air flow rate automatically.

# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## 1. SPECIFICATIONS

Item	Specifications		Remarks	
Air conditioning	"Full-air-mix" type			
Cooling performance	Cooling capacity (W)	5300		
	Air flow rate (m <sup>3</sup> /h)	460		
Refrigerant (g)	400±30			
Compressor	Type	Scroll	Denso SCSA08C	
	Capacity (cm <sup>3</sup> /rev)	74.5		
	Maximum permissible speed (rpm)	9000		
	Lubricant (amount contained in compressor in g)	Denso oil 8 (70)		
Magnetic clutch	Type	Dry, single disc		
	Power consumption (W)	35		
	Pulley ratio	1:1.43 (crankshaft pulley diameter: 133 mm; compressor pulley diameter: 125 mm)		
	Belt	Polyurethane V-belt with four ribs (H4) or six ribs (H6)		
Condenser	Type	Multi-flow type (with built-in liquid tank for subcooling)		
	Fan	Type		Electric-motor-driven axial flow fan
		Fan diameter		H4: 300 mm Turbo and H6: 320 mm (7+5 blades)
		Power consumption (W)		H4: 90 × 2, H6: 160 × 2, Turbo: 120 × 2
Evaporator	Type	Laminated		
	Expansion valve	External pressure equalizing type		
	Temperature control sensor	Thermistor		
Automatic control system	Temperature control	"Full-air-mix" system		
	Fan speed control	Automatic control: stepless Manual control: six steps		
	Air introduction selection	Manual (inside air recirculation/fresh air introduction)		
	Air outlet selection	Manual (ventilation, bi-level, heater, defroster and heater/defroster)		
Other controls	Fast idle control system	Engine control module (ECM)		
	High and low pressure limit control	Low-pressure switch: Turns off compressor at a pressure higher than 0.196 MPa High-pressure switch: Turns off compressor at a pressure higher than 3.140 MPa		
	High-speed limit control	Performed by ECM		
	Radiator and condenser fan control	Performed by ECM		
Diagnosis function	The auto A/C control module has a sensor and actuator diagnosis function.			
Other controls	Manual adjustment possible at maximum heating and maximum cooling positions			

# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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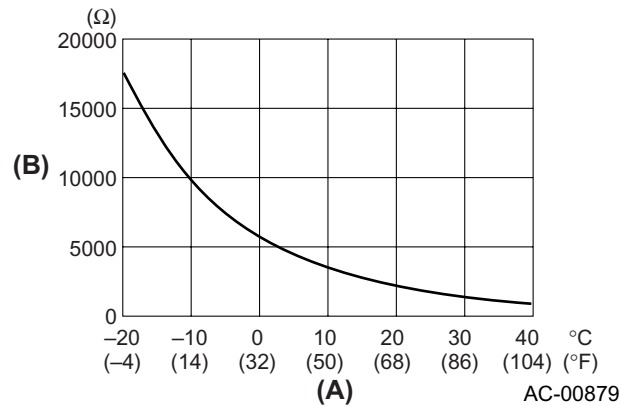
## B: CONTROL PANEL

<Ref. to AC-7, MODELS WITH AUTOMATIC AIR CONDITIONING, CONTROL PANEL, Heater System.>

## C: IN-VEHICLE SENSOR

The in-vehicle sensor detects the cabin temperature and sends an electric signal corresponding to the temperature to the A/C control module.

This sensor consists of an aspirator and a thermistor, the resistance of which changes in inverse proportion to the temperature. The aspirator operates by a vacuum generated in the heater unit (only when the blower unit is turned on).

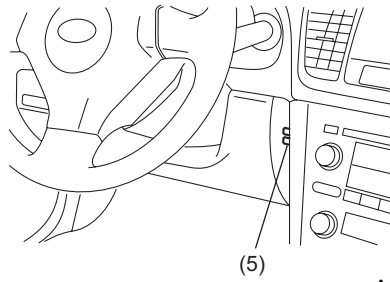
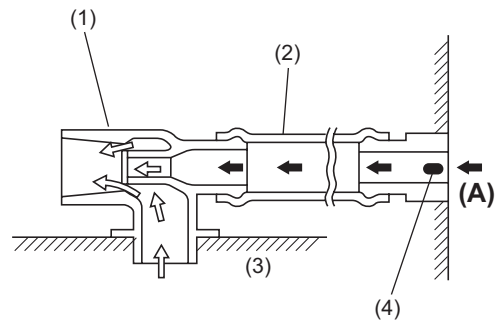


(A) Temperature

(B) Resistance

# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)



AC-01186

- (1) Aspirator
- (2) Aspirator duct
- (3) Heater unit

- (4) In-vehicle sensor
- (5) Cabin air inlet
- (A)** Cabin air

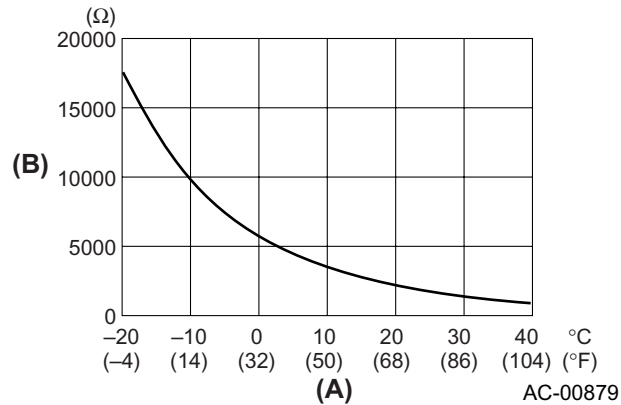
# AUTOMATIC AIR CONDITIONING

## HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

### D: AMBIENT SENSOR

The ambient sensor uses a thermistor to detect the ambient temperature and outputs a signal corresponding the detected temperature to the auto A/C control module.

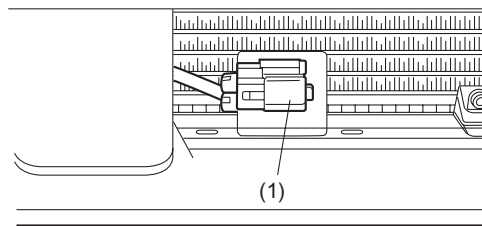
The thermistor is covered with a plastic molding to increase its thermal capacity, thus preventing it from being too sensitive to rapid changes in the temperature and enabling the sensor to output an average ambient temperature.



(A) Temperature

(B) Resistance

The ambient sensor is attached to the radiator lower panel at the portion where the radiator panel is located in such a way that it is exposed to outside air most efficiently.



AC-00712

(1) Ambient sensor

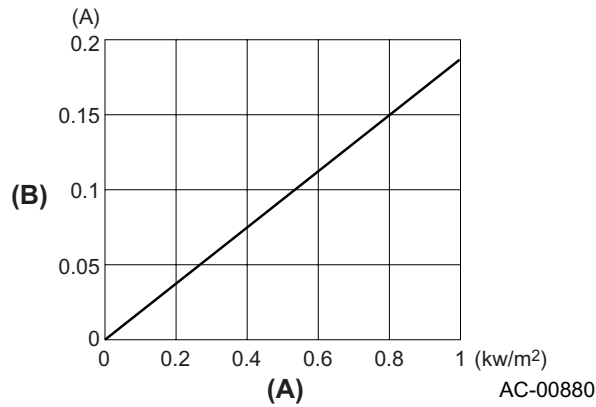
# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## E: SUN-LOAD SENSOR

The sun-load sensor uses a photodiode which can convert change in the intensity of solar radiation into change in the electric current. The output signal of the sensor is sent to the auto A/C control module.

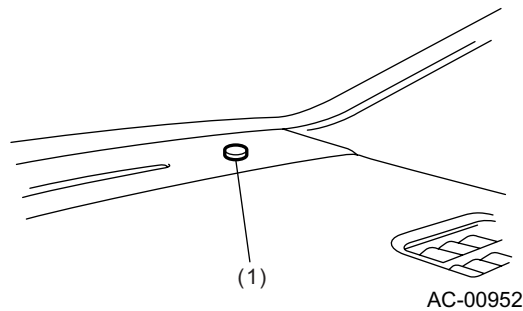
### Sun-load sensor characteristic



(A) Solar radiation

(B) Photoelectric current

The sun-load sensor is attached to the front defroster grill.



(1) Sun-load sensor

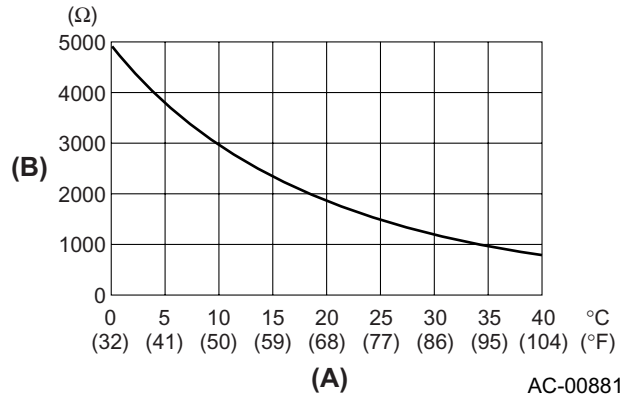
# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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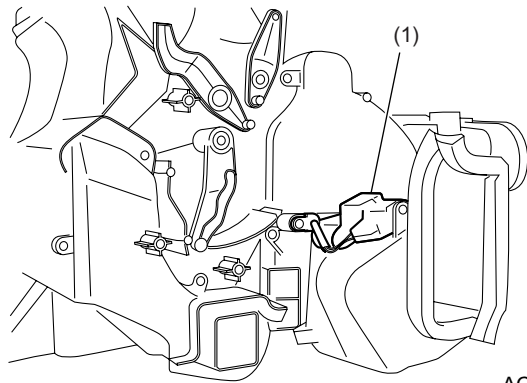
## F: EVAPORATOR SENSOR

The evaporator sensor detects the temperature of the air that has passed over the evaporator and transmits a signal corresponding to the temperature to the auto A/C control module.



(A) Temperature

(B) Resistance



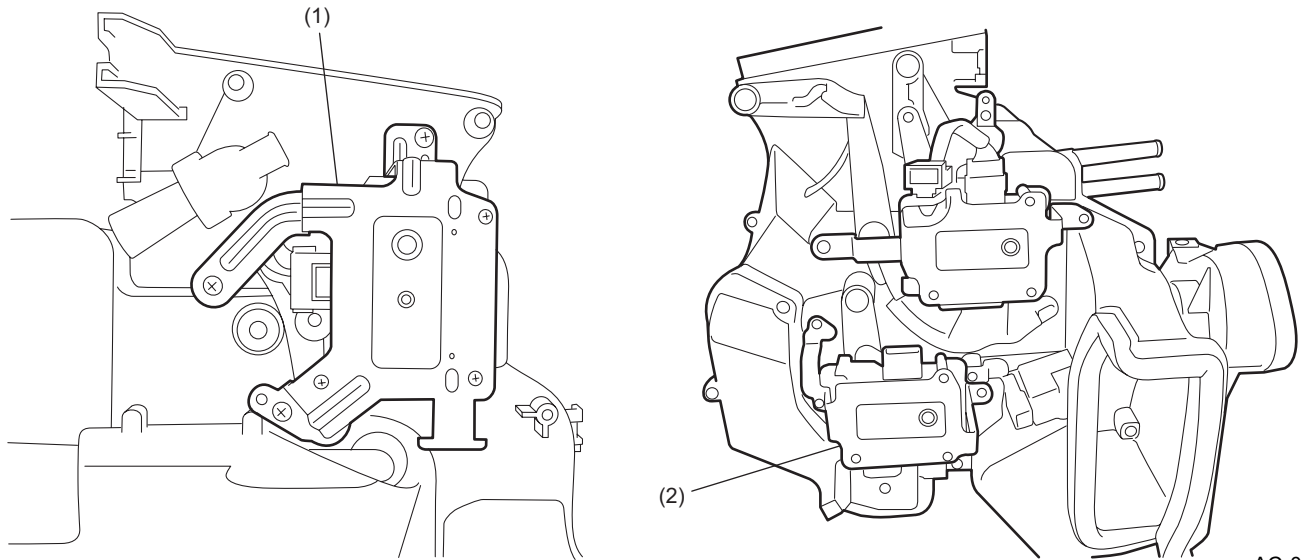
(1) Evaporator sensor connector

# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## G: AIR MIX DOOR ACTUATOR

Air mix door actuators are installed at left and right of the heater and cooling unit, and they move the left and right air mix doors independently to the proper position in response to signals from the auto A/C control module. This enables the driver and passenger to control the temperature individually.



AC-01123

- (1) Air mix door actuator (driver's seat)
- (2) Air mix door actuator (passenger's seat)



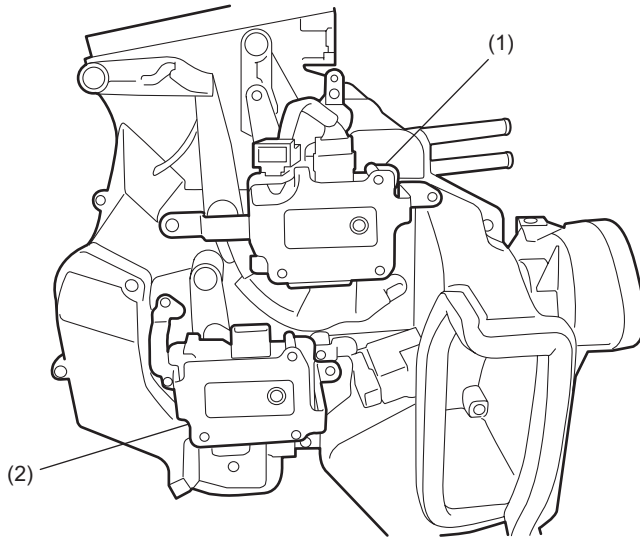
# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

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## H: MODE DOOR ACTUATOR

The mode door actuator incorporates an electric motor which turns in one or the other direction in response to signals from the auto A/C control module. The motion of the electric motor is transmitted to each mode door via a linkage and moves the door to the position appropriate for the selected air flow mode.



AC-00954

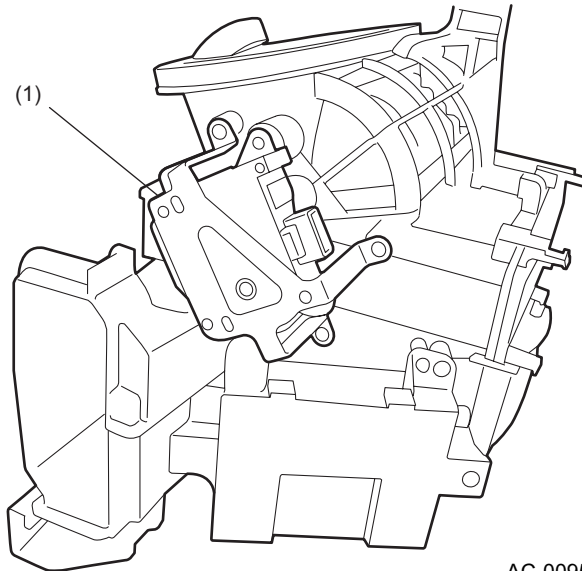
- (1) Mode door actuator
- (2) Air mix door actuator

# AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

## I: FRESH/RECIRC DOOR ACTUATOR

The FRESH/RECIRC door actuator incorporates an electric motor which turns in one or the other direction in response to a signal from the auto A/C control module. The motion of the electric motor is transmitted to the FRESH/RECIRC door via a linkage to move the door to the outside-air introduction or cabin-air-recirculation position.



AC-00955

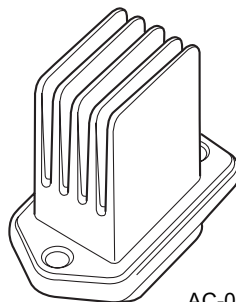
(1) FRESH/RECIRC door actuator

## J: FAN CONTROL AMPLIFIER

The fan control amplifier uses a MOS\* type field effect transistor. This amplifier steplessly regulates the blower motor voltage (in the range between approximately 3V and 12V) in response to gate voltage signals issued by the auto A/C control module.

Since this fan control amplifier features very small voltage drop, it can handle the maximum voltage for the maximum blower speed without need for a high-voltage relay.

\*MOS = metal oxide semiconductor



AC-00720

# **AUTOMATIC AIR CONDITIONING**

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

---

**MEMO**

### **1. Airbag System**

#### **A: GENERAL**

##### **1. SRS AIRBAG**

The SRS airbags supplement the seat belts which restrain the body if the driver or passenger is endangered by a severe impact to the front of the vehicle.

If an impact whose magnitude exceeding the preset value is applied to the vehicle, the airbags inflate immediately to prevent the driver and front seat passenger being hit against the steering wheel, instrument panel or windshield.

A two-staged inflator whose airbag inflation speed is changed according to the magnitude of the impact is used.

##### **2. SRS SIDE AIRBAG**

The SRS side airbag supplements the seat belts which restrain the body if the driver or passenger is endangered by a severe impact to the side of the vehicle.

If an impact whose magnitude exceeding the preset value is applied to the side of the vehicle, the side airbags inflate immediately to soften the impact to the driver or front seat passenger especially at their chest area.

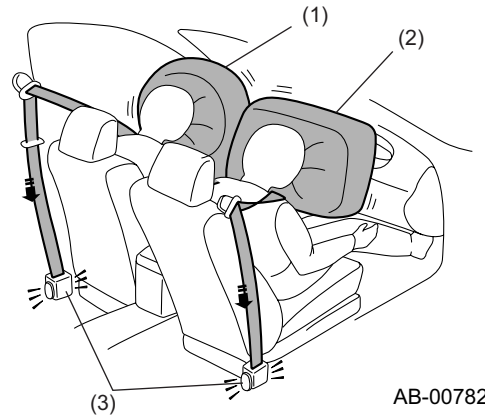
##### **3. SRS CURTAIN AIRBAG**

The SRS curtain airbag supplements the seat belts which restrain the body if the driver or passenger is endangered by a severe impact to the side of the vehicle.

If an impact whose magnitude exceeding the preset value is applied to the side of the vehicle, the curtain airbag inflates immediately to soften the impact to the passengers especially at their head area.

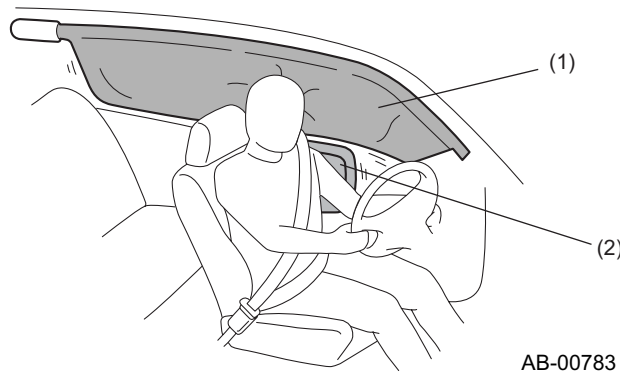
## 4. SEAT BELT PRETENSIONER

The seat belt pretensioner improves efficiency of body restraint by retracting the seat belt immediately if the driver or passenger is endangered by a severe impact to the front of the vehicle.



- (1) Driver's seat SRS airbag
- (2) Passenger's seat SRS airbag

- (3) Retractor with pretensioner



- (1) SRS curtain airbag

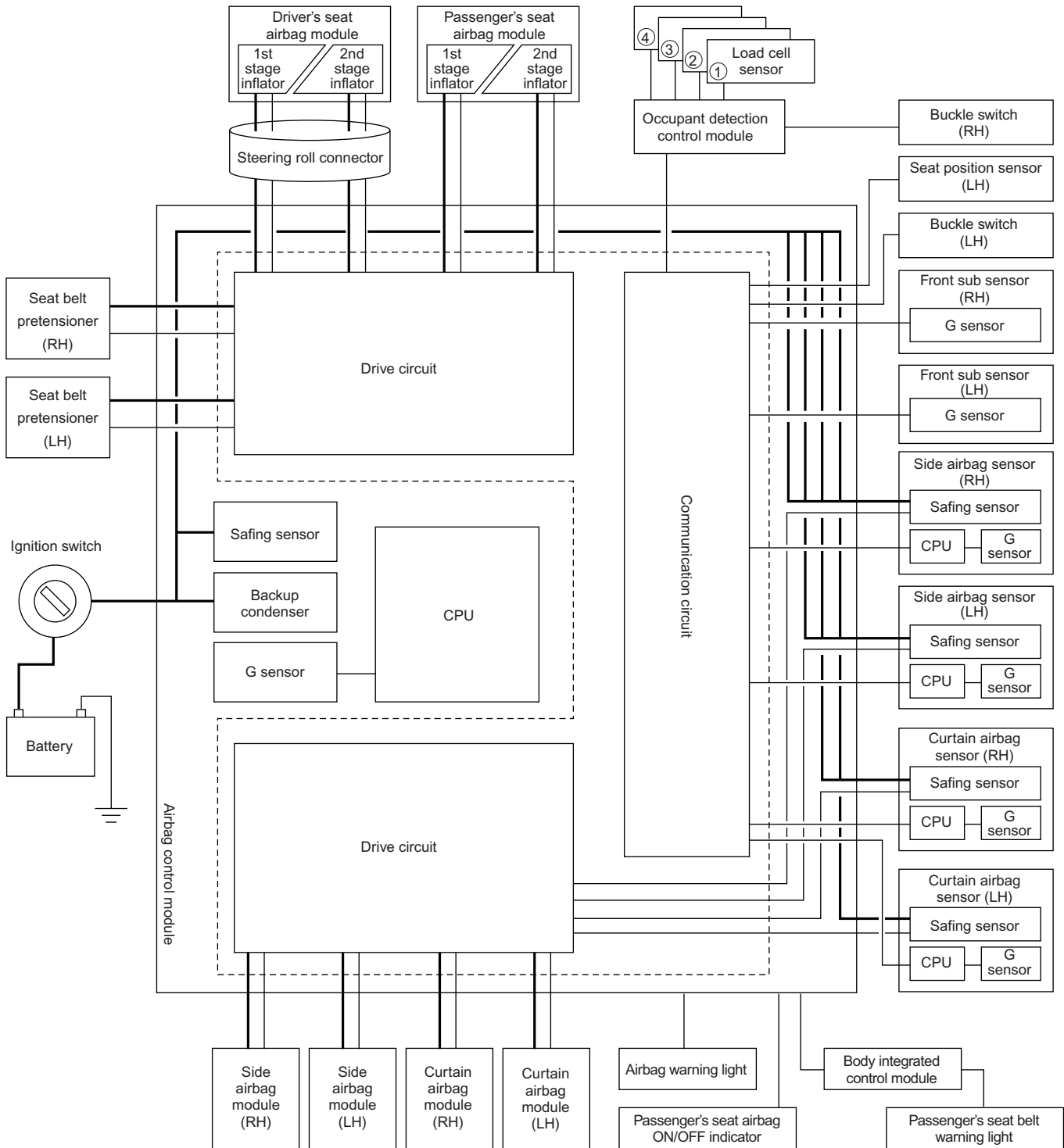
- (2) SRS side airbag

# SYSTEM COMPONENTS AND OPERATION

## AIRBAG SYSTEM

### 2. System Components and Operation

#### A: SYSTEM COMPONENTS



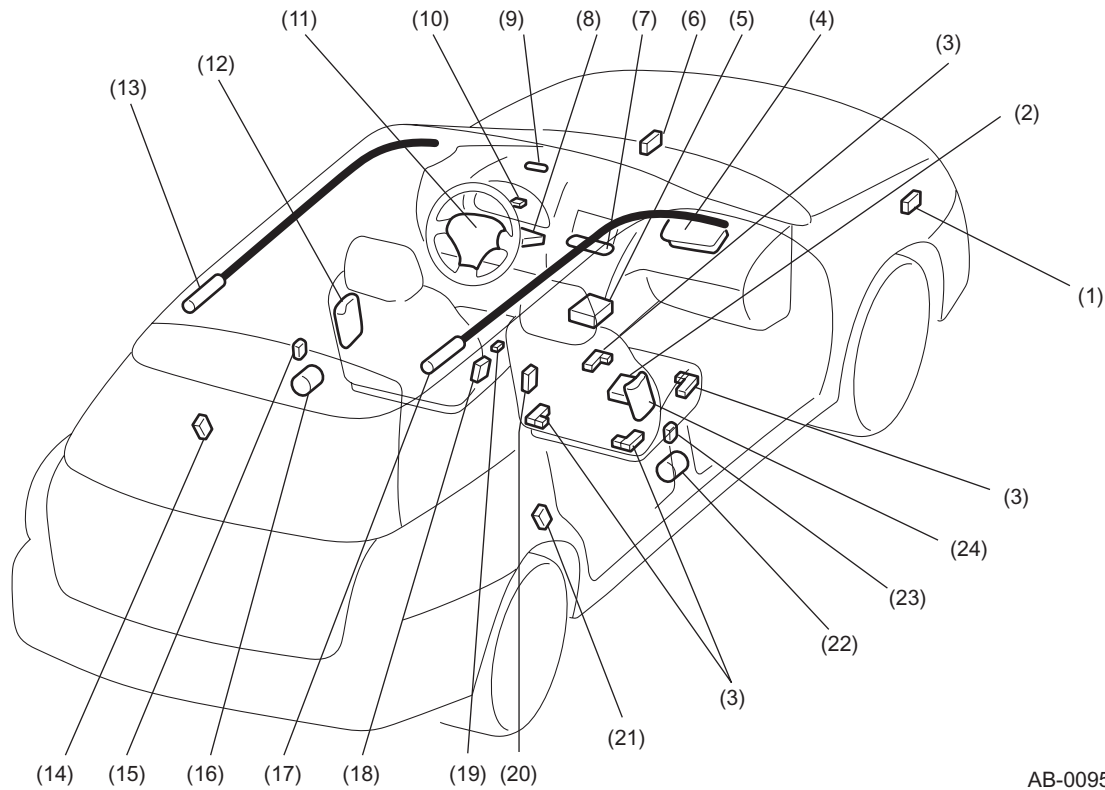
AB-00919

## B: COMPONENTS

Name	Major function	Location
Airbag control module	<ul style="list-style-type: none"> <li>● Senses impact and judges its magnitude by means of a safety sensor and G sensor built inside.</li> <li>● Serves as supplementary power supply if the battery voltage is lowered for some reason.</li> <li>● Directs airbags to inflate.</li> <li>● Performs self diagnosis of the airbag system.</li> </ul>	Inside center console.
Driver's seat air-bag module	Protects the driver's head and upper body to minimize injury in an event of frontal collision.	Stowed inside the pad at the center of the steering wheel.
Passenger's seat airbag module	Protects the passenger's head and upper body to minimize injury in an event of frontal collision.	Stowed inside the instrument panel at the front passenger's side.
Driver's seat side airbag module	Protects the driver's upper body to minimize injury in an event of side collision.	Stowed inside the driver's seat backrest.
Passenger's seat side airbag module	Protects the front passenger's upper body to minimize injury in an event of side collision.	Stowed inside the front passenger's seat backrest.
Curtain airbag module	Deploys together with the side airbag to protect the driver's or passenger's head and minimize injury in an event of side collision.	Stowed inside at left and right sides from the A pillars through the upper part of C pillars.
Steering roll connector	Provides electrical connection between the vehicle side airbag harness and steering wheel.	Between the combination switch and steering wheel.
Seat belt pretensioner	Retracts the seat belt immediately to restrain the body of front seat passengers in an event of a frontal collision.	Lower part of left and right B pillars.
Front sub sensor	Detects the impact in an event of a frontal collision and outputs a deceleration signal to the control module.	In front of left and right front frames.
Side airbag sensor	<ul style="list-style-type: none"> <li>● Senses impact and judges its magnitude in an event of a side collision by means of a safety sensor and G sensor built inside.</li> <li>● Performs self diagnosis of the airbag system.</li> </ul>	Inside the left and right B pillars.
Curtain airbag sensor	<ul style="list-style-type: none"> <li>● Senses impact and judges its magnitude in an event of a side collision by means of a safety sensor and G sensor built inside.</li> <li>● Performs self diagnosis of the airbag system.</li> </ul>	In front of rear left and right wheel arches.
Airbag warning light	<ul style="list-style-type: none"> <li>● Indicates whether the system is normal or abnormal.</li> <li>● Displays diagnostic trouble codes.</li> </ul>	Inside the combination meter.
Occupant detection control module	<ul style="list-style-type: none"> <li>● Decides whether an adult, child, or is nobody is sitting in the seat, based on the occupant detection sensor output.</li> <li>● Performs self diagnosis of the occupant detection system.</li> </ul>	Beneath the passenger's seat cushion.
Loadcell sensor	Detects the load on the seat applied by the passenger.	On the passenger's seat slide rail.
Passenger's seat airbag ON/OFF indicator	Indicates whether the deployment of the passenger's seat airbag is allowed or not, based on the decision of the occupant detection system.	Center of the instrument panel at the clock area.
Buckle switch	Detects whether the seat belt is fastened or not.	At the seat belt buckle.
Seat position sensor (LH)	Detects the fore-aft position of the driver's seat and distinguishes the passenger.	On the driver's seat slide rail.

# SYSTEM COMPONENTS AND OPERATION

## AIRBAG SYSTEM



AB-00952

- |   |                                   |
|---|-----------------------------------|
| (1) Front sub sensor RH                       | (13) Curtain airbag module LH     |
| (2) Occupant detection control module         | (14) Curtain airbag sensor LH     |
| (3) Load cell sensors                         | (15) Side inside airbag sensor LH |
| (4) Passenger's seat airbag module            | (16) Pretensioner LH              |
| (5) Airbag control module                     | (17) Curtain airbag module RH     |
| (6) Front sub sensor LH                       | (18) Buckle switch LH             |
| (7) Passenger's airbag ON/OFF indicator light | (19) Seat position sensor LH      |
| (8) Body integrated control module            | (20) Buckle switch RH             |
| (9) Passenger's seat belt warning light       | (21) Curtain airbag sensor RH     |
| (10) Airbag warning light                     | (22) Pretensioner RH              |
| (11) Driver's seat airbag module              | (23) Side airbag sensor RH        |
| (12) Side airbag module LH                    | (24) Side airbag module RH        |

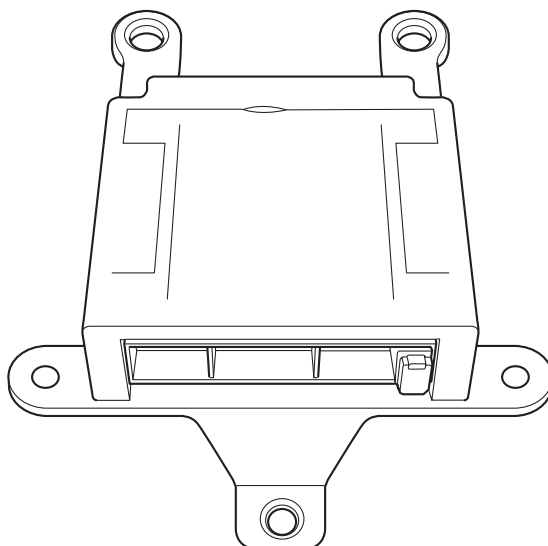


## 1. AIRBAG CONTROL MODULE

The airbag control module is installed inside the center console and contains a safety sensor, G sensor, ignition judgment circuit, and a backup power supply, etc.

The control module receives electric signals from the safety sensor and electric sensor inside the module and also from the front sub sensor to detect the deceleration of the vehicle and judge whether the airbag and pretensioners should be ignited or not. It also has a self diagnosis function which lights up the airbag warning light in the combination meter if a fault occurs in the system. Diagnostic trouble codes generated by the self diagnosis function are stored in the memory in the module.

To prepare for battery voltage fall in an event of an accident, the control module is provided with a backup power supply.



AB-00689

- **Safety sensor**

Inside of the sensor there is a mass weight, which works as a pendulum; if the sensor detects an impact acceleration exceeding a certain limit, the mass weight in the sensor moves to close the contacts and turn the switch ON.

- **G sensor**

Inside of the sensor there are comb-teeth shaped electrodes; in case of a collision the distance between the electrodes varies by the impact to enable detection of the impact acceleration.

# SYSTEM COMPONENTS AND OPERATION

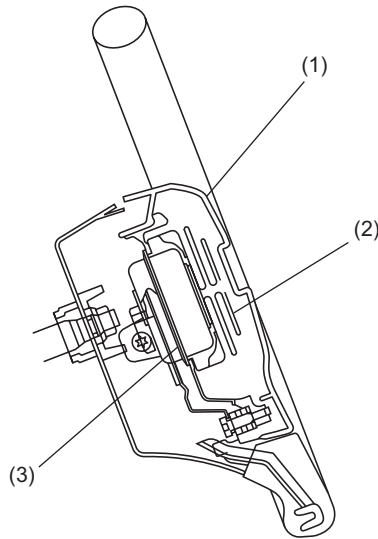
## AIRBAG SYSTEM

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### 2. DRIVER'S SEAT AIRBAG MODULE

The driver's seat airbag module is built in the steering wheel pad.

The SRS airbag module assembly cannot be disassembled. The driver's seat airbag module assembly consists of an inflator and airbag, and a steering wheel pad.



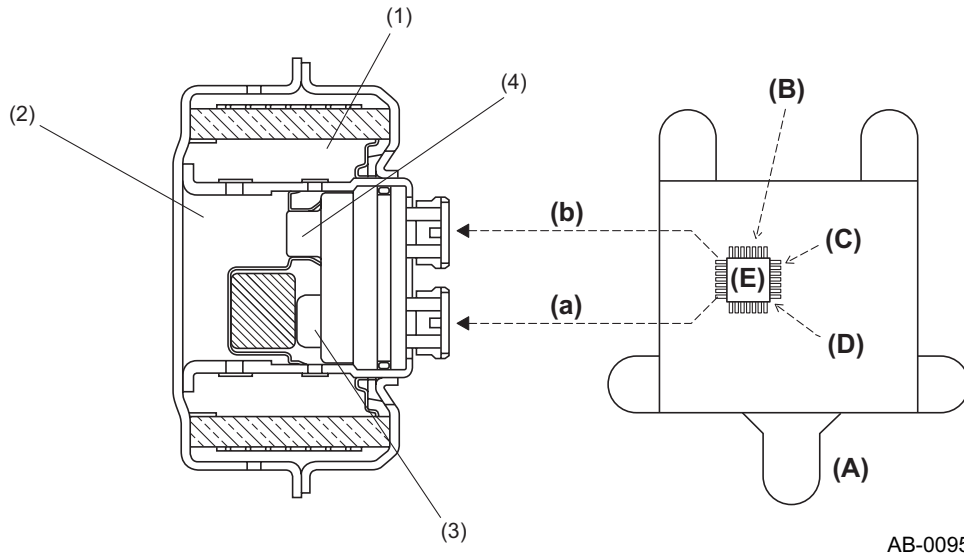
AB-00692

- (1) Steering wheel pad
- (2) Airbag

- (3) Inflator

# SYSTEM COMPONENTS AND OPERATION

The inflator houses igniters and gas generating agents in a metal container. Igniters and gas generating agents are placed at two locations, and a 2-stage inflator which controls the airbag inflating speed according to the magnitude of impact at a collision is used. If the impact detected by the airbag sensor is equivalent to the level detected at a high speed, sudden collision, the two gas heating agents are ignited simultaneously. If the event of a collision at low or mid speed, the ignition of the 2nd stage gas generating agent is delayed to reduce the output of the inflator. Thus the inflator outputs power suitable for the severity of collision and relieves the impact to the passenger's head or upper body.



AB-00953

- |                                    |                               |                           |
|------------------------------------|-------------------------------|---------------------------|
| (1) 1st stage gas generating agent | (a) 1st stage ignition signal | (A) Airbag control module |
| (2) 2nd stage gas generating agent | (b) 2nd stage ignition signal | (B) Front sub sensor      |
| (3) 1st stage igniter              |                               | (C) Safety sensor         |
| (4) 2nd stage igniter              |                               | (D) G sensor              |
|                                    |                               | (E) CPU                   |

# SYSTEM COMPONENTS AND OPERATION

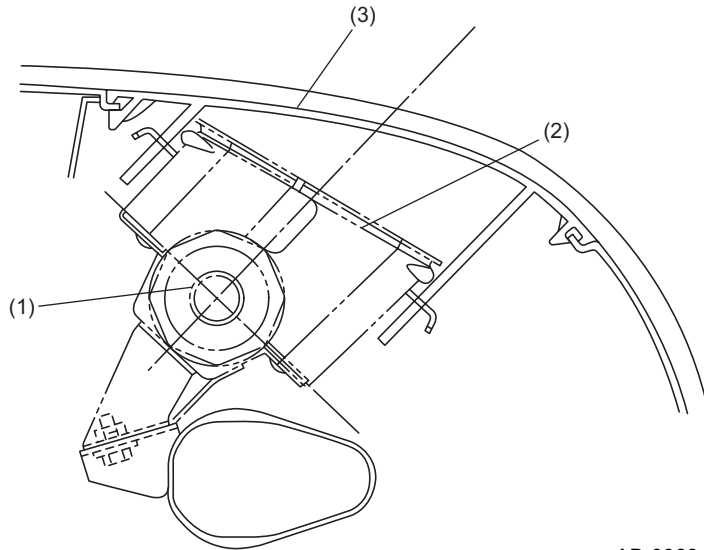
## AIRBAG SYSTEM

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### 3. PASSENGER'S SEAT AIRBAG MODULE

The front passenger's seat SRS airbag module assembly is built in the instrument panel at the front passenger's side.

The SRS airbag module assembly cannot be disassembled. The front passenger's seat airbag module is fixed to the steering support beam, and consists of an inflator and an airbag.



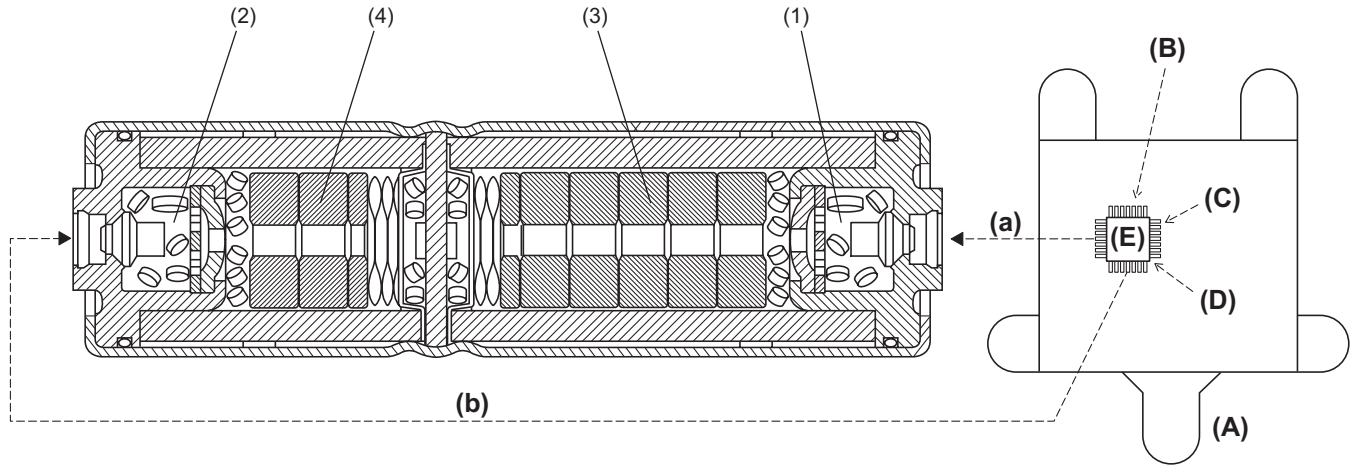
AB-00694

- (1) Inflator
- (2) Airbag

- (3) Lid

# SYSTEM COMPONENTS AND OPERATION

The inflator houses igniters and gas generating agents with a metal container. Igniters and gas generating agents are placed at two locations, and a 2-stage inflator which controls the airbag inflating speed according to the magnitude of impact at a collision is used. If the impact detected by the airbag sensor is equivalent to the level detected at a high speed, sudden collision, the two gas generating agents are ignited simultaneously. If the event of a collision at low or mid speed, the ignition of the 2nd stage gas generating agent is delayed to reduce the output of the inflator. Thus the inflator outputs power suitable for the severity of collision and relieves the impact to the passenger's head or upper body.



AB-00954

- (1) 1st stage igniter
- (2) 2nd stage igniter
- (3) 1st stage gas generating agent
- (4) 2nd stage gas generating agent

- (a) 1st stage ignition signal
- (b) 2nd stage ignition signal

- (A) Airbag control module
- (B) Front sub sensor
- (C) Safety sensor
- (D) G sensor
- (E) CPU

# SYSTEM COMPONENTS AND OPERATION

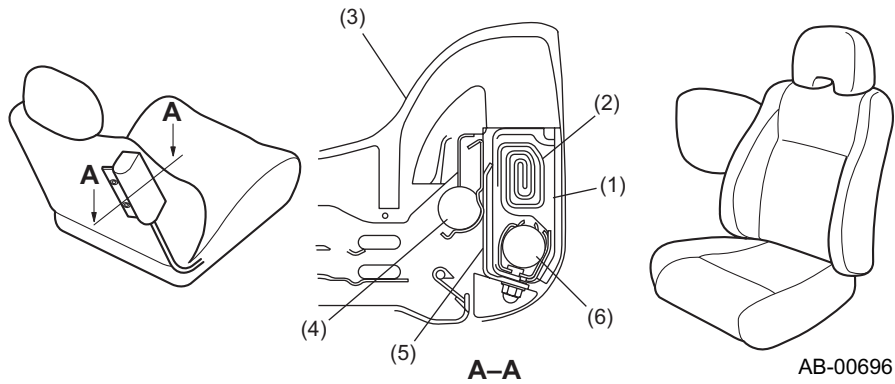
## AIRBAG SYSTEM

### 4. SIDE AIRBAG MODULE

The side airbag modules are built in the backrest of left and right front seats (at the door side).

The SRS side airbag module assembly cannot be disassembled. The side airbag module is fixed to the seat frame with a bracket, and consists of an inflator, airbag, and a case.

If a side-on collision occurs, the inflator produces a certain amount of gas to inflate the airbag in a very short time in response to the ignition signal from the side impact sensor.



- |                     |                |
|---------------------|----------------|
| (1) Case            | (4) Seat frame |
| (2) Airbag          | (5) Bracket    |
| (3) Seat upholstery | (6) Inflator   |

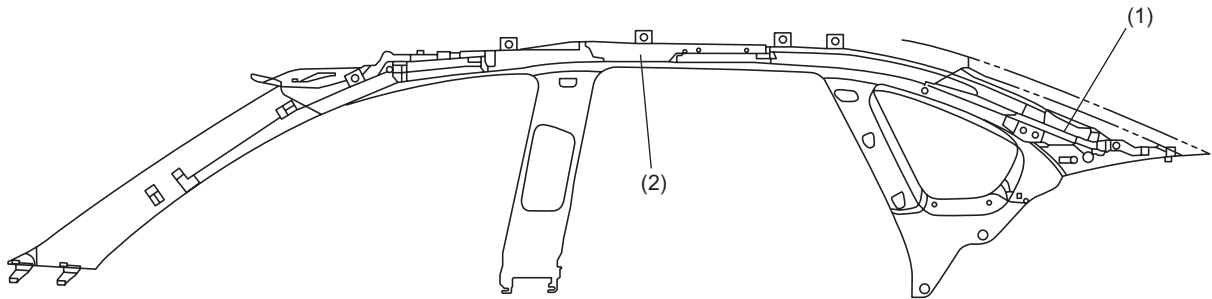
## 5. CURTAIN AIRBAG MODULE

The curtain airbag modules are placed at the front pillars, roof sides, and the rear pillars.

The SRS curtain airbag module cannot be disassembled. The curtain airbag modules are fixed to the vehicle body with a bracket and clips, and consists of an inflator and an airbag.

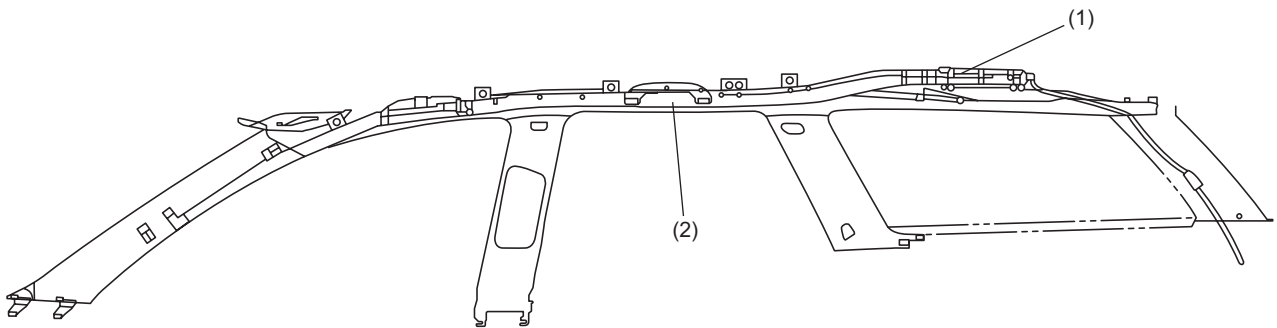
If a side-on collision occurs, the inflator produces a certain amount of gas to inflate the airbag in a very short time in response to the ignition signal from the side airbag sensor and curtain airbag sensor.

Sedan models



AB-00697

Wagon models



AB-00698

(1) Inflator

(2) Airbag

# SYSTEM COMPONENTS AND OPERATION

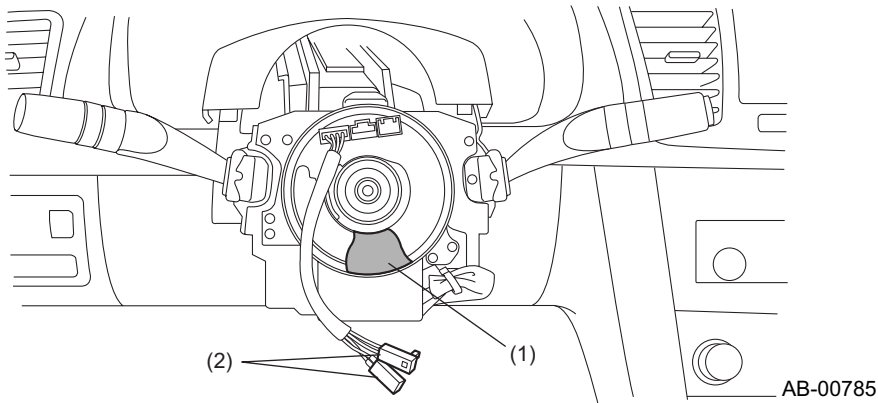
## AIRBAG SYSTEM

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### 6. STEERING ROLL CONNECTOR

The steering roll connector is in between the steering column and the steering wheel, and contains a spirally wound flat cable.

The flat cable maintains connection between the airbag module on the steering wheel and the airbag harness even when the steering wheel is turned. Ignition signal from the airbag control module is sent through the roll connector to the driver's seat airbag module.



(1) Flat cable

(2) Airbag module connector



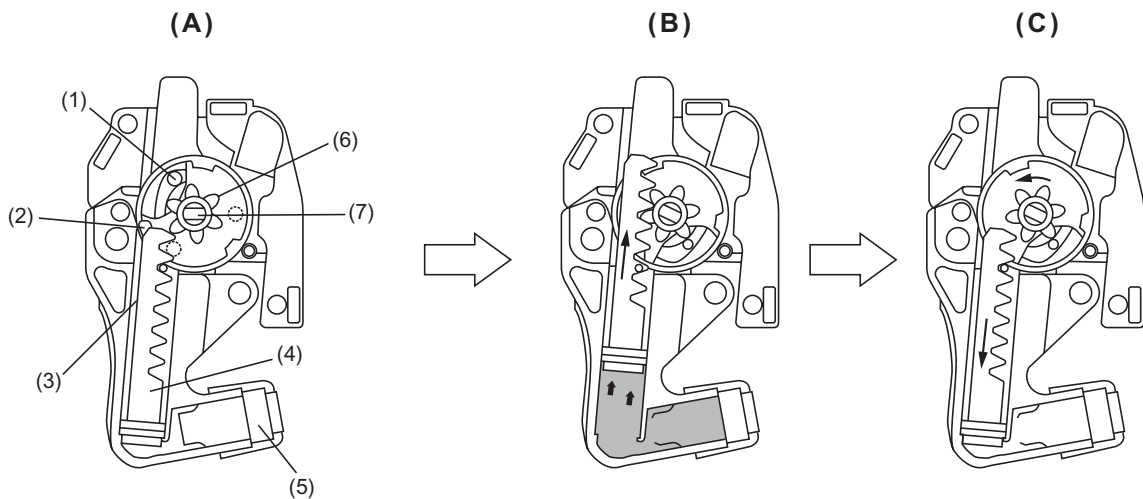
## 7. SEAT BELT PRETENSIONER

The driver's and front passenger's seat belt retractors contain a seat belt pretensioner.

The airbag control module controls the operation of the seat belt pretensioner. If the front sub sensor and the sensors inside the airbag control module detect an impact exceeding a specified level, the driver's seat and front passenger's seat airbags are deployed almost simultaneously. Upon receiving signals from the airbag control module the gas generator inside the pretensioners are ignited and the gas pressure retracts the seat belts in a very short time to improve the passenger restraint effect.

If the load placed on a seat belt exceeds the predetermined level, the torsion bar is twisted to allow the seat belt to be pulled out, thus lessening the load imposed on the belt wearer's chest.

Once the seat belt pretensioner has been activated, the seat belt retractor remains locked.



SB-00058

**(A)** Initial state

- (1) Roller
- (2) Shear rib
- (3) Shear pin

**(B)** Pretensioner operates

- (4) Piston
- (5) Gas generator
- (6) Pinion

**(C)** Load limiter

- (7) Sleeve

# SYSTEM COMPONENTS AND OPERATION

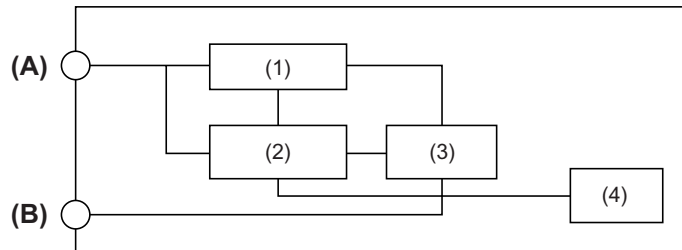
## AIRBAG SYSTEM

### 8. FRONT SUB SENSOR

The front sub sensor is installed to the tip of the front side frame.

If it detects an impact exceeding the specified level from the front, it sends a signal which is used for airbag system deployment judgment to the airbag control module.

To judge the impact to the front of the vehicle more precisely, the sensor is changed from the conventional pendulum type mechanical sensor to an electronic sensor.



AB-00700

(A) Power supply/communication terminal

(B) GND

(1) 5 V power

(2) Current communication circuit

(3) G sensor

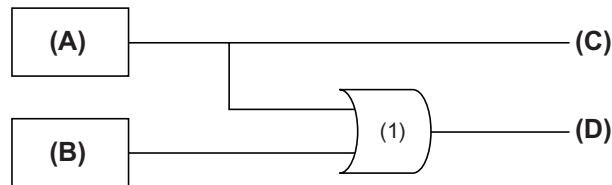
(4) Oscillator

## 9. SIDE IMPACT SENSOR

The side impact sensors (side airbag sensor, curtain airbag sensor) are installed at the bottom of the center pillars and the rear quarter pillars.

If the sensor in the side impact sensor detects an impact exceeding the specified level from the side, it sends a signal which is used for airbag system deployment judgment to the airbag control module.

Signals from the side airbag sensors are effective for both the side airbags and curtain airbags, while signals from the curtain airbag sensors detect impact to the rear seat sides and let only the curtain airbags deploy.



AB-00702

**(A)** Side airbag sensor

**(B)** Curtain airbag sensor

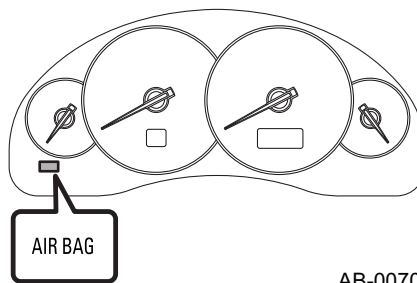
**(C)** Side airbag

**(D)** Curtain airbag

(1) OR

## 10. AIRBAG WARNING LIGHT

The airbag warning light is located inside the combination meter. It illuminates if a poor connection in the airbag circuit occurs, or if the airbag control module detects an abnormal condition. When the airbag system is normal, this light comes on when the ignition switch is turned ON and then goes out about 6 seconds later.



AB-00704

## 11. WIRING HARNESS

The airbag harnesses are integrated into the body harness as follows:

- Front sub sensor harness: integrated into the front harness.
- Airbag main harness: integrated into the bulkhead harness.
- Pretensioner and side airbag harnesses: integrated into the rear harness.

## 3. Airbag Connectors

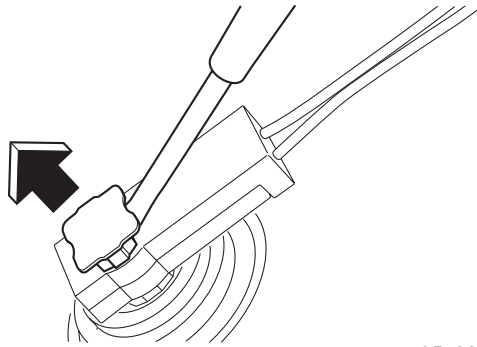
### A: GENERAL

The airbag system uses connectors with a double lock mechanism and an incomplete-coupling-detection mechanism for enhanced reliability. If coupling is incomplete, the airbag warning light comes on in the combination meter.

#### 1. DRIVER'S SEAT AIRBAG MODULE-TO-SEAT BELT PRETENSIONER CONNECTOR

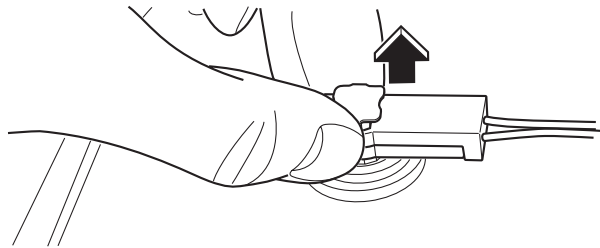
##### Disconnection:

- 1) Lift the lock button using a thin tipped tool like a miniature screwdriver.



AB-00529

- 2) Pull the connector out from the airbag module.

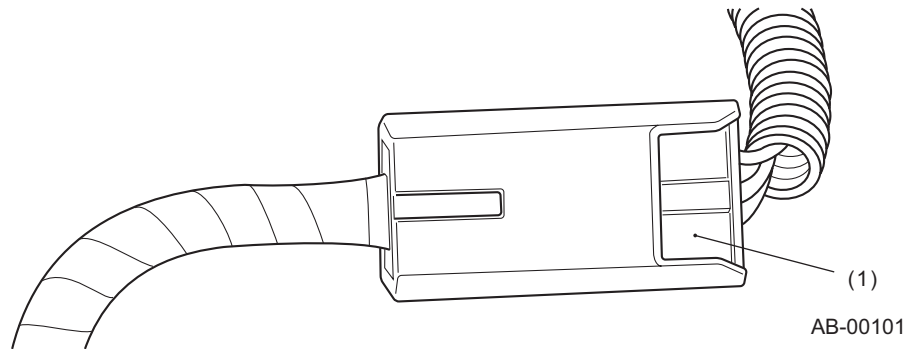


AB-00528

##### Connection:

Carefully insert the connector into the airbag module. Push the connector until a “click” is heard from the lock button.

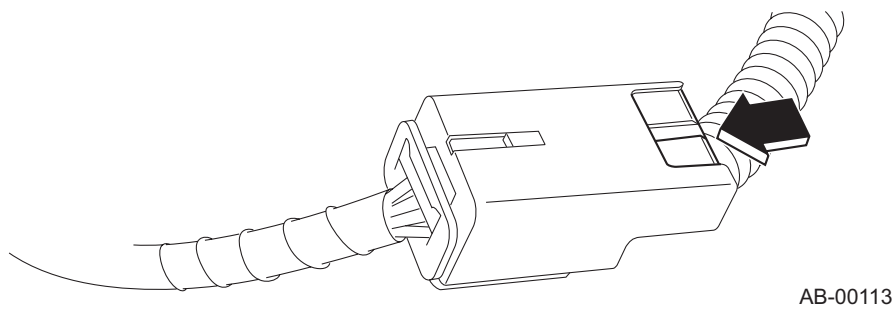
## 2. AIRBAG MAIN HARNESS-TO-ROLL CONNECTOR, AND PASSENGER'S SEAR AIRBAG MODULE CONNECTOR



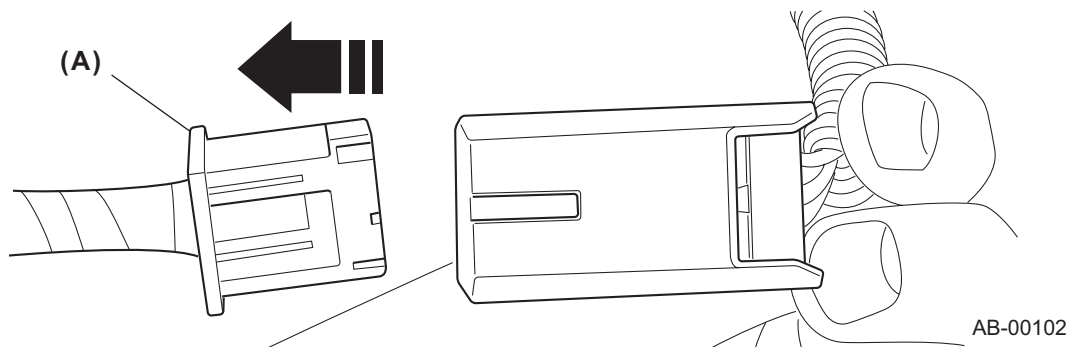
(1) Slide lock

### Disconnection:

- 1) Press the slide lock inwards.



- 2) While the slide lock pressed in, disconnect the connector (A).



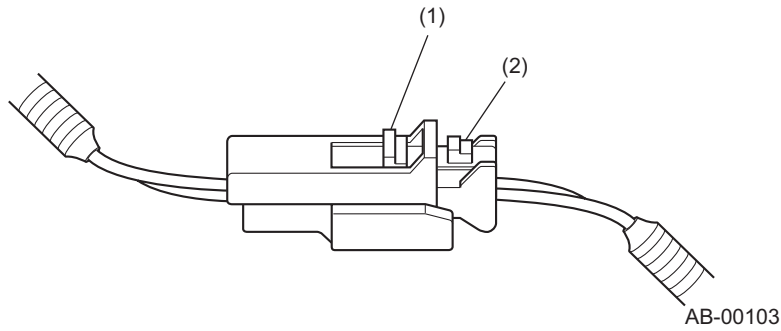
### Connection:

Insert the female side connector half into the other until a “click” is heard.

# AIRBAG CONNECTORS

AIRBAG SYSTEM

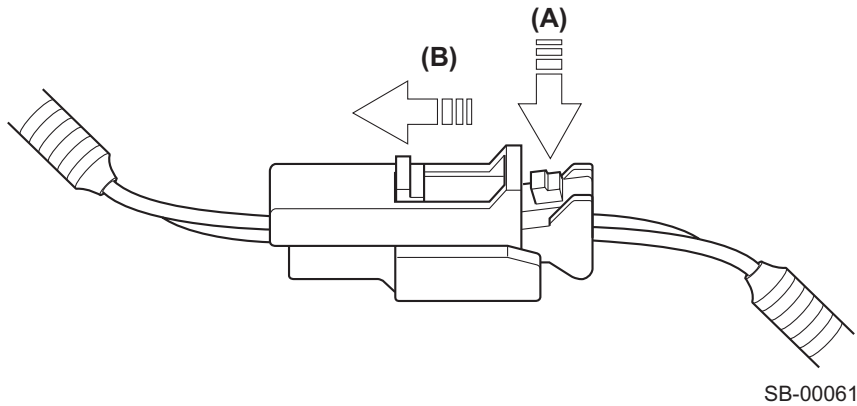
## 3. SIDE AIRBAG MODULE AND CURTAIN AIRBAG MODULE CONNECTORS



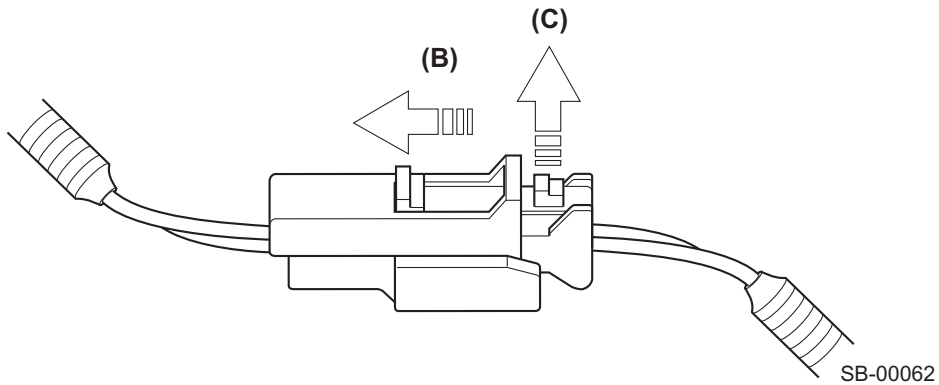
- (1) Slide lock
- (2) Lock arm

### Disconnection:

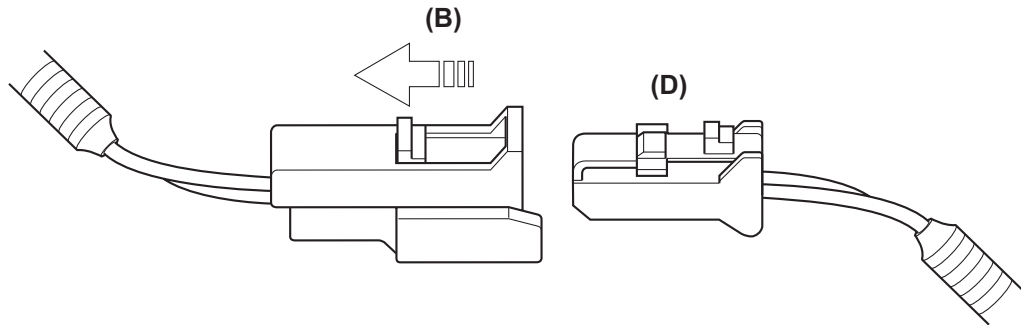
1) Push in and hold the lock arm (A), then pull the slide lock (B).



2) While the slide lock pulled and held (B), release the lock arm (C).



3) While the slide lock pulled and held (B), disconnect the connector (D).



SB-00063

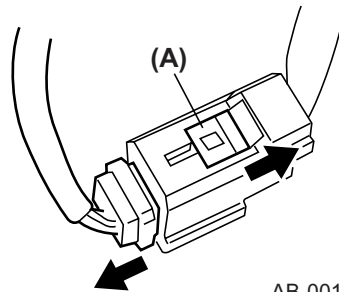
**Connection:**

Insert the female side connector half into the other until a “click” is heard.

## 4. AIRBAG HARNESS-TO-BODY HARNESS, OCCUPANT DETECTION CONTROL MODULE-TO-BODY HARNESS, AND SEAT BELT BUCKLE SWITCH CONNECTORS

**Disconnection:**

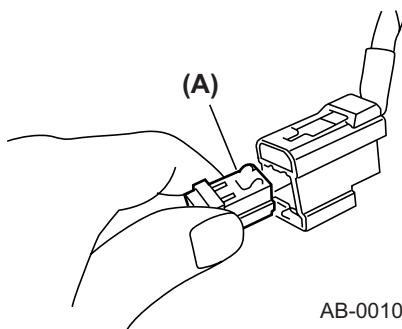
Hold slide lock (A) moved in the direction of the arrow, then pull the female connector in the direction of the arrow.



AB-00105

**Connection:**

Push the connector (A) into the male connector carefully until a “click” is heard.



AB-00106

# AIRBAG CONNECTORS

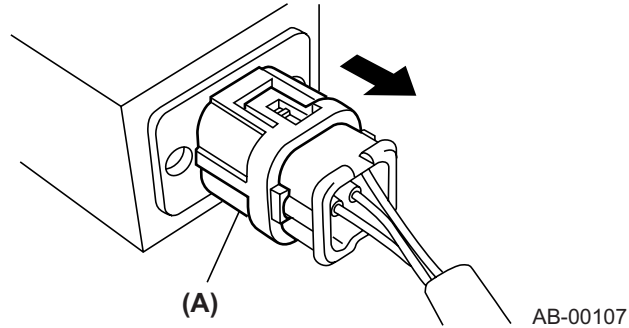
## AIRBAG SYSTEM

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### 5. FRONT SUB SENSOR, SIDE AIRBAG SENSOR, CURTAIN AIRBAG SENSOR, AND SEAT POSITION SENSOR (LH) CONNECTORS

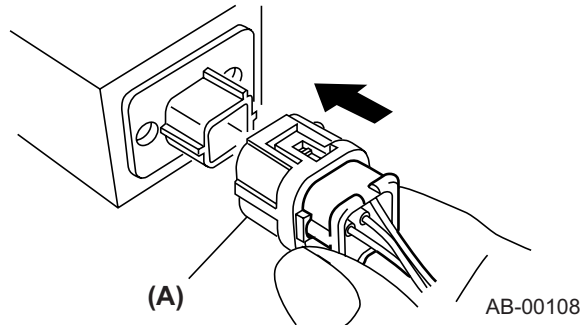
#### Disconnection:

Holding the outer part (A), pull the connector in the direction of the arrow.



#### Connection:

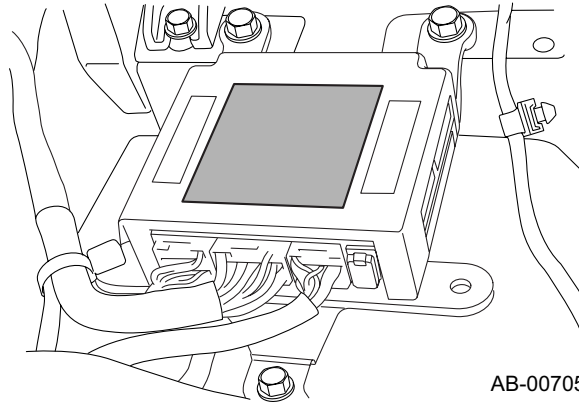
Holding the inner part, push the connector into the socket carefully until a “click” is heard. Do not hold the outer part (A) as it moves back during connection of the connector.





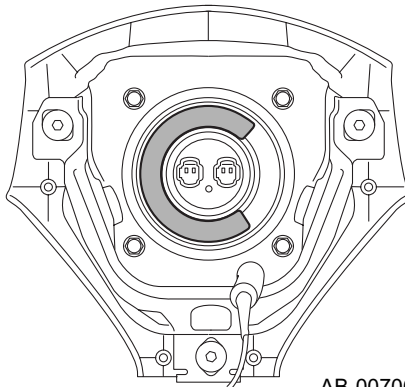
## 4. Locations of Warning and Caution Labels

### 1. AIRBAG CONTROL MODULE



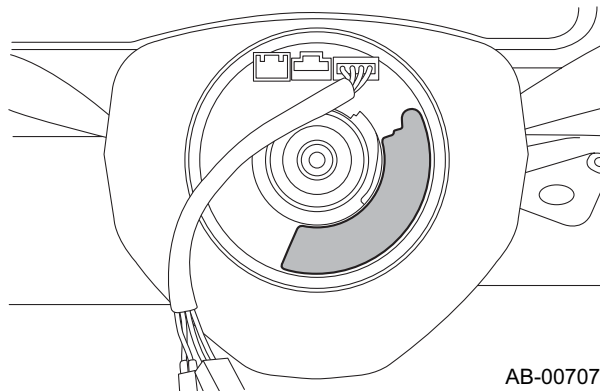
AB-00705

### 2. DRIVER'S SEAT AIRBAG MODULE



AB-00706

### 3. STEERING ROLL CONNECTOR



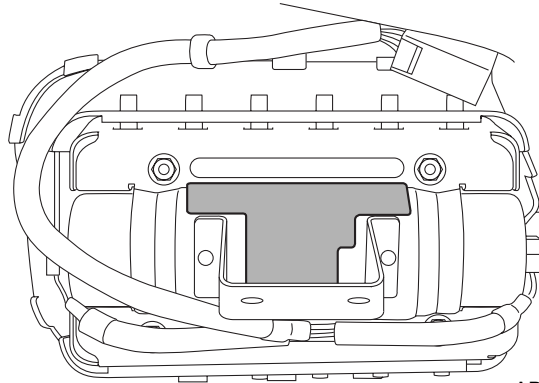
AB-00707

# LOCATIONS OF WARNING AND CAUTION LABELS

## AIRBAG SYSTEM

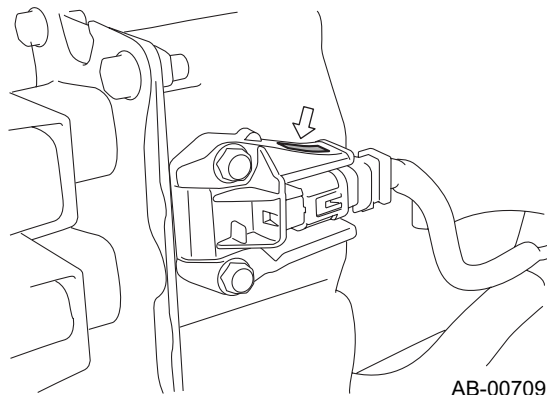
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### 4. PASSENGER'S SEAT AIRBAG MODULE



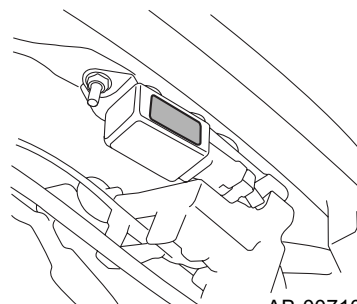
AB-00708

### 5. FRONT SUB SENSOR



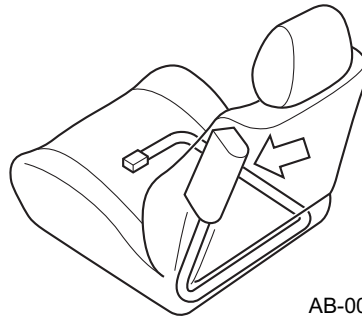
AB-00709

### 6. SIDE IMPACT SENSOR



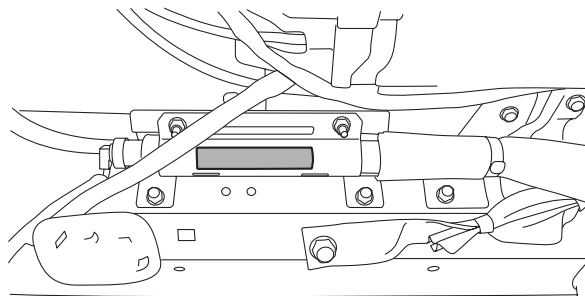
AB-00710

## 7. SIDE AIRBAG MODULE



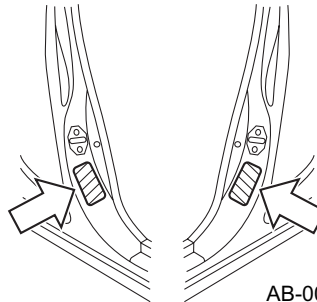
AB-00711

## 8. CURTAIN AIRBAG MODULE



AB-00712

## 9. CENTER PILLAR LOWER AREA



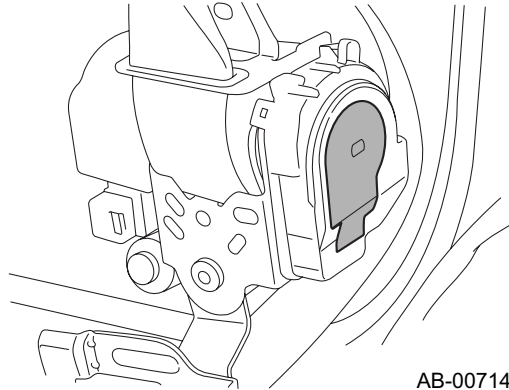
AB-00713

# LOCATIONS OF WARNING AND CAUTION LABELS

## AIRBAG SYSTEM

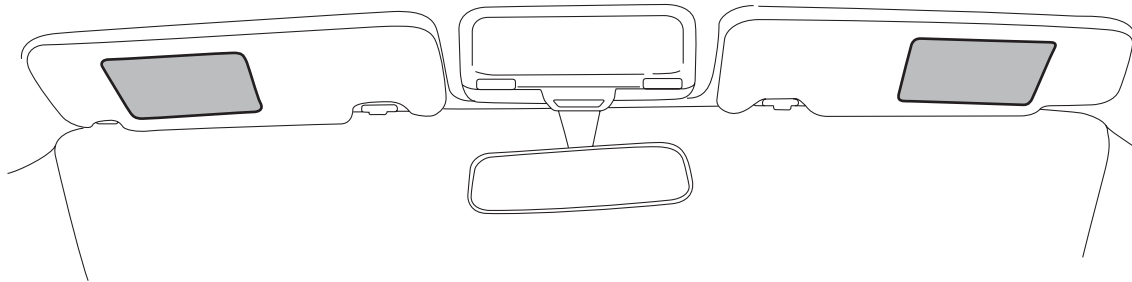
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### 10. SEAT BELT PRETENSIONER



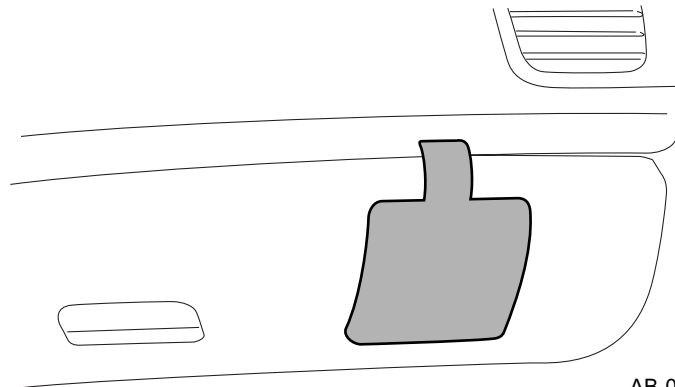
AB-00714

### 11. SUN VISOR



AB-00950

### 12. INSTRUMENT PANEL



AB-00951

# SEAT BELT

## SEAT BELT SYSTEM

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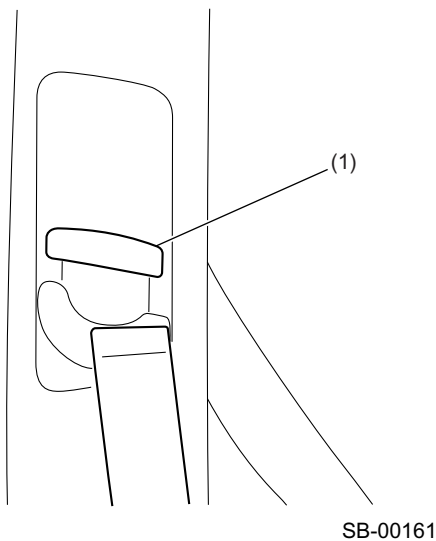
### 1. Seat Belt

#### A: ADJUSTABLE SHOULDER BELT ANCHOR

##### 1. FRONT

Each front seat belt system has an adjustable shoulder belt anchor, which allows the occupant to select the most appropriate anchor height from among the five positions in a 90 mm (3.54 in) range.

The sash guide is put inside the pillar trim to improve the appearance.

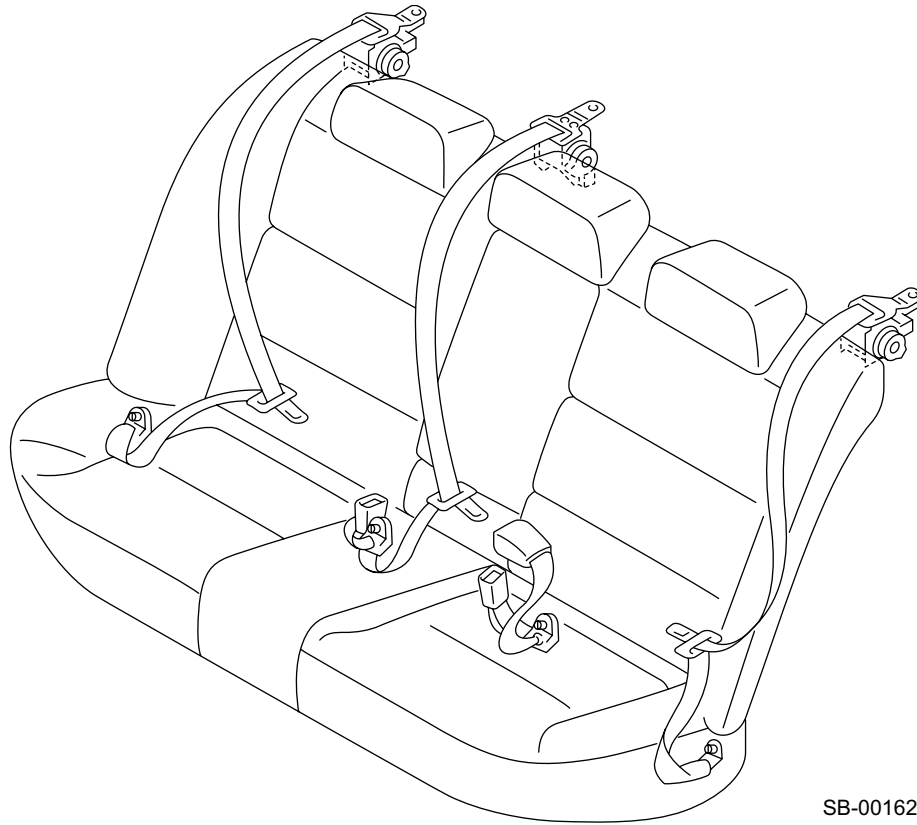


(1) Height adjuster button

### B: REAR SEAT BELT

#### 1. SEDAN MODELS

- A three-point type seat belt is provided on all seats.
- The retractor for the seat belt is installed on the rear shelf behind the seating position.



SB-00162

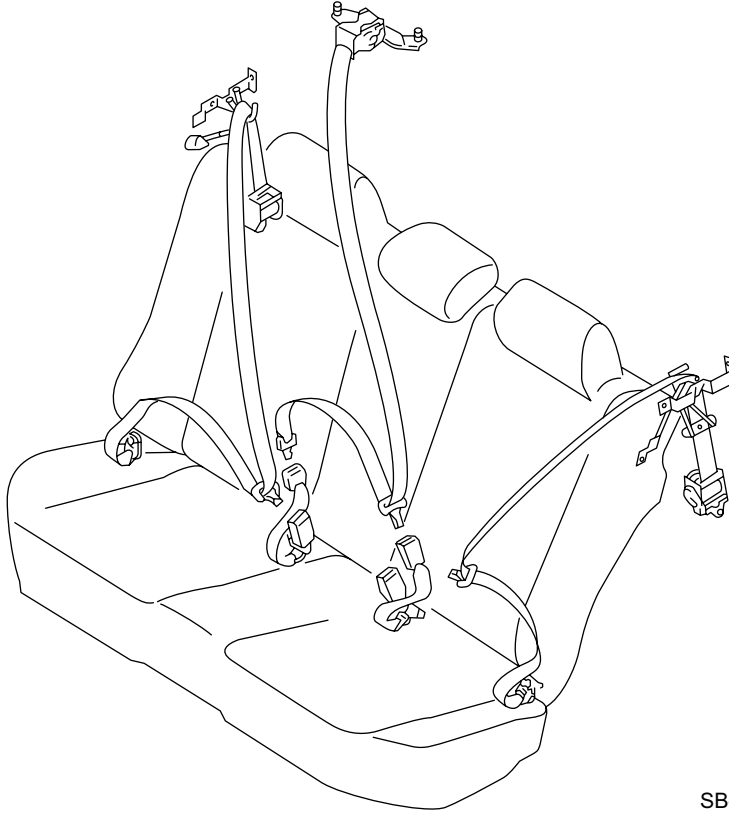
# SEAT BELT

## SEAT BELT SYSTEM

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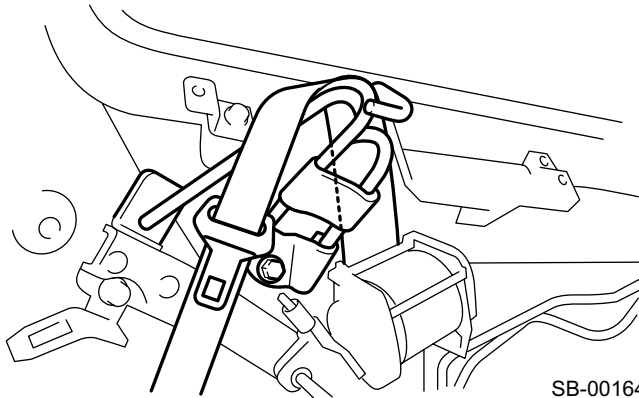
### 2. WAGON MODELS

- A three-point type seat belt is provided on all seats.
- The seat belt for the center seat is installed to the rear right corner of the roof and can be detached at its connector to save the luggage space.



SB-00163

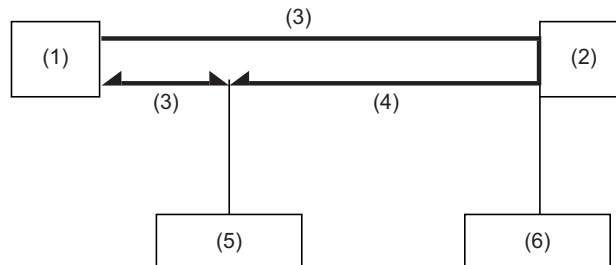
- Seat belts for the outer seats are provided with a new belt folding bracket at inside of the rear quarter trim to improve the appearance.



SB-00164

## C: AUTOMATIC RETRACTOR (CHILD RESTRAINT SYSTEM FIXING FEATURE)

When any of the rear seat belts is drawn out completely, its retractor is placed in the automatic locking mode, which is used when installing a child restraint system. In this mode, the belt can be retracted but cannot be extended. When the belt is retracted to a certain length, this mode is cancelled and normal operation is restored.



SB-00169

- (1) Fully retracted
- (2) Fully extended
- (3) Normal mode (belt can be retracted and pulled out)
- (4) Automatic lock mode (belt can be retracted but cannot be pulled out)
- (5) Automatic locking mode to normal mode changeover
- (6) Normal locking mode to automatic locking mode changeover



# SEAT BELT LIGHT

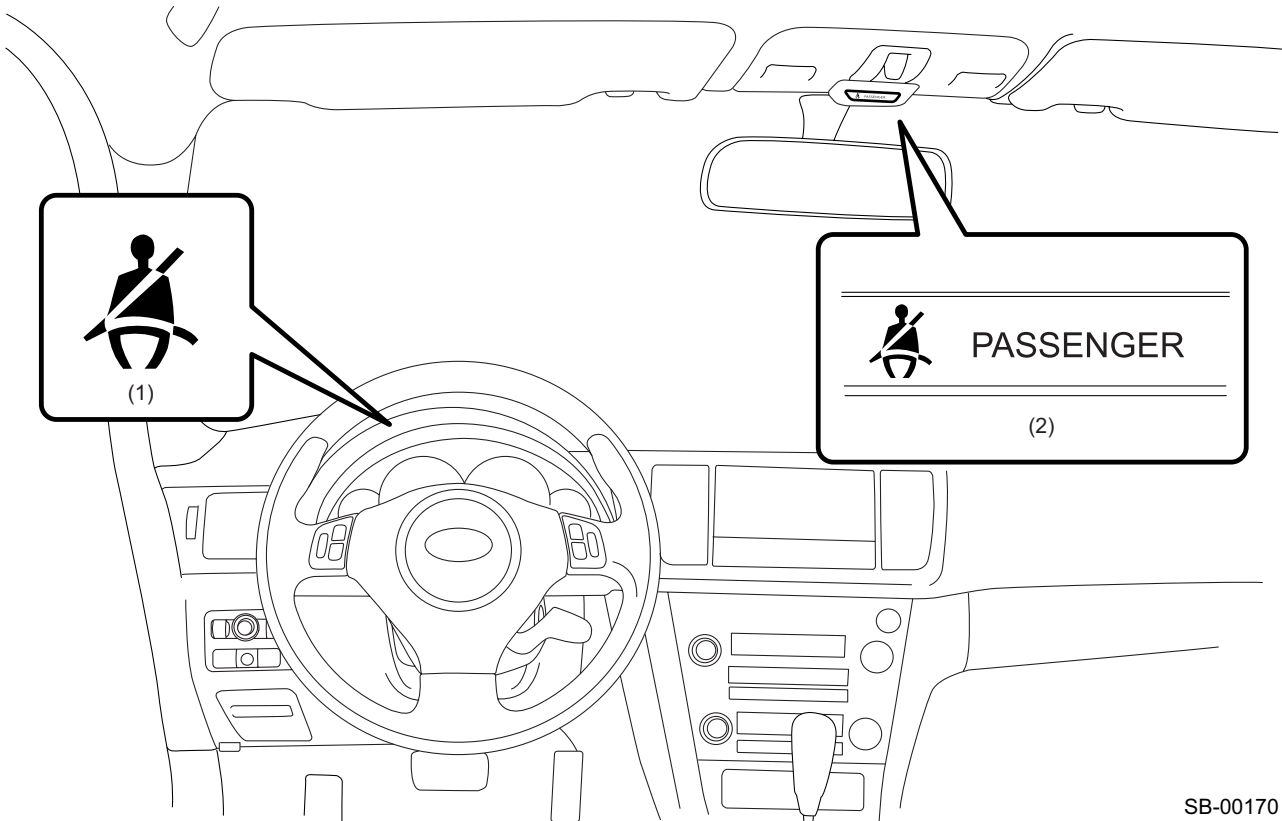
## SEAT BELT SYSTEM

### 2. Seat Belt Light

#### A: SEAT BELT WARNING LIGHT

A seat belt warning light is provided for the front seats to warn the passengers to fasten the seat belt.

The driver's seat warning light is located in the combination meter, and the front passenger's seat belt warning light and rear seat belt fastening indicator are located at the center of the map light lens.



SB-00170

(1) Driver's seat warning light

(2) Passenger's seat warning light

## **B: SEAT BELT ALARM SYSTEM**

### **1. GENERAL**

When the ignition switch is turned ON, the seat belt warning light in the combination meter illuminates for 6 seconds and the warning buzzer sounds to warn the driver to fasten the seat belt. The seat belt warning light turns off and the buzzer ceases when the seat belt tongue plate is inserted into the seat belt buckle.

If the driver starts the vehicle without fastening the seat belt, the warning light illuminates or blinks and the buzzer sounds to warn the driver to fasten the seat belt. The seat belt warning light turns off and the buzzer ceases when the seat belt tongue plate is inserted into the seat belt buckle.

The passenger's seat side is also provided with a seatbelt alarm system, which turns ON the passenger's seat belt warning light when it detects a passenger through the passenger sensor (load cell sensor). If the driver starts the vehicle without fastening the seat belt, the seat belt warning light illuminates or blinks and the buzzer sounds to warn the passenger to fasten the seat belt.

### **2. SYSTEM STATUS TRANSITION**

Alarms that are given with the seat belt warning light and buzzer vary in accordance with the vehicle speed and seat belt fastened/unfastened state. (The alarm system can warn the driver and the passenger individually, however, if both seat belts are not fastened, the buzzer will give priority to warn the driver.)

1) When the ignition switch is turned ON (with the seat belt not fastened), the seat belt warning light flashes for 6 seconds. If the seat belt is not fastened within this period, an alarm is given with a buzzer sound\*.

\*: The buzzer sounds only when the driver's seat belt is not fastened.

2) After 6 seconds since the ignition switch is turned ON, the seat belt warning light starts to illuminate or flash for every 15 seconds, and the buzzer will sound if the warning light is flashing.

3) If the seat belt is unfastened again when the vehicle speed is at or over 15 km/h (9 MPH), the seat belt warning light repeats illuminating or flashing, and the buzzer will sound if the warning light is flashing.

### **3. CUTOFF FUNCTION**

The warning given after 6 seconds since the ignition switch is turned ON, and the warning function that activates when the seat belt is unfastened while driving can be optionally cut off. The cutoff function is common for both the driver's seat and passenger's seat, and can be set with the driver's seat buckle switch.

Temporary (TEMP) cutoff

1) How to cut: Repeat fastening and unfastening the driver's seat belt for 3 times within 6 seconds after turning the ignition switch ON. (The setting is changed for both the driver's seat and passenger's seat.)

2) Setting lasts: While the ignition switch is turned ON until it is turned OFF. (The cutoff function is canceled when the ignition switch is once turned OFF.)

Permanent cutoff

1) How to cut: Repeat fastening and unfastening the driver's seat belt for 20 times within 30 seconds after turning the ignition switch ON. Enabling and disabling cutting is done with the same operation. (The setting is changed for both the driver's seat and passenger's seat.)

## SEAT BELT LIGHT

### SEAT BELT SYSTEM

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2) Setting lasts: Until the microprocessor is reset\*.

The cutoff function is reset when the battery is removed (battery positive terminal disconnected) or when the body integrated unit is removed. The cutting function may also be reset when the engine is cranked with low battery voltage.

# WIPER AND WASHER SYSTEMS

## WIPER AND WASHER SYSTEMS

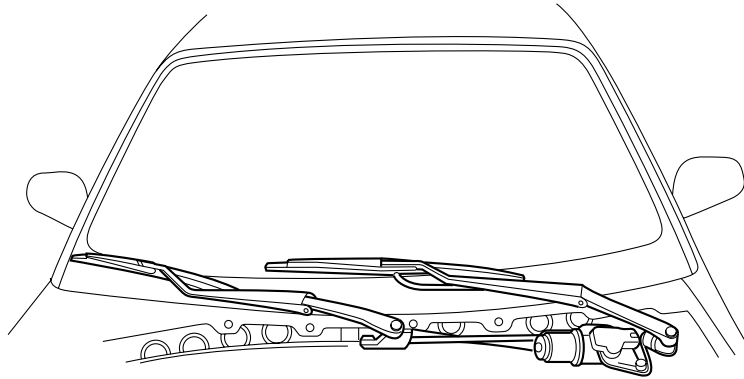
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### 1. Wiper and Washer Systems

#### A: GENERAL

##### 1. FRONT WIPER

- 1) The front wiper is of a tandem type featuring a wide wiping area. The blade is installed to the arm by means of U-hook joint to improve serviceability.
- 2) The front wiper operates in the HI and LOW speed modes and the INTERMITTENT mode. The operation modes can be selected by turning the wiper switch incorporated in the combination switch.
- 3) In the INTERMITTENT mode, the intermittent unit installed behind the combination switch controls the front wiper operation interval.
- 4) The front wiper system uses a modular construction in which the wiper motor forms an integral part of the linkage. The motor is installed on the body through rubber mounting.

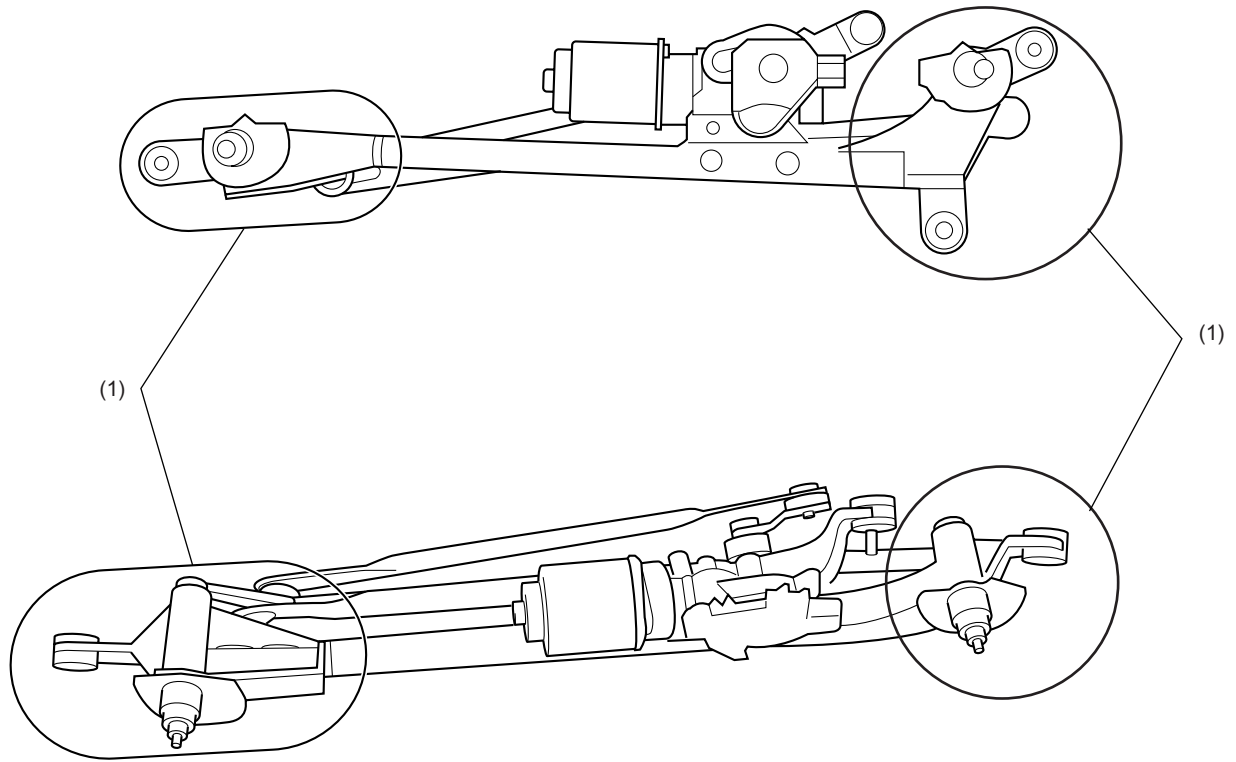


WW-00159

- 5) The size of the motor is minimized by changing the stator shape, coil windings and the magnet.

# WIPER AND WASHER SYSTEMS

6) The mounting bracket is modified. The bracket of the wiper link assembly bracket area breaks if it receives a force exceeding a certain level to absorb the impact in case of a traffic accident, etc.



WW-00228

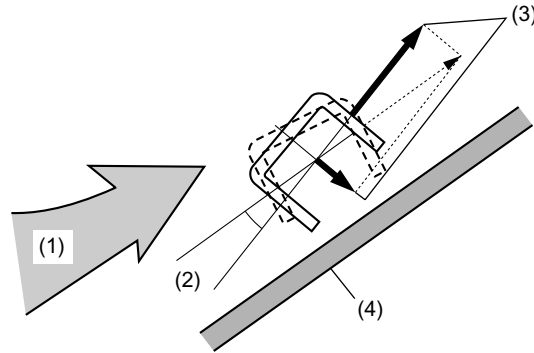
(1) Bracket

# WIPER AND WASHER SYSTEMS

## WIPER AND WASHER SYSTEMS

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7) The driver's side wiper arm is angled to disperse the force applied to the wiper arm by the airflow. A part of the dispersed force acts to press the wiper blade against the windshield helping to prevent the wiper blade being lifted up.



WW-00043

(1) Airflow

(2) Angle of twist

(3) Dispersed force

(4) Windshield

8) When wiper arms are raised in cases such as washing the car, always raise the driver's seat side wiper arm first and then raise the passenger's seat side wiper arm. If the passenger's seat side wiper arm is raised first, this will obstruct the way for the driver's side wiper arm. If forcibly raised in the wrong way, the passenger's side wiper arm may be damaged. When lowering the wiper arms, lower the passenger's side arm first.

# WIPER AND WASHER SYSTEMS

## 2. FRONT WASHER SYSTEM

- 1) The front washer system consists of a washer tank, motor and pump unit, and a pair of nozzles.
- 2) The washer tank is installed behind the front bumper under the left headlight.
- 3) The washer motor and pump unit is installed at the bottom of the washer tank.
- 4) The washer nozzles are installed to the front hood at its rear end and from the under side. Each nozzle has a spray hole.
- 5) Each washer nozzle has a check valve at a location approximately 100 mm (3.94 in) from the nozzle.
- 6) The washer tank is filled to its specified capacity when the fluid level is at the “FULL” mark on the filling pipe. Do not fill washer fluid until its level exceeds the “FULL” mark. The fluid may spill during driving or when replacing the head light bulb.

## 3. SPECIFICATIONS

Washer tank	Capacity	4.0 ℓ (4.2 US qt, 3.5 Imp qt)		
Wiper motor	Rated voltage	12 V		
	No-load current	4 A or less		
	Speed [at 2.0 N·m (20 kg-cm, 17 in-lb)]	HIGH	56 — 68 rpm	
		LOW	35 — 45 rpm	
	Motor characteristics when bound	HIGH	Torque	25.5 N·m (260 kg-cm, 1.88 ft-lb) or more
			Current	33 A or less
LOW		Torque	31.4 N·m (320 kg-cm, 2.31 ft-lb) or more	
		Current	29.0 A or less	
Wiper blade	Length	Driver side	600 mm (23.62 in)	
		Passenger side	450 mm (17.72 in)	

# REAR WIPER AND WASHER

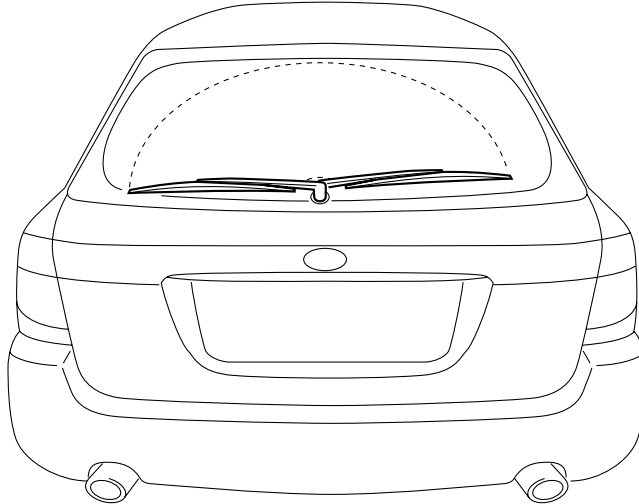
## WIPER AND WASHER SYSTEMS

### 2. Rear Wiper and Washer

#### A: GENERAL

##### 1. REAR WIPER

1) The rear wiper operates over an angle of 168°.



WW-00291

2) The rear wiper operates intermittently as shown in the following table only when the wiper switch is in the INT position on AT models.

Selector lever position (AT models only)	Vehicle speed km/h (MPH)	Interval (sec)
		Wagon
Reverse (R)	—	Continuous operation
Other than reverse (R)	0 — 20 (0 — 12.4)	12
	20 — 50 (12.4 — 31.1)	9
	50 — 80 (31.1 — 49.7)	6
	over 80 (49.7)	3



# REAR WIPER AND WASHER

## 2. REAR WASHER SYSTEM

- 1) The front and rear washers share the same washer tank.
- 2) The washer motor and pump unit is installed at the bottom of the washer tank.
- 3) The washer nozzle is installed to the lower part of the roof spoiler. The nozzle has two spray holes.
- 4) The washer nozzle is provided with a check valve, which is located just below it.

## 3. SPECIFICATIONS

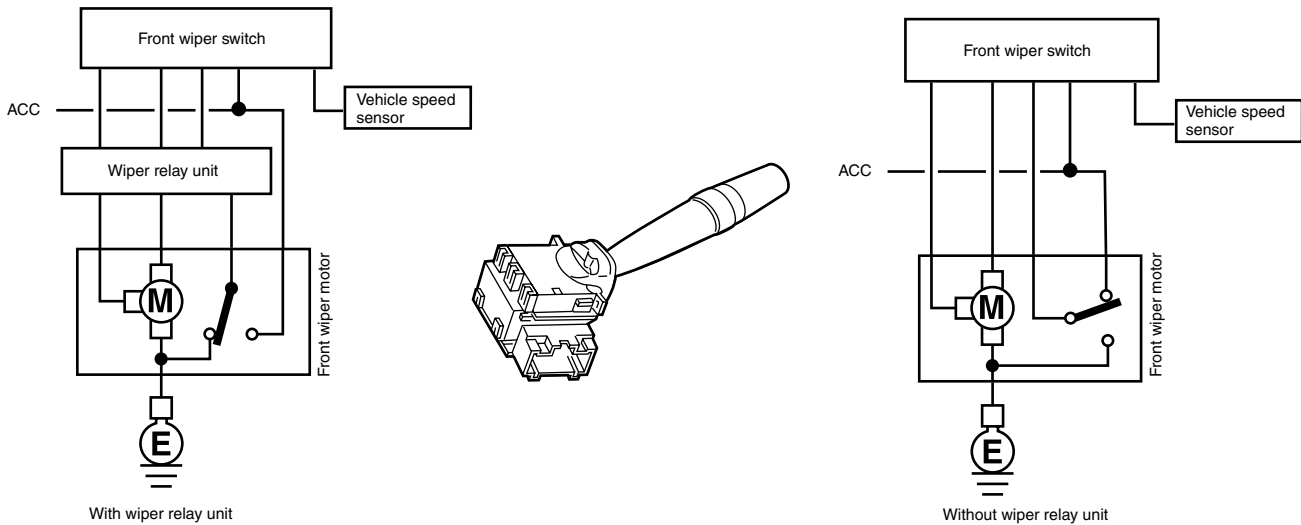
Wiper motor	Rated voltage	12 V	
	No-load current	2 A or less	
	Speed [at 0.5 N·m (5 kg·cm, 4.3 in·lb)]	25 rpm or more	
	Motor characteristics when bound	Torque	8.8 N·m (0.90 kgf·m, 6 ft·lb) or more
Current		13 A or more	
Wiper blade	Length	350 mm (13.78 in)	

### 3. Vehicle Speed Sensitive Intermittent Wipers (From '06MY)

#### A: GENERAL

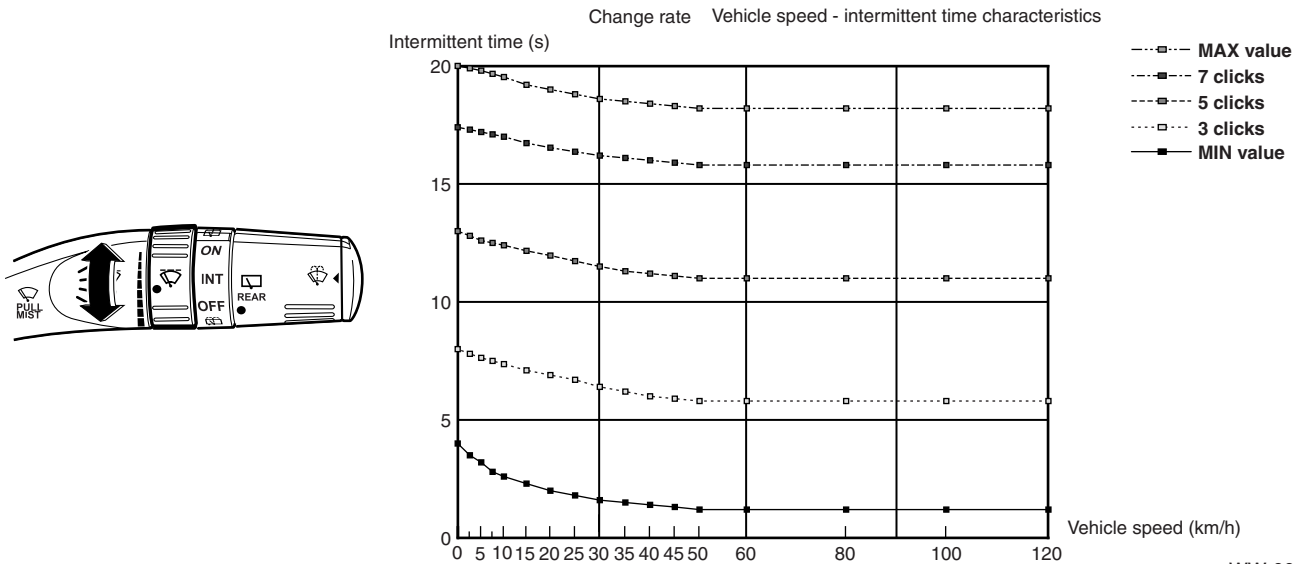
When the intermittent wiper is selected, the intermittent stop time is adjusted according to the vehicle speed to effectively secure visibility.

The control module built into the wiper switch assembly controls the intermittent stop time according to the vehicle speed signal provided from the body integrated unit.



WW-00468

The intermittent stop time will change according to the selected position of the intermittent volume switch.



WW-00467

**NOTE:**

- The intermittent stop time in relation to vehicle speed is as shown in the figure, but this may differ from the actual speed.
- Only 5 levels are shown here, but in actual use, it will operate at all positions of the intermittent volume switch.

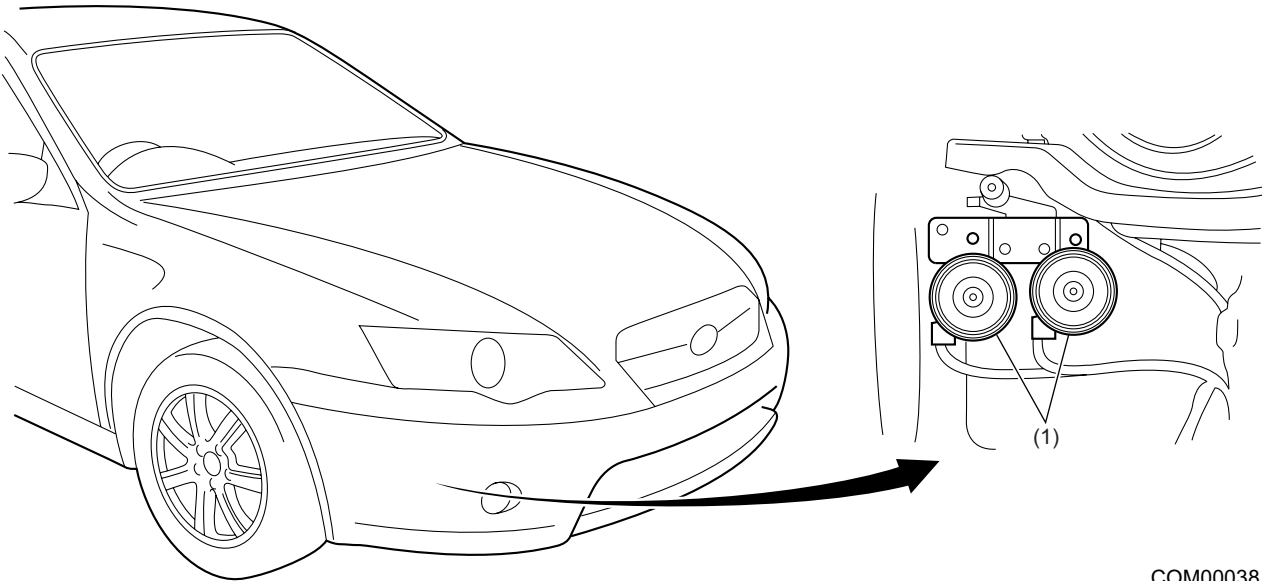
# HORNS

## COMMUNICATION SYSTEM

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### 1. Horns

#### A: GENERAL



COM00038

(1) Horns

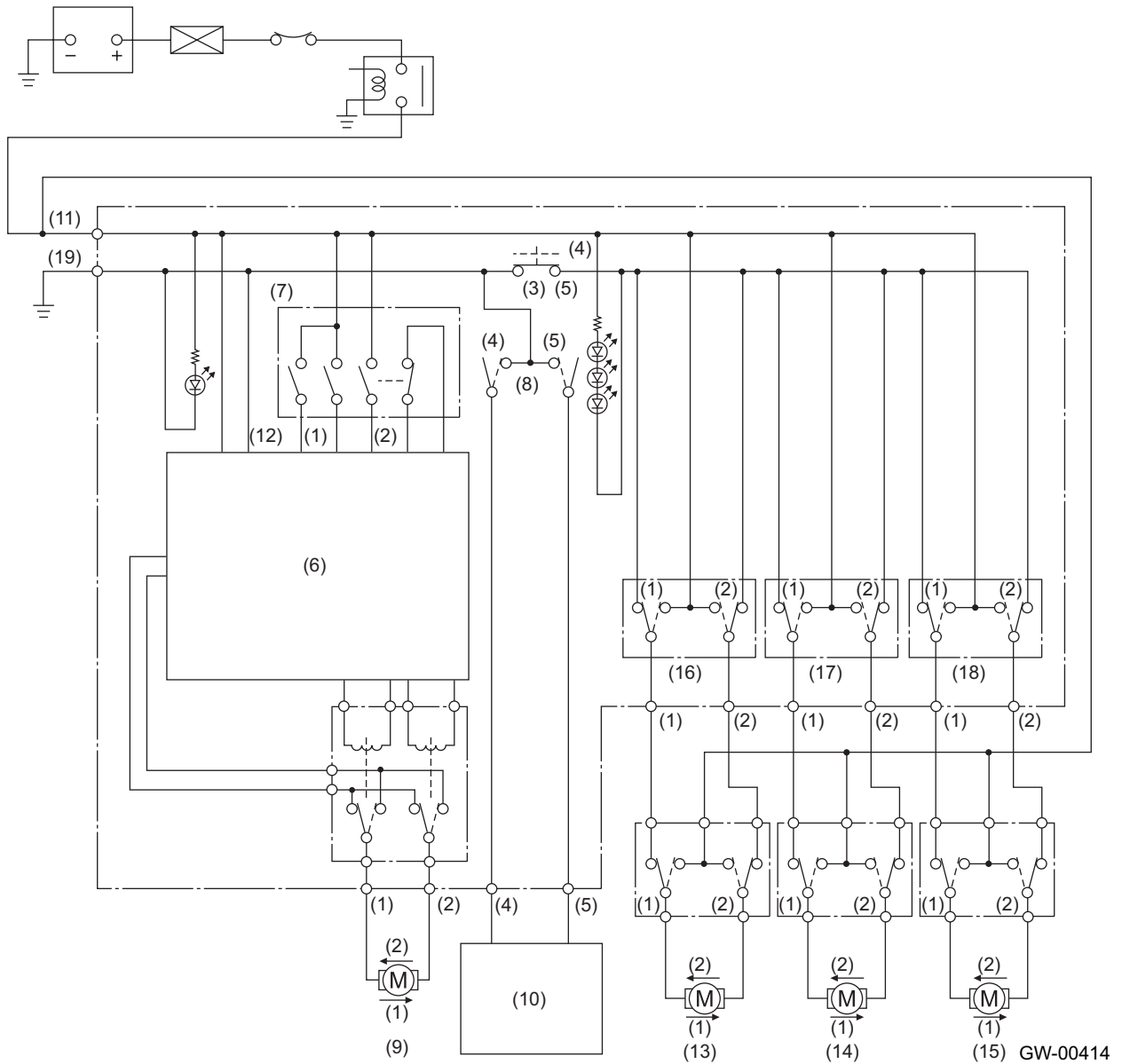
- Two horns (high and low tone) are installed behind the front bumper under the RH headlight.
- By positioning the horns at behind the front bumper and under the RH headlight, repair cost for damage due to light collision can be minimized.

## 1. Power Window

### A: CONSTRUCTION

- The power window system consists of regulator motors and switches for individual doors, relays and a circuit breaker unit.
- Each door window can be opened/closed by pushing down/pulling up the switch.
- Only the driver's door window switch has a 2-stage mechanism:
  - When the switch is pushed down or pulled up lightly and held, the window continues to lower or raise until the switch is released.
  - When the switch is pushed down fully, the window opens to the end position automatically.

## B: SCHEMATIC DRAWINGS



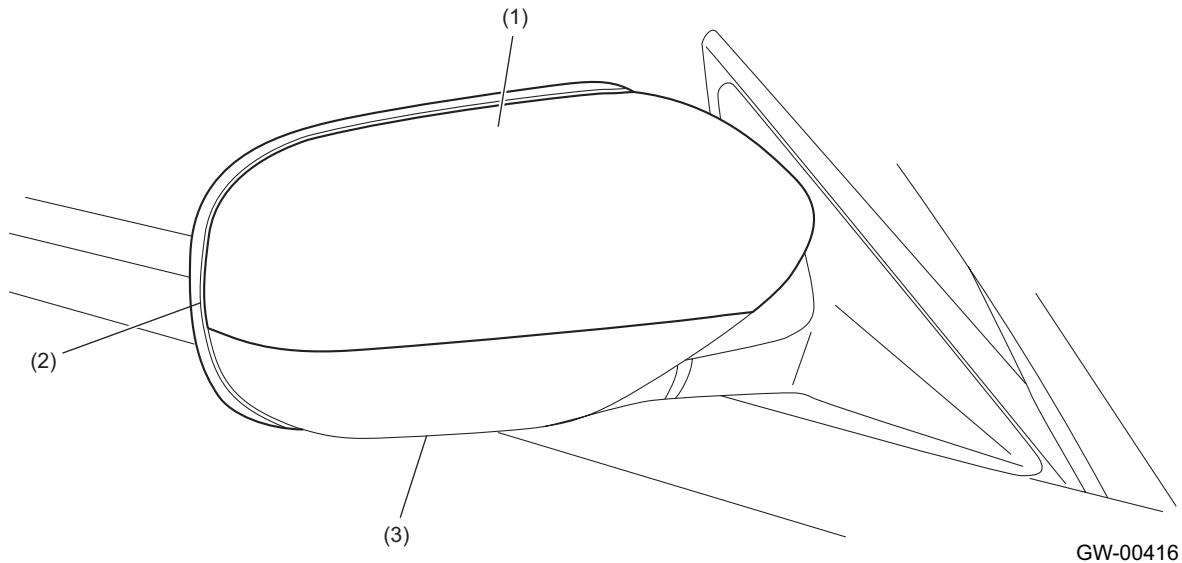
- |                                       |   |
|---------------------------------------|---|
| (1) Raise                             | (11) Ignition                             |
| (2) Lower                             | (12) Auto                                 |
| (3) Power window lock switch          | (13) Passenger's seat                     |
| (4) Lock                              | (14) Rear right                           |
| (5) Unlock                            | (15) Rear left                            |
| (6) Controller                        | (16) Power window passenger's seat switch |
| (7) Power window driver's seat switch | (17) Power window rear right seat switch  |
| (8) Door lock switch                  | (18) Power window rear left seat switch   |
| (9) Driver's seat side                | (19) Ground                               |
| (10) Door lock controller             |   |

# DOOR MIRRORS

## 2. Door Mirrors

### A: GENERAL

- Door mirrors are powered and remote controllable, and on some models each mirror has a side turn signal light built in it.
- The mirror body is structured as a scalp cap. The portion that may be damaged easier (scalp cap part and the side turn signal lamp part) can be replaced, contributing to reduce repair cost.
- Water drops cannot easily adhere to the mirror surface or front door glass while driving in rain.
- Mirror heaters are used on some models.

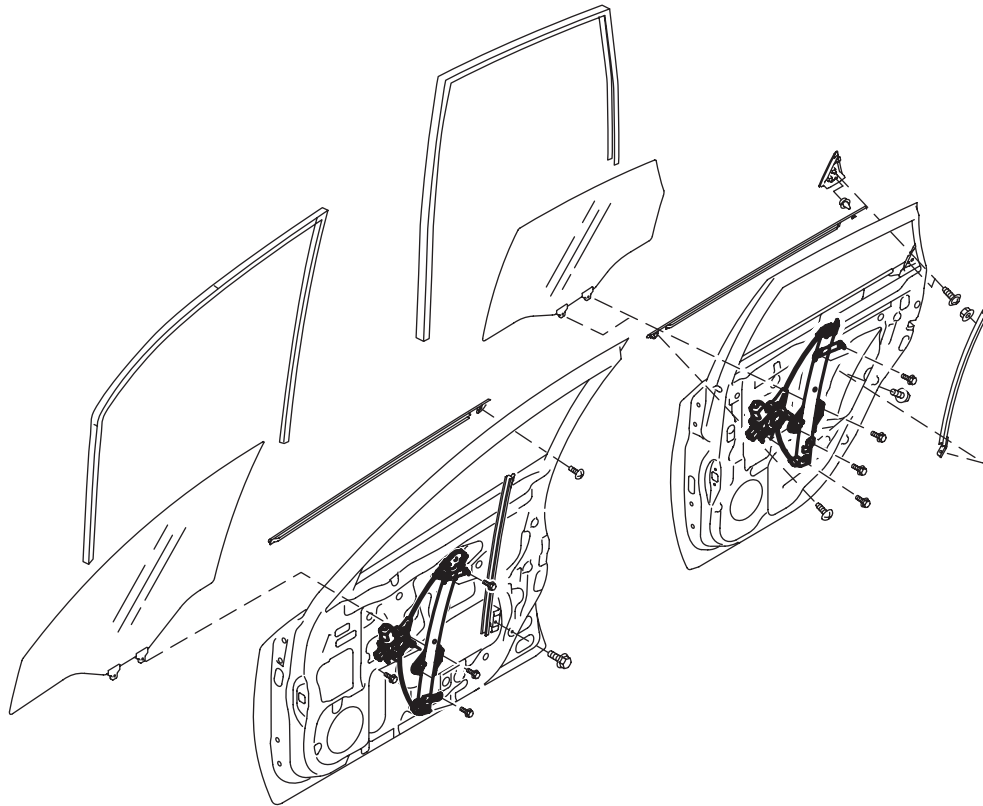


- (1) Scalp cap
- (2) Groove
- (3) Side turn signal light

## 3. Wire-type Window Regulator (From '08MY)

### A: GENERAL

- A wire-type window regulator can be more compact than X arm-type regulator. The design is intended for overall weight reduction of the power window regulator assembly.
- Introduction of the wire-type window regulator enables the up-and-down track to become more closer to the glass curvature for much more smooth up-and-down movement.
- A wider space inside the door panel is available now so a space to place a water bottle into is provided in the door trim.



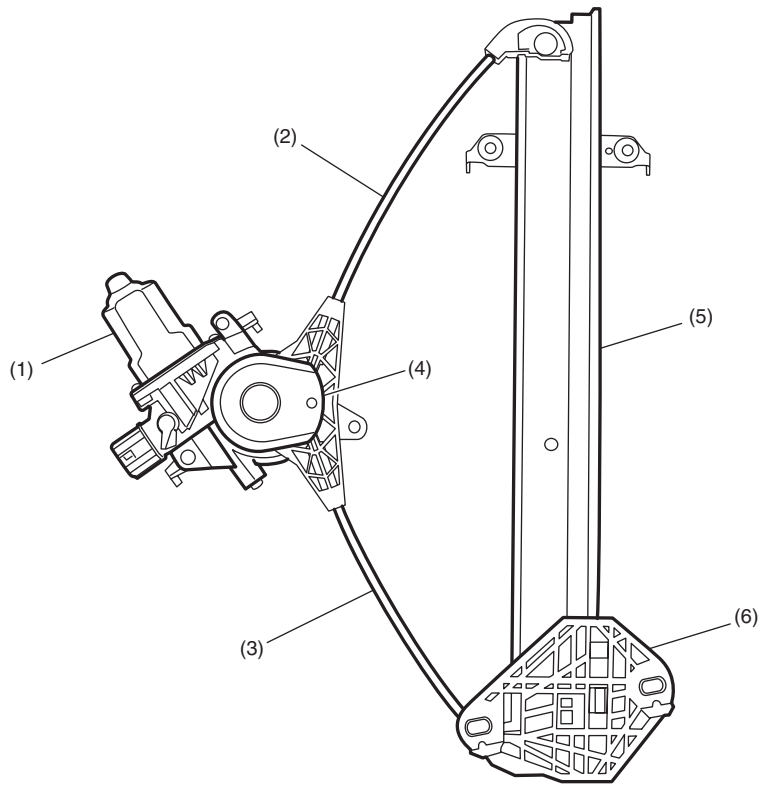
GW-00722

# WIRE-TYPE WINDOW REGULATOR (FROM '08MY)

GLASS/WINDOWS/MIRRORS

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## B: STRUCTURE



GW-00723

- (1) Motor
- (2) Upper wire

- (3) Lower wire
- (4) Wire-winding drum

- (5) Rail
- (6) Carrier plate



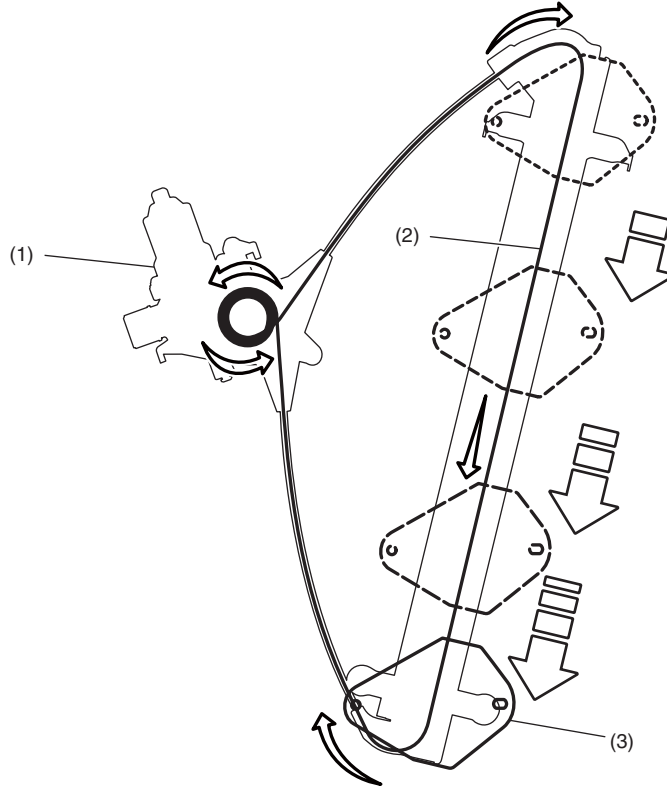
# WIRE-TYPE WINDOW REGULATOR (FROM '08MY)

GLASS/WINDOWS/MIRRORS

## C: OPERATION

The glass moves up and down when the wire (2) is wound or unwound as the motor (1) rotates. When a certain amount of the wire is wound or the same amount of the wire is unwound, the carrier plate (3) attached to the wire moves up and down. This move the glass that is attached to the carrier plate moves up and down as well.

- Glass moving down



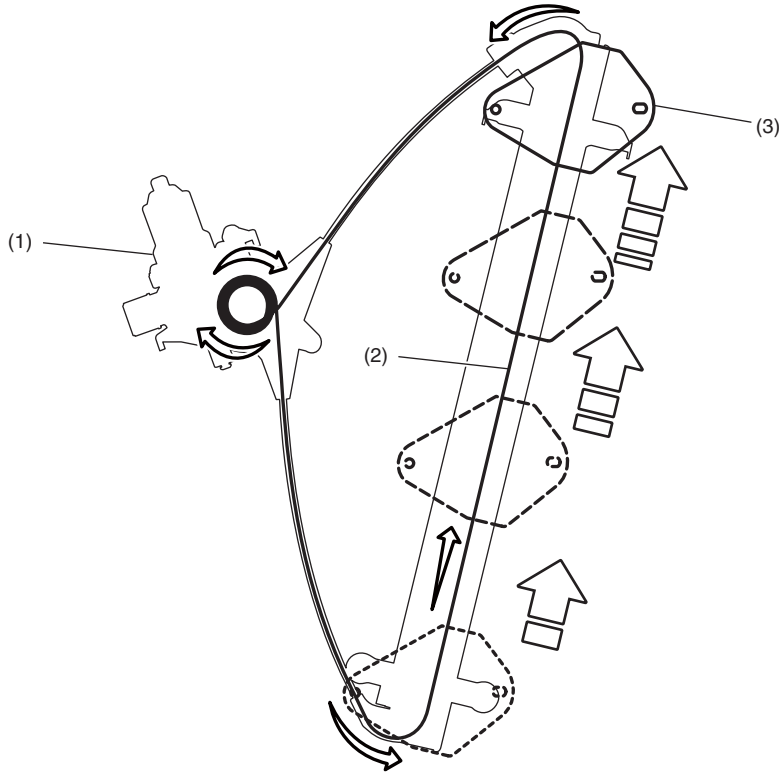
GW-00720

# WIRE-TYPE WINDOW REGULATOR (FROM '08MY)

GLASS/WINDOWS/MIRRORS

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- Glass moving up



GW-00721

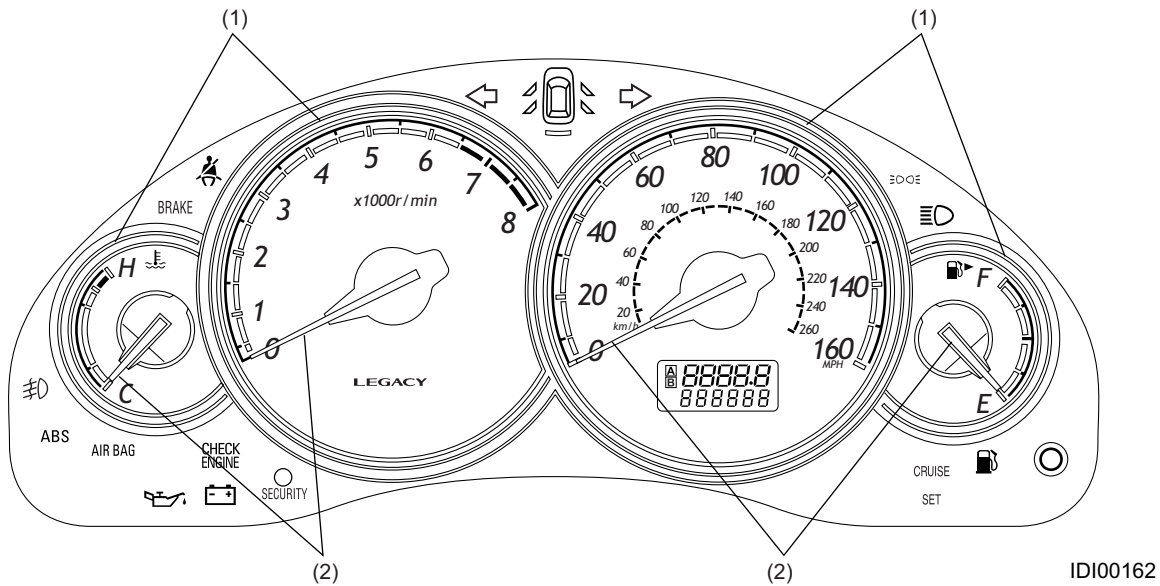
# COMBINATION METER

## 1. Combination Meter

### A: ELECTRO-LUMINESCENT METER

To increase desirability and visibility of the meter, an electro-luminescent meter is used on some models.

- Red LEDs are used for meter rings and needles illumination.
- The brightness of the meter display area can be properly adjusted to meet various conditions.
- An indicator that illuminates when the lighting switch is turned to the next position from OFF is provided.



IDI00162

(1) Meter ring

(2) Needle

## B: ILLUMINATION AND NEEDLES

### 1. INITIAL OPERATION

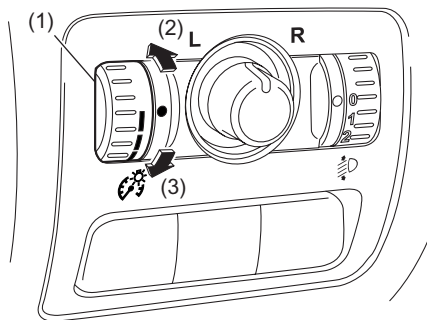
- Electro-luminescent meter

When the ignition switch is turned ON, the meter rings are illuminated first, and the needles are lit next. Then the needle moves from the minimum reading to the maximum reading, and then returns to the minimum reading. Finally the dial illumination and LCD turn on.

- Standard meter

When the ignition switch is turned ON, the meter needle moves from the minimum reading to the maximum reading and then returns to the minimum reading.

The illumination brightness can be adjusted by selecting any of the six steps of the instrument panel dial. (Adjustment is possible only when the lighting switch is ON for the standard meter.)



IDI00107

(1) Adjustment dial

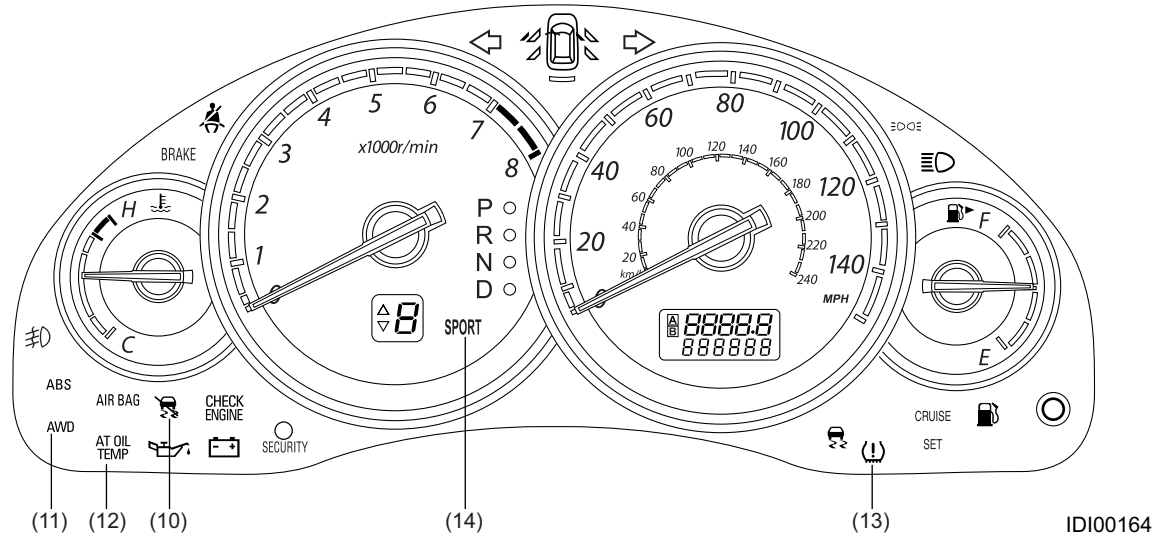
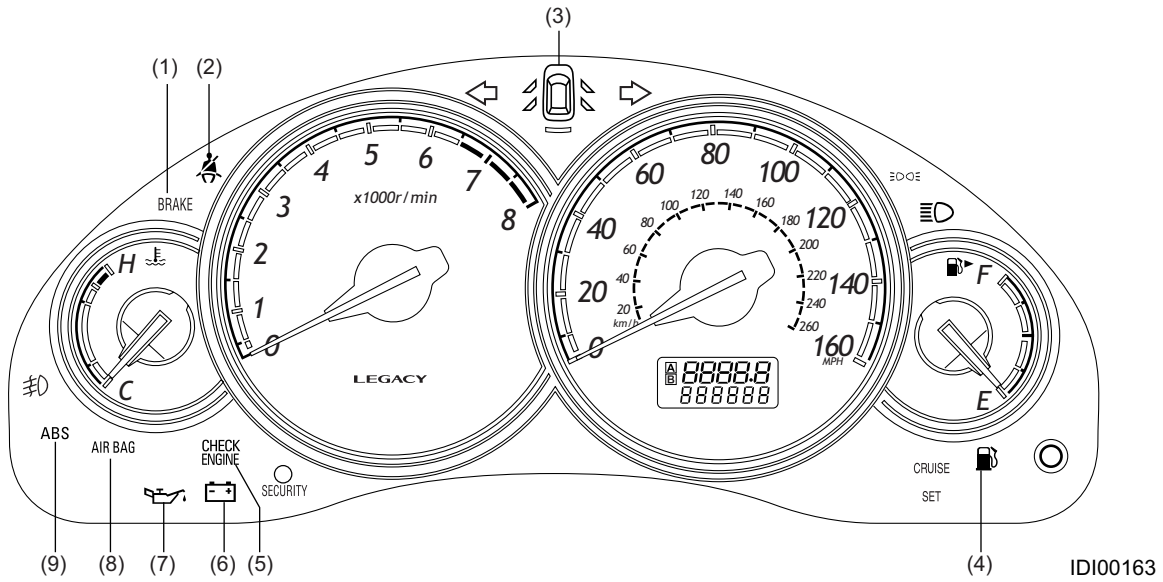
(2) Brighter

(3) Darker

# COMBINATION METER

INSTRUMENTATION/DRIVER INFO

## C: WARNING AND INDICATOR LIGHTS



- (1) Brake fluid level warning/parking brake indicator light  
This light illuminates if the fluid level in the brake reservoir tank lowers below the specified level and/or when the parking brake is applied.
- (2) Seat belt warning light  
This warning light illuminates when the ignition switch is turned ON, and goes out when the seat belt is fastened.
- (3) Door open warning light  
This warning light illuminates when one or more doors and/or rear gate are not completely closed.
- (4) Low fuel warning light  
This warning light comes ON when the quantity of the fuel remaining in the tank has decreased to 9 ℓ (2.4 US gal, 2.0 Imp gal) or less.
- (5) Engine malfunction indicator light  
This light illuminates if a fault occurs in the MFI (Multiple point Fuel Injection) system.
- (6) Charge warning light  
This warning light illuminates when a fault occurs in the charging system while the engine is running.
- (7) Oil pressure warning light  
This light illuminates when the engine oil pressure decreases below 14.7 kPa (0.15 kgf/cm<sup>2</sup>, 2.1 psi).
- (8) AIR BAG system warning light  
This warning light illuminates if a fault occurs in the airbag system.
- (9) ABS warning light  
This warning light illuminates if a fault occurs in any electrical component of the ABS (Anti-lock Brake System).
- (10) Vehicle dynamics control warning light and vehicle dynamics control OFF indicator light  
This light illuminates when a fault occurs in any electrical component of the vehicle dynamics control. It also illuminates when the vehicle dynamics control OFF switch is pressed.
- (11) AWD warning light (AT)  
This warning light illuminates if the vehicle is driven with front and rear tire sizes different from each other. On 4AT models, this indicator illuminates when the drive mode is changed from AWD to FWD (with the fuse installed in the FWD switch).
- (12) AT oil temperature warning light (AT)  
This warning light illuminates when the ATF temperature exceeds 150°C (302°F).
- (13) Tire pressure warning light  
This warning light illuminates when the air pressure in either of the tires drops below the specified value while traveling, and flashes when a fault occurs in the tire pressure monitoring system.
- (14) Sports mode indicator (AT)  
This indicator illuminates when the AT selector lever is put in the sports mode position, and blinks if a fault occurs in the AT control system.

## COMBINATION METER

### INSTRUMENTATION/DRIVER INFO

When everything is normal, the warning and indicator lights should be ON or OFF as shown below according to ignition switch positions.

Warning/Indicator light		Ignition switch position			
		LOCK/ACC	ON	ST	While engine is running
(1)	Brake fluid level / parking brake	OFF	ON	ON	*1
(2)	Seat belt	OFF	*2	*2	*2
(3)	Door or rear gate open	• Open	ON	ON	ON
		• Closed	OFF	OFF	OFF
(4)	Low fuel level	OFF	*3	*3	*3
(5)	Engine malfunction indicator	OFF	ON	ON	OFF
(6)	Charge	OFF	ON	ON	OFF
(7)	Oil pressure	OFF	ON	ON	OFF
(8)	AIR BAG	OFF	*4	*4	*4
(9)	ABS	OFF	*5	*5	*5
(10)	Vehicle dynamics control	OFF	ON	ON	OFF
(11)	AWD	OFF	*6	*6	*6
(12)	AT oil temperature	OFF	ON	ON	OFF
(13)	Tire pressure	OFF	*5	*5	*5
(14)	Sports mode	OFF	OFF	OFF	*7

\*1: This warning light illuminates when the parking brake is applied.

\*2: This warning light flashes after the ignition switch is turned ON until the drivers seat belt is fastened.

\*3: This warning light illuminates when the quantity of the fuel remaining in the tank has decreased to 9 ℓ (2.4 US gal, 2.0 Imp gal) or less.

\*4: This warning light illuminates for about 6 seconds, and then goes out.

\*5: This warning light illuminates for about 2 seconds, and then goes out.

\*6: This warning light illuminates if the front and rear tire sizes are different from each other. This also illuminates when the drive mode is changed from AWD to FWD (4AT models).

\*7: This light illuminates when the AT selector lever is moved to the sports mode position.

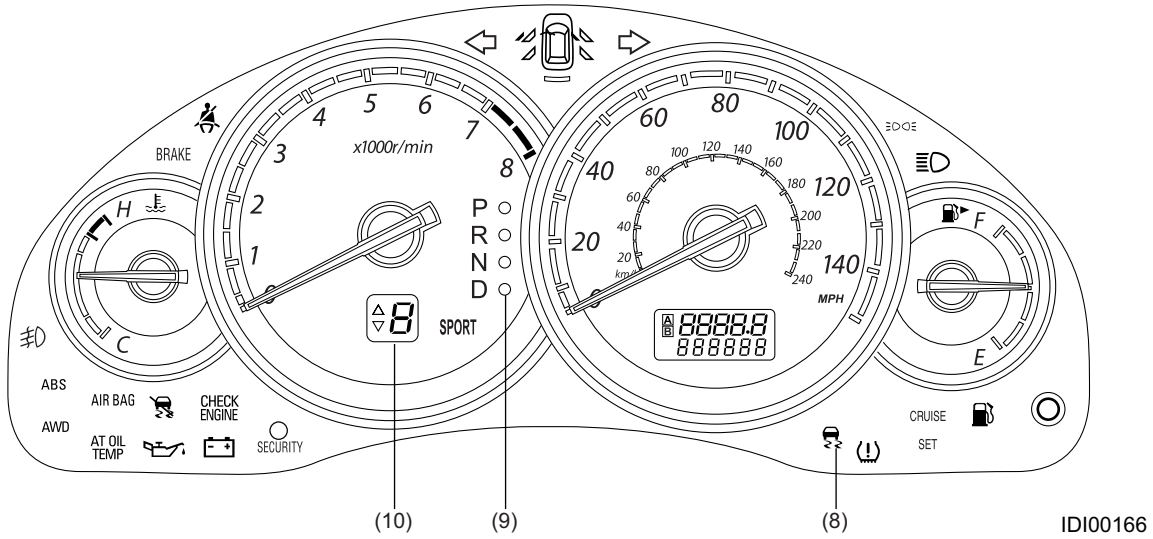
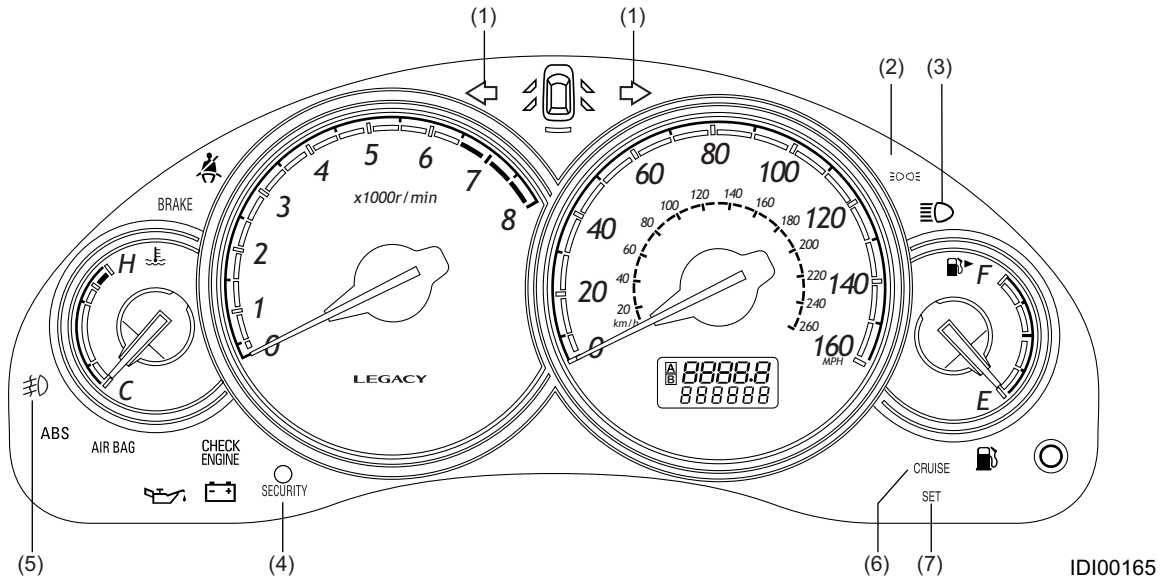
**MEMO**



# COMBINATION METER

INSTRUMENTATION/DRIVER INFO

## D: TELLTALE LIGHT



# COMBINATION METER

INSTRUMENTATION/DRIVER INFO

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- (1) Turn signal indicator light  
This light blinks in unison with the corresponding turn signal lights when the turn signal switch is operated.
- (2) Lighting switch indicator light  
Turns on when the lighting switch is turned to the next position from OFF.
- (3) Headlight beam indicator  
This light illuminates when the headlights are in the high-beam position.
- (4) Immobilizer indicator  
This light illuminates when the immobilizer systems are armed.
- (5) Front fog light indicator light  
This light illuminates when the front fog lights are ON.
- (6) CRUISE indicator light  
This light illuminates when the cruise control main switch is turned ON.
- (7) SET indicator light  
This light illuminates when the cruise control main switch is turned ON and the SET/COAST switch on the command switch is turned ON.
- (8) Vehicle dynamics control function indicator light  
This light blinks when the vehicle dynamics control is operating.
- (9) AT selector lever position indicator (AT)  
The indicator corresponding to the present AT select lever position illuminates when the ignition switch is in any position other than ACC and LOCK.
- (10) Sports shift indicator (AT)  
Indicates the current gear position when sports shift is selected.

## COMBINATION METER

### INSTRUMENTATION/DRIVER INFO

When everything is normal, the telltales should be ON, OFF or in other states as shown below according to ignition switch position.

Telltale light		Ignition switch position			
		LOCK/ACC	ON	ST	While engine is running
(1)	Turn signal	OFF	Blink	Blink	Blink
(2)	Lighting switch	OFF	*1	*1	*1
(3)	Headlight beam	• High beam	OFF	ON	ON
		• Low beam	OFF	OFF	OFF
(4)	Immobilizer	*2	OFF	OFF	OFF
(5)	Front fog light	Front fog light ON	OFF	ON	ON
(6)	CRUISE	OFF	OFF	OFF	ON
(7)	SET	OFF	OFF	OFF	*3
(8)	Vehicle dynamics control	OFF	*4	ON	OFF
(9)	AT selector lever position	OFF	ON	ON	ON
(10)	Sports shift indicator	OFF	*5	OFF	*5

\*1: Turns on when the lighting switch is turned to the next position from OFF.

\*2: This light illuminates when the immobilizer system is armed.

\*3: This light illuminates when the SET/COAST switch is turned ON while driving at 40 km/h (25 MPH) or higher.

\*4: This light illuminates for about 2 seconds, and then goes out.

\*5: Indicates the current gear position when sports shift is selected. It also illuminates for about 2 seconds when the ignition switch is turned ON.

## E: SPEEDOMETER

### 1. GENERAL

- The speedometer system is an electrical type that uses electric signals from the ABS or vehicle dynamics control (VDC) control module.
- Since the system does not use mechanical components such as rotating cable, there are no opportunities of occurring such problems as meter needle vibration and cable disconnection. Also, it does not constitute any means of mechanical noise transmission.
- The odometer and trip meter readings appear on a liquid crystal display (LCD).
- At the trip meter display, the illumination level and the following trouble information (abnormality of various control modules, communication system, vehicle speed signals, etc.) are shown in addition to the trip meter reading.

Indication	Indicated fault
“Er --”	High speed and low speed CAN communication failed simultaneously
“Er HC”	High speed CAN communication failure
“Er LC”	Low speed CAN communication failure
“Er IU”	Body integrated unit failure inside
“Er EG”	Engine control module communication counter failure
“Er tC”	Transmission control module communication counter failure
“Er Ab”	ABS/VDC control module communication counter failure
“Er SP”	Vehicle speed signal abnormal (ABS/VDC diagnostic trouble code information)
“Er SS”	Vehicle speed signal abnormal (wheel speed signal abnormal)

### 2. OPERATION

The ABS or VDC control module calculates the vehicle speed based on signals from the four wheel speed sensors and sends vehicle speed signals (4 pulses per rotation of wheel) to the speedometer drive circuit and odometer/trip meter drive circuit in the speedometer.

**NOTE:**

Signals from the ABS or VDC control module are also used by the engine control module, automatic transmission control module, etc.

### 3. SPECIFICATIONS

Speedometer	Type		Electric pulse type
	Indication	km/h	The needle points to 60 km/h (37.3 MPH) when 2,548 pulses are input per minute.
		MPH	The needle points to 60 MPH (95 km/h) when 4,104 pulses are input per minute.
Odometer	Type		Pulse count type
	Display		LCD/6 digits; 0 to 999,999 km (miles)
	Indication		Counts up 1 km per 2,548 pulses. (4,104 pulses per mile)(Count down is impossible.)
Trip meter	Type		Pulse count type
	Display		LCD/4 digits; 0 to 999.9 km (miles) and 1000 to 9999 km (miles).
	Indication		Counts up 1 km per 2,548 pulses. (4,104 pulses per mile)(To change the trip meter from A to B or B to A, push the knob momentarily. To return the trip meter to zero indication, keep the knob pushed for more than 1 second.)

# COMBINATION METER

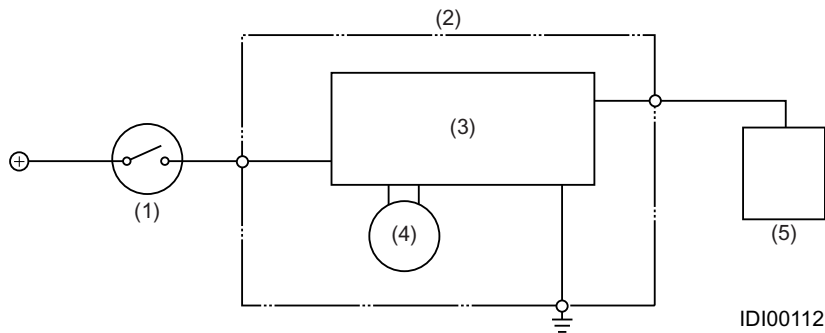
## INSTRUMENTATION/DRIVER INFO

### F: TACHOMETER

The tachometer drive circuit is connected to the engine speed sensing circuit in the engine control module.

When the engine speed increases or decreases, the voltage of the circuit also increases or decreases, changing the magnetic force of the tachometer drive coil.

The tachometer needle then moves in accordance with change in the engine speed.



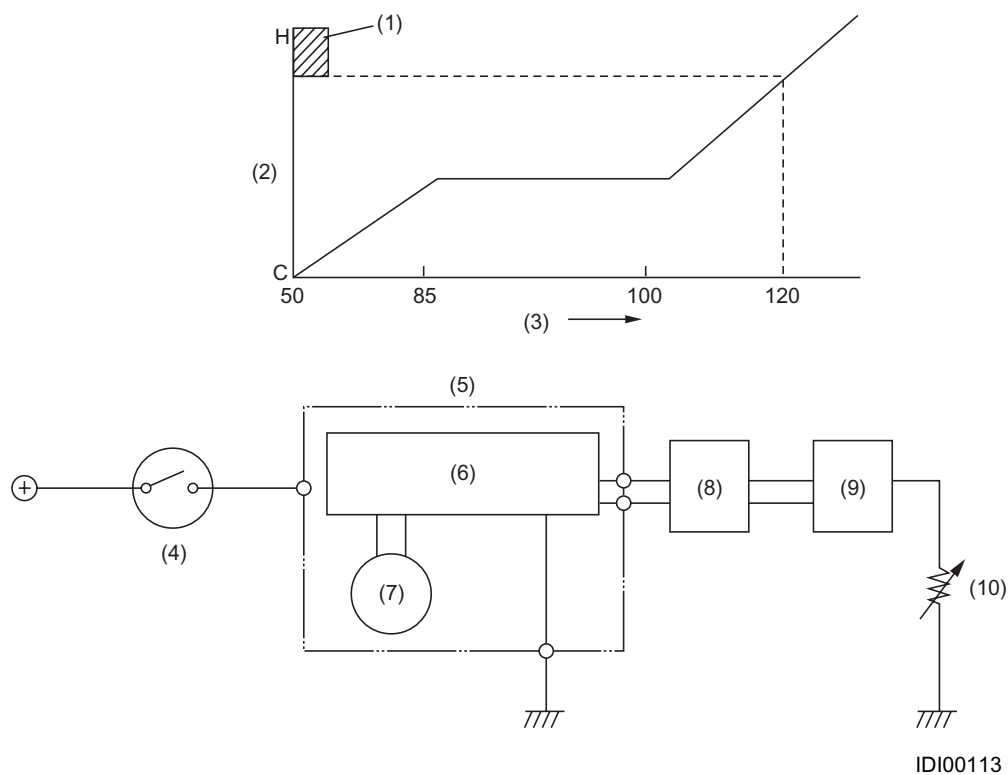
IDI00112

- (1) Ignition switch
- (2) Combination meter
- (3) Microprocessor

- (4) Tachometer
- (5) Engine control module

## G: WATER TEMPERATURE GAUGE

- Water temperature signals are generated at the engine coolant temperature sensor on the engine, and after converted into digital signals, these signals are sent via the body integrated unit to the combination meter.
- The resistance of the engine coolant temperature sensor changes according to the engine coolant temperature. Therefore, the signals sent to the water temperature gauge also changes according to the engine coolant temperature. As the change in signals causes the magnetic force of the step motor to change, the gauge needle moves according to the engine coolant temperature.
- When the coolant is at a normal operating temperature of approx. 85 to 100°C (158 to 212°F), the gauge needle stays in the middle of the indication range as shown below.



- (1) Red zone
- (2) Indication
- (3) Temperature (°C)
- (4) Ignition switch
- (5) Combination meter

- (6) Microprocessor
- (7) Water temperature gauge
- (8) Body integrated unit
- (9) Engine control module
- (10) Engine coolant temperature sensor

# COMBINATION METER

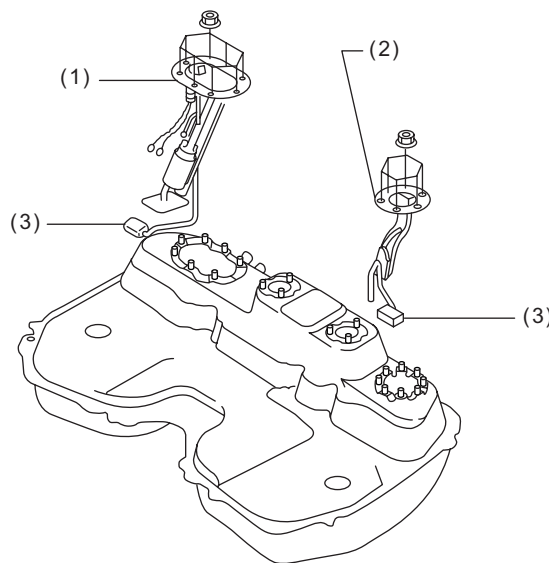
## INSTRUMENTATION/DRIVER INFO

### H: FUEL GAUGE

#### 1. GENERAL

- The fuel gauge unit consists of a float and a potentiometer whose resistance varies depending on movement of the float. It is located inside the fuel tank and forms an integral part of the fuel pump. The fuel gauge indicates the fuel level in the tank when the ignition switch is in the ON position. When the trip knob is pushed, the fuel gauge illumination comes ON and the fuel level registered just before the ignition switch was turned OFF is indicated, even when the ignition switch is in the OFF position.

- All models are equipped with two fuel level sensors. These sensors are installed in the fuel tank, one on the right side and the other on the left side. Two sensors are necessary because the fuel tank is divided into main and sub tank compartments.



IDI00017

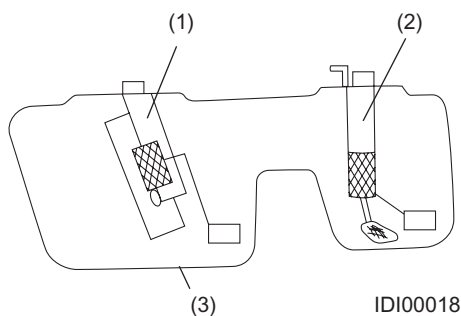
- (1) Main fuel level sensor
- (2) Fuel sub level sensor
- (3) Float

## 2. OPERATION

The low fuel warning light operates as follows:

The signal from the fuel level sensor is converted into a digital signal at the body integrated unit, and then sent to the combination meter. The combination meter microprocessor continually monitors this signal. It turns on the low fuel warning light in the combination meter if a resistance value corresponding to the critical fuel level is detected for a certain time while driving.

This monitoring time has been decided to avoid false operation of the warning light, which may happen when a large part of remaining fuel is collected temporarily in the sub tank compartment.



- (1) Main fuel level sensor
- (2) Fuel sub level sensor
- (3) Fuel tank

## 3. SPECIFICATIONS

	Fuel level	Resistance
Main fuel level sensor	Full	1.0 — 3.0Ω
	Empty	30.9 — 32.9Ω
Fuel sub level sensor	Full	1.0 — 3.0Ω
	Empty	61.1 — 63.1Ω



# COMBINATION METER

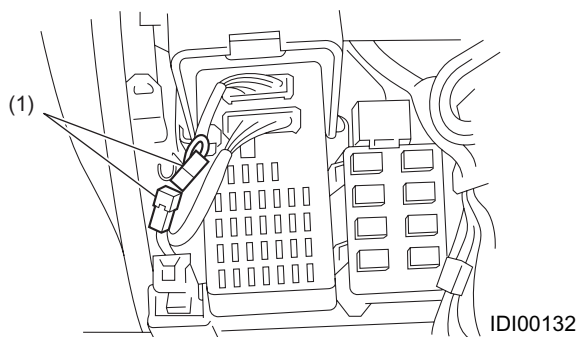
## INSTRUMENTATION/DRIVER INFO

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### I: DIAGNOSIS MODE

#### 1. GENERAL

The combination meter is provided with a self diagnosis function and a diagnostic trouble code display function which indicate DTCs for the engine, transmission and ABS/VDC control modules. To enter diagnosis mode, the diagnosis connector located near the fuse box under the right side of the driver's seat is used.



(1) Diagnosis connector

#### 2. PROCEDURE

##### ● Entering diagnosis mode

- 1) Connect the diagnosis connector.
- 2) Turn ON the ignition switch.
- 3) During initial operation of the meter and while the needle is moving, push the trip knob once to enter diagnostic trouble code display mode, or push the knob twice to enter self diagnosis mode.

##### NOTE:

If the vehicle is driven while in diagnosis mode (vehicle speed signals input), diagnosis mode is cancelled.

##### ● To exit diagnosis mode

Turn OFF the ignition switch and disconnect the diagnosis connector to exit diagnosis mode.

### 3. FUNCTION

- **Self diagnosis mode**

When self diagnosis mode is activated, the system switches to warning lights, indicators, needle movement, illumination or buzzer check mode (sports shift) each time the trip knob is pushed.

- **Diagnostic trouble codes display mode**

When diagnostic trouble code display mode is activated, the display switches to indicate engine control module, transmission control module, or ABS/VDC control module diagnostic trouble codes each time the trip knob is pushed. In addition to the type of control module, the display will show whether the diagnostic trouble codes are now being received, present, or not. If CAN communication is failed, "-----" is displayed.

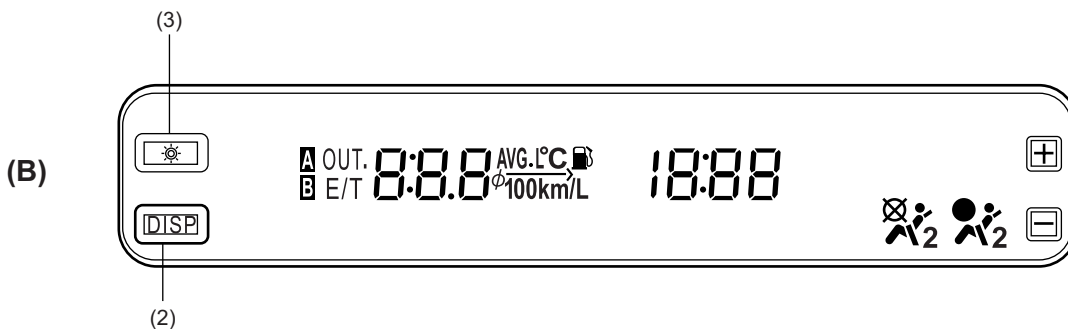
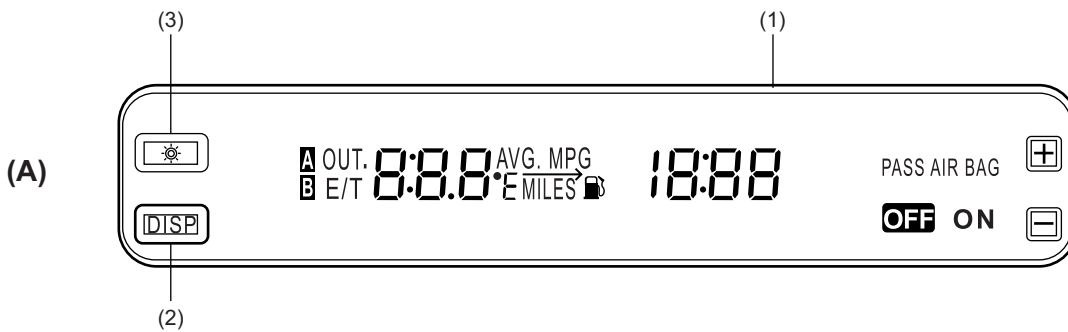
Control module	Status	Indication
Engine control module	Receiving diagnostic trouble codes	Trip "A" + "P (blink)"
	Diagnostic trouble codes present	Trip "A" + "P xxxx"
	No failure exists	Trip "A" + "P ----"
Transmission control module	Receiving diagnostic trouble codes	Trip "B" + "P (blink)"
	Diagnostic trouble codes present	Trip "B" + "P xxxx"
	No failure exists	Trip "B" + "P ----"
ABS/VDC control module	Receiving diagnostic trouble codes	Trip "A" + "C (blink)"
	Diagnostic trouble codes present	Trip "A" + "C xxxx"
	No failure exists	Trip "A" + "C ----"
CAN communication error	—	"-----"

# CLOCK UNIT

## 2. Clock Unit

### A: GENERAL

The clock unit display can be switched to indicate outside air temperature, fuel efficiency, remaining travel distance or continuous driving time, by operating a button. The DISP button is used for switching the display, and the indicated information switches in the following sequence each time the button is pressed: outside temperature → fuel efficiency at the instant → average fuel efficiency → remaining travel distance → continuous driving time. These data are sent from the combination meter by means of digital communication. This clock unit is provided with a function to automatically display a failure; if the accessory power circuit is open it displays “Acc”, and if the ignition power circuit is open it displays “ign”. If an abnormality is detected in the communication between the combination meter and clock unit or in the received data, “Err” is displayed. If no data can be received, “Err” will always be displayed even when the indication is switched with the DISP button, but when only a specific data is not received, “Err” will be displayed only when the indication is switched to display that data. For example, if outside temperature data is not received “Err” will be displayed only when the thermometer feature is selected, and other indications such as the fuel efficiency meter will be displayed normally.



(A) For U.S.

(B) For Canada

(1) Clock unit

(3) BRIGHT button

(2) DISP button

## **B: OPERATION**

### **1. CLOCK DISPLAY**

The clock shows time when the ignition switch is turned to ACC or further from OFF.

### **2. INSTANT FUEL EFFICIENCY, AVERAGE FUEL EFFICIENCY, REMAINING TRAVEL DISTANCE AND CONTINUOUS DRIVING TIME DISPLAY**

The combination meter microprocessor performs calculations based on vehicle speed signals from the ABS/VDC control module, remaining fuel signals from the body integrated unit, fuel efficiency signals from the engine control module, and engine start signals, and then sends the data to the clock unit.

- **Average fuel efficiency**

The value is calculated from the distance and total amount of consumed fuel since the trip meter has been reset the last time.

- **Instant fuel efficiency**

The value is calculated during driving, based on the traveled distance and amount of consumed fuel recorded for a certain period.

- **Remaining travel distance**

The value is calculated from the average fuel efficiency in recent 30 km (18.8 miles) and the amount of remaining fuel.

- **Continuous driving time**

Indicates the total time since the engine has been started.

### **3. OUTSIDE AIR TEMPERATURE DISPLAY**

The body integrated unit performs calculations based on outside air temperature signals from the ambient sensor and vehicle speed signals from the ABS/VDC control module, and then sends the data via the combination meter to the clock unit.

### **4. BRIGHT (DIMMER CANCELING) FUNCTION**

The dimmer can be cancelled by pushing the BRIGHT button when the lighting switch is ON. The lights returns to the dimmed state when the button is pushed again.

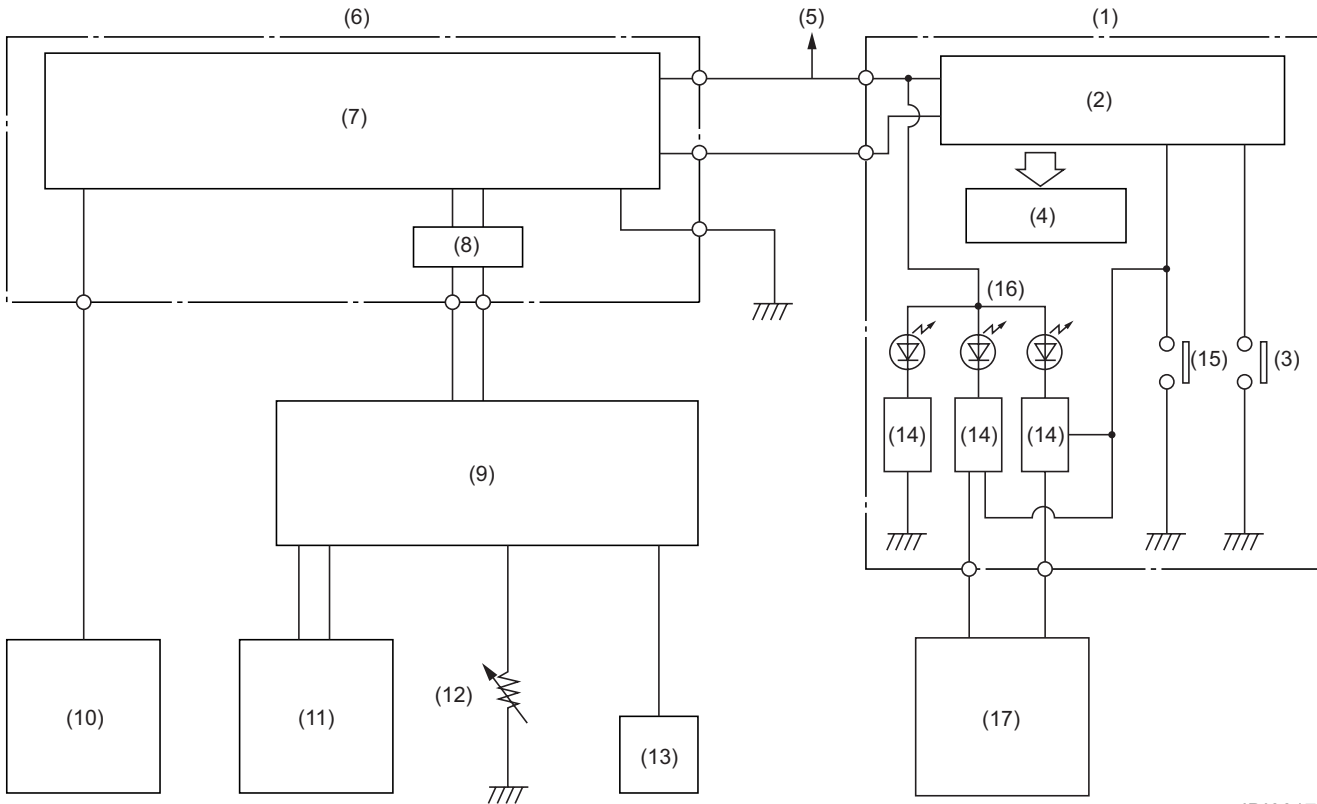
### **5. PASSENGER'S SEAT AIRBAG INDICATOR**

When this indicator (a mark on vehicles for Canada) is ON, the passenger's seat airbag will deploy in case of a front collision that should cause the airbag system to activate. When the indicator (a mark on vehicles for Canada) is OFF the passengers seat airbag will not deploy.

# CLOCK UNIT

INSTRUMENTATION/DRIVER INFO

## C: SCHEMATIC DRAWINGS



IDI00173

- |                                  |  |
|----------------------------------|--|
| (1) Clock unit                   | (10) ABS or VDC control module         |
| (2) Microprocessor               | (11) Engine control module             |
| (3) DISP button                  | (12) Fuel level sensor                 |
| (4) Display                      | (13) Ambient sensor                    |
| (5) Ignition switch              | (14) Dimmer canceling circuit          |
| (6) Combination meter            | (15) BRIGHT button                     |
| (7) Microprocessor               | (16) Passenger's seat airbag indicator |
| (8) CAN transmitter and receiver | (17) Airbag control module             |
| (9) Body integrated unit         |  |

# FRONT SEAT

SEAT

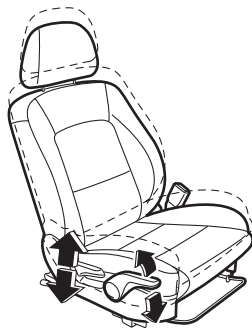
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## 1. Front Seat

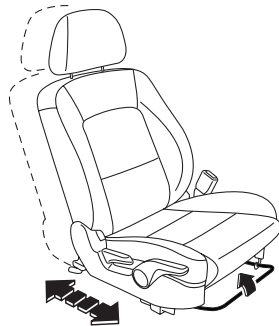
### A: ADJUSTMENT

Adjustment ranges are expanded to fit a wider variety of body types.

- The height of each headrest is adjustable to any of the 3 positions available.
- The uppermost position of the backrest is 11° rearwards from the perpendicular; the reclining angle is widened.
- A “towel bar” type seat slide lever is used for easier operation.
- The seat lifter mechanism has been changed from a system that lifts only the cushion to a system that lifts the entire seat.



SE-00419

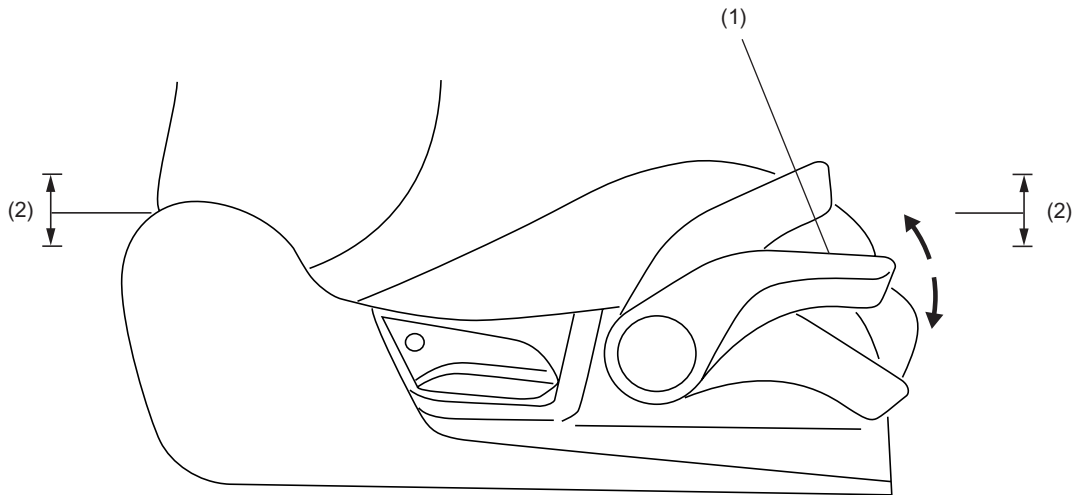


SE-00420

**B: HEIGHT ADJUSTER**

The driver's seat is provided with a height adjuster. Both the seat cushion and backrest rise every time the lifter lever is pulled up; they lower every time the lever is pushed down.

The lever is enlarged for easier operation.



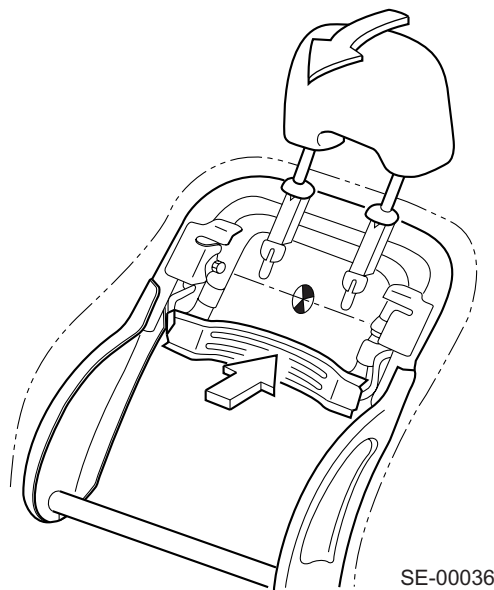
SE-00374

(1) Lifter lever

(2) Seat height adjustment range

**C: ACTIVE HEADREST**

In case of rear-end collision, the headrest moves forward to immediately support the passenger's head to reduce the possibility of injury to the neck.

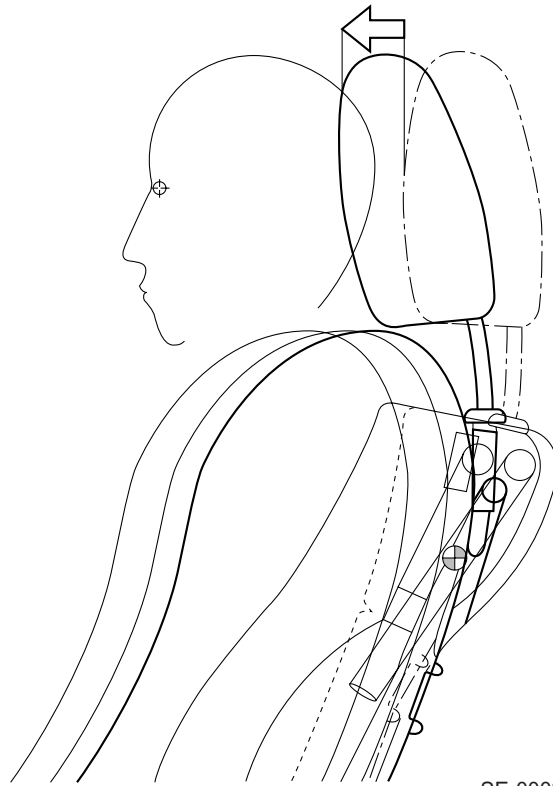


SE-00036

## FRONT SEAT

SEAT

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- 1) In case of rear-end collision, the passenger's body will move rearward by the impact.
- 2) When the body moves rearward, the thrust receiving plate inside the seat is pressed in.
- 3) When the thrust receiving plate is pressed in, the headrest moves forward due to a levering action.

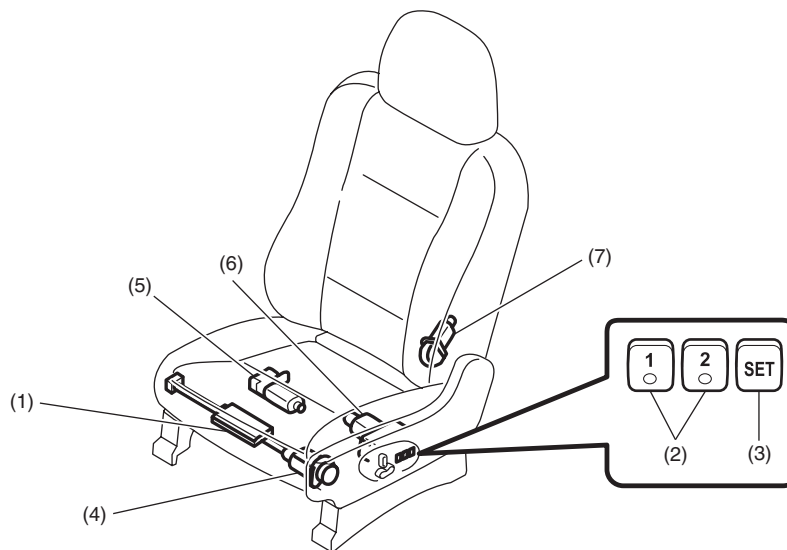


## 2. Powered Seat System With Memory Preset (From '06MY)

### A: GENERAL

- It is possible to register optimal seat positions adjusted by a driver (seat forward/back position, seat cushion height and angle, back rest angle) to the memory unit.
- Up to 2 seat positions can be registered, and even if the seat position has been changed, it will be possible to call out a registered seat position with a single button. It is possible to set this to use for different drivers, or to set a driving position and a rest position.
- The memory switch assembly for registering and calling out the memory, is located on the side cover of the driver's seat cushion (door side).

### B: COMPONENT



SE-00748

- |  |                       |                          |
|--|-----------------------|--------------------------|
| (1) Memory unit                                | (4) Slide motor ASSY  | (6) Tilt motor ASSY      |
| (2) Preset call button<br>(memory switch ASSY) | (5) Lifter motor ASSY | (7) Reclining motor ASSY |
| (3) SET button<br>(memory switch ASSY)         |                       |                          |

# POWERED SEAT SYSTEM WITH MEMORY PRESET (FROM '06MY)

SEAT

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## 1. MEMORY UNIT

In addition to storing the current slide/tilt/lifter/reclining positions based on the pulse signals from each motor assembly, registration/call out of preset seat positions is performed by the operation of the memory switch assembly.

The amount of movement for each motor is counted from a reference position, and the counts are recorded by this count. If the counts from the reference position exceeds the limit for some reason, the preset call feature may not operate properly, and initialization will be required in this case.

When a preset seat position is registered or called out, the built-in buzzer will sound.

## 2. MEMORY SWITCH ASSEMBLY

### • SET button

When the SET button is pressed, the unit will enter the registration preparation status. (If the preset call button is not pressed within 5 seconds, the registration preparation status will be cancelled.)

### • Preset call button

- Calls out the registered seat position.
- By pressing the preset call button after pressing the SET button, the seat position is registered.

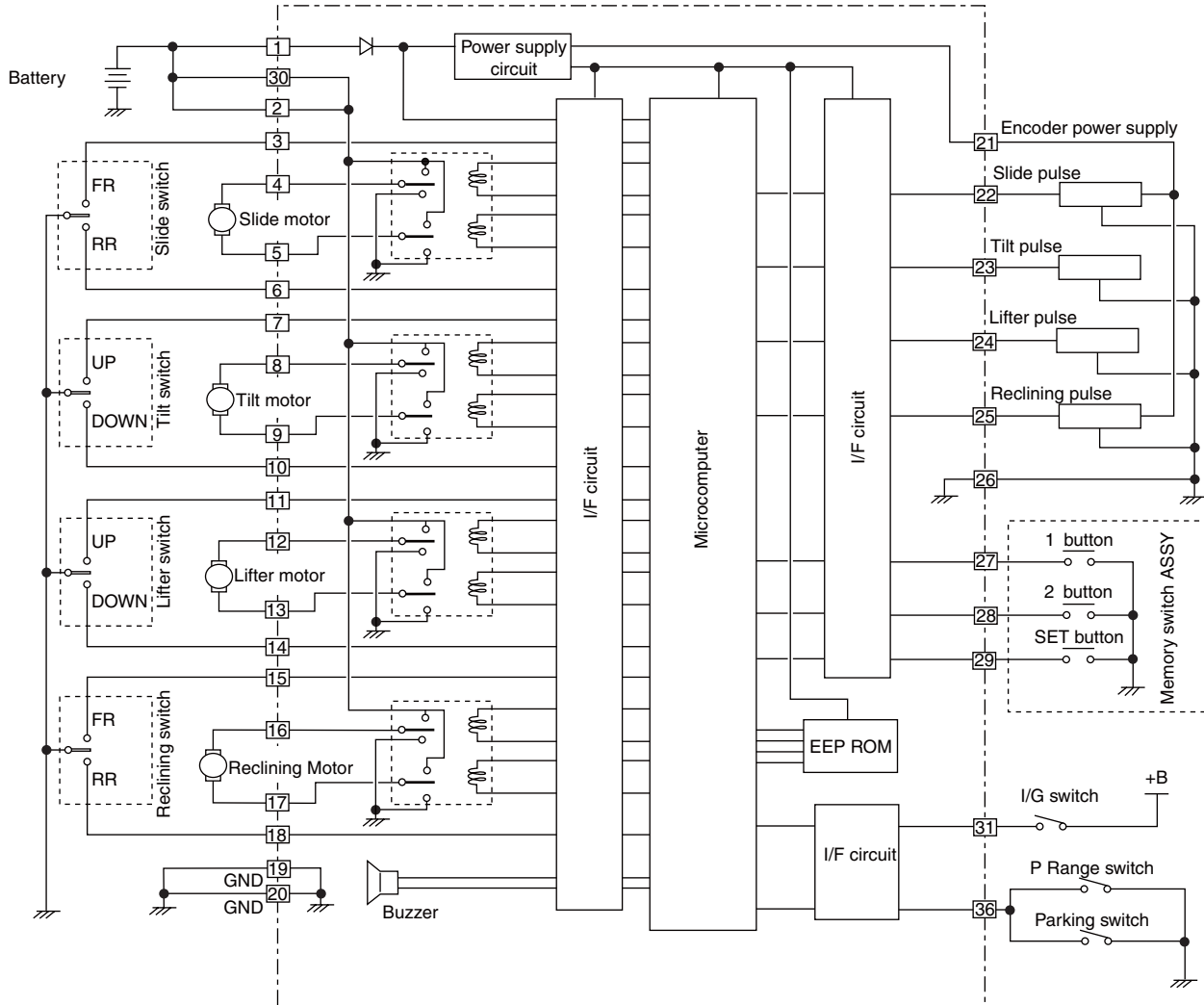
## 3. MOTOR ASSEMBLY

A motor assembly is provided for each function of slide, tilt, lifter, and reclining.

Each motor assembly has a built-in encoder, and sends a pulse signal to the memory unit.

## C: SPECIFICATION

### 1. SYSTEM DIAGRAM



SE-00758

# POWERED SEAT SYSTEM WITH MEMORY PRESET (FROM '06MY)

SEAT

## 2. I/O SIGNAL

DC10 to 16, -30 to +80°C

Terminal No.	Input/output name	Maximum input voltage (V)	Hi level minimum input/output voltage (V)	Low level maximum input/output voltage (V)	Maximum allowable current (A)
1	Main power supply input	16	10	—	3
2	Motor power supply 2 input	16	10	—	25
3	Slide forward switch input	—	—	1.5	50 mA
4	Slide motor forward output	16	9.5	—	23 <sup>*2</sup>
5	Slide motor reverse output	16	9.5	—	23 <sup>*2</sup>
6	Slide reverse switch input	—	—	1.5	50 mA
7	Tilt up switch input	—	—	1.5	50 mA
8	Tilt motor up output	16	9.5	—	23 <sup>*2</sup>
9	Tilt motor down output	16	9.5	—	23 <sup>*2</sup>
10	Tilt down switch input	—	—	1.5	50 mA
11	Lifter up switch input	—	—	1.5	50 mA
12	Lifter motor up output	16	9.5	—	23 <sup>*2</sup>
13	Lifter motor down output	16	9.5	—	23 <sup>*2</sup>
14	Lifter down switch input	—	—	1.5	50 mA
15	Reclining forward switch input	—	—	1.5	50 mA
16	Reclining motor forward output	16	9.5	—	25 <sup>*2</sup>
17	Reclining motor reverse output	16	9.5	—	25 <sup>*2</sup>
18	Reclining reverse switch input	—	—	1.5	50 mA
19	Main GND 1 input	—	—	—	25
20	Main GND 2 input	—	—	—	25
21	Encoder power supply output	16	8 <sup>*1</sup>	—	50 mA
22	Slide pulse input	—	—	1	50 mA
23	Tilt pulse input	—	—	1	50 mA
24	Lifter pulse input	—	—	1	50 mA
25	Reclining pulse input	—	—	1	50 mA
26	Motor pulse GND input	—	—	—	3
27	Preset call button 1 input	—	—	1	50 mA
28	Preset call button 2 input	—	—	1	50 mA
29	SET button input	—	—	1	50 mA
30	Motor power supply 1 input	16	10	—	25
31	Ignition switch input	16	10	—	3
36	Parking switch input	—	—	1.5	50 mA

\*1: When current flow is 8 mA or less.

\*2: When output time is 4 seconds or less (compatibility with built-in motor circuit breaker)

**D: OPERATION**

**1. SEAT POSITION REGISTRATION**

- 1) Set the seat to the optimum position.
- 2) Press the SET button, and press preset call button 1 or 2 within 5 seconds.
- 3) When the seat position is registered, the buzzer will sound once.

**NOTE:**

Even if the battery is removed, the registered seat position will not be deleted.

**2. CALLING OUT THE PRESET SEAT POSITION**

By pressing the preset call button 1 or 2, the seat will return to the registered seat position.

**CAUTION:**

**1 The operational conditions for the preset call operation is as follows.**

**AT model:**

<b>Ignition switch</b>	<b>Selector lever</b>	<b>Operational condition</b>
ON	"P" range position	Preset call allowed
ON	Other than the "P" range	Preset call prohibited
OFF	"P" range position	Preset call allowed
OFF	Other than the "P" range	Preset call allowed

**MT model:**

<b>Ignition switch</b>	<b>Parking brake</b>	<b>Operational condition</b>
ON	Applied	Preset call allowed
ON	Disengaged	Preset call prohibited
OFF	Applied	Preset call allowed
OFF	Disengaged	Preset call allowed

**2 If the following is performed while performing the seat preset call, the call out operation will be cancelled.**

- When power seat operation by manual switch is performed
- When preset call button 1 or 2 is pressed
- When the SET button is pressed

# POWERED SEAT SYSTEM WITH MEMORY PRESET (FROM '06MY)

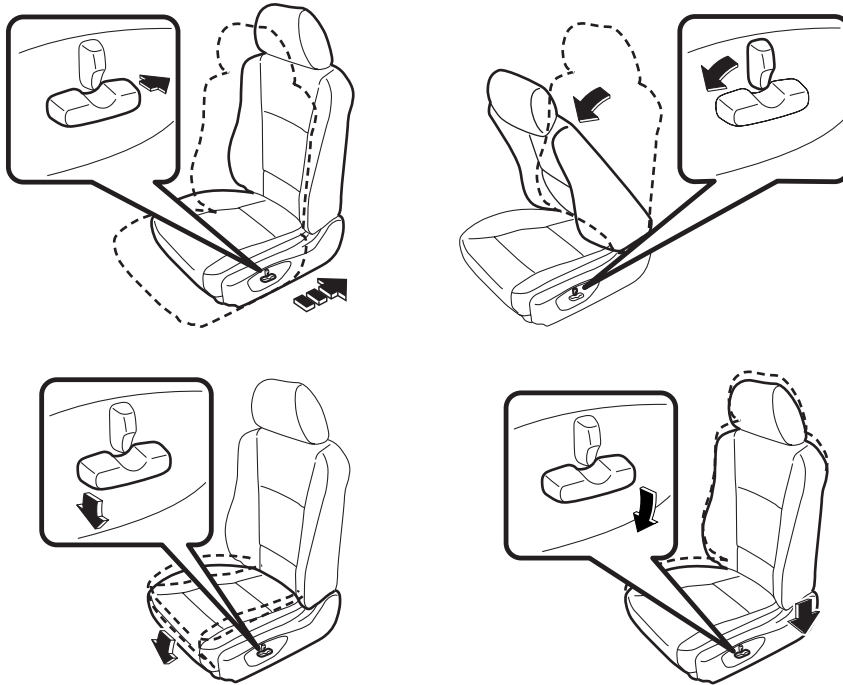
SEAT

## 3. INITIALIZATION

In relation to the reference position recorded by the memory unit, if the actual amount of seat movement does not match the pulse count, (eg. motor should only count up to 10 but counted to 11 during movement), the preset call operation may not function properly. If the registered position and the called out position differs, it is necessary to perform initialization.

NOTE:

Steps 1 to 4 may be performed in any order.



SE-00750

1. Operate the slide switch and move the seat towards the rear. Even after reaching the rearmost position, continue to operate the switch until a buzzer is heard.
2. Operate the reclining switch and move the back rest forward. Even after reaching the foremost position, continue to operate the switch until a buzzer is heard.
3. Operate the tilt switch and move the seat cushion downward. Even after reaching the lowest position, continue to operate the switch until a buzzer is heard.
4. Operate the lifter switch and move the seat cushion downward. Even after reaching the lowest position, continue to operate the switch until a buzzer is heard.
5. When the switch operation in the 4th step is turned from ON to OFF, if the initialization has been completed properly, the buzzer will sound 3 times.

NOTE:

If the following conditions occur, the initialization operation will be cancelled.

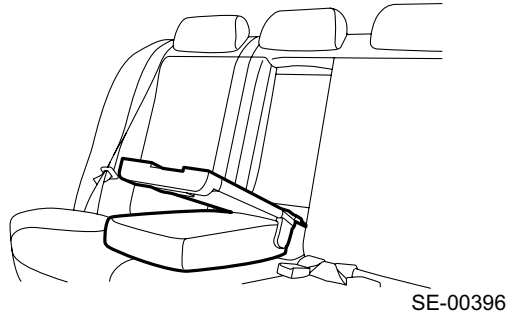
- If the interval of operations between steps 1 to 4 exceed 10 seconds
- If all operations from steps 1 to 4 are not performed
- If power is cut off during the operations of steps 1 to 4, or if the voltage to the unit falls below the operating voltage

## 3. Rear Seat

### A: OPERATION

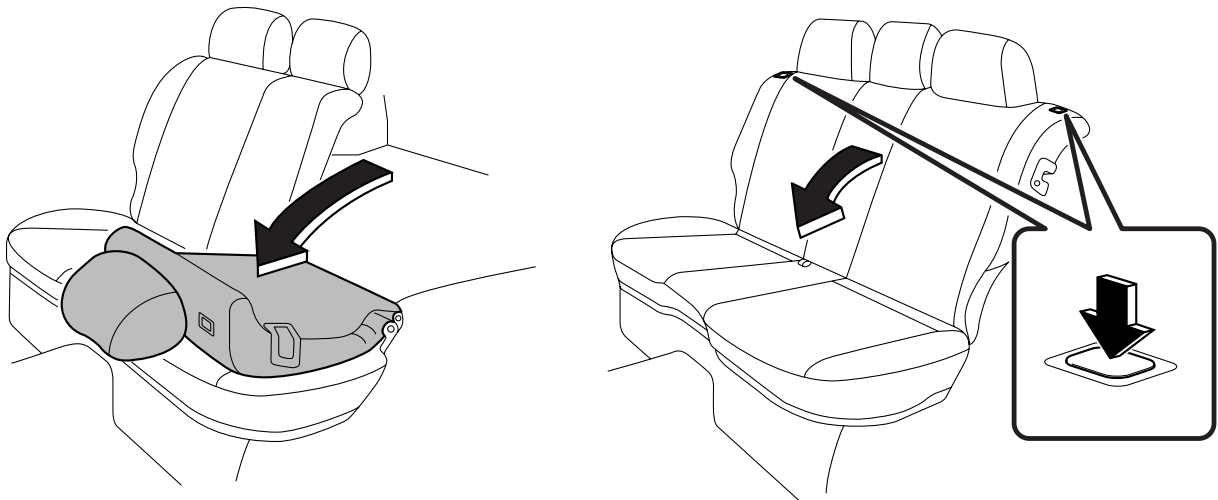
#### 1. SEDAN MODELS

The backrest has an armrest. It is also featured with a “center through” function.



#### 2. WAGON MODELS

- Unlock the backrest by pushing the release button and then fold the backrest forwards.
- The backrest and shoulder portions are separated to improve support of the rear passenger's body. The backrest is also provided with a single-action folding feature, which contributes to form a flat luggage room by folding only the backrest forwards.



SE-00377

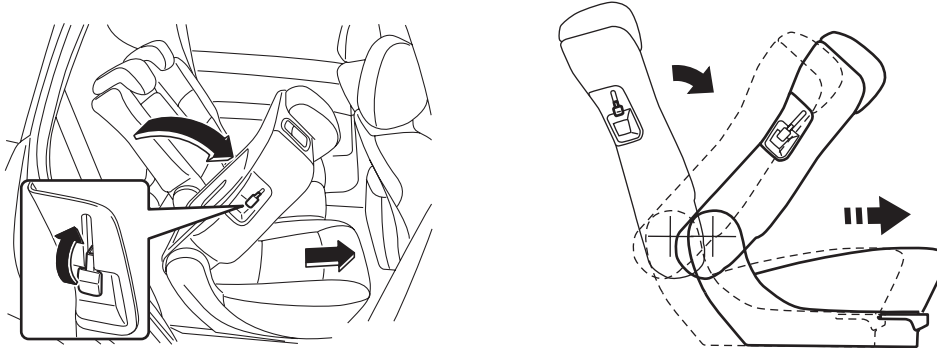
# WALK-IN FEATURE (FROM '06MY)

SEAT

## 4. WALK-IN Feature (From '06MY)

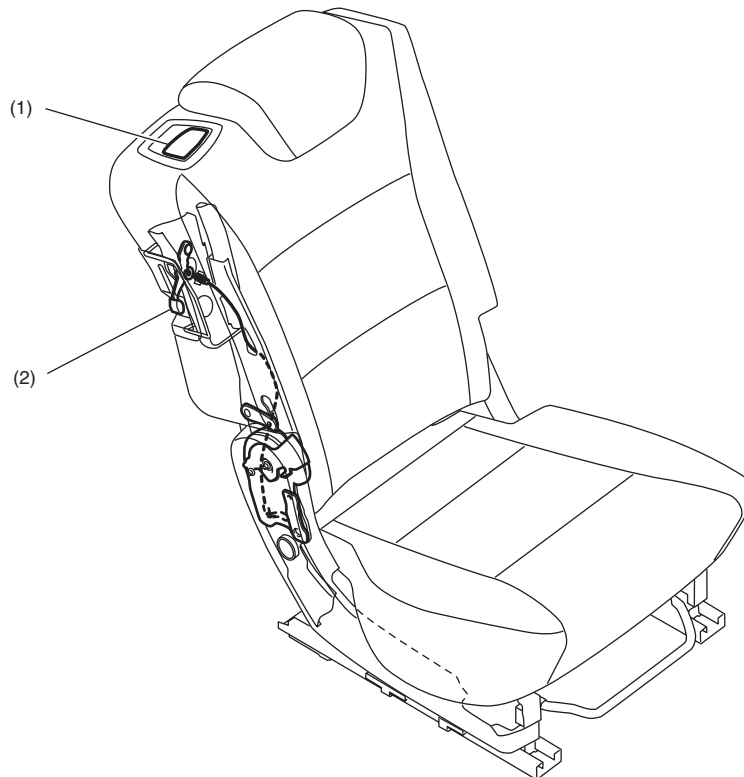
### A: GENERAL

A WALK-IN feature is provided on the second row seats to make it easier for the 3rd row passengers to get in and out of the vehicle.



SE-00752

### B: MECHANISM



SE-00753

(1) Reclining lever

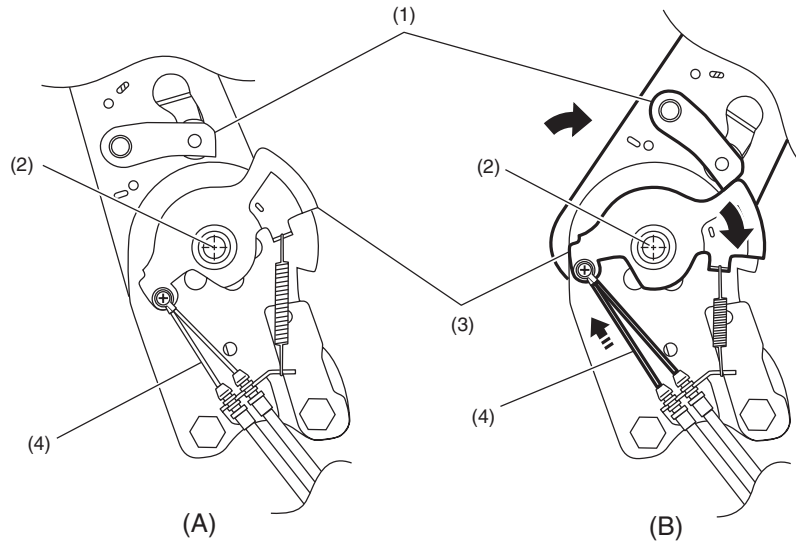
(2) WALK-IN lever



## C: FUNCTION

### 1. FOLDING

When the WALK-IN lever is operated, the recliner is released through a wire inside the seat, and the seat backrest will fold forward. This will press the WALK-IN bracket against the lock plate, and rotate centered on the hinge center, pulling the slide release cable, and the seat slide lock will be released.



SE-00754

(A) When locked

(B) When folded

(1) Lock plate

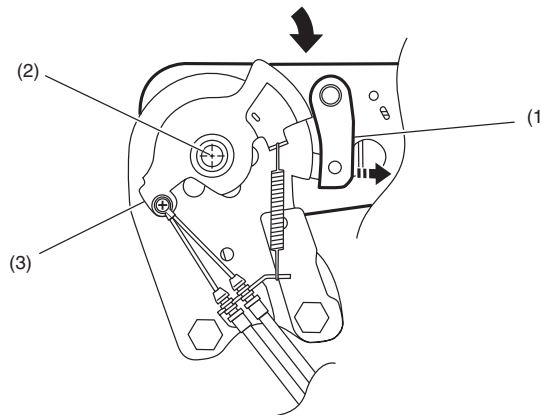
(3) WALK-IN bracket

(4) Slide release cable

(2) Hinge center

### 2. WHEN FOLDED FORWARD

When the reclining lever is operated, the lock plate is pulled up with the wire. The pulled up lock plate is maintained at that position, and it will become possible to fold forward.



SE-00755

(1) Lock plate

(2) Hinge center

(3) WALK-IN bracket

# OCCUPANT DETECTION SYSTEM (UNTIL '05MY)

SEAT

## 5. Occupant Detection System (Until '05MY)

### A: GENERAL

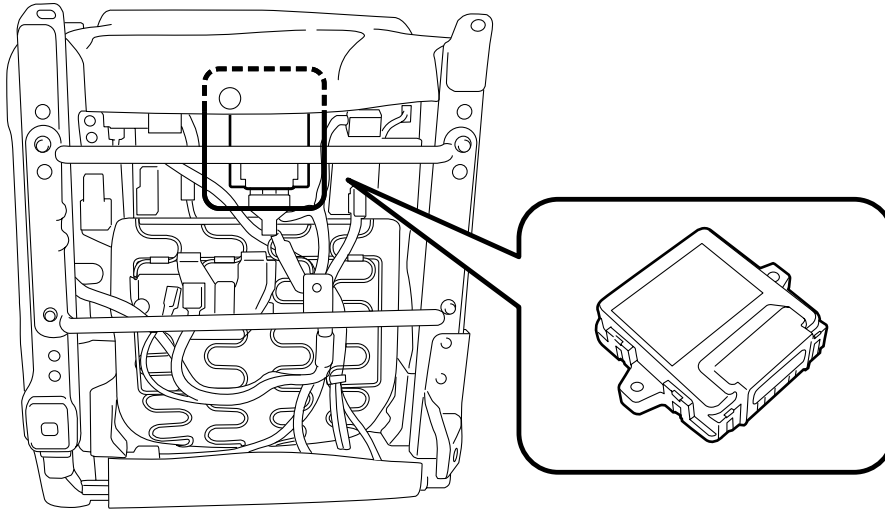
The passenger's seat is equipped with an occupant detection system, which consists of an occupant detection control module and four loadcell sensors, etc.

The occupant detection system sends signals to control the deployment of the passenger's seat air-bag when a child or small person is sitting in the passenger's seat.

### B: SYSTEM CONFIGURATION

The components of the occupant detection system are integrated as a seat cushion frame assembly; the assembly cannot be disassembled and the components cannot be replaced separately.

#### 1. OCCUPANT DETECTION CONTROL MODULE

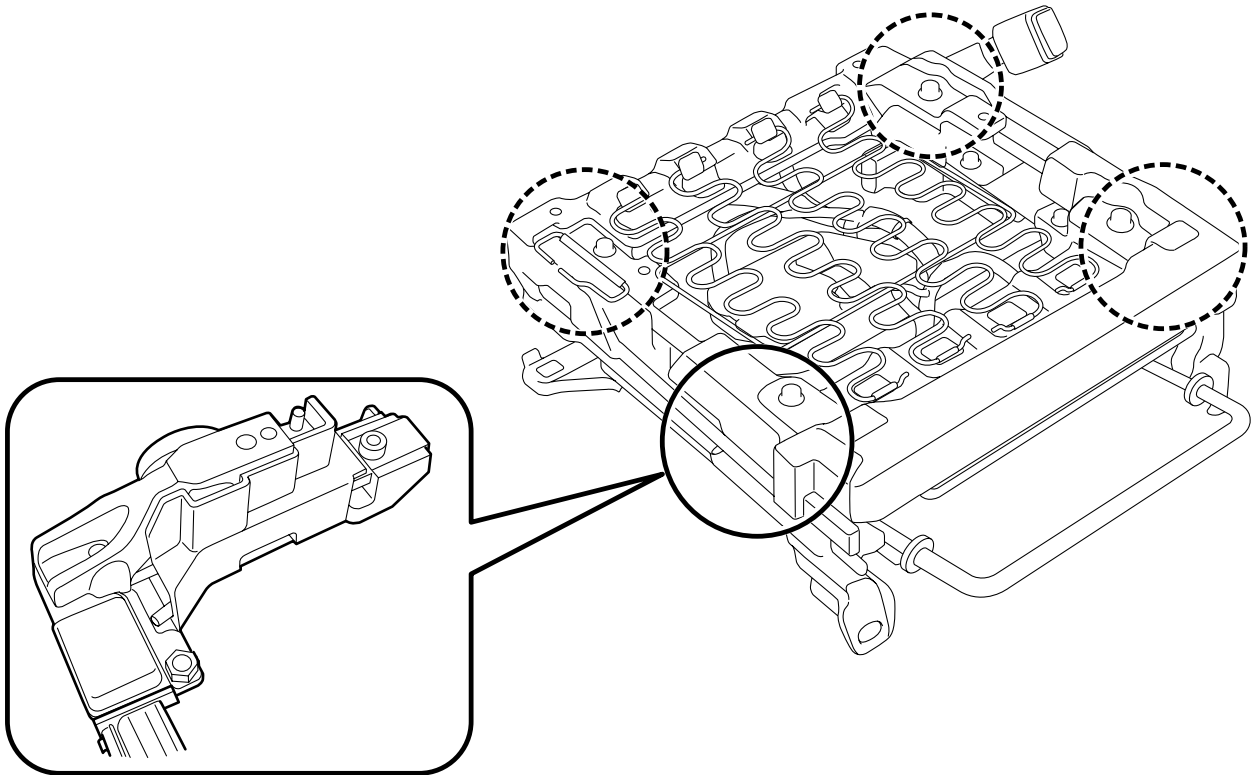


SE-00475

The occupant detection control module is installed under the passenger's seat and detects the presence/absence and physique of the person sitting in the passenger's seat based on signals sent from the loadcell sensors to send signals to the airbag control module.

If there is any abnormality in the occupant detection control module, the airbag warning light in the combination meter illuminates to warn the driver of system abnormality. Diagnostic trouble codes can be read by using a Subaru select monitor.

## 2. LOADCELL SENSOR



SE-00476

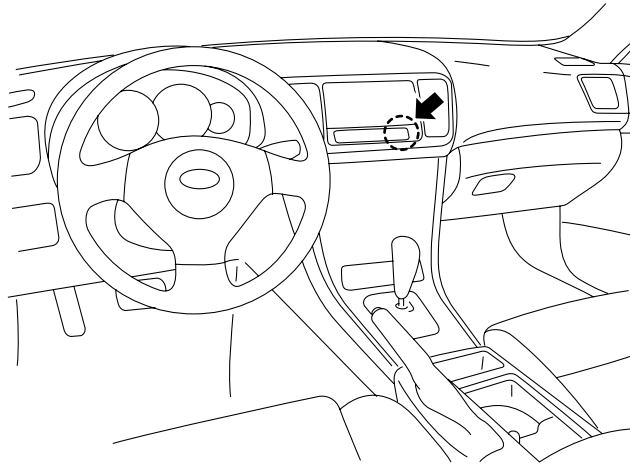
Four loadcell sensors are installed on the passenger's seat and each sensor measures the load to send signals to the load occupant detection control module.

# OCCUPANT DETECTION SYSTEM (UNTIL '05MY)

SEAT

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## 3. PASSENGER'S SEAT AIRBAG INDICATOR



SE-00477

The passenger's seat airbag indicator light is built in the center part of the instrument panel. The light indicates the result judged by the occupant detection control module.

Depending on the occupant detection control module's decision, the passenger's seat airbag may not deploy even in case of a frontal collision, however, the driver's seat airbag will deploy and the driver/passenger seat belt pretensioners are controlled to activate. Also, the driver/passenger seat side airbags and the left/right curtain airbags are controlled to activate.

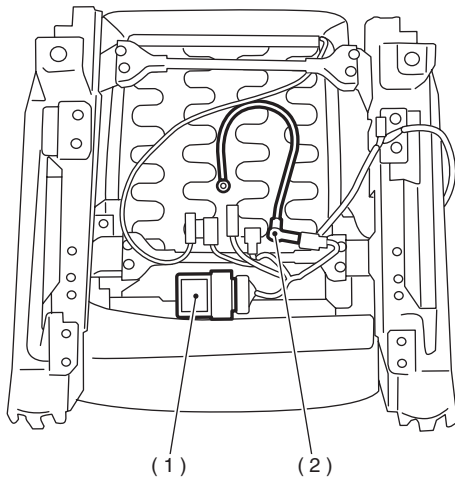
For initial check of the occupant detection system, both the ON (will deploy) and OFF (will not deploy) indicators will illuminate for about 6 seconds after the ignition switch is turned ON, and then turns OFF simultaneously for 2 seconds.

## 6. Occupant Detection System (From '06MY)

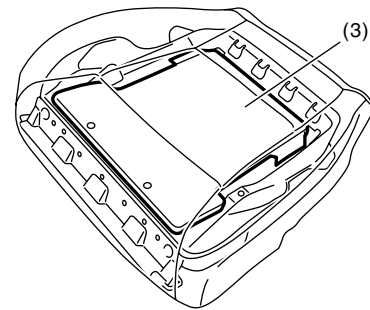
### A: GENERAL

In '06MY, the occupant detection system was changed. The loadcell sensor that is located between the seat cushion and the seat frame consists of the bladder (bag) containing silicon gel and the pressure sensor connected with a hose. When the passenger sits in the passenger's seat, the silicon gel contained in the bladder is pushed. The loadcell sensor measures this pressure, and then it sends the signal to the occupant detection control module. The occupant detection control module detects the physique of the person sitting in the passenger's seat based on the signals, and then it sends the control signal to the airbag control module.

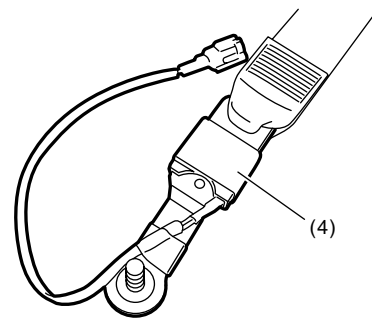
The belt tension sensor was also added to the outer seat belt. The belt tension sensor detects the status that seat belt is continuously tensioning (when the child seat is attached to the passenger's seat, etc.), and then it sends the signal to the occupant detection control module.



SE-00666



SE-00667



SE-00668

- (1) Occupant detection control module
- (2) Loadcell sensor
- (3) Bladder (with silicon gel)
- (4) Belt tension sensor

# OCCUPANT DETECTION SYSTEM (FROM '06MY)

SEAT

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MEMO

# SUNROOF

SUNROOF/T-TOP/CONVERTIBLE TOP

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## 1. Sunroof

### A: SEDAN MODELS

#### 1. DESCRIPTION

The sunroof operates on an automatic opening/closing system including tilt and slide mechanisms.

- A motor with a built-in microprocessor is used for the sunroof motor, which provides one-touch automatic opening and closing functions with a jamming prevention feature. (The system operates in auto mode when the switch is pushed for more than 0.3 seconds.)
- Reduced thickness of the sunroof provides extra overhead clearance in the passenger compartment.
- The frame, glass lid and mechanism parts are refined to reduce considerable amount of weight.

#### 2. FUNCTION

##### ● Sunroof tilting and sliding operation

- With the glass lid fully closed, pushing the rear side of the tilt switch causes the rear end of the glass lid to rise by 30 mm (1.18 in). Pushing then the front side of the switch causes the lid to lower to the original position.
- Pushing the OPEN/CLOSE switch rearward causes the glass lid to slide rearward and open. Pushing the switch forward causes the glass lid to move forward and stop at a point 150 mm (5.91 in) before the fully closed position. Pushing the switch again closes the lid completely.

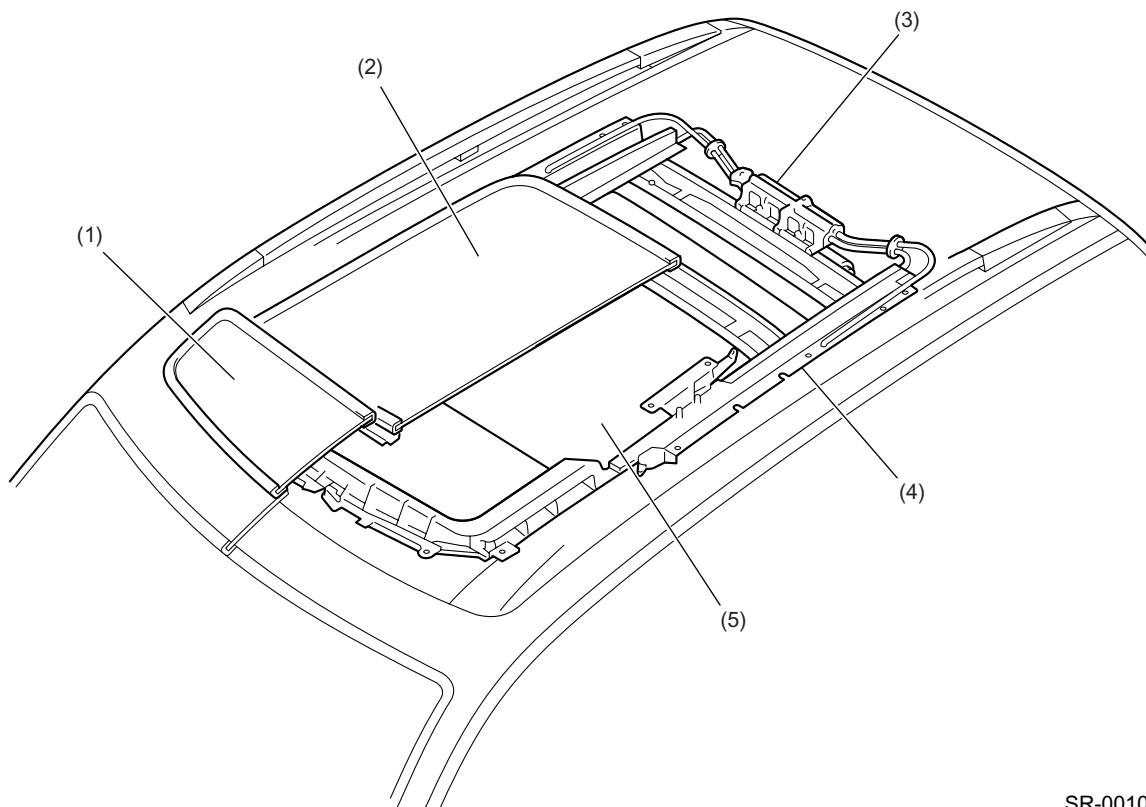
##### ● Sunshade operation

- The sunshade can be opened or closed manually when the glass lid is closed.
- The sunshade moves rearward together with the glass lid when the OPEN side of the OPEN/CLOSE switch is pushed. (When closed, only the glass lid moves.)

## B: WAGON MODELS

### 1. DESCRIPTION

The sunroof operates on an automatic opening/closing system, and the joined opening area consists of a tilting front glass lid and a sliding rear glass lid.



SR-00105

- (1) Front glass lid
- (2) Rear glass lid
- (3) Motor
- (4) Frame
- (5) Sunshade

- The sunroof openings are joined to form a single, wide opening (720 mm (28.35 in) long and 600 mm (23.62 in) wide), aiming to improve the “open and free” feeling to a great extent.
- A motor with a built-in microprocessor is used for the sunroof motor, which provides one-touch automatic opening and closing functions with a jamming prevention feature. (The system operates in auto mode when the switch is pushed.)
- The frame, glass lid and mechanism parts are refined to reduce considerable amount of weight.
- The contour and tilt-up angle of the front glass lid are refined to enhance the effect as a deflector and reduce the wind blowing into the cabin when the sunroof is open. Also, the edge shape of the front glass lid is optimized to minimize unpleasant wind shearing noise.



# SUNROOF

SUNROOF/T-TOP/CONVERTIBLE TOP

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## 2. FUNCTION

### ● **Open and close operations**

- When the switch is pushed rearwards, the rear edge of the front glass lid tilts up by 45 mm (1.77 in).
- When the switch is pushed forwards, the front glass lid tilts down to the fully closed position and then stops.
- When the sunroof switch is pushed rearwards while the front glass lid is fully closed, the rear end of the front glass lid stops at a position ready for tilting up. When the switch is pushed again, the rear end of the front glass lid further tilts up to a position of 70 mm (2.76 in), and the rear glass lid slides and opens to a position 410 mm (16.14 in) from the rear end of the front glass lid and stops. When the sunroof switch is pushed again, the rear glass lid opens to the wide-open position [550 mm (21.65 in) from the front glass lid rear end].
- When the sunroof switch is pushed forwards while the rear glass lid is at its wide-open position, the rear glass lid moves forward, and then comes to a stop when its front end reaches a position 150 mm (5.91 in) from the rear end of the front glass lid. When the sunroof switch is pushed again, the rear glass lid moves to the fully closed position, and the front glass lid closes until it reaches its tilted up position. When the sunroof switch is pushed once more, the front glass lid tilts down to the fully closed position.

### ● **Sunshade operation**

- When the front glass lid tilts up, the shade opens at its front edge by 20 mm (0.79 in) in connection with the lid, to improve ventilation. However, when tilting down the shade will not move in connection with the front glass lid so the shade must be manually closed.
- The sunshade automatically opens or closes together with the rear glass lid. However, when completely closing the sunroof, the sunshade will come to a stop at a position 170 mm (6.69 in) before the fully closed position even when the front glass lid is completely tilted down. Close the shade manually after the glass lid is completely closed.

# UNDER COVER

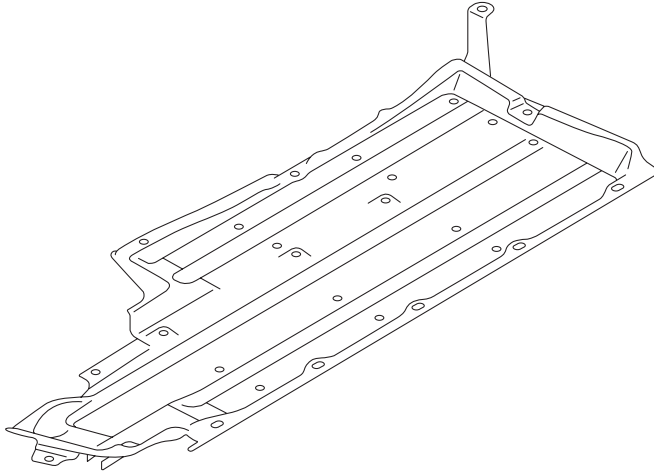
EXTERIOR/INTERIOR TRIM

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## 1. Under Cover

### A: FLOOR UNDER COVER

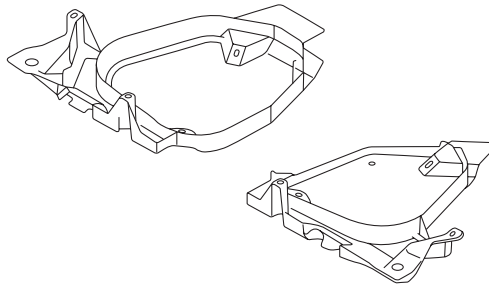
- A floor under cover is installed to both sides of the vehicle's floor part to improve the aerodynamic characteristics at the underside of the vehicle.
- Taking recycling reasons into account, polypropylene (PP) material is used.



EI-00824

### B: FUEL TANK PROTECTOR

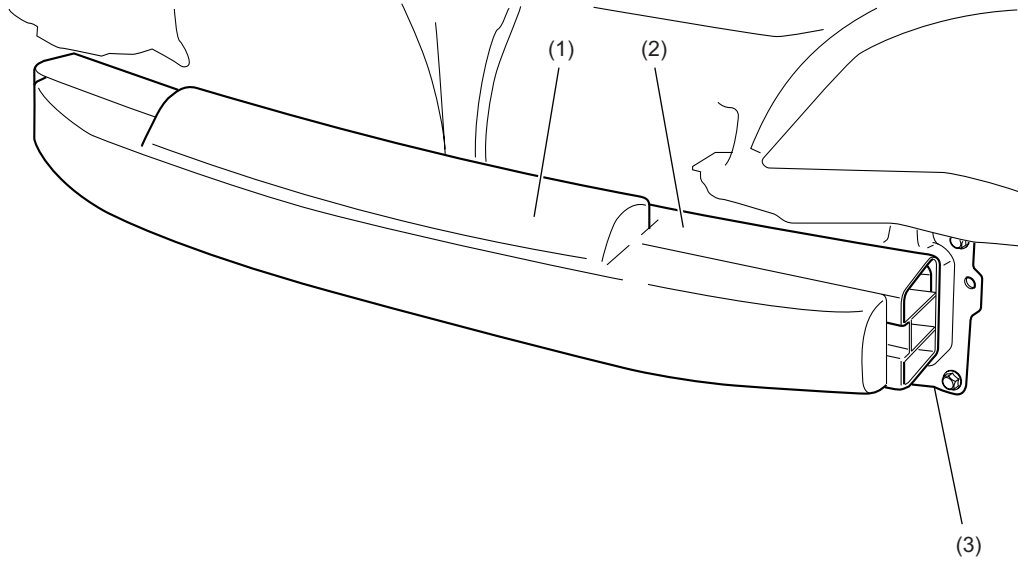
- A fuel tank protector is installed to prevent damage to the fuel tank by flying stones etc. during driving.
- Taking recycling reasons into account, polypropylene (PP) material is used.



EI-00825

## 2. Front Bumper Beam

A bumper beam assembly is placed inside the front bumper. The beam assembly is fastened to the chassis frame and absorbs the shock energy in case of a front collision to enhance safety of the vehicle.



EI-01034

- (1) Energy absorber foam
- (2) Bumper beam reinforcement
- (3) Bumper beam bracket

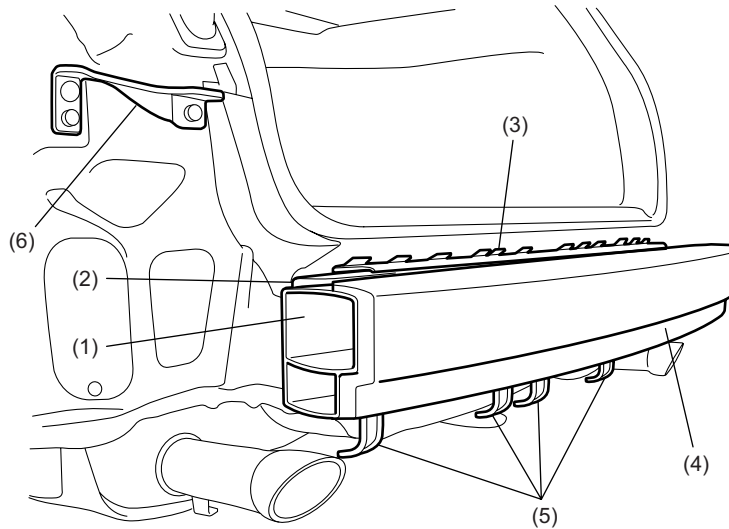
# REAR BUMPER BEAM

EXTERIOR/INTERIOR TRIM

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## 3. Rear Bumper Beam

- A bumper beam assembly is placed inside the rear bumper. The beam assembly is fastened to the chassis frame and absorbs the shock energy in case of a rear collision, etc. to reduce damage to the vehicle.
- The rear bumper assembly consists of a bumper face bracket, main beam, main beam bracket, and energy absorber foam made of PP foam.

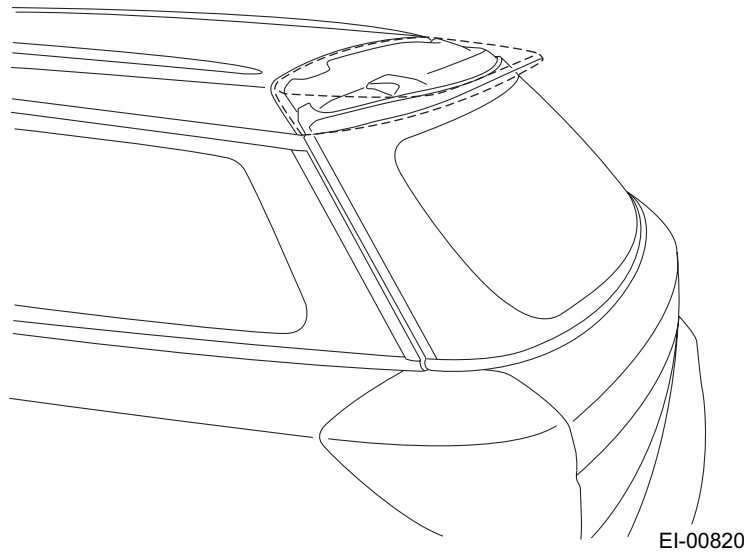


EI-01035

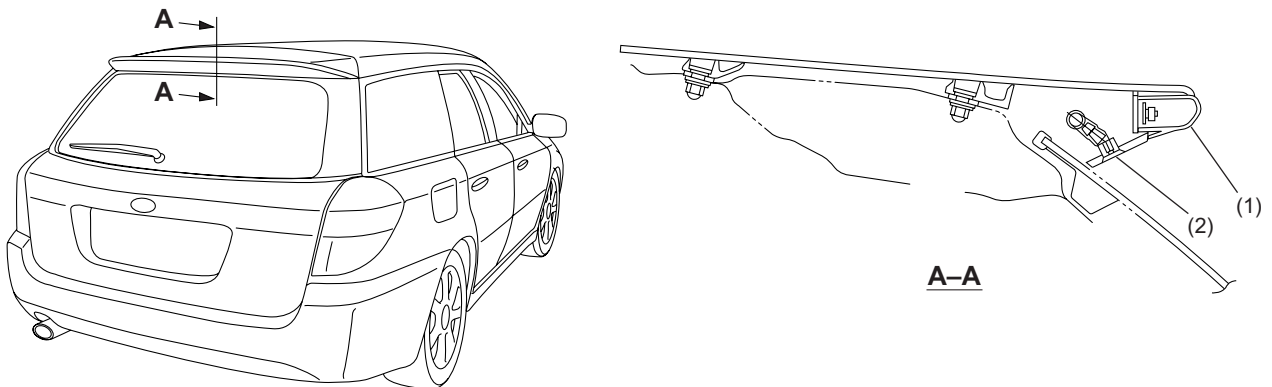
- |                       |                          |
|-----------------------|--------------------------|
| (1) Main beam         | (4) Energy absorber foam |
| (2) Main beam bracket | (5) Lower bracket        |
| (3) Beam upper rear   | (6) Corner bracket       |

## 4. Roof Spoiler (Wagon Models)

- The spoiler is built into the rear gate and is provided as standard equipment.



- In connection with providing the spoiler on all models, the high mount stop light and rear washer nozzle are incorporated in the roof spoiler.



EI-00821

(1) High mount stop light

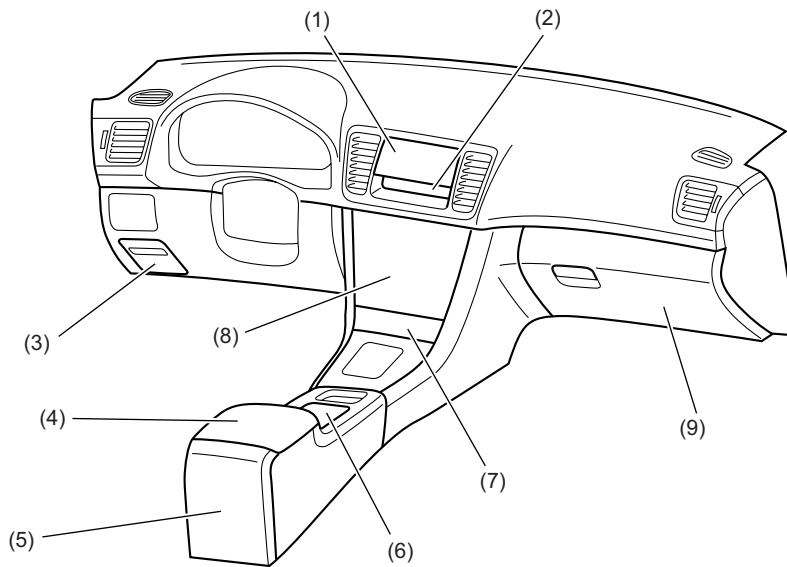
(2) Rear washer nozzle

# INSTRUMENT PANEL

EXTERIOR/INTERIOR TRIM

## 5. Instrument Panel

- By modularizing the panel with the steering support beam, a sufficient rigidity is obtained, its quality is stabilized, and maintainability is improved.
- By tilting the center panel toward the driver, its operability and visibility is improved.
- There is no longer a split line between the passenger's airbag module lid and the instrument panel, contributing to a better appearance.
- Taking recycling reasons into account, PP resin is used for the main body. The entire upper part of the instrument panel is covered with urethane foam material with a soft surface skin. This material feels soft while it also contributes to protect passengers.
- An insulator is installed to the backside of the instrument panel. The insulator absorbs noise from the engine room and contributes to improve the quietness in the cabin.
- The panel is upholstered as far as the leg area of front passenger to improve the feel of material.

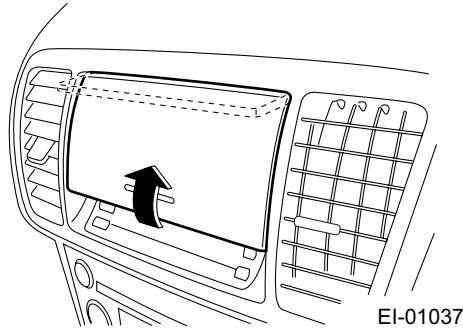


EI-01036

- |   |  |
|---|--|
| (1) Center pocket                       | (6) Cup holder for front seat passengers |
| (2) Clock                               | (7) Ashtray and cigarette lighter        |
| (3) Fuse box cover                      | (8) Center panel                         |
| (4) Console box                         | (9) Glove box                            |
| (5) Cup holder for rear seat passengers |  |

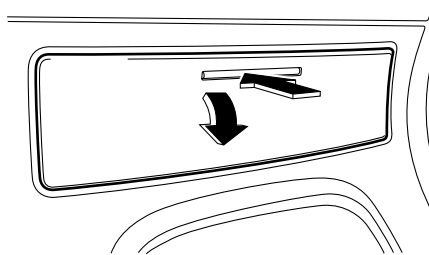
## A: CENTER POCKET

- A pocket with a lid is provided at the center of the instrument panel.
- Night illumination, which operates in connection with the lighting system, is provided.



## B: ASHTRAY AND CIGARETTE LIGHTER FOR FRONT SEAT PASSENGERS

- These are located at the lower part of the center panel and can be opened in one-push action.
- The ashtray and cigarette lighter are provided with night illumination, which operates in connection with the lighting system.



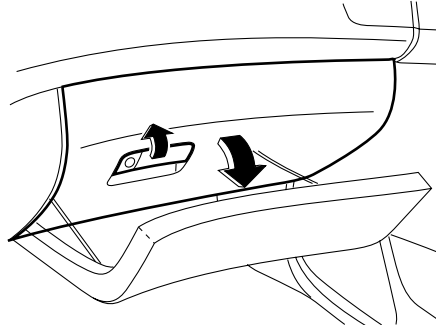
# INSTRUMENT PANEL

EXTERIOR/INTERIOR TRIM

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## C: GLOVE BOX

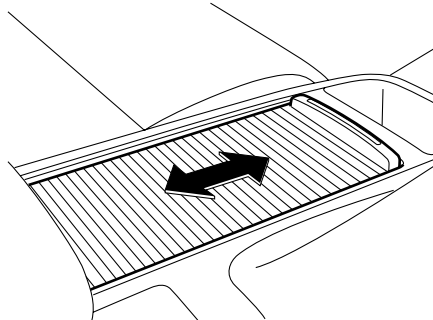
- The glove box is provided with a damper that controls the glove box lid to open slowly.
- It is also provided with night illumination that operates in connection with the lighting system.



EI-01068

## D: CUP HOLDER FOR FRONT SEAT PASSENGERS

- Provided with a shutter type lid that can be closed when the cup holder is not used.
- The cup holder can hold a container up to a 500 cc size plastic bottle or an L size paper cup.

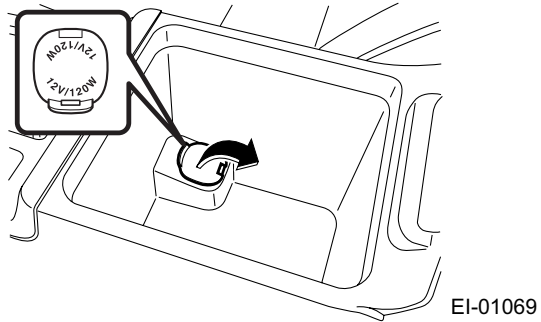


EI-00688



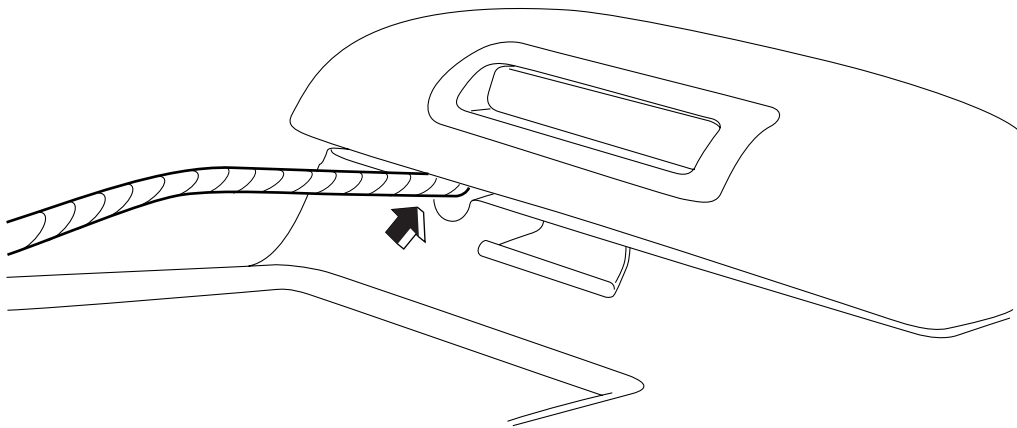
## E: CONSOLE BOX

- An accessory socket is provided in the console box.



EI-01069

- When using the socket, the cable can be routed out from the front of the console box so that the cable will not be trapped even when the console lid is closed.



EI-01038

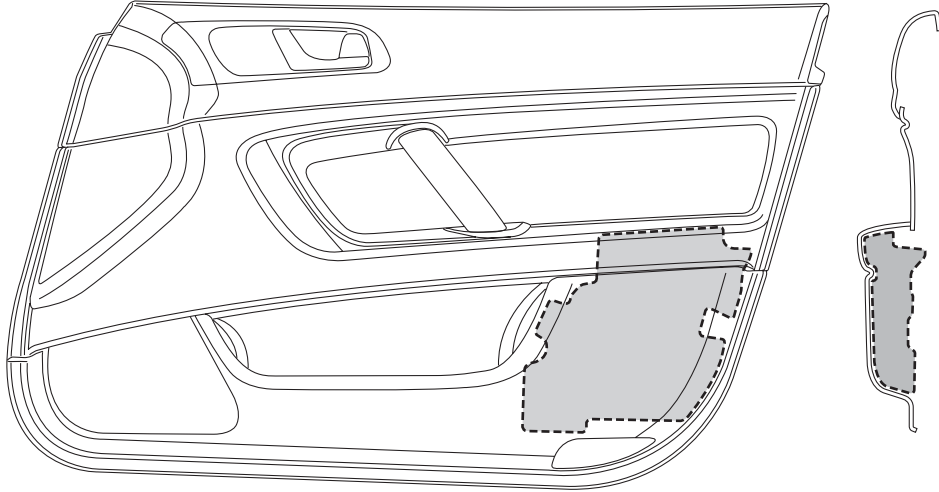
# DOOR TRIM

EXTERIOR/INTERIOR TRIM

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## 6. Door Trim

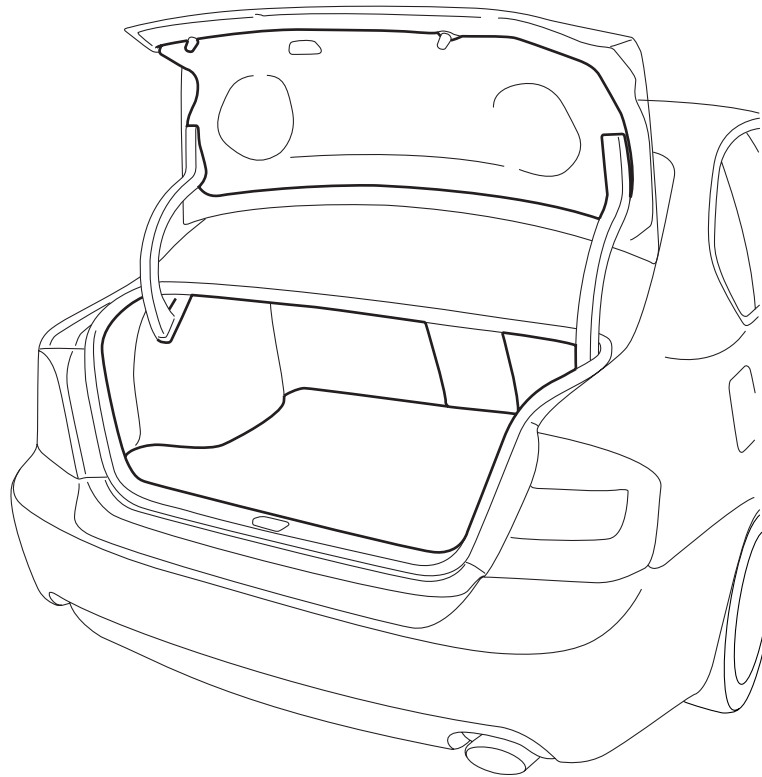
Shock absorbing pads installed to the backside of the front and rear door trims attenuate the impact due to a secondary collision.



EI-00826

## 7. Trunk Room Trim

Trunk lid trims and trunk lid arm covers are used to improve the feel of material.



EI-00823

# TRUNK ROOM TRIM

EXTERIOR/INTERIOR TRIM

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**MEMO**

# FRONT HOOD

EXTERIOR BODY PANELS

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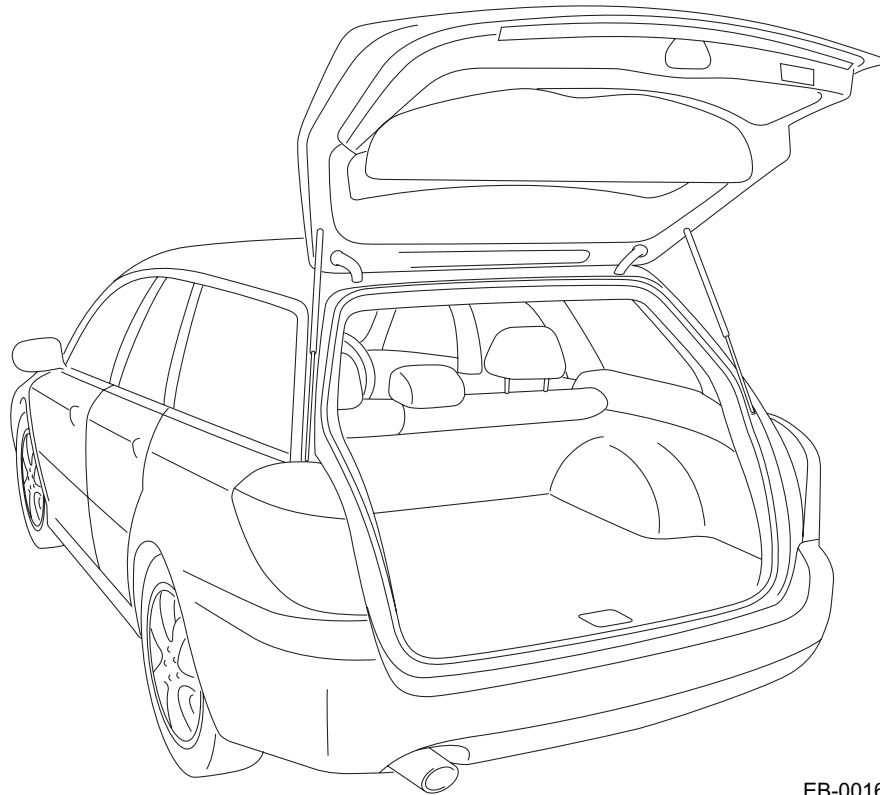
## 1. Front Hood

An aluminum hood is used on all models to reduce weight.

## 2. Rear Gate Panel

An aluminum rear gate panel is used on all models.

By changing the material to aluminum, the weight is reduced and the opening and closing of the rear gate is facilitated.



EB-00166

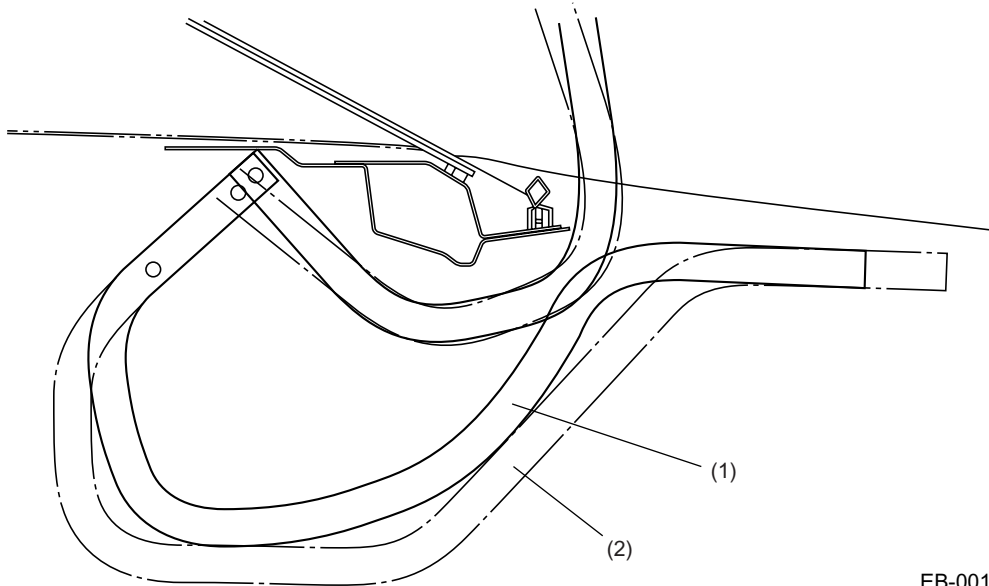
# TRUNK LID

## EXTERIOR BODY PANELS

### 3. Trunk Lid

#### A: TRUNK LID ARM

By minimizing the size of the trunk lid arm, the traveling radius of the arm is made smaller to acquire a wider cargo space.

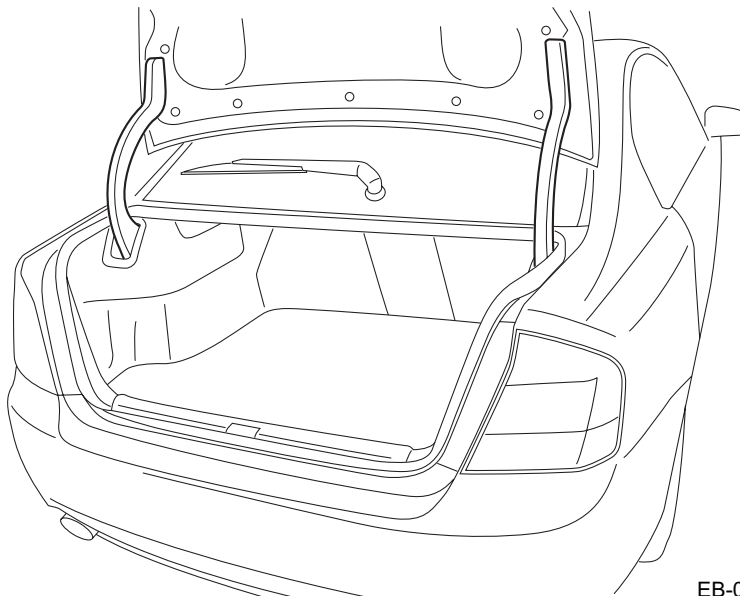


EB-00167

(1) New type

(2) Former type

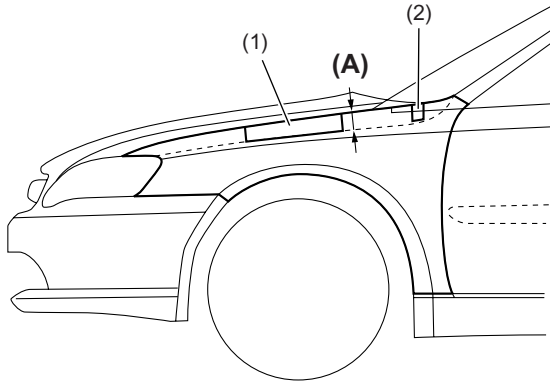
The trunk lid arm is stored inside the trunk trim when the trunk lid is closed. This prevents the luggage from interfering with the arm when closing the trunk.



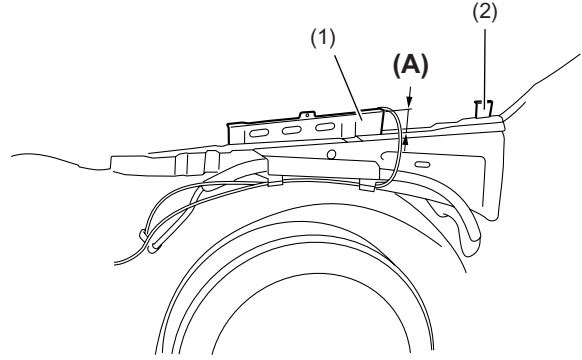
EB-00168

## 4. Front Fender Panel

By providing a clearance (A) between the wheel apron upper area and the fender upper area, the impact absorbing capacity and pedestrian protection is enhanced.



(1) Fender extension, front



(2) Fender extension, rear

EB-00172

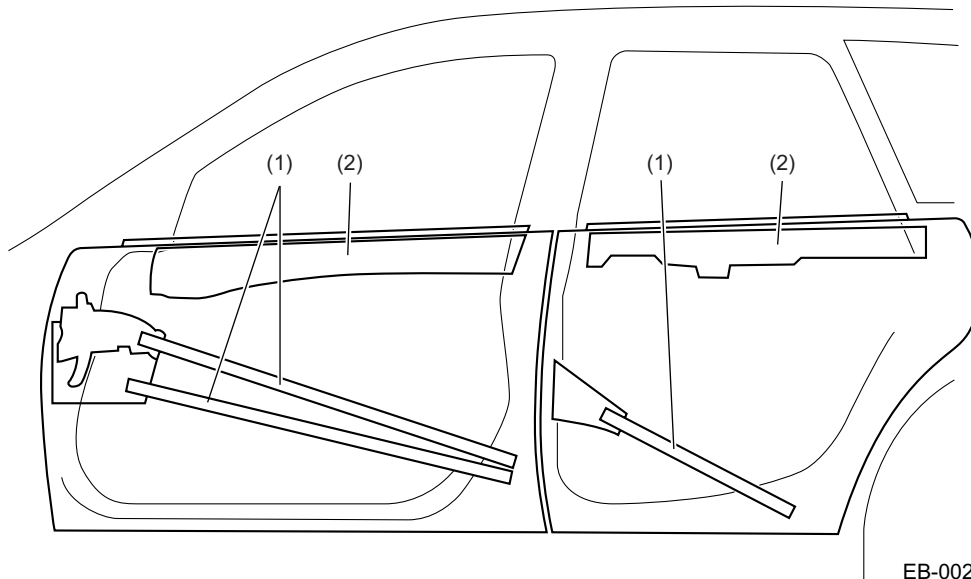


# DOOR

## 5. Door

### A: DOOR CONSTRUCTION

- The front and rear doors have in their inside a side door beam and a window shoulder area reinforcement.

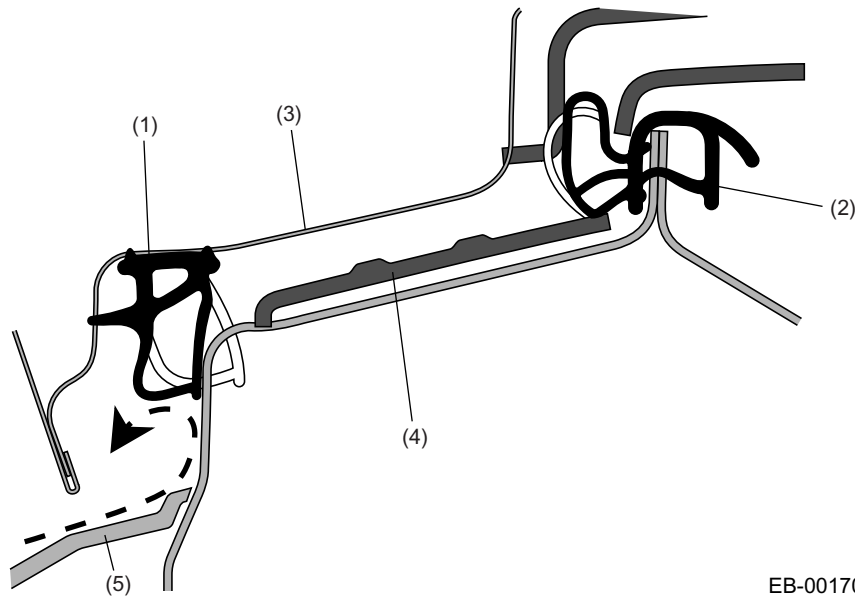


EB-00229

(1) Side door beam

(2) Window shoulder area reinforcement

- Tight closure of each door is ensured by the double weather strip at the bottom which also reduces intruding noise.



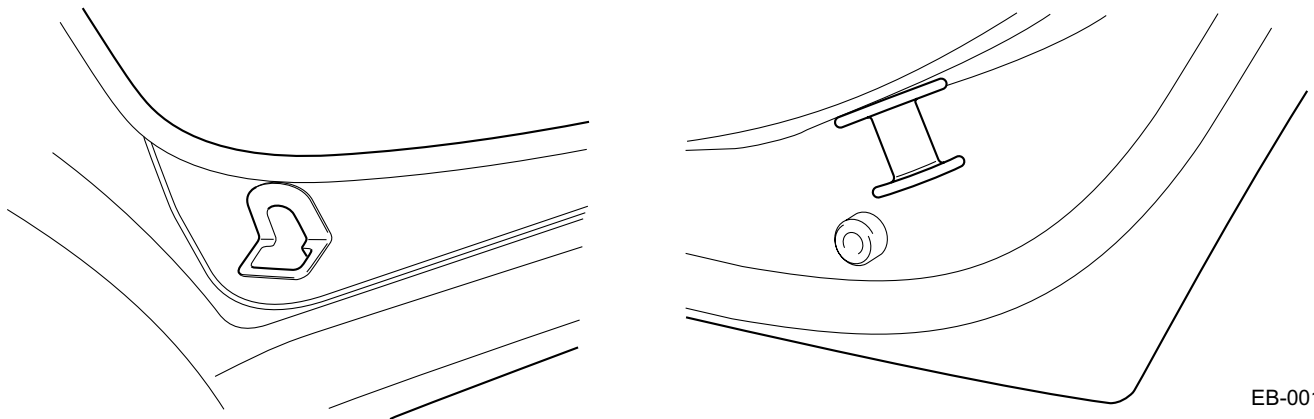
EB-00170

- (1) Outer weather strip
- (2) Inner weather strip
- (3) Door panel

- (4) Scuff plate
- (5) Side sill spoiler

### B: REAR DOOR CATCHER

This prevents the rear door from deflecting into the cabin in case of a side collision.



EB-00171

# DOOR

EXTERIOR BODY PANELS

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**MEMO**

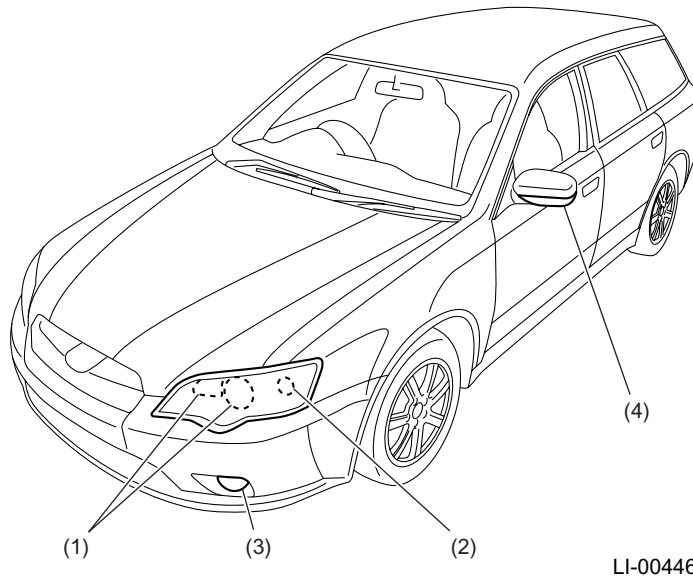
# FRONT

## LIGHTING SYSTEM

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### 1. Front

#### A: GENERAL



LI-00446

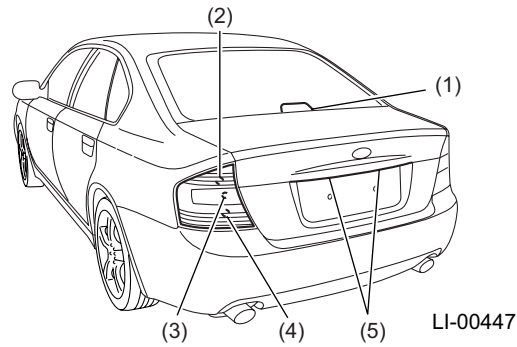
- |  |                            |
|--|----------------------------|
| (1) Headlight  | (3) Front fog light        |
| (2) Front turn signal/parking, front side marker light | (4) Side turn signal light |

- The headlight of all models consists of four halogen bulbs, and projector type low beam lights are used.
- The front turn signal/hazard warning light, parking/front side marker light and the front side reflex reflector are incorporated into the headlight.
- The fog light is either of a projector type or a large sized multiple reflector type.
- On some models, the side turn signal lights are built into the lower part of the door mirrors to improve visibility. Also, LEDs (light emitting diodes) are used for light source to improve the durability.

## 2. Rear

### A: GENERAL

#### Sedan models



(1) High mount stop light

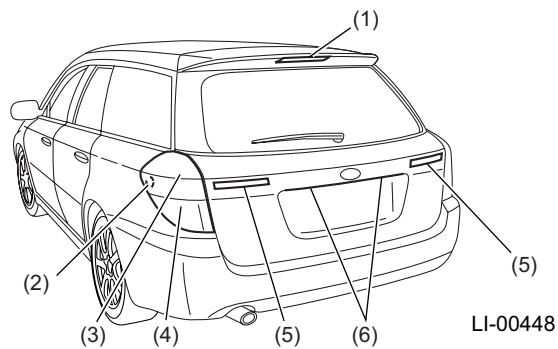
(2) Turn signal/hazard warning light

(3) Backup light

(4) Stop/tail/rear side marker light

(5) License plate light

#### Wagon models



(1) High mount stop light

(2) Rear side marker light

(3) Stop/tail light

(4) Turn signal/hazard warning light

(5) Backup light

(6) License plate light

## REAR

### LIGHTING SYSTEM

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- On sedan models, the rear turn signal/hazard warning light, stop/tail/rear side marker light, and the backup light are incorporated into the rear combination light. On wagon models, the rear turn signal/hazard warning light, stop/tail light, and the rear side marker light are incorporated into the rear combination light. On both the sedans and wagons, the rear reflex reflector and the rear side reflex reflector are incorporated into the rear combination light. On wagons, the backup lights are built in the rear gate garnish.
- The high mount stop light is installed to the bottom inside of the rear window on sedans, and to the rear of the roof spoiler on wagons.
- By using LEDs (light emitting diodes) as light source for the high mount stop light on wagon models, space is saved, efficiency is improved, and power consumption is reduced while the durability is improved.

# AUDIO SYSTEM

## ENTERTAINMENT SYSTEM

### 1. Audio System

#### A: GENERAL

##### 1. AUDIO

Three types are provided.

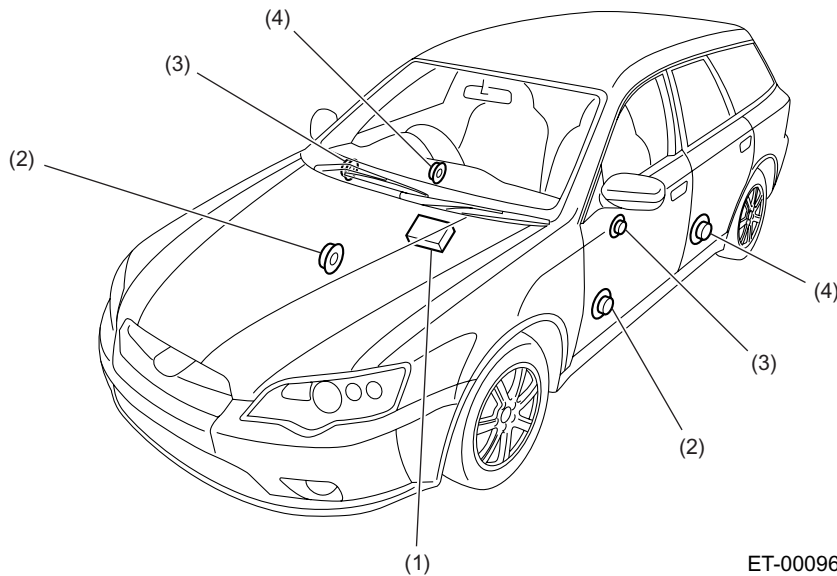
- Audio sets of all grades are shaped in a non-standard form to make them fit the contour of the instrument panel.
- All grades are CD-R/RW compatible\*.
- The highest grade audio system is also compatible with CD-R/CD-RWs\* containing MP3 files.
- The audio unit for automatic air conditioning equipped models has a built-in CD changer. Up to six CDs can be loaded.

\*: Some CD-R/RW discs with particular characteristics, scratches or dirty spots may not be usable.

##### 2. SPEAKERS

- On models with six speakers, a full-range speaker is installed to each door and a tweeter is installed to each front door.
- On models with seven speakers, a full-range speaker is installed to each door and a tweeter and sub woofer are installed to each front door. The sub woofer is mounted on the rear right quarter trim (wagons).

Models with the 6 speaker system

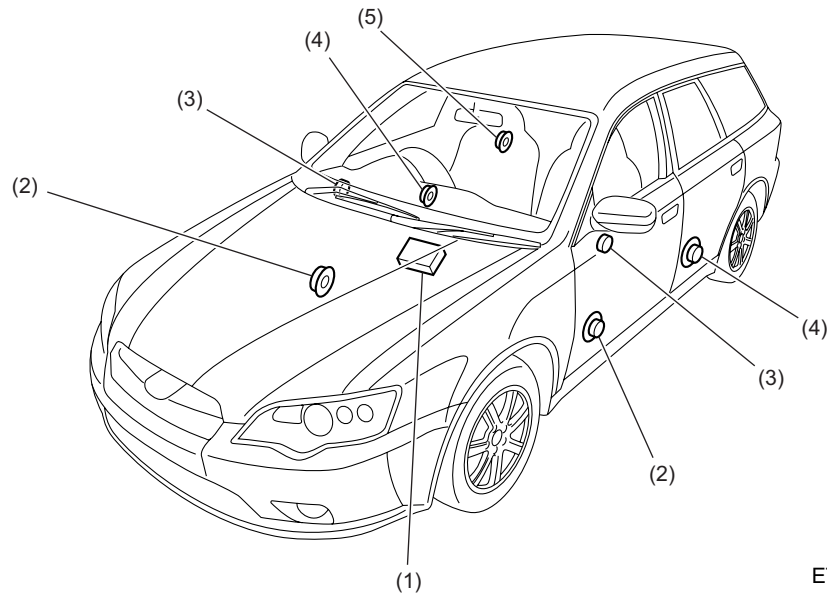


ET-00096

- (1) Audio unit
- (2) Front speaker

- (3) Tweeter
- (4) Rear speaker

## Models with the seven speaker system



ET-00152

- (1) Audio unit
- (2) Front speaker
- (3) Tweeter

- (4) Rear speaker
- (5) Woofer (wagons)

### 3. ANTENNA

- An on-glass antenna system is equipped on all models.
- The antenna amplifier is installed at the upper part of the rear left pillar on sedan models or at the upper center part of the rear gate on wagon models.



# SATELLITE SWITCHES

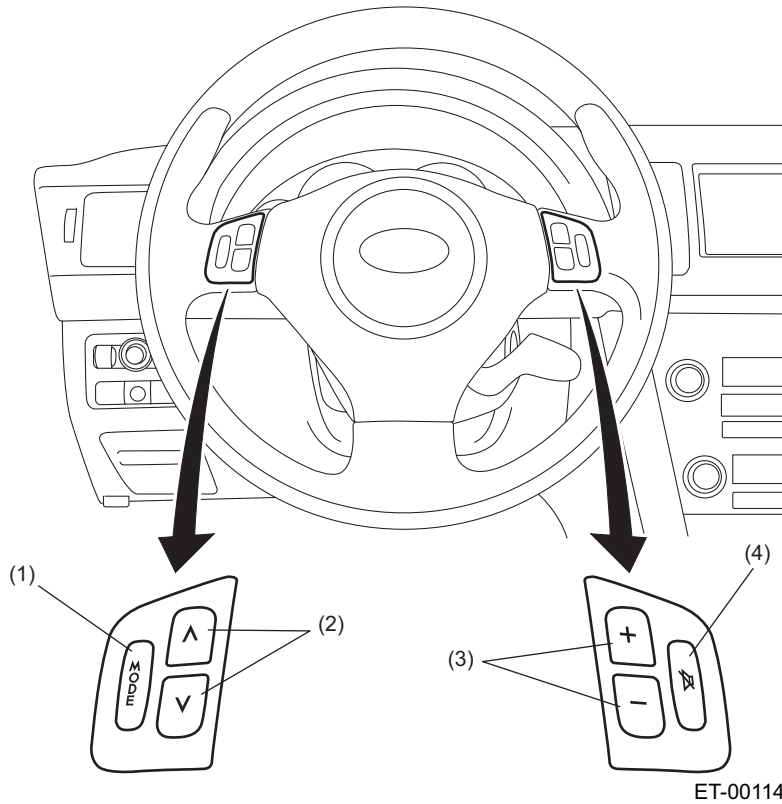
## ENTERTAINMENT SYSTEM

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### 2. Satellite Switches

#### A: GENERAL

The driver can operate the audio system without releasing the hand from the steering wheel, Illumination is provided for nighttime visibility.



- (1) Mode switch
- (2) ^ v (Up/down) switch

- (3) + - (volume) switch
- (4) Mute switch

## 1. MODE SWITCH

The mode of the audio system can be changed.

## 2. $\wedge$ $\vee$ (UP/DOWN) SWITCH

- When receiving radio or TV waves, the frequency can be changed upwards or downwards. When the receiver is tuned to a radio or TV station during the upward or downward seek, the seek stops. (seek up/seek down)
- While listening to a CD, the next track or previous track can be selected. (track up/track down)

## 3. + – (VOLUME) SWITCH

The sound level can be turned up or down.

## 4. MUTE SWITCH

The sound can be temporarily muted. When this switch is operated, "MUTE" is indicated on the audio display. The sound level is resumed when the switch is pushed again.

# SATELLITE SWITCHES

ENTERTAINMENT SYSTEM

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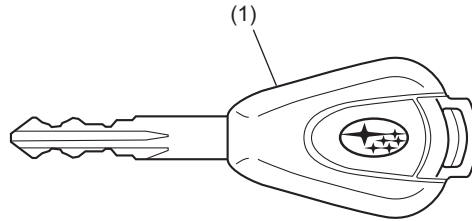
**MEMO**

# IGNITION KEY

## 1. Ignition Key

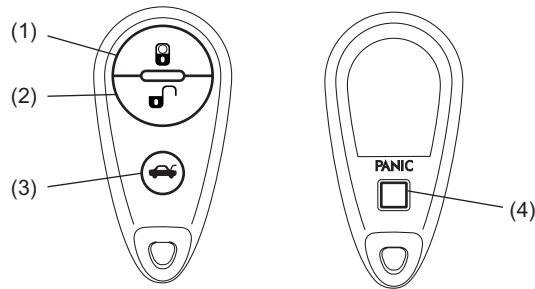
### A: GENERAL

- A keyless entry system with a keyfob type transmitter is introduced. On models with immobilizer system, a transponder is assembled in the key.



SL-00388

(1) Transponder built-in



SL-00389

- (1) Lock button
- (2) Unlock button

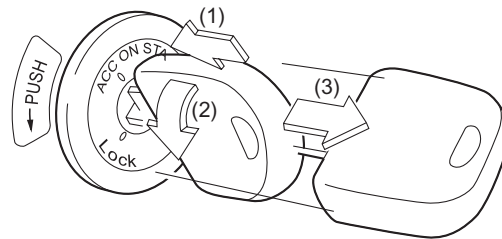
- (3) Trunk or rear gate button
- (4) Panic button

## 2. Ignition Switch

### A: GENERAL

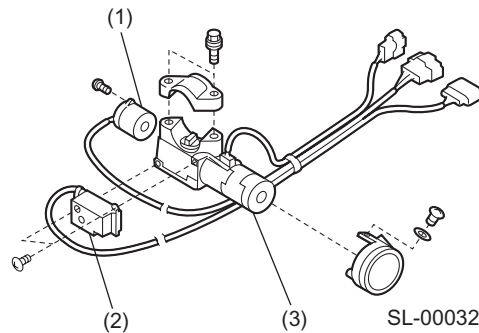
#### 1. IGNITION SWITCH

- The ignition switches on the MT models have a safety mechanism that prevents inadvertent locking of the steering wheel during driving. The driver cannot turn the ignition key from “ACC” to “LOCK” unless the key is pushed inward at the “ACC” position (arrow 1 in the drawing below).



SL-00031

- The ignition key for AT models can be turned to the LOCK position only when the select lever is in the P position.



SL-00032

- (1) Ignition switch
- (2) Key interlock solenoid (AT)
- (3) Ignition key cylinder

#### 2. KEY REMINDER CHIME

The reminder chime sounds when the driver’s door opens and the ignition key is in the “LOCK” or “ACC” position. The chime stops when the key is turned to the IGN position or removed from the ignition switch.

#### 3. IGNITION SWITCH ILLUMINATION

The ignition switch illumination is lit for 3 seconds and then gradually darkens and turns off after the driver’s door is closed. If the ignition switch is turned to the ON position while the ignition switch illumination is ON, the ignition switch illumination turns OFF immediately. The body integrated unit controls the delayed off function.

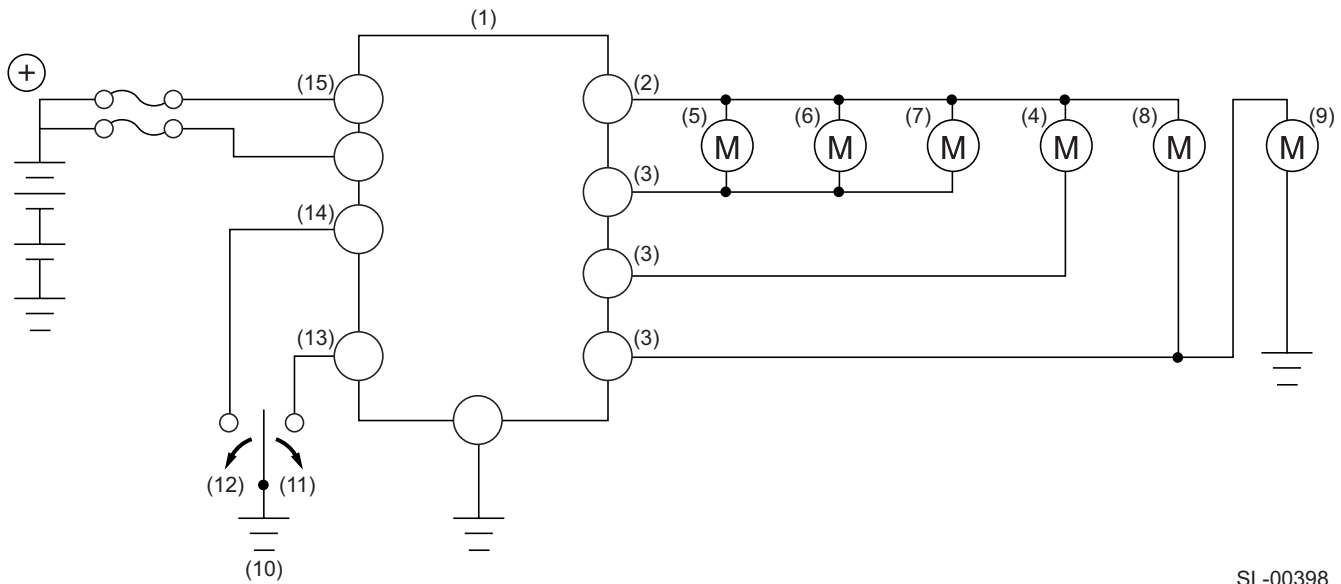
# POWER DOOR LOCK

## 3. Power Door Lock

### A: CONSTRUCTION

- The power door lock system consists of a body integrated unit, drivers door lock switch, front door lock actuators, rear door lock actuators, and a rear gate lock actuator.
- When the driver's/front passenger's door is locked or unlocked using the door lock switch, the other doors and the rear gate are also locked or unlocked automatically.

### B: SCHEMATIC DRAWINGS



SL-00398

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| (1) Body integrated unit             | (9) Trunk opener actuator (sedans) |
| (2) Lock output                      | (10) Door lock switch              |
| (3) Unlock output                    | (11) Unlock                        |
| (4) Front LH actuator                | (12) Lock                          |
| (5) Front RH actuator                | (13) Unlock switch                 |
| (6) Rear LH actuator                 | (14) Lock switch                   |
| (7) Rear RH actuator                 | (15) Battery                       |
| (8) Rear gate lock actuator (wagons) |                                    |

## 4. Keyless Entry System

### A: CONSTRUCTION

- The keyless entry system consists of a transmitter, keyless entry control unit (with a built-in antenna), body integrated unit, door lock actuators, door switches, hazard warning lights, buzzer, and the interior light.
- The keyless entry system operates on a radio frequency, so the transmitter can be used in almost all directions relative to the vehicle. However, in some radio wave conditions the system may not operate properly.

#### NOTE:

The customizing function enables selection of coupled operation with the hazard warning lights. <Ref. to SL-12, Customizing Function.>

### B: FUNCTION

#### 1. DOOR LOCKING

- 1) Push the LOCK button on the transmitter once.
- 2) All doors are locked.
- 3) Check that the buzzer sounds once and the hazard warning lights flash once.

#### 2. DOOR UNLOCKING (DRIVER'S DOOR)

- 1) Push the transmitter's UNLOCK button once.
- 2) The driver's door is unlocked and the interior light turns ON (when the interior light switch is set at the DOOR position).

#### NOTE:

The interior light illuminates for 15 seconds and then fades out. (However, if a door locking procedure is performed again during this period, the lights will go out immediately.) The extinguishing time can be changed with the customizing function.

- 3) Check that the buzzer sounds twice and the hazard warning lights flash twice.

#### 3. DOOR UNLOCKING (ALL DOORS)

- 1) Push the UNLOCK button on the transmitter 2 times within 5 seconds.
- 2) All doors are unlocked.
- 3) Check that the buzzer sounds twice and the hazard warning lights flash twice.

#### NOTE:

- When the unlock button is pushed while any of the doors (except rear gate or trunk) is open, all door locks are unlocked.
- When pushing the UNLOCK button on the transmitter twice to unlock all doors, the system may not respond if the interval between the 1st time and 2nd time is too short.

# KEYLESS ENTRY SYSTEM

## SECURITY AND LOCKS

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### 4. OPENING THE TRUNK

- 1) Push the TRUNK button on the transmitter for more than 1 second.
- 2) The trunk lid opens.
- 3) Check that the buzzer sounds twice and the hazard warning lights flash twice.

### 5. UNLOCKING THE REAR GATE LOCK

- 1) Push the TRUNK button on the transmitter once.
- 2) The rear gate lock is unlocked.
- 3) Check that the buzzer sounds twice and the hazard warning lights flash twice.

### 6. SELF POSITION DETECTION FUNCTION

- 1) Push the LOCK button on the transmitter 3 times within 5 seconds.
- 2) Check that the horn sounds once and the hazard warning lights flash 3 times.

### 7. PANIC ALARM

- 1) Push the panic button on the transmitter.
- 2) The horn sounds intermittently and the hazard warning lights will flash too. The panic alarm sounds for 30 seconds, however, to stop the alarm within this 30 seconds period, push any button on the transmitter.

### 8. ANSWER BACK (BUZZER SIGNALING) ON/OFF SELECTION

- 1) Push the UNLOCK button on the transmitter.
- 2) Push the LOCK and UNLOCK buttons on the transmitter simultaneously for more than 2 seconds to deactivate the answer back function. The function is armed again when the same operation is repeated.
- 3) When the answer back function is activated, the buzzer will sound once and the hazard warning lights flash once. When it is deactivated, the buzzer will sound twice and the hazard warning lights flash twice.

### 9. DOOR OPEN WARNING FUNCTION

The buzzer sounds five times and the hazard warning lights flash five times if the LOCK button on the transmitter is pressed with any door, the rear gate, or the trunk lid open.

### 10. TRANSMITTER REGISTRATION

- Up to 4 transmitters per vehicle can be registered.
- For the transmitter registration method, see Service Manual.



## 5. Alarm System (Burglar Alarm System)

### A: FEATURES

- The alarm system protects the vehicle from a theft action (unauthorized entry into the vehicle). Upon detection of such an action, it gives alarm by causing the horn to sound and the hazard warning lights to flash.
- Unauthorized entry is monitored through the switches on the doors, rear gate, and trunk lid. If any of the switches is turned ON, the system interprets it as an attempt of unauthorized entry and gives alarm warning.
- Unauthorized entry is also monitored by the impact sensor (dealer option). The system operates in the same manner as mentioned above whenever the sensor senses an abnormal impact on the vehicle.

### 1. WARNING

- When activated, the alarm system causes the hazard warning lights to flash and the horn to sound intermittently. In addition to this, the security indicator light in the combination meter lights up.
- The alarms automatically turn OFF after 30 seconds. However, they will be reactivated if the vehicle is tampered with again.
- The alarms are activated when a door, rear gate or trunk lid is opened without unlocking with the keyless entry transmitter. (When the system is set, a warning is given even if a door is opened by operating the inner door handle.)
- The alarms are also activated when an impact on vehicle body is sensed. (Only vehicles with an impact sensor, which is available as dealer option.)
- On vehicles with an impact sensor, the alarms are activated even if electrical wirings for these equipment are cut.

### NOTE:

- For information regarding the impact sensor, refer to their installation and operating instructions.

# ALARM SYSTEM (BURGLAR ALARM SYSTEM)

## SECURITY AND LOCKS

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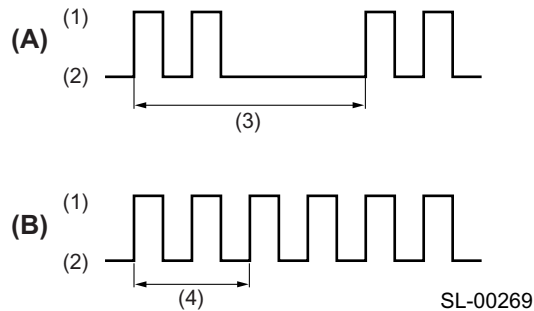
### 2. HOW TO SET THE SYSTEM

- 1) Remove the key from the ignition switch.
- 2) Close all the windows. Close and all doors, rear gate, and the trunk lid.
- 3) Push the LOCK button on the transmitter.
- 4) The keyless buzzer will sound once and the hazard warning lights flash once.

#### NOTE:

The system can be set even if the windows are open.

5) Check that the security indicator light flashes. If any of the doors or the rear gate is not closed properly, lock operation will not be accomplished when the LOCK button on the transmitter is pushed and therefore the keyless buzzer will not sound nor the hazard warning lights will not flash. When setting the alarm system, activation of the keyless entry system must be confirmed by the sound of keyless buzzer and flashing of the hazard warning lights. When the door, rear gate or trunk lid is closed, they will be automatically locked and the alarm system starts working. The indicator light blinks when the system is set and starts monitoring, and continues to blink until the system is disarmed. When the security indicator lamp is blinking as (B), the system is not ready yet and the alarm will not activate when a door is opened.



(A) Monitoring delay set to 0 seconds

(1) ON

(B) Monitoring delay set to 30 seconds (After 30 seconds has elapsed the system enters blinking status (A).)

(2) OFF

(3) 2 seconds

(4) 1 seconds

### 3. HOW TO UNSET THE SYSTEM

- 1) Push the UNLOCK button on the transmitter.
- 2) The keyless buzzer will sound twice and the hazard warning lights flash twice.
- 3) The security indicator light turns OFF.
- 4) The interior light illuminates for maximum 30 seconds and then fades out. (However, if a system is set during this period, the interior light will turn OFF.)
  - Insert the key into the door key cylinder and turn the key in the unlocking direction.

### 4. HOW TO STOP ALARMS

- Push a button on the transmitter. (Either of the LOCK, UNLOCK, or TRUNK buttons will work)
- Insert the key into the ignition switch and turn the key to the ON position. However, the alarm will not cease unless a registered key is used. (models with immobilizer)
- Insert the key into the ignition switch and repeat switching OFF to ON for three times. (models without immobilizer)
- Insert the key into the door key cylinder and turn the key in the unlocking direction.

## 6. Immobilizer System

### A: CONSTRUCTION

The immobilizer system consists of the following components: combination meter, body integrated unit, engine control module (ECM), transponder inside the ignition key, and an antenna fitted to the key cylinder.

The antenna receives a vehicle ID code emitted from the transponder when the key is inserted into the key cylinder.

The ID code is transmitted to the body integrated unit. The body integrated unit compares the code with a one that has been registered in it. The body integrated unit also compares the ID code with the ECM and the combination meter. If these ID codes match with each other, the system allows the engine to be started. The engine may be able to start when the key is inserted even if the codes do not match. The engine, however, will automatically stop after a few seconds.

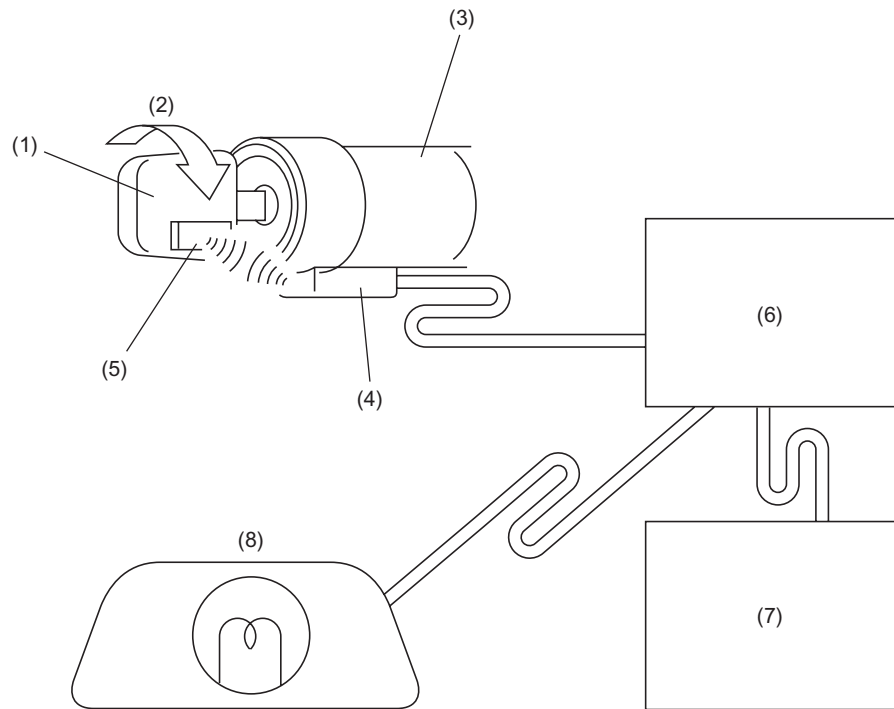
The immobilizer function is activated automatically when the key is removed from the key cylinder and when 60 seconds have passed after the ignition switch was turned to the "ACC" or "OFF" position. When the function is activated, the indicator light on the combination meter flashes at intervals of 0.2 seconds ON and 2.8 seconds OFF. (When security system is not set)

This indicator light flashing indicates to the thief that the system is ready to function.

If the immobilizer system fails, an incorrect key is used or an incorrect ECM is installed, the immobilizer indicator light will illuminate when the key is inserted into the key cylinder or when the ignition switch is turned ON.

#### NOTE:

To heighten the anti-theft performance of the immobilizer system, the system is designed in a way that the immobilizer cannot be deactivated by simply reconnecting the wiring or by replacing parts. Therefore, care must be taken when replacing or repairing the related components.



SL-00053

- |                        |  |
|------------------------|--|
| (1) Key                | (5) Transponder  |
| (2) Ignition switch ON | (6) Body integrated unit                               |
| (3) Key cylinder       | (7) Engine control module                              |
| (4) Antenna            | (8) Combination meter<br>(immobilizer indicator light) |

## B: REGISTRATION

Registration is a procedure that must be carried out when an additional key is purchased or when either a key, ECM or combination meter is replaced. The procedure includes initialization of the system and re-registration of the ID code. Once initialized, the system loses the ID code it has retained so far and has no code until a new code is registered. ID codes for up to four keys (transponders) can be registered with a body integrated unit.

To prevent a copied key to be used, any set of keys (four maximum) can be registered only with one body integrated unit. Therefore, if a body integrated unit is replaced with a new one, the keys having been used with the old body integrated unit cannot be used with the new body integrated unit. The keys must be replaced simultaneously with the body integrated unit.

Registration is carried out by an authorized person using a select monitor and a special program. Access to the program is strictly controlled for reasons of security. The security ID (kept by customer) is required for registration. As the ID code for all registered keys are cleared when registration is started, registration must be performed with all keys including spares handed from the customer.

# CUSTOMIZING FUNCTION

## SECURITY AND LOCKS

### 7. Customizing Function

#### A: GENERAL

- The following system can be customized by using a SUBARU select monitor.

System name		Initial setting	Customized settings	
Room light (delayed extinguishment)	Illuminating time after door closed	5 seconds	0 seconds (OFF)	
			3 seconds (short)	
			8 seconds (long)	
	Illuminating time after keyless unlock operation	20 seconds	0 seconds (OFF)	
			10 seconds (short)	
			30 seconds (long)	
Keyless entry system	Answer back buzzer	Existence setting	Yes	No
		ON/OFF	ON	OFF
	Hazard answer back		ON	OFF
Alarm system	Warning	ON/OFF	ON	OFF
		Monitoring delay setting	30 seconds	0 seconds
	Impact sensor	Existence setting	No	Yes
		ON/OFF	OFF	ON
	Passive arming switching		OFF	ON
Rear defogger timer		OFF after 15 minutes	Operates for 15 minutes or continuously	
Wiper deicer		OFF after 15 minutes	Operates for 15 minutes or continuously	
Lockout prevention		ON	OFF	
Battery drain prevention		ON	OFF	

\*:Setting is possible only with SUBARU select monitor.

#### NOTE:

Items above must be set to coincide with the vehicle's equipment and specifications for normal operation and diagnosis.

### 1. Cruise Control

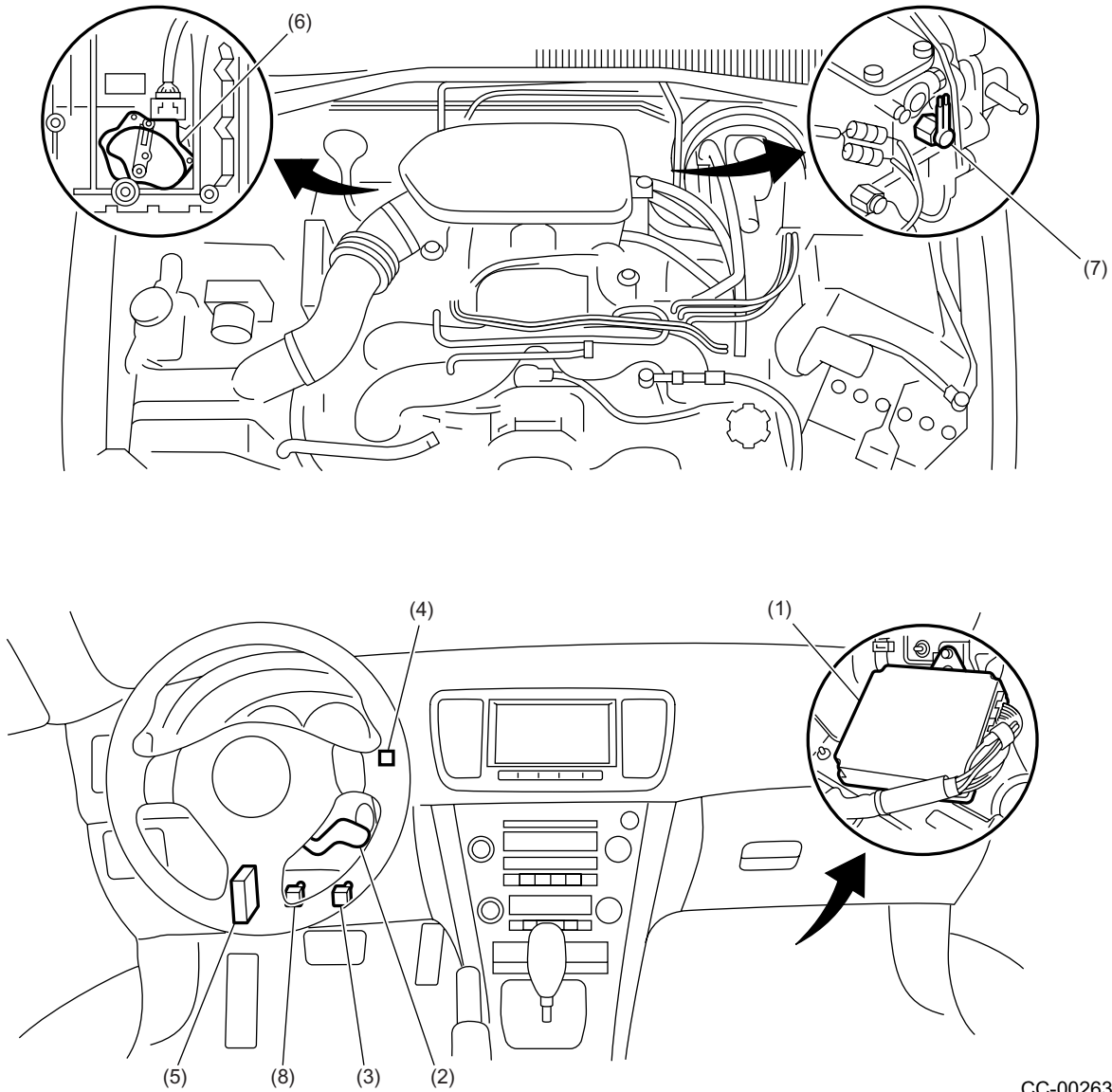
#### A: OPERATION

- The cruise control system automatically controls the vehicle speed. It allows the vehicle to run at a constant speed without need for the driver to keep the accelerator pedal depressed.
- The cruise control system is controlled by the engine control module (ECM).
- When the driver has activated the system and made a desired speed setting, the engine control module (ECM) compares the actual vehicle speed detected by the speed sensor with the preset speed in the engine control module (ECM) memory, and then generates a signal according to the difference between the two speeds.

This signal is transmitted to the electronic control throttle.

The electronic control throttle operates the throttle valve as necessary to keep the preset vehicle speed.

### B: LOCATION OF COMPONENTS



CC-00263

- (1) Engine control module (ECM)
- (2) Cruise control command switch (with built-in MAIN switch)
- (3) Stop light and brake switch
- (4) Cruise indicator light and cruise set indicator light
- (5) Transmission control module (TCM) (AT)
- (6) Inhibitor switch (AT)
- (7) Neutral position switch (MT)
- (8) Clutch switch (MT)



# CRUISE CONTROL

## CRUISE CONTROL SYSTEM

### C: CONTROL AND OPERATION

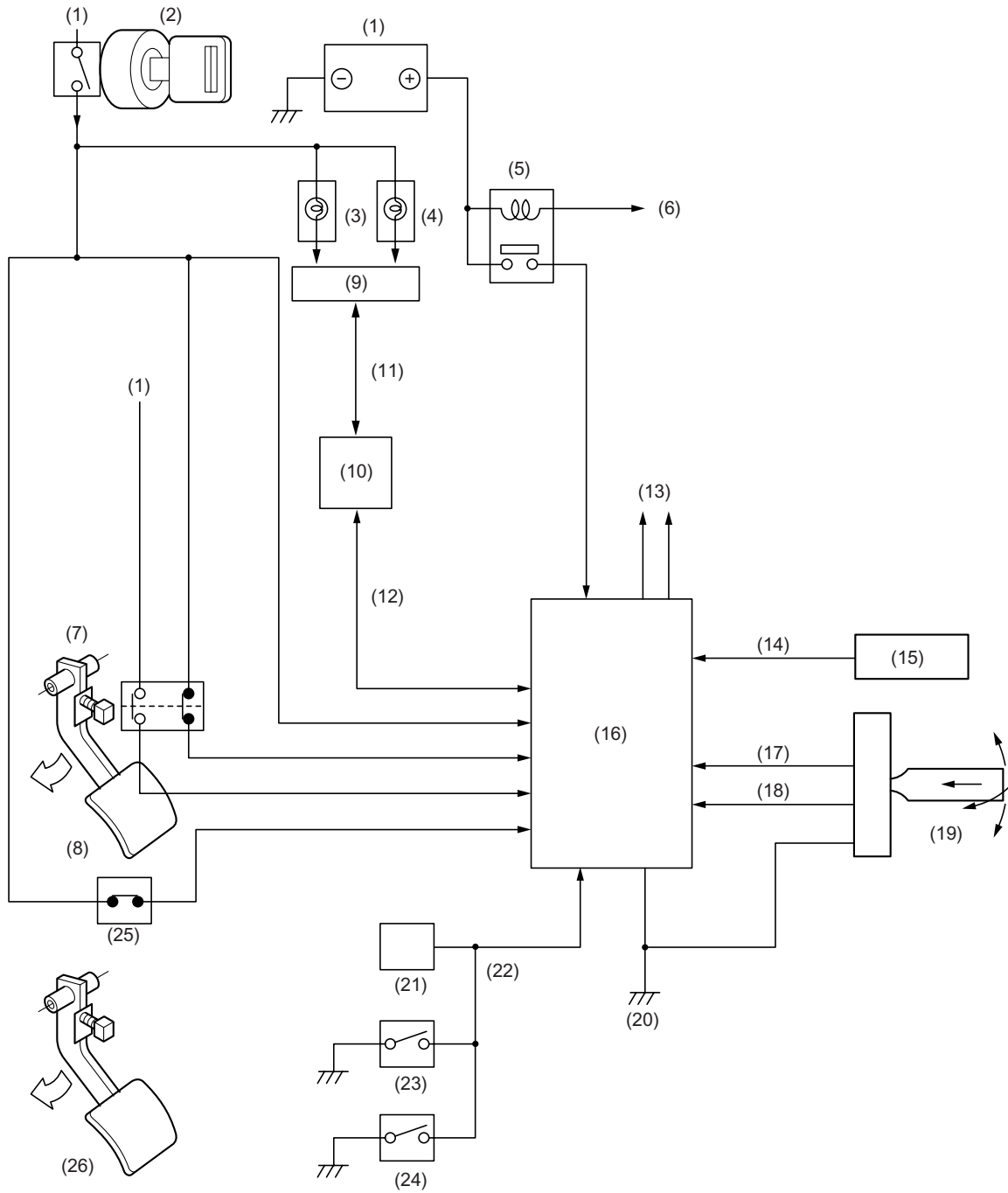
Vehicle speed control	When the actual vehicle speed is higher than the set speed, the throttle valve of the electronic control throttle moves in the closing direction by the amount corresponding to the difference between the two speeds. When the actual vehicle speed is lower than the set speed, the throttle valve of the electronic control throttle moves in the opening direction by the amount corresponding to the difference between the two speeds.
Speed set function (SET function)	When the SET/COAST switch is pressed while the vehicle is running at a speed greater than 40 km/h (25 MPH) and the MAIN switch is ON, the cruise control is set at the current vehicle speed (this speed becomes the "memorized speed") and the vehicle maintains this speed thereafter.
Resume control function (RESUME function)	When the RESUME/ACCEL switch is turned ON after the cruise control is temporarily cancelled, the vehicle speed returns to the memorized speed, which was stored just before the cruise control was cancelled. This occurs only when the vehicle is running at a speed greater than 32 km/h (20 MPH). In the following cases, however, the memorized speed is cleared. (1) Ignition switch is turned OFF (2) MAIN switch is turned OFF (3) Abnormality in the system is detected
Deceleration control function (1) (COASTING function)	When the SET/COAST switch is pressed for a prolonged time while the vehicle is governed by the cruise control, the memorized vehicle speed of the cruise control is changed to the vehicle speed value reached at the moment the switch is released after slowing down. However, the cruise control is cancelled when the vehicle speed becomes lower than the lower limit of the speed setting range.
Deceleration control function (2) (TAP DOWN function)	When the SET/COAST switch is pressed for a short time while the vehicle is governed by the cruise control, the cruise control subtracts a certain amount from the memorized speed to obtain a new value. However, when the actual vehicle speed largely differs from the memorized speed, the actual speed becomes the new memorized speed of the cruise control.
Acceleration control function (1) (ACCELERATING function)	When the RESUME/ACCEL switch is pressed for a prolonged time while the vehicle is governed by the cruise control, the memorized speed of the cruise control is changed to the vehicle speed value reached at the moment the switch is released after accelerating. However, when the vehicle speed is higher than the upper limit of the speed setting range, the upper limit becomes the memorized speed of the cruise control.
Acceleration control function (2) (TAP UP function)	When the RESUME/ACCEL switch is pressed for a short time while the vehicle is governed by the cruise control, the cruise control adds a certain amount to the memorized speed to obtain a new value. However, when the actual vehicle speed largely differs from the memorized speed, the cruise control maintains the former memorized speed.
Cruise control cancel function	When any of the following conditions is met, the cruise control is cancelled. (1) Stop light switch ON (brake pedal depressed) (2) Brake switch OFF (brake pedal depressed) (3) Clutch switch ON (clutch pedal depressed) (4) Neutral switch ON (shift lever moved to neutral) (5) CANCEL switch ON (command switch pulled) (6) Ignition switch OFF (7) MAIN switch OFF (8) Transmission gear in 1st or reverse (9) Actual vehicle speed drops below 32 km/h (20 MPH) (10) Abnormality in the system is detected

**MEMO**

# CRUISE CONTROL

## CRUISE CONTROL SYSTEM

### D: SCHEMATIC



CC-00272

# CRUISE CONTROL

## CRUISE CONTROL SYSTEM

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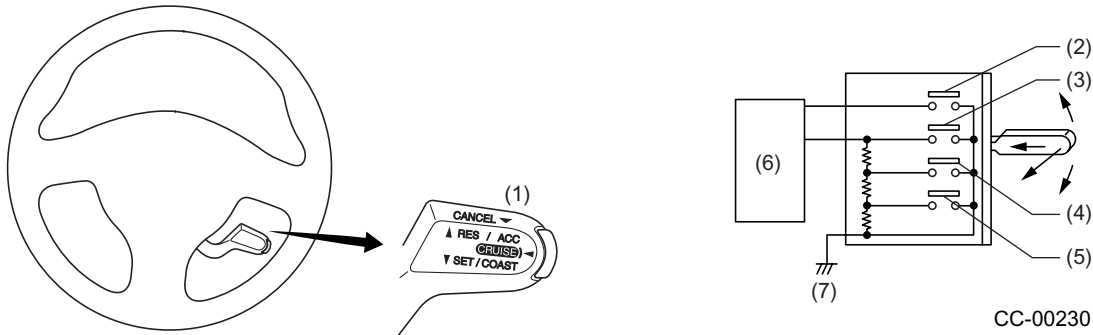
- |                                      |  |
|--------------------------------------|--|
| (1) Battery                          | (14) Vehicle speed signal  |
| (2) Ignition switch                  | (15) ABS control module/vehicle dynamic control (VDC) control module               |
| (3) Cruise indicator light           | (16) Engine control module (ECM)   |
| (4) Cruise set indicator light       | (17) MAIN switch signal  |
| (5) Main relay                       | (18) RESUME/ACCEL switch signal<br>CANCEL switch signal<br>SET/COAST switch signal |
| (6) Starter                          | (19) Cruise control command switch   |
| (7) Stop light and brake switch      | (20) Ground  |
| (8) Brake pedal                      | (21) AT control module (5AT)   |
| (9) Combination meter microprocessor | (22) Neutral signal  |
| (10) Body integrated unit            | (23) Inhibitor switch (4AT)  |
| (11) Low speed CAN communication     | (24) Neutral position switch (MT)  |
| (12) High speed CAN communication    | (25) Clutch switch (MT)  |
| (13) Electronic control throttle     | (26) Clutch pedal (MT)   |

# CRUISE CONTROL

## CRUISE CONTROL SYSTEM

### E: COMMAND SWITCH (CRUISE CONTROL LEVER)

- When the vehicle is driven with the cruise control activated, the command switch controls its operation. It inputs MAIN signal, SET/COAST signal, RESUME/ ACCEL signal or CANCEL signal to the engine control module (ECM).
- When the cruise control MAIN switch is turned ON, the cruise indicator light in the combination meter illuminates. Also, when the cruise control is set, the cruise set indicator light in the combination meter illuminates.



- (1) Command switch
- (2) MAIN
- (3) CANCEL
- (4) SET/COAST

- (5) RESUME/ACCEL
- (6) Engine control module (ECM)
- (7) Ground

- The command switch is located on the right side of the steering wheel, so the driver can operate it without releasing hands from the steering wheel.
- The command switch is a self-returning lever type.

#### 1. MAIN SWITCH

When the switch is pushed once the cruise control system turns ON and becomes ready to set the cruise control. When the switch is pushed again the cruise control turns OFF.

#### 2. CANCEL, RESUME/ACCEL AND SET/COAST SWITCH

Each switch contact is held closed as long as the lever is kept pressed in the relevant direction (except the CANCEL switch which should be pulled), and resulting current is applied as a signal to the engine control module (ECM).

### F: CANCEL SIGNAL

A cancel signal deactivates the cruise control function. Operating any of the following switches results in generation of a cancel signal. On receiving a signal, the engine control module (ECM) cancels the cruise control function.

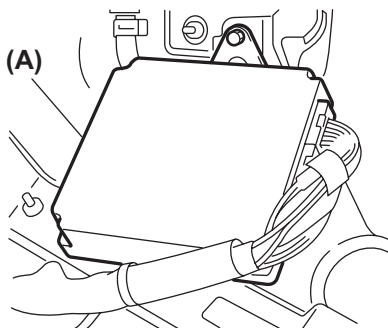
- Stop light switch
- Brake switch
- Clutch switch (MT)
- Inhibitor switch (AT)
- Neutral position switch (MT)
- MAIN switch (OFF operation)
- Command switch (CANCEL position)
- Ignition switch (OFF operation)

### G: VEHICLE SPEED SIGNAL

Vehicle speed signals are sent from the ABS control module or vehicle dynamic control (VDC) control module to the engine control module (ECM), which uses the signals in controlling the cruise control function.

### H: ENGINE CONTROL MODULE (ECM)

- Based on signals from the related switches and sensors, the engine control module (ECM) controls all the following control functions:  
Constant speed control; speed setting control; deceleration control; acceleration control; resume control; manual cancel control; low speed limit control; electronic control throttle control
- The engine control module (ECM) (A) is located at the legroom of the front passenger's seat.



CC-00274

# CRUISE CONTROL

## CRUISE CONTROL SYSTEM

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### I: FAIL-SAFE FUNCTION

The cruise control system has a fail-safe function that cancels the cruise control operation when any of the following conditions occurs.

#### 1. CONFLICT BETWEEN CRUISE CONTROL SWITCHES AND CANCELLATION SIGNAL GENERATING SWITCHES

- The cruise control system is deactivated if any of the cruise control switches (SET/COAST, RESUME/ACCEL, and CANCEL switches) is turned ON while any of the cancellation signal generating switches (brake, stop light, clutch, neutral position and inhibitor switches) is activated. The system is re-activated when the cruise control switch is turned OFF and then turn ON again after the cancellation signal generating switch has been returned to its released position.
- When the ignition switch is turned ON while any of the command switches is in the ON position, the cruise control system is deactivated. The system deactivating function is retained until the ignition switch is turned OFF.

#### 2. ABNORMALITIES IN ELECTRIC CIRCUITS

The cruise control system is deactivated and the set speed is also canceled if any of the following abnormalities occurs in the system electric circuits. The system deactivation function is retained until the ignition switch is turned OFF.

- Abnormality of the command switch is detected.
- Abnormality of the stop light switch and brake switch is detected.
- Abnormality of the inhibitor switch is detected. (AT)
- Abnormality of the neutral position switch is detected. (MT)
- Abnormality of the ignition switch is detected.
- Change in vehicle speed signal is detected.
- Abnormality in any of the engine related sensors is detected.
- Abnormality of the brake switch input circuit in the engine control module (ECM) is detected.
- The MAIN switch and command switch were already ON when the ignition switch is turned ON.

#### 3. CRUISE CONTROL CANCEL FUNCTION

When any of the following conditions is met, the cruise control is cancelled.

To set the cruise control again, the vehicle speed must be returned to within the speed setting range and necessary conditions must be met.

- Abnormal engine speed acceleration is detected.
- The vehicle speed has dropped below the lower control limit during cruise control driving.
- The vehicle has been running at speed higher than the set speed for an abnormally long time during cruise controlled driving.
- The set speed became impossible to be maintained for some reason (steep upgrade, hand brake operation, abnormal engine power drop, etc.).

### 1. General

#### A: LAN

- The LAN system\*<sup>1</sup> enables data sharing among computers, that otherwise are left to function as independent systems, by connecting them via communications lines.
- Introduction of the LAN\*<sup>1</sup> system has improved equipment and functions while reducing the weight of the vehicle by eliminating a considerable amount of harnesses.
- Data transmission/reception is via CAN \*<sup>2</sup>, which offers high-speed communication and also ensures a high level of reliability.
- Depending on control requirements, two transmission rates are used: high-speed CAN running at 500 Kbps, which is an ISO 11898 and manages power-related units; and low-speed CAN running at 125 Kbps, which is an ISO 11519-2 and manages body-related functions.
- Networks running at different transmission rates usually cannot share data between them, however, the body integrated unit with a gateway (hookup) function enables data sharing between different-rate networks.

#### NOTE:

\*<sup>1</sup>: LAN (Local Area Network). A system where multiple computers (units) are linked via serial communication for data sharing.

\*<sup>2</sup>: CAN (Controller Area Network). A serial communications protocol in compliance with ISO 11898 and ISO 11519-2.

#### B: CAN

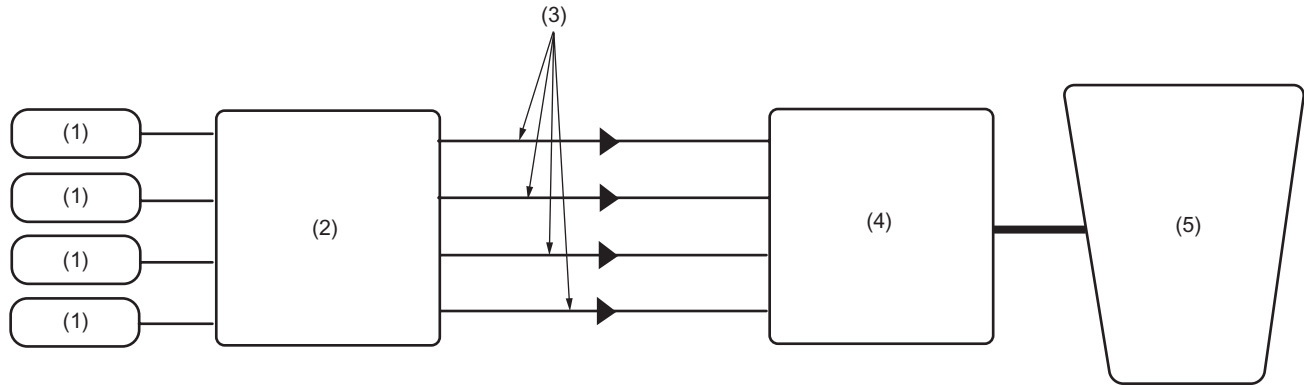
- CAN is a serial communications protocol in compliance with relevant ISO standards.
- With its high bit rates, CAN enables quick, large-volume data transmission/reception.
- Based on continuous change in bus level (logical signals: low “0” and high “1”) stemming from voltage difference between CAN\_High and CAN\_Low, data and other frames are configured for message identification.
- If an error is detected, CAN’s fault confinement feature prevents the error from impacting units.
- If an error is detected, an error frame (notification that an error has been detected) is sent to units, telling them not to perform control based on data including errors.
- Depending on the status of the error detected, transmission/reception of the relevant data will be aborted.



**C: COMPARISON BETWEEN CAN AND CONVENTIONAL DATA COMMUNICATION**

- With conventional data communication, each sensor relies on its dedicated wiring for message to be sent between units. As data volume grows, so does the volume of wiring.
- CAN uses only one twisted-pair cable to connect between units for shared communication.

**1. CONVENTIONAL COMMUNICATION**



LAN00045

- |                          |                  |
|--------------------------|------------------|
| (1) Sensor               | (4) TCM          |
| (2) ECM                  | (5) Transmission |
| (3) Communication wiring |                  |

**NOTE:**

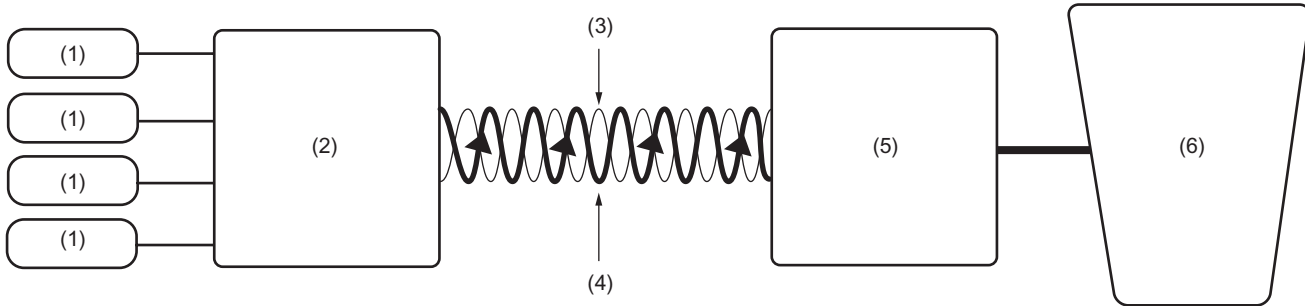
Conventional data communication needs as many data transmission lines as sensors used. (parallel signals)

# GENERAL

## LAN SYSTEM

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### 2. CAN COMMUNICATION



LAN00046

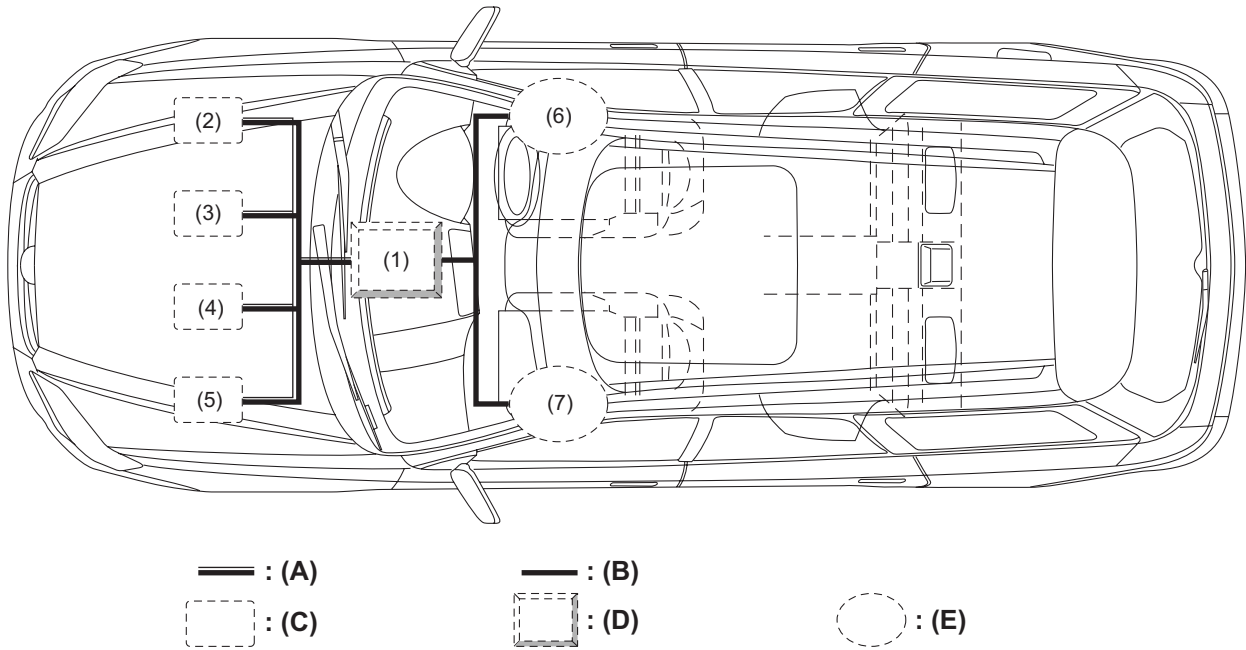
- |                   |                   |
|-------------------|-------------------|
| (1) Sensor        | (4) CAN line (HI) |
| (2) ECM           | (5) TCM           |
| (3) CAN line (LO) | (6) Transmission  |

#### NOTE:

- With CAN, one twisted-pair cable (2 wires) manages transmission of all data. (serial communication)
- The main wire runs between the terminal resistor on the ECM and that on the ABSCM or vehicle dynamics control (VDC) CM & H/U. Other units are connected, in parallel, to the main wire via branch wires.

## 2. LAN Configuration

### A: NETWORK ARCHITECTURE



LAN00131

- |  |  |                                      |
|--|--|--------------------------------------|
| (1) Body integrated unit                         | (6) Combination meter                        | <b>(A)</b> High-speed bus (500 Kbps) |
| (2) ECM  | (7) A/C ECM<br>(vehicles with automatic A/C) | <b>(B)</b> Low-speed bus (125 Kbps)  |
| (3) TCM  |  | <b>(C)</b> High-speed system units   |
| (4) ABSCM or VDCCM & H/U                         |  | <b>(D)</b> Body integrated unit      |
| (5) Steering angle sensor<br>(vehicles with VDC) |  | <b>(E)</b> Low-speed system units    |

**NOTE:**

- Bit rate 500 Kbps: The bit rate of 500 Kbps means that 500,000 bits of data are transmitted per second.
- Bit rate 125 Kbps: The bit rate of 125 Kbps means that 125,000 bits of data are transmitted per second.

# LAN CONFIGURATION

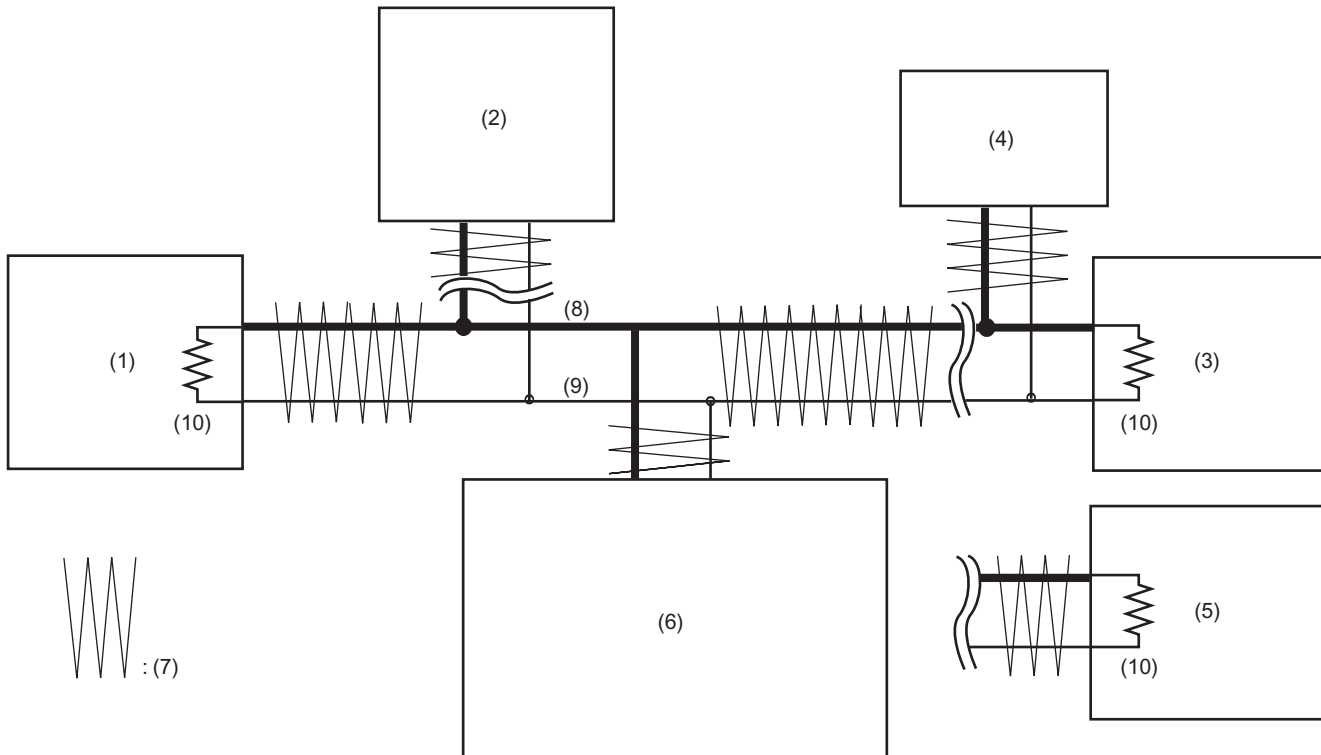
## LAN SYSTEM

### B: LAN CONNECTED UNITS

#### 1. UNITS CONNECTED VIA HIGH-SPEED LAN

Vehicle type	Sedan				Wagon			
Transmission	MT		AT		MT		AT	
Vehicles with ABS/VDC	ABS	Vehicles with VDC	ABS	Vehicles with VDC	ABS	Vehicles with VDC	ABS	Vehicles with VDC
ECM	○	○	○	○	○	○	○	○
TCM			○	○			○	○
ABSCM & H/U	○		○		○		○	
VDCCM & H/U		○		○		○		○
Steering angle sensor unit		○		○		○		○
Body integrated unit	○	○	○	○	○	○	○	○

○: Installed units



LAN00048

- (1) ECM
- (2) TCM (AT models)
- (3) VDCCM & H/U (vehicles with VDC)
- (4) Steering angle sensor (vehicles with VDC)
- (5) ABSCM & H/U (vehicles without VDC)
- (6) Body integrated unit
- (7) Twisted-pair cable
- (8) CAN\_HI
- (9) CAN\_LO
- (10) Terminal resistor

## NOTE:

- Terminal resistors built into the ECM and VDCCM & H/U stabilize traffic on the bus, and enables signals distinction from the voltage difference between the two bus lines (CAN\_High and CAN\_Low). These bus lines are called the main lines. Other units are connected in parallel to the main lines. These wires are called branch lines.
- If one bus line of the main lines becomes open, this is detected as an error and communication becomes no longer possible.
- If one bus line of a pair of branch lines becomes open, communication with the unit connected to the branch line becomes no longer possible, however, communication with other units remain intact. (The error will be displayed.)

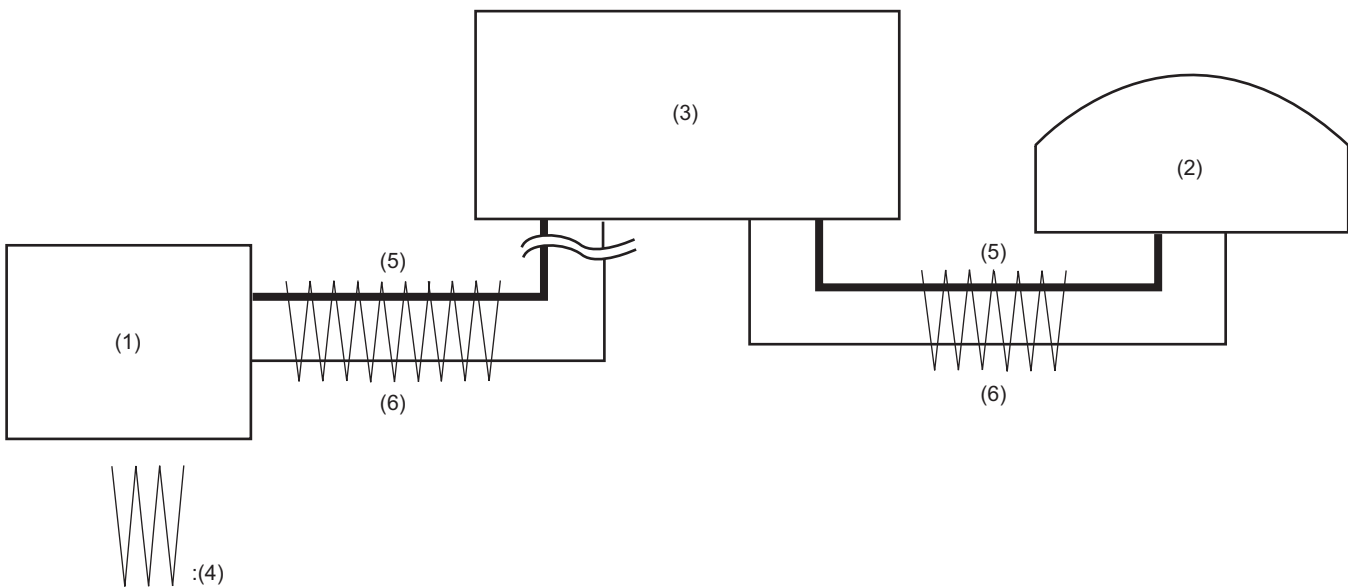
# LAN CONFIGURATION

## LAN SYSTEM

### 2. UNITS CONNECTED VIA LOW-SPEED LAN

Vehicle type	Sedan								Wagon							
	Yes		No		Yes		No		Yes		No		Yes		No	
Navigation system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A/C unit (vehicles with auto A/C)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combination meter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Body integrated unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

○: Installed units



LAN00132

(1) Auto A/C ECM (vehicles with auto A/C)

(4) Twisted-pair cable

(2) Combination meter

(5) CAN\_HI

(3) Body integrated unit

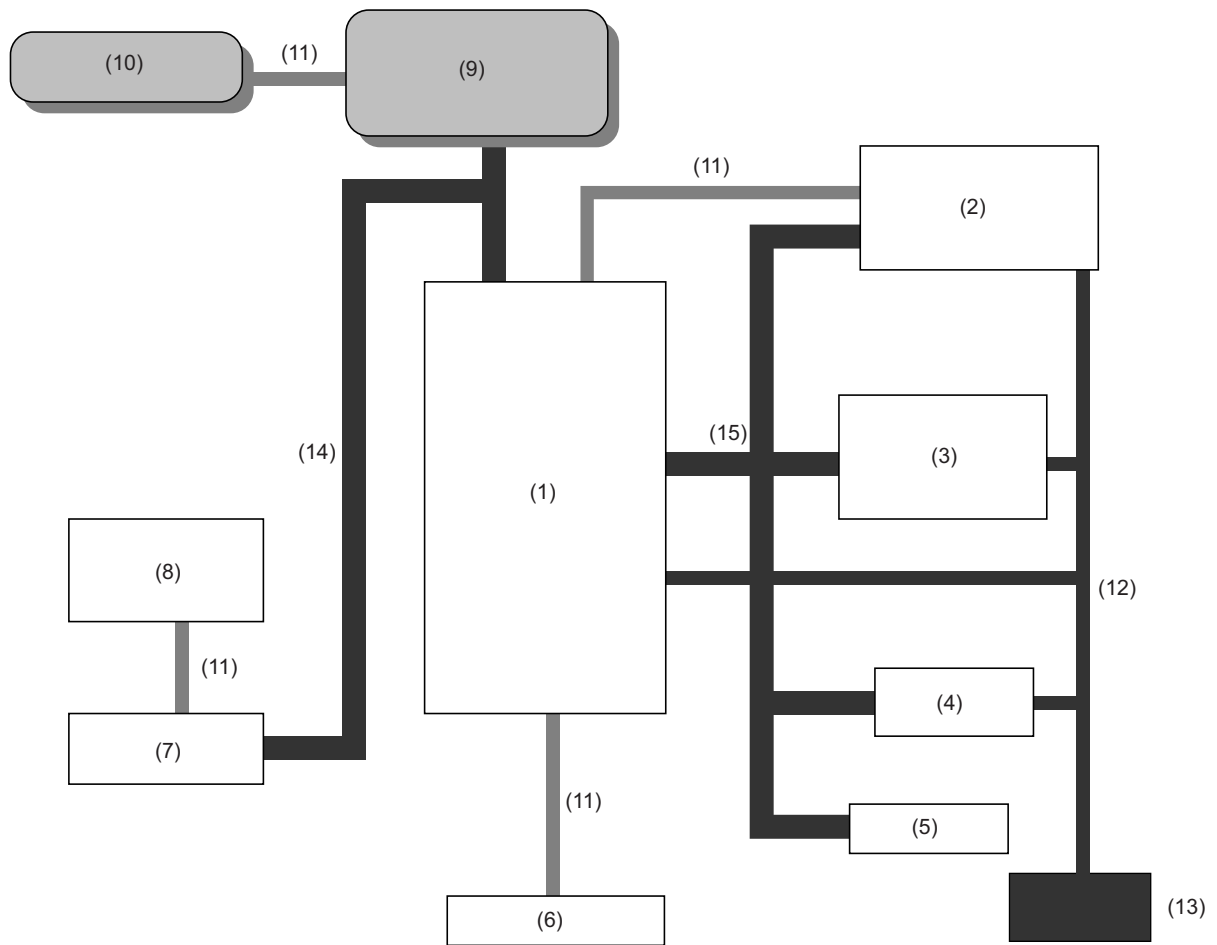
(6) CAN\_LO

#### NOTE:

In low-speed CAN, the system still allows communication even if one of the twisted-pair cable wires becomes open. (Errors will be detected.)

The high- and low-speed LANs described above, and the IE\_Bus, dedicated communication lines, and select monitor communication, etc. comprise the vehicle's data communication system.

# LAN CONFIGURATION



LAN00133

- |                           |  |  |
|---------------------------|--|--|
| (1) Body integrated unit  | (6) Keyless entry receiver                   | (11) Dedicated communication line            |
| (2) ECM                   | (7) A/C ECM (vehicles with auto A/C)         | (12) Select monitor communication wiring     |
| (3) TCM                   | (8) Audio and A/C control panel              | (13) Select monitor                          |
| (4) ABSCM or VDCCM        | (9) Combination meter                        | (14) Low-speed CAN (body control system)     |
| (5) Steering angle sensor | (10) Clock (vehicles without monitor screen) | (15) High-speed CAN (driving control system) |

## 3. What is CAN?

### A: FEATURES

- Some of the basic specifications of CAN, intended to ensure smooth multiplex data communication, are described below.

#### 1. MULTIMASTER

- When the bus (communication line) is free, any unit may start to transmit a message.

#### 2. MESSAGE TRANSFER

- All messages on CAN bus are sent in fixed formats.

- When the bus (communication line) is free, any unit connected to the bus may start to transmit a message.

- If two or more units start to transmit messages at the same time, these messages are prioritized using the identifier.

- The identifier does not indicate the destination of the message, but it signifies message priority for bus access.

- If two or more units start to transmit messages at the same time, bitwise (smallest-unit) arbitration is performed over the identifiers carried by the messages. The unit that has won the arbitration as carrying a higher-priority message continues to send the message while the unit that has a lower priority stops sending the message, and starts sending the message again after waiting for a while.

#### 3. SYSTEM FLEXIBILITY

- As units connected to the bus do not have unique information like an address, other units can be added to the bus without changing the software, hardware, or application of the units.

#### 4. BIT RATE

- The bit rate can be set to suit the applications of the communication network.

- The bit rate of all units connected to the same network (bus) must be uniform. Connecting units of different bit rates to the same bus will cause communication disturbances.

#### 5. ERROR SIGNALING AND COMMUNICATION RECOVERY

- Error signaling: Any unit connected to a bus can detect an error, and upon detecting an error, the unit notifies all other units of the error.

- Communication recovery: If a unit detects an error while sending a message, the unit will abort the message and keep retransmitting the message until it is successfully sent. (communication recovery)

#### 6. FAULT CONFINEMENT

- In CAN, there are two types of errors: temporary alteration of data on the bus caused by external noise or other disturbances; and permanent alteration of data on the bus caused by faulty units, failed drivers, open wire, or other failures. Causal units will be cut off from the bus to prevent such disturbances/failures from affecting other units.



## 7. CONNECTION ENVIRONMENTS

- The CAN bus accommodates connections of a number of units to it.
- There are no limitations on the number of units that can be connected to the CAN bus, however, if the bus length needs to be longer or the bit rate needs to be higher, the number of units needs to be smaller. On the other hand, if the bus length is relatively short or a relatively slower bit rate can be accepted, a greater number of units can be connected.
- As signals are distinguished with the voltage difference between the two bus lines (CAN\_High and CAN\_Low), the main lines and branch lines must be properly connected.

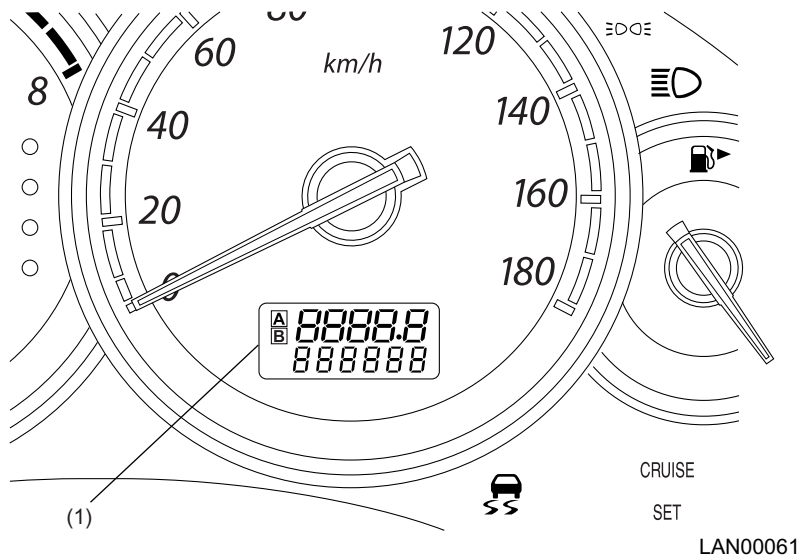
## 4. Fault Detection

### A: COMMUNICATION ERROR INDICATIONS

- If a fault occurs in the body integrated unit or LAN system (in any unit or the communication circuit), a communication error indication is given at the trip information display area on the combination meter.
- The indication differs by the type of fault, and related indicators such as the CHECK ENGINE light illuminate.
- If a communication error indication is given, one or more diagnostic trouble codes are stored in the body integrated unit. To read out diagnostic trouble codes, use a Subaru select monitor.
- If more than one diagnostic trouble code is stored, indication is given in the following order of priority: (1) High-speed CAN (2) Low-speed CAN (3) integrated unit (4) EGI (5) TCM (6) VDC

#### NOTE:

The indication returns to the normal trip display when the trip reset switch is pushed.



(1) Communication error indication area (trip meter)

#### CAUTION:

- Information registered in the body integrated unit must coincide with the vehicle's equipment and specifications for normal operation and diagnosis.
- If the body integrated unit is brand-new or put in factory mode, the key ring illumination blinks to indicate that equipment setting is not completed.

## Types of communication error indications

Communication error indication	Description	Location of fault
Er --	High-speed CAN and low-speed CAN failed	Abnormality is found in both the high-speed and low-speed CAN communication systems.
Er HC	High-speed CAN failed	Abnormality is found in the high-speed CAN system.
Er LC	Low-speed CAN failed	Abnormality is found in the low-speed CAN system.
Er IU	Integrated unit failed	Abnormality is found in the integrated ECM or in its related parts.
Er EG	EGI communication data abnormal	Abnormality is found in the EGI ECM or in its communication system.
Er tC	TCM communication data abnormal	Abnormality is found in the TCM ECM or in its communication system.
Er Ab	ABS/VDC communication data abnormal	Abnormality is found in the ABSCM/VDCCM & H/U unit or in its communication system.

## B: SUBARU SELECT MONITOR

### 1. READING DIAGNOSTIC TROUBLE CODES

- Diagnostic trouble codes can be read with a Subaru select monitor set in its body integrated unit mode.

### 2. READING CURRENT DATA

- Use a Subaru select monitor to read analog and digital data. (Confirm necessary items when customizing.)

### 3. MEMORY CLEAR MODE

- Use a Subaru select monitor to erase diagnostic trouble codes.

### 4. CUSTOMIZING (SETTING FUNCTIONS)

- Use a Subaru select monitor to perform detailed setting of body control related functions.
- When replacing immobilizer related components, registration of the immobilizer may be necessary.  
(Refer to the immobilizer registering manual.)

#### CAUTION:

When customizing, do not change the factory mode resetting function to factory mode. If you do this, settings stored in the body integrated unit will be reset to initial values and the unit will not operate normally. In this case, perform registration of the body integrated unit from the very beginning.

**FAULT DETECTION**

LAN SYSTEM

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**MEMO**

# FRONT SUSPENSION

## FRONT SUSPENSION

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### 1. Front Suspension

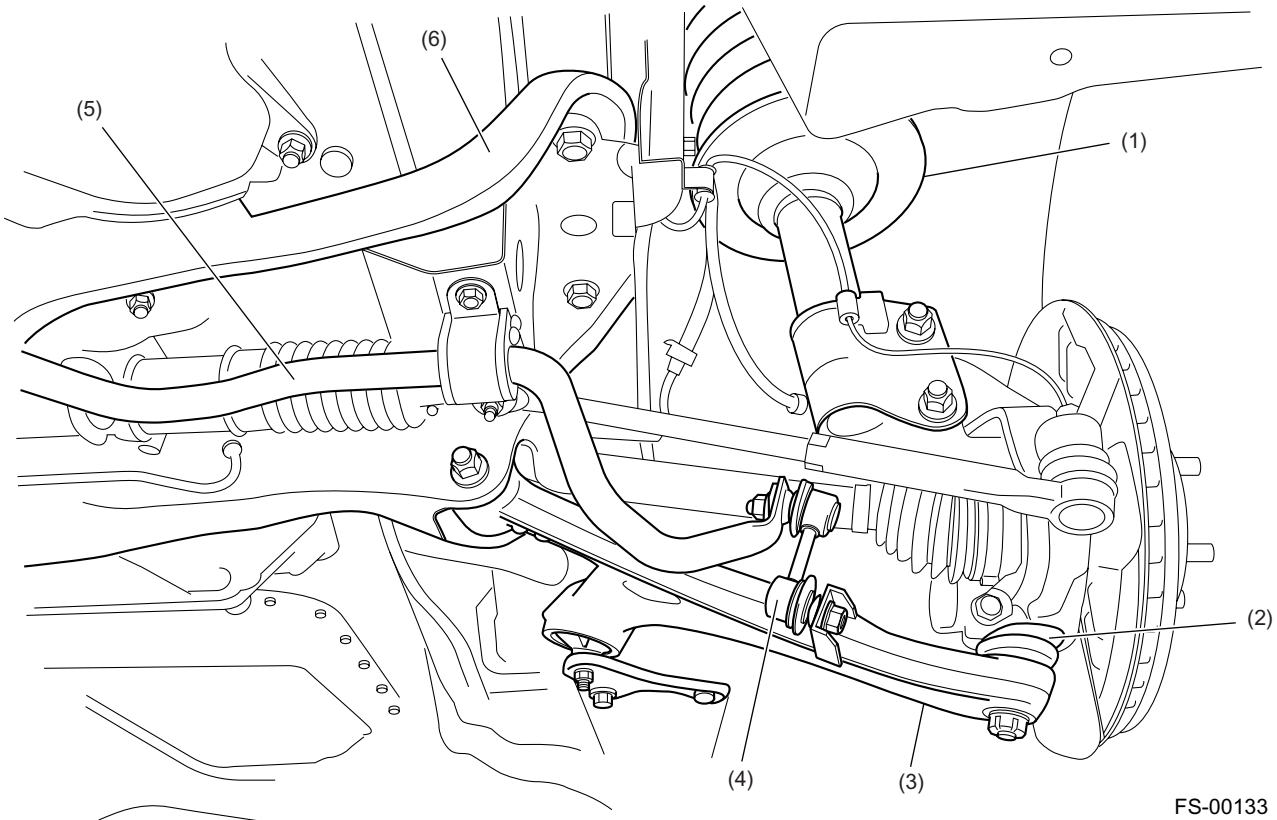
#### A: GENERAL

The front suspension is a McPherson strut-type independent suspension which have coil springs and dampers. The suspension on each side consists of a front arm, stabilizer, and a strut assembly.

The front arm is an "L" shaped arm. The outer end of the front arm is fixed to the front axle through a ball joint. The front of the arm's inner end is fitted to the front cross member while the rear of the inner end is fixed to the vehicle body.

The front cross member is bolted to the vehicle body.

The front cross member bears the front arm, steering gearbox, and stabilizer.



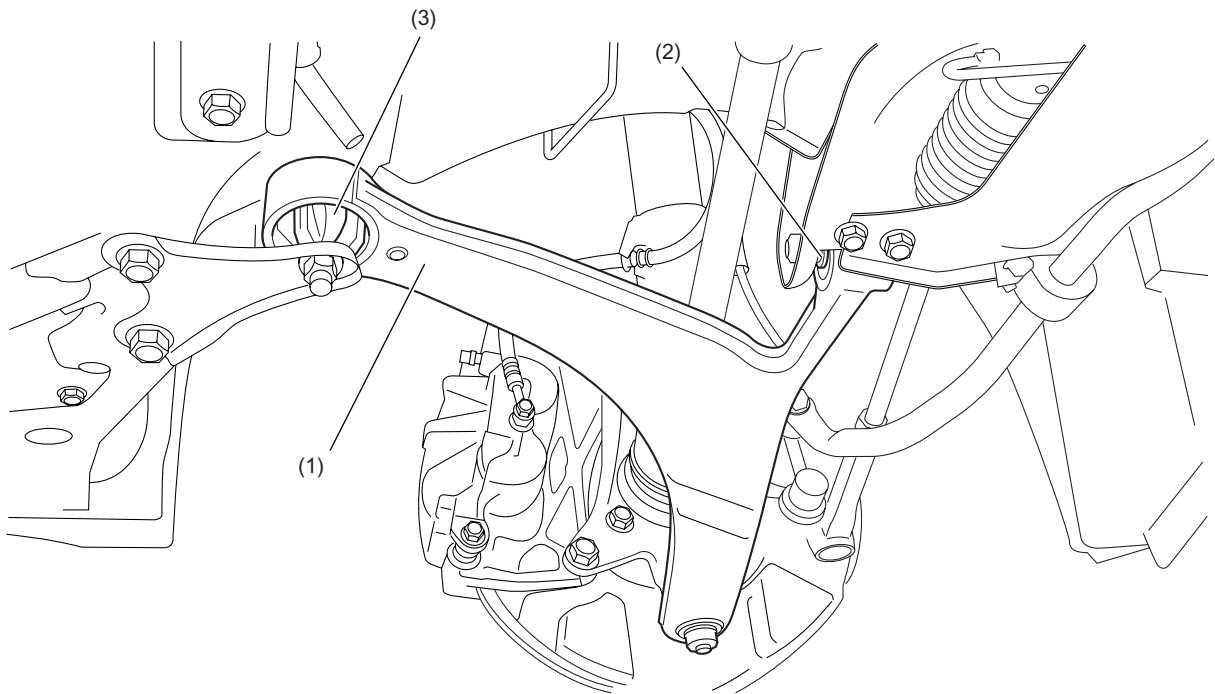
FS-00133

- |                |                        |
|----------------|------------------------|
| (1) Strut      | (4) Stabilizer link    |
| (2) Ball joint | (5) Stabilizer bar     |
| (3) Front arm  | (6) Front cross member |

## B: CONSTRUCTION

### 1. FRONT ARM

- By optimizing the shape of the front arm, a high strength and light weight are simultaneously achieved.
- The arm has a maintenance-free ball joint fitted by a castle nut at its outer end. A rubber bushing is used at the front, and a hollowed bushing is used at the rear.



FS-00134

- (1) Front arm
- (2) Front bushing
- (3) Rear bushing

# FRONT SUSPENSION

## FRONT SUSPENSION

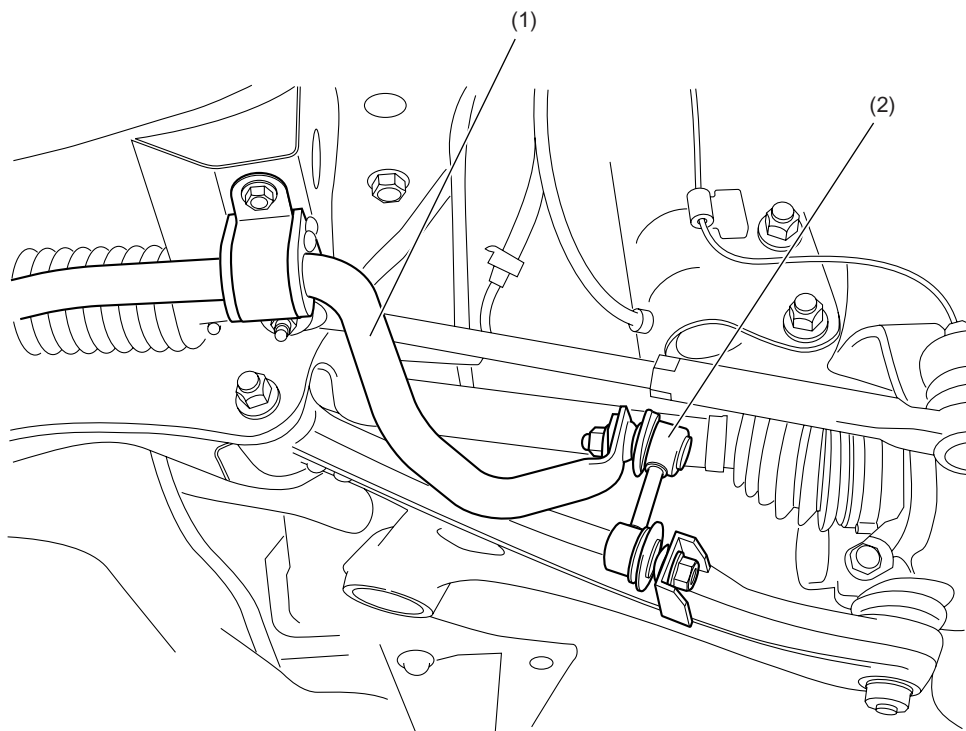
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### 2. STRUT

- The strut consists of a cylindrical double-acting low pressure gas filled damper that attenuates shock from the road surface.
- A camber angle adjustment mechanism, which uses eccentric bolts, is provided at the joint between the strut and axle housing.

### 3. STABILIZER

- The solid round rod stabilizer is attached to the front cross member through rubber cushions and its right and left ends are connected to the front arm through ball joints.
- The attitude change of the vehicle during a turn is controlled by the bar's torsional resistance.



FS-00135

- (1) Stabilizer bar
- (2) Stabilizer link

# REAR SUSPENSION (MULTI-LINK TYPE)

## REAR SUSPENSION

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### 1. Rear Suspension (Multi-link Type)

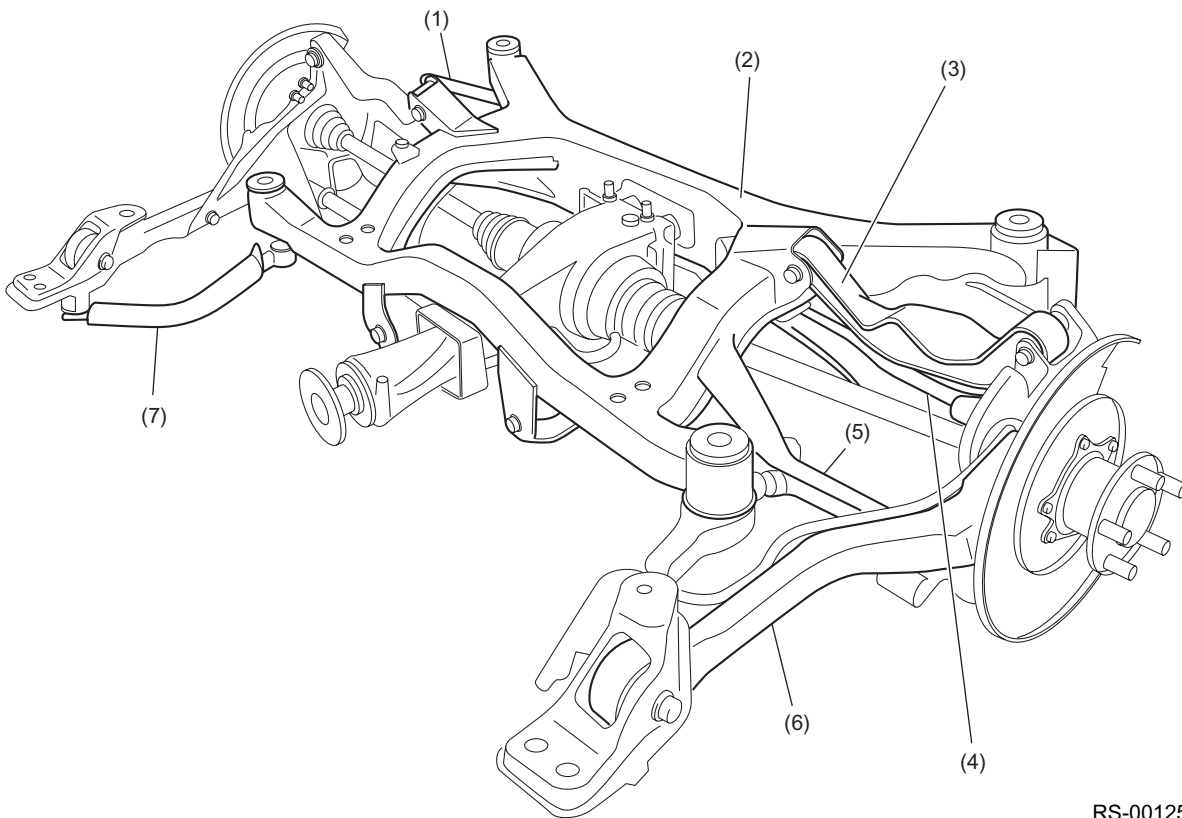
#### A: GENERAL

The rear suspension is a multilink type.

The suspension on each side consists of a rear arm, front link, upper link, rear link, sub frame support arm, shock absorber, and a coil spring.

The front link, rear link, and upper link are all attached to a sub frame which in turn is installed to the vehicle body through bushings.

This type of suspension is characterized by small changes in camber and toe-in against external input of vertical, longitudinal and lateral forces.



RS-00125

- (1) Rear stabilizer
- (2) Rear sub frame
- (3) Upper link
- (4) Rear link
- (5) Front link
- (6) Rear arm
- (7) Sub frame support arm



## B: CONSTRUCTION

### 1. REAR ARM

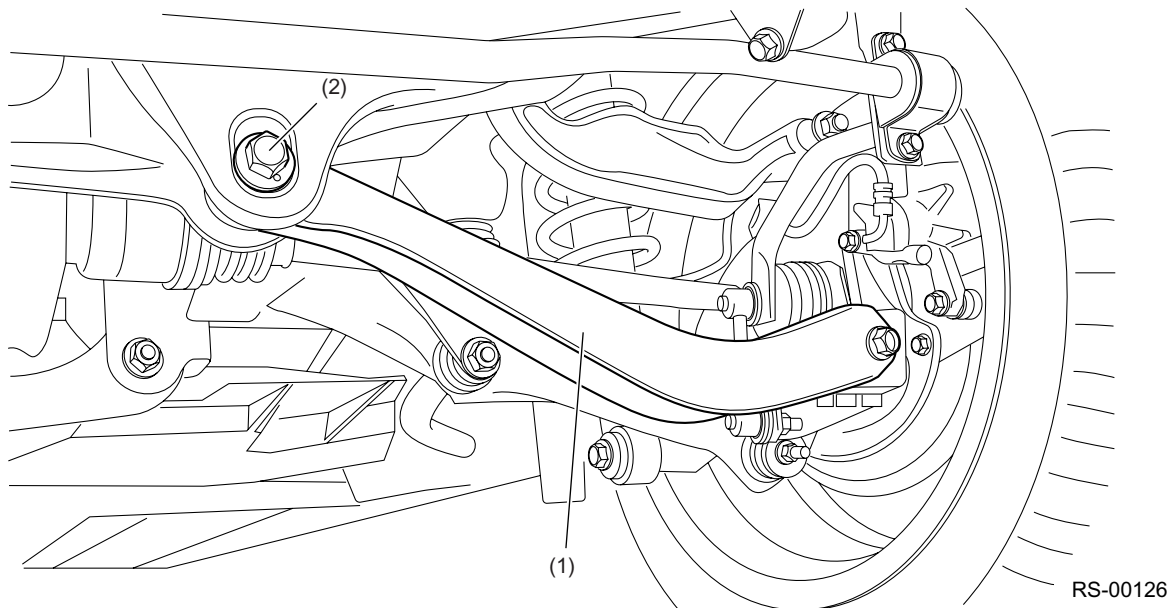
- Acts mainly on longitudinal loads.
- The rear arm bears the rear brake system and rear axle bearing unit.

### 2. FRONT LINK

- Acts on lateral loads.
- The link is made of steel pressed in a “U” section form, and the left and right ends of the link are connected to the rear sub frame and rear arm through rubber bushings.

### 3. REAR LINK

- Acts on lateral loads.
- The link is made of steel pressed in a “U” section form, and the link is connected to the rear sub frame and rear arm.
- A toe-in adjustment mechanism, which uses eccentric bolts, is provided at the joint between the rear link and rear sub frame.



- (1) Rear link
- (2) Eccentric bolt

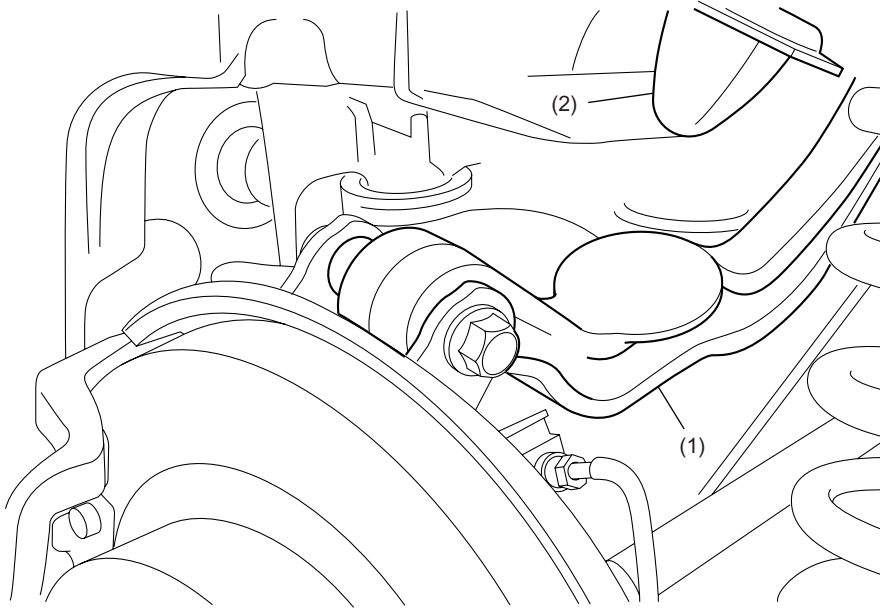
## REAR SUSPENSION (MULTI-LINK TYPE)

### REAR SUSPENSION

---

#### 4. UPPER LINK

- Acts on lateral loads.
- The left and right ends of the link are connected to the rear sub frame and rear arm through rubber bushings.
- This also supports the helper and prevents bottoming of the suspension.



RS-00127

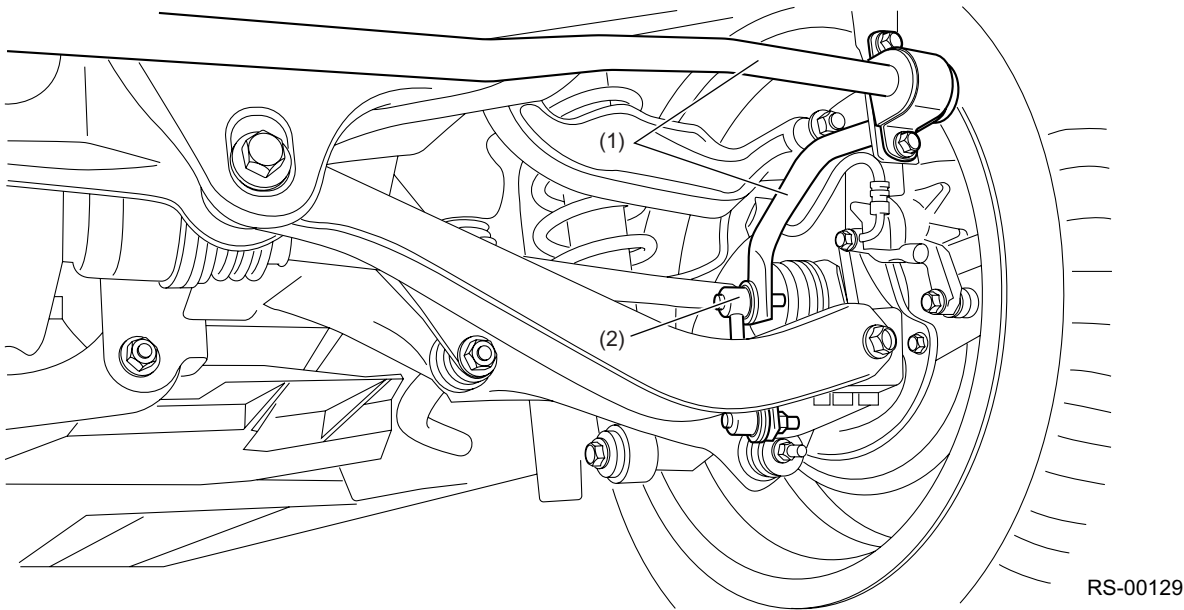
- (1) Upper link
- (2) Helper

## 5. SHOCK ABSORBER

- Acts on vertical loads together with the coil spring.
- The shock absorber is a cylindrical double-acting low pressure gas filled type and it attenuates shock from the road surface.

## 6. STABILIZER

- The solid round rod stabilizer is attached to the rear sub frame through rubber bushings and its right and left ends are connected to the rear arm through ball joints of the stabilizer link.
- The attitude change of the vehicle during a turn is controlled by the bar's torsional resistance.



- (1) Stabilizer bar
- (2) Stabilizer link

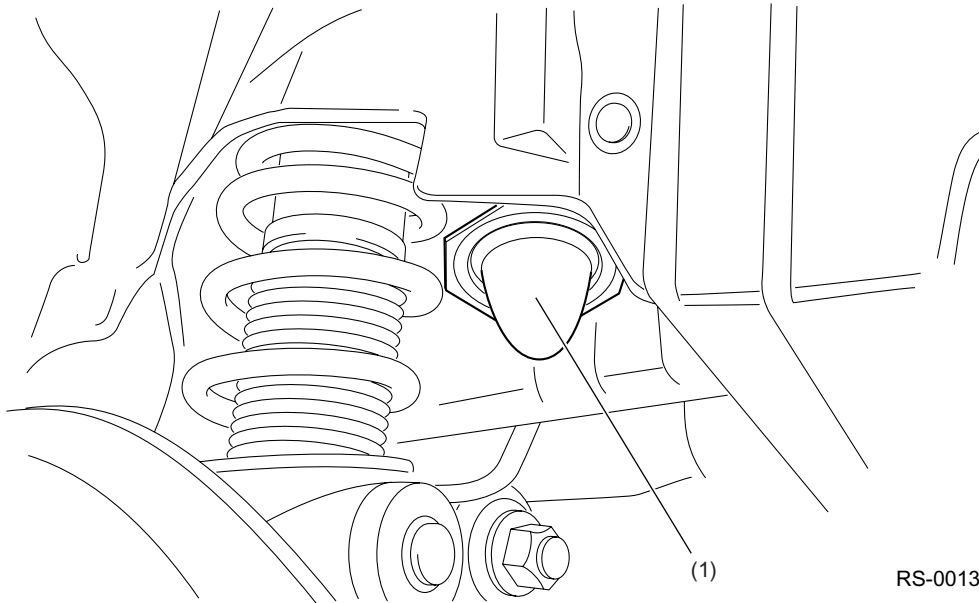
## REAR SUSPENSION (MULTI-LINK TYPE)

### REAR SUSPENSION

---

#### 7. HELPER

- The helper acts as a bump stopper together with the upper link by limiting the shock absorber stroke when the vehicle encounters a bump.

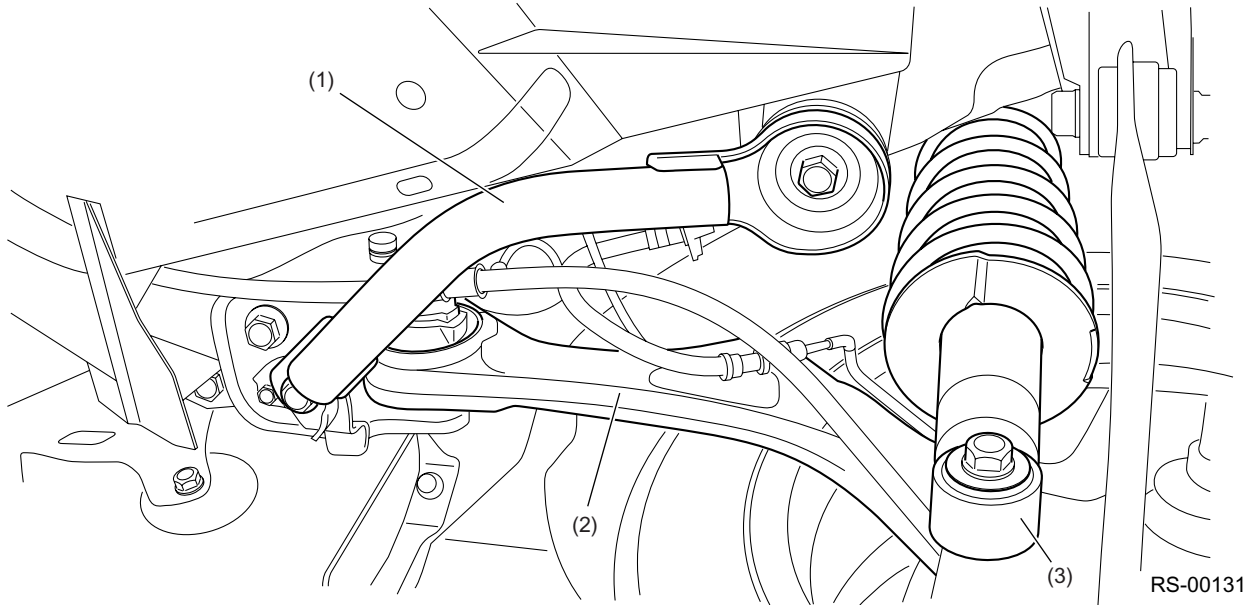


RS-00130

(1) Helper

## 8. SUB FRAME SUPPORT ARM

- Made of steel pipe whose both ends fixed to the rear arm bracket and rear sub frame.
- Restricts the twist between the rear sub frame and vehicle body.



- (1) Sub frame support arm
- (2) Rear arm
- (3) Rear shock absorber

# REAR SUSPENSION (DOUBLE WISHBONE TYPE)

## REAR SUSPENSION

---

### 2. Rear Suspension (Double Wishbone Type)

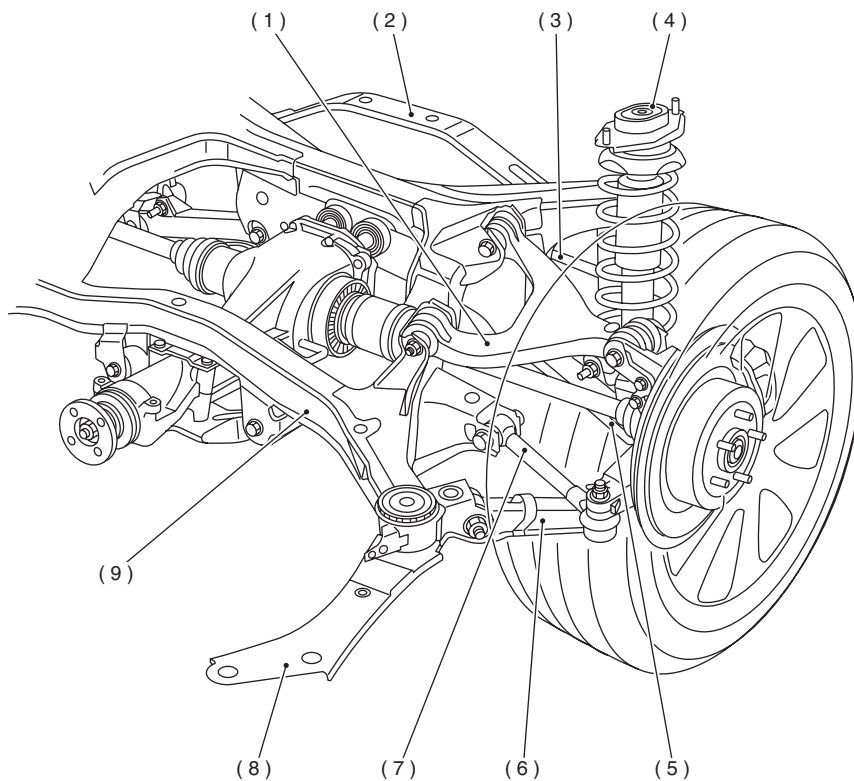
#### A: GENERAL

A new, double wishbone type suspension has been developed as the rear suspension for this 7-seat SUV.

This double wishbone type suspension consists of the upper arm, the front lateral link, the rear lateral link, the trailing link, the shock absorber, and the coil spring.

Without changing the drive advantage of the multi-link type rear suspension that was used in Legacy, the following measures have been taken to greatly improve the comfort of long-distance driving.

- Revision of the wheel stroke direction during the bump stroke  
During the bump stroke, the wheels are set to move toward the rear of the vehicle to reduce the harshness when driving over bumps.
- Revision of the damper lever ratio  
The lever ratio has been greatly reduced to 1.2, there is plenty of damping force even with a minute stroke, and a more flat feeling is given.
- Full floating type  
All the suspension arms and links are attached to the sub-frame, so the noise picked up by the tires is insulated by the bushing.



RS-00210

# REAR SUSPENSION (DOUBLE WISHBONE TYPE)

REAR SUSPENSION

---

- (1) Upper arm
- (2) Rear sub-frame support plate
- (3) Rear stabilizer
- (4) Shock absorber
- (5) Rear lateral link
- (6) Trailing link
- (7) Front lateral link
- (8) Front sub-frame support plate
- (9) Rear sub-frame

# REAR SUSPENSION (DOUBLE WISHBONE TYPE) (FROM '08MY)

## REAR SUSPENSION

### 3. Rear Suspension (Double Wishbone Type) (From '08MY)

#### A: FEATURE

Double wishbone rear suspension optimizes the camber angle in relation to the ground while increasing the amount of change in camber angle. This makes the tires grab the ground vertically at all times, providing the best result of the tire performance.

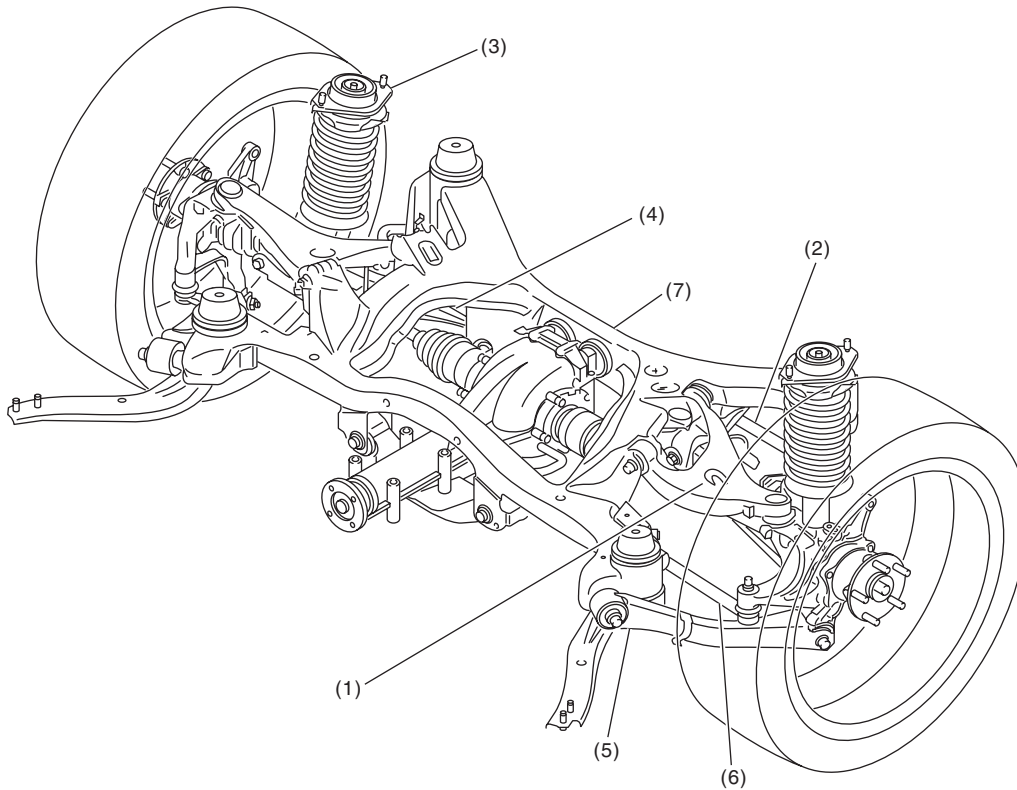
Length of each link is set as long as possible to eliminate an excessive toe change, providing more moderate bump toe-in. This suppresses behavior changes due to conditions on the road surface or body roll, assuring stable drivability.

#### B: STRUCTURE

Double wishbone rear suspension is mainly consists of A-shaped upper arms on top of both right and left sides, two lateral links underneath of the both sides, and the trailing links positioned in the longitudinal direction.

All link arms and rear differential system are attached to the sub frame and mounted on the body via bushings.

The rear lateral links are attached with the shock absorbers with coaxially-arranged coil springs and the stabilizers.



RS-00292

- |                     |                       |                        |
|---------------------|-----------------------|------------------------|
| (1) Upper arm       | (4) Rear lateral link | (6) Front lateral link |
| (2) Rear stabilizer | (5) Trailing link     | (7) Rear sub frame     |
| (3) Shock absorber  |                       |                        |

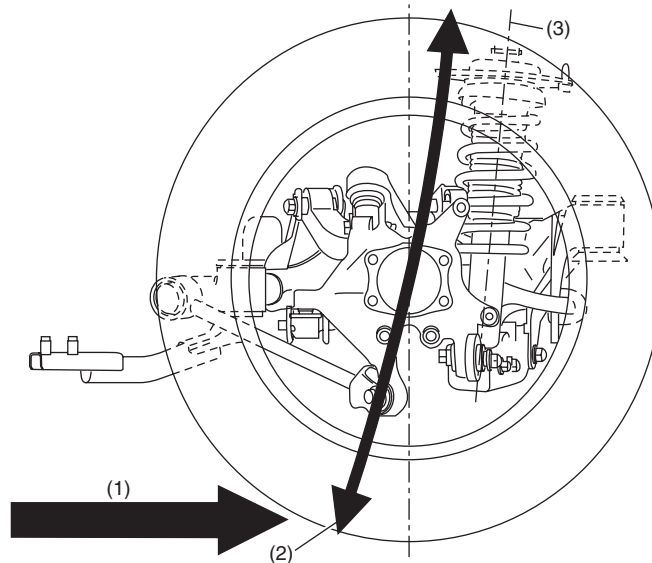


## C: OPERATION

The wheel center lateral trajectory is set to lean toward rear as shown in the figure below, providing arrangement that reduces inputs from road surface such as vibration and noise by diverting them rearward when the suspensions make strokes.

The shock absorbers are arranged in the same direction as the wheel center lateral trajectory to prevent the top mounts from twisting during strokes, receiving inputs from road surface directly into shock absorbers' axial direction.

In this design even small inputs are absorbed well, providing both drivability and ride quality at a high level.



RS-00288

(1) Input

(2) Wheel center lateral trajectory

(3) Shock absorber axis

# WHEEL & TIRE

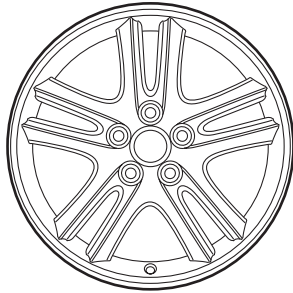
## WHEEL AND TIRE SYSTEM

### 1. Wheel & Tire

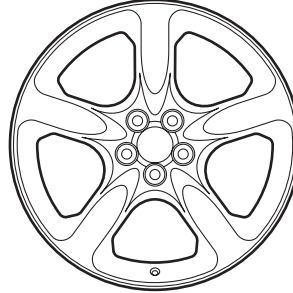
#### A: STANDARD TIRE

Aluminum wheels are provided with a center cap.

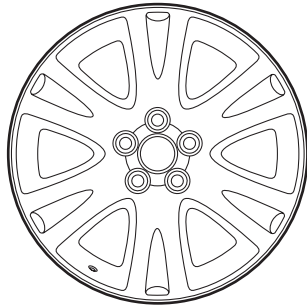
The following four types of disk wheels are provided for model grades.



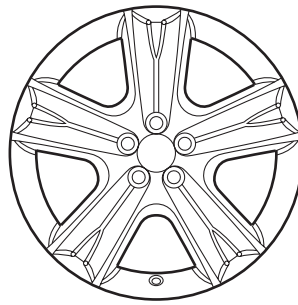
(1)



(2)



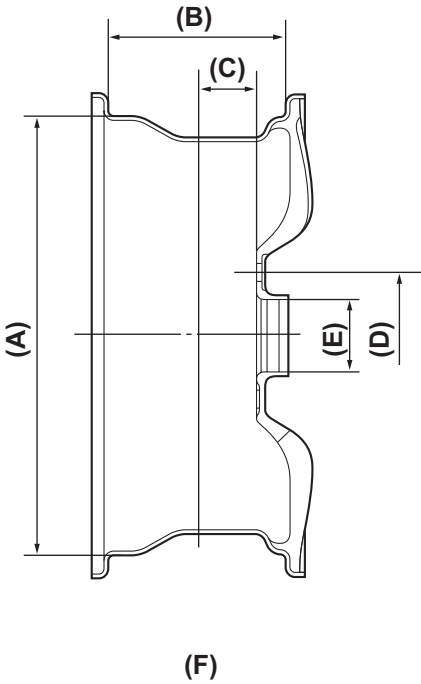
(3)



(4)

WT-00074

Disc wheel	Size	Rim diameter	Rim width	Offset	P.C.D.	Bolt holes	Center hole diameter	Tire size
		mm (in)	mm (in)	mm (in)	mm (in)		mm (in)	mm (in)
(1)	16 × 6 1/2JJ	φ405.6 (16.0)	165.5 (6.5)	55 (2.2)	φ100 (3.9)	5	φ56 (2.2)	P205/55R 16 89H
(2)	17 × 7JJ	φ436.6 (17.2)	178.0 (7)	55 (2.2)	φ100 (3.9)	5	φ56 (2.2)	215/45ZR 17
(3)	16 × 6 1/2JJ	φ405.6 (16.0)	165.5 (6.5)	48 (1.9)	φ100 (3.9)	5	φ56 (2.2)	P225/60R 16 97H
(4)	17 × 7JJ	φ436.6 (17.2)	178.0 (7)	48 (1.9)	φ100 (3.9)	5	φ56 (2.2)	P225/55R 17 95V



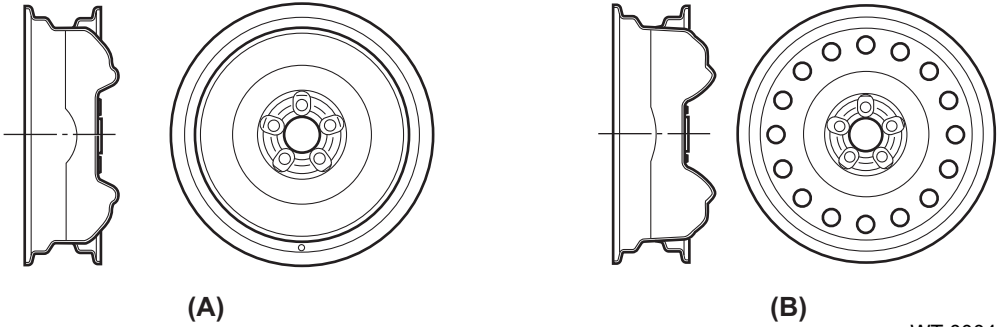
WT-00042

- (A) Rim diameter
- (B) Rim width
- (C) Offset
- (D) P.C.D.
- (E) Center hole diameter
- (F) Aluminum wheel

**B: SPARE TIRE**

A light and compact temporary type spare tire is equipped on some models.

Specifications	Tire size	Rim size
T-type tire	T135/70D17 102M T155/70D17 110M	17 × 4T
	T135/80R16 101M	16 × 4T



WT-00045

(A) 16 × 4T

(B) 17 × 4T

# TIRE PRESSURE MONITORING SYSTEM

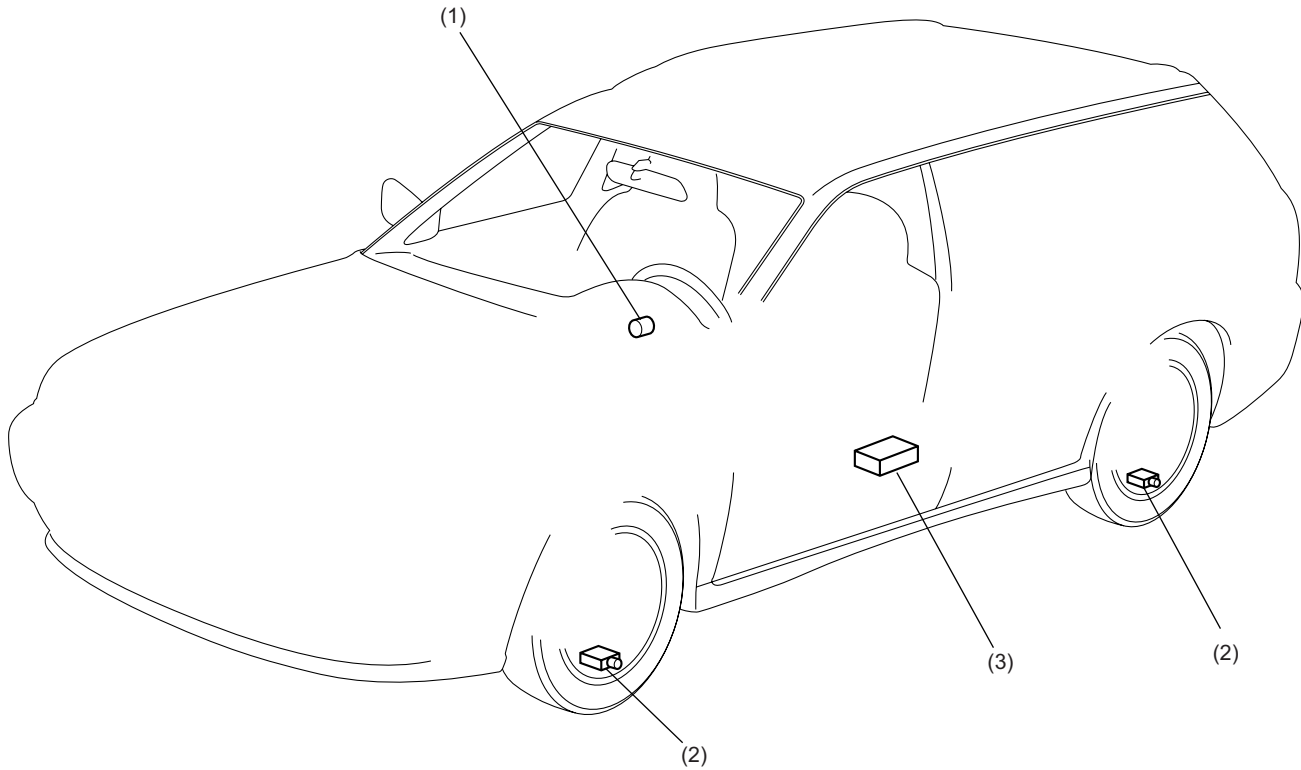
## WHEEL AND TIRE SYSTEM

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### 2. Tire Pressure Monitoring System

#### A: GENERAL

To comply with the requirements of FMVSS No. 138, a direct detecting type tire pressure monitoring system, which consists of four transmitters (each integrated with a tire air valve) and a receiver (installed under the driver's seat) is introduced.



WT-00075

- (1) Indicator lights
- (2) Transmitter
- (3) Receiver

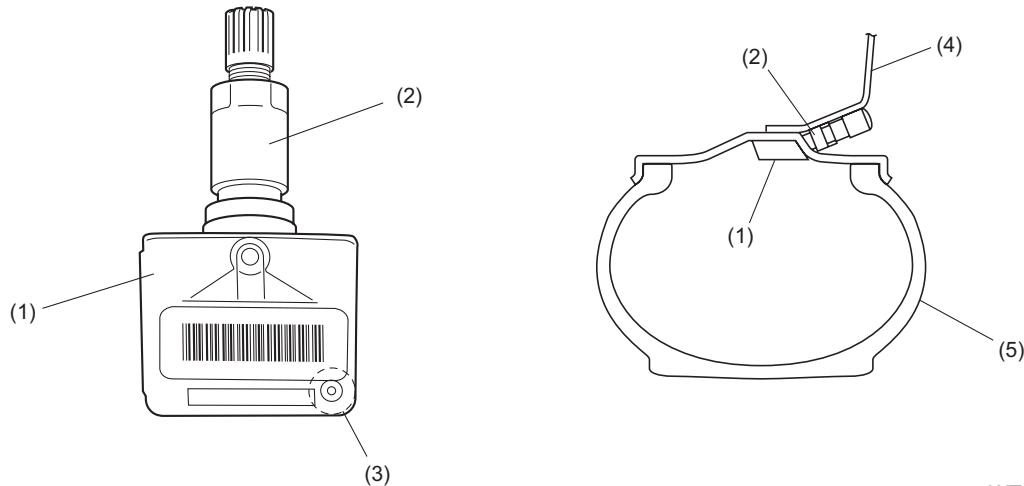
## B: TRANSMITTER (TIRE PRESSURE SENSOR)

Detects the tire pressure with the sensor built inside the transmitter, which is integrated with the tire air valve.

The sensor contains a battery as a power source.

The battery life is 10 years or 160,000 km (100,000 miles).

The battery cannot be replaced separately; when the battery becomes weak the whole sensor assembly must be replaced.



WT-00076

- (1) Transmitter (tire pressure sensor)
- (2) Nut
- (3) Tire pressure sensor built-in part
- (4) Wheel
- (5) Tire

When the vehicle speed increases to 11 — 32 km/h (7 — 20 MPH), the roll switch built in the sensor turns ON, and the sensor starts to transmit pressure data\*<sup>1</sup> together with the ID code\*<sup>2</sup> and function code\*<sup>3</sup>.

When the switch is turned ON, the transmitter takes measurement once in every 30 seconds, and sends the result once in every minute.

When the vehicle is stopped for 15 minutes or more, the sensor enters sleep mode to minimize battery consumption.

\*1: Detected tire pressure data

\*2: ID code allocated to each transmitter

\*3: A code indicating the current transmitter mode

The transmitter switches its mode according to its condition as follows.

These condition information are referred to as “function codes”.

# TIRE PRESSURE MONITORING SYSTEM

## WHEEL AND TIRE SYSTEM

---

### Function codes

Mode	Code	Function
Learn mode	000	This is the initial mode when the transmitter is turned ON using a transmission activation tool (ST).
Low battery mode	001	Enters this mode when the transmitter battery voltage drops. This code is transmitted when the transmitter voltage becomes low.
OFF mode	010	Transmitter is OFF (no pressure detection, no data transmission).
Re-measure mode	011	This code is transmitted if the detected pressure differs by 8.4 kPa (0.086 kgf/cm <sup>2</sup> , 1.218 psi) or more compared with the previous data. (sudden change in pressure due to tire burst, tire pressure adjustment, etc.)
Wake mode	101	This code is transmitted when the condition changes from vehicle stopped (transmitter roll switch OFF and data not transmitted) to vehicle running (transmitter roll switch turns ON and data transmission starts).
Normal pressure mode	111	This code is transmitted when the condition is none of the above; vehicle normally running or stopped (within 15 minutes after stopped).

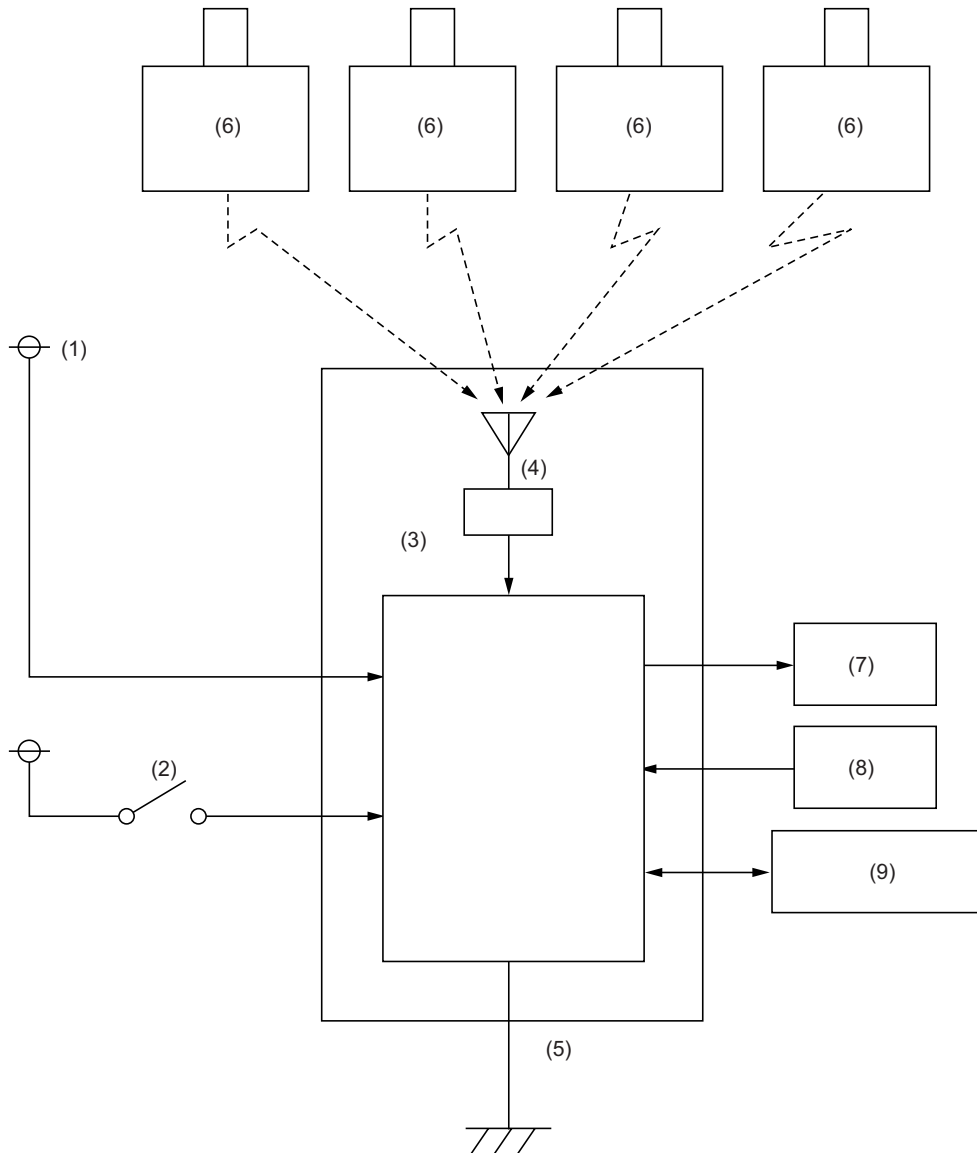
# TIRE PRESSURE MONITORING SYSTEM

## C: RECEIVER

The receiver has a built-in antenna.

The receiver collects tire pressure data from the transmitters, and turns on the indicator to warn the driver when it concludes that the tire pressure has dropped below a certain value.

The receiver is provided with a system fault diagnosis function.



WT-00079

- (1) Power supply
- (2) Ignition switch
- (3) Receiver
- (4) Antenna
- (5) Ground

- (6) Transmitter
- (7) Integrated unit
- (8) Vehicle speed
- (9) Subaru select monitor

# TIRE PRESSURE MONITORING SYSTEM

## WHEEL AND TIRE SYSTEM

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### 1. RECEIVER FUNCTIONS

- Receiving function: Receives data from the transmitters and decides whether the data is valid or not.
- Pressure judgment function: The indicator turns ON to warn the driver if the tire pressure drops below the preset value (180 kPa, 1.835 kgf/cm<sup>2</sup>, 26.11 psi). At the same time, a diagnostic trouble code is stored in the memory inside the receiver to identify which tire has low pressure. (low pressure detection turns ON at 180 kPa (1.835 kgf/cm<sup>2</sup>, 26.11 psi), turns OFF at 200 kPa (2.039 kgf/cm<sup>2</sup>, 29.01 psi))
- Diagnosis function: The indicator flashes and a diagnostic trouble code is stored in the memory inside the receiver if a system abnormality such as data reception failure, bad received data, or bad transmitter condition is detected.

### 2. CONDITIONS JUDGED AS A FAILURE

The receiver decides that the system has failed when any of the following conditions is met.

- EEPROM abnormal: The written data does not coincide with the loaded data when the ID is registered.
- Data reception failure: Transmitter data could not be received for 10 minutes or more while driving at a speed exceeding 40 km/h (24.9 MPH).
- Function code abnormal: “Re-measure” function code is received for 5 times in series, though the pressure change compared to the last data was within 7 kPa (0.071 kgf/cm<sup>2</sup>, 1.02 psi) while driving at a speed exceeding 40 km/h (24.9 MPH).
- Air pressure data abnormal: “FFH”\* pressure data has been received for 5 times in series while driving at a speed exceeding 40 km/h (24.9 MPH).
- Low battery: Function code for the “low battery” mode has been received for 20 times or more in series.
- Vehicle speed sensor abnormal: Function code for the “wake” mode has been received while the vehicle speed signal is 6 km/h (3.7 MPH) or lower.

\*FFH is transmitted when the pressure data exceeds the upper limit (352kPa, 3.59 kgf/cm<sup>2</sup>, 51.05 psi) of pressure detection.

If the indicator comes ON due to low tire pressure, the indicator will turn OFF when the under-inflated tire is inflated to normal pressure.



## **D: SUBARU SELECT MONITOR**

The Subaru Select Monitor (SSM) enables the user to perform the following operations.

- Transmitter ID registration: The new ID can be registered when the transmitter is replaced due to battery life, etc.
- Data monitoring: The status of the function code, tire pressure, vehicle speed, indicator illuminating pressure, or I/O signal can be displayed.
- ID data display: The registered four IDs and the currently received data for each ID can be displayed.
- Diagnostic trouble codes display: Stored diagnostic trouble codes can be read.
- Erasing diagnostic trouble codes: Diagnostic trouble codes can be erased after repair work is completed.

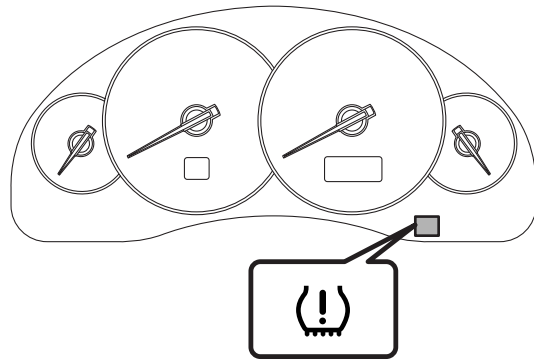
# TIRE PRESSURE MONITORING SYSTEM

## WHEEL AND TIRE SYSTEM

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### E: INDICATOR LIGHT

The indicator light warns the driver when the tire pressure drops or a failure occurs in the system.



(1)

WT-00078

(1) Tire pressure monitoring indicator light

# TIRE PRESSURE MONITORING SYSTEM

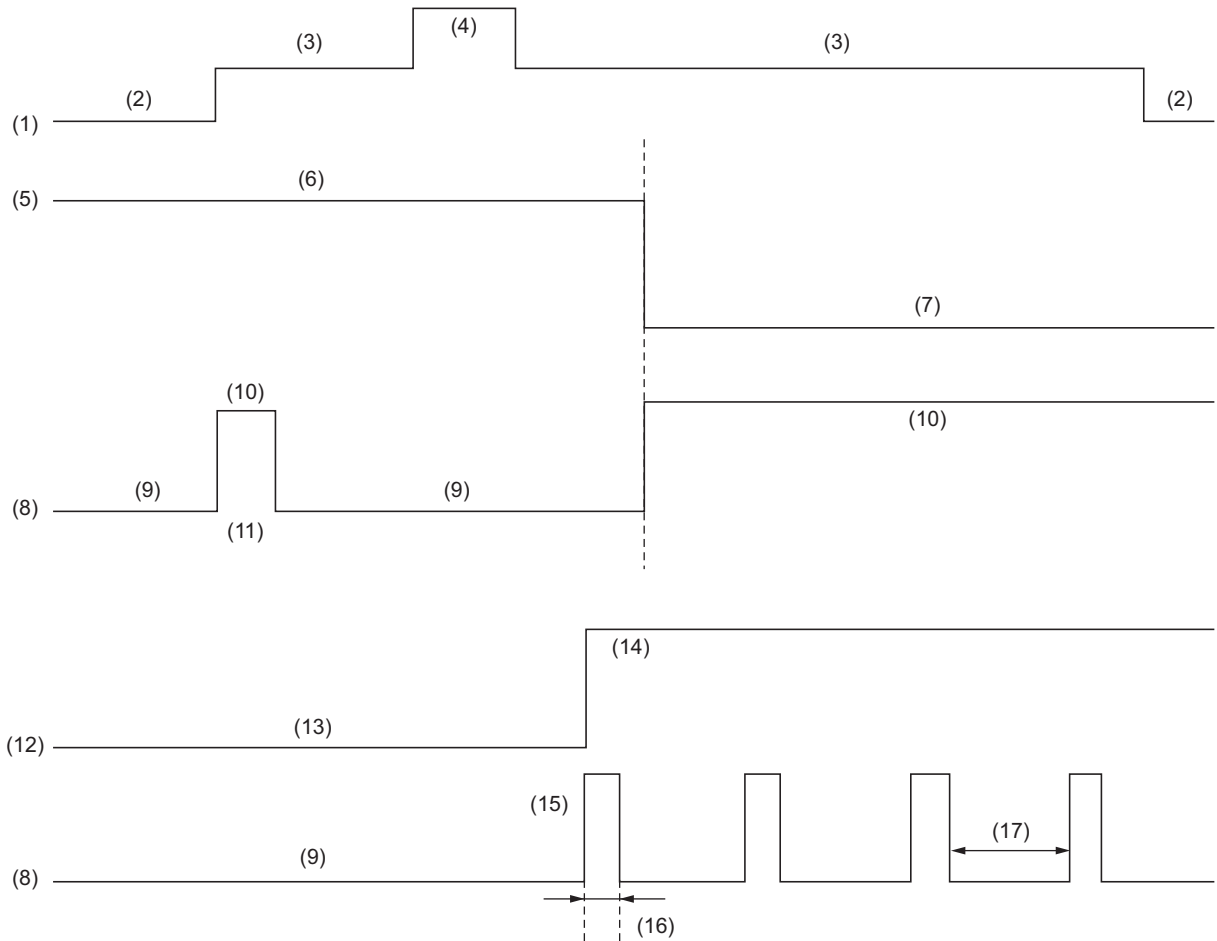
WHEEL AND TIRE SYSTEM

## 1. FAULT DISPLAY PATTERNS

When normal: indicator turns OFF at 2 seconds after the ignition switch has been turned ON

When low pressure is detected: illuminates

When system abnormality is detected: flashes (3 seconds OFF, 1 second ON)



WT-00077

(1) Ignition switch

(2) OFF

(3) ON

(4) Start

(5) Tire pressure

(6) Within standards

(7) 180 kPa (1.835 kgf/cm<sup>2</sup>, 26.11 psi) or less

(8) Tire pressure warning light

(9) OFF

(10) Illuminates

(11) 2 seconds

(12) System status

(13) Normal

(14) Abnormal

(15) Flash

(16) 1 second

(17) 3 seconds

# TIRE PRESSURE MONITORING SYSTEM

WHEEL AND TIRE SYSTEM

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**MEMO**

# REAR DIFFERENTIAL

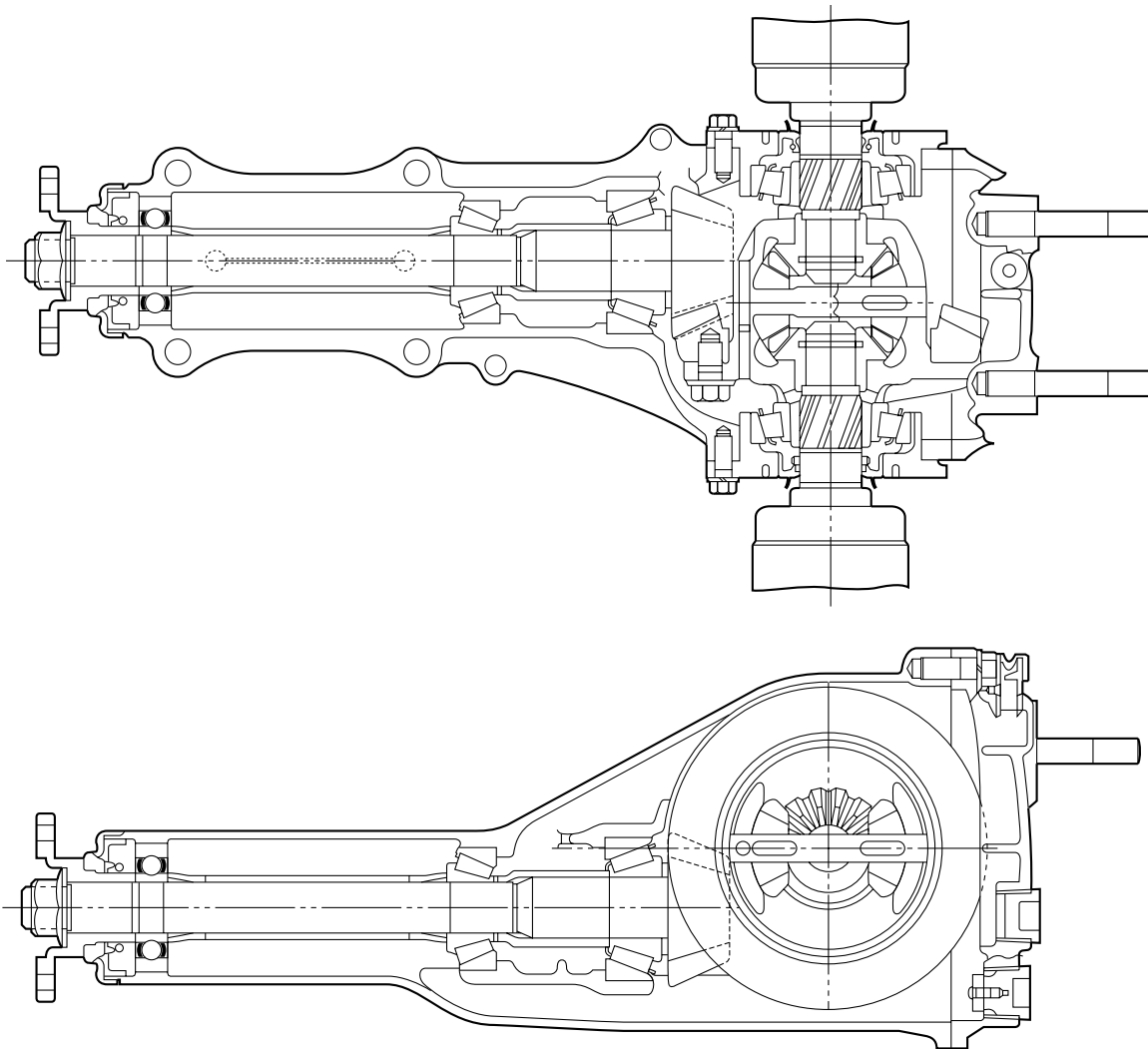
## DIFFERENTIALS

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### 1. Rear Differential

#### A: T-TYPE

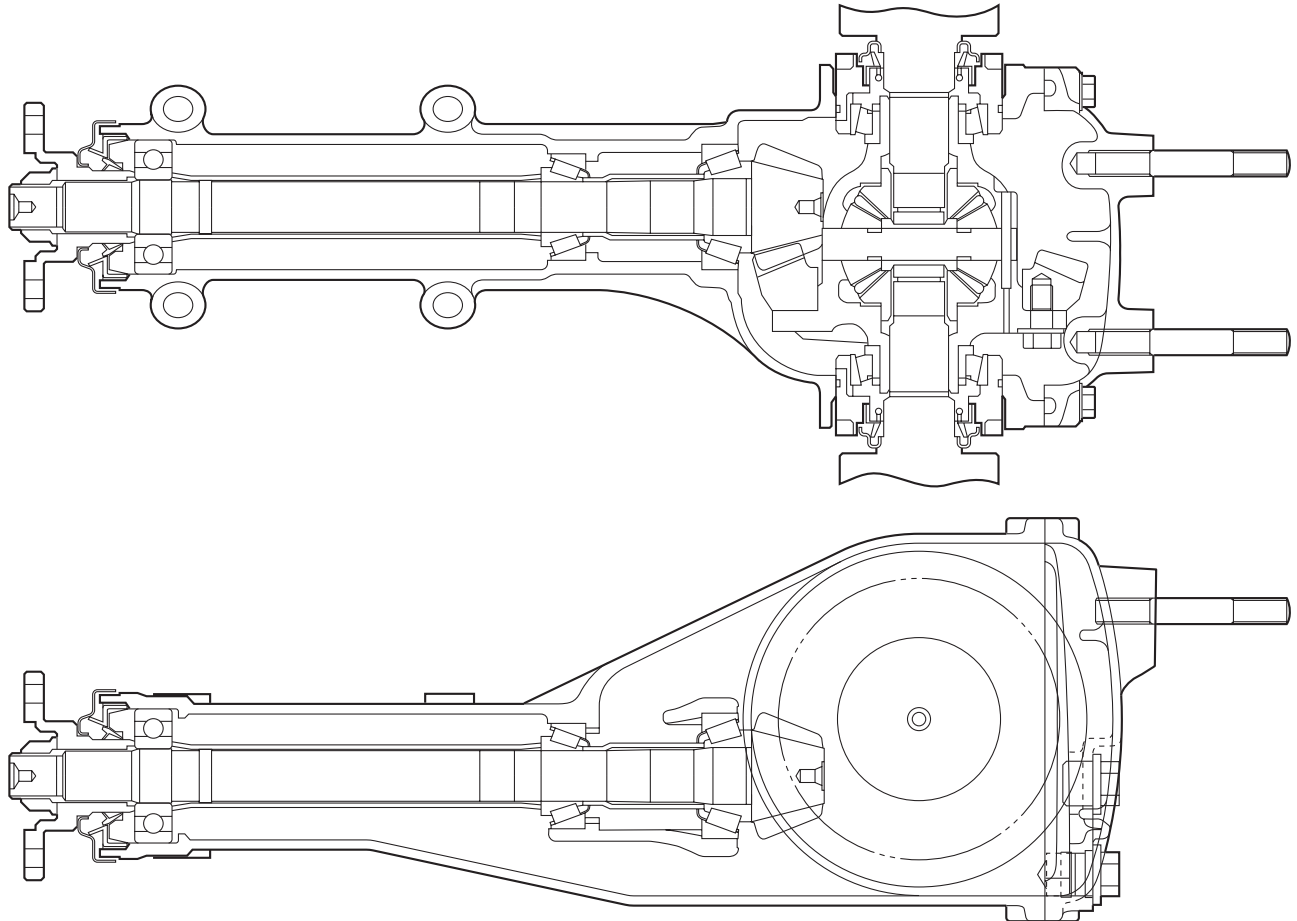
The drive gear is a hypoid gear with nominal diameter of 160 mm (6.30 in). The drive pinion shaft is supported by three bearings. The bearing preload is adjusted by selecting a spacer and washer combination of a proper thickness. The drive pinion height is adjusted by properly selecting the thickness of the washers located at the drive pinion neck using a dummy shaft and gauge.



DI-00231

## B: VA 1 TYPE

The drive gear is a hypoid gear with nominal diameter of 152 mm (5.98 in). The drive pinion shaft is supported by three bearings. The bearing preload is adjusted by selecting a spacer and washer combination of a proper thickness. The drive pinion height is adjusted by properly selecting the thickness of the washers located at the drive pinion neck using a dummy shaft and gauge.



DI-00305

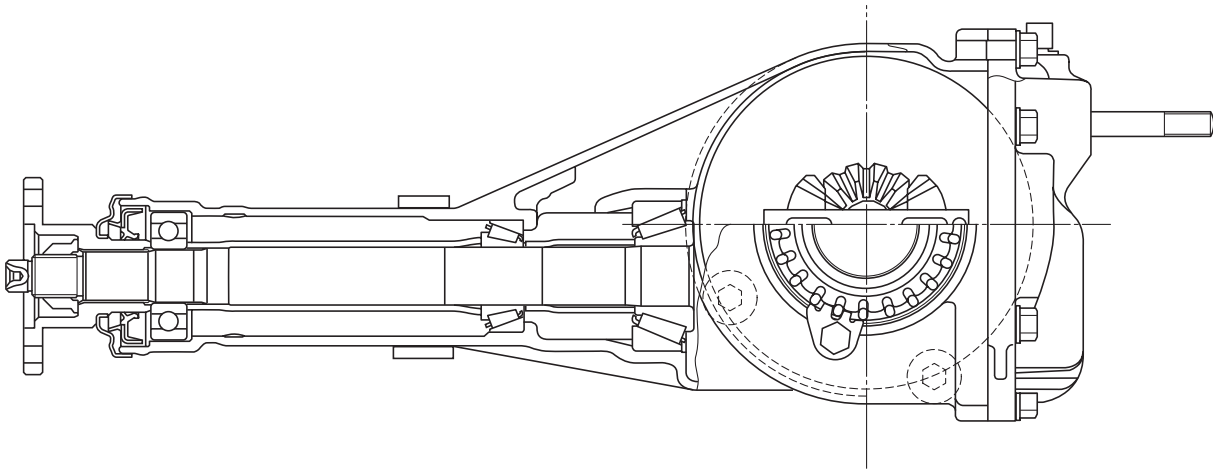
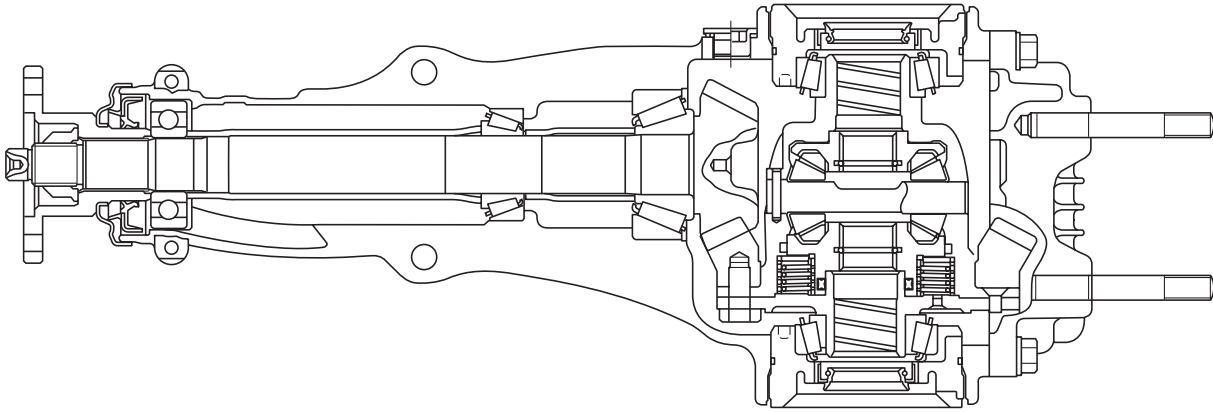
# REAR DIFFERENTIAL

## DIFFERENTIALS

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### C: VA 2 TYPE

The drive gear is a hypoid gear with nominal diameter of 160 mm (6.30 in). The drive pinion shaft is supported by three bearings. The bearing preload is adjusted by selecting a spacer and washer combination of a proper thickness. The drive pinion height is adjusted by properly selecting the thickness of the washers located at the drive pinion neck using a dummy shaft and gauge. The hypoid gear has uniform height teeth.



DI-00388

## 2. Limited Slip Differential (LSD) (Viscous Coupling Type)

### A: GENERAL

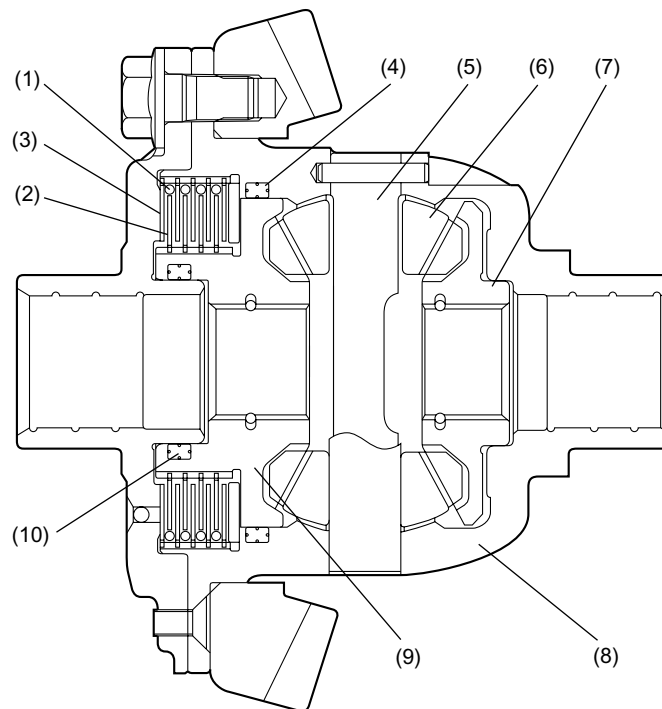
The limited slip differential (LSD) automatically limits the differential action and distributes torque to the left and right wheels adequately to enhance driving stability when the left and right wheels are rotating at speeds different from each other during driving on a slippery road (muddy, snow-covered or slushy road) or cornering.

### B: CONSTRUCTION

The V/C (viscous coupling) type LSD has outer plates and inner plates arranged alternately. Each outer plate is splined to the inside of the differential case at its outer periphery and each inner plate is splined to the outer circumference of the left side gear at its inner periphery.

The outer plates are held in position by spacer rings while the inner plates can slide in the axial direction along the spline teeth.

The space between the differential case and the left side gear is filled with a mixture of high viscosity silicone oil and air and hermetically sealed with X-rings.



DI-00295

- (1) Spacer ring
- (2) Inner plate
- (3) Outer plate
- (4) X-ring
- (5) Pinion shaft

- (6) Pinion gear
- (7) Side gear (right)
- (8) Differential case
- (9) Side gear (left)
- (10) X-ring



# LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

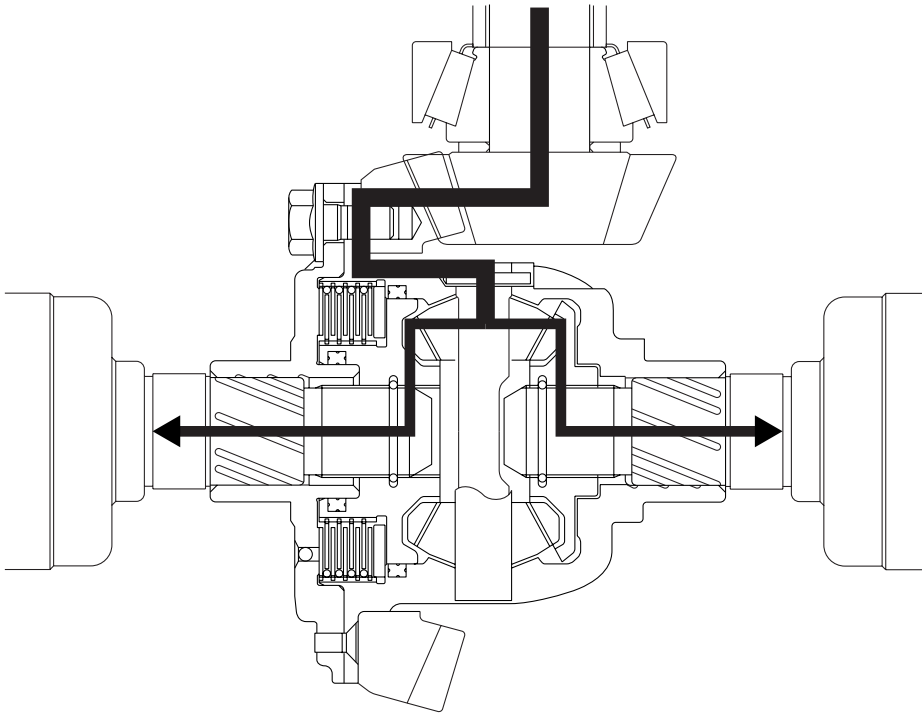
## DIFFERENTIALS

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### C: OPERATION

#### 1. WHEN RIGHT AND LEFT WHEELS ROTATE AT THE SAME SPEED

During normal straight-ahead driving where the right and left wheels rotate at the same speed, the differential case and side gears rotate together, just as in conventional differentials. As a result, driving torque is distributed equally to the right and left side gears.



DI-00296

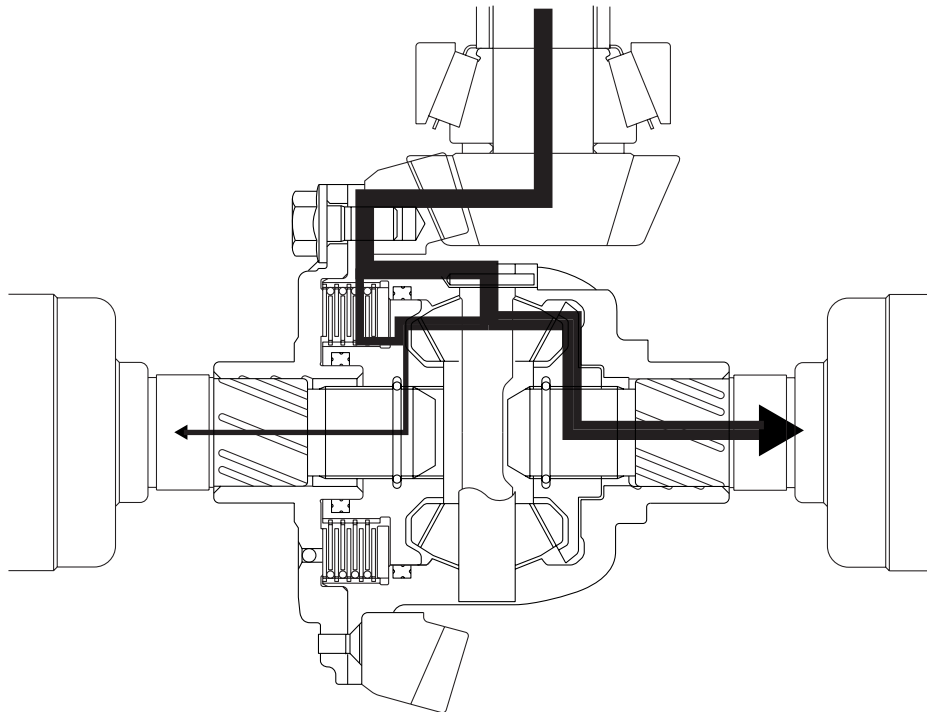
## 2. WHEN RIGHT AND LEFT WHEELS ROTATE AT DIFFERENT SPEEDS

When a speed difference occurs between the right and left wheels, the differential case and the left side gear do not rotate at the same speed any more. The speed difference between them corresponds to that between both the wheels. Because of the shear force caused in the silicone oil, a differential torque is then generated, which limits differential action.

For example, if the left wheel spins due to small road resistance, a speed difference occurs between the right and left wheels. Since there is the V/C between the differential case and left side gear, a differential torque corresponding to the speed difference is generated in the V/C. This differential torque is transferred from the left wheel to the right wheel. As a result, a greater driving torque is distributed to the right wheel which is rotating at a lower speed.

When the right wheel spins, the differential torque is transferred from the right wheel to the left wheel. Also in this case, a torque greater by the differential torque than the torque to the spinning wheel is transmitted to the wheel rotating at the lower speed.

### When left wheel spins



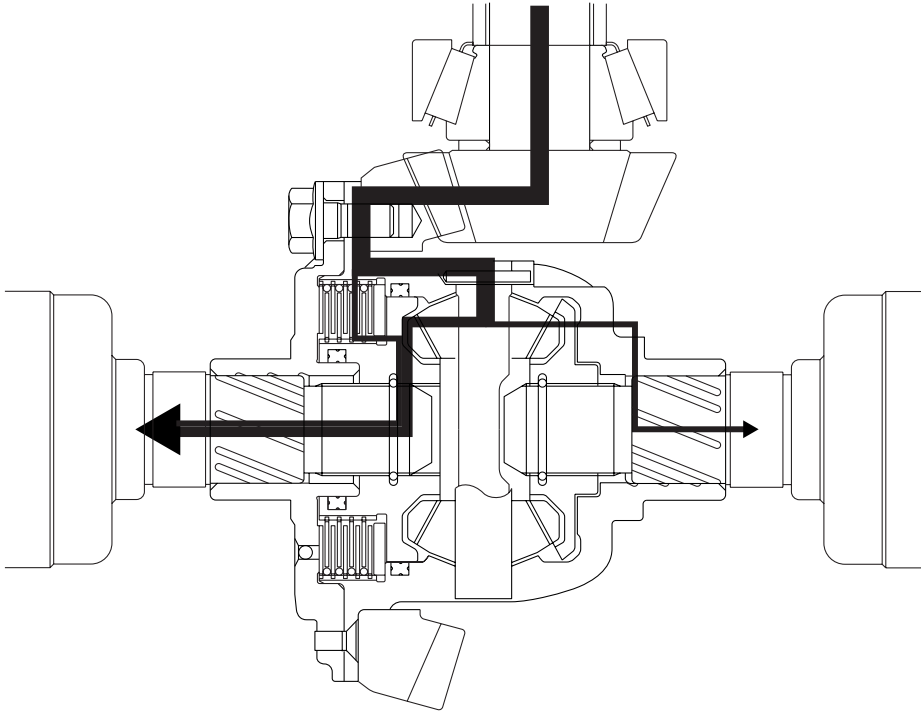
DI-00297

# LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

## DIFFERENTIALS

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### When right wheel spins



DI-00298

### D: SERVICE PROCEDURES FOR LSD

It is not recommended to disassemble the LSD assembly as component parts of LSD assembly are not available individually.

# CENTER DIFFERENTIAL

TRANSFER CASE

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## 1. Center Differential

Regarding the construction and operation of the center differential, refer to 5MT section. <Ref. to 5MT section.>

## 2. AWD Transfer System

Regarding the construction and operation of the AWD transfer system, refer to 4AT or 5AT section.  
<Ref. to 4AT section, AWD Transfer System.> <Ref. to 5AT section, AWD Transfer System.>

# AWD TRANSFER SYSTEM

TRANSFER CASE

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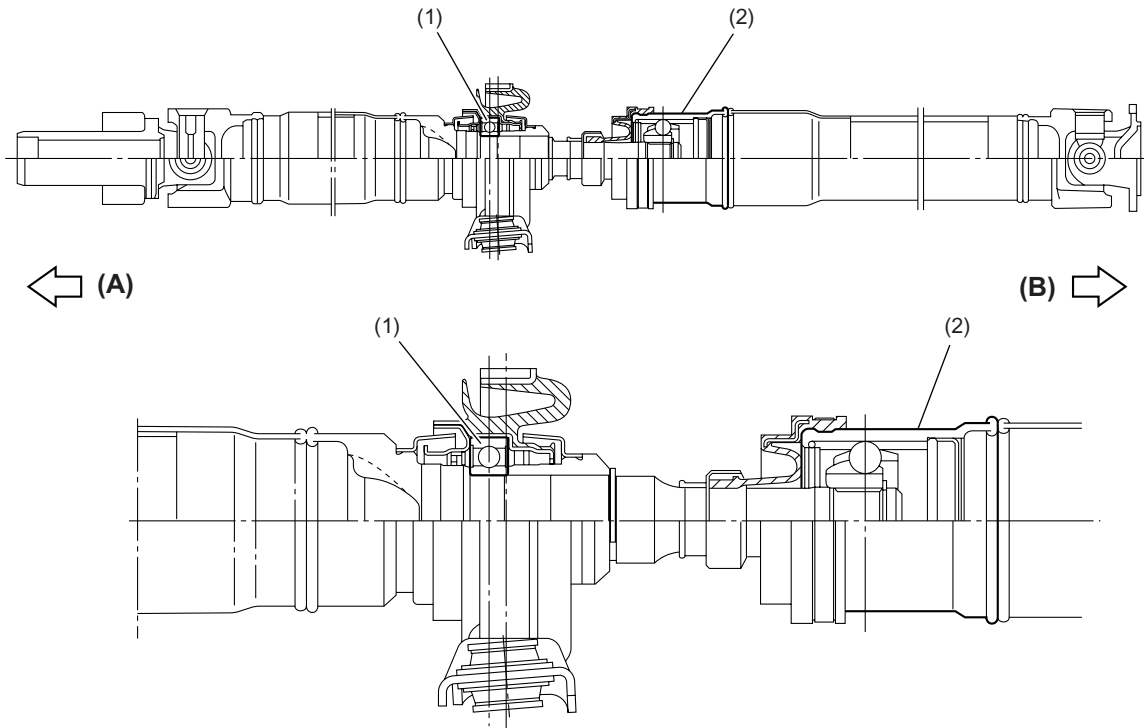
**MEMO**

# PROPELLER SHAFT

## DRIVE SHAFT SYSTEM

### 1. Propeller Shaft

To reduce noise, constant velocity joints are used on the propeller shafts. The center joint is a compact and small EDJ (High Efficiency Compact Double Offset Joint) type that can extend and retract in axial directions.



DS-00238

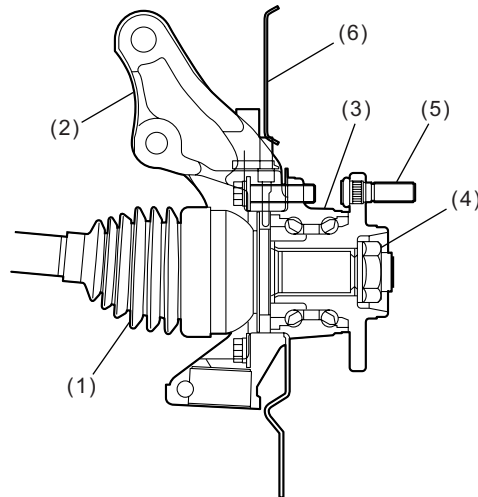
- (1) Center bearing
- (2) EDJ

- (A) Transmission side
- (B) Rear differential side

## 2. Front Axle

### A: GENERAL

- A double-rowed angular type ball bearing that features small rolling friction is used.
- The bearing is structured as a hub unit bearing where one of its bearing inner race is integrated with the hub, and features light weight and high rigidity.
- Also, the oil seal is integrated with the bearing.
- The hub unit, housing and the disk cover, which is sandwiched between them are held together with four bolts.
- To reduce noise from the front drive shafts, the transmission side drive axle shaft and joint are integrated. PTJ (Pillow Tripod Joint) type constant velocity joints are newly used at the transmission side, and light and compact EBJ (High Efficiency Compact Ball Fixed Joint) type joints are used at the wheel side.
- The EBJ's spindle is splined to the hub unit and is fastened with an axle nut which is clinched.



DS-00256

- |                  |                      |                |
|------------------|----------------------|----------------|
| (1) EBJ          | (3) Hub unit bearing | (5) Hub bolt   |
| (2) Axle housing | (4) Axle nut         | (6) Disc cover |

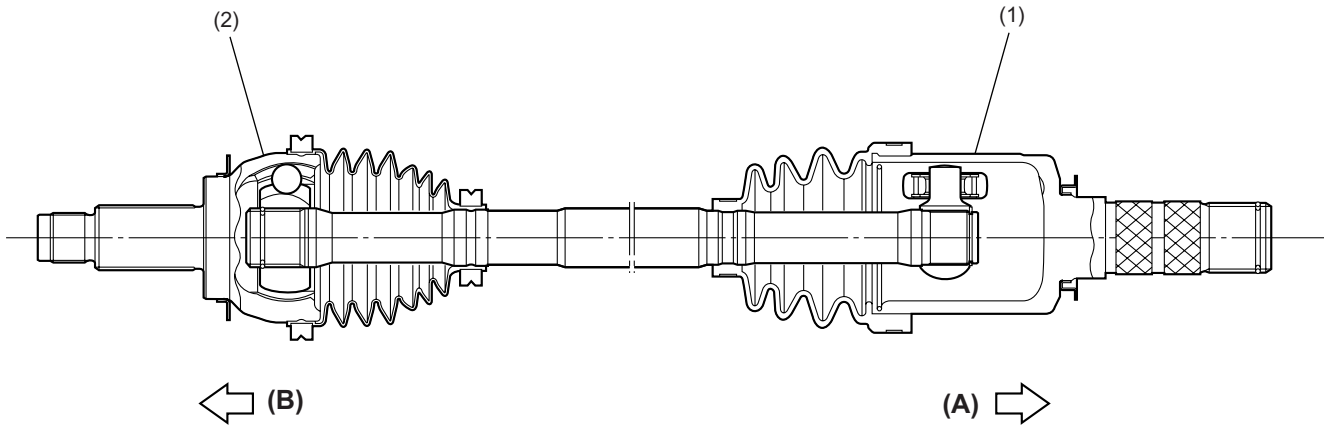


# FRONT AXLE

## DRIVE SHAFT SYSTEM

### B: FRONT DRIVE SHAFT

- The spline connection between the transmission side axle drive axle shaft and joint is abolished and changed to an integrated structure. PTJ (Pillow Tripod Joint) type joints are newly used at the transmission side, and light and compact EBJ (High Efficiency Compact Ball Fixed Joint) type joints are used at the wheel side.
- The rollers in the PTJ will not change its attitude even when the joint is angled, as they will slide while rolling in axial directions. The rollers will not be effected by the operating angle and will move smoothly inside in axial directions to reduce friction.



DS-00245

(1) PTJ

(2) EBJ

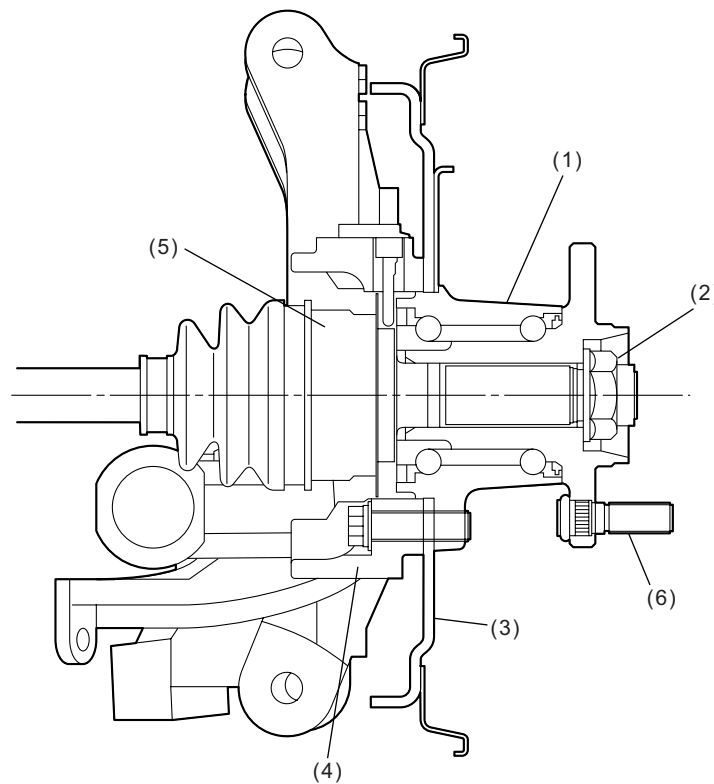
(A) Transmission side

(B) Wheel side

## 3. Rear Axle

### A: GENERAL

- A double-rowed angular type ball bearing that features small rolling friction is used.
- The bearing is structured as a hub unit bearing where one of its bearing inner race is integrated with the hub, and features light weight and high rigidity.
- Also, the oil seal is integrated with the bearing.
- The hub unit, rear arm and the brake backing plate, which is sandwiched between them are held together with four bolts.
- The drive shaft's spindle is splined to the hub unit and is fastened with an axle nut which is clinched.
- The disc rotor is held in position by the hub bolts and wheel nuts together with the wheel.



DS-00257

- |                         |                 |
|-------------------------|-----------------|
| (1) Hub unit            | (4) Rear arm    |
| (2) Axle nut            | (5) Drive shaft |
| (3) Brake backing plate | (6) Hub bolt    |

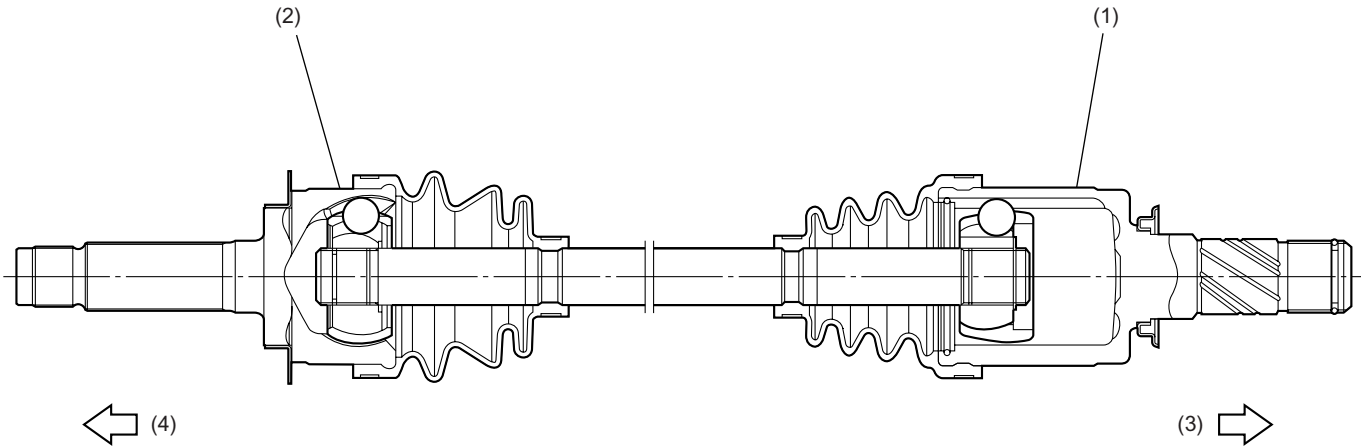
# REAR AXLE

## DRIVE SHAFT SYSTEM

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### B: REAR DRIVE SHAFT

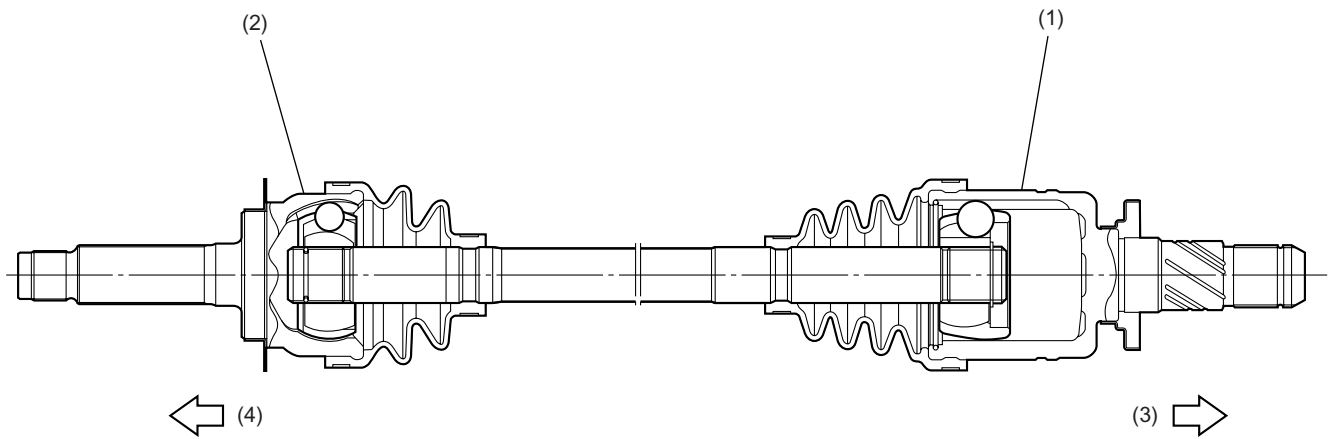
- A double offset joint (DOJ) is used on the differential side of each rear drive shaft.
- A bell joint (BJ) or a high efficiency compact ball fixed joint (EBJ) is used on the wheel side of each drive shaft.
- Rear drive shaft with BJ and DOJ joints



DS-00243

- (1) DOJ
- (2) BJ
- (3) Differential side
- (4) Wheel side

- Rear drive shaft with EBJ and DOJ joints



DS-00244

- (1) DOJ
- (2) EBJ
- (3) Differential side
- (4) Wheel side

# REAR AXLE

DRIVE SHAFT SYSTEM

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**MEMO**

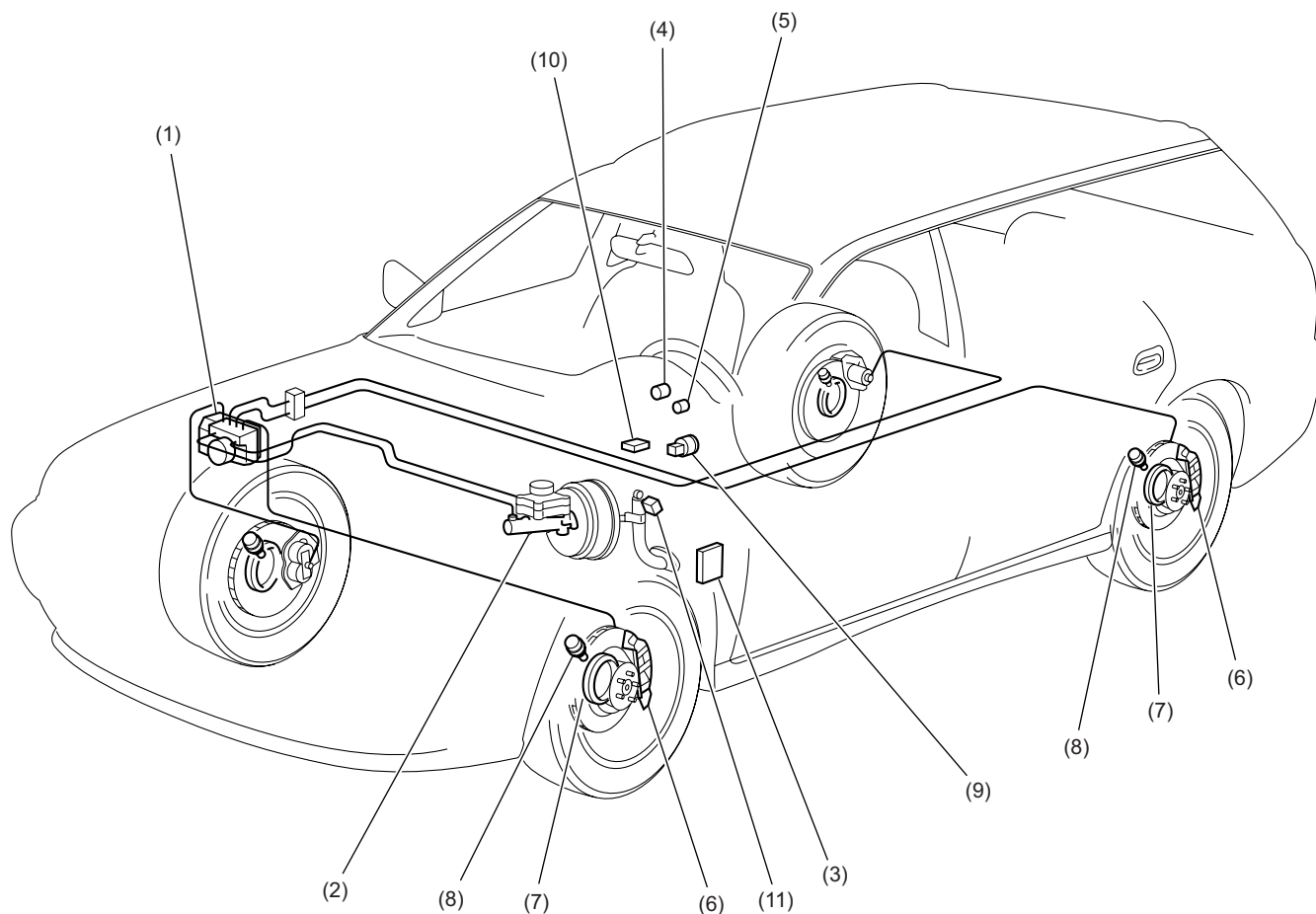
## 1. Anti-lock Brake System (ABS)

### A: FEATURES

- To reduce the size and weight, this ABS has a hydraulic control unit, an ABS control module, a valve relay and a motor relay integrated into a single unit (called ABSCM & H/U).
- The ABS electrically controls the brake fluid pressure to each wheel to prevent the wheel from locking during braking on slippery road surfaces, thereby enabling the driver to maintain the directional control.
- If the ABS becomes inoperative, a fail-safe system is activated to ensure same level of braking performance as with a conventional brake system. In that case, the warning light comes on to indicate that the ABS is malfunctioning.
- The ABS is a 4-sensor, 4-channel system. The system is a four-wheel independent control type, which controls each of the wheel brakes individually.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00575

- |   |                               |  |
|---|-------------------------------|--|
| (1) ABS control module and hydraulic control unit (ABSCM & H/U) | (5) Brake & EBD warning light | (9) G sensor   |
| (2) Master cylinder   | (6) Wheel cylinder            | (10) Data link connector (for SUBARU select monitor) |
| (3) Transmission control module (AT models only)                | (7) Magnetic encoder          | (11) Stop light switch                               |
| (4) ABS warning light   | (8) ABS wheel speed sensor    |  |

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS

## B: FUNCTIONS OF SENSORS AND ACTUATORS

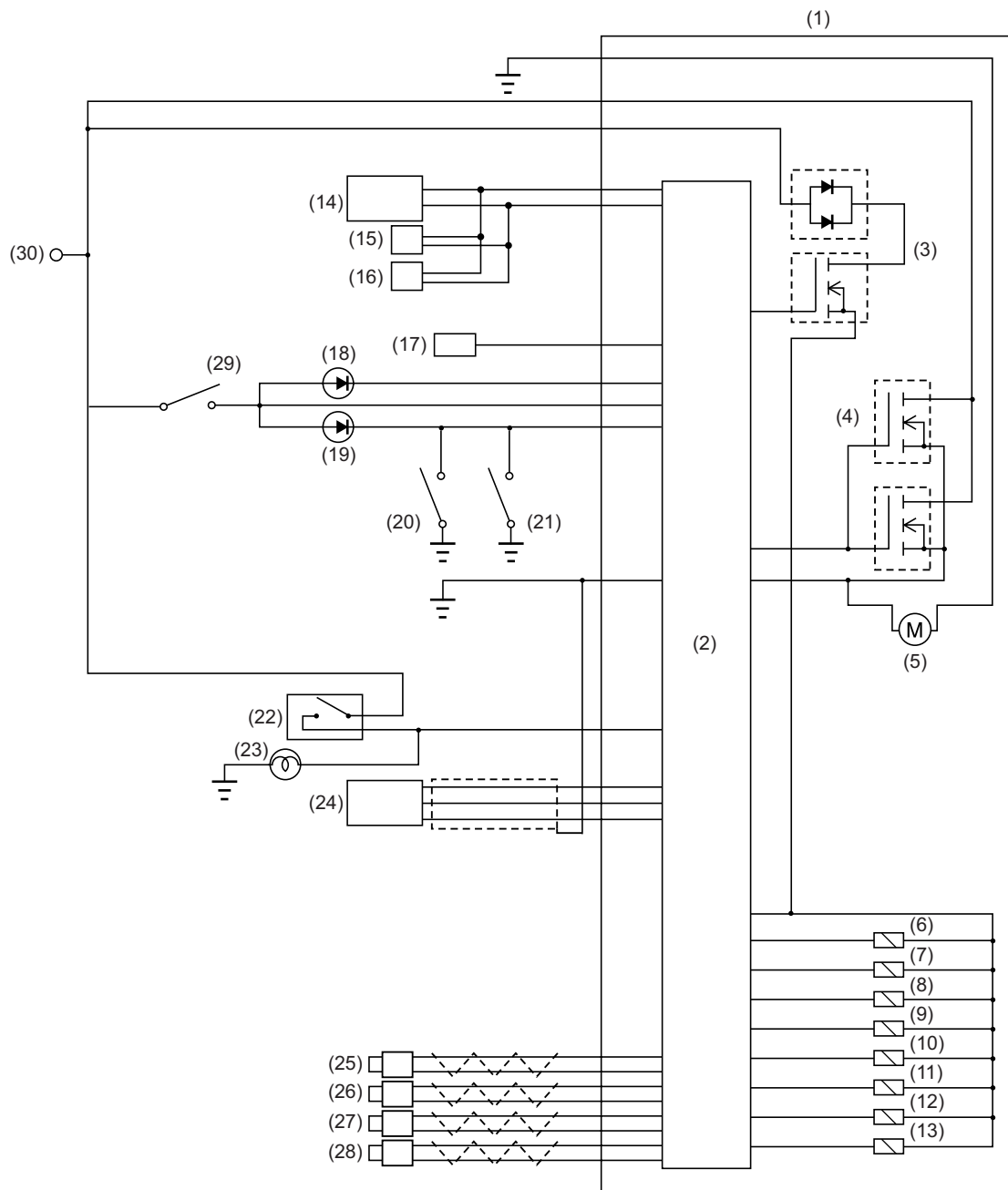
Name		Function
ABS control module and hydraulic control unit (ABSCM & H/U)	ABSCM section	<ul style="list-style-type: none"> <li>● It determines the conditions of the wheels and the vehicle body from the wheel speed data and controls the hydraulic unit depending on the result.</li> <li>● When the ABS is active, the ABSCM provides the automatic transmission control module with control signals which are used by the module for co-operative control of the vehicle with the ABSCM.</li> <li>● Whenever the ignition switch is placed at ON, the module performs a self diagnosis sequence. If anything wrong is detected, the module cuts off the system.</li> <li>● It communicates with the SUBARU select monitor.</li> </ul>
	H/U section	<ul style="list-style-type: none"> <li>● When the ABS is active, the H/U changes fluid passages to the wheel cylinders in response to commands from the ABSCM.</li> <li>● It constitutes the brake fluid passage from the master cylinder to the wheel cylinders together with the piping.</li> </ul>
	Valve relay section	It serves as a power switch for the solenoid valves. It operates in response to a command from the ABSCM.
	Motor relay section	It serves as a power switch for the pump motor. It operates in response to a command from the ABSCM.
ABS wheel speed sensor		Detects speed of each wheel and sends to the ABSCM.
Magnetic encoder		Incorporated with the hub unit bearing and causes the ABS wheel speed sensor to generate electrical signals.
G sensor		It detects a change in acceleration in the longitudinal direction of the vehicle and outputs it to the ABSCM as a voltage signal.
Stop light signal		Detects ON-OFF status of the brake pedal and sends to the ABSCM. The ABSCM uses it to determine ABS operation.
ABS warning light		It alerts the driver to an ABS fault.
Automatic transmission control module		It provides gear controls and changing power transmission to front and rear wheels in response to control signals from the ABSCM.
Brake warning light		It alerts the driver to an EBD fault. This warning light is also used for parking brake warning and brake fluid level warning.



**MEMO**

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00576

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS

- 
- |   |  |   |
|---|--|---|
| (1) ABS control module and hydraulic control unit | (11) Rear left outlet solenoid valve       | (21) Brake fluid level switch           |
| (2) ABS control module section                    | (12) Rear right inlet solenoid valve       | (22) Stop light switch                  |
| (3) Valve relay                                   | (13) Rear right outlet solenoid valve      | (23) Stop light                         |
| (4) Motor relay                                   | (14) Automatic transmission control module | (24) G sensor                           |
| (5) Motor   | (15) Body integrated unit                  | (25) Front left ABS wheel speed sensor  |
| (6) Front left inlet solenoid valve               | (16) Engine control module                 | (26) Front right ABS wheel speed sensor |
| (7) Front left outlet solenoid valve              | (17) Data link connector                   | (27) Rear left ABS wheel speed sensor   |
| (8) Front right inlet solenoid valve              | (18) ABS warning light                     | (28) Rear right ABS wheel speed sensor  |
| (9) Front right outlet solenoid valve             | (19) Brake warning light                   | (29) IGN                                |
| (10) Rear left inlet solenoid valve               | (20) Parking brake warning light switch    | (30) Battery                            |

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS

## C: PRINCIPLE OF ABS CONTROL

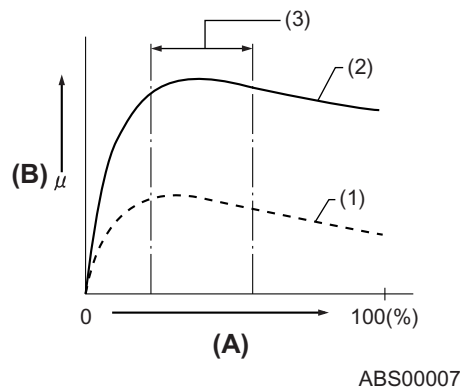
When the brake pedal is depressed during driving, the wheel speed decreases and the vehicle speed does as well. The decrease in the vehicle speed, however, is not always proportional to the decrease in the wheel speed. The non-correspondence between the wheel speed and vehicle speed is called “slip” and the magnitude of the slip is expressed by the “slip ratio” which is defined as follows:

$$\text{Slip ratio} = (\text{Vehicle speed} - \text{Wheel speed}) / \text{Vehicle speed} \times 100\%$$

When the slip ratio is 0%, the vehicle speed corresponds exactly to the wheel speed. When it is 100%, the wheels are completely locking while the vehicle is moving.

The braking effectiveness is represented by the “coefficient of friction” between the tire and road surface. The larger the coefficient, the higher the braking effectiveness. The diagram below shows the relationship between the coefficient of friction and the slip ratio for two different road surface conditions (asphalt-paved road and icy road), assuming that the same tires are used for both the conditions and the vehicles are moving forward. Although the braking effectiveness (coefficient of friction) depends on the road surface condition as shown and also on the type of the tire, its peak range generally corresponds to the 8 — 30% range of the slip ratio.

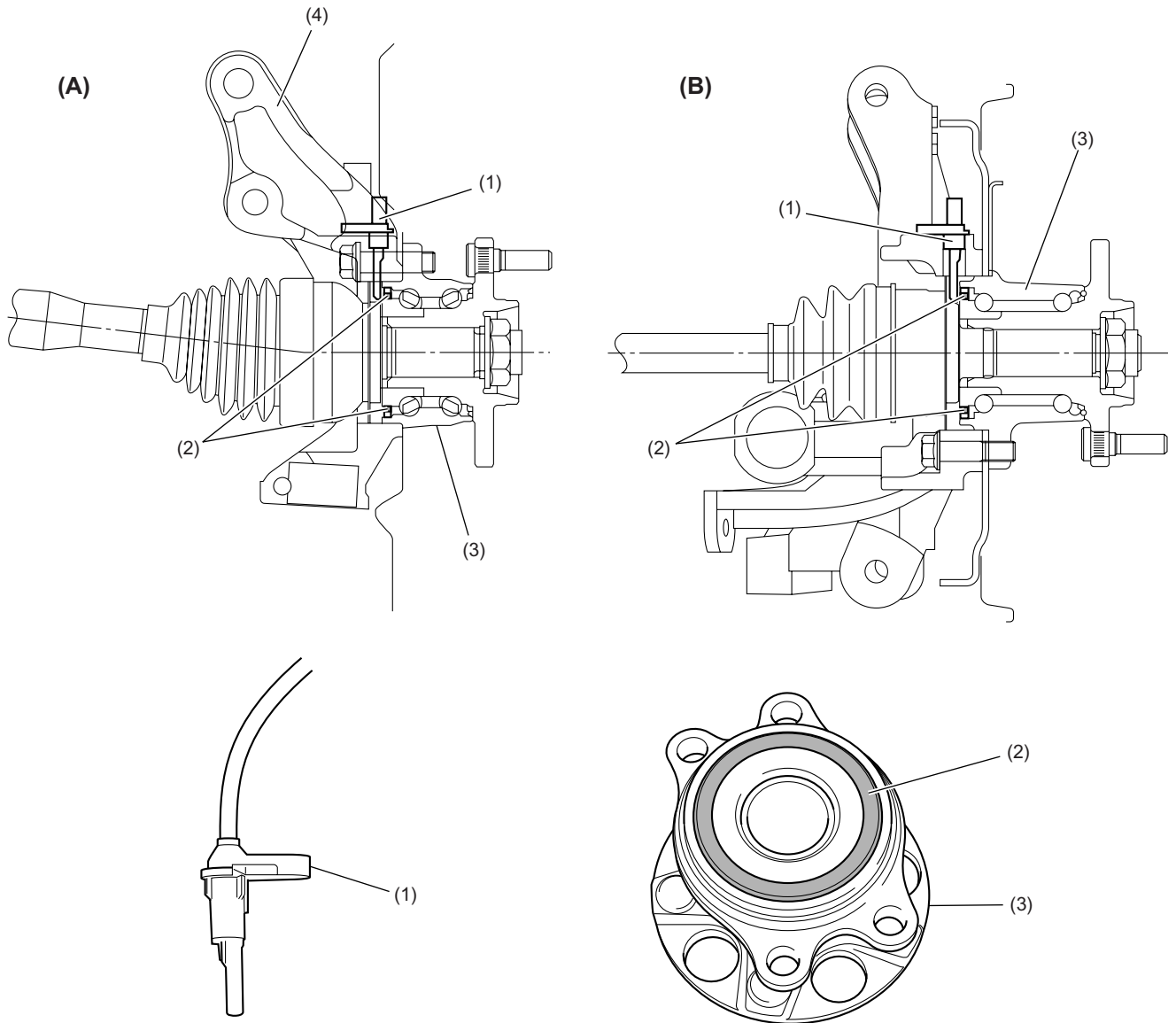
The ABS controls the fluid pressure to each wheel to maintain the slip ratio within this range.



- (A) Slip ratio
- (B) Coefficient of friction between tire and road surface
- (1) Icy road
- (2) Asphalt-paved road
- (3) Control range by ABS

## D: ABS WHEEL SPEED SENSOR

Each of the ABS wheel speed sensors detects the speed of the corresponding wheel. The sensor consists of a sensor body and a magnetic encoder. The magnetic encoder is a permanent magnet with N poles and S poles arranged alternately, and when this turns together with the wheel the magnetic field at the sensing area of the sensor body changes. The sensor body has a hall element and outputs signals at a frequency proportional to the wheel speed.



ABS00423

- (A) Front
- (B) Rear

- (1) Sensor body
- (2) Magnetic encoder

- (3) Hub unit bearing
- (4) Housing

# ANTI-LOCK BRAKE SYSTEM (ABS)

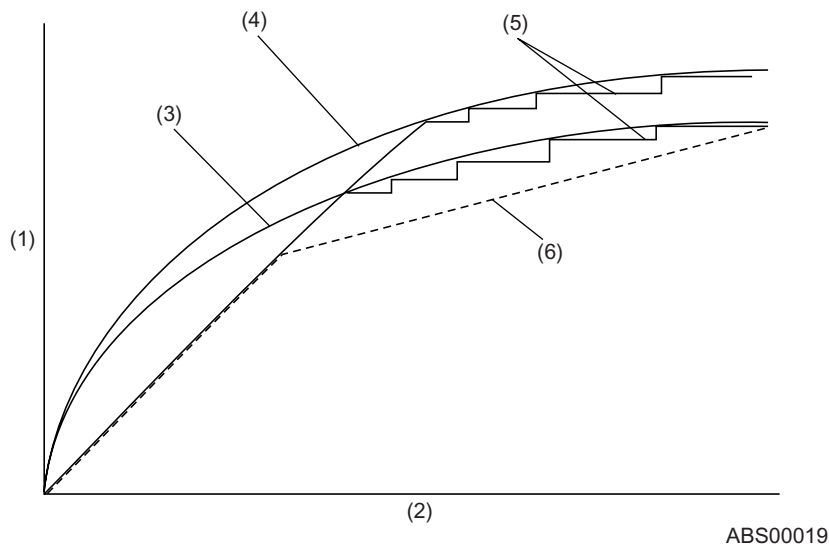
ABS

## E: EBD (ELECTRONIC BRAKE FORCE DISTRIBUTION)

The EBD system utilizes the function of the conventional ABS. This system prevents premature locking of the rear wheels by using electronic control instead of a proportioning valve. The system provides a feature to optimize the brake force distribution to the front and rear wheels according to change in loading conditions or displacement of the center of gravity during deceleration.

The ABSCM calculates the optimum brake force distribution from the difference in speed between the front and rear wheels. Based on the results, the ABSCM controls the rear wheel brake pressure through the ABS hydraulic unit (H/U) to achieve the optimum brake force distribution suitable for the driving condition.

The proportioning valve is disused on EBD equipped vehicles.



- (1) Brake force to rear wheels
- (2) Brake force to front wheels
- (3) Optimum brake force distribution for light loaded conditions
- (4) Optimum brake force distribution for heavy loaded conditions
- (5) EBD controlled brake force distribution
- (6) PCV controlled brake force distribution (reference)

## F: ABS CONTROL MODULE AND HYDRAULIC CONTROL UNIT (ABSCM & H/U)

### ● ABS control module section (ABSCM)

The ABSCM contains two micro control modules (MCMs) which communicate with each other. Both the MCMs process the same program and each MCM monitors the other's outputs. If a mismatch occurs between their outputs, the ABSCM cuts off the system and activate the fail-safe function.

The ABSCM can store a maximum of 3 diagnostic trouble codes (DTC) in a ROM. If more than 3 faults have occurred, only the 3 most recent failures are stored and others are erased. Trouble diagnostic trouble codes remain stored until they are internally or externally erased.

The ABSCM has a test routine (sequence control pattern) which facilitates checking of the hydraulic control unit.

### ● ABS control

Using primarily the wheel speed data from each ABS wheel speed sensor and secondarily the vehicle deceleration rate data from the G sensor as parameters, the ABSCM generates a simulated vehicle speed when there is a risk of wheel lock-up. Using the simulated vehicle speed (called "dummy" vehicle speed) as a reference, the ABSCM determines the state of the wheel in terms of the tendency toward lock-up. If the result shows that the wheels are about to lock, the ABSCM issues commands to energize or de-energize the solenoid valves and activate the motor pump of the H/U to modulate the brake fluid pressures that act on the wheel cylinders, thereby preventing the wheels from locking.

The ABSCM controls the fluid pressure to each of the four wheels independently.

### ● Functions available using SUBARU select monitor

When the SUBARU select monitor is connected, the ABSCM allows it:

- To read out analog data
- To read out ON/OFF data
- To read out or erase diagnostic trouble codes
- To read out data showing conditions under which a trouble code has been stored (freeze frame data)
- To initiate ABS sequence control pattern

### ● Indication functions

Under the control of the ABSCM, the ABS warning light provides the following two indication functions:

- ABS fault alerting
- Valve ON/OFF indication (when sequence control pattern is initiated)

## ANTI-LOCK BRAKE SYSTEM (ABS)

ABS

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### ● **Hydraulic control unit section (H/U)**

The H/U is a fluid pressure controller consisting of, among others, a motor, solenoid valves, a housing and relays. It also constitutes passage of the two diagonally split brake circuits.

- The pump motor drives an eccentric cam which in turn moves the plunger pump to generate hydraulic pressure.
- The housing accommodates the pump motor, solenoid valve and reservoir. It also constitutes a brake fluid passage.
- The plunger pump, when operated, draws the brake fluid from the reservoir, lets the fluid in a wheel cylinder drain into the reservoir, and/or forces the fluid into the master cylinder.
- The outlet solenoid valve is a 2-position type. It opens or closes the brake fluid passage between a wheel cylinder and the reservoir according to commands from the ABSCM.
- The inlet solenoid valve is duty-controlled to reduce brake fluid pulsation for minimum ABS operation noise.
- The reservoir temporarily stores the brake fluid drained from a wheel cylinder when pressure “decrease” control is performed.
- The valve relay controls power supply to the solenoid valves in response to a command from the ABSCM. In normal (IG ON) condition, the relay is closed to supply power to the solenoid valves. When an error occurs in the system, the valve relay is turned OFF to keep the fluid pressure circuit in the normal mode (non-ABS mode).
- The motor relay closes and supplies power to the pump motor in response to a command from the ABSCM during the ABS drive mode operations.
- The H/U has four operating modes; normal mode (non-ABS mode), and three ABS active modes, i.e., “increase”, “hold” and “decrease” modes.



## 1. DURING NORMAL BRAKING (ABS NOT ACTIVE)

Both the inlet and outlet solenoid valves are not energized.

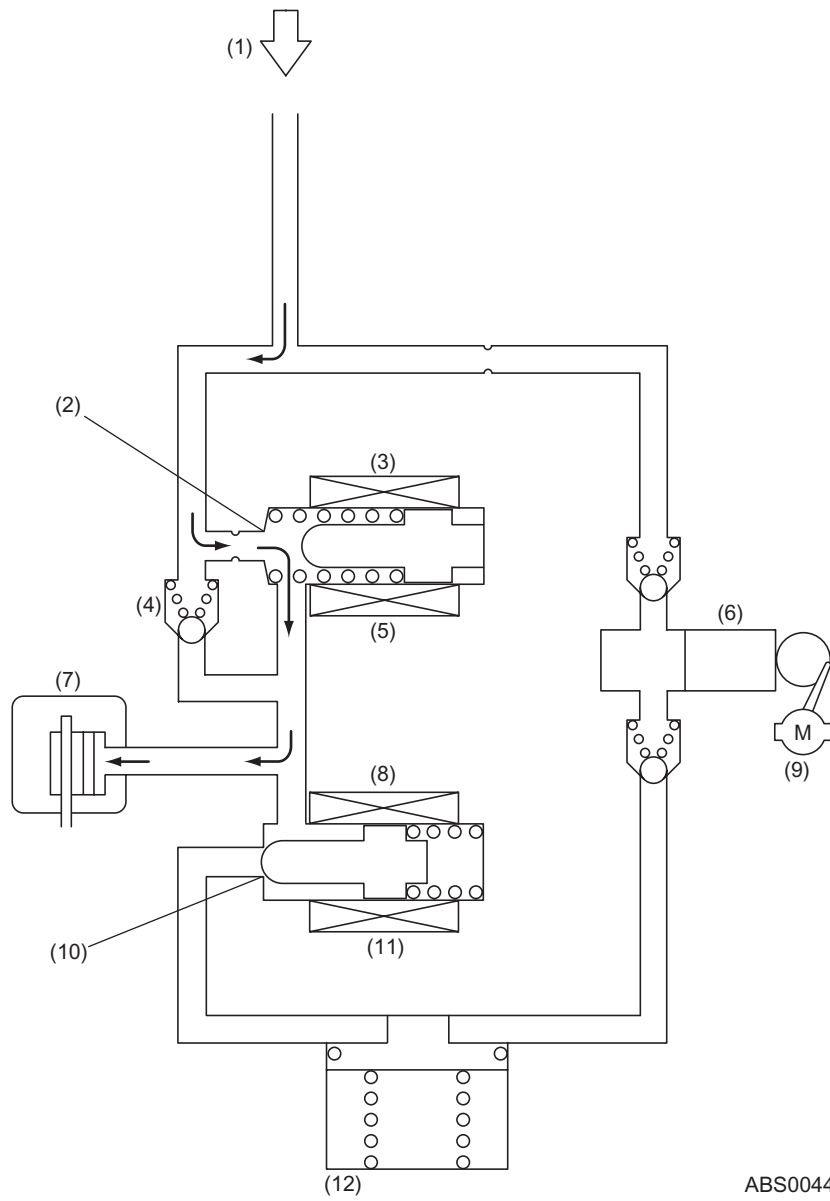
This means that the inlet port of the inlet solenoid valve is open, whereas the outlet port of the outlet solenoid valve is closed. So the fluid pressure generated in the master cylinder is transmitted to the wheel cylinder, producing a brake force.

### NOTE:

For simplicity of explanation, operation of the hydraulic control unit is represented by operation of a single wheel circuit.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00443

- |                          |                           |
|--------------------------|---------------------------|
| (1) From master cylinder | (7) Wheel cylinder        |
| (2) Inlet port open      | (8) Outlet solenoid valve |
| (3) Inlet solenoid valve | (9) Motor                 |
| (4) Check valve          | (10) Outlet port closed   |
| (5) Deenergized          | (11) Deenergized          |
| (6) Pump                 | (12) Reservoir            |

---

## 2. PRESSURE “DECREASE” CONTROL (ABS ACTIVE)

Both the inlet and outlet solenoid valves are energized, which means that the inlet port is closed and the outlet port is open.

In this state, the wheel cylinder is isolated from the master cylinder but open to the reservoir, so the brake fluid in it can be drained into the reservoir, decreasing its pressure and reducing the braking force of the wheel.

The brake fluid collected in the reservoir is forced into the master cylinder by the pump.

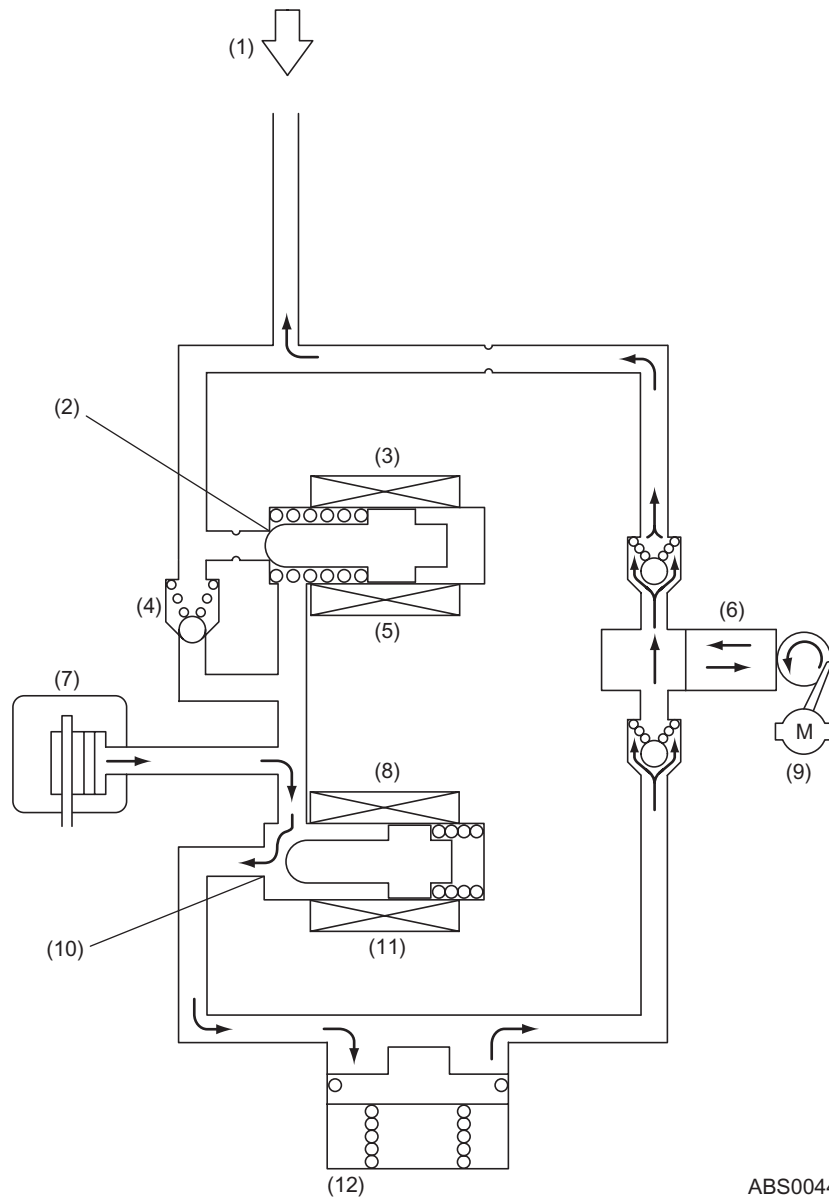
During this phase of ABS operation, the pump motor continues operating.

### NOTE:

For simplicity of explanation, operation of the H/U is represented by operation of a single wheel circuit.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00444

- |                          |                           |
|--------------------------|---------------------------|
| (1) From master cylinder | (7) Wheel cylinder        |
| (2) Inlet port closed    | (8) Outlet solenoid valve |
| (3) Inlet solenoid valve | (9) Motor                 |
| (4) Check valve          | (10) Outlet port open     |
| (5) Energized            | (11) Energized            |
| (6) Pump                 | (12) Reservoir            |

### 3. PRESSURE “HOLD” CONTROL (ABS ACTIVE)

The inlet solenoid valve is energized, so the inlet port is closed.

On the other hand, the outlet solenoid valve is de-energized, so the output port is also closed. In this state, all the passages connecting the wheel cylinder, master cylinder and reservoir are blocked. As a result, the fluid pressure in the wheel cylinder is held unchanged.

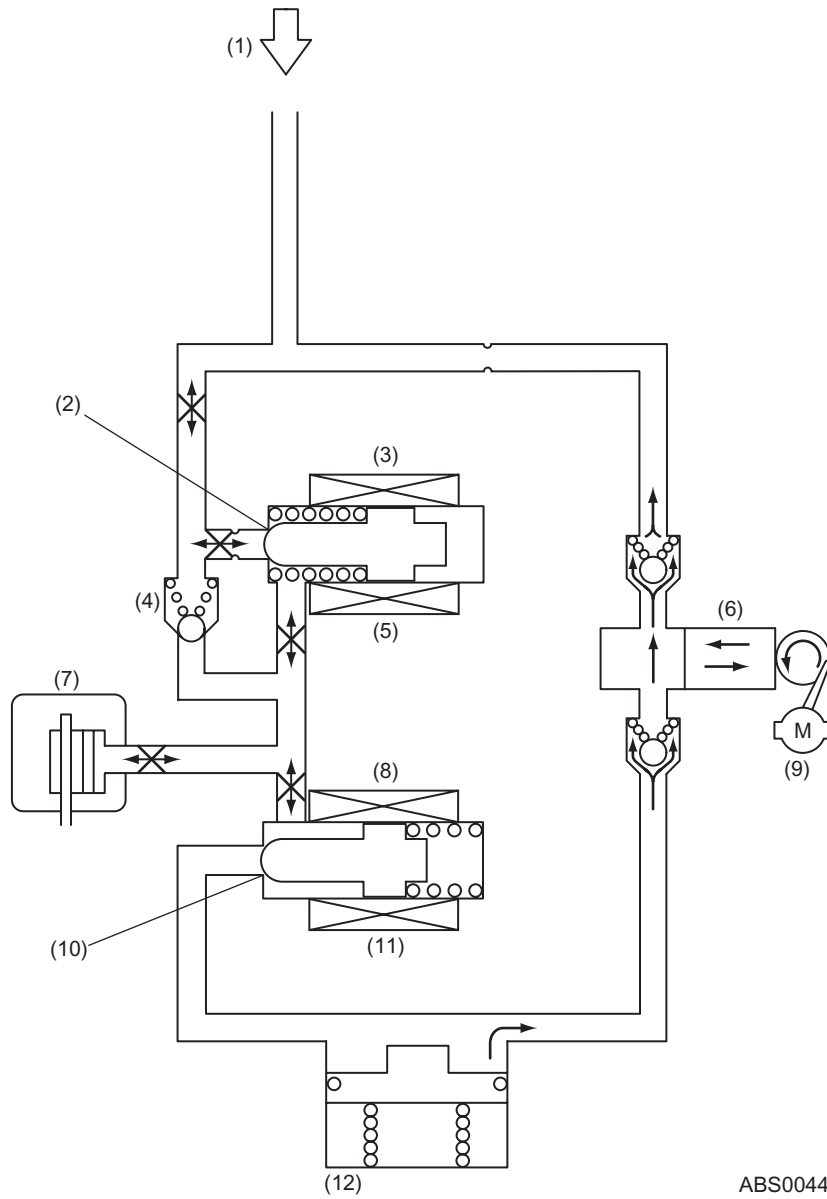
During this phase of ABS operation, the pump motor continues operating.

**NOTE:**

For simplicity of explanation, operation of the H/U is represented by operation of a single wheel circuit.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00445

- |                          |                           |
|--------------------------|---------------------------|
| (1) From master cylinder | (7) Wheel cylinder        |
| (2) Inlet port closed    | (8) Outlet solenoid valve |
| (3) Inlet solenoid valve | (9) Motor                 |
| (4) Check valve          | (10) Outlet port closed   |
| (5) Energized            | (11) Deenergized          |
| (6) Pump                 | (12) Reservoir            |

## 4. PRESSURE “INCREASE” CONTROL (ABS ACTIVE)

Both the inlet and outlet solenoid valves are de-energized, which means that the inlet port of the inlet solenoid valve is open, whereas the outlet port of the outlet solenoid valve is closed. So the fluid pressure generated in the master cylinder is transmitted to the wheel cylinder and increased fluid pressure in the wheel cylinder applies the brake with a larger force.

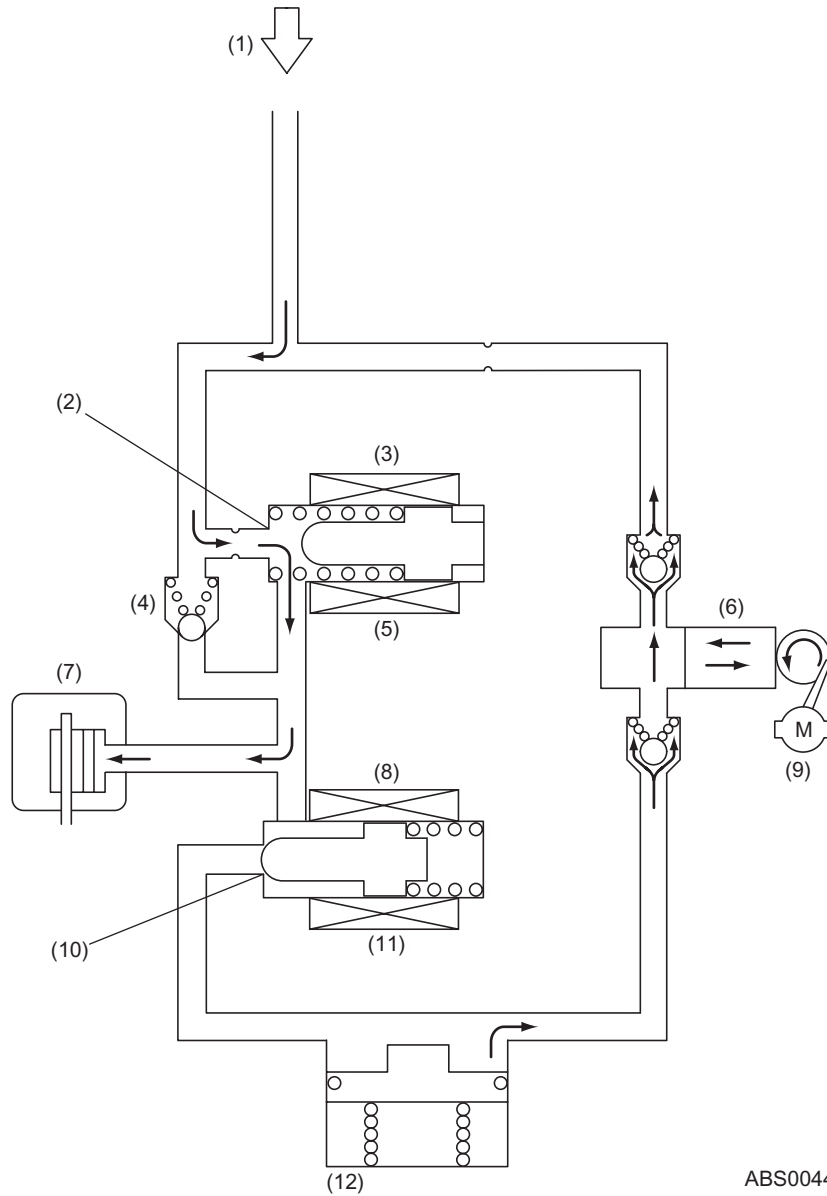
During this phase of ABS operation, the pump motor continues operating.

### NOTE:

For simplicity of explanation, operation of the H/U is represented by operation of a single wheel circuit.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



- (1) From master cylinder
- (2) Inlet port open
- (3) Inlet solenoid valve
- (4) Check valve
- (5) Deenergized
- (6) Pump

- (7) Wheel cylinder
- (8) Outlet solenoid valve
- (9) Motor
- (10) Outlet port closed
- (11) Deenergized
- (12) Reservoir



## G: ABS CONTROL CYCLE CURVES

Depressing the brake pedal increases the brake fluid pressure in each wheel cylinder, which in turn decreases the wheel speed (or increases the wheel deceleration rate). When the brake fluid pressure is increased to a level of point “A” of the brake fluid pressure curve in the diagram (at which the wheel deceleration rate exceeds threshold “ $-b_0$ ”), the ABSCM makes a pressure “hold” control. At the same time, the ABSCM calculates a “dummy” vehicle speed which is a reference speed it uses in the next stage of control.

When the wheel speed then drops below the slip ratio setting, i.e., a speed lower than the “dummy” vehicle speed by the predetermined value (at point “B” of the pressure curve), the ABSCM makes a control to prevent the wheel from locking, or a pressure “decrease” control.

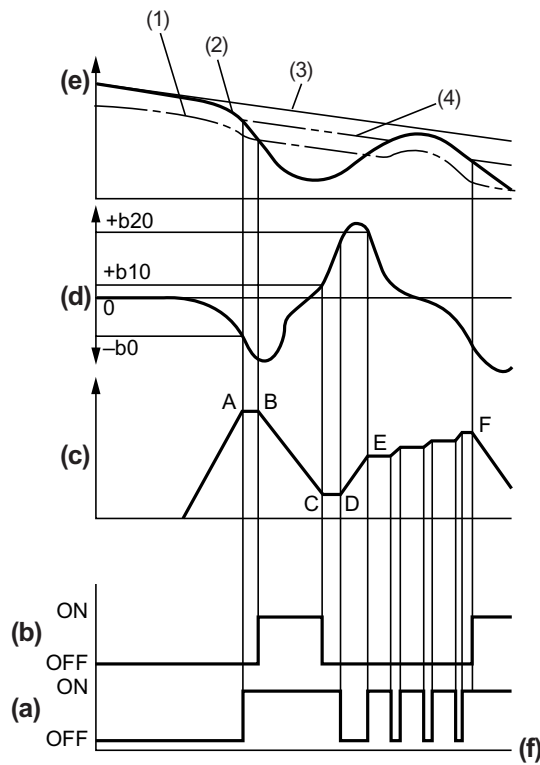
As the wheel cylinder pressure decreases, the wheel speed starts increasing (or the wheel acceleration rate starts rising). When the wheel acceleration rate exceeds threshold “ $+b_{10}$ ” (at point “C” of the pressure curve), the ABSCM makes a pressure “hold” control. When the wheel acceleration rate exceeds threshold “ $+b_{20}$ ” (at point “D” of the pressure curve), the ABSCM recognizes that wheel lock-up will not occur and then makes a pressure “increase” control.

When the wheel acceleration rate drops below threshold “ $+b_{20}$ ”, (at point “E” of the pressure curve), the ABSCM starts pressure “hold” and “increase” control cycles at a given interval.

When the wheel deceleration rate then exceeds threshold “ $-b_0$ ” (at point “F” of the pressure curve), the ABSCM immediately makes a pressure “decrease” control.

# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS



ABS00033

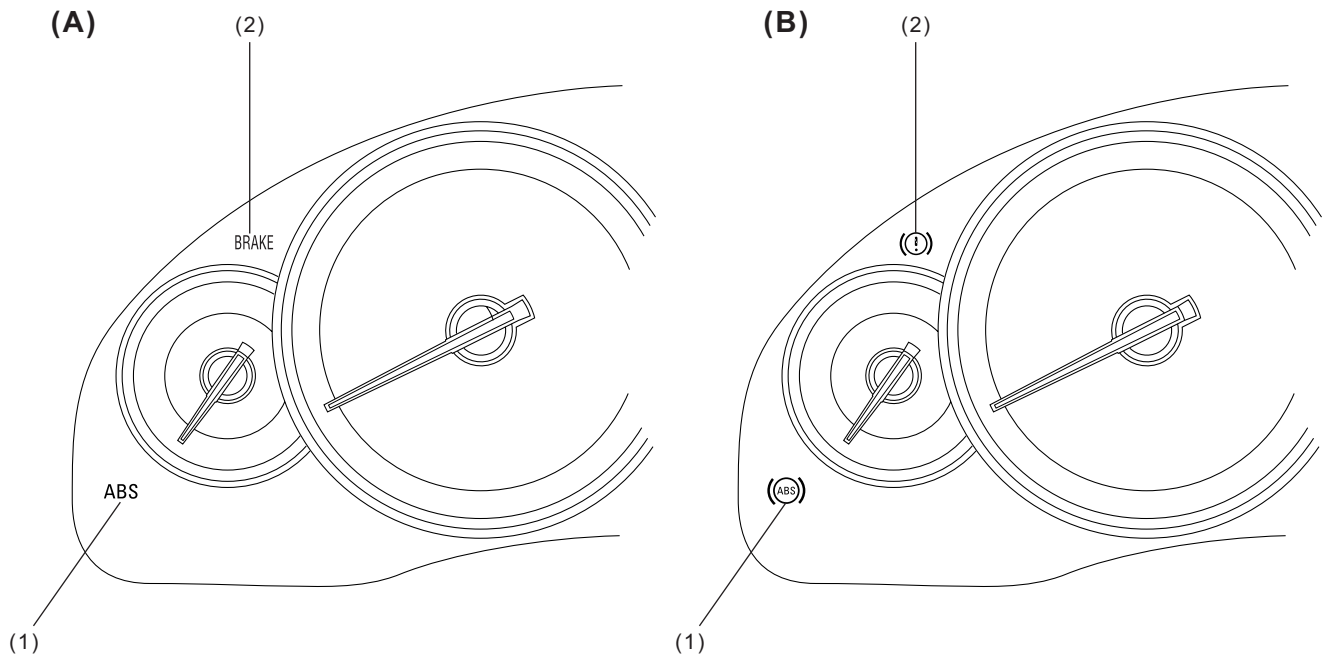
- (a) Inlet solenoid valve
- (b) Outlet solenoid valve
- (c) Brake fluid pressure
- (d) Wheel acceleration/deceleration
- (e) Speed
- (f) Time
- (1) Slip ratio setting
- (2) Wheel speed
- (3) Vehicle speed
- (4) Dummy vehicle speed

Brake fluid pressure	Inlet solenoid valve	Outlet solenoid valve
Increase	OFF	OFF
Hold	ON	OFF
Decrease	ON	ON

## H: ABS WARNING LIGHT AND BRAKE WARNING LIGHT (ALSO FUNCTIONS AS EBD WARNING LIGHT)

When a fault occurs in the signal transmission system or the ABSCM, the ABS warning light and brake warning light in the combination meter come on. At the same time, the current to the hydraulic control unit is interrupted. The brake system then functions in the same manner as a system without ABS.

If the warning light comes on, one or more diagnostic trouble codes should be stored in the ABSCM. To identify these codes, use a Subaru select monitor.



ABS00577

- (A) U.S. spec. vehicle
- (B) Canada spec. vehicle
- (1) ABS warning light
- (2) Brake warning light (also functions as EBD warning light)

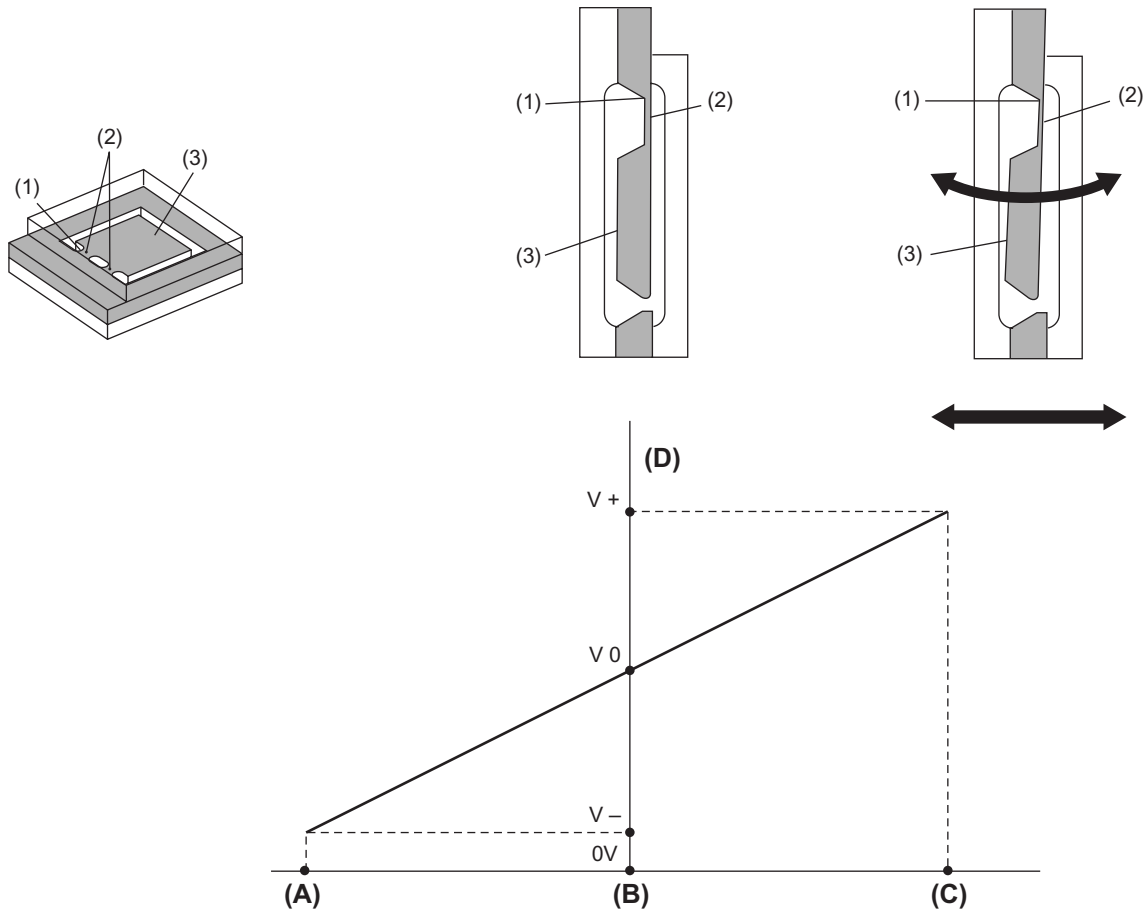
# ANTI-LOCK BRAKE SYSTEM (ABS)

ABS

## I: G SENSOR

The G sensor detects changes in the vehicle's acceleration/deceleration rate in the longitudinal direction.

A piezo-resistor is formed on the beam. When the mass area moves during acceleration and deceleration, the beam distorts causing the resistance of the piezo-resistor to change. This change is converted into change in voltage and sent to the ABSCM.



ABS00322

(1) Beam

(2) Piezo-resistor

(3) Mass area

(A) Accelerating

(B) Cruising

(C) Decelerating

(D) G sensor output voltage

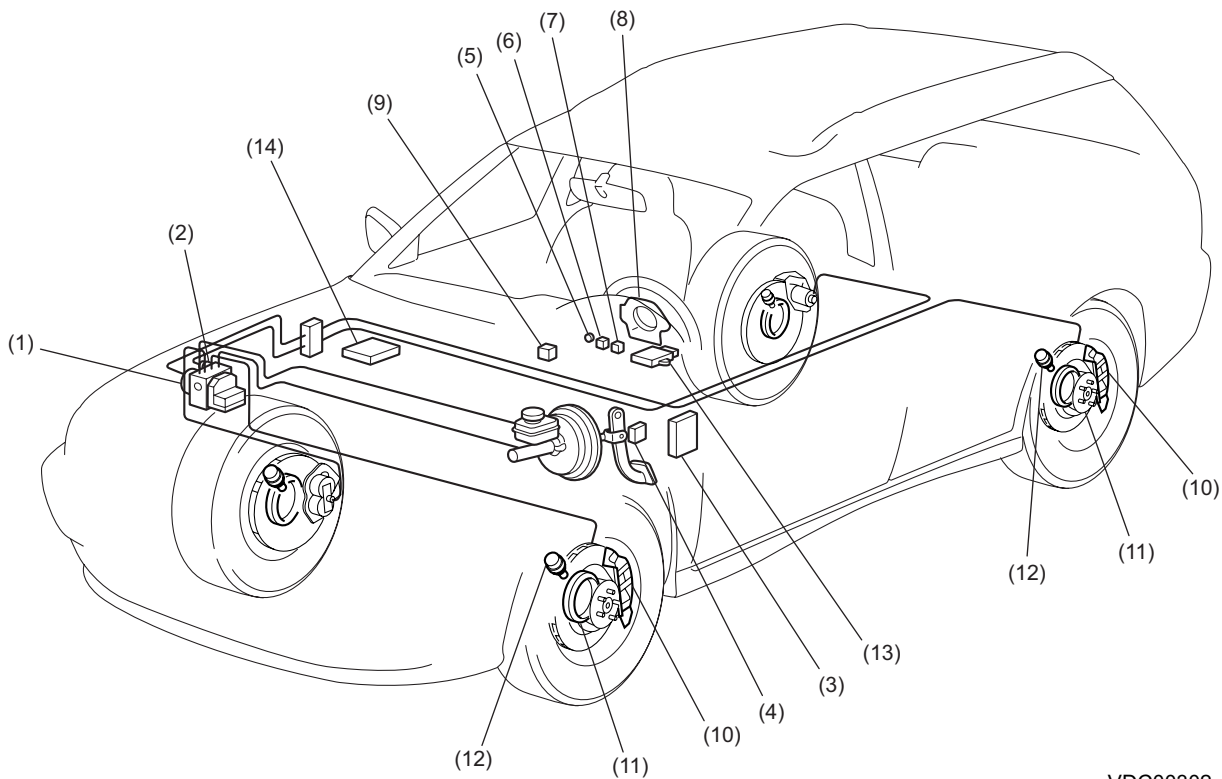
# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)

### 1. Vehicle Dynamics Control (VDC) System

#### A: GENERAL

The vehicle dynamics control (VDC) system is a driver assist system which enhances vehicle's running stability by utilizing the anti-lock brake system (ABS) and traction control system (TCS) functions in combination with its own function which reduces sudden changes in vehicle behavior that are likely to occur when traveling on a slippery road or quickly avoiding an obstacle on the road.



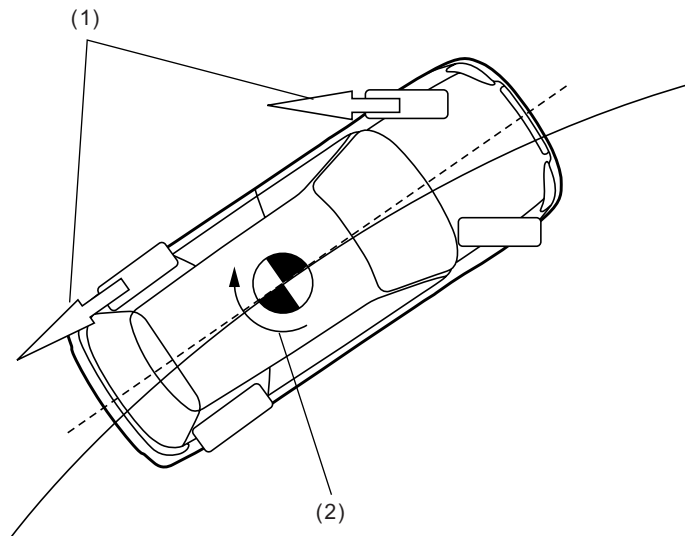
VDC00302

- |   |   |                                    |
|---|---|------------------------------------|
| (1) Vehicle dynamics control (VDC) control module | (6) Vehicle dynamics control (VDC) operation indicator light  | (11) Magnetic encoder              |
| (2) Pressure sensor                               | (7) Vehicle dynamics control (VDC) warning light and vehicle dynamics control (VDC) OFF indicator light | (12) ABS wheel speed sensor        |
| (3) Automatic transmission control module         | (8) Steering angle sensor   | (13) Yaw-rate and lateral G sensor |
| (4) Stop light switch                             | (9) Vehicle dynamics control (VDC) OFF switch   | (14) Engine control module         |
| (5) ABS warning light                             | (10) Wheel cylinder   |                                    |

## B: OPERATION PRINCIPLE OF VDC

### 1. OVERSTEER BEHAVIOR SUPPRESSION

When the vehicle starts to spin during cornering, the VDC control module (VDCCM) actuates the brakes on the front and rear outer wheels. As a result, a yaw moment is generated in a direction that counteracts the yaw moment resulting from oversteer so that the vehicle's behavior is stabilized.



VDC00105

- (1) Braking force
- (2) Yaw moment resulting from oversteer

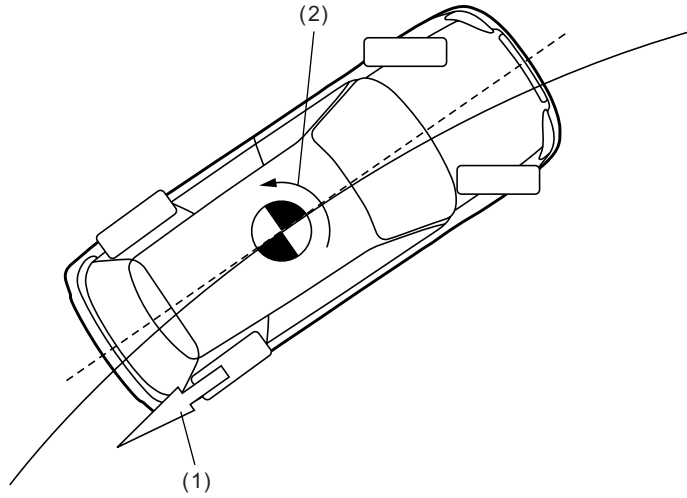
# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)

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### 2. UNDERSTEER BEHAVIOR SUPPRESSION

When the vehicle starts to drift outward during cornering, the VDCCM causes the rear inner wheel to be braked. As a result, a yaw moment is generated in a direction that counteracts the yaw moment resulting from understeer so that the vehicle's behavior is stabilized.



VDC00106

- (1) Braking force
- (2) Yaw moment resulting from understeer

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

VEHICLE DYNAMICS CONTROL (VDC)

## C: FUNCTIONS USED IN VEHICLE'S BEHAVIOR STABILIZATION CONTROL

Vehicle dynamics control (VDC) function	The vehicle dynamics control (VDC) determines the driver's intention from the data provided by the steering angle sensor, braking pressure sensor, engine-related sensors and other relevant sources and recognizes the result as the target vehicle behavior. At the same time, it determines the vehicles actual behavior from the data provided by the yaw-rate sensor, lateral G sensor, ABS wheel speed sensor and other relevant sources. Then, the module compares the target and actual vehicle behaviors to estimate how the vehicle is running (whether it understeers, oversteers, slips or is in other condition), and based on the result, performs braking control of individual wheels, engine output control and AWD control as necessary to correct the vehicle's running condition.
TCS function	The TCS constantly receives signals from the relevant sensors to monitor the vehicle speed. When the running wheels slip exceeding a certain limit, it performs braking control of individual wheels, engine output control and AWD control as required to maintain optimal traction and adequate side force.
ABS function	The ABS constantly receives signals from the relevant sensors to monitor the vehicle speed. When the slip of wheels during braking exceeds a certain limit, it performs braking control of individual wheels and AWD control as required to maintain optimal traction and adequate side force.

### NOTE:

- "Braking control" is effected by the VDCCM as follows:

The VDCCM calculates the required braking force for each wheel and sends signals to the VDC hydraulic unit. The hydraulic unit's motor pump is then operated to generate the required hydraulic pressure. Further, it controls the hydraulic unit's solenoid valves to increase, maintain or decrease the hydraulic pressure applied to the brake wheel cylinder as required.

When the brakes are applied by the driver, however, the braking force is controlled by the hydraulic pressure resulting from the driver's action.

- "Engine output control" is effected by the VDCCM as follows:

The VDCCM calculates the target engine output for each condition, and sends commands to the engine control module. The engine control module compares the target engine output with the current engine output. Based on the comparison, the throttle opening or fuel injection is controlled. The targeted engine output is then achieved.

- "AWD control" is effected by the VDCCM as follows:

When necessary, the VDCCM sends a command to the automatic transmission control module. According to the command, the transmission control module controls the transfer clutch so that the torque is distributed between the front and rear axles optimally.



# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)

### D: SYSTEM COMPONENTS AND FUNCTIONS

VDCCM	<ul style="list-style-type: none"><li>• Determines the vehicle's running condition from various sensor signals and, based on the result, controls the vehicle dynamics control (VDC) hydraulic unit, ABS and TCS as required.</li><li>• Performs CAN communication with the engine control module, automatic transmission control module and the steering angle sensor.</li><li>• Causes the system to stop and the warning light to illuminate if a fault occurs in a circuit of the electrical system. Stores the code that indicates the location of the fault.</li></ul>
Vehicle dynamics control (VDC) hydraulic unit (VDCH/U)	Actuates the pump motor in response to a command from the VDCCM and changes fluid passages using solenoid valves to control the hydraulic pressures applied to the wheel cylinders.
Steering angle sensor	Detects the steering direction and angle when the steering wheel is operated by the driver, and outputs signals corresponding to them to the CAN line.
Yaw-rate and lateral G sensor	Detects the yaw-rate and lateral G of the vehicle and outputs it to the VDCCM.
Pressure sensor	Detects the hydraulic pressure resulting from driver's brake pedal operation and outputs it to the VDCCM.
ABS wheel speed sensor	Detects the speed of each wheel and outputs it to the VDCCM.
Engine control module (ECM)	Controls the engine output in response to commands from the VDCCM. Further, it transmits current engine output and engine speed signals etc. to the VDCCM.
Automatic transmission control module	Controls the transfer clutch in response to commands from the VDCCM during vehicle dynamics control (VDC) control, ABS control or TCS control so that torque is distributed optimally between the front and rear axles.
ABS warning light	Alerts the driver to an ABS fault.
Vehicle dynamics control (VDC) warning light and vehicle dynamics control (VDC) OFF indicator light	<ul style="list-style-type: none"><li>• Alerts the driver to a vehicle dynamics control (VDC) or TCS fault.</li><li>• Illuminates to tell the driver that the vehicle dynamics control (VDC) and TCS are inactive. (when system is not failed)</li></ul>
Brake warning light	Alerts the driver to an EBD fault. This warning light is also used for parking brake warning and brake fluid level warning.
Vehicle dynamics control (VDC) operation indicator light	Blinks when the vehicle dynamics control (VDC) is operating or lights steadily when the TCS is operating.
Vehicle dynamics control (VDC) OFF switch	<ul style="list-style-type: none"><li>• Allows the driver to temporarily disengage the vehicle dynamics control (VDC).</li><li>• In "temporarily disengaged" status, the vehicle dynamics control (VDC) OFF indicator light illuminates.</li></ul>

#### NOTE:

CAN (Controller Area Network) communication refers to bidirectional multiplex high-speed communication.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

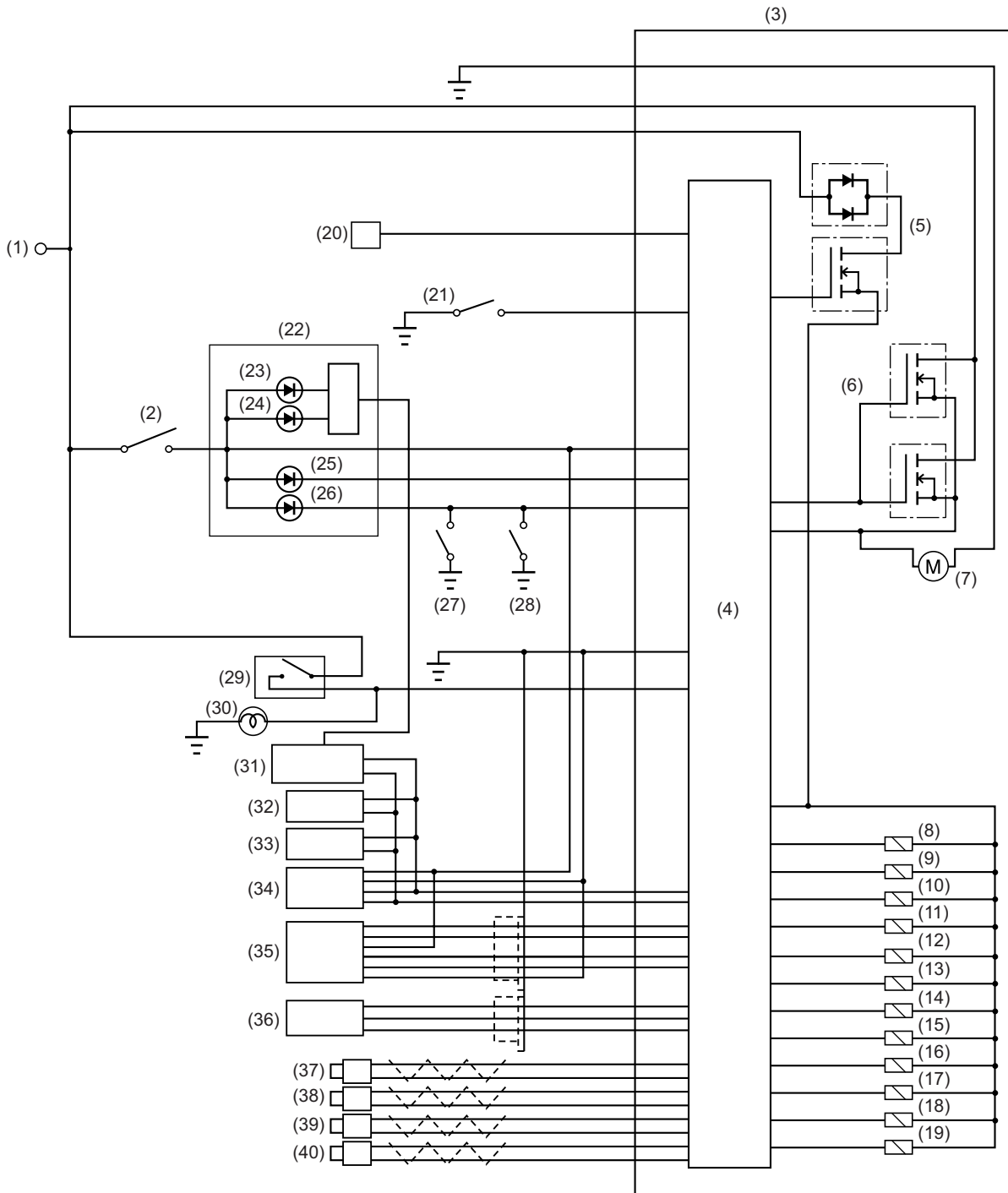
VEHICLE DYNAMICS CONTROL (VDC)

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MEMO

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00276

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

VEHICLE DYNAMICS CONTROL (VDC)

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- |  |  |   |
|--|--|---|
| (1) Battery  | (15) Rear right outlet solenoid valve  | (29) Stop light switch                  |
| (2) Ignition switch  | (16) Primary suction solenoid valve  | (30) Stop light                         |
| (3) Vehicle dynamics control (VDC) control module and hydraulic unit (VDCCM & H/U) | (17) Primary cut solenoid valve  | (31) Integrated unit                    |
| (4) Vehicle dynamics control (VDC) control module                                  | (18) Secondary suction solenoid valve  | (32) Engine control module              |
| (5) Valve relay  | (19) Secondary cut solenoid valve  | (33) Transmission control module        |
| (6) Motor relay  | (20) Data link connector   | (34) Steering angle sensor              |
| (7) Pump motor   | (21) Vehicle dynamics control (VDC) OFF switch   | (35) Yaw-rate and lateral G sensor      |
| (8) Front left inlet solenoid valve  | (22) Combination meter   | (36) Pressure sensor                    |
| (9) Front left outlet solenoid valve   | (23) Vehicle dynamics control (VDC) warning light and vehicle dynamics control (VDC) OFF indicator light | (37) Front left ABS wheel speed sensor  |
| (10) Front right inlet solenoid valve  | (24) Vehicle dynamics control (VDC) operation indicator light  | (38) Front right ABS wheel speed sensor |
| (11) Front right outlet solenoid valve   | (25) ABS warning light   | (39) Rear left ABS wheel speed sensor   |
| (12) Rear left inlet solenoid valve  | (26) Brake warning light   | (40) Rear right ABS wheel speed sensor  |
| (13) Rear left outlet solenoid valve   | (27) Parking brake switch  |   |
| (14) Rear right inlet solenoid valve   | (28) Brake fluid level switch  |   |

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)

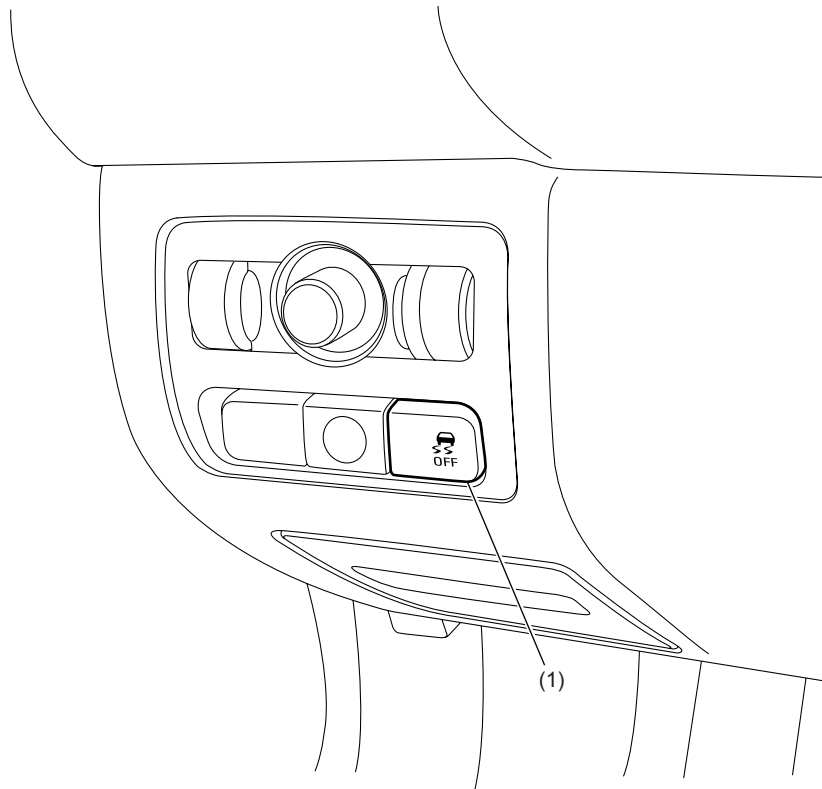
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### E: VDC OFF SWITCH

A switch which allows the driver to temporarily disengage VDC control.

In some occasions, better results are obtained by canceling the VDC to allow the drive wheels to slip for a certain amount:

- When starting the vehicle on icy or unpaved, steep uphill roads.
- When escaping from mud or snow when the wheels are caught in them.
- When the VDC OFF switch is pressed while the engine is running, the VDC OFF indicator light in the combination meter illuminates, and VDC control is temporarily disengaged. When the VDC OFF switch is pressed again, the VDC OFF indicator light turns off and the system returns to “engaged” status. (Temporarily disengaged status and engaged status are altered each time the switch is pressed.)
- If the VDC OFF switch is pressed and held for more than 10 seconds, the VDC OFF indicator light in the combination meter turns off. The system will not allow further operation of the switch until the engine is started for the next time.



VDC00249

(1) Vehicle dynamics control (VDC) OFF switch

## **F: OPERATION OF VDC HYDRAULIC UNIT (VDC H/U)**

### **1. DURING NORMAL BRAKING**

No solenoid valves are energized. The ports of the inlet solenoid valve and cut solenoid valve are open, while the ports of the outlet solenoid valve and suction solenoid valve are closed.

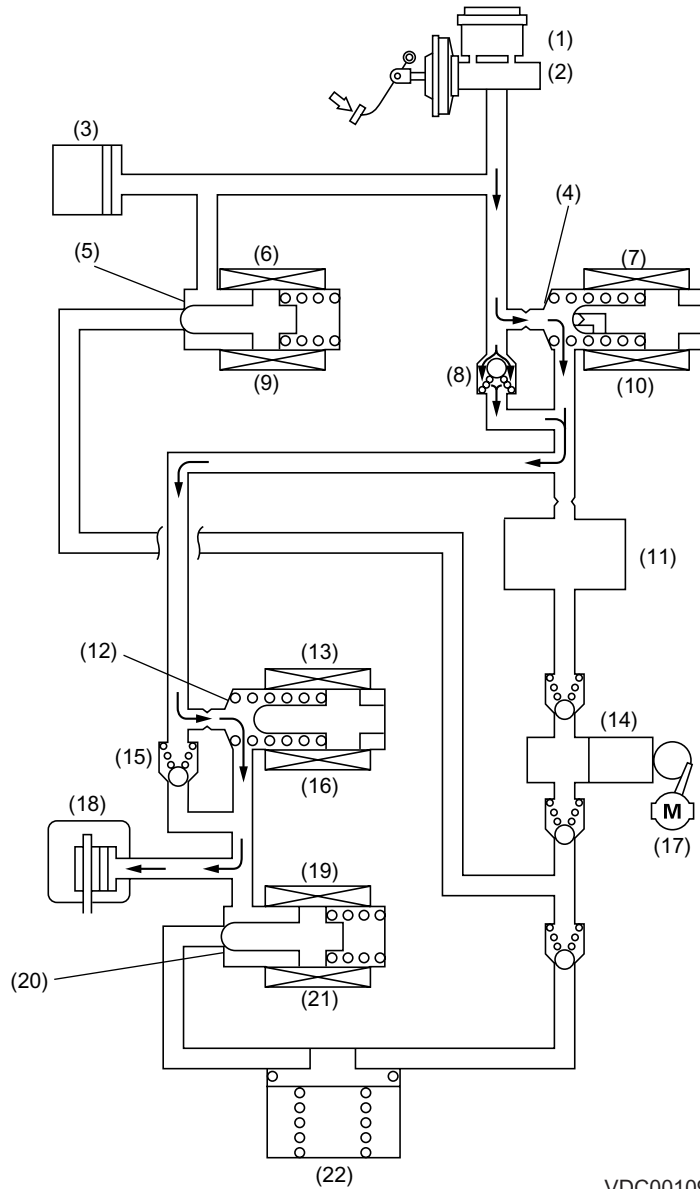
In this state, the fluid pressure generated by the master cylinder can be applied to the wheel cylinder through the open ports of the cut solenoid valve and inlet solenoid valve.

#### **NOTE:**

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00109

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Deenergized           | (17) Motor                 |
| (2) Master cylinder        | (10) Deenergized          | (18) Wheel cylinder        |
| (3) Pressure sensor        | (11) Damping chamber      | (19) Outlet solenoid valve |
| (4) Port open              | (12) Port open            | (20) Port closed           |
| (5) Port closed            | (13) Inlet solenoid valve | (21) Deenergized           |
| (6) Suction solenoid valve | (14) Pump                 | (22) Reservoir             |
| (7) Cut solenoid valve     | (15) Check valve          |                            |
| (8) Check valve            | (16) Deenergized          |                            |

## 2. PRESSURE “DECREASE” CONTROL WITH BRAKE PEDAL DEPRESSED

The inlet solenoid valve and outlet solenoid valve are energized, while the other solenoid valves are not energized. This means that the ports of the inlet solenoid valve and suction solenoid valve are closed, while those of the outlet solenoid valve and cut solenoid valve are open.

Although the fluid pressure generated by the master cylinder can reach the inlet solenoid valve through the open port of the cut solenoid valve, the pressurized fluid cannot go further since the passage is blocked there. On the other hand, since the port of the outlet solenoid valve is open, the brake fluid in the wheel cylinder can flow out into the reservoir. The fluid pressure in the wheel cylinder decreases as a result. The brake fluid in the reservoir is pumped back into the master cylinder.

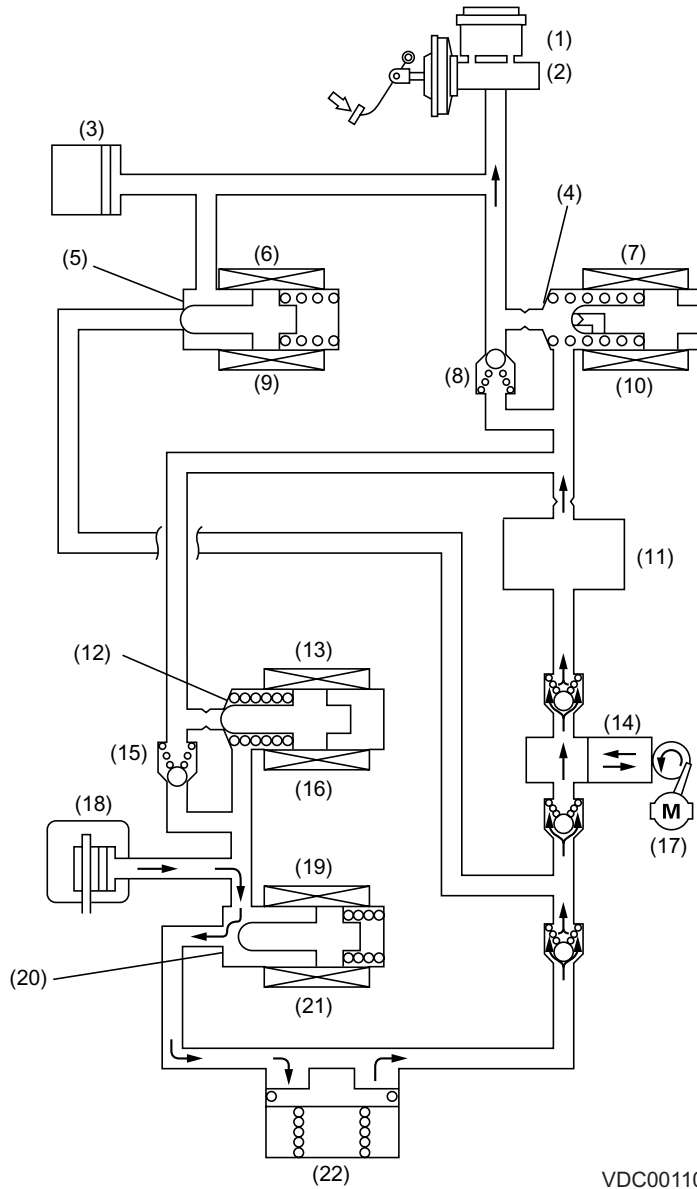
### NOTE:

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.



# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00110

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Deenergized           | (17) Motor                 |
| (2) Master cylinder        | (10) Deenergized          | (18) Wheel cylinder        |
| (3) Pressure sensor        | (11) Damping chamber      | (19) Outlet solenoid valve |
| (4) Port open              | (12) Port closed          | (20) Port open             |
| (5) Port closed            | (13) Inlet solenoid valve | (21) Energized             |
| (6) Suction solenoid valve | (14) Pump                 | (22) Reservoir             |
| (7) Cut solenoid valve     | (15) Check valve          |                            |
| (8) Check valve            | (16) Energized            |                            |

### 3. PRESSURE “HOLD” CONTROL WITH BRAKE PEDAL DEPRESSED

Only the inlet solenoid valve is energized. This means that the ports of the inlet solenoid valve, outlet solenoid valve and suction solenoid valve are all closed except that of the cut solenoid valve.

In this state, the fluid pressure generated by the master cylinder is transmitted through the open port of the cut solenoid valve to the inlet solenoid valve but not beyond the inlet solenoid valve since the passage is blocked there. Since the port of the outlet solenoid valve is also closed, the fluid pressure in the wheel cylinder is held unreleased.

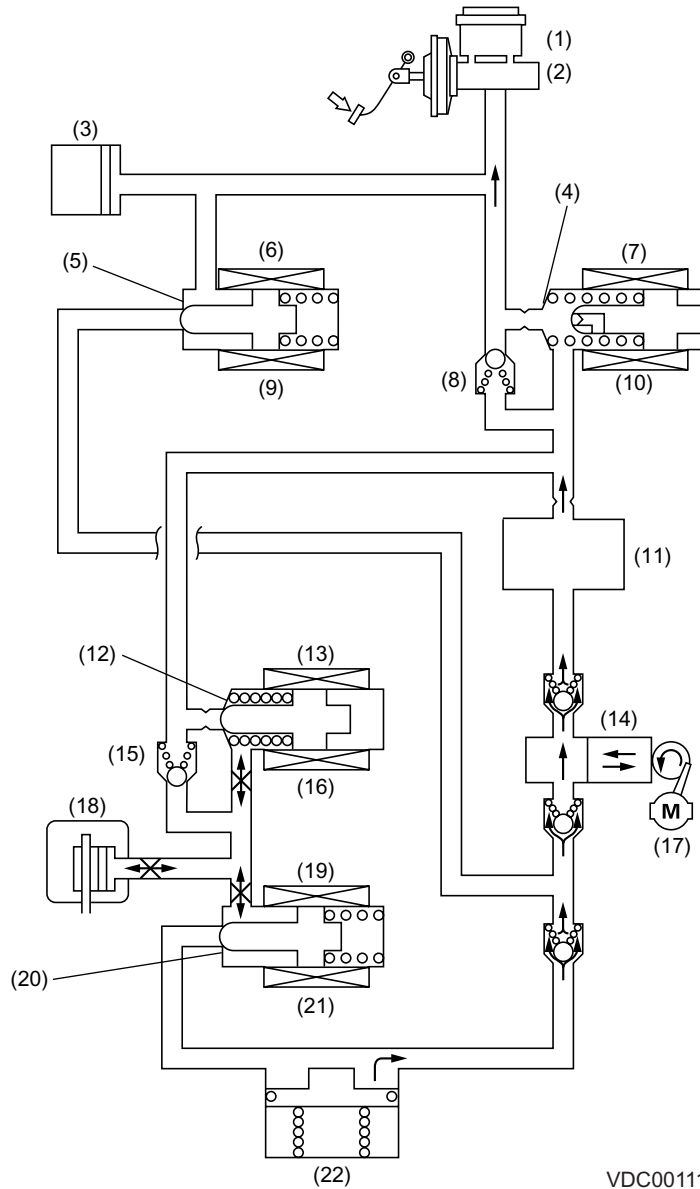
The pump is always operated whenever commanded by the VDCCM.

**NOTE:**

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00111

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Deenergized           | (17) Motor                 |
| (2) Master cylinder        | (10) Deenergized          | (18) Wheel cylinder        |
| (3) Pressure sensor        | (11) Damping chamber      | (19) Outlet solenoid valve |
| (4) Port open              | (12) Port closed          | (20) Port closed           |
| (5) Port closed            | (13) Inlet solenoid valve | (21) Deenergized           |
| (6) Suction solenoid valve | (14) Pump                 | (22) Reservoir             |
| (7) Cut solenoid valve     | (15) Check valve          |                            |
| (8) Check valve            | (16) Energized            |                            |

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

VEHICLE DYNAMICS CONTROL (VDC)

---

## 4. PRESSURE “INCREASE” CONTROL WITH BRAKE PEDAL DEPRESSED

No solenoid valves are energized. This means that the ports of the inlet solenoid valve and cut solenoid valve are open, while those of the outlet solenoid valve and suction solenoid valve are closed.

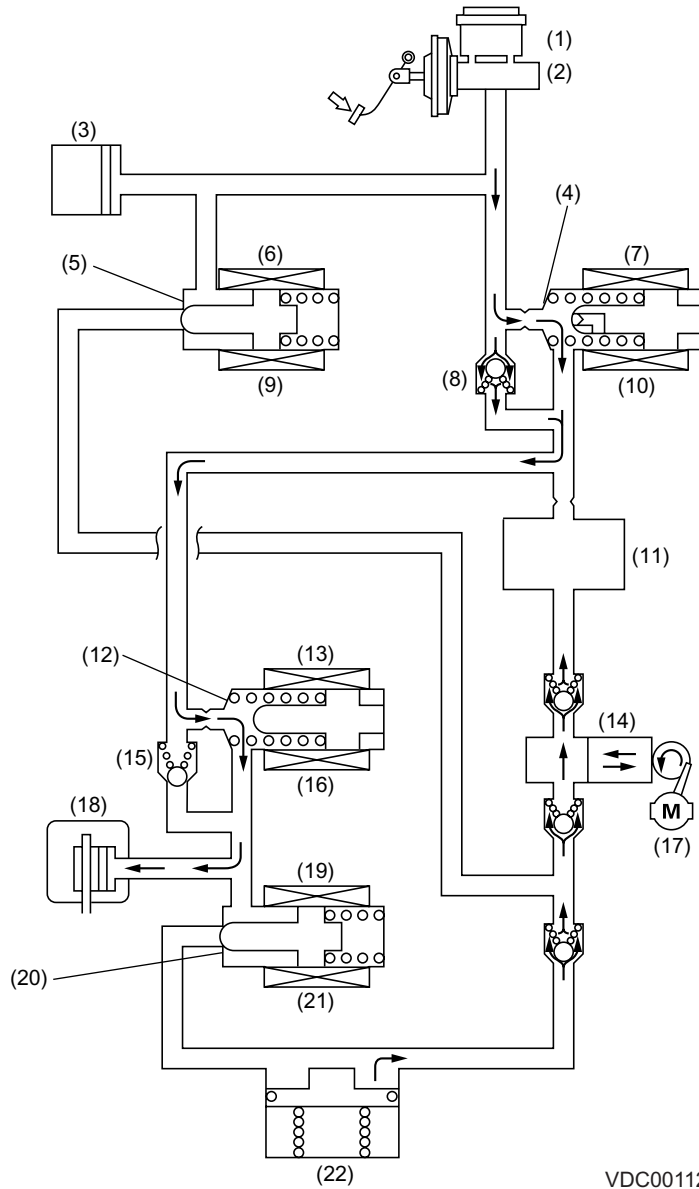
In this state, the fluid pressure generated by the master cylinder is transmitted to the wheel cylinder through the open ports of the cut solenoid valve and inlet solenoid valve, applying the brake with an increased force. The pump is always operated whenever commanded by the VDCCM.

### NOTE:

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00112

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Deenergized           | (17) Motor                 |
| (2) Master cylinder        | (10) Deenergized          | (18) Wheel cylinder        |
| (3) Pressure sensor        | (11) Damping chamber      | (19) Outlet solenoid valve |
| (4) Port open              | (12) Port open            | (20) Port closed           |
| (5) Port closed            | (13) Inlet solenoid valve | (21) Deenergized           |
| (6) Suction solenoid valve | (14) Pump                 | (22) Reservoir             |
| (7) Cut solenoid valve     | (15) Check valve          |                            |
| (8) Check valve            | (16) Deenergized          |                            |

## 5. PRESSURE “INCREASE” CONTROL WITH BRAKE PEDAL NOT DEPRESSED

The cut solenoid valve and suction solenoid valve are energized while the other solenoid valves are not energized. This means that the ports of the cut solenoid valve and outlet solenoid valve are closed, while those of the inlet solenoid valve and suction solenoid valve are open.

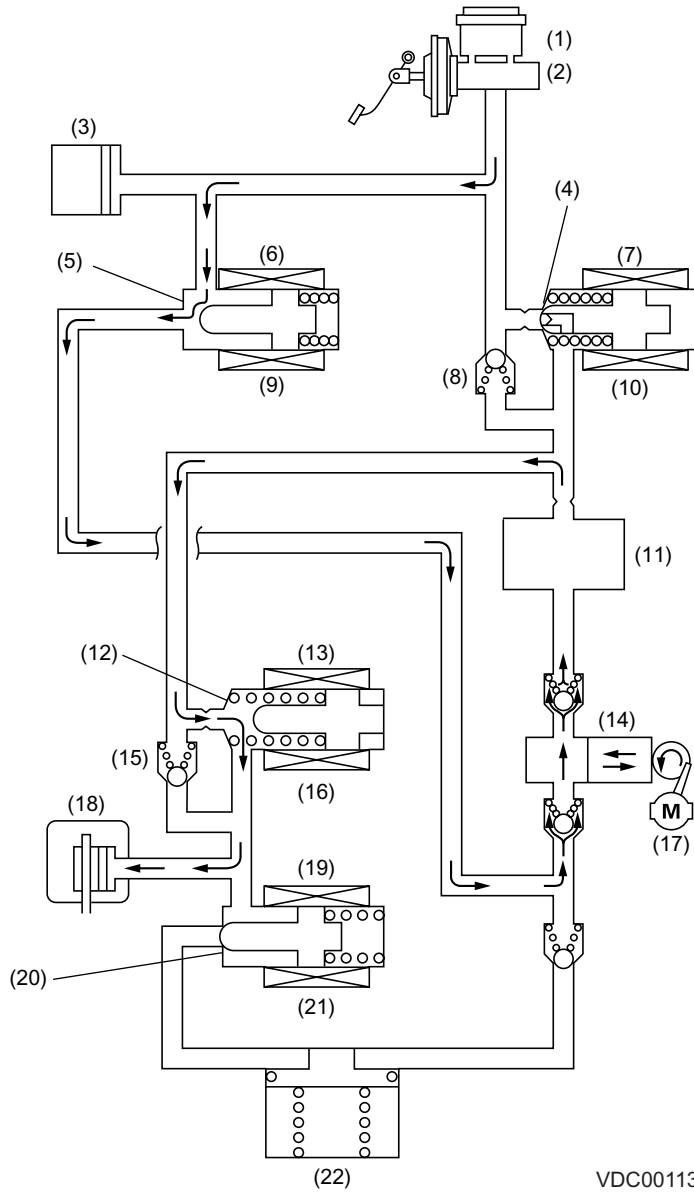
In this state, the pump is activated, forcing the brake fluid in the master cylinder reservoir tank into the wheel cylinder through the open port of the suction solenoid valve and then through the open port of the inlet solenoid valve. The brake is then applied with an increased force.

### NOTE:

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00113

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Energized             | (17) Motor                 |
| (2) Master cylinder        | (10) Energized            | (18) Wheel cylinder        |
| (3) Pressure sensor        | (11) Damping chamber      | (19) Outlet solenoid valve |
| (4) Port closed            | (12) Port open            | (20) Port closed           |
| (5) Port open              | (13) Inlet solenoid valve | (21) Deenergized           |
| (6) Suction solenoid valve | (14) Pump                 | (22) Reservoir             |
| (7) Cut solenoid valve     | (15) Check valve          |                            |
| (8) Check valve            | (16) Deenergized          |                            |

## 6. PRESSURE “HOLD” CONTROL WITH BRAKE PEDAL NOT DEPRESSED

The cut solenoid valve, suction solenoid valve and inlet solenoid valve are all energized, while the outlet solenoid valve is de-energized. This means that the ports of the cut solenoid valve, inlet solenoid valve and outlet solenoid valve are closed, while the port of the suction solenoid valve is open.

In this state, the pump is activated, forcing the brake fluid in the master cylinder reservoir tank through the open port of the suction solenoid valve. The fluid passage is, however, blocked by the closed inlet solenoid valve. Since the port of the outlet solenoid valve is also closed, the fluid pressure in the wheel cylinder is held unreleased.

The fluid pressure generated by the pump becomes higher and higher because the port of the inlet solenoid valve is closed. When it reaches a certain level, the built-in relief valve of the cut solenoid valve opens and allows the brake fluid to return into the master cylinder reservoir tank.

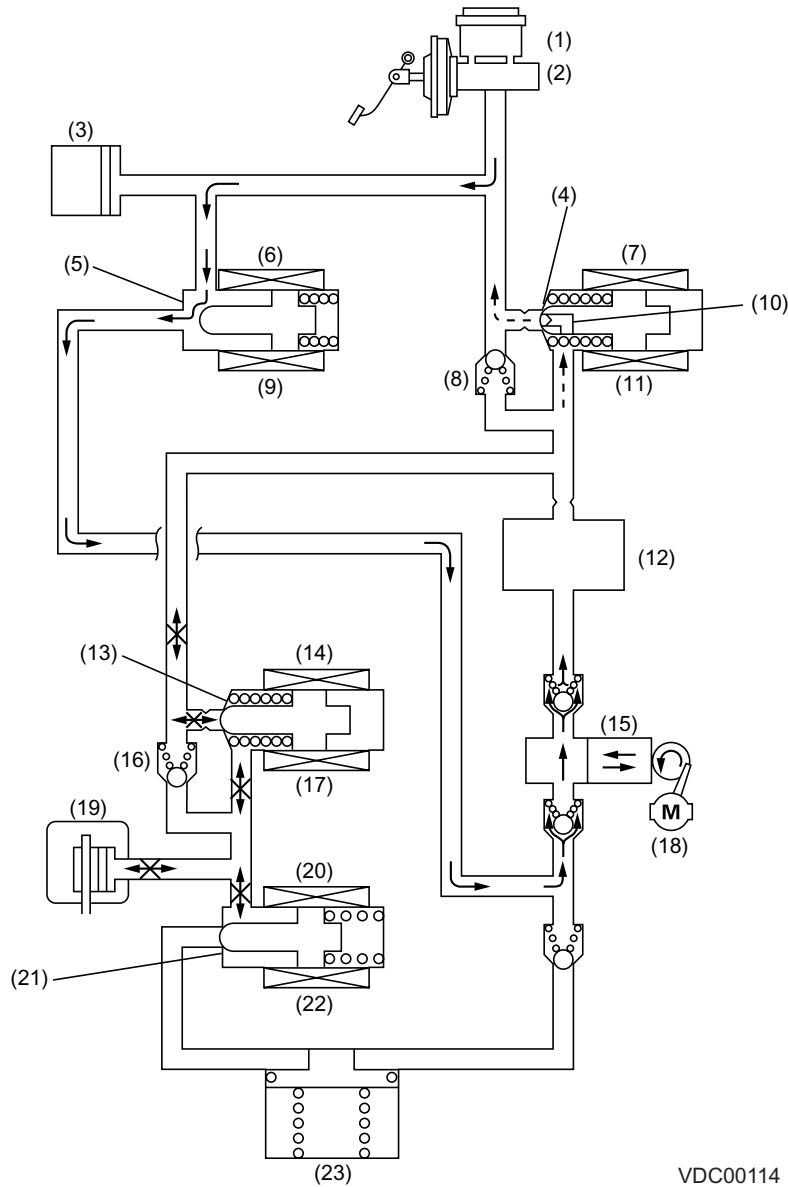
### NOTE:

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.



# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00114

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Energized             | (17) Energized             |
| (2) Master cylinder        | (10) Relief valve         | (18) Motor                 |
| (3) Pressure sensor        | (11) Energized            | (19) Wheel cylinder        |
| (4) Port closed            | (12) Damping chamber      | (20) Outlet solenoid valve |
| (5) Port open              | (13) Port closed          | (21) Port closed           |
| (6) Suction solenoid valve | (14) Inlet solenoid valve | (22) Deenergized           |
| (7) Cut solenoid valve     | (15) Pump                 | (23) Reservoir             |
| (8) Check valve            | (16) Check valve          |                            |

## 7. PRESSURE “DECREASE” CONTROL WITH BRAKE PEDAL NOT DEPRESSED

The cut solenoid valve, suction solenoid valve, inlet solenoid valve and outlet solenoid valve are all energized. This means that the ports of the cut solenoid valve and inlet solenoid valve are closed, while those of the suction and outlet solenoid valves are open.

In this state, the pump is activated drawing the brake fluid from the reservoir and forcing it toward the master cylinder through the open port of the suction solenoid valve. The fluid passage is blocked by the inlet solenoid valve, so the fluid cannot flow toward the wheel cylinder. Since the port of the outlet solenoid valve is open, on the other hand, the brake fluid in the wheel cylinder is allowed to be drawn into the reservoir, so the fluid pressure in the wheel cylinder decreases. The brake fluid drawn into the reservoir is raised from it and forced into the master cylinder reservoir tank through the suction solenoid valve.

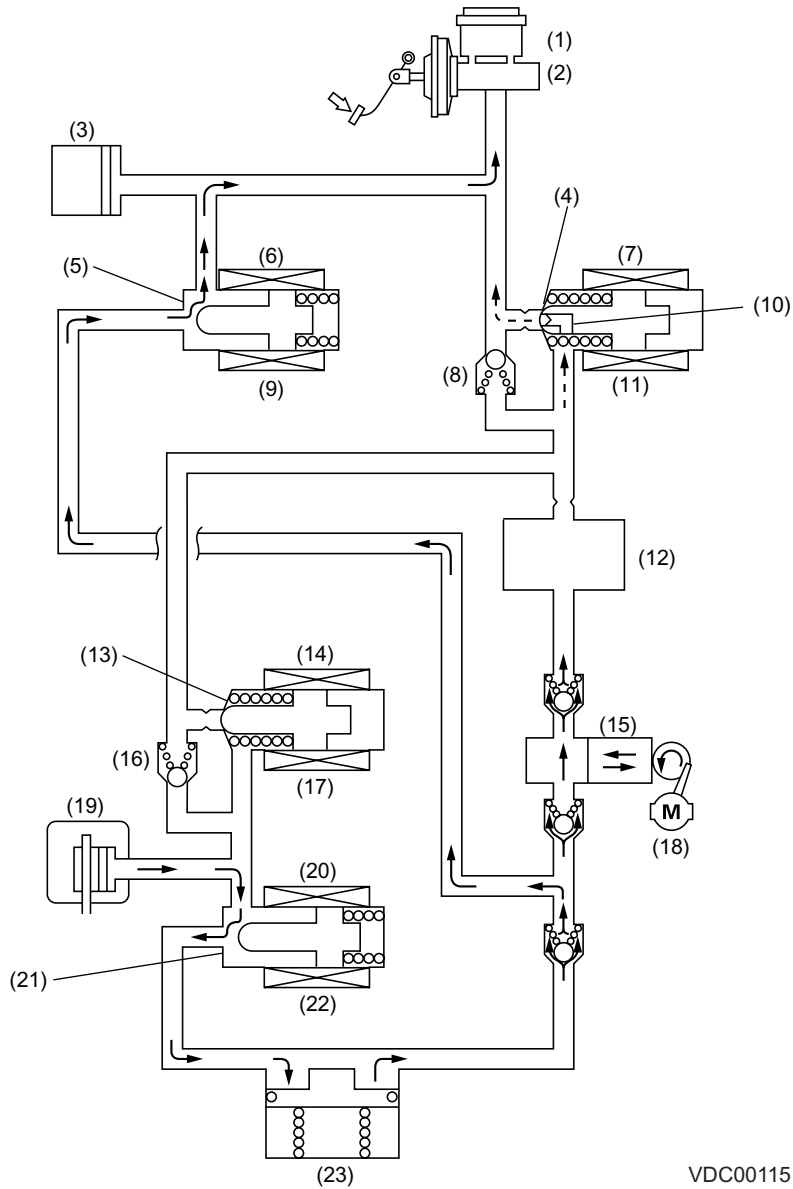
The pressure of the fluid in the passage toward the cut solenoid valve becomes higher and higher as the pump operates since the valve is closed. When the pressure reaches a certain level, the build-in relief valve of the cut solenoid valve opens, releasing the brake fluid into the master cylinder reservoir tank.

### NOTE:

For simplicity of explanation, operation of the hydraulic unit is represented by operation of a single wheel circuit.

# VEHICLE DYNAMICS CONTROL (VDC) SYSTEM

## VEHICLE DYNAMICS CONTROL (VDC)



VDC00115

- |                            |                           |                            |
|----------------------------|---------------------------|----------------------------|
| (1) Reservoir tank         | (9) Energized             | (17) Energized             |
| (2) Master cylinder        | (10) Relief valve         | (18) Motor                 |
| (3) Pressure sensor        | (11) Energized            | (19) Wheel cylinder        |
| (4) Port closed            | (12) Damping chamber      | (20) Outlet solenoid valve |
| (5) Port open              | (13) Port closed          | (21) Port open             |
| (6) Suction solenoid valve | (14) Inlet solenoid valve | (22) Energized             |
| (7) Cut solenoid valve     | (15) Pump                 | (23) Reservoir             |
| (8) Check valve            | (16) Check valve          |                            |

## 2. Hill Start Assist (From '08MY)

### A: GENERAL

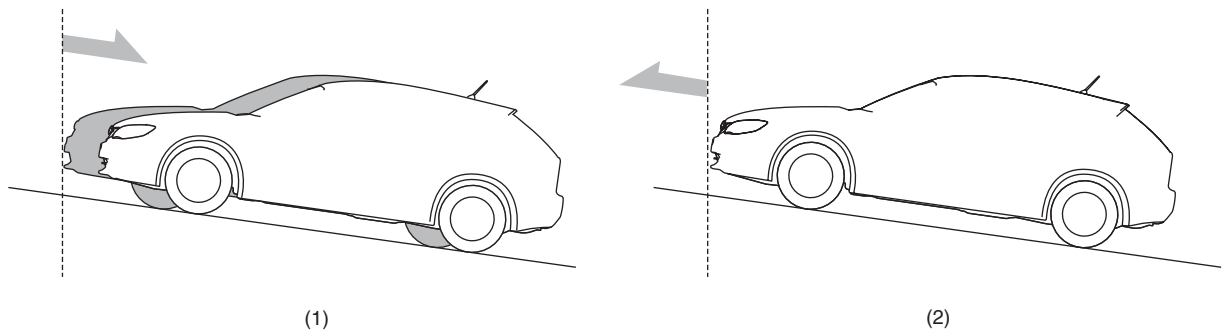
This system keeps the vehicle from moving backwards while a driver move foot from the brake to the accelerator by holding brake pressure for one second via brake pressure control, assisting the driver to start off the vehicle on a uphill.

### B: OPERATION

When the driver depresses the brake to stop the vehicle on an uphill, the system recognizes that the vehicle is at a stop from the wheel speed sensor signals.

Then the G sensor detects the inclination of the road surface where the vehicle stops.

The vehicle dynamic control unit holds brake pressure for one second when the brake is released (the brake light switch OFF) and the accelerator and clutch pedals are operated.



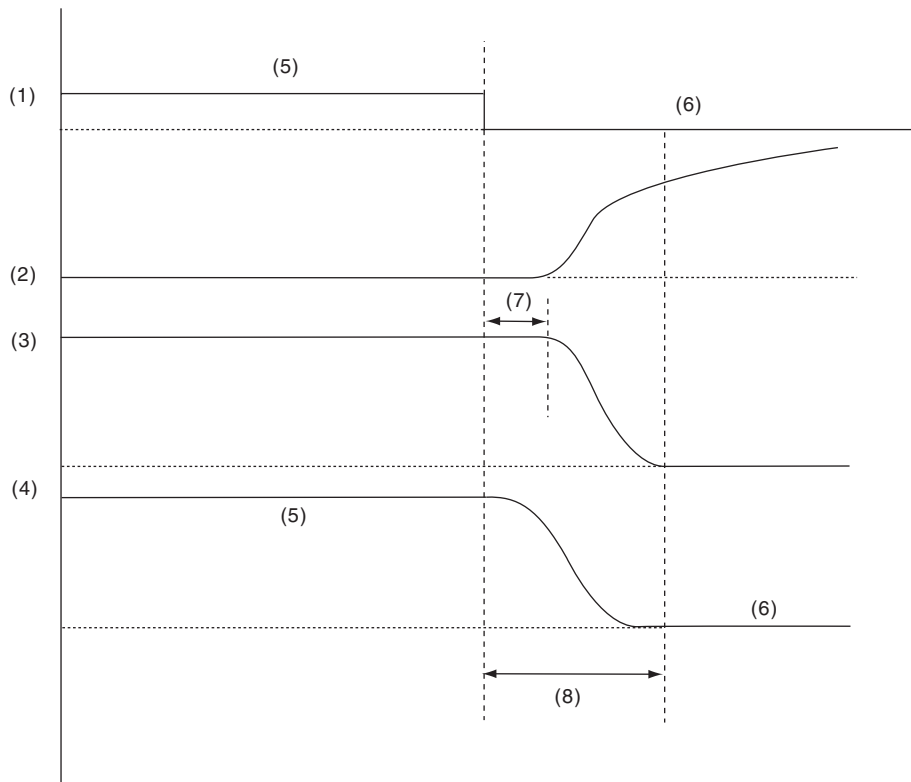
(1) Without hill start assist

(2) With hill start assist

VDC00608

# HILL START ASSIST (FROM '08MY)

## VEHICLE DYNAMICS CONTROL (VDC)



VDC-00609

- |  |                    |  |
|--|--------------------|--|
| (1) Brake light switch                     | (3) Brake pressure | (6) OFF                                  |
| (2) Engine torque (throttle opening angle) | (4) Clutch pedal   | (7) Approx. 1 second                     |
| (5) ON                                     |                    | (8) Operating range of hill start assist |

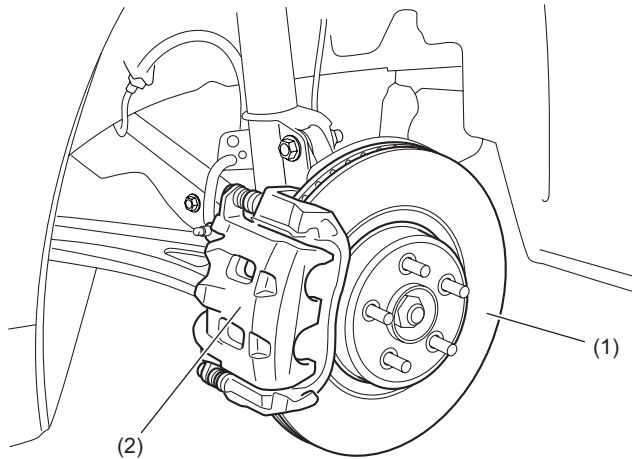
# FRONT AND REAR DISC BRAKES

## BRAKE

---

### 1. Front and Rear Disc Brakes

- Each of the front and rear disc brakes consist of a brake caliper, brake pads, and a brake disk rotor.
- The front disc brakes are of a ventilated disc type which features high heat dissipation and superb braking stability. The rear disc brakes are either a ventilated disk type or a solid disk type.
- Each disc rotor, which is fitted on the outside of the hub, is secured together with the wheel using the hub bolts. This facilitates its removal and installation.
- The brake pads have a wear indicator which gives a warning when the pad is worn down to the limit.

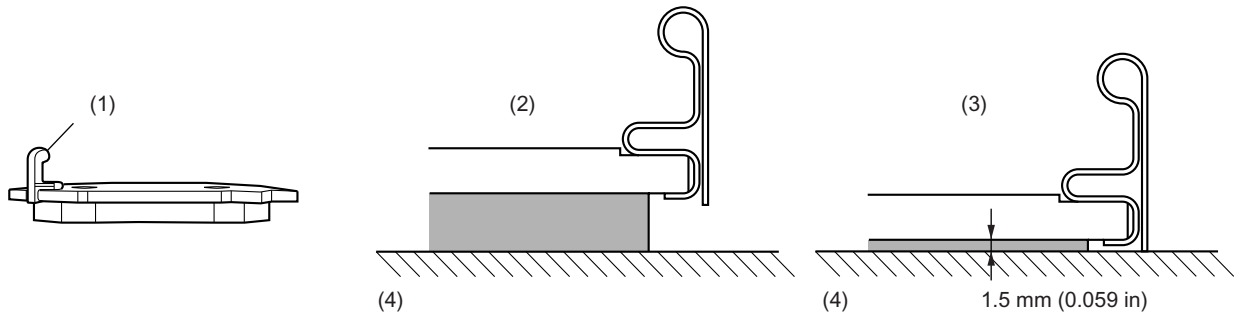


BR-00352

- (1) Disc rotor
- (2) Caliper body

## A: PAD WEAR INDICATOR

A wear indicator is provided on the inner disc brake pads. When the pad wears down to 1.5 mm (0.059 in) the tip of the wear indicator comes into contact with the disc rotor, and makes a squeaking sound as the wheel rotates. This alerts the driver to the situation.



BR-00020

(1) Wear indicator

(2) New pad

(3) Worn pad

(4) Disc rotor

## B: FRICTIONAL MATERIAL OF BRAKE PADS

The brake pads materials do not contain any asbestos which is harmful to human body.

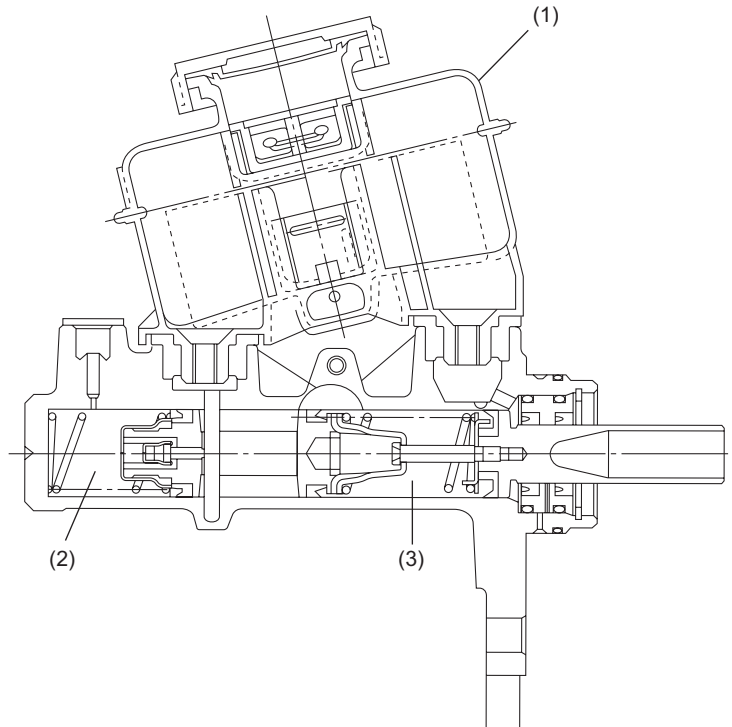
# MASTER CYLINDER

BRAKE

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## 2. Master Cylinder

- The master cylinder consists of a brake fluid reservoir chamber that stores brake fluid, and a hydraulic chamber section that converts the force applied to the brake pedal into hydraulic pressure.
- The hydraulic pressure generated in each of the two hydraulic chambers are sent to the brake caliper of each wheel through the 2 diagonally split brake circuits.



BR-00366

- (1) Reservoir tank
- (2) Secondary hydraulic chamber
- (3) Primary hydraulic chamber



## A: BRAKE FLUID LEVEL SWITCH

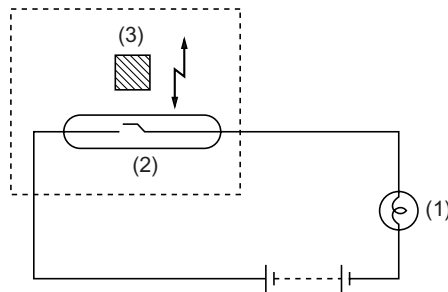
The brake fluid level switch is located inside the brake fluid reservoir tank and causes the brake system warning light on the combination meter to come on when the fluid level has dropped below the predetermined level.

The switch assembly consists of a reed switch (normally open) and a permanent magnet that is incorporated in a float.

When the brake fluid level is normal, the float is far above the reed switch, so the force of the magnet is unable to act on the reed switch. The warning light circuit, therefore, remains open.

When the brake fluid level drops to a level approximately 20 mm (0.79 in) below the maximum level and the float lowers accordingly, the magnet aligns with the reed switch, activating the reed switch contact. The warning light then comes on to warn the driver of the situation.

The warning light may, although momentarily, illuminate even when the brake fluid level is normal if the vehicle tilts or swing largely.



BR-00147

(1) Warning light

(2) Reed switch

(3) Permanent magnet

# BRAKE BOOSTER

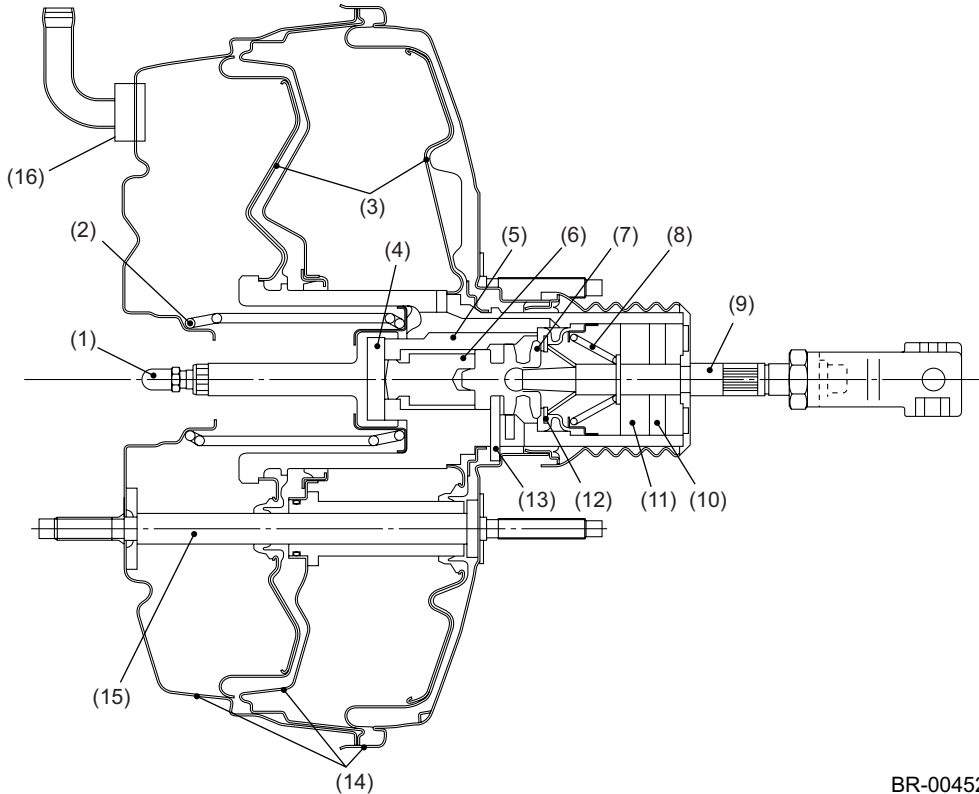
BRAKE

## 3. Brake Booster

The brake booster is a tandem type that uses two diaphragms.

By utilizing the differential pressure between the intake manifold vacuum and atmospheric pressure, a high braking force can be obtained even when the pedal depressing effort is small.

The brake booster is installed between the brake pedal and master cylinder. This contributes to improve the response to the brake pedal. If it fails, the brake servo effect is lost requiring a larger pedal effort, however, the braking force is still maintained.

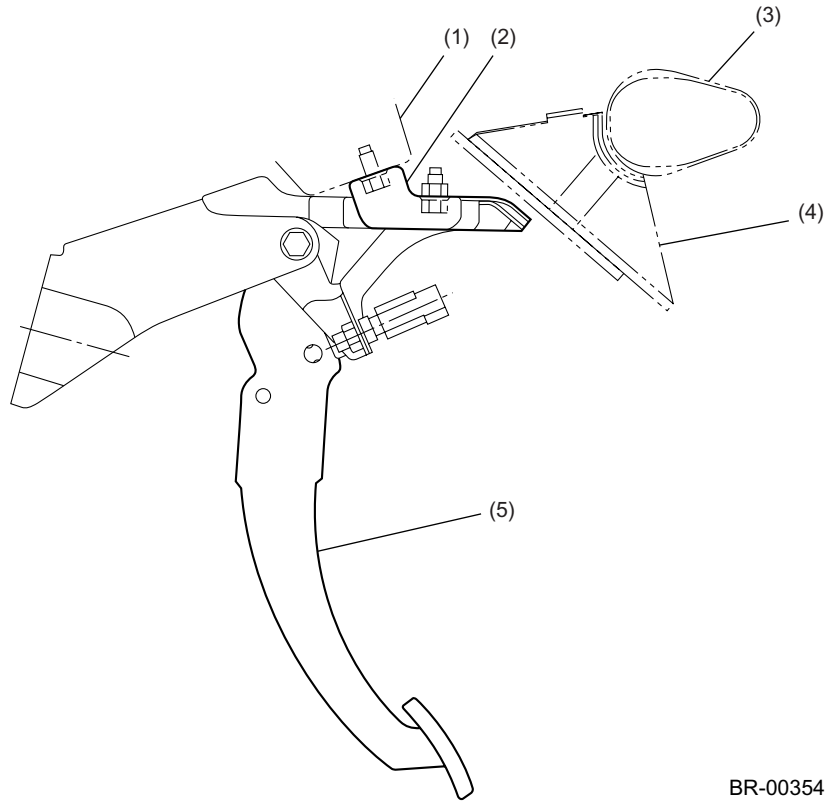


BR-00452

- |                     |                   |                             |
|---------------------|-------------------|-----------------------------|
| (1) Output rod      | (7) Plunger valve | (13) Stop plate             |
| (2) Return spring   | (8) Valve spring  | (14) Shell                  |
| (3) Diaphragm       | (9) Input rod     | (15) Tie-rod (through bolt) |
| (4) Reaction disc   | (10) Silencer     | (16) Check valve            |
| (5) Control housing | (11) Filter       |                             |
| (6) Piston          | (12) Poppet seal  |                             |

## 4. Brake Pedal

The brake pedal is provided with a mechanism to control movement to the rear in case of a frontal collision to minimize injury to the driver's legs.



BR-00354

- (1) Mounting bracket at body side
- (2) Bracket at brake pedal side
- (3) Steering support beam

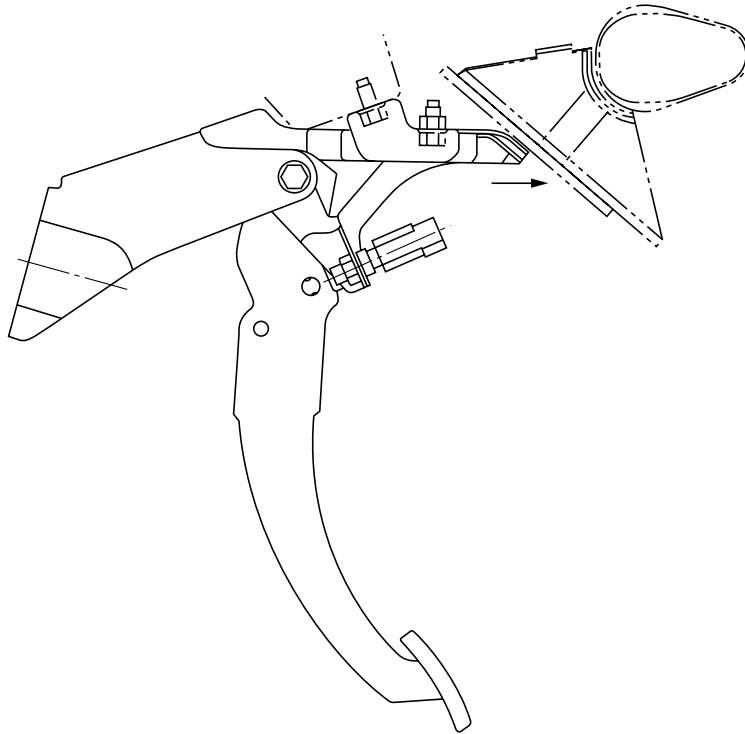
- (4) Brake pedal catcher
- (5) Brake pedal assembly

# BRAKE PEDAL

BRAKE

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If the brake pedal is pushed rearwards in case of a frontal collision, the brake pedal comes in contact with the catcher.



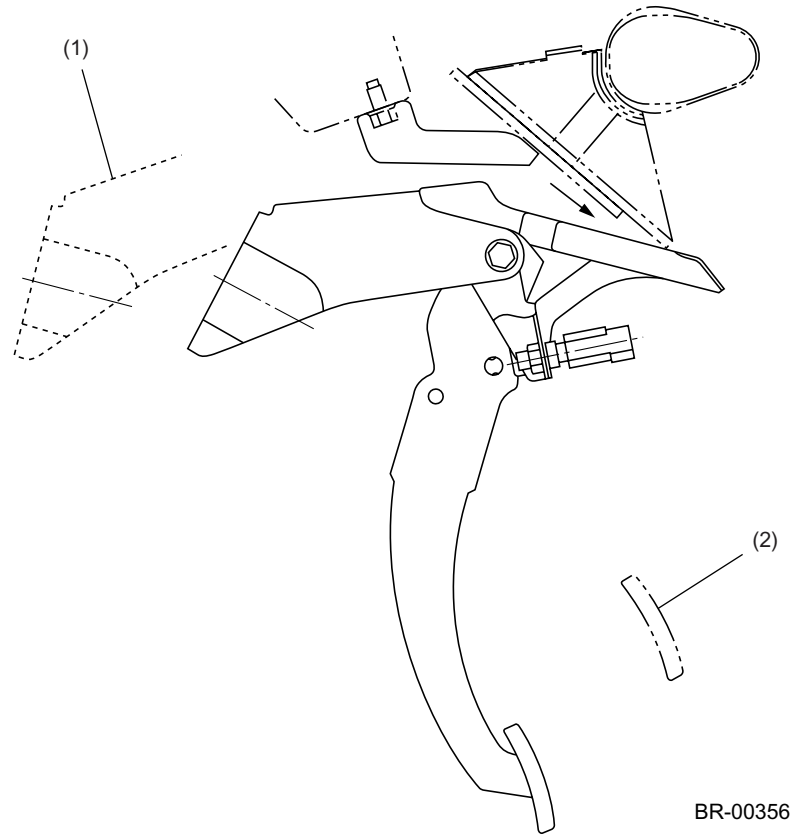
BR-00355

# BRAKE PEDAL

BRAKE

If the brake pedal is pressed further, the brake pedal will come apart from the pedal side bracket. The brake pedal will move along the brake catcher.

By letting the brake pedal to move down along the catcher, the rearward movement of the brake pad is controlled.



BR-00356

- (1) Mounted position before collision
- (2) Brake pedal pad position after a collision on a vehicle without a rearward movement control mechanism

# BRAKE PEDAL

BRAKE

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**MEMO**

# PARKING BRAKE

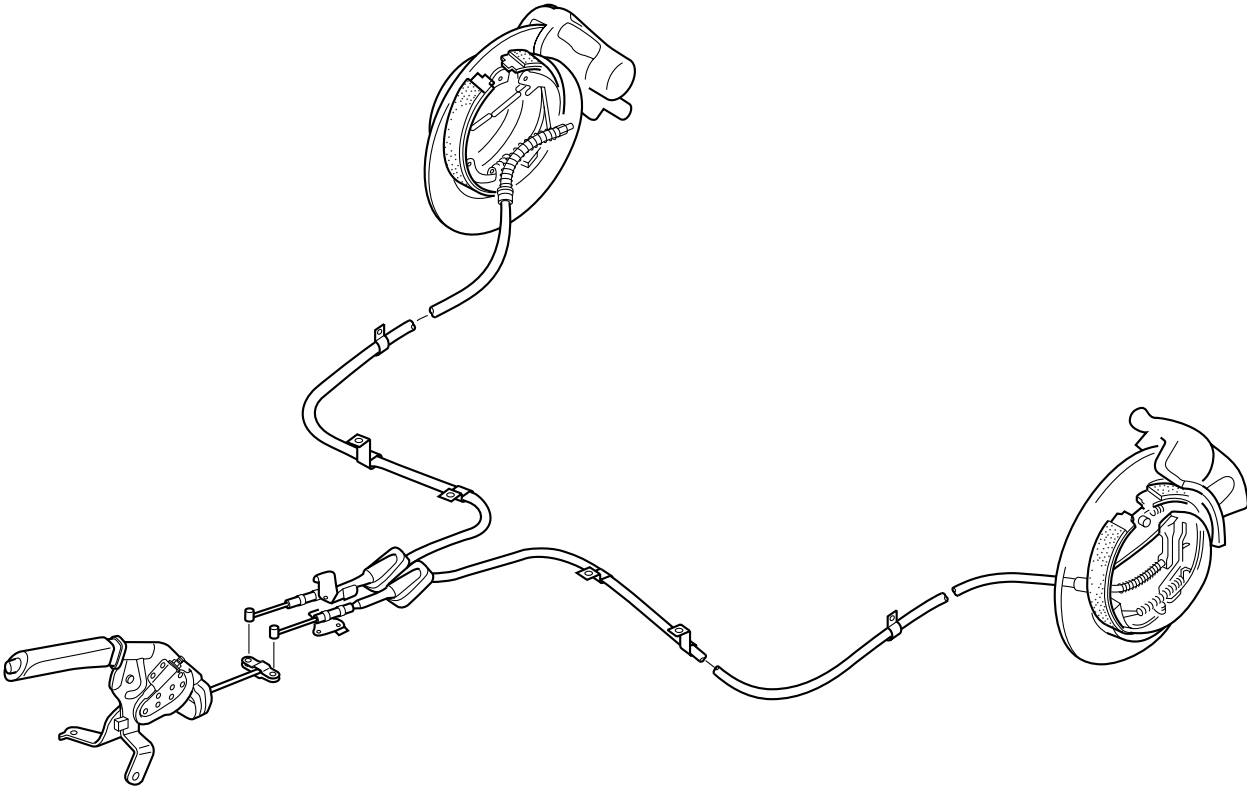
## PARKING BRAKE

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### 1. Parking Brake

The parking brakes are applied by manually operating the lever to mechanically control the rear wheels through a cable.

Each rear disc brake rotor contains a drum brake mechanism which is used exclusively for the parking brake.



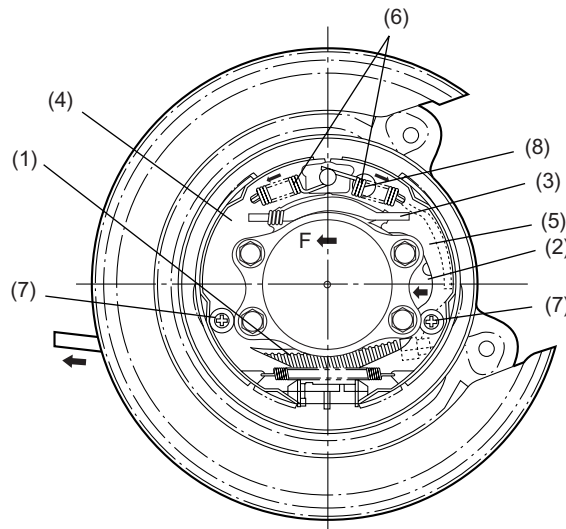
PB-00055

## A: OPERATION

### 1. SETTING

When the parking brake lever is pulled, the shoe actuating lever to which the end of the parking brake cable is connected turns the strut in direction “F” around point “P”.

The strut then presses the brake shoes A and B against the drum. These brake shoes utilize a floating design and are movably supported by hold-down pins. The force applied to brake shoe A and the reaction force “F” applied to the brake shoe B via point “P” press them against the brake drum.



PB-00051

- (1) Parking brake cable
- (2) Lever
- (3) Strut
- (4) Brake shoe A

- (5) Brake shoe B
- (6) Shoe return spring
- (7) Shoe hold down pin
- (8) Point “P”



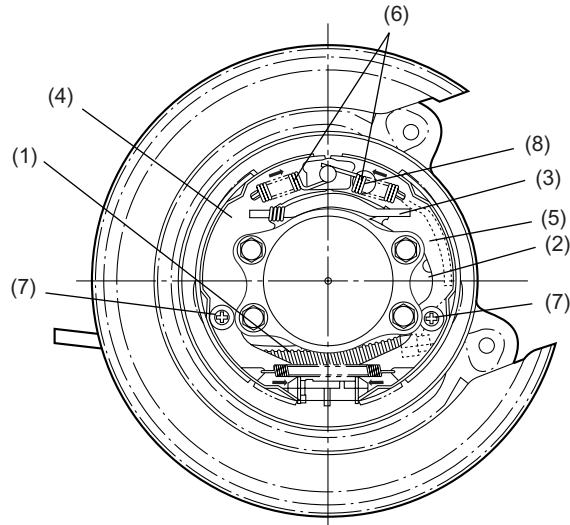
# PARKING BRAKE

## PARKING BRAKE

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### 2. RELEASING

When the parking brake lever is returned to the release position and the parking brake cables are slackened, the brake shoes A and B are moved back to their original positions by the tension of return springs, so that the parking brake is released.



PB-00052

- |                         |                        |
|-------------------------|------------------------|
| (1) Parking brake cable | (5) Brake shoe B       |
| (2) Lever               | (6) Shoe return spring |
| (3) Strut               | (7) Shoe hold down pin |
| (4) Brake shoe A        | (8) Point "P"          |

# TILT STEERING COLUMN

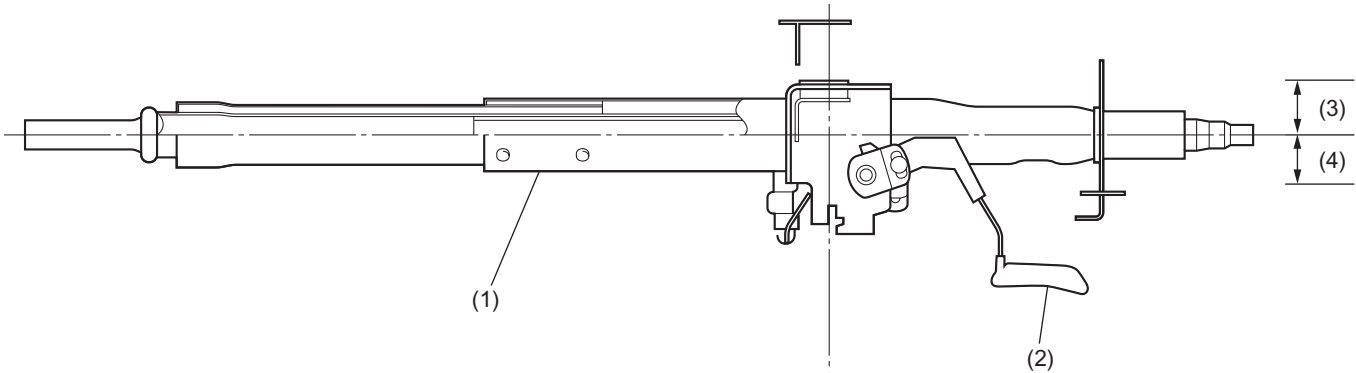
POWER ASSISTED SYSTEM (POWER STEERING)

---

## 1. Tilt Steering Column

### A: TILT MECHANISM

- The steering wheel vertical position can be adjusted within a 38 mm (1.50 in) range by using the tilt lever to unlock the steering column and lock it again at the desired position.



PS-00470

- (1) Tilt steering column
- (2) Tilt lever
- (3) 23 mm (0.91 in)
- (4) 15 mm (0.59 in)

### B: ENERGY-ABSORBING MECHANISM

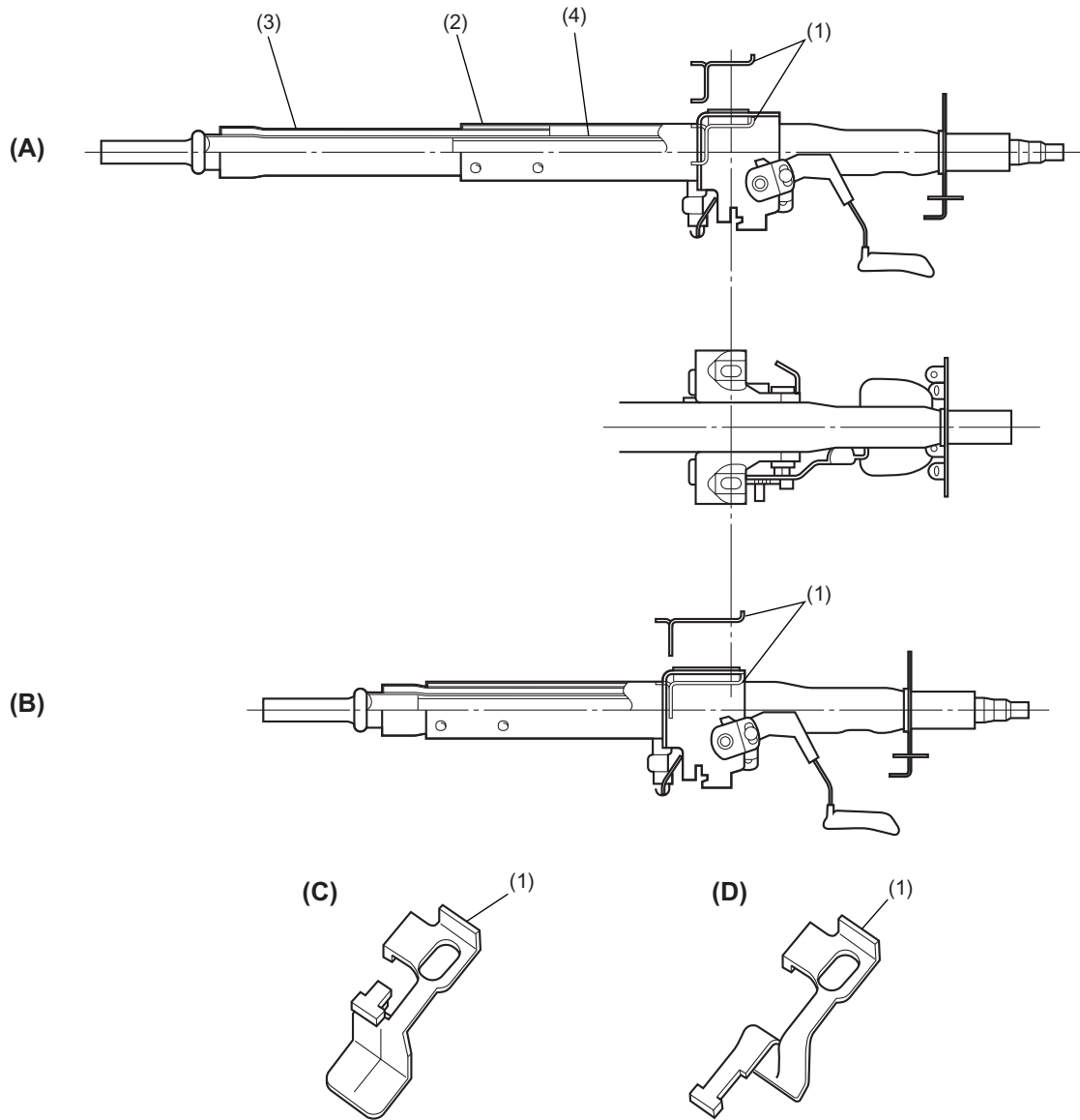
- To absorb the backward movement energy generated in the engine compartment in the event of a frontal collision, a press-fitted pipes type steering column jacket has been adopted. When an impact load exceeding a certain level is applied to the steering column, jacket A slides on jacket B.

Since jacket B is press-fitted in jacket A, friction generated between them absorbs the impact. The column bending load is supported by the press-fitted jackets.

- Another measure to alleviate impact on the driver in the event of a collision is the ripping plate, which is located between the steering column and the tilt bracket attached to the steering support beam. When a large impact load is applied to the steering column, the ripping plate is deformed and torn progressively. The impact energy is absorbed during this process.

# TILT STEERING COLUMN

POWER ASSISTED SYSTEM (POWER STEERING)



PS-00471

- (A) Before absorption of impact energy
- (B) After absorption of impact energy
- (C) Before ripping
- (D) After ripping

- (1) Ripping plate
- (2) Jacket A
- (3) Jacket B
- (4) Shaft

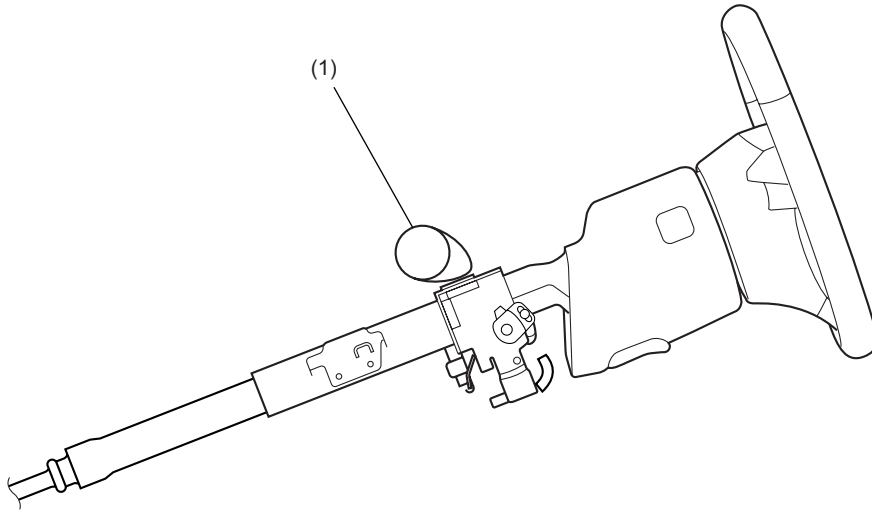
# TILT STEERING COLUMN

POWER ASSISTED SYSTEM (POWER STEERING)

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## C: STEERING SUPPORT BEAM

- The steering column is held in position by a support beam, which is installed crosswise in the vehicle body at a level close to the steering wheel to reduce the overhang distance of the steering wheel from the supporting point of the column. The steering shaft upper bearing is also located close to the steering wheel to increase supporting efficiency as well as to minimize vibration of the steering wheel.



PS-00475

(1) Steering support beam

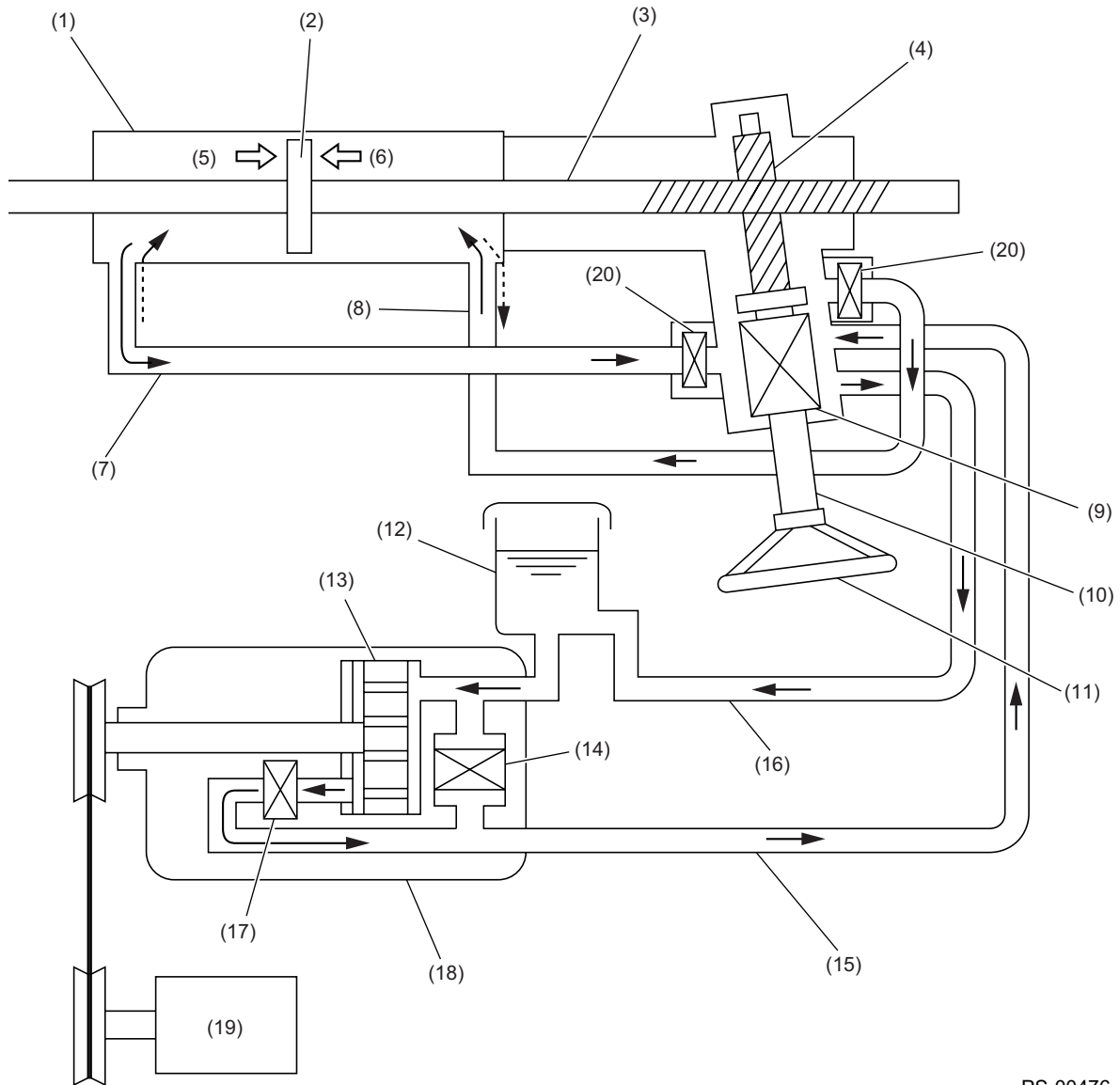
## 2. Power Steering System

### A: HYDRAULIC SYSTEM

- The fluid pump is directly driven by the engine through a belt.
- The fluid flow is maintained almost constant regardless of change in the engine speed by the function of the flow control valve. The flow-regulated fluid is delivered to the control valve through hose A.
- When the steering wheel is turned, the rotary control valve connected to the pinion shaft opens the hydraulic circuit corresponding to the direction in which the steering wheel is turned. The fluid then flows into chamber A or B via pipe A or B.
- The fluid pressure in chamber A or B acts on the rack piston in the same direction as the rack shaft is moved by rotation of the steering wheel. This helps reduce the effort required of the driver to operate the steering wheel.
- Movement of the rack piston causes the fluid in the other chamber to return to the reservoir tank via pipe A or B, control valve, and hose B.
  - As the steering shaft is connected to the pinion shaft mechanically via the rotary control valve, the steering system can operate as a manual system even if the hydraulic system becomes inoperative.
  - To control the maximum fluid pressure, a relief valve is built into the fluid pump to prevent build-up of excessive fluid pressure.
- Since a damper valve is provided in the fluid passage, the steering stability in straight forward direction is improved and kickback is reduced.

# POWER STEERING SYSTEM

## POWER ASSISTED SYSTEM (POWER STEERING)



PS-00476

- |                     |                     |
|---------------------|---------------------|
| (1) Power cylinder  | (11) Steering wheel |
| (2) Rack piston     | (12) Tank           |
| (3) Rack shaft      | (13) Vane pump      |
| (4) Pinion shaft    | (14) Relief valve   |
| (5) Chamber A       | (15) Hose A         |
| (6) Chamber B       | (16) Hose B         |
| (7) Pipe A          | (17) Control valve  |
| (8) Pipe B          | (18) Fluid pump     |
| (9) Control valve   | (19) Engine         |
| (10) Steering shaft | (20) Damper valve   |

# POWER STEERING SYSTEM

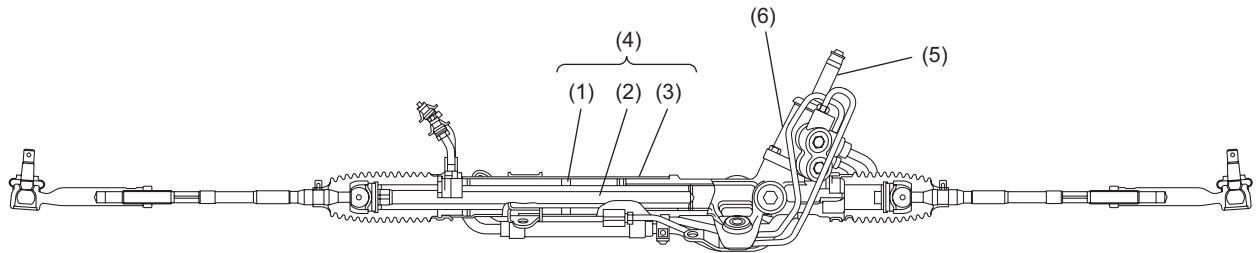
POWER ASSISTED SYSTEM (POWER STEERING)

## B: GEARBOX ASSEMBLY

### 1. POWER CYLINDER

The gearbox integrates the control valve and power cylinder into a single unit. The rack shaft serves as a power cylinder piston. The rotary control valve is located around the pinion shaft.

The rotary control valve and power cylinder are connected to each other by two hydraulic fluid pipes.



PS-00626

- (1) Piston
- (2) Rack shaft
- (3) Cylinder

- (4) Power cylinder
- (5) Pinion shaft
- (6) Control valve

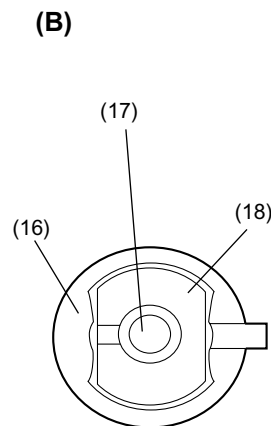
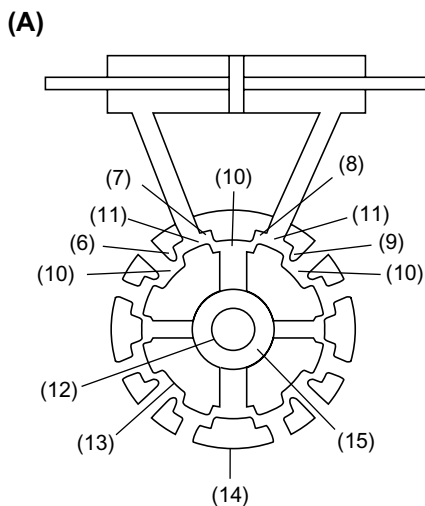
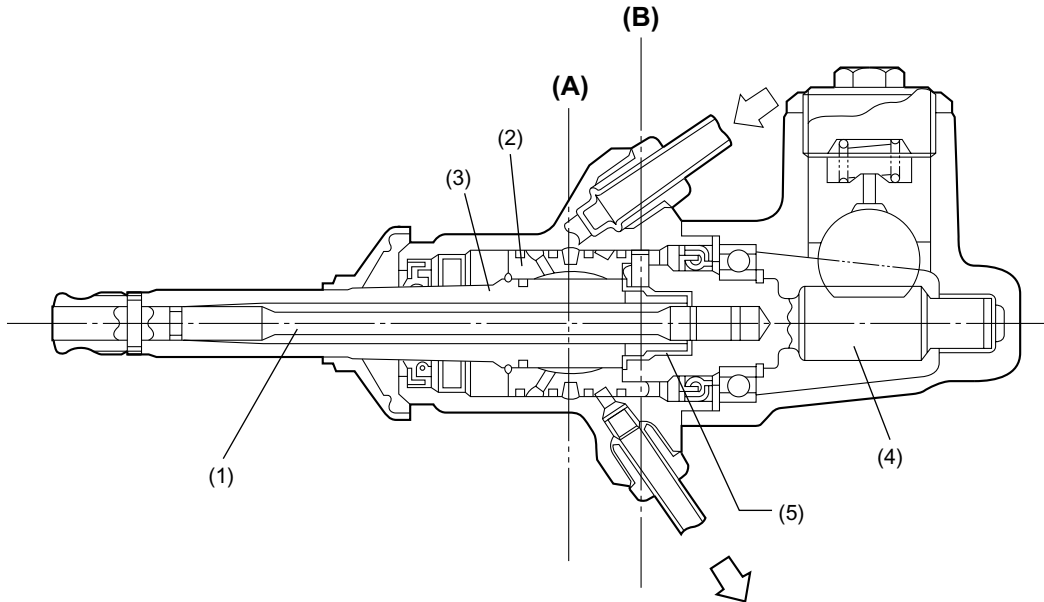
# POWER STEERING SYSTEM

## POWER ASSISTED SYSTEM (POWER STEERING)

### 2. ROTARY CONTROL VALVE

The rotary control valve consists of a rotor (which rotates together with the steering shaft), a pinion (which is connected to the rotor and torsion bar), and a sleeve (which rotates together with the pinion). The rotor and sleeve have grooves C and D, respectively, which form fluid passages  $V_1$  through  $V_4$ .

The pinion is in mesh with the rotor with adequate clearance, which enable the rack to be moved manually by rotating the steering shaft (fail-safe feature).



PS-00011



# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

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- (1) Torsion bar
- (2) Sleeve
- (3) Rotor
- (4) Pinion
- (5) Pinion-to-rotor engagement (fail-safe feature)
- (6) Fluid passage  $V_1$
- (7) Fluid passage  $V_2$
- (8) Fluid passage  $V_3$
- (9) Fluid passage  $V_4$
- (10) Groove C
- (11) Groove D
- (12) Torsion bar
- (13) Rotor
- (14) Sleeve
- (15) Fluid return line (to reservoir tank)
- (16) Pinion
- (17) Torsion bar
- (18) Rotor
- (A)** Cross-sectional view A (fluid passage switching circuit)
- (B)** Cross-sectional view B (pinion-to-rotor engagement)

# POWER STEERING SYSTEM

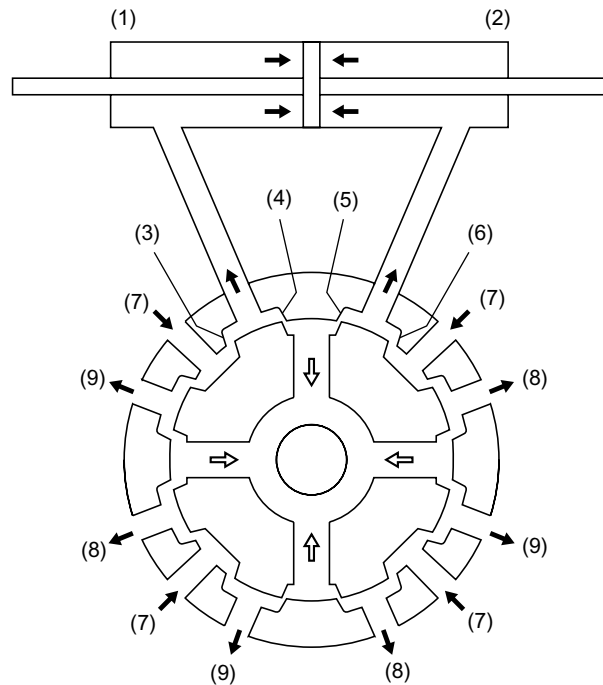
## POWER ASSISTED SYSTEM (POWER STEERING)

### ● Principle of operation

When the torsion bar is twisted by a rotational force applied to the steering wheel, the relative position between the rotor and sleeve changes. This changes the cross-sectional area of fluid passages  $V_1$ ,  $V_2$ ,  $V_3$  and  $V_4$ . The fluid passages are thus switched and the fluid pressure is controlled in accordance with the operation of the steering wheel.

### ● When no steering force is applied:

The rotor and sleeve are held at the neutral position. Fluid passages  $V_1$ ,  $V_2$ ,  $V_3$  and  $V_4$ , which are formed by grooves C and D are open equally. Under this condition, the fluid from the pump returns to the reservoir tank so that neither fluid pressure builds up nor the rack piston moves in the power cylinder.



PS-00012

- (1) Chamber A
- (2) Chamber B
- (3)  $V_1$

- (4)  $V_2$
- (5)  $V_3$
- (6)  $V_4$

- (7) From fluid pump
- (8) To A
- (9) To B

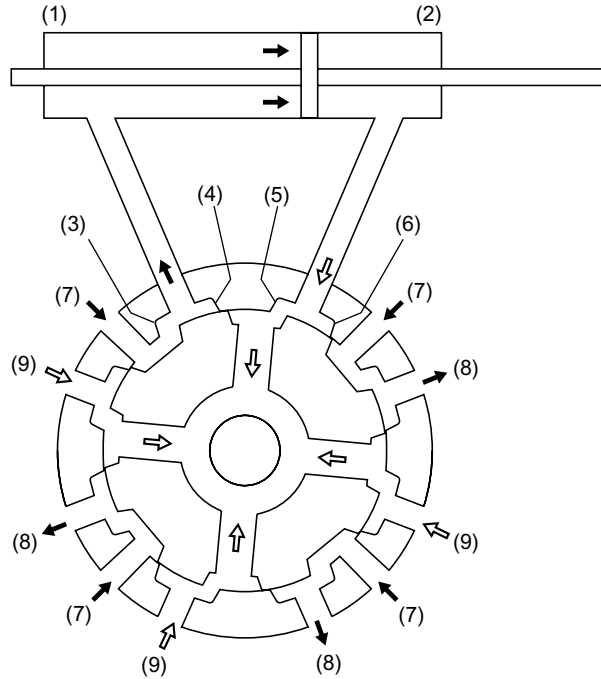
# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

- When steering force is applied:

When the steering wheel is turned to the right, for example, fluid passages  $V_1$  and  $V_3$  are opened while fluid passages  $V_2$  and  $V_4$  are nearly closed.

At this point, the fluid pressure in chamber A of the power cylinder increases depending on the degree of closure of fluid passages  $V_2$  and  $V_4$  so that the rack piston moves to the right. The fluid in chamber B, on the other hand, is drained through fluid passage  $V_3$  into the reservoir tank.



PS-00013

- (1) Chamber A
- (2) Chamber B
- (3)  $V_1$

- (4)  $V_2$
- (5)  $V_3$
- (6)  $V_4$

- (7) From fluid pump
- (8) To A
- (9) From B

- Fail-safe function

If fluid pressure fails to build up due to, for example, a broken fluid pump drive belt, the steering wheel rotating torque is transmitted from the valve rotor to the pinion through mechanical engagement between them.

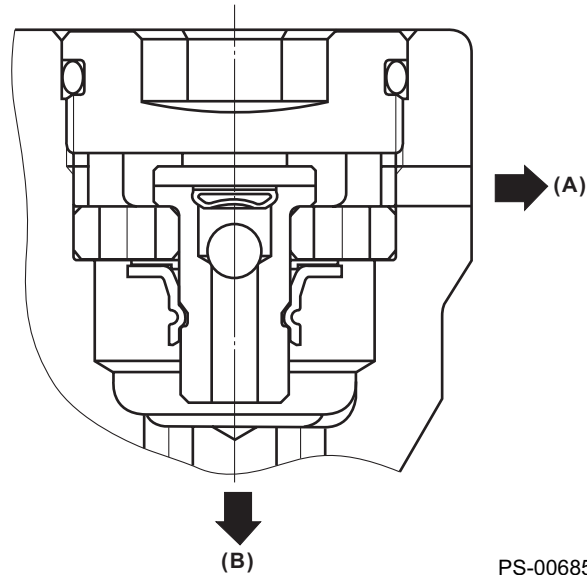
# POWER STEERING SYSTEM

## POWER ASSISTED SYSTEM (POWER STEERING)

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### 3. DAMPER VALVE

The damper valve is incorporated in the control valve body and is placed in the fluid passage at between the rotary control valve and the power cylinder chamber. Since the damper valve limits rapid flow of fluid caused by external force, the steering stability in straight forward direction is improved and kickback is reduced.



PS-00685

- (A) To control valve
- (B) To chamber A or B

# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

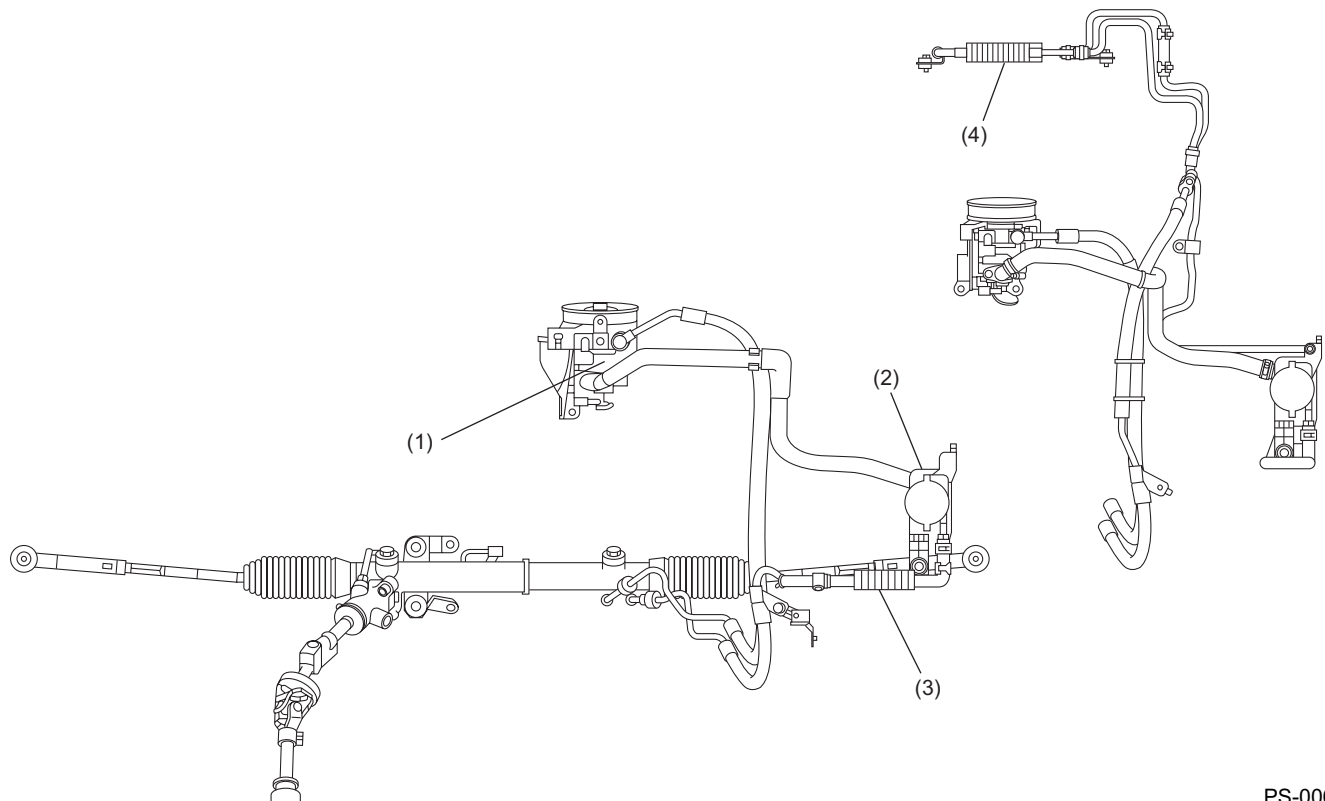
## C: FLUID PUMP AND RESERVOIR TANK

The fluid pump is a vane type driven by the engine via belt.

The reservoir tank is mounted on the vehicle body.

The fluid pump incorporates the flow control valve and relief valve, each performing the following functions:

- The flow control valve regulates the flow rate of discharged fluid to a constant level irrespective of the engine speed.
- The relief valve protects the system from excessively high pressures that may occur, for example, when the steering wheel is turned all the way.
- To stabilize the fluid temperature, an oil cooler is installed between the reservoir tank and gear-box.



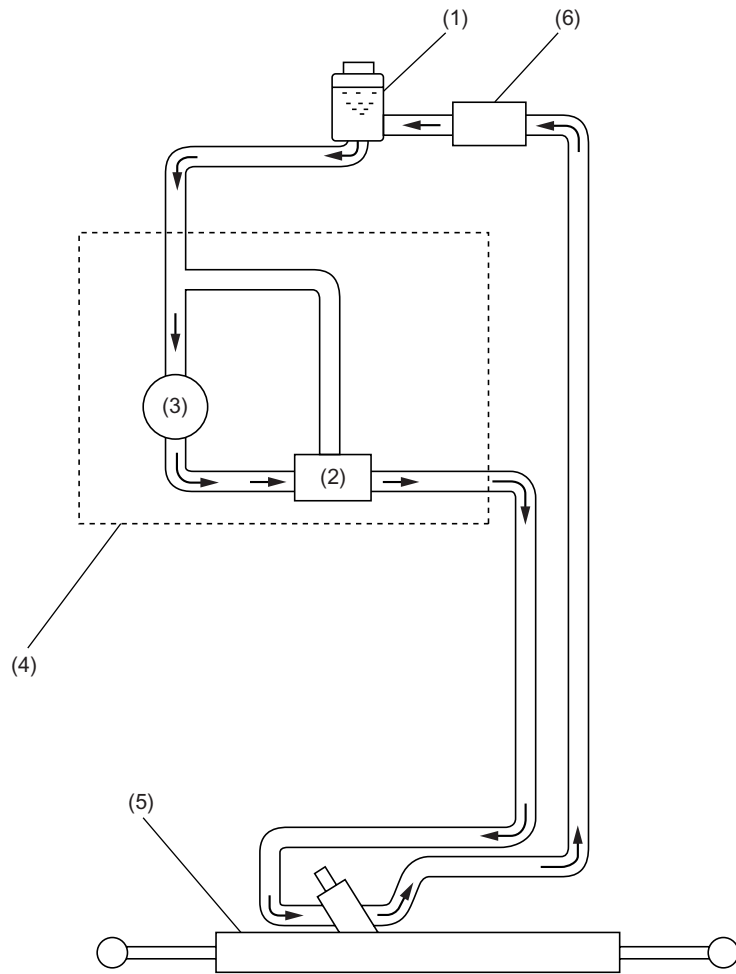
PS-00627

- (1) Fluid pump
- (2) Reservoir tank
- (3) Oil cooler (H4 models)
- (4) Oil cooler (H6 models)

# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

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PS-00504

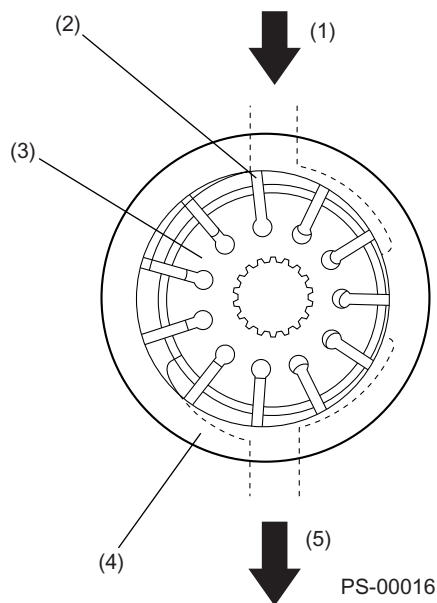
- (1) Reservoir tank
- (2) Relief valve assembly
- (3) Vane pump

- (4) Fluid pump assembly
- (5) Steering gearbox
- (6) Oil cooler

# POWER STEERING SYSTEM

## POWER ASSISTED SYSTEM (POWER STEERING)

- The fluid pump is belt-driven by the engine. The fluid flow is controlled according to the engine speed so that an adequate steering resistance is given during high-speed operation. The fluid pump is a variable capacity type vane pump whose delivery rate per rotation decreases as the engine speed increases. The pump is integral with a pump control valve and relief valve.
- The vane pump consists of a rotor, a cam ring, and 11 vanes. When the rotor rotates, the vane in each slot of the rotor is moved out by centrifugal force in radial directions and pressed against the cam ring. The fluid from the suction port is confined in chambers formed between two adjacent vanes and carried to the discharge port. Since the cam ring is movable in relation to the rotor, the volume of each chamber is variable. This enables the delivery rate per rotation of the pump to be changed.



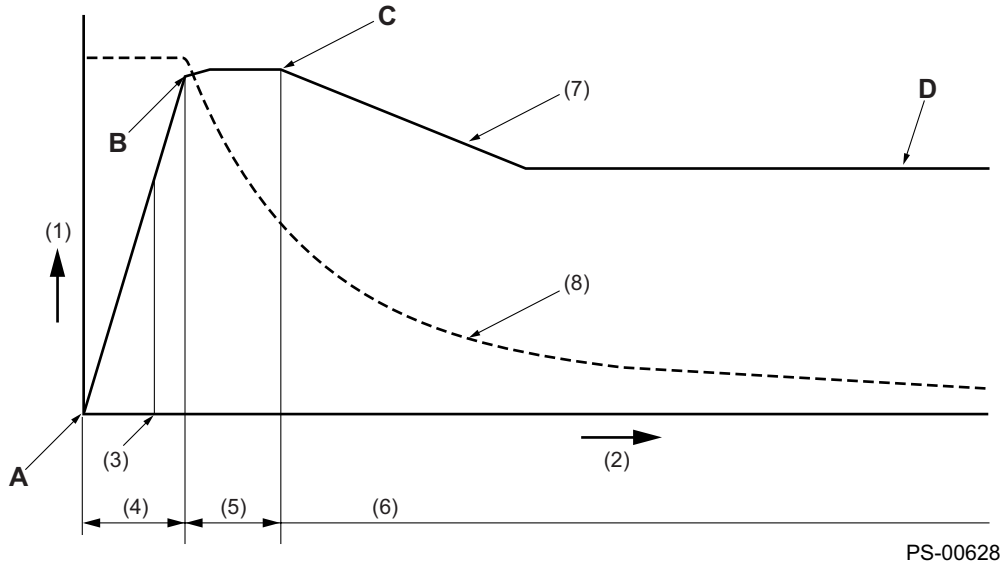
- (1) Suction
- (2) Vane
- (3) Rotor
- (4) Cam ring
- (5) Discharge

# POWER STEERING SYSTEM

## POWER ASSISTED SYSTEM (POWER STEERING)

### ● Flow control

The variable capacity pump changes its delivery rate per rotation by changing the degree of eccentricity of the cam ring according to its rotating speed (engine speed).



PS-00628

- |                |  |
|----------------|--|
| (1) Fluid flow | (5) Mid-speed                          |
| (2) Pump speed | (6) High-speed                         |
| (3) Idling     | (7) Delivery rate per unit time        |
| (4) Low-speed  | (8) Delivery rate per rotation of pump |

### NOTE:

In the following description, pump speed ranges will be indicated using the speed points A through D shown in the drawing above.



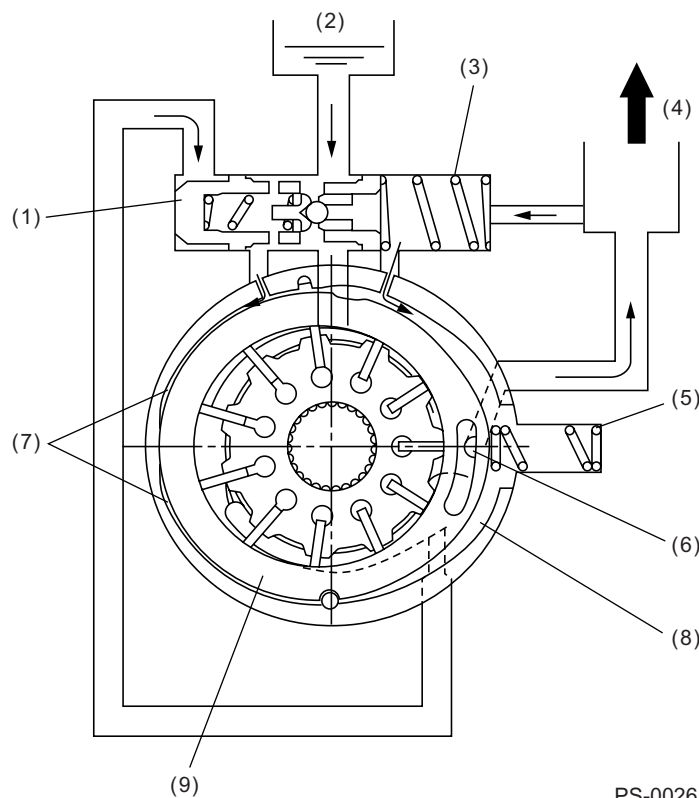
# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

## Low-range-speed operation (A — B range)

In this speed range, as well as in all the other speed ranges, two different pump discharge pressures are always applied to the control valve; one is directly led from the discharge port to the left end of the valve and the other is led through an orifice (variable orifice) to the right end of the valve. Since the orifice has a pressure reducing effect, the latter pressure is lower than the former.

When the pump is operating at a low speed, its discharge pressure is also low, resulting in only small difference between the two pressures. In this condition, the valve stays pushed leftward by the spring, allowing the non-pressurized tank fluid to enter chamber A. To chamber B, on the other hand, the orifice-reduced discharge pressure is applied, so the cam ring is pushed leftward by the cam ring spring. This makes the eccentricity of the cam ring a maximum and, therefore, the delivery rate per rotation of the pump becomes a maximum.



- (1) Control valve
- (2) Reservoir tank fluid
- (3) Control valve spring
- (4) Gear box
- (5) Cam ring spring

- (6) Variable orifice
- (7) Pressure chamber A
- (8) Pressure chamber B
- (9) Cam ring

# POWER STEERING SYSTEM

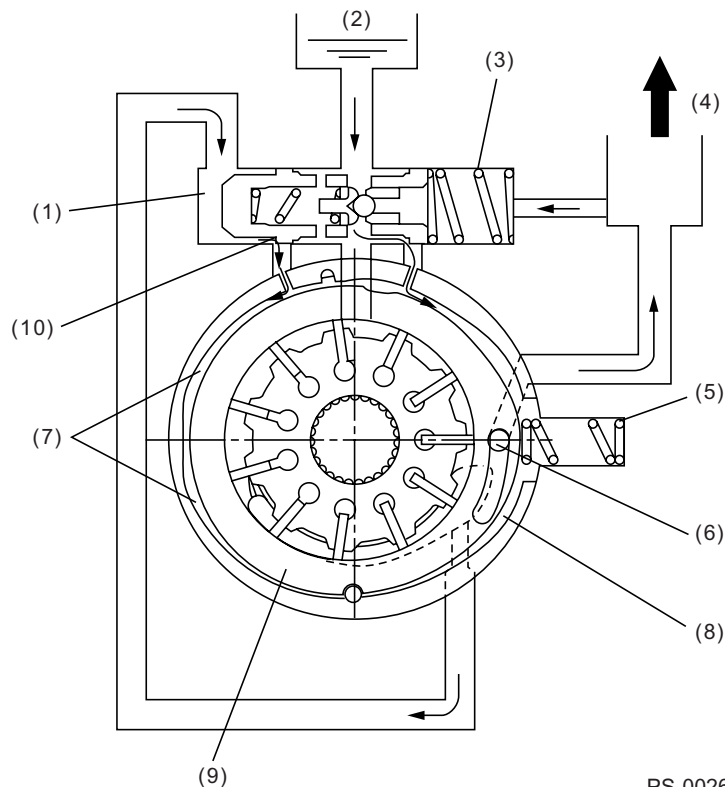
## POWER ASSISTED SYSTEM (POWER STEERING)

### Mid- to high-range-speed operation (B — D range)

During mid-range speed operation, the pump increases its delivery rate. Since the pressure before passing through the variable orifice increases, the control valve moves rightward, overcoming the tension of the control valve spring. This movement of the control valve allows the pressure upstream of the variable orifice to be directed to chamber A after being adjusted to a necessary pressure\* by the port opening area created by the control valve. On the other hand, chamber B receives the reservoir pressure (suction pressure). This means that the pressure in chamber A is higher than that in chamber B. As a result, the cam ring moves rightward against the tension of the cam spring. This causes the delivery rate per rotation of the pump to be reduced, so that the flow rate of the fluid to the steering gear box decreases accordingly.

The above control is performed when the pump is operating at a speed in the B — D range.

\* The “necessary pressure” for chamber A is a pressure required to move the cam ring to the position corresponding to each predetermined flow rate (pump delivery rate). The pressure is obtained by changing the port opening area appropriately through displacement of the control valve. The displacement of the control valve is determined by how much the pressure before the variable orifice is different from that after the orifice.



PS-00262

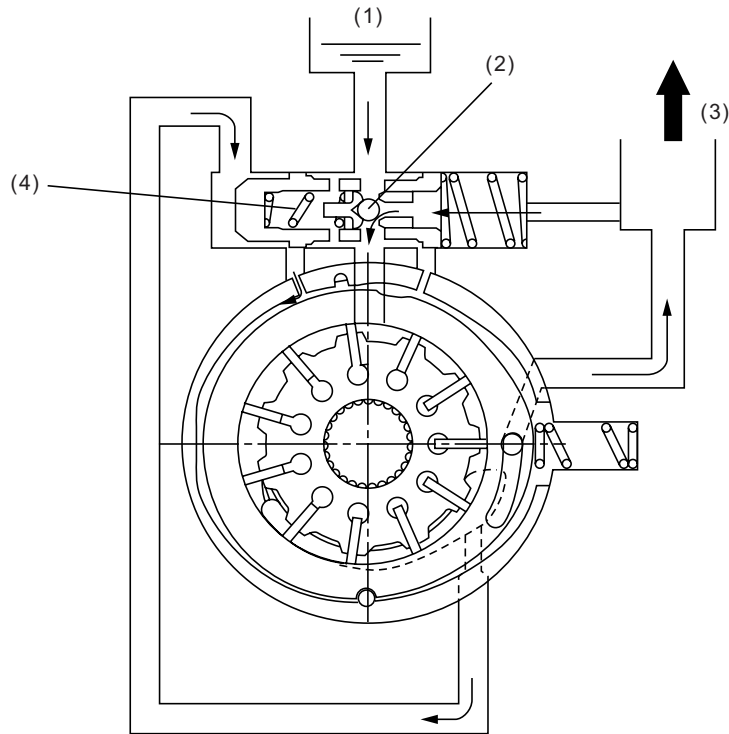
- |                          |                        |
|--------------------------|------------------------|
| (1) Control valve        | (6) Variable orifice   |
| (2) Reservoir tank fluid | (7) Pressure chamber A |
| (3) Control valve spring | (8) Pressure chamber B |
| (4) Gear box             | (9) Cam ring           |
| (5) Cam ring spring      | (10) Opening area      |

# POWER STEERING SYSTEM

POWER ASSISTED SYSTEM (POWER STEERING)

## Maximum pressure control

When the overall delivery rate of the pump exceeds a preset value, the relief valve opens to allow part of the discharged fluid to flow toward the suction side of the pump, thereby controlling the maximum pressure.



PS-00263

- (1) Reservoir tank fluid
- (2) Relief valve
- (3) Gear box
- (4) Relief spring

# **POWER STEERING SYSTEM**

POWER ASSISTED SYSTEM (POWER STEERING)

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**MEMO**